About This Manual

Introduction

WARNING: Before beginning any service procedure in this manual, refer to health and safety warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

This manual describes and directs repair procedures specified by Ford Motor Company for the vehicle. Critical health and safety precautions are included. Anyone who deviates from these instructions risks compromising personal safety or vehicle integrity.

SECTION CONTENT

This manual is divided into groups, each containing sections numbered based on the component part number. Section contents may include:

- Specifications
  - Fluid capacities, component specifications and torque values not covered in other procedures
- Description and Operation
  - Overview of the system, component locations, and system operation
- Diagnosis and Testing
  - Symptom charts, DTC charts and diagnostic tests
  - See the Diagnosis and Testing Information in this document
- General Procedures
  - Service adjustments, electronic programming and other special procedures
- Removal and Installation
  - Component removal and installation instructions
- Removal
  - Component removal instructions
- Installation
  - Component installation instructions
- Disassembly and Assembly
  - Component disassembly and assembly instructions
- Disassembly and Assembly of Subassemblies
  - Assembly disassembly and assembly instructions

IMPORTANT INFORMATION

Section number 100-00 General Information contains the following important information (including this document):

- Critical Health and Safety Precautions - service safety precautions applicable to the entire manual.
  For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- A Symbols Glossary - definitions of the action directed by each symbol.
  For additional information, refer to: Symbols Glossary (100-00 General Information, Description and Operation).
- Diagnostic Methods - support information for diagnostics.
  For additional information, refer to: Diagnostic Methods (100-00 General Information, Description and Operation).

Warnings, Notices and Notes

WARNINGS

Warnings provide information to avoid personal injury and to make sure service actions on critical safety systems are performed correctly. Warnings that apply to an entire system or workshop manual section are located in section 100-00 Description and Operation, Health and Safety Precautions.
For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTICES (in some publications, CAUTIONS)

Notices provide information to avoid damage to the vehicle or a component.

NOTES

Notes provide information critical for a complete and effective repair.

Warnings, Notices, or Notes that apply to an entire procedure will be placed at the beginning of the procedure. Warnings, Notices, or Notes that apply to a single step are placed at the beginning of the step. Those that apply to a group of steps will be placed at the first step requiring it.

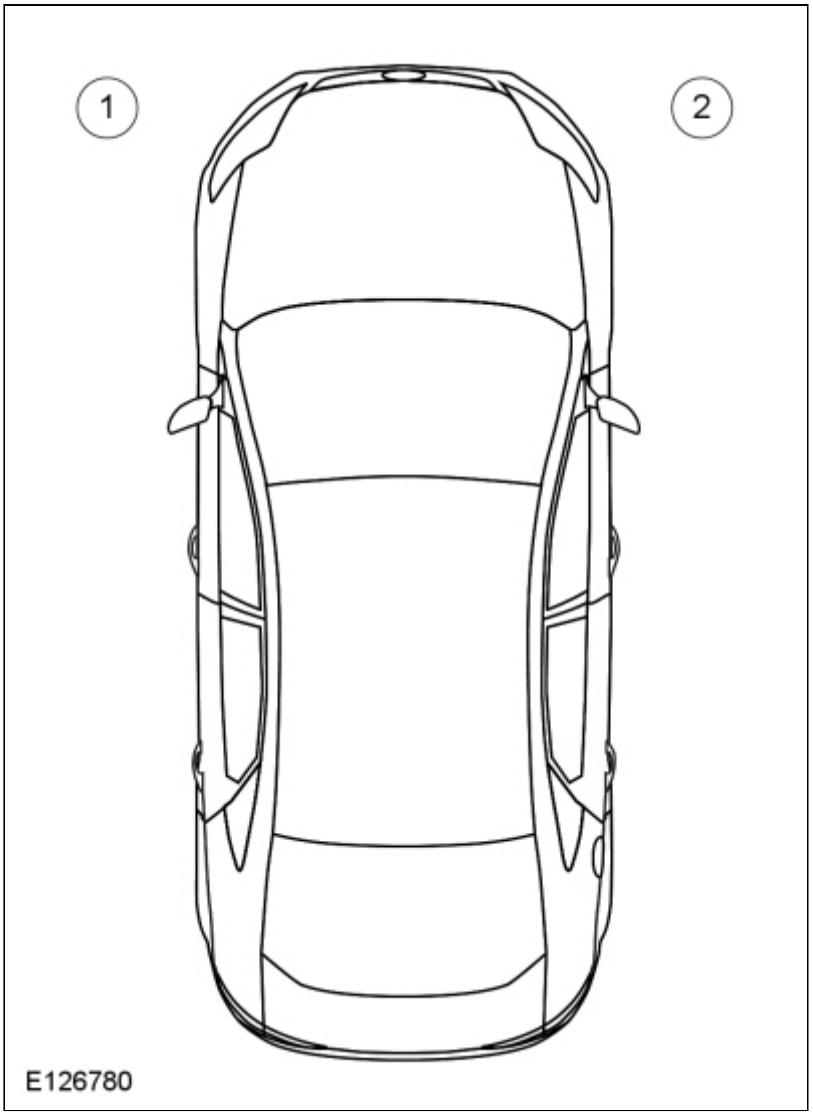
Specified Chemicals or Materials

Throughout this manual, chemicals or materials are specified that must be used to properly complete a service procedure or diagnostic step. In the event a specific material is not readily available, a substitute material meeting the same specification may be used. Ford has not reviewed third party products for compliance with environmental, health or safety regulations and is not responsible for their use. Use of third party products is at your own risk. Additionally, such products may cause degraded performance, premature failures, and/or vehicle component damage. All chemicals or materials used for vehicle servicing should be checked for compliance with local environmental and health and safety regulations.

LH and RH Designations

All LH and RH designations are oriented from the driver's seat position looking forward.

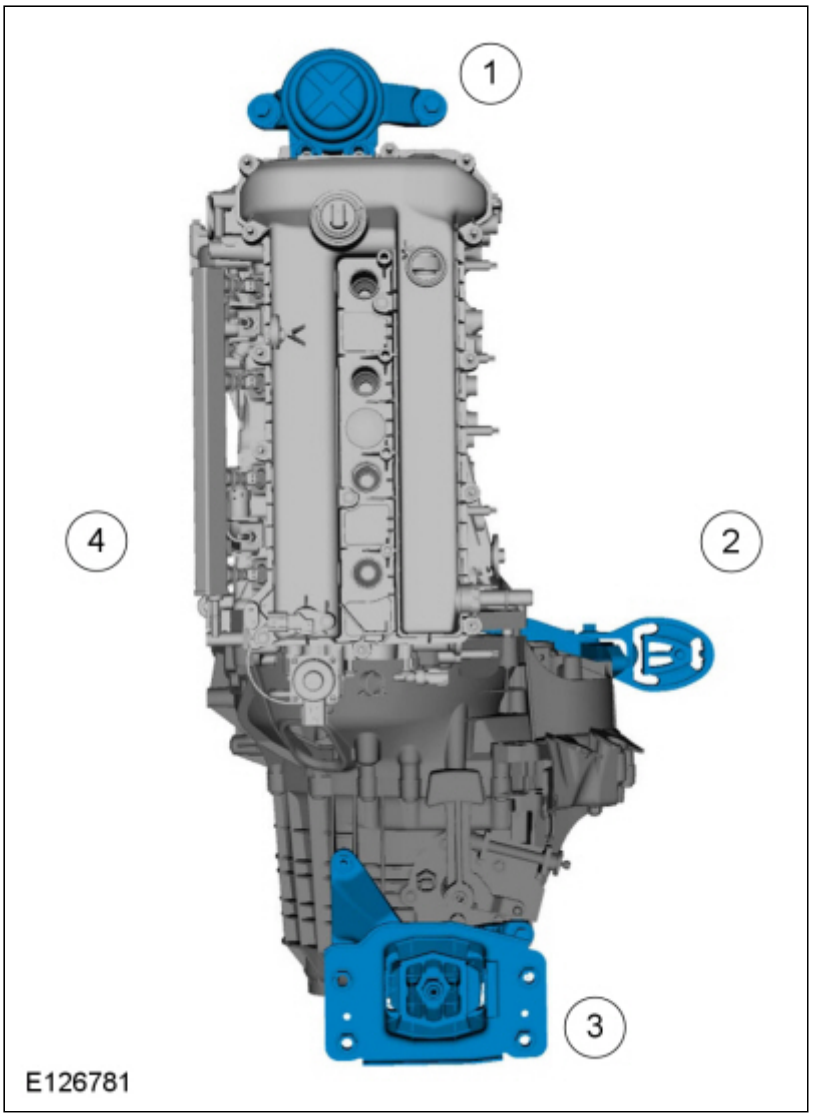
Vehicle LH and RH definition



Item	Part Number	Description
1	—	LH (left-hand)
2	—	RH (right-hand)

All LH and RH engine designations are oriented from the flywheel position looking toward the crankshaft pulley.

Powertrain LH and RH definition



Item	Part Number	Description
1	—	Front
2	—	RH (right-hand)
3	—	Rear
4	—	LH (left-hand)

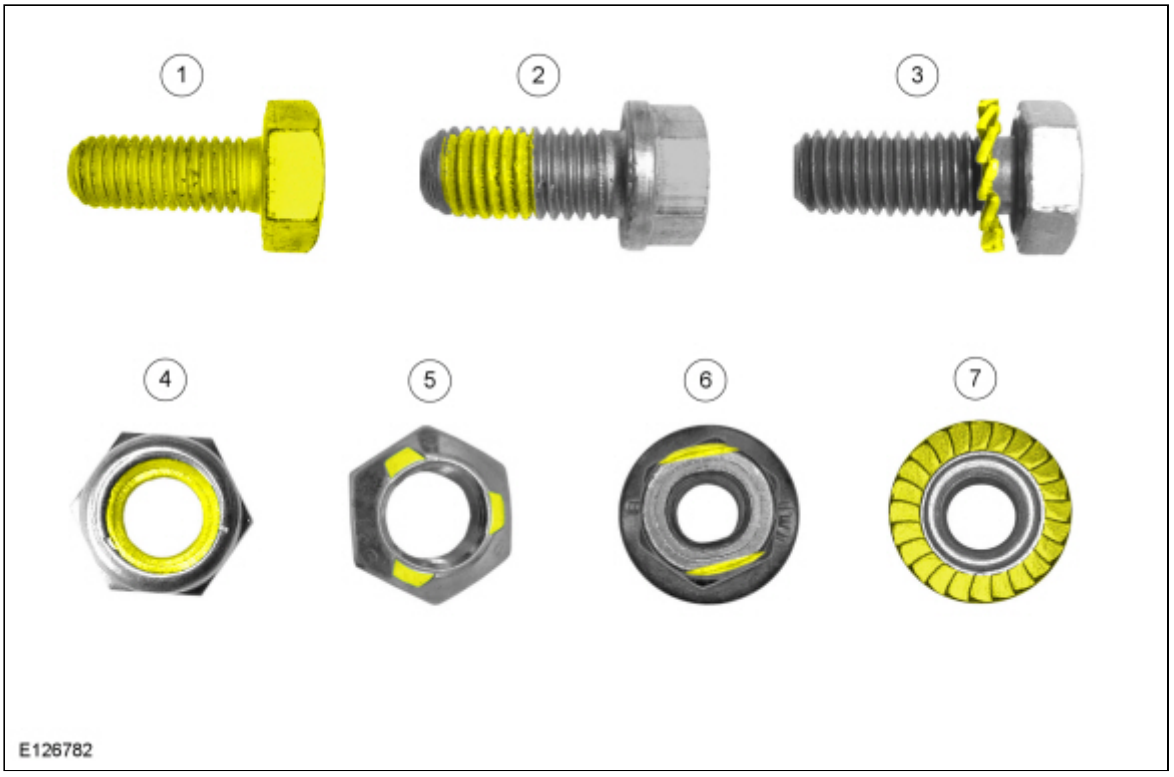
Standard Practices

The following rules apply, unless specified differently in the procedure:

FASTENERS

- Reuse standard fasteners.
- Replace fasteners with self-locking features.
  - Examples of fastener self-locking coatings or mechanical locking (with the locking features highlighted yellow) are shown in the illustration.
- Replace fasteners with torque angle specifications (those tightened a specified number of degrees).

Examples of self-locking nuts and bolts



Item	Part Number	Description
1	—	Completely coated self-locking bolt
2	—	Partially coated self-locking bolt
3	—	Self-locking bolt with a locking washer
4	—	Self-locking nut with a plastic locking insert
5	—	Self-locking nut with thread deformation (3 indentations)
6	—	Self-locking nut with thread deformation (to oval shape)
7	—	Self-locking nut with integrated locking ring

SEALS AND GASKETS

Replace seals and gaskets, unless specified differently in the procedure.

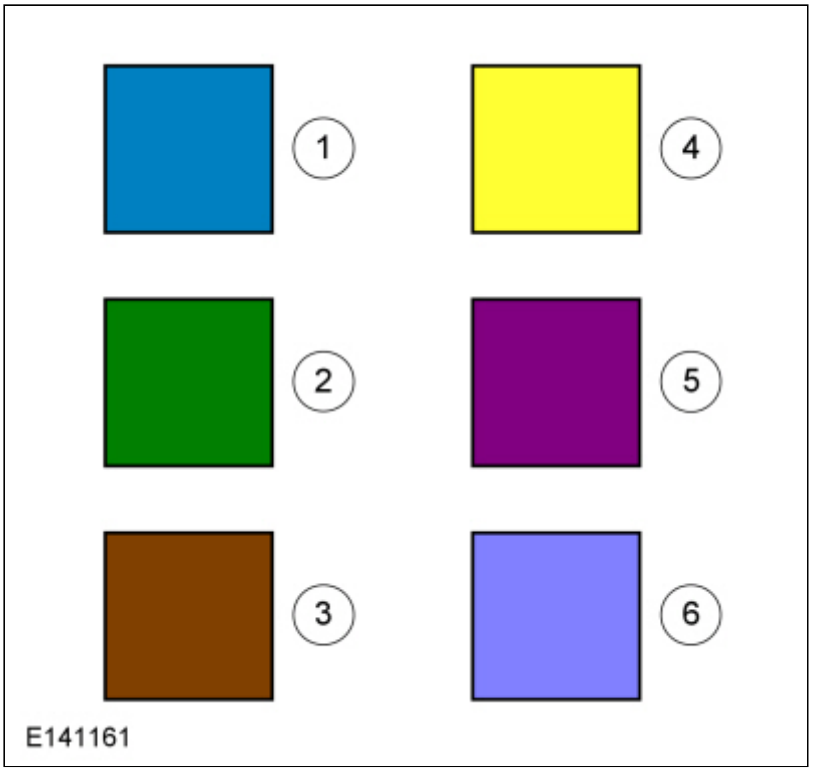
EXTERIOR TRIM PARTS

Replace exterior trim parts fastened with glue or adhesive tape, unless specified differently in the procedure.

Mechanical Procedures

Illustrations in this manual may be used instead of written step instructions. Color-coding (see color scheme illustration) is used to communicate the required step action or actions. Service action icons may be used to add information regarding the required action.
For additional information, refer to: Symbols Glossary (100-00 General Information, Description and Operation).

Illustration Color-coding



Item	Part Number	Description
1	—	Blue - Target or primary component to be removed/installed (or disassembled/assembled).
2	—	Green - Components that need to be removed prior to or installed after the target/primary.
3	—	Brown - Components that need to be removed prior to or installed after the target/primary.
4	—	Yellow - Components to be set aside for access, but not removed. Also highlighted areas to inspect or adjust.
5	—	Magenta - Electrical connectors and fasteners such as nuts, bolts, clamps, or clips to be: detached, attached, loosened, moved, removed or installed.
6	—	Pale Blue - Special tool(s), general equipment, or common tools used in an uncommon way.

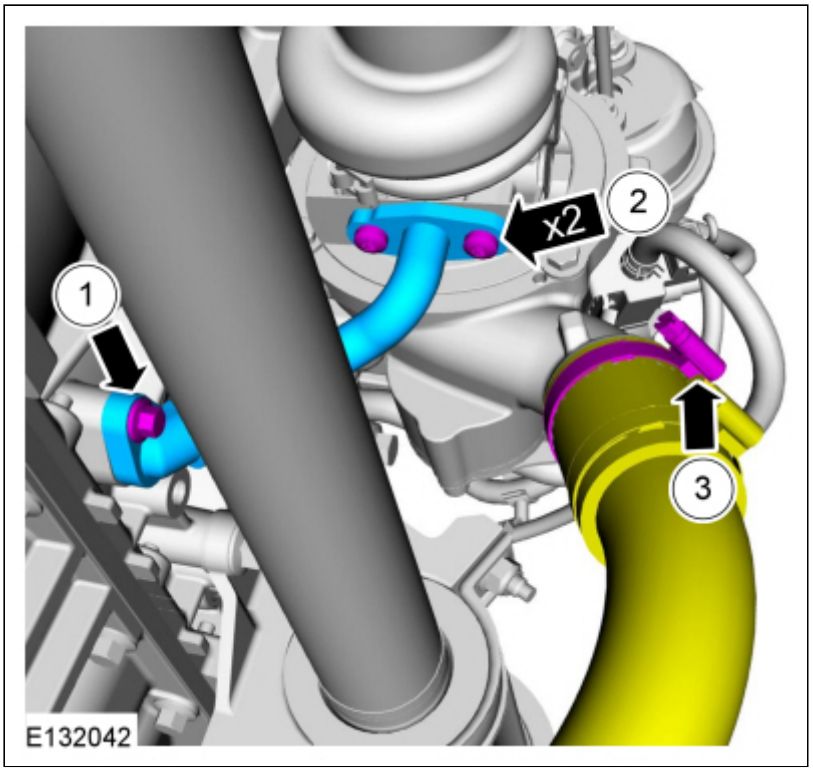
Other color coding

- Alternating Blue and White
  - Chemical, adhesive or sealer apply areas
- Red
  - Sectioned or cut-away areas
- Grey
  - Background components shown for location information

ILLUSTRATION TASK SEQUENCE

Components that must be removed or installed in a specific sequence are identified with a numbered callout. Any associated step text is numbered accordingly.

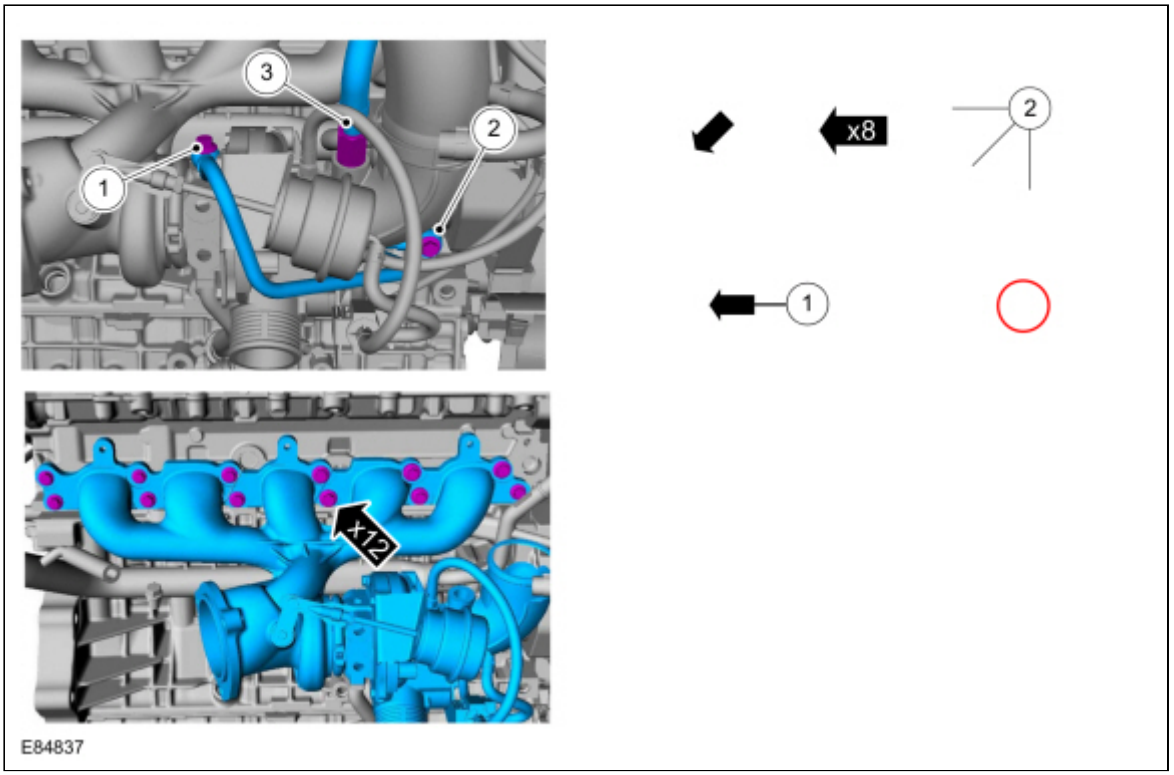
Simple procedure example showing color-coding and task sequence.



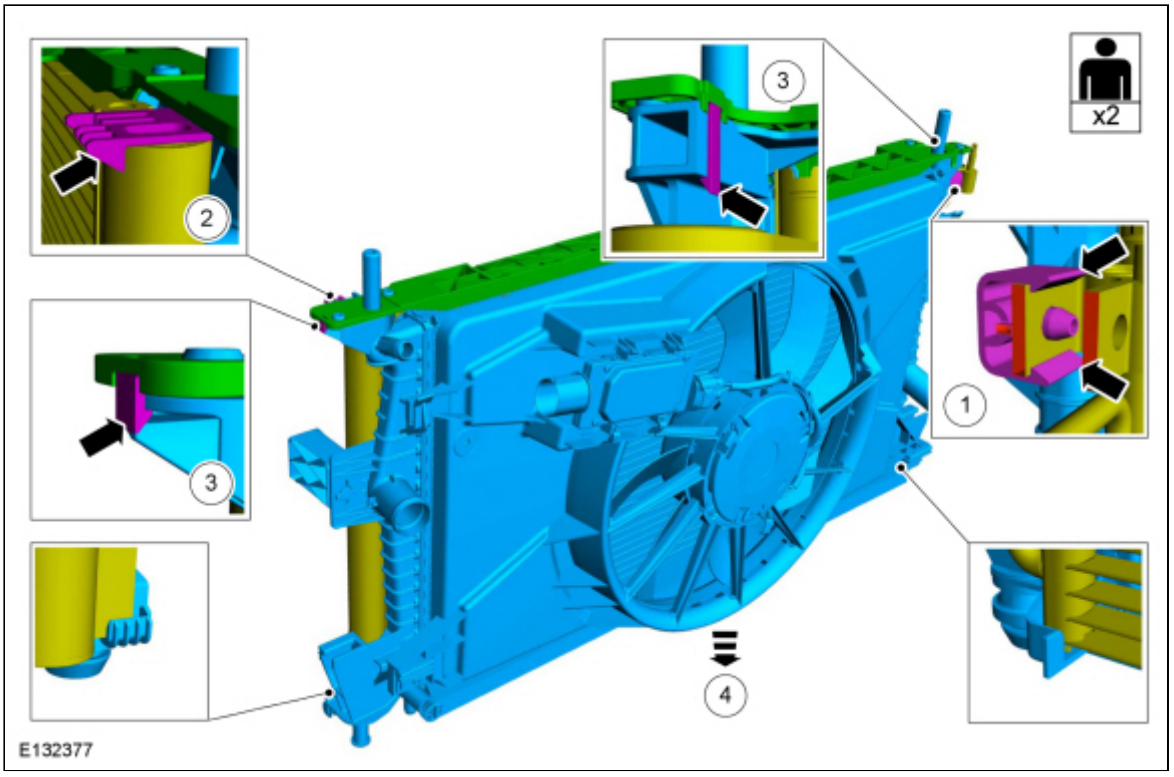
Black arrows are used to draw attention to components (usually fasteners). Arrows with multiples specified (here, x2) identify an identical number of fasteners or items. Callouts (numbers inside circles) show a required sequence or tightening torque.

In the illustration, the callouts indicate the removal sequence, **which is reversed for installation**. The yellow coloring of the hose indicates it is to be positioned aside (not removed). Two identical (magenta-colored) fasteners are indicated by the x2 arrow. The fasteners in this illustration require different torques (same torque for the x2 fasteners) so numbered callouts are used to identify them with torque values in the associated step text. The (magenta-colored) hose clamp is another fastener to be removed.

Examples of fastener removal sequence and an identical service action for 12 fasteners. Other possible symbols are shown on the right.



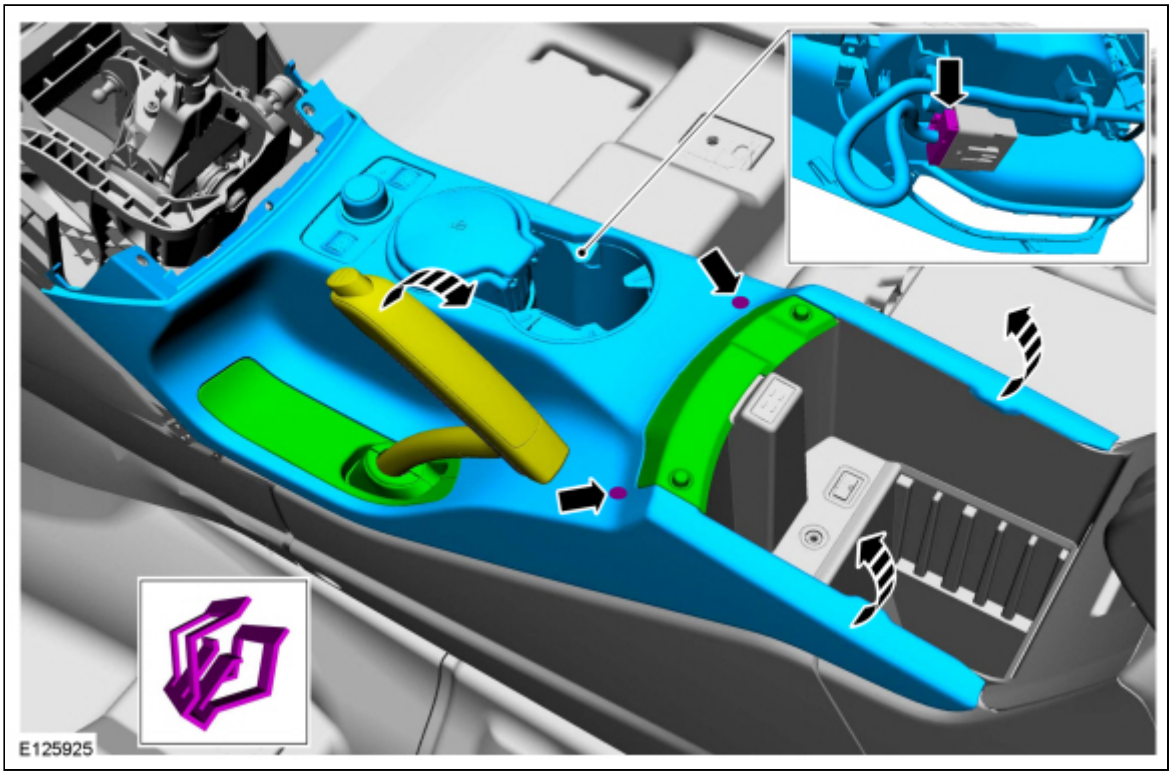
Example of fastener sequence information with two persons required for the service action

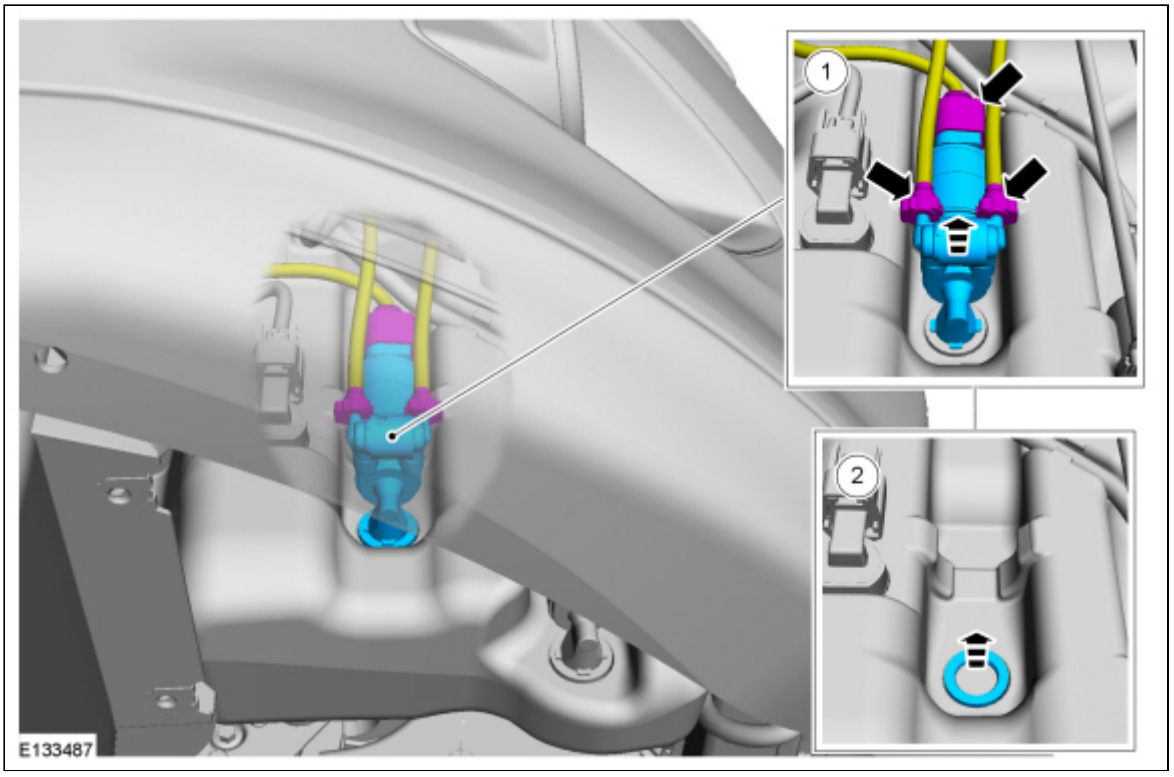


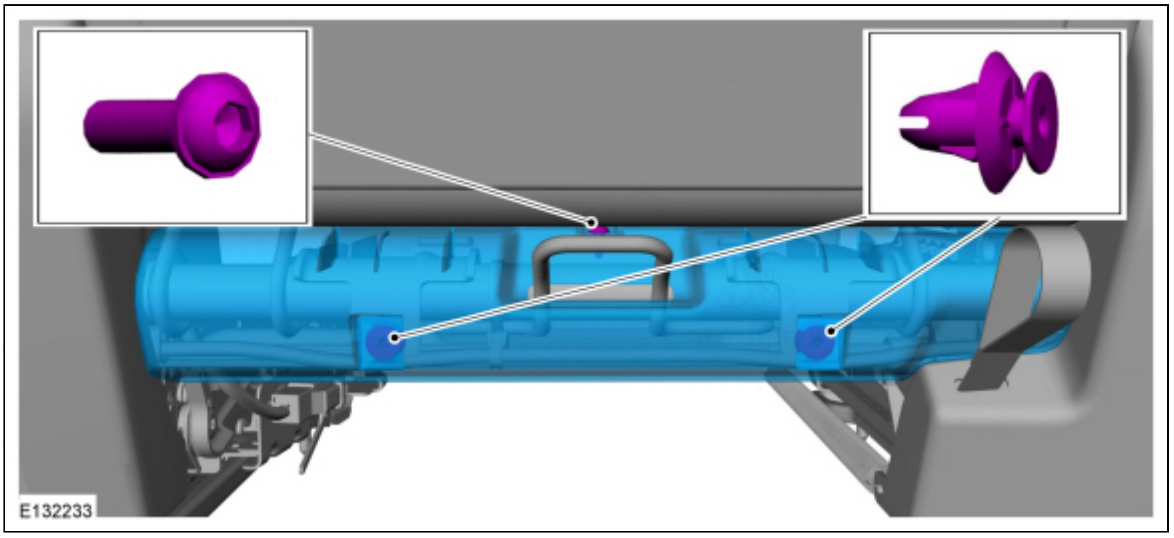
HIDDEN DETAILS

Separate detail boxes or transparent components may be used to show hidden items in an illustration.

Example of hidden fastener information



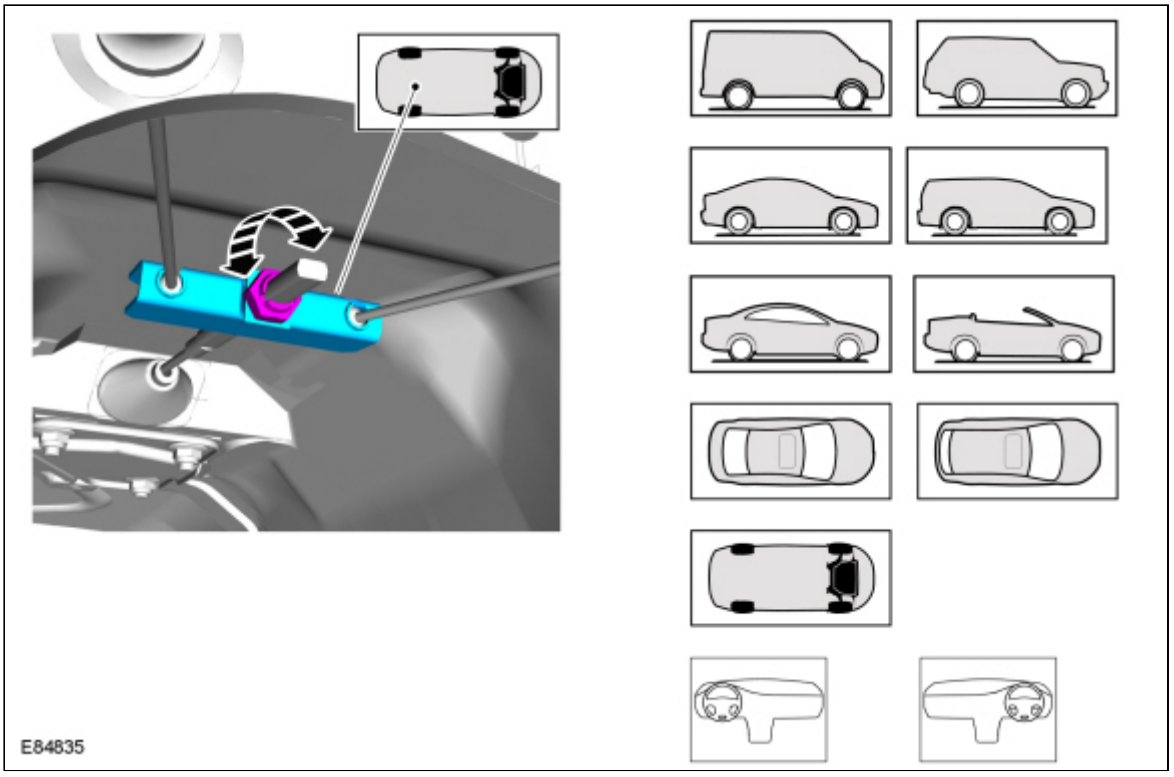




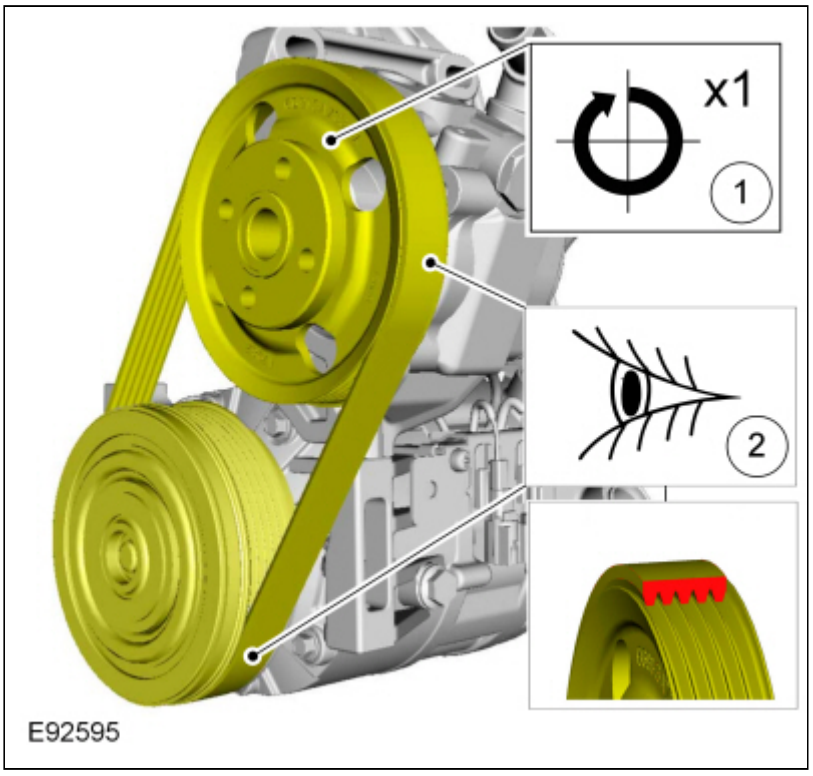
SERVICE ACTION ICONS

Service action icons may be used to add information regarding the required action.
For additional information, refer to: Symbols Glossary (100-00 General Information, Description and Operation).

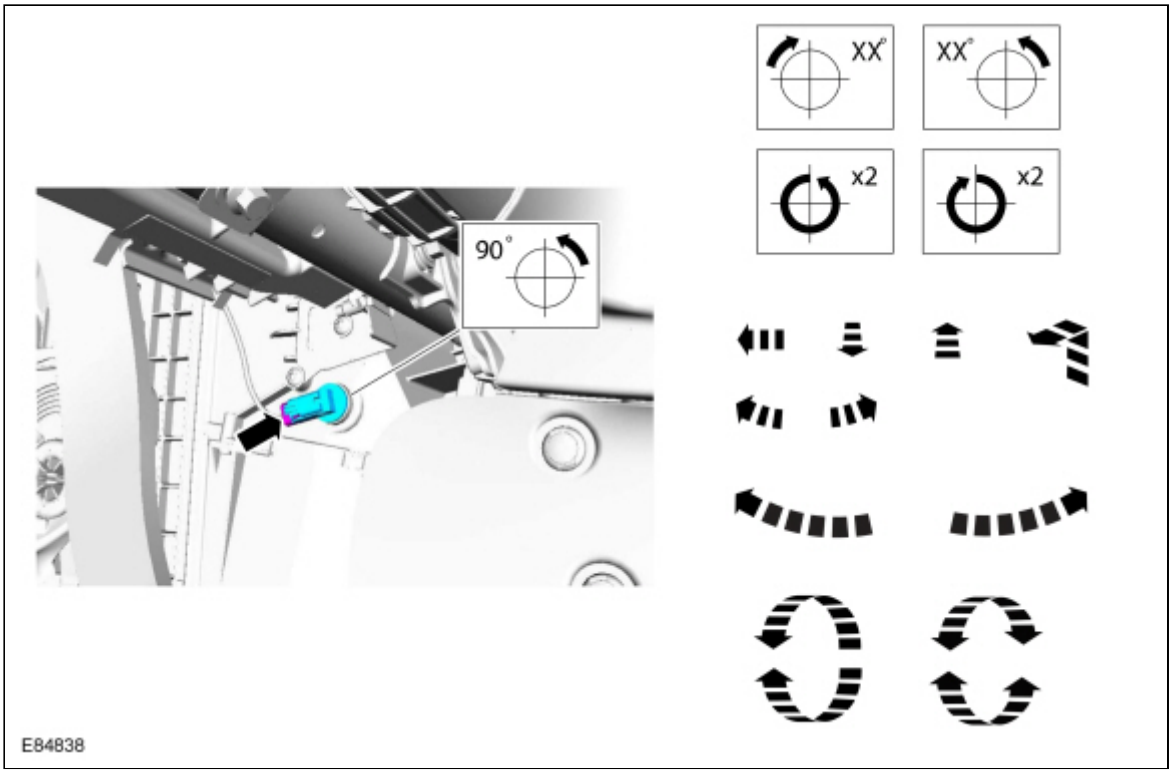
Location symbols show the location of a component or system on the vehicle.



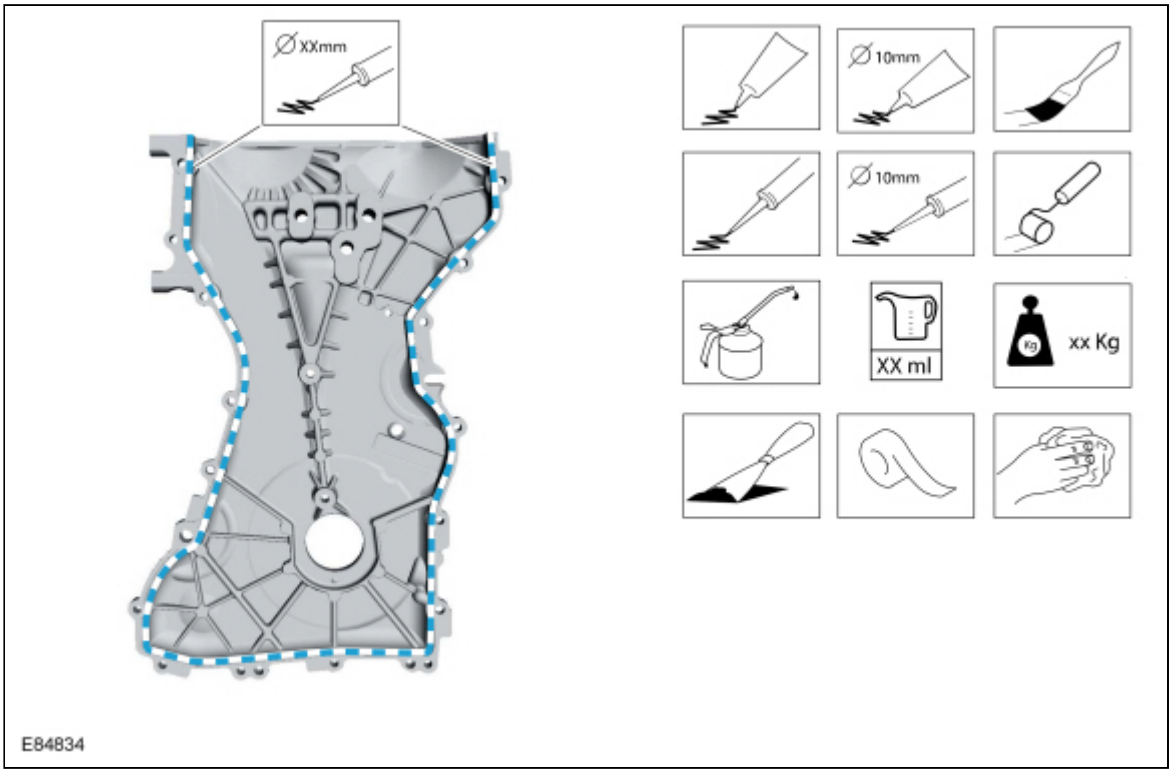
Example of service action icons pointing to highlighted components.



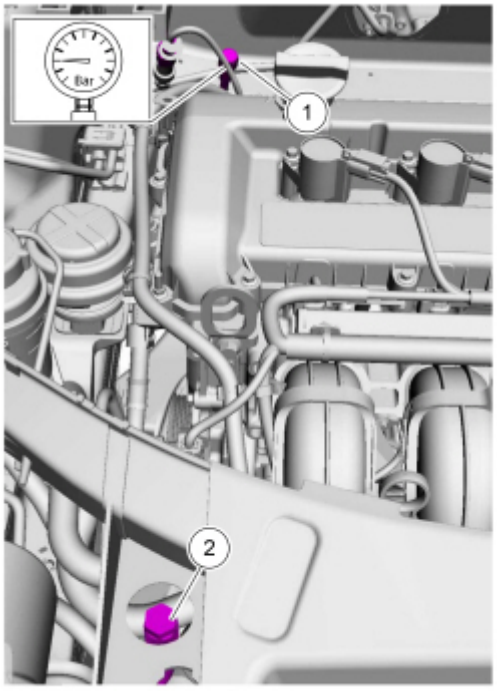
Movement arrows and service action icons show three dimensional or rotational movements.

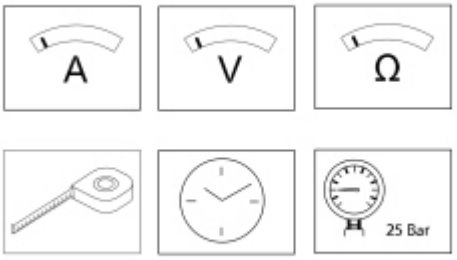


Instruction symbols are used to apply sealer, lubricant, weight, tape or cleaning detergent to a component.



Measurement symbols provide the information required to perform a specific measurement. These symbols may include specific values.



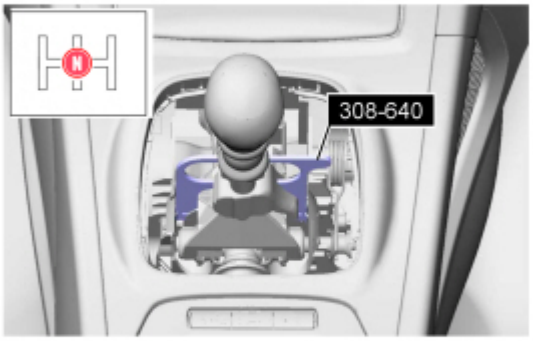


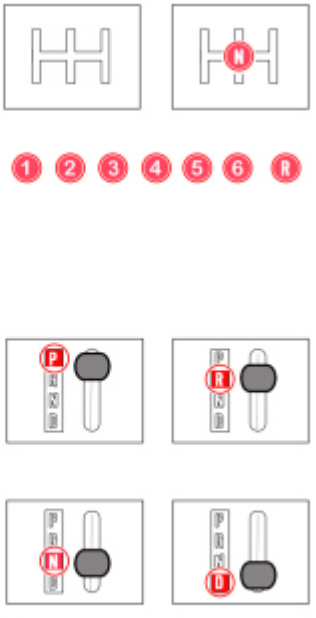
E84841

SPECIAL TOOLS, EQUIPMENT, MATERIALS AND TORQUE VALUES

When Ford special tools are required for the procedure, the tool and tool number are shown in an illustration. Special tool numbers, general equipment, materials or torque values for the procedure step are shown in the text steps.

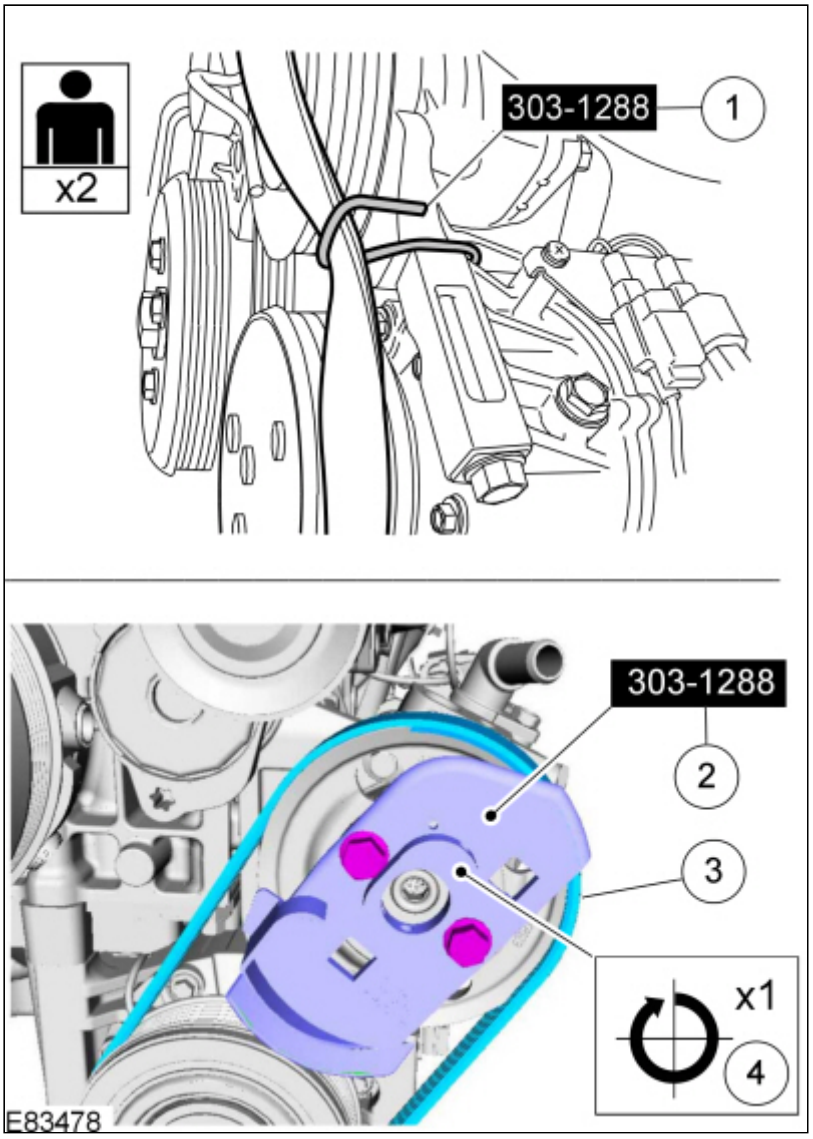
Example of special service tool and symbol used to hold the gear shift in the required gear position. Other possible symbols are shown on the right.



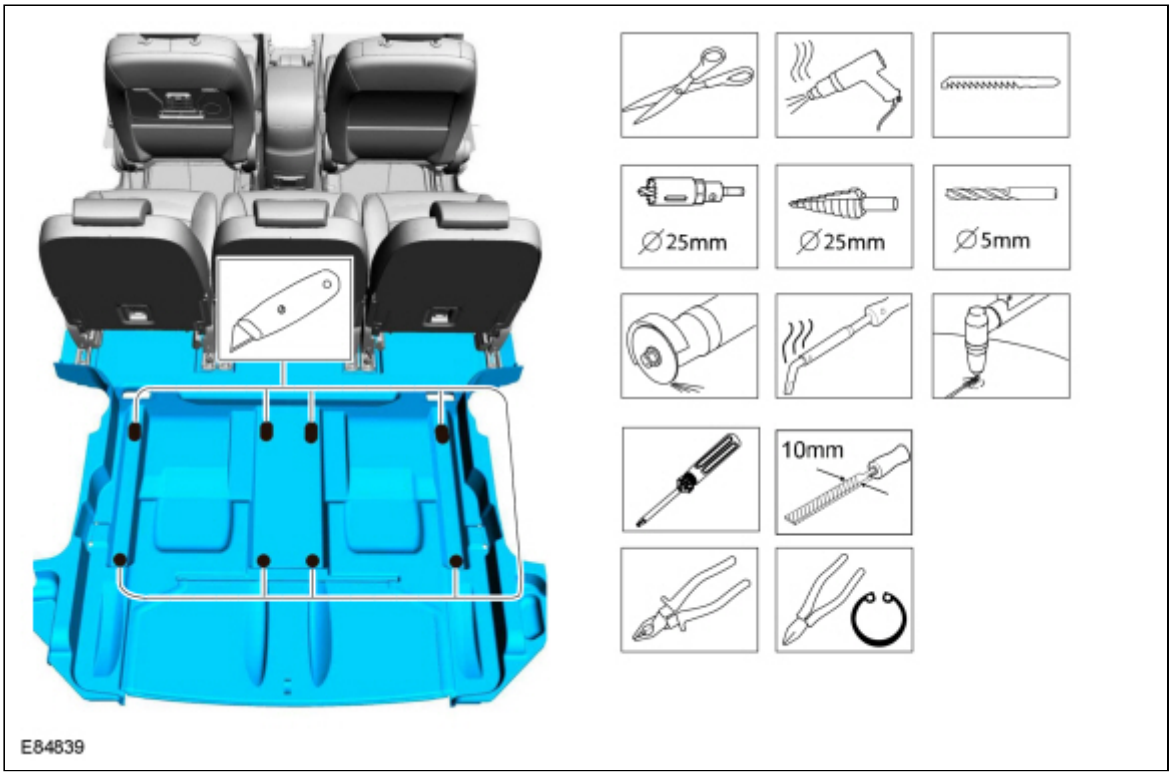


E84836

Example of two illustrations used together with sequence steps, service action icons and special service tools



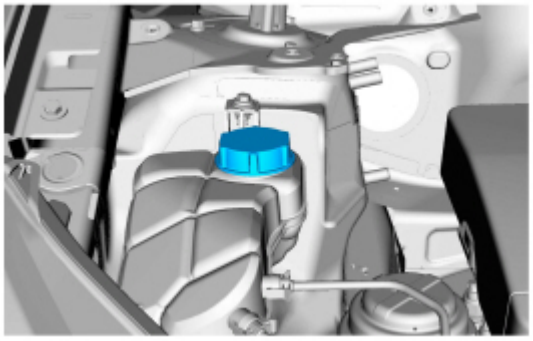
Tool symbols direct the use of standard tools. The tool size or dimension may be specified.



HEALTH AND SAFETY SYMBOLS

Some procedures may contain health and safety symbols that are associated with a specific service action. For additional information, refer to: Symbols Glossary (100-00 General Information, Description and Operation). Always read and understand all health and safety precautions found in Section 100-00 before beginning any procedure. For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

ISO warning symbols may be used to indicate potential hazards.

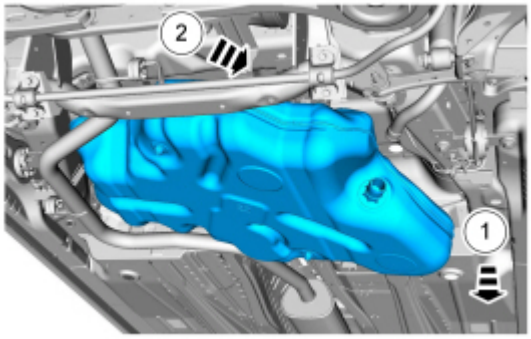


3. 



E85028

These symbols prohibit various hazardous actions

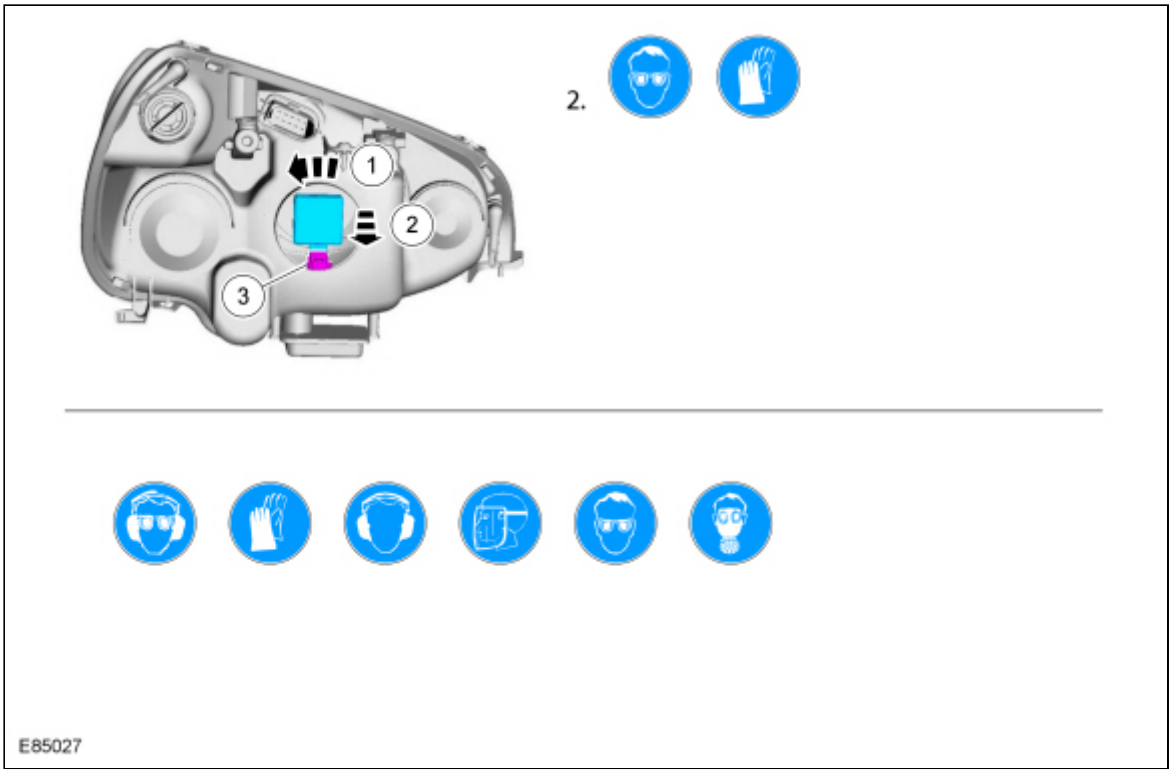


4. 



E85026

These symbols direct the use of personal protection equipment



Diagnosis and Testing Information

ELEMENTS OF DIAGNOSIS AND TESTING

Diagnosis and Testing may include:

- Preliminary Inspection
  - In older manuals, Inspection and Verification
- Symptom Chart
- DTC Chart
- Pinpoint Tests
- Component Tests

Some diagnostics may be contained in Symptom Based Diagnostics. Some engine performance and emission diagnostics may be placed in a separately published PC/ED manual.

MODULE NAMES MATCH THE DIAGNOSTIC SCAN TOOL

Module names and PID names in this manual match the Ford diagnostic scan tool: IDS.

The same diagnostic scan tool module name is found in some DTC definitions (for example, U024B Lost Communication with Seat Control Module "G").

MODULE DESCRIPTIVE NAMES

A descriptive name is sometimes added to the diagnostic scan tool name to clarify module function. The descriptive name will be followed by the diagnostic scan tool acronym in brackets.

- Example: “Driver Active Motion Seat Module [SCMG]”.
- Driver Active Motion Seat Module is the descriptive name added to clarify the function of the SCMG.
- The SCMG acronym is used by diagnostic scan tool, defined as “Seat Control Module G”.

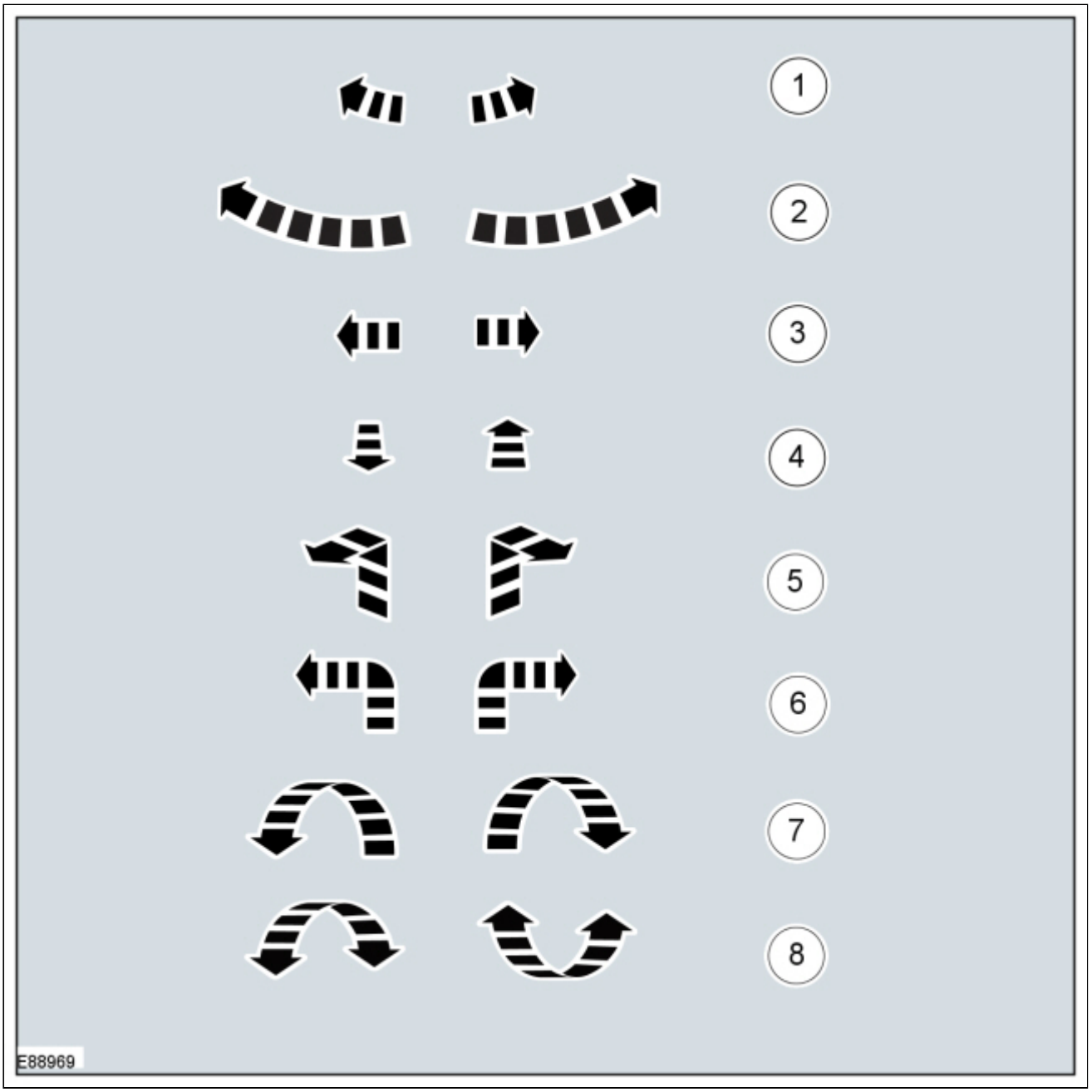
Copyright © 2016 Ford Motor Company

Symbols Glossary

Symbols are used inside the graphics and in the text area to enhance the information display.

Movement Symbols

Movement symbols provide detailed information to a required component movement. These component movements can be rotational or 1-3 dimensional movements.

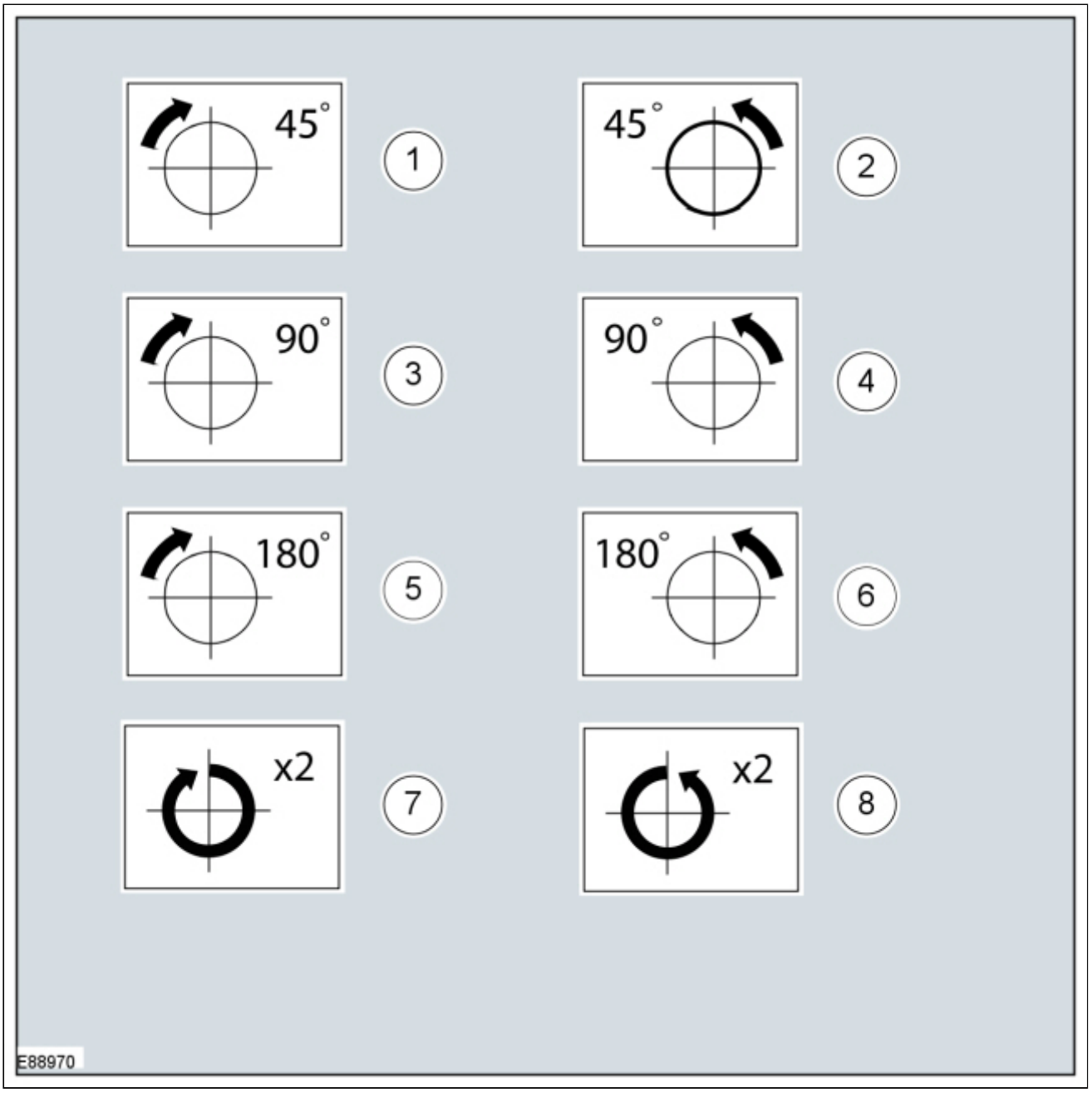


Item	Part Number	Description
1	—	Minor component movement clockwise/counterclockwise
2	—	Major component movement clockwise/counterclockwise
3	—	Component movement to the left/right/up/down
4	—	Component movement towards/away
5	—	3 dimensional component movement

6	—	2 dimensional component movement
7	—	3 dimensional component rotation
8	—	3 dimensional component cycling

Turn Symbols

Turn symbols are used to provide further information on the direction or angle of component turns.

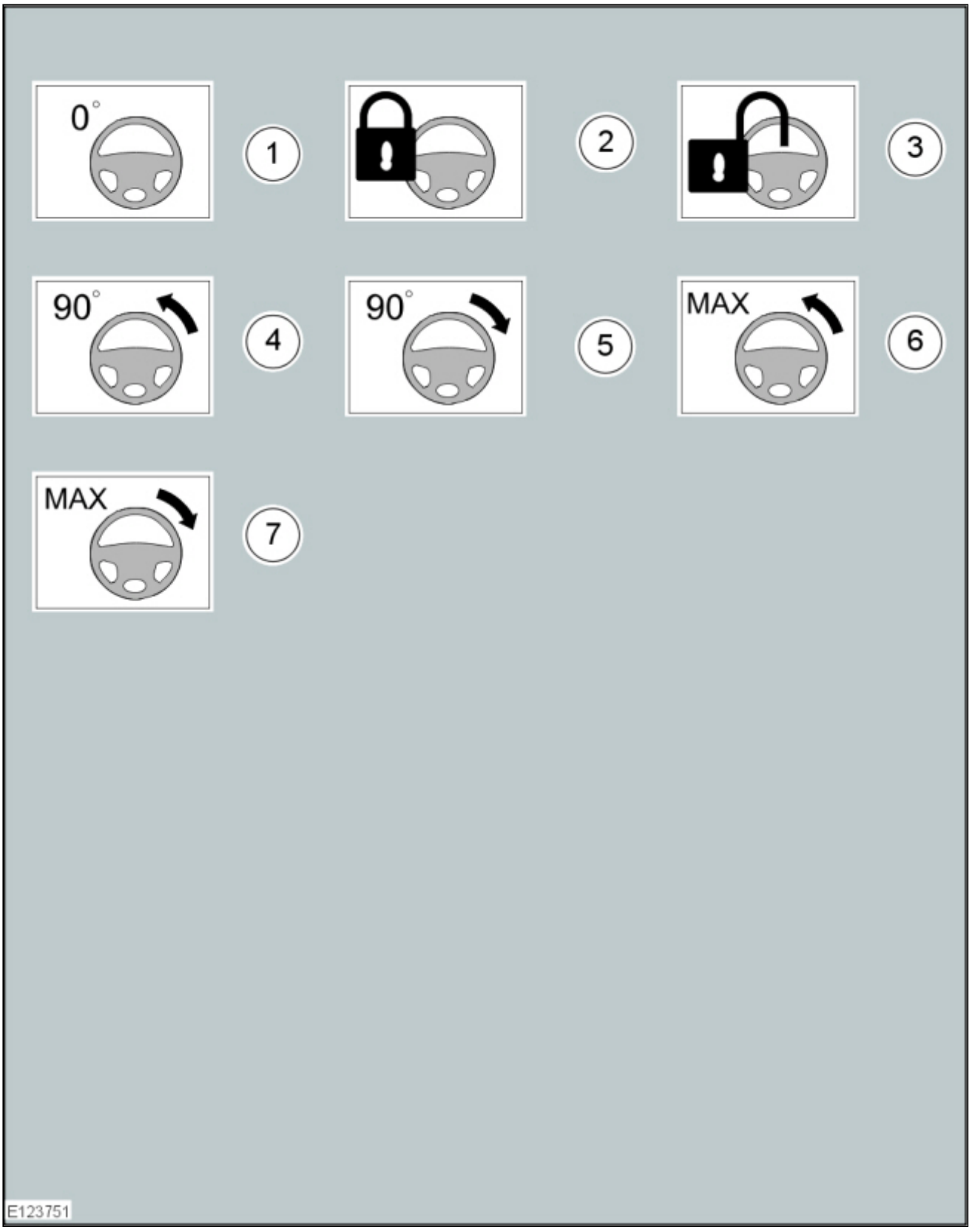


Item	Part Number	Description
1	—	Turn the component clockwise through 45°
2	—	Turn the component counterclockwise through 45°
3	—	Turn the component clockwise through 90°
4	—	Turn the component counterclockwise through 90°
5	—	Turn the component clockwise through 180°
6	—	Turn the component counterclockwise through 180°
7	—	Turn the component clockwise through 2 complete turns
8	—	Turn the component counterclockwise through 2 complete

		turns

Steering Wheel Symbols

Steering wheel symbols are used to provide further information to a required steering wheel position or steering column lock status.

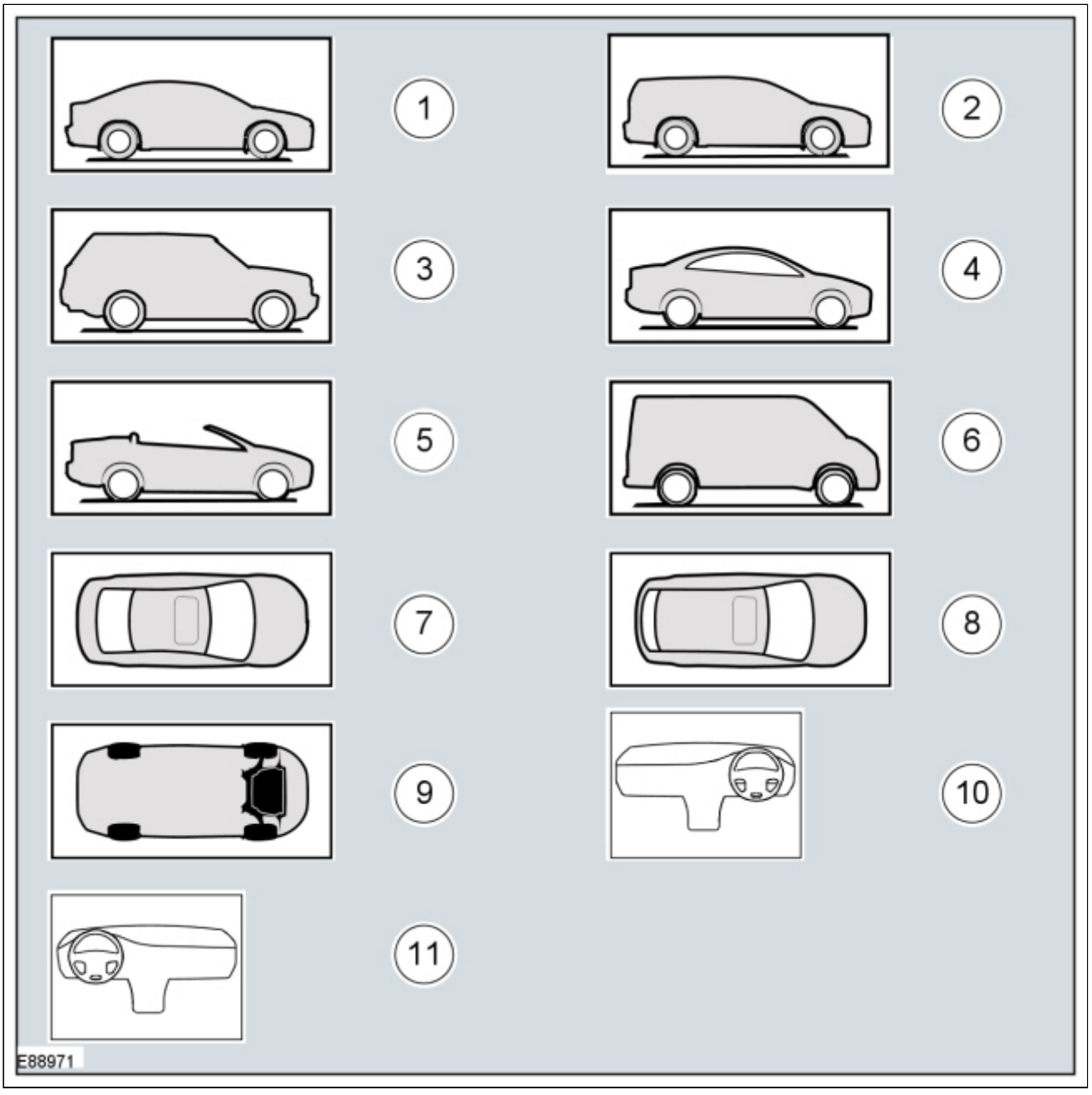


Item	Part Number	Description
1	—	Steering wheel in straight ahead position
2	—	Steering column lock locked

3	—	Steering column lock unlocked
4	—	Turn the steering wheel to the 90° left position
5	—	Turn the steering wheel to the 90° right position
6	—	Turn the steering wheel to the left-hand end position
7	—	Turn the steering wheel to the right-hand end position

Body Types

Body type symbols are used to identify different body configurations.

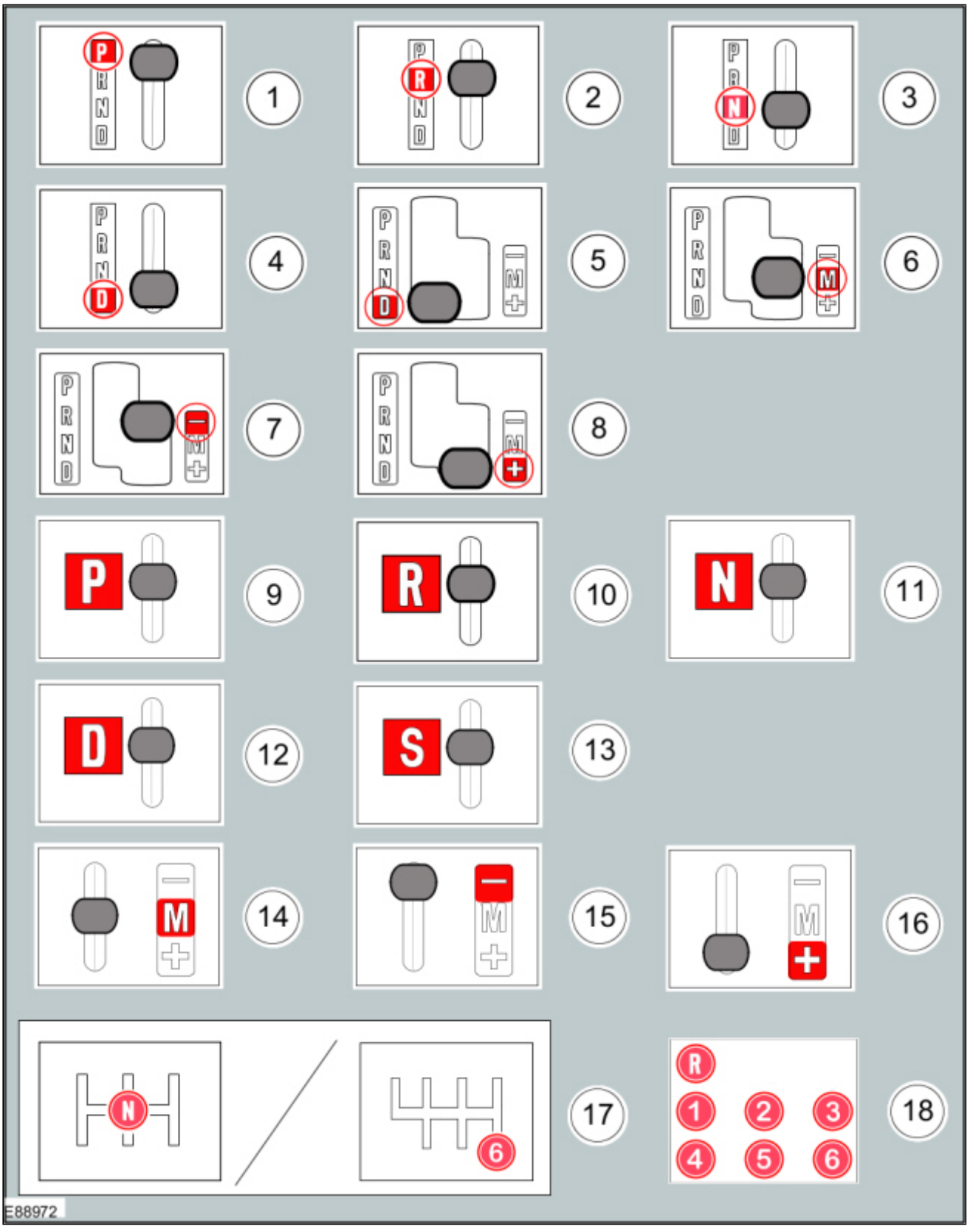


Item	Part Number	Description
1	—	3, 4, 5-door body style
2	—	Wagon body style
3	—	Sports utility vehicle body style
4	—	Coupe body style
5	—	Convertible body style
6	—	Van body style

7	—	3, 4, 5-door body style - Top View
8	—	Wagon body style - Top View
9	—	Underview
10	—	Right-hand drive (RHD) vehicle
11	—	Left-hand drive (LHD) vehicle

Gearshift lever and selector lever position symbols

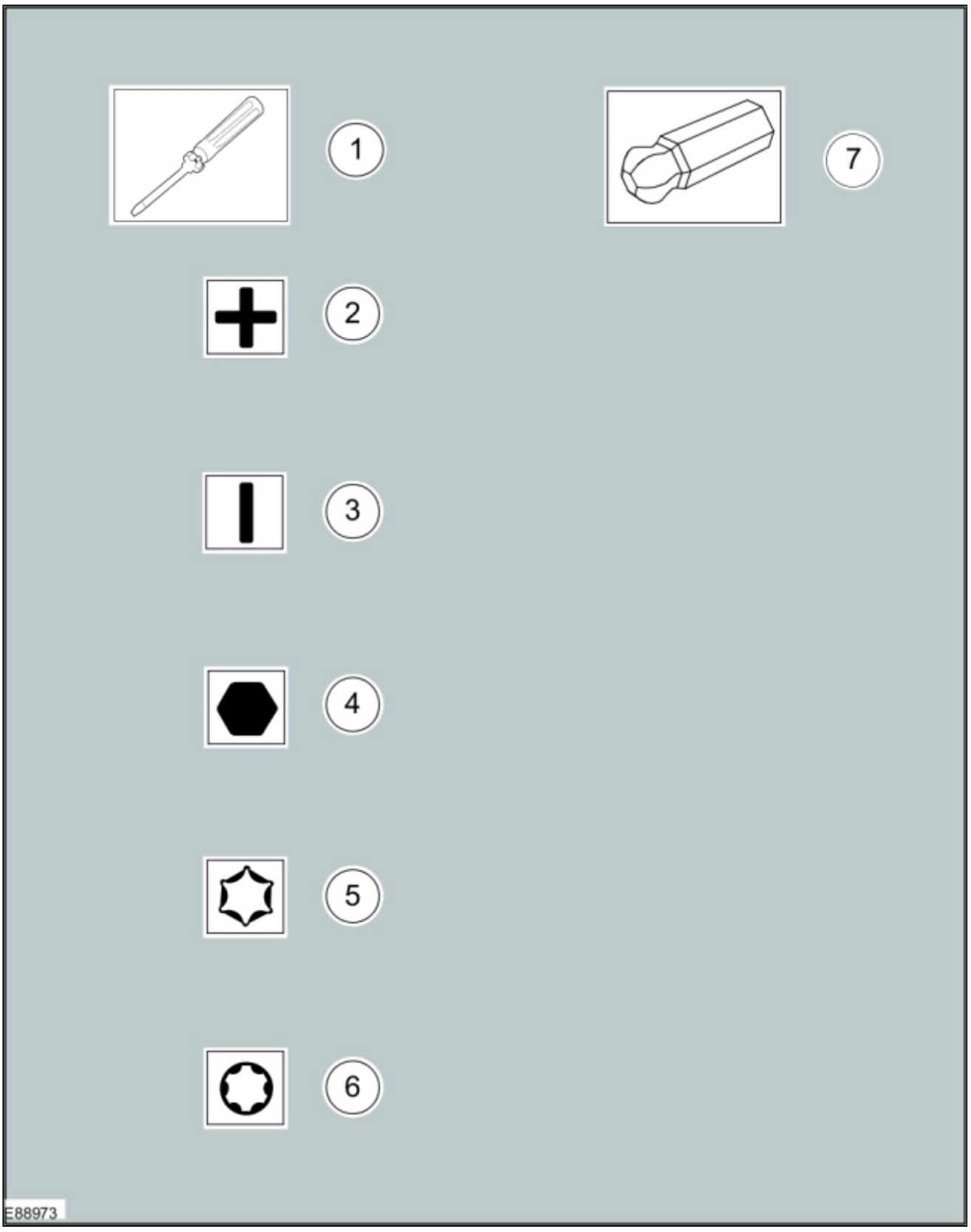
Gearshift lever and selector lever position symbols are used to show the lever position that is required to be selected to carry out a procedure step.



Item	Part Number	Description
1	—	Replaced by symbol 9
2	—	Replaced by symbol 10
3	—	Replaced by symbol 11
4	—	Replaced by symbol 12
5	—	Replaced by symbol 12
6	—	Replaced by symbol 14
7	—	Replaced by symbol 15
8	—	Replaced by symbol 16
9	—	Set the selector lever to the park (P) position
10	—	Set the selector lever to the reverse (R) position
11	—	Set the selector lever to the neutral (N) position
12	—	Set the selector lever to the drive (D) position
13	—	Set the selector lever to the drive (S) position
14	—	Set the selector lever to the drive (M) position
15	—	Set the selector lever to the drive (-) position
16	—	Set the selector lever to the drive (+) position
17	—	Set the gearshift lever to the neutral (N) position
18	—	Further gearshift lever positions that may appear in illustrations

Screwdriver symbols

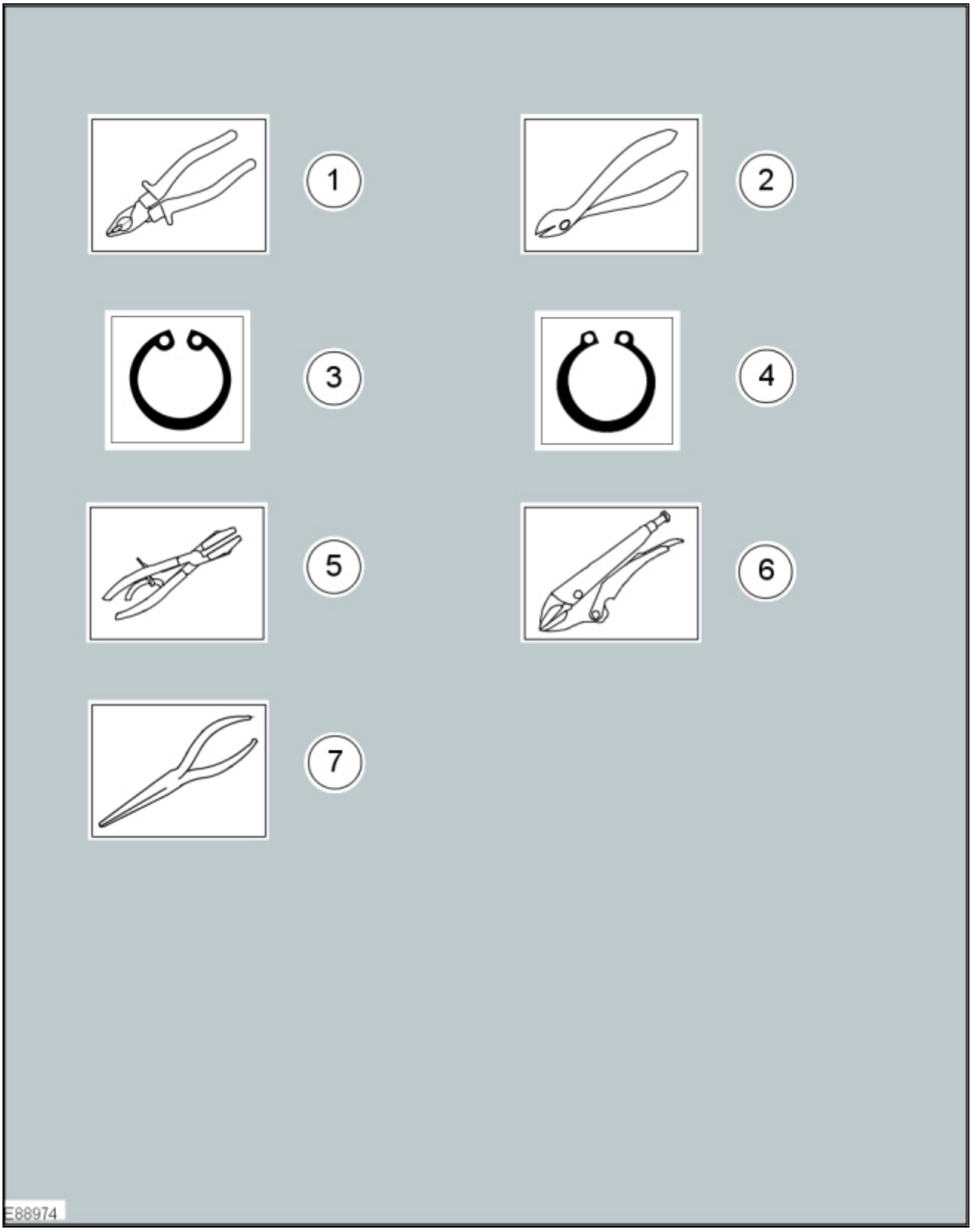
The screwdriver symbols are used to show which screwdriver bit is recommended to carry out a procedure step.



Item	Part Number	Description
1	—	Screwdriver
2	—	Cross bladed screwdriver / Cross bladed Bit Socket
3	—	Flat bladed screwdriver / Flat bladed Bit Socket
4	—	Hexagonal screwdriver / Hexagonal Bit Socket
5	—	TORX screwdriver / TORX Bit Socket
6	—	Polydrive screwdriver / Polydrive Bit Socket
7	—	Ball drive hex bit

Pliers symbols

The pliers symbols are used to show which pliers is recommended to carry out a procedure step.

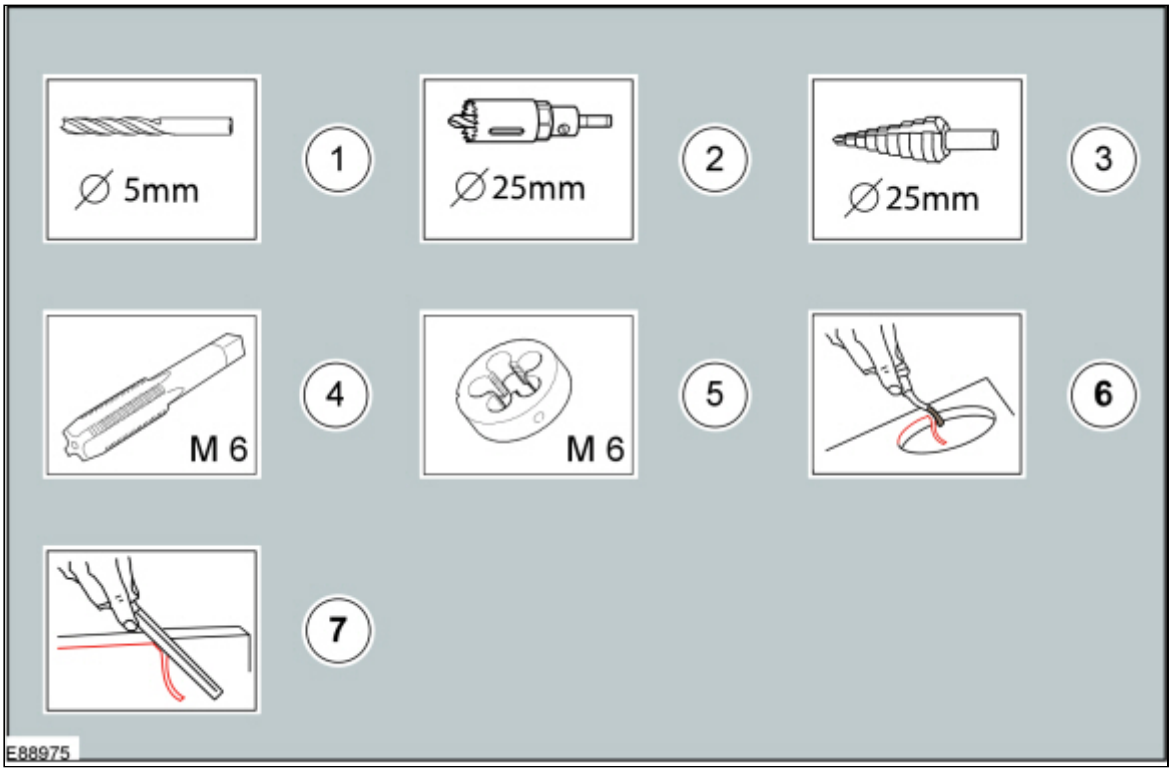


Item	Part Number	Description
1	—	Combination pliers
2	—	Side cutter pliers
3	—	Securing ring - inner
4	—	Securing ring - outer

5	—	Hose clamp pliers
6	—	Locking pliers
7	—	Long nose pliers

Drill symbols

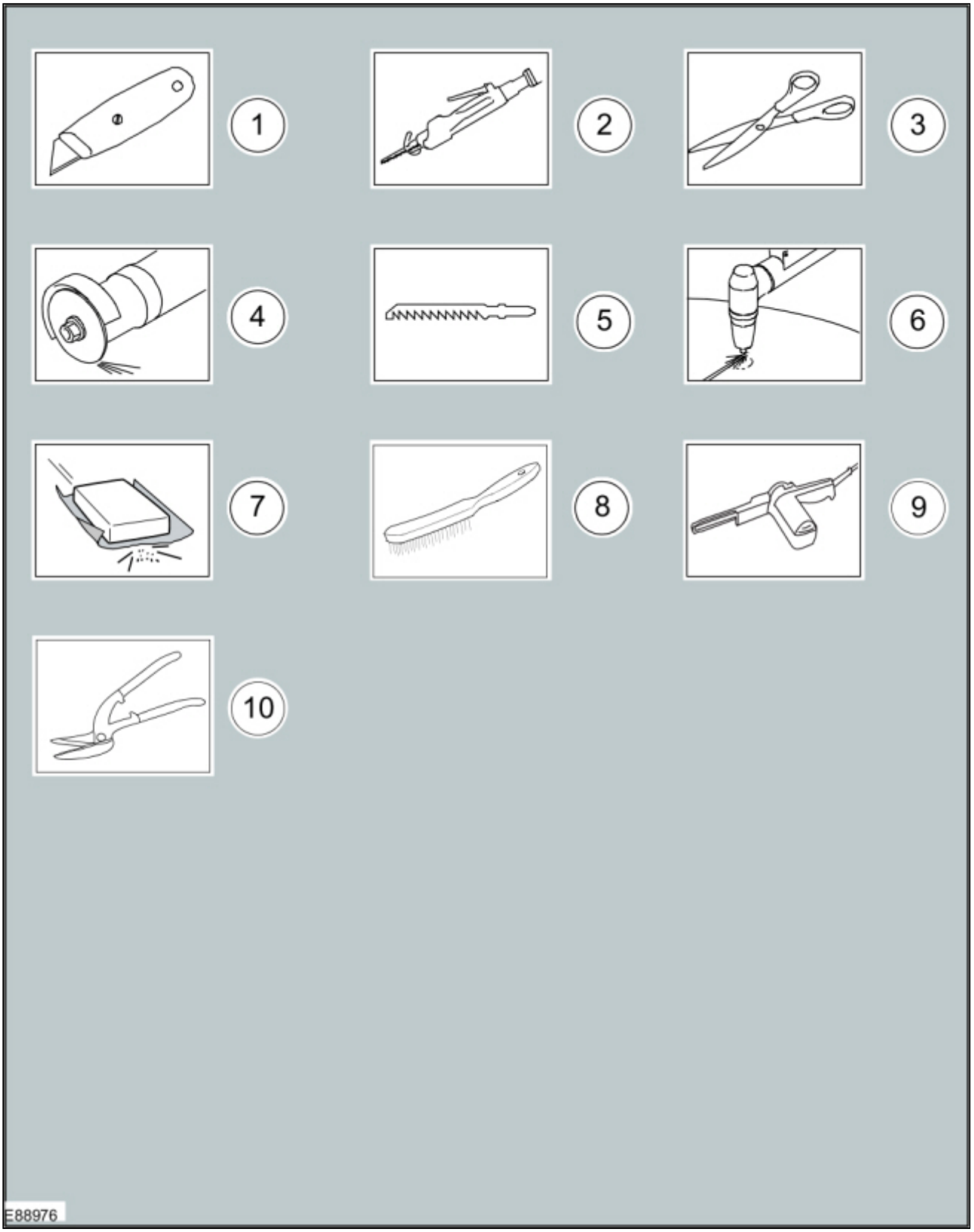
The drill symbols are used to show which type and size of drill bit is recommended to carry out a procedure step.



Item	Part Number	Description
1	—	Drill bit with a specified diameter
2	—	Hole saw with a specified diameter
3	—	Stepped drill bit with a specified diameter
4	—	Tap with a specified diameter
5	—	Die with a specified diameter
6	—	Scraper for circular holes
7	—	Scraper for straight edges

Cutting tool symbols

The cutting tool symbols are used to show which type of cutting tool is recommended to carry out a procedure step.

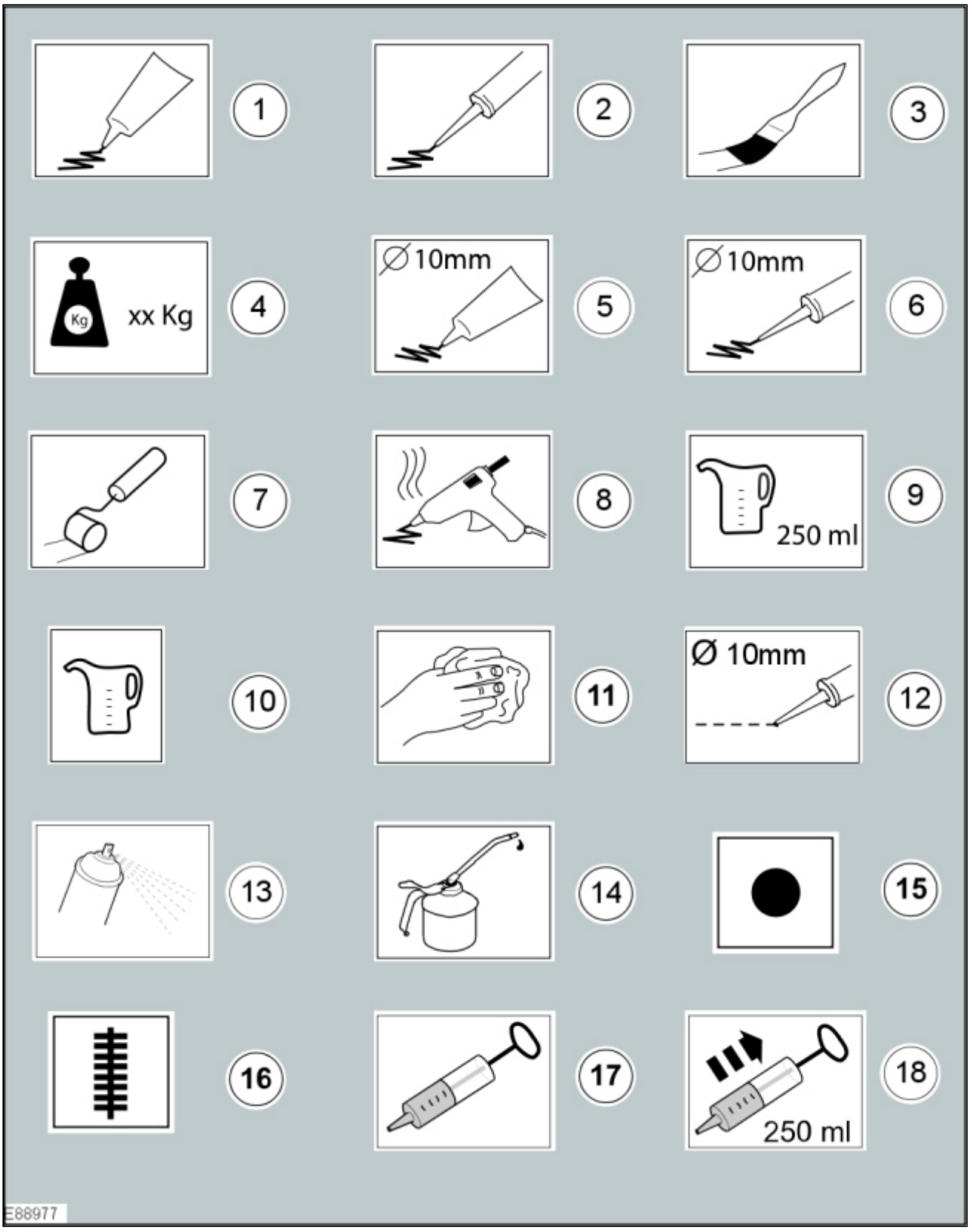


Item	Part Number	Description
1	—	Cutting knife
2	—	Air body saw
3	—	Scissors
4	—	Grinder
5	—	Jig saw
6	—	Plasma cutter
7	—	Sanding Paper

8	—	Wire brush
9	—	Belt Sander
10	—	Tin Snipes

Apply Chemical or load symbols

The apply chemical or load symbols are used to show where to apply which type of chemical or load to carry out a procedure step.

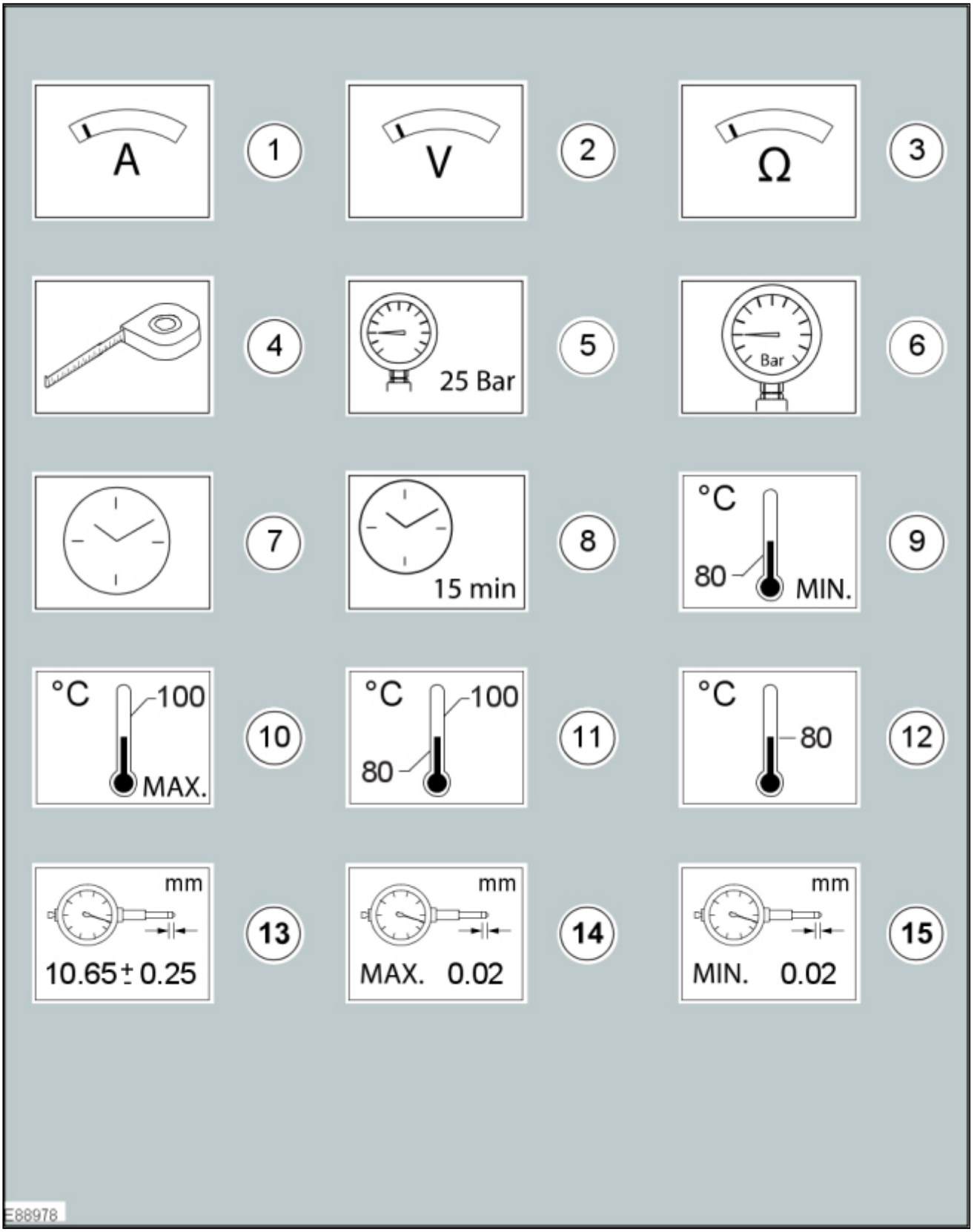


Item	Part Number	Description

1	—	Apply the substance from the specified tube
2	—	Apply the substance from the specified cartridge
3	—	Apply the specified chemical with a brush
4	—	Apply the specified load to the specified component
5	—	Apply a bead with a specific diameter from the specified tube
6	—	Apply a bead with a specific diameter from the specified cartridge
7	—	Apply the specified chemical with a roller
8	—	Apply hot glue to the specified component
9	—	Apply the specified amount of fluid from the fluid can
10	—	Apply fluid from the fluid can
11	—	Clean the specified component with the specified material
12	—	Apply a broken bead from the specified tube
13	—	Apply the specified chemical from a spray can
14	—	Apply the specified lubricant to the specified component
15	—	Apply spot welds to the specified component
16	—	Apply a continuous weld to the specified component
17	—	Handle the fluid using a syringe
18	—	Extract the specified amount of fluid using a syringe

Measurement symbols

The measurement symbols are used to show where to measure which type of measurement to carry out a procedure step.

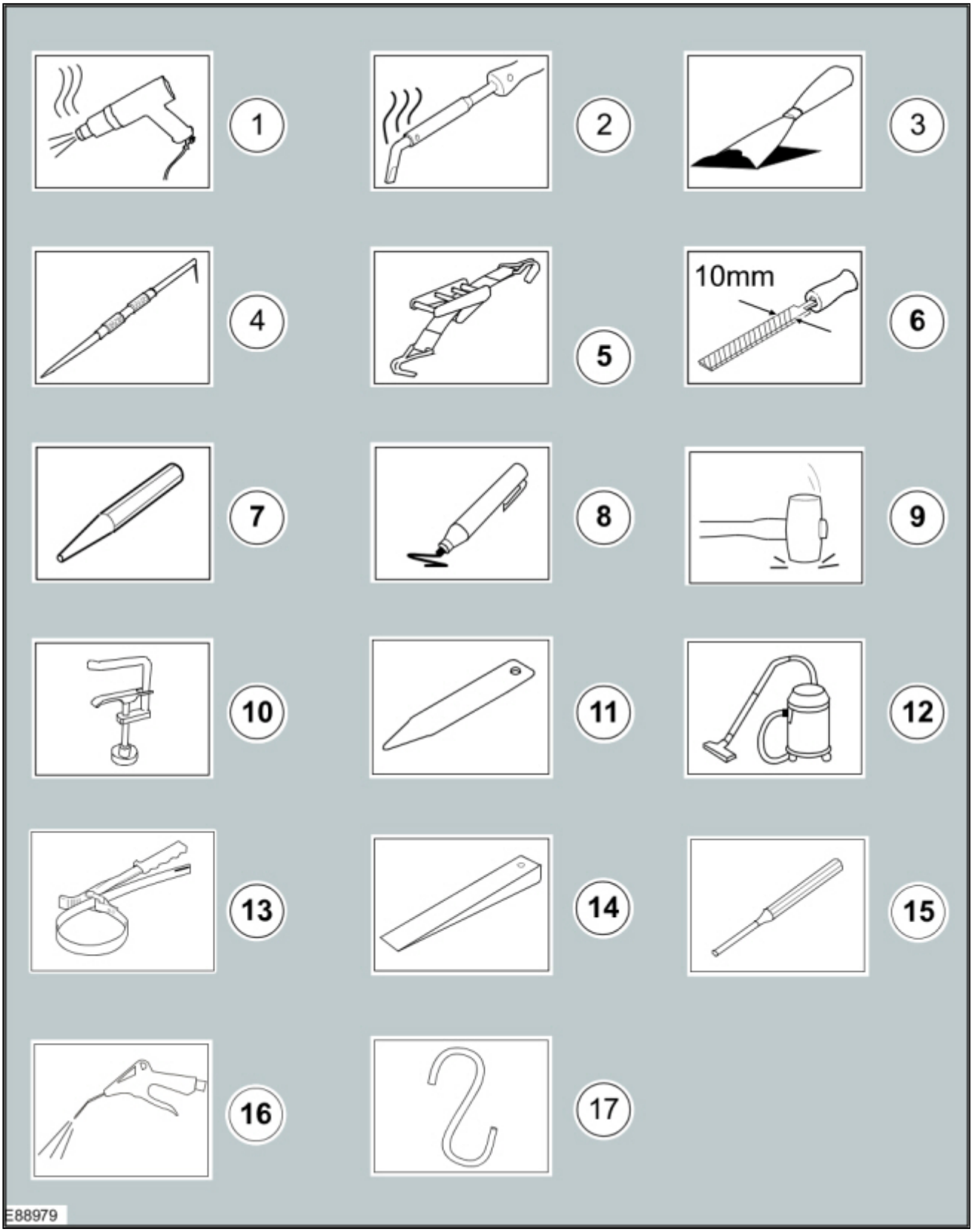


Item	Part Number	Description
1	—	Measure the current using a digital multimeter
2	—	Measure the voltage using a digital multimeter
3	—	Measure the resistance using a digital multimeter
4	—	Measure the length/distance
5	—	Check that the specified pressure is available using a suitable pressure gauge
6	—	Measure the pressure at the specified port using a suitable

		pressure gauge
7	—	Measure the time using a suitable stopwatch
8	—	Wait for the specified period of time
9	—	The specified task requires the specified minimum temperature
10	—	The specified task requires the specified maximum temperature not to be exceeded
11	—	The specified task requires the specified temperature range
12	—	The specified task requires the specified temperature
13	—	Measure and check for the specified value using a dial indicator gauge
14	—	Measure and check for the specified MAX value using a dial indicator gauge
15	—	Measure and check for the specified MIN value using a dial indicator gauge

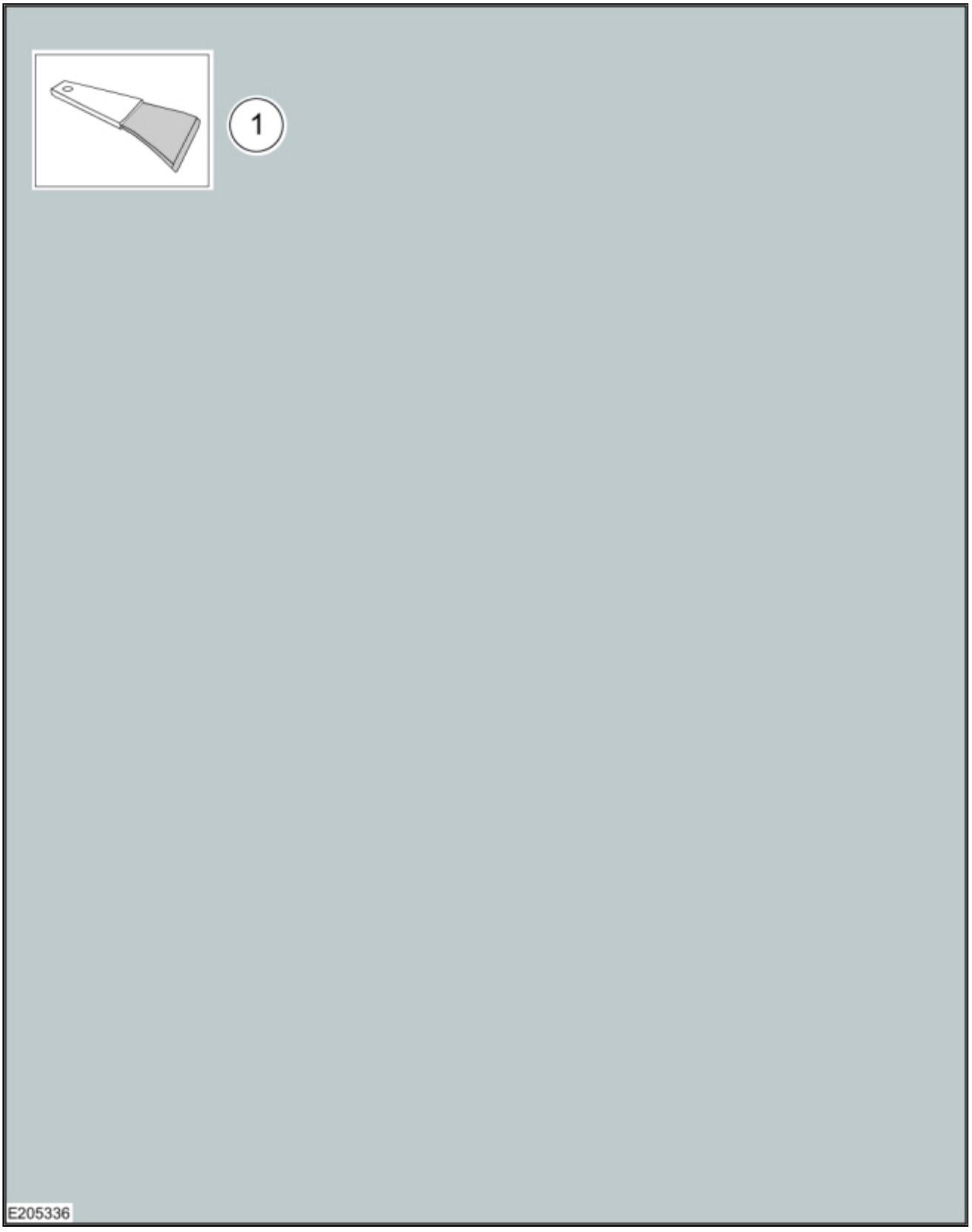
General equipment symbols

The general equipment symbols are used to show where to use which type of general equipment to carry out a procedure step.



Item	Part Number	Description
1	—	Hot air gun
2	—	Soldering iron
3	—	Scraper
4	—	Scriber
5	—	Securing strap
6	—	File with a specified size
7	—	Center punch

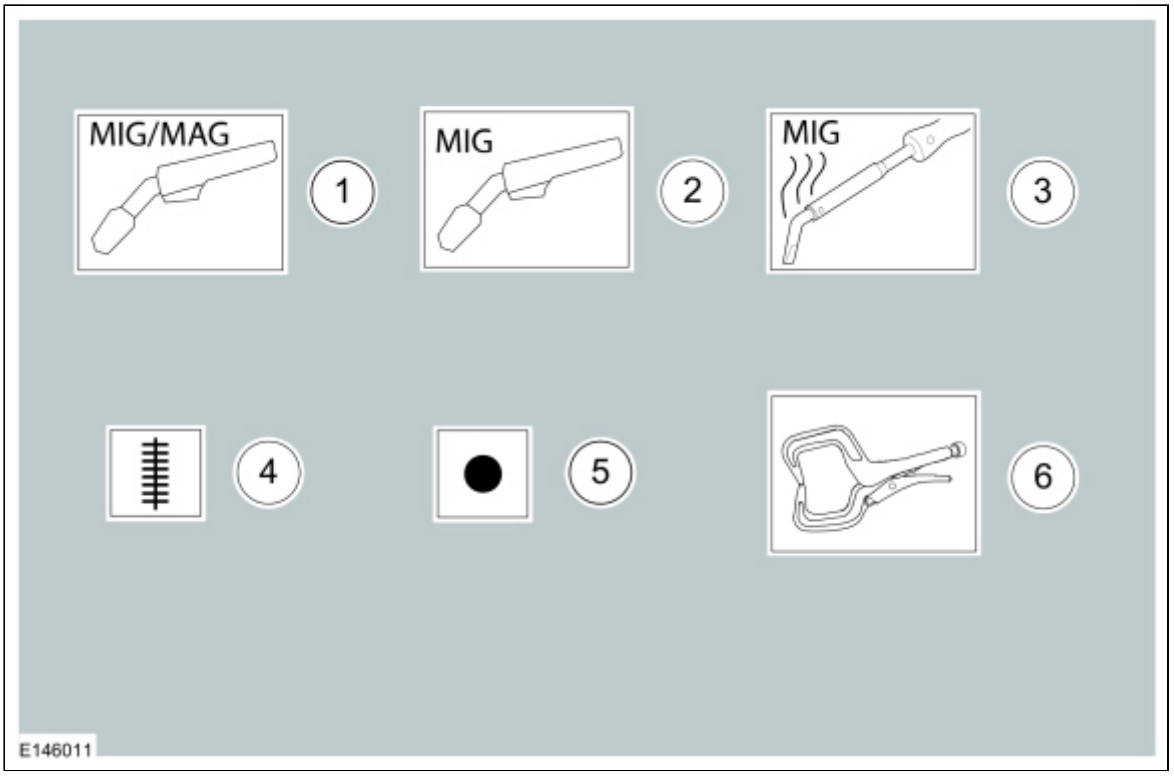
8	—	Marker
9	—	Mallet
10	—	Hose clamp
11	—	Interior trim remover
12	—	Vacuum cleaner
13	—	Strap wrench
14	—	Wedge
15	—	Pin Punch
16	—	Air blow gun
17	—	Relocate and support the component
18	—	C-clamp



Item	Part Number	Description
1	—	Plastic scraper

Welding symbols

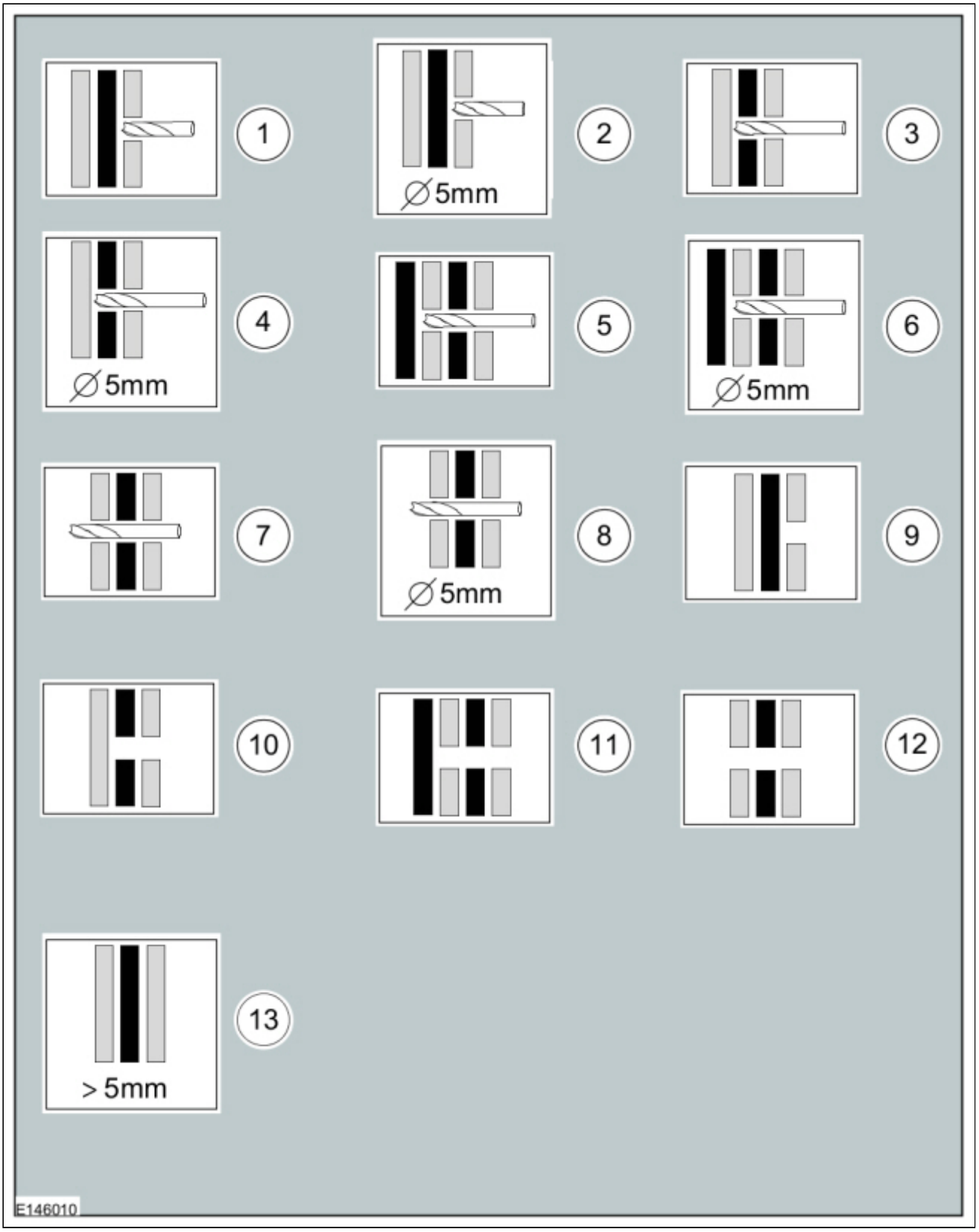
These symbols indicate the type of welding to be used.



Item	Part Number	Description
1	—	Metal inert gas (MIG) / Metal active gas (MAG) welding equipment
2	—	Metal inert gas (MIG) welding equipment
3	—	Metal inert gas (MIG) brazing equipment
4	—	Apply a continuous weld to the specified component
5	—	Apply spot welds to the specified component
6	—	C-clamp

Drilling and grinding symbols

These symbols indicate the type of drilling or grinding to be used.

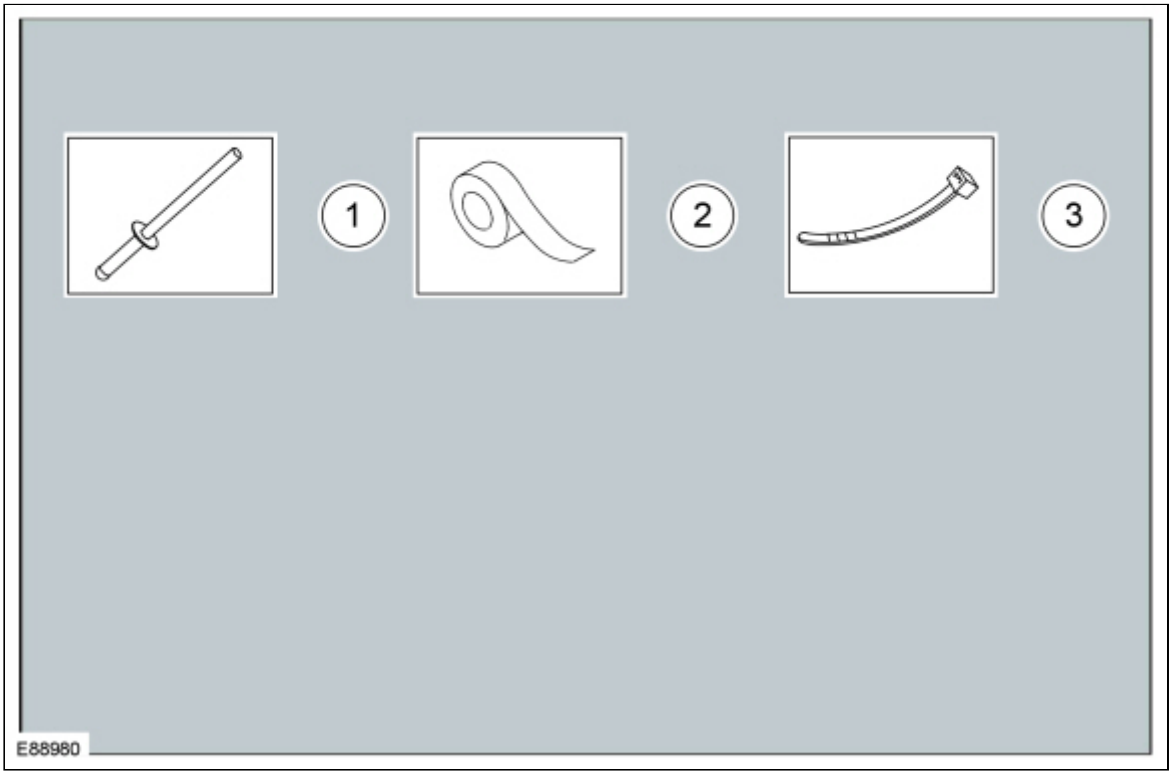


Item	Part Number	Description
1	—	Drill through first body layer with a suitable diameter
2	—	Drill through first body layer with the specified diameter
3	—	Drill through the indicated number of body layers with a suitable diameter
4	—	Drill through the indicated number of body layers with the specified diameter
5	—	Drill through the indicated number of body layers with a suitable diameter

6	—	Drill through the indicated number of body layers with the specified diameter
7	—	Drill through all body layers with a suitable diameter
8	—	Drill through all body layers with the specified diameter
9	—	Grind one layer
10	—	Grind two layers
11	—	Grind to last layer
12	—	Grind all layers
13	—	Material thickness > Xmm

Material symbols

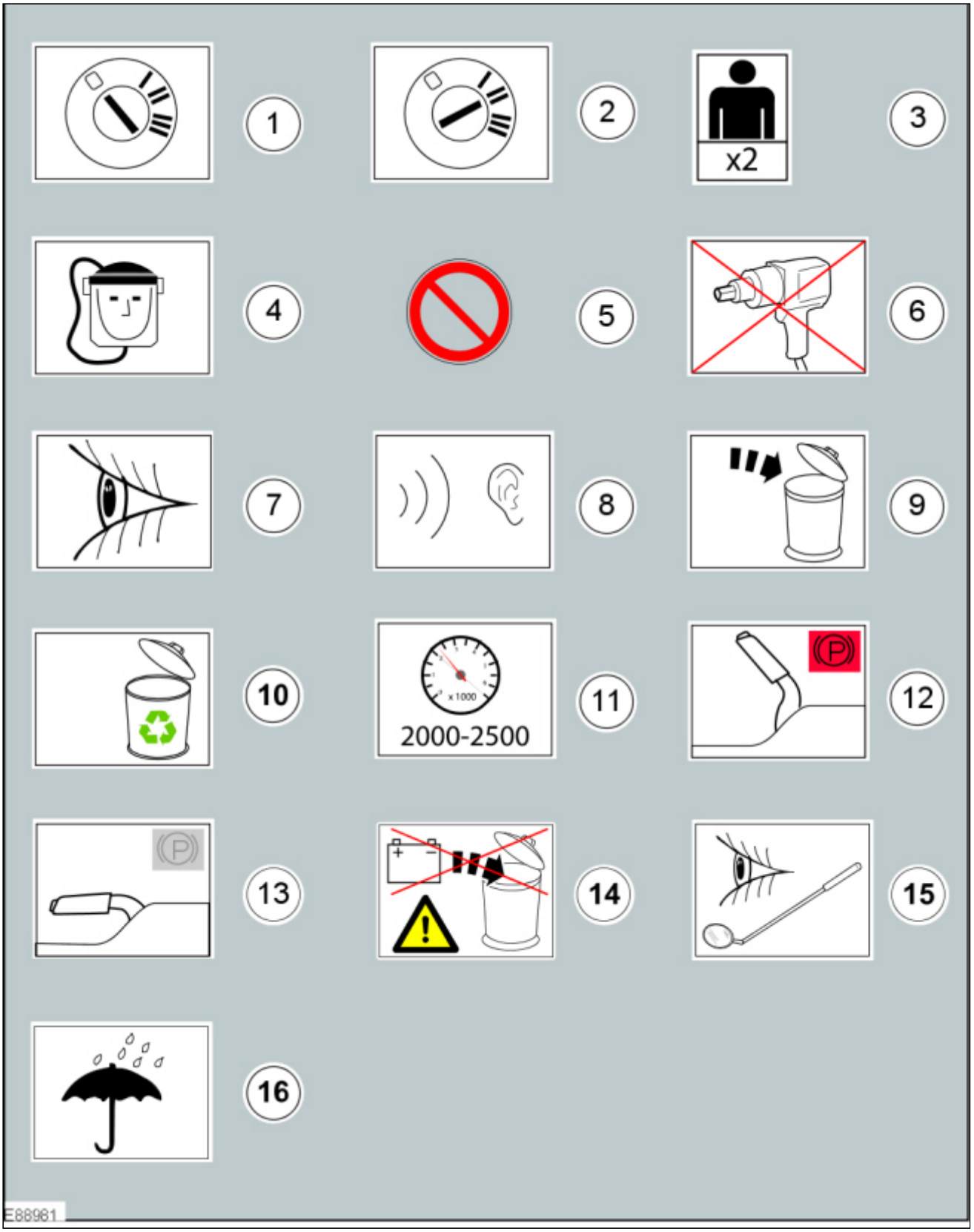
The material symbols are used to show where to use which type of material to carry out a procedure step.



Item	Part Number	Description
1	—	Remove/Install the specified blind rivet
2	—	Apply tape to the specified component/area
3	—	Remove/Install the specified cable tie

Miscellaneous symbols

These symbols provide further information that is required to carry out a procedure step.

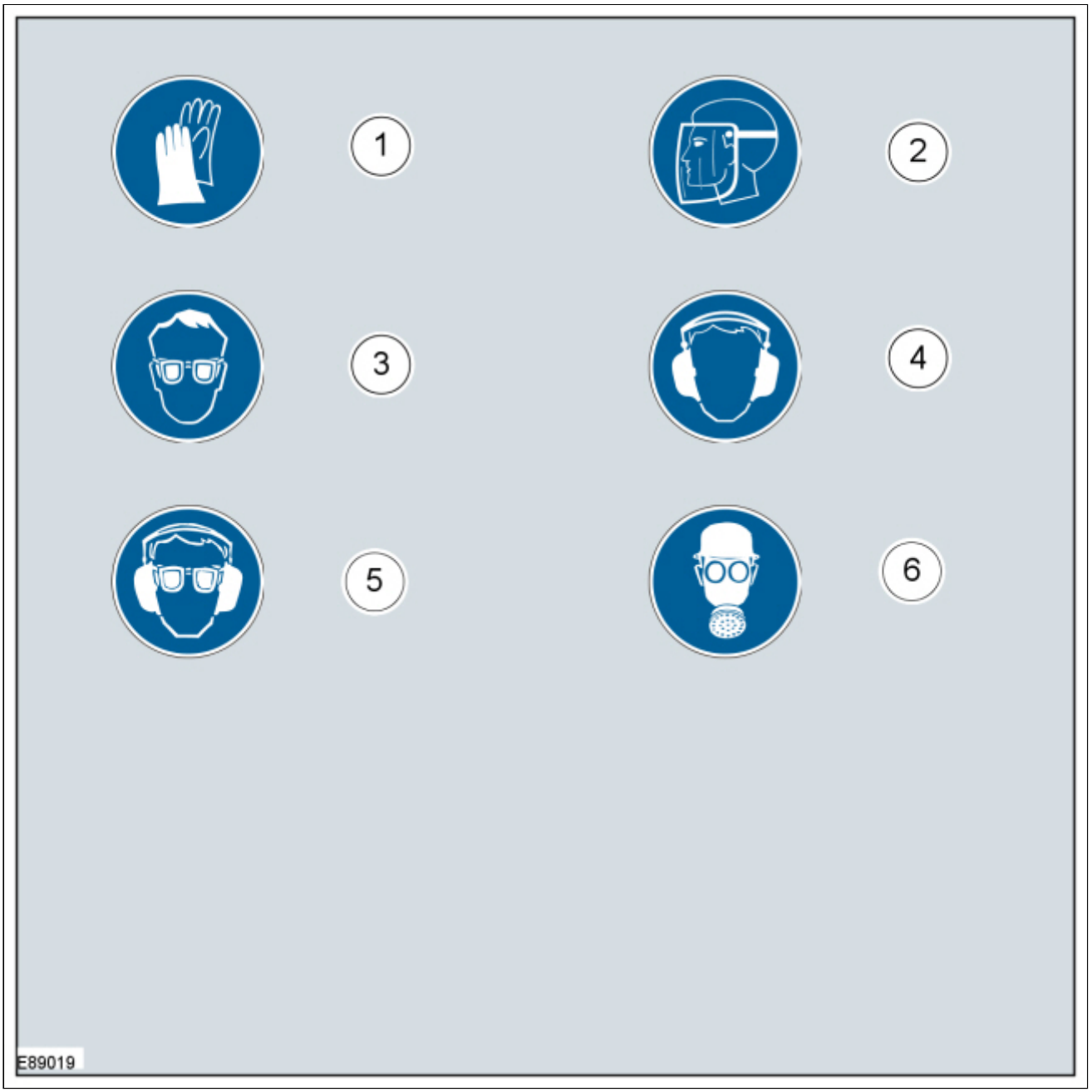


Item	Part Number	Description
1	—	Set the ignition switch to the 0 position
2	—	Set the ignition switch to the II position
3	—	The procedure step requires the aid of the specified number of supporting technicians
4	—	Self contained breathing apparatus
5	—	General prohibition used in combination with another symbol

6	—	Do not use power tools
7	—	Visual check
8	—	Noise check
9	—	Dispose the specified component
10	—	Replaced by item 9 (Dispose the specified component)
11	—	Set the engine speed to the specified value
12	—	Fully apply the parking brake lever
13	—	Fully release the parking brake lever
14	—	Do not dispose of batteries into the waste bin
15	—	Visual check using a mirror
16	—	Area/component must be dry

Mandatory Protective equipment - Health and safety symbols

The protective equipment symbols advise to use a mandatory protective equipment to avoid or at least reduce possible health and safety risks.

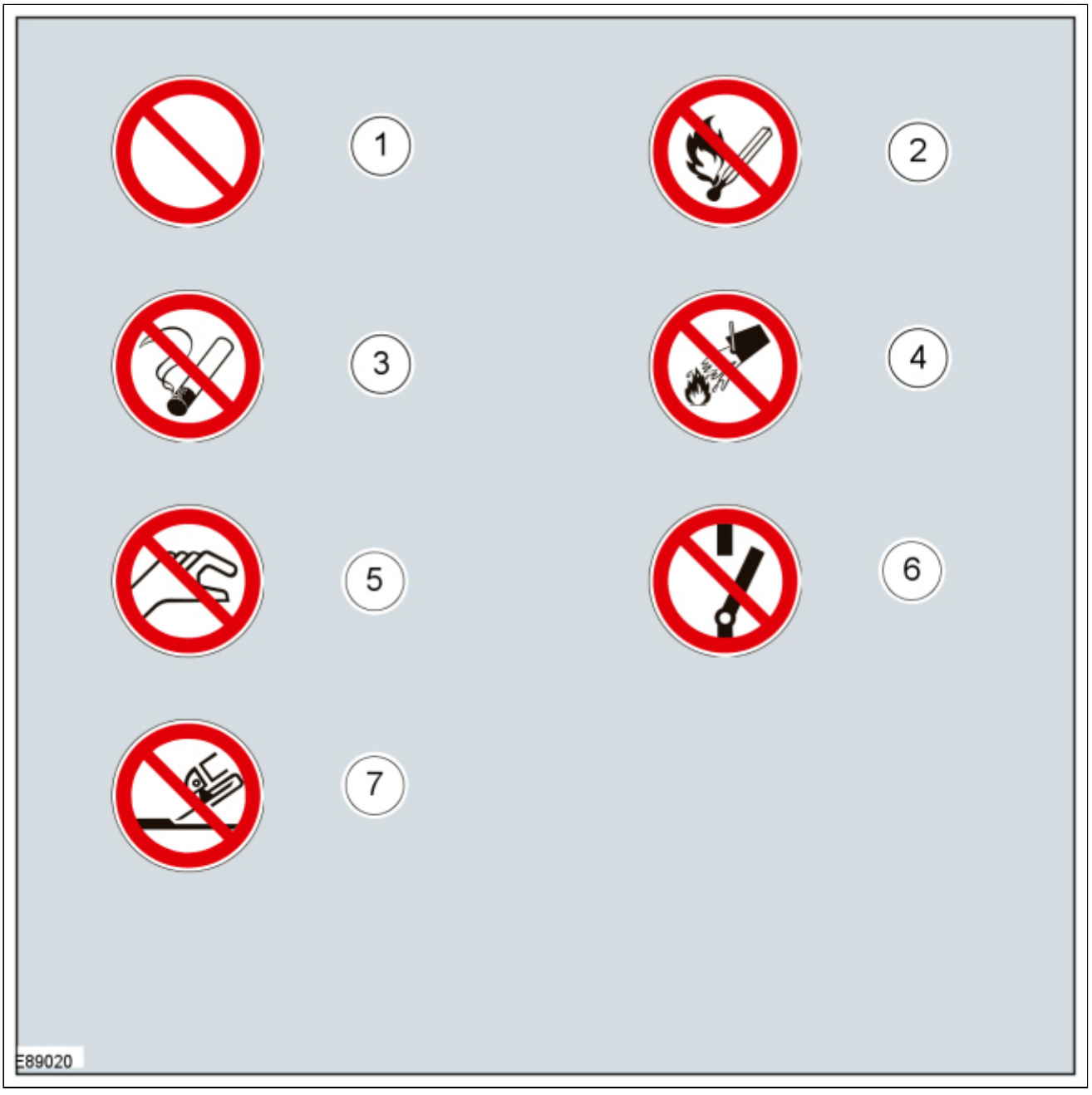


Item	Part Number	Description

1	—	Wear protective gloves
2	—	Wear face guard
3	—	Wear safety goggles
4	—	Wear ear protectors
5	—	Wear safety goggles and ear protectors
6	—	Wear a respirator

Prohibition - Health and safety symbols and component damage

The prohibition symbols are used to prohibit the specified actions to avoid or at least reduce possible component damage and health and safety risks.

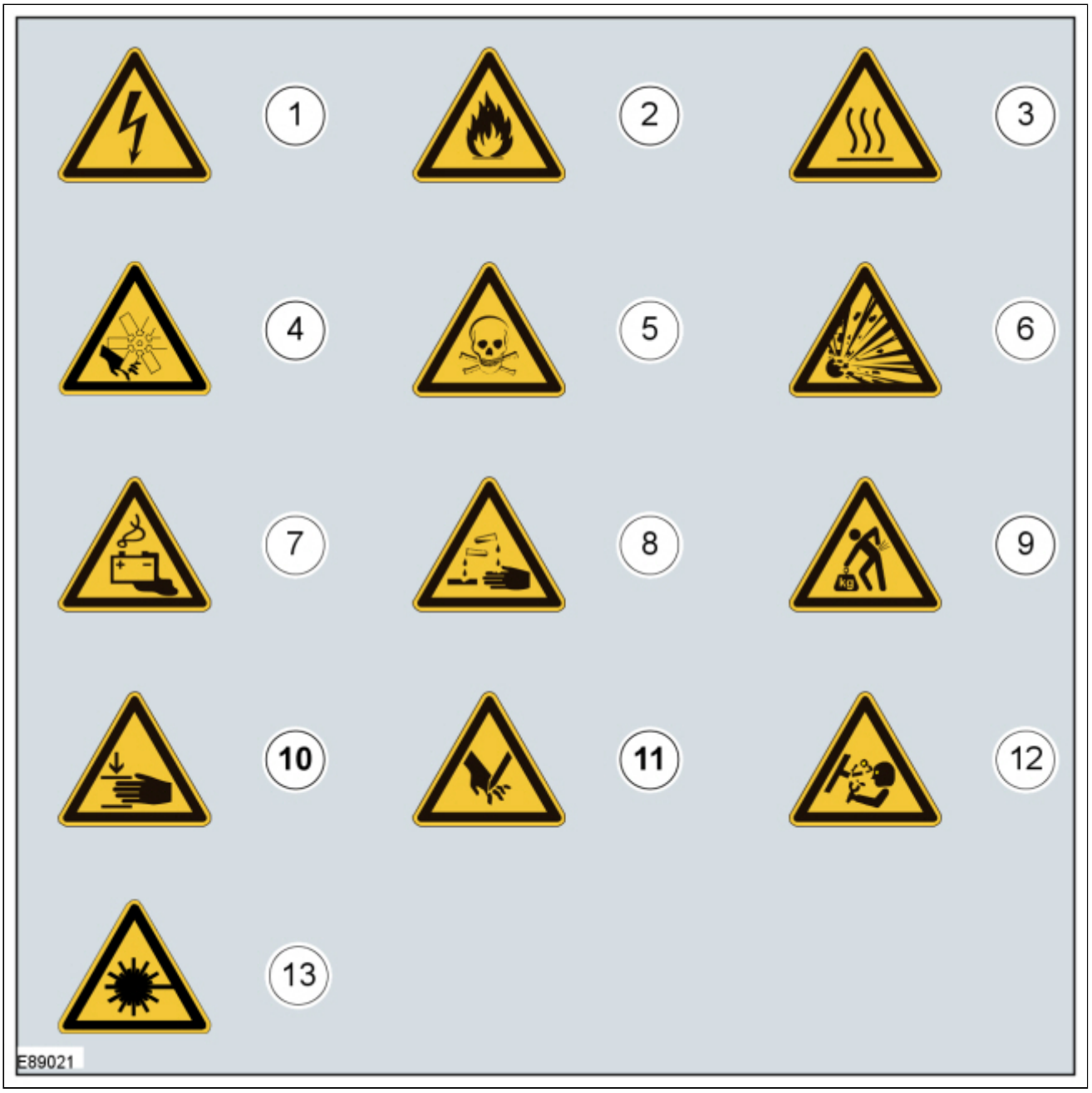


Item	Part Number	Description
1	—	General prohibition symbol
2	—	No naked flames
3	—	No smoking
4	—	No water

5	—	Do not touch
6	—	Do not switch
7	—	No grinding

Warning symbols - Health and safety and component damage

The warning symbols are used to advise on hazardous conditions to avoid or at least reduce possible component damage and health and safety risks.

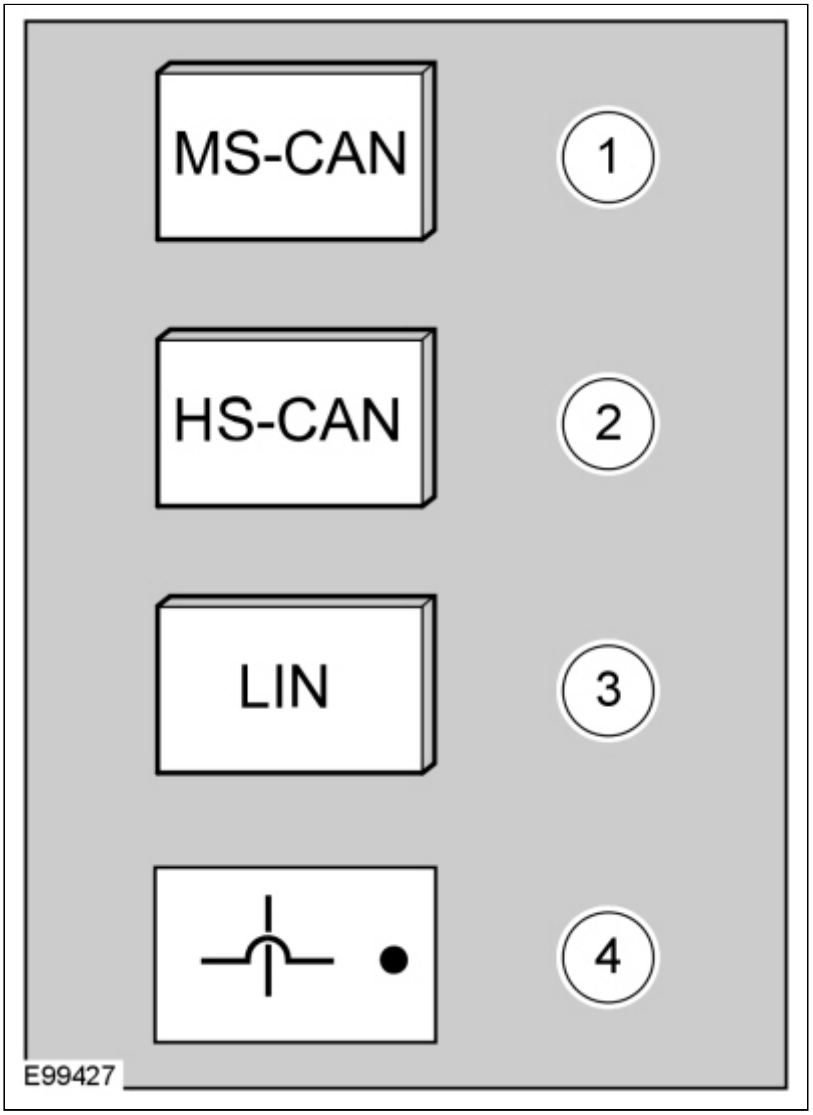


Item	Part Number	Description
1	—	Hazardous voltage/Electrical shock/Electrocution
2	—	Fire Hazard/Highly flammable
3	—	Burn hazard/Hot surface
4	—	Automatic start-up
5	—	Toxic
6	—	Explosive material

7	—	Battery hazard
8	—	Corrosive material
9	—	Lifting hazard
10	—	Hand crush/Force from above
11	—	Cutting of fingers or hand
12	—	Pressure hazard
13	—	Invisible laser radiation. Do not view directly with optical instruments (magnifiers). Class 1M laser product

Control Diagram symbols - Description and Operation procedures

These symbols provide further information on the type of connectivity, direction of flow or type of data bus of a system.



Item	Part Number	Description
1	—	Mid-speed Controller Area Network (CAN)
2	—	High-speed Controller Area Network (CAN)
3	—	Local Interconnect Network (LIN)
4	—	Wires crossing not connected

Copyright © 2016 Ford Motor Company

Health and Safety Precautions

Introduction

Many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health. This subsection lists, alphabetically, some of these hazardous operations and the materials and equipment associated with them. Precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures, and the handling of materials, should be carried out with health and safety in mind.

Before using any product the Materials Safety Data Sheet supplied by the manufacturer or supplier should be consulted.

Acids and Alkalis

See also Battery Acids.

For example caustic soda, sulphuric acid.

Used in batteries and cleaning materials.

Irritant and corrosive to the skin, eyes, nose and throat. Cause burns. Can destroy ordinary protective clothing.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective impervious apron, gloves and goggles. Do not breath mists.

Make sure access to eye wash bottles, shower and soap are readily available for splashing accidents.

Display Eye Hazard sign.

Air Bags

See also Fire, Chemical Materials.

Highly flammable, explosive – observe No Smoking policy.

Used as a safety restraint system mounted in the steering wheel and passenger side of the instrument panel.

The inflator contains a high-energetic propellant which, when ignited, produces a VERY HOT GAS (2500°C).

The gas generant used in air bags is Sodium Azide. This material is hermetically sealed in the module and is completely consumed during deployment. No attempt should be made to open an air bag inflator as this will lead to the risk of exposure to Sodium Azide. If a gas generator is ruptured, full protective clothing should be worn when dealing with the spillage.

After normal deployment, gloves and safety goggles must be worn during the handling process.

Deployed air bags should be disposed of in a plastic bag in accordance with local regulations at an approved chemical waste site.

Following any direct contact with gas generant.

- wash affected areas thoroughly with water.
- seek medical assistance if necessary.

Air Bags - Do's

- Do store modules in an upright position.
- Do keep modules dry.
- Do carry modules with the cover side pointing away from the body.
- Do place modules with their cover side upwards.
- Do carefully inspect modules for damage.
- Do stand to one side when connecting modules.
- Do make sure all test equipment is properly calibrated and maintained.
- Do wash hands after handling deployed air bags.

Air Bags - Do Nots

- Do not store highly flammable material together with modules or gas generators.
- Do not store gas generators at temperatures exceeding 80°C.
- Do not store modules upside down.
- Do not attempt to open a gas generator housing.
- Do not expose gas generators to open flame or sources of heat.
- Do not place anything on top of a module cover.
- Do not use damaged modules.
- Do not touch a fired module or gas generator for at least 10 minutes.
- Do not use any electrical probes on the wiring circuit.

Air Conditioning Refrigerant

See also Chlorofluorocarbon, Chemical Materials

Highly flammable, combustible – observe No Smoking policy.

Skin contact may result in frostbite.

Instructions given by the manufacturer must be followed. Avoid naked lights, wear suitable protective gloves and goggles.

If refrigerant comes into contact with the skin or eyes, immediately rinse the affected areas with water. Eyes should also be rinsed with an appropriate irrigation solution and should not be rubbed. SEEK MEDICAL ASSISTANCE IF NECESSARY.

Air Conditioning Refrigerant - Do Nots

- Do not expose refrigerant bottles to sunlight or heat.
- Do not stand refrigerant bottles upright; when filling, hold them with the valve downwards.
- Do not expose refrigerant bottles to frost.
- Do not drop refrigerant bottles.
- Do not vent refrigerant to atmosphere under any circumstance.
- Do not mix refrigerants, for example R12 (Freon) and R134a.

Adhesives and Sealers

See also Fire, Chemical Materials.

Highly flammable, flammable, combustible – observe No Smoking policy.

Generally should be stored in No Smoking areas. Cleanliness and tidiness in use should be observed, for example disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labeled appropriately.

Solvent-based Adhesives/Sealers - See Solvents

Follow manufacturers instructions.

Water-based Adhesives/Sealers

Those based on polymer emulsions and rubber latexes may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns and health hazards may arise from the inhalation of toxic fumes.

Use appropriate protective clothing and a thermostatically controlled heater with a thermal cut-out and adequate extraction.

Resin-based Adhesives/Sealers, for example Epoxide and Formaldehyde Resin-based

Mixing should be carried out in well ventilated areas, as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact.

Anaerobic, Cyanoacrylate (super-glues) and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin and respiratory tract. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturers instructions followed.

Cyanoacrylate adhesives (super-glues) MUST NOT contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and SEEK IMMEDIATE MEDICAL ATTENTION. Do not attempt to pull tissue apart. Use in well ventilated areas as vapors can cause irritation to the nose and eyes.

For two-pack systems see Resin-based and Isocyanate Adhesives/Sealers.

Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin-based Adhesives.

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Over exposure is irritating to the eyes and respiratory system. Excessive concentrations may produce effects on the nervous system including drowsiness. In extreme cases, loss of consciousness may result. Long term exposure to vapor concentrations may result in adverse health effects.

Prolonged contact with the skin may have a defatting effect which may lead to skin irritation and in some cases, dermatitis.

Splashes entering the eye will cause discomfort and possible damage.

Any spraying should preferably be carried out in exhaust ventilated booths, removing vapors and spray droplets from the breathing zone.

Wear appropriate gloves, eye and respiratory protection.

Antifreeze

See also Fire, Solvents.

For example isopropanol, ethylene glycol, methanol.

Highly flammable, flammable, combustible.

Used in vehicle coolant systems, brake air pressure systems, screenwash solutions.

Vapors may be given off from coolant antifreeze (glycol) when heated. Avoid breathing these vapors.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze, if swallowed, can be fatal and MEDICAL ATTENTION SHOULD BE SOUGHT IMMEDIATELY.

These products must not be used in any cooling or industrial water system that is connected or linked to general, food preparation or drinking water supplies.

Asbestos

See also Warning Symbols on Vehicles at the end of this subsection.

Breathing asbestos dust may cause lung damage or, in some cases, cancer.

Used in brake and clutch linings, transmission brake bands and gaskets.

The use of drum cleaning units, vacuum cleaning or damp wiping is preferred.

Asbestos dust waste should be dampened, placed in a sealed container and marked for safe disposal. If any cutting or drilling is attempted on materials containing asbestos the item should be dampened and only hand tools or low speed power tools used.

Battery Acids

See also Acids and Alkalis.

Gases released during charging are explosive. Never use naked flames or allow sparks near charging or recently charged batteries.

Make sure there is adequate ventilation.

Brake and Clutch Linings and Pads

See Asbestos.

Brake Fluids (Polyalkylene Glycols)

See also Fire.

Splashes to the skin and eyes are slightly irritating. Avoid skin and eye contact as far as possible. Inhalation vapor hazards do not arise at ambient temperatures because of the very low vapor pressure.

Brazing

See Welding.

Chemical Materials

See also Legal Aspects.

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, brake fluids, fuels, oils and grease should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly flammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life expectancy.

Chemical Materials - Do's

- Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, posters or other instructions. Material health and safety data sheets can be obtained from manufacturers.
- Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.
- Do organize work practices and protective clothing to avoid soiling of the skin and eyes; breathing vapors, aerosols, dusts or fumes; inadequate container labeling; fire and explosion hazards.
- Do wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.
- Do keep work areas clean, uncluttered and free of spills.
- Do store chemical materials according to national and local regulations.
- Do keep chemical materials out of the reach of children.

Chemical Materials - Do Nots

- Do not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals, give off toxic or harmful fumes or become explosive when mixed together.
- Do not spray chemical materials, particularly those based on solvents, in confined spaces, for example when people are inside a vehicle.
- Do not apply heat or flame to chemical materials except under the manufacturers instructions. Some are highly flammable and some may release toxic or harmful fumes.
- Do not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas such as pits.
- Do not transfer chemical materials to unlabelled containers.
- Do not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels, will dry the skin and may cause irritation leading to dermatitis or be absorbed through the skin in toxic or harmful quantities.
- Do not use emptied containers for other materials except when they have been cleaned under supervised conditions.
- Do not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful.

Chlorofluorocarbons (CFC)

There is concern in the scientific community that CFCs and Halons are depleting the upper ozone layer which filters out harmful ultraviolet radiation. Decreased filtration of ultraviolet radiation may result in increases in skin cancer, cataracts and immune system suppression in humans, as well as decreased productivity of crops and aquatic systems.

CFCs are used primarily as refrigerants in vehicle air conditioning systems and as aerosol propellants. Halons are used as fire extinguishants.

Clutch Fluids

See Brake fluids.

Clutch Linings and Pads

See Asbestos.

Corrosion Protection Materials

See also Solvents, Fire.

Highly flammable, flammable – observe No Smoking policy.

These materials are varied and the manufacturers instructions must be followed. They may contain solvents, resins or petroleum products. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

Cutting

See Welding.

Dewaxing

See Solvents and Fuels (Kerosene).

Dusts

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard. Avoid explosive limits and sources of ignition.

Electric Shock

Electric shock can result from the use of faulty electrical equipment or from the misuse of equipment in good condition.

Make sure that electrical equipment is maintained in good condition and frequently tested. Faulty equipment should be labeled and preferably removed from the workstation.

Make sure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Make sure that electrical equipment and flexes do not come into contact with water.

Make sure that electrical equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment that is in any way faulty. The results could be fatal.

Make sure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Make sure that the designated electrical workers are trained in basic First Aid.

In cases of electrocution:

- switch off the power supply before approaching the victim.
- if this is not possible push or drag the victim from the source of electricity using dry non-conductive material.
- commence resuscitation if trained to do so.
- SUMMON MEDICAL ASSISTANCE.

Engine Oils

See Lubricants and Grease.

Exhaust Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

Gasoline (petrol) engine

There may not be adequate warning of odor or of irritation before toxic or harmful effects arise. These may be immediate or delayed.

Diesel engine

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

Fibre Insulation

See also Dusts.

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

Fire

See also Welding, Foams, Legal Aspects.

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Make sure, before using electrical or welding equipment, that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

First Aid

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in First Aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

In case of cold burns, from alternative fuels, place affected area in cool to cold water.

Individuals affected by inhalation of gases and fumes should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertently, consult a doctor giving him the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

Fluoroelastomer

See Viton.

Foams - Polyurethane

See also Fire.

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Follow manufacturers instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work in or near uncured materials.

The components, vapors or spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapors and spray mists must not be inhaled. These materials must be applied with adequate ventilation and respiratory protection. Do not remove the respirator immediately after spraying; wait until the vapors/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, naked flames or the use of electrical equipment during foaming operations and until vapors/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation. See

also the vehicle Body Repair Manual.

Freon

See Air Conditioning Refrigerant.

Fuels

See also, Fire, Legal Aspects, Chemicals and Solvents.

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

Gasoline (Petrol)

Highly flammable - observe No Smoking policy.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs, through vomiting, is a very serious hazard.

Gasoline dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe smarting.

Motor gasoline may contain appreciable quantities of benzene, which is toxic upon inhalation, and the concentration of gasoline vapors must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Make sure there is adequate ventilation when handling and using gasoline. Great care must be taken to avoid the serious consequences of inhalation in the event of vapor build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasoline storage tanks.

Gasoline should not be used as a cleaning agent. It must not be siphoned by mouth. See First Aid.

Gas-oil (Diesel Fuel)

Combustible.

Gross or prolonged skin contact with high boiling point gas oils may also cause serious skin disorders including skin cancer.

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable - observe No Smoking policy.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs.

Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapors. Exposure to mists and vapors from kerosene at elevated temperature should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and make sure there is adequate ventilation.

Alternative Fuel

Highly flammable. Observe ``NO SMOKING'' signs.

Make sure there is adequate ventilation when working on alternative fuelled vehicles. Great care must be taken to avoid the serious consequences of inhalation in the event of vapor build up in confined spaces.

Inhalation in high concentrations may cause dizziness, headache, nausea and loss of co-ordination. Very high concentrations may result in loss of consciousness.

Contact with liquefied petroleum gas (LPG) or compressed natural gas (CNG) to the skin may cause cold burns and frost bite.

Long sleeved cotton overalls, steel toe capped safety boots and rubber neoprene gloves should be worn during removal and installation of LPG/CNG fuel system components.

LPG/CNG fuel leaks could cause a fire and be a hazard to health that can lead to personal injury, illness or even death.

If a leak is detected, under no circumstances attempt to seal the leak by tightening the union/connection until the fuel in the system or component is depressurized. Once tightened the system should be checked for integrity following the specified procedures.

If the fuel tank is to be removed for service or repair the fuel must be evacuated using dedicated equipment and following the specified procedures.

Gas Cylinders

See also Fire.

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 138 bar (2000 psi) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well-ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases, for example acetylene and propane, should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

Gases

See Gas Cylinders.

Gaskets (Fluoroelastomer)

See Viton.

General Workshop Tools and Equipment

It is essential that all tools and equipment are maintained in good condition and that the correct safety equipment is used where required.

Never use tools or equipment for any purpose other than that for which they were designed. Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high-speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiseling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment, working with asbestos-based materials or using spraying equipment.

Make sure there is adequate ventilation to control dusts, mists and fumes.

High Pressure Air, Lubrication and Oil Test Equipment

See also Lubricants and Greases.

Always keep high-pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high-pressure nozzle, for example diesel injector, at the skin as the fluid may penetrate to the underlying tissue, and cause serious injury.

Halon

See CFCs.

Legal Aspects

There are many laws and regulations relating to health and safety in the use and disposal of materials and equipment in a workshop.

For a safe working environment and to avoid environmental pollution, workshops should be familiar, in detail, with the many health and safety laws and regulations within their country, published by both national and local authorities.

Lubricants and Greases

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

Transmission Fluids

Safety instructions

Certain Transmission and Power Steering fluids supplied to Ford may contain additives which have the potential to cause skin disease (dermatitis) to exposed persons. The dermatitis may be irritant or allergic in nature. Risks are higher where prolonged or repeated skin contact with a fluid may occur. These fluids are used for vehicle initial fill and service purposes. This sub-section is to:

- Inform Service personnel who may come into contact with these vehicle fluids (hazard communication).
- Summarise appropriate workplace control measures and personal protective equipment requirements.
- Draw attention to the existence of Material Safety Datasheets (MSDS's) for the fluids (available from Ford Customer Service Division). These MSDS's contain detailed information on hazards and appropriate controls.

Control measures

Workplace risk assessments made under national chemical control regulations should identify operations involving the fluids as potentially hazardous and specify workplace control and worker awareness measures. In such circumstances, the relevant Material Safety Datasheet (see the details specified below) which specifies hazards and control measures in detail should be made available for guidance.

Avoid unprotected skin contact with the fluids, and in particular, avoid prolonged or repeated skin contact. Work practices should be organised so as to minimise the potential for skin contact. This may include the use of drip trays, absorbents, correct fluid handling equipment (funnels etc), and workplace housekeeping measures such as the cleaning of contaminated surfaces.

Personnel engaged in operations where skin contact could occur (such as fluid draining or filling) should wear impervious gloves made from nitrile rubber, certified to a chemical protection standard, e.g. Europe Standard EN374. This glove type is widely available from reputable suppliers of gloves for chemical protection [including the manufacturers Ansell-Admont (Solvex Range), North Safety products (North Nitrile Latex Gloves range), and Marigold Industrial (Blue Nitrile range)]. If gloves become torn or contaminated on the inside they should be replaced. Eye protection with safety glasses is appropriate. Use of an impervious apron and arm protectors may be necessary if more extensive exposure is possible. Use of skin barrier creams suitable for work with mineral oil products may offer some supplementary protection, but such barrier creams should not be used in place of protective clothing.

If accidental skin contact occurs with the fluids, wash the area thoroughly with soap or skin cleanser and water.

Accidental eye contact should be dealt with as per normal first aid practices, by flushing the eyes with an eye wash or clean cool water for 10 minutes, after which medical attention should be obtained.

Remove and launder clothing which becomes contaminated with the fluids. Do not place rags contaminated with fluid in clothing pockets.

Wash thoroughly after completing operations where skin exposure may have occurred.

It is important that personnel do not smoke, eat or drink whilst handling the fluids or affected transmissions. These measures are designed to limit the risk from accidental ingestion.

Label any decanted fluid properly/use an equivalent label to that on original product containers.

Clean up any spills promptly using an inert absorbent and wash down contaminated surfaces with detergent and water.

Dispose of any waste fluids safely as hazardous waste.

Safety Data Sheets

Safety Data Sheets, which detail specific material handling instructions and precautions are available from the respective national sales company, and via internet www.msds.ford.com.

Used Engine Oil

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants, which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

Environmental Precautions

Burning used engine oil in small space heaters or boilers can be recommended only for units of approved design. If in doubt check with the appropriate local authority and manufacturer of approved appliances.

Dispose of used oil and used oil filters through authorized waste disposal contractors or licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the relevant local authority for advice on disposal facilities.

It is illegal to pour used oil on to the ground, down sewers or drains, or into watercourses.

Noise

Some operations may produce high noise levels, which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

Noise Insulation Materials

See Foams, Fibre Insulation.

O-Rings (Fluoroelastomer)

See Viton.

Paints

See also Solvents, Chemical Materials.

Highly flammable, flammable - observe No Smoking policy

One Pack

Can contain harmful or toxic pigments, driers and other components as well as solvents. Spraying should be carried out only with adequate ventilation.

Two Pack

Can also contain harmful and toxic unreacted resins and resin hardening agents. The manufacturers instructions should be followed. See also Resin-based Adhesives and Isocyanate Adhesives and Sealers under Adhesives and Sealers.

Spraying should preferably be carried out in exhausted ventilated booths removing vapor and spray mists from the breathing zone. Individuals working in booths should wear appropriate respiratory protection. Those doing small-scale repair work in the open workshop should wear air-fed respirators.

Pressurized Equipment

See High Pressure Air, Lubrication and Oil Test Equipment.

Solder

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be produced.

Some fumes may be produced by the application of any flame to surfaces coated with grease, and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to make sure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

Solvents

See also Chemical Materials, Fuels (Kerosene), Fire.

For example acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning and dewaxing materials, paints, plastics, resins and thinners.

Some may be highly flammable or flammable.

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure of high concentrations of vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapors or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs, for example through vomiting, is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Make sure there is good ventilation when in use, avoid breathing fumes, vapors and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, for example paints, adhesive, coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers instructions.

Sound Insulation

See Fibre Insulation, Foams.

Suspended Loads

NOTICE: Never improvise lifting tackle.

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended or raised load, for example a suspended engine.

Always make sure that lifting equipment such as jacks, hoists, axle stands and slings are adequate and suitable for the job, in good condition and regularly maintained.

Transmission Brake Bands

See Asbestos.

Underseal

See Corrosion Protection.

Viton

In common with many other manufacturers vehicles, some components have O-rings, seals or gaskets, which contain a material known as `Viton'.

Viton is a fluoroelastomer, that is a synthetic rubber type material, which contains Fluorine. It is commonly used for O-rings, gaskets and seals of all types. Although Viton is the most well known fluoroelastomer, there are others, including Fluorel and Tecmoflon.

When used under design conditions fluoroelastomers are perfectly safe. If, however, they are exposed to temperatures in excess of 400°C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and may be absorbed directly, through contact, into the general body system.

O-rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT; under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluoroelastomer has been used in the affected O-ring, seal or gasket. If they are of natural rubber or nitrile there is no hazard. If in doubt, be cautious, as the material may be Viton or any fluoroelastomer.

If Viton or any other fluoroelastomers have been used, the affected area should be decontaminated before the commencement of work.

Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralize the acid before disposing of the decomposed Viton residue and final cleaning of the area. After use, the plastic gloves should be discarded carefully and safely.

Welding

See also Fire, Electric Shock, Gas Cylinders.

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at a high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultra-violet radiation, which may cause arc-eye, and skin burns to the operator and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

CONTACT LENS WEARERS ARE ADVISED TO REVERT TO ORDINARY SPECTACLES WHEN ARC WELDING as the arc spectrum is believed to emit microwaves which dry out the fluid between the lens and the eye. This may result in blindness when the lens is removed from the eye.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

Gas Welding (and Cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright, and eye protection should be used, but the ultra-violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be produced from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

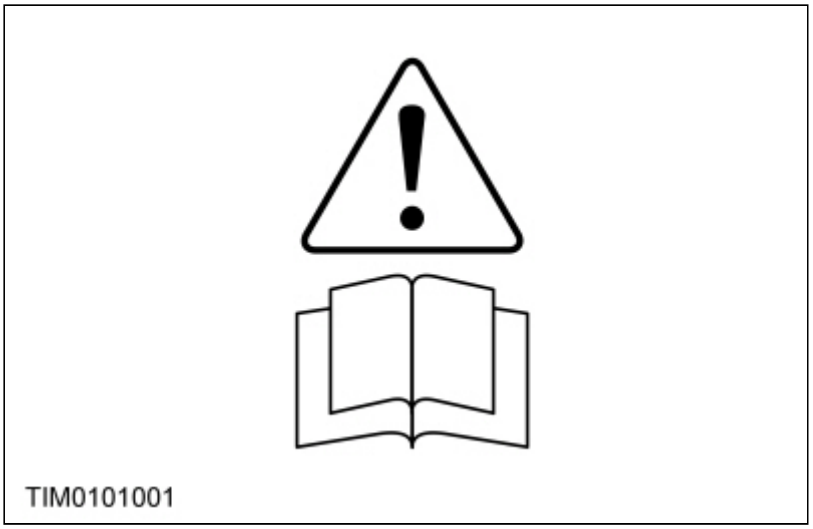
SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS, WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, FOR EXAMPLE BOILING OR STEAMING OUT OF FUEL TANKS.

Warning Symbols on Vehicles

Decals showing warning symbols will be found on various vehicle components.

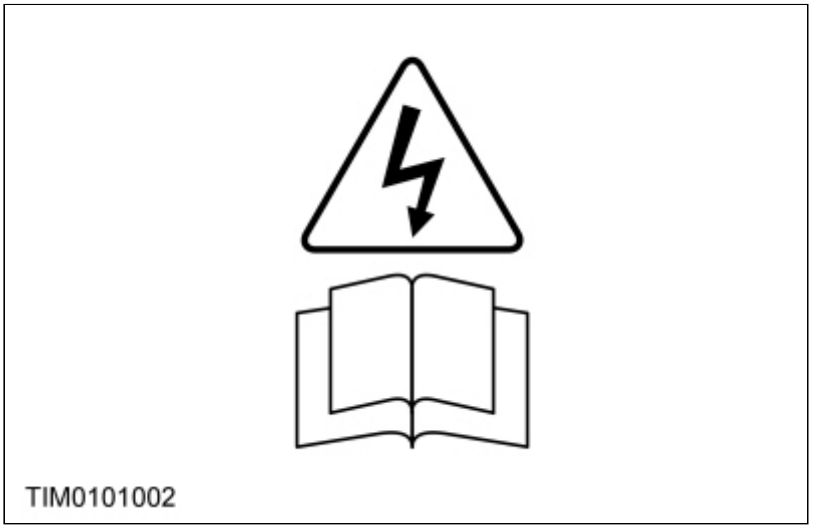
These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

The most commonly found decals are reproduced below together with an explanation of the warnings.



TIM0101001

1. Components or assemblies displaying the caution triangle and open book symbol advise consultation of the relevant section of the owner literature before touching or attempting adjustments of any kind.



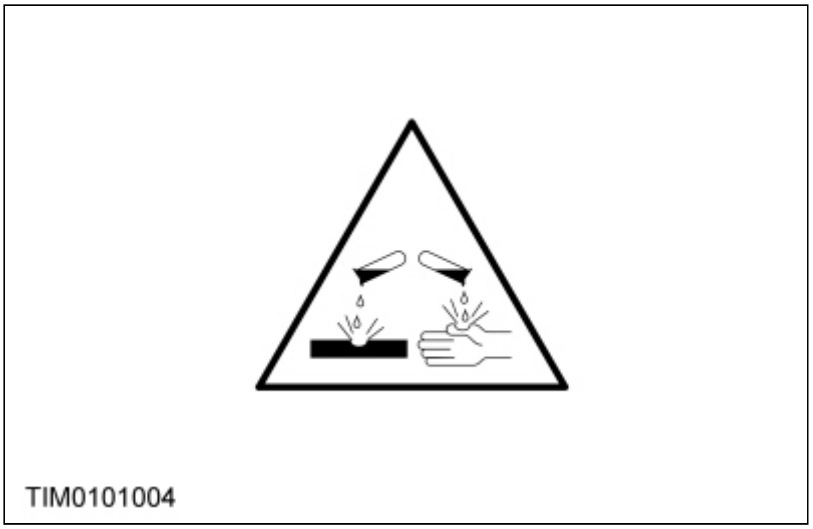
TIM0101002

2. Components or assemblies displaying the warning triangle with the `electrified' arrow and open book symbol give warning of inherent high voltages. Never touch these with the engine running or the ignition switched on. See Electric Shock in this subsection.



TIM0101003

3. Vehicles and replacement components which contain asbestos are identified by this symbol. See Asbestos in this subsection.



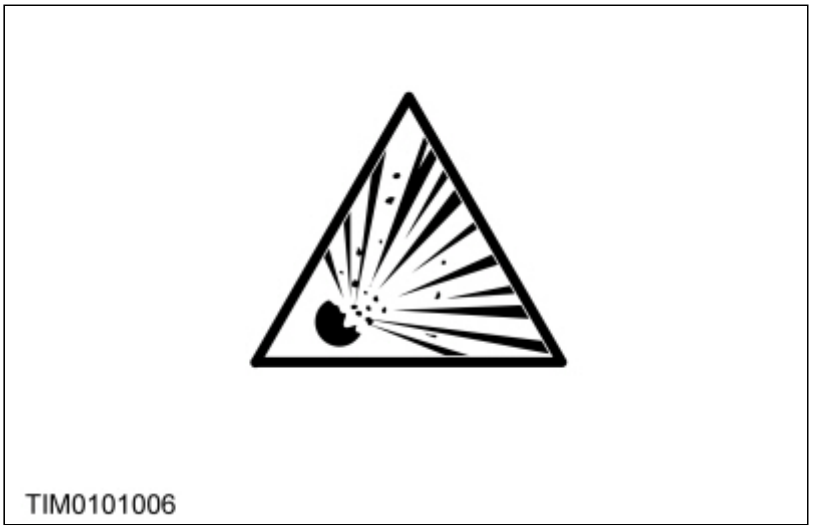
TIM0101004

4. Components or assemblies displaying this symbol give warning that the component contains a corrosive substance. See Acids and Alkalis in this subsection.



TIM0101005

5. Displaying the caution circle with a deleted lighted match symbol, caution against the use of naked lights or flames within the immediate vicinity due to the presence of highly flammable or explosive liquids or vapors. See Fire in this subsection.



TIM0101006

6. Displaying this symbol (normally in conjunction with 5 above) warn of the presence of potentially explosive matter within the immediate vicinity.



7. Displaying this symbol warn that children should not be allowed in the immediate vicinity unsupervised.

White Spirit

See Solvents.

Copyright © 2016 Ford Motor Company

Standard Workshop Practices

Vehicle in Workshop

This manual describes and directs repair procedures specified by Ford Motor Company for the vehicle. Critical health and safety precautions are included. Anyone who deviates from these instructions risks compromising personal safety or vehicle integrity.

Section number 100-00 General Information contains important safety warnings.

NOTE: *Always read and understand these before beginning any repair procedure.*

It is the responsibility of the dealership or automotive service business to make sure the work area is compliant with local health and safety and environmental regulations.

Understand and follow all safety practices, which include these examples:

- proper ventilation of work areas and vehicle exhaust.
- preventing unintended vehicle movement.
- proper shop and personal safety equipment (eye protection, fire extinguishers and other items).

Throughout this manual, chemicals or materials are specified that must be used to properly complete a service procedure or diagnostic step. In the event a specific material is not readily available, a substitute material meeting the same specification may be used.

Ford has not reviewed third party products for compliance with environmental, health or safety regulations and is not responsible for their use. Use of third party products is at your own risk.

Additionally, such products may cause degraded performance, premature failures, and/or vehicle component damage.

All chemicals or materials used for vehicle servicing should be checked for compliance with local environmental and health and safety regulations.

WARNING: Wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

WARNING: Chemicals or materials specified in this manual, if used improperly, may present a personal health hazard. Always consult the material safety information sheet before using any material specified by this manual. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not work under the hood of a vehicle with a damaged cooling fan, as it can separate during operation. With the ignition OFF, inspect all cooling fans for damage, cracks or separation and replace with a new fan as necessary. Failure to follow this instruction may result in serious personal injury.

WARNING: Vehicles with engine auto start-stop technology may start automatically with the ignition on. Make sure the ignition is off when servicing or working in close proximity to rotating engine parts. Failure to follow this instruction may result in serious personal injury.

WARNING: Serious injury may occur if the engine is accidently started by another person during service work. Remove the key from the vehicle to prevent unauthorized starts. Failure to follow this instruction may result in serious personal injury.

WARNING: Before lifting the vehicle with a jack, make sure the jack capacity is adequate for the vehicle weight, including any vehicle cargo or modifications. Identify the correct jacking points in section 100-02 of this manual. Position the vehicle on a hard, level surface. After jacking, always support vehicle with jack stands. Never get under a vehicle supported only by a jack. Set the parking brake and block all wheels remaining on the ground. Failure to follow these instructions may result in unintended vehicle movement and serious personal injury or death.

WARNING: Before raising the vehicle on a hoist, make sure the hoist capacity is adequate for the vehicle weight, including any vehicle cargo or modifications. Always position the hoist lift arms as shown in section 100-02 of this manual. Do not use the engine to power the drive wheels unless all drive wheels are elevated off the ground. Incorrect hoist arm positioning or drive wheels in contact with the ground can cause unintended vehicle movement. Failure to follow these instructions may result in serious personal injury or death.

WARNING: Removal of heavy components (such as engines, transmissions or axles) while the vehicle is lifted on a hoist may create a dangerous weight imbalance. Restrain the vehicle on the hoist with chains or straps to prevent vehicle movement. Failure to follow this instruction may result in serious personal injury or death.

WARNING: Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

WARNING: Turn off (disable) the power running boards (if equipped) before jacking, lifting or placing any object under the vehicle. Never place your hand between the power running board and the vehicle. Extended power running boards will retract when doors are closed. Failure to follow these instructions may result in serious personal injury.

WARNING: Never support an engine by the intake or exhaust manifolds. The engine may drop suddenly. Failure to follow this instruction may result in serious personal injury.

WARNING: Keep solvents away from ignition sources. Solvents may be flammable and can ignite or explode if not handled correctly. Failure to follow this instruction may result in serious personal injury.

WARNING: Use tools, not fingers, to hold flagnuts. Flagnuts may slip or spin unexpectedly when removing fasteners. Failure to follow this instruction may result in injured fingers.

Copyright © 2016 Ford Motor Company

Solvents, Sealants and Adhesives

Introduction

WARNING: Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.

NOTICE: If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information regarding storage, handling and application.

The Health and Safety Precautions subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken.

Copyright © 2016 Ford Motor Company

Road/Roller Testing

Road or roller testing may be carried out for various reasons and a procedure detailing pre-test checks, engine starting and stopping, pre-driving checks, on-test checks and final checks to be completed on completion of the test is given below.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system(s) being checked can be extracted.

Pre-Test Checks

WARNING: If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.

It is suggested that pre-test checks and functional tests of those systems and circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or roller test.

With the ignition switched off, check:

- the engine oil level.
- the engine coolant level.
- the tires, for correct pressure, compatible types and tread patterns, and wear within limits.
- that there is sufficient fuel in the tank to complete the test.
- all around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test.

Starting the Engine

NOTE: *On initial drive away from cold and within the first 1.5 km (1 mile), do not depress the accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.*

With the ignition switched off, check:

- that the parking brake is applied.
- that the gear lever is in the neutral position.
- that all instrument gauges (except fuel gauge) read zero.

With the ignition switched on, check:

- that the ignition controlled warning lamps are illuminated.
- that the engine temperature gauge registers a reading compatible with the engine temperature.
- that the fuel gauge registers a reading appropriate to the fuel level in the tank.
- the operation of the parking brake warning lamp and fluid level warning indicator.

Road or Roller Testing

NOTICE: If road testing, check the brake operation while still traveling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

During the road or roller test, check:

- that the clutch pedal operation is not stiff or heavy.
- that the initial gear engagement is smooth and there is no evidence of clutch drag.
- that the parking brake control operates smoothly and releases quickly and completely.
- that the clutch takes up the drive smoothly, without slip or judder.
- that gear changing is smooth with no abnormal noises or vibrations from the transmission.
- the engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation is not stiff or heavy, and engine speed returns to idle correctly.
- there is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions.

- that steering operation, including power steering (if equipped), is smooth, accurate, not excessively heavy or with excessive free play or vibration.
- that the steering does not pull to one side and self centers smoothly after cornering.
- that the speedometer, coolant temperature gauge and tachometer (if equipped) register the correct readings and operate correctly.
- that the switches and controls operate smoothly and positively, warning and indicator lamps operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.
- that the heating and ventilation systems operate correctly and effectively.
- the brake operation and efficiency.

Brake Testing

WARNING: When brake testing, avoid breathing the fumes from hot brakes, this may contain asbestos dust which is hazardous to health. Failure to follow this instruction may result in personal injury.
For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTICE: Avoid brake testing on busy roads where it may cause inconvenience or danger to other road users.

NOTICE: Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A brake disc or brake drum that feels hot or is appreciably hotter than the others, indicates that the brake is binding.

After completion of the test, check for:

- oil, coolant, hydraulic, air and fuel leaks.
- abnormal temperature of any moving components or assemblies, for example wheel hubs, transmission and axle, which might indicate over tightness or lack of lubrication.

Copyright © 2016 Ford Motor Company

Climate Control System Health and Safety Precautions

WARNING: Only qualified technicians are allowed to work on air conditioning (A/C) systems.

WARNING: Air conditioning (A/C) system components can become particularly hot or cold.

WARNING: Make sure that the air conditioning (A/C) system is at ambient temperature before carrying out any repair.

WARNING: When handling refrigerants, always wear protective goggles and gloves made of fluoroelastomer. Leather or fabric gloves are not suitable.

WARNING: SKIN CONTACT: If liquid refrigerant comes into contact with the skin, it produces severe frostbite. Immediately flush affected areas with plenty of cold running water for 15 minutes. Seek medical attention.

WARNING: EYE CONTACT: If refrigerant comes into contact with the eyes, immediately flush the eyes with plenty of running water for 15 minutes. Seek medical attention.

WARNING: INHALED: Toxic gases generated when refrigerant is heated are hazardous to health. The gases have an irritating smell and can cause lung damage. The symptoms can continue for a long time after having been in contact with the gases. The gases can cause lung damage even if the amount of gas in the air is too small to smell.

WARNING: Refrigerant is flammable and explosive.

WARNING: Make sure that refrigerant bottles are not exposed to temperatures greater than 45°C.

WARNING: Make sure that the local regulations regarding work on air conditioning (A/C) systems are adhered to.

WARNING: Make sure that refrigerant bottles are closed properly.

WARNING: Gaseous refrigerant has a higher density than air. There is a danger of suffocation when working close to the ground or in workshop pits.

WARNING: Provide adequate ventilation when handling refrigerant.

WARNING: Never release refrigerant into the atmosphere.

WARNING: Only use special tools, equipment and lubricants that are approved for the type of refrigerant being used.

WARNING: Always follow the manufacturer's instructions for the correct servicing unit operating procedure.

NOTICE: Do not mix refrigerant oils for different types of refrigerant.

NOTICE: Never mix different types of refrigerant or equipment intended for them.

NOTICE: Only use refrigerant in gas form when filling the system through the low-pressure connection.

NOTICE: Only use refrigerant in liquid form when filling the system through the high-pressure connection.

NOTICE: Refrigerant attacks certain plastics. Only use seals suitable for refrigerant.

NOTICE: If the air conditioning (A/C) compressor is damaged, the fixed orifice tube can become blocked with metal particles.

NOTICE: Any sort of blockage in the refrigerant circuit will damage the air conditioning (A/C) compressor irreparably.

NOTICE: If the air conditioning (A/C) system has been opened for a period greater than 2 hours, a new receiver drier must be installed and the evacuating time to be increased by a minimum of 2 hours.

NOTE: *New air conditioning (A/C) compressors are delivered prefilled.*

NOTE: *Refrigerant oil in new air conditioning (A/C) compressors can contain Teflon, visible as white particles, which will not harm the system.*

Copyright © 2016 Ford Motor Company

Battery and Battery Charging Health and Safety Precautions

WARNING: Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Wear safety goggles when working near the battery to protect against possible splashing of the acid solution.

WARNING: EYE CONTACT: If acid comes into contact with the eyes, flush immediately with plenty of running water for a minimum of 15 minutes. Seek immediate medical attention.

WARNING: SKIN CONTACT: If acid comes into contact with the skin, flush immediately with plenty of running water for a minimum of 15 minutes. Seek immediate medical attention.

WARNING: SWALLOWED: If acid is swallowed, rinse the mouth with plenty of water and then drink plenty of water or milk. Do not induce vomiting. Seek immediate medical attention.

WARNING: Batteries normally produce explosive gases. Do not allow naked flames, sparks or lighted substances to come near the battery.

WARNING: When charging the battery shield your face and wear safety goggles. Provide adequate ventilation.

NOTICE: Boost charging with excessive current or voltage above 16 volts will damage the battery.

Copyright © 2016 Ford Motor Company

Brake and Clutch Systems Health and Safety Precautions

WARNING: EYE CONTACT: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid comes into contact with the eyes, flush the eyes with plenty of cold running water for 15 minutes. Seek medical attention for any persistent eye irritation or abnormality.

WARNING: SWALLOWED: Brake fluid contains polyglycol ethers and polyglycols. If swallowed, drink plenty of water. Seek immediate medical attention.

WARNING: INHALED: Dust from friction materials can be harmful if inhaled.

WARNING: Only use new specified brake fluid from airtight containers.

NOTICE: If brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

Copyright © 2016 Ford Motor Company

Steering System Health and Safety Precautions

WARNING: When handling the power steering fluid, always wear protective goggles and gloves made of nitril.

WARNING: EYE CONTACT: Power steering fluid contains long chain alkyl amine thiophosphate. Avoid contact with the eyes. Wash hands thoroughly after handling. If power steering fluid comes into contact with the eyes, flush the eyes with plenty of cold running water for 15 minutes. Seek medical attention for any persistent eye irritation or abnormality.

WARNING: SKIN CONTACT: If power steering fluid comes into contact with the skin, remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality.

WARNING: INHALED: If oil mist is inhaled, move a victim to fresh air. Keep a victim warm and at rest. Seek immediate medical attention in cases of throat irritation or coughing.

WARNING: SWALLOWED: Power steering fluid contains long chain alkyl amine thiophosphate. If swallowed, drink plenty of water. Seek immediate medical attention.

NOTICE: If the power steering fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

Copyright © 2016 Ford Motor Company

Engine Cooling System Health and Safety Precautions

WARNING: Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.

WARNING: Vapors may be given off from antifreeze when heated. Avoid breathing these vapors.

WARNING: SKIN CONTACT: Antifreeze may be absorbed through the skin in toxic or harmful quantities.

WARNING: SWALLOWED: If antifreeze is swallowed, drink plenty of water, induce vomiting. Seek immediate medical attention.

WARNING: Antifreeze must not be used in any cooling or industrial water system that is connected or linked to general water supplies.

Copyright © 2016 Ford Motor Company

Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions

WARNING: Fuel may not give adequate warning before toxic or harmful effects arise.

WARNING: Exposure to fuel can be harmful and can cause severe health damage or death.

WARNING: Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.

WARNING: Highly flammable mixtures are always present and may ignite when working on fuel systems. Do not allow naked flames, sparks or lighted substances to come near fuel related components.

WARNING: Fuel must not be used as a cleaning agent.

WARNING: Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.

WARNING: SKIN CONTACT: Excessive or prolonged skin contact with diesel fuel may cause serious skin disorders including skin cancer.

WARNING: SKIN CONTACT: Fuel is mildly irritating to the skin and may cause dermatitis due to defatting effect. Remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality. Wash contaminated clothing before reuse.

WARNING: EYE CONTACT: Fuel is mildly irritating to the eyes. Flush with plenty of running water, blinking as often as possible. Do not force the eyelid open. Seek medical attention for any persistent eye irritation or abnormality.

WARNING: SWALLOWED: Fuel is moderately toxic and tends to foam on vomiting. If drawn into the lungs, inflammation may develop. Do not induce vomiting. If spontaneous vomiting occurs place the victim in a forward position to reduce the risk of fuel being drawn into the lungs. Give nothing by mouth. If breathing but unconscious, place in the recovery position. If breathing has stopped, apply artificial respiration. Seek immediate medical attention.

WARNING: INHALED: Fuel is toxic to the respiratory and other body systems. Exposure may result in various symptoms including drowsiness, unconsciousness or severe health damage. Move a victim to fresh air. Keep a victim warm and at rest. If unconscious, place in the recovery position. If not breathing, apply artificial respiration. Give cardiac massage if necessary. Seek immediate medical attention.

NOTICE: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.

NOTICE: Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.

Copyright © 2016 Ford Motor Company

Diesel Fuel System Health and Safety Precautions

WARNING: Fuel may not give adequate warning before toxic or harmful effects arise.

WARNING: Exposure to fuel can be harmful and can cause severe health damage or death.

WARNING: Provide adequate ventilation when working on fuel systems.

WARNING: Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.

WARNING: Fuel must not be used as a cleaning agent.

WARNING: Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.

WARNING: SKIN CONTACT: Fuel is mildly irritating to the skin and may cause dermatitis due to defatting effect. Remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality. Wash contaminated clothing before reuse.

WARNING: SKIN CONTACT: Excessive or prolonged skin contact with diesel fuel may cause serious skin disorders including skin cancer.

WARNING: EYE CONTACT: Fuel is mildly irritating to the eyes. Flush with plenty of running water, blinking as often as possible. Do not force the eyelid open. Seek medical attention for any persistent eye irritation or abnormality.

WARNING: SWALLOWED: Fuel is moderately toxic and tends to foam on vomiting. If drawn into the lungs, inflammation may develop. Do not induce vomiting. If spontaneous vomiting occurs place the victim in a forward position to reduce the risk of fuel being drawn into the lungs. Give nothing by mouth. If breathing but unconscious, place in the recovery position. If breathing has stopped, apply artificial respiration. Seek immediate medical attention.

WARNING: INHALED: Fuel is toxic to the respiratory and other body systems. Exposure may result in various symptoms including drowsiness, unconsciousness or severe health damage. Move a victim to fresh air. Keep a victim warm and at rest. If unconscious, place in the recovery position. If not breathing, apply artificial respiration. Give cardiac massage if necessary. Seek immediate medical attention.

NOTICE: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.

NOTICE: Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.

NOTICE: Make sure that non-plated tools are used.

NOTICE: Tools must be cleaned using a new brush and fresh suitable evaporative cleaning agent.

NOTICE: Make sure to use a steel topped workbench covered with clean, lint-free, non-flocking material.

NOTICE: Make sure that all parts removed from the vehicle are placed on the lint-free, non-flocking material.

NOTICE: Make sure that any protective clothing worn is clean and made from lint-free, non-flocking material.

NOTICE: Make sure to wear non-powdered latex type gloves.

NOTICE: Make sure to protect all electrical components and connectors with lint-free non-flocking material before using the suitable evaporative cleaning agent.

NOTE: *Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.*

Copyright © 2016 Ford Motor Company

Liquefied Petroleum Gas (LPG) and Compressed Natural Gas (CNG) Fuel Systems Health and Safety Precautions

WARNING: Vehicles with scheduled remote start technology may start at any time. Make sure the scheduled remote start system is disabled when servicing or working in close proximity to rotating engine parts. Failure to follow this instruction may result in serious personal injury.

WARNING: Service of Compressed Natural Gas (CNG) or Liquefied Petroleum Gas (LPG) vehicle systems is restricted to qualified personnel and authorized workshops. The required qualifications vary by region. Always observe local laws and legislative directives regarding CNG or LPG vehicle service. Failure to follow this instruction may result in serious personal injury or death.

WARNING: Compressed Natural Gas (CNG) or Liquefied Petroleum Gas (LPG) is highly flammable and toxic when contained in unventilated work areas. Work in a dedicated area with good ventilation and no sources of ignition. Failure to follow these instructions may result in serious personal injury or death.

WARNING: Liquefied Petroleum Gas (LPG) is capable of harming eyes or freezing skin. Always wear personal protection gear, including safety goggles and gloves to avoid contact with liquid gas. Failure to follow these instructions may result in serious personal injury.

WARNING: Always observe local regulations regarding storage or indoor parking of Liquefied Petroleum Gas (LPG) vehicles. Do not park vehicles near sources of heat, ignition or unventilated open pits. Failure to follow these instructions may result in serious personal injury.

WARNING: Liquefied Petroleum Gas (LPG) is heavier than air and will collect in low points in a building, such as drains or work pits. Never discharge a tank inside a building. If possible, tanks should be discharged beforehand by running the vehicle. Any discharge of gas must be done outside in well-ventilated flat areas. Failure to follow these instructions may result in the accumulation of combustible gas, which could cause personal injury or death in a fire or explosion.

WARNING: Extreme heat such as paint drying ovens will cause an increase in Compressed Natural Gas (CNG) or Liquefied Petroleum Gas (LPG) fuel tank pressure. The fuel tank must be removed before using paint drying ovens with temperatures above 60° C. Failure to follow this instruction may result in a release of combustible gas, which could cause personal injury or death in a fire or explosion.

WARNING: Liquefied Petroleum Gas (LPG) may present a personal health hazard if handled improperly. Always consult the LPG material safety information sheet before servicing a LPG vehicle. Failure to follow this instruction may result in serious personal injury or death.

Copyright © 2016 Ford Motor Company

Compressed Natural Gas (CNG) Fuel Systems Health and Safety Precautions

WARNING: Highly flammable and explosive mixtures are always present and may ignite when working on fuel systems. Do not allow naked flames, sparks or lighted substances to come near fuel related components.

WARNING: Only qualified technicians are allowed to work on CNG systems.

Make sure that all components of the CNG fuel system are labeled with the ECE R 110 approval label.

Fuel may not give adequate warning before toxic or harmful effects arise.

Exposure to fuel can be harmful and can cause severe health damage or death.

EYE CONTACT: If CNG comes into contact with the eyes, immediately flush the eyes with plenty of running water for 15 minutes. Seek immediate medical attention.

INHALED: If CNG is inhaled, move a victim to fresh air. Keep a victim warm and at rest. If breathing stops, provide artificial respiration. Seek immediate medical attention.

SKIN CONTACT: If CNG comes into contact with the skin, it produces severe frostbite. Immediately flush affected areas with plenty of cold running water. Seek immediate medical attention.

Provide adequate ventilation when working on fuel systems.

Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.

Copyright © 2016 Ford Motor Company

Pyrotechnic Device Health and Safety Precautions

WARNING: Service and handling of Pyrotechnic Components is restricted to qualified personnel. The required qualifications vary by region. Always observe local laws and legislative directives regarding Pyrotechnic Components service and handling. Failure to follow this instruction may result in serious personal injury or death.

WARNING: INHALED: Exposure to pyrotechnic residue may cause low blood pressure, severe headache, irritation of mucous membranes, fainting, shortness of breath or rapid pulse. Move a victim to fresh air. Seek immediate medical attention.

WARNING: EYE CONTACT: Exposure to unburned pyrotechnic residue may cause irritation, burning and etching of the eyes. Flush immediately with plenty of cold running water for at least 15 minutes. Seek immediate medical attention.

WARNING: EYE CONTACT: Exposure to burned pyrotechnic residue may cause irritation, burning and etching of the eyes. Flush immediately with diluted boric acid solution. Seek immediate medical attention.

WARNING: SKIN CONTACT: Unburned pyrotechnic residue may be rapidly absorbed through the skin in toxic quantities. Wash immediately with plenty of soap and water. Seek medical attention.

WARNING: SKIN CONTACT: Burned pyrotechnic residue may be rapidly absorbed through the skin in toxic quantities. Wash with plenty of water. Do not use soap. Seek medical attention.

WARNING: SWALLOWED: Unburned pyrotechnic residue is extremely toxic. If conscious drink plenty of water then induce vomiting. Seek immediate medical attention. If unconscious, or in convulsions do not attempt to induce vomiting or give anything by mouth. Seek immediate medical attention.

WARNING: SWALLOWED: Burned pyrotechnic residue is extremely toxic. Drink plenty of water and seek immediate medical attention.

WARNING: The deployment key must only be accessible to authorized personnel.

WARNING: Make sure that the deployment key remains removed from the deployment equipment except during deployment.

WARNING: If permenantly disabling or enabling the passenger air bag a new seat belt for vehicles without or with a passenger air bag must be installed.

WARNING: Undeployed pyrotechnic components must not be deployed in the vehicle.

WARNING: Pyrotechnic components must be deployed following local regulations.

WARNING: Check thoroughly that no loose objects can be spread during the deployment of pyrotechnic components.

WARNING: Pyrotechnic components must be transported following local regulations.

WARNING: Never carry out any electrical measurement on disconnected, undeployed pyrotechnic components.

WARNING: Pyrotechnic components must not be disassembled.

WARNING: Pyrotechnic components are not interchangeable between vehicles.

WARNING: Always carry a live air bag module away from the body with the air bag or trim cover pointing upwards.

WARNING: Live air bag modules must be placed in a suitable cage when removed from the vehicle. The air bag or trim cover must be facing upwards.

WARNING: Do not install a rearward facing child safety seat to the passenger seat with an activated passenger air bag.

NOTICE: Pyrotechnic components must not be subjected to temperatures higher than 110°C.

NOTICE: Never install aftermarket accessories to the vehicle on or adjacent to the supplemental restraint system module.

Copyright © 2016 Ford Motor Company

Window Glass Health and Safety Precautions

WARNING: Cured polyurethane (PU) adhesive can degrade if subjected to high temperatures. Isocyanide compounds can be released when grinding or welding in close proximity to cured PU adhesive.

WARNING: SKIN CONTACT: Prolonged exposure to polyurethane (PU) adhesive may cause skin irritation. If PU adhesive comes into contact with the skin, remove any contaminated clothing. Immediately wash the skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality.

WARNING: EYE CONTACT: Polyurethane (PU) adhesive may cause severe irritation or damage. If PU adhesive comes into contact with the eyes, immediately flush eyes with plenty of running water for at least 15 minutes. Seek immediate medical attention.

WARNING: SWALLOWED: If polyurethane (PU) adhesive is swallowed, flush the mouth thoroughly. Do not induce vomiting. Provide rest, warmth and fresh air. Seek immediate medical attention.

WARNING: INHALED: Persons having a respiratory allergy may have an allergic reaction when handling polyurethane (PU) adhesive.

WARNING: INHALED: Polyurethane (PU) adhesive can cause asthma like symptoms. Isocyanate vapor from primer or PU adhesive can cause allergies in the respiratory tract.

WARNING: INHALED: If polyurethane (PU) adhesive fumes are inhaled, move victim to fresh air. Provide oxygen if necessary. If breathing stops, provide artificial respiration. Keep a victim warm and at rest. Seek immediate medical attention.

NOTICE: Make sure that the direct glazing for bonded glass cutting blades are changed where the cutting depth changes to avoid damage to the body and trim panels.

NOTICE: During the curing period of the PU adhesive, the door windows must be left open to avoid a build up of pressure when the doors are opened and closed.

Copyright © 2016 Ford Motor Company

Body Repair Health and Safety and General Precautions

WARNING: Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.

WARNING: Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry out body side sectioning repairs in areas of door hinge or striker anchoring points. Welding within 50 mm (1.96 in) of door hinge or striker locations may compromise structural integrity during a collision. Failure to follow these instructions may result in serious injury to vehicle occupant(s).

WARNING: Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.

WARNING: All safety belt components must be inspected and corrected as part of any collision repair. Inspect all safety belt components as prescribed by Safety Belt Inspection and Repair After a Collision found in Section 501-20A General Procedures of this manual. Failure to follow this instruction may result in incorrect operation of the safety belt system and increase the risk of serious personal injury or death in a crash.

WARNING: If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

WARNING: Collision damage repair must conform to the instructions contained in this workshop manual. Replacement components must be new, genuine Ford Motor Company parts. Recycled, salvaged, aftermarket or reconditioned parts (including body parts, wheels or safety restraint components) are not authorized by Ford.

Departure from the instructions provided in this manual, including alternate repair methods or the use of substitute components, risks compromising crash safety. Failure to follow these instructions may adversely affect structural integrity and crash safety performance, which could result in serious personal injury to vehicle occupants in a crash.

Copyright © 2016 Ford Motor Company

Wheel and Tire Health and Safety Precautions

WARNING: Never inflate a tire that has been run flat without first removing the tire from the wheel to inspect for damage. A damaged tire can fail during inflation. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not mount tube-type tires on tubeless wheels or tubeless tires on tube-type wheels. Incorrect combinations could result in tire separation from wheel and may result in serious injury to vehicle occupant(s).

WARNING: Cracked wheels can be dangerous. Deflate tires on cracked wheels prior to removal of wheels from the vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Retighten wheel nuts within 160 km (100 mi) after a wheel is reinstalled. For dual rear wheel (DRW) only, a second retightening is required within 800 km (500 mi). Wheels can loosen after initial tightening. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

WARNING: Always match the tire size to the wheel size during assembly. Incorrect matching can result in tire bead damage or tire separation from the wheel. Failure to follow this instruction may result in serious personal injury to technician or vehicle occupant(s).

WARNING: Do not weld or peen wheels. A wheel needing such repairs must have a new wheel installed. Failure to follow these instructions may result in wheel failure and serious personal injury.

Copyright © 2016 Ford Motor Company

Diagnostic Methods

Effective Diagnostic Techniques

NOTE: *Do not use this document in place of Ford-prescribed Symptom Based Diagnostics or Workshop Manual diagnostics. Diagnostic Methods is intended to provide Ford vehicle diagnostic information only for support of Ford-prescribed diagnostics.*

The following diagnostic process is critical for consistently successful diagnoses. Random methods work inconsistently and often lead to multiple repairs and the accompanying frustration.

- Understand and verify the **symptom**.
  - Understanding a symptom requires understanding normal operation.
  - Duplicate the concern. Recreate the same conditions that demonstrated the original concern (road testing may be necessary).
- Determine the responsible **system**.
  - Gather data, such as a visual inspection and an OASIS report.
  - Perform system tests, such as pressure tests or DTC retrieval.
- Identify the responsible **component**.
  - Test the suspect component and related parts.
- Determine the root **cause**
  - Examine related components (wiring faults, misalignments, incorrect adjustments) that may be the actual cause or may have caused the component failure.
  - Repair all related faults to avoid repeat failures.
  - Verify the repair has corrected the concern (and not created any new ones) using the identical conditions that demonstrated the original concern.

Diagnostic Scan Tool Testing

Network Test

Performing a network test is always recommended for analysis of electronic system concerns. Always solve network issues before addressing individual symptoms or DTCs.

Recommended Practices: Refer to section 418-00 Module Communications Network, Diagnosis and Testing, to diagnose a network outage or no response from an individual module (or modules).

Diagnostic Trouble Code Retrieval

Generally, a good diagnostic strategy is to resolve all on-demand codes related to the system concern. Retrieving all continuous DTCs can also be beneficial to understand historic issues or issues outside of the suspect system that may be affecting your concern. On-demand testing should be done to ensure the fault represented by a continuous DTC is still present.

Continuous Memory Diagnostic Trouble Codes

Modules that produce diagnostic trouble codes have a program that evaluates system conditions, normally while the vehicle or system is in use. Module inputs can be checked for values indicating an electrical fault with the monitoring circuit or component. Module outputs can be monitored for correct function. Codes are stored when predefined limits are exceeded and retained even if the ignition is turned off (generally a DTC is retained for 40+ ignition cycles). Not all continuous codes have a matching on-demand code - and vice versa. This varies with different modules. For example, some network communication codes are continuous only. It is important to note that the presence of a continuous DTC does not guarantee that the fault currently exists.

Clearing Continuous Memory Diagnostic Trouble Codes

Continuous Memory DTCs caused by the issue being repaired or created during the diagnosis and repair must be cleared or they will confuse future diagnosis. NOTE: Do not clear DTCs from unresolved vehicle issues.

Ford On-Demand Diagnostic Trouble Codes

Ford Motor Company modules have a unique feature that performs a special diagnostic program at the request of the technician (using a diagnostic scan tool). This "On-demand" diagnostic program can exercise system outputs not normally running when the car is parked and record observed faults. These diagnostic codes are communicated to the scan tool, but are not recorded in module memory. An on-demand test is an effective tool for evaluating real input and

output conditions during module activity – activity that might not normally be occurring during service bay conditions. For example, an air suspension module on-demand test can run the compressor, vent the system, and observe the report from the height sensor even when the car is already at correct trim height and not requiring height adjustment.

Network Communication Diagnostic Trouble Codes

Network DTCs (U-prefix codes) are often a result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle repair procedures (such as module reprogramming or diagnostics with modules disconnected) often set network DTCs. Replacing a module to resolve a network DTC is unlikely to resolve the concern. To prevent recurrence of intermittent network concerns, inspect all network wiring, especially in-line and module connectors. Test the vehicle battery to make sure the vehicle voltage will be stable.

Recommended practice: Clear the DTC and retest. If the DTC repeats, test the vehicle communication network.

DTC Nomenclature (SAE J2012 and ISO 14229)

Many modules use 5-character DTCs followed by a 2-character failure-type code. The failure-type (sometimes called "fault byte") codes provide information about specific fault conditions such as opens or shorts to ground. Continuous memory DTCs have an additional 2-character DTC status code suffix to assist in determining DTC history.

Integrated Diagnostic System Scan Tool Usage

If The Integrated Diagnostic System Scan Tool Does Not Communicate With The Vehicle Communication Module

1. Check the Vehicle Communication Module connection and power from the DLC.
2. Check the communication between the scan tool and the Vehicle Communication Module.
3. Follow scan tool instructions to retry.

If The Integrated Diagnostic System Scan Tool Does Not Communicate With The Vehicle

The IDS scan tool first attempts to communicate with the PCM. After establishing communication with the PCM, the scan tool then attempts to communicate with all other modules on the vehicle.

1. Verify the scan tool operation with a known good vehicle.
2. Verify the ignition is ON.
3. If an IDS session cannot be established with the vehicle, (IDS may state "No communication can be established with the PCM"):
    - Choose "NO" when the scan tool prompts to retry communication.
    - Enter a PCM engineering part number, tear tag, or calibration number to identify the vehicle and start a session. These identifying numbers may be found:
        - The PCM engineering part number and the 4-character tear tag are printed on the PCM label.
        - (PTS website users only) The PCM engineering part number can be determined from OASIS using the VIN. Choose “HVBoM” from the OASIS tab menu and search Powertrain engine modules for the PCM engineering part number (If the first character is a "P" in the part number, enter only the characters following the "P" into IDS).
    - Establish a session based on the PCM information (above).
4. Using the tool box menu, run the network test.
    - Determine if all modules on the network are unresponsive or if only the PCM does not communicate.
    - **Recommended practice:** Refer to section 418-00 Module Communications Network, Diagnosis and Testing, to diagnose the network outage or no response from the PCM.

Measuring Automotive Circuits

Wiring Pin (Terminal) Fit And The Use Of Rotunda Flex Probes

- To avoid wiring pin (terminal) damage, Rotunda Flex Probes NUD105-R025D or Terminal Probe Kit 29-011A must be used to connect test equipment or jumper wires to pins (terminals).
- Male to female pin (terminal) fit is critical for correct connection and durability.
    - Pin (terminal) fit may be checked by using the mating pin (terminal) to test for normal separation force (a damaged pin or terminal will have very low separation force from the mating pin or terminal)
    - Correctly checking the separation force of small pins (terminals) may require removal of the connector terminal guide/retainer if it adds drag to the pin (terminal) insertion or removal
- Replace damaged connectors or pins (terminals).

Checking Power-Providing Circuits

- Measuring a power wire with the intended load disconnected using a Digital Multimeter (DMM) will only find open circuits (open fuse or wire).
- **Recommended practice:** Circuits carrying approximately 200-1000 mA* may be loaded with a 250-350 mA test light. Measure circuit voltage with a Digital Multimeter (DMM) while the test light is connected and illuminated. A reduction in the voltage present during test-light-loading indicates excessive circuit resistance.
- **Recommended practice:** Circuits carrying more than one ampere* should be loaded with a device requiring similar current (e.g., a headlamp bulb may be effective). A reduction in the voltage present during loading indicates excessive resistance.
- *Circuit current is matched to wire gauge/size; Examples:
  - Conductor sizes of 24 gauge (.5 mm) or smaller are generally used to carry approximately 1 ampere (1000 mA) or less. Use of the test light to load these circuits is appropriate.
  - Conductor sizes of 20 gauge (.8 mm) or larger are generally used to carry approximately 5 amperes (5000 mA) or more. Match the substitute load (measure substitute load current first as necessary) to this current level.

Checking Ground-Providing Circuits

- The best method of checking ground circuits is to measure the circuit voltage drop during component operation (or attempted operation).
- An ohmmeter may be accurately used if the battery has been disconnected.
- **Recommended practice:** Expect less than 2 ohms for most small diameter (18 gauge and smaller) wires.
- Ohmmeter accuracy is limited to circuits carrying less than approximately 5 amperes (this is due to the fact that very small resistances, undetectable by a Digital Multimeter (DMM), cause significant voltage loss in higher current circuits).
- Digital Multimeter (DMM) ohmmeter readings are easily corrupted by the normal voltage present (battery connected) in many ground circuits.
  - **Recommended practice:** Reverse the leads and check for changes in the measurement. Reversing the Digital Multimeter (DMM) lead connections should never change the resistance measurement (unless the circuit contains a semi-conductor). Measurement (non-semi-conductor) differences when leads are interchanged at the test points indicate invalid test results. The presence of voltage corrupts the reading, and causes the meter reading to change when the leads are reversed.

Checking Circuit Continuity

- **Recommended practice:** Expect less than 2 ohms of resistance for most wires.
- Ohmmeter low-resistance resolution (approximately 0.1 ohm) limits its use to circuits carrying less than approximately 5 amperes. This is due to the fact that very small resistances, below the resolution of a Digital Multimeter (DMM), cause significant voltage loss in higher current circuits.
- The Digital Multimeter (DMM) applies a small amount of voltage to the circuit or component to calculate resistance. As a result, Digital Multimeter (DMM) ohmmeters are very sensitive to any level of voltage present. Voltage present in the circuit will corrupt the Digital Multimeter (DMM) reading.

Checking For Unintended Continuity (Shorts) To Other Circuits

- A Digital Multimeter (DMM) ohmmeter may be used to detect undesired circuit connections to:
  - Ground
  - Other unpowered circuits
- **Recommended practice:** Expect greater than 10,000 ohms of resistance between two separate circuits; the best result is an open circuit Digital Multimeter (DMM) indication (no detected resistance).
- Shorts to voltage are checked with a voltmeter
- **Recommended practice:** Turn ignition on (with battery connected) and measure the circuit for any voltage present (none should be present)

Checking Circuits By Back-Probing A Connector

- Back-probing should be a testing method of last resort. It should only be employed where a diagnostic step requires a circuit to be tested under actual operating conditions. Back-probing is a risky testing method due to the uncertainty of the probe connection and the possibility of damaging terminals.
- Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors and subsequent electrical faults.
  - Use back probes specifically designed for the purpose to assist in making a good test connection and to prevent connector or terminal damage during back-probing.
- Do not test for the presence of voltage at a single point where zero volts is a possible result (you cannot tell the difference between a bad probe contact and a zero volt result).
- Do not test for continuity/opens (using an ohmmeter) between two points (you cannot tell the difference between bad probe contacts and an open circuit).
- Back-probing may be used where the circuit must be analyzed with the voltage-drop method (if the circuit carries greater than 5 amperes and no other means of testing will definitively eliminate circuit resistance as a

possible fault). A zero-volt result indicates incorrect test conditions (no current flow) or bad back-probe connections.
- Occasionally, module failure mode behavior will change the operation of a circuit when it is opened for testing. Back-probing is an acceptable remedy for these testing dilemmas.

Circuit Analysis Using Jumper Wires (Creating Substitute Circuits)

- Jumper wires may be employed for circuit analysis.
- **Cautions:**
  - Always use fused jumper wires — the recommended universal-testing jumper wire fuse is 2-5 amperes; larger fuse ratings should be used only in special circumstances.
  - Use flex probes or equivalent to prevent connector terminal damage (flex probes are not intended to carry higher currents necessary to operate motors such as a cooling fan or blower motor).
  - Follow workshop manual testing directions when using jumper wires to avoid component or harness damage due to incorrect jumper connections.
  - Never repair a circuit by adding a new wire in parallel to the old one (overlaying the circuit) without fully understanding what caused the circuit to fail. Always find, examine, and repair the fault to correct the root cause and to repair any adjacent wiring that has been damaged.

Checking Modules

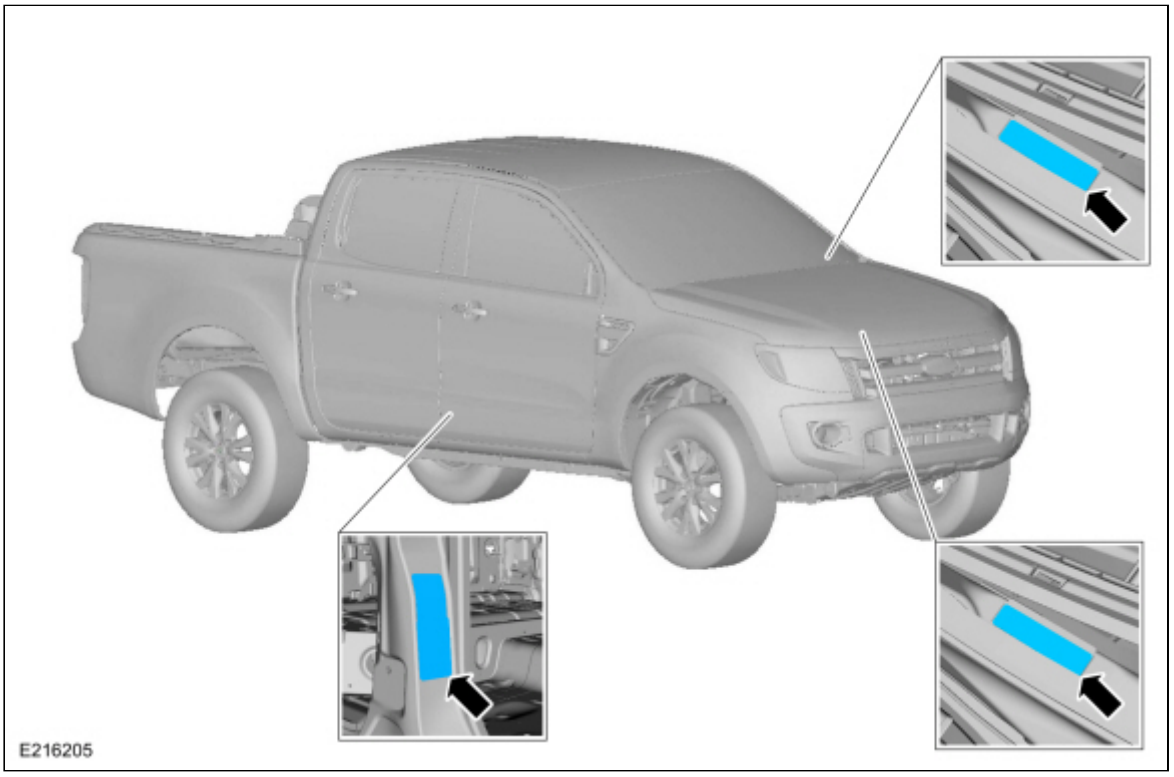
- Generally, module failure rate is very low and therefore replacement modules usually do not resolve the root cause. Incorrect replacement of a module is often the result of inadequate testing.
  - Understand the correct module function.
  - Make sure programmable parameters are set correctly for the function in question (Refer to 418-01 Module Configuration for more information).
  - Resolve DTCs first — as directed by Diagnostic Routines.
  - Test all inputs, both hard-wired and networked.
  - Test outputs (see "Checking module switching circuits" below).
  - Check applicable TSBs for module software changes (flash programming).
- Checking module switching circuits.
  - Using the scan tool module-output command function (for example, IDS Output State Control) to activate components is a fast way to confirm an output is capable of being switched on by the module. Testing that reveals normal module-output function confirms the need to analyze the module inputs.
  - Don't apply ground or power directly to module-switched components with jumper wires (unless directed by a workshop manual procedure), as the component could be damaged by a direct connection to ground/power.

Copyright © 2016 Ford Motor Company

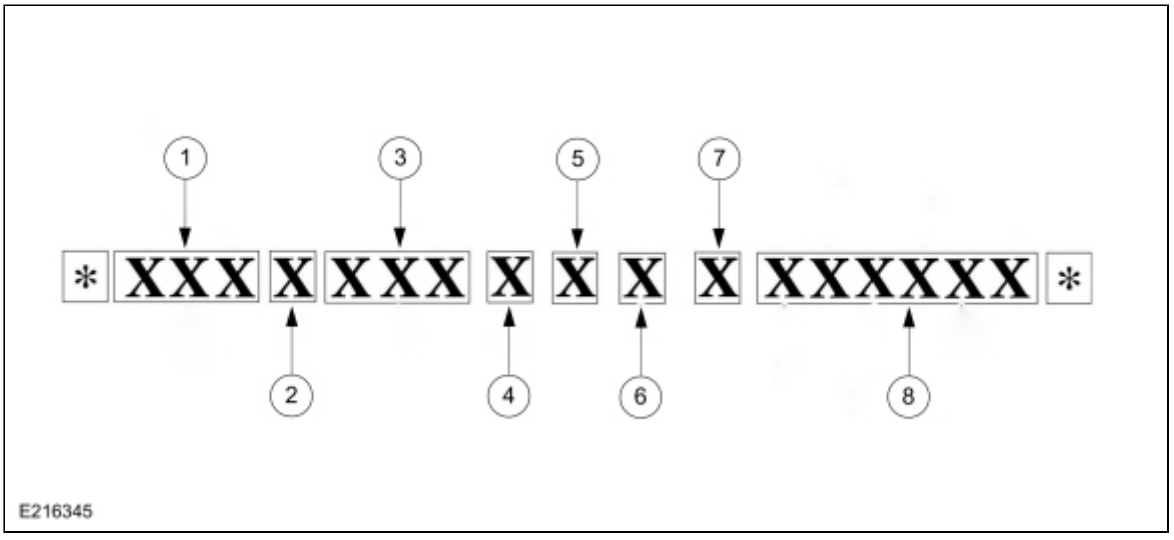
Identification Codes

NOTE: *The vehicle identification number (VIN) can be identified by an asterisk (*) at its start and finish.*

The vehicle identification number (VIN) is stamped on RH side of ladder frame of the vehicle . The VIN plate is located on the inside of the LH fender body panel, near to PCM. The code is stamped during production to enable the precise details of the vehicle build specification to be established.



Vehicle Identification Number



Item	Part Number	Description
1	—	VIN Positions 1, 2 and 3 — World Manufacturer Identifier
2	—	VIN Position 4 — Restraint-type code
3	—	VIN Positions 5, 6 and 7 — Vehicle line, series, body-type code

4	—	VIN Position 8— Engine-type code
5	—	VIN Position 9— Computer-generated check digit
6	—	VIN Position 10 — Model year code
7	—	VIN Position 11 — Assembly plant code
8	—	VIN Position 12-17— Production sequence number

VIN Positions 1, 2 and 3 — World Manufacturer Identifier

Code	World Manufacturer
MNA	**RHD:** Australia, New Zealand
MNB	**RHD:** Thailand , Indonesia, Malaysia, Bangladesh, Brunei, Fiji, Singapore, Sri Lanka, Nepal, Papua New Guinea, Hong Kong, Kiribati, East-Timor, Bhutan, Cook Islands, Solomon Islands, Tonga
MNC	**LHD:** Philippines, Vietnam, Taiwan, Burma (Myanmar), Cambodia, New Caledonia, Wallis, Vanuatu, Palau, Micronesia, Tahiti, Mongolia, Laos, Nauru, Majuro/ Marshall Islands & Futuna

VIN Positions 4 — Restraint System

Code	Air bag
B	Seat belts only
D	Driver Airbag + Seat belts
L	Driver airbag + passenger airbag
U	Driver airbag + passenger airbag + Side Curtain Airbags
W	Driver airbag + passenger airbag + Side airbags + Side Curtain Airbags

VIN Positions 5 — Production source

Code	Production source
M	Thailand

VIN Positions 6 — Body style

Code	Body style
A	Regular cab-chassis (Single)
B	Regular cab
E	Double cab-chassis
F	Double cab
1	RAP cab-chassis
2	RAP cab

VIN Position 7— GVM

Code	GVM
E	2723 to ≤ 3175 kg
F	> 3175 to 3629 kg

VIN Position 8 — Engine type

Code	Engine type
3	2.5L Petrol, EFI
0	2.2L Diesel low power (120PS)
2	2.2L Diesel mid power (130PS)
8	2.2L Diesel high power (150PS)
5	3.2L Diesel DOHC EFI I5 200PS

VIN Position 9 — Constant Value

Code	Constant Value
0	0

VIN Position 10 — Production Year/Model year

Code	Year	Production year for markets	Model year for markets
F	2015	**RHD:** Indonesia, Thailand, Australia, New Zealand **LHD:** Philippines, Taiwan	**RHD:** Malaysia, Bangladesh, Brunei, Fiji, Singapore, Sri Lanka, Papua New Guinea,Hong Kong, Samoa, Kiribati, East- Timor, Bhutan, Cook Islands, Nepal, Solomon Islands & Tonga **LHD:** Vietnam, Cambodia, New Caledonia, Wallis, Futuna, Vanuatu, Palau, Micronesia, French Polynesia, Tahiti, Mongolia, Laos, Nauru, Burma (Myanmar) & Majuro/ Marshall Islands
G	2016		
H	2017		
I	2018		
J	2019		

VIN Position 11 — Plant

Code	Plant
W	AutoAlliance Thailand

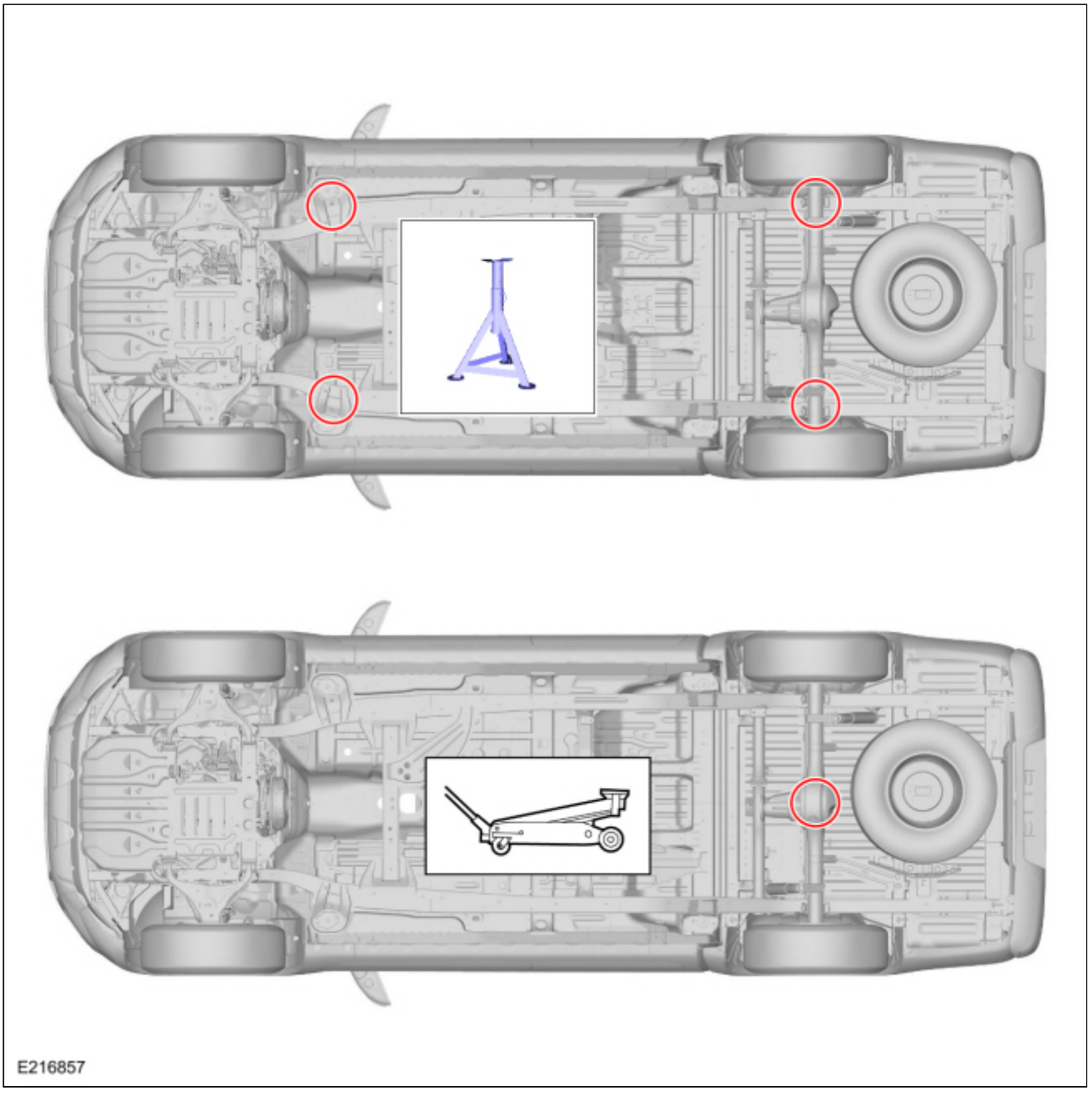
VIN Positions 12 to 17 — Serial Number

Vehicle Sequence Number (6 digits): 000001 – 999999

Copyright © 2016 Ford Motor Company

Jacking and Lifting - Overview

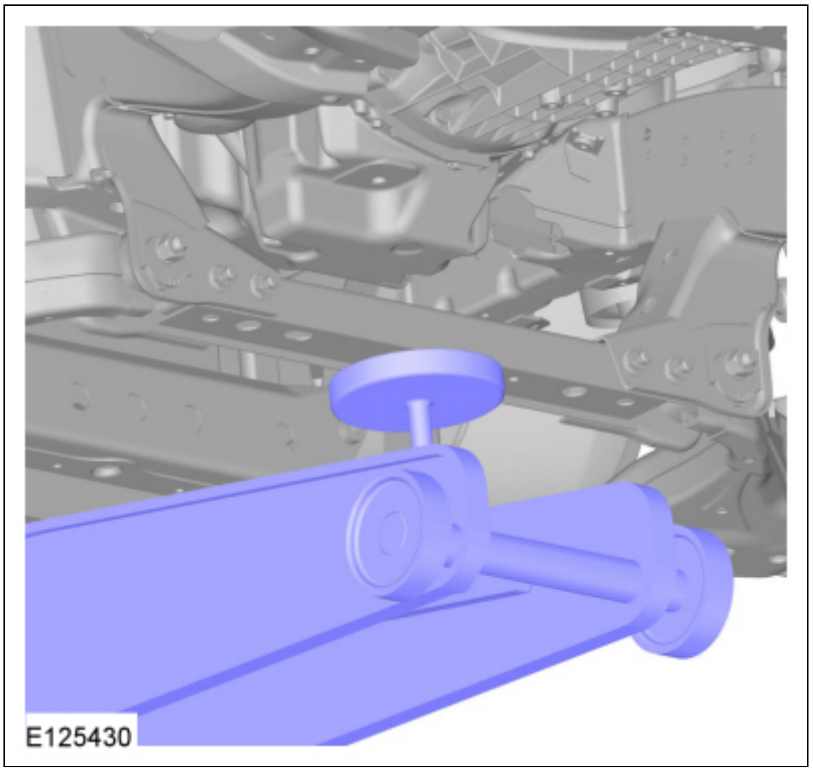
Jacking points



Only the specified jacking points may be used for jacking and supporting the vehicle.

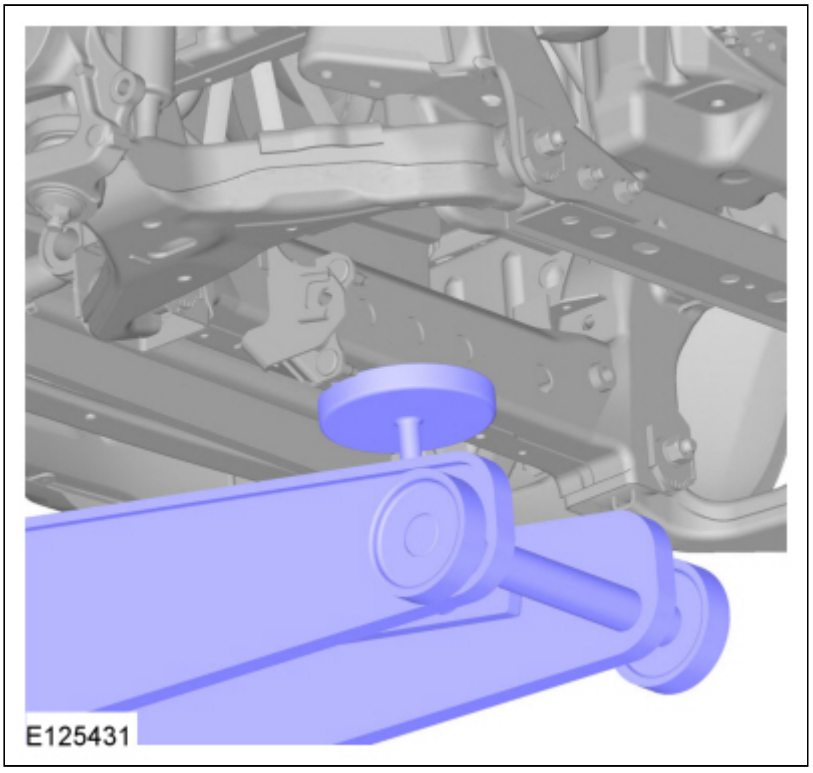
Front

4X2



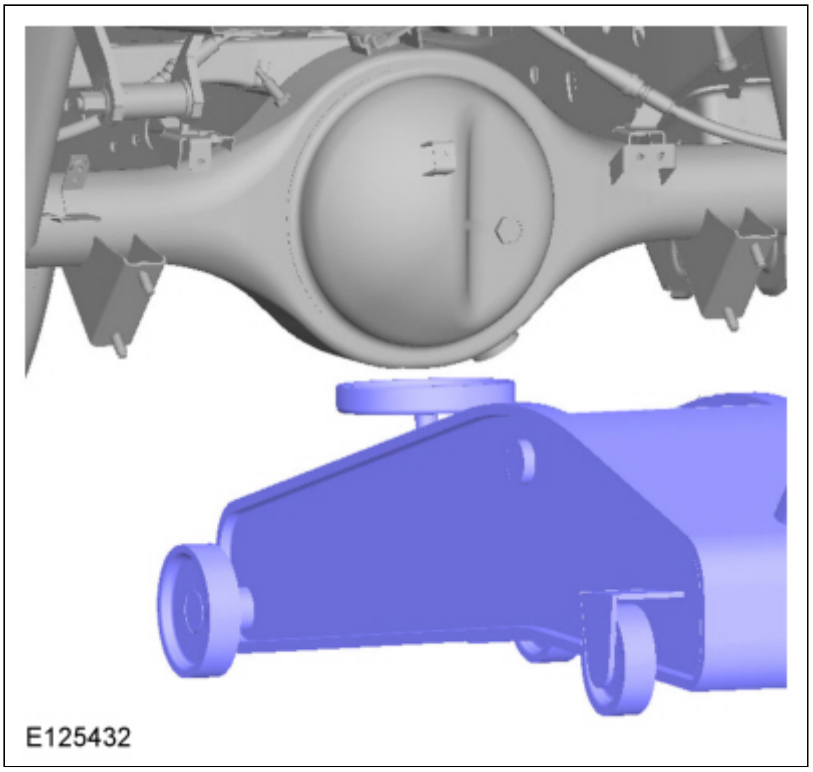
Use safety stands to support the vehicle after it has been lifted.

4X4



Use safety stands to support the vehicle after it has been lifted.

Rear

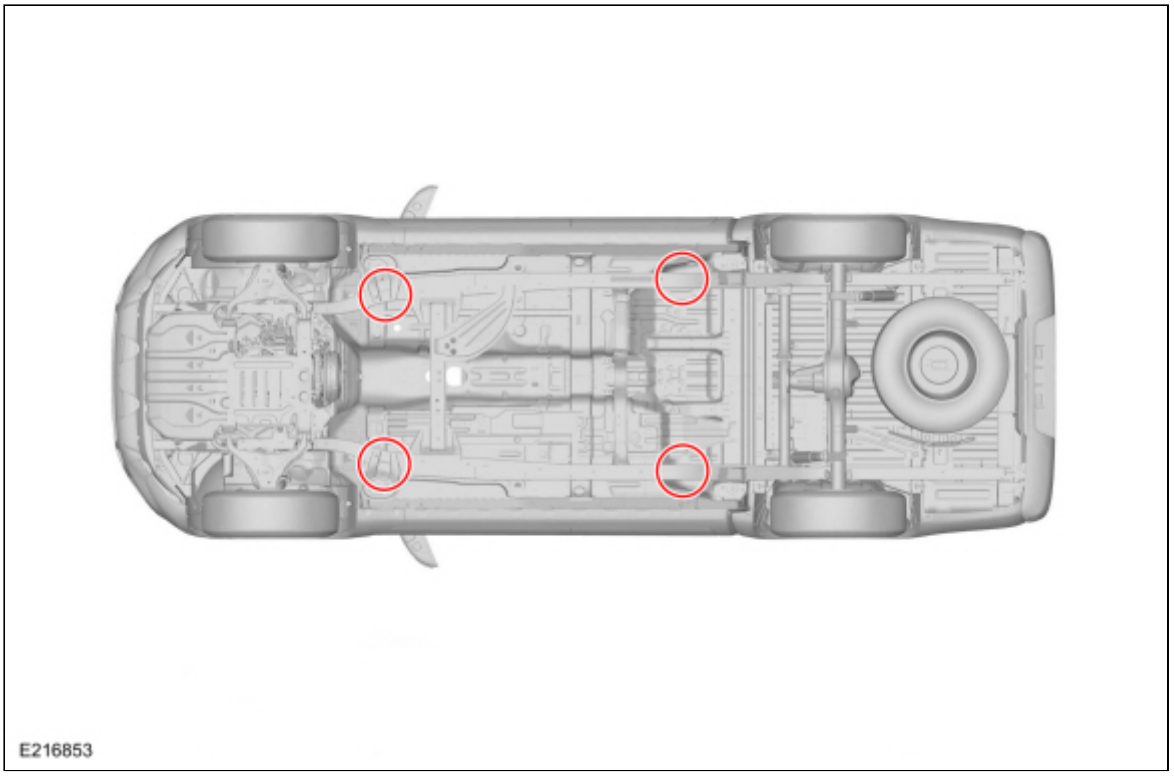


NOTE: *At the center of the rear diffferential.*

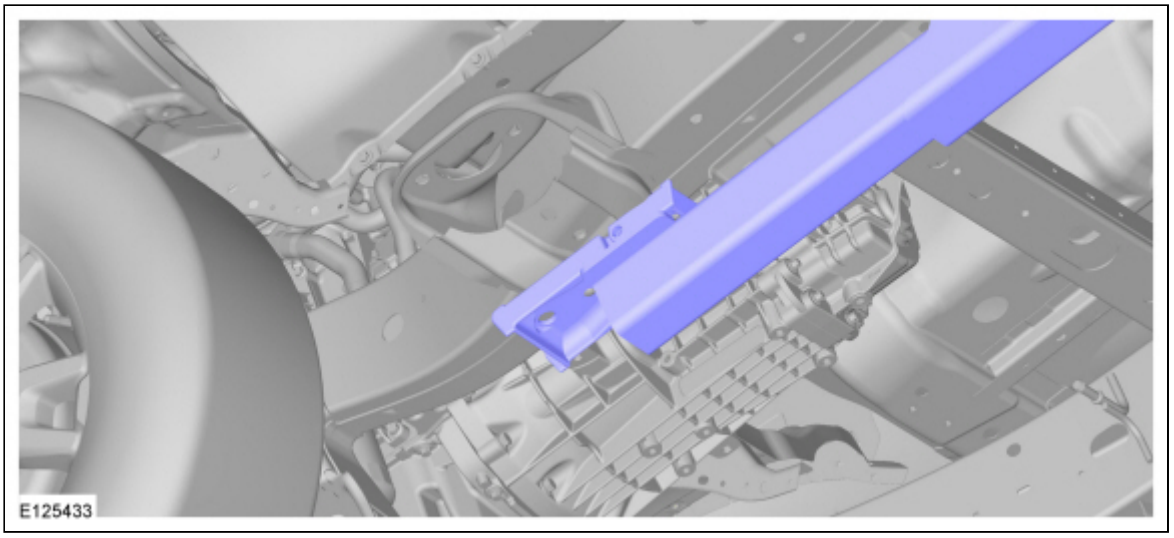
The rear jacking points are located on the rear axle.

Lifting points

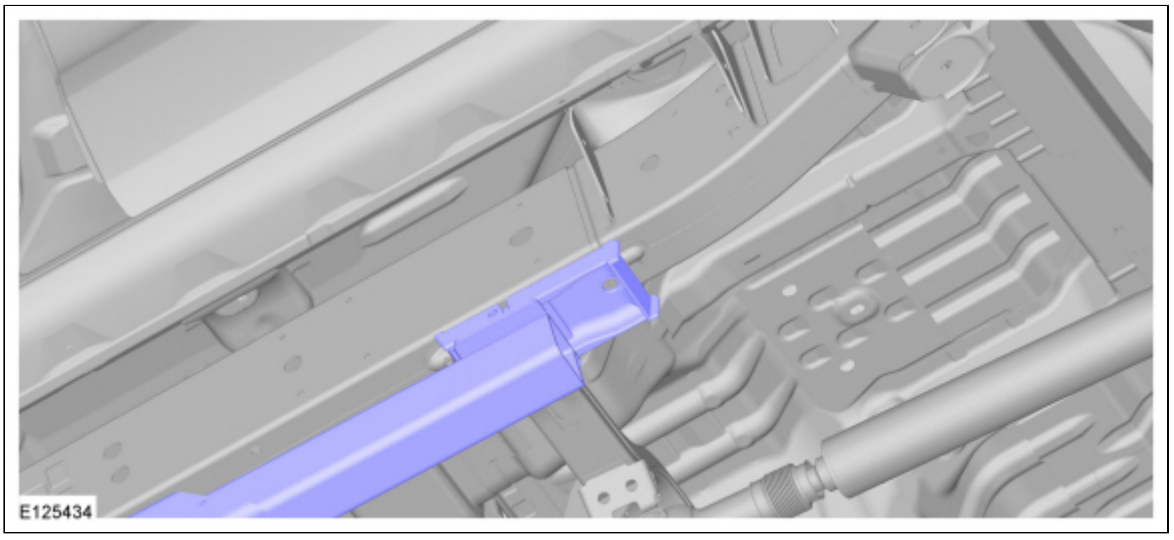
WARNING: When raising a vehicle on a two-column hoist, use care when positioning the vehicle so that the hoisting forks do not interfere with side steps, suspension components, mounting brackets or stabilizer mounting brackets, if equipped. In addition, use care in hoist positioning to avoid possible damage to the axle or rear cover.



Lifting points - Front



Lifting points - Rear



Copyright © 2016 Ford Motor Company

Noise, Vibration and Harshness (NVH)

Noise, vibration and harshness (NVH) is becoming more important as vehicles become more sophisticated and passenger comfort levels increase. This section is designed to aid in the diagnosis and testing and repair of NVH concerns.

- Noise is defined as sounds not associated with the operation of passenger compartment equipment that interface with customer satisfaction.
- Vibration is defined as impulses felt by the customer that are not caused by road surface changes.
- Harshness is a ride quality issue where the customer feels that the vehicle response to the road surface is sharply transmitted to the customer.

Diagnostic Theory

Diagnosis is more than just following a series of interrelated steps in order to find the solution to the specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also it is knowing how the system should work and whether it is working correctly.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition is usually found the first time through the system.

Know the System

- Know how the parts go together.
- Know how the system operates as well as its limits and what happens when the system goes wrong.
- Sometimes this means checking the system against one that is known to be working correctly.

Know the History of the System

A clue in any one of these areas may save time:

- How old or new is the system?
- What kind of treatment has it had?
- Has it been serviced in the past in such a manner that might relate to the present condition?
- What is the service history?

Know the History of the Condition

- Did it start suddenly or appear gradually?
- Was it related to some other occurrence such as a collision or previous part replacement?
- Know how the condition made itself known; it may be an important clue to the cause.

Know the Probability of Certain Conditions Developing

- Look for the simple rather than the complex.
- For example:
    - Electrical conditions usually occur at connections rather than components.
    - An engine no-start is more likely to be caused by a loose wire or small adjustment rather than a sheared-off camshaft.
- Know the difference between impossible and improbable. Certain failures in a system can be improbable but still happen.
- New parts are just that, new. It does not mean they are always good functioning parts.

Do Not Cure the Symptom and Leave the Cause

Lowering the pressure in a front tire may correct the condition of a vehicle leaning to one side, but it does not correct the original condition.

Be Positive the Cause is Found

- Double check findings.
- What caused a worn component?
- A loose transmission or engine mount could indicate that other mounts are also loose.

Diagnostic Charts

Charts are a simple way of expressing the relationship between basic logic and a physical system of components. They help discover the cause of a condition in the least time. Diagnostic charts combine many areas of diagnosis into one visual display:

- Probability of certain things occurring in a system.
- Speed of checking certain components or functions before others.
- Simplicity of performing certain tests before others.
- Elimination of checking huge portions of a system by performing simple tests.
- Certainty of narrowing down the search to a small portion before performing in-depth testing.

The fastest way to find a condition is to work with the tools that are available. This means working with proven diagnostic charts and the correct special equipment for the system.

Copyright © 2016 Ford Motor Company

Noise, Vibration and Harshness (NVH)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and REFER to the Symptom Chart.

How to Use this Diagnostic Procedure Section

- Noise, vibration and harshness (NVH) concerns have become more important as vehicles have become more sensitive to these vibrations. This section is designed to aid in identifying these concerns.
- The section provides diagnostic procedures based on symptom. If the condition occurs at high speed, for instance, the most likely place to start is under Shake and Vibration While Driving.
- The road test procedure will tell how to sort the conditions into categories and how to tell a vibration from a shake.
- A series of Road Test Quick Checks are provided to make sure that a cause is either pinpointed or eliminated.
- Name the condition, proceed to the appropriate section and locate the correct diagnosis. When the condition is identified, the job is partly done.
- Follow the diagnostic procedure as outlined.
- Quick Checks are described within the step, while more involved tests and adjustments are outlined in General Procedures.
- Always follow each step exactly and make notes to recall important findings later.

Customer Interview

The road test and customer interview (if available) provide information that will help identify the concern and will provide direction to the correct starting point for diagnosis.

Identify the Condition

NVH usually occur in four areas:

- tires
- engine accessories
- suspension
- driveline

It is important, therefore, that an NVH concern be isolated into its specific area(s) as soon as possible. The easiest and quickest way to do this is to carry out the Road Test as outlined. To assist in the diagnosis and testing procedure(s), use a suitable approved NVH diagnosis tester.

Noise Diagnostic Procedure

Non-Axle Noise

The five most common sources of non-axle noise are exhaust, tires, roof racks, trim panels and transmission.

Therefore, make sure that none of the following conditions are the cause of the noise before proceeding with a driveline teardown and diagnosis.

- In certain conditions, the pitch of the exhaust may sound very much like gear noise. At other times, it can be mistaken for a wheel bearing rumble.
- Tires, especially snow tires, can have a high pitched tread whine or roar, similar to gear noise. Radial tires may have this characteristic. Also, any non-standard tire with an unusual tread construction may emit a roar or whine noise.
- Trim panels can also cause whistling or whining noise.
- Clunk may be a metallic noise heard when the automatic transaxle is engaged in "R" (REVERSE) or "D" (DRIVE) or it may occur when the throttle is applied or released. It is caused by backlash somewhere in the driveline.
- Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a damaged wheel

bearing.

Noise Conditions

- Gear noise is typically a howling or whining due to gear damage or incorrect bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.
- Chuckle is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 64 km/h (40 mph) and can usually be heard all the way to a stop. The frequency varies with vehicle speed.
- Knock is very similar to chuckle, though it may be louder and occurs on acceleration or deceleration. The teardown will disclose what has to be corrected.

Clicking, popping or grinding noises may be caused by the following:

- worn, damaged or incorrectly installed wheel bearing, suspension or brake component.

Check and rule out tires, exhaust and trim items before disassembling the transmission to diagnose and correct gear noise.

The noises described under Road Test usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard on the road test and driving conditions.

Vibration Conditions

Vibration at highway speeds may be caused by the following:

- out-of-balance front or rear wheels.
- out-of-round tires.

Shudder or vibration during acceleration may be caused by the following:

- damaged powertrain/drivetrain mounts.
- excessively high constant velocity (CV) joint operating angles caused by incorrect ride height. Check ride height, verify correct spring rate and check items under inoperative conditions.

Road Test

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and may be audible at certain speeds or under various driving conditions, as on a newly paved asphalt road. The slight noise is in no way detrimental and must be considered normal.

The road test and customer interview (if available) provide information needed to identify the condition and give direction to the correct starting point for diagnosis.

1. Make notes throughout the diagnosis routine. Make sure to write down even the smallest bit of information, because it may turn out to be the most important.

2. Do not touch anything until a road test and a thorough visual inspection of the vehicle have been carried out. Leave the tire pressures and vehicle load just where they were when the condition was first observed. Adjusting tire pressures, vehicle load or making other adjustments may reduce the condition(s) intensity to a point where it cannot be identified clearly. It may also inject something new into the system, preventing correct diagnosis.

3. Make a visual inspection as part of the preliminary diagnosis routine, writing down anything that does not look right. Note tire pressures, but do not adjust them yet. Note leaking fluids, loose nuts and bolts, or bright spots where components may be rubbing against each other. Check the load space for unusual loads.

4. Road test the vehicle and define the condition by reproducing it several times during the road test.

5. Carry out the Road Test Quick Checks as soon as the condition is reproduced. This will identify the correct diagnostic procedure. Carry out the Road Test Quick Checks more than once to verify they are providing a valid result. Remember, the Road Test Quick Checks may not tell where the concern is, but they will tell where it is not.

Road Test Quick Checks

1. 24-80 km/h (15-50 mph): with light acceleration, a moaning noise is heard and possibly a vibration felt in the front floor panel. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed. It may also produce a moaning sound, depending on what component is causing it. REFER to Tip-in Moan in the Driveline Noise and Vibration Symptom Chart.

2. Acceleration/Deceleration: With slow acceleration and deceleration, a shake is sometimes noticed in the

steering wheel/column, seats, front floor panel, front door trim panel or front end sheet metal. It is a low frequency vibration (around 9-15 cycles per second). It may or may not be increased by applying the brakes lightly. REFER to Idle Boom/Shake/Vibration in the Driveline Noise and Vibration Symptom Chart.

3. High Speed: A vibration is felt in the front floor panel or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with the clutch pedal depressed (manual transmission) or shift control selector lever in "N" (NEUTRAL) (automatic transmission) and engine idling. If vibration is still evident, it may be related to wheels, tires, front brake discs, wheel hubs or front wheel bearings. REFER to Shake and Vibration While Driving in the Driveline Noise and Vibration Symptom Chart.

4. Engine rpm Sensitive: A vibration is felt whenever the engine reaches a particular rpm. It will disappear in neutral coasts. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is stationary. It can be caused by any component, from the accessory drive belt to the clutch or torque converter which turns at engine speed when the vehicle is stopped. REFER to Shake and Vibration While Driving in the Driveline Noise and Vibration Symptom Chart.

5. Noise and Vibration While Turning: Clicking, popping or grinding noises may be due to the following:

- worn, damaged or incorrectly installed front wheel bearing.
- damaged powertrain/drivetrain mounts.

Road Conditions

An experienced technician will always establish a route that will be used for all NVH diagnosis road tests. The road selected should be reasonably smooth, level and free of undulations (unless a particular condition needs to be identified). A smooth asphalt road that allows driving over a range of speeds is best. Gravel or bumpy roads are unsuitable because of the additional road noise produced. Once the route is established and consistently used, the road noise variable is eliminated from the test results.

NOTE: *Some concerns may be apparent only on smooth asphalt roads.*

If a customer complains of a noise or vibration on a particular road and only on a particular road, the source of the concern may be the road surface. If possible, try to test the vehicle on the same type of road.

Vehicle Preparation

Carry out a thorough visual inspection of the vehicle before carrying out the road test. Note anything which is unusual. Do not repair or adjust any condition until the road test is carried out, unless the vehicle is inoperative or the condition could pose a hazard to the technician. After verifying that the condition has been corrected, make sure all components removed have been installed.

Power Steering Conditions

Check for the noise in the following conditions to verify the customer concern.

- Check for the noise in several temperature conditions.
- Is the noise from when the vehicle was new?
- Can the noise be repeated constantly or is it random?
- Check the condition of the vehicle age, mileage and service record.
- Interview the customer to find the operating condition in which the noise will occur. Test the vehicle based on the detail(s) from the customer interview.
- Follow the power steering operation noise condition tables below, to find which condition the noise will occur.

Power Steering Operation Noise Check

Step 1: Check for NVH concerns from non-steering components, which may sound like noises coming from the steering system.

Power assisted steering operating condition			
Parking		**Driving**	
Steering central/slightly off center	Steering at a steering lock stop	Driving straight ahead	Cornering condition
REFER to NVH concerns from other components column A	REFER to NVH concerns from other components column B	REFER to NVH concerns from other components column C	REFER to NVH concerns from other components column D

NVH concerns from other components

NVH concerns from other condition (column A to D)					
Noise	**Driving Condition**	**A**	**B**	**C**	**D**
Pedal box knocking	Drive off, stop driving and slow cornering over uneven roads	X	X	O	X
Stabilizer bar link knocking	Drive off, driving and cornering	X	O	O	X
Engine support insulator knocking	Drive off, driving, acceleration and deceleration	X		X	
Air conditioning knocking	Engine on, activate switch for air conditioning	X	X	O	O
Suspension knocking (Subframe, Springs)	Drive off, driving, cornering, acceleration and deceleration	X		O	X
Constant velocity (CV) joint knocking	Drive off, driving, cornering, acceleration and deceleration	X	O		X
Washer bottle	Deceleration, acceleration and single impact	O		X	
Loose suspension bolts	All driving conditions	O		O	X
Instrument panel rattle/squeak	All driving conditions. Engine rpm dependant	X	X	X	X

- X = Noise will most likely occur in this operating condition.
- O = Noise can possibly occur in this operating condition.
- Blank = Noise is unlikely to occur in this operating condition.

Step 2: Check for steering system NVH concerns according to operation condition described at the customer interview.

Power assisted steering operating condition					
Parking		**Driving**		**Vehicle stationary with engine off**	
Steering central/slightly off center	Steering at a steering lock stop	Steering central/slightly off center	Steering at a steering lock stop	Steering central/slightly off centre	Steering at a steering lock stop
REFER to steering system NVH concerns column A	REFER to steering system NVH concerns column B	REFER to steering system NVH concerns column C	REFER to steering system NVH concerns column D	REFER to steering system NVH concerns column E	REFER to steering system NVH concerns column F

Steering system NVH concerns

Steering System operation condition (column A to F)							
Noise	**Driving condition**	**A**	**B**	**C**	**D**	**E**	**F**
Moan	Parking between lock stops, at engine idle and also increased engine speed	X	O				
Whine	Driving, high engine rpm. Must be present from new	O	O	X	X		
Hiss	a) Parking between lock stops. Must be present from new	X	X	O	O		
	b) Holding steering wheel against lock stops. Must be present from new		X				
Lock stop impact knock	a) Parking at lock stop. Must be present from new		X				X
Mechanical knock	b) Parking between lock stops, engine OFF. Must be present from new					X	

(power assisted steering (PAS) off)							
Mechanical Knock (PAS on)	c) Parking between lock stops, engine ON (ball joint knock)	X					
Hammer knock	d) Parking into lock stop and release (vehicle with hydraulic power assisted steering (HPAS) only, not for vehicles with electro-hydraulic power assisted steering (EHPAS))		X				
Hydraulic knock (clonk)	e) Driving, cobble stones, rough road (clonk). Must be present from new			O	X		
Column knock	f) Parking, driving. cobble stones and rough roads	X	X	O	X	X	X
Column rattle	Mainly driving on rough roads	O		X	X	O	
Toc-toc	Steering left and right at high frequency. Must be present from new	X					
Grinding	When turning steering wheel	X			O	X	
Zip	At engine start, low temperatures below -10°C only	X	O				

- X = Noise will most likely occur in this operating condition.
- O = Noise can possibly occur in this operating condition.
- Blank = Noise is unlikely to occur in this operating condition.

Step 3: According to each identified operating condition (Column A, B, C, D, E, F), check each possible Steering System NVH concern with the detail symptom charts below.

Before conducting a vehicle test to identify a NVH concern carry out the following checks.

1. Check the tire pressures and adjust to specification, as necessary.
2. Make sure the steering system fluid is correct, the system is free of leaks and is operating correctly.
3. Make sure the vehicle steering system temperature is the same as described at the customer interview.
4. All evaluations must take place in a relatively quiet location.
5. The heating - air conditioning (A/C) fan and radio must be turned off during evaluations and the windows closed.

Symptom Chart

Power Steering Moan Noise

Test Condition

Listen for steering moan noise with the vehicle parked, transmission in neutral and all windows closed in the following test conditions.

1. Engine speed at idle with no steering action.
2. Engine speed at idle with slow 90 degrees per second turning of the steering wheel.
3. Engine speed at 1250 +/- 50 rpm with no steering action.
4. Engine speed at 1250 +/- 50 rpm with slow 90 degrees per second turning of the steering wheel.

Symptom	Possible Sources	Action
	Power	• CHECK the routing of the power steering lines. • CHECK the power steering line clamps are secure. • CHECK the power

Power steering system moan noise – A continuous low pitched humming noise occurs when the steering wheel is turned and the steering system is loaded. Noise frequency changes with engine rpm changes. Particularly annoying at lower engine speed.	steering lines.	steering lines for clearance from the vehicle body, front axle crossmember and steering gear.
	Incorrect power steering fluid.	FLUSH the power steering system. REFER to: (211-00 Steering System - General Information) Power Steering System Flushing (General Procedures).
	Power steering pump.	Pressure pulses from the power steering pump. Certain amount of noise level acceptable, not a safety critical item.

Power Steering Whine Noise

Test Condition

Listen for steering whine noise with the vehicle parked, transmission in neutral and all windows closed in the following test conditions.

1. Engine speed at 1800 +/- 50 rpm with no steering action.
2. Engine speed at 1800 +/- 50 rpm with slow 90 degrees turning of the steering wheel.
3. Engine speed at 3000 +/- 50 rpm with no steering action.
4. Engine speed at 3000 +/- 50 rpm with slow 90 degrees turning of the steering wheel.

Symptom	Possible Sources	Action
Power steering system whine noise – a high pitched buzzing sound like an electric motor or drill. Whine occurs at the higher engine rpm, 1500 - 5000 rpm, frequency does not change if system is loaded or not loaded.	Power steering fluid aeration.	BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
	Incorrect power steering fluid.	FLUSH the power steering system. REFER to: (211-00 Steering System - General Information) Power Steering System Flushing (General Procedures).
	Overheated power steering fluid.	FLUSH the power steering system. REFER to: (211-00 Steering System - General Information) Power Steering System Flushing (General Procedures).
	Hydraulic operating condition of the power steering	Certain amount of noise level acceptable, not a safety critical item.

	pump.	

Power Steering Hiss Noise

Test Condition

Listen for steering hiss noise with the vehicle parked, transmission in neutral and all windows closed in the following test conditions.

Symptom	Possible Sources	Action
NOTE: *Engine speed at idle turning the steering wheel slowly lock to lock.* Power steering system hiss noise – a high frequency, continuous rush or swish noise like escaping air from a balloon. Hiss occurs while turning between the steering lock stops, all steering angles. Noise does not change with engine rpm and is worse at high operating temperatures.	Floor seal.	CHECK the installation and potential damage of the floor seal.
	Power steering gear valve design.	Certain amount of noise level acceptable, not a safety critical item.
	Power steering system hydraulic design.	Certain amount of noise level acceptable, not a safety critical item.
NOTE: *Engine speed at idle holding the steering wheel against a steering lock for three seconds. Do not hold for more than five seconds.* Power steering system hiss noise – a continuous noise like escaping air occurs while holding the steering against a steering lock stop.	Power steering pump pressure relief valve.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Lock Stop Impact Knock Noise

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions (noise also apparent with engine off).

1. Turn the steering wheel to the left-hand and right-hand steering locks and listen for the impact noise.

Symptom	Possible Sources	Action
Power steering system knock noise – a heavy loud sound like a knock on a door that occurs in parking condition when hitting the lock stop.	Power steering gear mechanical noise, metal to metal at end of steering travel.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Hammer Knock (Hydraulic) Noise

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions (for vehicles with hydraulic power assisted steering only, not electro-hydraulic power steering).

1. Turn the steering wheel to a steering lock position and return quickly.

Symptom	Possible Sources	Action
Power steering system knock noise – loud, metallic sound if hitting the suspension crossmember with a hammer (sounds like metallic noise but is created by pressure impulse in gear and return line).	Hydraulic noise created by pressure impulses.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Hydraulic Knock/Clonk Noise HPAS

Test Condition

Listen for steering knock/clonk noise in the following test conditions with the windows closed.

1. Drive over cobbled roads at low speed 10-30 km/h (6-20 mph) with and without turning.
2. Drive over straight tar strips road rails or 25 mm tall harshness strips at low speed 10-30 km/h (6-20 mph) both driving straight and with moderate turning.

Symptom	Possible Sources	Action
Power steering system knock/clonk noise – sounds almost identical to column knock that occurs when driving and cornering over cobbled stones or rough roads. Noise may appear to emanate from a location closer to the floor than that for column knock (Sounds like metallic noise but is created by pressure impulse in gear and return line – similar to a sound like quickly turning off a water tap).	Power steering return lines.	Certain amount of noise level acceptable, not a safety critical item.
	High power assist gain of power steering gear valve (steering gear design - no quality issue).	Certain amount of noise level acceptable, not a safety critical item.
	High power steering pump flow rate (by design).	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Mechanical Knock Noise HPAS

Test Condition

Listen for steering knock noise with the engine off in the following test conditions (no power assist).

1. Turn the steering wheel 90 degrees to the right, hold and then quickly release.
2. Turn the steering wheel 90 degrees to the left, hold and then quickly release.

Symptom	Possible Sources	Action
Power steering system knock noise – a heavy loud repeating sound like a knock on a door	Power steering system knock noise – a damped, metallic knock noise which only occurs at steering condition with engine off (very high efforts).	Certain amount of noise level acceptable, not a safety critical item.

that occurs in several driving and steering conditions.	Tolerances in the steering gear components.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Mechanical Knock Noise HPAS

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions (power assist).

1. Turn the steering wheel to a steering lock and return to center quickly.
2. Turn the steering wheel 90 degrees to the left and then 90 degrees to the right quickly.

Symptom	Possible Sources	Action
Power steering system knock noise – clear knock noise from steering gear linkage area.	Worn tie-rod ball joints (inner and outer ball joints).	REFER to Steering System.

Power Steering Mechanical Knock Noise (EPAS off)

Test Condition

Listen for steering knock noise with the engine off in the following test conditions.

1. Turn the steering wheel 90 degrees to the right, hold and then quickly release.
2. Turn the steering wheel 90 degrees to the left, hold and then quickly release.

Symptom	Possible Sources	Action
Power steering system knock noise – a heavy loud repeating sound like a knock on a door that occurs in several driving and steering conditions.	Power steering system knock noise – a damped, metallic knock noise which only occurs at steering condition with engine off (very high efforts).	Certain amount of noise level acceptable, not a safety critical item.
	Tolerances in the steering gear components.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Mechanical Knock Noise (EPAS on)

Test Condition

Listen for steering knock noise with the engine speed at idle in the following test conditions.

1. Turn the steering wheel to a steering lock and return to center quickly.
2. Turn the steering wheel 90 degrees to the left and then 90 degrees to the right quickly.

Symptom	Possible Sources	Action
Power steering system knock noise – clear knock noise from steering gear linkage area.	Worn tie-rod ball joints (inner and outer ball	REFER to: Power Steering (211-02A

	joints).	Power Steering, Diagnosis and Testing).

Power Steering Toc-Toc Noise

Test Condition

Listen for steering toc-toc noise with the engine speed at idle and the vehicle parked, automatic transmission in "P" (PARK) or manual transmission in neutral and the windows closed.

1. Turn the steering wheel from left to right abruptly changing direction.
2. Drive the vehicle for low speed parking manoeuvres constantly changing steering direction.

Symptom	Possible Sources	Action
Power steering system toc-toc noise – a metallic noise created when changing direction of steering wheel rotation during parking manoeuvre or at standstill.	Steering gear (design tolerance in steering rack).	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Column Knock Noise

Test Condition

Listen for steering knock noise in the following test conditions with windows closed.

1. Drive over cobbled stones at low speed 16-40 km/h (10-25 mph) with and without steering input carefully listening for knock sounds.
2. Drive over straight tar strips, road rails or 25 mm tall harshness strips at low speed 16-40 km/h (10-25 mph) both driving straight and with moderate cornering.

Symptom	Possible Sources	Action
Power steering system column knock noise – a loose sounding rattle or vibration coming from the column. Noticeable by hearing and touch.	Steering column or steering column shaft.	CHECK the steering column retaining bolts and attachments to the steering column and secure if necessary.
		Check steering column and intermediate shaft for free play or loose components.

Power Steering Toc-Toc Noise

Test Condition

Listen for steering toc-toc noise with the engine speed at idle and the vehicle parked, automatic transmission in "P" (PARK) or manual transmission in neutral and the windows closed.

1. Turn the steering wheel from left to right abruptly changing direction.
2. Drive the vehicle for low speed parking manoeuvres constantly changing steering direction.

Symptom	Possible Sources	Action
Power steering system toc-toc noise – a metallic noise created when changing direction of steering wheel rotation during parking	Steering gear (design tolerance in	Certain amount of noise level acceptable, not a

manoeuvre or at standstill.	steering rack).	safety critical item.

Power Steering Grinding Noise

Test Condition

Listen for steering grinding noise with the engine speed at idle and the vehicle parked, automatic transmission in "P" (PARK) or manual transmission in neutral and the windows closed.

1. Slowly turn the steering wheel from lock to lock.
2. Tilt and extend the steering column in various positions and slowly turn the steering wheel from lock to lock.

Symptom	Possible Sources	Action
Power steering system grinding noise – an abrasive noise (like sand paper rubbing against wood) occurs between moving components such as steering wheel and the steering column shroud.	Steering wheel to shroud interference.	Certain amount of noise level acceptable, not a safety critical item.
	Steering column bearing.	Certain amount of noise level acceptable, not a safety critical item.
	Foreign material in contact with the steering column shaft.	CHECK if floor covering is obstructing the steering gear pinion.
		CHECK the installation of the floor seal.
	Clockspring.	CHECK the clockspring and secure if necessary. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

Power Steering Zip Noise HPAS

Symptom	Possible Sources	Action
Power steering system zip noise – occurs when hydraulic fluid does not flow freely through the power steering pump supply hose from steering fluid reservoir to power steering pump causing cavitation at the pump. Zip is primarily a cold weather start-up phenomenon (below -10°C).	High viscosity of power steering fluid at low temperature.	Certain amount of noise level acceptable, not a safety critical item.
	Aeration of the power steering fluid.	BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Driveline Noise and Vibration

Symptom	Possible Sources	Action

Shake and vibration while driving	• Wheel end vibration. • Engine/transmission.	GO to Pinpoint Test A
Tip-in moan	• Air cleaner. • Power assisted steering. • Powertrain. • Powertrain/drivetrain mounts. • Exhaust system.	GO to Pinpoint Test B
Idle boom/shake/vibration/shudder	• Cable(s)/hose(s). • Powertrain/drivetrain mounts. • Exhaust system. • Belt/pulleys.	GO to Pinpoint Test C

Suspension Noise and Vibration

Symptom	Possible Sources	Action
Wheel end vibration analysis	• Suspension. • Wheel bearings.	GO to Pinpoint Test D
Non-axle noise	• Trim panels. • Air conditioning (A/C) system. • Accessories.	GO to Pinpoint Test E

Pinpoint Tests

NOTE: *These Pinpoint Tests are designed to take the technician through a step-by-step diagnosis procedure to determine the cause of a condition. It may not always be necessary to follow the chart to its conclusion. Carry out only the pinpoint test steps necessary to correct the condition. Then check the operation of the system to make sure the condition has been corrected.*

After verifying that the condition has been corrected, make sure all components removed have been installed.

PINPOINT TEST A : SHAKE AND VIBRATION WHILE DRIVING

A1 NEUTRAL COAST

- Carry out the neutral coast test.

Does the vibration disappear during the neutral coast test?

Yes	GO to A2
No	GO to Pinpoint Test D

A2 CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS

- Carry out the powertrain/drivetrain mount neutralizing procedure

Are the mounts OK?

Yes	Vehicle condition corrected. ROAD TEST as necessary.
No	INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST B : TIP-IN MOAN

B1 CHECK THE AIR CLEANER

- Check the condition of the air cleaner mounts, inlet tube, outlet tube, resonators and all other components associated with the air induction system for correct installation and tightness of all connections.

Are the components OK?

Yes	GO to B2
No	REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.

B2 CHECK THE EXHAUST SYSTEM

- Carry out the exhaust system neutralizing procedure.

Is the exhaust system OK?

Yes	GO to B3
No	REPAIR as necessary. ROAD TEST as necessary.

B3 CHECK THE POWER STEERING

- Remove the accessory drive belt and test for tip-in moan. REFER to:
  Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation),
  Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation),
  Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Is the tip-in moan OK?

Yes	REPAIR the power steering as necessary. REFER to: (211-00)
No	GO to B4

B4 CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS

- Carry out the powertrain/drivetrain mount neutralizing procedure

Are the powertrain/drivetrain mounts OK?

Yes	Vehicle condition corrected. ROAD TEST as necessary.
No	INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST C : IDLE BOOM/SHAKE/VIBRATION/SHUDDER

C1 CHECK THE CABLE/HOSES

- Check the engine compartment for any component that may have a touch condition between the engine and body or chassis. For example: control cable, air conditioning (A/C) hoses, acceleration cable.

Are the components OK?

Yes	GO to C2
No	REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.

C2 CHECK THE ENGINE COOLING RADIATOR

- Check the engine cooling radiator mountings and bushings for security and condition. Check the radiator installation for any component that may have a touch condition.

Is the installation and bushings OK?

Yes	GO to C3
No	REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.

C3 CHECK THE EXHAUST SYSTEM

- Carry out the exhaust system neutralizing procedure.

Is the exhaust system OK?

Yes	GO to C4
No	REPAIR as necessary. ROAD TEST as necessary.

C4 CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS

- Carry out the powertrain/drivetrain mount neutralizing procedure

Are the powertrain/drivetrain mounts OK?

Yes	Vehicle condition corrected. ROAD TEST as necessary.
No	INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST D : WHEEL END VIBRATION ANALYSIS

D1 INSPECT THE WHEELS AND TIRES

- Inspect the wheels and tires.
  REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).

Are the wheels and tires OK?

Yes	GO to D2
No	INSTALL new wheels or tires as necessary. REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation). ROAD TEST as necessary.

D2 INSPECT THE WHEEL BEARINGS

- Inspect the wheel bearings.

Are the wheel bearings OK?

Yes	GO to D3
No	INSTALL new wheel bearings as necessary. REFER to: (204-01 Front Suspension) Front Wheel Bearing (Removal and Installation). ROAD TEST as necessary.

D3 INSPECT THE WHEEL AND TIRE RUNOUT
• Inspect the wheel and tire runout. **Is the wheel and tire runout OK?**

Yes	Balance the wheels and tires. Refer to the wheel balance equipment manufacturer's instructions. ROAD TEST as necessary.
No	INSTALL new wheels or tires as necessary. REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation). ROAD TEST as necessary.

PINPOINT TEST E : NON-AXLE NOISE

E1 INSPECT THE VEHICLE TRIM
• Check the radiator grille and trim panels to see if they are the source of the noise. **Are the vehicle trim components causing the noise?**

Yes	INSTALL new trim components or REPAIR as necessary. ROAD TEST as necessary.
No	GO to E2

E2 CHECK THE AIR CONDITIONING (A/C) SYSTEM FOR NOISE
• Start the engine. • Ignition ON. • Check the A/C system components for noise by turning the A/C system on and off. **Is the A/C system causing the noise?**

Yes	INSPECT the A/C system. REFER to: (412-00 Climate Control System - General Information) Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (Diagnosis and Testing), Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (Diagnosis and Testing), Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (Diagnosis and Testing). ROAD TEST as necessary.
No	GO to E3

E3 CHECK NON-FACTORY FITTED ACCESSORIES
• Check any non-factory installed accessories for being the source of the noise. For example: touch condition body-to-frame, antennas, deflectors and fog lights. **Are the accessories the cause of the noise?**

Yes	ADJUST, REPAIR, or INSTALL new accessories or fasteners as required. ROAD TEST as necessary.
No	VERIFY the customer concern.

Copyright © 2016 Ford Motor Company

Specifications

General Specifications

Item	Specification
Ball Joint Deflection	
Lower	0-0.2 mm
Front Ride Height	
High ride height vehicles (4WD and 2WD)	109 mm ± 20 mm
Low ride height vehicles (2WD only)	110 mm ± 20 mm
Rear Ride Height	
High ride height vehicles (4WD and 2WD)	324 mm ± 20 mm
Low ride height vehicles (2WD only)	246 mm ± 20 mm
Side-to-Side Variation (All Vehicles)	
Front	0 mm ± 15 mm
Rear	0 mm ± 20 mm

Front Wheel Alignment (at curb weight) - Low ride height vehicles (2WD only)

NOTE: *All alignment specifications are with the vehicle fuel tank full.*

Description		Nominal and Tolerance Range		
		Single cab	Super cab	Double cab
Caster angle	Degrees and minutes	2°53' ± 1°	3°00' ± 1°	
	Decimal Degrees	2.88° ± 1°	3.00° ± 1°	
Camber angle	Degrees and minutes	0°00' ± 0.50º		
	Decimal Degrees	0.00° ± 0.50º		
Total Toe	mm	0.00 ± 2		
	Degrees and minutes	0°00' ± 9'		
	Decimal Degrees	0.00° ± 0.15º		

Front Wheel Alignment (at curb weight) - High ride height vehicles (4WD and 2WD)

Description		Nominal and Tolerance Range	
		RHD	LHD
Caster angle (right-hand side)	Degrees and minutes	2°34' ± 1°	3°04' ± 1°
	Decimal Degrees	2.57° ± 1°	3.07° ± 1°
Caster angle (left-hand side)	Degrees and minutes	3°04' ± 1°	2°34' ± 1°
	Decimal Degrees	3.07° ± 1°	2.57° ± 1°

Camber angle	Degrees and minutes	0°00' ± 0.50º
	Decimal Degrees	0.00° ± 0.50º
Total Toe	mm	0.00 ± 2
	Degrees and minutes	0°00' ± 9'
	Decimal Degrees	0.00° ± 0.15º

Copyright © 2016 Ford Motor Company

Suspension System

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
Tire pressure(s)
Wheels and tires
Wheel knuckles
Tie-rod ends
Front suspension lower arm ball joints
Front suspension lower arm bushings
Front suspension upper arm ball joints
Front suspension upper arm bushings
Front strut and spring assemblies
Front stabilizer bar and connecting links
Rear leaf springs, bushes, shackles and interleaf buttons
Rear shock absorbers Rear stabilizer bar and connecting links Rear suspension beam axle and bushings Front bump stop
Rear bump stop

3. CARRY OUT the Suspension and Steering Components Initial Inspection component test in this procedure.
4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
5. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Drift left or right	• Vehicle attitude incorrect (front or rear is high or low).	• CHECK for abnormal loading, spring sag or non-standard springs.
	• Steering gear or linkage worn or damaged.	• CHECK the steering system.
	• Brake system.	• CHECK the brake system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	• Incorrect wheel	• ADJUST the wheel alignment.

	alignment.	
	• Worn front wheel bearings.	• CHECK the wheel bearings.
	• Worn rear wheel bearings (If equipped).	• CHECK the wheel bearings.
	• Wheels and tires.	• GO to Pinpoint Test A
• Steering wheel off-center	• Vehicle attitude incorrect (front or rear is high or low).	• CHECK for abnormal loading, spring sag or non-standard springs.
	• Steering gear or linkage worn or damaged.	• CHECK the steering system.
	• Suspension lower/upper arm ball joint.	• CARRY OUT the Ball Joint Inspection component test in this procedure.
	• Incorrect wheel alignment.	• ADJUST the wheel alignment.
• Tracks incorrectly	• Incorrect front suspension toe, castor or camber angles.	• CHECK the wheel alignment. • INSTALL new suspension components as necessary.
	• Incorrect rear suspension toe or camber angles.	• CHECK the wheel alignment. • INSTALL new suspension components as necessary.
	• Front or rear suspension damage.	• INSTALL new suspension components as necessary.
• Rough ride	• Front strut and spring assemblies.	• CARRY OUT the Strut or Shock Absorber Testing component test in this procedure. • CHECK and INSTALL new suspension components as necessary.
	• Front stabilizer bar, connecting links or bushings.	• CHECK and INSTALL new suspension components as necessary. REFER to: (204-01 Front Suspension) Front Stabilizer Bar (Removal and Installation).
	• Rear stabilizer bar and connecting links.	• CHECK and INSTALL new suspension components as necessary. REFER to: (204-02)
	• Front suspension lower arm bushings.	• INSTALL a new lower arm. REFER to: Lower Arm - LHD RWD/RHD RWD (204-01 Front Suspension, Removal and Installation).
	• Front suspension upper arm bushings.	• INSTALL a new upper arm. REFER to: Upper Arm (204-01 Front Suspension, Removal and Installation).
	• Rear suspension bushings.	• CHECK and INSTALL new components as necessary.
	• Rear shock absorbers.	• CARRY OUT the Strut or Shock Absorber Testing component test in this procedure. • CHECK and INSTALL new suspension components as necessary.
• Excessive noise	• Front strut and spring assembly or rear shock absorber and spring upper mounting bolts or nuts loose or broken.	• GO to Pinpoint Test B
	• Shock absorbers leaking	• GO to Pinpoint Test B

	• Shock absorber performance incorrect	• GO to Pinpoint Test B
	• Stabilizer bar components	• GO to Pinpoint Test B
	• Strut and spring assembly and springs	• GO to Pinpoint Test B
	• Springs moving on spring upper or lower seats	• GO to Pinpoint Test B
	• Suspension bushings	• GO to Pinpoint Test B
	• Lower arm ball joint	• GO to Pinpoint Test B
	• Upper arm ball joint	• GO to Pinpoint Test B
	• Worn front wheel bearings	• GO to Pinpoint Test B
	• Worn rear wheel bearings	• GO to Pinpoint Test B
	• Wheels and tires	• GO to Pinpoint Test B
• Incorrect tire wear	• Front or rear suspension damage.	• CHECK and INSTALL new suspension components as necessary.
	• Incorrect wheel alignment.	• ADJUST the wheel alignment.
• Vibration	• Damaged or worn front wheel bearings.	• CHECK the front wheel bearings.
	• Damaged or worn rear wheel bearings.	• CHECK the rear wheel bearings.
	• Wheels and tires.	• CHECK the tires. BALANCE or INSTALL new tires as necessary.
	• Incorrect wheel alignment.	• ADJUST the wheel alignment.
	• Steering gear or linkage worn or damaged.	• CHECK the steering system.
	• Front strut and spring assemblies.	• CARRY OUT the Strut or Shock Absorber Testing component test in this procedure. • CHECK and INSTALL new suspension components as necessary.
	• Damaged front suspension lower arm(s).	• INSTALL a new lower arm(s). REFER to: Lower Arm - LHD RWD/RHD RWD (204-01 Front Suspension, Removal and Installation).
	• Damaged front suspension upper arm(s).	• INSTALL a new upper arm(s). REFER to: Upper Arm (204-01 Front Suspension, Removal and Installation).
• Rear suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads	• Loose or damaged rear shock absorber(s) or shock absorber bushing(s).	• Inspect the rear suspension. INSTALL new components as necessary. REFER to: Rear Suspension - Component Location (204-02 Rear Suspension, Description and Operation).

	• Rear leaf spring tip isolator or bushing.	• Inspect the rear suspension. INSTALL new components as necessary. REFER to: Rear Suspension - Component Location (204-02 Rear Suspension, Description and Operation).
	• Damaged leaf spring or leaf spring mount(s).	• Inspect the rear suspension. INSTALL new components as necessary. REFER to: Rear Suspension - Component Location (204-02 Rear Suspension, Description and Operation).
	• Worn or damaged stabilizer bar bushing(s) or link(s).	• Inspect the rear suspension. INSTALL new components as necessary. REFER to: Rear Suspension - Component Location (204-02 Rear Suspension, Description and Operation).
	• Rear leaf spring or bushing contaminated with dirt, sand or mud.	• **NOTE:** *To avoid the re-occurrence of noise, make sure that all contamination and moisture trapped between the individual leaf spring components have been completely removed.* • **NOTE:** *Do not apply any lubricant or grease to the leaf springs as this will attract dirt and moisture.* • PRESSURE WASH the leaf springs between the individual spring leafs and the gaps between the spring bushings, mounting brackets and shackles to remove any trapped debris. USE compressed (shop) air to remove any remaining debris and to completely dry between all of the individual spring components.

Pinpoint Tests

PINPOINT TEST A : DRIFT LEFT OR RIGHT

WARNING: To avoid personal injury due to the loss of vehicle control, the inspection should be carried out by two people to maintain safe driving conditions. Adequate grip should always be maintained on the steering wheel. Failure to follow these instructions may result in personal injury.

NOTE: *The following conditions must be met when evaluating the vehicle.*

NOTE: *The tire swapping procedures are for bi-directional rotating tires only.*

A1 SWAP THE FRONT WHEEL AND TIRE ASSEMBLIES

- Raise and support the vehicle.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - Swap the front left-hand wheel and tire assembly with the front right-hand wheel and tire assembly.
  - Road test the vehicle.

Does the vehicle drift?

Yes	GO to A2
No	Vehicle condition corrected.

A2 SWAP THE REAR WHEEL AND TIRE ASSEMBLIES

- Raise and support the vehicle.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - Swap the rear left-hand wheel and tire assembly with the rear right-hand wheel and tire assembly.
  - Road test the vehicle.

Does the vehicle drift?

Yes	GO to A3
No	Vehicle condition corrected.

A3 SWAP THE LEFT-HAND WHEEL AND TIRE ASSEMBLIES

- Raise and support the vehicle.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - Swap the front left-hand wheel and tire assembly with the rear left-hand wheel and tire assembly.
  - Road test the vehicle.

Does the vehicle drift?

Yes	GO to A4
No	Vehicle condition corrected.

A4 SWAP THE RIGHT-HAND WHEEL AND TIRE ASSEMBLIES

- Raise and support the vehicle.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - Swap the front right-hand wheel and tire assembly with the rear right-hand wheel and tire assembly.
  - Road test the vehicle.

Does the vehicle drift?

Yes	GO to A5
No	Vehicle condition corrected.

A5 SWAP THE FRONT LEFT-HAND WHEEL AND TIRE ASSEMBLY

- Raise and support the vehicle.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - Swap the front left-hand wheel and tire assembly with the rear right-hand wheel and tire assembly.
  - Road test the vehicle.

Does the vehicle drift?

Yes	GO to A6
No	Vehicle condition corrected.

A6 SWAP THE FRONT RIGHT-HAND WHEEL AND TIRE ASSEMBLY

- Raise and support the vehicle.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - Swap the front right-hand wheel and tire assembly with the rear left-hand wheel and tire assembly.
  - Road test the vehicle.

Does the vehicle drift?

Yes	GO to A7
No	Vehicle condition corrected.

A7 INSTALL NEW TIRES

NOTE: *Install new tires only once.*

- Install new tires to the four road wheels. TEST the system for normal operation.

Does the vehicle drift?

Yes	Verify possible sources, refer to the Symptom Chart.
No	Vehicle condition corrected.

PINPOINT TEST B : EXCESSIVE NOISE

B1 INSPECT ALL STRUT AND SPRING ASSEMBLY AND SHOCK ABSORBER MOUNTING BOLTS AND NUTS

- Inspect the strut and spring assembly and shock absorber mounting bolts and nuts.

Are the mounting bolts or nuts loose or broken?

Yes	TIGHTEN or INSTALL new mounting bolts and nuts.
No	GO to B2

B2 INSPECT THE STRUT AND SPRING ASSEMBLIES AND SHOCK ABSORBERS FOR LEAKS

- **NOTE:** *Make sure that the oil is not from another source.*

  Inspect the strut and spring assemblies and shock absorbers for signs of oil weepage or leaks. Refer to weepage and leakage conditions in the Strut or Shock Absorber Testing component test in this procedure.

Are the struts or shock absorbers leaking?

Yes	INSTALL new struts or shock absorbers as necessary. REFER to: Front Strut and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly), Front Strut and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly), Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).
No	GO to B3

B3 INSPECT THE SPRINGS AND STABILIZER BAR(S)

- Inspect the springs and stabilizer bar(s) for damage.

Are the springs or stabilizer bar(s) damaged?

Yes	INSTALL new springs or stabilizer bar(s). REFER to: Front Strut and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly), Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation), Spring (204-02 Rear Suspension, Removal and Installation).
No	GO to B4

B4 INSPECT THE SUSPENSION BUSHINGS

- Inspect the suspension bushings for excessive wear or damage.

Are the bushings worn or damaged?

Yes	INSTALL new components as necessary. REFER to: Lower Arm - LHD RWD/RHD RWD (204-01 Front Suspension, Removal and Installation), Upper Arm (204-01 Front Suspension, Removal and Installation), Front Strut and Spring Assembly (204-01 Front Suspension, Removal and Installation), Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation),
No	GO to B5

B5 INSPECT THE SUSPENSION LOWER/UPPER ARM BALL JOINTS

- Carry out the Ball Joint Inspection component test in this procedure.

Is the lower/upper arm ball joint or gaiter damaged?

Yes	INSTALL a new lower/upper arm. REFER to: (204-01 Front Suspension) Lower Arm - LHD RWD/RHD RWD (Removal and Installation), Upper Arm (Removal and Installation).
No	GO to B6

B6 INSPECT THE WHEEL BEARINGS

- Check the wheel bearings.

Are the wheel bearings damaged?

Yes	INSTALL/ADJUST a new wheel bearing(s). REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation),
No	GO to B7

B7 INSPECT THE WHEELS AND TIRES

- Check the tires for uneven wear.

Is there uneven tire wear?

Yes	REFER to the Symptom Chart.
No	GO to B8

B8 INSPECT THE STRUT AND SPRING ASSEMBLY AND REAR SUSPENSION SPRING INTERFACE

- Loosen the strut and spring assemblies and shock absorbers top and bottom mounting bolts and nuts. Tighten the mounting bolts and nuts.
  - Carry out a road test.
    REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

Is the concern still evident?

Yes	GO to B9
No	Vehicle condition corrected.

B9 INSPECT THE STRUT AND SPRING ASSEMBLIES AND SHOCK ABSORBER COMPONENTS

- Check that the spring is correctly located on the spring seat and has not moved.
- Disassemble the strut and spring and assembly and inspect the individual components.
  REFER to: Front Strut and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly).
- Inspect the shock absorber top mount for wear or damage.
- Carry out the Strut or Shock Absorber Testing component test in this procedure.

Are any of the strut and spring assemblies or shock absorber components damaged?

Yes	INSTALL new components as necessary. REFER to: Front Strut and Spring Assembly (204-01 Front Suspension, Removal and Installation), Spring (204-02 Rear Suspension, Removal and Installation), Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).
No	REINSTALL the strut and spring assemblies or shock absorbers. GO to B10

B10 CARRY OUT A ROAD TEST
• Carry out a road test. REFER to: Road/Roller Testing (100-00 General Information, Description and Operation). **Is the concern still evident?**

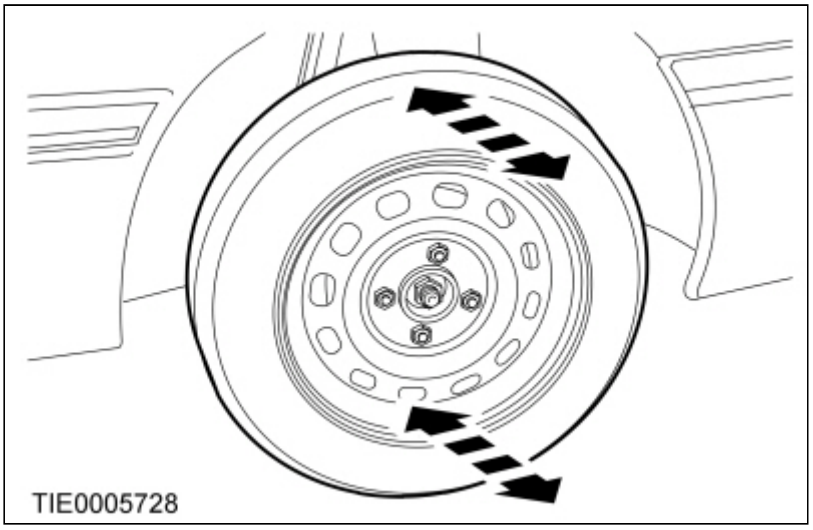
Yes	REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).
No	Vehicle condition corrected.

Component Tests

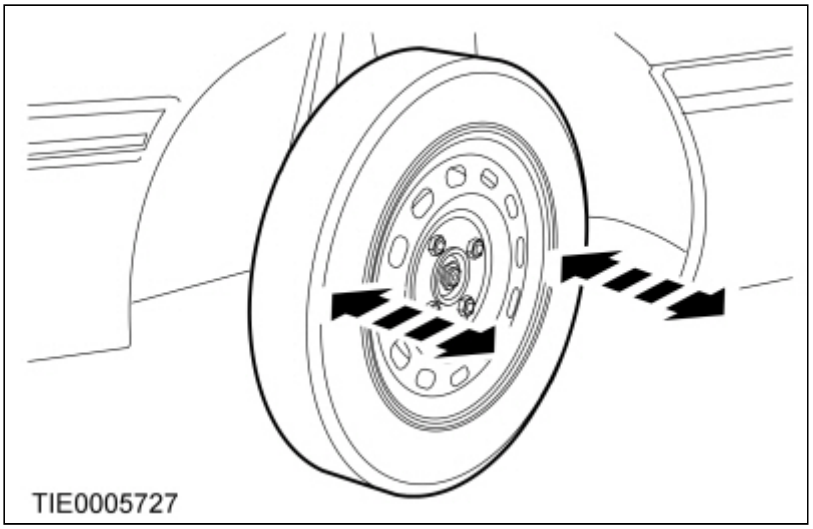
Noises such as knocks, which may appear to originate from the front suspension components, may also be generated by the steering linkage.
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Raise and support the vehicle.
REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Suspension and Steering Components Initial Inspection



1. With the aid of another technician observing for any free play in the wheel bearing and feeling for any free play in suspension components firmly grasp the road wheel and apply a rocking motion.
2. The wheel bearing and suspension components should have no free movement.
3. If there is any free movement install new components as necessary.REFER to: (204-01 Front Suspension)
   Lower Arm - LHD RWD/RHD RWD (Removal and Installation),
   Upper Arm (Removal and Installation),
   Front Wheel Bearing (Removal and Installation).
4. If a new lower/upper arm is installed it will be necessary to check and adjust the front wheel alignment.



5. With the aid of another technician feeling for any free play in the steering linkage, position the steering against the right-hand steering lock stop. Firmly grasp the road wheel and apply a rocking motion. Repeat the task on the left-hand steering lock stop.

6. Tie-Rod and Tie-Rod ends should have no free movement

7. If there is any free movement install a new components as necessary.REFER to: (211-02A Power Steering)
   Tie Rod - LHD (Removal and Installation),
   Tie Rod End - LHD (Removal and Installation).

8. If a Tie-Rod or Tie-Rod End is installed it will be necessary to check and adjust the front wheel alignment.

Ball Joint Inspection

1. Firmly grasp the outer end of the suspension lower/upper arm and try to move it up and down, watching and feeling for any movement. Free movement will usually be accompanied by an audible "click''. There should be no free movement.

2. If there is any free movement install a new lower/upper arm.REFER to: (204-01 Front Suspension)
   Lower Arm - LHD RWD/RHD RWD (Removal and Installation),
   Upper Arm (Removal and Installation).

3. If a new lower/upper arm is installed it will be necessary to check and adjust the front wheel alignment.

Strut or Shock Absorber Inspection

NOTE: *Inspect the struts or shock absorber for signs of oil weepage or leaks. Make sure that the oil is not from another source.*

Weepage:

- deposits a thin film of oil on the strut and spring assembly or shock absorber.
- is normally noticed due to a collection of dust on the strut and spring assembly or shock absorber.
- occurs during the normal running-in period of 4800 - 8050 km. After this period no new signs of oil should be visible.
- does not require new struts or shock absorbers to be installed.

Leakage:

- covers the entire strut and spring assembly or shock absorber with oil.
- will drip oil onto the surrounding suspension components.

- requires new struts or shock absorbers to be installed.

Strut or Shock Absorber Testing

NOTE: *Struts or shock absorbers must be tested in the vertical position.*

1. Remove both strut and spring assemblies or shock absorbers. The piston rods should extend.
   - Disassemble the strut and spring assemblies.
     REFER to: Front Strut and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly).

2. Compress the piston rods. Both piston rods should offer the same resistance when compressing.

3. Compress and release the piston rods. The piston rods should extent equally.

4. Compress and pull the piston rod in the vertical position. Feel if the resistance force at the point of direction change-over is perceptible without a lag. If a lag is perceptible it is an indication of damper valve damage and new struts or shock absorbers must be installed. REFER to:
   Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation),
   Front Strut and Spring Assembly (204-01 Front Suspension, Removal and Installation).

Copyright © 2016 Ford Motor Company

Camber and Caster Adjustment

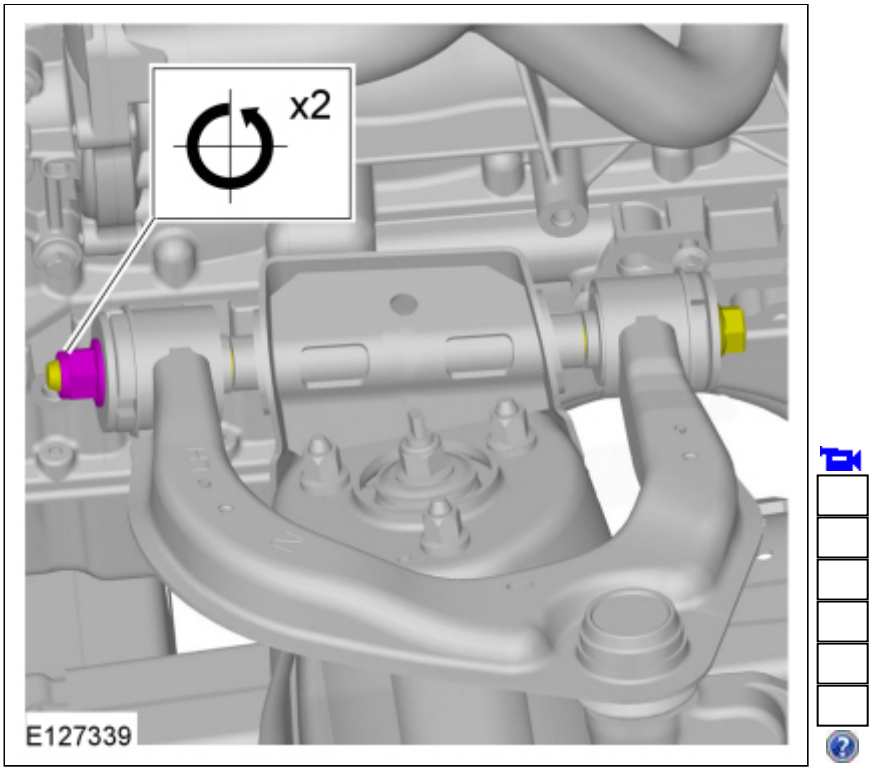
Special Tool(s) / General Equipment

Wheel Alignment System

Adjustment

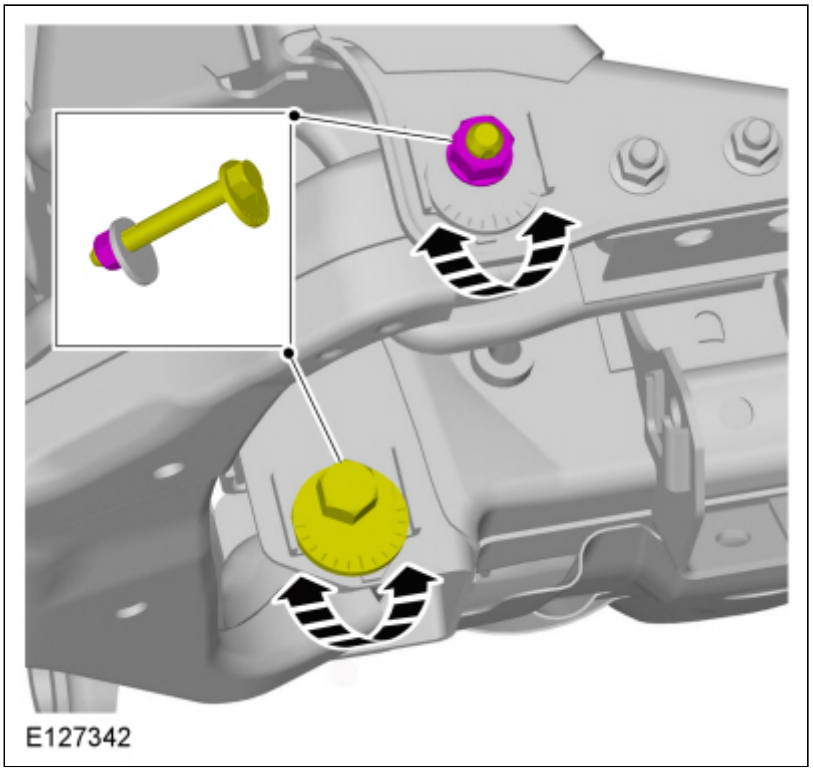
NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

NOTE: *Make sure that the tire pressures are to specification and that the vehicle is unladen.*

1. Using alignment equipment and the manufacturer's instructions, measure the front caster and camber.
   Refer to: Specifications (204-00 Suspension System - General Information, Specifications).
   Use the General Equipment: Wheel Alignment System
2. 

3. Loosen the lower arm bolt(s) and adjust the caster and camber settings according to manufacturer's instructions.
4. **NOTE:** *Make sure that the weight of the vehicle is on the wheels and that no suspension settings are disurbed.*

   On both sides.
   Torque:
   Upper arm bolt : 86 Nm
   Lower arm bolt: 270 Nm



5. Check and if necessary, adjust front toe.
   Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Front Toe Adjustment

Special Tool(s) / General Equipment

Wheel Alignment System

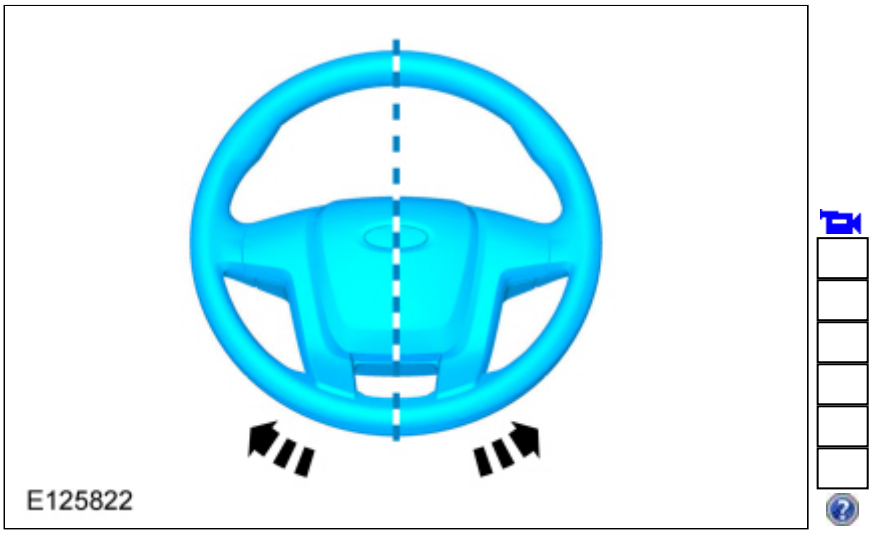
Check

NOTE: *Make sure that the vehicle is standing on a level surface.*

NOTE: *Make sure that the tire pressures are to specification and that the vehicle is unladen.*

1. **NOTICE: Make sure that the steering wheel is locked.**

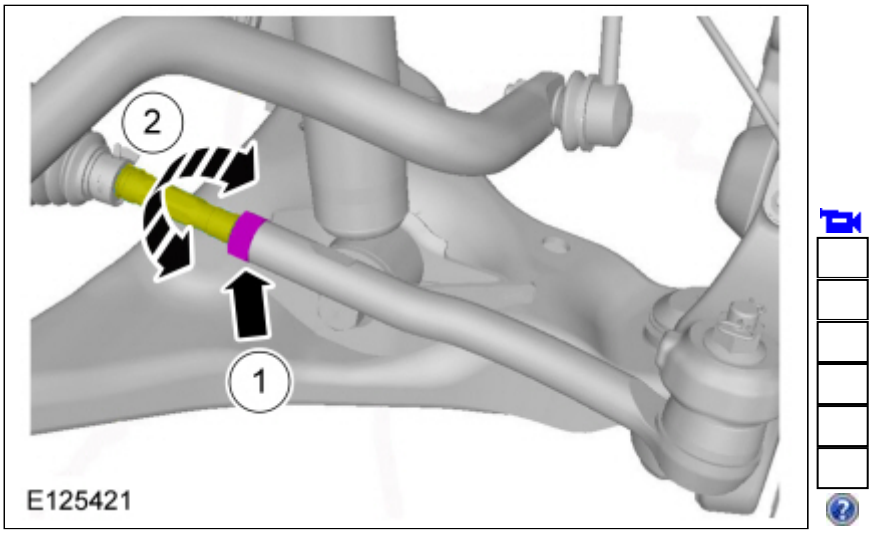
   NOTE: *Make sure that the road wheels are in the straight ahead position.*



2. Using alignment equipment and the manufacturer's instructions, check the front toe setting on both sides. Use the General Equipment: Wheel Alignment System

3. **NOTICE: Take extra care not to damage the component.**

   On both sides.
   Torque: 73 Nm



4. **NOTICE: One turn of the tie rod (both sides) changes the toe-in by about approx. 30 mm (1.18 in).**

   NOTE: *The left and right tie rods are both right threaded. To increase toe-in, turn the right tie rod toward the*

front of the vehicle sand the left tie rod equally toward the rear.

NOTE: *Make sure that the boot is correctly located.*

Copyright © 2016 Ford Motor Company

Ride Height Measurement

Special Tool(s) / General Equipment

Surface Gauge

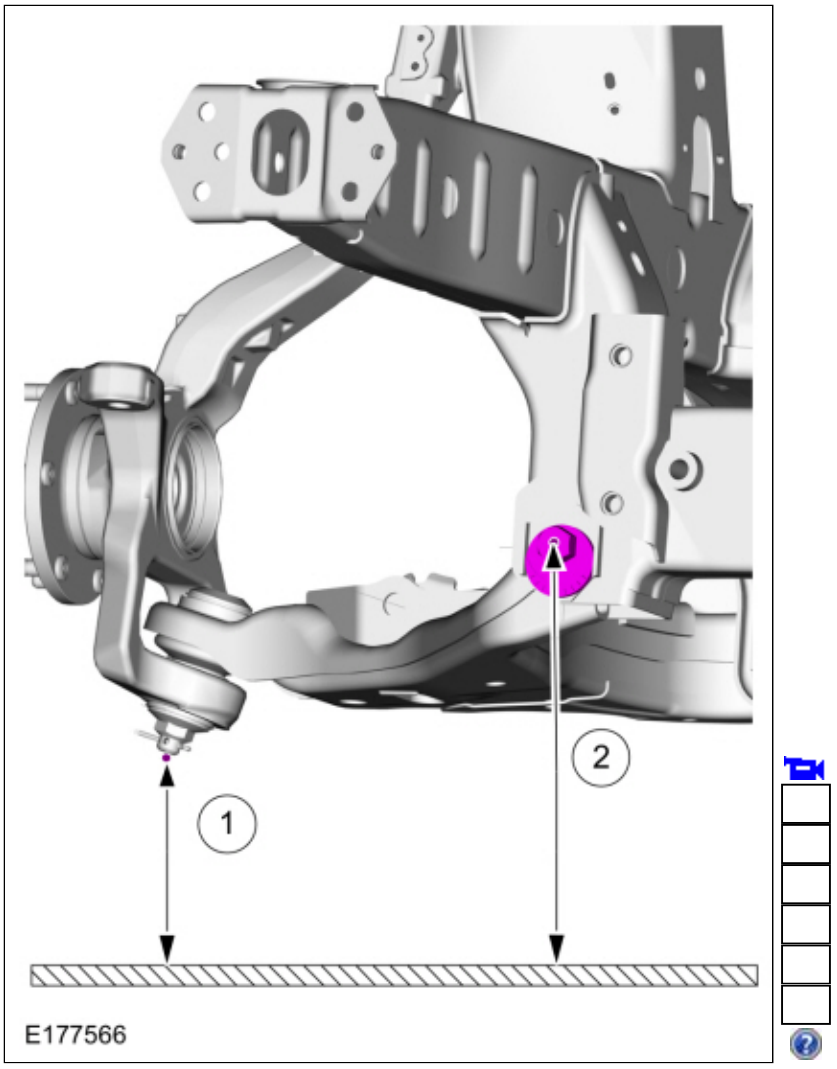
Check

Front Ride Height Measurement

NOTE: *Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. The vehicle should have a full tank of fuel.*

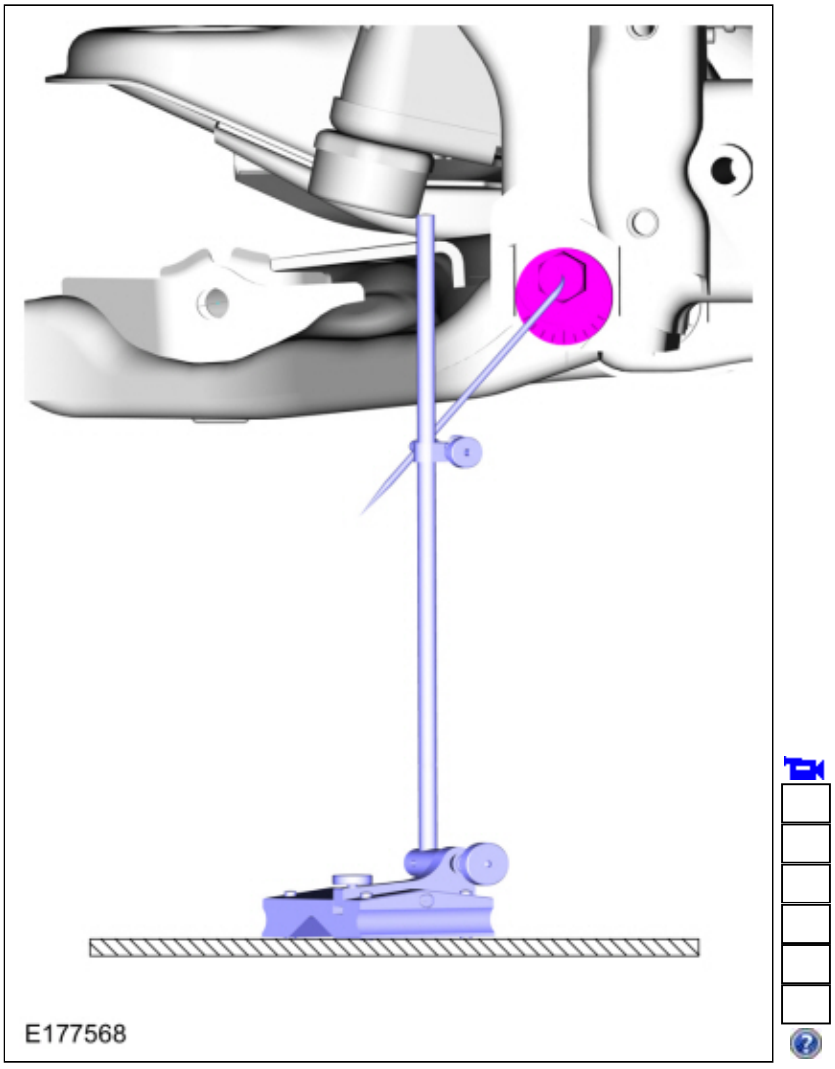
1. Refer to: Specifications (204-00 Suspension System - General Information, Specifications).

    1. Ride height = (Measurment2) - (Measurment1)

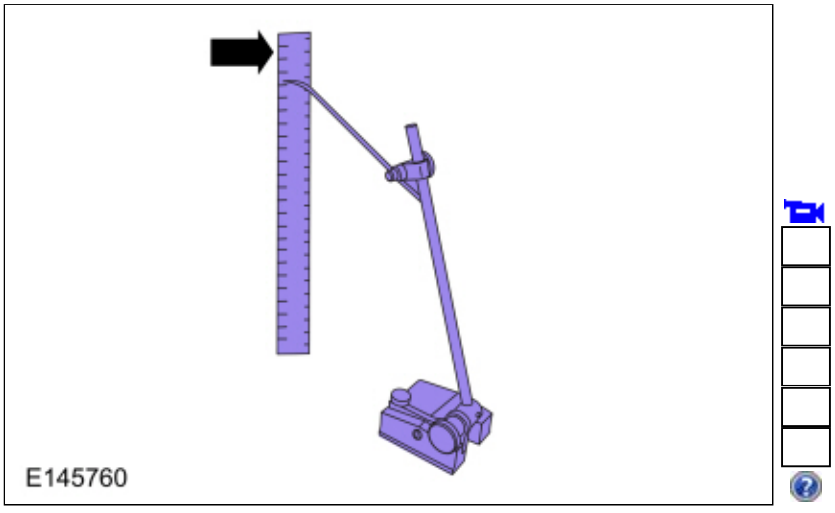


3. **NOTE:** *Lock the tool in the position shown.*

    Position the surface gauge on the same flat, level surface, adjust the gauge arm until the scriber point is located in the center of the front lower arm bolt.
    Use the General Equipment: Surface Gauge

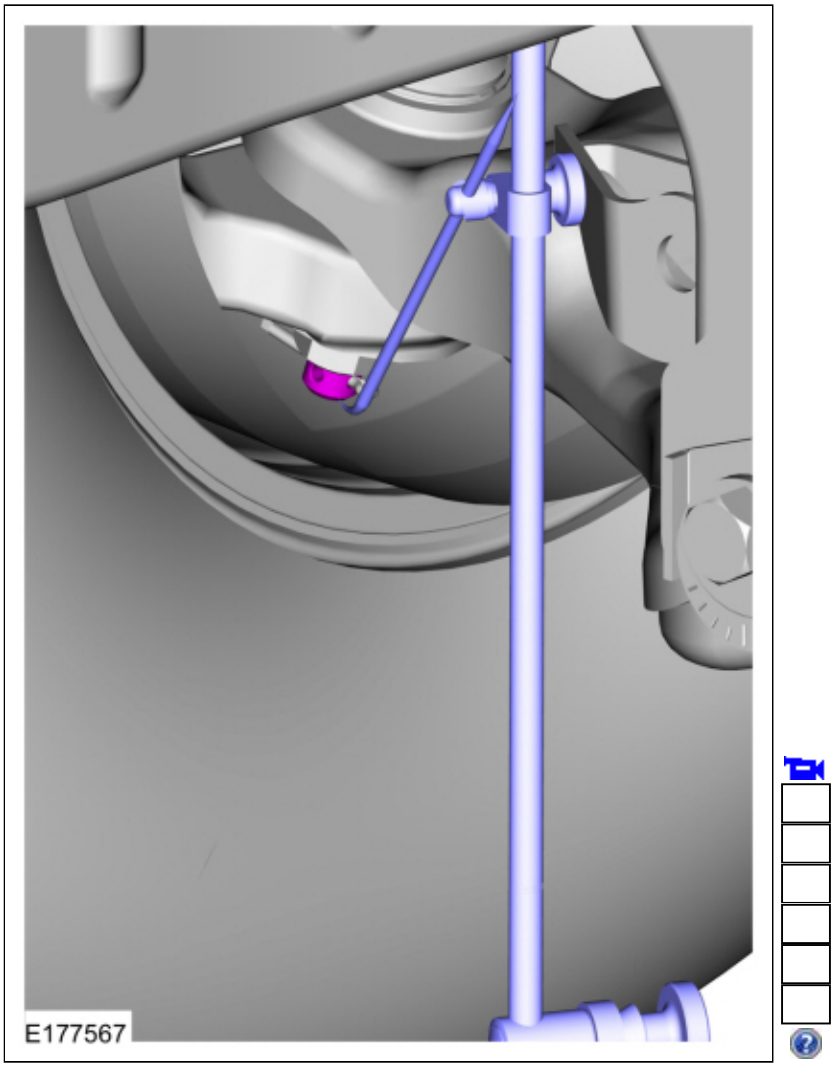


4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 2).
   Use the General Equipment: Surface Gauge

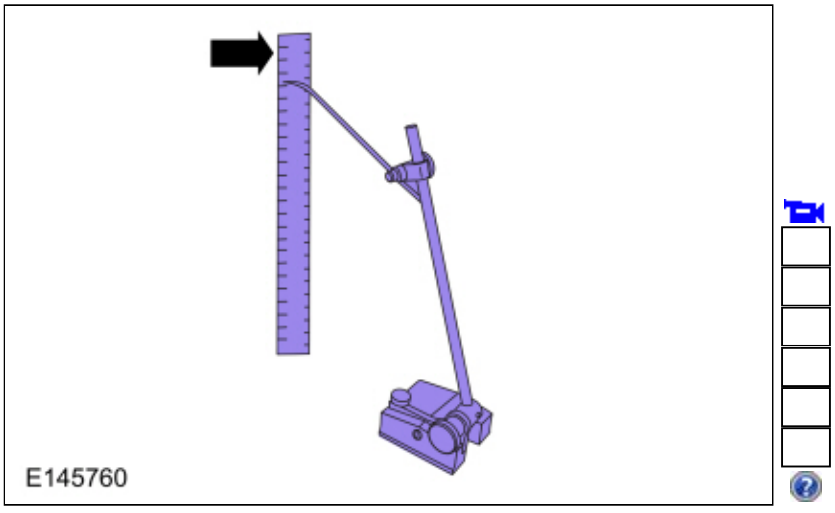


5. **NOTE:** *Lock the tool in the position shown.*

   Position the surface gauge on the same flat, level surface, adjust the gauge arm until the scriber point is located in the center of the lower ball joint stud.
   Use the General Equipment: Surface Gauge



6. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 1).



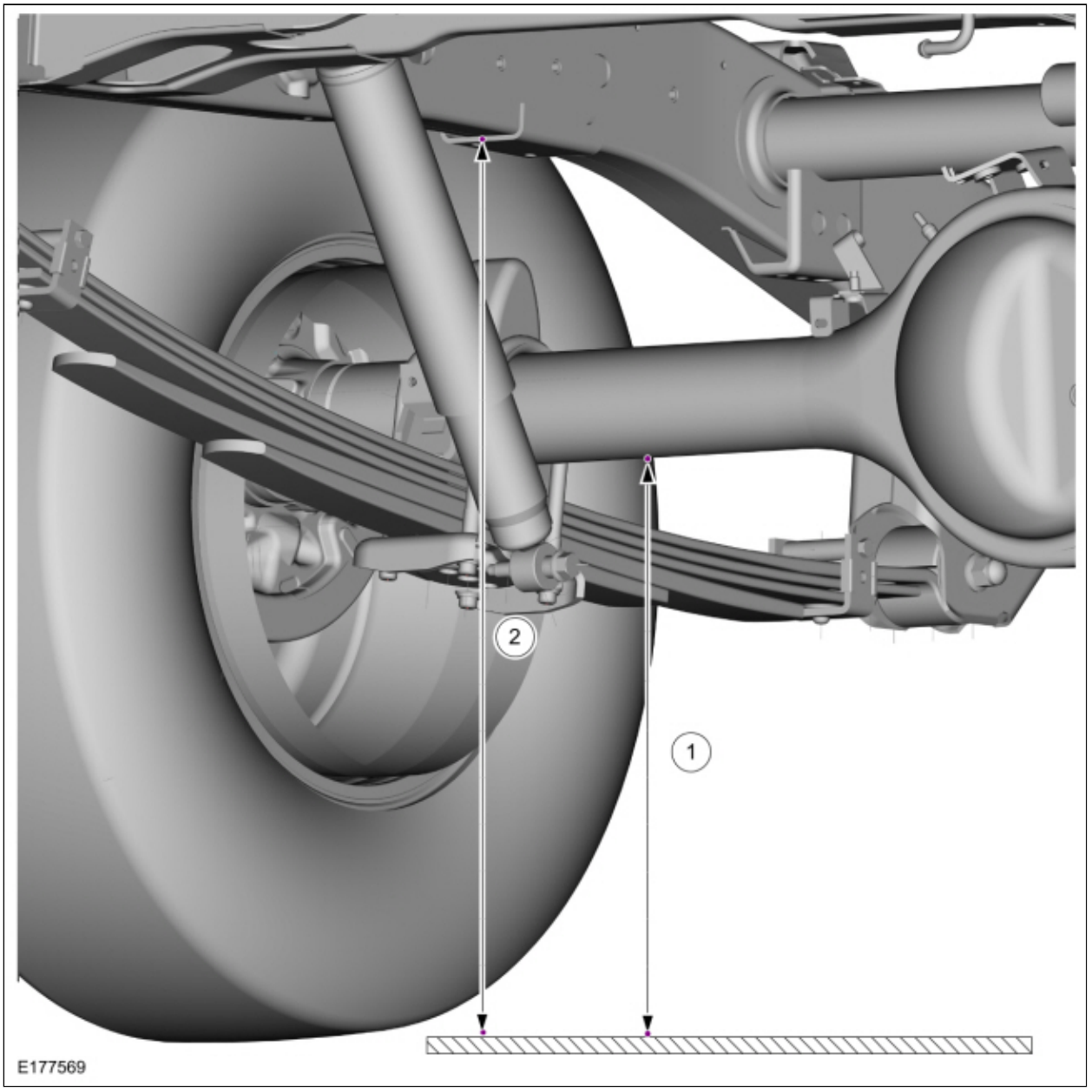
7. Subtract measurement 1 from measurement 2 to obtain the front ride height.

Rear Ride Height Measurement

NOTE: *Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. The vehicle should have a full tank of fuel.*

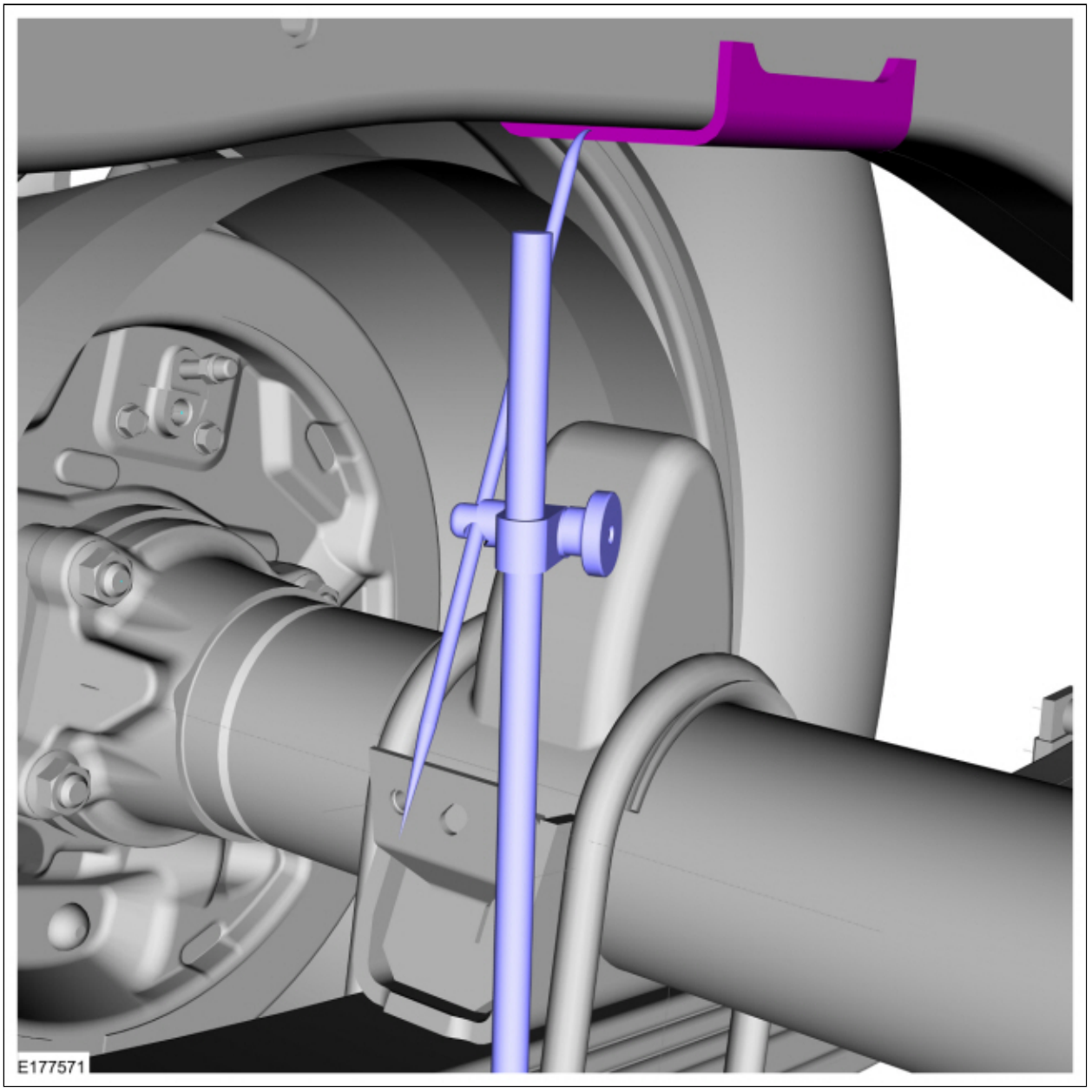
8. Refer to: Specifications (204-00 Suspension System - General Information, Specifications).

    1. Ride height = (Measurment2) - (Measurment1)

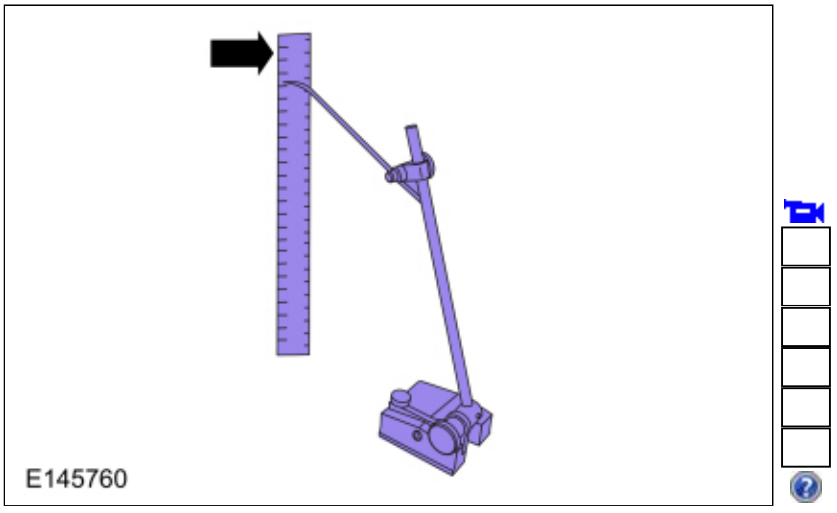


10. **NOTE:** *Lock the tool in the position shown.*

    Position the surface gauge on the same flat, level surface, adjust the gauge arm until the scriber point is located on the rear of the lower edge of the chassis rail bump stop bracket.
    Use the General Equipment: Surface Gauge

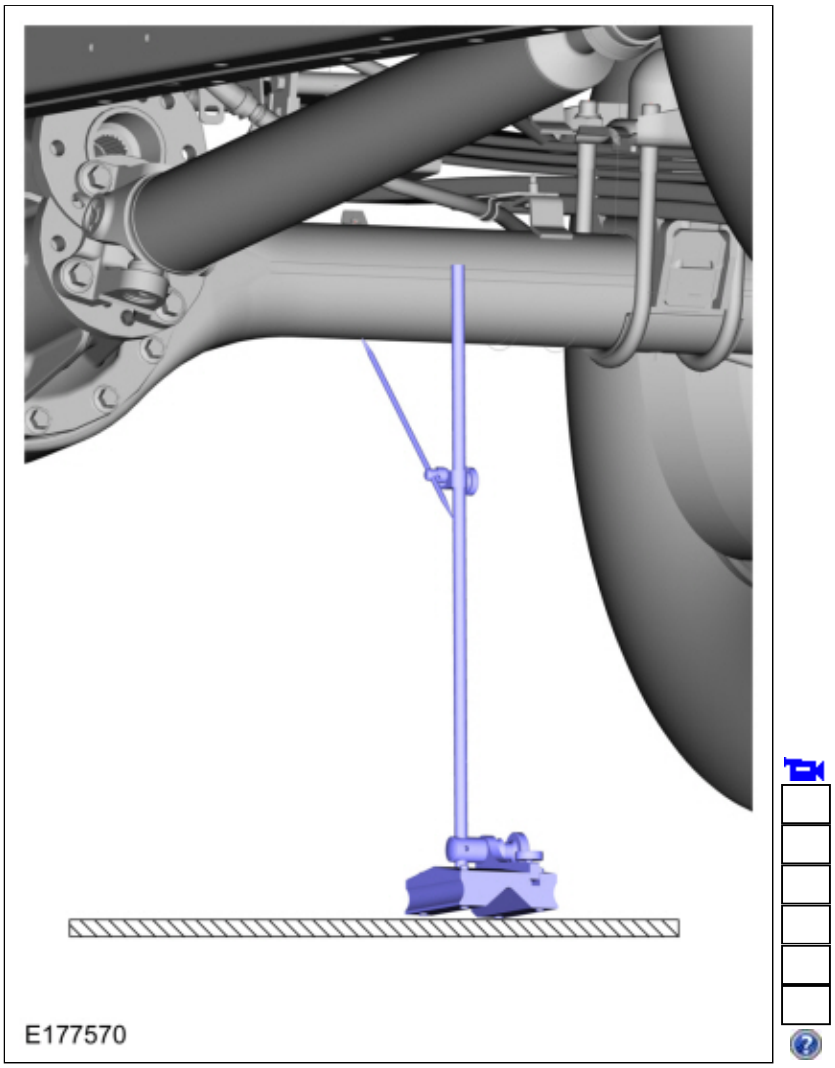


11. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 2).
    Use the General Equipment: Surface Gauge

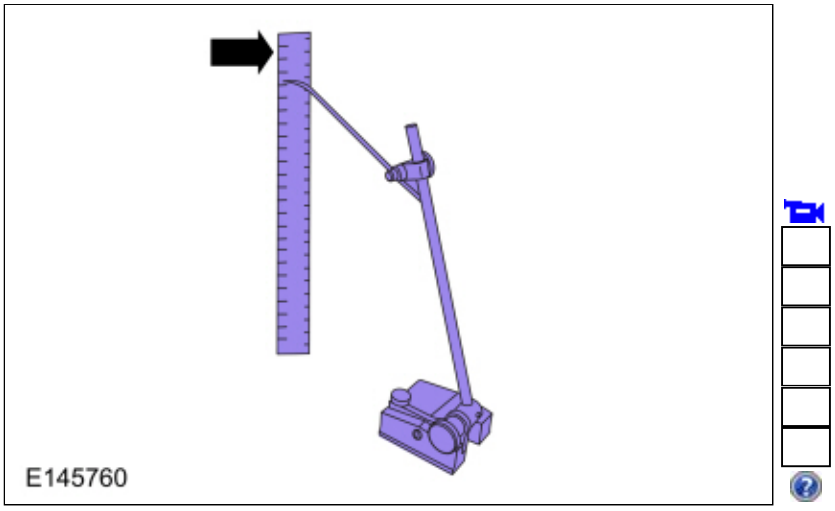


12. **NOTE:** *Lock the tool in the position shown.*

    Position the surface gauge on the same flat, level surface, adjust the gauge arm until the scriber point is located in the lower side of axle tube.
    Use the General Equipment: Surface Gauge



13. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement 1).

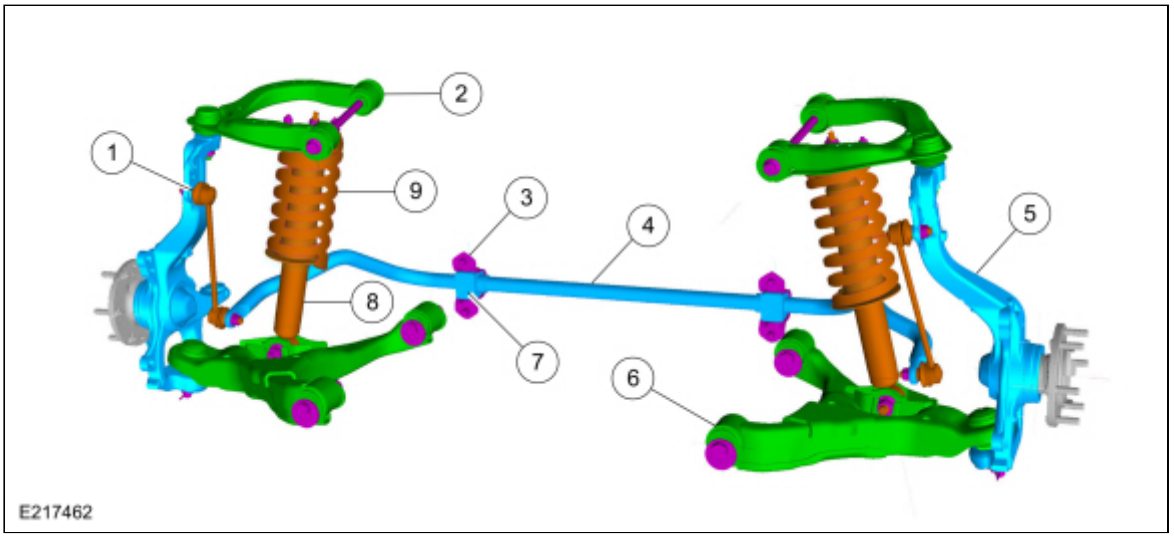


14. Subtract measurement 1 from measurement 2 to obtain the rear ride height.

Copyright © 2016 Ford Motor Company

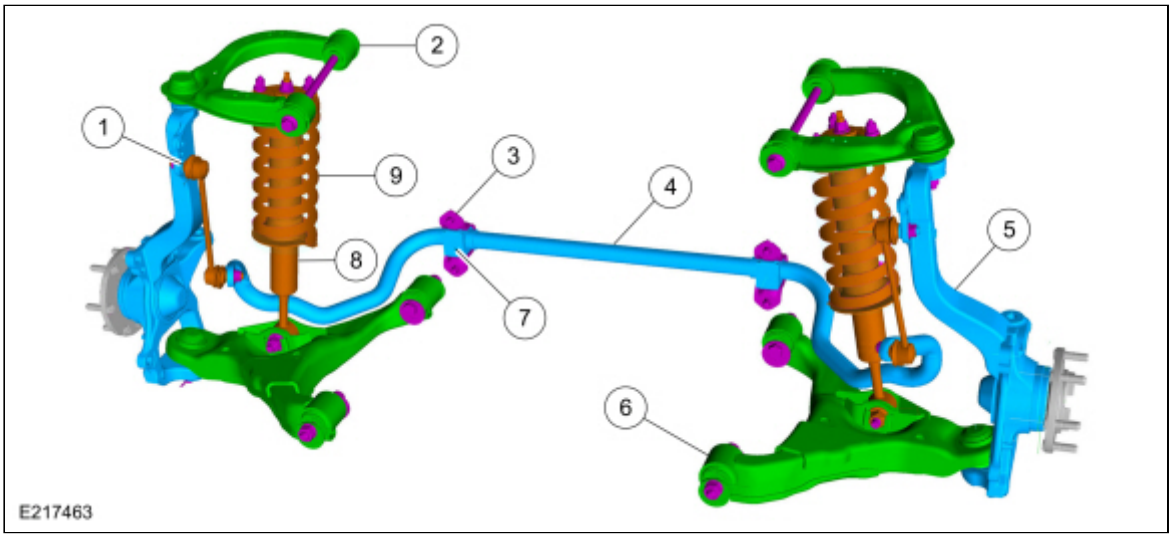
Front Suspension - Component Location

Low Ride Height - 4X2



Item	Part Number	Description
1	—	Stabilizer bar link
2	—	Upper arm
3	—	Stabilizer bar bracket
4	—	Stabilizer bar
5	—	Knuckle
6	—	Lower arm
7	—	Stabilizer bar bush
8	—	Shock absorber unit
9	—	Suspension unit

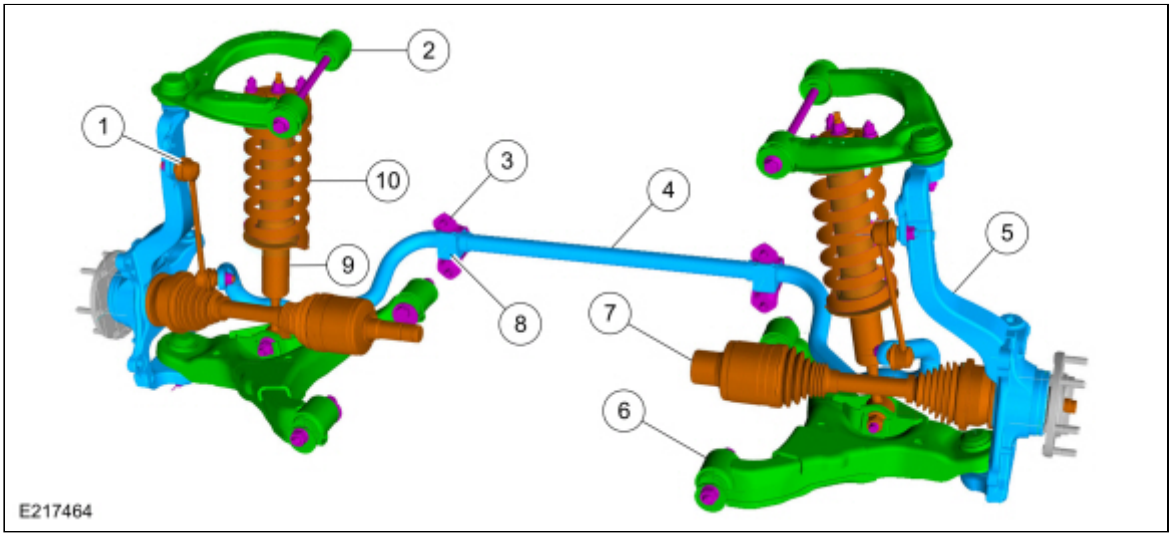
High Ride Height - 4X2



Item		Description

	Part Number	
1	—	Stabilizer bar link
2	—	Upper arm
3	—	Stabilizer bar bracket
4	—	Stabilizer bar
5	—	Knuckle
6	—	Lower arm
7	—	Stabilizer bar bush
8	—	Shock absorber unit
9	—	Suspension unit

High Ride Height - 4X4



Item	Part Number	Description
1	—	Stabilizer bar link
2	—	Upper arm
3	—	Stabilizer bar bracket
4	—	Stabilizer bar
5	—	Knuckle
6	—	Lower arm
7	—	Half Shafts
8	—	Stabilizer bar bush
9	—	Shock absorber unit
10	—	Suspension unit

Copyright © 2016 Ford Motor Company

Front Suspension

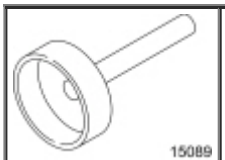
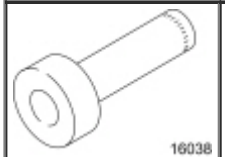
For additional information, refer to Section 204-00.

Copyright © 2016 Ford Motor Company

Front Wheel Bearing

Base Part Number: 1215

Special Tool(s) / General Equipment

 15089	205-307 Installer, Wheel Speed Sensor Ring
 16038	308-095 Installer, Input Shaft Bearing
Hydraulic Press	
Bearing Separator	

Removal

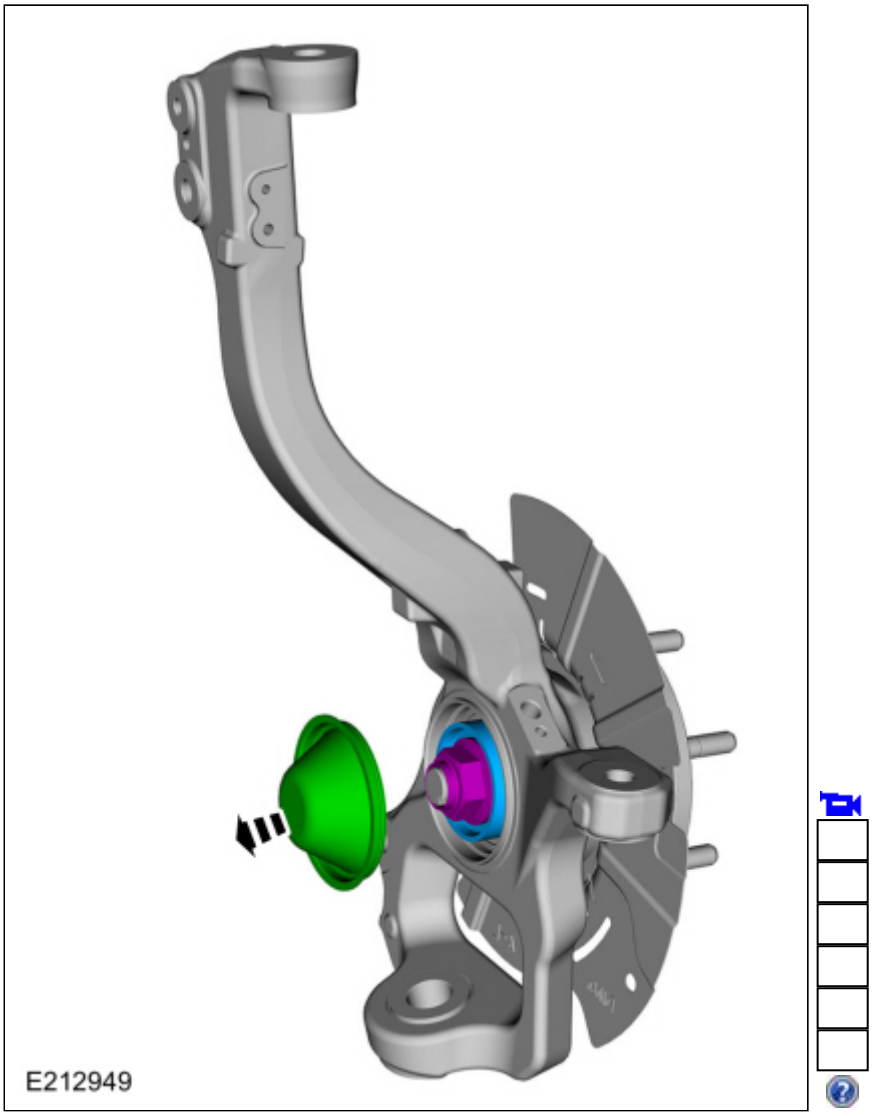
NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

4x2

2. Refer to: Wheel Knuckle - LHD RWD/RHD RWD (204-01 Front Suspension, Removal and Installation).
3. *Torque*: 300 Nm



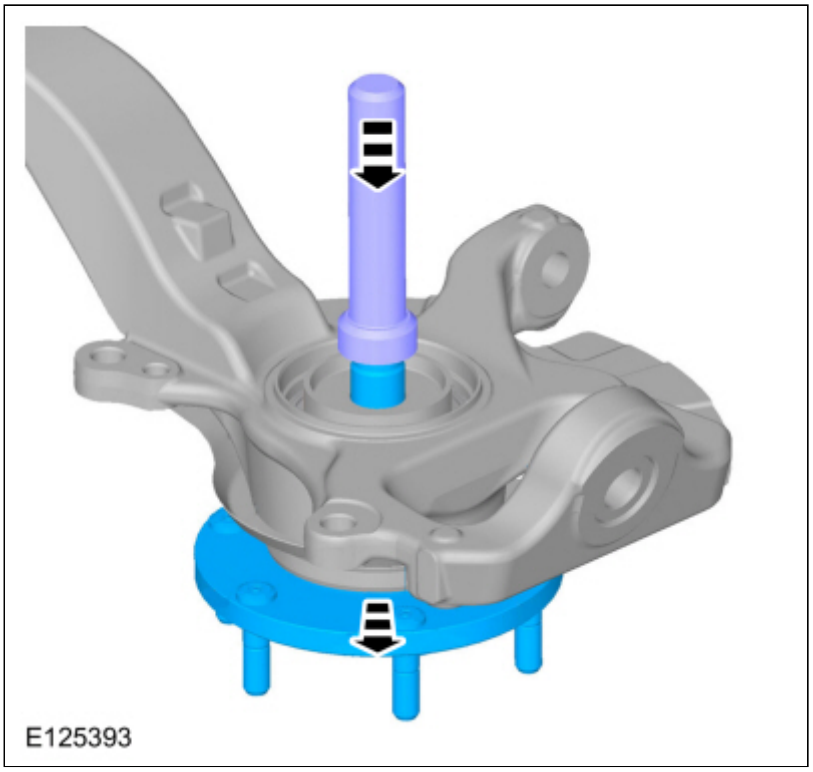
4x4

4. Refer to: Wheel Knuckle - LHD 4WD/RHD 4WD (204-01 Front Suspension, Removal and Installation).

All vehicles

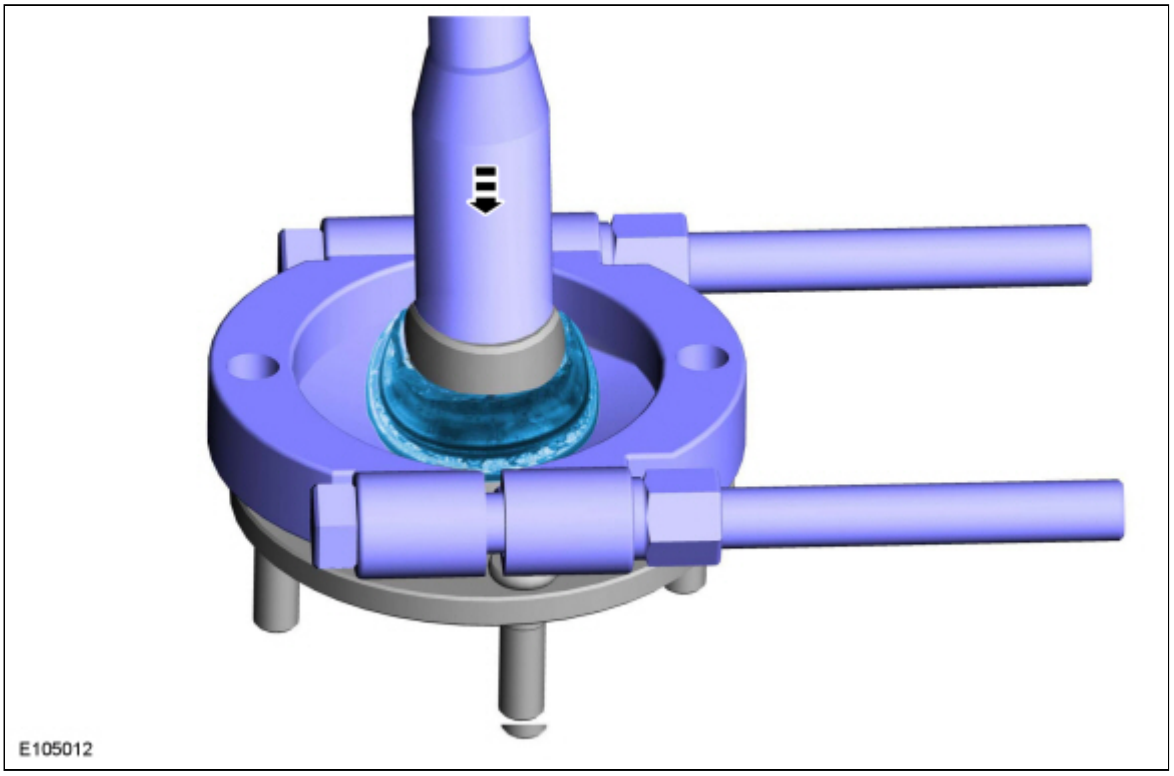
5. **NOTICE: Use a suitable tool to prevent damage to the component during removal.**

   Use the General Equipment: Hydraulic Press

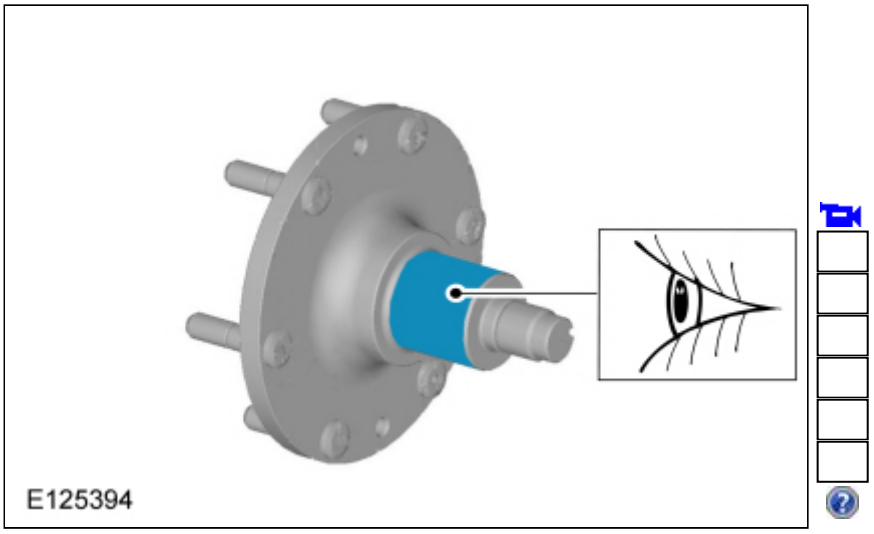


6. **NOTICE: Use a suitable tool to prevent damage to the component during removal.**

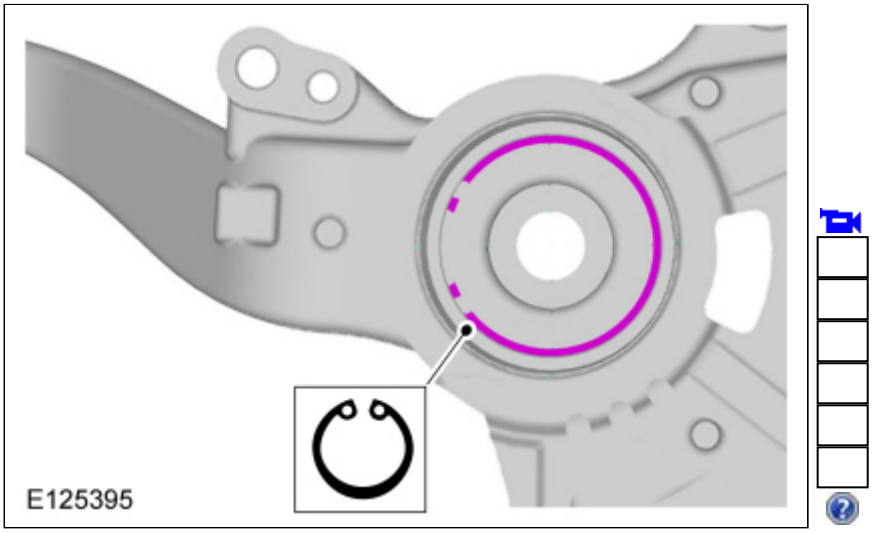
   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



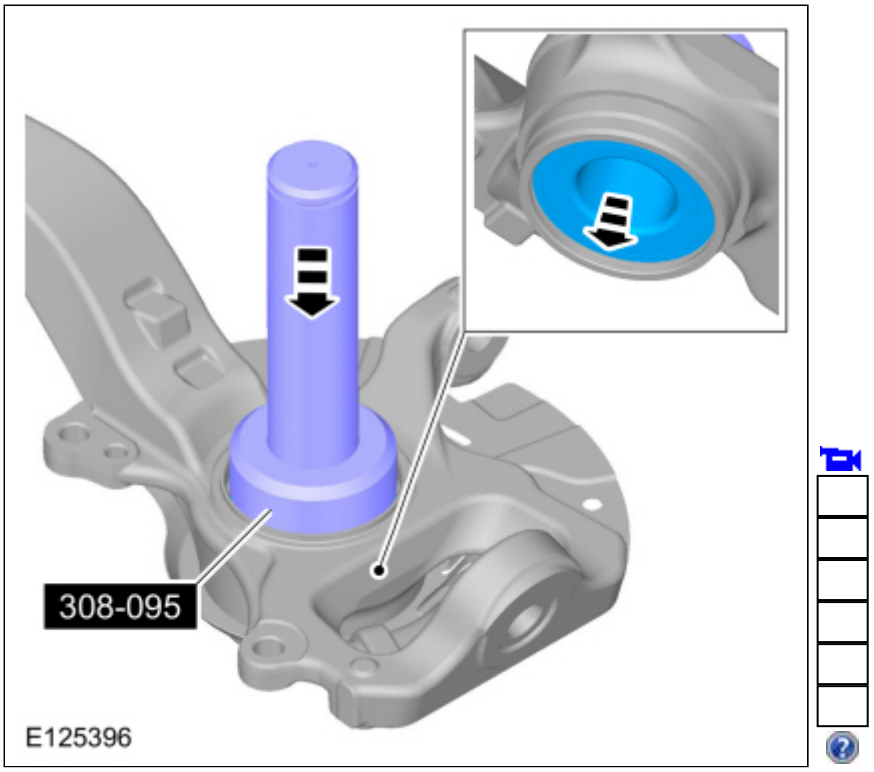
7.



8.

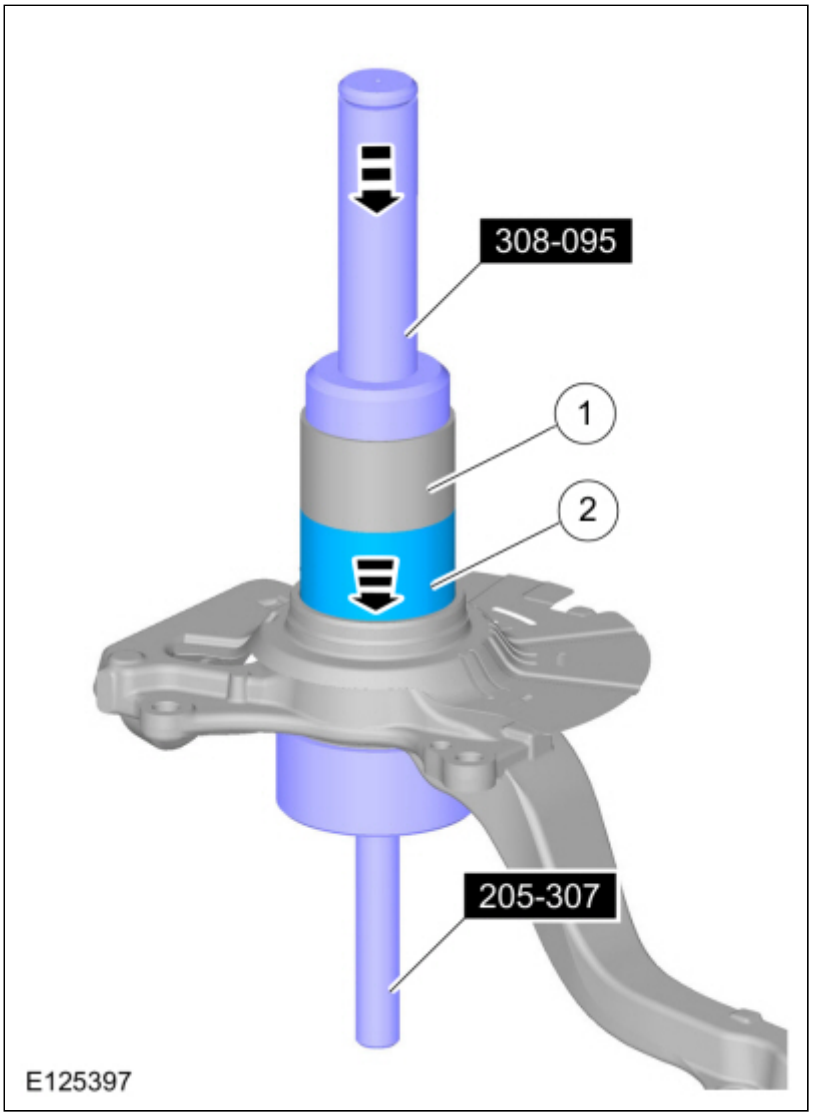


9. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing.
   Use the General Equipment: Hydraulic Press



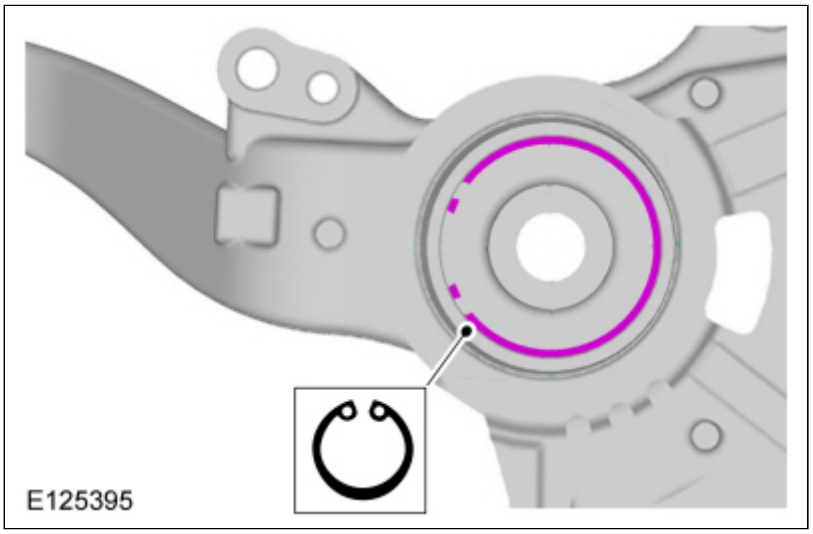
Installation

1. Old Front wheel bearing.
2. New Front wheel bearing.
3. Press and install the new wheel bearing.
   Use Special Service Tool: 308-095 Installer, Input Shaft Bearing. , 205-307 Installer, Wheel Speed Sensor Ring.
   Use the General Equipment: Hydraulic Press

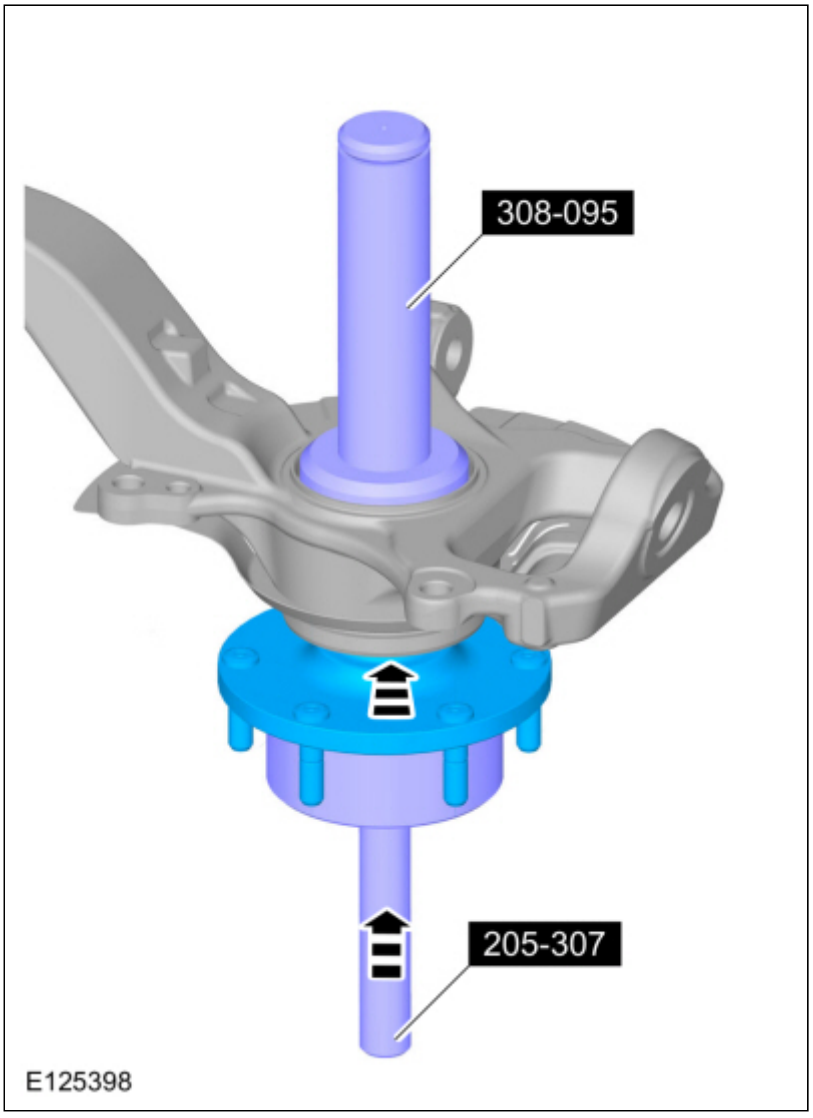


2. **NOTE:** *Make sure that the sensor ring is correctly located.*

   NOTE: *Make sure that a new snap ring is installed.*



3. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing. , 205-307 Installer, Wheel Speed Sensor Ring.
   Use the General Equipment: Hydraulic Press



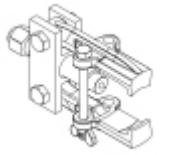
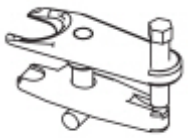
4. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Wheel Knuckle - LHD RWD/RHD RWD

Base Part Number: 3K170

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm
 E139377	49-T028-3A0 Remover, Ball Joint Puller Set

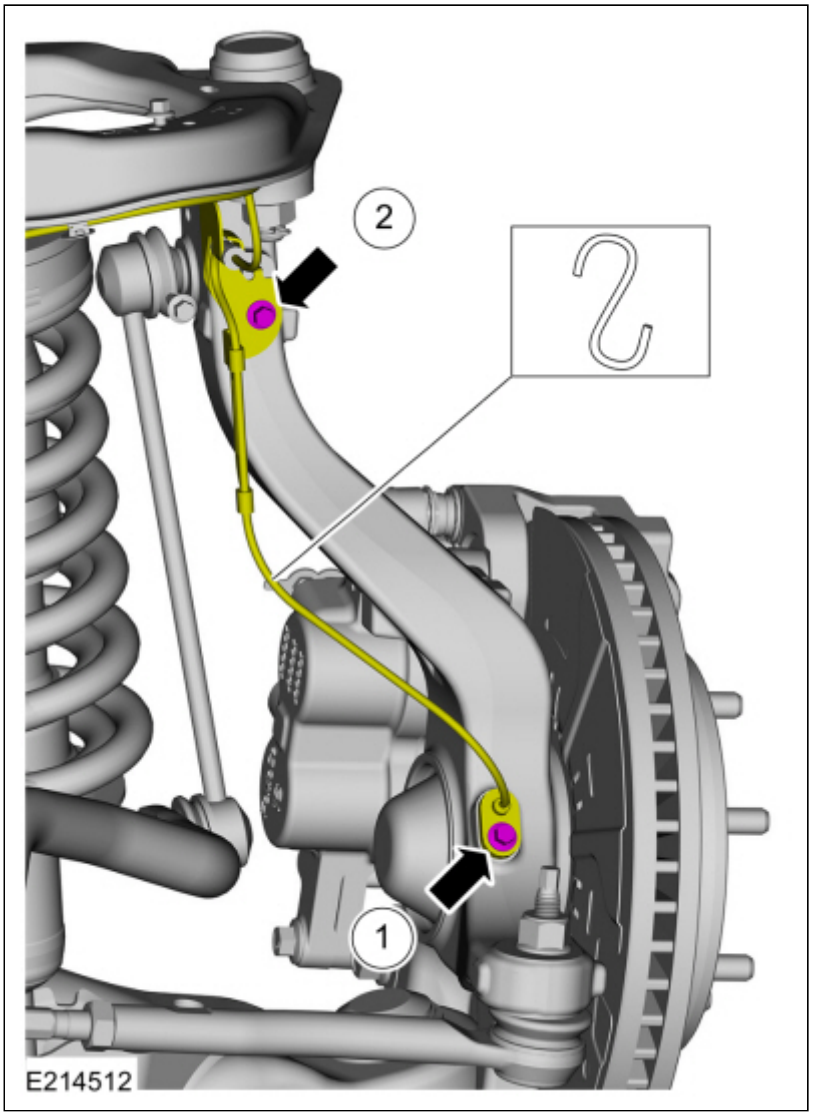
Removal

NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

NOTICE: Before performing the following procedures, remove the ABS wheel-speed sensor (axle side) and fix it to an appropriate place where the sensor will not be pulled by mistake while the vehicle is being serviced.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. *Torque*: 6 Nm



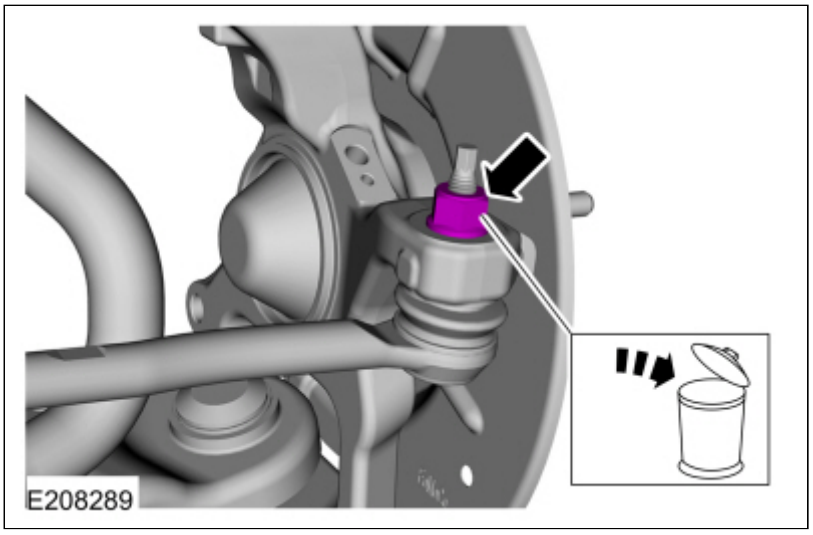
4. **NOTICE: Make sure that no load is placed on the brake hose.**

   Refer to: Brake Disc (206-03 Front Disc Brake, Removal and Installation).

5. **NOTICE: Make sure that a new nut is installed.**

   NOTICE: Make sure that ball joint does not rotate.

   Torque: 63 Nm



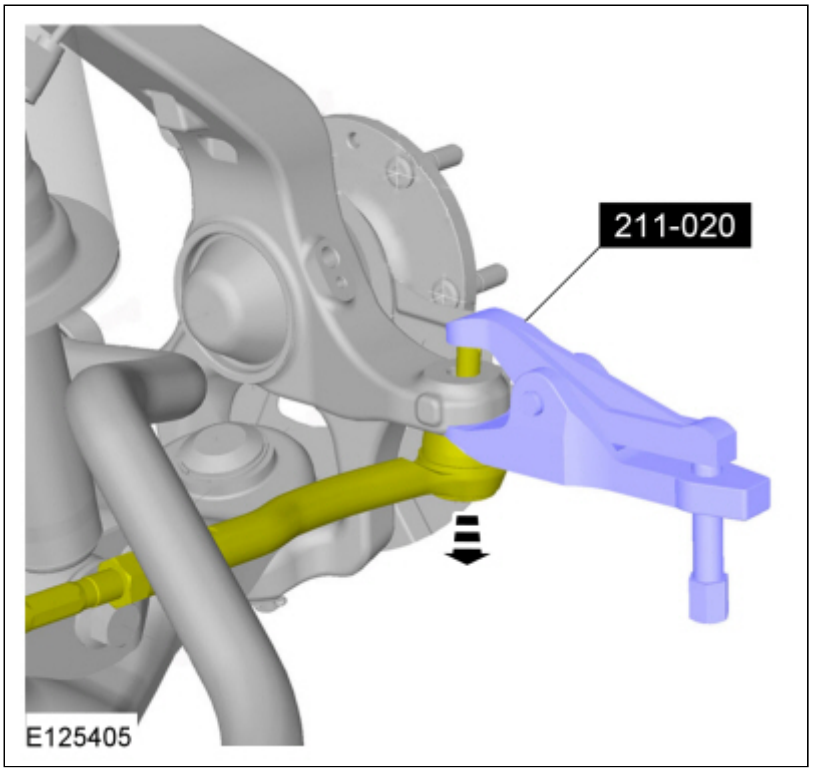
6. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

   NOTICE: Take extra care not to damage the component.

NOTICE: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

NOTICE: Protect the ball joint seal using a soft cloth to prevent damage.

Use Special Service Tool: 211-003 (T64P-3590-F) Remover, Steering Arm.

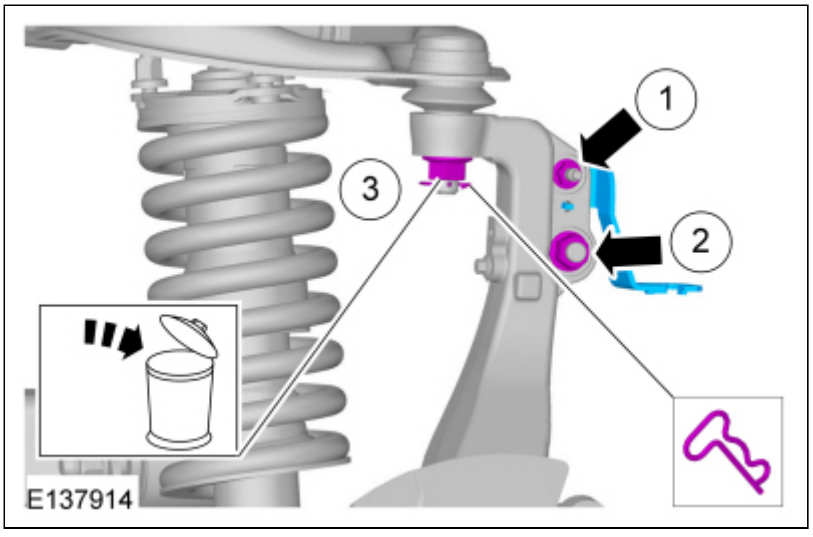


7. **NOTICE: Make sure that a new nut is installed.**

   NOTICE: Use suitable packing material to prevent damage to the component.

   NOTICE: Make sure that the ball joint ball does not rotate.

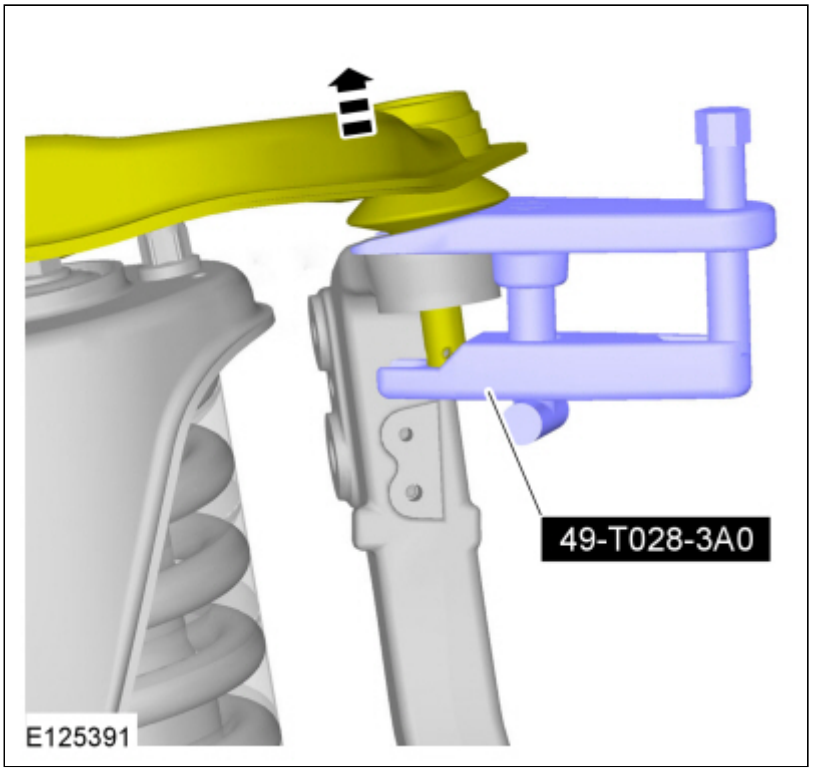
   1. *Torque*: 14 Nm
   2. *Torque*: 90 Nm
   3. *Torque*: 63 Nm



8. **NOTICE: Protect the component with a soft cloth to prevent damage.**

   NOTICE: Take extra care not to damage the component.

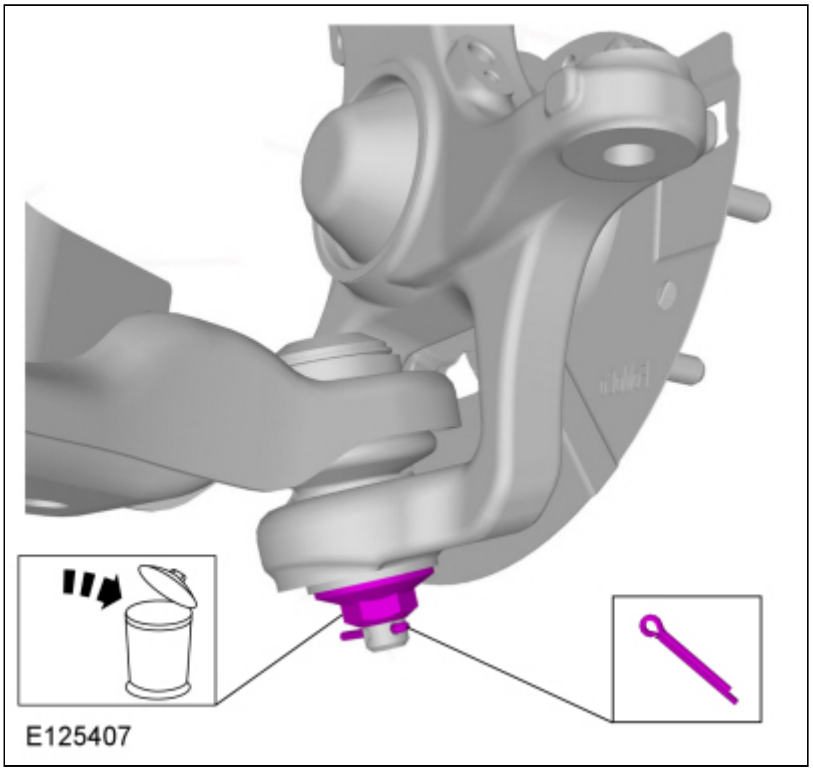
   Use Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



9. **NOTICE: Make sure that a new nut is installed.**

   NOTE: *Make sure that the component is correctly secured..*

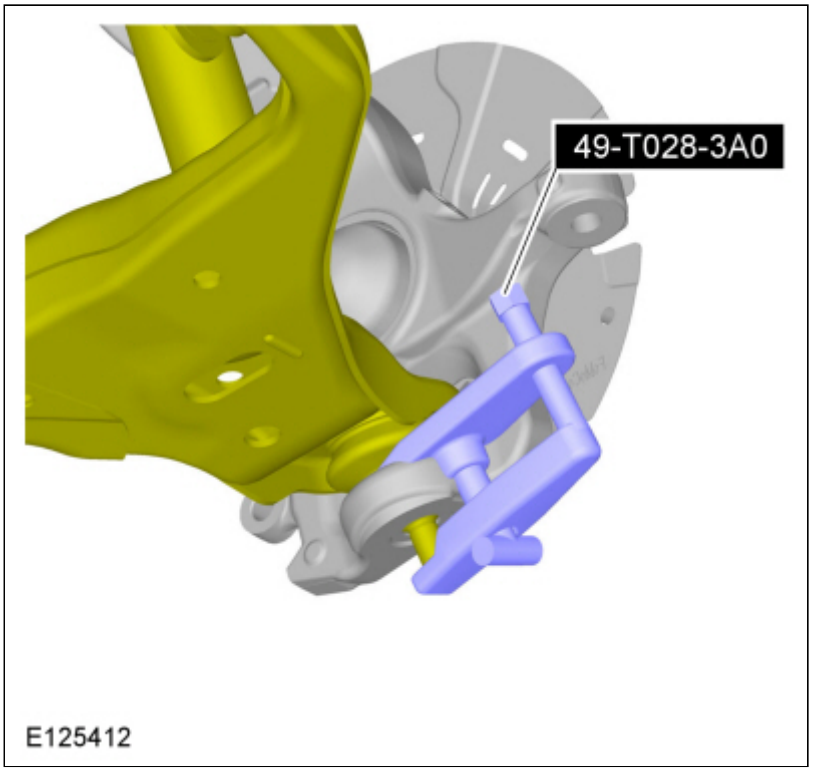
   Torque: 175 Nm



10. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

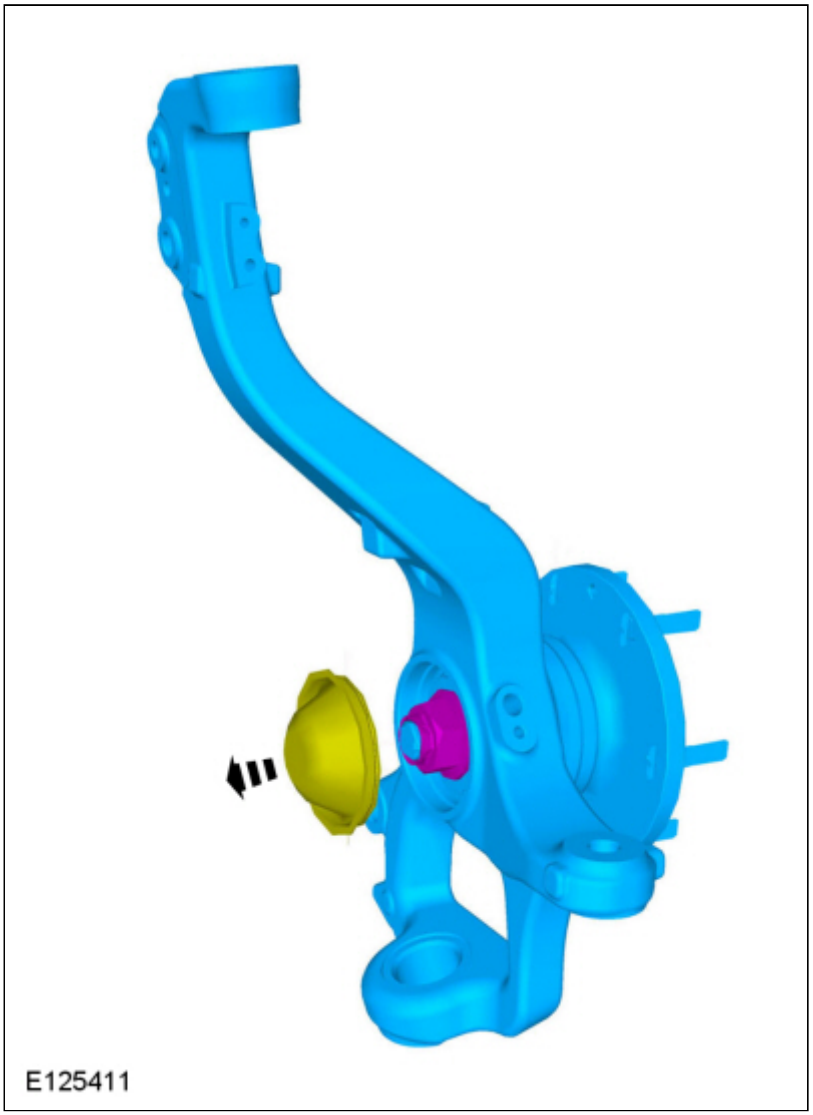
    NOTICE: Take extra care not to damage the component.

    Use Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



11. **NOTE:** *This step is only necessary when installing a new component.*

    Refer to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).



Installation

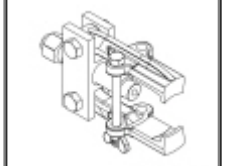
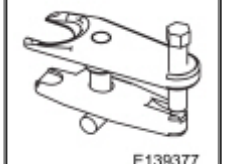
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Wheel Knuckle - LHD 4WD/RHD 4WD

Base Part Number: 3K170

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm
 E139377	49-T028-3A0 Remover, Ball Joint Puller Set
Puller	

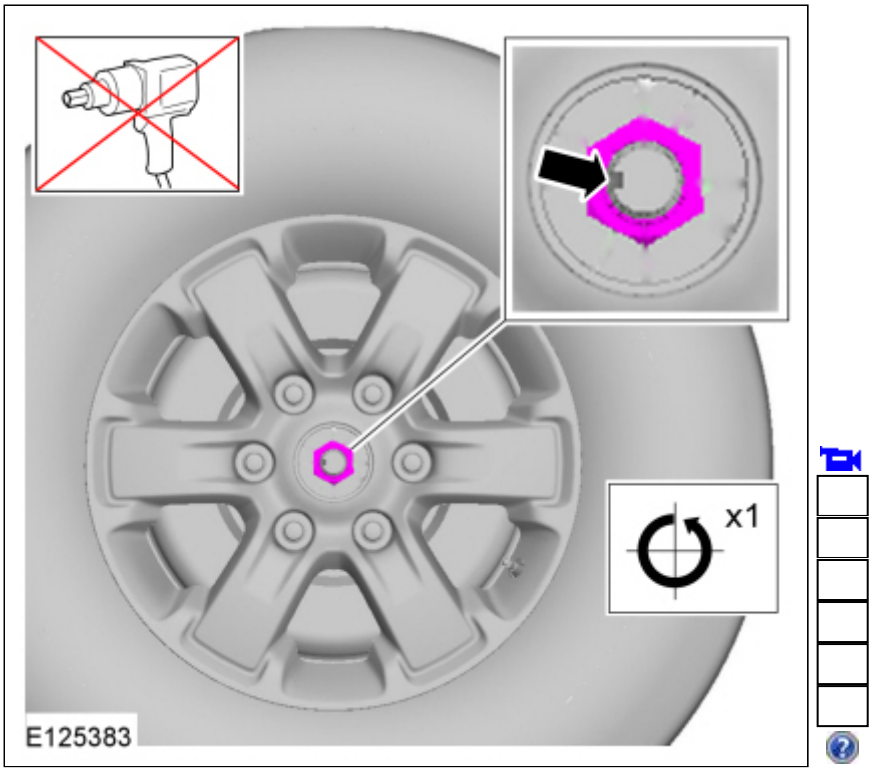
Removal

NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

NOTICE: Before performing the following procedures, remove the ABS wheel-speed sensor (axle side) and fix it to an appropriate place where the sensor will not be pulled by mistake while the vehicle is being serviced.

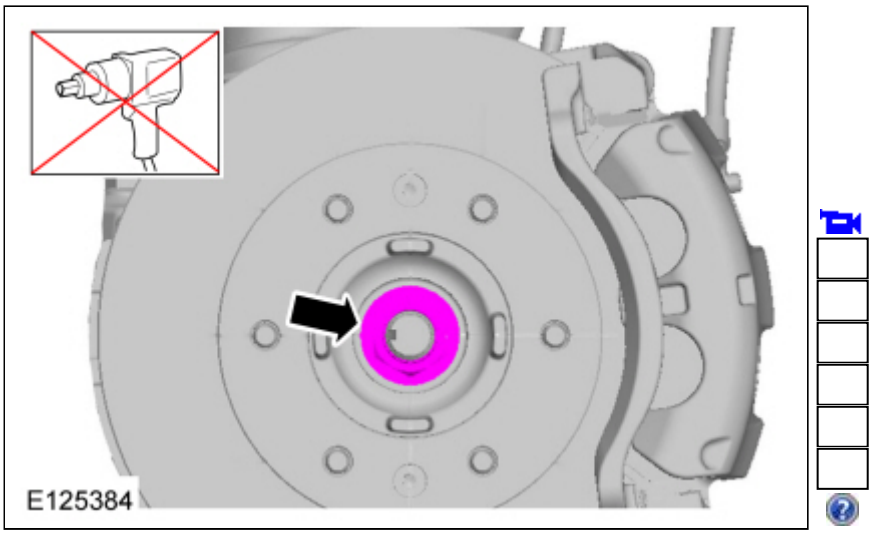
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Make sure the hub nut is unpinned before removal.*

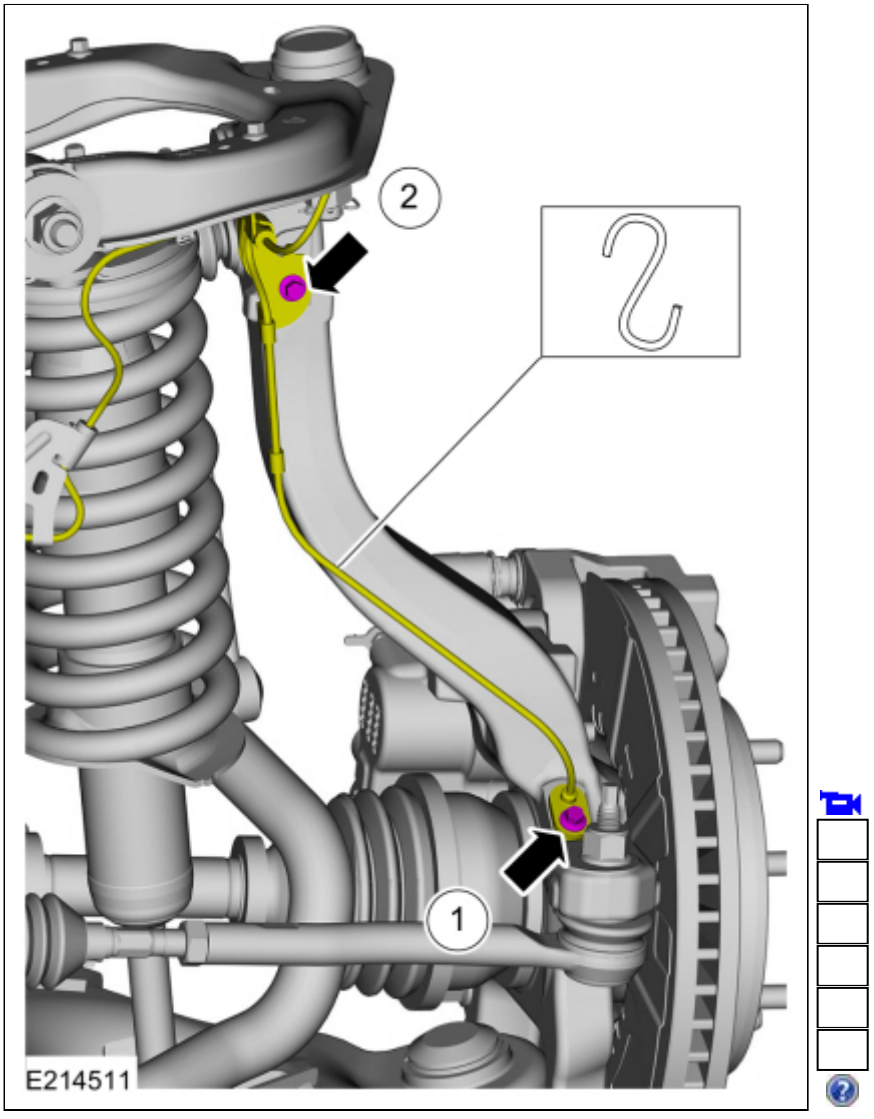


3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

4. **NOTICE: If the outer constant velocity (CV) joint boot is damaged a new halfshaft must be installed.**



5. *Torque*: 6 Nm

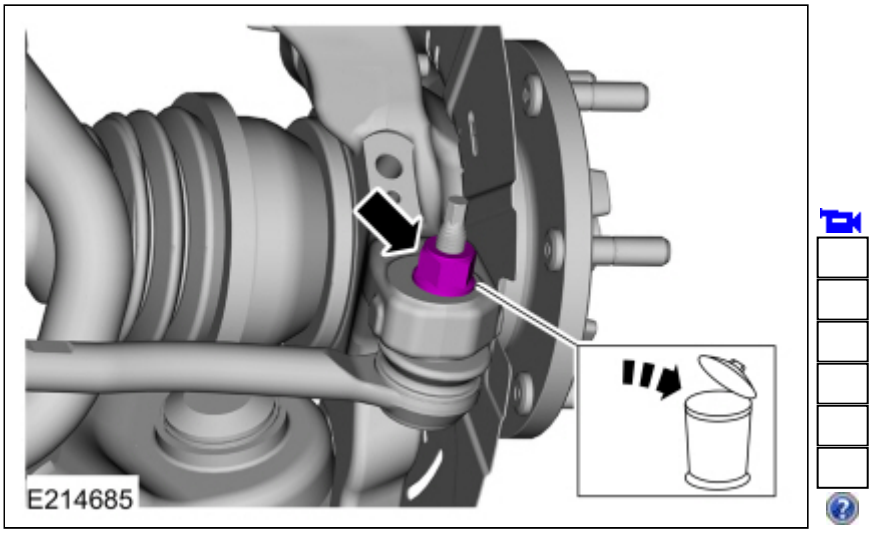


6. **NOTICE: Make sure that no load is placed on the brake hose.**

   Refer to: Brake Disc (206-03 Front Disc Brake, Removal and Installation).

7. **NOTICE: Make sure that the ball joint ball does not rotate.**

   Torque: 63 Nm



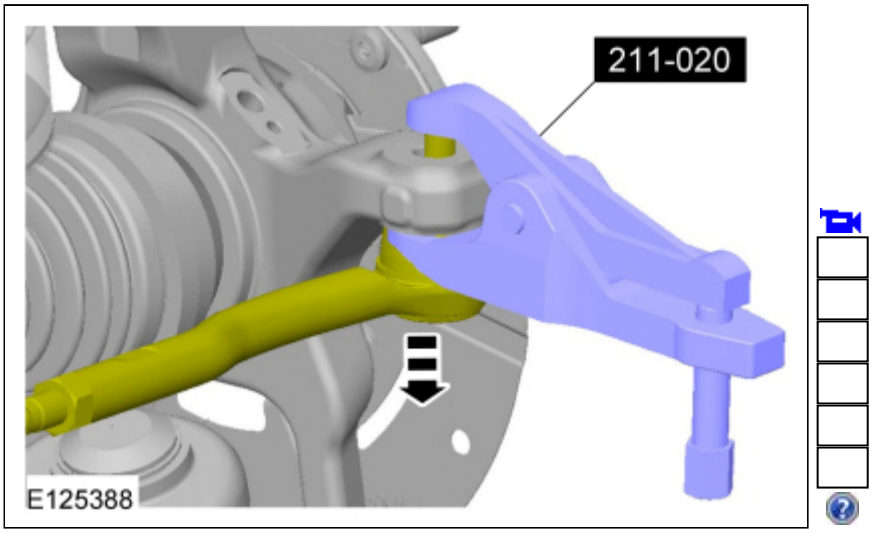
8. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

   NOTICE: Take extra care not to damage the component.

   NOTICE: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

   NOTICE: Protect the component with a soft cloth to prevent damage.

   Use Special Service Tool: 211-003 (T64P-3590-F) Remover, Steering Arm.

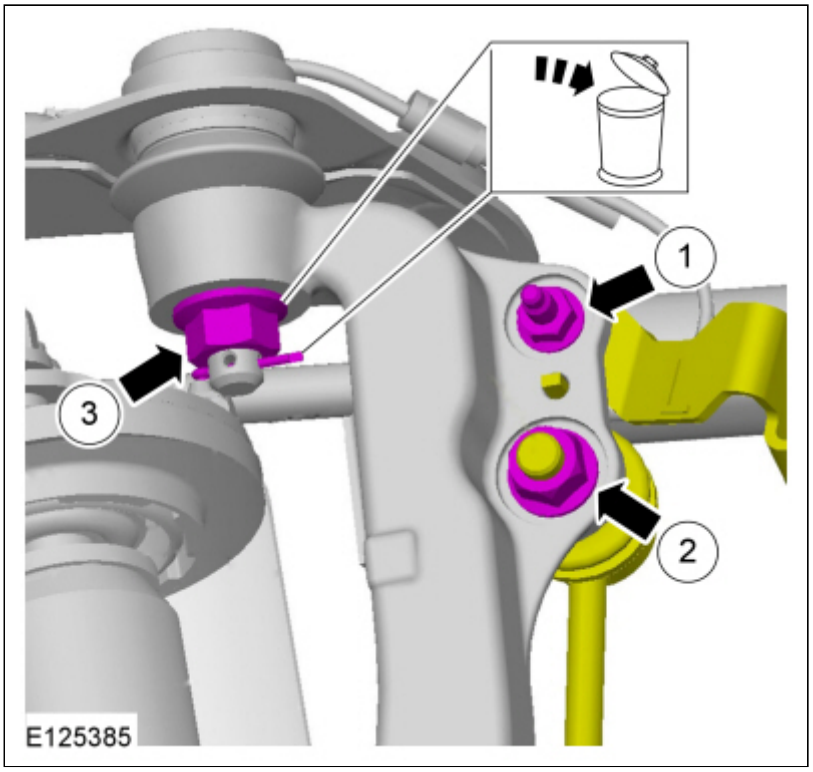


9. **NOTICE: Make sure that a new nut is installed.**

   NOTICE: Use suitable packing material to prevent damage to the component.

   NOTICE: Make sure that the ball joint ball does not rotate.

   1. *Torque*: 14 Nm
   2. *Torque*: 90 Nm
   3. *Torque*: 63 Nm

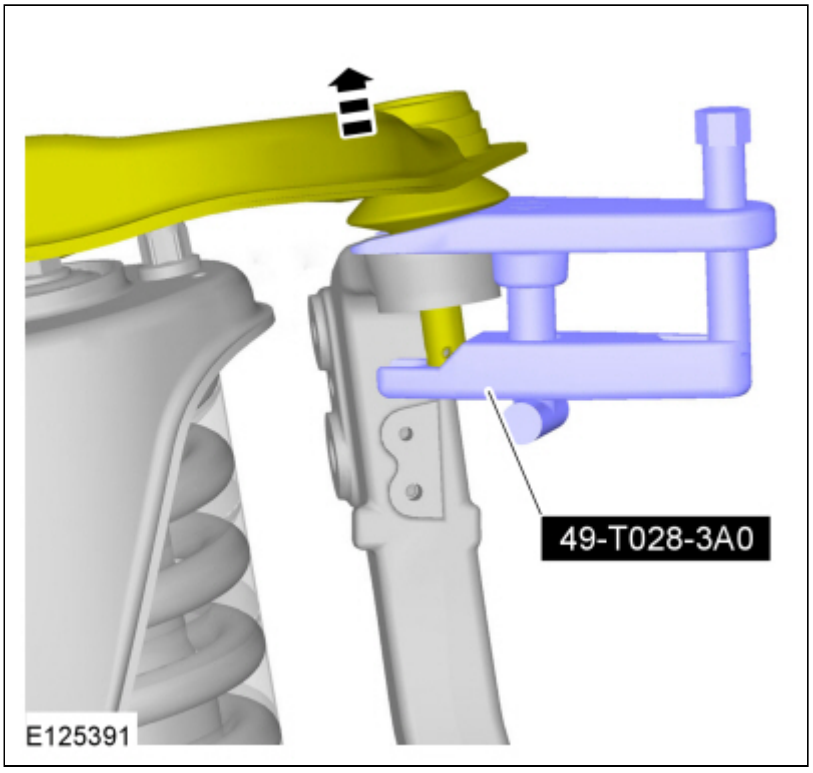


10. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

    NOTICE: Take extra care not to damage the component.

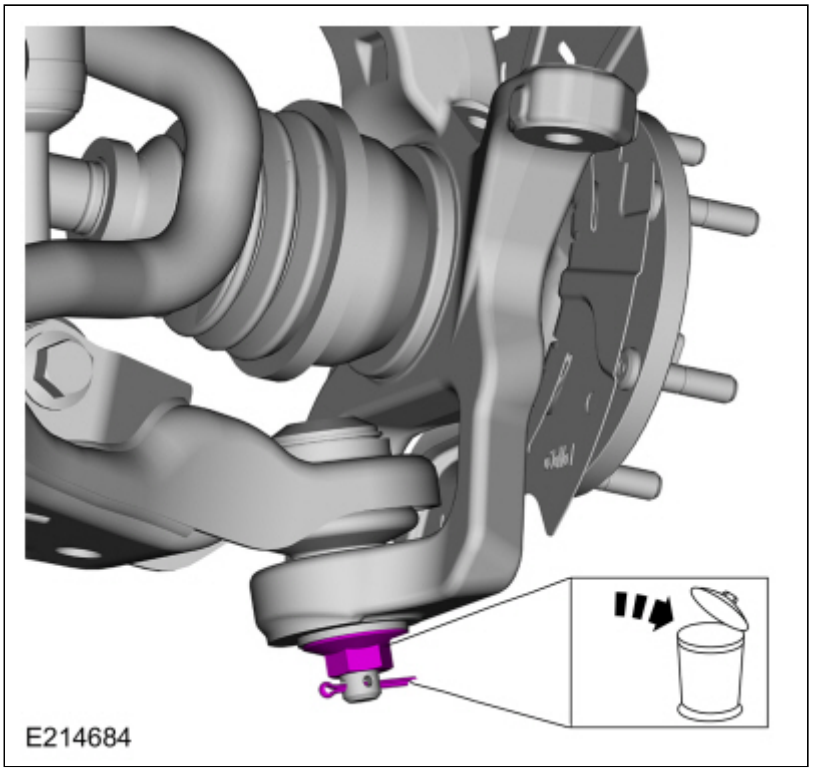
    NOTICE: Protect the component with a soft cloth to prevent damage.

    Use Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



11. **NOTE:** *Make sure that the component is correctly secured.*

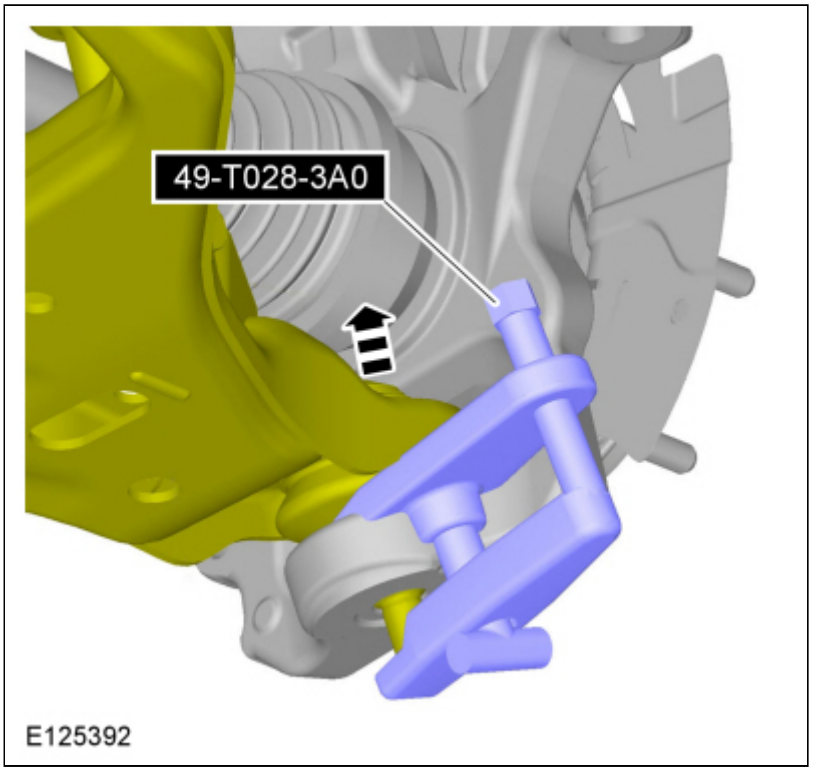
    Torque: 175 Nm



12. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

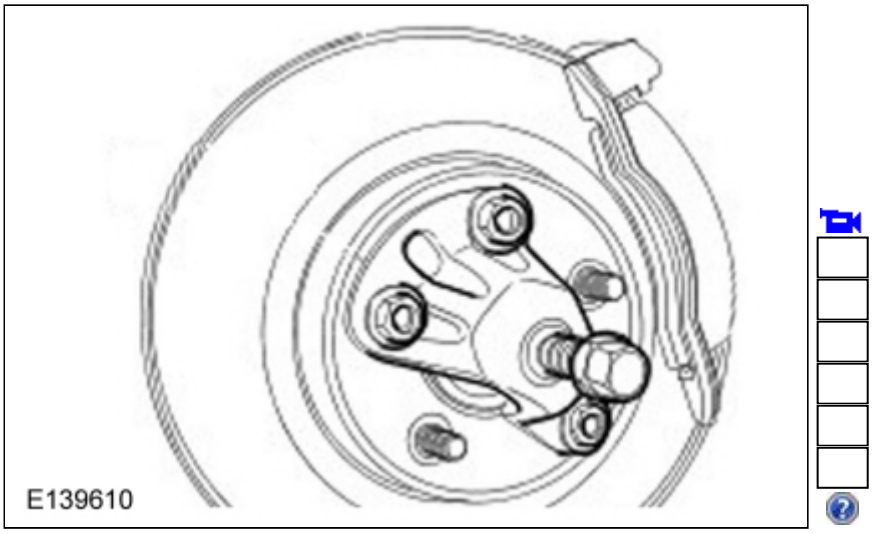
    NOTICE: Take extra care not to damage the component.

    Use Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



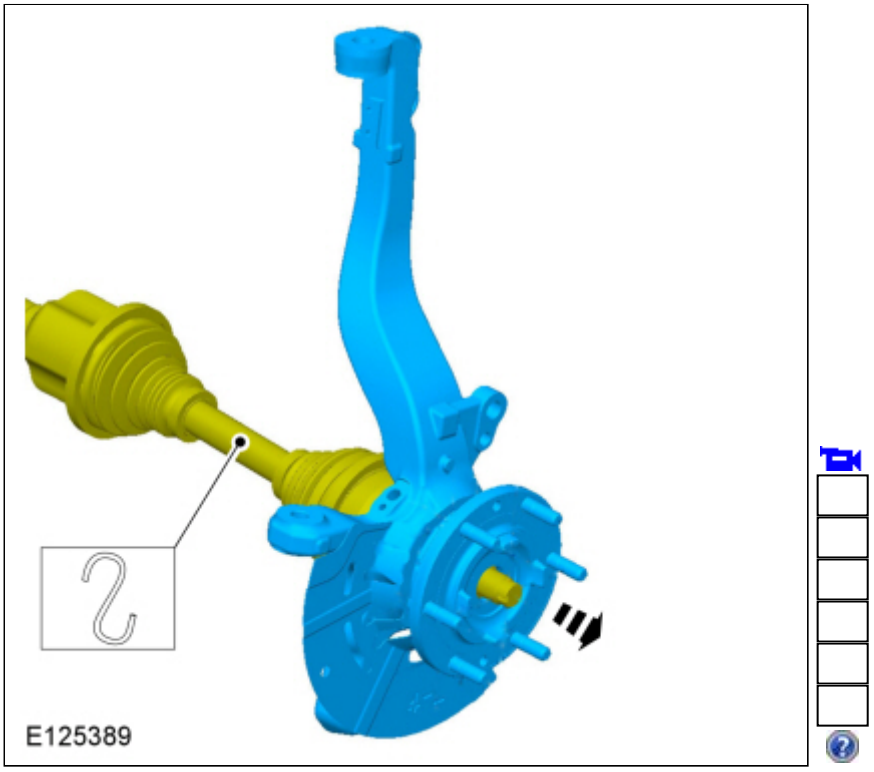
13. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

    Using the special tool, press the outboard CV joint until it is loose in the hub.
    Use the General Equipment: Puller



14. **NOTICE: Take extra care not to damage the mating faces.**

    NOTICE: Take extra care not to damage the seal.



Installation

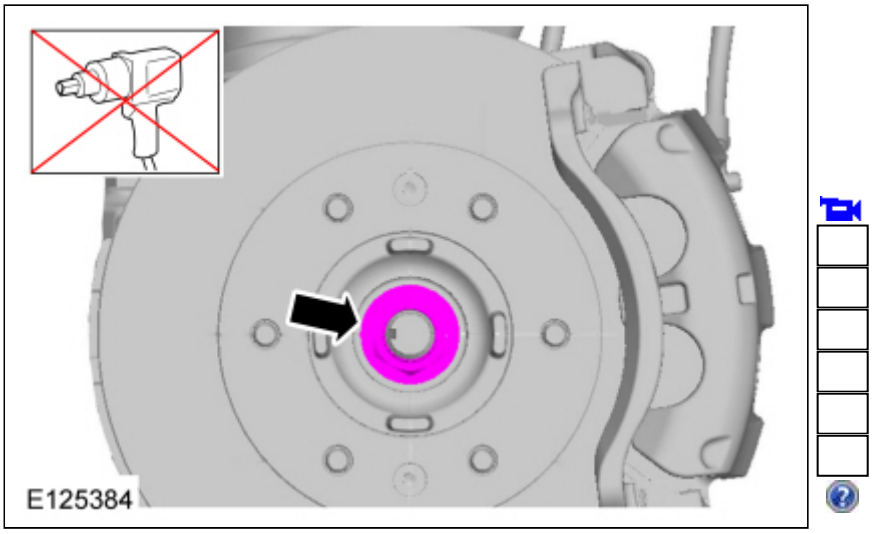
1. **NOTICE: Make sure that the ball joint ball does not rotate.**

   NOTE: *This step is only necessary if the component needs to be replaced.*

   NOTE: *Install a new component if it is damaged or has excessive wear.*

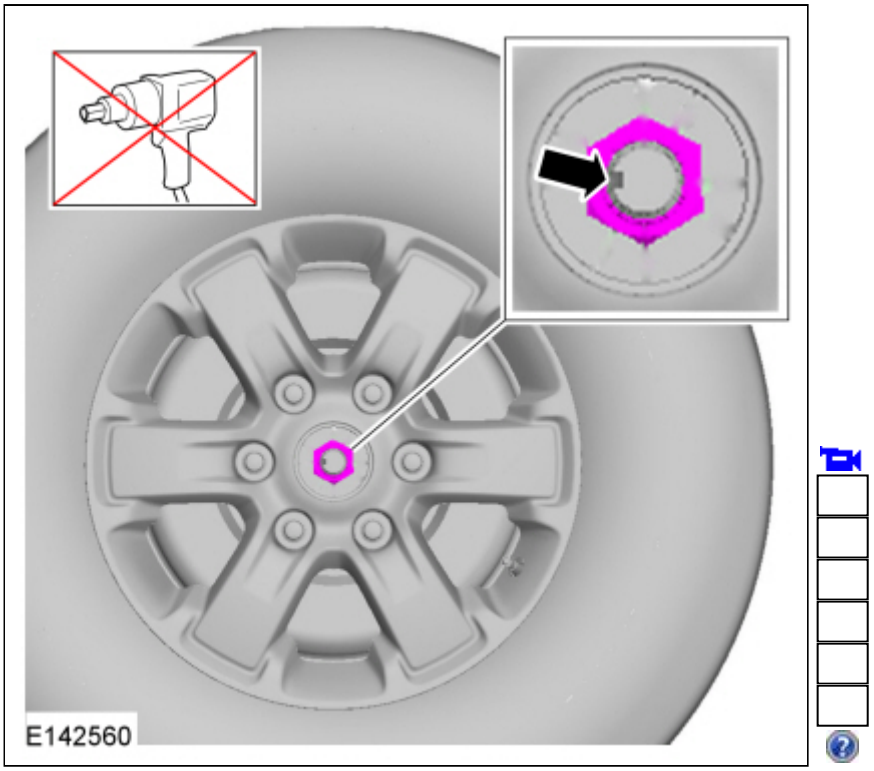
2. To install, reverse the removal procedure.
3. **NOTICE: If the outer constant velocity (CV) joint boot is damaged a new halfshaft must be installed.**

   NOTE: *Only tighten the hub nut finger tight at this stage.*



4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. **NOTICE: Make sure that the hub nut is pinned after installation.**

   General Equipment: Ford approved diagnostic tool
   Torque: 300 Nm



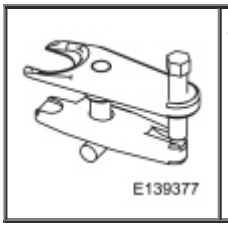
6. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Front Strut and Spring Assembly

Base Part Number: 18045

Special Tool(s) / General Equipment

 E139377	49-T028-3A0 Remover, Ball Joint Puller Set

Removal

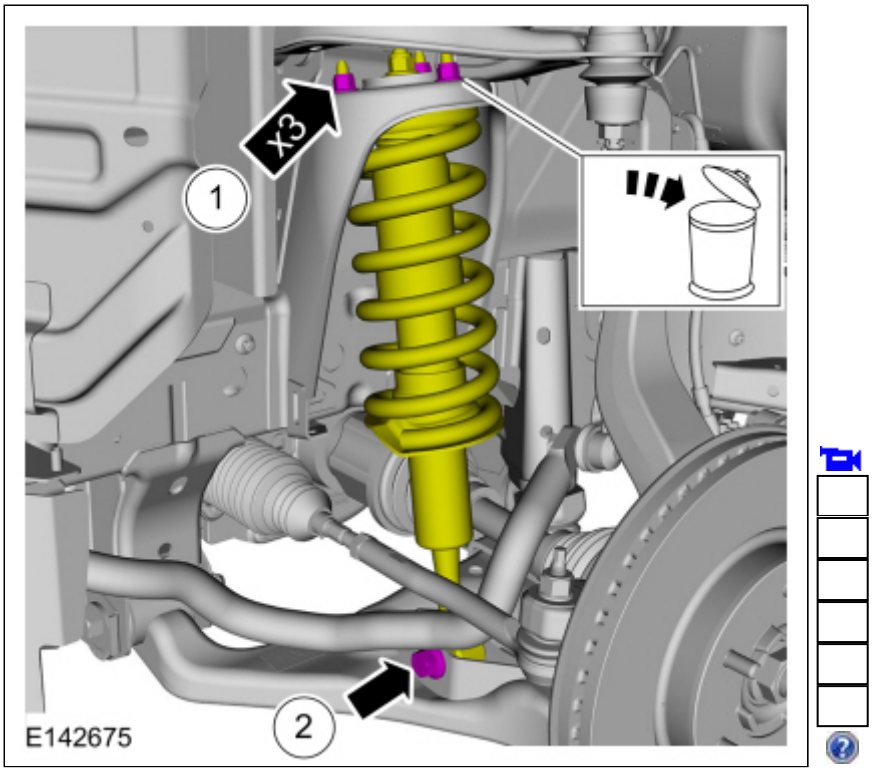
WARNING: All vehicles are equipped with gas-pressurized shock absorbers which will extend unassisted. Do not apply heat or flame to the shock absorbers during removal or component servicing. Failure to follow these instructions may result in personal injury.

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

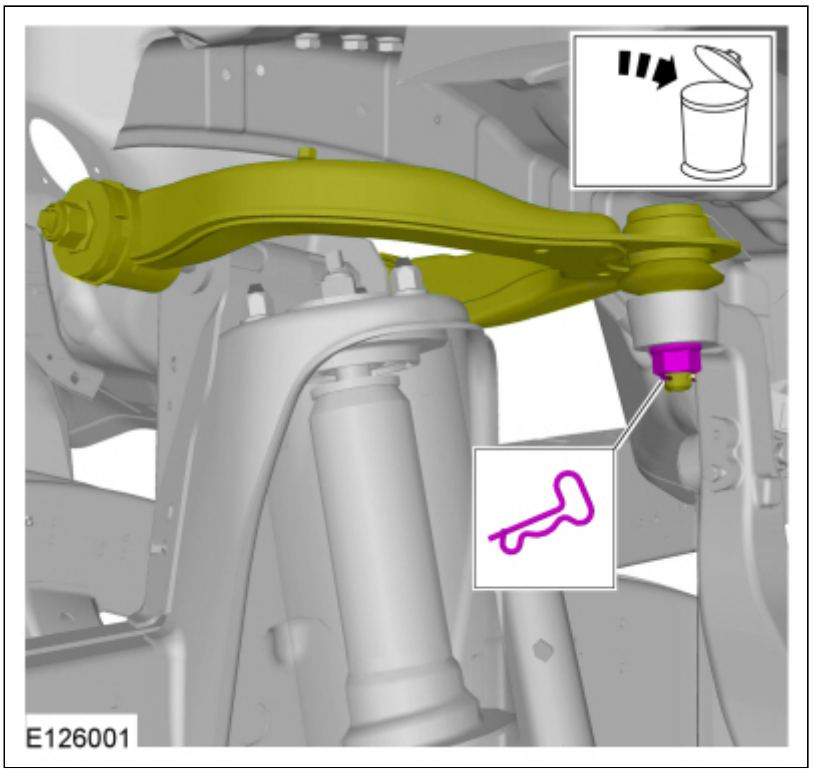
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

1. *Torque*: 55 Nm
2. *Torque*: 235 Nm



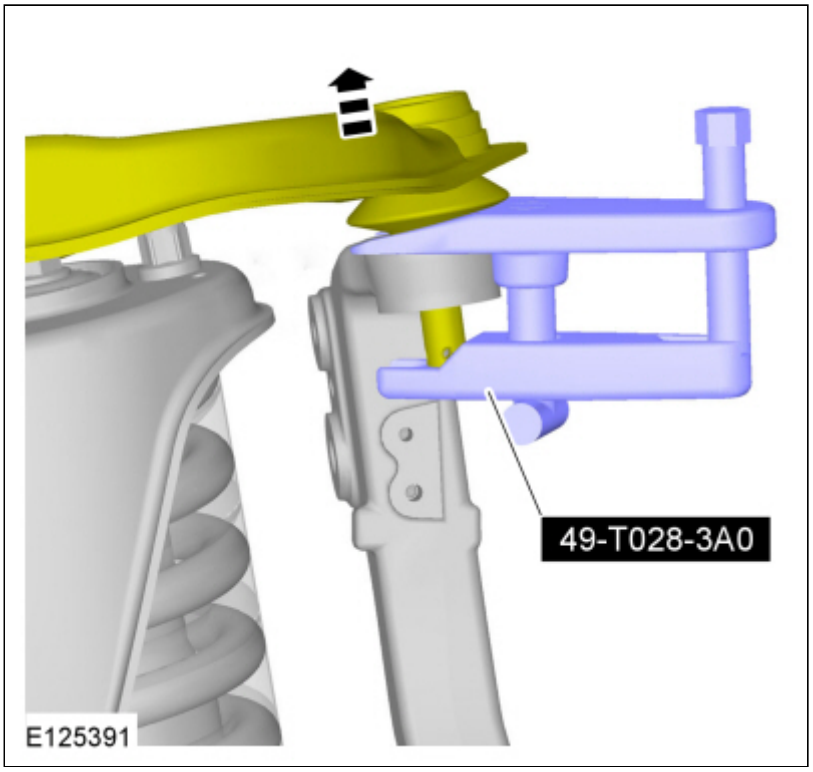
4. *Torque*: 65 Nm



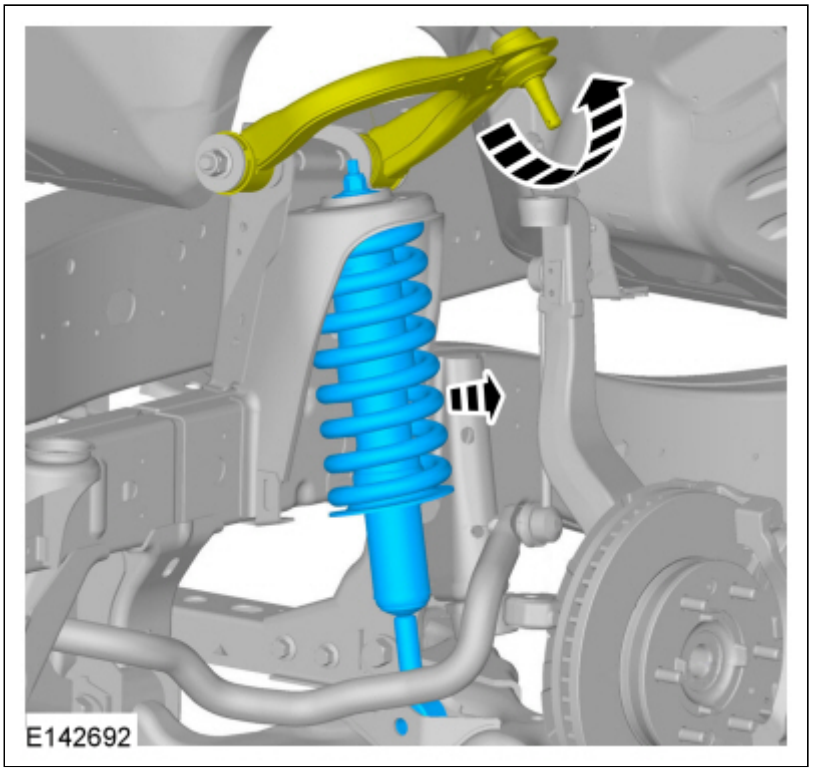
5. **NOTICE: Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

   - **Do not damage the ball joint boot while installing the special tool.**
   - **Make sure that the knuckle assembly is secured with suitable retaining straps.**

   Use Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



6. Using a suitable jack support the lower control arm near the lower ball joint.
7. Lower the jack support to lower the control arm.
8. **NOTE:** *Note the position of the components before removal.*



Installation

NOTICE: Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension.

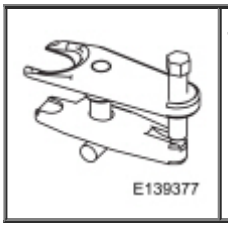
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Lower Arm - LHD RWD/RHD RWD

Base Part Number: 3051

Special Tool(s) / General Equipment

 E139377	49-T028-3A0 Remover, Ball Joint Puller Set

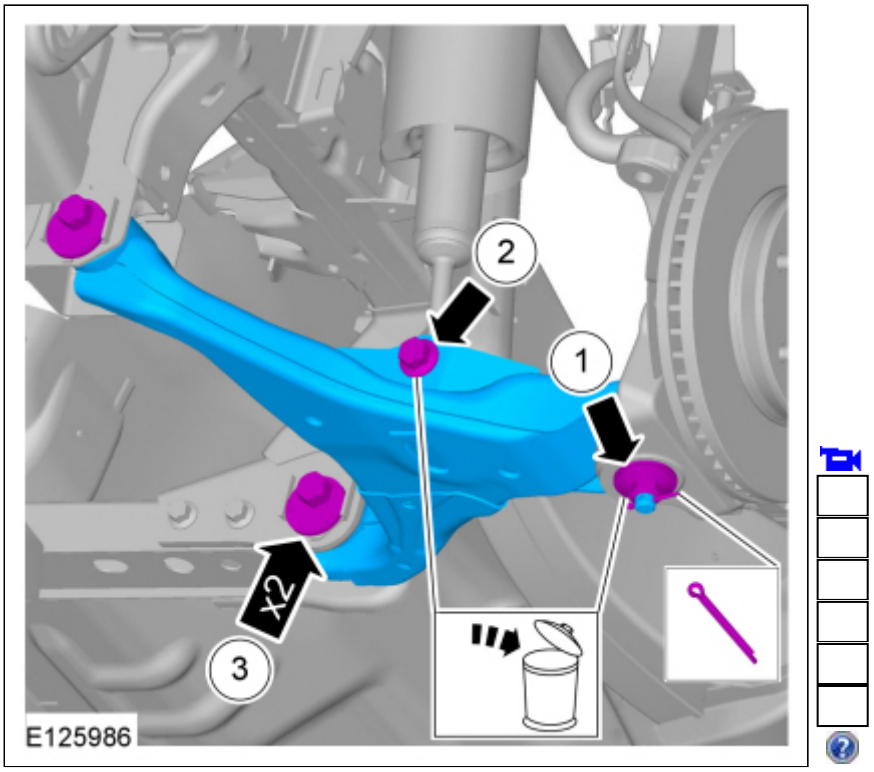
Removal

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

1. *Torque*: 175 Nm
2. *Torque*: 235 Nm
3. *Torque*: 260 Nm

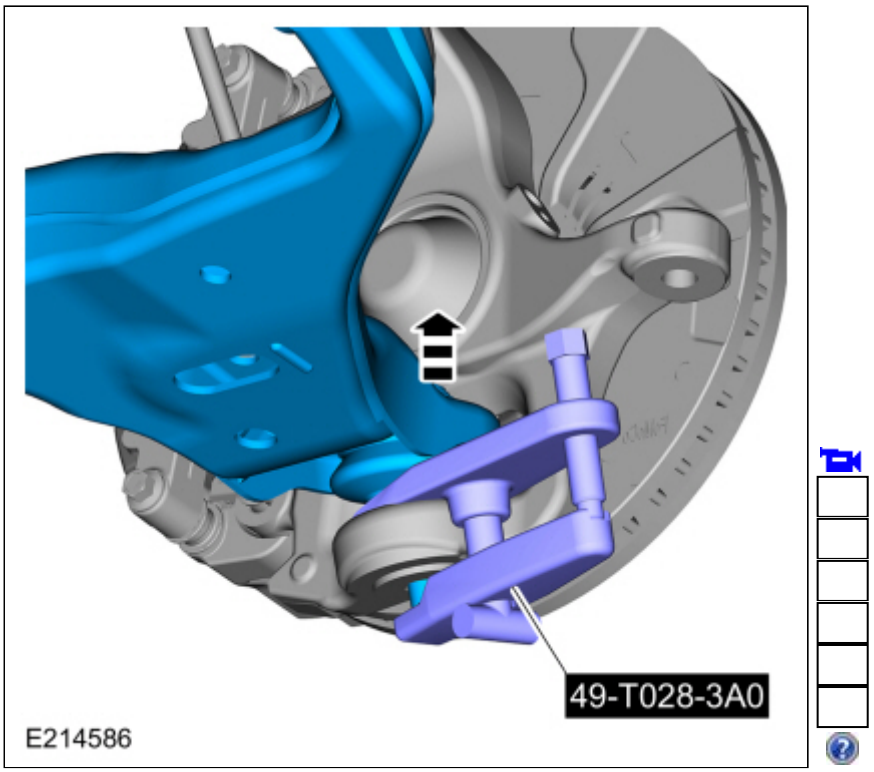


3. **NOTICE: Do not damage the ball joint boot while installing the special tool.**

   NOTICE: Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.

   NOTICE: Make sure that the wheel knuckle is correctly secured.

Remove Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



Installation

NOTICE: Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension.

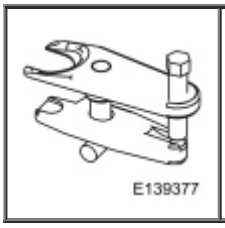
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Lower Arm - LHD 4WD/RHD 4WD

Base Part Number: 3051

Special Tool(s) / General Equipment

 E139377	49-T028-3A0 Remover, Ball Joint Puller Set

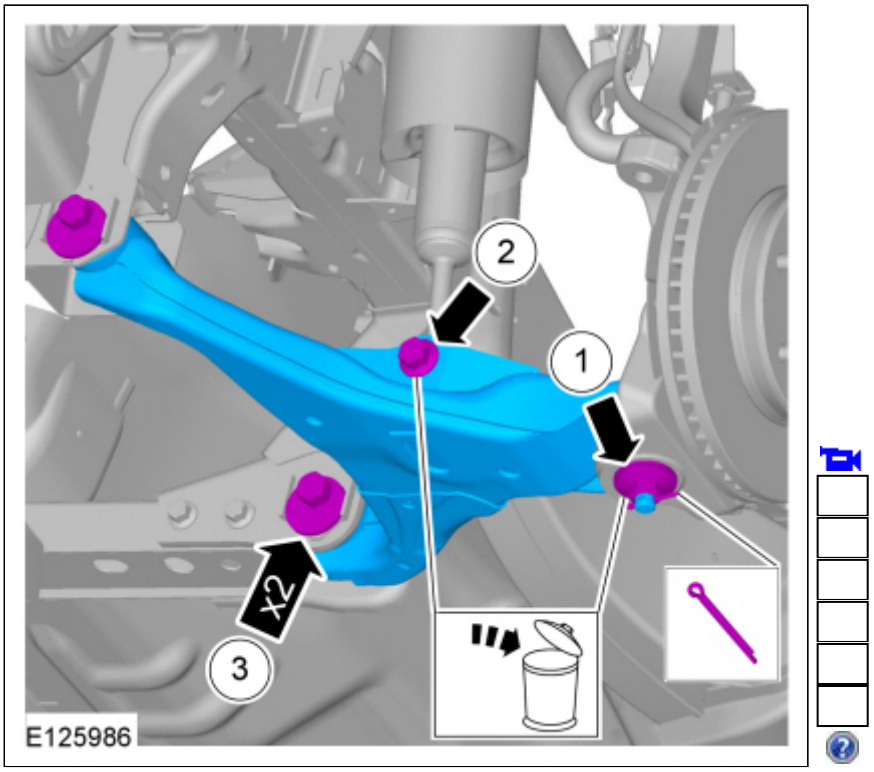
Removal

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

1. *Torque*: 175 Nm
2. *Torque*: 235 Nm
3. *Torque*: 260 Nm

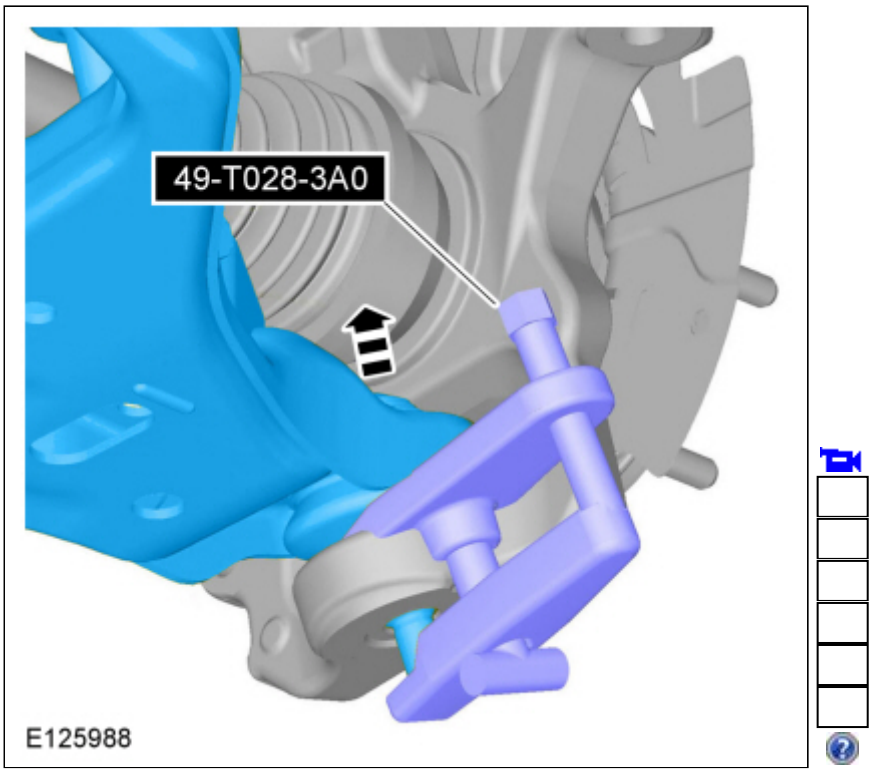


3. **NOTICE: Do not damage the ball joint boot while installing the special tool.**

   NOTICE: Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.

   NOTICE: Make sure that the wheel knuckle is correctly secured.

Remove Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



Installation

NOTICE: Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension.

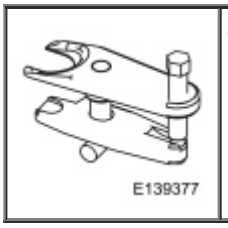
1. To install, reverse the removal procedure.
2. Refer to: Camber and Caster Adjustment (204-00 Suspension System - General Information, General Procedures).
3. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Upper Arm

Base Part Number: 3082

Special Tool(s) / General Equipment

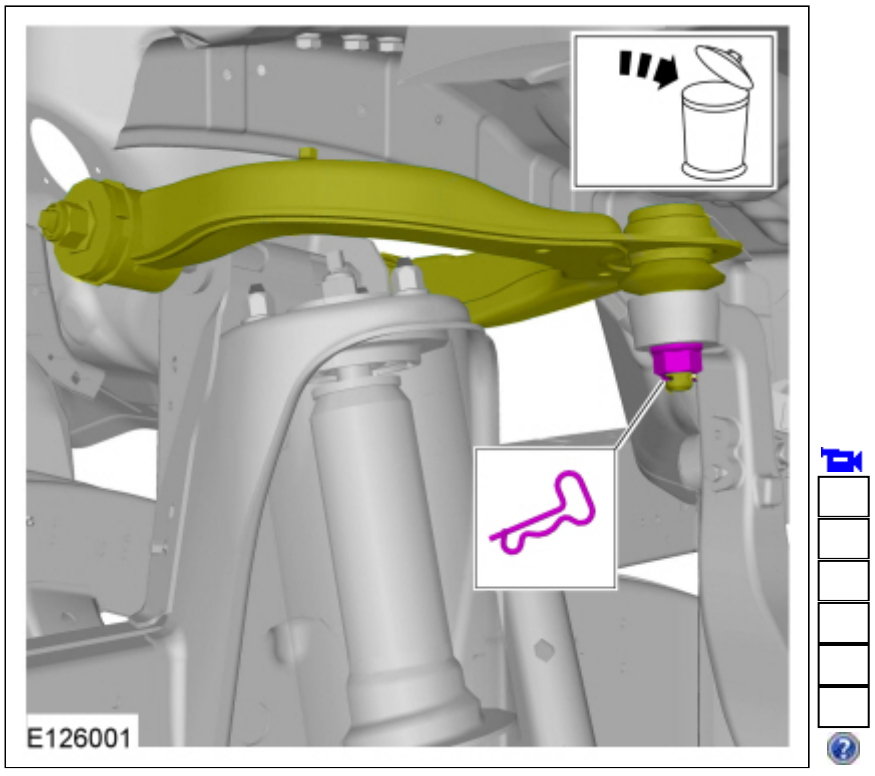
 E139377	49-T028-3A0 Remover, Ball Joint Puller Set

Removal

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. Refer to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
4. *Torque*: 63 Nm

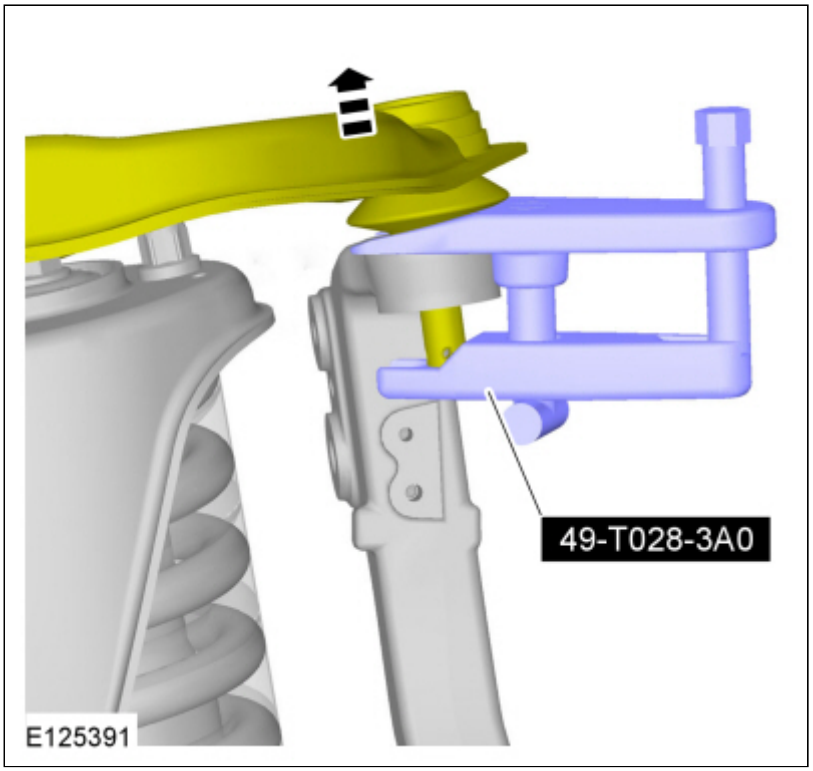


5. **NOTICE: Do not use a hammer to separate the ball joint from the wheel knuckle or damage to the wheel knuckle can result.**

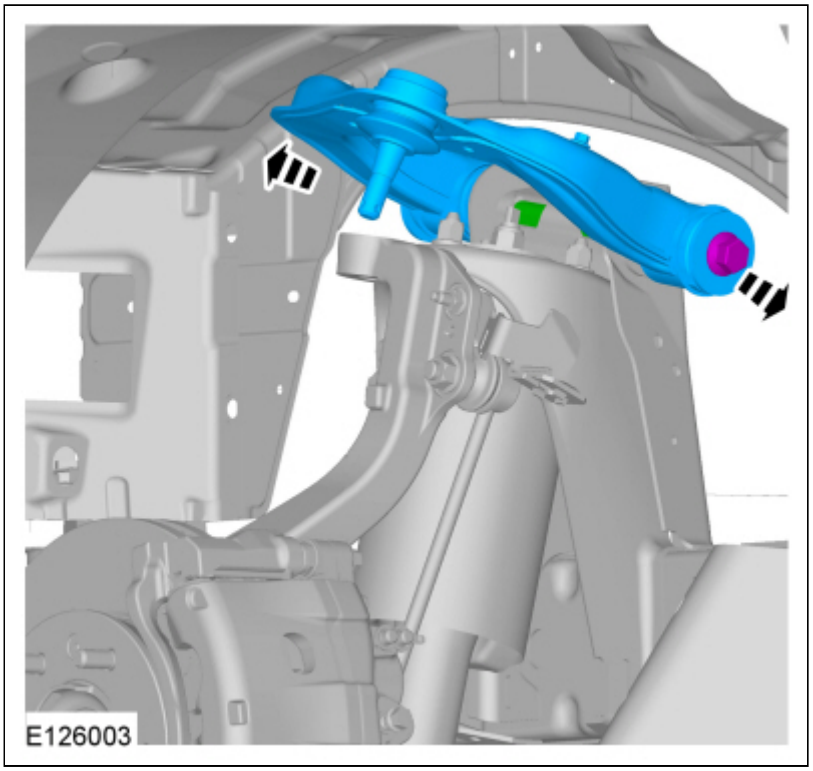
   NOTICE: Do not damage the ball joint boot while installing the special tool.

NOTICE: Make sure that the knuckle assembly is secured with suitable retaining straps.

Use Special Service Tool: 49-T028-3A0 Remover, Ball Joint Puller Set.



6. *Torque*: 185 Nm



Installation

NOTICE: Before tightening any suspension bushing fasteners, use a suitable jack to raise the suspension.

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Stabilizer Bar

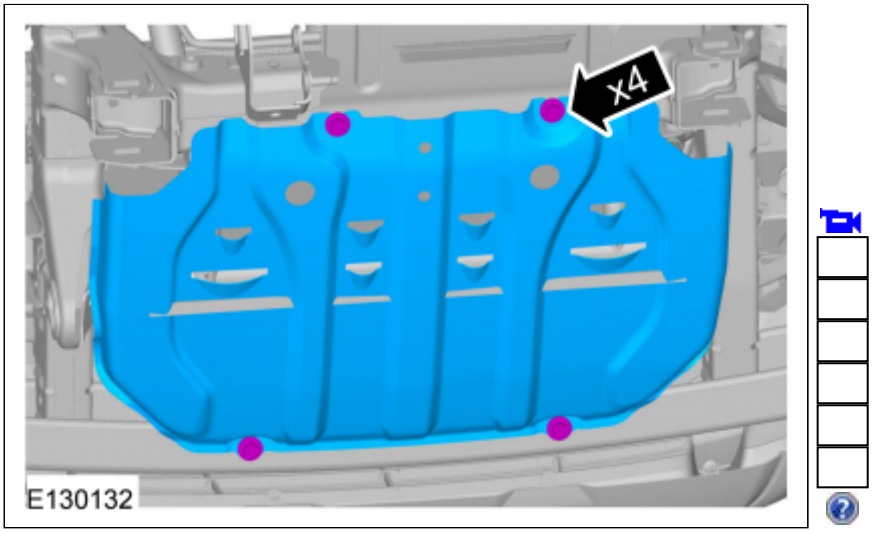
Base Part Number: 5482

Removal

NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

NOTE: *Removal steps in this procedure may contain installation details.*

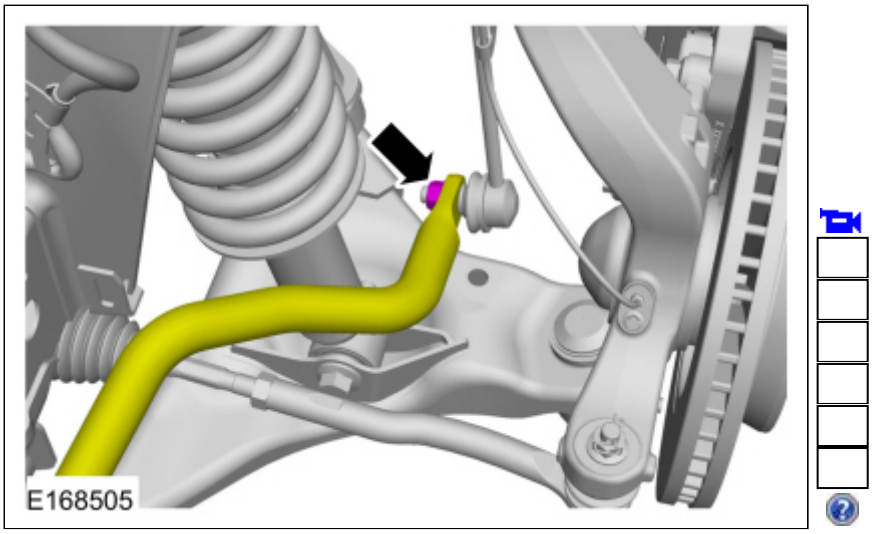
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. If equipped.
   Torque: 30 Nm



3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

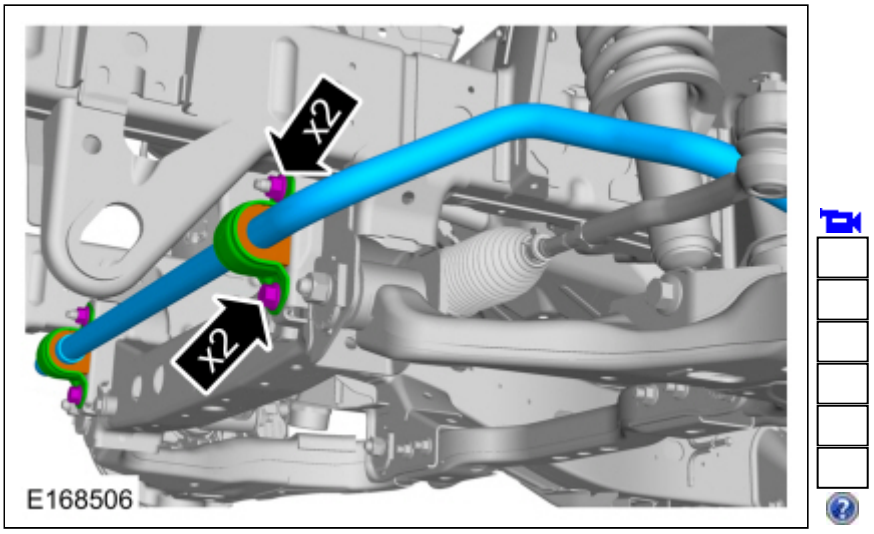
4x2

4. On both sides.
   Torque: 90 Nm



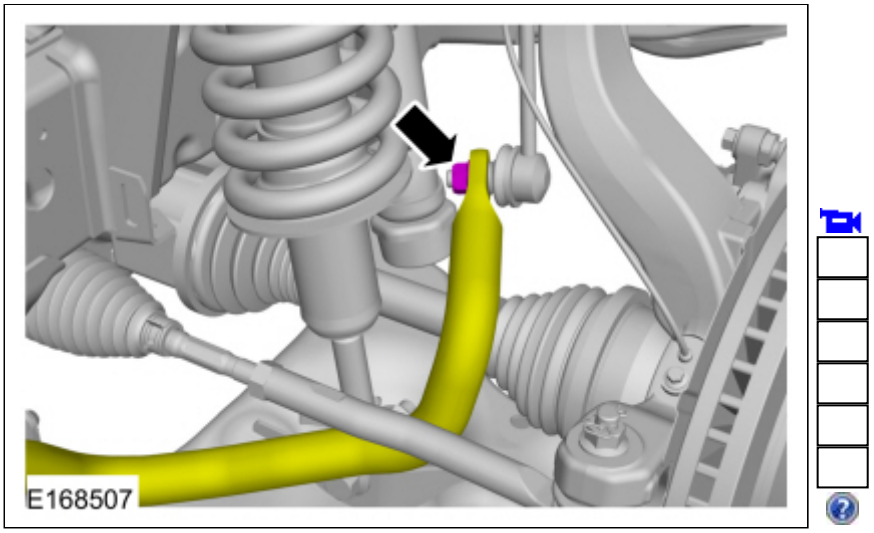
5. **NOTE:** *Note the position of the components before removal.*

   Torque: 90 Nm



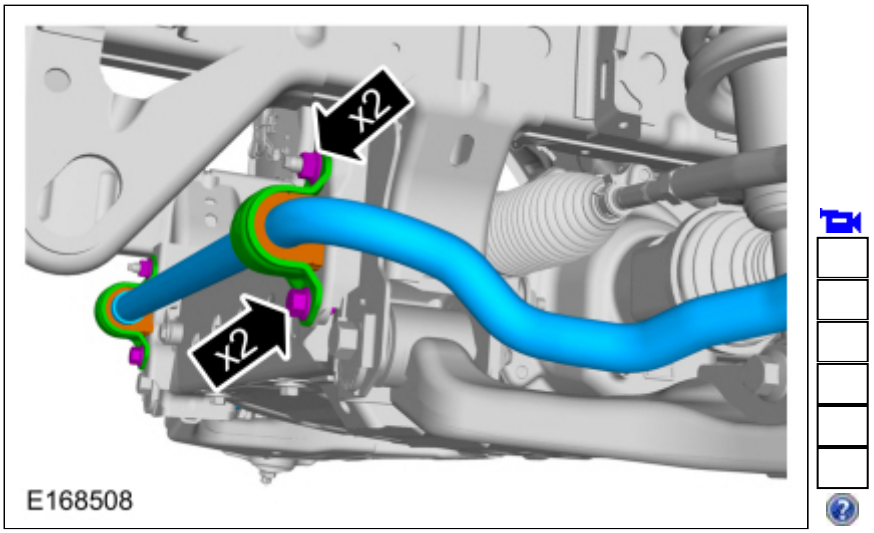
4x4

6. On both sides.
   Torque: 90 Nm



7. **NOTE:** *Note the position of the components before removal.*

   Torque: 90 Nm



Installation

1. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   NOTE: *Make sure that the components are installed to the position noted before removal.*

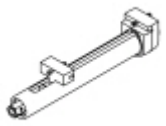
To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Strut and Spring Assembly

Base Part Number: 18045

Special Tool(s) / General Equipment

 E199894	204-167 Compressor, Coil Spring
 E199896	204-215 Adapter for 204-167
Vise	

DISASSEMBLY

1. **WARNING: Coil springs and strut assemblies are compressed under extreme load. Always use a spring compressor for disassembly. Follow procedure instructions carefully and make sure the spring compressor has the correct spring plates or adapters. Failure to follow these instructions may result in serious personal injury..**

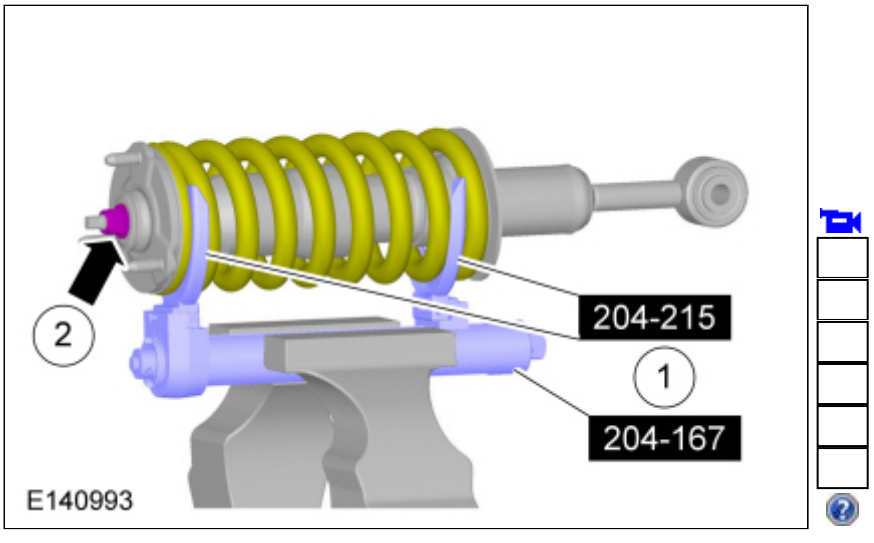
   Refer to: Front Strut and Spring Assembly (204-01 Front Suspension, Removal and Installation).

   1. **NOTICE: Take extra care not to damage the component.**

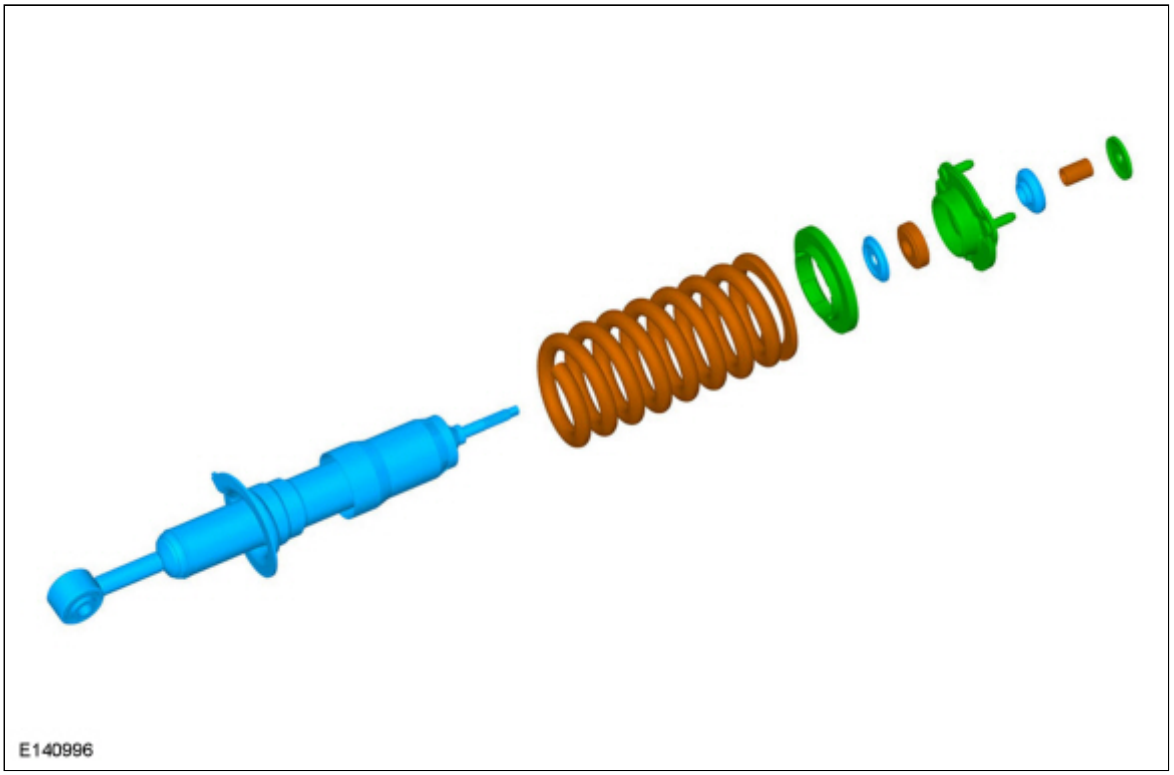
      NOTICE: Do not use power tools to remove the nut.

      NOTE: *Typical assembly shown. actual application may vary.*

      Carefully remove and discard the strut rod nut and remove the bearing plate.
      Install Special Service Tool: 204-167 Compressor, Coil Spring. , 204-215 Adapter for 204-167.



3. **NOTE:** *Note the position of the component before removal.*



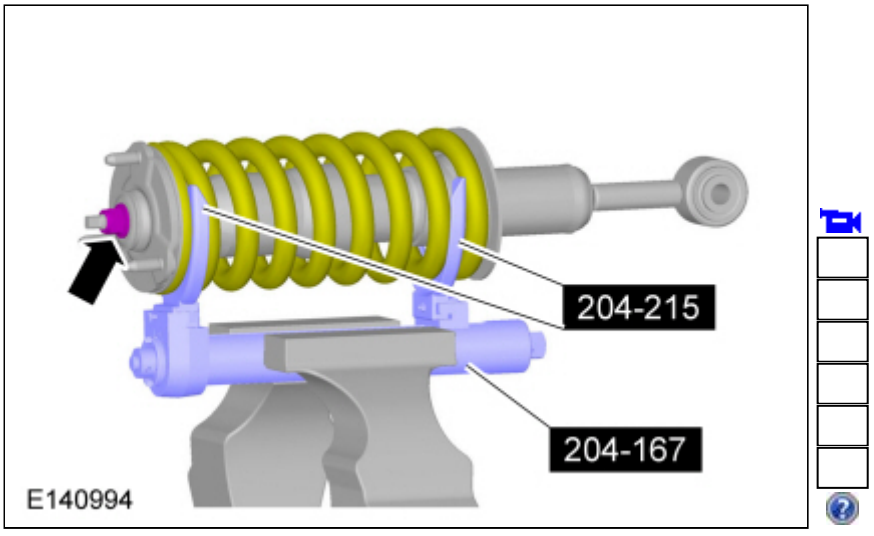
ASSEMBLY

1. **WARNING: Take extra care when handling a compressed spring. Failure to follow this instruction may result in personal injury.**

   To assemble, reverse the disassembly procedure.

2. **NOTE:** *Only tighten the nut finger tight at this stage.*

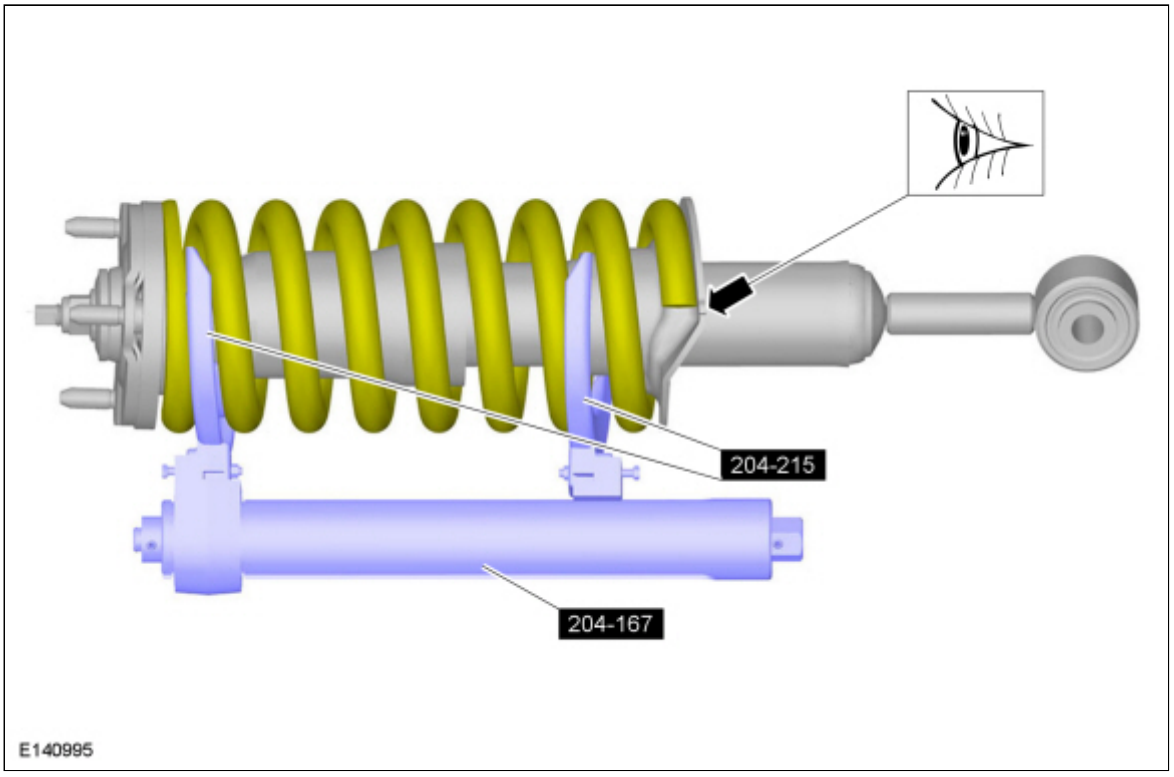
   Use Special Service Tool: 204-167 Compressor, Coil Spring. , 204-215 Adapter for 204-167.
   Use the General Equipment: Vise



3. **NOTE:** *Make sure that the components are installed to the position noted before removal.*

   NOTE: *Make sure that the installation marks are aligned.*

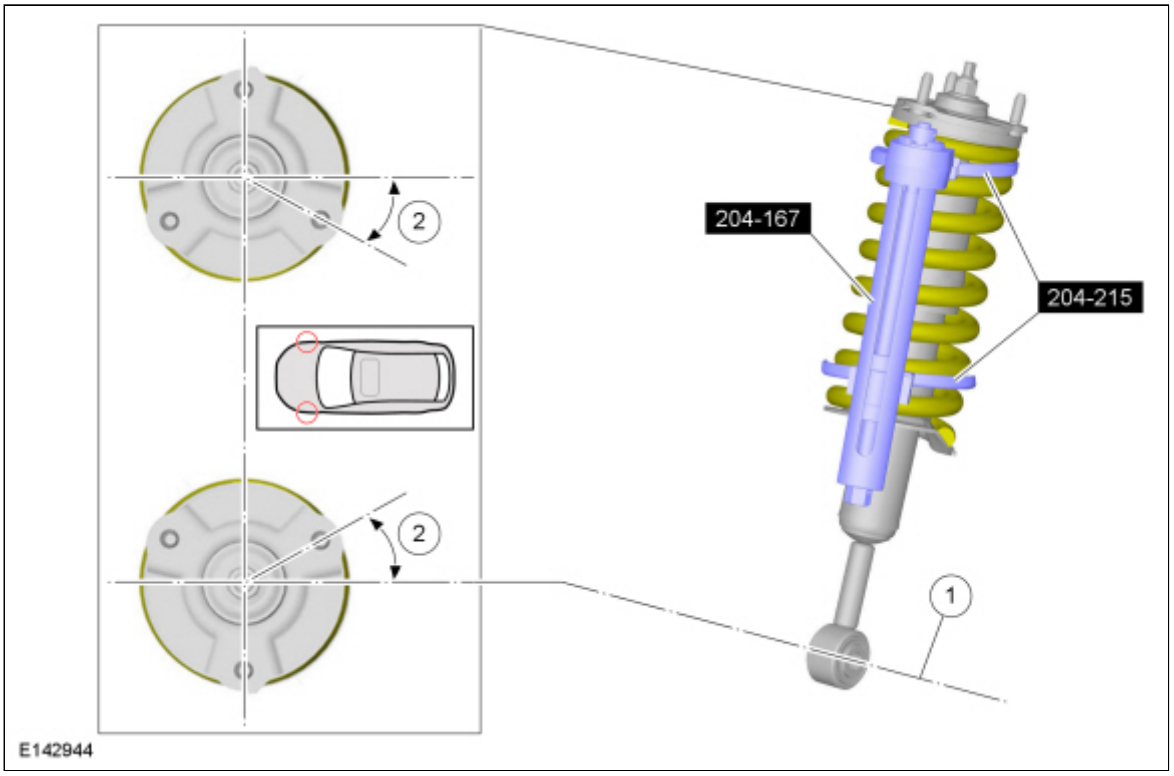
   Use Special Service Tool: 204-167 Compressor, Coil Spring. , 204-215 Adapter for 204-167.



1. Damper bush bottom axis .
   Use Special Service Tool: 204-167 Compressor, Coil Spring. , 204-215 Adapter for 204-167.

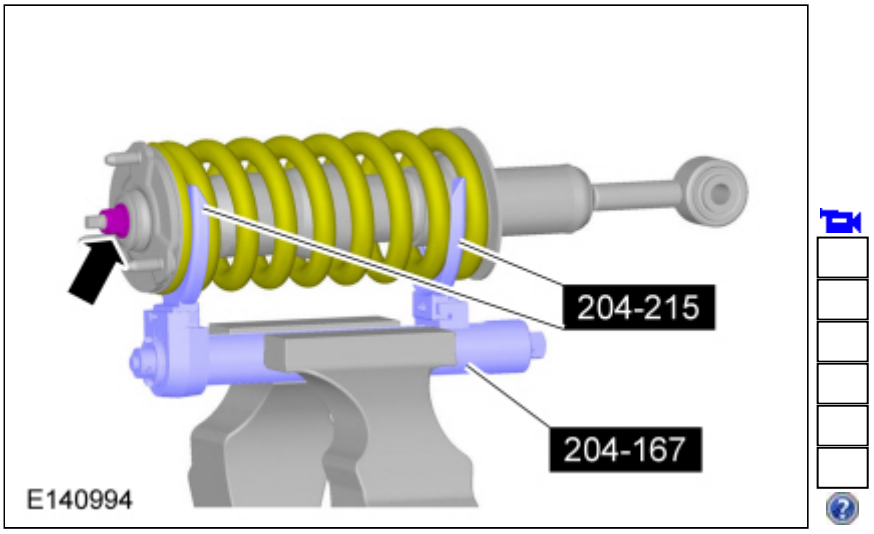
2. **NOTE:** *Make sure that the correct tolerances are observed.*

   37° ± 3°



5. **NOTICE: Use an open-ended wrench to prevent the component from turning.**

   Use Special Service Tool: 204-167 Compressor, Coil Spring. , 204-215 Adapter for 204-167.
   Use the General Equipment: Vise
   Torque: 65 Nm

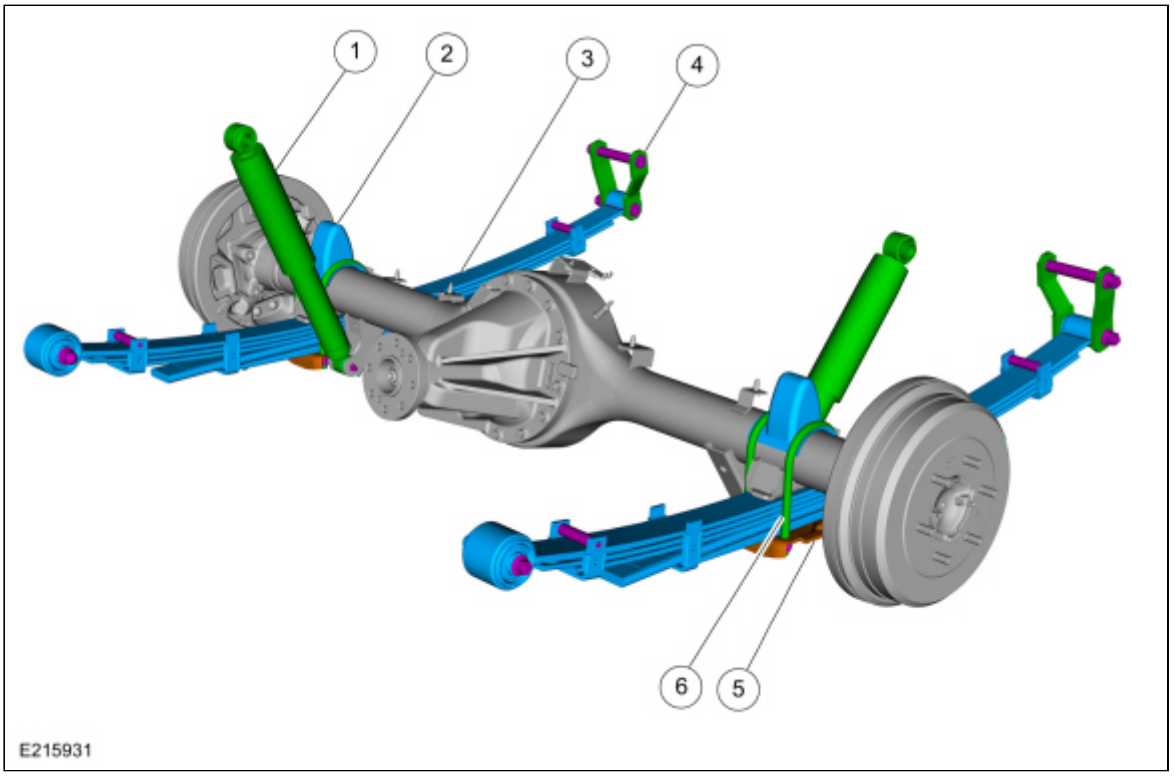


6. Remove Special Service Tool: 204-167 Compressor, Coil Spring. , 204-215 Adapter for 204-167.
7. Refer to: Front Strut and Spring Assembly (204-01 Front Suspension, Removal and Installation).

Copyright © 2016 Ford Motor Company

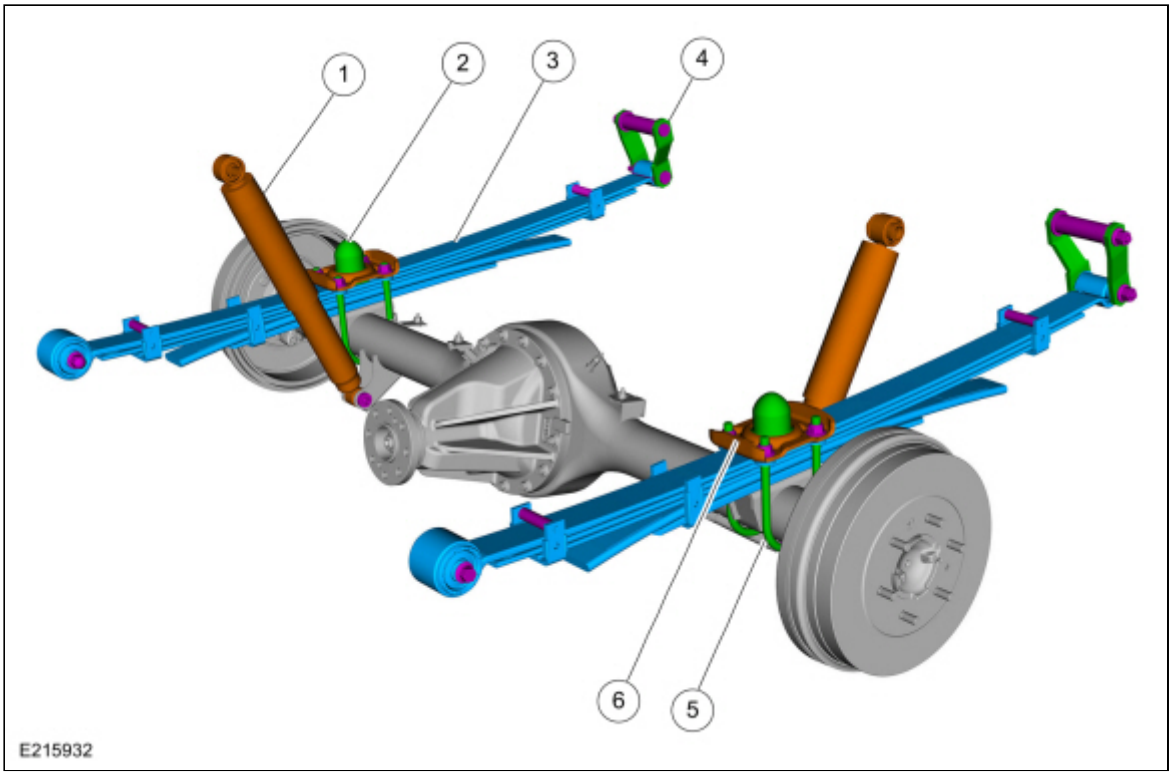
Rear Suspension - Component Location

Low Ride Vehicles



Item	Part Number	Description
1	—	Shock absorber
2	—	Bump stop
3	—	Leaf Spring
4	—	Shackle Assembly
5	—	U-bolt plate
6	—	U-bolts

High Ride Vehicles



Item	Part Number	Description
1	—	Shock absorber
2	—	Bump stop
3	—	Leaf Spring
4	—	Shackle Assembly
5	—	U-bolts
6	—	U-bolt plate

Copyright © 2016 Ford Motor Company

Rear Suspension

For additional information, refer to Section 204-00.

Copyright © 2016 Ford Motor Company

Spring

Removal

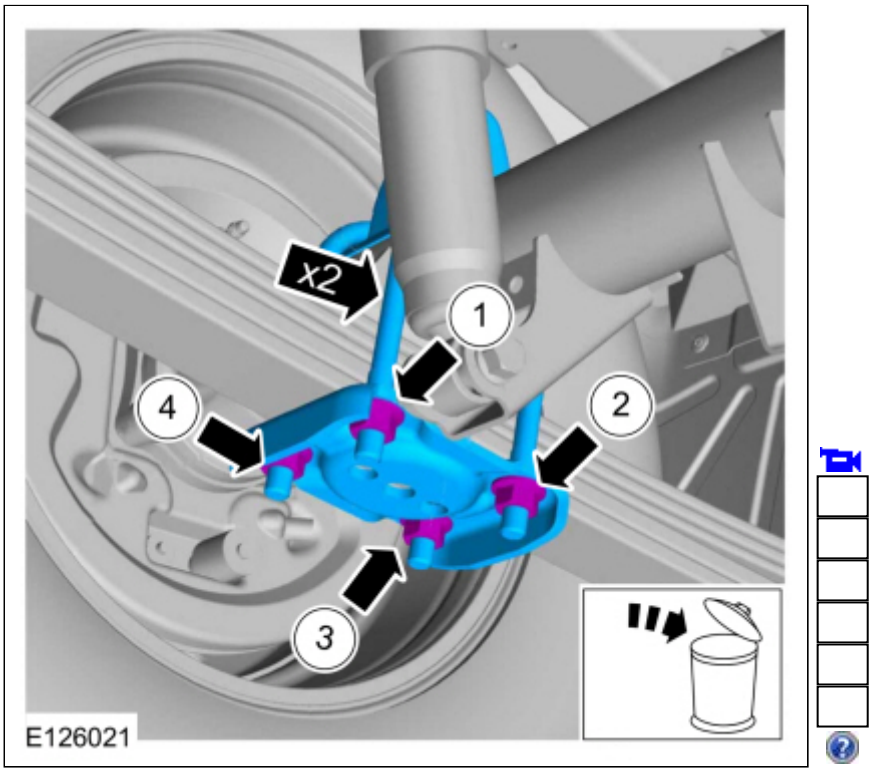
NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

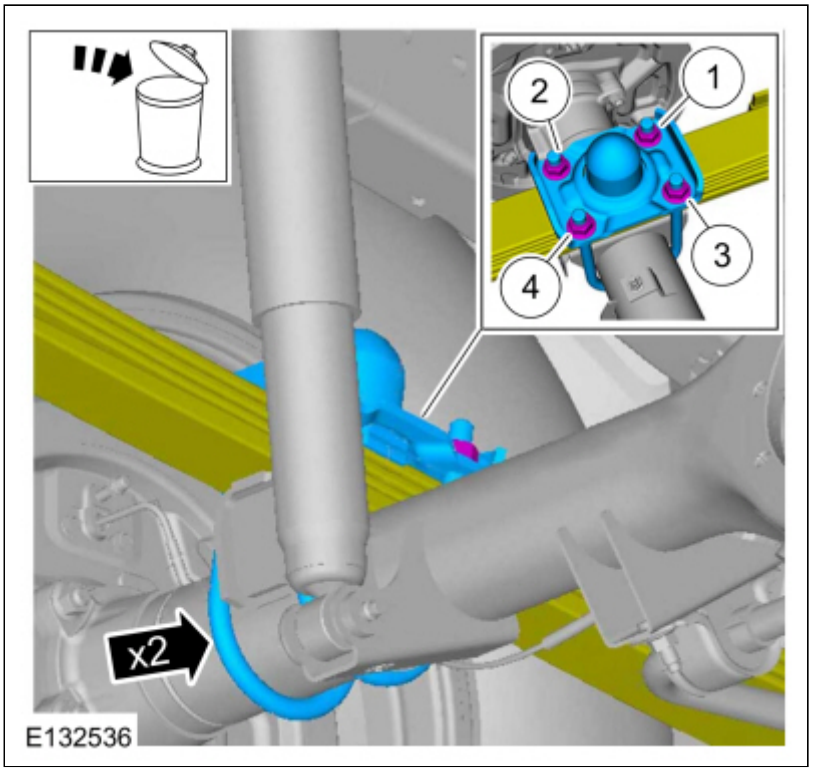
Low Ride Vehicles

2. *Torque*: 120 Nm



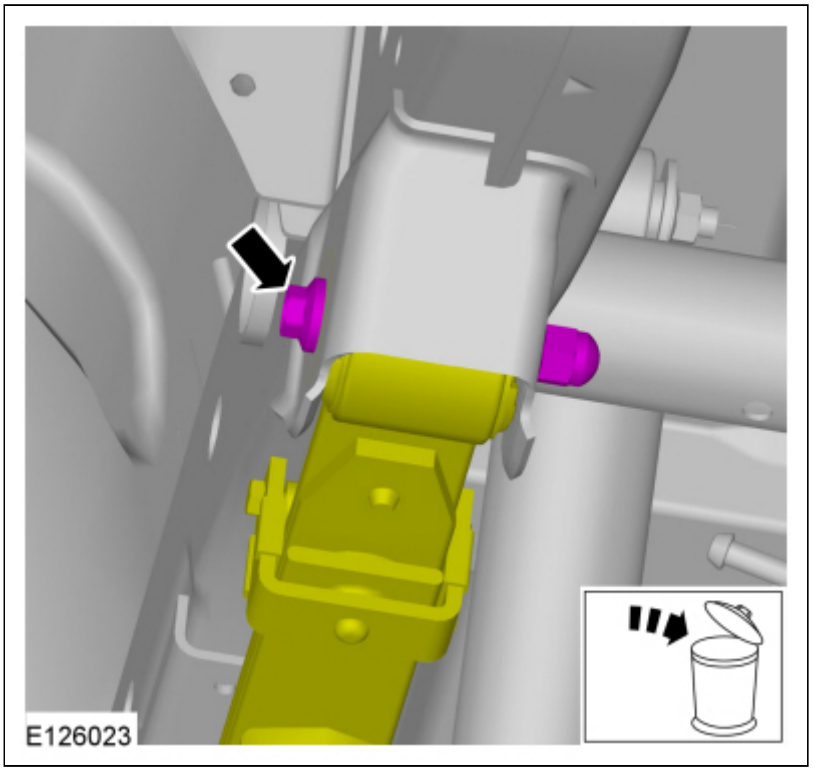
High Ride Vehicles

3. *Torque*: 120 Nm



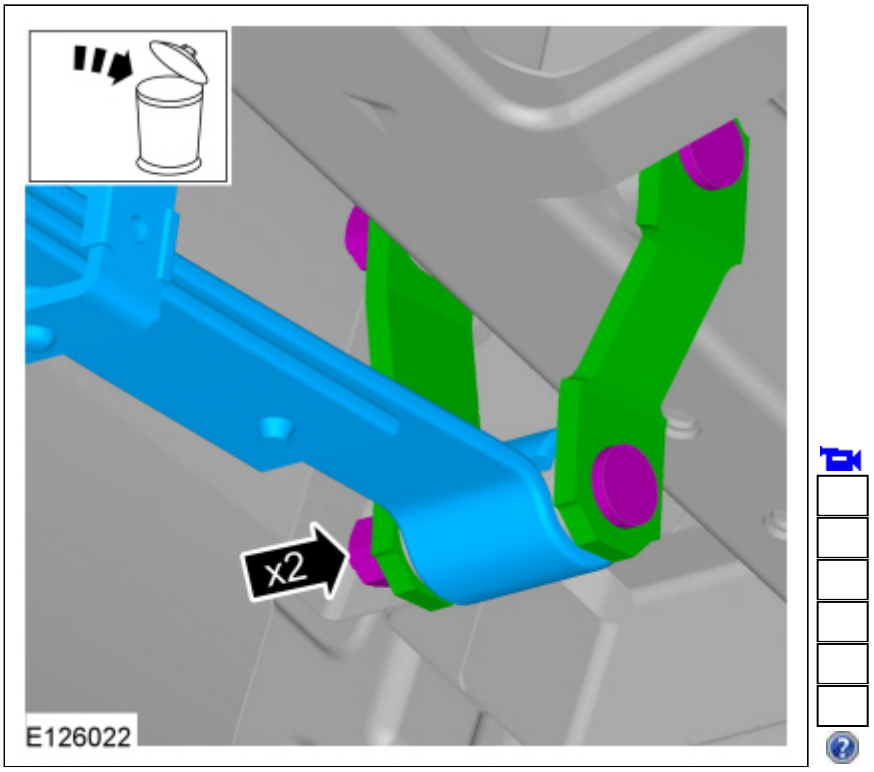
All vehicles

4. *Torque*: 162 Nm



5. **NOTE:** *Note the position of the component before removal.*

   Torque: 103 Nm



Installation

NOTE: *Make sure that new bolts are installed.*

NOTE: *Make sure that new nuts are installed.*

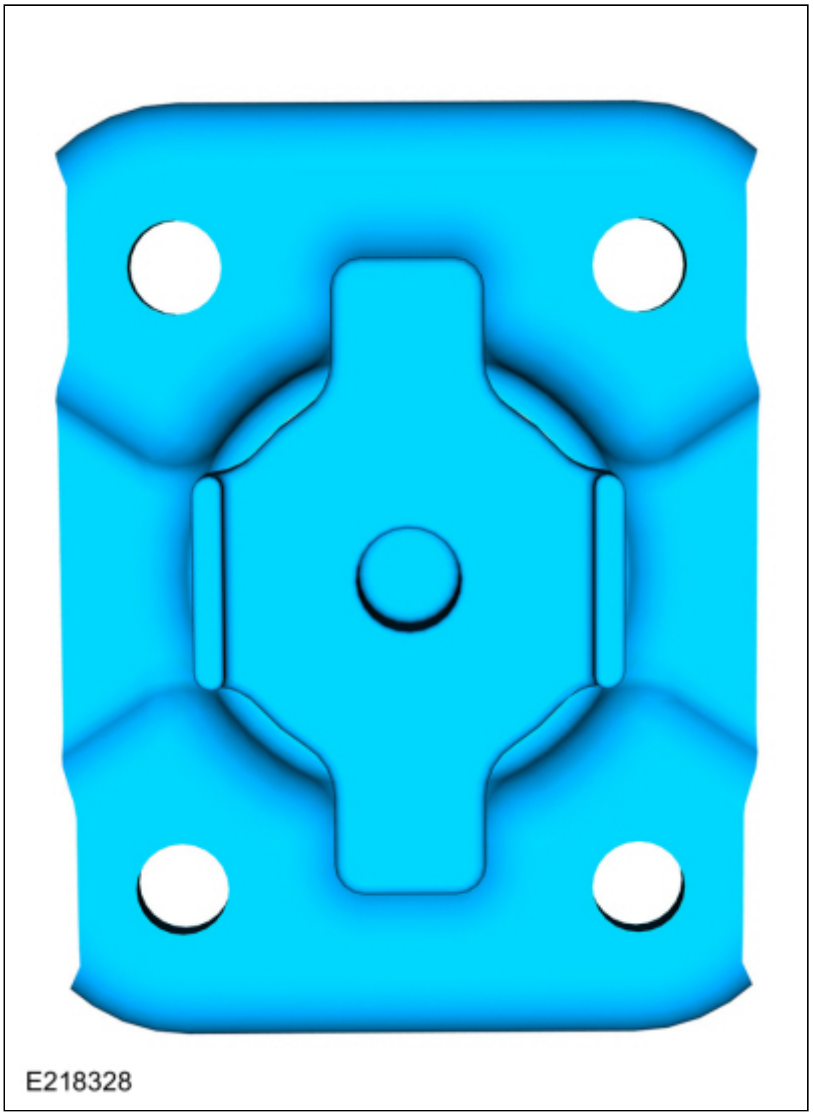
NOTE: *Do not fully tighten the component until the vehicle weight is on the road wheels.*

1. To install, reverse the removal procedure.

High Ride Vehicles

NOTE: *Make sure that the clamp is installed to the same orientation as when removed.*

2.



Copyright © 2016 Ford Motor Company

Rear Shock Absorber

Base Part Number: 18080

Special Tool(s) / General Equipment

Trolley Jack

Removal

WARNING: Keep all body parts clear of shock absorbers and strut rods. Failure to follow this instruction may result in serious personal injury.

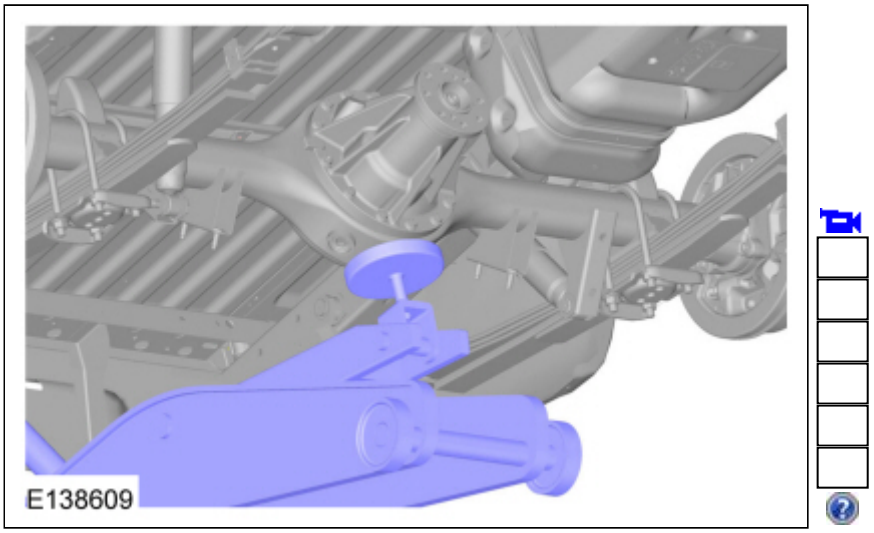
WARNING: Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.

NOTICE: Replace the component with the same or equivalent parts to prevent component failure.

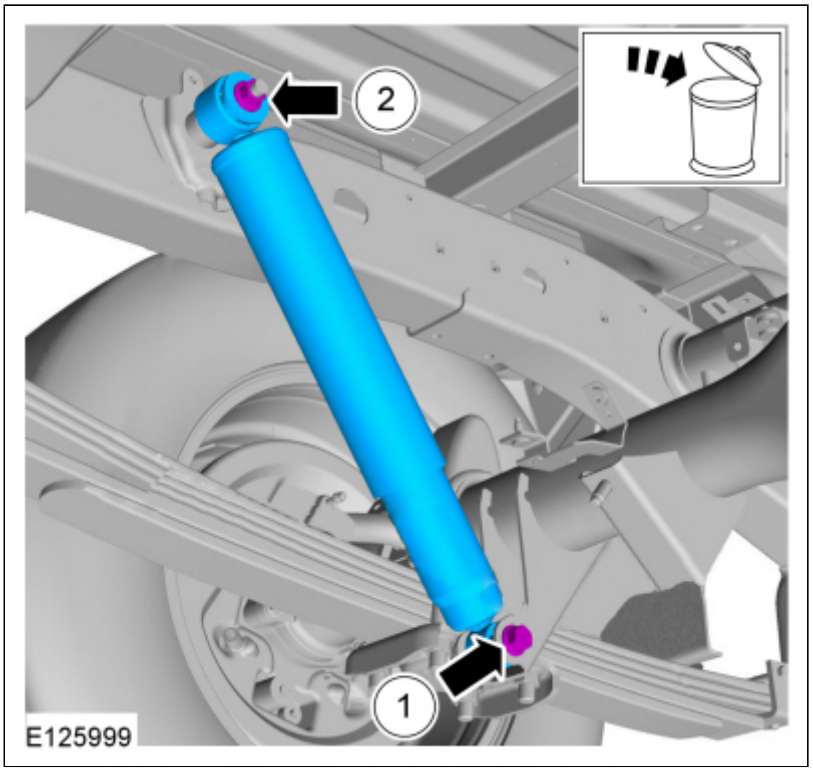
NOTICE: Failure to follow instructions can cause damage to the vehicle.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Use the General Equipment: Trolley Jack



1. *Torque*: 48 Nm
2. *Torque*: 48 Nm



Installation

1. **NOTE:** *Do not fully tighten the component until the vehicle weight is on the road wheels.*
2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Leaf Spring Tip Isolator

Special Tool(s) / General Equipment

Knife

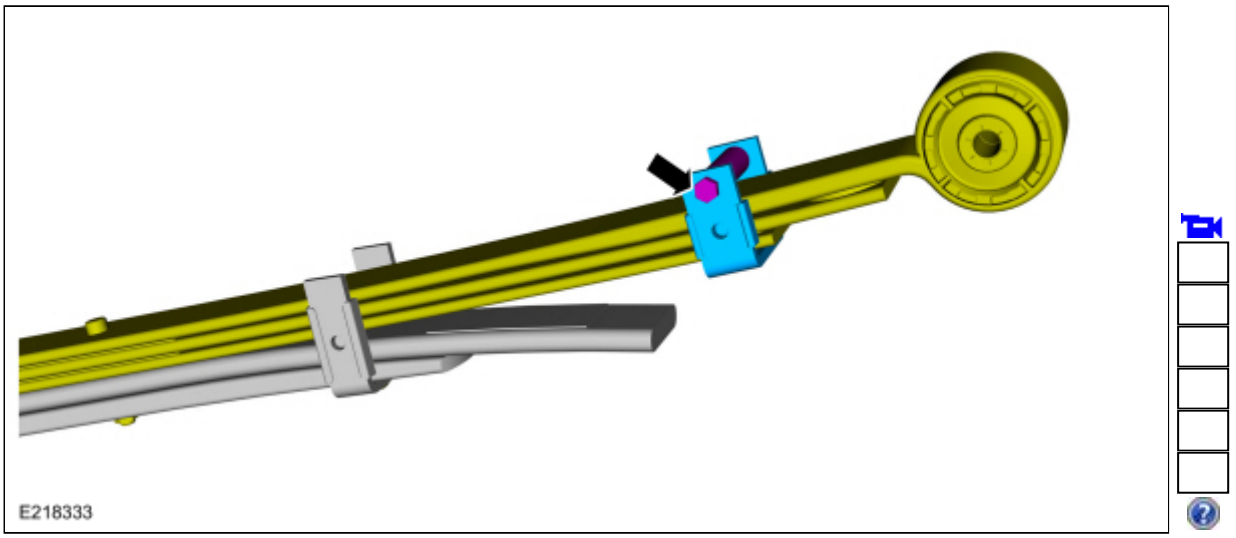
Materials

Name	Specification
Grease - Silicone	ESE-M1C171-A
Brake Cleaner	-

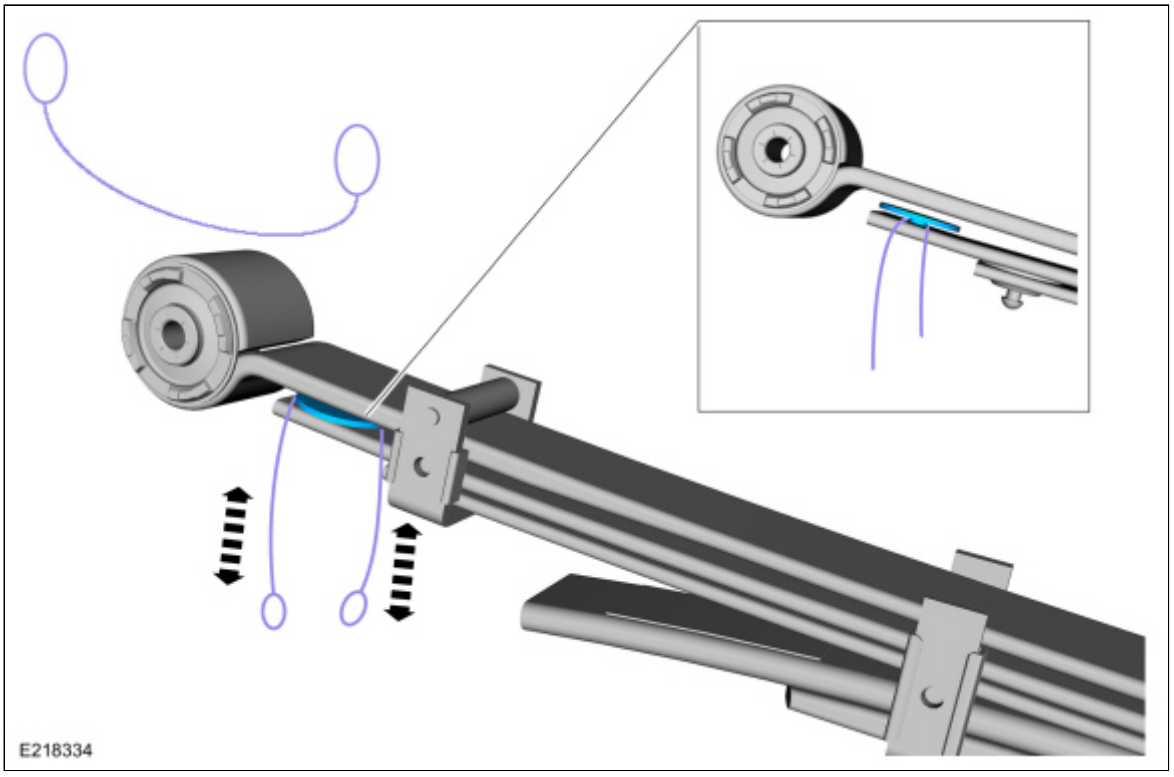
Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. **NOTICE: It is very important to use a non-metallic wedge or corrosion protection can be compromised.**

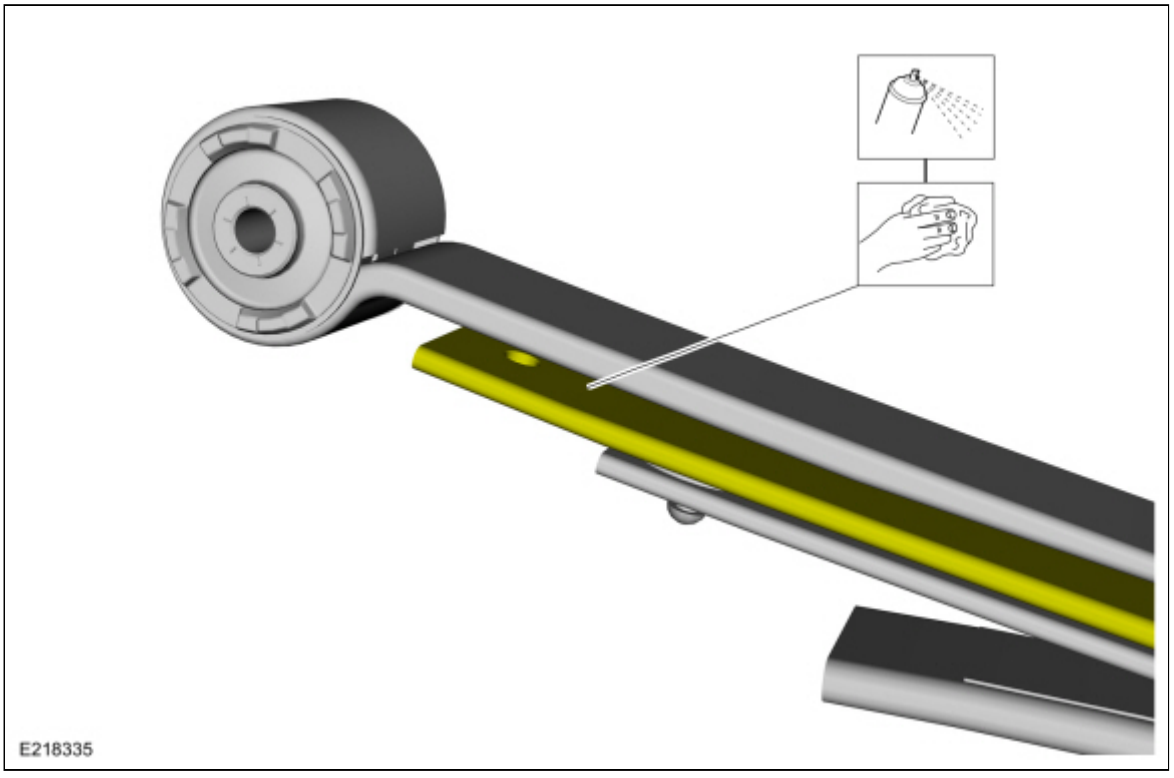
   Use a non-metallic wedge (such as a rubber door stop or rubber coated pry bar) near the leaf spring tip isolator and wedge the leaf spring apart.
   Torque: 30 Nm



4. Using a locally obtained PVC cable saw, cut the top of the leaf spring tip isolator off and remove the insert.



5. Thoroughly rinse the leaf spring tip isolator area with brake clean and a clean shop rag to remove debris from the leaf spring tip isolator seating area.
   Material: Brake Cleaner



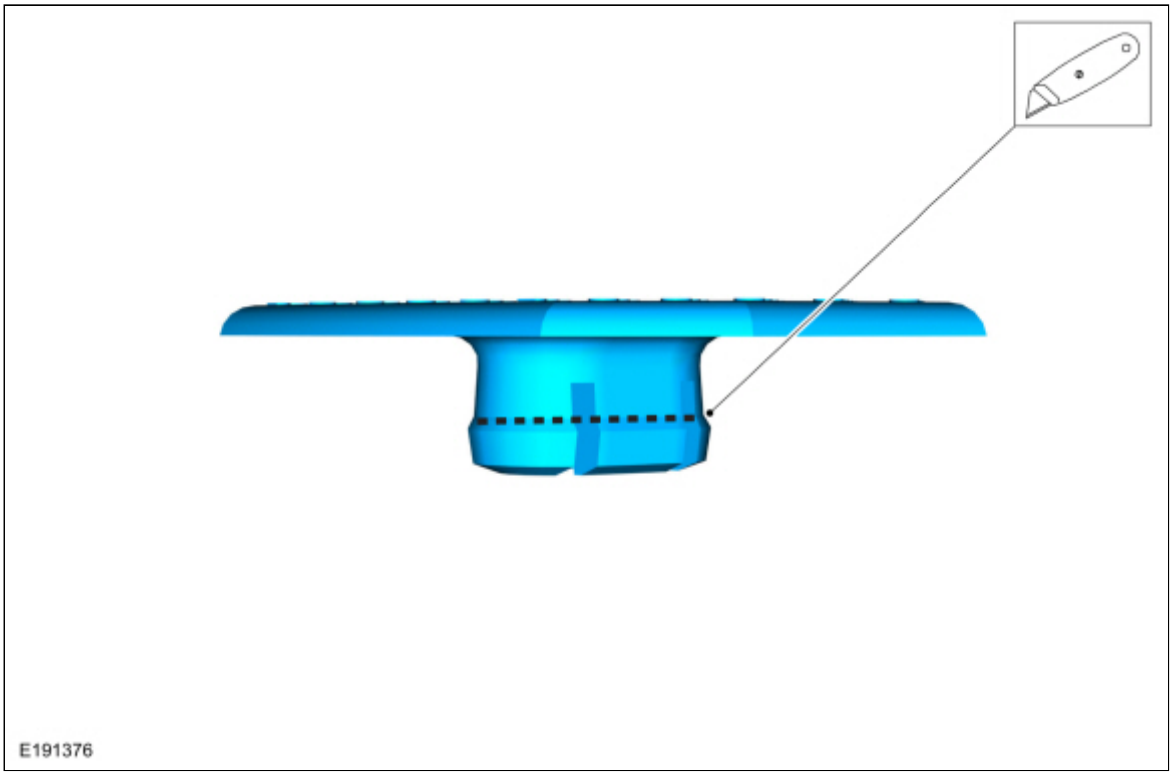
Installation

NOTE: *Leaf spring isolator tips can be replaced. Replacement components will depend on the vehicle payload rating.*

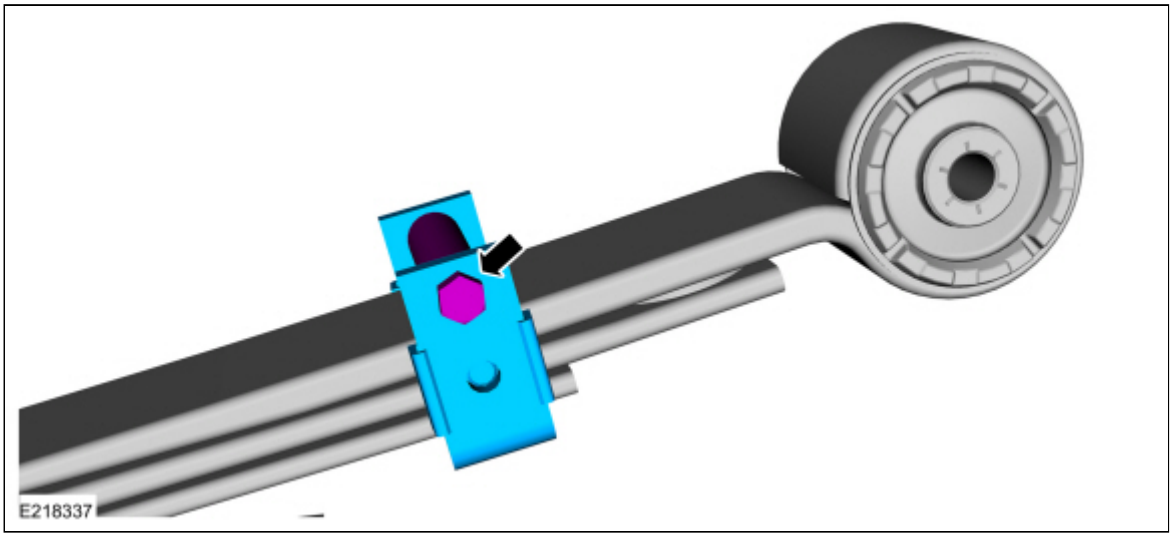
- *Black — Base payload vehicles*
- *White — Heavy duty payload vehicles (greasable)*

1. **NOTE:** *This step is only necessary if the trim leaf spring tip isolator post to aid installation between the leaves.*

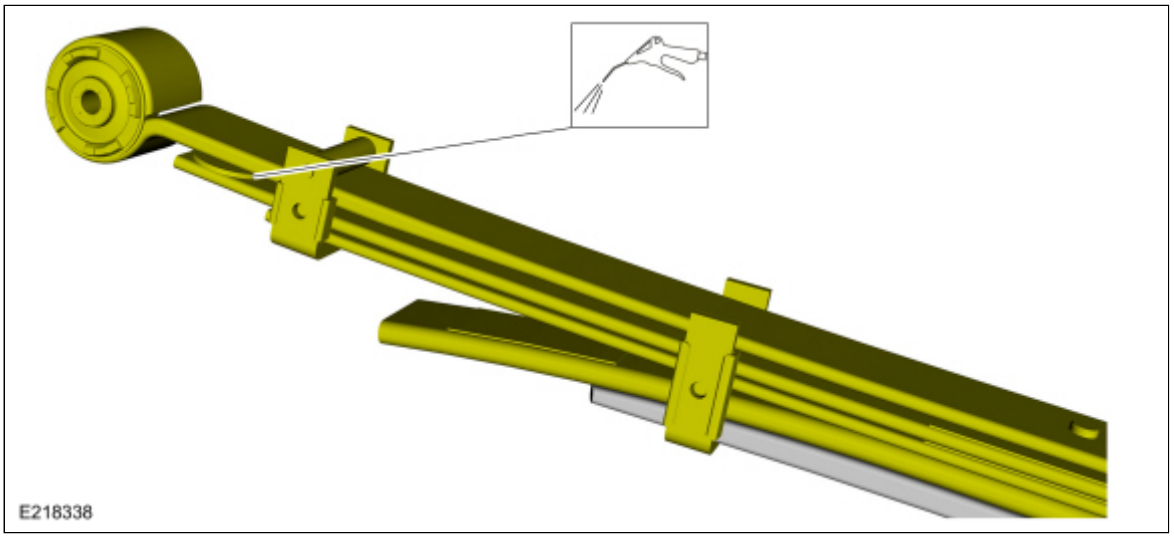
   If necessary.
   Use the General Equipment: Knife



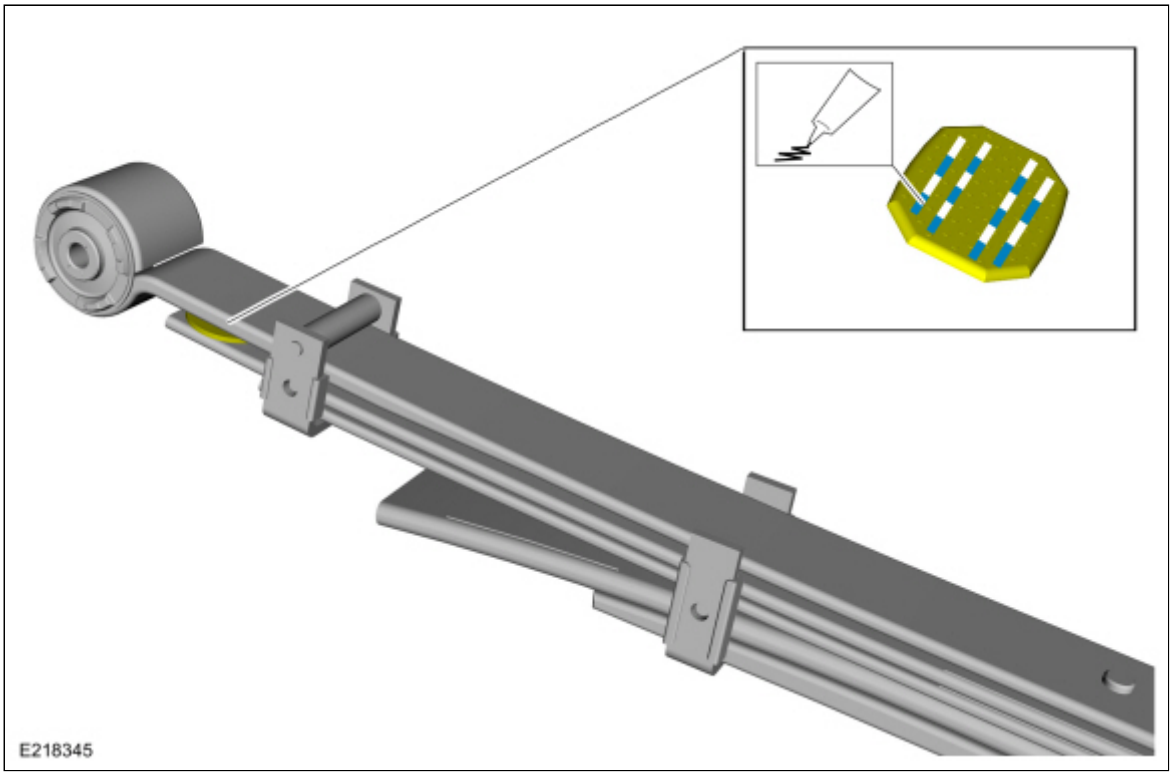
2. Install the new leaf spring tip isolator and remove the non-metallic wedge.
   Torque: 30 Nm



3. Wash the leaf spring assembly to remove any remaining dirt or debris using a power washer or direct stream of water. Using shop air, dry the leaf spring assembly thoroughly.



4. On heavy duty payload vehicles (white leaf tip insert), apply a thin coat of grease to the leaf spring tip isolator surface.
   Material: Grease - Silicone (ESE-M1C171-A)



5. Repeat the procedure for the remaining leaf spring tip isolators.

Copyright © 2016 Ford Motor Company

Specifications

Torque Specifications

Description	Nm
Wheel nuts	135

Tire pressures (cold tires)

Variant	Tyre size	Normal load		Economical Load		Full load	
		Front	Rear	Front	Rear	Front	Rear
		bar (psi)	bar (psi)	bar (psi)	bar (psi)	bar (psi)	bar (psi)
4X2	T215/70 R 16	2.4 (35)	2.4 (35)	2.6 (38)	2.6 (38)	2.6 (38)	3.8 (54)
All	T255/70 R 16	2.4 (35)	2.4 (35)	2.6 (38)	2.6 (38)	2.6 (38)	3 (44)
All	T265/65 R 17	2.4 (35)	2.4 (35)	2.6 (38)	2.6 (38)	2.6 (38)	3 (44)
All	T265/60 R 18	2.4 (35)	2.4 (35)	2.6 (38)	2.6 (38)	2.6 (38)	3 (44)

Copyright © 2016 Ford Motor Company

Safety Precautions - Overview

Overview

WARNING: Before servicing any tire, ask the customer if anyone injected a tire sealant into the tire. Tire sealants may be flammable and can burn or explode if exposed to an ignition source. Failure to follow this instruction may result in serious personal injury.

NOTICE: Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents or damage to the wheel finish may occur.

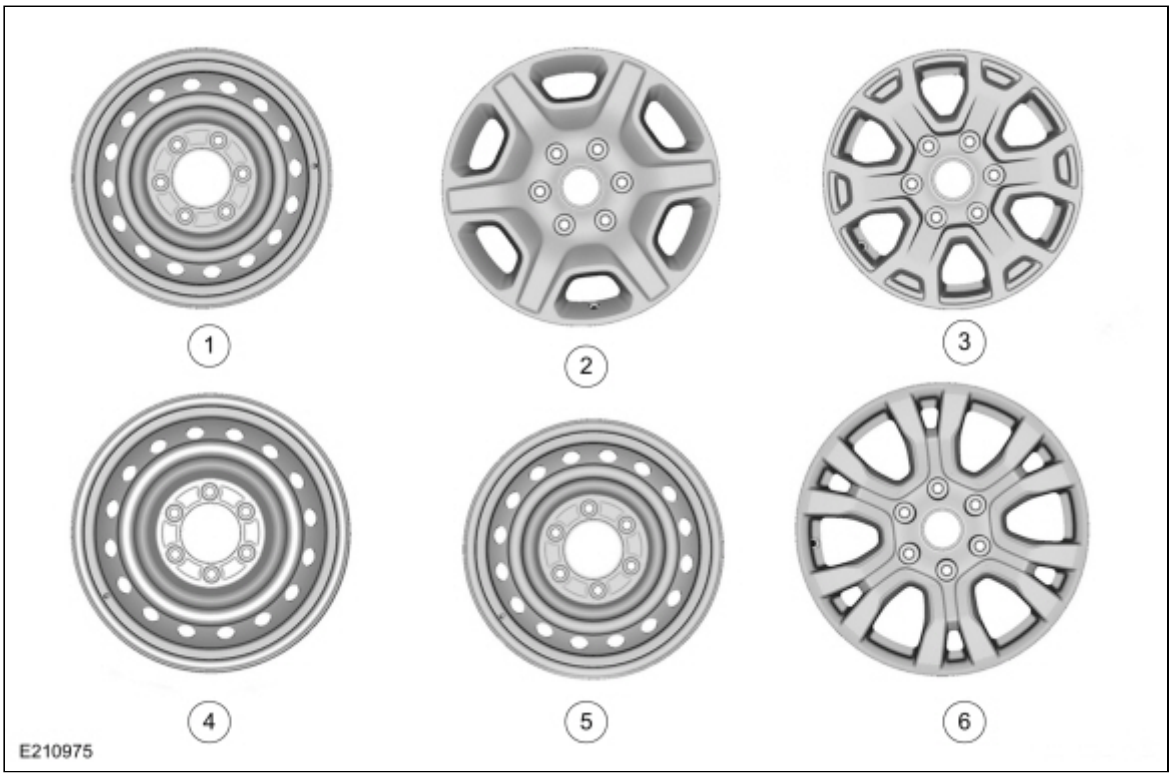
Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

To equalize tire wear, the tires should be rotated at recommended intervals.

Copyright © 2016 Ford Motor Company

Wheels and Tires



Item	Part Number	Description
1	—	16 x 7.0 Inch steel wheel
2	—	17 x 8.0 Inch aluminum alloy wheel
3	—	16 X 7.0 Inch alloy wheel
4	—	17 X 7.5 Inch steel wheel
5	—	16 X 6.5 Inch steel wheel
6	—	18 X 8.0 Inch aluminum alloy wheel

Copyright © 2016 Ford Motor Company

Wheels and Tires

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
Wheel(s)
Tire(s)
Tire pressure(s) *
Valve stem(s)
Wheel nuts
Wheel studs
* Vehicles equipped with a tire pressure monitoring system must be inspected for correct operation using the Ford diagnostic equipment.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Tires should be checked for correct:

- tire pressure(s)
- tire sizes
- speed rating
- load range.
- tire construction type

The use of any other tire/wheel size, load range or type can seriously affect:

- ride
- handling
- speedometer/odometer calibration
- vehicle ground clearance
- tire clearance between the body and chassis
- wheel bearing life.
- braking performance

New wheels need to be installed when the vehicle wheels:

- are bent
- are cracked
- are dented
- are heavily corroded
- are leaking
- have elongated wheel hub bolt holes
- have excessive lateral or radial runout

It is mandatory to use only the tire sizes recommended on the tire label located on the door pillar attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

Inspect the tires for signs of uneven wear. the following descriptions to identify the type of wear.

Check the tires for:

- cuts
- stone bruises
- abrasions
- blisters
- embedded objects

Check the valve stems for:

- cracks
- cuts

Install a new valve stem when damage is found or when a new tire is installed.

Normal Tire Wear

Normal tire wear is identified as even wear around and across the tread. Because there are many factors (driving style, road surfaces, type of vehicle, type of tire) that can affect tire wear, there is no absolute mileage expectation for a normal wear condition. A tire is considered worn-out when the tread has worn to the level of the tread-wear indicators.

Abnormal/Incorrect Tire Wear

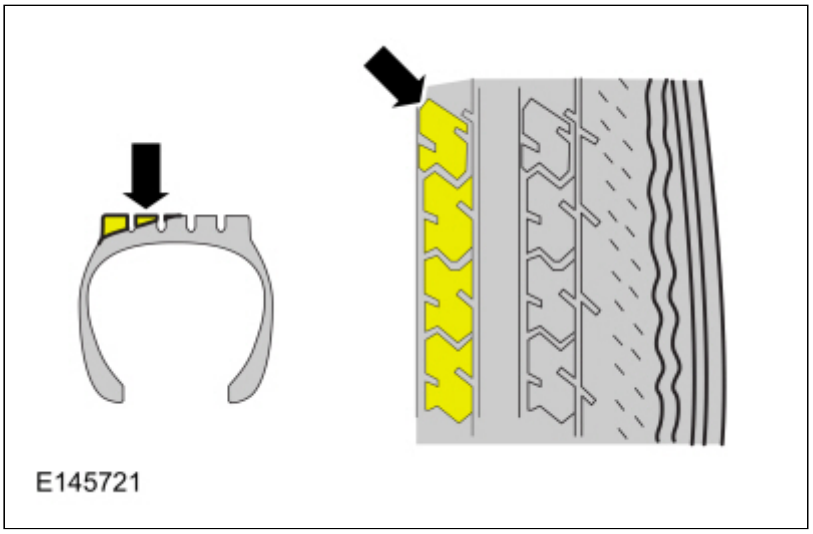
Abnormal/incorrect tire wear is identified as tire wear that is not even around or across the tread and that creates performance-related issues.

Abnormal/incorrect wear can be caused by numerous factors, some of which include driving style (aggressive, passive), climate (hot, cold), road conditions, vehicle loading and maintenance (correct tire pressure, rotation intervals and balance). It is important to determine the root cause of wear on a vehicle before carrying out repair. Tires exhibiting abnormal/incorrect tire wear may still be serviceable provided that the minimum tread depth is greater than and the tire is not causing a vehicle performance (noise/vibration) concern.

Inner Edge/Shoulder Wear

Inner edge (or shoulder) wear occurs on the inside edge of the tire and is usually caused by excessive toe out and/or excessive negative camber. If the tread depth of the outer shoulder is at least 50% greater than the tread depth of the inner shoulder, the tire is experiencing inner edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, it may be necessary to measure the tread depth of each rib and compare it to that of the shoulder.

NOTE: *Right-Front tire shown, others similar.*

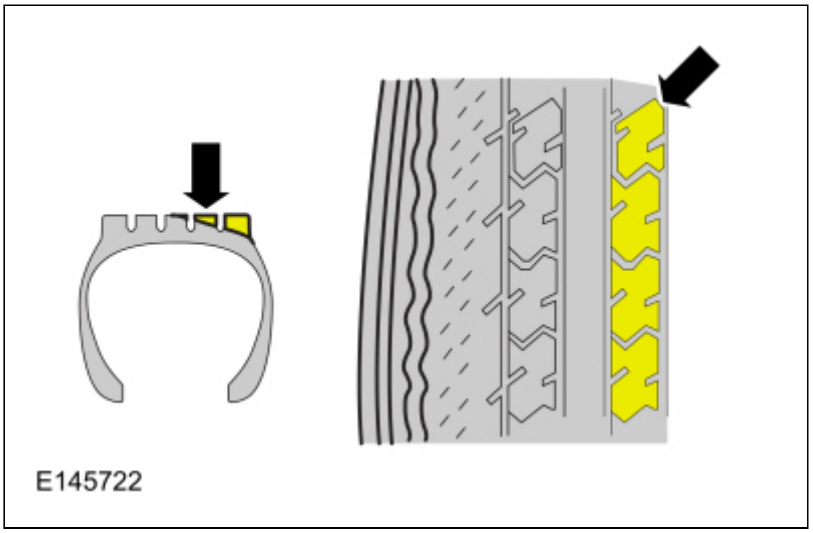


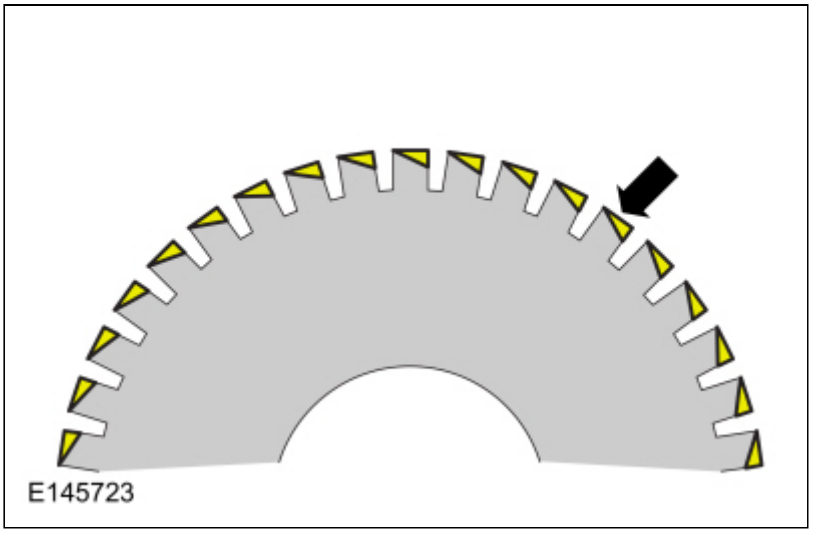
Outer Edge/Shoulder Wear

Outer edge (or shoulder) wear occurs on the outside edge of the tire and is usually caused by excessive toe in and/or excessive positive camber. If the tread depth of the inner shoulder is at least 50% greater than the tread depth of the

outer shoulder, the tire is experiencing outer edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, it may be necessary to measure the tread depth of each rib and compare it to that of the shoulder.

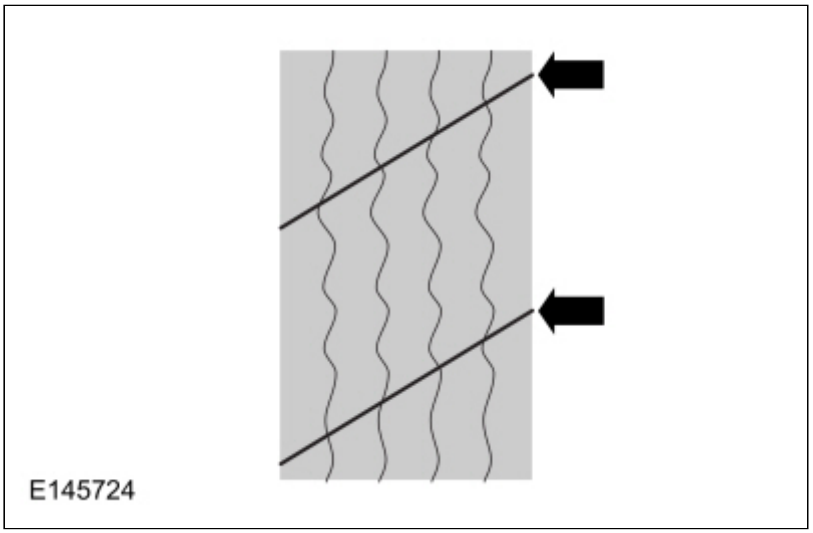
NOTE: *Right-Front tire shown, others similar.*





Heel/Toe Wear

Heel/toe wear (also known as feathering) occurs along the outside or inside edge/shoulder of the tire. To determine whether tires have this type of wear, visually inspect the tires in both the inside and outside shoulder ribs. In some instances, it may be necessary to measure the difference in tread depth of leading versus trailing edge of each lug in the inside and outside shoulder rib.



Diagonal Wear

Diagonal wear occurs diagonally across the tread area and around the circumference of the tire. To determine whether tires have this type of wear, visually inspect the tires to determine if the wear pattern runs diagonally across the tread and around the circumference of the tire. In some instances, the difference in tread depth along the diagonal wear pattern may need to be measured.

Tire Vibration Diagnosis

A tire vibration diagnostic procedure should begin with a road test. The road test and customer interview (if available) will provide much of the information needed to find the source of a vibration.

During the road test, drive the vehicle on a road that is smooth and free of undulations. If vibration is apparent, note and record the following:

- the speed at which the vibration occurs
- what type of vibration occurs in each speed range.
  - mechanical or audible
- how the vibration is affected by changes in the following:
  - engine torque
  - vehicle speed
  - engine speed
- type of vibration - sensitivity:
  - torque sensitive
  - vehicle speed sensitive
  - engine speed sensitive

The following explanations help isolate the source of the vibration.

Torque Sensitive

This means that the condition can be improved or made worse by accelerating, decelerating, coasting, maintaining a steady vehicle speed or applying engine torque.

Vehicle Speed Sensitive

This means that the vibration always occurs at the same vehicle speed and is not affected by engine torque, engine speed or the transmission gear selected.

Engine Speed Sensitive

This means that the vibration occurs at varying vehicle speeds when a different transmission gear is selected. It can sometimes be isolated by increasing or decreasing engine speed with the transmission in NEUTRAL or by stall testing with the transmission in gear. If the condition is engine speed sensitive, the cause is probably not related to the tires.

If the road test indicates that there is tire whine, but no shake or vibration, the noise originates with the contact between the tire and the road surface.

A thumping noise usually means that the tire is flat or has soft spots making a noise as they slap the roadway. Tire whine can be distinguished from axle noise. Tire whine remains the same over a range of speeds.

1. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Tire(s) show excess wear on edge of tread	• Tire(s) under-inflated.	• ADJUST the tire pressure(s).
	• Vehicle overloaded.	• CORRECT as necessary.
	• Incorrect wheel alignment.	• ADJUST the wheel alignment. REFER to: (204-00 Suspension System - General Information) Specifications (Specifications), Front Toe Adjustment (General Procedures).
• Tire(s)	• Tire(s) over-	• ADJUST the tire pressure(s).

show excess wear in center of tread	inflated.	
• Other excessive tire wear concerns	• Incorrect tire pressure(s).	• ADJUST the tire pressure(s).
	• Wheel and tire assemblies need rotating.	• ROTATE the wheel and tire assemblies.
	• Incorrect wheel alignment.	• ADJUST the wheel alignment. REFER to: (204-00 Suspension System - General Information) Specifications (Specifications), Front Toe Adjustment (General Procedures).
	• Vehicle overloaded.	• CORRECT as necessary.
	• Loose or leaking front strut and spring assembly.	• TIGHTEN or INSTALL new suspension components as necessary. REFER to: (204-01 Front Suspension) Front Strut and Spring Assembly (Removal and Installation).
	• Wheel bearings worn.	• INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation),
	• Suspension components, bushings and ball joints.	• CHECK or INSTALL new suspension components as necessary.
	• Excessive lateral or radial runout of wheel or tire.	• BALANCE the wheel and tire assemblies. Using a suitable dial indicator gauge and holding fixture, CHECK lateral and radial runout of the wheel and tire assemblies. INSTALL new wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Specifications (204-04 Wheels and Tires) , Wheel and Tire (Removal and Installation).
• Wobble or shimmy affecting wheel runout	• Damaged wheel.	• INSPECT the wheel rims for damage. BALANCE the wheel and tire assemblies. Using a suitable dial indicator gauge and holding fixture, CHECK lateral and radial runout of the wheel and tire assemblies. INSTALL new wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Specifications (204-04 Wheels and Tires) , Wheel and Tire (Removal and Installation).
	• Front wheel bearing.	• CHECK or INSTALL new wheel bearings as necessary. REFER to: (204-01 Front Suspension) Front Wheel Bearing (Removal and Installation).
• Excessive vehicle vibration, rough steering	• Suspension components.	• CHECK or INSTALL new suspension components as necessary.
• Vehicle vibrations from wheels and tires	• Incorrect tire pressure(s).	• ADJUST the tire pressure(s).
	• Wheel or tire imbalance.	• BALANCE the wheel and tire assemblies.
	• Uneven tire wear.	• INSTALL a new tire(s) as necessary. REFER to: (204-04A Wheels and Tires) Wheel and Tire (Removal and Installation).
	• Brake disc imbalance	• CHECK the brake disc for foreign material.

	imbalance.	
	• Water in tire(s).	• REMOVE the water.
	• Bent wheel.	• INSTALL a new wheel and tire assembly. REFER to: (204-04A Wheels and Tires) Wheel and Tire (Removal and Installation).
	• Incorrectly seated tire bead.	• SPIN the wheel on the vehicle. EXAMINE the area where the tire and the wheel meet. If that section of the tire appears to waver while being rotated, the tire bead may not be correctly seated on the wheel. REMOVE the tire and CLEAN the bead seat areas on both wheel and tire.
	• Excessive lateral or radial runout of wheel or tire.	• BALANCE the wheel and tire assemblies. Using a suitable dial indicator gauge and holding fixture, CHECK the lateral and radial runout of the wheel and tire assemblies. INSTALL new wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Specifications (204-04 Wheels and Tires) , Wheel and Tire (Removal and Installation).
	• Foreign material between wheel mounting face and hub mounting surface.	• CLEAN mounting surfaces.
	• Front wheel bearing.	• CHECK or INSTALL new wheel bearings as necessary. REFER to: (204-01 Front Suspension) Front Wheel Bearing (Removal and Installation).
• Rust streaks from the wheel stud holes in the wheel	• Wheel nuts.	• REMOVE the wheel and tire assembly. Inspect the wheel nuts and wheel and tire assembly for damage. INSTALL new wheel nuts and wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Specifications (204-04 Wheels and Tires) , Wheel and Tire (Removal and Installation).
• Seized wheel nuts	• Corrosion.	• CAUTION: Do not permit lubricant to get on cone sets of stud holes or on cone angle of wheel nuts. If corrosion is slight, wire brush away. If corrosion is excessive, INSTALL new wheel studs and nuts. REFER to: (204-04 Wheels and Tires) Specifications (204-04 Wheels and Tires) , Wheel and Tire (Removal and Installation). If the condition persists, LUBRICATE the first three threads of each wheel stud with a graphite-based lubricant.
	• Vehicle overloaded	• CORRECT as necessary.

Copyright © 2016 Ford Motor Company

Wheel and Tire

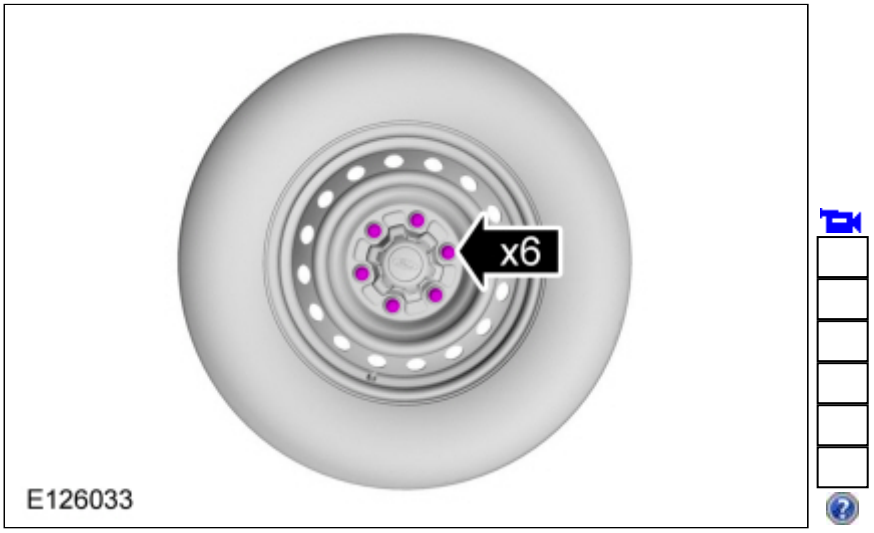
Base Part Number: 1007

Removal

NOTICE: Do not use heat to loosen a seized wheel nut.

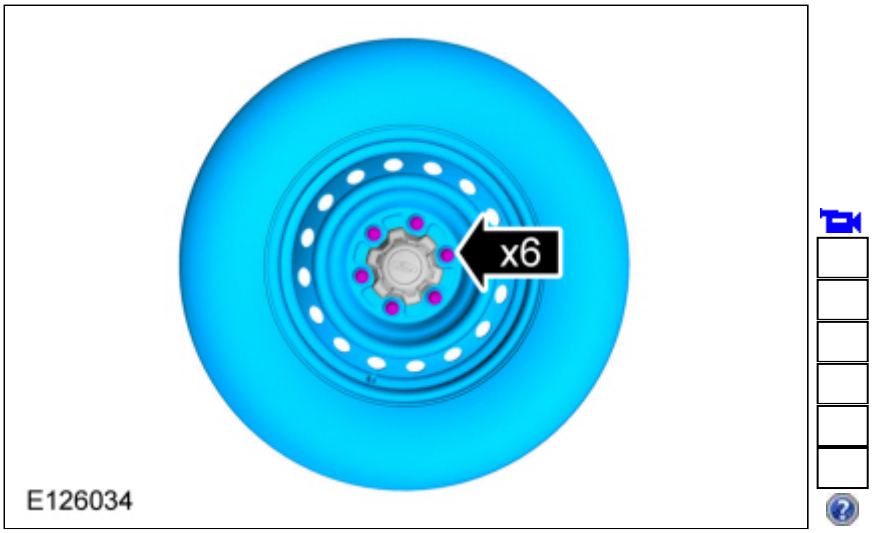
NOTICE: Do not use power tools on locking wheel nuts.

1. Loosen
   1.



2. For additional information, refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   For additional information, refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

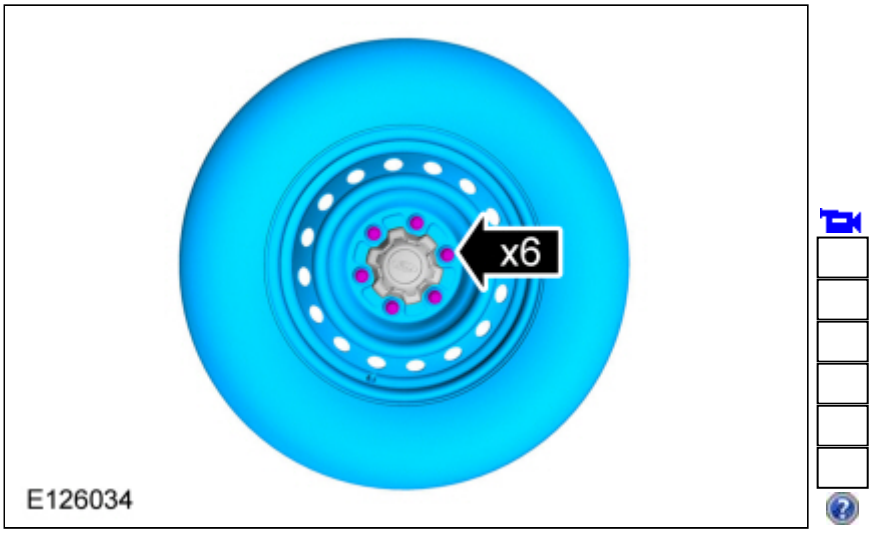
3.



Installation

1. **NOTICE: Make sure that the mating faces are clean and free of corrosion and foreign material.**

   NOTE: *Only tighten the nuts finger tight at this stage.*

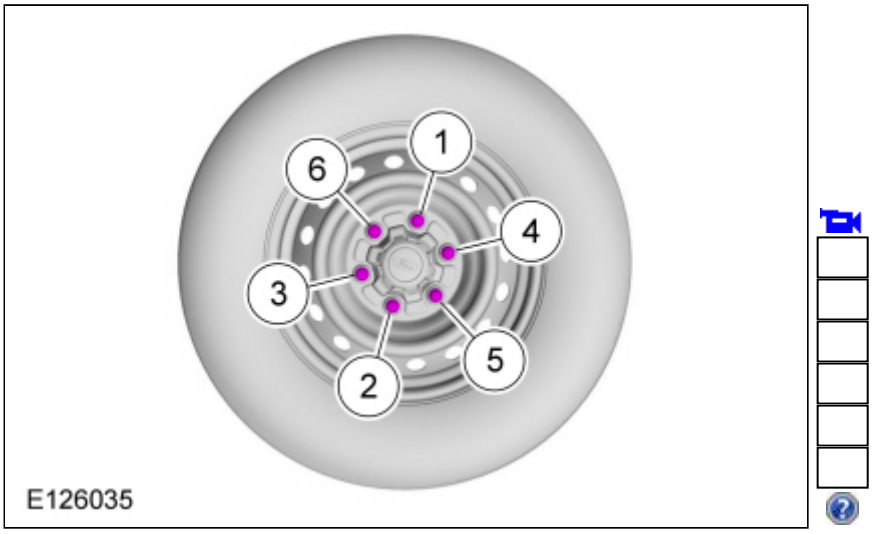


2. Lower the vehicle.
3. **NOTICE: Failure to tighten the wheel nuts in a star/cross pattern can result in high brake disc runout, which accelerates the development of brake roughness, shudder and vibration.**

   NOTE: *The wheel nut torque specification is for clean, dry wheel stud and wheel nut threads.*

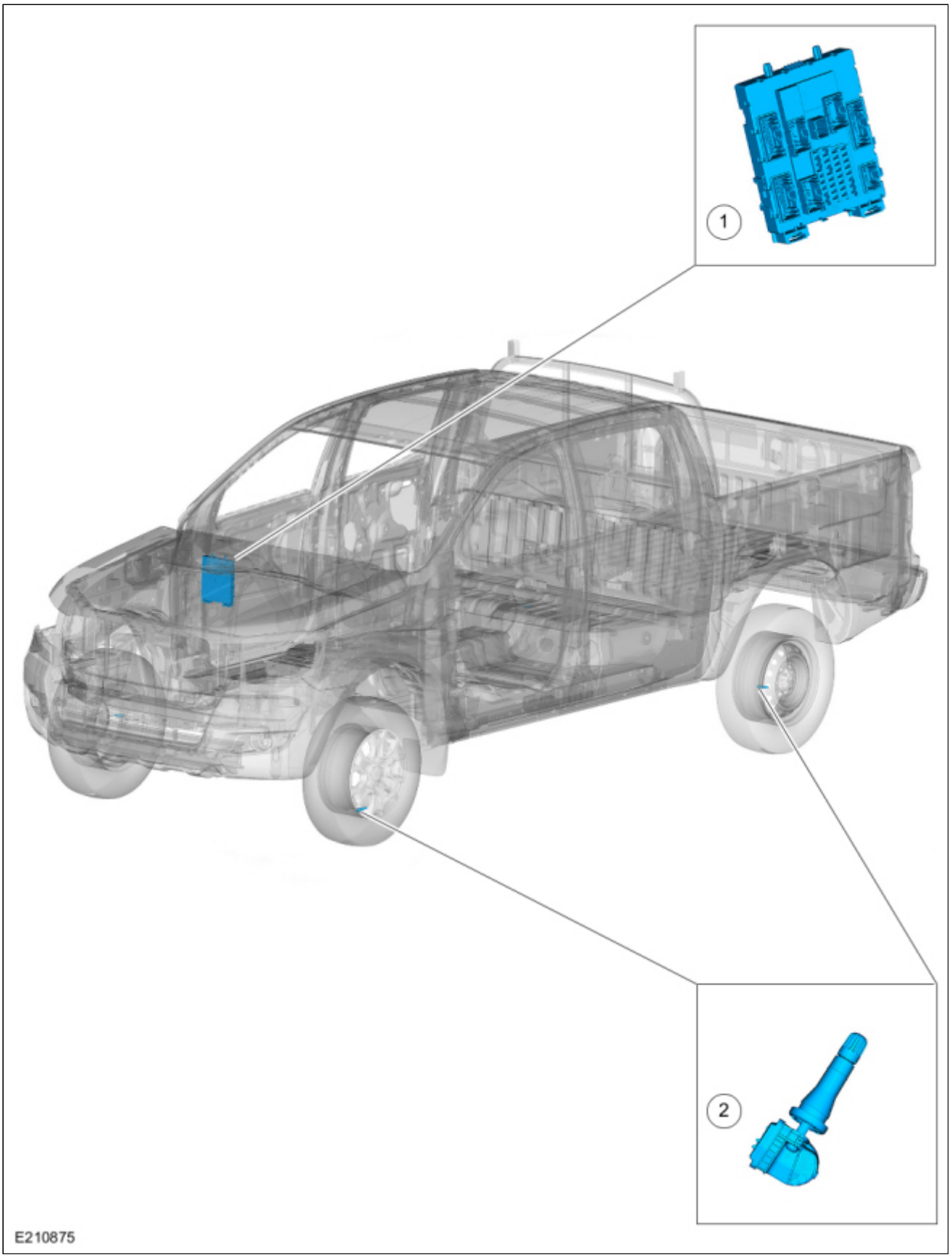
   NOTE: *Final tightening to be performed with vehicle resting on tires.*

   For additional information, refer to: Specifications - Vehicles Built Up To: 16-08-2015 (204-04 Wheels and Tires) .



Copyright © 2016 Ford Motor Company

Tire Pressure Monitoring System (TPMS)



Item	Part Number	Description

1	—	BCM (body control module)
2	—	TPMS (tire pressure monitoring system) sensor assembly (4 required)

Copyright © 2016 Ford Motor Company

Tire Pressure Monitoring System (TPMS) Sensor Activation

Special Tool(s) / General Equipment

 E170534	204-D081 TPM Activation Tool

Activation

1. **NOTE:** *The tire pressure sensors will go into a "sleep mode" when a vehicle is stationary to conserve battery power. The sensors do not transmit information while in sleep mode. It will be necessary to wake them up so they will transmit the latest tire pressure information.*

   Turn the ignition switch to the ON position.

2. Position the special tool against the Left Front (LF) tire sidewall at the tire valve stem.
   Use Special Service Tool: 204-D081 TPM Activation Tool.

3. **NOTE:** *The special tool should provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire pressure sensor. This feedback may not always be present, do not rely on it as a confirmation that the module heard a particular sensor.*

   NOTE: *If a sensor does not respond to the special tool move the vehicle to rotate the wheels at least one-fourth of a turn and attempt to activate the same sensor again. If the sensor still does not respond, attempt to activate the same sensor again using the customer activation tool (if available). If the sensor still fails to train, attempt to train the sensor with the vehicle doors open.*

   Press the test button on the special tool to activate the sensor. Activate the sensor at least 2 times.
   Use Special Service Tool: 204-D081 TPM Activation Tool.

4. Repeat Steps 2 and 3 for the remaining tires.

5. If the TPMS indicator remains illuminated after adjusting and activating each sensor,
   Refer to: Tire Pressure Monitoring System (TPMS) Sensor Activation (204-04B Tire Pressure Monitoring System (TPMS), General Procedures).

Copyright © 2016 Ford Motor Company

Tire Pressure Monitoring System (TPMS) Sensor Location Calibration

Special Tool(s) / General Equipment

 E170534	204-D081 TPM Activation Tool
Ford Diagnostic Equipment	

Programming

NOTE: *The TPMS can be placed into learn mode using a diagnostic scan tool or manually where a diagnostic scan tool is not available.*

NOTE: ***Enter Training Mode With Scan Tool***

NOTE: *The TPMS can be placed into learn mode using a diagnostic scan tool or manually where a diagnostic scan tool is not available.*

NOTE: ***Enter Training Mode With Scan Tool***

1. **NOTE:** *The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN Left Front (LF) TIRE.*

    1. Select Chassis.
    2. Select TPMS.
    3. Select Training Mode.
       Use the General Equipment: Ford Diagnostic Equipment

Programming

NOTE: ***Enter Training Mode Without Scan Tool***

1. **NOTE:** *The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN Left Front (LF) TIRE.*

   With the ignition OFF, press and release the brake pedal.

2. Using the start/stop switch, position the ignition from OFF to RUN 3 times, ending in the RUN position.

3. Press and release the brake pedal.

4. Position the ignition to OFF position.

5. Using the start/stop switch, position the ignition from OFF to RUN 3 times, ending in the RUN position.

Programming

NOTE: ***TPMS Sensor Training Procedure***

1. **NOTE:** *It may take up to 6 seconds to activate a tire pressure sensor. During this time, the special tool must remain in place at the valve stem.*

   Place the special tool on the Left Front (LF) tire sidewall at the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the BCM.
   Use Special Service Tool: 204-D081 TPM Activation Tool.

2. Within 2 minutes of the horn sounding, place the special tool on the Right Front (RF) tire sidewall at the valve stem and press and release the test button to train the Right Front (RF) tire pressure sensor.
   Use Special Service Tool: 204-D081 TPM Activation Tool.

3. Repeat Step 1 for the Right Rear (RR) and Left Rear (LR) tires. The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE. For vehicles not equipped with a message center, successful completion of the training procedure will be verified by positioning the ignition to OFF without the horn sounding. If the horn sounds twice when the ignition is positioned to OFF, the training procedure was not successful.

4. Using the scan tool, locate the updated TPMS sensor identifiers trained to the BCM and document them on the applicable warranty claim.
   Use Special Service Tool: 204-D081 TPM Activation Tool.

5. This step is required to clear DTC B1182:55, cause the BCM to exit the manufacturing mode and to make sure there are no other concerns with a newly programmed BCM.

6. If the sensors are being trained due to the installation of a new BCM, clear any DTC and carry out the BCM On-Demand Self Test.

Copyright © 2016 Ford Motor Company

Tire Pressure Monitoring System (TPMS) Sensor

Base Part Number: 1552

Removal

1. **WARNING: Before beginning any service procedure in this section. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **WARNING: The Tire Pressure Monitoring System (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of Tire Pressure Monitoring System (TPMS) sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.**

   NOTE: *The Tire Pressure Monitoring System (TPMS) sensor cannot be removed without disassembly of the wheel and tire.*

   NOTE: *The maximum shelf life of a TPMS snap in valve stems before being mounted to a wheel is 1 year. The production date / week / year is marked on the TPMS sensor / valve stem itself. Snap in valve stems which are older than 1 year are to be scrapped. TPMS snap in sensors with valve stems older than one year should not be mounted but the valve stem should be replaced.*

   Refer to: Tire Pressure Monitoring System (TPMS) Sensor (204-04B Tire Pressure Monitoring System (TPMS), Disassembly and Assembly).

Installation

1. **NOTE:** *The Tire Pressure Monitoring System (TPMS) sensor cannot be installed without disassembly of the wheel and tire.*

   Refer to: Tire Pressure Monitoring System (TPMS) Sensor (204-04B Tire Pressure Monitoring System (TPMS), Disassembly and Assembly).

Copyright © 2016 Ford Motor Company

Tire Pressure Monitoring System (TPMS) Sensor

Base Part Number: 1552

Special Tool(s) / General Equipment

Wooden Block

DISASSEMBLY

NOTICE: Failure to follow the instructions below may result in damage to the TPMS.

NOTICE: The TPMS sensor is mounted to the valve stem. Removal of the valve stem requires dismounting the tire from the wheel and removal of the TPMS sensor.

NOTE: *Use only the Digital Tire Pressure Gauge any time tire pressures are measured to be sure that accurate values are obtained.*

1. Refer to: Wheel and Tire Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. **NOTICE: The valve stem is connected to the TPMS sensor. Do not pull the valve stem from the wheel, or damage to the sensor will occur.**

   NOTE: *If a new TPMS sensor is being installed, remove and discard the valve stem-to-sensor screw and the sensor.*

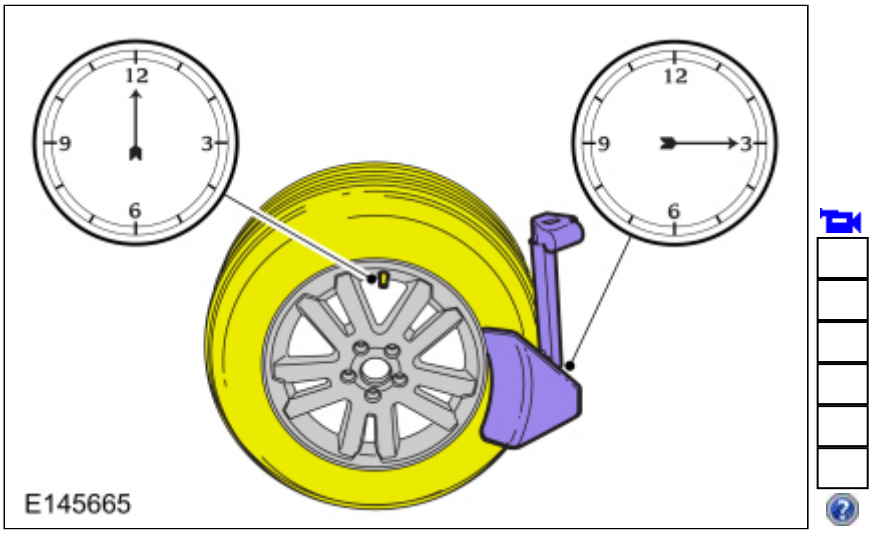
   Remove the valve stem core and fully deflate all air from the tire.
4. **NOTICE: Do not allow the tire beads to move beyond the wheel mid-plane (middle of the wheel) when separating the beads from the wheels, damage to the TPMS sensor may occur.**

   NOTICE: Tire and valve stem position is critical to prevent damage to theTPMS sensor when using a paddle-type bead separator.

   NOTE: *Some machines may have a nylon roller bead separator at the 12 o'clock position instead of the paddle-type bead separator at the 3 o'clock position.*

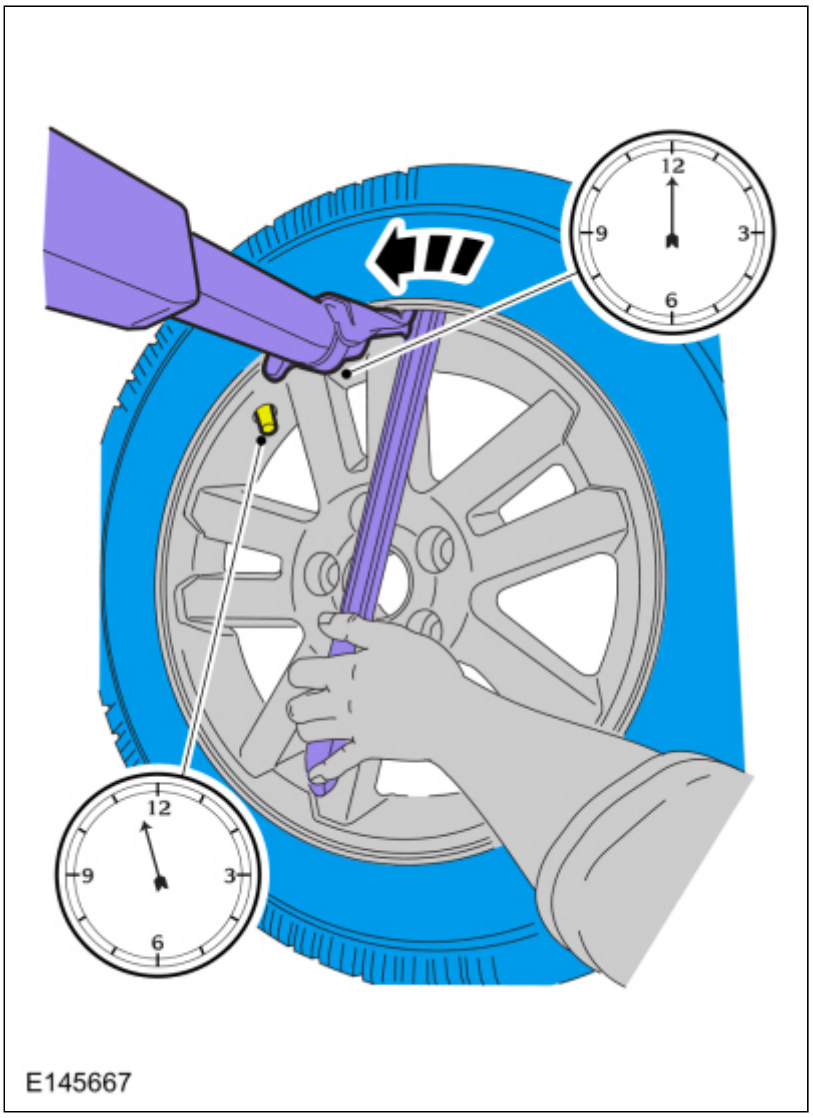
   - *For a paddle-type tire machine, position the valve stem at the 12 o'clock or 6 o'clock position and the paddle at the 3 o'clock position.*
   - *For a roller-type tire machine, align the valve stem with the roller at any position.*

   NOTE: *Paddle type shown, roller type similar.*



5. **NOTE:** *Index-mark the valve stem and wheel weight positions on the tire.*

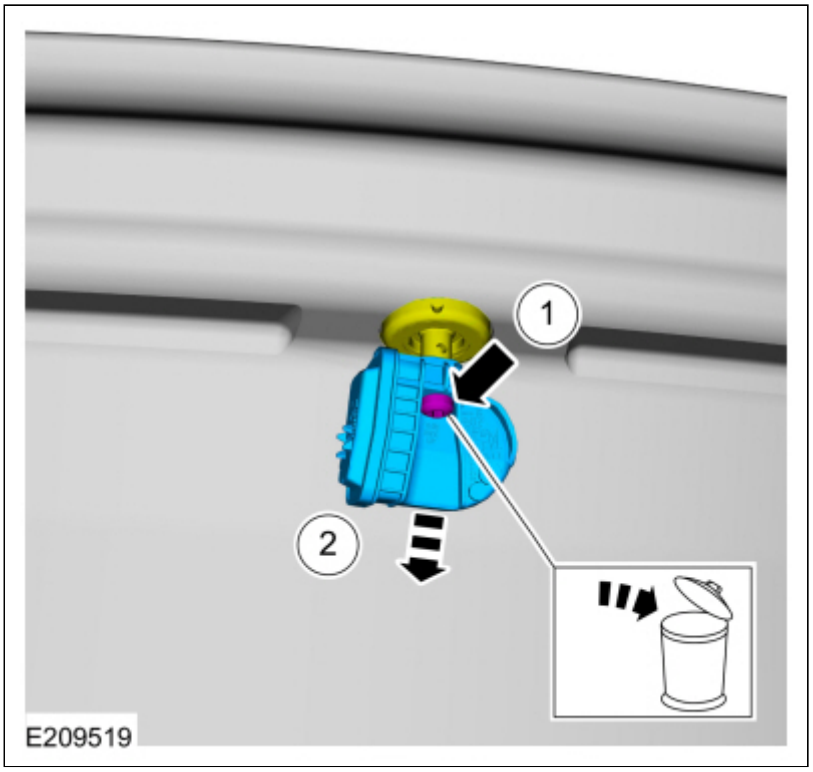
   Place the wheel and tire assembly on the turntable of the tire machine with the valve stem at the 11:30 position and the machine arm at the 12 o'clock position and dismount the outer bead from the wheel.



6. Reset the wheel and tire assembly on the turntable of the tire machine with the valve stem at the 11:30 position and the machine arm at the 12 o'clock position and dismount the inner bead from the wheel.

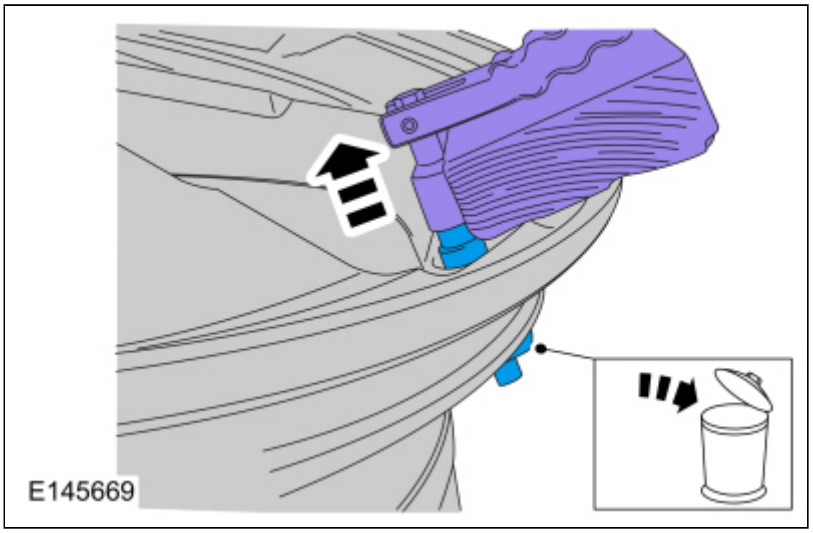
7. **NOTE:** *A new valve stem must be installed whenever a new tire or wheel is installed.*

   1. Remove and discard the TPMS sensor-to-valve stem screw.
   2. Separate the TPMS sensor from the valve stem.



8. **NOTICE: Use care not to damage the wheel surface when removing the valve stem.**

   Using a suitable valve stem remover/installer, remove and discard the valve stem.
   Use the General Equipment: Wooden Block

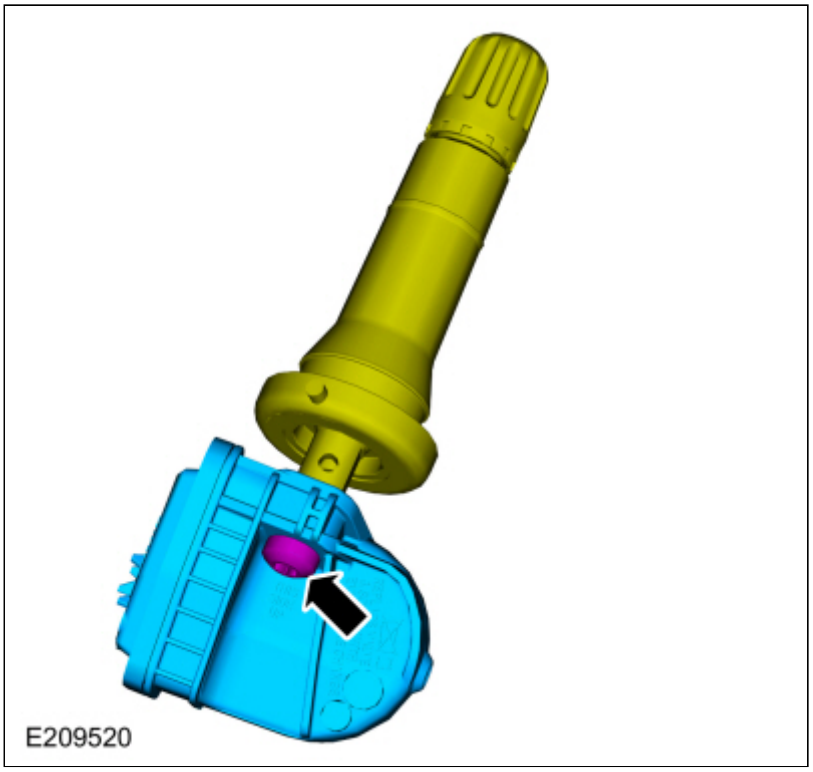


NOTE: *When installing a new wheel, always install a new valve stem and sensor screw. Reuse theTPMS sensor from the previous wheel if possible. The TPMS will not have to be trained if the sensor is reused.*

NOTE: *If the TPMS sensor is being reused, inspect the TPMS sensor for damage and install a new sensor as necessary.*

9. **NOTICE: To prevent TPMS sensor and valve stem damage, the valve stem must be installed onto the TPMS sensor and then installed into the wheel as an assembly.**

   Position the new valve stem onto the TPMS sensor and install the new screw.
   Torque: 1.5 Nm



ASSEMBLY

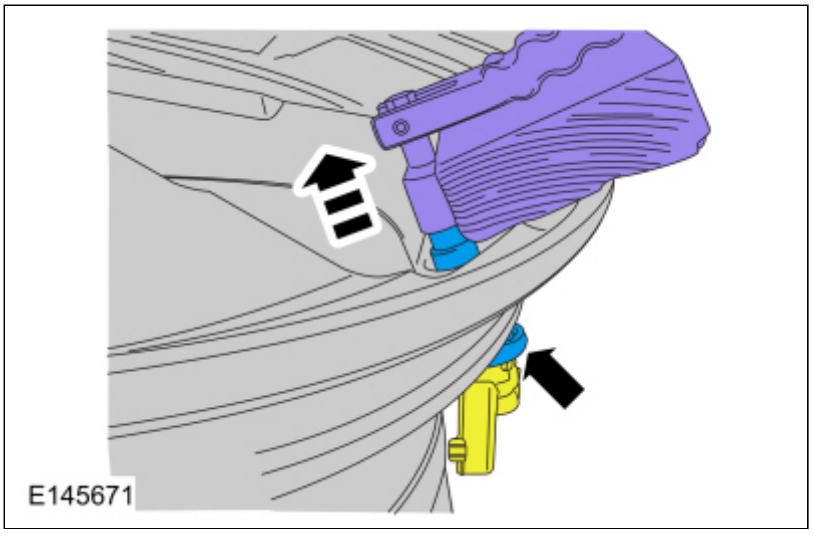
NOTICE: Damage to the TPMS sensor may result if the tire mounting is not carried out as instructed.

1. **NOTICE: It is important to pull the valve stem and TPMS sensor assembly through the wheel rim hole in a direction parallel to the valve stem hole axis. If the assembly is pulled through at an angle, damage to the valve stem and sensor assembly may occur.**

   NOTICE: Use care not to damage the wheel surface when installing the valve stem and TPMS sensor assembly.

   NOTE: *Lubricate the valve stem with soapy water and install the valve stem and TPMS sensor assembly into the wheel using a block of wood and a suitable valve stem installer.*

   Using a suitable valve stem installer, install the new valve stem and TPMS sensor assembly.
   Use the General Equipment: Wooden Block



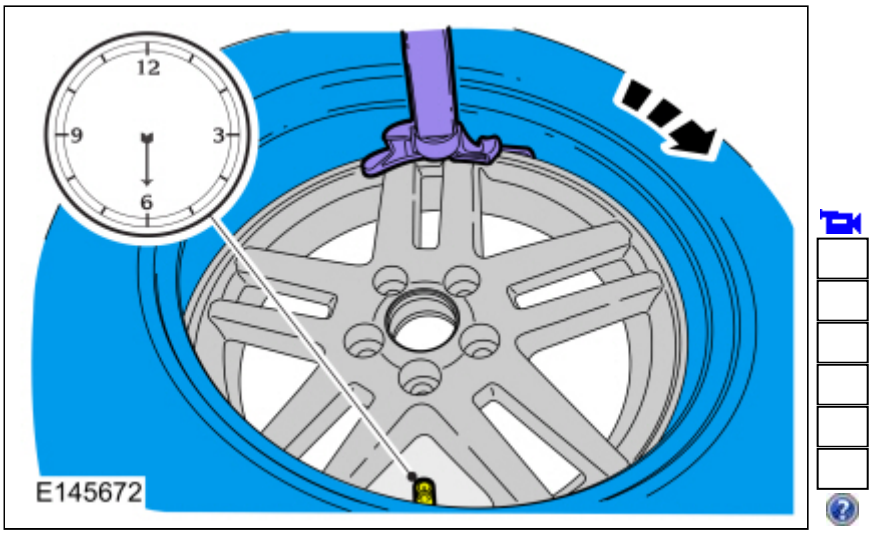
2. **NOTE:** *Lubricate the tire beads using a suitable fast-drying, corrosion-inhibiting tire bead lubricant.*

   NOTE: *Do not mount the tire at this time.*

   Position the wheel on the turntable of the tire machine, then lubricate and position the bottom bead of the tire on the wheel.

3. Position the wheel to align the valve stem with the machine arm, at the 6 o'clock position, and mount the

bottom bead of the tire.



4. Reposition the wheel to align the valve stem with the machine arm at the 6 o'clock position, and mount the top bead of the tire.
5. **NOTE:** *Use only the Digital Tire Pressure Gauge any time tire pressures are measured to be sure that accurate values are obtained.*

   Inflate the tire to the pressure specified on the VC label located on the driver door or door pillar.

NOTE: *Proceed to the next step if the tire beads do not seat at the specified inflation pressure.*

6. **WARNING: If there is a need to exceed the maximum pressure indicated on the sidewall of the tire in order to seat the beads, follow all steps listed below. Failure to follow these steps may result in serious personal injury.**

   NOTICE: The following steps should only be carried out if the tire beads cannot be seated by inflating the tire up to the maximum inflation pressure listed on the tire sidewall.

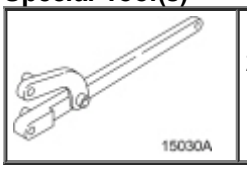
   1. Relubricate the tire bead and wheel bead seat area.
   2. Install a remote valve and pressure gauge.
   3. Wear eye and ear protection and stand at a minimum of 3.65 m (12 ft) away from the wheel and tire assembly.
   4. Inflate the tire using the remote valve and tire gauge until the beads have seated or until the pressure gauge is 138 kPa (20 psi) more than maximum inflation pressure on tire sidewall. If beads have not seated, deflate the tire and proceed to the next step.
   5. Place the wheel and tire assembly in an OSHA-approved tire safety cage.
   6. Inflate the tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 276 kPa (40 psi) more than maximum inflation pressure on the tire sidewall. **Do not exceed 276 kPa (40 psi) above the maximum pressure on tire sidewall. Install a new tire if the beads do not seat at this pressure.**

7. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

Copyright © 2016 Ford Motor Company

Driveline System

Special Tool(s)

	Flange Holding Wrench, Universal 205-072 (15-030A)

Inspection and Verification

Certain axle noise or vibration symptoms are also common to the engine, transmission, wheel bearings, tires and other parts of the vehicle. For this reason, make sure that the cause of the trouble is in the axle before disassembling, adjusting or repairing the axle.
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Certain driveshaft vibration symptoms are common to the engine accessory drive, the engine, transmission or tires. Make sure the cause of the concern is the driveshaft before repairing or installing a new driveshaft.
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Noise Acceptability

NOTE: *A gear driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions such as a newly tarmaced road. Slight noise is not detrimental to the operation of the axle and is considered normal.*

Universal Joint Inspection

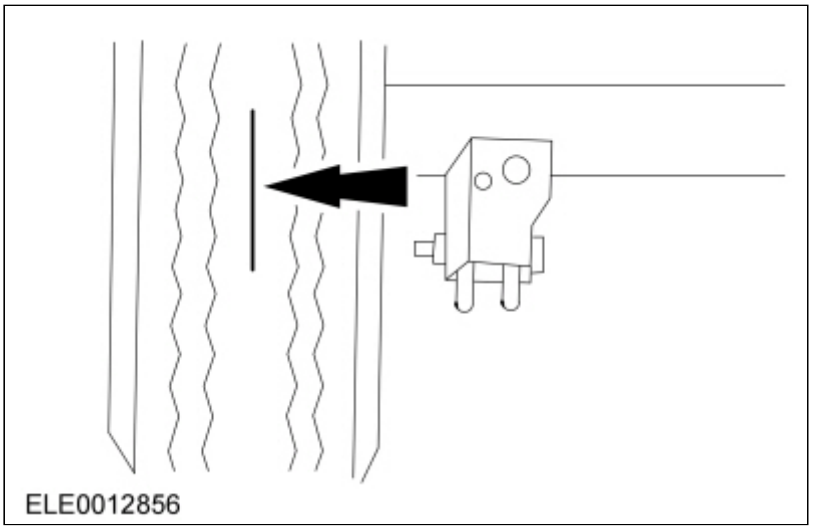
Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting)

Jacking and Lifting - Overview (Description and Operation).
Place the vehicle on a wheel free lift and rotate the driveshaft by hand. Check for rough operation or seized universal joints.

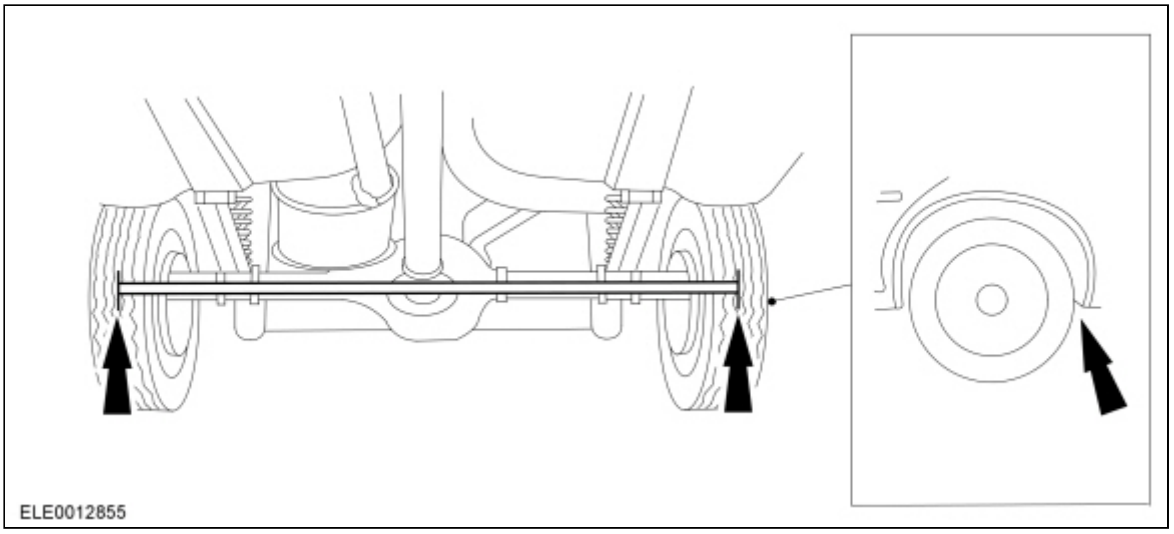
Inspection for Bent Rear Axle

1. Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting)
   Jacking and Lifting - Overview (Description and Operation).
   Allow the rear axle to be freely suspended.

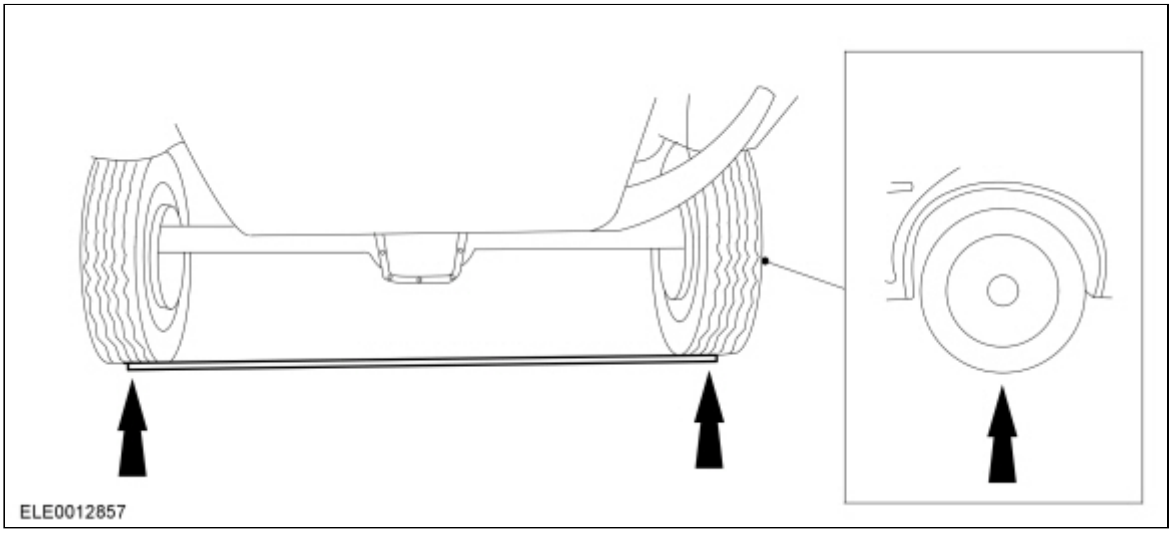
2. Use white chalk or paint to mark a vertical line on the center of each rear tire.



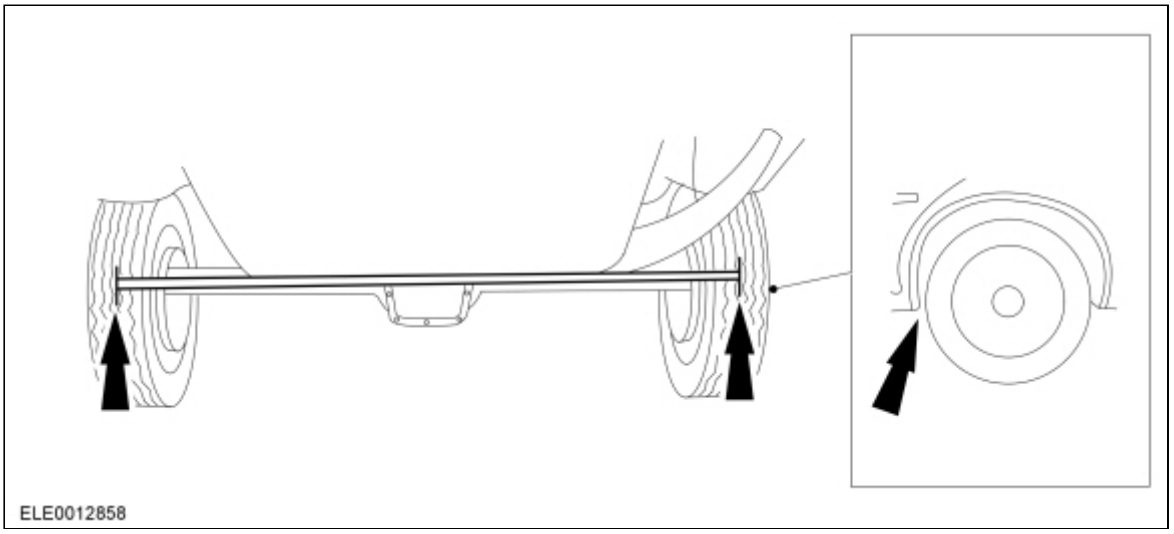
3. Adjust both wheels so that the markings face the front of the vehicle. With a tape measure, measure the distance between the marks and note this measurement (front measurement).



4. Rotate the rear wheels so the markings are directly underneath the vehicle. With a tape measure, measure the distance between the marks and note this measurement (bottom measurement).



5. Rotate the rear wheels so the markings face the rear of the vehicle. With a tape measure, measure the distance between the marks and note this measurement (rear measurement).



6. Compare the front and the rear measurements (Steps 3 and 5) to find the toe - in or toe - out condition.
    - Toe - in occurs when the front measurement is less than the rear measurement.
    - Toe - out occurs when the rear measurement is less than the front measurement.

7. To determine camber, find the average of the front and the rear measurements (Steps 3 and 5). Subtract the bottom measurement (Step 4) from this number.

Positive (+) camber is when the bottom measurement is less than the average of the front and rear measurements.
Negative (-) camber is when the bottom measurement is greater than the average of the front and rear measurements.

8. The results of the calculations in Steps 6 and 7 must conform to the following specification:

Toe - in: 0 - 1.6 mm.

Toe - out: 0 - 4.8 mm.

Camber: 0 ± 4 mm.

If the axle housing does not meet these specifications, a new axle housing must be installed. REFER to: (205-02 Rear Drive Axle/Differential)

Axle Assembly - 2WD (Removal and Installation),
Axle Assembly - 4WD (Removal and Installation).

9. After the axle housing has been installed, repeat steps the previous steps.

Analysis of Leakage

Clean up the leaking area to identify the exact source.

A blocked axle housing vent can cause excessive drive pinion oil seal lip wear due to the internal pressure buildup.

Make sure axle oil level is correct.
REFER to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Axle Vent

NOTE: *If a blocked vent cannot be cleared, install a new one.*

A blocked vent will cause excessive oil seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. Make sure the vent hose is not kinked. Remove the hose from the vent nipple and clear the hose of any foreign material. While the hose is removed, pass a length of mechanics wire or a small diameter Allen key in and out of the vent to clean it. Connect the hose when done.

Drive Pinion Oil Seal

Leaks at the axle drive pinion oil seal orginate for the following reasons:

- The drive pinion oil seal was not correctly installed.

Any damage to the oil seal bore (dings, dents, gouges, or other imperfections) will distort the oil seal casing and allow leakage past the outer edge of the axle drive pinion oil seal.

The axle drive pinion oil seal can be torn, cut, or gouged if it is not installed correctly. The spring that holds the axle drive pinion oil seal lip against the drive pinion flange may be dislodged resulting in allowing leakage past the lip of the oil seal.

The rubber oil seal lips can occasionally become hard (like plastic) with cracks at the lip contact point. The contact point on the drive pinion flange may blacken, indicating excessive heat. Marks, nicks, gouges, or rough surface texture on the oil seal journal of the drive pinion flange will also cause leaks.

Axle drive pinion oil seal wear 1.27 mm or greater is considered excessive.

A new drive pinion flange must be installed if any of these conditions exist.

Metal chips or sand trapped at the oil seal lip may also cause oil leaks. This can cause a wear groove on the drive pinion flange and heavy drive pinion oil seal wear.

When an oil seal leak occurs, install a new oil seal and check the vent. Make sure they are clean and free of foreign material.

Axle Shaft Oil Seals

The axle shaft oil seals are susceptible to the same kinds of damage as axle drive pinion oil seals if incorrectly installed. The oil seal bore must be clean and the oil seal lip handled carefully to avoid cutting or tearing it. The axle shaft journal surface must be free of nicks, gouges, and rough surface texture.

Analysis of Vibration

Few vibration conditions are caused by the front or rear axle. Follow the diagnosis procedure unless there is a good reason to suspect the axle.
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Tires

WARNING: Do not balance the wheels and tires while they are mounted on the vehicle. Possible tire disintegration/differential failure could result, causing personal injury/extensive component damage. Use an off - vehicle wheel and tire balancer only.

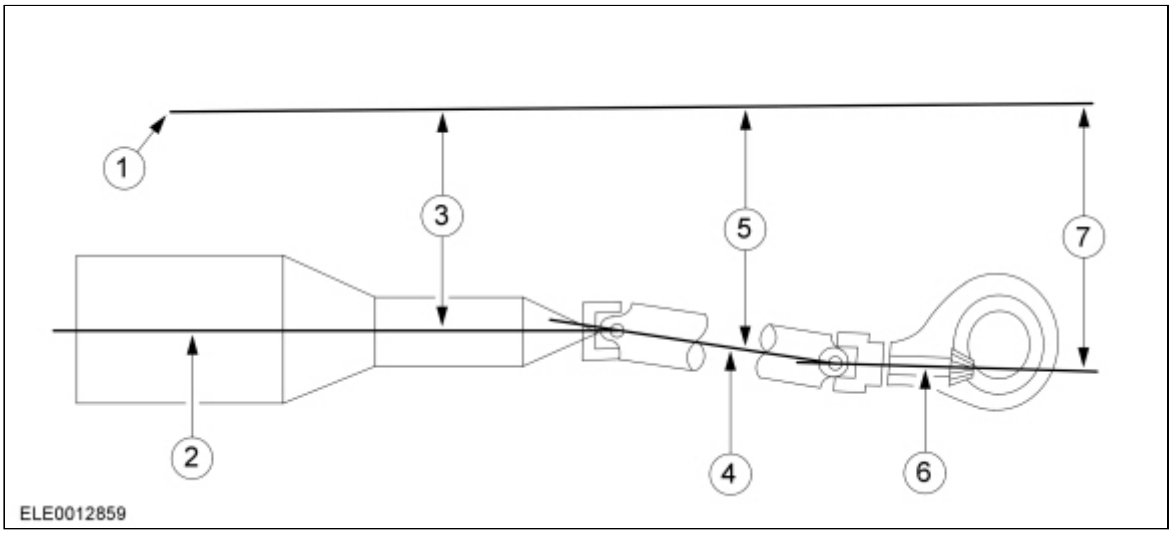
Most vibration in the rear end is caused by tires or driveline angle.

Vibration is a concern with modern, high - mileage tires if they are not ``true" both radially and laterally. They are more susceptible to vibration around the limits of radial and lateral runout of the tire and wheel assembly. They also require more accurate balancing. Wheel and tire runout checks, truing and balancing are normally done before axle inspection.
REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).

Driveline Angle

Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft, and the rear axle drive pinion. Factors determining driveline angularity include ride height, rear spring, and engine mounts.

Driveline Angle



Item	Part Number	Description
1	—	Bottom of the frame
2	—	Engine crankshaft centerline
3	—	Engine angle
4	—	Driveshaft and coupling shaft centerline
5	—	Driveshaft and coupling angle
6	—	Rear axle drive pinion centerline
7	—	Axle drive pinion angle

An incorrect driveline (drive pinion) angle can often be detected by the driving condition in which the vibration occurs.

- A vibration during coasting from 72 to 56 km/h 45 to 35 mph) is often caused by a high axle drive pinion angle.
- A vibration during acceleration, from 56 to 72 km/h (35 to 45 mph) may indicate a low drive pinion angle.

When these conditions exist, check the driveline angles.
REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).

If the tires and driveline angle are not the cause, carry out the NVH tests to determine whether the concern is caused by a condition in the axle.
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

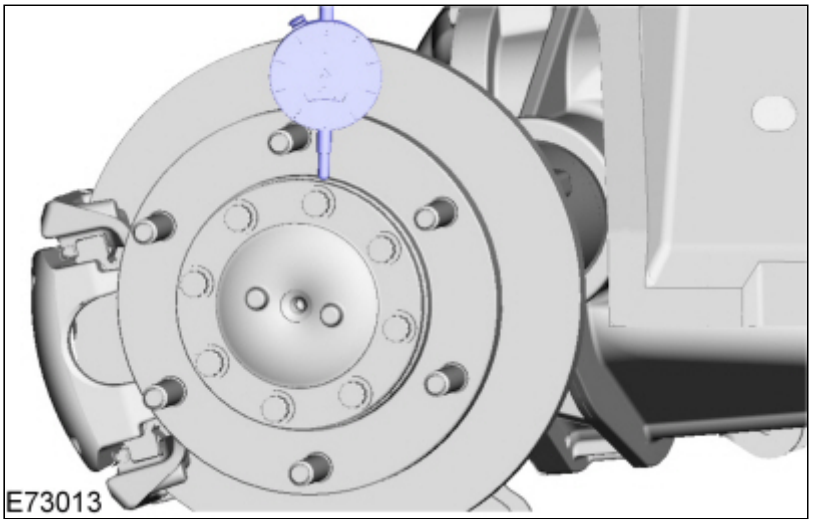
Universal Joint Wear

Place the vehicle on a wheel free lift and rotate the driveshaft by hand. Check for rough operation or seized universal joints.

Pilot Runout

1. **NOTE:** *Clean the wheel hub flange with abrasive paper before positioning the dial indicator gauge with magnetic base.*

   Position the dial indicator with magnetic base as close to the wheel hub or axle flange face as possible. Zero the indicator dial.

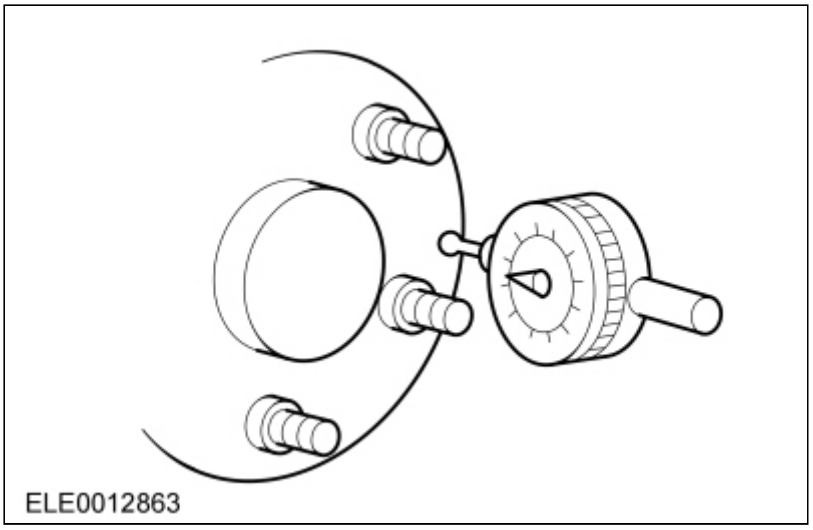


2. Rotate the wheel hub or axle flange one full turn and note the maximum and minimum measurements. The difference between the maximum and minimum measurements will be the total runout. Pilot runout must not exceed 0.15 mm.

Wheel hub or Axle Flange Face Runout

NOTE: *If the axle shaft assembly is removed, check the runout of the axle shaft itself. The forged (unmachined) part of the axle shaft is allowed to have as much as 3.0 mm runout. This alone will not cause a vibration condition.*

1. Position the dial indicator gauge on the wheel hub or axle flange face, as close to the outer edge as possible. Zero the indicator dial.



2. Rotate the wheel hub or axle flange one full turn and note the maximum and minimum measurements. The difference between the maximum and minimum measurements will be the total face runout. The runout must not exceed 0.25 mm.

Drive Pinion and Drive Pinion Flange

Check the drive pinion flange runout when all other checks have failed to show the cause of vibration.

One cause of excessive drive pinion flange runout is incorrect installation of the axle drive pinion oil seal. Check to see if the spring on the oil seal lip has been dislodged before installing a new ring gear and drive pinion.

Axle Noise

NOTE: *Before disassembling the axle to diagnose and correct gear noise, eliminate the tires, exhaust system, trim*

items, roof racks, axle shafts and wheel bearings as possible causes. Follow the diagnostic procedures.

The noises described as follows usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard during the road test.
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Gear Howl and Whine

Howling or whining of the ring gear and drive pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload.

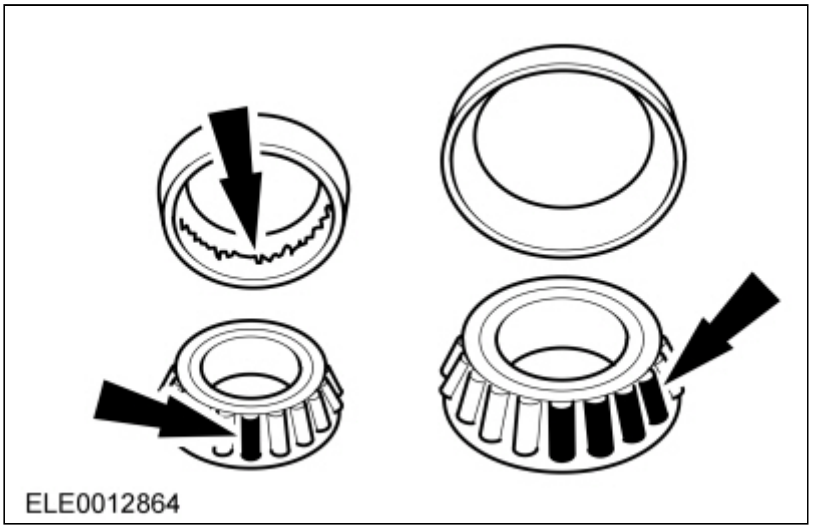
Bearing Whine

Bearing whine is a high - pitched sound similar to a whistle. It is usually caused by worn or damaged drive pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which usually comes and goes as speed changes.

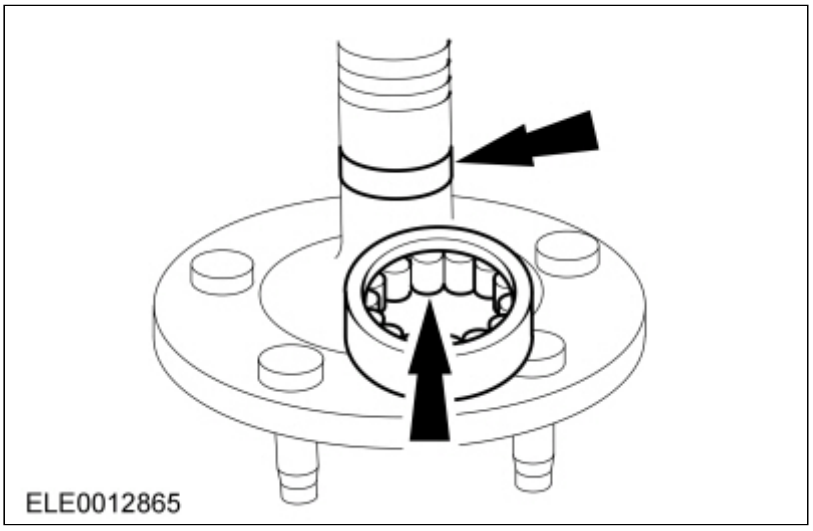
As noted, drive pinion bearings make a high - pitched, whistling noise, usually at all speeds. If however there is only one drive pinion bearing that is worn or damaged, the noise may vary in different driving phases. New drive pinion bearings must not be installed unless scoring or damage is found or there is a specific drive pinion bearing noise. A worn or damaged bearing will normally be obvious at disassembly. Examine the large diameter of the rollers for wear. If the drive pinion bearings original blend radius has worn to a sharp edge, a new front and rear drive pinion bearing must be installed.

NOTE: *A low - pitched rumble normally associated with a worn or damaged wheel bearing can be caused by an exterior luggage rack or tires.*

A wheel bearing noise can be mistaken for a drive pinion bearing noise. Check the wheel bearing for a spalled cup, and spalled or damaged rollers. Install a new wheel bearing if any of these concerns are detected.



If the wheel bearing is damaged, the roller surface on the axle shaft may also be damaged. Install a new axle shaft if any damage is detected.



Chuckle

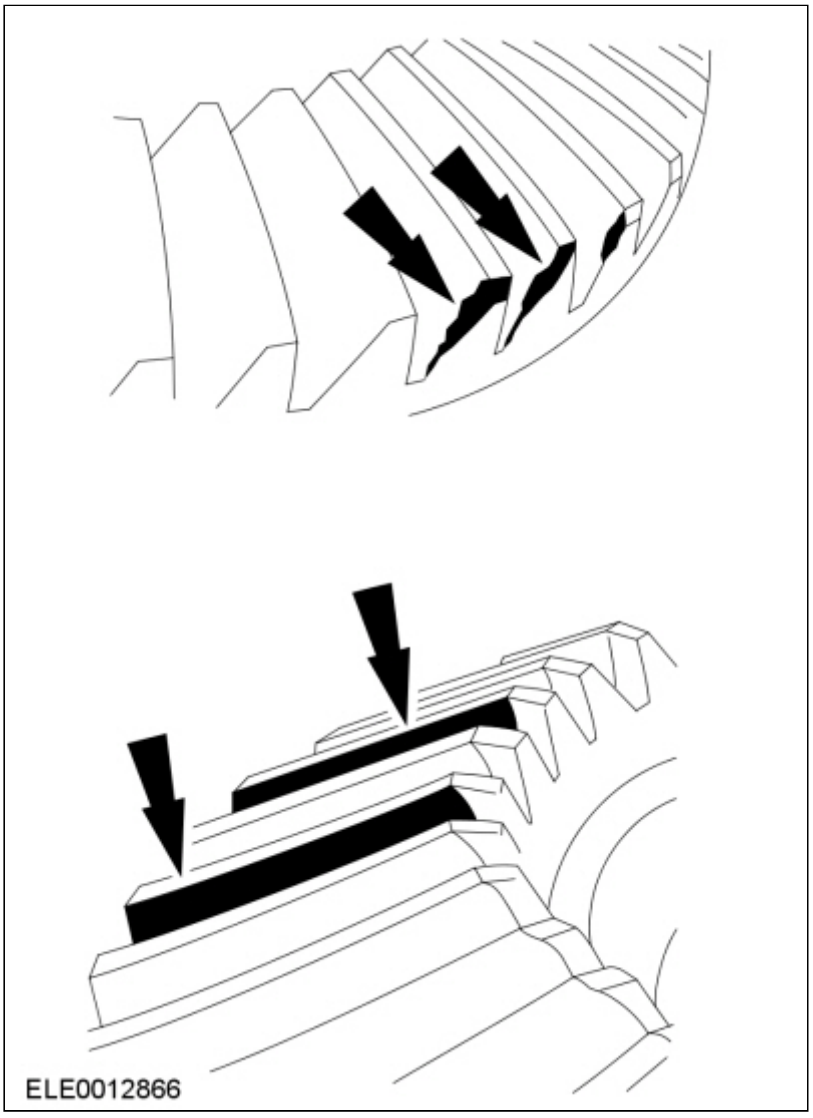
Chuckle that occurs on coasting is usually caused by excessive clearance between the differential gear wheel hub and the differential case bore.

Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise.

Clean the gear tooth nick or ridge with a small grinding wheel. If the damaged area is larger than 3.2 mm, install a new gearset.

To check the ring gear and drive pinion, remove as much oil as possible from the gears with clean solvent. Wipe the gears dry or blow them dry with compressed air. Look for scored or damaged teeth. Also look for cracks or other damage.

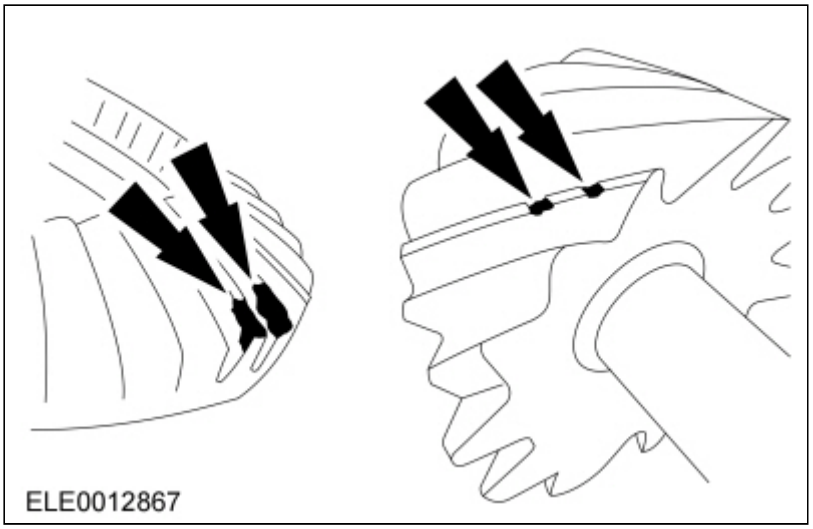
If either gear is scored or damaged badly, a new ring gear and drive pinion must be installed.



If metal has broken loose, the axle housing must be cleaned to remove particles that will cause damage. At this time if any other damaged parts are found in the axle housing, new parts must also be installed.

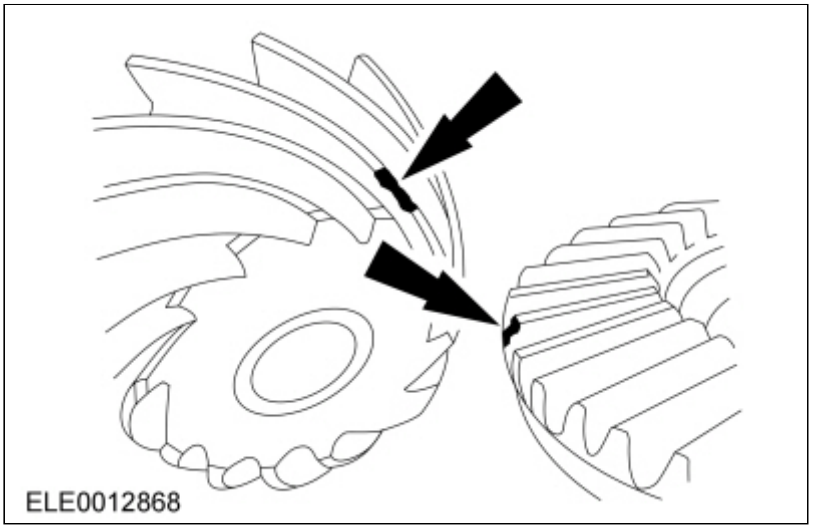
Knock

Knock, which can occur on all driving phases, has several causes including damaged teeth or gearset.



In most cases, one of the following conditions will occur:

1. A gear tooth damaged on the drive side is a common cause of the knock. This can usually be corrected by grinding the damaged area.



2. **NOTE:** *Measure the end play with a dial indicator gauge and not by feel.*

   The knock is also caused by excessive end play in the axle shafts. Up to 0.76 mm is allowed in semi - floating axles. The frequency of the knock will be less because the axle shaft speed is slower than the driveshaft.

Clunk

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise may also occur when throttle is applied or released. It is caused by backlash somewhere in the driveline or loose suspension components; it is felt or heard in the axle.

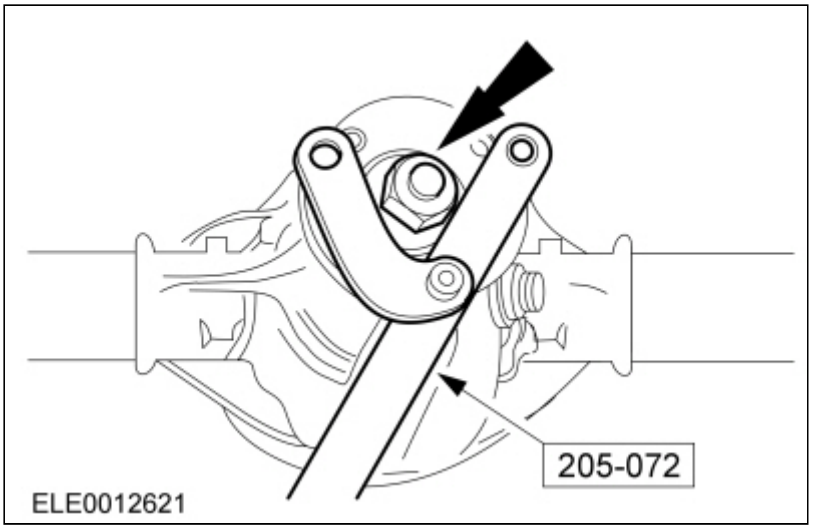
Additionally, clunk may be heard upon initial drive - away. This occurs as engine torque shifts vehicle weight, forcing changes in driveline angles, preventing the driveshaft slip - yoke from sliding on the output shaft. To correct this condition, lubricate the slip - yoke splines.

Total Backlash Check

1. Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting)
   Jacking and Lifting - Overview (Description and Operation).

2. Remove the driveshaft.
   REFER to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

3. Install the special tool.
   - Clamp a rigid bar or pipe to the tool. Clamp the other end of the bar or pipe to the frame or a body member in order to prevent movement of the drive pinion flange.



4. Lower the vehicle so that one rear wheel is resting on a wheel chock to prevent it from turning. The other rear wheel will be used to measure total rear axle backlash.

5. Rotate the free wheel slowly, by hand, until the feeling of driving the rear axle is encountered. Place a mark on the side of the tire, 305 mm from the center of the wheel, with a crayon or chalk.

6. While holding the crayon or chalk against the tire, rotate the wheel slowly in the opposite direction until the feeling of driving the rear axle is encountered again.

7. Measure the length of the mark on the tire.
    - If the length of the mark is 25 mm or less, the rear axle backlash is within specification.
    - If the mark is greater than 25 mm, check for these conditions:
        - Elongation of the differential drive pinion shaft and holes in the differential case.
        - Galling of the differential drive pinion shaft and bore.
        - Excessive ring gear and drive pinion backlash. Follow the procedure for the type of rear axle to check backlash.

Axle Shaft Bearing Noise

Axle shaft bearing noise is similar to gear noise and differential drive pinion bearing whine. Axle shaft bearing noise will usually distinguish itself from gear noise by occuring in all driving modes (drive, coast, and float), and will persist with the transmission in NEUTRAL while the vehicle is moving at the speed in which the concern is occuring. If the vehicle makes this noise, remove the suspect axle shaft and install a new bearing and axle oil seal. Re - evaluate the vehicle for noise before removing any internal components.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn or damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one - third of the driveshaft speed. Wheel bearing noise also may be high - pitched, similar to gear noise, but will be evident in all driving modes.

Analysis of Inoperative Conditions

If the axle does not operate, it may be caused by broken welds or wheel bearing wear or damage.

Broken Welds

If axle housing welds are completely broken, install a new axle housing.

Wheel Bearing Wear or Damage

Because of the severe loads they must handle, new wheel bearings may be required at high mileage. If a wheel bearing fails at low mileage, it is often caused by overloading.

Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
• Oil leaking from the drive pinion oil seal, axle shaft oil seals or support arm to the housing	• Axle housing vent.	• CLEAN the axle housing vent.
	• Damage in the oil seal contact	• INSTALL a new drive pinion

	areas or dust slinger on the drive pinion flange dust shield.	flange and the drive pinion oil seal if damage is found.

Component Tests

Driveline Vibration

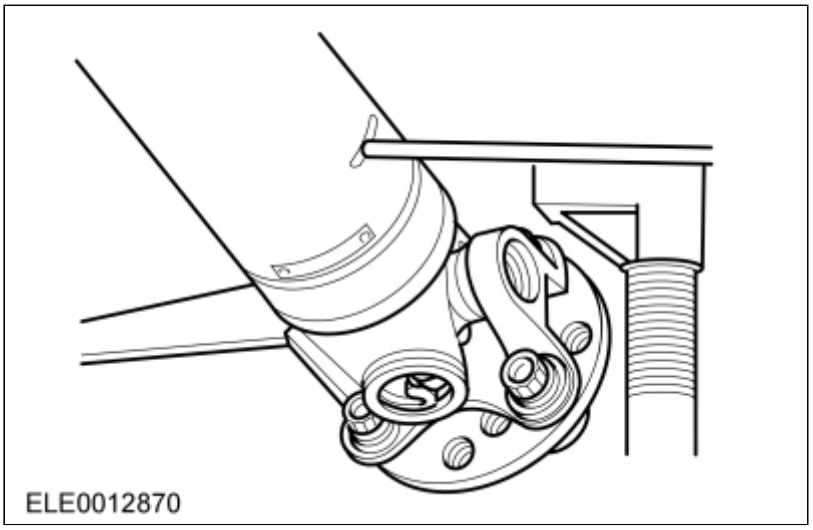
Driveline vibration exhibits a higher frequency and lower amplitude than does high - speed shake. Driveline vibration is directly related to the speed of the vehicle and is usually noticed at various speed ranges. Driveline vibration can be perceived as a tremor in the floor pan or is heard as a rumble, hum or boom. Driveline vibration can exist in all drive modes, but may exhibit different symptoms depending upon whether the vehicle is accelerating, decelerating, floating, or coasting. Check the driveline angles if the vibration is particulary noticeable during acceleration or deceleration, especially at lower speeds. Driveline vibration can be duplicated by supporting the axle upon a vehicle lift or upon axle stands, though the brakes may need to be applied lightly in order to simulate road resistance.

1. Raise and support the vehicle promptly after road testing. Use a two post lift or axle stands to prevent tire flat - spotting. Engage the drivetrain and accelerate to the observed road test speed to verify the presence of the vibration. If the vibration is not evident, check the nondriving wheels with a wheel balancer to rule out imbalance as a possible cause. If required, balance the nondriving wheels and repeat the road test. If the vibration is still evident, proceed to the following step.

2. Mark the relative position of the drive wheels to the wheel bolts. Remove the wheels. Install all the wheel nuts in the reversed position and repeat the road speed acceleration test. If the vibration is gone, refer to the wheel and tire runout procedure.
   REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).
   If the vibration persists, proceed to the following step.

3. Inspect the driveshafts for signs of physical damage, missing balance weight, undercoating, incorrect seating, wear and binding universal joints. Clean the driveshaft and install new universal joints or install a new driveshaft if damaged. Check the index marks (paint spots) on the rear of the driveshaft and drive pinion flange. If these marks are more than one - quarter turn apart, disconnect the driveshaft and reindex to align the marks as closely as possible. After any corrections are made, recheck for vibration at the road test speed. If the vibration is gone, install the wheels and road test the vehicle. If the vibration persists, proceed to following step.

4. Raise and support the vehicle. REFER to: (100-02 Jacking and Lifting)
   Jacking and Lifting - Overview (Description and Operation).
   Remove the wheels and tires.
   REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
   Rotate the driveshaft by turning the axle and measure the runout at the front, the center, and the rear of the driveshaft with the dial indicator gauge. If the runout exceeds 0.89 mm at the front or center, a new driveshaft must be installed. If the front and center are within this limit, but the rear runout is not, mark the rear runout high point and proceed to following step. If the runout is within specifications at all points, proceed to following step.

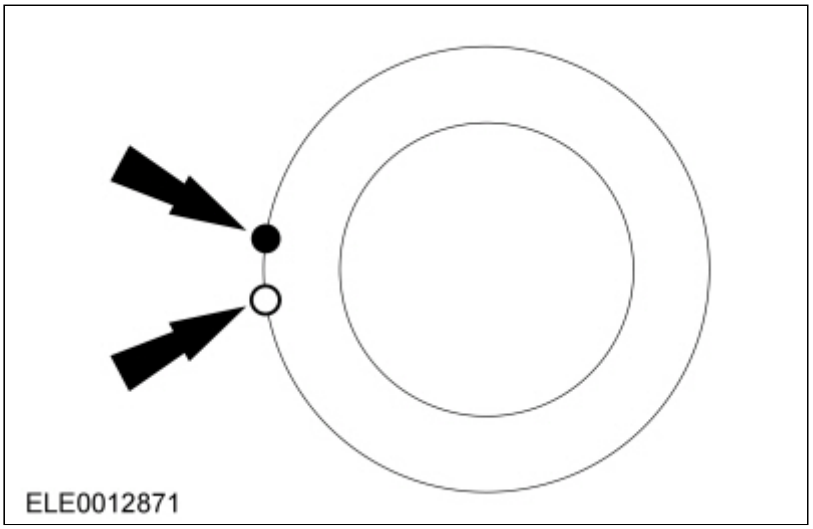

ELE0012870

5. **NOTE:** *Check the universal joints during re - indexing. If a universal joint feels stiff or gritty, install new universal joints.*

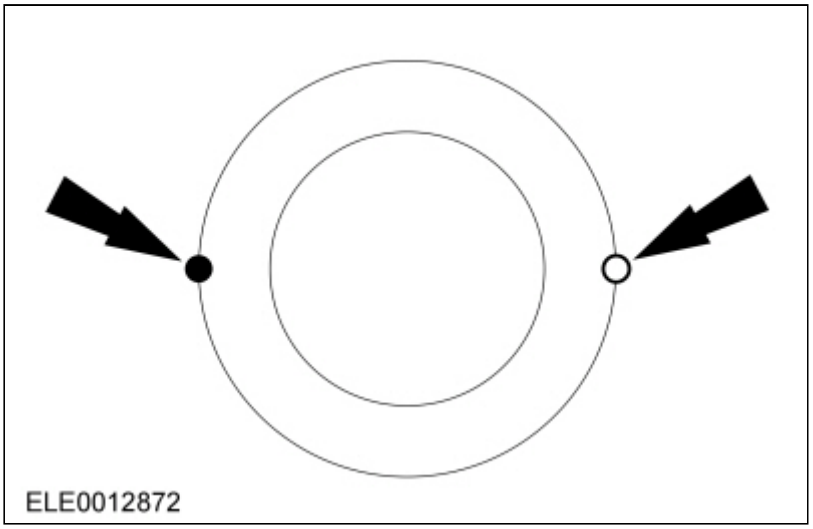
   Scribe alignment marks on the driveshaft and the drive pinion flange. Disconnect the driveshaft, rotate it one - half turn and reconnect it. Circular drive pinion flanges can be turned by one - quarter increments to fine tune the runout condition; half - round drive pinion flanges are limited to two positions. Check the runout at the rear of the driveshaft. If it is still over 0.89 mm, mark the high point and proceed to the following step. If the runout

is no longer excessive, check for vibration at the road test speed. If vibration is still present, reindex the driveshaft slip - yoke on the transmission output shaft one half - turn and road test the vehicle. If the vibration persists, proceed to the following Step.

6. Excessive driveshaft runout may originate in the driveshaft itself or in the drive pinion flange. To determine which, compare the two high points marked in previous steps. If the marks are close together, within about 25 mm, a new driveshaft must be installed and the vehicle road tested.



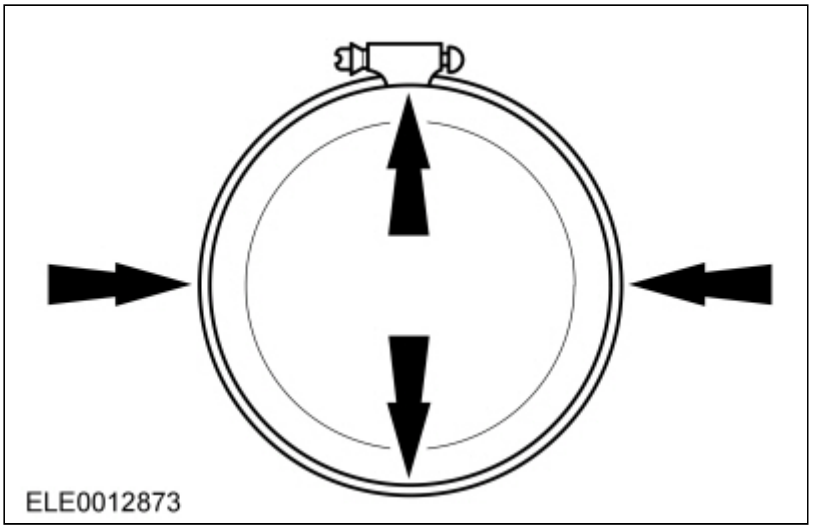
If the marks are on opposite sides of the driveshaft, the yoke or drive pinion flange is responsible for the vibration.



When installing a new drive pinion flange, the driveshaft runout must not exceed 0.89 mm. When runout is within limits, recheck for vibration at road speed. If vibration persists, balance the driveshaft.

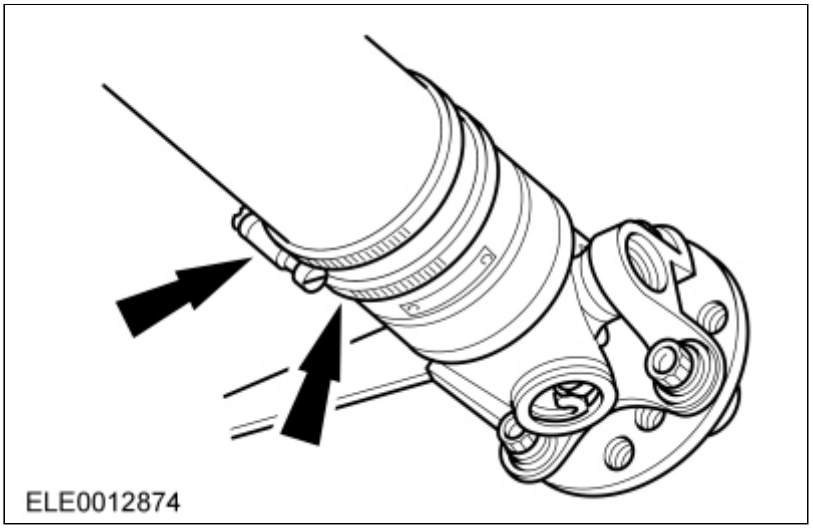
7. To balance the driveshaft, install one or two hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined by trial - and - error.

8. Mark the rear of the driveshaft into four approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1.

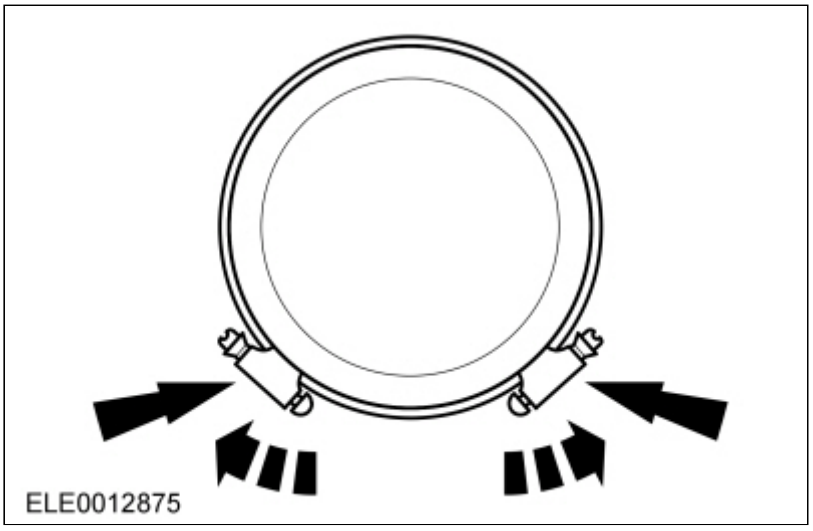


Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If two adjacent positions show equal improvement, position the clamp head between them.

9. If the vibration persists, add a second clamp at the same position and recheck for vibration.



If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in the previous step. Separate the clamp heads about 13 mm and recheck for vibration at the road speed.



Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

10. Install the wheels and road test the vehicle (vibration noticeable on the vehicle lift may not be evident during the road test). If the vibration is still not acceptable, install a new axle driveline vibration damper first (if equipped).

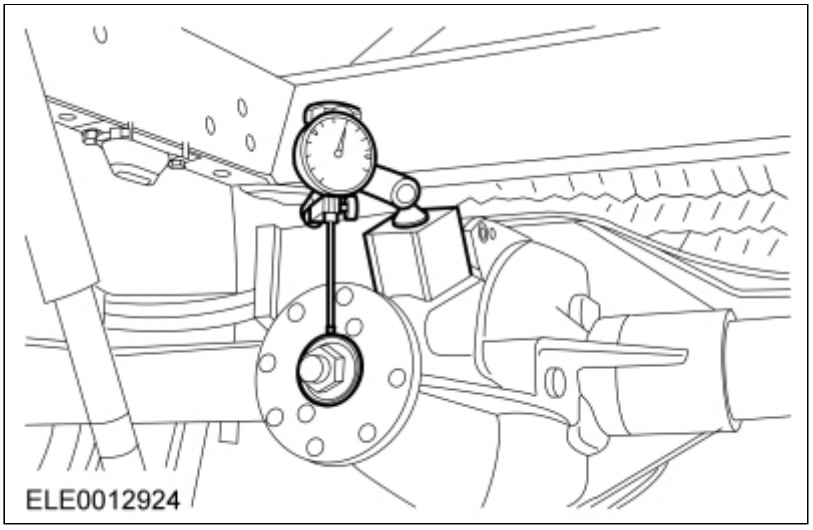
Driveshaft Vibrates

1. Road test the vehicle to determine the critical vibration points. Note the road speed, the engine rpm, and the gearshift lever positions at which the vibration occurs.
2. Stop the vehicle, place the gearshift lever in neutral and run the engine through the critical speed ranges determined in previous step.
3. If no vibration is felt, balance the driveshaft.

Drive Pinion Flange Runout Check

NOTICE: Drive pinion bearing preload must be reset if the drive pinion nut has been loosened or removed for drive pinion flange reindexing or renewal.

1. Raise and support the vehicle on a two post lift that supports the rear axle.
2. Remove the driveshaft.
   REFER to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
3. Check the drive pinion flange for damage.
4. Position a dial indicator gauge with magnetic base on the drive pinion flange.



If the drive pinion flange runout exceeds 0.25 mm, remove the drive pinion flange, reindex the drive pinion flange one - half turn on the drive pinion and install it. REFER to: (205-02 Rear Drive Axle/Differential)

Differential Carrier (Disassembly and Assembly).

5. Check the runout again. If necessary, rotate the drive pinion flange until an acceptable runout is obtained. If the drive pinion flange runout is still more than 0.25 mm, install a new drive pinion flange.
6. If excessive runout is still evident after installation of a new drive pinion flange, install a new ring gear set. Repeat the above checks until the runout is within specifications.
7. Install the driveshaft.
   REFER to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

Tooth Contact Pattern Check - Gearset

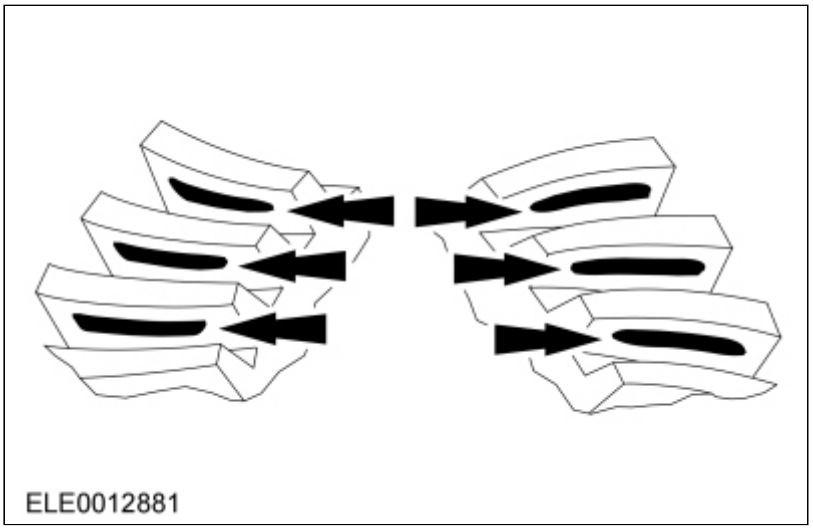
1. To check the gear tooth contact, paint the gear teeth with the special marking compound. A mixture that is too wet will run and smear; a mixture that is too dry cannot be pressed out from between the teeth.
2. Use a box wrench on the ring gear bolts as a lever to rotate the ring gear several complete revolutions in both directions or until a clear tooth contact pattern is obtained.
3. Certain types of gear tooth contact patterns on the ring gear indicate incorrect adjustment. Incorrect adjustment can be corrected by readjusting the ring gear or the drive pinion.

Contact Pattern Location

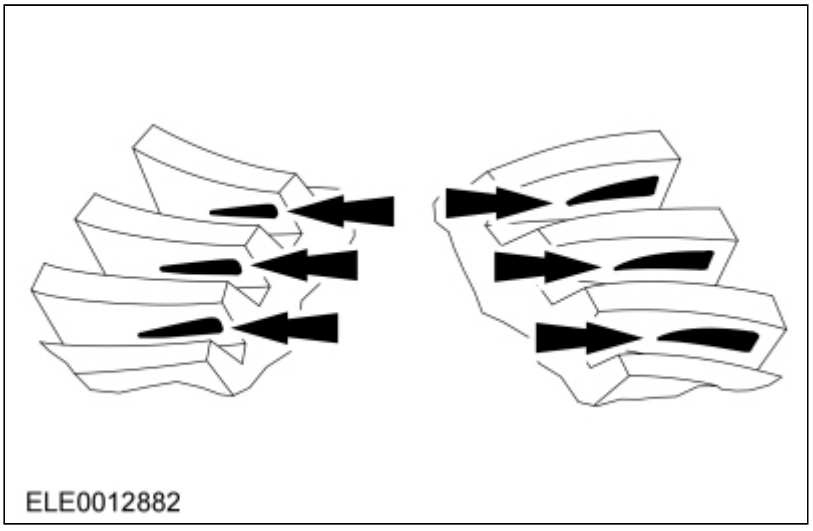
In general, acceptable ring gear tooth patterns must have the following characteristics:

- Drive pattern on the drive side ring gear well centered on the tooth.
- Coast pattern in the coast side ring gear well centered on the tooth.
- Clearance between the pattern and the top of the tooth.
- No hard lines where the pressure is high.

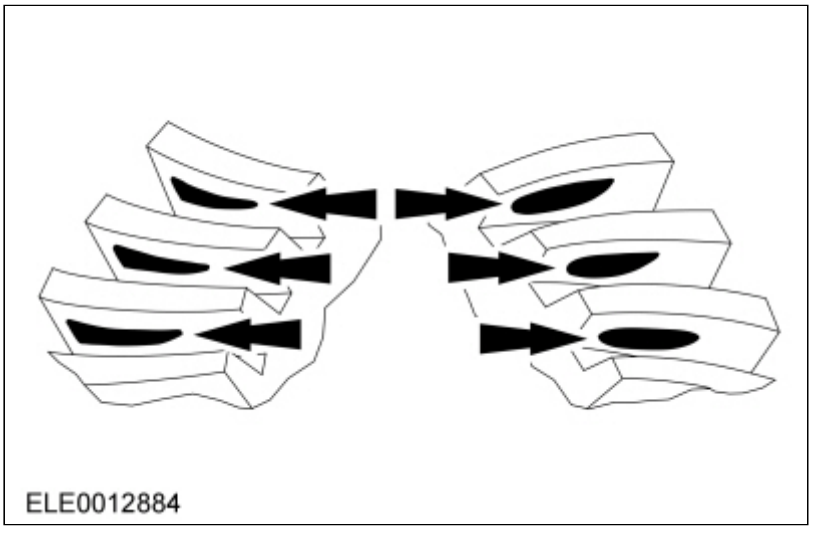
Acceptable ring gear tooth patterns for all axles.



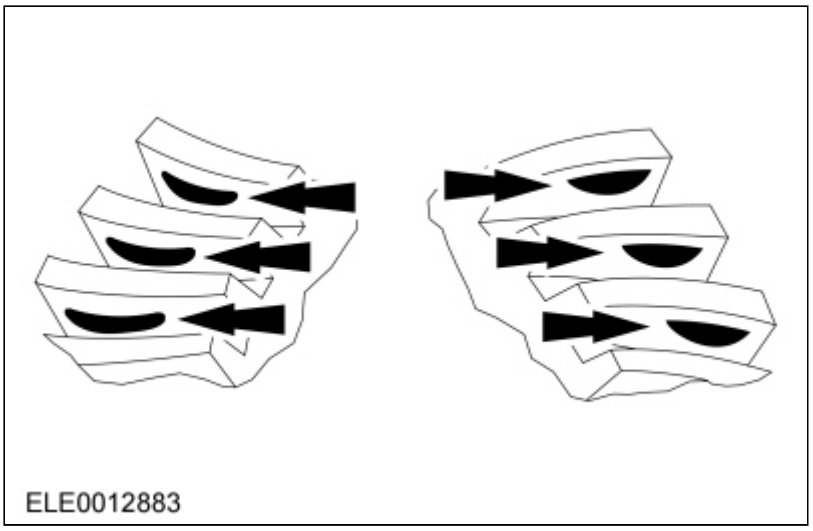
Correct backlash with a thinner drive pinion position shim.



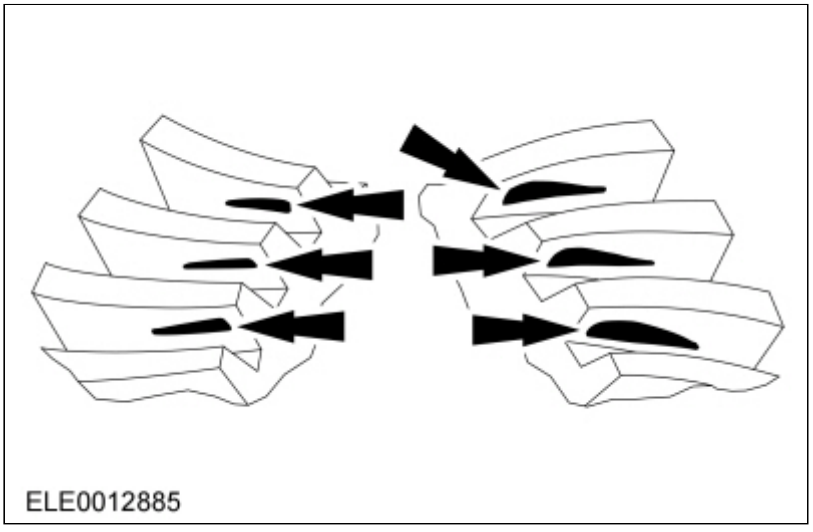
Correct backlash with a thicker drive pinion position shim required.



Correct drive pinion position shim that requires a decrease in backlash.



Correct drive pinion position shim that requires an increase in backlash.



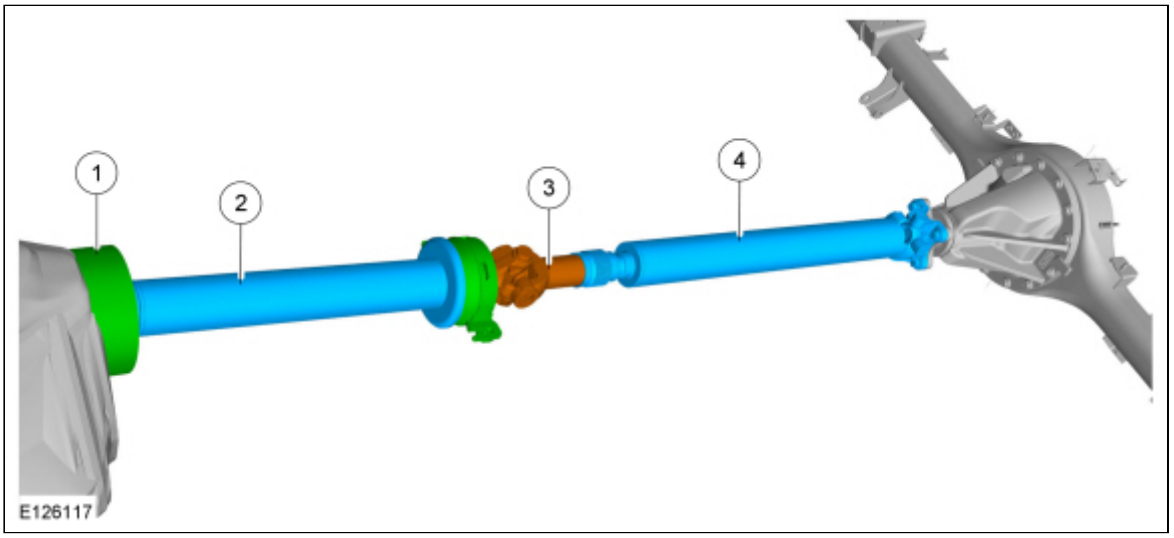
Copyright © 2016 Ford Motor Company

Driveshaft

Base Part Number: 4602

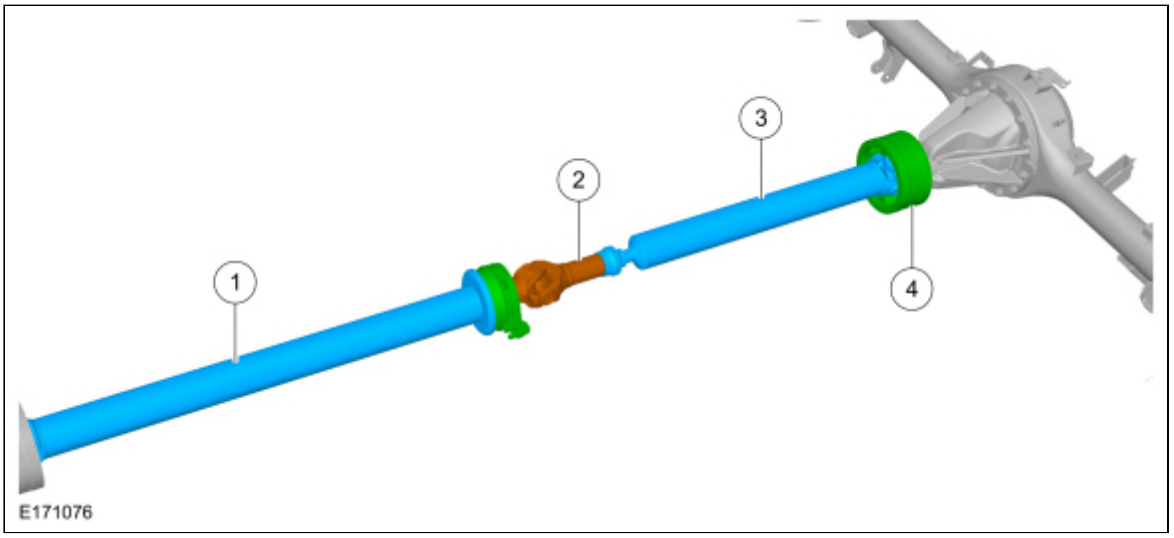
NOTE: *The position of the driveshaft damper may vary depending on vehicle variant.*

Vehicles with driveshaft damper fitted on transmission



Item	Part Number	Description
1	—	Driveshaft damper
2	—	Coupling shaft
3	—	Universal joint
4	—	Rear propeller shaft

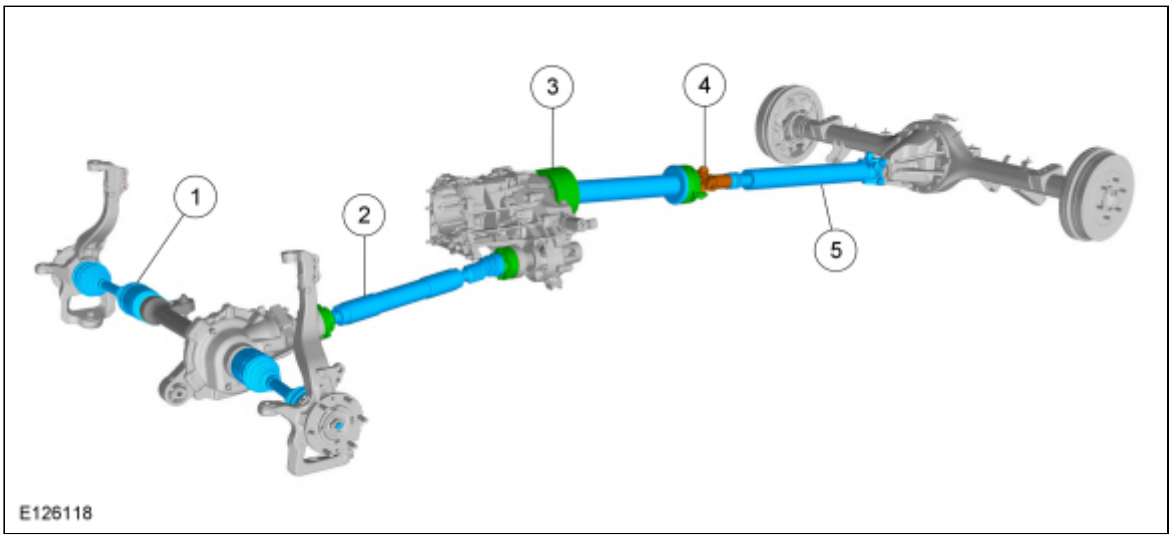
Vehicles with driveshaft damper fitted on rear axle



Item	Part Number	Description
1	—	Coupling shaft
2	—	Universal joint

3	—	Rear propeller shaft
4	—	Driveshaft damper

4x4



Item	Part Number	Description
1	—	Front half shafts
2	—	Front propeller shaft
3	—	Driveshaft damper (position may vary)
4	—	Universal joint
5	—	Rear propeller shaft

Driveshaft Damper Location

Engine	Transmission	Drive	Final Drive Ratio	Driveshaft Damper Location
2.5L Duratec-HE	MT75	4x2	5.29	Rear axle
2.5L Duratec-HE	MT75	4x2/4x4	4.70	Transmission
2.2L Duratorq-TDCi	MT75	4x2/4x4	4.70	Transmission
2.2L Duratorq-TDCi	MT82	4x2/4x4	3.31/3.55	Transmission
2.2L Duratorq-TDCi	6R80	4x2/4x4	3.73	Transmission
3.2L Duratorq-TDCi	MT82	4x2/4x4	3.31/3.55	Transmission
3.2L Duratorq-TDCi	6R80	4x2/4x4	3.73	Rear axle

Copyright © 2016 Ford Motor Company

Driveshaft

Base Part Number: 4602

For additional information, refer to Section 205-00.

Copyright © 2016 Ford Motor Company

Driveshaft Angle Measurement

Check

NOTE: *This procedure does not apply to CV joints, flex couplers or double cardan joints that are used in some driveshafts. This check is for single-cross and roller-style joints found in the driveshafts.*

NOTE: *Prior to checking driveline angularity, inspect the U-joints for correct operation.*

NOTE: *An incorrect driveline angle can cause a vibration or shudder.*

NOTE: *Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft and the rear axle pinion. Factors determining driveline angularity include ride height, rear spring and engine mounts.*

1. **NOTE:**

   - *Special Tool(s): Anglemaster II Driveline Inclinometer/Protractor 164-R2402. Carry out the following preliminary setup steps:*

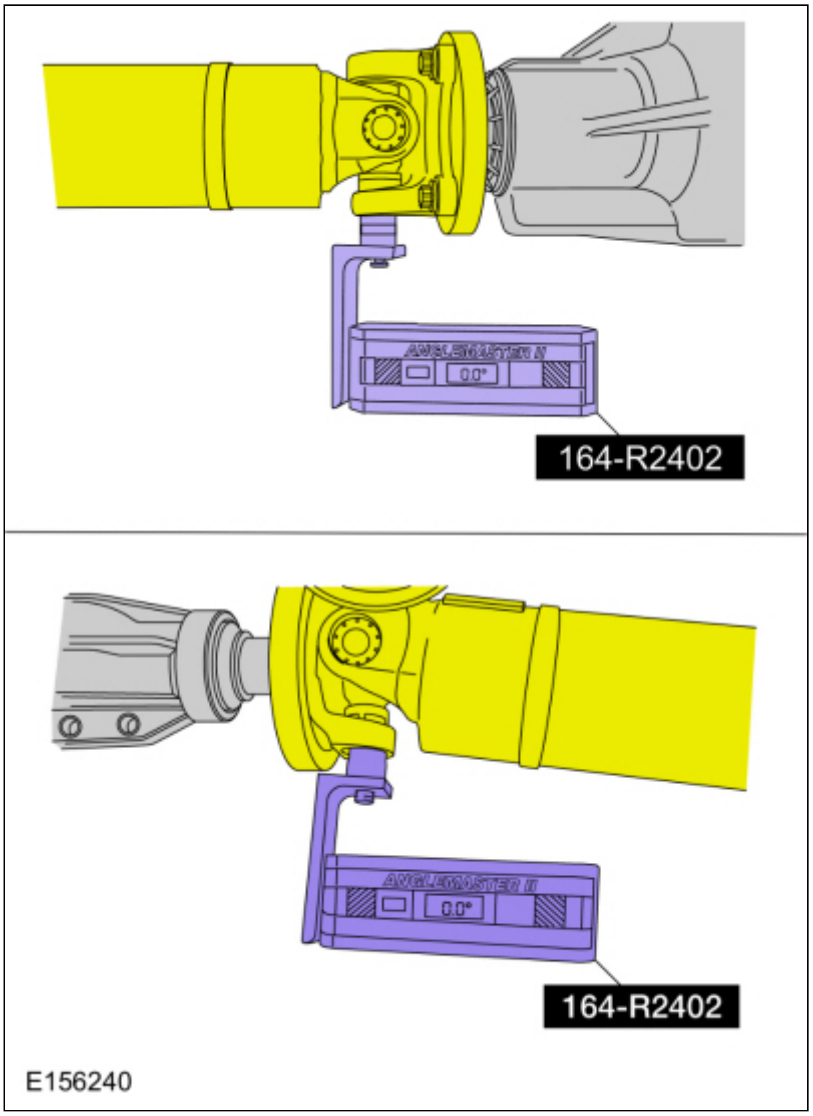
   1. Inspect the U-joints for correct operation.
   2. Park the vehicle on a level surface such as a drive-on hoist, or back onto a front end alignment rack.
   3. Verify the curb position ride height is within specifications with the vehicle unloaded and all of the tires are inflated to their normal operating pressures.
   4. Calibrate the Anglemaster II Driveline Inclinometer/Protractor by placing it on a clean, flat level section of the frame rail and press the ALT-ZERO button.

Vehicles with flat-flanged, split-pin or slip-flanged U-joints

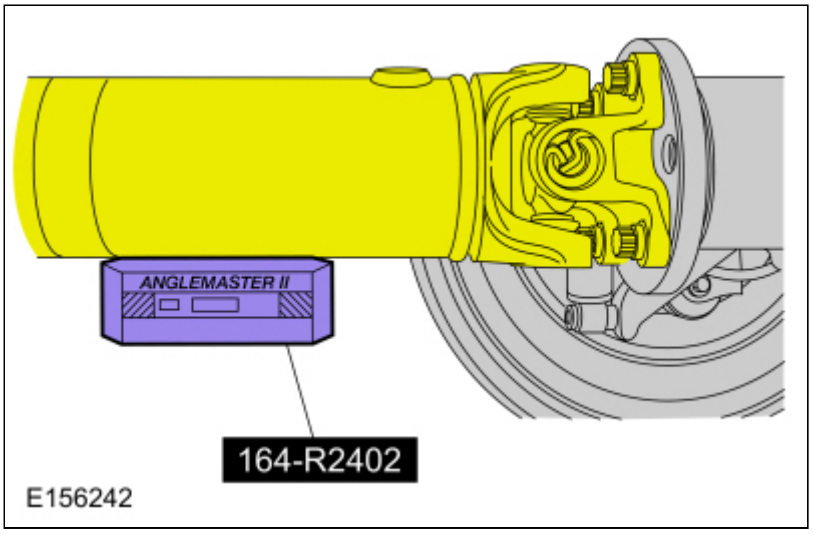
2. **NOTE:** *If equipped, remove the snap ring to allow access to the base of the U-joint cup. Make sure the Anglemaster II Driveline Inclinometer/Protractor is seated against the U-joint cup.*

   NOTE: *Rotate the driveshaft until the flange U-joint cup is parallel with the floor. This will simplify taking measurements.*

   Special Tool(s): Anglemaster II Driveline Inclinometer/Protractor 164-R2402. Check and record the flange angle as angle A.



3. Special Tool(s): Anglemaster II Driveline Inclinometer/Protractor 164-R2402. Measure the slope of the connecting component. Record the measurement of the component angle as angle B.

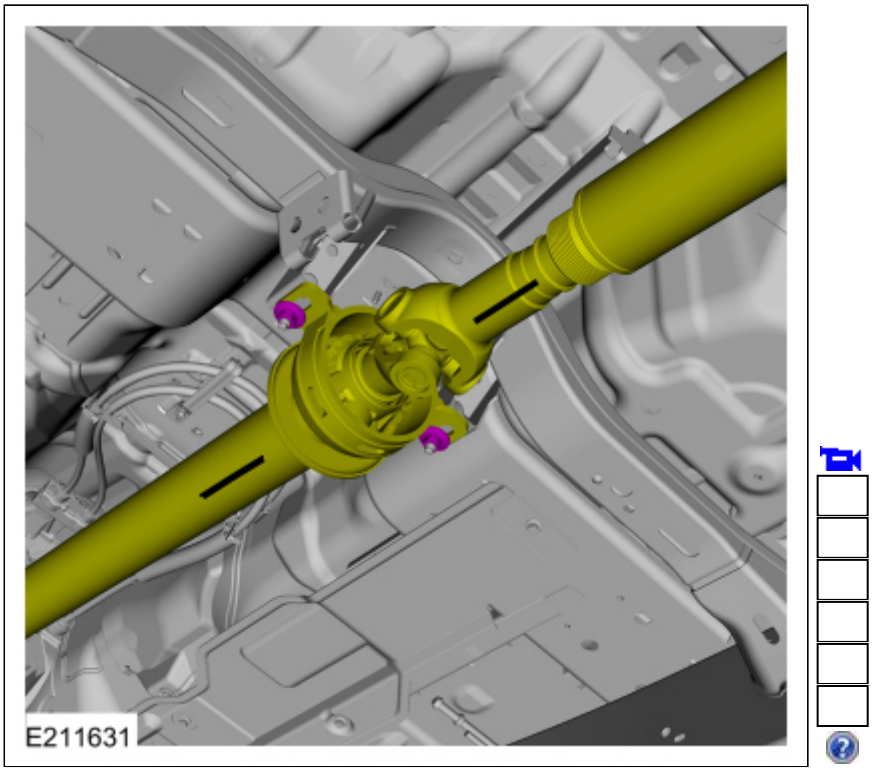


Multiple piece driveshafts

4. **NOTE:** *Repeat this step for each center support bearing on the driveshaft.*

   NOTE: *It is not necessary to remove the U-joint snap ring, if equipped, for these measurements.*

   Special Tool(s): Anglemaster II Driveline Inclinometer/Protractor 164-R2402. Measure the slope of the components in front and behind the center support bearing U-joint in the area indicated. Record the front component as angle A and the rear component as angle B.



All vehicles

5. **NOTE:** *When 2 connected components slope in the same direction, subtract the smallest number from the larger number to find the U-joint operating angle. When 2 connected components slope in the opposite direction, add the measurements to find the U-joint operating angle.*

   Calculate the difference in the slope of the components to determine the U-joint operating angle.

6. **NOTE:**

   - *The U-joint operating angle is the angle formed by 2 yokes connected by a cross and bearing kit. Ideally, the operating angles on each connection of the driveshaft must:*

   1. be equal or within one degree of each other.
   2. have a 3 degree maximum operating angle.
   3. have at least one-half of one degree continuous operating angle.

7. If the angle is not within specifications, repair or adjust to obtain the correct angle. Inspect the engine mounts, transmission mounts, center support bearing mounting, rear suspension, rear axle, rear axle mounting or the frame for wear or damage.

Copyright © 2016 Ford Motor Company

Driveshaft Runout and Balancing

Base Part Number: 04602

Special Tool(s) / General Equipment

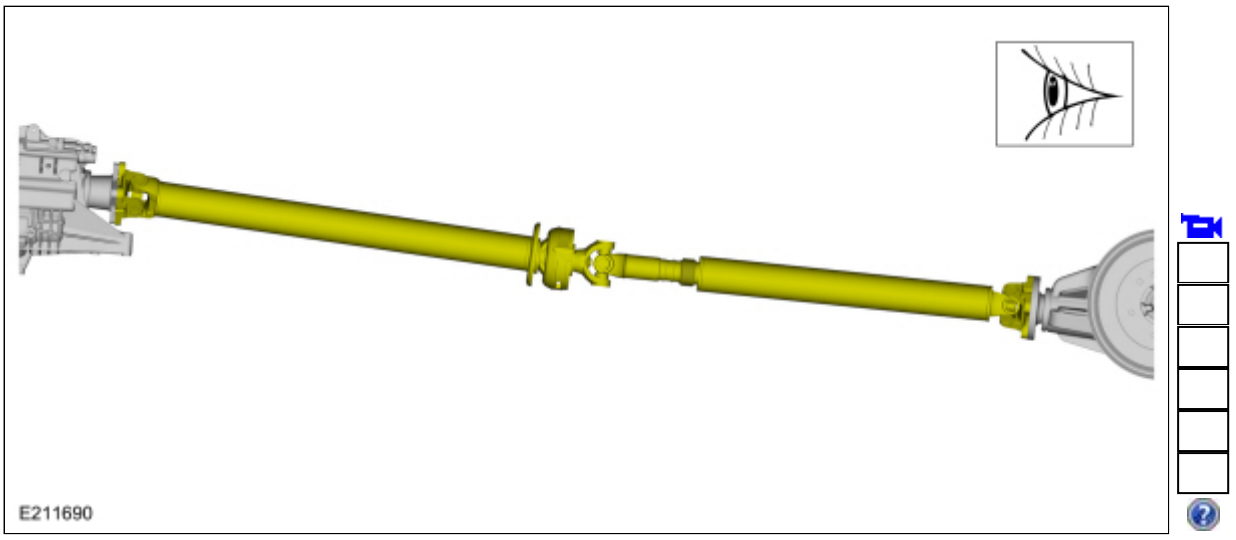
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge

Inspection

NOTE: *Driveline vibration exhibits a higher frequency and lower amplitude then high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is noticed at various speeds. Driveline vibration can be perceived as a tremor in the floorpan or heard as a rumble, hum or boom.*

NOTE: *Refer to Specifications in this section for runout specifications.*

1. **NOTE:** *Do not make any adjustments before carrying out a road test. Do not change the tire pressure or the vehicle load.*
    - *Carry out a visual inspection of the vehicle. Operate the vehicle and verify the condition by reproducing it during the road test.*
    - The concern should be directly related to vehicle road speed. not affected by acceleration or deceleration or could be reduced by coasting in NEUTRAL.
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. **NOTE:** *The driveshaft should be kept at an angle equal to or close to the curb-weighted position. Use a twin-post hoist or a frame hoist with jackstands.*
    - *Inspect the driveshaft for damage, undercoating or incorrectly seated U-joints. Rotate the driveshaft slowly by hand and feel for binding or end play in the U-joint trunions. Remove the driveshaft. Inspect the slip yoke splines for any galling, dirt, rust or incorrect lubrication. Clean the driveshaft or install new U-joints as necessary. Install a new driveshaft if damaged. After any corrections or new components are installed, recheck for the vibration at the road test speed.*
    - *If the vibration persists after inspection, measure the driveshaft runout.*

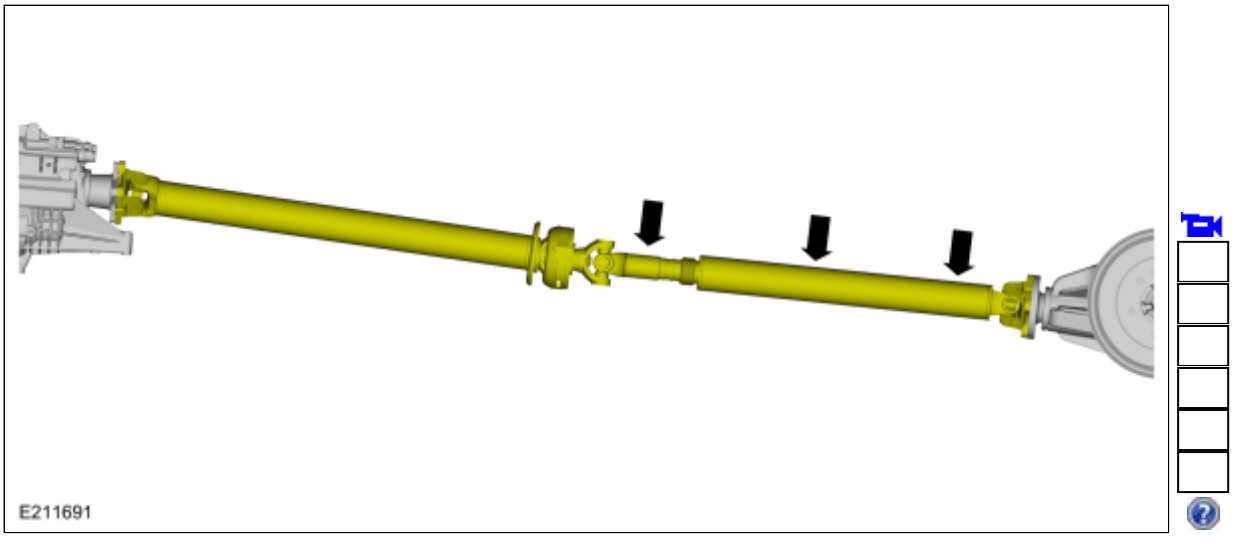


Check

1. **NOTE:**

- *Measure and check for the specified maximum value. Install the Dial Indicator Gauge with Holding Fixture. Rotate the driveshaft by turning the axle and measure the runout at the front, center and rear of the driveshaft. Multiple piece driveshaft measure each section at the front, center and rear.*

1. If the runout exceeds 1 mm (0.040 in) at the front or center, install a new driveshaft.
   Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.
2. If the front and center is within 1 mm (0.040 in) , but the rear runout is not, index-mark the rear runout high point and proceed to step 2.
3. If the runout is within 1 mm (0.040 in) at all points, recheck for vibration at road test speed. If the vibration persists, balance the driveshaft. Refer to Driveshaft Balancing in this procedure.



2. **NOTE:** *Circular pinion flanges can be turned in 90 degree or one-fourth increments. Half-round pinion flanges are limited to 2 positions. CV joint pinion flanges that have 6 bolts, can be turned in 60 degree or one-sixth increments.*

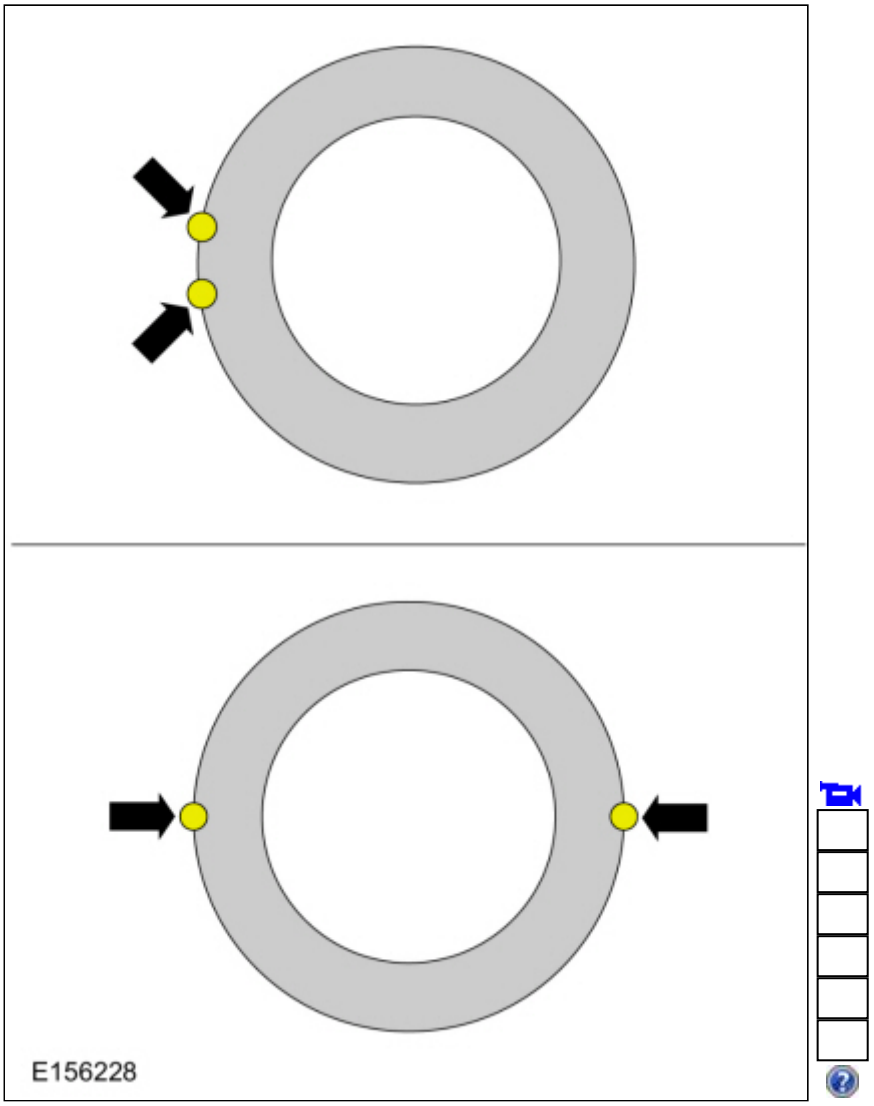
   - *Index-mark the driveshaft to the pinion flange. Disconnect the driveshaft and rotate it 180 degrees. Reconnect the driveshaft. Recheck the runout at the rear of the driveshaft.*

   1. If the runout is still over specification, mark the high point and proceed to Step 3.
   2. If the runout is within specification, check for the vibration at the road test speed. If the vibration is still present, balance the driveshaft. Refer to Driveshaft Balancing in this procedure.

3. **NOTE:**

   - *Excessive driveshaft runout can originate in the driveshaft itself or from the pinion flange. To find the source, compare the 2 high points previously determined.*

   1. If the index marks are close together, within 25 mm (1 in), the driveshaft is eccentric. Install a new driveshaft.
   2. If the marks are on opposite sides of the driveshaft, 180 degrees apart, the slip yoke or pinion flange is responsible. Check the pinion flange runout. If the pinion flange runout exceeds specifications, a bent pinion is indicated.
      Refer to: Rear Drive Axle and Differential (205-02 Rear Drive Axle/Differential) .
   3. If the pinion flange and pinion runouts are within specifications, road test and check for the vibration at the road test speed. If the vibration persists, balance the driveshaft. Refer to Driveshaft Balancing in this procedure.



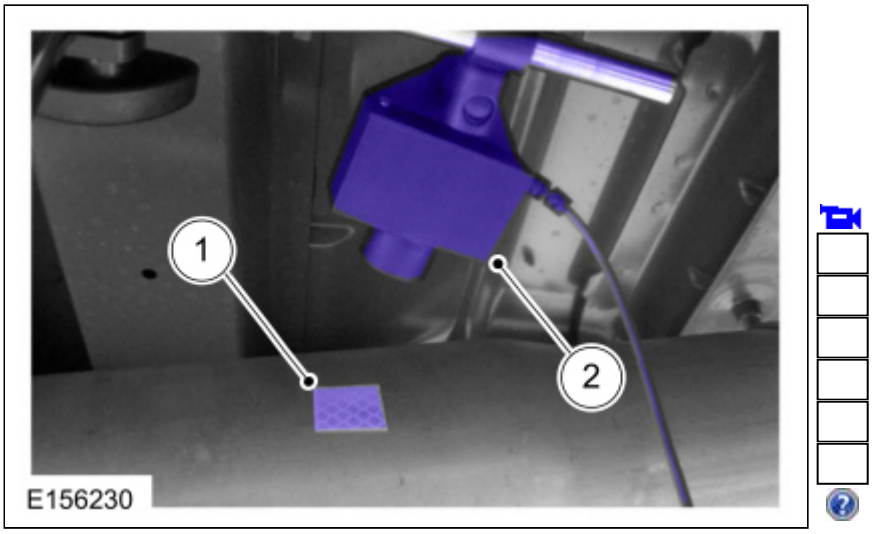
Driveshaft Balancing – Using the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)

4. Special Tool(s): Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018. Working under the vehicle, install an accelerometer. The accelerometer can be attached and mounted near either the transmission or differential end of the driveshaft.

5. **NOTE:**

    - *Clean an area of the driveshaft and install the reflective tape, then install the photo-tachometer sensor. The sensor should be placed at approximately a 20-degree angle from perpendicular to the surface of the reflective tape. Make sure the sensor does not get moved during the balance procedure.*

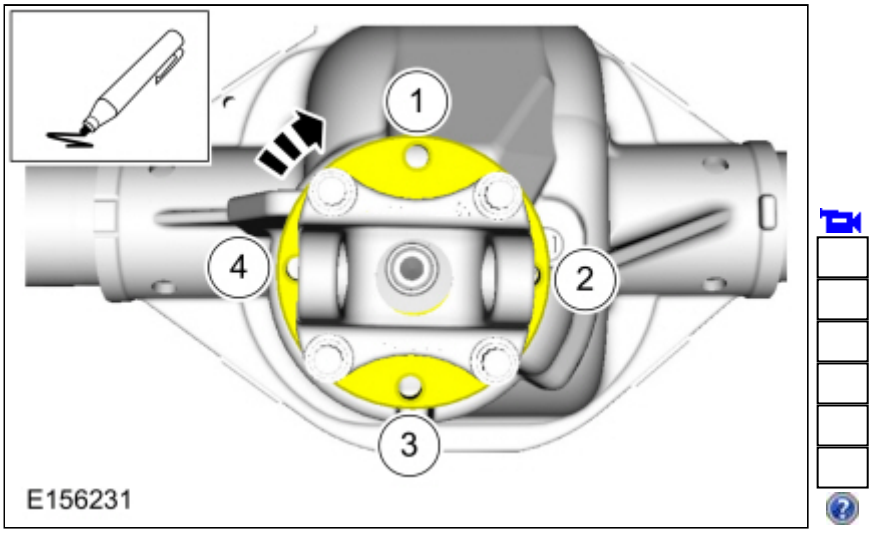
    1. Reflective tape.
    2. Photo-tachometer sensor.



6. Special Tool(s): Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018. Run a driveshaft balance test with the driveshaft unmodified.
   Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.

Vehicles with tapped pinion flanges

7. Label the tapped holes in the pinion flange numerically, starting at the top hole as 1. Mark the remaining holes 2, 3, 4, (depending on flange type, 5 and 6 may also be needed). Label in the direction of rotation.



8. Special Tool(s): Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018. Run a second test with the 12 mm (0.47 in) test weight set screw in the No. 1 hole, previously marked on the pinion flange.

9. Remove the test weight, then install the weight combination directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix).

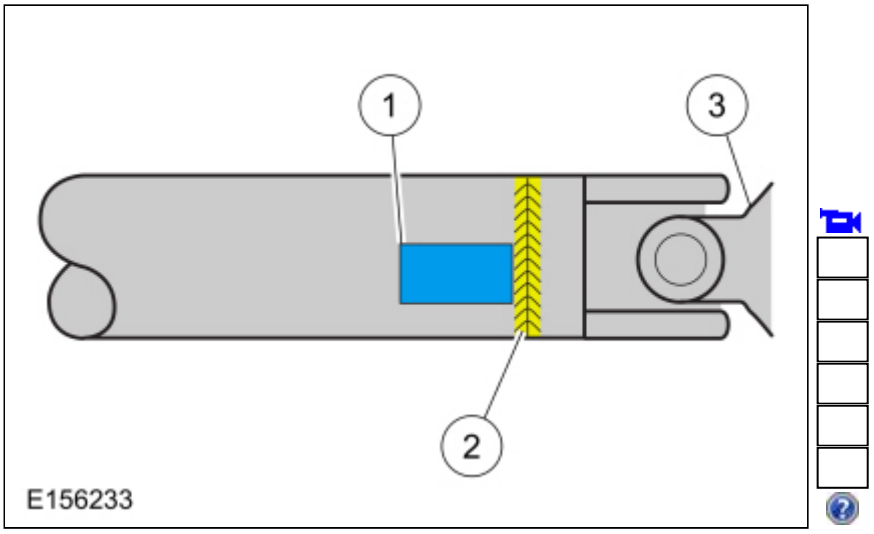
Vehicles without tapped pinion flanges

10. **NOTE:**

    - *Special Tool(s): Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018. Run a second test with a test weight. Using a metal band, secure the test weight to the end of the driveshaft. The weight should be placed at the end of the driveshaft tube, as close to the tube-to-yoke weld seam as possible. Mark the location of the test weight on the driveshaft, as shown in the figure below.*

1. Test weight.
2. Tube-to-yoke weld seam.
3. Driveshaft pinion flange.

- Select the test weight based on driveshaft size. Larger driveshafts use 10 g (0.353 oz). Smaller driveshafts use 5 g (0.176 oz).

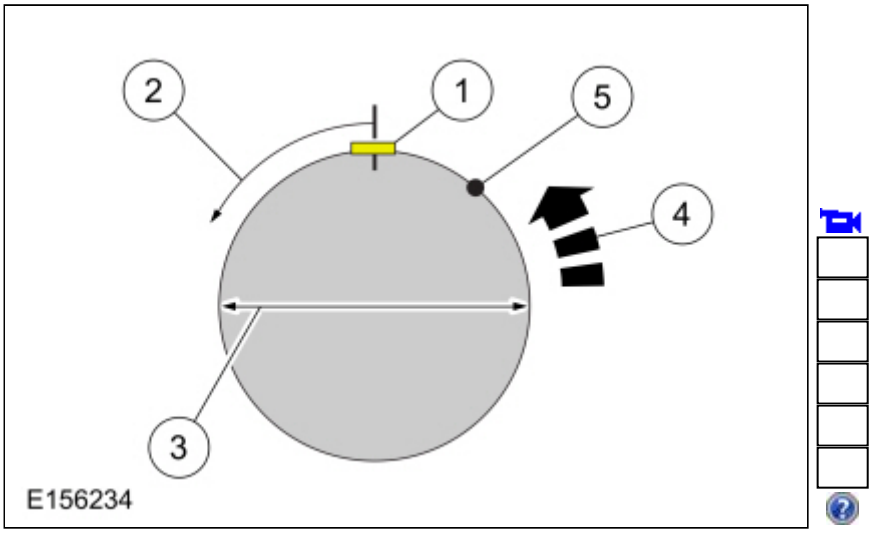


11. **NOTE:**

    - *Remove the test weight, then install the recommended weight at the position directed by the Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix). Using a metal band and epoxy, secure the test weight to the driveshaft, as shown in the figure below.*

1. Test weight.
2. Measure in this direction.
3. Driveshaft diameter.
4. Directional rotation.
5. Balance weight relative to test weight centerline.

- The results are displayed with respect to the location to where the test weight was placed.



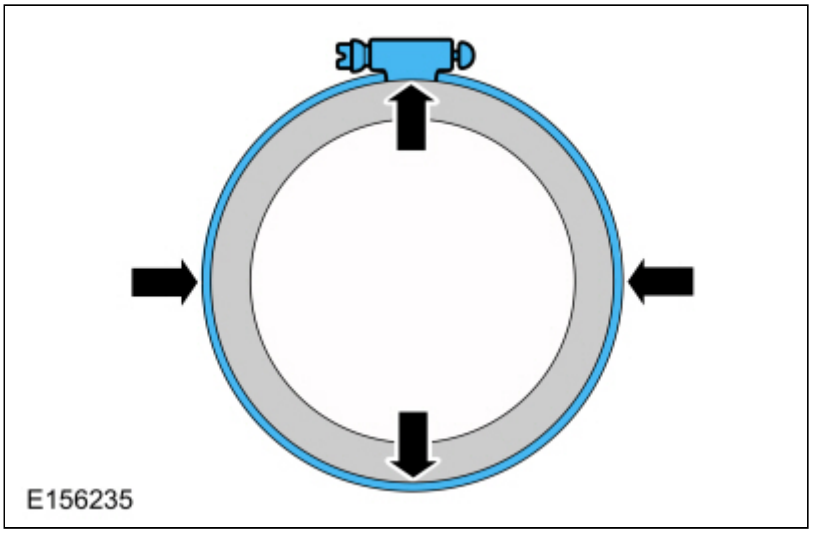
All vehicles

12. Special Tool(s): Mastertech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) 257-00018. Run a third test to verify the repair.

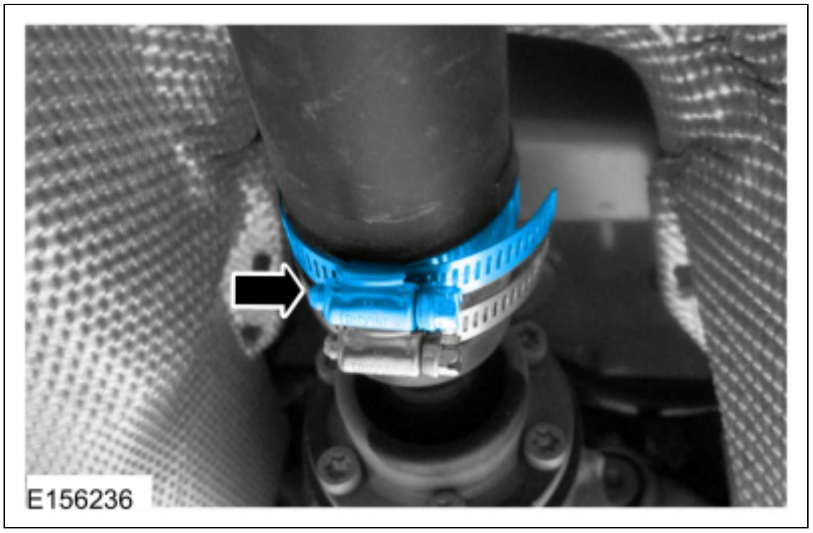
Driveshaft Balancing – Hose Clamp Method

13. Install 1 or 2 hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined through trial and error.

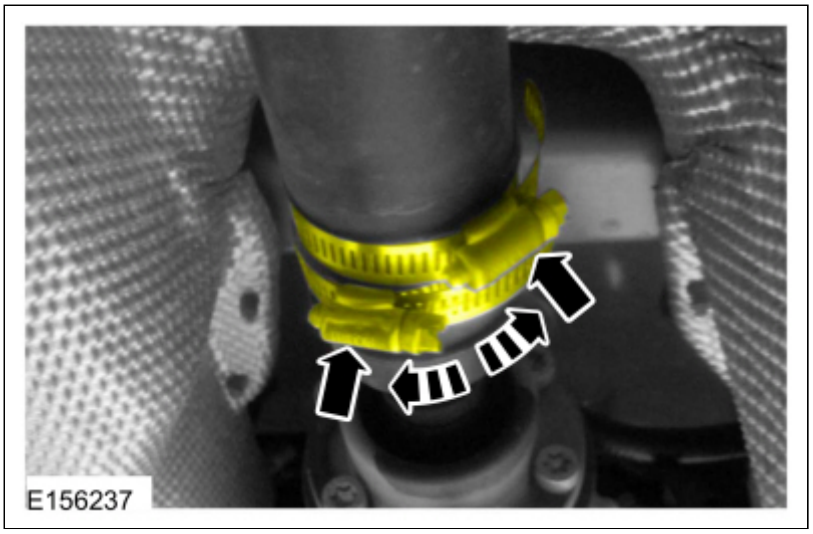
14. Mark the rear of the driveshaft into 4 approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1, as shown in the figure below. Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If 2 adjacent positions show equal improvement, position the clamp head between them.



15. If the vibration persists, add a second clamp at the same position and recheck for vibration.



16. If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 14. Separate the clamp heads about 13 mm (1/2 in) and recheck for vibration at the road speed.



17. Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

Copyright © 2016 Ford Motor Company

Front Driveshaft - 4WD

Removal

NOTICE: Always disconnect the front driveshaft from the transfer case first. Otherwise, the weight of the driveshaft can pinch the boot between the driveshaft and the constant velocity (CV) joint flange which can cause the boot to tear.

NOTICE: It is possible to fit the driveshaft incorrectly. Note the orientation before removal.

NOTE: *A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.*

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

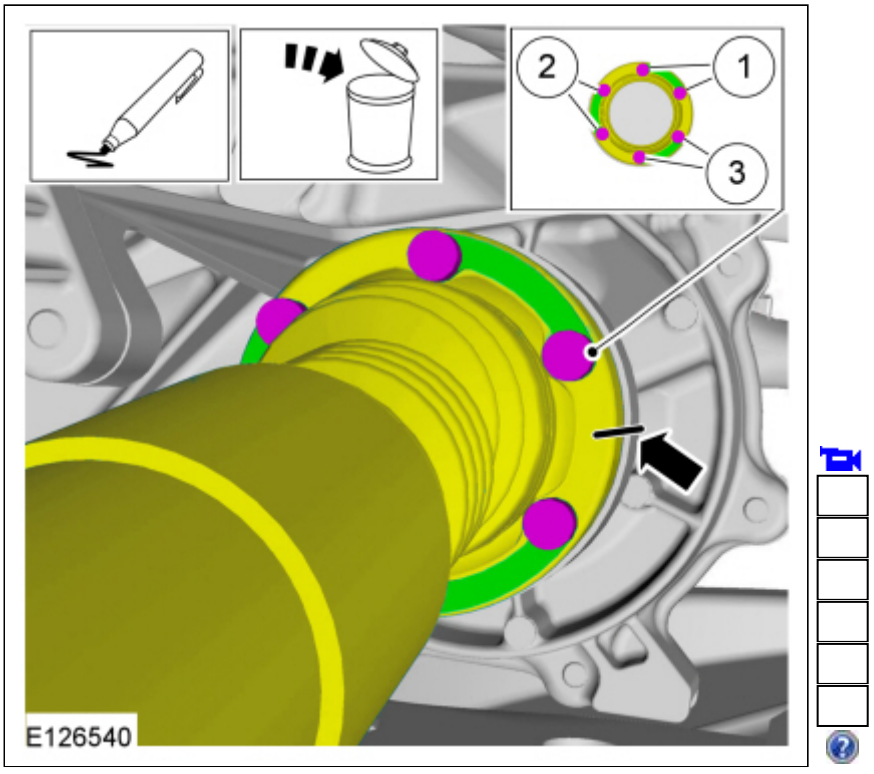
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

2. **NOTICE: To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.**

   NOTICE: Do not reuse the bolts, install new bolts or damage to the vehicle may occur.

   NOTE: *Lock the driveshaft before removing the bolts to avoid slipping.*

   Torque:
   Stage 1: 15 Nm
   Stage 2: 180°



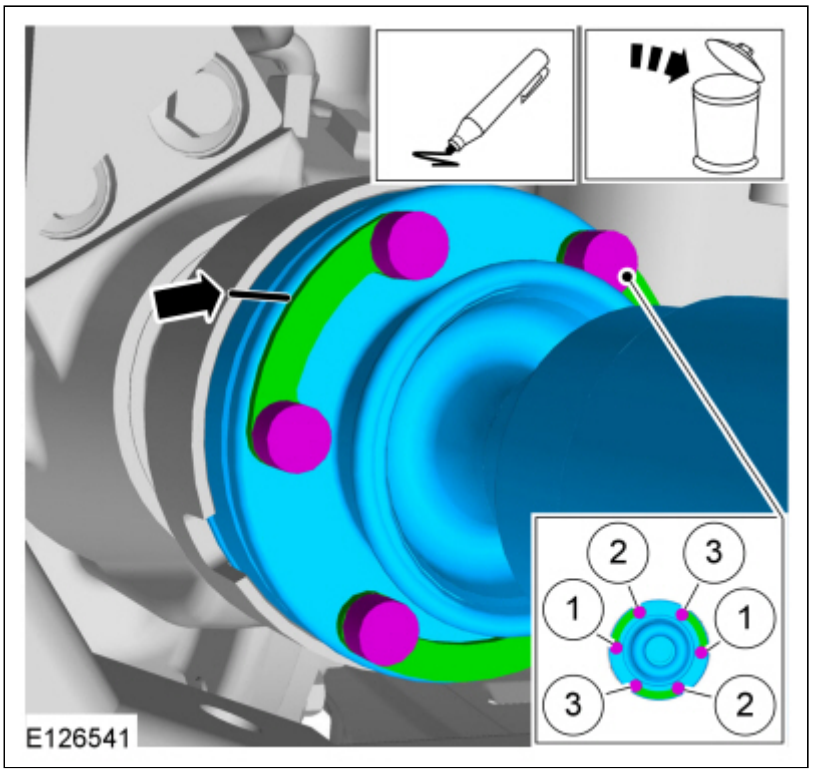
3. **NOTICE: To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.**

   NOTICE: Do not reuse the bolts, install new bolts or damage to the vehicle may occur.

   NOTE: *Lock the driveshaft before removing the bolts to avoid slipping.*

   Torque:
   Stage 1: 15 Nm

Stage 2: 180°



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Driveshaft

Removal

WARNING: The normal operating temperature of the exhaust system is very high. Never attempt to remove any part of the system until it has cooled. Be especially careful when working around the catalytic converters. The temperature of the converter rises to a high level after only a few minutes of engine operation. Failure to follow these instructions may result in personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

2. **NOTE:** *The position of the driveshaft damper may vary depending on vehicle variant.*

   For further information on driveshaft damper location.
   Refer to: Driveshaft (205-01 Driveshaft, Description and Operation).

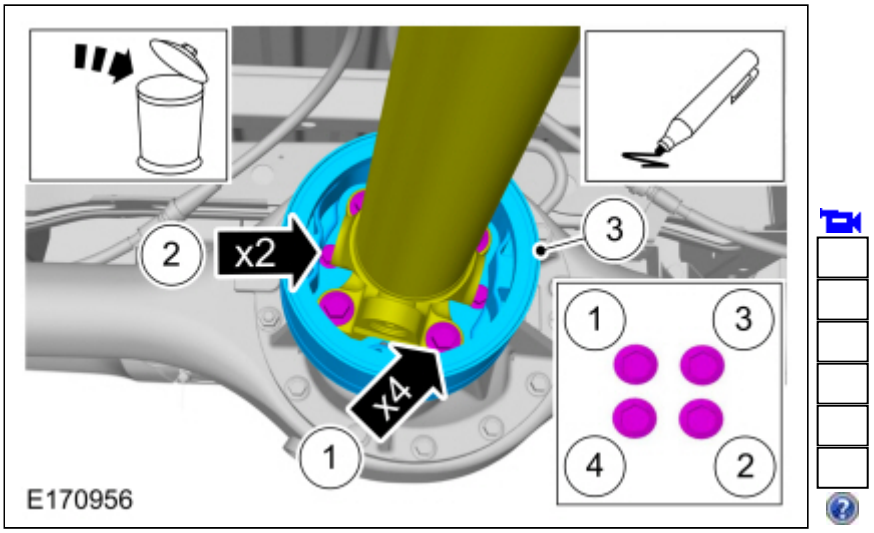
Vehicles with driveshaft damper fitted on rear axle

3. **NOTICE: Note the position of the component before removal.**

   NOTE: *Make sure that new bolts are installed.*

   NOTE: *Make sure that the damper is fully seated on the axle flange and square to the flange.*

   Torque:
   1: 110 Nm
   2: 10 Nm



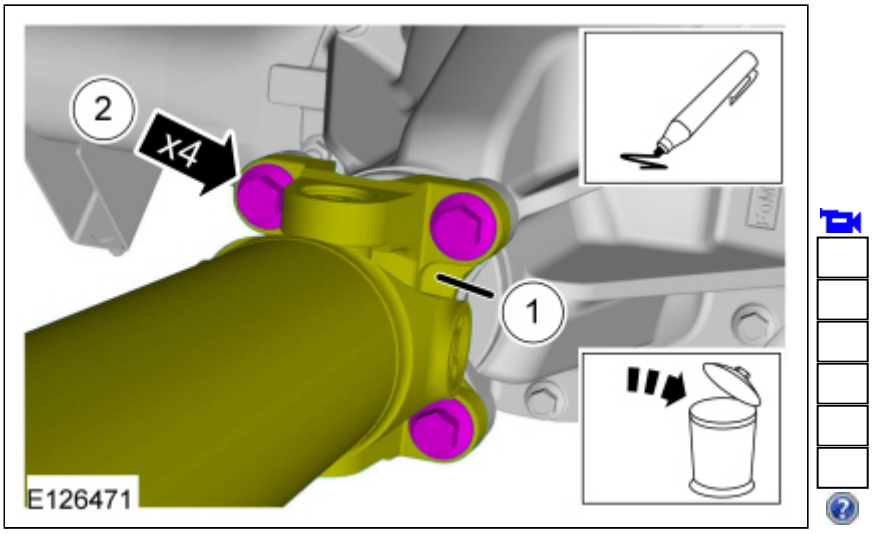
Vehicles without driveshaft damper fitted on rear axle

4. **NOTICE: Note the position of the component before removal.**

   NOTE: *Make sure that new bolts are installed.*

   NOTE: *Make sure that the damper is fully seated on the transmission flange and square to the flange.*

   Torque: 110 Nm



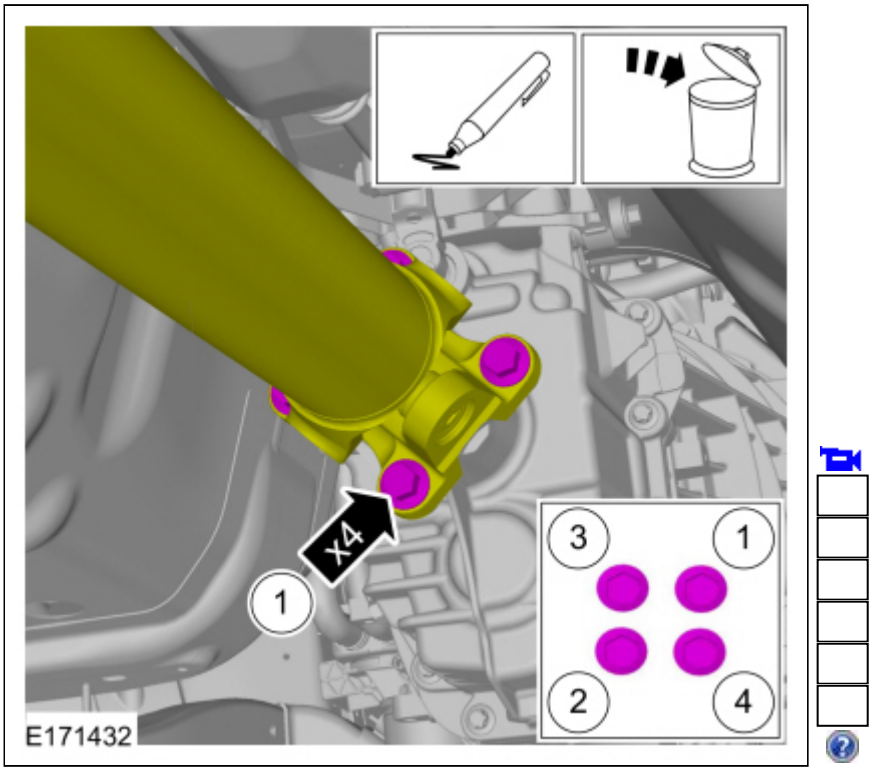
Vehicles without driveshaft damper fitted on transmission

5. **NOTICE: Note the position of the component before removal.**

   NOTE: *Make sure that new bolts are installed.*

   NOTE: *Make sure that the damper is fully seated on the transmission flange and square to the flange.*

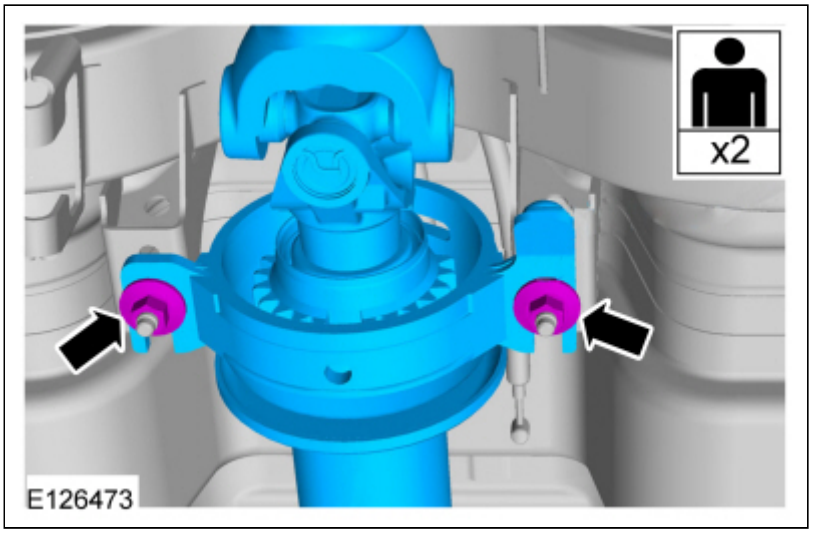
   Torque: 110 Nm



All vehicles

6. **NOTE:** *Make sure that the center bearing is aligned with the propeller shaft and mounting bracket so that the FoMoCo on the center bearing is on the topside.*

   Torque: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Driveshaft Universal Joint

Special Tool(s) / General Equipment

	205-086 (T74P-4635-C) Installer/Remover, C-Frame and Screw
Vise	

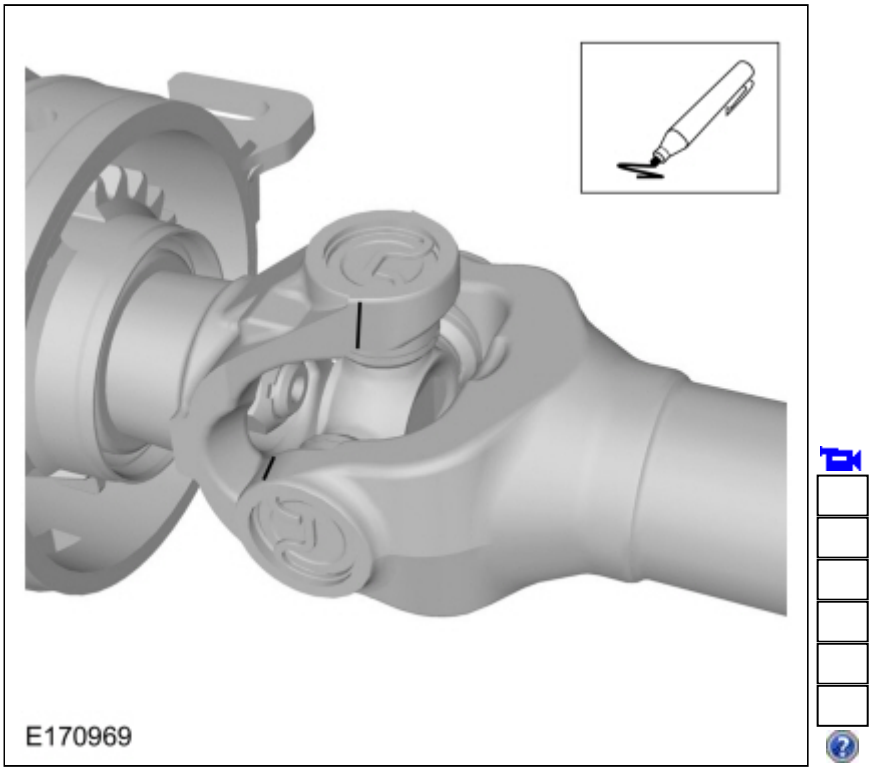
DISASSEMBLY

1. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

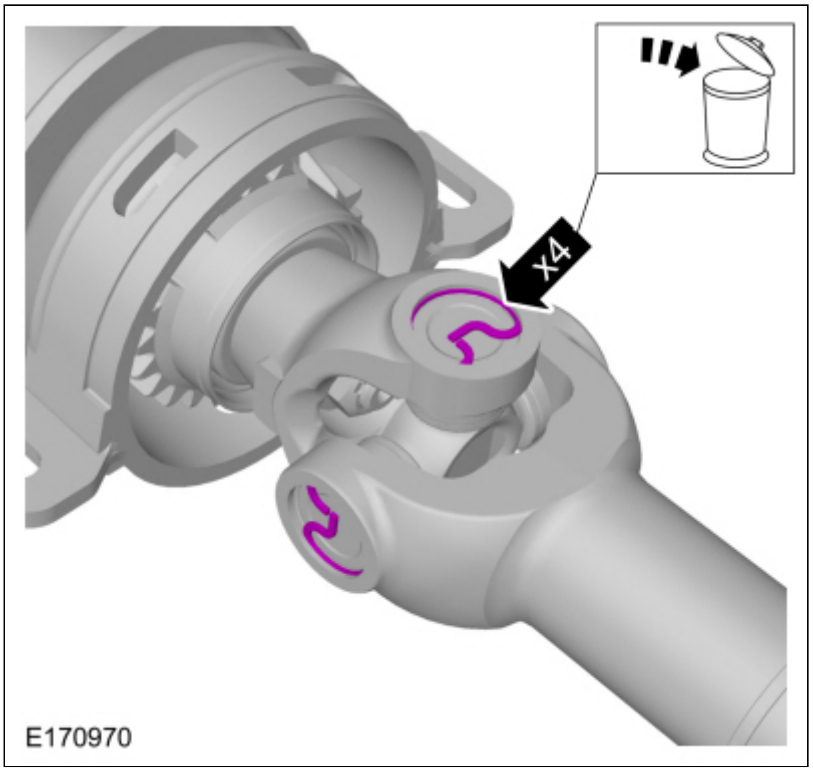
2. **NOTE:** *Do not clamp the driveshaft assembly in the jaws of a vise or similar holding fixture. Denting or localized fracturing may result, causing driveshaft failure or vibration during vehicle operation.*

   NOTE: *Place the driveshaft on a suitable workbench.*

3. **NOTE:** *If the components are not marked and therefore installed incorrectly, driveshaft imbalance can occur.*

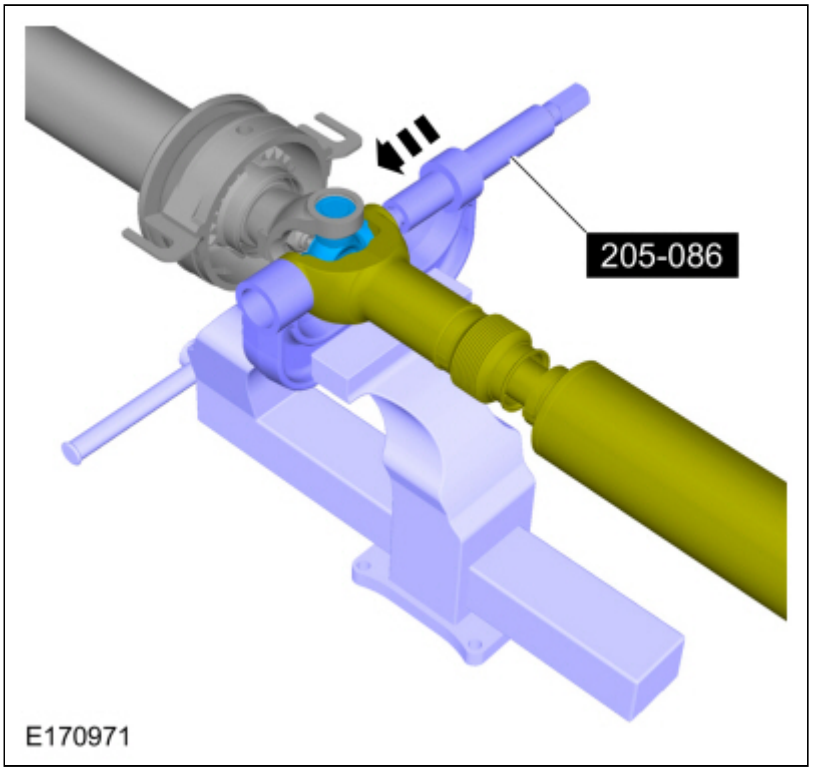


4.



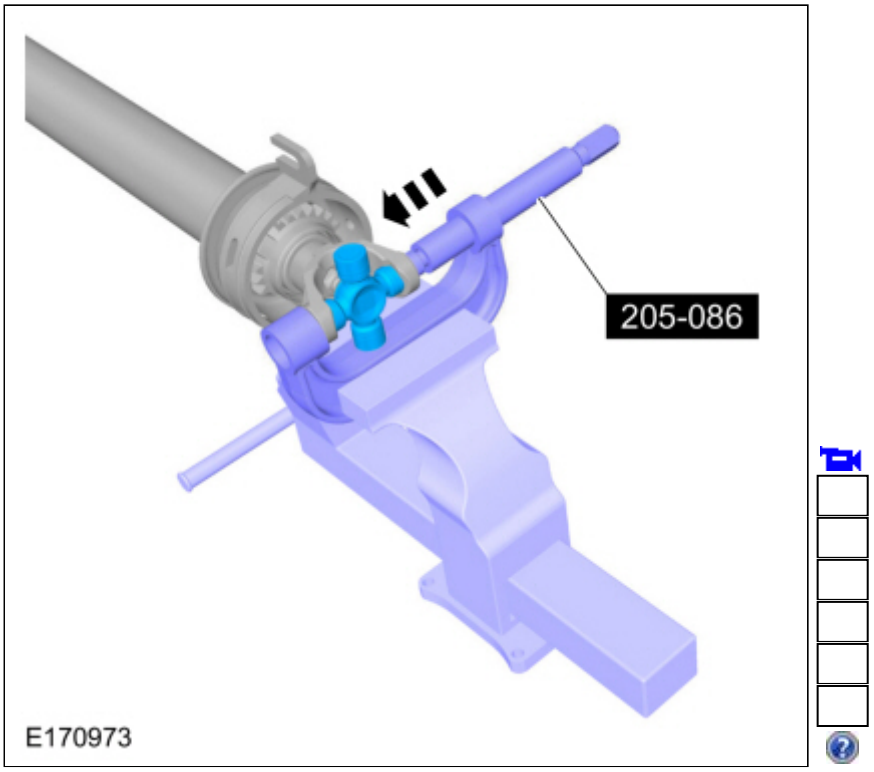
5. **NOTE:** *If necessary, use a pair of pliers to remove a bearing cup that fails to press out all the way.*

   Use Special Service Tool: 205-086 (T74P-4635-C) Installer/Remover, C-Frame and Screw.
   Use the General Equipment: Vise

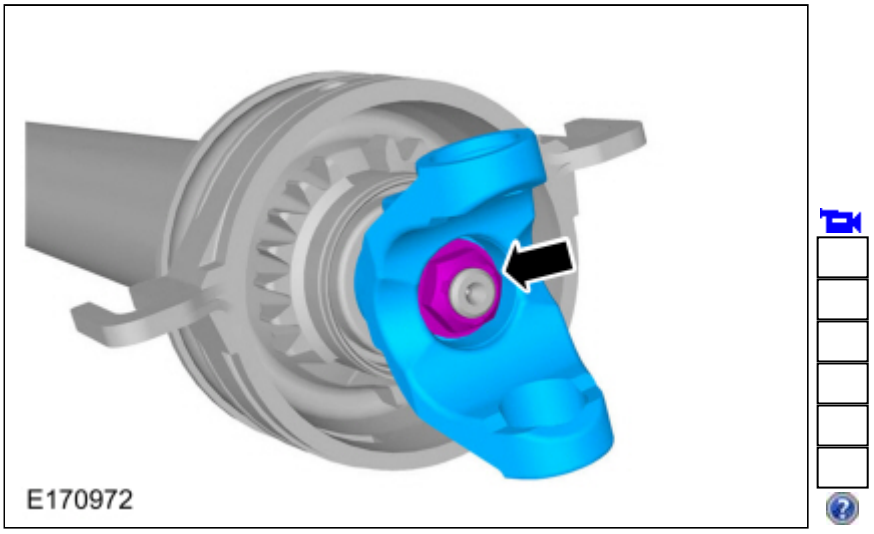


6. **NOTICE: Inspect the bearing cup bores and retaining ring grooves. Remove any rust or other surface irregularities.**

   Use Special Service Tool: 205-086 (T74P-4635-C) Installer/Remover, C-Frame and Screw.
   Use the General Equipment: Vise



7. *Torque*: 150 Nm



ASSEMBLY

1. **NOTE:** *Lubricate the driveshaft slip yoke and driveshaft yoke bearing cup bores with grease before installing the bearing cups.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Rear differential oil (standard differential)

Description	Specification
Rear differential oil	WSP-M2C197-A
Viscosity	SAE 80W-90
Oil capacity (4x2)	3.05L ± 0.05L
Oil capacity (4x4 and 4x2 vehicles with increased ride height)	3.40L ± 0.05L

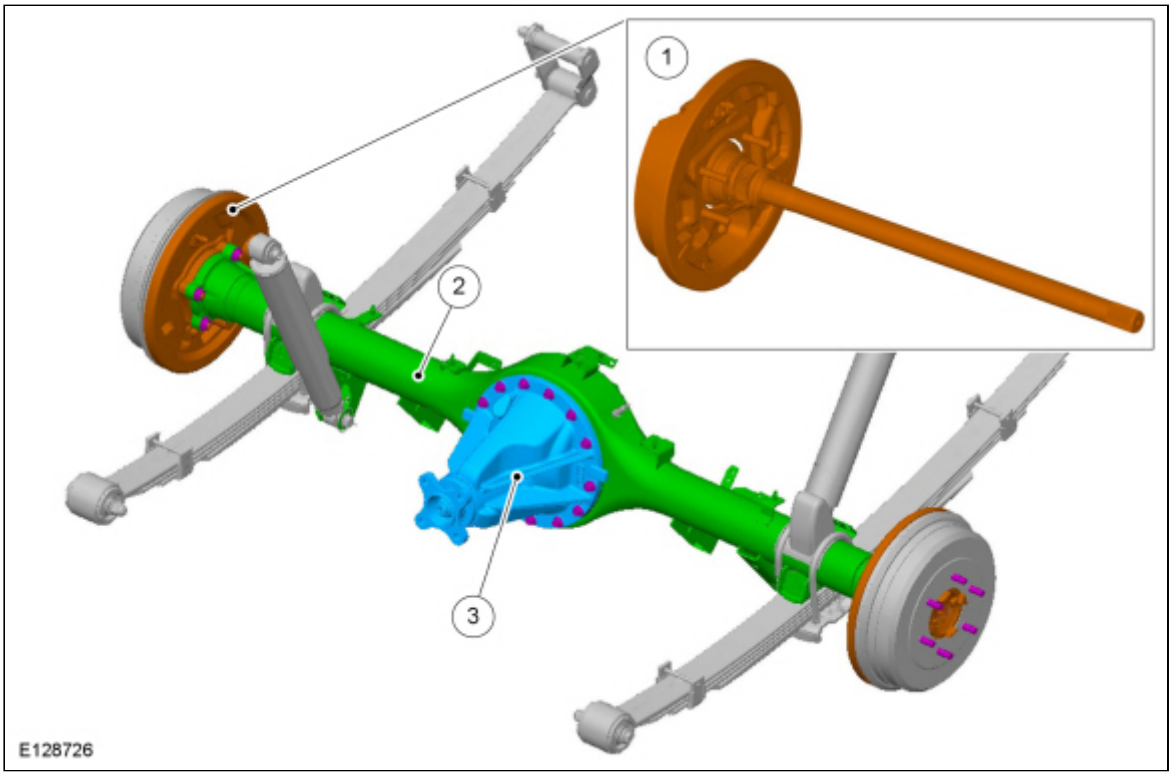
Rear differential oil (LSD)

Description	Type
Rear differential oil	WSP-M2C197-A
Rear differential friction modifier	EST-M2C118-A
Viscosity	SAE 80W-90
Oil capacity (4x2)	2.90L ± 0.05L and plus 0.15L friction modifier
Oil capacity (4x4 and 4x2 vehicles with increased ride height)	3.23L ± 0.05L and plus 0.17L friction modifier

Copyright © 2016 Ford Motor Company

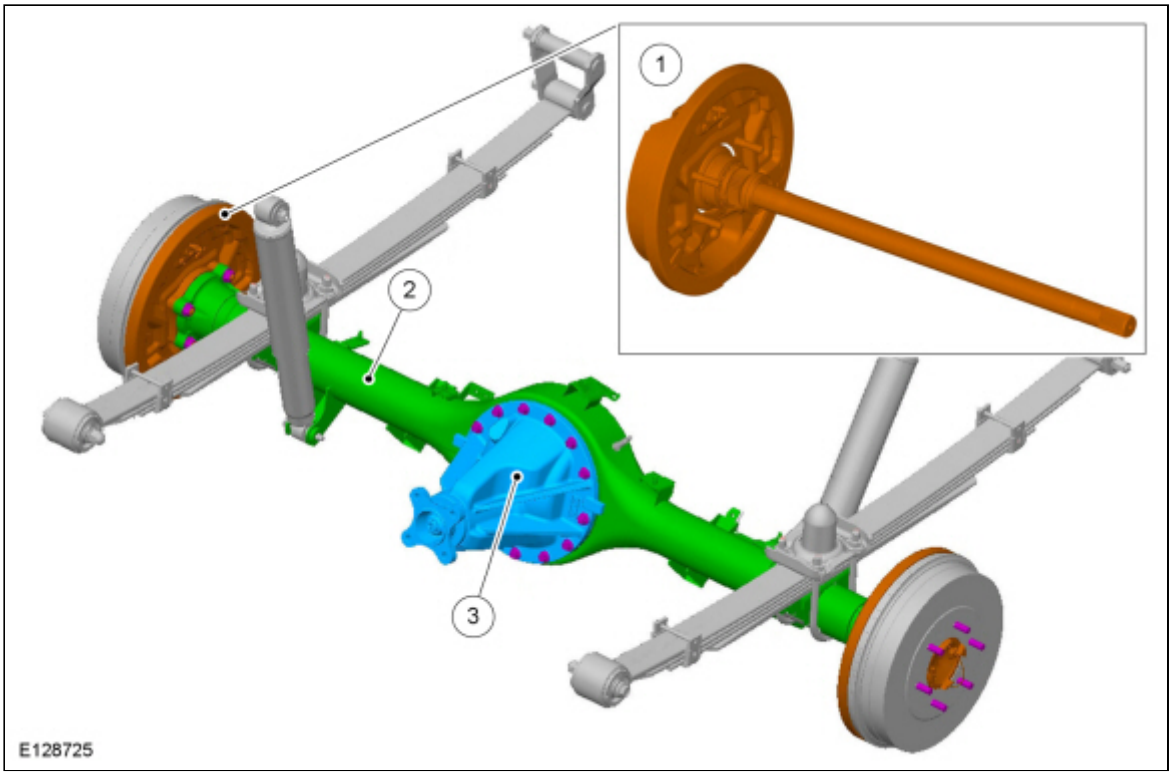
Rear Drive Axle and Differential - Component Location

4x2



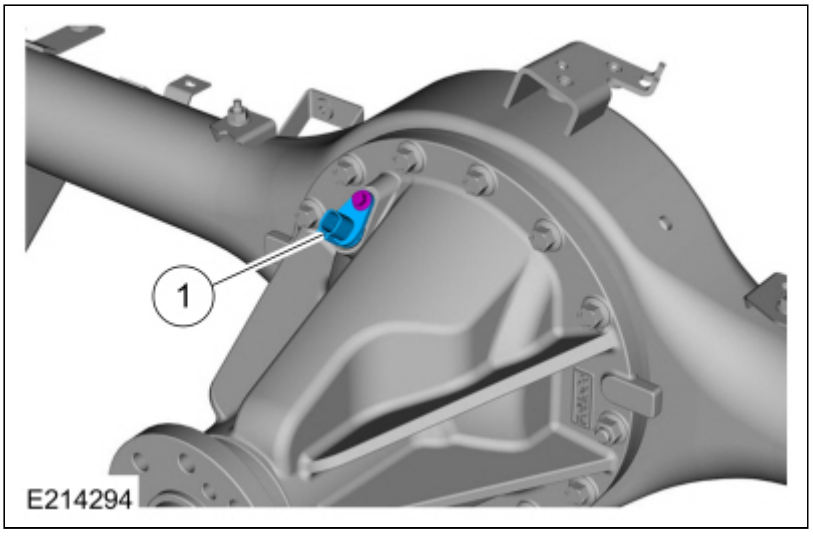
Item	Part Number	Description
1	—	Axle shaft
2	—	Axle housing
3	—	Differential carrier

4x4 and 4x2 vehicles with increased ride height



Item	Part Number	Description
1	—	Axle shaft
2	—	Axle housing
3	—	Differential carrier

Vehicles with Electronic locking differential



Item	Part Number	Description
1	—	Electronic locking differential

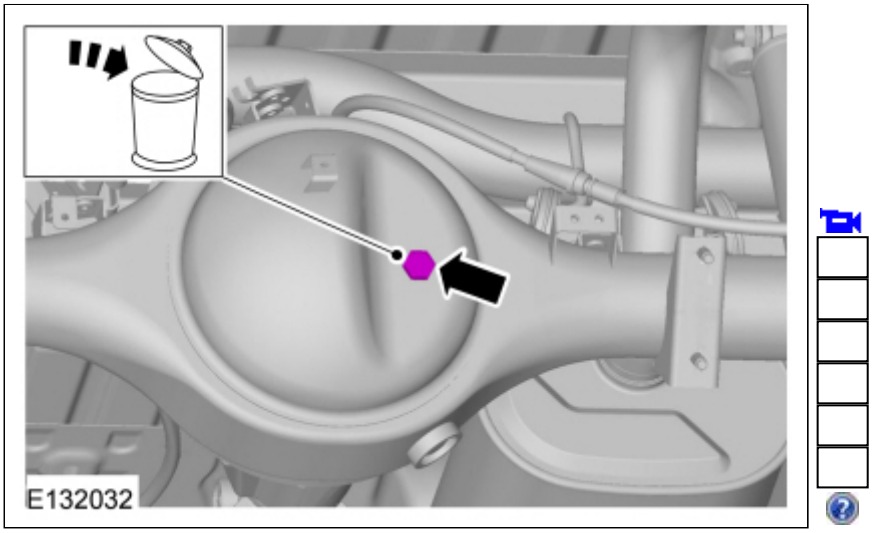
Copyright © 2016 Ford Motor Company

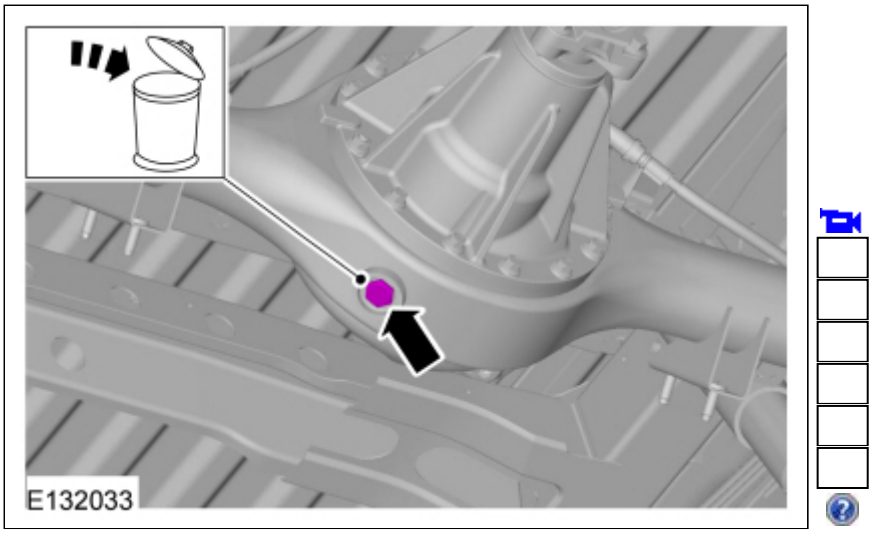
Differential Draining and Filling

Materials

Name	Specification
Friction Modifier	EST-M2C118-A
Gear/Transmission Fluid - SAE 80W-90	WSP-M2C197-A

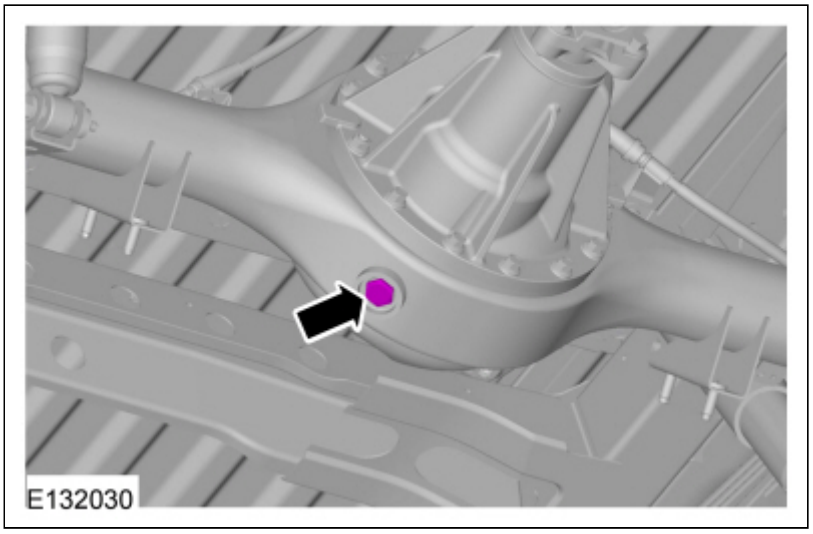
Draining

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. 

3. **NOTE:** *Be prepared to collect escaping fluids.*


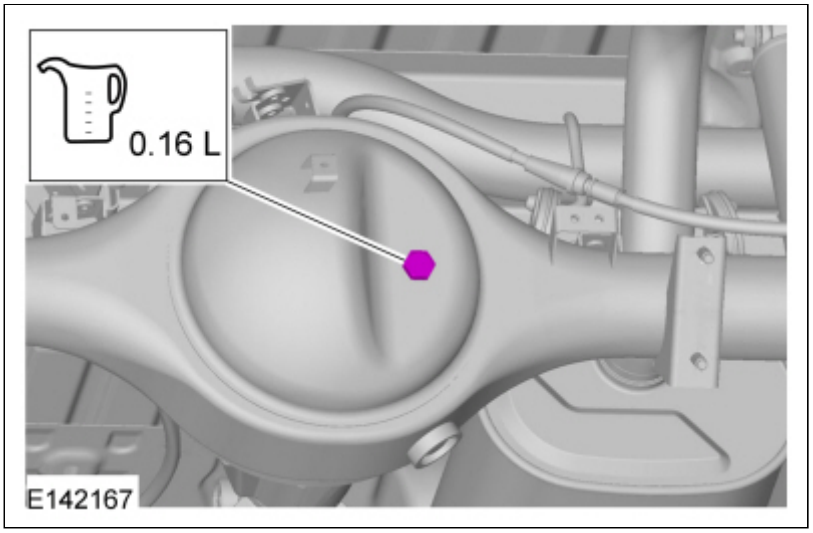
4. **NOTE:** *Make sure that a new component is installed.*

   Torque: 45 Nm

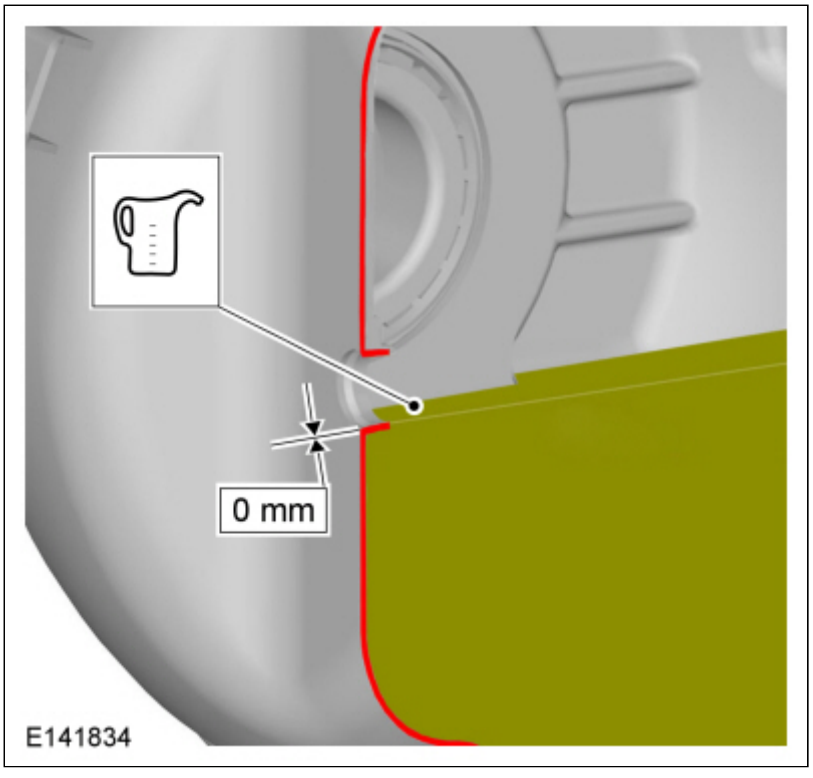


Filling

1. Vehicles with Limited slip differential.
   Material: Friction Modifier (EST-M2C118-A)

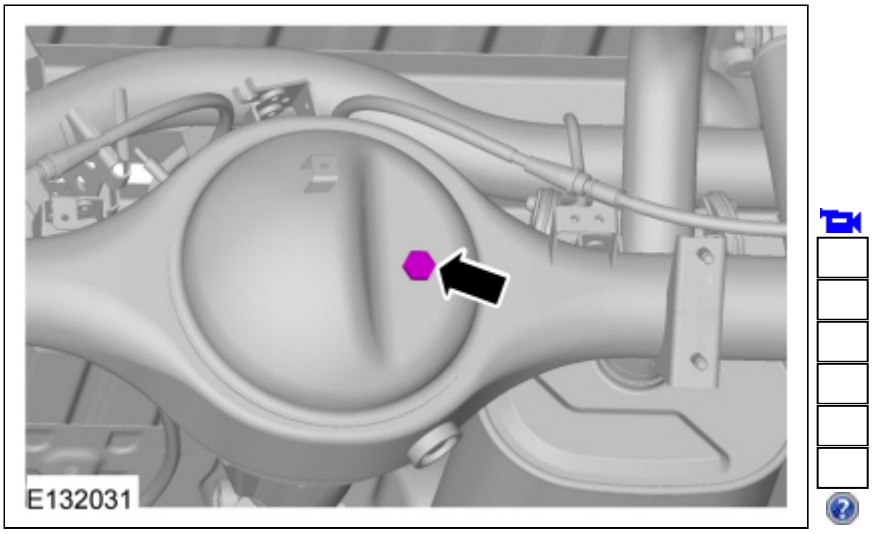


2. *Material*: Gear/Transmission Fluid - SAE 80W-90 (WSP-M2C197-A)



3. **NOTE:** *Make sure that a new component is installed.*

Torque: 45 Nm



Copyright © 2016 Ford Motor Company

Axle Assembly - 2WD

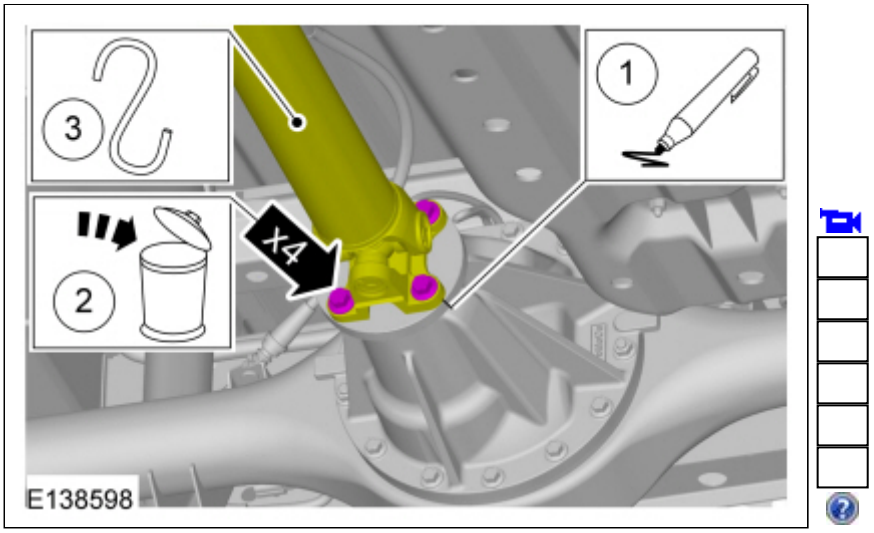
Base Part Number: 4000

Special Tool(s) / General Equipment

Trolley Jack

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

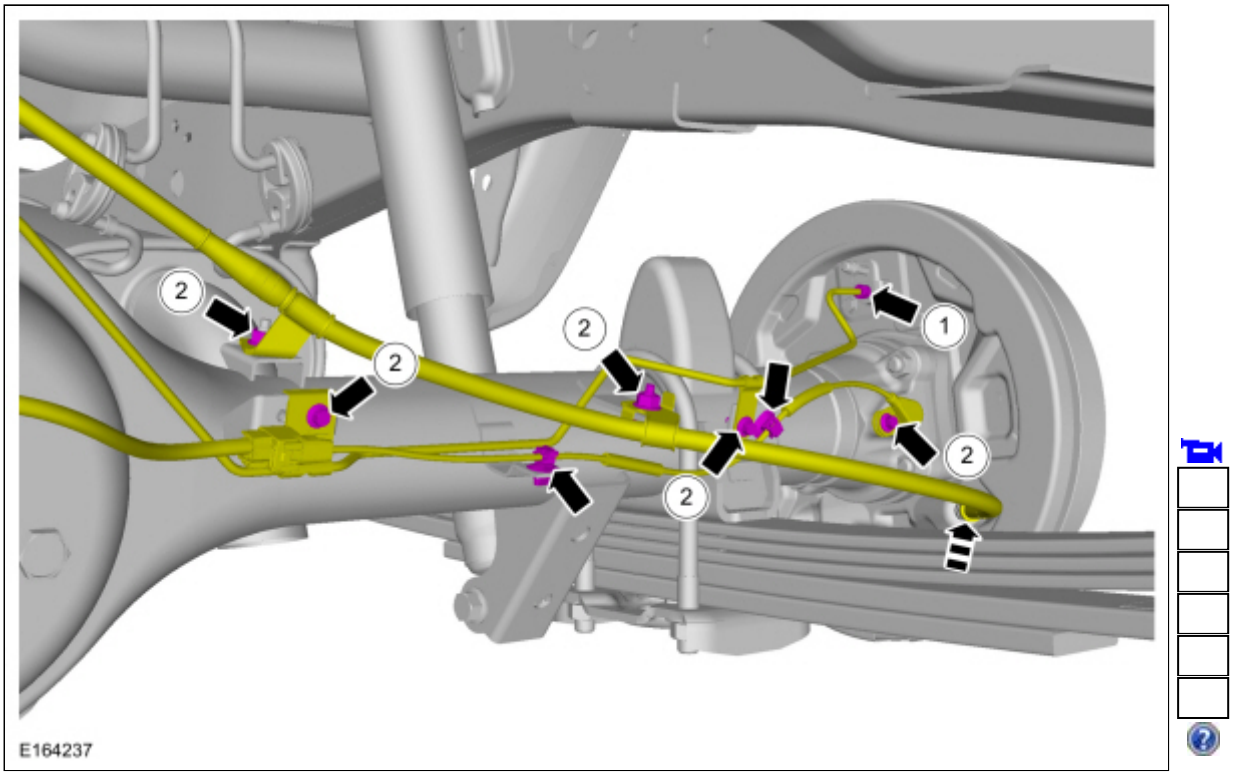
1. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

4. **NOTICE: If the fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.**

   NOTICE: Make sure that all openings are sealed with new blanking caps.

   NOTE: *Be prepared to collect escaping fluid.*

   1. *Torque*: 18 Nm
   2. *Torque*: 6 Nm

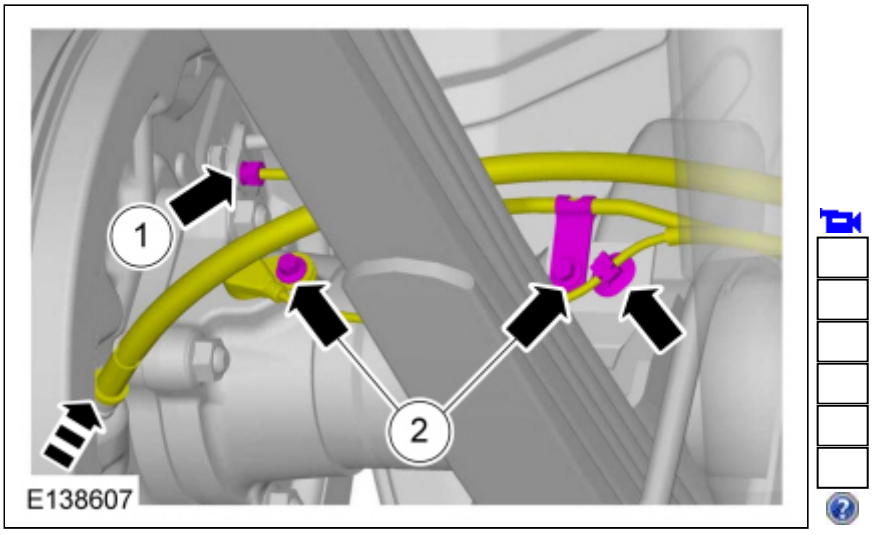


5. **NOTICE: If the fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.**

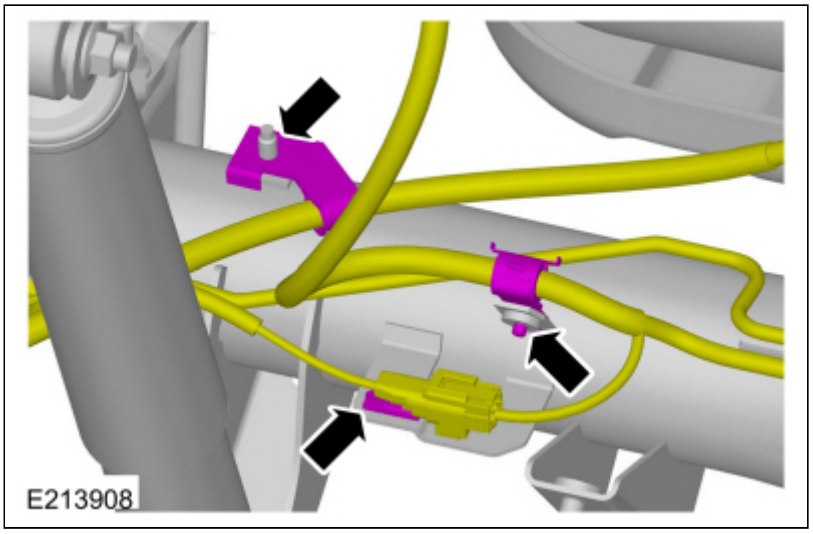
   NOTICE: Make sure that all openings are sealed with new blanking caps.

   NOTE: *Be prepared to collect escaping fluid.*

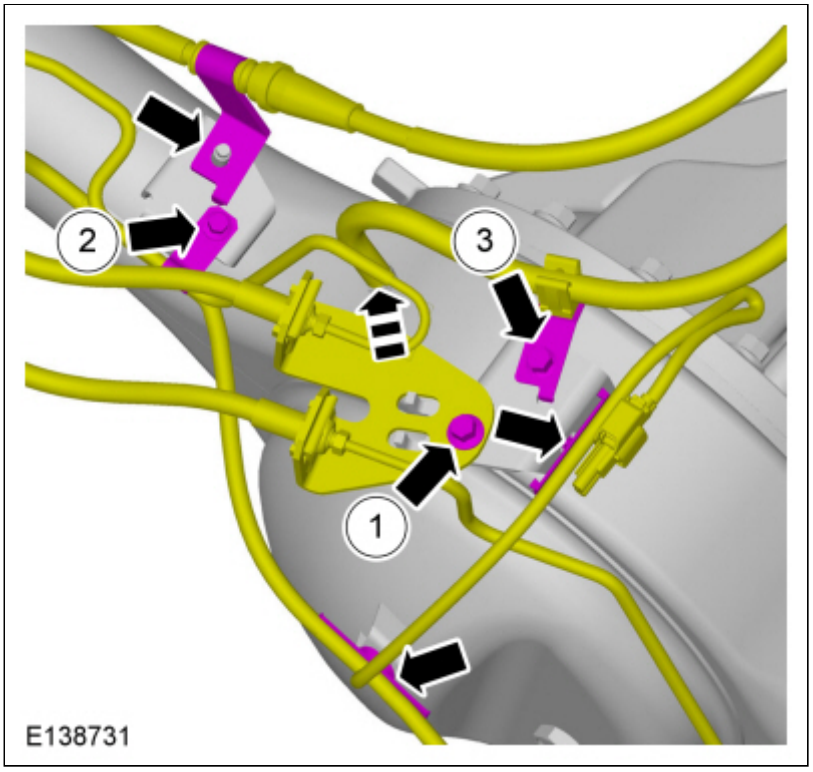
   1. *Torque*: 18 Nm
   2. *Torque*: 6 Nm



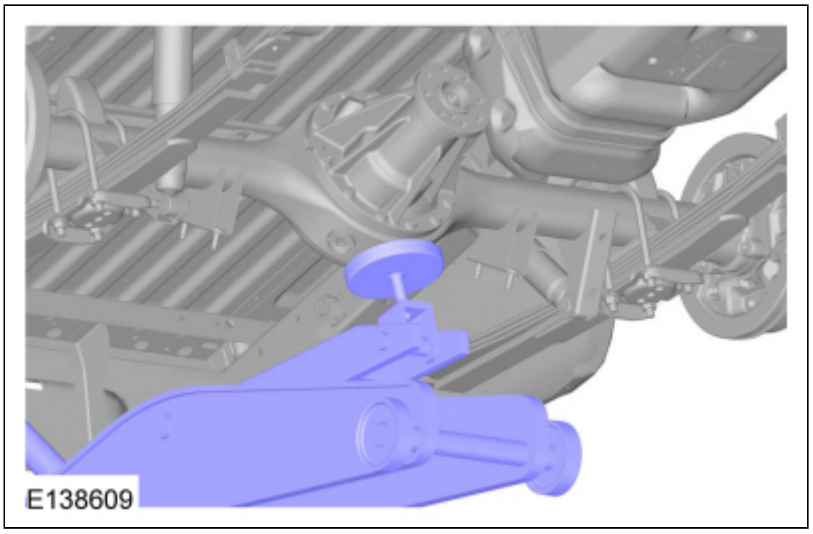
6. *Torque*: 6 Nm



1. *Torque*: 14 Nm
2. *Torque*: 6 Nm
3. *Torque*: 25 Nm

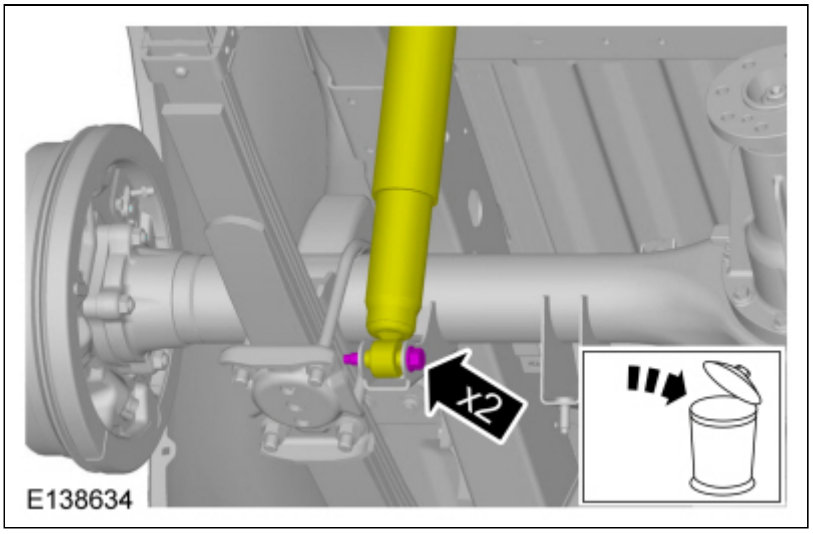


8. Use the General Equipment: Trolley Jack

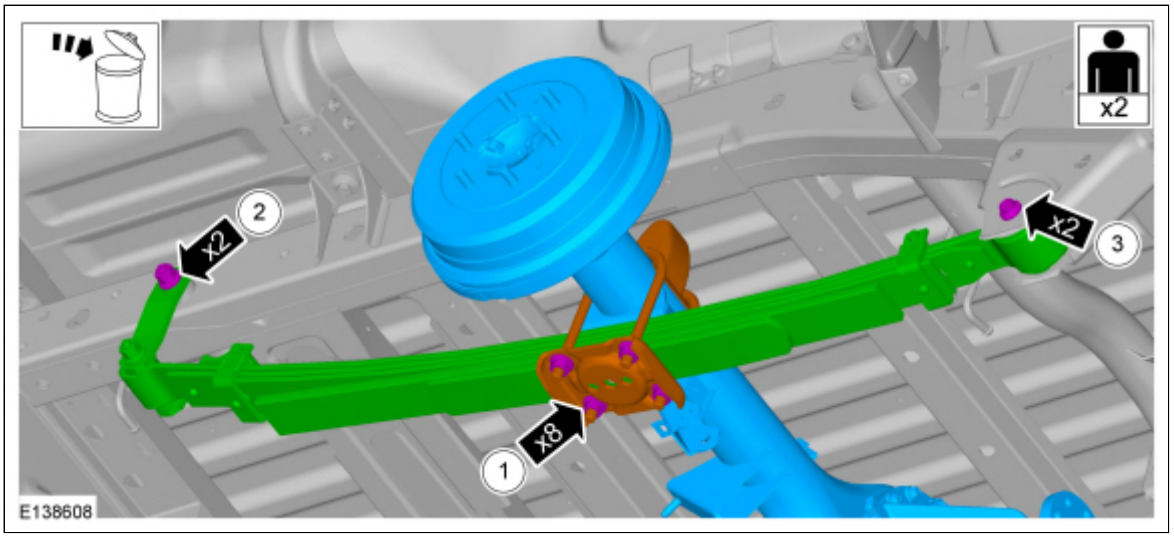


9. **NOTE:** *Make sure that new bolts are installed.*

   On both sides.
   Use the General Equipment: Trolley Jack
   Torque: 48 Nm



10. On both sides.



Installation

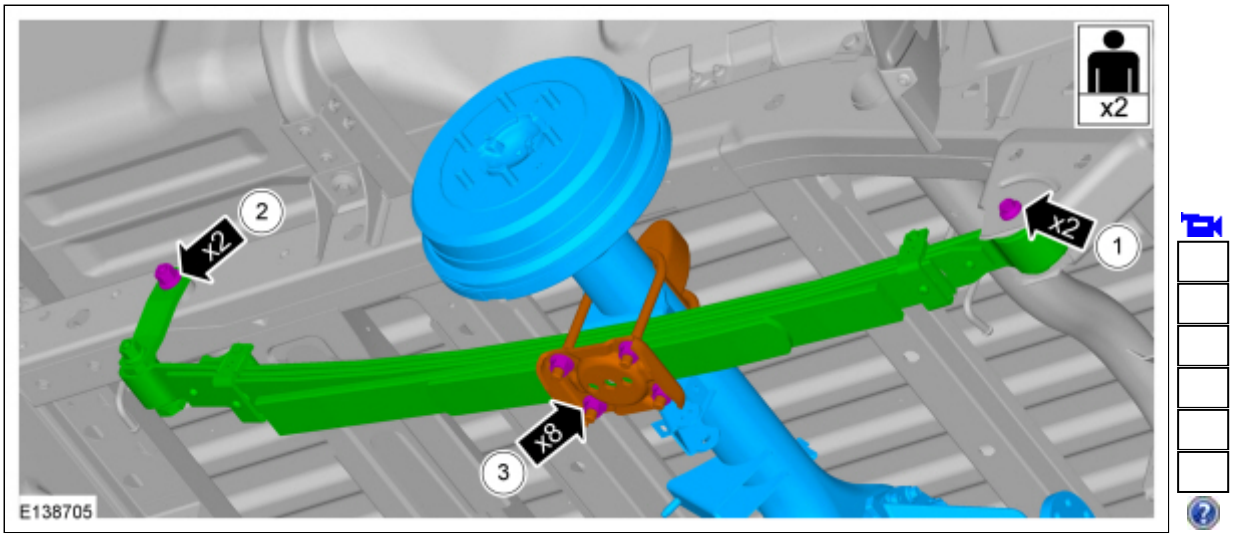
1. **NOTE:** *Make sure that new bolts are installed.*

   1. On both sides.
      Torque: 162 Nm

2. On both sides.
   Torque: 103 Nm

3. **NOTE:** *Only tighten the nuts finger tight at this stage.*

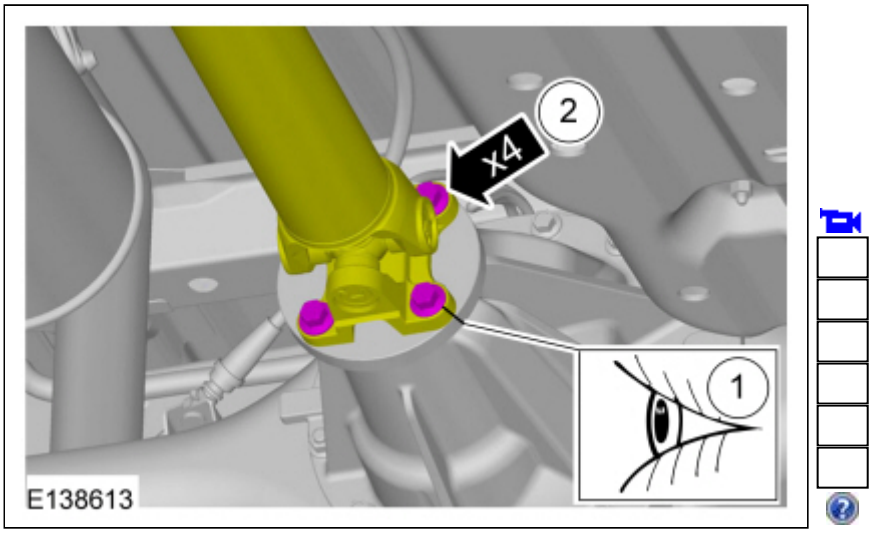
   On both sides.



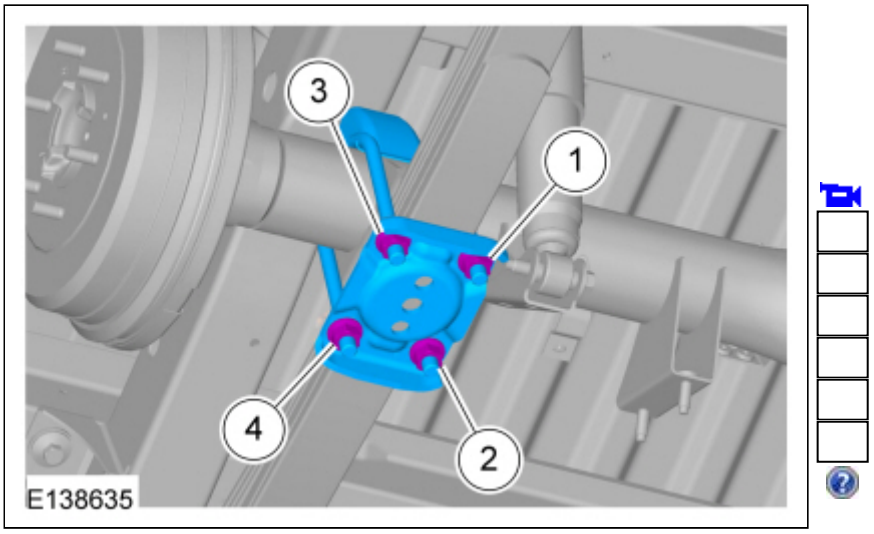
2. To install, reverse the removal procedure.

3. **NOTE:** *Make sure that new bolts are installed.*

   Torque: 135 Nm



4. On both sides.
   Torque:
   Stage 1: 25 Nm
   Stage 2: 50 Nm
   Stage 3: 75 Nm
   Stage 4: 100 Nm
   Stage 5: 120 Nm



5. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

6. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

Copyright © 2016 Ford Motor Company

Axle Assembly - 4WD

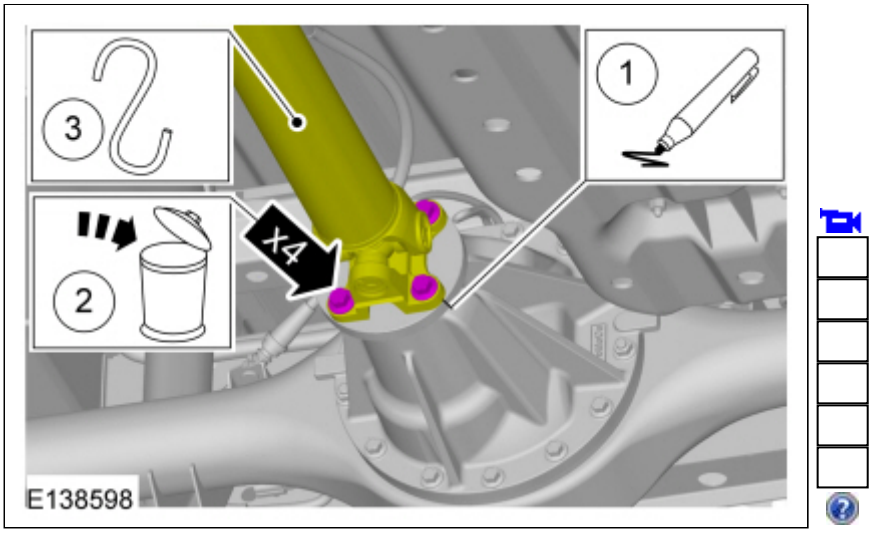
Base Part Number: 4000

Special Tool(s) / General Equipment

Trolley Jack

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

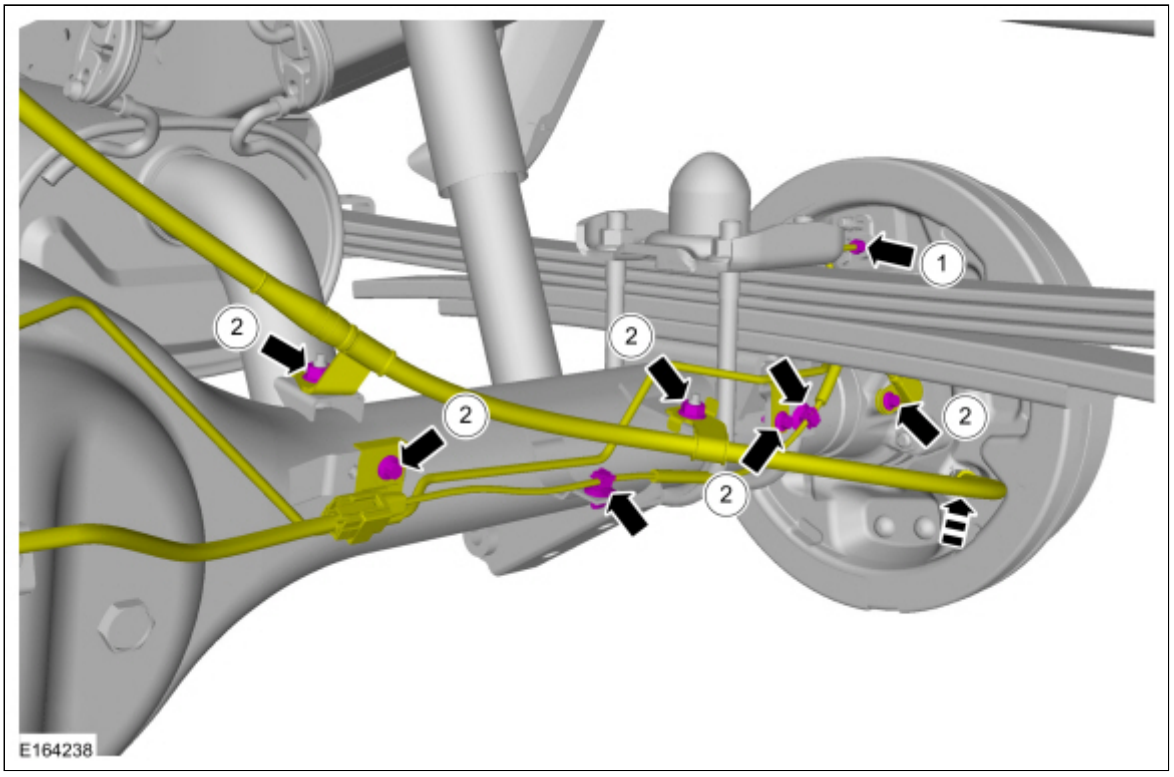
1. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

4. **NOTICE: If the fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.**

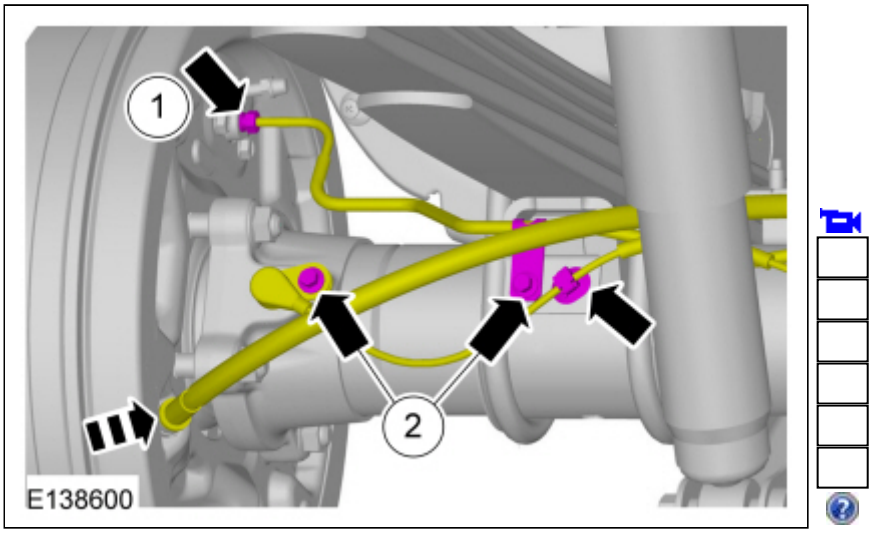
   NOTICE: Make sure that all openings are sealed with new blanking caps.

   NOTE: *Be prepared to collect escaping fluid.*

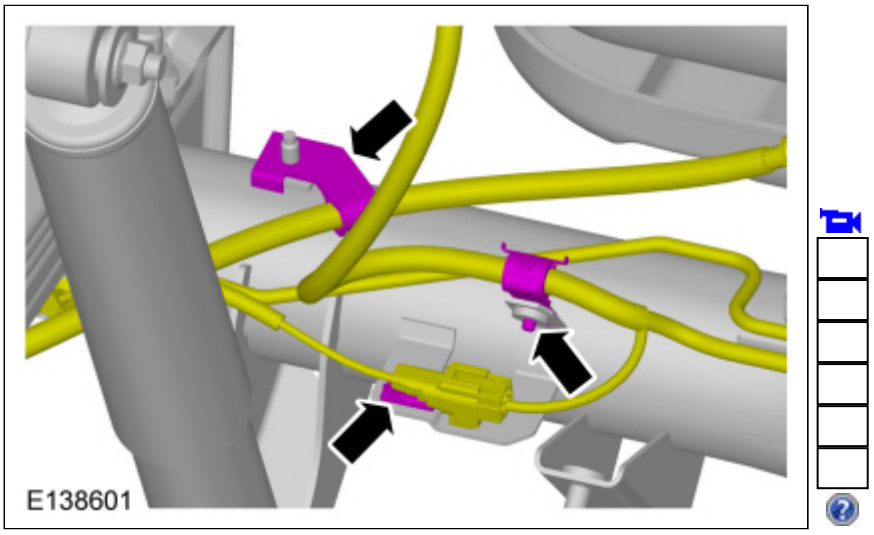
   1. *Torque*: 18 Nm
   2. *Torque*: 6 Nm



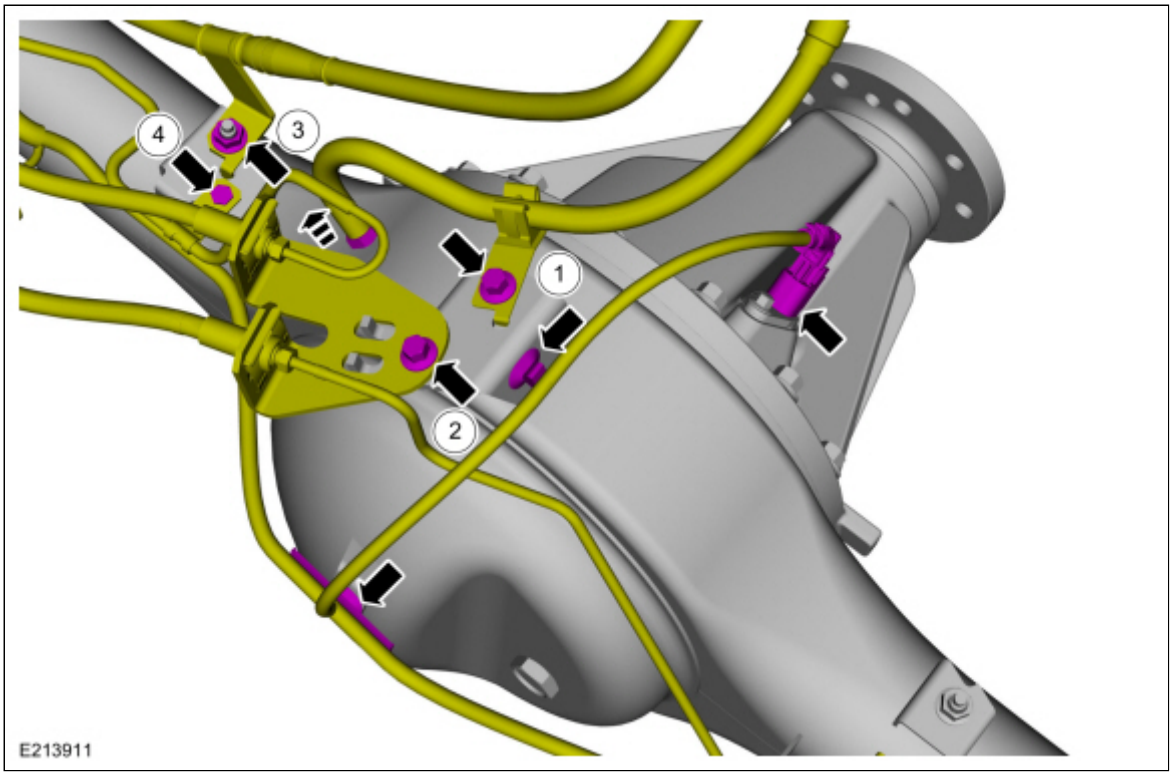
1. *Torque*: 18 Nm
2. *Torque*: 6 Nm



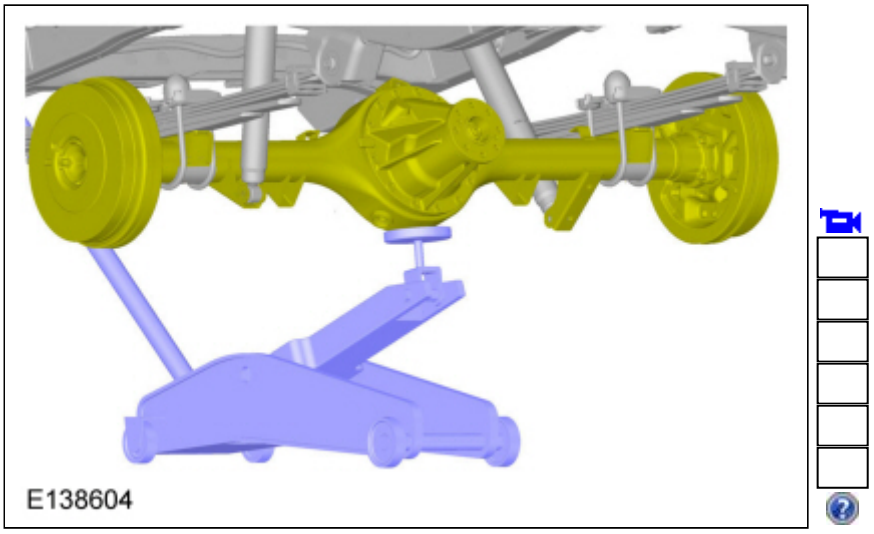
6. *Torque*: 6 Nm



1. *Torque*: 25 Nm
2. *Torque*: 14 Nm
3. *Torque*: 6 Nm
4. *Torque*: 6 Nm

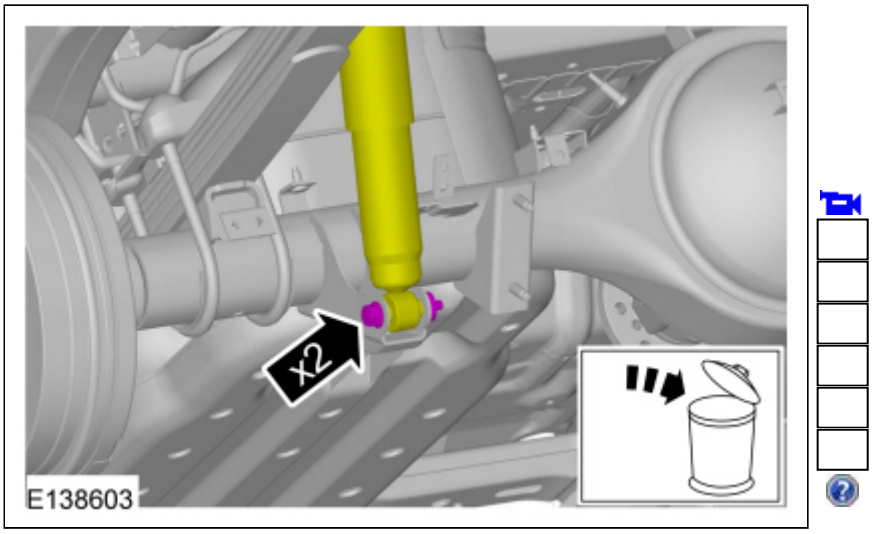


8. Use the General Equipment: Trolley Jack

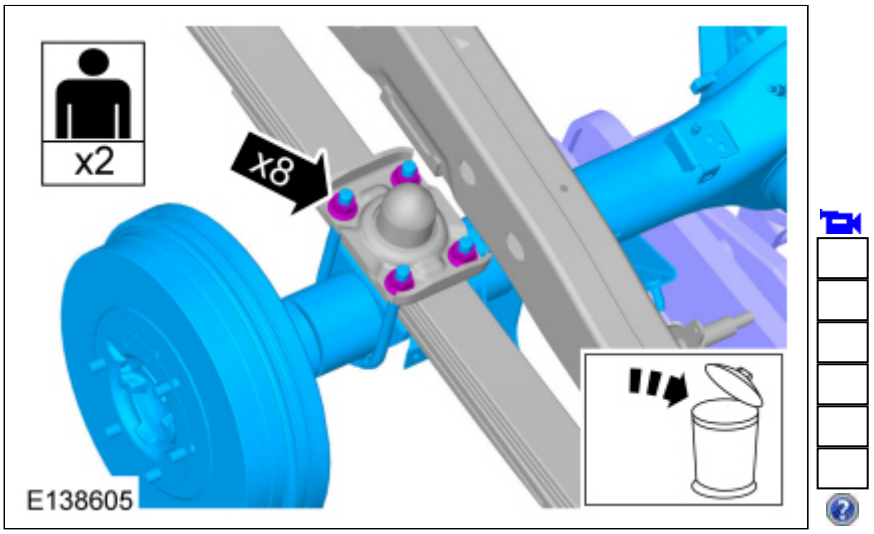


9. **NOTE:** *Make sure that new bolts are installed.*

On both sides.
Torque: 48 Nm



10. On both sides.
    Use the General Equipment: Trolley Jack

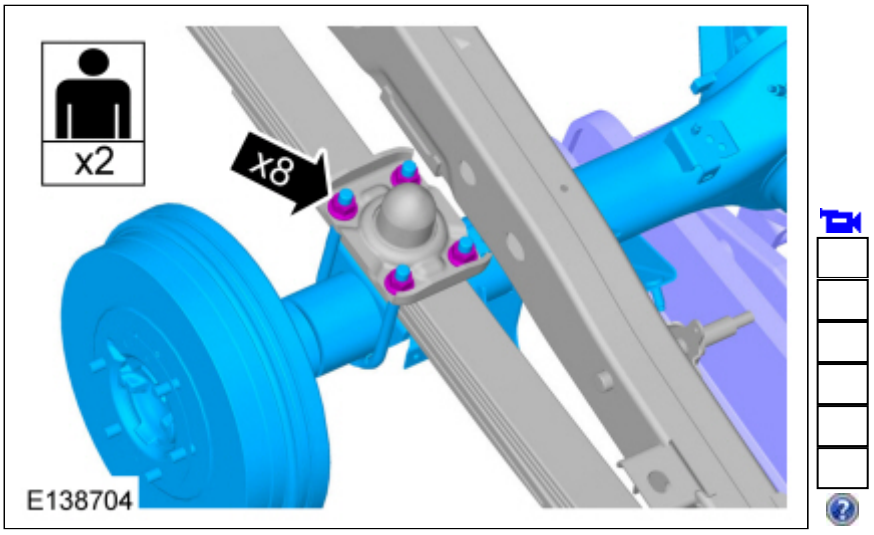


Installation

1. **NOTE:** *Make sure that new bolts are installed.*

   NOTE: *The component must be installed by hand before final tightening.*

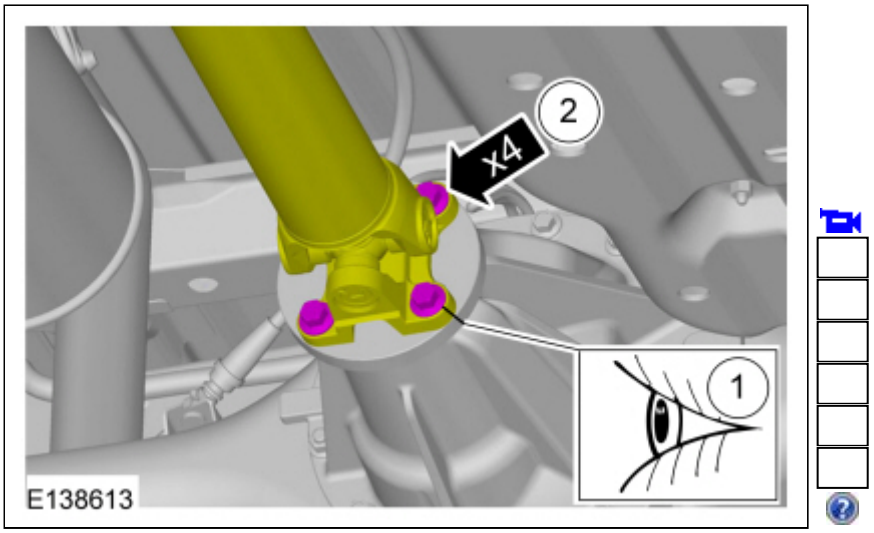
   On both sides.
   Use the General Equipment: Trolley Jack



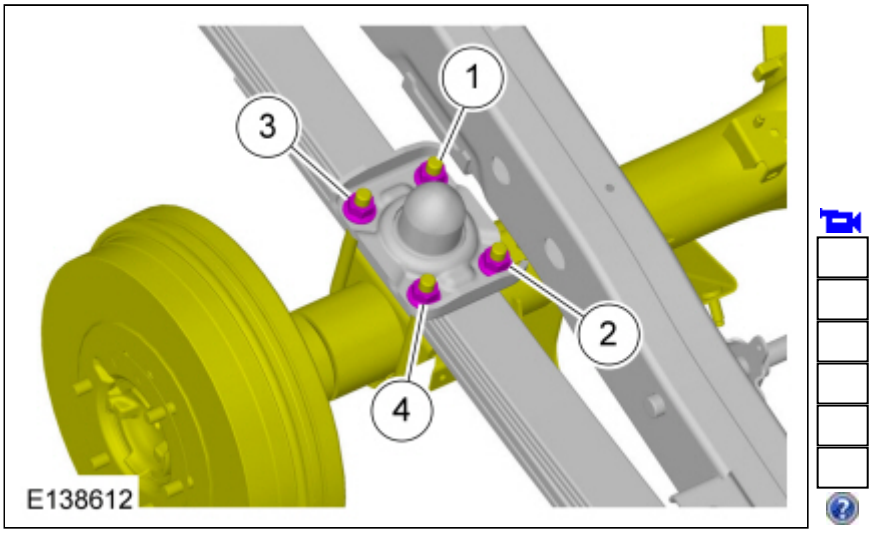
2. To install, reverse the removal procedure.

3. **NOTE:** *Make sure that new bolts are installed.*

   Torque: 135 Nm



4. On both sides.
   Torque:
   Stage 1: 25 Nm
   Stage 2: 50 Nm
   Stage 3: 75 Nm
   Stage 4: 100 Nm
   Stage 5: 120 Nm



5. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

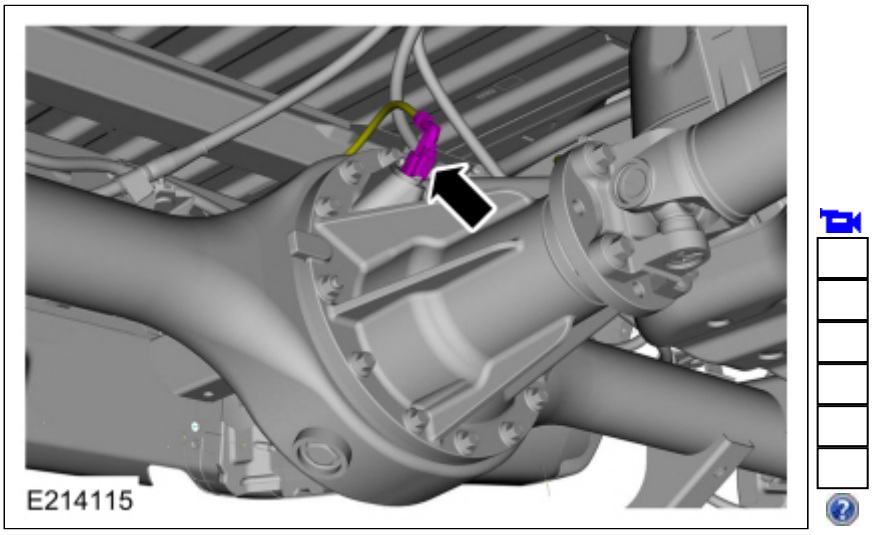
6. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

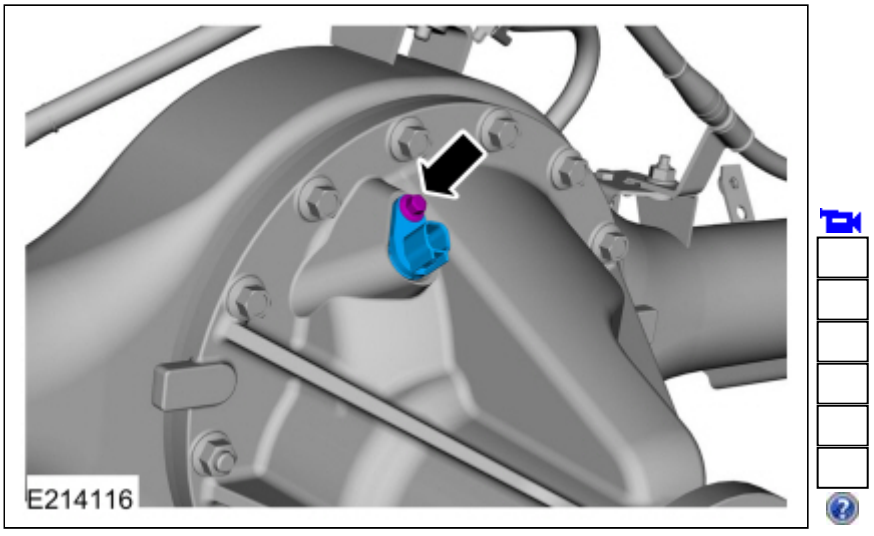
Copyright © 2016 Ford Motor Company

Electronic Locking Differential (ELD)

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. 

3. *Torque*: 00 Nm


Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

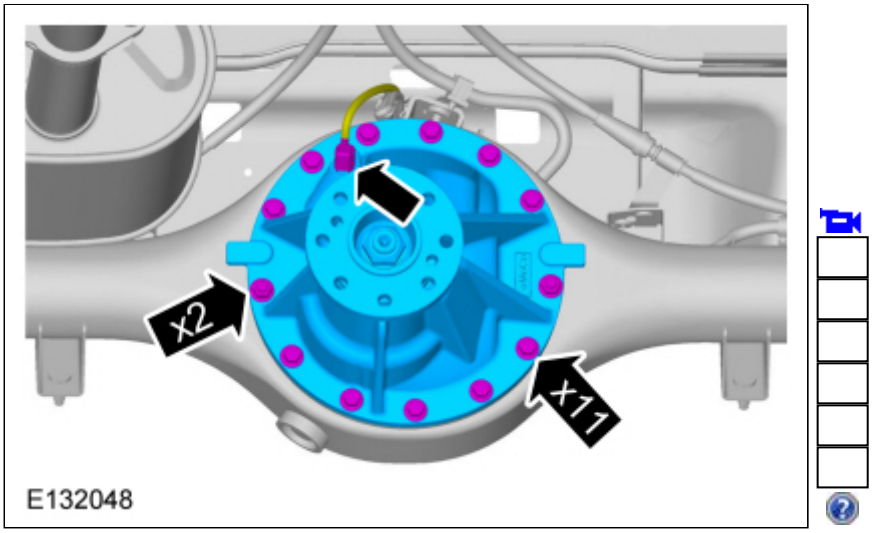
Differential Carrier

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Drain the rear differential oil.
   Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).
2. **NOTE:** *The driveshaft flange fits tightly on the pinion flange pilot. Never hammer on the driveshaft or any of its components to disconnect the driveshaft flange from the pinion flange or damage to the component may occur.*

   Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
3. Refer to: Rear Halfshaft (205-05 Rear Drive Halfshafts, Removal and Installation).
4. *Torque*: 65 Nm



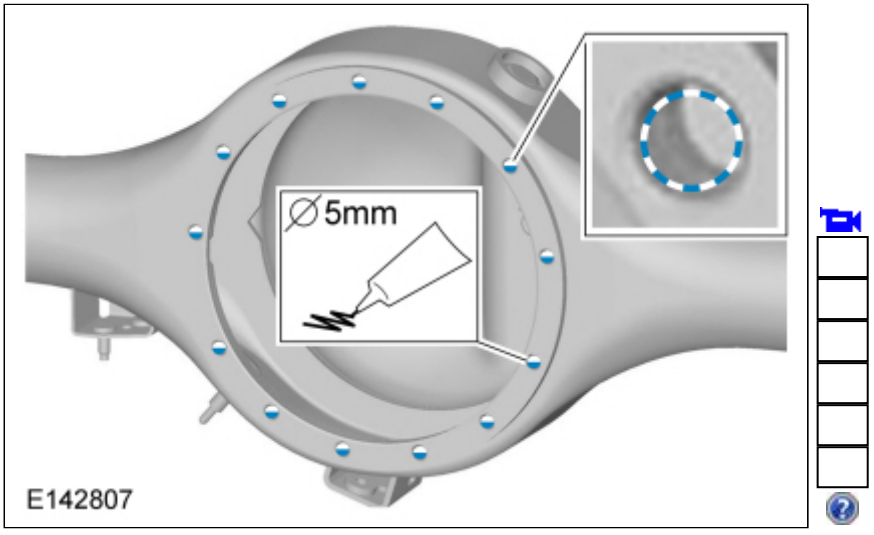
Installation

1. **NOTICE: Clean away the old sealant before applying the new sealant.**

   NOTICE: Install the differential carrier 10 min. after applying sealant.

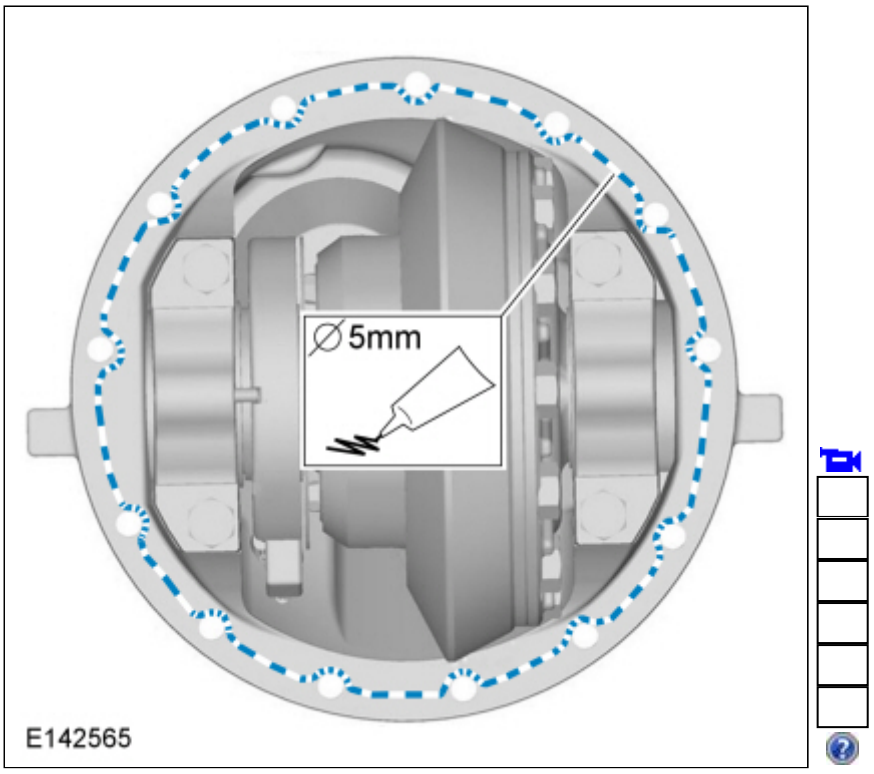
   NOTICE: Allow the sealant to set at least 30 min. after installation before filling the differential with the specified oil.

   Material: WSS-M4G323-A8 (Sealant)



2. **NOTICE: Clean away the old sealant before applying the new sealant.**

   Material: WSS-M4G323-A8 (Sealant)



3. To install, reverse the removal procedure.

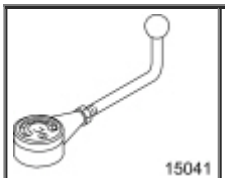
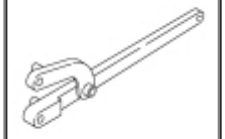
4. Fill the rear differential oil.
   Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Copyright © 2016 Ford Motor Company

Drive Pinion Seal

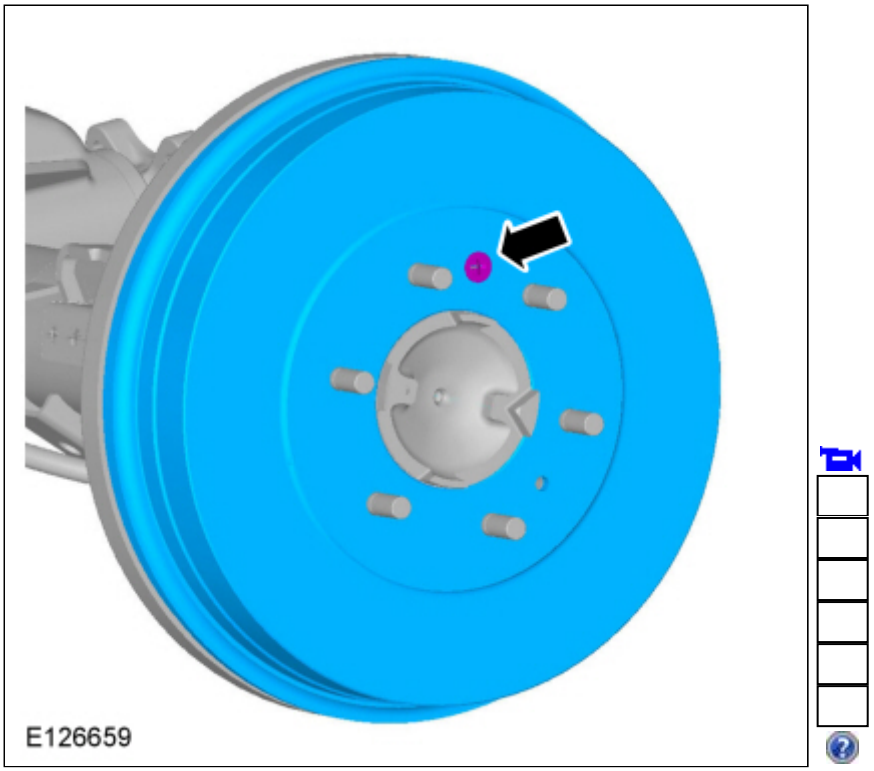
Base Part Number: 3N134

Special Tool(s) / General Equipment

 15041	205-067 Preload Gauge
 15030A	205-072 Universal Flange Holding Wrench
 E163724	205-1002 Installer, Drive Pinion Seal
Flat Headed Screw Driver	
Two Leg Puller	

Removal

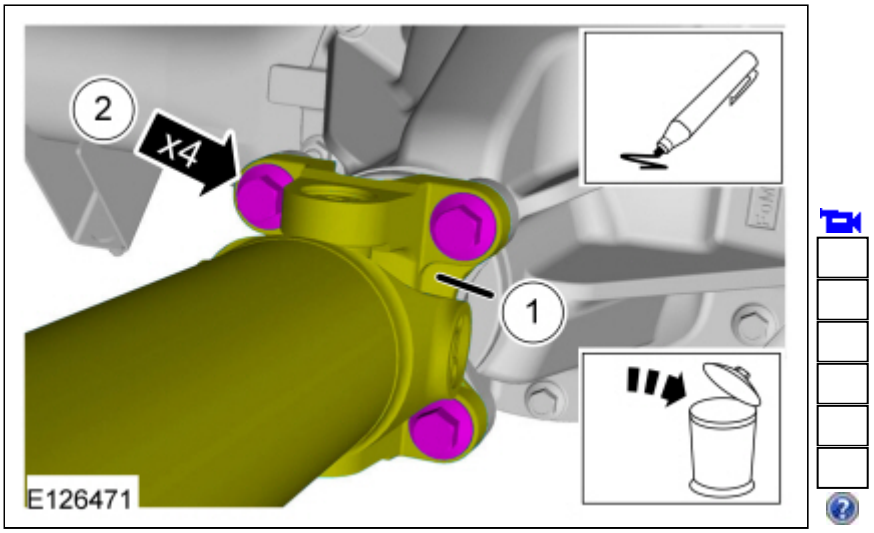
1. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. **NOTE:** *The brake drums must be removed to prevent drag during drive pinion bearing preload measurement.*



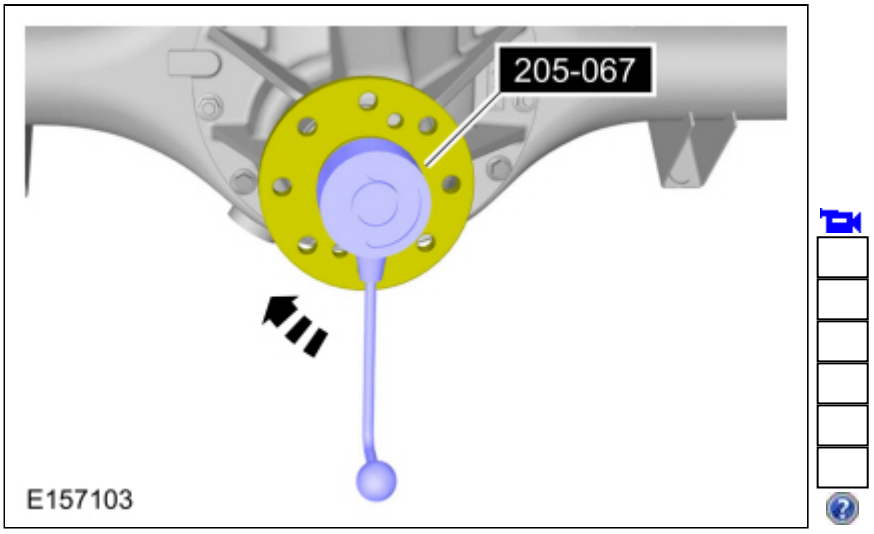
3. **NOTE:** *Make sure that new bolts are installed.*

NOTE: *Make sure to note the position of the driveshaft in relation to the companion flange prior to removal.*

NOTE: *Note the position of the component before removal.*

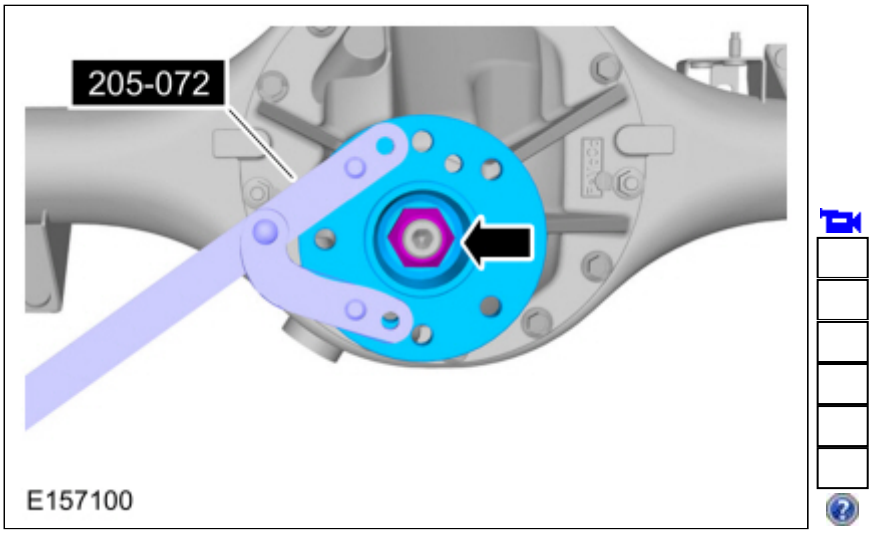


4. Turn the drive pinion smoothly with the preload gauge and note the value.
   Use Special Service Tool: 205-067 Preload Gauge.

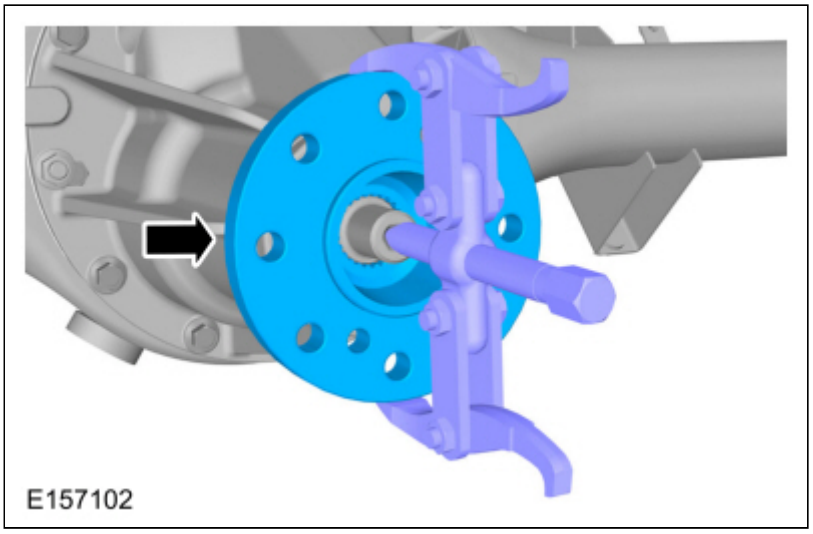


5. **NOTE:** *Discard the nut*

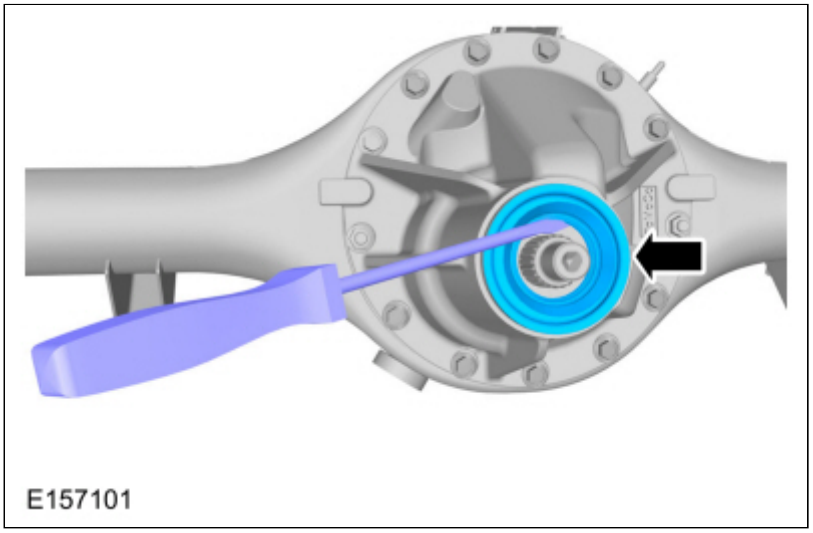
   Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



6. Use the General Equipment: Two Leg Puller



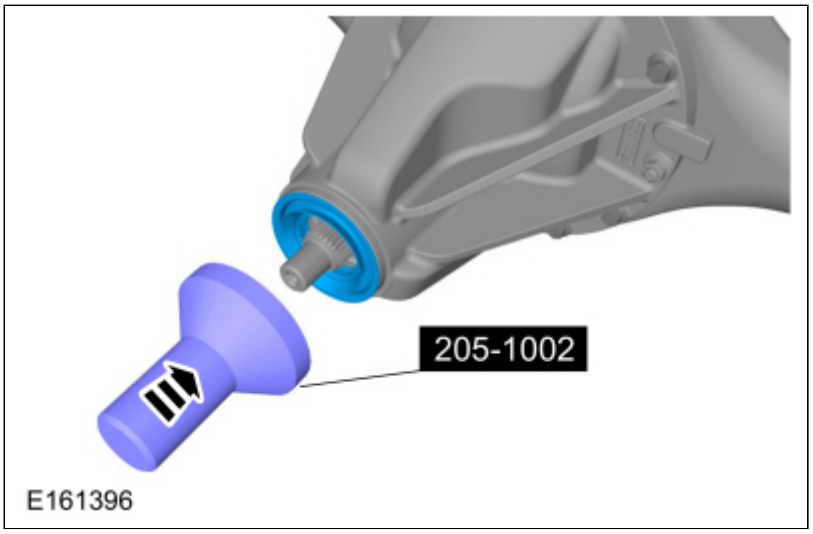
7. Use the General Equipment: Flat Headed Screw Driver



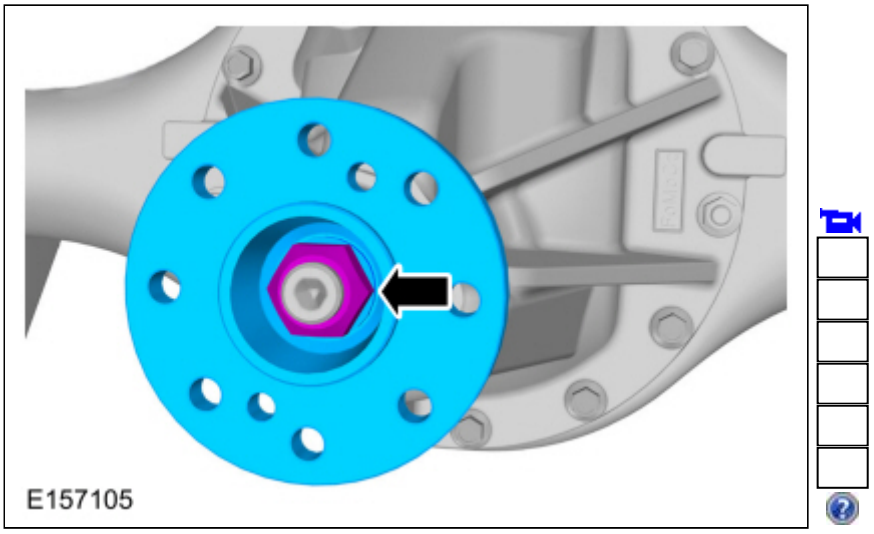
Installation

1. **NOTE:** *Make sure that a new component is installed.*

   Use Special Service Tool: 205-1002 Installer, Drive Pinion Seal.

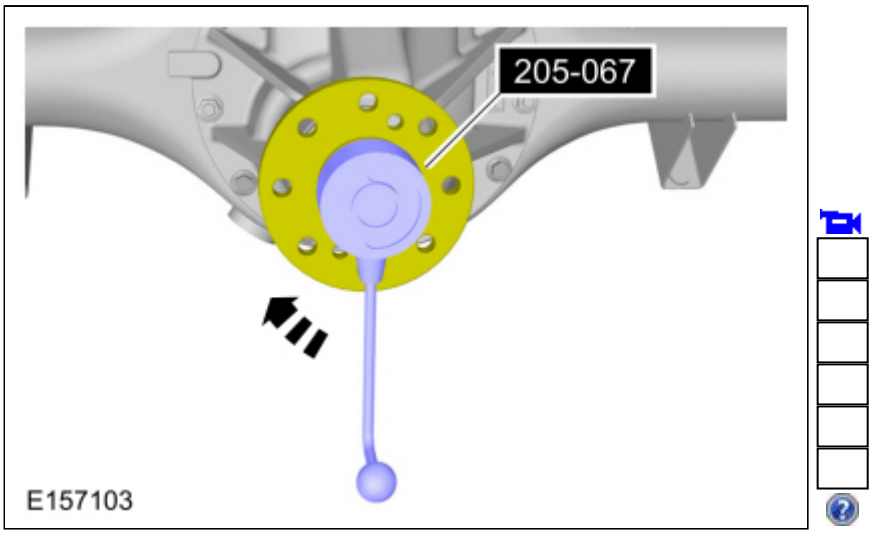


2. *Torque*: 300 Nm



3. **NOTICE: If the specified torque is exceeded a new drive pinion flange collapsible spacer and a new drive pinion flange locknut must be installed.**

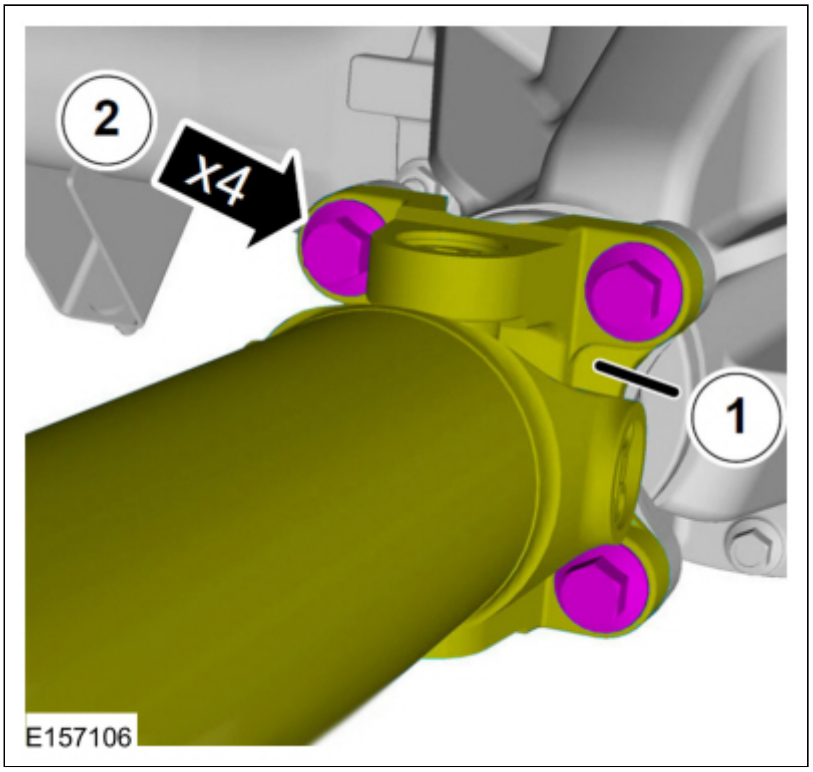
   Using the special tool, measure the torque to rotate. Tighten the drive pinion nut until the previously determined torque plus 0.3 - 1.0 Nm value is reached.
   Use Special Service Tool: 205-067 Preload Gauge.
   Torque: 650 Nm



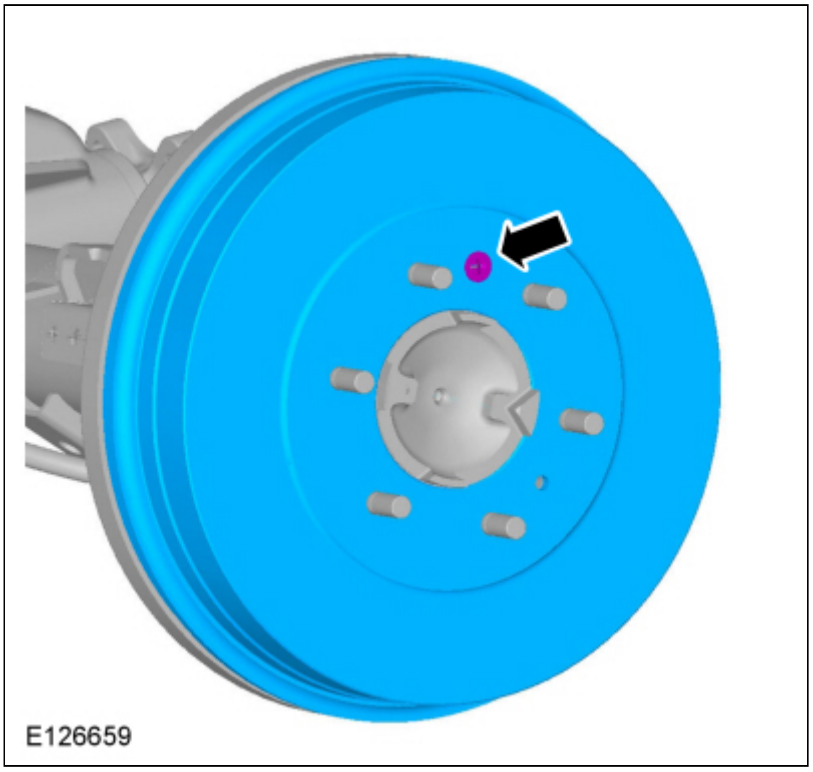
4. **NOTICE: Make sure that the installation marks are aligned.**

   NOTE: *Make sure that new bolts are installed.*

   Torque: 110 Nm



5.

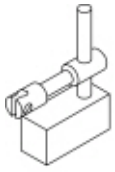
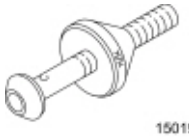
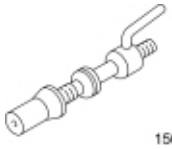
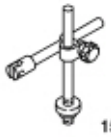
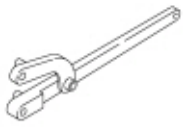
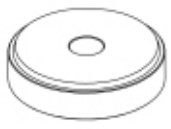


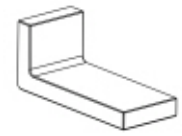
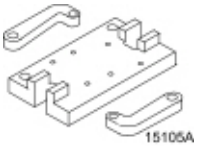
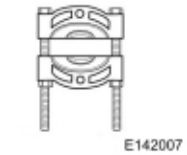
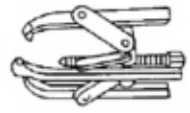
6. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

Copyright © 2016 Ford Motor Company

Differential Carrier

Special Tool(s) / General Equipment

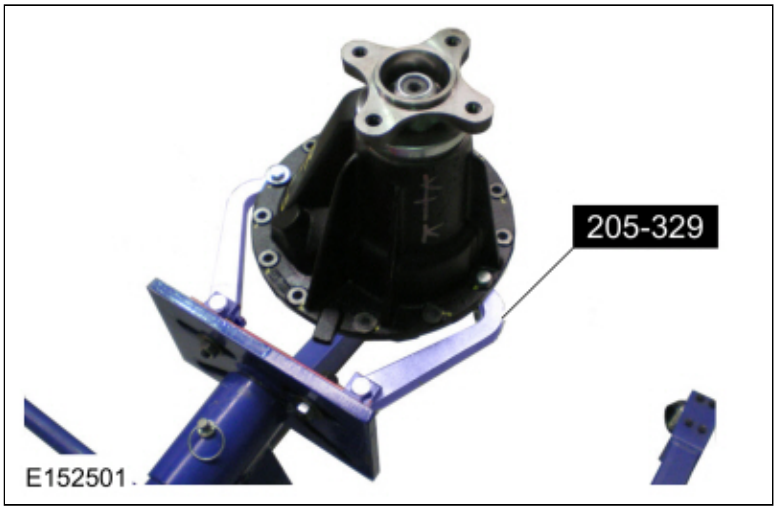
 E216590	204-069 (T81P-1104-C) Remover/Installer, Front Wheel Hub
 15008	205-044 Holding Fixture, Dial Indicator Gauge
 15019	205-058 Adjustment Gauge, Drive Pinion
 15020	205-059 Gauge, Master Pinion
 15041	205-067 Preload Gauge
 15022a	205-070 Holding Fixture, Dial Indicator Gauge
 15030A	205-072 Universal Flange Holding Wrench
 E163722	205-1000 Installer, Rear Differential Bearing
 E163723	205-1001 Installer, Rear Differential Bearing
	205-1002 Installer, Drive Pinion Seal

 E163724	
 E163725	205-1006 Gauge, Drive Pinion Height
 E133913	205-153 (T80T-4000-W) Handle
 15105A	205-329 Mounting Bracket, Engine/Differential
 E142007	205-D002 Bearing Splitter
 E142008	205-D018 Adapter
	205-D027 (D80L-1013-A) 2 or 3 Jaw Puller
Hydraulic Press	
Copper Hammer	
Bearing Separator	

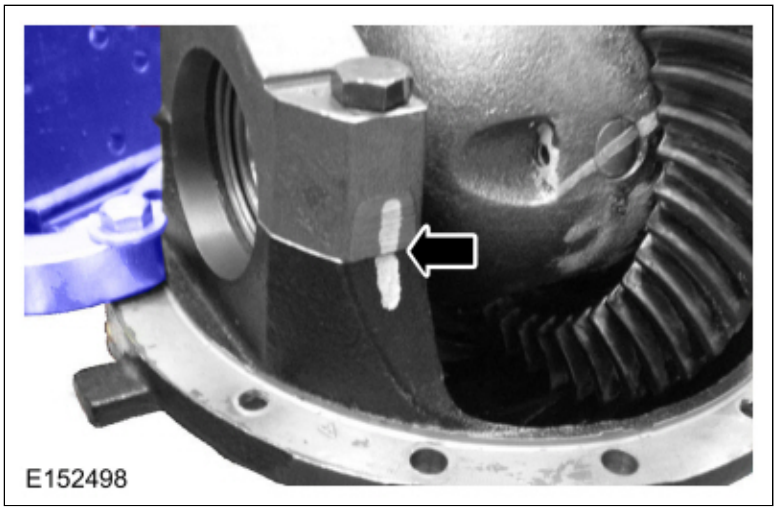
DISASSEMBLY

WARNING: The engine stand is equipped with a self-lock mechanism, however, if the rear differential is tilted, the self-lock mechanism could become inoperative. If the rear differential unexpectedly rotates, it could cause injury, therefore do not maintain the rear differential tilted. When turning the rear differential, grasp the rotation handle firmly.

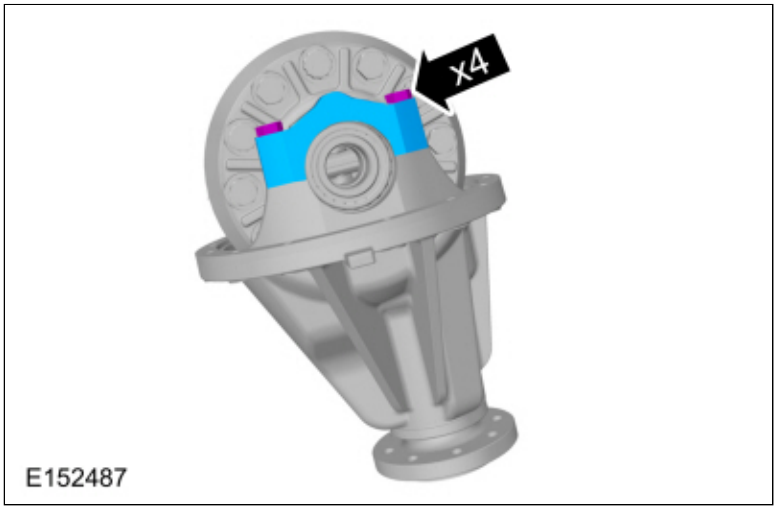
1. Refer to: Differential Carrier (205-02 Rear Drive Axle/Differential, Removal and Installation).
2. Use Special Service Tool: 205-329 Mounting Bracket, Engine/Differential.



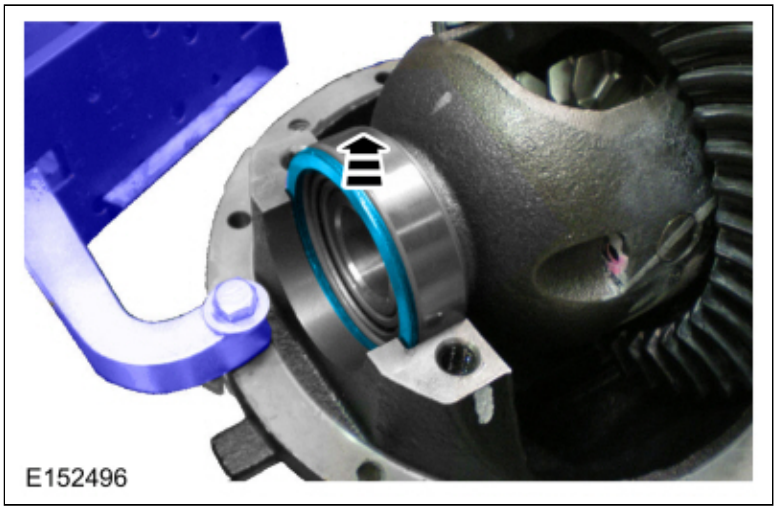
3. **NOTE:** *Place a mark on one of the bearing caps to ensure assembly to the same position.*



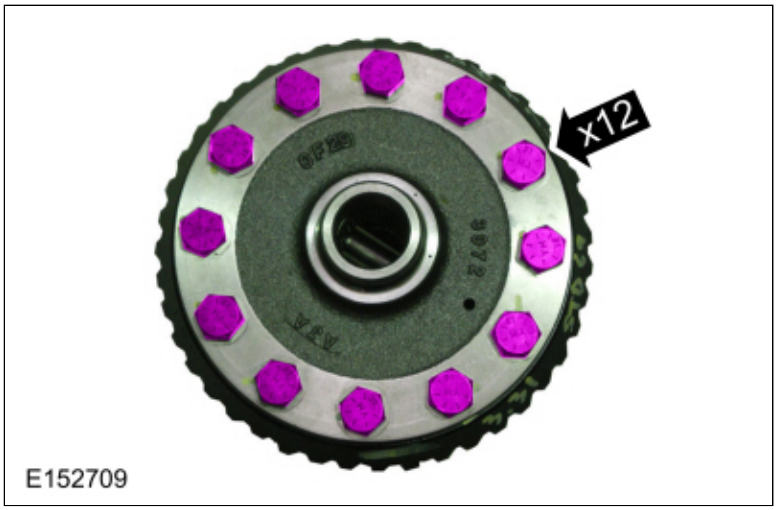
4.



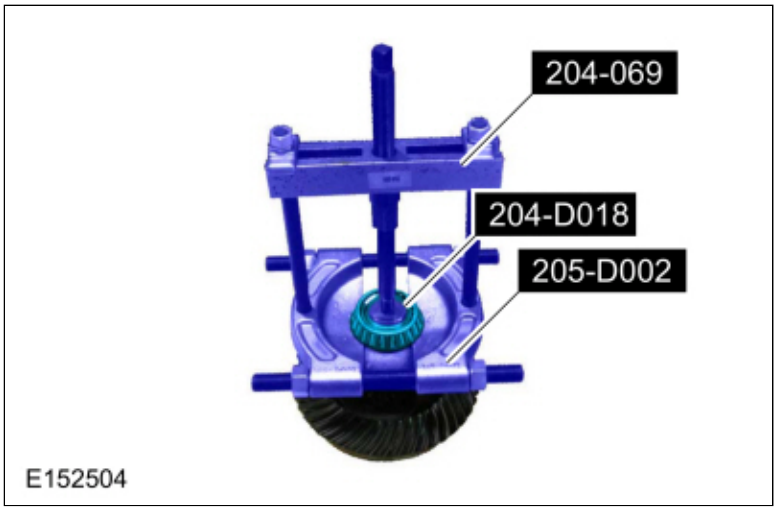
5. **NOTE:** *Make sure that the component is installed to the position noted before removal.*



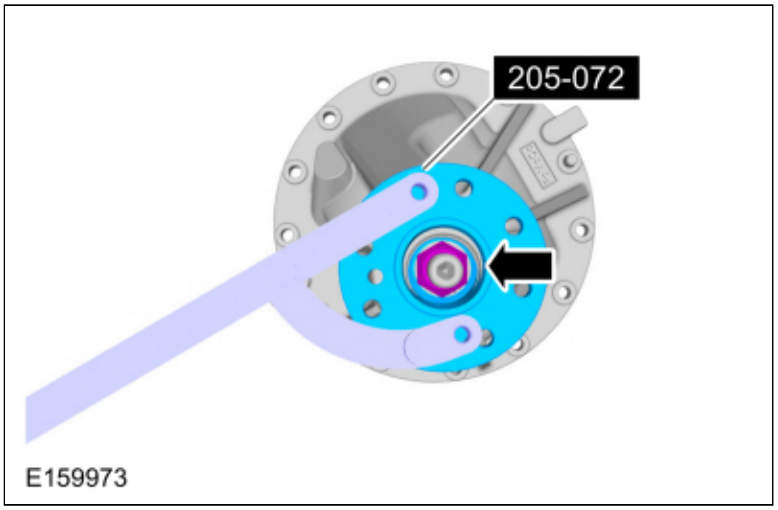
6.



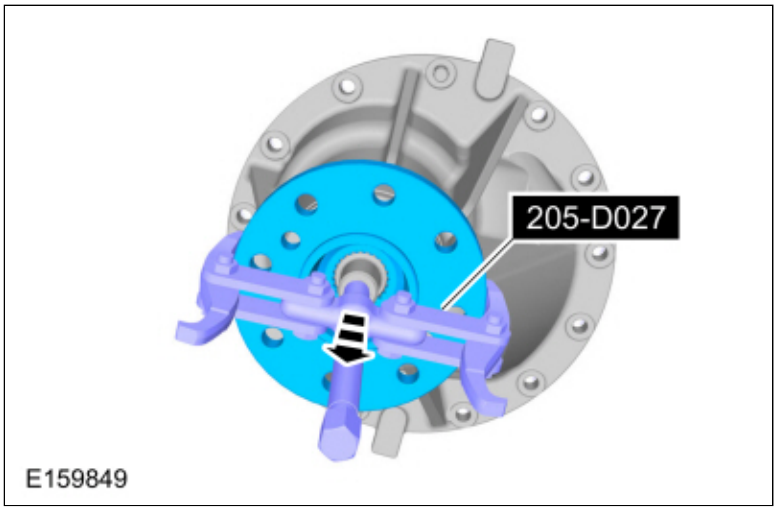
7. Use Special Service Tool: 204-069 (T81P-1104-C) Remover/Installer, Front Wheel Hub. , 205-D018 Adapter. , 205-D002 Bearing Splitter.



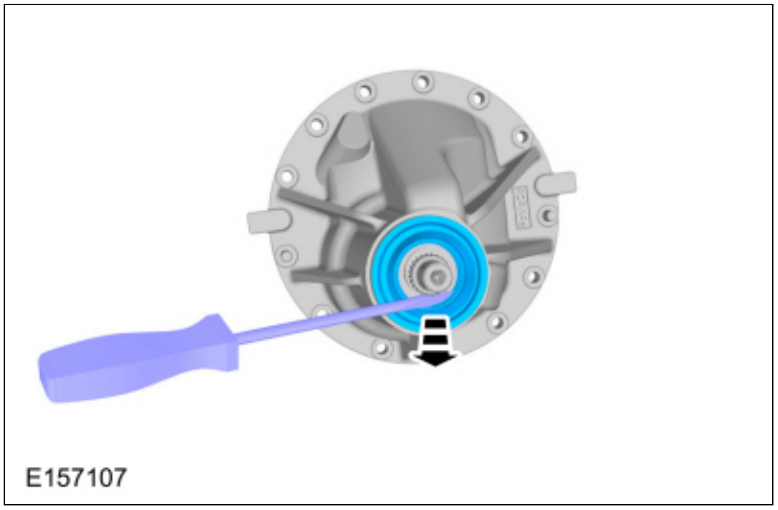
8. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



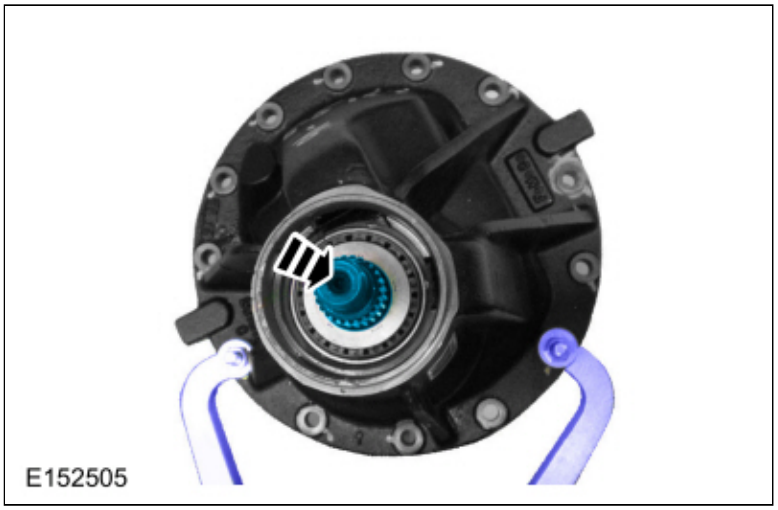
9. Use Special Service Tool: 205-D027 (D80L-1013-A) 2 or 3 Jaw Puller.



10.



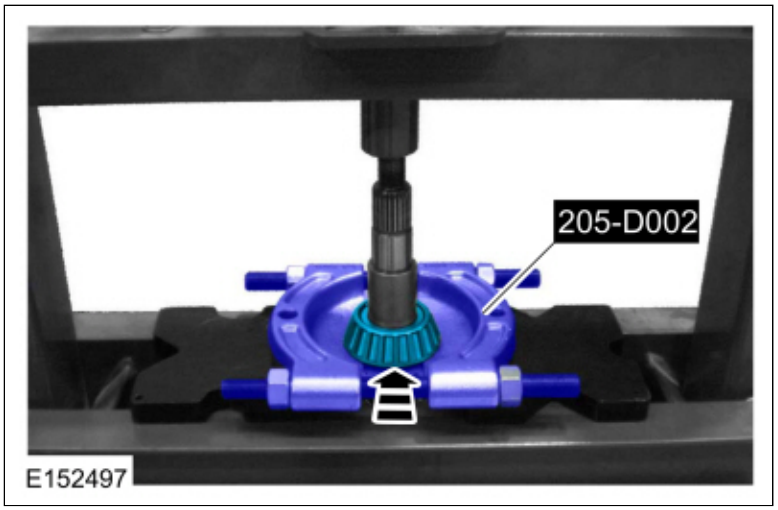
11. Use the General Equipment: Copper Hammer



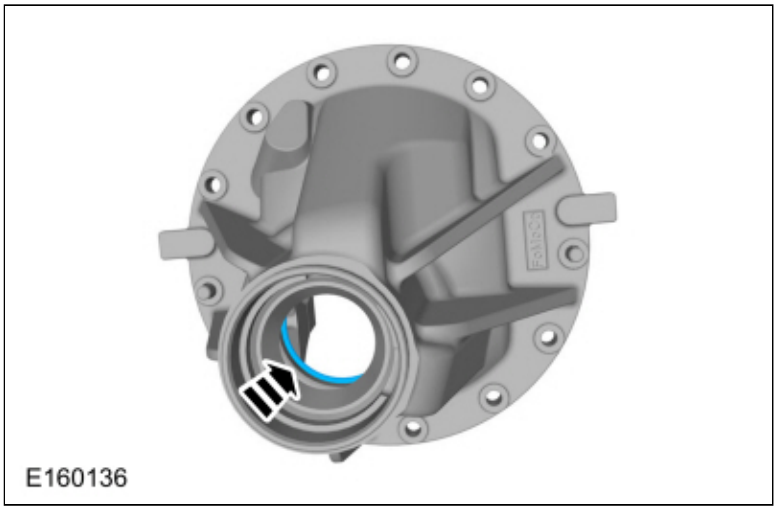
12.



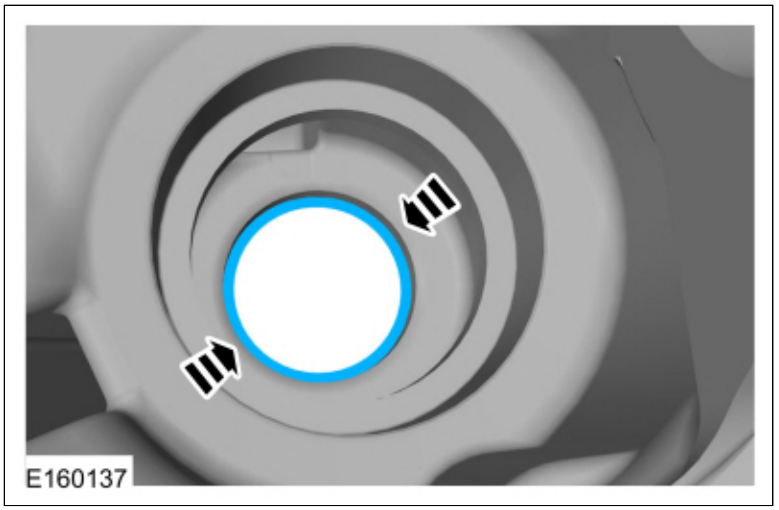
13. Use Special Service Tool: 205-D002 Bearing Splitter.
Use the General Equipment: Hydraulic Press



14.

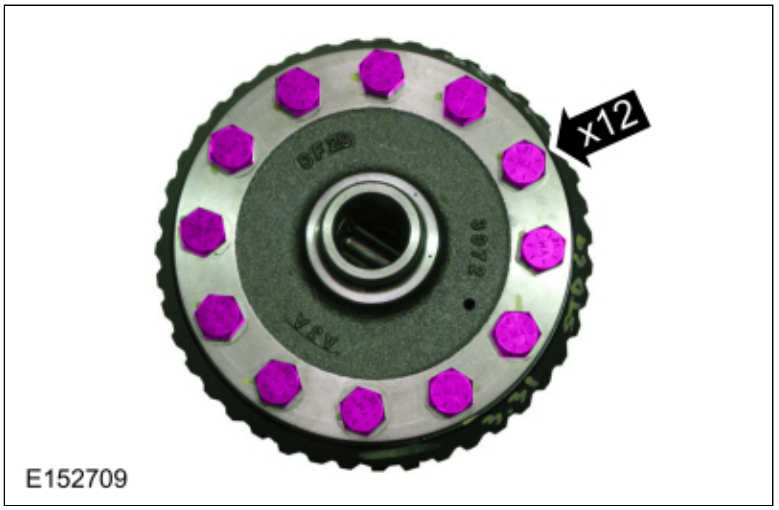


15.



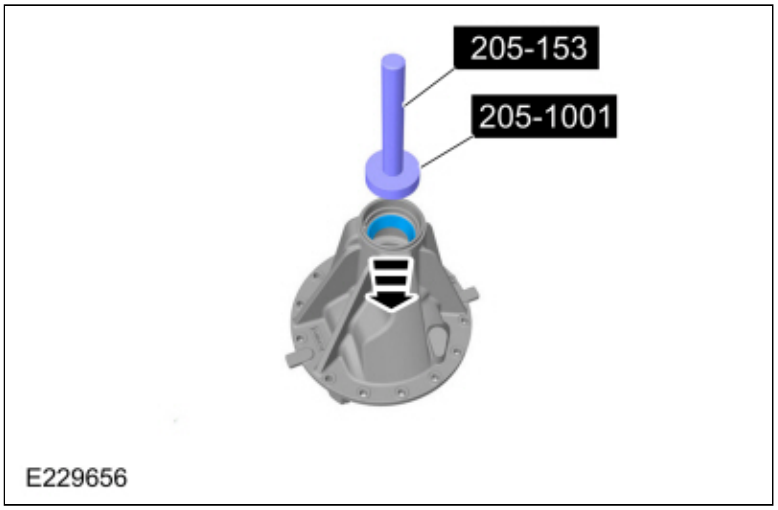
ASSEMBLY

1. *Torque*: 255 Nm

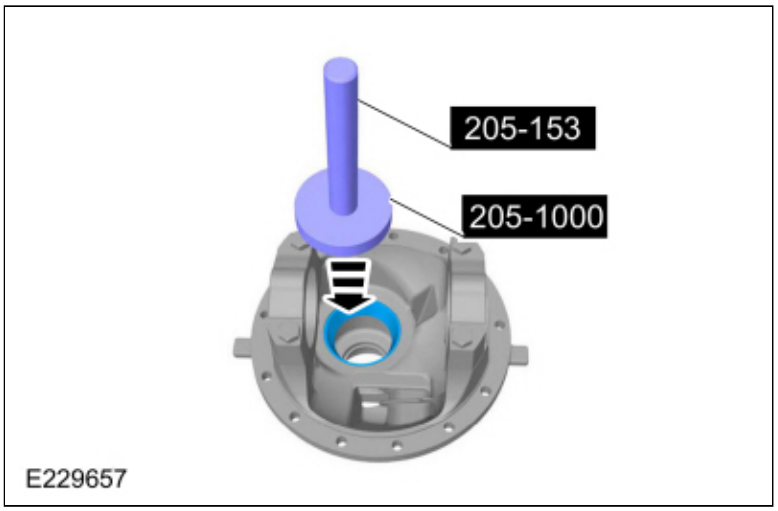


2. **NOTE:** *New bearings should be used when diff case is changed.*

3. Install Special Service Tool: 205-153 (T80T-4000-W) Handle.
   Use Special Service Tool: 205-1001 Installer, Rear Differential Bearing.



4. Install Special Service Tool: 205-153 (T80T-4000-W) Handle.
   Use Special Service Tool: 205-1000 Installer, Rear Differential Bearing.

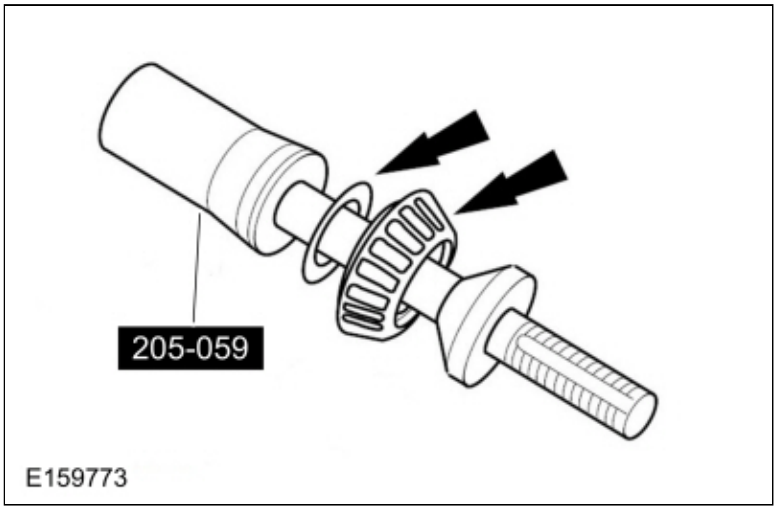


5. **NOTICE: Make sure that the drive pinion shim is centralized on the special tool.**

   NOTE: *Lubricate the drive pinion bearing cones with rear axle oil.*

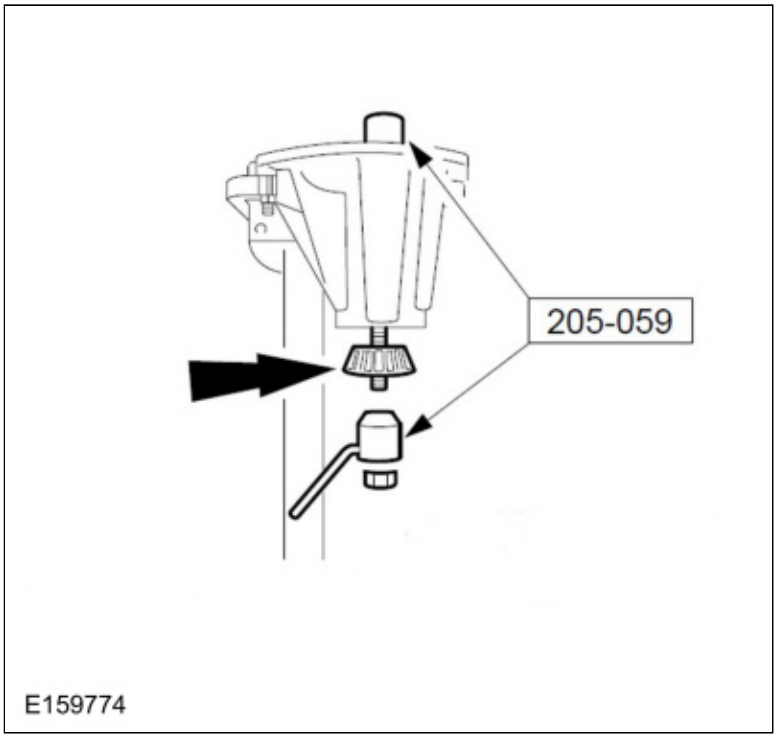
   NOTE: *The conical nut of the special has a left-hand thread.*

   Assemble the special tool with the old drive pinion shim and the drive pinion rear bearing cone.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.

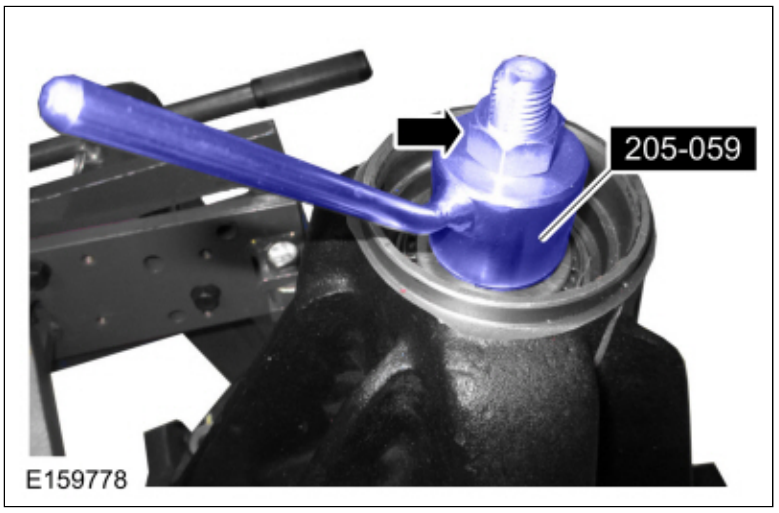


6. **NOTE:** *Lubricate the drive pinion bearing cones with rear axle oil.*

   Assemble the special tools with the drive pinion front bearing cone.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.



7. Tighten the retaining nut and check bearings for smooth rotation.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.
   Torque: 30 Nm

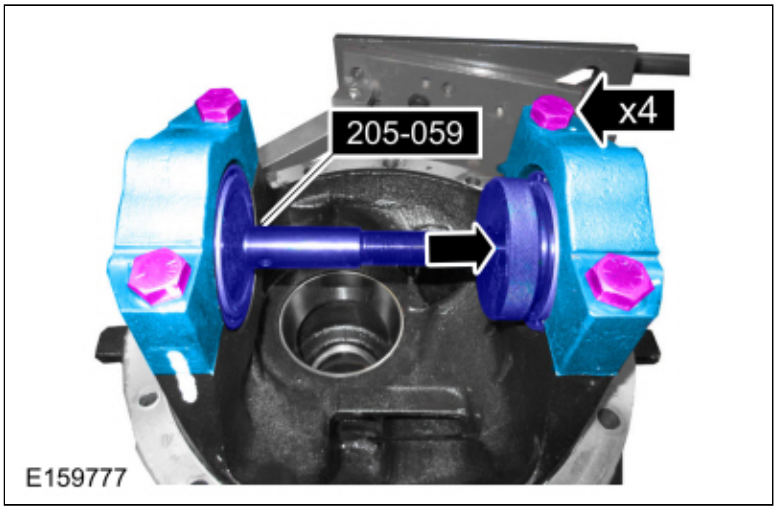


8. **NOTICE: Make sure that the bearing caps are installed to their original positions.**

   NOTE: *Lubricate the differential bearing cones with rear axle oil.*

   NOTE: *The adjusting nuts must be tight against the differential bearing cups.*

   Install the special tool together with the differential bearings and the adjusting nuts.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.
   Torque: 88 Nm



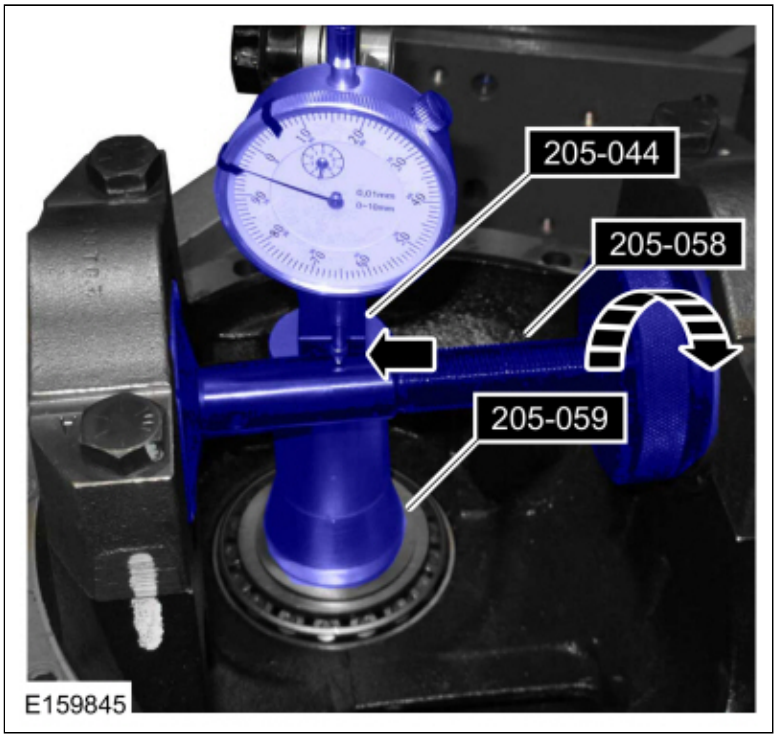
9. **NOTE:** *Make sure that the special tool can still be turned by hand.*

   Using a suitable drift, tighten the adjusting nut of the special tool.
   Use Special Service Tool: 205-058 Adjustment Gauge, Drive Pinion.



10. **NOTE:** *The dial indicator gauge plunger must be on the center line of the special tool.*

    Using a suitable dial indicator gauge, determine the total deflection of the special tool as it is rotated.
    Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion.



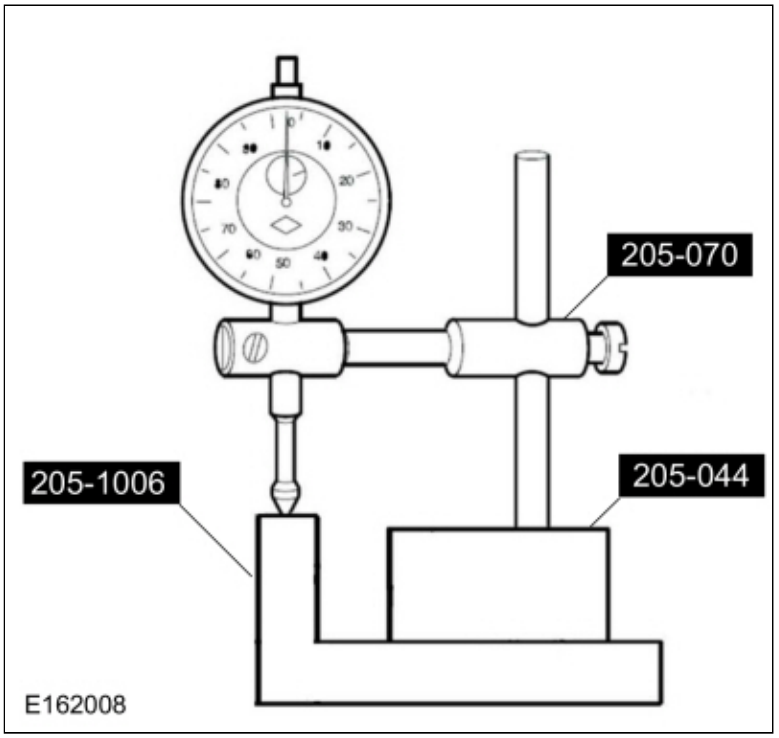
11. **NOTICE: When half of the total deflection is shown on the dial indicator gauge, do not turn the special tool further.**

    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Turn the special tool until half of the total deflection is shown on the dial indicator gauge.

12. **NOTICE: Make sure that the dial indicator settings are not altered while transfering the dial indicator to the master pinion gauge.**

    Using the special tools, zero the dial indicator gauge on the step gauge.
    Use Special Service Tool: 205-1006 Gauge, Drive Pinion Height. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-070 Holding Fixture, Dial Indicator Gauge.

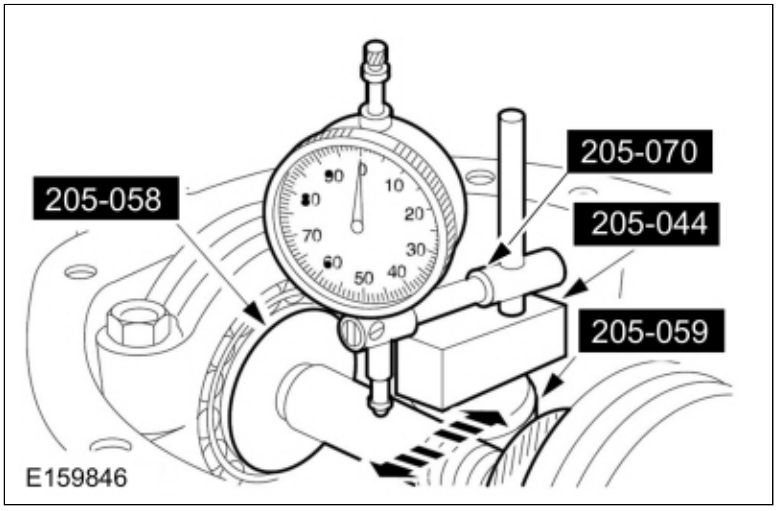


13. **NOTE:** *Verify the measurement three times.*

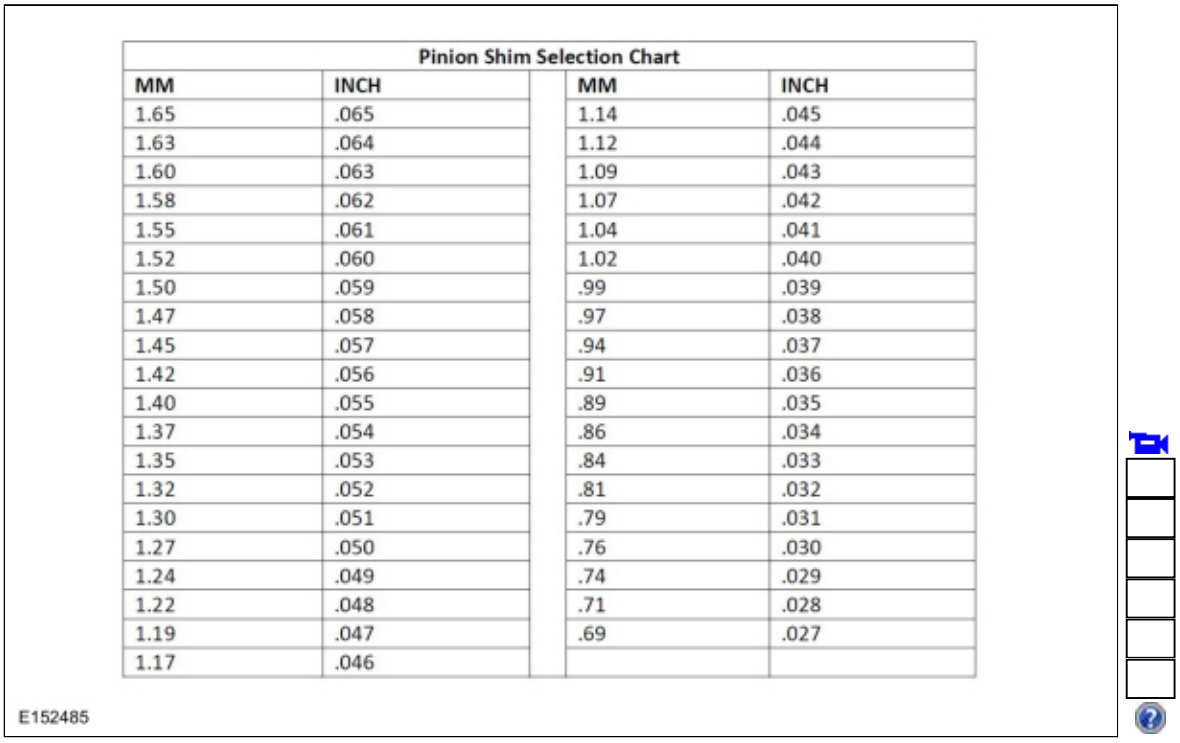
    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Calculate the required drive pinion shim thickness.
    - Slide the dial indicator gauge plunger slowly across the drive pinion adjustment gauge (as shown).

- Make a note of the measurement when the dial indicator gauge plunger is on the highest point of the drive pinion adjustment gauge and the dial indicator gauge pointer changes direction.
- If the measurement is positive, the dial indicator gauge reading must be added to the old shim thickness.
- If the measurement is negative, the dial indicator gauge reading must be subtracted from the old shim thickness.
  Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion. , 205-070 Holding Fixture, Dial Indicator Gauge.



14. Select the appropiate shim from the pinion shim selection chart.



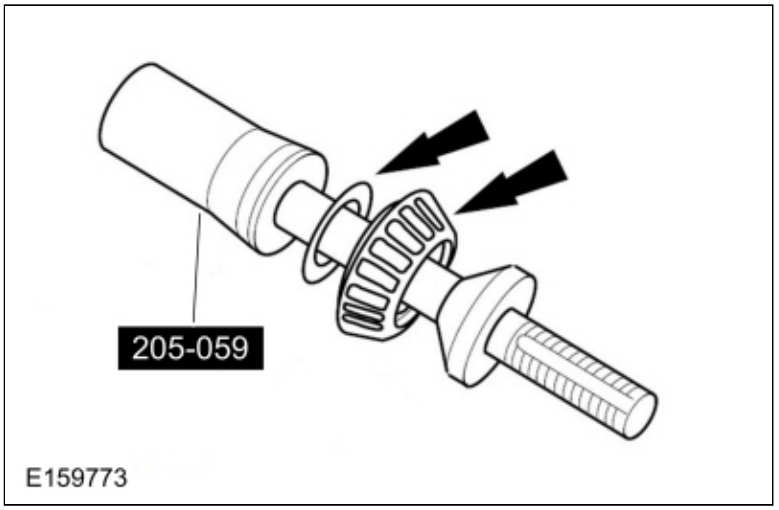
Pinion Shim Selection Chart

MM	INCH		MM	INCH
1.65	.065		1.14	.045
1.63	.064		1.12	.044
1.60	.063		1.09	.043
1.58	.062		1.07	.042
1.55	.061		1.04	.041
1.52	.060		1.02	.040
1.50	.059		.99	.039
1.47	.058		.97	.038
1.45	.057		.94	.037
1.42	.056		.91	.036
1.40	.055		.89	.035
1.37	.054		.86	.034
1.35	.053		.84	.033
1.32	.052		.81	.032
1.30	.051		.79	.031
1.27	.050		.76	.030
1.24	.049		.74	.029
1.22	.048		.71	.028
1.19	.047		.69	.027
1.17	.046			

- Remove Special Service Tool: 205-059 Gauge, Master Pinion.

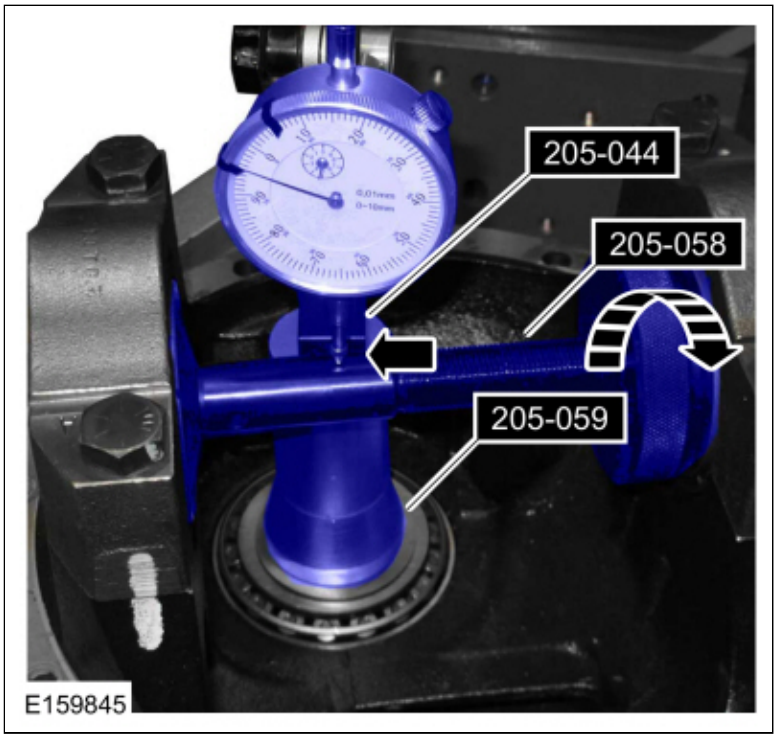
16. **NOTE:** *The conical nut of the special tool has a left-hand thread.*

- Re-assemble the special tool with the new drive pinion shim and the drive pinion rear bearing cone.
  Use Special Service Tool: 205-059 Gauge, Master Pinion.



17. **NOTE:** *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    Using a suitable dial indicator gauge, determine the total deflection of the special tool as it is rotated.
    Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion.



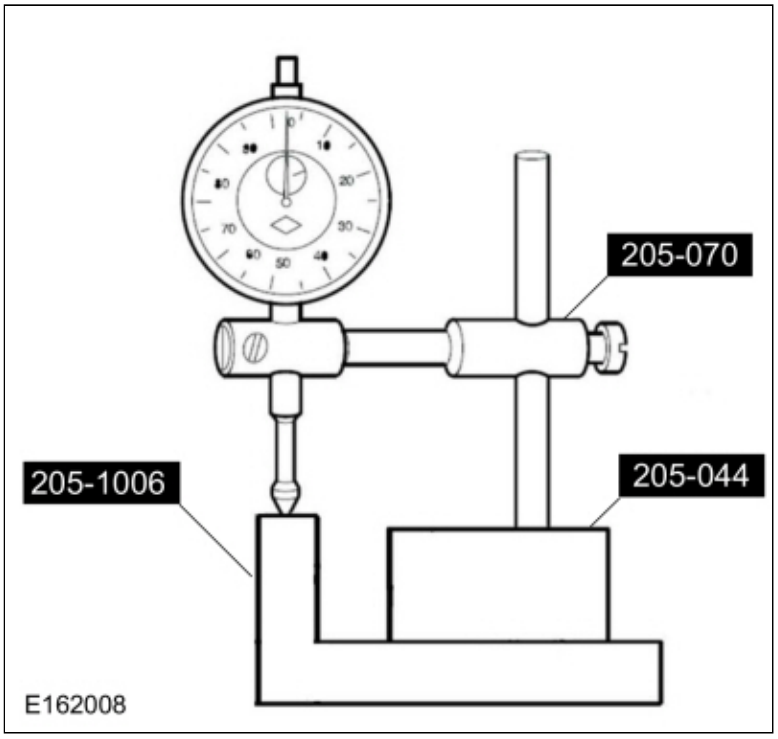
18. **NOTICE: When half of the total deflection is shown on the dial indicator gauge, do not turn the special tool further.**

    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Turn the special tool until half of the total deflection is shown on the dial indicator gauge.

19. **NOTICE: Make sure that the dial indicator settings are not altered whilst transfering the dial indicator to the master pinion gauge.**

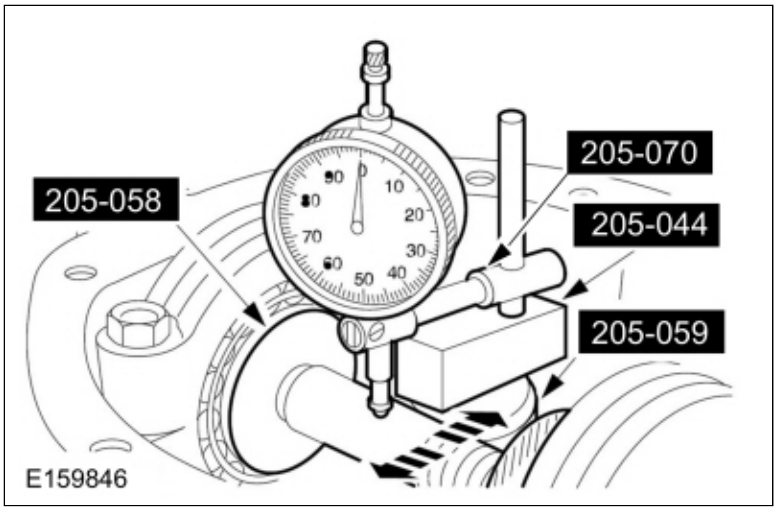
    Using the special tools, zero the dial indicator gauge on the step gauge.
    Use Special Service Tool: 205-1006 Gauge, Drive Pinion Height. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-070 Holding Fixture, Dial Indicator Gauge.



20. **NOTE:** *Verify the measurement three times.*

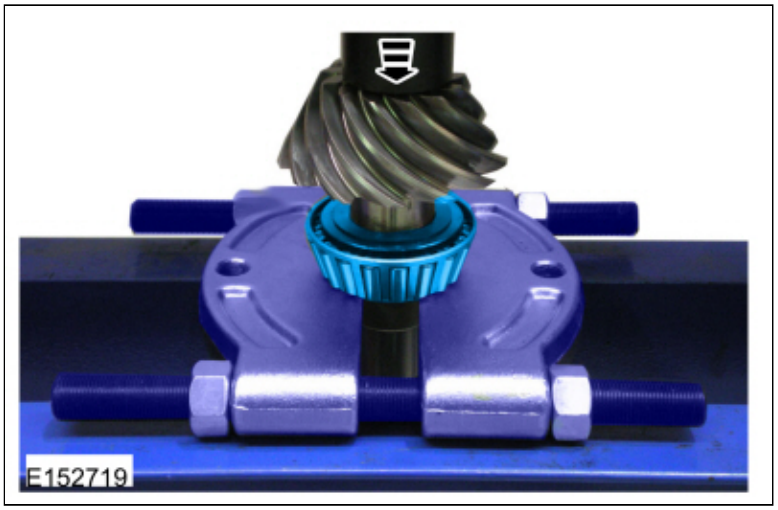
    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Slide the dial indicator gauge plunger slowly across the drive pinion adjustment gauge (as shown).
    - Make a note of the measurement when the dial indicator gauge plunger is on the highest point of the drive pinion adjustment gauge and the dial indicator gauge pointer changes direction.
    - If the selected shim is correct, the dial gauge reading should be zero. If the reading is not zero, repeat the shim selection proccess and adjust the shim thickness accordingly.
      Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion. , 205-070 Holding Fixture, Dial Indicator Gauge.

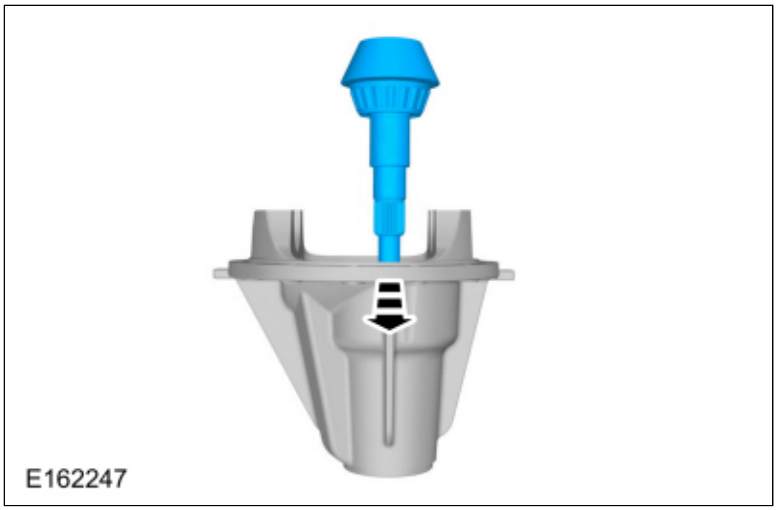


    - Remove Special Service Tool: 205-044 Holding Fixture, Dial Indicator Gauge. , 205-070 Holding Fixture, Dial Indicator Gauge. , 205-059 Gauge, Master Pinion. , 205-058 Adjustment Gauge, Drive Pinion.

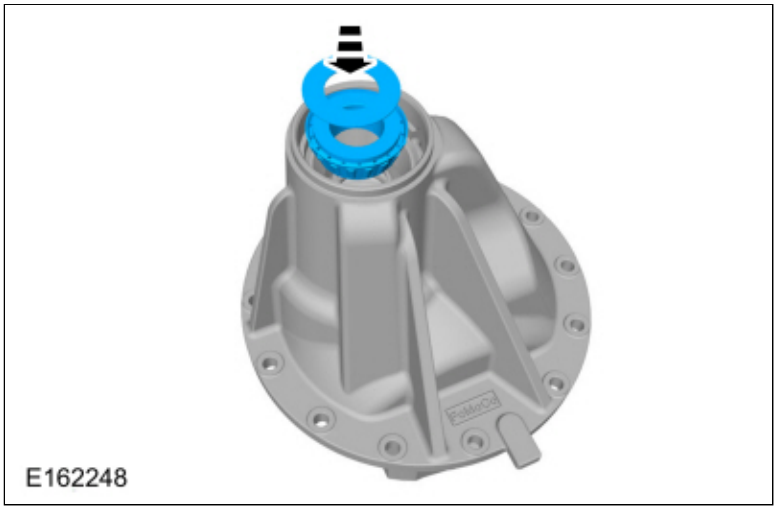
22. Install the pinion **bearing** and **shim**.
    Use the General Equipment: Hydraulic Press
    Use the General Equipment: Bearing Separator



23.

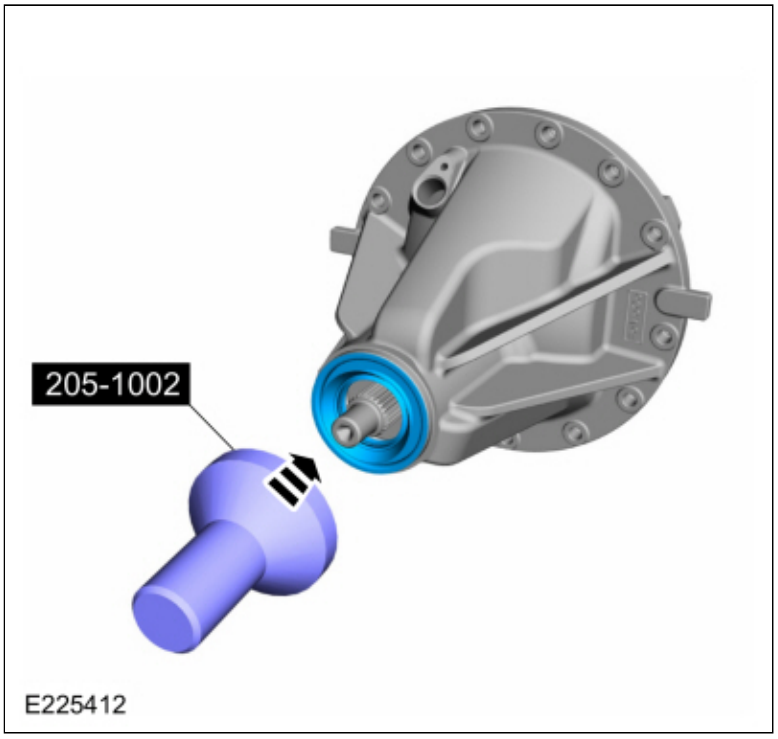


24.

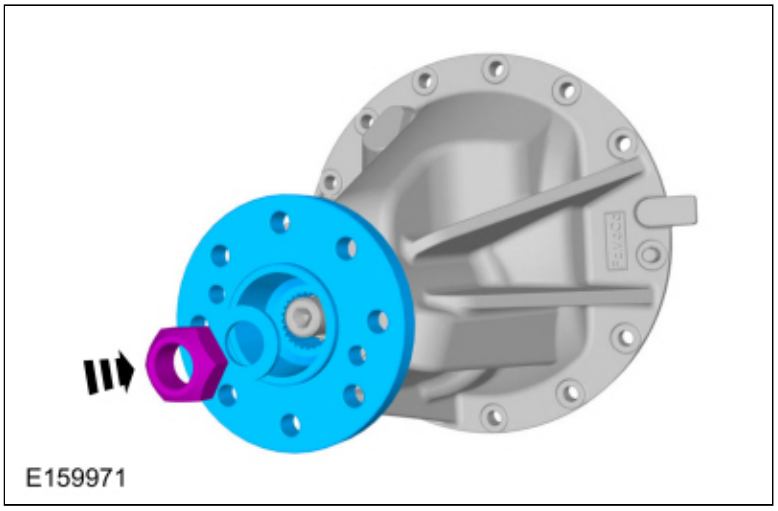


25. Apply differential oil to the lip of a new oil seal.

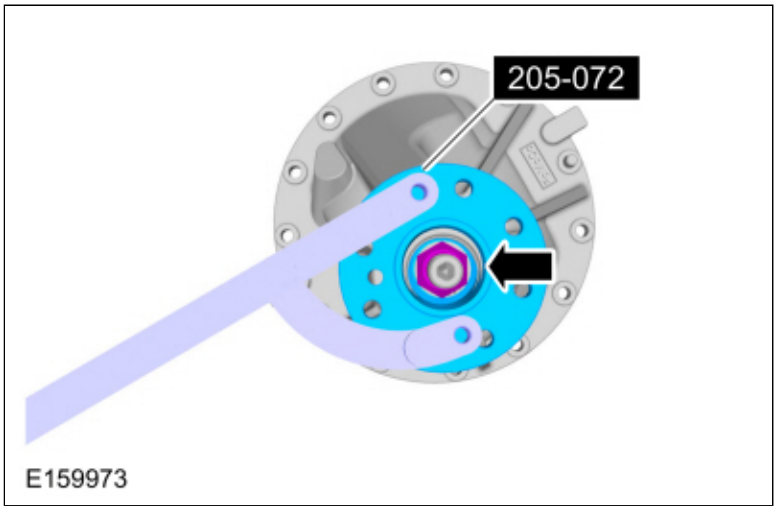
26. Use Special Service Tool: 205-1002 Installer, Drive Pinion Seal.



27. **NOTE:** *Only tighten the nut finger tight at this stage.*

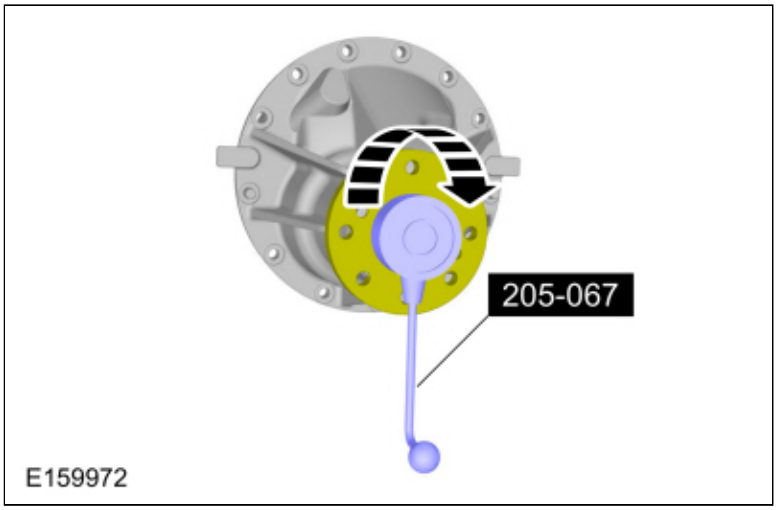


28. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Torque: 300 Nm

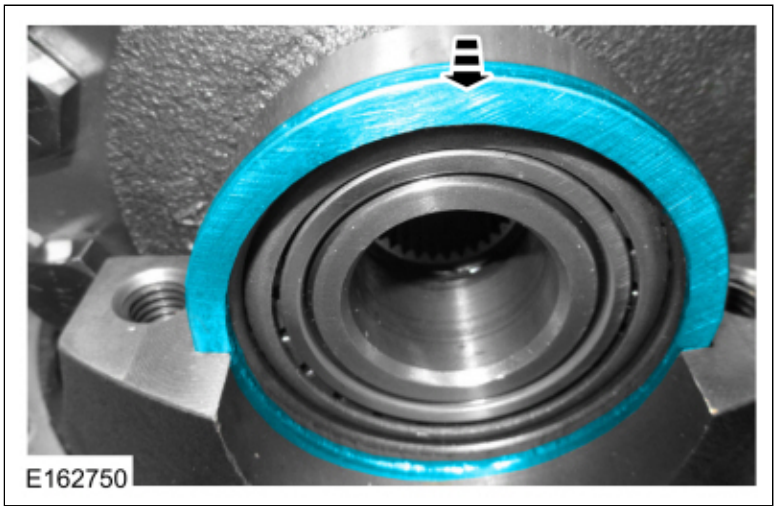


- Using the preload gauge, measure the torque to rotate. Tighten the drive pinion nut untill the torque to rotate measures 2-3 Nm.
- If the specified preload can’t be obtained within a pinion nut torque of 237 - 650 Nm, replace the collapsable

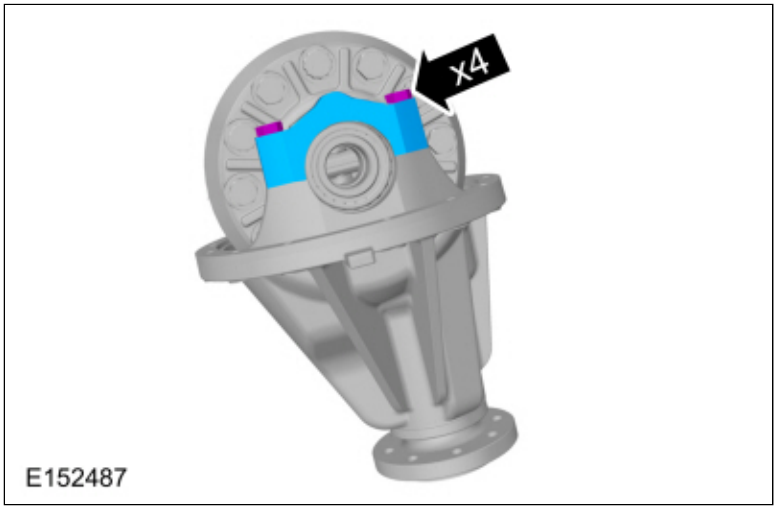
spacer and inspect again.
Use Special Service Tool: 205-067 Preload Gauge.



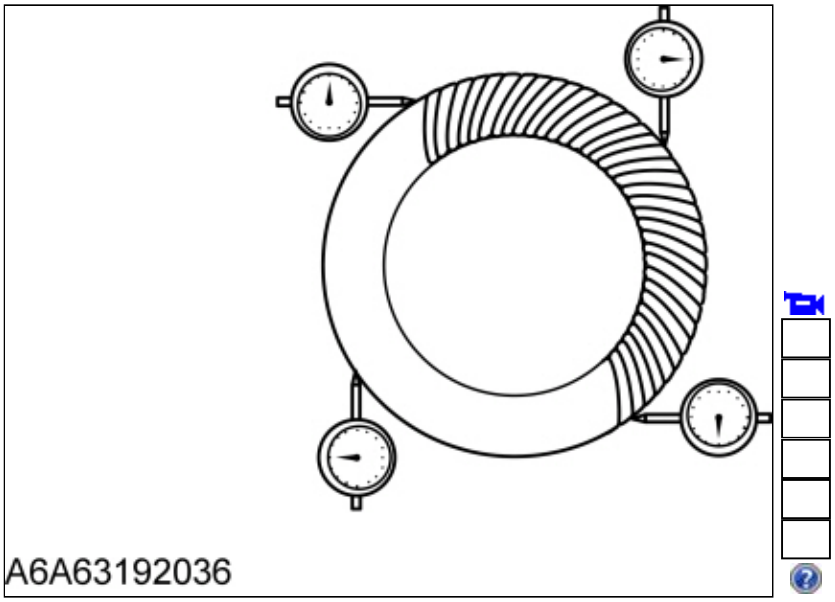
- Install the gear case component on the differential carrier.
- The original shims can be re-used if the ring and pinion is not replaced.
- If a new ring and pinion is fitted, measure the total thickness of the original shims, and split the thickness evenly between left and right.



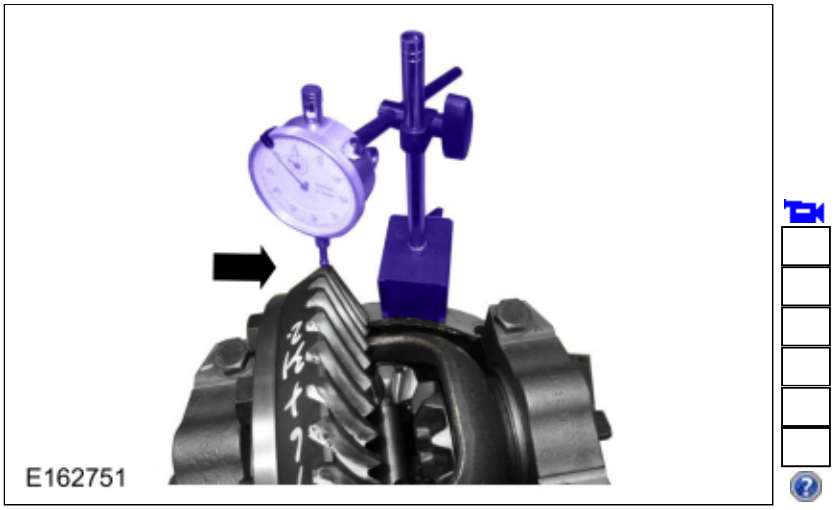
31. *Torque*: 110 Nm



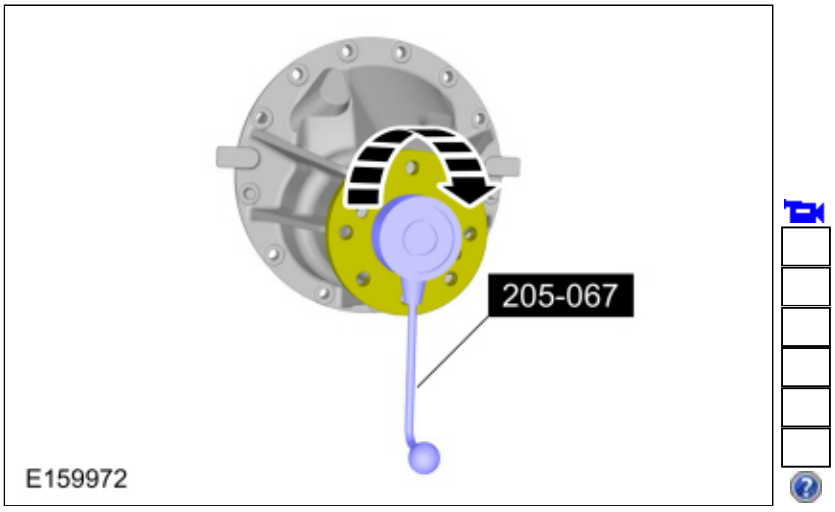
32. Mark the ring gear at four points at 90° intervals.



- Adjust the drive pinion, ring gear backlash and the side bearing preload as follows:
- Mount a dial indicator to the carrier so that the feeler comes in contact at a 90° angle with one of the ring gear teeth.
- Inspect the backlash at the three other marked points and make sure that the measurement is between 0.127 —0.203 mm {0.005—0.008 in}.



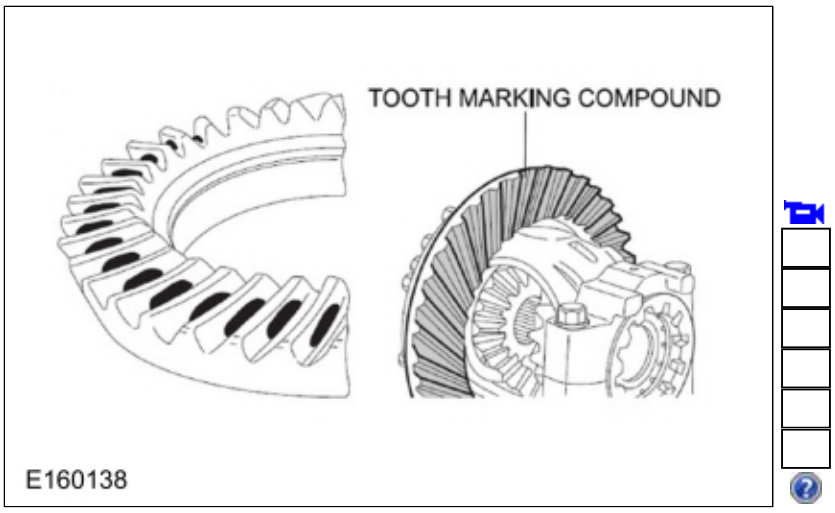
34. Using the preload gauge, measure the torque to rotate. The readings should not exceed 3.0 Nm. If the backlash is within specification but the rotating torque is high, the preload may be adjusted by removing an equal amount of shim thickness from both sides of the differential.
    Use Special Service Tool: 205-067 Preload Gauge.



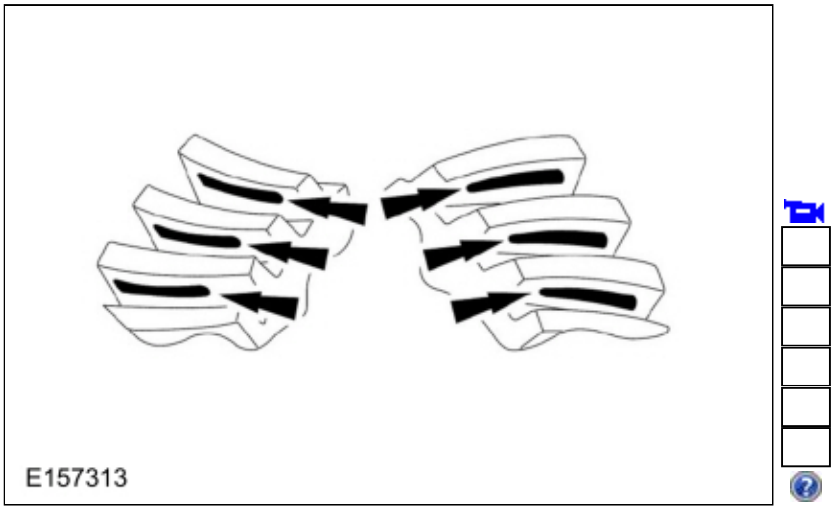
35. If backlash is not as specified, correct the backlash by adding and subtracting the required shim thickness from

either left or right, keeping the total shim thickness the same.

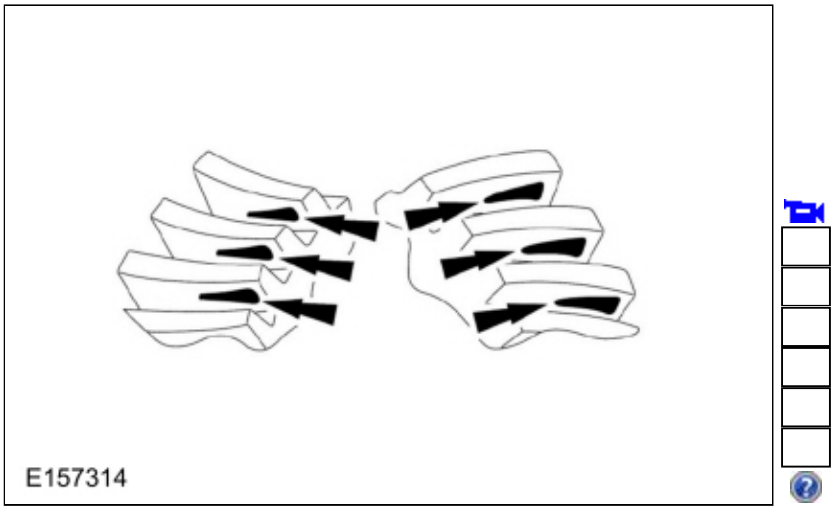
- The inspection and adjustment procedure is as follows:
- Coat both surfaces of 6—8 teeth of the ring gear uniformly with a tooth marking compound.
- While moving the ring gear back and forth by hand, rotate the drive pinion several times and inspect the tooth contact.
- If the tooth contact is good, wipe off the tooth marking compound.



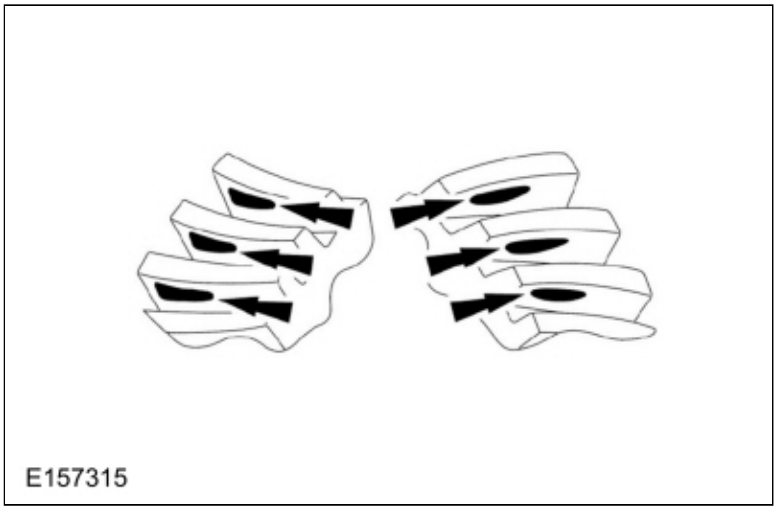
37. Acceptable ring gear tooth patterns for all axles.



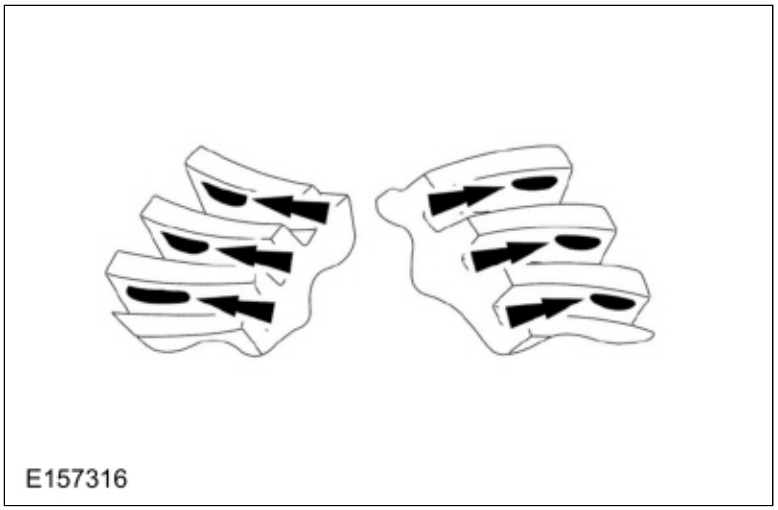
38. Correct backlash with a thinner pinion position shim.



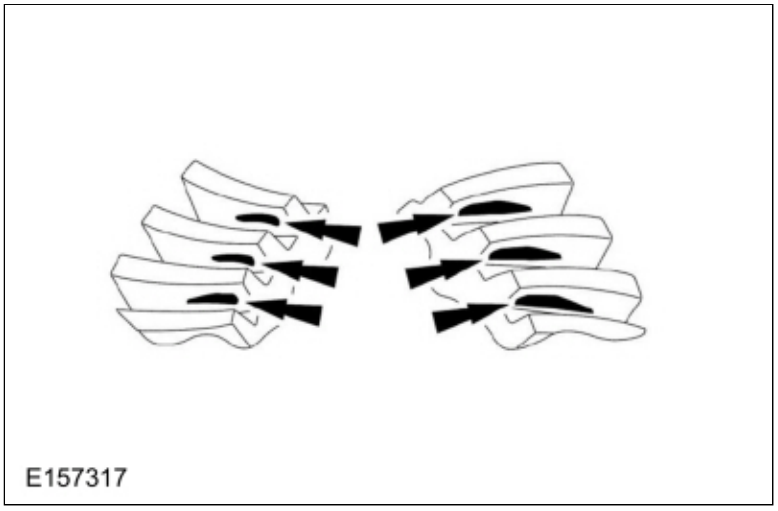
39. Correct backlash with a thicker pinion position shim.



40. Correct pinion position shim that requires a decrease in backlash.



41. Correct pinion position shim that requires an increase in backlash.



- Select the appropriate shim from the differential bearing preload shim selection table.

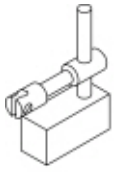
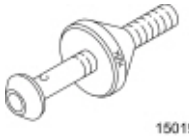
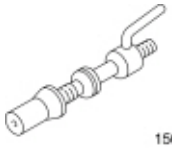
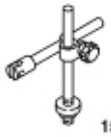
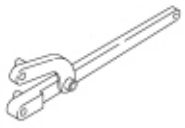
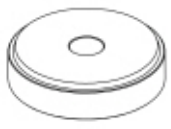
Differential Bearing Preload Shim Selection				
MM	INCH		MM	INCH
4.17	0.164		3.23	0.127
4.14	0.163		3.20	0.126
4.11	0.162		3.18	0.125
4.09	0.161		3.15	0.124
4.06	0.160		3.12	0.123
4.04	0.159		3.10	0.122
4.01	0.158		3.07	0.121
3.99	0.157		3.05	0.120
3.96	0.156		3.02	0.119
3.94	0.155		3.00	0.118
3.91	0.154		2.97	0.117
3.89	0.153		2.95	0.116
3.86	0.152		2.92	0.115
3.84	0.151		2.90	0.114
3.81	0.150		2.87	0.113
3.78	0.149		2.84	0.112
3.76	0.148		2.82	0.111
3.73	0.147		2.79	0.110
3.71	0.146		2.77	0.109
3.68	0.145		2.74	0.108
3.66	0.144		2.72	0.107
3.63	0.143		2.69	0.106
3.61	0.142		2.67	0.105
3.58	0.141		2.64	0.104
3.56	0.140		2.62	0.103
3.53	0.139		2.59	0.102
3.51	0.138		2.57	0.101
3.48	0.138		3.20	0.126
3.45	0.136			
3.43	0.135			
3.40	0.134			
3.38	0.134			
3.35	0.132			
3.33	0.131			
3.30	0.130			
3.28	0.129			
3.25	0.128			
3.23	0.127			

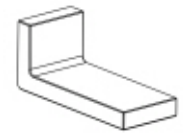
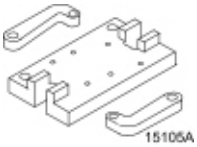
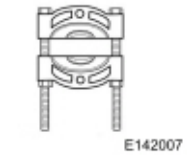
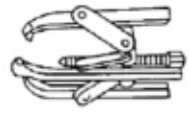
E157474

Copyright © 2016 Ford Motor Company

Differential Carrier - Vehicles With: Electronic Locking Differential (ELD)

Special Tool(s) / General Equipment

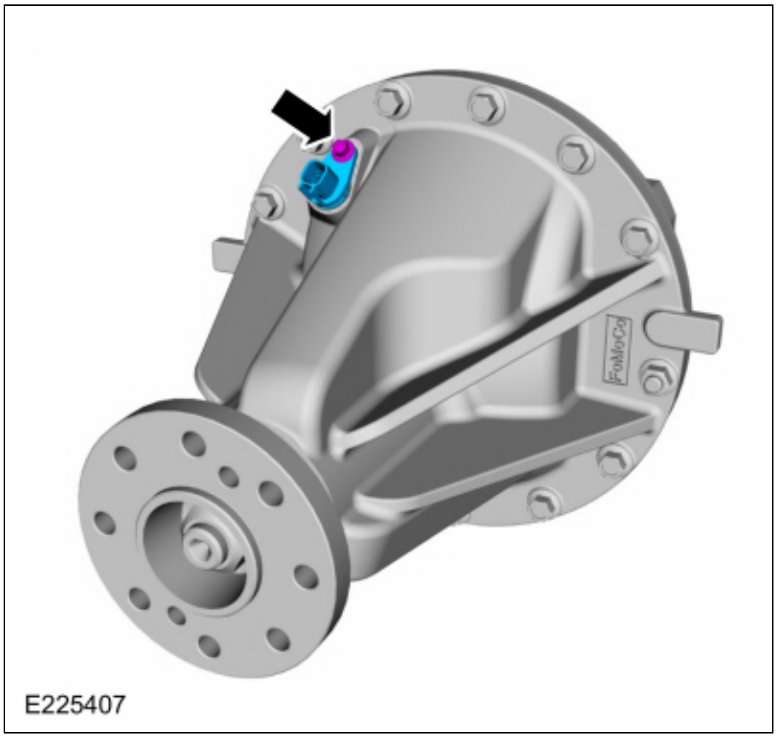
 E216590	204-069 (T81P-1104-C) Remover/Installer, Front Wheel Hub
 15008	205-044 Holding Fixture, Dial Indicator Gauge
 15019	205-058 Adjustment Gauge, Drive Pinion
 15020	205-059 Gauge, Master Pinion
 15041	205-067 Preload Gauge
 15022a	205-070 Holding Fixture, Dial Indicator Gauge
 15030A	205-072 Universal Flange Holding Wrench
 E163722	205-1000 Installer, Rear Differential Bearing
 E163723	205-1001 Installer, Rear Differential Bearing
	205-1002 Installer, Drive Pinion Seal

 E163724	
 E163725	205-1006 Gauge, Drive Pinion Height
 E133913	205-153 (T80T-4000-W) Handle
 15105A	205-329 Mounting Bracket, Engine/Differential
 E142007	205-D002 Bearing Splitter
 E142008	205-D018 Adapter
	205-D027 (D80L-1013-A) 2 or 3 Jaw Puller
Hydraulic Press	
Copper Hammer	
Bearing Separator	

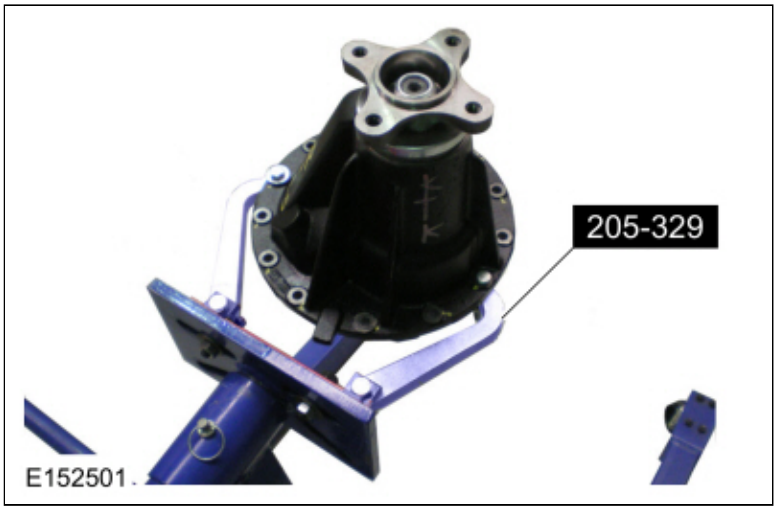
DISASSEMBLY

WARNING: The engine stand is equipped with a self-lock mechanism, however, if the rear differential is tilted, the self-lock mechanism could become inoperative. If the rear differential unexpectedly rotates, it could cause injury, therefore do not maintain the rear differential tilted. When turning the rear differential, grasp the rotation handle firmly.

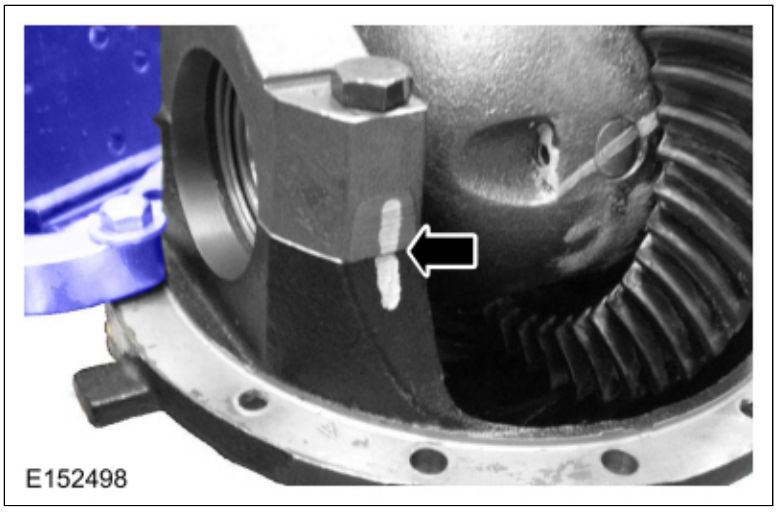
1. Refer to: Differential Carrier (205-02 Rear Drive Axle/Differential, Disassembly and Assembly).
2.



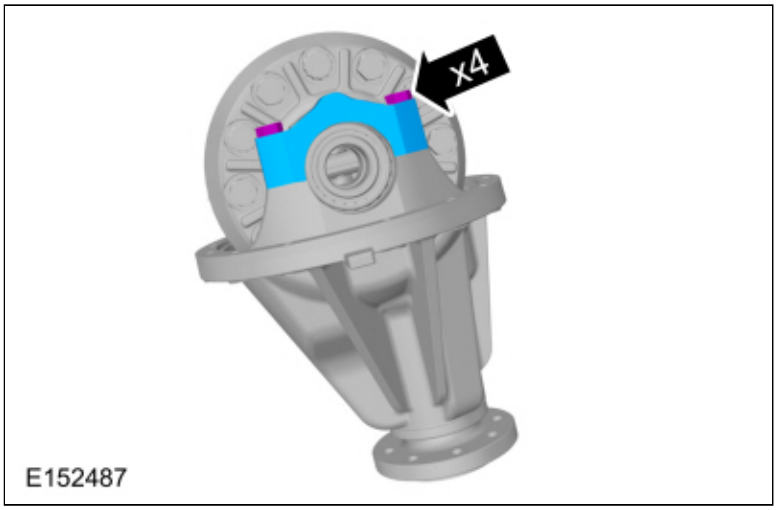
3. Use Special Service Tool: 205-329 Mounting Bracket, Engine/Differential.



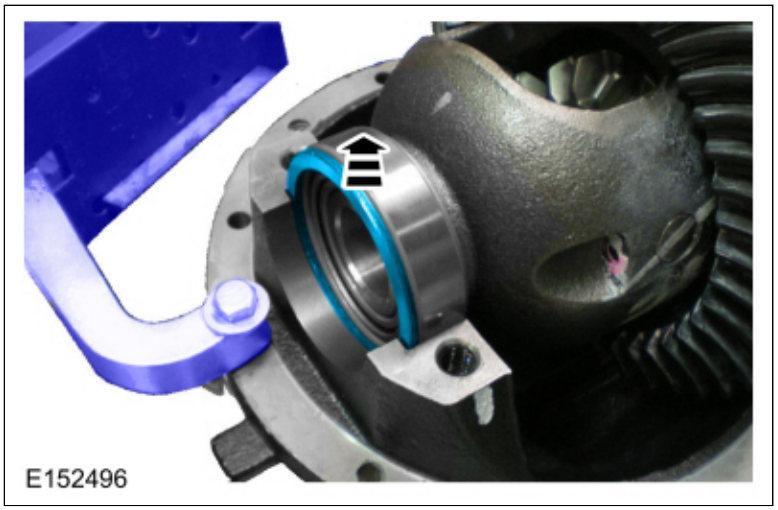
4. **NOTE:** *Place a mark on one of the bearing caps to ensure assembly to the same position.*



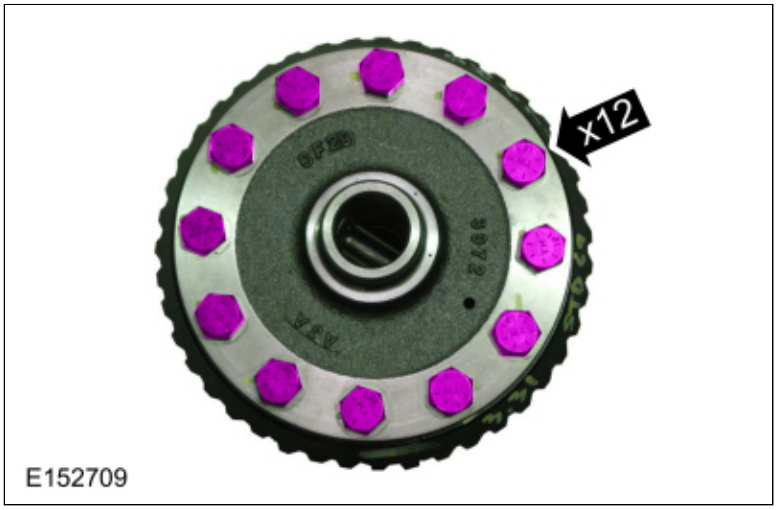
5.



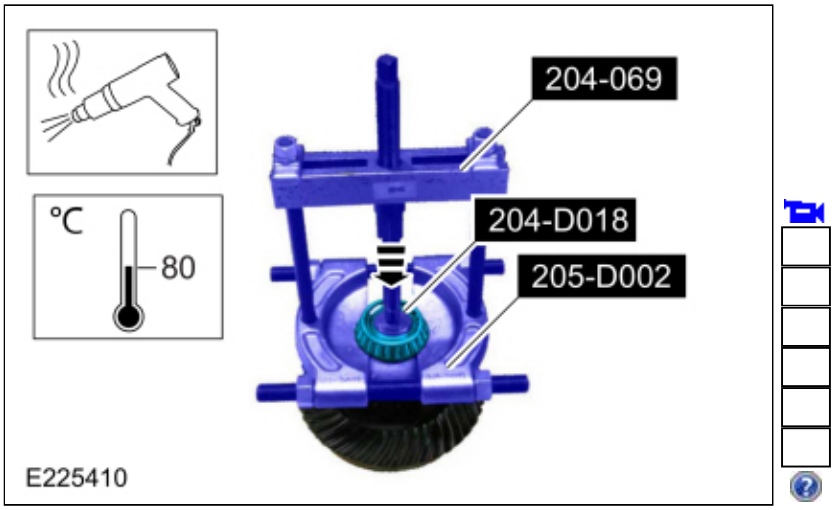
6. **NOTE:** *Take note of the position of the bearings and shims upon removal to ensure assembly to the same positions.*



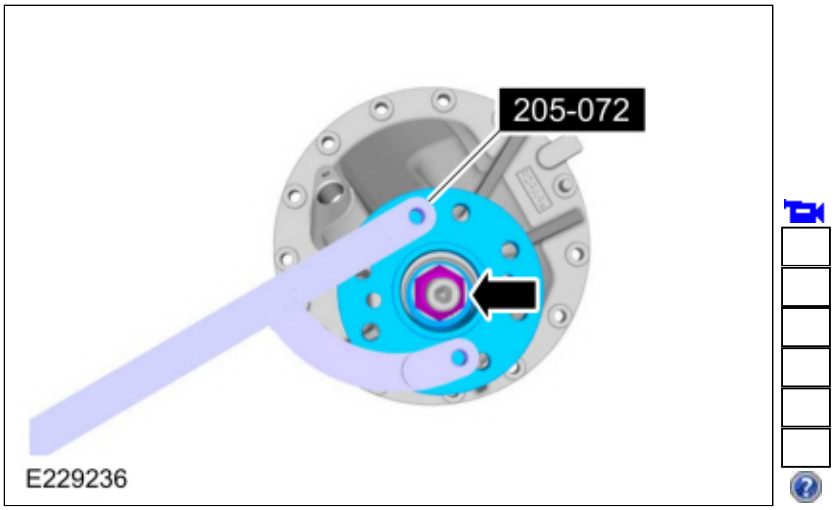
7.



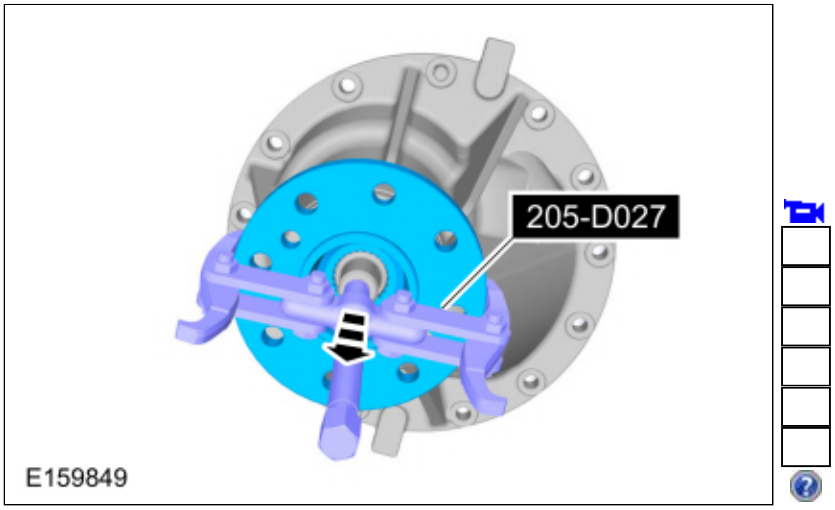
8. Use Special Service Tool: 204-069 (T81P-1104-C) Remover/Installer, Front Wheel Hub. , 205-D018 Adapter. , 205-D002 Bearing Splitter.



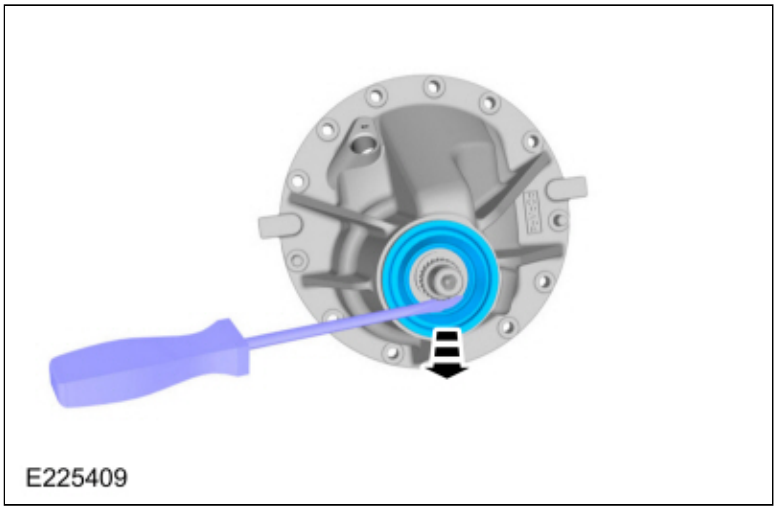
9. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



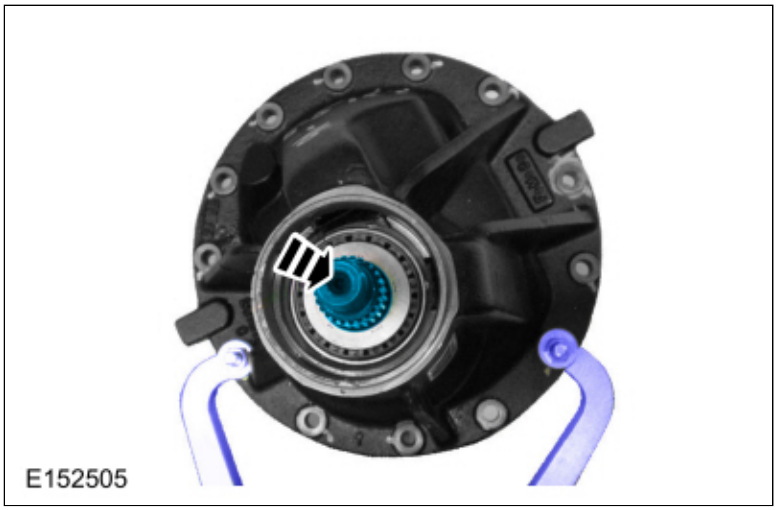
10. Use Special Service Tool: 205-D027 (D80L-1013-A) 2 or 3 Jaw Puller.



11.



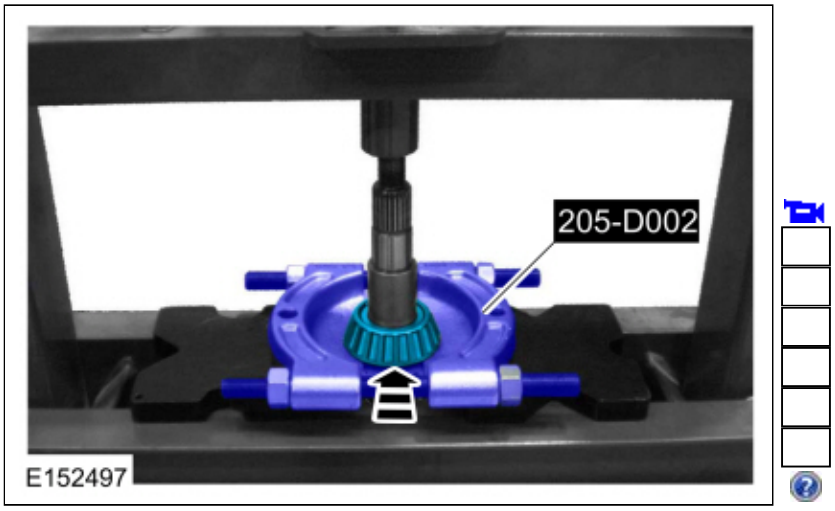
12. Use the General Equipment: Copper Hammer



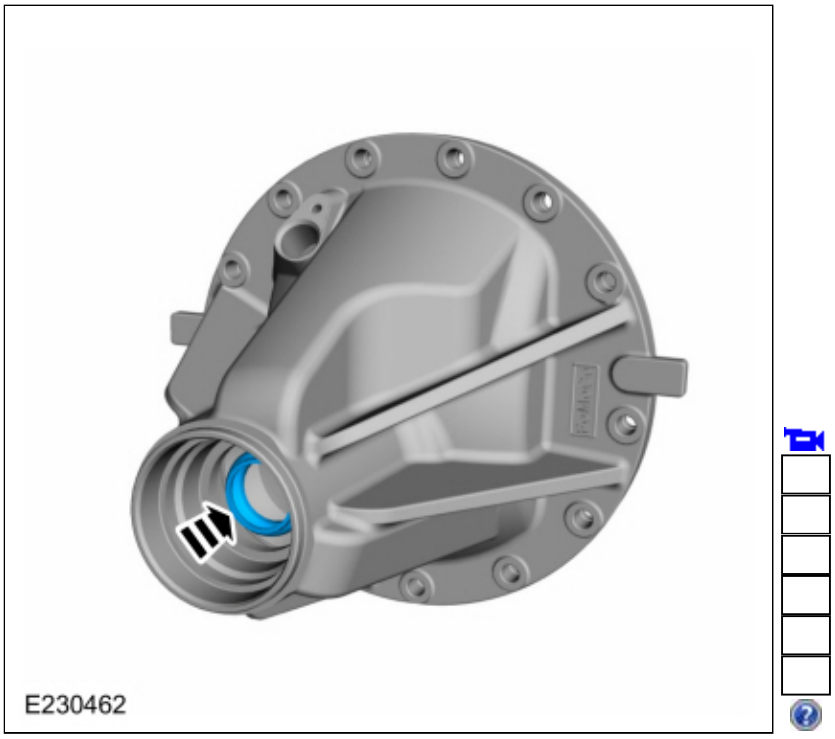
13.



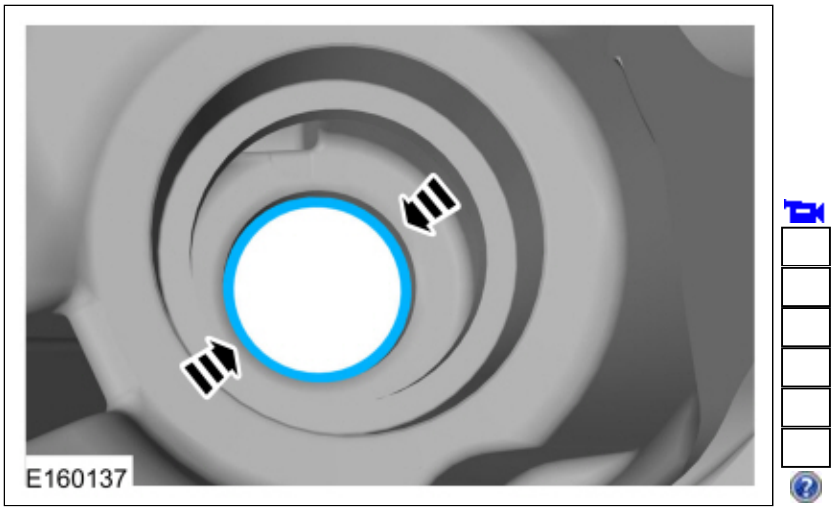
14. Use Special Service Tool: 205-D002 Bearing Splitter.
    Use the General Equipment: Hydraulic Press



15.

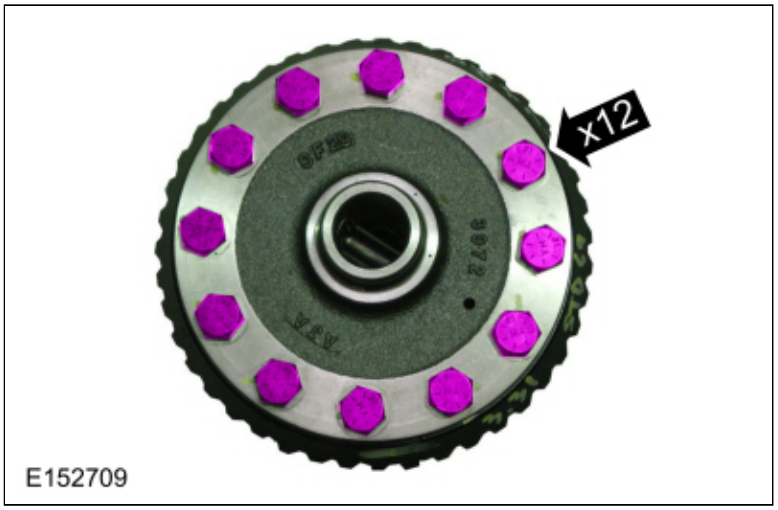


16.

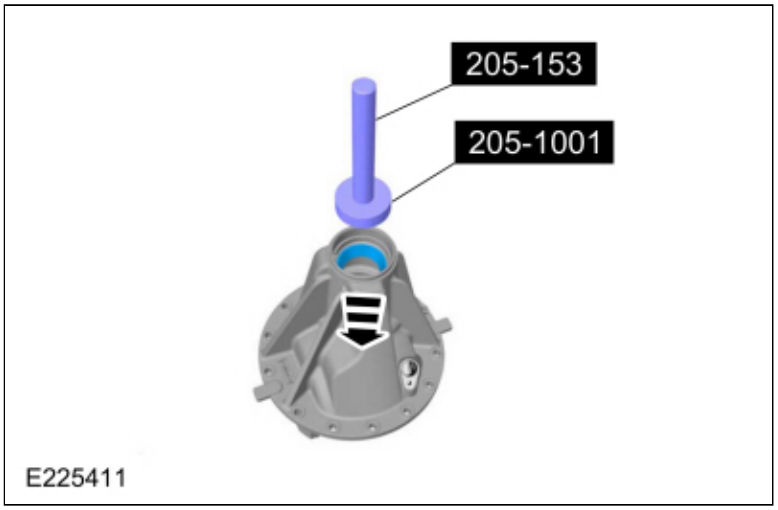


ASSEMBLY

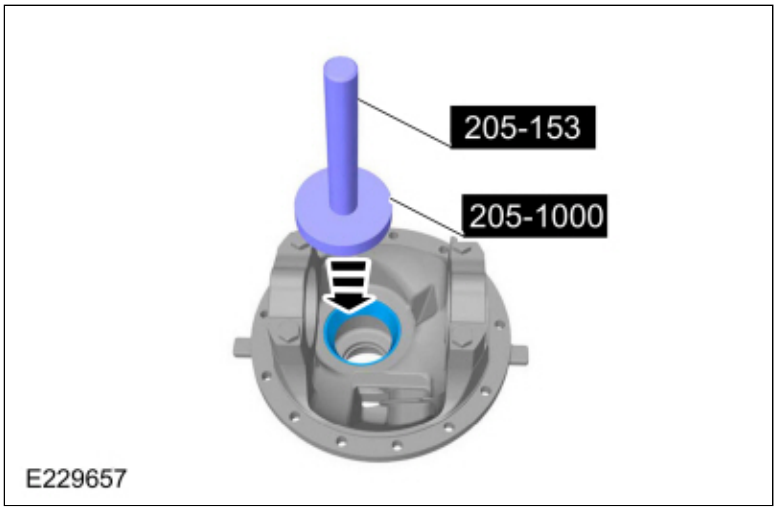
1. *Torque*: 255 Nm



2. **NOTE:** *New bearings should be used when diff case is changed.*
3. Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-1001 Installer, Rear Differential Bearing.



4. Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-1000 Installer, Rear Differential Bearing.

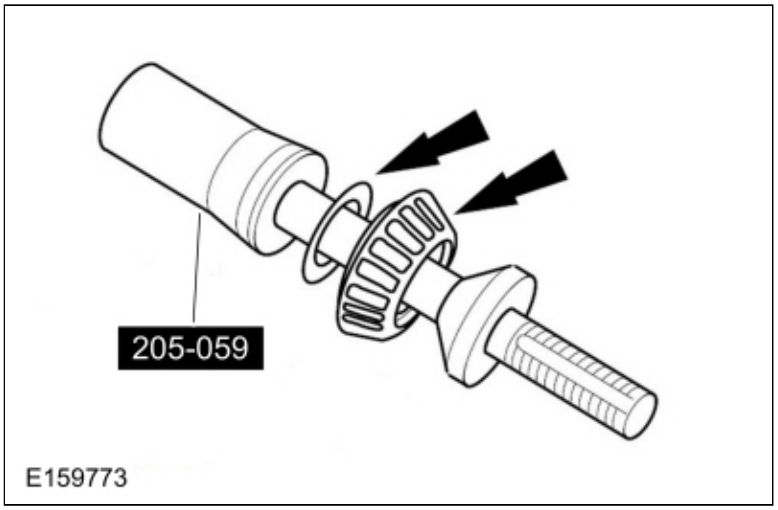


5. **NOTICE: Make sure that the drive pinion shim is centralized on the special tool.**

   NOTE: *Lubricate the drive pinion bearing cones with rear axle oil.*

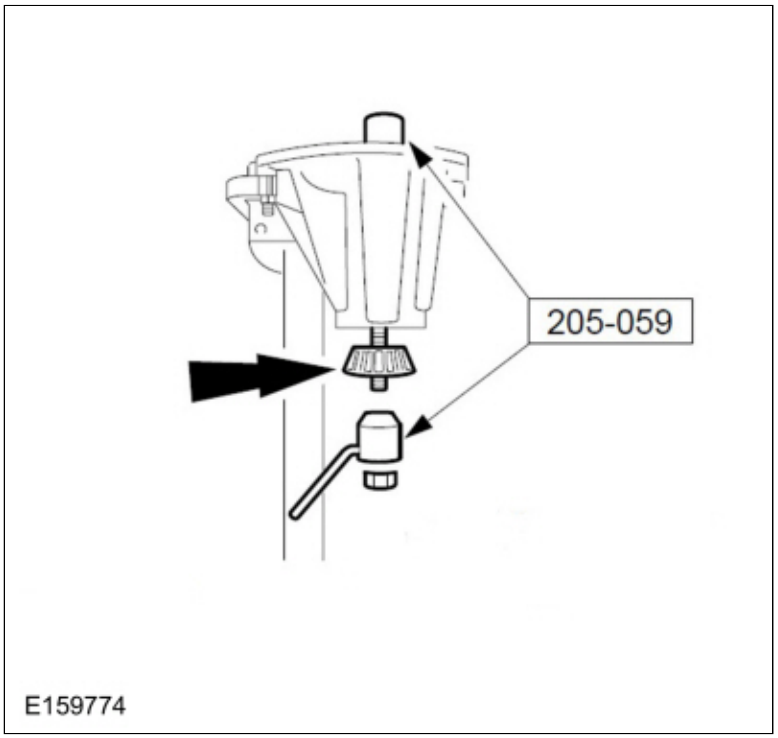
   NOTE: *The conical nut of the special has a left-hand thread.*

   Assemble the special tool with the old drive pinion shim and the drive pinion rear bearing cone.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.

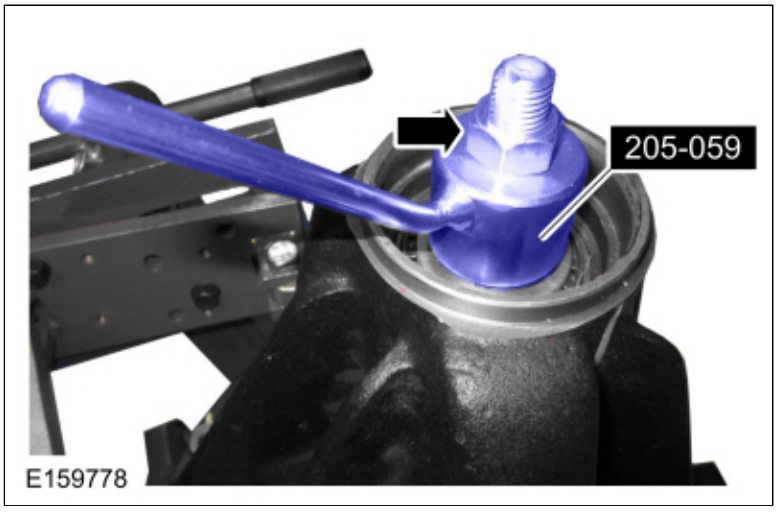


6. **NOTE:** *Lubricate the drive pinion bearing cones with rear axle oil.*

   Assemble the special tools with the drive pinion front bearing cone.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.



7. Tighten the retaining nut and check bearings for smooth rotation.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.
   Torque: 30 Nm

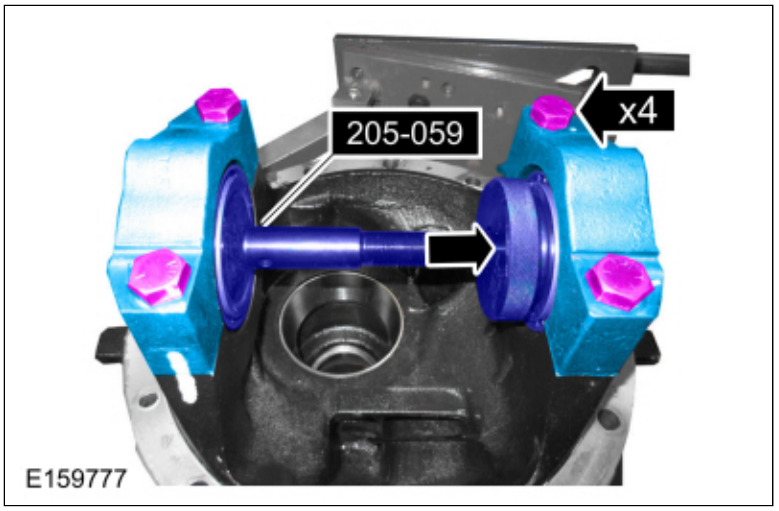


8. **NOTICE: Make sure that the bearing caps are installed to their original positions.**

   NOTE: *Lubricate the differential bearing cones with rear axle oil.*

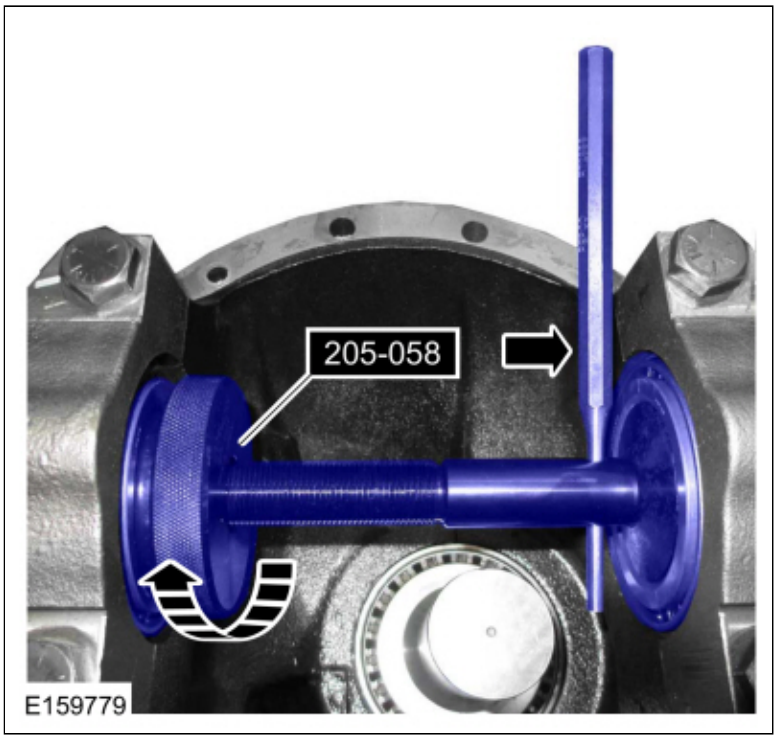
   NOTE: *The adjusting nuts must be tight against the differential bearing cups.*

   Install the special tool together with the differential bearings and the adjusting nuts.
   Use Special Service Tool: 205-059 Gauge, Master Pinion.
   Torque: 88 Nm



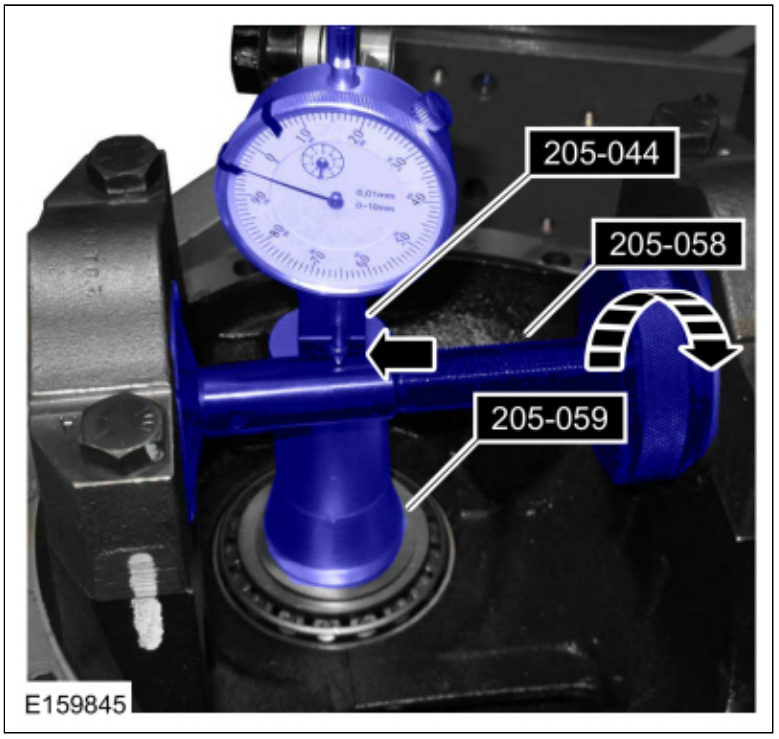
9. **NOTE:** *Make sure that the special tool can still be turned by hand.*

   Using a suitable drift, tighten the adjusting nut of the special tool.
   Use Special Service Tool: 205-058 Adjustment Gauge, Drive Pinion.



10. **NOTE:** *The dial indicator gauge plunger must be on the center line of the special tool.*

    Using a suitable dial indicator gauge, determine the total deflection of the special tool as it is rotated.
    Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion.



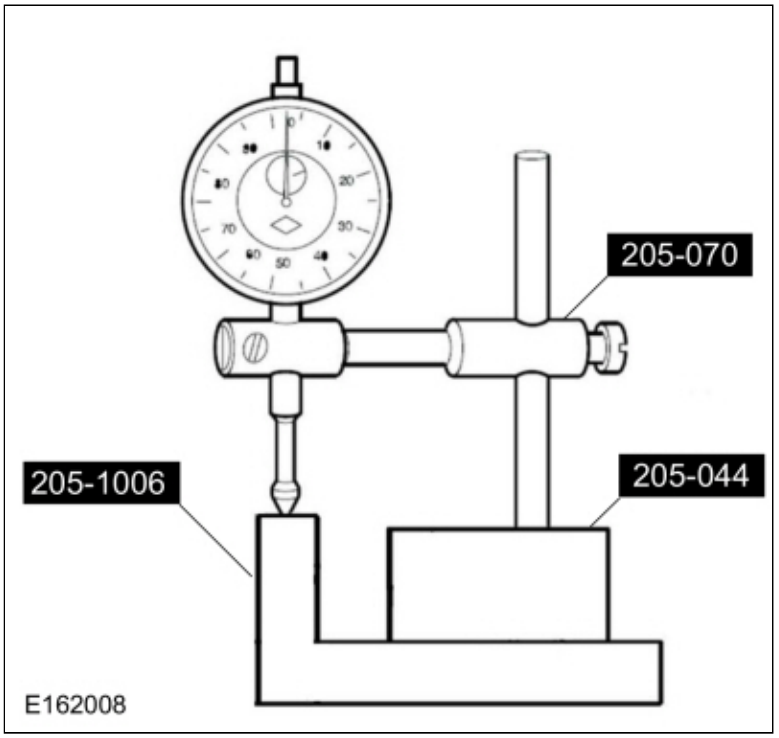
11. **NOTICE: When half of the total deflection is shown on the dial indicator gauge, do not turn the special tool further.**

    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Turn the special tool until half of the total deflection is shown on the dial indicator gauge.

12. **NOTICE: Make sure that the dial indicator settings are not altered while transfering the dial indicator to the master pinion gauge.**

    Using the special tools, zero the dial indicator gauge on the step gauge.
    Use Special Service Tool: 205-1006 Gauge, Drive Pinion Height. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-070 Holding Fixture, Dial Indicator Gauge.

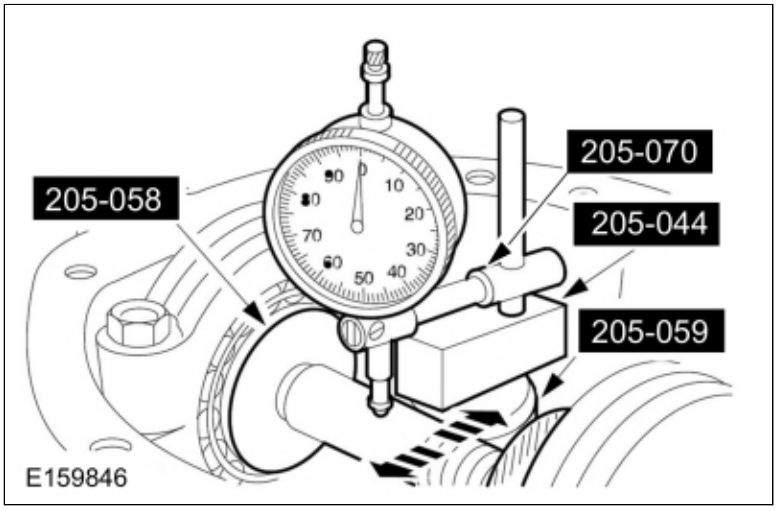


13. **NOTE:** *Verify the measurement three times.*

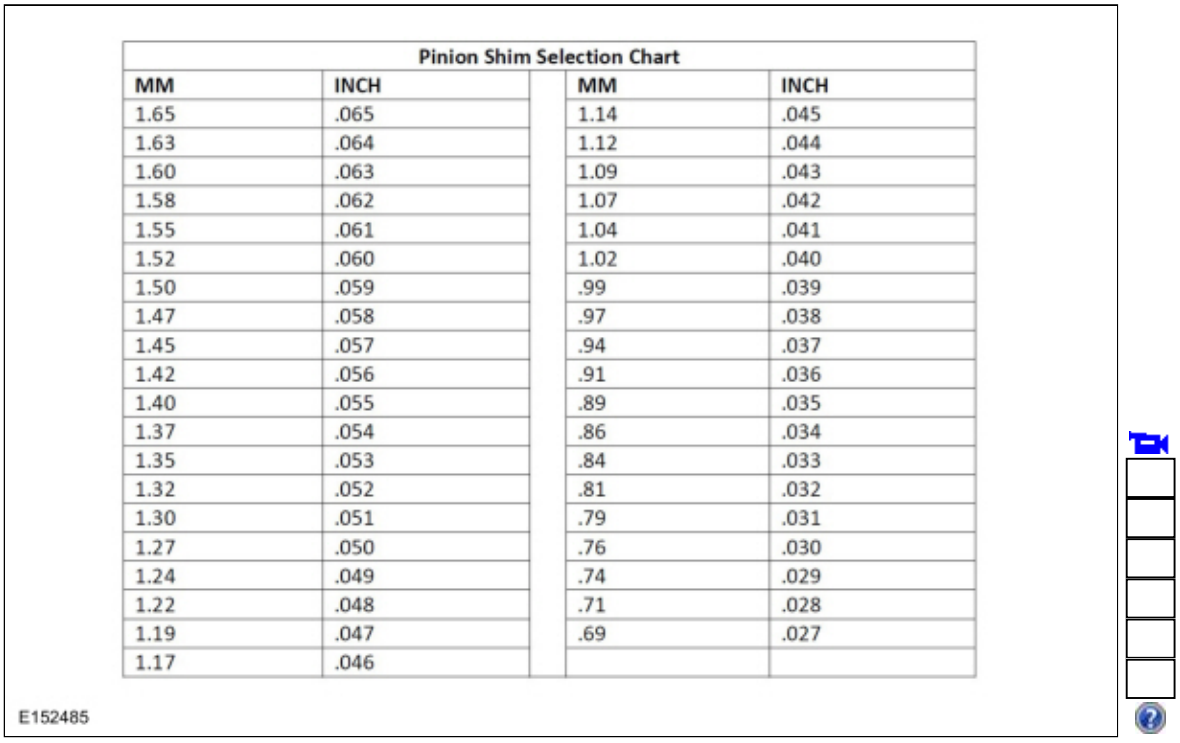
    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Calculate the required drive pinion shim thickness.
    - Slide the dial indicator gauge plunger slowly across the drive pinion adjustment gauge (as shown).

- Make a note of the measurement when the dial indicator gauge plunger is on the highest point of the drive pinion adjustment gauge and the dial indicator gauge pointer changes direction.
- If the measurement is positive, the dial indicator gauge reading must be added to the old shim thickness.
- If the measurement is negative, the dial indicator gauge reading must be subtracted from the old shim thickness.
  Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion. , 205-070 Holding Fixture, Dial Indicator Gauge.



14. Select the appropiate shim from the pinion shim selection chart.



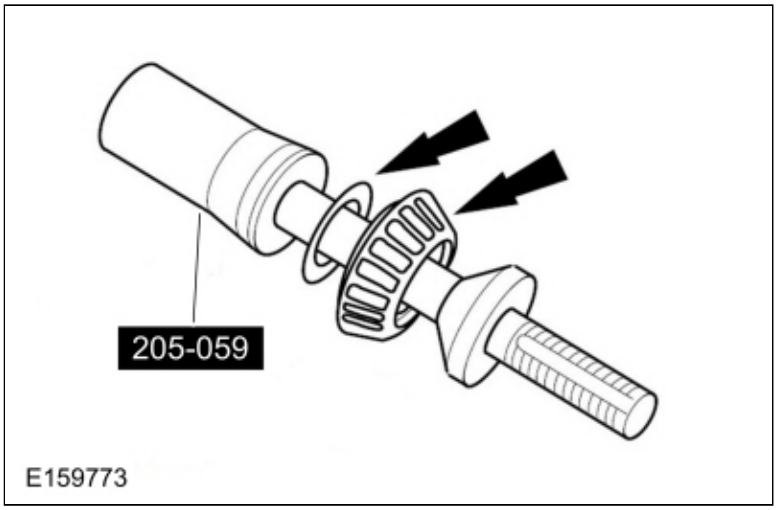
Pinion Shim Selection Chart

MM	INCH		MM	INCH
1.65	.065		1.14	.045
1.63	.064		1.12	.044
1.60	.063		1.09	.043
1.58	.062		1.07	.042
1.55	.061		1.04	.041
1.52	.060		1.02	.040
1.50	.059		.99	.039
1.47	.058		.97	.038
1.45	.057		.94	.037
1.42	.056		.91	.036
1.40	.055		.89	.035
1.37	.054		.86	.034
1.35	.053		.84	.033
1.32	.052		.81	.032
1.30	.051		.79	.031
1.27	.050		.76	.030
1.24	.049		.74	.029
1.22	.048		.71	.028
1.19	.047		.69	.027
1.17	.046			

- Remove Special Service Tool: 205-059 Gauge, Master Pinion.

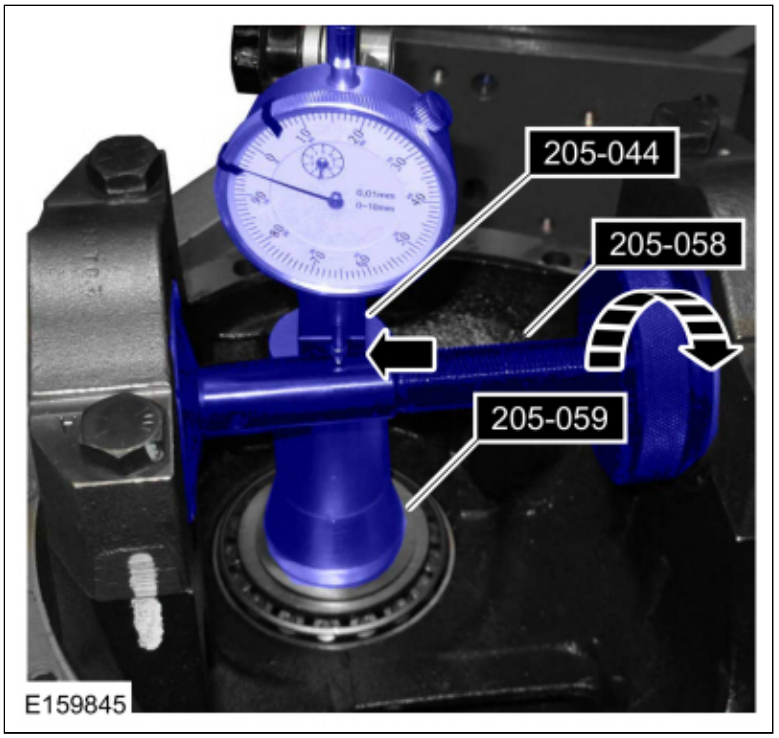
16. **NOTE:** *The conical nut of the special tool has a left-hand thread.*

- Re-assemble the special tool with the new drive pinion shim and the drive pinion rear bearing cone.
  Use Special Service Tool: 205-059 Gauge, Master Pinion.



17. **NOTE:** *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    Using a suitable dial indicator gauge, determine the total deflection of the special tool as it is rotated.
    Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion.



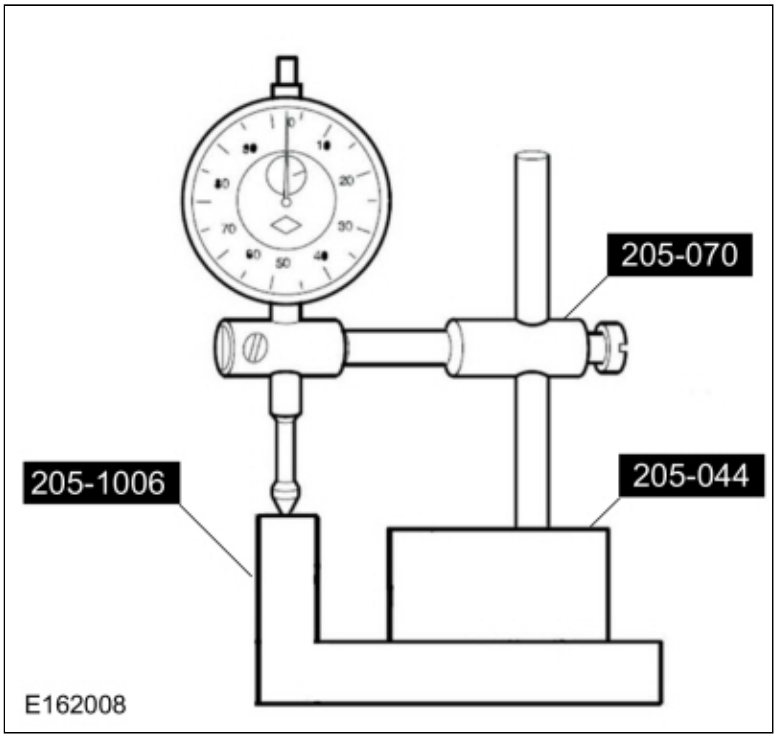
18. **NOTICE: When half of the total deflection is shown on the dial indicator gauge, do not turn the special tool further.**

    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Turn the special tool until half of the total deflection is shown on the dial indicator gauge.

19. **NOTICE: Make sure that the dial indicator settings are not altered whilst transfering the dial indicator to the master pinion gauge.**

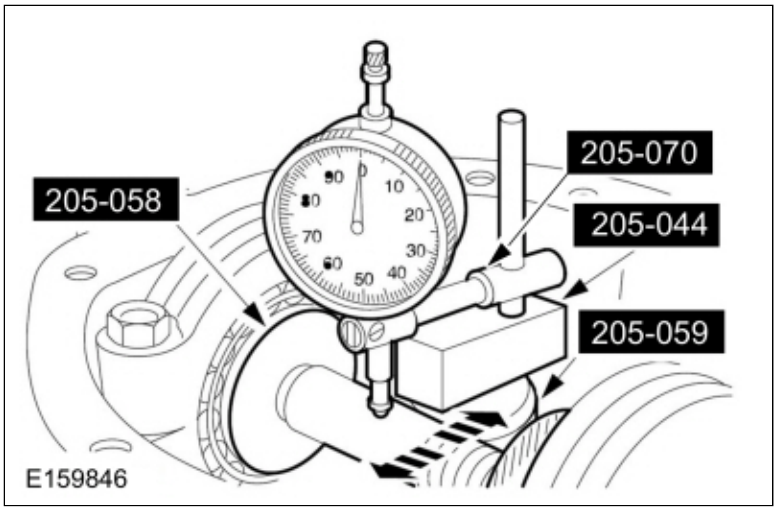
    Using the special tools, zero the dial indicator gauge on the step gauge.
    Use Special Service Tool: 205-1006 Gauge, Drive Pinion Height. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-070 Holding Fixture, Dial Indicator Gauge.



20. **NOTE:** *Verify the measurement three times.*

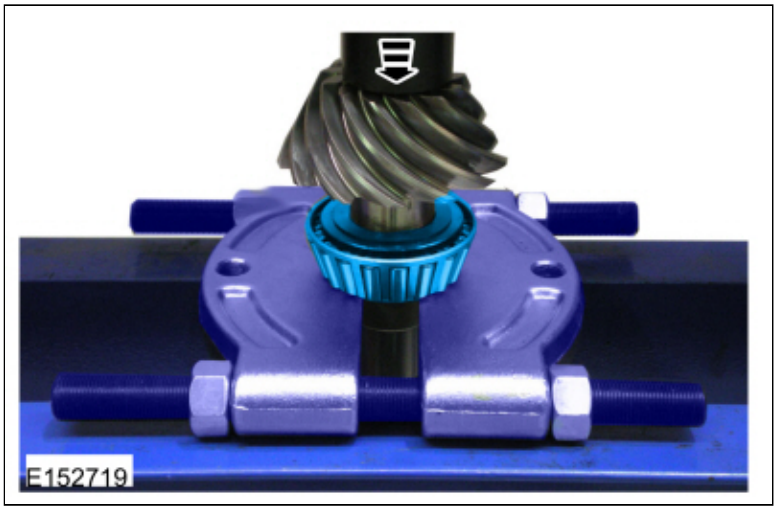
    NOTE: *The dial indicator gauge plunger must be on the center line of the special tool (as shown).*

    - Slide the dial indicator gauge plunger slowly across the drive pinion adjustment gauge (as shown).
    - Make a note of the measurement when the dial indicator gauge plunger is on the highest point of the drive pinion adjustment gauge and the dial indicator gauge pointer changes direction.
    - If the selected shim is correct, the dial gauge reading should be zero. If the reading is not zero, repeat the shim selection proccess and adjust the shim thickness accordingly.
      Use Special Service Tool: 205-059 Gauge, Master Pinion. , 205-044 Holding Fixture, Dial Indicator Gauge. , 205-058 Adjustment Gauge, Drive Pinion. , 205-070 Holding Fixture, Dial Indicator Gauge.

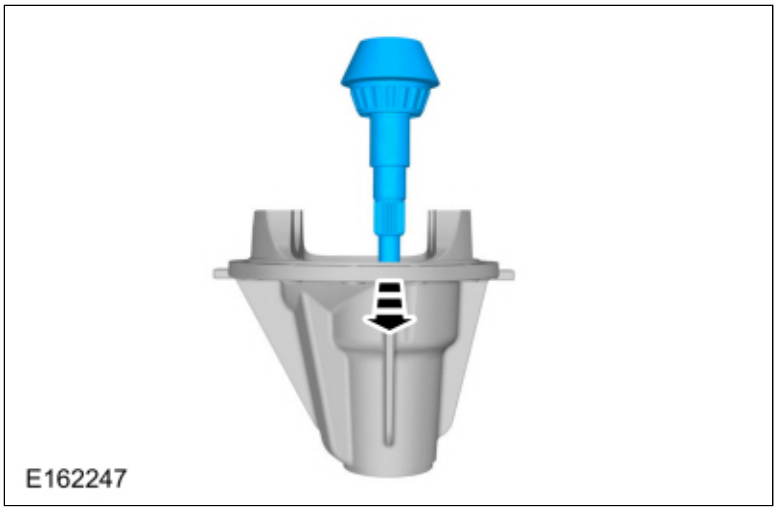


    - Remove Special Service Tool: 205-044 Holding Fixture, Dial Indicator Gauge. , 205-070 Holding Fixture, Dial Indicator Gauge. , 205-059 Gauge, Master Pinion. , 205-058 Adjustment Gauge, Drive Pinion.

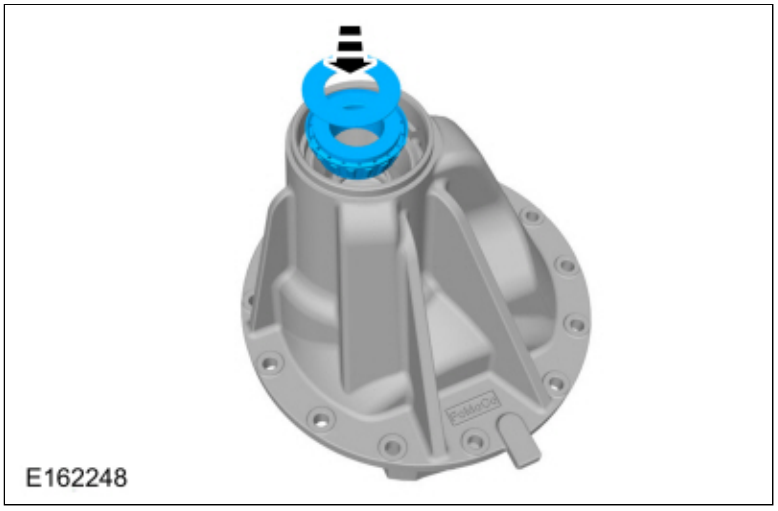
22. Install the pinion **bearing** and **shim**.
    Use the General Equipment: Hydraulic Press
    Use the General Equipment: Bearing Separator



23.

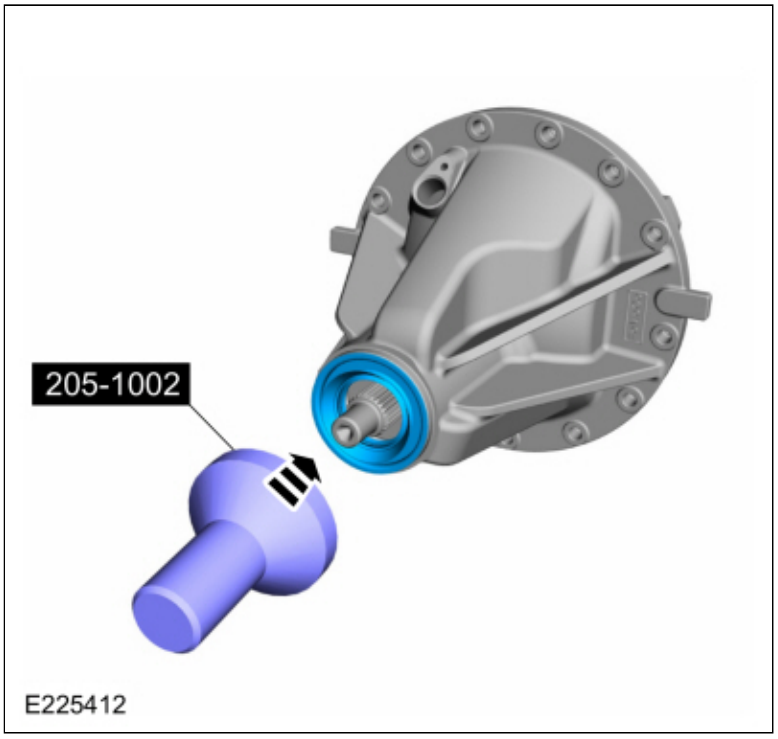


24.

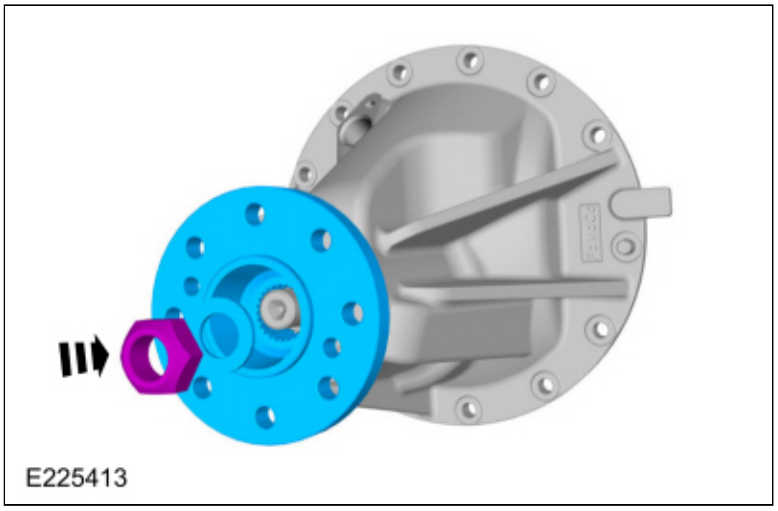


25. Apply differential oil to the lip of a new oil seal.

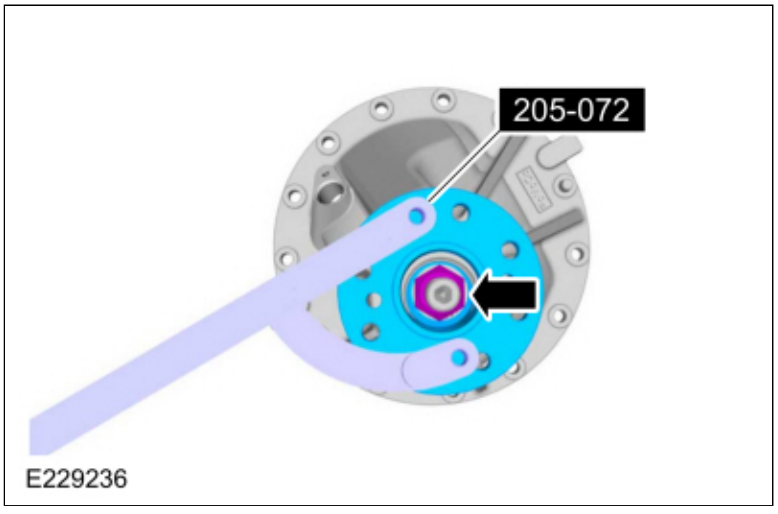
26. Use Special Service Tool: 205-1002 Installer, Drive Pinion Seal.



27. **NOTE:** *Only tighten the nut finger tight at this stage.*

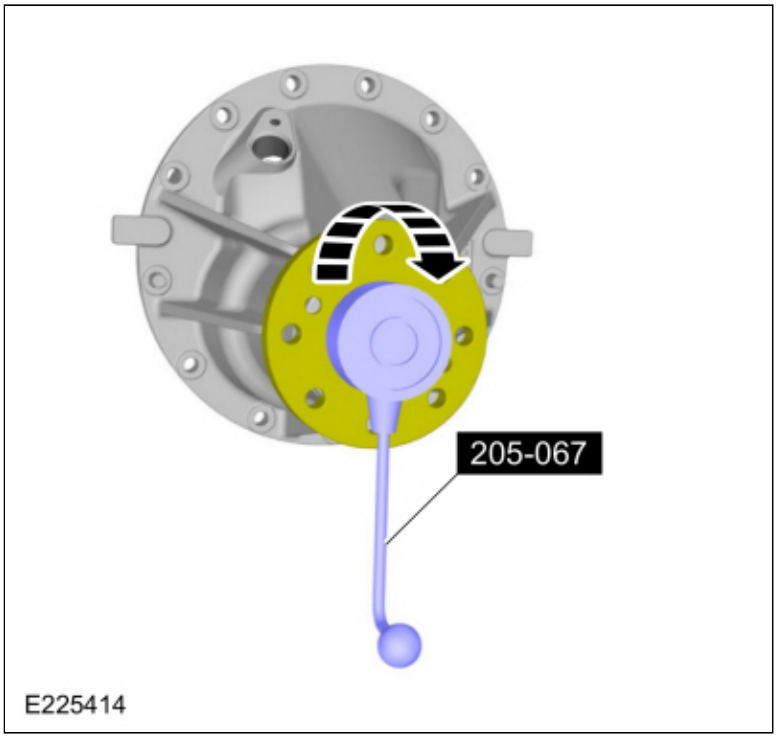


28. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Torque: 300 Nm

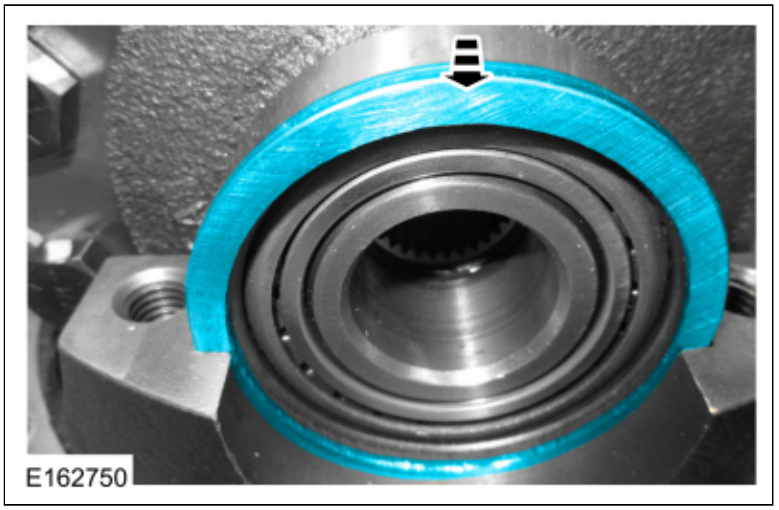


- Using the preload gauge, measure the torque to rotate. Tighten the drive pinion nut untill the torque to rotate measures 2-3 Nm.
- If the specified preload can’t be obtained within a pinion nut torque of 237 - 650 Nm, replace the collapsable

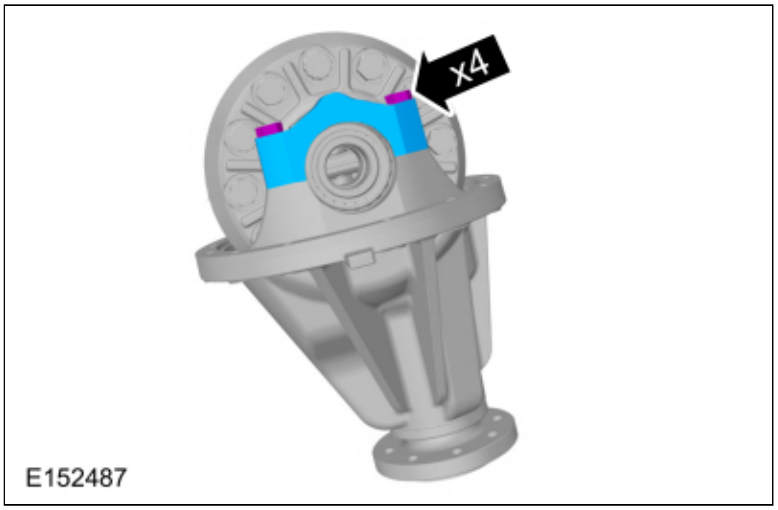
spacer and inspect again.
Use Special Service Tool: 205-067 Preload Gauge.



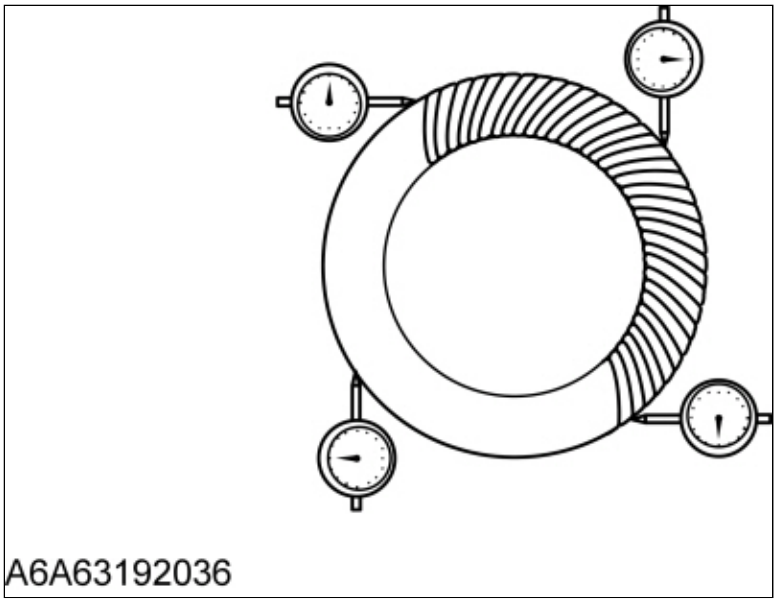
- Install the gear case component on the differential carrier.
- The original shims can be re-used if the ring and pinion is not replaced.
- If a new ring and pinion is fitted, measure the total thickness of the original shims, and split the thickness evenly between left and right.



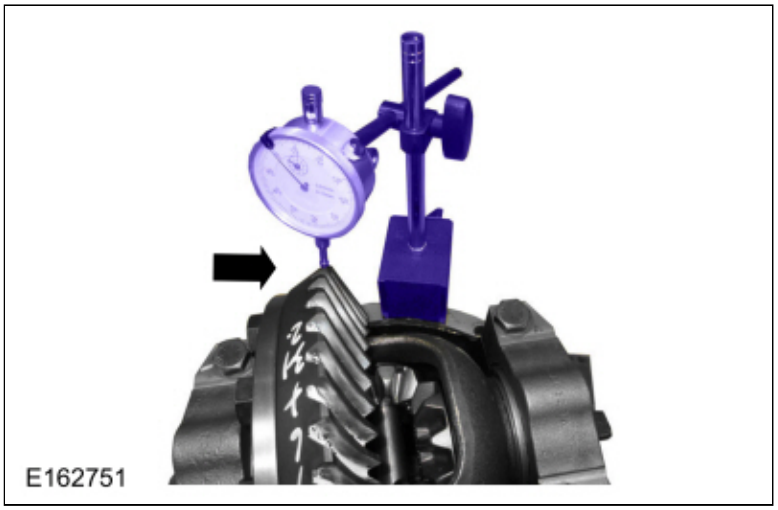
31. *Torque*: 110 Nm



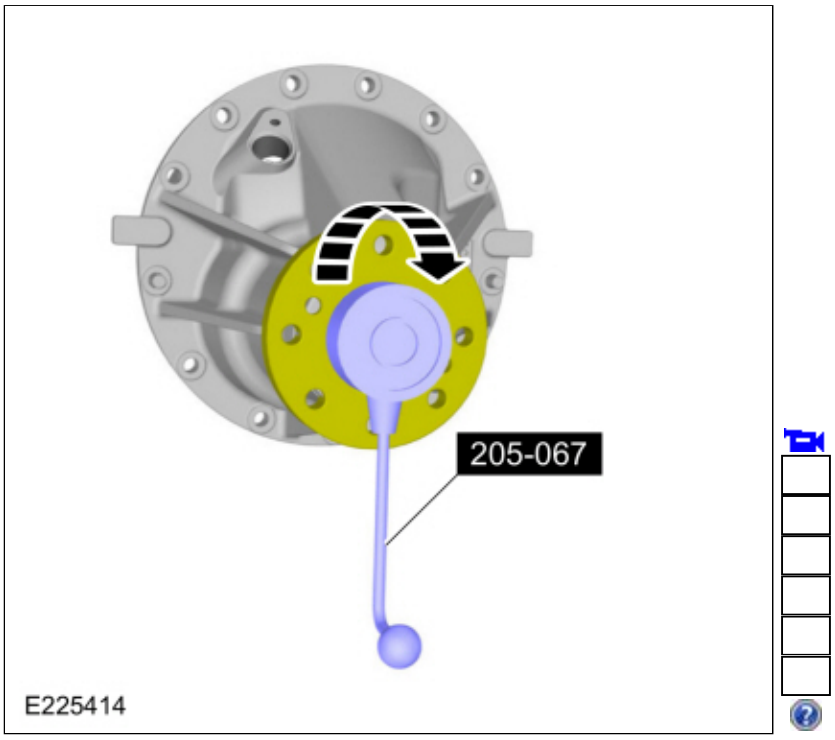
32. Mark the ring gear at four points at 90° intervals.



- Adjust the drive pinion, ring gear backlash and the side bearing preload as follows:
- Mount a dial indicator to the carrier so that the feeler comes in contact at a 90° angle with one of the ring gear teeth.
- Inspect the backlash at the three other marked points and make sure that the measurement is between 0.127 —0.203 mm {0.005—0.008 in}.

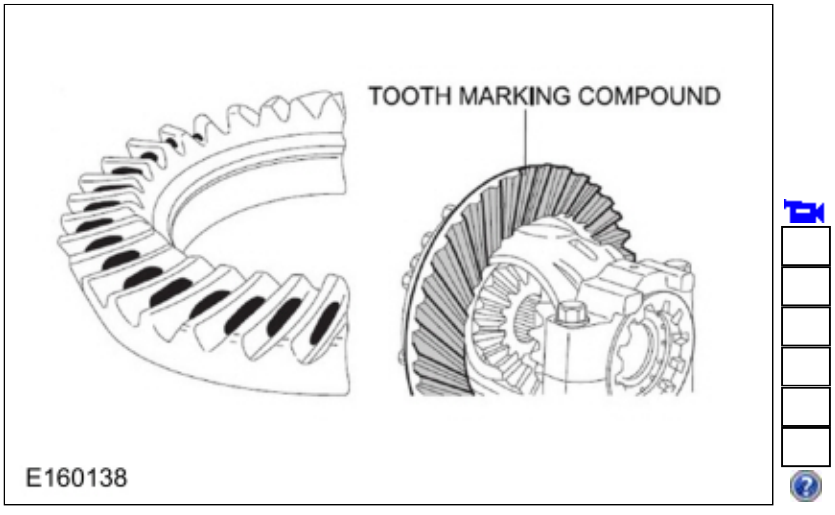


34. Using the preload gauge, measure the torque to rotate. The readings should not exceed 3.0 Nm. If the backlash is within specification but the rotating torque is high, the preload may be adjusted by removing an equal amount of shim thickness from both sides of the differential.
Use Special Service Tool: 205-067 Preload Gauge.

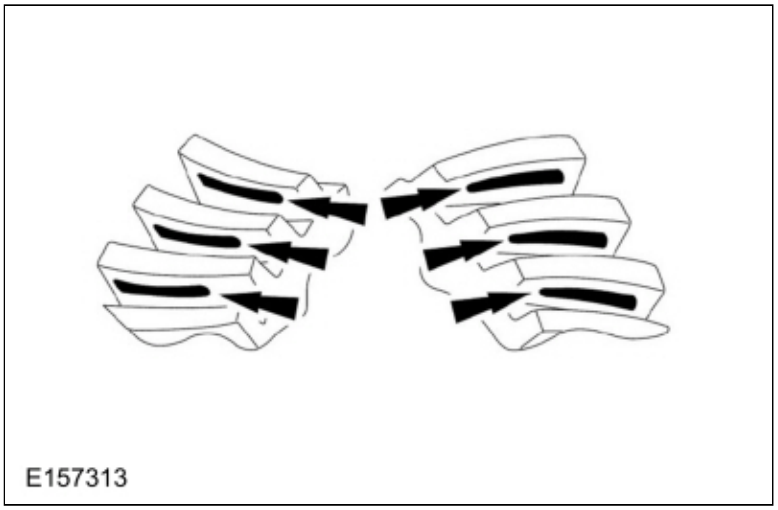


35. If backlash is not as specified, correct the backlash by adding and subtracting the required shim thickness from either left or right, keeping the total shim thickness the same.

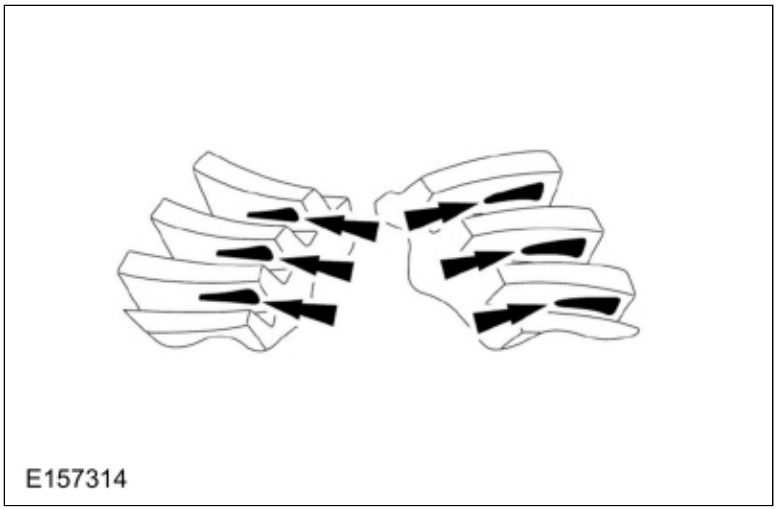
- The inspection and adjustment procedure is as follows:
- Coat both surfaces of 6—8 teeth of the ring gear uniformly with a tooth marking compound.
- While moving the ring gear back and forth by hand, rotate the drive pinion several times and inspect the tooth contact.
- If the tooth contact is good, wipe off the tooth marking compound.



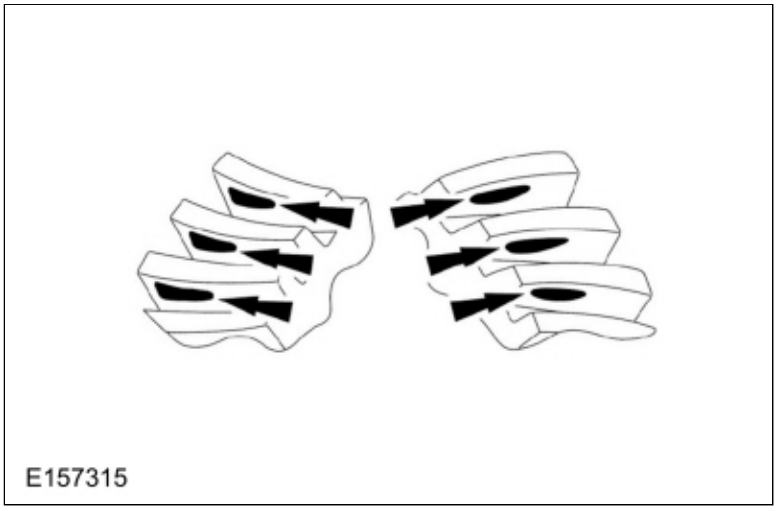
37. Acceptable ring gear tooth patterns for all axles.



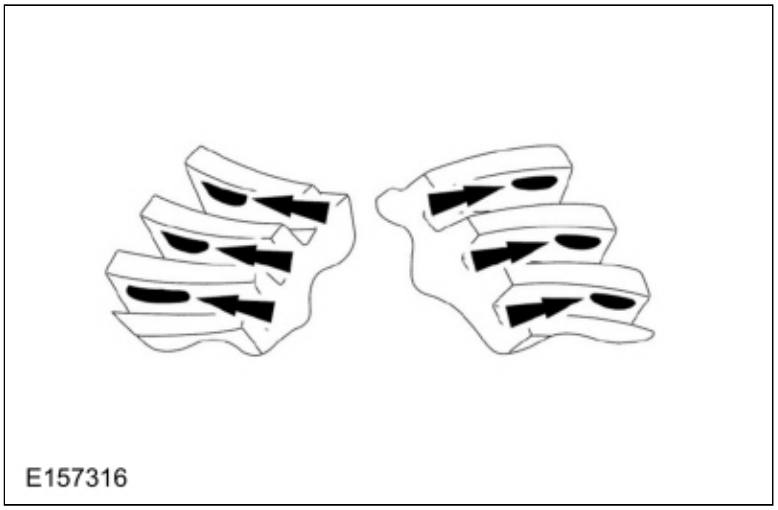
38. Correct backlash with a thinner pinion position shim.



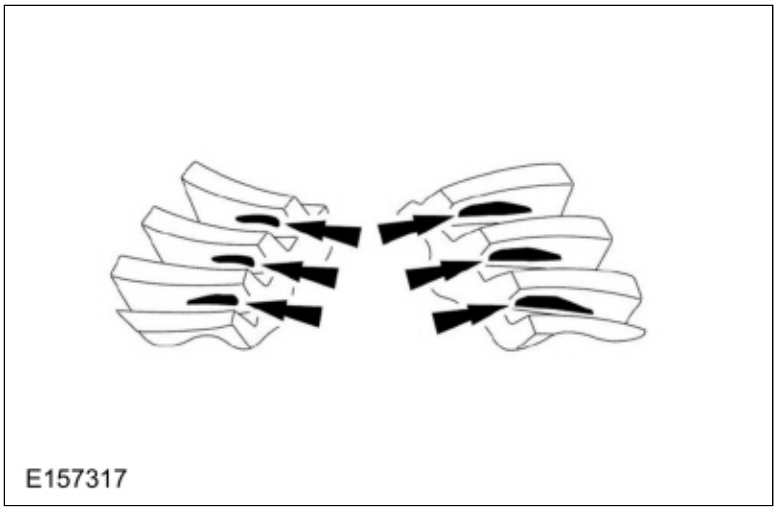
39. Correct backlash with a thicker pinion position shim.



40. Correct pinion position shim that requires a decrease in backlash.



41. Correct pinion position shim that requires an increase in backlash.



- Select the appropriate shim from the differential bearing preload shim selection table.

Differential Bearing Preload Shim Selection				
MM	INCH		MM	INCH
4.17	0.164		3.23	0.127
4.14	0.163		3.20	0.126
4.11	0.162		3.18	0.125
4.09	0.161		3.15	0.124
4.06	0.160		3.12	0.123
4.04	0.159		3.10	0.122
4.01	0.158		3.07	0.121
3.99	0.157		3.05	0.120
3.96	0.156		3.02	0.119
3.94	0.155		3.00	0.118
3.91	0.154		2.97	0.117
3.89	0.153		2.95	0.116
3.86	0.152		2.92	0.115
3.84	0.151		2.90	0.114
3.81	0.150		2.87	0.113
3.78	0.149		2.84	0.112
3.76	0.148		2.82	0.111
3.73	0.147		2.79	0.110
3.71	0.146		2.77	0.109
3.68	0.145		2.74	0.108
3.66	0.144		2.72	0.107
3.63	0.143		2.69	0.106
3.61	0.142		2.67	0.105
3.58	0.141		2.64	0.104
3.56	0.140		2.62	0.103
3.53	0.139		2.59	0.102
3.51	0.138		2.57	0.101
3.48	0.138		3.20	0.126
3.45	0.136			
3.43	0.135			
3.40	0.134			
3.38	0.134			
3.35	0.132			
3.33	0.131			
3.30	0.130			
3.28	0.129			
3.25	0.128			
3.23	0.127			

E157474

Copyright © 2016 Ford Motor Company

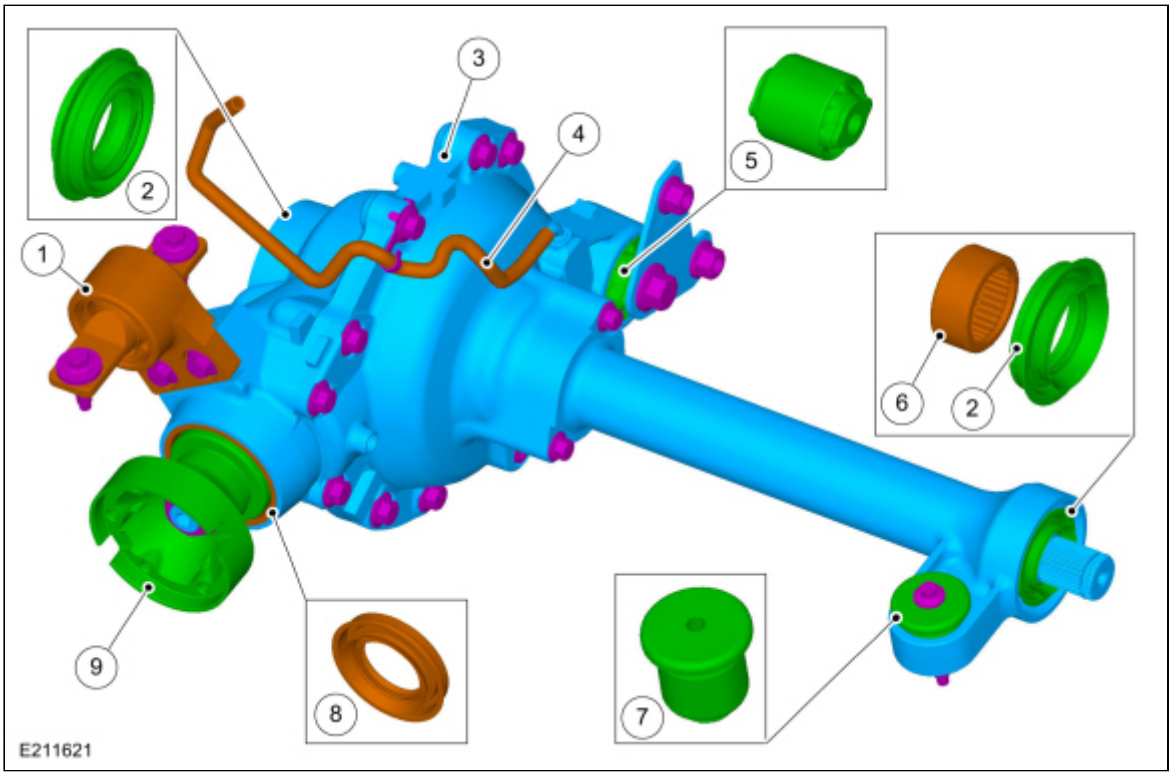
Specifications

Description	Specification
Front differential oil	WSP-M2C197-A
Oil capacity	1.27L +0.05/-0.00

Copyright © 2016 Ford Motor Company

Front Drive Axle and Differential - Component Location

4x4



Item	Part Number	Description
1	—	Axle carrier bushing
2	—	Axle shaft seal
3	—	Axle assembly
4	—	Differential breather tube
5	—	Axle cover bushing
6	—	Axle tube bearing
7	—	Axle tube bushing
8	—	Drive pinion seal
9	—	Drive pinion flange

Copyright © 2016 Ford Motor Company

Front Drive Axle and Differential - Overview

Front Drive Axle and Differential

The front differential is conventional open differential. The front hubs are not fitted with locking/unlocking devices, therefore the front drive shafts and propshaft rotate in 2WD or 4WD.

The front driveshafts are fitted with CV joints and transfer torque from the front differential to the front wheels. The front differential is driven by a prop shaft from the transfer case.

Copyright © 2016 Ford Motor Company

Front Drive Axle

Principles of Operation

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart - Front Differential

Symptom Chart - Front Differential

Condition	Possible Sources	Actions
Axle overheating	• Axle lubricant low	• CHECK the lubricant level. FILL the axle to specification. REFER to: Specifications (205-03 Front Drive Axle/Differential, Specifications).
	• Incorrect or contaminated lubrication type	• INSPECT the axle for damage. REPAIR as necessary. CLEAN and REFILL the axle to specification as necessary. REFER to: Specifications (205-03 Front Drive Axle/Differential, Specifications).
	• Excessive gear wear	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Incorrect ring gear backlash	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Broken gear teeth on the ring gear or pinion	• Overloading the vehicle	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Differential side gears/pinion gears are scored	• Insufficient lubrication	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Incorrect or contaminated lubricant type	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Front axle will not disengage	• Mode switch	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

	• Wiring/relays	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	• 4x4 control module	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	• Shift motor	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
Front axle will not engage	• Mode switch	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	• Wiring/relays	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	• 4x4 control module	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
	• Shift motor	• REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
Gray or milky axle lubricant in low mileage vehicles	• Marking compound in axle fluid	• Inspect axle housing and vent for damage or leaks. Refer to Axle Fluid Analysis in this section.
Lubricant leaking from the pinion seal, axle shaft oil seals or support arm to the housing	• Vent	• CLEAN the axle housing vent.
	• Damage in the seal contact area or dust slinger on the pinion flange dust shield	• INSTALL a new pinion seal if damage is found.

Symptom Chart - NVH

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart - NVH

Condition	Possible Sources	Actions
Axle howling or whine	• Axle lubricant low	• CHECK the lubricant level. FILL the axle to specification. REFER to: Specifications (205-03 Front Drive Axle/Differential, Specifications).

	• Axle housing damage	• INSPECT the axle housing for damage. INSTALL a new axle as necessary. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Damaged or worn wheel hub bearings	• CHECK for abnormal wheel hub bearing play or roughness.
	• Damaged or worn differential ring and pinion	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Damaged or worn differential side or pinion bearings	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Driveline clunk - loud clunk when shifting from REVERSE to DRIVE	• Incorrect axle lubricant level	• CHECK the lubricant level. FILL the axle to specification. REFER to: Specifications (205-03 Front Drive Axle/Differential, Specifications).
	• Excessive backlash in the axle	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Damaged or worn pinion bearings	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.
Driveline clunk — occurs as the vehicle starts to move forward following a stop	• Loose axle mount	• CHECK the axle for loose bolts. TIGHTEN to proper torque. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.
Driveline clunk — occurs during acceleration or from cruise to coast/deceleration	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.
High pitched chattering — noise from the axle when the vehicle is turning	• Incorrect or contaminated lubricant	• CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). CLEAN and REFILL the axle to specification. REFER to: Specifications (205-03 Front Drive Axle/Differential, Specifications).
	• Damaged or worn differential (differential side gears and pinion gears)	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).

Grunting — normally associated with a shudder experienced during acceleration from a complete stop	• Loose axle mount bolts or suspension fasteners	• INSPECT the front suspension and axle. TIGHTEN the fasteners to specification. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Howl — can occur at various speeds and driving conditions. Affected by acceleration and deceleration	• Incorrect ring and pinion contact, incorrect bearing preload or gear damage	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Chuckle — heard at coast/deceleration. Also described as a knock	• Incorrect ring and pinion contact or damaged teeth on the coast side of the ring and pinion	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Knock — noise occurs at various speeds. Not affected by acceleration or deceleration	• Gear tooth damage to the drive side of the ring and pinion	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Scraping noise — a continuous low pitched noise starting at low speeds	• Worn or damaged pinion bearings	• INSTALL new axle assembly. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
Driveline shudder – occurs during acceleration from a slow speed or stop	• Drive axle assembly mispositioned	• CHECK the axle mounts and the front suspension for damage or wear. REPAIR as necessary. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Loose axle bolts	• CHECK the axle for loose bolts. TIGHTEN the bolts to specification. REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
	• Loose or missing fasteners	• CHECK all driveline fasteners for proper torque.

Axle Fluid Analysis

The appearance of milky or gray axle fluid in early mileage axles is a result of white marking compound used at the assembly plant to verify gear mesh contact pattern. The marking compound within the fluid will darken some over time. The milky fluid appearance will diminish and cause no harm and does not require a fluid change.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source.

A plugged front axle housing vent can cause excessive pinion seal lip wear due to internal pressure buildup.

Verify the differential lubricant level is at the correct level.
REFER to: Specifications (205-03 Front Drive Axle/Differential, Specifications).

Axle Vent

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. If the vent cannot be cleared, install a new vent.

Drive Pinion Seal

Leaks at the drive pinion seal originate from the following causes:

- Damaged seal
- Worn seal journal surface

A new drive pinion seal must be installed if any of these conditions exist.

- The drive pinion seal can be torn, cut or gouged if it is not installed correctly. The spring that holds the drive pinion seal against the pinion flange may be knocked out and allow fluid to pass the lip.
- Metal chips trapped at the sealing lip can cause oil leaks. These can cause a wear groove on the drive pinion flange and result in pinion seal wear.
- When a seal leak occurs, install a new drive pinion seal and check the vent to make sure it is clean and free of foreign material.

If a mechanical failure is causing the leak, the axle must be replaced.
REFER to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).

Differential Seals

NOTICE: When installing shafts, do not allow splines to contact seals during installation or damage to the seals may occur.

Halfshaft pilot bearing housing seals are susceptible to the same types of damage as drive pinion seals if incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

Copyright © 2016 Ford Motor Company

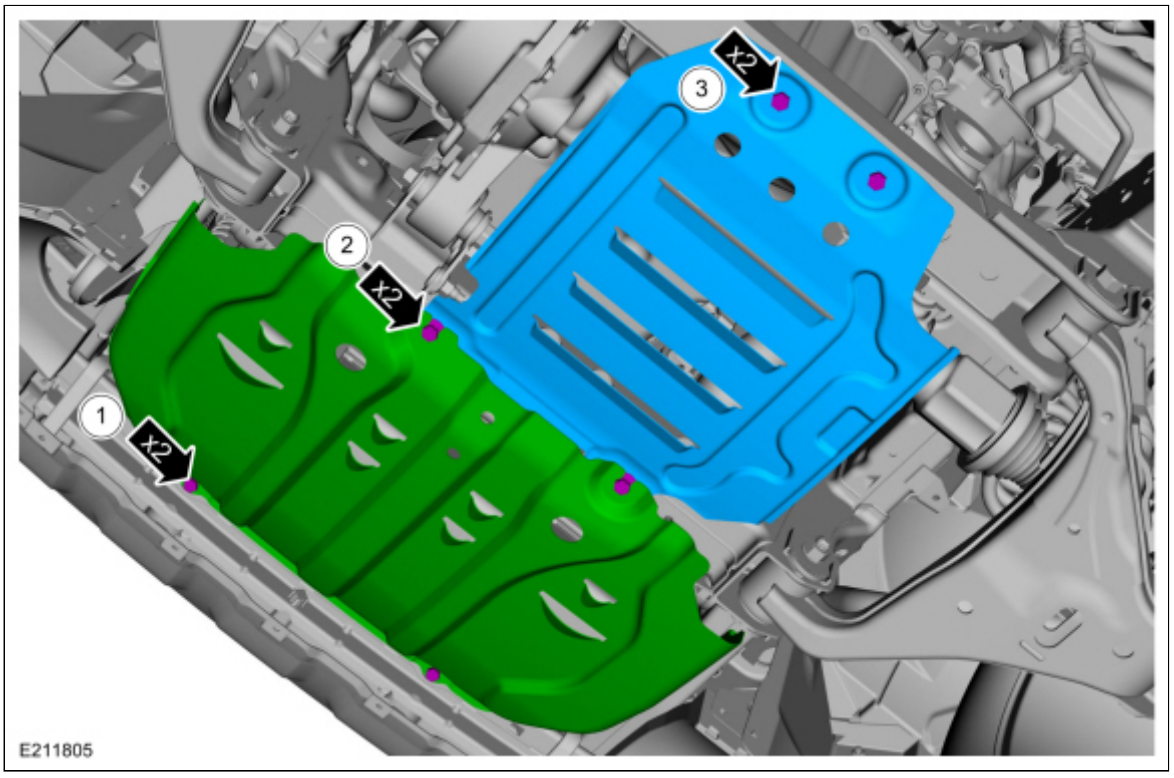
Differential Draining and Filling

Materials

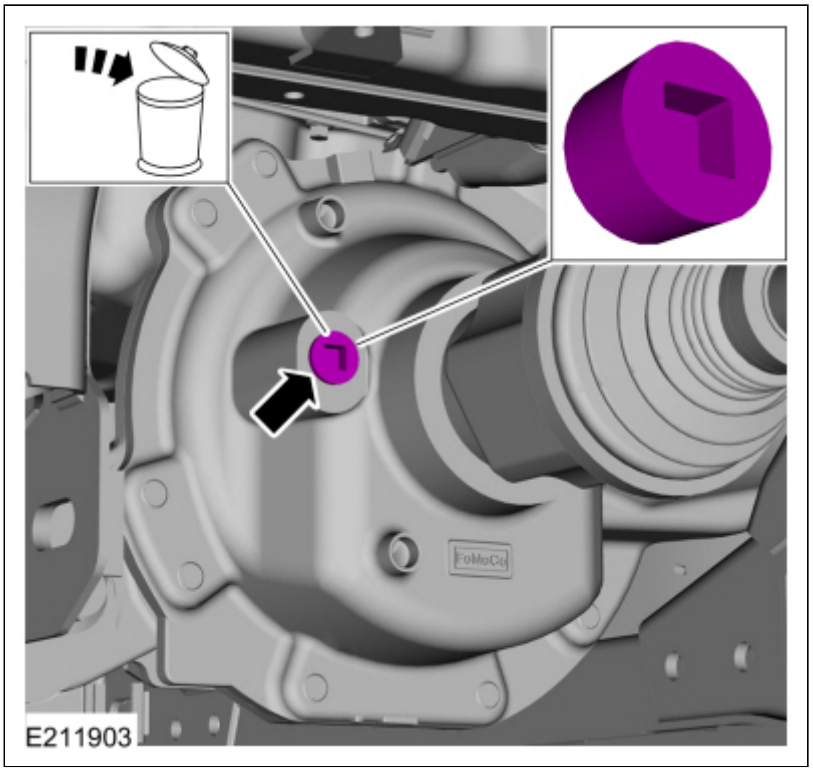
Name	Specification
Gear/Transmission Fluid - SAE 80W-90	WSP-M2C197-A

Draining

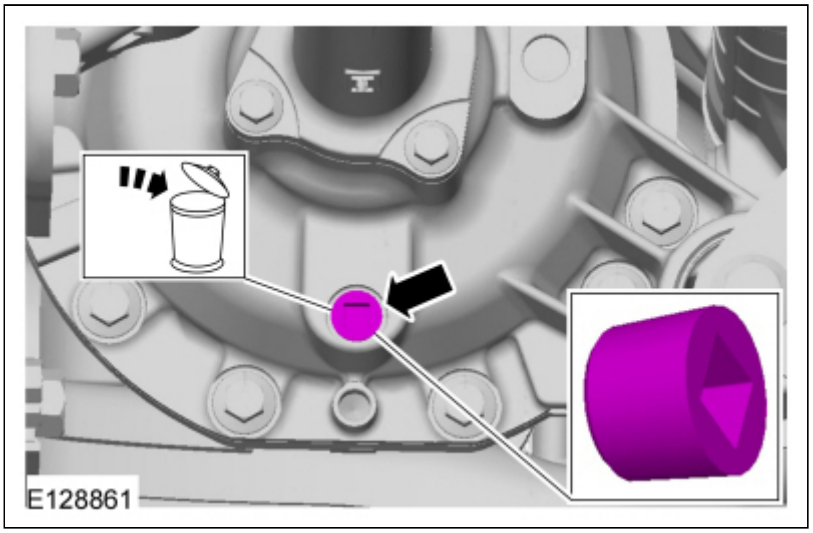
1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. *Torque*: 30 Nm



3.



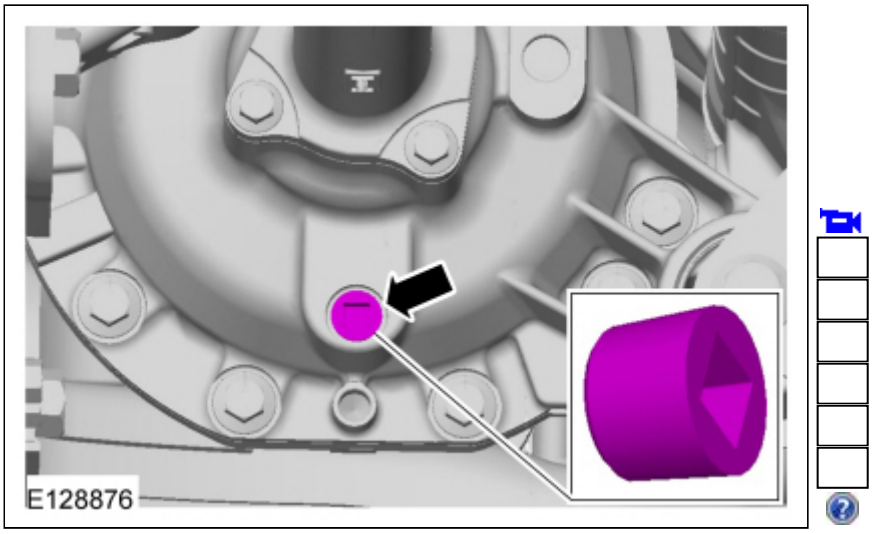
4. **WARNING: Be prepared to collect escaping fluids.**



5. **NOTE:** *Make sure that a new component is installed.*

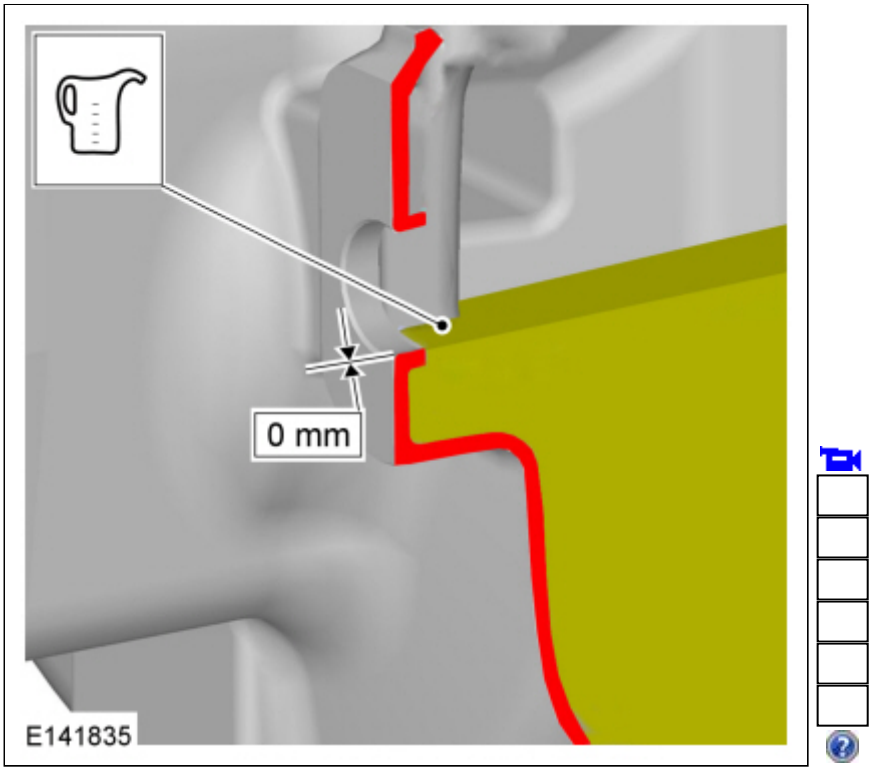
   NOTE: *The drain plug is magnetic. Make sure that the correct component is installed.*

   Torque: 30 Nm



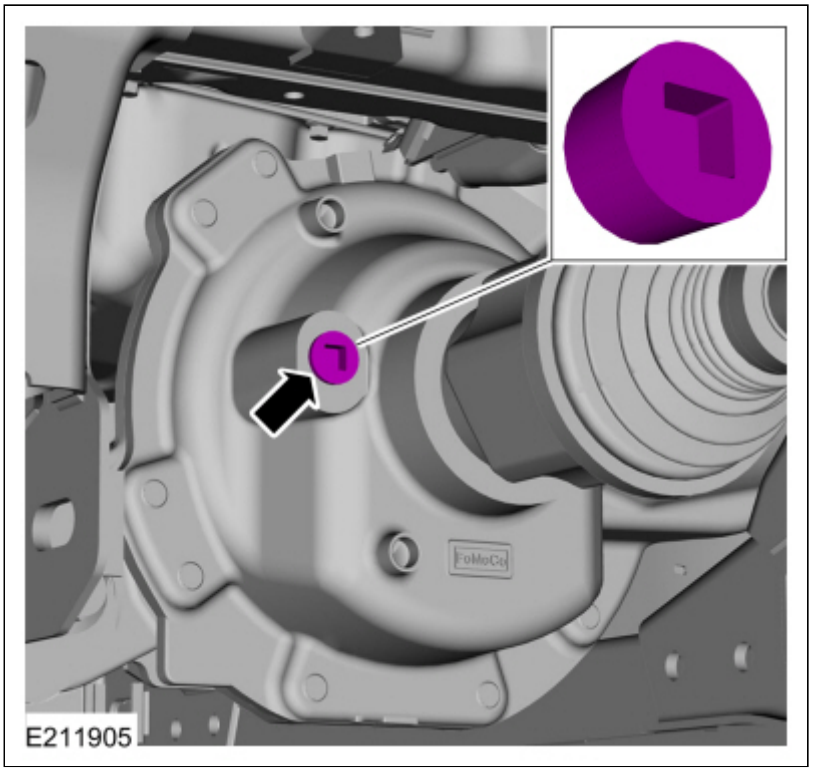
Filling

1. Refer to: Specifications (205-03 Front Drive Axle/Differential, Specifications).
   Material: Gear/Transmission Fluid - SAE 80W-90 (WSP-M2C197-A)



2. **NOTE:** *Make sure that a new component is installed.*

   Torque: 30 Nm



Copyright © 2016 Ford Motor Company

Axle Assembly

Base Part Number: 4000

Special Tool(s) / General Equipment

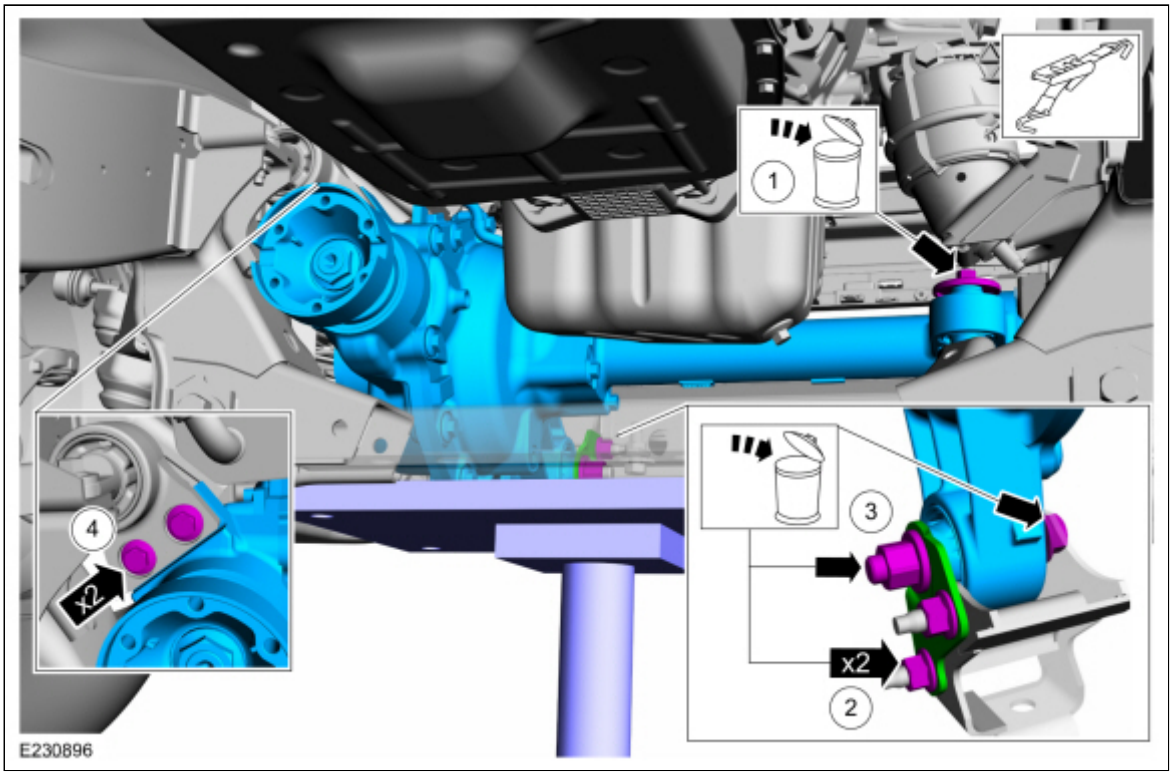
Transmission Jack

Removal

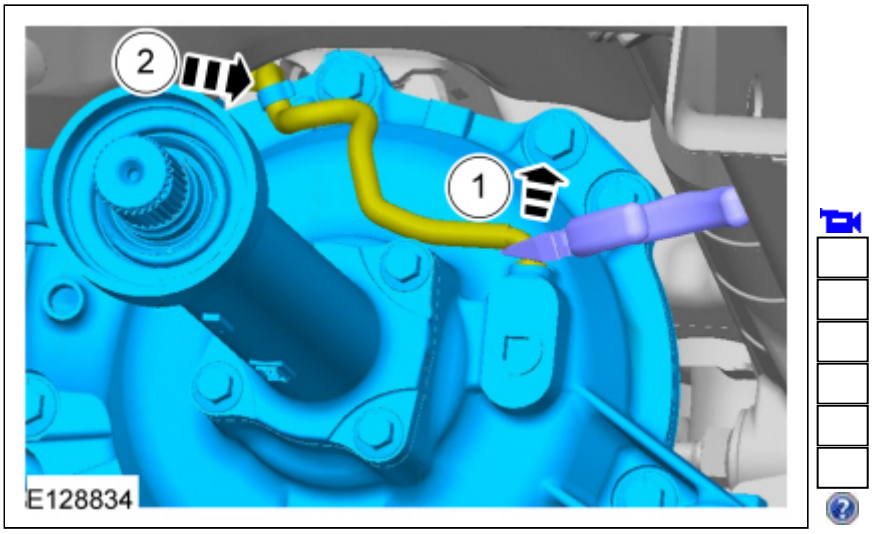
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
3. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
4. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
5. **NOTE:** *Make sure a new nut and bolt is installed.*

   Use the General Equipment: Transmission Jack
   Torque:
   1: 70 Nm
   2: 90 Nm
   3: 265 Nm
   4: 110 Nm



6.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Axle Carrier Bushing

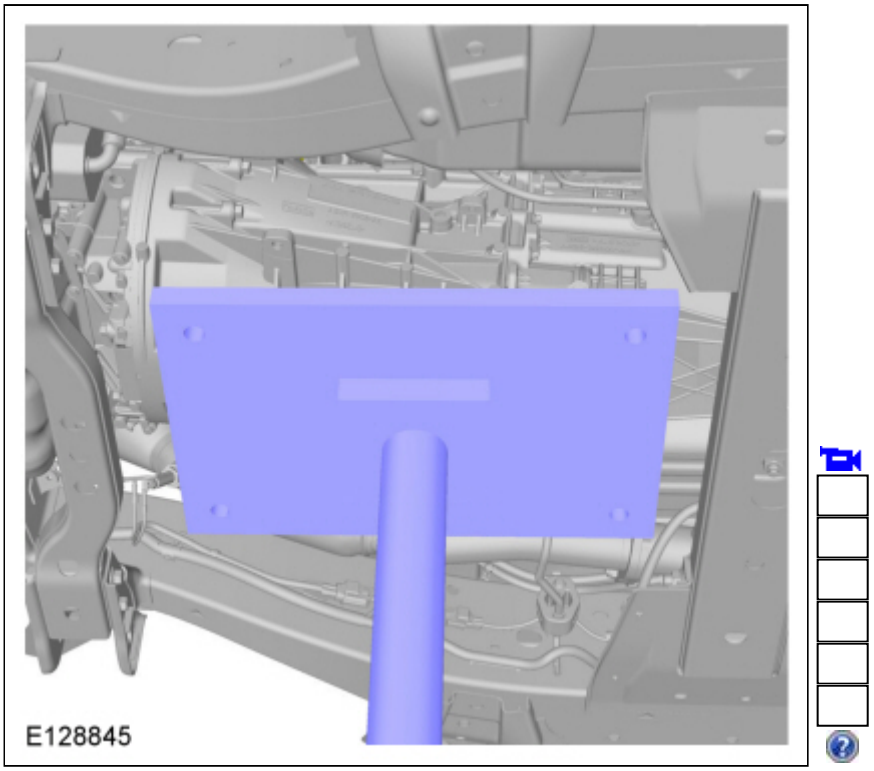
Special Tool(s) / General Equipment

Transmission Jack

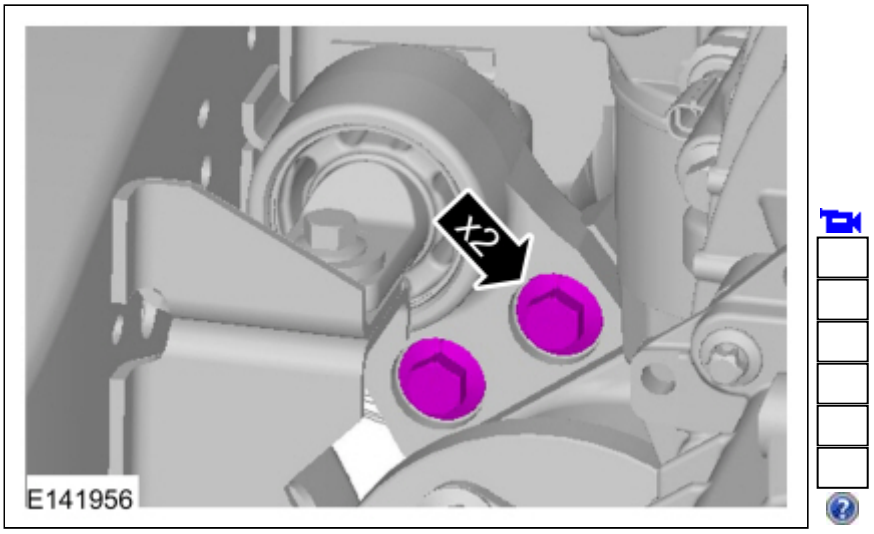
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

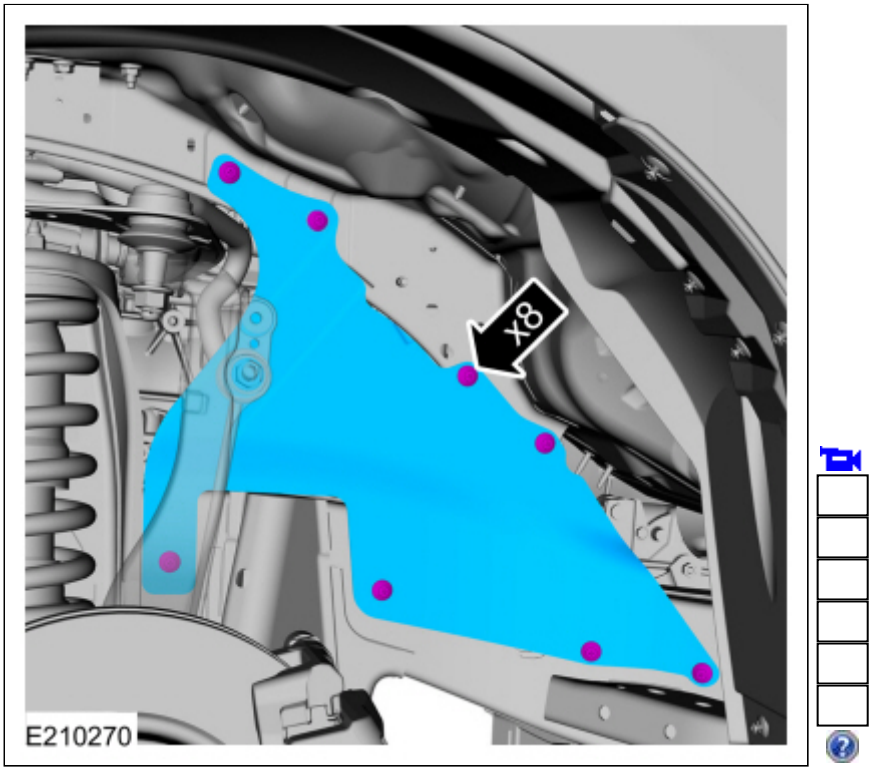
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove front LH wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. Use the General Equipment: Transmission Jack



6. *Torque*: 110 Nm

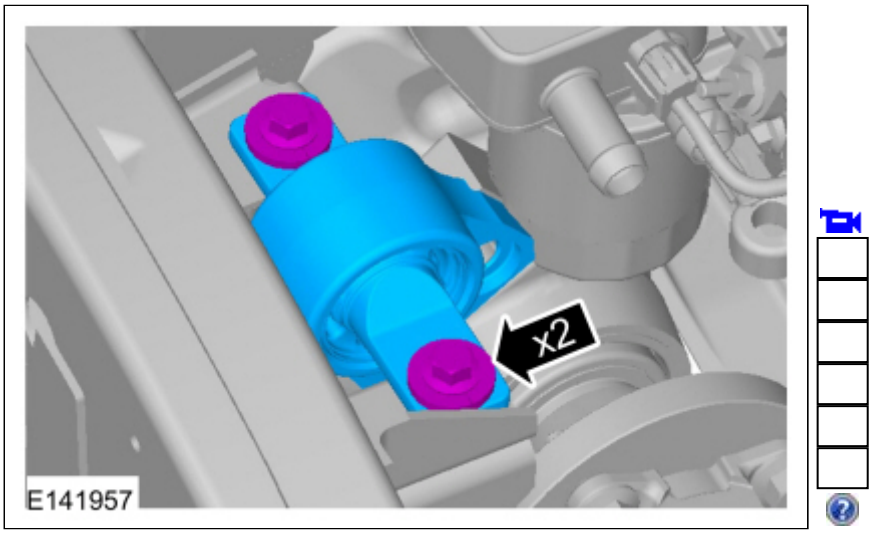


7.



8. **NOTE:** *Make sure that new bolts are installed.*

Torque: 47 Nm



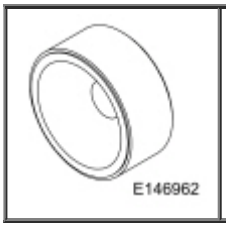
Installation

1. To install, reverse the removal the procedure.

Copyright © 2016 Ford Motor Company

Axle Cover Bushing

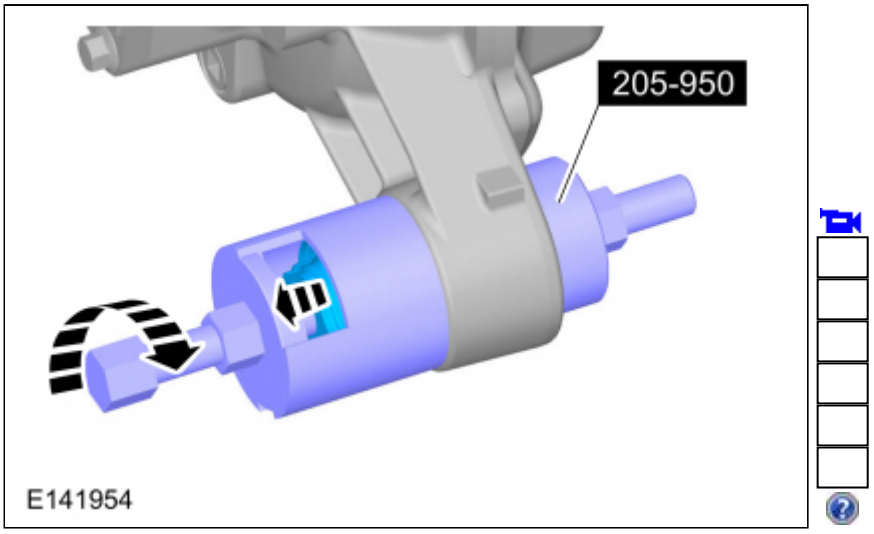
Special Tool(s) / General Equipment

 E146962	205-950 Replacer, Differential Bushing

Removal

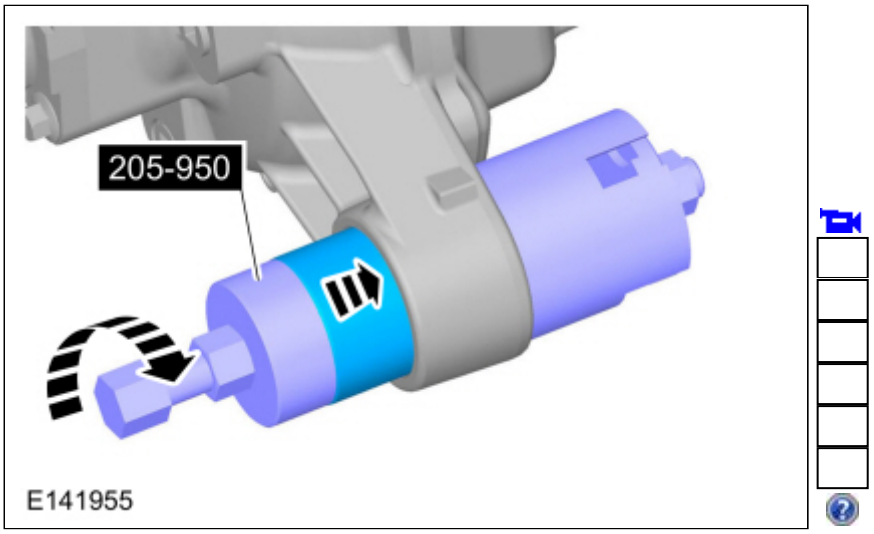
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).
2. Use a forcing screw and receiver cup with the special tool to remove the bushing.
   Use Special Service Tool: 205-950 Replacer, Differential Bushing.



Installation

1. Use a forcing screw and receiver cup with the special tool to install the bushing.
   Use Special Service Tool: 205-950 Replacer, Differential Bushing.

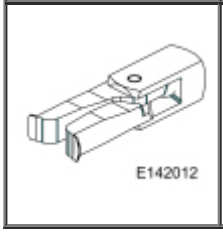


2. Refer to: Axle Assembly (205-03 Front Drive Axle/Differential, Removal and Installation).

Copyright © 2016 Ford Motor Company

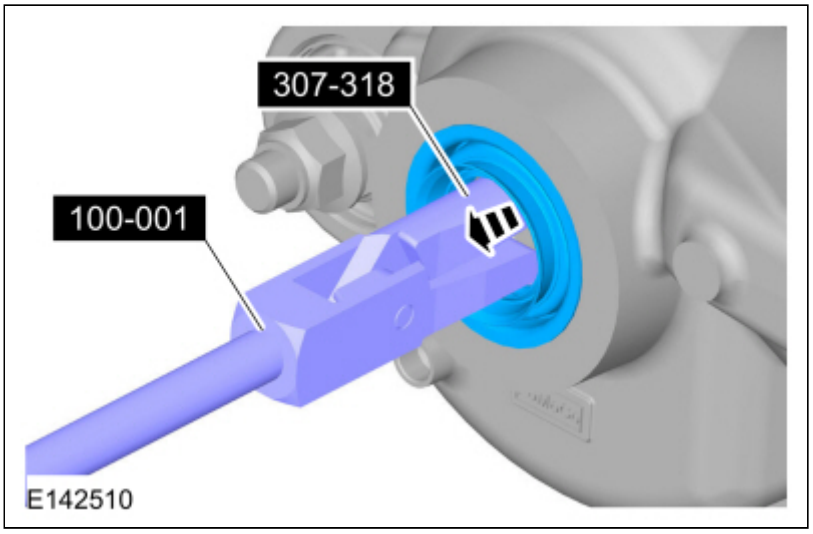
Axle Shaft Seal

Special Tool(s) / General Equipment

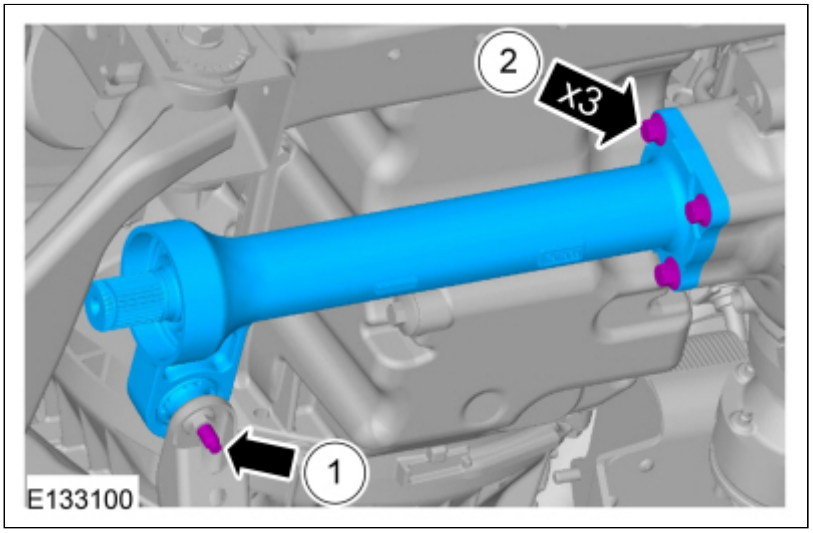
 E129694	100-001 (T50T-100-A) Slide Hammer
 E133913	205-153 (T80T-4000-W) Handle
 E142005	205-350 Installer, Front Axle Seal
 E142012	307-318 Remover, Stator Bearing

Removal

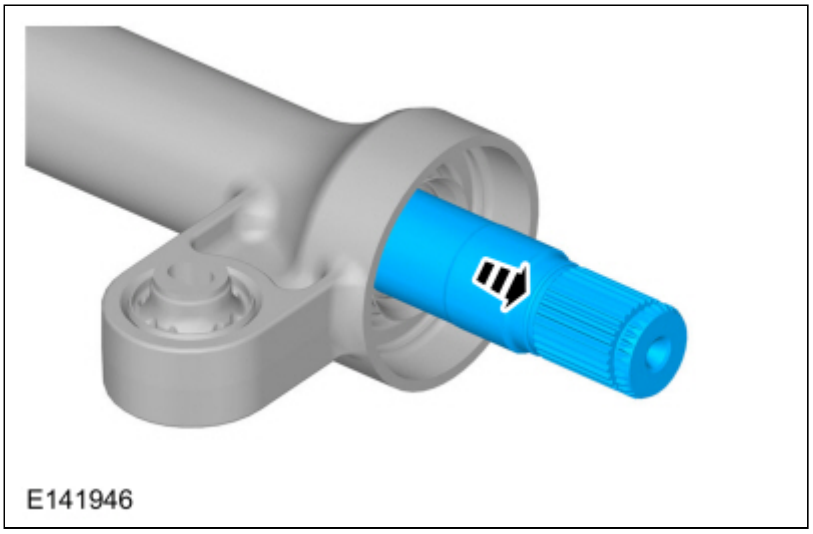
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
6. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
7. LH side.
   Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 307-318 Remover, Stator Bearing.



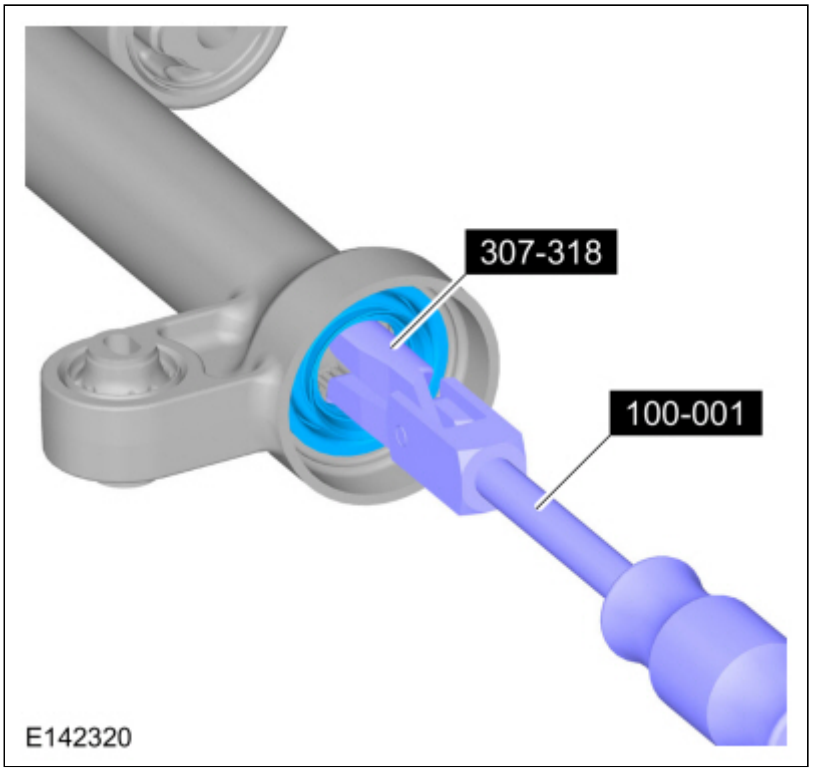
8.



9.

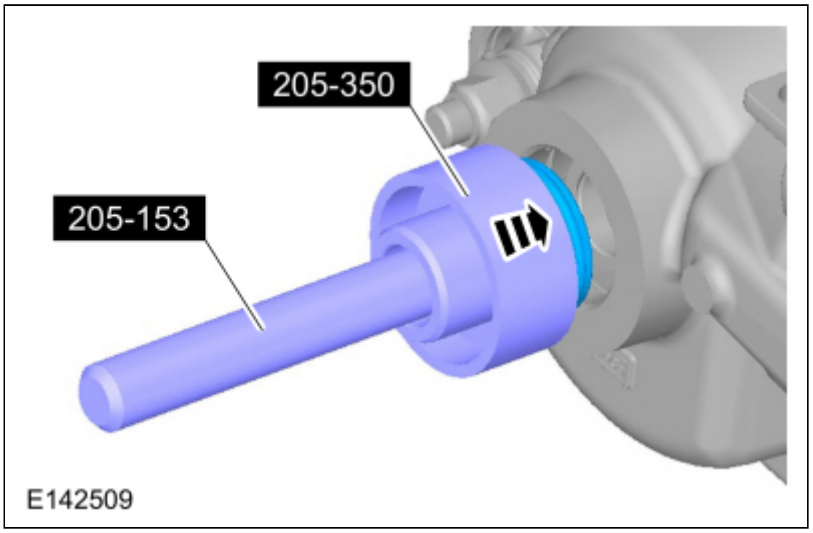


10. Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 307-318 Remover, Stator Bearing.

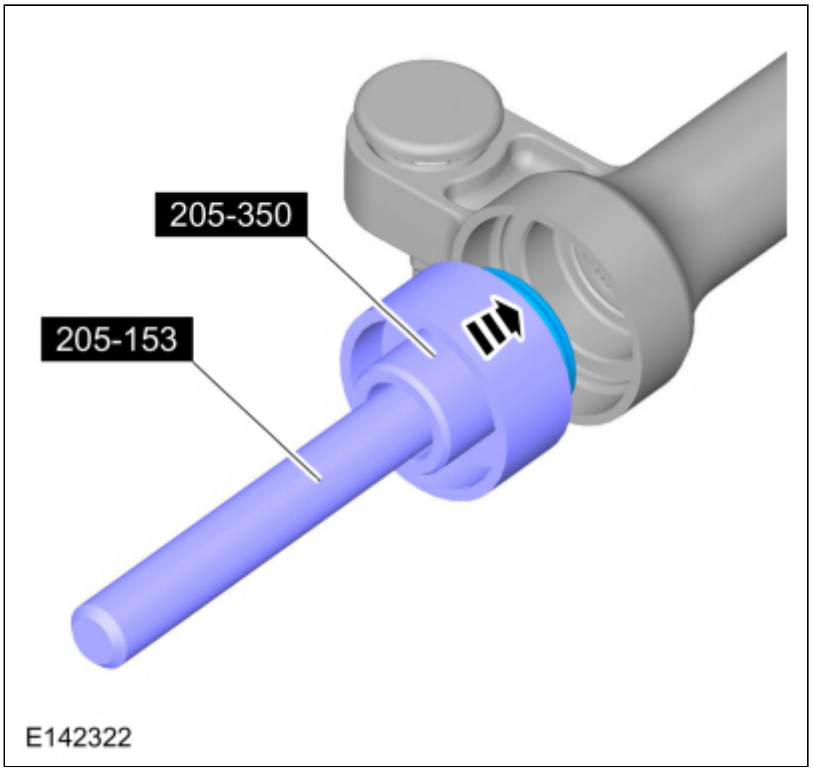


Installation

1. LH side.
   Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-350 Installer, Front Axle Seal.

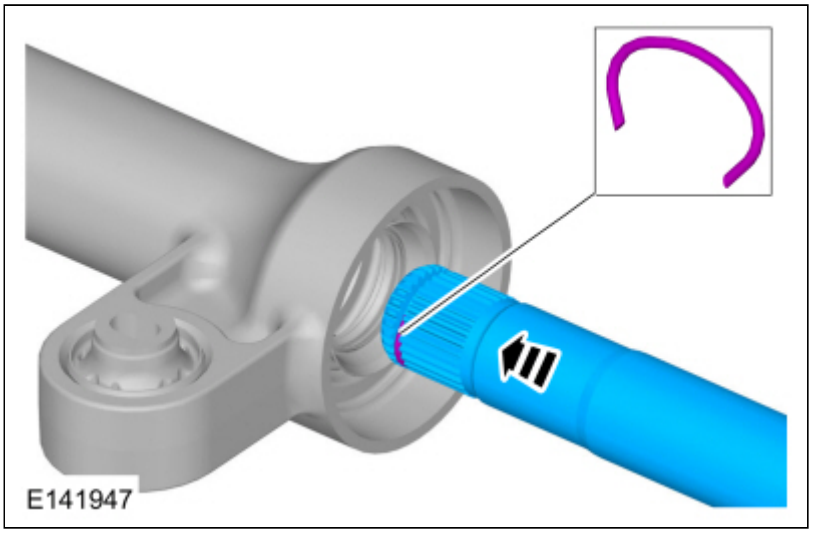


2. Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-350 Installer, Front Axle Seal.

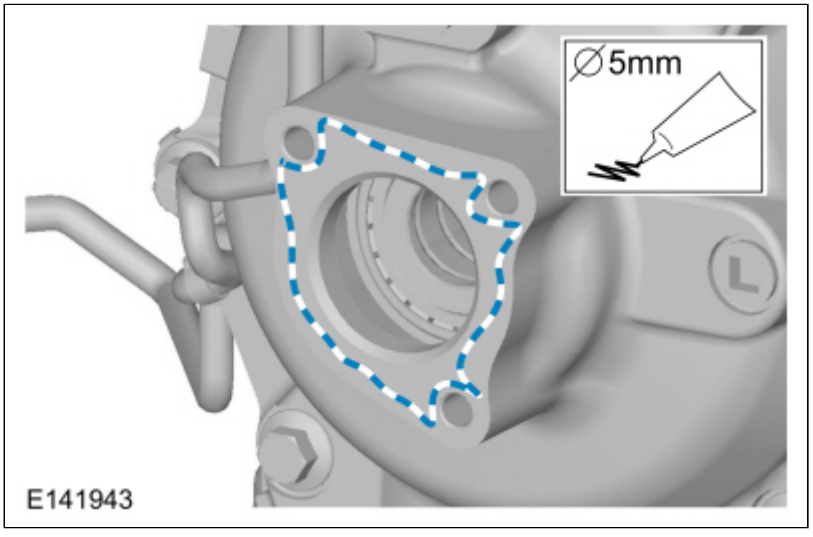


3. **NOTE:** *Make sure that new component is installed.*

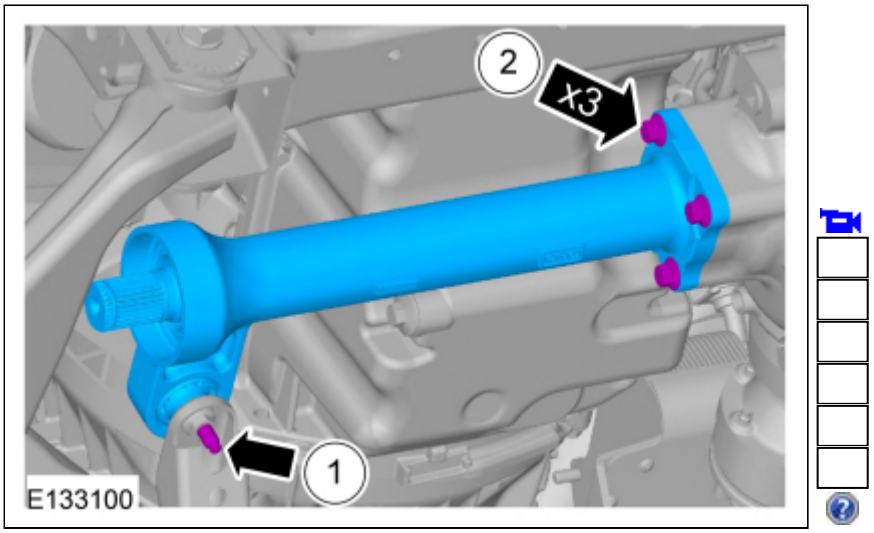
   Start one end of the retainer in the groove and work it over the halfshaft and into the groove to prevent the retainer from over expanding.



4. Material: WSS-M4G323-A8



1. *Torque*: 70 Nm
2. *Torque*: 40 Nm

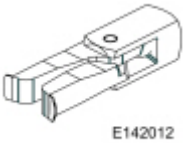


6. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Axle Tube Bearing

Special Tool(s) / General Equipment

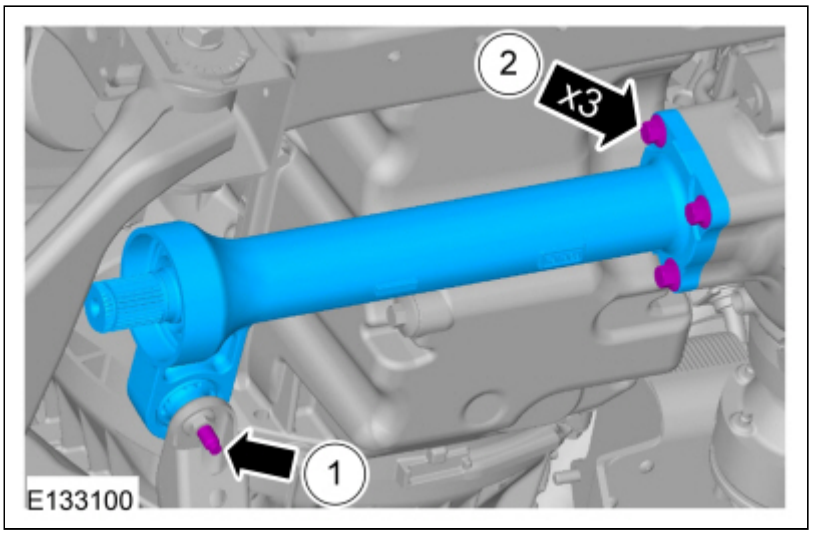
 E129694	100-001 (T50T-100-A) Slide Hammer
 E133913	205-153 (T80T-4000-W) Handle
 E142005	205-350 Installer, Front Axle Seal
 E142012	307-318 Remover, Stator Bearing
 E156412	307-607 Installer, Seal
 E142027	308-125 Remover, Transfer Case Bearing

Removal

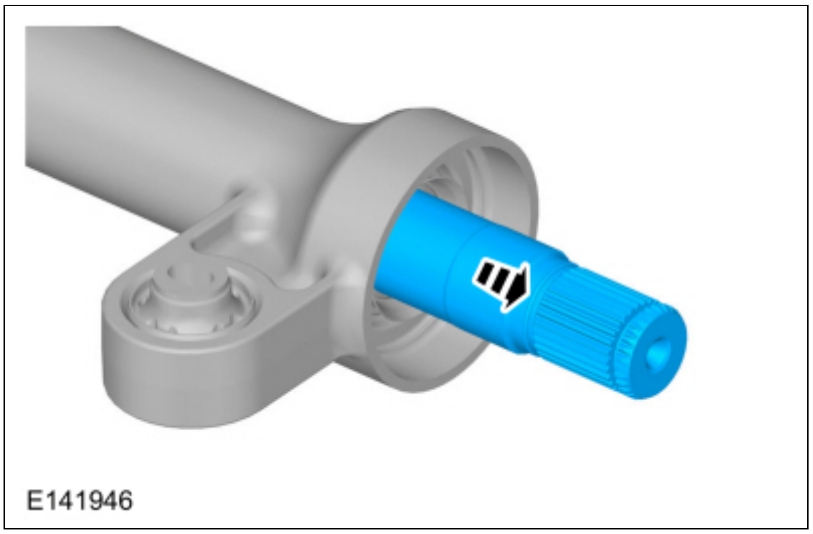
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove front RH wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
6. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

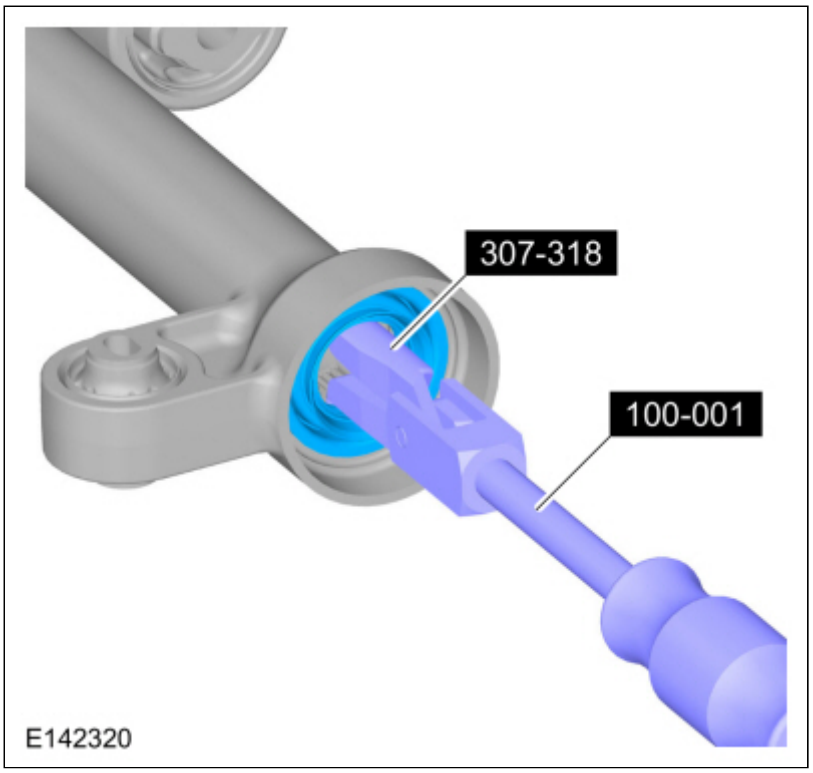
7.



8.

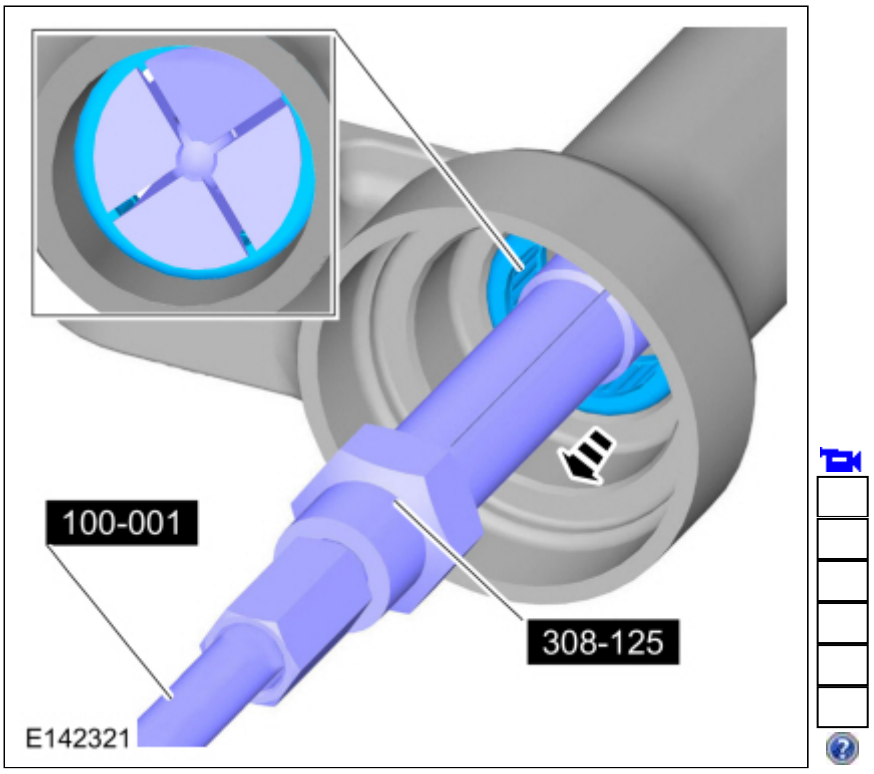


9. Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 307-318 Remover, Stator Bearing.



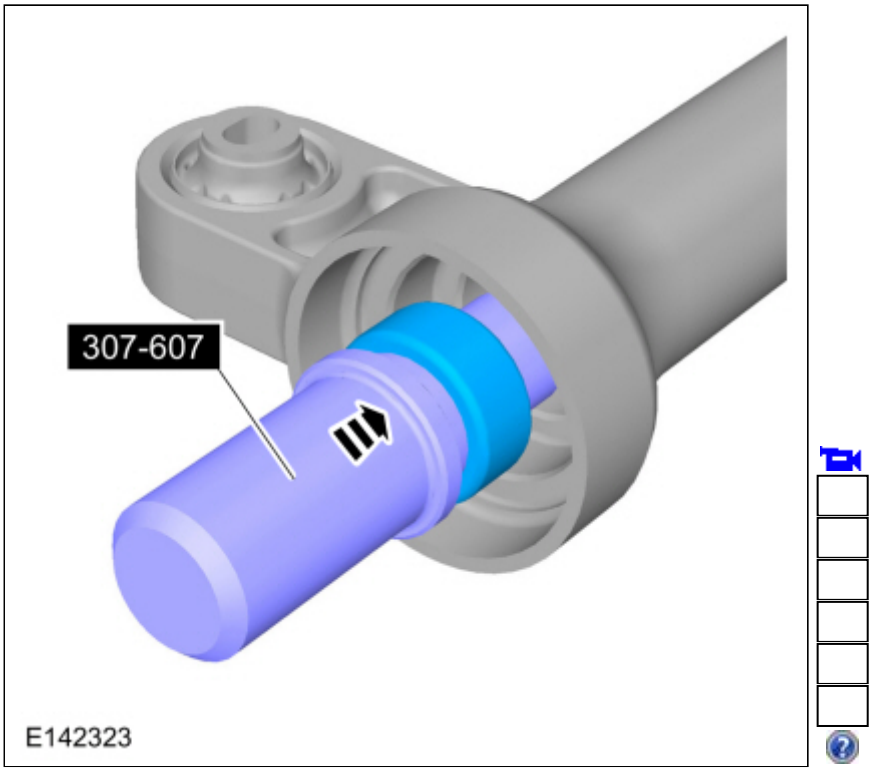
10. **NOTICE: Make sure that the special tool does not make contact with the axle tube during bearing removal. Failure to follow this instruction will cause damage to the axle tube.**

    Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 308-125 Remover, Transfer Case Bearing.

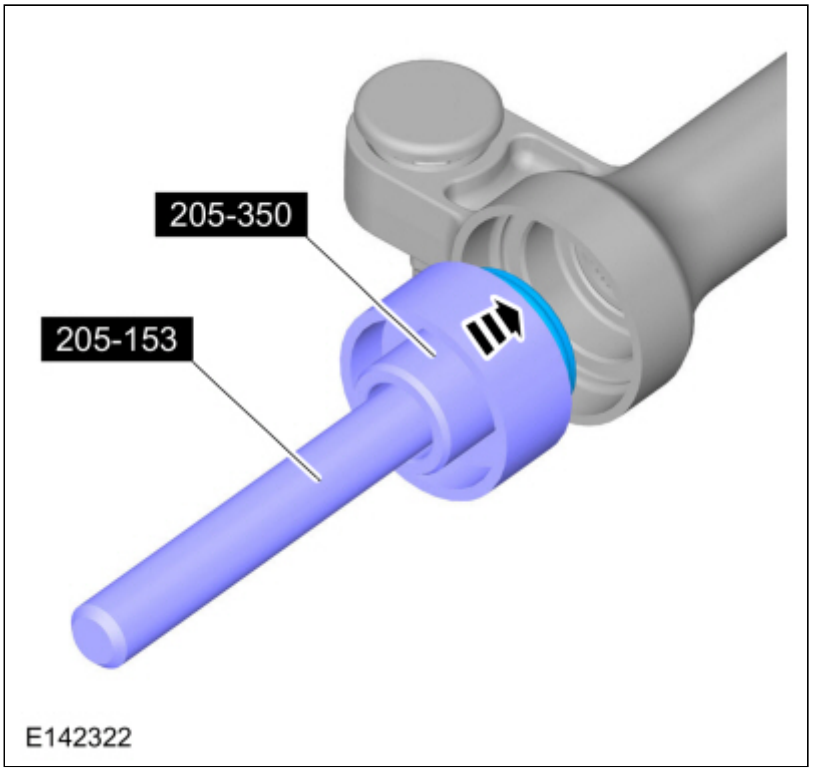


Installation

1. Use Special Service Tool: 307-607 Installer, Seal.

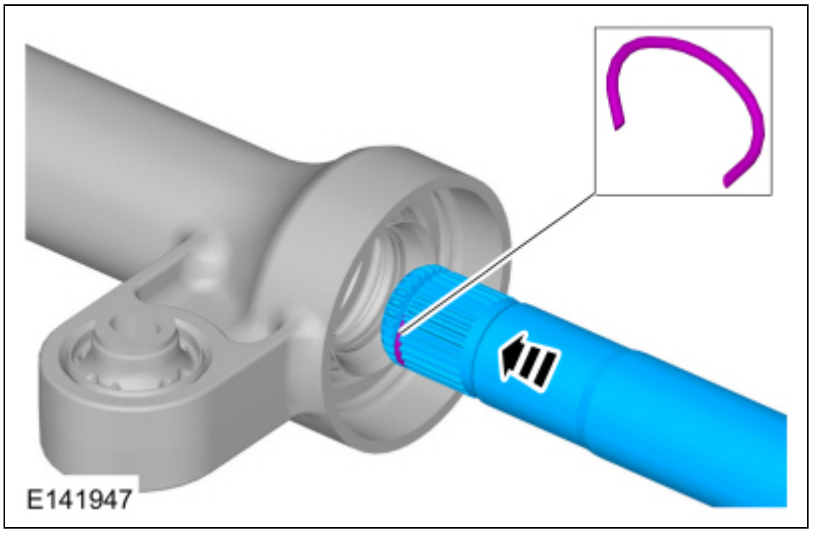


2. Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-350 Installer, Front Axle Seal.

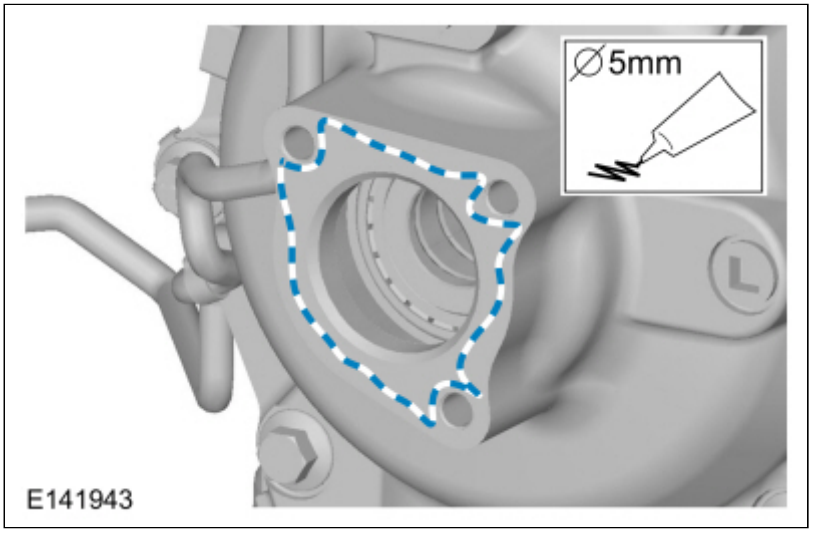


3. **NOTE:** *Make sure that new component is installed.*

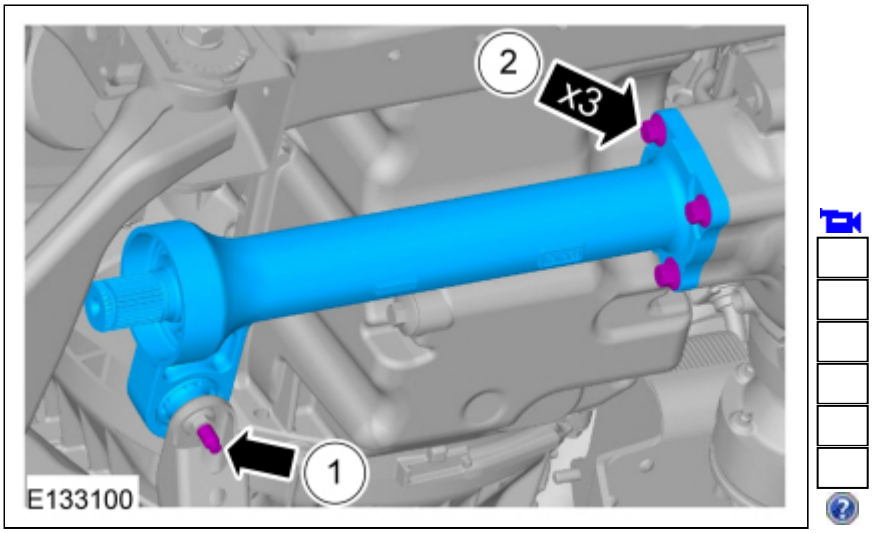
   Start one end of the retainer in the groove and work it over the halfshaft and into the groove to prevent the retainer from over expanding.



4. Material: WSS-M4G323-A8



1. *Torque*: 70 Nm
2. *Torque*: 40 Nm

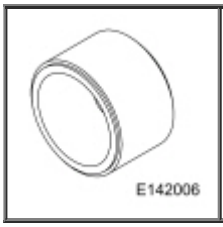


6. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

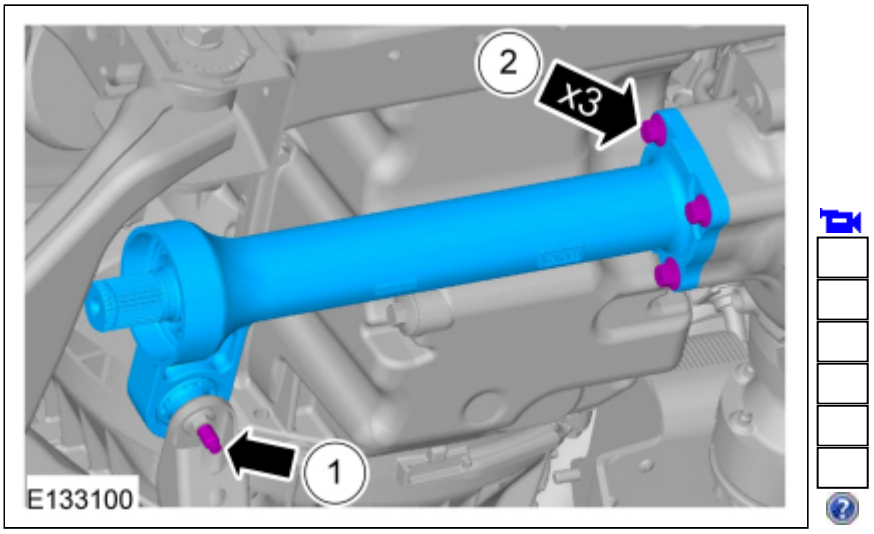
Axle Tube Bushing

Special Tool(s) / General Equipment

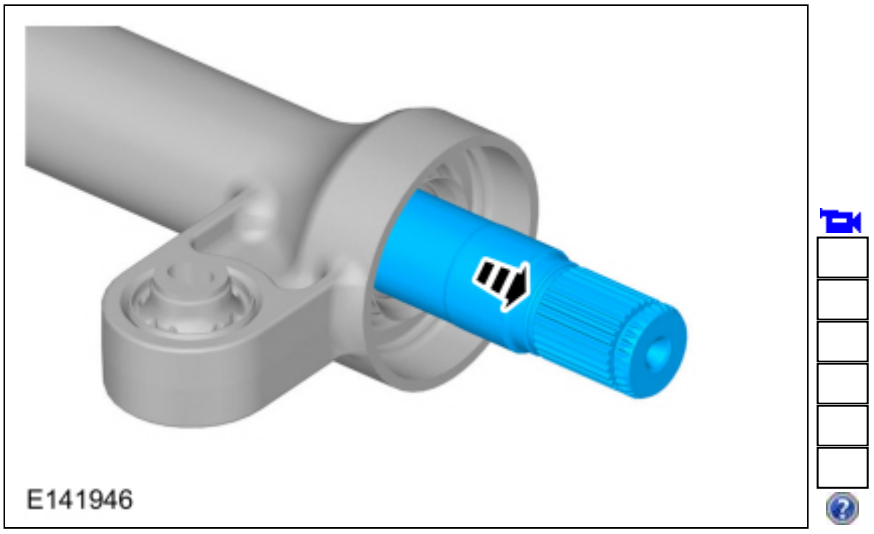
 E142006	205-987 Replacer, Differential Bushing

Removal

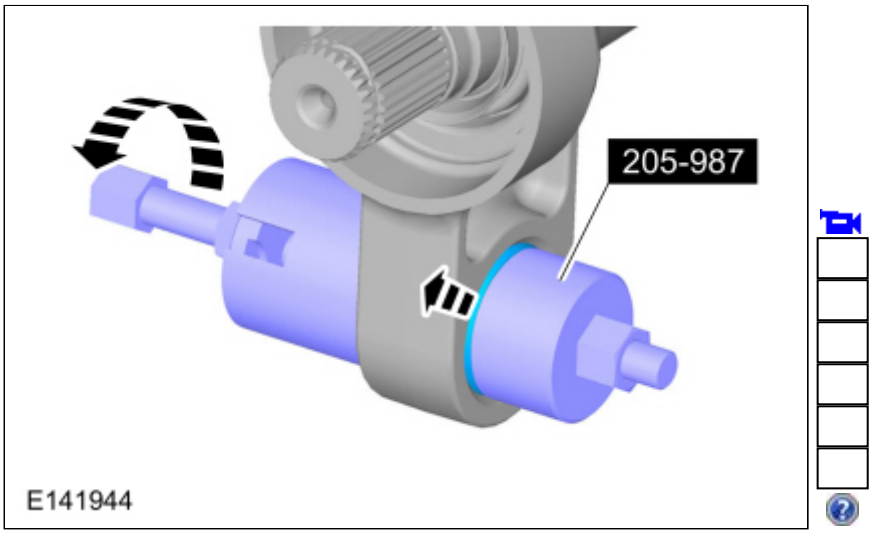
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove front RH wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
6. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
7. 

8.

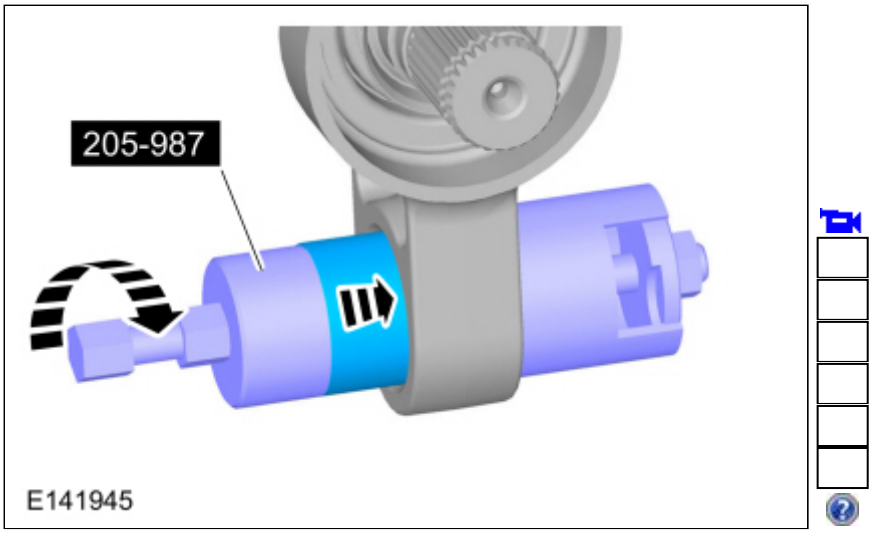


9. Use a forcing screw and receiver cup with the special tool to remove the bushing.
   Use Special Service Tool: 205-987 Replacer, Differential Bushing.



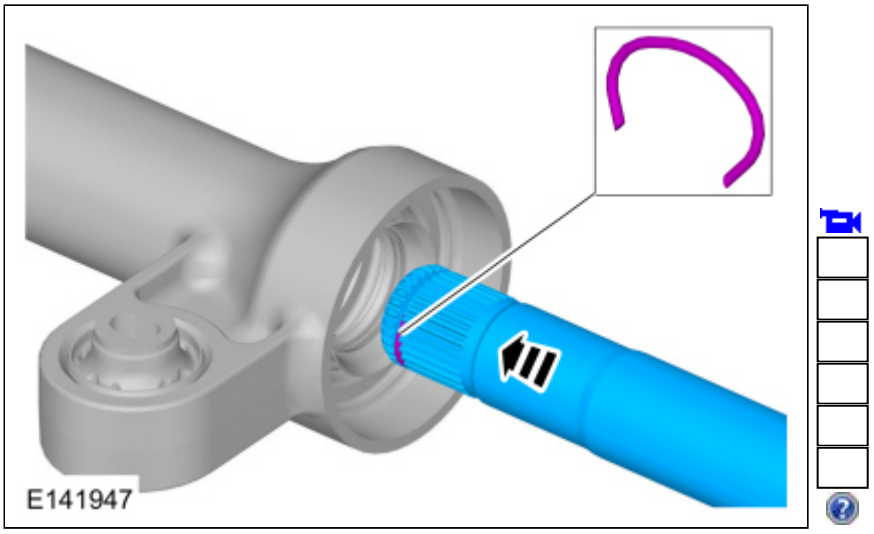
Installation

1. Use a forcing screw and receiver cup with the special tool to install the bushing.
   Use Special Service Tool: 205-987 Replacer, Differential Bushing.

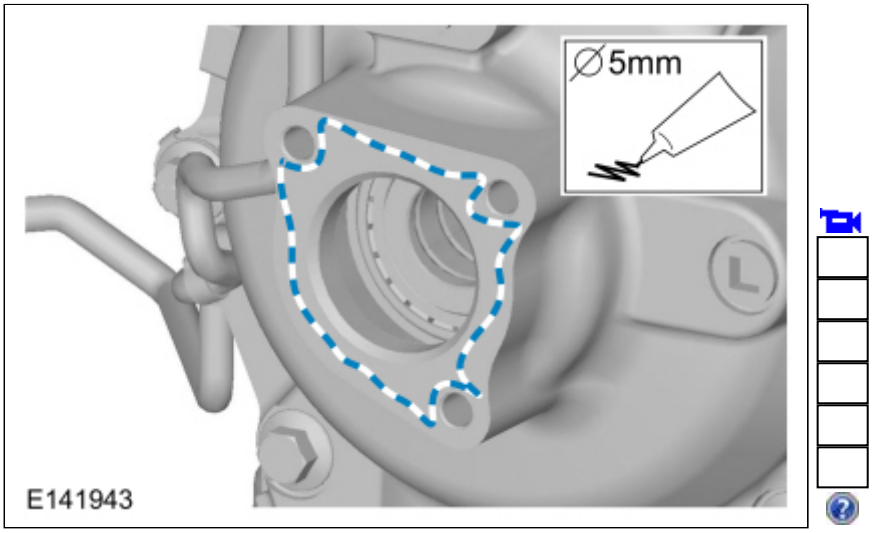


2. **NOTE:** *Make sure that new component is installed.*

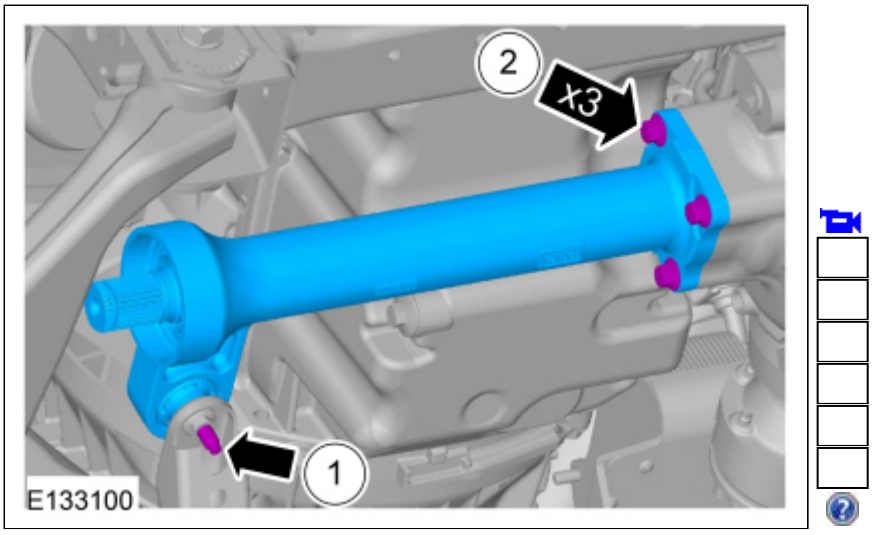
   Start one end of the retainer in the groove and work it over the halfshaft and into the groove to prevent the retainer from over expanding.



3. Material: WSS-M4G323-A8



1. *Torque*: 70 Nm
2. *Torque*: 40 Nm



5. To install, reverse the removal the procedure.

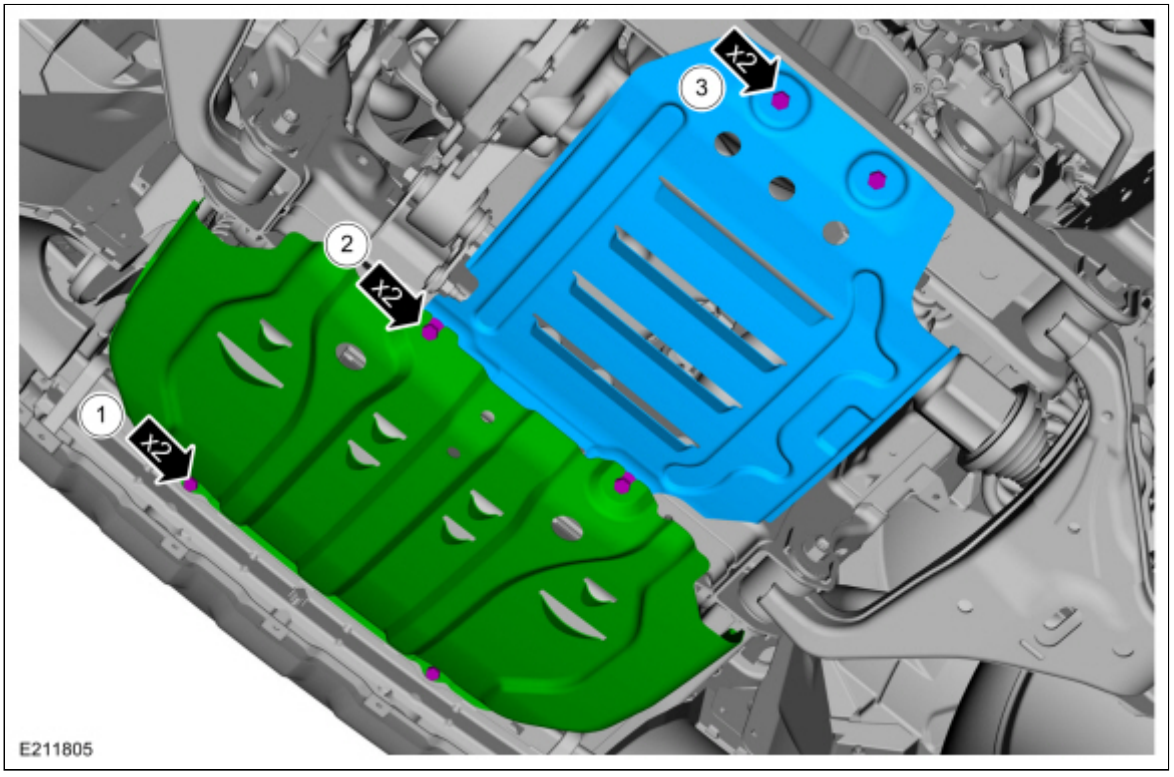
Copyright © 2016 Ford Motor Company

Differential Breather Tube

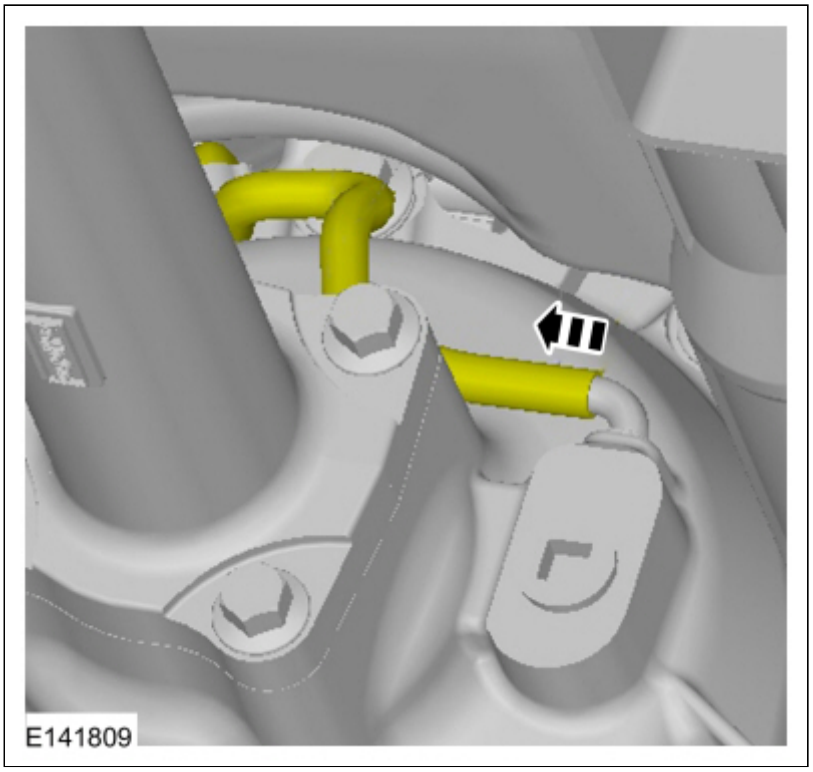
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

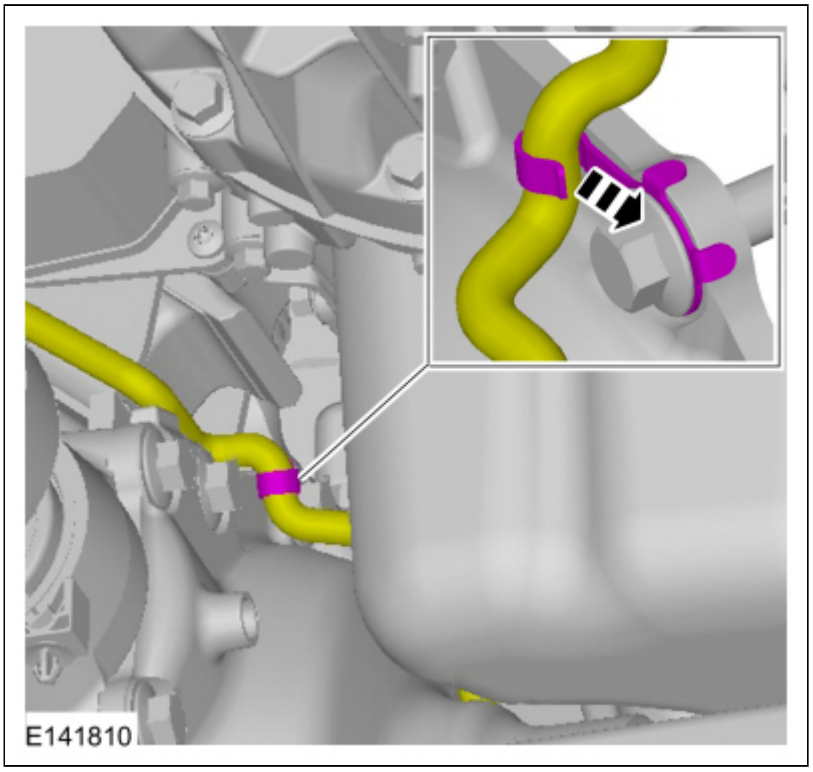
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove front LH wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. *Torque*: 30 Nm



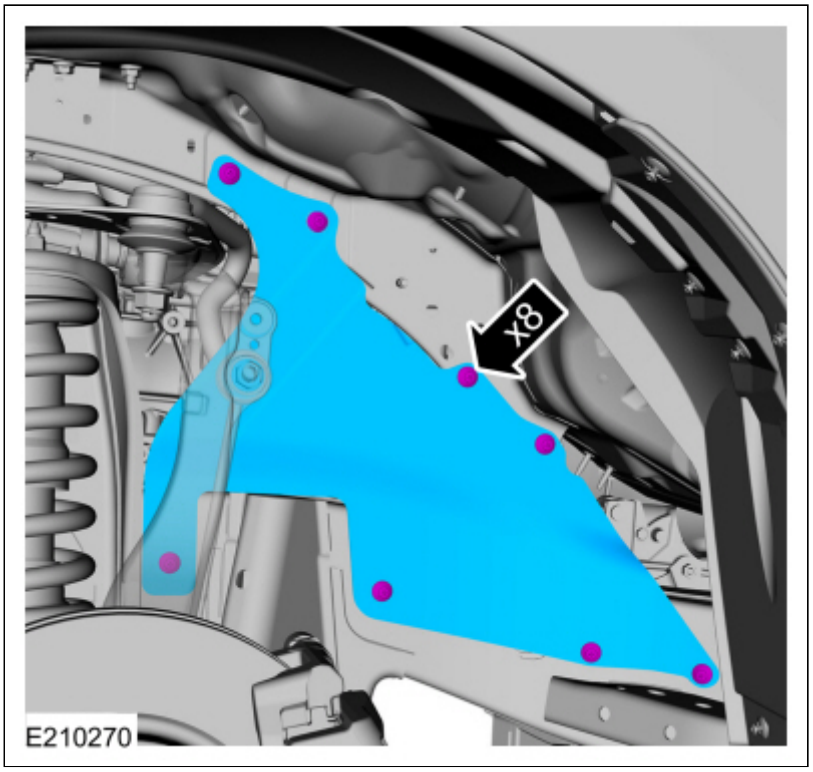
6.



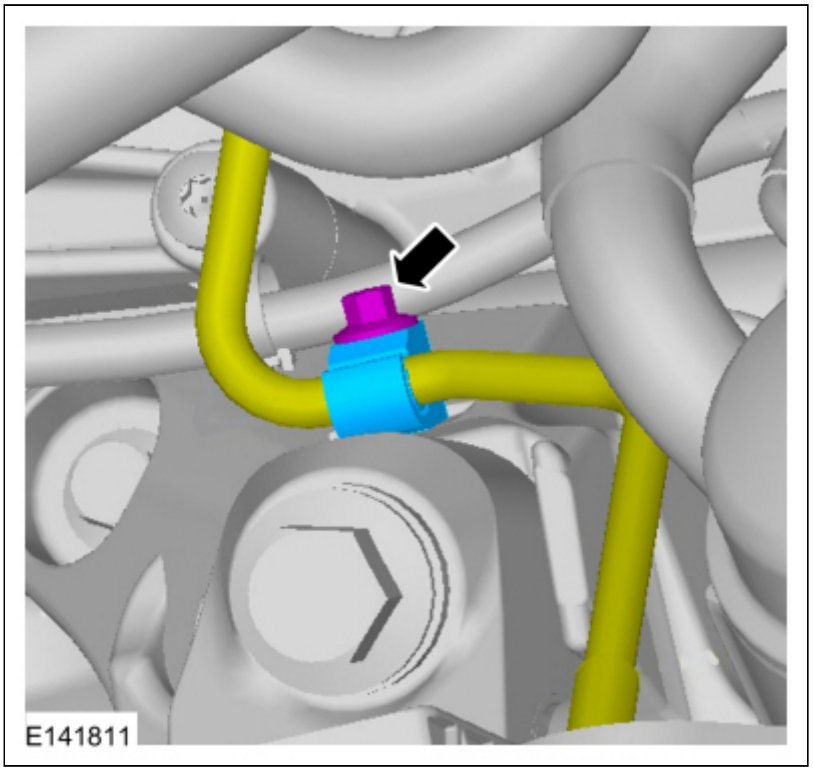
7.



8.

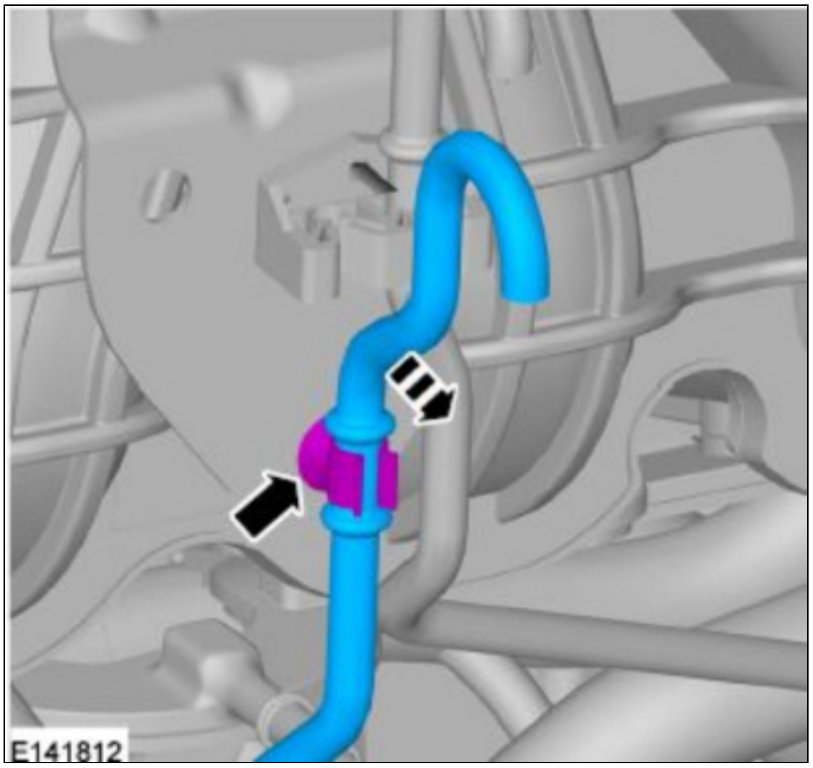


9. *Torque*: 7 Nm



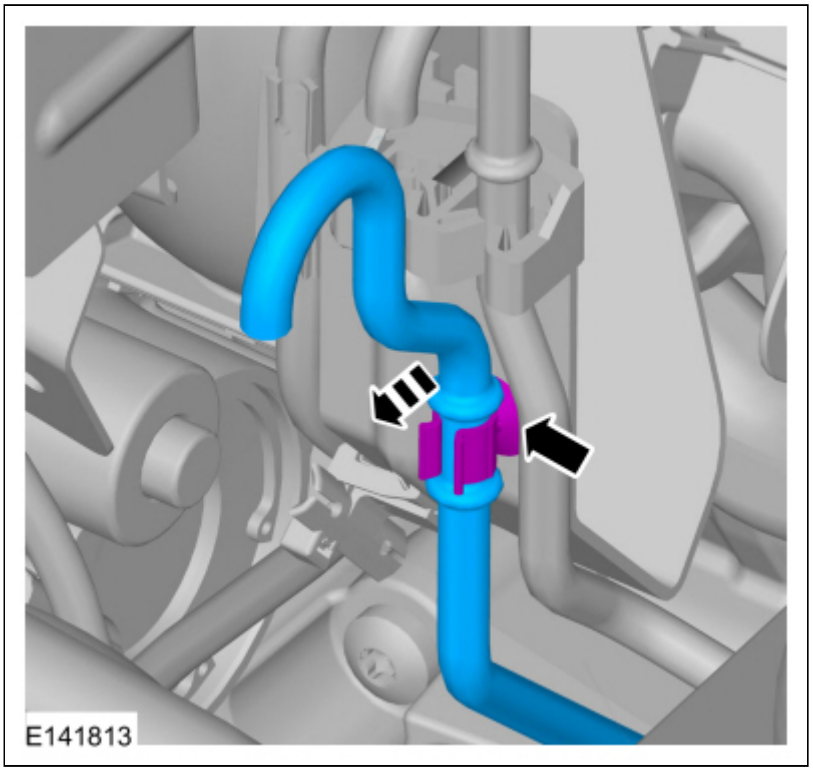
Vehicles with petrol engine

10.



Vehicles with diesel engine

11.



Installation

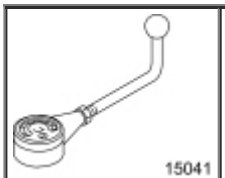
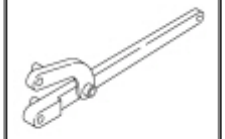
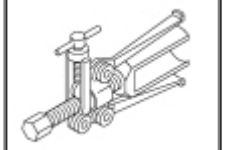
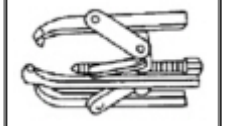
1. To install, reverse the removal the procedure.

Copyright © 2016 Ford Motor Company

Drive Pinion Flange and Seal

Base Part Number: 3N134

Special Tool(s) / General Equipment

 15041	205-067 Preload Gauge
 15030A	205-072 Universal Flange Holding Wrench
 15048	205-078 Remover, Drive Pinion Seal
 E163724	205-1002 Installer, Drive Pinion Seal
	205-D027 (D80L-1013-A) 2 or 3 Jaw Puller

Removal

NOTICE: Exceeding the drive pinion bearing preload will damage the bearings.

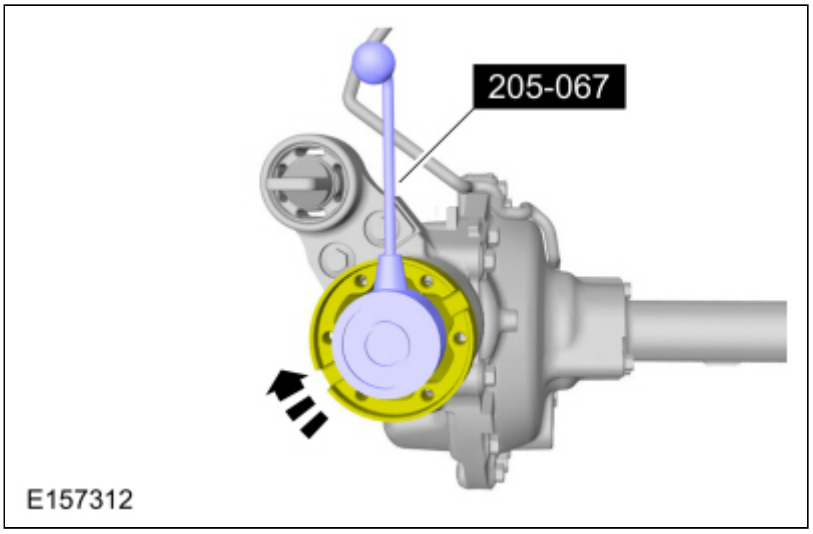
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *The front wheels and tires and brake calipers must be removed to prevent drag during the pinion bearing preload recording and adjustment.*

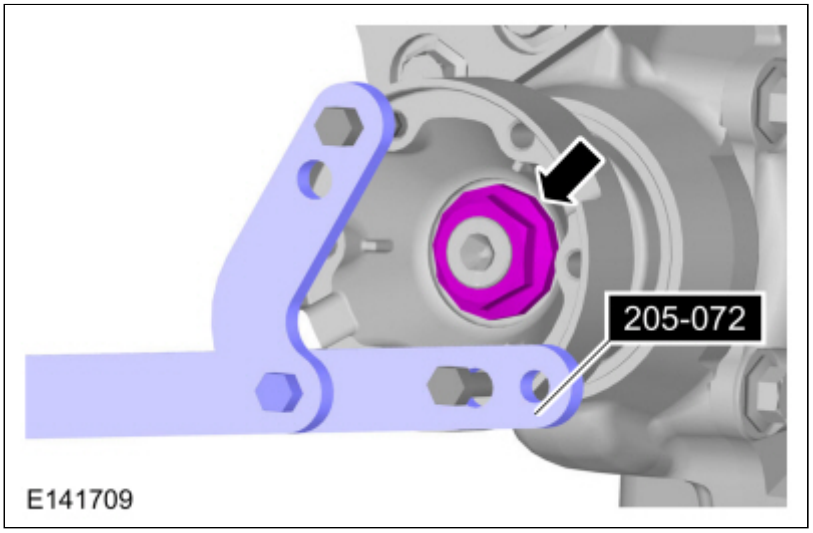
   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

2. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

3. Turn the drive pinion smoothly with the preload gauge and note the value.
   Use Special Service Tool: 205-067 Preload Gauge.

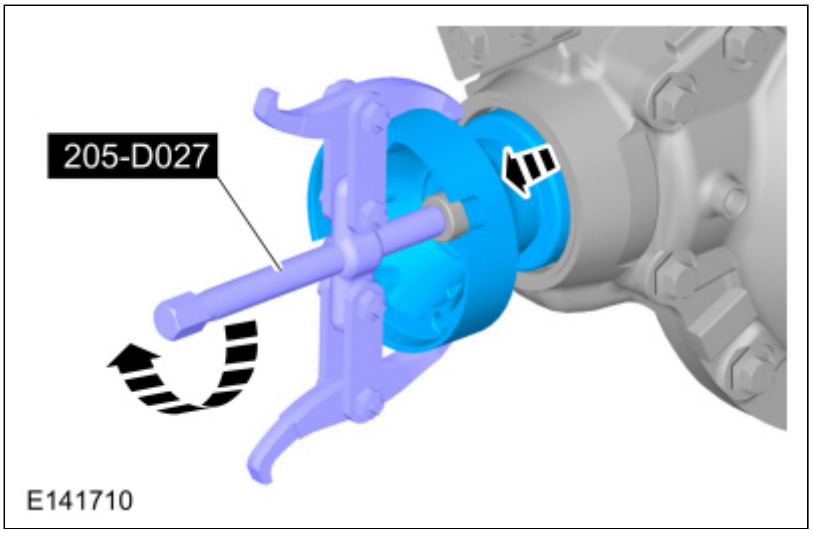


4. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.

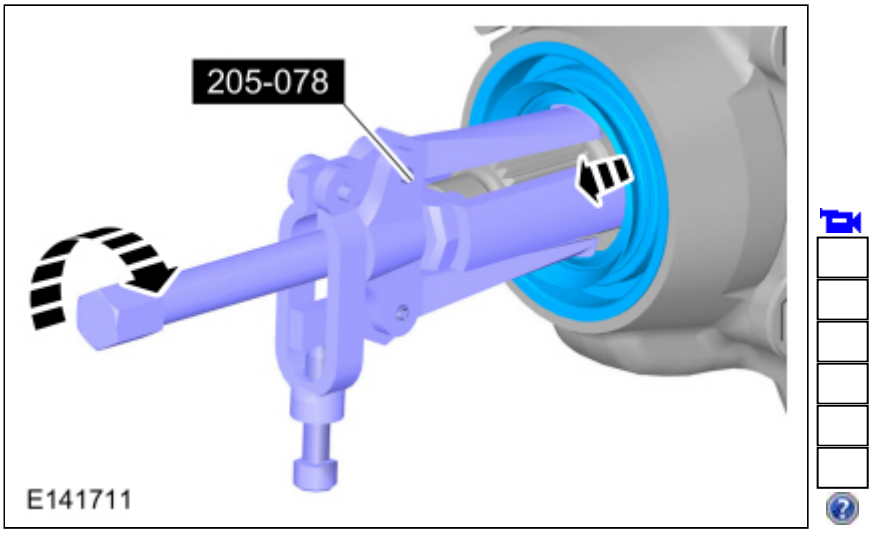


5. **NOTICE: Do not use power tools to remove the pinion flange.**

   Use Special Service Tool: 205-D027 (D80L-1013-A) 2 or 3 Jaw Puller.

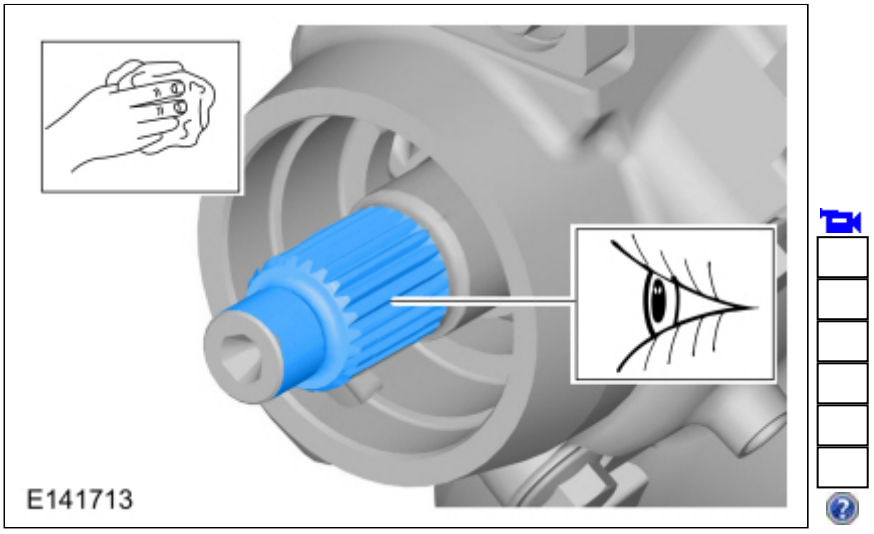


6. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal.



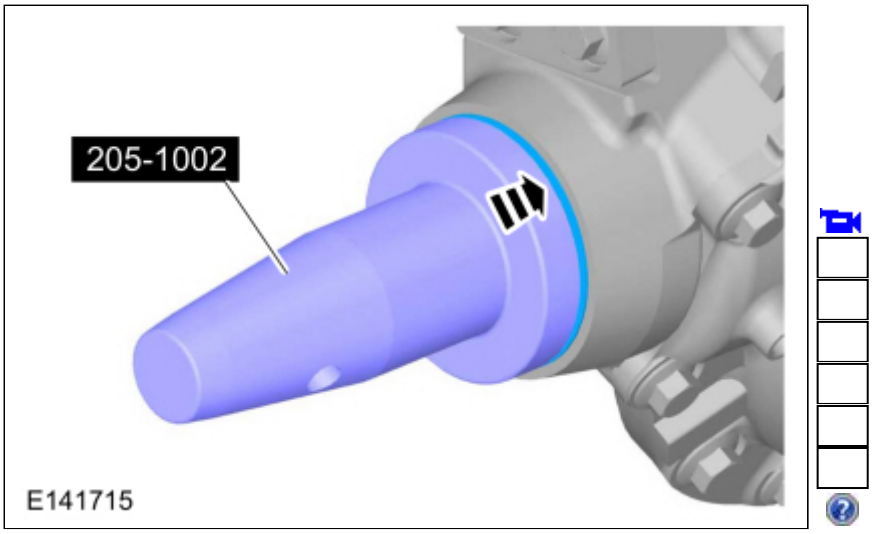
Installation

1.

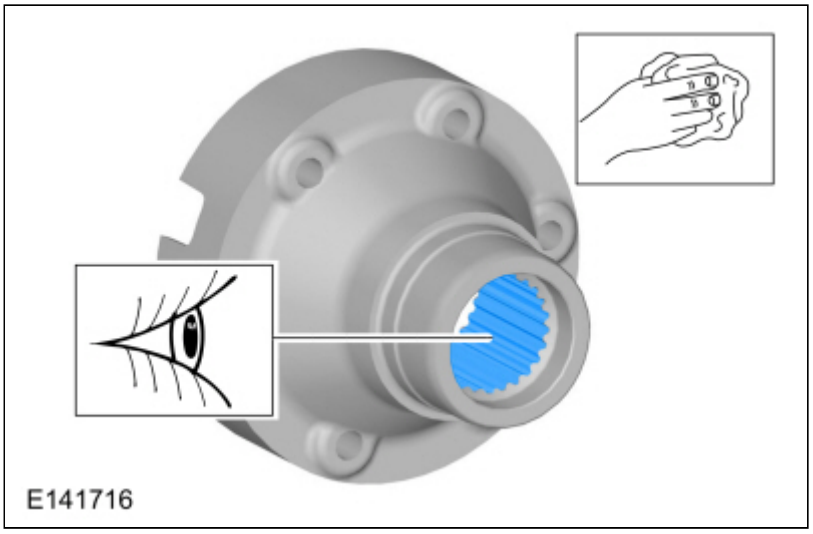


2. **NOTICE: Only use the specified material to lubricate the seals.**

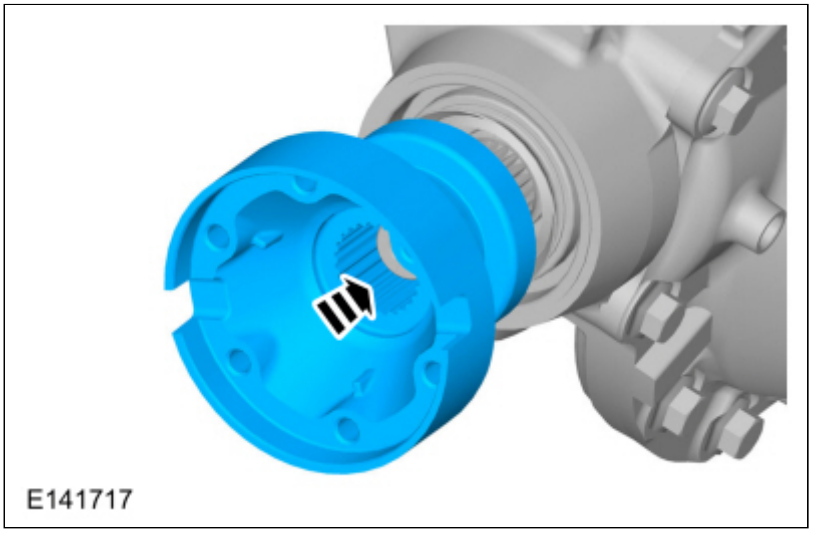
   Use Special Service Tool: 205-1002 Installer, Drive Pinion Seal.



3.



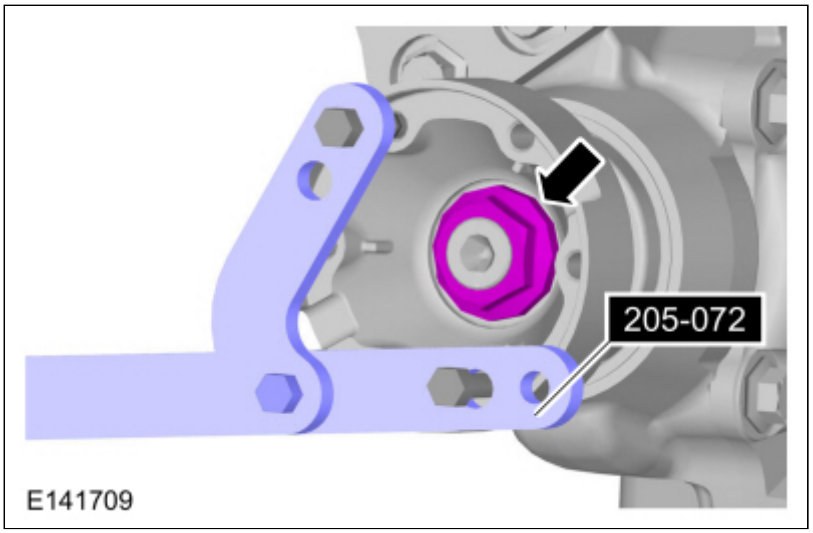
4.



5. **NOTE:** *Only tighten the nut finger tight at this stage.*

   NOTE: *Make sure that a new nut is installed.*

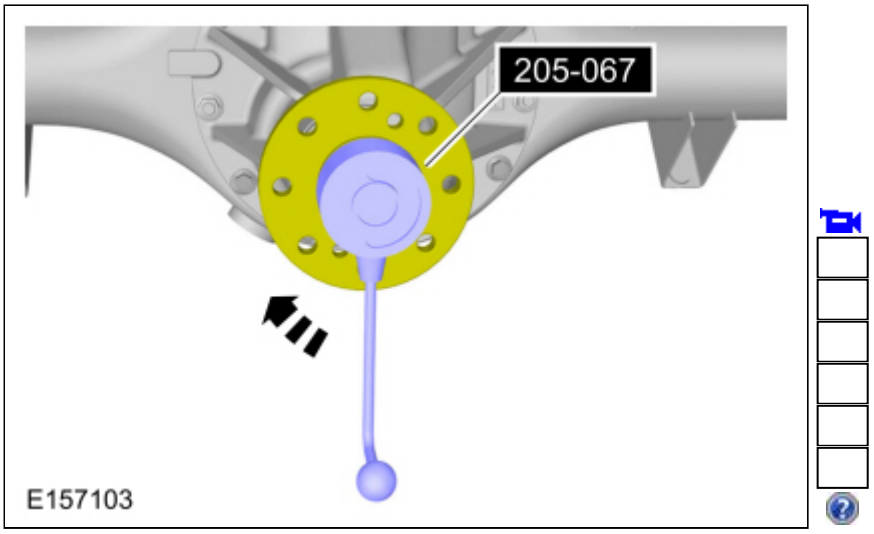
   Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
   Torque: 300 Nm



6. **NOTICE: Do not exceed the specified torque. If excess preload is applied, the differential unit may require replacement.**

   Using the special tool, measure the torque to rotate. Tighten the drive pinion nut untill the previosly determined torque plus 0.3 - 1.0 Nm value is reached.

Use Special Service Tool: 205-067 Preload Gauge.
Torque: 650 Nm



7. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
8. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Outer Constant Velocity Joint Grease	GKN 504218 GKY H-15
Inner Constant Velocity Joint Grease	GKN 504419 OLC Improved

Capacity

Description	Driveshaft Joint Grease Fill Capacity				CV joint Boot measured distance between end positions	
	Inner (Grams)	Inner Grease	Outer (Grams)	Outer Grease	Inner (mm)	Outer (mm)
Vehicles with Diesel engines	165+10	GKN 504419 OLC Improved	135+5	GKN 504218 GKY H-15	99-101	95-96
Vehicles with Petrol engines	165+10	GKN 504419 OLC Improved	174+10	GKN 504218 GKY H-15	99-101	95

Copyright © 2016 Ford Motor Company

Front Drive Halfshafts

Inspection and Verification

NOTE: *New front wheel drive halfshafts should not be installed unless disassembly and inspection reveals unusual wear.*

1. Inspect front wheel driveshaft joint boots for evidence of cracks, tears or splits.

NOTE: *While inspecting the front wheel driveshaft CV joint boots, watch for indentations (dimples) in the boot convolutions. If an indentation is observed, it must be removed.*

2. Inspect the underbody for any indication of grease splatter in the vicinity of the front wheel driveshaft CV joint boots outboard and inboard locations, which is an indication of front wheel driveshaft CV joint boot and/or front wheel driveshaft CV joint boot clamp damage.
3. Inspect for inboard CV joint stub shaft pilot bearing housing seal leakage at the front wheel driveshaft CV joint.
4. Make sure front axle wheel hub retainer is the correct prevailing torque type.
5. If the concerns remain after the inspection, determine the symptoms and go to the Symptom Chart. For additional Noise, Vibration and Harshness (NVH).
   REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness) .

Symptom Chart

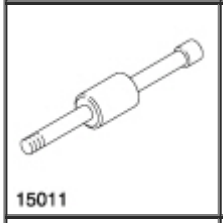
Symptom	Possible Sources	Action
• Clicking, Popping or Grinding Noises While Turning	• Inadequate or contaminated lube in outboard/inboard front wheel driveshaft CV joint.	• INSPECT, CLEAN and LUBRICATE as necessary.
	• Another component contacting driveshaft assembly.	• INSPECT and REPAIR as necessary.
	• Wheel bearings, brakes, suspension or steering components.	• INSPECT and REPAIR as necessary. REFER to: Suspension System (204-00 Suspension System - General Information) . REFER to: Brake System (206-00 Brake System - General Information) . REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).
• Vibration at Highway Speeds	• Out of balance front wheels or tires.	• REPAIR or INSTALL new as necessary. REFER to: Wheels and Tires (204-04 Wheels and Tires) .
	• Out-of-round tires.	• REPAIR or INSTALL new as necessary. REFER to: Wheels and Tires (204-04 Wheels and Tires) .
	• Incorrectly seated outboard front wheel driveshaft CV joint in front wheel hub.	• REPAIR or INSTALL new as necessary. REFER to: Front Drive Halfshafts (205-04 Front Drive Halfshafts) .
• Shudder Vibration During Acceleration.	• Excessively high CV joint operating angles caused by incorrect ride height.	• CHECK ride height, VERIFY correct spring rate and CHECK items under Halfshaft Joint Pullout. REPAIR or INSTALL new as necessary.
	• Excessively worn or damaged inboard front wheel driveshaft joint or outboard front wheel driveshaft joint.	• INSPECT and INSTALL new as necessary.
• Halfshaft Joint Pullout	• Inboard driveshaft bearing retainer circlip missing or not correctly	• INSPECT and REPAIR or INSTALL new as necessary.

Pullout	circlip missing or not correctly seated in differential side gear.	necessary.
	• Engine/transaxle assembly mispositioned.	• CHECK engine mounts for damage or wear. REPAIR or INSTALL new as necessary.
	• Frame rail or strut tower out of position or damaged.	• CHECK underbody dimensions.
	• Front suspension components worn or damaged.	• CHECK for worn bushings or bent components (front stabilizer bar, front suspension lower arm). REPAIR or INSTALL new as necessary.

Copyright © 2016 Ford Motor Company

Front Halfshaft LH

Special Tool(s) / General Equipment

 16092	204-226 Remover, Halfshaft
 15011	205-047 Slide Hammer
 E225294	205-1047 Protector, Halfshaft Seal

Removal

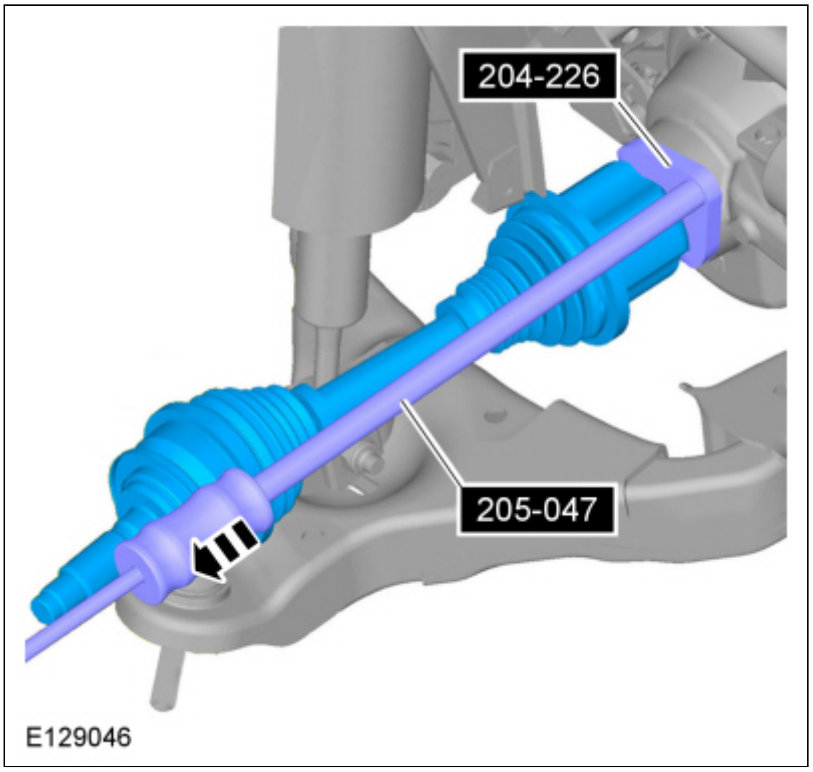
NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTICE: Never pick up or hold the halfshaft by the inboard or outboard CV joint only.

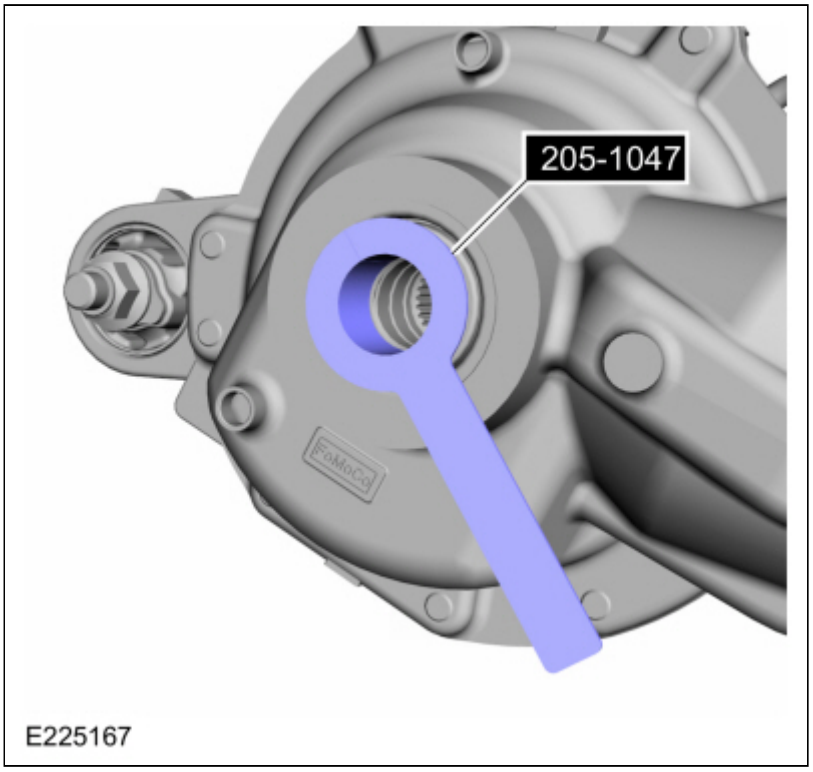
NOTICE: The inner constant velocity (CV) joint must not be bent more than 18°.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
3. Refer to: Wheel Knuckle - LHD 4WD/RHD 4WD (204-01 Front Suspension, Removal and Installation).
4. Use Special Service Tool: 205-047 Slide Hammer. , 204-226 Remover, Halfshaft.



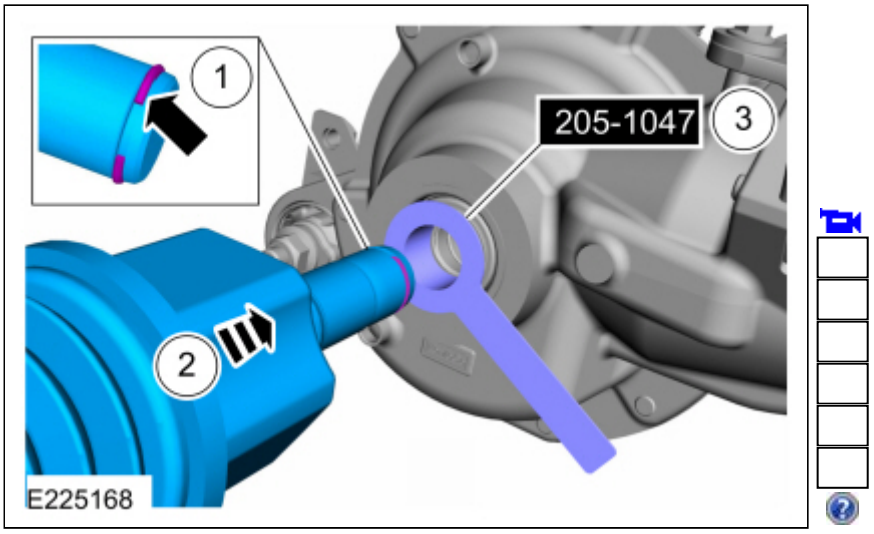
5. Install Special Service Tool: 205-1047 Protector, Halfshaft Seal.



Installation

1. **NOTE:** *Make sure that a new component is installed.*

2. Remove the halfshaft seal protector before completely installing the halfshaft.
3. Remove Special Service Tool: 205-1047 Protector, Halfshaft Seal.

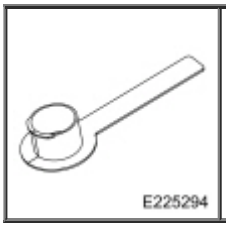


2. Refer to: Wheel Knuckle - LHD 4WD/RHD 4WD (204-01 Front Suspension, Removal and Installation).
3. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

Copyright © 2016 Ford Motor Company

Front Halfshaft RH

Special Tool(s) / General Equipment

 E225294	205-1047 Protector, Halfshaft Seal

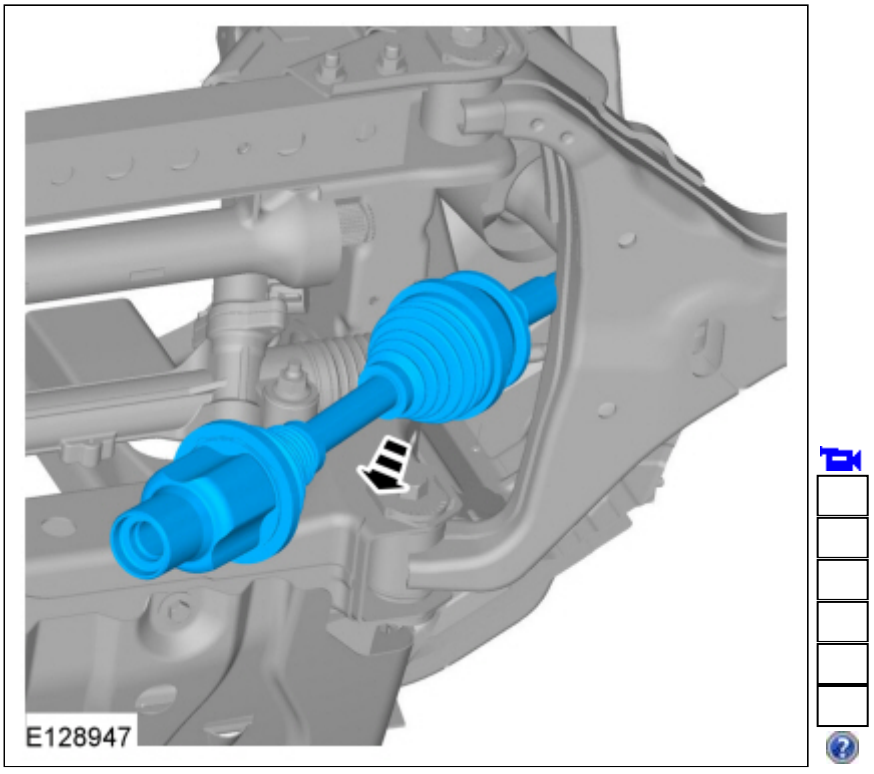
Removal

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTICE: Never pick up or hold the halfshaft by the inboard or outboard CV joint only.

NOTICE: The inner constant velocity (CV) joint must not be bent more than 18°.

NOTE: *Removal steps in this procedure may contain installation details.*

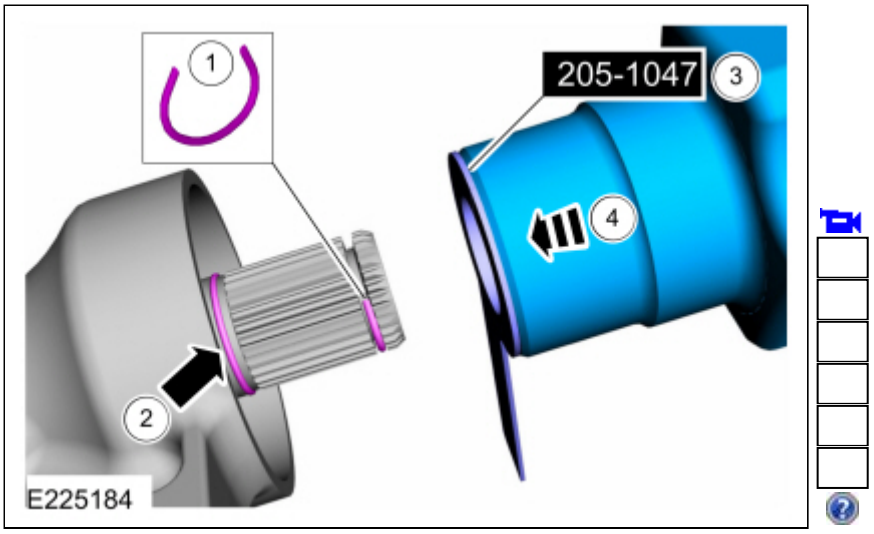
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel Knuckle - LHD 4WD/RHD 4WD (204-01 Front Suspension, Removal and Installation).
3. 

Installation

1. **NOTE:** *Start one end of the retainer in the groove and work it over the halfshaft and into the groove to prevent the retainer from over expanding.*
    1. **NOTE:** *Make sure that new component is installed.*

2. **NOTE:** *Make sure that new component is installed.*

3. Install Special Service Tool: 205-1047 Protector, Halfshaft Seal.
4. Remove the halfshaft seal protector before completely installing the halfshaft.
   Remove Special Service Tool: 205-1047 Protector, Halfshaft Seal.

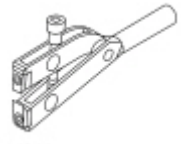
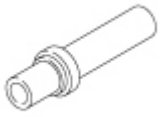


2. Refer to: Wheel Knuckle - LHD 4WD/RHD 4WD (204-01 Front Suspension, Removal and Installation).

Copyright © 2016 Ford Motor Company

Inner Constant Velocity (CV) Joint Boot

Special Tool(s) / General Equipment

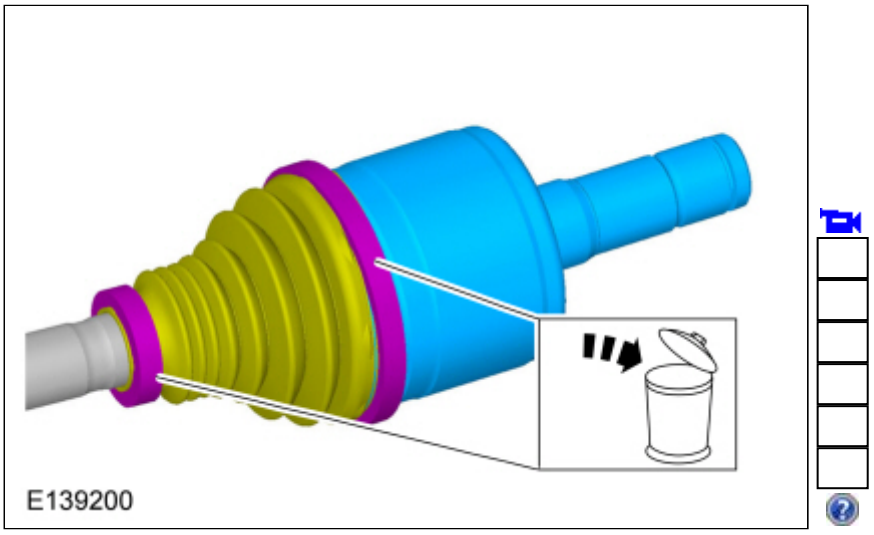
 14044	204-169 Clamping Tool, Boot Retaining Clamp
 15091	205-310 Remover, Bearing/Gear
 15092	205-311 Remover, Bearing/Gear
 16016	308-046 Installer, Transmission Extension Housing Bushing/Seal
Vise	
Vise Jaw Protectors	

Removal

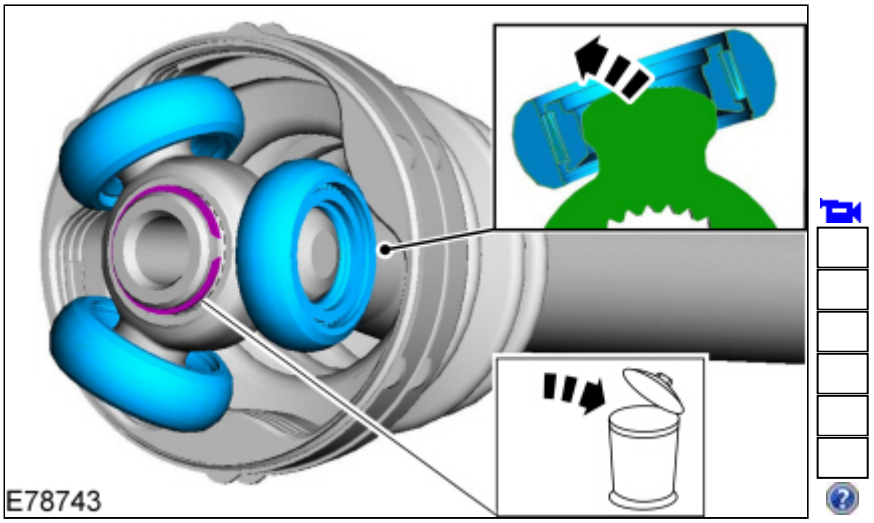
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

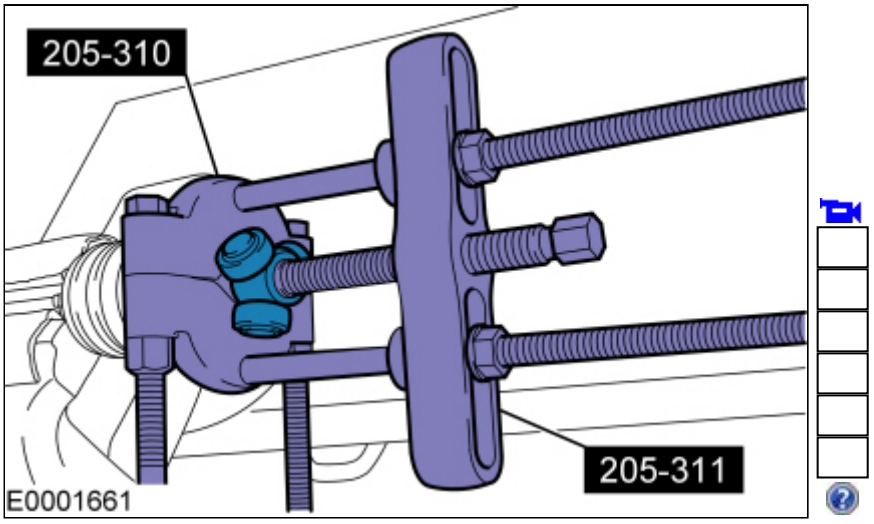
2. Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



3. Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



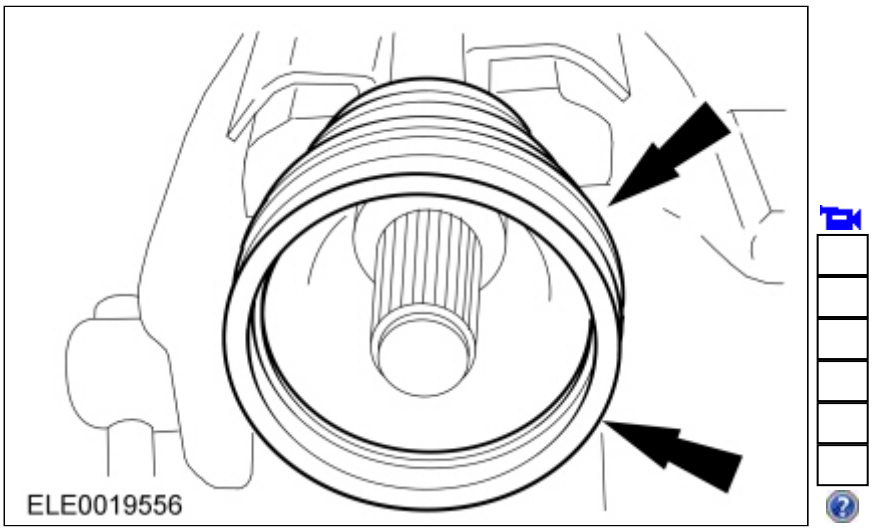
4. Install Special Service Tool: 205-310 Remover, Bearing/Gear. , 205-311 Remover, Bearing/Gear.
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



Installation

1. **NOTE:** *Make sure that a new inner constant velocity (CV) joint boot is installed.*

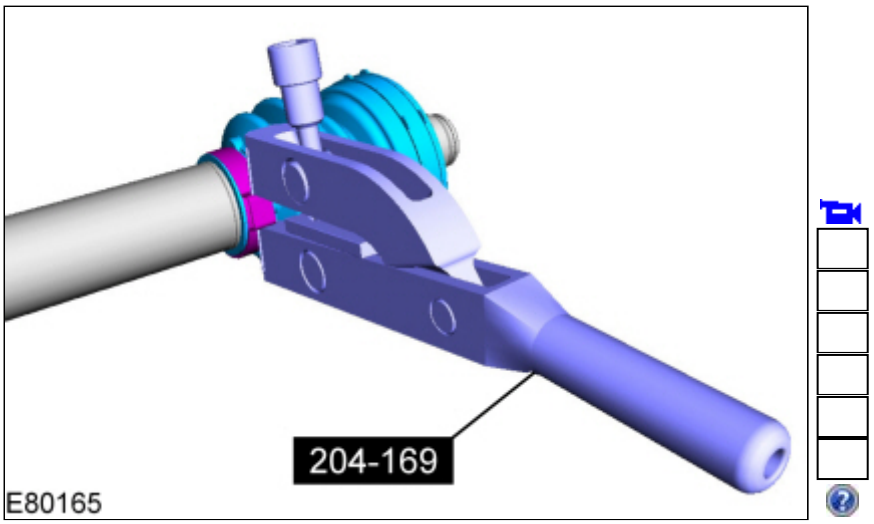
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



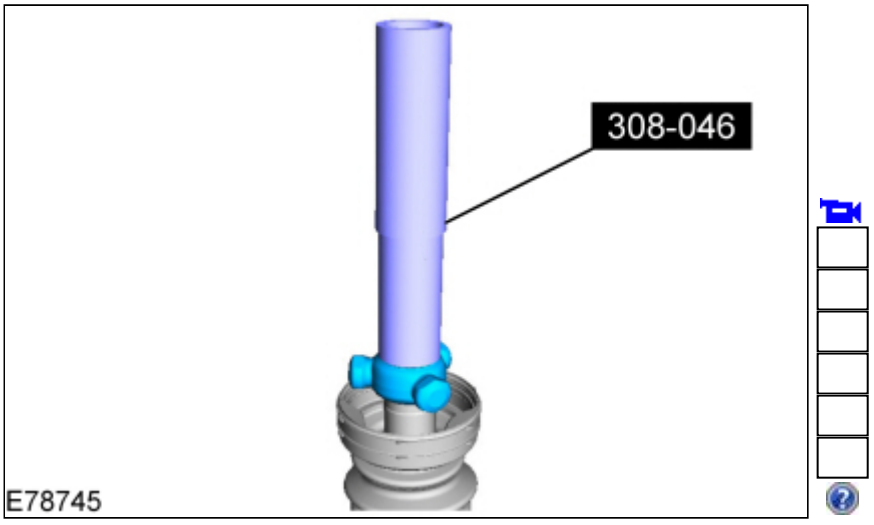
2. **NOTE:** *Make sure that a new component is installed.*

   NOTE: *Make sure that the component is correctly located.*

   Install boot into groove on bar-shaft at small end first.
   Use Special Service Tool: 204-169 Clamping Tool, Boot Retaining Clamp.
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors
   Torque: 21 Nm



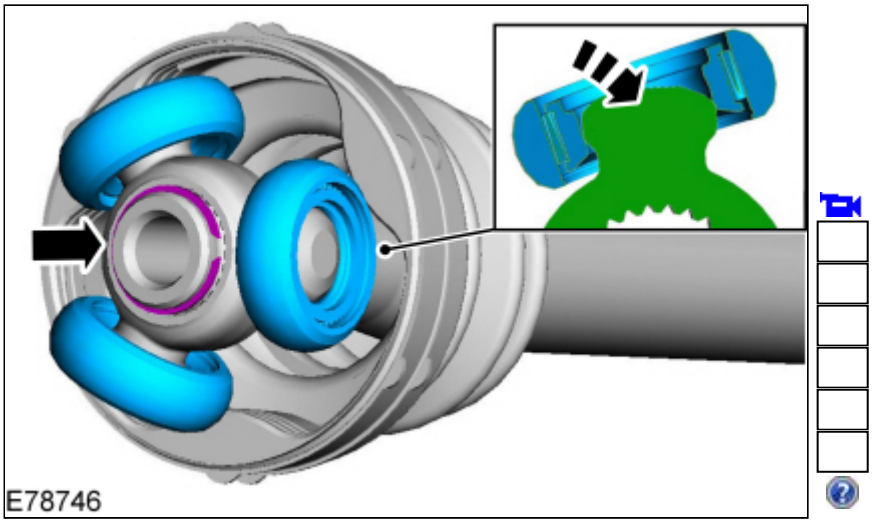
3. Use Special Service Tool: 308-046 Installer, Transmission Extension Housing Bushing/Seal.
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



4. **NOTE:** *Make sure that a new component is installed.*

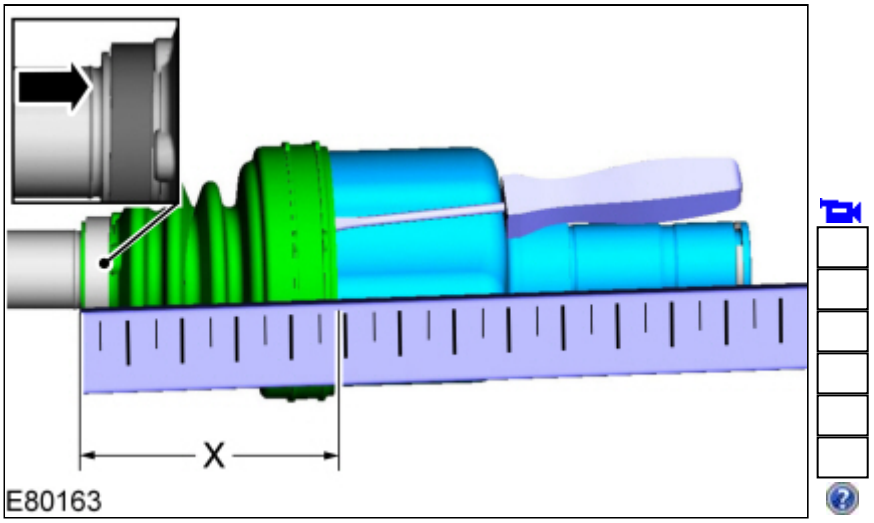
   NOTE: *Make sure that the component is correctly located.*

   Refer to: Specifications (205-04 Front Drive Halfshafts, Specifications).



5. **NOTE:** *Make sure that air can freely escape.*

   Insert a small screwdriver with clean rag under the boot seat to allow the air to escape.
   Refer to: Specifications (205-04 Front Drive Halfshafts, Specifications).
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors

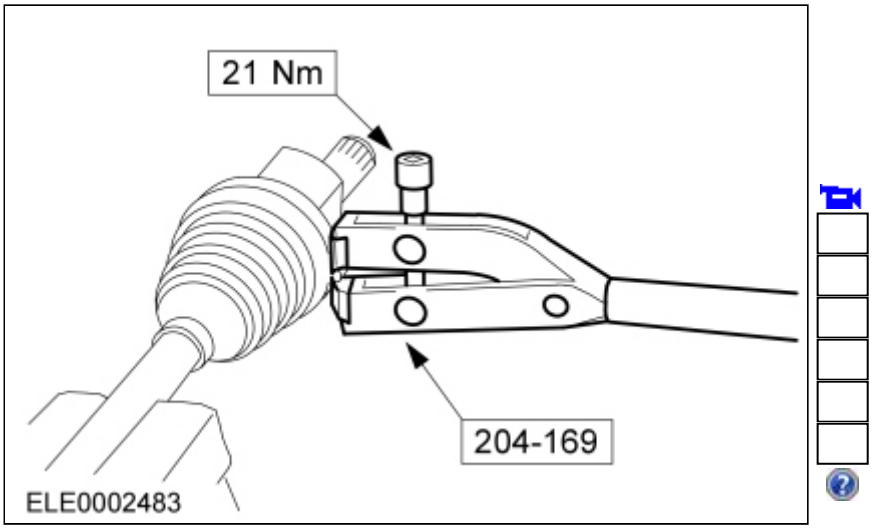


6. **NOTICE: The inner constant velocity (CV) joint must not be bent more than 18°.**

   NOTE: *Make sure that a new component is installed.*

   NOTE: *Make sure that the component is installed to the position noted before removal.*

   Use Special Service Tool: 204-169 Clamping Tool, Boot Retaining Clamp.
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors
   Torque: 21 Nm

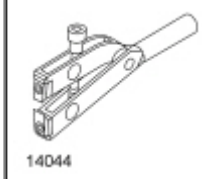


7. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

Copyright © 2016 Ford Motor Company

Outer Constant Velocity (CV) Joint Boot

Special Tool(s) / General Equipment

 14044	204-169 Clamping Tool, Boot Retaining Clamp
Vise	
Vise Jaw Protectors	

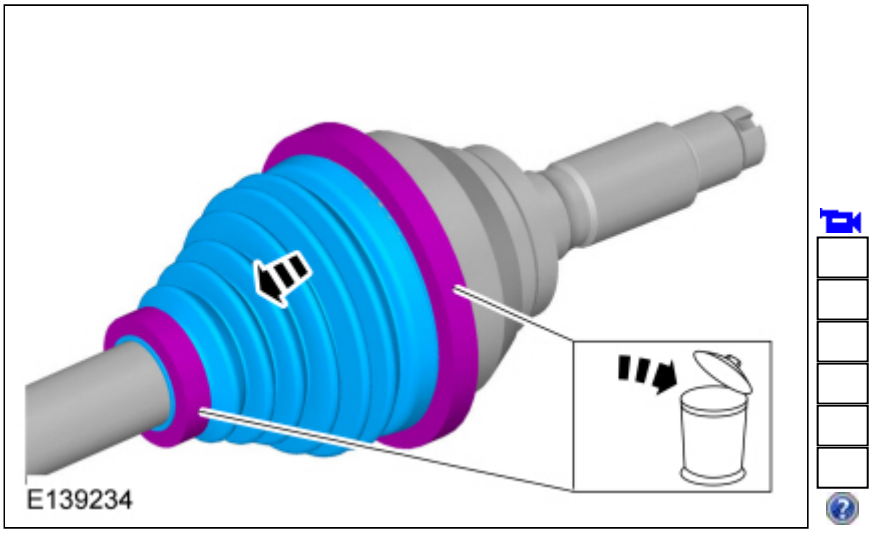
Removal

NOTICE: The component must not be disassembled.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Inner Constant Velocity (CV) Joint Boot (205-04 Front Drive Halfshafts, Removal and Installation).
2. **NOTE:** *Discard the damaged component.*

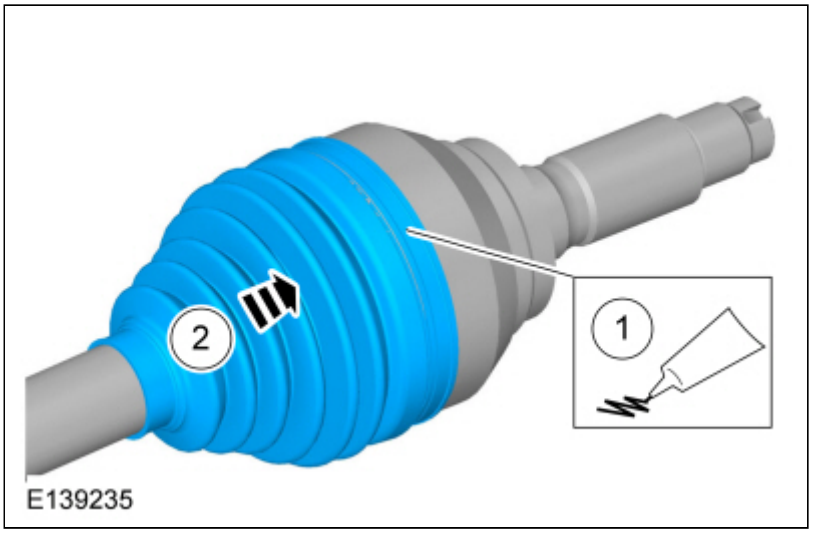
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



Installation

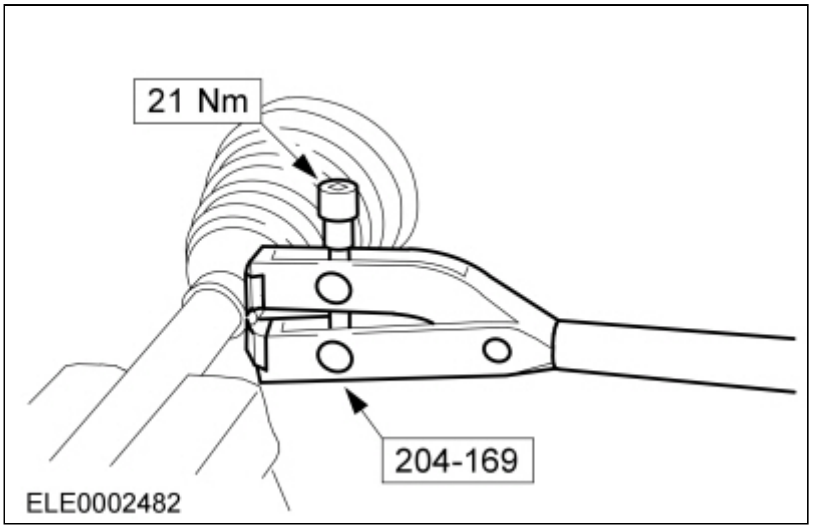
1. **NOTE:** *Make sure that a new component is installed.*

   Refer to: Specifications (205-04 Front Drive Halfshafts, Specifications).
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors



2. **NOTE:** *Make sure that a new clamp is installed.*

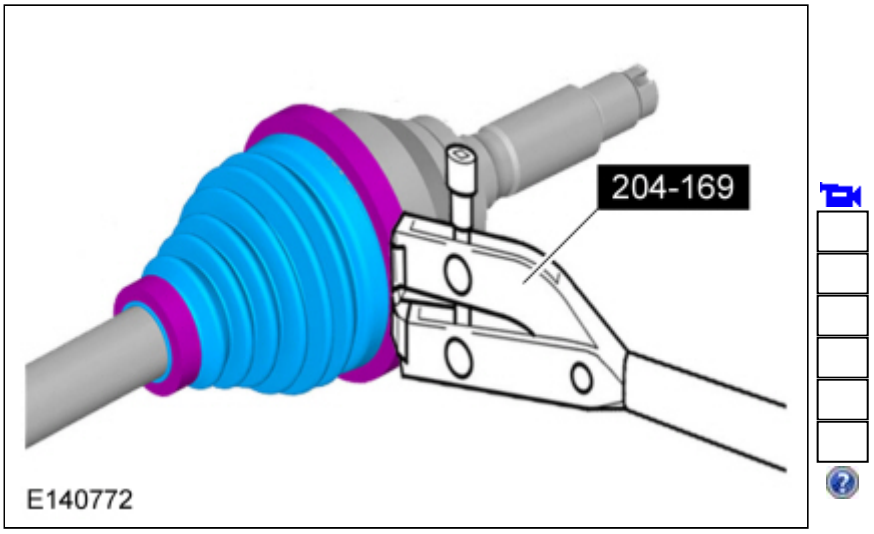
   Use Special Service Tool: 204-169 Clamping Tool, Boot Retaining Clamp.
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors
   Torque: 21 Nm



3. **NOTICE: Make sure that a new clamp is installed.**

   NOTE: *Do not move the CV joint housing. Make sure that the CV joint boot is installed with the boot in the CV groove.*

   Use Special Service Tool: 204-169 Clamping Tool, Boot Retaining Clamp.
   Use the General Equipment: Vise
   Use the General Equipment: Vise Jaw Protectors
   Torque: 21 Nm

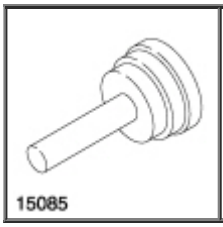


4. Refer to: Inner Constant Velocity (CV) Joint Boot (205-04 Front Drive Halfshafts, Removal and Installation).

Copyright © 2016 Ford Motor Company

Rear Halfshaft

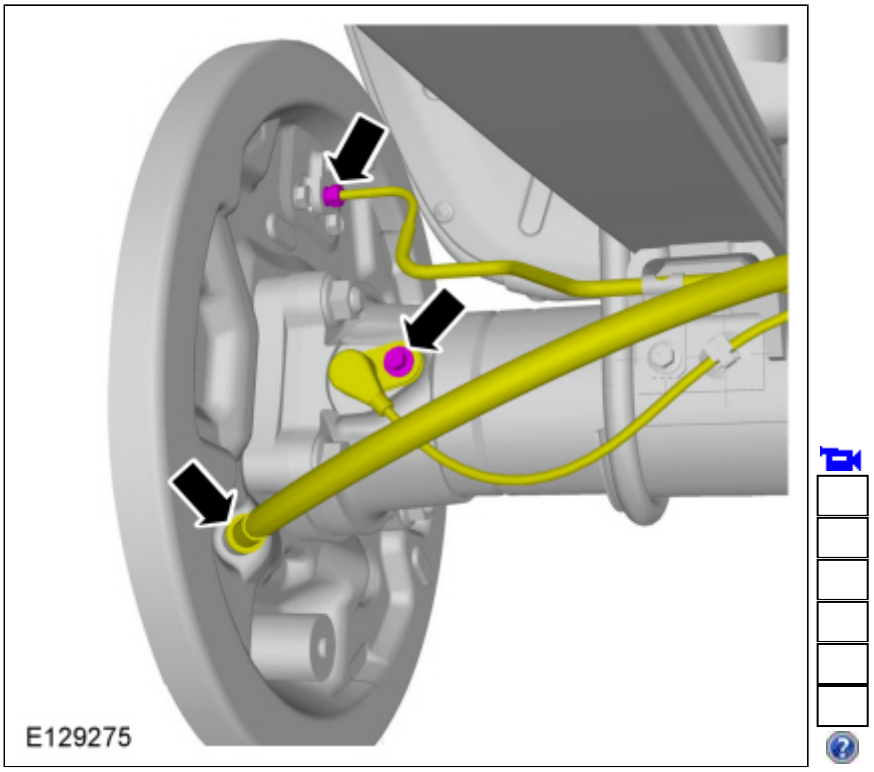
Special Tool(s) / General Equipment

 15085	205-296 Installer, Wheel Hub Bearing Cone/Seal

Materials

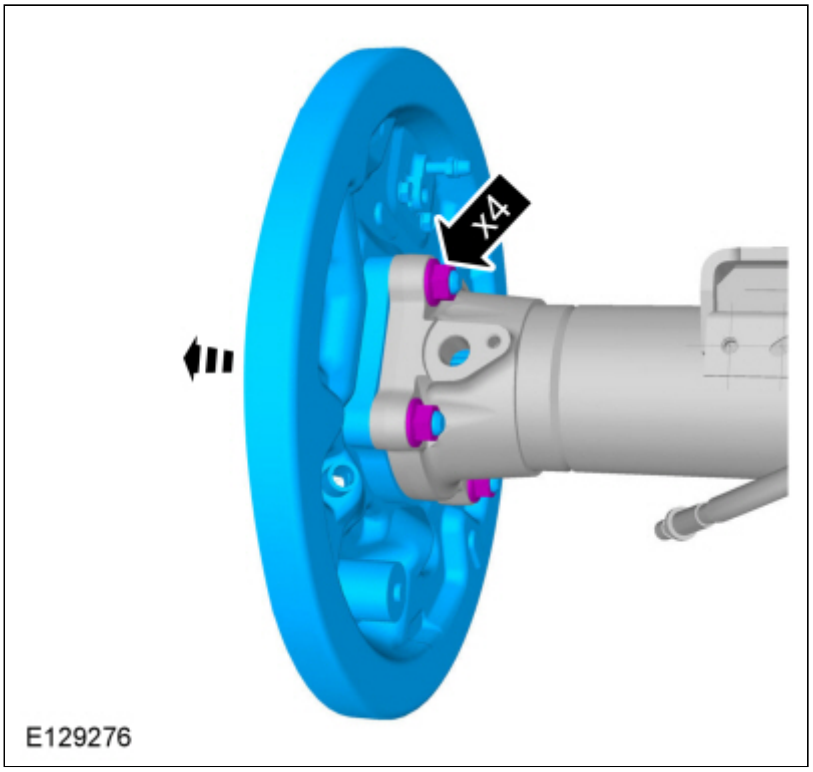
Name	Specification
Grease - Electrical Contact	WSB-M1C239-A

Removal

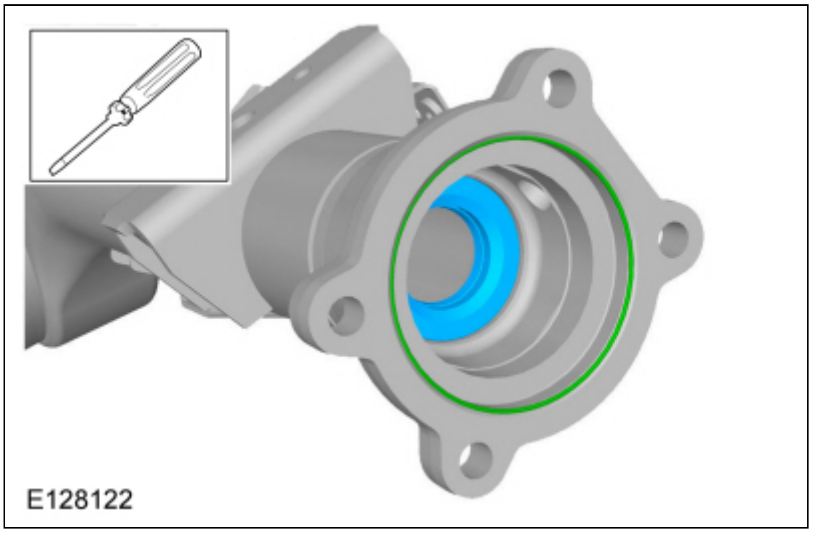
1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).
4. Refer to: Wheel Cylinder (206-02 Drum Brake, Removal and Installation).
   Refer to: Brake Shoes (206-02 Drum Brake, Removal and Installation).
5. 

6. **NOTICE: Be careful not to damage the oil seal while pulling out the axle shaft.**

   Torque: 108 Nm

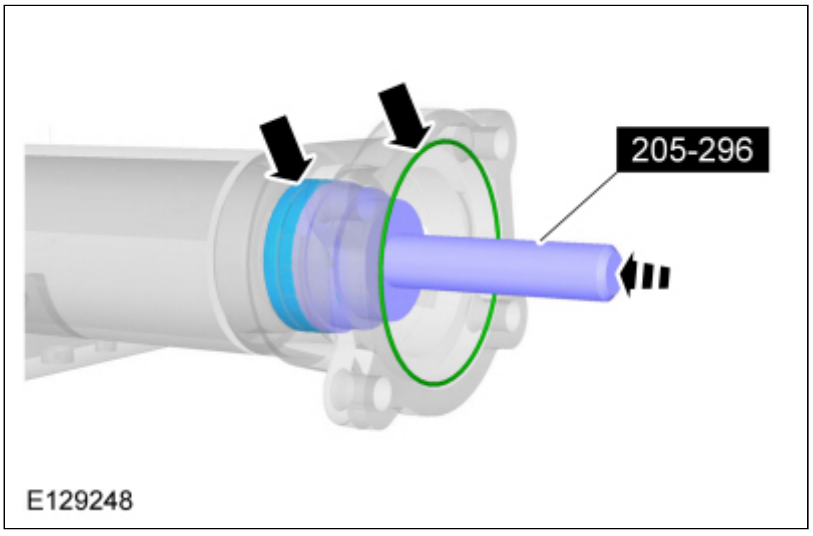


7.



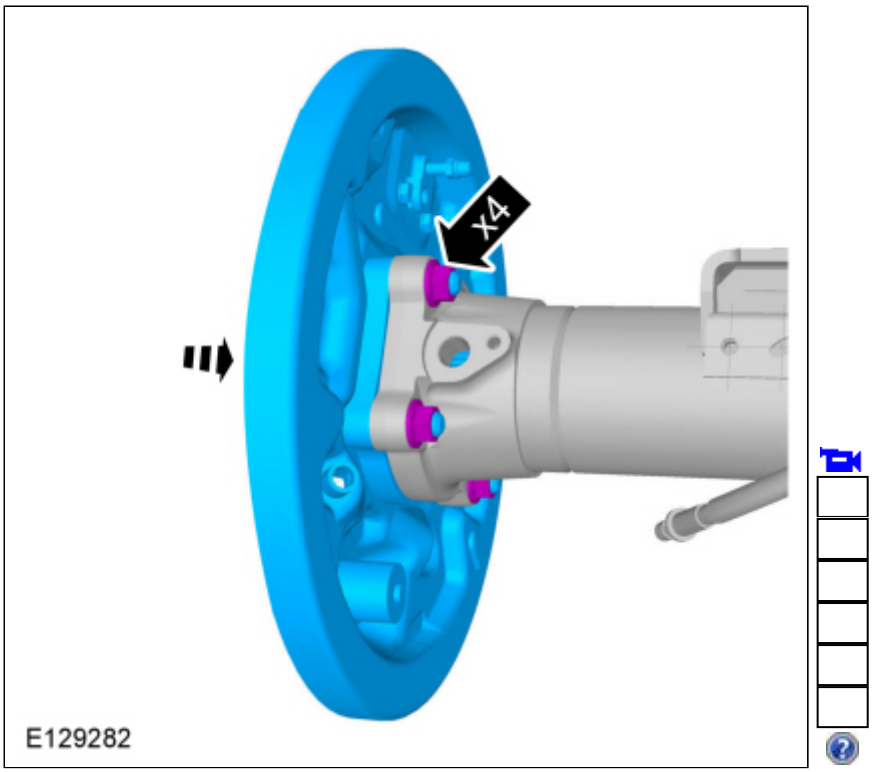
Installation

1. Use Special Service Tool: 205-296 Installer, Wheel Hub Bearing Cone/Seal.
   Material: Grease - Electrical Contact (WSB-M1C239-A)

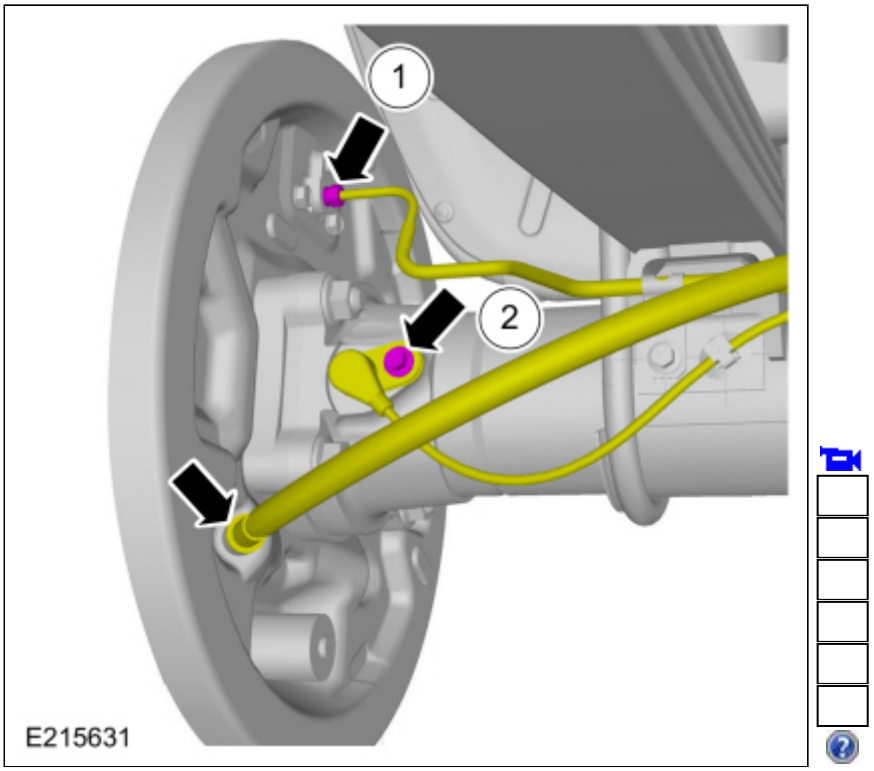


2. **NOTICE: Be careful not to damage the oil seal while installing the axle shaft.**

   Torque: 108 Nm



1. *Torque*: 18 Nm
2. *Torque*: 6 Nm



4. Refer to: Wheel Cylinder (206-02 Drum Brake, Removal and Installation).
   Refer to: Brake Shoes (206-02 Drum Brake, Removal and Installation).

5. Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

6. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

Copyright © 2016 Ford Motor Company

Specifications

BRAKE TECHNICAL DATA

ITEM	SPECIFICATION
Brake fluid type	WSS-M6C65-A2, DOT4 LV
Brake pedal height	214—219 mm
Standard pedal play	3.0—8.0 mm
Standard pedal-to-floor clearance	105 mm or more
Power brake unit fluid pressure when pedal depressed at 200 N {20 kgf}	At 0 kPa {0 mmHg}: 237 kPa or more
Power brake unit fluid pressure when pedal depressed at 200 N {20 kgf}	At 67 kPa {500 mmHg}:8.75 kpa or more
Minimum front disc pad thickness	1.5 mm min
Minimum front disc plate thickness	30 mm
Minimum front disc plate thickness after machining using a brake lathe on-vehicle	30.8 mm
Front disc plate runout limit	0.05 mm max
Minimum rear brake lining thickness	1.0 mm
Maximum rear brake drum diameter - 4x2 (except vehicles with increased ride height)	270—271.5 mm
Maximum rear brake drum diameter - 4x2 vehicles with increased ride height and 4x4	296.5 mm
Parking brake lever stroke when pulled at 98 N {10 kgf}	3—6 notches

Load sensing proportioning valve (LSPV) fluid pressure

Type	Front wheel cylinder fluid pressure (kPa)	Rear wheel cylinder (kPa)
4x2 (except vehicles with increased ride height)	4,900	1,950-2,470
	9,800	3,070-3,910
4x2 vehicles with increased ride height and 4x4	4,900	1,820-2,320
	9,800	2,950-3,750

Copyright © 2016 Ford Motor Company

Brake System

Inspection and Verification

NOTE: *Before carrying out any diagnosis, make sure that the brake system warning indicator operates correctly.*

1. Verify the customer concern, carrying a road test with the customer if necessary.
   REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
– Tire pressure(s) – Wheels and tires – Brake line(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• The brakes pull or drift	• Brake pads • Front brake disc(s) • Brake caliper(s) • Wheel alignment	• GO to Pinpoint Test A
	• Wheel bearing(s)	• CHECK or INSTALL new wheel bearings as necessary.
• The red brake warning indicator is always on	• Brake fluid level	• FILL the brake system to specification. INSPECT the brake lines for leaks.
	• Brake master cylinder primary piston cup	• INSTALL a new brake master cylinder. REFER to: (206-06 Hydraulic Brake Actuation) Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation), Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation).
	• Parking brake control	• RELEASE and ADJUST the parking brake cable. REFER to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).
	• Circuit • Anti-lock braking system (ABS)	• GO to Pinpoint Test B
• Vibration when brakes are applied	• Grease or fluid on brake pads; glazed linings	• GO to Pinpoint Test C
	• Brake caliper retaining bolts	• TIGHTEN the brake caliper bolts.
	• Insufficient	• APPLY

	• Insufficient grease on sliding parts	• APPLY grease as necessary.
	• Foreign material or scratches on front brake disc contact surfaces	• INSTALL a new brake disc. REFER to: Brake Disc (206-03 Front Disc Brake, Removal and Installation),
	• Loose wheel hub nuts	• TIGHTEN or INSTALL new wheel hub nuts.
	• Wheel bearings	• CHECK or INSTALL new wheel bearings as necessary.
	• Wheel and tire imbalance	• CHECK and BALANCE the wheels and tires as necessary.
• The brake pedal goes down fast	• Leak in brake system	• GO to Pinpoint Test D
	• Air in the brake system	• BLEED the brakes. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures).
	• Brake master cylinder	• INSTALL a new brake master cylinder. REFER to: (206-06 Hydraulic Brake Actuation) Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation), Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation).
	• Brake pads	• INSPECT the brake pads. REPAIR or INSTALL new brake pads as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation),
• The brake pedal eases down slowly	• Air in the brake system	• BLEED the brakes. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures).
	• Brake Booster • Brake master cylinder	• GO to Pinpoint Test E
• The brake pedal is low or feels spongy	• Brake pads	• INSPECT the brake pads. INSTALL new brake pads as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation),
	• Brake system	• GO to Pinpoint Test F
• Brake lockup during light brake pedal force	• Brake pads • Brake calipers • Brake load sensor proportioning valve	• GO to Pinpoint Test G
• Excessive/erratic brake pedal travel	• Brake pads	• INSPECT the brake pads. REPAIR or INSTALL new brake pads as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation),
	• Air in the brake system	• Bleed the brake. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures).
• Brakes drag	• Brake booster • Seized brake caliper • Parking brake control applied/inoperative/over adjusted • Seized parking brake cables • Seized brake caliper	• GO to Pinpoint Test H

	slide pins	
• Excessive brake pedal effort	• Brake booster	• CHECK the brake booster. Carry out the component test. REPAIR or INSTALL a new brake booster as necessary. REFER to: (206-07 Power Brake Actuation) Brake Booster - RHD 4WD/RHD RWD (Removal and Installation), Brake Booster - RHD 4WD/RHD RWD (Removal and Installation).
	• Brake pads	• INSPECT the brake pads.
	• Brake booster check valve	• GO to Pinpoint Test I
• Slow or incomplete brake pedal return	• Brake booster • Brake master cylinder	• GO to Pinpoint Test J

Pinpoint Tests

PINPOINT TEST A : THE BRAKES PULL OR DRIFT

A1 INSPECT THE BRAKE PADS

- Check the brake pads for grease or fluid on the linings and excessive wear.

Are the brake pad linings contaminated, or worn excessively?

Yes	INSTALL new brake pads. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation),
No	GO to A2

A2 INSPECT THE BRAKE CALIPERS

- Check the brake caliper components for binding, leaking or sticking.

Is there evidence of leaks, or do the pistons and pins bind or stick?

Yes	INSTALL new pistons or pins as necessary. REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation), TEST the system for normal operation.
No	GO to A3

A3 INSPECT THE BRAKE DISCS

- Check the brake discs for damage.

Are the brake discs damaged?

Yes	INSTALL new brake discs. REFER to: Brake Disc (206-03 Front Disc Brake, Removal and Installation),
No	GO to A4

A4 CHECK THE VEHICLE WHEEL ALIGNMENT

- Check the vehicle wheel alignment.

Is the wheel alignment within specification?

Yes	Vehicle is OK. VERIFY the customer concern.

No	ADJUST the wheel alignment as necessary. REFER to: (204-00 Suspension System - General Information) Specifications (Specifications). TEST the system for normal operation.

PINPOINT TEST B : THE RED BRAKE WARNING INDICATOR IS ALWAYS ON

B1 CHECK THE RED BRAKE WARNING INDICATOR

- Ignition ON.

Is the red brake warning indicator on?

Yes	GO to B2
No	Vehicle is OK. VERIFY the customer concern.

B2 CHECK THE AMBER ABS WARNING INDICATOR

- Ignition ON.

Is the amber ABS warning indicator on?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to B3

B3 CHECK THE PARKING BRAKE

- Check the parking brake is fully released.

Does the red brake warning indicator go out?

Yes	Vehicle is OK. TEST the system for normal operation.
No	GO to B4

B4 CHECK THE PARKING BRAKE SWITCH FOR SHORT TO GROUND

- Ignition OFF.
- Disconnect Parking Brake Switch C306.
- Ignition ON.

Does the red brake warning indicator go out?

Yes	INSTALL a new parking brake warning indicator switch. TEST the system for normal operation.
No	GO to B5

B5 CHECK THE BRAKE FLUID LEVEL

- Check the brake fluid level in the brake fluid reservoir.

Is the brake fluid level within specification?

Yes	GO to B6
No	FILL the brake fluid reservoir to the MAX mark.

B6 CHECK THE LOW BRAKE FLUID WARNING INDICATOR SWITCH FOR SHORT TO GROUND

- Disconnect Low Brake Fluid Warning Indicator Switch C157 LHD, C124 RHD.

Does the red brake warning indicator go out?

Yes	INSTALL a new low brake fluid warning indicator switch. TEST the system for normal operation.
No	GO to B7

B7 CHECK LOW BRAKE FLUID SIGNAL CIRCUIT FOR SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280A-28	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). TEST the system for normal operation.
No	REPAIR circuit. TEST the system for normal operation.

PINPOINT TEST C : VIBRATION WHEN BRAKES ARE APPLIED

C1 ROAD TEST THE VEHICLE

- Road test the vehicle between 40-80 km/h (25-50 mph) without depressing the brakes.

Is a vibration present?

Yes	TEST for noise, vibration and harshness. REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing). REPEAT the road test if necessary.
No	GO to C2

C2 CHECK FOR REAR BRAKE VIBRATION

- Road test the vehicle between 40-80 km/h (25-50 mph) with medium application on the parking brake control only.

Is a vibration present?

Yes	CHECK the brake rotors and brake pads for excessive wear. INSTALL new brake rotors or brake pads as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation), TEST the system for normal operation.
No	GO to C3

C3 CHECK FOR FRONT BRAKE VIBRATION

- Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.

Is a vibration present?

Yes	CHECK the brake rotors and brake pads for excessive wear. INSTALL new brake rotors or brake pads as necessary. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation), TEST the system for normal operation.
No	Vehicle is OK. VERIFY the customer concern.

PINPOINT TEST D : THE PEDAL GOES DOWN FAST

D1 CHECK THE BRAKE PEDAL EFFORT

- Road test the vehicle and depress the brake pedal.

Is the brake pedal effort OK?

Yes	Vehicle is OK. VERIFY the customer concern.
No	GO to D2

D2 CHECK THE BRAKE FLUID LEVEL

- Check the brake fluid level in the brake fluid reservoir.

Is the brake fluid level between the MAX and MIN mark?

Yes	GO to D3
No	INSPECT the brake fluid reservoir sealing points. For additional information, refer to the procedure Brake Master Cylinder component test in this procedure. ADD brake fluid and BLEED the brake system. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures). INSPECT the brake system for further leaks. TEST the system for normal operation.

D3 CHECK THE BRAKE PEDAL HEIGHT - PRESSURIZE THE SYSTEM

- Pump the brake pedal rapidly five times and hold in the depressed position.

Does the brake pedal height build up and then hold?

Yes	BLEED the brake system. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures). TEST the system for normal operation. ROAD TEST as necessary. REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).
No	GO to D4

D4 CHECK THE BRAKE SYSTEM FOR LEAKS

- Inspect for external brake system leaks. For additional information, refer to the procedure Brake Master Cylinder component test in this section.

Are leaks found?

Yes	REPAIR as necessary. ADD brake fluid and BLEED the brake system. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures). TEST the system for normal operation.
No	GO to D5

D5 CHECK BRAKE MASTER CYLINDER BYPASS CONDITION

- Test for brake master cylinder bypass condition. For additional information, refer to the procedure Brake Master Cylinder component test in this section.

Are any concerns found?

Yes	INSTALL a new brake master cylinder. REFER to: (206-06 Hydraulic Brake Actuation) Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation), Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation).
No	System is OK.

PINPOINT TEST E : THE PEDAL EASES DOWN SLOWLY

E1 CHECK THE BRAKE BOOSTER

- With the engine running, apply and release the brake pedal three times. Slowly apply the brake pedal.

Does the brake pedal continue to gradually apply before holding?

Yes	System is OK. This is a characteristic of a tandem type brake booster.
No	GO to E2

E2 CHECK THE BRAKE PEDAL OPERATION

- Check if the condition occurs during actual stopping application by depressing the brake pedal while the vehicle is moving.

Does the condition occur when the vehicle is moving?

Yes	GO to E3
No	GO to E4

E3 CHECK THE BRAKE SYSTEM FOR LEAKS

- Check for external brake system leaks. For additional information, REFER to the procedure Brake Master Cylinder component test in this section.

Are leaks found?

Yes	REPAIR as necessary. ADD brake fluid and BLEED the brake system. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures). TEST the system for normal operation.
No	GO to E4

E4 CHECK THE BRAKE MASTER CYLINDER BYPASS CONDITION

- Test the brake master cylinder bypass condition. For additional information, REFER to the procedure Brake Master Cylinder component test in this section.

Are any concerns found?

Yes	INSTALL a new brake master cylinder. REFER to: (206-06 Hydraulic Brake Actuation) Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation), Brake Master Cylinder - RHD 4WD/RHD RWD (Removal and Installation). TEST the system for normal operation.
No	System is OK.

PINPOINT TEST F : THE PEDAL IS LOW OR FEELS SPONGY

F1 CHECK FOR SPONGY BRAKE PEDAL FEEL

- Road test the vehicle and depress the brake pedal.

Is the brake pedal effort normal?

Yes	Vehicle is OK. VERIFY the customer concern.
No	GO to F2

F2 CHECK BRAKE PEDAL RESERVE

NOTE: *The increased resistance may feel like the brake pedal has bottomed out.*

- Start the engine.
- Engine at idle.
- Pump the brake pedal lightly three or four times.
- Wait 15 seconds for the vacuum to replenish.
- Depress the brake pedal until it stops moving downwards or an increased resistance to the brake pedal travel occurs.
- Hold the brake pedal in the depressed position while increasing the engine speed to 2000 rpm.
- Release the accelerator pedal.

Does the brake pedal move downwards as the engine speed returns to idle?

Yes	GO to F3
No	CHECK the vacuum to the brake booster. For additional information, REFER to the procedure Brake Booster component test in this procedure.

F3 CHECK THE BRAKE FLUID LEVEL

- Check the brake fluid reservoir fluid level.

Is the brake fluid level between the MAX and MIN mark?

Yes	BLEED the brake system. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures). TEST the system for normal operation.
No	CHECK the brake fluid reservoir sealing points. For additional information, REFER to the procedure Brake Master Cylinder component test in this procedure. ADD fluid and BLEED the brake system. REFER to: (206-00 Brake System - General Information) Brake System Bleeding (General Procedures), Brake System Pressure Bleeding (General Procedures).

	TEST the system for normal operation. ROAD TEST as necessary. REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

PINPOINT TEST G : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE

G1 TEST BRAKE LOCKUP

- Road test the vehicle and depress the brake pedal lightly.

Do the rear brakes lockup?

Yes	GO to G2
No	Vehicle is OK. VERIFY the customer concern.

G2 INSPECT THE BRAKE PADS

- Inspect the brake pads for grease or fluid on the linings and wear concerns, correct installation, damage, correct size and type.

Are any concerns found?

Yes	INSTALL new brake pads. REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation), TEST the system for normal operation. ROAD TEST as necessary.
No	GO to G3

G3 CHECK THE BRAKE LOAD SENSOR PROPORTIONING VALVE

- Check the brake load sensor proportioning valve for correct installation and adjustment.

Is the brake load sensor proportioning valve correctly adjusted?

Yes	INSTALL a new brake load sensor proportioning valve. TEST the system for normal operation.
No	ADJUST the brake load sensor proportioning valve.

PINPOINT TEST H : BRAKE DRAG

H1 ROAD TEST THE VEHICLE

- Road test the vehicle and apply the brakes.

Are the brakes functioning correctly?

Yes	Vehicle is OK. VERIFY the customer condition.
No	INSPECT individual brake calipers and INSTALL brake calipers as necessary. REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation), GO to H2

H2 CHECK THE BRAKE BOOSTER

- Check the brake booster actuating rod alignment and travel.

Is the actuating rod OK?

Yes	Vehicle is OK. VERIFY the customer condition.
No	INSTALL a new brake booster. REFER to: (206-07 Power Brake Actuation) Brake Booster - RHD 4WD/RHD RWD (Removal and Installation), Brake Booster - RHD 4WD/RHD RWD (Removal and Installation). TEST the system for normal operation.

PINPOINT TEST I : EXCESSIVE BRAKE PEDAL EFFORT

I1 CHECK THE VACUUM

- Disconnect the vacuum hose from the brake booster.
- Connect the vacuum/pressure tester to the vacuum hose.
- Start the engine.
- Run the engine at normal operating temperature.
- Record the vacuum reading.

Is the vacuum reading 40.5kPa (12in-Hg)?

Yes	GO to I2
No	LOCATE and REPAIR the source of low vacuum. TEST the system for normal operation.

I2 INSPECT THE VACUUM SYSTEM

- Ignition OFF.
- Reconnect the vacuum hose.
- Inspect the brake booster, rubber grommet, and all vacuum hoses for cracks, holes, bad connections, or missing clamps.
- Pump the brake pedal five times to exhaust the vacuum and hold in the depressed position.

Does the brake pedal move down when the engine is started?

Yes	Vacuum system is OK.
No	GO to I3

I3 CHECK THE BRAKE BOOSTER CHECK VALVE

- Check the brake booster check valve. For additional information, REFER to the procedure Brake Booster component test in this section.

Is the brake booster check valve OK?

Yes	CHECK the brake booster. For additional information, REFER to the procedure Brake Booster component Test in this section. INSTALL a new brake booster as necessary. REFER to: (206-07 Power Brake Actuation) Brake Booster - RHD 4WD/RHD RWD (Removal and Installation), Brake Booster - RHD 4WD/RHD RWD (Removal and Installation). TEST the system for normal operation.
No	INSTALL a new brake booster check valve. TEST the system for normal operation.

PINPOINT TEST J : SLOW OR INCOMPLETE BRAKE PEDAL RETURN

J1 CHECK THE BRAKE PEDAL RETURN

- Start the engine.
- Run the engine at fast idle while making several brake applications.
- Pull the brake pedal rearward with approximately 44.5 N (10 lb) of force.
- Release the brake pedal and measure the pedal travel. From the floor pan to the pedal rubber.

- Make a hard brake application.
- Release the brake pedal and measure the brake pedal travel. The brake pedal should return to its original position.

Does the brake pedal return to its original position?

Yes	Vehicle is OK. VERIFY the customer concern.
No	GO to J2

J2 CHECK FOR BRAKE PEDAL BINDING

- Check the brake pedal to make sure it is operating freely.

Is the brake pedal operating freely?

Yes	INSTALL a new brake booster. REFER to: (206-07 Power Brake Actuation) Brake Booster - RHD 4WD/RHD RWD (Removal and Installation), Brake Booster - RHD 4WD/RHD RWD (Removal and Installation). TEST the system for normal operation.
No	REPAIR or INSTALL new brake pedal bushings. REFER to: Brake Pedal and Bracket (206-06 Hydraulic Brake Actuation, Removal and Installation). TEST the system for normal operation.

Component Tests

Brake Booster

1. Inspect all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the brake booster check valve for damage.

2. Check the hydraulic brake system for leaks or low fluid.

3. With the transmission in PARK (automatic transmission), stop the engine and operate the parking brake. Operate the brake pedal several times to exhaust all vacuum in the system.

4. With the engine turned OFF and all vacuum in the system exhausted, operate the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.

5. Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the transmission in PARK or NEUTRAL. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, the vacuum booster system is not functioning.

6. Run the engine for a minimum of 10 seconds at fast idle. Stop the engine and let the vehicle stand for 10 minutes. Then, operate the brake pedal with approximately 89 Nm (20 lb) of force. The pedal feel (brake applications) should be the same as noted with the engine running. If the brake pedal feels hard (no power assist), install a new check valve and then repeat the testing. If the brake pedal stills feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system. REFER to: (206-00 Brake System - General Information)
   Brake System Bleeding (General Procedures),
   Brake System Pressure Bleeding (General Procedures).

Brake Master Cylinder

NOTE: *Before carrying out any diagnosis, make sure the brake system warning indicator is functional.*

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In

diagnosing the condition of the brake master cylinder, check brake pedal feel as evidence of a brake concern.

Check for brake warning indicator illumination and the brake fluid level in the brake fluid reservoir.

Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

1. New brake systems are not designed to produce as hard a pedal effort as in the past. Complaints of light pedal efforts should be compared to pedal efforts of another vehicle, same model and year.

2. During normal operation of the brake master cylinder, the brake fluid level in the reservoir will rise during brake application and fall during release. The net brake fluid level (after brake application and release) will remain unchanged.

3. A trace of brake fluid exists on the brake booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore end seal.

4. Brake fluid level will fall with brake pad wear.

Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques are brake pedal feel, brake warning indicator illumination and low brake fluid level as indicators in diagnosing brake system concerns. The following conditions are considered abnormal and indicate that the brake master cylinder is in need of repair.

5. Brake pedal goes down fast. This could be caused by an external or internal leak.

6. Brake pedal eases down slowly. This could be caused by an external or internal leak.

7. Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder reservoir, brake fluid reservoir cap vent holes blocked or air in the hydraulic system.

8. Brake pedal effort is excessive. This may be caused by a bind or obstruction in pedal or linkage, blocked fluid control valve or insufficient brake booster vacuum.

9. Rear brakes lock up during light pedal force. This may be caused by grease or fluid on brake pads, damaged brake pads and linings, incorrectly adjusted parking brakes, damaged, contaminated brake pressure control valve.

10. Brake pedal effort is erratic. This condition could be caused by the brake booster being in operative, extreme brake caliper piston knock back or incorrectly installed brake pads.

11. Brake warning indicator is always ON. This may be caused by low fluid level, ignition wire routing too close to the fluid level indicator, or float assembly damage.

Bypass Condition Test

12. Check the brake fluid level in the brake fluid reservoir. Fill the brake fluid reservoir to the MAX mark if low or empty.

13. Observe the brake fluid level in the brake fluid reservoir. If after several brake applications, the brake fluid level remains the same, measure the wheel turning torque required to rotate the wheels with rearward with brakes applied as follows:
    1. Place the transmission in NEUTRAL and raise and support the vehicle.
       REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

    2. Operate the brakes with a minimum of 445 N (100 lb) and hold for approximately 15 seconds. With the brakes still applied, exert torque on the front wheels to 102 Nm (75 lb-ft). If either wheel rotates, install a new brake master cylinder.

Non-Pressure Leaks

Any empty brake fluid reservoir condition may be the result of two types of non-pressure external leaks.

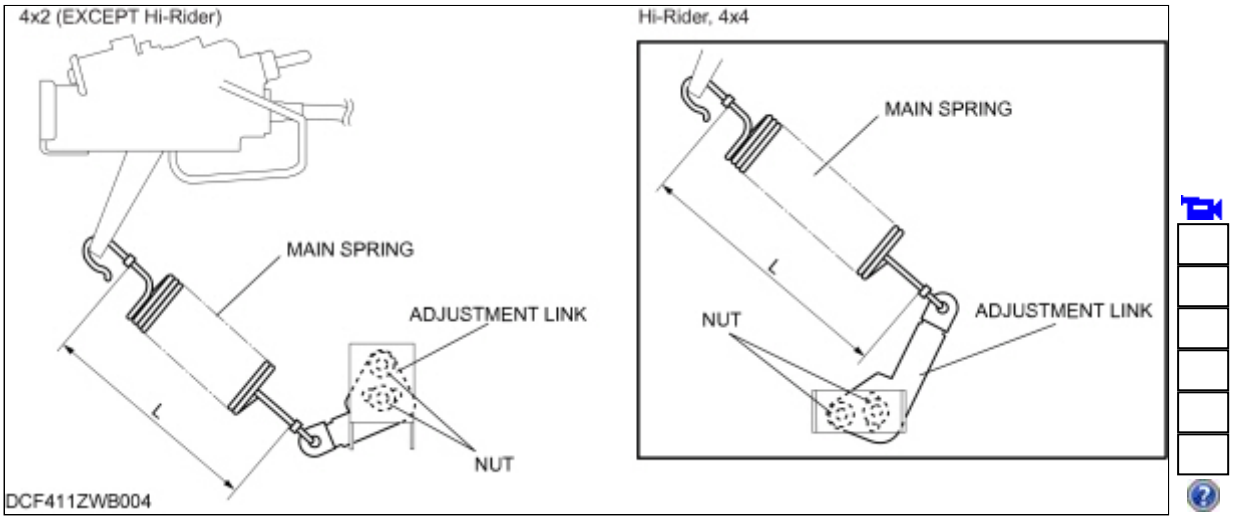
- Type 1: An external leak may occur at the brake fluid reservoir cap because of incorrect positioning of the gasket and cap. Reposition the gasket and cap.
- Type 2: An external leak may occur at the brake fluid reservoir mounting seals, install new seals.

Copyright © 2016 Ford Motor Company

Brake Load Sensor Proportioning Valve Adjustment

1. Place the unloaded vehicle on level ground. Unloaded: Fuel tank is full. Jack and tools are in designated position.
2. A change of 5 mm (0.20 in) in dimension L results in a change of the following.

Type	Change (kPa {kgf/cm2, psl})
4x2 (except Hi-Rider) Without 4W-ABS	625 (8.7, 123)
Hi-Rider, 4x4 Without 4W-ABS	510 (11, 154)



3. Adjust main spring dimension L between the LSPV and the adjustment link loosening and repositioning the LSPV.
   · Decrease dimension L if the fluid pressure is low.
   · Increase dimension L if the fluid pressure is high.

Specification Dimension L

Type	Dimension x (mm {in})
4x2 (except Hi-Rider) Without 4W-ABS	166.0—173.0 (5.808—6.082)
Hi-Rider, 4x4 Without 4W-ABS	184.5—191.5 (6.910—7.185)

5. Tightening the nut.
   Specification 11.4—15.6 Nm (1.90—2.59 kgfm, 13.8—18.7 ftlbf).
6. After adjustment, recheck the fluid pressure.
   If not as specified, replace the LSPV as a component.

Copyright © 2016 Ford Motor Company

Brake System Bleeding

General Equipment

Ford diagnostic equipment

Bleeding

All Vehicles

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

NOTICE: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

NOTE: *Make sure that the vehicle is standing on a level surface.*

NOTE: *The system consists of separate circuits for each front and diagonally opposite rear wheel. Each circuit can be bled independently.*

1. **NOTICE: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.**

   Install the bleed tube to the bleed nipple.
2. Immerse the end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.
3. Position the bleed jar base at least 300 mm above the bleed nipple to maintain fluid pressure and prevent air leaking past the threads of the bleed nipple.
4. Loosen the rear left bleed nipple by one-half turn.
5. Operate the brake pedal fully (pumping brake fluid and air into the bleed jar) and allow the brake pedal to return to the rest position.
6. **NOTE:** *Rear brakes only.*

   Rapidly operate the parking brake control several times.
7. Fill the brake fluid reservoir to the MAX mark.
8. Continue operating the brake pedal until air-free fluid is being pumped into the bleed jar.
9. With the brake pedal fully depressed tighten the bleed nipple.
10. **NOTICE: Make sure that the bleed nipple cap is installed after bleeding the brake line(s). This will prevent corrosion to the bleed nipple. Failure to follow this instruction may result in the bleed nipple becoming seized.**

    Repeat the procedure for the remaining brake lines in the following order:
    1. Front left.
    2. Front right.
    3. Rear right.

Vehicles with anti-lock brakes

11. **NOTE:** *This step is only necessary when changing the brake fluid to remove the used brake fluid from the hydraulic control unit (HCU).*

    Using Ford diagnostic equipment, bleed the brake system.

Copyright © 2016 Ford Motor Company

Brake System Leak Check

Check

1. **NOTE:** *Brake fluid is water soluble and it is possible that all evidence of fluid leakage has been washed off if the vehicle has been operated in rain or snow.*

   Check the brake fluid level. Add brake fluid as necessary.

2. Apply the brakes several times and make sure the pedal feel is not spongy. If necessary, bleed the brake system.
   For additional information, refer to: Brake System Bleeding.

3. Check the brake fluid level and verify that the fluid level is actually dropping.

4. **NOTE:** *If the brake fluid level drops and no external leak is evident, check for a brake master cylinder bore end seal leak.*

   Locate and correct the external leak.

Copyright © 2016 Ford Motor Company

Brake System Pressure Bleeding

General Equipment

Ford diagnostic equipment
Brake/clutch system pressure bleeder/filler

Bleeding

All vehicles

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

NOTICE: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

NOTE: *Make sure that the vehicle is standing on a level surface.*

NOTE: *The system consists of separate circuits for each front and diagonally opposite rear wheel. Each circuit can be bled independently.*

1. Fill the brake fluid reservoir to the MAX mark.
2. **NOTICE: Make sure that the pressure within the brake system does not exceed 1 bar.**

   NOTICE: Make sure that the pressure bleeding equipment is filled with new brake fluid to the correct specification.

   Using the brake/clutch system pressure bleeder/filler, pressure bleed the system in accordance with the manufacturer's instructions in the following order:
   1. Rear left.
      - Rapidly operate the parking brake control several times.
   2. Front left.
   3. Front right.
   4. Rear right.
      - Rapidly operate the parking brake control several times.

NOTICE: Make sure that the bleed nipple cap is installed after bleeding the brake line(s). This will prevent corrosion to the bleed nipple. Failure to follow this instruction may result in the bleed nipple becoming seized.

3. Fill the brake fluid reservoir to the MAX mark as necessary.

Vehicles with anti-lock brakes

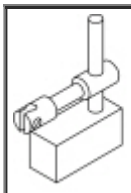
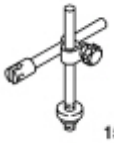
4. **NOTE:** *This step is only necessary when changing the brake fluid to remove the used brake fluid from the hydraulic control unit (HCU).*

   Using Ford diagnostic equipment, bleed the brake system.

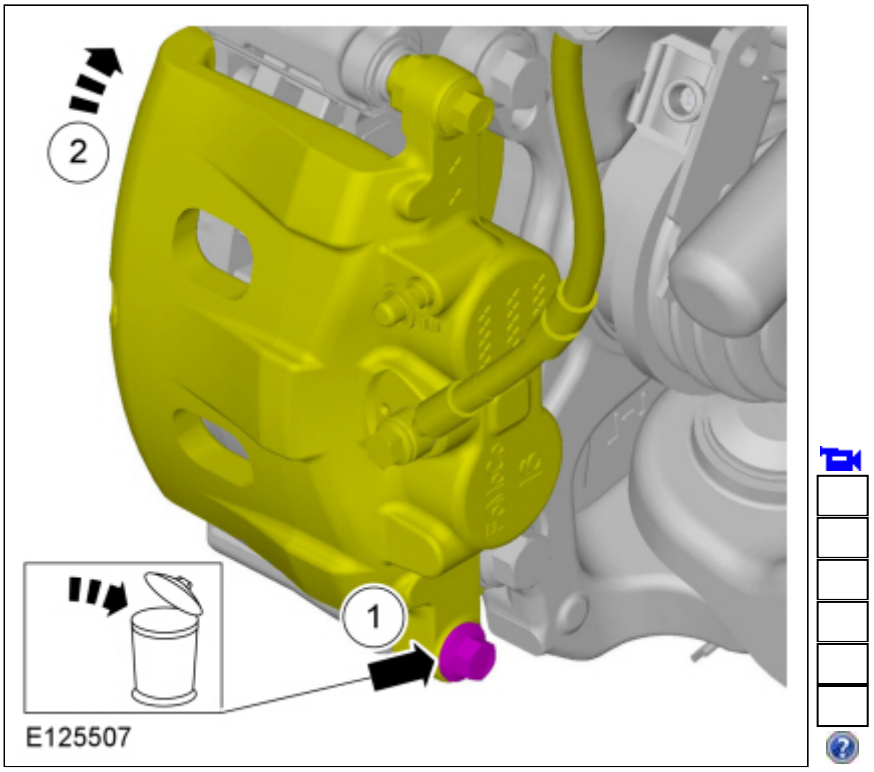
Copyright © 2016 Ford Motor Company

Front Brake Disc Runout Check

Special Tool(s) / General Equipment

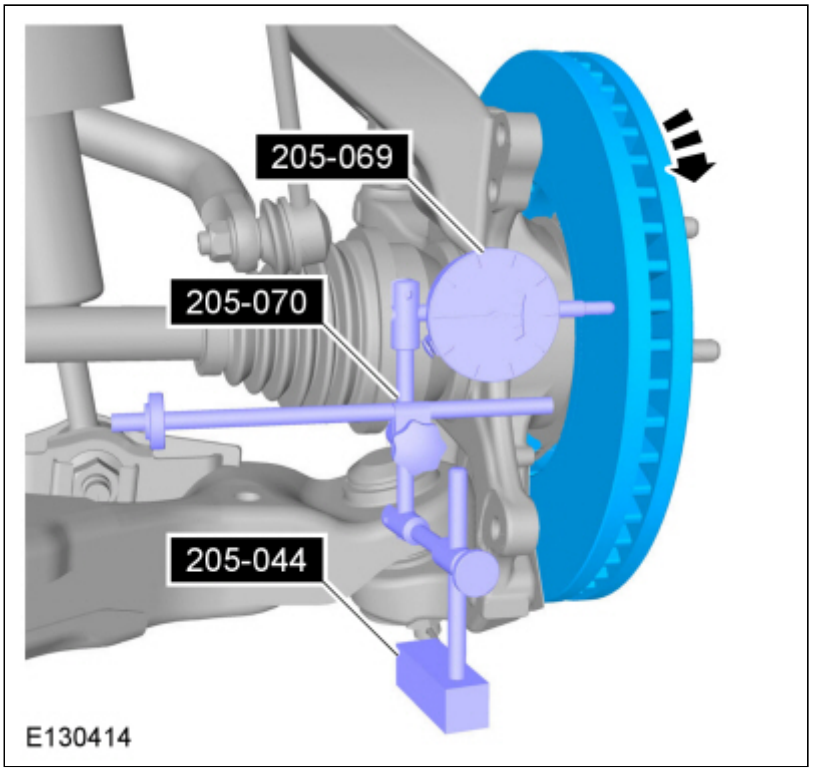
 15008	205-044 Holding Fixture, Dial Indicator Gauge
 15046	205-069 Dial Indicator Gauge (Metric)
 15022a	205-070 Holding Fixture, Dial Indicator Gauge
Caliper Gauge	

Activation

1. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. 

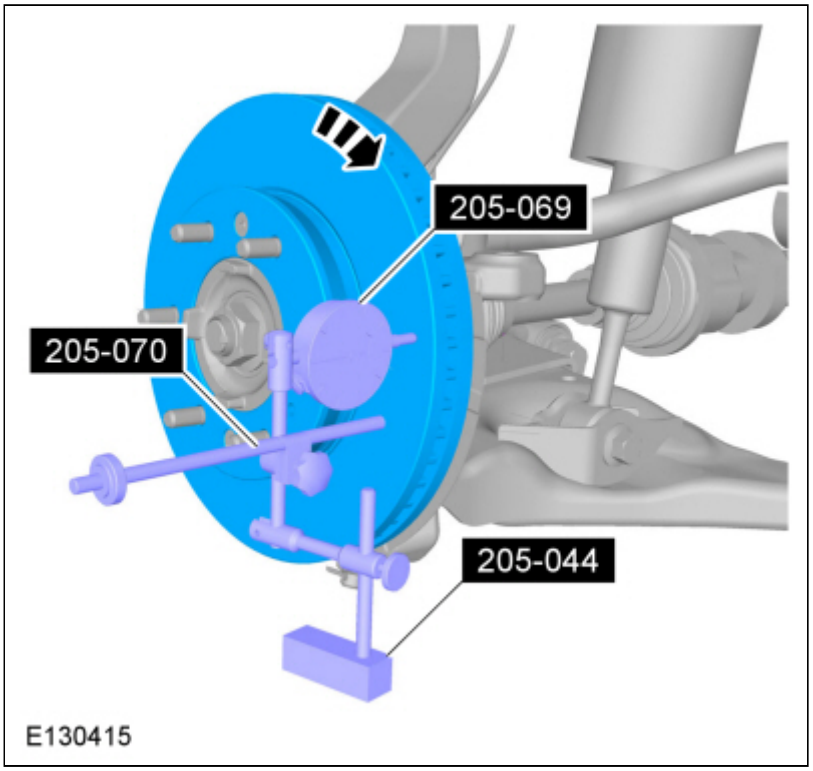
3. **NOTE:** *The total dial indicator gauge reading should not exceed specification.*

   Use Special Service Tool: 205-069 Dial Indicator Gauge (Metric). , 205-070 Holding Fixture, Dial Indicator Gauge. , 205-044 Holding Fixture, Dial Indicator Gauge.



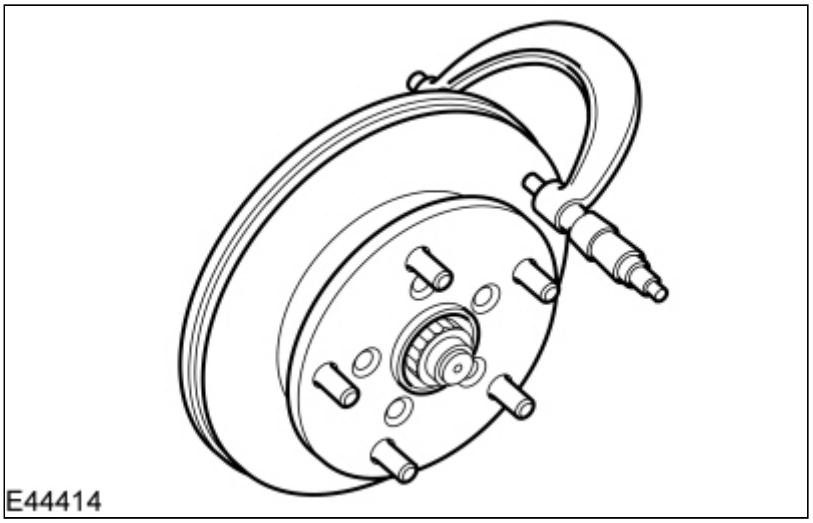
4. **NOTE:** *The total dial indicator gauge reading should not exceed specification.*

   Use Special Service Tool: 205-069 Dial Indicator Gauge (Metric). , 205-070 Holding Fixture, Dial Indicator Gauge. , 205-044 Holding Fixture, Dial Indicator Gauge.



5. **NOTE:** *If any of the measurements exceed the run out specification of 0.05 mm or the brake disc thickness variation is more than 0.018 mm, a new brake disc must be installed and the brake disc runout re-checked.*

   Using a suitable micrometer, measure the brake disc thickness at eight positions, 45 degrees apart and approximately 10 mm from the outer edge of the brake disc.
   Use the General Equipment: Caliper Gauge



Copyright © 2016 Ford Motor Company

Wheel Cylinder

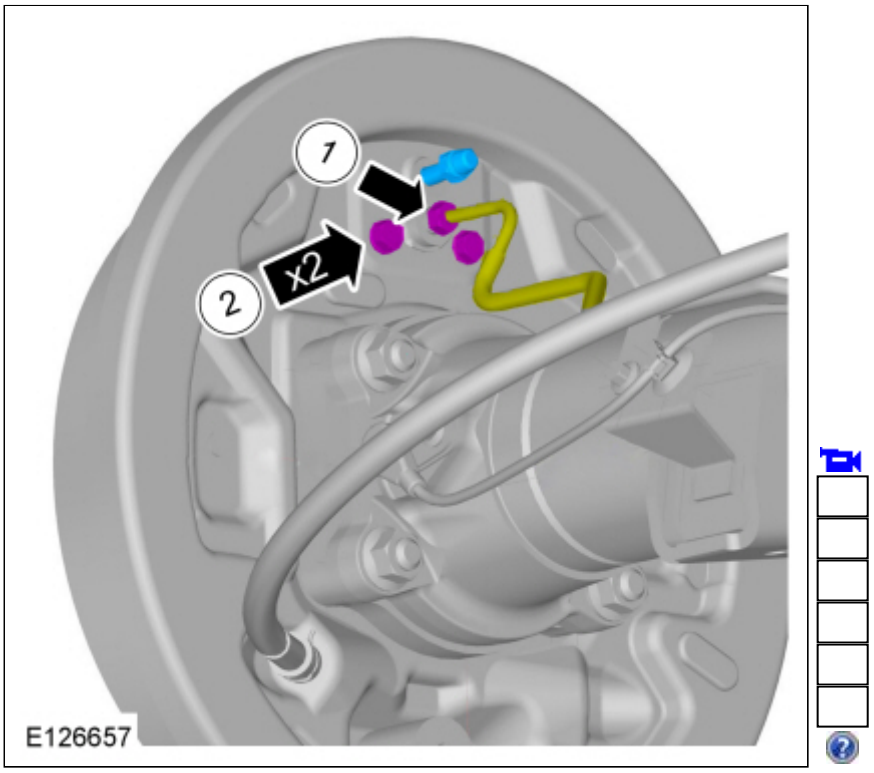
Base Part Number: 2261

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Brake Shoes (206-02 Drum Brake, Removal and Installation).

1. *Torque*: 19 Nm
2. *Torque*: 13 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

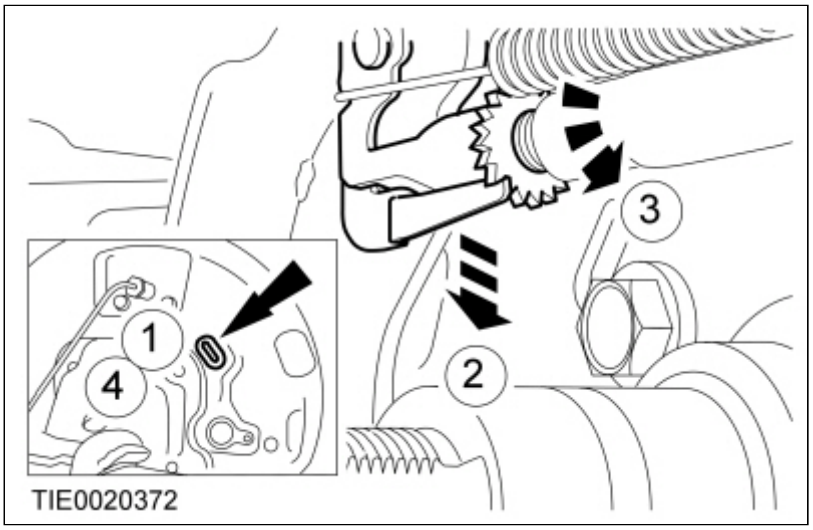
Brake Shoes

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

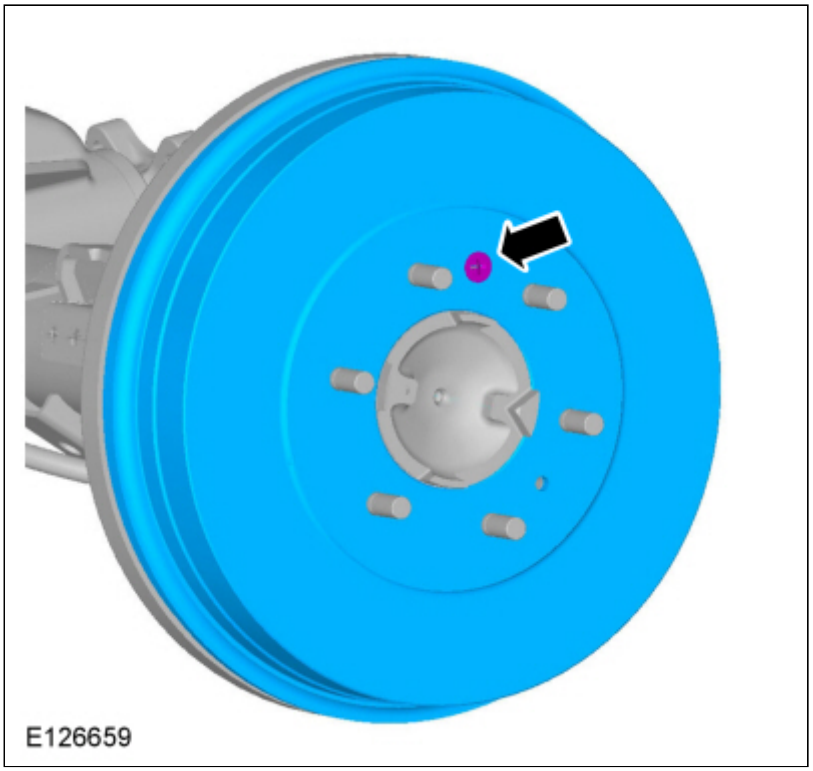
NOTE: *Parking brake lever should be rest position.*

1.

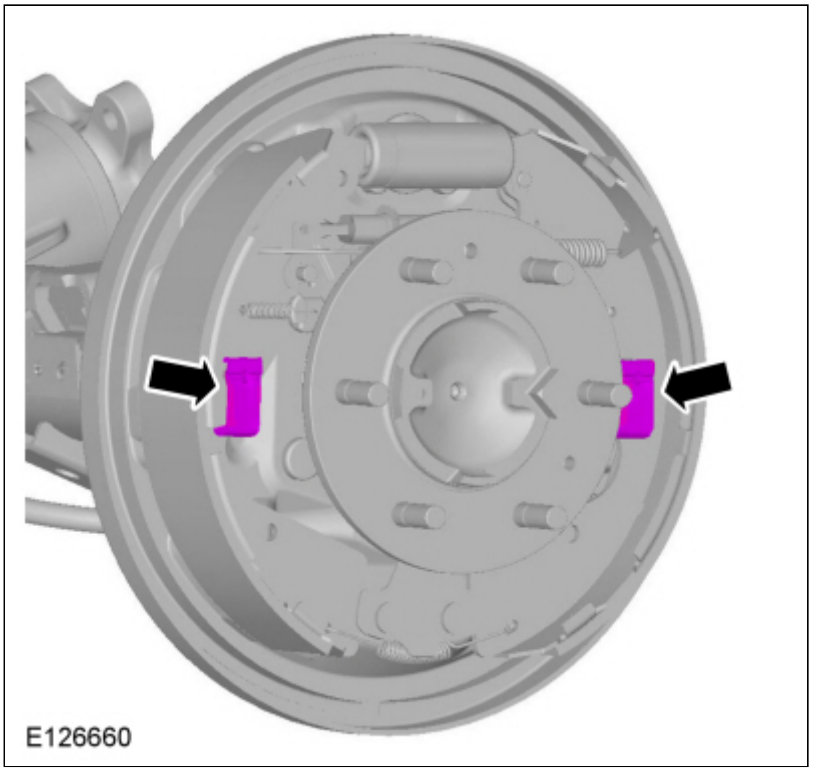


2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

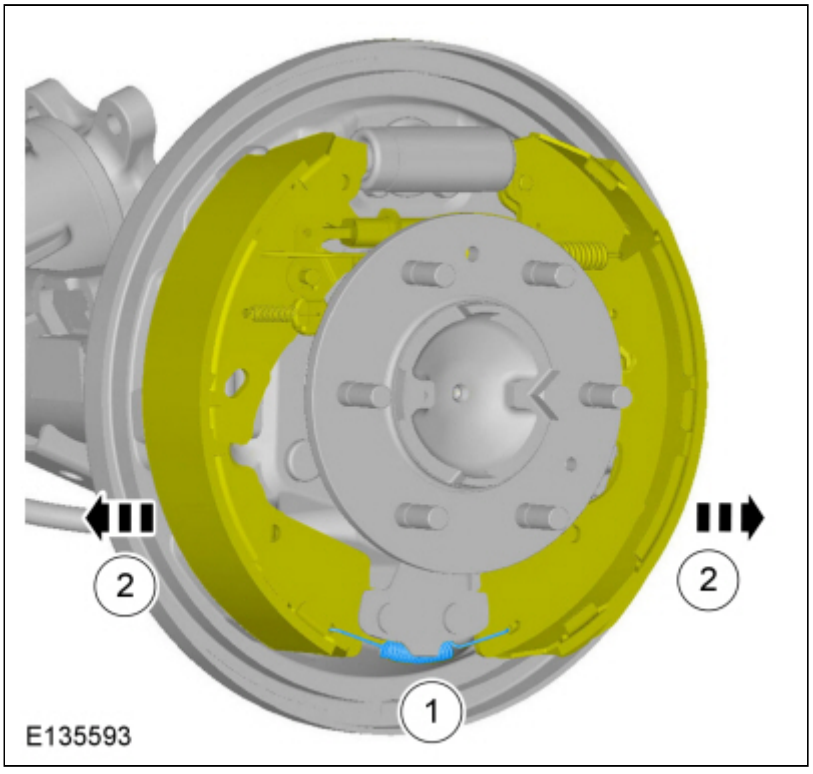
3.



4.

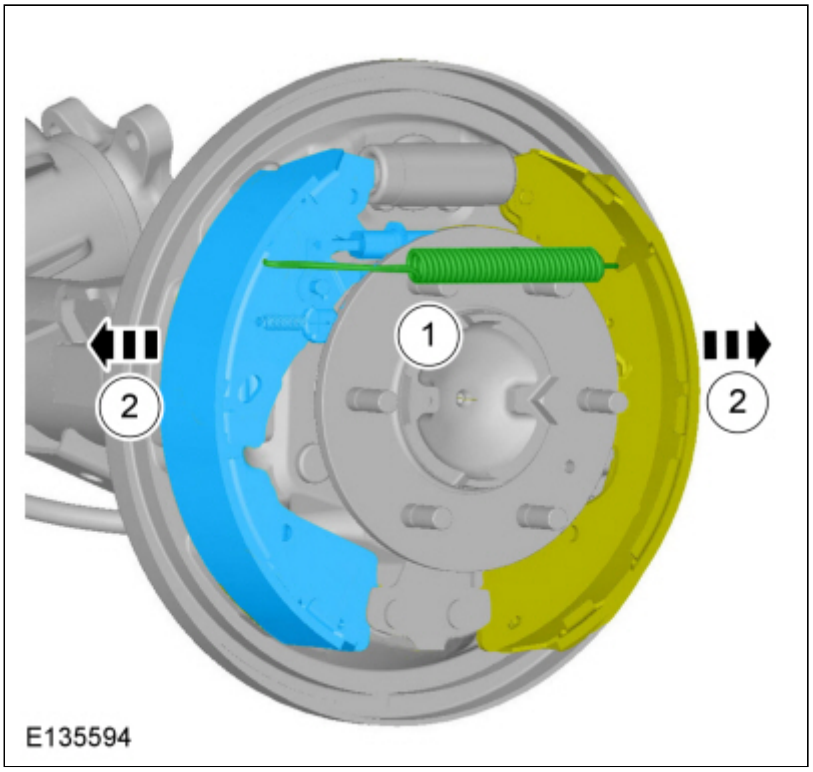


5.

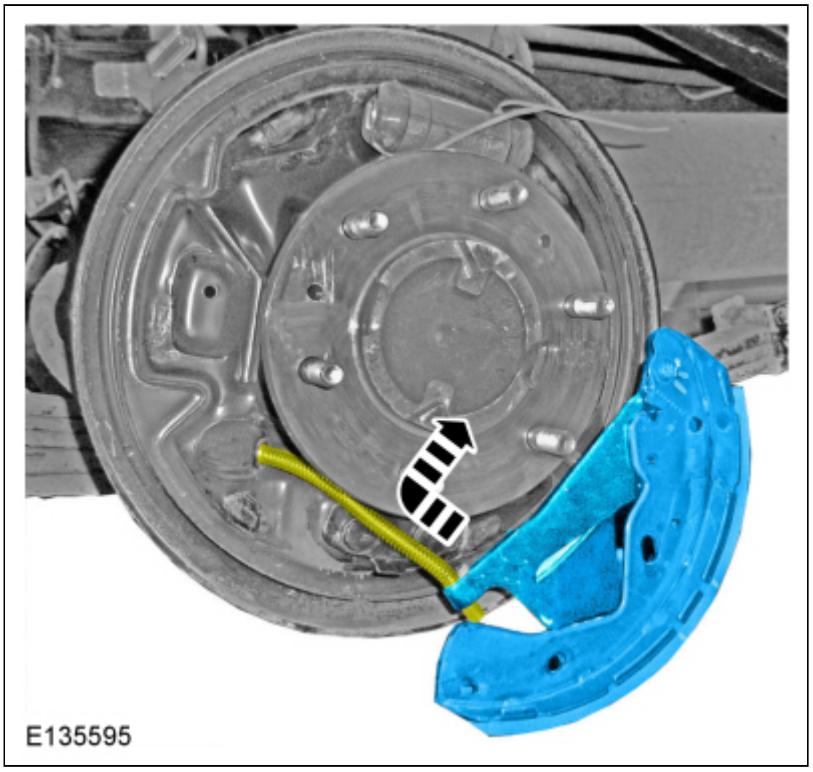


6. Hold the wheel cylinder pistons in place with a plastic band before removal of shoes.

7. **NOTICE: Do not damage the wheel cylinder boots.**

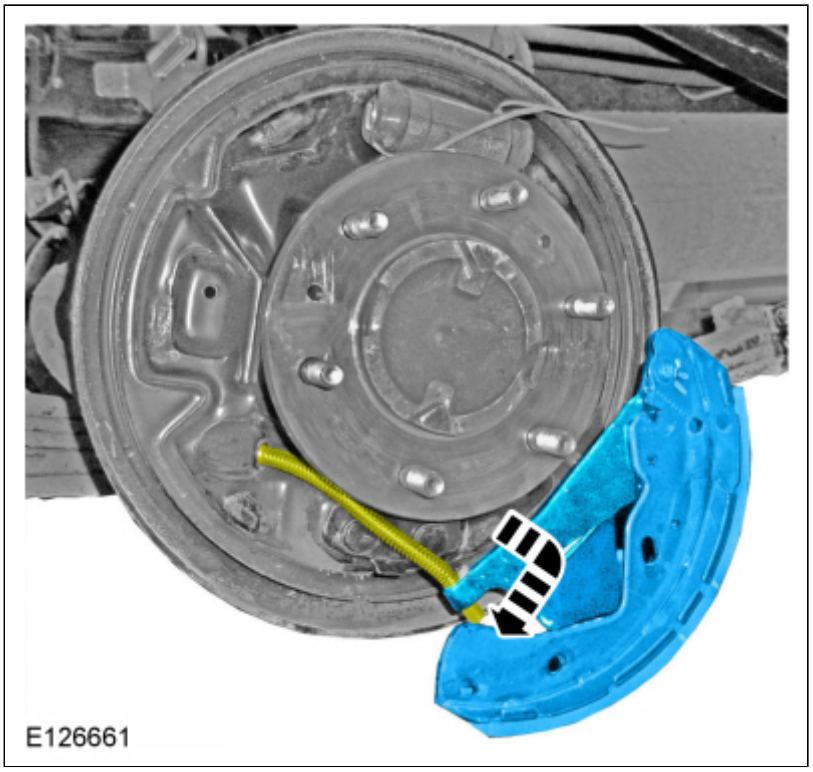


8.

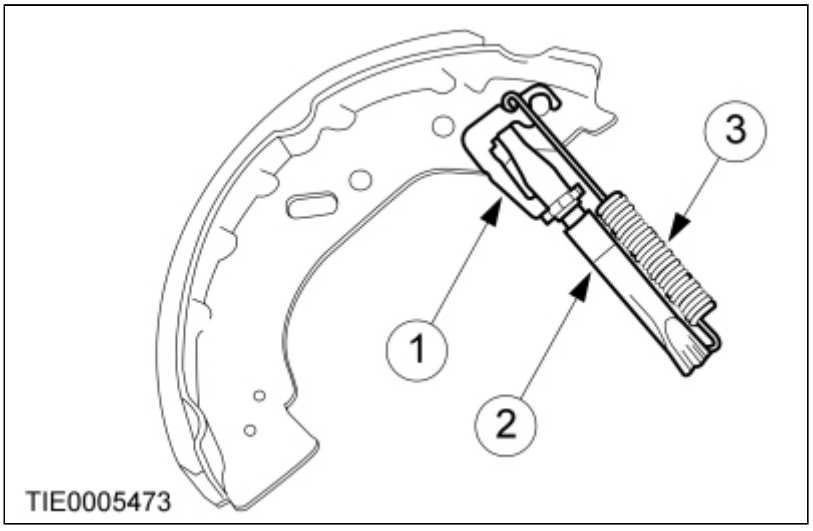


Installation

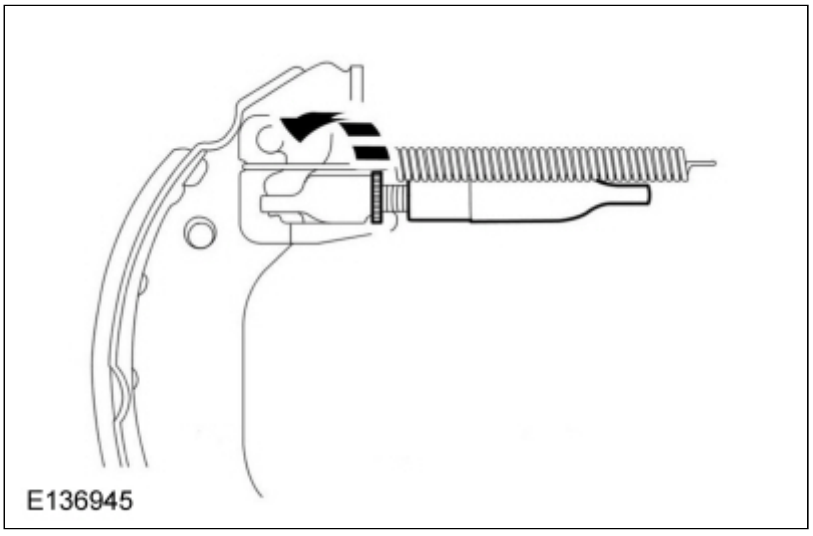
1.



2.



3. Turn the adjuster on the adjustment strut to adjust the brake shoe until the outer diameter of the brake shoe is as specified.
   Refer to: Specifications (206-00 Brake System - General Information, Specifications).



4. To install, reverse the removal procedure.
5. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
6. Depress the brake pedal to adjust the brake shoes.

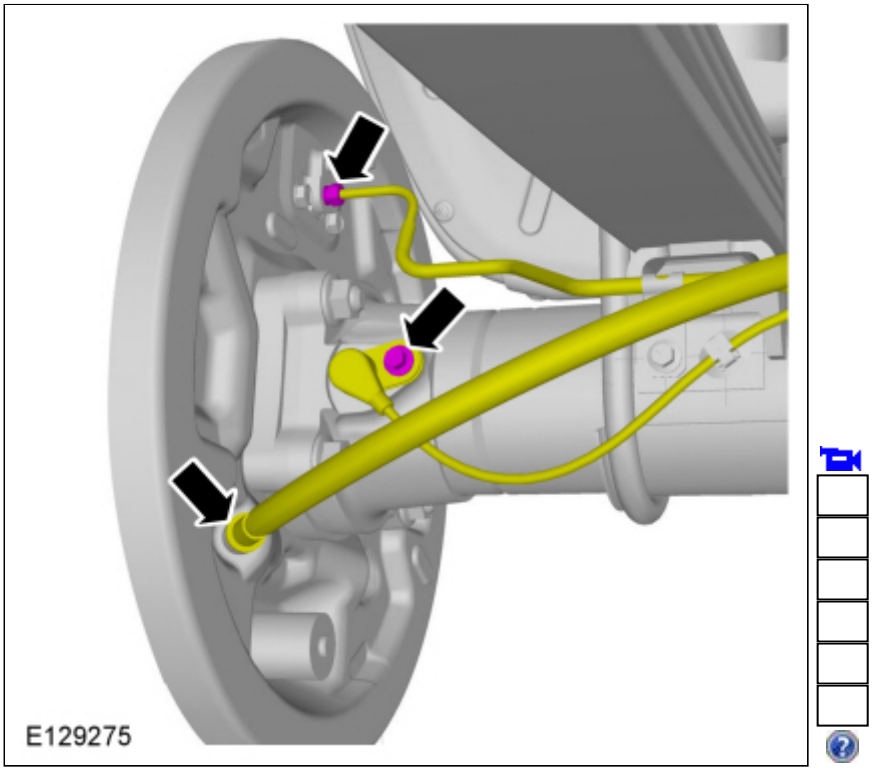
Copyright © 2016 Ford Motor Company

Brake Backing Plate

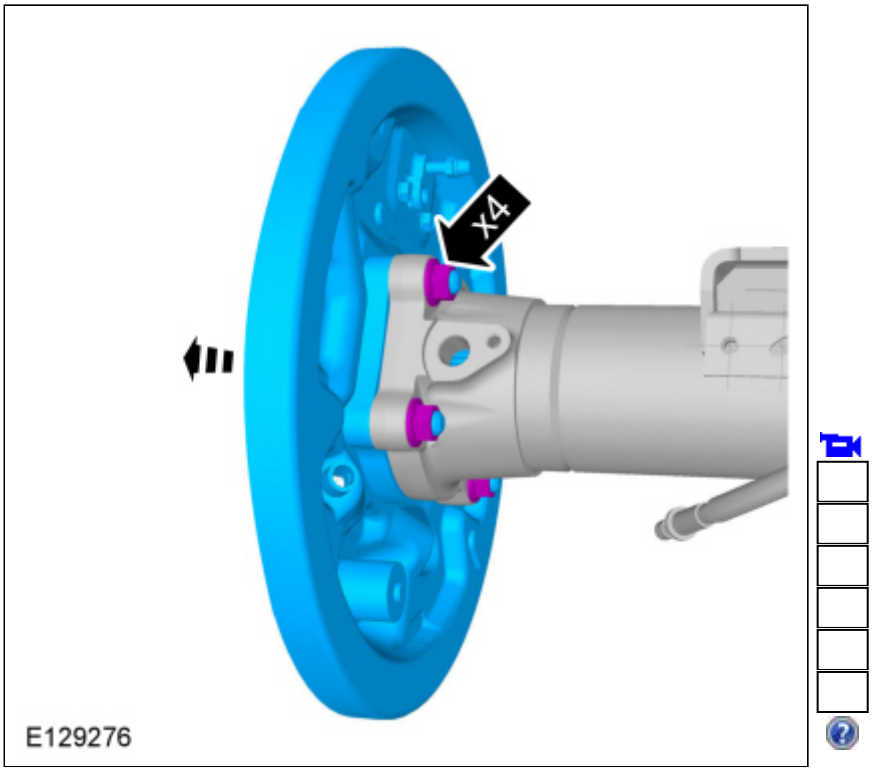
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).
4. Refer to: Brake Shoes (206-02 Drum Brake, Removal and Installation).
5. *Torque*: 15 Nm



6. *Torque*: 108 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Brake Shoes (206-02 Drum Brake, Removal and Installation).
3. Refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

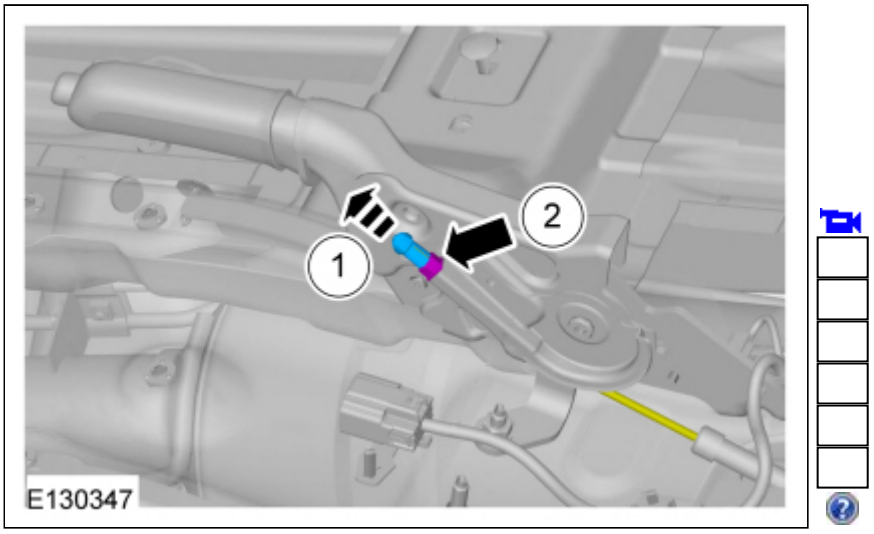
Copyright © 2016 Ford Motor Company

Brake Drum

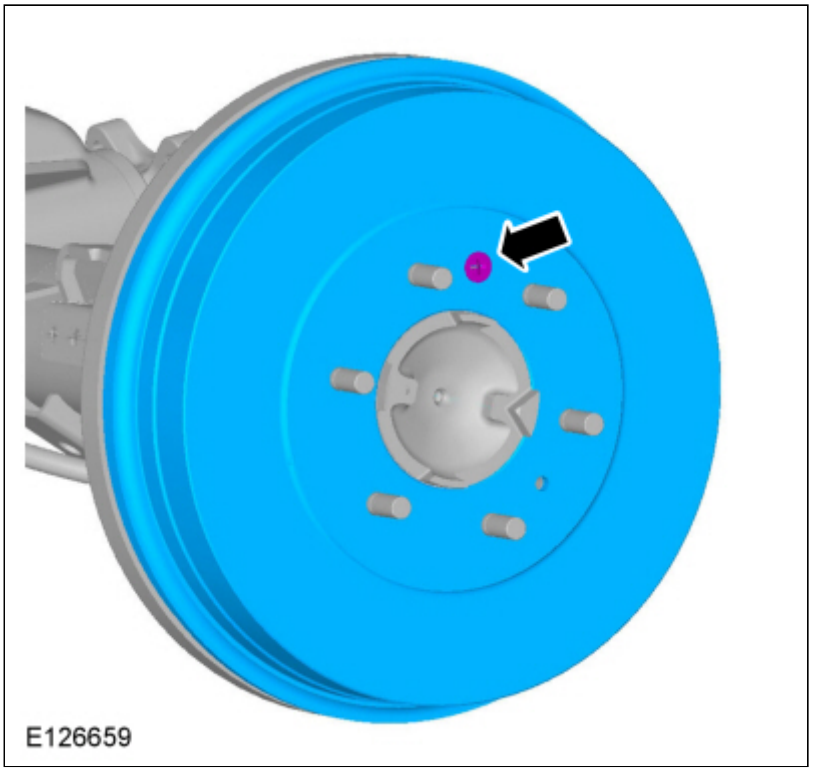
Special Tool(s) / General Equipment

 E139244	206-D002 (D81L-1103-A) Gauge, Brake Adjustment
Flat Headed Screw Driver	
Cable Ties	

Removal

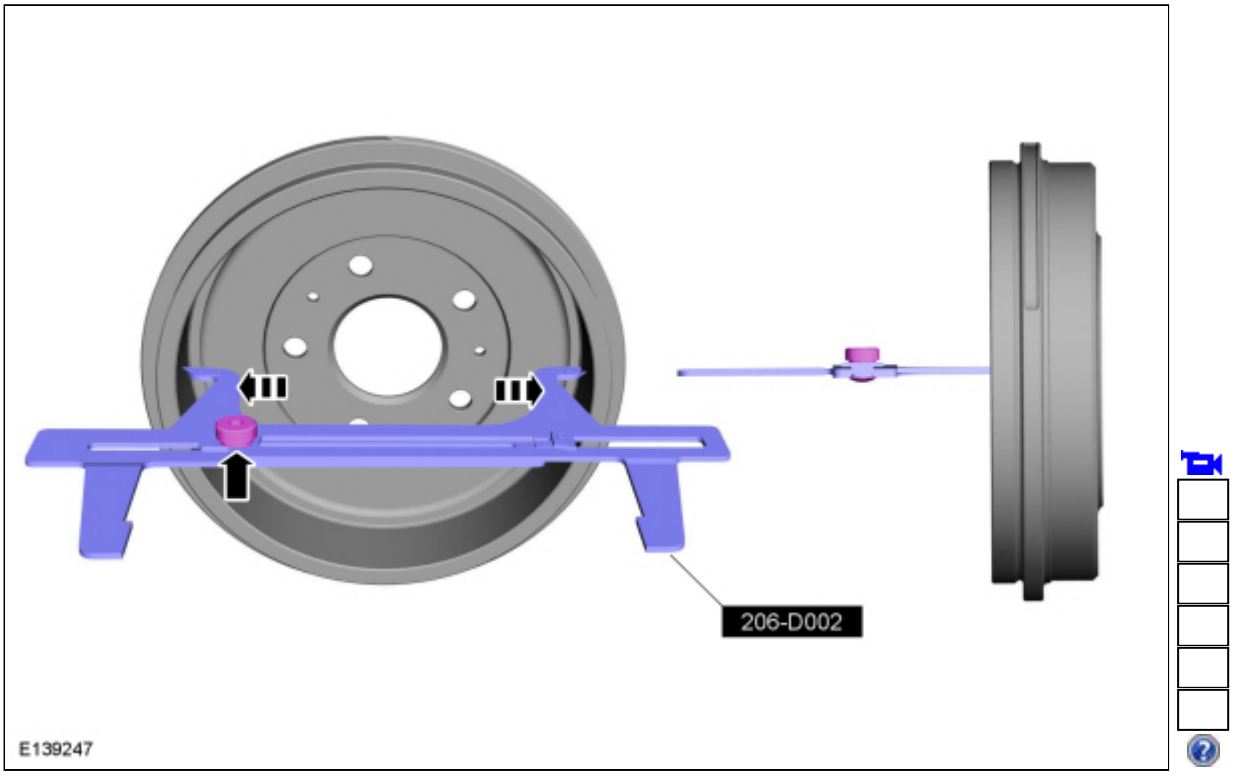
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
3. 

4. On both sides.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. On both sides.

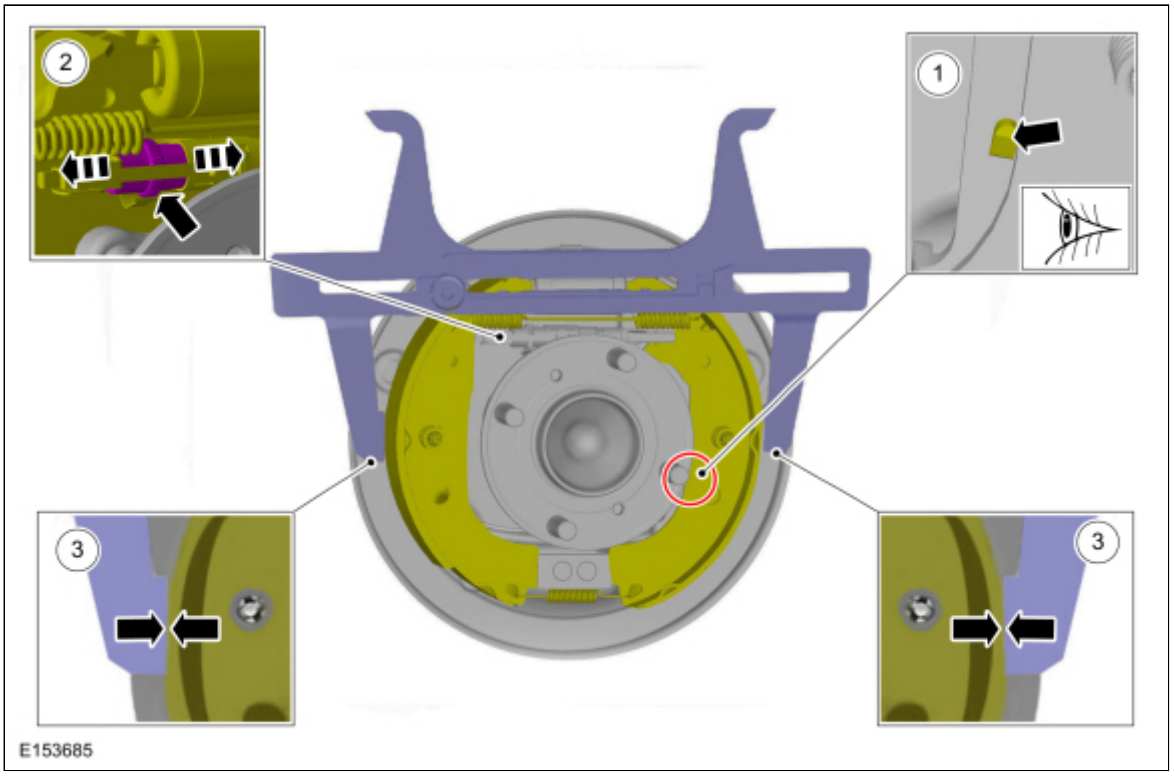


Installation

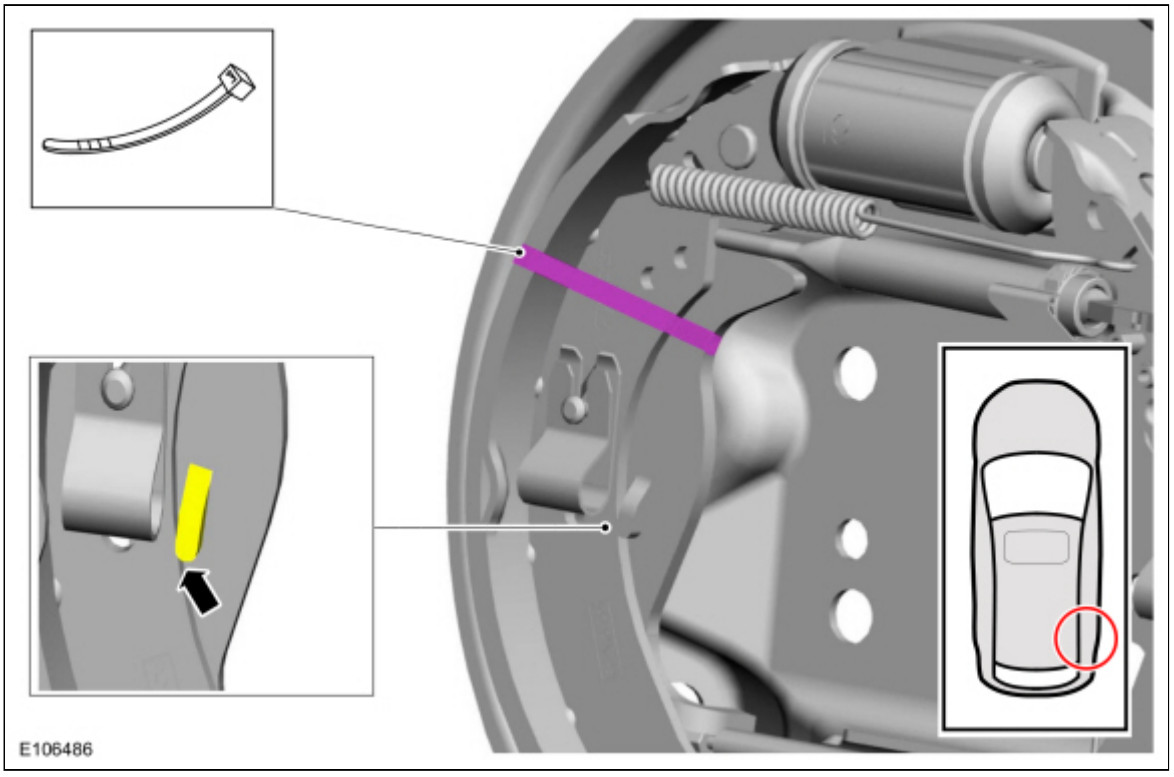
1. On both sides.
   Use Special Service Tool: 206-D002 (D81L-1103-A) Gauge, Brake Adjustment.



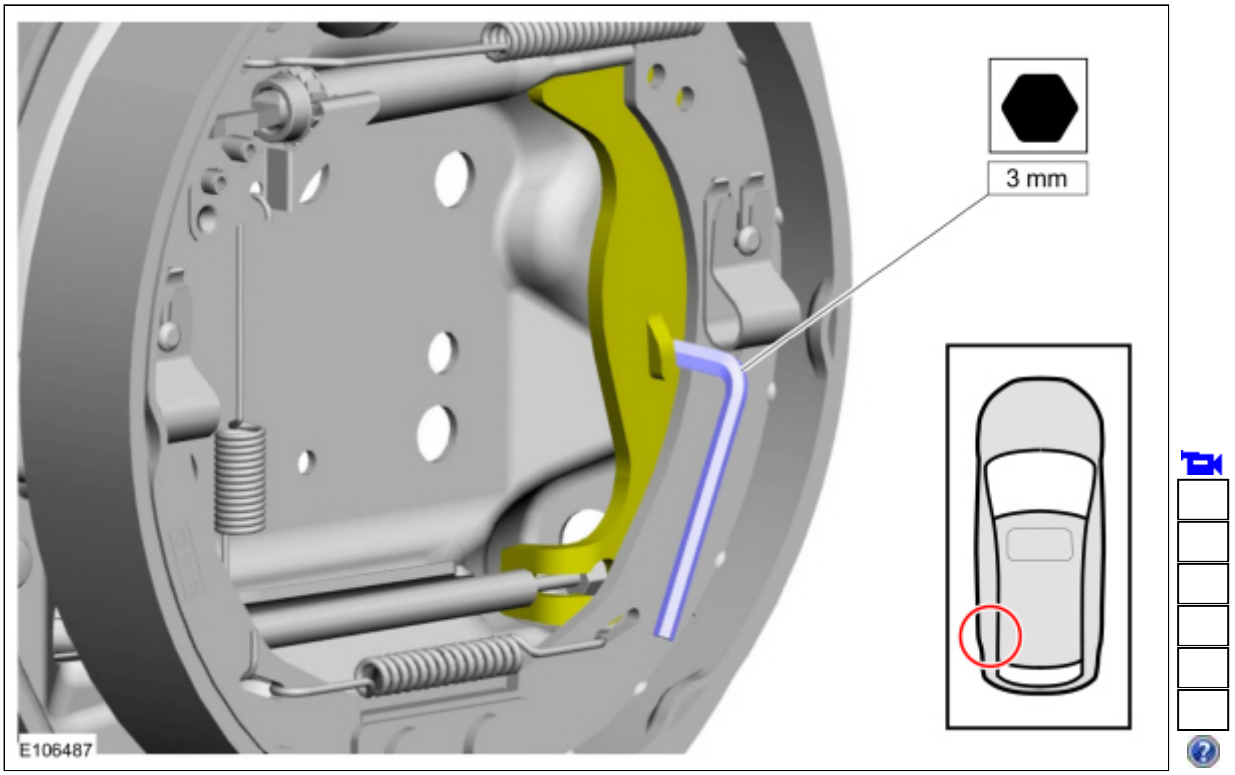
2. On both sides.
   Use Special Service Tool: 206-D002 (D81L-1103-A) Gauge, Brake Adjustment.
   Use the General Equipment: Flat Headed Screw Driver



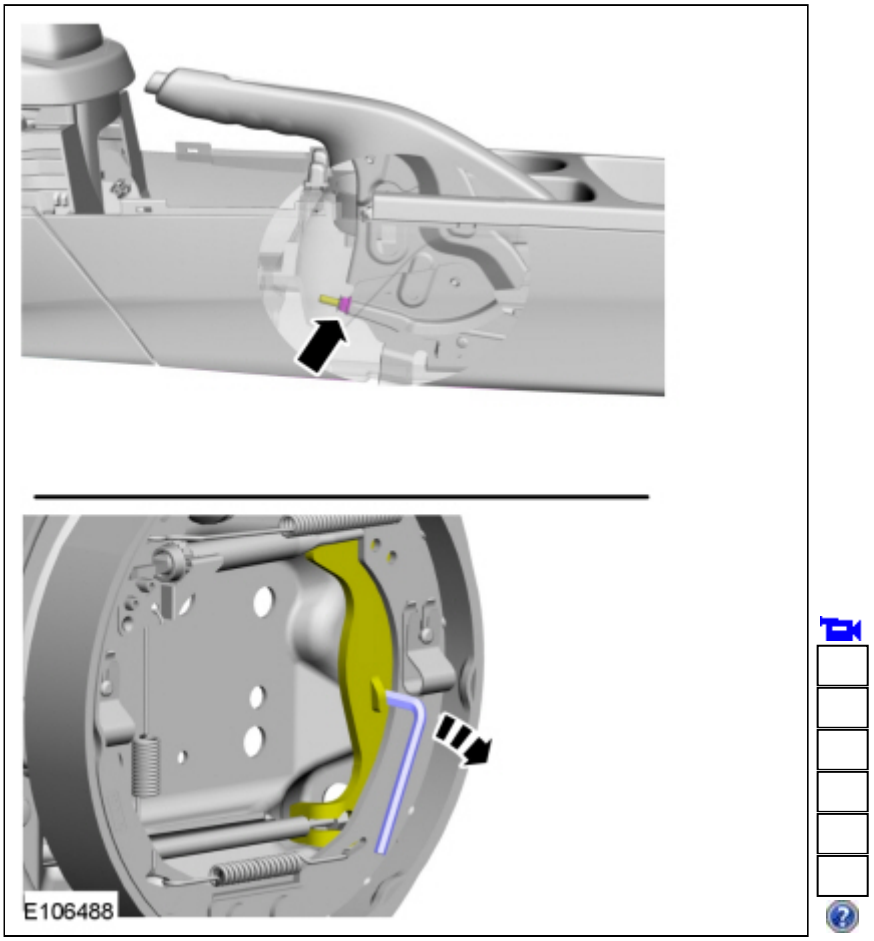
3. Use the General Equipment: Cable Ties



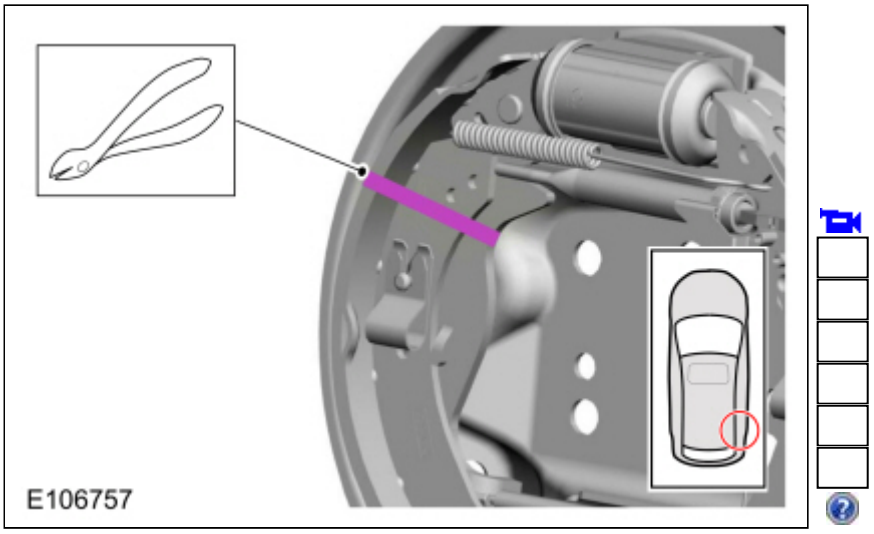
4.



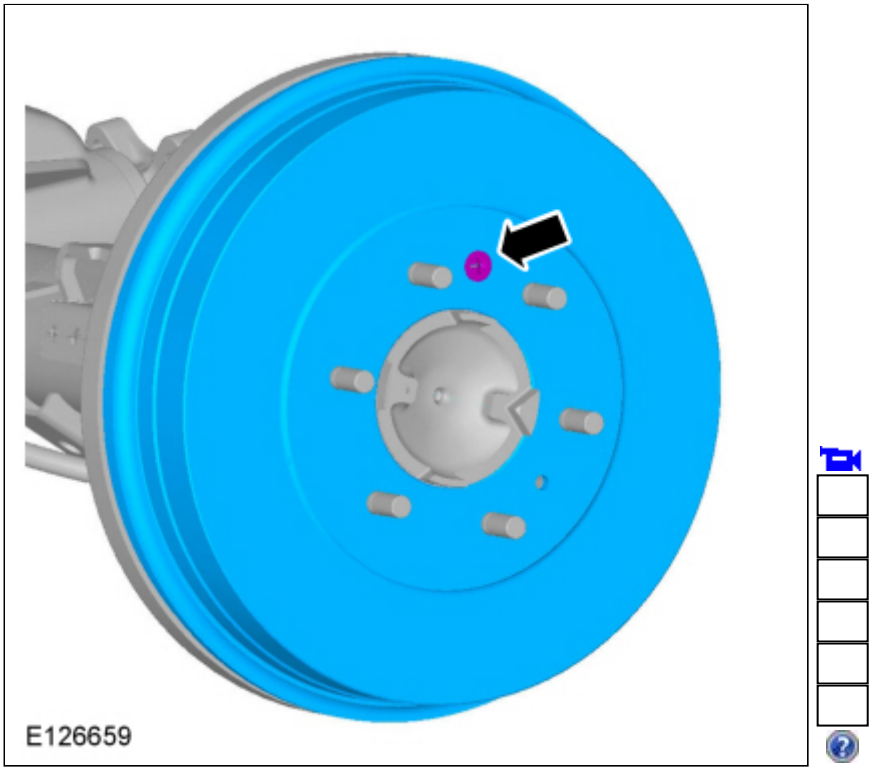
5. Adjust the parking brake cable adjustment nut until the allen key falls out.



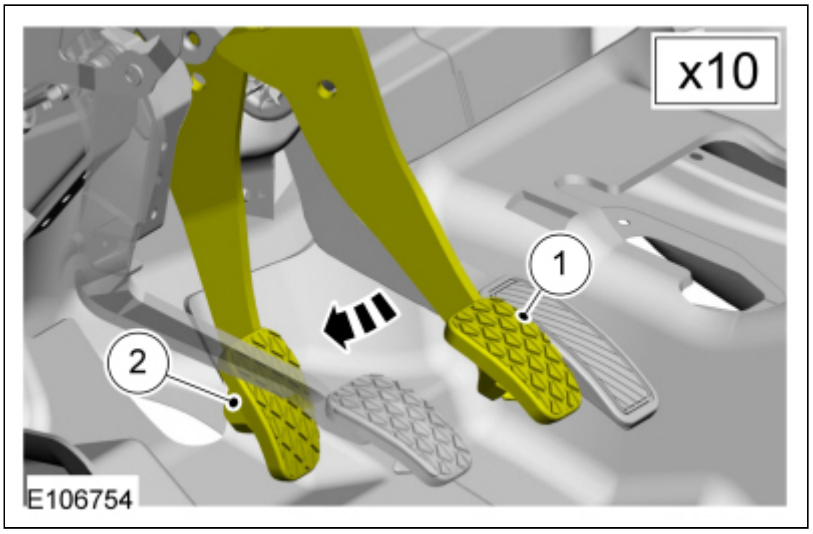
6.



7. On both sides.



8. On both sides.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
9. Start the engine.
10.

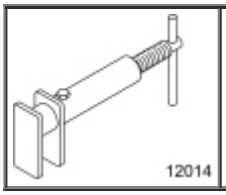


Copyright © 2016 Ford Motor Company

Brake Pads

Base Part Number: 2001

Special Tool(s) / General Equipment

	206-005 Retractor, Brake Caliper Piston

Materials

Name	Specification
Brake Fluid	WSS-M6C65-A2

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.**

   NOTICE: Only use the specified material.

   NOTICE: If the brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

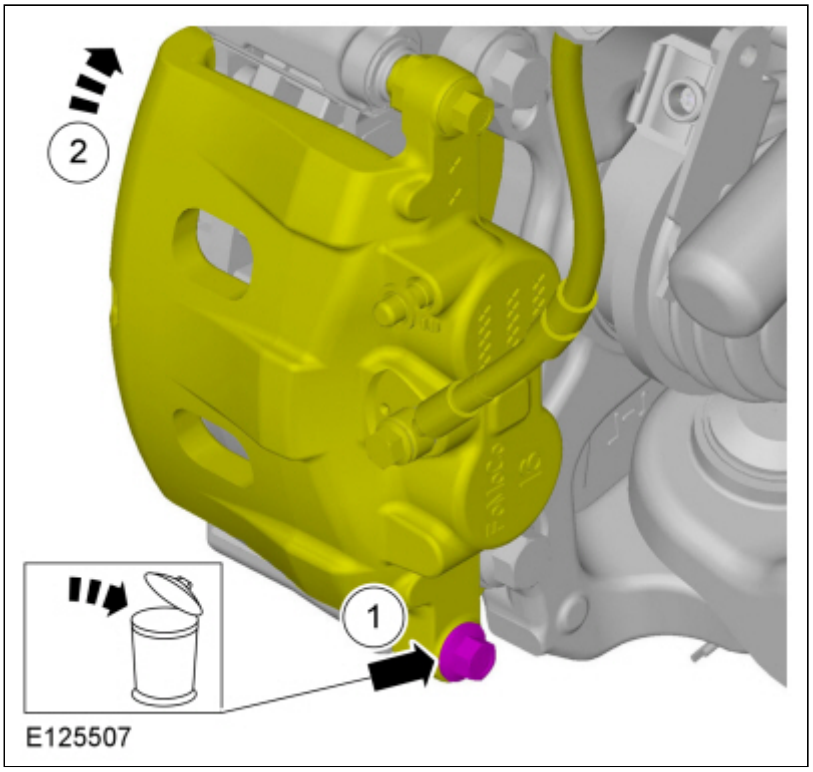
   Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

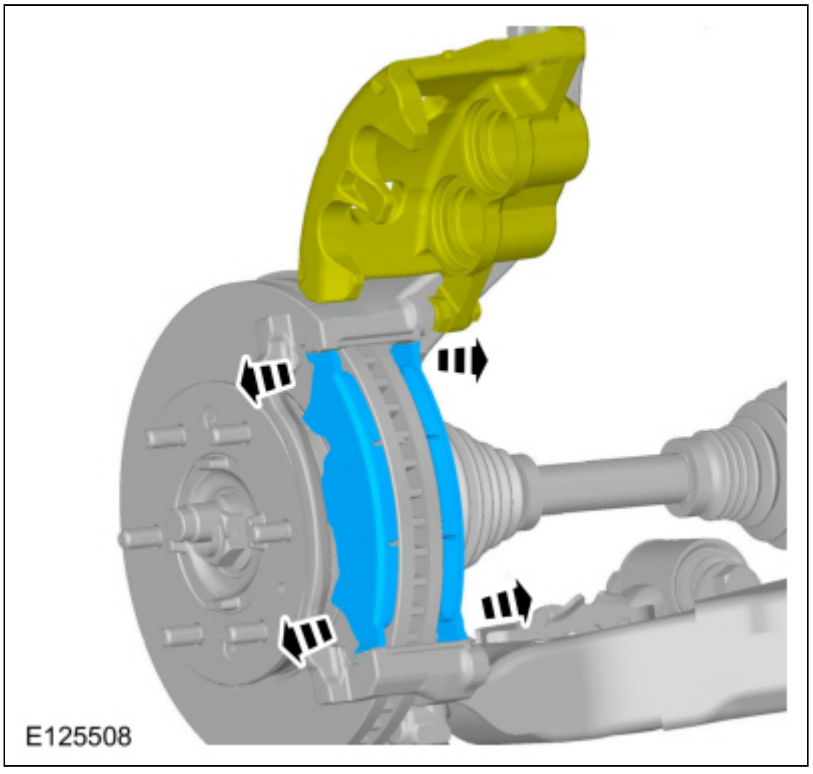
3. **NOTICE: Make sure that no load is placed on the brake hose.**

   NOTICE: Do not pry in the brake caliper sight hole to retract the pistons as this can damage the pistons and boots.

   Torque: 52 Nm



4. **NOTE:** *Note the position of the components before removal.*

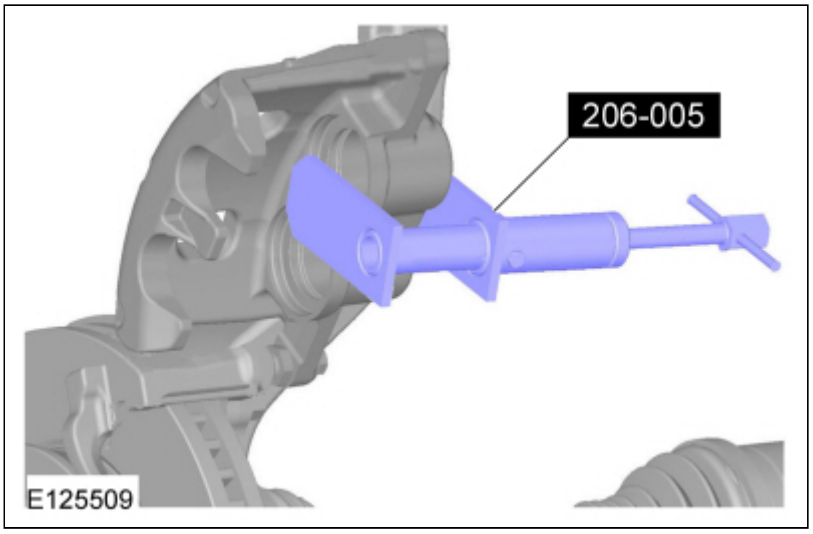


5. **NOTICE: Take extra care not to damage the component.**

   NOTE: *Make sure that the brake pad contact points are clean and free of foreign material.*

   NOTE: *Remove the adhesive foil from the rear of the brake pad.*

   Use Special Service Tool: 206-005 Retractor, Brake Caliper Piston.



Installation

1. **NOTICE: Do not allow grease, oil, brake fluid or other contaminants to contact the pad lining material. Do not install contaminated pads.**

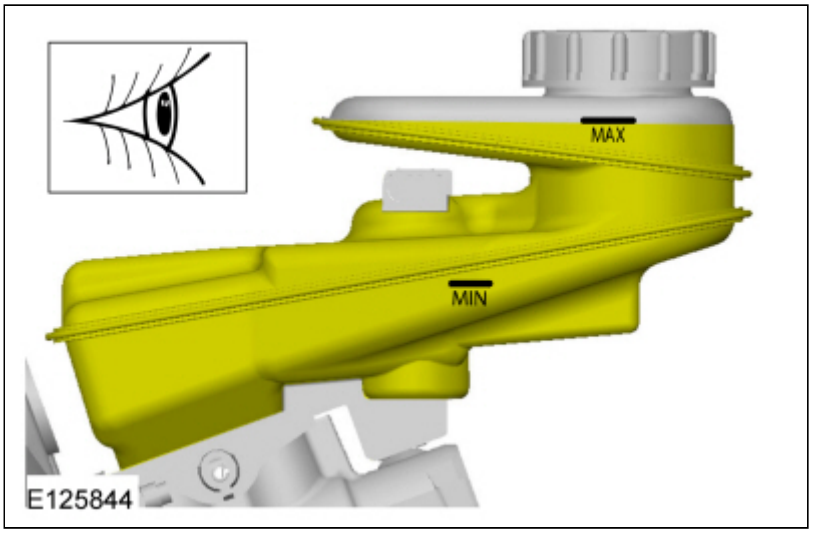
   NOTICE: Make sure that the brake hose is not twisted and is correctly located.

   NOTE: *Make sure that the mating faces are clean and free of foreign material.*

2. To install, reverse the removal procedure.

3. **NOTICE: The fluid level must remain between the MAX and MIN marks.**

   Depress the brake pedal, check the brake fluid level in the brake fluid reservoir and top up as necessary with brake fluid.
   Material: Brake Fluid (WSS-M6C65-A2)



Copyright © 2016 Ford Motor Company

Brake Caliper

Base Part Number: 2B302

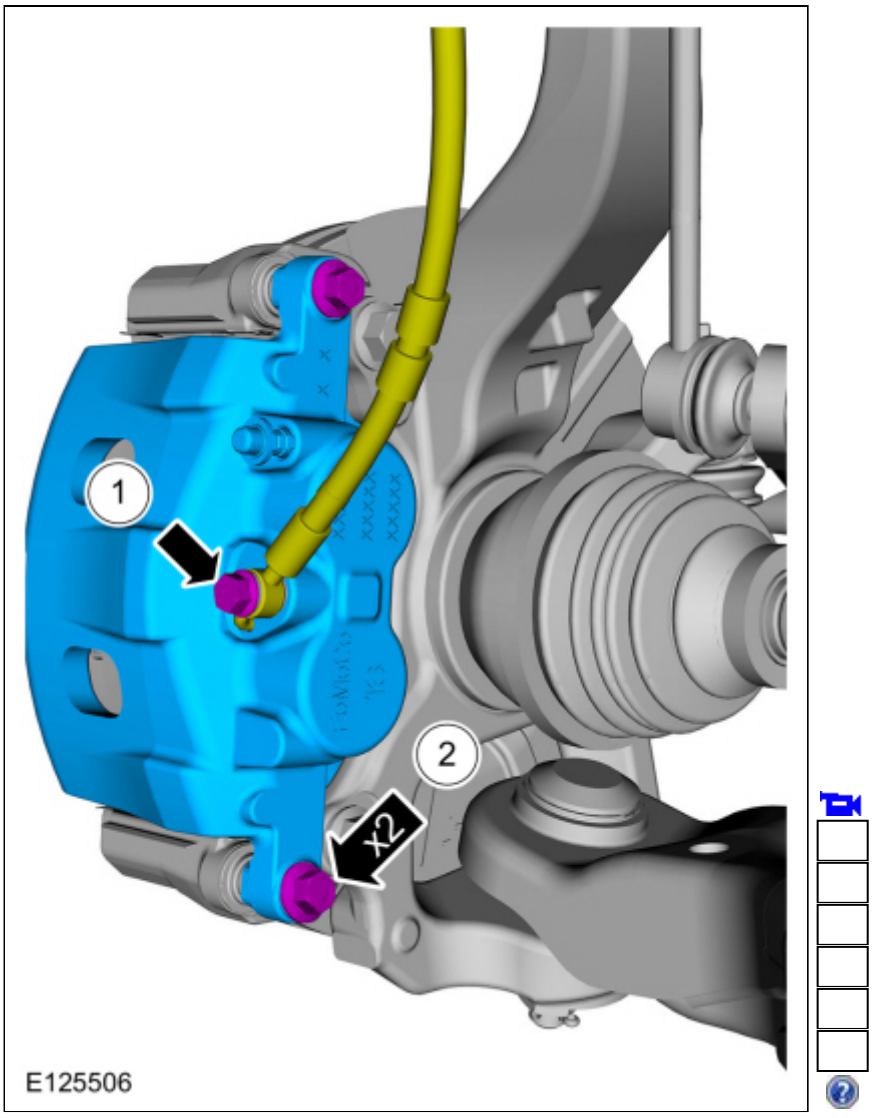
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. **NOTE:** *Make sure that the brake fluid level does not drop below the min mark.*

   NOTE: *Use new seals.*

   1. *Torque*: 28 Nm
   2. *Torque*: 30 Nm



Installation

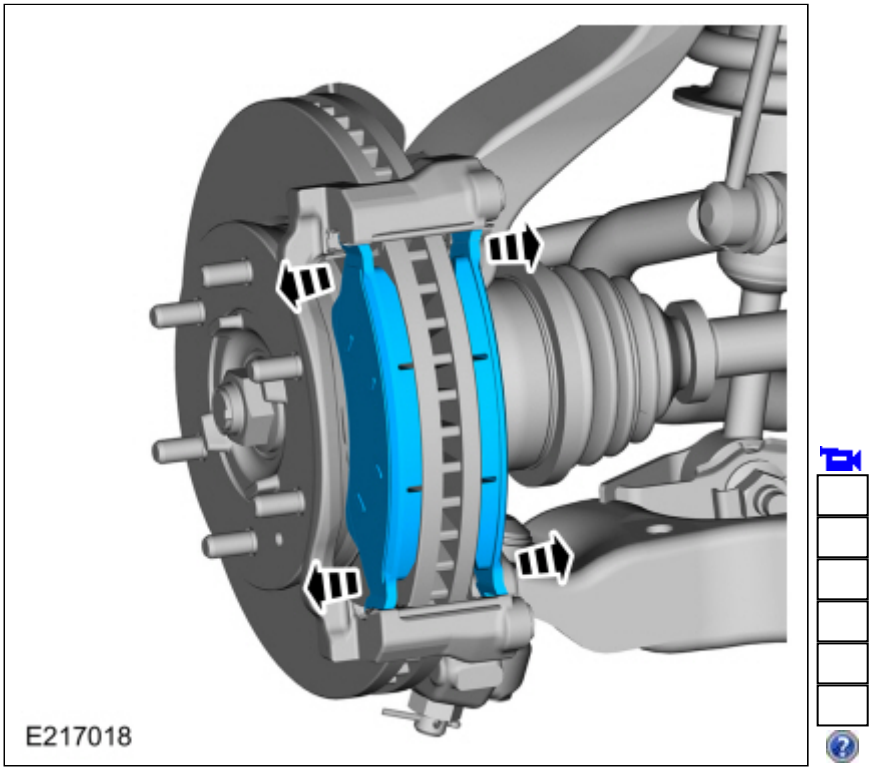
NOTICE: Make sure that the brake hose is not twisted and is correctly located.

1. To install , reverse the removal procedure.
2. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

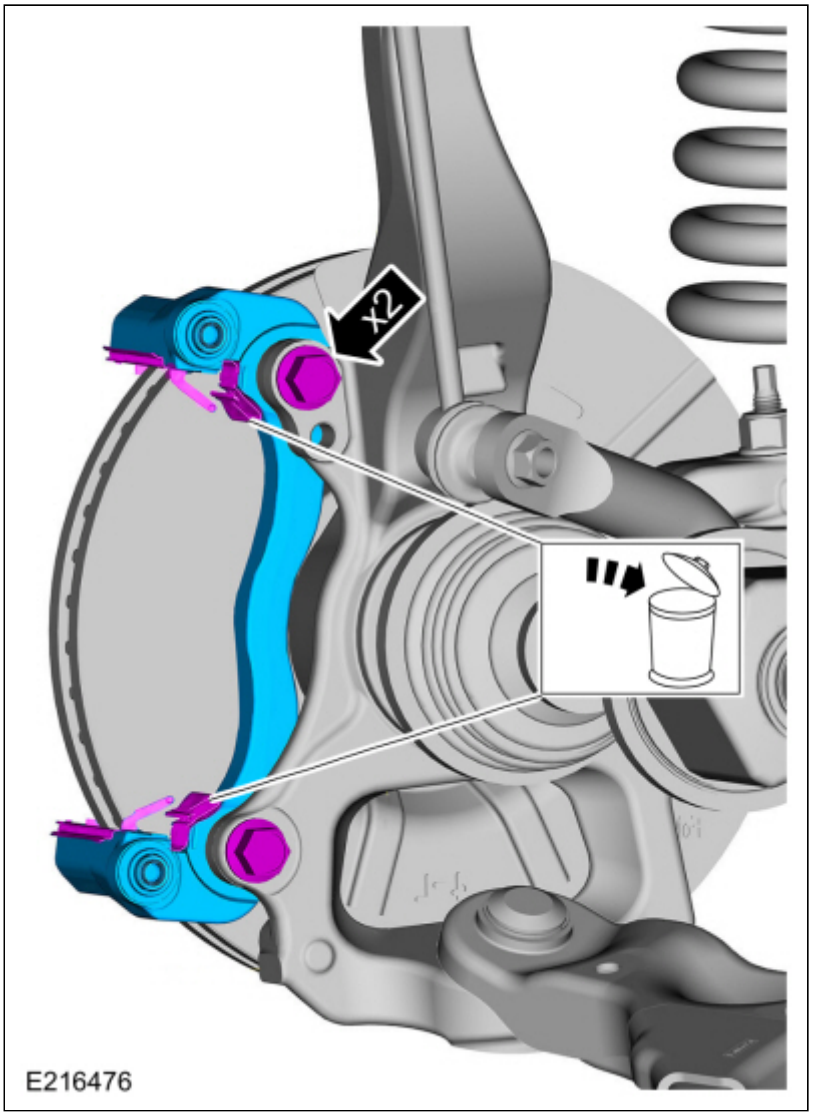
Copyright © 2016 Ford Motor Company

Brake Caliper Anchor Plate

Removal

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation).
3. 

4. *Torque*: 133 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Brake Disc

Base Part Number: 1125

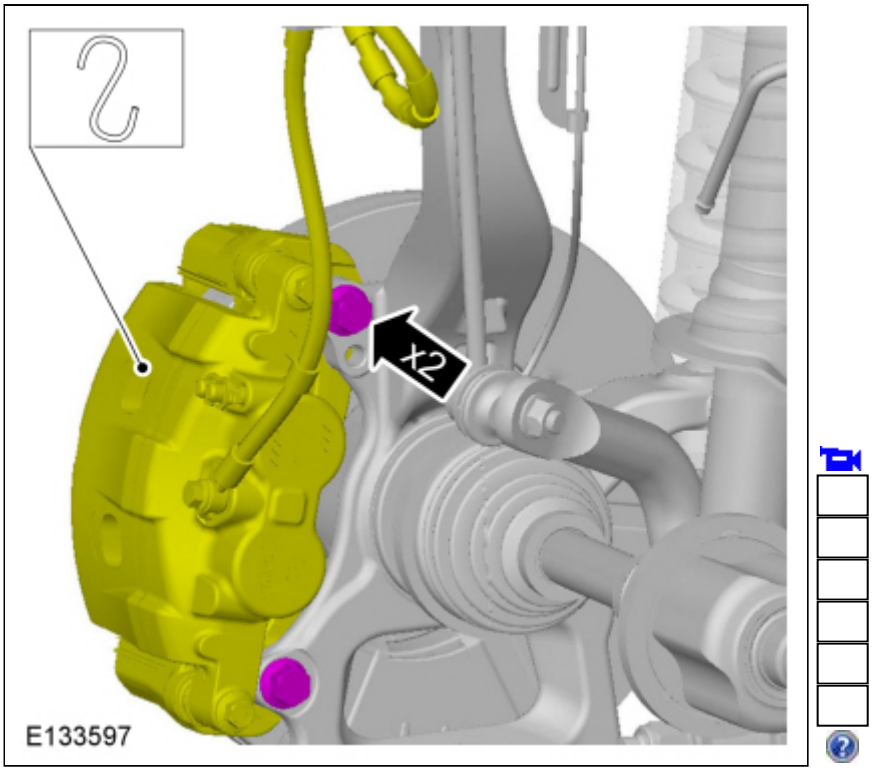
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

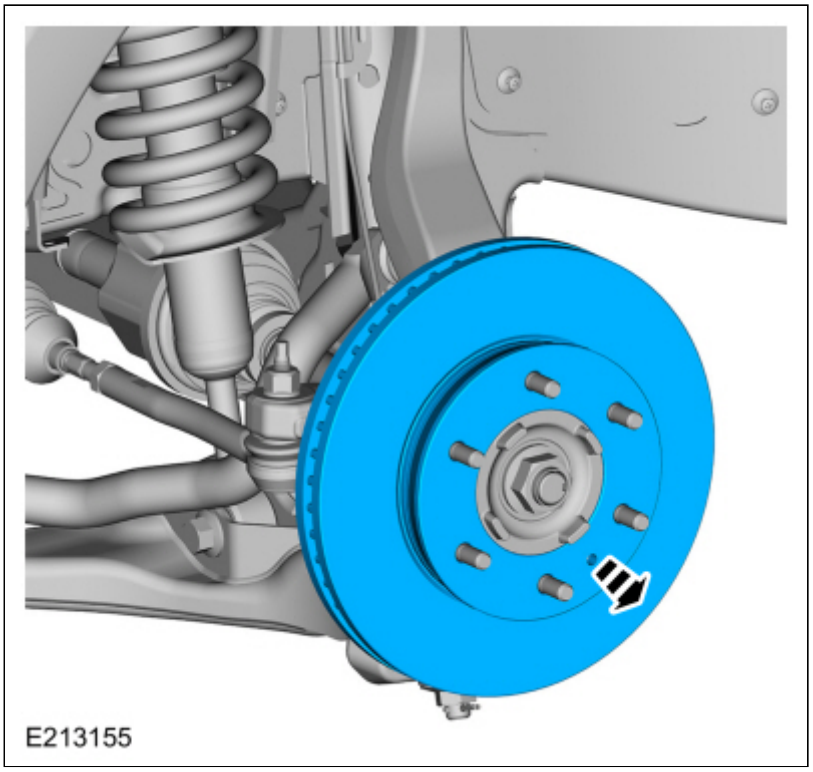
1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. **NOTICE: Do not pry in the caliper sight hole to retract the pistons as this can damage the pistons and boots.**

   NOTICE: Make sure that no load is placed on the brake hose.

   Torque: 115 Nm



4.



Installation

NOTICE: Make sure that the brake hose is not twisted when installing the brake caliper or damage to the brake flexible hose may occur.

1. To install, reverse the removal procedure.
2. Apply the brake pedal several times to verify correct brake system operation.

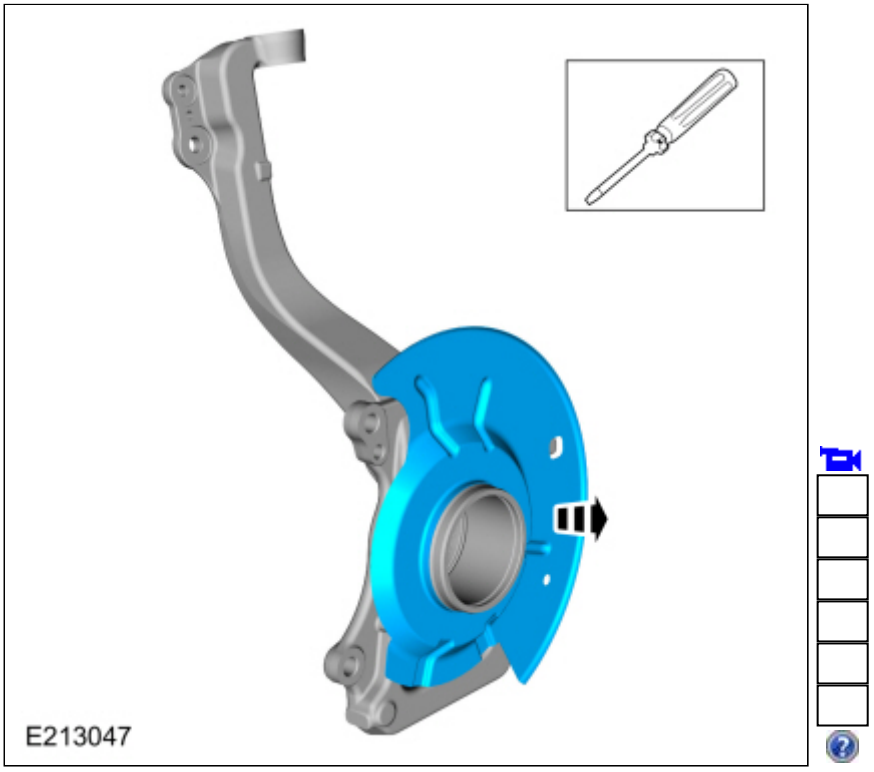
Copyright © 2016 Ford Motor Company

Brake Disc Shield

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
3. **NOTE:** *Make sure that the components are installed to the position noted before removal.*



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Brake Flexible Hose

Removal

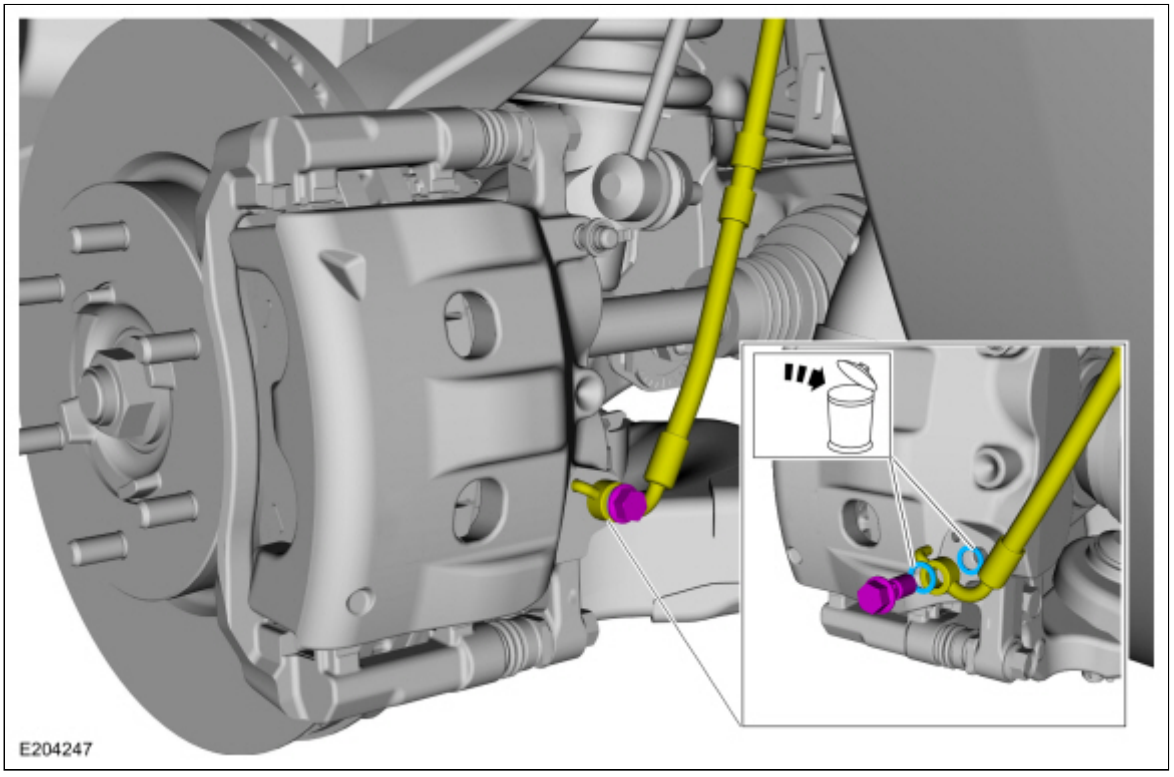
NOTICE: Make sure that all openings are sealed.

NOTICE: If the brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

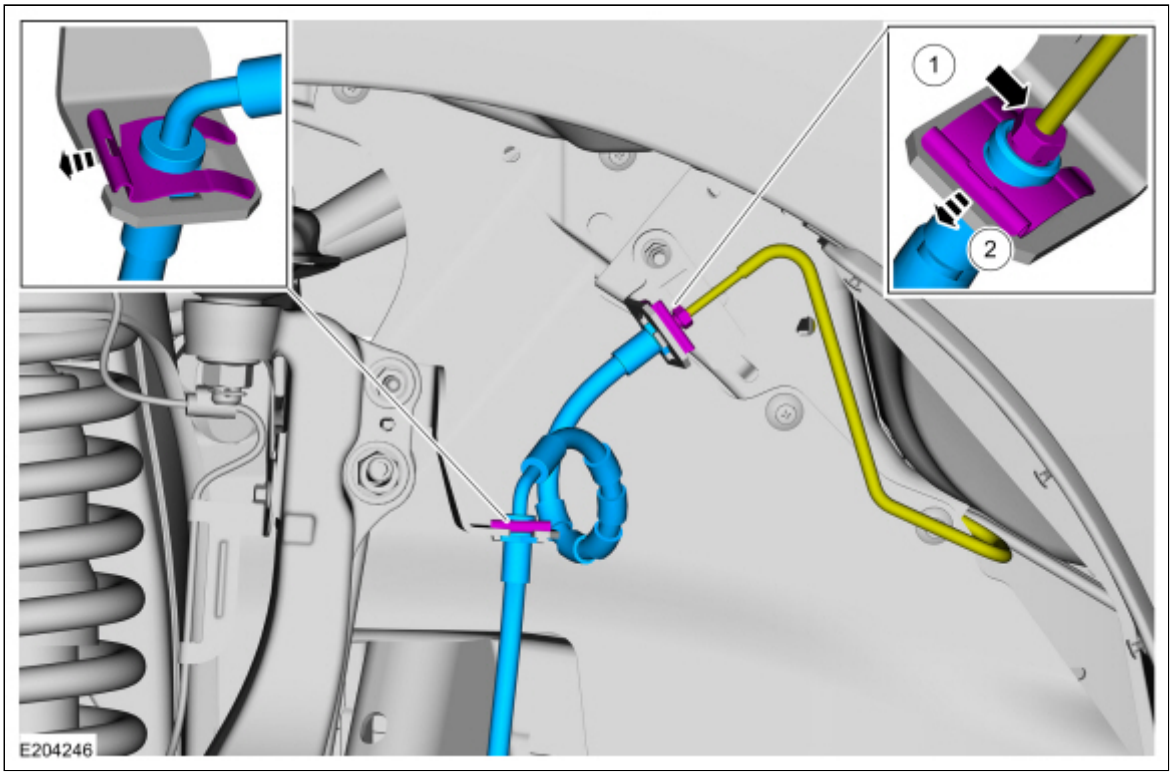
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. **NOTE:** *Be prepared to collect escaping fluid.*

   Torque: 28 Nm



3. *Torque*: 18 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Parking Brake

Inspection and Verification

1. Verify the customer concern by operating the parking brake system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Parking brake control REFER to: Parking Brake Control (206-05 Parking Brake and Actuation, Removal and Installation). – Cable and conduit REFER to: Parking Brake Rear Cables (206-05 Parking Brake and Actuation, Removal and Installation).	– Parking brake warning circuit. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
• The parking brake will not apply	• Parking brake control. • Cable and conduit.	• GO to Pinpoint Test A
• The parking brake will not release	• Parking brake control. • Cable and conduit.	• GO to Pinpoint Test B

Pinpoint Tests

PINPOINT TEST A : THE PARKING BRAKE WILL NOT APPLY

A1 CHECK FOR MISADJUSTED REAR PARKING BRAKE CABLE

- Operate the parking brake control several times to adjust the cable.

Does the parking brake now engage correctly?

Yes	Vehicle OK
No	GO to A2

A2 CHECK FOR WORN BRAKE SHOES OR PADS

- Inspect the brake shoes or pads for excessive wear.
  REFER to: Brake Shoes (206-02 Drum Brake, Removal and Installation).
  REFER to: Brake Shoes (206-02 Drum Brake, Removal and Installation).
  REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation).

Are the brake shoe linings or brake pads OK?

Yes	GO to A3
No	INSTALL new brake shoes or pads. REFER to: Brake Shoes (206-02 Drum Brake, Removal and Installation). REFER to: Brake Pads (206-03 Front Disc Brake, Removal and Installation). TEST the system for normal operation.

A3 CHECK FOR DAMAGED PARKING BRAKE CABLES

- Inspect the parking brake cables and conduits for damage, rust or fraying.

Are the parking brake cables and conduits OK?

Yes	CHECK for other causes such as loose parking brake control or conventional brake system components.
No	REPAIR or INSTALL cables and conduit as necessary. TEST the system for normal operation.

PINPOINT TEST B : THE PARKING BRAKE WILL NOT RELEASE

B1 CHECK PARKING BRAKE CONTROL

- Raise and support the vehicle on a lift with the parking brake fully applied.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
  - With the aid of another technician, release the parking brake and check the operation of the brake cables and levers.

Did the parking brake release?

Yes	CHECK the other causes such as conventional brake system components. REPAIR or INSTALL new components as necessary.
No	GO to B2

B2 CHECK PARKING BRAKE CABLES

- Loosen the parking brake cable tension.
  - Rotate the rear wheels by hand.

Did the rear wheels turn freely?

Yes	INSTALL a new parking brake control. REFER to: Parking Brake Control (206-05 Parking Brake and Actuation, Removal and Installation). TEST the system for normal operation.
No	GO to B3

B3 CHECK FRONT PARKING BRAKE CABLE

- Disconnect the parking brake front cable and conduit from the rear brake cable and conduit at the equalizer.
  - Rotate the rear wheels by hand.

Did the rear wheels turn freely?

Yes	INSTALL a new front parking brake cable and conduit. REFER to: Parking Brake Rear Cables (206-05 Parking Brake and Actuation, Removal and Installation). TEST the system for normal operation.

No	GO to B4

B4 CHECK REAR PARKING BRAKE CABLES

- Disconnect the parking brake at the rear brakes, one at a time.
  - Rotate the wheel affected by the disconnected parking brake.

Did the wheel turn freely?

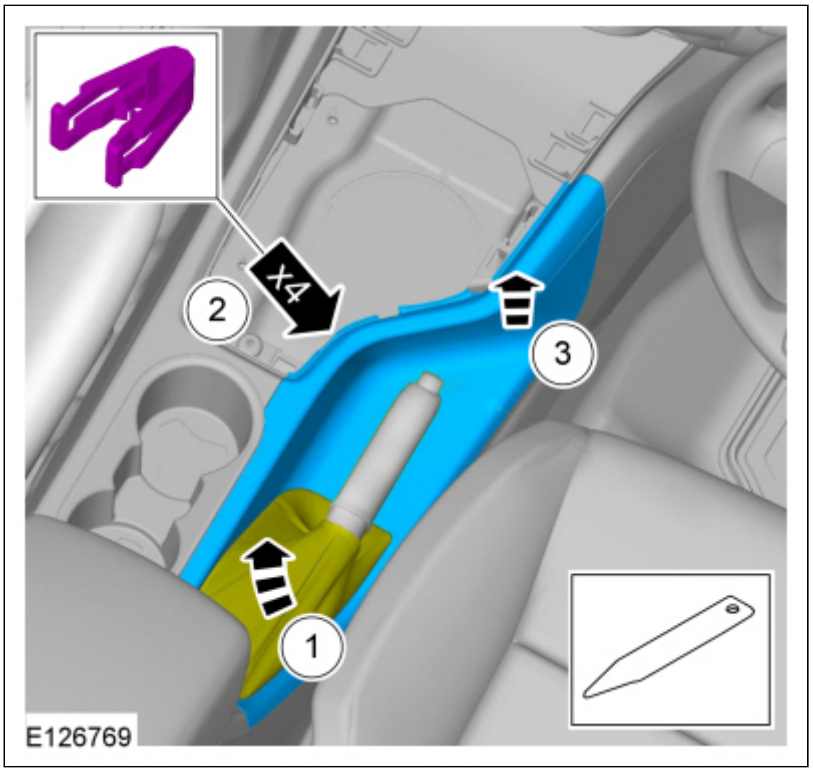
Yes	INSTALL a new parking brake control lever on the rear drum brakes or caliper assembly on rear disc brakes. REFER to: Brake Shoes (206-02 Drum Brake, Removal and Installation). REFER to: Brake Caliper (206-03 Front Disc Brake, Removal and Installation). TEST the system for normal operation.
No	REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

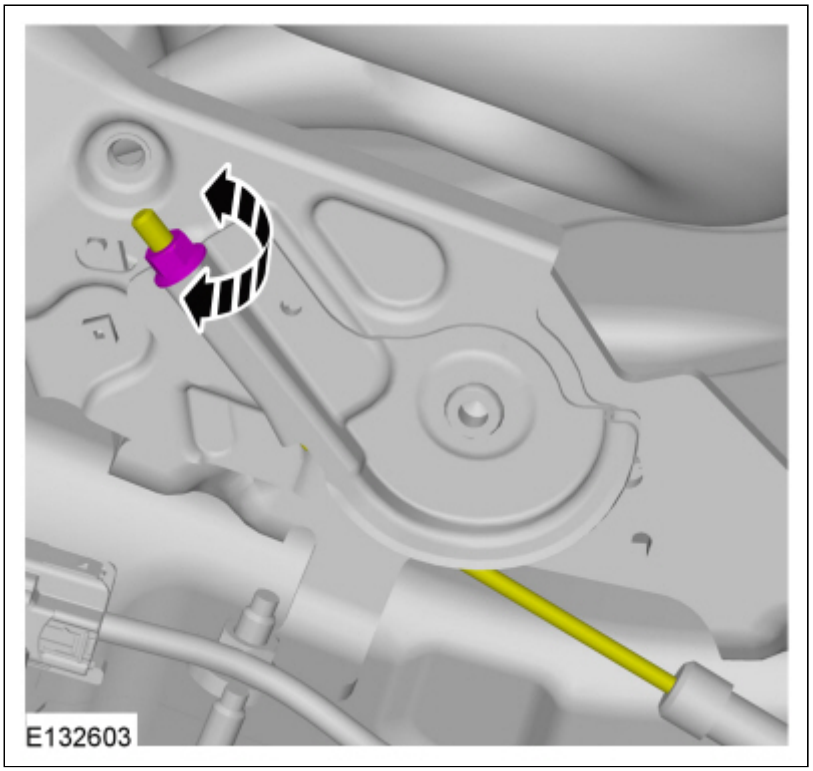
Parking Brake Cable Adjustment

Base Part Number: 2780

1. Before adjustment, depress the brake pedal several times while the vehicle is moving in reverse.



2. Pull the parking lever two to three times and turn the adjustment nut until the stroke reaches within range.
   - Parking brake lever stroke when pulled at 98 N (10 kgf, 22 lbf) 3-6 notches.



3. After adjustment, pull the parking brake lever one notch and verify that the parking brake warning light illuminates.

4. Verify that the rear brakes do not drag.

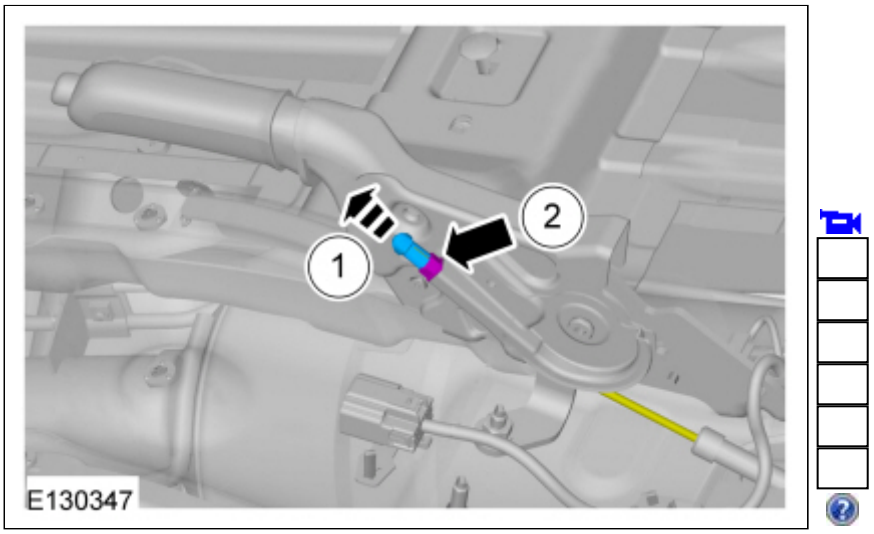
Copyright © 2016 Ford Motor Company

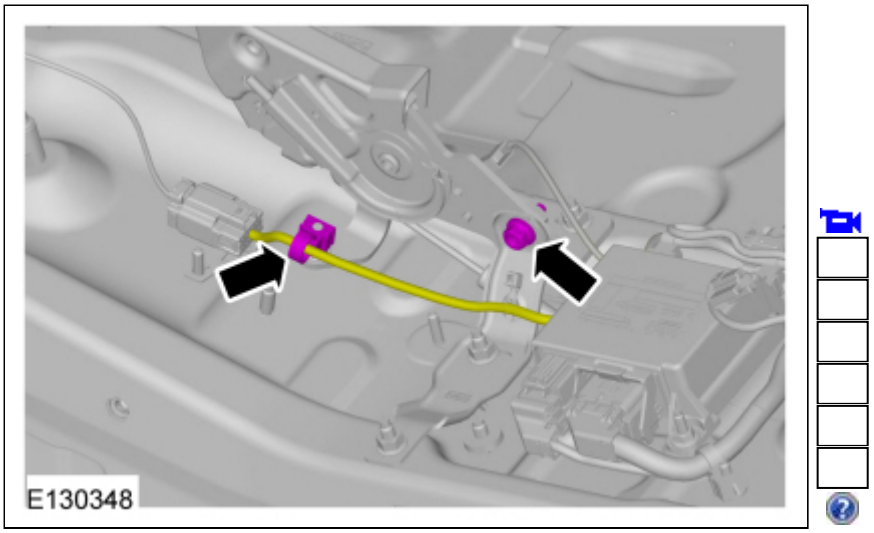
Parking Brake Control

Base Part Number: 2780

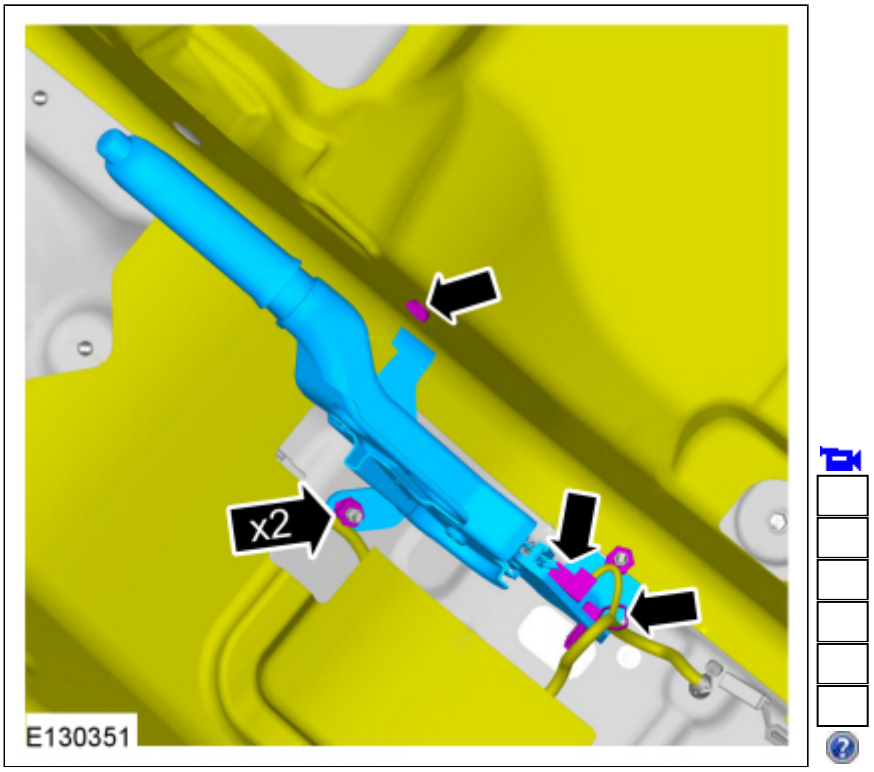
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
3. 

4. *Torque*: 22 Nm


5. *Torque*: 22 Nm



Installation

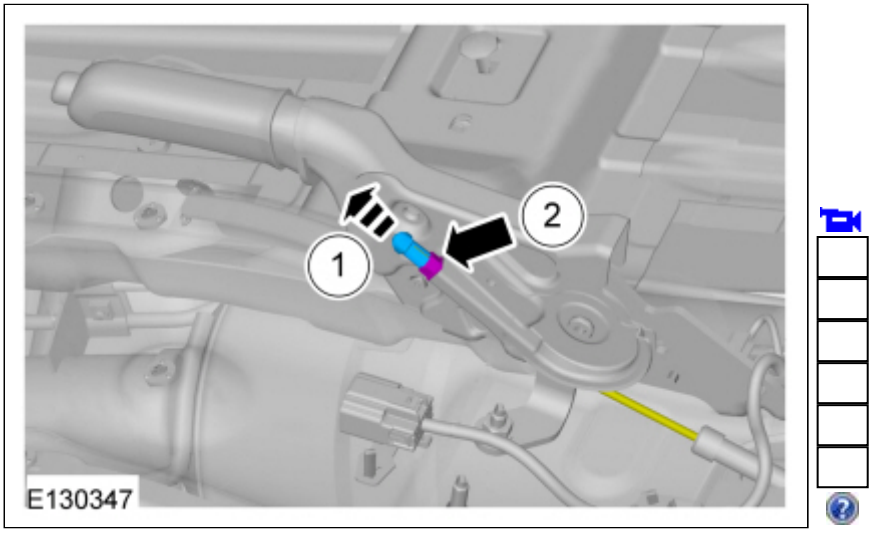
1. To install, reverse the removal procedure.
2. Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

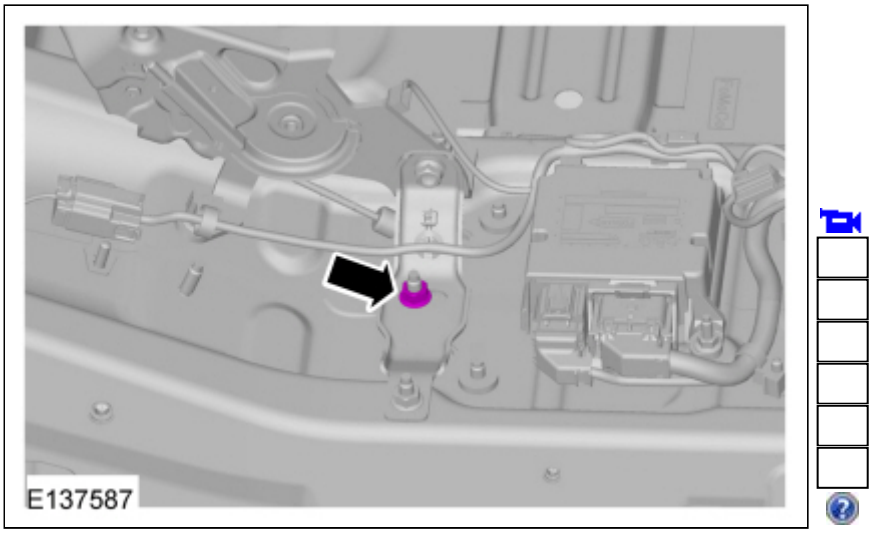
Copyright © 2016 Ford Motor Company

Parking Brake Front Cable

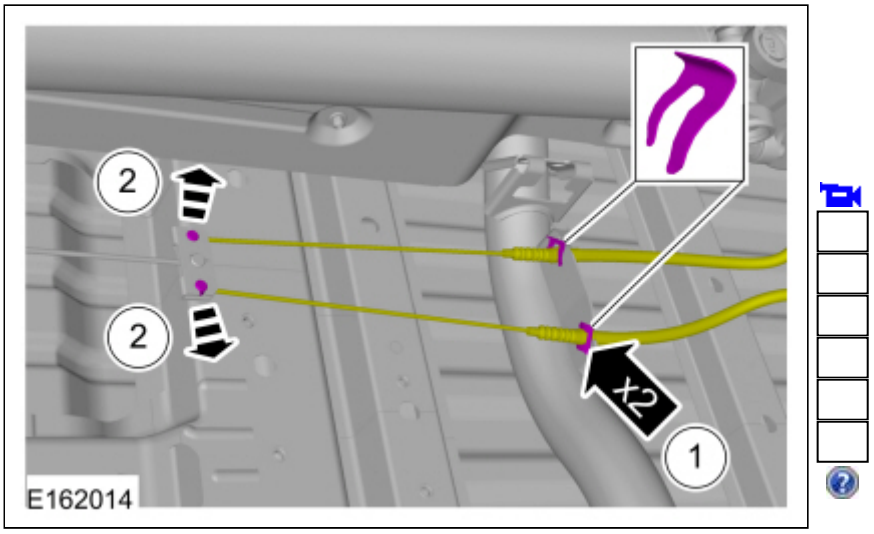
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

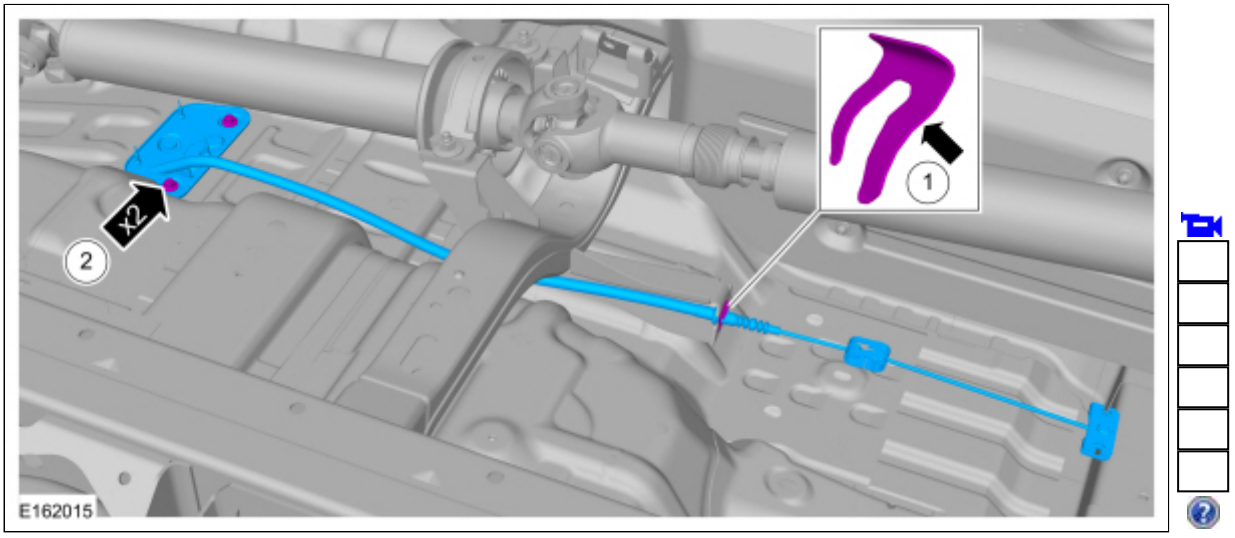
1. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3. *Torque*: 18 Nm


4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5.



6. *Torque*: 18 Nm



Installation

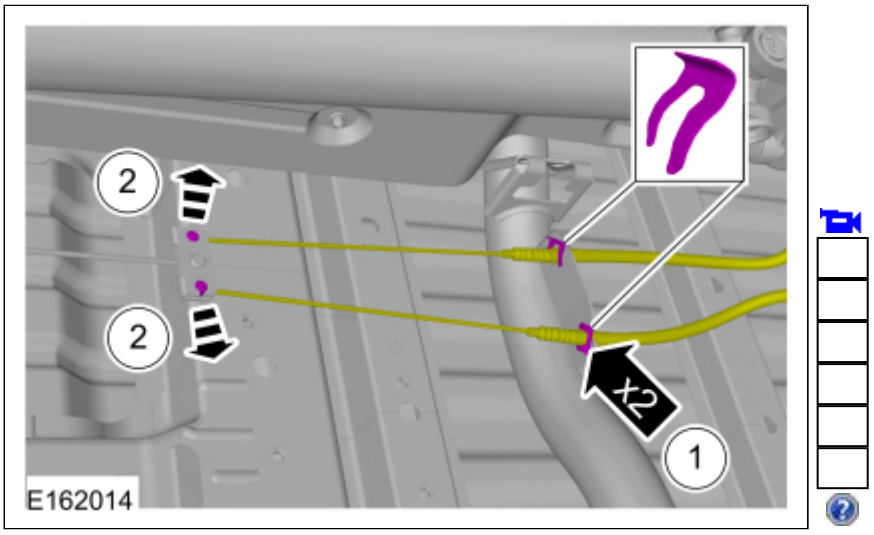
1. To install, reverse the removal procedure.
2. Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

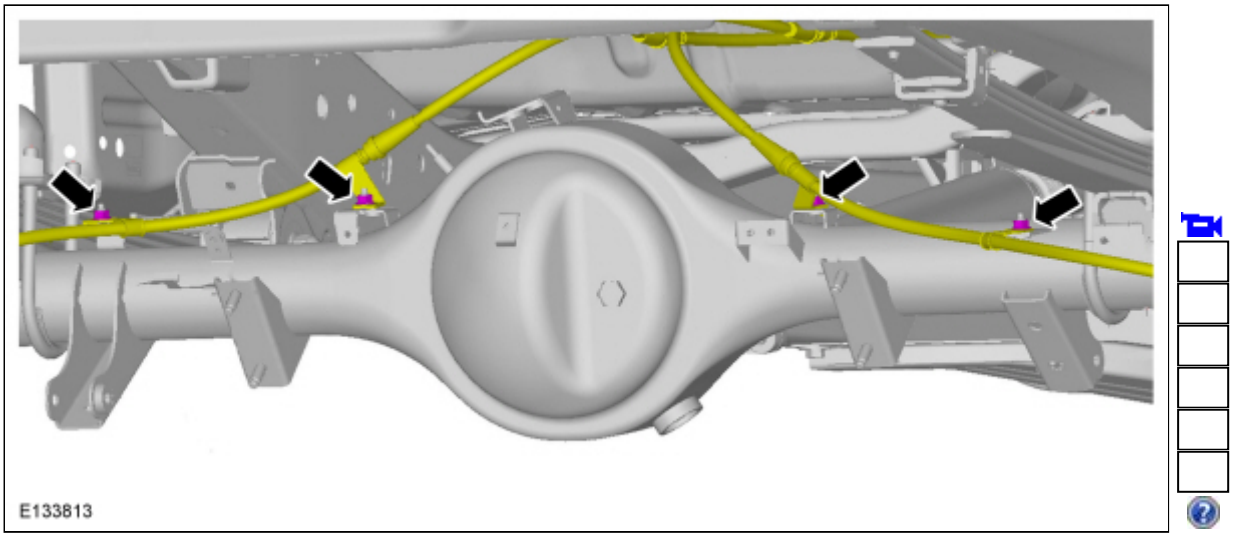
Copyright © 2016 Ford Motor Company

Parking Brake Rear Cables

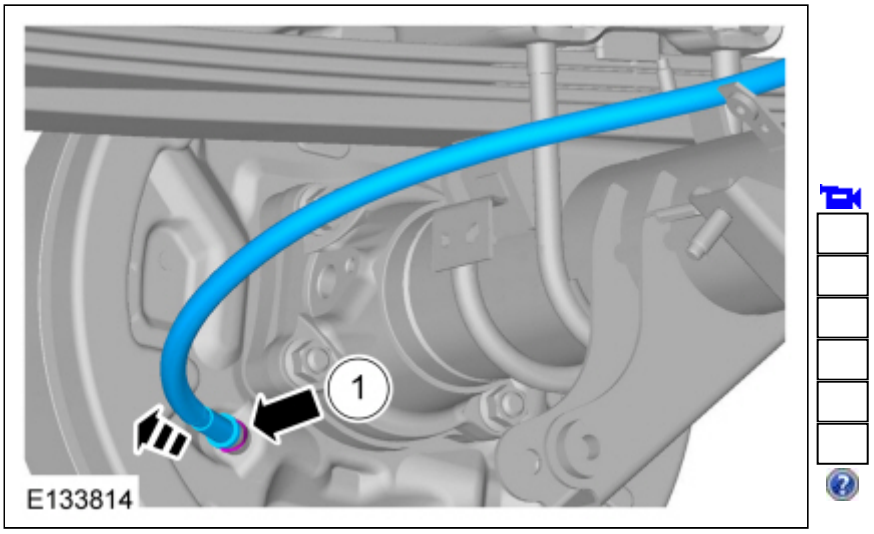
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake Shoes (206-02 Drum Brake, Removal and Installation).
2. 

3. *Torque*: 17 Nm


4. On both sides.



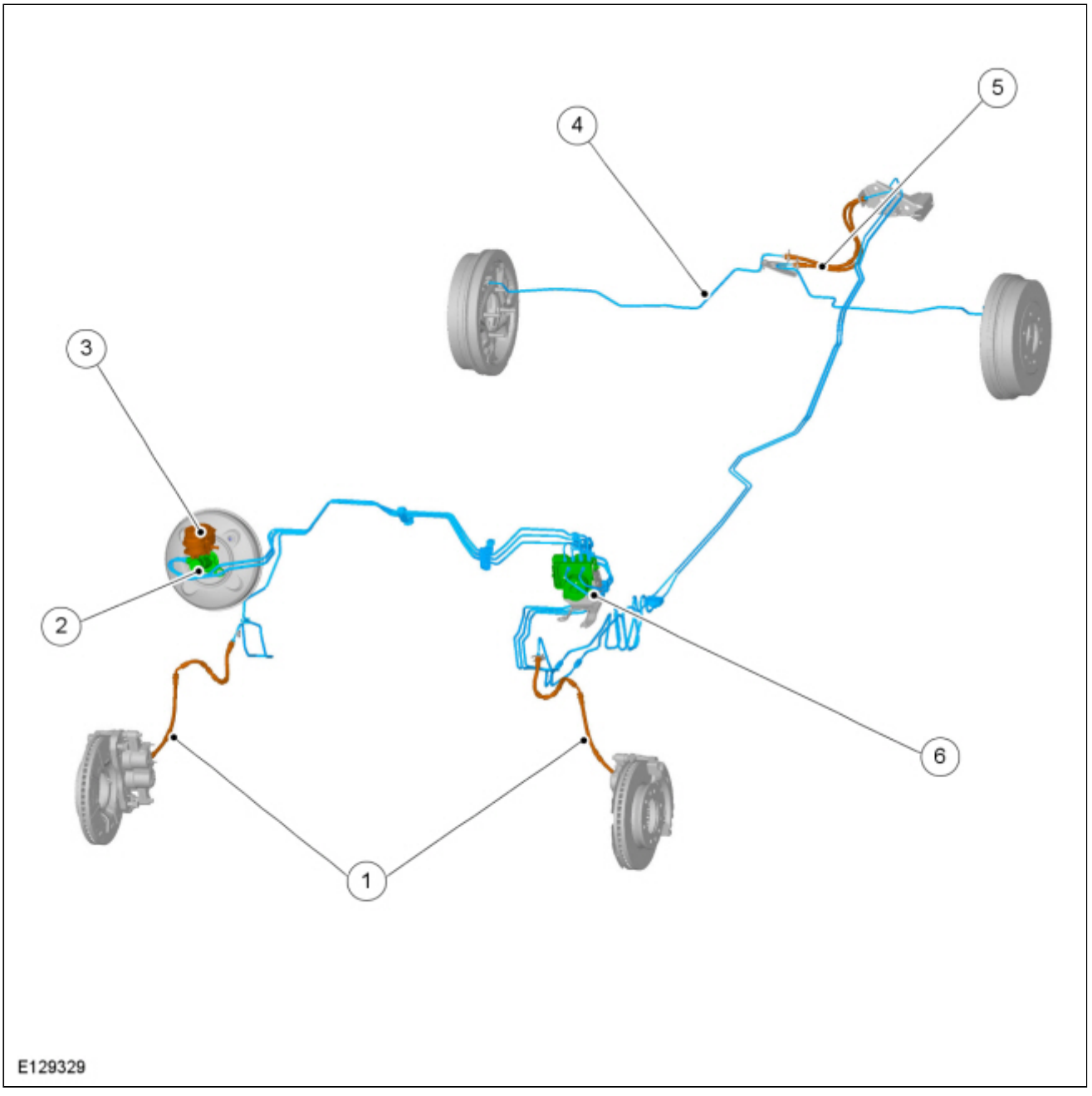
Installation

1. To install, reverse the removal procedure.
2. Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

Copyright © 2016 Ford Motor Company

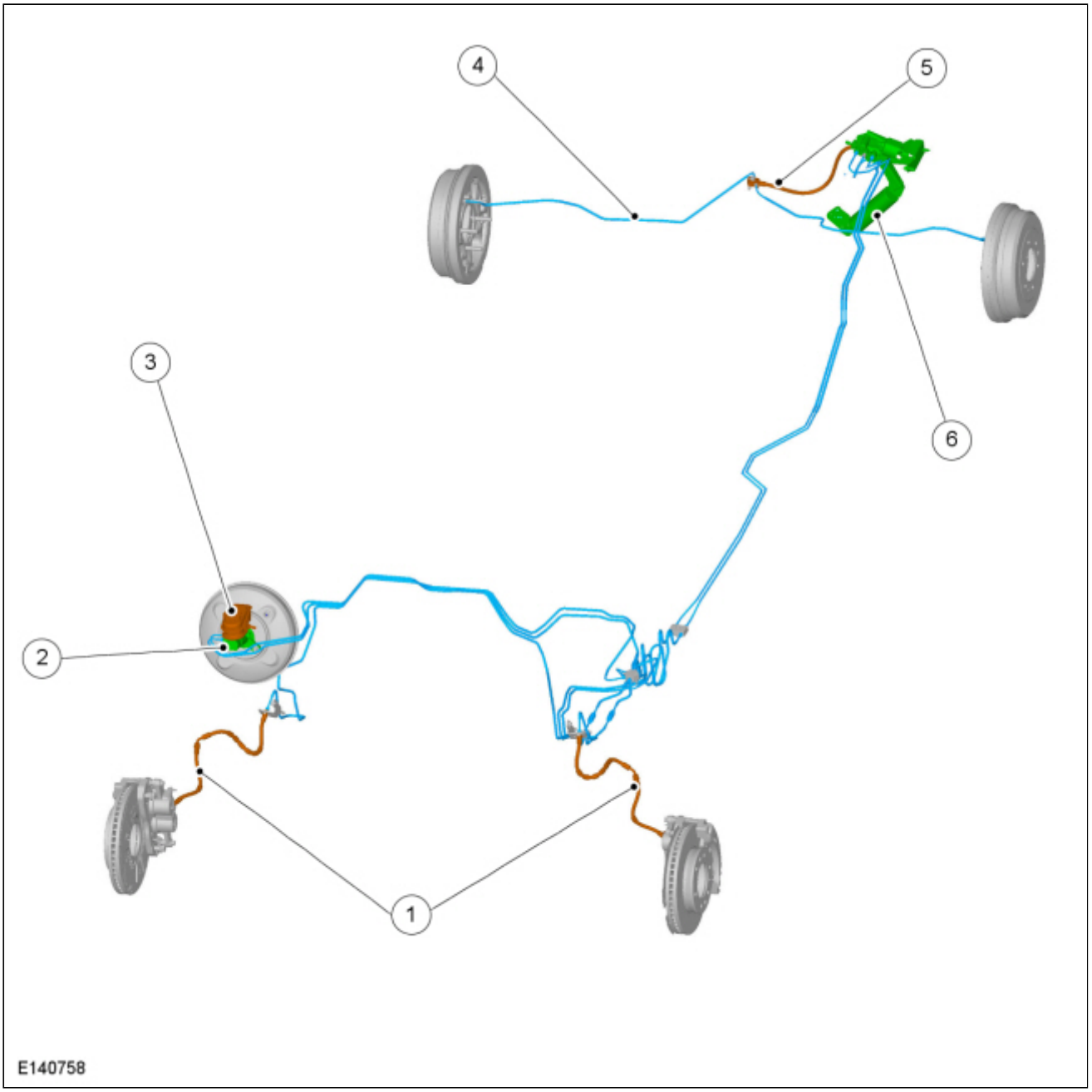
Hydraulic Brake Actuation

ABS/ESC Vehicle



Item	Part Number	Description
1	—	Front brake flexible hoses
2	—	Brake master cylinder
3	—	Brake fluid reservoir
4	—	Rear brake tubes
5	—	Rear brake flexible hoses
6	—	Hydraulic control unit (HCU)

Non ABS Vehicle



Item	Part Number	Description
1	—	Front brake flexible hoses
2	—	Brake master cylinder
3	—	Brake fluid reservoir
4	—	Rear brake tubes
5	—	Rear brake flexible hose
6	—	Brake load sensor proportioning valve

Copyright © 2016 Ford Motor Company

Hydraulic Brake Actuation

For additional information, refer to Section 206-00.

Copyright © 2016 Ford Motor Company

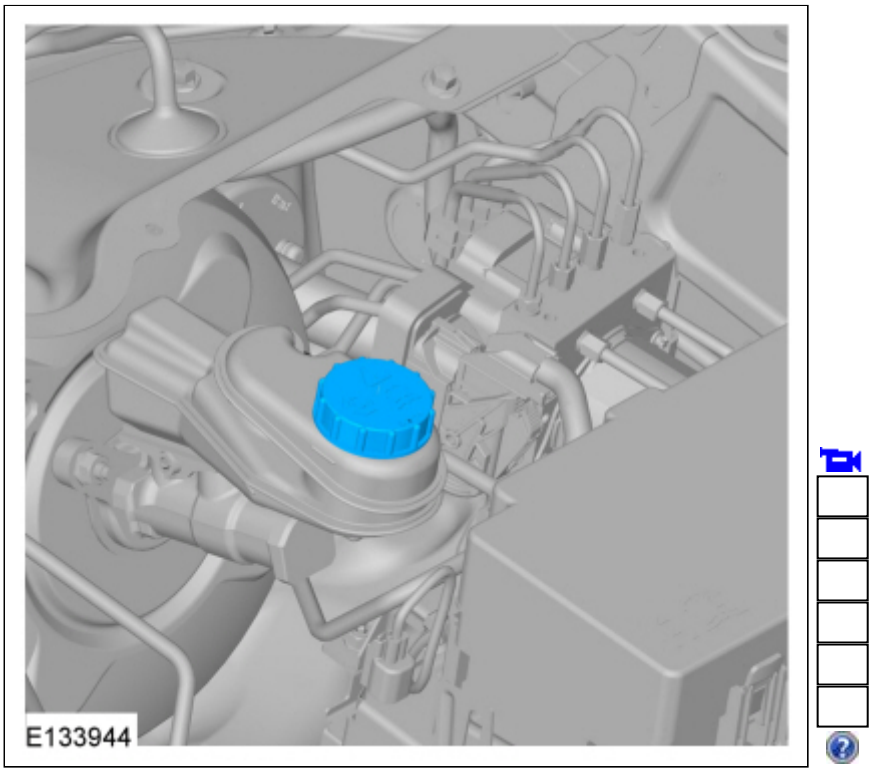
Brake Master Cylinder - LHD 4WD/LHD RWD

Base Part Number: 2A032

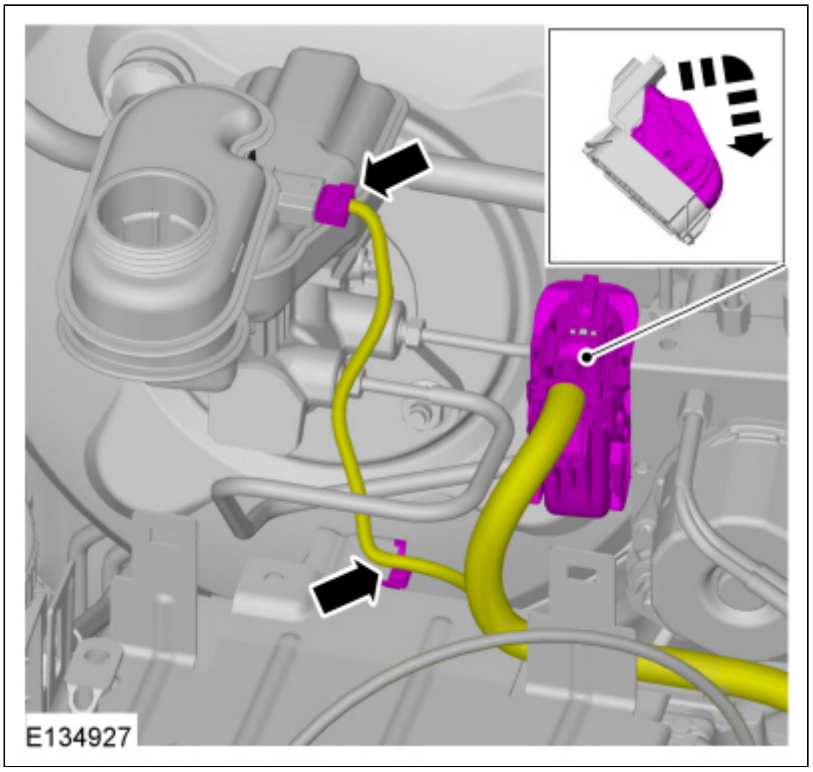
Removal

NOTICE: Before removing the master cylinder, relieve the vacuum in the brake booster or the master cylinder O-ring seal may be drawn into the brake booster, causing brake booster failure and increased brake pedal effort.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

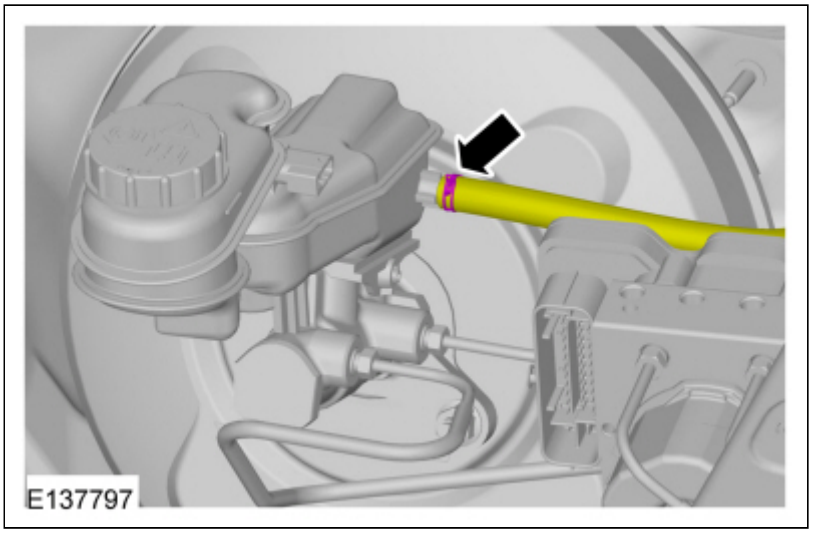
    1. Connect one end of a suitable piece of clear plastic pipe to the brake caliper bleed nipple and place the other end into a suitable container.
    2. Loosen the bleed nipple.
    3. Depress the brake pedal until no more brake fluid comes through the bleed nipple.
    4. Tighten the bleed nipple.
    5. Repeat the draining procedure on the opposite side brake caliper.
4.



Vehicles with manual transmission

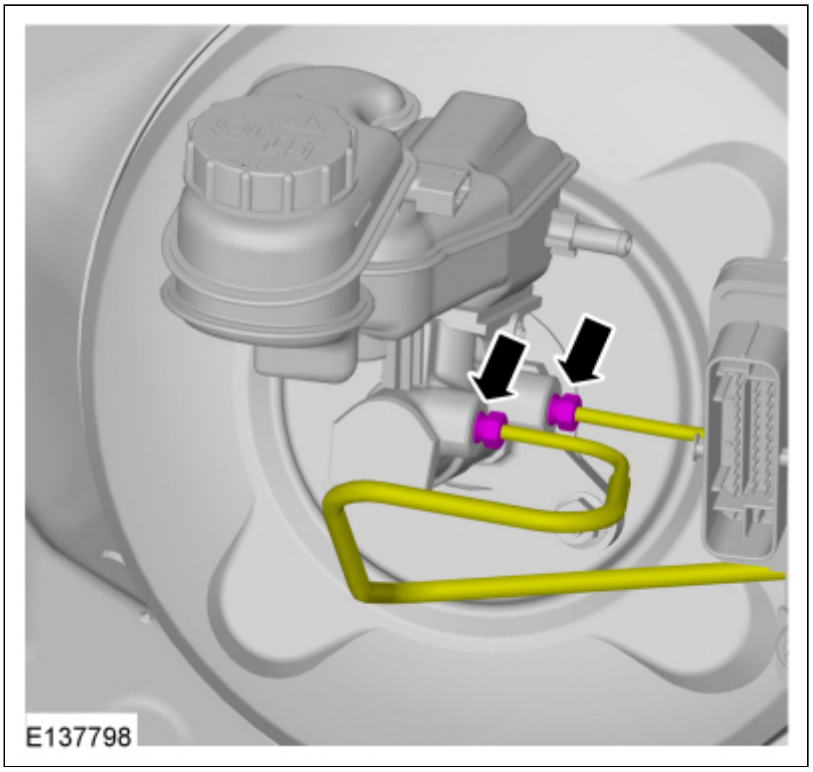
5. 

NOTE: *Be prepared to collect escaping fluids.*



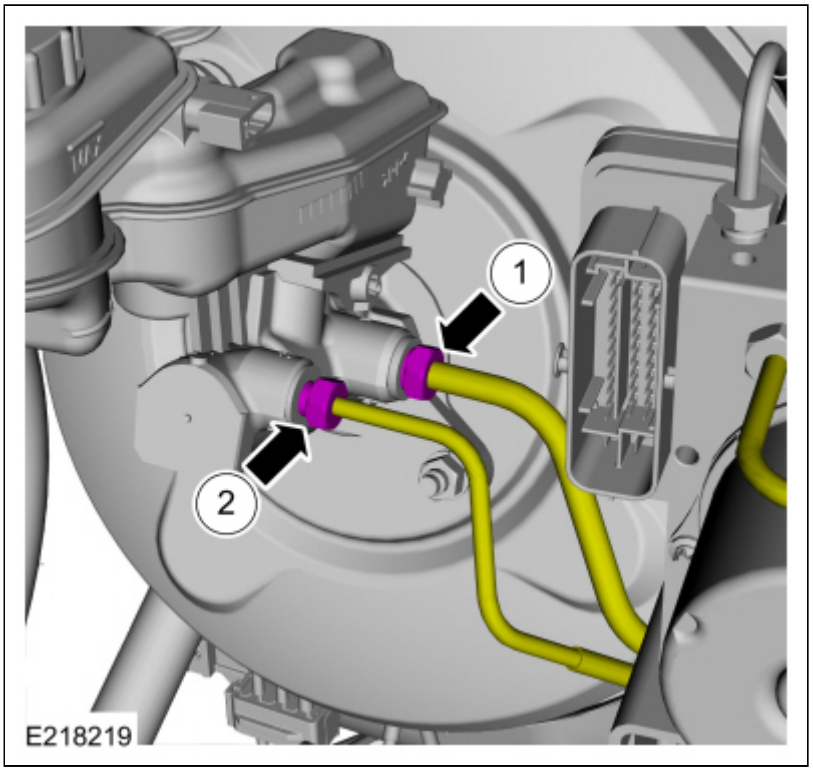
Vehicles With: 4-Channel ABS

6. *Torque*: 17 Nm



Vehicles With: 4-Channel ABS/Stability Assist/Hill Start Assist

1. *Torque*: 28 Nm
2. *Torque*: 23 Nm



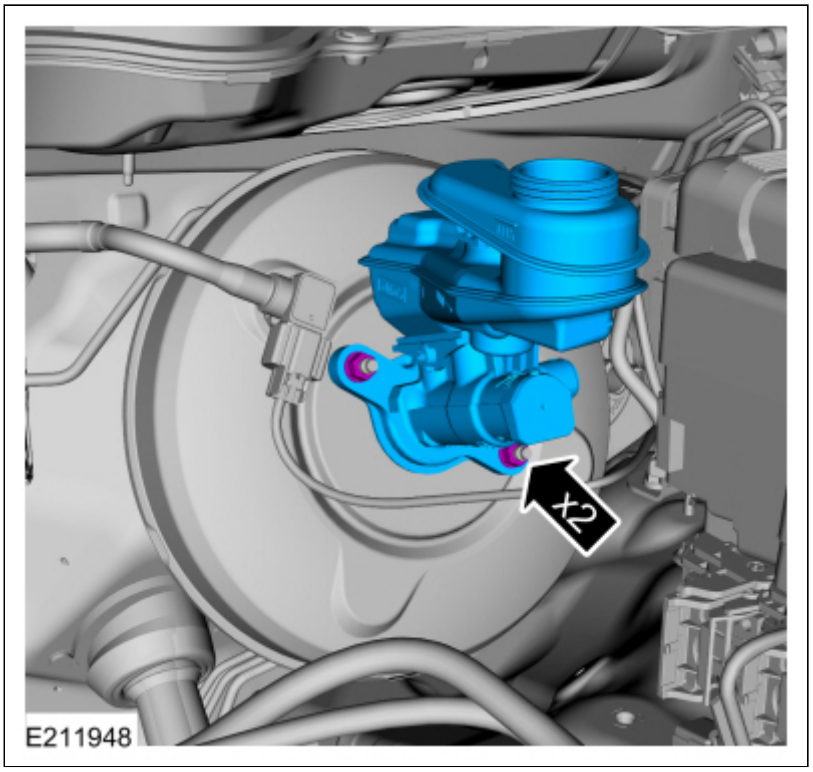
Vehicles With: Auto-Start-Stop

8. **NOTICE: Make sure that all openings are sealed.**

   NOTICE: Take extra care when handling the components.

   NOTE: *Depress the brake pedal 3 to 4 times to release the vacuum from brake booster.*

   Torque: 13 Nm



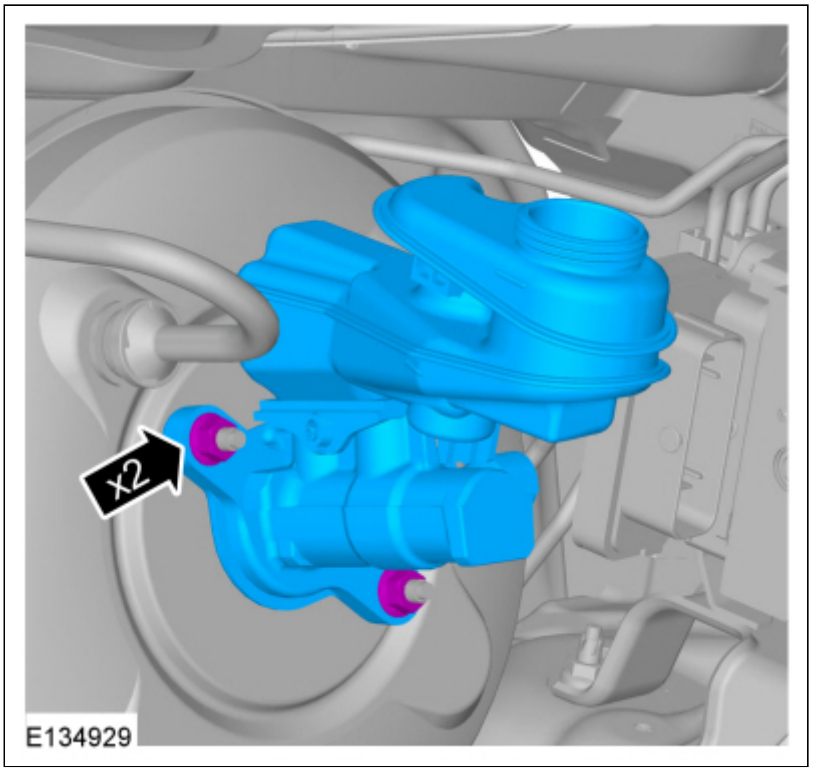
All vehicles

9. **NOTICE: Make sure that all openings are sealed.**

   NOTICE: Take extra care when handling the components.

   NOTE: *Depress the brake pedal 3 to 4 times to release the vacuum from brake booster.*

   Torque: 13 Nm



Installation

1. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

2. To install, reverse the removal procedure.

Vehicles with manual transmission

3. Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).
   Refer to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).

Copyright © 2016 Ford Motor Company

Brake Master Cylinder - RHD 4WD/RHD RWD

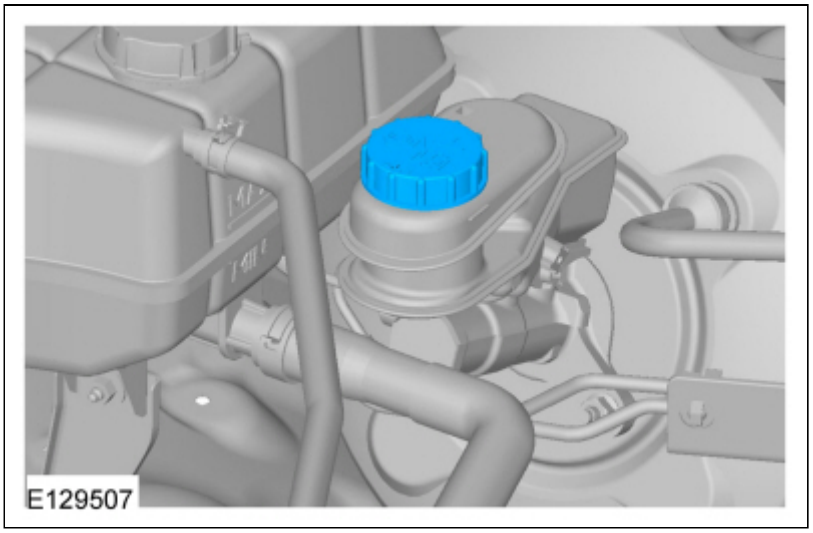
Base Part Number: 2A032

Removal

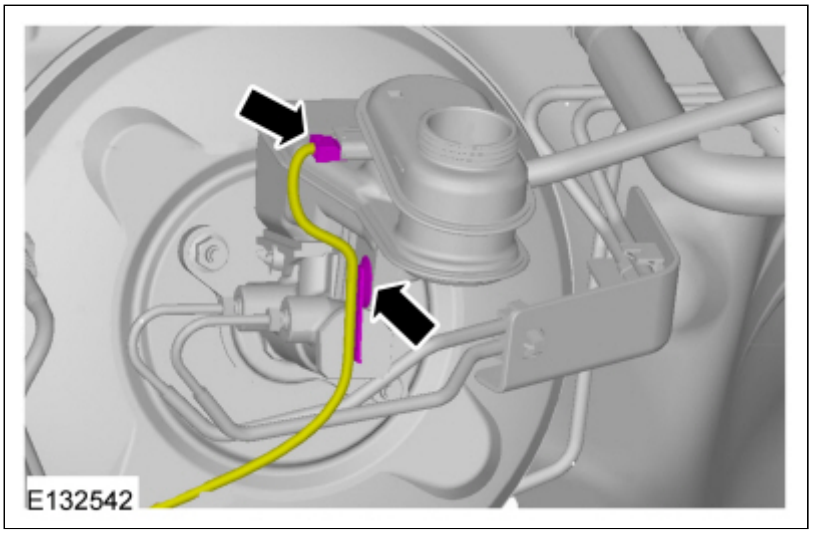
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Connect one end of a suitable piece of clear plastic pipe to the brake caliper bleed nipple and place the other end into a suitable container.
2. Loosen the bleed nipple.
3. Depress the brake pedal until no more brake fluid comes through the bleed nipple.
4. Tighten the bleed nipple.
5. Repeat the draining procedure on the opposite side brake caliper.



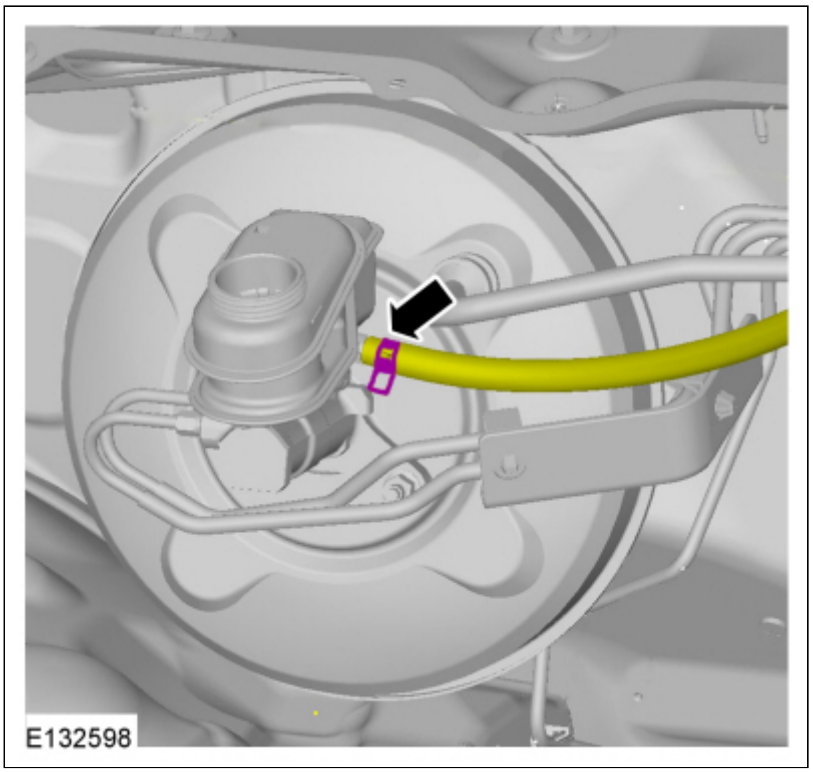
3.



Vehicles with manual transmission

4. 

NOTE: *Be prepared to collect escaping fluids.*



Vehicles With: 4-Channel ABS

5.

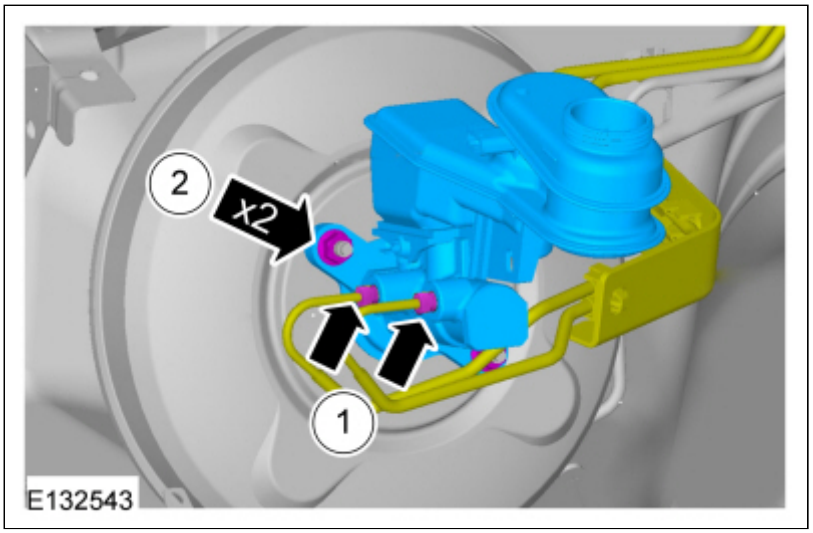
NOTICE: Make sure that all openings are sealed.

NOTICE: Take extra care when handling the components.

NOTE: *Be prepared to collect escaping fluids.*

NOTE: *Depress the brake pedal 3 or 4 times to release the vacuum from brake booster.*

1. *Torque*: 17 Nm
2. *Torque*: 13 Nm



Vehicles With: 4-Channel ABS/Stability Assist/Hill Start Assist

6.

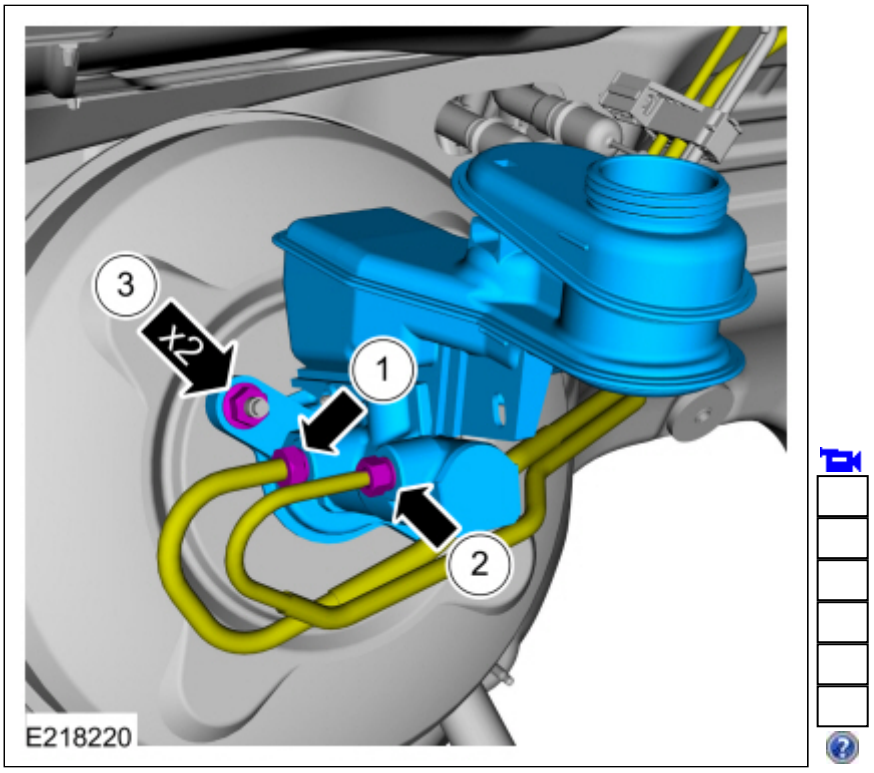
NOTICE: Make sure that all openings are sealed.

NOTICE: Take extra care when handling the components.

NOTE: *Be prepared to collect escaping fluids.*

NOTE: *Depress the brake pedal 3 or 4 times to release the vacuum from brake booster.*

1. *Torque*: 28 Nm
2. *Torque*: 23 Nm
3. *Torque*: 13 Nm



Installation

1. To install, reverse the removal procedure.
   Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

Vehicles with manual transmission

2. Refer to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).
   Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

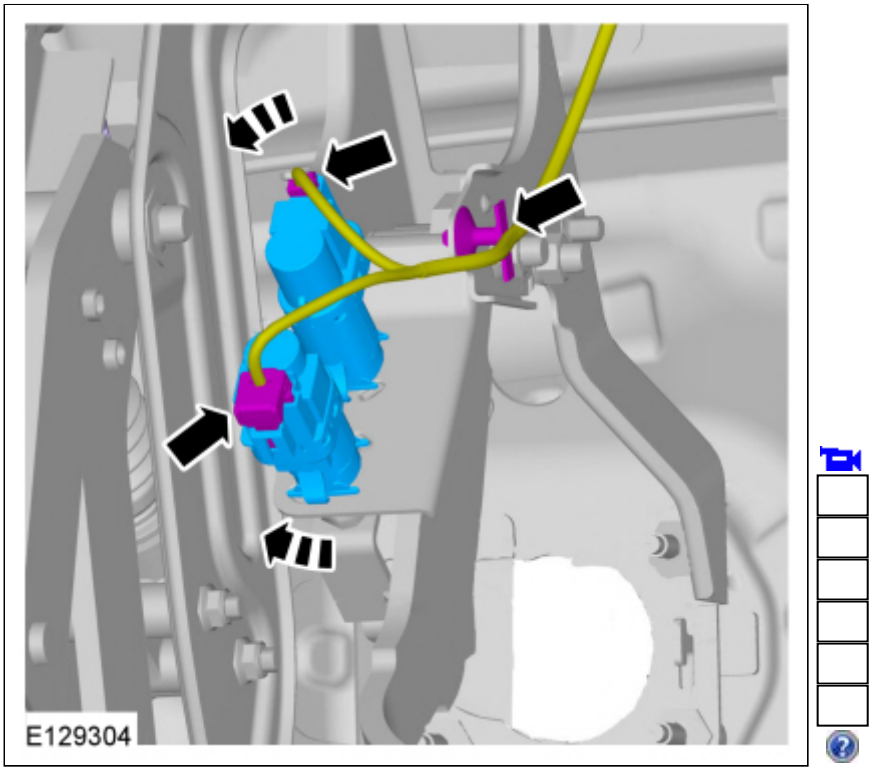
Brake Pedal and Bracket

Base Part Number: 2455

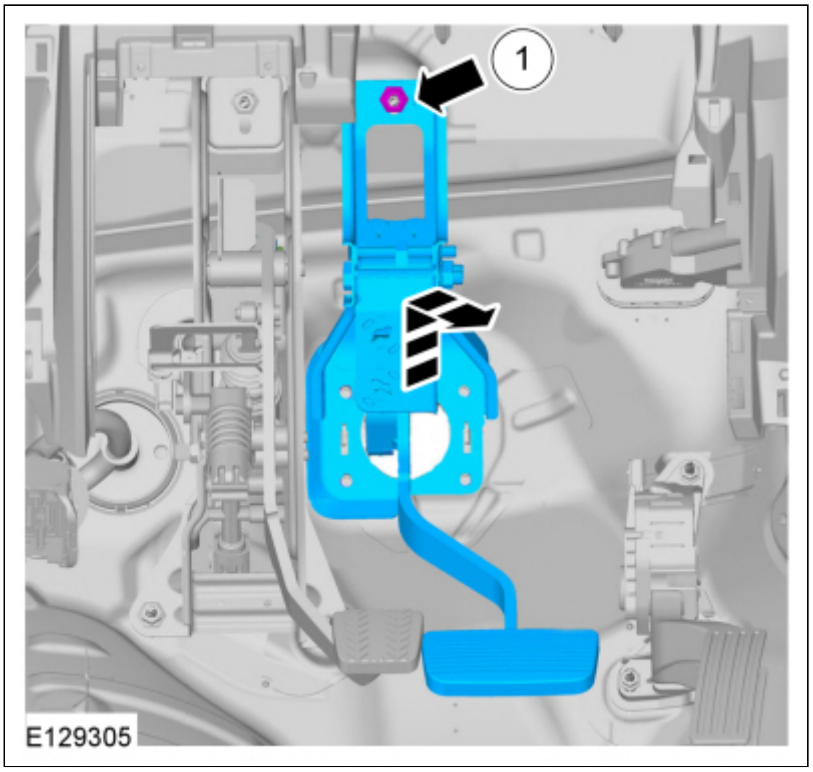
Removal

NOTICE: Do not service the brake pedal or brake booster without first removing the stoplamp switch. This switch must be removed with the brake pedal in the at-rest position. The switch plunger must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake Booster - RHD 4WD/RHD RWD (206-07 Power Brake Actuation, Removal and Installation).
   Refer to: Brake Booster - LHD 4WD/LHD RWD (206-07 Power Brake Actuation, Removal and Installation).
2. 

3. Torque : 15 Nm



Installation

1. **NOTICE: Make sure that the brake booster push rod is correctly located.**

   NOTICE: An incorrectly set Stop Lamp Switch causes either over-heating brakes in the case of the pedal being pushed down or ABS faults in the case of it being lifted during Stop Lamp Switch installation. To avoid damages to the brake system, remove the Stop Lamp Switch and install with the brake pedal in neutral position.

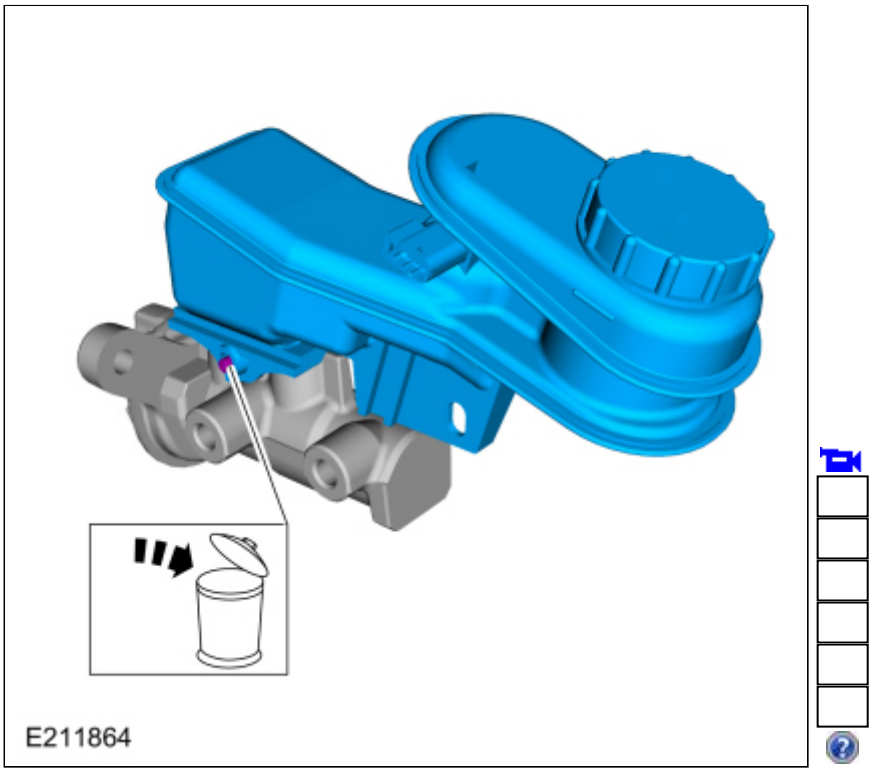
   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Brake Fluid Reservoir

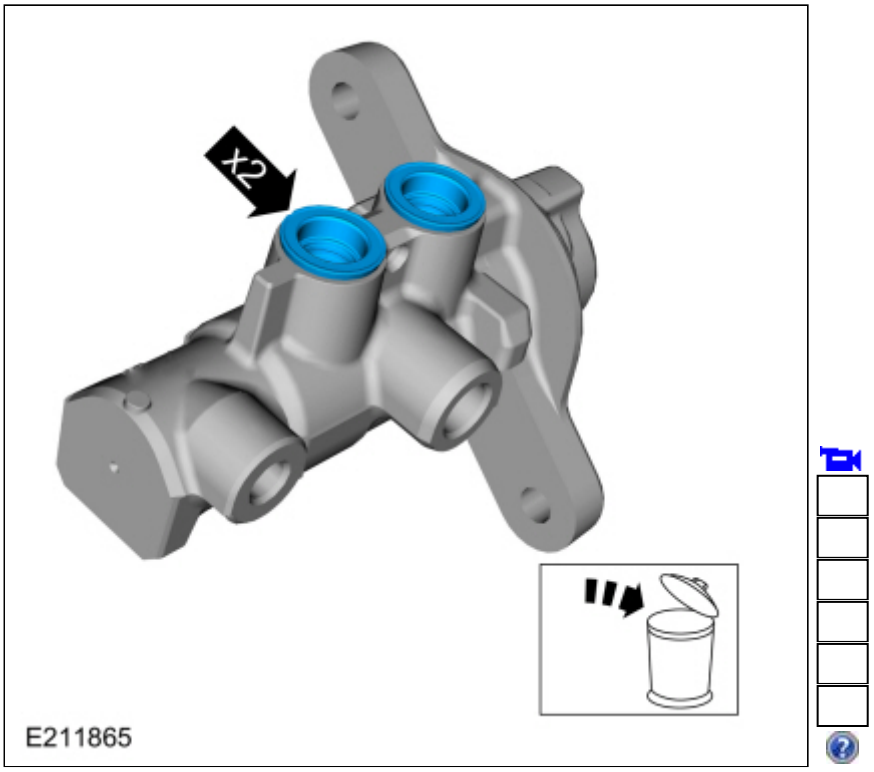
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Brake Master Cylinder - LHD 4WD/LHD RWD (206-06 Hydraulic Brake Actuation, Removal and Installation).
3. Refer to: Brake Master Cylinder - RHD 4WD/RHD RWD (206-06 Hydraulic Brake Actuation, Removal and Installation).
4. 

5. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure a new component is installed.*



Installation

1. To install, reverse the removal procedure.
2. Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Brake System

For additional information, refer to Section 206-00.

Copyright © 2016 Ford Motor Company

Brake Booster - LHD 4WD/LHD RWD

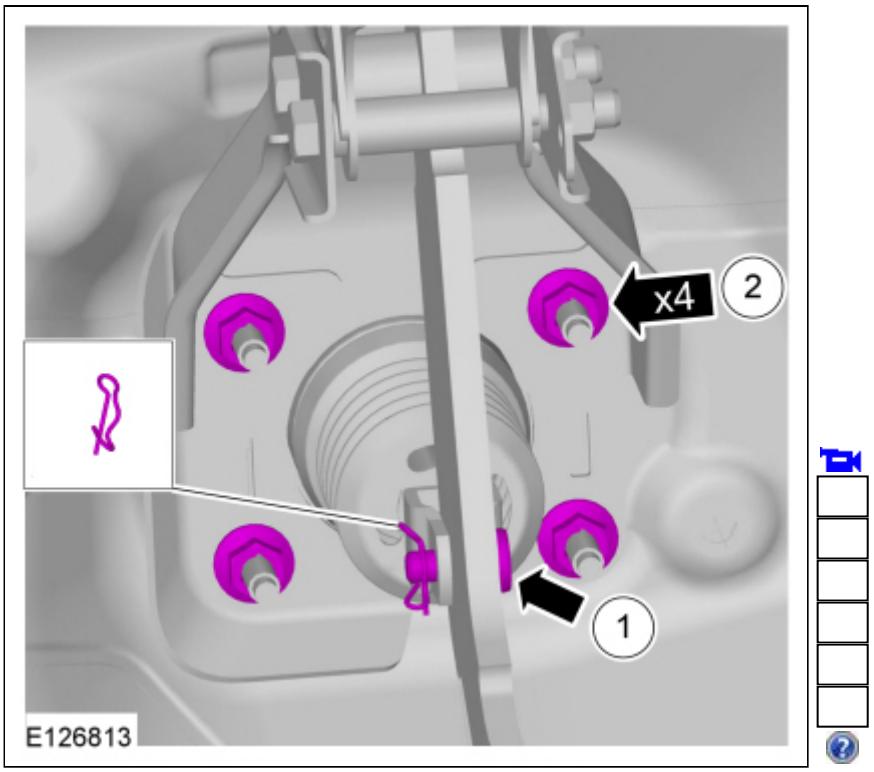
Base Part Number: 2002

Removal

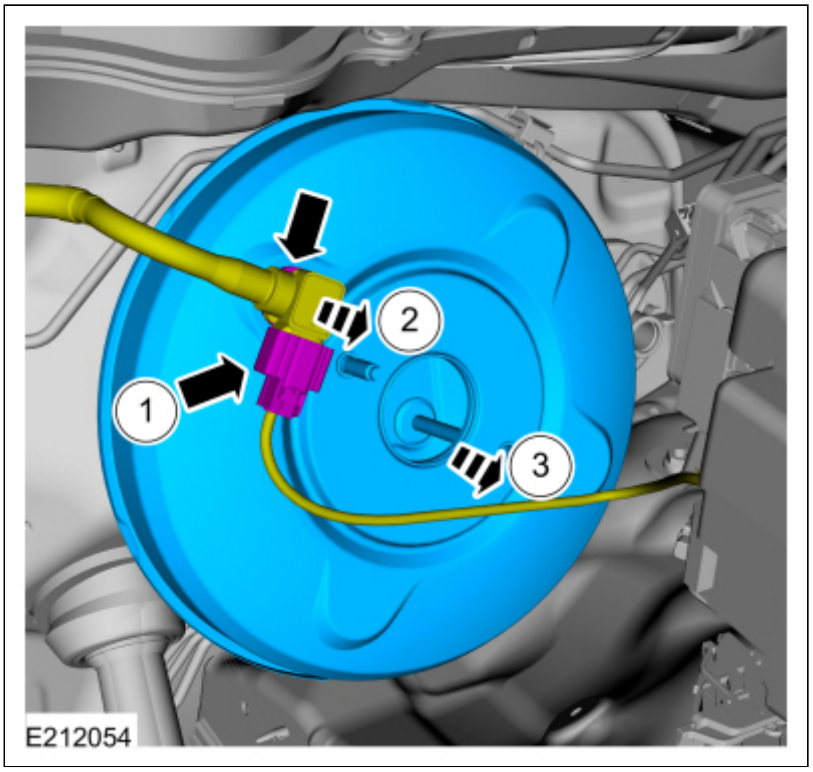
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Brake Master Cylinder - LHD 4WD/LHD RWD (206-06 Hydraulic Brake Actuation, Removal and Installation).

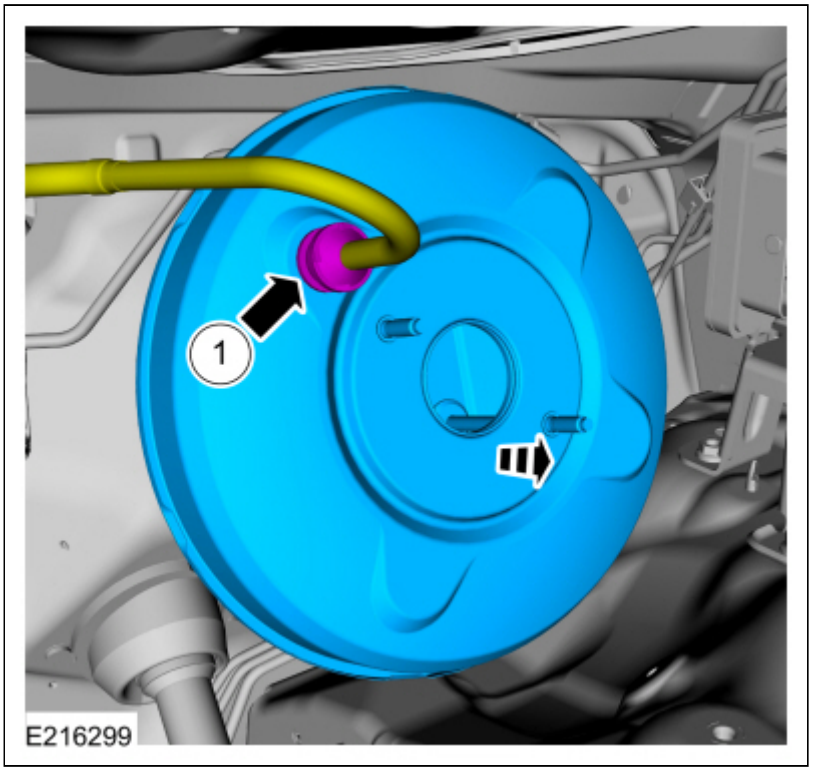
2. *Torque*: 15 Nm



5. Vehicles With: Auto-Start-Stop



6. Vehicles Without: Auto-Start-Stop



Installation

NOTICE: Make sure that the brake booster push rod is correctly located.

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

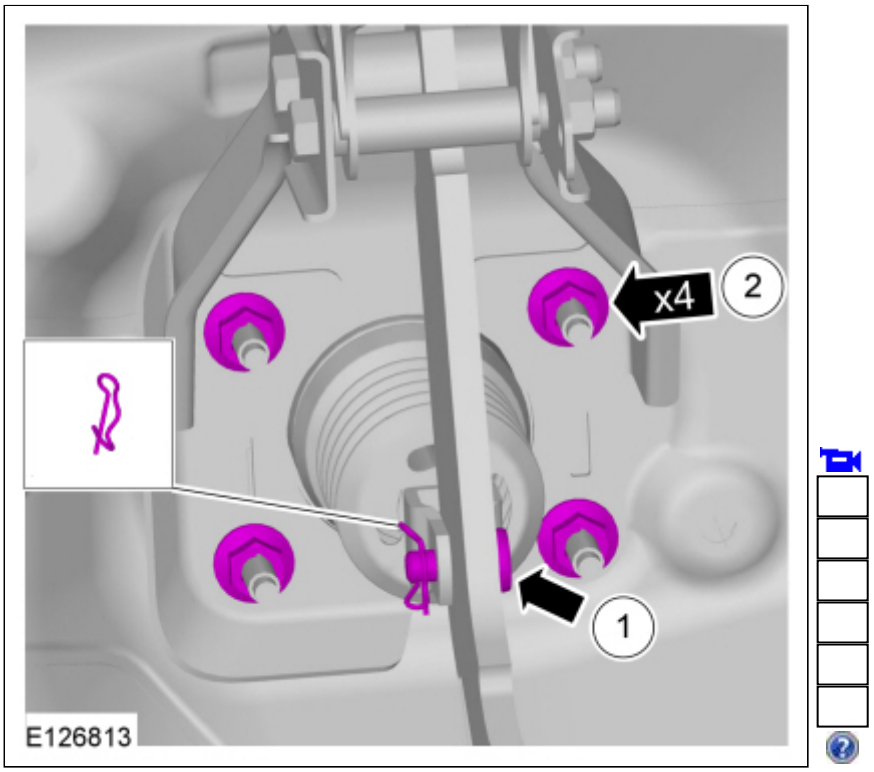
Brake Booster - RHD 4WD/RHD RWD

Base Part Number: 2002

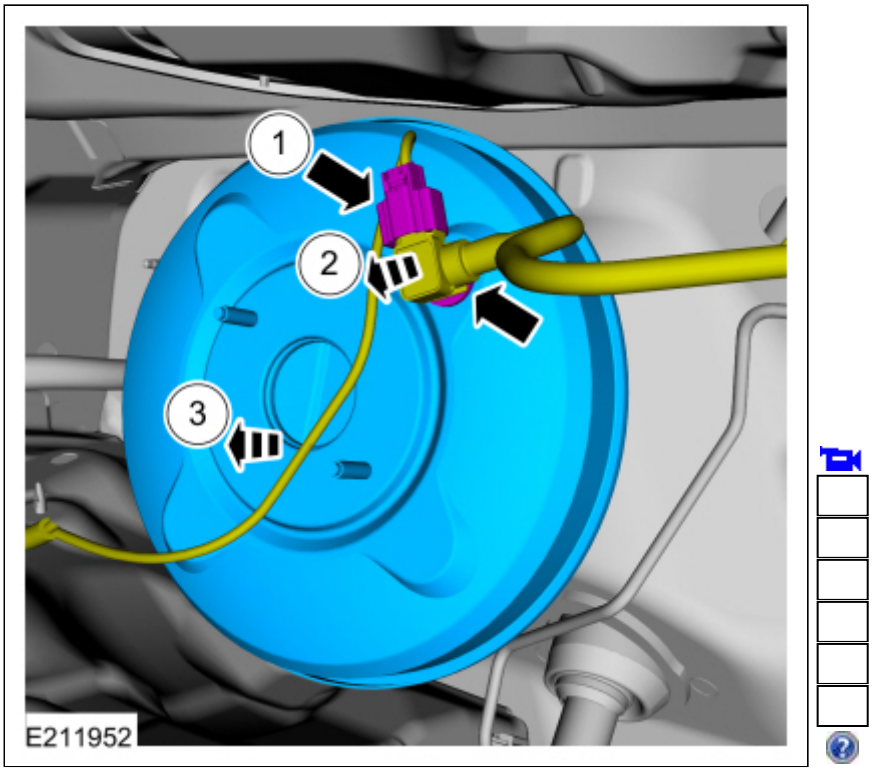
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

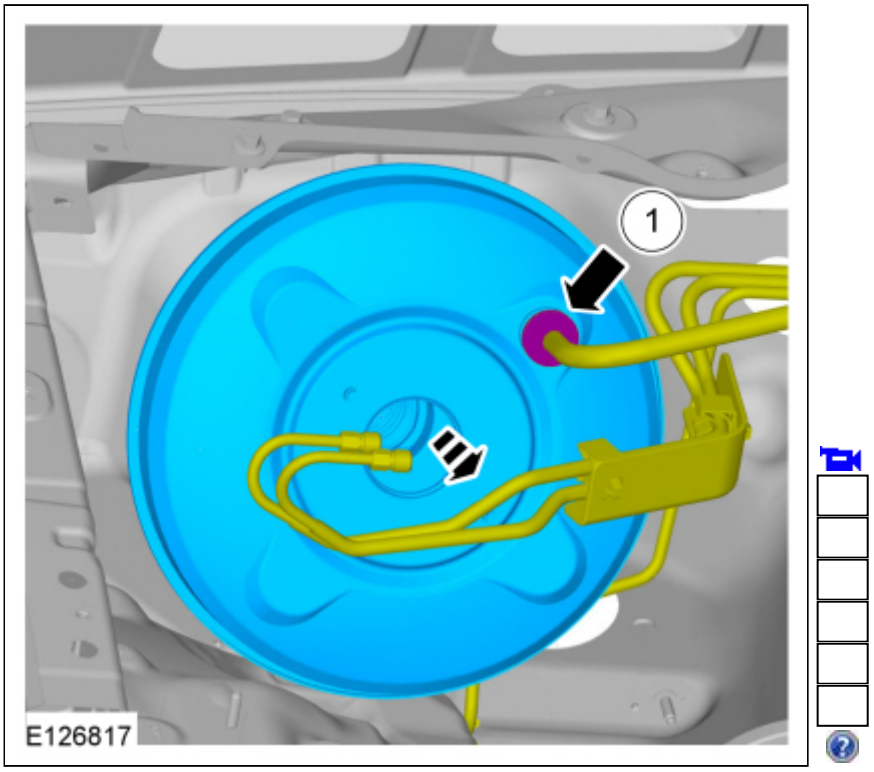
1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Brake Master Cylinder - LHD 4WD/LHD RWD (206-06 Hydraulic Brake Actuation, Removal and Installation).
3. *Torque*: 15 Nm



4. Vehicles With: Auto-Start-Stop



5. Vehicles Without: Auto-Start-Stop



Installation

NOTICE: Make sure that the brake booster push rod is correctly located.

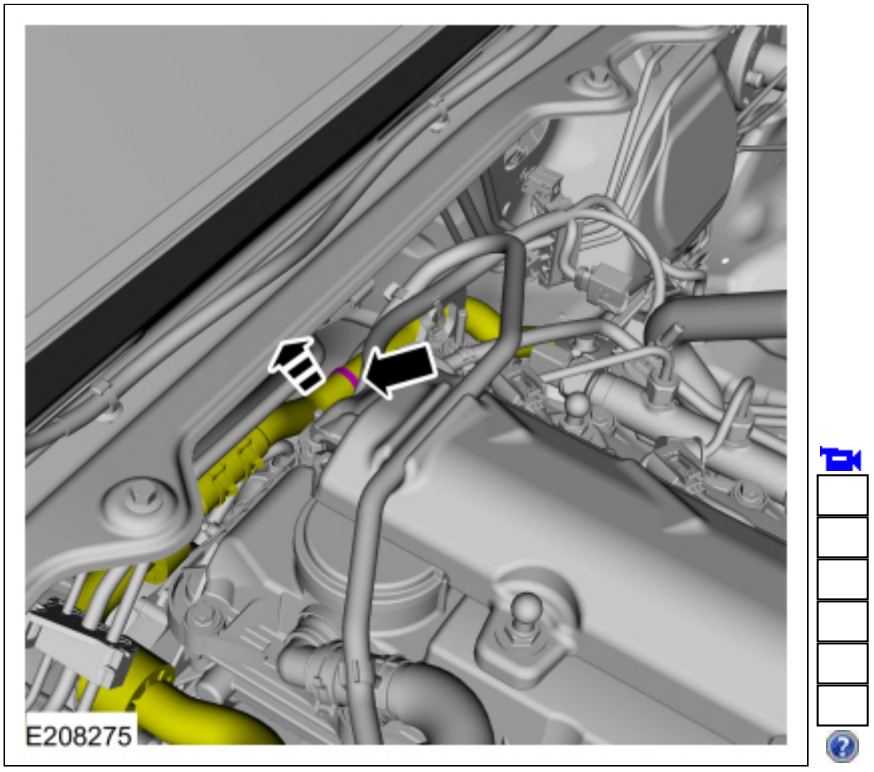
1. To install , reverse the removal procedure.

Copyright © 2016 Ford Motor Company

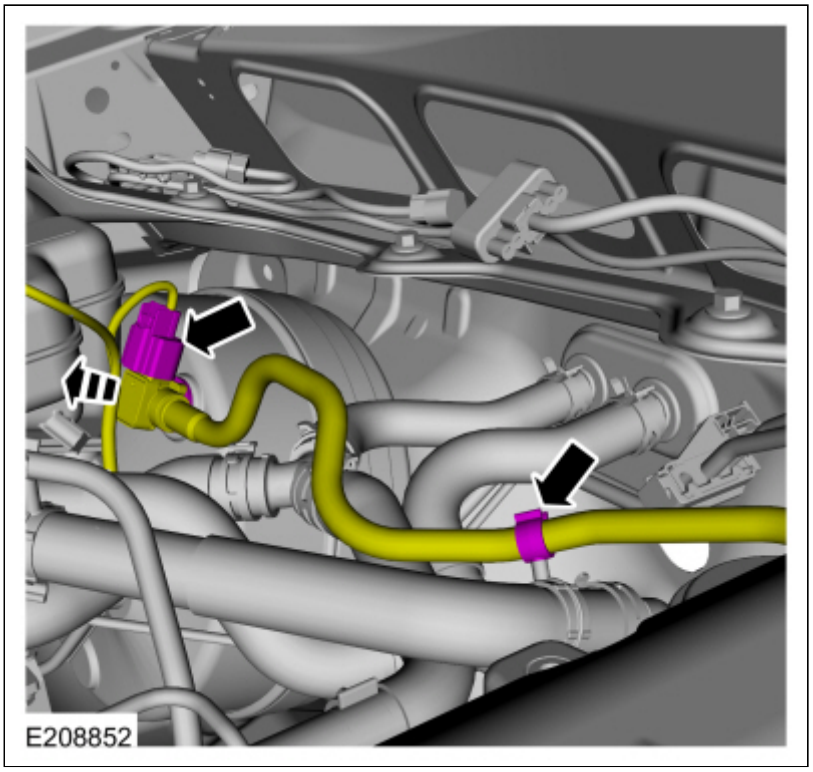
Brake Vacuum Pump - RHD

Base Part Number: 2A451

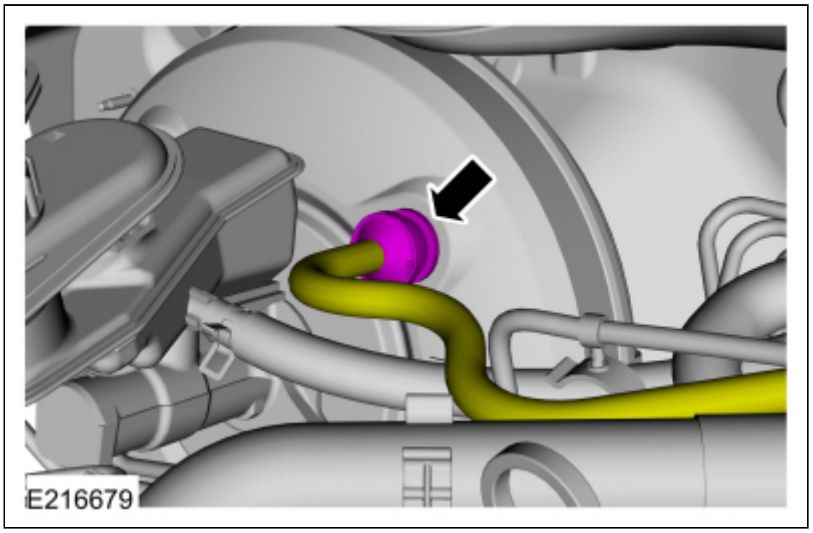
Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
3. 

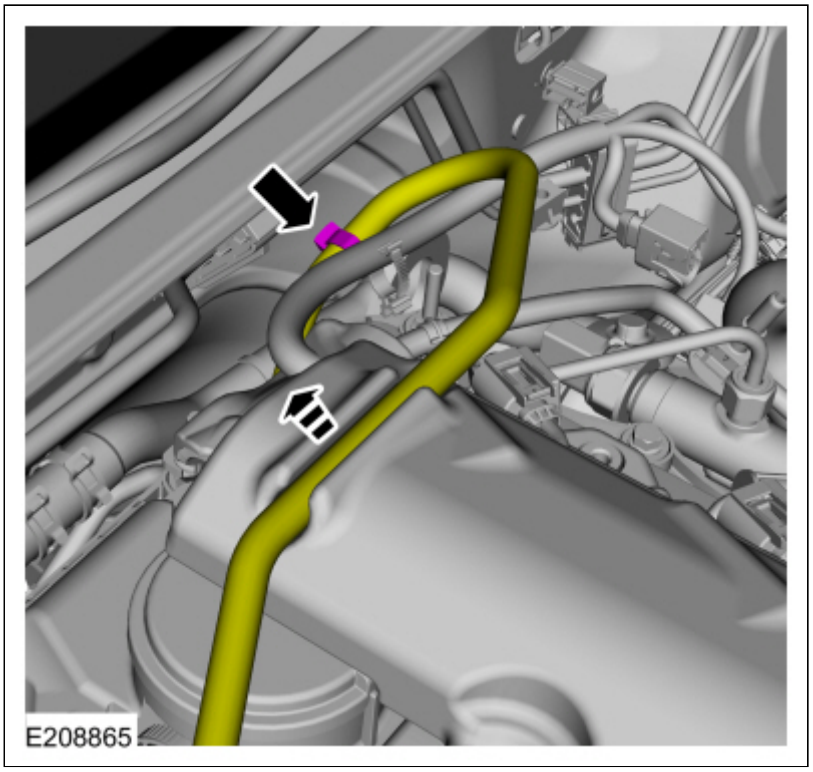
4. If equipped



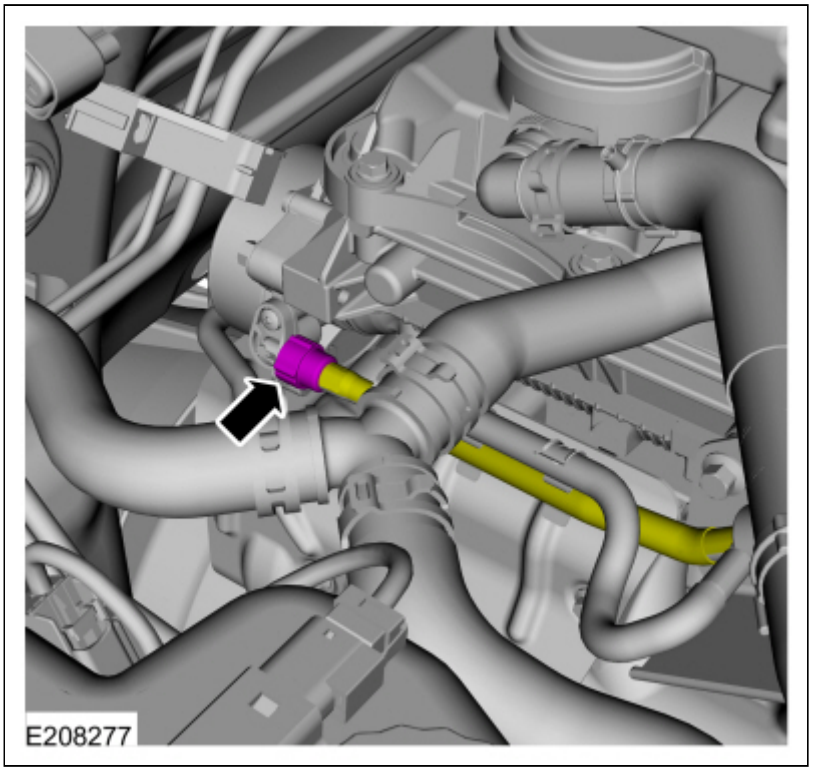
5.



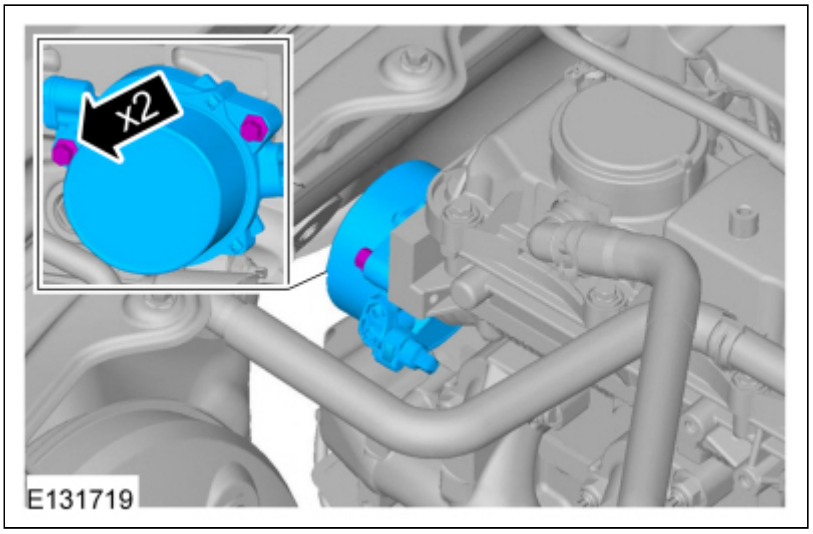
6.



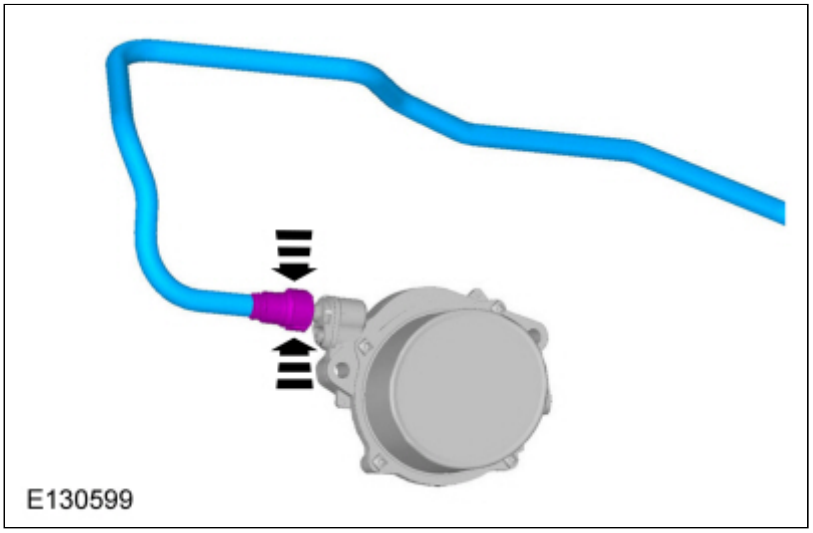
7.



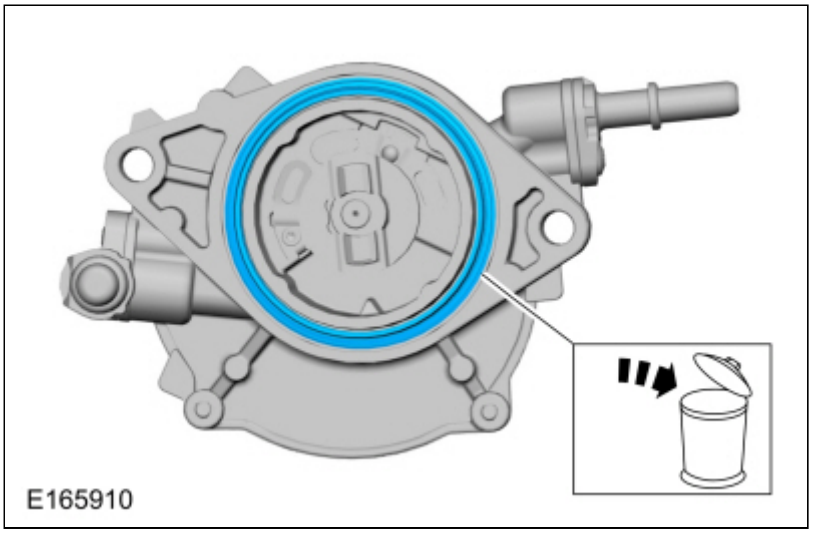
8.



9.

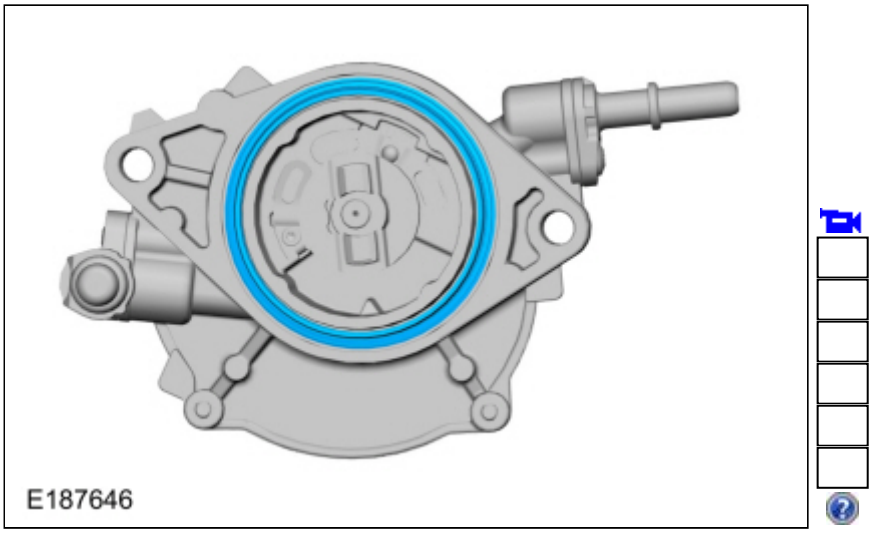


10.

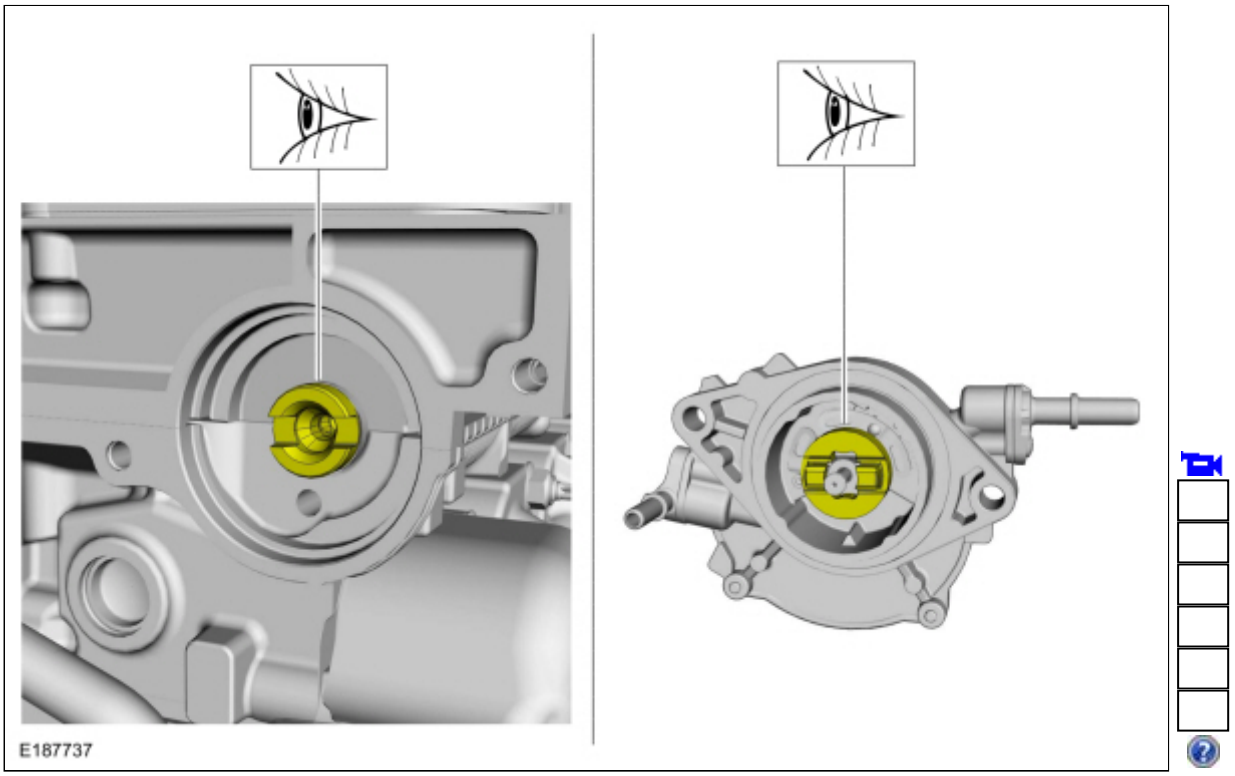


Installation

1.



2. **NOTICE: Align the camshaft and vacuum pump couplings correctly or damage to the camshaft or vacuum pump may occur.**

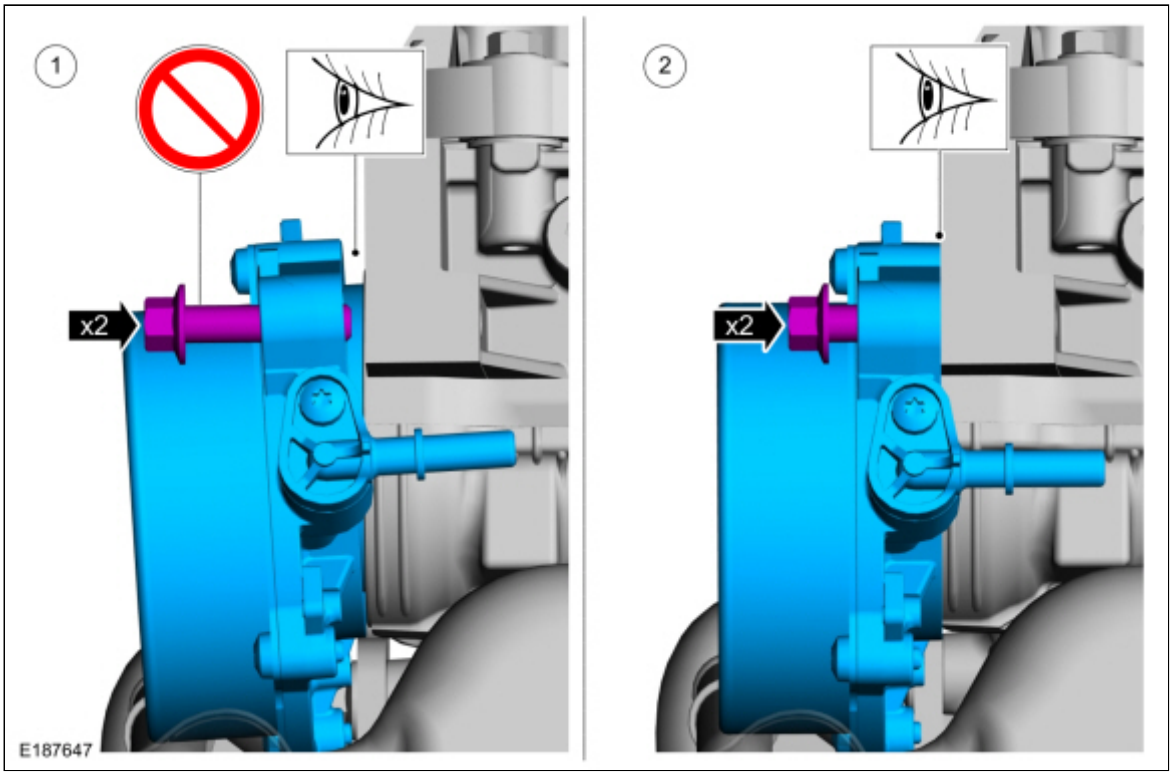


3. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

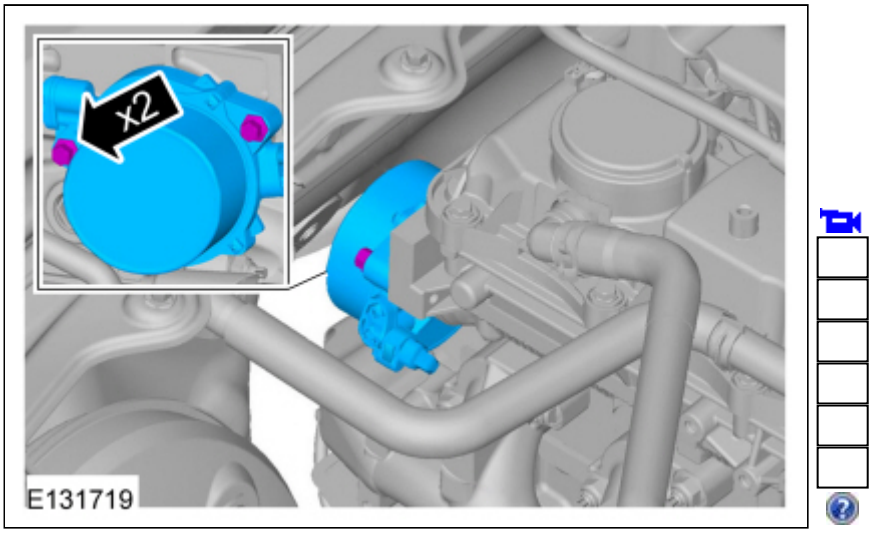
    1. **NOTE:** *Before fitting bolts, check that the vacuum pump couple drive and camshaft keyway are aligned. If a gap is present between vacuum pump and cylinder head, do not fit and run bolts.*

       NOTE: *Under no circumstances should the retaining bolts be tightened if a gap between pump and head faces is present.*

    2. **NOTE:** *Only tighten the bolts finger tight at this stage.*



4. *Torque*: 23 Nm



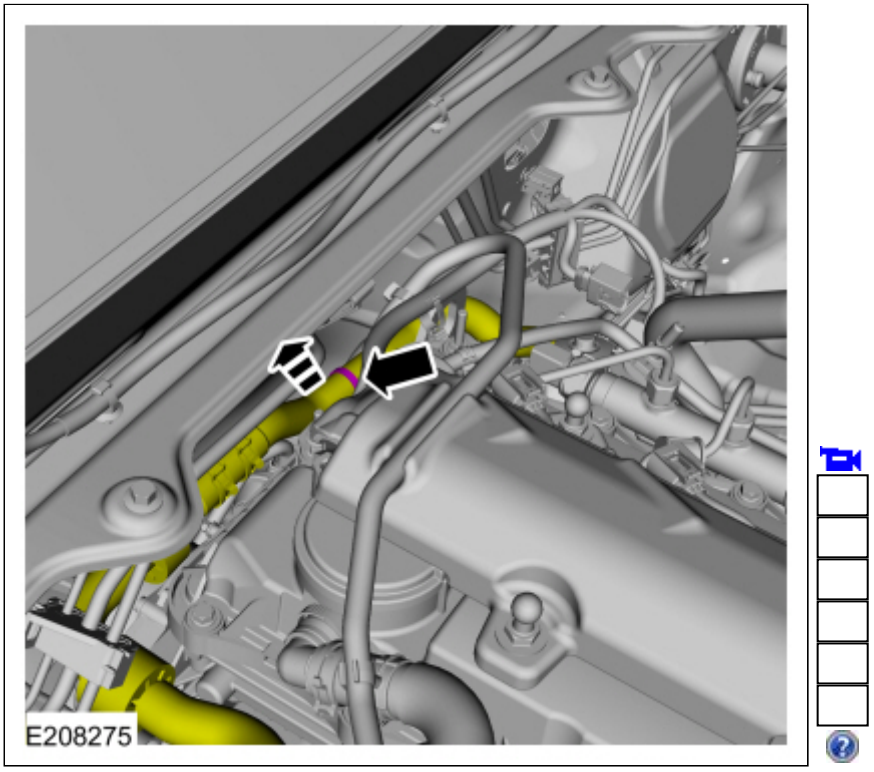
5. To install, reverse the removal procedure.

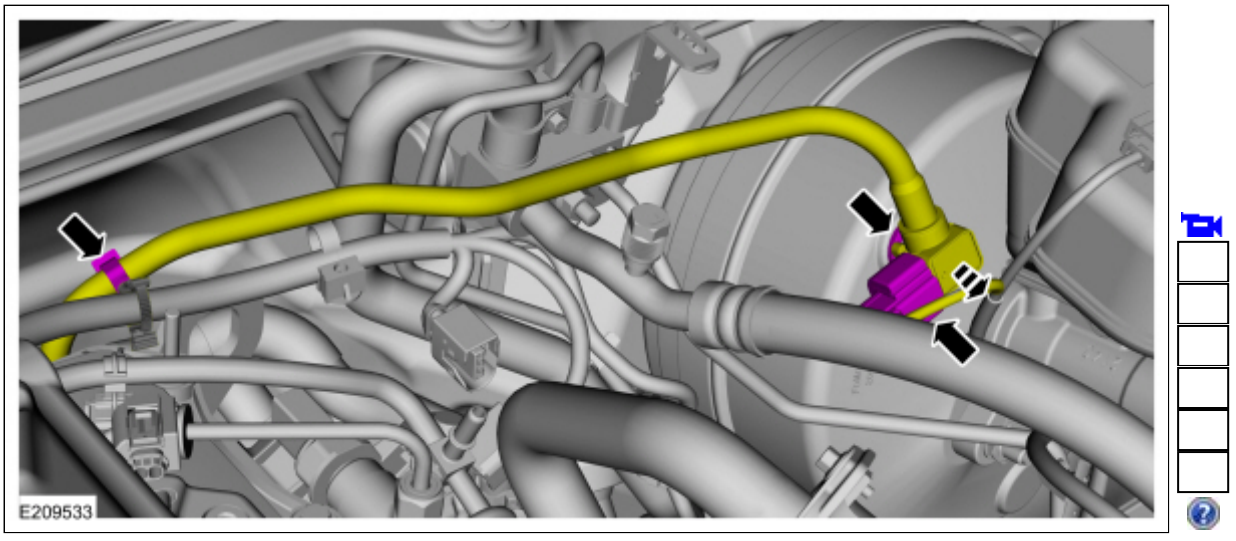
Copyright © 2016 Ford Motor Company

Brake Vacuum Pump - LHD

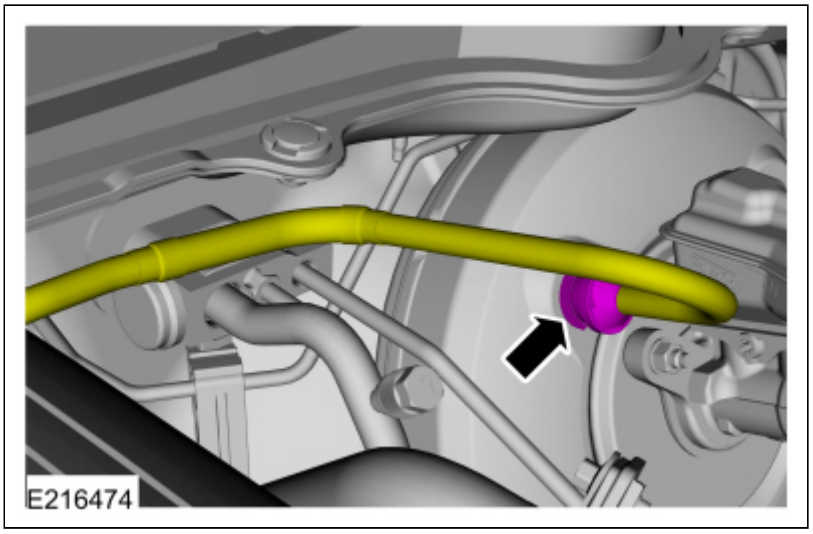
Base Part Number: 2A451

Removal

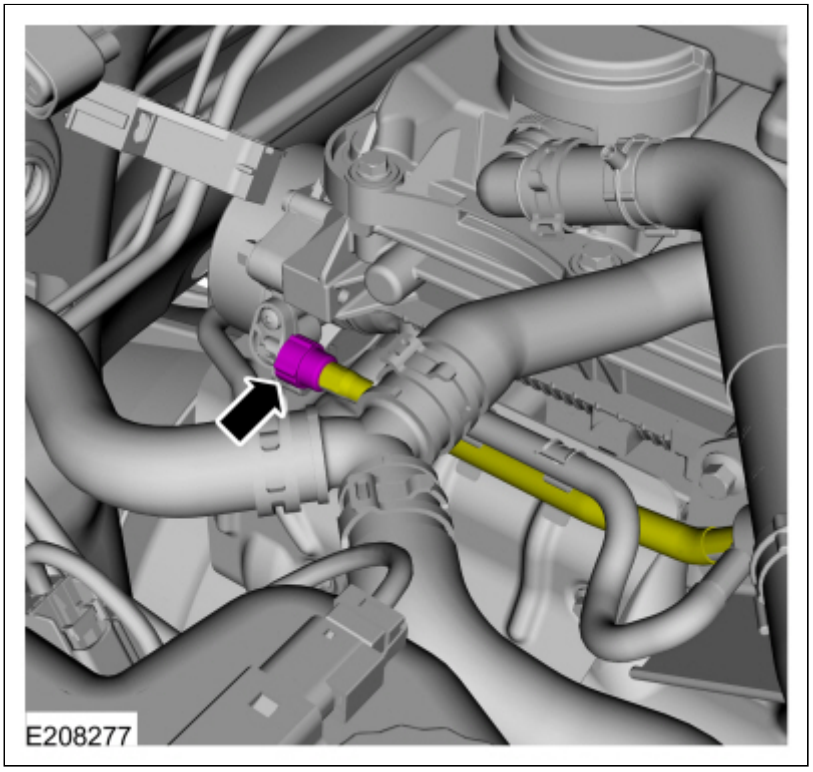
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
3. 

4. If equipped


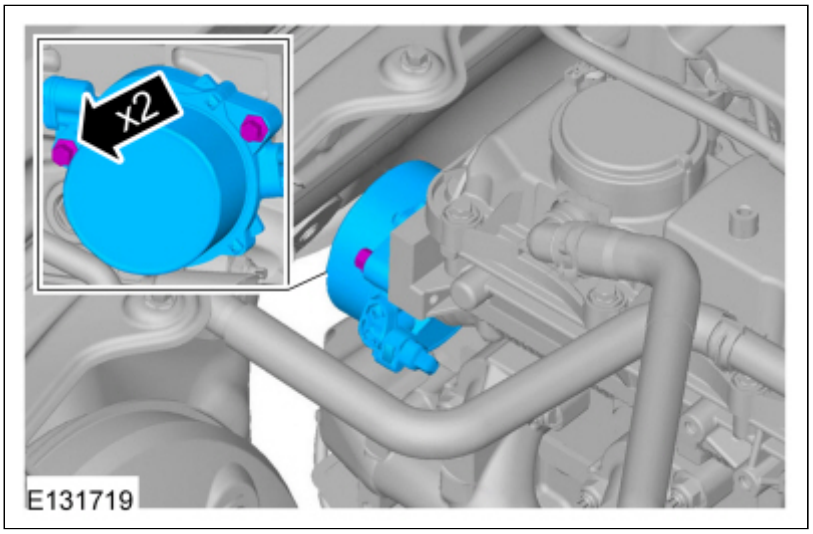
5.



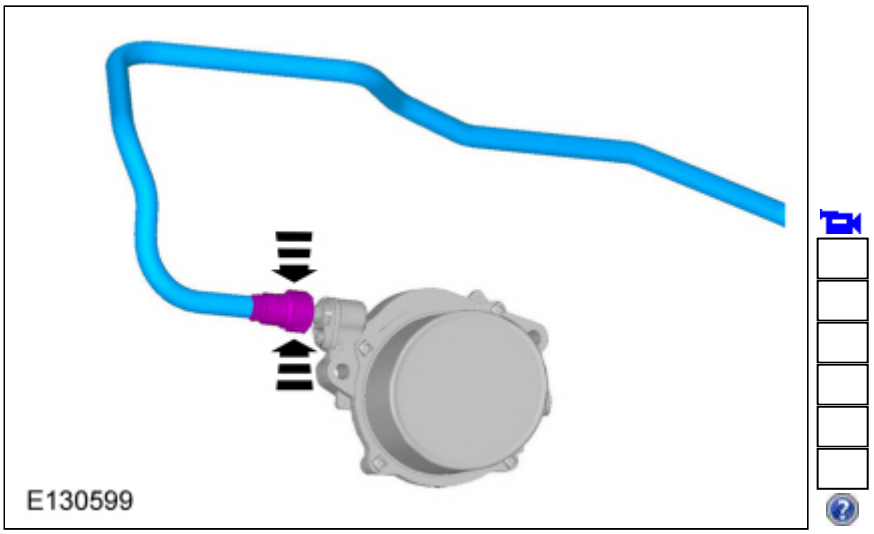
6.



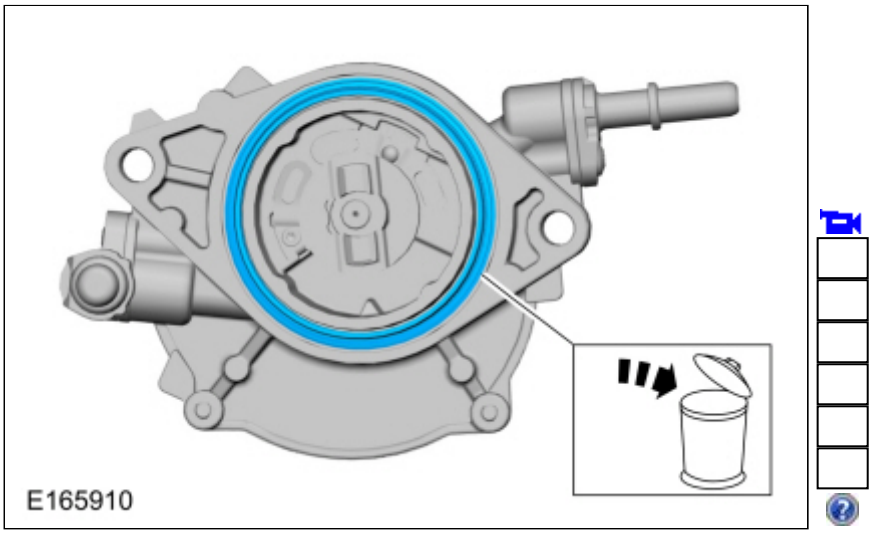
7.



8.

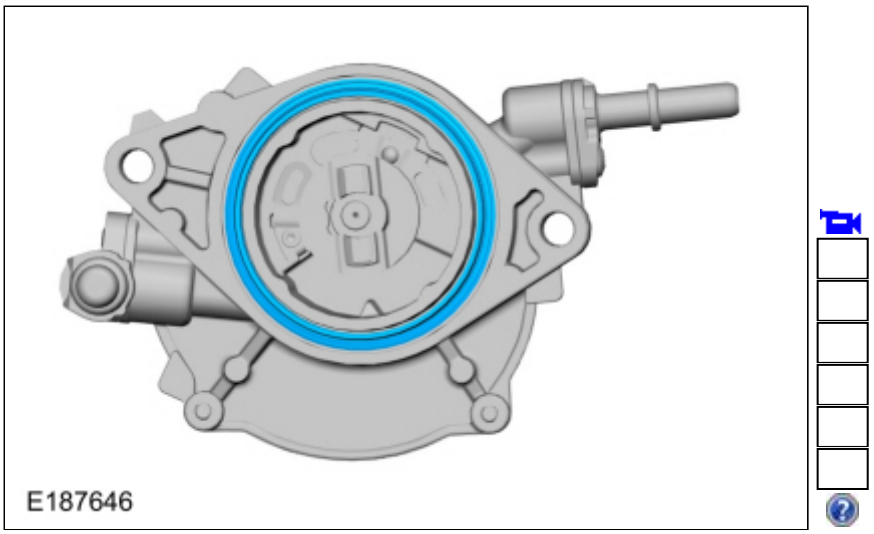


9.

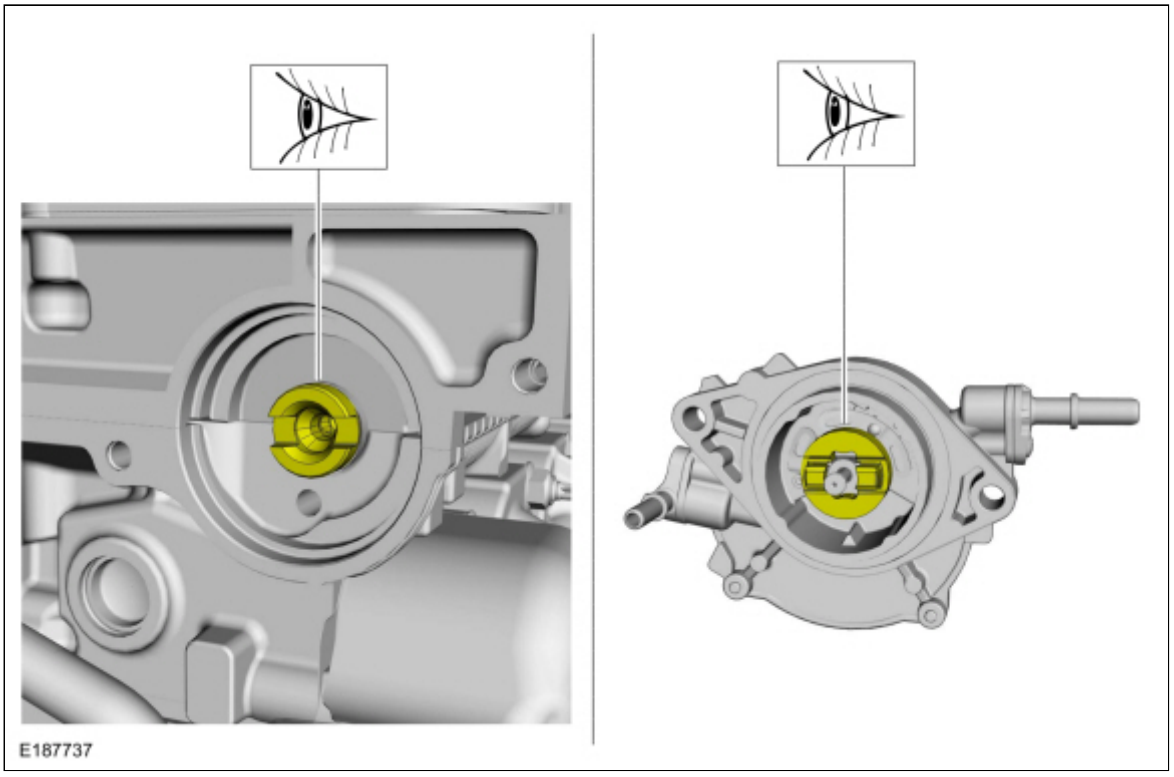


Installation

1.



2. **NOTICE: Align the camshaft and vacuum pump couplings correctly or damage to the camshaft or vacuum pump may occur.**

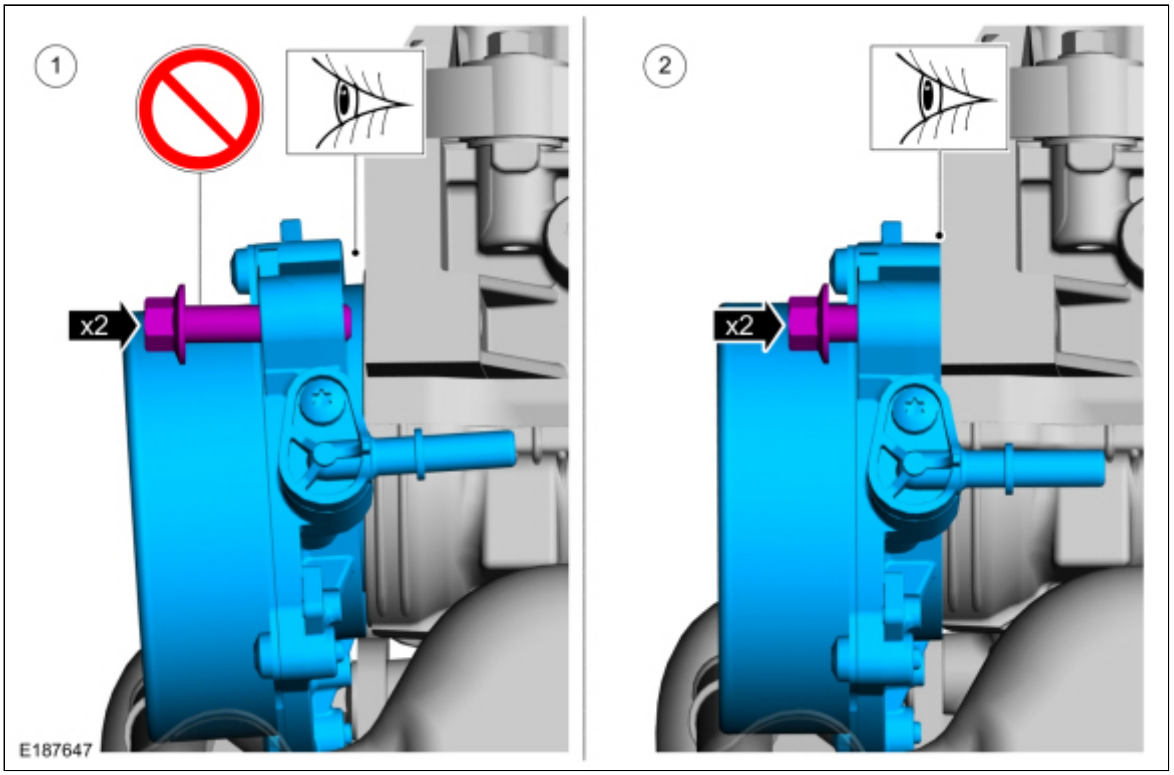


3. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

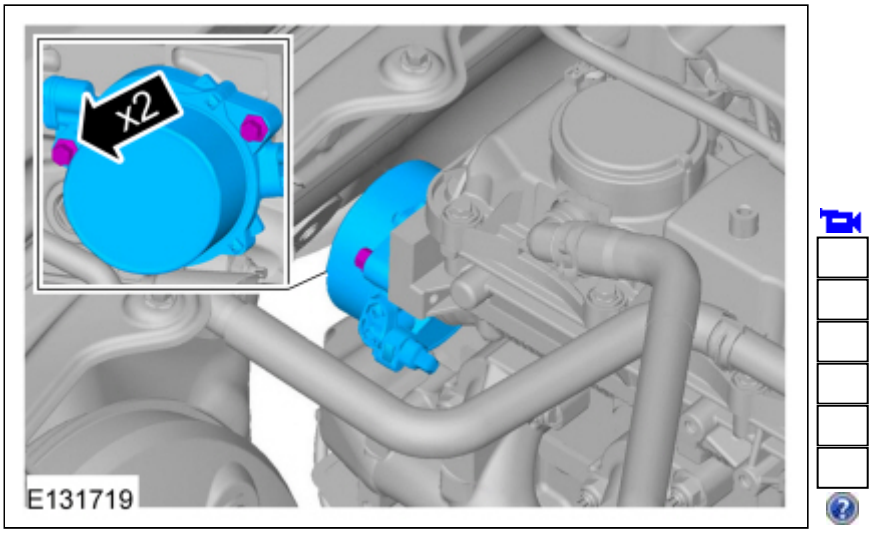
    1. **NOTE:** *Before fitting bolts, check that the vacuum pump couple drive and camshaft keyway are aligned. If a gap is present between vacuum pump and cylinder head, do not fit and run bolts.*

        NOTE: *Under no circumstances should the retaining bolts be tightened if a gap between pump and head faces is present.*

    2. **NOTE:** *Only tighten the bolts finger tight at this stage.*



4. *Torque*: 23 Nm



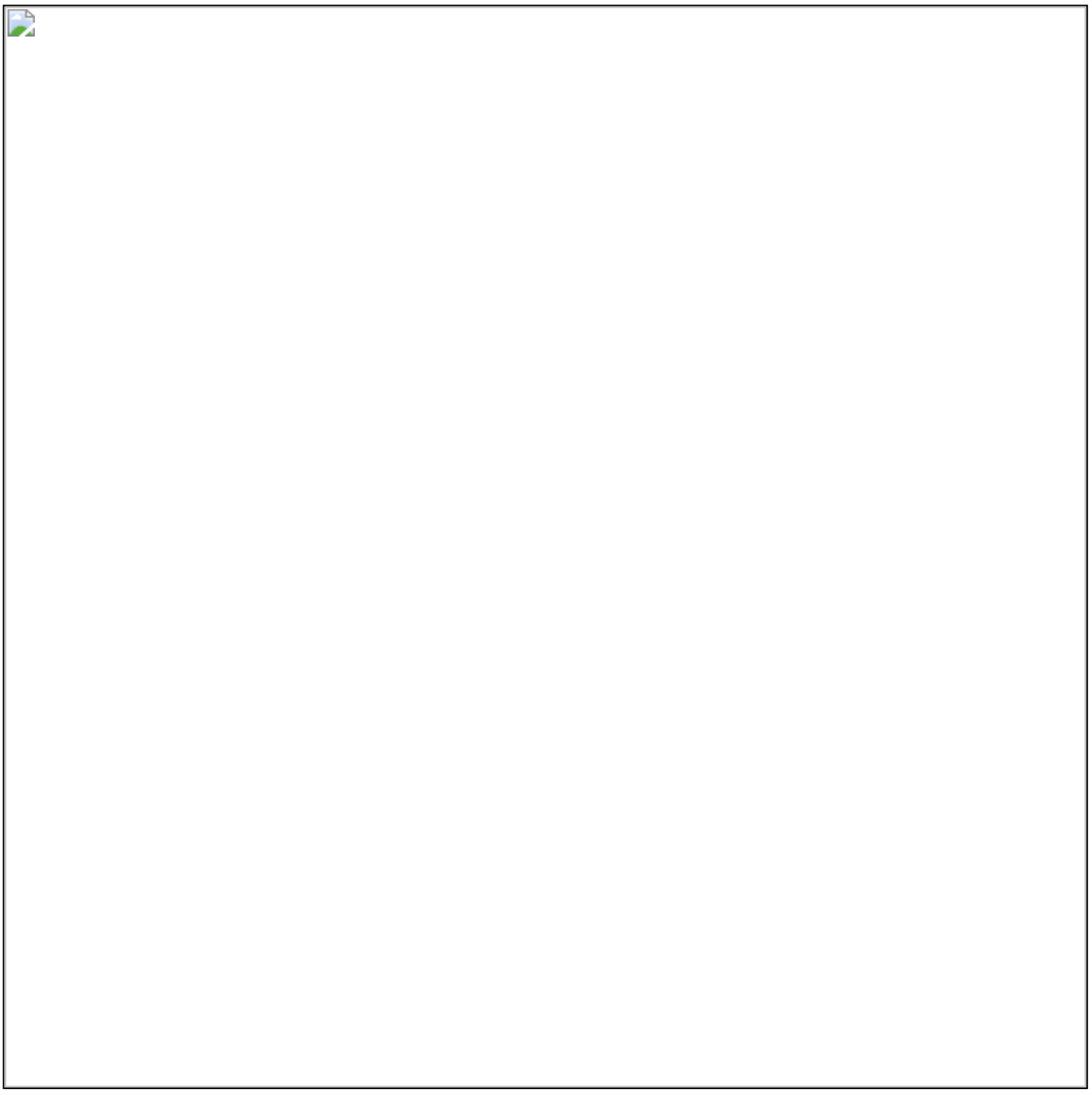
5. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages - ABS Module

Broadcast Message	Originating Module	Message Purpose
Accelerator pedal position	PCM	This message is sent to the GWM and then to the ABS module. The ABS module uses accelerator pedal position information for correct operation of the ABS, traction control and ESC.
Adaptive cruise control	CCM	This message is used to request vehicle deceleration by the ABS module to maintain the distance gap set by the driver for the adaptive cruise control system.

braking deceleration		
Adaptive cruise control brake torque request	CCM	This message informs the ABS module of the amount of braking required to maintain the distance gap set by the driver for the adaptive cruise control system.
Adaptive cruise control precharge request	CCM	This message is used to request precharging of the hydraulic brake system in preparation of a severe braking event.
4WD locking status	TCCM	This message is sent to the GWM and then to the ABS module. The ABS module uses 4WD information for correct operation of the ABS and stability control systems.
Brake on/off switch	PCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module the driver has applied the brake pedal. This message is also used by the ABS module to check the brake pressure sensor located inside the HCU.
Brake pedal applied	PCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module the driver has applied the brake pedal. This message is also used by the ABS module to check the brake pressure sensor located inside the HCU.
Collision mitigation by braking deceleration	CCM	This message is used to request vehicle deceleration by the ABS module for the collision avoidance system.
Collision mitigation by braking precharge request	CCM	This message is used to request precharging of the hydraulic brake system in preparation of a severe braking event.
Door ajar status	BCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module of the current door ajar status. There is a separate message for each door. The ABS module resets the parameters used for the ESC function when a door is opened.
Driver seat belt buckle	RCM	This message informs the ABS module of the current driver seat belt buckle status, buckled or unbuckled.
Engine disable status	PCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module the engine is currently disabled or enabled due to the stop-start system.
Engine status	PCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module of the current status of the engine system; off, on, hot or cold.
Gear lever position	PCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module of the current transmission selector lever position, this is used for the hill start assist system and the ESC system. The hill start assist system operates in forward and reverse gears. The ESC system does not operate when the transmission is in REVERSE.
Hill start assist request	IPC	This message is sent to the GWM and then to the ABS module. This message informs the ABS module of the current, driver selected mode for the hill start assist system; off, auto or manual.
Ignition status	BCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module of the current ignition status; off, accessory, run, start, unknown or invalid.
Odometer master value	IPC	This message is sent to the GWM and then to the ABS module. This message informs the ABS module of the current odometer mileage.
RCM serial number	RCM	The ABS module stores the RCM serial number and verifies the serial number when the vehicle is started or the ignition is set to RUN or ACC. Over time, the ABS module learns the offset of the sensors inside the RCM. When a new serial number is found and the IVD Initialization procedure is carried out using a scan tool, the ABS module resets the offset number learned for ESC.
Steering angle sensor data	PSCM	Several steering angle messages are sent to the ABS module from the PSCM. These messages include steering angle sensor status, steering wheel angle and steering wheel rotation count. The ABS module uses the steering angle sensor data for ESC and RSC system operation.

Traction control request	IPC	This message is sent to the GWM and then to the ABS module. This message informs the ABS module the driver has chosen a mode for the traction control feature, ON or OFF.
Trailer sway configuration	IPC	This message is sent to the GWM and then to the ABS module. This message informs the ABS module the driver has chosen a mode for the trailer sway feature, ON or OFF.
Transmission in reverse	PCM	This message is sent to the GWM and then to the ABS module. This message informs the ABS module when the transmission is in REVERSE, this is used for the hill start assist system and the ESC system. The hill start assist system operates in forward and reverse gears. The ESC system does not operate when the transmission is in REVERSE.
Vehicle configuration data	BCM	This message is sent to the GWM and then to the ABS module. This message provides the ABS module with the current optional and configured items such as tire size, axle ratio, manual or automatic transmission, keyless entry and VIN.
Vehicle lateral acceleration data	RCM	This message provides the ABS module with the current vehicle lateral acceleration and deceleration information and whether or not the information is valid.
Vehicle longitudinal acceleration data	RCM	This message provides the ABS module with the current vehicle longitudinal acceleration information and whether or not the information is valid.
Vehicle roll rate data	RCM	This message provides the ABS module with the current vehicle roll rate information and whether or not the information is valid.
Vehicle speed	PCM	This message is sent to the GWM and then to the ABS module. This message provides the ABS module with the current vehicle speed.
Vehicle yaw data	RCM	This message provides the ABS module with the current vehicle yaw information and whether or not the information is valid.

ABS

The ABS module continuously monitors brake pedal input, longitudinal vehicle motion and the rotational speed of each wheel. The ABS module receives the brake pedal input from the PCM and the longitudinal acceleration sensor information from the RCM. The PCM sends the information to the GWM over the HS-CAN1. The GWM then relays the information to the ABS module over the HS-CAN2. The RCM sends the information directly to the ABS module over the HS-CAN2. Wheel speed information is received by the ABS module using 4 wheel speed sensors. When the ABS module detects an impending wheel lock during a braking event, the ABS module modulates brake pressure to the appropriate wheel by opening and closing the appropriate solenoid valves inside the HCU while the hydraulic pump motor is activated. Once the affected wheel(s) return to the desired speed, the ABS module returns the solenoid valves in the HCU to their normal position.

When the ABS module is initialized (ignition ON), a preliminary electrical check of the system sensors is carried out and hydraulic pump motor is activated for approximately one-half second. During this time, a buzzing or humming noise may be heard and a vibration may be felt in the brake pedal, this is a normal condition. During the module initialized self-test, the pump motor check is carried out at approximately 10 km/h (6 mph). Any malfunction detected in the system causes the ABS module to set a DTC, disable the ABS function and send a message over the HS-CAN2 to the GWM. The GWM relays the message to the IPC over the HS-CAN3 to illuminate the ABS warning indicator. The base hydraulic power assist braking system functions normally.

EBD

On initial application of the brake pedal, full pressure is applied to the rear brakes. The ABS module then uses wheel speed sensor inputs to evaluate rear wheel slip. Once the rear wheel slip exceeds a predetermined threshold, the ABS module commands the HCU to close the appropriate isolation valves to hold the rear brake pressure constant while allowing the front brake pressure to build. This creates a balanced braking condition between the front and rear wheels. If the rear wheel slip continues and exceeds a second predetermined threshold, the ABS module commands the HCU to open the dump valves to decrease the rear brake pressure and allow the rear wheels to recover. A slight bump sensation may be felt in the brake pedal when EBD is active.

If the ABS is disabled due to a DTC being present in the ABS module, EBD continues to function unless the DTC is for wheel speed sensors or the HCU. When EBD is disabled, the ABS warning indicator, the red brake warning indicator and stability-traction control indicator (sliding car icon) illuminate.

Traction Control

The ABS module continuously monitors and compares the rotational speed of the drive wheels in relation to the non-driven wheels. When the drive wheels begin to spin faster than the non-driven wheels, the ABS module modulates brake pressure to the appropriate wheel(s) by opening and closing the appropriate solenoid valves inside the HCU while the hydraulic pump motor is activated. At the same time, the ABS module calculates how much engine torque reduction is required to eliminate the wheel slip and sends this torque reduction message along with a traction event message to the GWM over the HS-CAN2. The GWM sends the engine torque reduction message to the PCM over the HS-CAN1 and the traction event message to the IPC over the HS-CAN3. When the PCM receives the torque reduction message, it adjusts engine timing and decreases fuel injector pulses to reduce the engine torque to the requested level. When the IPC receives the traction event message it flashes the stability-traction control indicator (sliding car icon). Once the driven wheel speed returns to the desired speed, the ABS module returns the solenoid valves in the HCU to their normal position, deactivates the hydraulic pump motor and stops sending the traction event and torque reduction messages. The PCM returns engine timing and fuel injectors to normal operation and the IPC extinguishes the stability-traction control indicator (sliding car icon). After the vehicle speed exceeds 100 km/h (62 mph), traction control is accomplished only through the PCM torque control.

Traction control can be disabled through the menu in the message center, refer to the Owner's Literature for instructions on disabling traction control. This is independent of the ABS and ESC, which cannot be disabled by the driver. When the driver disables traction control, the IPC communicates traction control status to the GWM along the HS-CAN3. The GWM sends the message to the ABS module along the HS-CAN2. The ABS module takes no further action in regards to traction control until the driver activates the function or until the ignition is cycled from OFF to ON.

Traction control is disabled if there is a wheel speed sensor or solenoid valve DTC present in the ABS module. Traction control is also disabled if there is a communication error between the ABS module and the GWM. When traction control is disabled, the ABS module sends a message to the GWM along the HS-CAN2 which gateways the message to the IPC over the HS-CAN3 to illuminate the stability-traction control OFF indicator (sliding car OFF icon).

ESC

The ABS module continuously monitors the vehicle motion relative to the intended course. This is done by using sensors to compare the steering wheel sensor messages, yaw rate sensor messages and longitudinal acceleration with the actual vehicle motion. The ABS module determines steering wheel angle using information from the wheel speed sensors, the PSCM and the RCM. Steering angle information is calculated by the PSCM and sent to the ABS module over the HS-CAN2. Vehicle yaw rate and longitudinal acceleration information is sent to the ABS module from the RCM over the HS-CAN2. If the ABS module determines from the inputs the vehicle is unable to travel in the intended direction, the brake pressure to the appropriate wheel(s) is modulated by opening and closing the appropriate solenoid valves inside the HCU while the hydraulic pump motor is activated. At the same time the ABS module calculates how much engine torque reduction is required to reduce vehicle speed to help stabilize the vehicle and sends this torque reduction message, along with an ESC event message, to the GWM over the HS-CAN2. The GWM sends the torque reduction message to the PCM over the HS-CAN1 and the ESC event message to the IPC over the HS-CAN3. When the PCM receives the torque reduction message, it adjusts engine timing and decreases fuel injector pulses to reduce the engine torque to the requested level. When the IPC receives this message, it flashes the stability-traction control indicator (sliding car icon).

Once the vehicle instability has been corrected, the ABS module returns the solenoid valves in the HCU to their normal position, deactivates the hydraulic pump motor and stops sending the ESC event and torque reduction messages. The PCM returns engine timing and fuel injectors to normal operation and the IPC extinguishes the stability-traction control indicator (sliding car icon).

ESC does not operate with the transmission in REVERSE. ESC is disabled if there is a wheel speed sensor, stability sensor or steering angle sensor DTC present in the ABS module. ESC is also disabled if there is a communication error between the ABS module and the PSCM or the ABS module and the RCM. When ESC is disabled, the ABS module sends a message to the GWM along the HS-CAN2 which gateways the message to the IPC over the along the HS-CAN3 to illuminate the stability-traction control OFF indicator (sliding car OFF icon).

Trailer Sway Control

Trailer sway is the undesirable yaw force a trailer can apply to the towing vehicle. Trailer sway control is a unique function of the stability control system that uses steering wheel angle information and yaw rate information to determine if a trailer sway event is taking place. The ABS module determines steering wheel angle using information from the wheel speed sensors, the PSCM and the RCM. Steering angle information is calculated by the PSCM and sent to the ABS module over the HS-CAN2. Vehicle yaw rate information is sent to the ABS module from the RCM over the HS-CAN2. If the ABS module determines from the inputs a trailer sway event is taking place, the ABS module modulates brake pressure to the appropriate brake calipers by opening and closing the appropriate solenoid valves inside the HCU while the hydraulic pump motor is activated. At the same time, the ABS module calculates how much engine torque reduction is required to eliminate the trailer sway and sends this torque reduction message to the GWM over the HS-CAN2 which relays the message to the PCM over the HS-CAN1. The ABS module also sends a trailer sway event message to the GWM over the HS-CAN2 which relays this message to the IPC over the HS-CAN3. When the PCM receives the torque reduction message, it adjusts engine timing and decreases fuel injector pulses to reduce the engine torque to the requested level. When the IPC receives the vehicle stability event message, it flashes the stability-traction control indicator (sliding car icon) and displays TRAILER SWAY REDUCE SPEED in

the message center.

Once the trailer sway has been corrected, the ABS module returns the solenoid valves in the HCU to their normal position, deactivates the hydraulic pump motor and stops sending the traction event and torque reduction messages. The PCM returns engine timing and fuel injectors to normal operation and the IPC extinguishes the stability-traction control indicator (sliding car icon) and stops displaying the trailer sway message in the message center. Trailer sway control only activates when vehicle speed is greater than 65 km/h (40 mph). Any malfunction disabling RSC also disables trailer sway control.

The driver can enable and disable the trailer sway control feature using the message center and steering wheel controls. For additional information, refer to the Owner's Literature.

Curve Control

The ABS module continuously monitors the vehicle motion relative to the intended course. This is done by using sensors to compare the steering wheel input, the yaw rate sensor input, the lateral acceleration sensor input and the longitudinal acceleration sensor input with that of the actual vehicle motion. The ABS module determines steering wheel angle using information from the wheel speed sensors, the PSCM and the RCM. Steering angle information is calculated by the PSCM and sent to the ABS module over the HS-CAN2. Vehicle yaw rate, lateral acceleration and longitudinal acceleration information is sent to the ABS module from the RCM over the HS-CAN2. If the ABS module determines from the inputs the vehicle is experiencing over-steer or under-steer while traveling through a curve, the module sends a curve control event message over the HS-CAN2 to the GWM. The GWM relays this message to the PCM over the HS-CAN1 and to the IPC over the HS-CAN3. When the PCM receives this message, it assists with curve control by adjusting engine timing and decreasing fuel injector pulses. When the IPC receives this message, it flashes the stability-traction control indicator (sliding car icon). The ABS module continues to monitor the sensor inputs while the PCM assists with curve control. If the ABS module determines PCM intervention is insufficient to control the stability event, the ABS module modulates brake pressure to the appropriate brake caliper(s) by opening and closing the appropriate solenoid valves inside the HCU while the hydraulic pump motor is activated. Once the vehicle instability has been corrected, the ABS module returns the solenoid valves in the HCU to their normal position, deactivates the hydraulic pump motor and stops sending the curve control event message. The PCM returns engine timing and fuel injectors to normal operation and the IPC extinguishes the stability-traction control indicator (sliding car icon).

The Curve Control function does not operate with the transmission in REVERSE. The ABS module disables the Curve Control function if there are any wheel speed sensor, stability sensor or steering angle sensor Diagnostic Trouble Codes (DTCs) present in the ABS module. Also, if there is a communication error between the ABS module and the PSCM or the RCM, the Curve Control function is disabled. When the Curve Control function is disabled, the ABS module sends a message over the HS-CAN2 to the GWM. The GWM relays this message over the HS-CAN3 to the IPC to illuminate both the stability-traction control indicator (sliding car icon) and the stability-traction control disabled indicator (sliding car OFF icon).

Hill Start Assist

When the vehicle is stopped on an incline greater than 1.5 degrees (approximately a 3% grade), the ABS module holds the brake pressure for approximately 1.5 seconds while the driver transitions from the brake pedal to the accelerator pedal. This is accomplished by monitoring several HS-CAN messages and several sensors to determine if the vehicle is stopped and not parked, and if the vehicle is on an appropriate incline. The brake pedal message sent by the PCM and the wheel speed sensor inputs allow the ABS module to determine the vehicle has come to a complete stop. The transmission selector lever message sent by the PCM informs the ABS module the vehicle is not parked. The stability sensor messages sent by the RCM enable the ABS module to determine if the vehicle is on an incline greater than 1.5 degrees (approximately a 3% grade). Once the above conditions have been met, the hill start assist function automatically engages. As the driver releases the brake pedal, the ABS module commands the HCU to close the isolation valves which maintain the current brake system pressure, preventing the vehicle from rolling down the incline. Once the driver presses the accelerator pedal and the engine RPM increases, the ABS module gradually releases the brake pressure to make sure the vehicle is neither rolling back nor driving off until there is sufficient driving torque to accelerate the vehicle forward (or backward if reversing up the incline).

Stability-Traction Control Indicator (Sliding Car Icon)

Refer to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Stability-Traction Control Disabled Indicator (Sliding Car OFF Icon)

Refer to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Component Description

ABS Module

The ABS module is attached directly to the HCU but is available separately for service. The ABS module is the ECU for all of the ABS and stability control systems. The ABS module monitors all sensor inputs and all CAN messages relating to ABS and stability control, then directly controls the solenoid valves and the hydraulic pump motor in the HCU.

When a new ABS module is installed, it must be programmed with the vehicle configuration information and programmed with the latest level of module software. These procedures are carried out using a diagnostic scan tool, follow all scan tool instructions. For additional information,
Refer to: Module Configuration (418-01 Module Configuration) .

When an ABS or stability control system fault has been corrected or a new component installed, the ABS module must be calibrated. The calibration procedure is required for the stability control sensors to learn the zero-position of the vehicle. The calibration procedure requires the vehicle to be on a level surface and not moving. The calibration procedure (IVD Initialization) is carried out using a diagnostic scan tool. The vehicle must also be driven over 20 km/h (12 mph) for at least 1 minute on a fairly straight road which allows the ABS module to find the steering angle center.

Brake Booster Vacuum Sensor (Vehicles Equipped With Start-Stop Only)

The brake booster vacuum sensor is a piezoelectric device used by the ABS module to monitor the vacuum in the brake booster. The sensor is hardwired to the ABS module by 3 circuits. One circuit is for the 5 volt sensor supply, one circuit is for sensor ground and one circuit is for sensor output. The sensor output is a serial data stream which communicates the vacuum level in the booster to the ABS module.

HCU

The HCU contains the solenoid valves, the hydraulic pump motor and the pressure sensor used by the ABS for the various stability control systems. The ABS module and the HCU are attached directly together, a new HCU comes with a new ABS module.

When a new ABS module and HCU assembly is installed, it must be programmed with the vehicle configuration information and programmed with the latest level of module software. These procedures are carried out using a diagnostic scan tool, follow all scan tool instructions. For additional information,
Refer to: Module Configuration (418-01 Module Configuration) .

When an ABS or stability control system fault has been corrected or a new component installed, the ABS module must be calibrated. The calibration procedure is required for the stability control sensors to learn the zero-position of the vehicle. The calibration procedure requires the vehicle to be on a level surface and not moving. The calibration procedure (IVD Initialization) is carried out using a diagnostic scan tool. The vehicle must also be driven over 20 km/h (12 mph) for at least 1 minute on a fairly straight road which allows the ABS module to find the steering angle center.

Stability Control Sensors

The stability control sensors for the vehicle dynamic system consist of the yaw rate sensor, lateral accelerometer, longitudinal accelerometer and roll rate sensor. The sensors are housed in the RCM which sends sensor information to the ABS module over a private HS-CAN. If any of the sensors are defective, a new RCM must be installed.

- The yaw rate sensor measures the yaw angle which is the difference between the direction the vehicle is pointing when cornering and the direction the vehicle is actually moving.
- The longitudinal accelerometer measures the acceleration and deceleration of the vehicle as it moves forward and backward.
- The lateral accelerometer measures the force created when a vehicle corners that tends to push a vehicle sideways.
- The roll rate sensor measures the rate of rotation of the vehicle along the centerline of the vehicle from front to back.

Lateral acceleration has 2 forms. The first is the centrifugal acceleration that is generated when the vehicle travels around in a circle. The second is the acceleration due to gravity. On level ground there is no lateral acceleration due to gravity. However, if the vehicle is parked sideways on a bank or incline, the sensor measures some lateral acceleration due to gravity, even though the vehicle is not moving.

Steering Wheel Rotation Sensor

The steering wheel rotation sensor is part of the SASM and clockspring assembly. The steering wheel rotation speed, angle and direction of travel is derived based on the position of the steering wheel position sensor and is sent to the ABS module over the HS-CAN2.

Information from the wheel speed sensors, PSCM and RCM are used by the ABS module to determine steering wheel angle when the vehicle is driven after initial start up. The ABS module uses the information received to calculate the steering center and save the information in memory. Then, using the information provided from the PSCM along with

the saved center data, the ABS module determines the steering angle. The ABS module must re-learn the steering center whenever power is lost, for example during service when the battery is disconnected. To re-learn the steering center, the vehicle must be driven over 20 km/h (12 mph) for at least 1 minute on a fairly straight road.

Wheel Speed Sensor

All 4 wheel speed sensors are active (magneto resistive) sensors that operate on the Hall-effect principle to generate a square wave signal proportional to the rotational speed of the wheel. Because these are active sensors, receiving voltage from the ABS module and then sending a varying voltage back to the ABS module, they are able to detect much lower rotational speeds than passive (magnetic inductive) sensors. Each wheel speed sensor is connected to the ABS module by 2 circuits. One circuit provides voltage for sensor operation and the other circuit provides sensor input to the ABS module.

Copyright © 2016 Ford Motor Company

Anti-Lock Brake System (ABS) and Stability Control - Overview

Overview

The ABS and stability control systems are comprised of the following subsystems which assist the driver in maintaining control of the vehicle:

- ABS
- Curve control
- EBD
- ESC
- Hill start assist
- RSC
- Supplemental braking assist
- Supports adaptive cruise control
- Supports collision avoidance
- Torque vectoring control
- Traction control
- Trailer sway control

The ABS helps maintain steering control by preventing the wheels from locking up during hard braking. The ABS also includes a supplemental brake assist function providing maximum brake system pressure during a severe braking event.

The curve control system helps to maintain vehicle stability during adverse maneuvers such as cornering or avoiding objects in the roadway.

The EBD system helps maintain vehicle control by keeping a balanced braking condition between the front and rear wheels.

The ESC system helps prevent skids or lateral slides by modulating brake fluid to the brake calipers and reducing engine torque.

The hill start assist system is designed to assist the driver during hill starts. Using the ABS, the hill start assist system holds the vehicle on an incline for a short time, allowing the driver to release the brake pedal and press the accelerator pedal without needing to use the parking brake.

The supplemental braking assist system uses the hydraulic pump motor and the HCU to provide additional braking assist in the event of severe vacuum loss at the brake booster.

The ABS supports the adaptive cruise control system by applying the brakes as necessary to maintain the distance gap that has been set. For information on the adaptive cruise control system,
Refer to: Cruise Control - System Operation and Component Description (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Description and Operation).

The ABS supports the collision avoidance system by monitoring information and precharging the brake system to allow the vehicle to stop in the shortest distance possible. For information on the collision avoidance system,
Refer to: Collision Warning and Collision Avoidance System - Component Location (419-03C Collision Warning and Collision Avoidance System, Description and Operation).

The traction control system helps prevent loss of traction by reducing drive wheel spin during acceleration.

The trailer sway control system helps maintain vehicle stability while towing a trailer by detecting and aiding in the reduction of conditions that cause trailer sway.

Torque vectoring control uses the rear brakes to adjust the speed between the driven wheels while accelerating through a corner, forcing the front end to hug the inside of the curve and improve tire grip.

Some noise from the system and pulsations in the brake pedal are normal conditions during most ABS and stability control events. Also, longer than normal brake pedal travel may be experienced immediately following an ABS or stability control activation.

Copyright © 2016 Ford Motor Company

Anti-Lock Brake System (ABS) and Stability Control

DTC Charts

DTC Chart: Anti-Lock Brake System (ABS) Module

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

ABS Module DTC Chart

DTC	Description	Action
C0001:49	TCS Control Channel A Valve 1: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. CLEAR the DTCs. REPEAT the self-test. • If the DTC returns on vehicles without adaptive cruise control, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). • If the DTC returns on vehicles with adaptive cruise control, INSTALL a new ABS module and HCU. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0002:49	TCS Control Channel A Valve 2: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. CLEAR the DTCs. REPEAT the self-test. • If the DTC returns on vehicles without adaptive cruise control, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). • If the DTC returns on vehicles with adaptive cruise control, INSTALL a new ABS module and HCU. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0003:49	TCS Control Channel B Valve 1: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. CLEAR the DTCs. REPEAT the self-test. • If the DTC returns on vehicles without adaptive cruise control, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). • If the DTC returns on vehicles with adaptive cruise control, INSTALL a new ABS module and HCU. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control

		(206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0004:49	TCS Control Channel B Valve 2: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. CLEAR the DTCs. REPEAT the self-test. • If the DTC returns on vehicles without adaptive cruise control, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). • If the DTC returns on vehicles with adaptive cruise control, INSTALL a new ABS module and HCU. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0020:16	ABS Pump Motor Control: Circuit Voltage Below Threshold	GO to Pinpoint Test H
C0020:17	ABS Pump Motor Control: Circuit Voltage Above Threshold	GO to Pinpoint Test H
C0020:49	ABS Pump Motor Control: Internal Electronic Failure	GO to Pinpoint Test H
C0030:07	Left Front Tone Wheel: Mechanical Failure	GO to Pinpoint Test B
C0031:01	Left Front Wheel Speed Sensor: General Electrical Failure	GO to Pinpoint Test J
C0031:07	Left Front Wheel Speed Sensor: Mechanical Failure	GO to Pinpoint Test B
C0031:12	Left Front Wheel Speed Sensor: Circuit Short to Battery	GO to Pinpoint Test J
C0031:14	Left Front Wheel Speed Sensor: Circuit Short to Ground or Open	GO to Pinpoint Test J
C0031:24	Left Front Wheel Speed Sensor: Signal Stuck High	GO to Pinpoint Test B
C0031:25	Left Front Wheel Speed Sensor: Signal Shape / Waveform Failure	GO to Pinpoint Test B
C0031:28	Left Front Wheel Speed Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	GO to Pinpoint Test B

C0031:29	Left Front Wheel Speed Sensor: Signal Invalid	GO to Pinpoint Test B
C0031:2F	Left Front Wheel Speed Sensor: Signal Erratic	GO to Pinpoint Test B
C0031:38	Left Front Wheel Speed Sensor: Signal Frequency Incorrect	GO to Pinpoint Test B
C0031:4A	Left Front Wheel Speed Sensor: Incorrect Component Installed	• DIAGNOSE all other wheel speed sensor Diagnostic Trouble Codes (DTCs) before diagnosing any "Incorrect Component Installed" wheel speed sensor Diagnostic Trouble Codes (DTCs). • This DTC sets when the incorrect type of wheel speed sensor has been installed. • INSTALL a new wheel speed sensor. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0031:62	Left Front Wheel Speed Sensor: Signal Compare Failure	GO to Pinpoint Test B
C0031:65	Left Front Wheel Speed Sensor: Has Too Few Transitions or Events	GO to Pinpoint Test B
C0031:76	Left Front Wheel Speed Sensor: Wrong Mounting Position	GO to Pinpoint Test B
C0032:11	Left Front Wheel Speed Sensor Supply: Circuit Short to Ground	GO to Pinpoint Test J
C0033:07	Right Front Tone Wheel: Mechanical Failure	GO to Pinpoint Test B
C0034:01	Right Front Wheel Speed Sensor: General Electrical Failure	GO to Pinpoint Test J
C0034:07	Right Front Wheel Speed Sensor: Mechanical Failure	GO to Pinpoint Test B
C0034:12	Right Front Wheel Speed Sensor: Circuit Short to Battery	GO to Pinpoint Test J
C0034:14	Right Front Wheel Speed Sensor: Circuit Short to Ground or Open	GO to Pinpoint Test J
C0034:24	Right Front Wheel Speed Sensor: Signal Stuck High	GO to Pinpoint Test B
C0034:25	Right Front Wheel Speed Sensor: Signal Shape / Waveform Failure	GO to Pinpoint Test B
C0034:28	Right Front Wheel	GO to Pinpoint Test B

	Speed Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	
C0034:29	Right Front Wheel Speed Sensor: Signal Invalid	GO to Pinpoint Test B
C0034:2F	Right Front Wheel Speed Sensor: Signal Erratic	GO to Pinpoint Test B
C0034:38	Right Front Wheel Speed Sensor: Signal Frequency Incorrect	GO to Pinpoint Test B
C0034:4A	Right Front Wheel Speed Sensor: Incorrect Component Installed	• DIAGNOSE all other wheel speed sensor Diagnostic Trouble Codes (DTCs) before diagnosing any "Incorrect Component Installed" wheel speed sensor Diagnostic Trouble Codes (DTCs). • This DTC sets when the incorrect type of wheel speed sensor has been installed. • INSTALL a new wheel speed sensor. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0034:62	Right Front Wheel Speed Sensor: Signal Compare Failure	GO to Pinpoint Test B
C0034:65	Right Front Wheel Speed Sensor: Signal Has Too Few Transitions / Events	GO to Pinpoint Test B
C0034:76	Right Front Wheel Speed Sensor: Wrong Mounting Position	GO to Pinpoint Test B
C0035:11	Right Front Wheel Speed Sensor Supply: Circuit Short To Ground	GO to Pinpoint Test J
C0036:07	Left Rear Tone Wheel: Mechanical Failure	GO to Pinpoint Test B
C0037:01	Left Rear Wheel Speed Sensor: General Electrical Failure	GO to Pinpoint Test K
C0037:07	Left Rear Wheel Speed Sensor: Mechanical Failure	GO to Pinpoint Test B
C0037:12	Left Rear Wheel Speed Sensor: Circuit Short to Battery	GO to Pinpoint Test K
C0037:14	Left Rear Wheel Speed Sensor: Circuit Short to Ground or Open	GO to Pinpoint Test K
C0037:24	Left Rear Wheel Speed Sensor: Signal Stuck High	GO to Pinpoint Test B

C0037:25	Left Rear Wheel Speed Sensor: Signal Shape / Waveform Failure	GO to Pinpoint Test B
C0037:28	Left Rear Wheel Speed Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	GO to Pinpoint Test B
C0037:29	Left Rear Wheel Speed Sensor: Signal Invalid	GO to Pinpoint Test B
C0037:2F	Left Rear Wheel Speed Sensor: Signal Erratic	GO to Pinpoint Test B
C0037:38	Left Rear Wheel Speed Sensor: Signal Frequency Incorrect	GO to Pinpoint Test B
C0037:4A	Left Rear Wheel Speed Sensor: Incorrect Component Installed	• DIAGNOSE all other wheel speed sensor Diagnostic Trouble Codes (DTCs) before diagnosing any "Incorrect Component Installed" wheel speed sensor Diagnostic Trouble Codes (DTCs). • This DTC sets when the incorrect type of wheel speed sensor has been installed. • INSTALL a new wheel speed sensor. REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C0037:62	Left Rear Wheel Speed Sensor: Signal Compare Failure	GO to Pinpoint Test B
C0037:65	Left Rear Wheel Speed Sensor: Signal Has Too Few Transitions / Events	GO to Pinpoint Test B
C0037:76	Left Rear Wheel Speed Sensor: Wrong Mounting Position	GO to Pinpoint Test B
C0038:11	Left Rear Wheel Speed Sensor Supply: Circuit Short to Ground	GO to Pinpoint Test K
C0039:07	Right Rear Tone Wheel: Mechanical Failure	GO to Pinpoint Test B
C003A:01	Right Rear Wheel Speed Sensor: General Electrical Failure	GO to Pinpoint Test K
C003A:07	Right Rear Wheel Speed Sensor: Mechanical Failure	GO to Pinpoint Test B
C003A:12	Right Rear Wheel Speed Sensor: Circuit Short to Battery	GO to Pinpoint Test K
C003A:14	Right Rear Wheel Speed Sensor: Circuit Short to Ground or Open	GO to Pinpoint Test K

C003A:24	Right Rear Wheel Speed Sensor: Signal Stuck High	GO to Pinpoint Test B
C003A:25	Right Rear Wheel Speed Sensor: Signal Shape / Waveform Failure	GO to Pinpoint Test B
C003A:28	Right Rear Wheel Speed Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	GO to Pinpoint Test B
C003A:29	Right Rear Wheel Speed Sensor: Signal Invalid	GO to Pinpoint Test B
C003A:2F	Right Rear Wheel Speed Sensor: Signal Erratic	GO to Pinpoint Test B
C003A:38	Right Rear Wheel Speed Sensor: Signal Frequency Incorrect	GO to Pinpoint Test B
C003A:4A	Right Rear Wheel Speed Sensor: Incorrect Component Installed	• DIAGNOSE all other wheel speed sensor Diagnostic Trouble Codes (DTCs) before diagnosing any "Incorrect Component Installed" wheel speed sensor Diagnostic Trouble Codes (DTCs). • This DTC sets when the incorrect type of wheel speed sensor has been installed. • INSTALL a new wheel speed sensor. REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C003A:62	Right Rear Wheel Speed Sensor: Signal Compare Failure	GO to Pinpoint Test B
C003A:65	Right Rear Wheel Speed Sensor: Signal Has Too Few Transitions / Events	GO to Pinpoint Test B
C003A:76	Right Rear Wheel Speed Sensor: Wrong Mounting Position	GO to Pinpoint Test B
C003B:11	Right Rear Wheel Speed Sensor Supply: Circuit Short to Ground	GO to Pinpoint Test K
C0040:24	Brake Pedal Switch "A": Signal Stuck High	GO to Pinpoint Test N
C0040:64	Brake Pedal Switch "A": Signal Plausibility Failure	GO to Pinpoint Test N
C0051:23	Steering Wheel Position Sensor: Signal Stuck Low	• This DTC sets if the steering wheel position signal from the PSCM is unchanged for a predetermined amount of time. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

		• If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0051:27	Steering Wheel Position Sensor: Signal Rate of Change Above Threshold	• This DTC sets if steering angle signal message sent from the PSCM indicates a higher rate of change than other ABS module inputs. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0051:29	Steering Wheel Position Sensor: Signal Invalid	• This DTC sets if the steering angle signal message does not match other ABS module inputs. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0051:54	Steering Wheel Position Sensor: Missing Calibration	• This DTC sets if the steering angle center position is not found and the speed or time limit is exceeded. This DTC clears automatically as soon as the center position is found. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0051:62	Steering Wheel Position Sensor: Signal Compare Failure	• This DTC sets when the ABS module detects a time-out, quality factor failure, plausibility failure of the yaw or active yaw signals or a plausibility failure of the wheel speed data. When this occurs, the steering angle center cannot be determined to be valid and the system triggers the steering angle center learning process. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM, ABS module and RCM communication (U-code) Diagnostic Trouble Codes (DTCs). REPAIR all communication Diagnostic Trouble Codes (DTCs) before repairing DTC C0051:62. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE any wheel speed sensor Diagnostic Trouble Codes (DTCs) present in the ABS module. • If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, ABS

		module and RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0051:64	Steering Wheel Position Sensor: Signal Plausibility Failure	• This DTC sets when the ABS module determines the PSCM steering angle message is implausible when compared to the steering angle module value (based on the yaw rate sensor information). This DTC also sets if the long term offset compensation monitoring is completed after more than 30 km (18 miles) of straight driving resulting in a long term filtered steering angle offset greater than 15 degrees. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0051:86	Steering Wheel Position Sensor: Signal Invalid	• This DTC sets in the ABS module when there is a time-out, quality factor failure or plausibility failure of the steering angle sensor data. When this occurs, the steering angle sensor center cannot be determined to be valid and the system triggers the relearn center process. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
C0061:22	Lateral Acceleration Sensor: Signal Amplitude > Maximum	GO to Pinpoint Test T
C0061:28	Lateral Acceleration Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	GO to Pinpoint Test T
C0061:64	Lateral Acceleration Sensor: Signal Plausibility Failure	GO to Pinpoint Test T
C0062:02	Longitudinal Acceleration Sensor: General Signal Failure	GO to Pinpoint Test T
C0062:22	Longitudinal Acceleration Sensor: Signal Amplitude > Maximum	GO to Pinpoint Test T
C0062:23	Longitudinal Acceleration Sensor: Signal Stuck Low	GO to Pinpoint Test T
C0062:28	Longitudinal	GO to Pinpoint Test T

	Acceleration Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	
C0062:2A	Longitudinal Acceleration Sensor: Signal Stuck In Range	GO to Pinpoint Test T
C0062:64	Longitudinal Acceleration Sensor: Signal Plausibility Failure	GO to Pinpoint Test T
C0062:67	Longitudinal Acceleration Sensor: Signal Incorrect After Event	GO to Pinpoint Test T
C0063:22	Yaw Rate Sensor: Signal Amplitude > Maximum	GO to Pinpoint Test T
C0063:27	Yaw Rate Sensor: Signal Rate of Change Above Threshold	GO to Pinpoint Test T
C0063:28	Yaw Rate Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	GO to Pinpoint Test T
C0063:62	Yaw Rate Sensor: Signal Compare Failure	GO to Pinpoint Test T
C0063:64	Yaw Rate Sensor: Signal Plausibility Failure	GO to Pinpoint Test T
C0064:64	Yaw Rate Sensor: Signal Plausibility Failure	GO to Pinpoint Test T
C0064:96	Roll Rate Sensor: Component Internal Failure	GO to Pinpoint Test T
C006B:00	Stability System Active Too Long: No Sub Type Information	GO to Pinpoint Test B
C0089:73	TCS Disable Switch: Actuator Stuck Closed	GO to Pinpoint Test L
C101A:15	Vacuum Pressure Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test O
C101A:16	Vacuum Pressure Sensor: Circuit Voltage Below Threshold	GO to Pinpoint Test O
C101A:1C	Vacuum Pressure Sensor: Circuit Voltage Out of Range	GO to Pinpoint Test C
C101A:29	Vacuum Pressure Sensor: Signal Invalid	GO to Pinpoint Test O
		This DTC sets if an active... if the ABS module has...

C101F:4B	Generic Valve Failure: Over Temperature	• This DTC sets in continuous memory if the ABS module plausibility monitor of the hydraulic valves in the HCU determines degraded valve performance due to operating temperatures greater than 195°C (383°F). • This is most likely due to extended ABS usage (Hill Descent Control™, traction control, ESC or RSC) without allowing sufficient time for the system and components to cool. SET the ignition to OFF and ALLOW the vehicle to cool for at least 30 minutes.
C1020:00	Brake System Fill Not Complete: No Sub Type Information	• This DTC is pre-set in a new ABS module and can only be cleared after PMI has been successfully preformed. • REPEAT the PMI procedure as directed by the diagnostic scan tool. • If the DTC is still present after the second PMI procedure, INSTALL a new ABS module and HCU assembly. FOLLOW all instructions in the removal and installation procedure. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C1137:64	Reverse Gear Switch: Signal Plausibility Failure	• This DTC sets when the reverse gear message sent from the PCM indicates the transmission is in REVERSE when other stability control inputs received by the ABS module indicate the vehicle is moving forward. • VERIFY the reverse lamps operate correctly. If the lamps do not operate correctly, REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing). • If the reverse lamps operate correctly and the vehicle has a manual transmission, RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the PCM. REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . • If the reverse lamps operate correctly and the vehicle has an automatic transmission, RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the TCM. REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
C1A76:49	Valve Relay: Internal Electronic Failure	• This DTC is set when the valve relay circuit feedback does not match the commanded state. • Using a diagnostic scan tool, CLEAR the ABS module Diagnostic Trouble Codes (DTCs). CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD all ABS module Diagnostic Trouble Codes (DTCs). If C1A76:49 returns, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C1A77:11	Valve Relay Supply Circuit: Circuit Short To Ground	• This DTC is set when the monitoring detects UVR voltage compared to the UBVR voltage indicates the valve relay has a high impedance short to ground. • Using a diagnostic scan tool, CLEAR the ABS module Diagnostic Trouble Codes (DTCs). CYCLE the ignition from ON to OFF and back to ON.

		• Using a diagnostic scan tool, RETRIEVE and RECORD all ABS module Diagnostic Trouble Codes (DTCs). If C1A77:11 returns, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C1A78:49	Left Front Inlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A78:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A79:49	Left Front Outlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A79:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A80:49	Right Front Inlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A80:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A81:49	Right Front Outlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A81:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A82:49	Left Rear Inlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A82:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A83:49	Left Rear Outlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON.

		• Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A83:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A84:49	Right Rear Inlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A84:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A85:49	Right Rear Outlet Valve: Internal Electronic Failure	• This DTC indicates that part of the ABS module has failed internally. • Using a diagnostic scan tool, CLEAR the DTCs. CYCLE the ignition from ON to OFF and back to ON. • Using a diagnostic scan tool, RETRIEVE and RECORD any DTCs. If DTC C1A85:49 is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). CLEAR the DTC. REPEAT the self-test.
C1A95:02	Wheel Speed Sensor: General Signal Failure	GO to Pinpoint Test B
C1A95:2F	Wheel Speed Sensor: Signal Erratic	GO to Pinpoint Test B
C1A95:4A	Wheel Speed Sensor: Incorrect Component Installed	COMPARE the part numbers of the installed wheel speed sensors to the part numbers in the parts catalog or equivalent. INSTALL new wheel speed sensor as necessary. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C1A95:62	Wheel Speed Sensor: Signal Compare Failure	GO to Pinpoint Test B
C1A95:64	Wheel Speed Sensor: Signal Plausibility Failure	GO to Pinpoint Test B
C1A99:01	Pressure Sensor: General Electrical Failure	• This DTC indicates the brake fluid line hydraulic pressure sensor signal line located inside the ABS module has failed. • CLEAR the DTC. CYCLE the ignition from ON to OFF and back to ON. REPEAT the ABS module self-test. • If the DTC returns, INSTALL a new ABS module and HCU assembly. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
C1A99:28	Pressure Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	• This DTC indicates the brake fluid line hydraulic pressure sensor located inside the ABS module has failed. • CLEAR the DTC. CYCLE the ignition from ON to OFF and back to ON. REPEAT the ABS module self-test.

		• If the DTC returns, INSTALL a new ABS module and HCU assembly. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
P050F:00	Brake Assist Vacuum Too Low: No Sub Type Information	GO to Pinpoint Test U
P0604:94	Internal Control Module Random Access Memory (RAM) Error: Unexpected Operation	CLEAR the DTC. CYCLE the ignition switch. REPEAT the ABS module self-test. If the DTC is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
P062F:46	Internal Control Module EEPROM Error: Calibration / Parameter Memory Failure	CLEAR the DTC. CYCLE the ignition switch. REPEAT the ABS module self-test. If the DTC is retrieved again, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U0073:88	Control Module Communication Bus "A" Off: Bus Off	• The module could not communicate on the network at a point in time. The fault is not currently present since the module is able to communicate with the diagnostic scan tool to report this DTC. • VERIFY the integrity of the connectors and wiring. Refer to Wiring Diagrams Cell 14 for schematic and connector information.
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test I
U0104:00	Lost Communication With Cruise Control Module: No Sub Type Information	GO to Pinpoint Test M
U0131:00	Lost Communication With Power Steering Control Module: No Sub Type Information	GO to Pinpoint Test P
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test D
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	GO to Pinpoint Test F
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test G
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test Q
U0401:00	Invalid Data	• This DTC sets in continuous memory if the brake pedal position message,

	Received From ECM/PCM "A": No Sub Type Information	driven wheel torque message or the accelerator pedal position message from the PCM (sent through the GWM) contains invalid information. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PCM and GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . • If the diagnostic scan tool cannot communicate with the PCM or GWM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PCM or GWM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PCM and GWM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0401:02	Invalid Data Received From ECM/PCM "A": General Signal Failure	• This DTC sets if the brake pedal position message, driven wheel torque message or the accelerator pedal position message from the PCM (sent through the GWM) contains invalid information during an auto stop-start event. DTC U3013:16 is also set when U0401:02 sets. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PCM and GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . • If the diagnostic scan tool cannot communicate with the PCM or GWM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the PCM or GWM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PCM and GWM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0401:86	Invalid Data Received From ECM/PCM "A": Signal Invalid	GO to Pinpoint Test R
U0403:00	Invalid Data Received From Transfer Case Control Module: No Sub Type Information	• This DTC sets if the AWD locking torque request message or the rear differential locking torque message from the TCCM contains "fault" instead of the actual information. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all TCCM Diagnostic Trouble Codes (DTCs). REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

		• If the diagnostic scan tool cannot communicate with the TCCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the TCCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all TCCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0405:82	Invalid Data Received From Cruise Control Module: Alive / Sequence Counter Incorrect / Not Updated	• This DTC sets if the counter signal value in the adaptive cruise control message does not increase. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the CCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the CCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all CCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0405:83	Invalid Data Received From Cruise Control Module: Value of Signal Protection Calculation Incorrect	• This DTC sets if an invalid checksum value is received in the adaptive cruise control message. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the CCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the CCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all CCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0420:00	Invalid Data Received From Power Steering Control Module: No Sub Type Information	• This DTC sets if the ABS module receives invalid data values in the steering wheel data messages. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no DTCs in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0420:82	Invalid Data Received From Power Steering Control Module: Alive / Sequence Counter Incorrect / Not Updated	• This DTC sets if the information in the steering wheel data message from the PSCM does not change for a predetermined amount of time. This DTC clears automatically in the same ignition cycle it was set once valid data has been received. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no DTCs in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM

		electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0420:83	Invalid Data Received From Power Steering Control Module: Value of Signal Protection Calculation Incorrect	• This DTC sets if the checksum data in the steering wheel data message from the PSCM is incorrect. This DTC clears automatically in the same ignition cycle it was set after receiving 5 seconds of valid data. If the DTC is set a second time, it does not clear in the same ignition cycle. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no DTCs in the PSCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all PSCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	• This DTC sets if the ignition signal status message is invalid for 5 seconds. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the BCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the BCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF. DISCONNECT and INSPECT all BCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0452:00	Invalid Data Received From Restraints Control Module: No Sub Type Information	• This DTC sets if the yaw rate, roll rate, longitudinal acceleration or lateral acceleration messages from the RCM are invalid. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the RCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF and WAIT 1 minute. DISCONNECT and INSPECT all RCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0452:02	Invalid Data Received From Restraints Control Module: General Signal Failure	• This DTC sets if the yaw rate, roll rate, longitudinal acceleration or lateral acceleration messages from the RCM are invalid during an auto stop-start event. DTC U3013:16 is also set when U0452:02 sets. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the RCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF and WAIT 1 minute. DISCONNECT and INSPECT all RCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.

U0452:81	Invalid Data Received From Restraints Control Module: Invalid Serial Data Received	• This DTC sets if the yaw rate, roll rate, longitudinal acceleration or lateral acceleration messages from the RCM are not received. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the RCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF and WAIT 1 minute. DISCONNECT and INSPECT all RCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0452:82	Invalid Data Received From Restraints Control Module: Alive / Sequence Counter Incorrect / Not Updated	• This DTC sets if the yaw rate, roll rate, longitudinal acceleration or lateral acceleration counter signal message from the RCM does not update. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the RCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF and WAIT 1 minute. DISCONNECT and INSPECT all RCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0452:83	Invalid Data Received From Restraints Control Module: Value of Signal Protection Calculation Incorrect	• This DTC sets if the yaw rate, roll rate, longitudinal acceleration or lateral acceleration counter signal message from the RCM is invalid. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the RCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF and WAIT 1 minute. DISCONNECT and INSPECT all RCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.
U0452:92	Invalid Data Received From Restraints Control Module: Performance or Incorrect Operation	• This DTC sets if the yaw rate, roll rate, longitudinal acceleration or lateral acceleration messages from the RCM are not within the specified data range for at least 200 milliseconds. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If the diagnostic scan tool cannot communicate with the RCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • If there are no Diagnostic Trouble Codes (DTCs) in the RCM, the condition may be caused by an intermittent concern. • SET the ignition to OFF and WAIT 1 minute. DISCONNECT and INSPECT all RCM electrical connectors and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR as necessary.

U2007:49	Valve(s): Internal Electronic Failure	• This DTC sets due to an electrical failure (open circuit, short to ground, short to voltage) in one or more of the ABS module valve coils. • CLEAR the DTC and REPEAT the self-test. If the DTC returns, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC is pre-set in a new ABS module and clears automatically when the ABS module is configured correctly. • CHECK the service history for recent service actions related to the clears module. This DTC sets due to incomplete or improper PMI procedures. • If there have been recent service actions with the ABS module, REPEAT the PMI procedure as directed by the diagnostic scan tool. • If there have been no recent service actions, INSTALL a new ABS module to correct the failure to retain the configuration data. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U2100:46	Initial Configuration Not Complete: Calibration / Paramenter Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	This DTC sets due to incomplete or improper flash programming procedures. REPEAT the programming procedure as directed by the diagnostic scan tool.
U2107:00	Collision Mitigation By Braking: No Sub Type Information	• This DTC sets when the collision deceleration message from the CCM is sent too often or the duration of the message is too long. This is most likely caused by a network communication concern or an internal failure of the CCM. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
U2108:62	Adaptive Cruise Control: Signal Compare Failure	• This DTC sets when the actual vehicle deceleration monitored by the module exceeds the CCM deceleration maximum request limit by 1.0 m/s^2. • Using a diagnostic scan tool, RETRIEVE and DIAGNOSE all CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
U2200:00	Control Module Configuration Memory Corrupt: No Sub Type Information	• CHECK the service history for recent service actions related to the clears module. This DTC sets due to incomplete or improper PMI procedures. • If there have been recent service actions with the ABS module, REPEAT the PMI procedure as directed by the diagnostic scan tool. • If there have been no recent service actions, INSTALL a new ABS module to correct the failure to retain the configuration data. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:00	Control Module: No Sub Type Information	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs).

		• If the DTC returns, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:44	Control Module: Data Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:45	Control Module: Program Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:46	Control Module: Calibration / Parameter Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:47	Control Module: Watchdog / Safety μC^a Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:48	Control Module: Supervisor Software Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). CYCLE the ignition. CARRY OUT the ABS module self-test. RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). • If the DTC returns INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
U3000:4B	Control Module: Over Temperature	• This DTC sets due to excessive temperatures in the ABS module. • Allow the vehicle to cool down for at least 30 minutes.
U3002:62	Vehicle Identification Number: Signal	GO to Pinpoint Test S

	Compare Failure	
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test A
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test E
U3013:16	Control Module Input Power "C": Voltage Below Threshold	• This DTC is for informational purposes only. • This DTC sets in continuous memory when the ABS module has detected an auto stop-start event with vehicle speed less than 10 km/h (6 mph). Low voltage is expected during an auto stop-start event.

[a]Micro-Controller

Symptom Chart

Symptom Chart: Anti-Lock Brake System (ABS) and Stability Control

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart: ABS and Stability Control

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • ABS module concern	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The brake warning indicator is always or never on	• Low brake fluid level • Brake fluid level sensor • Parking brake applied • Parking brake switch • IPC concern • ABS concern	RETRIEVE and DIAGNOSE all ABS module Diagnostic Trouble Codes (DTCs). If there are no ABS module Diagnostic Trouble Codes (DTCs), DIAGNOSE the brake warning indicator. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
The ABS warning indicator is always or never on	• IPC concern • ABS concern	RETRIEVE and DIAGNOSE all ABS module Diagnostic Trouble Codes (DTCs). If there are no ABS module Diagnostic Trouble Codes (DTCs), DIAGNOSE the ABS warning indicator. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
The stability-traction control OFF indicator (sliding-car OFF icon) is always on	• IPC concern • ABS concern	RETRIEVE and DIAGNOSE all ABS module Diagnostic Trouble Codes (DTCs). If there are no ABS module Diagnostic Trouble Codes (DTCs), DIAGNOSE the stability-traction control OFF indicator. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
ABS false activation, ABS too sensitive, ABS activates on normal stop	Front or rear suspension concern	ELIMINATE the front or rear suspension as the cause of the problem. REFER to: Front Suspension (204-01 Front Suspension, Diagnosis and Testing). REFER to: Rear Suspension (204-02 Rear Suspension, Diagnosis and Testing).
	RCM mounting	CONFIRM the RCM is mounted correctly. REINSTALL as necessary. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and

		Installation).
	Loose wheel speed sensor or excessive air gap	INSPECT wheel speed sensors for looseness or excessive air gap. TIGHTEN or INSTALL new as necessary. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
	Rear wheel speed sensor tone ring or front wheel bearing damaged, rusted or contaminated with foreign material	INSPECT the rear tone rings and front wheel bearings for damage, rust and foreign material. CLEAN, REMOVE foreign material or INSTALL new as necessary. For the front wheel bearing, REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
	Parking brake shoes out of adjustment (dragging)	CHECK and if necessary, ADJUST the parking brake. REFER to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).
The traction control system is inoperative or cannot be disabled	Refer to the Pinpoint Test	GO to Pinpoint Test L
The Hill Descent Control™ system is inoperative or cannot be disabled	Refer to the Pinpoint Test	GO to Pinpoint Test R

Pinpoint Tests

U3003:16

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

The ABS module, hydraulic pump and solenoid valves require an operating voltage that is between 10 and 17 volts. The ABS module receives this voltage from the BJB. The ABS module has 2 ground circuits that splice together and terminate at a single location. Excessive resistance or an open in one or more of these circuits, a discharged battery or a inoperative charging system results in the ABS module setting a DTC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	This DTC sets in continuous memory and on-demand if the voltage supplied to the ABS module falls below 10 volts.

Possible Causes

- Fuses
- Wiring, terminals or connectors
- Charging system concern
- Battery
- ABS module

Visual Inspection and Diagnostic Pre-checks

- Make sure both battery terminals and cables are free of any corrosion and other contaminants.
- Make sure both battery terminals are tightened to their correct torque specifications.

- Make sure AJB fuses are OK.

PINPOINT TEST A : U3003:16

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

A1 RECHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Is DTC U3003:16 still present?

Yes	GO to A2
No	The system is operating correctly at this time. The DTC may have set due to a previous low battery voltage condition.

A2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC B1317, U3003:16 or U3003:17 present in 1 or more modules AND are any charging system Diagnostic Trouble Codes (DTCs) present in the PCM?

Yes	DIAGNOSE the PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to A3

A3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Carry out the Battery Condition Test diagnostic routine.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Did the battery pass the condition test?

Yes	GO to A4
No	INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

A4 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE VOLTAGE (VPWR_ABS) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Measure and record the voltage at the battery.
- Using a diagnostic scan tool, monitor the VPWR_ABS PID.

Is the PID display within 0.2 volt of the recorded battery voltage?

Yes	GO to A7
No	GO to A5

A5 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect ABS module C135.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-1	V	Ground
C135-25	V	Ground
C135-28	V	Ground

Is each voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to A6
No	VERIFY AJB fuses are OK. If not OK, REFER to the Wiring Diagrams manual to identify the cause of the circuit short. If OK, REPAIR the affected circuit for high resistance or an open.

A6 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect the battery negative cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-13	Ω	Ground
C135-38	Ω	Ground

Are the resistances less than 3 ohms?

Yes	GO to A7
No	REPAIR the circuit.

A7 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected) and related in-line connectors.
- Using a good light source, inspect all connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Is the connector free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to A8
No	REPAIR the connector or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

A8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Connect the battery negative cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Wheel Speed Sensor Erratic Signal Faults

Normal Operation and Fault Conditions

The wheel speed sensor uses the tone ring to generate a square wave signal proportional to wheel speed which is sent to the ABS module. The front wheel bearings, rear axle shafts, encoder (tone) rings and wheel speed sensors must be undamaged and free from any contamination to produce a clean signal for use by the ABS module. Also, all 4 tires and wheels must be of the same manufacturer recommended size for the wheel speed sensor to generate an accurate wheel speed signal.

The front wheel speed sensors and encoder rings are part of the front wheel hub and bearing assembly.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
• C0030:07 • C0033:07 • C0036:07 • C0039:07	• Left Front Tone Wheel: Mechanical Failure • Right Front Tone Wheel: Mechanical Failure • Left Rear Tone Wheel: Mechanical Failure • Right Rear Tone Wheel: Mechanical Failure	These Diagnostic Trouble Codes (DTCs) set in continuous memory if there is damage to the wheel speed sensor or tone ring. After module initialization and when vehicle speed is above 48 km/h (30 mph), the ABS module monitors the raw wheel speed sensor signal for a cyclically reoccurring gap or slope in the signal. This indicates a possible missing tooth in the tone ring. If the signal is incorrect for more than 1 minute, the DTC is set.

• C0031:07 • C0034:07 • C0037:07 • C003A:07	• Left Front Wheel Speed Sensor: Mechanical Failure • Right Front Wheel Speed Sensor: Mechanical Failure • Left Rear Wheel Speed Sensor: Mechanical Failure • Right Rear Wheel Speed Sensor: Mechanical Failure	The ABS module monitors wheel speed sensor signal for noise which could create an invalid signal. If the ABS module detects noise on one or more of the wheel speed sensor signals, this DTC is set.
• C0031:24 • C0034:24 • C0037:24 • C003A:24	• Left Front Wheel Speed Sensor: Signal Stuck High • Right Front Wheel Speed Sensor: Signal Stuck High • Left Rear Wheel Speed Sensor: Signal Stuck High • Right Rear Wheel Speed Sensor: Signal Stuck High	After the ABS has initialized, wheel speed sensor supply voltage is above 9 volts and vehicle speed exceeds 60 km/h (37 mph) for more than 5 seconds, the ABS module monitors wheel speed sensor signal plausibility. If one or more wheel speed signals does not match the other and exceeds a pre-set parameter, one or more of these Diagnostic Trouble Codes (DTCs) set in continuous memory.
• C0031:25 • C0034:25 • C0037:25 • C003A:25	• Left Front Wheel Speed Sensor: Signal Shape / Waveform Failure • Right Front Wheel Speed Sensor: Signal Shape / Waveform Failure • Left Rear Wheel	After module initialization, the ABS module monitors each wheel speed sensor input waveform and sets one or more of these Diagnostic Trouble Codes (DTCs) in continuous memory or on-demand if the waveform is implausible when compared to other inputs.

	Speed Sensor: Signal Shape / Waveform Failure • Right Rear Wheel Speed Sensor: Signal Shape / Waveform Failure	
• C0031:28 • C0034:28 • C0037:28 • C003A:28	• Left Front Wheel Speed Sensor: Signal Bias Level Out of Range/Zero Adjustment Failure • Right Front Wheel Speed Sensor: Signal Bias Level Out of Range/Zero Adjustment Failure • Left Rear Wheel Speed Sensor: Signal Bias Level Out of Range/Zero Adjustment Failure • Right Rear Wheel Speed Sensor: Signal Bias Level Out of Range/Zero Adjustment Failure	These Diagnostic Trouble Codes (DTCs) set in continuous memory or on-demand if the wheel speed signal input is out of range, continuously indicates low wheel speed or continuously indicates high wheel speed.
• C0031:29 • C0034:29 • C0037:29 • C003A:29	• Left Front Wheel Speed Sensor: Signal Invalid • Right Front Wheel Speed Sensor: Signal Invalid	After the ABS module is initialized, wheel speed sensor supply voltage is above 9 volts and vehicle speed exceeds 60 km/h (37 mph) for 72 seconds the ABS module compares the wheel speed signals to each other and to a calculated reference speed. If the difference between maximum and minimum wheel speed related to the calculated reference speed exceeds 16% or the difference between the left wheel speed sensor and the right wheel speed sensor on same axle exceeds 5% one or more of these Diagnostic Trouble Codes (DTCs) sets in continuous memory or on-demand.

	• Left Rear Wheel Speed Sensor: Signal Invalid • Right Rear Wheel Speed Sensor: Signal Invalid	
• C0031:38 • C0034:38 • C0037:38 • C003A:38	• Left Front Wheel Speed Sensor: Signal Frequency Incorrect • Right Front Wheel Speed Sensor: Signal Frequency Incorrect • Left Rear Wheel Speed Sensor: Signal Frequency Incorrect • Right Rear Wheel Speed Sensor: Signal Frequency Incorrect	After the ABS has initialized, wheel speed sensor supply voltage is above 9 volts and vehicle speed exceeds 60 km/h (37 mph) for more than 5 seconds with no brake pedal input, the ABS module monitors wheel speed sensor signal plausibility. If there is a wheel speed sensor signal plausibility due to interference or a signal disturbance, one or more of these Diagnostic Trouble Codes (DTCs) set in continuous memory.
• C0031:65 • C0034:65 • C0037:65 • C003A:65	• Left Front Wheel Speed Sensor: Signal Has Too Few Transitions / Events • Right Front Wheel Speed Sensor: Signal Has Too Few Transitions / Events • Left Rear Wheel Speed Sensor: Signal Has Too Few Transitions / Events • Right Rear Wheel	After the ABS has initialized, wheel speed sensor supply voltage is above 9 volts and vehicle speed exceeds 60 km/h (37 mph) for more than 5 seconds, the ABS module monitors wheel speed sensor signal plausibility. If a wheel speed sensor signal does not increase past 43 km/h (27 mph), one or more of these Diagnostic Trouble Codes (DTCs) set in continuous memory.

	Speed Sensor: Signal Has Too Few Transitions / Events	
• C0031:76 • C0034:76 • C0037:76 • C003A:76	• Left Front Wheel Speed Sensor: Wrong Mounting Position • Right Front Wheel Speed Sensor: Wrong Mounting Position • Left Rear Wheel Speed Sensor: Wrong Mounting Position • Right Rear Wheel Speed Sensor: Wrong Mounting Position	After the ABS has initialized and the wheel speed sensor signal monitoring is complete, the ABS module monitors wheel speed sensor signal plausibility. If the module detects signal behavior indicating a sensor installation issue (excessive air gap, incorrect mounting position), one or more of these Diagnostic Trouble Codes (DTCs) set in continuous memory.
C006B:00	Stability System Active Too Long: No Sub Type Information	This DTC is set if the ABS module detects continuous ABS or EBD control activations for an implausible time period (more than 60 seconds) at one or more wheels.
C1A95:02	Wheel Speed Sensor: General Signal Failure	This DTC is set if there is low power to the wheel speed sensors or reverse current on the wheel speed sensor supply is detected.
C1A95:2F	Wheel Speed Sensor: Signal Erratic	This DTC sets when multiple wheel speed sensors simultaneously exhibit suspicious failure type behavior for more than 500 milliseconds.
C1A95:62	Wheel Speed Sensor: Signal Compare Failure	This DTC is set when the ABS module detects one wheel speed sensor mounted in the wrong direction.
C1A95:64	Wheel Speed Sensor: Signal Plausibility Failure	This DTC is set when the ABS module monitoring determines an implausible ABS control activation has been requested for more 1 second.

Possible Causes

- Underinflated tires
- Incorrect or mismatched tires
- Wiring, terminals or connectors
- Wheel bearings
- Wheel speed sensor tone rings
- Wheel speed sensors
- ABS module

PINPOINT TEST B : WHEEL SPEED SENSOR ERRATIC SIGNAL FAULTS

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

B1 CHECK FOR ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).

Is DTC C0031:01, C0031:12, C0031:14, C0032:11, C0034:01, C0034:12, C0034:14 or C0035:11 present?

Yes	GO to Pinpoint Test J
No	If DTC C0037:01, C0037:12, C0037:14, C0038:11, C003A:01, C003A:12, C003A:14 or C003B:11 is present, GO to Pinpoint Test K If one or more of the Diagnostic Trouble Codes (DTCs) shown in the DTC Fault Trigger Conditions table is present, GO to B2 For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the ABS Module DTC Chart.

B2 CHECK THE TIRES SIZE AND PRESSURE

- Ignition OFF.
- Verify all the tires and wheels are the same size and the tire size and inflation pressures are correct as indicated on the VC label.

Are the tires and wheels OK?

Yes	GO to B3
No	INSTALL the correct size tire or wheel or ADJUST tire pressure as necessary.

B3 CHECK THE WHEEL SPEED SENSOR ELECTRICAL CONNECTOR FOR DAMAGE

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Disconnect the suspect wheel speed sensor electrical connector.
- Using a good light source, inspect the wheel speed sensor and electrical connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
  - water intrusion - clean and dry the connector, install a new connector as necessary
- Inspect the wheel speed sensor and harness for abrasions, broken connector tabs or water intrusion.

Is the wheel speed sensor and harness OK?

Yes	For rear wheel speed sensor Diagnostic Trouble Codes (DTCs), GO to B4 For front wheel speed sensor Diagnostic Trouble Codes (DTCs), GO to B5
No	INSTALL a new wheel speed sensor. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).

B4 INSPECT THE WHEEL SPEED SENSOR MOUNTING

- Inspect the rear wheel speed sensor and fastener for looseness.
- Inspect the rear wheel speed sensor installation.

Is the wheel speed sensor installed correctly and are the wheel speed sensor and fastener tight?

Is the wheel speed sensor installed correctly and are the wheel speed sensor and fastener tight?

Yes	GO to B5
No	REINSTALL or TIGHTEN the wheel speed sensor fastener to specification.

B5 CHECK THE FRONT WHEEL BEARINGS AND REAR TONE RINGS FOR DAMAGE

- Inspect the front wheel bearings for abnormal wear or roughness, deformation or contamination of the seal and tone ring.
- Inspect the front wheel speed sensor for signs of damage.
- Inspect the rear wheel speed sensor tone rings for signs of damage, deformation and missing teeth.

Are the front wheel bearings, front wheel speed sensors and rear tone rings OK?

Yes	If DTC C003x:24, C003x:25, C003x:28, C003x:29, C003x:38 or C003x:76 is present, GO to B6 If DTC C003x:07, C003x:65 or C1A95:2F is present, GO to B7
No	INSTALL new components as necessary. For the front wheel speed sensor, REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). For the front wheel hub, REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).

B6 CHECK THE WHEEL SPEED SENSOR SIGNAL RETURN CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect the suspect wheel speed sensor electrical connector (if not previously disconnected).
- Disconnect ABS module C135.
- For the LH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-8	Ω	C150-1

- For the RH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-4	Ω	C160-1

- For the LH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-18	Ω	C440-1

- For the RH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-29	Ω	C426-1

Is the resistance less than 3 ohms?

Yes	GO to B7
No	REPAIR the circuit.

B7 CHECK FOR RETURNING DIAGNOSTIC TROUBLE CODES (DTCS)

- Connect the suspect wheel speed sensor electrical connector.
- Connect ABS module C135.
- Ignition ON.
- Using a diagnostic scan tool, clear all ABS module Diagnostic Trouble Codes (DTCs).
- Test drive the vehicle under normal driving conditions above 60 km/h (37 mph) for a minimum of 2 minutes.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Is one or more of the Diagnostic Trouble Codes (DTCs) shown in the DTC Fault Trigger Conditions table present?

Yes	GO to B8
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B8 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Is the connector free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to B9
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

B9 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Connect any disconnected wheel speed sensor electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

C101A:1C

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

The brake booster vacuum sensor receives a sensor supply voltage of 5 volts from the ABS module. The sensor is also grounded through the ABS module. The sensor uses the pressure differential between the atmosphere and the brake booster vacuum chamber to produce a return voltage signal to the ABS module between 0.3 volt and 4.7 volts. The ABS module uses other sensor inputs such as wheel speed, brake pedal and stability sensors to determine if the vehicle is stopping and at what rate of deceleration. This information is compared against the vacuum pressure sensor to determine the validity of the sensor signal and the working condition of the sensor itself.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C101A:1C	Vacuum Pressure Sensor: Circuit Voltage Out of Range	This DTC sets in continuous memory if the 5-volt sensor supply voltage falls outside of a predetermined specification (either too high or too low).

Possible Causes

- Brake booster vacuum leak
- Wiring, terminals or connectors
- Brake booster vacuum sensor
- ABS module

Visual Inspection and Diagnostic Pre-checks

- Inspect the brake booster for vacuum leaks.
- Inspect the brake booster for any obvious signs of damage.
- Inspect the brake booster vacuum sensor harness and connector of any obvious signs of damage.
- Make sure the brake booster vacuum sensor electrical connector is free from any corrosion or other contaminants.

PINPOINT TEST C : C101A:1C

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

C1 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Disconnect brake booster vacuum sensor C1603 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Using a suitable mating terminal, check each female terminal for deformed or enlarged contacts by comparing the mating terminal's fit between each of the following pins:
  - C135-5
  - C135-10
  - C135-37
  - C1603-1
  - C1603-2
  - C1603-3

Are both connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to C2

No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

C2 CHECK THE VACUUM SENSOR WIRING FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-5	V	Ground
C135-10	V	Ground
C135-37	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C3

C3 CHECK THE VACUUM SENSOR WIRING FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-5	Ω	Ground
C135-32	Ω	Ground
C135-37	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE VACUUM SENSOR WIRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-5	Ω	C1603-3
C135-10	Ω	C1603-2
C135-37	Ω	C1603-1

Are the resistances less than 3 ohms?

Yes	GO to C5

No	REPAIR the circuit.

C5 CHECK THE VACUUM SENSOR WIRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1603-1	Ω	C1603-2
C1603-1	Ω	C1603-3
C1603-2	Ω	C1603-3

Are the resistances greater than 10,000 ohms?

Yes	GO to C6
No	REPAIR the circuit.

C6 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OUTPUT

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1603-3	V	Ground

Is the voltage between 4.7 and 5.2 volts?

Yes	INSTALL a new brake booster vacuum sensor.
No	GO to C7

C7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Connect brake booster vacuum sensor C1603 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0140:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the BCM sends messages to the GWM over the HS-CAN1, the GWM relays these message to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the ABS module sets Diagnostic Trouble Codes (DTCs). This can be due to a BCM failure, a GWM failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the BCM,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	This DTC sets in the ABS module if the ABS module does not receive any messages from the BCM.

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- GWM
- BCM
- ABS module

PINPOINT TEST D : U0140:00

D1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Do the GWM and the BCM pass the Network Test?

Yes	GO to D2
No	DIAGNOSE the no communication with the GWM or the BCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Repeat the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0140:00 retrieved again?

Yes	GO to D3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK

BRAKE SYSTEM) SELF-TEST

- Review the recorded Diagnostic Trouble Codes (DTCs) from the ABS module self-test.

Is DTC U3003:16 or U3003:17 present in the ABS module?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to D4

D4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE GWM (GATEWAY MODULE A)

- Using a diagnostic scan tool, carry out the GWM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the GWM?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to D5

D5 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE BCM (BODY CONTROL MODULE)

- Using a diagnostic scan tool, carry out the BCM self-test.
- Retrieve and record all Diagnostic Trouble Codes (DTCs) from the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the BCM?

Yes	DIAGNOSE the BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to D6

D6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:XX SET IN OTHER MODULES

- Using the diagnostic scan tool, carry out the self-test for all modules.
- Retrieve and record the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140:xx set in 1 or more modules other than the ABS module?

Yes	GO to D7
No	GO to D8

D7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect all BCM connectors and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all BCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical

	Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

D8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U3003:17

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

The ABS module, hydraulic pump and solenoid valves require an operating voltage between 10 and 17 volts. The ABS module receives this voltage from the BJB. The ABS module has 2 ground circuits that splice together and terminate at a single location. An overcharging condition in the charging system results in the ABS module setting a DTC. This DTC may also set in the ABS module due to battery charging or vehicle jump starting events.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	This DTC sets on-demand if the voltage supplied to the ABS module is above 17 volts.

Possible Causes

- Charging system concern
- ABS module

PINPOINT TEST E : U3003:17

E1 CHECK FOR HIGH VOLTAGE DIAGNOSTIC TROUBLE CODES (DTCS) SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, retrieve and record all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC B1317, B1318, B1676, U3003:16 or U3003:17 present in one or more modules AND are any charging system Diagnostic Trouble Codes (DTCs) present in the PCM?

Yes	DIAGNOSE the PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to E2

E2 CHECK THE BATTERY VOLTAGE

- Turn off all interior lights, exterior lights and accessories.
- **NOTE:** *Do not allow the engine speed to increase above 2,000 RPM while performing this step or the generator may self-excite and result in default charging system output voltage. If engine speed increases above 2,000 RPM, turn the vehicle off and restart the engine before performing this step.*

  Start and run the engine at approximately 1,500 RPM for 3 minutes while monitoring the battery voltage.

Is the battery voltage between 13 and 15.2 volts ?

Yes	GO to E3
No	DIAGNOSE the overcharging condition. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

E3 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Turn the engine off.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Repeat the ABS module self-test.

Is DTC U3003:17 still present?

Yes	GO to E4
No	The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

E4 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect all connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins

- pushed-out pins - install new pins as necessary
- spread terminals - install new terminals as necessary

Is the connector free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to E5
No	REPAIR the connector or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

E5 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0146:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the GWM sends messages to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the ABS module sets Diagnostic Trouble Codes (DTCs). This can be due to a GWM failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the GWM,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	This DTC sets in the ABS module if any of the GWM messages is missing. This can be due to a failure, a circuit failure on the HS-CAN or an excessive load on the network

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- GWM
- ABS module

PINPOINT TEST F : U0146:00

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

F1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using the diagnostic scan tool, carry out the Network Test.

Does the GWM pass the Network Test?

Yes	GO to F2
No	DIAGNOSE the no communication with the GWM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

F2 RECHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Repeat the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0151:00 retrieved again?

Yes	GO to F3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

F3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) SELF-TEST

- Review the recorded Diagnostic Trouble Codes (DTCs) from the ABS module self-test.

Is DTC U3003:16 or U3003:17 present in the ABS module?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to F4

F4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE GWM (GATEWAY MODULE A)

- Using a diagnostic scan tool, carry out the GWM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the GWM?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to F5

F5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0146:XX SET IN OTHER MODULES

- Using the diagnostic scan tool, carry out the self-test for all modules.
- Retrieve and record the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0146:xx set in 1 or more modules other than the ABS module?

Yes	GO to F6
No	GO to F7

F6 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Wait one minute then disconnect all GWM connectors and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, DIAGNOSE the GWM concern. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

F7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0151:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the RCM sends messages to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the ABS module sets Diagnostic Trouble Codes (DTCs). This can be due to a RCM failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the RCM,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	This DTC sets in the ABS module if the time allotted for stability sensor messages expires before the ABS module receives any stability sensor messages.

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- RCM
- ABS module

PINPOINT TEST G : U0151:00

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

G1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using the diagnostic scan tool, carry out the Network Test.

Does the RCM pass the Network Test?

Yes	GO to G2
No	DIAGNOSE the no communication with the RCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

G2 RECHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Repeat the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0151:00 retrieved again?

Yes	GO to F3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

G3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) SELF-TEST

- Review the recorded Diagnostic Trouble Codes (DTCs) from the ABS module self-test.

Is DTC U3003:16 or U3003:17 present in the ABS module?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to G4

G4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE RCM (RESTRAINTS CONTROL MODULE)

- Using a diagnostic scan tool, carry out the RCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the RCM?

Yes	DIAGNOSE the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to G5

G5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:XX SET IN OTHER MODULES

- Using the diagnostic scan tool, carry out the self-test for all modules.
- Retrieve and record the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0151:xx set in 1 or more modules other than the ABS module?

Yes	GO to G6
No	GO to G7

G6 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Wait one minute then disconnect all RCM connectors and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all RCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, DIAGNOSE the RCM concern. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

G7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C0020:16, C0020:17, C0020:49

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

The ABS module uses an internal solid state switch to operate the hydraulic pump motor. The ABS module tests the hydraulic pump motor by activating it for 30 milliseconds. While the pump motor is activated, the ABS module monitors the voltage drop across the hydraulic pump motor. After 30 milliseconds have passed, the ABS module stops applying voltage to the pump motor and monitors the voltage the spinning hydraulic pump motor is generating and the voltage drop across the hydraulic pump motor solid state switch. If the monitored voltages are not within specifications, the ABS module sets a DTC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C0020:16	ABS Pump Motor Control: Circuit Voltage Below Threshold	This DTC sets if the ABS module detects an under voltage condition at the pump motor voltage input.
C0020:17	ABS Pump Motor Control: Circuit Voltage Above Threshold	This DTC sets on-demand if the ABS module detects a pump motor voltage input greater than 17 volts for more than 0.5 seconds.
C0020:49	ABS Pump Motor Control: Internal Electronic Failure	This DTC sets if the hydraulic pump motor actual state does not match the commanded state for 30 seconds; pump is running, pump is not running or pump motor relay shorted.

Possible Causes

- Fuse
- Wiring, terminals or connectors
- HCU
- ABS module

Visual Inspection and Diagnostic Pre-checks

- Make sure the vehicle battery terminals and cables are free of any corrosion and other contaminants.
- Make sure the vehicle battery terminals are tightened to their correct torque specifications.
- Make sure BJB fuses and the fuse sockets are OK.

PINPOINT TEST H : C0020:16, C0020:17, C0020:49

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

H1 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE ELECTRICAL CONNECTOR

- Ignition OFF.
- Disconnect ABS module C135.
- Using a good light source, inspect ABS module C135 for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to H2
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

H2 CHECK FOR FAULT REPEATABILITY

- Connect ABS module C135.
- Ignition ON.
- Using a diagnostic scan tool, clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Test drive the vehicle at speeds greater than 20 km/h (12 mph).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).

Are any ABS module Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For DTC C0020:16 GO to H4 For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the DTC Chart: ABS Module.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

H3 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE PUMP MOTOR VOLTAGE SUPPLY FOR AN OPEN

- Ignition OFF.
- Remove BJB fuse (60A).
- Disconnect ABS module C135.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-1	Ω	BJB fuse (60A) Output Cavity

Is the resistance less than 0.5 ohm?

Yes	GO to H4
No	REPAIR the circuit.

H4 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE PUMP MOTOR VOLTAGE SUPPLY FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to H5
No	REPAIR the circuit. REFER to the Wiring Diagrams manual to identify the cause of the circuit short.

H5 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE GROUND CIRCUIT FOR AN OPEN

- Disconnect the battery negative cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-13	Ω	Ground

Is the resistance less than 0.5 ohm?

Yes	GO to H6
No	REPAIR the circuit.

H6 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect ABS module C135 (if not previously disconnected).
- Repair:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect ABS module C135. Make sure it seats and latches correctly.
- Install BJB fuse 11 (60A).
- Connect the battery negative cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module and HCU. REFER to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).

	REFER to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0100:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the PCM sends messages to the GWM over the HS-CAN1, the GWM relays these message to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the ABS module sets Diagnostic Trouble Codes (DTCs). This can be due to a PCM failure, a GWM failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the PCM,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	This DTC sets if the ABS module does not receive any messages from the PCM.

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- GWM
- PCM
- ABS module

PINPOINT TEST I : U0100:00

I1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Do the GWM and PCM pass the Network Test?

Yes	GO to I2
No	DIAGNOSE the no communication with the GWM or PCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

I2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Retrieve and record the ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0100:00 retrieved again?

Yes	GO to I3
No	For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the DTC Chart: ABS Module. If no Diagnostic Trouble Codes (DTCs) are present, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) SELF-TEST

- Review the recorded Diagnostic Trouble Codes (DTCs) from the ABS self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to I4

I4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE GWM (GATEWAY MODULE A)

- Using a diagnostic scan tool, carry out the GWM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the GWM?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to I5

I5 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, carry out the PCM KOEO self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the PCM?

Yes	DIAGNOSE the PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to I6

I6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, carry out the self-test for all modules.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0100:xx set in 1 or more modules in addition to the ABS module?

Yes	GO to I7
No	GO to I8

I7 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect all PCM connectors and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all PCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

I8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Wheel Speed Sensor Electrical Faults - Front

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

Active wheel speed sensors generate a square wave signal proportional to wheel speed which is sent to the ABS module. Each wheel speed sensor is connected to the ABS module through 2 wires and a connector at each wheel speed sensor. One wire is for sensor voltage supply from the ABS module and the other wire is for the signal return to the ABS module. When the ignition is set to ON, the ABS module carries out a self-test by sending a reference voltage through the wheel speed sensors and their circuitry.

The front wheel speed sensors and encoder rings are part of the front wheel hub and bearing assembly.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
• C0031:01 • C0034:01	• Left Front Wheel Speed Sensor: General Electrical Failure • Right Front Wheel Speed Sensor: General Electrical Failure	These Diagnostic Trouble Codes (DTCs) set in continuous memory and on-demand if one or more wheel speed sensors are not sending a signal to the ABS module.
• C0031:12 • C0034:12	• Left Front Wheel Speed Sensor: Circuit Short to Battery • Right Front Wheel Speed Sensor: Circuit Short to Battery	These Diagnostic Trouble Codes (DTCs) set in continuous memory and on-demand if there is a short to battery voltage in the sensor signal return circuit. A short to battery voltage may be due to the sensor signal return circuit and the sensor voltage supply circuit shorted together. These Diagnostic Trouble Codes (DTCs) also set if the sensor has an internal short to battery voltage.
• C0032:11 • C0035:11	• Left Front Wheel Speed Sensor Supply: Circuit Short to Ground • Right Front Wheel Speed Sensor Supply: Circuit Short to Ground	These Diagnostic Trouble Codes (DTCs) set in continuous memory if there is a short to ground in the sensor signal voltage supply circuit.

• C0031:14 • C0034:14	• Left Front Wheel Speed Sensor: Circuit Short to Ground or Open • Right Front Wheel Speed Sensor: Circuit Short to Ground or Open	These Diagnostic Trouble Codes (DTCs) set in continuous memory and on-demand if there is a short to ground or an open in the sensor signal return circuit or if the sensor has an internal short to ground or an internal open.

Possible Causes

- Wiring, terminals or connectors
- Wheel speed sensor
- ABS module

Visual Inspection and Diagnostic Pre-checks

- Make sure the wheel speed sensor harness is routed correctly and is undamaged.
- Make sure the wheel speed sensor electrical connector is free from any corrosion or other contaminants.

PINPOINT TEST J : WHEEL SPEED SENSOR ELECTRICAL FAULTS - FRONT

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

J1 CHECK FOR FAULT REPEATABILITY

- Ignition ON.
- Using a diagnostic scan tool, clear all ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Test drive the vehicle under normal driving conditions above 60 km/h (37 mph) for a minimum of 2 minutes.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Is DTC C0031:01, C0031:12, C0031:14, C0032:11, C0034:01, C0034:12, C0034:14 or C0035:11 present?

Yes	If the Rotunda Active Wheel Speed Sensor Tester **is** available, GO to J2 If the Rotunda Active Wheel Speed Sensor Tester **is not** available and DTC C0031:01, C0031:12, C0034:01 or C0034:12 is present, GO to J5 If the Rotunda Active Wheel Speed Sensor Tester **is not** available and DTC C0031:14 or C0034:14 is present, GO to J6 If the Rotunda Active Wheel Speed Sensor Tester **is not** available and DTC C0032:11 or C0035:11 is present, GO to J7
No	The system is operating correctly at this time. INSPECT both front wheel speed sensor electrical connectors and the ABS module electrical connector. REPAIR or CLEAN the connector as necessary. ADDRESS the root cause of any connector or pin issues.

J2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OUTPUT USING THE ROTUNDA ACTIVE WHEEL SPEED SENSOR TESTER

- Ignition OFF.
- Disconnect the suspect wheel speed sensor electrical connector.
- Connect the Rotunda Active Wheel Speed Sensor Tester to the wheel speed sensor connectors.

- Ignition ON.
- Select the correct system polarity on the Rotunda Active Wheel Speed Sensor Tester and turn the power switch to the ON position.

Is the tester output LED illuminated?

Yes	GO to J3
No	GO to J5

J3 CHECK THE WHEEL SPEED SENSOR FOR A SHORT TO VOLTAGE WITH THE ROTUNDA ACTIVE WHEEL SPEED SENSOR TESTER

- Observe the current overload LED on the Rotunda Active Wheel Speed Sensor Tester.

Is the current overload LED illuminated?

Yes	REPAIR the suspect wheel speed sensor circuit for a short to voltage.
No	GO to J4

J4 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE ROTUNDA ACTIVE WHEEL SPEED SENSOR TESTER

- Raise the suspect wheel until it can spin freely.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- While monitoring the Rotunda Active Wheel Speed Sensor Tester, slowly spin the suspect wheel.

Do the sensor output Light-emitting Diodes (LEDs) illuminate and flash?

Yes	The system is operating correctly at this time. INSPECT all wheel speed sensor electrical connectors and the ABS module electrical connectors. REPAIR or CLEAN the connector as necessary. ADDRESS the root cause of any connector or pin issues.
No	INSTALL a new wheel speed sensor.

J5 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO BATTERY VOLTAGE

- Ignition OFF.
- Disconnect ABS module C135.
- Disconnect the suspect wheel speed sensor.
- Ignition ON.
- For the LH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-8		Ground
C135-19		Ground

- For the RH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-4		Ground
C135-16		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to J6

J6 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected).
- Disconnect the suspect wheel speed sensor (if not previously disconnected).
- For the LH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-8	Ω	C150-1
C135-19	Ω	C150-2

- For the RH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-4	Ω	C160-1
C135-16	Ω	C160-2

Are the resistances less than 3 ohms?

Yes	GO to J7
No	REPAIR the circuit.

J7 CHECK FOR SHORTED WHEEL SPEED SENSOR CIRCUITS

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected).
- Disconnect the suspect wheel speed sensor (if not previously disconnected).
- For the LH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C150-1	Ω	C150-2

- For the RH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C160-1	Ω	C160-2

Is the resistance greater 10,000 ohms?

Yes	If DTC C0031:01, C0031:14, C0032:11, C0034:01, C0034:14, C0035:11 is present, GO to J8 If DTC C0031:12 or C0034:12 is present, GO to J9
No	REPAIR the circuit.

J8 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO GROUND

- For the LH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-8	Ω	Ground
C135-19	Ω	Ground

- For the RH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-4	Ω	Ground
C135-16	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J9
No	REPAIR the circuit.

J9 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OUTPUT

- Ignition OFF.
- Connect ABS module C135.
- Ignition ON.
- For the LH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C150-1	V	C150-2

- For the RH front wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C160-1	V	C160-2

Is the voltage greater 10 volts?

Yes	INSTALL a new wheel speed sensor. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	GO to J10

J10 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected) and related in-line connectors.

- Disconnect the suspect wheel speed sensor electrical connector (if not previously disconnected) and related in-line connectors.
- Using a good light source, inspect all connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Is the connector free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to J11
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

J11 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Connect the suspect wheel speed sensor and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Wheel Speed Sensor Electrical Faults - Rear

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

Active wheel speed sensors generate a square wave signal proportional to wheel speed which is sent to the ABS module. Each wheel speed sensor is connected to the ABS module through 2 wires and a connector at each wheel speed sensor. One wire is for sensor voltage supply from the ABS module and the other wire is for the signal return to the ABS module. When the ignition is set to ON, the ABS module carries out a self-test by sending a reference voltage through the wheel speed sensors and their circuitry.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
• C0037:01 • C003A:01	• Left Rear Wheel Speed Sensor: General Electrical Failure • Right Rear	These Diagnostic Trouble Codes (DTCs) set in continuous memory and on-demand if one or more wheel speed sensors are not sending a signal to the ABS module.

	Wheel Speed Sensor: General Electrical Failure	
• C0037:12 • C003A:12	• Left Rear Wheel Speed Sensor: Circuit Short to Battery • Right Rear Wheel Speed Sensor: Circuit Short to Battery	These Diagnostic Trouble Codes (DTCs) set in continuous memory and on-demand if there is a short to battery voltage in the sensor signal return circuit. A short to battery voltage may be due to the sensor signal return circuit and the sensor voltage supply circuit shorted together. These Diagnostic Trouble Codes (DTCs) also set if the sensor has an internal short to battery voltage.
• C0037:14 • C003A:14	• Left Rear Wheel Speed Sensor: Circuit Short to Ground or Open • Right Rear Wheel Speed Sensor: Circuit Short to Ground or Open	These Diagnostic Trouble Codes (DTCs) set in continuous memory and on-demand if there is a short to ground or an open in the sensor signal return circuit or if the sensor has an internal short to ground or an internal open.
• C0038:11 • C003B:11	• Left Rear Wheel Speed Sensor Supply: Circuit Short to Ground • Right Rear Wheel Speed Sensor Supply: Circuit Short to Ground	These Diagnostic Trouble Codes (DTCs) set in continuous memory if there is a short to ground in the sensor signal voltage supply circuit.

Possible Causes

- Wiring, terminals or connectors
- Wheel speed sensor
- ABS module

Visual Inspection and Diagnostic Pre-checks

- Make sure the wheel speed sensor harness is routed correctly and is undamaged.
- Make sure the wheel speed sensor electrical connector is free from any corrosion or other contaminants.

PINPOINT TEST K : WHEEL SPEED SENSOR ELECTRICAL FAULTS - REAR

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

K1 CHECK FOR FAULT REPEATABILITY

- Ignition ON.
- Using a diagnostic scan tool, clear all ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Test drive the vehicle under normal driving conditions above 60 km/h (37 mph) for a minimum of 2 minutes.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Is DTC C0037:01, C0037:12, C0037:14, C0038:11, C003A:01, C003A:12, C003A:14 or C003B:11 present?

Yes	If the Rotunda Active Wheel Speed Sensor Tester **is** available, GO to K2 If the Rotunda Active Wheel Speed Sensor Tester **is not** available and DTC C0037:01, C0037:12, C003A:01 or C003A:12 is present, GO to K5 If the Rotunda Active Wheel Speed Sensor Tester **is not** available and DTC C0037:14 or C003A:14 is present, GO to K6 If the Rotunda Active Wheel Speed Sensor Tester **is not** available and DTC C0038:11 or C003B:11 is present, GO to K7
No	The system is operating correctly at this time. INSPECT both front wheel speed sensor electrical connectors and the ABS module electrical connector. REPAIR or CLEAN the connector as necessary. ADDRESS the root cause of any connector or pin issues.

K2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OUTPUT USING THE ROTUNDA ACTIVE WHEEL SPEED SENSOR TESTER

- Ignition OFF.
- Disconnect the suspect wheel speed sensor electrical connector.
- Connect the Rotunda Active Wheel Speed Sensor Tester to the wheel speed sensor connectors.
- Ignition ON.
- Select the correct system polarity on the Rotunda Active Wheel Speed Sensor Tester and turn the power switch to the ON position.

Is the tester output LED illuminated?

Yes	GO to K3
No	GO to K5

K3 CHECK THE WHEEL SPEED SENSOR FOR A SHORT TO VOLTAGE WITH THE ROTUNDA ACTIVE WHEEL SPEED SENSOR TESTER

- Observe the current overload LED on the Rotunda Active Wheel Speed Sensor Tester.

Is the current overload LED illuminated?

Yes	REPAIR the suspect wheel speed sensor circuit for a short to voltage.
No	GO to K4

K4 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE ROTUNDA ACTIVE WHEEL SPEED SENSOR TESTER

- Raise the suspect wheel until it can spin freely.

REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- While monitoring the Rotunda Active Wheel Speed Sensor Tester, slowly spin the suspect wheel.

Do the sensor output Light-emitting Diodes (LEDs) illuminate and flash?

Yes	The system is operating correctly at this time. INSPECT all wheel speed sensor electrical connectors and the ABS module electrical connectors. REPAIR or CLEAN the connector as necessary. ADDRESS the root cause of any connector or pin issues.
No	INSTALL a new wheel speed sensor. REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).

K5 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO BATTERY VOLTAGE

- Ignition OFF.
- Disconnect ABS module C135.
- Disconnect the suspect wheel speed sensor.
- Ignition ON.
- For the LH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-18		Ground
C135-31		Ground

- For the RH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-17		Ground
C135-29		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to K6

K6 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected).
- Disconnect the suspect wheel speed sensor (if not previously disconnected).
- For the LH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-18	Ω	C440-1
C135-31	Ω	C440-2

- For the RH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead

C135-17	Ω	C426-2
C135-29	Ω	C426-1

Are the resistances less than 3 ohms?

Yes	GO to K7
No	REPAIR the circuit.

K7 CHECK FOR SHORTED WHEEL SPEED SENSOR CIRCUITS

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected).
- Disconnect the suspect wheel speed sensor (if not previously disconnected).
- For the LH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C440-1	Ω	C440-2

- For the RH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C426-1	Ω	C426-2

Is the resistance greater 10,000 ohms?

Yes	If DTC C0037:01, C0037:14, C0038:11, C003A:01, C003A:14, C003B:11 is present, GO to K8 If DTC C0037:12 or C003A:12 is present, GO to K9
No	REPAIR the circuit.

K8 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO GROUND

- For the LH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-18	Ω	Ground
C135-31	Ω	Ground

- For the RH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C135-17	Ω	Ground
C135-29	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to K9
No	REPAIR the circuit.

K9 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OUTPUT

- Ignition OFF.
- Connect ABS module C135.
- Ignition ON.
- For the LH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C440-1		C440-2

- For the RH rear wheel speed sensor, measure:

Positive Lead	Measurement / Action	Negative Lead
C426-1		C426-2

Is the voltage greater 10 volts?

Yes	INSTALL a new wheel speed sensor. REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	GO to K10

K10 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135 (if not previously disconnected) and related in-line connectors.
- Disconnect the suspect wheel speed sensor electrical connector (if not previously disconnected) and related in-line connectors.
- Using a good light source, inspect all connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Is the connector free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to K11
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

K11 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Connect the suspect wheel speed sensor and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Traction Control System Is Inoperative Or Cannot Be Disabled

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

The traction control switch is used to switch the AdvanceTrac features (traction control, ESC and RSC) on or off. When the driver presses the traction control switch, the IPC receives a ground signal from the switch and illuminates the stability-traction control OFF indicator. The IPC sends a traction control switch message to the GWM over the HS-CAN3 and the GWM relays this message to the ABS module over the HS-CAN2. The ABS module takes the necessary action depending on the switch inputs and traction control message. For additional information on disabling AdvanceTrac,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

If equipped, MyKey® allows users to configure traction control to be either always on or selectable. If a MyKey® restricted key is in use with the MyKey® traction control feature configured to always on, traction control cannot be disabled. An admin key must be used to enable and disable traction control.

NOTE: *For vehicles equipped with a keyless vehicle system, this test requires the use of at least 2 passive keys programmed to the vehicle; one admin passive key and one restricted passive key.*

NOTE: *For vehicles not equipped with a keyless vehicle system, this test requires the use of at least 2 Integrated Keyhead Transmitters (IKTs) programmed to the vehicle, one admin IKT and one restricted IKT.*

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C0089:73	TCS Disable Switch: Actuator Stuck Closed	This DTC sets in the ABS module if the traction control switch is pressed and held in the applied position for longer than 30 seconds, this can be caused by a short to ground on the traction control off circuit or if there is an internal failure of the traction control switch.

Possible Causes

- A MyKey® restricted key is in use
- Wiring, terminals or connectors
- Traction control switch
- IPC

PINPOINT TEST L : THE TRACTION CONTROL SYSTEM IS INOPERATIVE OR CANNOT BE DISABLED

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.
L1 VERIFY THAT THE KEY IN USE IS NOT RESTRICTED
• For vehicles equipped with a keyless vehicle system; – place 1 of the passive keys inside the vehicle and all other passive keys at least 1 meter (3 feet)

away from the vehicle.
  - press the start-stop button without pressing the brake pedal.
- For vehicles not equipped with a keyless vehicle system, turn the ignition to the ON position.
- Monitor the message center.

Does the message center display MYKEY ACTIVE DRIVE SAFELY?

Yes	The current passive key or IKT is a restricted key and is operating correctly. REPEAT the test using different passive keys or Integrated Keyhead Transmitters (IKTs) until the message center **does not** display MYKEY ACTIVE DRIVE SAFELY. GO to L2
No	GO to L2

L2 VERIFY THE MYKEY® TRACTION CONTROL SETTING

- Using the message center, verify the MyKey® traction control setting. Refer to the Owner's Literature for instructions on setting the MyKey® functions.

Is the MyKey® traction control setting configured to always on?

Yes	GO to L3
No	GO to L4

L3 VERIFY TRACTION CONTROL FUNCTION CAN BE DISABLED USING THE ADMIN PASSIVE KEY OR THE ADMIN IKT (INTEGRATED KEYHEAD TRANSMITTER)

- Using the message center, verify traction control can be enabled and disabled using the admin passive key or the admin IKT. Refer to the Owner's Literature for instructions on enabling and disabling traction control.

Can traction control be enabled and disabled using the admin passive key or the admin IKT?

Yes	The system is operating correctly at this time. The concern may have been caused by the use of a restricted passive key or restricted IKT. INFORM the customer that traction control can only be disabled using an admin passive key or an admin IKT when the MyKey® traction control setting is configured to always on.
No	GO to L4

L4 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the IPC self-test.

Are there any Diagnostic Trouble Codes (DTCs) in the IPC?

Yes	DIAGNOSE all IPC Diagnostic Trouble Codes (DTCs). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	If the IPC does not communicate with the diagnostic scan tool, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If the IPC does communicate with the diagnostic scan tool and there are no Diagnostic Trouble Codes (DTCs) present, GO to L5

L5 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.

Is DTC C0089:73 or U0155:00 present in the ABS module?

Yes	If DTC U0155:00 is present, GO to Pinpoint Test Q If DTC C0089:73 is present, GO to L6
No	If no Diagnostic Trouble Codes (DTCs) are present in the ABS module, GO to L6 For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the DTC Chart: ABS Module.

L6 CHECK THE TRACTION CONTROL SWITCH

- Ignition OFF.
- Disconnect multifunction switch C202.
- Measure **component side** while pressing and releasing the traction control switch:

Positive Lead	Measurement / Action	Negative Lead
C202-1	Ω	C202-12

Is the resistance less than 3 ohms with the switch pressed and greater than 10,000 ohms with the switch released?

Yes	If DTC C0089:73 is not present, GO to L7 If DTC C0089:73 is present, GO to L9
No	INSTALL a new stability-traction control switch.

L7 CHECK THE TRACTION CONTROL SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C202-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to L8
No	REPAIR the circuit.

L8 CHECK THE TRACTION CONTROL SWITCH SIGNAL CIRCUIT FOR AN OPEN

- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C202-1	Ω	C220-18

Is the resistance less than 3 ohms?

Yes	GO to L9
No	REPAIR the circuit.

L9 CHECK THE TRACTION CONTROL SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect IPC C220 (if not previously disconnected).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C202-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to L10
No	REPAIR the circuit.

L10 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect IPC C220 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to L11
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

L11 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Connect IPC C220 and related in-line connectors. Make sure they seat and latch correctly.
- Connect center stack switch assembly C2114. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern is still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0104:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the CCM sends messages to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the module sets a DTC. This can be due to a CCM failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the CCM,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0104:00	Lost Communication With Cruise Control Module: No Sub Type Information	This DTC sets in continuous memory in the ABS module if the ABS module does not receive any messages from the CCM.

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- CCM
- ABS module

PINPOINT TEST M : U0104:00

M1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the CCM pass the Network Test?

Yes	GO to M2
No	DIAGNOSE the no communication with the CCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

M2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Record the ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0104:00 retrieved again?

Yes	GO to M3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) SELF-TEST

- Check the recorded Diagnostic Trouble Codes (DTCs) from the ABS module self-test.

Was DTC U3003:16 or U3003:17 recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to M4

M4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE CCM (CRUISE CONTROL MODULE)

- Using a diagnostic scan tool, carry out the CCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the CCM?

Yes	DIAGNOSE the CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing).
No	GO to M5

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0104:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, carry out the self-test for all modules.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0104:xx set in 1 or more modules in addition to the ABS module?

Yes	GO to M6
No	GO to M7

M6 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect all CCM connector and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all CCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C0040:24, C0040:64

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The ABS module receives BPP and accelerator pedal position from the PCM through the GWM over the HS-CAN2. The ABS module uses the brake fluid pressure sensor in the HCU, wheel speed sensor and lateral acceleration information to verify the brake pedal position message. An incorrectly installed BPP switch can cause a signal plausibility concern. An implausible signal can also be created if the driver is resting one foot on the brake pedal while using the other foot to press the accelerator with vehicle speed above 10 km/h (6 mph).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C0040:24	Brake Pedal Switch "A": Signal Stuck High	There are 2 conditions which can cause this DTC to set in continuous memory in the ABS module. Thet first condition is if the PCM CAN messages indicate the brake pedal and accelerator pedals are pressed, vehicle speed is above 10 km/h (6 mph) and the brake fluid hydraulic pressure sensor in the HCU indicates less than 500 kPa (5 bar) for more than 60 seconds. The second condition is if the PCM CAN messages indicate the brake pedal and accelerator pedals are pressed and vehicle speed is greater than 10 km/h (6 mph) for more than 30 seconds.
C0040:64	Brake Pedal Switch "A": Signal Plausibility Failure	This DTC sets in continuous memory in the ABS module if the PCM CAN messages indicates the brake pedal is not being pressed, but brake hydraulic pressure is over 30 bar (435 psi) for more than 1 second.

Possible Causes

- Wiring, terminals or connectors
- BPP switch
- Network communication concern
- PCM
- Pressing both pedals (brake and accelerator) at the same time

Visual Inspection and Diagnostic Pre-checks

- Make sure the brake pedal switch electrical connector is connected and free of corrosion and other contaminants.
- Make sure the brake pedal switch is installed correctly.
- Make sure the brake pedal switch is operating correctly.

PINPOINT TEST N : C0040:24, C0040:64

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector

NOTE: *The BPP is also known as the stoplamp switch.*

N1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Using a diagnostic scan tool, carry out the PCM KOEO self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the PCM?

Yes	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to N2

N2 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) IN THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE

- Using a diagnostic scan tool, carry out the ABS module self-test.

Are any lost communication with PCM, invalid data from PCM, pressure sensor, wheel speed sensor or stability control sensor Diagnostic Trouble Codes (DTCs) present in the ABS module?

Yes	DIAGNOSE all lost communication with PCM, invalid data from PCM, pressure sensor, wheel speed sensor or stability control sensor Diagnostic Trouble Codes (DTCs) before diagnosing DTC C0040:64. GO to the DTC Chart: ABS Module.
No	GO to N3

N3 CHECK THE STOPLAMP SWITCH AND BRAKE PEDAL ASSEMBLY INSTALLATION

- Inspect the stoplamp switch and brake pedal assembly, verify there is no brake pedal pressure unintentionally applied due to incorrect stoplamp switch or brake pedal installation.

Are the stoplamp switch and brake pedal assembly installed correctly?

Yes	GO to N4
No	REINSTALL the stoplamp switch or brake pedal assembly.

N4 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE BRAKE ON / OFF (BOO_ABS) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, monitor the ABS module BOO_ABS PID while pressing and releasing the brake pedal.

Does the PID reflect the brake pedal movement?

Yes	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.
No	GO to N5

N5 CHECK THE PCM (POWERTRAIN CONTROL MODULE) BRAKE PEDAL POSITION (BOO1) PID (PARAMETER IDENTIFICATION)
• Ignition ON. • Using a diagnostic scan tool, monitor the PCM BOO1 PID while pressing and releasing the brake pedal. **Does the PID reflect the brake pedal movement?**

Yes	The concern is not present at this time and may have been caused by high network traffic, a loose or corroded connector or an intermittent condition. SET the ignition to OFF. DISCONNECT and INSPECT all PCM electrical connectors, stoplamp switch C278 and related in-line connectors for corrosion, bent pins, pushed-out pins and spread terminals. REPAIR or INSTALL new as necessary.
No	DIAGNOSE the BPP switch. REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).

C101A:15, C101A:16, C101A:29

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

The brake booster vacuum pressure sensor receives a sensor supply voltage of 5 volts from the ABS module. The sensor is also grounded through the ABS module. The sensor uses the pressure differential between the atmosphere and the brake booster vacuum chamber to produce a return voltage signal to the ABS module between 0.39 volt and 4.38 volts. The ABS module uses other sensor inputs such as wheel speed, brake pedal and stability sensors to determine if the vehicle is stopping and at what rate of deceleration. This information is compared against the vacuum pressure sensor to determine the validity of the sensor signal and the working condition of the sensor itself. An open circuit, a short to ground, a short to voltage or a faulted vacuum sensor cause the ABS module to set a DTC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C101A:15	Vacuum Pressure Sensor: Circuit Short To Battery or Open	This DTC sets in continuous memory in the ABS module if the brake booster vacuum sensor return signal line outside the expected range, 0.3 volt and 4.7 volts.
C101A:16	Vacuum Pressure Sensor: Circuit Voltage Below Threshold	This DTC sets in continuous memory in the ABS module if the brake booster vacuum sensor return signal line outside the expected range, 0.3 volt and 4.7 volts.
C101A:29	Vacuum Pressure Sensor: Signal Invalid	This DTC sets in continuous memory in the ABS module if the driver applies the brake pedal and the brake fluid pressure sensor indicates an increase in pressure but the vacuum level in the brake booster does not decrease by the expected amount.

Possible Causes

- Wiring, terminals or connectors
- Brake booster vacuum sensor
- Low battery voltage

Visual Inspection and Diagnostic Pre-checks

- Make sure the brake pedal switch electrical connector is connected and free of corrosion and other

contaminants.
- Make sure the brake pedal switch is installed correctly.
- Make sure the brake pedal switch is operating correctly.

PINPOINT TEST O : C101A:15, C101A:16, C101A:29

O1 CHECK FOR OTHER ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Are any brake pedal position or pressure sensor Diagnostic Trouble Codes (DTCs) present in the ABS module?

Yes	DIAGNOSE all ABS module brake pedal position or pressure sensor Diagnostic Trouble Codes (DTCs) before diagnosing DTC C101A:15 or C101A:16.
No	GO to O2

O2 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect ABS module C135.
- Disconnect brake booster vacuum sensor C1782.
- Using a good light source, inspect each connector terminal for any corrosion.
- Inspect both connectors for any pushed-out pins.
  Refer to Wiring Diagrams Cell 5 for schematic and connector information.
- Using a suitable mating terminal, check each female terminal for deformed or enlarged contacts by comparing the mating terminal's fit between each of the following pins:
  - C135-5
  - C135-10
  - C135-37
  - C1782-1
  - C1782-2
  - C1783-3

Are both connectors free of corrosion, pushed-out pins and deformed or enlarged contacts?

Yes	GO to O3
No	REPAIR the affected terminal. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

O3 RECHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Connect ABS module C135.
- Connect brake booster vacuum sensor C1782.
- Ignition ON.
- Using a diagnostic scan tool, clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Start the engine and allow it to run for at least 1 minute to build up vacuum in the brake booster.
- Fully and firmly, press and release the brake pedal 3 times.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Is DTC C101A:15 or C101A:16 present?

Yes	GO to O4
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

O4 CHECK THE VACUUM SENSOR WIRING FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ABS module C135.
- Disconnect brake booster vacuum sensor C1782.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-5		Ground
C135-10		Ground
C135-37		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to O5

O5 CHECK THE VACUUM SENSOR WIRING FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-5	Ω	Ground
C135-10	Ω	Ground
C135-37	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O6
No	REPAIR the circuit.

O6 CHECK THE VACUUM SENSOR WIRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-5	Ω	C1782-3
C135-10	Ω	C1782-2
C135-37	Ω	C1782-1

Are the resistances less than 3 ohms?

Yes	GO to O7
No	REPAIR the circuit.

O7 CHECK THE VACUUM SENSOR WIRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1782-1	Ω	C1782-2
C1782-1	Ω	C1782-3
C1782-2	Ω	C1782-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new brake booster vacuum sensor.
No	REPAIR the circuit.

U0131:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the PSCM sends messages to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the module sets a DTC. This can be due to a PSCM failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the PSCM,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0131:00	Lost Communication With Power Steering Control Module: No Sub Type Information	This DTC sets in continuous memory in the ABS module if the ABS module does not receive any messages from the PSCM.

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- PSCM
- ABS module

PINPOINT TEST P : U0131:00

P1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the PSCM pass the Network Test?

Yes	GO to P2

No	DIAGNOSE the no communication with the PSCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

P2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Record the ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0131:00 retrieved again?

Yes	GO to P3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

P3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) SELF-TEST

- Check the recorded Diagnostic Trouble Codes (DTCs) from the ABS module self-test.

Was DTC U3003:16 or U3003:17 recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to P4

P4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PSCM (POWER STEERING CONTROL MODULE)

- Using a diagnostic scan tool, carry out the PSCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the PSCM?

Yes	DIAGNOSE the PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	GO to P5

P5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0131:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, carry out the self-test for all modules.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0131:xx set in 1 or more modules in addition to the ABS module?

Yes	GO to P6
No	GO to P7

P6 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not

be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect all PSCM connector and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all PSCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, REFER to the EPAS symptom chart or DTC chart.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0155:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition ON, the IPC sends messages to the GWM over the HS-CAN3, the GWM relays these messages to the ABS module over the HS-CAN2. If the ABS module does not receive these messages within the specified time frame, the module sets a DTC. This can be due to a GWM failure, an IPC failure, a circuit failure on the network or an excessive load on the network. For information on the messages sent to the ABS module by the IPC,
REFER to: Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (206-09 Anti-Lock Brake System (ABS) and Stability Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	This DTC sets in continuous memory in the ABS module if the ABS module does not receive any messages from the IPC.

Possible Causes

- Wiring, terminals or connectors
- Network communication concern
- GWM
- IPC
- ABS module

PINPOINT TEST Q : U0155:00

Q1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Do the GWM and the IPC pass the Network Test?

Yes	GO to Q2
No	DIAGNOSE the no communication with the GWM or IPC. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Q2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Record the ABS module Diagnostic Trouble Codes (DTCs).

Is DTC U0155:00 retrieved again?

Yes	GO to Q3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) SELF-TEST

- Check the recorded Diagnostic Trouble Codes (DTCs) from the ABS module self-test.

Was DTC U3003:16 or U3003:17 recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test A For DTC U3003:17, GO to Pinpoint Test E
No	GO to Q4

Q4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE GWM (GATEWAY MODULE A)

- Using a diagnostic scan tool, carry out the GWM self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the GWM?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to Q5

Q5 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) IN THE IPC (INSTRUMENT PANEL CLUSTER)

- Using a diagnostic scan tool, carry out the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the IPC?

Yes	DIAGNOSE the IPC Diagnostic Trouble Codes (DTCs). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to Q6

Q6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, carry out the self-test for all modules.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0155:xx set in 1 or more modules in addition to the ABS module?

Yes	GO to Q7
No	GO to Q8

Q7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect all IPC connector and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect all IPC connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Q8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line connectors.
- Using a good light source, inspect the electrical connectors for the following:

- corrosion - install new connector or terminal and clean the module pins
- damaged or bent pins - install new terminals or pins
- pushed-out pins - install new pins as necessary
- spread terminals - install new terminals as necessary

- Connect ABS module C135 and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Hill Descent Control™ System Is Inoperative Or Cannot Be Disabled

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

The Hill Descent Control™ switch is used to activate and deactivate the Hill Descent Control™ system. When the driver presses the Hill Descent Control™ switch, the IPC receives a ground signal from the switch and illuminates the Hill Descent Control™ indicator. The IPC sends a Hill Descent Control™ switch message to the GWM over the HS-CAN3 and the GWM relays this message to the ABS module over the HS-CAN2. The ABS module takes the necessary action depending on the switch inputs and traction control message.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0401:86	Invalid Data Received From ECM/PCM "A": Signal Invalid	This DTC sets in continuous memory if the Hill Descent Control™ switch message from the IPC indicates the switch is stuck or held in place for longer than 30 seconds. This can be caused by a short to ground on the Hill Descent Control™ circuit or if there is an internal failure of the Hill Descent Control™ switch.

Possible Causes

- A MyKey® restricted key is in use
- Wiring, terminals or connectors
- Traction control switch
- IPC

PINPOINT TEST R : THE HILL DESCENT CONTROL™ SYSTEM IS INOPERATIVE OR CANNOT BE DISABLED

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.
R1 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)
• Ignition ON. • Using a diagnostic scan tool, carry out the IPC self-test. **Are there any Diagnostic Trouble Codes (DTCs) in the IPC?**

Yes	DIAGNOSE all IPC Diagnostic Trouble Codes (DTCs). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	If the IPC does not communicate with the diagnostic scan tool, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If the IPC does communicate with the diagnostic scan tool and there are no Diagnostic Trouble Codes (DTCs) present, GO to R2

R2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.

Are there any "lost communication" or "invalid data" Diagnostic Trouble Codes (DTCs) present in the ABS module?

Yes	DIAGNOSE all ABS module "lost communication" and "invalid data" Diagnostic Trouble Codes (DTCs)
No	GO to R3

R3 CHECK THE HILL DESCENT CONTROL™ SWITCH

- Ignition OFF.
- Disconnect multifunction switch C202.
- Measure **component side** while pressing and releasing the Hill Descent Control™ switch:

Positive Lead	Measurement / Action	Negative Lead
C202-4	Ω	C202-12

Is the resistance less than 3 ohms with the switch pressed and greater than 10,000 ohms with the switch released?

Yes	GO to R4
No	INSTALL a new multifunction switch.

R4 CHECK THE HILL DESCENT CONTROL™ SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C202-12	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to R5
No	REPAIR the circuit.

R5 CHECK THE HILL DESCENT CONTROL™ SWITCH SIGNAL CIRCUIT FOR AN OPEN

- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C202-4	Ω	C220-10

Is the resistance less than 3 ohms?

Yes	GO to R6
No	REPAIR the circuit.

R6 CHECK THE HILL DESCENT CONTROL™ SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C202-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to R7
No	REPAIR the circuit.

R7 VERIFY ALL WIRING CONNECTIONS

- Ignition OFF.
- Disconnect IPC C220 and related in-line connectors.
- Using a good light source, inspect the Hill Descent Control™ switch, the IPC and related in-line electrical connectors for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to R8
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

R8 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Connect IPC C220 and related in-line connectors. Make sure they seat and latch correctly.
- Connect center stack switch assembly C2114. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern is still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical

	Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U3002:62

Normal Operation and Fault Conditions

When the ignition is ON, the ABS module and the PCM share VIN information through the GWM over the HS-CAN1 and the HS-CAN2.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3002:62	Vehicle Identification Number: Signal Compare Failure	This DTC sets in continuous memory if the VIN message sent by the PCM over the HS-CAN1 does not match the VIN stored in the ABS module.

Possible Causes

- Module configuration (ABS and PCM)
- ABS module

PINPOINT TEST S : U3002:62

S1 VERIFY THE PCM (POWERTRAIN CONTROL MODULE) VIN (VEHICLE IDENTIFICATION NUMBER)

- Ignition ON.
- Using a diagnostic scan tool, compare the VIN in the PCM with the VIN plate on the vehicle.

Does the VIN in the PCM match the VIN plate?

Yes	GO to S2
No	RECONFIGURE the PCM. FOLLOW the instructions on the diagnostic scan tool. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

S2 VERIFY THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE PART NUMBER

- Using a diagnostic scan tool, retrieve and record the ABS module part number.
- Compare the part number retrieved to the part number in the parts catalog or equivalent.

Is the correct ABS module installed in the vehicle?

Yes	CONFIGURE the ABS module. FOLLOW the instructions on the diagnostic scan tool. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).
No	INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation). REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS)

and Stability Control, Removal and Installation).

Stability Control Sensor Signal Faults

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The ABS module receives vehicle yaw rate, lateral acceleration, longitudinal acceleration and roll rate from RCM over the HS-CAN2. The yaw rate sensor, lateral accelerometer and longitudinal accelerometer are contained in the RCM. A failure of the HS-CAN2, an incorrectly installed RCM, an internal failure of the RCM or the internal sensors causes the ABS to set one or more Diagnostic Trouble Codes (DTCs).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
• C0061:22 • C0062:22 • C0063:22	• Lateral Acceleration Sensor: Signal Amplitude > Maximum • Longitudinal Acceleration Sensor: Signal Amplitude > Maximum • Yaw Rate Sensor: Signal Amplitude > Maximum	This DTC sets if the absolute value of the yaw rate, lateral acceleration or longitudinal acceleration message from the RCM is outside of the maximum allowable range.
• C0061:28 • C0062:28 • C0063:28	• Lateral Acceleration Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure • Longitudinal Acceleration Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure • Yaw Rate Sensor: Signal Bias Level Out of Range / Zero Adjustment Failure	This DTC sets if the difference between the measured yaw rate and the calculated yaw rate is greater than a predetermined limit or if the learned lateral acceleration sensor offset or learned longitudinal acceleration sensor offset exceeds the programmed limits.
• C0061:64 • C0062:64 • C0063:64	• Lateral Acceleration Sensor:	This DTC sets if the yaw rate, lateral acceleration or longitudinal acceleration does not match other sensor input or calculated values.

• C0064:64	Signal Plausibility Failure • Longitudinal Acceleration Sensor: Signal Plausibility Failure • Yaw Rate Sensor: Signal Plausibility Failure • Roll Rate Sensor: Signal Plausibility Failure	
• C0062:02	• Longitudinal Acceleration Sensor: General Signal Failure	This DTC sets if the ABS module calibration of the longitudinal acceleration sensor is incomplete or not completed correctly.
• C0062:23	• Longitudinal Acceleration Sensor: Signal Stuck Low	This DTC sets if the absolute value of the longitudinal acceleration message from the RCM is outside stuck low.
• C0062:2A	• Longitudinal Acceleration Sensor: Signal Stuck In Range	This DTC is set in the ABS module if, during each drive-off acceleration, the measured longitudinal acceleration signal value sent from the RCM does not change as expected when compared to the calculated reference longitudinal acceleration signal value.
• C0062:67	• Longitudinal Acceleration Sensor: Signal Incorrect After Event	This DTC only sets when the ABS module does not complete a successful IVD Initialization routine. The ABS module longitudinal acceleration sensor input (LONG_ACCL) PID can be used to read the sensor value. The longitudinal acceleration sensor signal value from the RCM during standstill calibration on a level surface should be less than 2 m/s^2.
• C0063:27	• Yaw Rate Sensor: Signal Rate of Change Above Threshold	This DTC sets if the yaw rate signal gradient received from the RCM is greater than 500 deg/s^2.
• C0063:62	• Yaw Rate Sensor: Signal Compare Failure	This DTC sets if the difference between the yaw rate received from the RCM and the calculated reference yaw rate exceeds a predetermined threshold.
• C0064:96	• Roll Rate Sensor: Component Internal Failure	This DTC sets if the RCM sends an implausible roll rate sensor value.

Possible Causes

- Underinflated tires
- Incorrect or mismatched tires
- Network communication concern
- Incorrect or incomplete ABS module IVD Initialization
- Incorrectly installed RCM
- RCM

PINPOINT TEST T : STABILITY CONTROL SENSOR SIGNAL FAULTS

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

T1 CHECK FOR RETURNING ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Test drive the vehicle above 12 km/h (7 mph) and make at least 1 left turn and 1 right turn.
- Using a diagnostic scan tool, carry out the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) present in the ABS module?

Yes	If any of the Diagnostic Trouble Codes (DTCs) listed in the DTC Fault Trigger Conditions table are present, GO to T2 For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the DTC Chart: ABS Module.
No	The fault is not present and cannot be recreated at this time. CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSPECT all in-line connectors and the wire harness between the RCM and the ABS module for corrosion, loose terminals, spread terminals, loose wire connections, frayed wire connections, pinched wire harnesses and cut or pierced wire harnesses. REPAIR as necessary.

T2 CHECK THE WHEELS AND TIRES

- Inspect the wheels and tires for any damage or excessive wear.
- Verify all wheels and tires are the same size and match the size indicated on the VC label.
- Verify the inflation pressure of all 4 tires is correct as indicated on the VC label.

Are the wheels and tires OK?

Yes	GO to T3
No	INSTALL the correct size wheel or tire as necessary. ADJUST tire pressure as necessary. REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

T3 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the RCM pass the Network Test?

Yes	GO to T4
No	DIAGNOSE the RCM does not communicate with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

T4 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the ABS module self-test.
- Retrieve and record all ABS module Diagnostic Trouble Codes (DTCs).
- Clear the ABS module Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) present in the ABS module?

Yes	If any of the Diagnostic Trouble Codes (DTCs) listed in the DTC Fault Trigger Conditions table are present, GO to T5 For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the DTC Chart: ABS Module.
No	GO to T6

T5 CHECK THE RCM (RESTRAINTS CONTROL MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the RCM self-test.

Are there any Diagnostic Trouble Codes (DTCs) present in the RCM?

Yes	DIAGNOSE all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to T6

T6 VERIFY STABILITY CONTROL SENSOR CALIBRATION

NOTE: *The vehicle must be on level ground and at a complete standstill during IVD initialization. Any vehicle movement results in false values for this test.*

- Using the diagnostic scan tool, carry out the IVD Initialization routine. Follow the diagnostic scan tool directions.
- Ignition OFF.
- Ignition ON.
- Test drive the vehicle above 12 km/h (7 mph) and make at least 1 left turn and 1 right turn.

Is the Advance Trac® warning indicator illuminated?

Yes	Using a diagnostic scan tool, CARRY OUT the ABS module self-test. If any of the Diagnostic Trouble Codes (DTCs) listed in the DTC Fault Trigger Conditions table are present, GO to T7 For all other ABS module Diagnostic Trouble Codes (DTCs), GO to the DTC Chart: ABS Module.
No	The condition which caused the concern is no longer present. The concern was most likely due to an incomplete calibration or a failed calibration of the stability control sensors.

T7 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE PID (PARAMETER IDENTIFICATION) VALUES

NOTE: *The vehicle must be on level ground and at a complete standstill during this step. Any vehicle movement results in false values for this test.*

- Ignition OFF.
- Ignition ON.

- Using a diagnostic scan tool, monitor the following ABS module Parameter Identifications (PIDs):
  - Yaw rate (YAW_RATE)
  - Lateral accelerometer (LAT_ACCL)
  - Longitudinal accelerometer (LONG_ACCL)
  - Roll rate (ROLL_RATE)

Is the YAW_RATE PID value between -0.05 and 0.05, the LAT_ACCL PID value between -0.4 and 0.4, the LONG_ACCL PID value between -0.4 and 0.4, and the ROLL_RATE PID value between -0.05 and 0.05?

Yes	GO to T9
No	GO to T8

T8 CHECK THE RCM (RESTRAINTS CONTROL MODULE) INSTALLATION AND MOUNTING SURFACE

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Wait one minute then disconnect RCM C310A and C310B.
- Inspect the RCM installation and make sure the fasteners are fully seated and tightened to specifications. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
- Inspect the RCM mounting surface for damage, corrosion or dirt.

Is the RCM installed correctly and is the mounting surface clean and free from damage?

Yes	GO to T9
No	CLEAN or REPAIR the mounting surface or correctly REINSTALL the RCM as necessary. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).

T9 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect ABS module C135 and related in-line electrical connectors.
- Inspect the ABS module, RCM and related in-line electrical connectors for:
  - corrosion
  - loose or spread terminals
  - loose or frayed wire connections at terminals
  - pushed-out or bent pins
  - damage, pinched, cut or pierced wires
- Repair any electrical connector concerns found,
  Refer to Wiring Diagrams Cell 5 for schematic and connector information.
- Ignition OFF.
- Wait one minute then connect RCM C310A and C310B. Make sure the connectors seat and latch correctly.
- Connect ABS module C135 and related in-line electrical connectors. Make sure the connectors seat and latch correctly.
- Test drive the vehicle above 12 km/h (7 mph) and make at least 1 left turn and 1 right turn.

Is the Advance Trac® warning indicator illuminated?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, DIAGNOSE the RCM concern. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

DTC P050F:00

Normal Operation and Fault Conditions

The vacuum pump is mechanically driven by the camshaft. The ABS module uses a sensor mounted on the brake booster to monitor the vacuum. A vacuum pump failure or a leak in the vacuum hoses, check valve, seals or brake booster can all cause insufficient vacuum for brake booster operation.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P050F:00	Brake Assist Vacuum Too Low: No Sub Type Information	This DTC sets if the either of these conditions exist. Condition 1: vacuum level in the brake booster is less than -10 kPa (-3 inch Hg) for more than 10 seconds and there are no ABS hydraulic pressure Diagnostic Trouble Codes (DTCs) present and it has been more than 1 minute after engine start or vehicle speed is greater than 1.25 km/h (0.77 mph) for 10 seconds. Condition 2: vacuum level in the brake booster is less than -10 kPa (-3 inch Hg) for more than 1 second and there are ABS hydraulic pressure Diagnostic Trouble Codes (DTCs) present and vehicle speed is greater than 1.25 km/h (0.77 mph) for 10 seconds.

Possible Causes

- Vacuum hoses
- Brake master cylinder seal
- Check valve grommet
- Vacuum sensor grommet
- Check valve
- Brake vacuum pump

PINPOINT TEST U : DTC P050F:00

U1 CHECK FOR OTHER ABS MODULE DTCS

- Ignition ON.
- Using a diagnostic scan tool, perform the ABS module self-test.

Is DTC C101A:15, C101A:16, C101A:1C or C101A:29 present?

Yes	For DTC C101A:15, C101A:16 and C101A:29, GO to Pinpoint Test O For DTC C101A:1C, GO to Pinpoint Test C
No	The system is operating correctly at this time.

U2 CHECK THE BRAKE BOOSTER AND VACUUM COMPONENTS

- Ignition OFF.
- Inspect the following components for signs of obvious damage:
  - Check valve grommet
  - Vacuum sensor grommet
  - Brake master cylinder seal
  - Check valve
  - Vacuum hoses
  - Brake booster

Are the components listed free from any damage?

Yes	GO to U3
No	INSTALL new components as necessary, then GO to U3

U3 TEST THE BRAKE BOOSTER

- 1. Carry out the Component Test – Brake Booster.
  REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

Was the component test successful?

Yes	GO to U4
No	INSTALL new components as directed by the component test.

U4 VERIFY ABS MODULE VACUUM / PRESSURE SENSOR SIGNAL 1 (VAC_PRS_S1) PID (PARAMETER IDENTIFICATION)

NOTE: *Running the engine with the vacuum sensor removed from the brake booster sets Diagnostic Trouble Codes (DTCs) in the ABS module. Clear all Diagnostic Trouble Codes (DTCs) once the repair is complete.*

- Start the engine and allow to idle for at least 20 seconds.
- Using a diagnostic scan tool, observe ABS module PID VAC_PRS_S1.
- Record the PID display.
- Ignition OFF.
- Remove the vacuum sensor from the brake booster (leave the electrical connector connected).
- Connect a vacuum gauge to the vacuum sensor port.
- Start the engine and allow to idle for at least 20 seconds.
- Read and record the vacuum gauge display.
- Ignition OFF.
- Disconnect the vacuum gauge from the brake booster and install the vacuum sensor.

Does the VAC_PRS_S1 PID display match the recorded vacuum gauge display ±10 kPa (3 inches Hg) of each other?

Yes	The condition causing the concern is not present at this time. The concern may be temperature related. ALLOW the vehicle to remain outside overnight and RETEST the vacuum system.
No	INSTALL a new brake booster vacuum sensor.

Copyright © 2016 Ford Motor Company

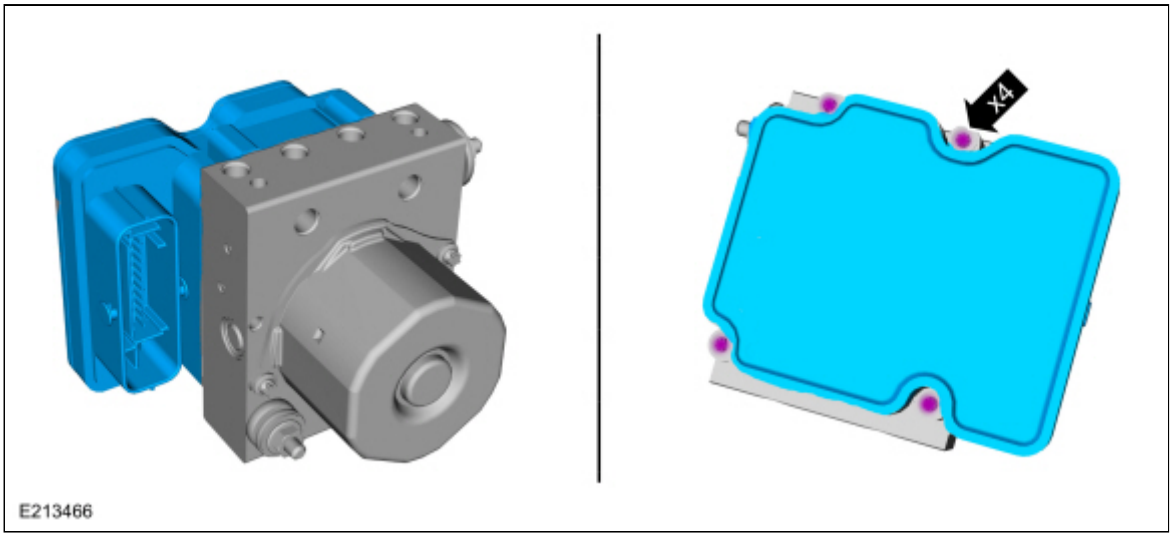
Anti-Lock Brake System (ABS) Module

Base Part Number: 2C219

Removal

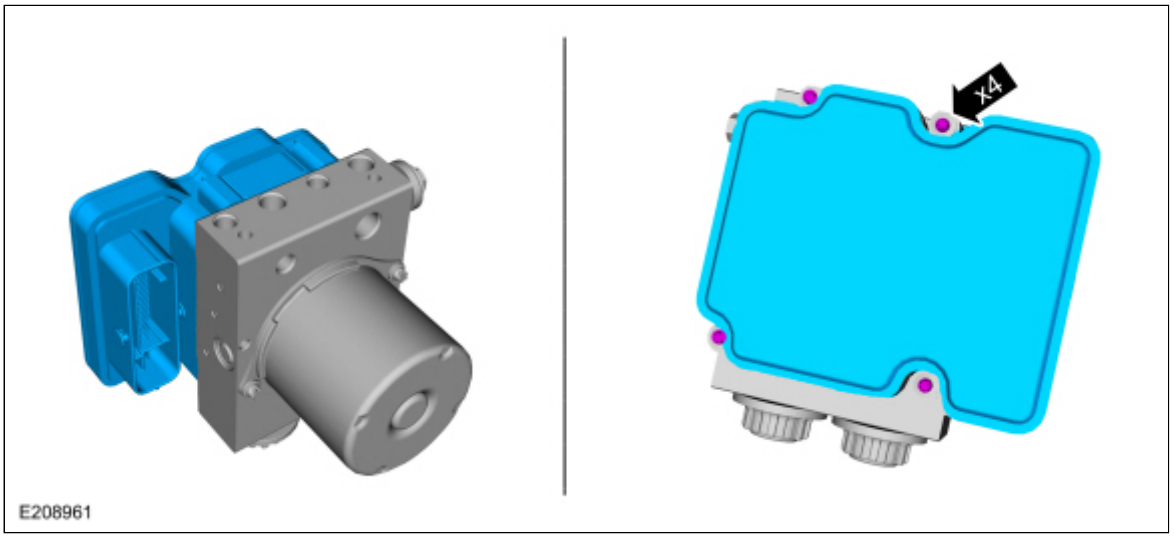
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
3. Refer to: Hydraulic Control Unit (HCU) - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
4. **NOTICE: Make sure the HCU and ABS module are clean and free of brake fluid or foreign material before separating the components. Do not allow any brake fluid or foreign material to enter the mating side of the ABS module or component damage can occur.**

   Type 1
   Torque: 6 Nm



5. **NOTICE: Make sure the HCU and ABS module are clean and free of brake fluid or foreign material before separating the components. Do not allow any brake fluid or foreign material to enter the mating side of the ABS module or component damage can occur.**

   Type 2
   Torque: 6 Nm



Installation

1. To install, reverse the removal procedure.

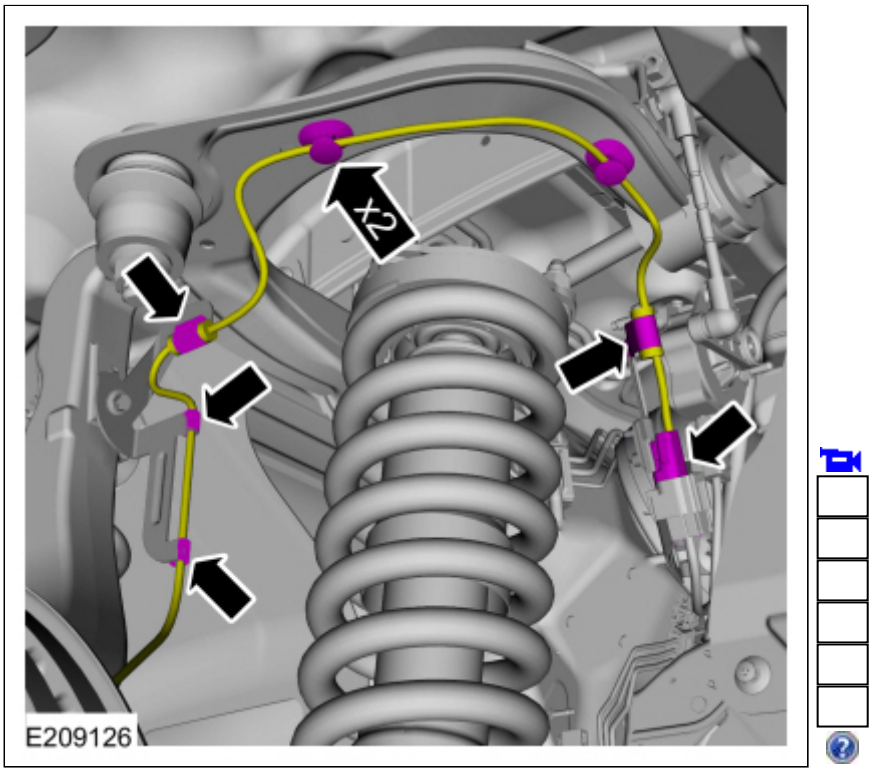
Copyright © 2016 Ford Motor Company

Front Wheel Speed Sensor

Base Part Number: 2C204

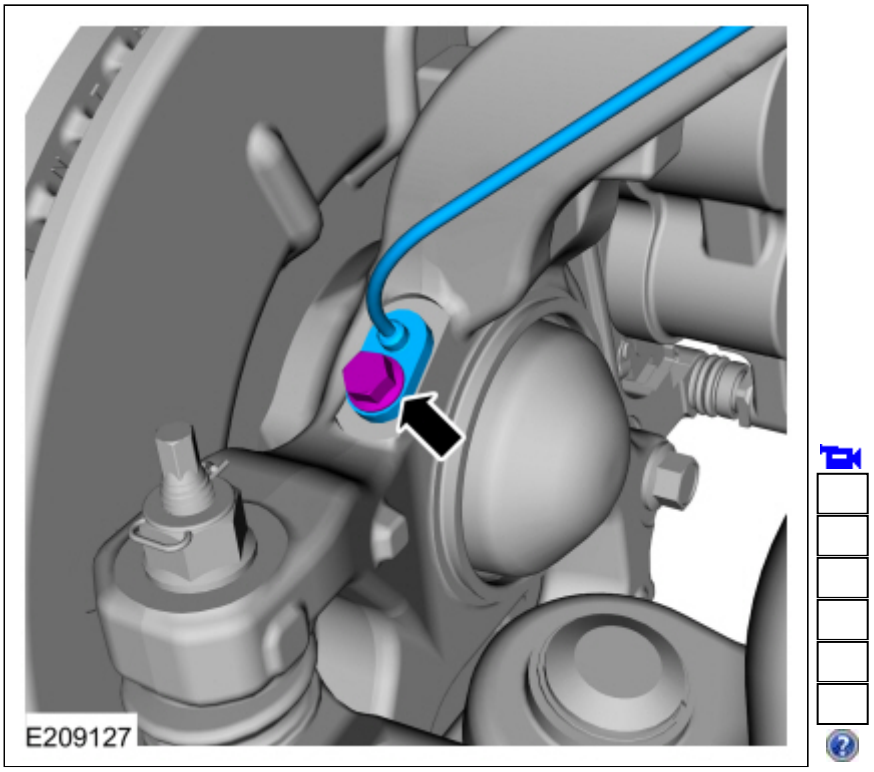
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. 

4. **NOTICE: Make sure that the area around the component is clean and free of foreign material.**

   Torque: 6 Nm



Installation

1. To install, reverse the removal procedure.

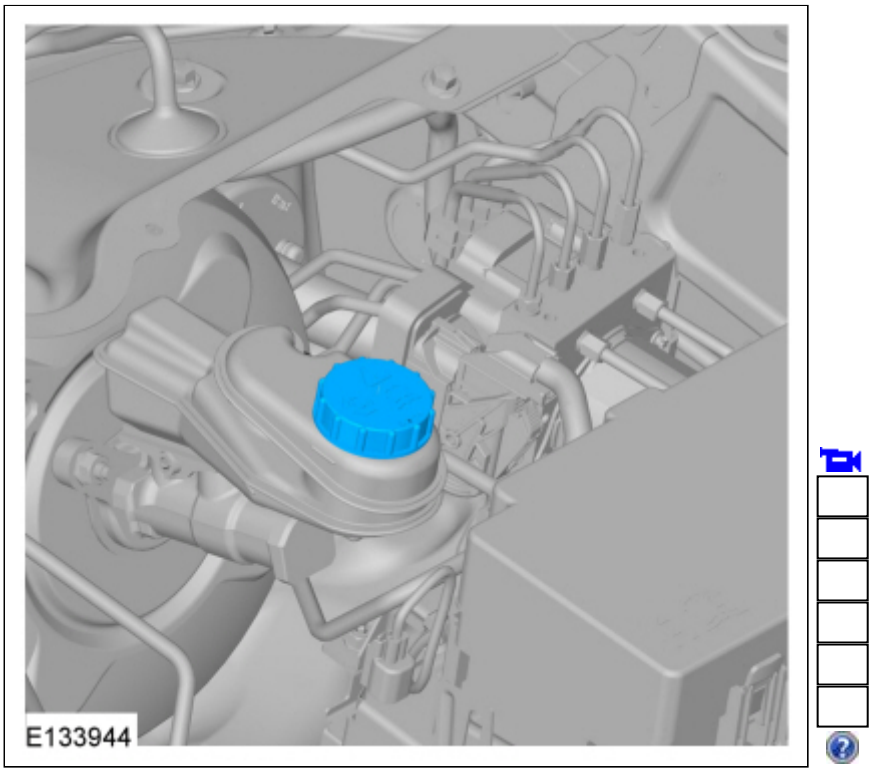
Copyright © 2016 Ford Motor Company

Hydraulic Control Unit (HCU) - Vehicles Without: Stability Control

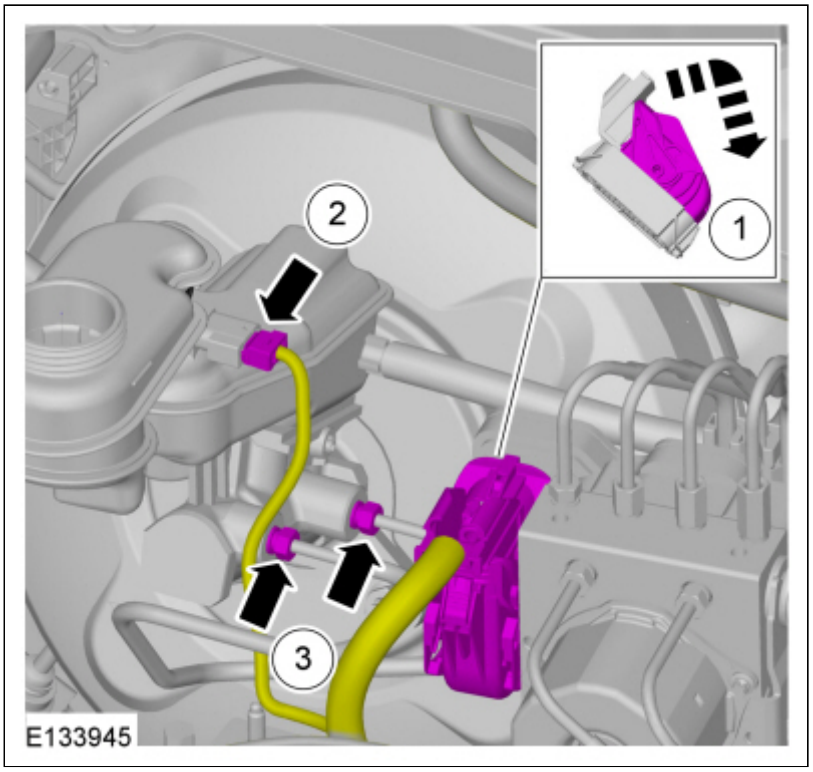
Base Part Number: 2C405

Removal

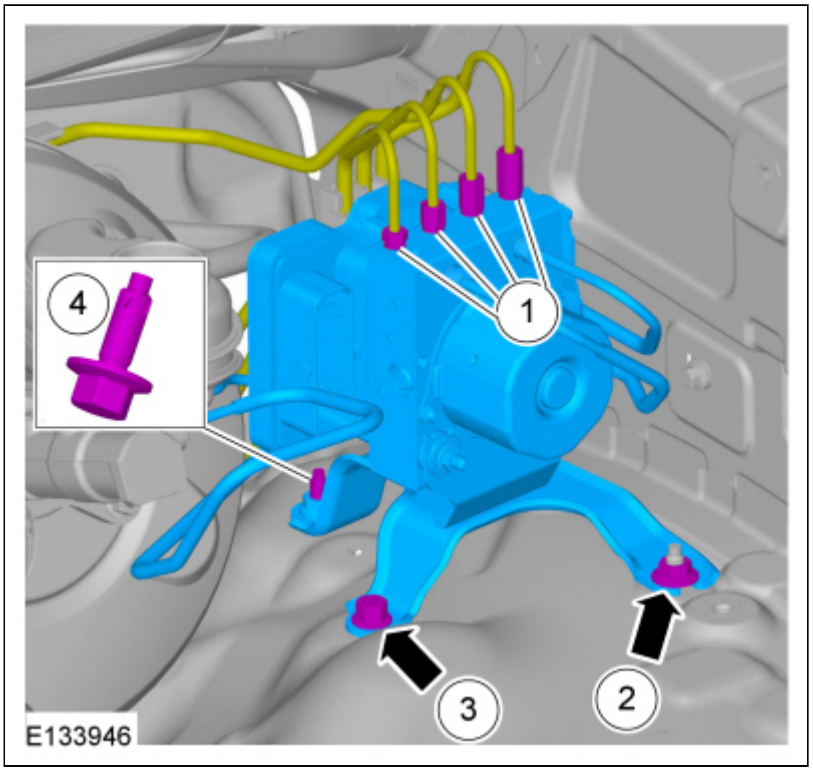
NOTICE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

1. Refer to: Brake and Clutch Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

4. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).
5. **NOTICE: Make sure that all openings are sealed.**
   3. *Torque*: 18 Nm

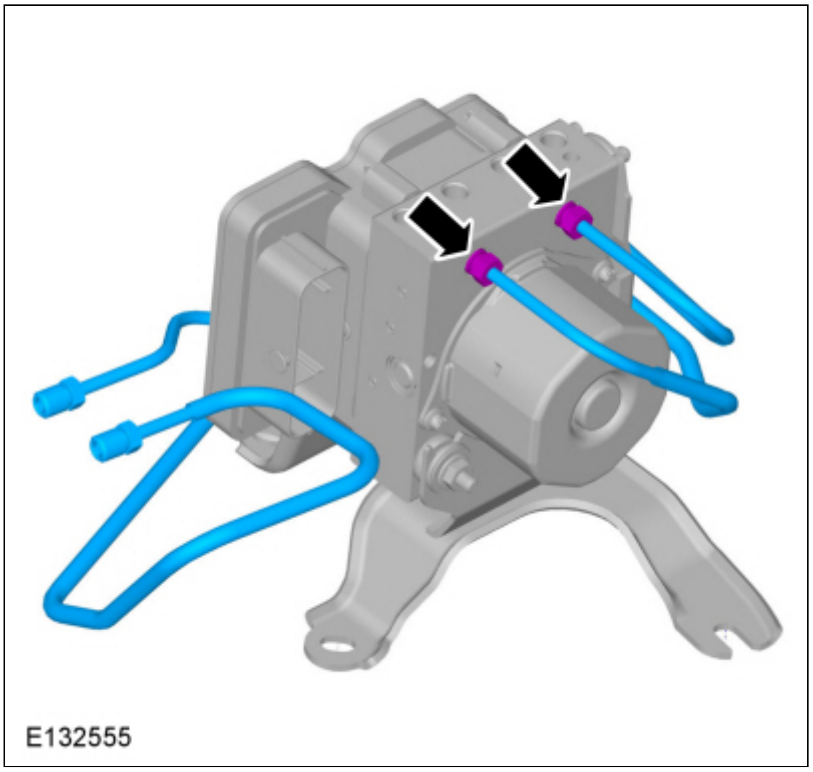


1. *Torque*: 18 Nm
2. *Torque*: 25 Nm
3. *Torque*: 25 Nm
4. *Torque*: 25 Nm



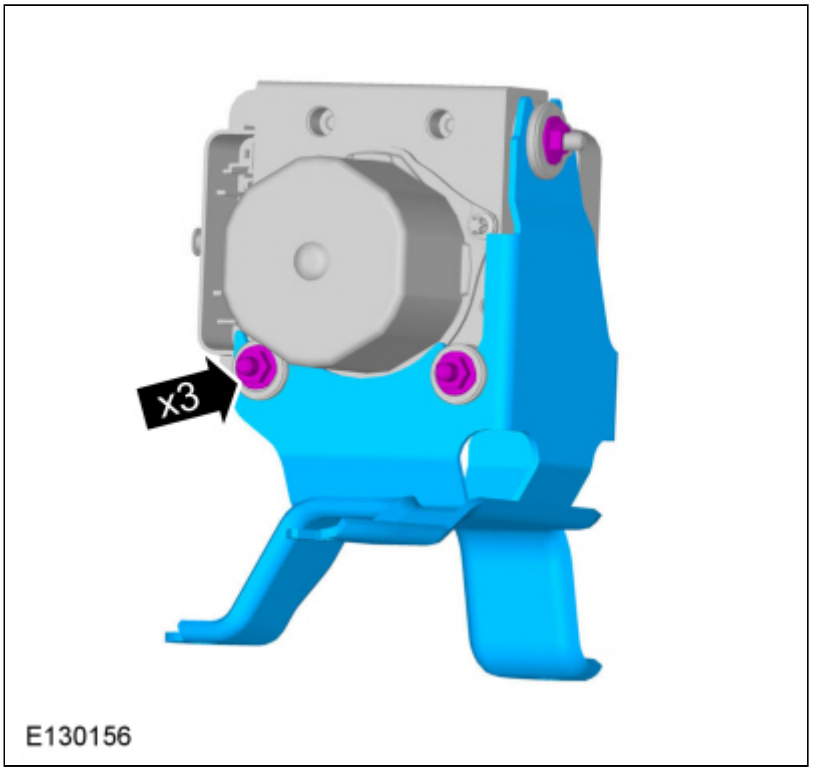
7. **NOTE:** *Make sure that all openings are sealed.*

   Torque: 18 Nm



8. **NOTICE: Make sure the HCU and ABS module are clean and free of brake fluid or foreign material before separating the components. Do not allow any brake fluid or foreign material to enter the mating side of the ABS module or component damage can occur.**

   Torque: 9 Nm



Installation

1. **NOTICE: If accidentally dropped or knocked install a new hydraulic control unit (HCU) and module assembly.**

   NOTICE: The blanking caps/plugs must not be removed until the brake tubes are ready to be connected.

   To install, reverse the removal procedure.

2. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Hydraulic Control Unit (HCU) - Vehicles With: Stability Control

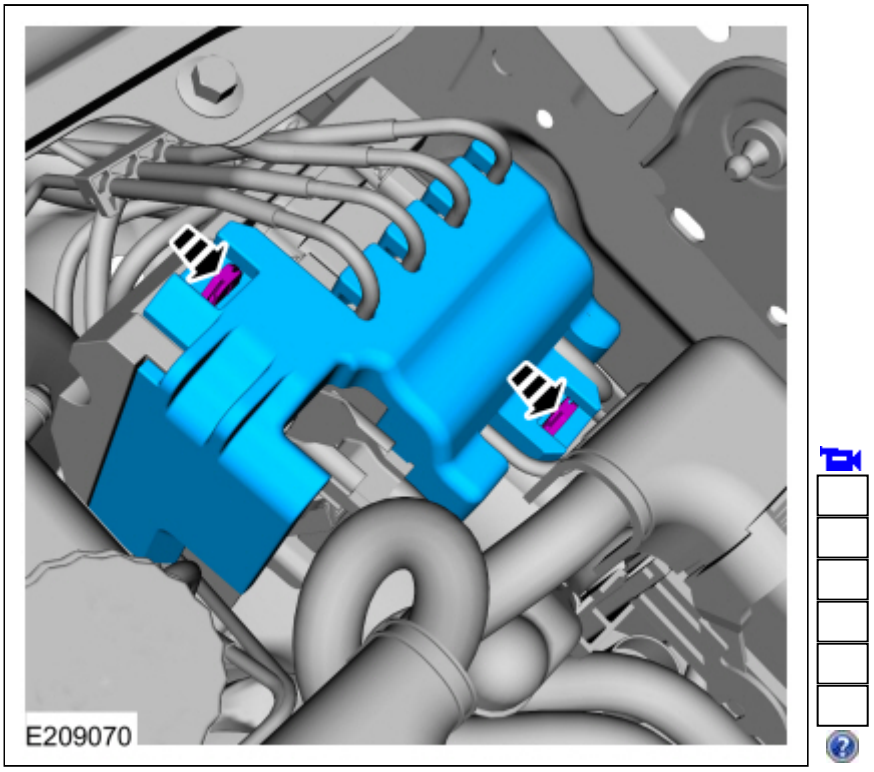
Base Part Number: 2C405

Removal

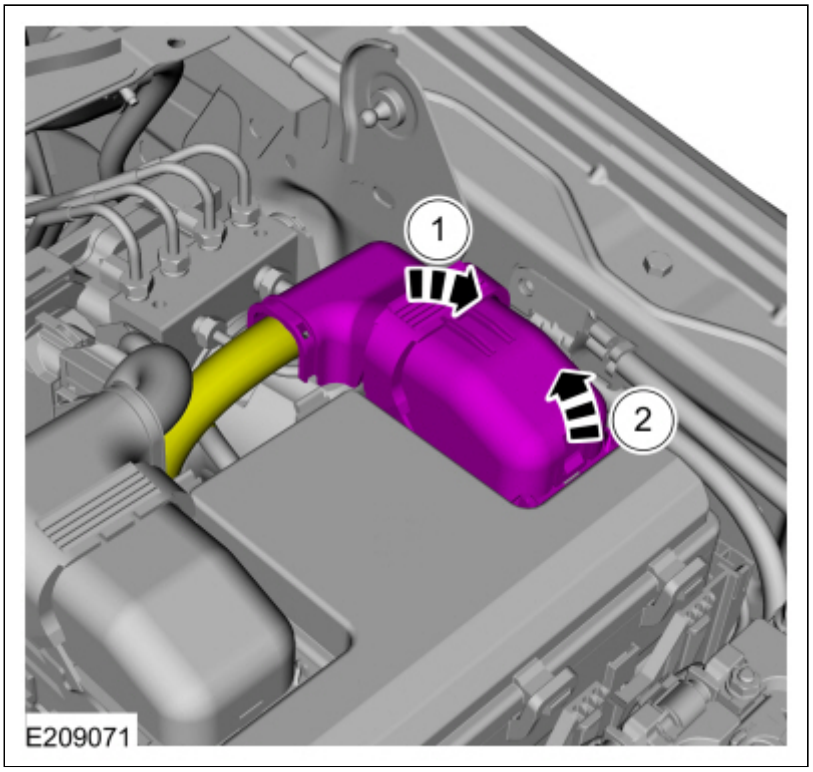
NOTICE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

NOTE: *Removal steps in this procedure may contain installation details.*

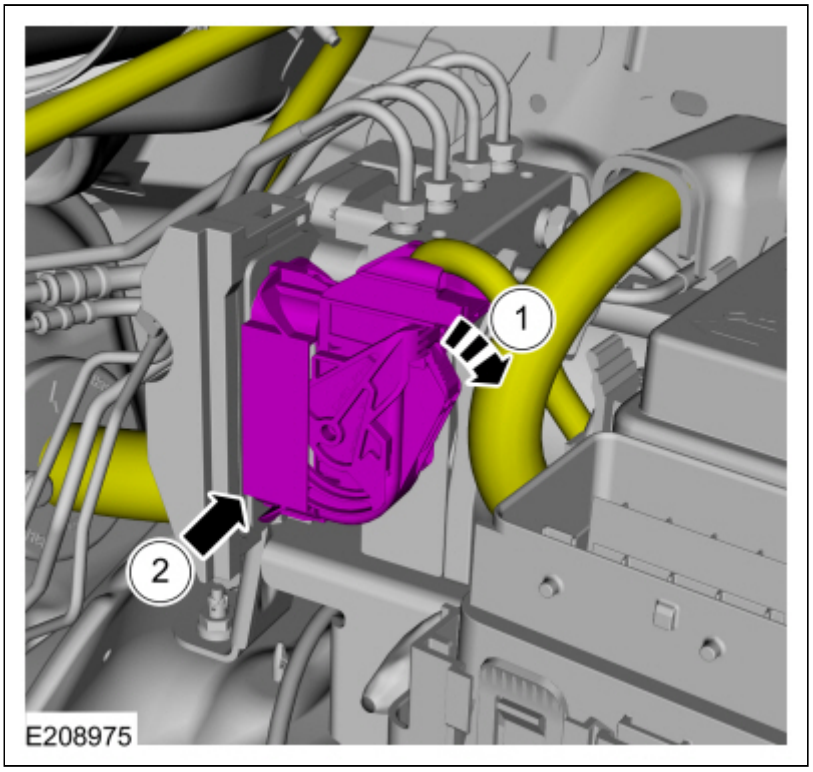
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *The PMI process must begin with the current ABS module installed. If the current ABS module does not respond to the diagnostic scan tool, the tool may prompt for As-Built Data as part of the repair.*

   Using a diagnostic scan tool, begin the PMI process for the ABS module following the onscreen instructions.
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. 

5.

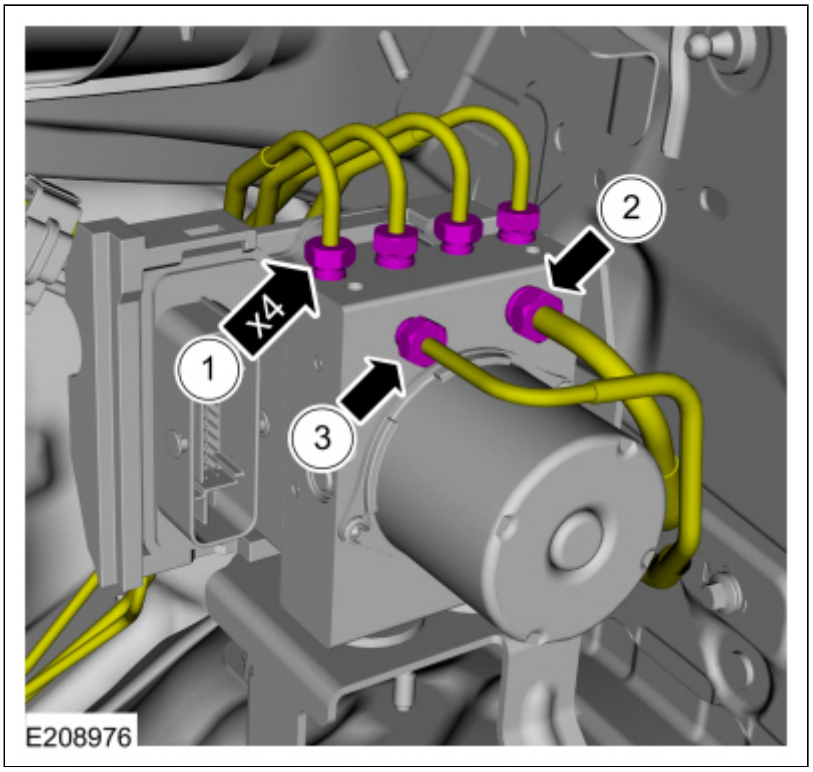


6.



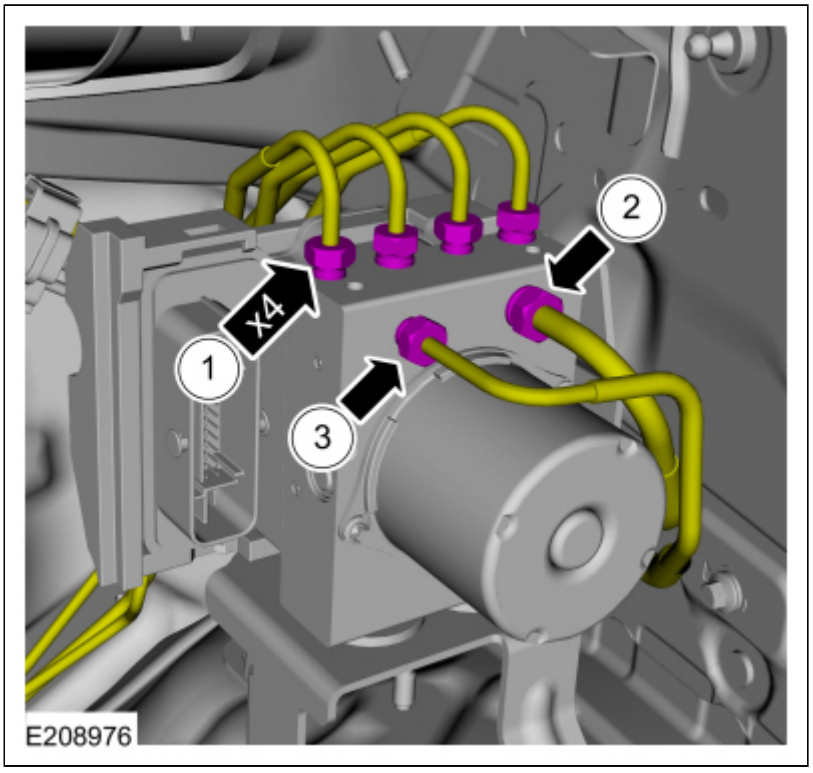
7. **NOTE:** *If equipped.*

1. *Torque*: 18 Nm
2. *Torque*: 23 Nm
3. *Torque*: 23 Nm

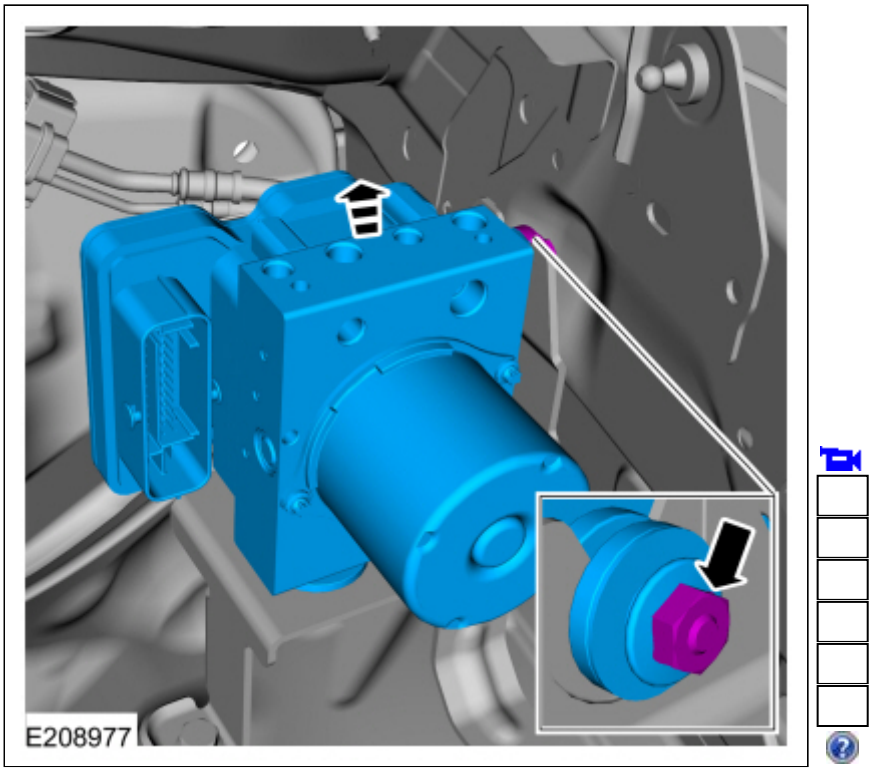


8. **NOTE:** *If equipped.*

    1. *Torque*: 23 Nm
    2. *Torque*: 28 Nm
    3. *Torque*: 23 Nm



9. *Torque*: 8 Nm



Installation

1. To install, reverse the removal procedure.
2. Using a diagnostic scan tool, complete the PMI process for the ABS module following the on-screen instructions.
3. If a new HCU/ ABS module assembly was installed, carryout the initialization using the scan tool and following the scan tool on-screen instructions.
4. Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

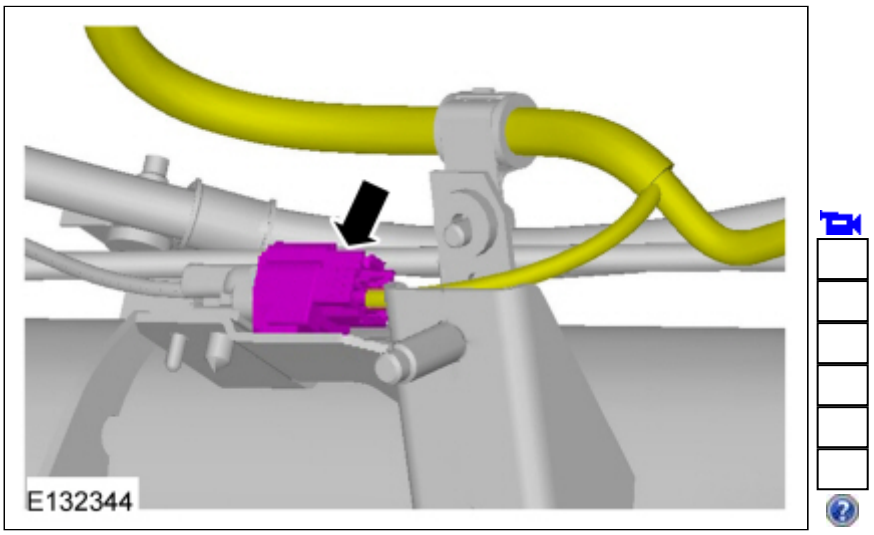
Copyright © 2016 Ford Motor Company

Rear Wheel Speed Sensor

Base Part Number: 2C190

Removal

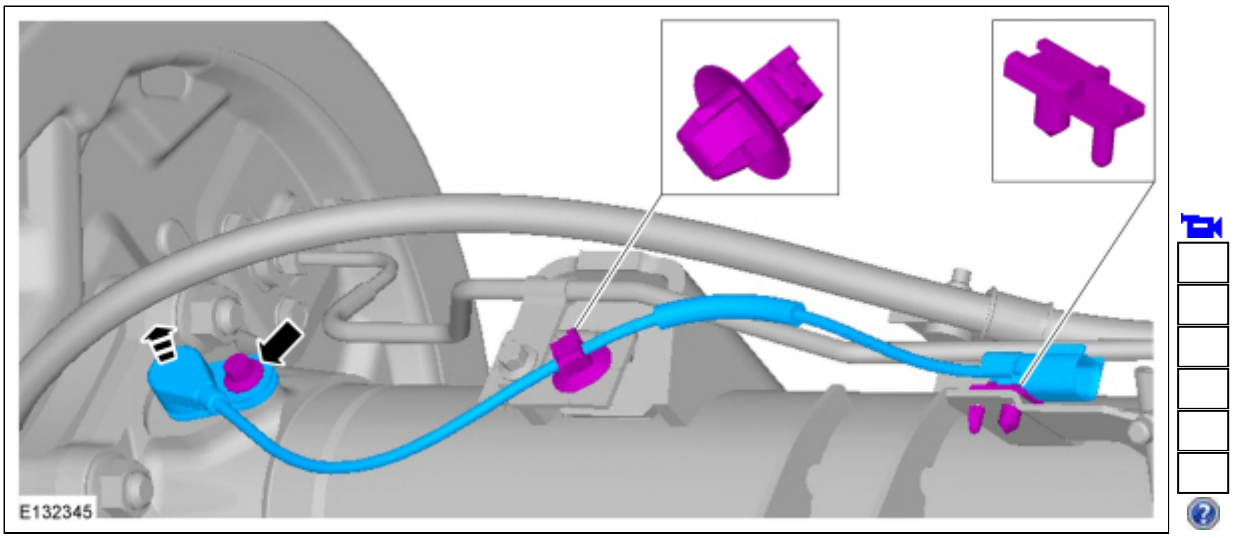
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3. **NOTICE: Take extra care not to damage the component.**

   NOTE: *Make sure that the area around the component is clean and free of foreign material.*

   Torque: 6 Nm



Installation

1. **NOTICE: Use the white stripe on rear wheel speed sensor harness for orientation purposes, making sure the harness is not twisted during installation. Make sure the the clips and plastic ties on the EPB wiring harness are correctly aligned with the tape on the wheel speed sensor harness.**

   NOTICE: Make sure that the alignment line is not twisted.

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Steering Gear Checks After a Collision

General Equipment

Feeler gauge
Straight edge
Ford diagnostic equipment

Items to be observed when checking the steering system

The following list of steering gear conditions and the methods of testing should be taken into account when carrying out checks to the steering system:

- If the steering gear has no faults after completing the following checks, do not install a new steering gear.
- Surface corrosion and marks on the tie-rod are acceptable.
- When checking for turning effort torque peaks in the steering gear, turn the steering wheel from steering lock stop to steering lock stop in approximately 15 seconds.
- A steady increase of turning effort torque from steering center to steering lock stop is acceptable.
- Noises from the power steering, for example the power steering motor, are acceptable. If in doubt, compare the noise level to a known good vehicle of similar specification.

STEERING GEAR HOUSING

1. Connect the Ford diagnostic equipment to the vehicle and check for any EPAS DTC(s). If DTC U3000-49, U3000-53 or U3000-96 is present, install a new steering gear.
   REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
2. Raise and support the vehicle.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Visually inspect the steering gear housing (especially along the split lines), power steering motor, electrical connectors, rubber bushes, and wiring harness for cracks, cuts and damage. If the steering gear housing, power steering motor/electrical connector or bushes of the steering gear are cracked or damaged, install a new steering gear.
   REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
   If the vehicle-side wiring harness or electrical connectors are cut or damaged, install a new wiring harness.

STEERING GEAR BOOTS

1. Visually inspect the steering gear boot(s) for splits, damage and correct fitment. If the steering gear boot(s) is split, damaged or incorrectly fitted, install a new steering gear boot(s) as necessary.
   REFER to: Steering Gear Boot (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

TIE RODS AND TIE-ROD ENDS

1. Using a straight edge and feeler gauge, check the tie-rods to see if they are straight. If the distance between the tie-rod and straight edge is greater than 0.5 mm, install a new steering gear.
   REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
2. Check the tightening torque of the tie-rod end to wheel knuckle nut.
   REFER to: Tie Rod End (211-02) .
3. Check the tightening torque of the tie-rod end locking nut.
   REFER to: Tie Rod End (211-02) .

CHECK FOR TURNING EFFORT TORQUE PEAKS IN THE STEERING GEAR

1. Lower and support the vehicle making sure that the road wheels are just clear of the floor.
2. With the ignition switch in position I (engine off), slowly turn the steering wheel from steering lock stop to steering lock stop.
3. Only continue to the step 4, if a turning effort torque peak or judder is felt while turning the steering wheel.
4. Detach the tie-rods from the wheel knuckles.
5. Slowly turn the steering wheel from steering lock stop to steering lock stop.

- If no torque peak or judder can be felt now, investigate the front suspension for damage.
- If a turning effort torque peak or judder is felt while turning the steering wheel, install a new steering gear.
  REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

6. Lower the vehicle and drive it onto a four-post hoist or inspection pit.
7. Run the engine at idle and slowly turn the steering wheel to the left-hand steering lock stop. Hold the steering wheel in this position for 5 seconds with a turning effort torque of 15 Nm at the steering wheel rim and check for steering gear movements and touch conditions to surrounding components.
8. Turn the steering wheel away from the left-hand steering lock stop for 30 seconds.
9. Run the engine at idle and slowly turn the steering wheel to the right-hand steering lock stop. Hold the steering wheel in this position for 5 seconds with a turning effort torque of 15 Nm at the steering wheel rim and check for steering gear movements and touch conditions to surrounding components.
10. Turn the steering wheel away from the right-hand steering lock stop.
11. Rectify any touch conditions found.
12. Install new steering gear retaining bolts and tighten to the correct torque if steering gear movement was found.
    REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
13. Drive the vehicle on roads at different vehicle speeds while executing different steering manoeuvres. In an appropriate location, drive several figures of 8. Carry out a parking manoeuvre and steer to full lock during this manoeuvre. Check for torque peaks, judder noise and any warning messages in the message center.
14. If available, use Active Park Assist to carry out a parking manoeuvre.
15. If available, drive on straight roads with clearly visible side limitation bars at speeds above 60 km/h and check the Lane Departure Warning and Lane Keeping Aid for correct function.
16. Rectify any faults found.

Copyright © 2016 Ford Motor Company

Steering System

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Tire pressure(s) − Accessory drive belt − Loose tie-rod end(s) − Tie-rod(s) − Steering gear housing − Loose strut and spring assemblies or ball joints − Loose pinch bolts on steering column shaft flexible coupling − Wheels and tires − Power steering lines fluid leaks − Steering gear bellows	− Power steering pressure (PSP) switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Drift left or right	• Vehicle attitude incorrect (front or rear is high or low).	• CHECK for abnormal loading, coil spring sag or non-standard springs.
	• Incorrect wheel alignment.	• CHECK the wheel alignment and ADJUST if necessary. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
	• Worn front wheel bearings.	• CHECK and INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension) .
	• Brake system.	• CHECK the brake system. REFER to: Brake System (206-00 Brake System - General Information) .
	• Steering linkage.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
	• Steering gear.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
	• Wheels and tires.	• REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).

• Steering wheel off center	• Vehicle attitude incorrect (front or rear is high or low).	• CHECK for abnormal loading, coil spring sag or non-standard springs.
	• Incorrect wheel alignment.	• CHECK the wheel alignment and ADJUST if necessary. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
	• Suspension lower arm ball joint.	• CARRY OUT the Ball Joint Inspection Component Test. REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).
	• Steering linkage.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
	• Steering gear.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
• Vibration	• Incorrect wheel alignment.	• CHECK the wheel alignment and ADJUST if necessary. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
	• Wheels and tires.	• CHECK the wheels and tires. BALANCE or INSTALL new wheels and tires as necessary.
	• Damaged or worn front wheel bearings.	• CHECK and INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension) .
	• Front strut and spring assemblies.	• CHECK and INSTALL new suspension components as necessary.
	• Damaged front suspension lower arm(s).	• CHECK and INSTALL new suspension components as necessary.
	• Steering linkage.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
• Steering effort is high/low	• Power steering hose restriction.	• CHECK the power steering hoses for damage, kinks or restrictions. INSTALL new components as necessary.
	• Power steering fluid contamination.	• FLUSH the power steering system. REFER to: (211-00 Steering System - General Information) Power Steering System Flushing (General Procedures), Power Steering System Filling (General Procedures), Power Steering System Bleeding (General Procedures).
	• Aeration of the power steering fluid.	• BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
	• Steering gear floor seal touch condition.	• CHECK the installation of the floor seal.
	• Steering column.	• CHECK if the floor covering is obstructing the steering gear pinion. • CHECK the installation of the floor seal. • CARRY OUT the Steering Column Universal Joint Component Test. REFER to Steering Column Universal Joint Component Test.

	• Steering linkage.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
	• Steering gear.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.
	• Worn power steering pump.	• INSTALL a new power steering pump. REFER to: (211-02A Power Steering) Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (Removal and Installation).
• Excessive noise	• Power steering operation noise.	• CARRY OUT the Power Steering Operation Noise Check. REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness) .
	• Aeration of the power steering fluid.	• BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
	• Power steering lines.	• CHECK that the power steering line clamps are secure. • CHECK the power steering lines for clearance from the vehicle body, subframe and steering gear. • CHECK the steering gear transfer lines for clearance from the steering gear.
	• Loose steering gear retaining bolts.	• CHECK and INSTALL new bolts as necessary.
	• Power steering pump.	• INSTALL a new power steering pump. REFER to: (211-02A Power Steering) Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (Removal and Installation).
	• Tie-rod.	• CARRY OUT the Tie-Rod Component Test. REFER to Tie-Rod Component Test in this procedure.
• Steering does not vary with increased wheel rotation	• Worn tie-rod ends.	• INSTALL new components as necessary. REFER to: Tie Rod End (211-03 Steering Linkage) .
	• Worn front suspension bushings.	• CHECK and INSTALL new components as necessary.
	• Suspension lower arm ball joint.	• CARRY OUT the Ball Joint Inspection Component Test. REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).
	• Steering gear insulator bushings worn or perished.	• CHECK and INSTALL new components as necessary.
	• Loose steering gear retaining bolts.	• CHECK and INSTALL new bolts as necessary.
	• Loose steering column retaining bolts.	• CHECK and INSTALL new bolts as necessary.
	• Loose steering column to steering gear pinion retaining bolt.	• CHECK and INSTALL a new bolt as necessary.
	• Excessive steering gear backlash.	• CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test in this procedure.

Components Tests

Steering Linkage

1. Grasp the steering wheel firmly and move it up and down and to the left and right without turning the steering wheel to check the steering column bearing for wear, steering column shaft for wear, steering wheel for looseness and steering column for looseness. If the steering column bearing or the steering column shaft is worn install a new steering column shaft.
   REFER to: Steering Column (211-04 Steering Column) .
   If the steering wheel or the steering column is loose, tighten the steering wheel or the steering column retaining bolts.

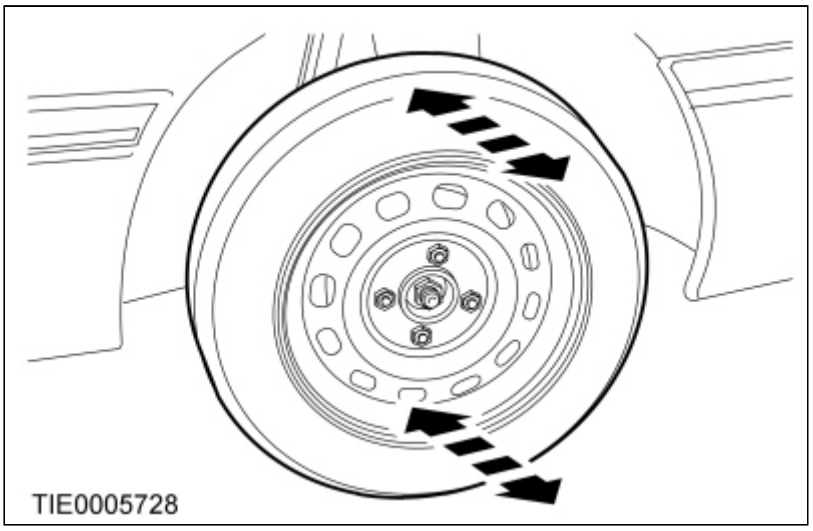
2. With the road wheels in the straight ahead position, gently turn the steering wheel to the left and the right to check for free play in the steering linkage.

3. There should be no excessive free play at the steering wheel rim. If there is excessive free play, CHECK the tie-rod inner and outer ball joints, REFER to Tie-Rod Component Test in this procedure. CHECK the steering column universal joint, REFER to Steering Column Universal Joint Component Test in this procedure. If there is no free play in the tie-rod and the steering column, install a new steering gear.
   REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

Tie-Rod

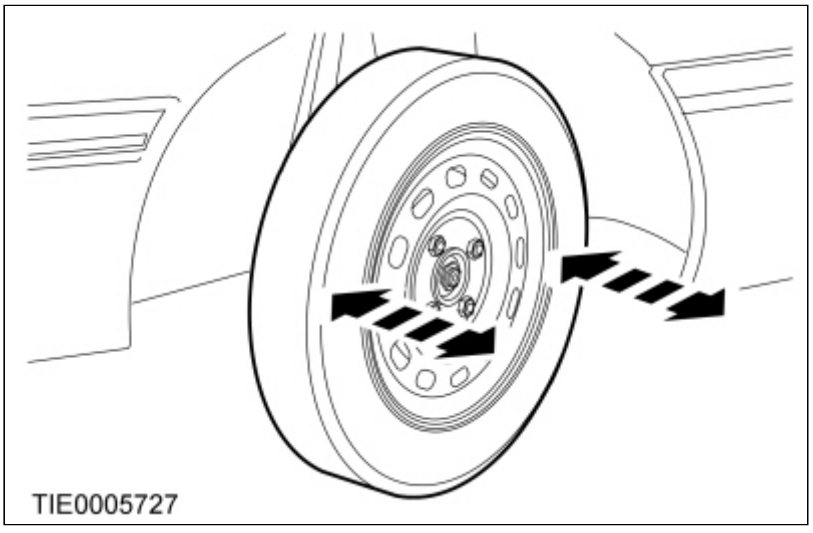
1. Noises such as knocks, which may appear to originate from the steering linkage, may also be generated by front suspension components.
   REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness) .

2. Raise and support the vehicle. REFER to: Jacking (100-02) .
   REFER to: Lifting (100-02) .

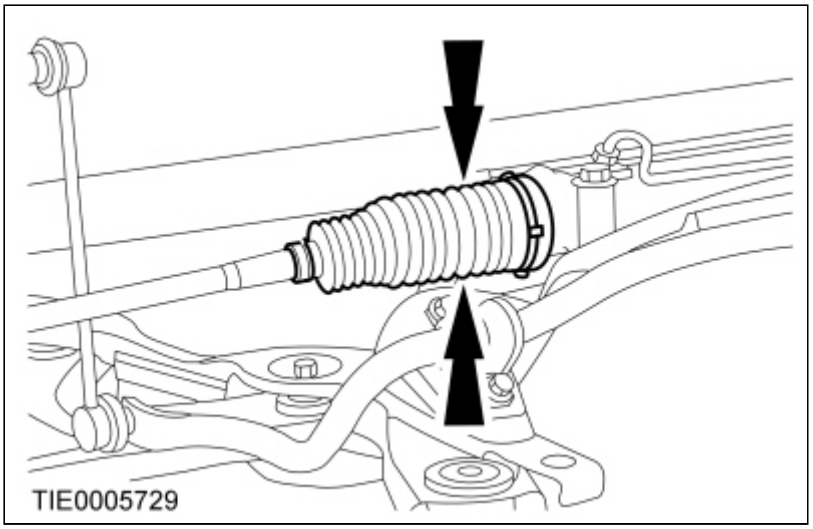


3. Firmly grasp the road wheel and apply a rocking motion checking for any free play in the wheel bearing or suspension components.

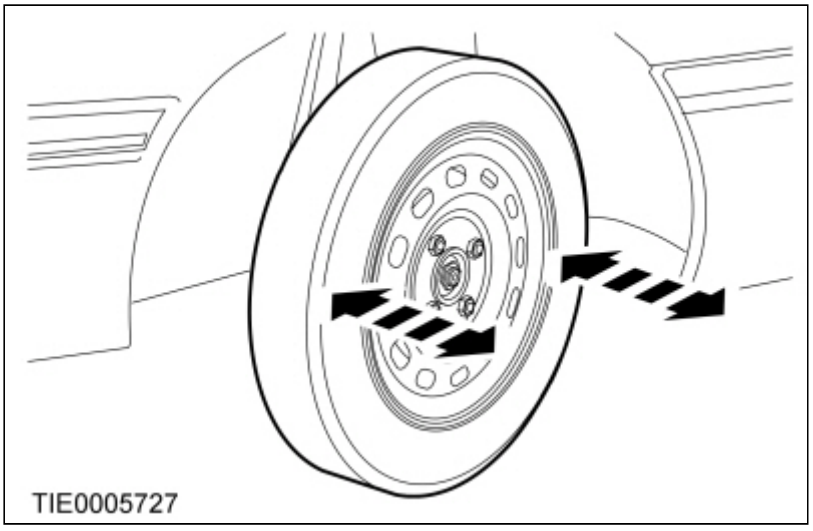
4. Turn the steering wheel to position the steering linkage against the right-hand steering lock stop.



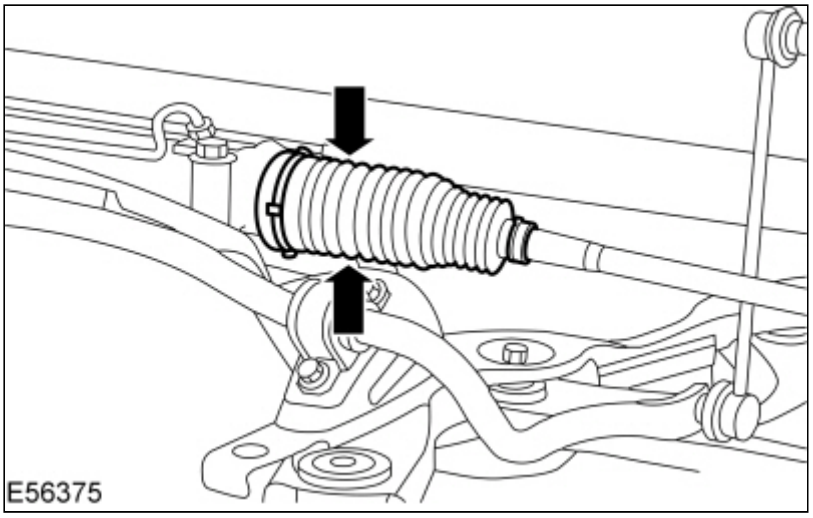
5. With the aid of another technician holding the steering linkage against the right-hand steering lock stop, firmly grasp the right-hand road wheel and apply a rocking motion checking for any free play in the steering linkage.



6. Detach the steering gear boot from the steering gear body and check for free play at the tie-rod inner ball joint.
7. If there is free play at the tie-rod inner ball joint, install a new tie-rod.
   REFER to: Tie Rod (211-03 Steering Linkage) .
8. Check the tie-rod end for free play. Install a new tie-rod end if necessary.
   REFER to: Tie Rod End (211-03 Steering Linkage) .
9. Attach the steering gear boot to the steering gear body. Install new steering gear boot clamps.
10. Turn the steering wheel to position the steering linkage against the left-hand steering lock stop.



11. With the aid of another technician holding the steering against the left-hand steering lock stop, firmly grasp the left-hand road wheel and apply a rocking motion checking for any free play in the steering linkage.



12. Detach the steering gear boot from the steering gear body and check for free play at the tie-rod inner ball joint.

13. If there is free play at the tie-rod inner ball joint, install a new tie-rod.
REFER to: Tie Rod (211-03 Steering Linkage) .

14. Check the tie-rod end for free play. Install a new tie-rod end if necessary.
REFER to: Tie Rod End (211-03 Steering Linkage) .

15. Attach the steering gear boot to the steering gear body. Install new steering gear boot clamps.

Turning Effort Test

1. Before carrying out the turning effort test, make sure that the following are serviceable:

- Suspension components.
- Steering column.
- Toe adjustment.
  REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
- Tire pressures.

2. Park the vehicle on a dry, even surface and apply the parking brake.

3. Remove the driver air bag module.
REFER to: Driver Airbag (501-20 Supplemental Restraint System) .

4. Connect the air bag simulators to the sub-harnesses in place of the driver air bag module at the top of the steering column.

5. Start the engine and turn the steering wheel from lock to lock several times until the power steering fluid has reached normal operating temperature.

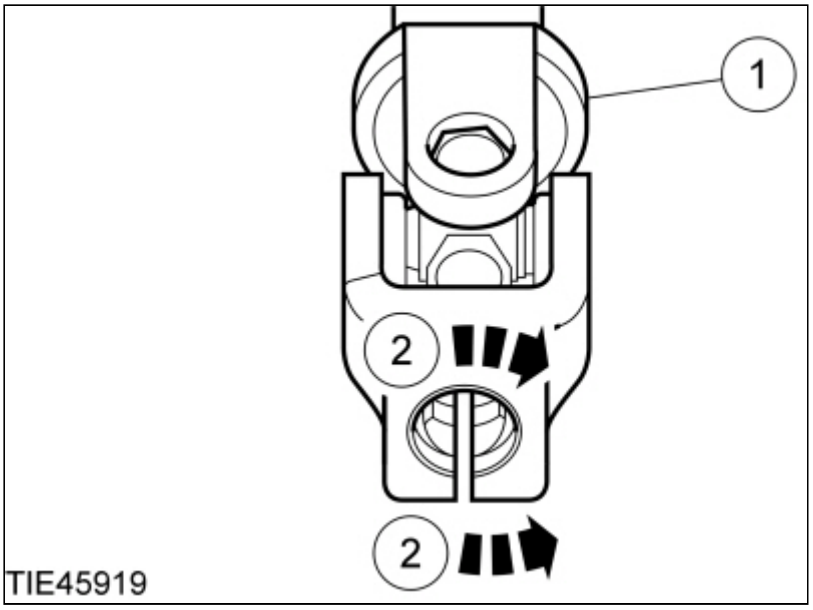
6. Using a suitable torque wrench and socket, check the steering wheel turning effort.

7. If the steering wheel turning effort is greater than the specification, install a new steering gear.
REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

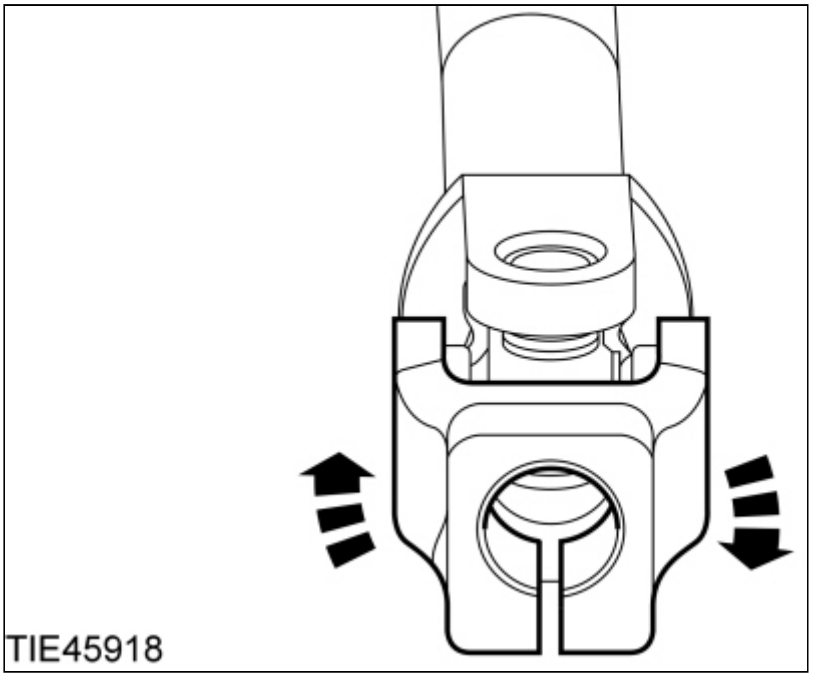
Steering Column Universal Joint

1. **WARNING: Make sure that a new steering column flexible coupling bolt is installed.**

   Detach the steering column from the steering gear pinion.
   - Discard the steering column to steering gear pinion retaining bolt.



2. Check for smooth movement of the steering column universal joint.
    1. Hold the steering column universal joint yoke.
    2. Articulate the free yoke in a figure of eight movement.
    - If the movement is not smooth or resistance is felt, install a new steering column or shaft as necessary. REFER to: Steering Column (211-04 Steering Column) .



3. Hold both of the steering column universal joint yokes and twist them clockwise and counterclockwise.
    - If movement is felt, install a new steering column or shaft as necessary. REFER to: Steering Column (211-04 Steering Column) .

Lower Arm Ball Joint Inspection

1. Raise and support the vehicle.

2. Firmly grasp the outer end of the suspension lower arm and try to move it up and down, watching and feeling for any movement. Free movement will usually be accompanied by an audible "click". There should be no free movement.

3. If there is any free movement, install a new lower arm. REFER to: Lower Arm - 2WD (204-01 Front Suspension) .

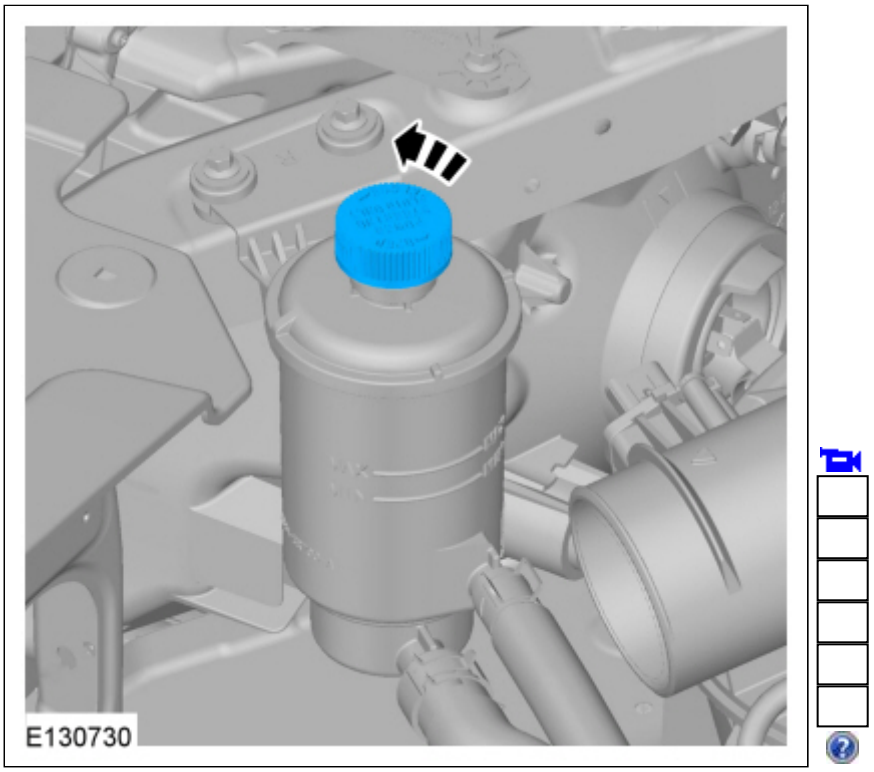
Copyright © 2016 Ford Motor Company

Power Steering System Flushing

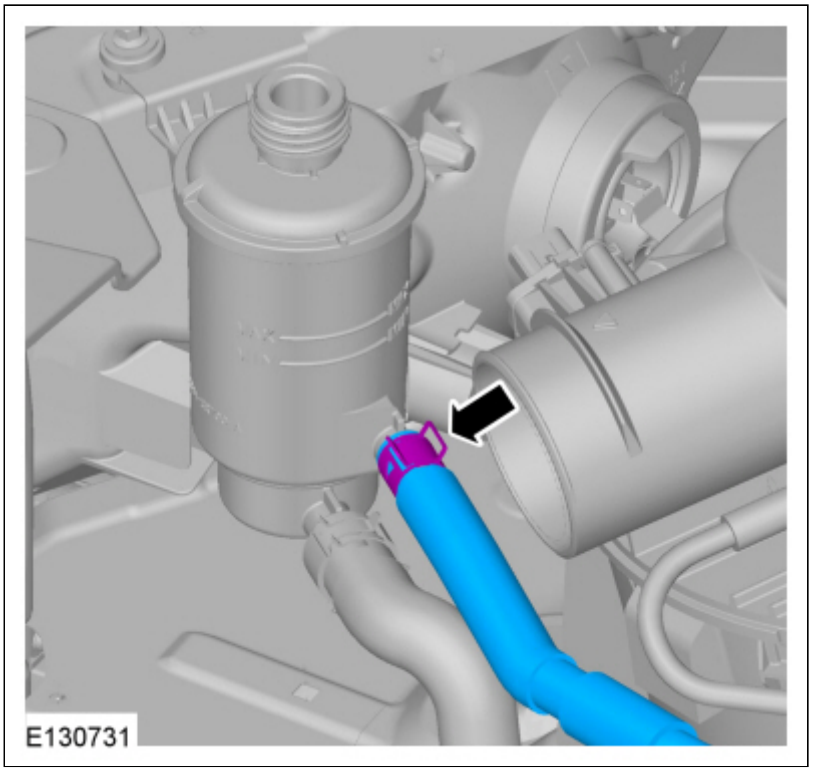
Activation

NOTICE: Do not mix fluid types. Any mixture or any unapproved fluid may lead to seal deterioration and leaks. A leak may ultimately cause loss of fluid, which may result in a loss of power steering assist.

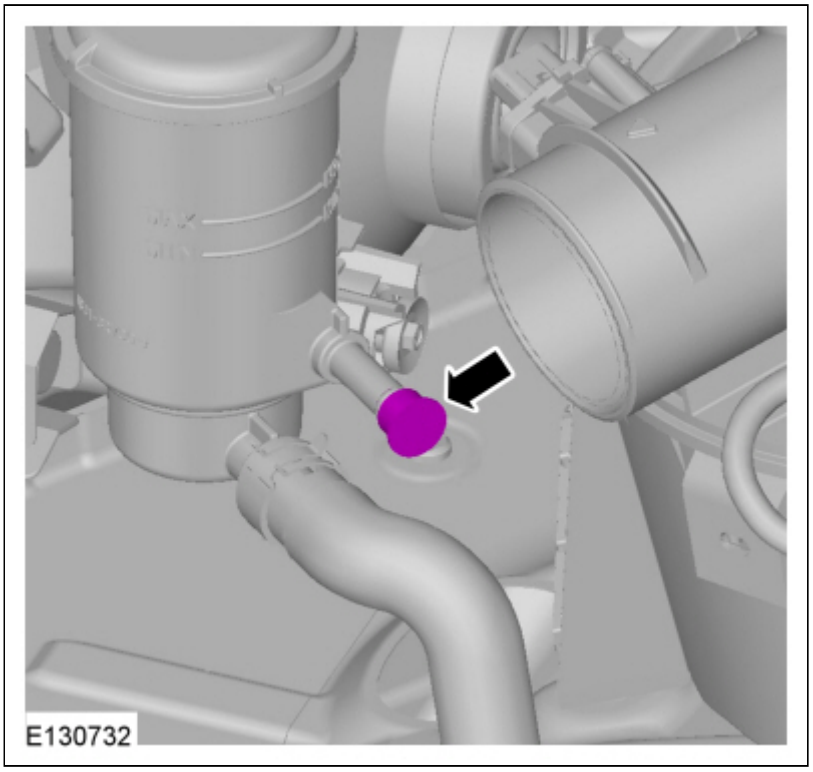
1.



2. Using a suitable suction device, remove the power steering fluid from the reservoir.
3. Remove the clamp from the hose and allow the remaining fluid to drain out of the reservoir.



4. Plug the power steering fluid reservoir inlet port.



5. Attach an extension hose to the return hose.
6. **NOTE:** *Do not reuse the power steering fluid that has been flushed from the power steering system.*

   Place the open end of the extension hose into a suitable container.
7. If equipped with Hydro-Boost®, apply the brake pedal 4 times.
8. **NOTE:** *Do not overfill the reservoir.*

   Fill the reservoir as needed with the specified fluid.
9. **NOTICE: Do not allow the power steering pump to run completely dry of power steering fluid. Damage to the power steering pump may occur.**

Start the engine and let it idle, simultaneously turn the steering wheel to lock and then immediately turn the ignition switch to the OFF position.

10. **NOTICE: Avoid turning the steering wheel without the engine running as this may cause air to be pulled into the steering gear.**

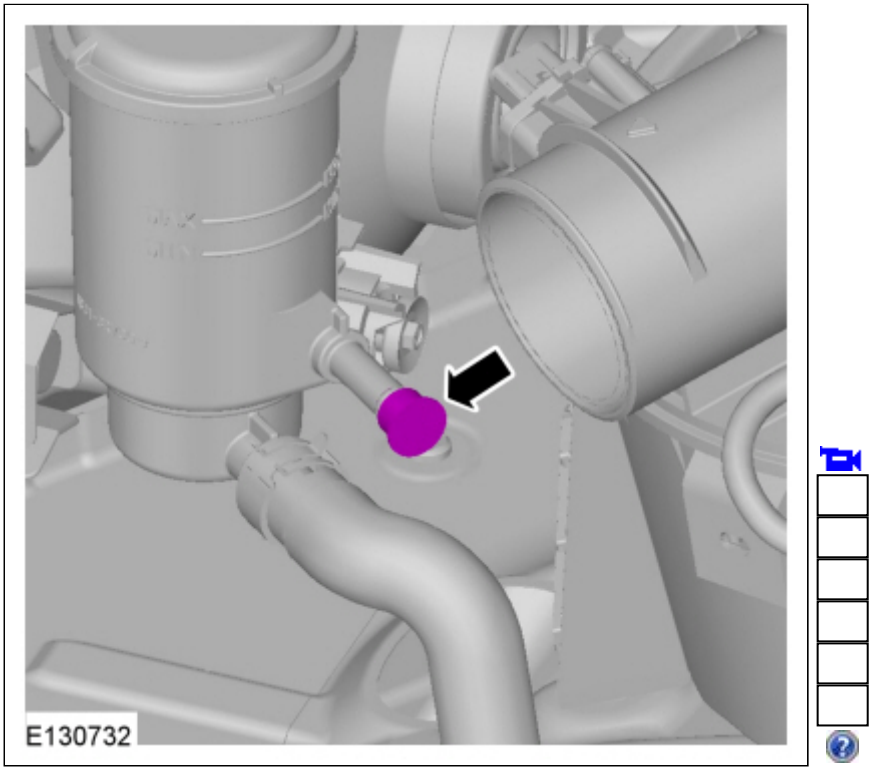
    NOTE: *Do not overfill the reservoir.*

    Fill the reservoir as needed with the specified fluid.

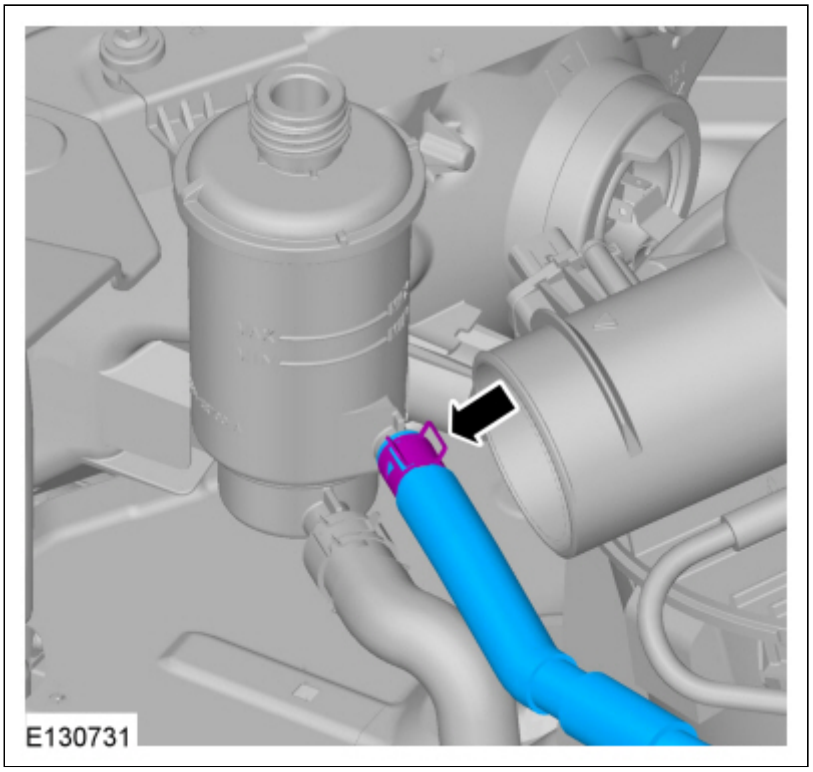
11. Repeat Steps 8 and 9, turning the steering wheel in the opposite direction each time, until the fluid exiting the power steering fluid return hose is clean and clear of foreign material.

12. Remove the extension hose from the return hose.

13. Remove the plug from the fluid reservoir inlet port.



14. Install the clamp and connect the power steering return hose to the reservoir.



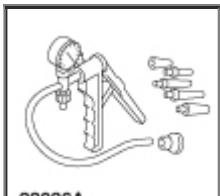
15. **NOTE:** *If, after correctly filling the power steering system, there is power steering noise accompanied by evidence of aerated fluid and there are no fluid leaks, it may be necessary to bleed the power steering system.*

    Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Steering System Bleeding

Special Tool(s) / General Equipment

 23036A	416-D001 Hand Vacuum Pump/Pressure Pump

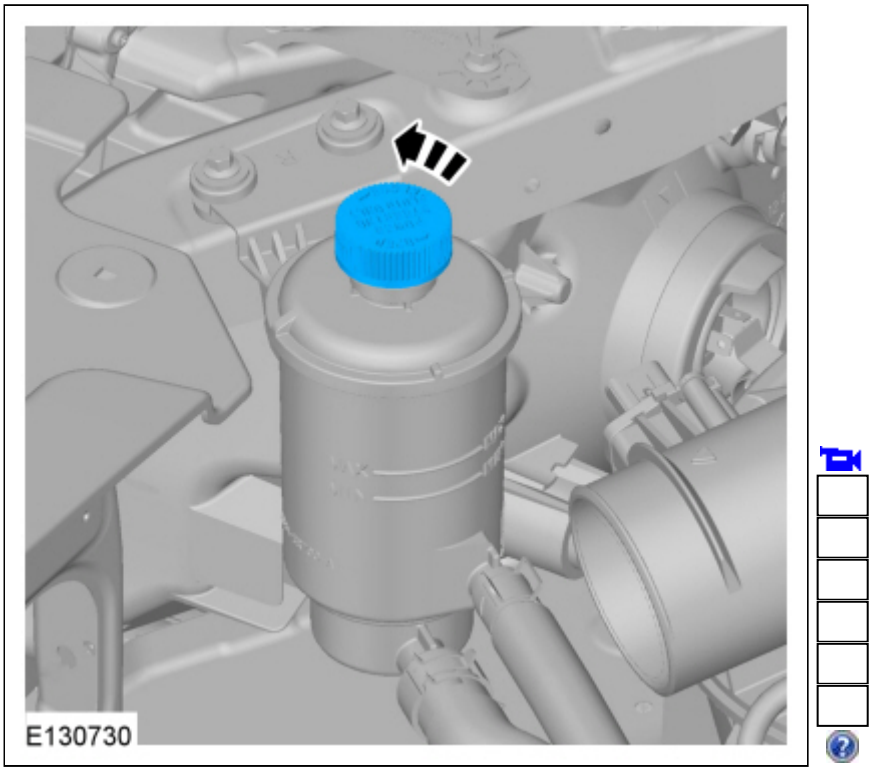
Activation

NOTICE: If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition may occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.

NOTE: *When filling the power steering fluid reservoir, make sure that the power steering fluid is clean and not agitated prior to use. The power steering fluid should be poured slowly into the reservoir to minimize the possibility of aeration.*

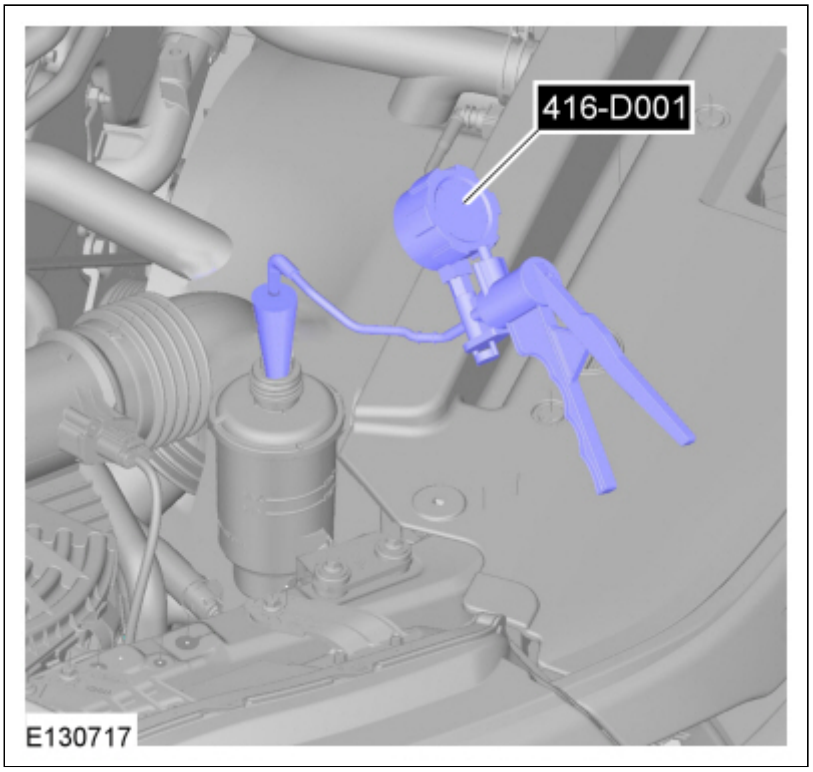
1. **NOTE:** *Make sure that the power steering fluid in the power steering fluid reservoir does not fall below the MIN mark, as air could enter the system.*

   Remove the power steering reservoir cap. Check the fluid.



2. Raise and support the vehicle making sure that the road wheels are just clear of the floor.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

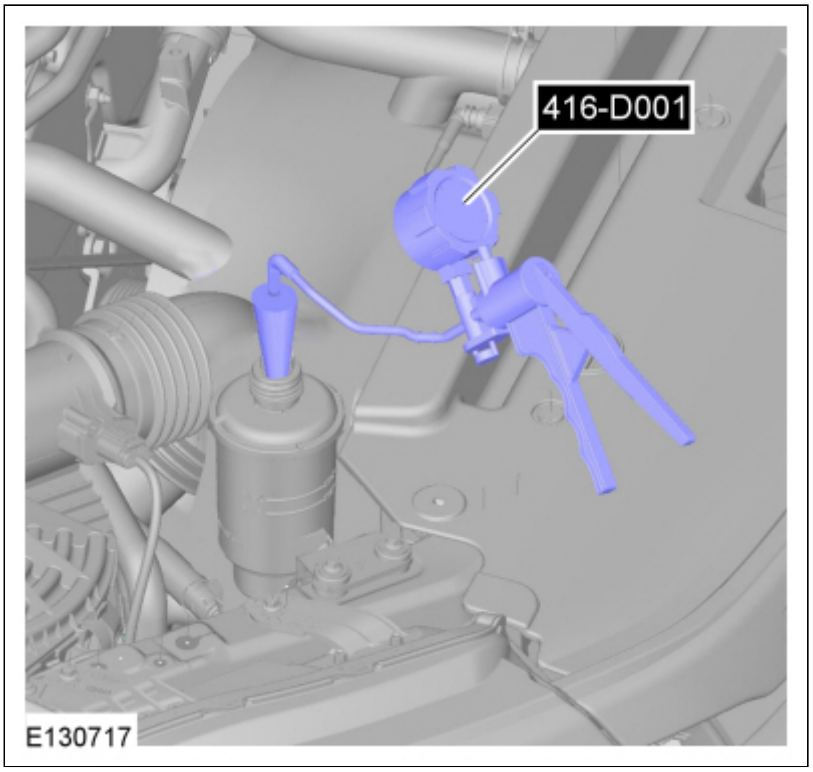
3. Use Special Service Tool: 416-D001 Hand Vacuum Pump/Pressure Pump.



4. Start the engine and let it idle.
5. Using the Vacuum Pump Kit, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
6. If the vacuum decreases by more than 5cm-Hg in 5 minutes,check the power steering system for leaks .
7. If equipped with Hydro-Boost®, apply the brake pedal 4 times.
8. **NOTICE: Do not hold the steering wheel against the stops for more than 5 seconds. Damage to the power steering pump may occur.**

   Cycle the steering wheel fully from stop-to-stop 10 times.
9. Stop the engine.
10. Release the vacuum and remove the Vacuum Pump Kit.
11. **NOTE:** *Do not overfill the reservoir.*

    Fill the power steering fluid reservoir to the MAX mark with the appropriate power steering fluid.
12. Start the engine and let it idle.
13. Install the Vacuum Pump Kit. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
    Use Special Service Tool: 416-D001 Hand Vacuum Pump/Pressure Pump.



14. **NOTICE: Do not hold the steering wheel against the stops for more than 5 seconds. Damage to the power steering pump may occur.**

    Cycle the steering wheel fully from stop-to-stop 10 times.

15. Stop the engine, release the vacuum and remove the Vacuum Pump Kit.

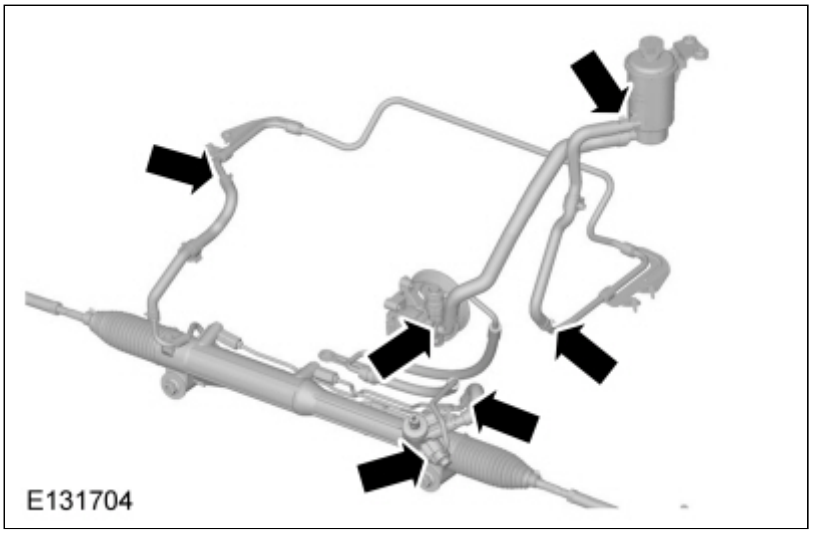
16. **NOTE:** *Do not overfill the reservoir.*

    Fill the power steering fluid reservoir to the MAX mark with the appropriate power steering fluid.

17. **NOTICE: Do not hold the steering wheel against the stops for more than 5 seconds. Damage to the power steering pump may occur.**

    NOTE: *The points where fluid leakage may occur are indicated in the figure.*

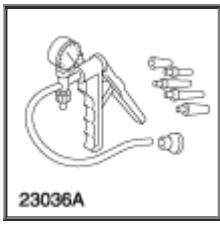
    Visually inspect the power steering system for leaks. Start the engine and let it idle, turn the steering wheel from lock to lock. If excessive noise is apparent, repeat the power steering bleeding procedure.



Copyright © 2016 Ford Motor Company

Power Steering System Filling

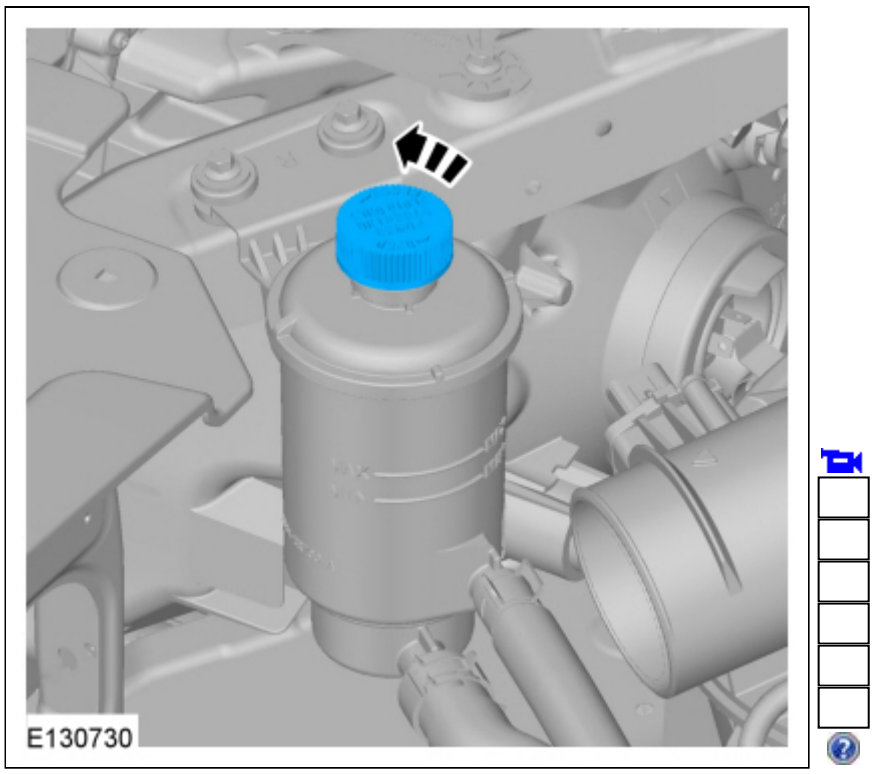
Special Tool(s) / General Equipment

 23036A	416-D001 Hand Vacuum Pump/Pressure Pump

Activation

NOTE: *When filling the power steering fluid reservoir, make sure that the power steering fluid is clean and not agitated prior to use. The power steering fluid should be poured slowly into the reservoir to minimize the possibility of aeration.*

1.

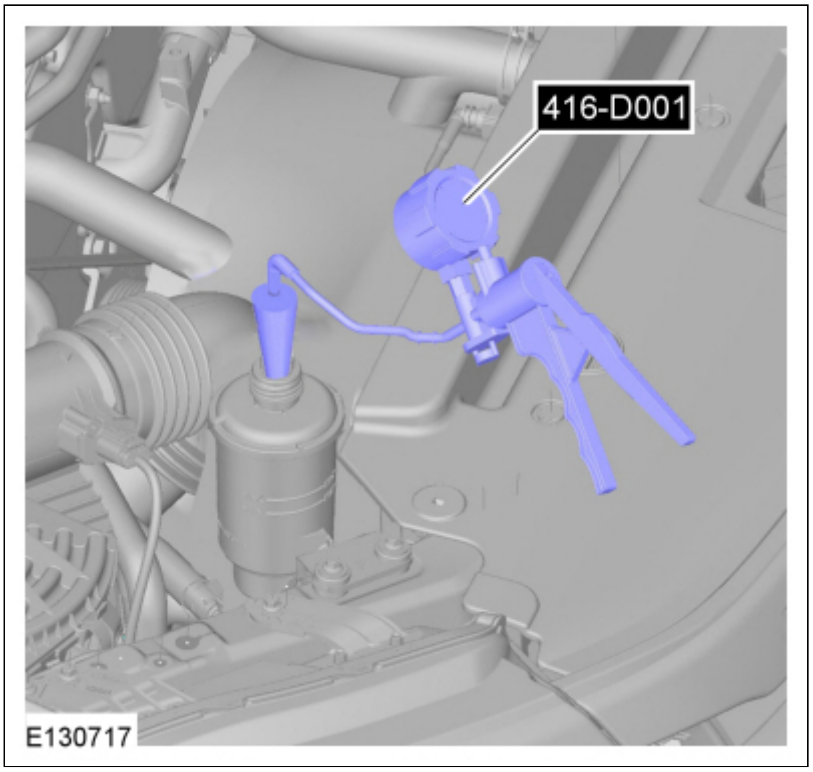


2. **NOTE:** *Make sure that the power steering fluid in the power steering fluid reservoir does not fall below the MIN mark, as air could enter the system.*

   Fill the reservoir as needed with the specified fluid.

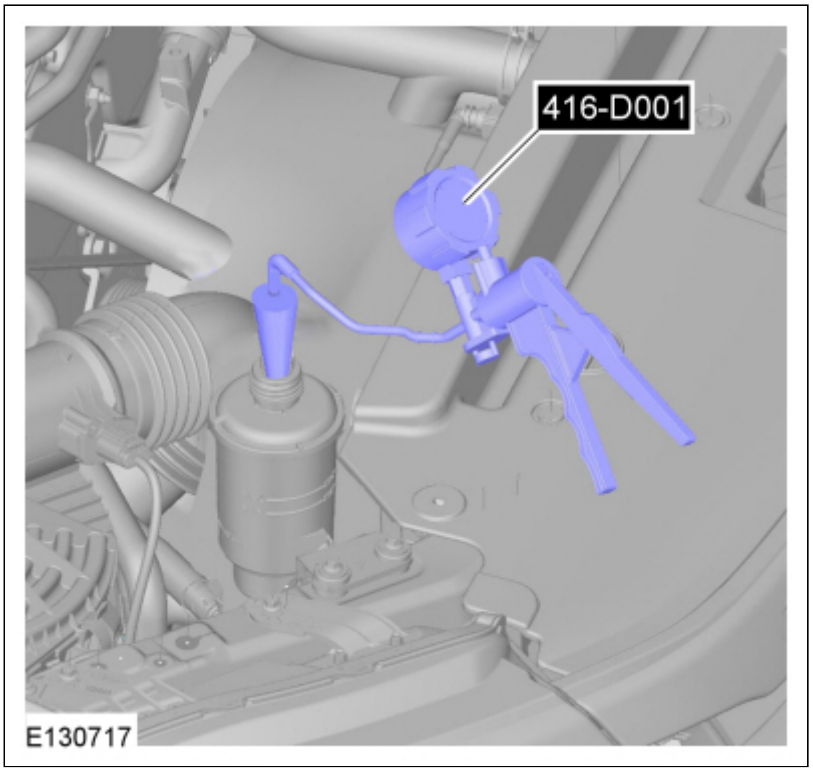
3. Raise and support the vehicle making sure that the road wheels are just clear of the floor.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Use Special Service Tool: 416-D001 Hand Vacuum Pump/Pressure Pump.



5. Using the Vacuum Pump Kit, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
6. If the vacuum decreases by more than 5cm-Hg in 5 minutes,check the power steering system for leaks .
7. Remove the Power Steering Evacuation Cap and Vacuum Pump Kit.
8. **NOTE:** *Do not overfill the reservoir.*

   Fill the power steering fluid reservoir to the MAX mark with the appropriate power steering fluid.
9. Install the Vacuum Pump Kit. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
   Use Special Service Tool: 416-D001 Hand Vacuum Pump/Pressure Pump.



10. Start the engine and let it idle.
11. **NOTICE: Do not hold the steering wheel against the stops for more than 5 seconds. Damage to the power steering pump may occur.**

NOTE: *There will be a slight drop in the power steering fluid level in the reservoir when the engine is started.*

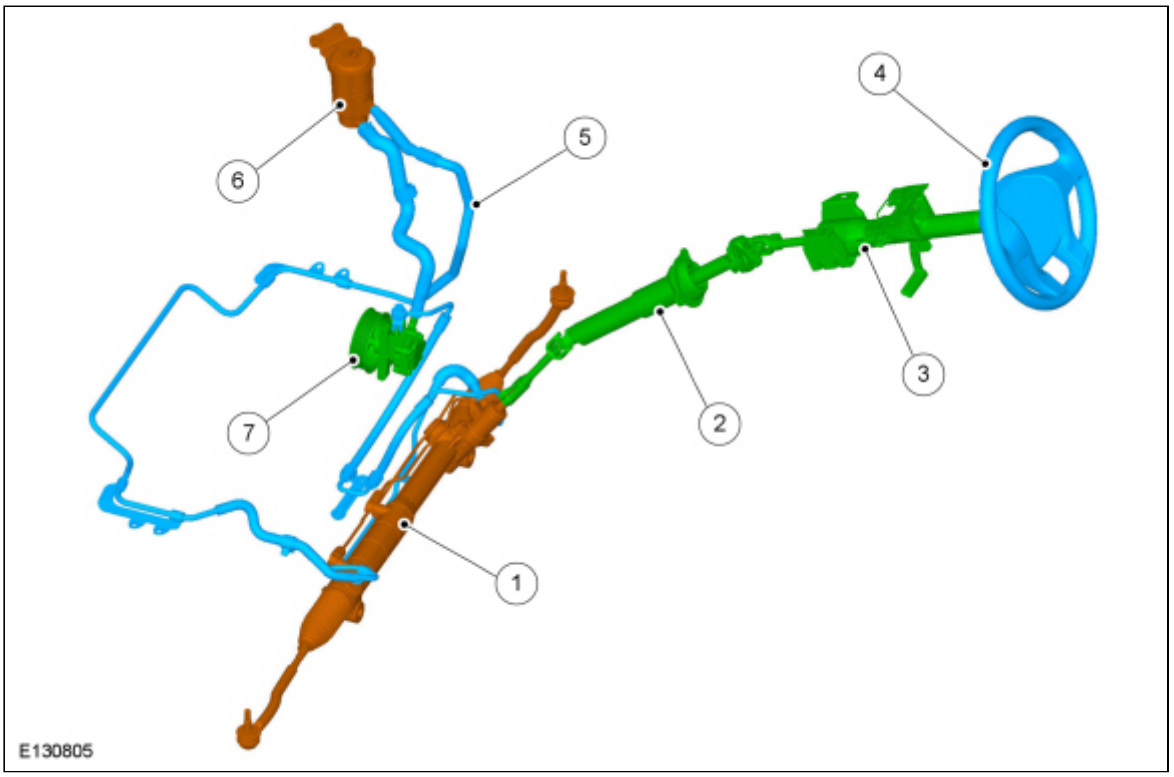
Cycle the steering wheel fully from stop-to-stop 10 times.

12. Stop the engine, release the vacuum and remove the Vacuum Pump Kit.
13. **NOTE:** *Do not overfill the reservoir.*

    Fill the power steering fluid reservoir to the MAX mark with the appropriate power steering fluid.

Copyright © 2016 Ford Motor Company

Power Steering - Component Location



Item	Description
1	Steering gear and linkage
2	Steering shaft
3	Steering column
4	Steering wheel
5	Power steering lines
6	Power steering fluid reservoir
7	Power steering pump

Copyright © 2016 Ford Motor Company

Power Steering

The hydraulic power steering system consists of the following components:

- Power steering pump
- Power steering fluid reservoir
- Power steering pressure and return lines/hoses
- Power steering fluid cooler (gas engines)
- Steering gear
- Inner tie rod
- Outer tie rod

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is then trapped between the pump vanes and moved to the high-pressure side of the pump creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

Vehicles are built using a left biased steering gear to help compensate for road crown.

Copyright © 2016 Ford Motor Company

Power Steering

Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is trapped between the pump vanes and moved to the high pressure side of the pump creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	—
Material: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)	MERCON® LV

Preliminary Inspection

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage or leaks.

Visual Inspection Check

- Fluid level
- Tire pressure
- Tires
- Drive belt
- Drive belt tensioner
- Steering column alignment
- Tie-rod ends
- Suspension components
- Steering column shaft U-joints
- Intermediate shaft bolts
- Power steering reservoir baffle
- Power steering reservoir screen
- Power steering pressure lines, fittings or O-rings
- Power steering return hoses and clamps
- Steering gear
- Power steering pump
- Power steering fluid cooler (if equipped)

3. Inspect the power steering fluid for the following conditions:
    - Aeration or foam: Purge the power steering system.
    - Overheating or contamination: Flush the power steering system.
4. **NOTE:** *It may be necessary to add power steering fluid to achieve the correct level.*

Check the fluid level and clean the power steering components. With the ignition OFF:

- check the power steering fluid level and add fluid as necessary.Automatic Transmission Fluid (WSS-M2C938-A;MERCON® LV)
- wipe off any visible signs of fluid or residue build up.

- **NOTICE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

  Start the engine and turn the steering wheel from stop-to-stop several times.

5. Visually inspect the power steering hydraulic line/hose connections for damage or leaks.
   - If a leak is detected at a threaded fitting or clamp plate joint, tighten to specification. If the leak is still evident, visually inspect the O-rings or Teflon® seals. Install new O-rings or Teflon® seals as necessary.
   - If a leak is detected at a constant tension spring clamp, verify that the hose is not damaged and fully installed on the hose fitting. Make sure that the constant tension spring clamp is positioned 2 mm (0.078 in) from the end of the hose. If the leak remains, install a new constant tension spring clamp.
   - If a leak is detected at a screw clamp joint, verify that the hose is not damaged and fully installed on the hose fitting and the clamp is positioned 2 mm (0.078 in) from the end of the hose before tightening the screw clamp. If the leak remains, install a new screw clamp.

6. Visually inspect the power steering components for leaks.
   - If a leak is detected in the power steering pressure line or return hose, install a new hose.
   - If a leak is detected in the steering gear turn tubes, repair or install new turn tubes.
   - If a leak is detected in the power steering pump, install a new power steering pump.
     REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation).
     REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation).
     REFER to: Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).

   - **NOTE:** *On vehicles with rack-and-pinion steering gear, it may be necessary to remove the bellows boot clamp from the steering gear bellows boot to inspect for internal steering gear leaks.*

     If a leak is detected in the steering gear, repair or install a new steering gear.
     REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
     REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

7. For information on power steering leak detection, refer to Component Tests in this section.

8. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.

9. If the cause is not visually evident, verify the symptom and GO to Symptom Chart — Steering System or GO to Symptom Chart - NVH.

Steering System Symptom Definitions

Drift/Pull

Pull is described as a tugging sensation felt by the hands on the steering wheel that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with the hands off the steering wheel.

- A vehicle-related drift/pull on a flat road can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle, such as wind or road camber.

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Lack of Assist or Inconsistent Assist

Lack of assist or inconsistent assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving or during high-effort parking maneuvers.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or steering correction is completed.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Symptom Chart — Steering System

Condition	Possible Sources	Action
Steering has lack of assist or inconsistent assist	• Contaminated power steering fluid • Steering gear • Power steering pump • Restricted power steering lines/hoses	GO to Pinpoint Test A
Excessive steering wheel play	• Steering gear • Steering column shaft/coupling • Steering linkage	GO to Pinpoint Test B
Steering system drift/pull wander	• Steering column shaft/U-joints • Steering gear • Steering gear mounts	GO to Pinpoint Test C
Poor returnability/sticky steering	Binding steering column shaft/coupling U-joints	To continue the steering column diagnosis. REFER to: Steering Column (211-04) .
	Suspension components	To continue the suspension diagnosis. REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).
	Binding steering column bearing(s)	To continue the steering column diagnosis. REFER to: Steering Column (211-04) .
	Binding dash boot seal	INSTALL a new dash boot seal.
	Steering gear	The steering gear cannot be adjusted. INSTALL a new steering gear as necessary. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

Symptom Chart — NVH

NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms,
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Description and Operation).

. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).
for the next likely system and continue diagnosis.

Condition	Possible Sources	Action
Steering system cold start noise	Blockage in the power steering fluid reservoir filter screen or return ports caused by power steering fluid contamination	**NOTE:** *Some noise during an extremely cold start (-12.2°C [-10°F]) is normal and should improve as the steering system warms up (usually within 60 seconds).* **NOTE:** *It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir filter/screen or to remove blockage in the return ports.* CHECK the power steering fluid reservoir filter/screen or return ports for contaminants or blockage. FLUSH the power steering system as necessary.
	Air in the steering hydraulic system (aerated fluid)	CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system.
Steering grunt or shudder — occurs when turning into or out of a turn at low speeds (temperature sensitive)	Air in the steering hydraulic system (aerated fluid)	CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system.
	Steering gear or power steering hoses	GO to Steering Gear Grunt/Shudder Component Test in this section.
Steering system clonk — hydraulic knocking sound	Air in the steering hydraulic system (aerated fluid)	**NOTE:** *Some amount of clonk noise is considered acceptable. If in doubt of the acceptability, compare to another vehicle.* CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system.
Power steering pump moan — loud humming noise occurs when the steering wheel is rotated to the stop position. Produces a 120-600 Hz frequency that changes with rpm	Low fluid and/or air in the steering hydraulic system (aerated fluid)	CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system. If a pump moan still exists, INSTALL a new power steering pump. REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).
	Blockage in the power steering fluid reservoir filter/screen or return ports caused by power steering fluid contamination	**NOTE:** *It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir filter/screen or to remove blockage in the return ports.* CHECK the power steering fluid reservoir filter/screen or return ports for contaminants or blockage. FLUSH the power steering system as necessary.
	Power steering line/hose grounded to chassis	INSPECT the power steering lines/hoses. REPAIR as necessary.

	Power steering pump brackets loose or misaligned	CHECK bolts, brackets and bracket alignment. TIGHTEN bolts to specification. REPAIR or INSTALL new brackets as necessary. REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).
	Steering gear isolators	INSPECT the isolators for wear or damage. REPAIR as necessary.
Steering gear clunk — occurs only while cornering over a bump (can be temperature sensitive)	Steering gear	INSPECT the steering gear for loose mounting bolts. TIGHTEN to specification as necessary. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
Feedback (rattle, chuckle or knocking noise in the steering gear) — roughness is felt in the steering wheel when the vehicle is driven over rough surfaces	Loose, damaged or worn tie rod ends	INSPECT and INSTALL new tie-rod ends as necessary. GO to Steering Linkage Component Test in this section.
	Steering gear insulators or mounting bolts loose or damaged	TIGHTEN the bolts to specification or INSTALL new bolts as necessary. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
Power steering hiss or whistle	Steering column shaft/coupling-to-steering gear is binding or misaligned	To continue the steering column diagnosis. REFER to: Steering Column (211-04) .
	Grounded or loose steering column boot at the dash panel	To continue the steering column diagnosis. REFER to: Steering Column (211-04) .
	Damaged or worn steering gear input shaft and valve	REPAIR or INSTALL a new steering gear as necessary. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
	Restricted power steering lines/hoses	GO to Pinpoint Test A
Steering gear squeak	Incorrect power steering fluid in system	If incorrect power steering fluid is suspected, FLUSH the power steering system. If noise persists after system flush, INSTALL a new steering gear. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
	Steering gear rotary seal	**NOTE:** *Use the chassis ears to verify that the steering gear is the source of the noise. It may be*

		steering gear is the source of the noise. It may be necessary to replicate the customer operating conditions (fluid temperature, turning rate of steering wheel) to get the squeak to reoccur. INSTALL a new steering gear as necessary. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
	Stone shield (if equipped)	MAKE SURE that the stone shield is correctly installed and that it is not making contact with the steering shaft. REPOSITION stone shield or INSTALL a new stone shield as necessary.
Power steering pump noisy	Blockage in the power steering fluid reservoir filter/screen or return ports caused by power steering fluid contamination	**NOTE:** *It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir filter/screen or to remove blockage in the return ports.* CHECK the power steering fluid reservoir filter/screen or return ports for contaminants or blockage. FLUSH the power steering system as necessary.
	Power steering pump	INSTALL a new power steering pump as necessary. REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).
Power steering pump noise (steering wheel turned fully to stop/lock)	Power steering fluid flow into the bypass valve of the pump valve housing, with fluid temperature below 54°C (130°F)	Acceptable condition.
Power steering pump whine noise	Aerated fluid	CHECK for a leak in the system. REFER to Power Steering Fluid Leak Test Component Test. PURGE the air from the system.
	Blockage in the power steering fluid reservoir filter/screen or return ports caused by power steering fluid contamination	**NOTE:** *It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir filter/screen or to remove blockage in the return ports.* CHECK the power steering fluid reservoir filter/screen or return ports for contaminants or blockage. FLUSH the power steering system as necessary.
	Damaged power steering pump	INSTALL a new power steering pump as necessary. REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 3.2L Duratorq-

		TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).
High speed shake or shimmy — occurs at high speeds	Worn or damaged steering linkage components	GO to Steering Linkage Component Test in this section.

Pinpoint Tests

Pinpoint Test A: Steering Has a Lack of Assist or Inconsistent Assist

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

NOTE: *Hard steering or lack of assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn, occur near the end of a turn or differ right to left.*

Possible Causes

- Power steering fluid contamination
- Steering gear
- Power steering pump
- Power steering hoses

PINPOINT TEST A : STEERING HAS A LACK OF ASSIST OR INCONSISTENT ASSIST

A1 CHECK FOR POWER STEERING FLUID CONTAMINATION

- Check the power steering fluid for contamination.

Is the power steering fluid free of any contamination?

Yes	GO to A2
No	FLUSH the power steering system. TEST the system for normal operation. If the assist concern is still present, GO to A2

A2 CHECK THE STEERING ASSIST WITH THE ENGINE SPEED RAISED

- **NOTICE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**
  Set the engine speed to 2,100 rpm and turn the steering wheel fully to the left and right.

Is steering assist fully restored to normal with the engine speed raised?

Yes	INSTALL a new power steering pump. REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).
No	GO to A3

A3 CHECK FOR A CHANGE IN ASSIST ON LEFT AND RIGHT TURNS

- With the engine running at idle, turn the steering wheel fully to the left and to the right.

Does the steering assist change when turning from right to left?

Yes	INSTALL a new power steering gear. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
No	GO to A4

A4 CHECK THE STEERING LINES AND HOSES FOR RESTRICTIONS

- Inspect the steering lines and hoses for damage, kinks or restrictions.

Are the steering lines and hoses free from any damage, kinks and/or restrictions?

Yes	GO to A5
No	INSTALL new lines and/or hoses as necessary. TEST the system for normal operation.

A5 MONITOR THE ENGINE SPEED CHANGES

NOTICE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

NOTE: *Make sure that the vehicle is on a flat dry surface, all accessories are in the OFF position and that the steering system is at normal operating temperature.*

- Connect the diagnostic tool.
- Start the engine.
- With the engine running at idle, raise the power steering fluid temperature to 74°- 80°C (165°-176°F) by rotating the steering wheel fully to the left and to the right several time.
- Using a diagnostic scan tool, monitor the Engine Revolutions Per Minute (RPM) PIDwhile turning the steering wheel quickly to the left stop position and then to the right stop position.
- Note the engine Revolutions Per Minute (RPM) during the turns.

Does the engine speed change (even temporarily) by more than 30 rpm when turning the steering wheel?

Yes	INSTALL a new power steering gear. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
No	INSTALL a new power steering pump. REFER to: Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4 (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (211-02A Power Steering, Removal and Installation). REFER to: Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (211-02A Power Steering, Removal and Installation).

Pinpoint Test B: Excessive Steering Wheel Play

Diagnostic Overview

Possible Causes

- Steering linkage
- Steering column shaft
- Steering gear

PINPOINT TEST B : EXCESSIVE STEERING WHEEL PLAY

B1 CHECK THE STEERING LINKAGE
• Carry out the Steering Linkage Component Test in this section. **Is the steering linkage OK?**

Yes	REFER to: Steering Column (211-04) .
No	INSTALL new steering linkage components as necessary.

Pinpoint Test C: Steering System Drift/Pull/Wander

Diagnostic Overview

Possible Causes

- Steering column shaft
- Steering gear
- Steering gear mounts
- Steering column shaft U-joints

PINPOINT TEST C : STEERING SYSTEM DRIFT/PULL/WANDER

C1 CHECK THE STEERING COLUMN SHAFT
• Inspect the steering column shaft U-joints for looseness or wear. REFER to: Steering Column (211-04) . **Are the steering column shaft U-joints OK?**

Yes	GO to C2
No	INSTALL new steering column shaft as necessary. REFER to: Steering Column Lower Shaft (211-04 Steering Column, Removal and Installation). REFER to: Steering Column Upper Shaft (211-04 Steering Column, Removal and Installation).

C2 CHECK THE STEERING GEAR MOUNTING
• Check the steering gear mounts for looseness or wear. **Are the steering gear mounts OK?**

Yes	GO to C3
No	INSTALL a new steering gear as necessary. REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation). REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

C3 CHECK THE STEERING GEAR
• Carry out the Steering Gear Valve Component Test in this section. **Is the steering gear valve OK?**

Yes	To diagnose suspension system drift/pull/wander, REFER to: Suspension System (204-00 Suspension System - General Information, Diagnosis and Testing).
No	INSTALL a new steering gear as necessary.

REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

Component Tests

Power Steering Fluid Leak Test

NOTE: *This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to Inspection and Verification.*

1. Remove the power steering pump reservoir cap and check the power steering fluid level. If necessary, add the specified power steering fluid. Automatic Transmission Fluid (WSS-M2C938-A;MERCON® LV)
2. Tightly install the Power Steering Evacuation Cap onto the reservoir and connect the Vacuum Pump Kit to the Evacuation Cap.
3. Using the Vacuum Pump Kit, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
4. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), a leak is present.
5. Remove the Vacuum Pump Kit.
6. Start the engine and insert the Dial Thermometer into the Evacuation Cap.
7. **NOTICE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

   With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
8. Stop the engine and visually inspect the system for leaks.

- If a leak is evident, repair as necessary.
- If a leak is not evident, add the specified UV fluorescent tracer dye to the power steering fluid. Use 14.78 ml (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid.

9. Start the engine.
10. **NOTICE: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

    With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
11. Stop the engine and inspect the system for traces of UV dye using the 100W/12 Volt DC UV Lamp. Repair as necessary.

Steering Gear Valve Test

1. Position vehicle on a hoist.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

- Raise the vehicle until the front wheels are off the ground.

2. **NOTE:** *Do not hold the steering wheel while carrying out this step.*

   Start the engine.

- If the steering wheel rotates in either direction (with no hand input), install a new steering gear.
  REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
  REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

Steering Gear Grunt/Shudder Test

1. Place a Dial Thermometer in the power steering fluid reservoir.
2. With the engine cold, start the engine and set engine idle speed to 1,200 rpm.
3. **NOTICE: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.**

   Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Slowly turn the steering wheel back and forth approximately one-twelfth of a full turn.
4. Turn the steering wheel another 90 degrees. Slowly turn the steering wheel back and forth approximately one-twelfth of a full turn.
5. Repeat the test with the power steering fluid at different temperatures until the temperature reaches 74-80°C (165-176°F).
6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.
7. If a loud grunt is heard, or a strong shudder is felt, purge the power steering system. If a loud grunt or strong shudder still exists, check the power steering lines/hoses for restrictions or damage and repair as necessary. If the lines/hoses are OK, install a new steering gear.
   REFER to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
   REFER to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

Steering Linkage Test

1. Position vehicle on a hoist.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Using hand force only, check the inner and outer tie rods for vertical and lateral movement in the tie-rod ball studs/sockets.

- If there is any lateral or vertical movement in the tie-rod ball studs/sockets (inner or outer), a new tie-rod must be installed.
  REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
  REFER to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).

Copyright © 2016 Ford Motor Company

Power Steering Pump - 2.5L Duratec-HE (122kW/165PS) - MI4

Base Part Number: 3A696

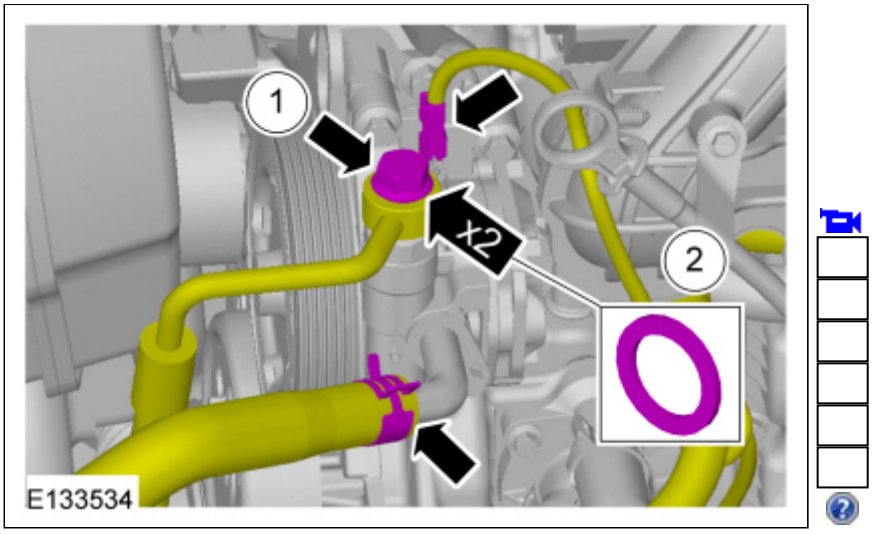
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

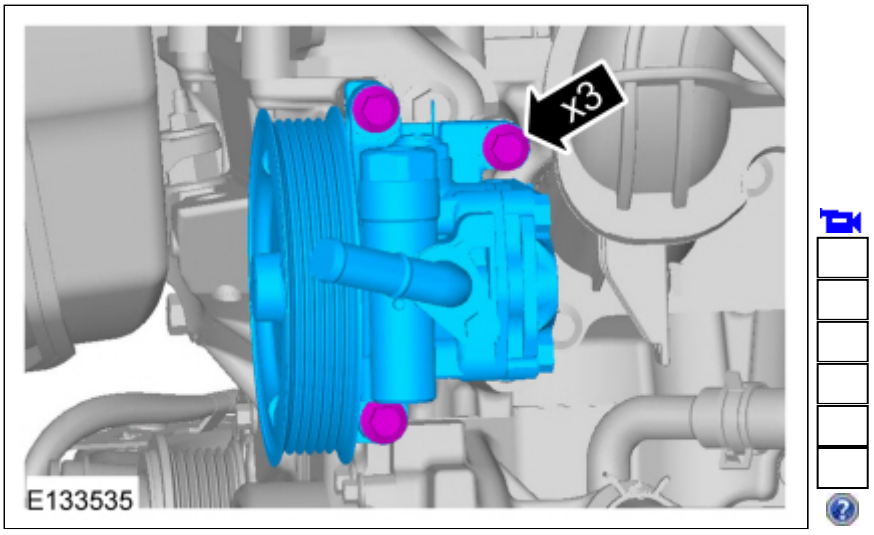
1. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. **NOTICE: Make sure that all openings are sealed.**

   NOTE: *Be prepared to collect escaping fluids.*

   Torque: 35 Nm



4. *Torque*: 20 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

3. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

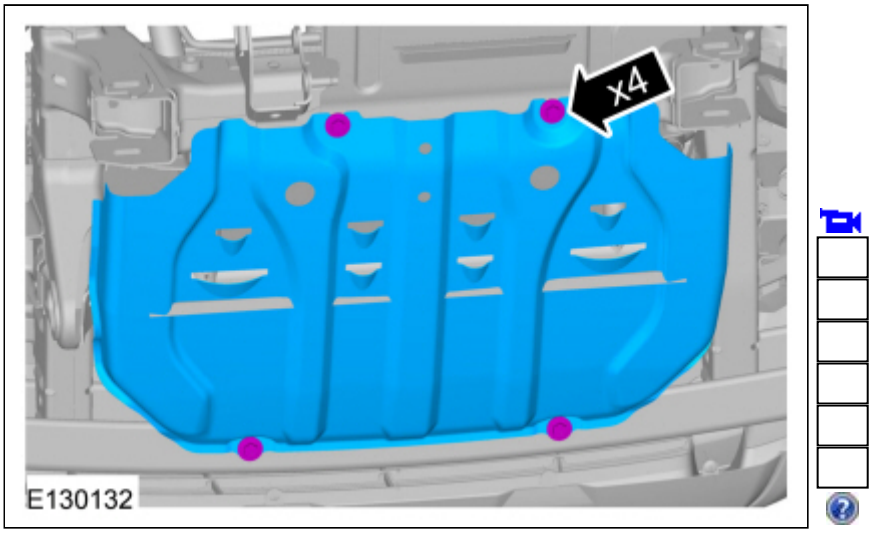
Base Part Number: 3A696

Removal

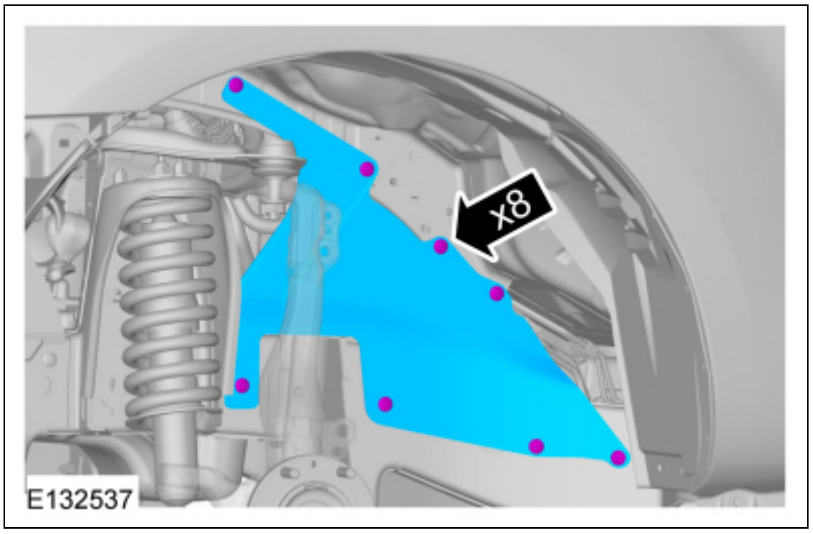
NOTICE: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. *Torque*: 30 Nm

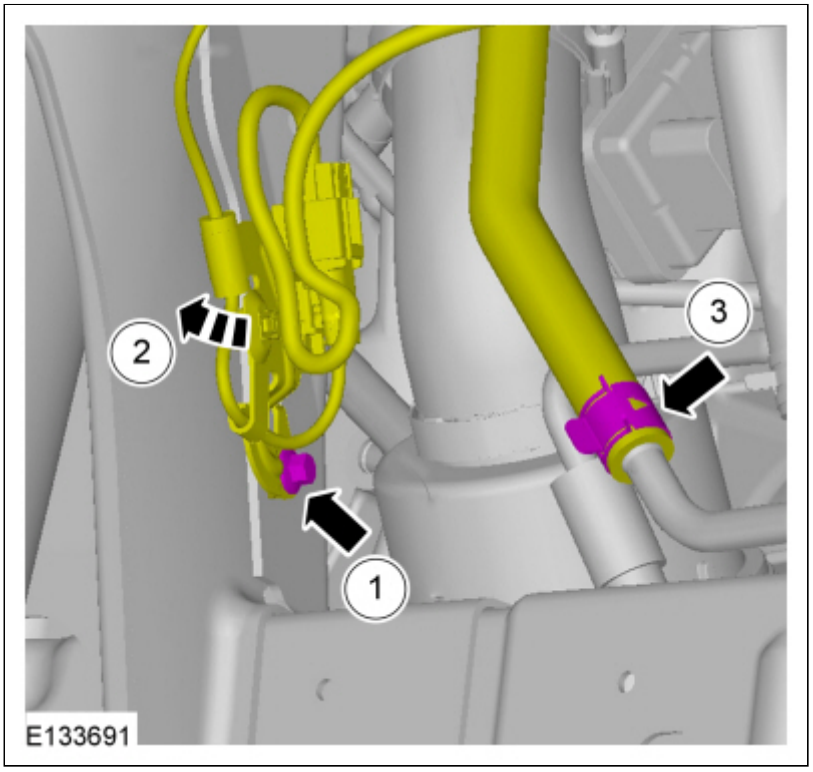


6. Remove front RH side wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
7.



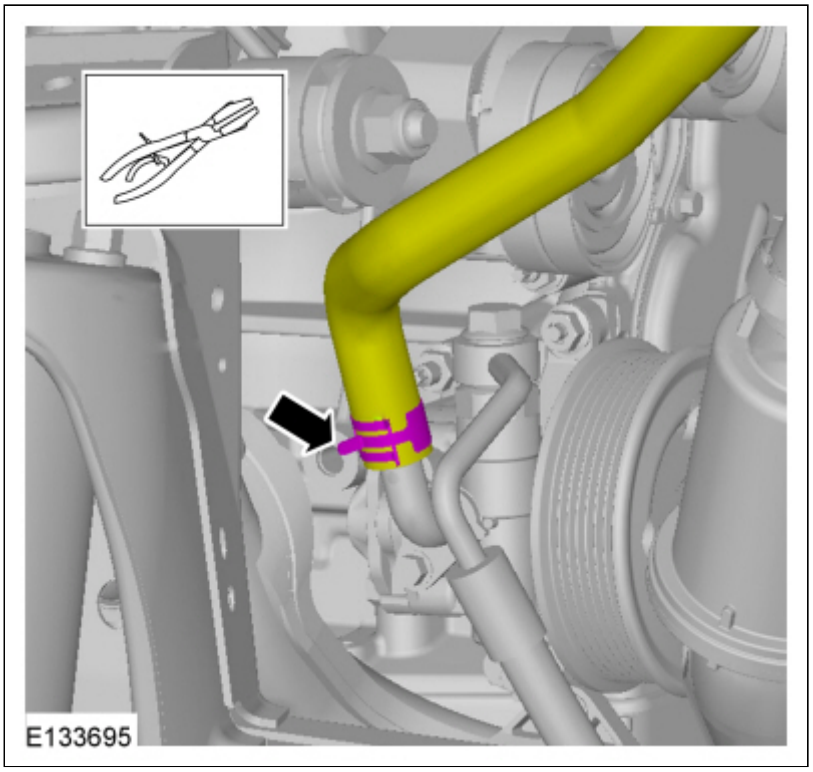
8. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

   Torque: 7 Nm



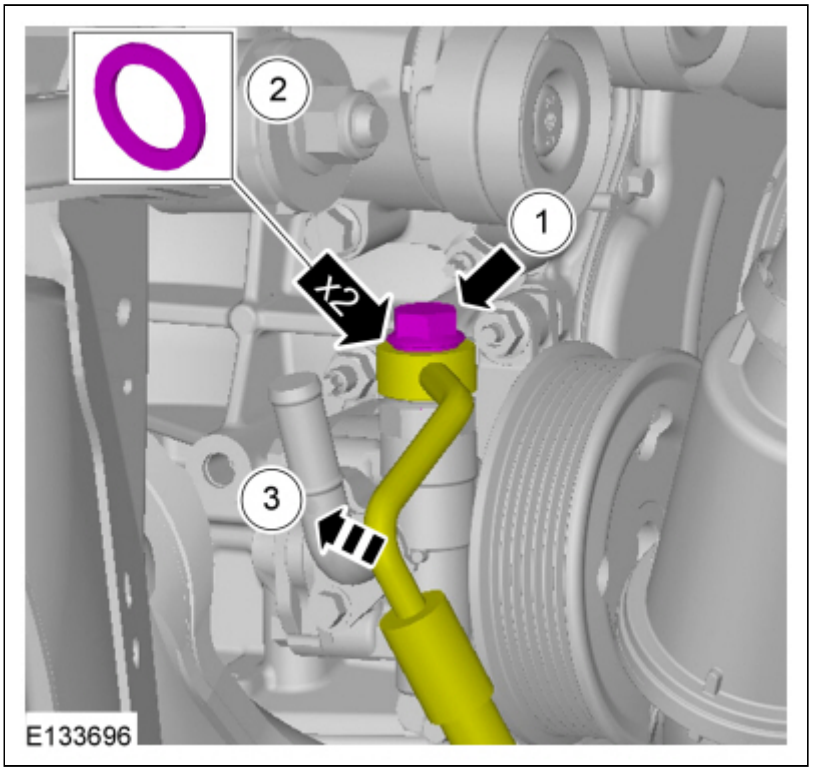
9. **WARNING: Be prepared to collect escaping fluid.**

   NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.

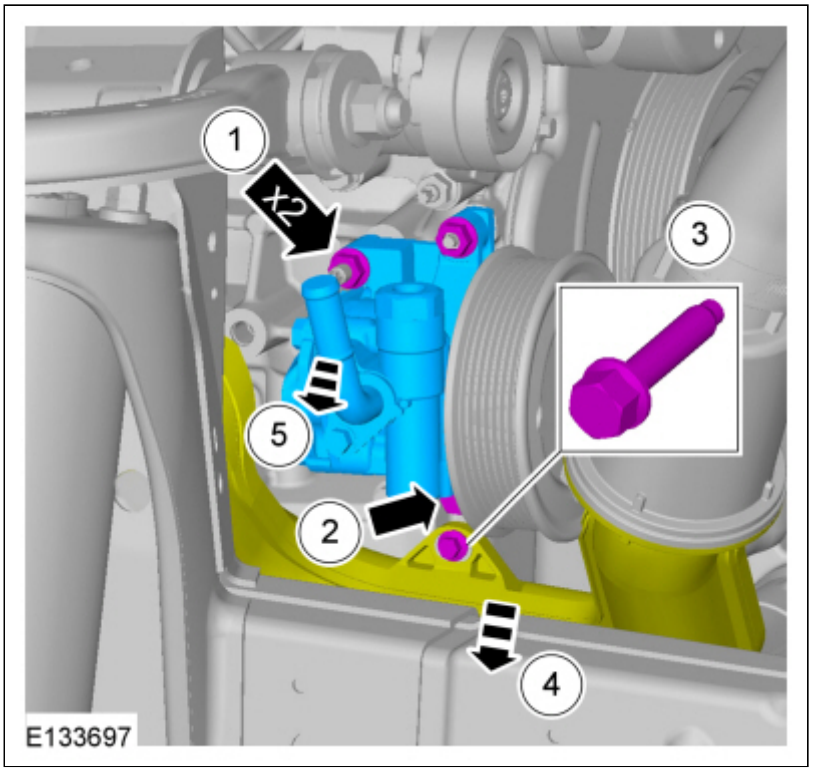


10. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

    Torque: 35 Nm

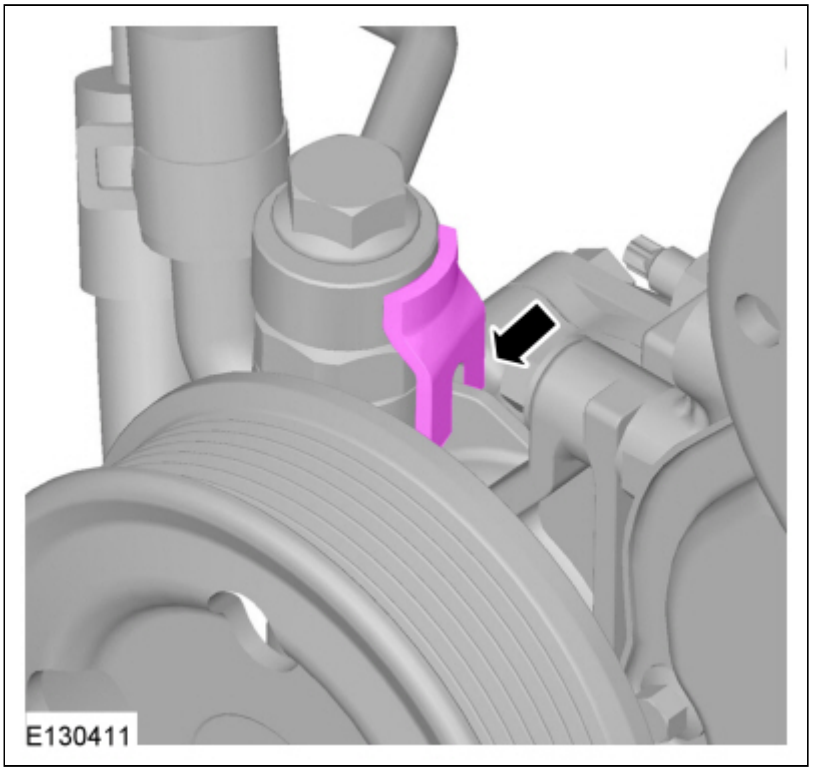


1. *Torque*: 20 Nm
2. *Torque*: 20 Nm
3. *Torque*: 10 Nm



Installation

1. **NOTE:** *Make sure that the high pressure line is located correctely.*



2. To install, reverse the removal procedure.
3. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
4. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Steering Pump - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

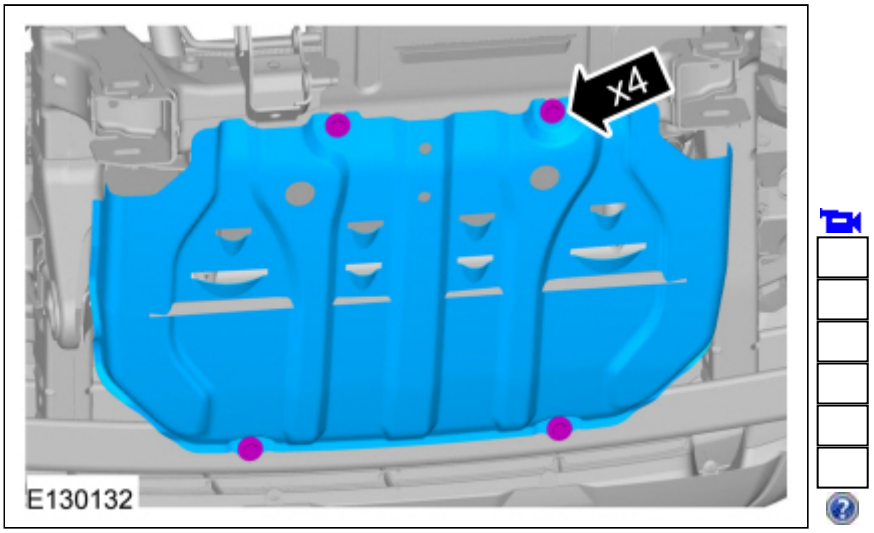
Base Part Number: 3A696

Removal

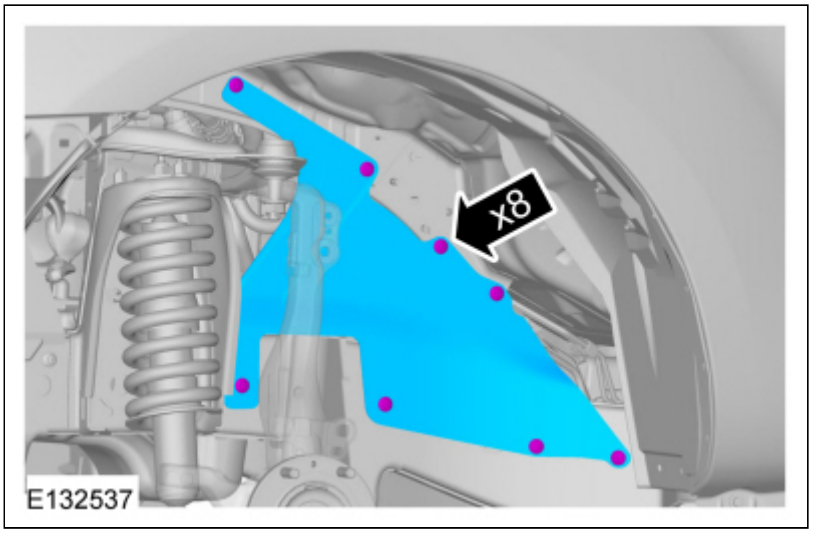
NOTICE: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. *Torque*: 30 Nm

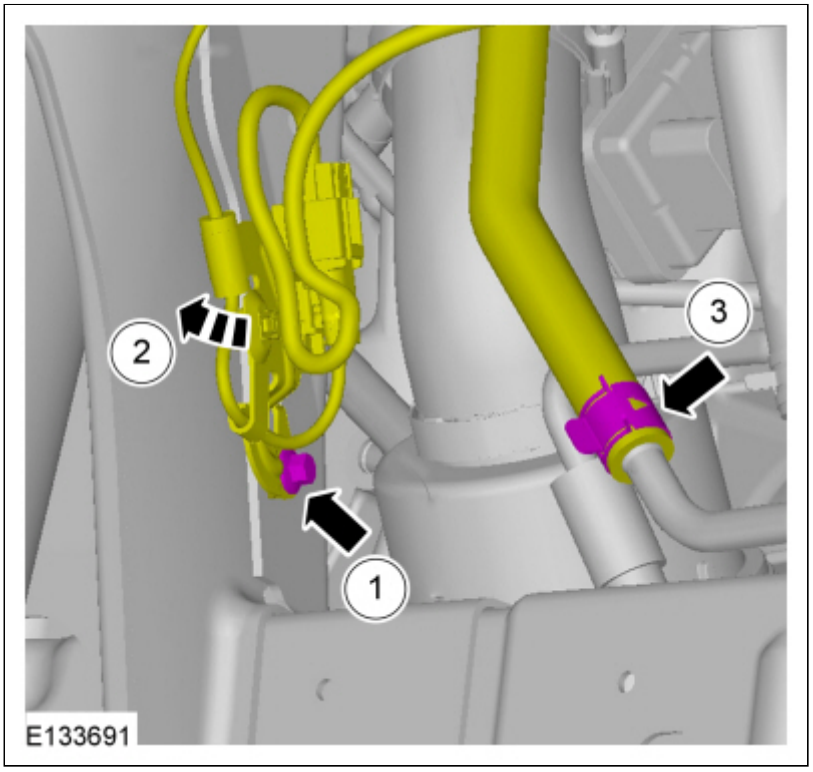


6. Remove front RH side wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
7.



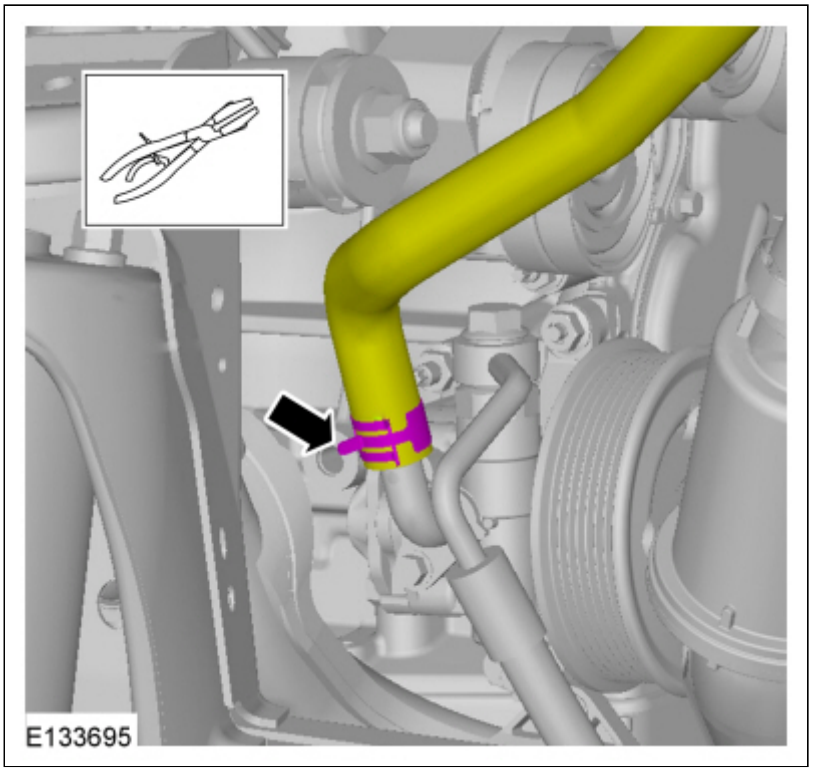
8. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

   Torque: 7 Nm



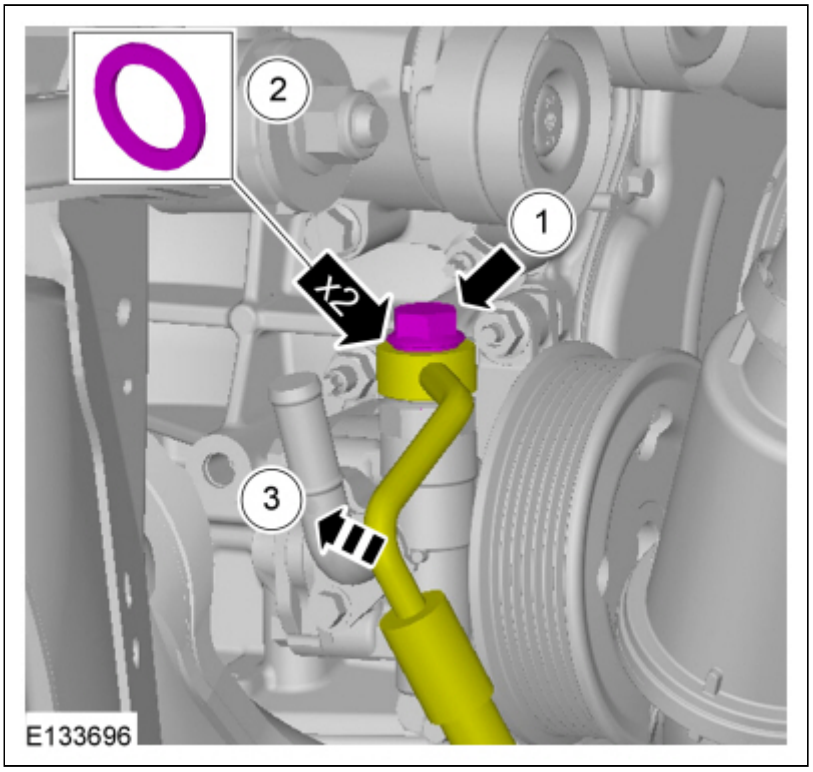
9. **WARNING: Be prepared to collect escaping fluid.**

   NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.

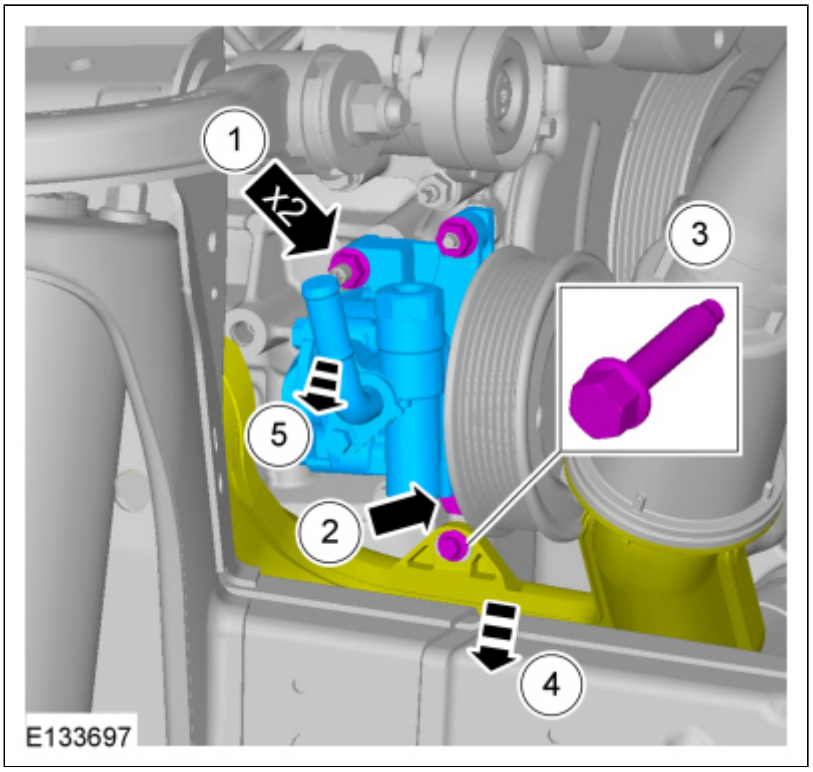


10. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

    Torque: 35 Nm

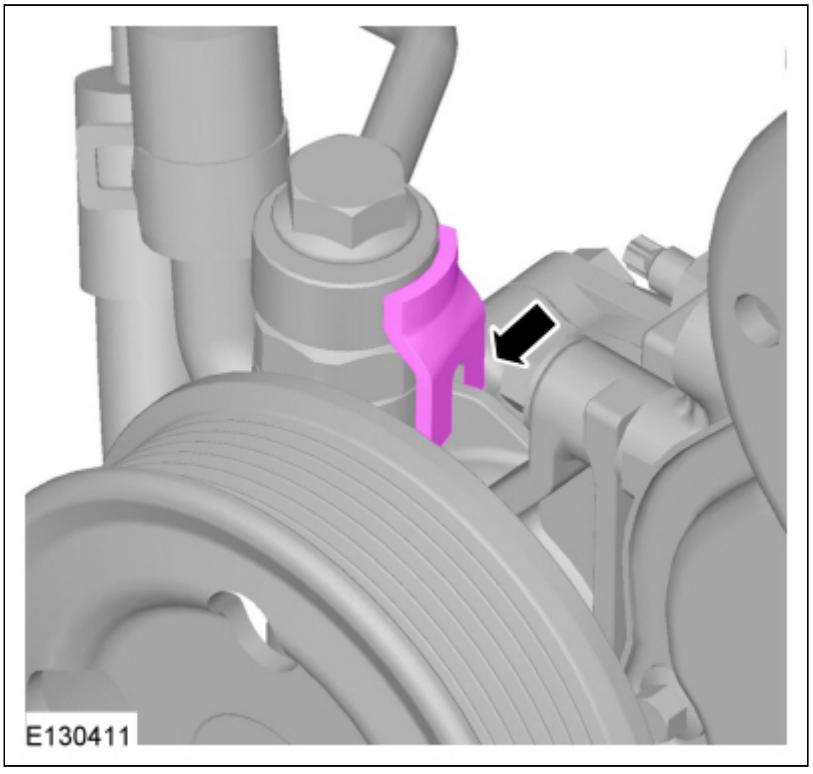


1. *Torque*: 20 Nm
2. *Torque*: 20 Nm
3. *Torque*: 10 Nm



Installation

1. **NOTE:** *Make sure that the high pressure line is located correctely.*



2. To install, reverse the removal procedure.
3. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
4. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Steering Pump - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

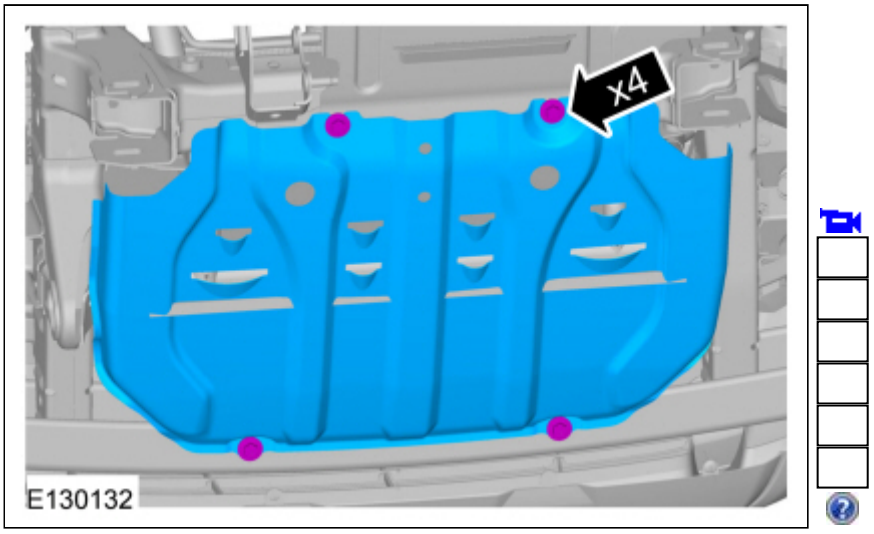
Base Part Number: 3A696

Removal

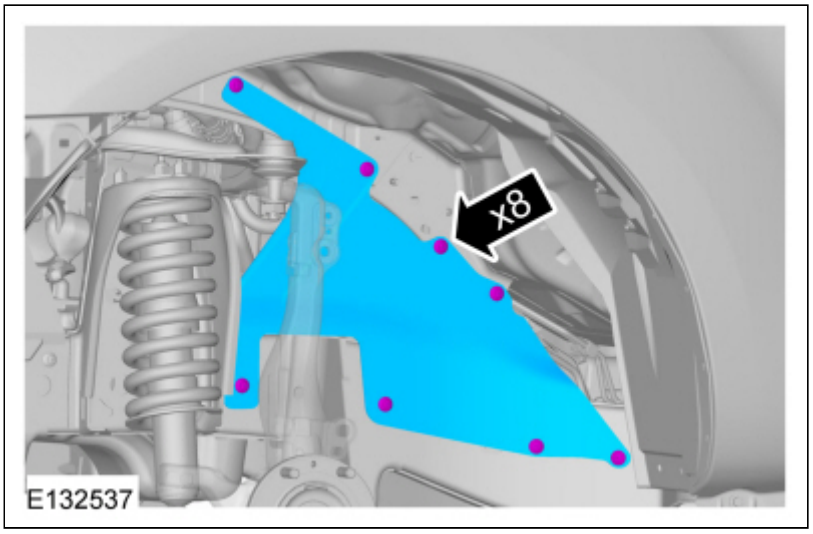
NOTICE: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. *Torque*: 25 Nm

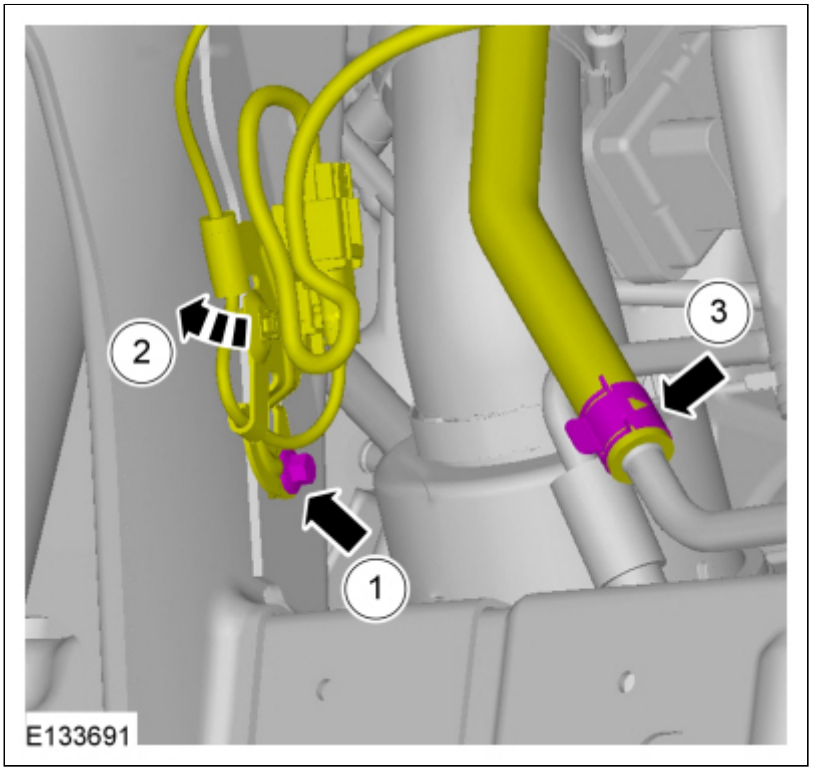


6. Remove front RH side wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
7.



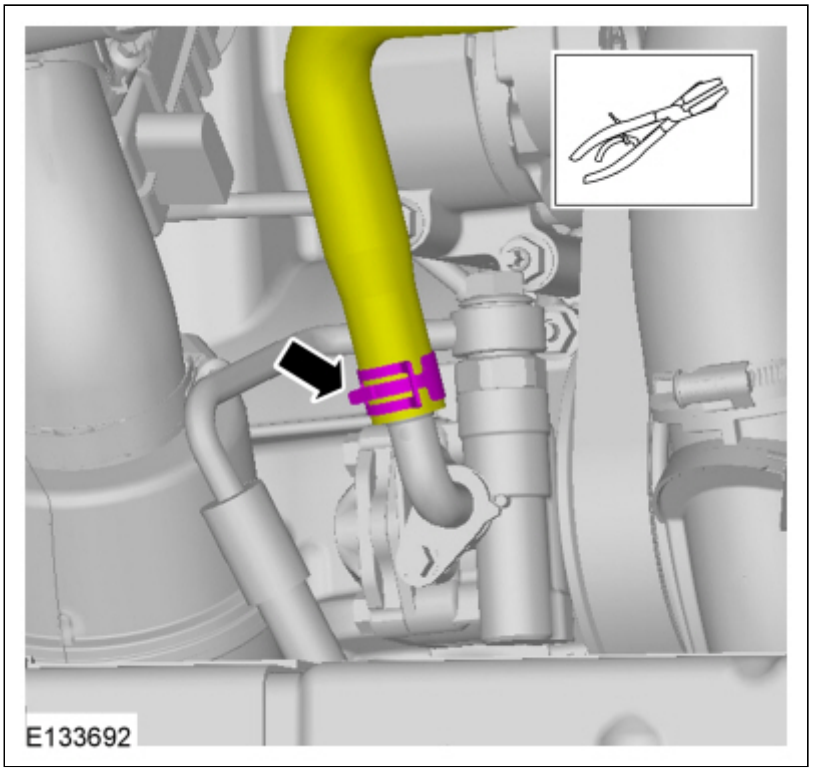
8. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

   Torque: 7 Nm



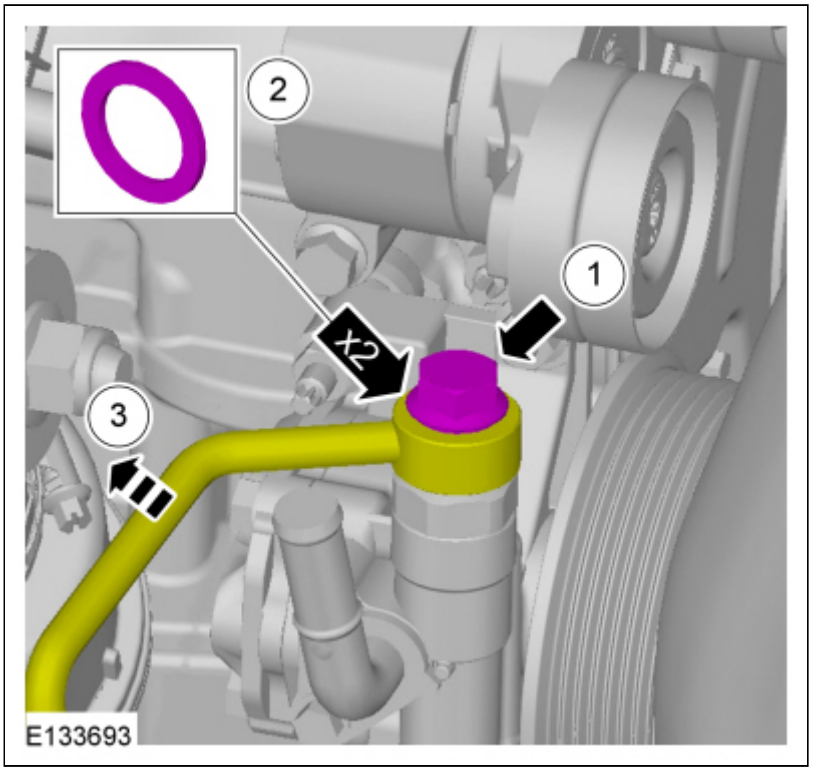
9. **WARNING: Be prepared to collect escaping fluid.**

   NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.

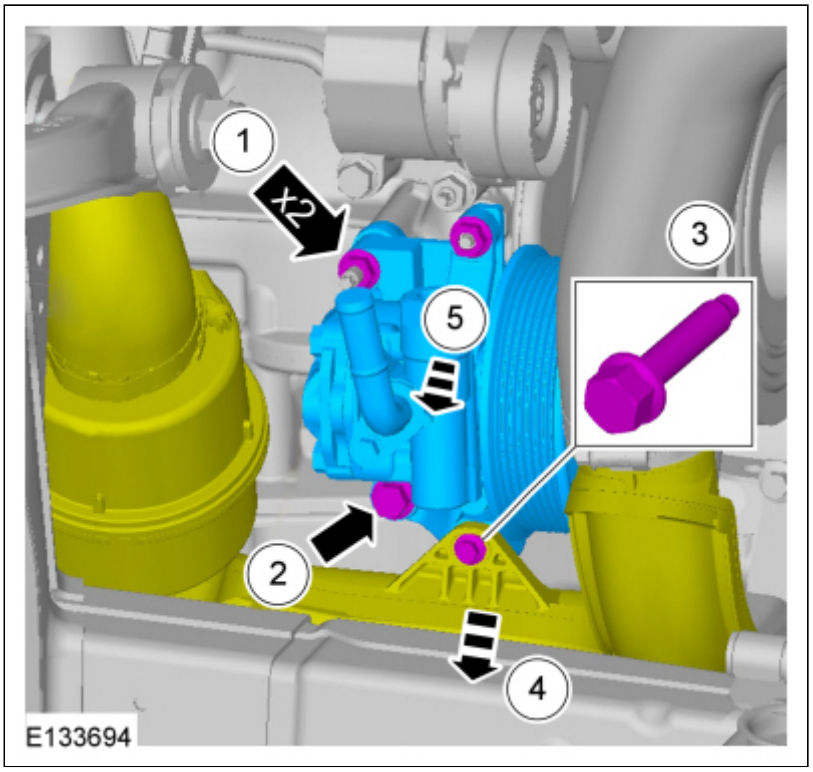


10. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

    Torque: 35 Nm

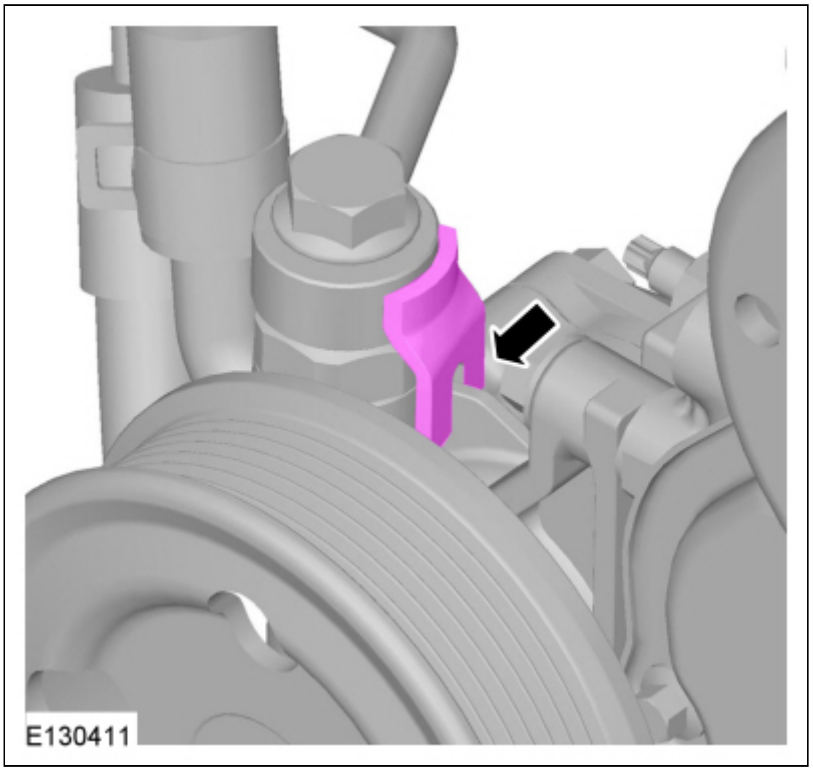


1. *Torque*: 20 Nm
2. *Torque*: 20 Nm
3. *Torque*: 10 Nm



Installation

1. **NOTE:** *Make sure that the high pressure line is located correctely.*



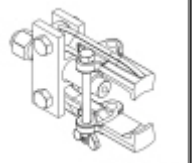
2. To install, reverse the removal procedure.
3. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
4. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Steering Gear - RHD 4WD/RHD RWD/RHD

Base Part Number: 3D080

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

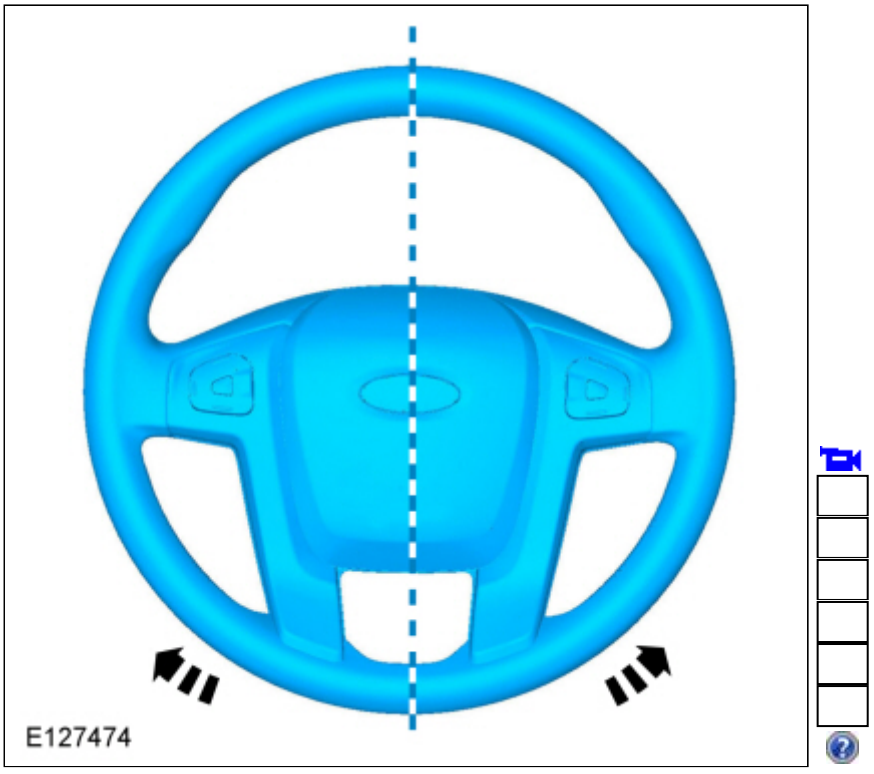
Removal

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Disconnect the battery ground cable anytime the steering gear is being serviced or damage to the steering gear internal power relay may occur resulting in steering gear replacement.**

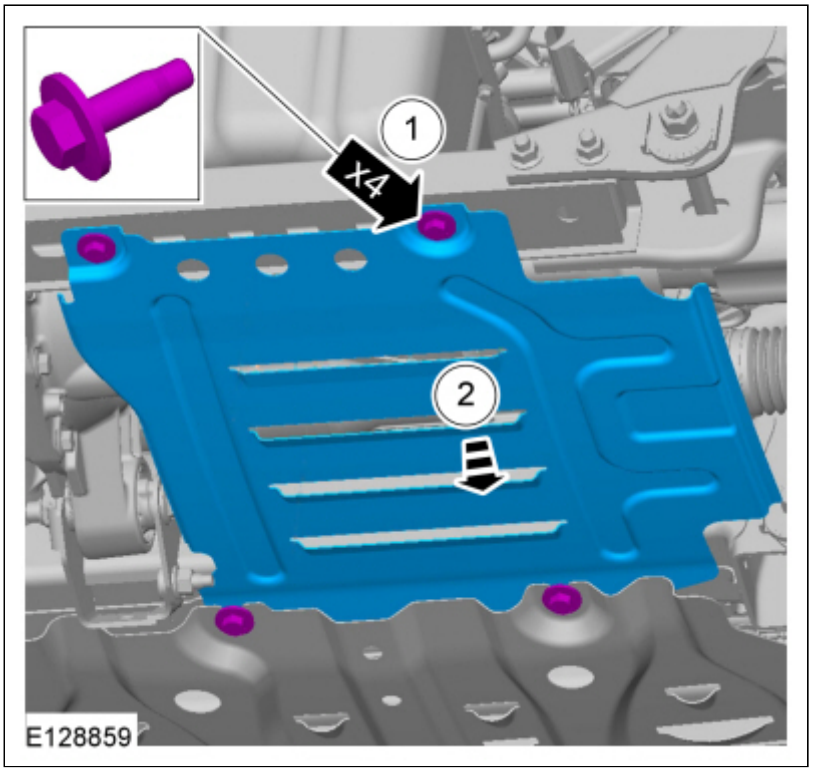
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*



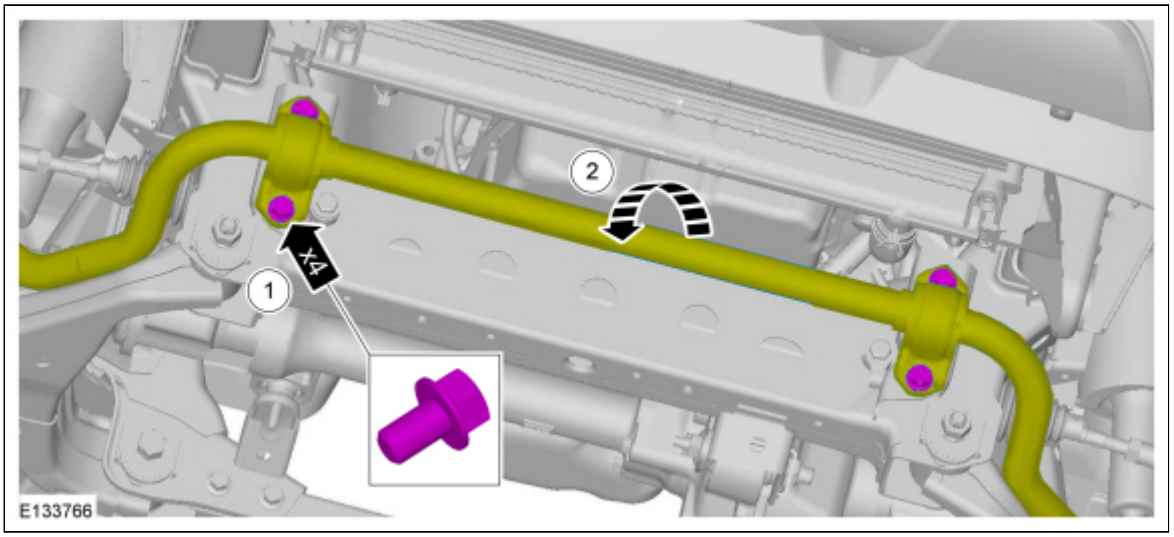
4. Remove both front wheels.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4x4

6. *Torque*: 30 Nm



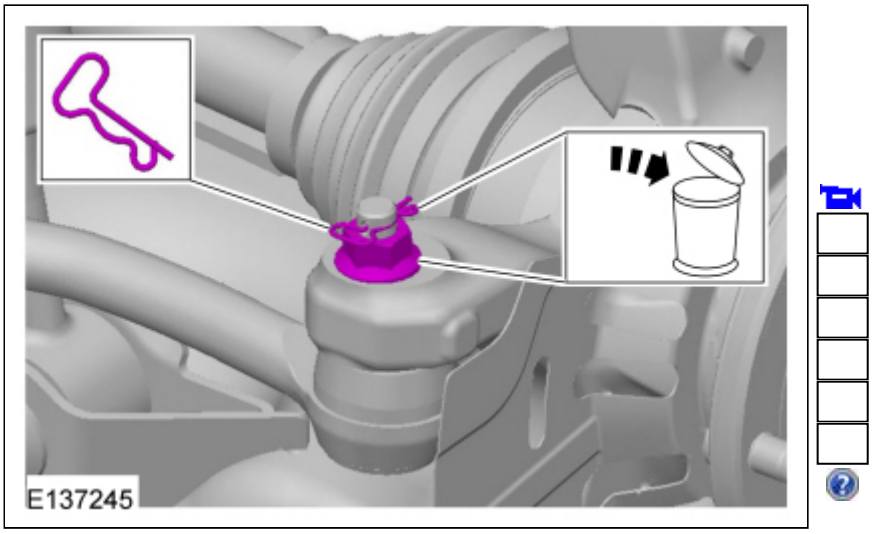
7. *Torque*: 90 Nm



All vehicles

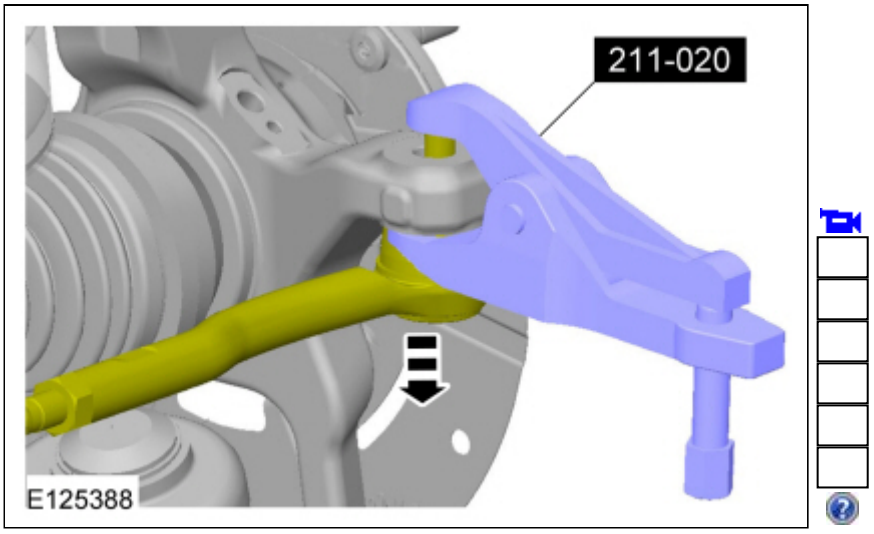
8. **NOTE:** *Make sure that the ball joint ball does not rotate.*

   On both sides.
   Torque: 63 Nm



9. **NOTICE: Do not use a hammer to separate the tie rod from the wheel knuckle or damage to the wheel knuckle can result.**

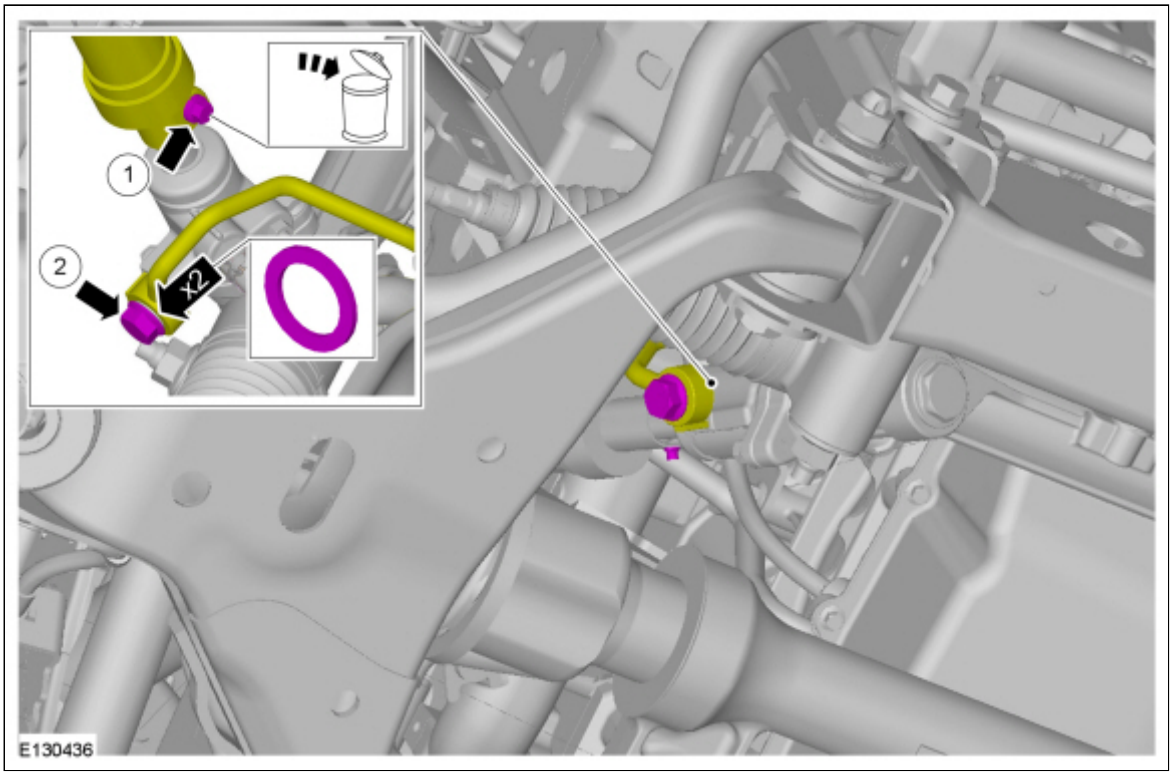
   On both sides.
   Use Special Service Tool: 211-003 (T64P-3590-F) Remover, Steering Arm.



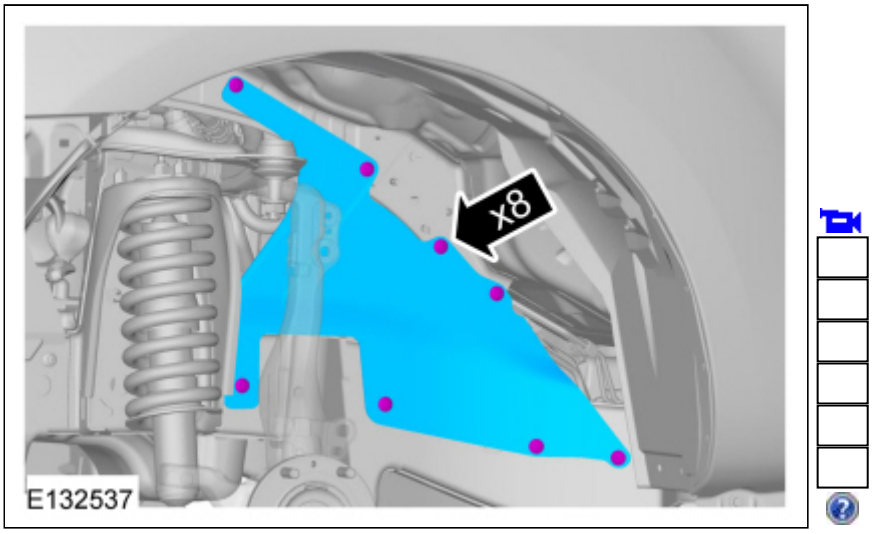
10. **NOTICE: Cap the power steering line and steering gear body to prevent fluid loss or dirt ingress.**

    NOTE: *Be prepared to collect escaping fluid.*

    1. *Torque*: 15 Nm
    2. *Torque*: 35 Nm

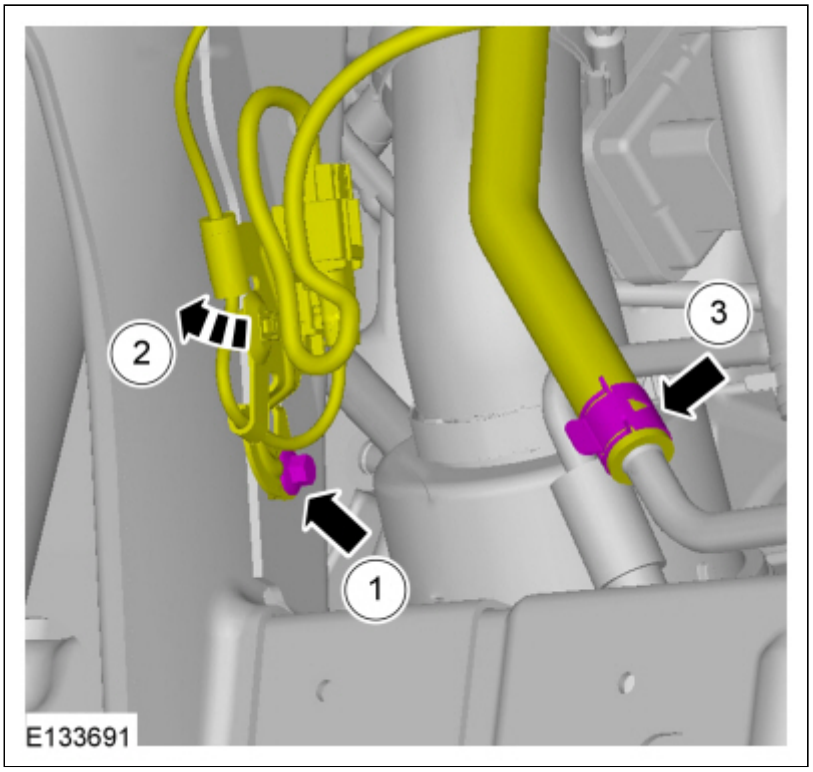


11.



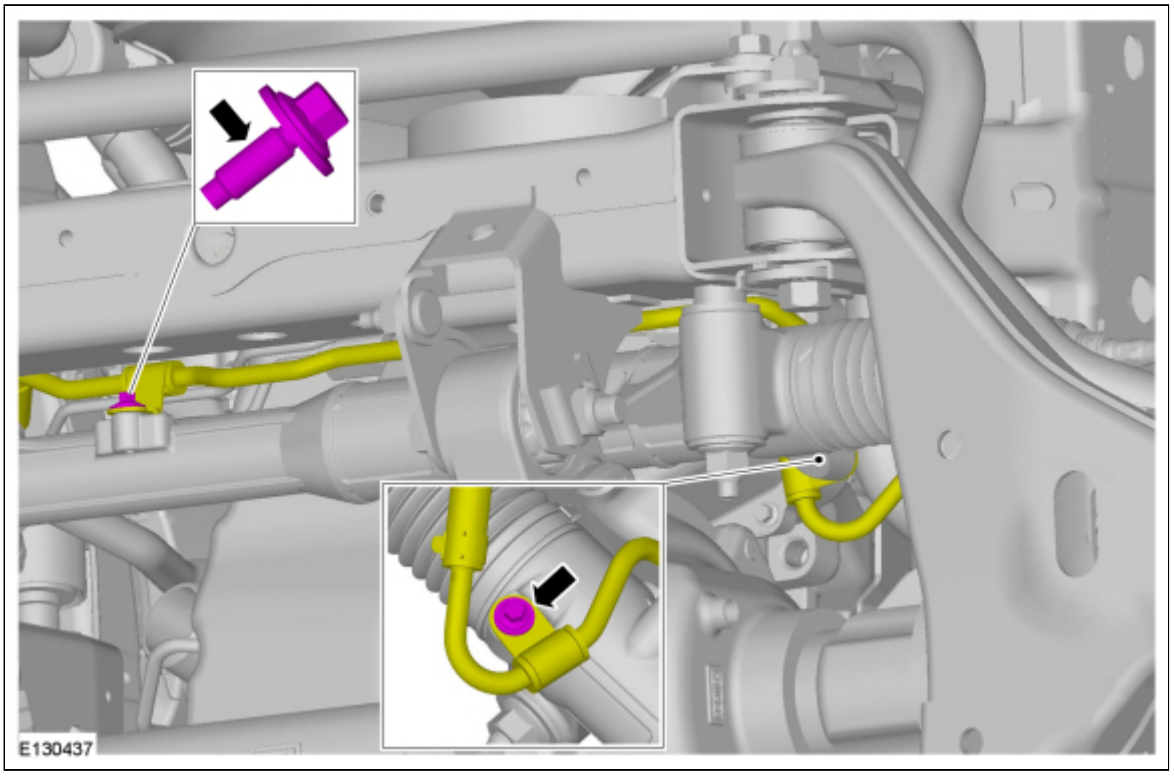
12. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

Torque: 7 Nm



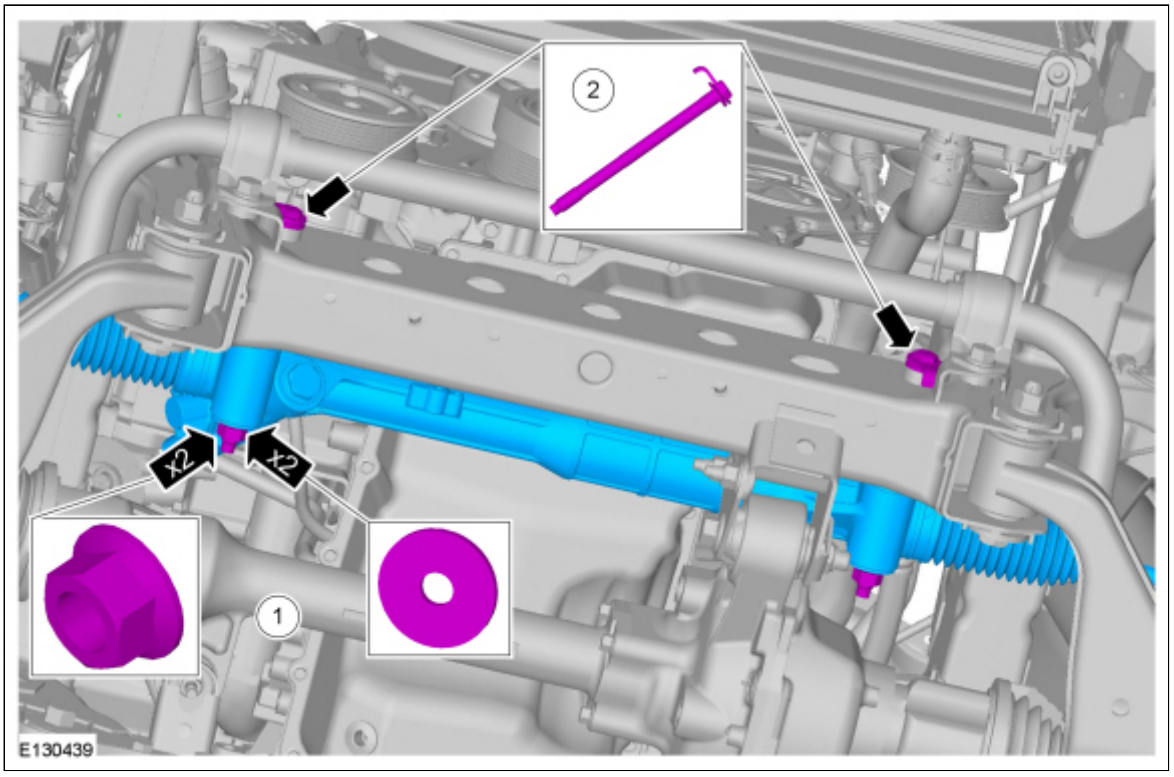
Vehicles with diesel engine

13. *Torque*: 10 Nm

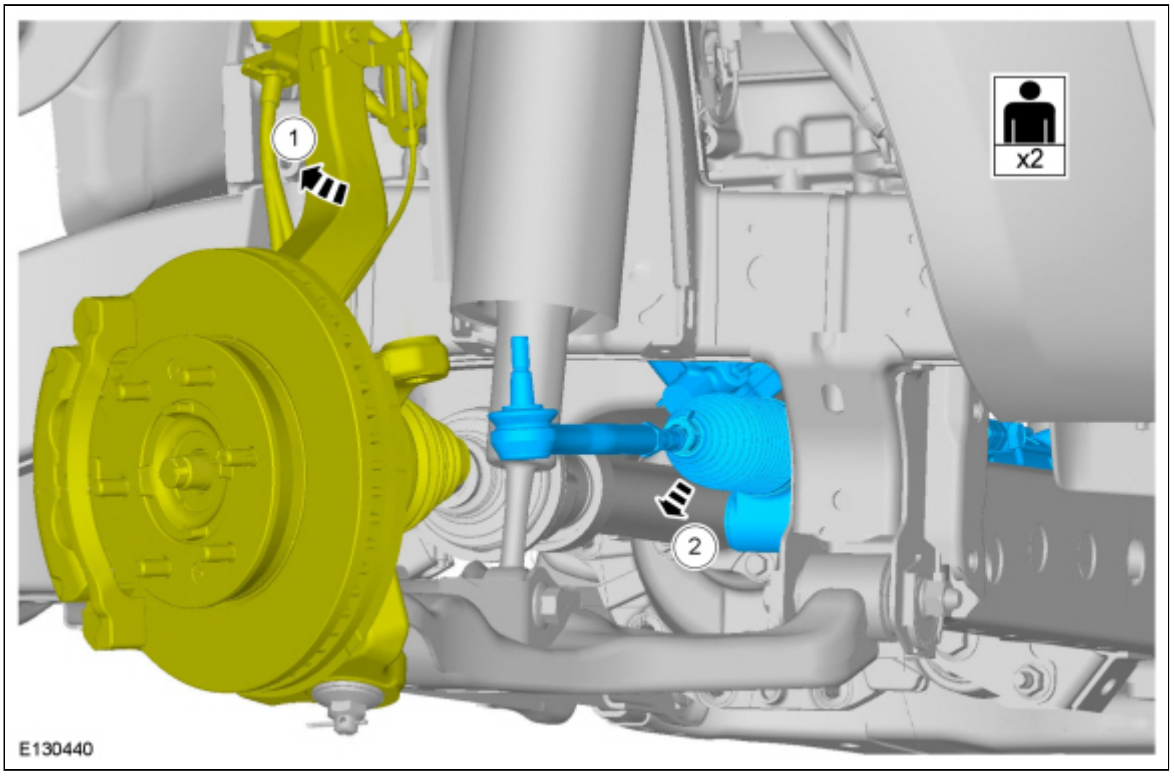


All vehicles

14. *Torque*: 150 Nm

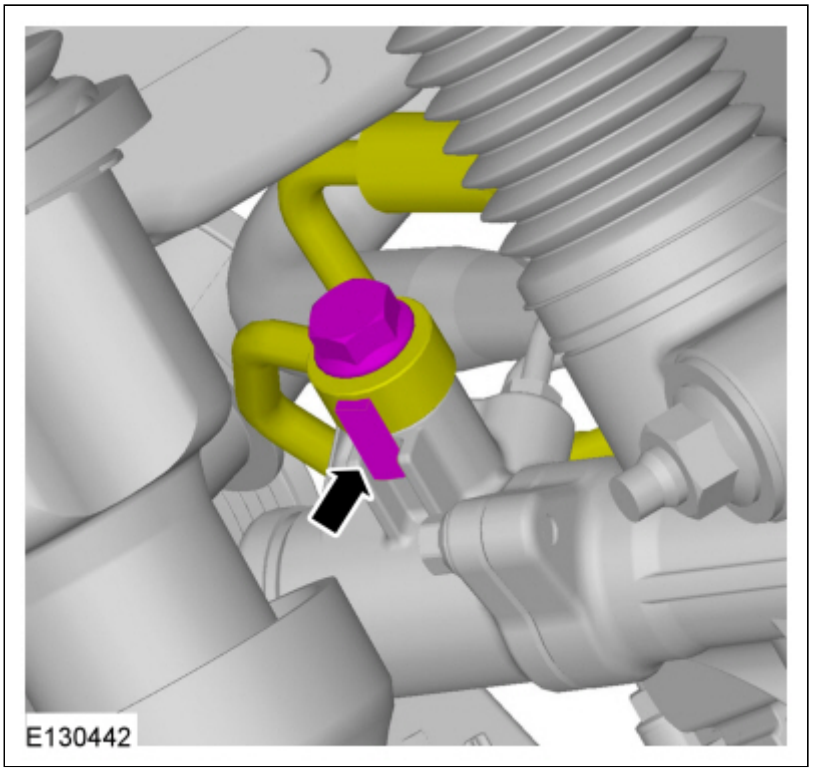


15.



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *Make sure that the components are correctly located.*



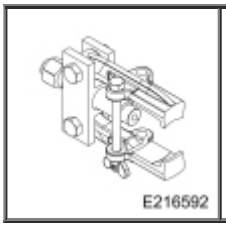
3. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
4. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Steering Gear - LHD 4WD/LHD RWD

Base Part Number: 3D080

Special Tool(s) / General Equipment

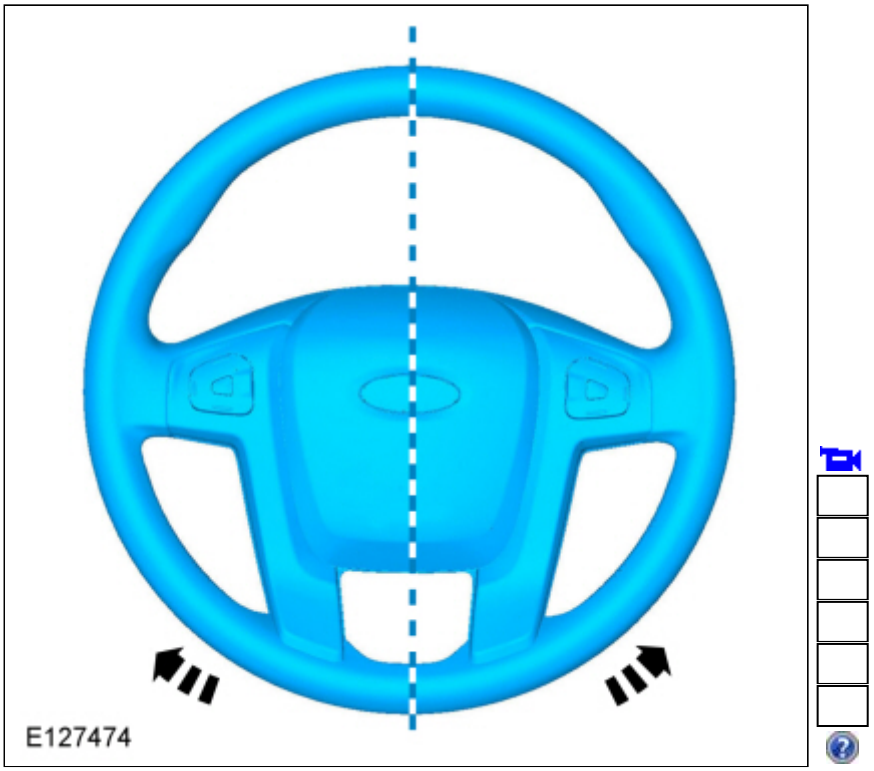
 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

NOTICE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure can result in major service expense. A new part with the same part number or an equivalent part must be installed, if installation is necessary. Do not use a part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: *Removal steps in this procedure may contain installation details.*

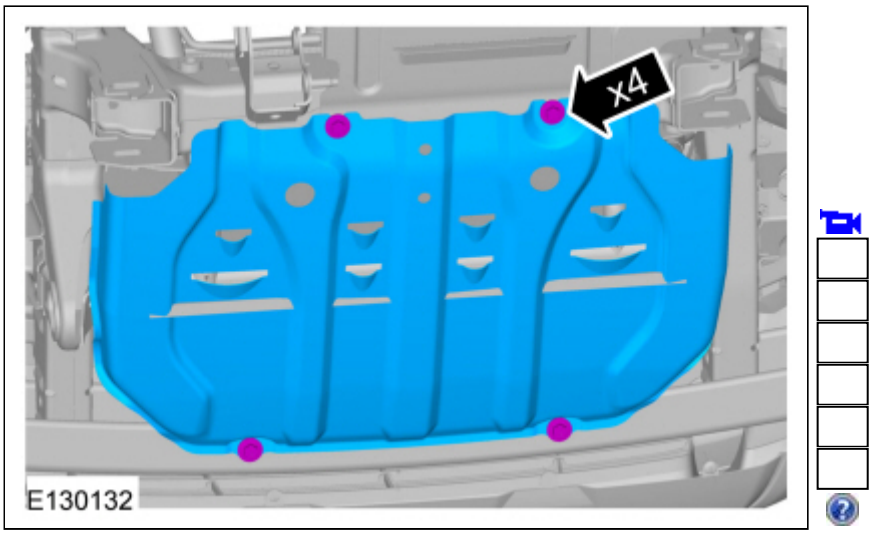
1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*



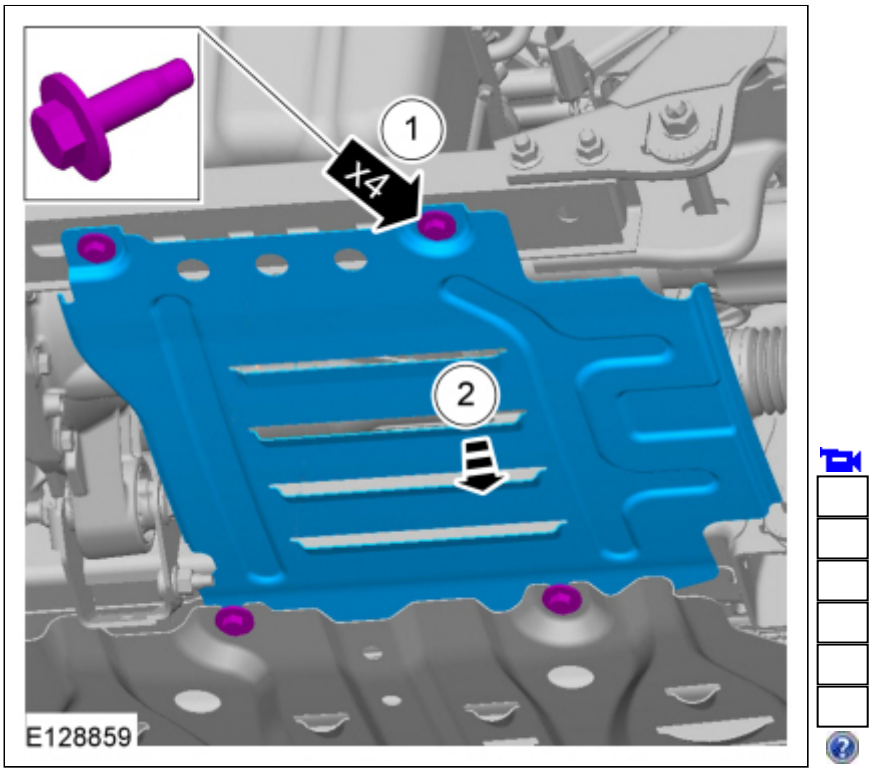
4. Remove both front wheels.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4x4

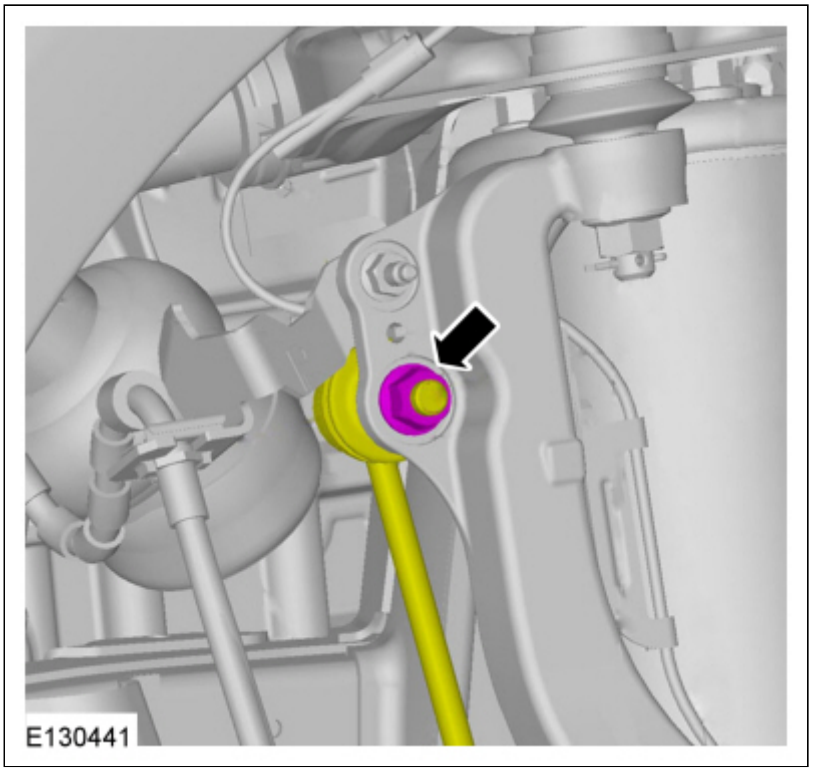
6. *Torque*: 30 Nm



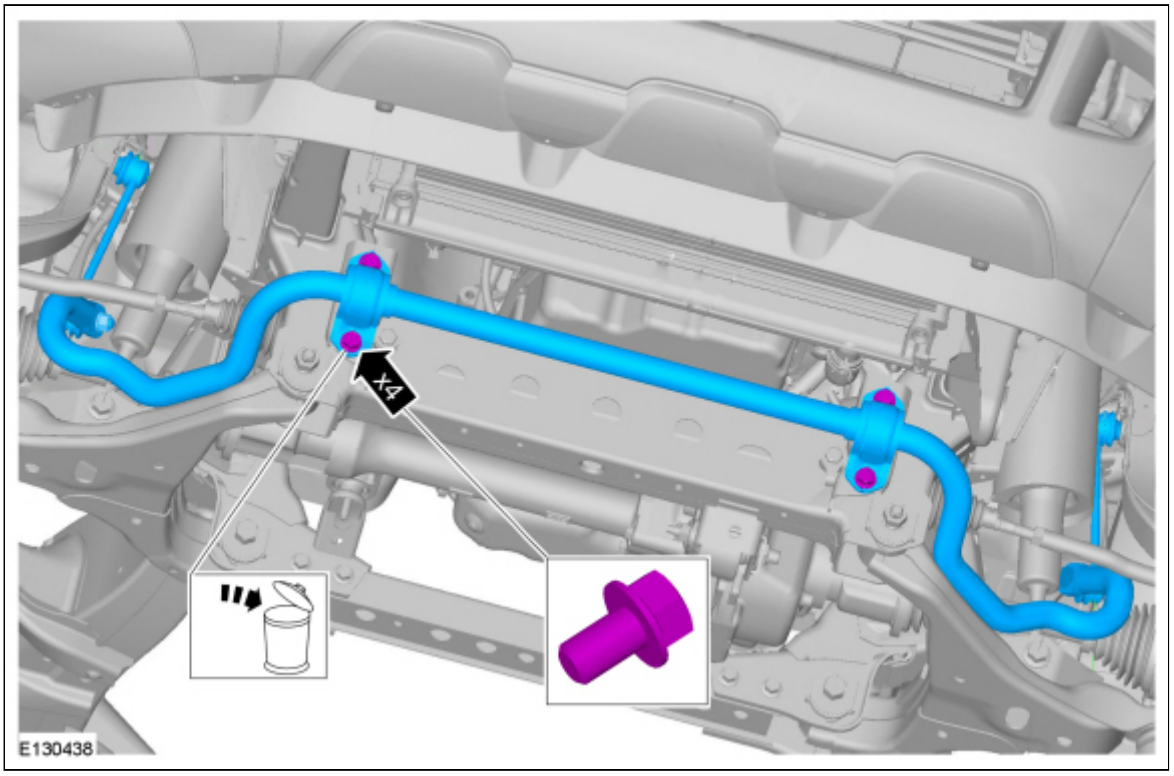
7. *Torque*: 30 Nm



8. *Torque*: 90 Nm

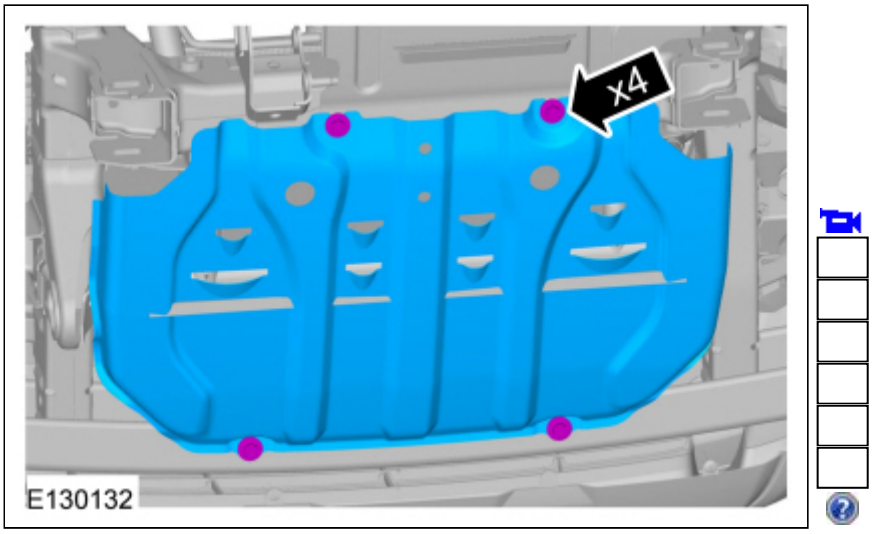


9. *Torque*: 90 Nm



4x2

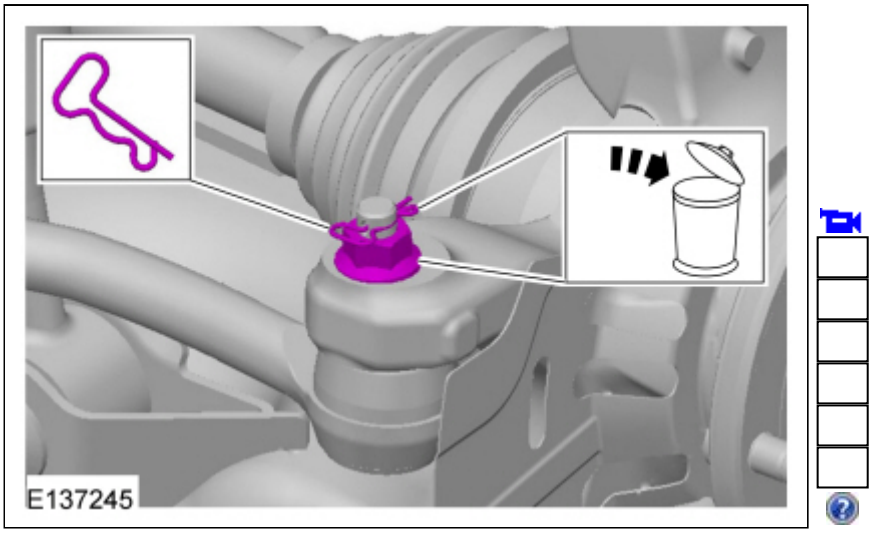
10. *Torque*: 30 Nm



All vehicles

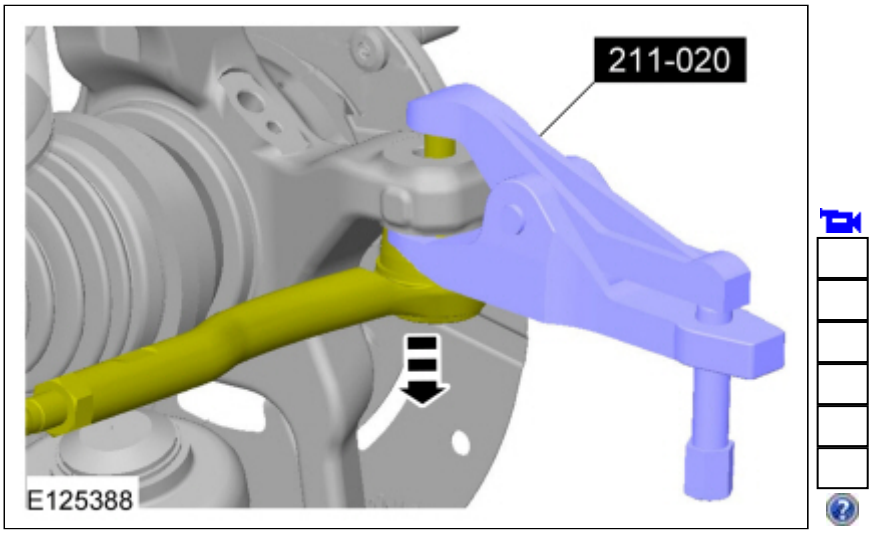
11. **NOTE:** *Make sure that the ball joint ball does not rotate.*

    On both sides.
    Torque: 63 Nm



12. **NOTICE: Do not use a hammer to separate the tie rod from the wheel knuckle or damage to the wheel knuckle can result.**

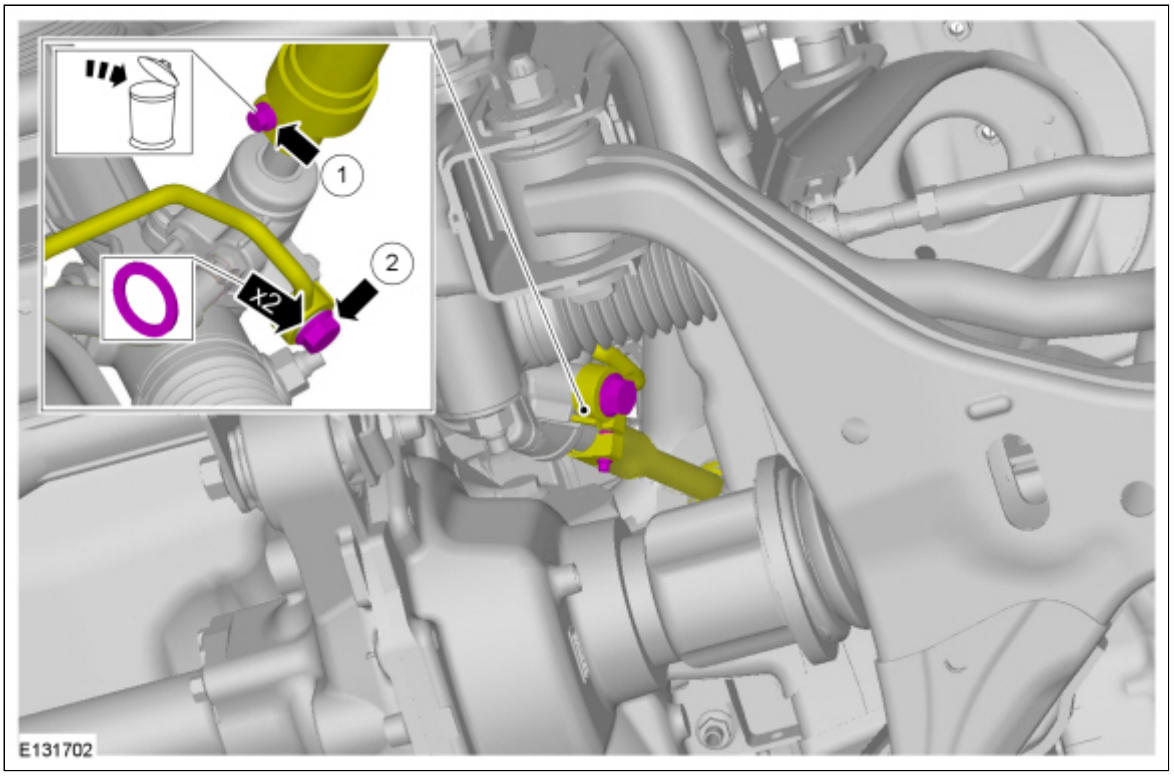
    On both sides.
    Use Special Service Tool: 211-003 (T64P-3590-F) Remover, Steering Arm.



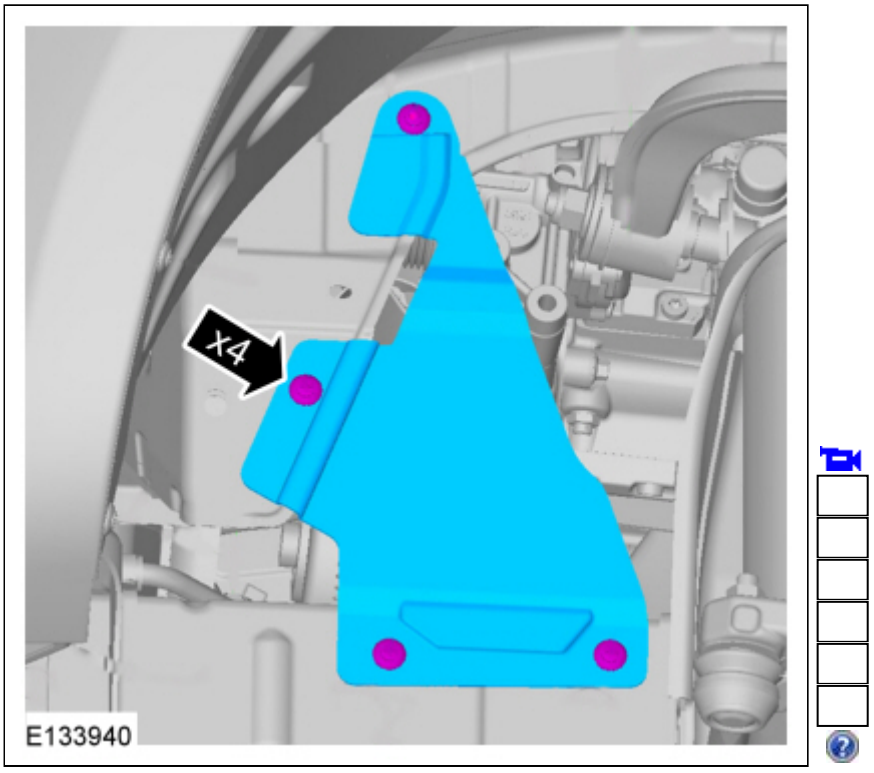
13. **NOTICE: Make sure that all openings are sealed with clean blanking caps.**

NOTE: *Be prepared to collect escaping fluid.*

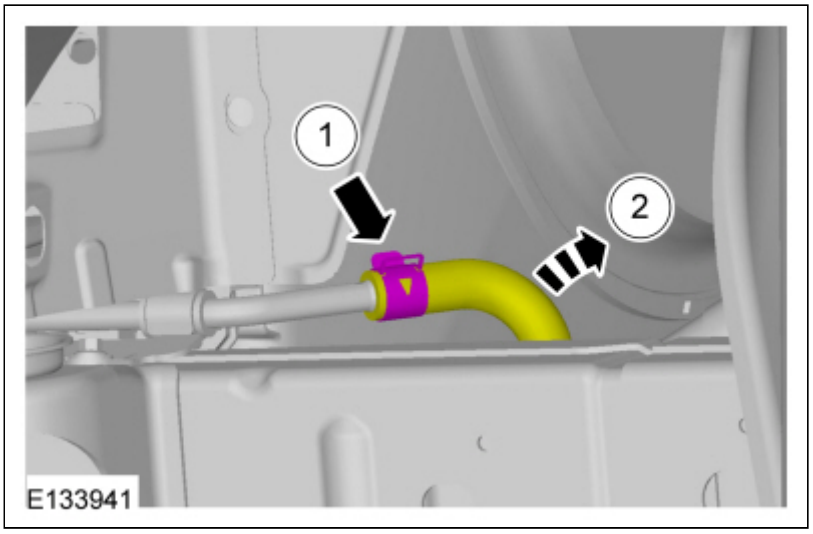
1. *Torque*: 18 Nm
2. *Torque*: 35 Nm



14.

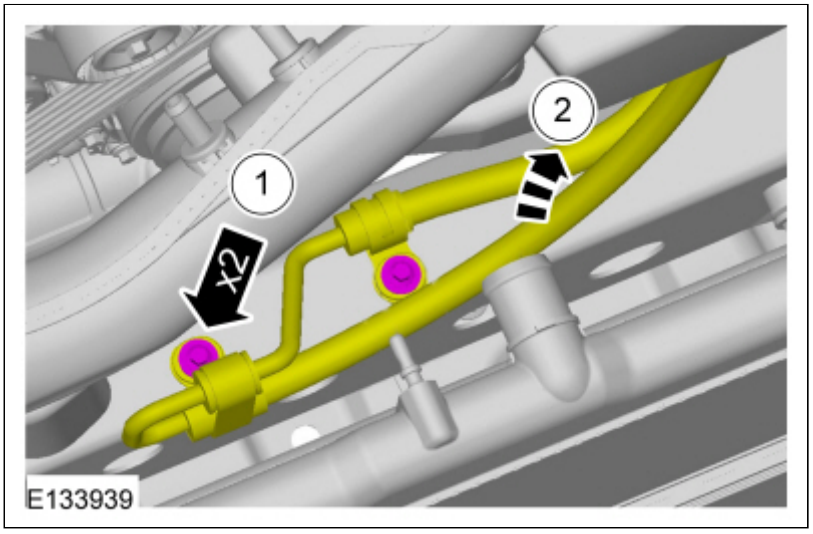


15. **NOTICE: Make sure that all openings are sealed with clean blanking caps.**



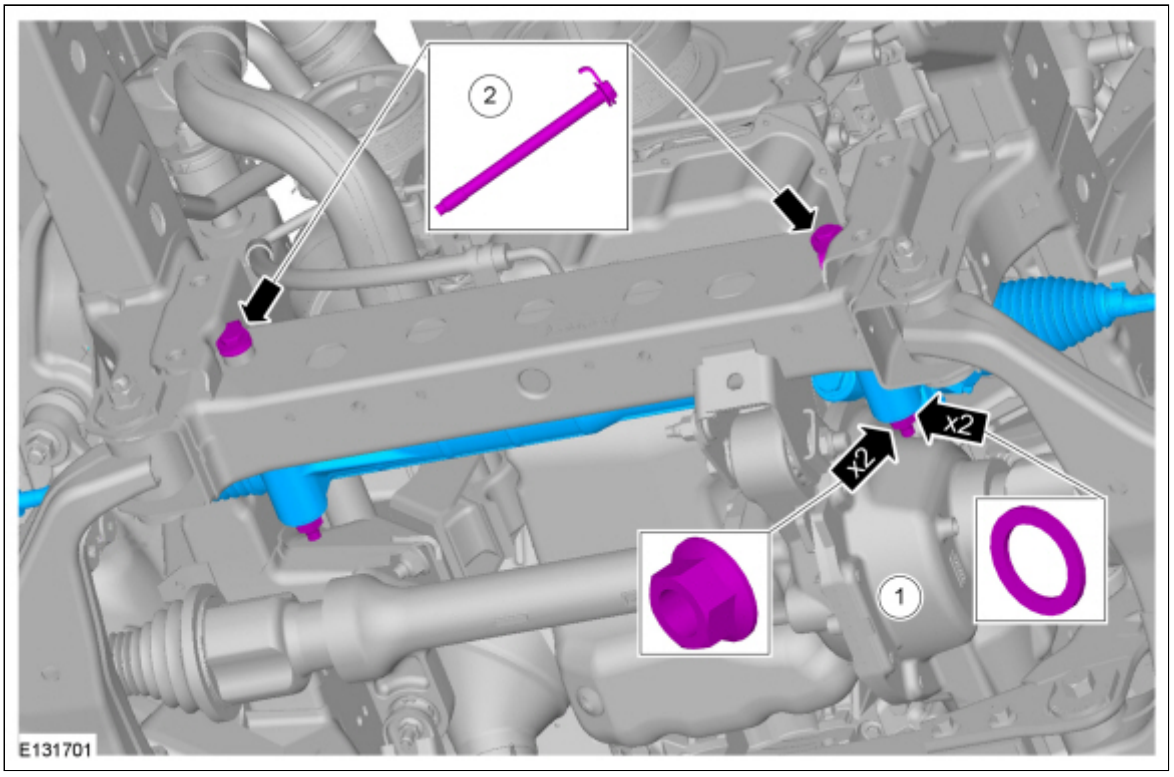
2.5L

16. *Torque*: 10 Nm

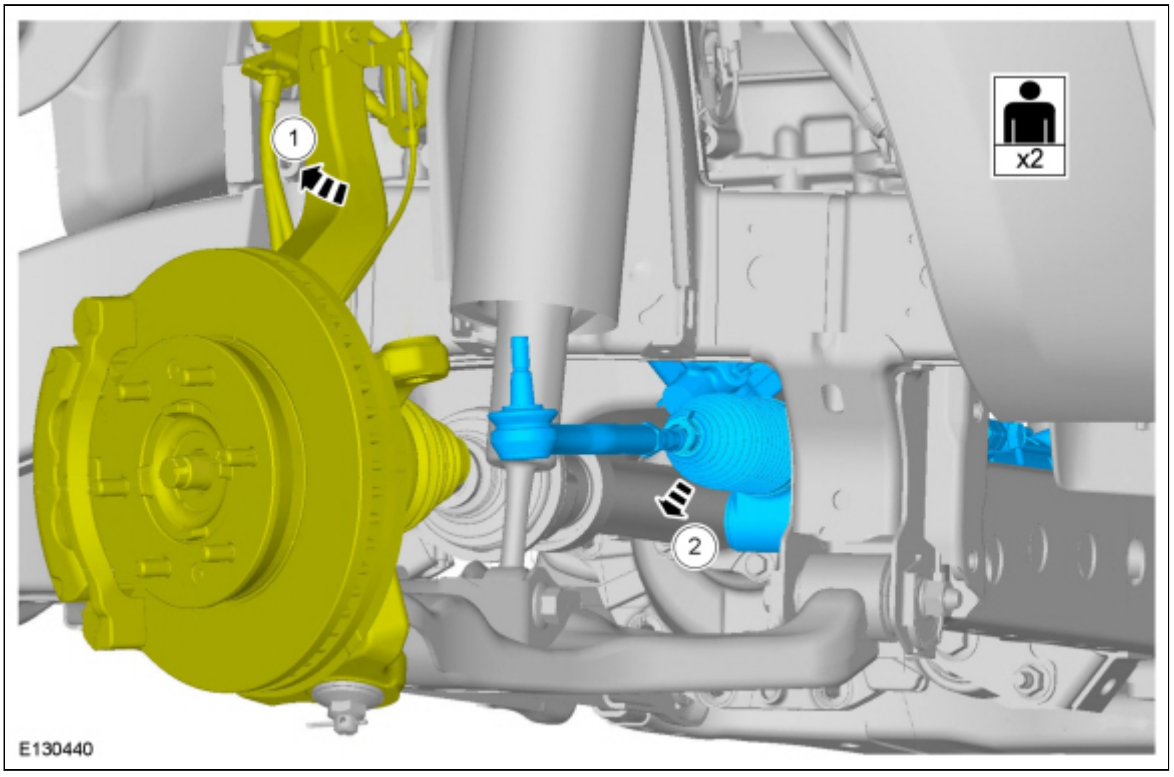


All vehicles

17. *Torque*: 150 Nm

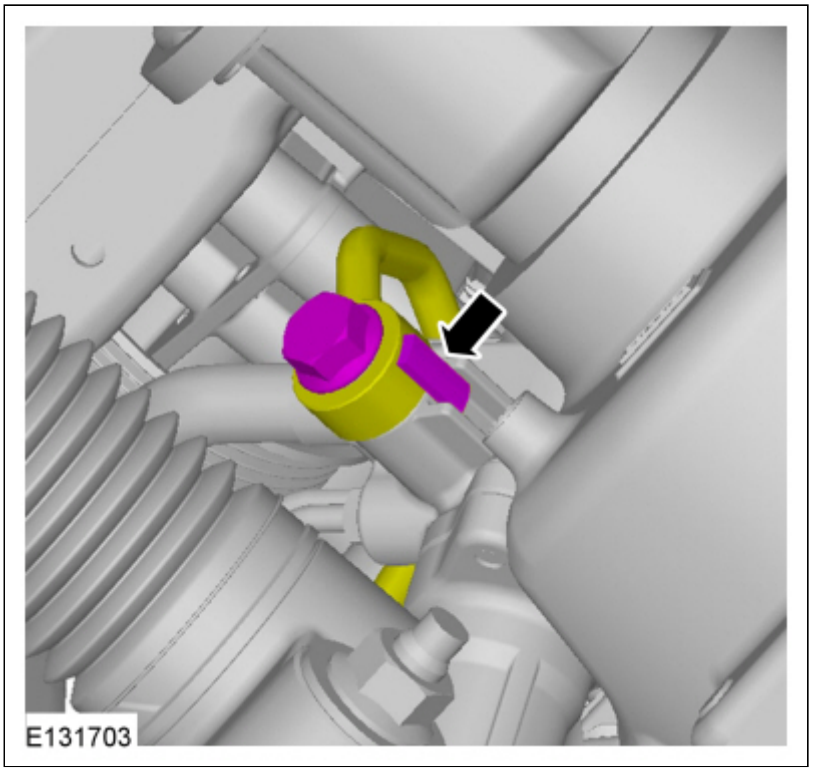


18.



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *Make sure that the high pressure line is located correctly.*



3. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
4. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Steering Pump to Steering Gear Pressure Line - 2.5L Duratec-HE (122kW/165PS) - MI4

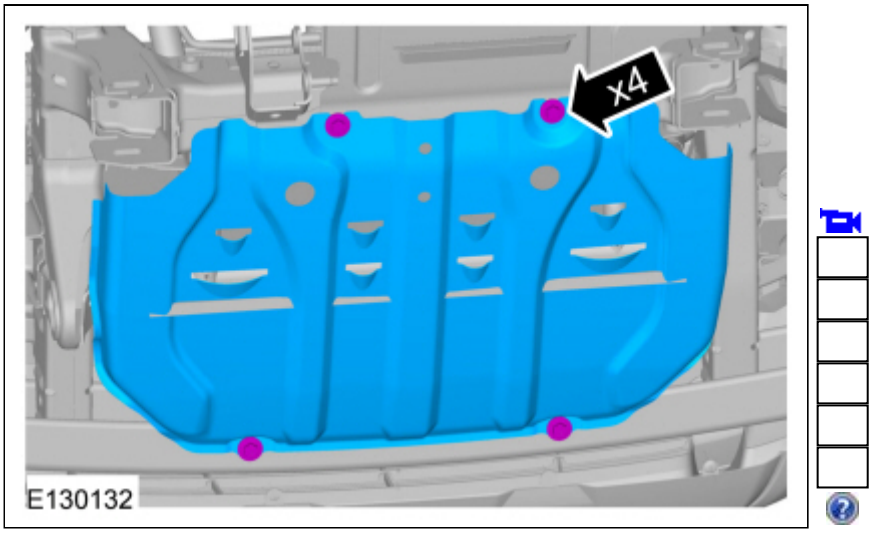
Base Part Number: 3F523

Removal

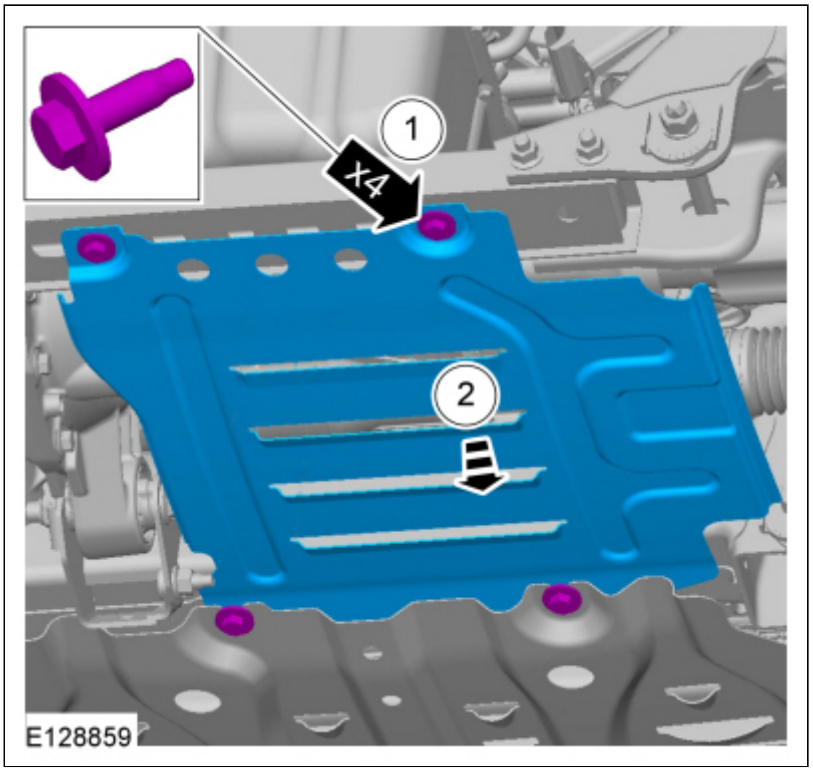
NOTICE: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. *Torque*: 30 Nm



5. *Torque*: 30 Nm

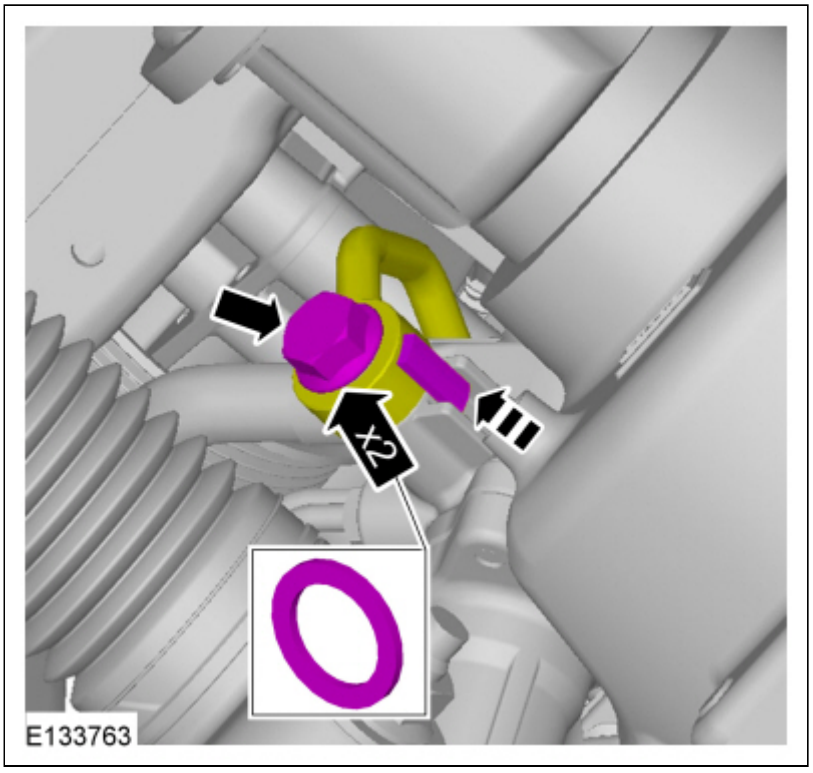


LHD

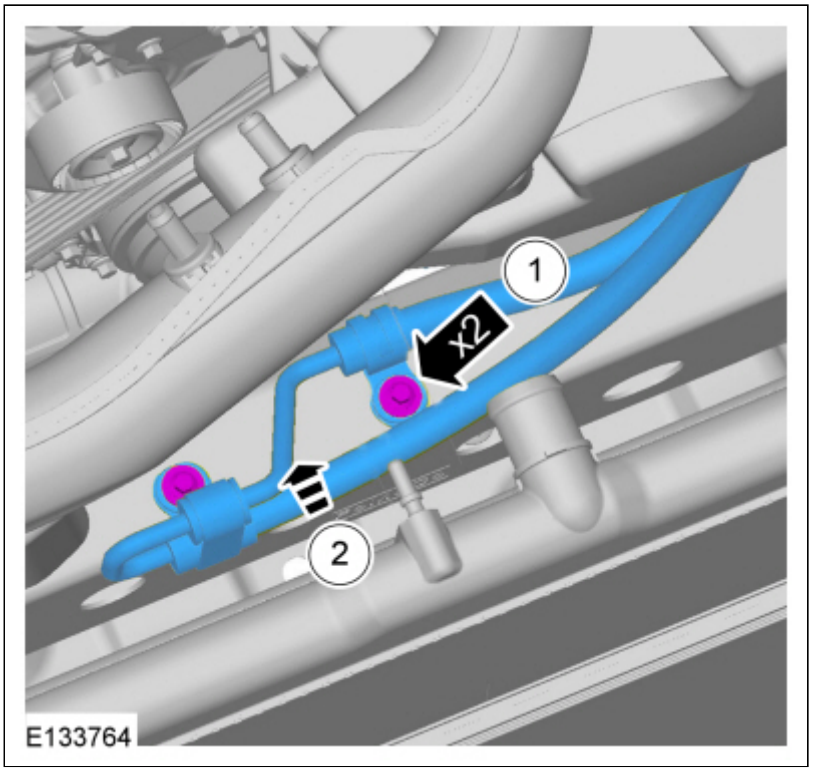
6. **NOTICE: Make sure that all openings are sealed with clean blanking caps.**

   NOTE: *Be prepared to collect escaping fluid.*

   Torque: 35 Nm



7. *Torque*: 10 Nm

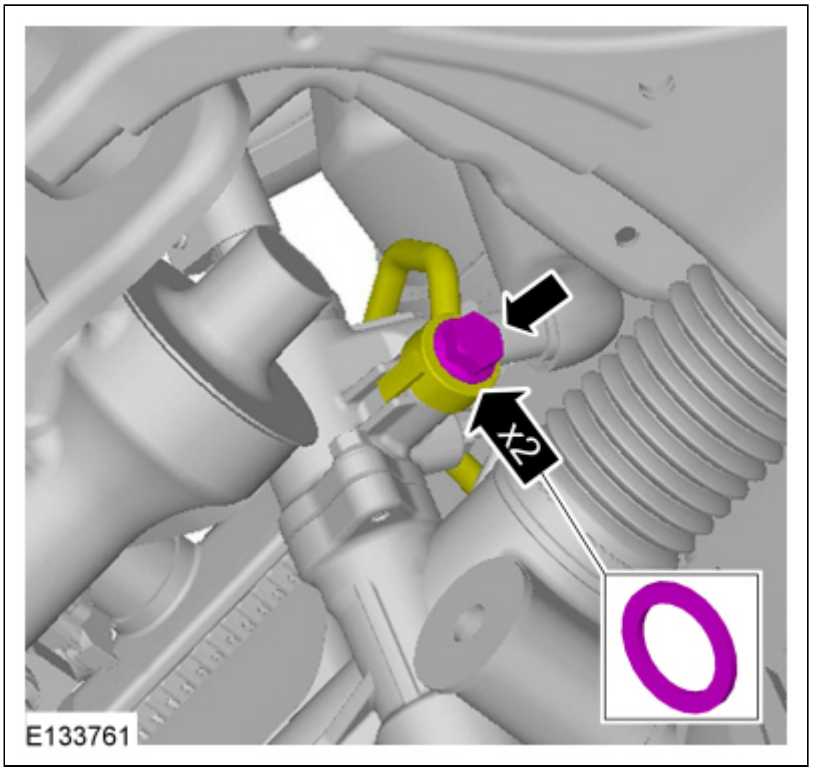


RHD

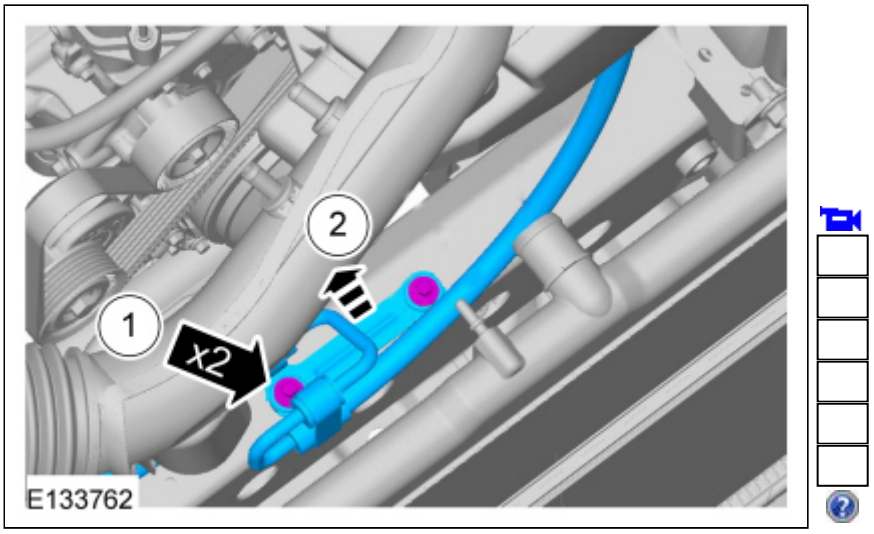
8. **NOTICE: Make sure that all openings are sealed with clean blanking caps.**

   NOTE: *Be prepared to collect escaping fluid.*

   Torque: 35 Nm



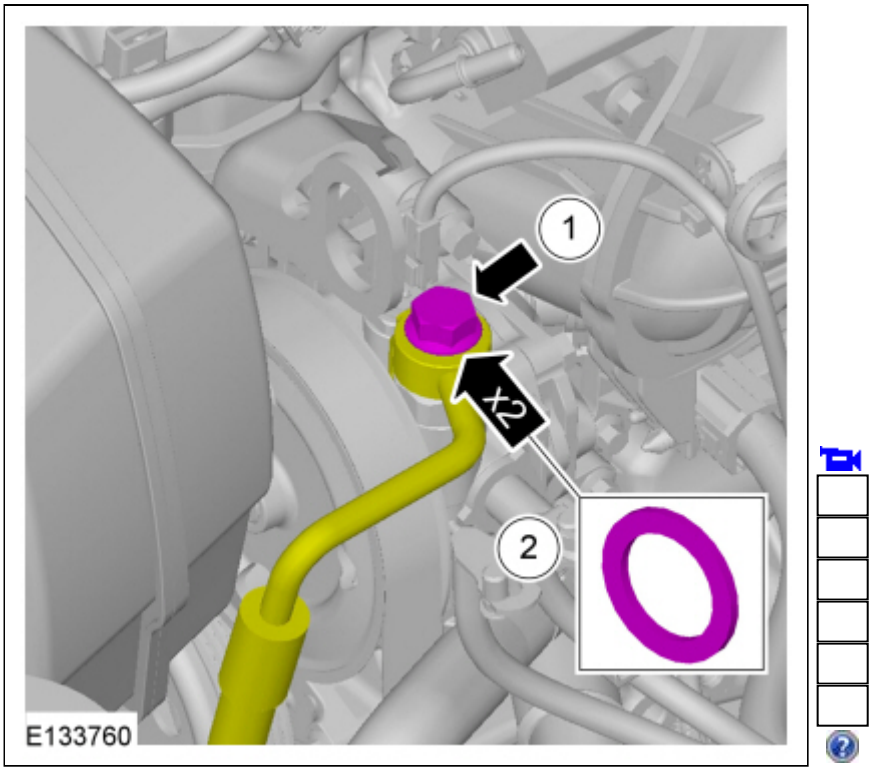
9. *Torque*: 10 Nm



All vehicles

10. **NOTICE: Make sure that all openings are sealed with clean blanking caps.**

    Torque: 35 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
3. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Power Steering Pump to Steering Gear Pressure Line - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma

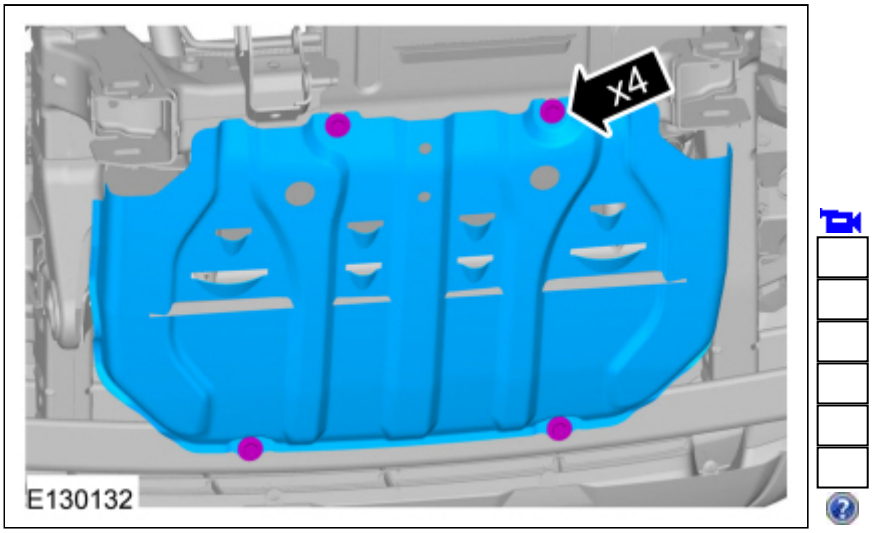
Base Part Number: 3F523

Removal

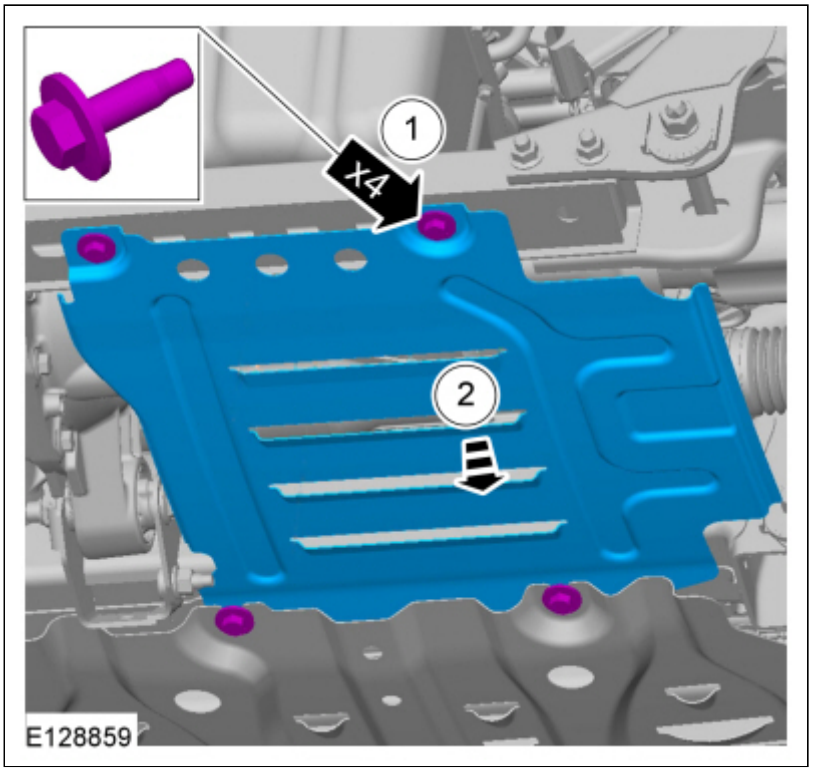
NOTICE: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. *Torque*: 30 Nm

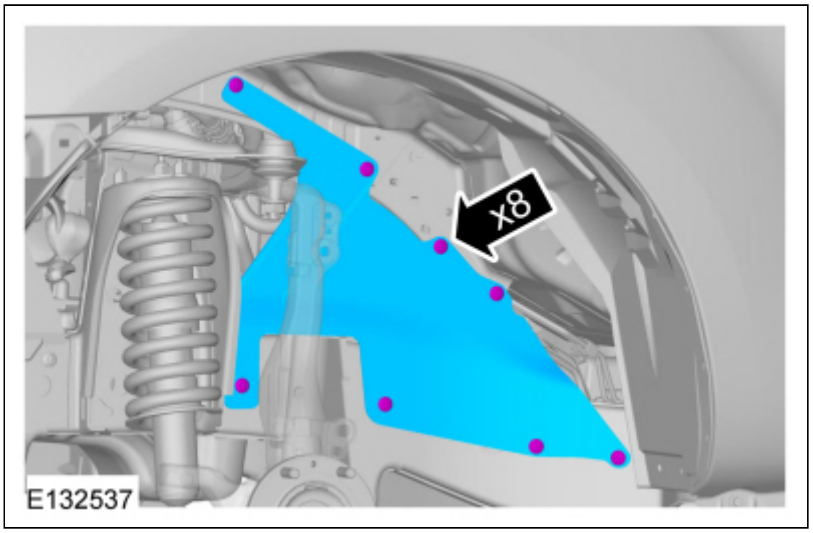


5. *Torque*: 30 Nm

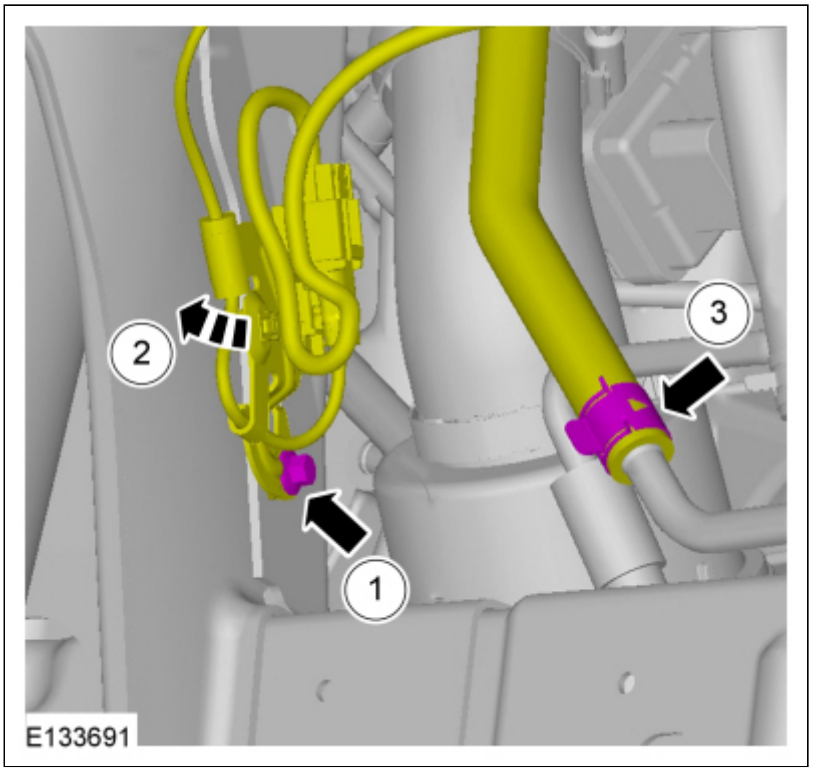


6. Remove front RH side wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

7.

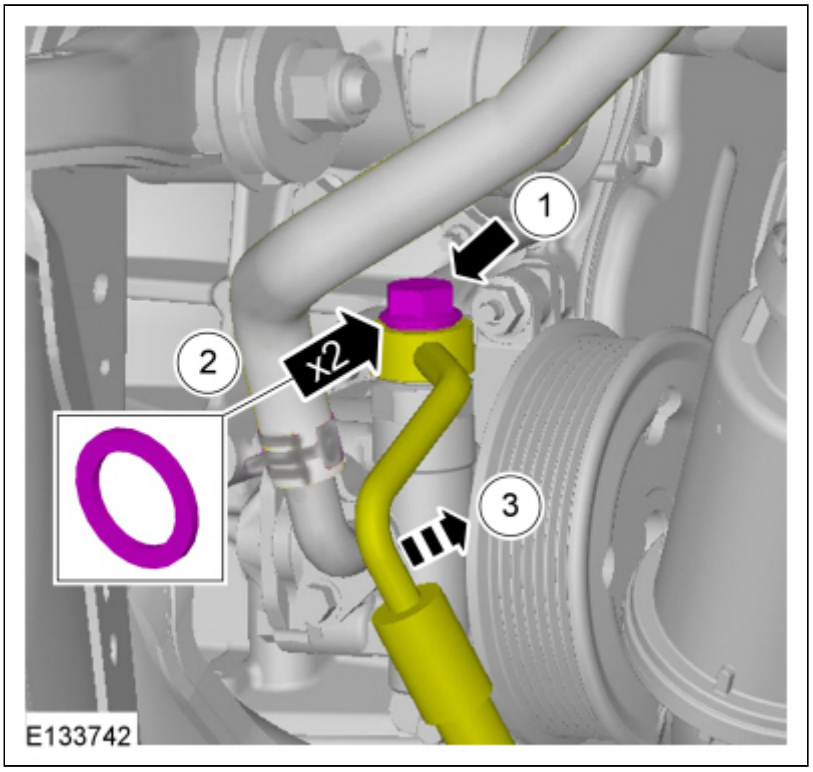


8. *Torque*: 7 Nm



9. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

   Torque: 35 Nm

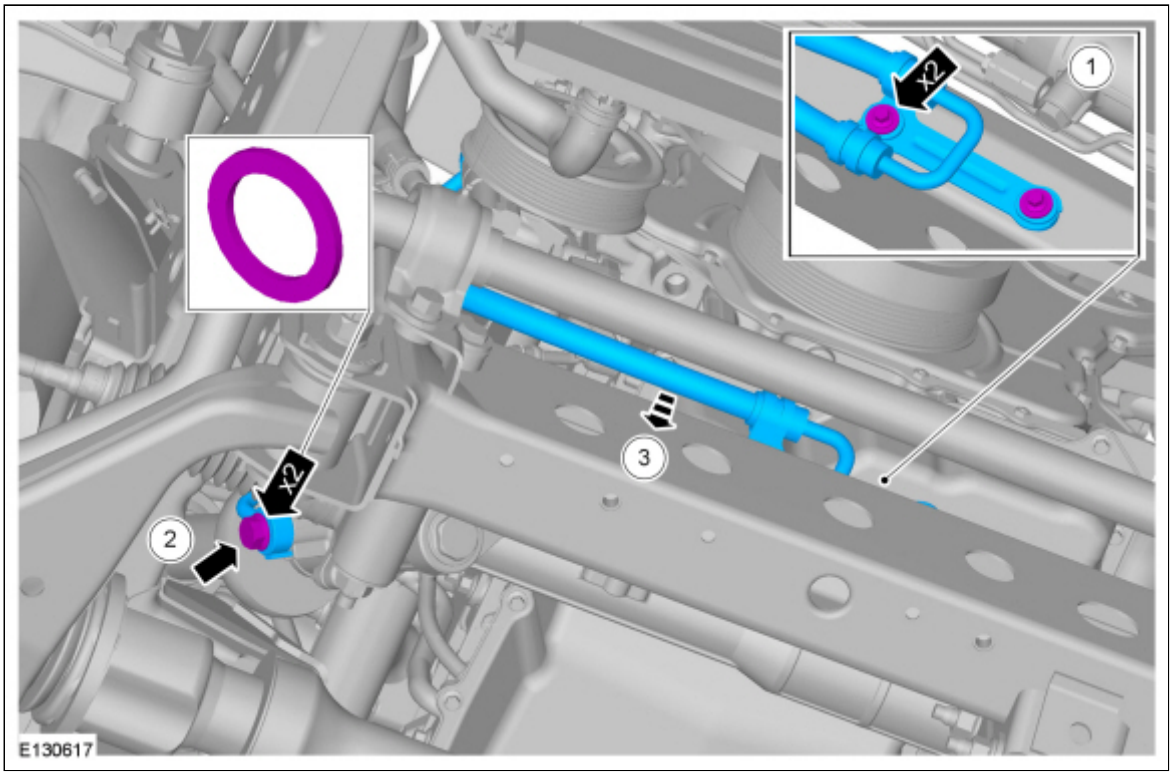


Right-hand drive vehicles

10. **WARNING: Be prepared to collect escaping fluid.**

    NOTICE: Cap the steering gear body to prevent fluid loss or dirt ingress.

    1. *Torque*: 10 Nm
    2. *Torque*: 35 Nm

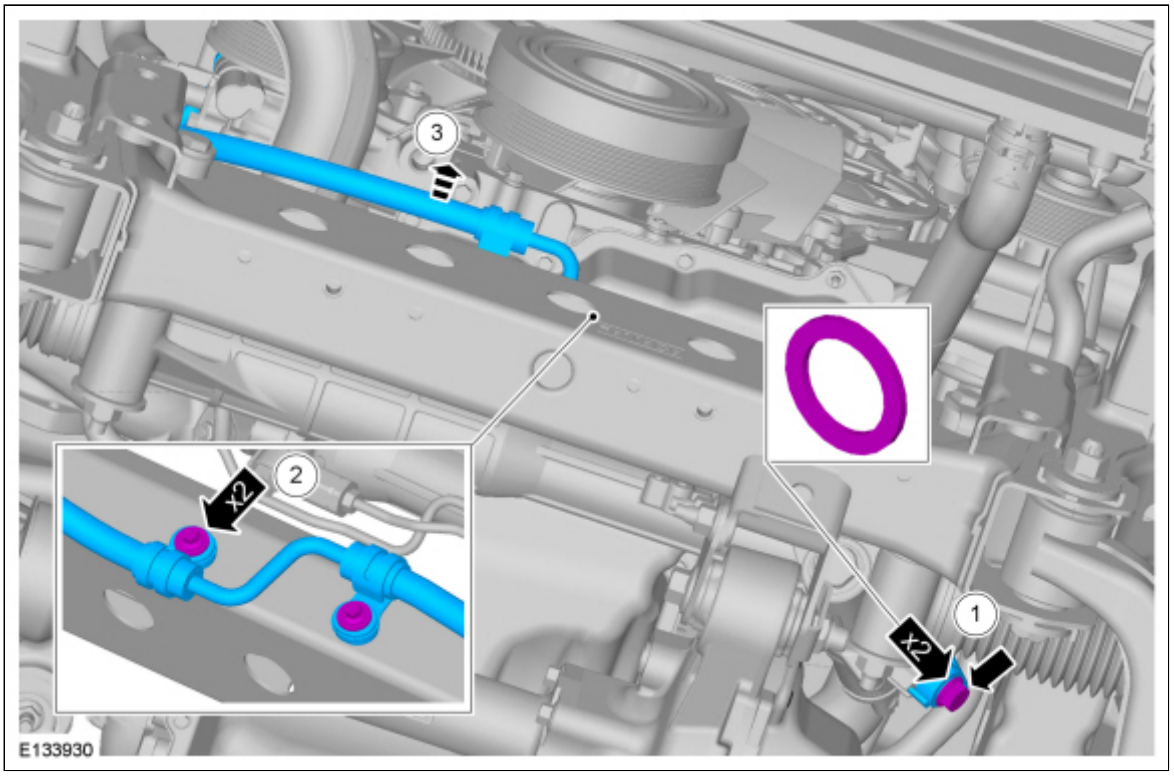


Left-hand drive vehicles

11. **WARNING: Be prepared to collect escaping fluid.**

    NOTICE: Cap the steering gear body to prevent fluid loss or dirt ingress.

    1. *Torque*: 35 Nm
    2. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
3. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General

Procedures).

Copyright © 2016 Ford Motor Company

Steering Gear Boot

Materials

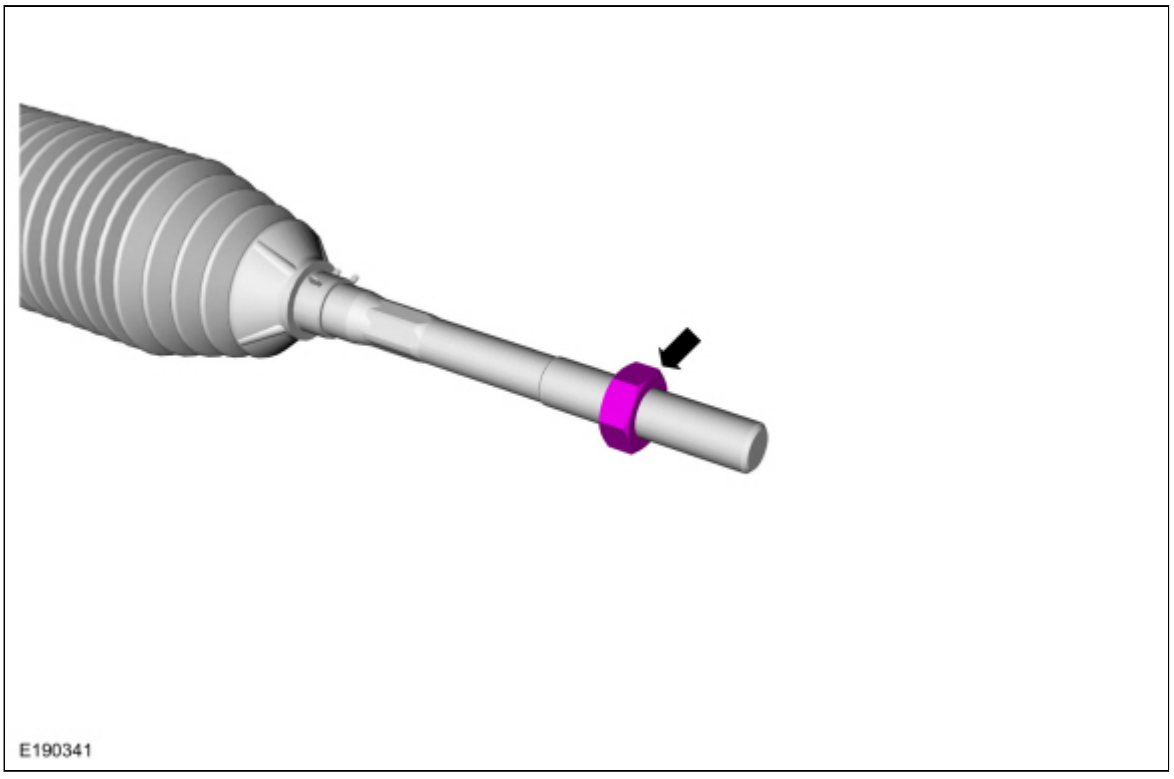
Name	Specification
Grease	ESA-M1C75-B

Removal

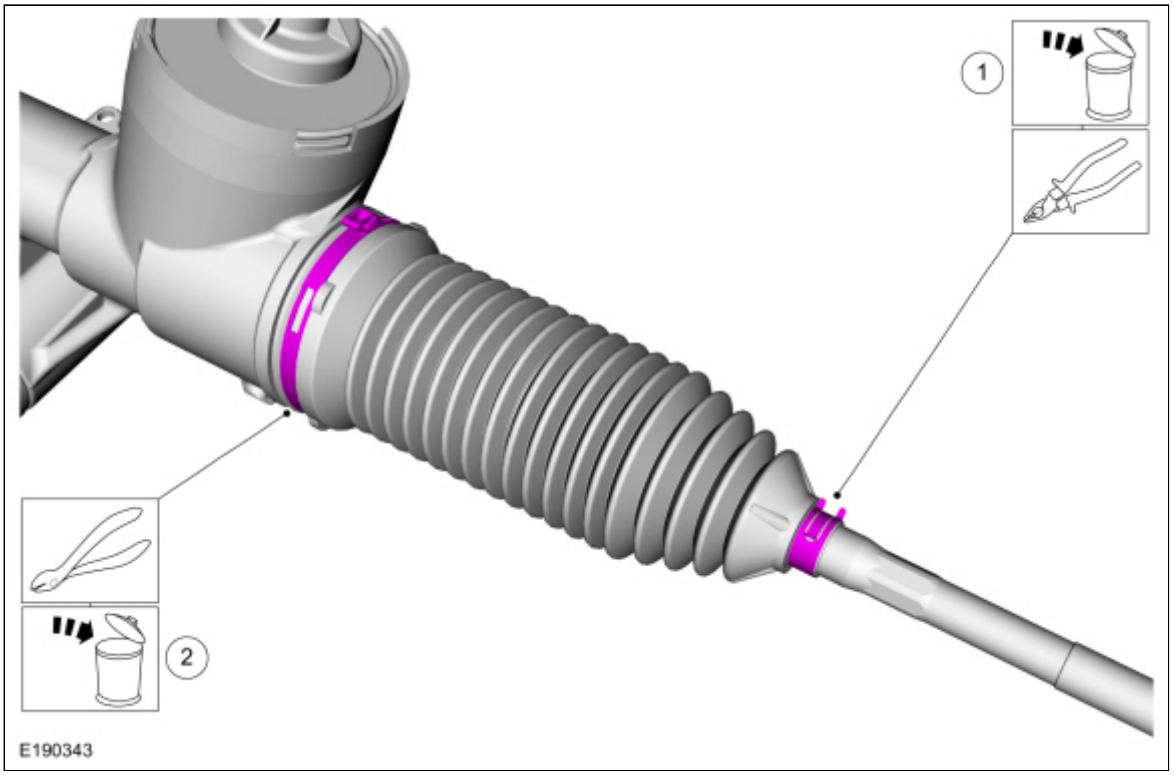
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
   Refer to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).
3. **NOTE:** *Note the number of turns when removing the tie rod end.*

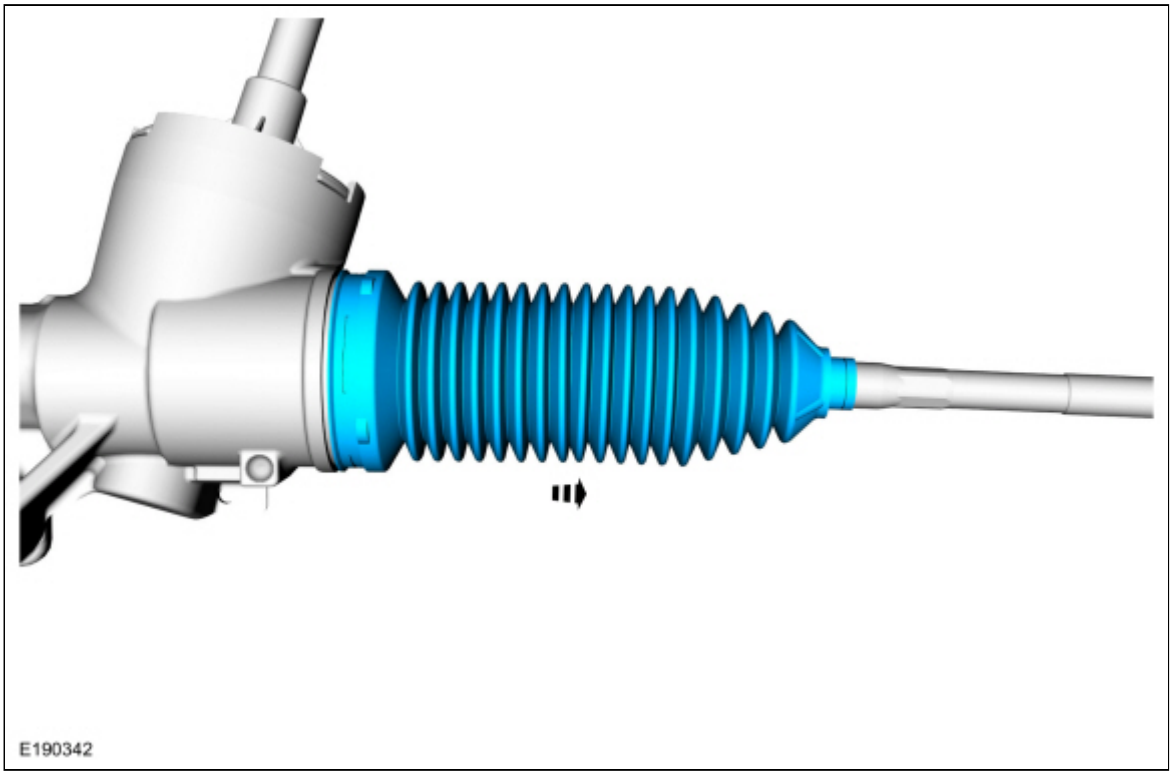
   On both sides



4. On both sides

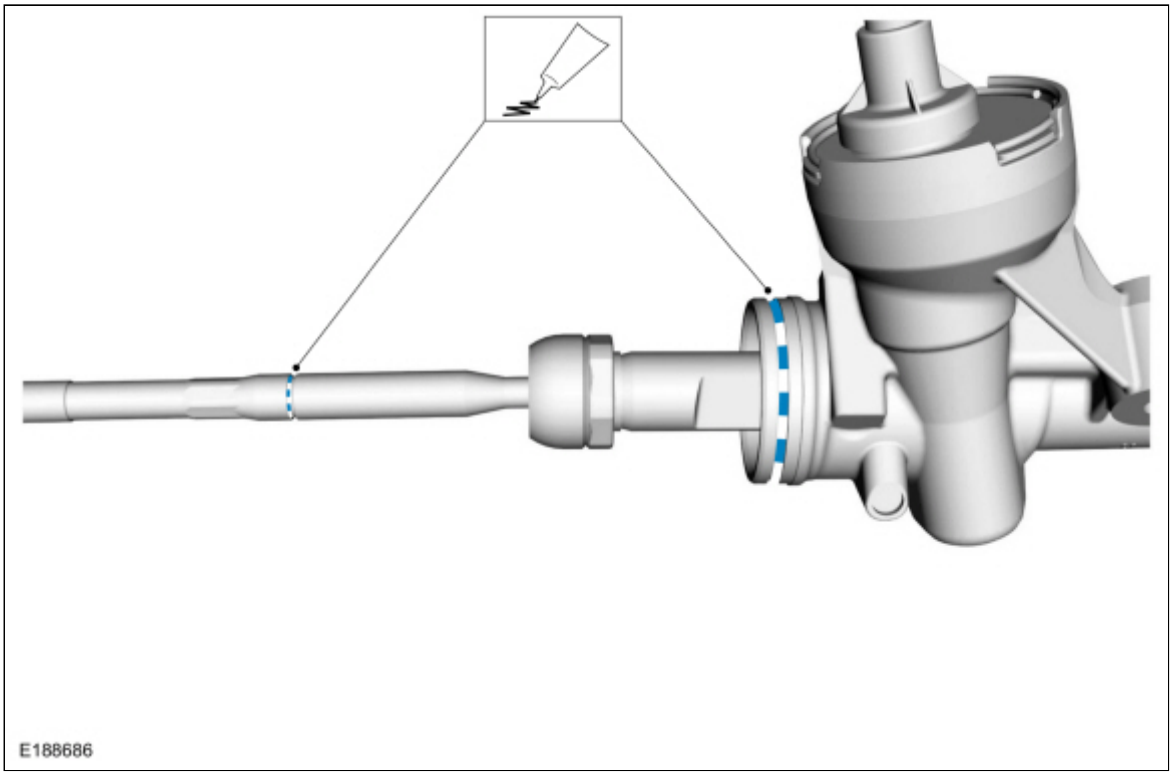


5.



Installation

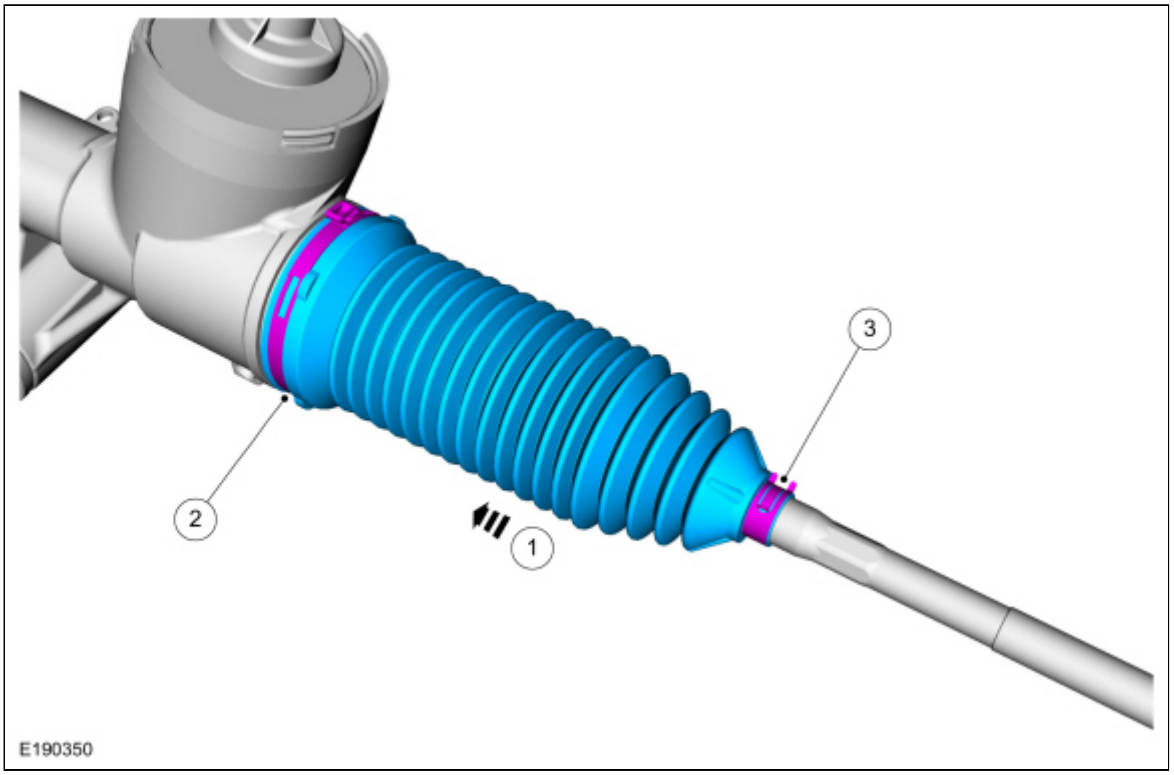
1. *Material*: Grease (ESA-M1C75-B)



2. **NOTE:** *Make sure that the boot is correctly located.*

   NOTE: *LH side shown, RH similar.*

   On both sides



3. To install, reverse the removal procedure.

4. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
   Refer to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).

Copyright © 2016 Ford Motor Company

Tie Rod - LHD

Special Tool(s) / General Equipment

Boot Clamp Pliers

Materials

Name	Specification
Grease	ESA-M1C75-B

Removal

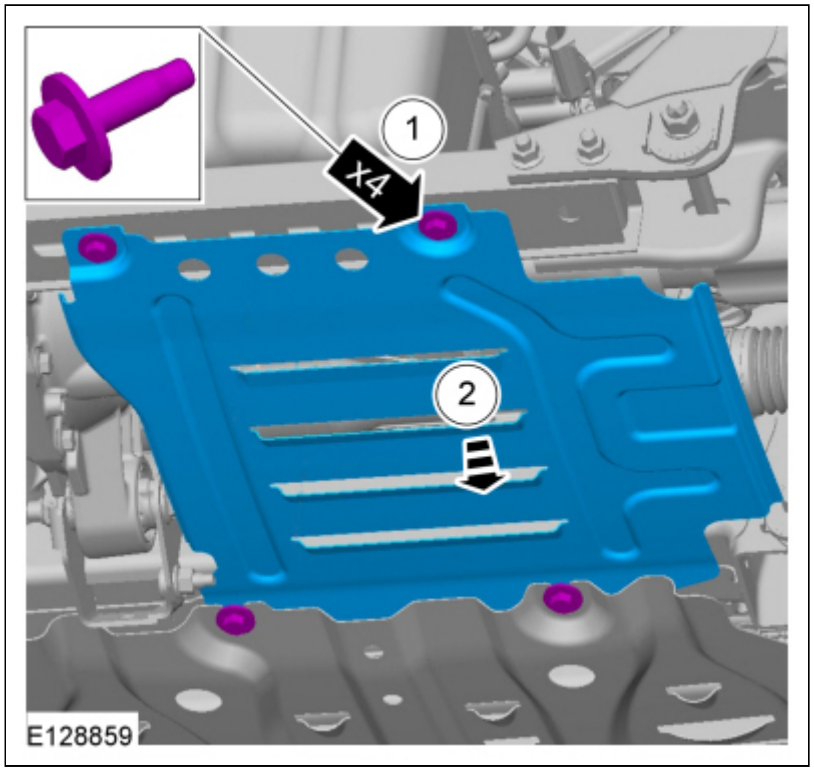
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
   Refer to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).

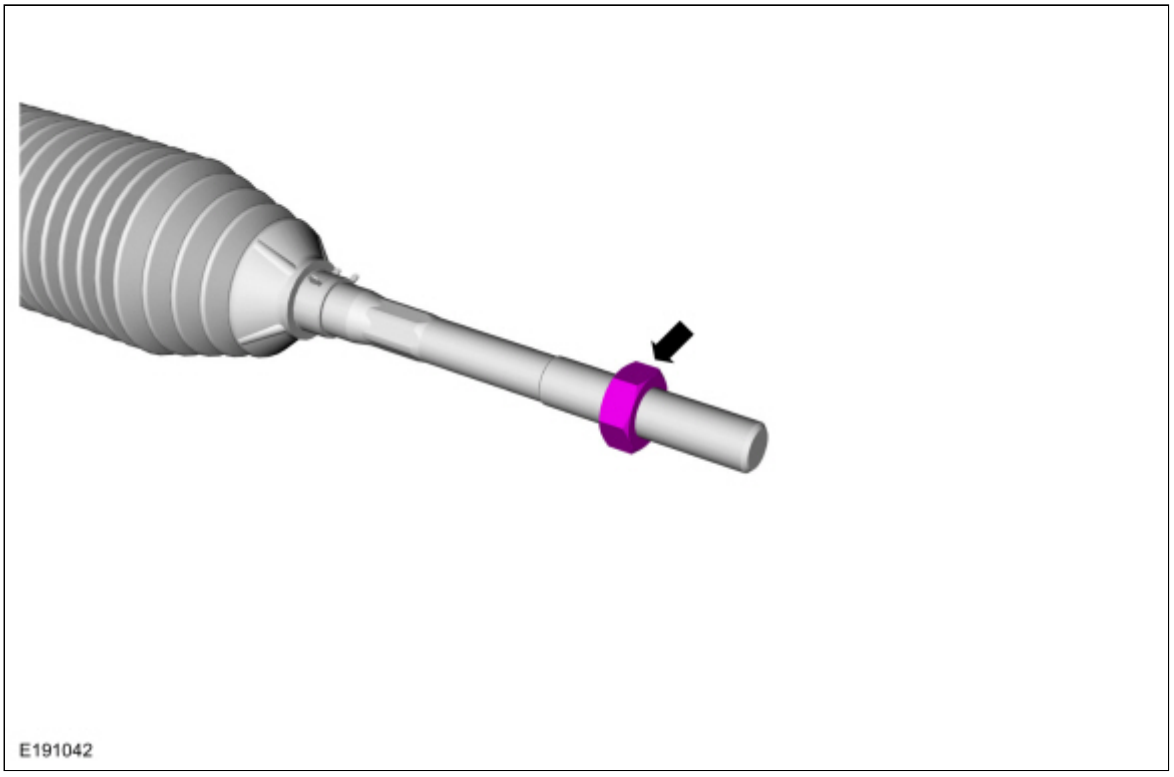
AWD

3. *Torque*: 30 Nm

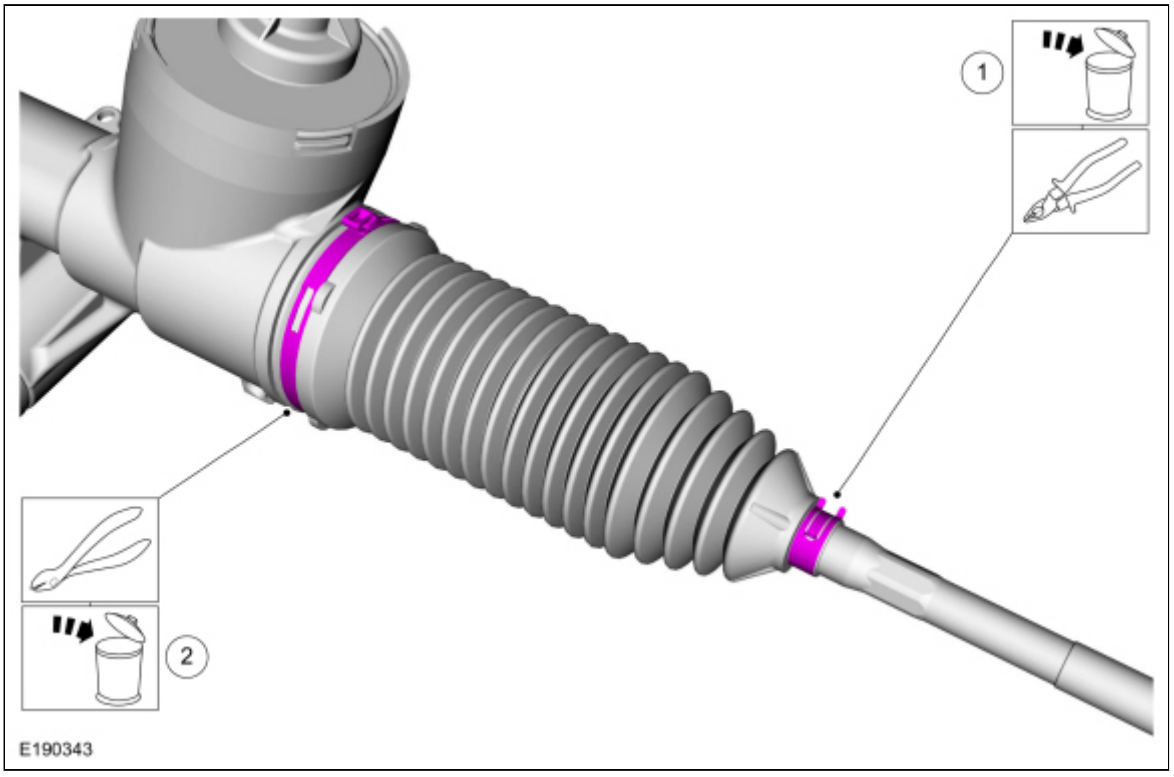


All vehicles

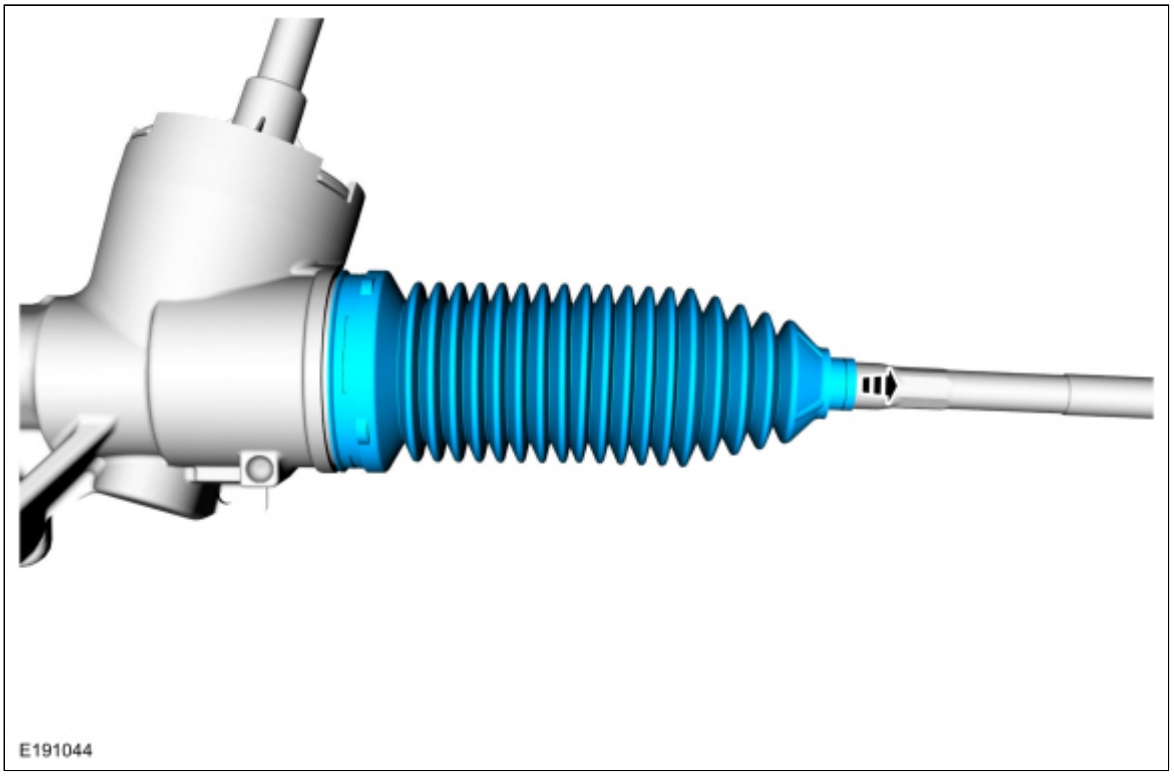
4.



5. **NOTE:** *If servicing the RH tie rod, both bellows boots must be removed.*

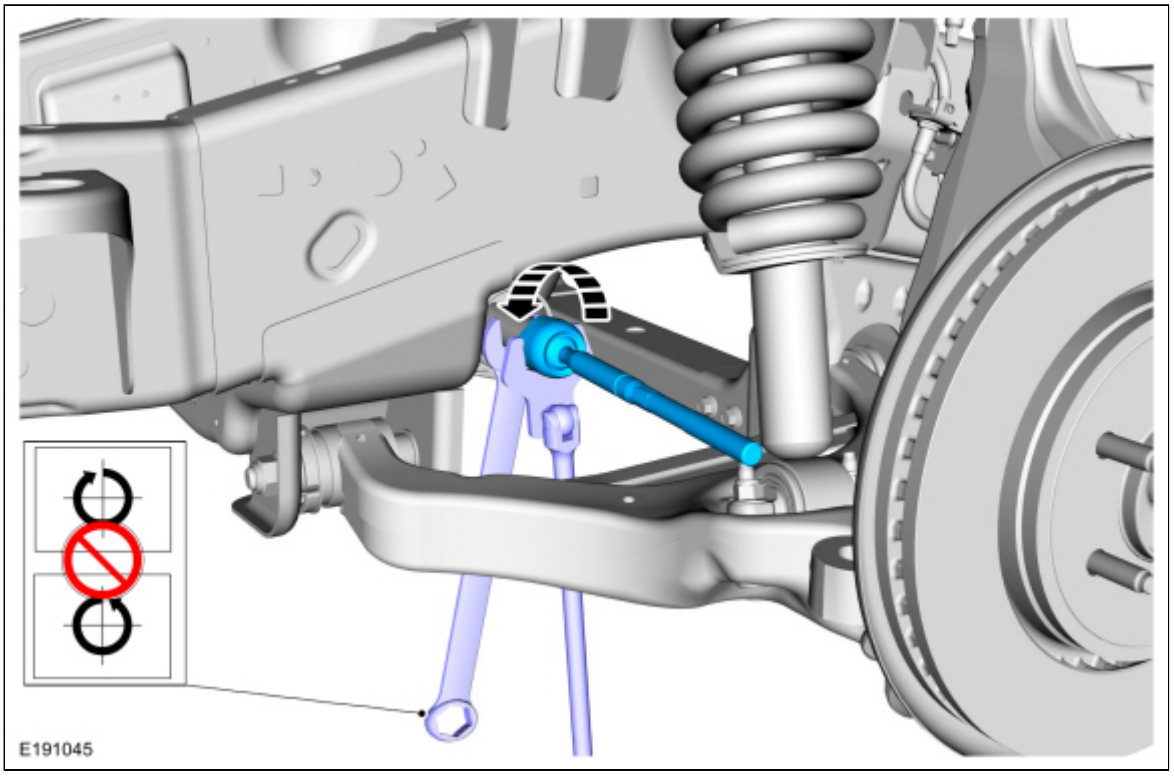


6.



7. **NOTICE: Place the steering gear at the center position and hold the steering gear rack while loosening the inner tie rod. Use an appropriate-sized wrench on the flat/teeth of the rack to resist rotation and to prevent damage during removal of the inner tie rod.**

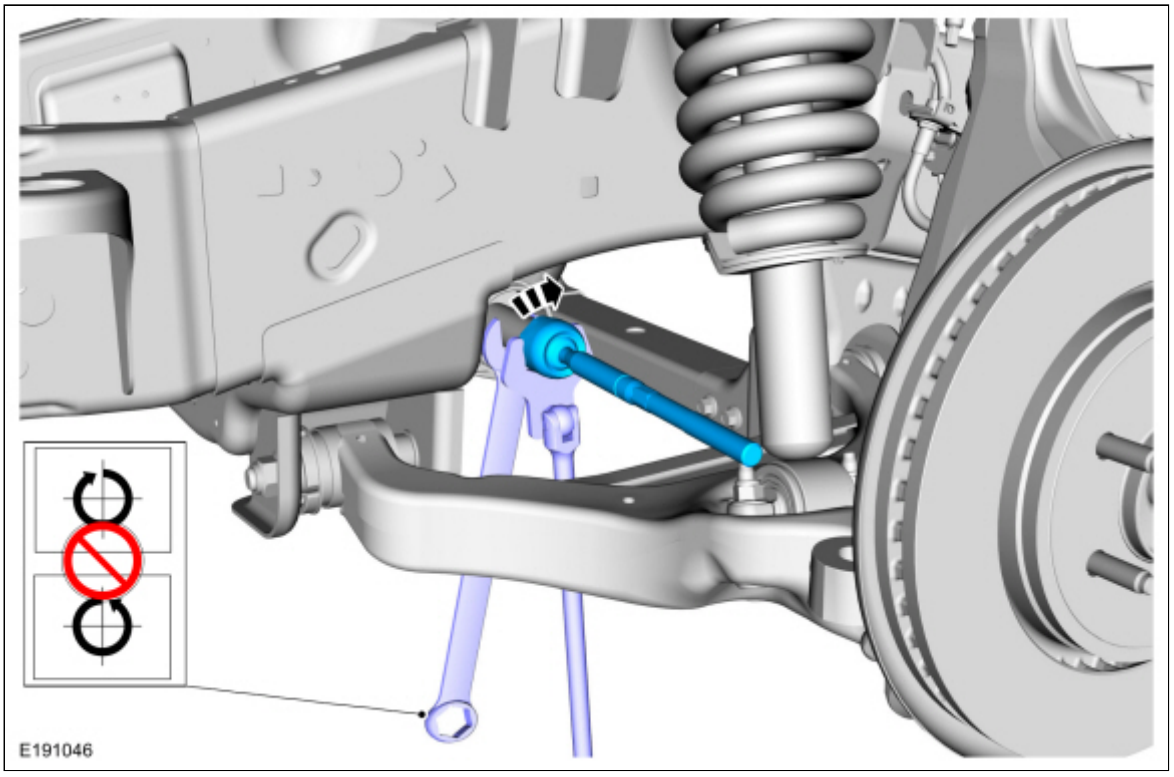
   NOTE: *The steering gear rack can only be held on the LH side.*



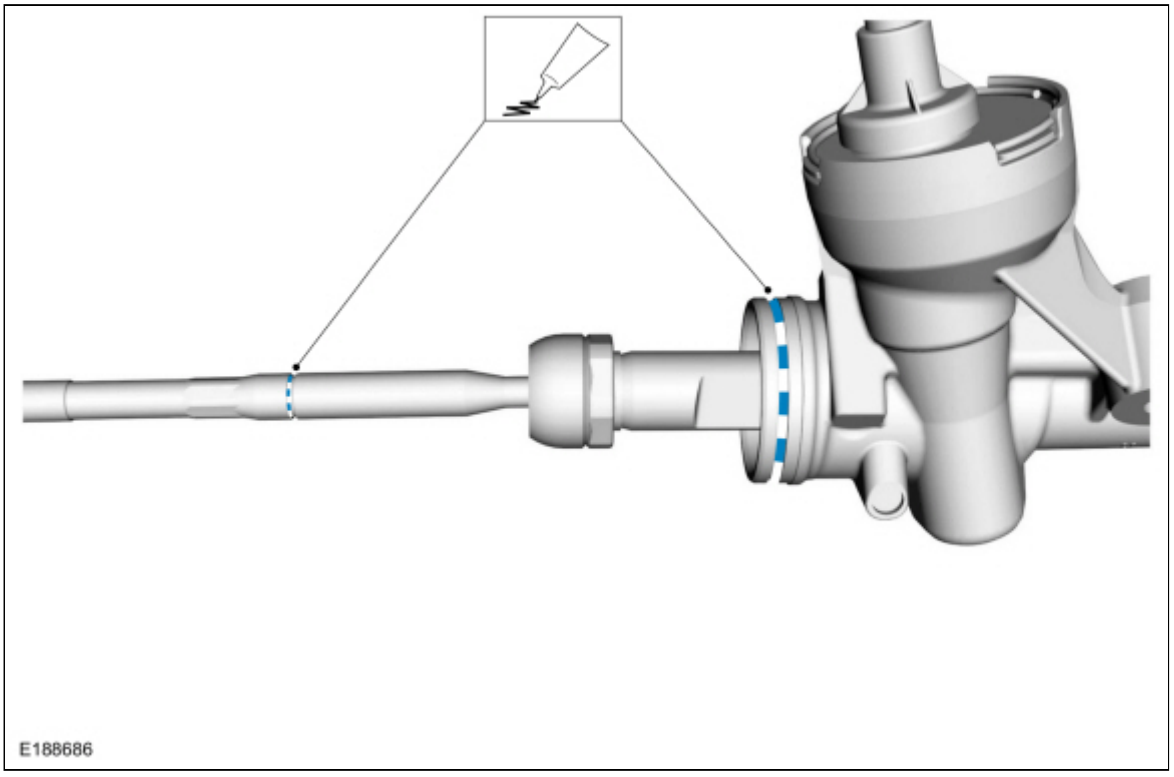
Installation

1. **NOTE:** *The help of an assistant may be necessary to torque the RH inner tie rod.*

   Torque: 120 Nm



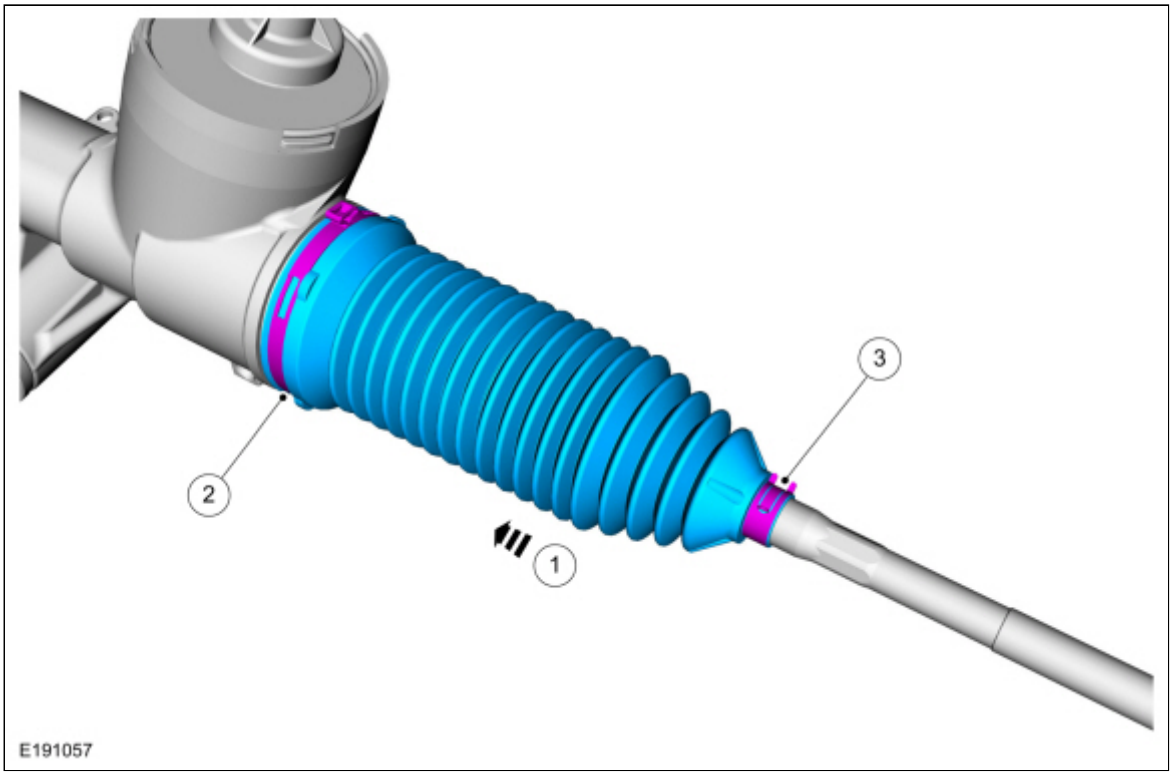
2. *Material*: Grease (ESA-M1C75-B)



3. **NOTE:** *LH side shown, RH side similar.*

   Make sure the steering gear bellows boot is positioned correctly over the steering gear housing bead and the groove in the inner tie rod.

   Use the General Equipment: Boot Clamp Pliers



4. To install, reverse the removal procedure.
5. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
   Refer to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).

Copyright © 2016 Ford Motor Company

Tie Rod - RHD

Special Tool(s) / General Equipment

Boot Clamp Pliers

Materials

Name	Specification
Grease	ESA-M1C75-B

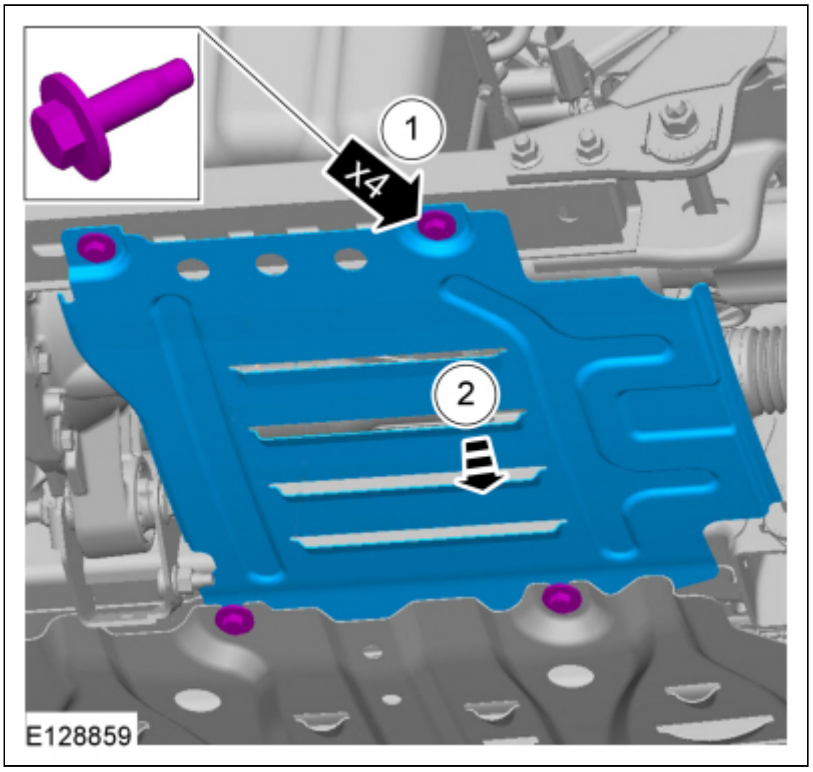
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).

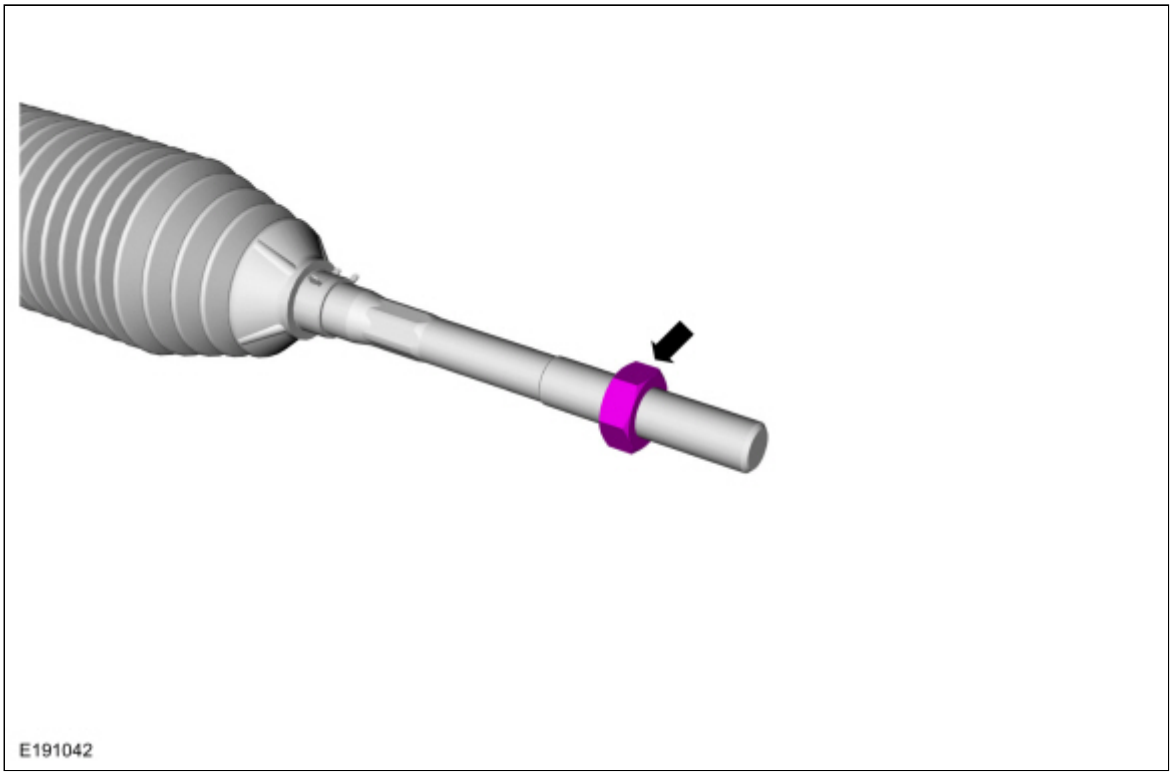
AWD

3. *Torque*: 30 Nm

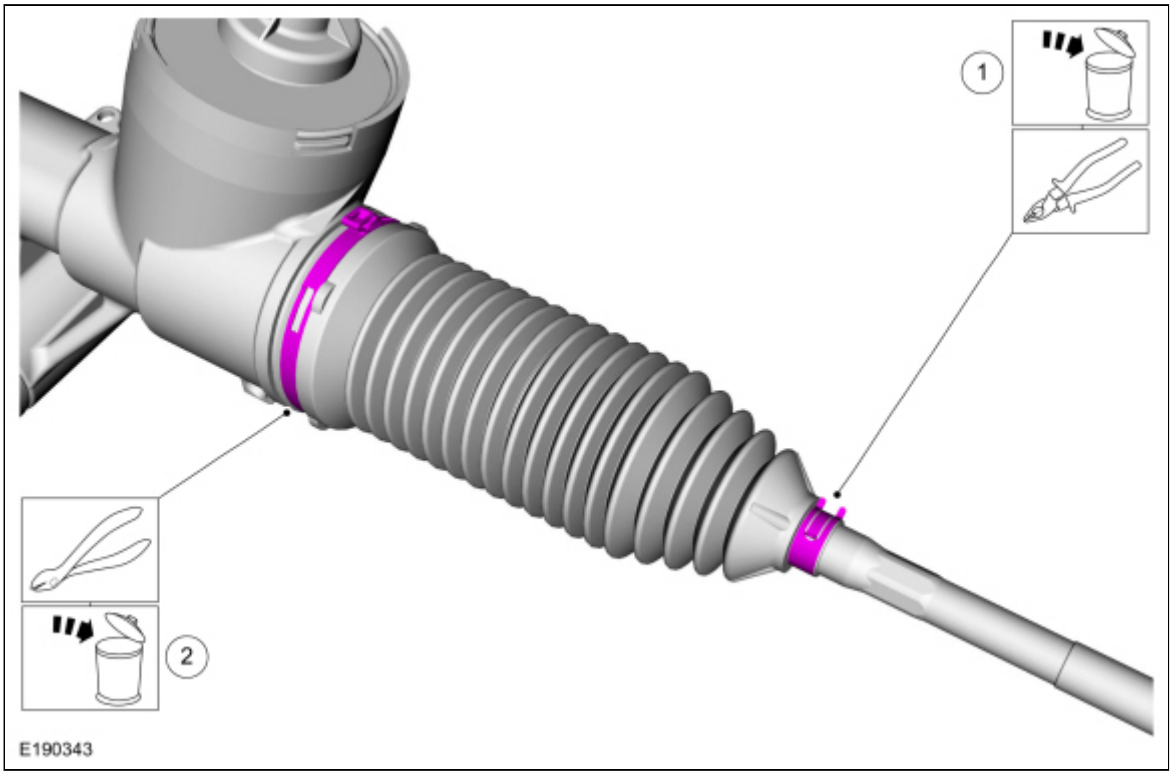


All vehicles

4.

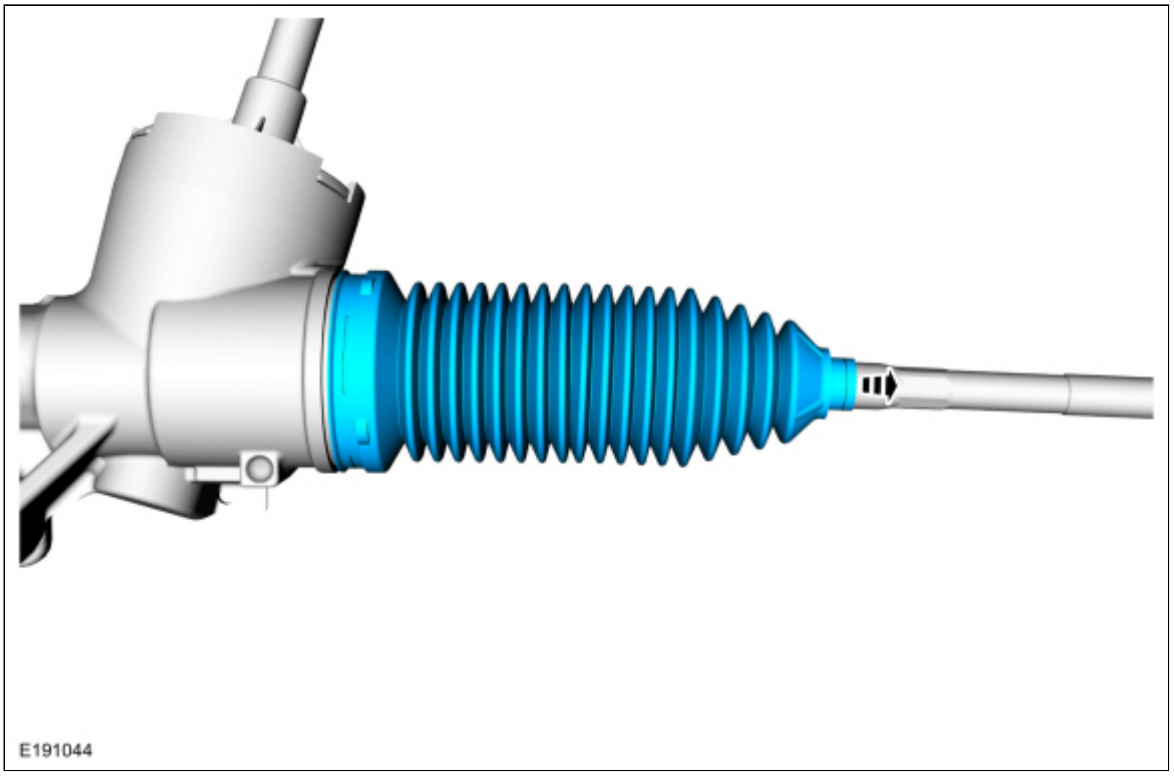


5. **NOTE:** *If servicing the RH tie rod, both bellows boots must be removed.*

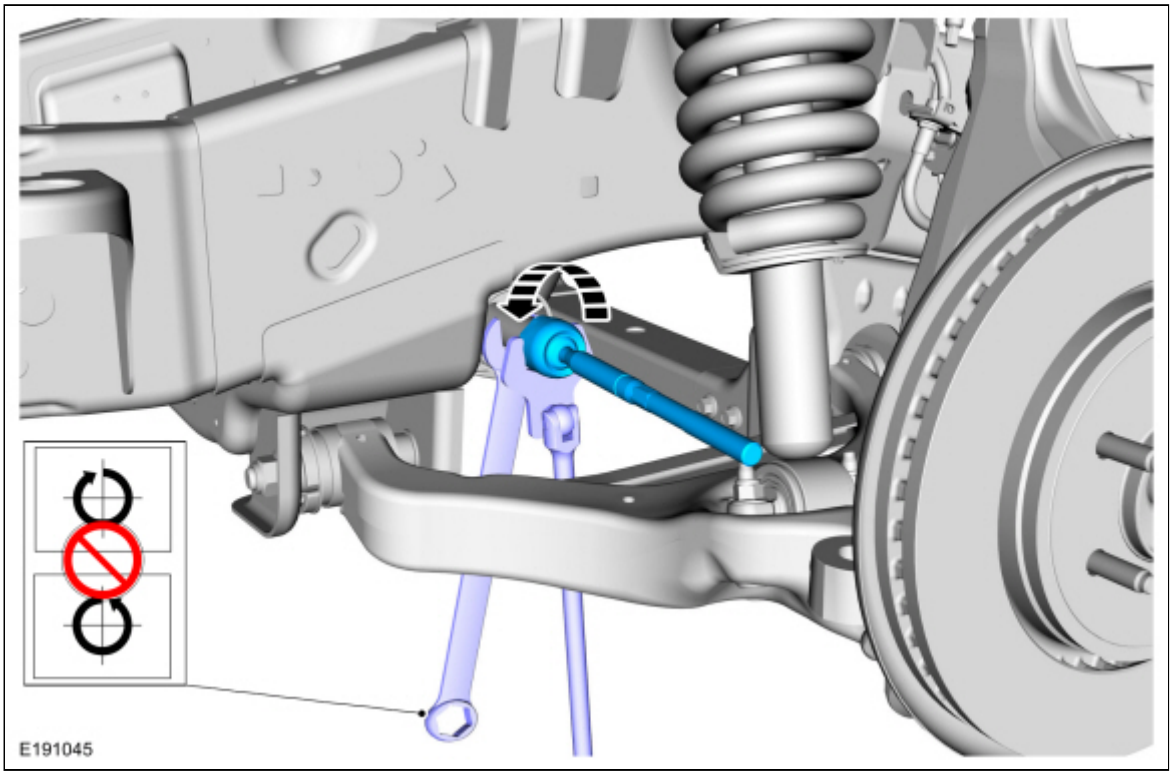


6. **NOTE:** *If servicing the RH tie rod, both bellows boots must be removed.*

   NOTE: *Move the bellows boot enough to gain access to the inner tie rod nut.*



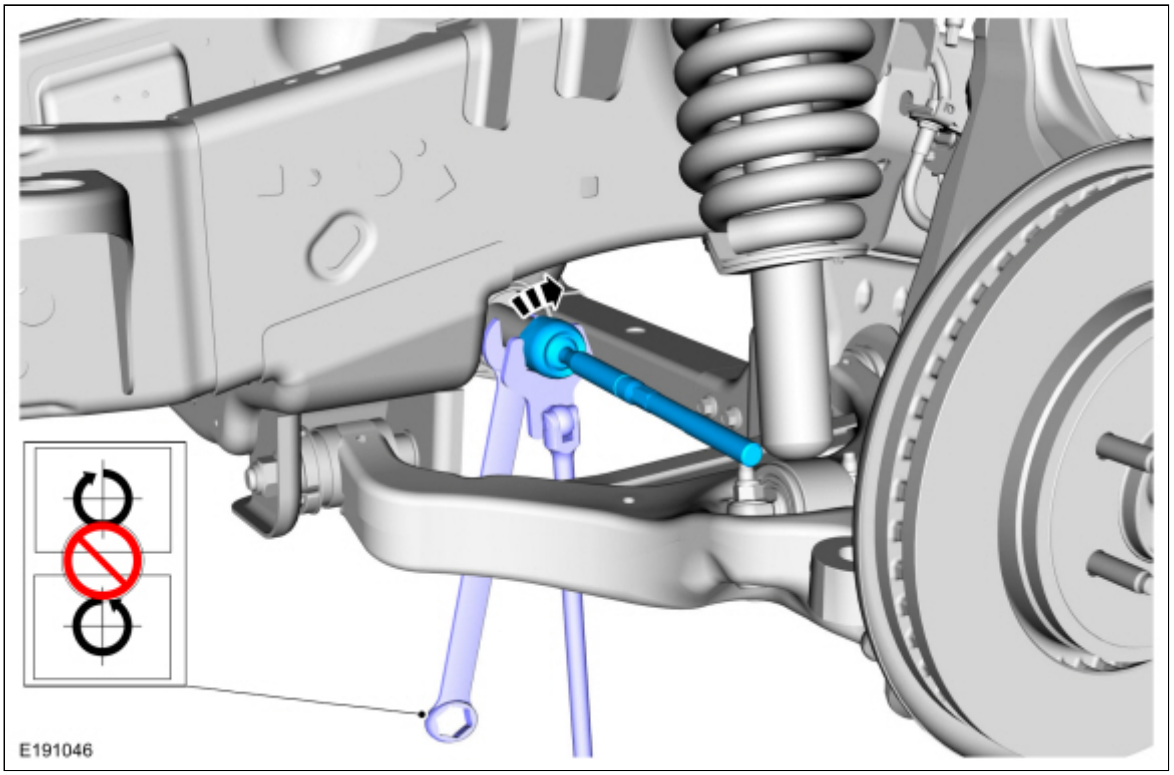
7. **NOTICE: Place the steering gear at the center position and hold the steering gear rack while loosening the inner tie rod. Use an appropriate-sized wrench on the flat/teeth of the rack to resist rotation and to prevent damage during removal of the inner tie rod.**



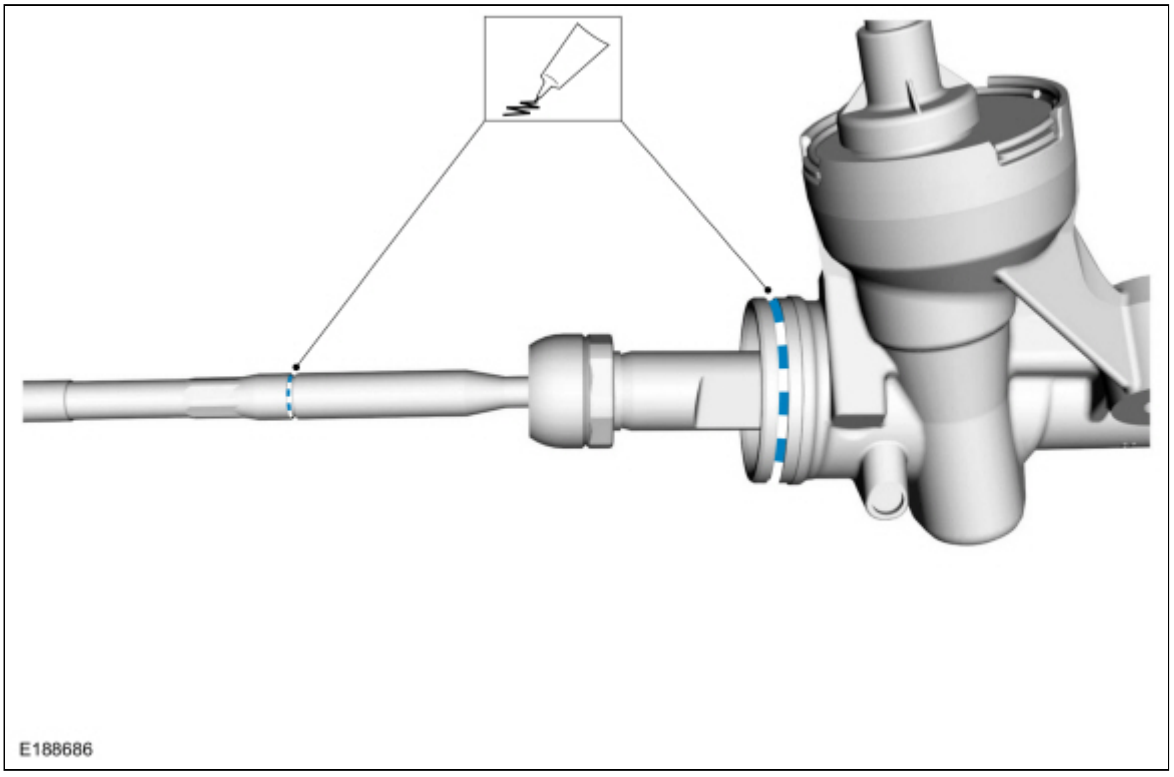
Installation

1. **NOTE:** *The help of an assistant may be necessary to torque the RH inner tie rod.*

   Torque: 120 Nm



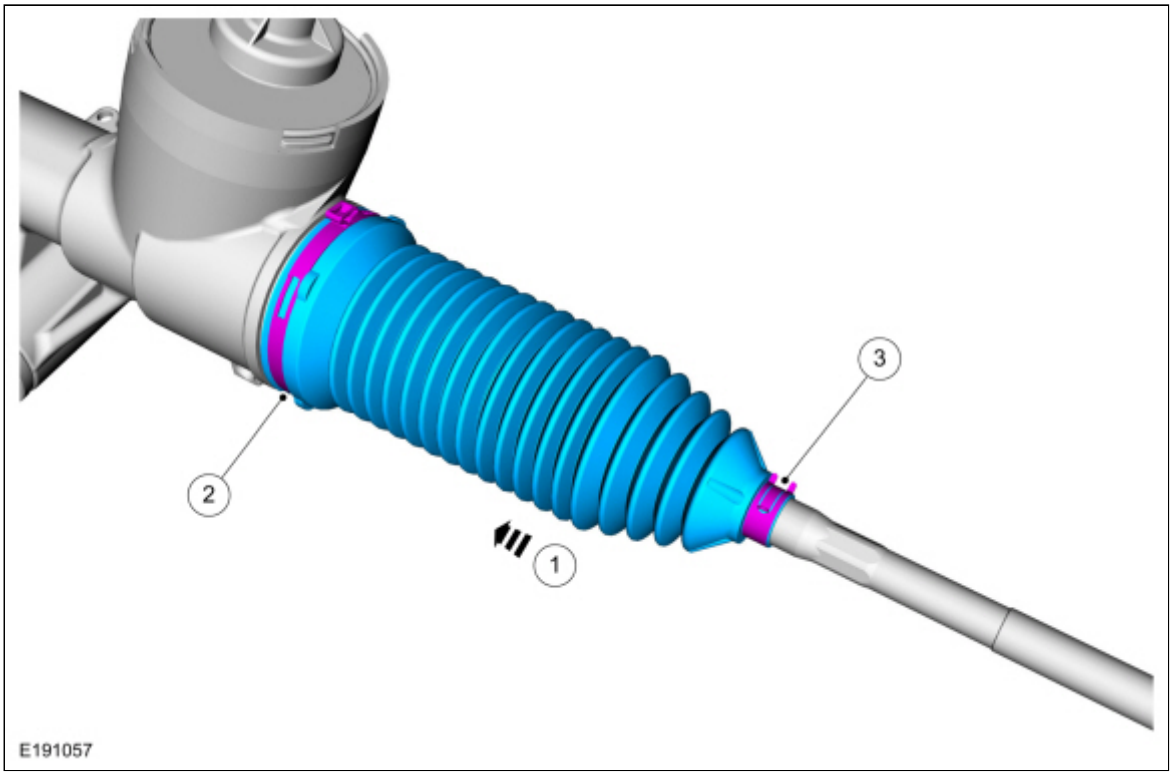
2. *Material*: Grease (ESA-M1C75-B)



3. **NOTE:** *LH side shown, RH side similar.*

   NOTE: *Make sure the steering gear bellows boot is positioned correctly over the steering gear housing bead and the groove in the inner tie rod.*

   Use the General Equipment: Boot Clamp Pliers



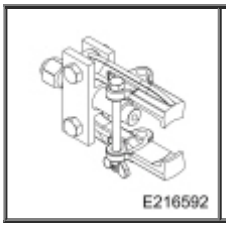
4. To install, reverse the removal procedure.
5. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).

Copyright © 2016 Ford Motor Company

Tie Rod End - LHD

Base Part Number: 3304

Special Tool(s) / General Equipment

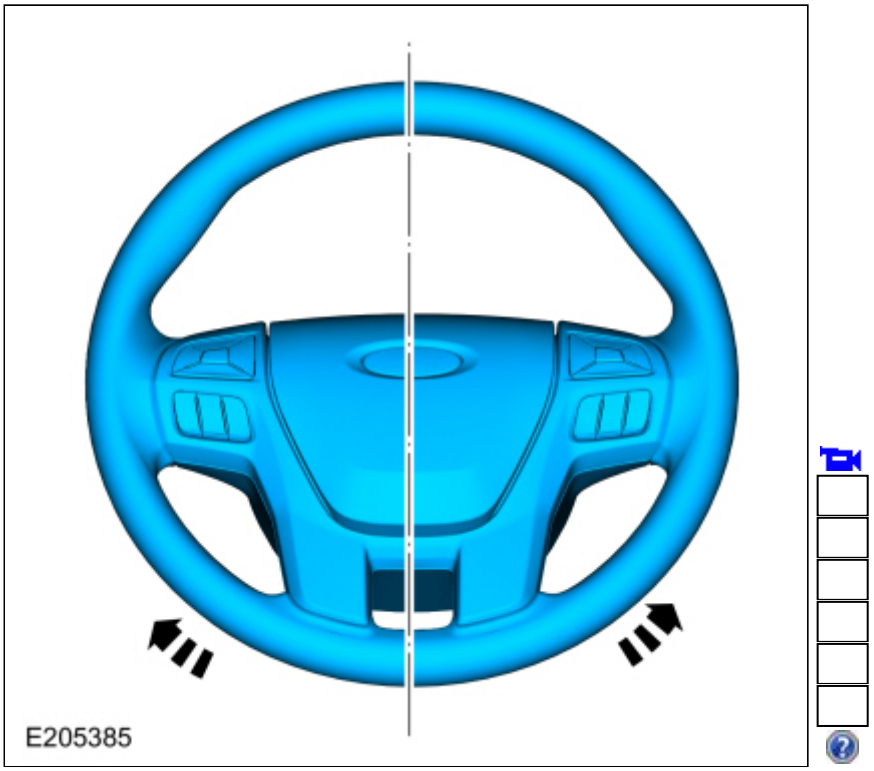
 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

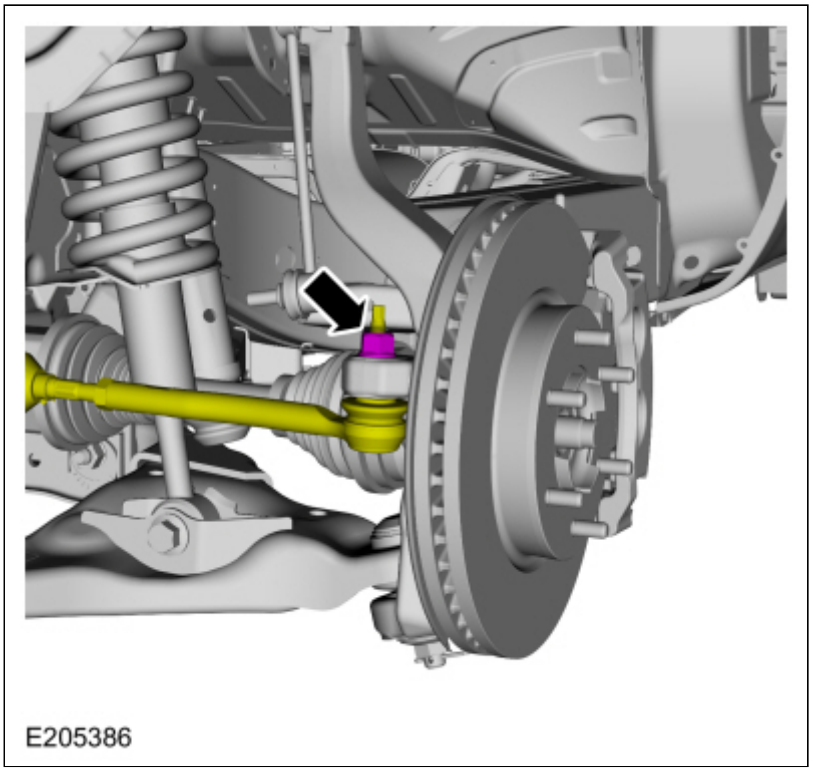
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Disconnect the battery ground cable anytime the steering linkage is being serviced or damage to the steering gear may occur resulting in steering gear replacement.**

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*

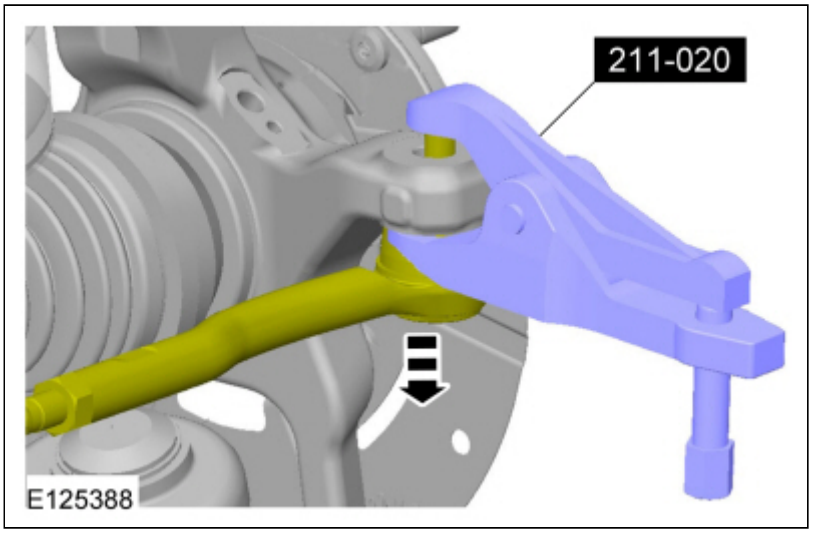


5. *Torque*: 23 Nm



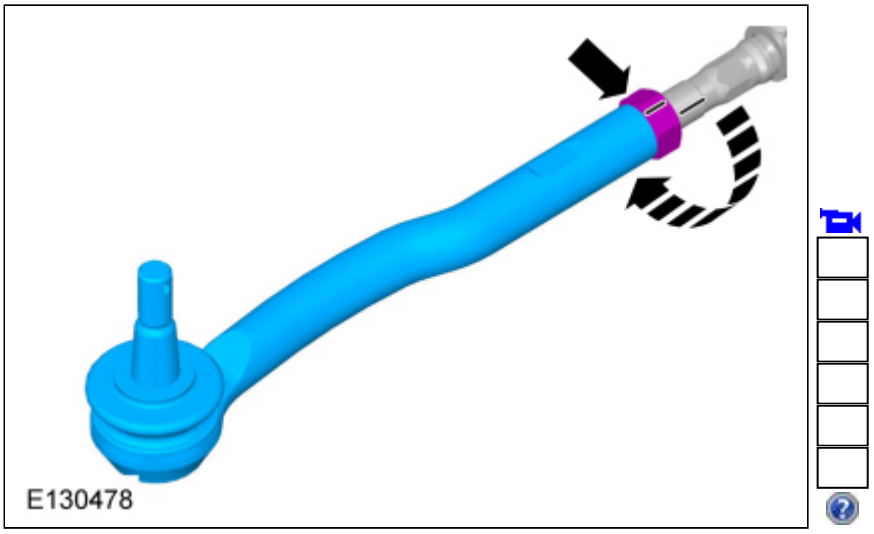
6. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

   Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



7. **NOTE:** *Make sure that the tie rod end is installed with the same number of turns as when removed.*

   Torque: 80 Nm



Installation

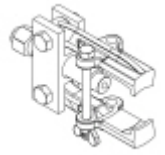
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Tie Rod End - RHD

Base Part Number: 3304

Special Tool(s) / General Equipment

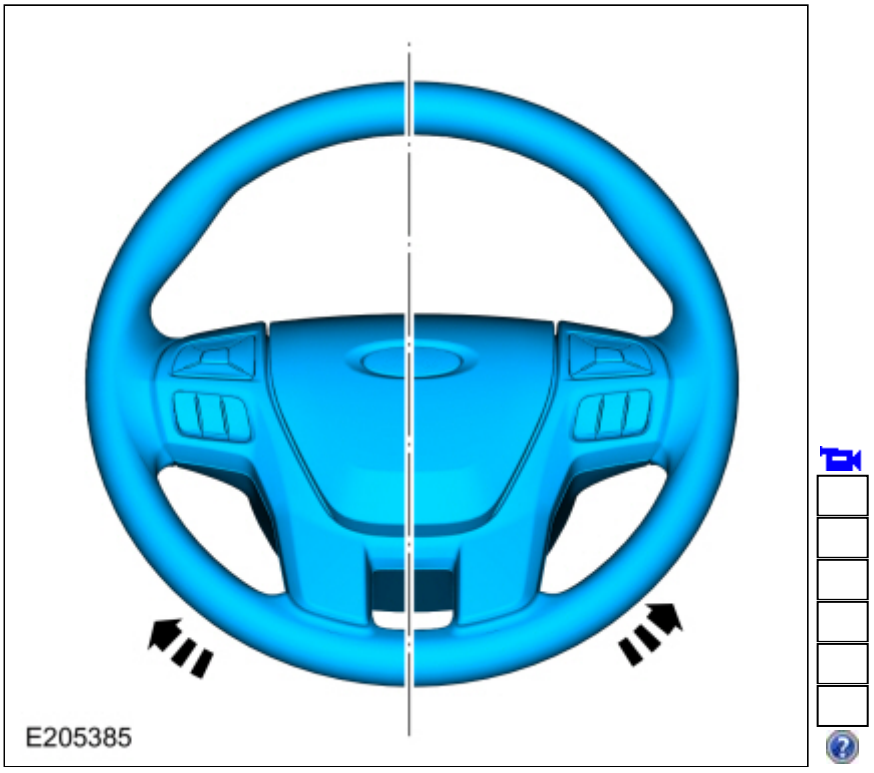
 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

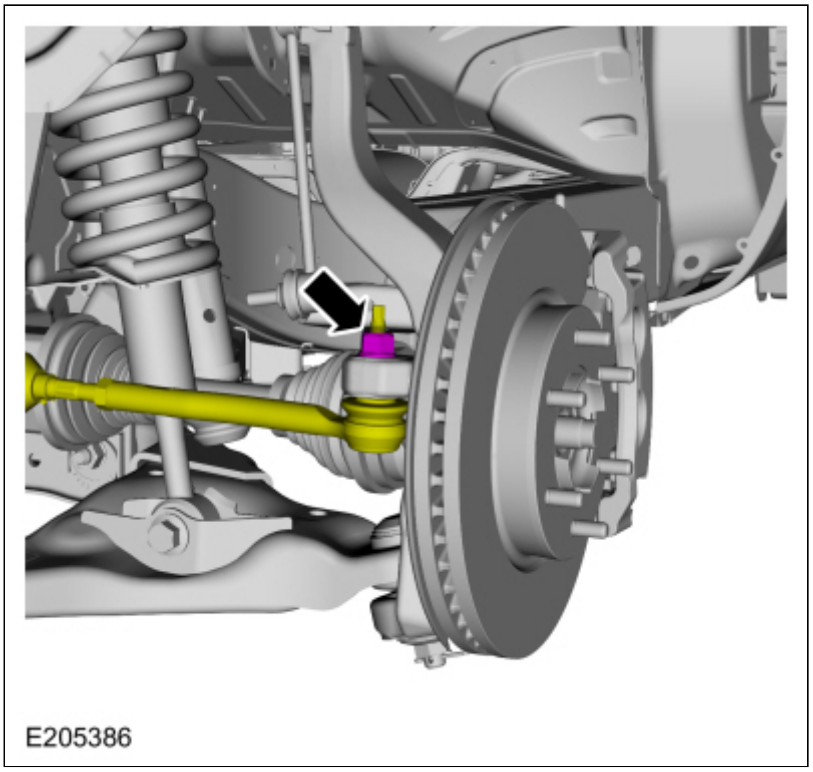
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Disconnect the battery ground cable anytime the steering linkage is being serviced or damage to the steering gear may occur resulting in steering gear replacement.**

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*

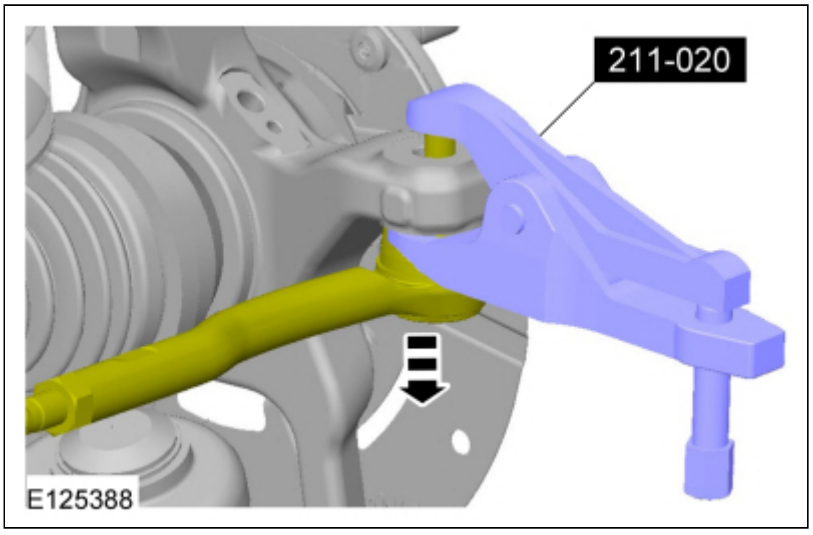


5. *Torque*: 63 Nm



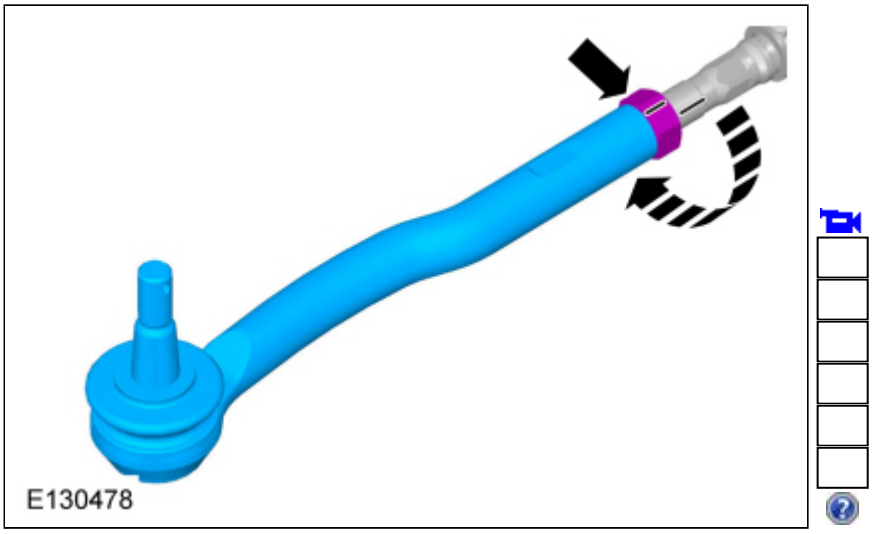
6. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

   Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



7. **NOTE:** *Make sure that the tie rod end is installed with the same number of turns as when removed.*

   Torque: 80 Nm



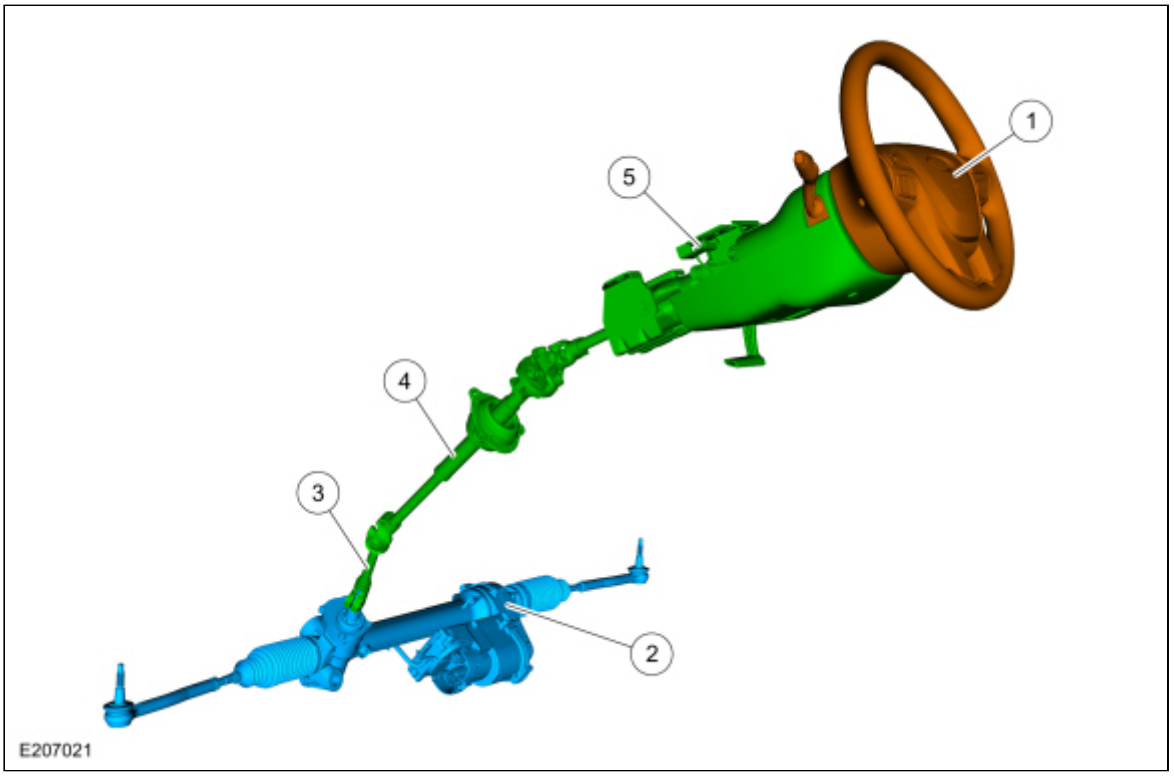
Installation

1. To install, reverse the removal procedure.
2. Check and if necessary, adjust front toe.
   Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

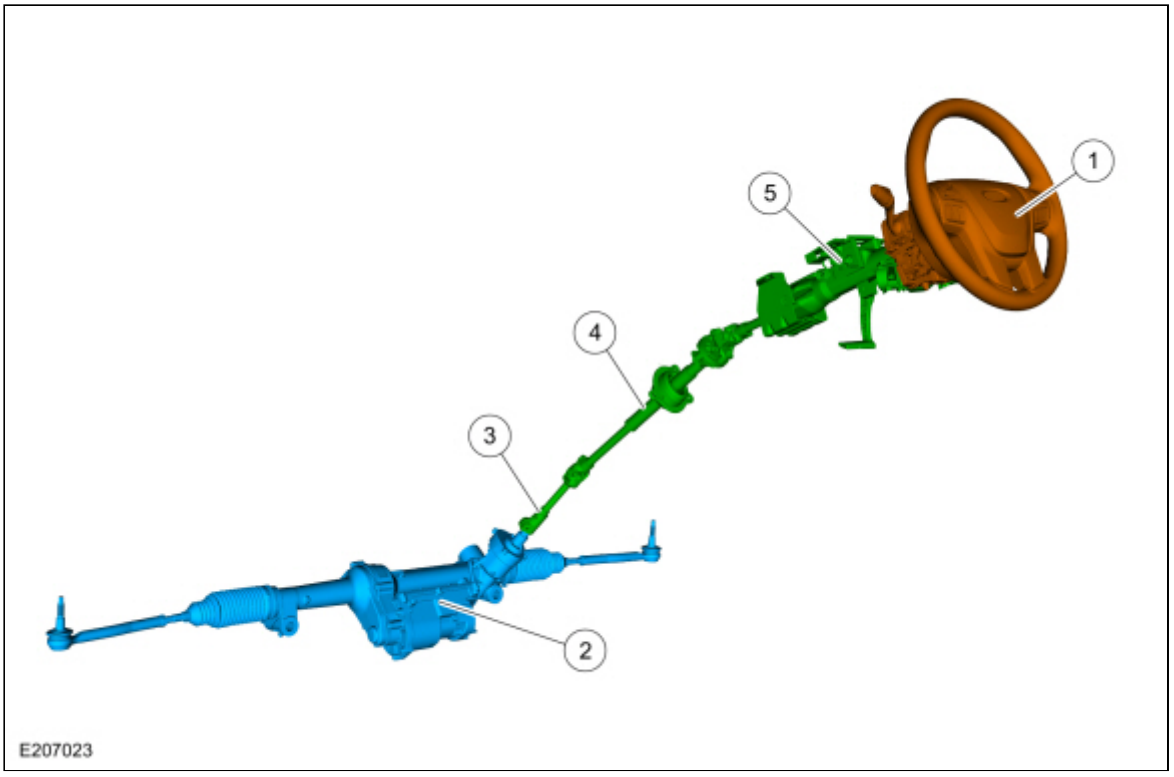
Power Steering - Component Location

LHD



Item	Description
1	Steering wheel
2	EPAS gear and linkage
3	Steering Lower shaft
4	Steering Upper shaft
5	Steering column

RHD



Item	Description
1	Steering wheel
2	EPAS gear and linkage
3	Steering Lower shaft
4	Steering Upper shaft
5	Steering column

Copyright © 2016 Ford Motor Company

Power Steering - Overview

Overview

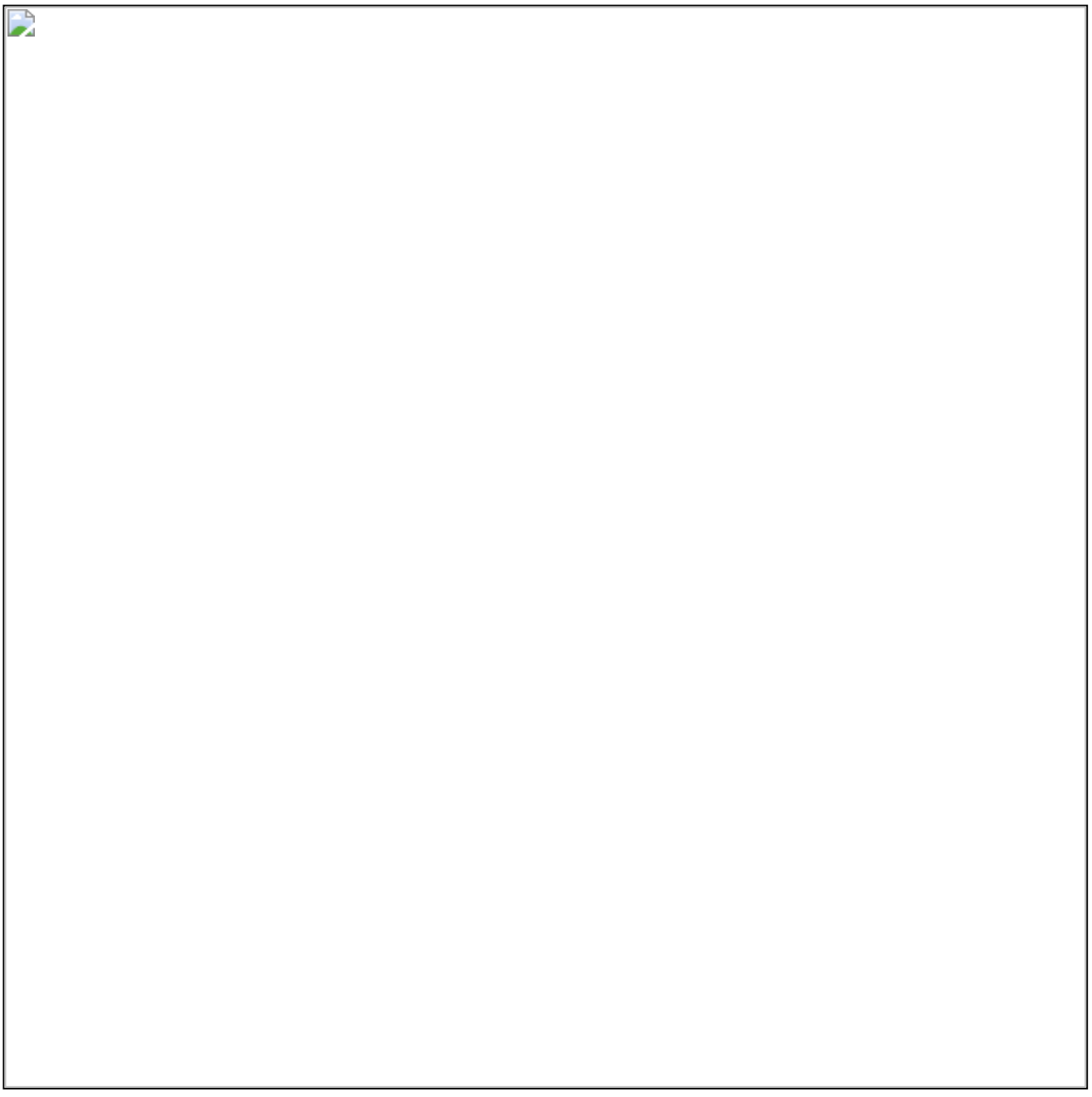
The EPAS system provides steering assist to the driver by replacing the conventional hydraulic valve system with a steering gear equipped with an integrated electrical motor and PSCM. The motor operation and level of steering assist provided is controlled by the PSCM.

Copyright © 2016 Ford Motor Company

Power Steering - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

PSCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
ABS active	ABS	Used to confirm the operational state of the ABS.
Ignition status	BCM	This message is first sent to the GWM and then to the PSCM. Used to confirm the ignition status of the vehicle.
Power pack status	PCM	This message is first sent to the GWM and then to the PSCM. Used to confirm the status of the operating mode; off - torque not available, on - torque not available, start in

		progress - torque not available or on - torque available.
Power system status	BCM	This message is first sent to the GWM and then to the PSCM. Used to confirm the status of the vehicle battery and charging system.
Stability control brake active	ABS	Used to confirm the operational state of the stability control system.
Steering wheel angle	ABS	Used to verify the validity of the steering angle sensor.
Traction control brake active	ABS	Used to confirm the operational state of the traction control system.
Vehicle configuration information	BCM	This message is first sent to the GWM and then to the PSCM. Used to compare the PSCM configuration against the vehicles specific configuration (central car configuration).
Vehicle lateral acceleration	ABS	Used by the PSCM for steering assist calculations.
Vehicle lateral acceleration	RCM	Used by the PSCM for steering assist calculations.
Vehicle longitudinal acceleration	ABS	Used by the PSCM for steering assist calculations.
Vehicle speed	PCM	This message is first sent to the GWM and then to the PSCM. Used to determine the level of assist supplied to the steering gear.
Vehicle yaw rate	ABS	Used by the PSCM for steering assist calculations.
Wheel speed data	ABS	Used to determine the level of assist supplied to the steering gear and to validate the steering wheel component angle by comparing the rotational speeds of each wheel. The difference in the speed of each wheel is used to derive a steering angle for comparison against the EPAS motor position sensor.

EPAS System

The PSCM controls the functions of the EPAS system and communicates with other modules over the HS-CAN2 and through the GWM.

To activate, the EPAS system requires battery voltage at the hot at all times PSCM input, battery voltage at the PSCM ignition-run input, the PSCM must communicate with other modules over the HS-CAN2 and the PSCM must receive the power pack status message from the PCM.

The main input for calculating the level of EPAS assist is the steering torque sensor signal (internal to the PSCM). Vehicle speed is also taken into consideration in order to achieve the vehicle speed dependent steering assist characteristic.

The EPAS gear uses a reversible motor to apply the steering assist by moving the rack inside the steering gear. The motor is connected to the rack of the steering gear by a toothed belt and pulley-bearing assembly.

The PSCM continually monitors and adjusts steering efforts based on the steering torque sensor signal, motor position and HS-CAN2 inputs to enhance the feel of the steering system. As vehicle speed increases, the amount of assist decreases to improve and enhance road feel at the steering wheel. As vehicle speed decreases, the amount of assist increases to ease vehicle maneuvering. Compensation is made to reduce the effect of pull or drift experienced when driving on roads with a high degree of camber. Compensation is also made for the impact of wheel imbalance on steering feel, up to a predetermined threshold.

The steering torque sensor senses the torque at the steering wheel. It is integrated into the PSCM and works by measuring the relative rotation between an input and output shaft which are connected by a torsion bar. The steering torque sensor sends out 2 opposing signals which allows a channel to channel cross-check and an accurate correction of the neutral point.

The PSCM is self-monitoring and is capable of setting and storing Diagnostic Trouble Codes (DTCs). Depending on

the DTC set, the PSCM may enter a failure mode. In addition, the PSCM may send a request to the IPC to display a message in the message center, alerting the driver of a potential EPAS concern. The warning message is sent over the HS-CAN2 to the GWM which relays the message to the IPC over the HS-CAN3.

Failure Modes

When a DTC is present in the PSCM, the EPAS enters 1 of 2 modes of operation.

The EPAS enters a **reduced steering assist mode** to protect the internal components of the EPAS when a non-critical safety concern is detected by the PSCM, concerns such as low battery voltage, high battery voltage or over-temperature are considered non-critical safety concerns. This reduced steering assist mode gives the steering operation a heavier than normal feel.

The EPAS enters a **manual steering mode** (no electrical steering assistance is provided) when a concern considered to be a critical safety concern is detected. In manual steering mode, the vehicle has mechanical steering only which gives the steering operation a heavy feel.

Active Park Assist

NOTE: *If equipped*

The active park assist system is controlled by the PAM (integrated into the BCM) and, when activated, can detect a parking space and steer the vehicle into the space by sending commands to the EPAS gear (the driver still controls the throttle, brakes and transmission). The active park assist system is comprised of several systems and modules working together to aid in parallel parking maneuvers. The presence of certain Diagnostic Trouble Codes (DTCs) in any of those modules or systems may keep the active park assist system from being enabled or may disable the system if currently being used.
Refer to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

Lane Keeping System (LKS)

The Lane Keeping System (LKS) utilizes the camera located in the IPMA to detect and track the road lane markings. The Lane Keeping System (LKS) has 2 functions, lane keeping alert and lane keeping aid. The lane keeping alert detects unintentional drifting toward the outside of the lane and alerts the driver through steering wheel vibrations and a visual alert in the IPC message center. The lane keeping aid assists the driver by automatically providing steering torque to help the driver keep the vehicle in the lane.
Refer to: Lane Keeping System - Overview (419-07 Lane Keeping System, Description and Operation).

Component Description

EPAS Steering Gear

The EPAS gear is an assembly consisting of a PSCM, a motor, and a steering torque sensor, all of which are serviced as an assembly. The inner and outer tie rods and the steering gear bellows boots are available separately for service.

- The steering torque sensor is mounted near the input shaft of the EPAS gear and is used by the PSCM to determine how much force is being used to turn the steering wheel.
- The EPAS gear has one inner tie rod located at each end of the gear assembly.
- The EPAS gear has one outer tie rod located at each end of the gear assembly.
- The EPAS gear has one bellows boot located at each side of the EPAS gear assembly. Each boot is held in place with 2 boot clamps.

PSCM

The PSCM is the ECU for the EPAS system. The module monitors all sensor inputs and HS-CAN2 messages relating to the EPAS system and directly controls the output of the EPAS motor.

Copyright © 2016 Ford Motor Company

Power Steering

DTC Chart: Power Steering Control Module (PSCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

NOTE: *If present, diagnose DTC B1D23:68 before diagnosing any other Diagnostic Trouble Codes (DTCs).*

PSCM DTC Chart

DTC	Description	Action
B1D23:68	Overheat Sensor: Event Information	• The PSCM uses a thermistor to monitor the internal temperature of the EPAS gear and sets DTC B1D23:68 when the temperature exceeds a predetermined threshold. DTC B1D23:68 appearing by itself **does not** indicate a fault condition in the steering system. • DTC B1D23:68 indicates an over-temperature condition due to ambient conditions or a heavy load on the EPAS system. A heavy load is defined as multiple parking lot maneuvers over a short duration of time with low tire pressure or towing for long distances followed by multiple parking maneuvers. • The thermistor used by the PSCM is calibrated for 80°C (176°F) and as ambient temperature decreases, so does the accuracy of the sensor. At room temperature and lower, the sensor is ±20°C (68°F). • If no other Diagnostic Trouble Codes (DTCs) are present, INFORM the customer high ambient temperatures or heavy loads on the EPAS system cause this DTC to set, resulting in higher than usual steering efforts.
C102D:00	High Friction Inside Power Steering: No Sub Type Information	GO to Pinpoint Test C
C1B00:00	Steering Angle Sensor: No Sub Type Information	GO to Pinpoint Test B
C1B00:2F	Steering Angle Sensor: Signal Erratic	GO to Pinpoint Test B
C200B:61	Steering Shaft Torque Sensor 1: Signal Calculation Failure	GO to Pinpoint Test B
U0001:88	High Speed CAN Communication Bus: Bus off	A HS-CAN fault was present at a point in time. The fault is not currently present since the module is communicating with the diagnostic scan tool. CLEAR the DTC. REPEAT the Network Test with the diagnostic scan tool. VERIFY the integrity of the connectors and wiring. Refer to Wiring Diagrams Cell 14 for schematic and connector information.
U0100:00	Lost Communication with ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test D
U0102:00	Lost Communication with Transfer Case Control Module (TCCM): No Sub Type Information	GO to Pinpoint Test E

U0121:00	Lost Communication with Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test F
U0140:00	Lost Communication with Body Control Module: No Sub Type Information	GO to Pinpoint Test G
U0151:00	Lost Communication with Restraints Control Module: No Sub Type Information	GO to Pinpoint Test H
U0155:00	Lost Communication with Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test I
U0159:00	Lost Communication With Parking Assist Control Module A: No Sub Type Information	GO to Pinpoint Test J
U0212:00	Lost Communication With Steering Column Control Module: No Sub Type Information	GO to Pinpoint Test K
U0401:00	Invalid Data Received from ECM/PCM A: No Sub Type Information	GO to Pinpoint Test D
U0415:00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test F
U0423:00	Invalid Data Received from Instrument Panel Cluster Control Module: No Sub Type Information	GO to Pinpoint Test I
U0452:00	Invalid Data Received from Restraints Control Module: No Sub Type Information	GO to Pinpoint Test H
U045A00	Invalid Data Received From Parking Assist Control Module A: No Sub Type Information	GO to Pinpoint Test J
U053B:00	Invalid Data Received from Image Processing Module A: No Sub Type Information	• This DTC sets if the PSCM receives an invalid or unknown message from the IPM-A instead of valid lane information. • RETRIEVE and RECORD all IPM-A DTCs. Diagnose the IPM-A concern.
U053C:00	Invalid Data Received from Image Processing Module B: No Sub Type Information	• This DTC sets if the PSCM receives an invalid or unknown message from the IPM-B instead of valid lane information. • RETRIEVE and RECORD all IPM-B DTCs. Diagnose the IPM-B concern.
U0554:00	Invalid Data Received from Accessory Protocol Interface	• This DTC sets if the PSCM receives an invalid or unknown message from the APIM instead of valid lane information. • RETRIEVE and RECORD all APIM DTCs. Diagnose the APIM concern.

	Module (APIM): No Sub Type Information	
U2011:61	Motor: Signal Calculation Failure	GO to Pinpoint Test B
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• DTC U2100:00 sets if the PSCM was not correctly configured before leaving the assembly plant. • INSTALL As-Built data from Professional Technician Society (PTS) following diagnostic scan tool instructions under Module Programming>As-Built. • If DTC is still set, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
U2100:55	Initial Configuration Not Complete: Not Configured	• When a new EPAS gear is installed, the PSCM must be configured with the vehicle information. Configuration is checked during initial PSCM power up (ignition ON) when the voltage supply to the PSCM is greater than 6 volts. • If the PSCM detects the vehicle data configuration or the component base data configuration is missing or incomplete, DTC U2100:55 sets. This usually occurs when the initial PSCM configuration is not carried out or if the configuration fails. • CHECK vehicle service history for recent service actions related to the PSCM. This DTC sets due to incomplete or improper PMI procedures. • If there have been recent service actions with the PSCM, REPEAT the PMI procedure as directed by the diagnostic scan tool. • If there have been no recent service actions, INSTALL a new EPAS gear to correct the failure to retain configuration data. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
U3000:41	Control Module: General Checksum Failure	GO to Pinpoint Test B
U3000:49	Control Module: Internal Electronic Failure	GO to Pinpoint Test B
U3000:62	Control Module: Signal Compare Failure	• Using a diagnostic scan tool, CLEAR the DTC. • CYCLE the ignition from ON to OFF, WAIT at least 15 seconds and SET the ignition back to ON. Using a diagnostic scan tool, CARRY OUT the PSCM self-test. • If DTC U3000:62 returns, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
U3000:64	Control Module: Signal Plausibility Failure	• Using a diagnostic scan tool, CLEAR the DTC. • CYCLE the ignition from ON to OFF, WAIT at least 15 seconds and SET the ignition back to ON. Using a diagnostic scan tool, CARRY OUT the PSCM self-test. • If DTC U3000:64 returns, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and

		Installation).
U3000:96	Control Module: Component Internal Failure	• Using a diagnostic scan tool, CLEAR the DTC. • CYCLE the ignition from ON to OFF, WAIT at least 15 seconds and SET the ignition back to ON. Using a diagnostic scan tool, CARRY OUT the PSCM self-test. • If DTC U3000:96 returns, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage below Threshold	GO to Pinpoint Test A
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test A
U3003:68	Battery Voltage: Event Information	GO to Pinpoint Test A

Symptom Chart(s)

Symptom Chart: Steering System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

NOTE: *Multiple conditions (overheating protection, high voltage, low voltage, etc.) may result in limited or reduced assist in the EPAS system. Address all existing PSCM Diagnostic Trouble Codes (DTCs) prior to diagnosing any steering assist symptoms.*

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Communication network concern • PSCM	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Excessive steering wheel play	Refer to the Pinpoint Test	GO to Pinpoint Test L
Lack of assist or inconsistent assist	Refer to the Pinpoint Test	GO to Pinpoint Test M
Message center displays STEERING FAULT SERVICE NOW	Diagnostic Trouble Codes (DTCs) present in the PSCM	• This message appears when a condition has been detected in the EPAS system requiring the PSCM to disable the system (remove assist) to help prevent the system from sustaining any possible damage. This message (and related symptom) may be cleared when the ignition is cycled and may not be present at the time of diagnosis. • RETRIEVE all PSCM Diagnostic Trouble Codes (DTCs) and REFER to the DTC Chart: PSCM.
Message center	Diagnostic Trouble	• This message appears if a condition exists (high friction for

displays STEERING LOSS STOP SAFELY	Codes (DTCs) present in the PSCM	example) that puts extra load on the EPAS gear. Steering assist remains for the current ignition cycle, but with a reduced level of assist. If the ignition is set to OFF and then back to ON, STEERING LOSS STOP SAFELY appears in the message center and steering assist is removed until the condition is repaired. • RETRIEVE all PSCM Diagnostic Trouble Codes (DTCs) and REFER to the DTC Chart: PSCM.
Message center displays STEERING ASSIST FAULT SERVICE REQUIRED	Diagnostic Trouble Codes (DTCs) present in the PSCM	• This message appears when a condition has been detected in the EPAS system requiring the PSCM to disable the system (remove assist) to help prevent the system from sustaining any possible damage. This message (and related symptom) cannot be cleared until the condition has been repaired. • RETRIEVE all PSCM Diagnostic Trouble Codes (DTCs) and REFER to the DTC Chart: PSCM.
Poor returnability or sticky steering	Refer to the Pinpoint Test	GO to Pinpoint Test M
Steering system pull, drift or wander	Refer to the Pinpoint Test	GO to Pinpoint Test N
Steering wheel is off center	Refer to the Pinpoint Test	GO to Pinpoint Test N

Symptom Chart: Noise, Vibration and Harshness (NVH)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

NVH symptoms should be identified using the diagnostic tools available. For a list of these tools, an explanation of their uses and a glossary of common terms,
REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Description and Operation).
Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Condition	Possible Sources	Actions
Feedback (rattle, chuckle or knocking noise) - roughness is felt in the steering wheel when driven over rough surfaces	Refer to the Pinpoint Test	GO to Pinpoint Test O
Grinding noise or gravely feel	Refer to the Pinpoint Test	GO to Pinpoint Test P
Shimmy	Refer to the Pinpoint Test	GO to Pinpoint Test O
Steering column squeaks, clicks or grinds	• Loose or misaligned steering column shrouds • Steering wheel rubbing against steering column shrouds	• TIGHTEN the steering column shroud screws. • ALIGN the steering column shrouds.
Steering gear clunk occurs only while cornering over a bump (can	• EPAS gear mounting bolts	**NOTE:** *Some noise when turning into the steering stops is normal.*

be temperature sensitive)	loose or damaged • EPAS gear has reached the end of travel and is contacting the steering stops	• If the mounting bolts are loose, INSTALL new bolts and TIGHTEN to specification. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). • COMPARE to other EPAS equipped vehicles. If the noise is excessive, INSPECT the outer tie-rods and suspension ball joints. TIGHTEN or INSTALL new as necessary.
Whirring or whine noise that gets louder with increased steering wheel speed	• Grounded or loose steering column shaft dash panel seal • EPAS gear	**NOTE:** *Some noise from the EPAS gear is considered normal.* • REPAIR or INSTALL a new dash panel seal as necessary. REFER to: Steering Column (211-04 Steering Column, Removal and Installation). • COMPARE to other EPAS equipped vehicles. If the noise is excessive, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Pinpoint Tests

U3003:16, U3003:17, U3003:68

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operations and Fault Conditions

The EPAS is supplied voltage through one high current circuit. The EPAS internally monitors supply voltage to detect system power concerns on the high current circuit. The EPAS system uses a shared ground circuit via the vehicle's engine and body. Although the ground circuit is not directly monitored, ground circuit concerns may be interpreted by the PSCM as voltage supply concerns.

When DTC U3003:68 is set, the PSCM reduces steering assist if the voltage is below 11.3 volts. The PSCM reporting **only**DTC U3003:68 **does not** indicate a concern with the EPAS system.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	If the voltage supply to the PSCM falls below 9 volts with the ignition ON, DTC U3003:16 is set. DTC U3003:16 can also set if the vehicle has been recently jump started or the 12-volt battery has been discharged. The 12-volt battery may become discharged due to excessive loads on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.
U3003:17	Battery	If the voltage supply to the PSCM exceeds 16.4 volts for less than 1 second with the

	Voltage: Circuit Voltage Above Threshold	ignition ON, DTC U3003:17 is set. DTC U3003:17 can also set if the vehicle has been recently jump started or the 12-volt battery has been recently charged.
U3003:68	Battery Voltage: Event Information	If the voltage supply to the PSCM is between 9 volts and 11.2 volts, and the PSCM is commanded to provide steering assist greater than the present voltage level allows, DTC U3003:68 is set.

Possible Sources

- Fuses
- Wiring, terminals or connectors
- Charging system concern
- Battery
- PSCM

Visual Inspection and Diagnostic Pre-checks

- Make sure the vehicle battery terminals and cables are free of any corrosion and other contaminants.
- Make sure the vehicle battery terminals are tightened to their correct torque specifications.
- Make sure high current BJB fuse(s) is OK.
- Make sure BJB fuse(s) is OK.

PINPOINT TEST A : U3003:16, U3003:17, U3003:68

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

A1 CHECK FOR KNOWN CONCERNS

- Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to A2

A2 RECHECK THE PSCM (POWER STEERING CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.

Is U3003:16 the only DTC present in the PSCM?

Yes	GO to A3
No	GO to A4

A3 FAULT CONDITION CONFIRMATION

NOTE: *If DTC U3003:13 is present and the steering assist is unaffected, the DTC may have been set due to the battery voltage dropping below the required parameters during engine cranking.*

- Test drive the vehicle and identify any EPAS related symptoms.

Is the vehicle experiencing heavy steering or a lack of steering assist?

Yes	DIAGNOSE the vehicle battery and charging system. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	The system is operating correctly at this time. The DTC may have been set due to the battery voltage dropping below the required parameters during engine cranking.

A4 RETRIEVE ALL CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS) FROM ALL MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is the PCM and at least one other module, in addition to the PSCM, reporting charging system or battery voltage Diagnostic Trouble Codes (DTCs)?

Yes	DIAGNOSE the vehicle battery and charging system. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to A5

A5 CHECK THE BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery Condition Test.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Did the battery pass the condition test?

Yes	GO to A6
No	INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

A6 CHECK THE CHARGING SYSTEM VOLTAGE

- Start the engine.
- Turn off all interior lights, exterior lights and accessories.
- Measure and record the battery voltage.
- Turn on all interior lights, exterior lights and set the HVAC fan to HIGH.
- Measure and record the battery voltage.

Are the recorded voltages between 13 and 15.2 volts?

Yes	GO to A7
No	DIAGNOSE the vehicle charging system. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and

	Testing).

A7 CHECK THE PSCM (POWER STEERING CONTROL MODULE) MODULE SUPPLY VOLTAGE (MOD_SUP_V) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, access and monitor the PSCM MOD_SUP_V PID.
- Turn the steering wheel from lock to lock with the vehicle running and note the MOD_SUP_V PID reading while holding the wheel in a lock position.

Does the MOD_SUP_V PID match the previously recorded loaded battery voltage ±1.5 volts?

Yes	The system is operating correctly at this time. The DTC may have been set due to an intermittent fault in the wiring harness. INSPECT for chaffed wires or other physical damage to the wire harness along the top of the EPAS gear and both PSCM electrical connectors.
No	GO to A8

A8 CHECK THE PSCM (POWER STEERING CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect the battery negative cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Disconnect high current BJB C1617A.
- Disconnect PSCM C1463B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1617B-1	Ω	C1463A-2

Is the resistance less than 0.5 ohms?

Yes	GO to A9
No	INSPECT the high-current BJB fuse (125A). If the fuse is open, REFER to the Wiring Diagrams manual to determine the cause of the circuit short. If the high-current BJB fuse is **not** open, INSPECT the PSCM connectors for corrosion, spread terminals and pushed-out terminals. REPAIR as necessary. If the connectors are OK, REPAIR the circuit.

A9 CHECK THE PSCM (POWER STEERING CONTROL MODULE) GROUND

- Inspect ground for looseness and corrosion.

Are the ground bolt and eyelet tight and free from any corrosion?

Yes	INSPECT the PSCM wiring harness and connectors for damage, corrosion, spread terminals or pushed out pins. If the wiring harness and connectors are OK, REPAIR the PSCM ground circuit.
No	CLEAN and TIGHTEN the ground connection.

Steering Angle Sensor Signal, Steering Shaft Torque Sensor Signal, Motor or Control Module Failure

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operation and Fault Conditions

While the ignition is set to ON and the voltage supply to the PSCM is above 6 volts, the module monitors the motor, steering angle sensor and the 2 steering torque sensors inside the EPAS gear to calculate the relative and actual steering wheel angle. This value is then transmitted to other modules over the HS-CAN2. The PSCM monitors various inputs and outputs of the EPAS system in order to keep the system operating at peak capacity. Information provided by sensors (steering torque, vehicle speed, vehicle travel distance, etc.) are all compared to programmed and learned information. Likewise, outputs like the motor and steering rack (travel) are tested against programmed and learned information.

When DTC C1B00:2F, C200B:61, U3000:41 or U3000:49 is present, the PSCM sends a message to the IPC to display STEERING FAULT SERVICE NOW in the message center.

When DTC U2011:61 is present, the PSCM sends a message to the IPC to display SERVICE POWER STEERING in the message center.

When DTC C1B00:2F is present, the EPAS gear enters a reduced performance mode, the EPAS gear does not automatically assist to return to center after completing a turn.

When DTC C200B:61 or U2011:61 is present, the EPAS gear enters manual steering mode, no electrical power assistance is provided and the steering operation has a heavy feel.

The presence of DTC U3000:49 may or may not affect steering assist. It depends on what other Diagnostic Trouble Codes (DTCs) (if any) are set along with U3000:49. If other Diagnostic Trouble Codes (DTCs) are set along with U3000:49, then power steering assist is affected as described in those DTC fault conditions.

The EPAS gear is very susceptible to water, moisture, dust, rust and other contaminants. If a damaged boot is discovered the inner tie rods and steering rack should be inspected for contamination. If contamination is found a new EPAS gear should be installed. New bellows boots and clamps must be installed whenever they are removed. To avoid unnecessary repairs, address all other Diagnostic Trouble Codes (DTCs) and customer concerns before removing the bellows boots and inspecting the EPAS gear.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
• C1B00:00 • C1B00:2F	• Steering Angle Sensor : No Sub Type Information • Steering Angle Sensor : Signal Error	• If the steering angle calculated by the PSCM does not match other sensor input, DTC C1B00:00 is set. • If the steering angle calculated by the PSCM exceeds a calibrated threshold, DTC C1B00:2F is set.
• C200B:61	• Steering Shaft Torque Sensor 1: Signal Calculation Failure	• If the steering shaft torque sensor signals do not equal 5 volts when combined or if either sensor signal is invalid, DTC C200B:61 is set.
• U2011:61	• Motor: Signal Calculation Failure	• If the difference between the motor position signals exceeds a calibrated threshold, or the calculated motor position is outside allowable tolerances, or the difference between the expected command and the actual command is outside allowable tolerances, DTC U2011:61 is set.
• U3000:41	• Control	• If at any time during normal operation the module detects an internal

• U3000:49	Module: General Checksum Failure • Control Module: Internal Electronic Failure	software error with more than 6 volts supplied to the PSCM, DTC U3000:41 is set. • If at any time during normal operation with more than 6 volts supplied to the PSCM, the module detects a software or internal hardware error then DTC U3000:49 is set.

Possible Sources

- Wiring, terminals or connectors
- EPAS gear
- Inner tie rods
- PSCM

PINPOINT TEST B : STEERING ANGLE SENSOR SIGNAL, STEERING SHAFT TORQUE SENSOR SIGNAL, MOTOR OR CONTROL MODULE FAILURE

B1 CHECK FOR KNOWN CONCERNS

- Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to B2

B2 INSPECT THE EPAS (ELECTRONIC POWER ASSIST STEERING) GEAR WIRING HARNESS

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Ignition OFF.
- Thoroughly inspect the wire harness along the top of the EPAS gear for cuts, breaks and pinched wires.
- **NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.**

  Disconnect PSCM C1463A and C1463B connectors and inspect them for corrosion, pushed-out pins, bent pins and spread terminals.

Is the wire harness undamaged and are connectors in good condition?

Yes	CONNECT PSCM C1463A and C1463B connectors. GO to B3
No	REPAIR the connectors and wiring harness as necessary. REPAIR whatever caused the damage to the wire harness. CONNECT PSCM C1463A and C1463B connectors. GO to B5

B3 INSPECT THE INNER TIE RODS AND STEERING RACK FOR CORROSION

NOTICE: When installing new bellows boots and clamps, apply new lubricant as instructed to prevent water contamination or damage to the EPAS gear may result.

- Remove the outer tie rods and bellows boots.
  REFER to: Tie Rod - LHD (211-02A Power Steering, Removal and Installation).
  REFER to: Tie Rod - RHD (211-02 Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS)) .

  REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).

REFER to: Tie Rod End - RHD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation).

- The following inspection must be carried out on **both** sides of the steering rack:
  - Expose the steering rack by turning the steering wheel in one direction all the way until it stops.
  - Inspect the rack, inner tie rod and gear housing for rust, moisture, corrosion and other signs of harmful contamination.

Is the rack, inner tie rod and gear housing free of moisture, rust, corrosion and other harmful contamination?

Yes	INSTALL the removed outer tie rods and INSTALL new EPAS gear bellows boots with new clamps. REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod - LHD (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod - RHD (211-02 Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS)) . REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod End - RHD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). ADJUST the front toe setting. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures). GO to B4
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

B4 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B.
- Using a good light source, inspect PSCM C1463A and C1463B for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	GO to B5
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

B5 TEST DRIVE TO CHECK FOR RETURNING DIAGNOSTIC TROUBLE CODES (DTCS)

- Connect PSCM C1463A and C1463B.
- Ignition ON.
- Using a diagnostic scan tool, clear the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- **NOTE:** *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.* Test drive the vehicle in the following manner:

- With the engine running, stop the vehicle on an unsealed concrete or asphalt surface (in order to provide adequate friction for a thorough test).
- With the vehicle in DRIVE and the brakes applied, turn the steering wheel from lock-to-lock.
- Return the steering wheel to the center position and move the vehicle forward approximately 32 cm (1 ft).
- With the vehicle in DRIVE and the brakes applied, turn the steering wheel from lock-to-lock.
- Return the steering wheel to the center position and move the vehicle forward approximately 32 cm (1 ft).
- With the vehicle in DRIVE and the brakes applied, turn the steering wheel from lock-to-lock.
- The test drive is complete.

- Select PARK.
- Using a diagnostic scan tool, carry out the PSCM self-test.

Is DTC C1B00:00, C1B00:2F, C200B:61, U2011:61, U3000:41 or U3000:49 present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by loose or corroded connector. ADDRESS the root cause of any connector or wire harness concerns.

C102D:00

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operations and Fault Conditions

The PSCM monitors various inputs and outputs of the EPAS system to keep the system operating at peak capacity. Information provided by sensors (steering torque, motor position, vehicle speed, vehicle travel distance, etc.) are all compared to programmed and learned information. Likewise, outputs like the motor and steering rack (travel) are tested against programmed and learned information. If a concern is detected, the PSCM sets one or more Diagnostic Trouble Codes (DTCs) and sends the appropriate message to the IPC message center.

When DTC C102D:00 is set steering assist is unaffected during the ignition cycle the DTC set. During the next ignition cycle, the EPAS gear enters manual steering mode, no electrical power assistance is provided and the steering operation has a heavy feel. The message center displays STEERING MALFUNCTION SERVICE NOW during the ignition cycle the DTC set and STEERING LOSS STOP SAFELY during the next ignition cycle after the DTC set.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C102D:00	High Friction Inside Power Steering: No Sub Type Information	This DTC sets in the PSCM if the calculated friction value exceeds a predetermined threshold.

Possible Sources

- EPAS gear internal failure

PINPOINT TEST C : C102D:00

C1 CHECK FOR KNOWN CONCERNS
• Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service

Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to C2

C2 CHECK AND RECORD THE LEFT FRONT AND RIGHT FRONT TIRE PRESSURES

- Check and record the left front and right front tire pressures.
- Compare the recorded tire pressure readings with the information on the VC label.

Is the air pressure in the tires correct as indicated on the VC label?

Yes	GO to C3
No	ADJUST the air pressure in the tires. GO to C3

C3 CHECK FOR UNLOADED STEERING RACK TRAVEL FEEL

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Ignition OFF.
- Raise the vehicle until the front wheels no longer touch the ground.
- Rotate the steering wheel from lock-to-lock and inspect the steering rack travel for the following:
  - Abnormal noises
  - Rough spots
  - Sticky spots
  - Tight spots

Is steering rack travel smooth and free of any abnormal noises, rough, sticky and tight spots?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	GO to C5

C4 ISOLATE THE FRONT SUSPENSION COMPONENTS

- Disconnect the outer tie rods from the wheel knuckles.
  REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
  REFER to: Tie Rod End - RHD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
- Rotate the steering wheel from lock-to-lock and inspect the steering rack travel for the following:
  - Abnormal noises
  - Rough spots
  - Sticky spots
  - Tight spots

Is steering rack travel smooth and free of any abnormal noises, rough, sticky and tight spots?

Yes	The condition may be caused by tires, wheel knuckles, ball joints, struts or damaged subframe. ISOLATE the component(s) causing the binding. INSTALL new component(s) as necessary.
No	GO to C5

C5 CHECK THE UNLOADED STEERING COLUMN FEEL

NOTICE: Do not allow the steering column to rotate more than 1 complete revolution in each direction. If the steering column shaft is allowed to rotate more than 1 complete revolution in each direction damage to the clockspring may occur.

- Disconnect the steering column intermediate shaft from the EPAS gear.
  - Discard the bolt.
- Rotate the steering wheel 1 complete revolution in each direction and inspect the steering column travel for the following:
  - Abnormal noises
  - Rough spots
  - Sticky spots
  - Tight spots
- Using a suitable steering wheel holding device, hold the steering wheel in the straight ahead position.

Is steering column travel smooth and free of any abnormal noises, rough, sticky and tight spots?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	GO to C6

C6 INSPECT THE STEERING COLUMN SHAFT U-JOINTS

NOTICE: Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the clockspring may result. If there is evidence that the steering column shaft has rotated, the clockspring must be removed and re-centered.

- Inspect the steering column shaft U-joints for looseness or wear.

Are the steering column shaft U-joints OK?

Yes	CONNECT the steering column shaft to the EPAS gear. INSTALL a new bolt and tighten to specifications. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). DIAGNOSE further possible causes, REFER to: Front Suspension (204-01 Front Suspension, Diagnosis and Testing).
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new steering column shaft. REFER to: Steering Column Lower Shaft (211-04 Steering Column, Removal and Installation).

U0100:00, U0401:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the PCM sends messages to the GWM over the HS-CAN1, the GWM relays these messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON

for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation. For information on the network messages sent to the PSCM by the PCM,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

When DTC U0100:00 is initially set, steering assist remains unaffected. Once the PSCM has detected missing messages from the PCM for at least 200 milliseconds, the PSCM enters the reduced steering assist failure mode, resulting in higher steering efforts during low-speed maneuvering.

When DTC U0401:00 is present the PSCM enters the reduced steering assist failure mode, resulting in higher steering efforts during low-speed maneuvering.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication With ECM / PCM "A": No Sub Type Information	This DTC sets if communications between the PSCM and the PCM fail or if the vehicle speed, engine torque or transmission gear message is missing for more than 200 milliseconds. This can be due to a GWM failure, a PCM failure, a circuit failure on the HS-CAN1, HS-CAN2 or an excessive load on the network.
U0401:00	Invalid Data Received From ECM / PCM "A": No Sub Type Information	This DTC sets if the PSCM receives "fault" or "unknown" messages from the PCM instead of valid gear lever position or valid power pack status messages.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- GWM
- PCM

PINPOINT TEST D : U0100:00, U0401:00

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

D1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Do the PCM and the GWM pass the Network Test?

Yes	GO to D2
No	DIAGNOSE the GWM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). DIAGNOSE the PCM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).

- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0100:00 or U0401:00 retrieved again?

Yes	GO to D3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the recorded Diagnostic Trouble Codes (DTCs) from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	GO to D4

D4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE GWM (GATEWAY MODULE A) SELF-TEST

- Using a diagnostic scan tool, carry out the GWM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to D5

D5 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, carry out the PCM KOEO self-test.

Is DTC P0562 or P0563 present?

Yes	DIAGNOSE the PCM Diagnostic Trouble Codes (DTCs). Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
No	GO to D6

D6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:XX OR U0401:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0100:xx or U0401:xx set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

	REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	GO to D7

D7 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, carry out the ABS module self-test.

Are any ABS DTCs recorded?

Yes	DIAGNOSE the ABS module Diagnostic Trouble Codes (DTCs). REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to D8

D8 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors..
- Disconnect All PCM electrical connectors..
- Disconnect All GWM electrical connectors..
- Disconnect All ABS electrical connectors..
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN1 or HS-CAN2.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0102:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the TCCM module sends messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation. For information on the network messages sent to the PSCM by the TCCM module,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0102:00	Lost Communication with Transfer Case Control Module (TCCM): No Sub Type Information	This DTC sets when communications between the PSCM and the TCCM module fails. This can be due to an TCCM failure, a circuit failure on the HS-CAN2 or an excessive load on the network.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- TCCM

PINPOINT TEST E : U0102:00

E1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the TCCM module pass the Network Test?

Yes	GO to E2
No	DIAGNOSE the TCCM module does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clear the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0102:00 retrieved again?

Yes	GO to E3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

E3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) recorded from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	For Everest, GO to E4 For Ranger, GO to E5

E4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE TCCM (TRANSFER CASE CONTROL MODULE) MODULE SELF-TEST

- Using a diagnostic scan tool, carry out the TCCM module self-test.

Are any Uxxx DTCs recorded?

Yes	DIAGNOSE the TCCM module Diagnostic Trouble Codes (DTCs). REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .
No	GO to E5

E5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0102 SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0102 set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TCCM module.
No	GO to E6

E6 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect TCCM electrical connectors.
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN2.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0121:00, U0415:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the ABS module sends messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation. For information on the network messages sent to the PSCM by the ABS module,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121:00	Lost Communication With Anti-lock Brake System (ABS) Control Module: No Sub Type Information	This DTC sets when communications between the PSCM and the ABS module fails or if the steering wheel compensation angle, wheel speed sensor, traction control active, stability control active or ABS active message is missing for more than 250 milliseconds. This can be due to an ABS module failure, a circuit failure on the HS-CAN2 or an excessive load on the network.
U0415:00	Invalid Data Received From Anti-lock Brake System (ABS) Control Module: No Sub Type Information	This DTC sets if the PSCM receives "fault" or "unknown" messages from the ABS module instead of valid steering wheel compensation angle, wheel speed sensor, traction control active, stability control active or ABS active messages.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- ABS Module

PINPOINT TEST F : U0121:00, U0415:00

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

F1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the ABS module pass the Network Test?

Yes	GO to F2
No	DIAGNOSE the ABS module does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

F2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clear the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0121:00 or U0415:00 retrieved again?

Yes	GO to F3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

F3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) recorded from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	GO to F4

F4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, carry out the ABS module self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the ABS module Diagnostic Trouble Codes (DTCs). REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to F5

F5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121:XX OR U0415:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0121:xx or U0415:xx set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	GO to F6

F6 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect ABS module C135.
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN2.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0140:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the BCM sends messages to the GWM over the HS-CAN1, the GWM relays the messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation. For information on the network messages sent to the PSCM by the BCM,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

The Battery Charger Control Module (BCCM) is an internal component of the BCM.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	This DTC sets when communication between the PSCM and the BCM fails or if the ignition status message, power system status or vehicle configuration message is missing for more than 1000 milliseconds. This can be due to a GWM failure, a BCM failure, a circuit failure on the HS-CAN1, HS-CAN2 or an excessive load on the network.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- GWM
- BCM

PINPOINT TEST G : U0140:00

G1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Do the GWM and the BCM pass the Network Test?

Yes	GO to G2
No	DIAGNOSE the GWM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). DIAGNOSE the BCM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

G2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clean the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.

- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0140:00 retrieved again?

Yes	GO to G3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

G3 REVIEW THE RECORDED CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) recorded from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	GO to G4

G4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE GWM (GATEWAY MODULE A) SELF-TEST

- Using a diagnostic scan tool, carry out the GWM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to G5

G5 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to G6

G6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140:xx set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).

No	GO to G7

G7 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect all BCM electrical connectors.
- Disconnect all GWM electrical connectors.
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN1 or HS-CAN2.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0151:00, U0452:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the RCM sends messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation. For information on the network messages sent to the PSCM by the RCM,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	This DTC sets if communications between the PSCM and the RCM fail or if the vehicle speed, engine torque or transmission gear message is missing for more than 100 milliseconds. This can be due to a RCM failure, a circuit failure on the HS-CAN2 or an excessive load on the network.
U0452:00	Invalid Data Received From Restraints Control Module: No Sub Type Information	This DTC sets if the PSCM receives "fault" or "unknown" messages from the RCM instead of valid vehicle lateral acceleration messages.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- RCM

PINPOINT TEST H : U0151:00, U0452:00

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

H1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the RCM module pass the Network Test?

Yes	DIAGNOSE the RCM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to H2

H2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clear the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0151:00 or U0452:00 retrieved again?

Yes	GO to H3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

H3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) recorded from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	GO to H4

H4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, carry out the RCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to H5

H5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:XX OR U0452:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0151:xx or U0452:xx set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	GO to H6

H6 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect all RCM electrical connectors.
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN2.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0155:00, U0423:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the IPC sends messages to the GWM over the HS-CAN3, the GWM relays these messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	This DTC sets if communications between the PSCM and the IPC fail or if the odometer master value message is missing for more than 1 second. This can be due to a GWMfailure, an IPC failure, a circuit failure on the HS-CAN3, HS-CAN2 or an excessive load on the network.
U0423:00	Invalid Data Received From Instrument Panel Cluster Control Module: No Sub Type Information	This DTC sets if the PSCM receives "fault" or "unknown" message from the IPC instead of valid odometer master value message.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- GWM
- IPC

PINPOINT TEST I : U0155:00, U0423:00

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

I1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Do the GWM and the IPC pass the Network Test?

Yes	GO to I2
No	DIAGNOSE the GWM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). DIAGNOSE the IPC does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

I2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clean the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0155:00 or U0423:00 retrieved again?

Yes	GO to I3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) recorded from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	GO to I4

I4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE GWM (GATEWAY MODULE A) SELF-TEST

- Using a diagnostic scan tool, carry out the GWM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to I5

I5 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, carry out the IPC self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the IPC Diagnostic Trouble Codes (DTCs). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to I6

I6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:XX OR U0423:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0155:xx or U0423:xx set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	GO to I7

I7 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect all IPC electrical connectors.
- Disconnect all GWM electrical connectors.
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN2 or HS-CAN3.
No	REPAIR the affected connectors or terminals.

	Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0159:00, U045A:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the PAM sends messages to the relays these messages to the PSCM over the HS-CAN. For information on the network messages sent to the PSCM by the PAM,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0159:00	Lost Communication With Park Assist Control Module "A": No Sub Type Information	This DTC is set if communication between the PSCM and the PAM fails. The PAM sends various commands to the PSCM along the HS-CAN bus.
U045A:00	Invalid Date Received from Park Assist Control Module "A": No Sub Type Information	This DTC sets if the PSCM receives an "invalid" or "unknown" message from the PAM instead of a valid steering angle request message.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- GWM
- PAM

PINPOINT TEST J : U0159:00, U045A:00

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

J1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the Network Test.

Does the PAM pass the Network Test?

Yes	GO to J2
No	DIAGNOSE the PAM does not respond to the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

J2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Using a diagnostic scan tool, clean the PSCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait at least 15 seconds to allow modules to properly shut down.
- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.

- Retrieve and record the PSCM Diagnostic Trouble Codes (DTCs).

Is DTC U0159:00 or U045A:00 retrieved again?

Yes	GO to J3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J3 REVIEW THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) recorded from the PSCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	GO to Pinpoint Test A
No	GO to J4

J4 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, carry out the PAM self-test.

Are any DTCs recorded?

Yes	DIAGNOSE the PAM Diagnostic Trouble Codes (DTCs). REFER to: Parking Aid (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Diagnosis and Testing).
No	GO to J5

J5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0159:XX OR U045A:XX SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0159:xx or U045A:xx set in 1 or more modules in addition to the PSCM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PAM. REFER to: Parking Assist Control Module (PAM) (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
No	GO to J6

J6 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect all PAM electrical connectors.
- Using a good light source, inspect each connector for the following:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary

- spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN2 or HS-CAN3.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

U0212:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

With the ignition set to ON, the SCCM sends messages to the GWM over the HS-CAN1, the GWM relays these messages to the PSCM over the HS-CAN2. The PSCM monitors the HS-CAN2 when the ignition has been set to ON for more than 5 seconds, when the voltage to the PSCM is greater than 9 volts and when there are no Diagnostic Trouble Codes (DTCs) inhibiting PSCM operation. For information on the network messages sent to the PSCM by the PCM,
REFER to: Power Steering - System Operation and Component Description (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0212:00	Lost Communication With Steering Column Control Module: No Sub Type Information	This DTC sets if communications between the PSCM and the SCCM fail. This can be due to a GWM failure, a SCCM failure, a circuit failure on the HS-CAN1, HS-CAN2 or an excessive load on the network.

Possible Sources

- Wiring, terminals or connectors
- Network communication concern
- GWM
- SCCM

PINPOINT TEST K : U0212:00

K1 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the SCCM pass the network test?

Yes	GO to K2
No	DIAGNOSE no communication with the SCCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

K2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the DTCs

- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3003:16 or U3003:17 recorded?

Yes	DIAGNOSE the GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to K3

K3 RETRIEVE THE RECORDED DTCS ( ) FROM THE SCCM (STEERING COLUMN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to 211-05 Steering Wheel and Column Electrical Components, Diagnosis and Testing
No	GO to K4

K4 RECHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the DTCs
- Wait 10 seconds.
- Using a diagnostic scan tool, check the PSCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0212:00 still present?

Yes	GO to K5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

K5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0212 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory DTCs.

Is DTC U0212:xx set in any other module?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM.
No	GO to K6

K6 VERIFY ALL WIRING CONNECTIONS

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect PSCM C1463A and C1463B electrical connectors.
- Disconnect all SCCM electrical connectors.
- Using a good light source, inspect each connector for the following:

- corrosion - install new connector or terminal and clean the module pins
- damaged or bent pins - install new terminals or pins
- pushed-out pins - install new pins as necessary
- spread terminals - install new terminals as necessary

Are the connectors free of corrosion, damaged pins, bent pins, pushed-out pins and spread terminals?

Yes	The condition that caused the concern is not present at this time. The concern is intermittent and may have been caused by a loose or corroded connector, low battery voltage or an excessive load on the HS-CAN2 or HS-CAN3.
No	REPAIR the affected connectors or terminals. Refer to Wiring Diagrams Cell 5 for schematic and connector information.

Excessive Steering Wheel Play

Normal Operation and Fault Conditions

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Possible Sources

- Steering column shaft fasteners
- Steering column shaft U-joints
- Steering linkage

PINPOINT TEST L : EXCESSIVE STEERING WHEEL PLAY

L1 CHECK FOR KNOWN CONCERNS

- Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to L3

L2 CHECK FOR PSCM (POWER STEERING CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record all PSCM Diagnostic Trouble Codes (DTCs).

Are there any Diagnostic Trouble Codes (DTCs) present in the PSCM?

Yes	DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs) before diagnosing any steering assist symptoms. GO to the DTC Chart: PSCM.
No	If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If there are no Diagnostic Trouble Codes (DTCs) present in the PSCM, GO to L3

L3 CHECK THE STEERING COLUMN SHAFT FASTENERS

- Inspect the steering column shaft fasteners for looseness.

Are the steering column shaft fasteners OK?

Yes	GO to L4
No	TIGHTEN the steering column shaft fasteners to specifications. REFER to: Steering Column (211-04 Steering Column, Removal and Installation).

L4 CHECK THE STEERING COLUMN SHAFT U-JOINTS

NOTICE: Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the clockspring may result. If there is evidence the steering column shaft has rotated, the clockspring must be removed and recentered.

- Disconnect the steering column intermediate shaft from the EPAS gear.
  - Discard the bolt.
- Inspect the steering column shaft U-joints for looseness.

Are the steering column shaft U-joints OK?

Yes	CONNECT the steering column shaft to the EPAS gear. INSTALL a new bolt and tighten to specifications. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). INSPECT the tie rods and ball joints. For tie rods, GO to Pinpoint Test O For ball joints, REFER to the Ball Joint Inspection Component Test. REFER to: Front Suspension (204-01 Front Suspension, Diagnosis and Testing).
No	INSTALL a new steering column shaft assembly. REFER to: Steering Column Lower Shaft (211-04 Steering Column, Removal and Installation). REFER to: Steering Column Upper Shaft (211-04 Steering Column, Removal and Installation).

Poor Returnability, Sticky Steering, Lack of Assist or Inconsistent Assist

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operation and Fault Conditions

With a fully charged battery and the ignition ON, the EPAS system provides adequate assist to maneuver the vehicle and returns to the straight-ahead position with little difficulty. The assist provided by the EPAS system should be smooth and consistent at all times. The steering and suspension components should be free of any binding conditions and should not interfere with the steering assist provided by the EPAS system.

If the steering wheel is held at lock end for more than 2 seconds the EPAS system noticeably reduces steering assist. This is a normal condition programmed into the PSCM to protect the system from permanent damage.

It is important to know the difference between lack of assist or inconsistent assist and poor returnability or sticky steering.

- Poor returnability or sticky steering is used to describe how the steering wheel returns to center after a turn or steering correction is completed.
- Lack of assist or inconsistent assist (also known as hard steering) is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn or occur near the end of a turn.

Possible Sources

- Fuses

- Wiring, terminals or connectors
- Under inflated or mismatched tires
- EPAS gear internal failure
- Inner tie rods
- Outer tie rods
- Misaligned steering column shrouds
- Binding lower steering column shaft coupling or U-joint
- Loose, worn or damaged steering linkage
- Binding suspension components
- Binding EPAS gear bearing
- Binding steering column shaft dash panel seal

PINPOINT TEST M : POOR RETURNABILITY, STICKY STEERING, LACK OF ASSIST OR INCONSISTENT ASSIST

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM which can not be cleared and result in the need to install a new EPAS gear.

M1 CHECK FOR KNOWN CONCERNS

- Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to M2

M2 CHECK FOR PSCM (POWER STEERING CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record all PSCM Diagnostic Trouble Codes (DTCs).

Are there any Diagnostic Trouble Codes (DTCs) present in the PSCM?

Yes	DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs) before diagnosing any steering assist symptoms. GO to the DTC Chart: PSCM.
No	If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If there are no Diagnostic Trouble Codes (DTCs) present in the PSCM, GO to M3

M3 CONFIRM THE CONDITION WHILE STATIONARY

- Start the engine.
- With the transmission in PARK, turn the steering wheel to the left and the right to confirm if a sticky or binding feel condition exists.

Does the steering have a sticky or binding feeling when turning the steering wheel?

Yes	GO to M5
No	GO to M4

M4 CONFIRM THE CONDITION WHILE DRIVING

NOTE: *It may be necessary to drive the vehicle up to 16 km (10 miles) to experience the condition.*

NOTE: *It may be necessary to test drive a similar vehicle in a similar fashion and compare the test drive results.*

- Test drive the vehicle above 73 km/h (45 mph). Drive straight, make only small turns (10 degrees or less) of the steering wheel. Stay within your lane and check for any stickiness or binding while turning the steering wheel.

Does the steering have a sticky or binding feeling when turning the steering wheel?

Yes	GO to M5
No	CONSULT the customer for clarification on the concern.

M5 CHECK CHARGING SYSTEM VOLTAGE

- Start the engine.
- With the vehicle running, turn the steering wheel from lock-to-lock and take the voltage measurement while holding the wheel in a lock position.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Battery Positive Terminal		Battery Negative Terminal

- Using a diagnostic scan tool, monitor the PSCM module supply voltage (MOD_SUP_V) PID.
- Turn the steering wheel from lock to lock with the vehicle running and note the PID reading while holding the wheel in a lock position.

Is the battery voltage greater than 13 volts and does the PID match battery voltage ±1.5 volts?

Yes	GO to M6
No	GO to M9

M6 INSPECT STEERING SYSTEM, TIRES, SUSPENSION AND WIRING

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Start the engine.
- While turning the steering wheel from side to side, inspect the following for binding, excessive play or damage:
  - steering wheel-to-steering shrouds
  - steering shaft-to-dash panel seal
  - steering shaft U-joints
  - misplaced carpet or mats
  - foreign material or debris on steering parts or steering joints
  - EPAS gear bellows boots
  - tie-rod ends
- Inspect the front suspension joints and components for:
  - free movement
  - free of rust
- Inspect all 4 tires for:
  - correct air pressure per the VC label
  - being the correct size per the VC label
  - being the same size
- Ignition OFF.
- **NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM that can not be cleared and result in the need to install a new EPAS gear.**

  Disconnect PSCM C1463A and C1463B.
- Inspect the condition of the following electrical components:

- High-current BJB fuse (125A)
- PDB fuse (10A)
- PSCM electrical connectors

Did all items listed pass the inspection?

Yes	GO to M7
No	CLEAN, ADJUST or INSTALL new, the component or components that failed the inspection. DRIVE the vehicle as directed in Step 4 to confirm the condition has been eliminated.

M7 ISOLATE AND INSPECT THE EPAS (ELECTRONIC POWER ASSIST STEERING) GEAR

- Using a suitable steering wheel holding device, hold the steering wheel in the straight ahead position.
- Disconnect the steering column intermediate shaft from the EPAS gear.
  - Discard the bolt.
- Raise the vehicle until the front wheels no longer touch the ground.
- **NOTICE: Turning the front wheels by hand too quickly may cause internal damage to the EPAS gear. Do not use excessive force while turning the front wheels.**

  Using hand force only, carefully turn the front wheels side to side and check for a sticky condition or a binding condition.

Does the steering have a sticky or binding feeling when turning the front wheels?

Yes	CONNECT the steering column shaft to the EPAS gear. INSTALL a new bolt and tighten to specifications. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). GO to M8
No	REPAIR or INSTALL new steering column components as necessary to repair the binding condition. DRIVE the vehicle as directed in Step 4 to confirm the condition has been eliminated.

M8 ISOLATE THE WHEEL KNUCKLES AND BALL JOINTS

NOTE: ***Do not*** *disconnect the EPAS gear from the steering column.*

- Isolate the EPAS gear from the steering knuckles.
- Turn the steering wheel through the full range of motion (lock-to-lock).

Does the steering have a sticky or binding feeling when turning the steering wheel?

Yes	INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). DRIVE the vehicle as directed in Step 4 to confirm the condition has been eliminated.
No	The condition may have been caused by tires, wheels, wheel knuckles or ball joints. ISOLATE the component or components causing the condition. REPAIR or INSTALL new as necessary. DRIVE the vehicle as directed in Step 4 to confirm the condition has been eliminated.

M9 CHECK THE BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery Condition Test.

REFER to: Battery (414-01 Battery, Mounting and Cables) .

Did the battery pass the condition test?

Yes	GO to M10
No	INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

M10 CHECK THE CHARGING SYSTEM VOLTAGE

- Start the engine.
- Turn off all interior lights, exterior lights and accessories.
- Measure and record the battery voltage.
- Turn on all interior lights, exterior lights and set the HVAC fan to HIGH.
- Measure and record the battery voltage.

Are the recorded voltages between 13 and 15.2 volts?

Yes	GO to M11
No	DIAGNOSE the vehicle battery and charging system. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).

M11 CHECK THE PSCM (POWER STEERING CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

NOTICE: The ignition must be set to OFF when disconnecting PSCM electrical connectors. Failure to follow this direction may lead to Diagnostic Trouble Codes (DTCs) being set in the PSCM that can not be cleared and result in the need to install a new EPAS gear.

- Ignition OFF.
- Disconnect the battery negative cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Disconnect high current BJB C1617B.
- Disconnect PSCM C1463A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1617K-1	Ω	C1463B-2

Is the resistance less than 0.5 ohms?

Yes	GO to M12
No	INSPECT the PSCM connectors for corrosion, spread terminals and pushed-out terminals. REPAIR as necessary. If the connectors are OK, REPAIR the circuit.

M12 CHECK THE PSCM (POWER STEERING CONTROL MODULE) GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1463B-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to M13
No	INSPECT the PSCM ground eyelet for looseness and corrosion, Refer to Wiring Diagrams Cell 10 for schematic and connector information. CLEAN and TIGHTEN as necessary. If the PSCM ground is OK, REPAIR the circuit.

M13 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Disconnect and inspect both PSCM C1463A and C1463B electrical connectors (if not previously disconnected).
- Repair:
  - corrosion - install new connector or terminal and clean the module pins
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
  - spread terminals - install new terminals as necessary
- Connect PSCM C1463A and C1463B, make sure the connectors seat and latch correctly.
- Connect the positive battery cable.
  REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Steering Wheel is Off Center, Steering System Pull, Drift, Wander

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operation and Fault Conditions

The EPAS system is designed to compensate for some steering issues (drift, pull, wander, etc.). If the steering issue is severe enough the steering wheel may become off center due to system compensation. The system starts compensating when vehicle speed exceeds 40 km/h (25 mph) and the vehicle is traveling straight. The system compensates on any road crown condition; however, some amount of pull is present during, and shortly after, quick lane transitions. After driving straight on a constant road crown with both hands on the steering wheel for at least 45 seconds, the pull condition can be assessed. The system does not compensate when turning at low speeds. For the system to compensate, the driver's hands must remain on the steering wheel.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

Pull is described as a tugging sensation on the steering wheel felt by the driver, which must be overcome to keep the vehicle going straight.

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

A vehicle-related drift or pull, on a flat road, can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.

Drift or pull can be induced by conditions external to the vehicle, such as wind or road camber.

Possible Sources

- Alignment
- Tires
- EPAS gear mounts
- Steering column shaft U-joints
- Steering column
- Suspension components
- EPAS gear

PINPOINT TEST N : STEERING WHEEL IS OFF CENTER, STEERING SYSTEM PULL, DRIFT, WANDER

N1 CHECK FOR KNOWN CONCERNS

- Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to N2

N2 CHECK FOR PSCM (POWER STEERING CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record all PSCM Diagnostic Trouble Codes (DTCs).

Are there any Diagnostic Trouble Codes (DTCs) present in the PSCM?

Yes	DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs) before diagnosing any steering assist symptoms. GO to the DTC Chart: PSCM.
No	If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If there are no Diagnostic Trouble Codes (DTCs) present in the PSCM, GO to N3

N3 VEHICLE DRIFT PULL EVALUATION

NOTE: *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

- Test drive the vehicle in the following manner:
  - Drive straight on a constant right road crown, at a speed greater than 40 km/h (25 mph), with both hands on the steering wheel for more than 45 seconds.
  - Drive straight on a constant left road crown, at a speed greater than 40 km/h (25 mph), with both hands on the steering wheel for more than 45 seconds.
  - Drive straight on a road with constant minimal road crown, at a speed greater than 40 km/h (25 mph), with both hands on the steering wheel for greater than 45 seconds.
- If the vehicle pulls left on a left crown, pulls right on a right crown and does not pull on flat (no crown) roads when driven as instructed above, the EPAS system is performing as designed.

Is the EPAS system performing as designed?

Yes	RETURN the vehicle to the customer and EXPLAIN the pull-drift compensation operation to the customer.
No	GO to N4

No	GO to N4

N4 CHECK THE STEERING WHEEL INSTALLATION

- Remove the steering wheel.
  REFER to: Steering Wheel (211-04 Steering Column) .
- Verify that the steering wheel connection is not bent or twisted and the steering wheel has been correctly installed.

Is the steering wheel connection undamaged and has the steering wheel been correctly installed?

Yes	GO to N5
No	REINSTALL or INSTALL new components (steering wheel or steering column) as necessary.

N5 CHECK FOR UNEVENLY LOADED VEHICLE

- Visually check the vehicle for an uneven loading condition.

Is the vehicle unevenly loaded?

Yes	ADVISE the customer of the uneven loading condition.
No	GO to N6

N6 CHECK THE TIRE PRESSURES AND CONDITIONS

- Check the tire pressures. Refer to the VC label.
- Check the tires for uneven and abnormal wear.
  REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).

Are the tire pressures and tire conditions OK?

Yes	GO to N7
No	ADJUST the tire pressures to the specified pressure or INSTALL new tires as necessary. REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

N7 ISOLATE TIRE DRIFT PULL CONDITION

- Cross the front wheel and tire assemblies from left-to-right.
  REFER to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
- **NOTE:** *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

  Test drive the vehicle in the following manner:
  - Drive straight on a constant right road crown, at a speed greater than 40 km/h (25 mph), with both hands on the steering wheel for more than 45 seconds.
  - Drive straight on a constant left road crown, at a speed greater than 40 km/h (25 mph), with both hands on the steering wheel for more than 45 seconds.
  - Drive straight on a road with constant minimal road crown, at a speed greater than 40 km/h (25 mph), with both hands on the steering wheel for greater than 45 seconds.

Does the vehicle drift or pull?

Yes	If the vehicle drifts or pulls in the same direction, GO to N8 If the vehicle drifts or pulls in the opposite direction, tire forces are causing the drift or pull. DIAGNOSE the tire concern, REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).
No	Tire forces were causing the drift or pull concern. The concern has been corrected.

N8 CHECK FOR BRAKE DRAG

N8 CHECK FOR BRAKE DRAG

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Spin all 4 wheel and tire assemblies by hand and check for brake drag.

Do the wheels spin freely?

Yes	GO to N9
No	DIAGNOSE the brake drag condition, REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

N9 CHECK THE WHEEL ALIGNMENT

- Using alignment equipment and the manufacturer's instructions, check the wheel alignment.

Is the wheel alignment within specification?

Yes	GO to N10
No	ADJUST the alignment as necessary. REFER to: Front Suspension (204-01 Front Suspension, Diagnosis and Testing).

N10 CHECK THE EPAS (ELECTRONIC POWER ASSIST STEERING) GEAR MOUNT FASTENERS

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Check the EPAS gear for loose fasteners.
  REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
  REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Are the EPAS gear fasteners OK?

Yes	GO to N11
No	INSTALL new fasteners and TIGHTEN to specification. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

N11 CHECK THE STEERING COLUMN SHAFT FASTENERS

- Verify the steering column shaft rotates freely and is not grounded against other vehicle components.

Does the steering shaft rotate freely and is it free from grounding against other components?

Yes	GO to N12
No	REPAIR or INSTALL new components as necessary. REFER to: Steering Column (211-04 Steering Column, Removal and Installation).

N12 INSPECT THE STEERING COLUMN SHAFT U-JOINTS

NOTICE: Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the clockspring may result. If there is evidence the steering column shaft has rotated, the clockspring must be removed and recentered.

- Disconnect the lower steering shaft from the EPAS gear.
  - Discard the bolt.

- Inspect the steering column shaft upper and lower U-joints for looseness.

Are the steering column shaft U-joints OK?

Yes	CONNECT the steering column shaft to the EPAS gear. INSTALL a new bolt and tighten to specifications. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). DIAGNOSE further possible causes of pulling, drifting or wandering. REFER to: Front Suspension (204-01 Front Suspension, Diagnosis and Testing).
No	INSTALL a new steering column shaft assembly. REFER to: Steering Column Lower Shaft (211-04 Steering Column, Removal and Installation). REFER to: Steering Column Upper Shaft (211-04 Steering Column, Removal and Installation).

Shimmy Or Feedback

Normal Operation and Fault Conditions

The tie rods connect the EPAS gear to the wheel knuckles. There should be very little to no vertical or lateral movement in the inner and outer tie rod studs or sockets. Some rotational movement is acceptable.

Possible Sources

- Steering column shaft coupling bolts loose
- Steering column shaft joints damaged or worn
- EPAS gear mounting bolts loose
- EPAS gear insulators damaged
- Inner tie rods
- Outer tie rods

PINPOINT TEST O : SHIMMY OR FEEDBACK

O1 CHECK FOR KNOWN CONCERNS

- Using the VIN, check OASIS for any applicable Technical Service Bulletins (TSBs) or Special Service Messages (SSMs).

Are there any Technical Service Bulletins (TSBs) or Special Service Messages (SSMs) relating to the customer concern?

Yes	DISCONTINUE this test and FOLLOW the TSB or Special Service Message (SSM) instructions.
No	GO to O2

O2 CHECK FOR PSCM (POWER STEERING CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record all PSCM Diagnostic Trouble Codes (DTCs).

Are there any Diagnostic Trouble Codes (DTCs) present in the PSCM?

Yes	DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs) before diagnosing any steering NVH symptoms. GO to the DTC Chart: PSCM.
No	If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis

	and Testing). If there are no Diagnostic Trouble Codes (DTCs) present in the PSCM, GO to O3

O3 CHECK THE STEERING COLUMN SHAFT FASTENERS

- Verify the steering column mounting bolts are installed and tightened to the correct specifications.
  REFER to: Steering Column (211-04 Steering Column, Removal and Installation).
- Verify the steering column intermediate shaft-to-EPAS gear lower shaft bolt and upper shaft bolt is installed and tightened to the correct specification.
  REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
  REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Are the fasteners installed and tightened to the correct specification?

Yes	GO to O4
No	INSTALL or TIGHTEN the fasteners as necessary. For the steering column mounting bolts, REFER to: Steering Column (211-04 Steering Column, Removal and Installation). For the steering column intermediate shaft-to-EPAS gear upper shaft and lower shaft bolts, REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

O4 CHECK THE STEERING COLUMN SHAFT U-JOINTS

- Inspect the steering column shaft U-joints for looseness.

Are the steering column shaft U-joints OK?

Yes	GO to O5
No	INSTALL a new steering column shaft assembly. REFER to: Steering Column Lower Shaft (211-04 Steering Column, Removal and Installation). REFER to: Steering Column Upper Shaft (211-04 Steering Column, Removal and Installation).

O5 CHECK THE EPAS (ELECTRONIC POWER ASSIST STEERING) GEAR ISOLATORS AND MOUNTING BOLTS

- With the transmission in NEUTRAL, position the vehicle on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Verify the EPAS gear mounting bolts are present and tightened to the correct specification.
  REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
  REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Are the EPAS gear isolators present and undamaged and are the mounting bolts present and tightened to the correct specification?

Yes	GO to O6
No	TIGHTEN the EPAS gear mounting bolts to specification or INSTALL new bolts as necessary. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic

	Power Assist Steering (EPAS), Removal and Installation).

O6 CHECK THE INNER AND OUTER TIE RODS FOR MOVEMENT

NOTICE: When installing new bellows boots and clamps, apply new lubricant as instructed to prevent water contamination or damage to the EPAS gear may result.

- Remove the EPAS gear bellows boots.
  REFER to: Tie Rod - LHD (211-02A Power Steering, Removal and Installation).
  REFER to: Tie Rod - RHD (211-02 Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS)) .
  REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation).
- **Using hand force only**, check the inner and outer tie rods for vertical and lateral movement in the tie-rod ball studs and sockets.

Are the inner and outer tie rods free from any vertical or lateral movement?

Yes	GO to O7
No	INSTALL a new inner or outer tie rod as necessary and INSTALL new EPAS gear bellows boots with new clamps. REFER to: Tie Rod - LHD (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod - RHD (211-02 Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS)) . REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation).

O7 INSPECT THE INNER TIE RODS AND STEERING RACK FOR CORROSION

NOTICE: When installing new bellows boots and clamps, apply new lubricant as instructed to prevent water contamination or damage to the EPAS gear may result.

- Remove the outer tie rods.
  REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
  REFER to: Tie Rod End - RHD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
- The following inspection must be carried out on **both** sides of the steering rack:
  - Expose the steering rack by turning the steering wheel in one direction all the way until it stops.
  - Inspect the rack, inner tie rod and gear housing for rust, moisture, corrosion and other signs of harmful contamination.

Is the rack, inner tie rod and gear housing free of moisture, rust, corrosion and other harmful contamination?

Yes	INSTALL the removed outer tie rods and INSTALL new EPAS gear bellows boots with new clamps. REFER to: Tie Rod - LHD (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod - RHD (211-02 Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS)) . REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation). ADJUST the front toe setting. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures). The condition may be caused by wheel and tire runout. REFER to: Wheels and Tires (204-04A Wheels and Tires, Diagnosis and Testing).
No	INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Grinding Noise Or Gravely Feel

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operation and Fault Conditions

The EPAS gear is very susceptible to water, moisture, dust, rust and other contaminants. If a damaged boot is discovered, the inner tie rods and steering rack should be inspected for contamination. If contamination is found, a new EPAS gear should be installed. New bellows boots and clamps must be installed whenever they are removed. To avoid unnecessary repairs, address all other Diagnostic Trouble Codes (DTCs) and customer concerns before removing the bellows boots and inspecting the steering gear.

Possible Sources

- EPAS gear bellows boot
- Inner tie rod
- EPAS gear internal failure

PINPOINT TEST P : GRINDING NOISE OR GRAVELY FEEL

P1 CHECK FOR KNOWN CONCERNS

- Ignition ON.
- Using a diagnostic scan tool, carry out the PSCM self-test.
- CHECK OASIS for any applicable steering system Technical Service Bulletins (TSBs).

Are there any Diagnostic Trouble Codes (DTCs) present or are there any applicable Technical Service Bulletins (TSBs)?

Yes	DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs) before diagnosing this symptom. GO to the DTC Chart: PSCM. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions.
No	GO to P2

P2 CHECK FOR PSCM (POWER STEERING CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PSCM self-test.
- Retrieve and record all PSCM Diagnostic Trouble Codes (DTCs).

Are there any Diagnostic Trouble Codes (DTCs) present in the PSCM?

Yes	DIAGNOSE all PSCM Diagnostic Trouble Codes (DTCs) before diagnosing any steering NVH symptoms. GO to the DTC Chart: PSCM.
No	If the diagnostic scan tool cannot communicate with the PSCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If there are no Diagnostic Trouble Codes (DTCs) present in the PSCM, GO to P3

P3 INSPECT THE INNER TIE RODS AND STEERING RACK FOR CORROSION

NOTICE: When installing new bellows boots and clamps, apply new lubricant as instructed to prevent water contamination or damage to the EPAS gear may result.

- Remove the outer tie rods and bellows boots.
  REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
  REFER to: Tie Rod End - RHD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
  REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation).
- The following inspection must be carried out on **both** sides of the steering rack:
  - Expose the steering rack by turning the steering wheel in one direction all the way until it stops.
  - Inspect the rack, inner tie rod and gear housing for rust, moisture, corrosion and other signs of harmful

contamination.

Is the rack, inner tie rod and gear housing free of moisture, rust, corrosion and other harmful contamination?

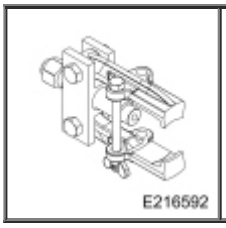
Yes	INSTALL the removed outer tie rods and INSTALL new EPAS gear bellows boots with new clamps. REFER to: Tie Rod - LHD (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod - RHD (211-02 Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS)) . REFER to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation). REFER to: Tie Rod End - RHD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear Boot (211-02A Power Steering, Removal and Installation). ADJUST the front toe setting. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures). The condition may be caused by ball joints, wheel knuckles, steering column or steering column shrouds. INSPECT the suspension components and REPAIR or INSTALL new as necessary. REFER to: Front Suspension (204-01 Front Suspension, Diagnosis and Testing). INSPECT the steering column or steering column shrouds and REPAIR or INSTALL new as necessary. REFER to: Steering Column (211-04 Steering Column, Removal and Installation).
No	INSTALL a new EPAS gear. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Copyright © 2016 Ford Motor Company

Steering Gear - LHD RWD

Base Part Number: 3D080

Special Tool(s) / General Equipment

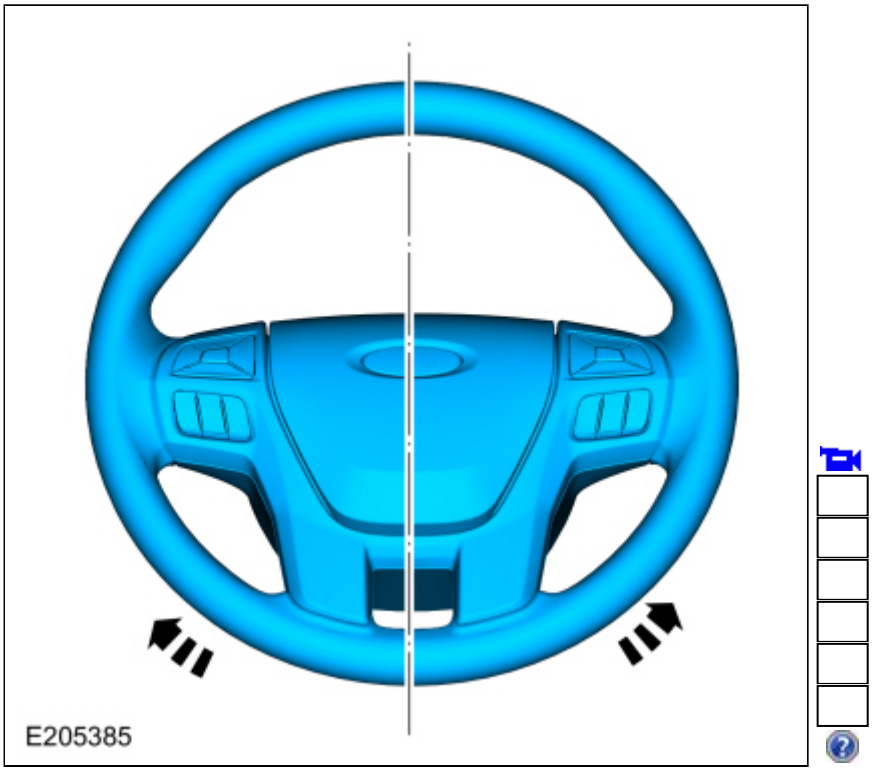
 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

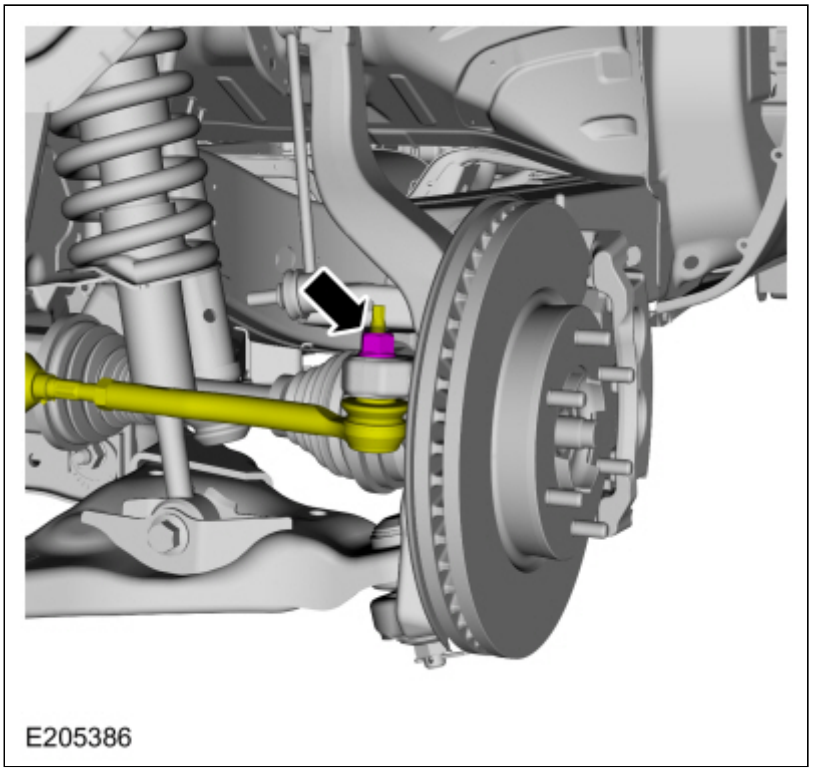
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Disconnect the battery ground cable anytime the steering linkage is being serviced or damage to the steering gear may occur resulting in steering gear replacement.**

   Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .
3. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*



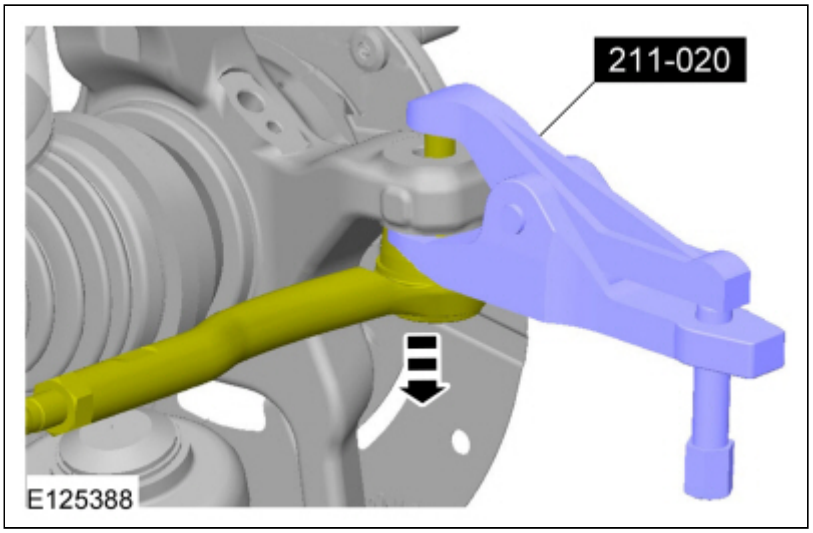
4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. *Torque*: 63 Nm



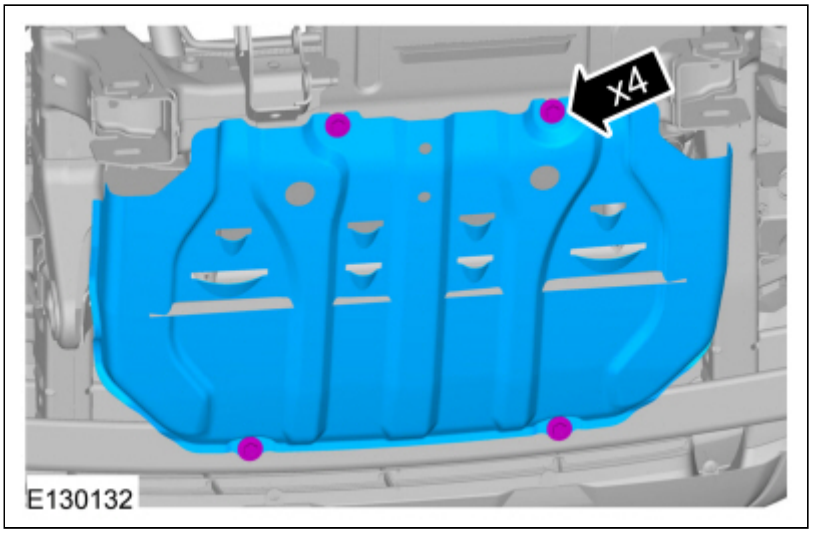
6. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

   NOTICE: Use care when installing the tie rod separator or damage to the outer tie-rod end boot may occur.

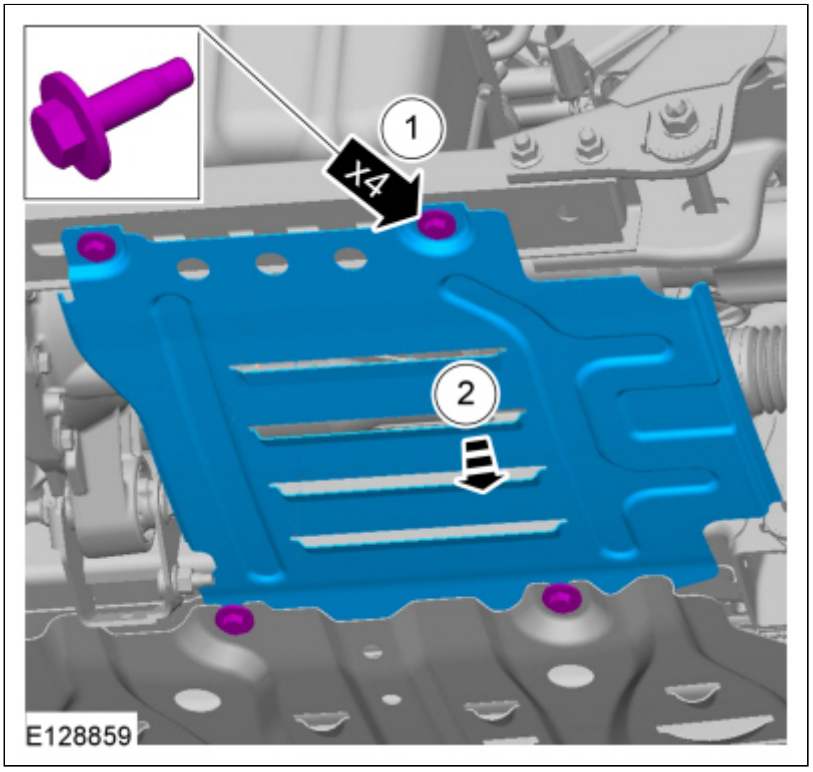
   Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



7. *Torque*: 30 Nm

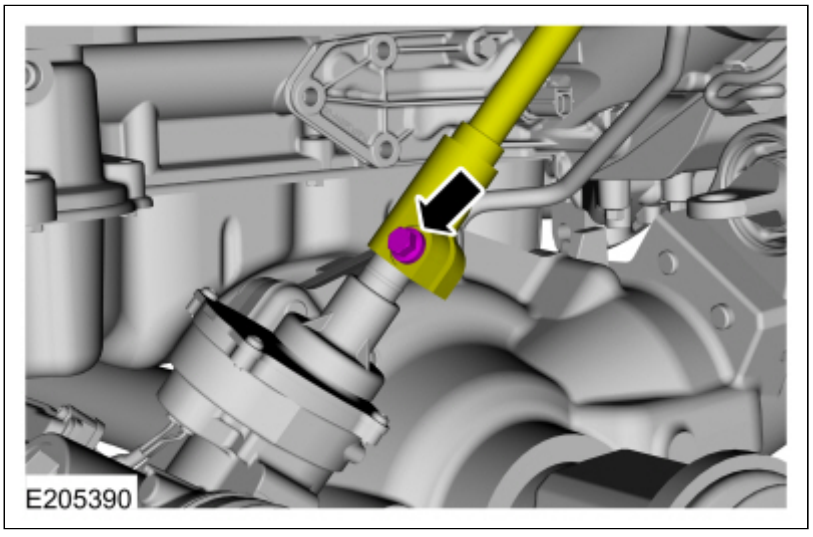


8. *Torque*: 30 Nm

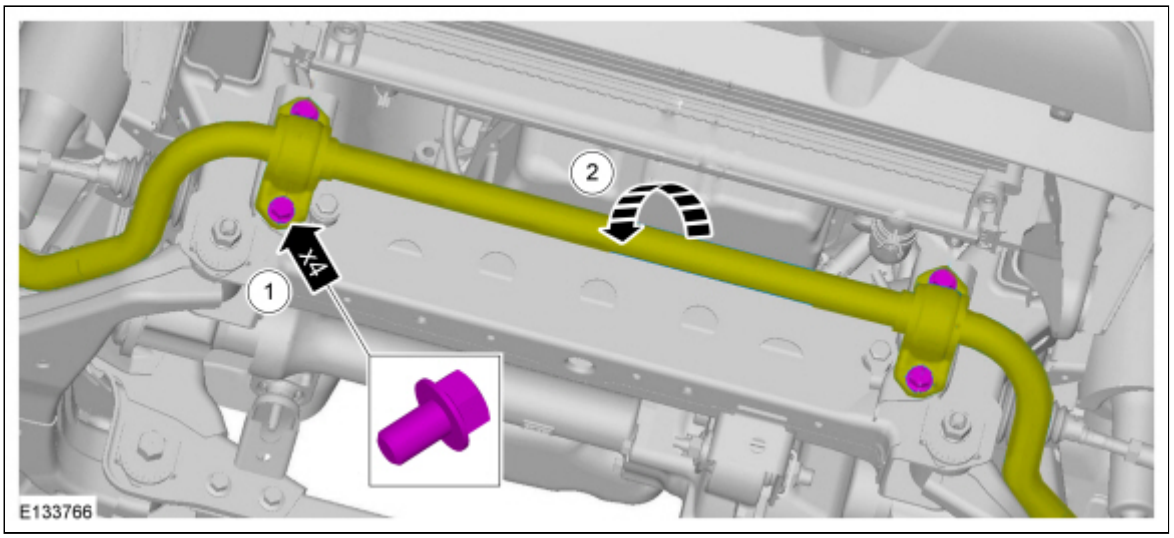


9. **NOTICE: Make sure that a new bolt is installed.**

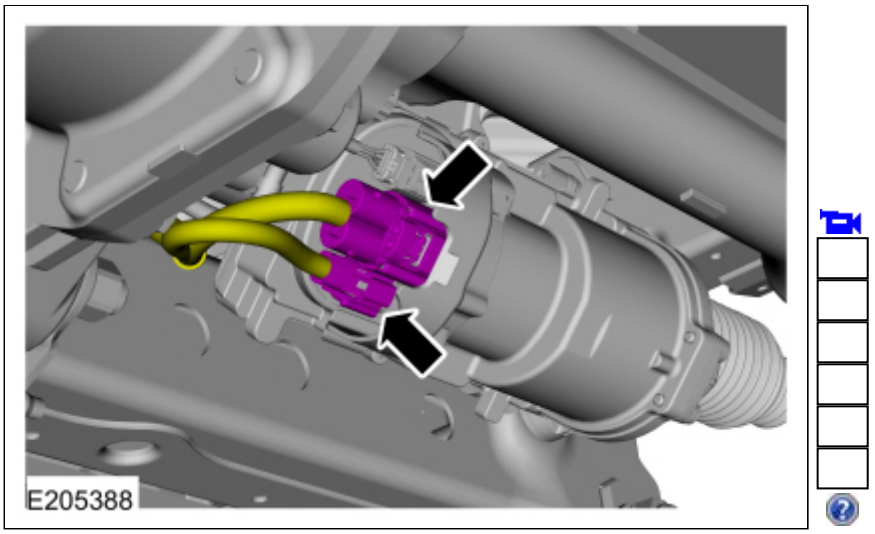
   Torque: 23 Nm



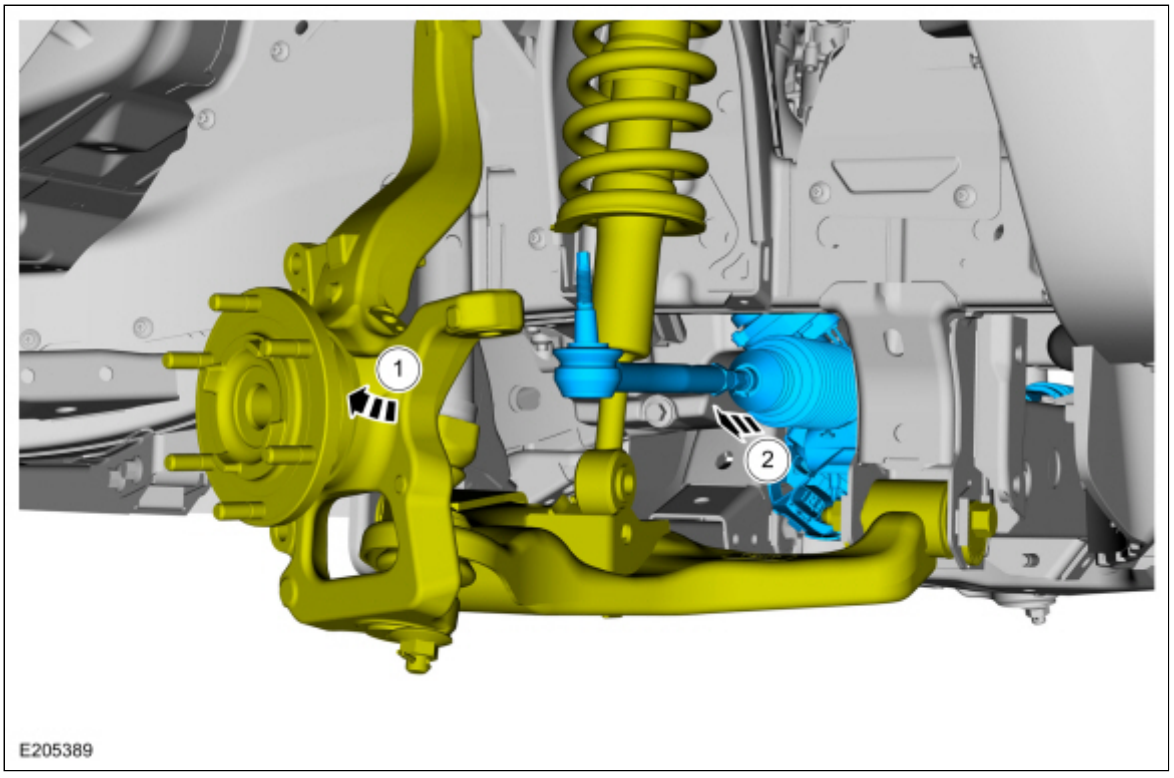
10. *Torque*: 90 Nm



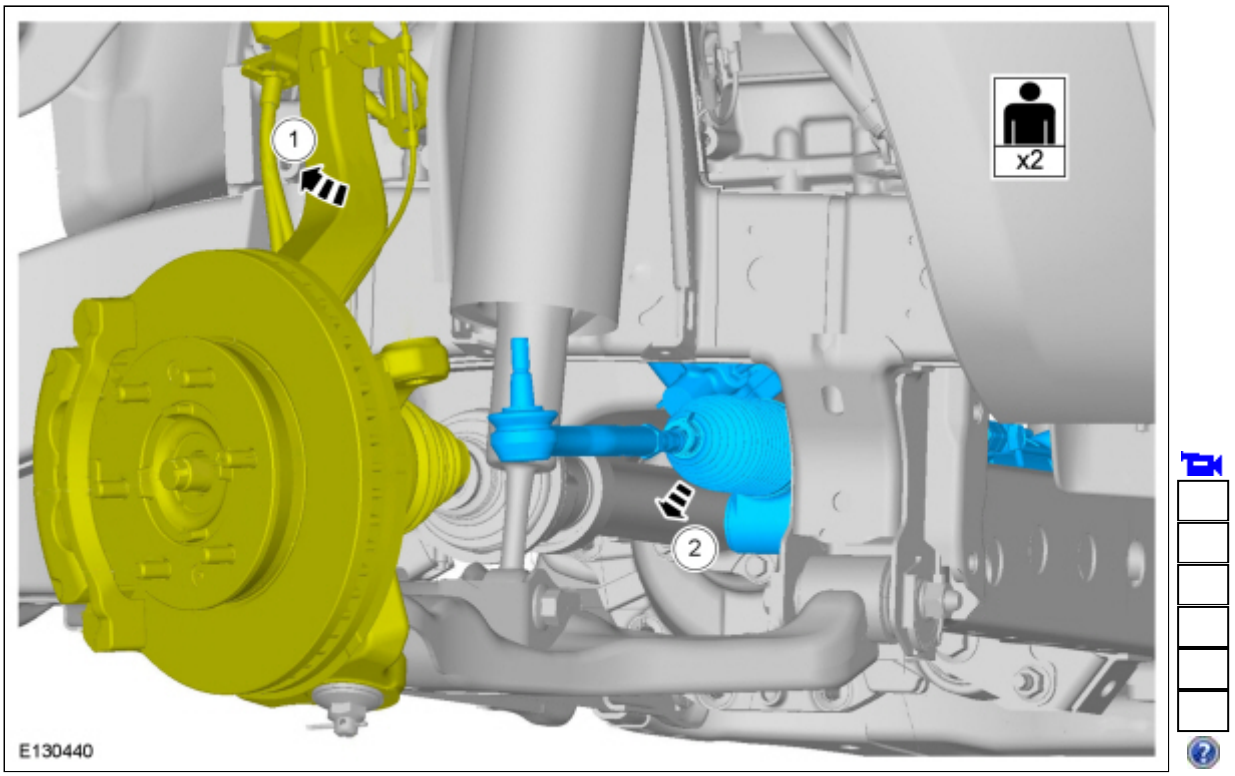
11.



12. *Torque*: 165 Nm



13.



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary when installing a new component.*

   Reset the EPAS system with IDS tool
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .
5. Check and if necessary, adjust front toe.
   Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Steering Gear - LHD 4WD

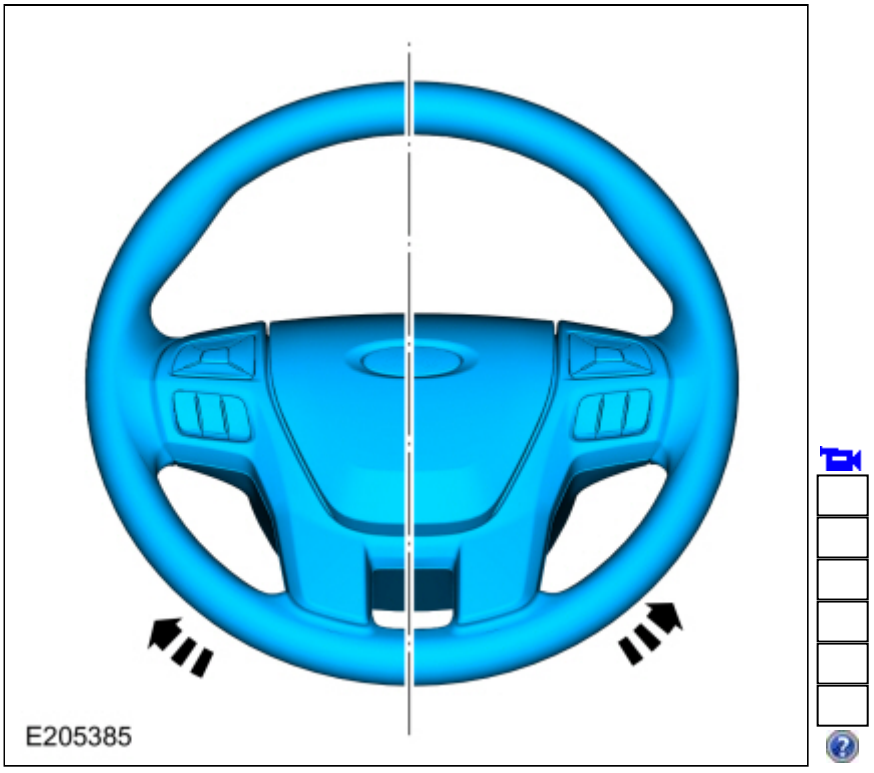
Base Part Number: 3D080

Removal

NOTICE: Disconnect the battery ground cable anytime the steering linkage is being serviced or damage to the steering gear may occur resulting in steering gear replacement.

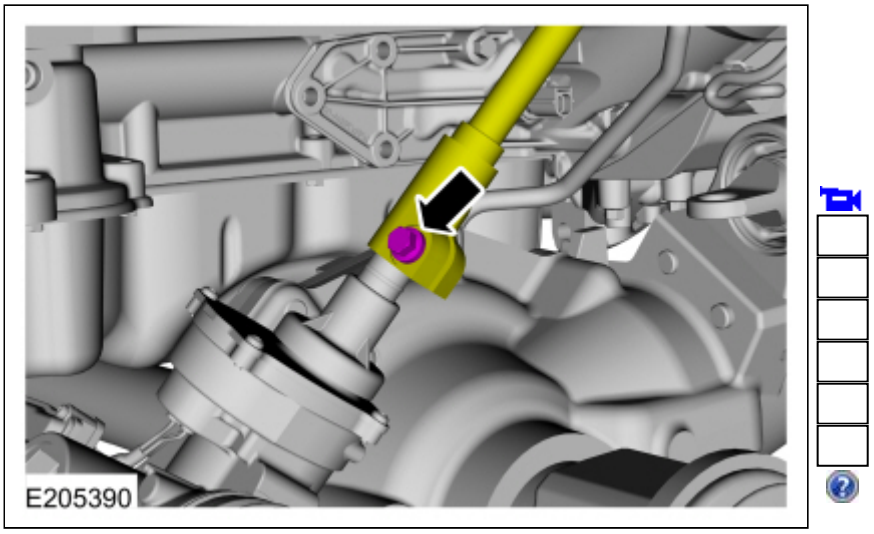
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .
3. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*

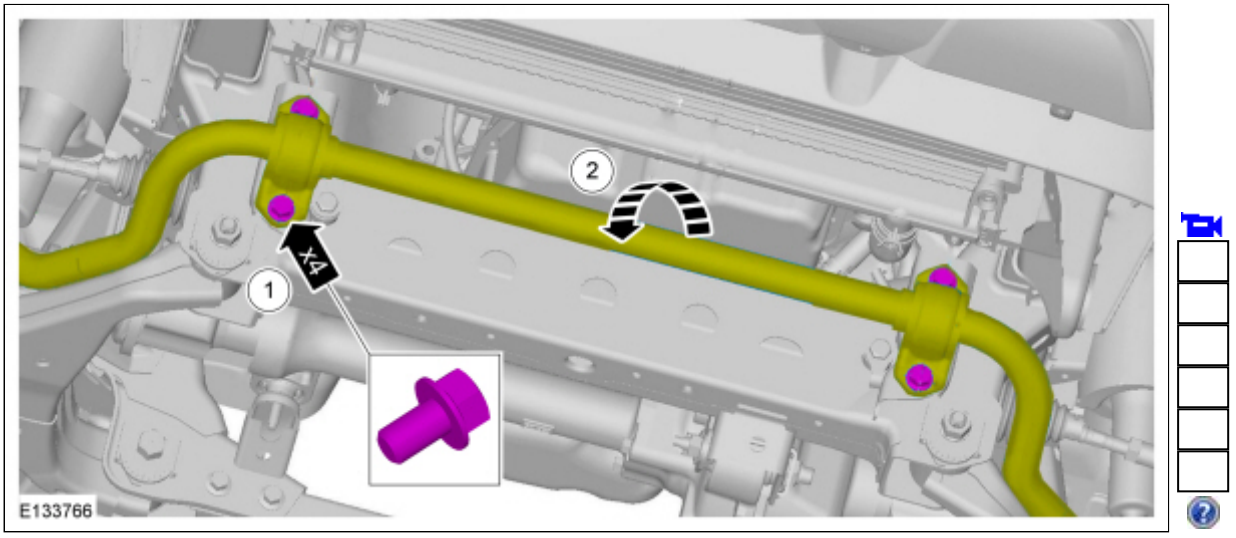


4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Refer to: Axle Assembly - Vehicles Built Up To: 16-08-2015 (205-03 Front Drive Axle/Differential) .
6. **NOTE:** *Make sure that a new bolt is installed.*

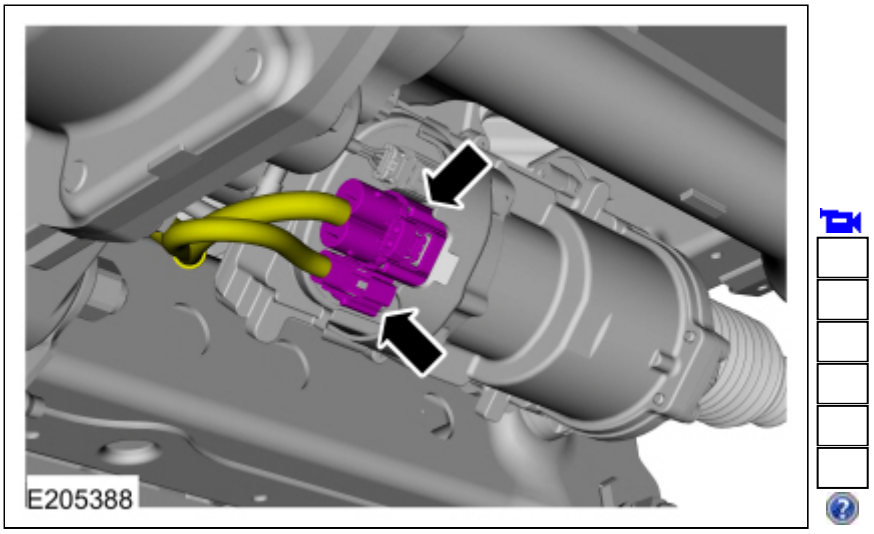
   Torque: 23 Nm



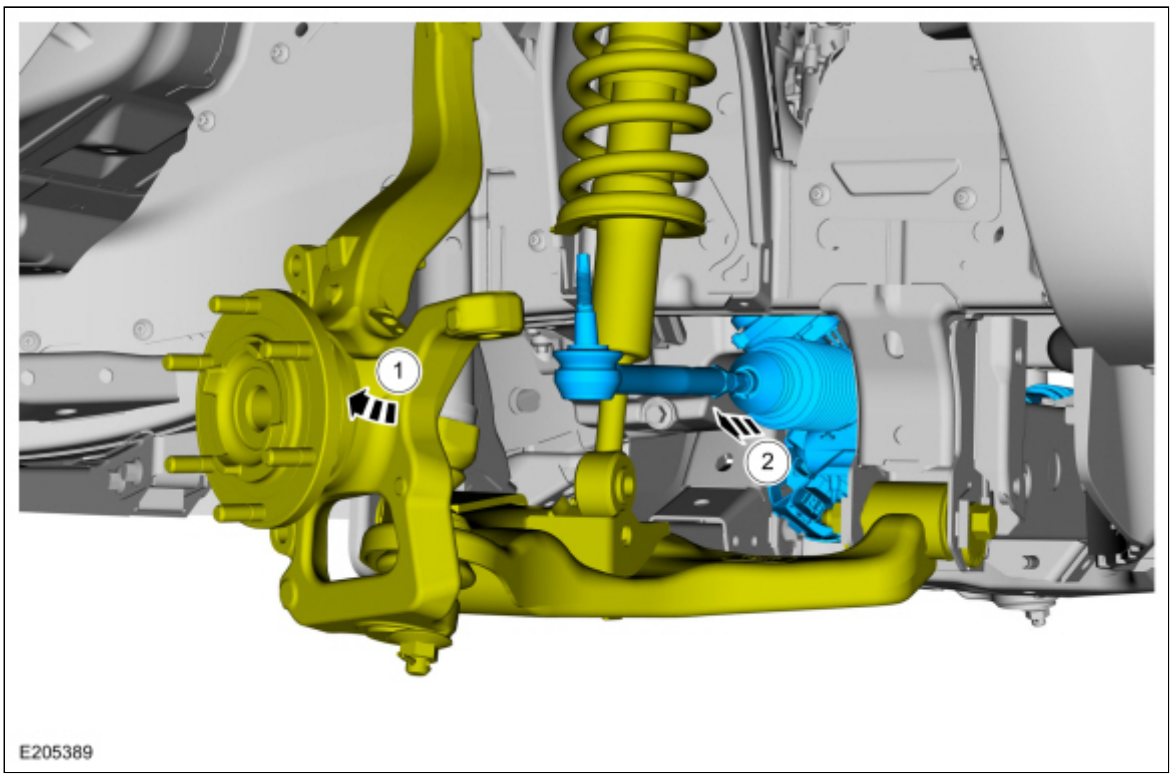
7. *Torque*: 90 Nm



8.



9. *Torque*: 165 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary when installing a new component.*

   Reset the EPAS system with IDS tool
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .
5. Check and if necessary, adjust front toe.
   Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Steering Gear Boot

Materials

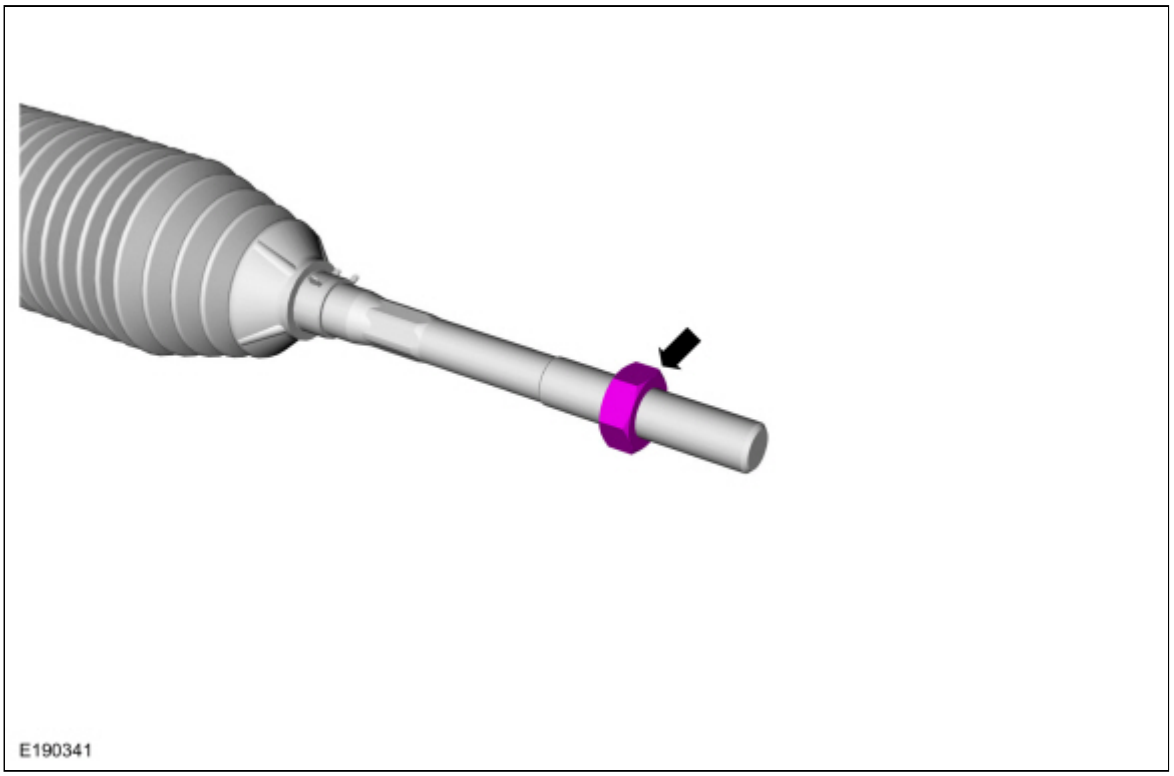
Name	Specification
Grease	ESA-M1C75-B

Removal

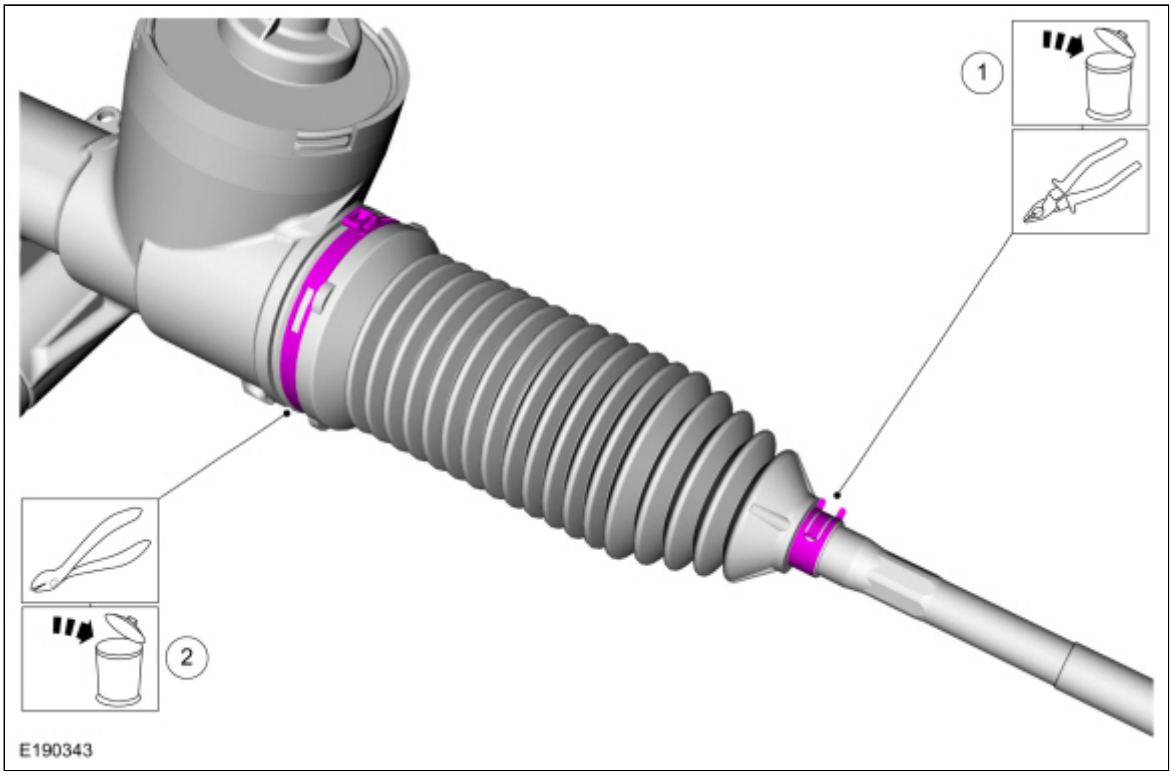
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
   Refer to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).
3. **NOTE:** *Note the number of turns when removing the tie rod end.*

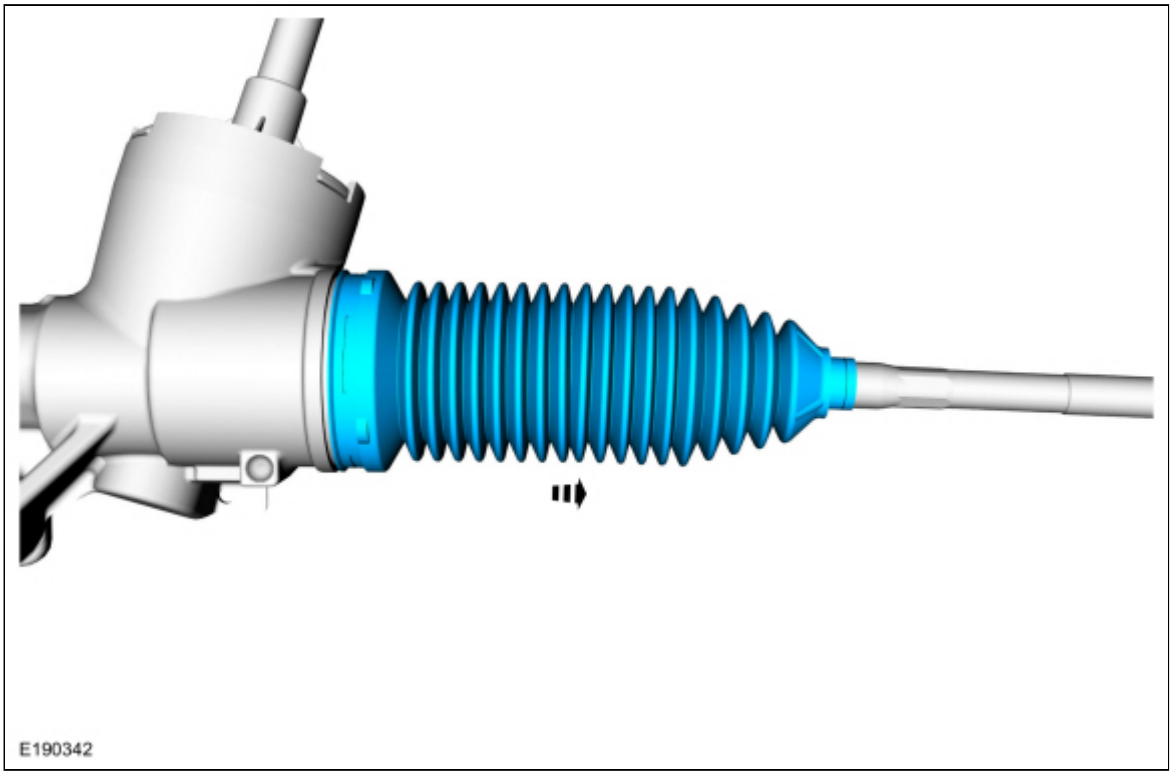
   On both sides



4. On both sides

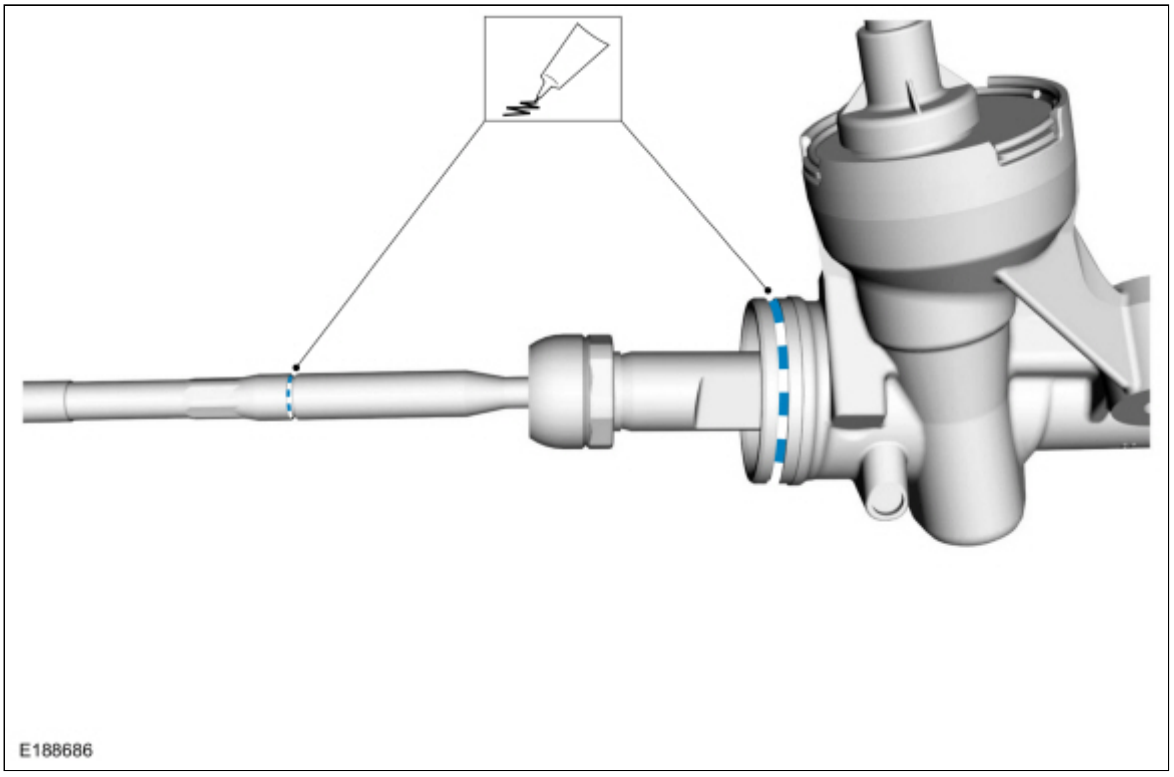


5.



Installation

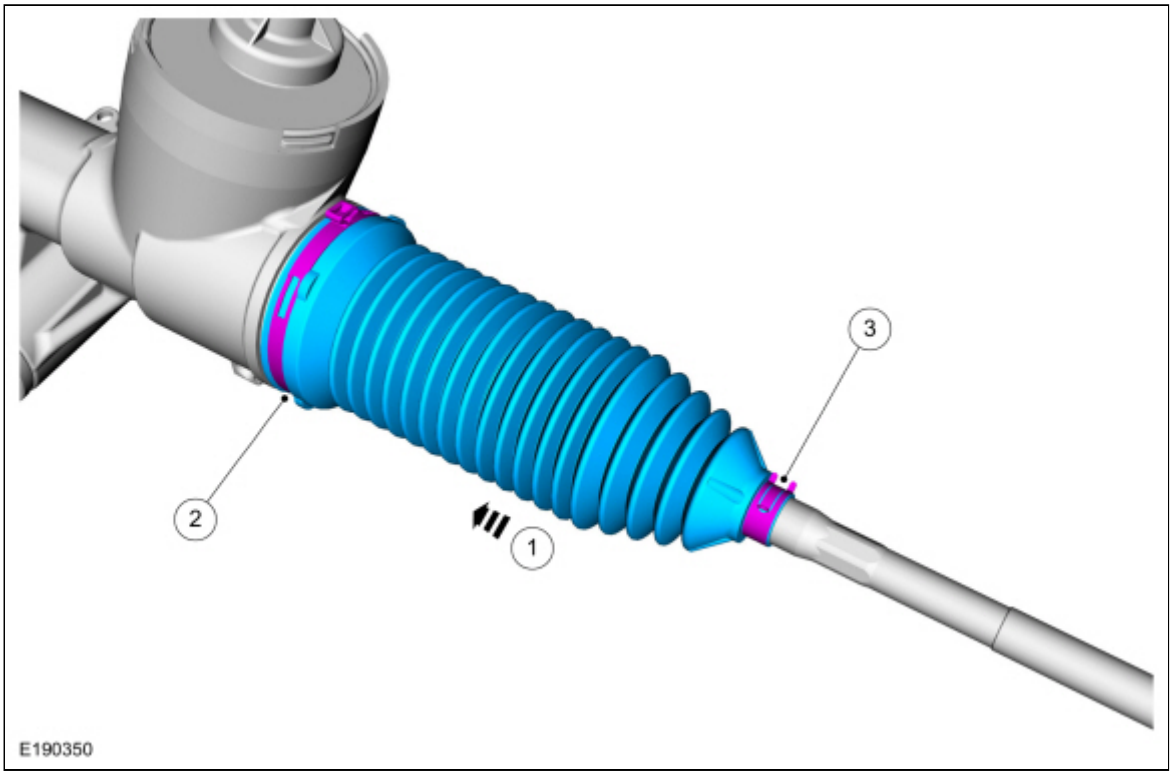
1. *Material*: Grease (ESA-M1C75-B)



2. **NOTE:** *Make sure that the boot is correctly located.*

   NOTE: *LH side shown, RH similar.*

   On both sides



3. To install, reverse the removal procedure.

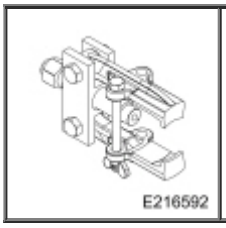
4. Refer to: Tie Rod End - LHD (211-02A Power Steering, Removal and Installation).
   Refer to: Tie Rod End - RHD (211-02A Power Steering, Removal and Installation).

Copyright © 2016 Ford Motor Company

Tie Rod End - LHD

Base Part Number: 3304

Special Tool(s) / General Equipment

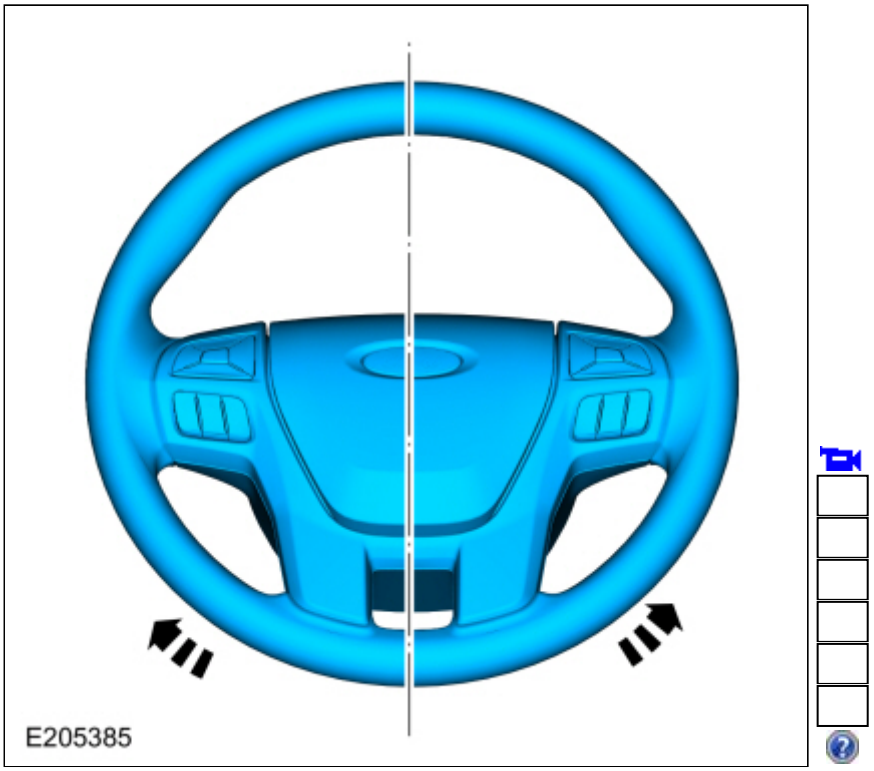
 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

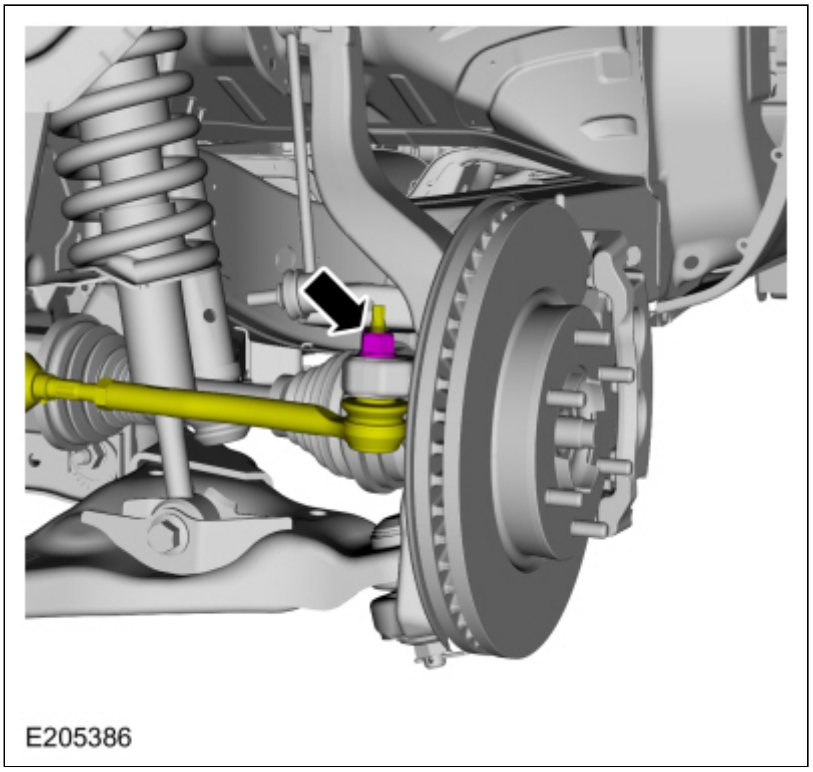
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Disconnect the battery ground cable anytime the steering linkage is being serviced or damage to the steering gear may occur resulting in steering gear replacement.**

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*

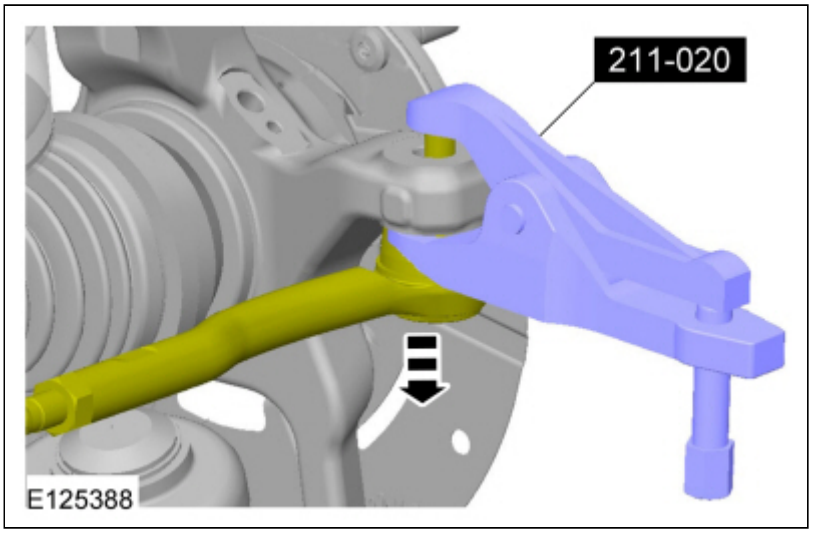


5. *Torque*: 23 Nm



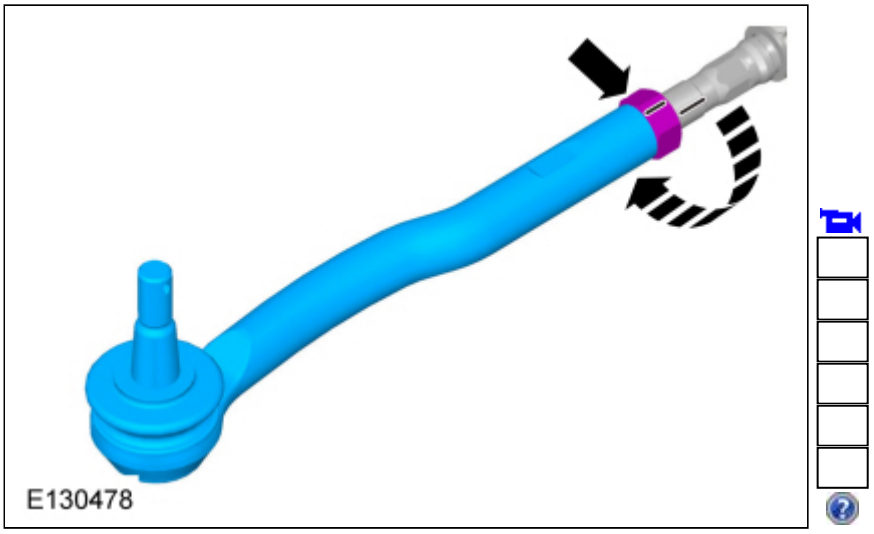
6. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

   Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



7. **NOTE:** *Make sure that the tie rod end is installed with the same number of turns as when removed.*

   Torque: 80 Nm



Installation

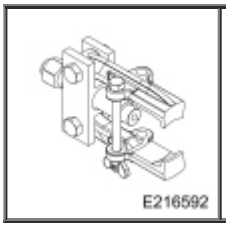
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Tie Rod End - RHD

Base Part Number: 3304

Special Tool(s) / General Equipment

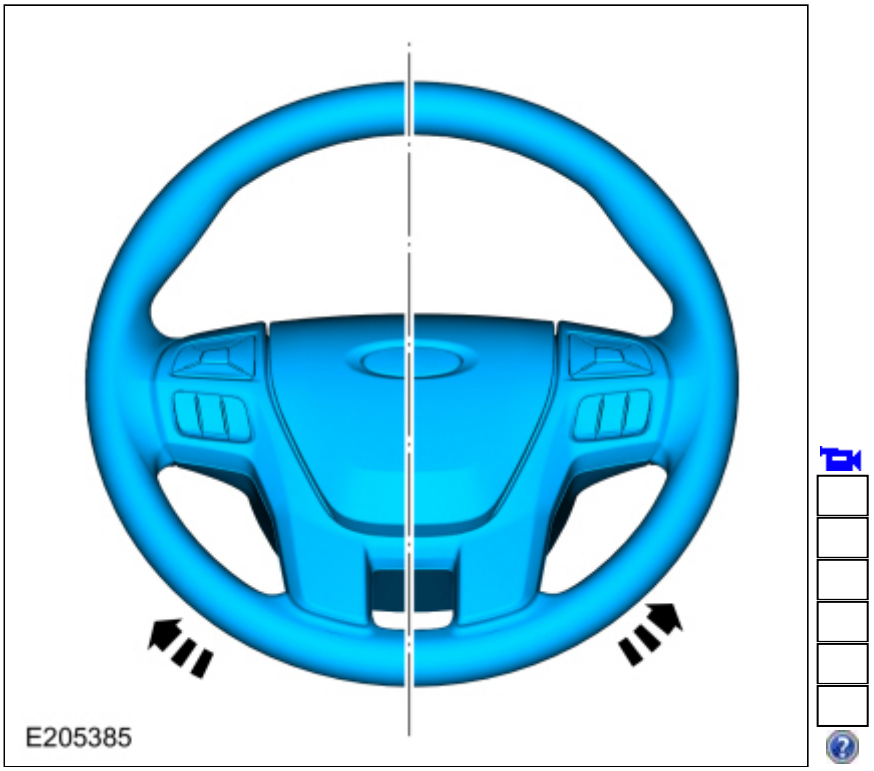
 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

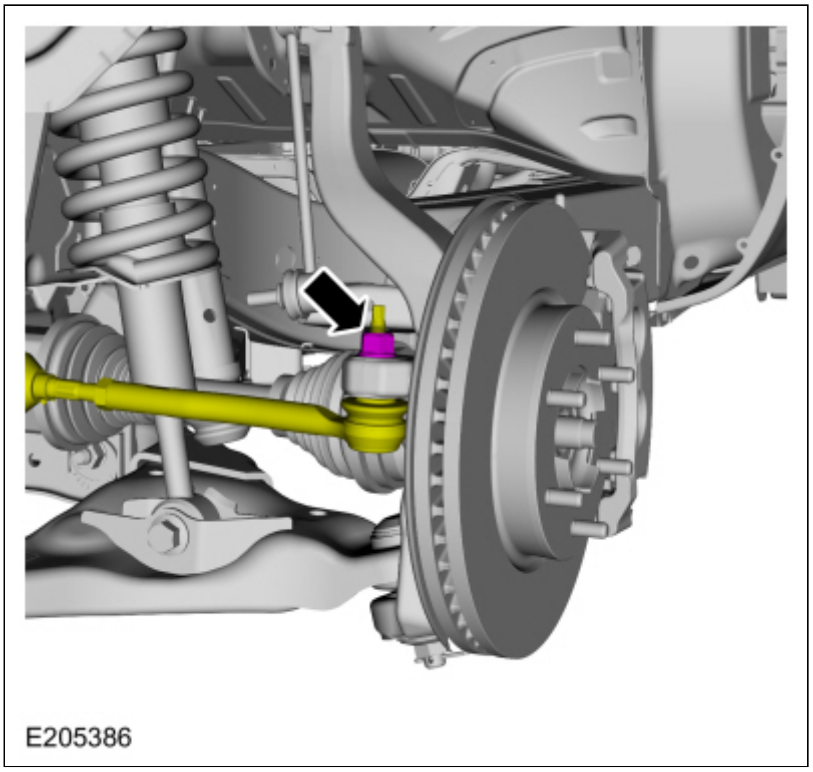
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Disconnect the battery ground cable anytime the steering linkage is being serviced or damage to the steering gear may occur resulting in steering gear replacement.**

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. **NOTE:** *Make sure that the road wheels are in the straight ahead position.*

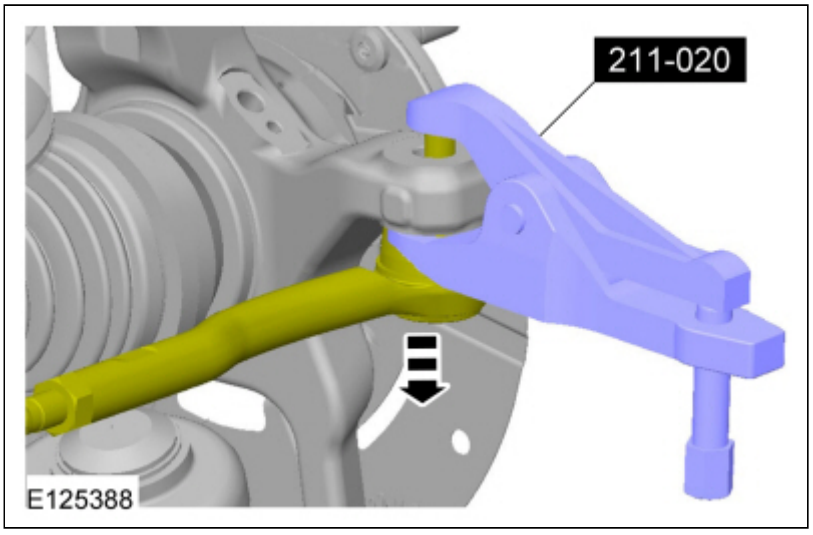


5. *Torque*: 63 Nm



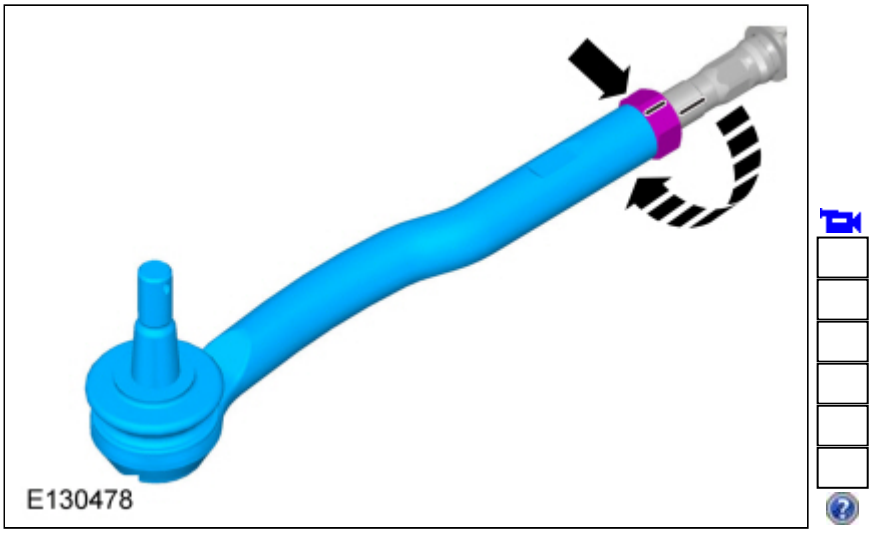
6. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

   Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



7. **NOTE:** *Make sure that the tie rod end is installed with the same number of turns as when removed.*

   Torque: 80 Nm



Installation

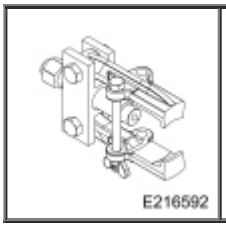
1. To install, reverse the removal procedure.
2. Check and if necessary, adjust front toe.
   Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Steering Gear - LHD RWD

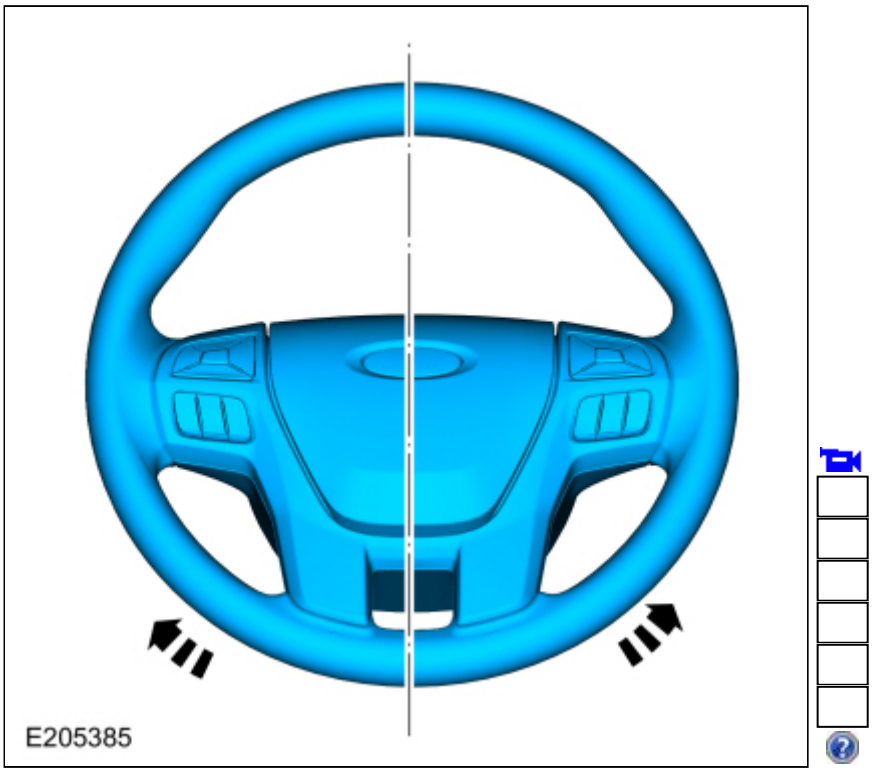
Base Part Number: 3D080

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

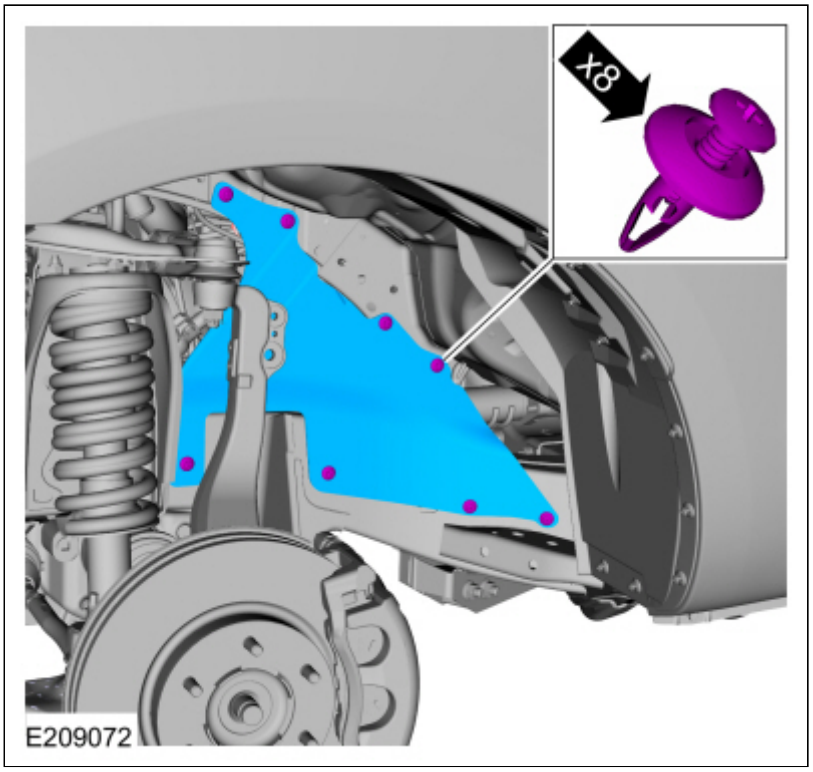
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. 

4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

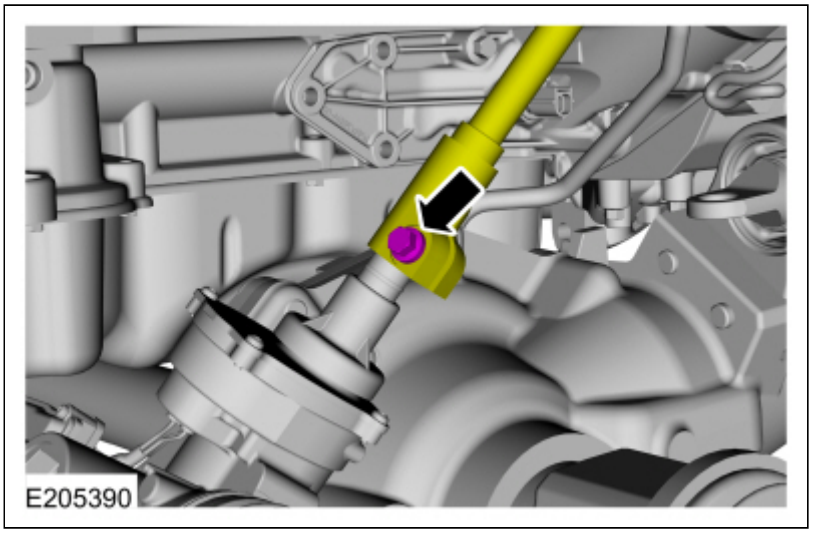
Refer to: Engine Undershield () .

5.

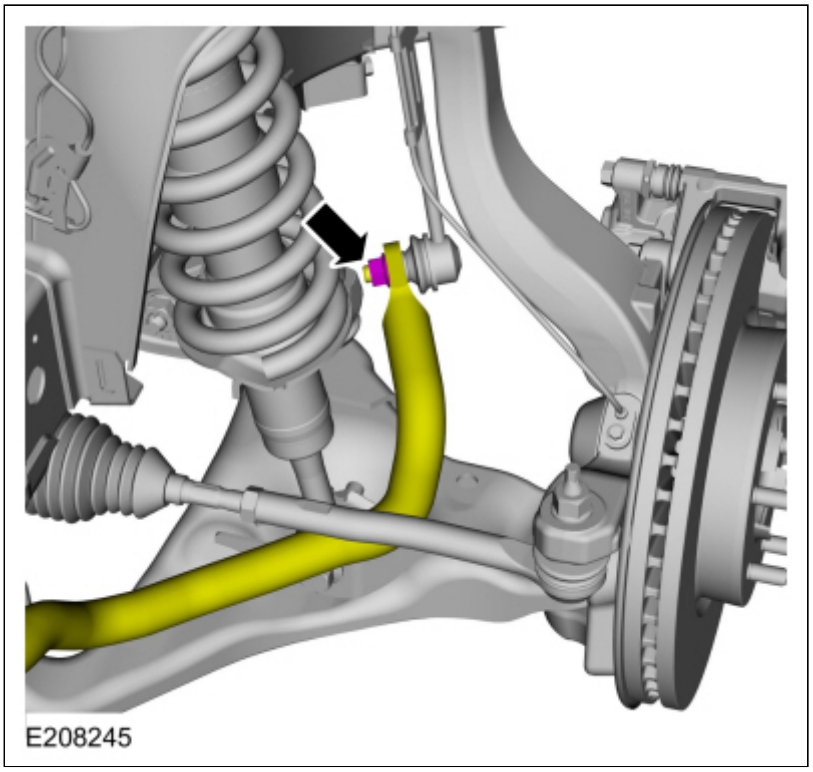


6. **WARNING: Do not reuse steering column shaft bolts. This may result in fastener failure and steering column shaft detachment or loss of steering control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

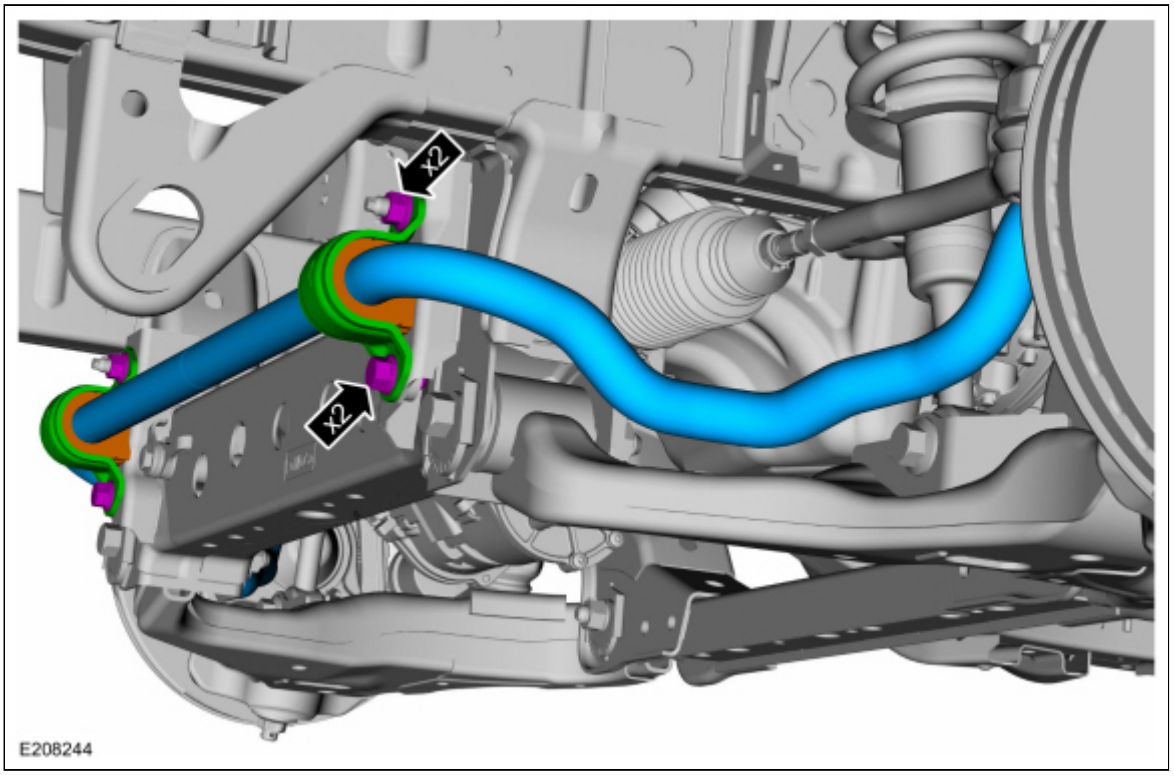
   Torque: 23 Nm



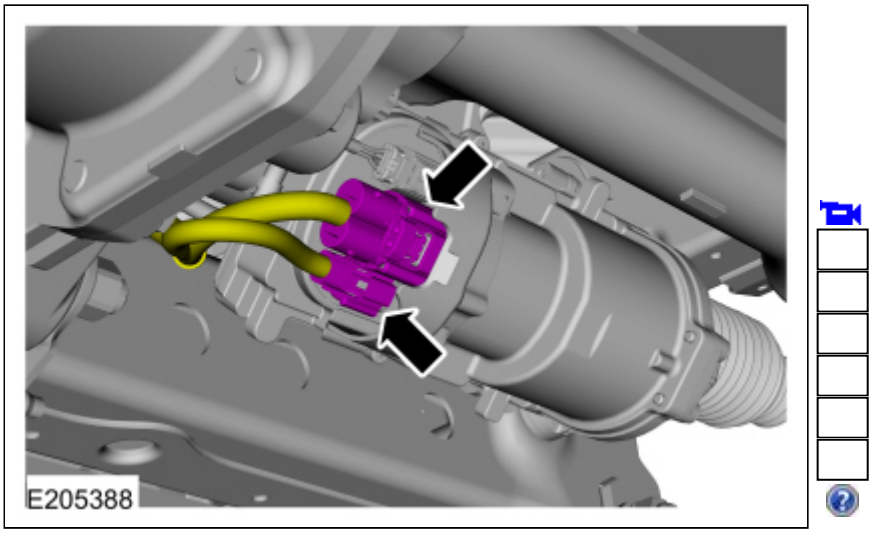
7. On both sides.
   Torque: 90 Nm



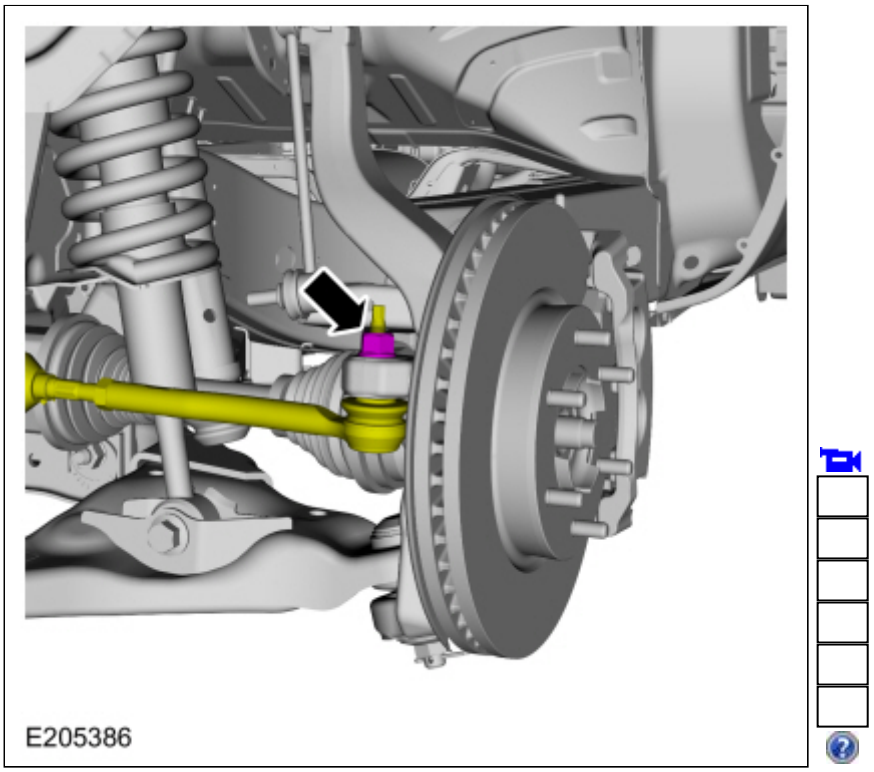
8. *Torque*: 90 Nm



9.



10. On both sides
    Torque: 63 Nm

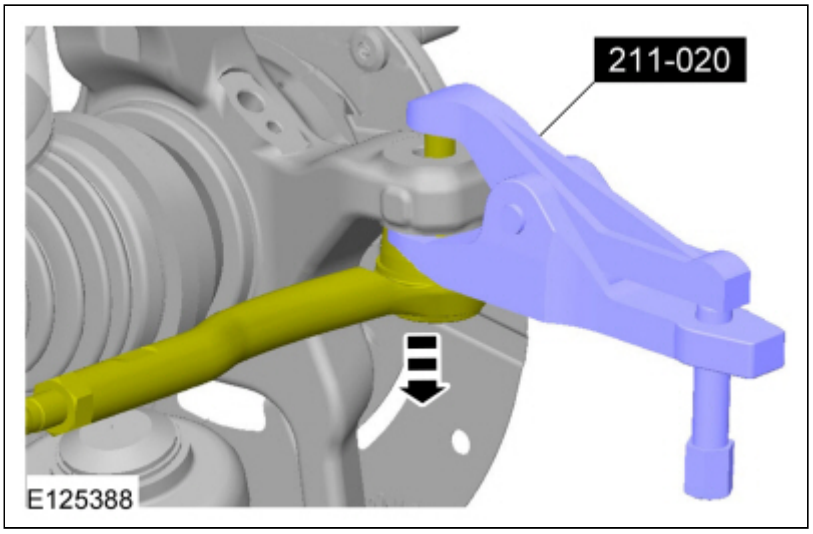


11. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

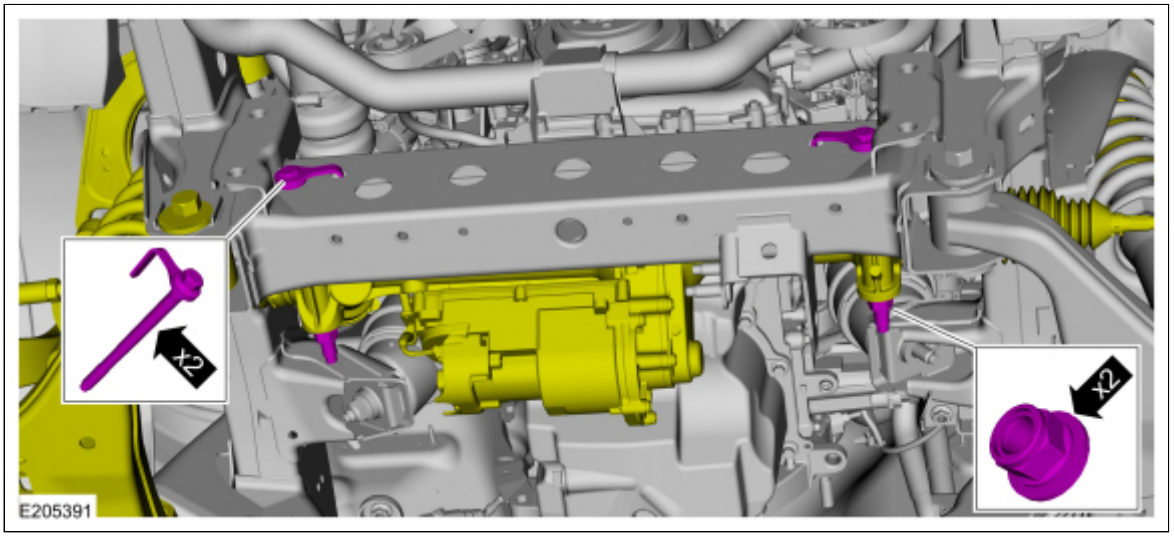
    NOTICE: Do not damage the tie-rod boot while installing the special tool.

    NOTICE: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

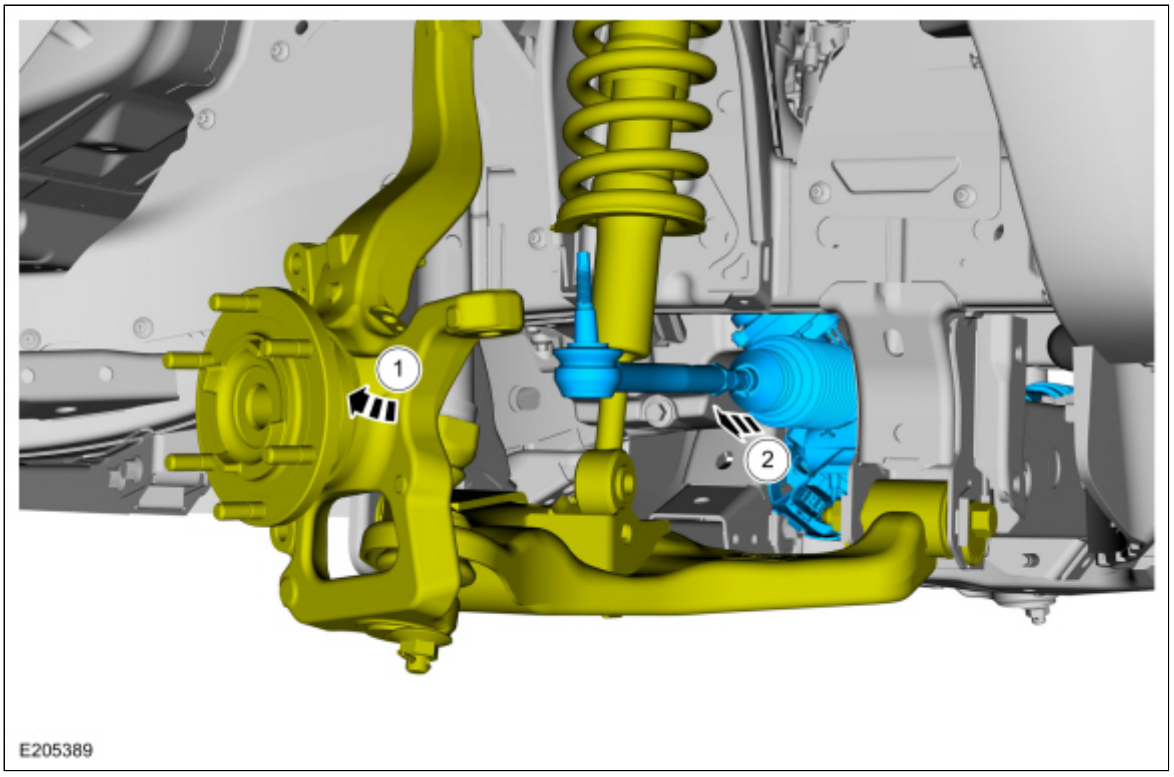
    On both sides
    Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



12. *Torque*: 48 Nm



13. *Torque*: 48 Nm



Installation

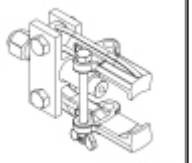
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information) .

Copyright © 2016 Ford Motor Company

Steering Gear - LHD 4WD

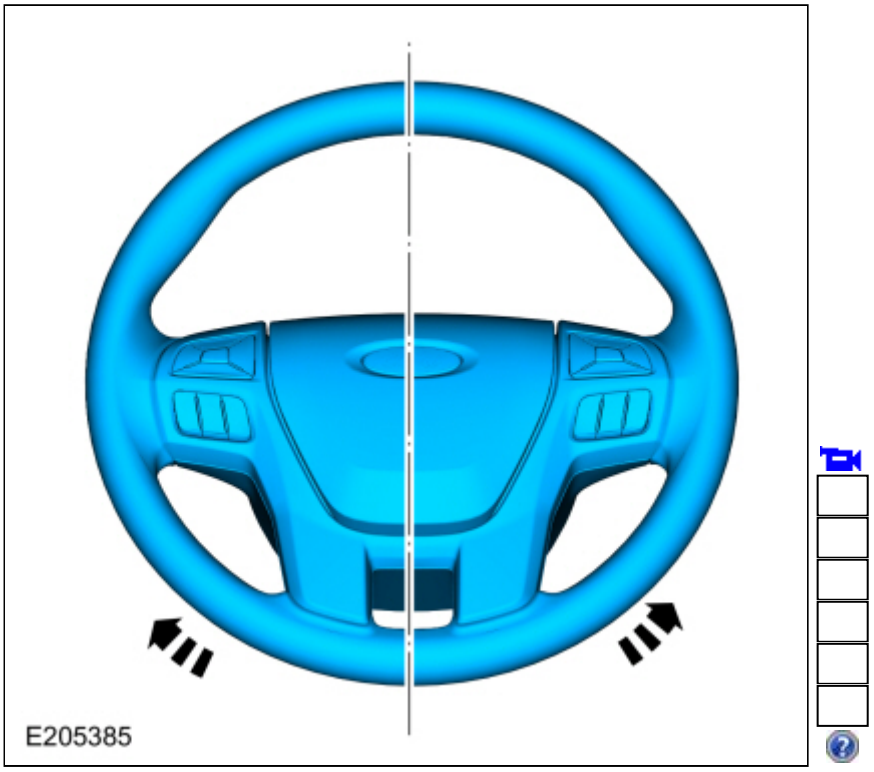
Base Part Number: 3D080

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm
Transmission Jack	

Removal

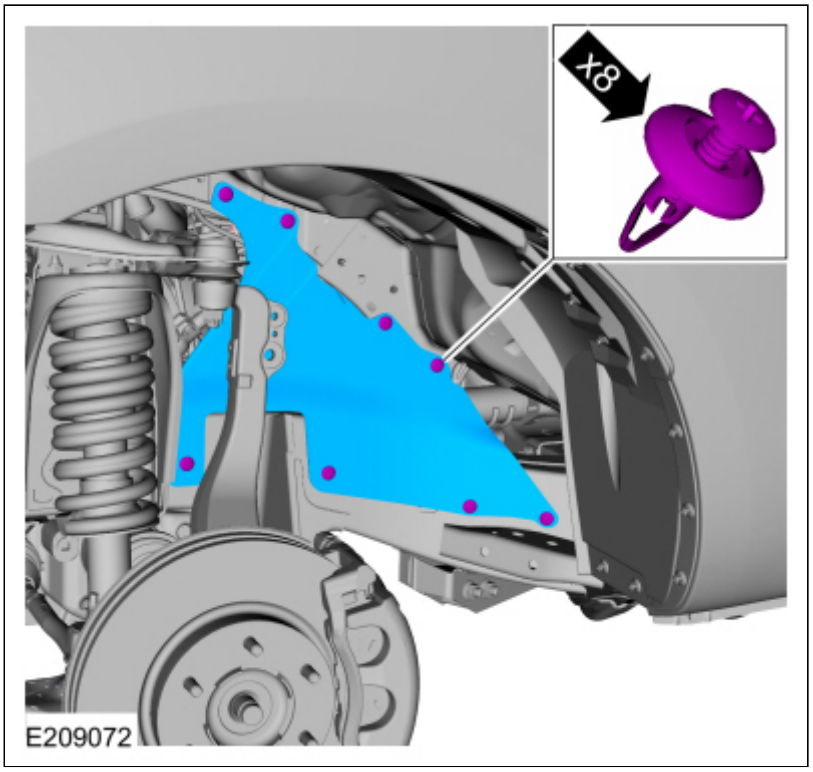
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. 

4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

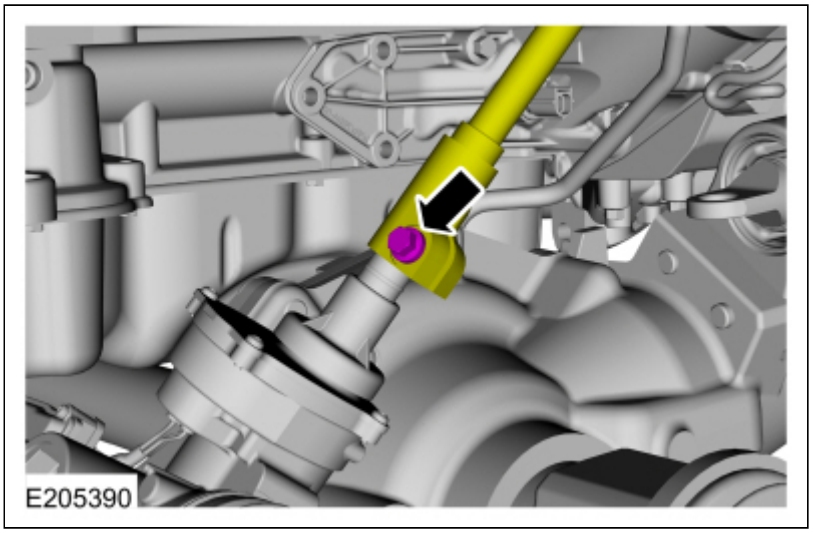
Refer to: Engine Undershield () .

5.

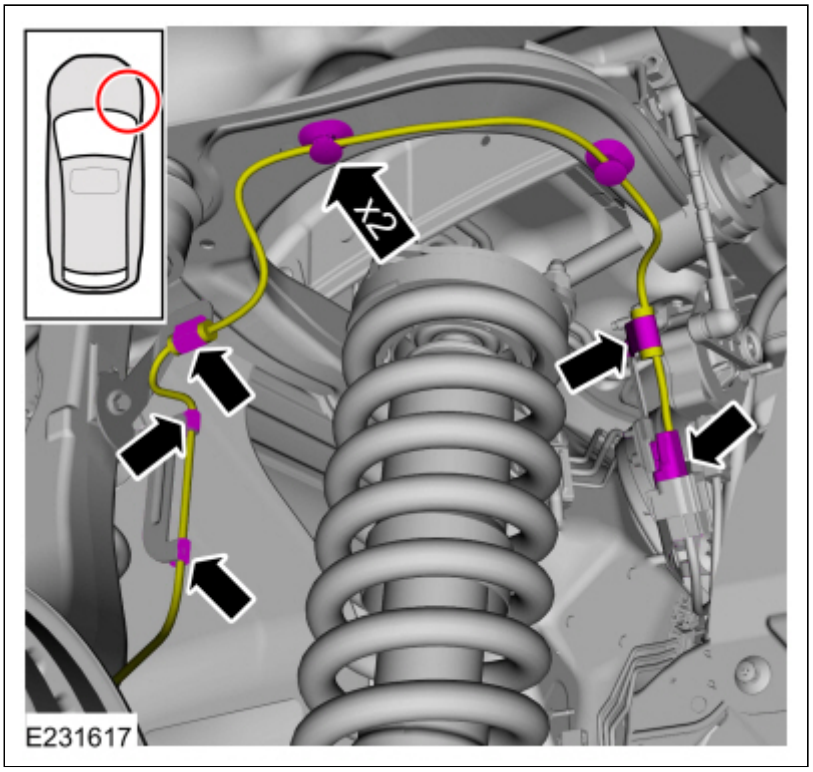


6. **WARNING: Do not reuse steering column shaft bolts. This may result in fastener failure and steering column shaft detachment or loss of steering control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

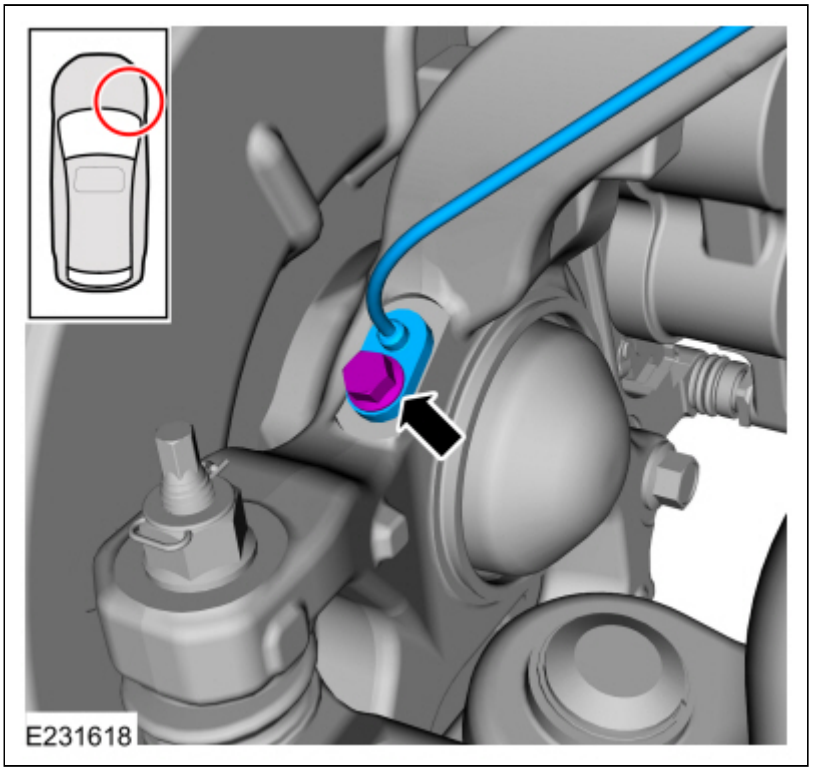
   Torque: 23 Nm



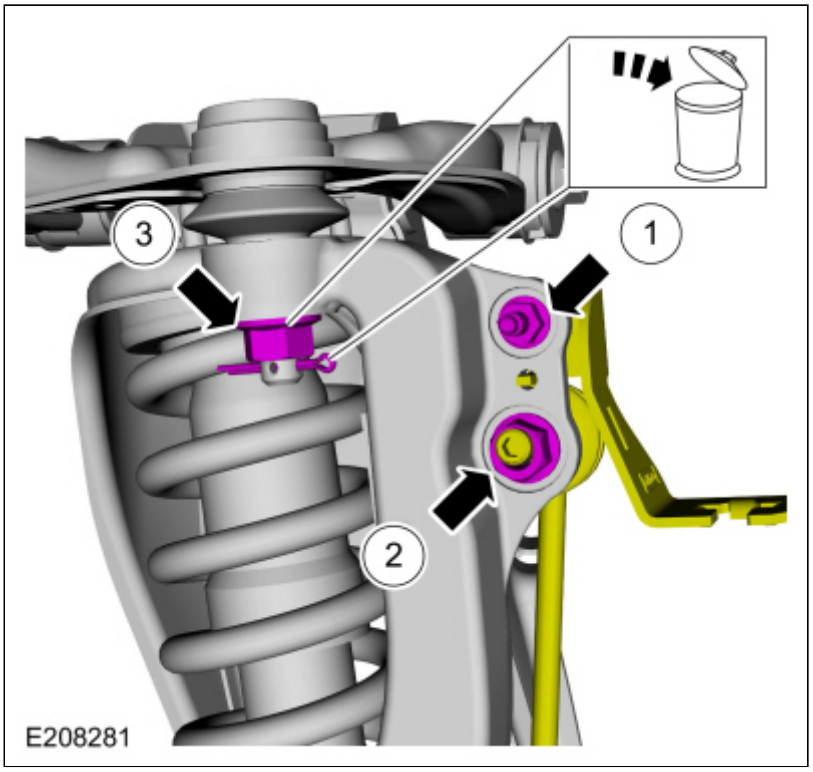
7.



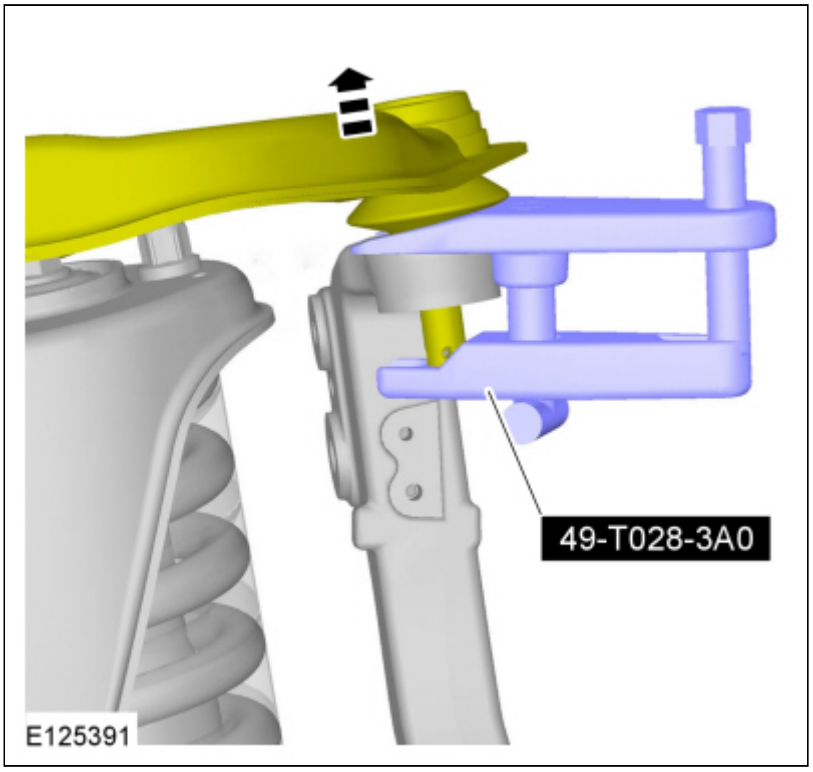
8. *Torque*: 6 Nm



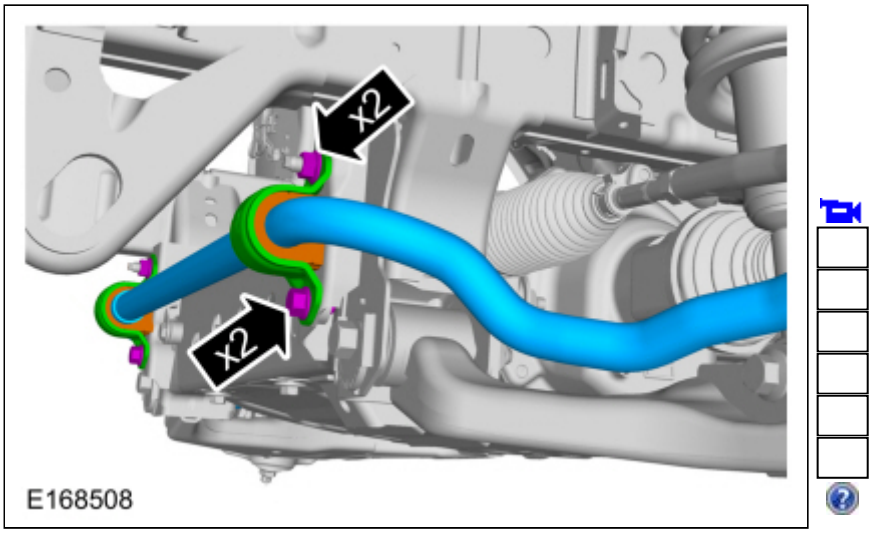
9. RH side
   Torque:
   1: 14 Nm
   2: 90 Nm
   3: 63 Nm



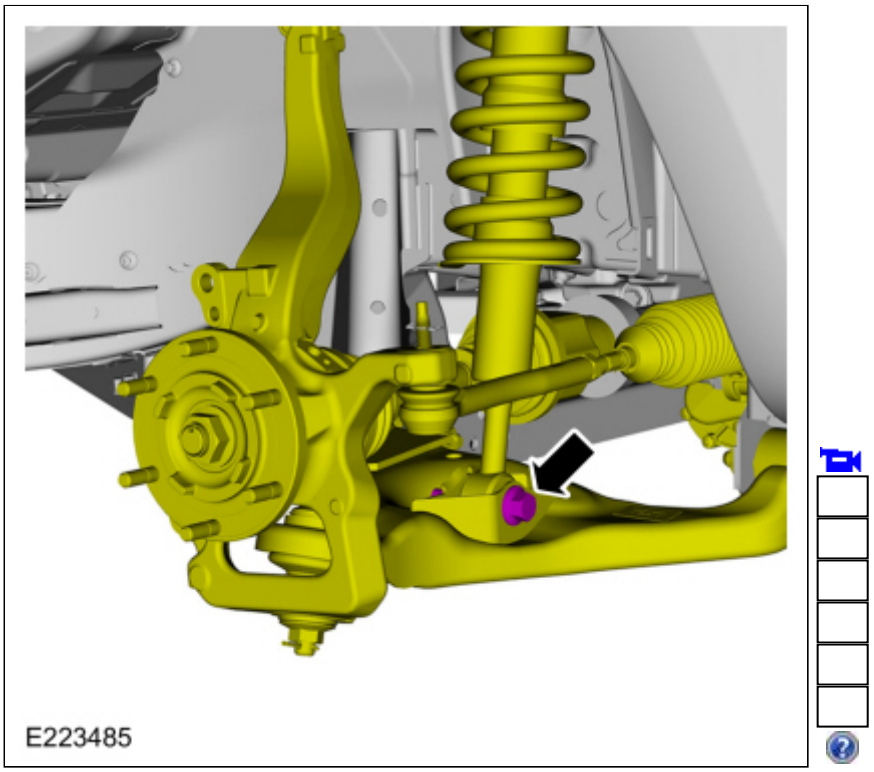
10. RH side



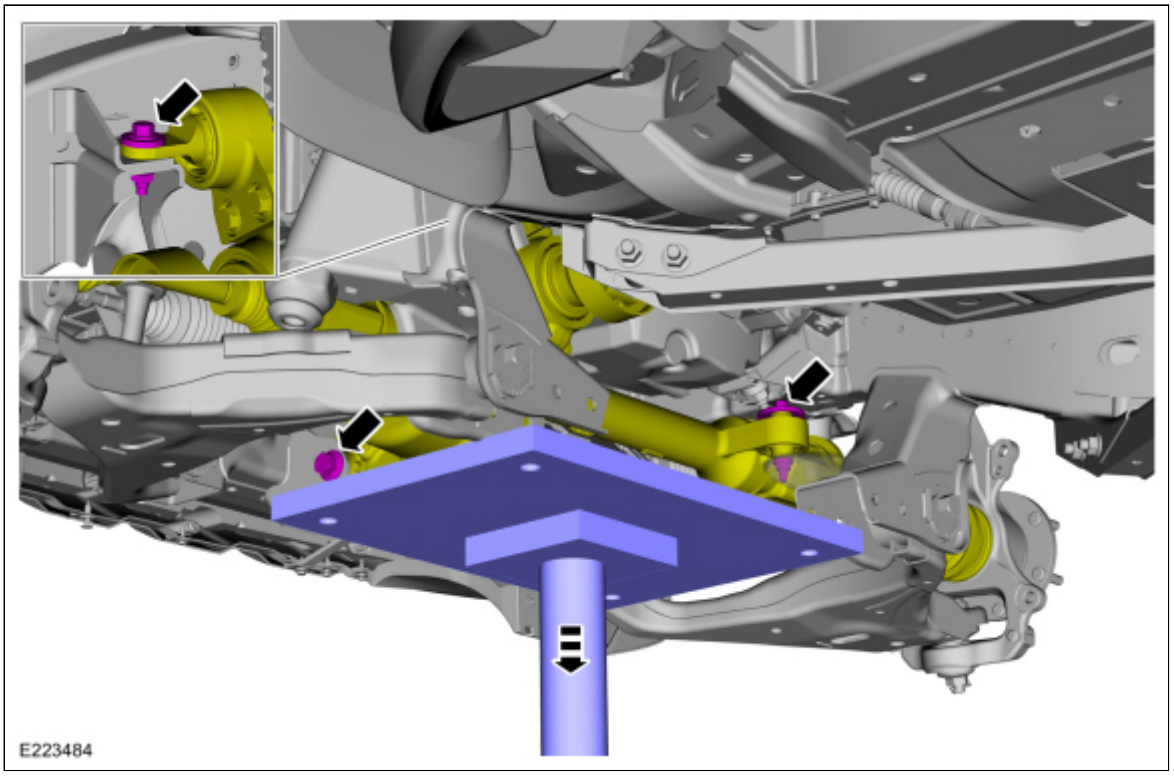
11. *Torque*: 90 Nm



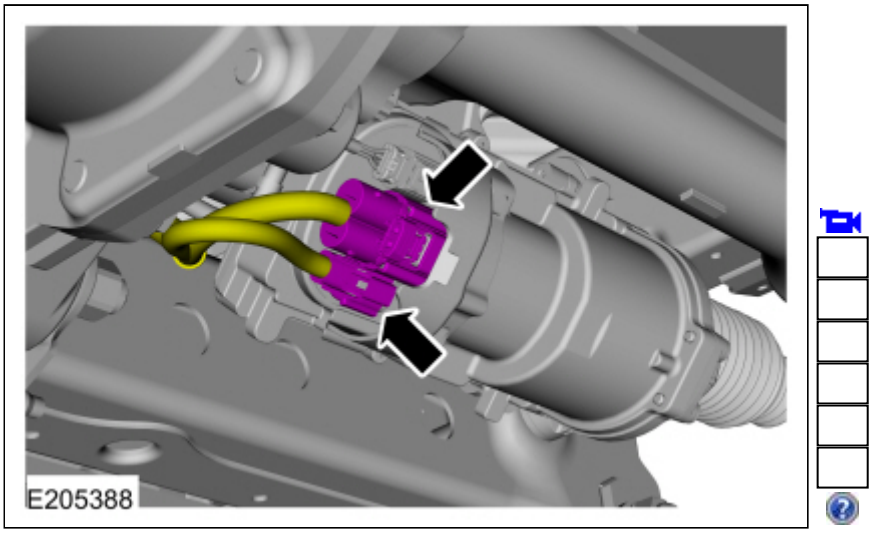
12. RH side
    Torque: 63 Nm



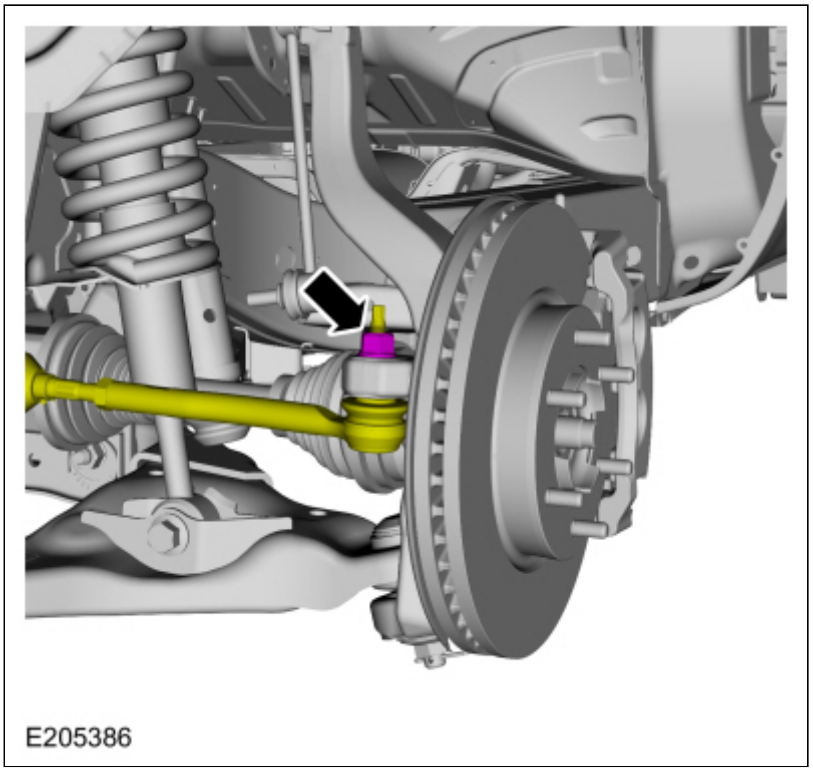
13. *Torque*: 63 Nm



14.



15. On both sides.
    Torque: 63 Nm

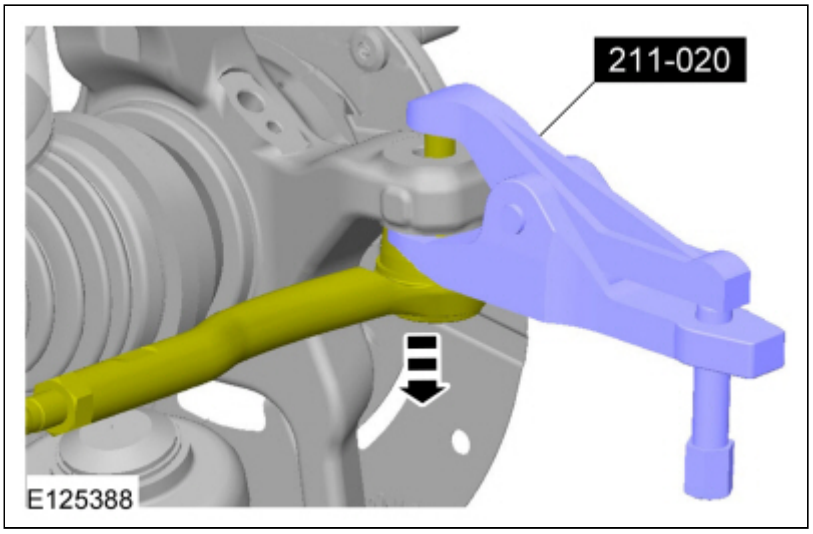


16. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

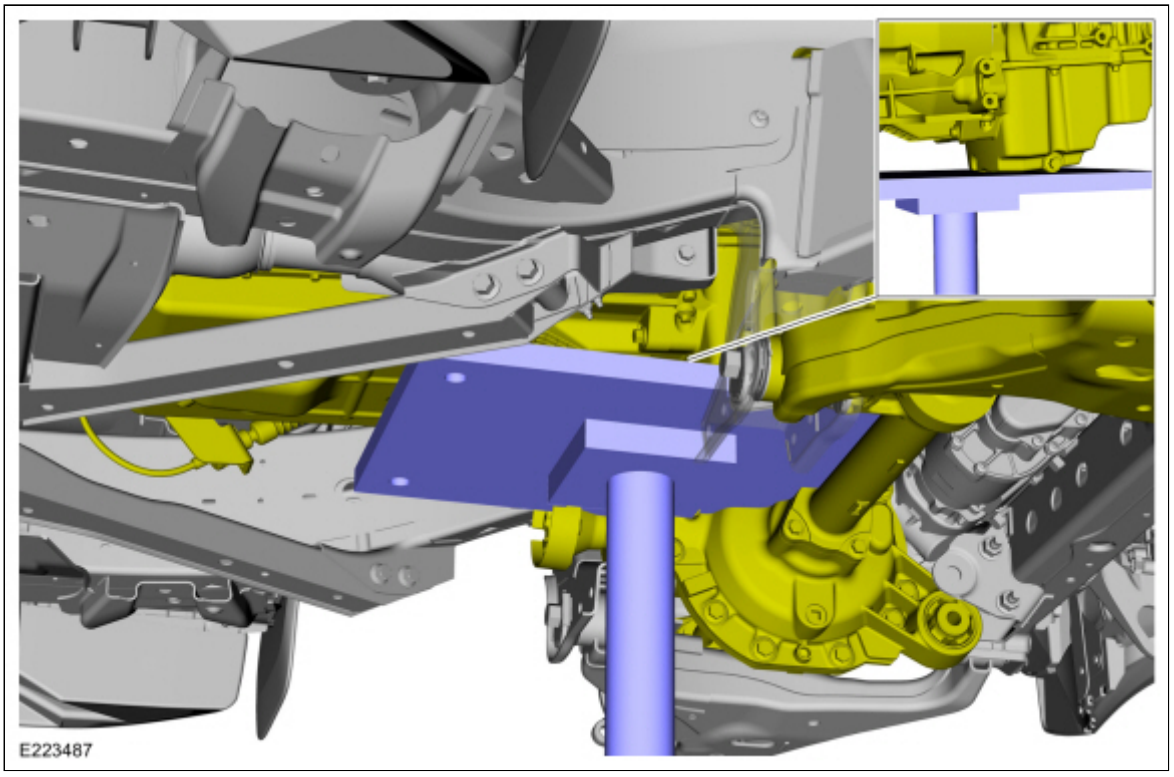
    NOTICE: Do not damage the tie-rod boot while installing the special tool.

    NOTICE: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

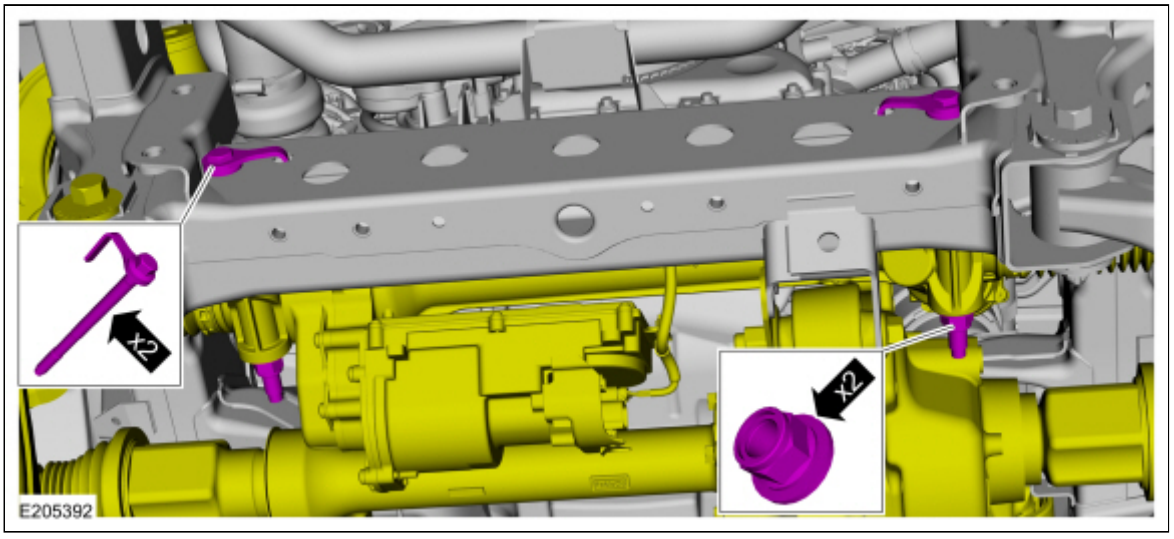
    On both sides
    Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



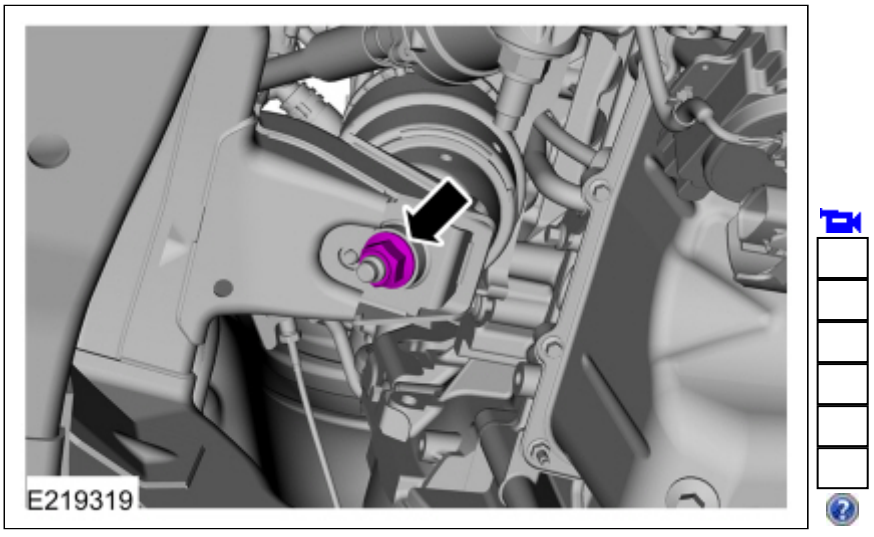
17. Use the General Equipment: Transmission Jack



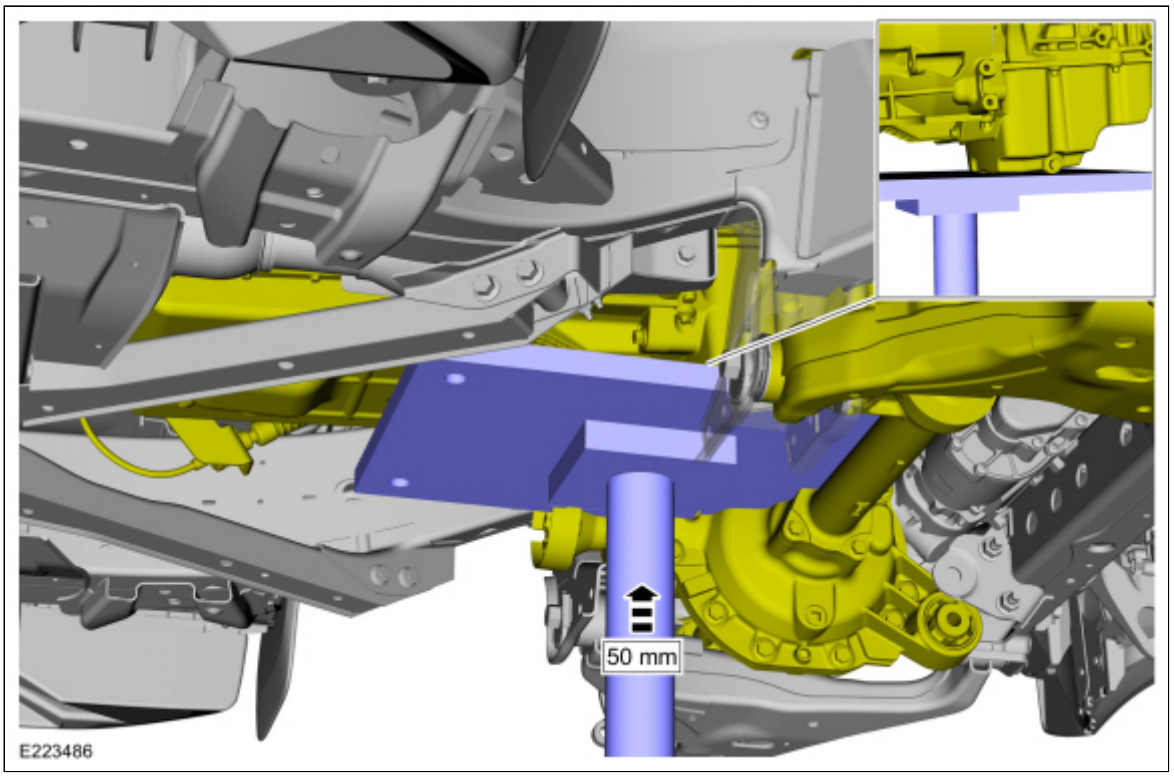
18. *Torque*: 48 Nm



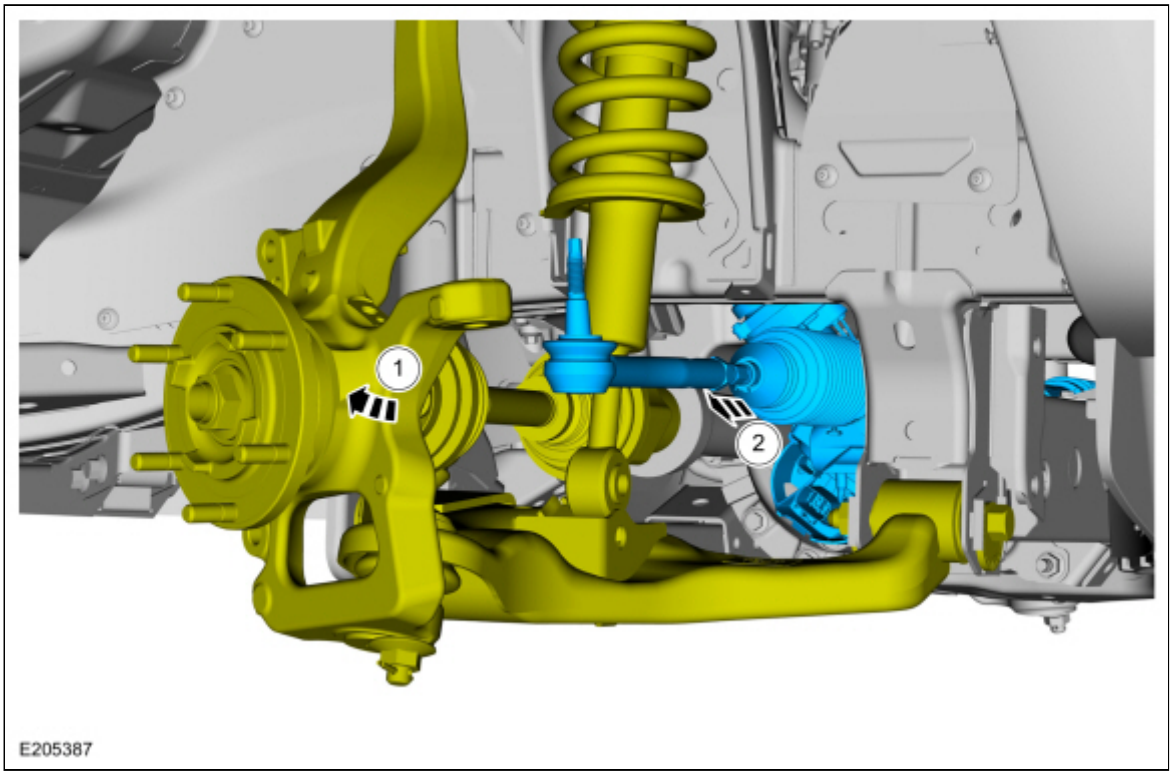
19. On both sides
    Torque: 80 Nm



20. Use the General Equipment: Transmission Jack



21.



Installation

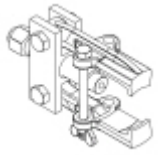
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information) .

Copyright © 2016 Ford Motor Company

Steering Gear - RHD RWD

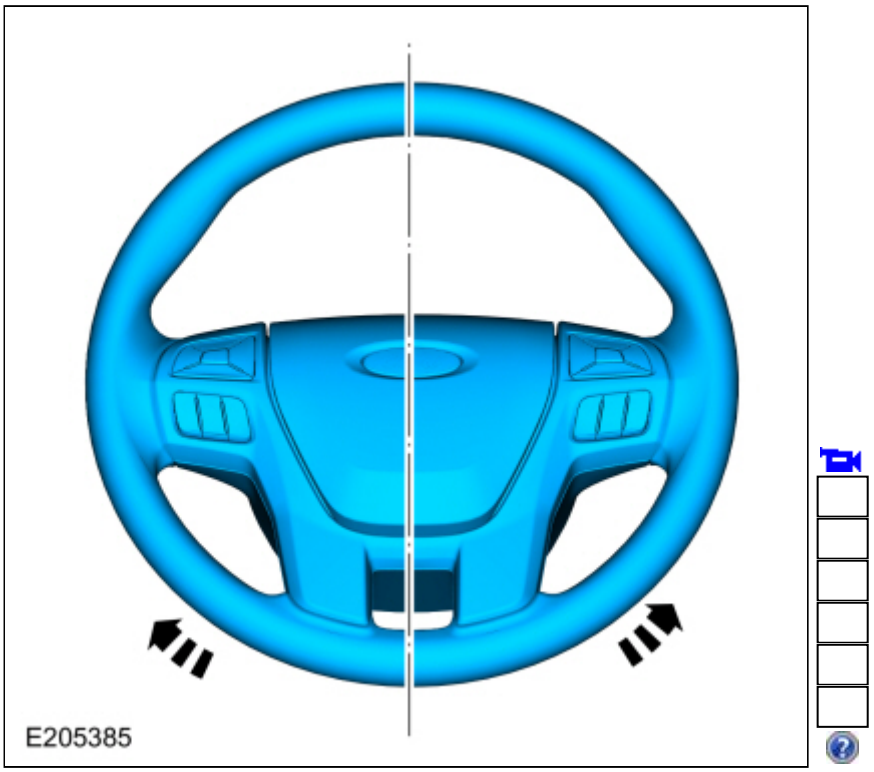
Base Part Number: 3D080

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

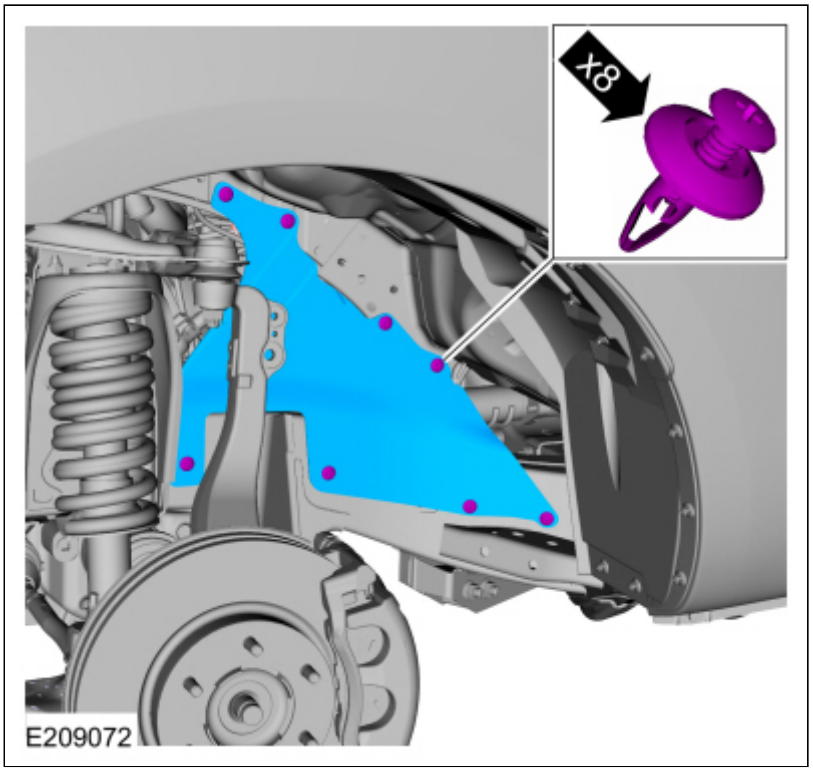
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. 

4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

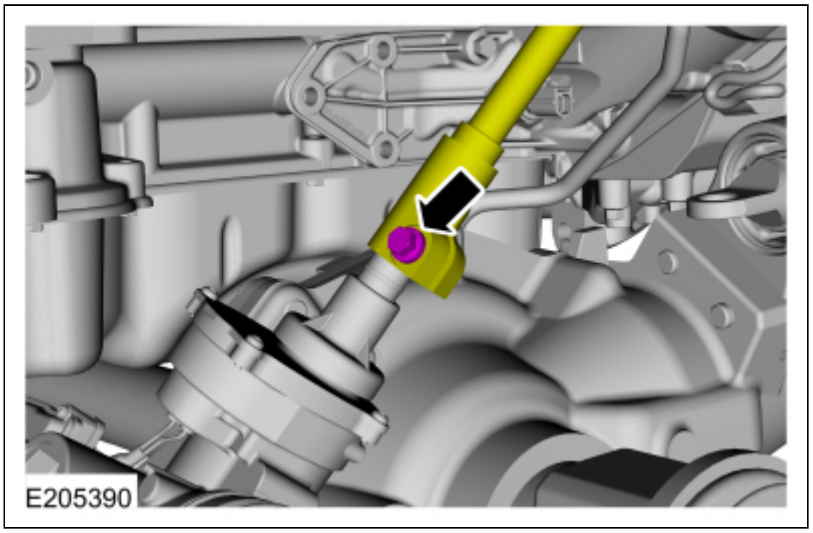
Refer to: Engine Undershield () .

5.

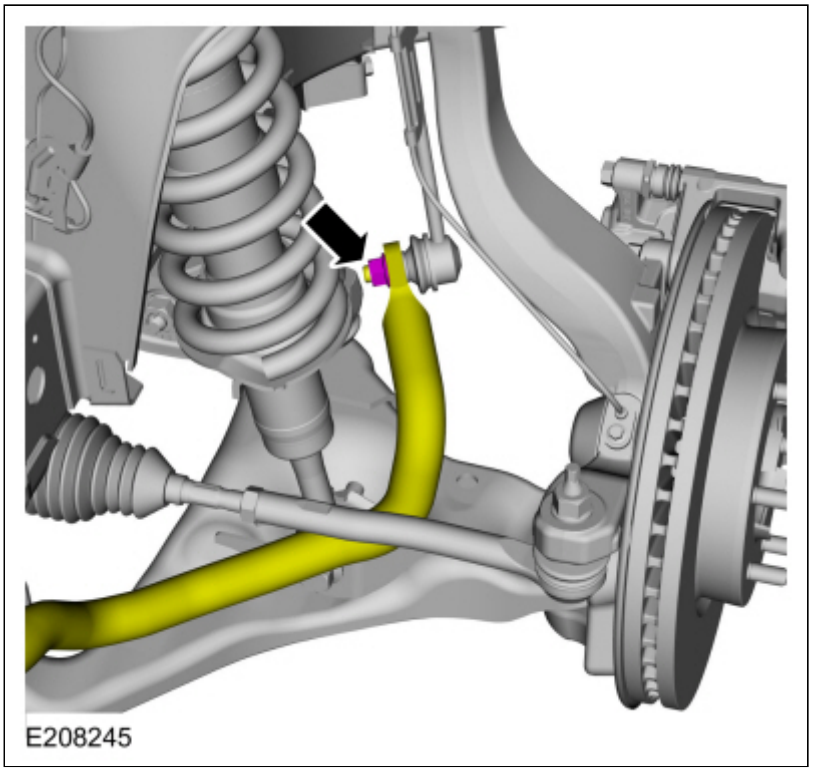


6. **NOTICE: Make sure that a new bolt is installed.**

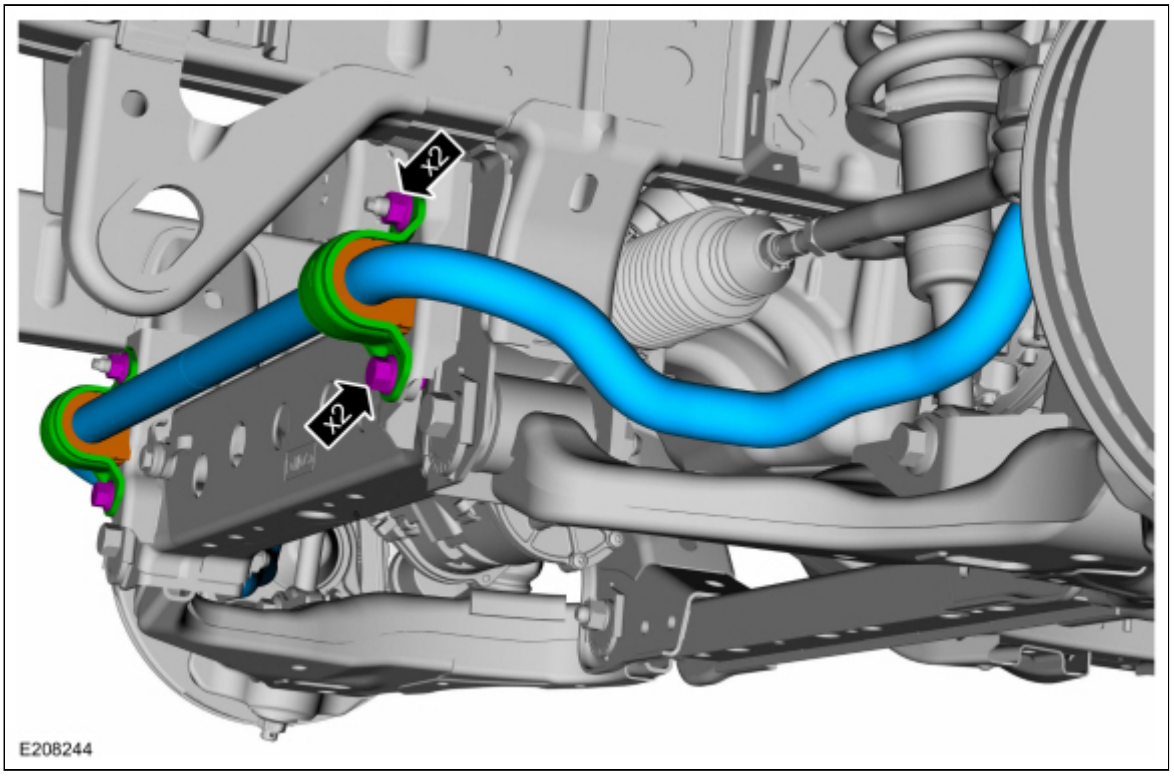
   Torque: 23 Nm



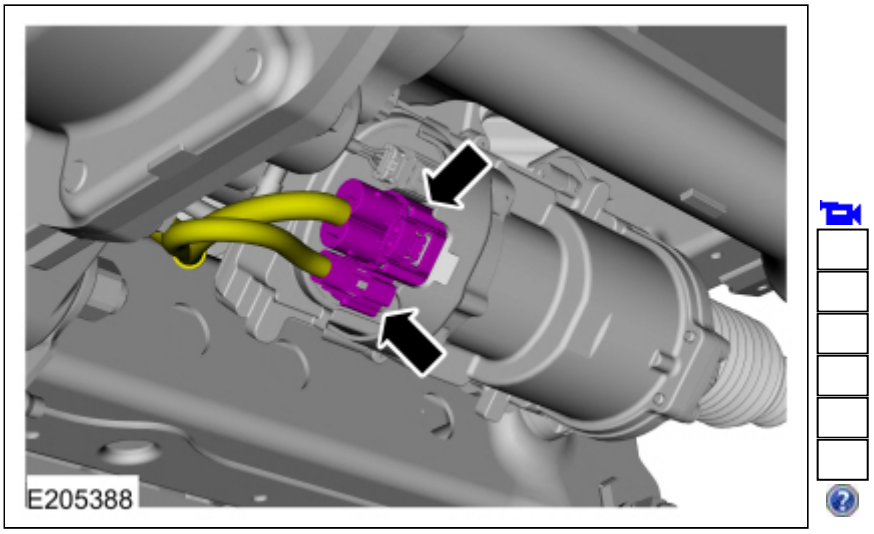
7. On both sides.
   Torque: 90 Nm



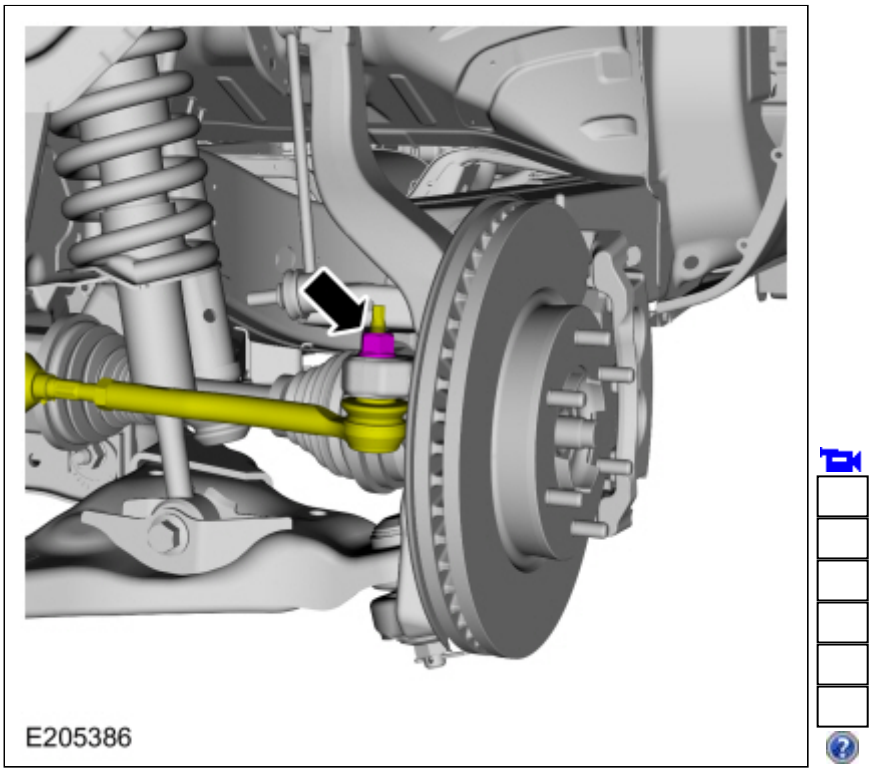
8. *Torque*: 90 Nm



9.



10. On both sides
    Torque: 63 Nm

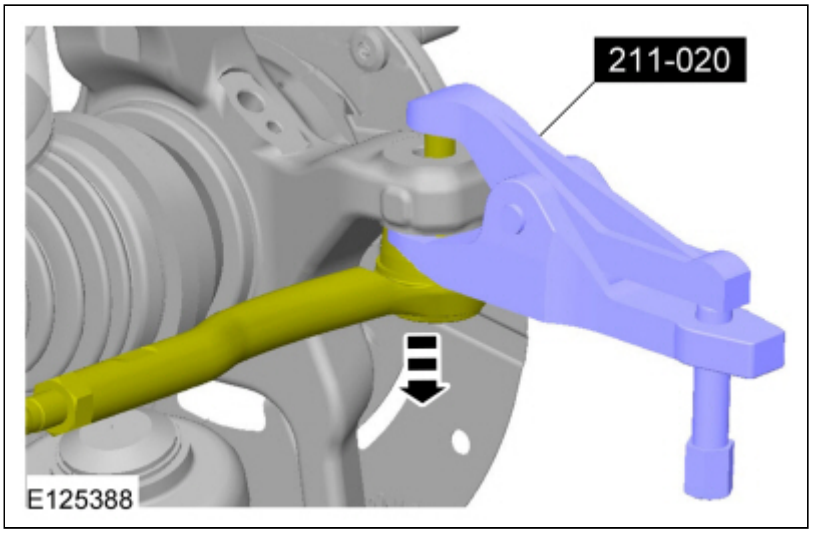


11. **NOTICE: Use a suitable tool to prevent damage to the components during removal.**

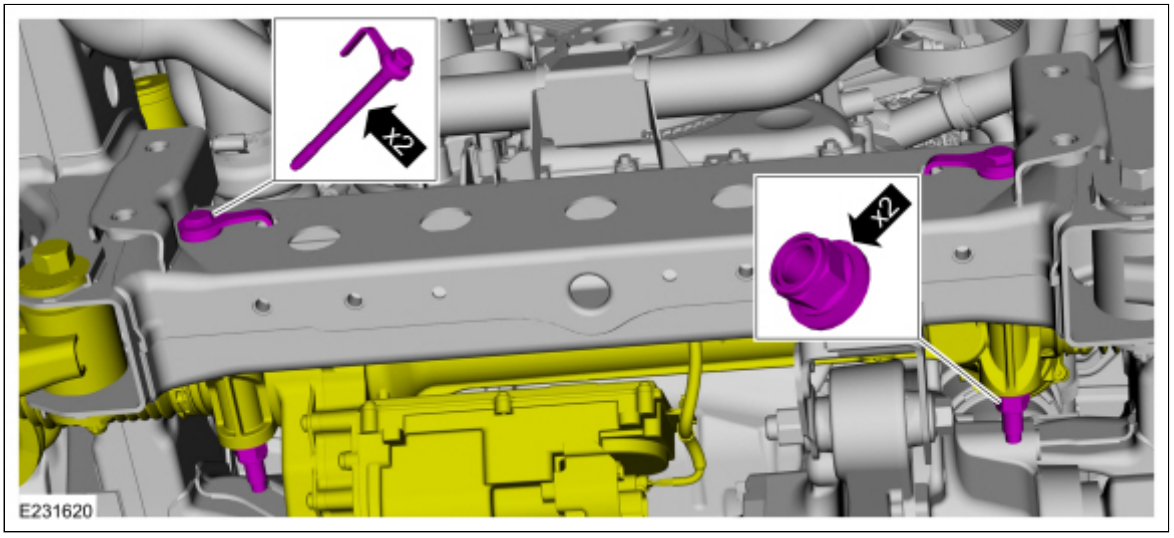
    NOTICE: Take extra care not to damage the component.

    NOTICE: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

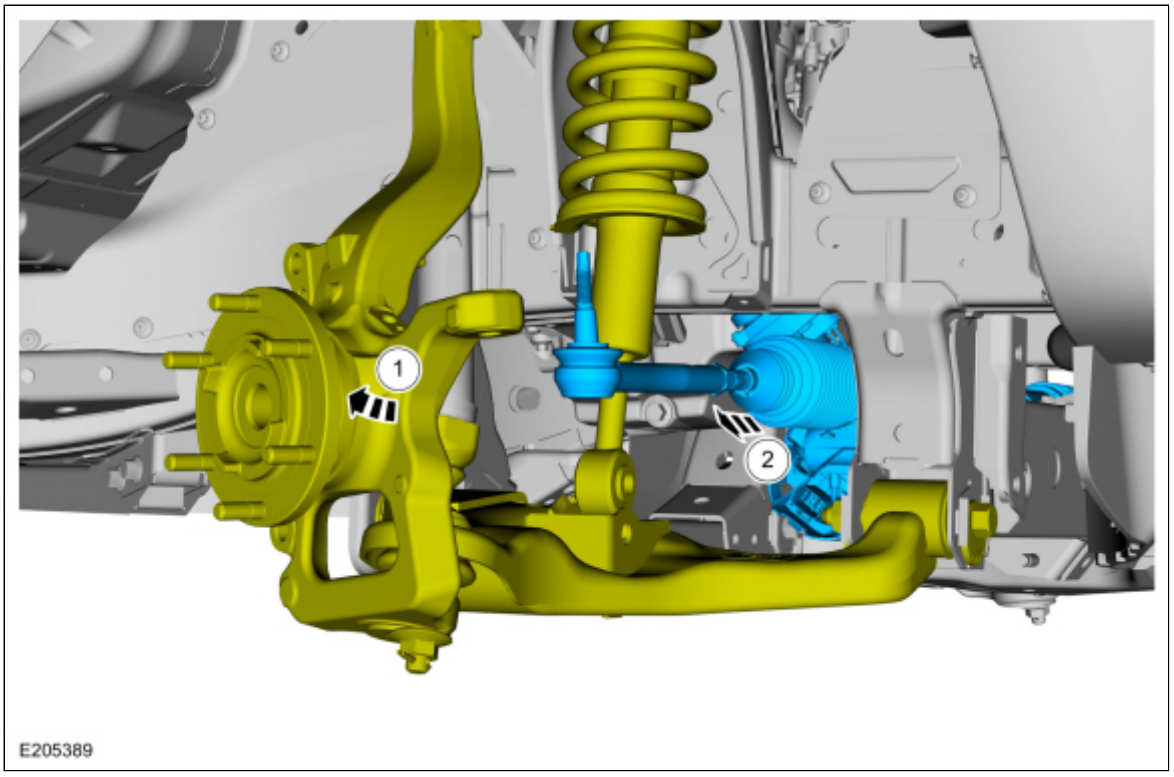
    On both sides
    Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



12. *Torque*: 48 Nm



13.



Installation

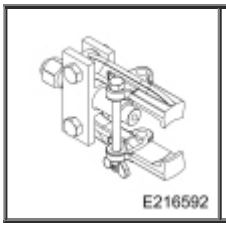
1. To install, reverse the removal procedure.
2. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information) .

Copyright © 2016 Ford Motor Company

Steering Gear - RHD 4WD

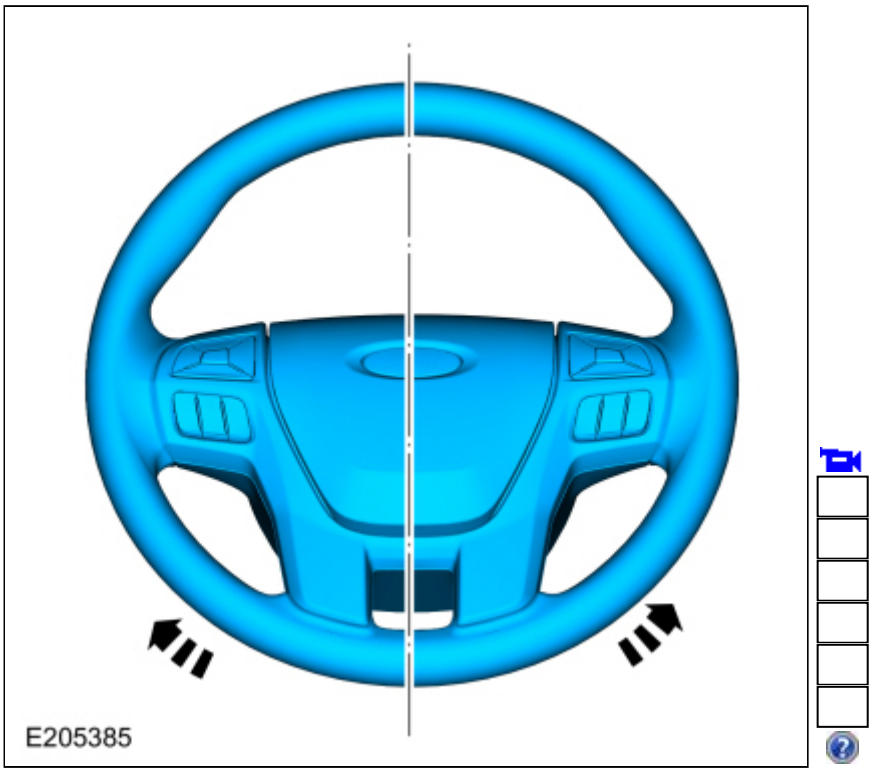
Base Part Number: 3D080

Special Tool(s) / General Equipment

 E216592	211-003 (T64P-3590-F) Remover, Steering Arm

Removal

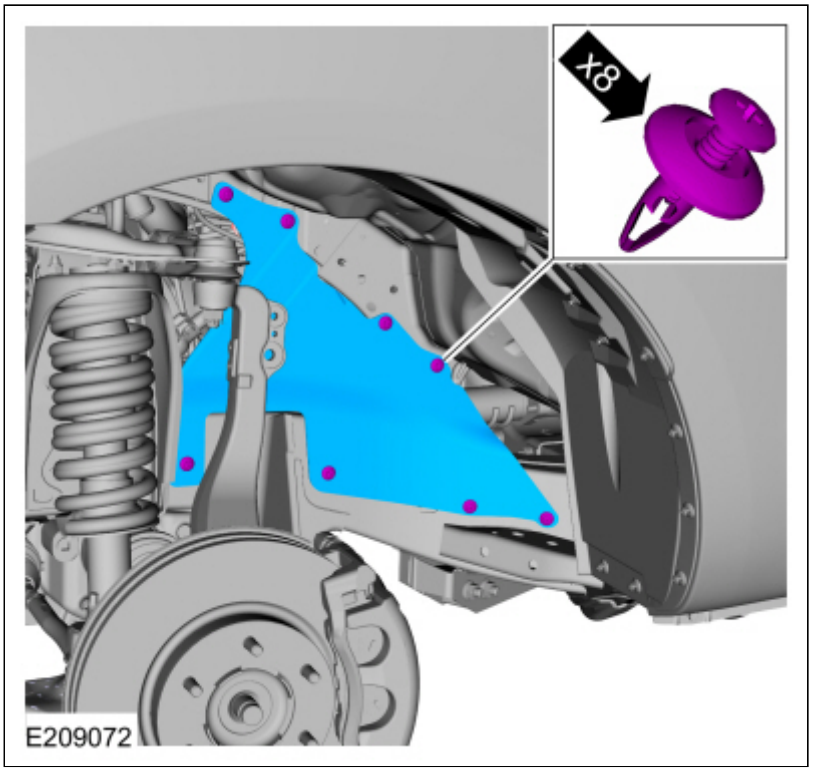
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. 

4. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

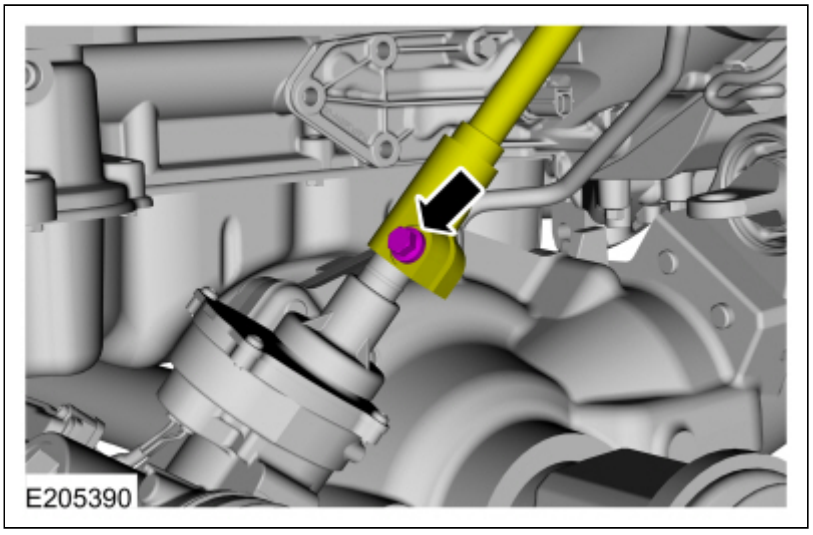
Refer to: Engine Undershield () .

5.

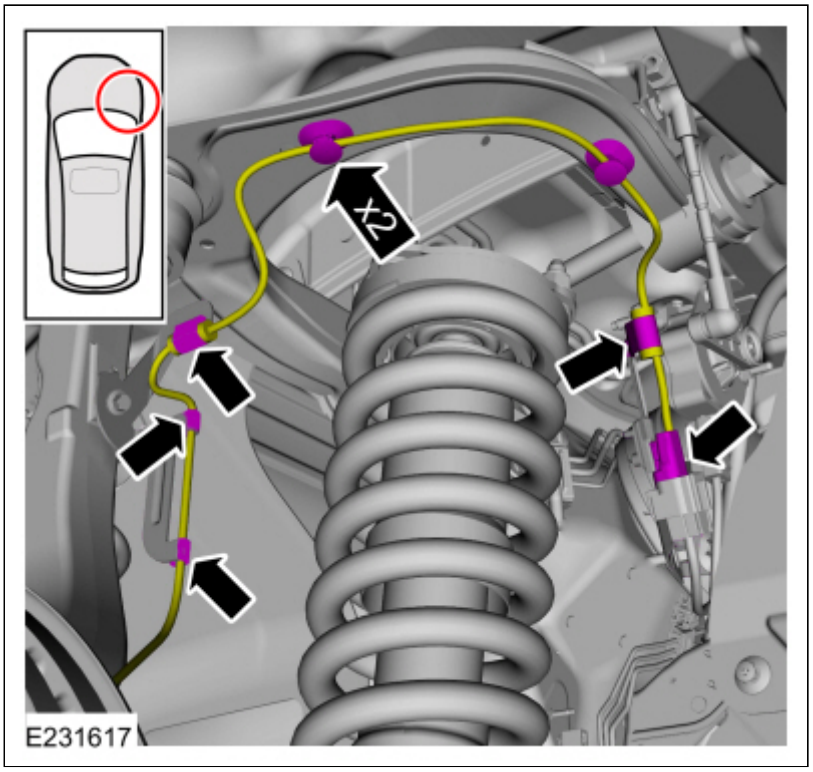


6. **WARNING: Do not reuse steering column shaft bolts. This may result in fastener failure and steering column shaft detachment or loss of steering control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

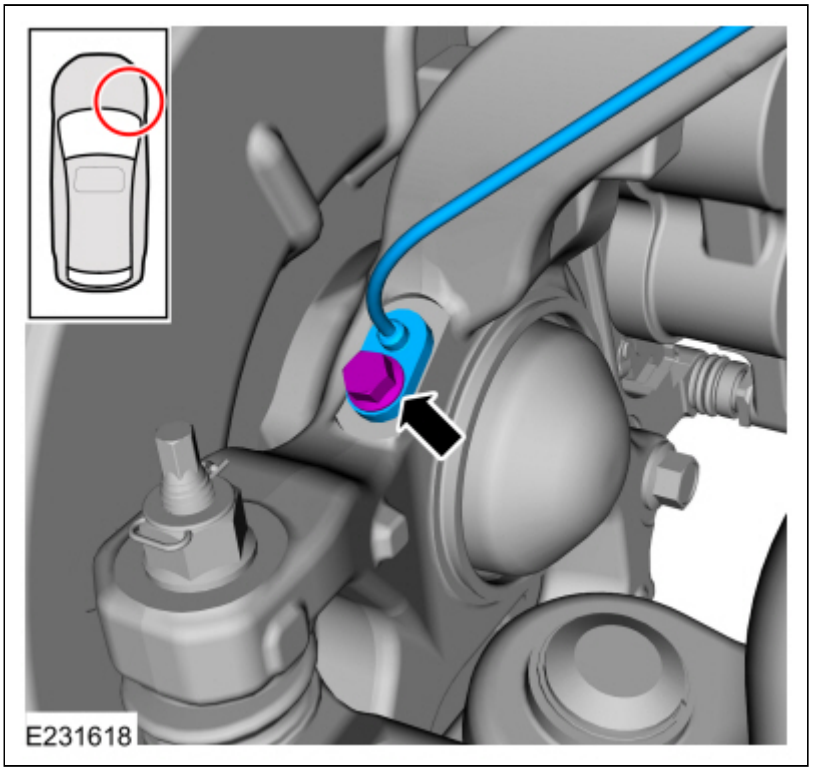
   Torque: 23 Nm



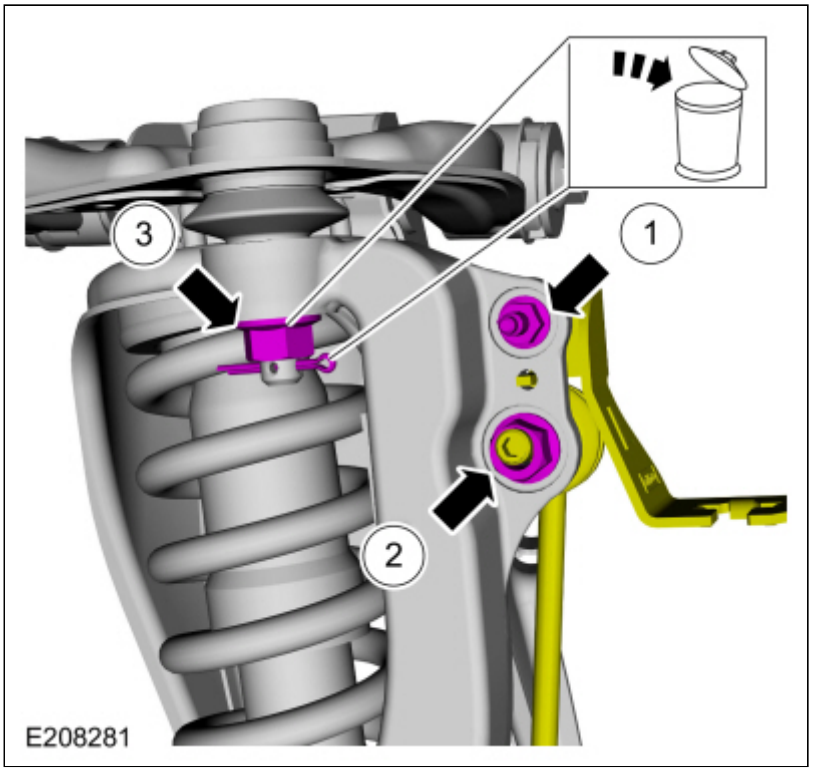
7.



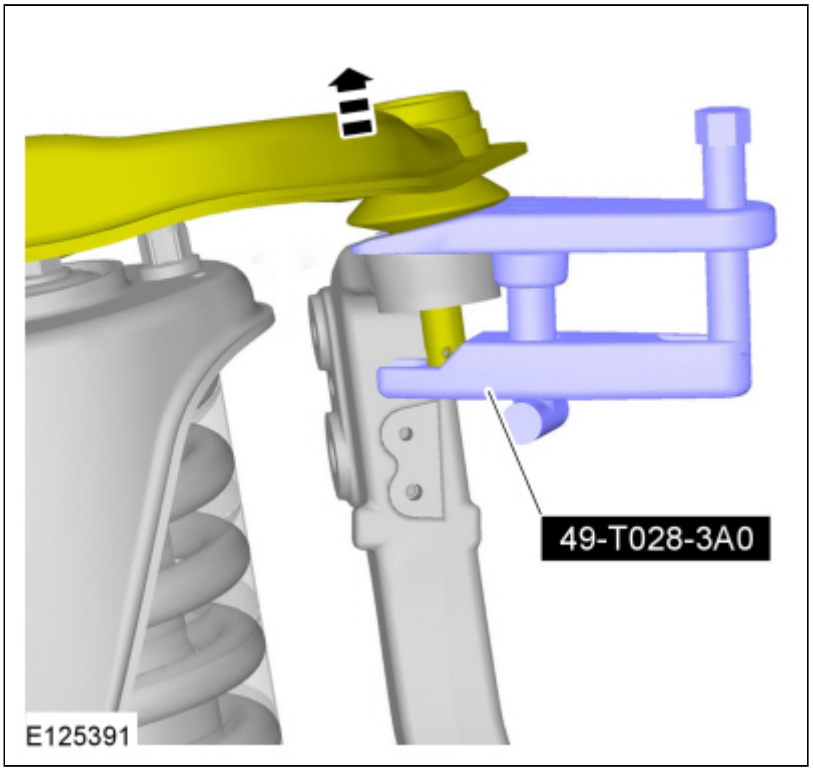
8. *Torque*: 6 Nm



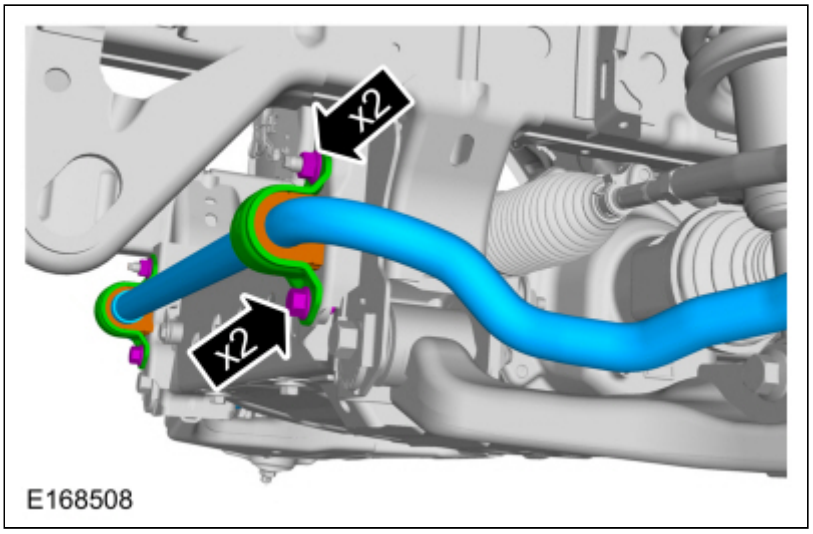
9. RH side
   Torque:
   1: 14 Nm
   2: 90 Nm
   3: 63 Nm



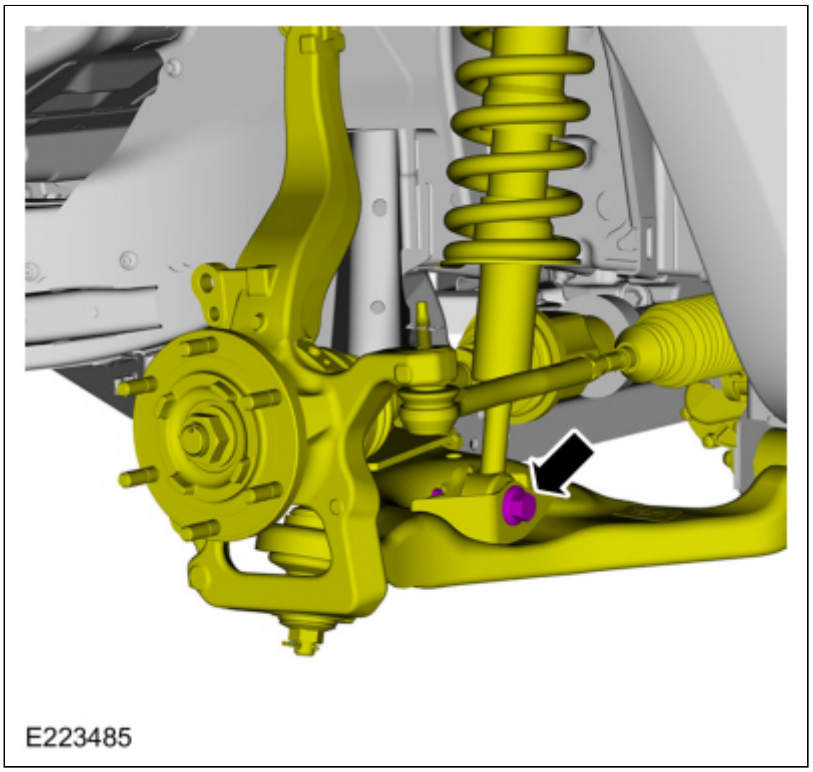
10. RH side



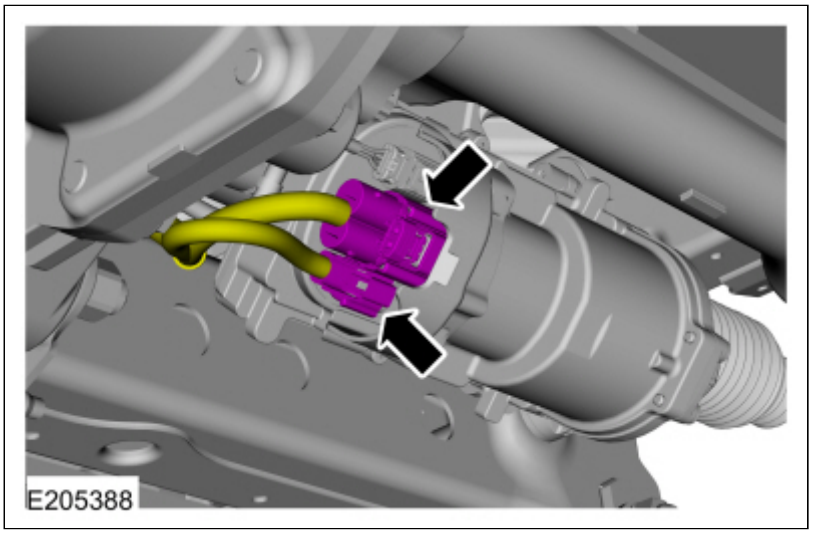
11. *Torque*: 90 Nm



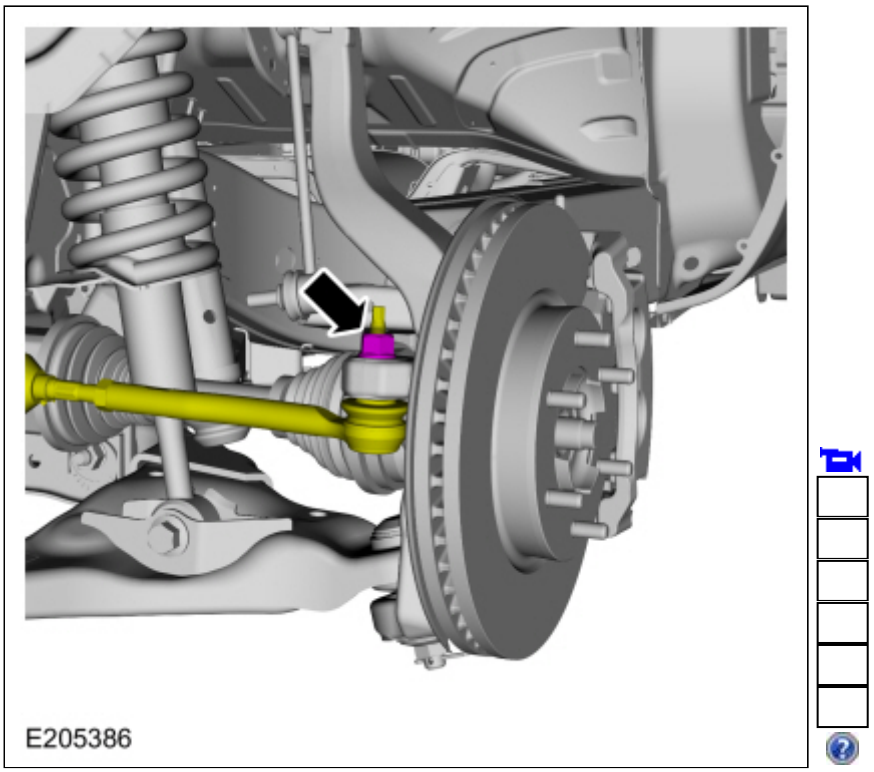
12. RH side
    Torque: 63 Nm



13.



14. *Torque*: 63 Nm

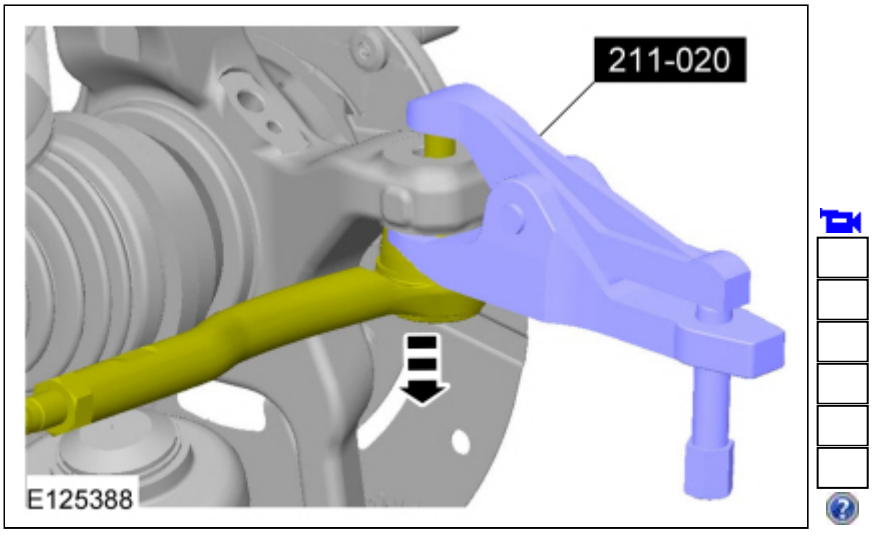


15. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

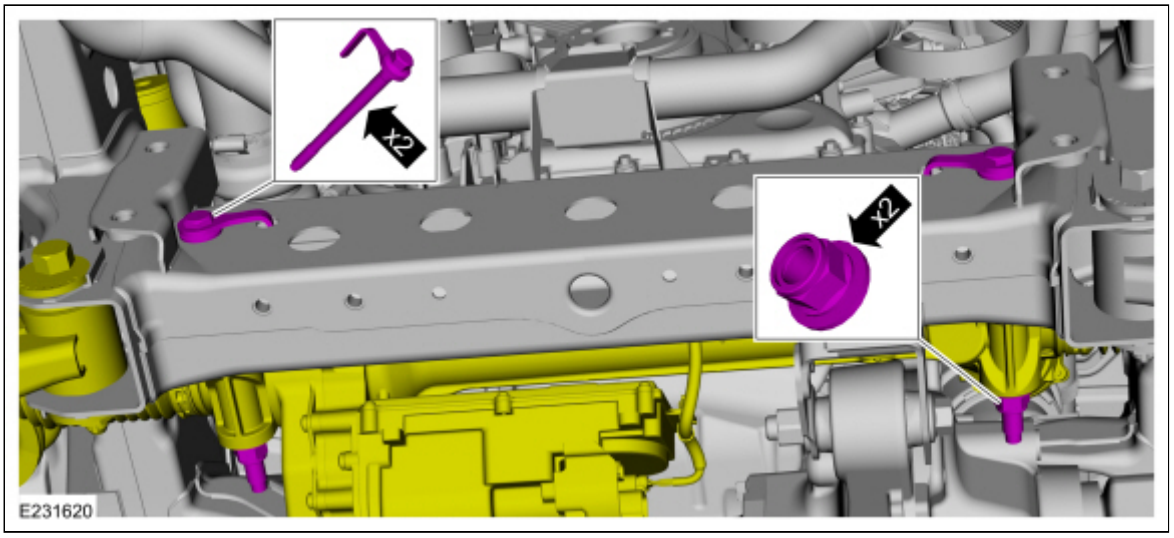
    NOTICE: Do not damage the tie-rod boot while installing the special tool.

    NOTICE: Leave the tie-rod end retaining nut in place to protect the ball joint stud.

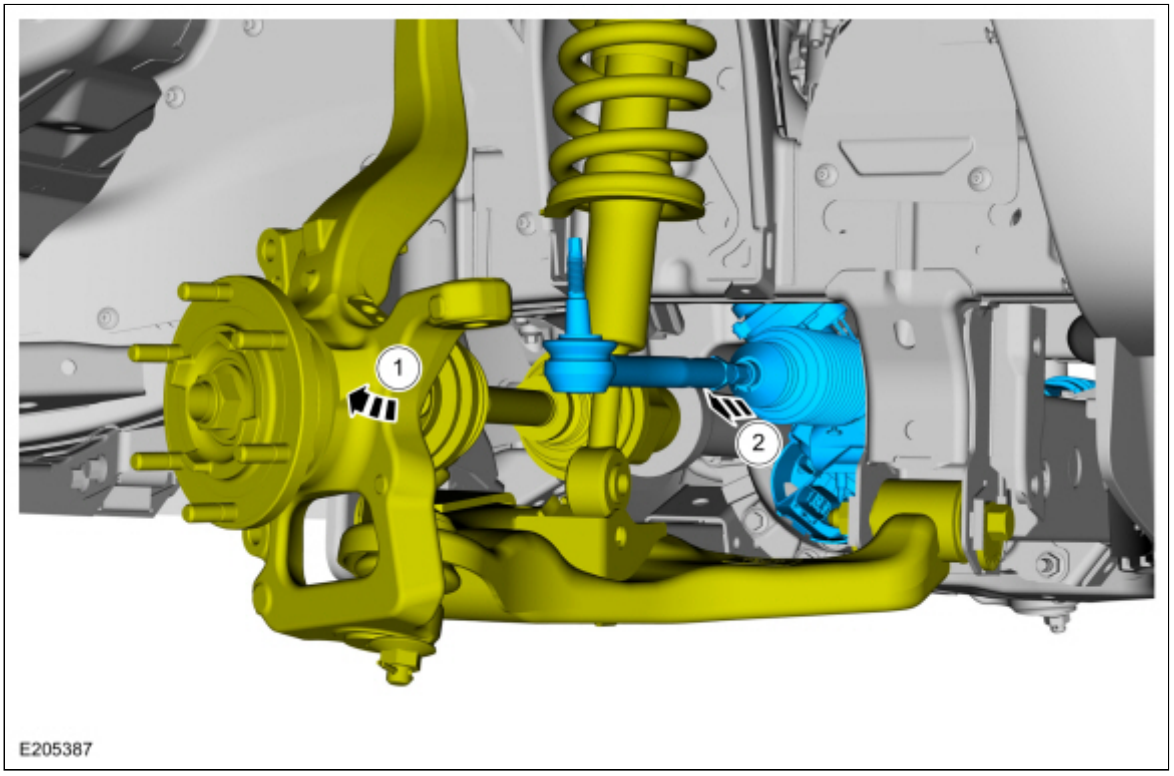
    On both sides
    Use Suggested Tool: 211-003 (T64P-3590-F) Remover, Steering Arm. Tool shown or a commercially available equivalent can be used.



16. *Torque*: 48 Nm



17.



Installation

1. To install, reverse the removal procedure.
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
4. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information) .

Copyright © 2016 Ford Motor Company

Steering Column - Vehicles With: Electronic Power Assist Steering (EPAS) - Overview

Base Part Number: 3524

Steering Column Overview

The steering column system consists of the following components:

- Steering wheel
- SCCM
- Upper and lower steering shafts
- Steering column control switch (power steering column)

The steering column is the mechanical linkage between the steering wheel and the steering gear. The steering wheel is mounted to a shaft which passes through the center of the steering column to the steering gear. The steering column shaft utilizes non-servicable U-joint type couplings.

Vehicles with the manual tilt/telescope steering column are controlled by a mechanical lever on the underside of the steering column to lock and unlock the steering column. When the lever is pulled down, the steering column can be adjusted up or down and in or out to the desired position. While holding the steering wheel in the desired position, pulling the lever up to its original position locks the steering column.

Copyright © 2016 Ford Motor Company

Steering Wheel Cover Repair

Materials

Name	Specification
Adhesive	WSK-M2G402-A4

Activation

1. **NOTE:** *If re-adhering leather to the front side of the steering wheel only, it will not be necessary to remove the steering wheel. Steering wheel removal is necessary only when repairing loose leather on the backside of the steering wheel.*

   If necessary, remove the steering wheel.
   Refer to: Steering Wheel (211-04 Steering Column) .

2. Position the loose leather out of the way.

3. Apply the specified adhesive evenly over the wheel spoke.
   Material: Adhesive (WSK-M2G402-A4)

4. Position the loose leather back into the original position.

5. **NOTE:** *The adhesive should be completely set after 5 minutes. Do not pull on the repair area.*

   Smooth the leather and tuck in for neat appearance.

6. Apply pressure (for at least 30 seconds) until the leather is bonded to the wheel spoke.

7. If removed, install the steering wheel.
   Refer to: Steering Wheel (211-04 Steering Column) .

Copyright © 2016 Ford Motor Company

Steering Wheel

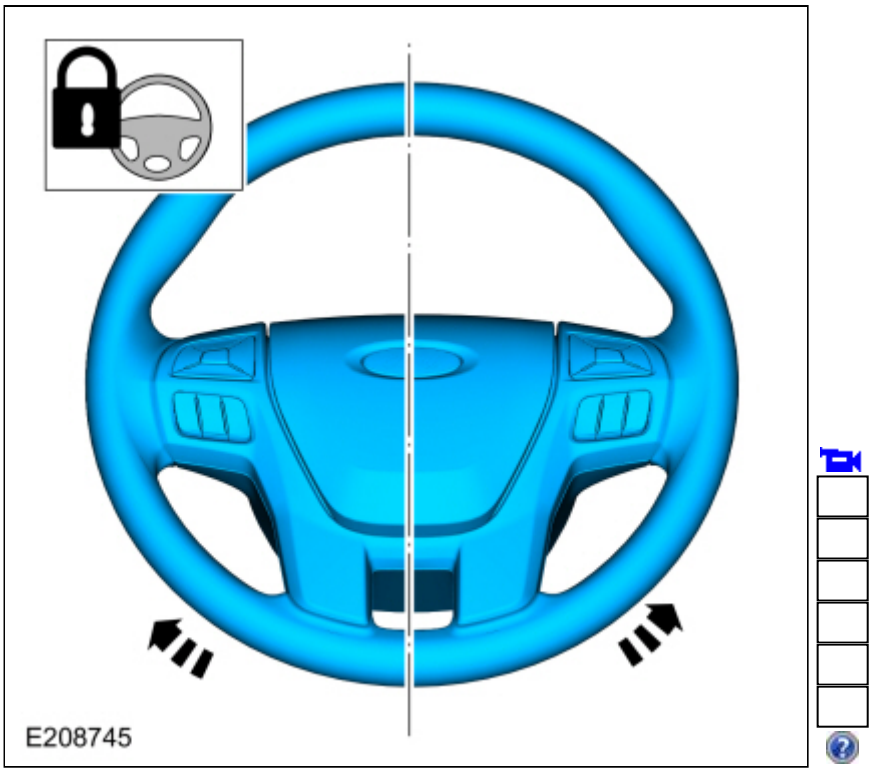
Base Part Number: 3600

Special Tool(s) / General Equipment

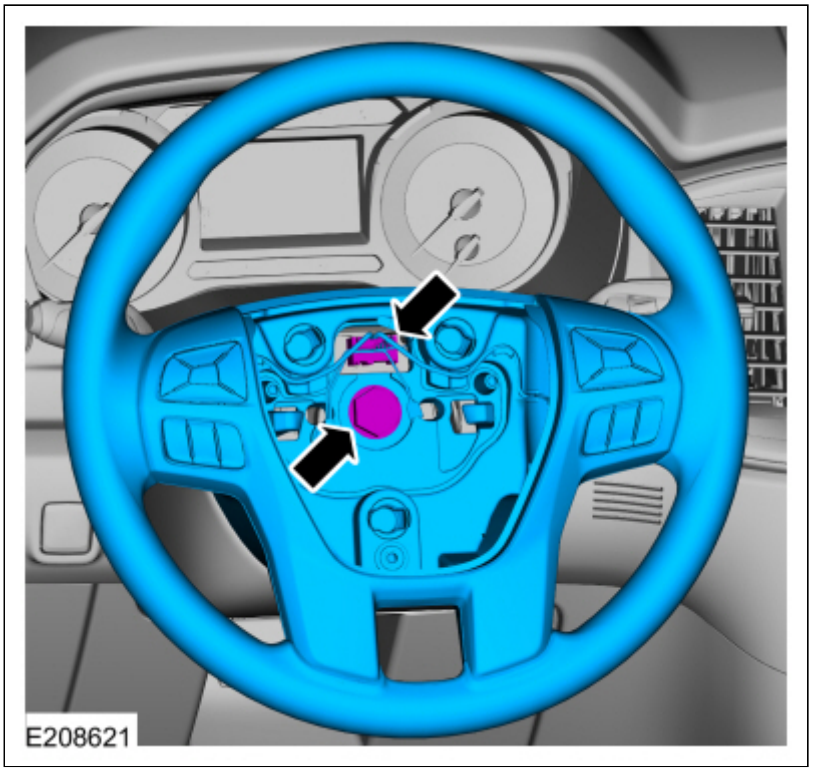
Adhesive Tape

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

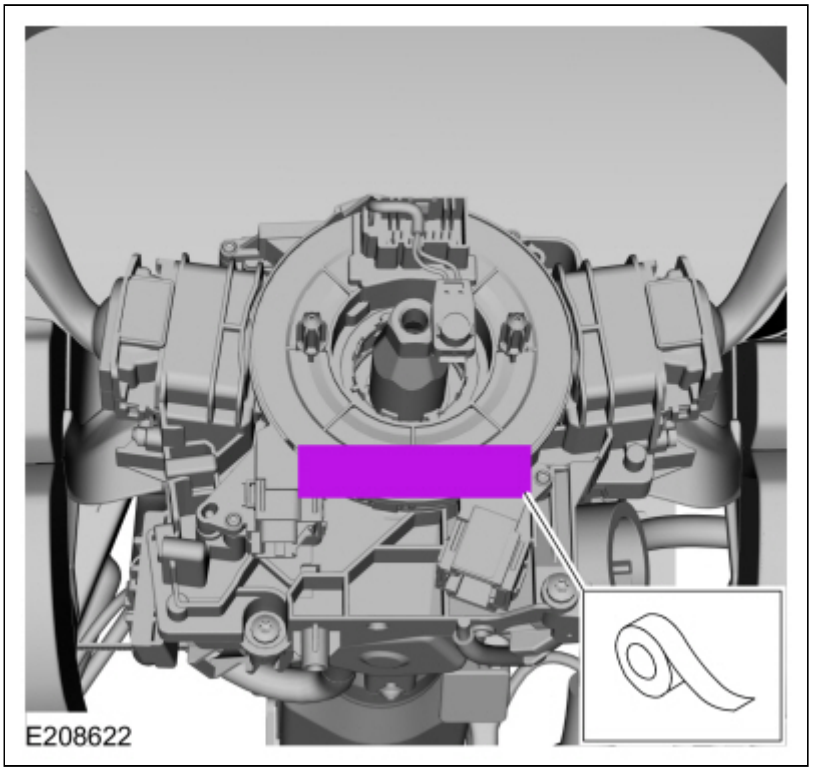
1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Driver Airbag (501-20B) .
3. 

4. *Torque*: 40 Nm



5. **NOTICE: Make sure that the clockspring rotor does not rotate.**

   Use the General Equipment: Adhesive Tape



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Steering Column

Base Part Number: 3524

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

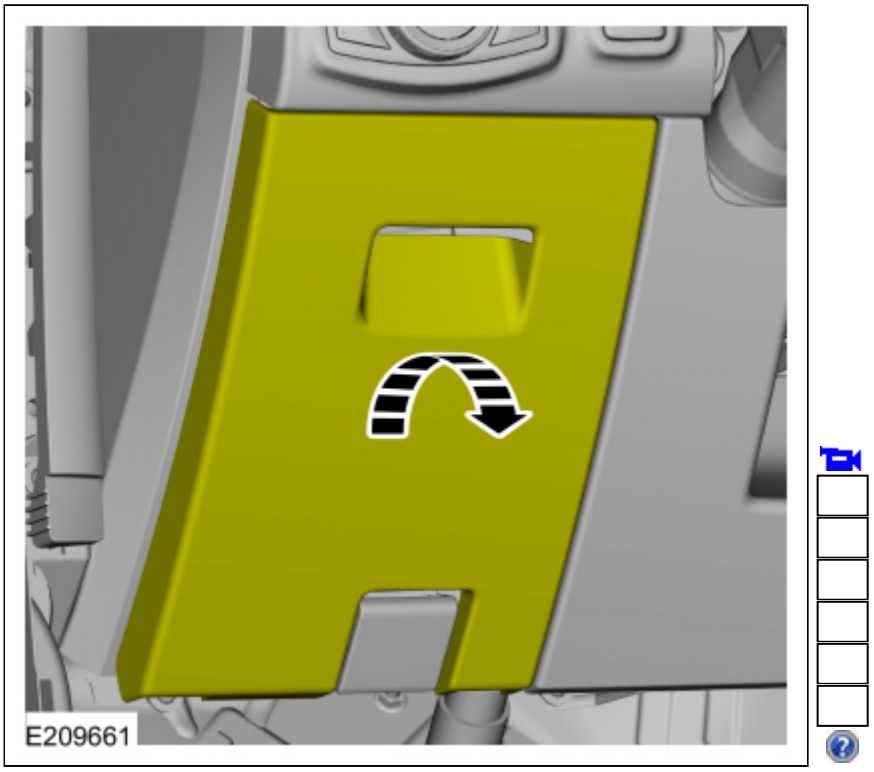
1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
3. Refer to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).
4. Refer to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

Vehicles With: Driver Knee Airbag

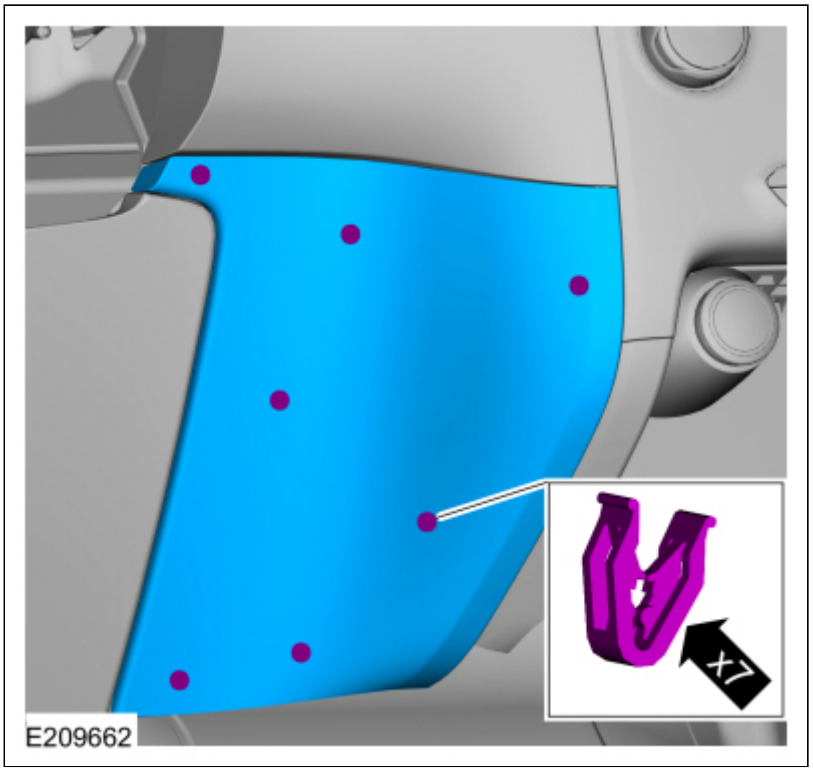
5. Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

Vehicles without driver lower air bag

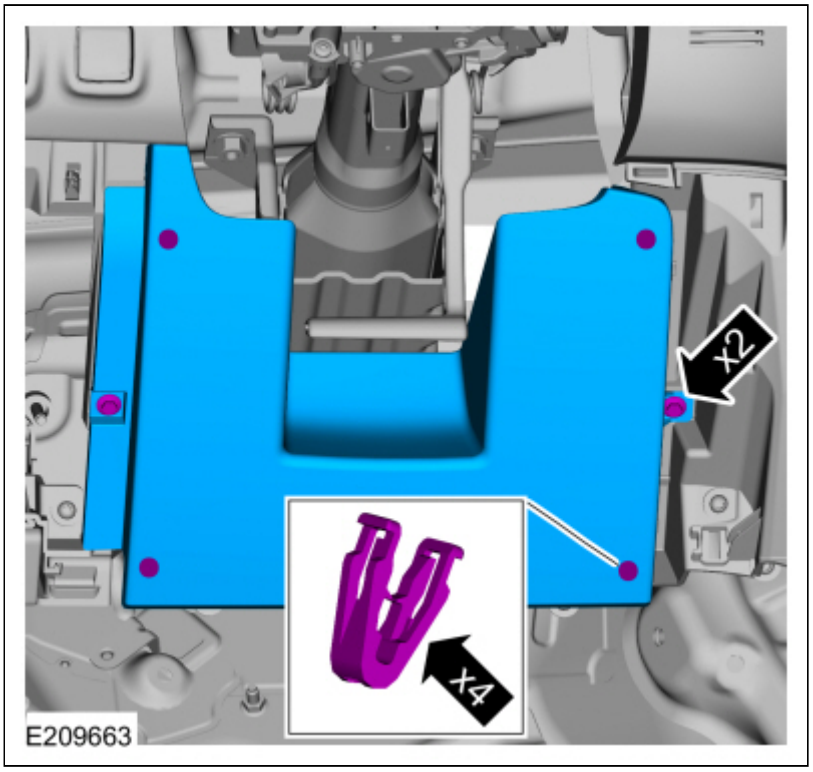
6.



7.



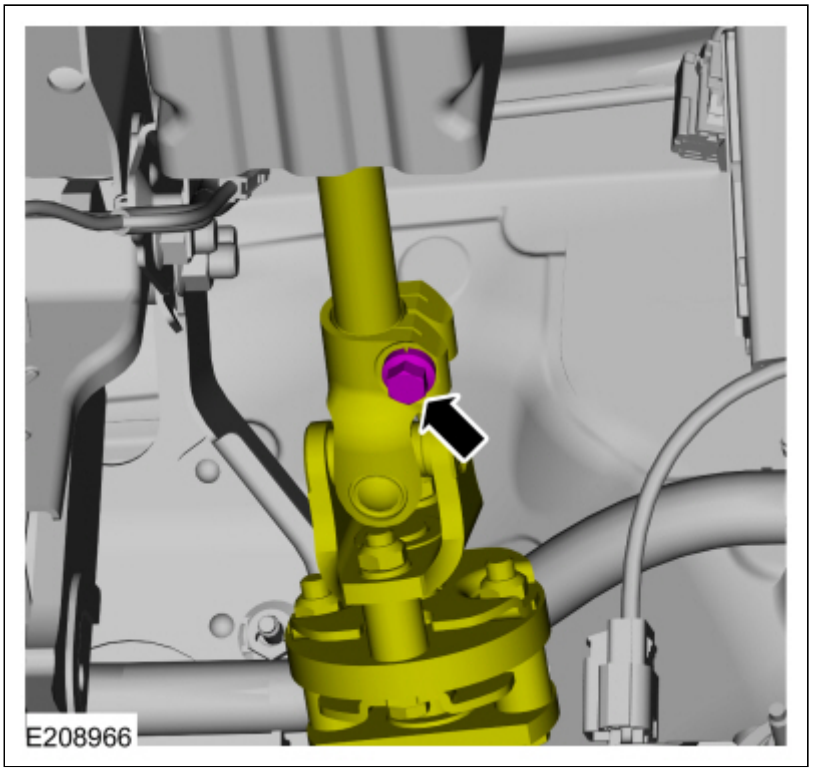
8. *Torque*: 3 Nm



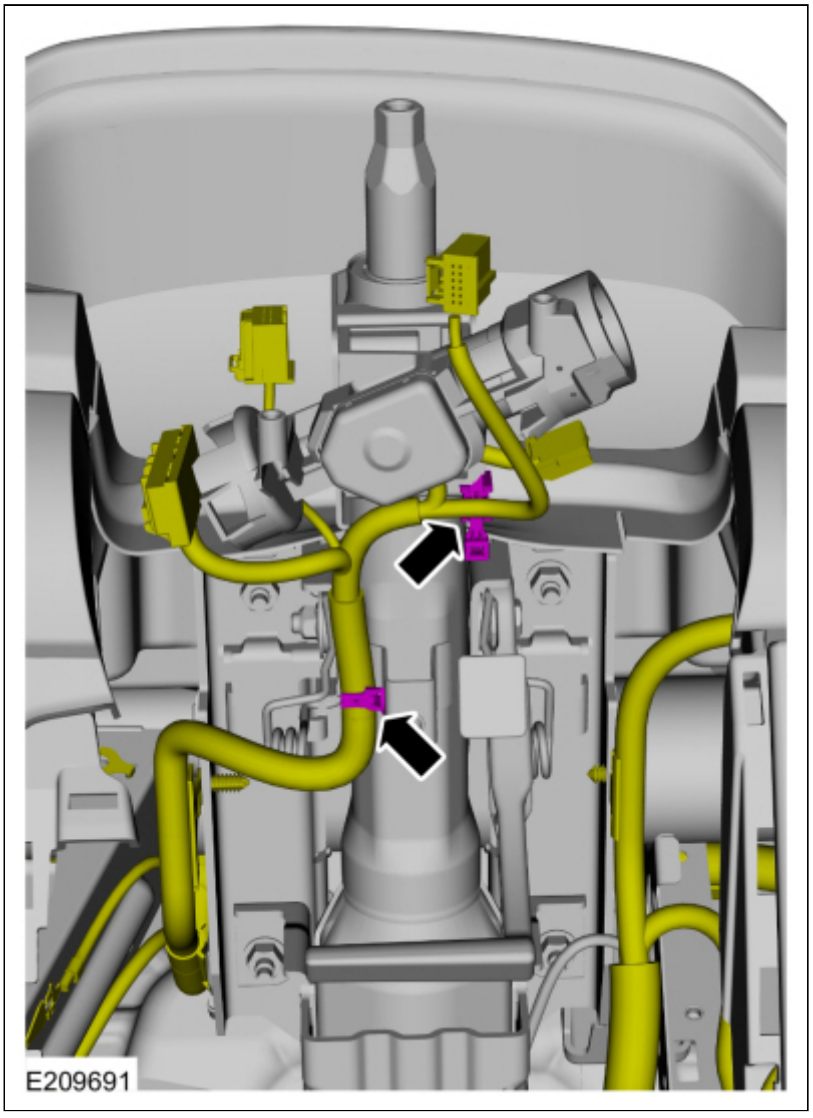
All vehicles

9. **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Torque: 23 Nm



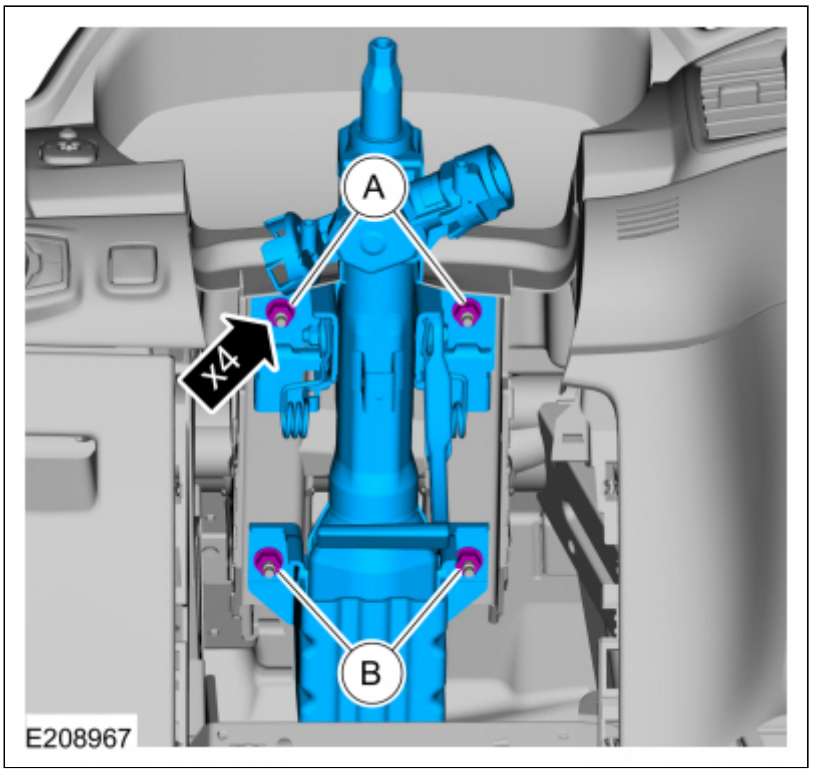
10.



11. **NOTE:** *Tighten nuts A first then B in order.*

    NOTE: *Do not release tilt lever before tightening nuts A and B completely.*

Torque: 15 Nm



Installation

1. To install, reverse the removal procedure.

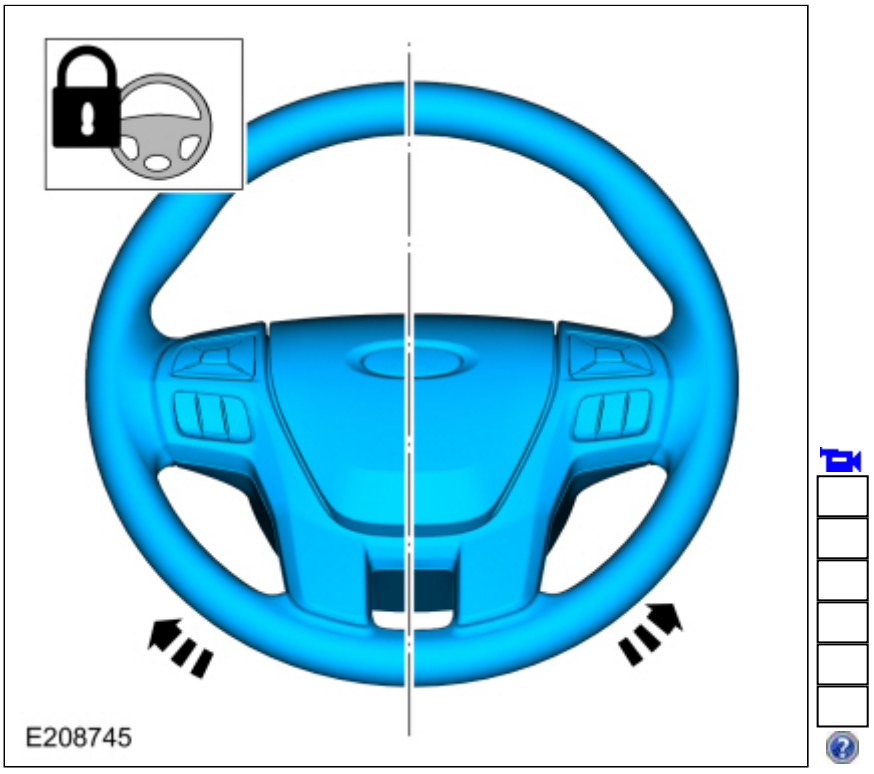
Copyright © 2016 Ford Motor Company

Steering Column Lower Shaft

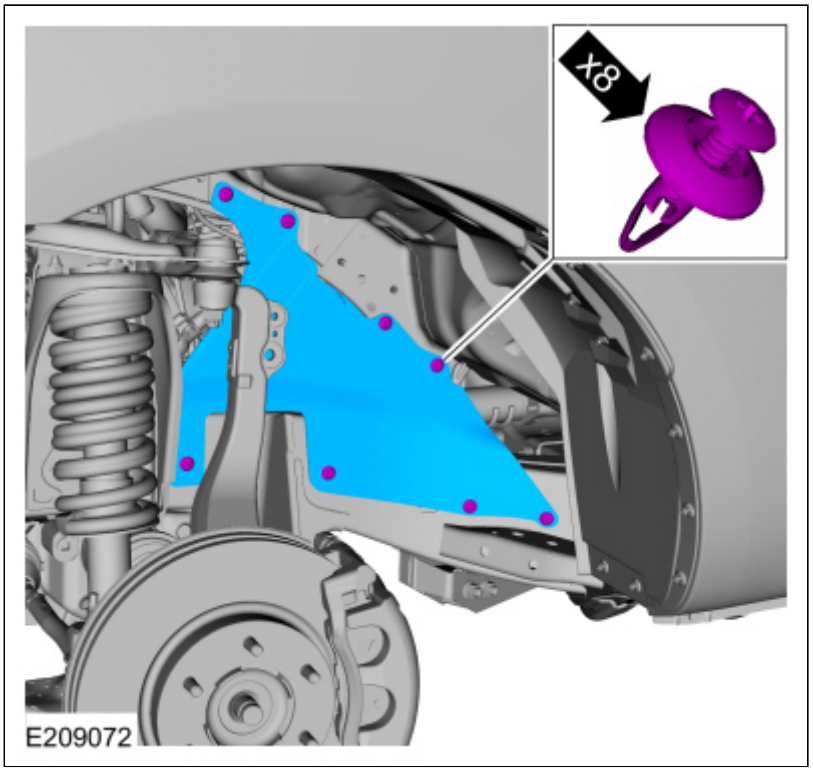
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the steering column internal sensor may result.*

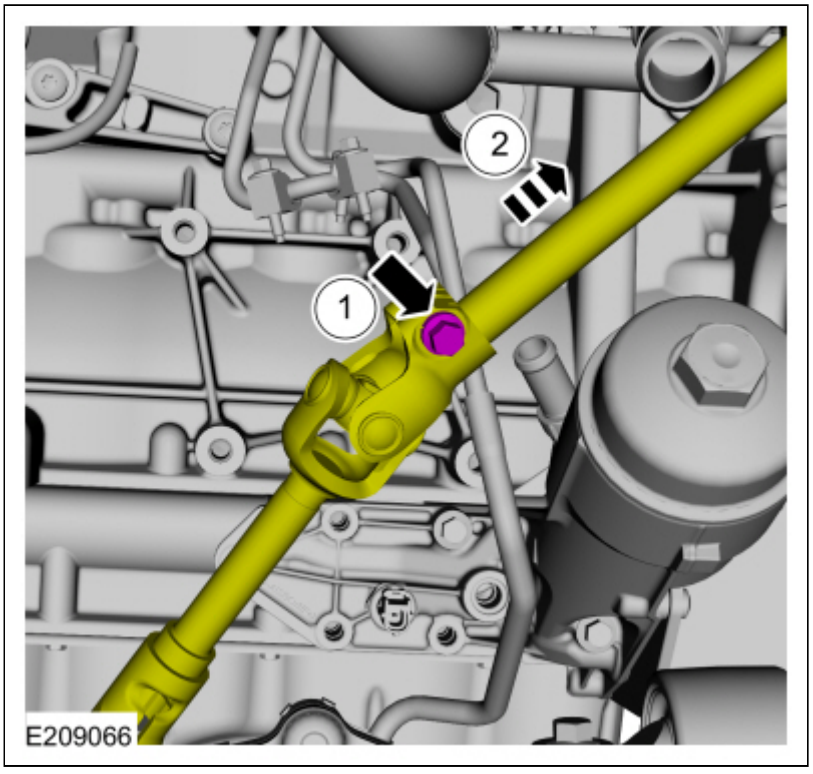


3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4.



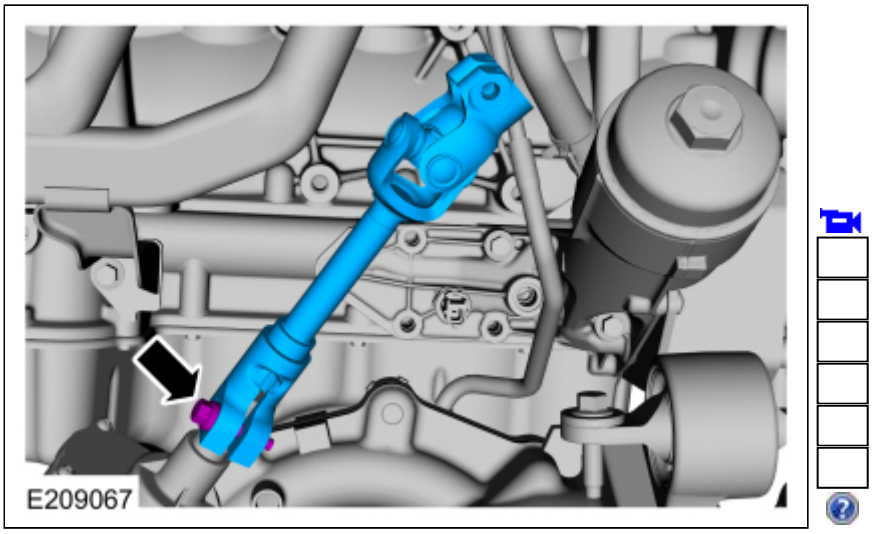
5. **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Torque: 23 Nm



6. **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Torque: 23 Nm



Installation

1. To install, reverse the removal procedure.

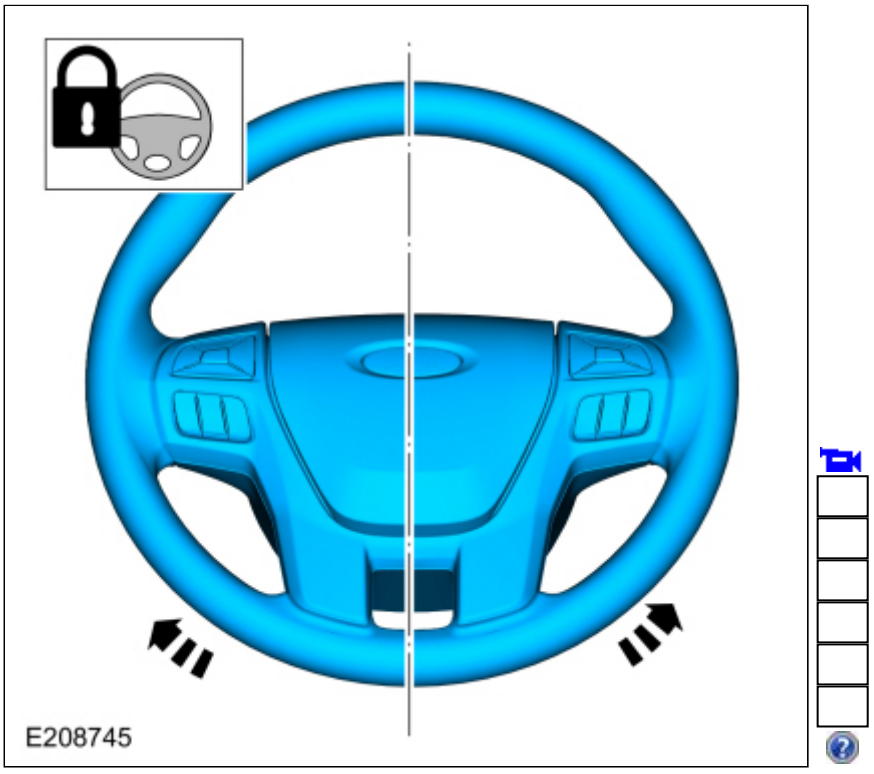
Copyright © 2016 Ford Motor Company

Steering Column Upper Shaft

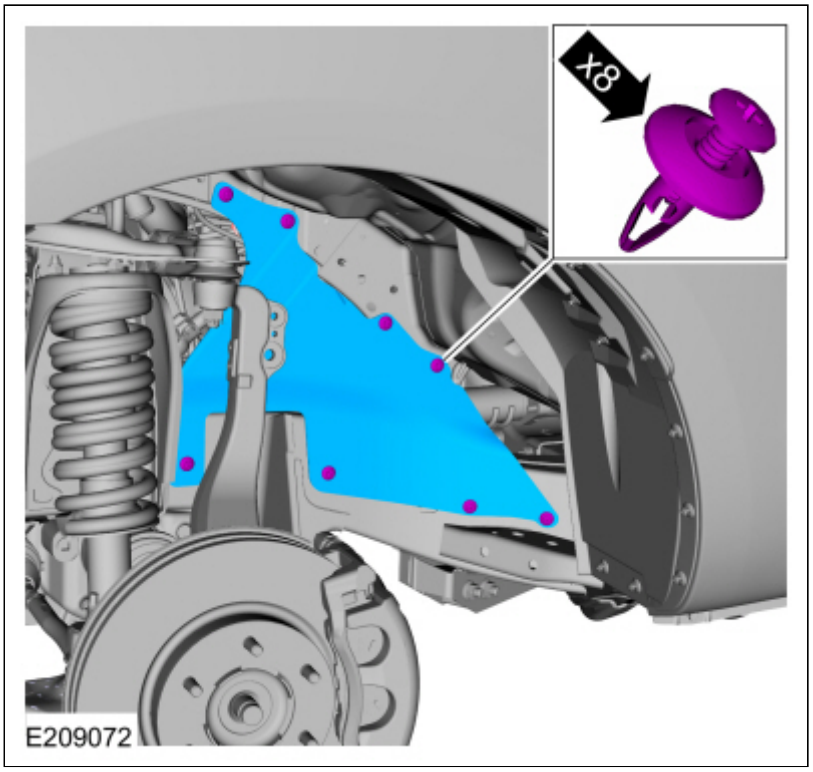
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the steering column internal sensor may result.*

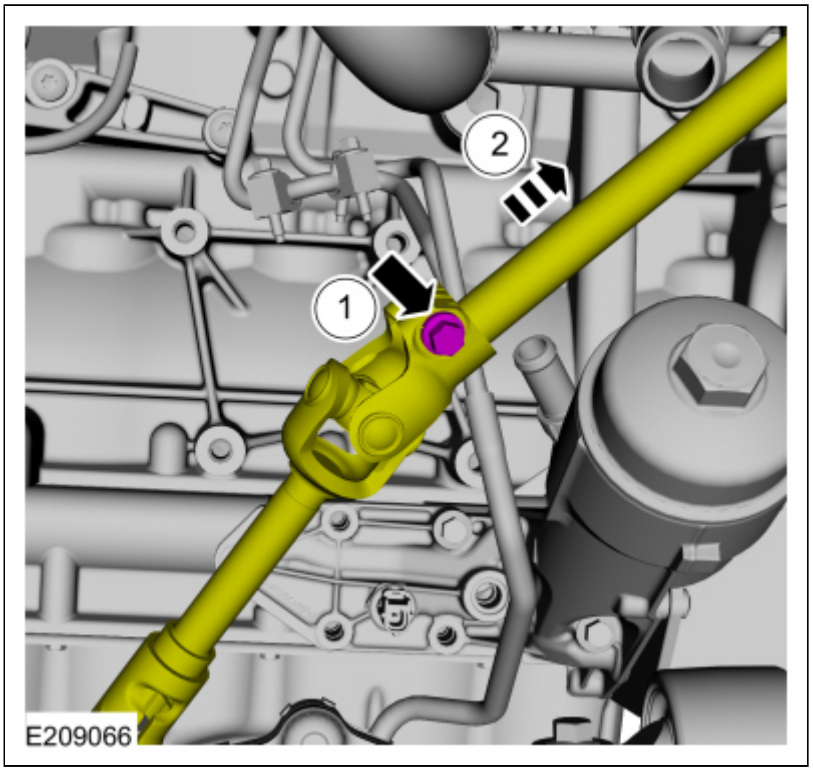


3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4.



5. **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

   Torque: 23 Nm

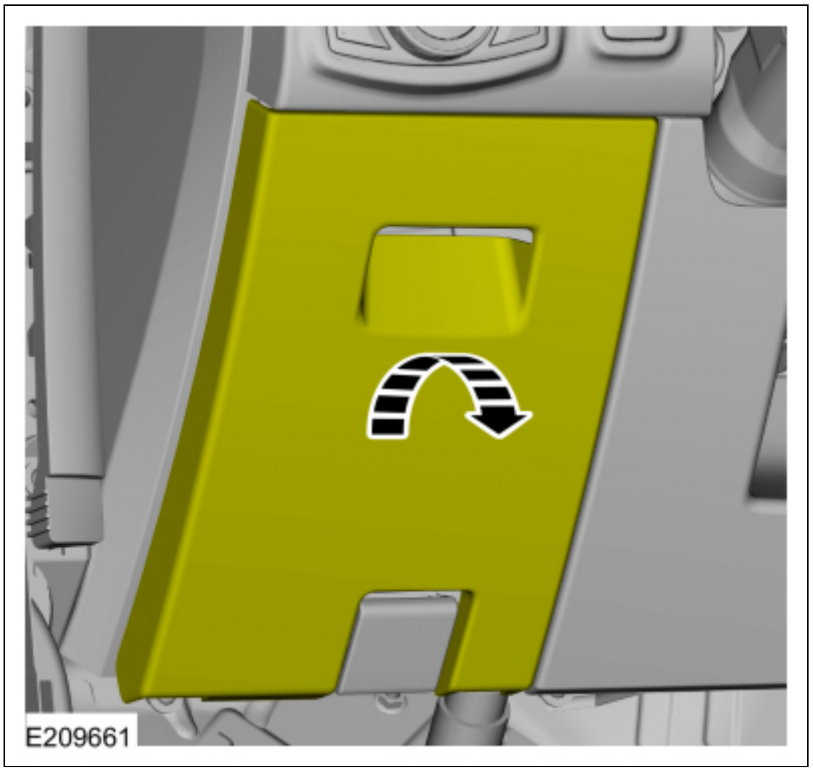


Vehicles With: Driver Knee Airbag

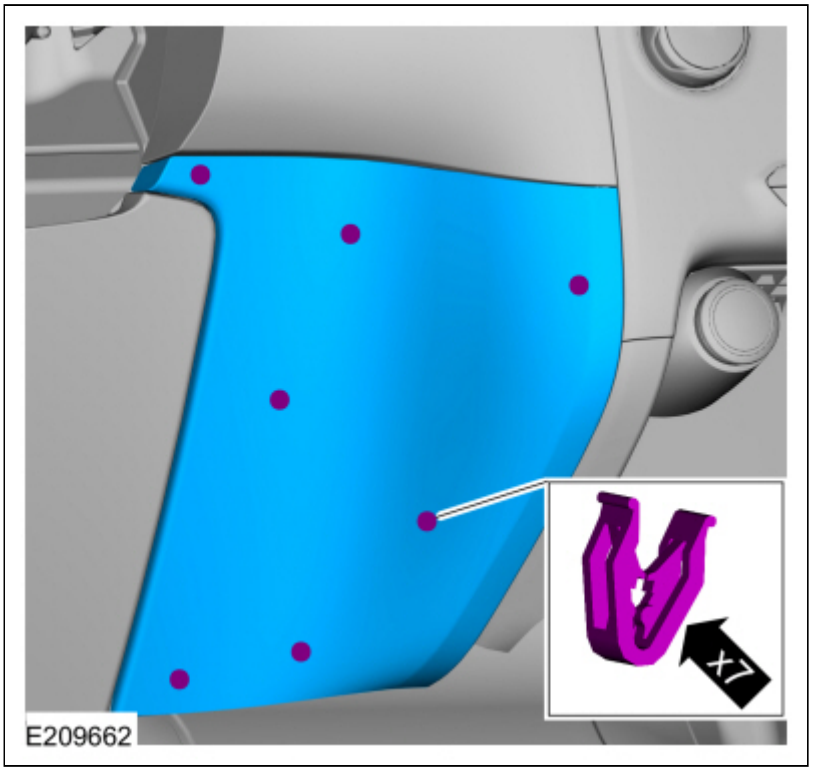
6. Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

Vehicles without driver lower air bag

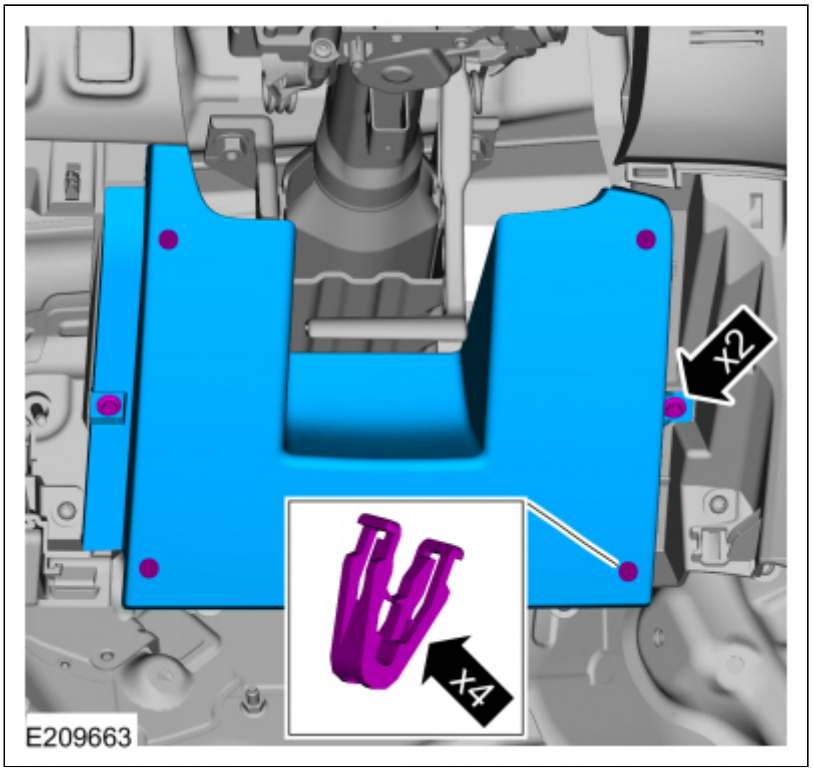
7.



8.



9. *Torque*: 3 Nm

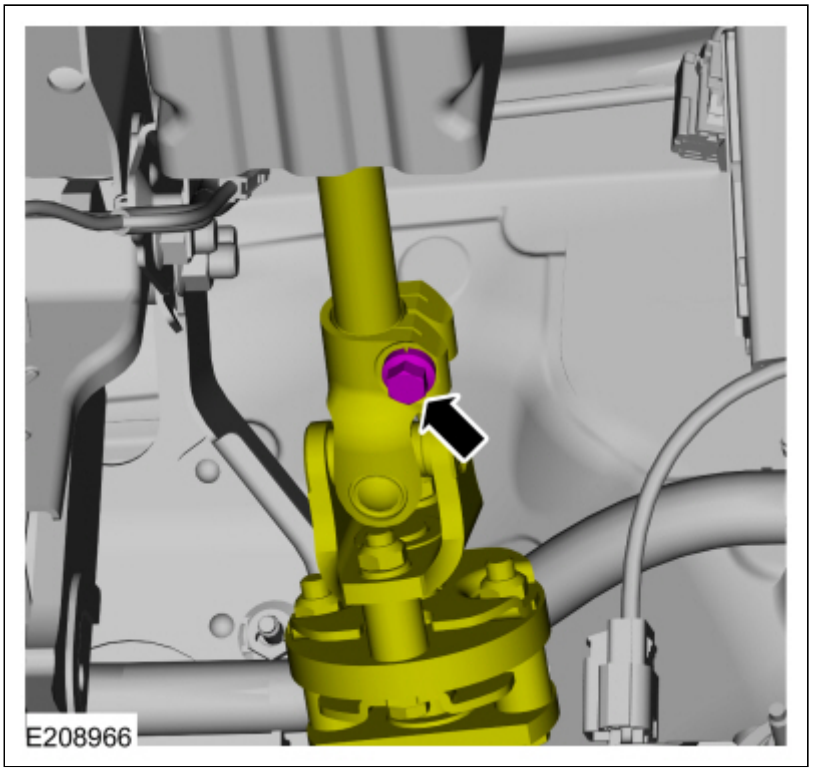


All vehicles

10. Refer to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).

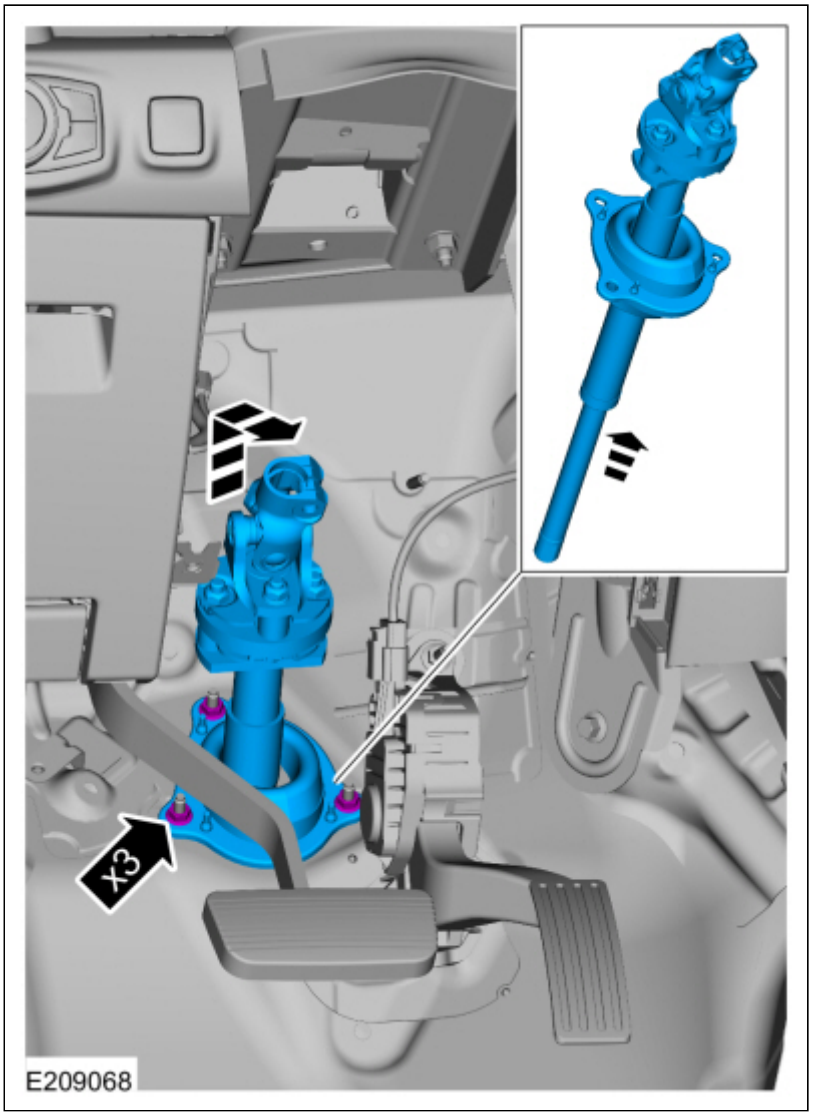
11. **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

    Torque: 23 Nm



12. **WARNING: Install a new steering column shaft bolt. Reuse could result in bolt failure and loss of vehicle control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

    Torque: 7 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Steering Wheel and Column Electrical Components - Overview

Steering Column Switches Overview

The steering column switches are located on and around the steering column. They enable the driver to control various vehicle functions while remaining focused on driving. The steering column switches consist of:

- Left multifunction switch - mounted on the left side of the SCCM and is used:
  - to control the turn signals, low/high beam selection and the flash-to-pass feature.
    Refer to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).
  - to control the windshield wipers and washer.
    Refer to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).
- Steering wheel switches - mounted on the front of the steering wheel and can be serviced separately from the steering wheel. These are used to access settings and controls displayed in the message center or for control of the cruise control system, the audio system and the SYNC® system.
  - For the message center (left upper switch),
    Refer to: Message Center - Overview (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).
  - For the cruise control system (left lower switch),
    Refer to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).
    Refer to: Cruise Control - System Operation and Component Description (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Description and Operation).
  - For the audio system (right upper switch), Refer to the appropriate section in Group 415 for the procedure.
  - For the SYNC® system (right lower switch), Refer to the appropriate section in Group 415 for the procedure.

The steering column and steering wheel switches interface with other modules and components on the vehicle through the SCCM, which communicates on the High Speed Controller Area Network 2 (HS2-CAN).

Conventional Ignition Switch Overview

The conventional ignition switch is controlled by the ignition lock cylinder and key. The ignition lock cylinder and ignition switch are connected mechanically. Turning the ignition lock cylinder places the ignition switch into the desired position. The available ignition switch positions are:

- OFF
- ACC
- ON
- START

When placed in ACC or ON, the ignition switch provides voltage inputs to the BCM.

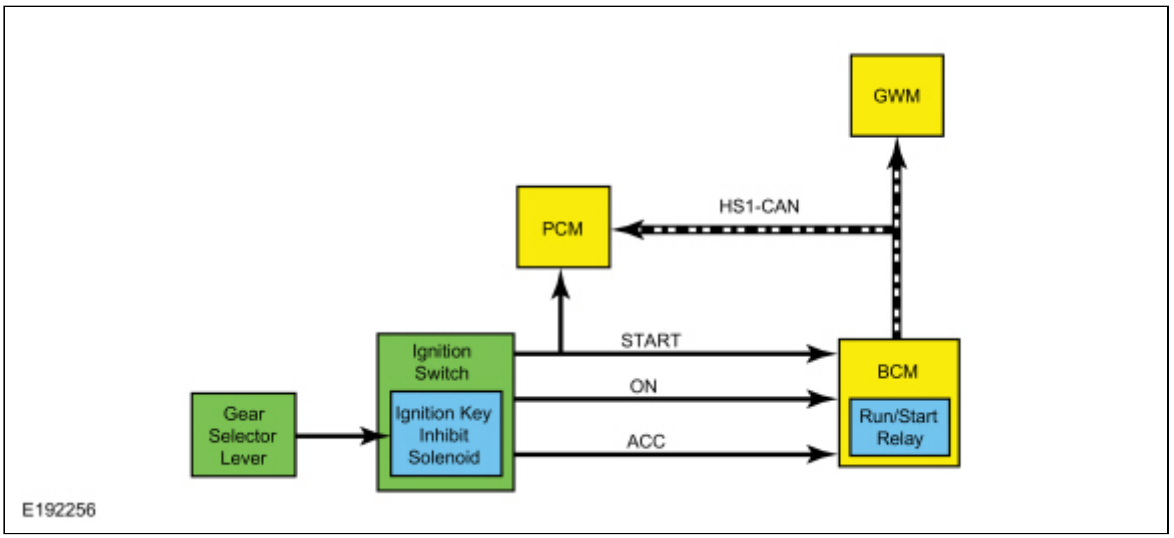
When placed in START, the ignition switch provides voltage inputs to the BCM and PCM.

Copyright © 2016 Ford Motor Company

Steering Wheel and Column Electrical Components - System Operation and Component Description

System Operation

System Diagram - Conventional Ignition Switch



Network Message Chart - Conventional Ignition Switch

GWM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	This message informs the GWM of the current ignition status; off, on, start, unknown or invalid.

PCM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	This message informs the PCM of the current ignition status; off, on, start, unknown or invalid.

Ignition Switch System

The BCM controls the ignition modes, including OFF, ACC, ON and START. This allows some systems to be activated without starting the vehicle.

The BCM provides voltage at all times to the ignition switch. Depending on the ignition switch position, voltage may be routed to one or two of the ignition switch input circuits back to the BCM.

OFF

The BCM supplies voltage to the ignition switch at all times. When the ignition switch is in the OFF position, the switch is open, preventing any voltage signals from reaching the BCM. When the BCM does not detect voltage from any of the ignition mode-designated circuits, the BCM interprets this as the ignition off mode.

The BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN

and does not energize any relays to prevent voltage from being distributed to the various electrical systems.

ACC

When the ignition switch is in the ACC position, the switch routes voltage through the ACC-designated circuit to the BCM. The BCM interprets this as the ignition accessory mode.

The BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN and energizes the accessory designated relays and provides power to some electrical system.

ON

When the ignition switch is in the ON position, the switch routes voltage through the ACC-designated and ON-designated circuits to the BCM. The BCM interprets this as the ignition on mode.

The BCM communicates the ignition mode to the other modules by sending an ignition status message over the CAN and activates the internal run/start relay, providing ignition power to the various vehicle systems and modules.

START

When the ignition switch is placed in the START position, the switch routes voltage through the ON-designated and START-designated circuits to the BCM.

The BCM interprets this as the ignition start mode and communicates the ignition mode to the other modules by sending an ignition status message over the CAN. Additionally, the ignition switch routes voltage to the PCM indicating a request to start the vehicle.

The START-designated circuit is only used for vehicle starting.

Ignition Key Inhibit (Vehicles with Automatic Transmission)

The ignition key cylinder inhibit feature prevents the ignition lock cylinder from being rotated to the OFF/LOCK position when the vehicle is not in PARK.

The key removal inhibit solenoid (part of the ignition switch) receives battery voltage at all times from the BCM fuse 18 (5A). The ground control circuit for the key removal inhibit solenoid is routed to a park detect switch within the selector lever assembly (floor shift).

For vehicles equipped with a floor shifter, the ground is controlled by the BCM.

When the selector lever is in PARK, the park detect switch inside the selector lever assembly (floor shift) is open, preventing the solenoid from actuating. When the selector lever is moved out of PARK, the switch closes and completes the circuit to the BCM (floor shifter).

For vehicles with a floor shifter, the BCM controls the ground by means of a Field Effect Transistor (FET). The BCM enables the path to ground when it detects the vehicle is not in PARK based on messages received over the CAN.

When the selector lever is in PARK, the key removal inhibit solenoid deactivates and allows the ignition lock cylinder to be turned to the OFF/LOCK position to remove the key.

Component Description

Conventional Ignition Switch

The ignition switch is a multiple position rotary switch that is controlled by a lock cylinder and a key. The ignition switch is monitored by the BCM, which controls the voltage to the various electrical systems depending on input from the ignition switch.

The key removal inhibit solenoid (internal to the ignition switch) is an electronically controlled solenoid that prevents the ignition lock cylinder from being turned to the OFF/LOCK position unless the selector lever is in the PARK position. This also prevents the key from being removed from the ignition lock cylinder.

BCM

The BCM controls the run/start relays and sets the vehicle ignition mode based on inputs from the ignition switch. It communicates the ignition mode to other modules over the CAN. If a fault is detected with the ignition switch system, Diagnostic Trouble Codes (DTCs) are set in the BCM.

The BCM requires at least 2 keys to be programmed and PMI when replaced. Additionally, the parameter reset procedure must be carried out.

Copyright © 2016 Ford Motor Company

Steering Wheel and Column Electrical Components

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B1142:29	Ignition Status 1: Signal Invalid	GO to Pinpoint Test C
B130F:12	Run Accessory Control: Circuit Short to Battery	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B130F:14	Run Accessory Control: Circuit Short to Ground or Open	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1472:12	Ignition Key Removal Inhibit: Circuit Short To Battery	GO to Pinpoint Test E
B1472:14	Ignition Key Removal Inhibit: Circuit Short To Ground or Open	GO to Pinpoint Test E
U300A:01	Ignition Switch: General Electrical Failure	GO to Pinpoint Test F
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

SCCM DTC Chart

DTC	Description	Action
B1007:09	High-Beam Headlamp Switch: Component Failure	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1008:09	Wiper Mode Switch: Component Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1051:09	Front Washer Switch: Component Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10AD:02	Rain Sensor: General Signal Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).

B10AD:08	Rain Sensor: Bus Signal/Message Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10AD:49	Rain Sensor: Internal Electronic Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10AD:55	Rain Sensor: Not Configured	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1131:02	Wiper motor module: General Signal Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1131:08	Wiper motor module: Bus Signal/Message Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1131:11	Wiper motor module: Circuit Short To Ground	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1131:49	Wiper motor module: Internal Electronic Failure	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1131:55	Wiper motor module: Not Configured	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1131:9A	Wiper motor module: Component or System Operating Conditions	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B137F:09	Steering Wheel Left Switch Pack: Component Failure	REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
B1380:09	Steering Wheel Right Switch Pack: Component Failure	Refer to the appropriate section in Group 415 for the procedure.
B1380:11	Steering Wheel Right Switch Pack: Circuit Short to Ground	Refer to the appropriate section in Group 415 for the procedure.
B1380:17	Steering Wheel Right Switch Pack: Circuit	Refer to the appropriate section in Group 415 for the procedure.

	Voltage Above Threshold	
B1D36:09	Turn Indicator Switch: Component Failure	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	Check vehicle service history for recent service actions related to this module. This DTC will set due to incomplete or improper PMI procedures. If there have been recent service actions with this module, REPEAT/CARRY OUT the PMI procedure as directed by the diagnostic scan tool. If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data.
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	This DTC sets if the steering wheel switches do not match the switch function configuration data in the SCCM. CHECK the parts catalog and CONFIRM that the correct SCCM and steering wheel control switches are installed in the vehicle. INSTALL the correct components, as necessary.

Symptom Charts

Symptom Chart: Ignition Switch - Conventional

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Causes	Actions
No power in all ignition switch positions	• Refer to Pinpoint Test	• GO to Pinpoint Test A
No power in ACC	• Refer to Pinpoint Test	• GO to Pinpoint Test B
No power in ON	• Refer to Pinpoint Test	• GO to Pinpoint Test C
No power in START	• Refer to Pinpoint Test	• DIAGNOSE the no-start condition. Refer to the appropriate section in Group 303 for the procedure.
Key not detected displays in the message center	• Refer to Pinpoint Test	• REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
The ignition key cannot be returned to the OFF position	• Refer to Pinpoint Test	• GO to Pinpoint Test D
The ignition key can be turned to the OFF position when the selector lever is not in PARK	• Refer to Pinpoint Test	• GO to Pinpoint Test E
The ignition lock cylinder is difficult to turn	• Refer to Pinpoint	• REFER to: Locks, Latches and Entry Systems

	Test	(501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

Pinpoint Tests

No Power in All Ignition Switch Positions - Conventional Ignition Switch

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

Possible Causes

- Fuse
- Wiring, terminals or connectors
- Ignition switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the battery and battery cables
- Inspect the BCM fuse 18 (5A)

PINPOINT TEST A : NO POWER IN ALL IGNITION SWITCH POSITIONS - CONVENTIONAL IGNITION SWITCH

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE VEHICLE BATTERY

- Carry out the Battery Condition Test.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery OK?

Yes	GO to A2
No	CORRECT the battery condition.

A2 CHECK FOR VOLTAGE TO THE IGNITION SWITCH

- Ignition OFF.
- Disconnect Ignition Switch C250.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C250-4		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	VERIFY the BCM fuse 18 (5A) is OK. If OK, GO to A3 If not OK, REFER to the Wiring Diagrams manual to identify the possible cause of the circuit short.

A3 CHECK THE IGNITION SWITCH VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Disconnect BCM C2280B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C250-4	Ω	C2280B-12

Is the resistance less than 3 ohms?

Yes	GO to A4
No	REPAIR the circuit.

A4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and all other previously disconnected connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

No Power in ACC - Conventional Ignition Switch

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- Ignition switch
- BCM

PINPOINT TEST B : NO POWER IN ACC - CONVENTIONAL IGNITION SWITCH

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK FOR BCM (BODY CONTROL MODULE) DTC (DIAGNOSTIC TROUBLE CODE) U300A:01

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC U300A:01 present?

Yes	GO to Pinpoint Test F
No	GO to B2

B2 CHECK FOR VOLTAGE TO THE BCM (BODY CONTROL MODULE) WITH THE IGNITION SWITCH IN THE ACC POSITION

- Ignition OFF.
- Disconnect BCM C2280G.
- Accessory ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-50		Ground

Is the voltage greater than 11 volts?

Yes	GO to B4
No	GO to B3

B3 CHECK THE IGNITION ACC CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Ignition Switch C250.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-50	Ω	C250-6

Is the resistance less than 3 ohms?

Yes	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	REPAIR the circuit.

B4 CHECK FOR VOLTAGE TO THE BCM (BODY CONTROL MODULE) WITH THE IGNITION SWITCH IN THE ON POSITION

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-50		Ground

Is the voltage greater than 11 volts?

Yes	GO to B5
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

B5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

No Power in ON - Conventional Ignition Switch

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1142:29	Ignition Status 1: Signal Invalid	Sets when the BCM does not receive a valid ignition signal during a BCM self-test.

Possible Causes

- Network concern
- Wiring, terminals or connectors
- Ignition switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the BCM fuse 34 (30A)

PINPOINT TEST C : NO POWER IN ON - CONVENTIONAL IGNITION SWITCH

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CARRY OUT A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, carry out the network test.

Does the BCM and the IPC pass the network test?

Yes	GO to C2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

C2 CHECK FOR BCM (BODY CONTROL MODULE) DTC (DIAGNOSTIC TROUBLE CODE) U300A:01

- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC U300A:01 present?

Yes	GO to Pinpoint Test F
No	GO to C3

C3 CHECK FOR VOLTAGE TO THE BCM (BODY CONTROL MODULE) WITH THE IGNITION SWITCH IN THE ON POSITION

- Ignition OFF.
- Disconnect BCM C2280G.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-37		Ground

Is the voltage greater than 11 volts?

Yes	VERIFY the BCM fuse 34 (30A) is OK. If OK, GO to C5 If not OK, REFER to the Wiring Diagrams manual to identify the possible cause of the circuit short.
No	GO to C4

C4 CHECK THE IGNITION ON-DESIGNATED INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Ignition Switch C250.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-37	Ω	C250-1

Is the resistance less than 3 ohms?

Yes	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	REPAIR the circuit.

C5 CHECK FOR AN INTERMITTENT COMMUNICATION CONCERN

- Ignition OFF.
- Connect BCM C2280G.
- Using a diagnostic scan tool, retrieve the Continuous Mode Diagnostic Trouble Codes (CMDTCs) from all modules.

Are multiple communication Diagnostic Trouble Codes (DTCs) set in multiple modules?

Yes	DIAGNOSE an intermittent network concern. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to C6

C6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and all other previously disconnected connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Ignition Key Cannot Be Returned to the OFF Position

Refer to Wiring Diagrams Cell 37 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- Ignition switch
- Ignition lock cylinder
- Selector lever assembly (floor shifter)

PINPOINT TEST D : THE IGNITION KEY CANNOT BE RETURNED TO THE OFF POSITION

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK FOR AN ENERGIZED KEY REMOVAL INHIBIT SOLENOID

- Disconnect BCM fuse 18 (5A).
- Attempt to turn the ignition lock cylinder to the ON position and then back to the OFF-LOCK position and remove the key.

Can the ignition lock cylinder be turned to the OFF-LOCK position and the key removed?

Yes	GO to D3
No	GO to D2

D2 CHECK THE IGNITION SWITCH FOR MECHANICAL DAMAGE

- Remove the ignition switch.
  REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
- Attempt to turn the ignition lock cylinder to the OFF-LOCK position and remove the ignition key.

Does the ignition lock cylinder turn to the OFF-LOCK position and can the key be removed?

Yes	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new ignition lock cylinder. REFER to: Ignition Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

D3 CHECK THE KEY REMOVAL INHIBIT SOLENOID CIRCUIT FOR A SHORT TO GROUND

NOTE: *The following pinpoint test step uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250- 300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.*

- Connect BCM fuse 18 (5A).
- Select PARK.
- Disconnect Ignition Switch C250.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C250-4		C250-3

Does the test lamp illuminate?

Yes	GO to D4
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

D4 CHECK THE KEY REMOVAL INHIBIT SOLENOID CIRCUIT FOR A SHORT TO GROUND

NOTE: *The following pinpoint test step uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250- 300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.*

- Disconnect Selector Lever Assembly C3245 (floor shifter).
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C250-4		C250-3

Does the test lamp illuminate?

Yes	INSTALL a new selector lever assembly (floor shifter). REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
No	REPAIR the circuit.

The Ignition Key Can Be Turned to the OFF Position When the Selector Lever is Not in PARK

Refer to Wiring Diagrams Cell 37 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1472:12	Ignition Key Removal Inhibit: Circuit Short To Battery	Sets when the BCM detects a short to voltage from the key removal inhibit solenoid control circuit.
B1472:14	Ignition Key Removal Inhibit: Circuit Short To Ground or Open	Sets when the BCM detects an open from the key removal inhibit solenoid control circuit.

Possible Causes

- Wiring, terminals or connectors
- Ignition switch
- Selector lever assembly (floor shifter)
- BCM

PINPOINT TEST E : THE IGNITION KEY CAN BE TURNED TO THE OFF POSITION WHEN THE SELECTOR LEVER IS NOT IN PARK

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
NOTE: *The following Pinpoint Test uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250- 300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.*

E1 CHECK THE KEY INHIBIT SOLENOID CIRCUIT FOR GROUND

- Ignition OFF.
- Disconnect Ignition Switch C250.
- Set the park brake.
- Select NEUTRAL.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C250-4		C250-3

Is the test lamp illuminated?

Yes	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	GO to E2

E2 CHECK THE KEY INHIBIT SOLENOID CIRCUIT FOR AN OPEN

- Disconnect Selector Lever Assembly C3245 (floor shifter).
- Measure:

Floor Shifter

Positive Lead	Measurement / Action	Negative Lead
C250-3	Ω	C3245-4

Is the resistance less than 3 ohms?

Yes	For vehicles equipped with a floor shifter, GO to E3
No	REPAIR the circuit.

E3 BYPASS THE SELECTOR LEVER

- Connect:

Positive Lead	Measurement / Action	Negative Lead
C250-4		C250-3

- Connect:

Lead 1	Measurement / Action	Lead 2
C3245-4		C3245-10

- Remove the fused jumper wire.

Does the test lamp illuminate with the fused jumper wire connected?

Yes	INSTALL a new selector lever assembly. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
No	GO to E4

E4 CHECK THE KEY INHIBIT SOLENOID CIRCUIT FOR A SHORT TO VOLTAGE

- Connect:

Positive Lead	Measurement / Action	Negative Lead
C3245-4		Ground

Does the test lamp illuminate?

Yes	REPAIR the circuit.
No	GO to E5

E5 CHECK THE BCM (BODY CONTROL MODULE) KEY INHIBIT GROUND CONTROLLED CIRCUIT FOR A SHORT TO VOLTAGE

- Connect Ignition Switch C250.
- Ignition ON.
- Disconnect BCM C2280G.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C3245-10		Ground

Does the test lamp illuminate?

Yes	REPAIR the circuit.
No	GO to E6

E6 CHECK THE BCM (BODY CONTROL MODULE) KEY INHIBIT GROUND CONTROLLED CIRCUIT FOR AN OPEN

- Connect BCM C2280G.
- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-10	Ω	C2280G-12

Is the resistance less than 3 ohms?

Yes	GO to E7

No	REPAIR the circuit.

E7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and all other previously disconnected connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U300A:01

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U300A:01	Ignition Switch: General Electrical Failure	Sets when the BCM detects an invalid combination from the ignition switch input circuits, such as a voltage signal only from the ON-designated circuit, a voltage signal only from the START-designated circuit or a voltage signal from ACC and START-designated circuits at the same time.

Possible Causes

- Wiring, terminals or connectors
- Ignition switch
- BCM

PINPOINT TEST F : U300A:01

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

F1 CHECK FOR IGNITION SWITCH CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280G.
- Disconnect BCM C2280H.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-50		Ground
C2280G-37		Ground
C2280H-14		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to F2

F2 CHECK THE BCM (BODY CONTROL MODULE) IGNITION SWITCH INPUT CIRCUITS FOR VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-50		Ground
C2280G-37		Ground

- While placing the ignition switch to the START position, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-37		Ground
C2280H-14		Ground

Are the voltages greater than 11 volts?

Yes	GO to F4
No	GO to F3

F3 CHECK THE IGNITION SWITCH CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-50	Ω	C250-6
C2280G-37	Ω	C250-1
C2280H-14	Ω	C250-7

Are the resistances less than 3 ohms?

Yes	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	REPAIR the circuit in question.

F4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and all other previously disconnected connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

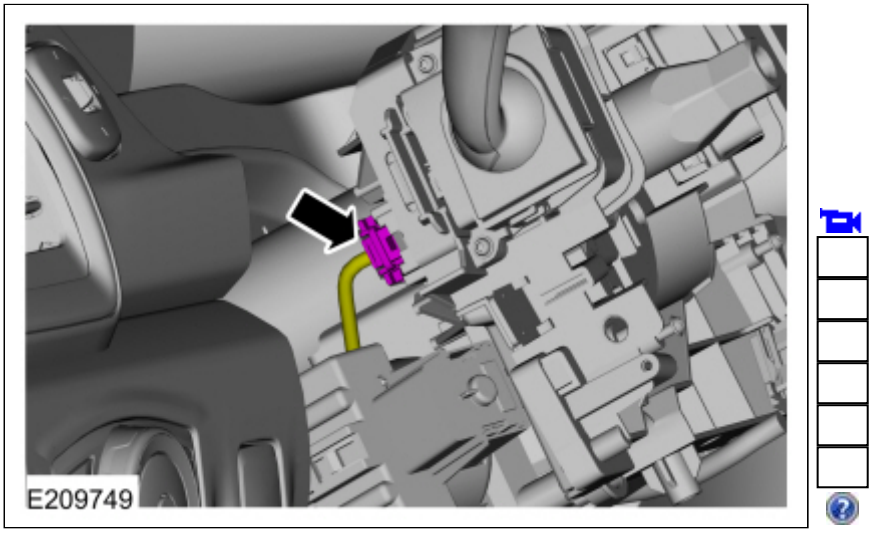
Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

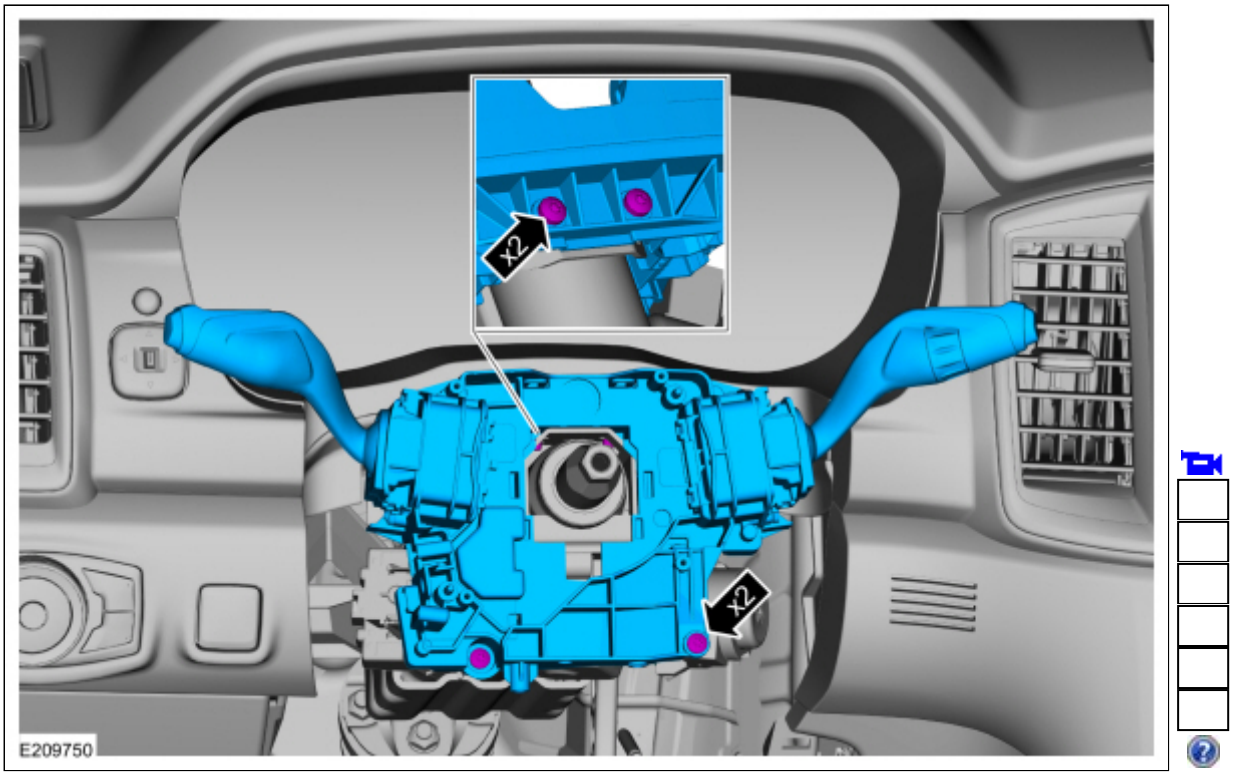
Steering Column Control Module (SCCM)

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).
3. 

4. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

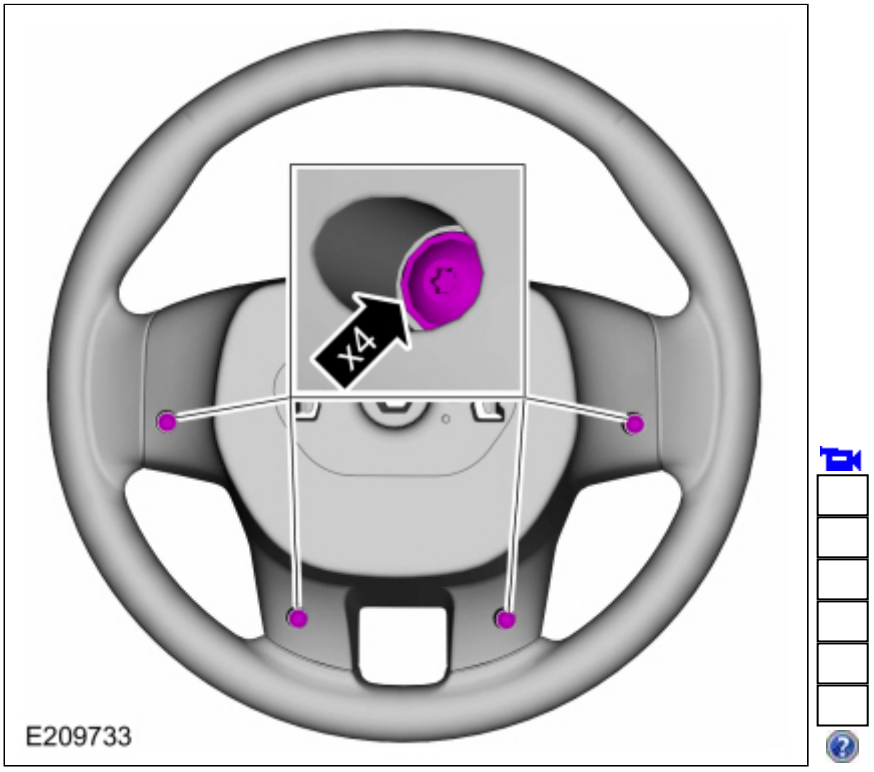
Copyright © 2016 Ford Motor Company

Steering Wheel Multifunction Switch

Removal

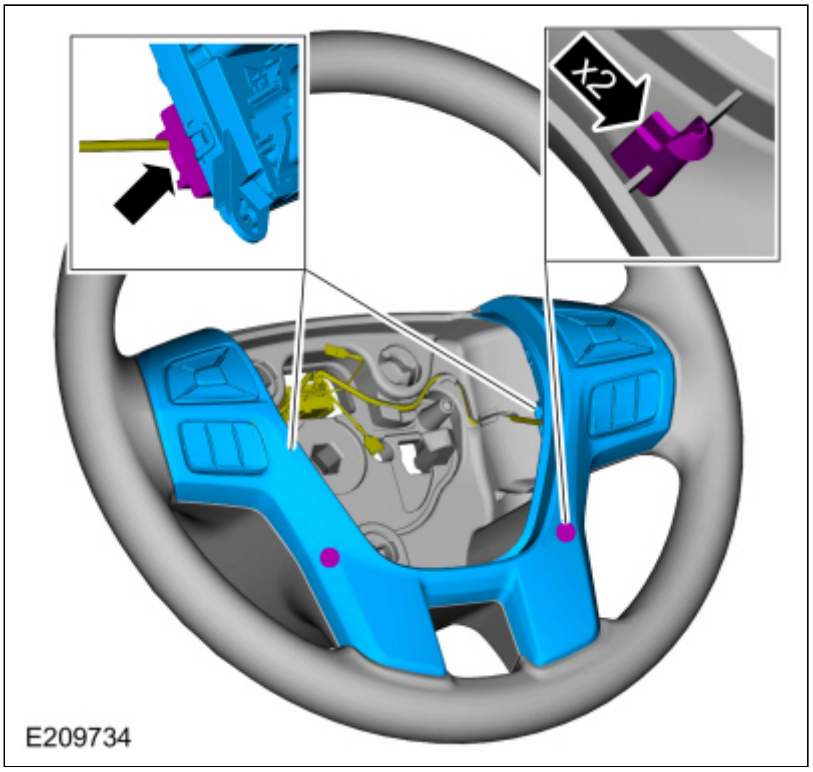
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Steering System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
3. *Torque*: 3 Nm

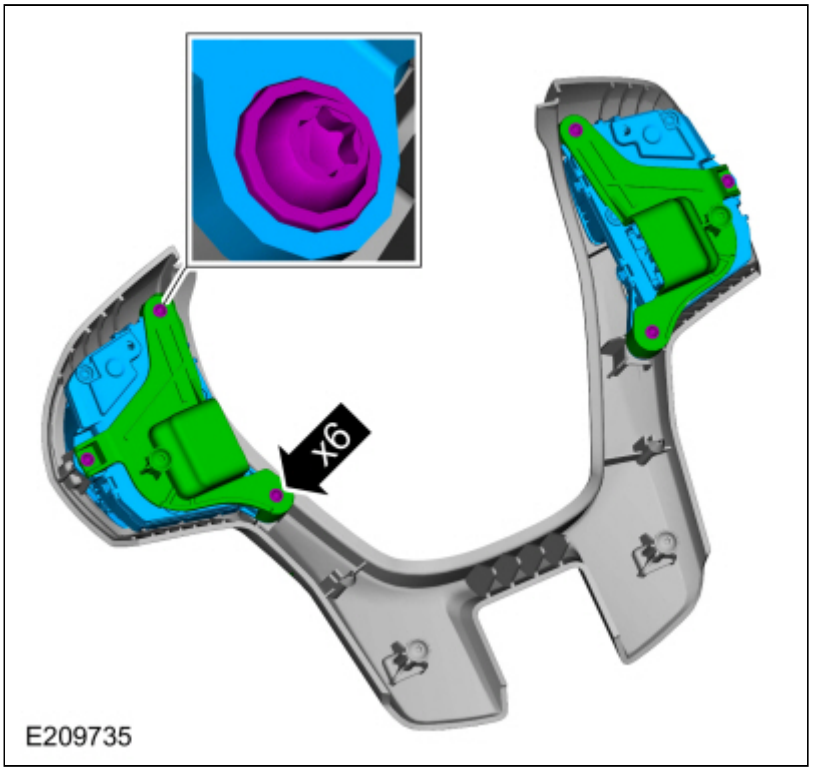


Vehicles With: Cruise Control

4.

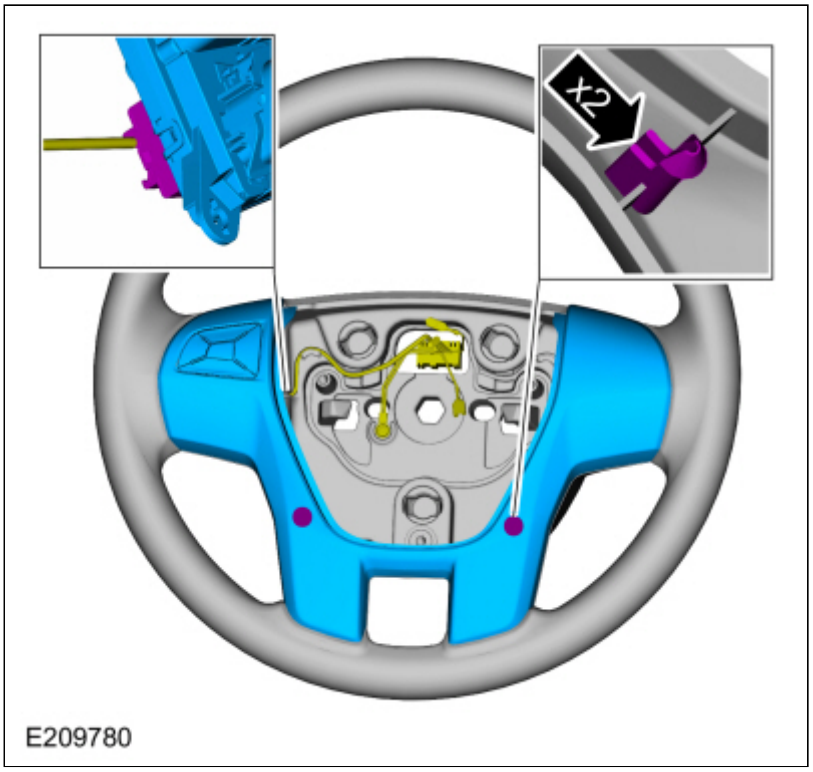


5. *Torque*: 3 Nm

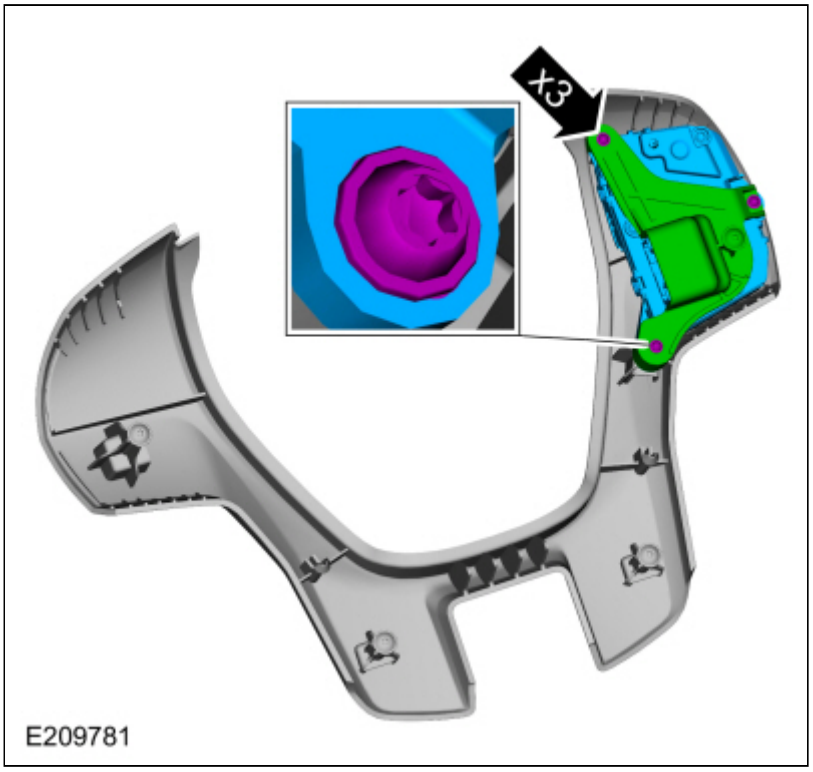


All vehicles

6.



7. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Engine Data

Item	Specification
Maximum cylinder head distortion	X distortion: 0.02 mm {0.0008 in}
	Y distortion: 0.05 mm {0.0020 in}
Maximum manifold contact surface distortion	0.05 mm {0.002 in} max.
Maximum manifold contact surface grinding	0.15 mm {0.0059 in} max.
Standard valve margin thickness	IN: 1.55—1.85 mm {0.061—0.072 in}
	EX: 1.80—2.10 mm {0.070—0.082 in}
Standard valve length	IN: 111.65—112.25 mm {4.394—4.413 in}
	EX: 111.6—112.2 mm {4.390—4.409 in}
Minimum valve length	IN: 111.50 mm {4.390 in}
	EX: 111.45 mm {4.388 in}
Standard valve stem diameter	IN: 5.970—5.985 mm {0.2350—0.2356 in}
	EX: 5.965—5.980 mm {0.2348—0.2354 in}
Minimum valve stem diameter	IN: 5.920 mm {0.2330 in}
	EX: 5.915 mm {0.2328 in}
Standard valve guide inner diameter	6.97—6.99 mm {0.2344—0.2751 in}
Standard valve guide height	IN: 12.0—13.0 mm {0.4724—0.5118 in}
	EX: 8.0—9.0 mm {0.3149—0.3543 in}
Standard valve seat contact gauge line depth	IN:0.43—0.63 mm {0.0169—0.0248 in}
	EX:0.6-0.8 mm {0.0236—0.0314 in}
Valve seat angle	IN: 45°
	IN: 45°
Standard valve recession	IN: 0.79—1.27 mm {0.039—0.050 in}
	EX: 0.84—1.32 mm {0.033—0.051 in}
Maximum valve recession	IN: 1.68 mm {0.066 in}
	EX: 1.73 mm {0.062 in}
Valve spring installation pressing force	172.9—195.6 N {15.67—17.74 kgf, 34.48—39.02 lbf}
Valve spring installation height	39.0 mm {1.53 in}
Maximum valve spring out-of-square	2.0°(1.60mm {0.062 in})
Maximum camshaft runout	0.03 mm {0.001 in} max.
Standard cam lobe height	IN: 42.067—42.167 mm {1.6561—1.6601 in}
	EX: 41.949—42.049 mm {1.6515—1.6554 in}
Minimum cam lobe height	IN: 41.717 mm {1.6424 in}
	EX: 41.599 mm {1.6377 in}
Standard cam journal diameter	No.1: 31.940—31.965 mm {1.2575—1.2582 in
	No.2—No.4: 25.910—25.935 mm {1.0201—1.0210 in}
	No.5: 25.940—25.965 mm {1.0212—1.0222 in}

Minimum cam journal diameter	No.1: 31.890 mm {1.2555 in}
	No.2—No.4: 25.860 mm {1.0181 in}
	No.5: 25.890 mm {1.0193 in}
Standard camshaft clearance	No.1: 0.035—0.081 mm {0.0014—0.0031 in}
	No.2—4: 0.065—0.111 mm {0.0026—0.0043 in}
	No.5: 0.056—0.081 mm {0.0014—0.0031 in}
Maximum camshaft clearance	No.1: 0.12 mm {0.0047 in}
	No.2—4: 0.15 mm {0.0059 in}
	No.5: 0.16 mm {0.0063 in}
Standard camshaft end play	0.030—0.160 mm {0.0012—0.0062 in}
Maximum camshaft end play	0.20 mm {0.0079 in}
Maximum cylinder block distortion	X direction: 0.02 mm {0.0008 in}
	Y direction: 0.05 mm {0.0020 in}
Cylinder bore size	Standard: 93.000—93.022 mm {3.6615—3.6622 in}
	0.25 {0.01} oversize: 93.250—93.272 mm {3.6713—3.6721 in}
	0.50 {0.02} oversize: 93.500—93.522 mm {3.6811—3.6819 in}
Cylinder bore wear limit	0.15 mm {0.0059 in}
Flywheel maximum runout	1.5 mm {0.059 in}
Oil jet air pressure	137.6—196.4 kPa {1.5—2.0 kgf/cm2, 20—28 psi}
Piston diameter	Standard: 92.918—92.944 mm {3.6582—3.6592 in}
	0.25 {0.0098} oversize: 93.153—93.179 mm {3.6675—3.6684 in}
	0.50 {0.02} oversize: 93.403—93.429 mm {3.6773—3.6782 in}
Standard piston clearance	0.071—0.089 mm {0.0015—0.0022 in}
Maximum piston clearance	0.15 mm {0.0059 in}
Standard piston ring clearance	Top: 0.06—0.10 mm {0.0024—0.0039 in}
	Second: 0.06—0.08 mm {0.0024—0.0031 in}
	Oil: 0.02—0.06 mm {0.0012—0.0023 in}
Maximum piston ring clearance	0.15 mm {0.0059 in}
Standard piston ring end gap	Top: 0.22—0.32 mm {0.0087—0.0125 in}
	Second: 0.49—0.64 mm {0.0193—0.0251 in}
	Oil: 0.22—0.52 mm {0.0087—0.0204 in}
Maximum piston ring end gap	1.0 mm {0.039 in}
Standard piston pin bore diameter	33.997—34.007 mm {1.3384—1.3388 in}
Standard connecting rod small end inner diameter	34.012—34.033 mm {1.3391—1.3398 in}
Standard piston pin diameter	33.994—34.000 mm {1.3384—1.3385 in}
Standard piston pin-to-piston pin bore clearance	–0.003—0.013 mm {–0.00011—0.00051 in}
Standard connecting rod small end-to-piston pin clearance	0.012—0.039 mm {0.00048—0.00153 in}
Maximum crankshaft runout	0.05 mm {0.0020 in}
Main journal diameter [No.1,2,4,5]	Standard: 66.937—66.955 mm {2.6354—2.6360 in}
	0.25 {0.01} undersize: 66.687—66.705 mm {2.6255—2.6261 in}
	0.50 {0.02} undersize: 66.437—66.455 mm {2.6157—2.6163 in}

	0.75 {0.03} undersize: 66.187—66.205 mm {2.6058—2.6064 in}
Main journal diameter [No.3]	Standard: 66.920—66.938 mm {2.6347—2.6353 in}
	0.25 {0.01} undersize: 66.670—66.688 mm {2.6248—2.6255 in}
	0.50 {0.02} undersize: 66.420—66.438 mm {2.6150—2.6156 in}
	0.75 {0.03} undersize: 66.170—66.188 mm {2.6052—2.6058 in}
Main journal wear limit	0.05 mm {0.0020 in}
Main journal out-of-round	0.03 mm {0.0012 in}
Crank pin diameter	Standard: 54.940—54.955 mm {2.1630—2.1635 in}
	0.25 {0.01} undersize: 54.690—54.705 mm {2.1532—2.1537 in}
	0.50 {0.02} undersize: 54.440—54.455 mm {2.1434—2.1438 in}
	0.75 {0.03} undersize: 54.190—54.205 mm {2.1335—2.134 in}
Crank pin wear limit	0.05 mm {0.0020 in}
Crank pin out-of-round	0.03 mm {0.0012 in}
Standard main journal clearance	No.1, 2, 4, 5: 0.027—0.045 mm {0.0011—0.0017 in}
	No.3: 0.044—0.062 mm {0.0018—0.0024 in}
Maximum main journal clearance	0.08 mm {0.0031 in}
Main bearing thickness	Standard: 2.006—2.021 mm {0.0790—0.0795 in}
	0.25 {0.01} undersize: 2.124—2.134 mm {0.0837—0.0840 in}
	0.50 {0.02} undersize: 2.249—2.259 mm {0.0886—0.0889 in}
	0.75 {0.03} undersize: 2.374—2.384 mm {0.0935—0.0938 in}
Standard crankshaft end play	0.040—0.282 mm {0.0016—0.0111 in}
Maximum crankshaft end play	0.3 mm {0.012 in}
Thrust bearing thickness	Standard: 2.455—2.505 mm {0.0967—0.986 in}
	0.35 {0.010} oversize: 2.630—2.680 mm {0.1036—0.1055 in}
Connecting rod bending	0.075 mm {0.0030 in} max/50 mm {2.0 in}
Connecting rod distortion	0.18 mm {0.0071 in} max/50 mm {2.0 in}
Connecting rod center-to-center distance	162.96—163.04 mm {5.983—5.986 in}
Standard connecting rod oil clearance	0.025—0.052 mm {0.0010—0.0020 in}
Maximum connecting rod oil clearance	0.08 mm {0.0031 in}
Connecting rod bearing thickness	Standard: 1.507—1.516 mm {0.0594—0.0596 in}
	0.25 {0.01} undersize: 1.624—1.634 mm {0.0640—0.0643 in}
	0.50 {0.02} undersize: 1.749—1.759 mm {0.0689—0.0692 in}
	0.75 {0.03} undersize: 1.874—1.884 mm {0.0738—0.0741 in}
Standard connecting rod side clearance	0.110—0.262 mm {0.0044—0.0103 in}
Maximum connecting rod side clearance	0.35 mm {0.014 in}
Balance shaft Standard end play	0.04—0.16 mm {0.002—0.006 in}
Standard diameter	Front: 41.945—41.960 mm {1.6514—1.6519 in}
	Center: 39.945—39.960 mm {1.5727—1.5732 in}
	Rear: 37.975—37.990 mm {1.4951—1.4956 in}
Standard clearance	Front, rear: 0.050—0.115 mm {0.0020—0.0045 in}

	Center: 0.080—0.145 mm {0.0032—0.0057 in}
Cylinder head bolt length (2.2L Diesel)	M10 Bolts
	Standard length: 138.2—139.3 mm {5.440—5.484 in}
	Maximum length: 122 mm {4.803 in}
	M8 Bolts
	Standard length: 120.3—121.7 mm {4.736—4.791 in}
	Maximum length: 122 mm {4.803 in}
Cylinder head bolt length (3.2L Diesel)	M10 Bolts
	Standard length: 158.7—160.3 mm {6.248—6.311 in}
	Maximum length: 160.4 mm {6.314 in}
	M8 Bolts
	Standard length: 120.3—121.7 mm {4.736—4.791 in}
	Maximum length: 122 mm {4.803 in}
Main bearing cap bolt length	Standard length: 84.7—85.3 mm {3.34—3.35 in}
	Maximum length: 86.0 mm {3.39 in}
Connecting rod cap bolt length	Standard length: 55.45—56.05 mm {2.19—2.20 in}
	Maximum length: 56.75 mm {2.23 in}
Valve clearance (engine cold)	IN: 0.10—0.16 mm {0.0040—0.0062 in}
	EX: 0.17—0.23 mm {0.0067—0.0090 in}
Standard oil pump tip clearance	0.10—0.19 mm {0.0040—0.0074 in}
Maximum oil pump tip clearance	0.20 mm {0.0079 in}
Standard oil pump side clearance	0.04—0.09 mm {0.0016—0.0035 in}
Maximum oil pump side clearance	0.15 mm {0.0059 in}
Standard plunger spring length	43.8 mm {1.72 in}
Front oil seal press-in amount	0—0.4 mm {0—0.015 in}
Fuel injection pump oil seal press-in amount	0—0.4 mm {0—0.015 in}
Camshaft oil seal press-in amount	0.5—1.0 mm {0.020—0.039 in}

Bearing Data

Item	Specification
Maindrive gear bearing end play	0—0.15 mm {0.0—0.0059 in}
Mainshaft center bearing end play	0—0.15 mm {0.0—0.0059 in}

Maindrive Gear Bearing Retaining Ring

Thickness (mm {in})
2.60 {0.102}
2.67 {0.105}
2.74 {0.108}

Countershaft Adjustment Shim Selective Chart

Dimension A (mm {in})	Shim thickness (mm {in})
25.0—25.1 {0.985—0.988}	0.5 {0.020}
25.1—25.2 {0.989—0.992}	0.4 {0.016}
25.2—25.3 {0.993—0.996}	0.3 {0.012}
25.3—25.4 {0.997—1.000}	0.2 {0.008}
25.4—25.5 {1.000—1.003}	0.1 {0.004}
25.5—25.6 {1.004—1.007}	-

Mainshaft Center Bearing Retaining Ring

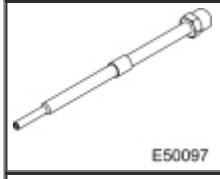
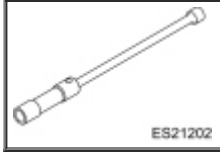
Thickness (mm {in})
3.1 {0.122}
3.2 {0.126}
3.3 {0.130}

Copyright © 2016 Ford Motor Company

Engine

Base Part Number: 6L084

Special Tool(s)

 E50097	Adapter, Compression Test 303-1305
 ES21202	Socket, Spark Plug 303-499

General Equipment

Ford diagnostic equipment
Compression tester
Oil pressure gauge
UV leak detection lamp

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Coolant leaks − Oil leaks − Fuel system leaks − Visibly damaged or worn parts − Loose or missing nuts or bolts	− Fuse(s) − Loose or corroded connector(s) − Control module − Damaged or worn switch(es)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Loss of oil	• Oil leaks from the engine or auxiliary components.	• Look for evidence of oil leaks on components. Use an UV leak tester if oil leak is not evident. Install new gaskets or components as required.
	• Internal or external leak at the oil cooler.	• Check the coolant expansion tank for oil film on the coolant surface. Install a new oil cooler or oil cooler gasket.
	• Leak at the crankshaft	• Install a new oil seal.

	front or rear oil seal.	• Align the front cover.
• Oil consumption	• Use of the wrong type of engine oil.	• Determine the last type of engine oil used (refer to the latest invoice or oil receipt) and compare with the specification. Change the engine oil.

	• Faulty positive crankcase ventilation system.
	  • Hoses or ventilation/breather valves are blocked. This causes excessive pressure in the crankcase which causes oil to enter the combustion chamber.
	  • Crankcase ventilation oil separator is faulty and engine oil can enter the combustion chamber through the intake manifold.
		• Check that the crankcase ventilation system is operating correctly and repair as necessary.

	• Turbocharger seals.	• Install a new turbocharger.REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation).

	• Damaged gaskets or mating surfaces.
	  • Cylinder head gasket is damaged or mating faces are warped.
	  • Valve stem oil seals are worn causing engine oil to enter the combustion chamber between the valve stem and the valve stem guide.
		• Check the gaskets and mating surfaces for damage.
		  • Remove the cylinder head. Check the mating faces, cylinder head gaskets and the flatness of the cylinder head and engine block mating faces.
		  • Install new valve stem oil seals.

	• Piston ring or cylinder liner wear.	• Install new components as necessary.
• Coolant consumption	• Cooling system components.	• REFER to: Engine Cooling (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing), Engine Cooling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and

		Testing), Engine Cooling (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• EGR (if equipped).	• Install a new EGR cooler.
	• Oil cooler.	• Install a new oil cooler.
	• Damaged gaskets or warped mating faces.	• Check the cylinder head gasket for damage. Check the cylinder head and cylinder block for distortion. REFER to: (303-00 Engine System - General Information) Cylinder Head Distortion (General Procedures), Cylinder Block Distortion (General Procedures).
	• Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	• Determine the damaged engine component and install a new component.
• Engine will not crank	• Battery or cables.	• Check the battery, bracket and cables. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
	• Starter motor or cables.	• Check the starting system. REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing), Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing), Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
• Engine cranks but will not start	• Fuel tank is empty.	• Check the fluid level.
	• Water in fuel.	• Drain the water from the fuel system.
	• Fuel filter blocked (only vehicles with diesel engine).	• Install a new fuel filter element. REFER to: (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Fuel Filter Element (Removal and Installation).
	• Air in fuel lines (only vehicles with diesel engine).	• Bleed the fuel system. Check the fuel system for leaks. REFER to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
	• Engine intake air system.	• Check the intake air system. REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering -

		12A Intake Air Distribution and Filtering - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing), Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Glow plug faulty (only vehicles with diesel engine).	• Check the glow plugs. Install new glow plugs as necessary. REFER to: Glow Plugs (303-07B Glow Plug System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation), Glow Plugs (303-07C Glow Plug System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Engine management system.	• Check the engine management system. REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) , Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) .
	• Fuel injection pump faulty or incorrect timing (only vehicles with diesel engine).	• Check the fuel injection pump for correct timing and performance.
	• Incorrect valve timing.	• Check and adjust the valve timing.
	• Broken or damaged timing chain or sprocket.	• Check the timing chain and sprockets. Install new components as necessary.
• Very poor power output/fuel consumption too high/engine running rough	• Fuel system.	• Check the fuel system components.
	• Engine intake air system.	• Check the intake air system. REFER to: Intake Air Distribution and Filtering (303-12A Intake Air Distribution and Filtering - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing), Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Exhaust system blocked.	• Check the exhaust system.
	• Engine management system.	• Check the engine management system. REFER to: Electronic Engine Controls - Vehicles Built

		From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) , Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) .
	• Turbocharger (only vehicles with diesel engine).	• Check the turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger (Diagnosis and Testing).
	• Fuel injection pump faulty or incorrect timing (only vehicles with diesel engine).	• Check and adjust fuel injection pump timing.
	• Incorrect valve timing, timing chain or timing sprocket damaged.	• Check and adjust valve timing. Install new components as necessary.
• Noisy running	• Engine auxiliary components loose or damaged.	• Check engine auxiliary components for damage/looseness.
• Noisy running, misfiring/backfiring	• Incorrect fuel	• Determine which type of fuel was the last put in the tank (note the country specific fuel specifications).
	• Water in fuel or fuel contaminated.	• Check the fuel system for water or other contamination.
	• Fuel injection pump faulty or incorrect timing (only vehicles with diesel engine).	• Check and adjust fuel injection pump timing.
	• Valve timing incorrect, timing chain or timing sprocket damaged.	• Check and adjust valve timing. Install new components as necessary.
• Noisy running/valve train noise	• Excessive valve clearance due to faulty hydraulic valve tappets.	• Install new hydraulic valve tappets.
	• Timing chain damaged.	• Install a new timing chain.
	• Timing chain incorrectly tensioned.	• Check the timing chain tension. Install a new tensioner, as necessary.
	• Timing chain guides worn or damaged.	• Check the timing chain guides. Install new guides as necessary.

• Noisy running/engine block	• Engine components
	  • Pistons
	  • Piston rings
	  • Connecting rod large end, main bearing or thrust bearing journals
	  • Connecting rods bent or damaged.
		• Check the engine components for wear or damage. Make sure all components are within specification. Install new components as necessary.

Engine Oil Leaks

NOTE: *Before installing new gaskets or oil seals, make sure that the fault is clearly established.*

If the oil leak cannot be identified clearly by a visual inspection, carry out a UV test:

UV Testing

1. Clean the engine and transmission with a suitable cleaning fluid such as brake cleaner.
2. Pour test fluid GV-2911-3090A in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.

WARNING: On manual transmissions put the transmission into NEUTRAL. Failure to follow these instructions may result in personal injury.

3. Start the engine and let it run for about five minutes.
4. Switch off the engine.

NOTE: *If no leak can be found, road test the vehicle under various loads and again check the engine for leaks.*

5. Check the engine for oil leaks using an UV leak detection lamp GV-2929 or UV leak detection lamp GV-2911 B11. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be required for the leak to appear.
6. Rectify any leaks found and recheck the engine for oil leaks.
7. At the end of test, make sure the oil level is within the upper and lower oil indicator marks. Remove oil as necessary if it registers above the full mark.

Leakage Points - Underhood

Examine the following areas for oil leakage:

- Valve cover gaskets
- Cylinder head gaskets
- Oil cooler, if equipped
- Oil filter adapter
- Engine front cover
- Oil filter adapter and filter body
- Oil level indicator tube connection
- Oil pressure switch

Leakage Points - Under Engine, With Vehicle on Hoist

Examine the following areas for oil leakage:

- Oil pan gaskets
- Oil pan sealer
- Engine front cover gasket
- Crankshaft front seal
- Crankshaft rear oil seal
- Oil filter adapter and filter body
- Oil cooler, if equipped
- Oil pressure switch

Leakage Points - With Transmission and Flywheel/Flexplate Removed

Examine the following areas for oil leakage:

- Crankshaft rear oil seal
- Rear main bearing cap parting line
- Flexplate mounting bolt holes (with flexplate installed)
- Pipe plugs at the end of oil passages

Measure the Compression Pressure

NOTE: *The PCM receives an error message when the relay is removed or electrical components are disconnected. This error message must be deleted from the fault memory by connecting the Ford diagnostic equipment after completing the measurement.*

NOTE: *Valve clearance must be set correctly before performing a compression test. Make sure engine is at the normal operating temperature.*

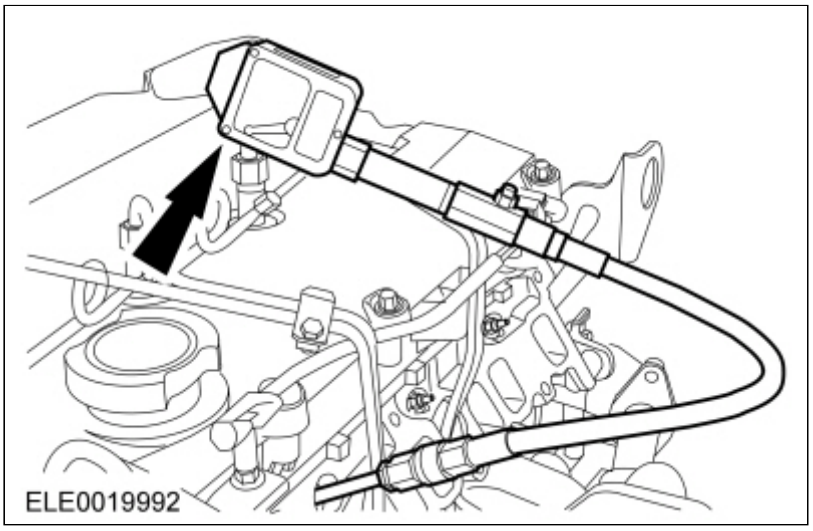
NOTE: *The varying design of compression checking devices and fluctuating starter motor speeds normally only allows to check if the compression is even in all cylinders.*

Vehicles with diesel engines

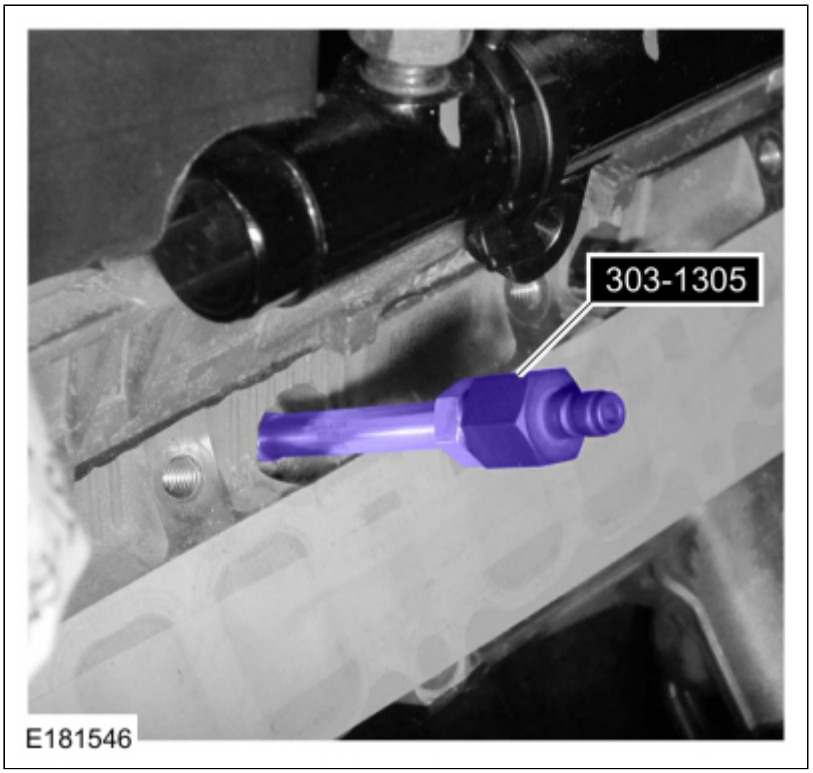
1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level.
2. **NOTE:** *Failure to remove all glow plugs may result in inconsistent test results.*

   The battery charger must be left connected during the compression test and disconnected when the test is complete.

   Remove the glow plugs. REFER to:
   Glow Plugs (303-07B Glow Plug System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation),
   Glow Plugs (303-07C Glow Plug System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).



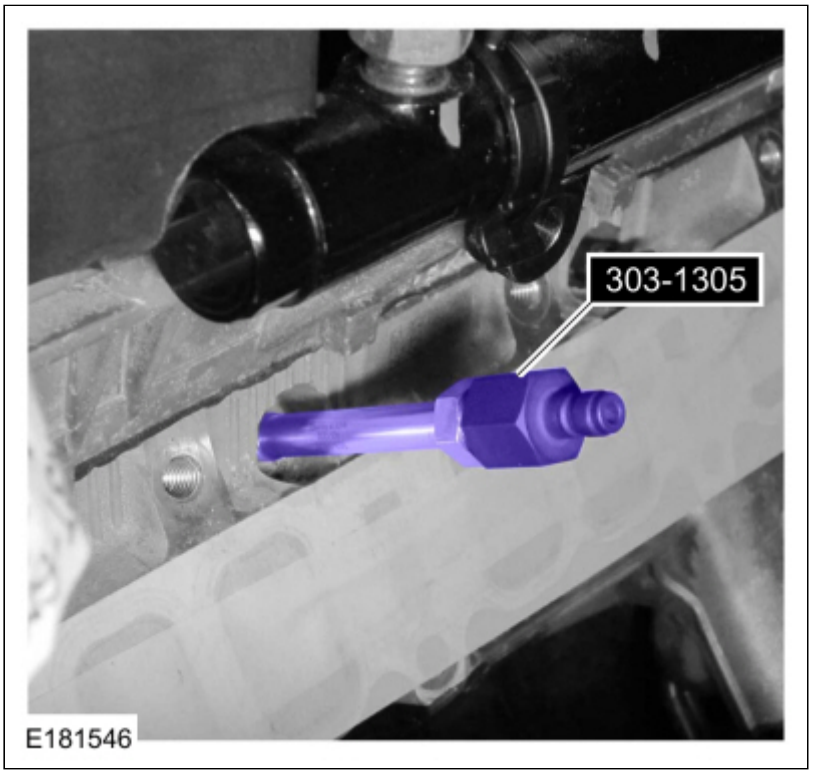
3. Connect a battery charger to the battery.



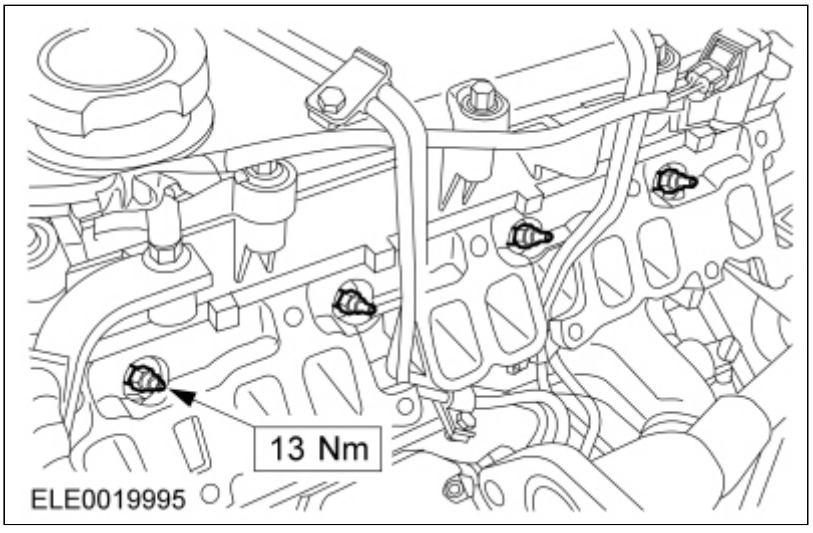
4. Install the Compression Test Adapter (303-1305) and a commercially available diesel compression tester.

NOTE: *Note the approximate number of compression strokes necessary to obtain the highest reading.*

5. Carry out the measurement on all cylinders, following the measuring equipment manufacturer's instructions and compare each cylinder compression reading.
6. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of 5 compression strokes and record the highest reading.
7. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
    - There must not have no more than a 20% difference from the average on any given cylinder.
8. Investigate and repair any cylinder(s) that are outside the 20% range.



9. Remove the Compression Test Adapter (303-1305) and the commercially available diesel compression tester.
10. Disconnect the battery charger from the battery.
11. Detach the compression tester and adapter.



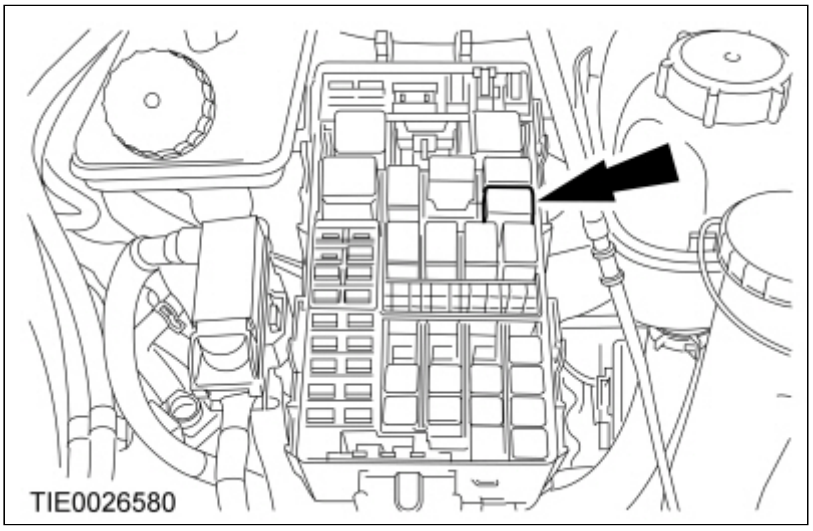
12. Install the glow plugs.
    REFER to: Glow Plugs (303-07B Glow Plug System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    REFER to: Glow Plugs (303-07C Glow Plug System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal

and Installation).

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are worn or damaged.
2. If compression does not improve, valves are sticking or not seating correctly.
3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

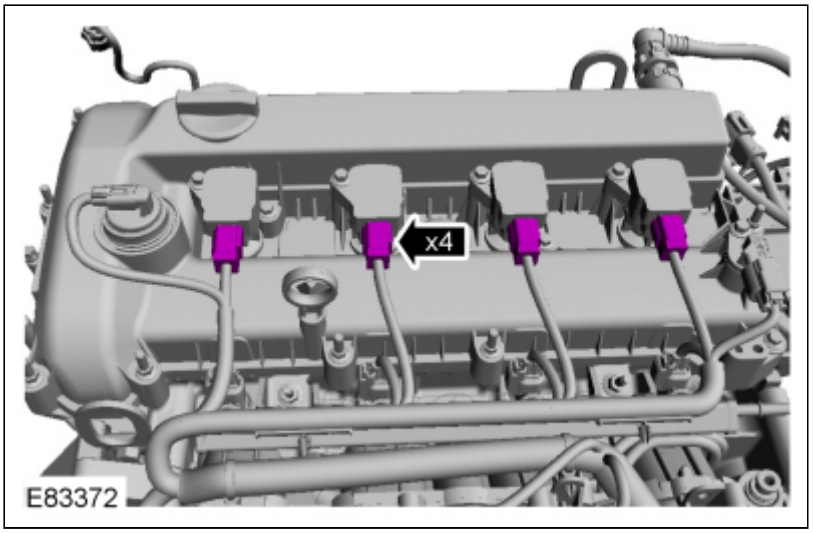
Vehicles with gasoline engines



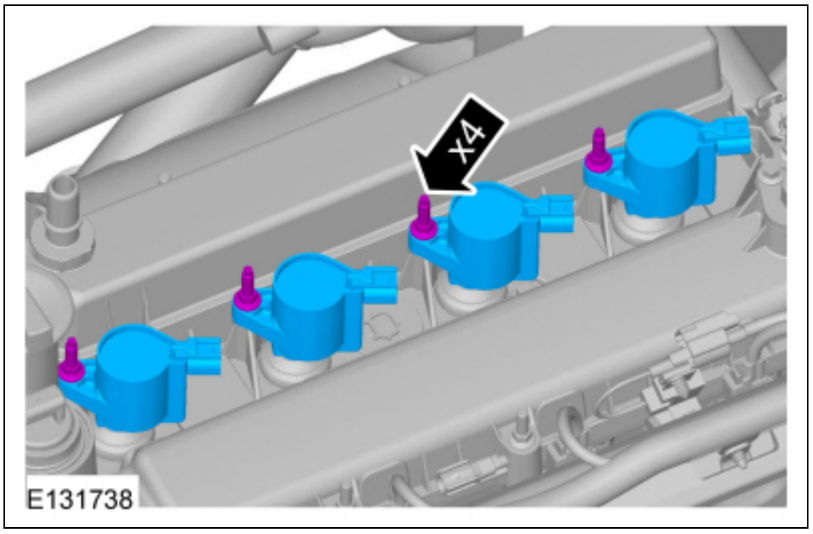
1. Open the Battery Junction Box (BJB) and remove the fuel pump relay.

NOTE: *The engine will start, run for a few seconds and then stop.*

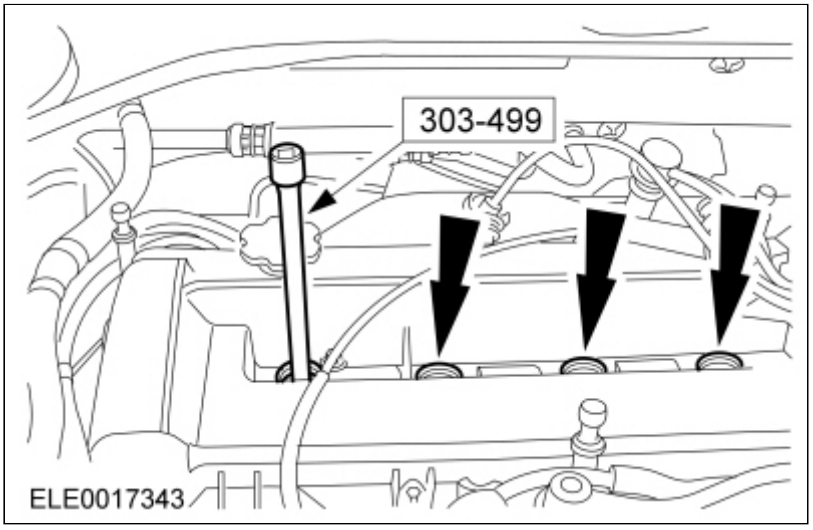
2. Start the engine.



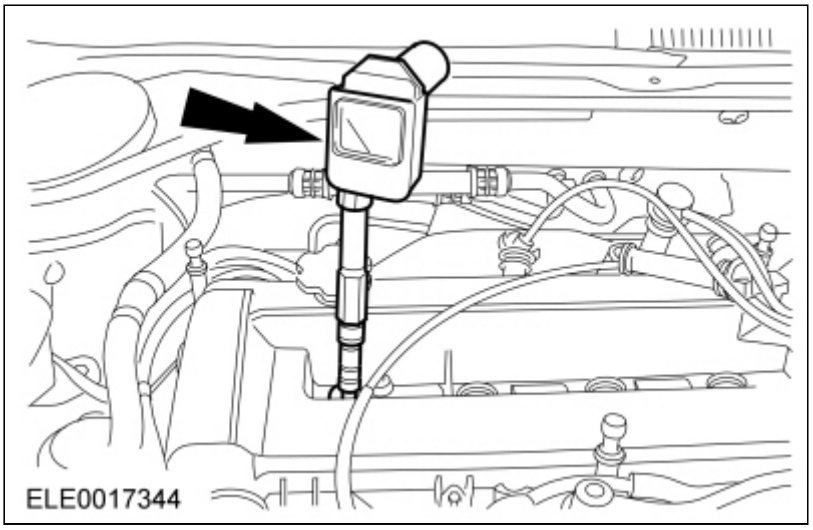
3. Disconnect the ignition coil electrical connectors.



4. Remove the ignition coils.

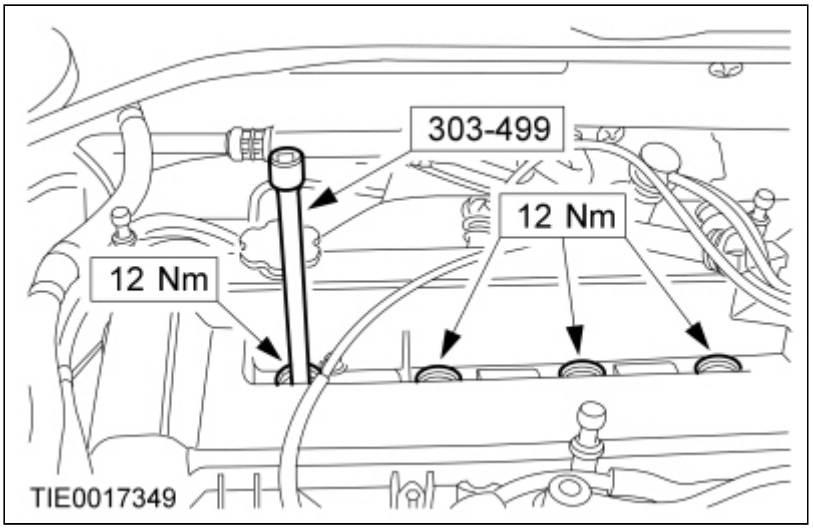


5. Using the special tool, remove the spark plugs.

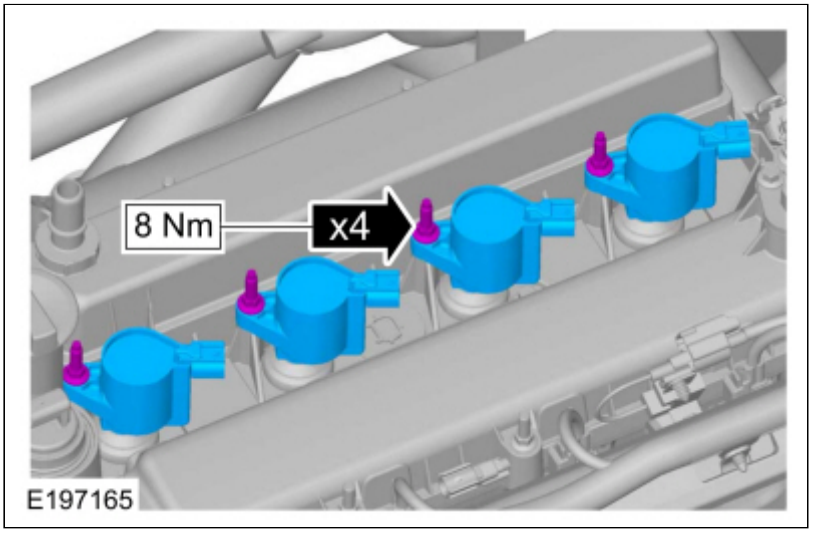


NOTE: *Crank the engine with the starter motor and with wide open throttle, until the reading on the compression tester stops rising.*

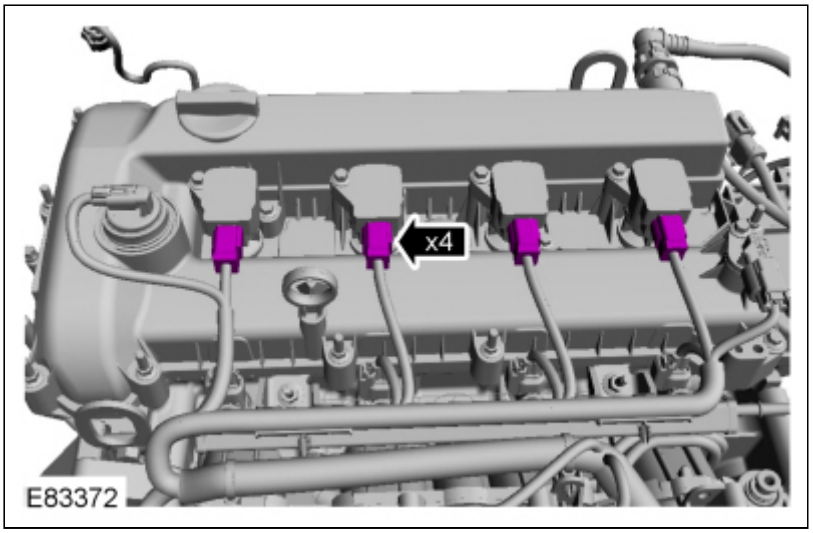
6. Carry out the measurement on all cylinders, following the measuring equipment manufacturer's instructions and compare each cylinder compression reading.



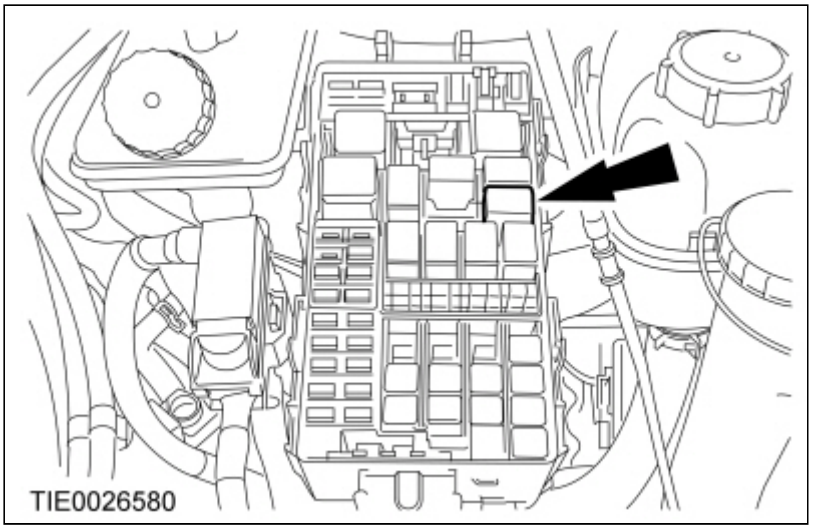
7. Using the special tool, install the spark plugs.



8. Install the ignition coils.



9. Connect the ignition coil electrical connectors.



10. Install the fuel pump relay.
11. Reset the PCM fault memory.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure	Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure	Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure	Maximum Recorded Cylinder Pressure	Minimum Recorded Cylinder Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (145 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (105 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (189 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (135 psi)	745 kPa (108 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (236 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (174 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (237 psi)	1,145 kPa (166 psi)	–	–

E151691

If one or more cylinders reads low, squirt approximately one tablespoon of engine oil meeting Ford specification on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of a cylinder leakage tester will be helpful in pinpointing the exact cause.

The leakage tester is inserted in the glow plug hole, the piston is brought up to TDC on the compression stroke, and compressed air is admitted.

Once the combustion chamber is pressurized, the leakage tester gauge will read the percentage of leakage. Leakage exceeding 20% is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve will be heard in the Throttle Body (TB). A leak at the exhaust valve can be heard at the tailpipe. Leakage past the piston rings will be audible at the crankcase vent oil separator connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the glow plug hole of the cylinder into which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator.

Excessive Engine Oil Consumption

Nearly all engines consume oil, which is essential for normal lubrication of the cylinder bore walls and pistons and rings. Determining the level of oil consumption may require testing by recording how much oil is being added over a given set of miles.

Customer driving habits greatly influence oil consumption. Mileage accumulated during towing or heavy loading

generates extra heat. Frequent short trips, stop-and-go type traffic or extensive idling, prevent the engine from reaching normal operating temperature. This prevents component clearances from reaching specified operating ranges.

The following diagnostic procedure may be utilized to determine internal oil consumption. Make sure that the concern is related to internal oil consumption, and not external leakage, which also consumes oil. Verify there are no leaks before carrying out the test. Once verified, the rate of internal oil consumption can be tested.

A new engine may require extra oil in the early stages of operation. Internal piston-to-bore clearances and sealing characteristics improve as the engine breaks in. Engines are designed for close tolerances and do not require break-in oils or additives. Use the oil specified in the Owner's Literature. Ambient temperatures may determine the oil viscosity specification. Verify that the correct oil is being used for the vehicle in the geographic region in which it is driven.

Basic Pre-checks

1. For persistent complaints of oil consumption, interview the customer to determine the oil consumption characteristics. If possible, determine the brand and grade of oil currently in the oil pan. Look at the oil filter or oil-change station tags to determine if Ford-recommended maintenance schedules have been followed. Make sure that the oil has been changed at the specified mileage intervals. If vehicle mileage is past the first recommended drain interval, the OEM (original equipment manufacturer) production filter should have been changed.

2. Ask how the most current mileage was accumulated. That is, determine whether the vehicle was driven under the following conditions:
    - Extended idling or curbside engine operation
    - Stop-and-go traffic or taxi operation
    - Towing a trailer or vehicle loaded heavily
    - Frequent short trips (engine not up to normal operating temperature)
    - Excessive throttling or high engine-rpm driving

3. Verify that there are no external leaks. If necessary, review the diagnostic procedure under Engine Oil Leaks in the Diagnosis and Testing portion of this section.

4. Inspect the crankcase ventilation system for:
    - disconnected hoses at the valve cover or ACL (air cleaner).
    - loose or missing valve cover fill cap.
    - missing or incorrectly seated engine oil level indicator.
    - incorrect or damaged crankcase vent oil separator.

5. Inspect for signs of sludge. Sludge affects crankcase vent oil separator performance and can plug or restrict cylinder head drainback wells. It can also increase oil pressure by restricting passages and reducing the drainback capability of piston oil control rings.

6. Inspect the air filter for dirt, sludge or damage. A hole in the filter element will allow unfiltered air to bypass into the air induction system. This can cause premature internal wear (engine dusting), allowing oil to escape past rings, pistons, valves and guides.

7. If the engine is hot or was recently shut down, wait at least 10-minutes to allow the oil to drain back. Ask the customer if this requirement has been followed. Adding oil without this wait period can cause an overfill condition, leading to excessive oil consumption and foaming which may cause engine damage.

8. Make sure the oil level indicator (dipstick) is correctly and fully seated in the indicator tube. Remove the oil level indicator and record the oil level.

Detailed Pre-checks

1. Check the thermostat opening temperature to make sure that the cooling system is operating at the specified temperature. If it is low, internal engine parts are not running at specified internal operating clearances.

Oil Consumption Test

1. **NOTE:** *Once all of the previous conditions are met, carry out an oil consumption test.*

    Drain the engine oil and remove the oil filter. Install a new manufacturer-specified oil filter. Make sure the vehicle is positioned on a level surface. Refill the oil pan to a level one liter (quart) less than the specified fill level, using manufacturer-specified oil.

2. Run the engine for 3 minutes (if hot) or 10 minutes (if cold). Allow for a minimum 10-minute drainback period and then record the oil level shown on the oil level indicator. Place a mark on the backside of the oil level indicator noting the oil level location.

3. Add the final one liter (quart) to complete the normal oil fill. Restart the engine and allow it to idle for 2 minutes. Shut the engine down.

4. After a 10-minute drainback period, record the location of the oil level again. Mark the oil level indicator with the new oil level location. (Note: Both marks should be very close to the MIN-MAX upper and lower limits or the upper and lower holes on the oil level indicator. These marks will exactly measure the engine's use of oil, with a one quart differential between the new marks.) Demonstrate to the customer that the factory-calibrated marks on the oil level indicator are where the oil should fall after an oil change with the specified fill amount. Explain however, that this may vary slightly between MIN-MAX or the upper and lower holes on the oil level indicator.

5. Record the vehicle mileage.

6. Advise the customer that oil level indicator readings must be taken every 320 km (200 mi) or weekly, using the revised marks as drawn. Remind the customer that the engine needs a minimum 10-minute drainback for an accurate reading and that the oil level indicator must be firmly seated in the tube prior to taking the reading.

7. When the subsequent indicator readings demonstrate a full liter (quart) has been used, record the vehicle mileage. The mileage driven should not be less than 4,800 km (3,000 mi). The drive cycle the vehicle has been operated under must be considered when making this calculation. It may be necessary to have the customer bring the vehicle in for a periodic oil level indicator reading to closely monitor oil usage.

Post Checks, Evaluation and Corrective Action

1. If test results indicate excessive oil consumption, carry out a cylinder compression test. The cylinder compression test should be carried out with a fully charged battery and all glow plugs removed.

2. Compression should be consistent across all cylinders. If compression tested within the specifications found in this section, the excessive oil consumption may be due to wear on the valve guides, valves or valve seals.

3. A cylinder leak detection test can be carried out using a cylinder leakage detector. This can help identify valves, piston rings, or worn valve guides/valve stems, inoperative valve stem seals or other related areas as the source of oil consumption.

4. If an internal engine part is isolated as the root cause, determine if the repair will exceed cost limits and proceed with a repair strategy as required.

5. Once corrective action to engine is complete and verifying that all pre-check items were eliminated in the original diagnosis, repeat the Oil Consumption Test as described above and verify consumption results.

Oil Pressure - Measure

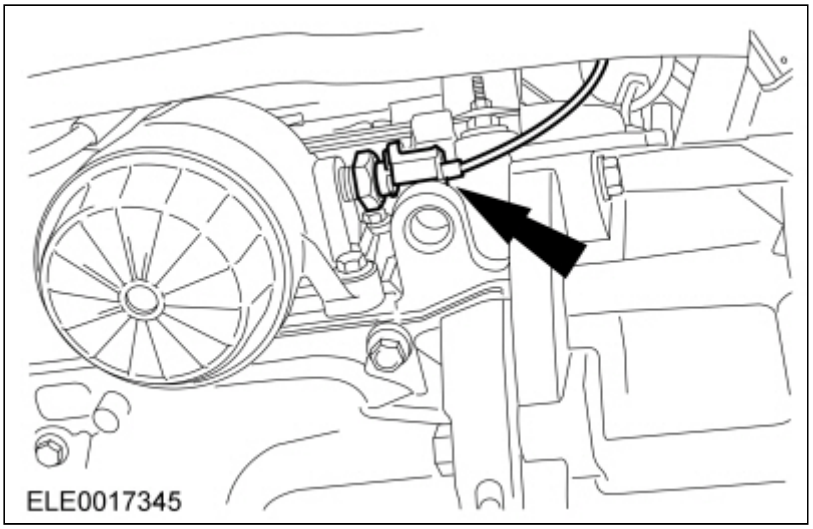
The oil pressure depends on various factors (engine speed, oil temperature, oil viscosity, amount of oil filter contamination etc.).

NOTE: *Measure the oil pressure at the specified engine speed. Measure the oil pressure at an oil temperature of 80°C.*

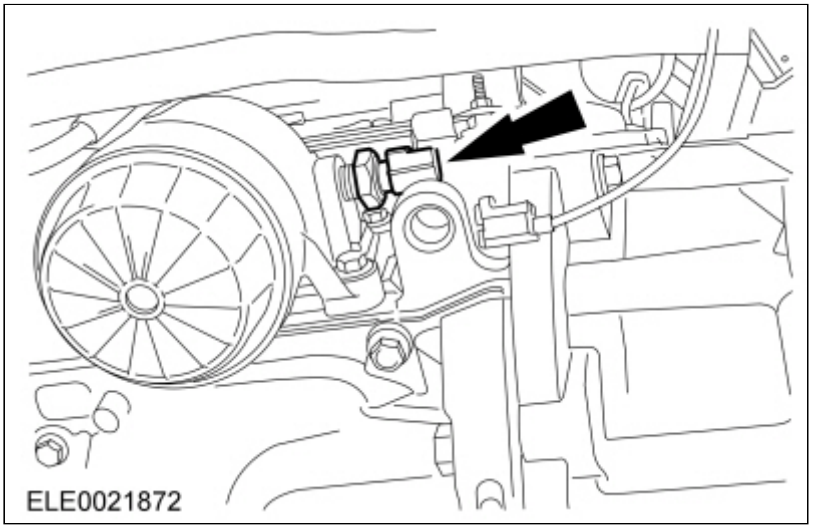
Vehicles with gasoline engines

1. Raise and support the vehicle.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

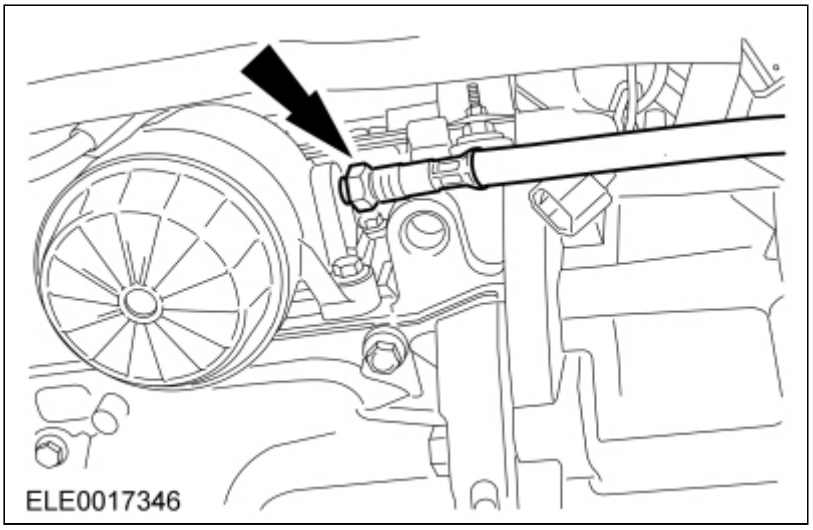
2. Remove the engine undershield.



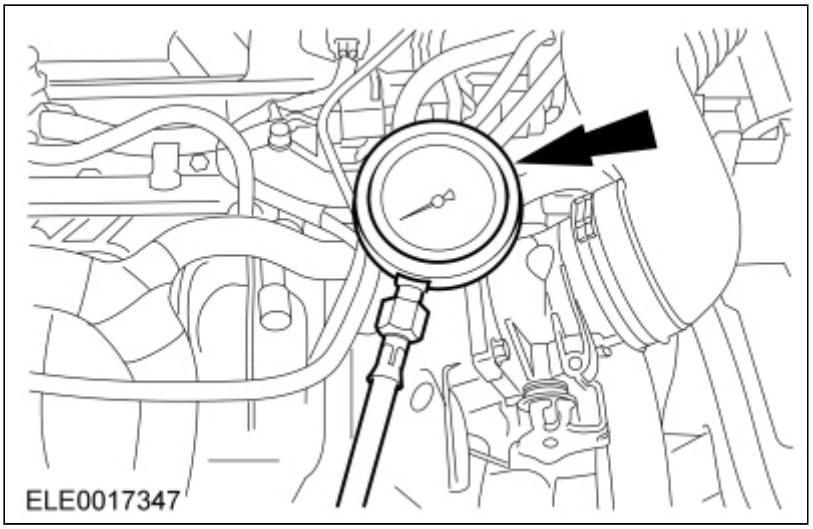
3. Disconnect the oil pressure switch electrical connector.



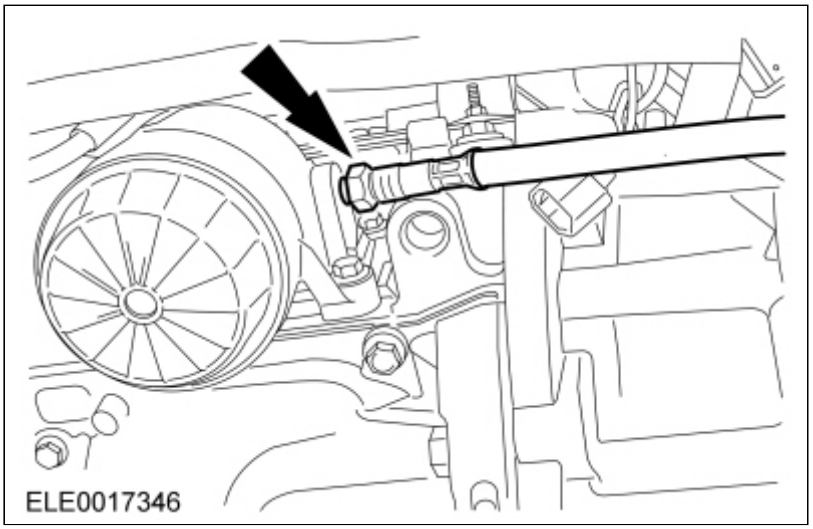
4. Remove the oil pressure switch.



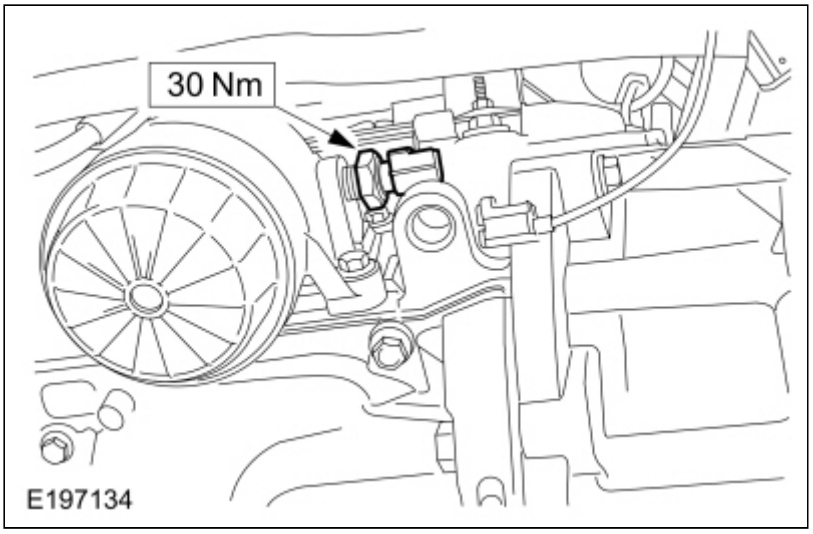
5. Attach the oil pressure gauge (GV 2134) with the oil pressure gauge connector.
6. Lower the vehicle.
7. Start the engine.
8. Raise and support the vehicle.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).



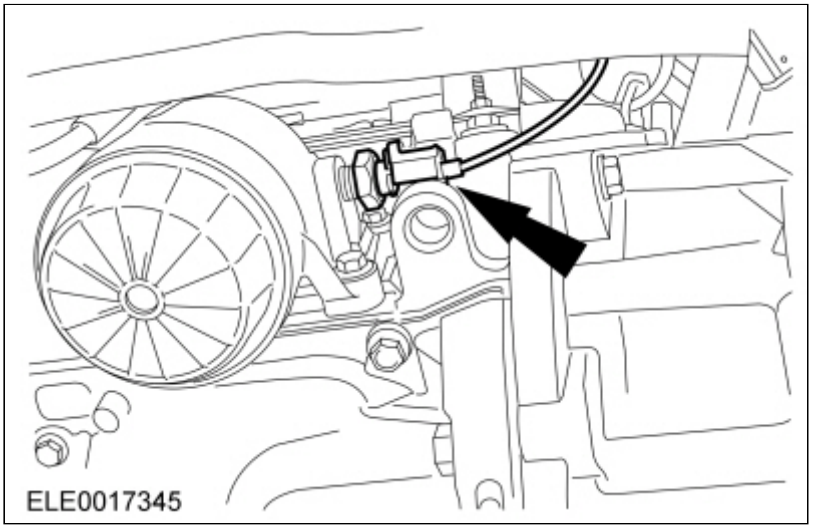
9. Run the engine until normal operating temperature is reached.
10. Run the engine at the specified rpm and record the gauge reading.
11. Measure the oil pressure.
12. The oil pressure should be within specifications.
    REFER to: Specifications - Vehicles Built Up To: 16-08-2015 (303-01A) .
    REFER to: Specifications (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).
13. If the pressure is not within specification, check the following possible sources:
    - Insufficient Oil
    - Oil leakage
    - Worn or damaged oil pump
    - Oil pump screen cover and tube
    - Excessive main bearing clearance
    - Excessive connecting rod bearing clearance
    - Chain tensioner leak
14. Lower the vehicle.
15. Stop the engine.
16. Raise and support the vehicle.
    REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).



17. Remove the oil pressure gauge and the oil pressure gauge connector.



18. Install the oil pressure switch.

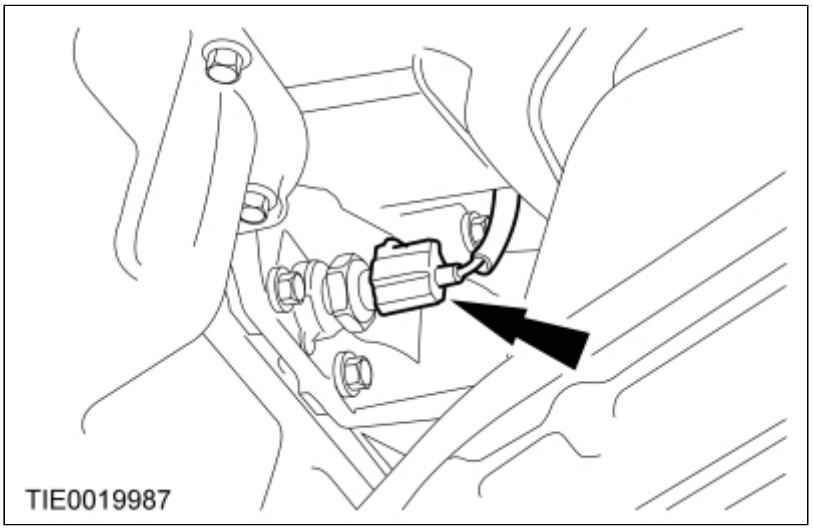


19. Connect the oil pressure switch electrical connector.
20. Install the engine undershield.
21. Lower the vehicle.

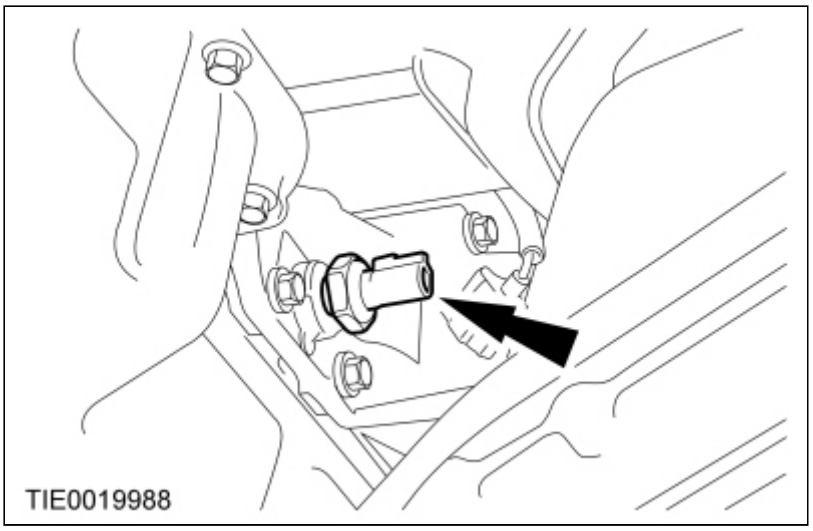
Vehicles with diesel engines

1. Raise and support the vehicle.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

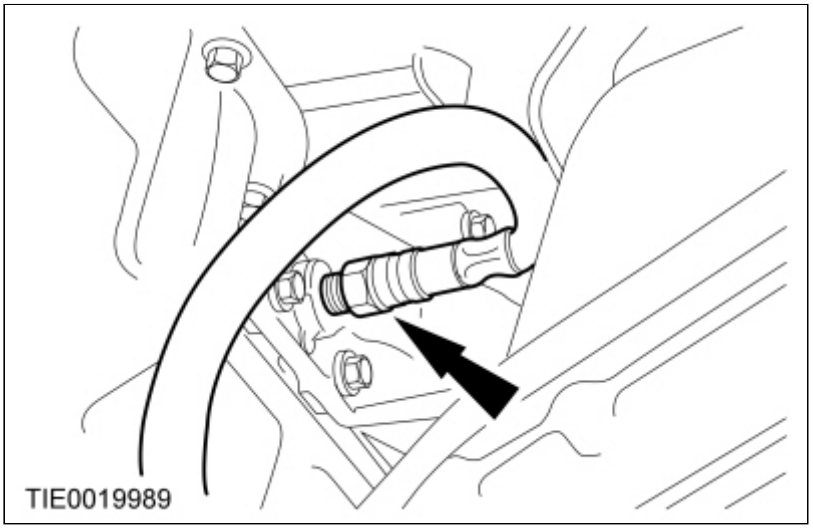
2. Remove the engine undershield.



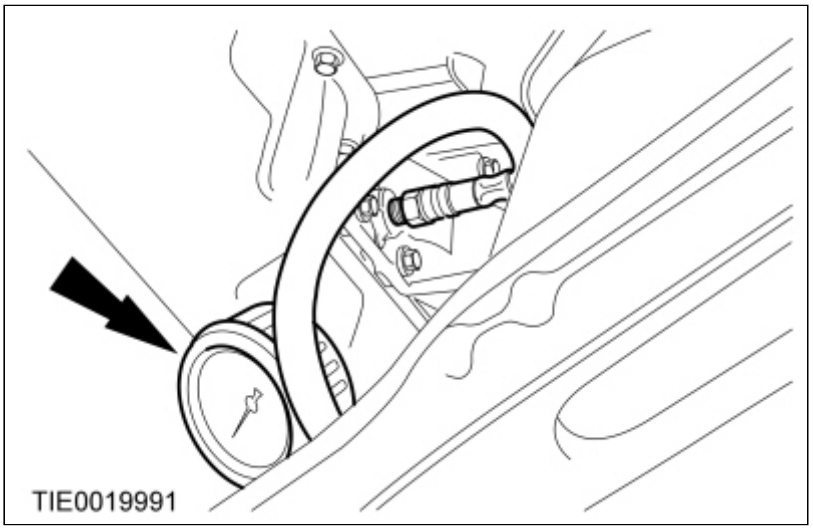
3. Disconnect the oil pressure switch electrical connector.



4. Remove the oil pressure switch.



5. Attach the oil pressure gauge (GV 2134) with the oil pressure gauge connector.
6. Lower the vehicle.
7. Start the engine
8. Raise and support the vehicle.
   REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).



9. Run the engine until normal operating temperature is reached.

10. Run the engine at the specified rpm and record the gauge reading.

11. Measure the oil pressure.

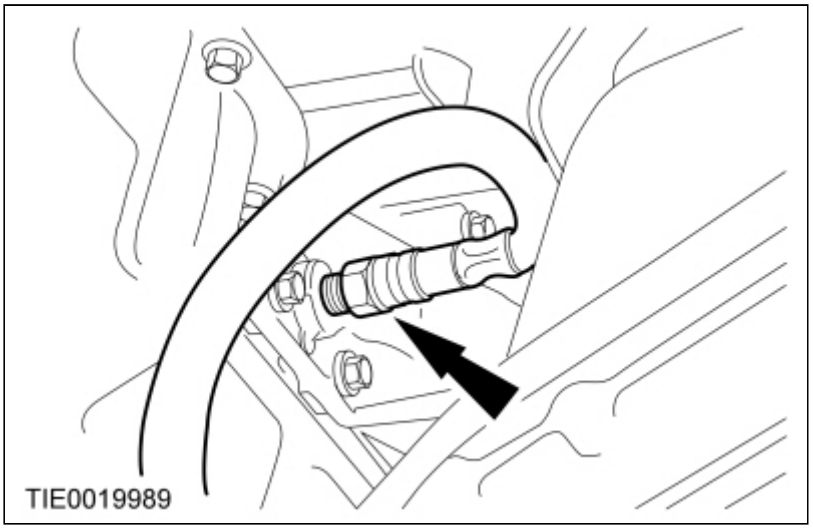
12. The oil pressure should be within specifications.
    REFER to: Specifications - Vehicles Built Up To: 16-08-2015 (303-01B) .
    REFER to: Specifications (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Specifications).
    REFER to: Specifications - Vehicles Built Up To: 16-08-2015 (303-01C) .
    REFER to: Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

13. If the pressure is not within specification, check the following possible sources:
    - Insufficient Oil
    - Oil leakage
    - Worn or damaged oil pump
    - Oil pump screen cover and tube
    - Excessive main bearing clearance
    - Excessive connecting rod bearing clearance
    - Chain tensioner leak

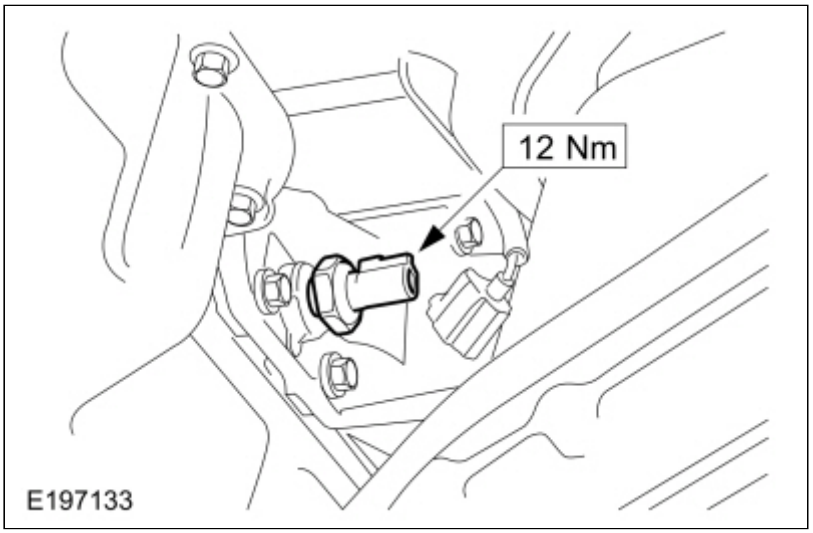
14. Lower the vehicle.

15. Stop the engine.

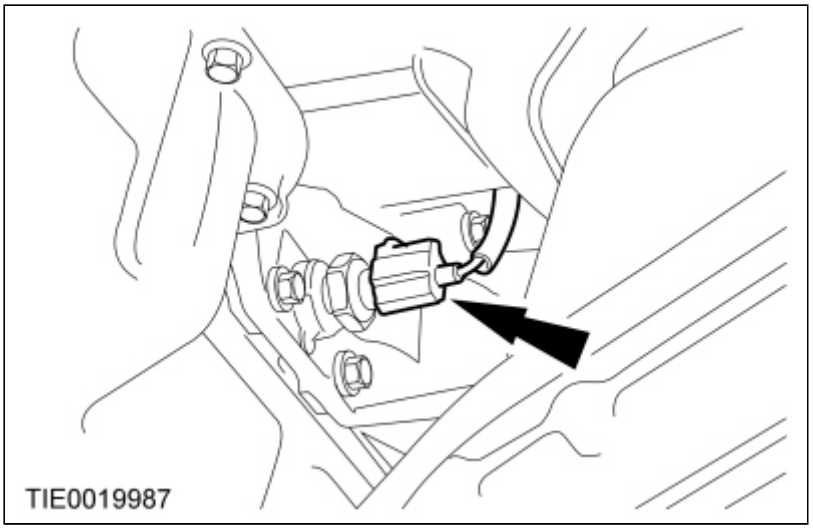
16. Raise and support the vehicle.
    REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).



17. Remove the oil pressure gauge and the oil pressure gauge connector.



18. Install the oil pressure switch.



19. Connect the oil pressure switch electrical connector.
20. Install the engine undershield.
21. Lower the vehicle.

Valve Train Analysis - Static (Engine Off)

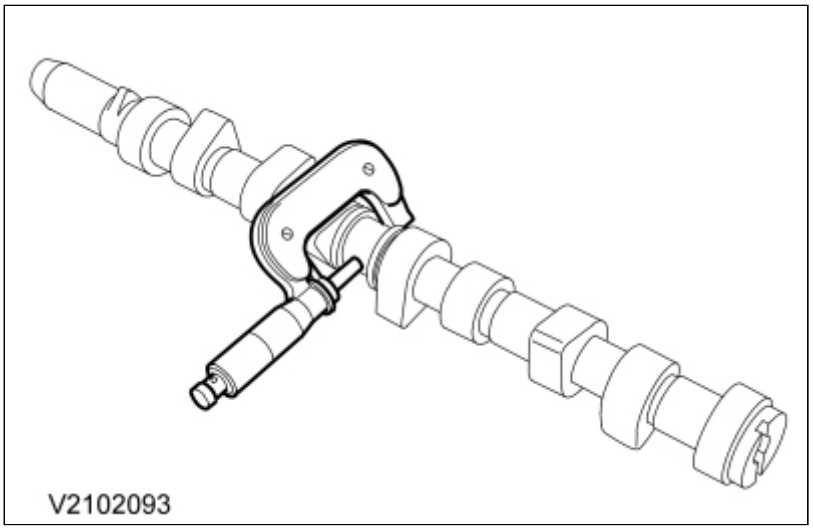
1. Remove the valve cover.

Check all components of the valve train for damage and wear. Make sure that only original components are installed and that all nuts and bolts are tightened to the specified torque.

Copyright © 2016 Ford Motor Company

Camshaft Bearing Journal Diameter

1. Determine the diameter of the camshaft journals.
    - Using a micrometer measure the diameter at 90 degrees intervals to determine if the journals are out-of-round.
    - Measure at two different points on the journal to determine if there is any tapering.
    - If the measurements are out of the specified range, install a new camshaft.



Copyright © 2016 Ford Motor Company

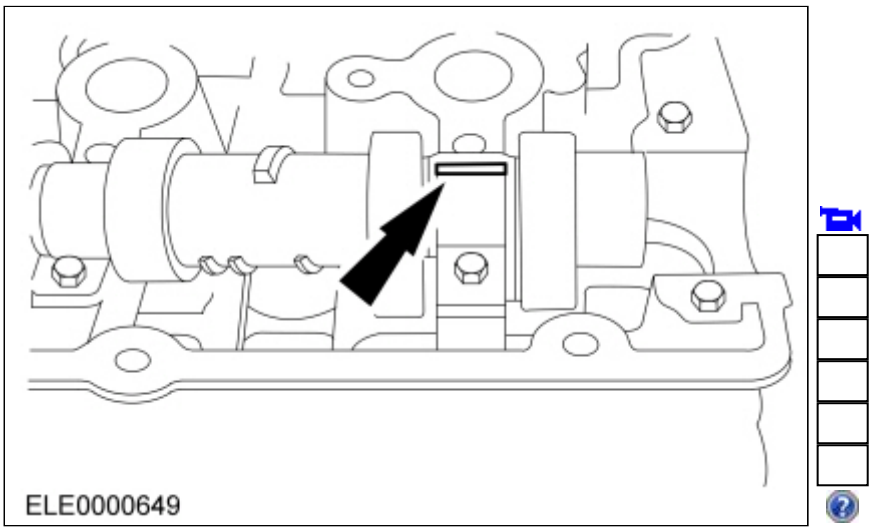
Camshaft Bearing Journal Clearance

1. **NOTE:** *Make sure that the following stages are followed exactly. The tappets or followers must be removed to carry out this measurement.*

   NOTE: *Make sure that the camshaft is to specification.*

   NOTE: *The bearing caps and journals should be free from engine oil and dirt.*

   Position on a width of plastigage on the bearing cap.
   - Insert the camshaft, without lubrication, into the cylinder head.
   - Position a plastigage strip, which should be equal to the width of the bearing cap, on the bearing journal.

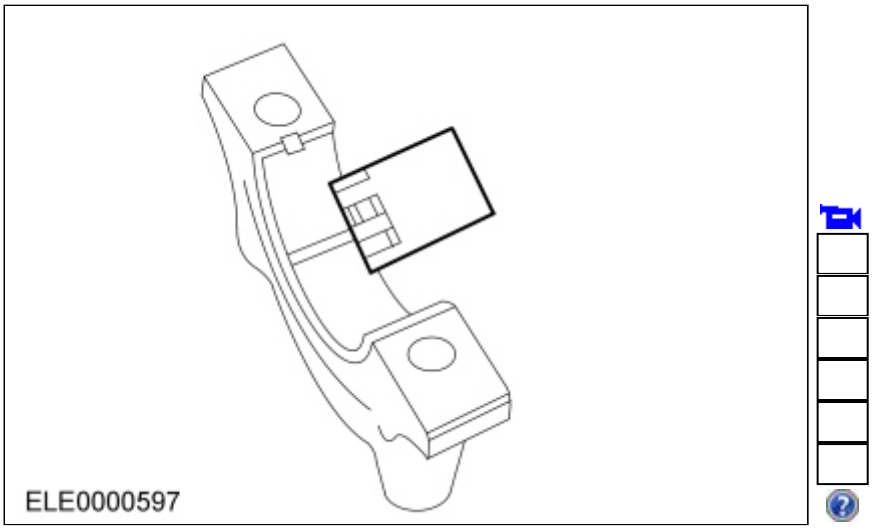


2. Following the tightening specification, install the camshaft bearing caps. Refer to the corresponding Section 303-01.

3. **NOTE:** *Do not strike the bearing caps.*

   Remove the camshaft bearing caps, refer to the corresponding Section 303-01.

4. Using the Plastigage, read off the measurement.
   - Compare the width of plastigage with the plastigage scale.
   - The value that is read off is the bearing clearance.

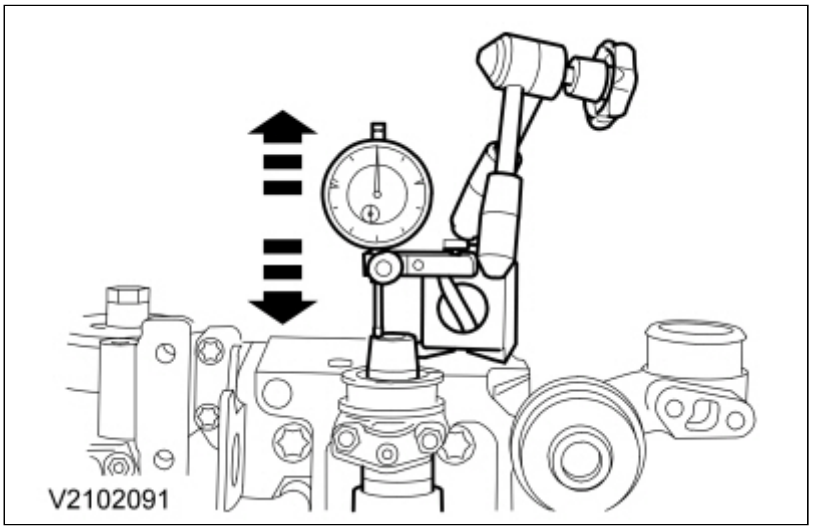


Copyright © 2016 Ford Motor Company

Camshaft End Play

1. **NOTE:** *Make sure that the camshaft is to specification.*

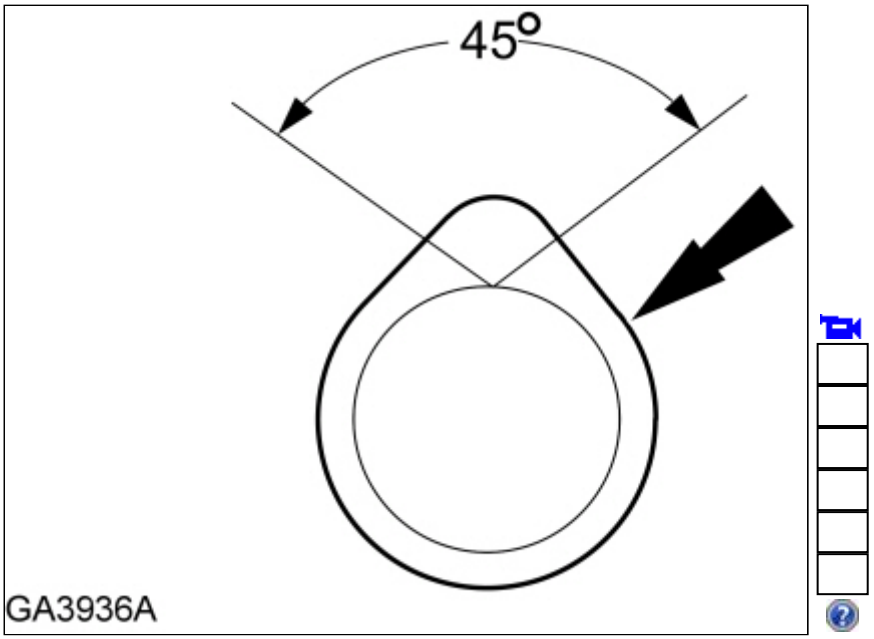
   Using a Dial Indicator Gauge, measure the end play.
   - Slide the camshaft in both directions. Read and note the maximum and minimum values on the Dial Indicator Gauge.
     - End play = maximum value minus minimum value
   - If the measurement is out of specification, install new components.



Copyright © 2016 Ford Motor Company

Camshaft Surface Inspection

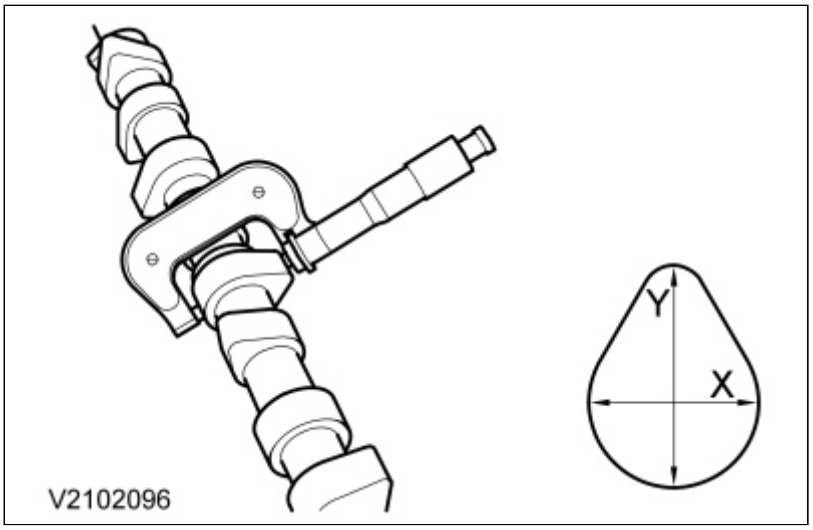
1. Inspect the camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.



Copyright © 2016 Ford Motor Company

Camshaft Lobe Lift

1. Determine the cam lift.
    - Using a micrometer measure the cam in two directions.
    - The difference between the two measurements is the cam lift.



Copyright © 2016 Ford Motor Company

Crankshaft Main Bearing Journal Clearance

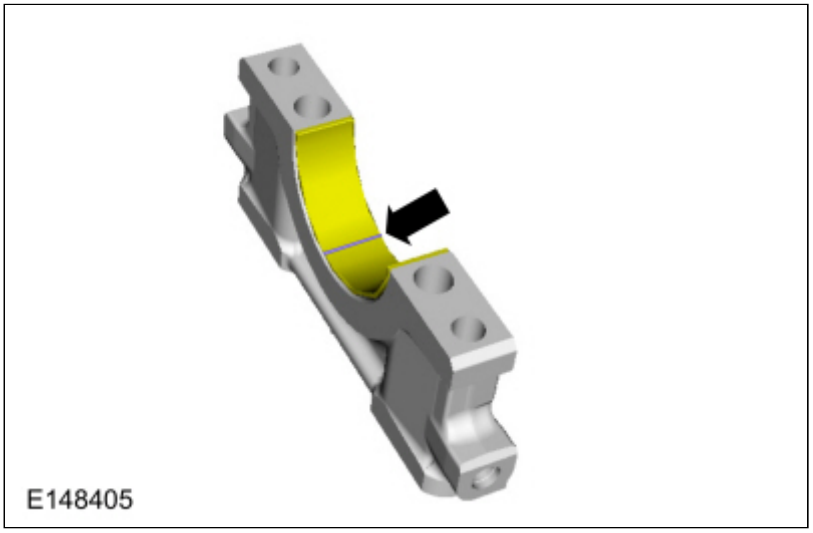
Check

NOTE: *Refer to the appropriate Section 303-01 for the specification.*

1. **NOTE:** *Crankshaft main bearing journals must be within specifications before checking journal clearance.*

   Remove the crankshaft main bearing cap and crankshaft main bearing.

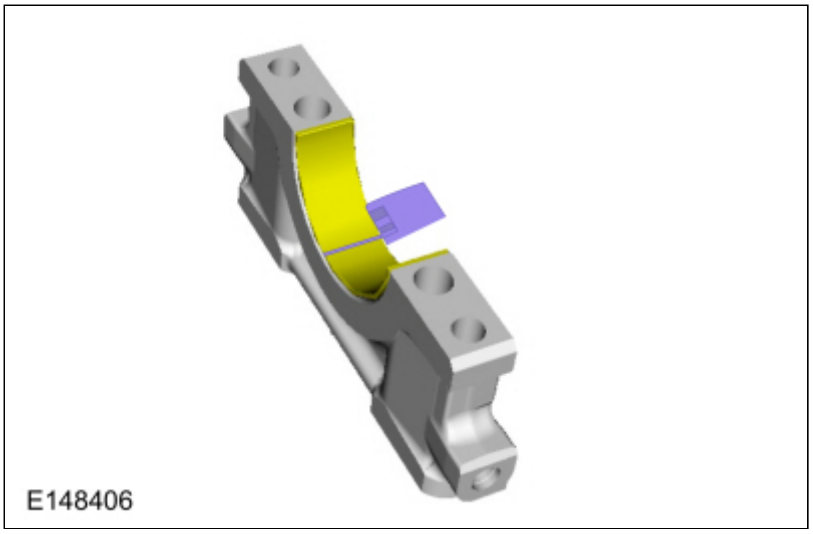
2. Position a piece of Plastigage across the crankshaft main bearing surface.



3. **NOTE:** *Do not turn the crankshaft while carrying out this procedure.*

   Install and tighten to specifications, then remove the crankshaft main bearing cap.

4. Measure the Plastigage to get the crankshaft main bearing clearance. The Plastigage should be smooth and flat. A changing width indicates a tapered or damaged crankshaft or crankshaft bearing.



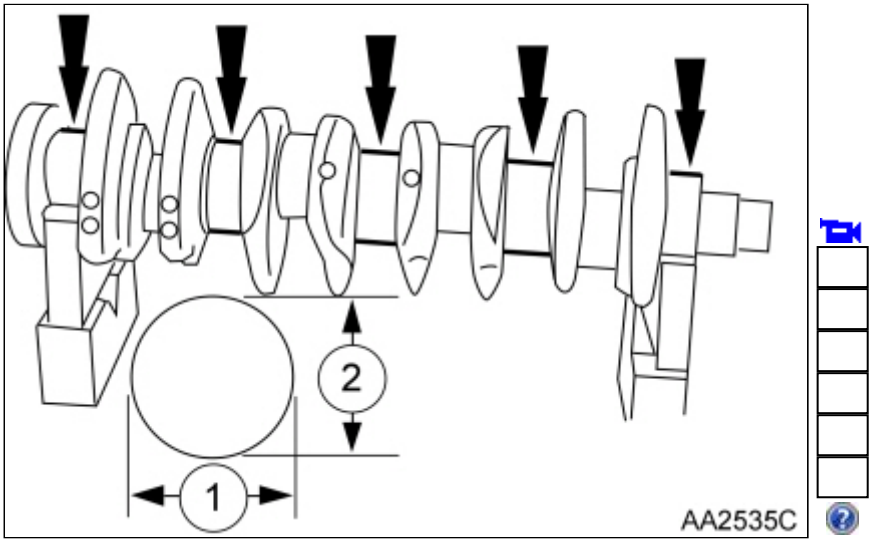
Copyright © 2016 Ford Motor Company

Crankshaft Main Bearing Journal Diameter

General Equipment

Micrometer

1. Measure the diameter of the main bearing journals and the big-end bearing journals.
    - Repeat the measurement with the micrometer offset by 90°, in order to determine any eccentricity which may be present.
    - Measure the journal at two different positions to determine any conicity which may be present.



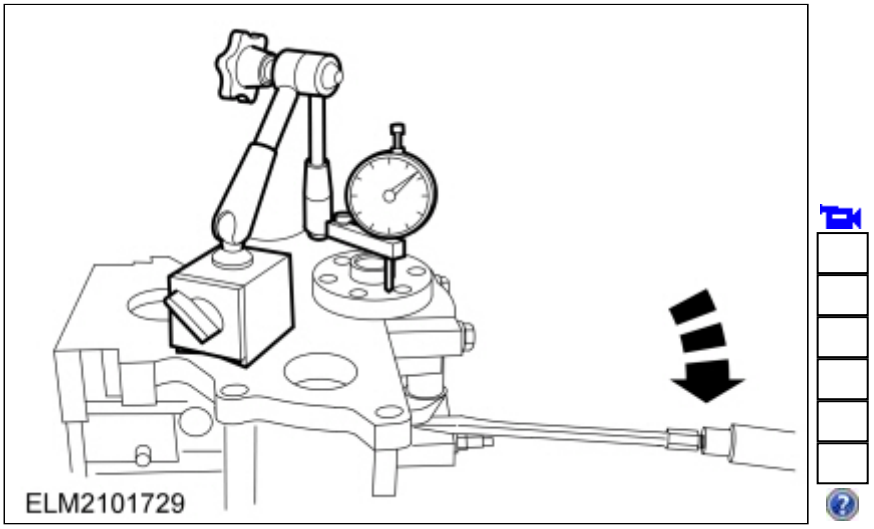
Copyright © 2016 Ford Motor Company

Crankshaft End Play

General Equipment

Dial indicator
Dial indicator fixture

1. Determine the end float
   - Place on the dial indicator and bracket .
   - Determine the end float by raising the crankshaft with the aid of a screwdriver.
   - If necessary, correct the end float by using new thrust half washers.

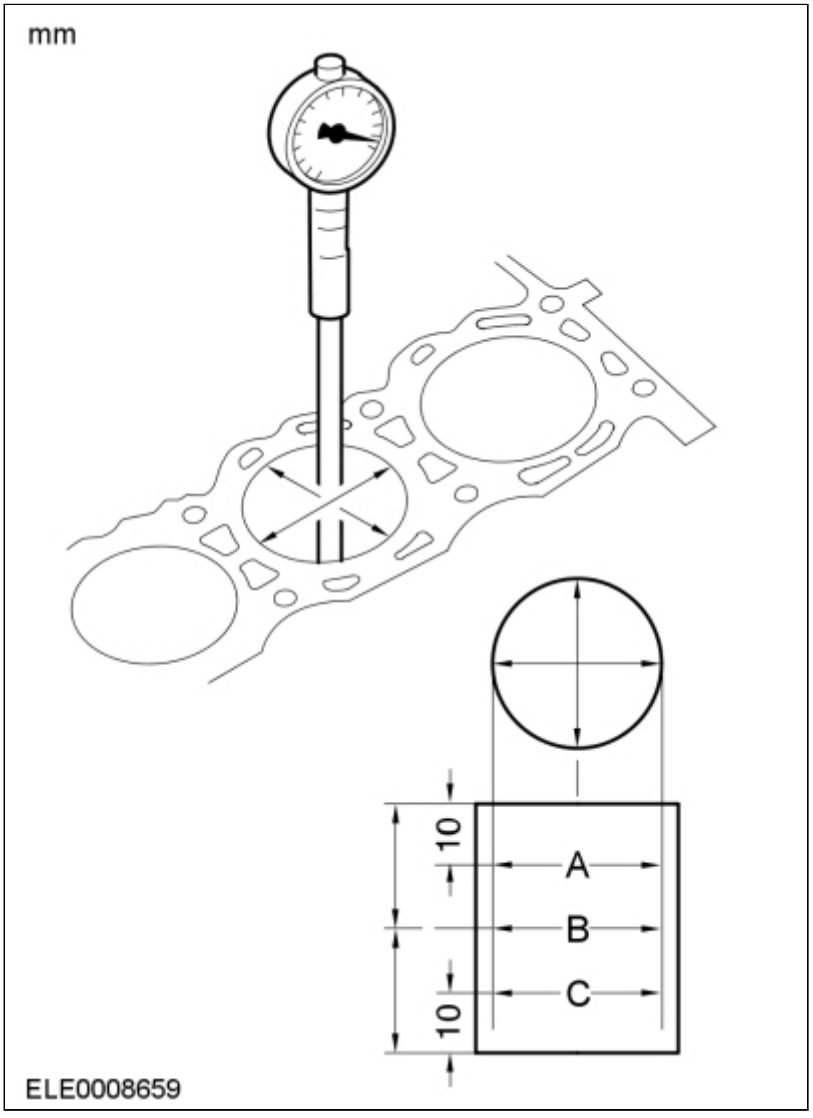


Copyright © 2016 Ford Motor Company

Cylinder Bore Taper

1. **NOTE:** *The main bearing caps or lower crankcase must be in place and tightened to the specified torque; however, the bearing shells should not be installed.*

   Measure the cylinder bore with an internal micrometer.
   - Carry out the measurements in different directions and at different heights to determine if there is any out-of-roundness or tapering.
   - If the measurement is out of the specified range, install a new block or hone out the cylinder block (if aplicable/allowed).

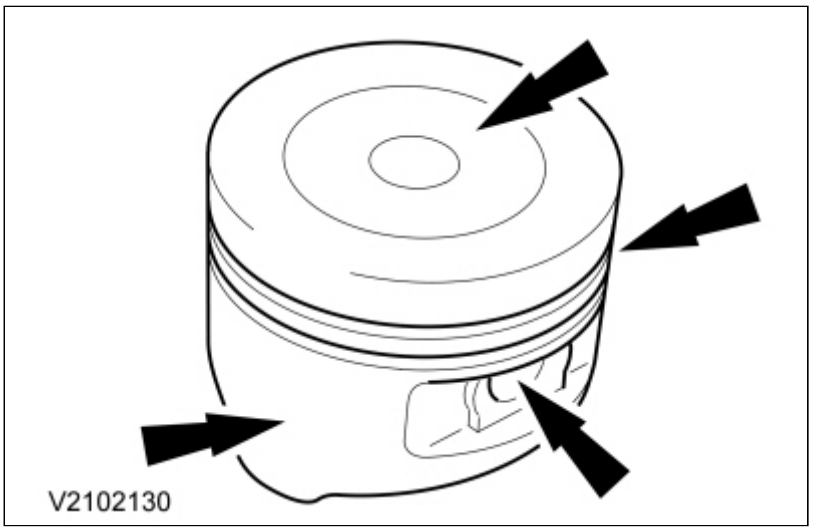


Copyright © 2016 Ford Motor Company

Piston Inspection

1. **NOTICE: Do not use any aggressive cleaning fluid or a wire brush to clean the piston.**

   Carry out a visual inspection.
   - Clean the piston skirt, pin bush, ring grooves and crown and check for wear or cracks.
   - If there are signs of wear on the piston skirt, check whether the connecting rod is twisted or bent.

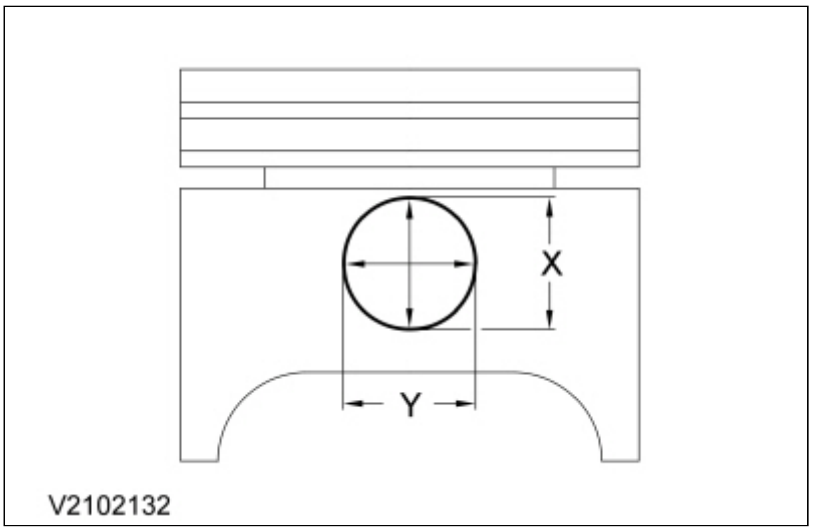


Copyright © 2016 Ford Motor Company

Piston Pin to Bore Diameter

1. **NOTE:** *The piston and piston pin form a matched pair. Do not mix up the components.*

   Measure the diameter of the piston pin bore.
   - Measure the diameter in two directions.
   - If the values are not to specification, install both a new piston and a new piston pin.



Copyright © 2016 Ford Motor Company

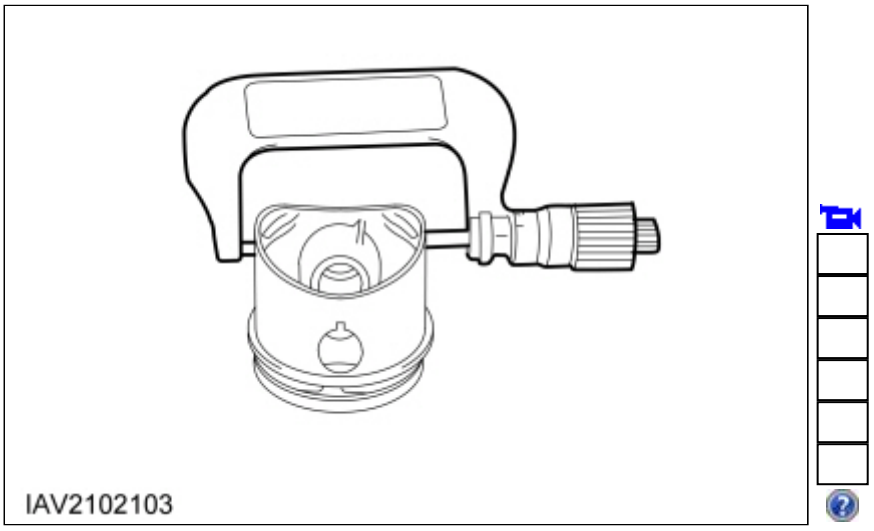
Piston Diameter

General Equipment

Micrometer

1. **NOTE:** *Mark the piston to make sure the piston is installed correctly.*

   Using a Micrometer measure the piston diameter.

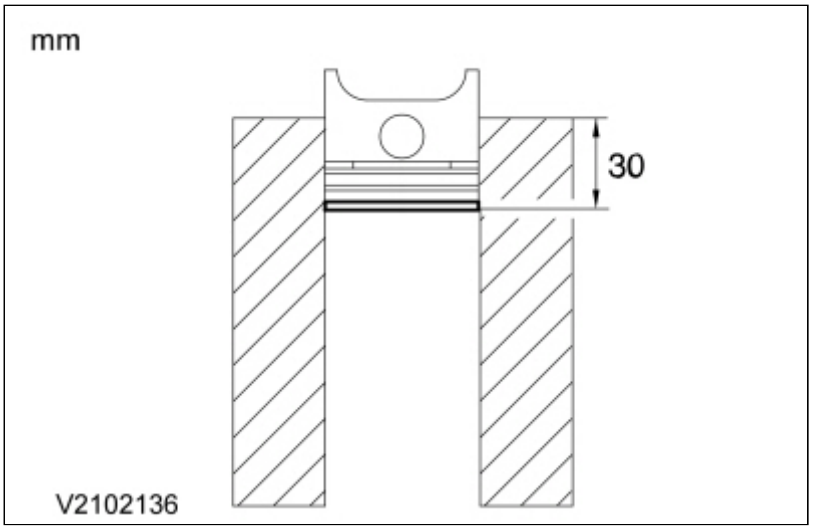


Copyright © 2016 Ford Motor Company

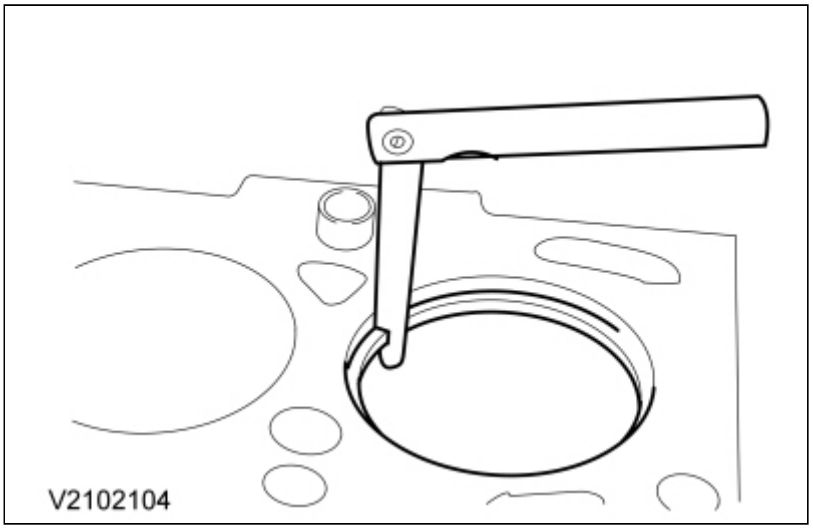
Piston Ring End Gap

1. **NOTICE: Do not mix up the piston rings. Install the piston rings in the same position and location.**

   Take the piston ring and use a piston without rings to push the piston ring about 30 mm into the cylinder bore.



2. Using the Feeler Gauge, measure the piston ring gap.



Copyright © 2016 Ford Motor Company

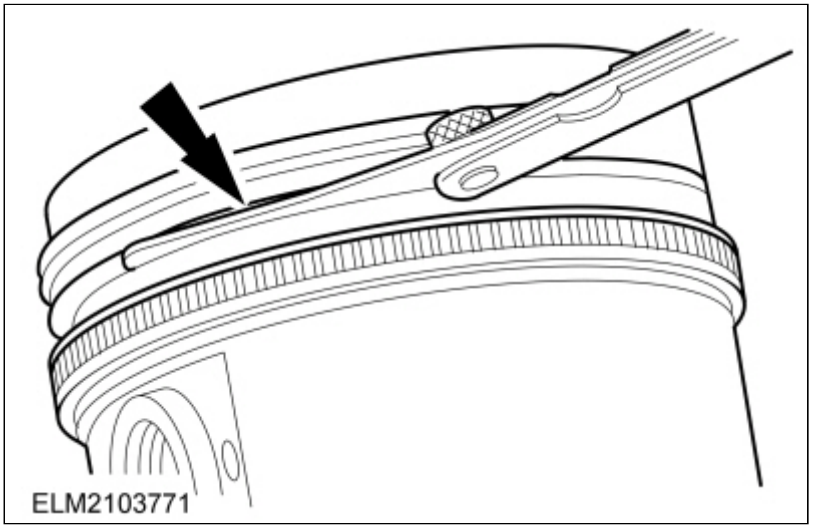
Piston Ring-to-Groove Clearance

General Equipment

Feeler Gauge

1. **NOTE:** *The piston ring must protrude from the piston groove. To determine the piston ring clearance, insert the Feeler Gauge right to the back of the groove, behind the wear ridge.*

   Using the Feeler Gauge , measure the piston ring clearance.

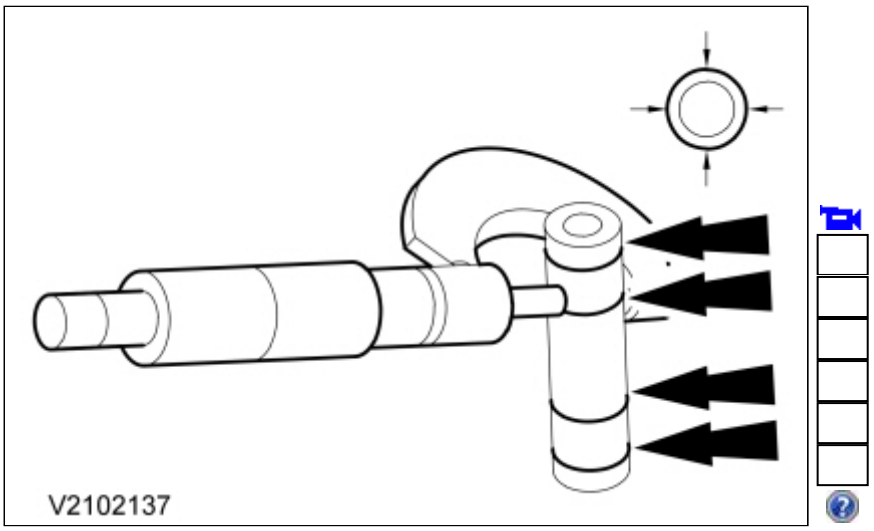


Copyright © 2016 Ford Motor Company

Piston Pin Diameter

1. **NOTE:** *The piston and piston pin are a matched pair. Do not mix up the components.*

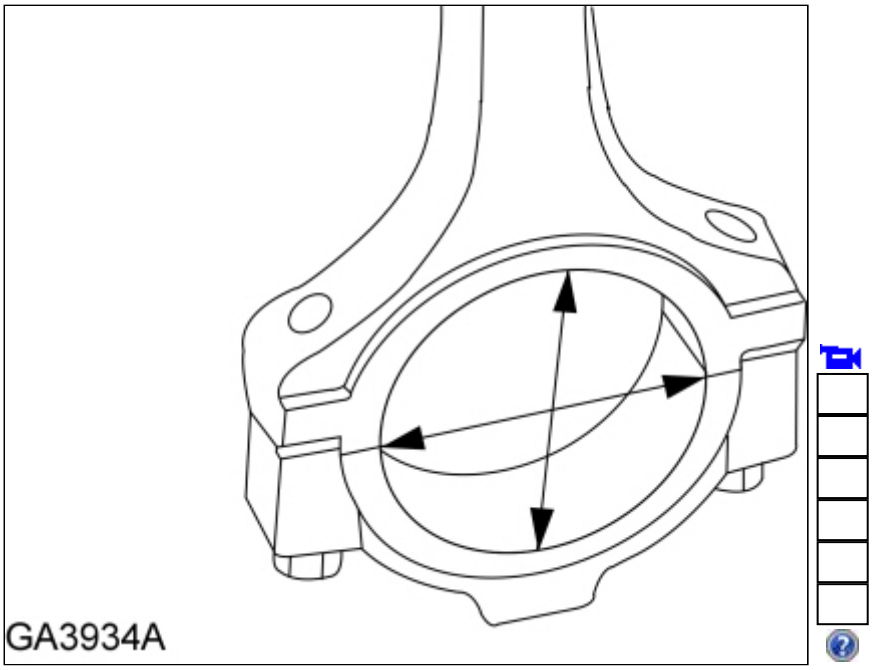
   Measure the piston pin diameter.
   - Measure the diameter in two directions.
   - If the values are not to specification, install a new piston and a new piston pin.



Copyright © 2016 Ford Motor Company

Connecting Rod Large End Bore

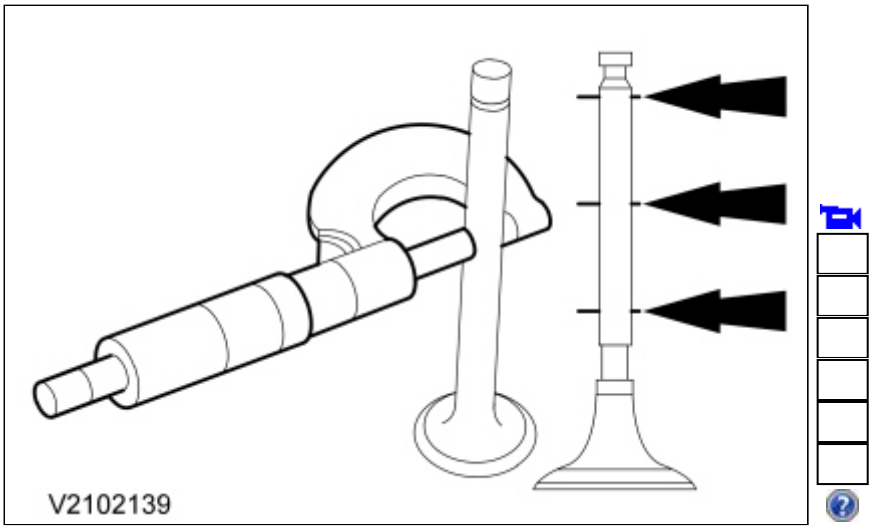
1. Measure the bearing bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round and the bearing bore is within specification.



Copyright © 2016 Ford Motor Company

Valve Stem Diameter

1. Using a micrometer measure the diameter of the valve stems.
    - If the measurements are not to specification, install a new valve.



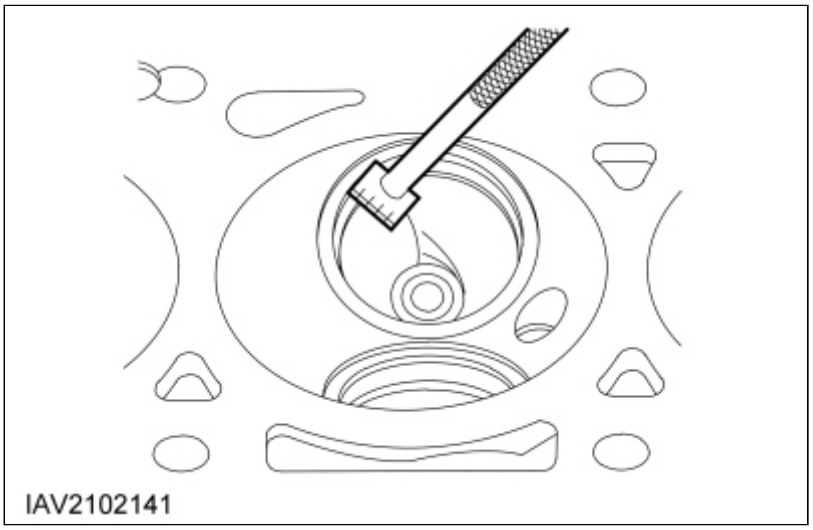
Copyright © 2016 Ford Motor Company

Valve Seat Inspection

General Equipment

Valve seat width scale

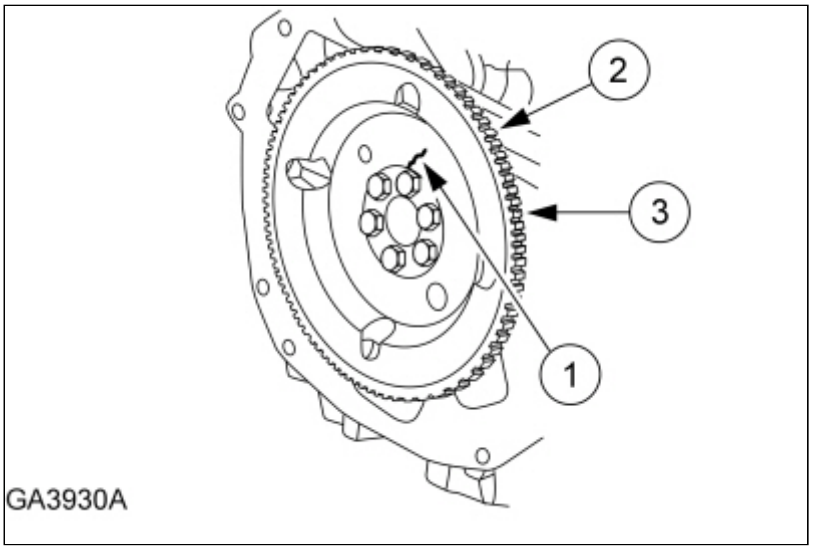
1. Measure the width of the valve seat.
    - Measure the valve seat width using the Valve seat width scale.
    - If the value is not to specification rework the valve seat.



Copyright © 2016 Ford Motor Company

Flywheel Inspection

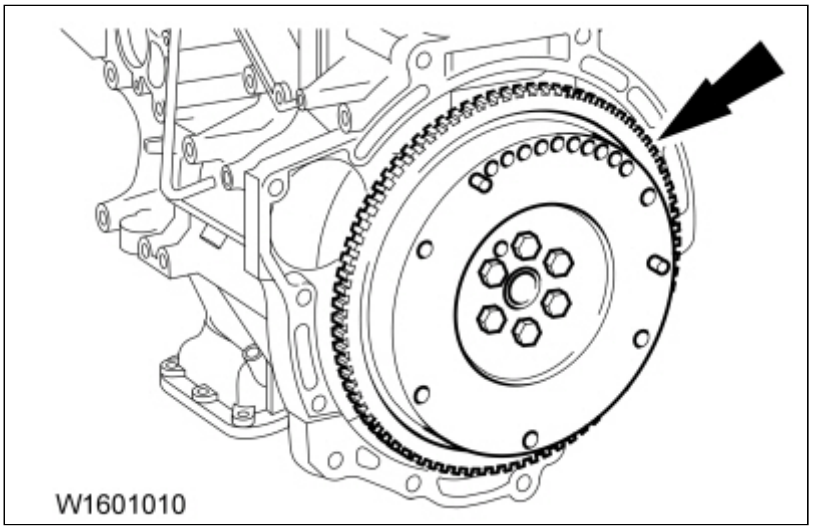
1. Inspect the flywheel. If there is evidence of the following, install a new flywheel.
    1. Cracks.
    2. Worn ring gear teeth.
    3. Chipped or cracked ring gear teeth.



Copyright © 2016 Ford Motor Company

Flywheel Clutch Surface Inspection

1. Check the flywheel for:
    - burning
    - grooves
    - cracks
    - Renew the flywheel if necessary.



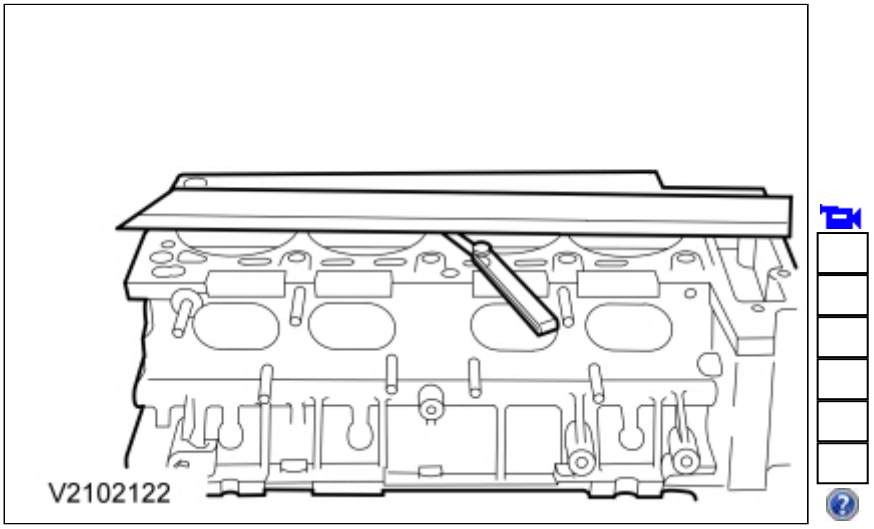
Copyright © 2016 Ford Motor Company

Cylinder Head Distortion

General Equipment

Feeler gauge
Straight edge

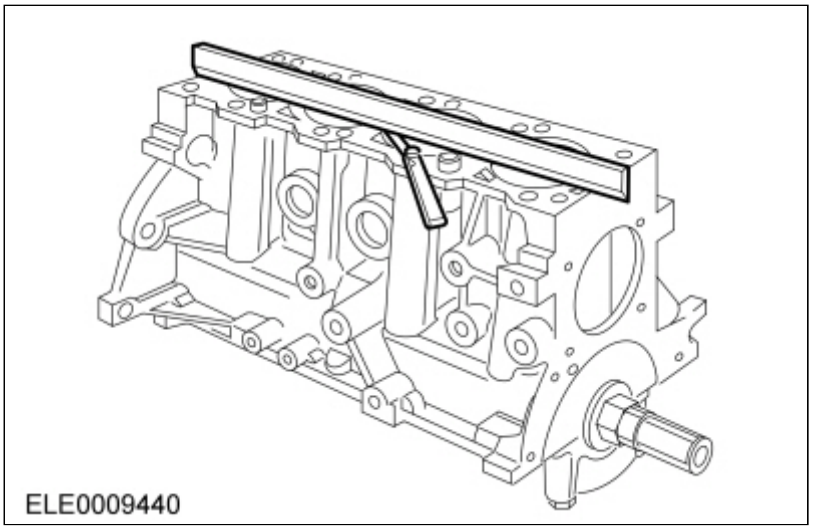
1. Using a straight edge and feeler gauge, measure the cylinder head distortion.
    - Measure the mating face distortion.
    - Refer to Specifications in the appropriate engine section.



Copyright © 2016 Ford Motor Company

Cylinder Block Distortion

1. Using a Straight Edge and a Feeler Gauge, measure the cylinder block/cylinder head distortion.
    - Measure the mating face distortion.
    - If the value is not to specification rework the mating face (if allowed).



Copyright © 2016 Ford Motor Company

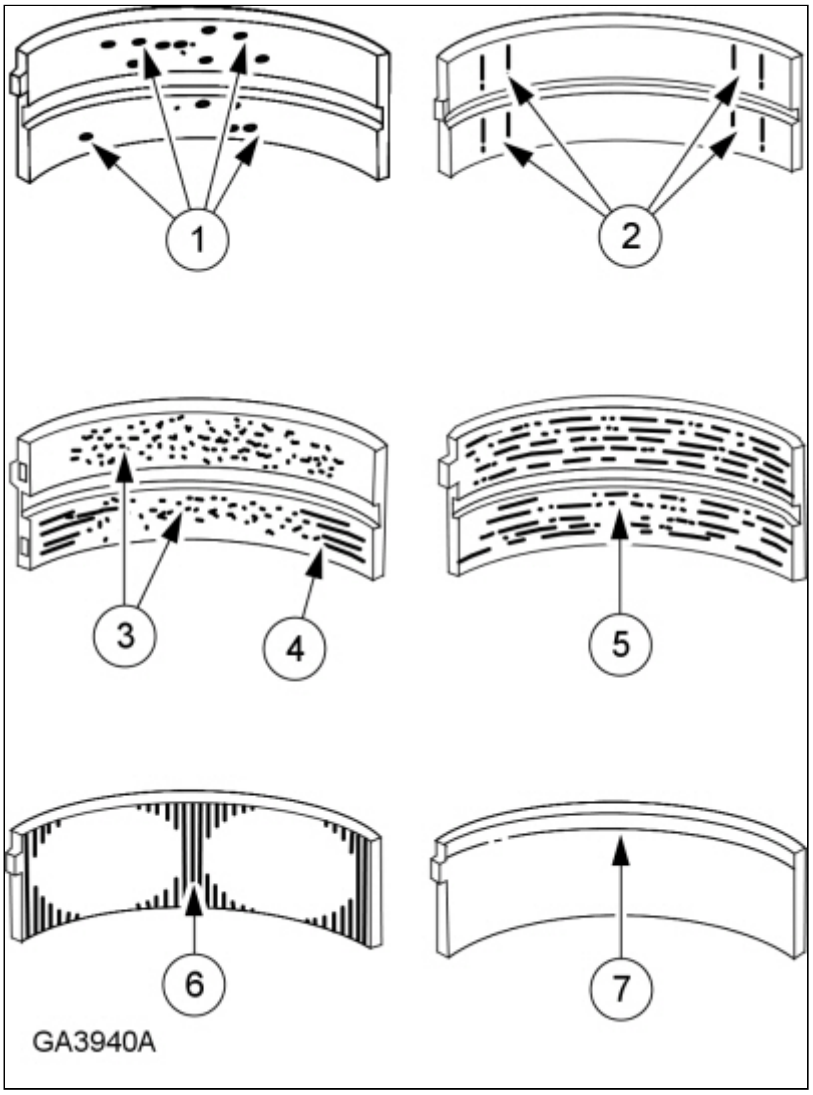
Exhaust Manifold Cleaning and Inspection

1. Inspect the cylinder head joining flanges of the exhaust manifold for evidence of exhaust gas leaks.
2. Inspect the exhaust manifold for cracks, damaged gasket surfaces, or other damage that would make it unfit for further use.

Copyright © 2016 Ford Motor Company

Bearing Inspection

1. Inspect bearings for the following defects.
    1. Cratering - fatigue failure
    2. Spot polishing - incorrect seating.
    3. Imbedded dirt engine oil.
    4. Scratching - dirty engine oil.
    5. Base exposed - poor lubrication.
    6. Both edges worn - journal damaged.
    7. One edge worn - journal tapered or bearing not seated.



Copyright © 2016 Ford Motor Company

Specifications

Engine data

Description	Specification
Engine code	ENEV
Firing order	1-3-4-2
Emission level	Stage II, Stage IV
Displacement	2.5L
No. of cylinders	4
Bore	89 mm
Stroke	100 mm
Cubic capacity	2488.5 cm^3
Compression ratio	9.7 : 1
Power output at 5500 rpm	122 kW (165 PS)
Maximum torque at 1500 rpm	213 Nm
Maximum engine speed (intermittent)	6500 rpm
Maximum engine speed (continuous)	6000 rpm
Idle speed	700 rpm
Number of main bearings	5
Camshaft drive	Chain
Oil pressure (hot @ 2,000 rpm)	200-268 kPa (29-39 psi)
Engine weight (without accessory drive components and flexplate or flywheel)	203.8 kg

Engine oil capacity

Description	Liters
Initial fill including oil filter	6.7
Service fill including oil filter	6.4
Service fill without oil filter	6

Engine oil

Viscosity	Specification
SAE 5W-20 Engine oil	WSS-M2C930-A
SAE 5W-20 Engine oil	WSS-M2C945-A
SAE 5W-20 Engine oil	API-SM
SAE 5W-20 Engine oil	API-SN

SAE-5W-30 Engine oil	WSS-M2C913-C
SAE-5W-30 Engine oil	WSS-M2C913-D
SAE-5W-30 Engine oil	WSS-M2C929-A
SAE-5W-30 Engine oil	WSS-M2C946-A
SAE-5W-30 Engine oil	API-SM
SAE-5W-30 Engine oil	API-SN

Cylinder block

Description	mm
Cylinder bore diameter	89.0 - 89.03 mm
Cylinder bore maximum out-of-round	0.008 mm
Main bearing bore diameter	57.018 - 57.040 mm
Head gasket surface flatness	0.1 mm/general and 0.05 mm/200 x 200

Piston

Description	mm
Diameter (1)	88.965 - 88.975 mm
Diameter (2)	88.975 - 88.985 mm
Diameter (3)	88.985 - 88.995 mm
Piston-to-bore clearance	0.025 - 0.045 mm
Ring groove width - top	1.203 - 1.205 mm
Ring groove width - 2nd	1.202 - 1.204 mm
Ring groove width - oil	2.501 - 2.503 mm
Piston skirt coating thickness	0.008 - 0.016 mm

Piston pin

Description	mm
Diameter	19.995 - 20.0 mm
Length	54.7 - 55.0 mm

Valve

Description	mm and degree
Valve head diameter - intake	34.85 - 35.15 mm
Valve head diameter - exhaust	29.85 - 30.15 mm
Valve stem diameter - intake	5.470 - 5.485 mm

Valve stem diameter - exhaust	5.465 - 5.480 mm
Valve stem-to-guide clearance - intake	0.0027 mm
Valve stem-to-guide clearance - exhaust	0.0029 mm
Valve face runout	0.05 mm
Valve face angle	45 degrees

Valve spring - compression pressure

Description	kg and mm
Intake and exhaust (installed)	17.5 kg
Intake (valve open) 8.9 mm of lift	44 kg
Exhaust (valve open) 7.4 mm of lift	42 kg
Free length	44.92 mm
Assembled height	37.9 mm

Cylinder head

Description	mm and degree
Cylinder head flatness	0.08 maximum overall, a maximum of 0.05 mm within 150 mm
Valve lift @ zero lash (exhaust)	7.7 mm
Valve lift @ zero lash (intake)	8.8 mm
Valve guide diameter	5.509 - 5.539 mm
Valve seat width - intake/exhaust	0.99 - 1.84 mm
Valve seat angle	45 degrees
Valve seat runout	0.075 mm
Valve lash adjuster bore diameter	31.00 - 31.03 mm
Cam bore diameter	25.015 - 25.040 mm

Crankshaft

Description	mm
Main bearing journal diameter	51.978 - 52.002 mm
Production repair	51.730 - 51.750 mm
Main bearing clearance	0.016 - 0.047 mm
Connecting rod journal diameter	51.978 - 52.002 mm
Production repair	51.730 - 51.750 mm
End play	0.220 - 0.450 mm

Rings

Description	mm
Width - top	1.17 - 1.185 mm
Width - 2nd	1.197 - 1.199 mm
Width - oil	2.38 - 2.45 mm
Ring gap (in bore) - top	0.16 - 0.26 mm
Ring gap (in bore) - 2nd	0.31 - 0.46 mm
Ring gap (in bore) - oil	0.15 - 0.40 mm

Valve tappet

Description	mm
Diameter	30.97 - 30.98 mm
Tappet-to-valve clearance -intake	0.22 - 0.28 mm
Tappet-to-valve clearance -exhaust	0.27 - 0.33 mm
Tappet-to-bore clearance	0.02 - 0.06 mm

Valve tappet for flex fuel vehicles (FFV)

Description	mm
Diameter	30.97 - 30.98 mm
Tappet-to-valve clearance -intake	0.25 - 0.31 mm
Tappet-to-valve clearance -exhaust	0.30 - 0.36 mm
Tappet-to-bore clearance	0.02 - 0.06 mm

Camshaft

Description	mm
Intake camshaft lobe lift	8.24999 mm
Exhaust camshaft lobe lift	7.80007 mm
Runout (1)a	0.03 mm
Thrust clearance	0.09 - 0.24 mm
Journal diameter	24.96 - 24.98 mm
Journal-to-bore clearance	0.035 - 0.080 mm

a - No. 3 journal - supported by No. 1 and No. 5 journals.

Connecting rod

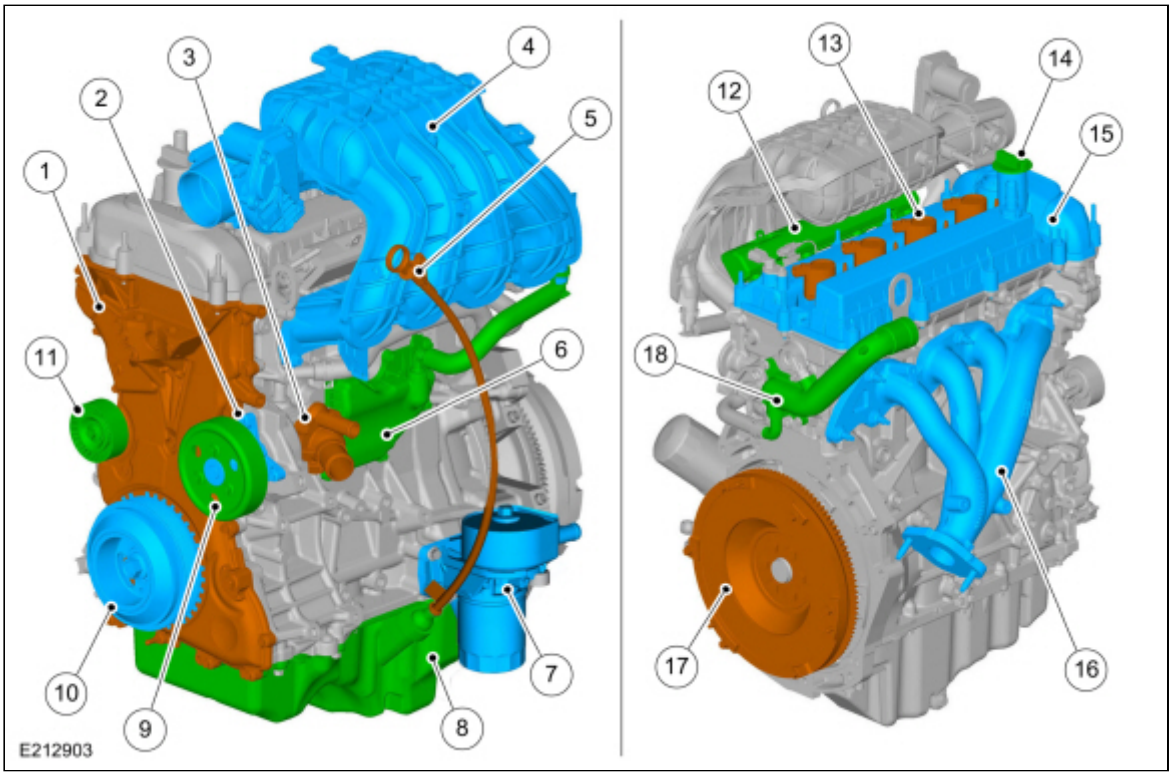
Description	mm

Bearing clearance	0.027 - 0.052 mm
Bearing thickness	1.496 - 1.520 mm
Crank bore diameter	55.025 - 55.045 mm
Pin bore diameter (with bushing inserted)	20.010 - 20.021 mm
Length (center-to-center)	151.8 mm
Side clearance	1.95 - 3.05 mm
Axial clearance	0.14 - 0.36 mm

Copyright © 2016 Ford Motor Company

Engine - Component Location

Base Part Number: 6L084



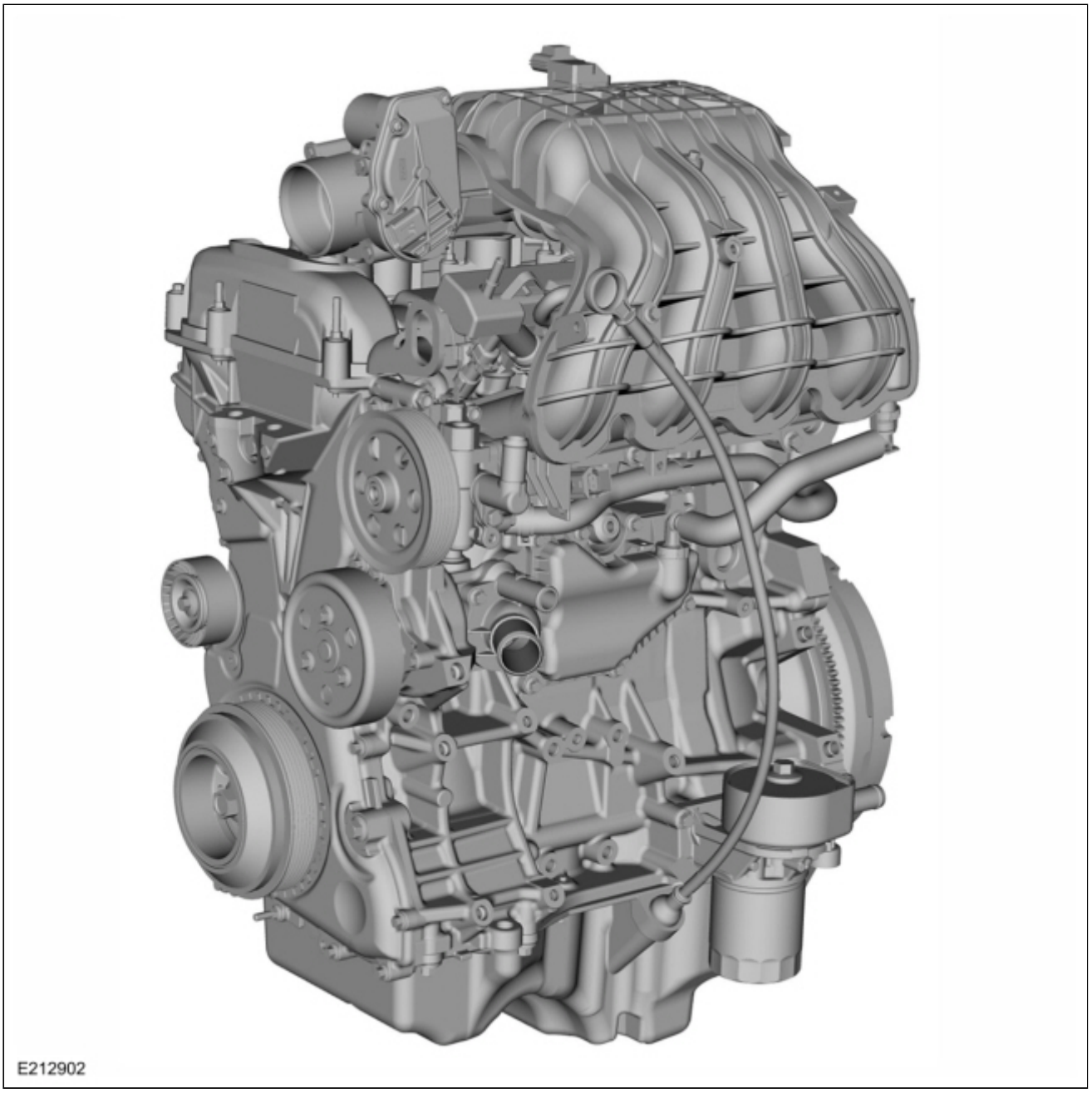
Item	Description
1	Engine front cover
2	Coolant pump
3	Thermostat
4	Intake manifold
5	Oil level indicator
6	Crankcase ventilation oil separator
7	Oil filter and cooler
8	Oil pan
9	Coolant pump pulley
10	Cranksahft pulley
11	Accessory drive belt idler pulley
12	Fuel rail
13	Ignition coils
14	Oil filler cap
15	Valve cover
16	Exhaust manifold
17	Flywheel
18	Water outlet connector

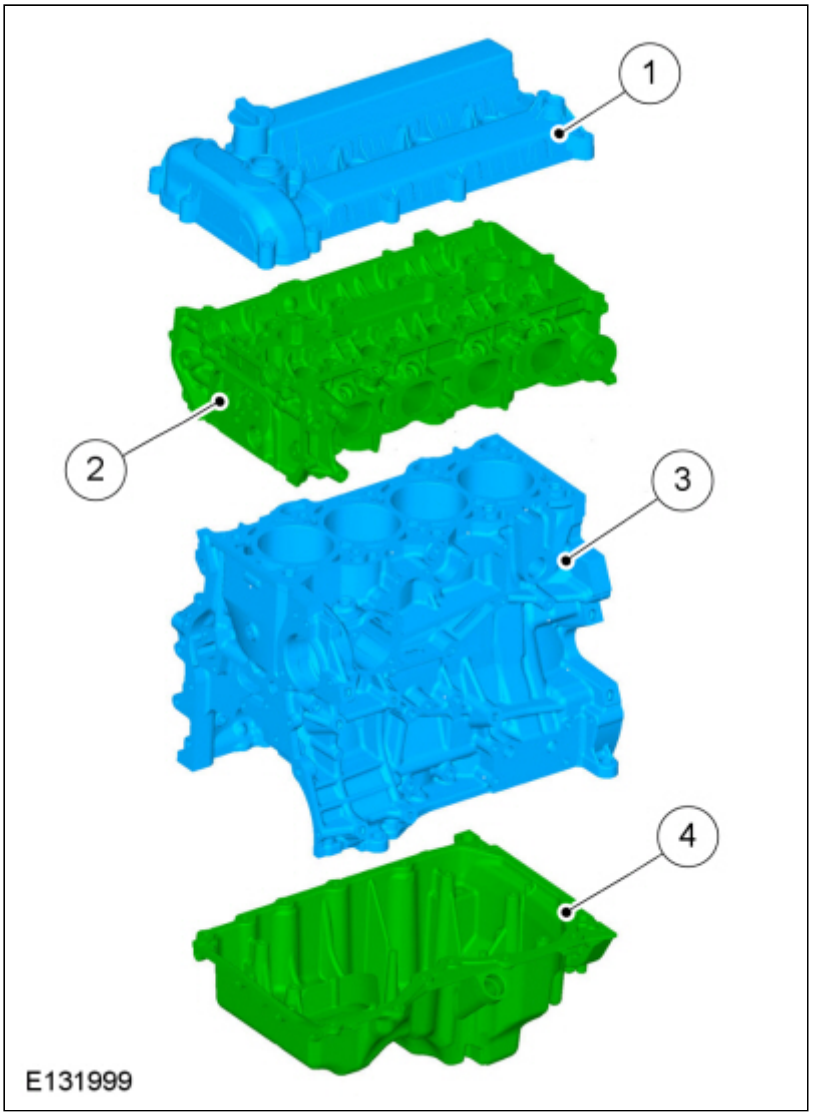
Copyright © 2016 Ford Motor Company

Engine - Overview

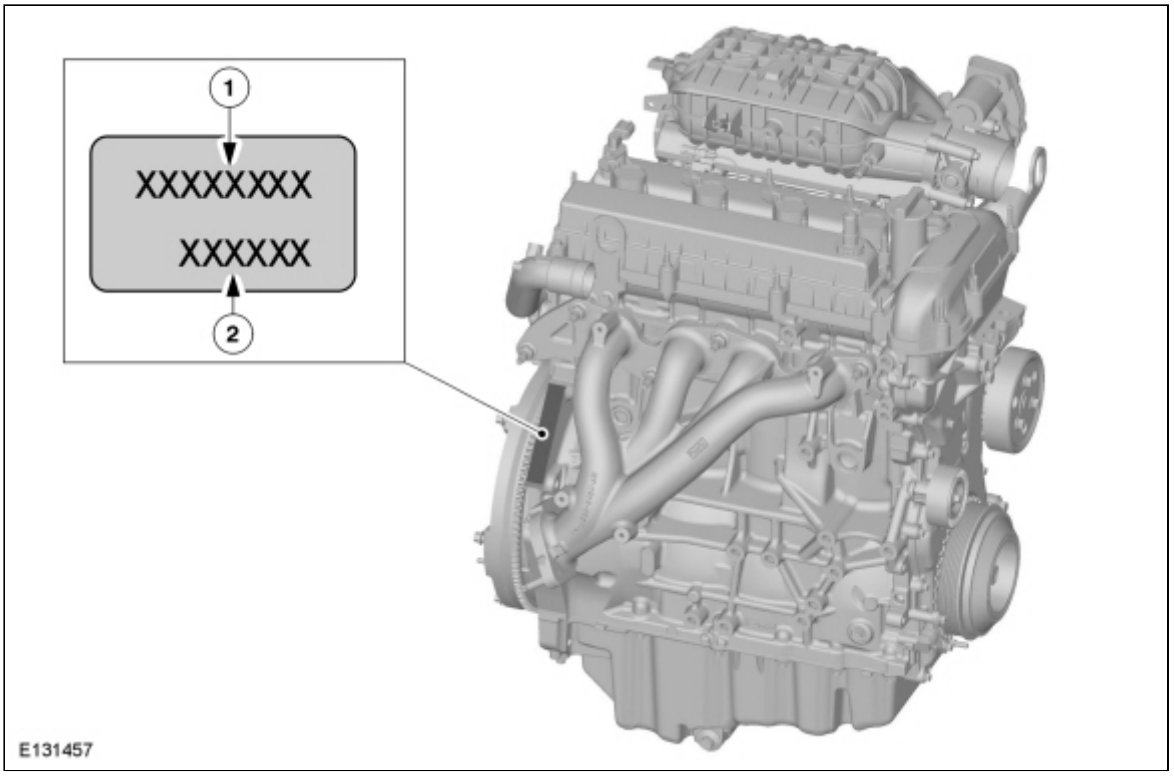
Base Part Number: 6L084

General View



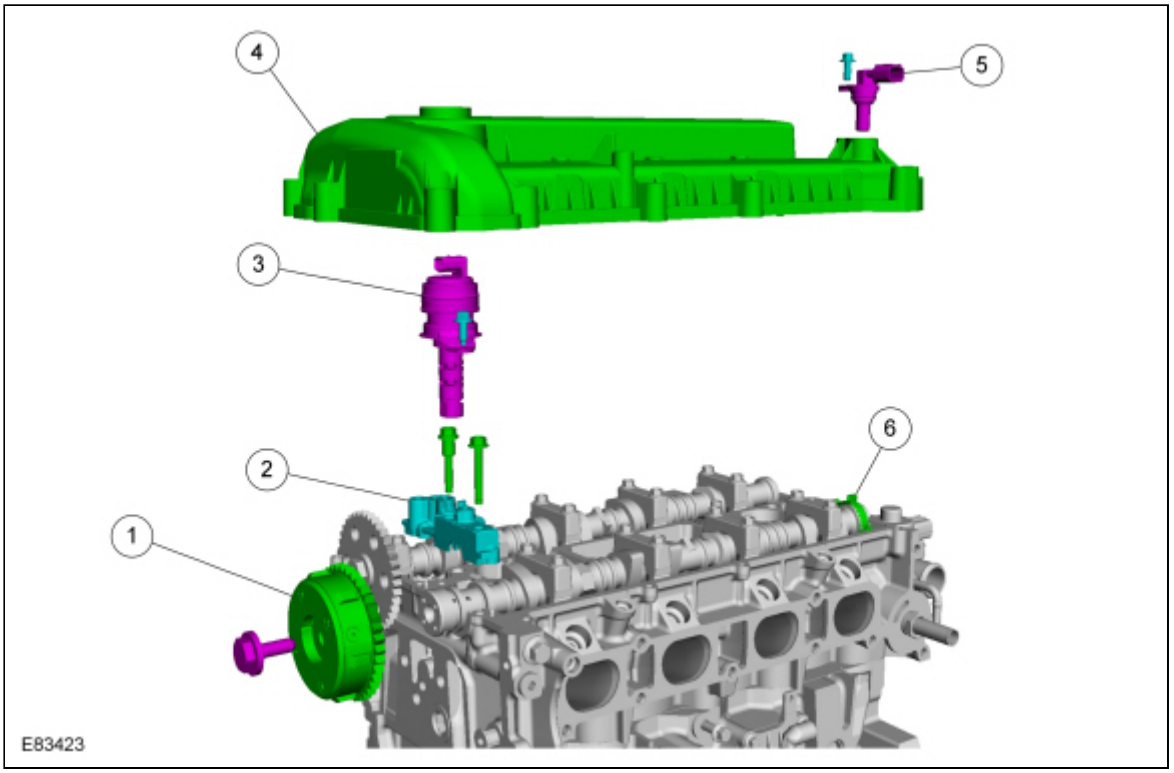


Item	Description
1	Valve cover
2	Cylinder head
3	Cylinder block
4	Oil pan



Item	Description
1	Engine code
2	Engine serial number

Variable camshaft timing (VCT)



Item	Description
1	Control unit - variable camshaft timing
2	Camshaft bearing cap
3	VCT oil control solenoid
4	Valve cover
5	Camshaft position sensor

6	Camshaft sensor ring

This system is an electronically controlled camshaft adjuster that allows variable timing for the inlet camshaft.

The valves are driven by a timing chain which drives the inlet camshaft timing control unit. This unit drives the associated camshafts. The timing chain is tensioned using a conventional timing chain tensioner.

The inlet camshaft is fitted with a sensor ring for the active camshaft position (CMP) sensor.

This CMP sensor is mounted inside the valve cover.

Timing chain replacement does not require the variable camshaft timing control unit to be disconnected.

To ensure trouble-free operation of the variable camshaft timing system and optimum engine performance, it is essential to adhere precisely to the valve timing adjustment procedure.

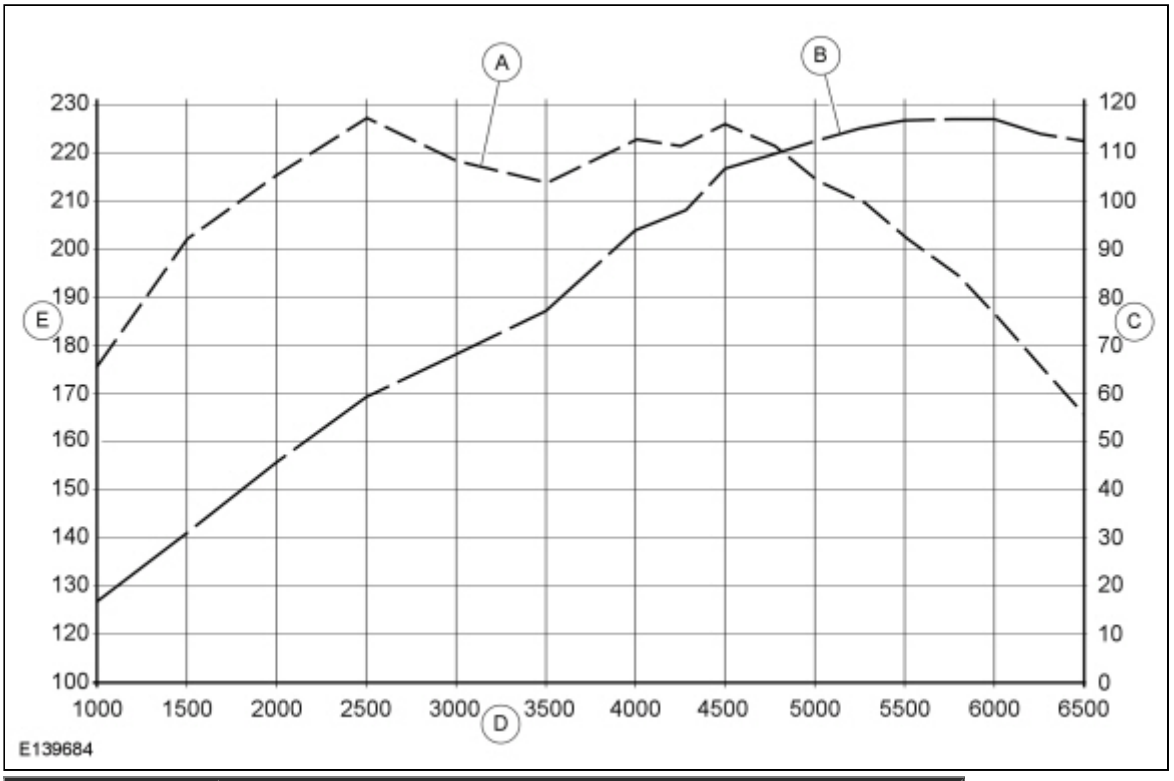
A special tool is needed to fix the camshafts in the adjustment position.

Remember that this special tool must not be used to keep the camshaft from rotating when mounting the camshaft sprocket. They may only be kept from rotating by using the hexagon, which has been specially provided for this purpose.

Advantages of variable camshaft timing (VCT).

- Lower fuel consumption due to improved volumetric efficiency
- Enhanced engine power and torque
- Improved idling characteristics

Power and torque curve



Item	Description
A	Torque curve
B	Power curve
C	SAE Power (kW)
D	Engine speed (rpm)
E	SAE torque (Nm)

Service note: (If applicable)

The valve clearance of the engine only needs to be monitored (every 60,000 km) if the engine is converted to operation using alternative fuel such as LPG, CNG or ethanol blends.

Conversion of the engine to operation with alternative fuel requires no modification to the engine as the valve seats are reinforced as standard. All that is required is an adaptation of the fuel system.

Valves and valve seats

The engines for petrol operation and LPG/CNG operation are basically identical. Because LPG/CNG is a dry fuel and combusts at a higher temperature, the valve train is under higher stress. The adaptations described below are therefore necessary.

Because of the higher stress involved in LPG/CNG operation:

- The inlet valves are made of a harder material.
- The inlet and exhaust valve seats are made of a harder material.
- The valve clearances must be checked and corrected if necessary.

Lubrication System

The engine lubrication system operates as follows:

- Oil is drawn into the oil pump through the oil pump screen cover and tube in the sump of the oil pan.
- Oil is pumped through the oil filter on the right front side of the cylinder block.
- Oil enters the main gallery where it is distributed to the crankshaft main journals and to the cylinder head.
- From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly.

Copyright © 2016 Ford Motor Company

Engine

Base Part Number: 6L084

1. For basic mechanical concerns.
   REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
   For driveability concerns. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Copyright © 2016 Ford Motor Company

Valve Clearance Adjustment

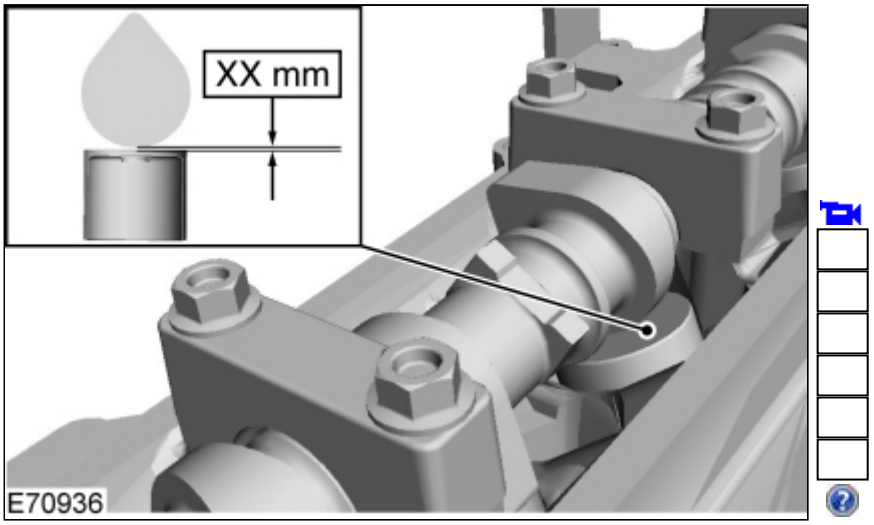
Materials

Name	Specification
Engine Oil - SAE 5W-30	WSS-M2C913-C

Check

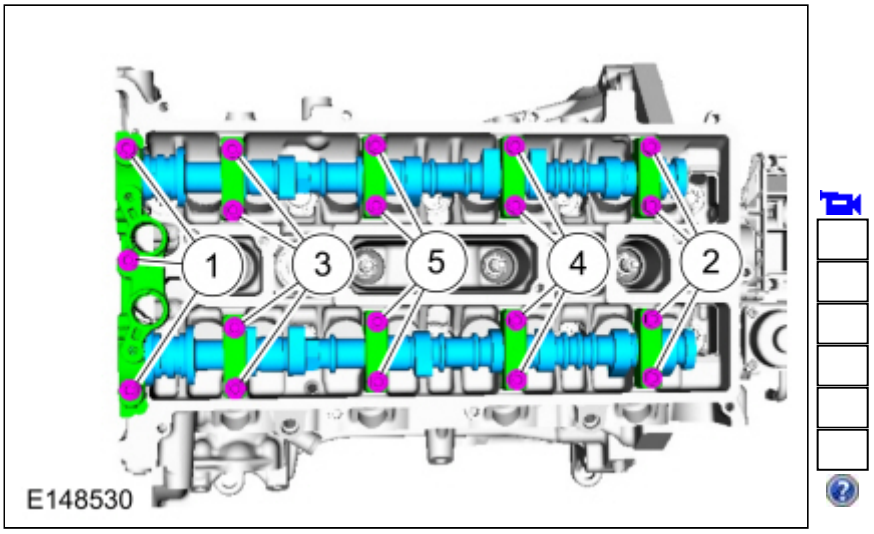
1. Refer to: Valve Cover (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. **NOTICE: Only rotate the crankshaft clockwise.**

   Rotate the crankshaft until the cam pair of the cylinder to be adjusted are pointing upwards. Using a suitable feeler gauge, measure the valave clearance.
3. Make a note of each cylinder number with the corresponding valve clearance.
4. Compare the measured valve clearance(s) with the specifications.
   Refer to: Specifications (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).



Adjustment

1. **NOTE:** *Only carry out the following steps when the valve clearance(s) require adjustment.*
2. Refer to: Timing Chain (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. **NOTICE: Note the position of each component before removal.**



- Remove the valve tappet and read the thickness from the underside.
- The number on the valve tappet indicates the thickness of the bottom of the tappet. However, the number only indicates the digits after the decimal point (example: .650 = 3,650).

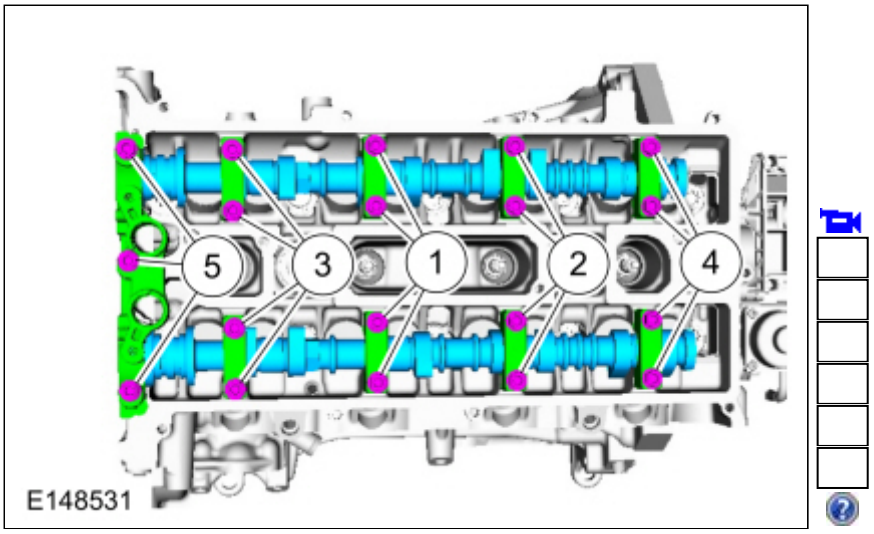
- Calculate the required thickness of the valve tappet with the following formula: **X = S + M - V**
- Required thickness of tappet = **X**
- Thickness of currently fitted tappet = **S**
- Measurement of existing valve clearance (actual value) = **M**
- Desired valve clearance = **V**

6. Install the correct valve tappet.

7. **NOTICE: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.**

   Coat the camshaft bearing caps with oil.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)

8. Install the camshafts approximately at valve overlap position cylinder No. 4.
   Torque:
   Stage 1: 7 Nm
   Stage 2: 16 Nm

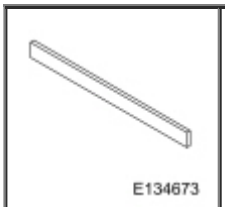
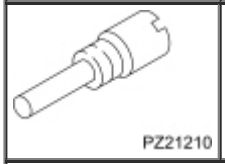


9. Refer to: Timing Chain (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Copyright © 2016 Ford Motor Company

Camshafts

Special Tool(s) / General Equipment

 E134673	303-465 Tool, Camshaft Align Timing
 PZ21210	303-507 Timing Peg, Crankshaft TDC
2 mm Punch	

Materials

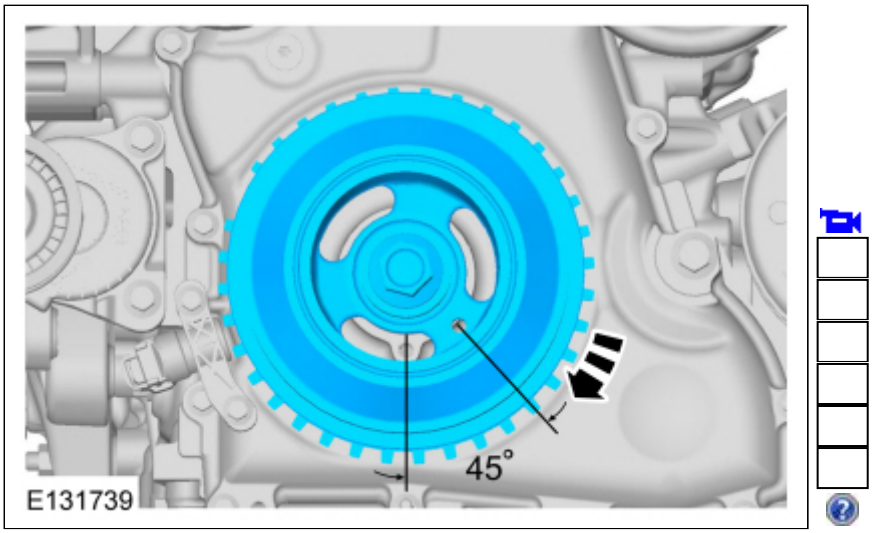
Name	Specification
Gear/Transmission Fluid - SAE 85W-90	SQ-M2C9002-AA
Thread Locking Adhesive	WSK-M2G349-A7

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

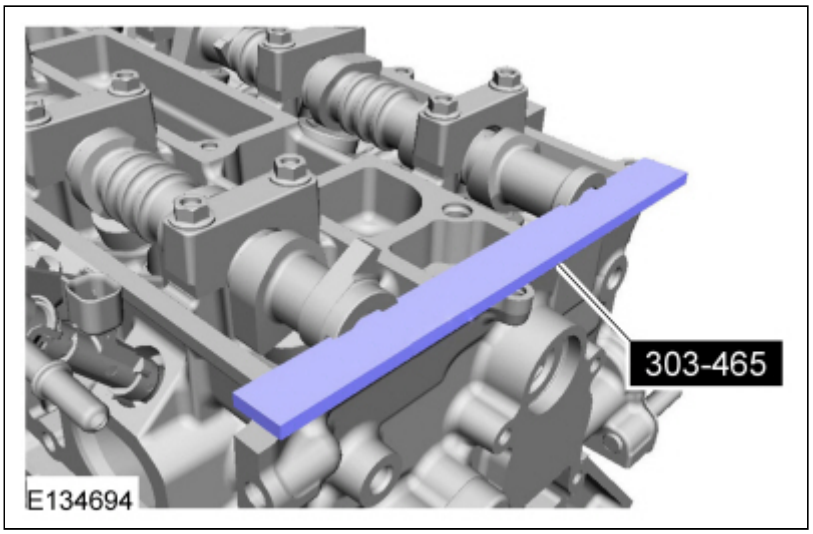
1. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. Refer to: Valve Cover (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. **NOTICE: Only rotate the crankshaft clockwise.**

   Turn the crankshaft until no. 1 piston is at about 45° before TDC.

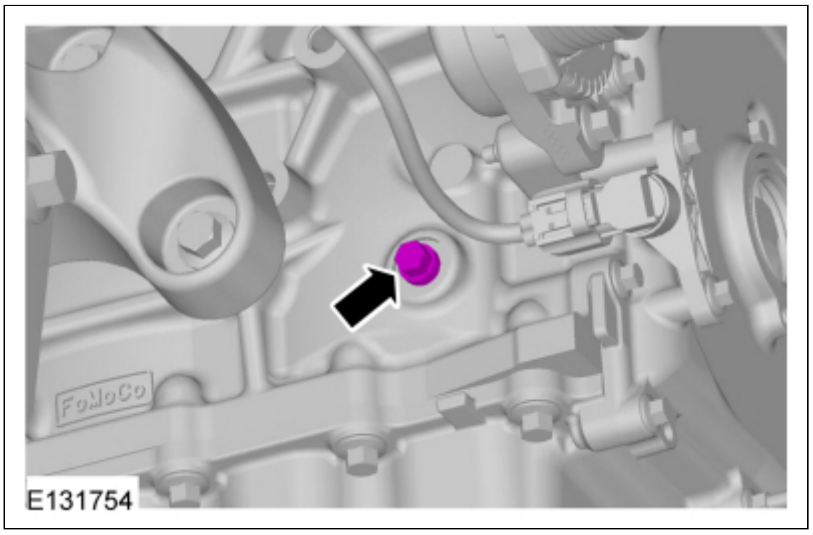


4. **NOTE:** *The camshaft timing slots are offset. If the camshaft alignment plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.*

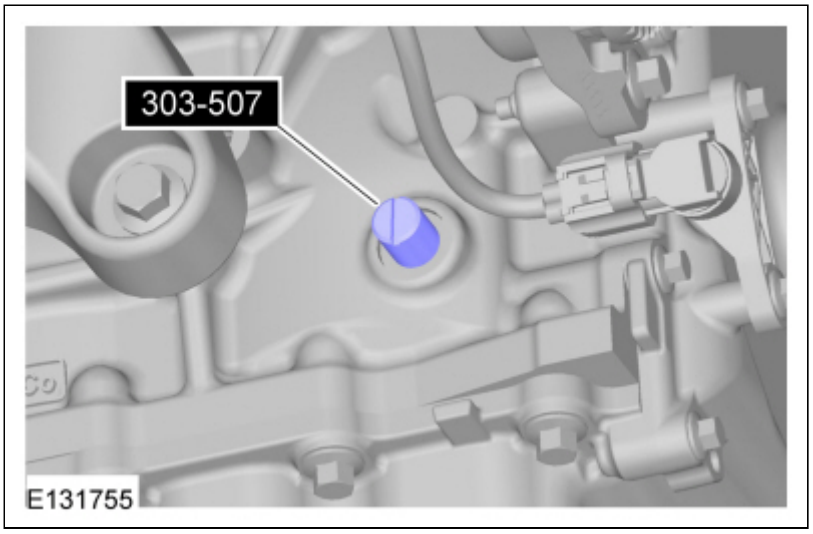
   Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.



5.

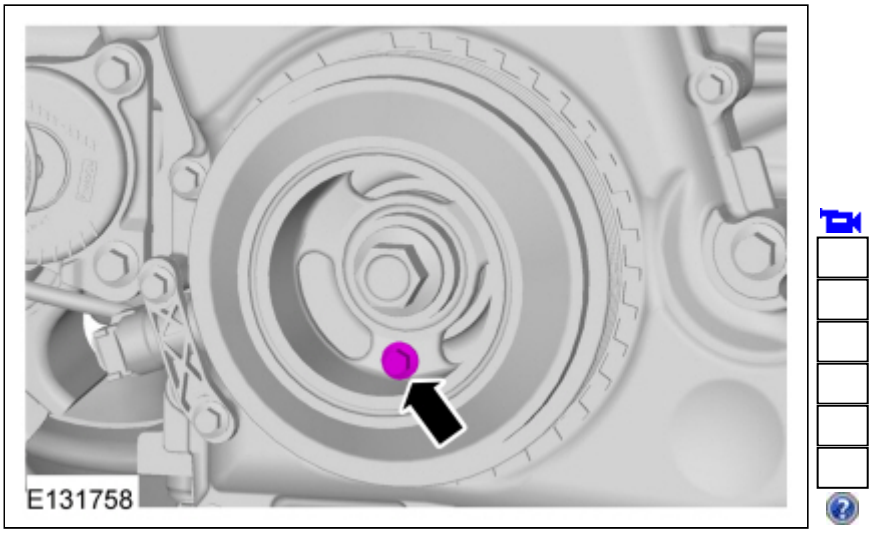


6. Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.

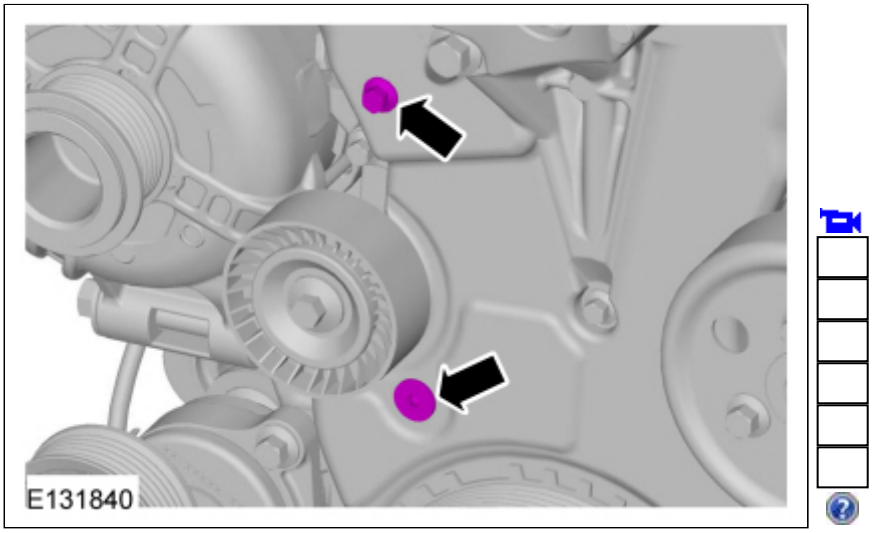


7. **NOTE:** *Only tighten the bolt finger tight at this stage.*

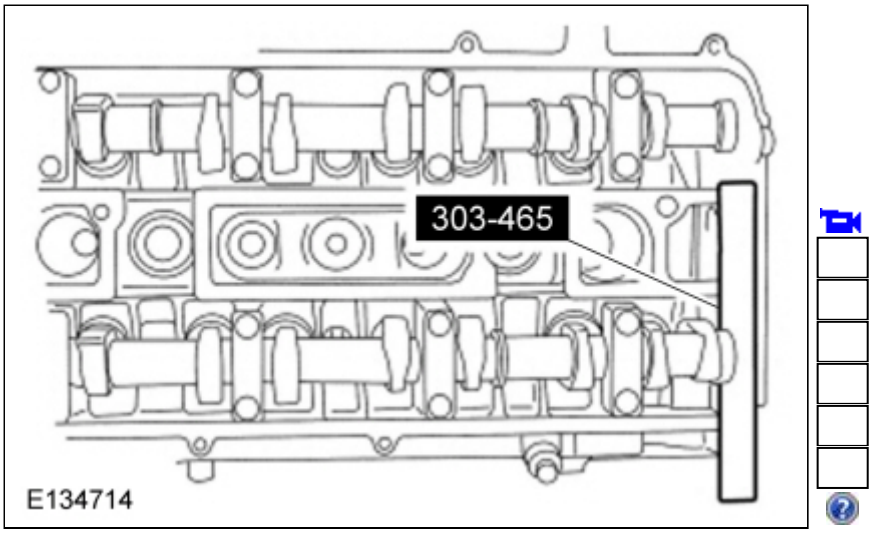
- Bolt M6 x 18 mm



8.

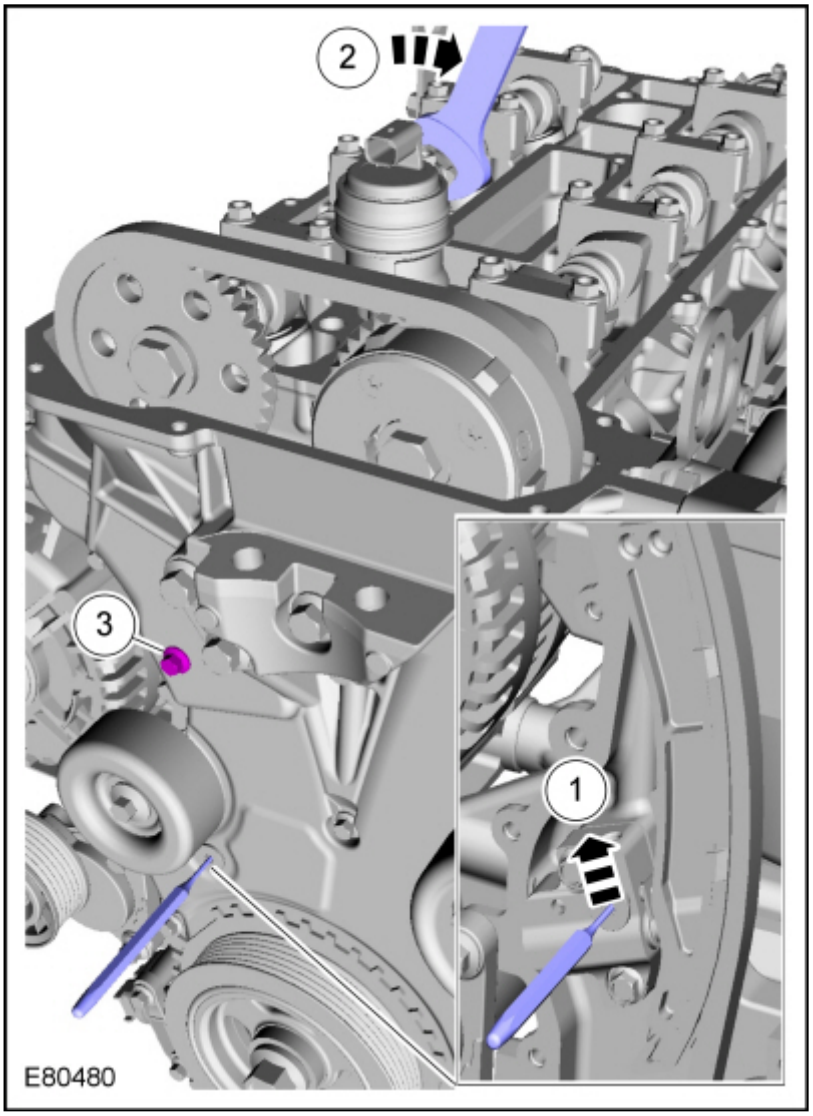


9. Reposition the camshaft alignment plate to the slot on the rear of the intake camshaft only.
   Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.

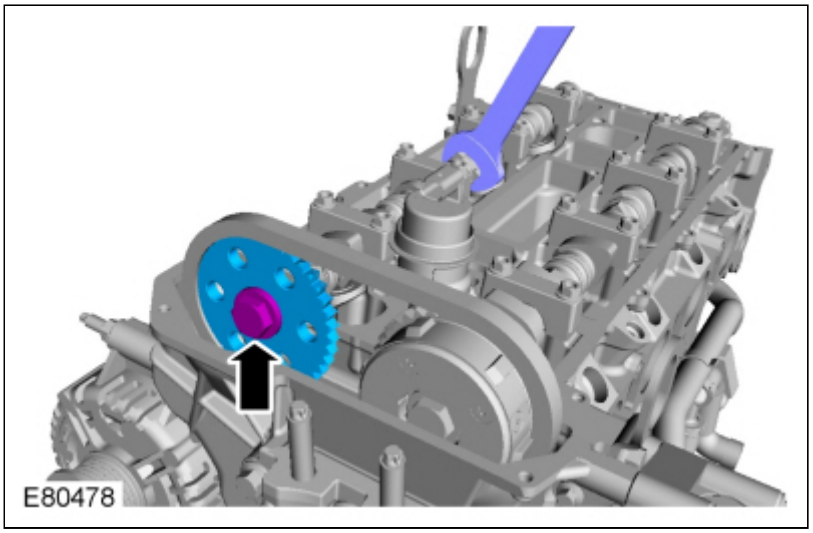


10. **NOTE:** *To hold the tensioner arm in a retracted position and allow enough slack in the timing chain for removal of the exhaust camshaft gear,, install an M6 x 25 mm bolt into the upper front cover timing hole.*

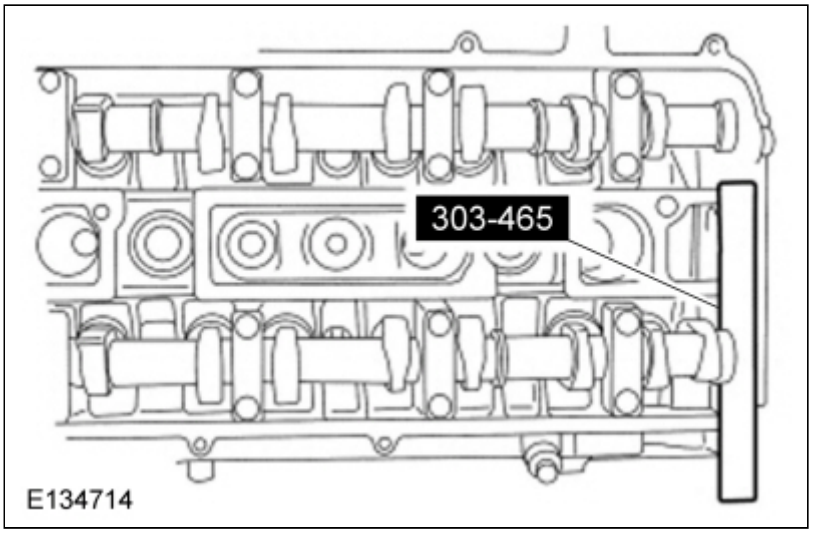
    1. Use the General Equipment: 2 mm Punch
    3. Bolt M6 x 25 mm



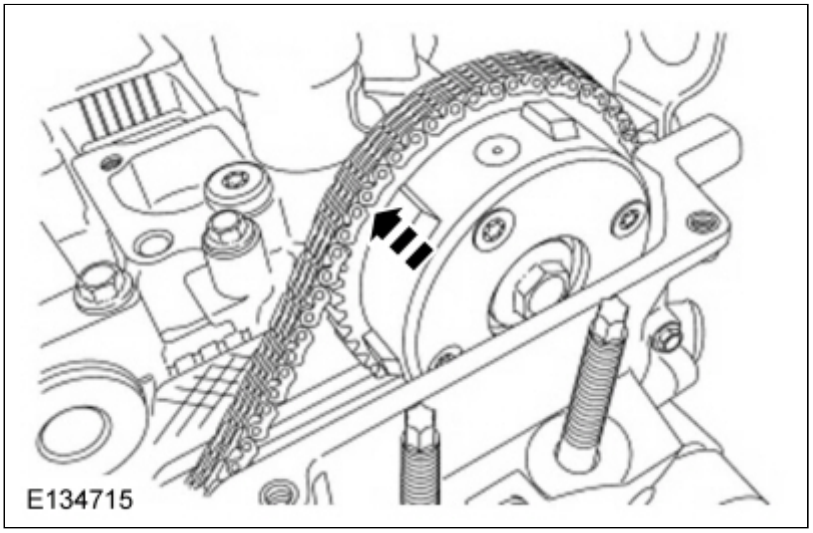
11. **NOTICE: Use an open-ended wrench to prevent the component from turning..**



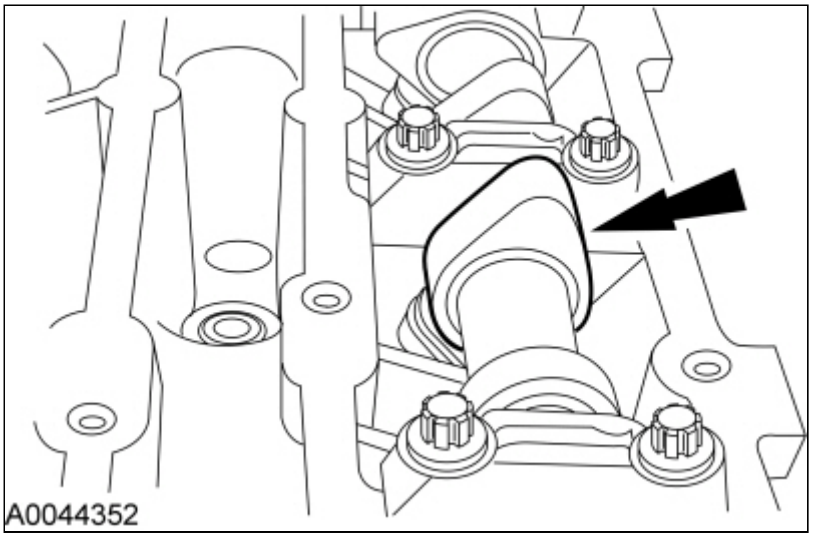
12. Remove Special Service Tool: 303-465 Tool, Camshaft Align Timing.



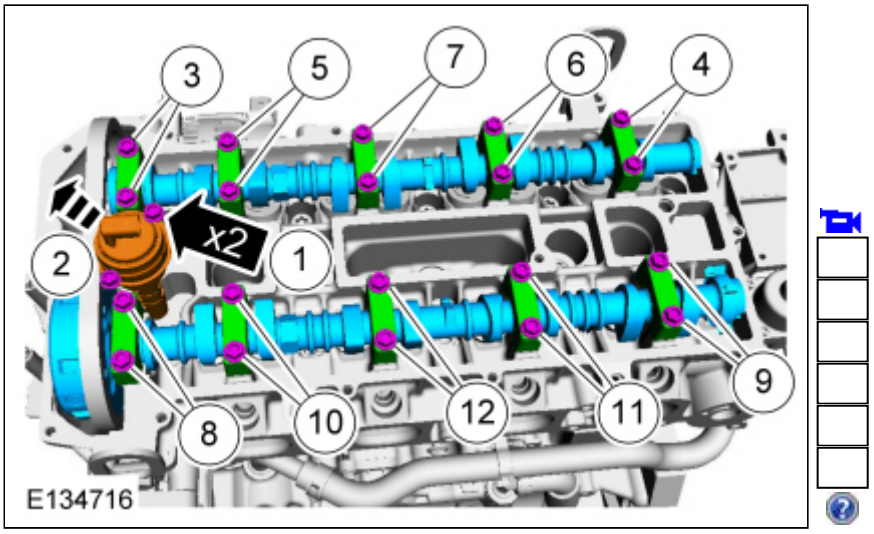
13. Remove the timing chain from the intake camshaft drive gear.



14. Mark the position of the camshaft lobes on the No. 1 cylinder for installation reference.



15. **NOTE:** *Note the position of the components before removal.*

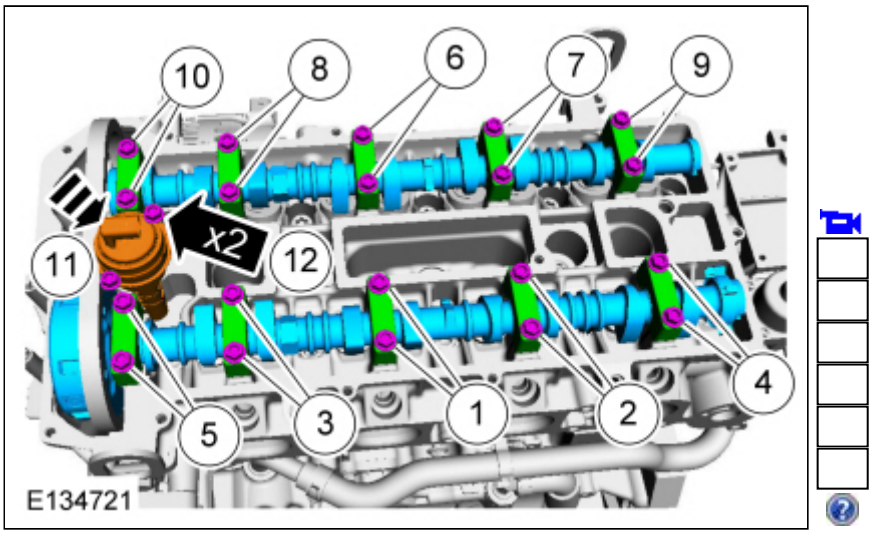


Installation

1. **NOTE:** *Make sure that the components are installed to the position noted before removal.*

   NOTE: *Lubricate the components with clean engine oil..*

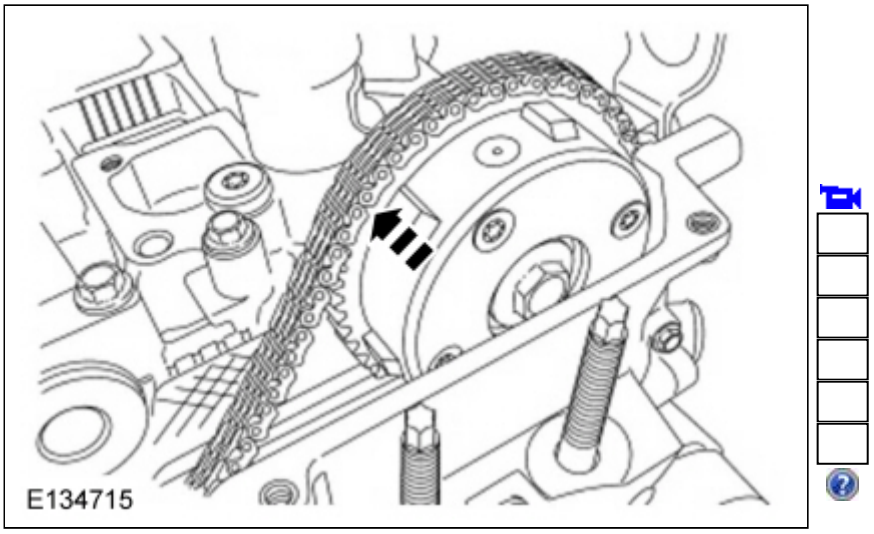
   Coat the camshaft bearing caps with oil and install the camshafts approximately at valve overlap position cylinder No. 4.
   Material: Gear/Transmission Fluid - SAE 85W-90 (SQ-M2C9002-AA)
   Torque:
   Stage 1: 7 Nm
   Stage 2: 16 Nm



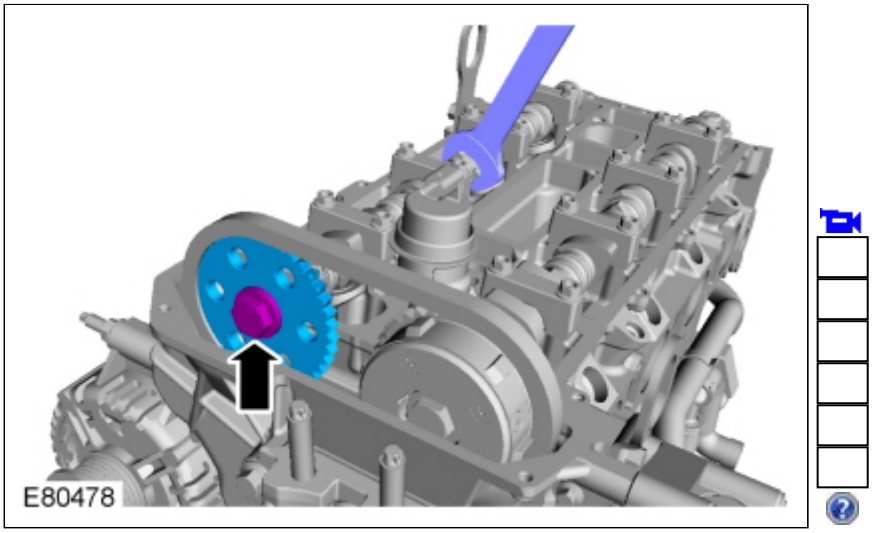
2. **NOTE:** *This step is only necessary when installing a new component.*

   Refer to: Valve Clearance Adjustment (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

3. Install the timing chain on the intake camshaft drive gear.

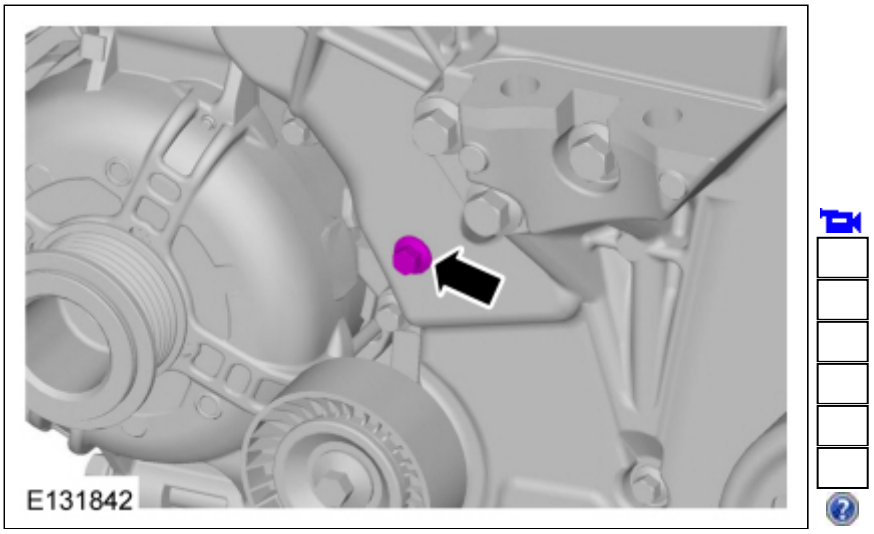


4. **NOTE:** *Only tighten the bolt finger tight at this stage.*



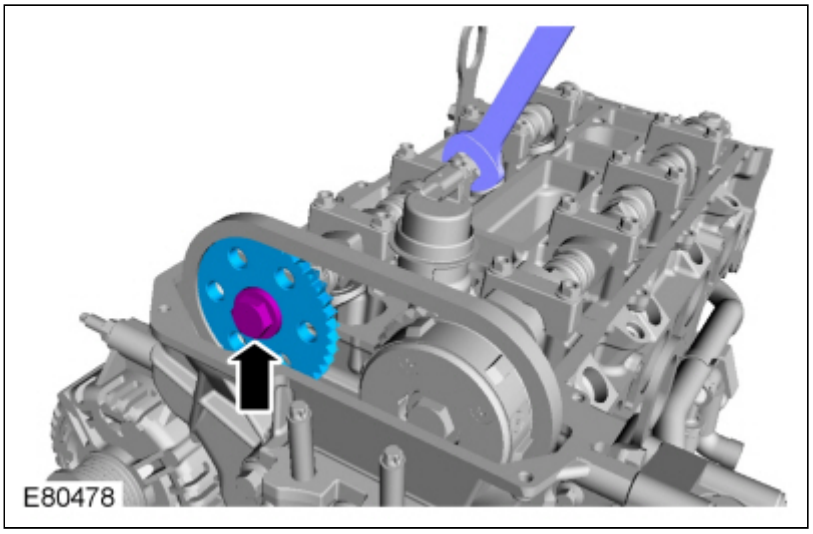
5. **NOTE:** *Releasing the tensioner arm will remove the slack from the timing chain..*

   Remove the bolt M6 x 30mm.

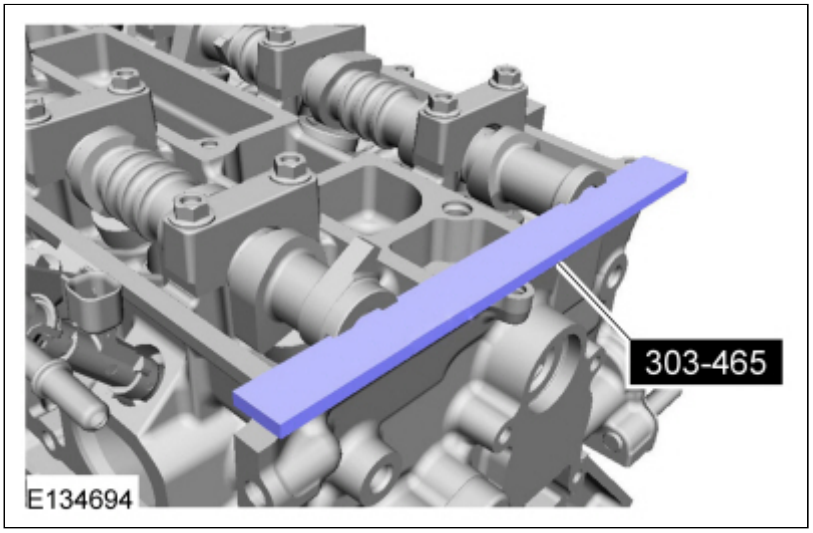


6. **NOTICE: Use an open-ended wrench to prevent the component from turning.**

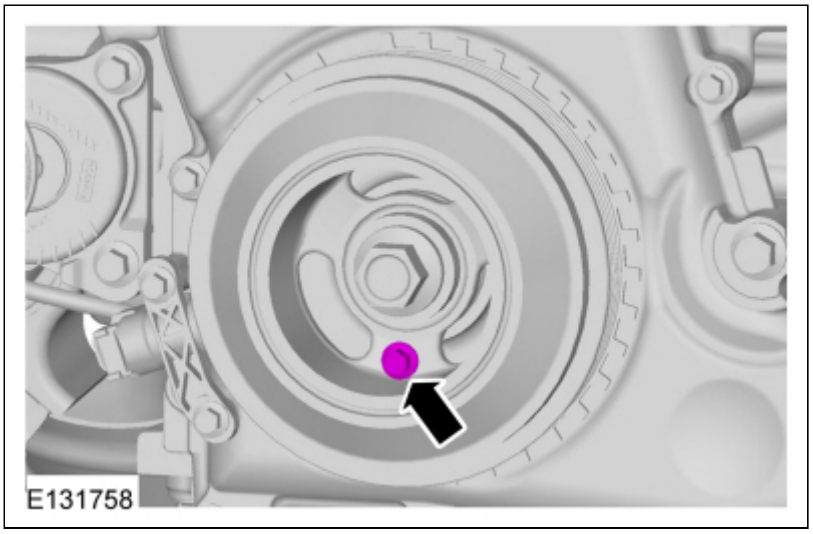
   Torque: 72 Nm



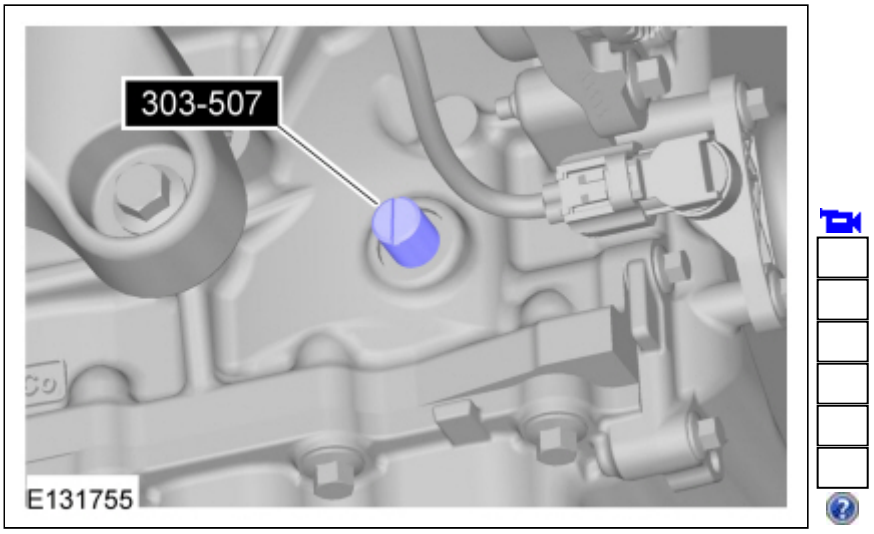
7. Remove Special Service Tool: 303-465 Tool, Camshaft Align Timing.



8. Remove the bolt M6 x 18 mm.

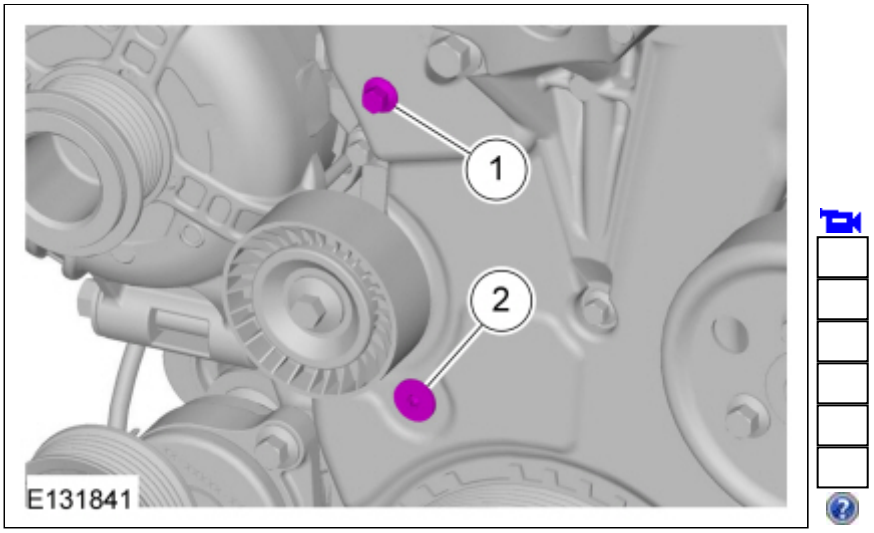


9. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.

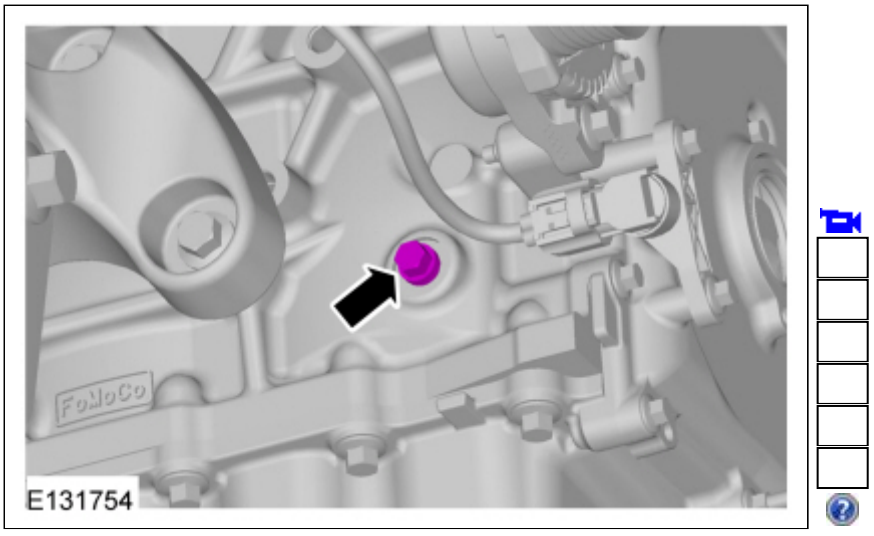


- *Material*: Thread Locking Adhesive (WSK-M2G349-A7)

1. *Torque*: 10 Nm
2. *Torque*: 12 Nm



11. *Torque*: 20 Nm



12. Refer to: Valve Cover (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
13. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Copyright © 2016 Ford Motor Company

Crankshaft Front Seal

Base Part Number: 6700

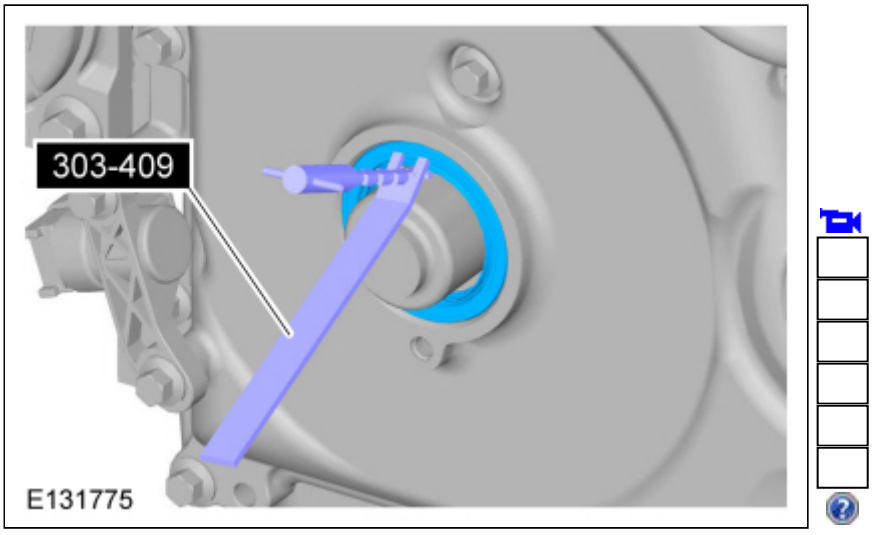
Special Tool(s) / General Equipment

 21148	303-318 Aligner/Installer, Crankshaft Front Seal
 E134603	303-409 (T92C-6700-CH) Remover, Crankshaft Seal

Removal

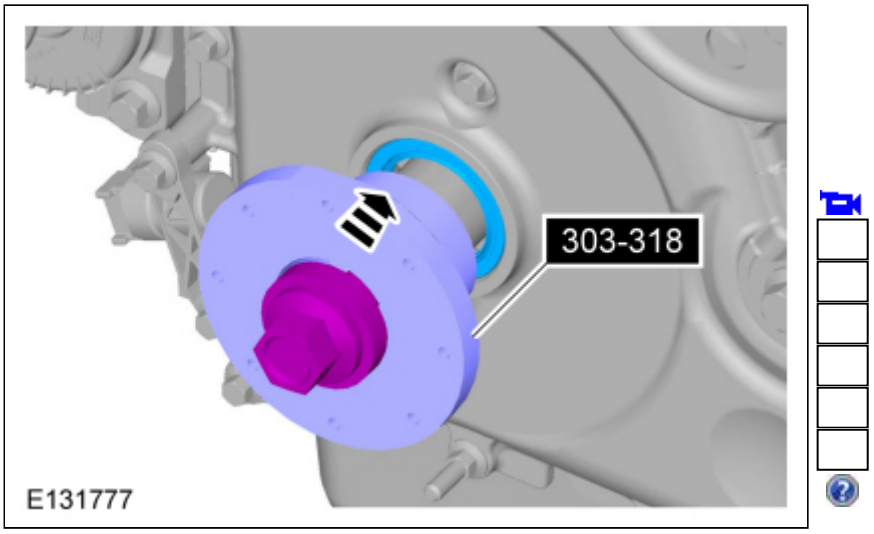
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Crankshaft Pulley (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. Use Special Service Tool: 303-409 (T92C-6700-CH) Remover, Crankshaft Seal.

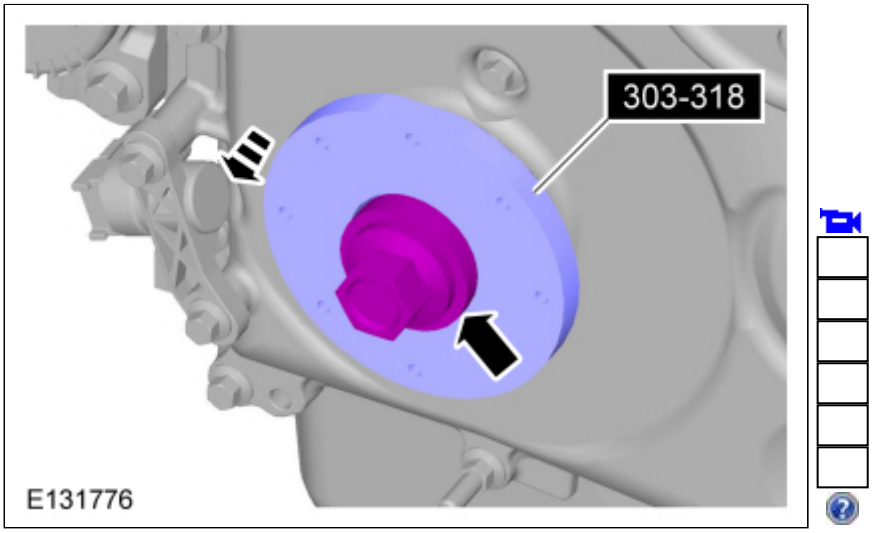


Installation

1. Use Special Service Tool: 303-318 Aligner/Installer, Crankshaft Front Seal.



2. Remove Special Service Tool: 303-318 Aligner/Installer, Crankshaft Front Seal.

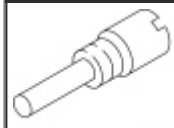


3. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Crankshaft Pulley

Special Tool(s) / General Equipment

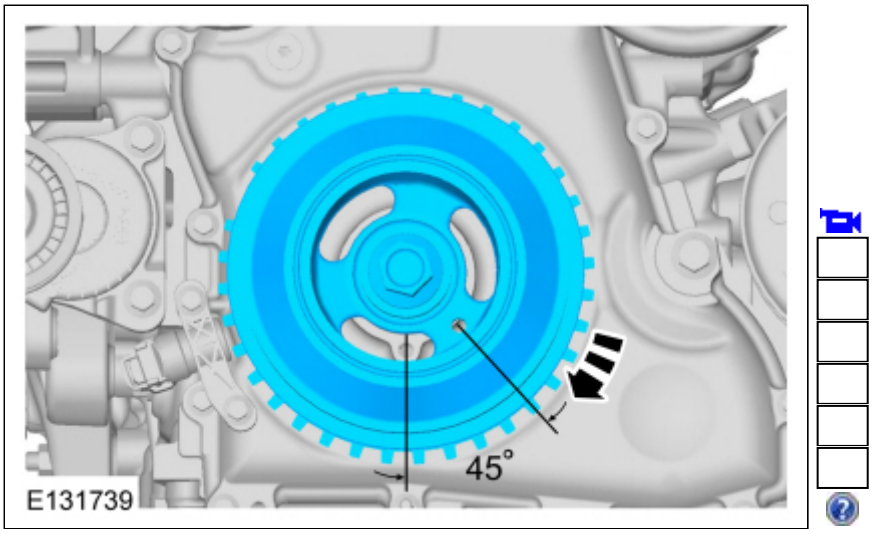
 E134674	303-1416 Tool, Crank Damper Holding
 E134673	303-465 Tool, Camshaft Align Timing
 PZ21210	303-507 Timing Peg, Crankshaft TDC

Removal

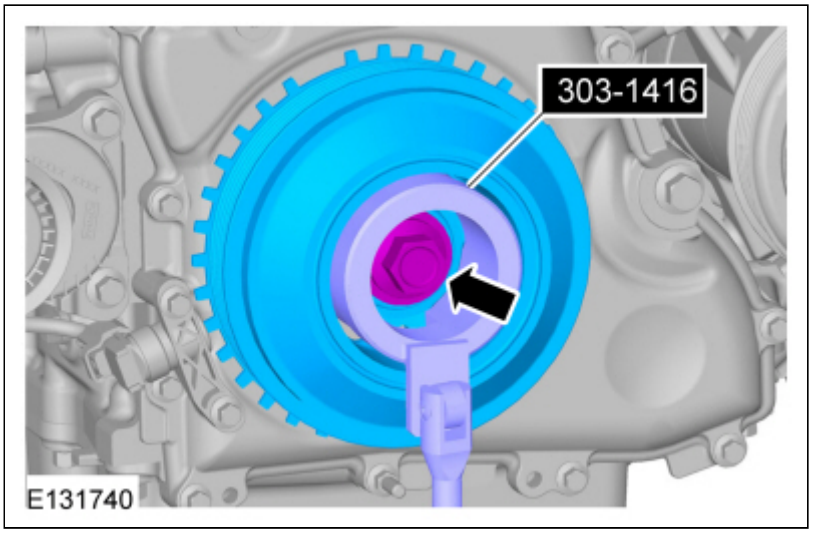
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. Refer to: Valve Cover (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. **NOTICE: Only rotate the crankshaft clockwise.**

   Turn the crankshaft until no. 1 piston is at about 45° before TDC.



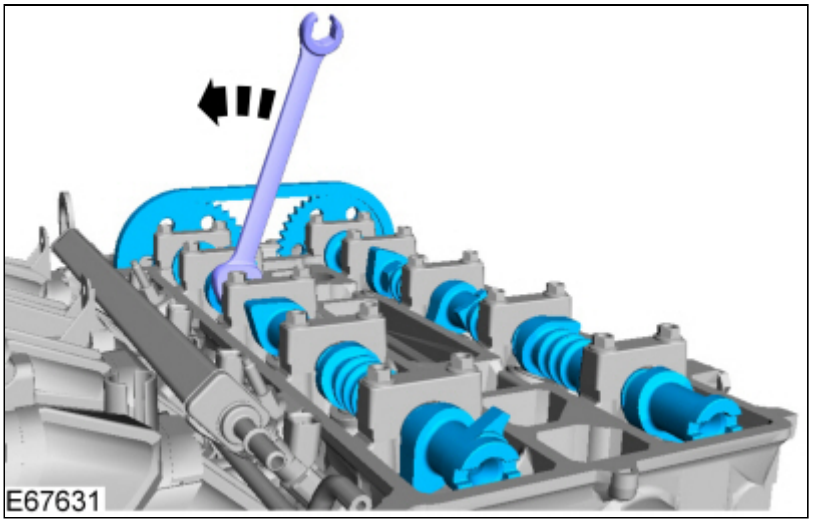
4. Use Special Service Tool: 303-1416 Tool, Crank Damper Holding.



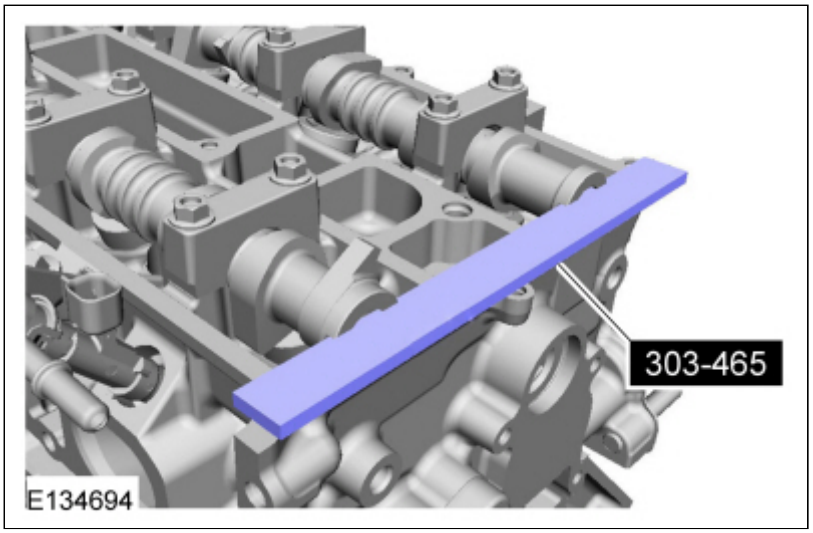
Installation

1. **NOTICE: Only rotate the crankshaft clockwise.**

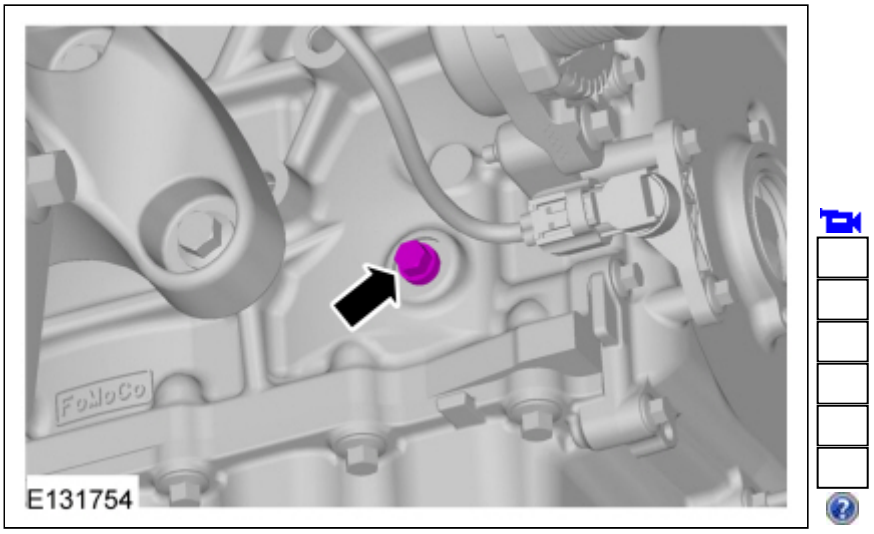
   Turn the camshafts to cylinder no. 4 valve overlap position.



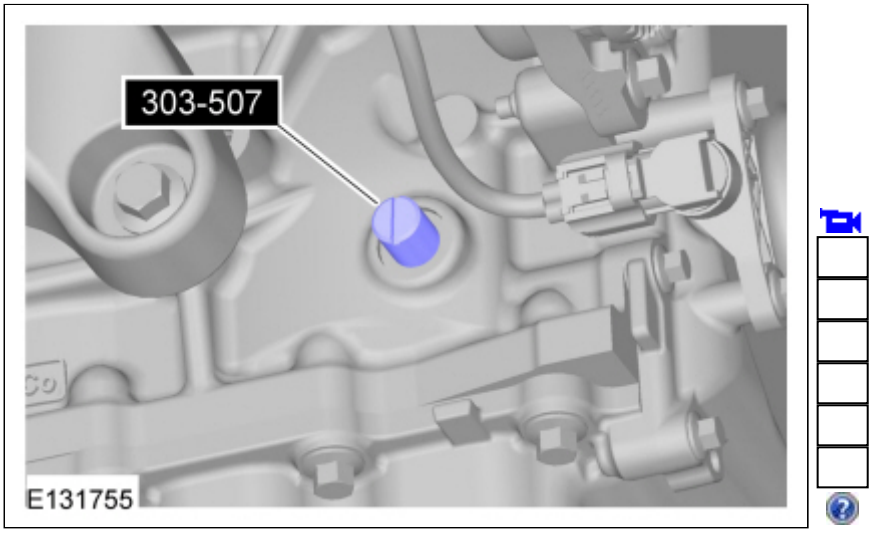
2. Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.



3.

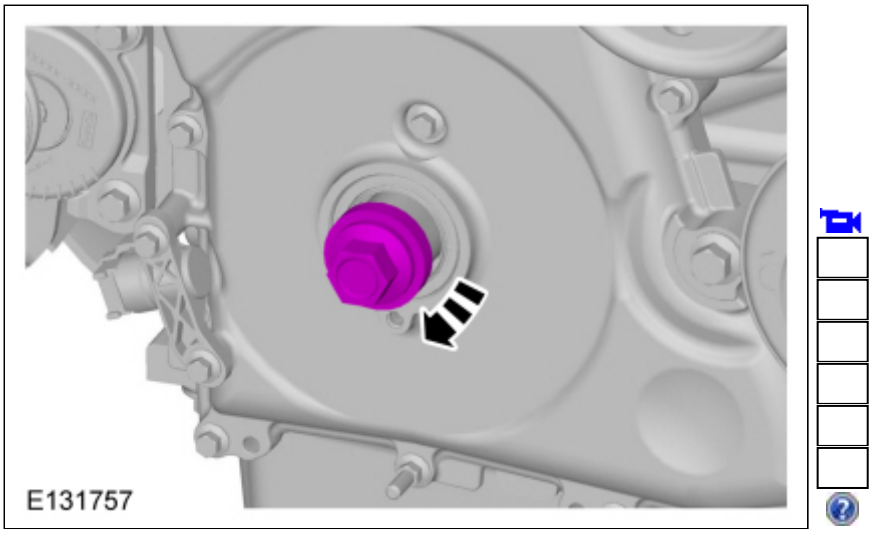


4. Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.

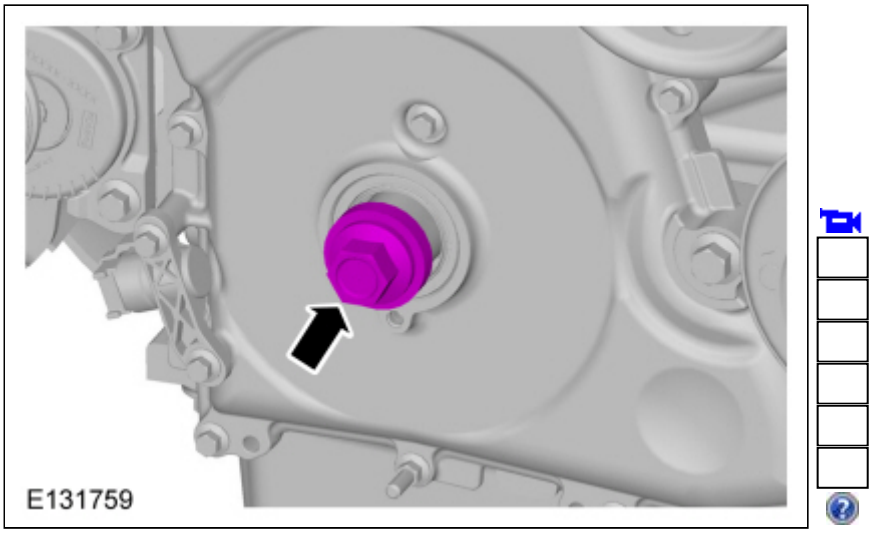


5. **NOTICE: Only rotate the crankshaft clockwise.**

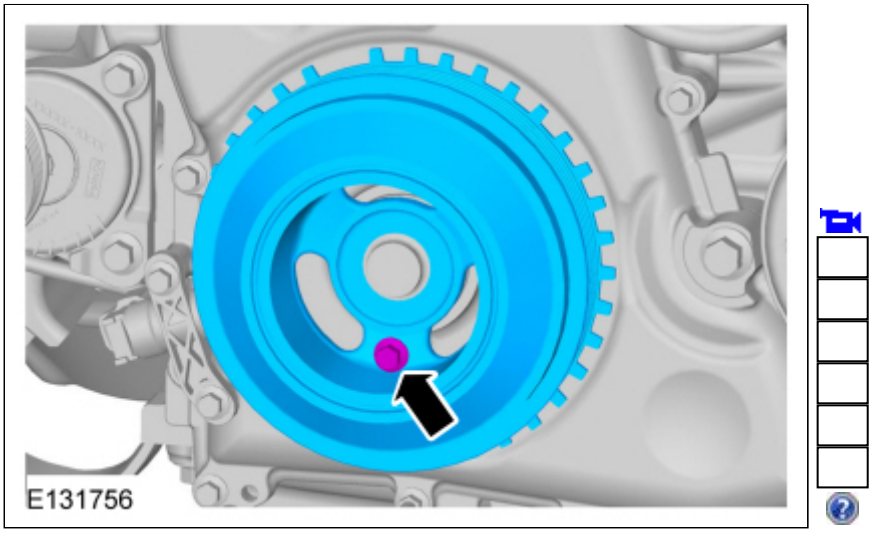
   Turn the crankshaft until it stops against the special tool.



6.

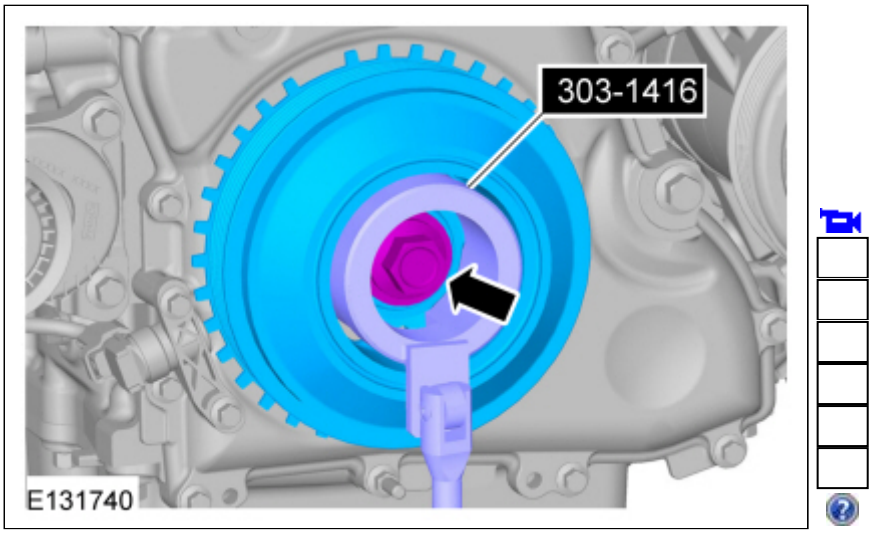


7. **NOTE:** *Only tighten the bolt finger tight at this stage.*
   - M6 x 18 mm.

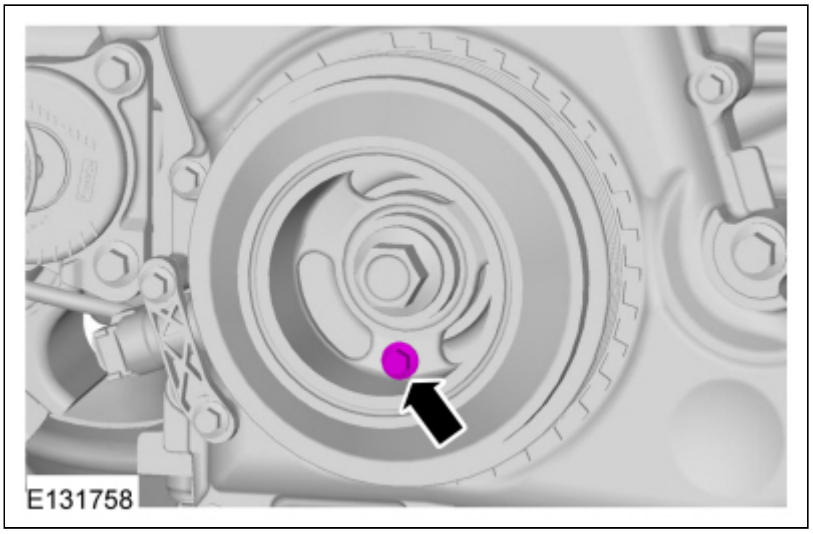


8. **NOTICE: Make sure that a new bolt is installed.**

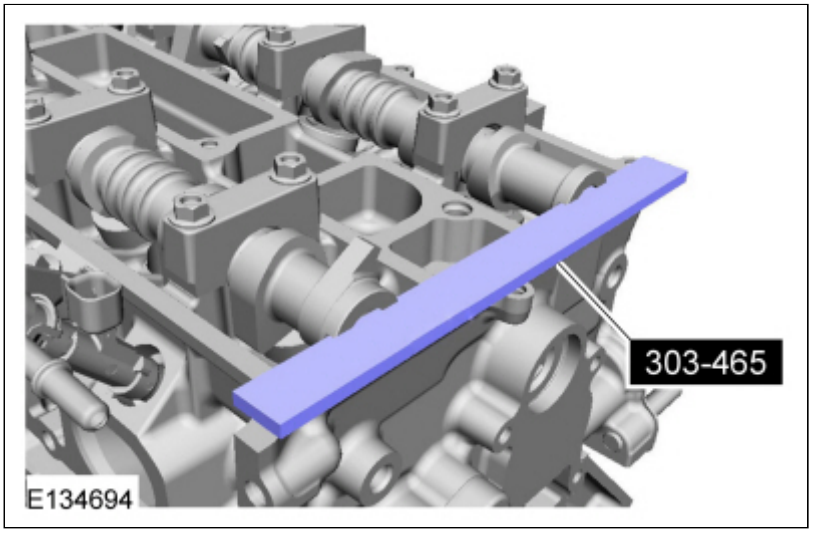
   Use Special Service Tool: 303-1416 Tool, Crank Damper Holding.
   Torque:
   Stage 1: 100 Nm
   Stage 2: 90°



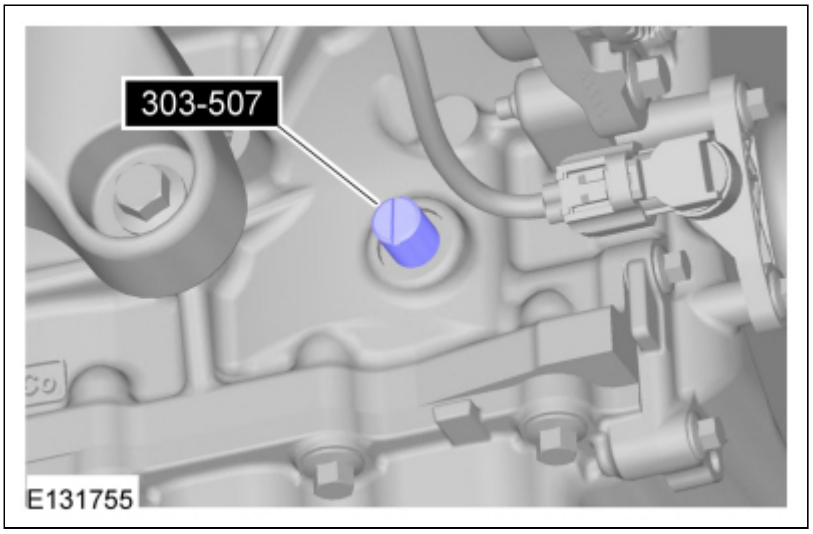
9.



10. Remove Special Service Tool: 303-465 Tool, Camshaft Align Timing.

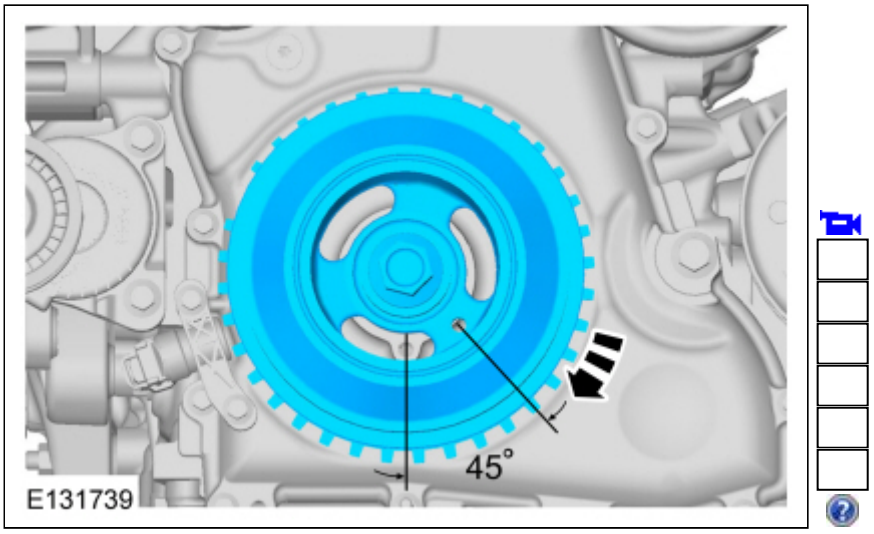


11. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.

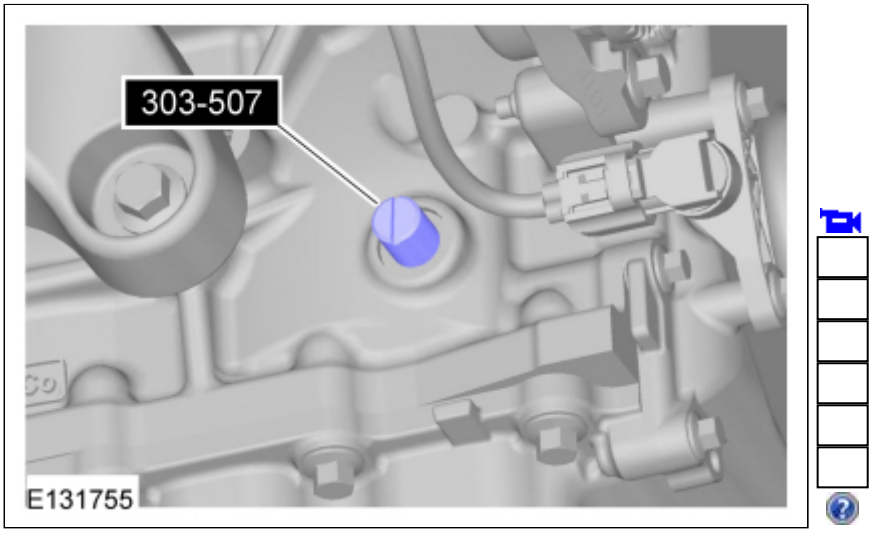


12. **NOTICE: Only rotate the crankshaft clockwise.**

    Turn the crankshaft one and three quarters of a turn until no. 1 piston is at about 45° before TDC.

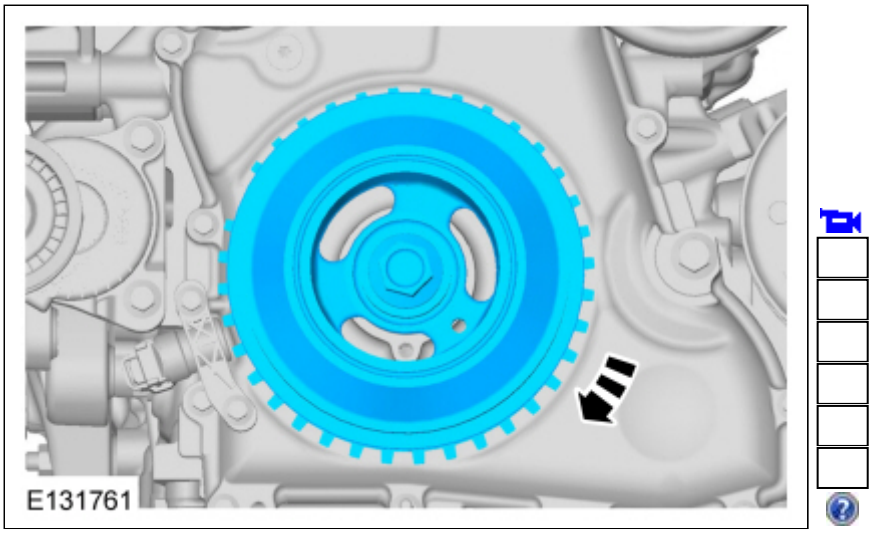


13. Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



14. **NOTICE: Only rotate the crankshaft clockwise.**

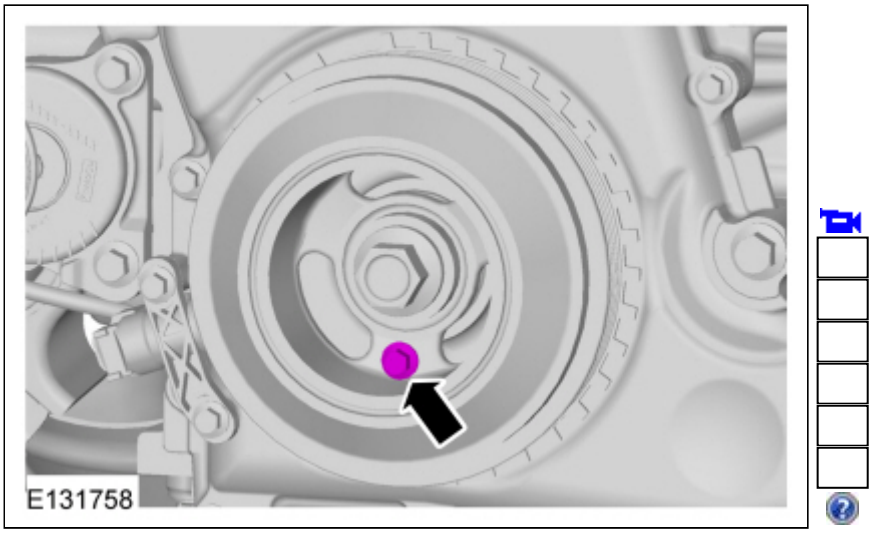
    Turn the crankshaft until it stops against the special tool.



15. **NOTE:** *Only tighten the bolt finger tight at this stage.*

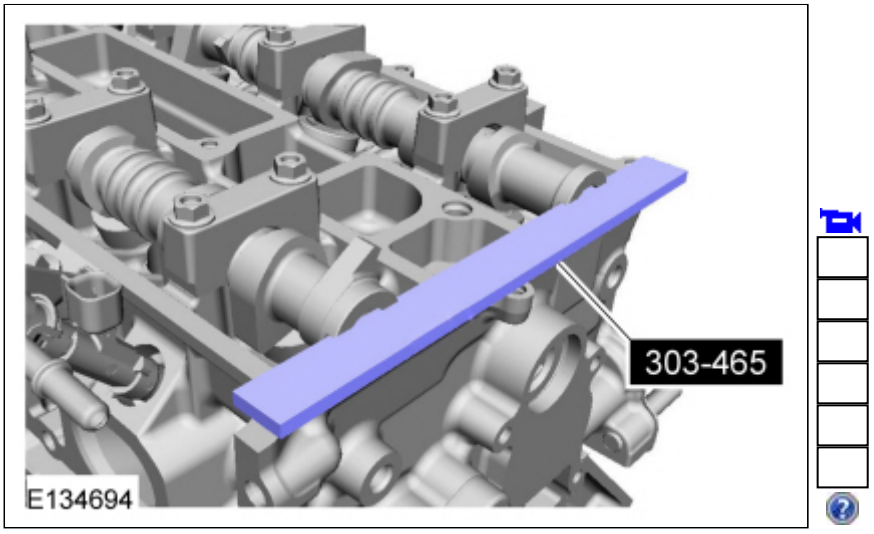
    NOTE: *The bolt can only be installed if the valve timing is correct.*

    - M6 x 18 mm.

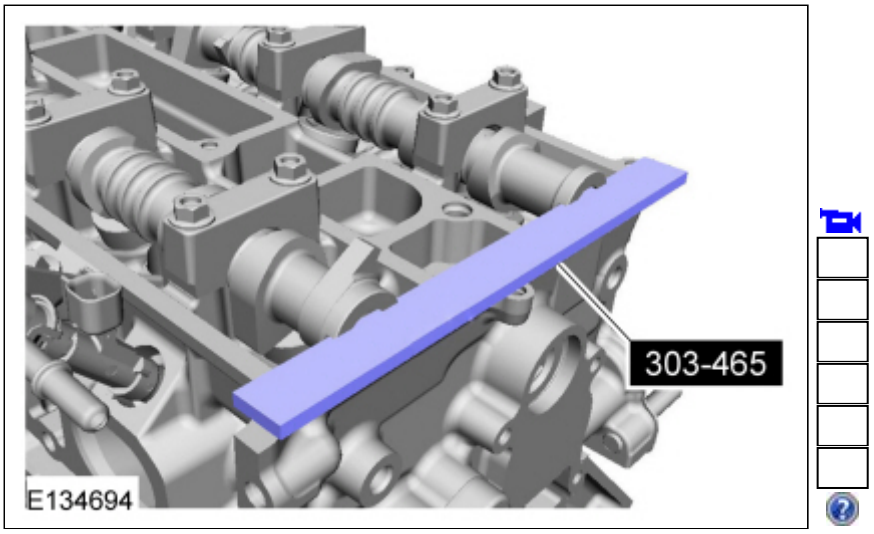


16. **NOTE:** *The special tool can only be installed if the valve timing is correct.*

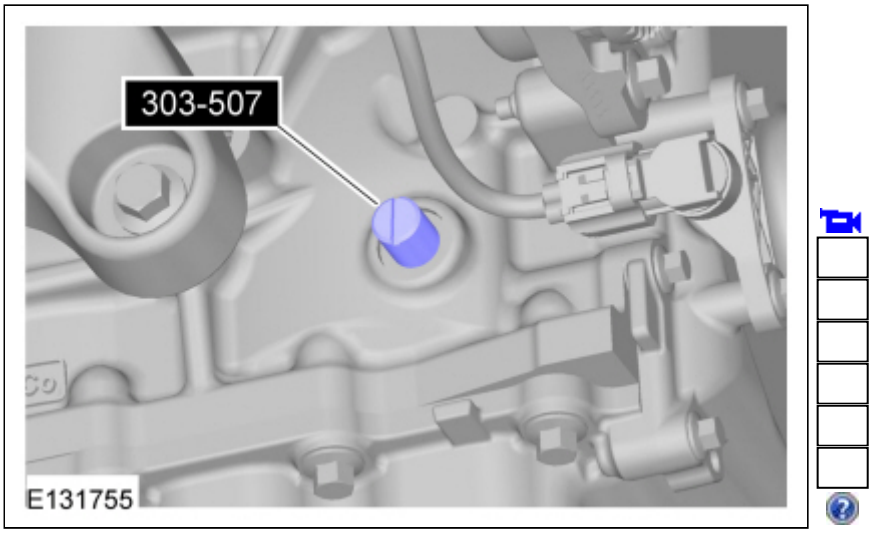
    Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.



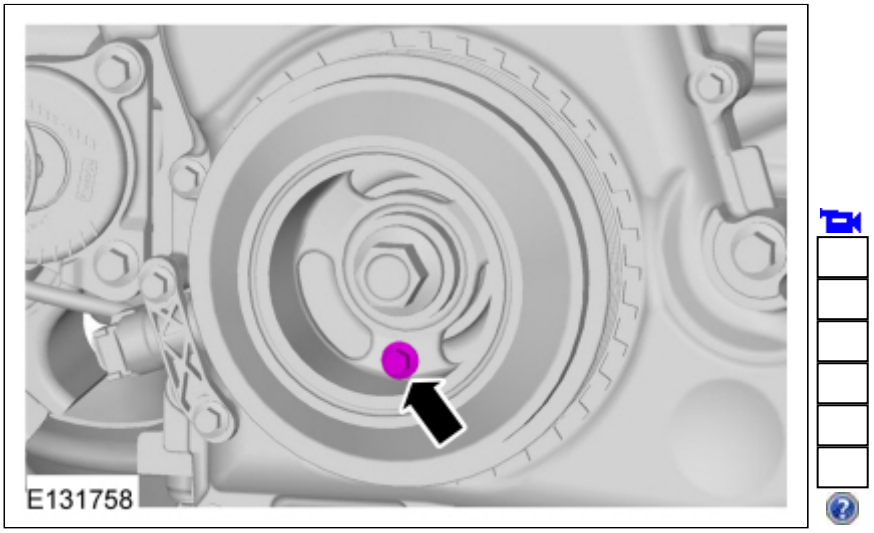
17. Remove Special Service Tool: 303-465 Tool, Camshaft Align Timing.



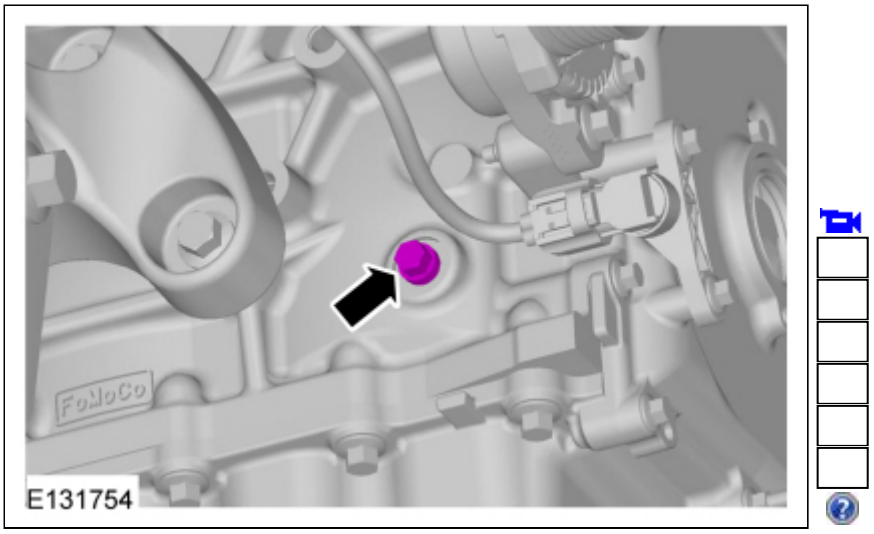
18. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



19. M6 x 18 mm.



20. *Torque*: 20 Nm



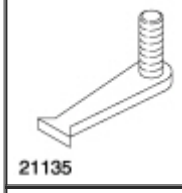
21. To install reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Crankshaft Rear Seal

Base Part Number: 6701

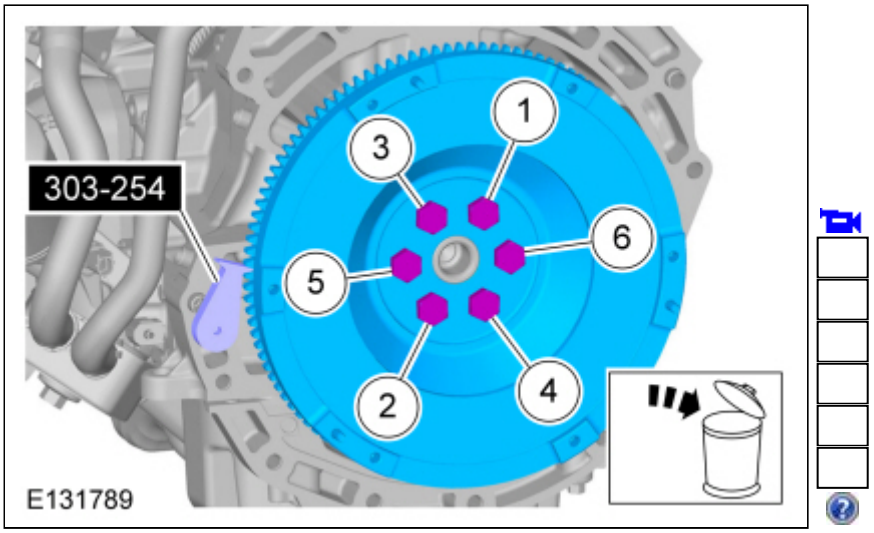
Special Tool(s) / General Equipment

 21135	303-254 Locking Tool, Flywheel
 E134675	303-328 (T88P-6701-B1) Replacer, Rear Seal

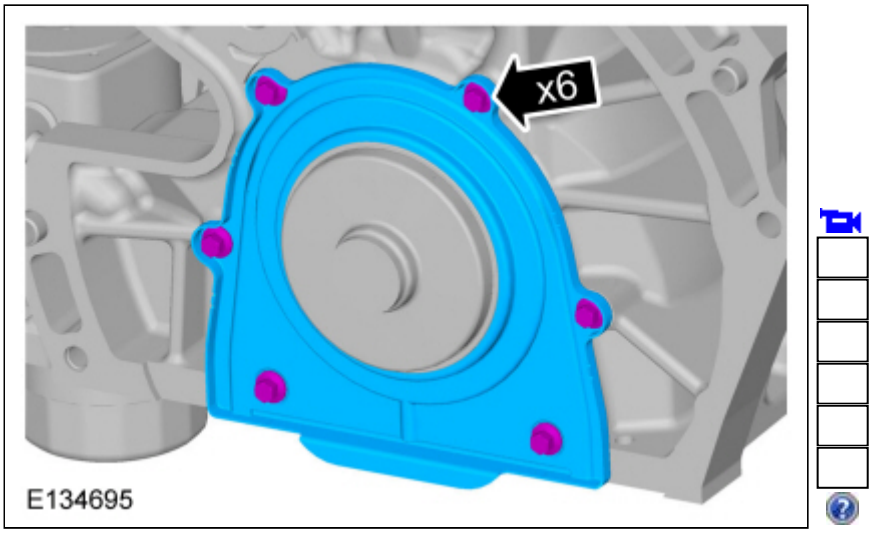
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
2. Use Special Service Tool: 303-254 Locking Tool, Flywheel.
   Torque:
   Stage 1: 50 Nm
   Stage 2: 80 Nm
   Stage 3: 112 Nm



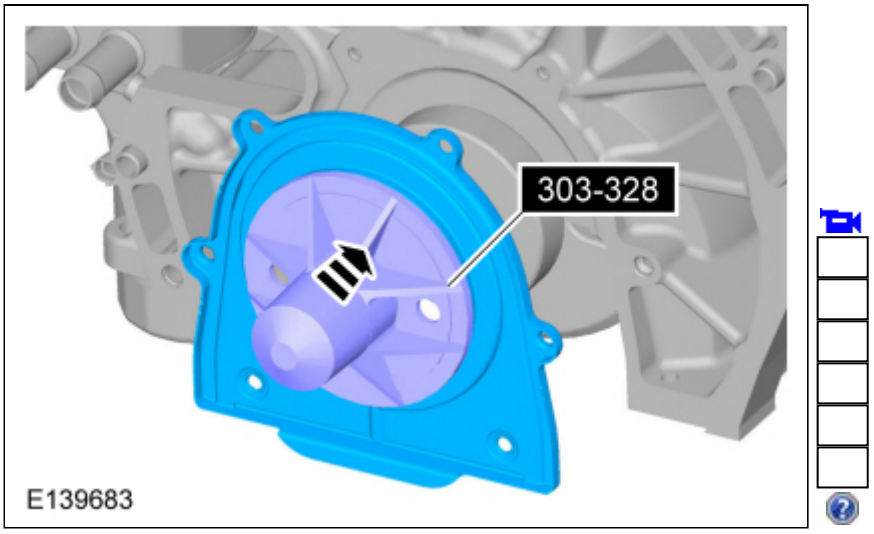
3. Refer to: Oil Pan (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
4.



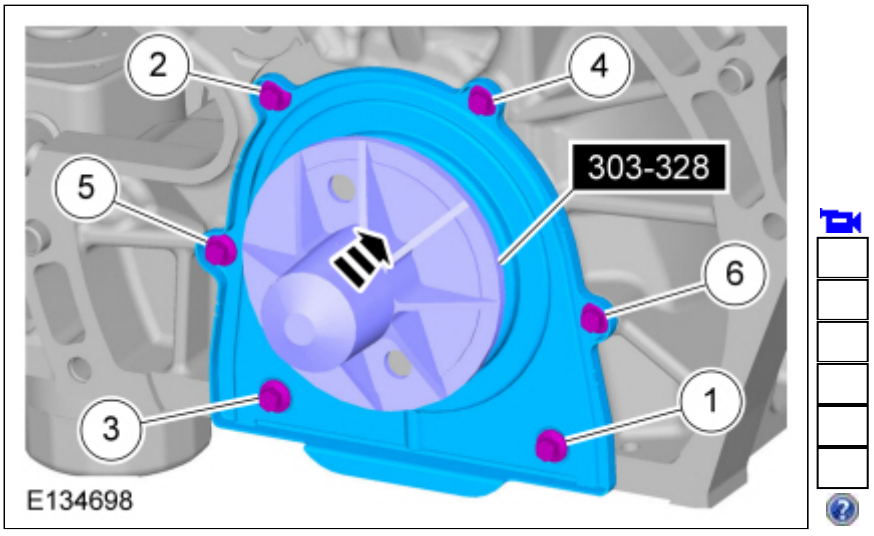
Installation

1. **NOTE:** *Make sure that a new component is installed.*

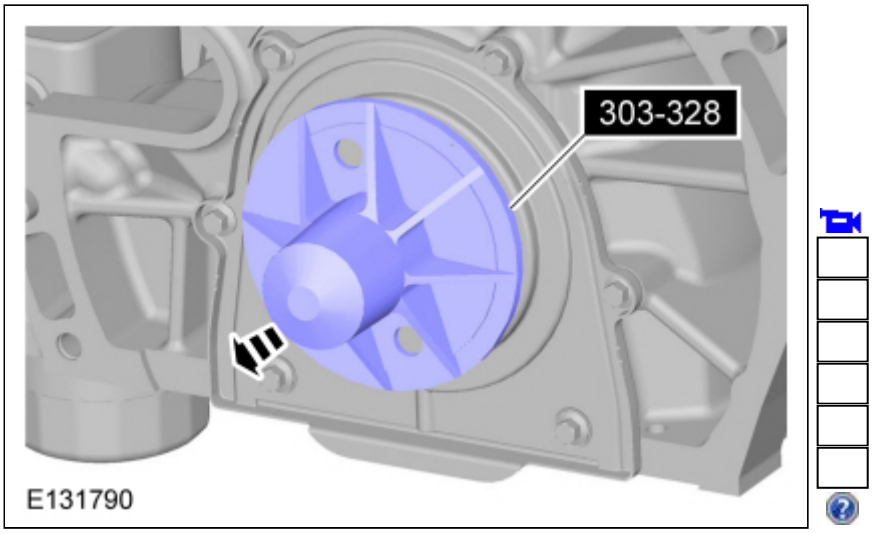
   Use Special Service Tool: 303-328 (T88P-6701-B1) Replacer, Rear Seal.



2. Use Special Service Tool: 303-328 (T88P-6701-B1) Replacer, Rear Seal.
   Torque: 10 Nm



3. Remove Special Service Tool: 303-328 (T88P-6701-B1) Replacer, Rear Seal.



4. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Cylinder Head

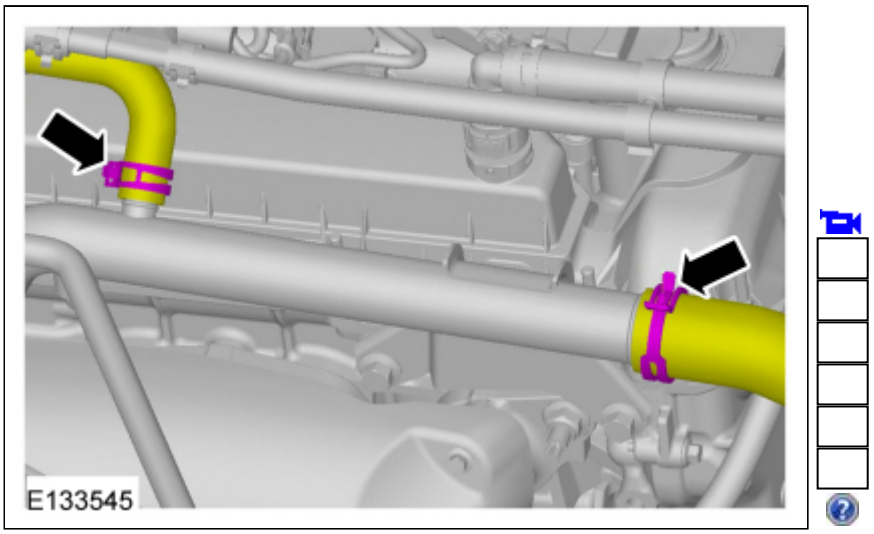
Base Part Number: 6051

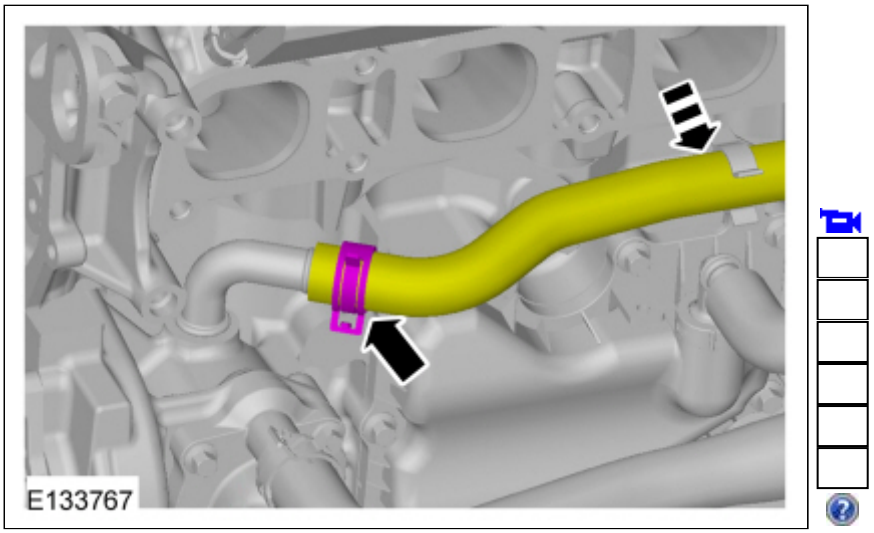
Materials

Name	Specification
Gear/Transmission Fluid - SAE 85W-90	SQ-M2C9002-AA

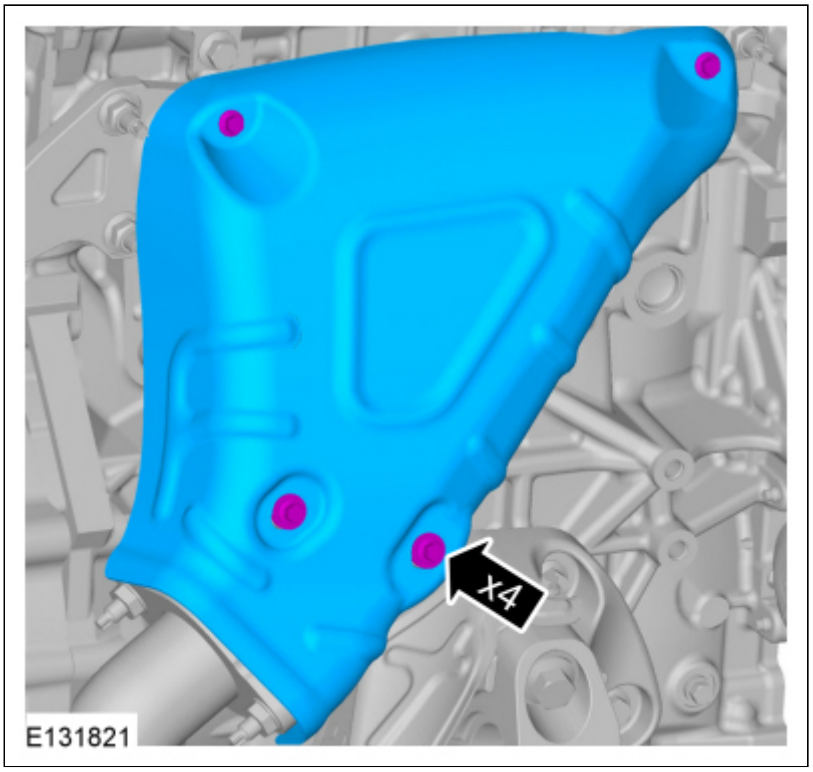
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
2. Refer to: Timing Chain (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. 

4. 

5. *Torque*: 10 Nm

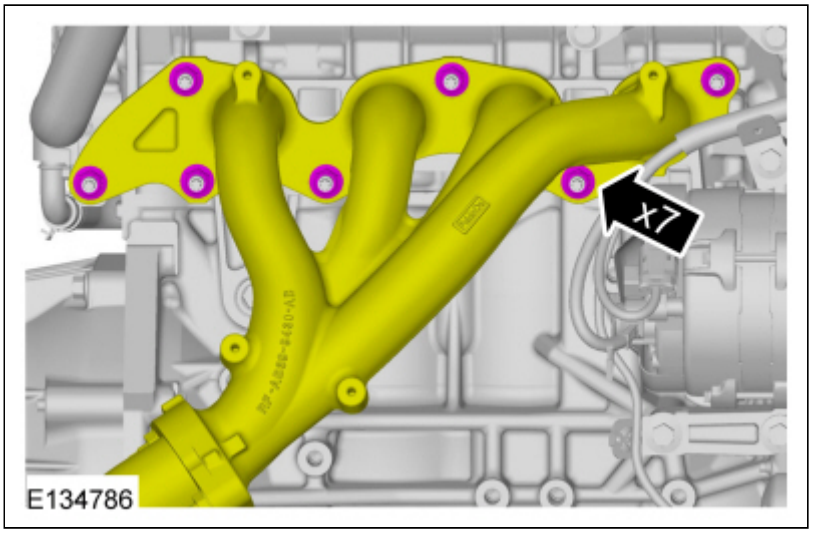


6. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

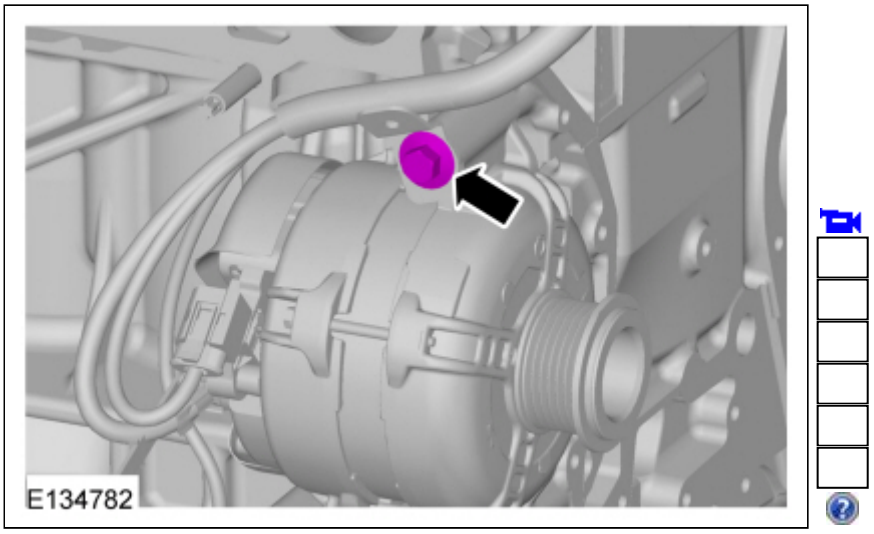
   NOTICE: Make sure that the catalytic converter is supported with suitable retaining straps.

   NOTE: *The gasket is to be reused unless damaged.*

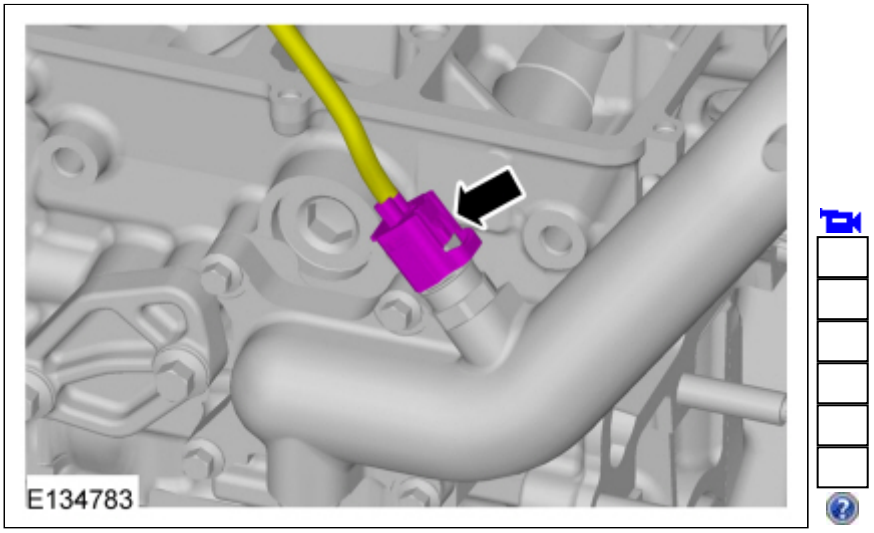
   Torque: 48 Nm



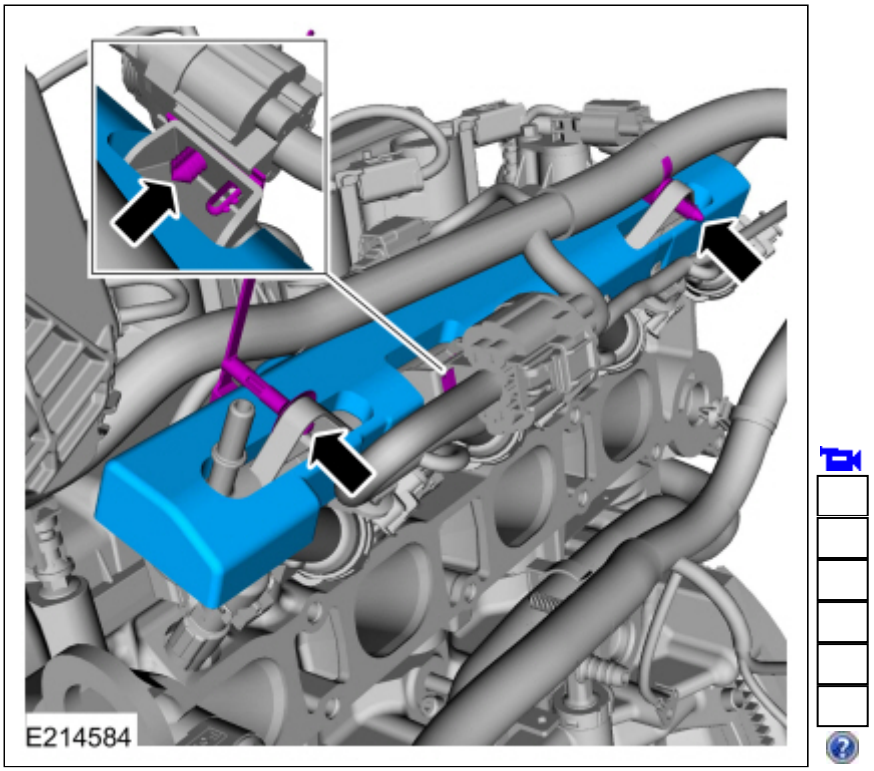
7. *Torque*: 48 Nm



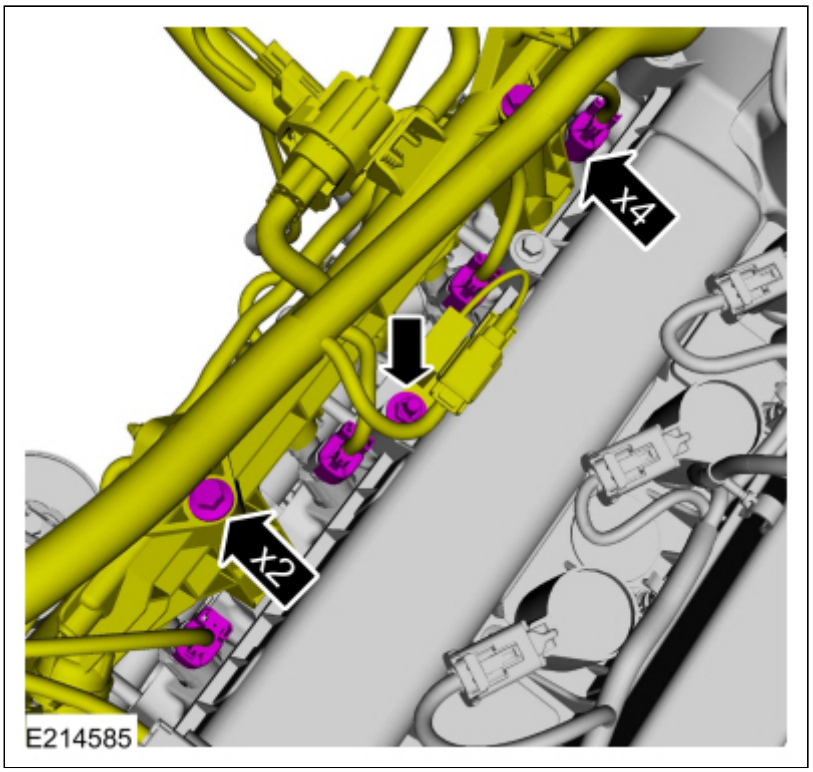
8.



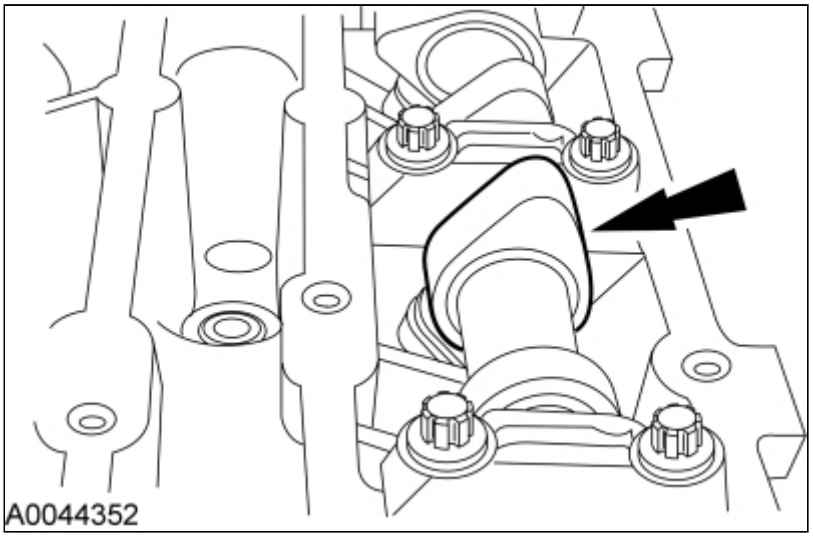
9.



10. *Torque*: 23 Nm



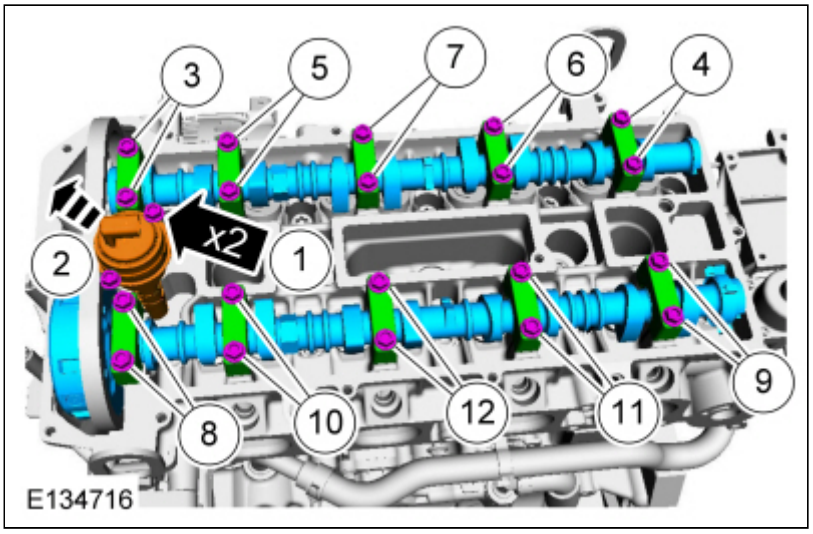
11. Mark the position of the camshaft lobes on the No. 1 cylinder for installation reference.



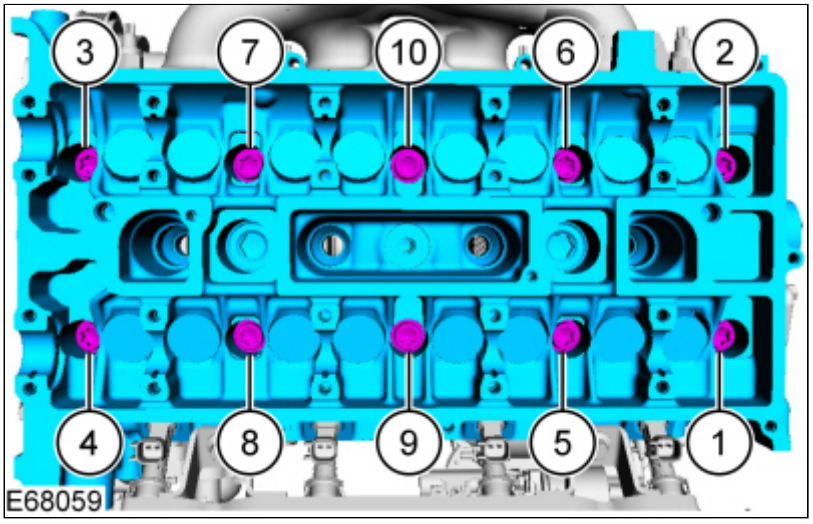
12. **NOTICE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.**

    NOTICE: Note the position of each component before removal.

    NOTE: *Mark the location and orientation of each camshaft bearing cap.*

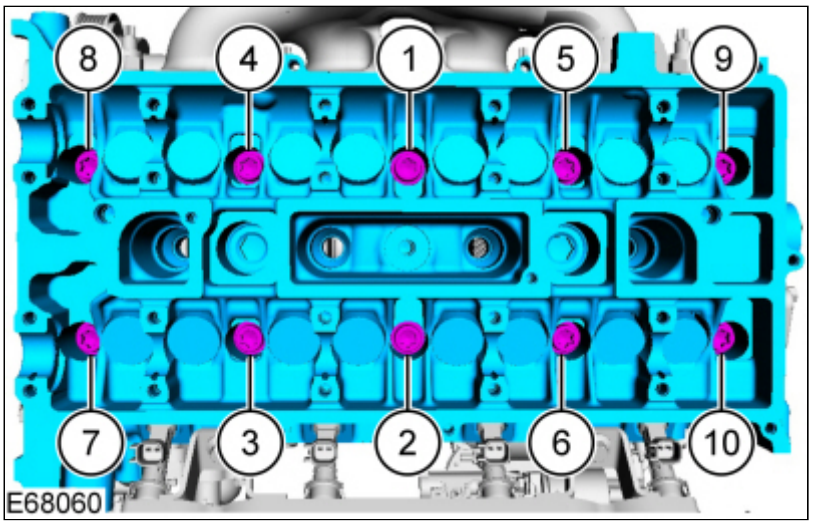


13. Discard the cylinder head bolts.



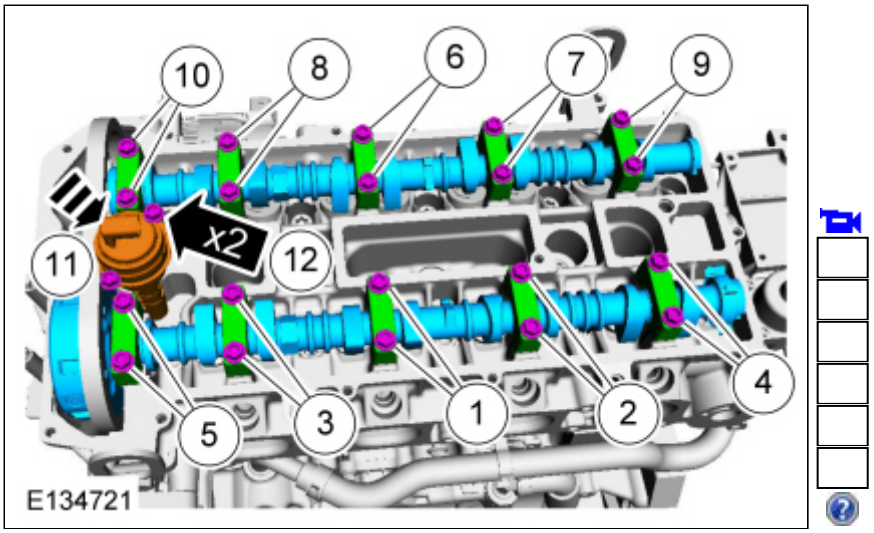
Installation

1. Install new cylinder head bolts.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 15 Nm
   Stage 3: 45 Nm
   Stage 4: 90°
   Stage 5: 90°



2. **NOTICE: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.**

Apply hypoid gear oil to the camshaft bearing caps. Install the camshafts approximately at valve overlap position cylinder No. 4.
Material: Gear/Transmission Fluid - SAE 85W-90 (SQ-M2C9002-AA)
Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm



3. To install reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Engine Front Cover

Base Part Number: 6C086

Special Tool(s) / General Equipment

 E134676	303-1417 Tool, Crank Sensor Alignment

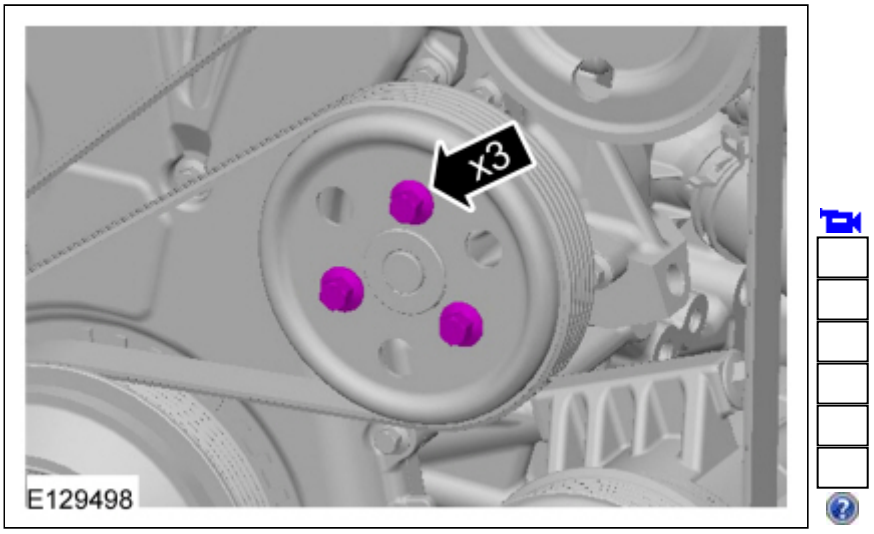
Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

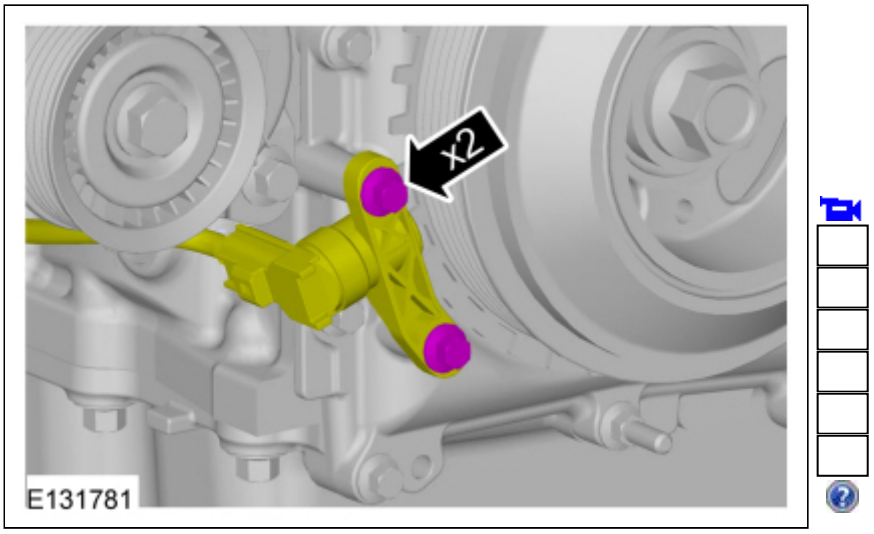
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Loosen: 3 turn(s)



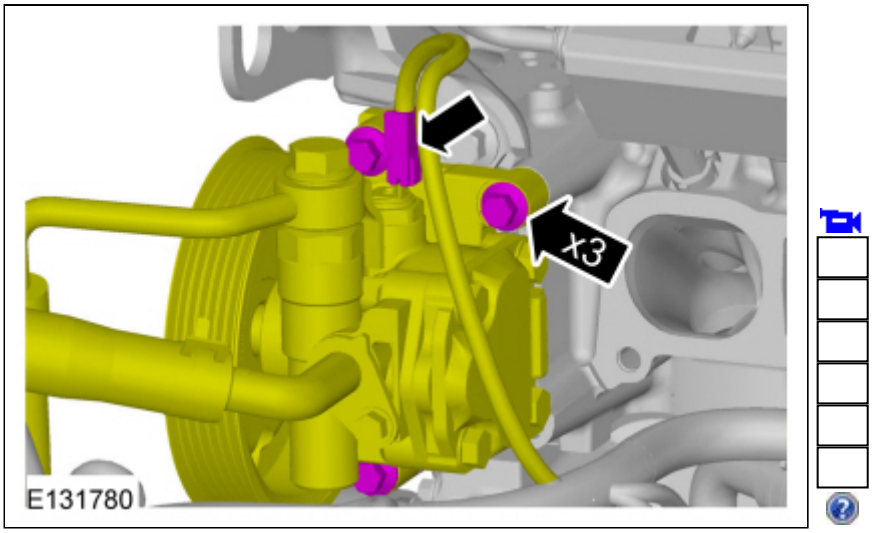
2.



3. Refer to: Crankshaft Pulley (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

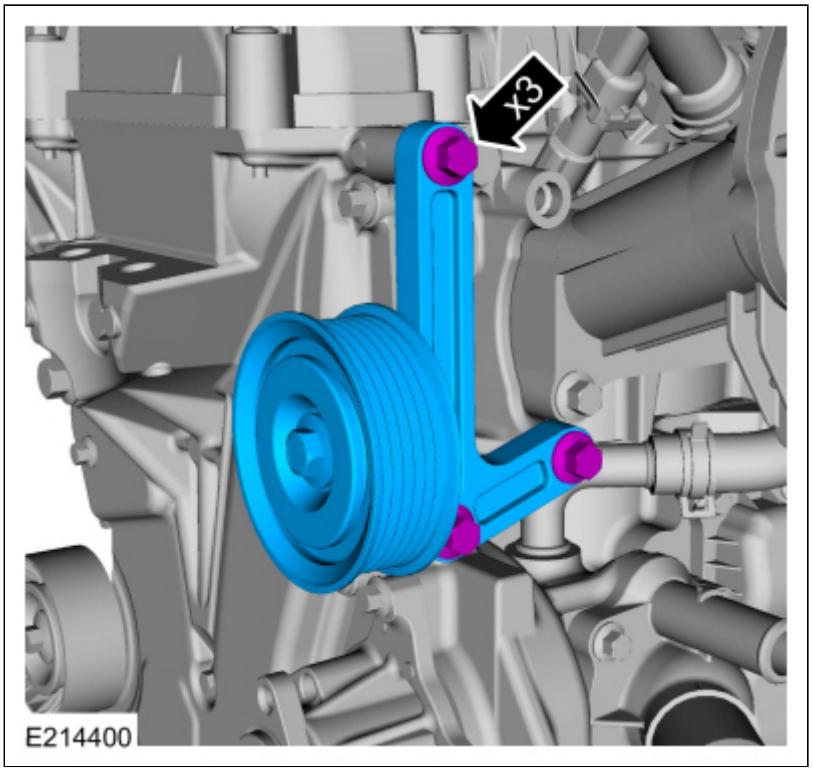
Vehicles With: Hydraulic Power Assist Steering (HPAS)

4. *Torque*: 20 Nm



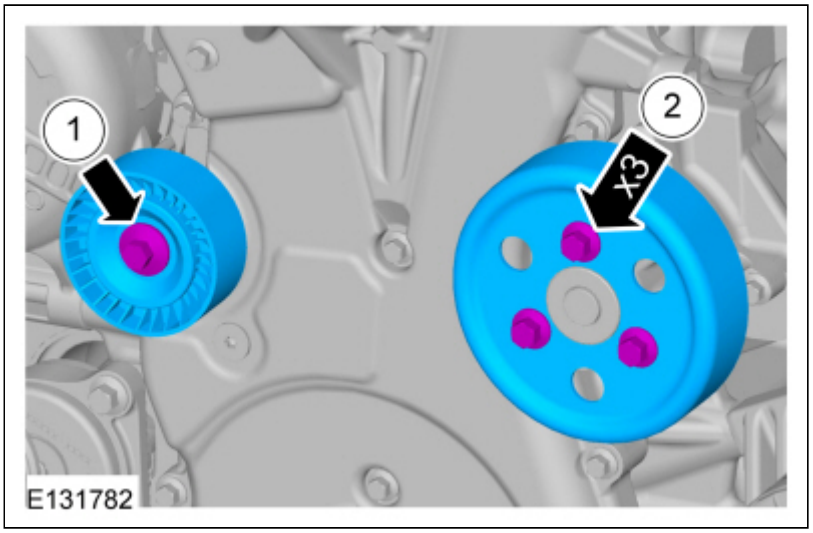
Vehicles With: Electronic Power Assist Steering (EPAS)

5. *Torque*: 25 Nm

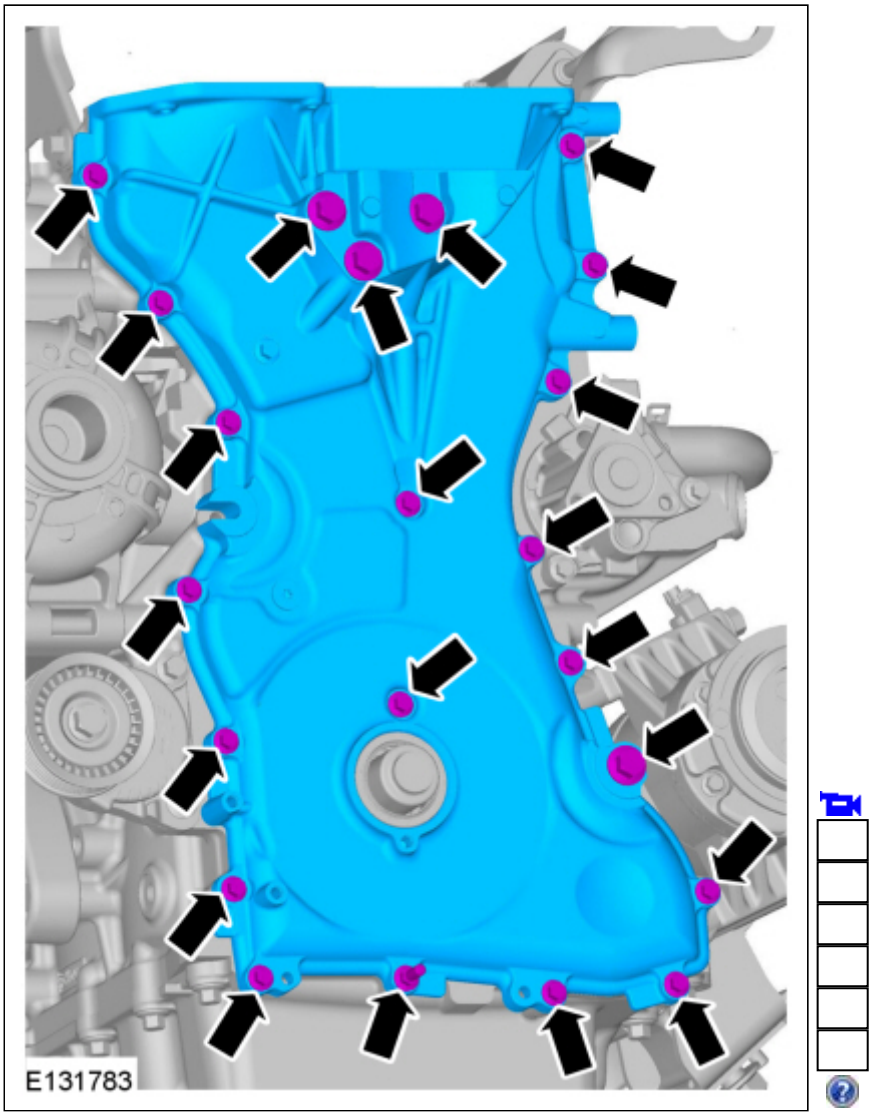


All vehicles

1. *Torque*: 25 Nm
2. *Torque*: 20 Nm



7.



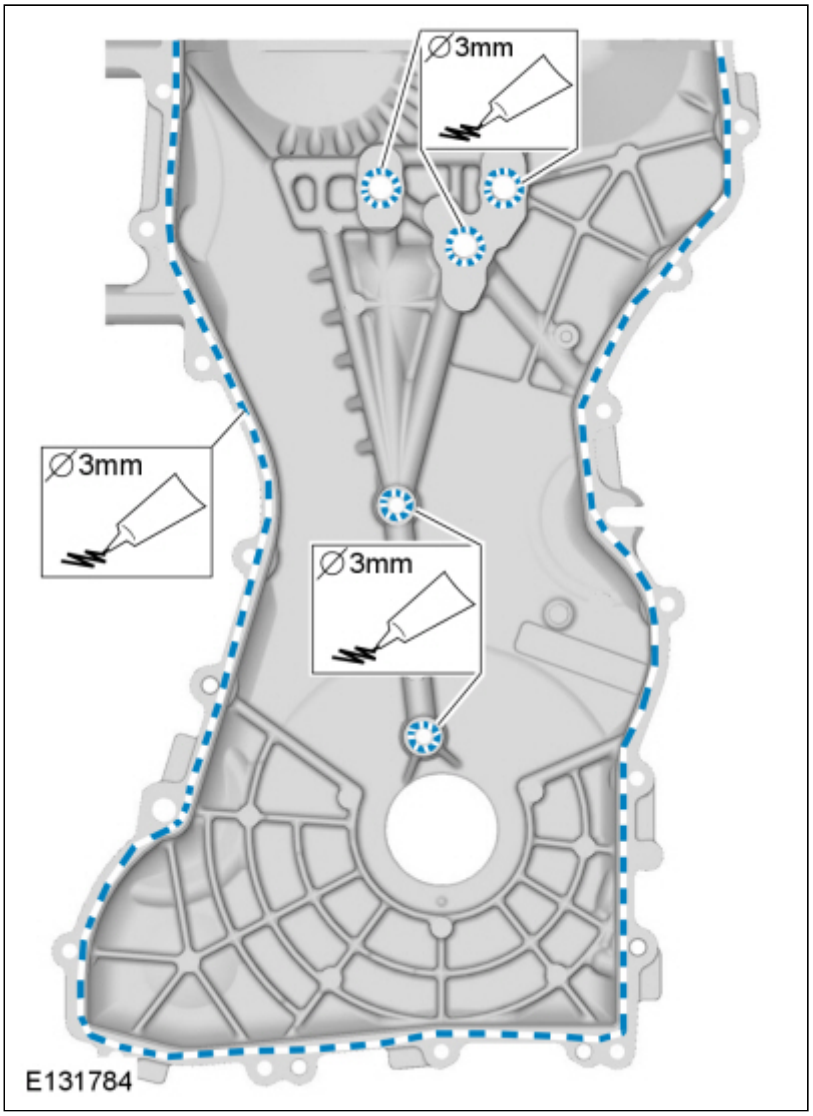
Installation

1. **NOTICE: Install the engine front cover within five minutes of applying the sealer.**

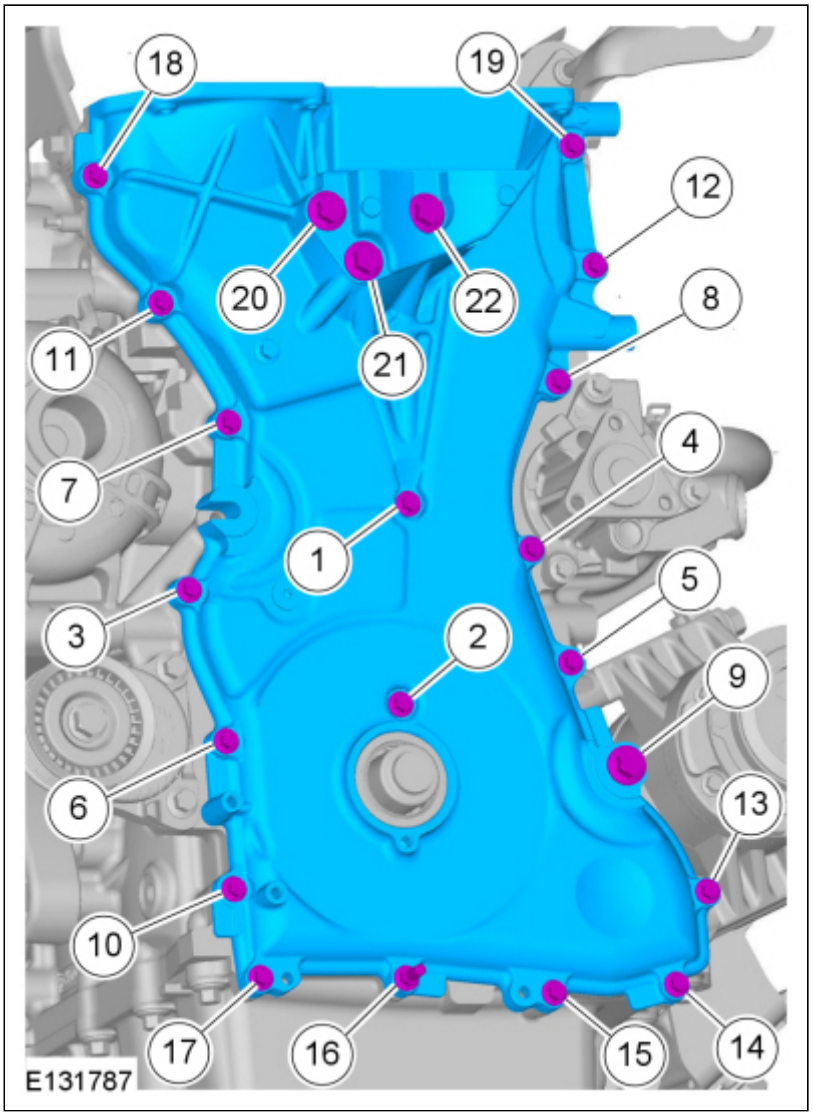
   NOTE: *Do not damage the mating faces.*

   NOTE: *Mating surface should not have traces of oil to improve the adhesion.*

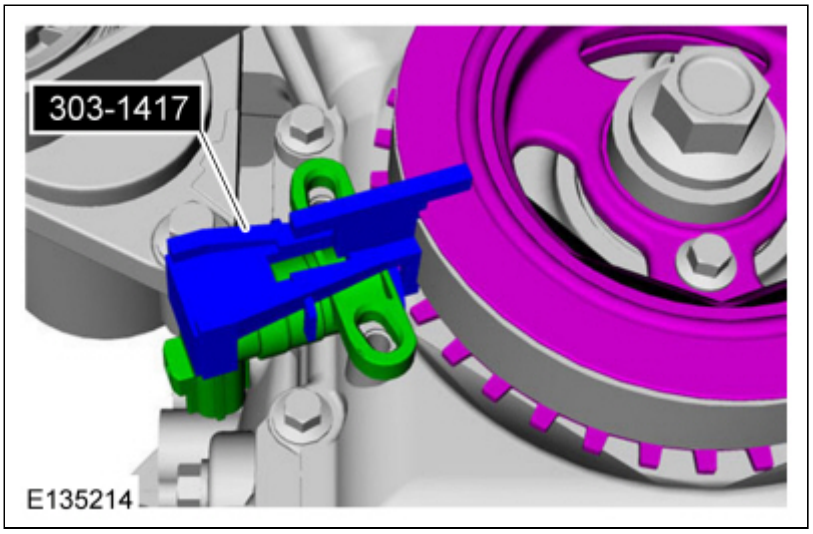
   Apply sealant to the engine front cover (bead diameter: 3 mm).
   Material: Silicone Sealant (WSE-M4G323-A4)



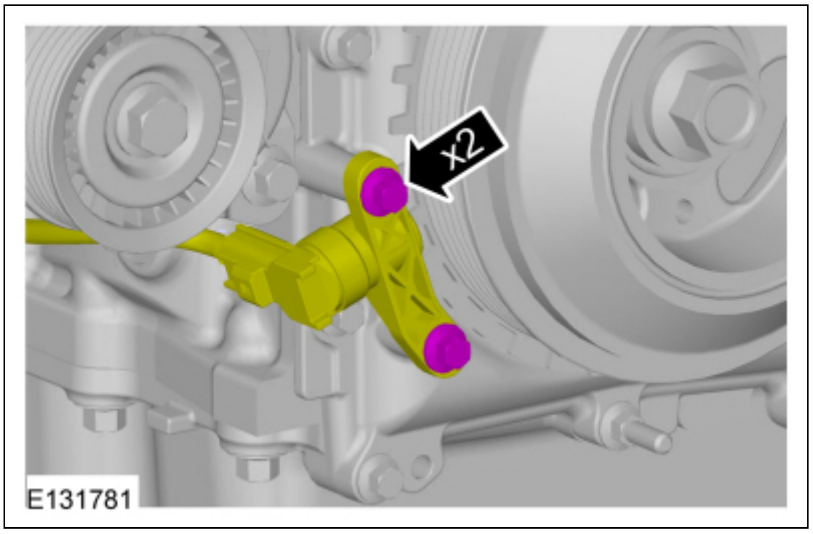
2. *Torque*:
   1 - 8: 10 Nm
   9: 48 Nm
   10 - 19: 10 Nm
   20 - 22: 48 Nm



3. To install, reverse the removal procedure.
4. Use Special Service Tool: 303-1417 Tool, Crank Sensor Alignment.



5. *Torque*: 7 Nm



Copyright © 2016 Ford Motor Company

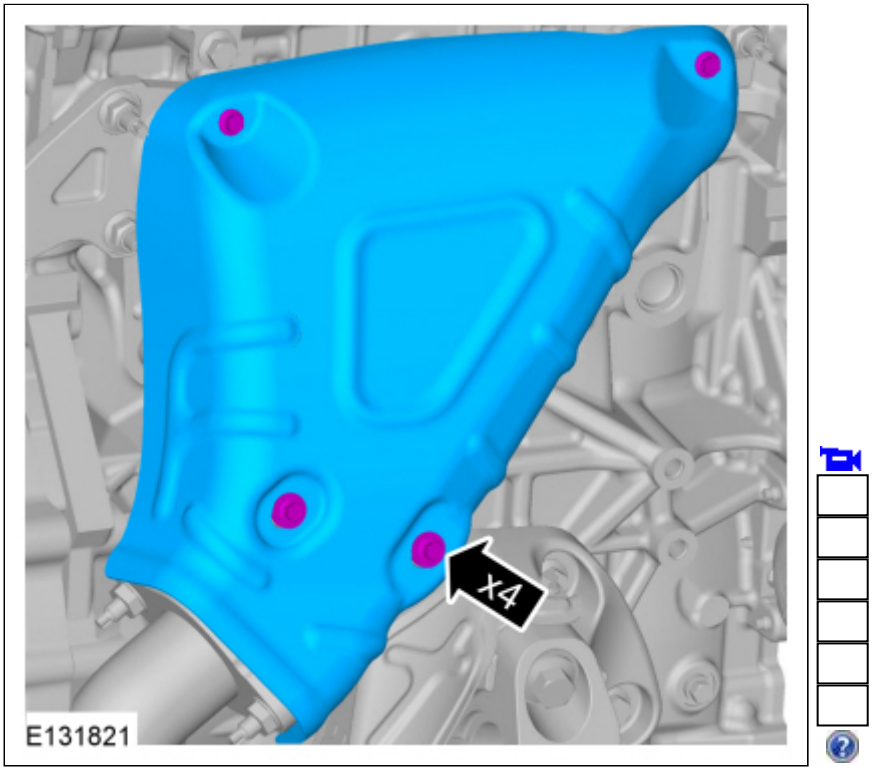
Exhaust Manifold

Base Part Number: 9431

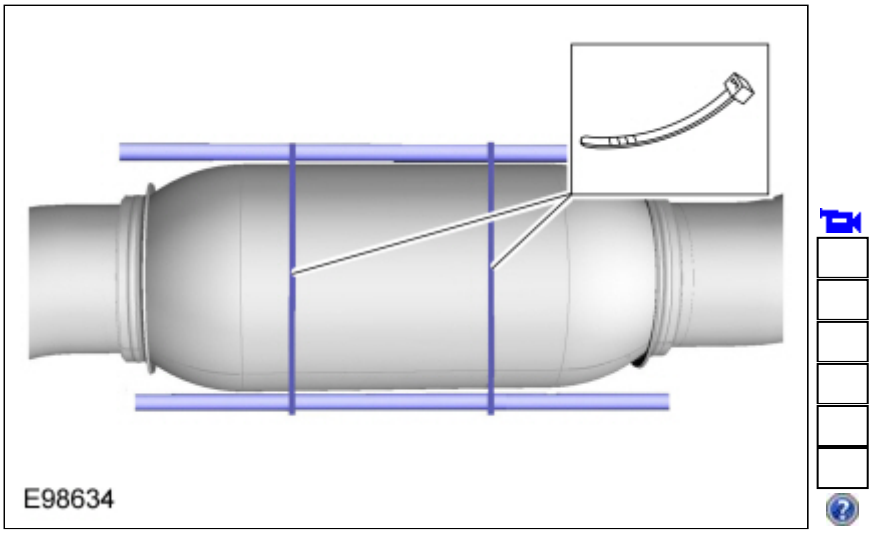
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. *Torque*: 10 Nm

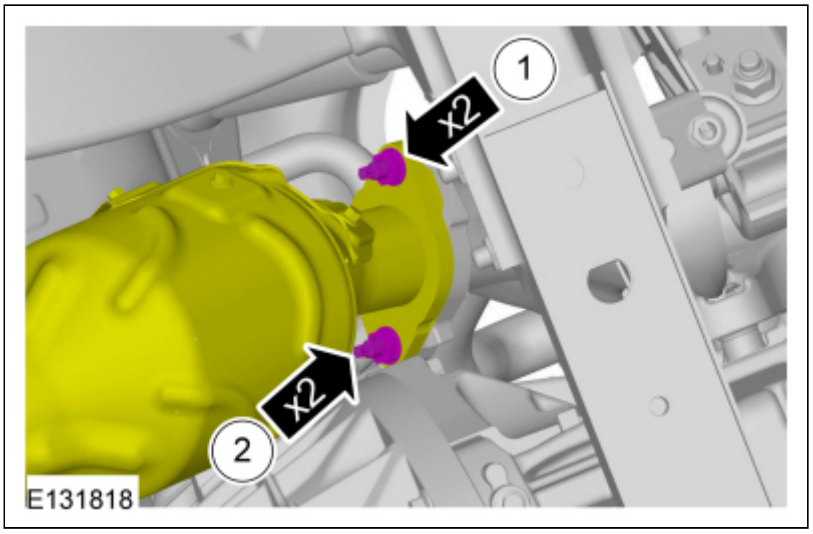


3. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**



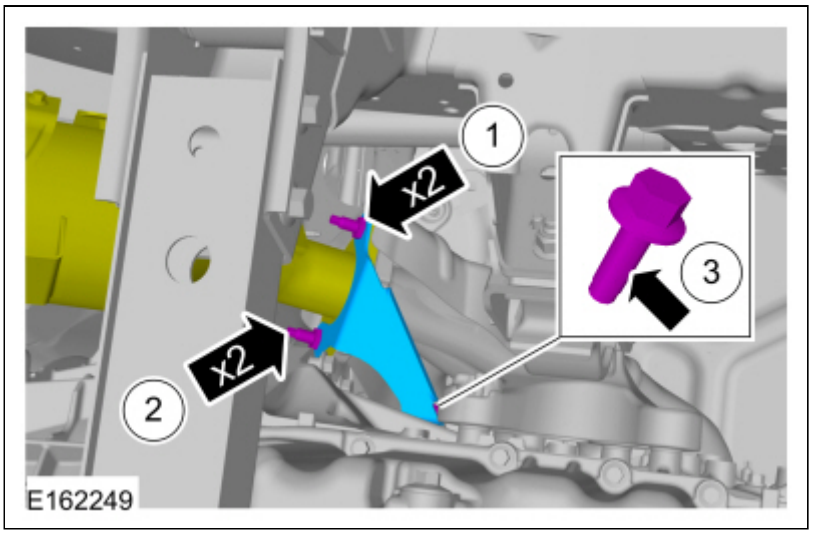
- If equipped.

1. *Torque*: 48 Nm
2. *Torque*: 25 Nm

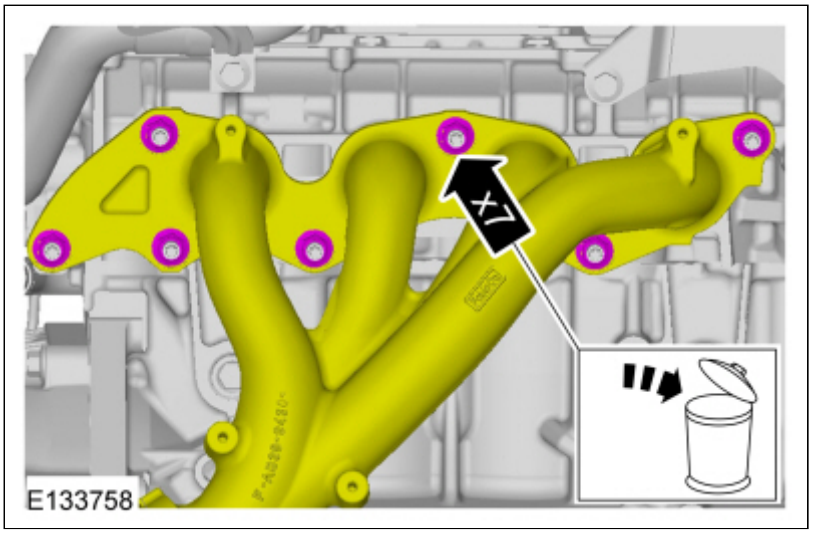


- If equipped.

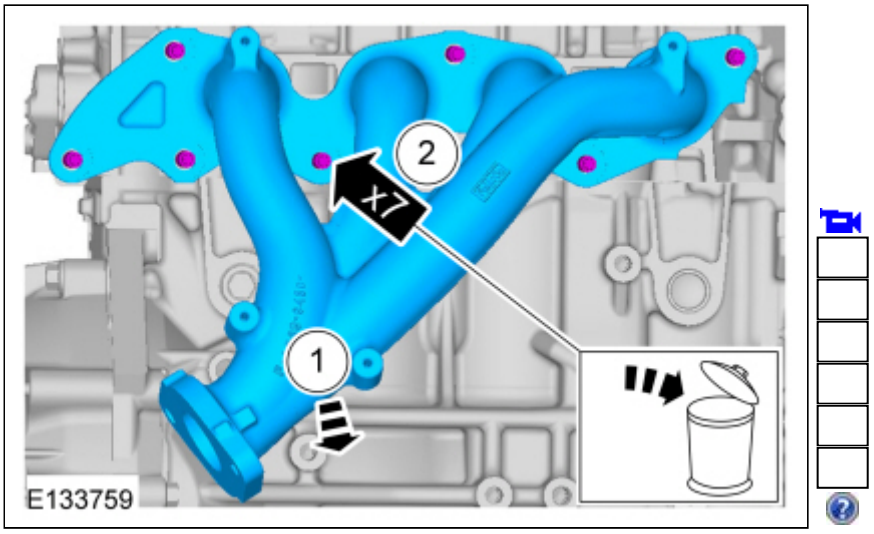
1. *Torque*: 48 Nm
2. *Torque*: 25 Nm
3. *Torque*: 26 Nm



6.

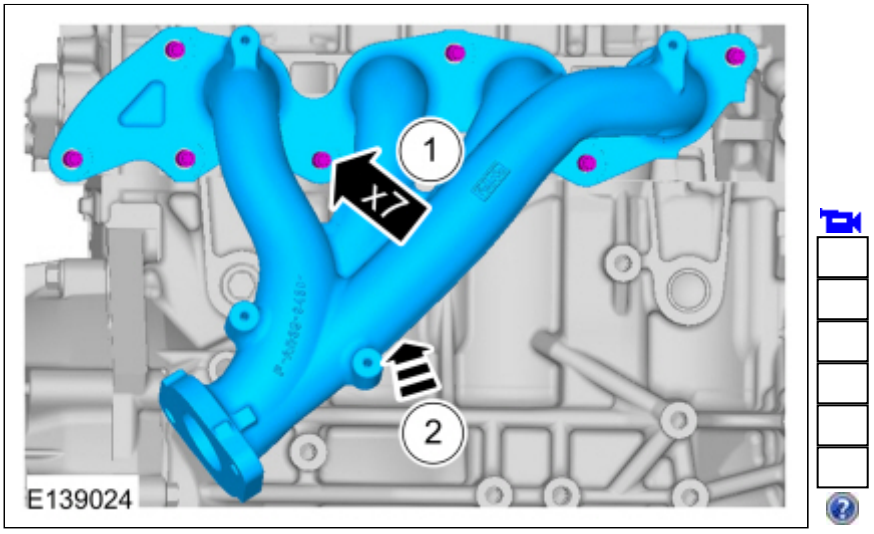


7.

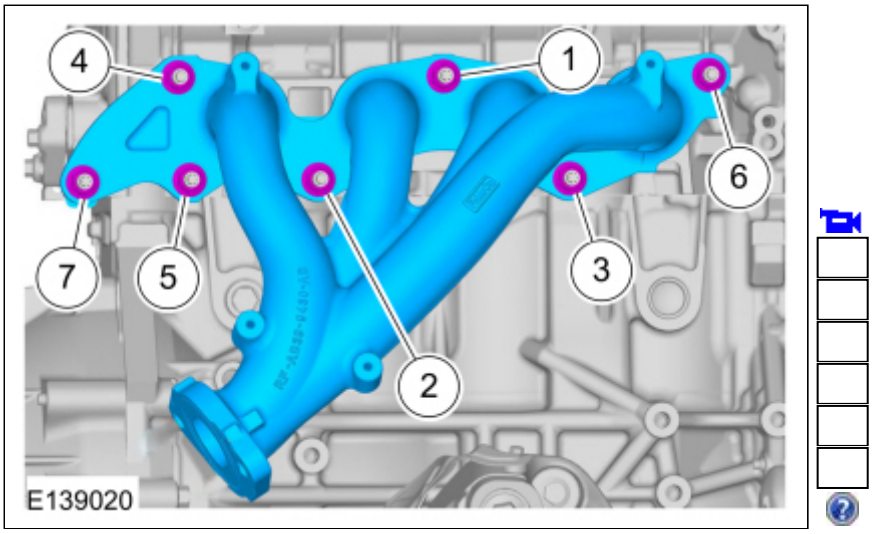


Installation

1. *Torque*: 17 Nm



2. *Torque*: 55 Nm



3. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Intake Manifold

Base Part Number: 9424

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

   WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

   WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

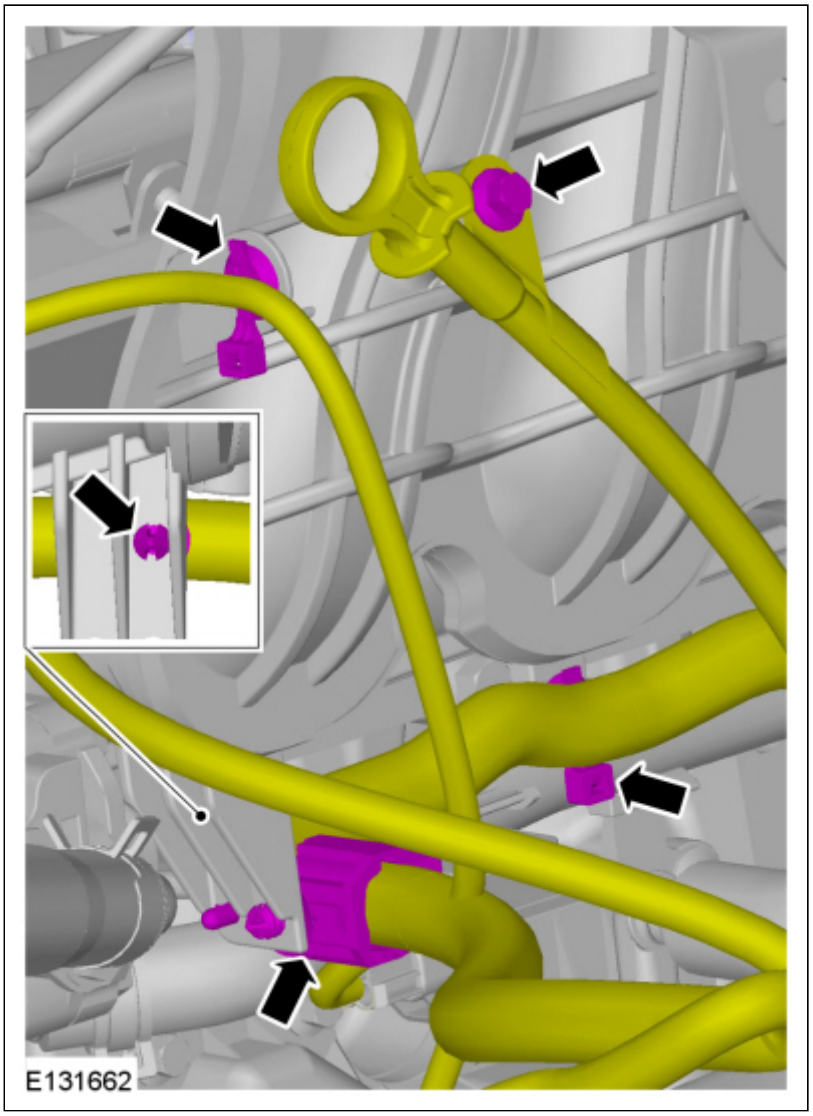
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

3. Refer to: Throttle Body (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

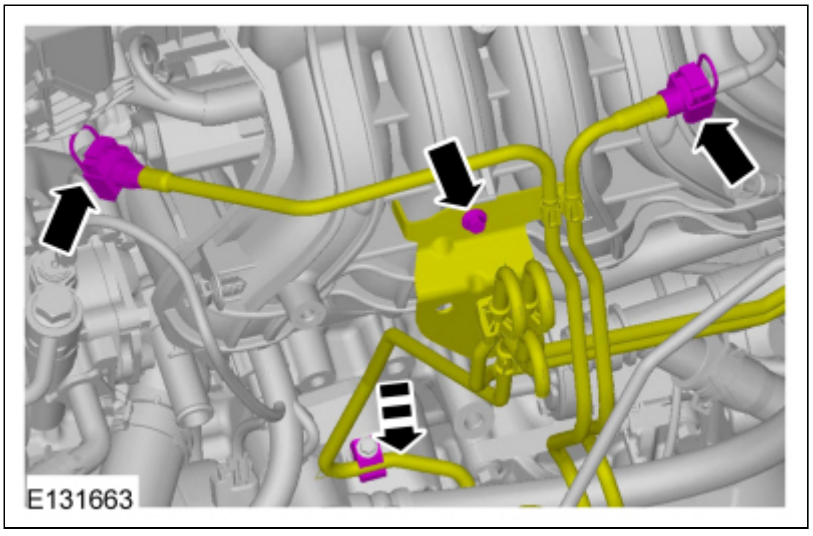
4. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

5. *Torque*: 10 Nm

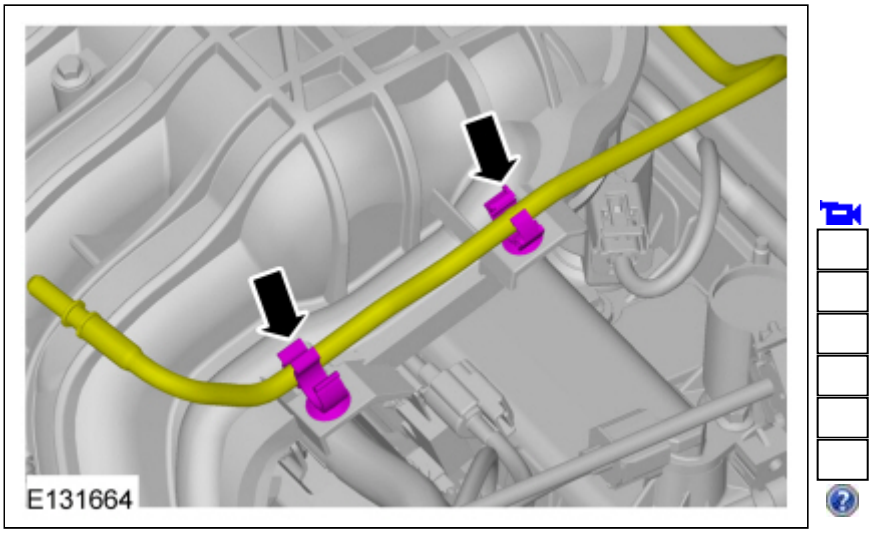


6. **NOTE:** *Securely strap the fuel and breather tubes.*

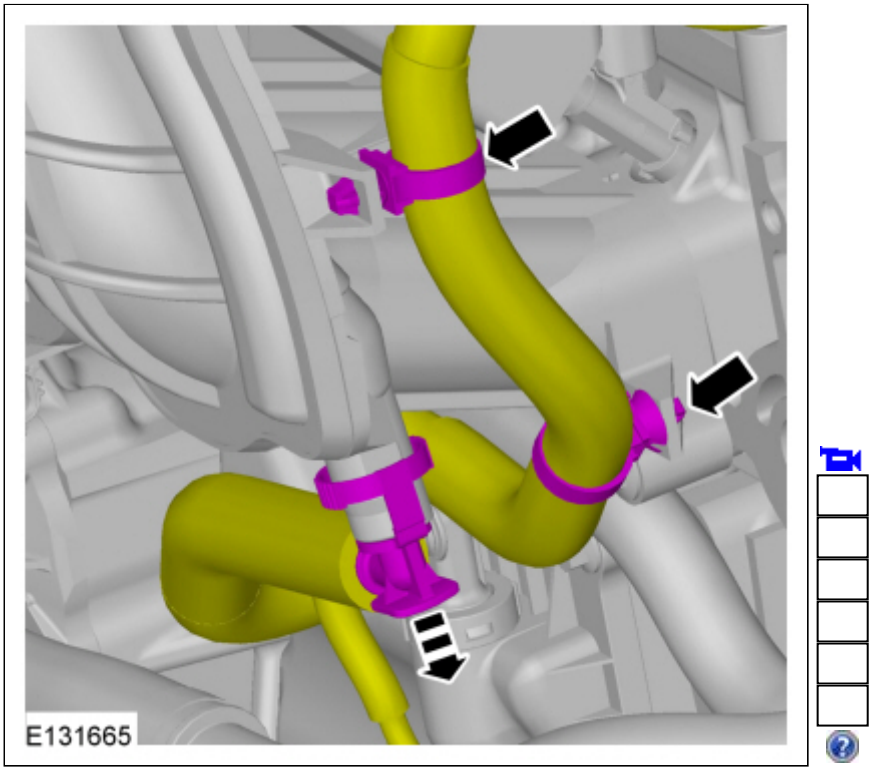
   Torque: 8 Nm



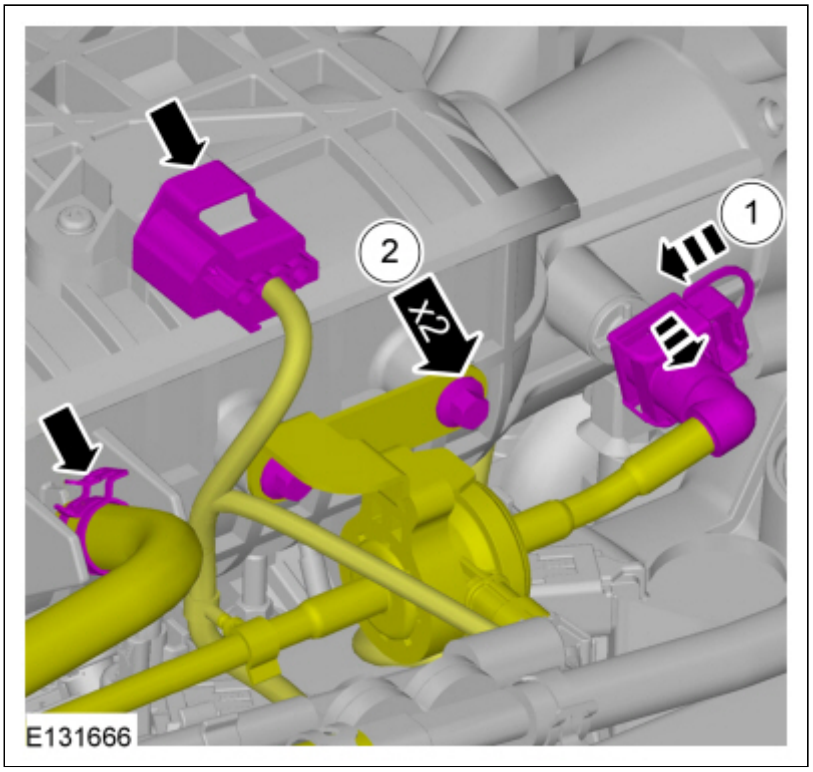
7.



8.

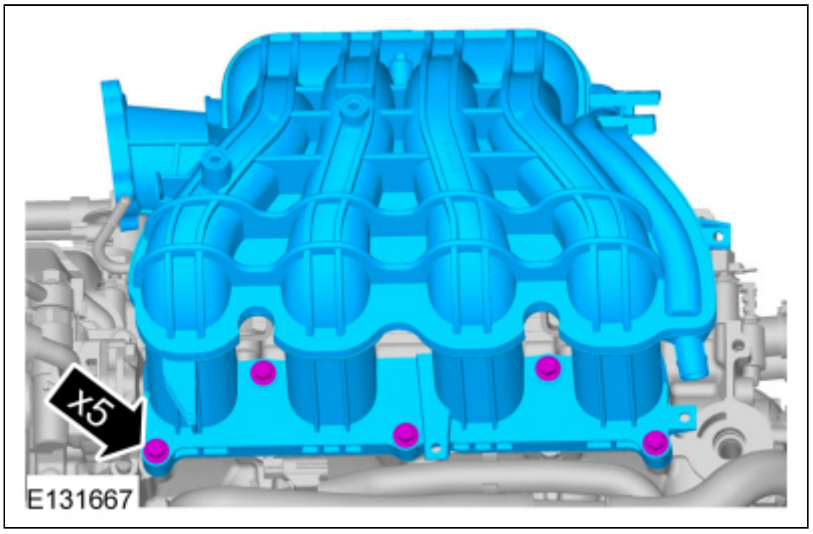


9. *Torque*: 11 Nm



10. **NOTE:** *The gasket is to be reused unless damage.*

    Torque: 19 Nm



Installation

1. **NOTE:** *Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools can cause scratches and gouges which can make leak paths. Use a plastic scraping tool to remove all traces of the old intake manifold gaskets.*

   NOTE: *If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.*

2. To install, reverse the removal procedure.

3. **NOTE:** *Make sure that the pedals remain in the rest position.*

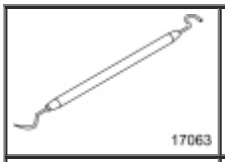
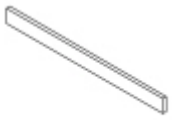
   Turn the ignition key to position II and then wait one minute in order to initialise the throttle valve.

4. Turn the ignition key to the OFF position.

Copyright © 2016 Ford Motor Company

Timing Chain

Special Tool(s) / General Equipment

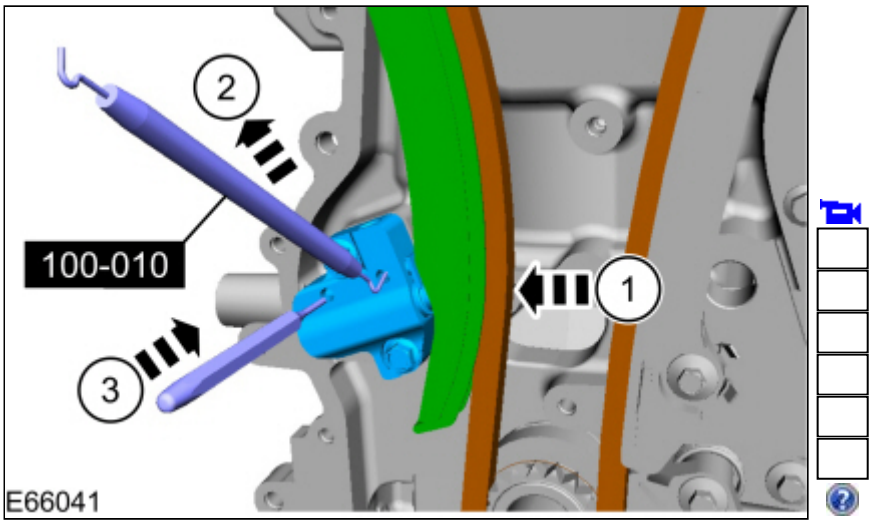
 17063	100-010 Remover, O-Ring Seal
 E134673	303-465 Tool, Camshaft Align Timing
2 mm Punch	

Removal

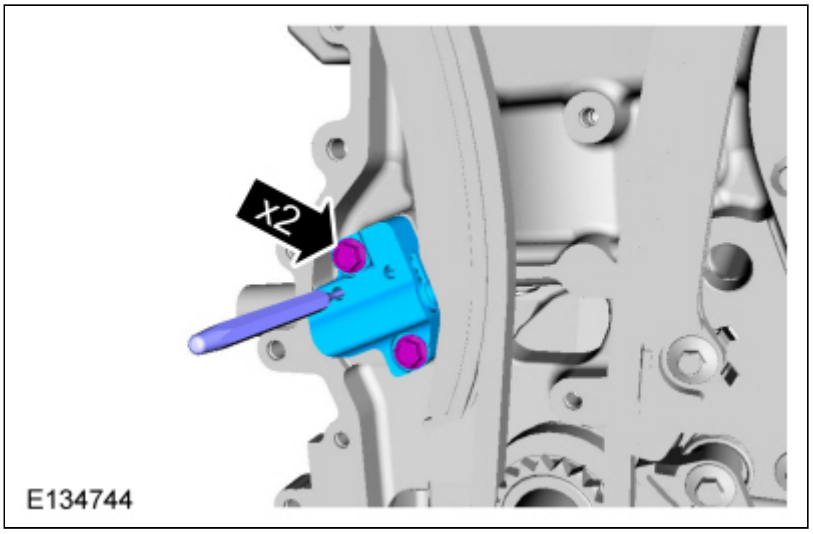
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Engine Front Cover (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

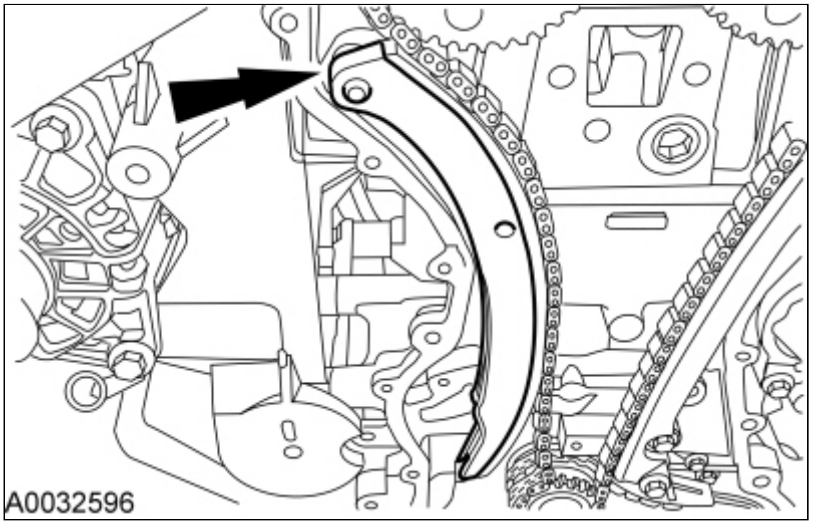
2. Use Special Service Tool: 100-010 Remover, O-Ring Seal.
3. Use the General Equipment: 2 mm Punch



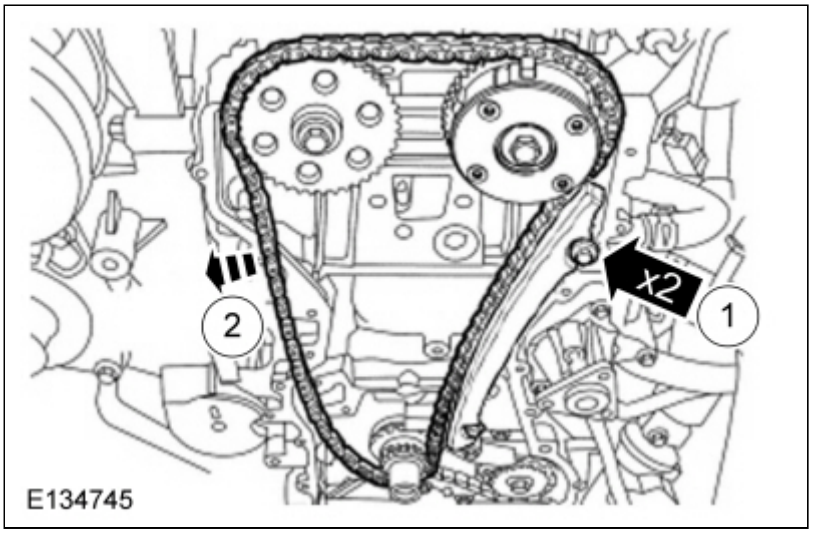
3.



4. Remove the timing chain tensioner arm.



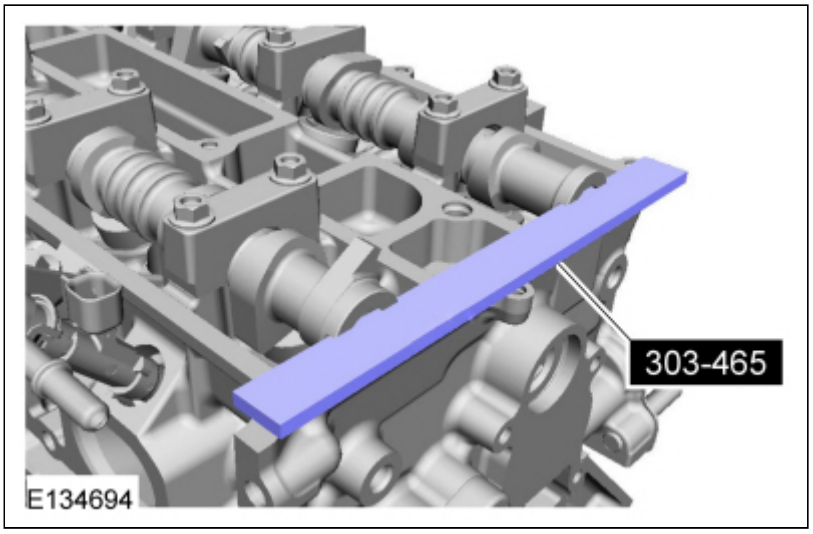
5.



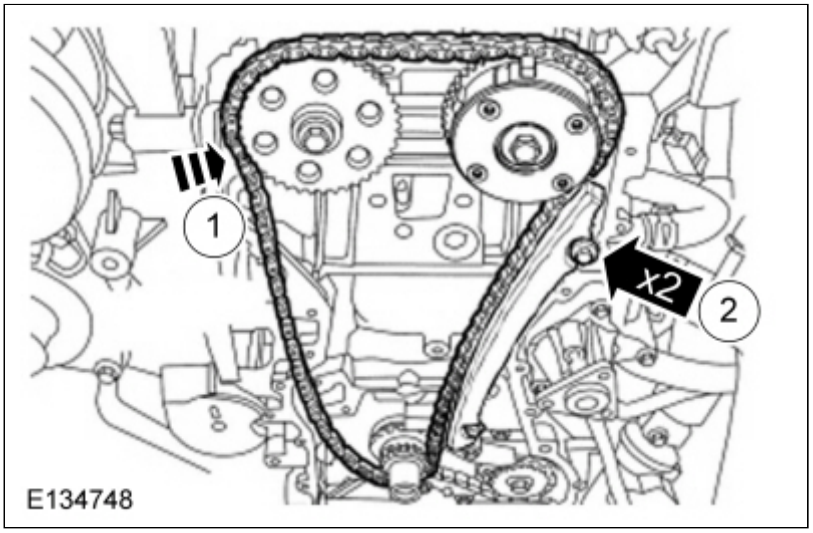
Installation

1. **NOTICE: Only rotate the camshaft clockwise.**

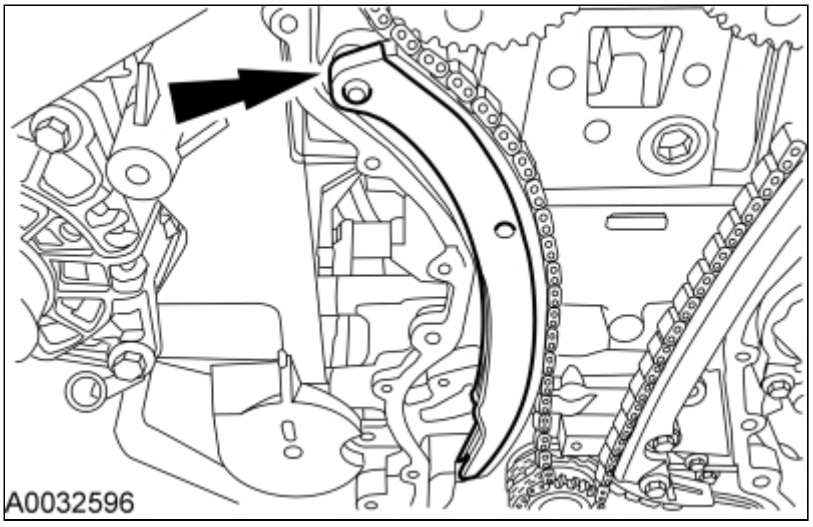
   Turn the camshafts to cylinder no. 4 valve overlap position.
   Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.



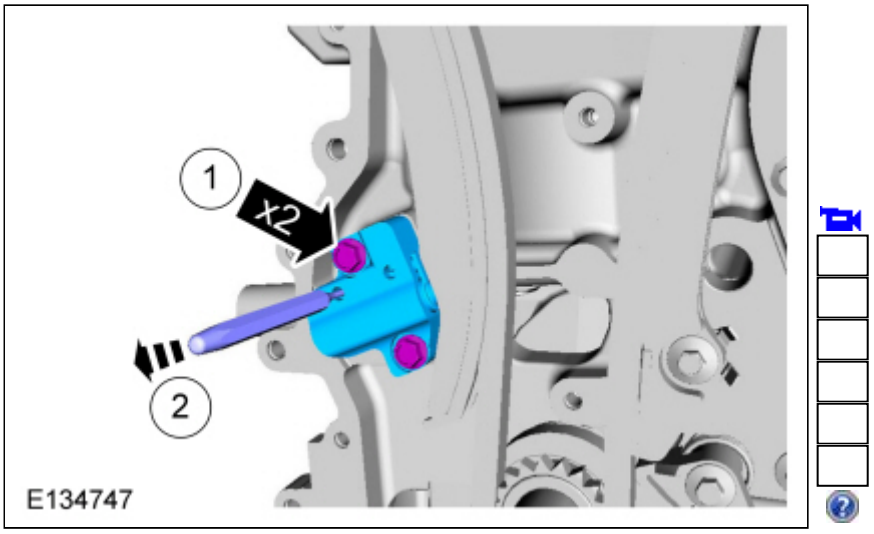
2. *Torque*: 10 Nm



3.



4. *Torque*: 10 Nm



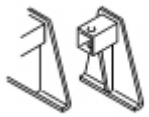
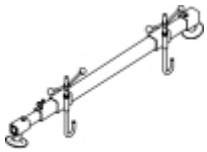
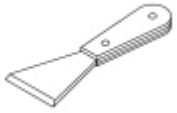
5. Refer to: Engine Front Cover (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Copyright © 2016 Ford Motor Company

Oil Pan

Base Part Number: 6675

Special Tool(s) / General Equipment

 2114001	303-290-01 Adapter for 303-290A
 30329003A	303-290-03A Adapter for 303-290A
 E63421	303-290B Support Bar, Engine
 21179	303-428 Separator, Oil Pan

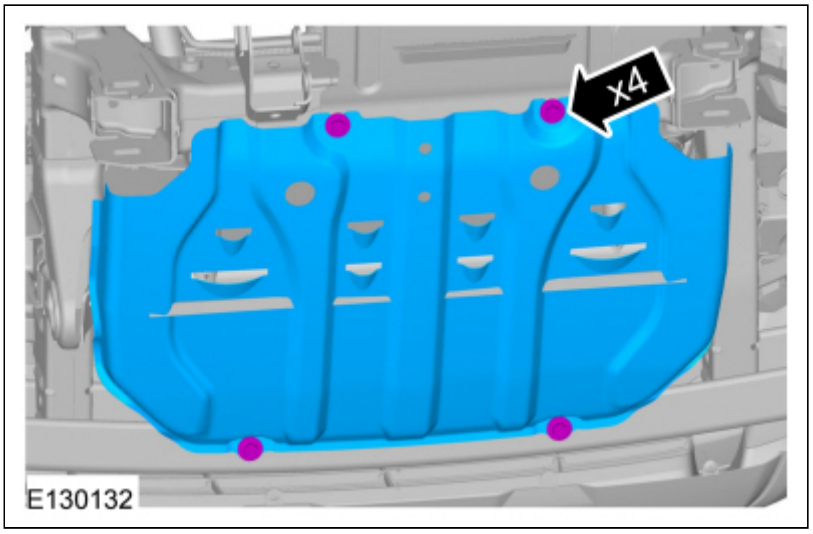
Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

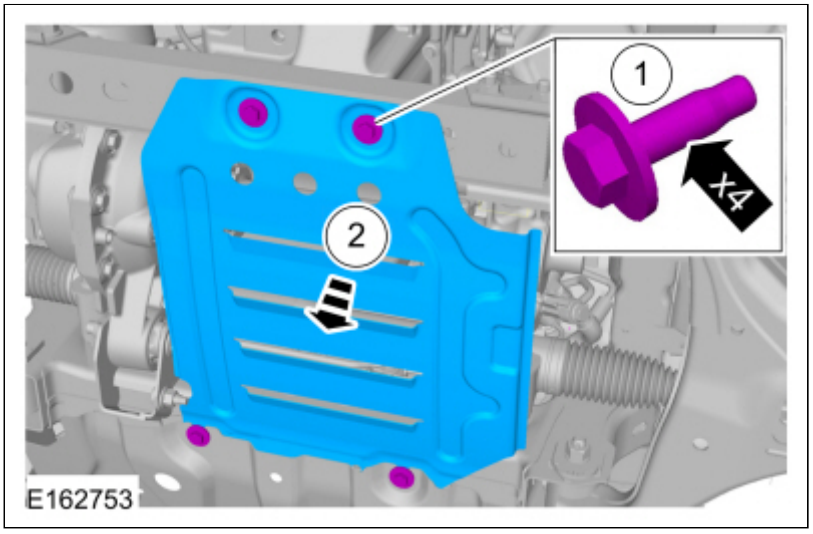
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4.



4x4

5.

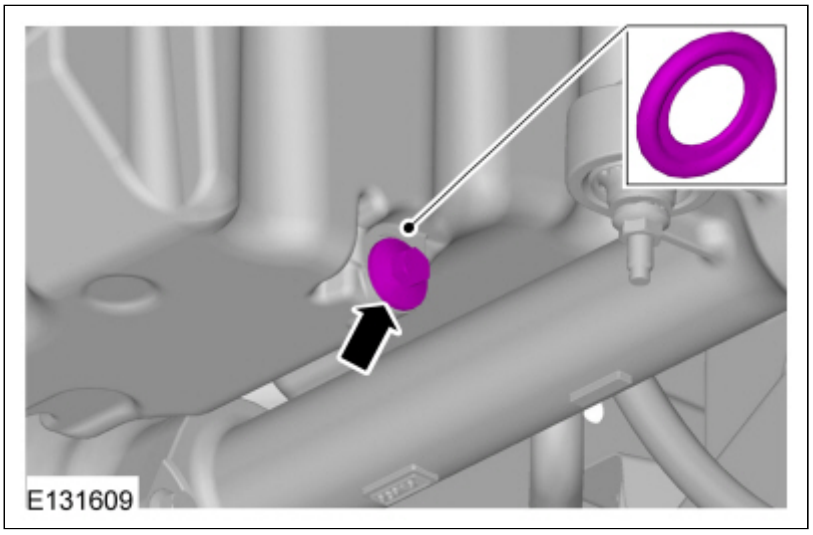


All vehicles

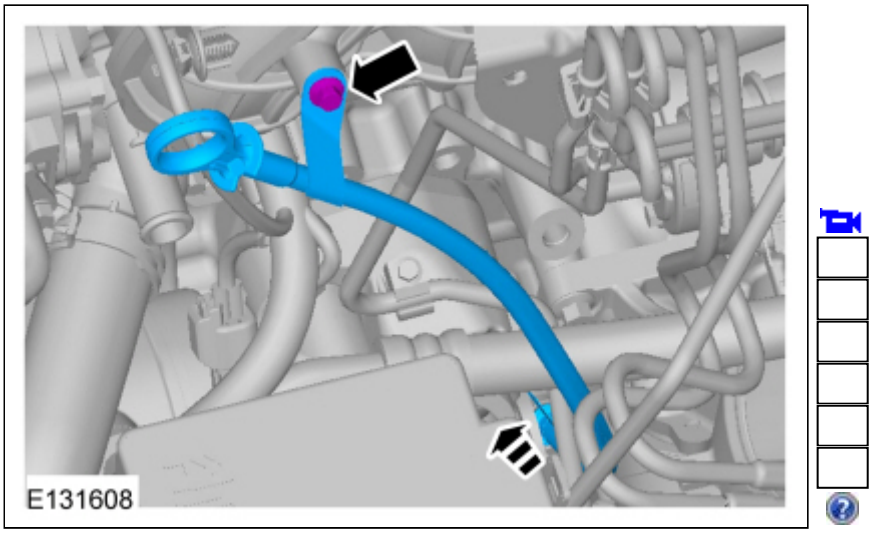
6. **NOTE:** *Be prepared to collect escaping fluids.*

   NOTE: *The seal is to be reused unless damaged.*

   Drain the oil into a suitable container.



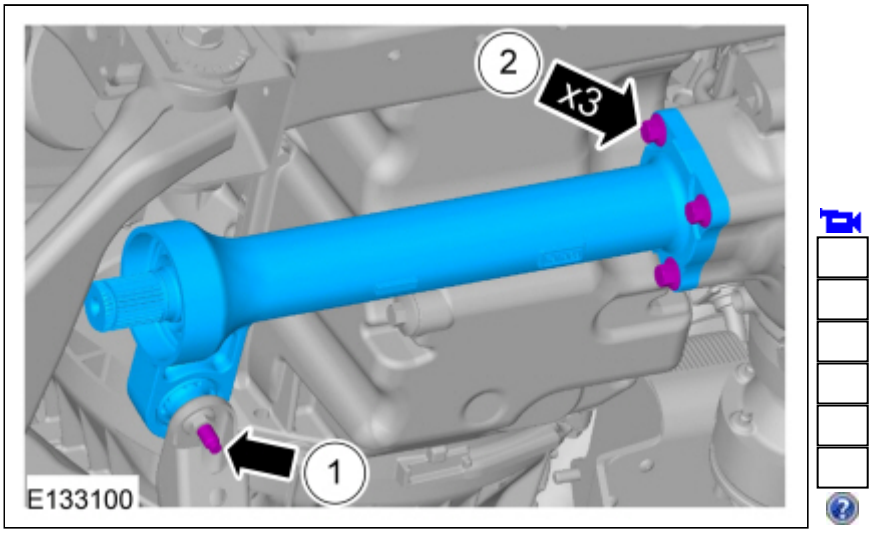
7.



8. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

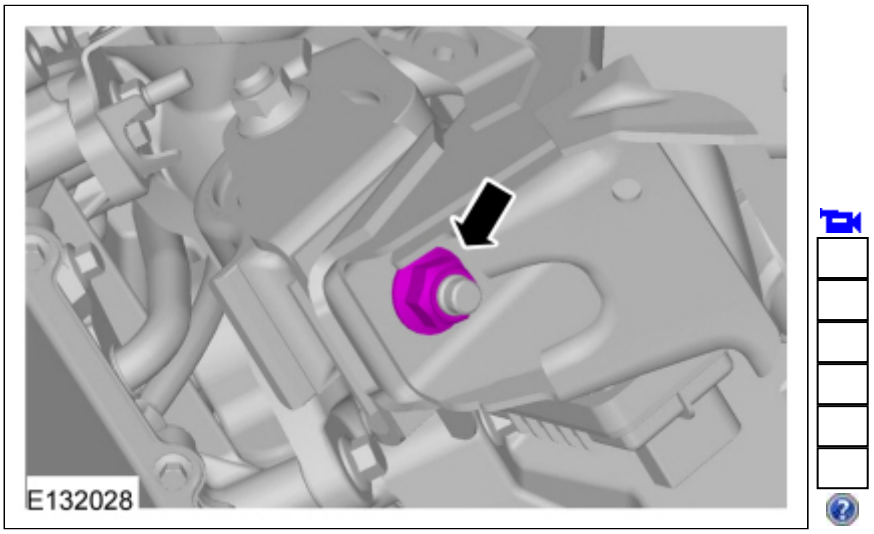
4x4

9. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
10. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
11.



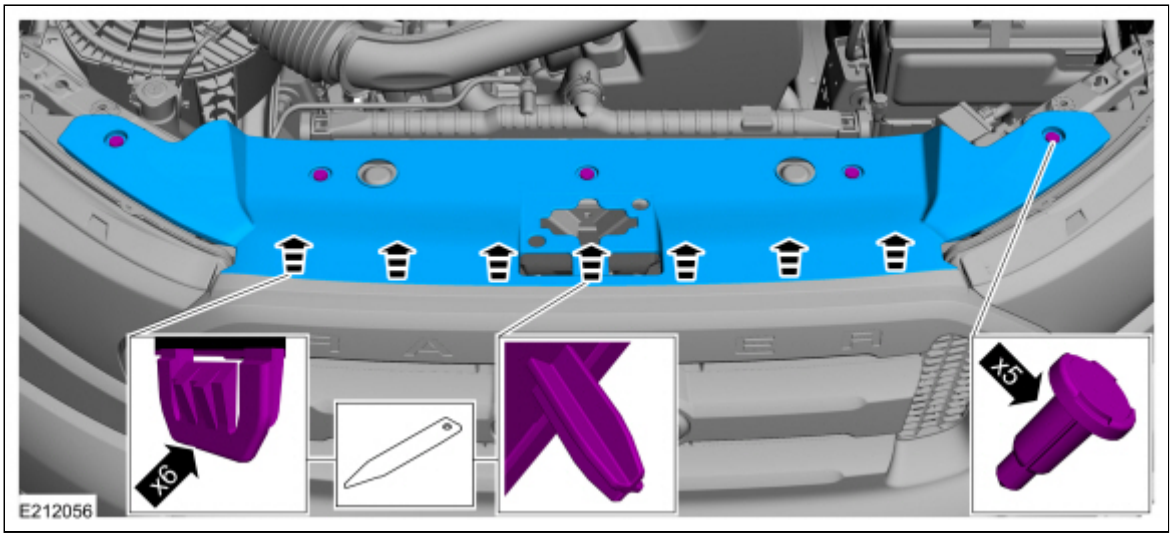
All vehicles

12. On both sides.



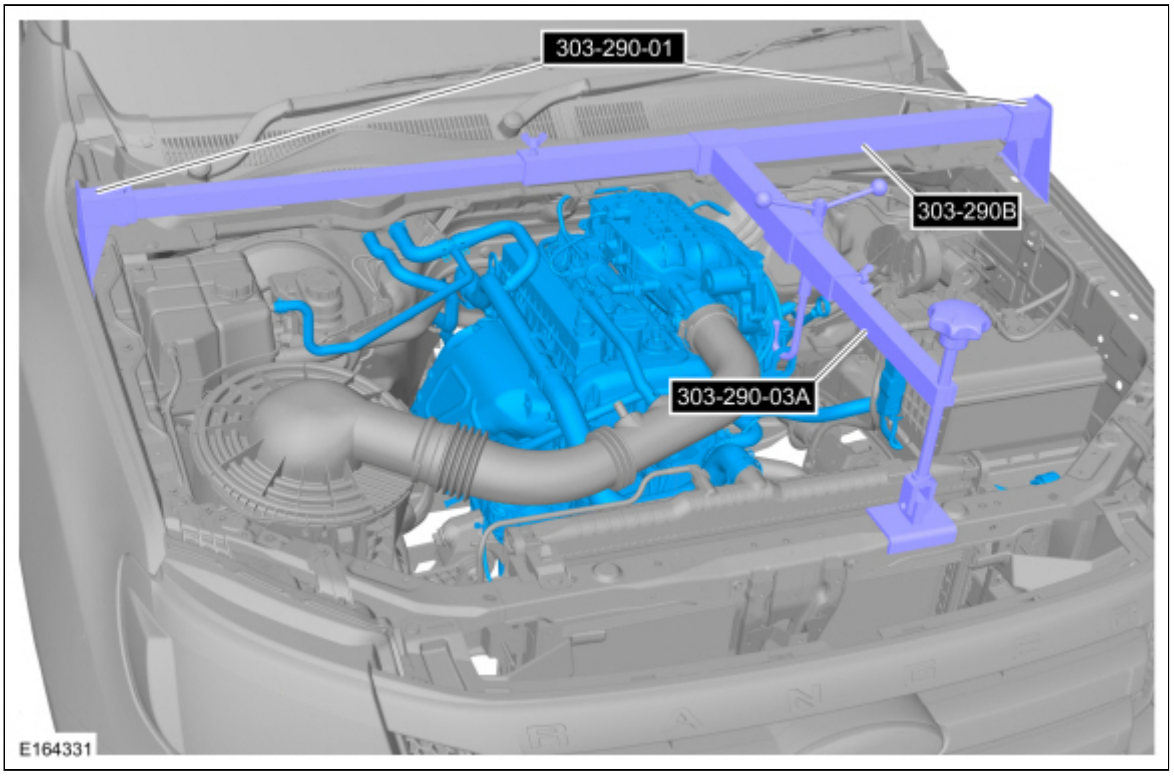
13. Lower the vehicle.

14.



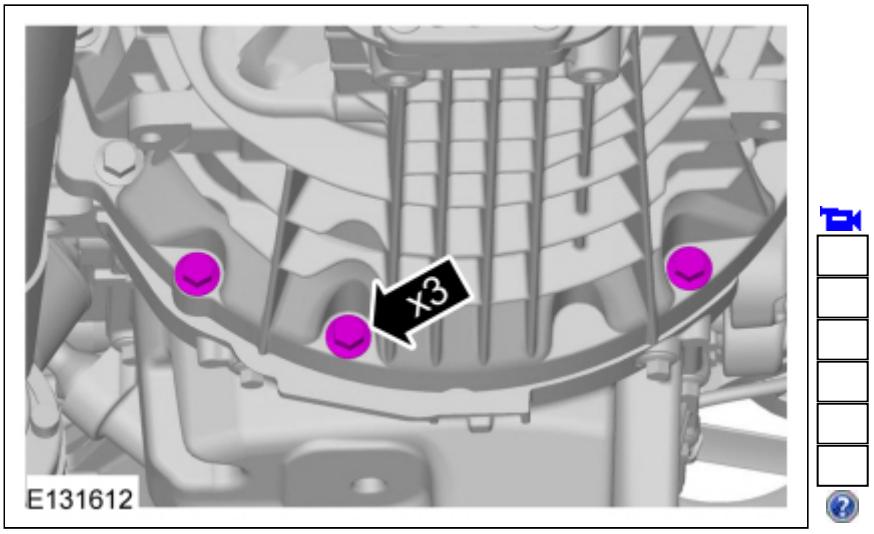
15. Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

16. Install the special tools and lift the engine to 60mm approximately.
Install Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.

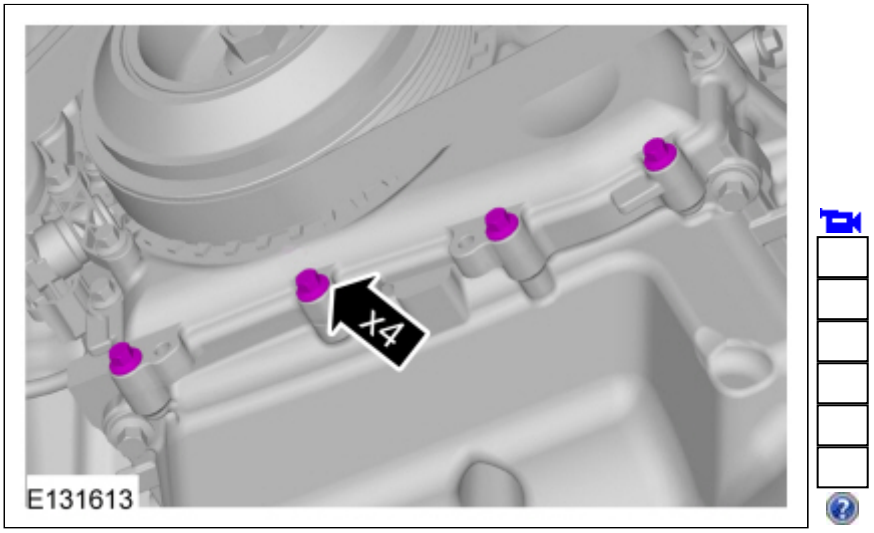


17. Raise the vehicle.

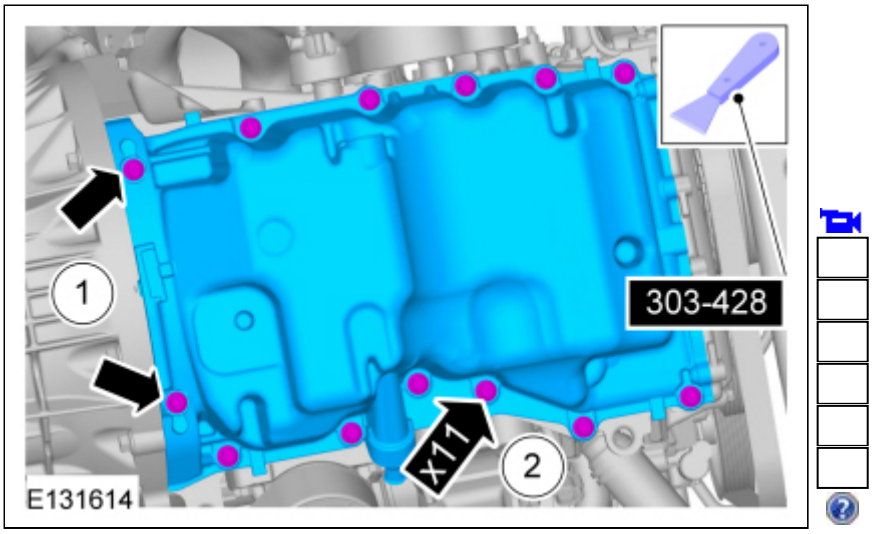
18.



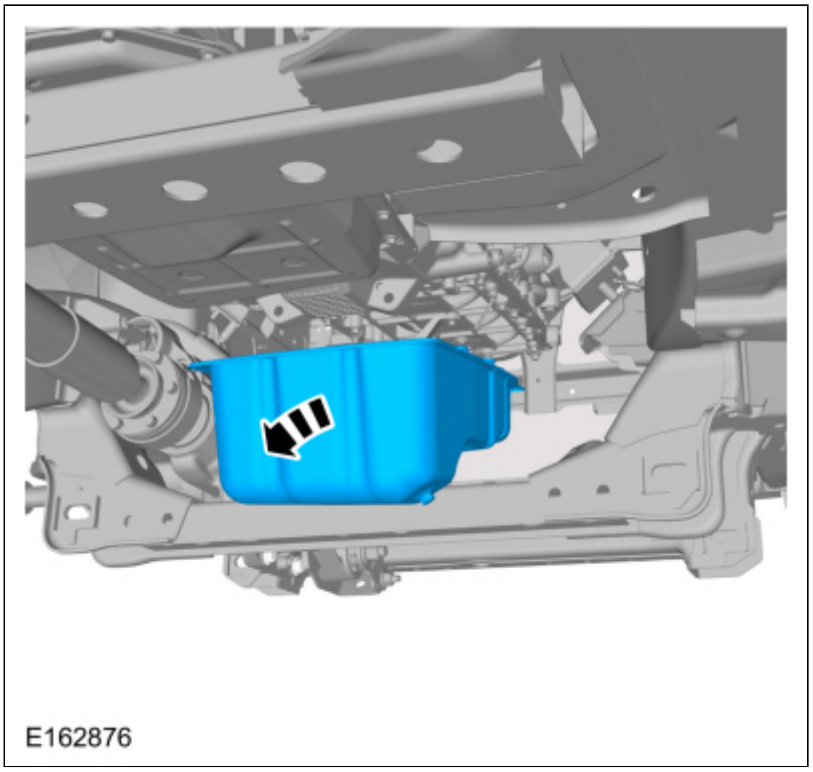
19.



20. Use Special Service Tool: 303-428 Separator, Oil Pan.

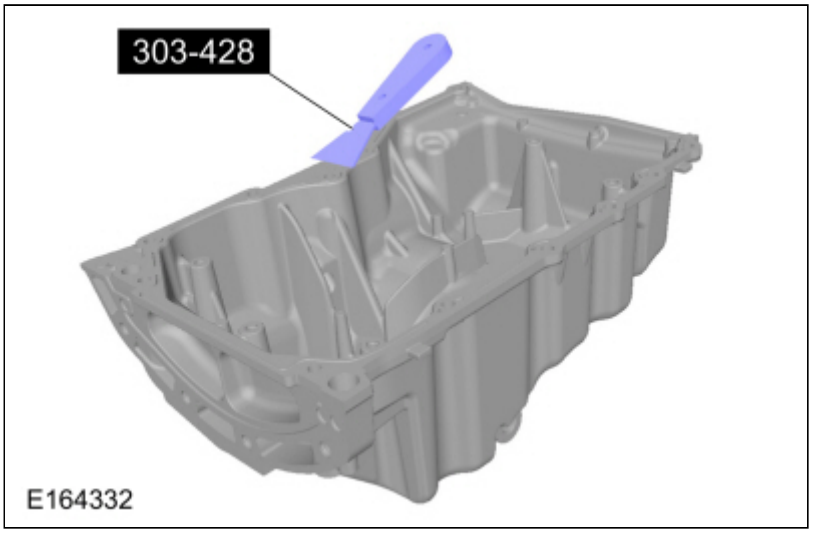


21.



Installation

1. Use Special Service Tool: 303-428 Separator, Oil Pan.

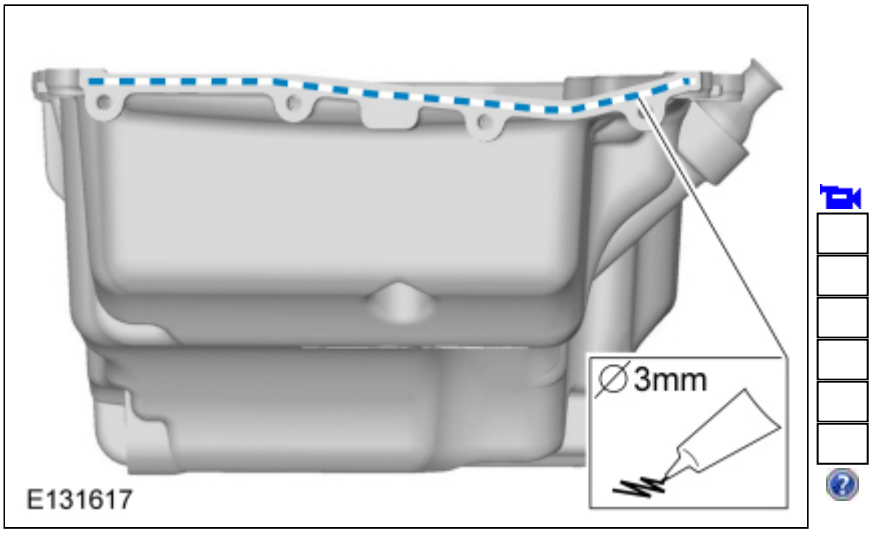


2. **NOTICE: Take extra care not to damage the mating faces.**

   NOTE: *The component must be installed within 5 minutes of applying the sealant.*

   NOTE: *Make sure that the mating faces are clean and free of foreign material.*

   Material: Silicone Sealant (WSE-M4G323-A4)

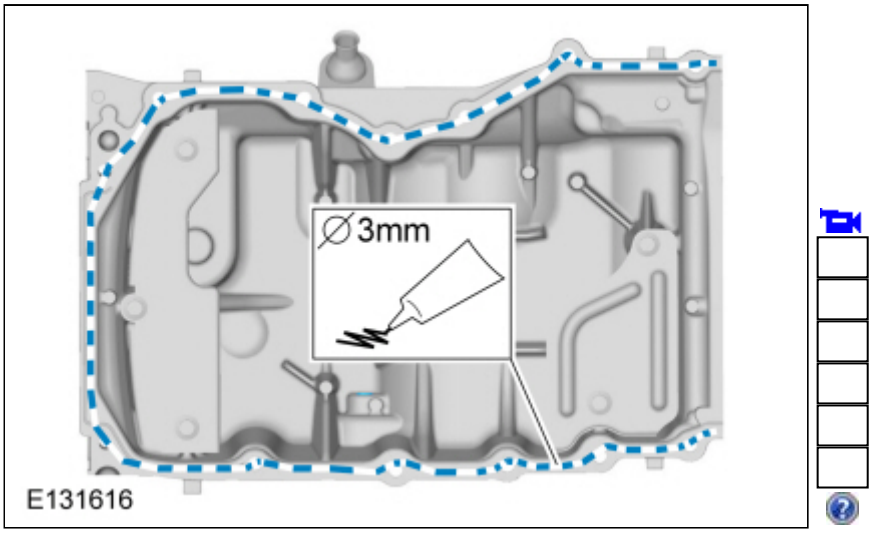


3. **NOTICE: Take extra care not to damage the mating faces. .**

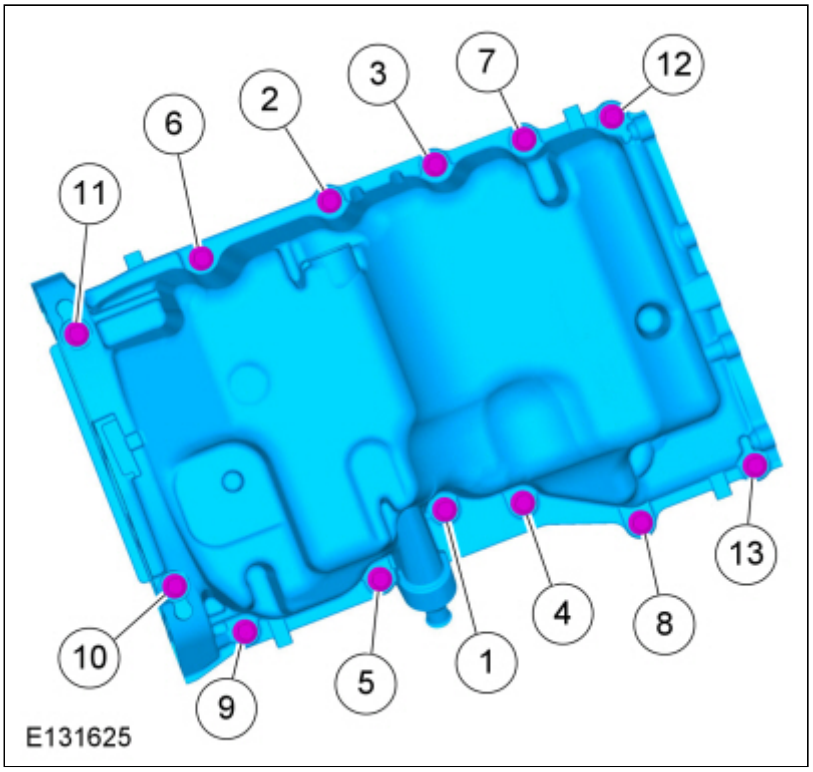
   NOTE: *The component must be installed within 5 minutes of applying the sealant.*

   NOTE: *Make sure that the mating faces are clean and free of foreign material..*

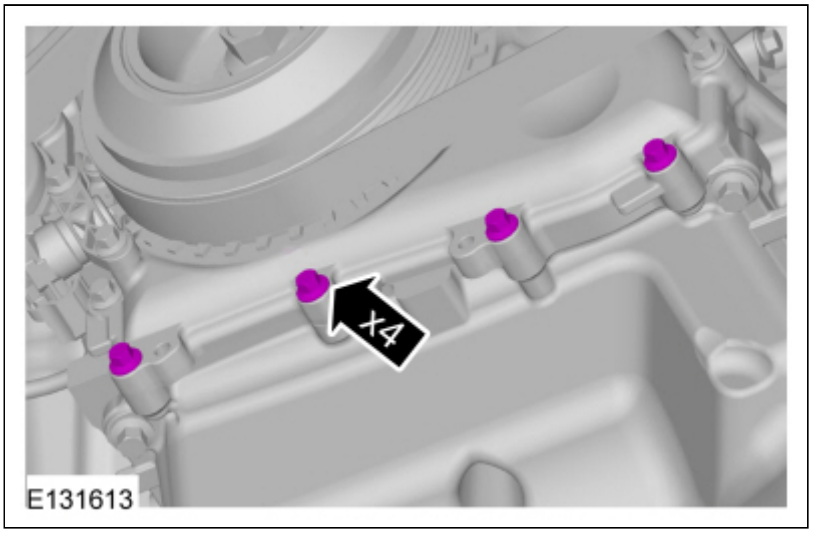
   Material: Silicone Sealant (WSE-M4G323-A4)



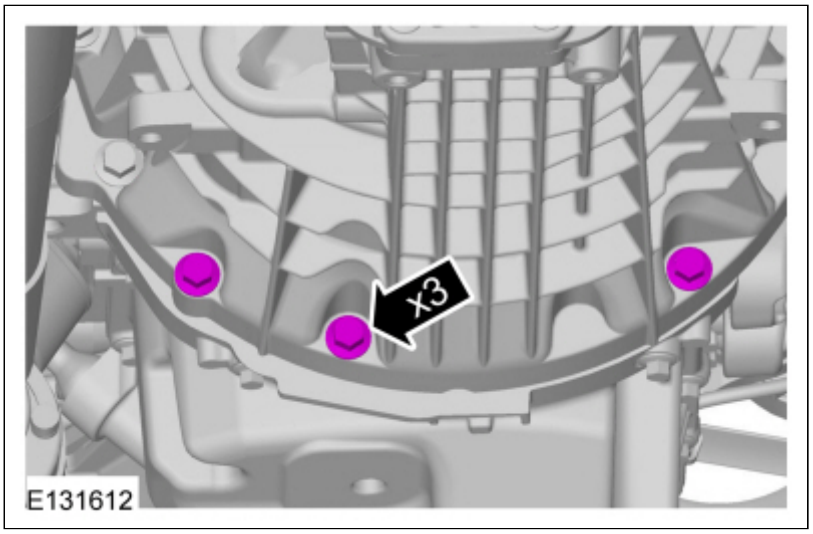
4. *Torque*: 25 Nm



5. *Torque*: 10 Nm

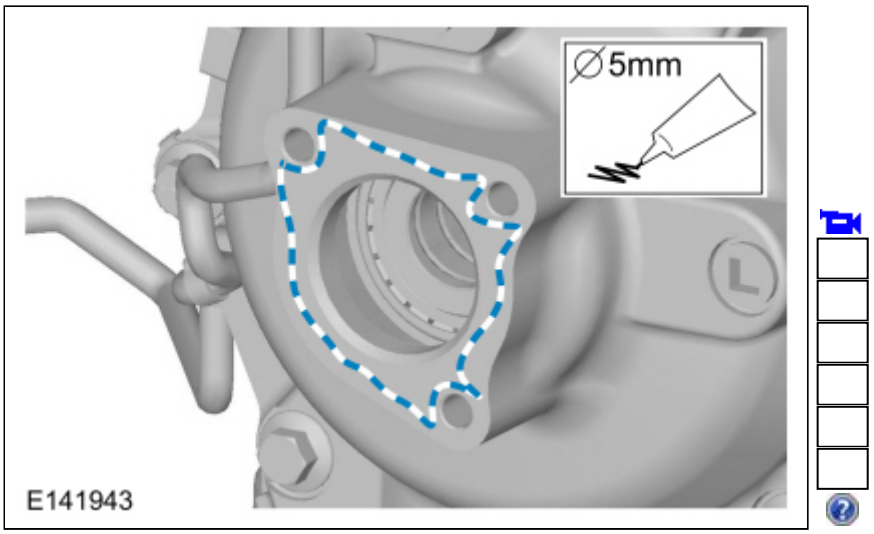


6. *Torque*: 48 Nm

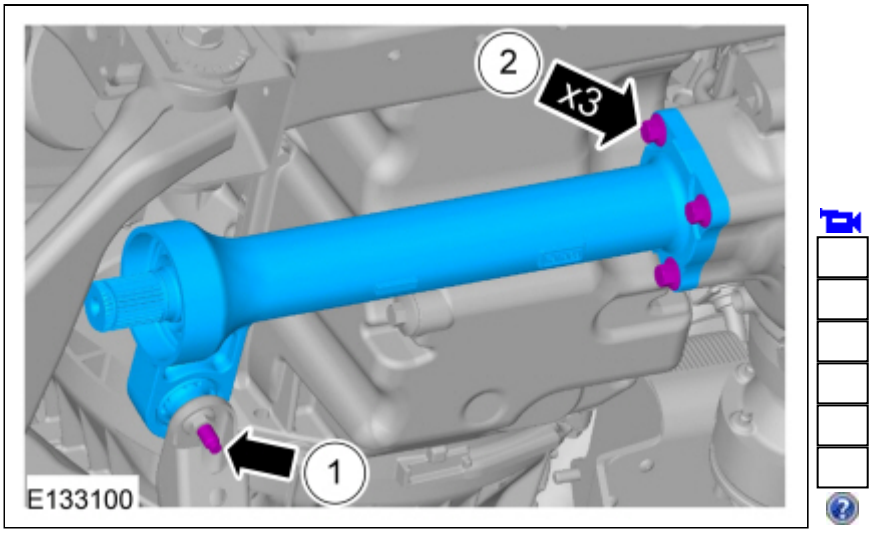


4x4

7. Material: WSS-M4G323-A8



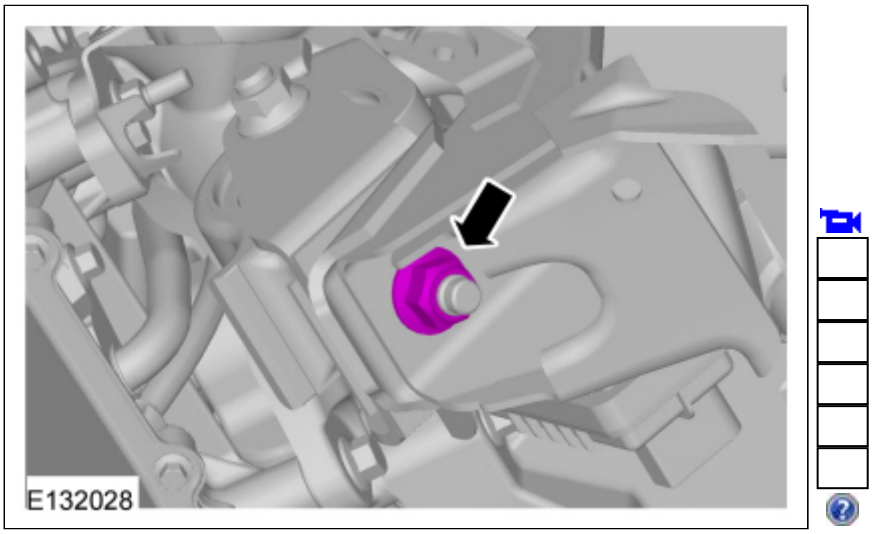
1. *Torque*: 70 Nm
2. *Torque*: 40 Nm



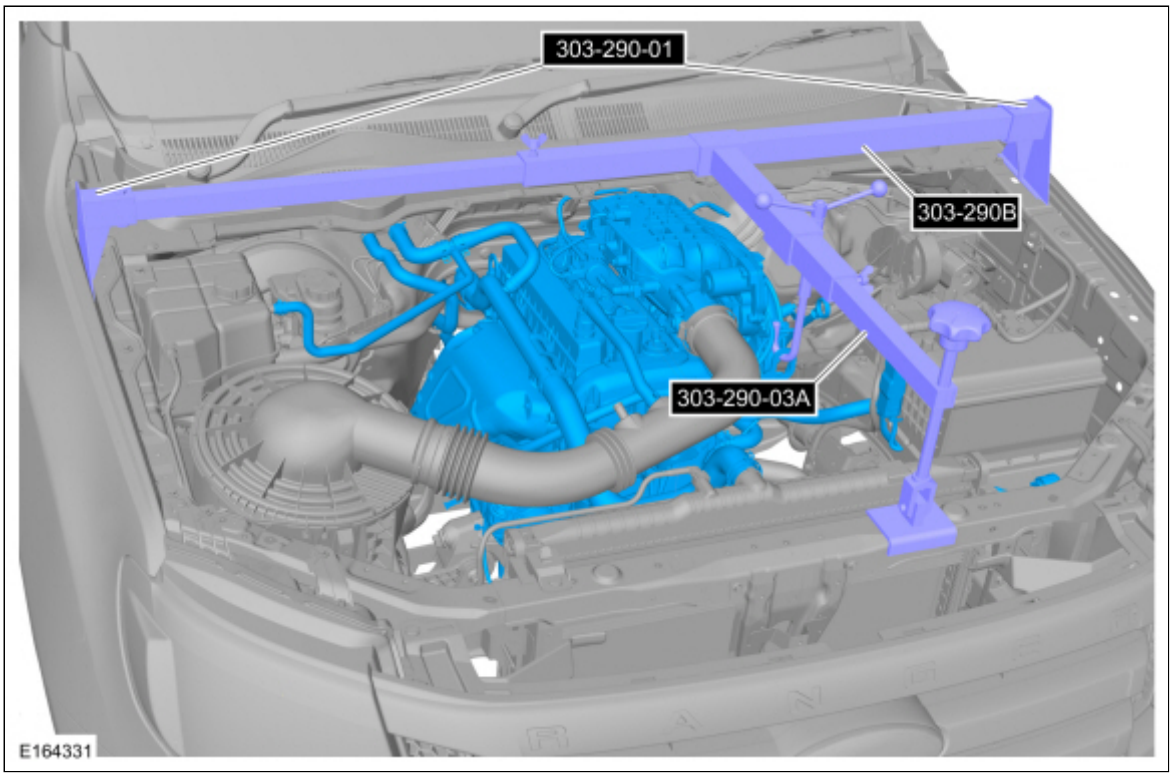
9. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
10. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

All vehicles

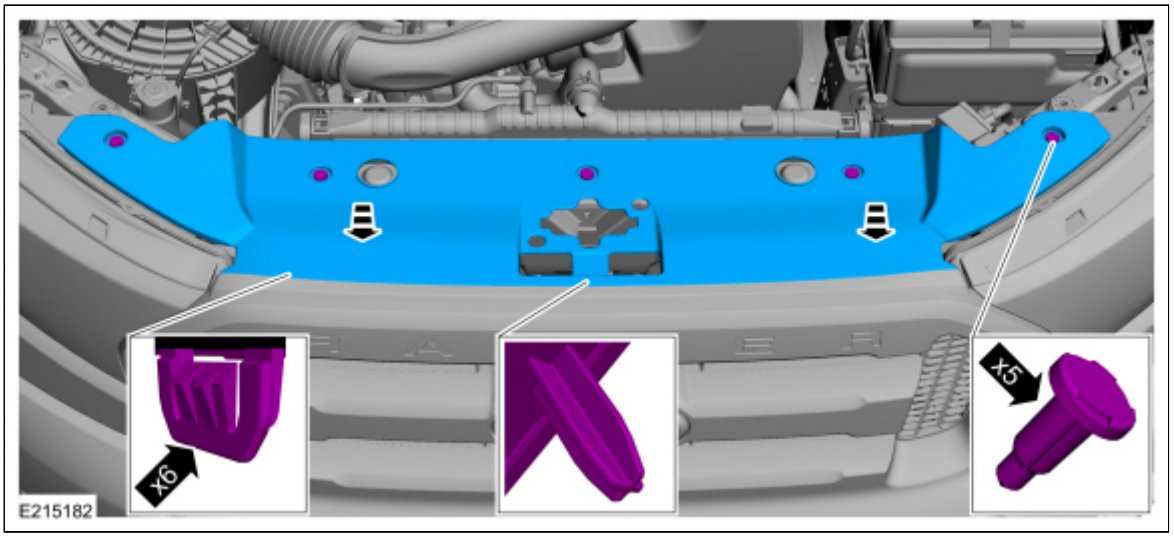
11. *Torque*: 80 Nm



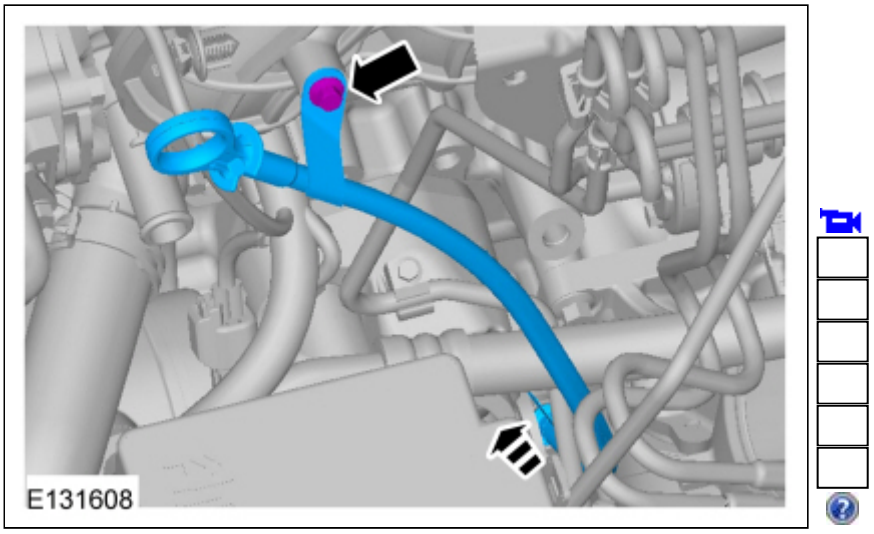
12. Lower the vehicle.
13. Remove Special Service Tool: 303-290B Support Bar, Engine. , 303-290-01 Adapter for 303-290A. , 303-290-03A Adapter for 303-290A.



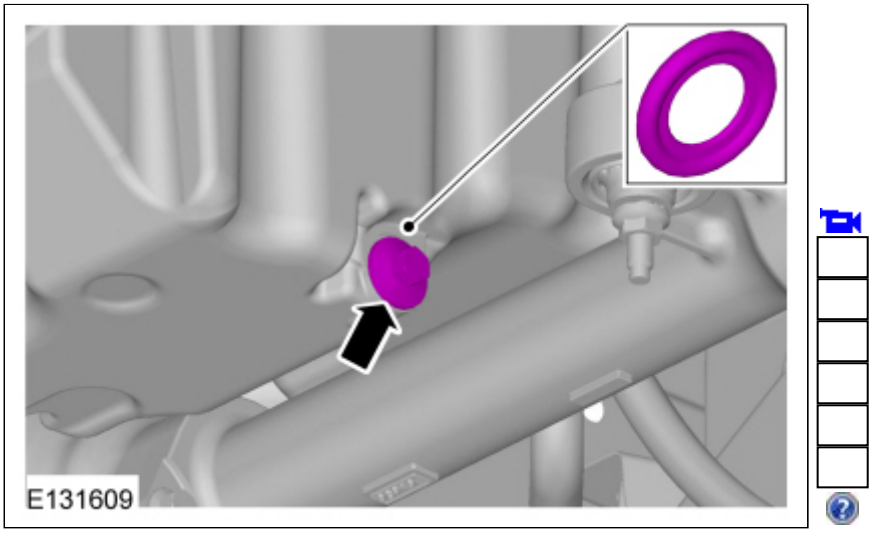
14. Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
15.



16. Raise the vehicle.
17. *Torque*: 10 Nm

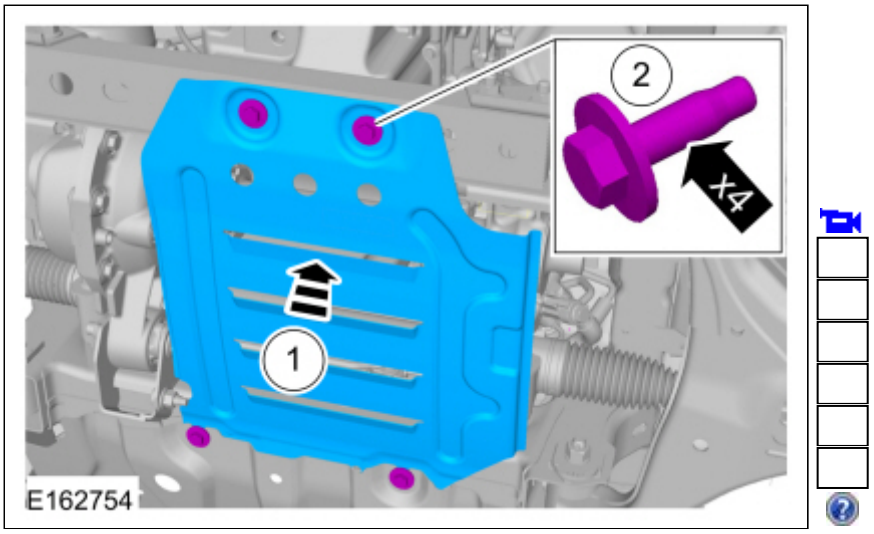


18. *Torque*: 28 Nm



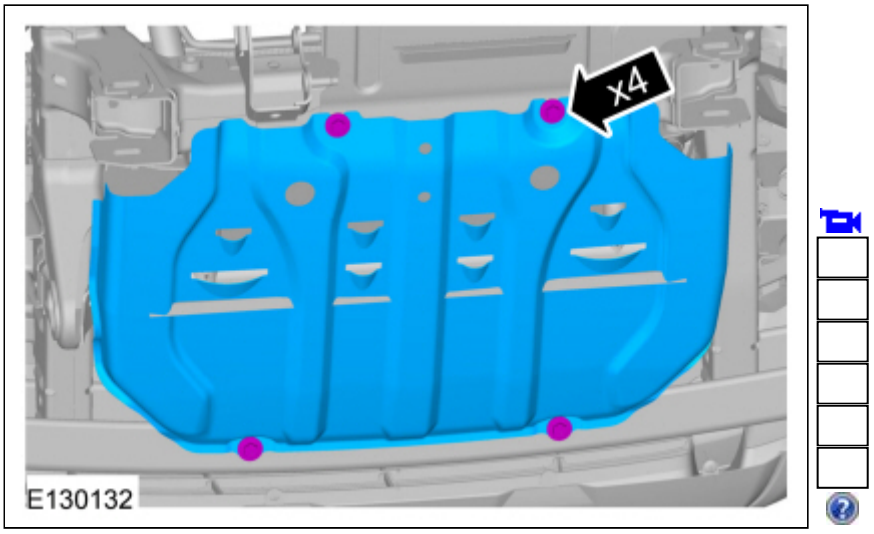
4x4

19. *Torque*: 30 Nm



All vehicles

20. *Torque*: 30 Nm



21. Install the front wheels.
    Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

22. Lower the vehicle.

23. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

24. Fill the oil pan with clean engine oil.
    Refer to: Specifications (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).

25. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

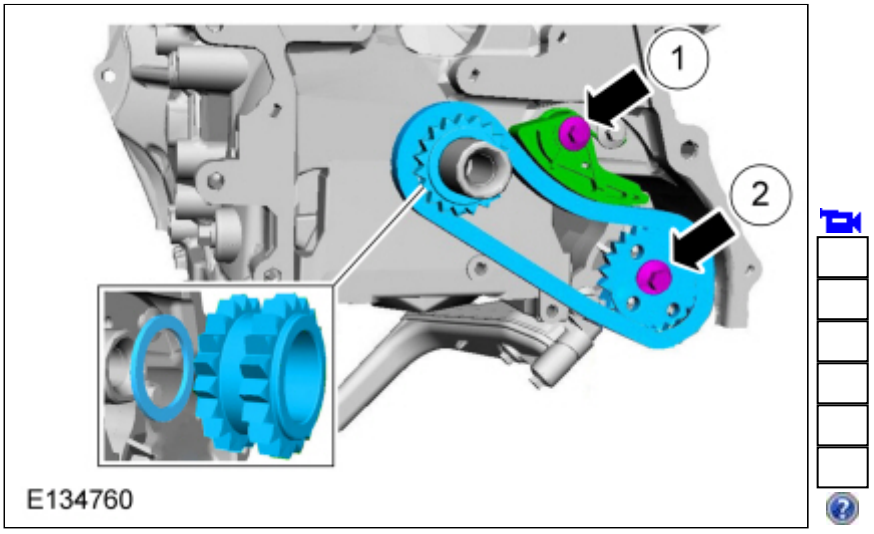
Oil Pump

Base Part Number: 6621

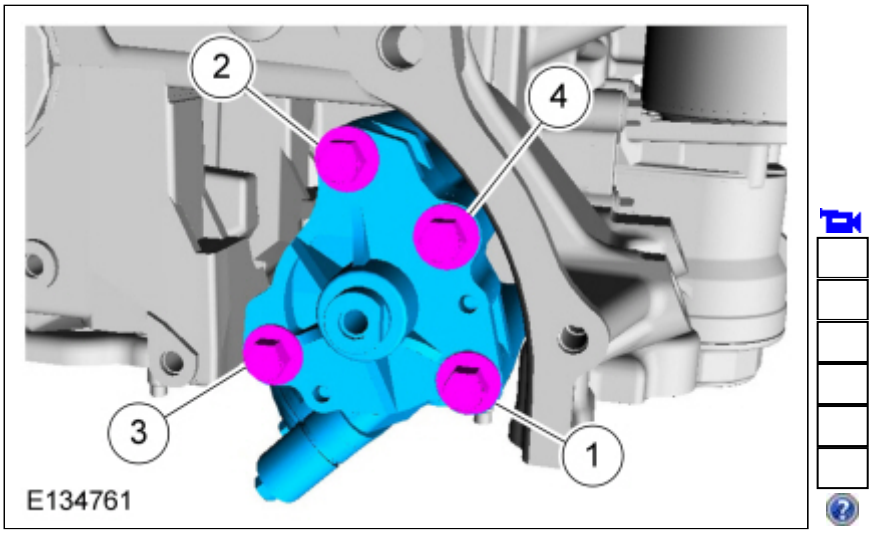
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Timing Chain (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. Refer to: Oil Pan (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. **NOTICE: Make sure that a new friction washer is installed.**
    1. *Torque*: 10 Nm
    2. *Torque*: 25 Nm



4. Remove the 2 bolts and the oil pump screen and pickup tube.
   Torque: 10 Nm
5. *Torque*:
   Stage 1: 10 Nm
   Stage 2: 20 Nm



Installation

1. To install, reverse removal procedure.

Copyright © 2016 Ford Motor Company

Valve Cover

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

   WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

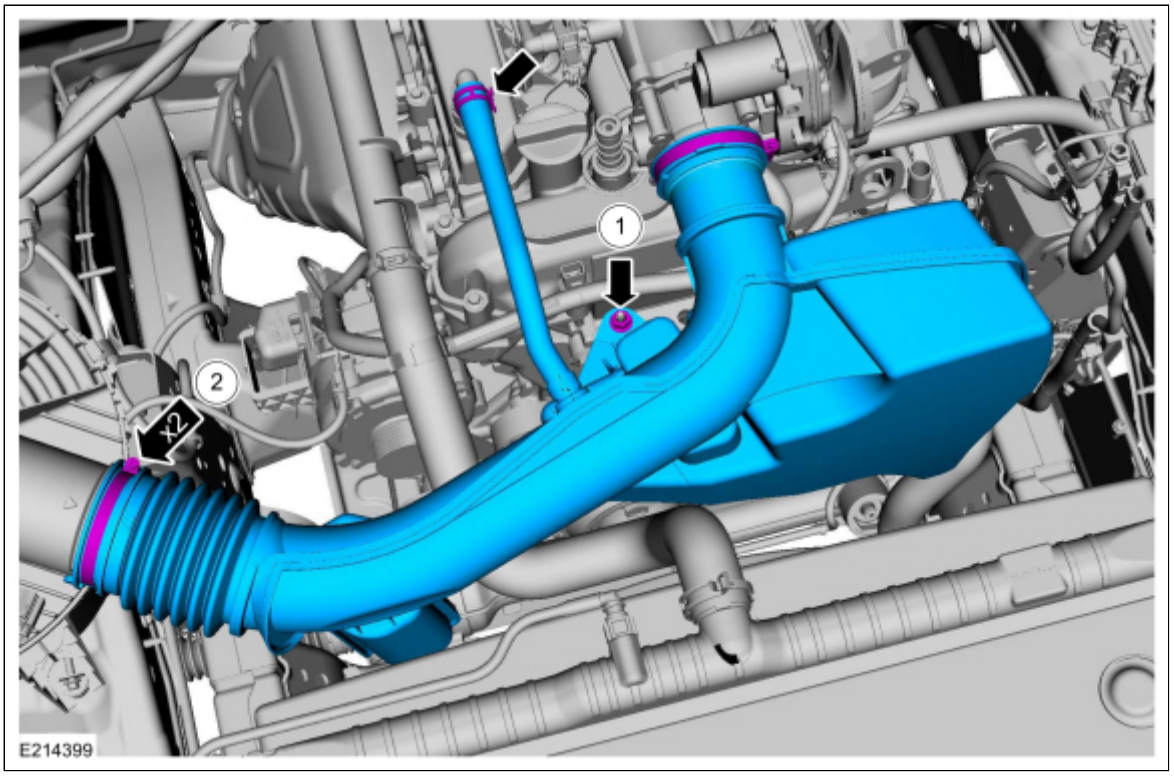
   WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

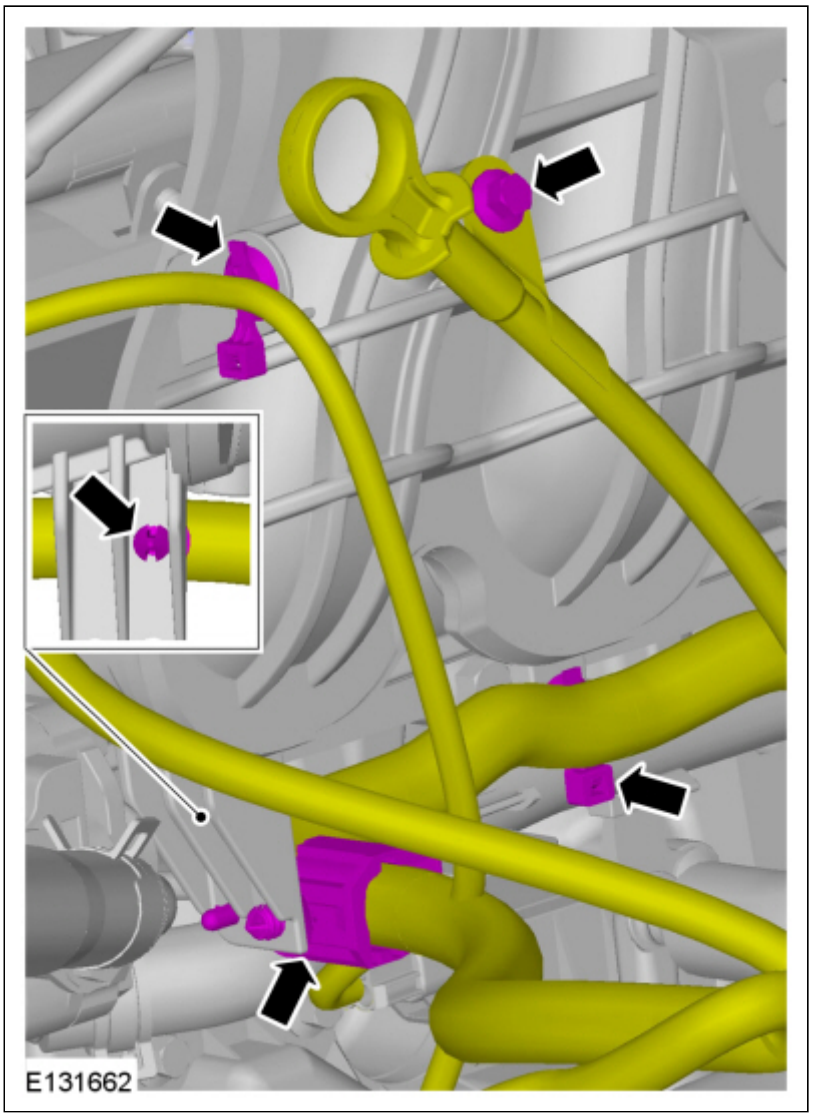
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

3. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

4. *Torque*: 11 Nm

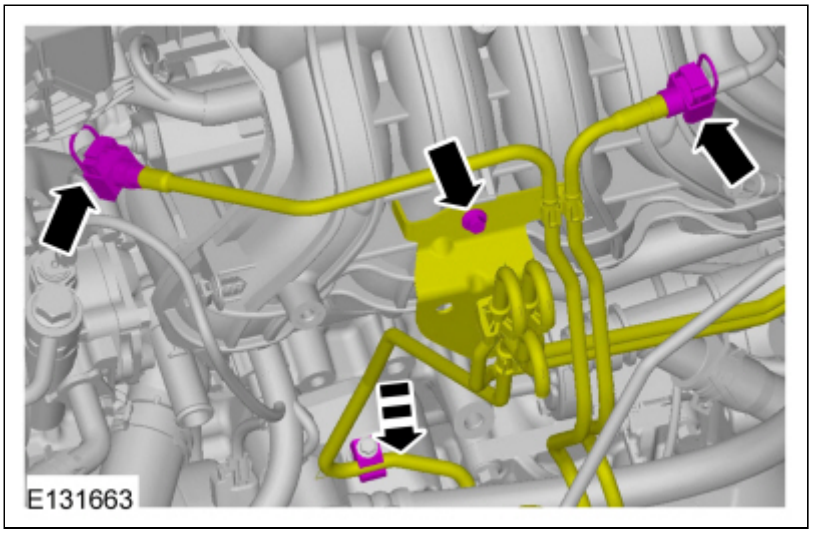


5. *Torque*: 10 Nm

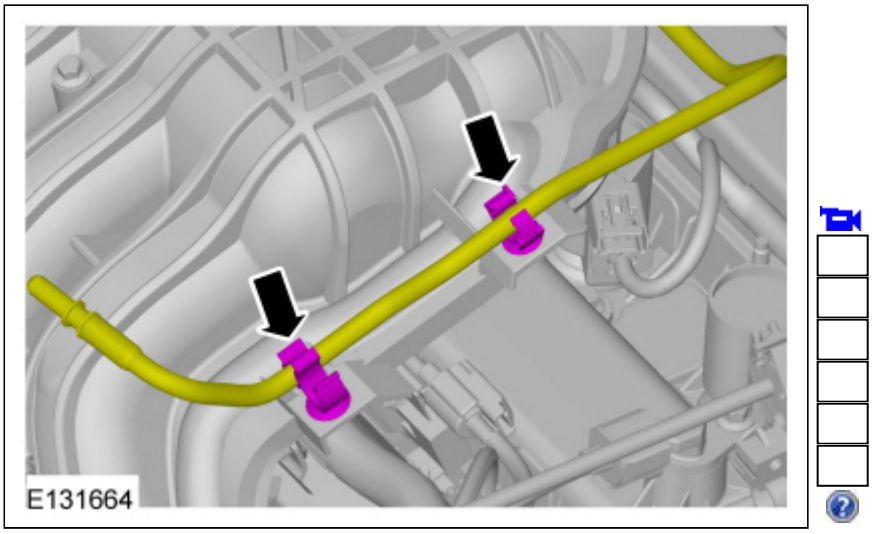


6. **NOTE:** *Securely strap the fuel and breather tubes.*

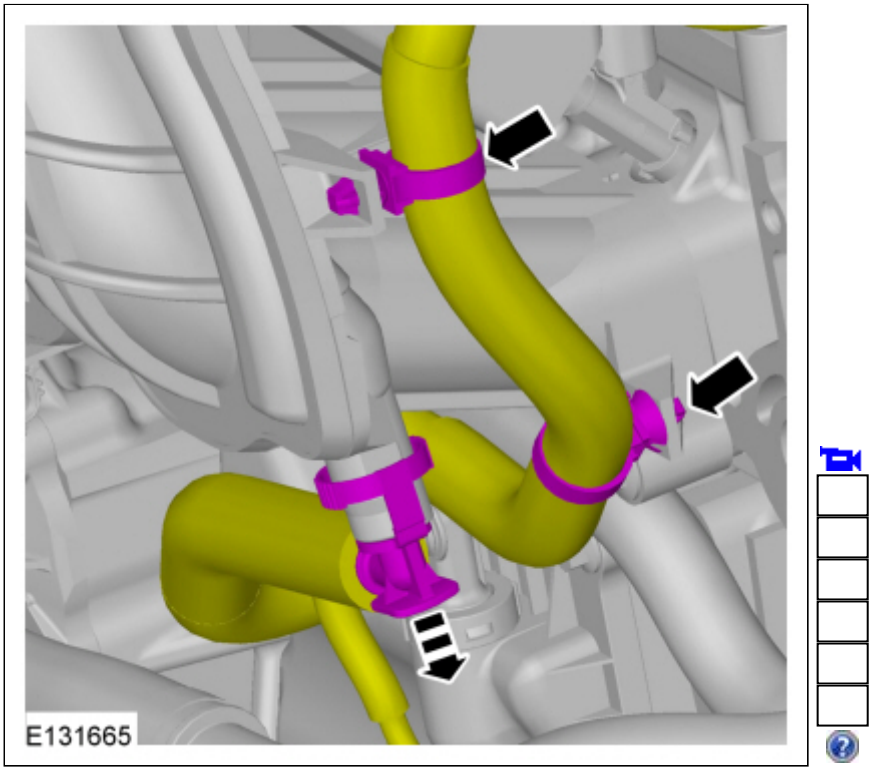
   Torque: 8 Nm



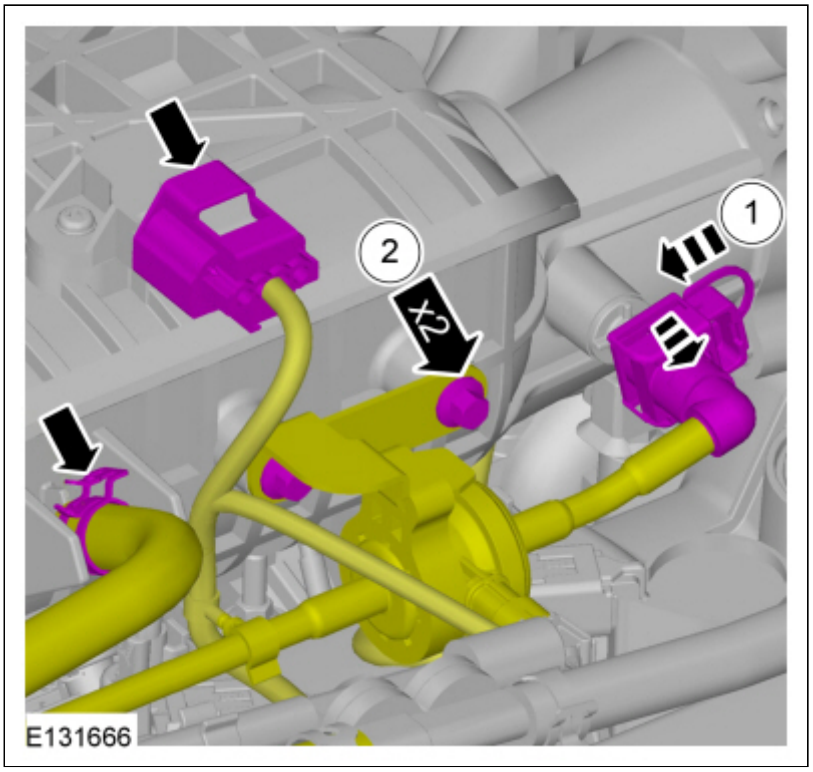
7.



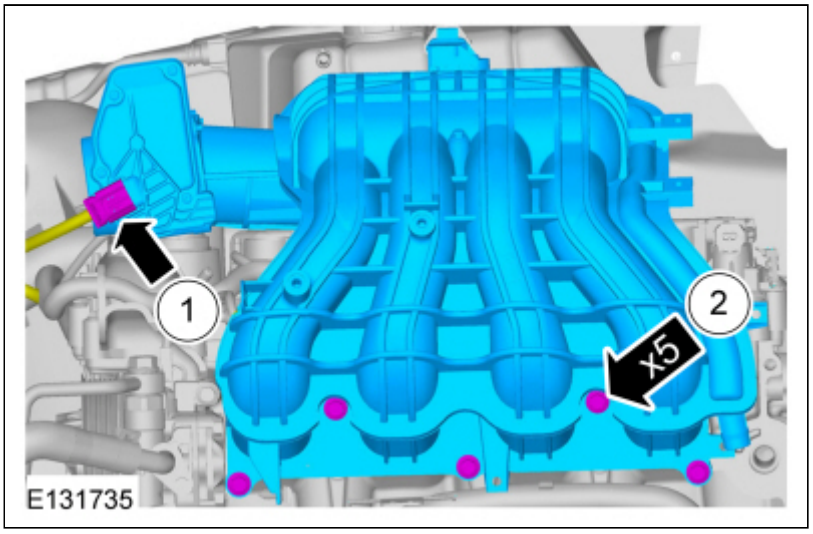
8.



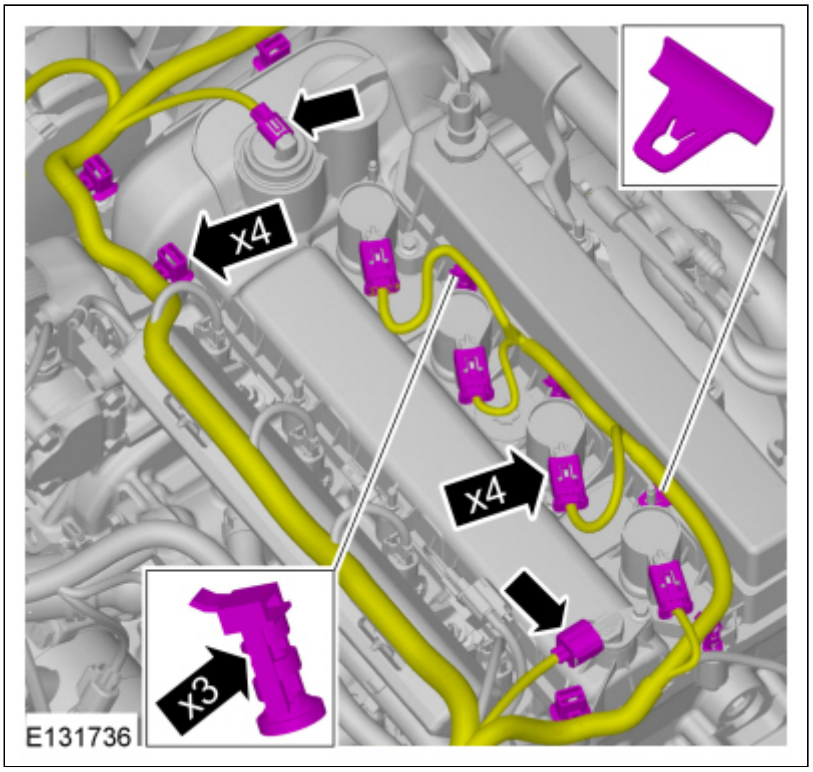
9. *Torque*: 11 Nm



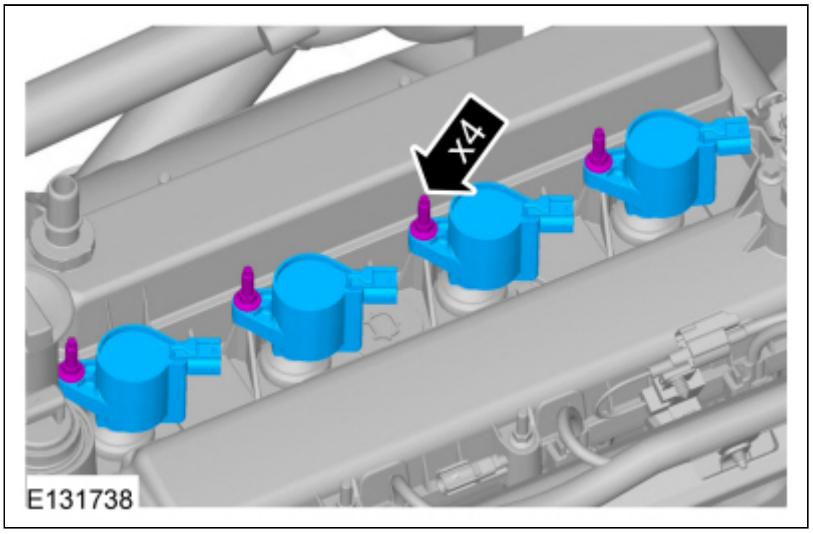
10. *Torque*: 19 Nm



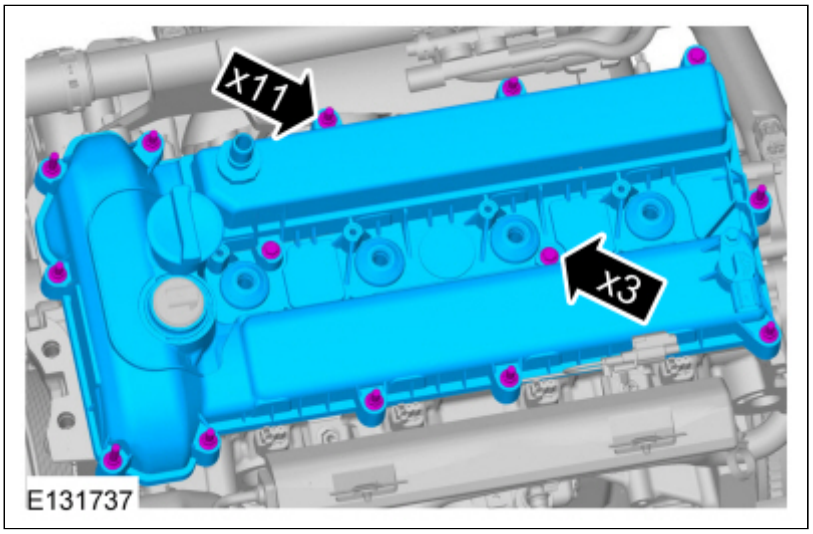
11.



12. *Torque*: 8 Nm



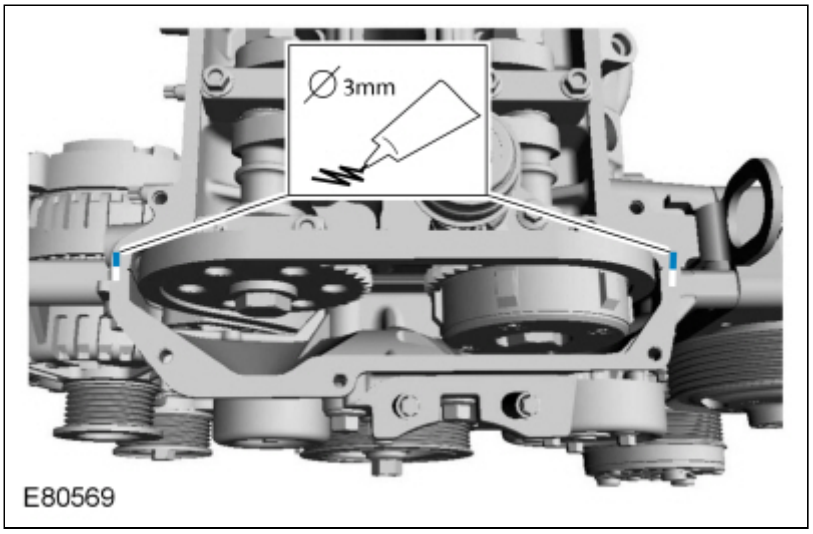
13.



Installation

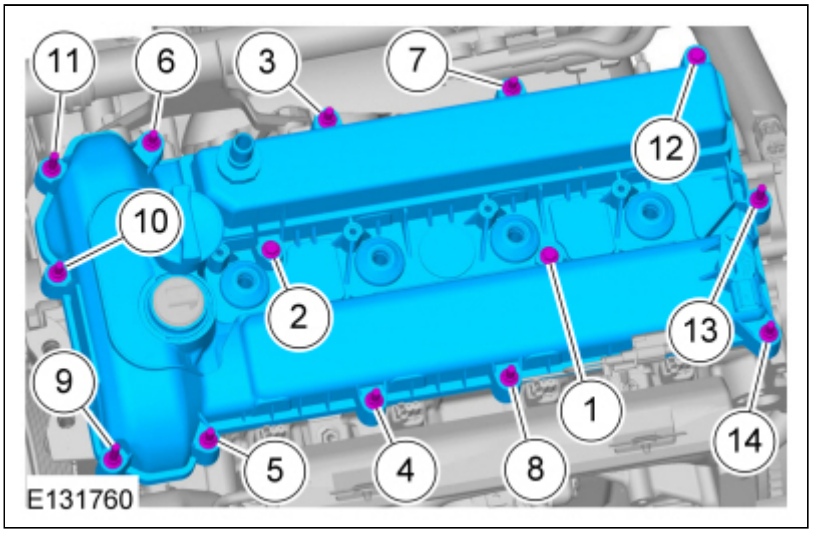
1. **NOTE:** *The valve cover must be secured within 4 minutes of silicone gasket application. If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep.*

   Material: Silicone Sealant (WSE-M4G323-A4)



2. **NOTE:** *The gasket is to be reused unless damaged.*

   Torque: 10 Nm

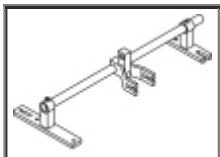
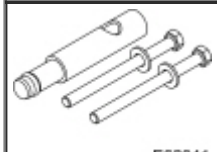
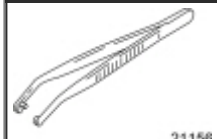
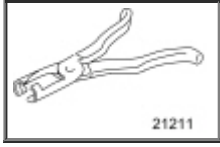


3. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

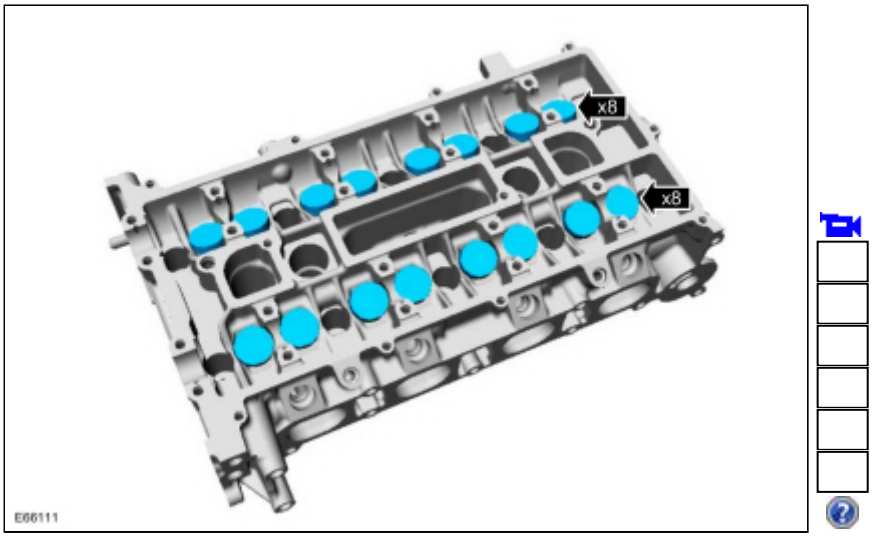
Valve Stem Seals

Special Tool(s) / General Equipment

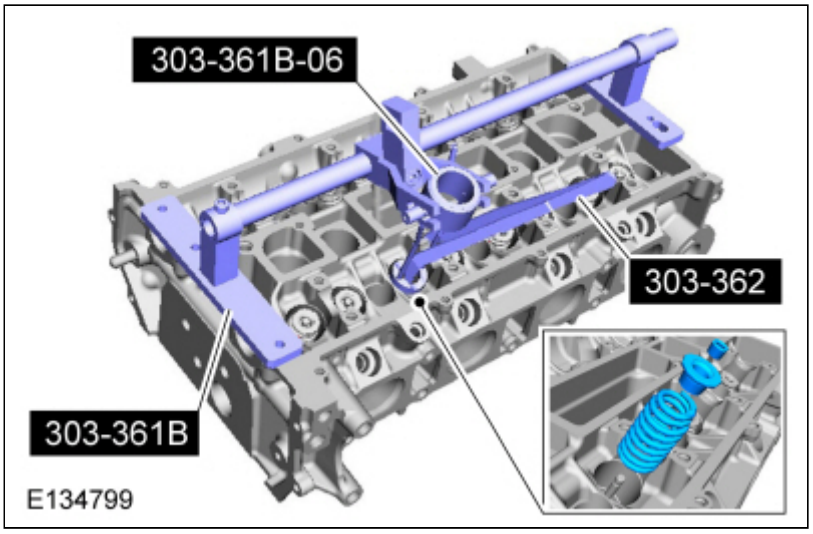
 E62757	303-361B Compressor, Valve Spring
 E62041	303-361B-06 Adapter for 303-361B
 21156	303-362 Installer, Valve Stem Collets
 21211	303-508 Pliers, Valve Stem Seal

Removal

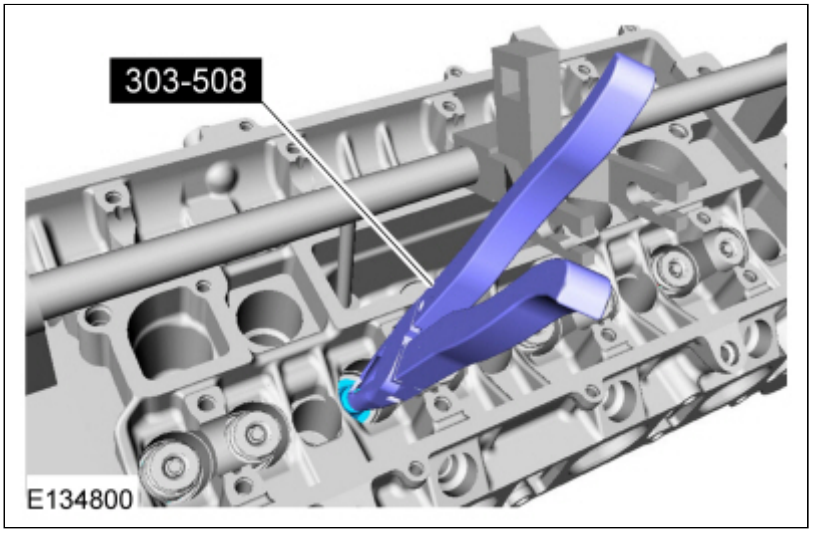
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Camshafts (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. 

3. Use Special Service Tool: 303-361B Compressor, Valve Spring. , 303-361B-06 Adapter for 303-361B. , 303-362 Installer, Valve Stem Collets.



4. Use Special Service Tool: 303-508 Pliers, Valve Stem Seal.



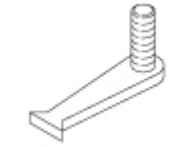
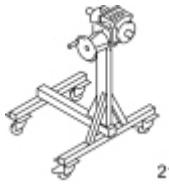
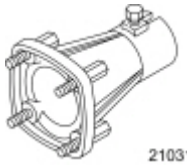
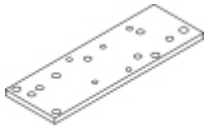
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

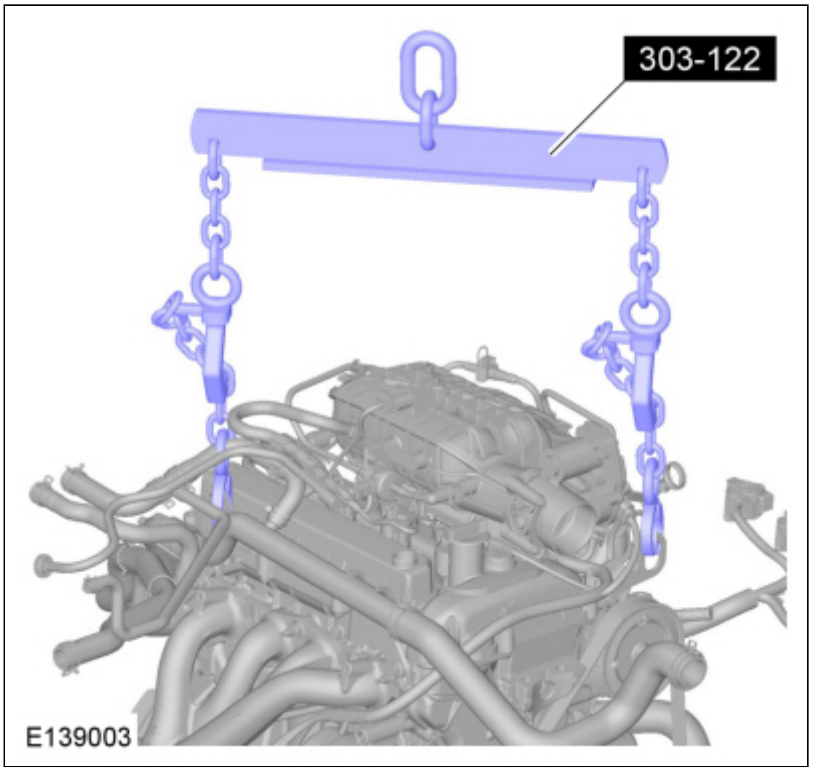
Engine Accessories

Special Tool(s) / General Equipment

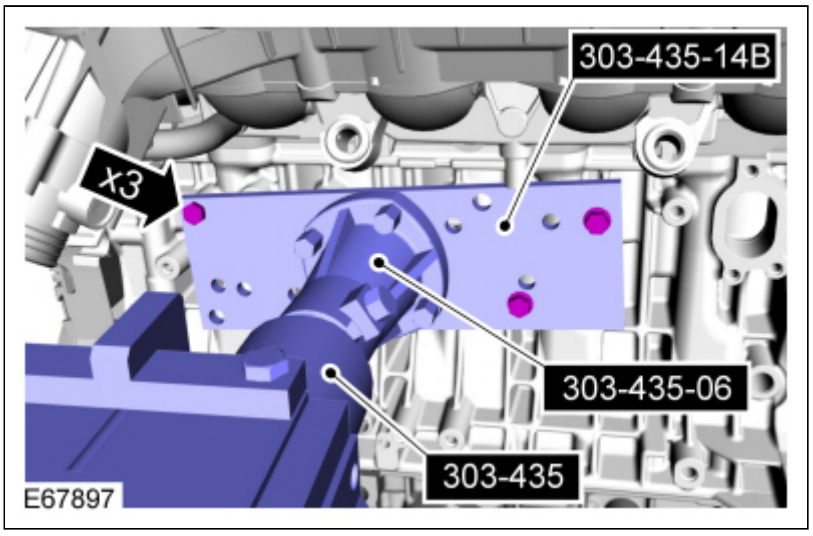
 21068A	303-122 Lifting Bracket, Engine
 21135	303-254 Locking Tool, Flywheel
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E62805	303-435-14B Mounting Plate for 303-435-06
Floor Crane	

All vehicles

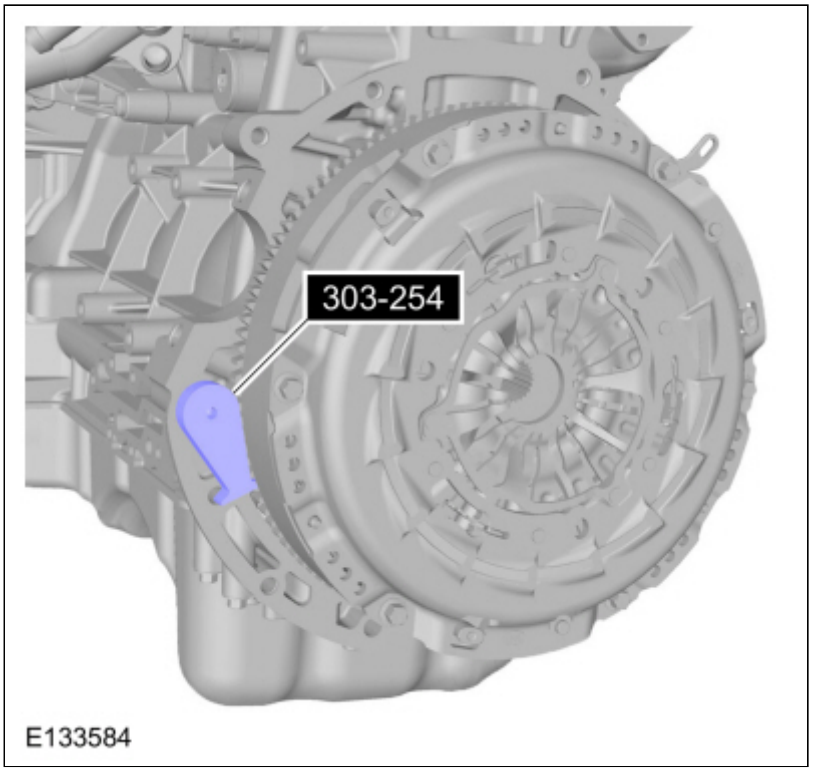
1. Use Special Service Tool: 303-122 Lifting Bracket, Engine.
   Use the General Equipment: Floor Crane



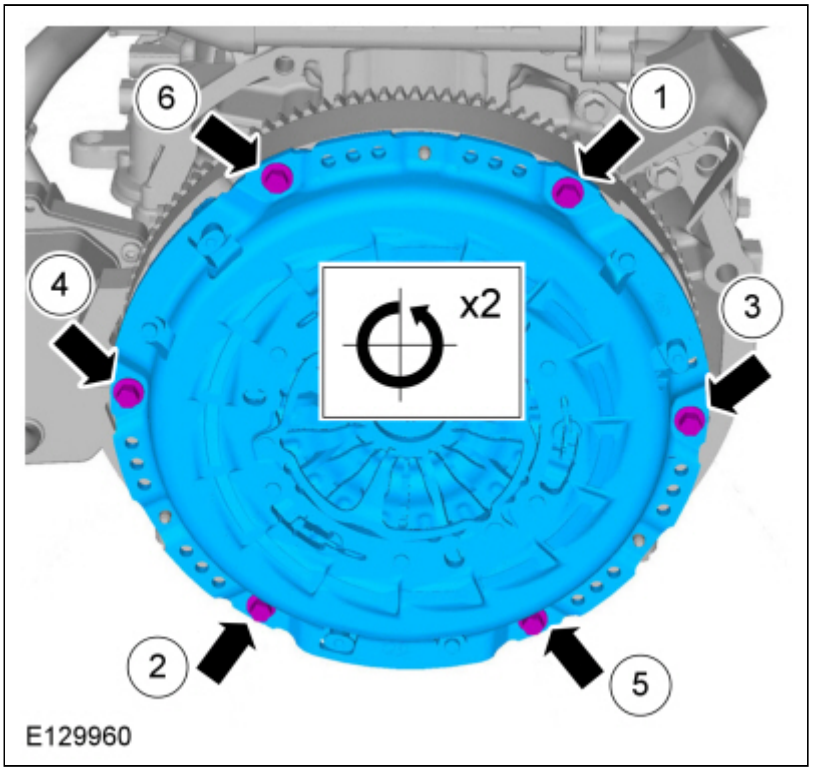
2. Use Special Service Tool: 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435. , 303-435-14B Mounting Plate for 303-435-06.



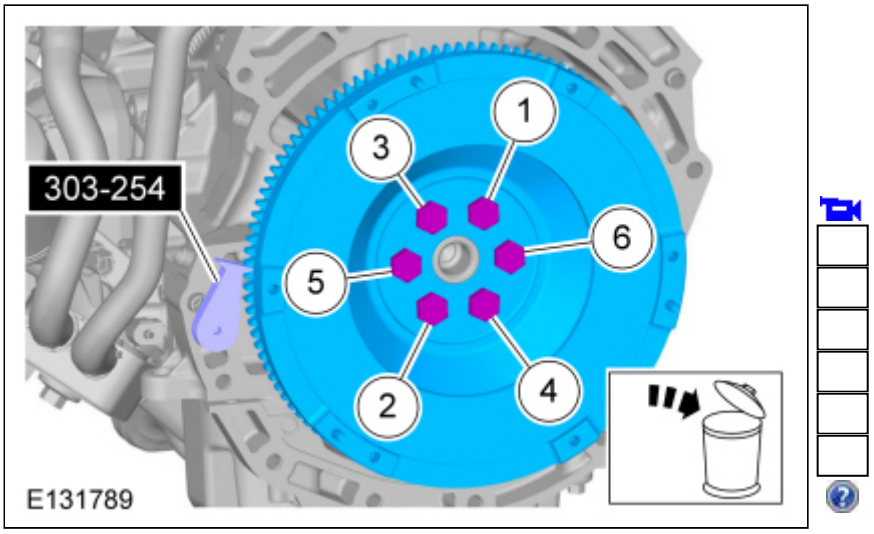
3. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



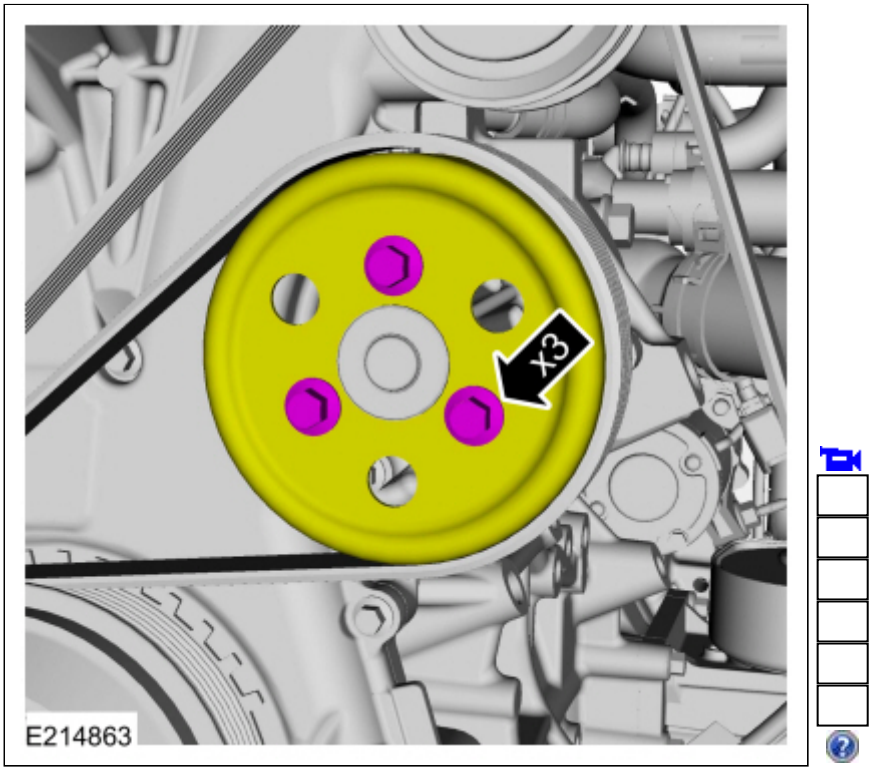
4. **NOTICE: Loosen the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.**



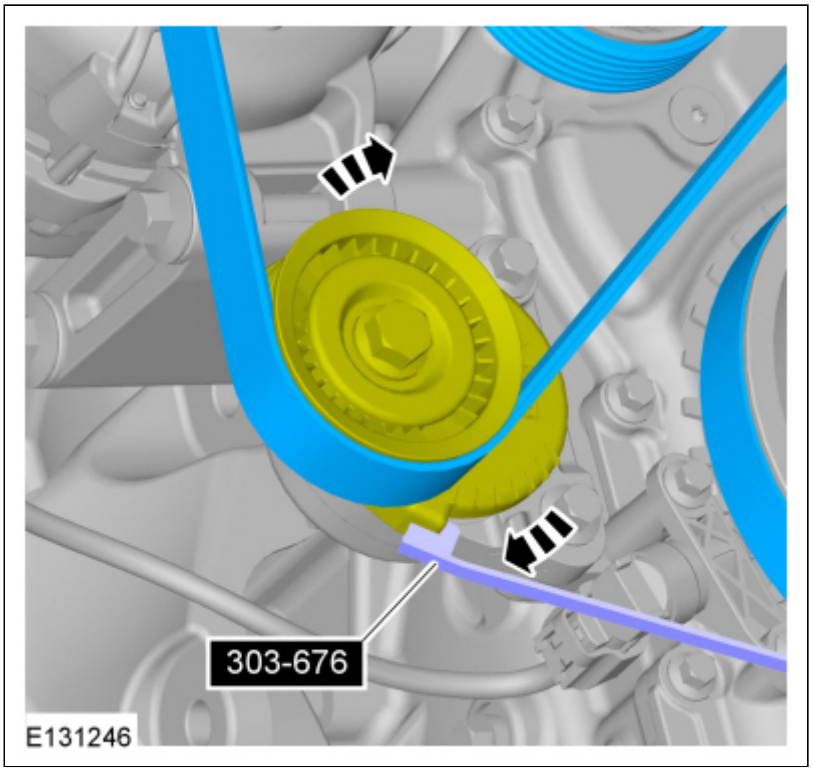
5. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



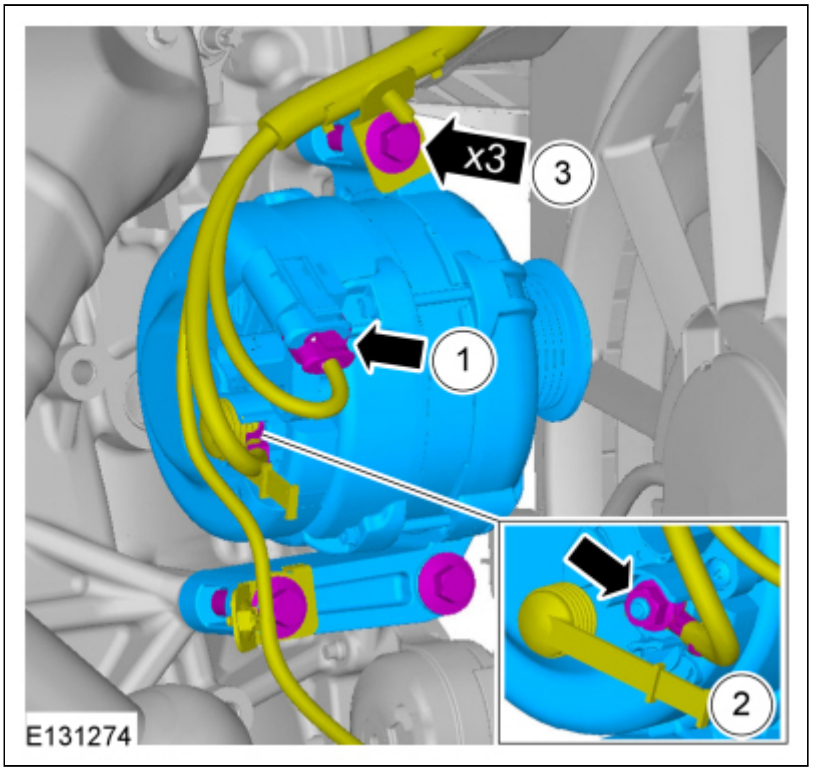
6. At this stage Lossen two turns.



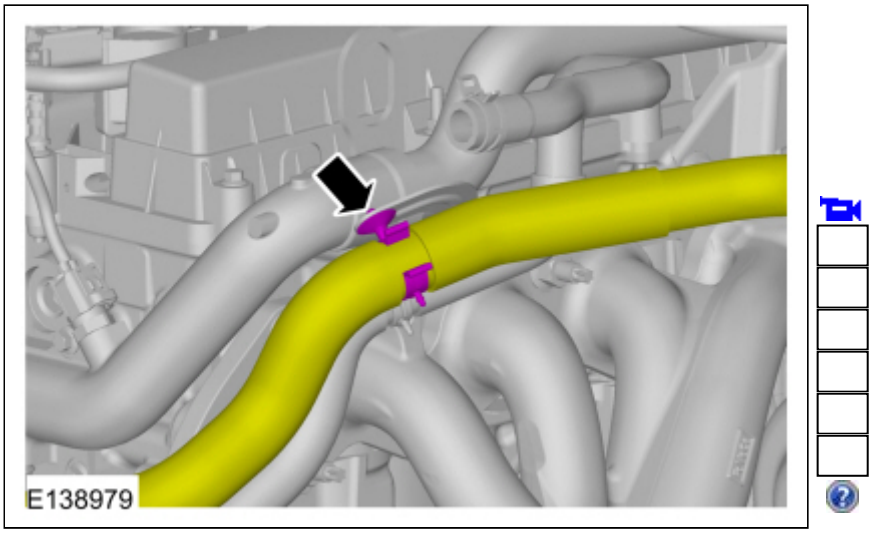
7. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.



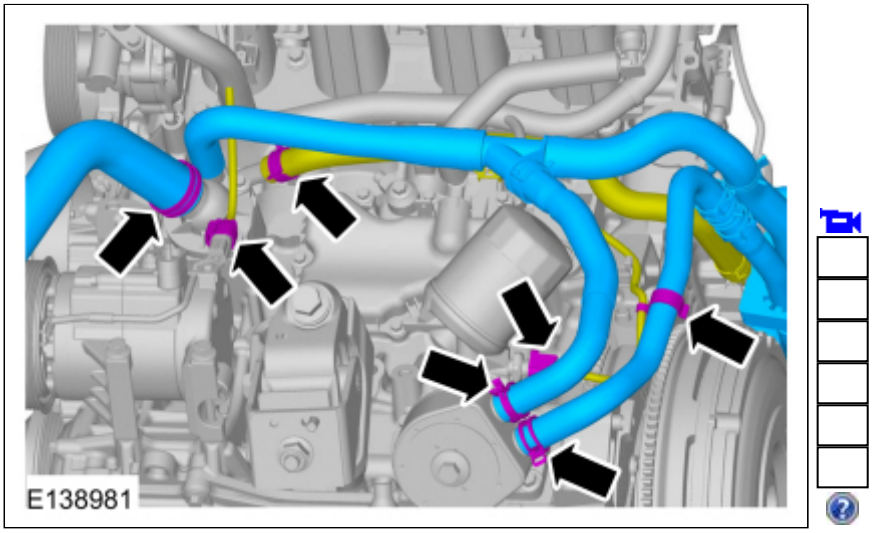
8. **NOTICE: Take extra care not to damage the wiring harnesses.**



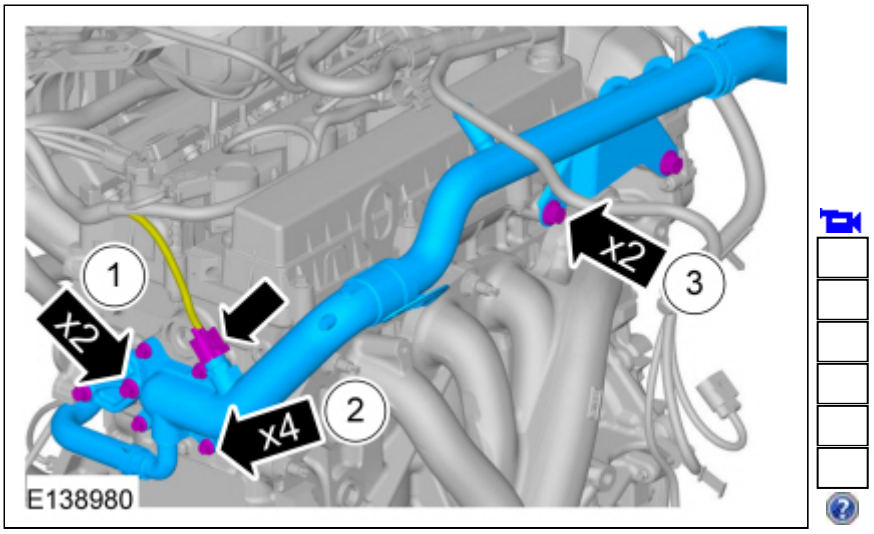
9.



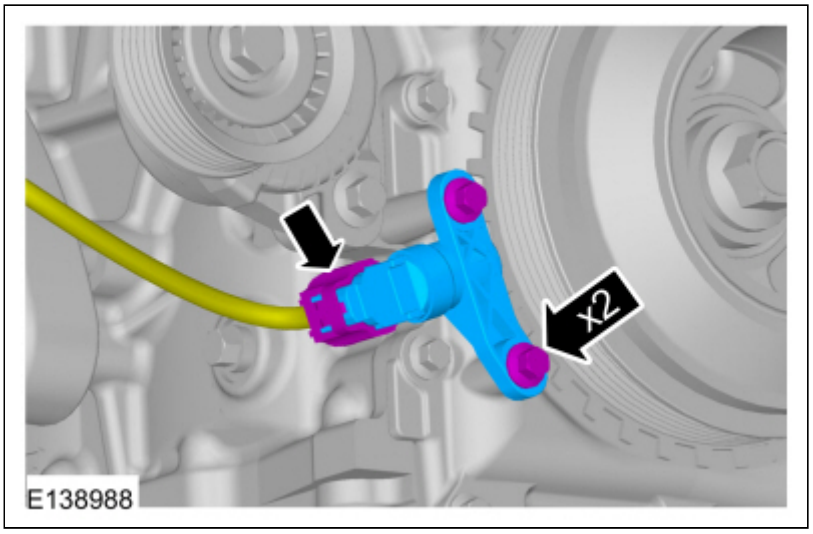
10. **NOTE:** *Make sure that the components are installed to the position noted before removal.*



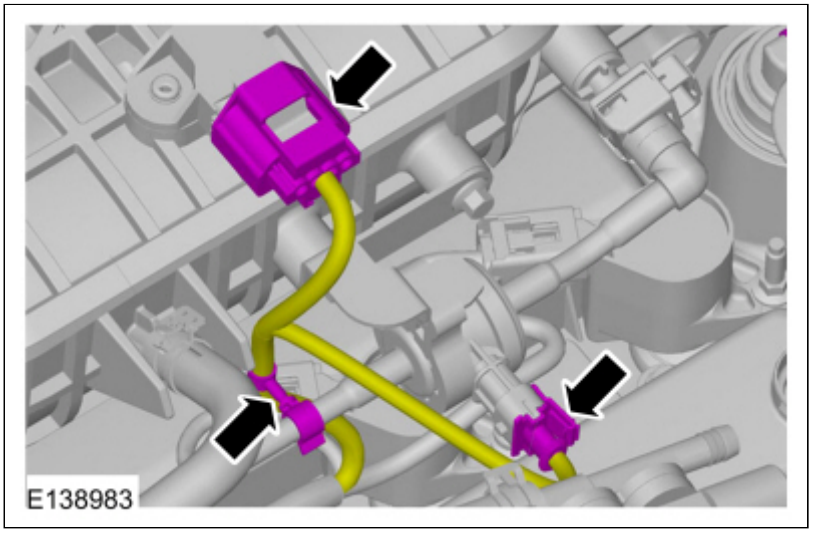
11. **NOTE:** *Make sure that the components are installed to the position noted before removal.*



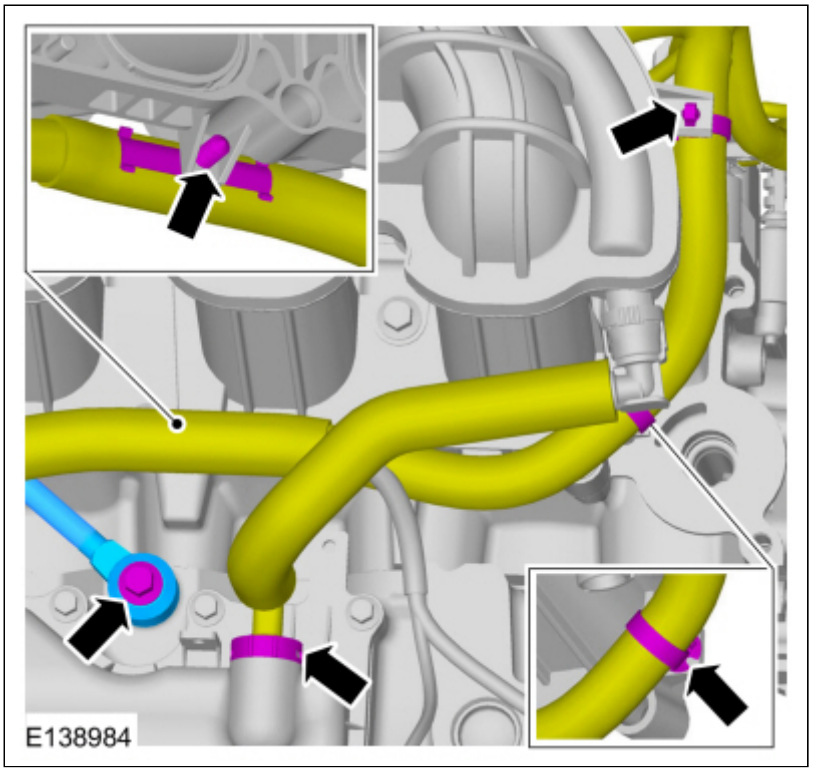
12.



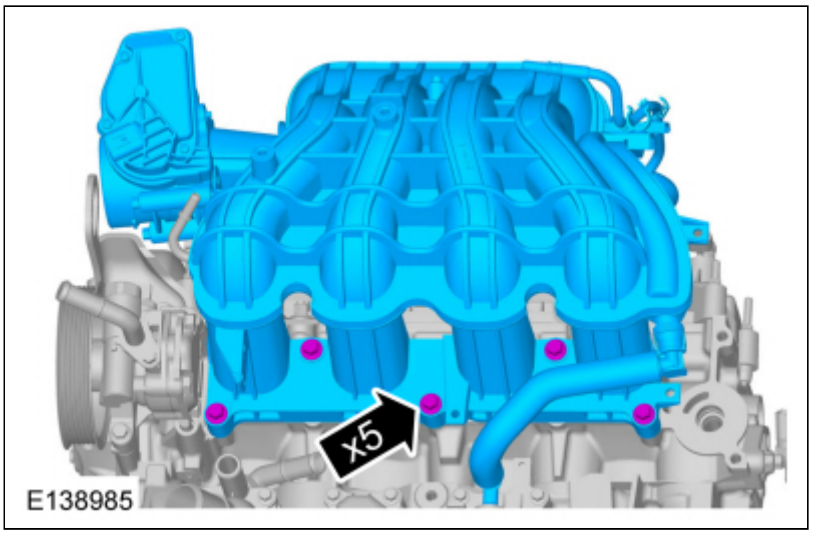
13.



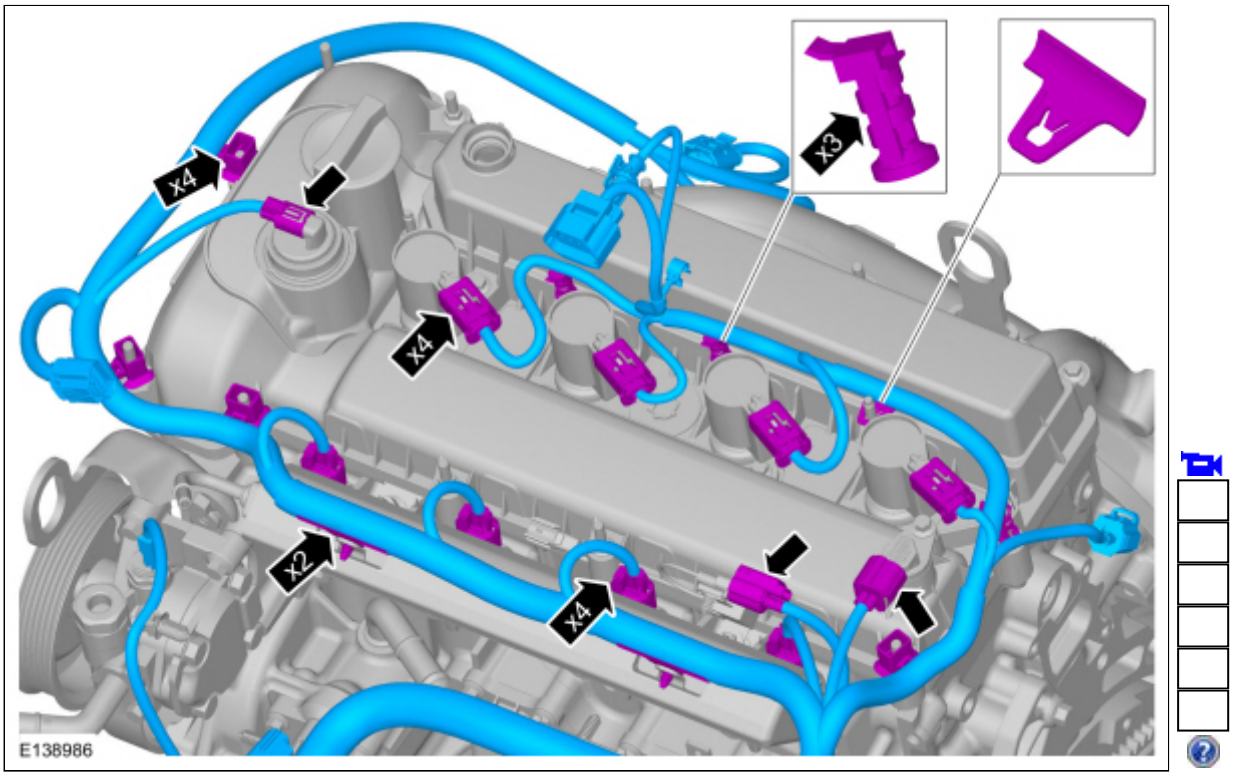
14.



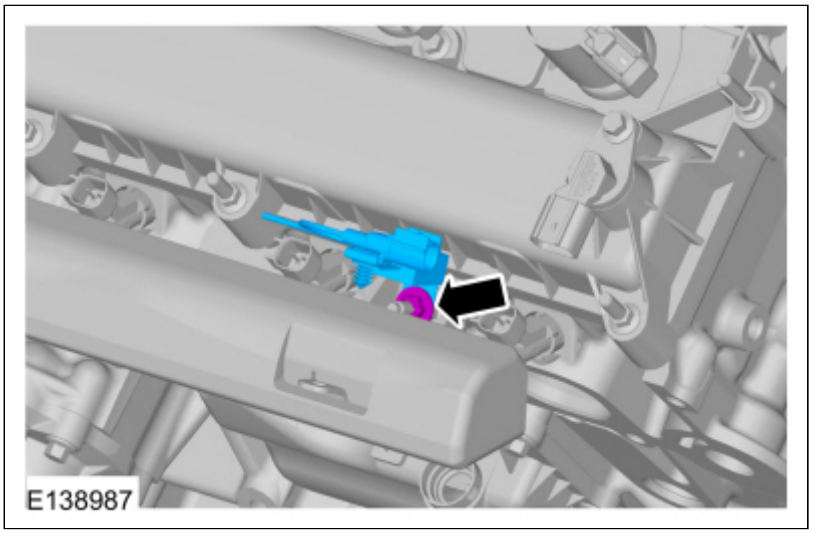
15.



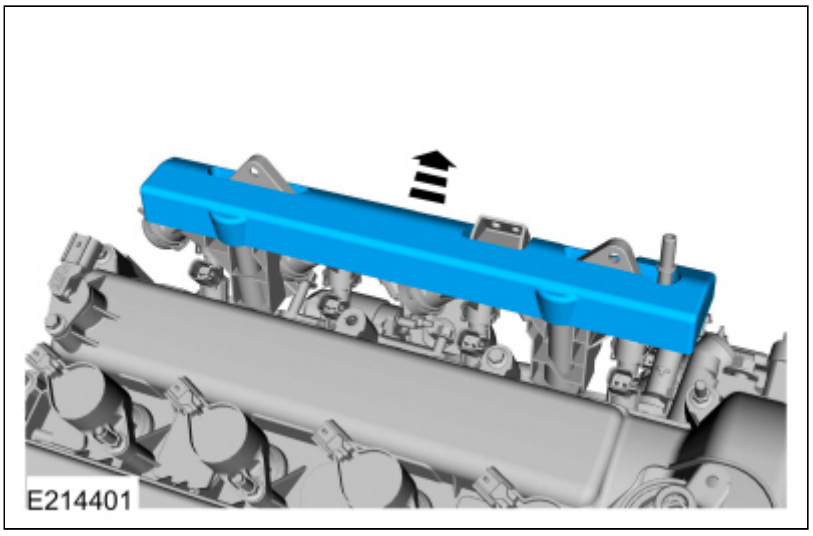
16.



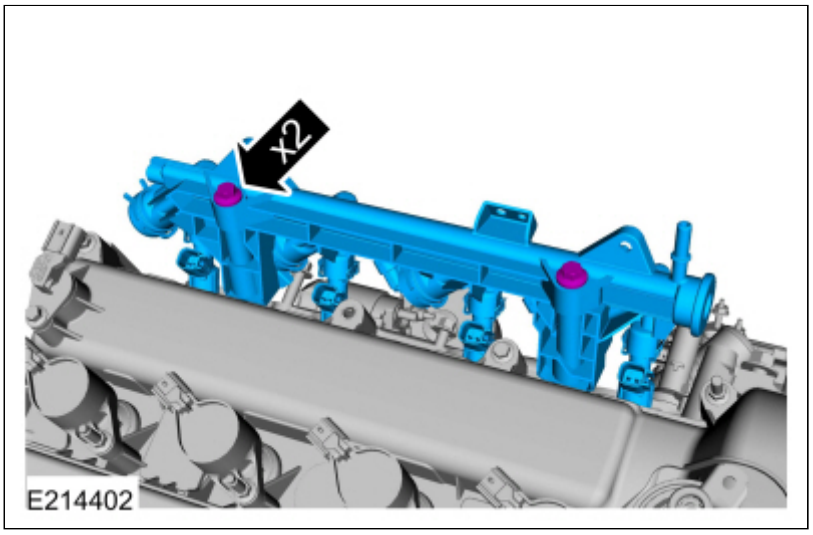
17.



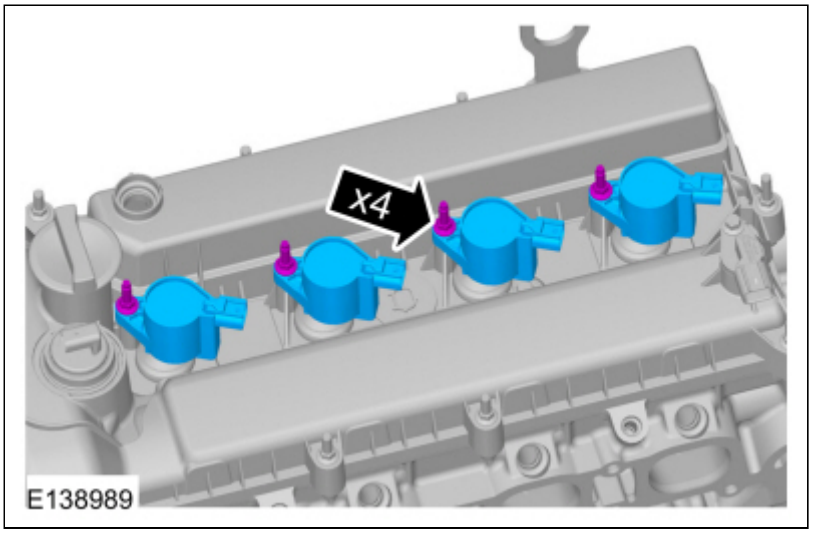
18.



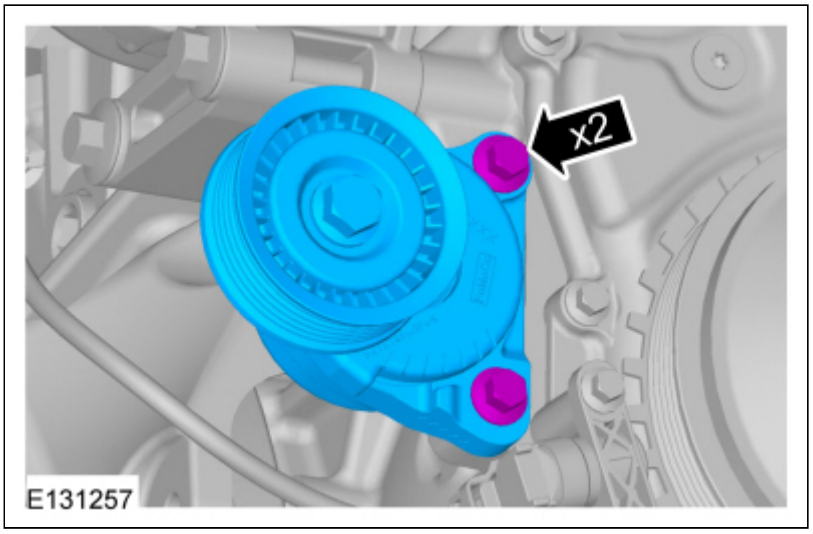
19.



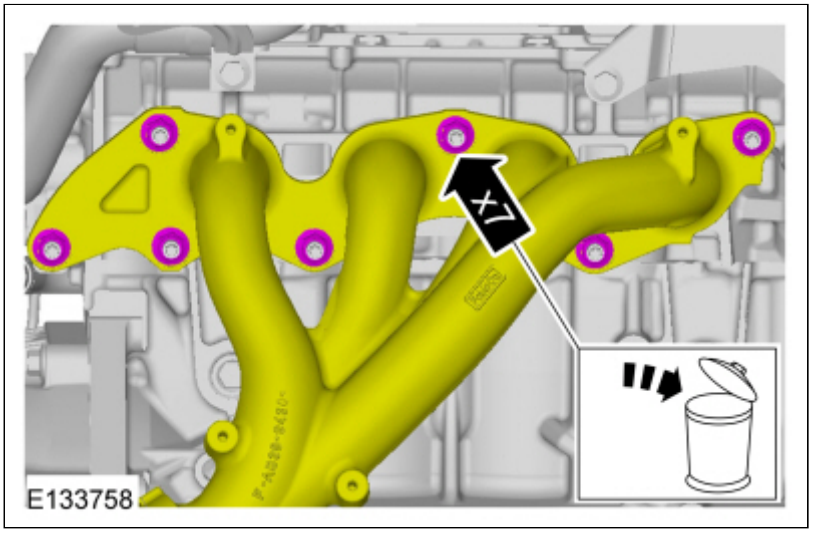
20.



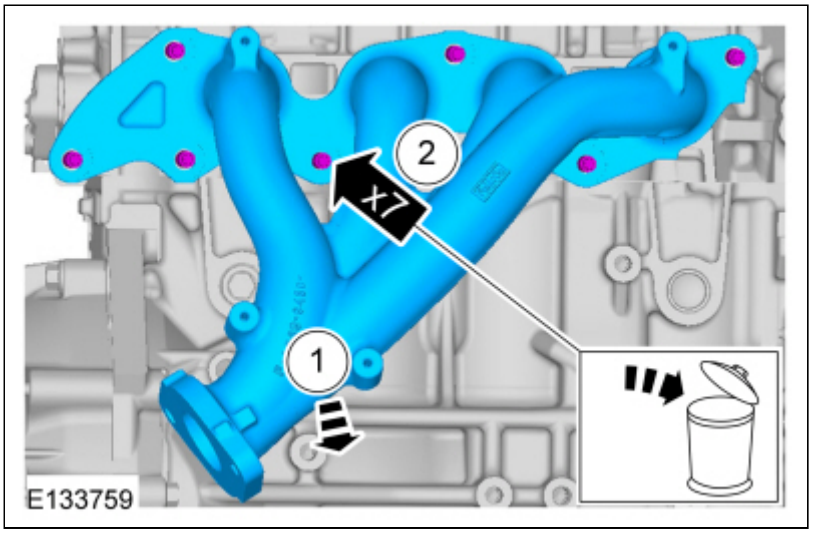
21.



22.

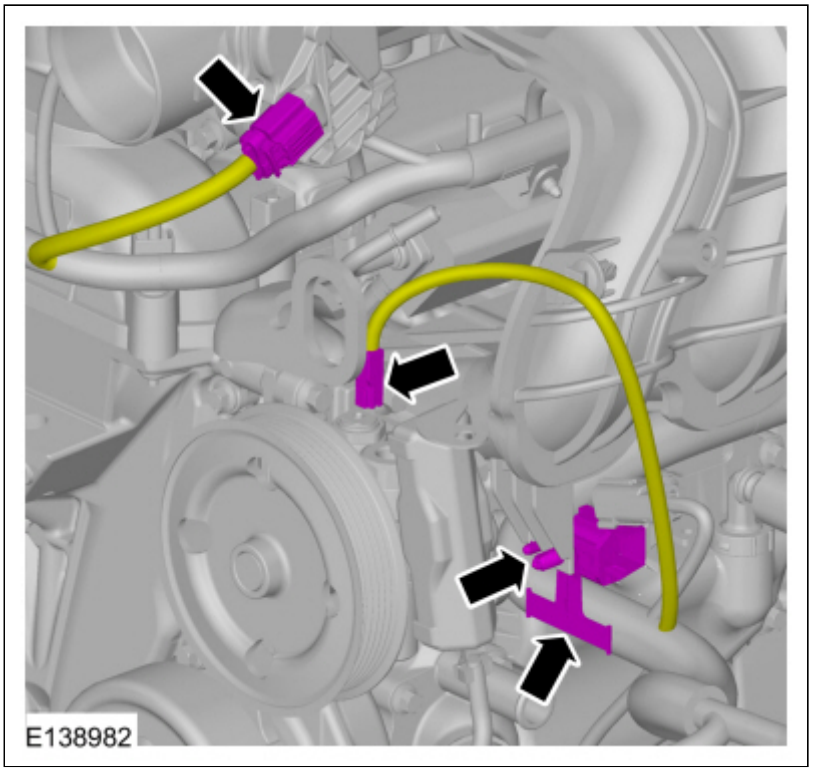


23.

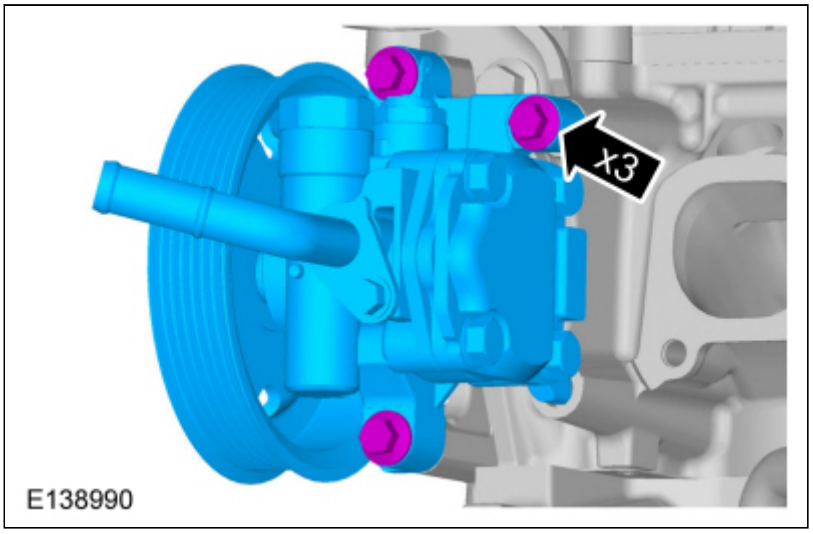


Vehicles With: Hydraulic Power Assist Steering (HPAS)

24.

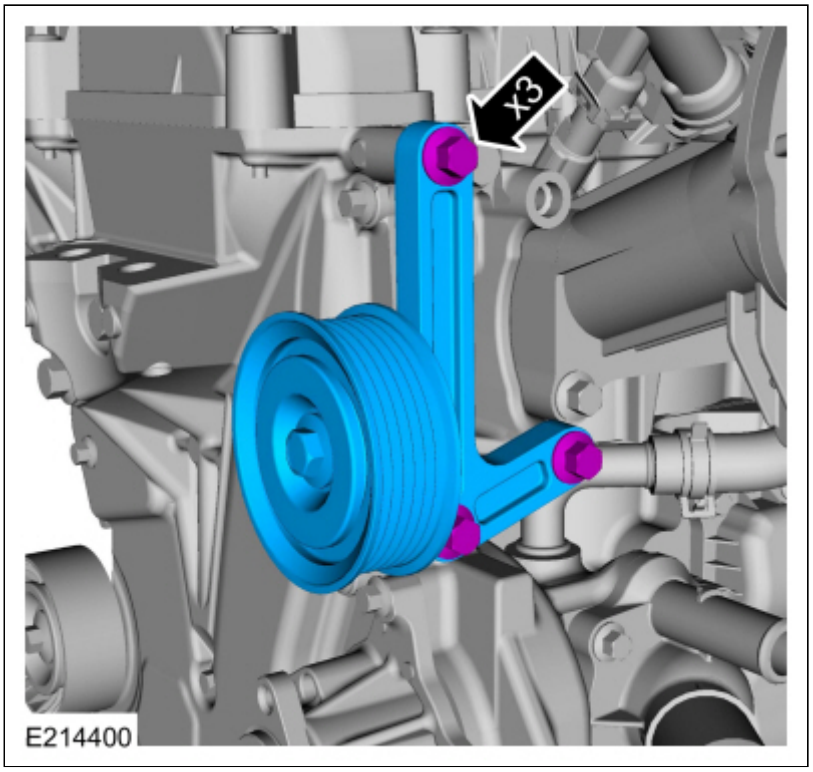


25.



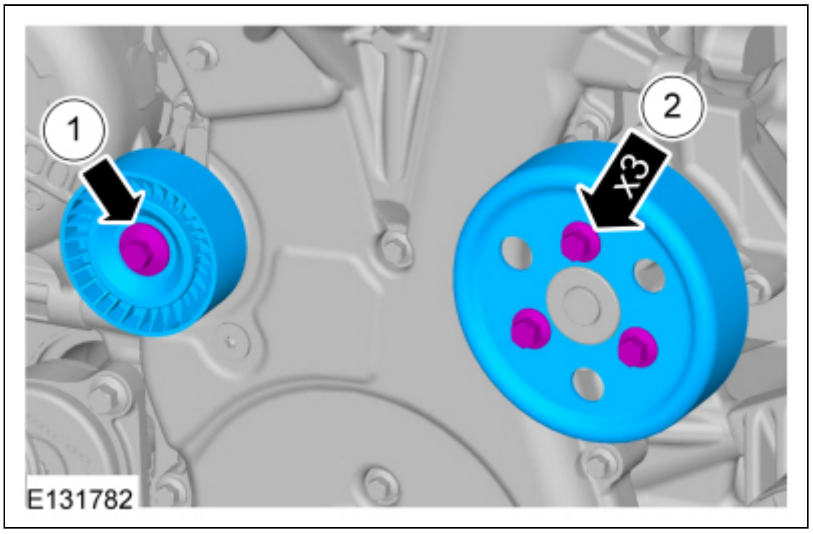
Vehicles With: Electronic Power Assist Steering (EPAS)

26.

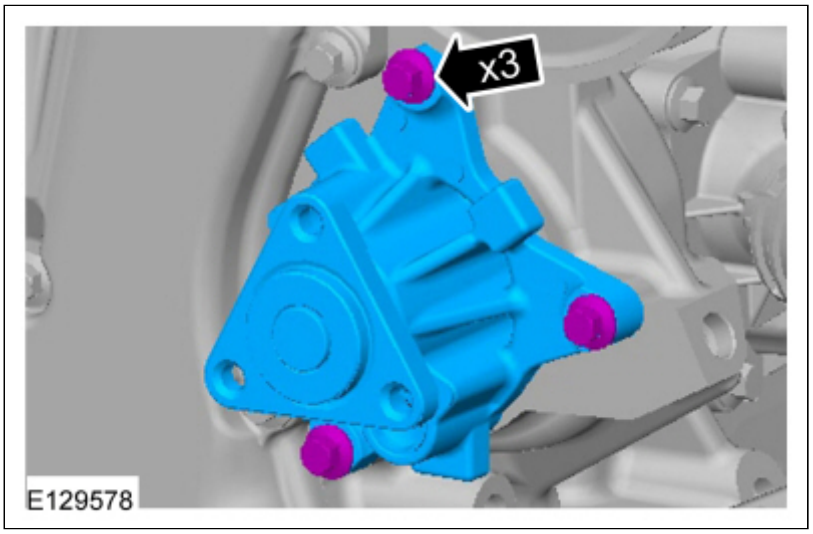


All vehicles

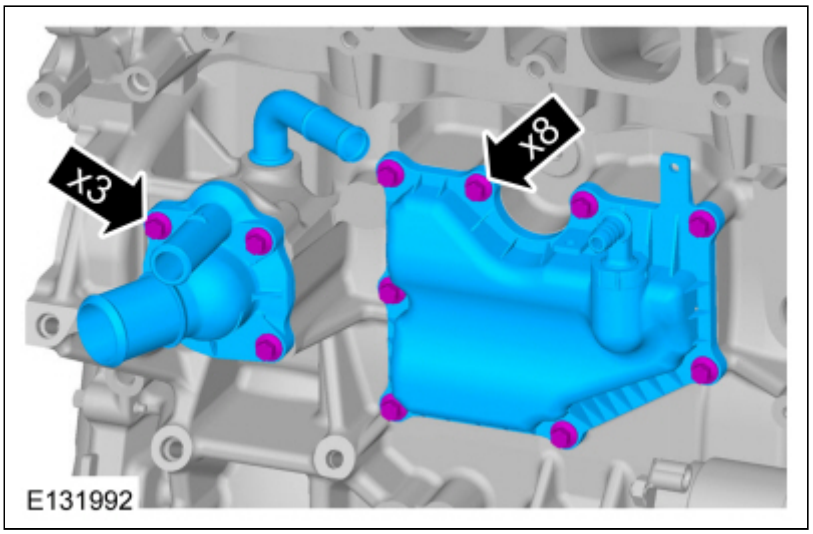
27.



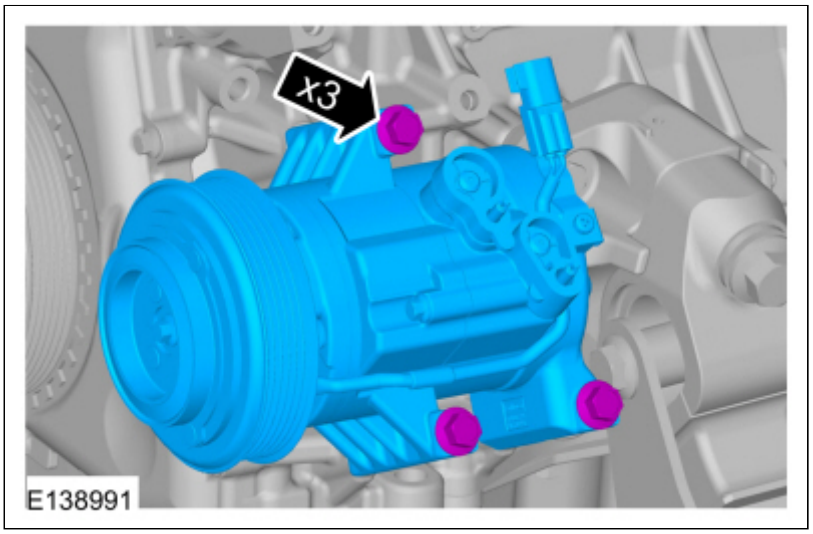
28.



29.

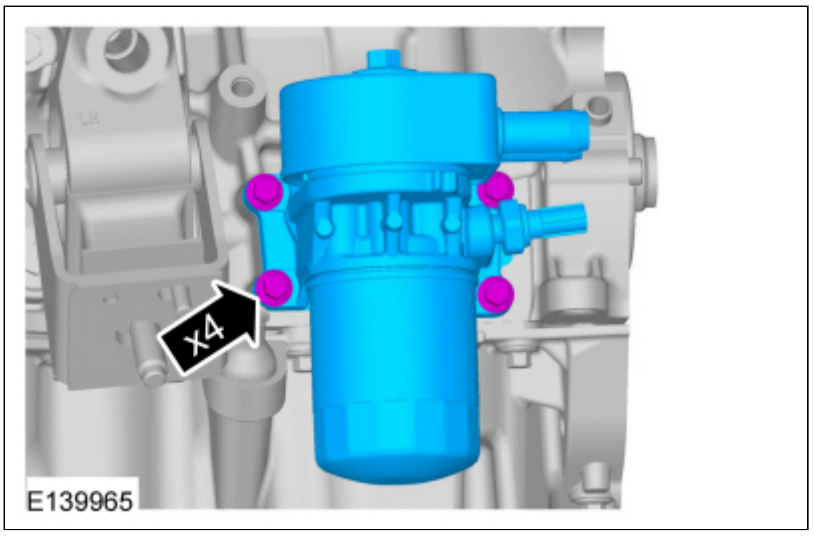


30.



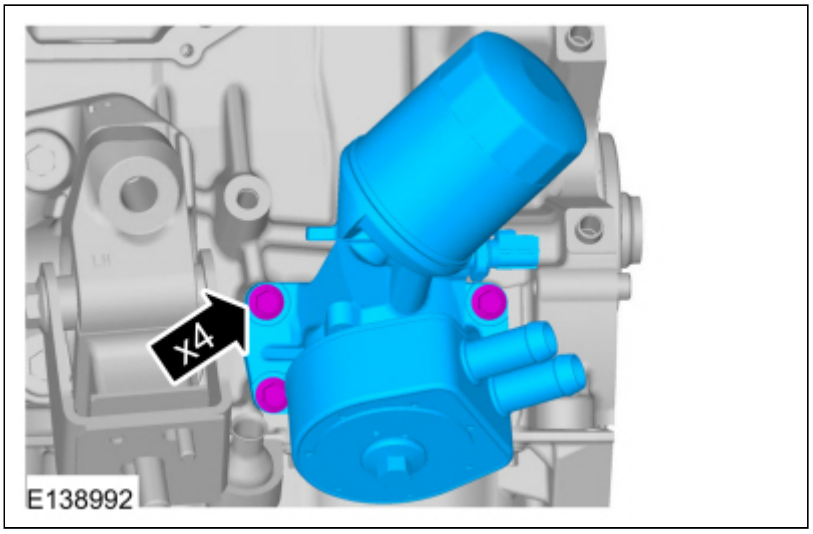
4x2

31.



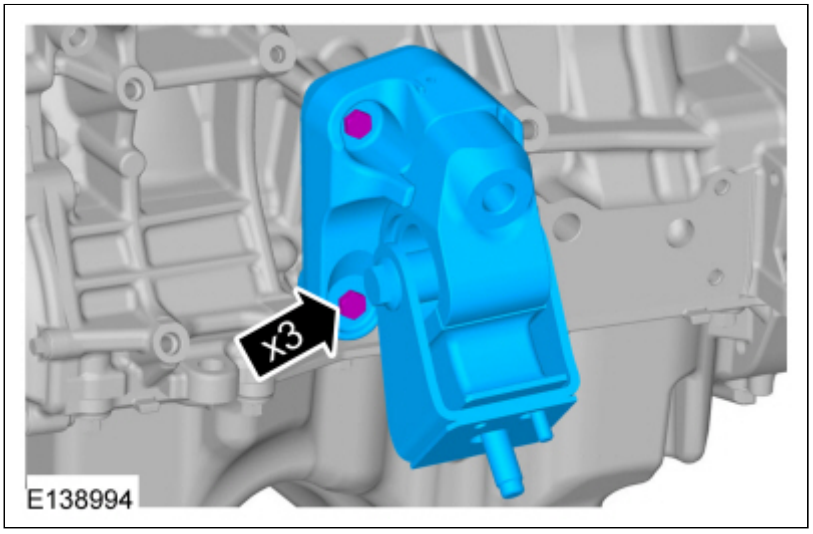
4x4

32.



All vehicles

33.



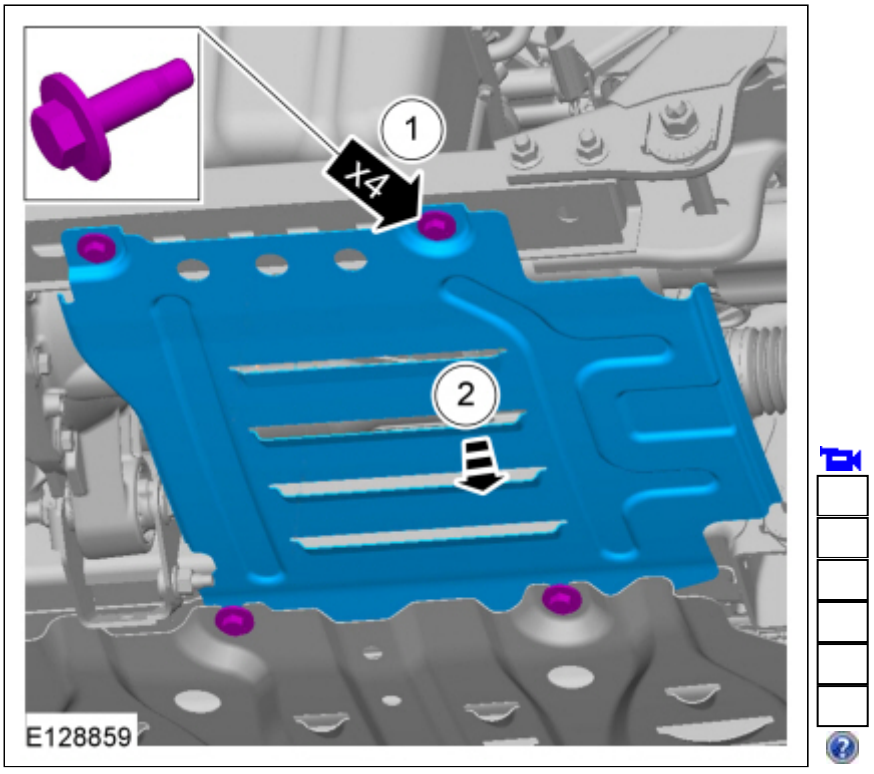
Copyright © 2016 Ford Motor Company

Engine - 5-Speed Manual Transmission - MT75

Base Part Number: 6L084

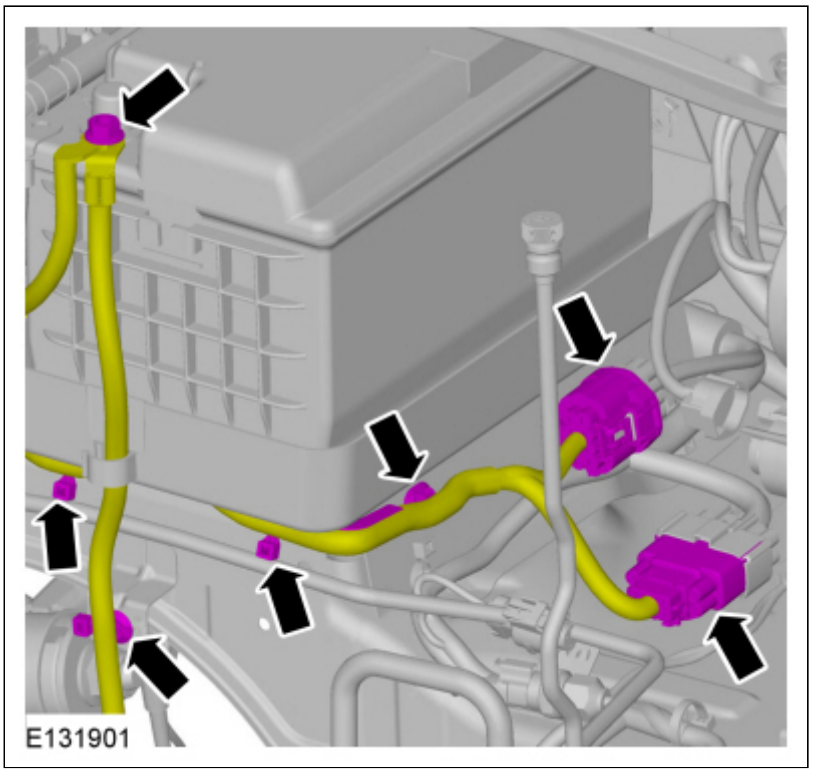
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
Floor Crane	
Transmission Jack	

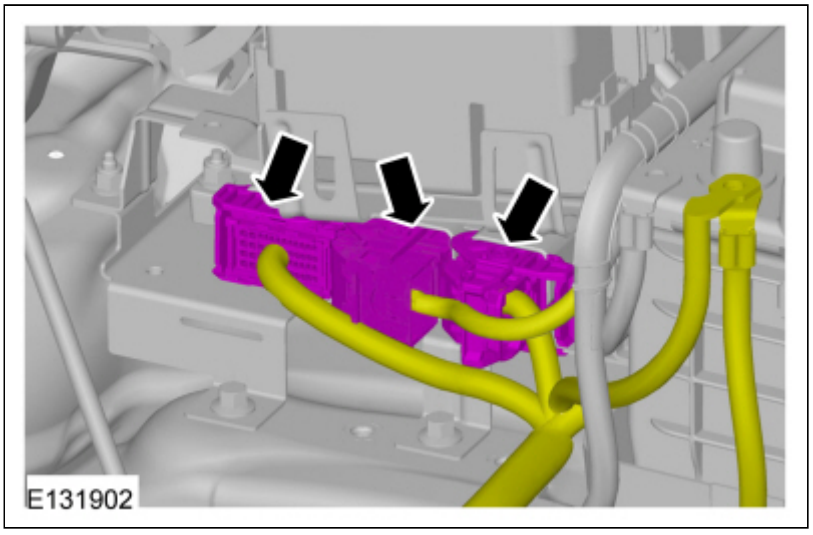
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
4. Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
5. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
6. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
7. 

8. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
9. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).

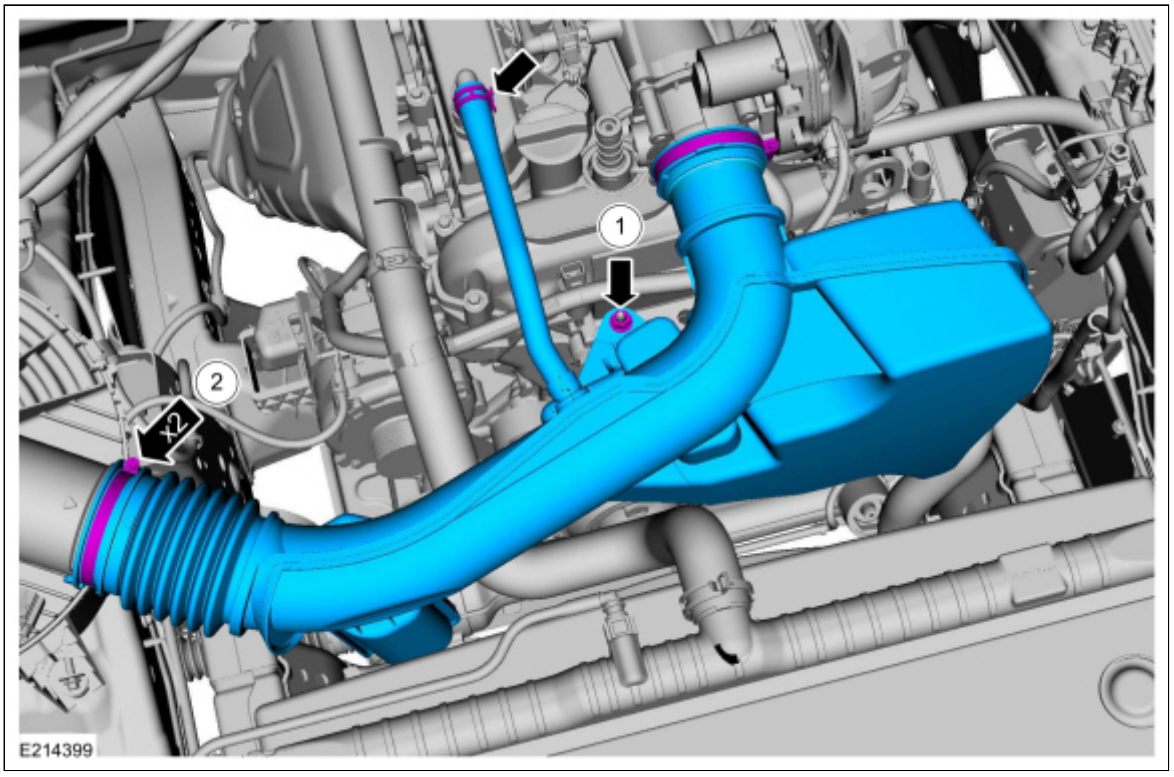
10.



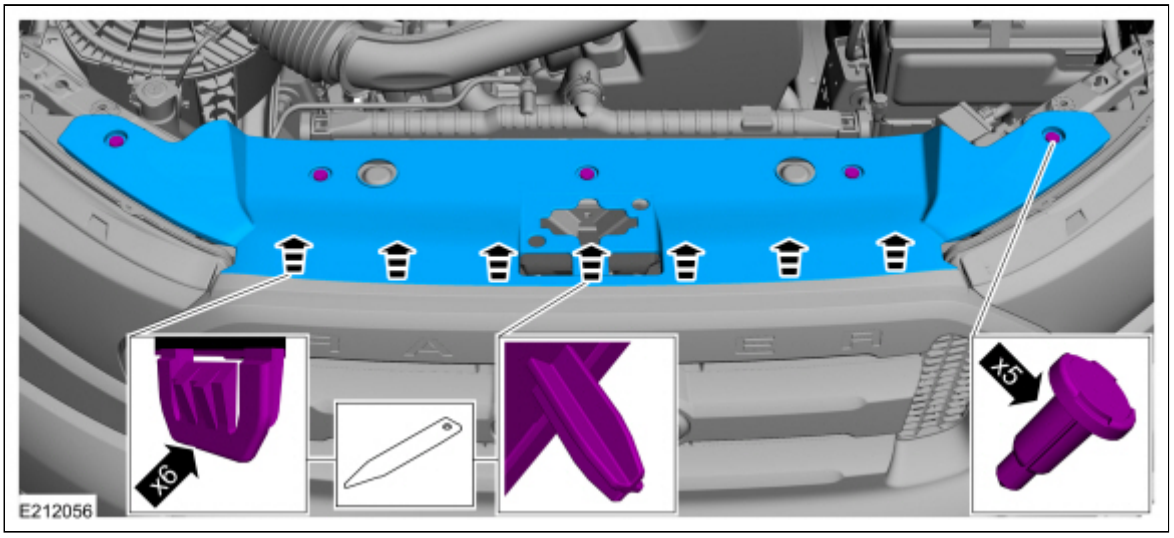
11.



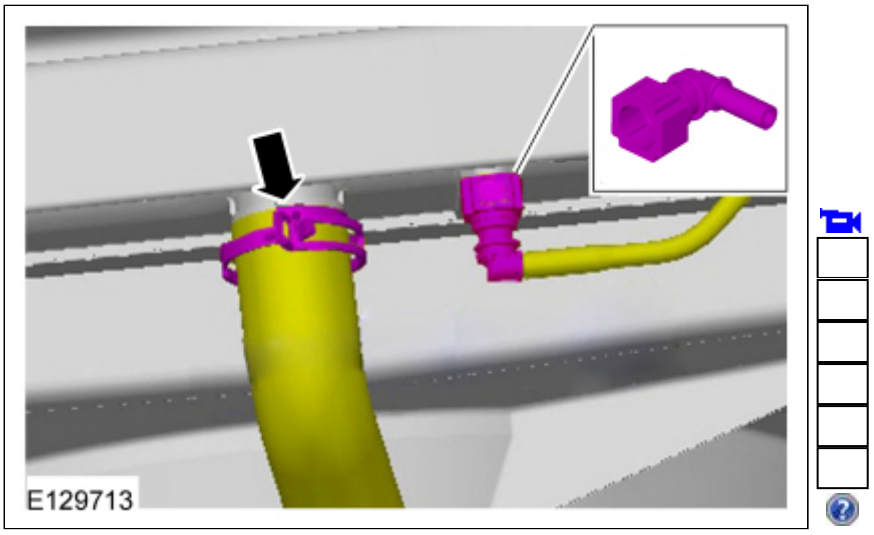
12.



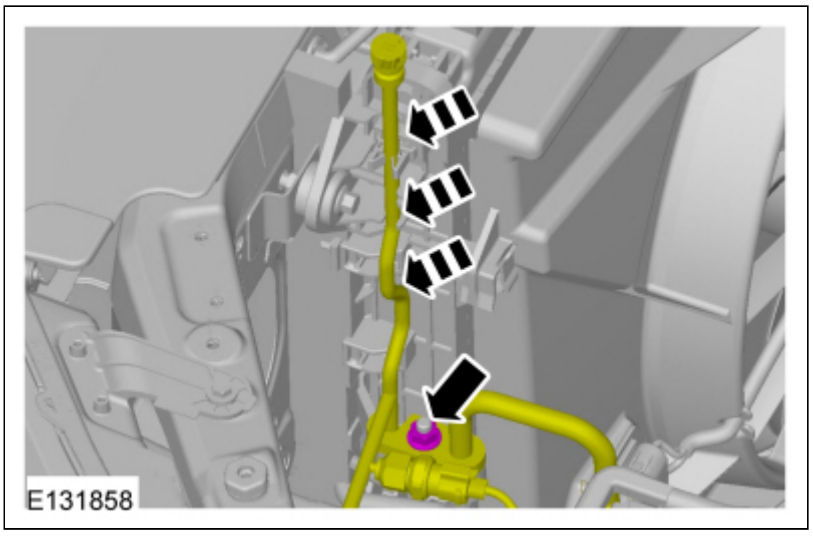
13.



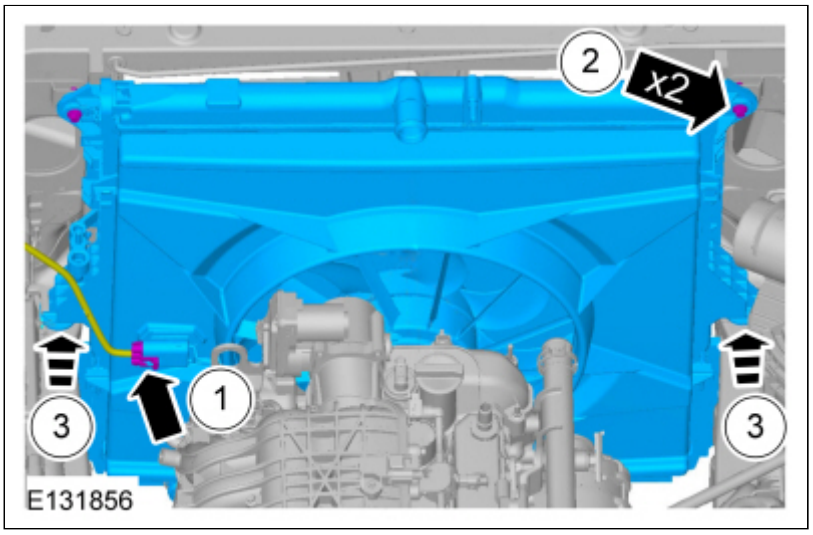
14.



15.



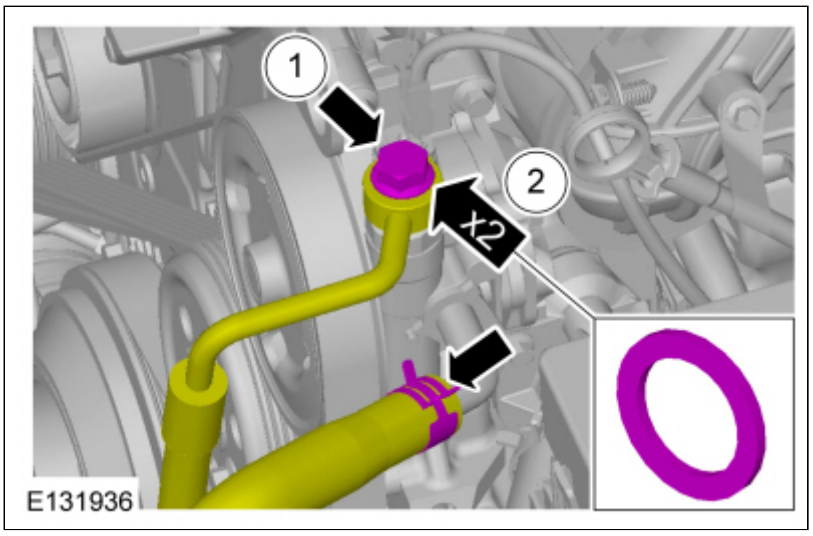
16.



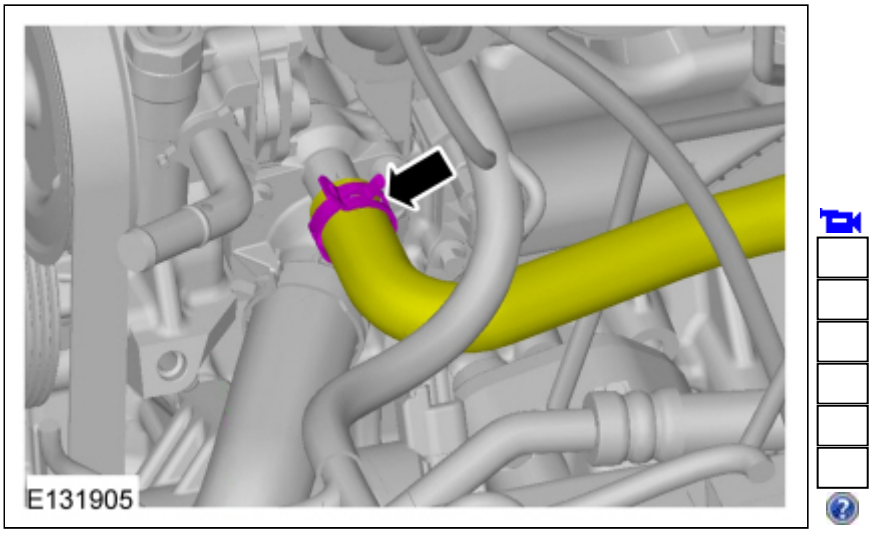
Vehicles With: Hydraulic Power Assist Steering (HPAS)

17. **WARNING: Be prepared to collect escaping fluids.**

    NOTICE: Make sure that all openings are sealed.

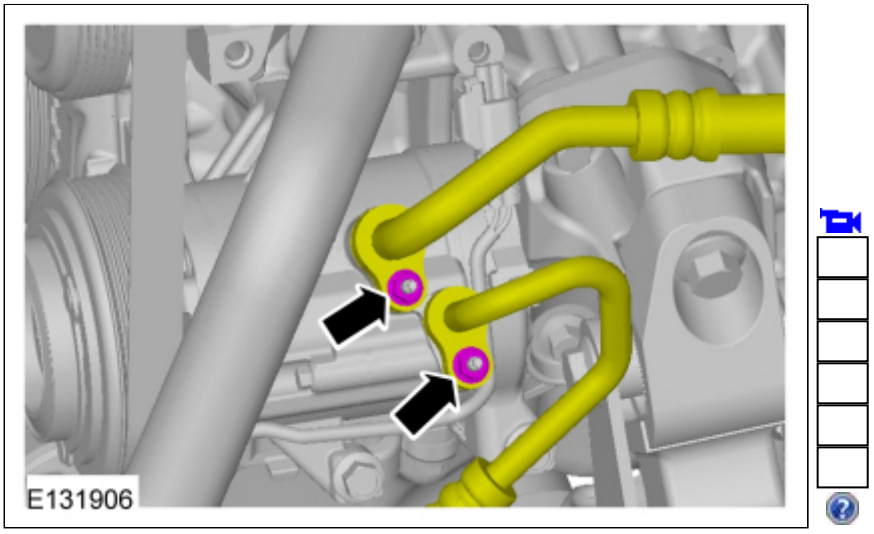


18.

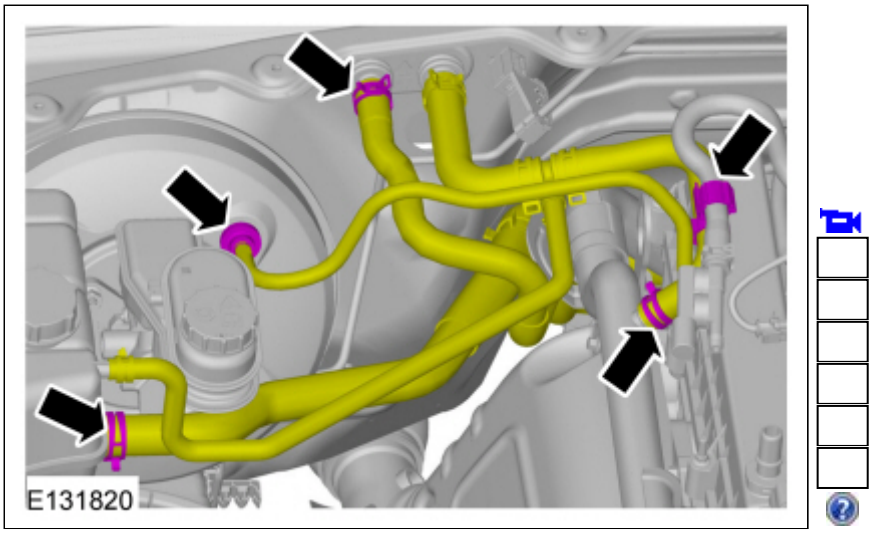


All vehicles

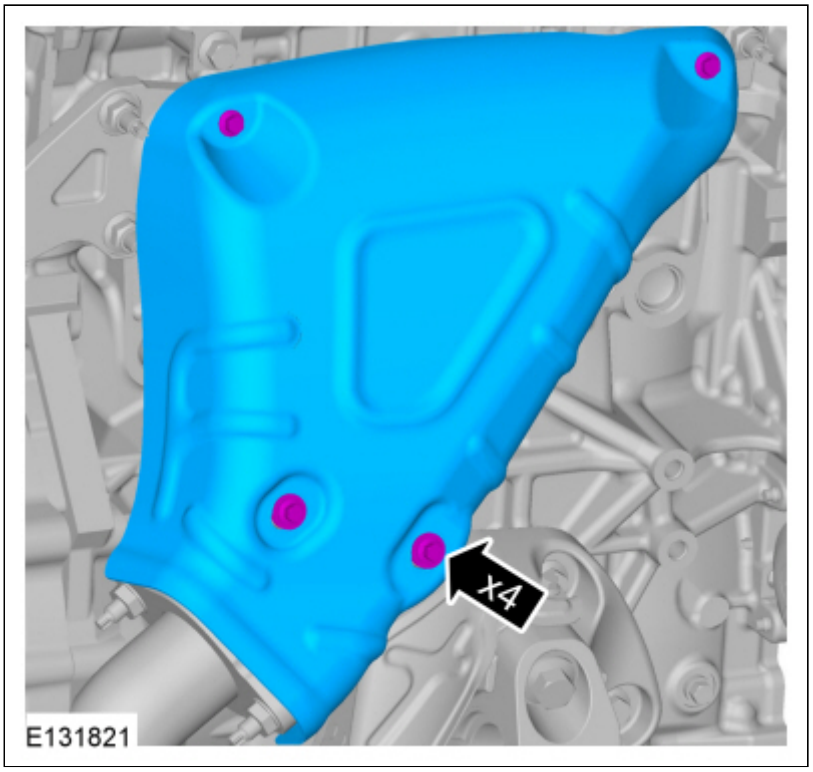
19.



20.

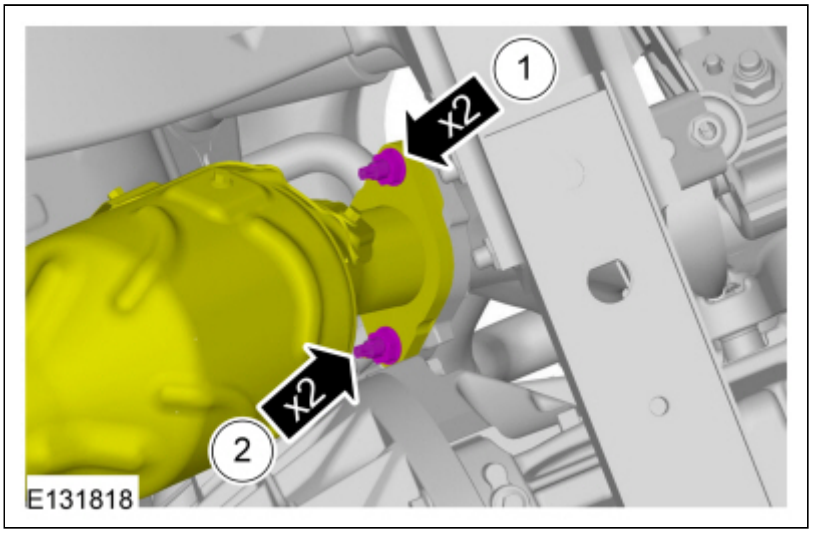


21.

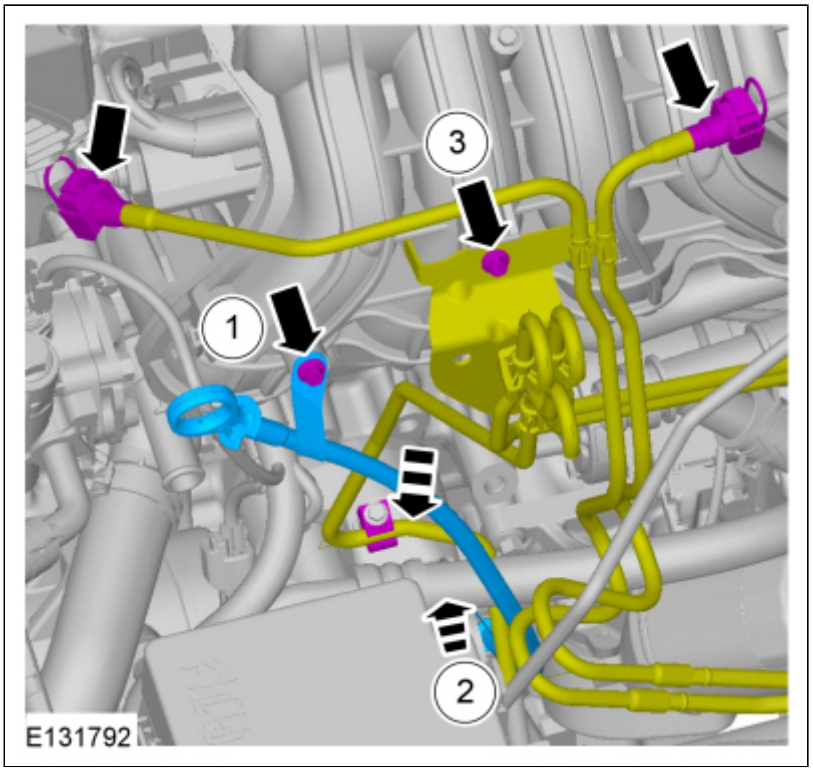


22. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

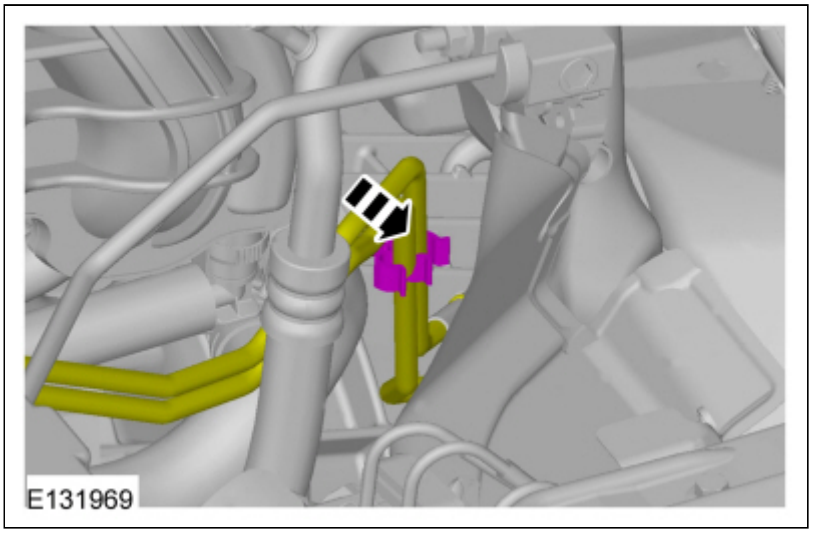
    NOTICE: Make sure that the catalytic converter is supported with suitable retaining straps.



23.



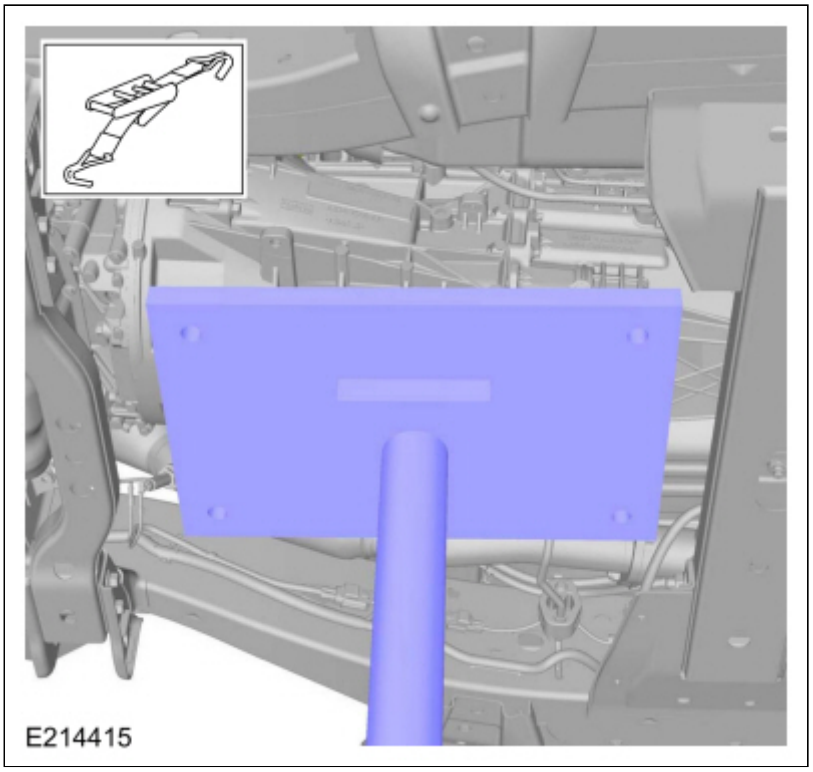
24.



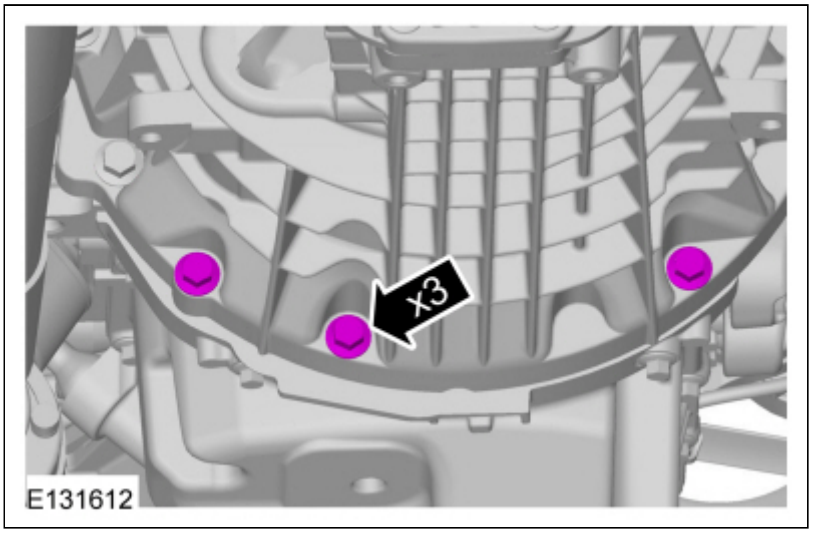
25. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

NOTICE: Do not tilt the transmission. This may cause damage to the pilot bearing.

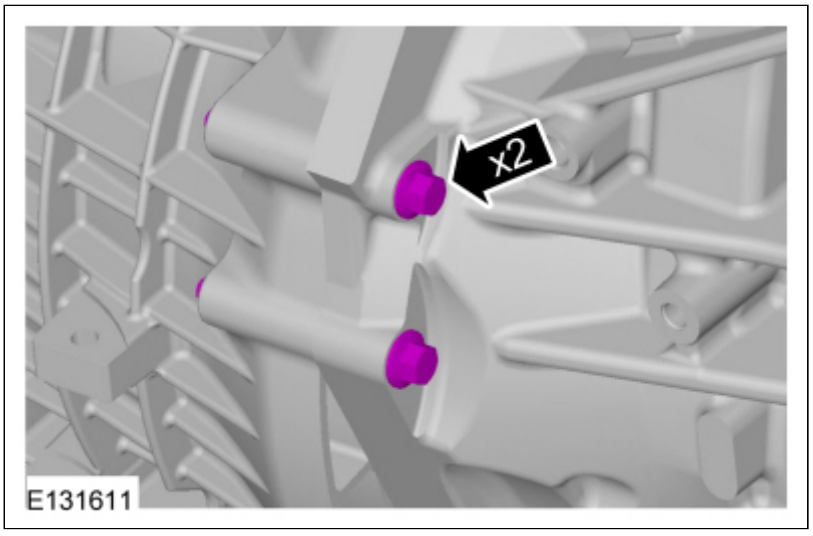
Use the General Equipment: Transmission Jack



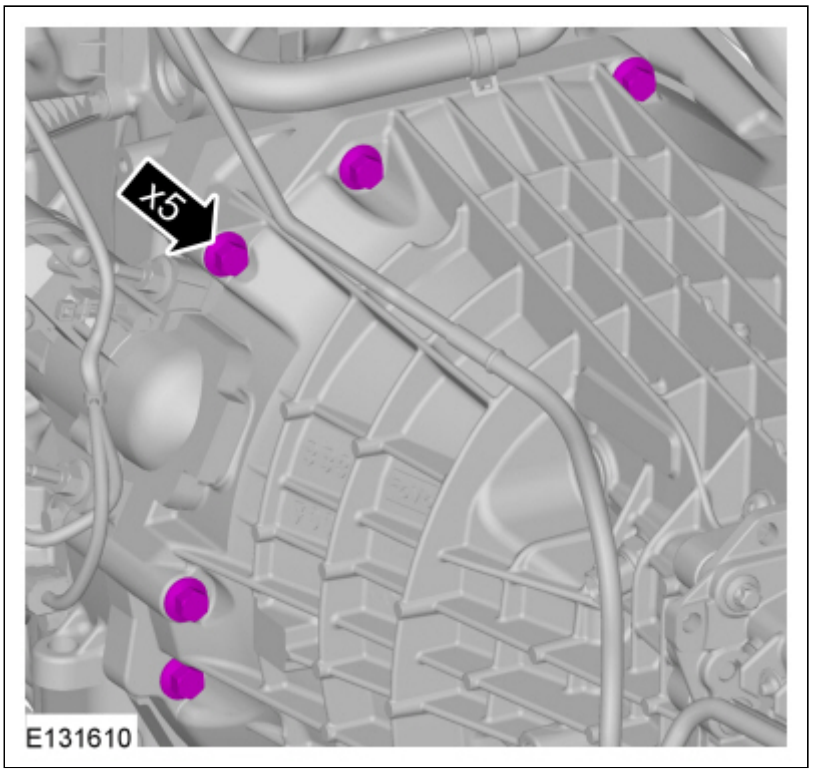
26.



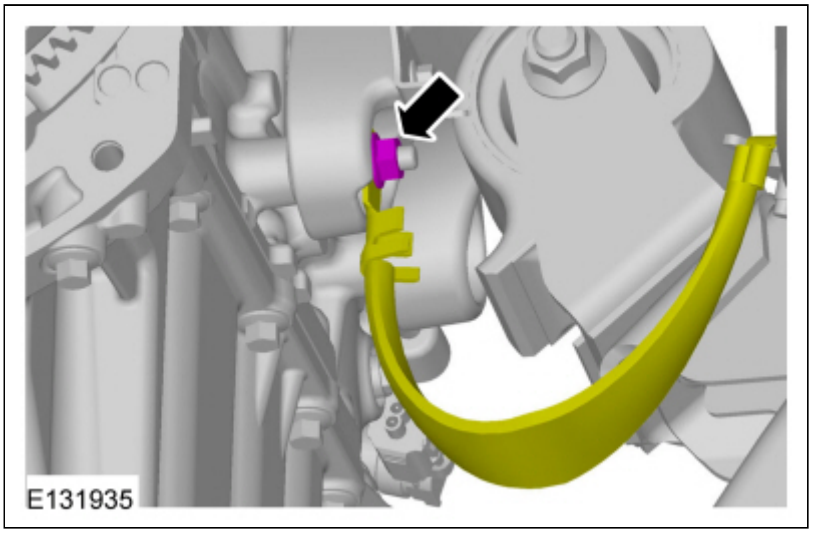
27.



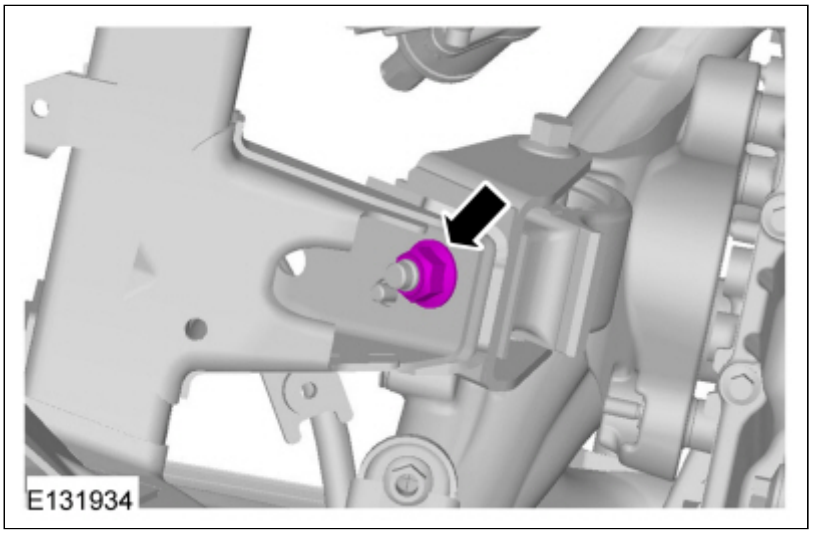
28.



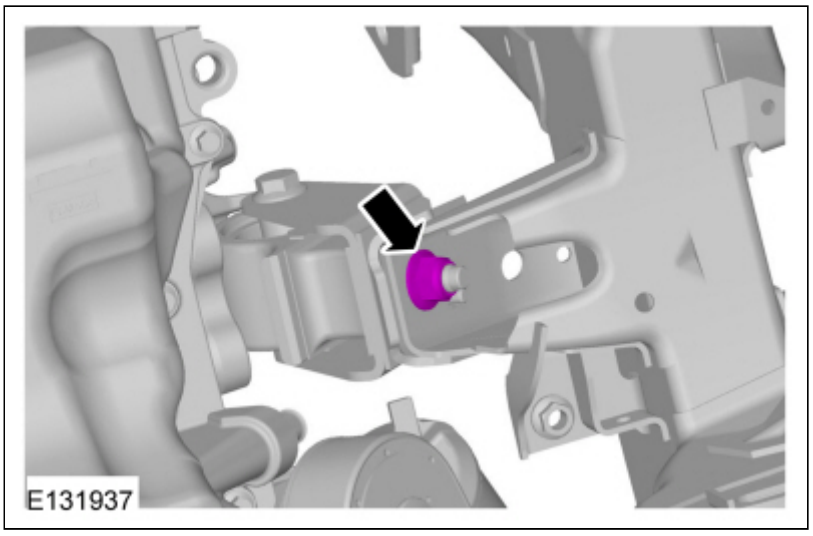
29.



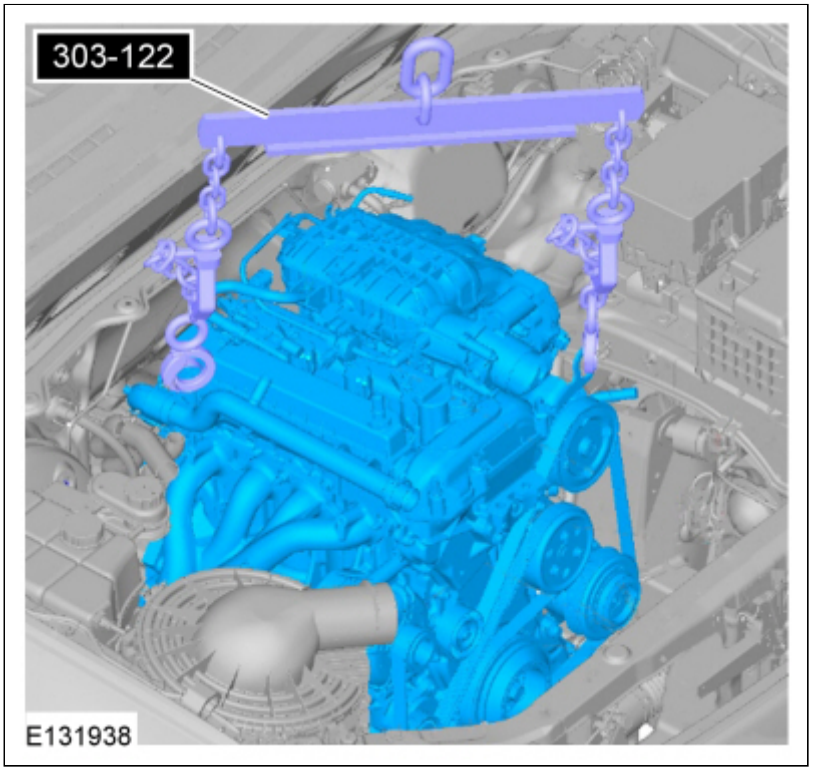
30.



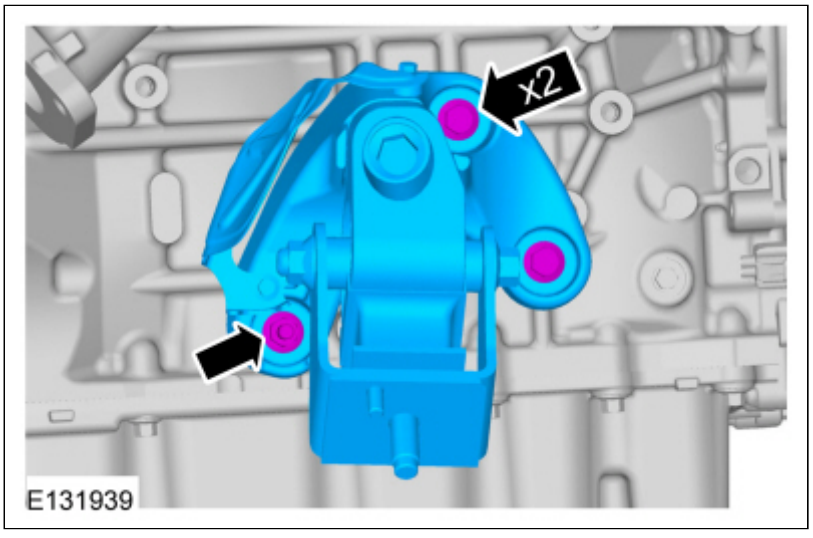
31.



32. Use Special Service Tool: 303-122 Lifting Bracket, Engine.
Use the General Equipment: Floor Crane



33.

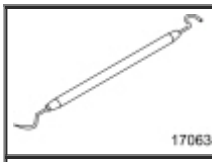
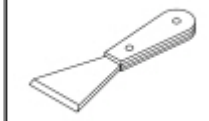
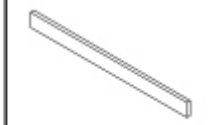


Copyright © 2016 Ford Motor Company

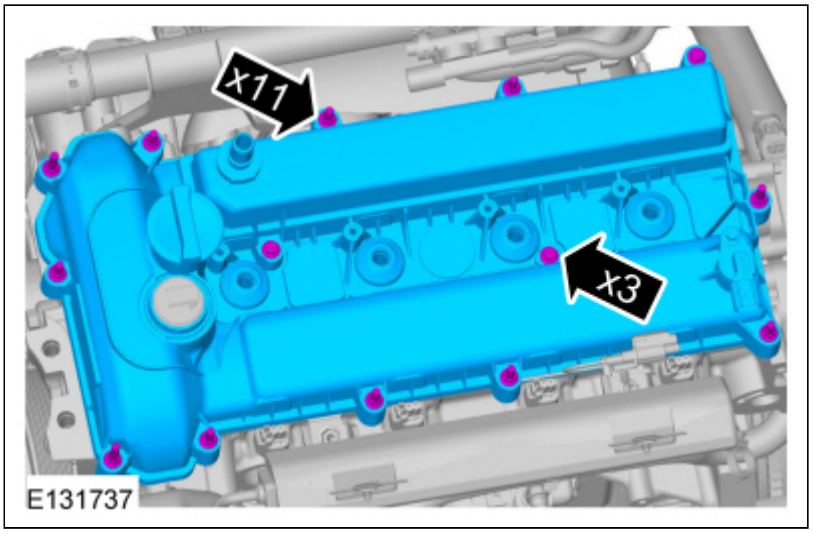
Engine

Base Part Number: 6L084

Special Tool(s) / General Equipment

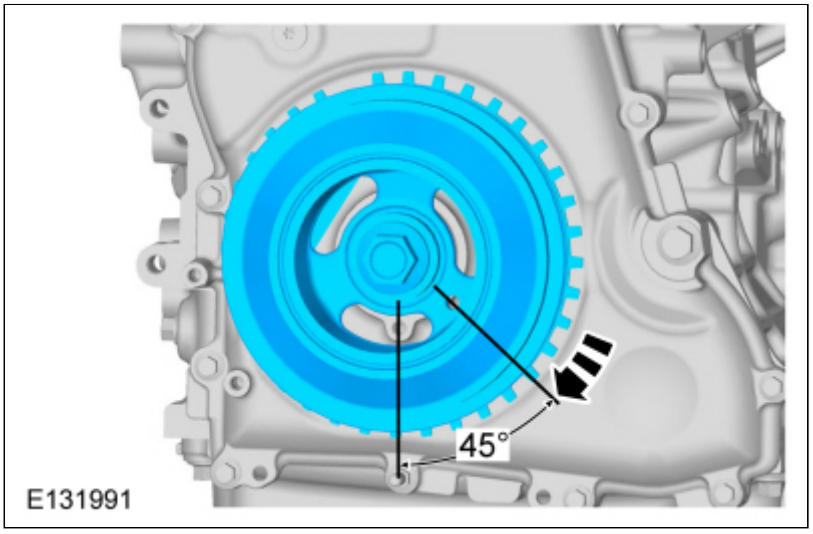
 17063	100-010 Remover, O-Ring Seal
 E134674	303-1416 Tool, Crank Damper Holding
 E134603	303-409 (T92C-6700-CH) Remover, Crankshaft Seal
 21179	303-428 Separator, Oil Pan
 E139375	303-462 Installer, Connecting Rod
 E134673	303-465 Tool, Camshaft Align Timing
 PZ21210	303-507 Timing Peg, Crankshaft TDC
2 mm Punch	

1.

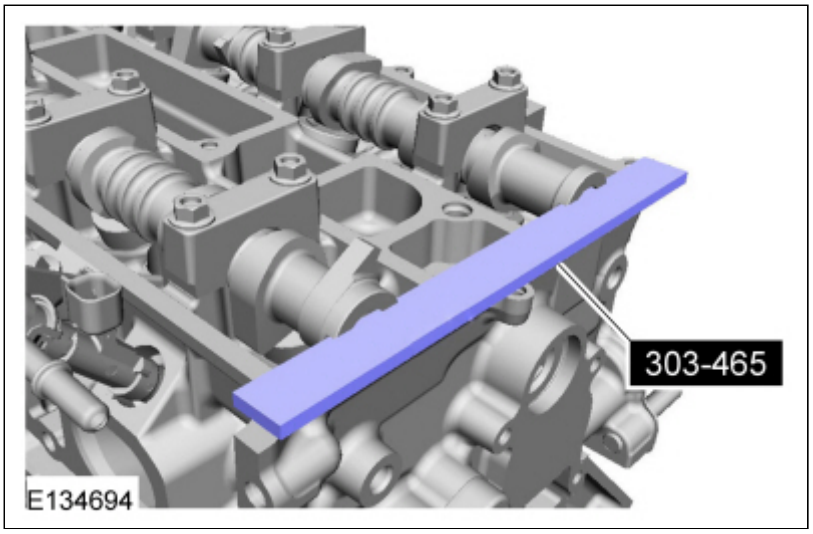


2. **NOTICE: Only rotate the crankshaft clockwise.**

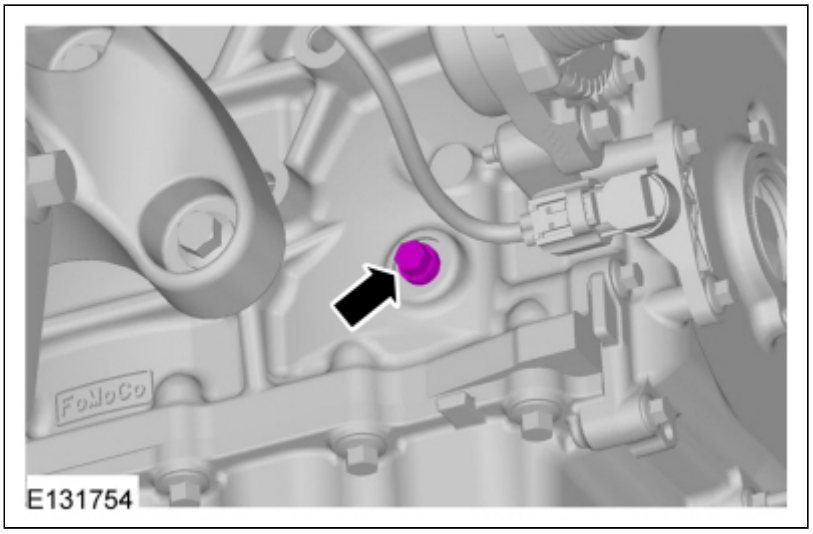
   Rotate the crankshaft until piston No. 1 is approximately 45 degrees before top dead center (TDC).



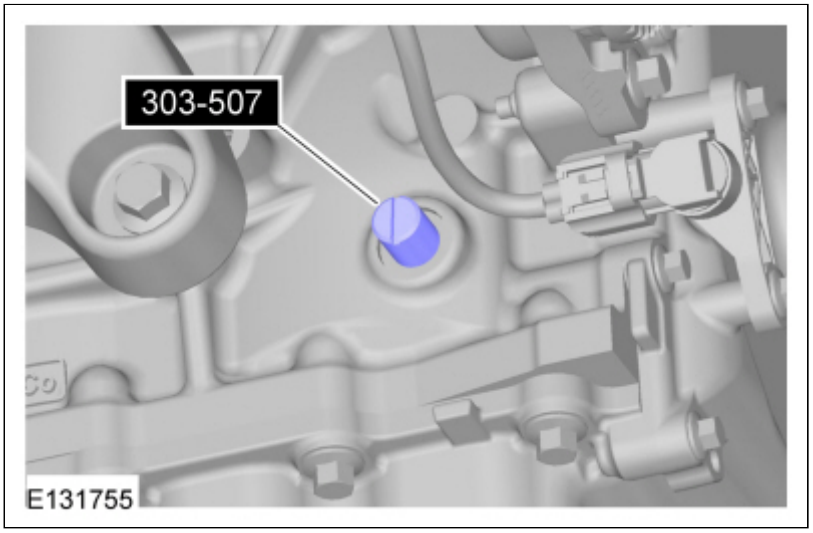
3. Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.



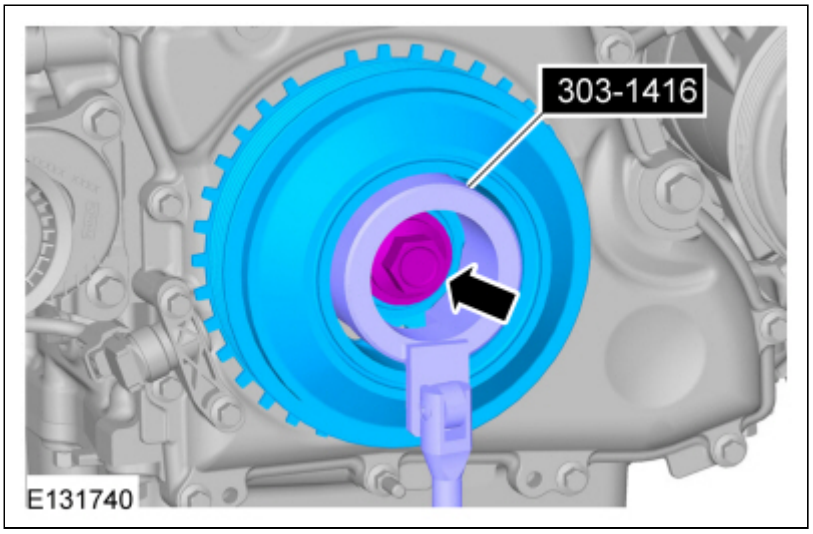
4.



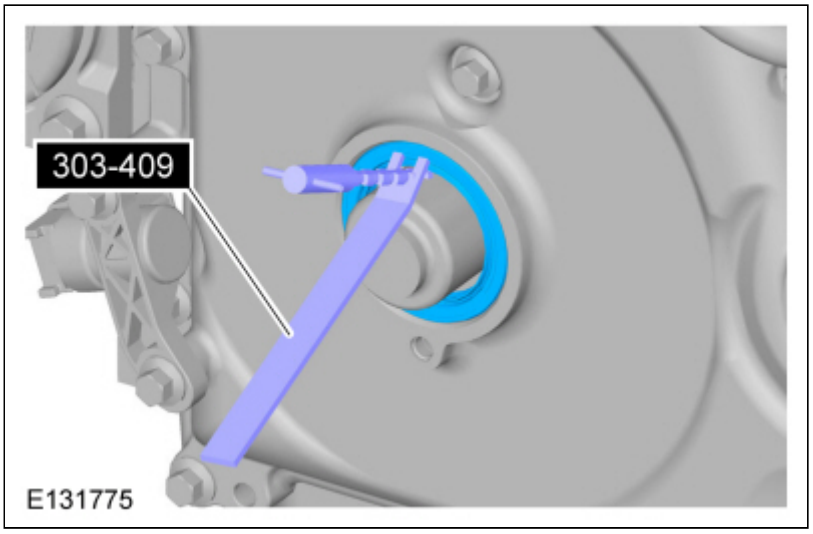
5. Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



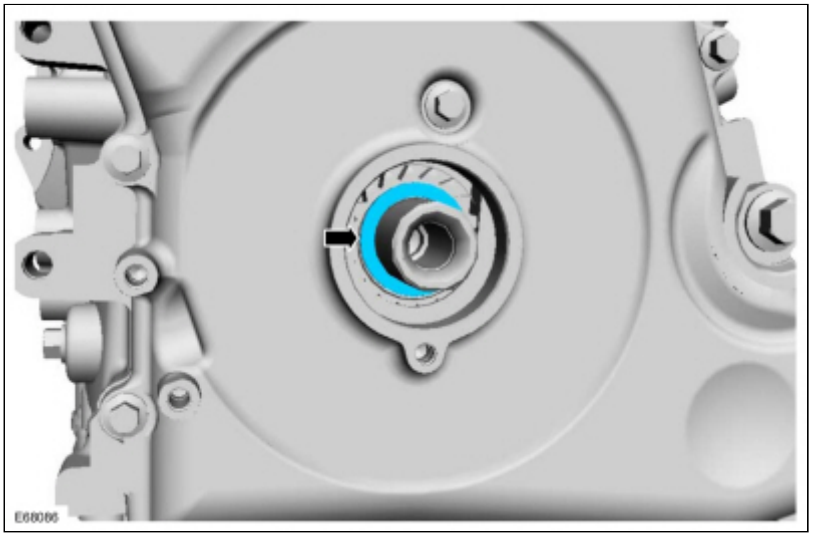
6. Use Special Service Tool: 303-1416 Tool, Crank Damper Holding.



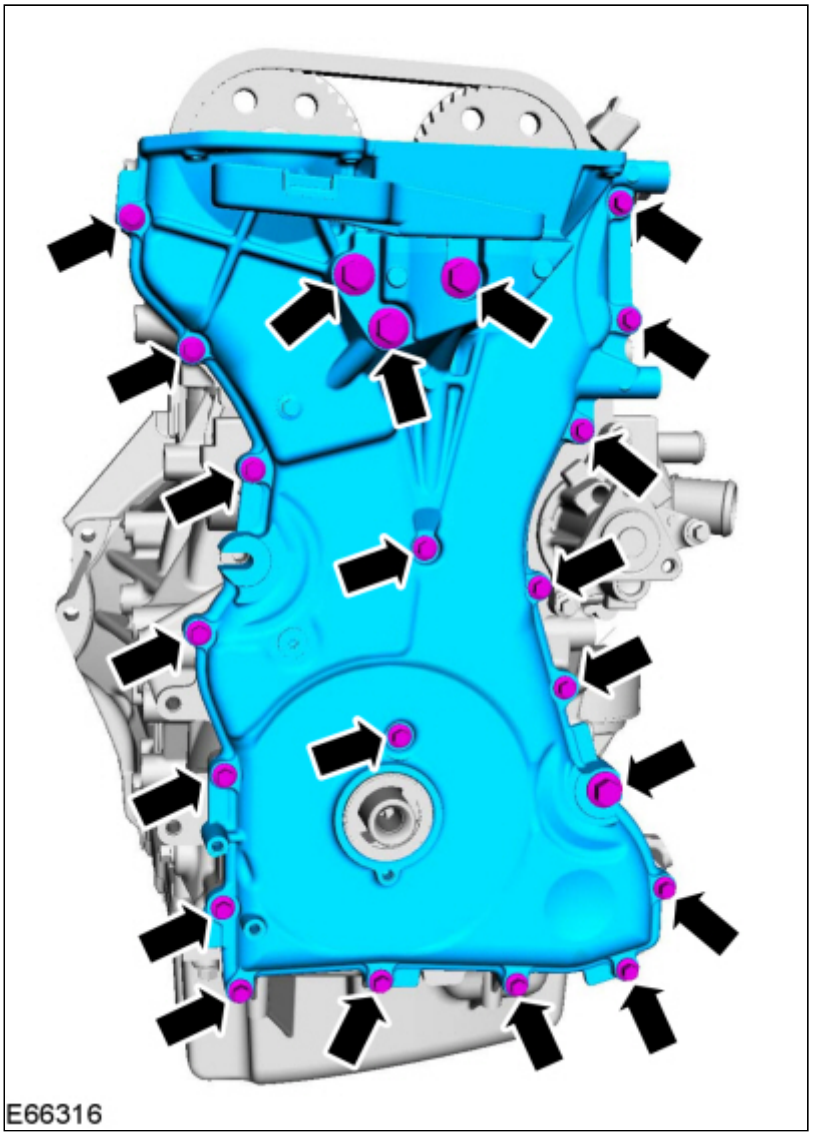
7. Use Special Service Tool: 303-409 (T92C-6700-CH) Remover, Crankshaft Seal.



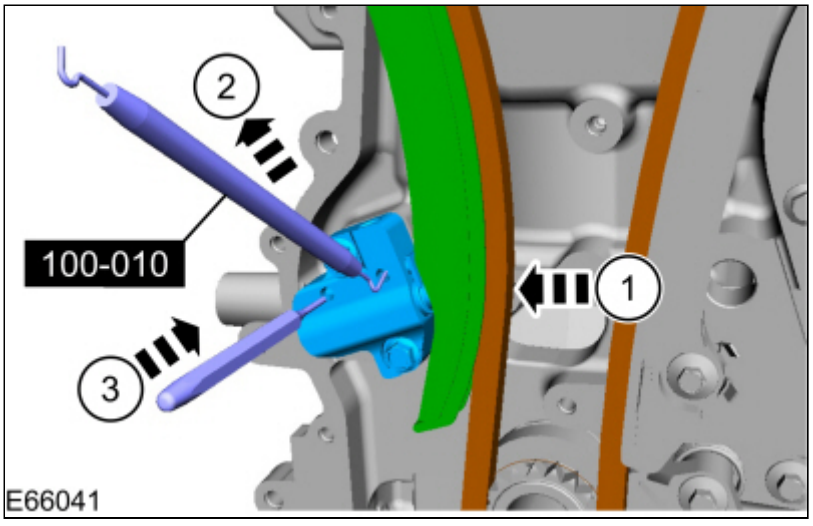
8. Discard the friction washer.



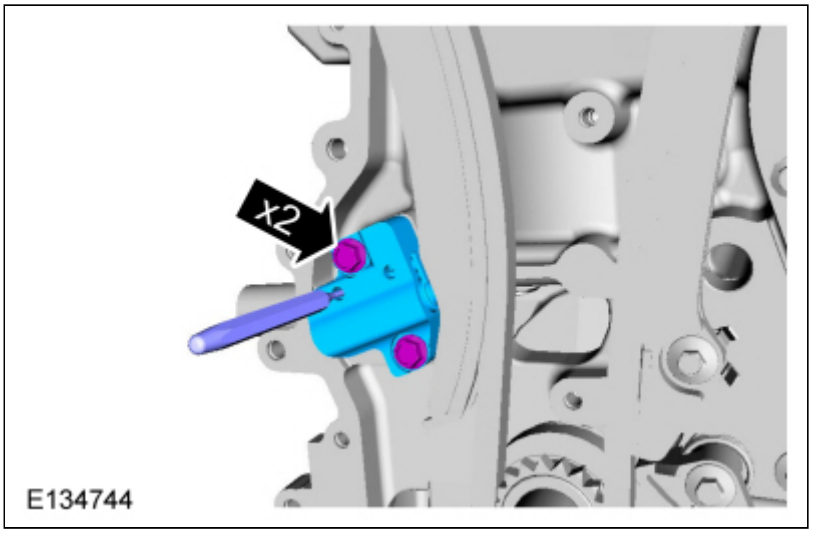
9.



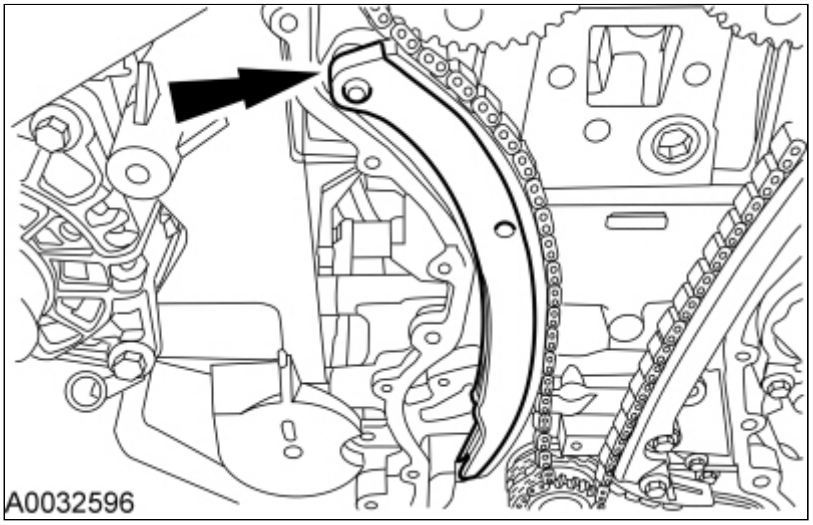
10. Use Special Service Tool: 100-010 Remover, O-Ring Seal.
    Use the General Equipment: 2 mm Punch



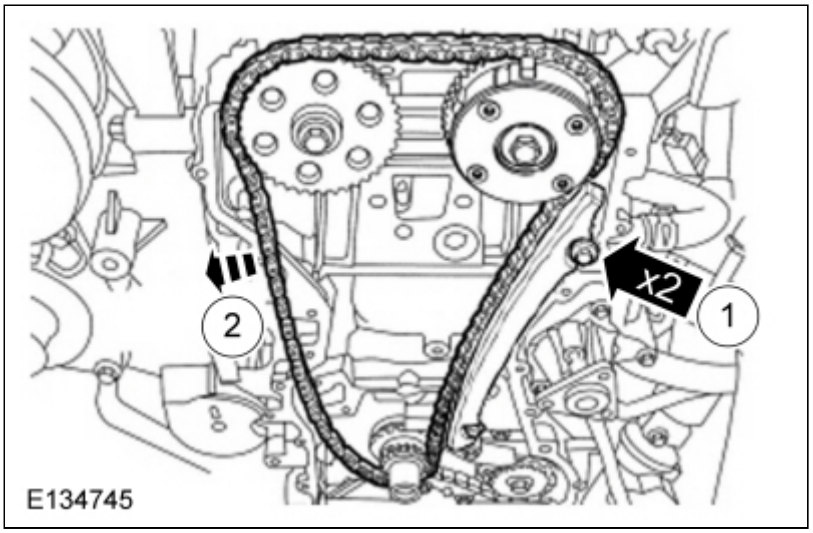
11.



12. Remove the RH timing chain guide.

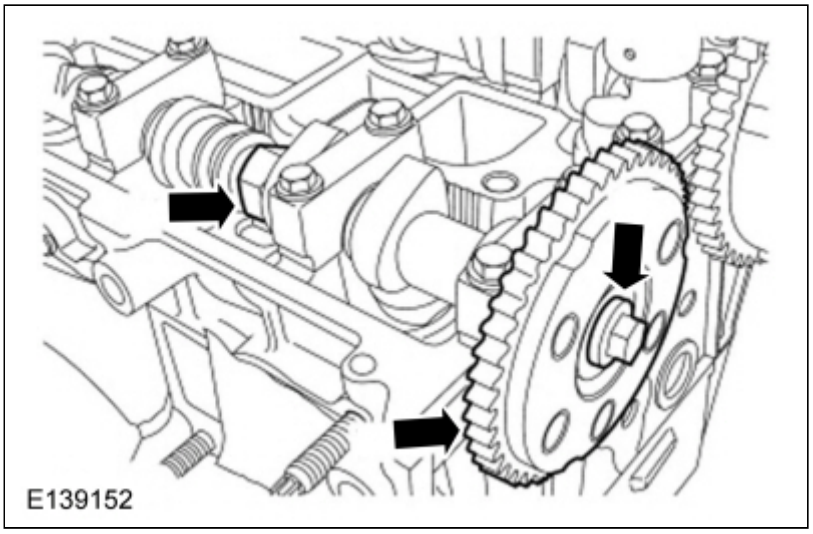


13. Remove the timing chain.



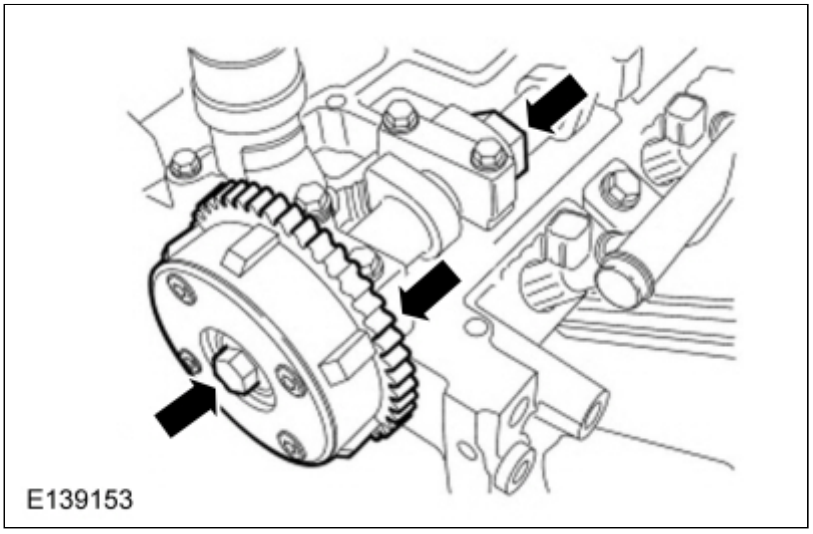
14. **NOTICE: Use an open-ended wrench to prevent the component from turning.**

    Remove the bolt and the exhaust camshaft sprocket.

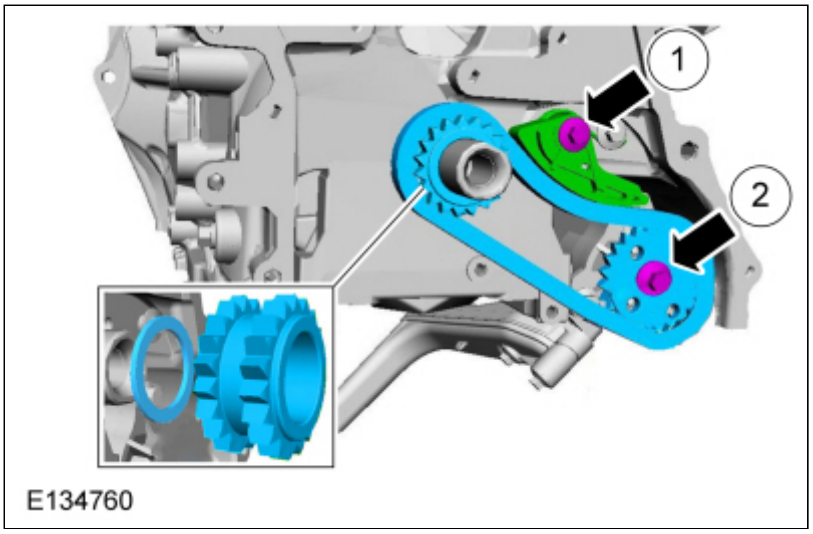


15. **NOTICE: Use an open-ended wrench to prevent the component from turning.**

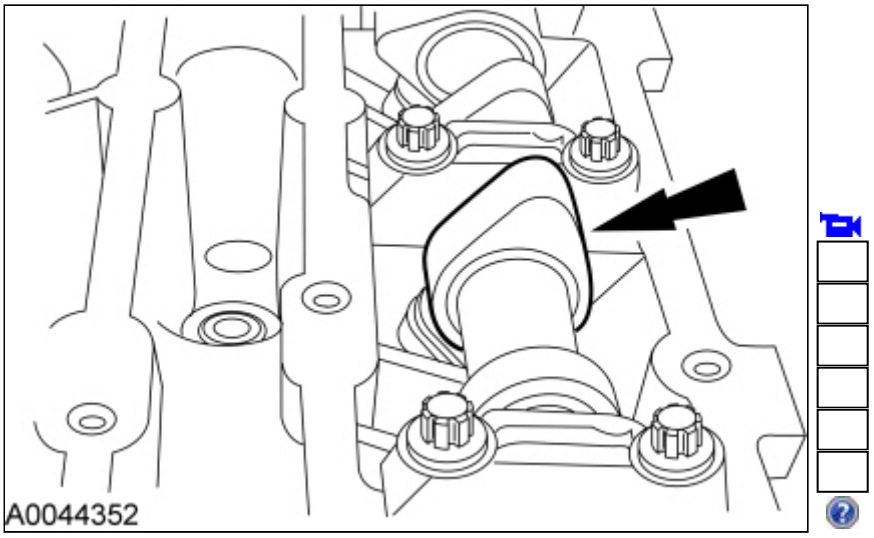
    Remove the bolt and the camshaft phaser and sprocket.



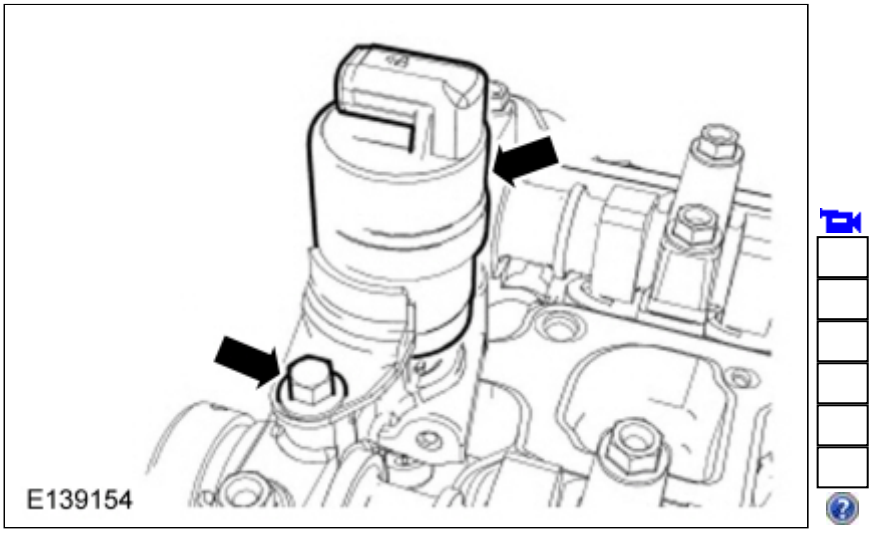
16. **NOTICE: Make sure that a new friction washer is installed.**



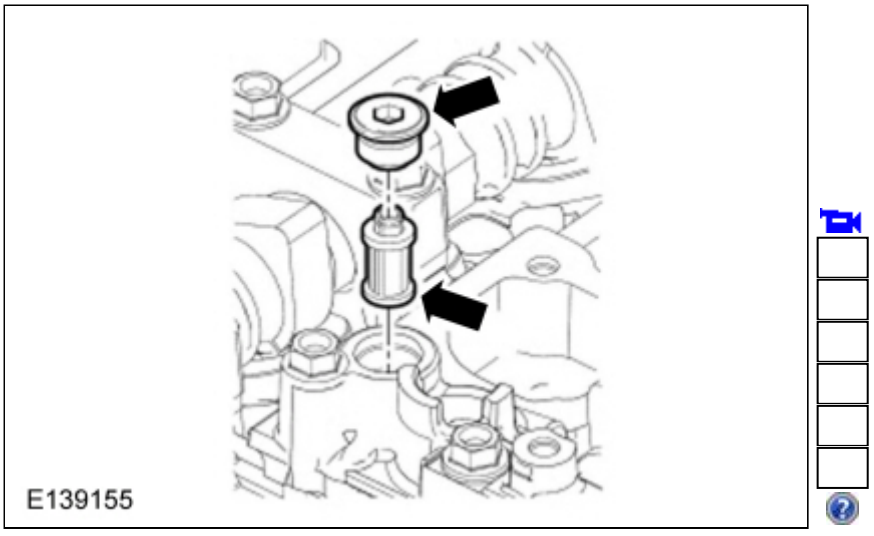
17. Mark the position of the camshaft lobes on the No. 1 cylinder for assembly reference.



18. Remove the bolt and the VCT solenoid.

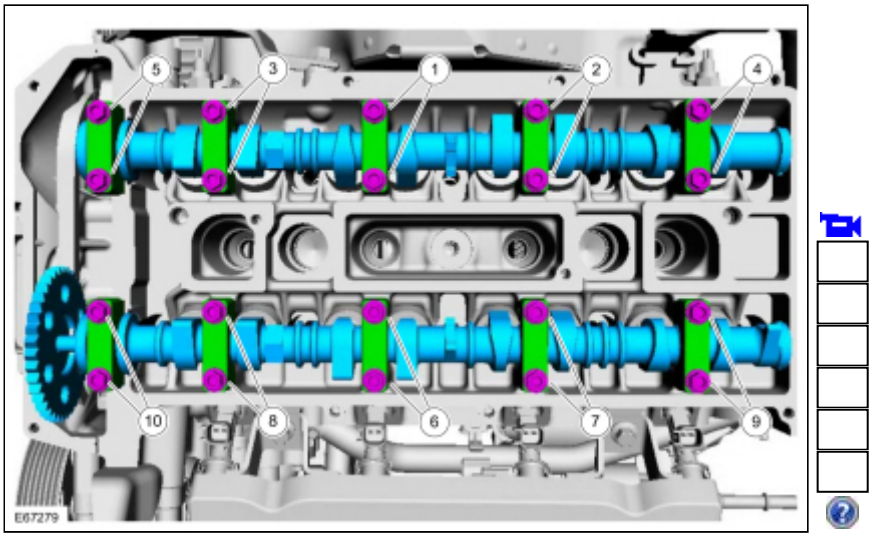


19. Remove the plug and the VCT system oil filter from the intake camshaft thrust cap.



20. **NOTICE: Failure to follow this procedure may result in damage to the components.**

    NOTE: *Mark the location and orientation of each component..*

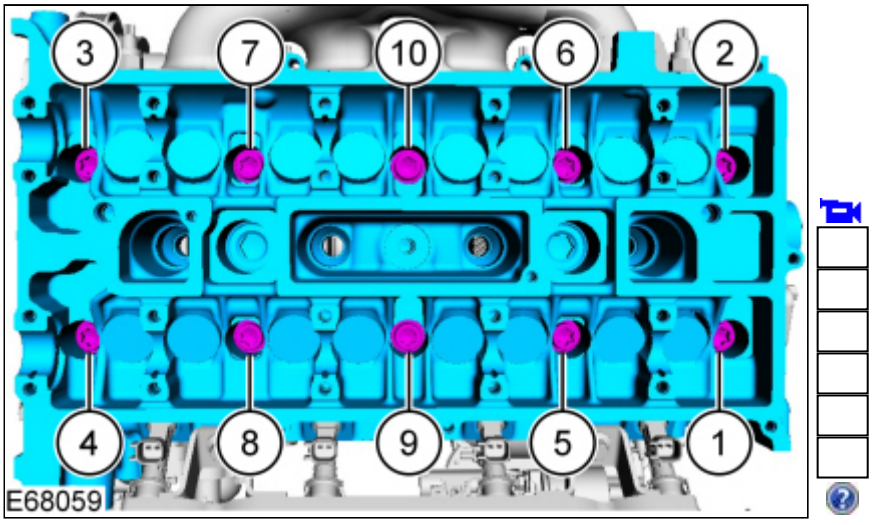


21. **NOTE:** *Note the position of the components before removal.*

    NOTE: *The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.*

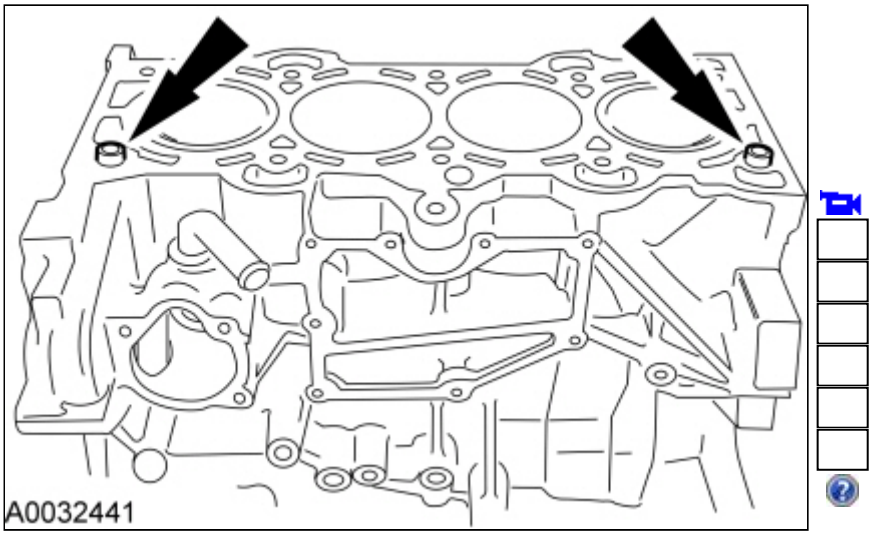
    Remove and inspect the valve tappets.

22. Discard the cylinder head bolts.

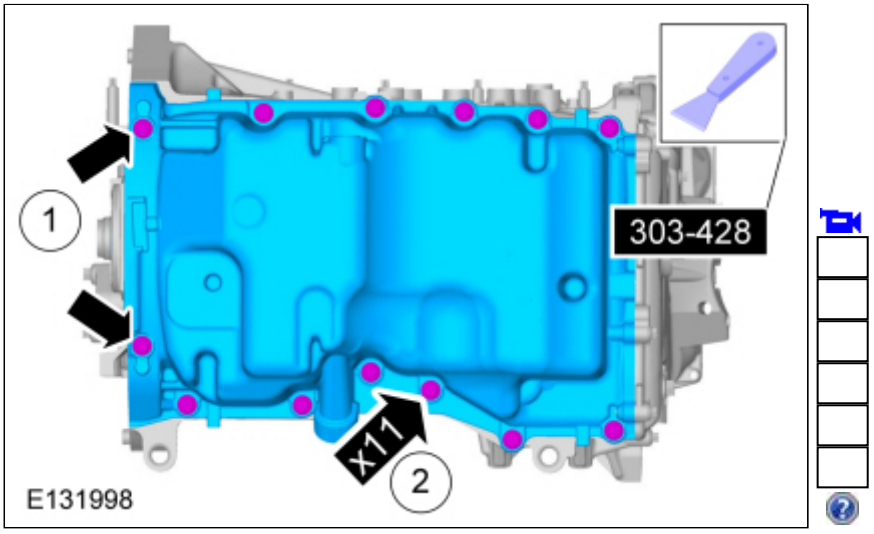


23. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion.
    Refer to: Cylinder Head Distortion (303-00 Engine System - General Information, General Procedures).
    Refer to: Cylinder Block Distortion (303-00 Engine System - General Information, General Procedures).

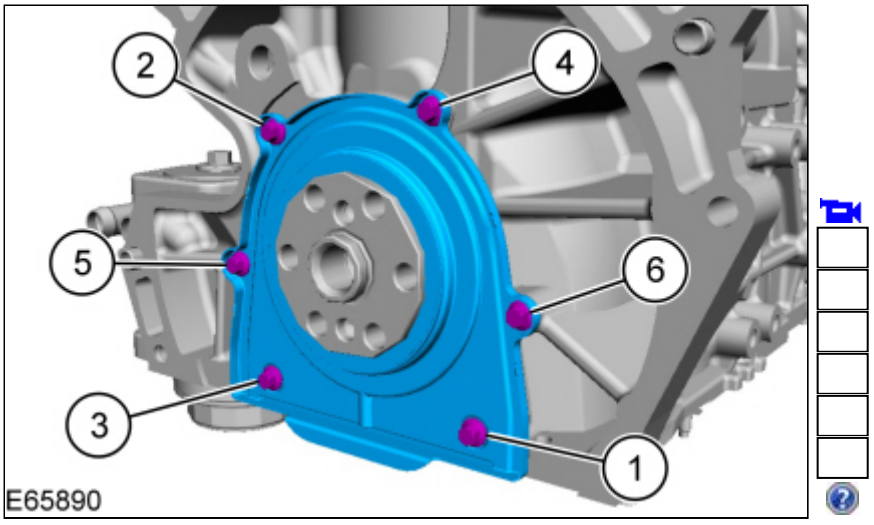
24. Remove the cylinder head alignment dowels.



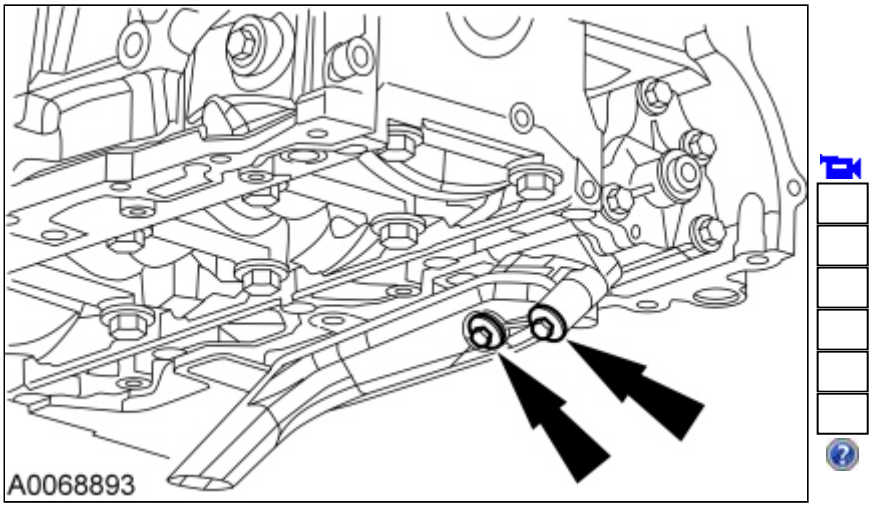
25. Use Special Service Tool: 303-428 Separator, Oil Pan.



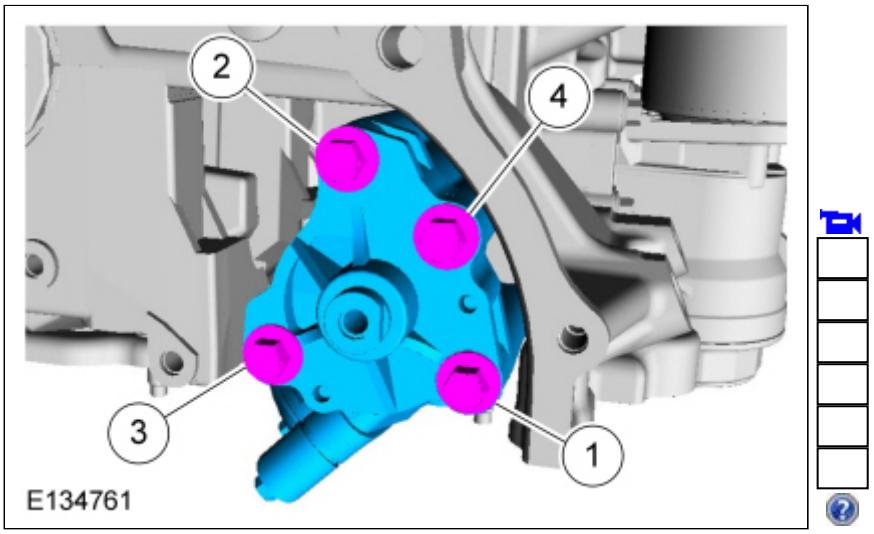
26.



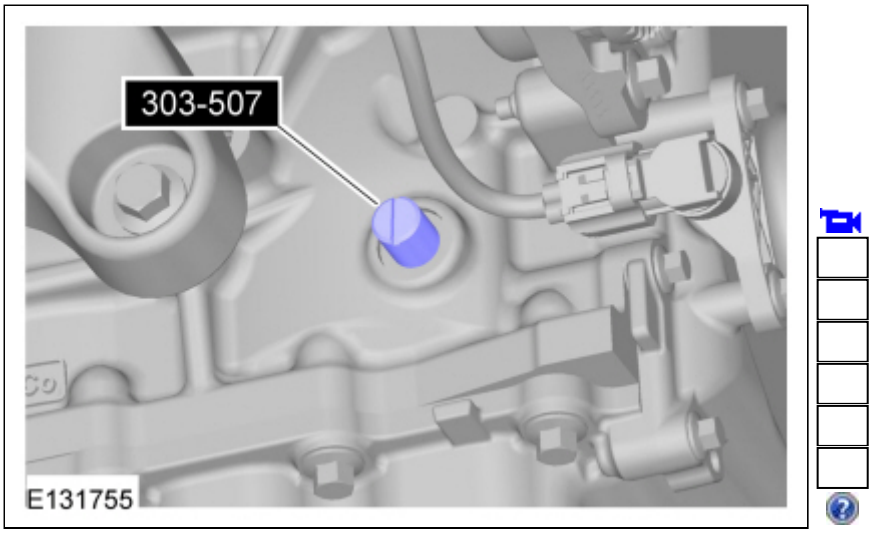
27. Remove the bolts, oil pump pickup tube and discard the gasket.



28.

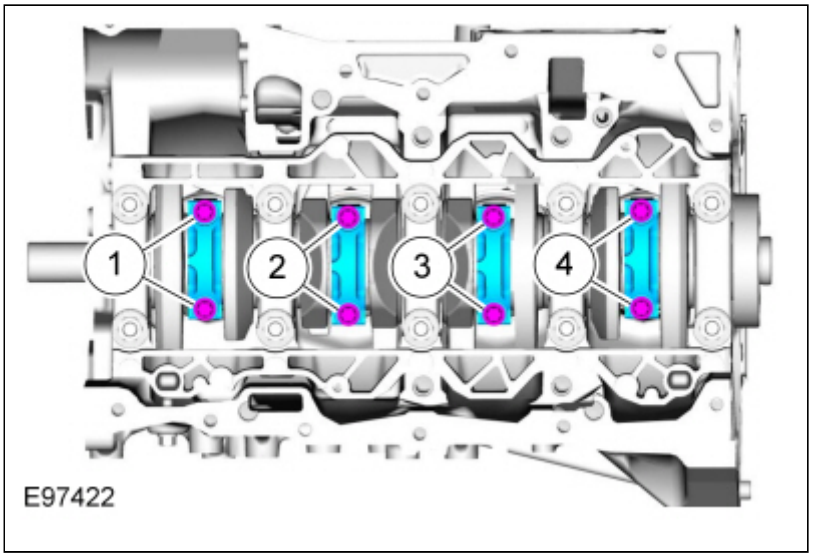


29. Rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the crankshaft TDC timing peg.
Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



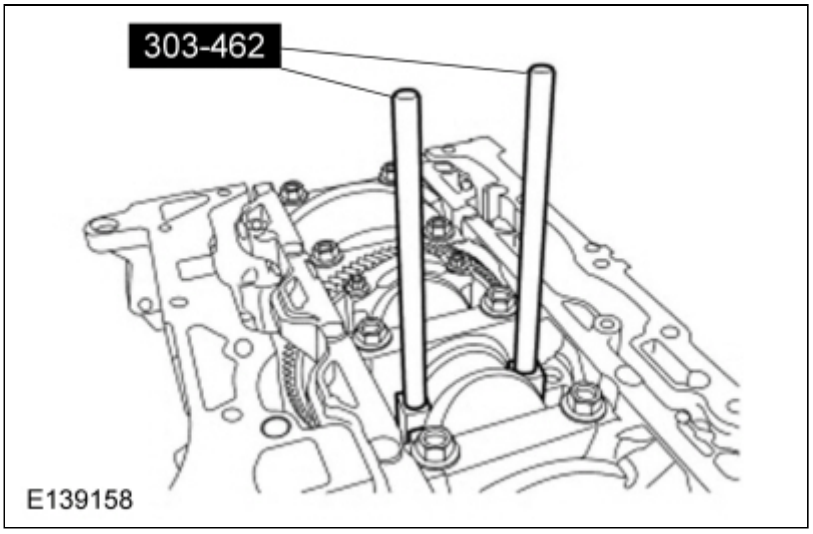
30. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following manufacturer's instructions.

31. **NOTE:** *Note the position of the components before removal*

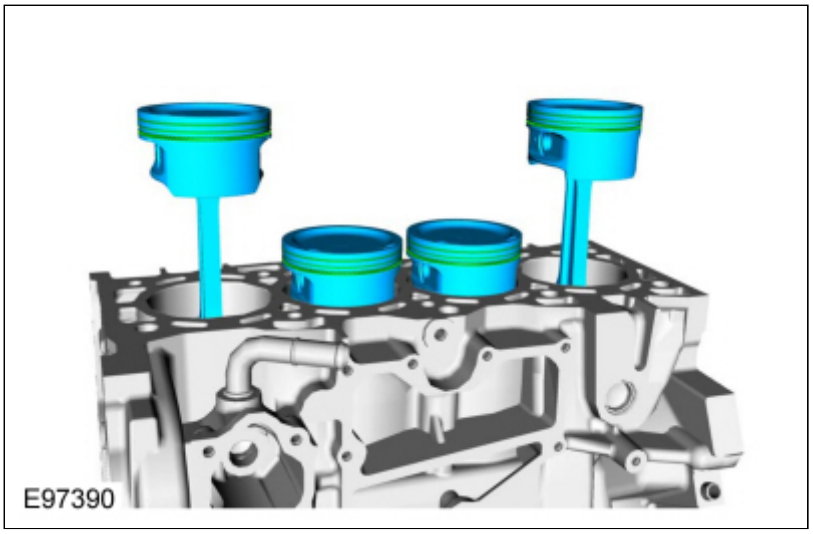


32. **NOTICE: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.**

    Using the connecting rod installer, remove the piston or rod assembly from the engine block.
    Use Special Service Tool: 303-462 Installer, Connecting Rod.

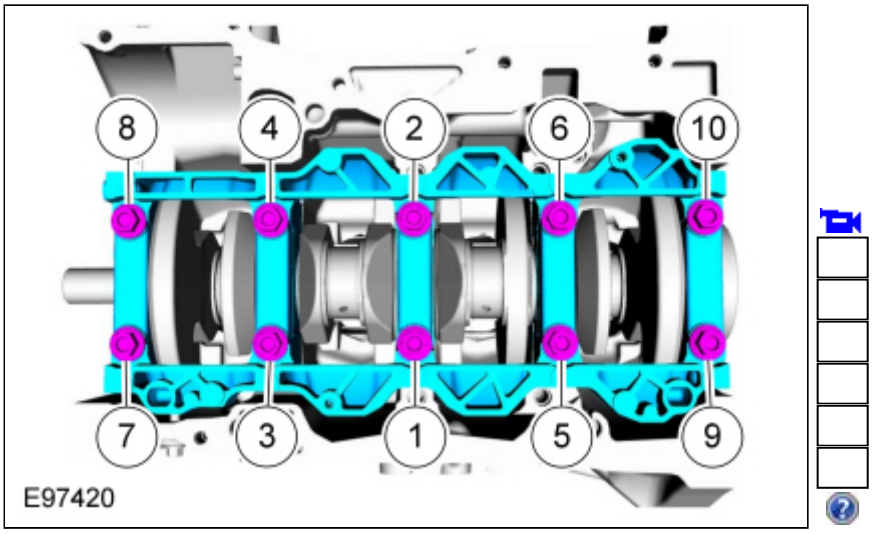


33. **NOTE:** *Note the position of each component before removal.*

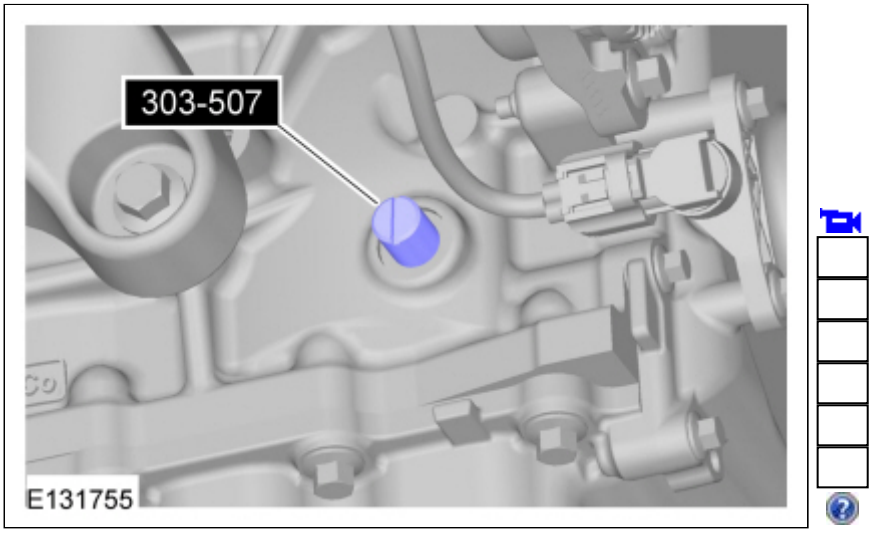


34. Repeat the previous 2 steps until all the piston or rod assemblies are removed from the engine block.

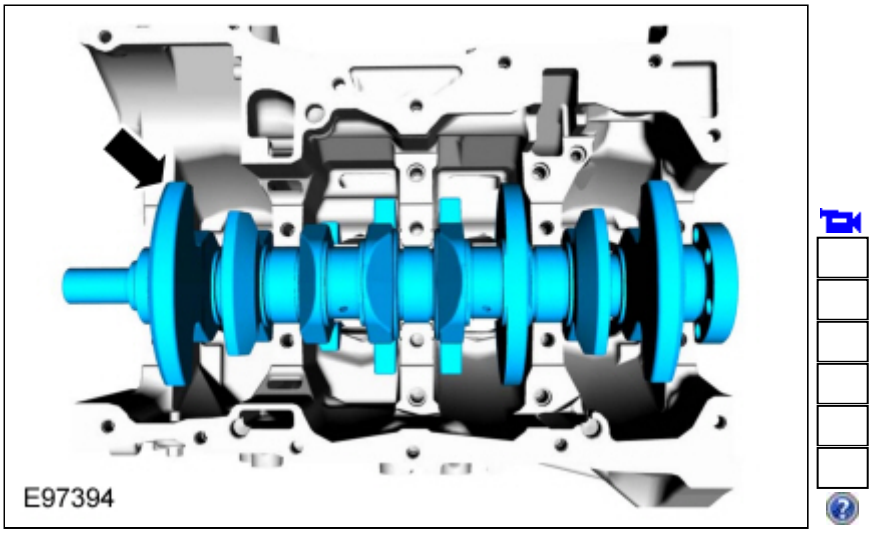
35. Discard the bolts.



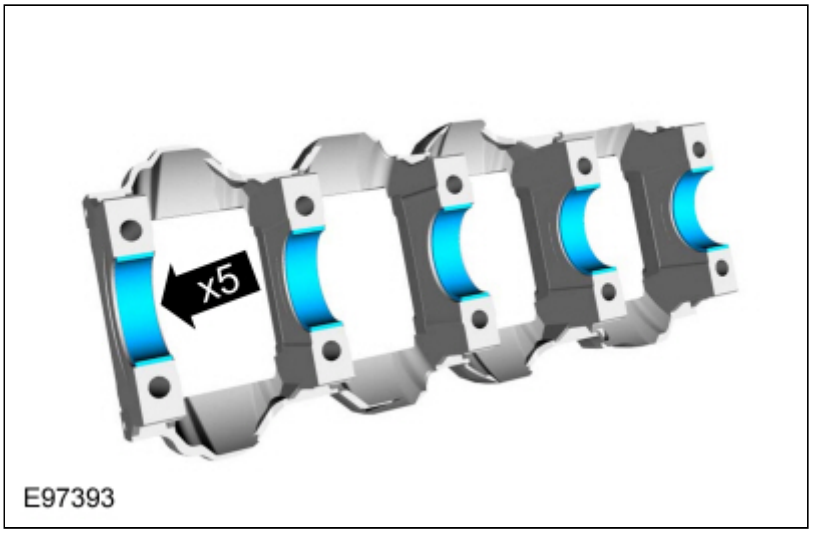
36. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



37. **NOTICE: Make sure that the balance shaft oil feed plug remain installed in the cylinder block.**



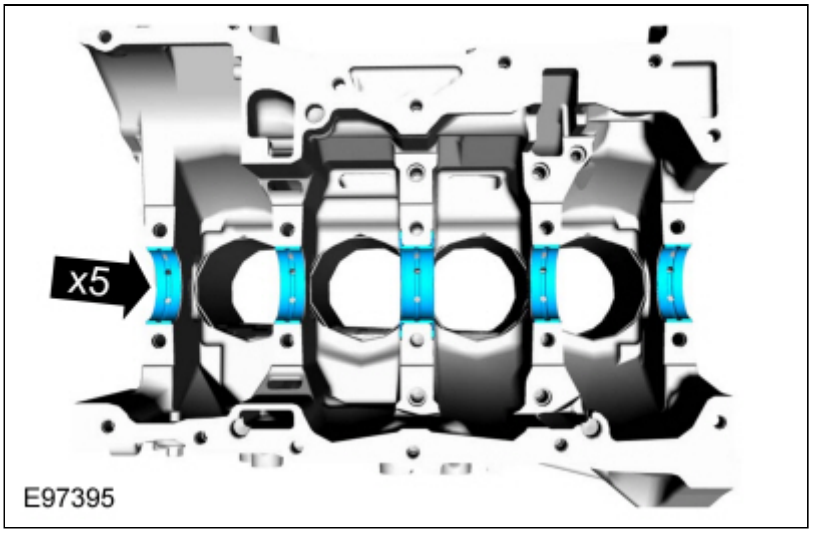
38. **NOTE:** *If the components are to be reused, make sure that they are installed to the position noted before removal*



39. **NOTE:** *If the main bearings are being reused,Note the position of the components before removal..*

    NOTE: *The thrust bearing is located in the center bulkhead.*

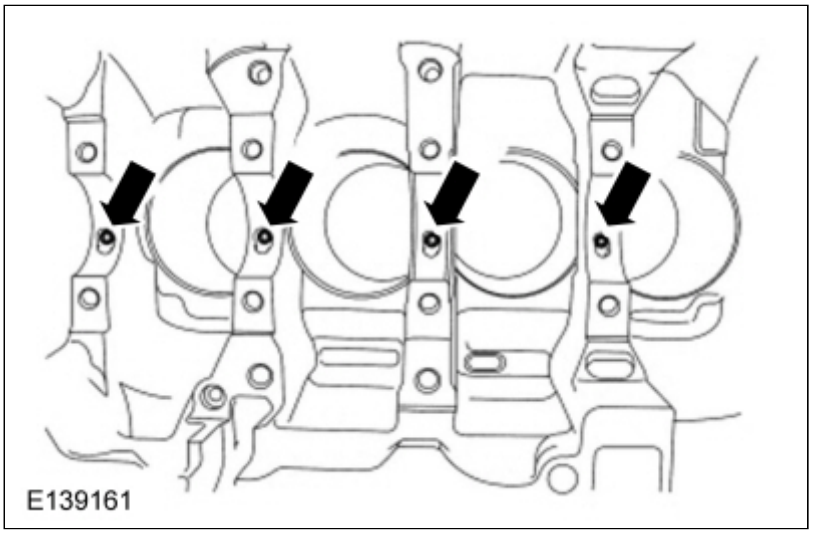
    Remove the main bearings from the cylinder block.



40. **NOTE:** *If the components are to be reused, make sure that they are installed to the position noted before removal..*

    NOTE: *The front bulkhead does not have an oil squirter.*

    Remove the 4 oil squirters.



41. Inspect the cylinder block, main bearing beam, pistons and connecting rods.

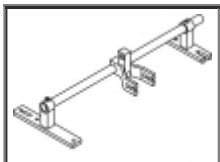
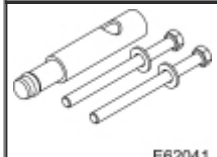
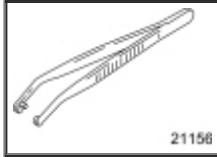
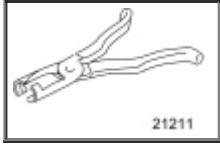
Refer to: Piston Inspection (303-00 Engine System - General Information, General Procedures).
Refer to: Bearing Inspection (303-00 Engine System - General Information, General Procedures).
Refer to: Connecting Rod Large End Bore (303-00 Engine System - General Information, General Procedures).
Refer to: Cylinder Block Distortion (303-00 Engine System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Cylinder Head

Base Part Number: 6051

Special Tool(s) / General Equipment

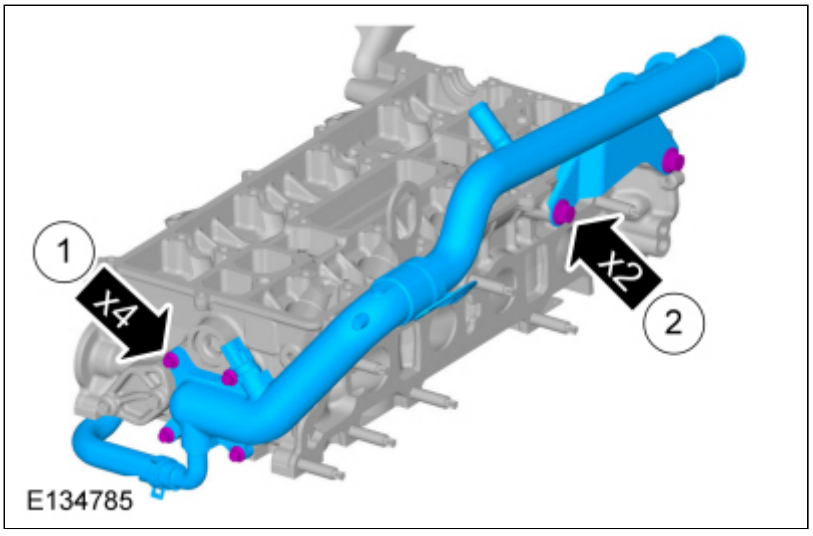
 E62757	303-361B Compressor, Valve Spring
 E62041	303-361B-06 Adapter for 303-361B
 21156	303-362 Installer, Valve Stem Collets
 21211	303-508 Pliers, Valve Stem Seal

DISASSEMBLY

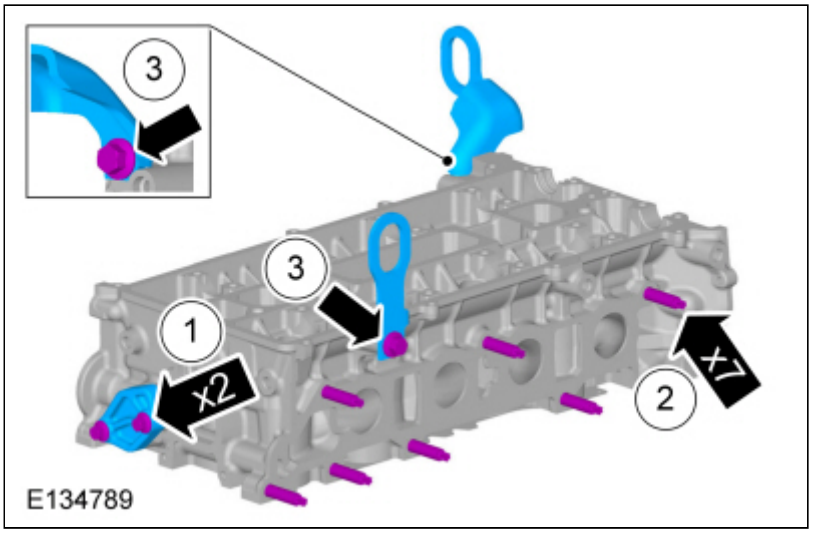
NOTE: *Disassembly steps in this procedure may contain assembly details.*

1. Refer to: Cylinder Head (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

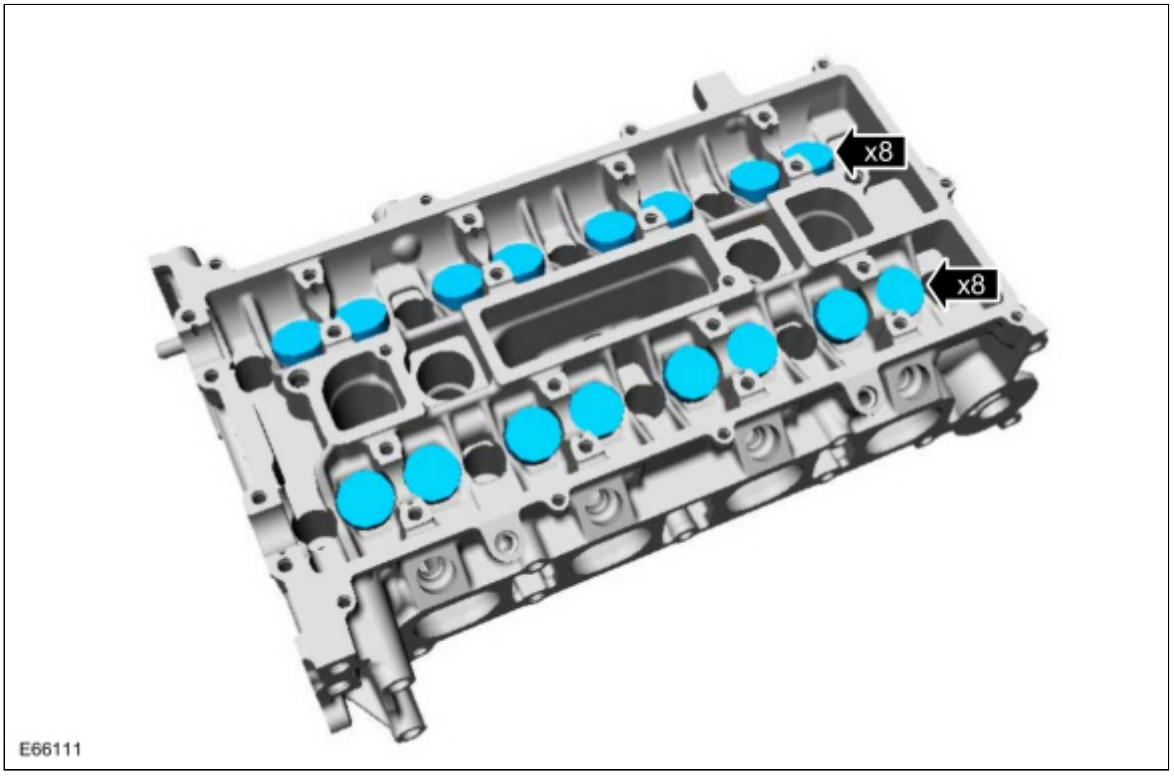
1. *Torque*: 10 Nm
2. *Torque*: 48 Nm



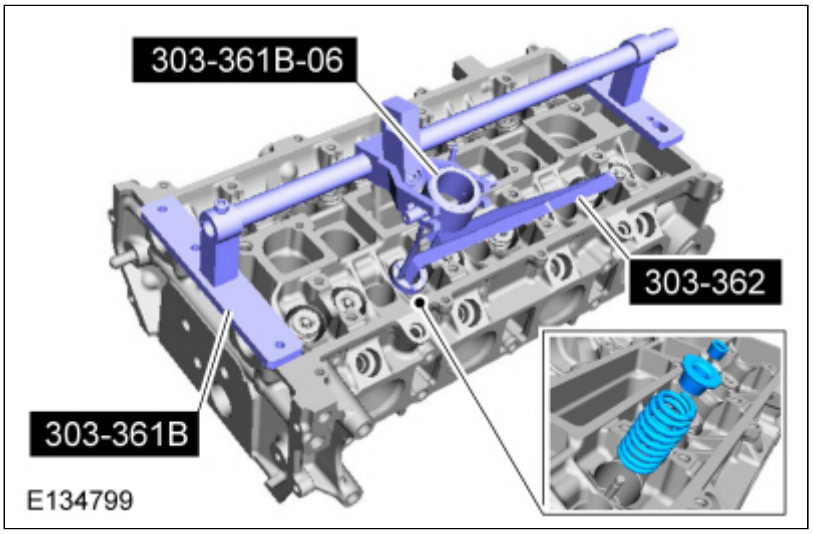
1. *Torque*: 25 Nm
2. *Torque*: 17 Nm
3. *Torque*: 45 Nm



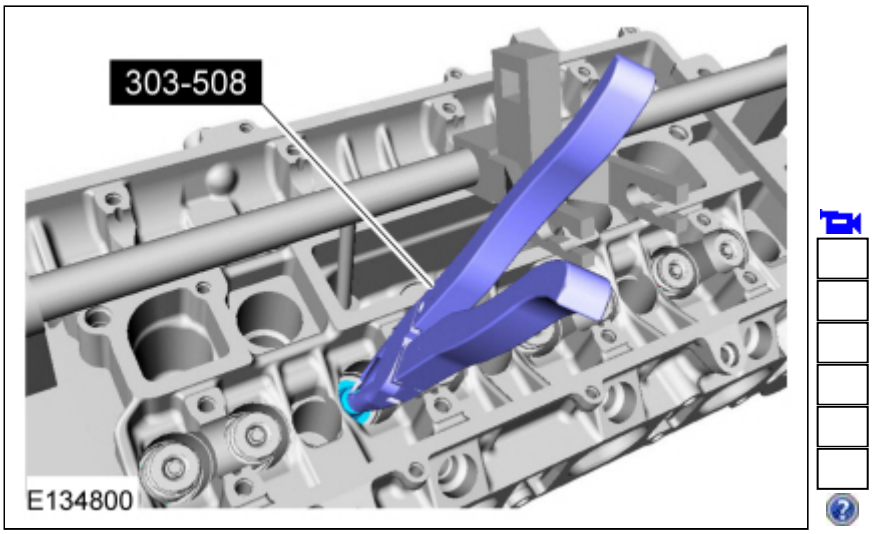
4.



5. Use Special Service Tool: 303-361B Compressor, Valve Spring. , 303-361B-06 Adapter for 303-361B. , 303-362 Installer, Valve Stem Collets.



6. Use Special Service Tool: 303-508 Pliers, Valve Stem Seal.



ASSEMBLY

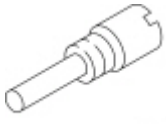
1. To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

Engine

Base Part Number: 6L084

Special Tool(s) / General Equipment

 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 E134674	303-1416 Tool, Crank Damper Holding
 21148	303-318 Aligner/Installer, Crankshaft Front Seal
 E134675	303-328 (T88P-6701-B1) Replacer, Rear Seal
 E139375	303-462 Installer, Connecting Rod
 E134673	303-465 Tool, Camshaft Align Timing
 PZ21210	303-507 Timing Peg, Crankshaft TDC
 E139376	303-D032 (D81L-6002-C) Compressor, Piston Ring

Materials

Name	Specification
Gear/Transmission Fluid - SAE 85W-90	SQ-M2C9002-AA

Silicone Sealant	WSE-M4G323-A4

1. **NOTICE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage may occur.**

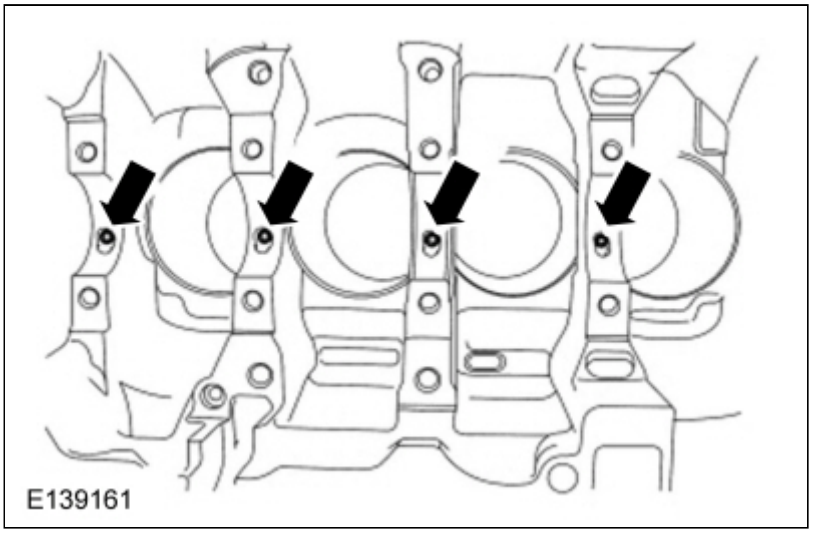
   NOTICE: During engine repair procedures, cleanliness is extremely important. All parts must be thoroughly cleaned and any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

   NOTE: *Assembly of the engine requires various inspections/measurements of the engine components (engine block, crankshaft, connecting rods, pistons and piston rings). These inspections/measurements will aid in determining if the engine components will require replacement.*

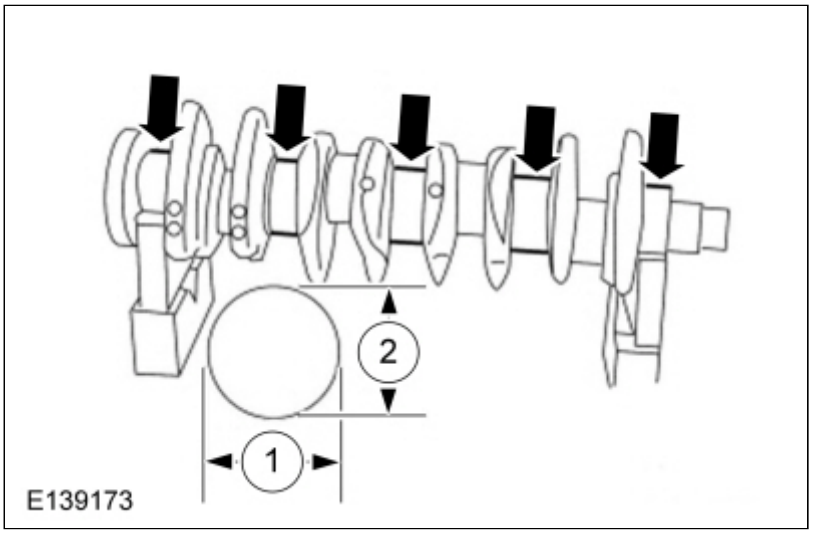
2. **NOTE:** *If the oil squirters are being reused, they must be installed in the same location as marked during disassembly.*

   NOTE: *The front bulkhead does not have an oil squirter.*

   Install the 4 oil squirters.
   Torque: 4 Nm

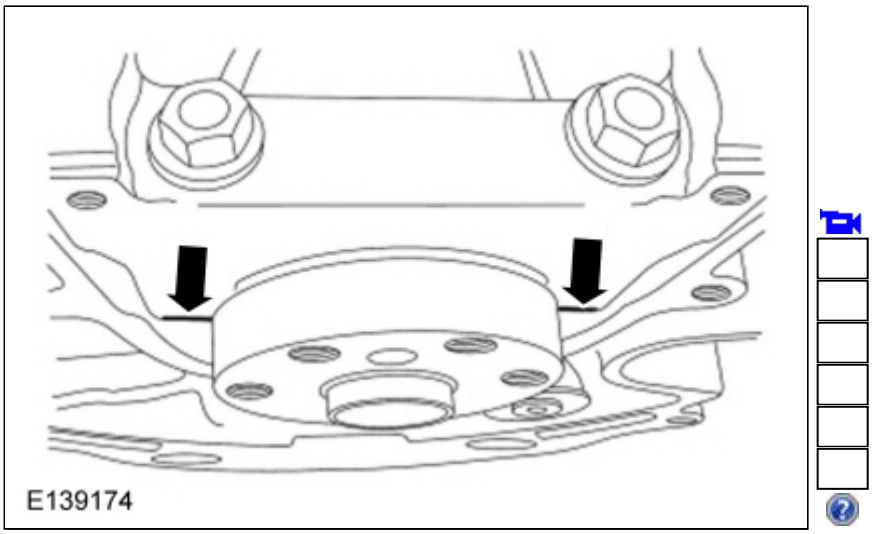


3. Measure each of the crankshaft main bearing journal diameters in at least 2 directions and record the smallest diameter for each journal.

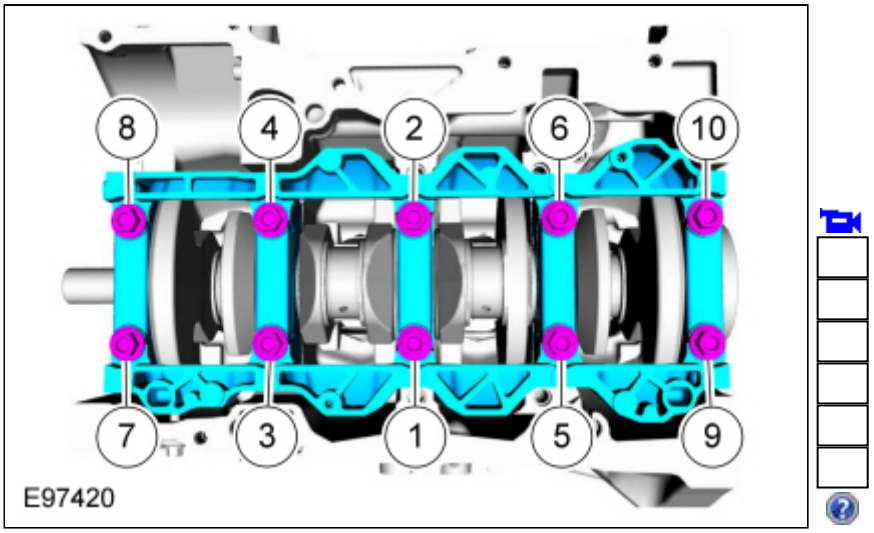


4. Position the main bearing beam in the engine block with the main bearing beam mounted flush with the rear

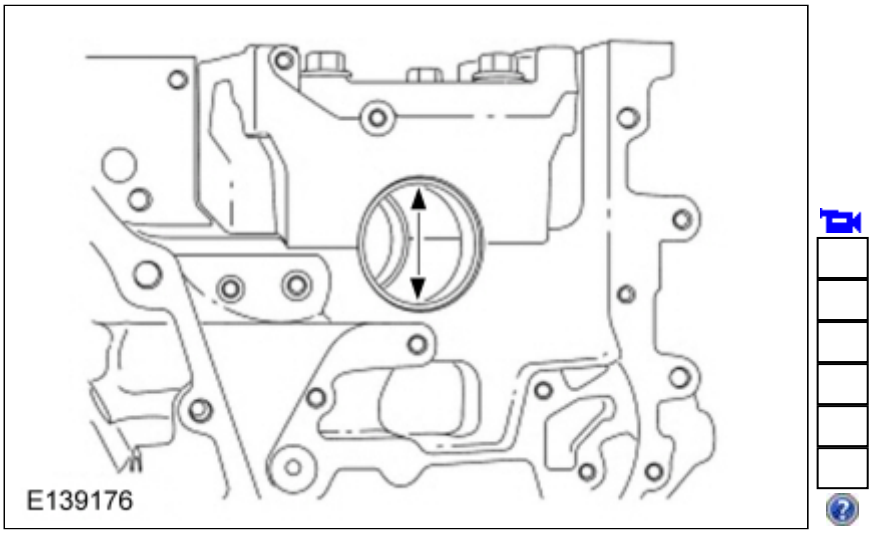
face of the engine block.



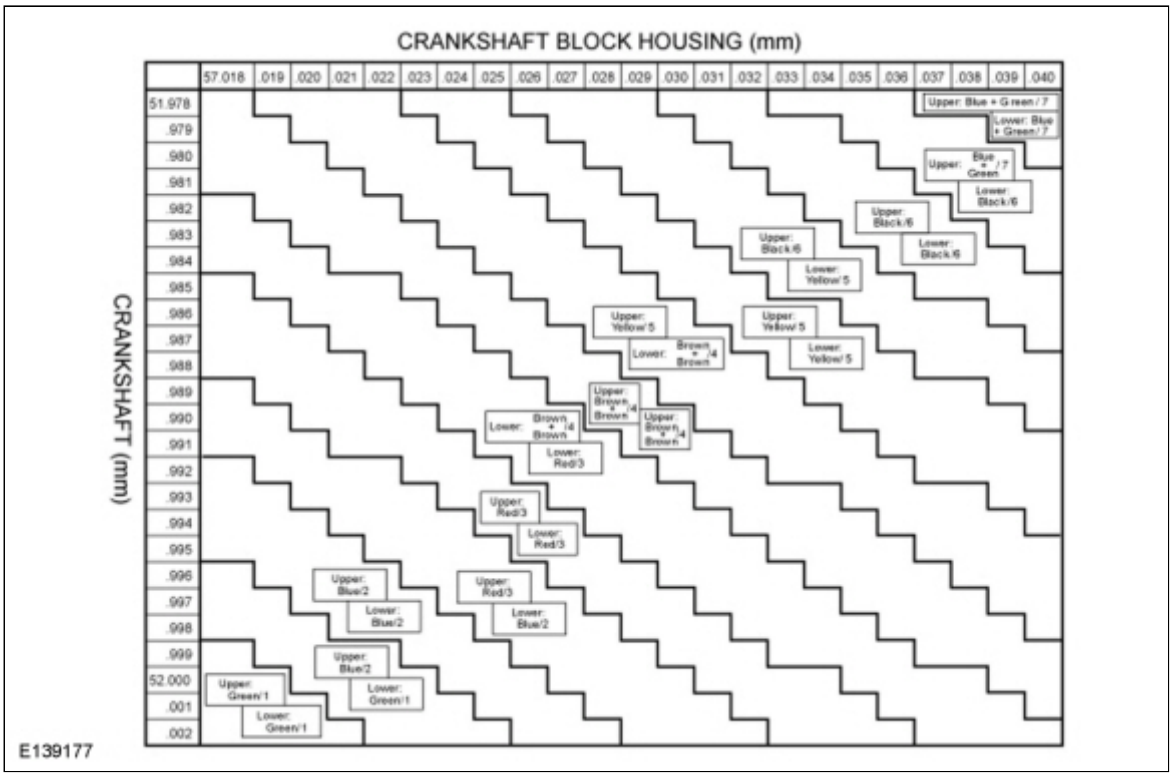
5. Using the original main bearing beam bolts, install and tighten the 10 main bearing beam bolts.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 25 Nm
   Stage 3: 90 °



- Measure each crankshaft block main bearing bore diameter.
- Remove the bolts and the main bearing beam.
- Discard the main bearing beam bolts.

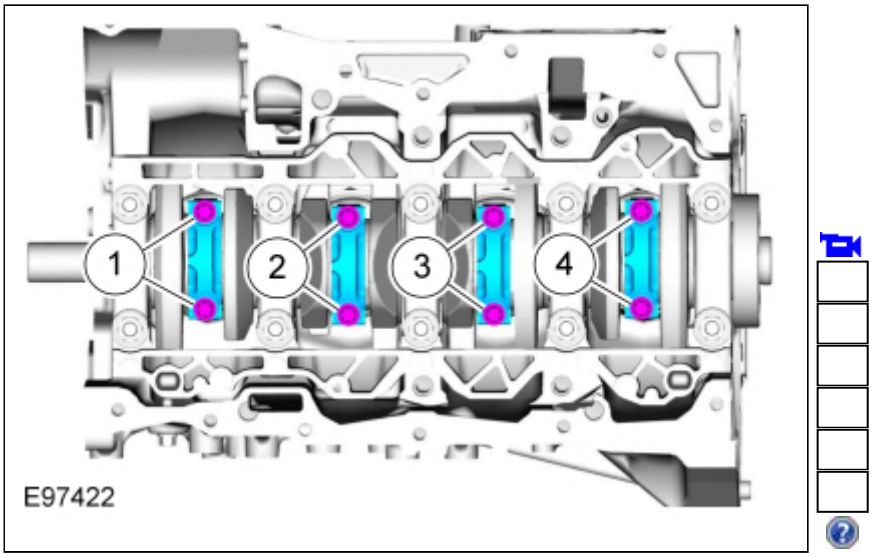


7. Using the chart, select the crankshaft main bearings.

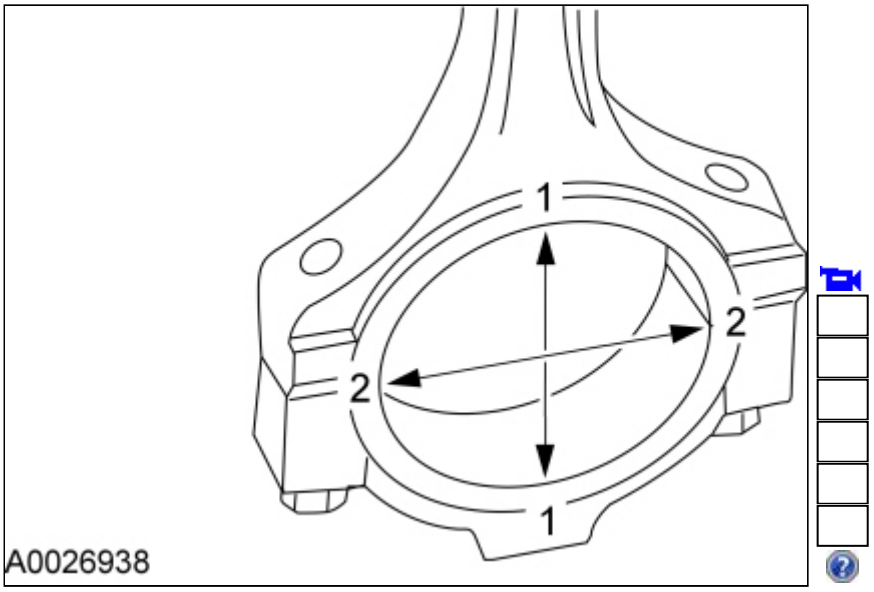


8. **NOTICE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.**

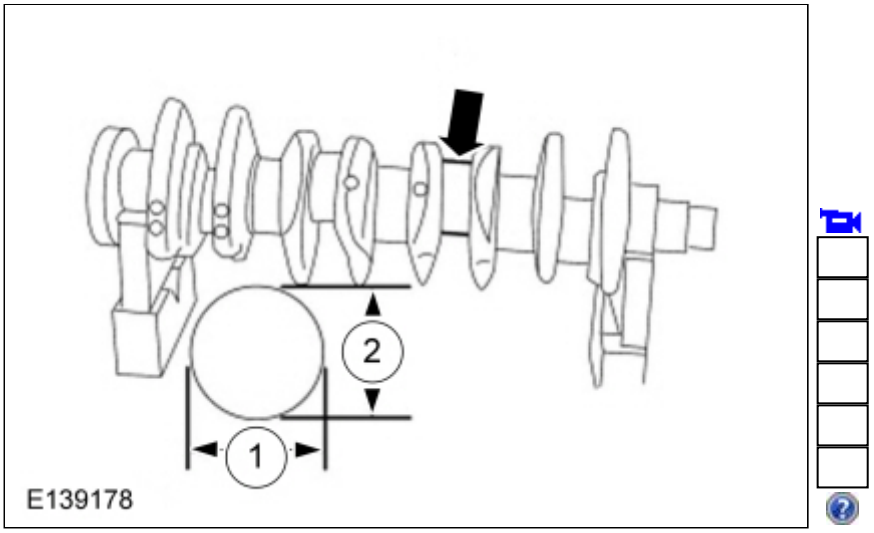
   Using the original connecting rod cap bolts, install the connecting caps and bolts.
   Torque:
   Stage 1: 29 Nm
   Stage 2: 90 °



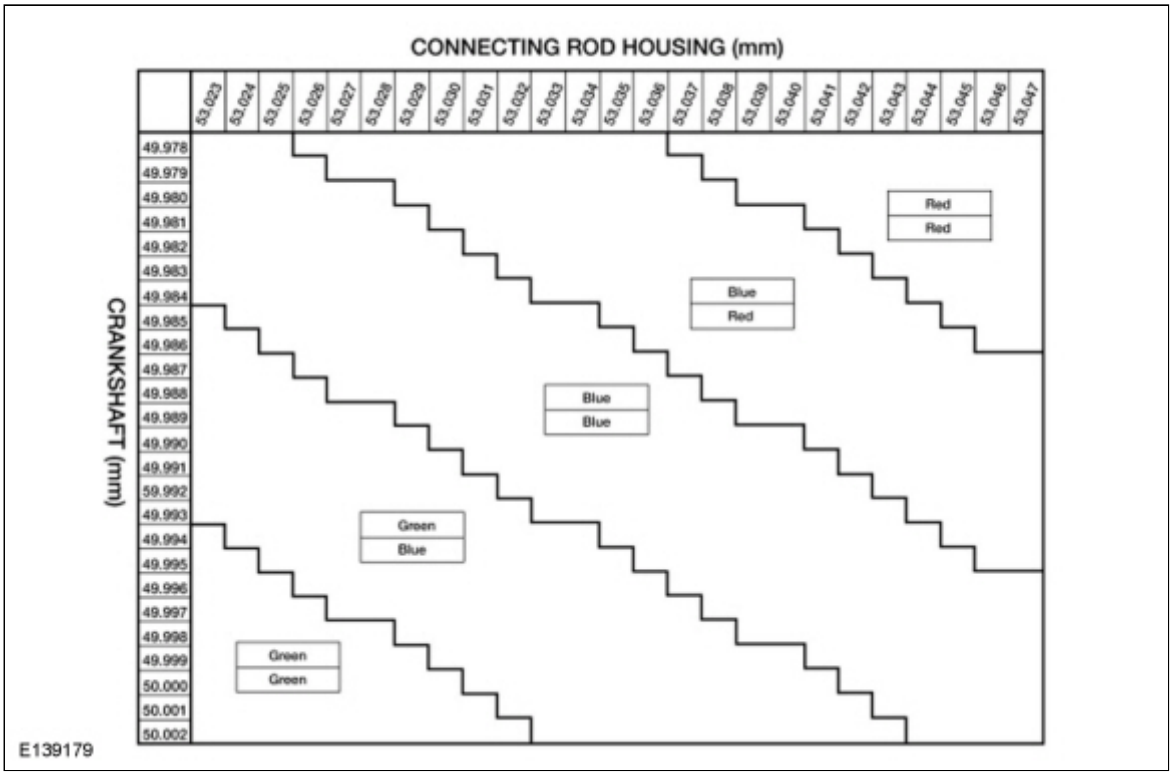
- Measure the connecting rod large end bore in 2 directions. Record the smallest measurement for each connecting rod.
- Remove the bolts and the connecting rod cap.
- Discard the connecting rod cap bolts.



10. Measure each of the crankshaft connecting rod bearing journal diameters in at least 2 directions. Record the smallest measurement for each connecting rod journal.



11. Using the chart, select the correct connecting rod bearings for each crankshaft connecting rod journal.



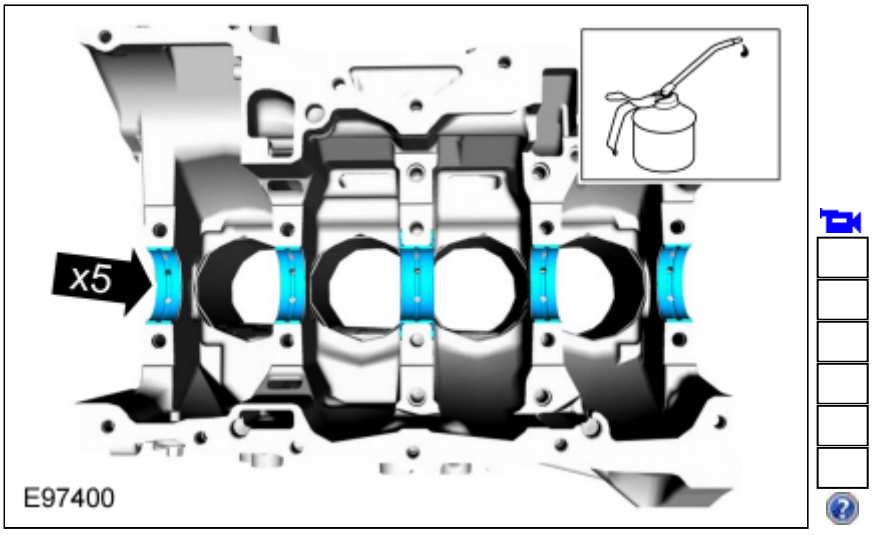
12. **NOTE:** *Before assembling the cylinder block, all sealing surfaces must be free of chips, dirt, paint and foreign material. Also, make sure the coolant and oil passages are clear.*

    NOTE: *If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.*

    NOTE: *The center bulkhead is the thrust bearing.*

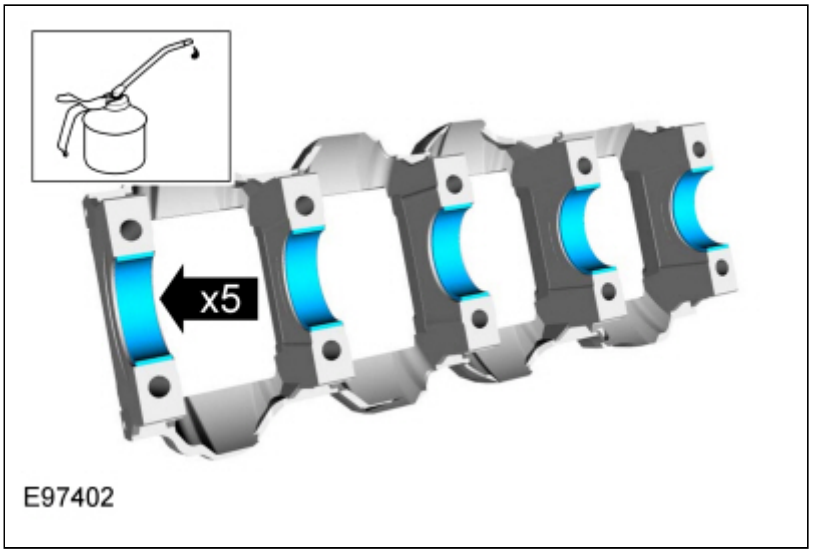
    NOTE: *Make sure that these components are installed to the noted removal position.*

    Lubricate the upper crankshaft main bearings with clean engine oil and install the 5 crankshaft main bearings in the cylinder block.

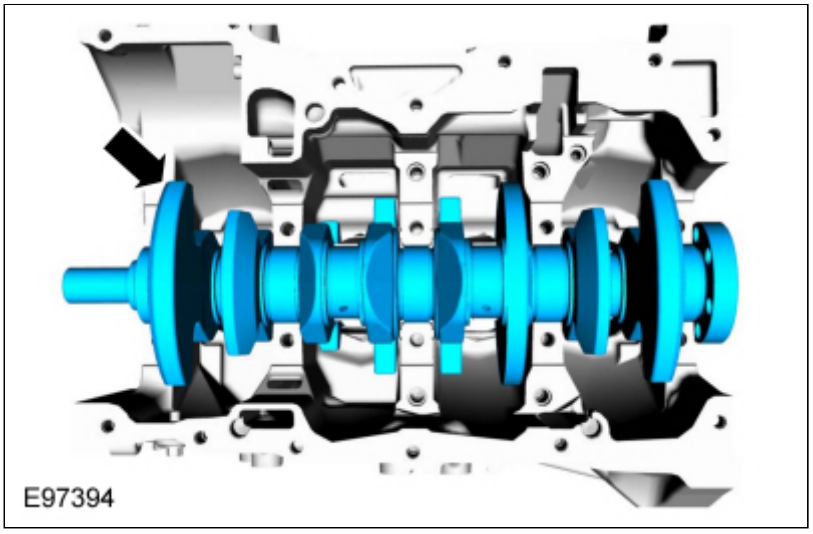


13. **NOTE:** *If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.*

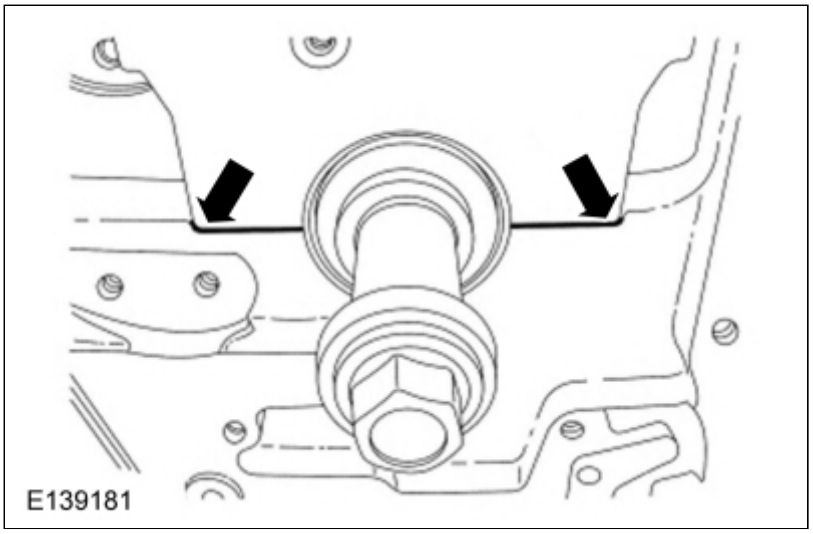
    Lubricate the crankshaft main bearings with clean engine oil and install the 5 crankshaft main bearings in the main bearing beam.



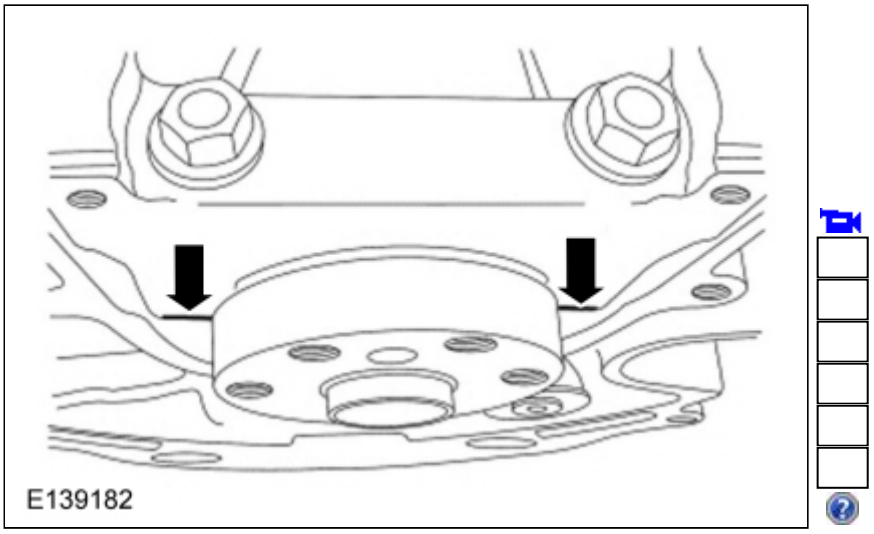
14. Lubricate journals on the crankshaft with clean engine oil.
15. Position the crankshaft in the cylinder block.



16. Lubricate the 10 main bearing beam side fit surfaces (front 2 shown) with clean engine oil.



17. Lubricate the crankshaft bearing journals on the main bearing beam with clean engine oil. Then position the main bearing beam in the engine block with the main bearing beam mounted flush with the rear face of the engine block.

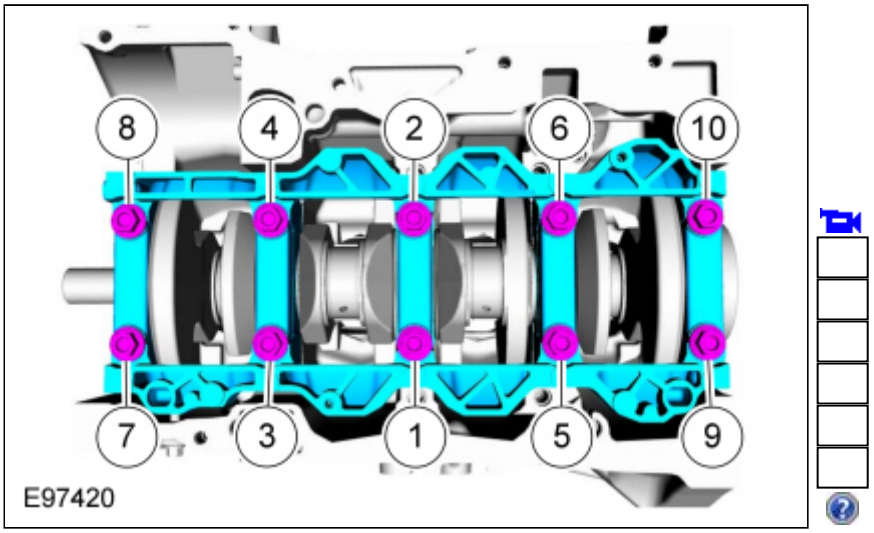


18. **NOTICE: Make sure that new bolts are installed.**

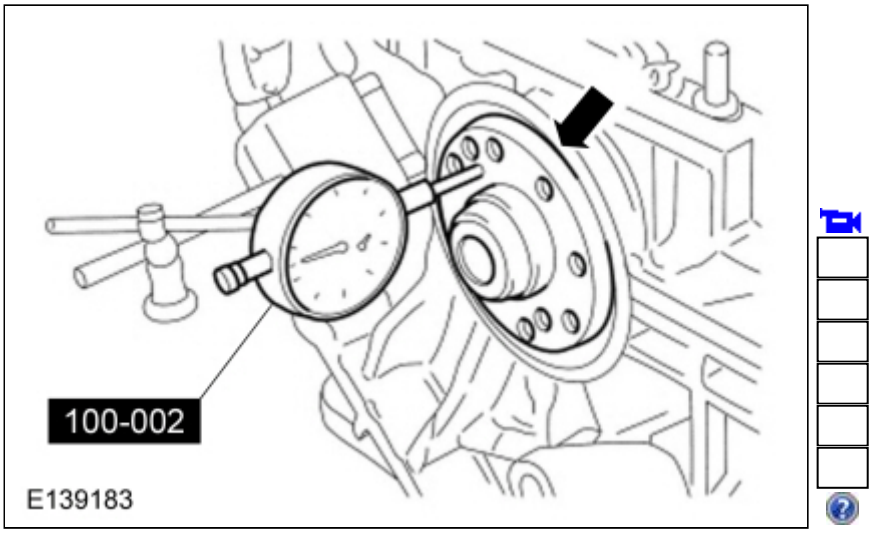
    NOTE: *Lubricate the main bearing beam bolts threads and under the bolt heads with clean engine oil.*

    NOTE: *Position the crankshaft to the rear of the cylinder block, then position the crankshaft to the front of the cylinder block before tightening the main bearing beam bolts.*

    Torque:
    Stage 1: 5 Nm
    Stage 2: 25 Nm
    Stage 3: 90°



- Using the dial indicator gauge with holding fixture, measure crankshaft end play.
  Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.
- Position the crankshaft to the rear of the cylinder block.
- Zero the dial indicator gauge with holding fixture.
- Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.
- Acceptable crankshaft end play is 0.22-0.43 mm (0.008-0.016 in). If the crankshaft end play exceeds the specified range, install new parts as necessary.

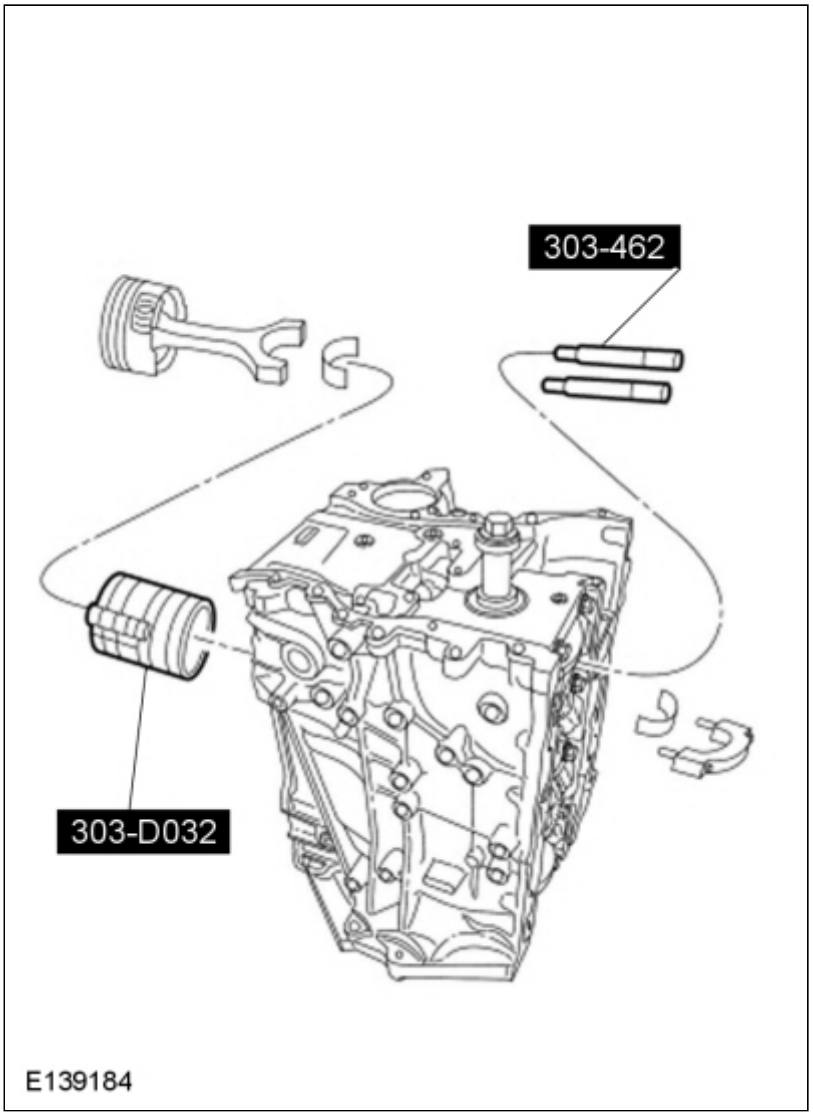


20. **NOTICE: Be sure not to scratch the cylinder wall or crankshaft journal with the connecting rod. Push the piston down until the connecting rod bearing seats on the crankshaft journal.**

    NOTE: *Lubricate the pistons, piston rings, connecting rod bearings and the entire cylinder bores with clean engine oil.*

    NOTE: *Make sure the piston arrow on top is facing toward the front of the engine.*

    - Using the piston ring compressor and the connecting rod installer, install the piston and connecting rod assemblies.
      Use Special Service Tool: 303-D032 (D81L-6002-C) Compressor, Piston Ring. , 303-462 Installer, Connecting Rod.
    - When installing the pistons and connecting rod assemblies, the oil ring gaps must be positioned 60 degrees apart from each other and a minimum of 90 degrees from the expander gap.
    - The position of the upper and lower compression ring gaps are not controlled for installation.

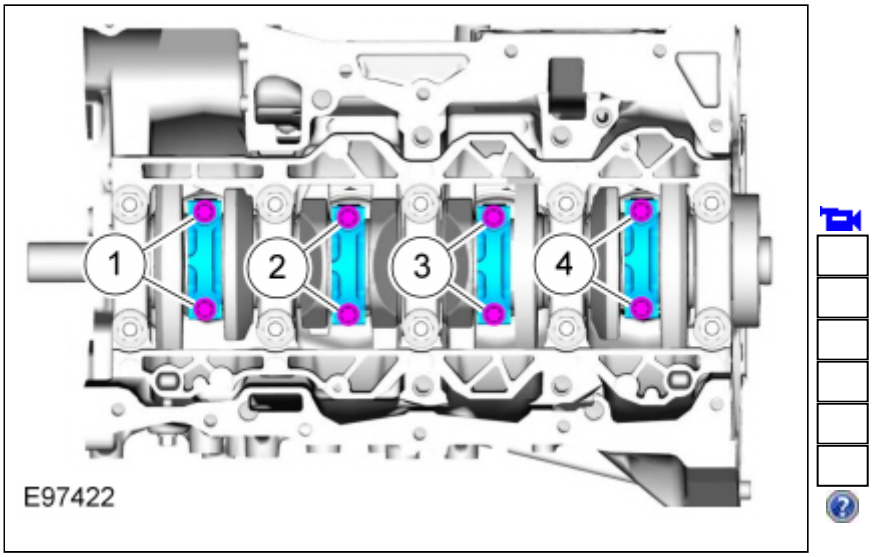


21. **NOTICE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.**

    NOTE: *Install connecting rod caps and bolts on the connecting rods for cylinders 1 and 4 first and tighten. Then rotate crankshaft 180 degrees and install connecting rod caps and bolts on connecting rods for cylinders 2 and 3 and tighten.*

    NOTE: *After installation of each connecting rod cap, rotate the crankshaft to verify smooth operation.*

    Install the connecting rod caps and the new bolts.
    Torque:
    Stage 1: 29 Nm
    Stage 2: 90 °

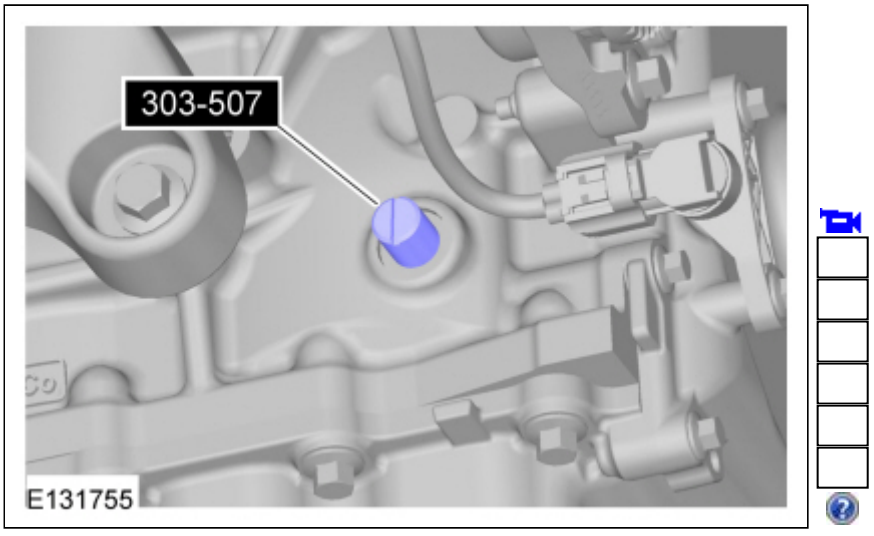


22. **NOTICE: Failure to position the No. 1 piston at TDC can result in damage to the engine. Turn the engine in the normal direction of rotation only.**

    Turn the crankshaft clockwise to position the No. 1 piston at TDC.

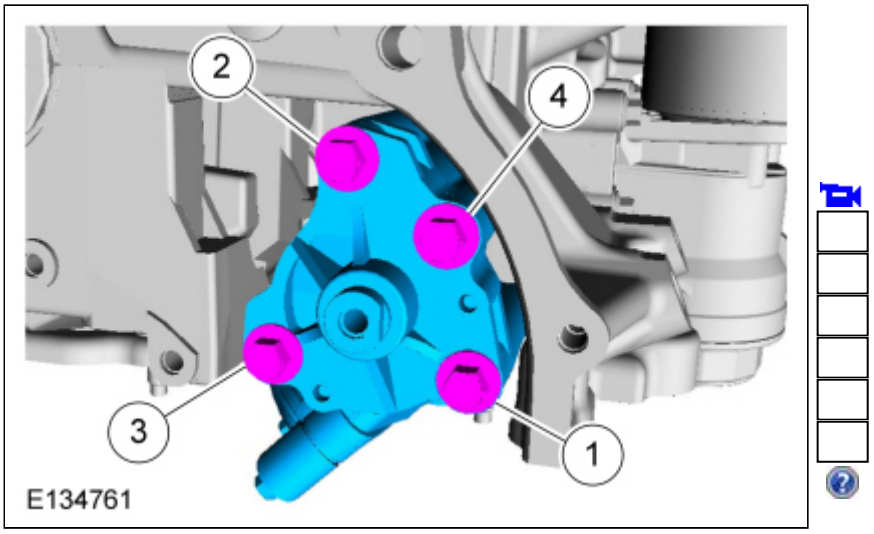
23. **NOTE:** *The crankshaft TDC timing peg will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position until the timing drive components and crankshaft pulley are installed. Install the crankshaft TDC timing peg.*

    Install the crankshaft TDC timing peg.
    Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.

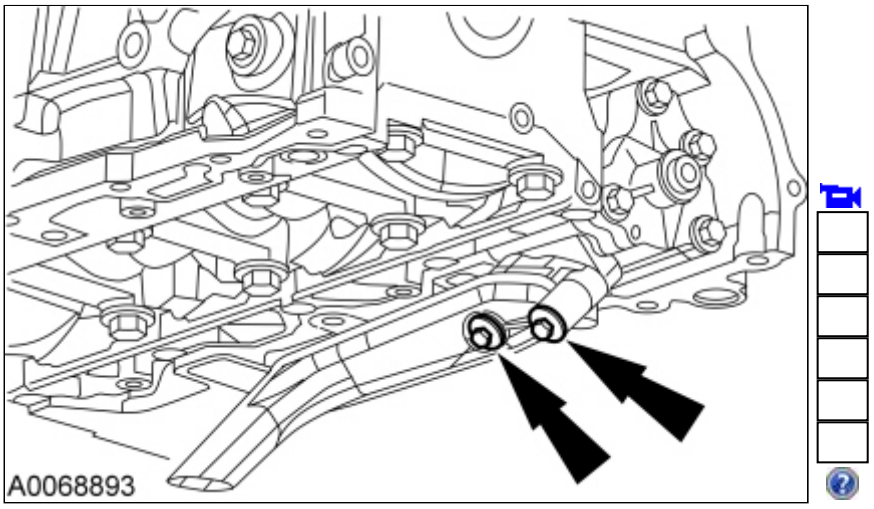


24. **NOTE:** *Clean the oil pump and cylinder block mating surfaces with metal surface prep.*

    Torque:
    Stage 1: 10 Nm
    Stage 2: 20 Nm



25. Install a new oil pump pickup tube gasket and the pickup tube.
    Torque: 10 Nm

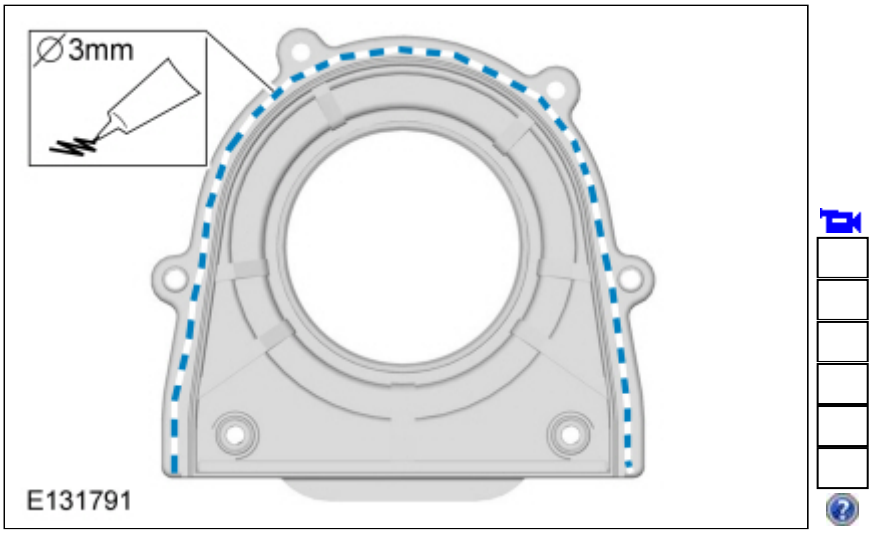


26. **NOTICE: Install the crankshaft rear seal carriers within five minutes of applying the sealer.**

    NOTE: *Do not damage the mating faces.*

    NOTE: *Mating surface should not have traces of oil to improve the adhesion.*

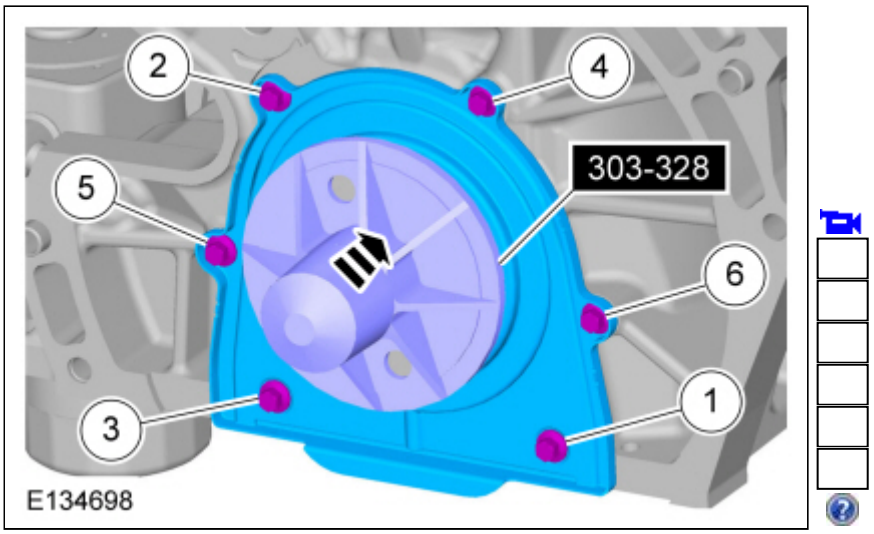
    Material: Silicone Sealant (WSE-M4G323-A4)



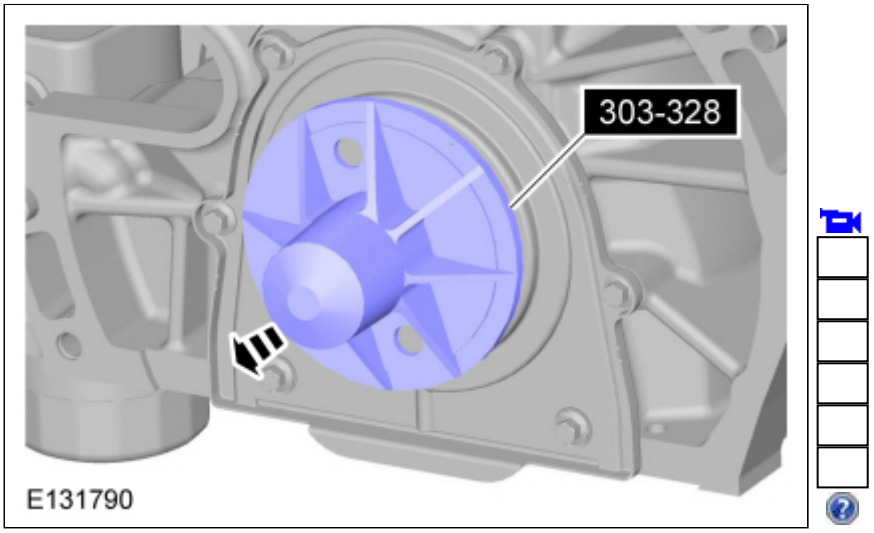
27. **NOTE:** *New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.*

    Use Special Service Tool: 303-328 (T88P-6701-B1) Replacer, Rear Seal.

Torque: 10 Nm



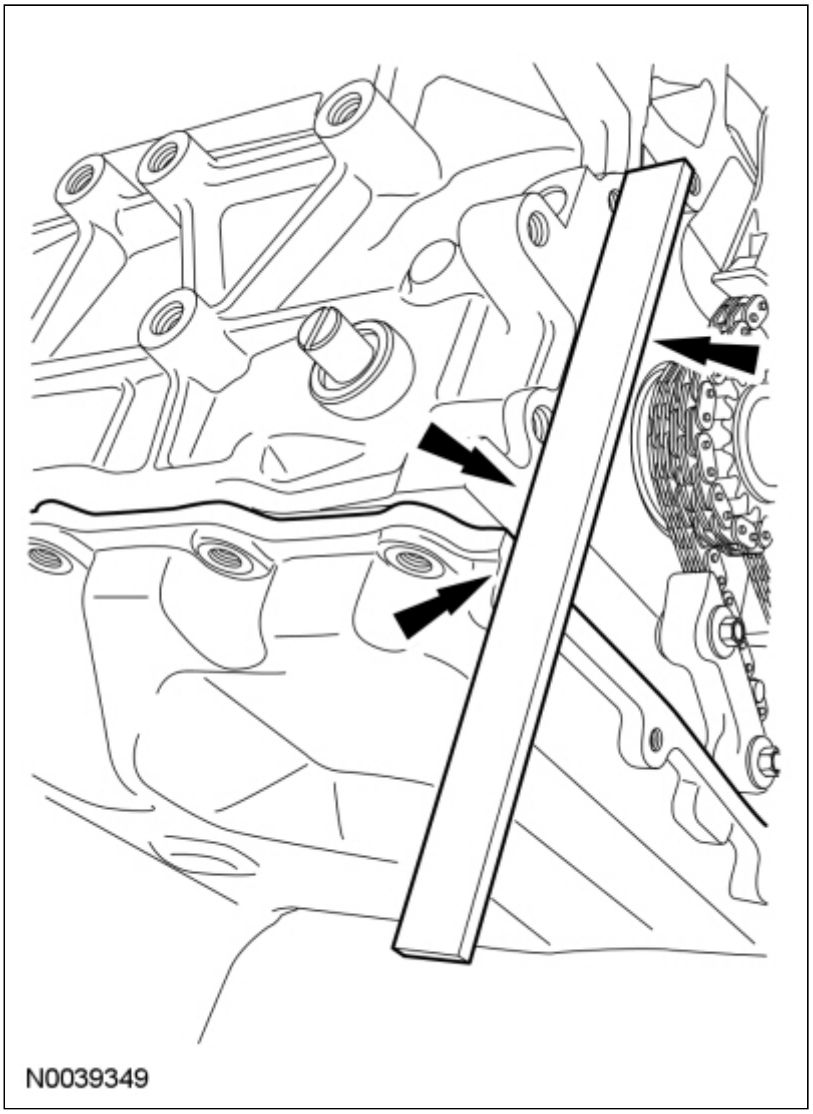
28. Remove Special Service Tool: 303-328 (T88P-6701-B1) Replacer, Rear Seal.



29. **NOTICE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove traces of sealant.**

    Clean and inspect all mating surfaces.

30. Using a suitable straight edge, align the front surface of the oil pan flush with the front surface of the engine block.

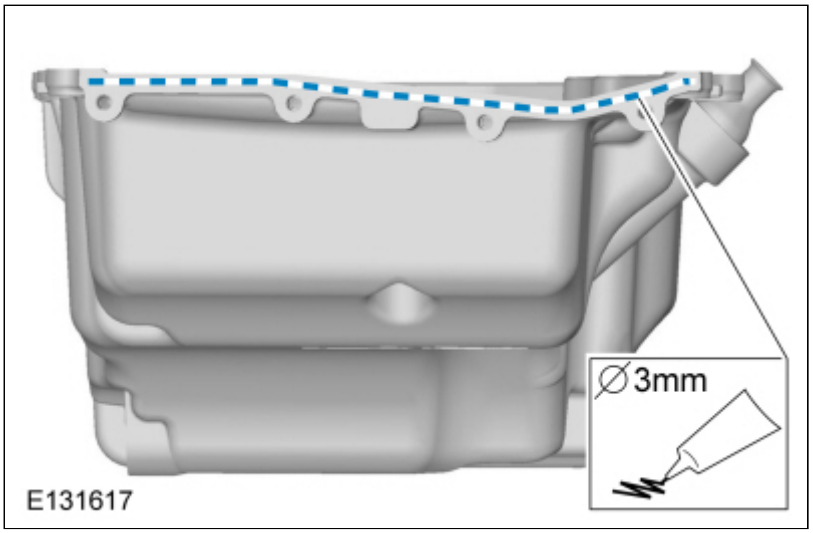


31. **NOTICE: Install the oil pan within five minutes of applying the sealer.**

    NOTE: *Do not damage the mating faces.*

    NOTE: *Mating surface should not have traces of oil to improve the adhesion.*

    Material: Silicone Sealant (WSE-M4G323-A4)

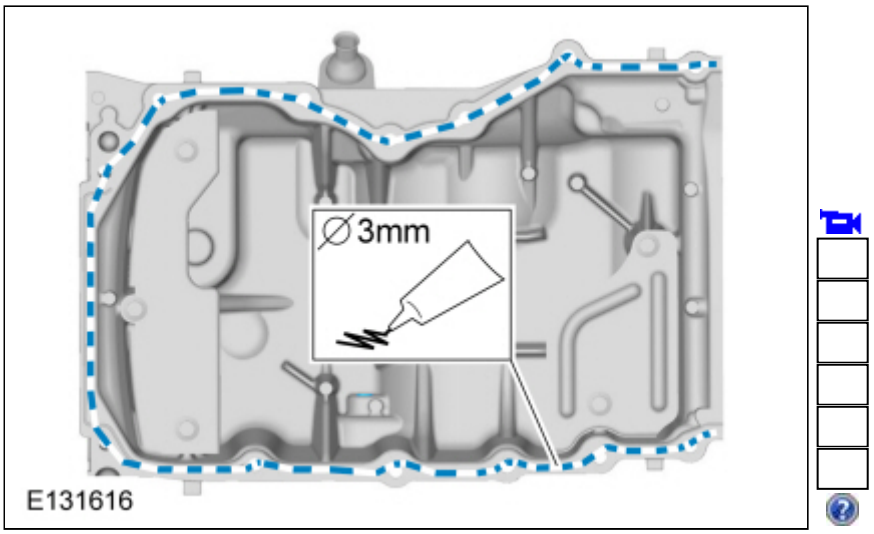


32. **NOTICE: Install the oil pan within five minutes of applying the sealer.**

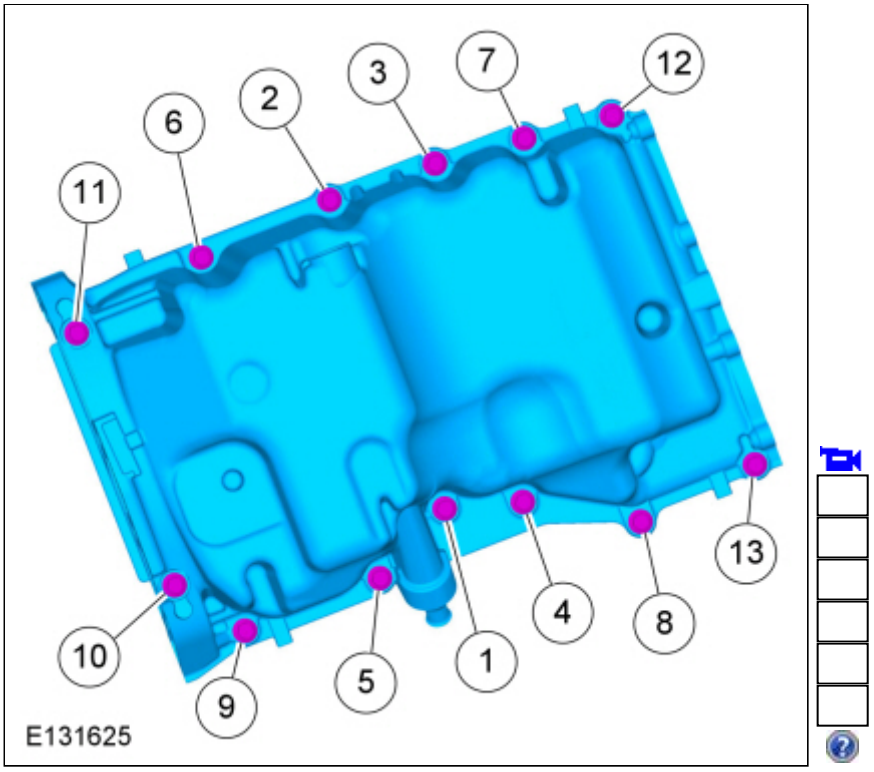
    NOTE: *Do not damage the mating faces.*

    NOTE: *Mating surface should not have traces of oil to improve the adhesion.*

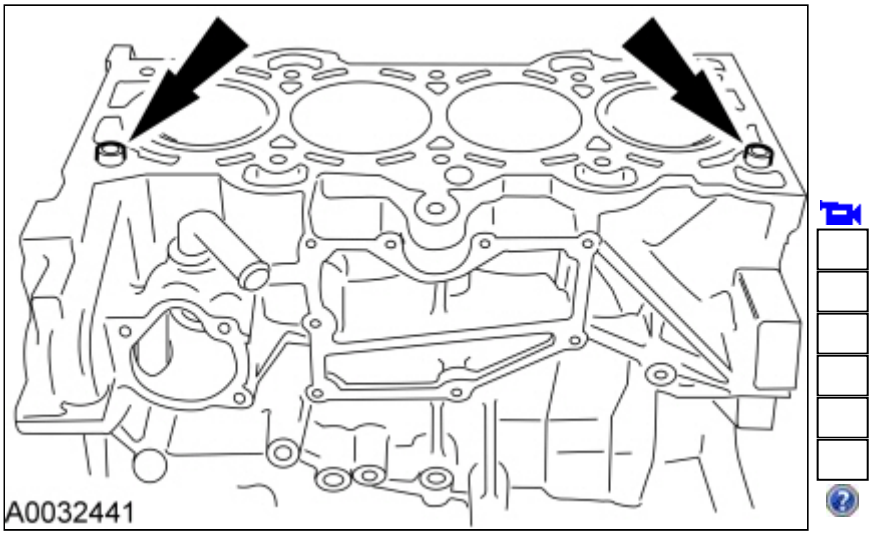
Material: Silicone Sealant (WSE-M4G323-A4)



33. Install the oil pan.
Torque: 25 Nm



- Install the cylinder head alignment dowels.
- Dowels must be fully seated in the cylinder block.



35. **NOTICE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

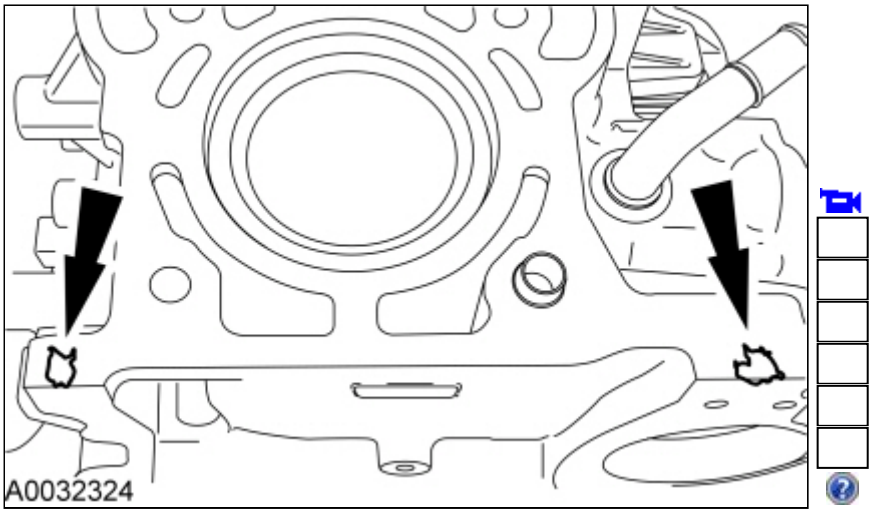
    NOTE: *Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.*

    NOTE: *If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.*

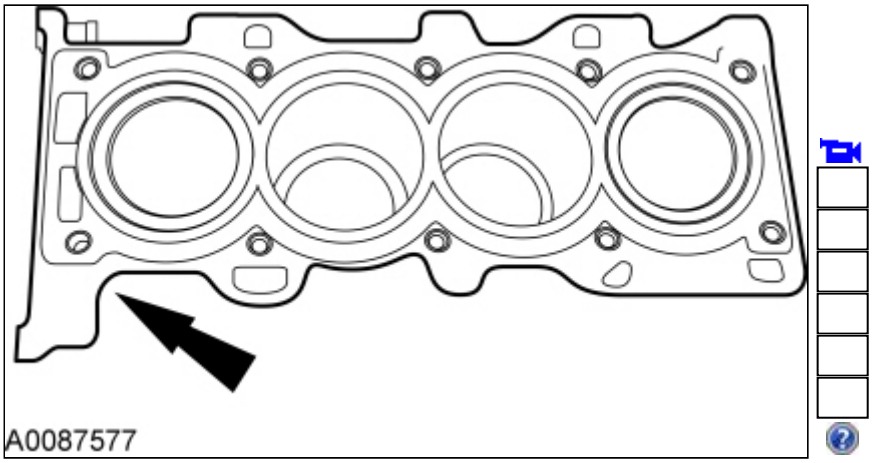
    - Clean the cylinder head-to-cylinder block mating surface of both the cylinder head and the cylinder block in the following sequence.

    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any traces of oil or coolant, and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

36. Apply silicone gasket and sealant to the locations shown.



37. Install a new head gasket.

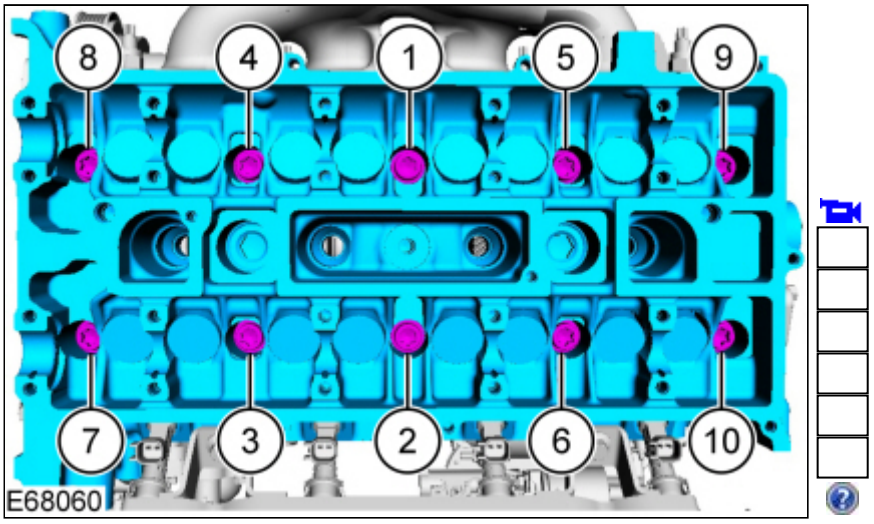


38. **NOTICE: Make sure that new bolts are installed.**

    NOTE: *The cylinder head bolts are torque-to-yield and must not be reused.*

    NOTE: *Lubricate the bolts with clean engine oil prior to installation.*

    Torque:
    Stage 1: 5 Nm
    Stage 2: 15 Nm
    Stage 3: 45 Nm
    Stage 4: 90°
    Stage 5: 90°



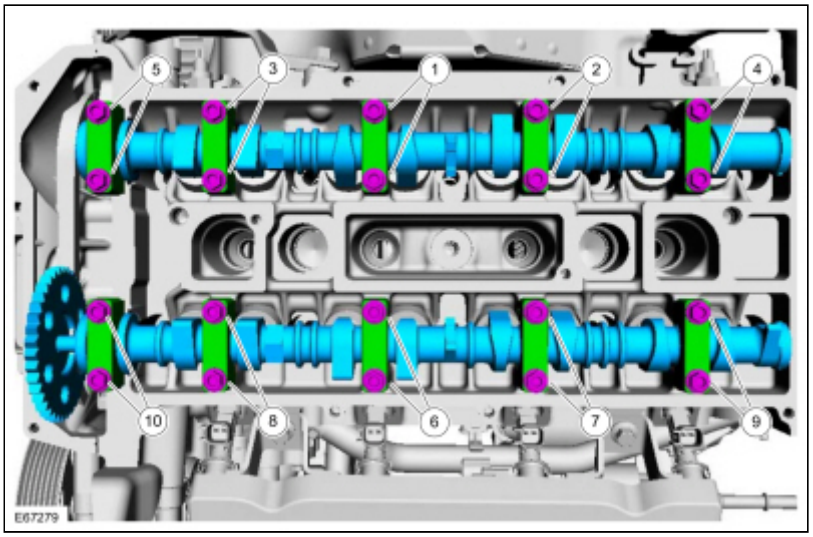
39. **NOTE:** *Coat the valve tappets with clean engine oil prior to installation.*

    Install the valve tappets.

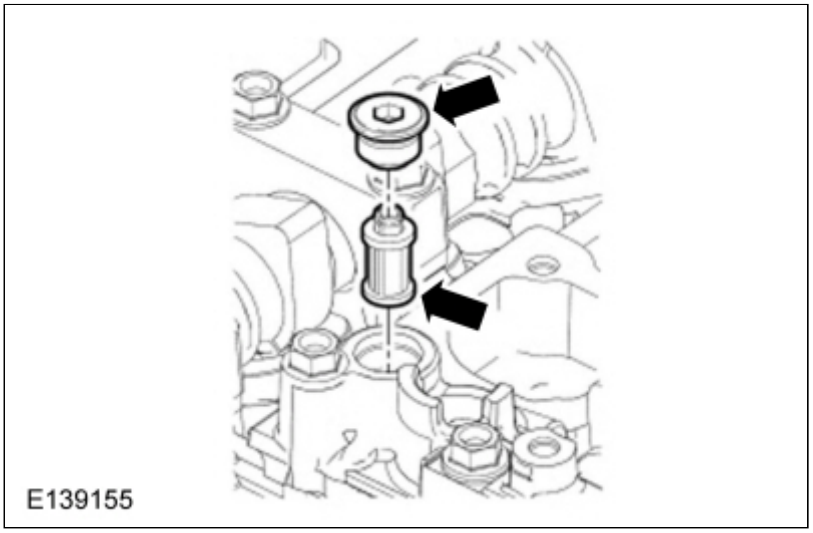
40. **NOTICE: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.**

    NOTE: *Lubricate the camshaft journals and bearing caps with clean engine oil.*

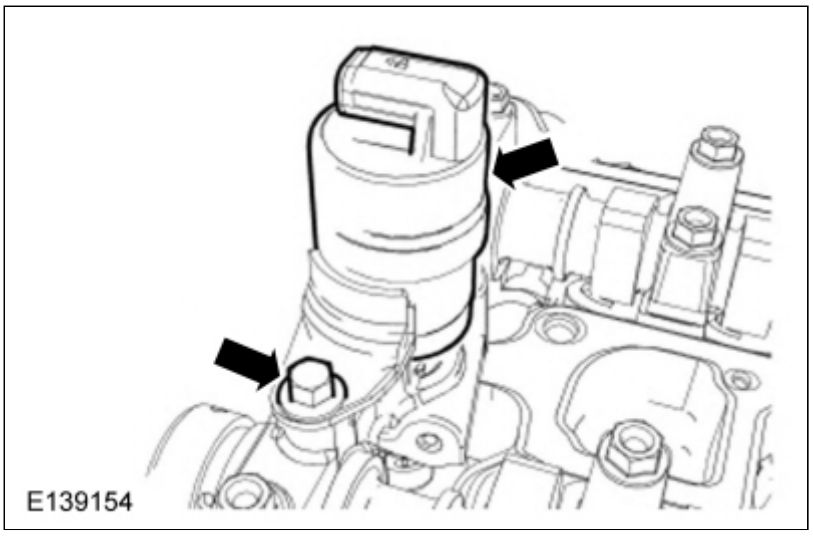
    Install the camshafts approximately at valve overlap position cylinder No. 4 and tighten the camshaft bearing cap bolts one at a time until finger-tight.
    Material: Gear/Transmission Fluid - SAE 85W-90 (SQ-M2C9002-AA)
    Torque:
    Stage 1: 7 Nm
    Stage 2: 16 Nm



41. Install the variable camshaft timing (VCT) system oil filter and the plug in the intake camshaft thrust cap.
    Torque: 17 Nm

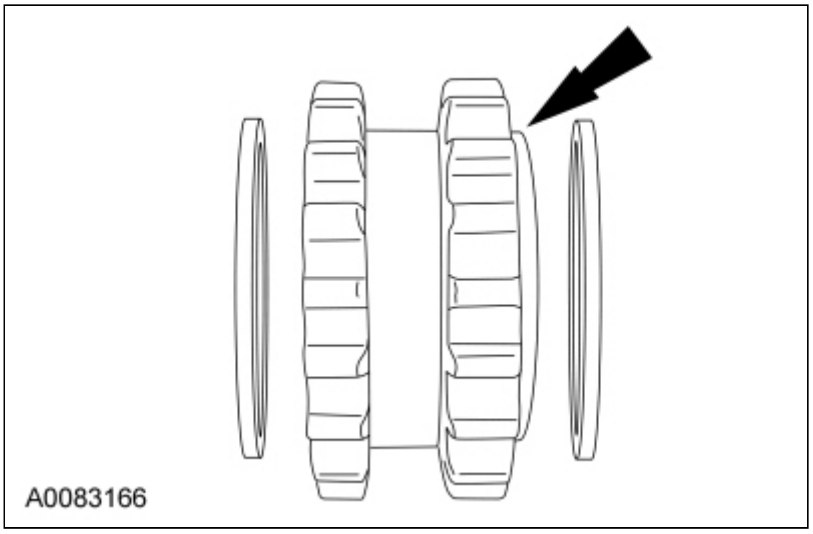


42. Install the VCT solenoid and the bolt.
    Torque: 10 Nm



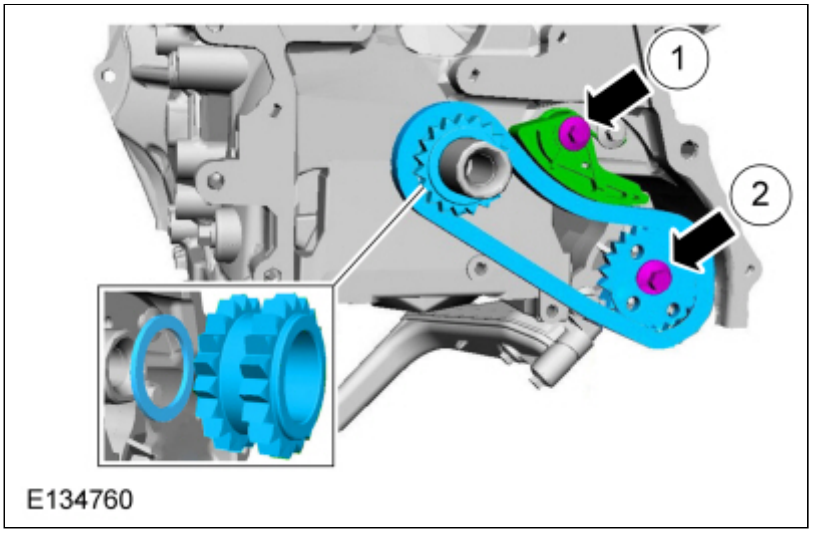
43. **NOTE:** *Install a new crankshaft sprocket diamond washer on both sides of the crankshaft sprocket.*

- Install the crankshaft sprocket, new crankshaft sprocket diamond washers, oil pump chain and oil pump sprocket.
- The crankshaft sprocket flange must be facing away from the engine block.

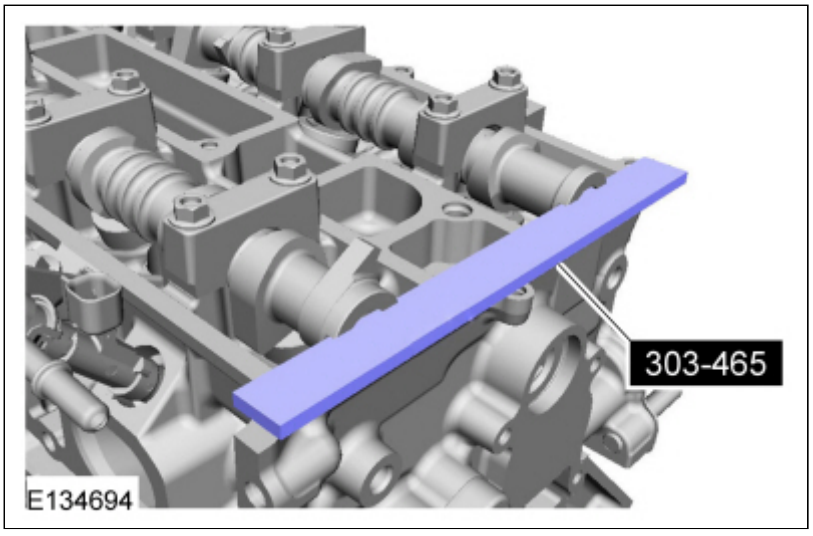


44. **NOTICE: Make sure that a new friction washer is installed.**

    1. *Torque*: 10 Nm
    2. *Torque*: 25 Nm

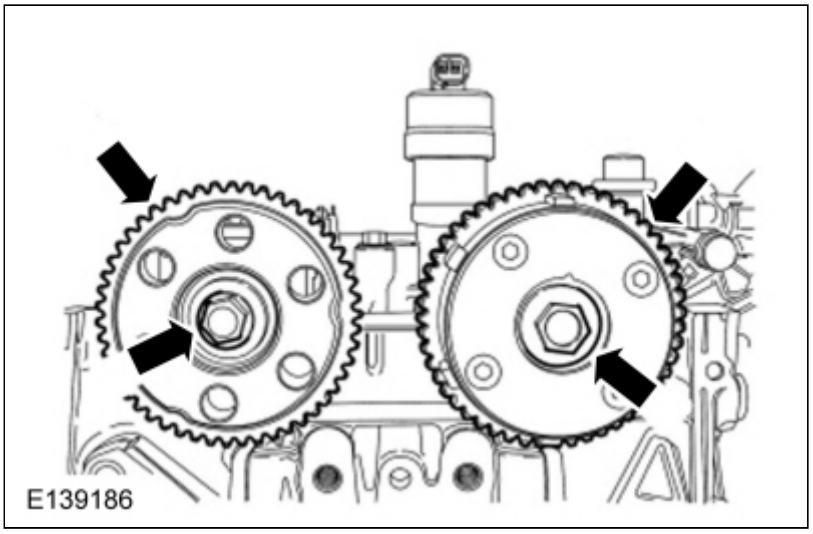


45. Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.

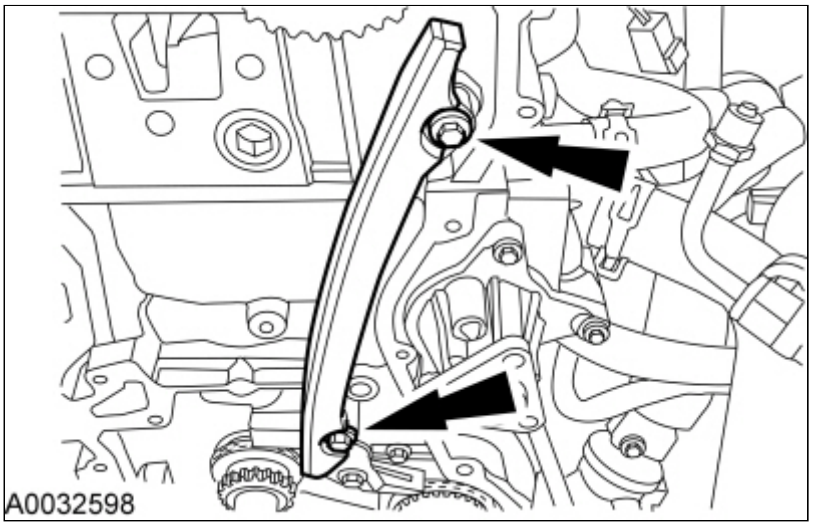


46. **NOTE:** *Hand tighten the bolts at this stage.*

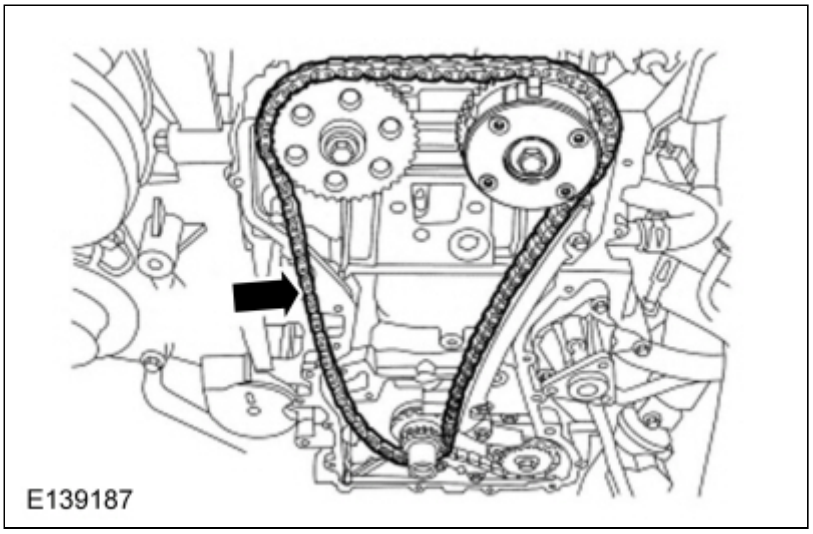
    Install the camshaft sprockets and the bolts.



47. Install the timing chain guide and the bolts.
    Torque: 10 Nm

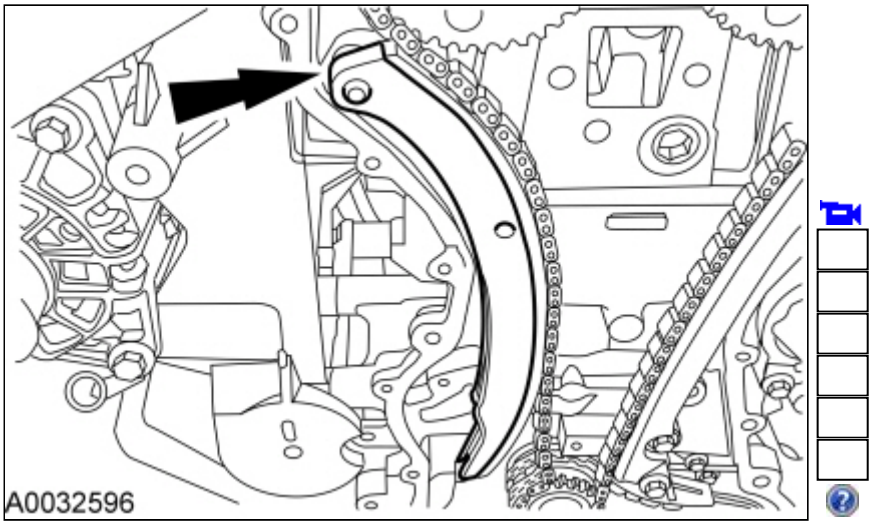


48. Install the timing chain.



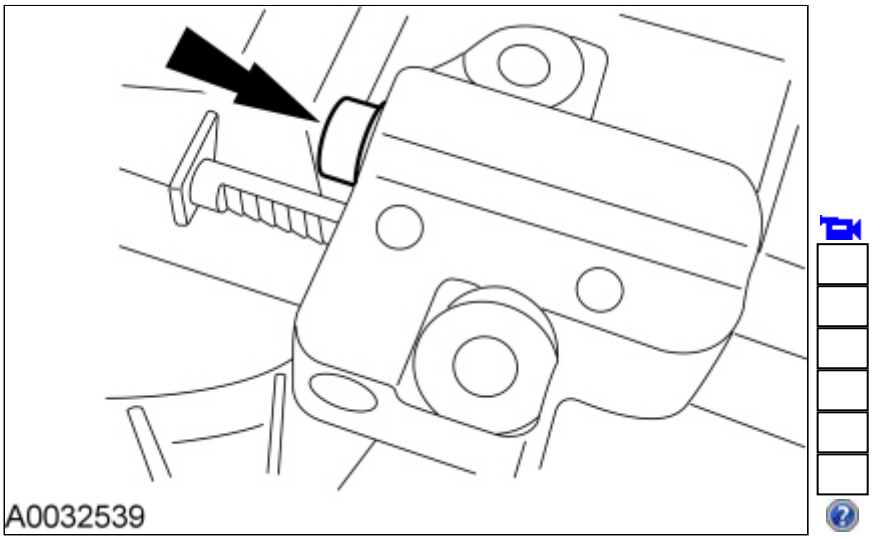
49. **NOTE:** *If the timing chain tensioner plunger and ratchet assembly are not pinned in the compressed position, follow the next 4 steps.*

    Install the timing chain guide.

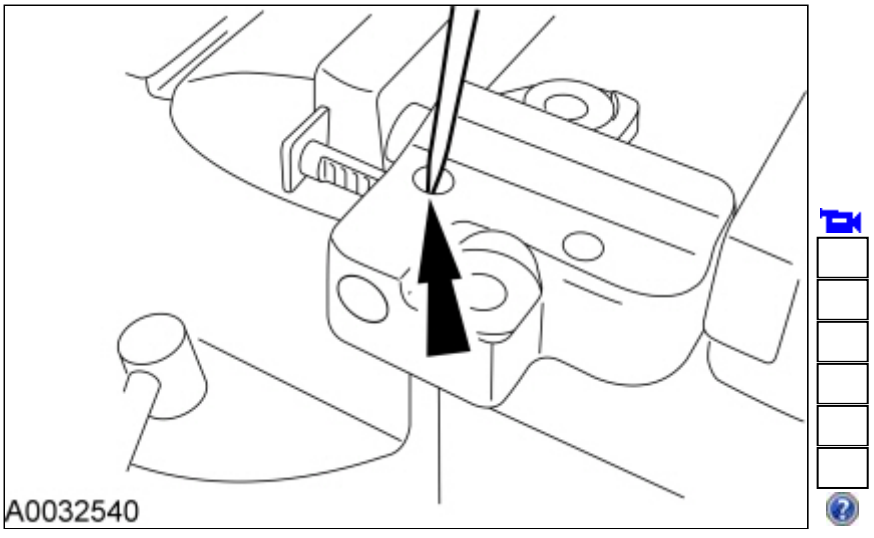


50. **NOTICE: Do not compress the ratchet assembly. This will damage the ratchet assembly.**

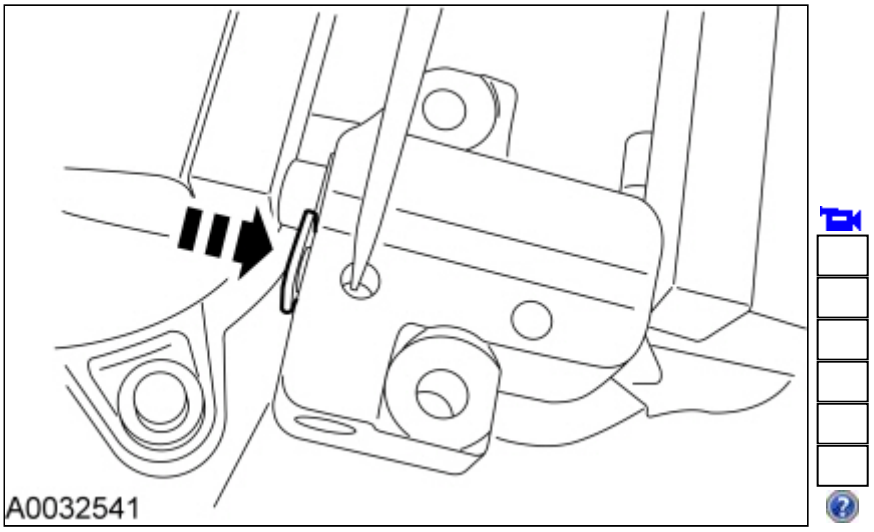
    Using the edge of a vise, compress the timing chain tensioner plunger.



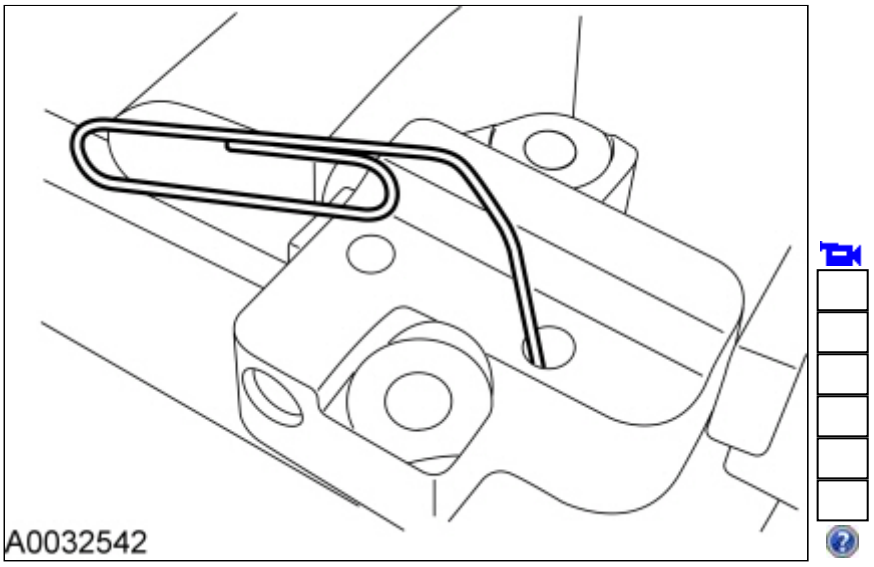
51. Using a small pick, push back and hold the ratchet mechanism.



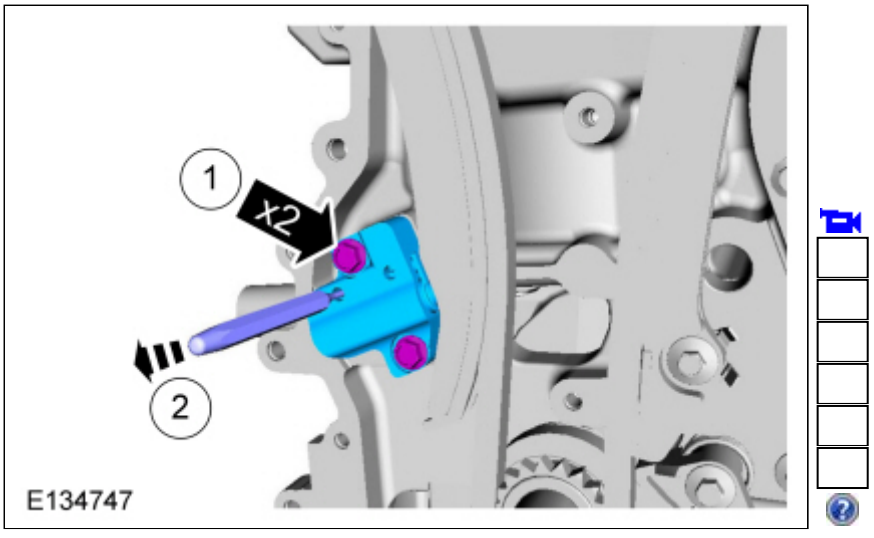
52. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.



53. Install a paper clip into the hole in the tensioner housing to hold the ratchet assembly and the plunger in during installation.

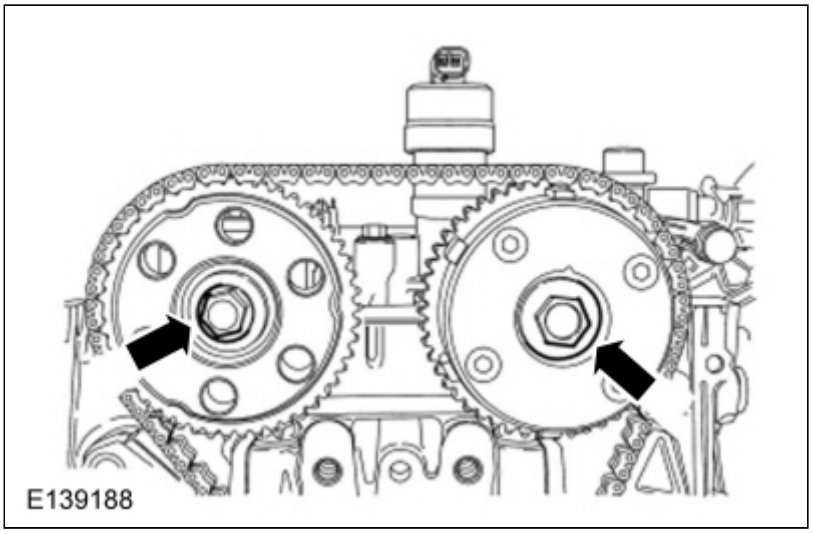


54. Install the timing chain tensioner and the bolts.
Torque: 10 Nm



55. **NOTICE: Use an open-ended wrench to hold the camshafts by the hexagon to prevent the camshafts from turning.**

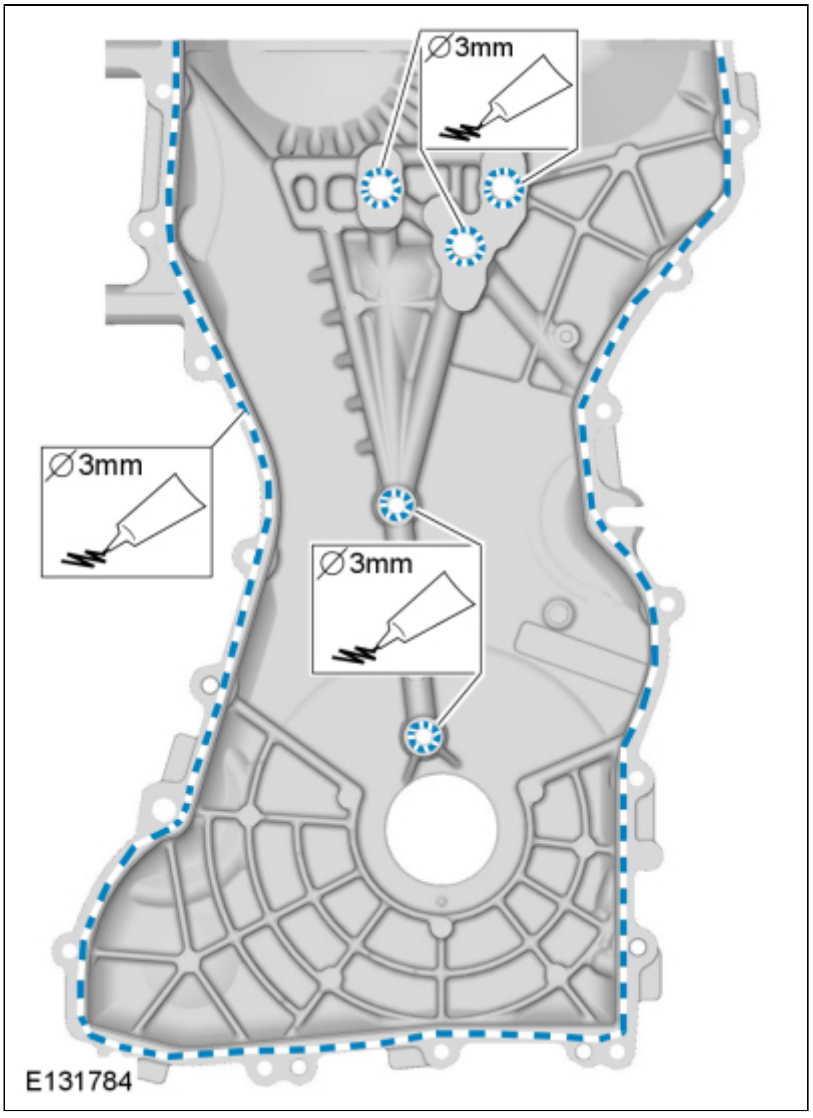
Torque: 72 Nm



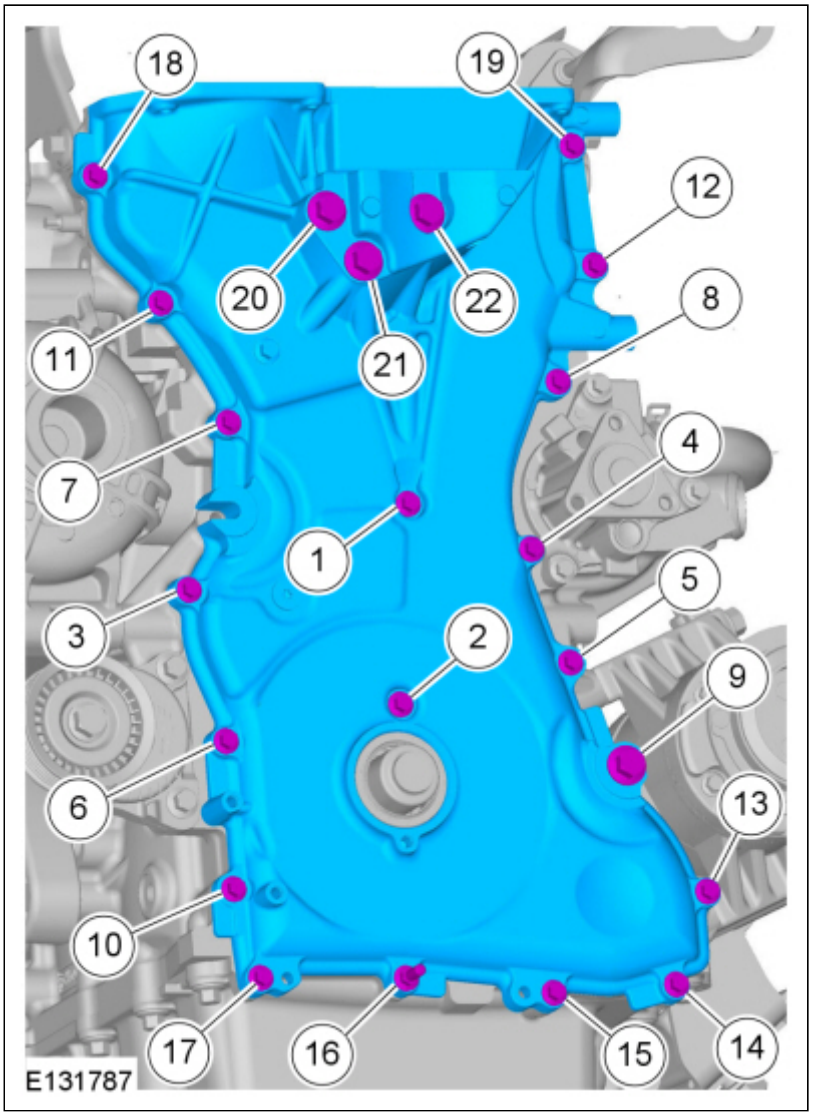
56. **NOTICE: Install the engine front cover within five minutes of applying the sealer.**

    NOTE: *The engine front cover must be installed and the bolts tightened within 4 minutes of applying the silicone gasket and sealant.*

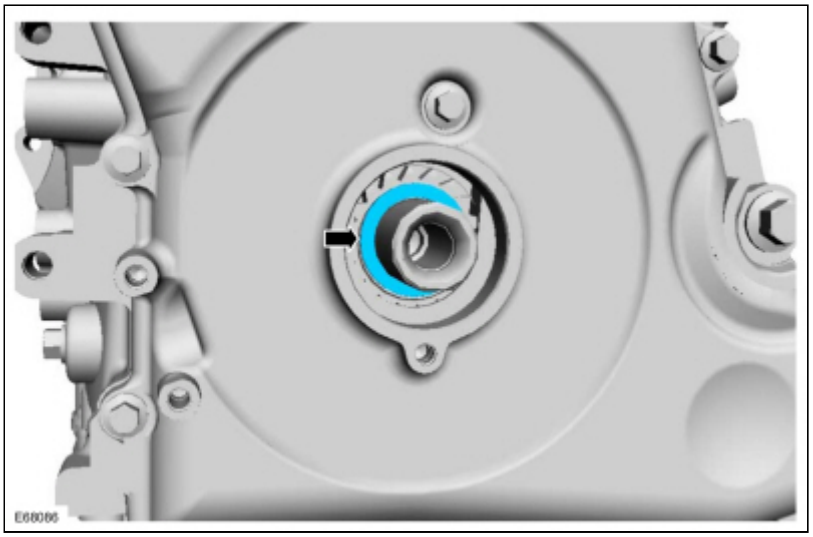
    Material: Silicone Sealant (WSE-M4G323-A4)



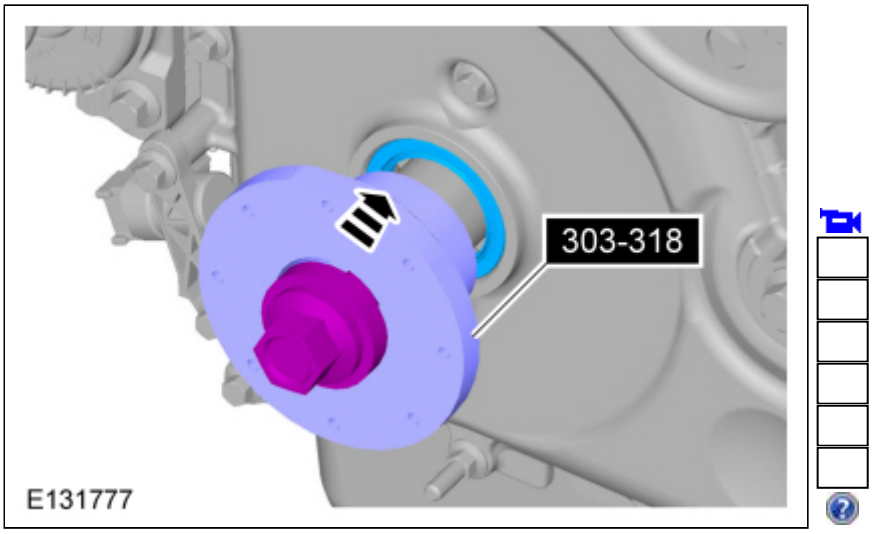
57. *Torque*:
    1 - 8: 10 Nm
    9: 48 Nm
    10 - 19: 10 Nm
    20 - 22: 48 Nm



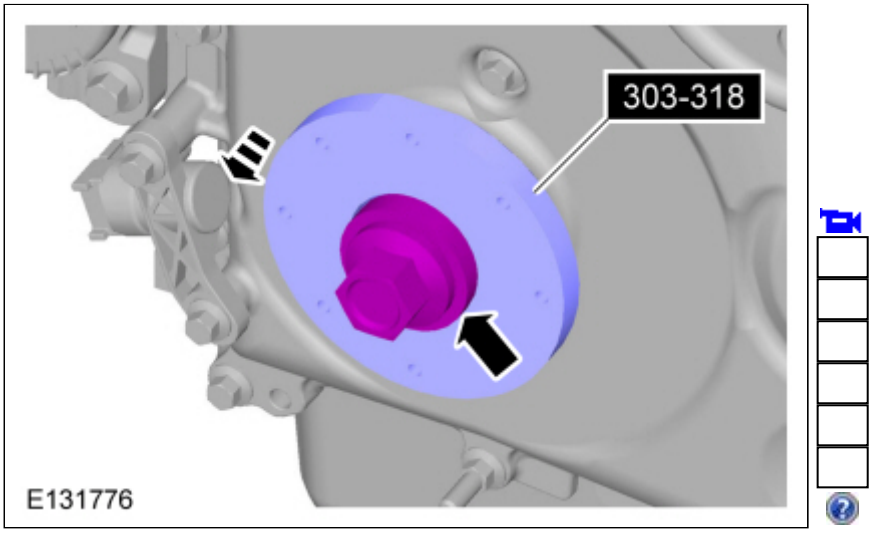
58. **NOTICE: Make sure that a new friction washer is installed.**



59. Use Special Service Tool: 303-318 Aligner/Installer, Crankshaft Front Seal.
Torque: 50 Nm

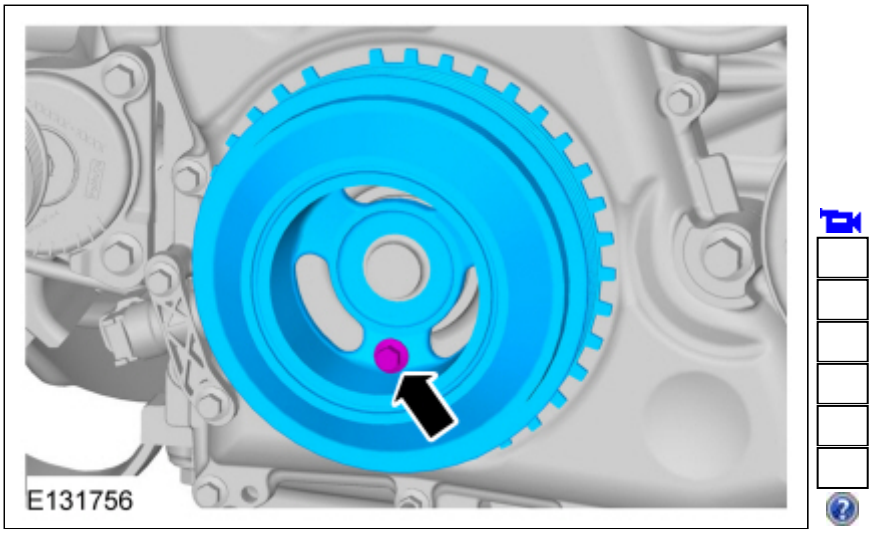


60. Remove Special Service Tool: 303-318 Aligner/Installer, Crankshaft Front Seal.



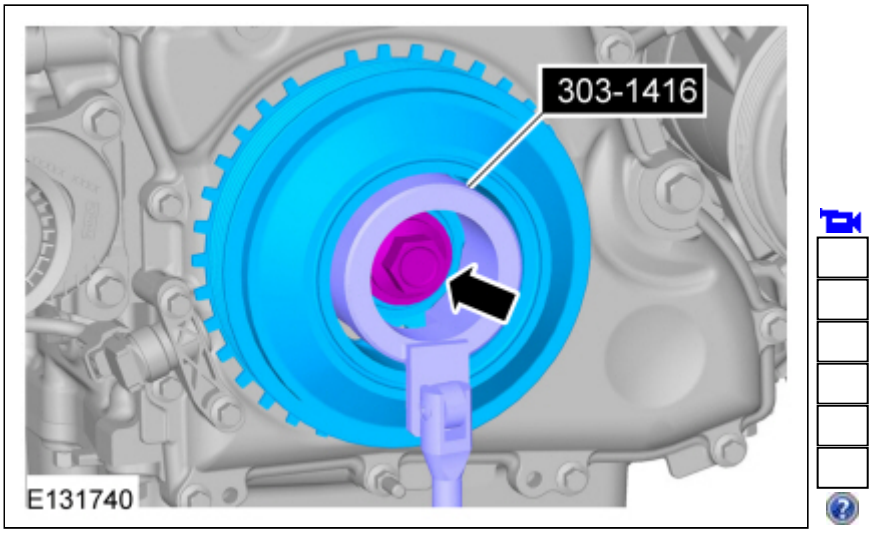
61. **NOTE:** *Hand tighten the bolt at this stage.*

- Bolt M6 x 18 mm

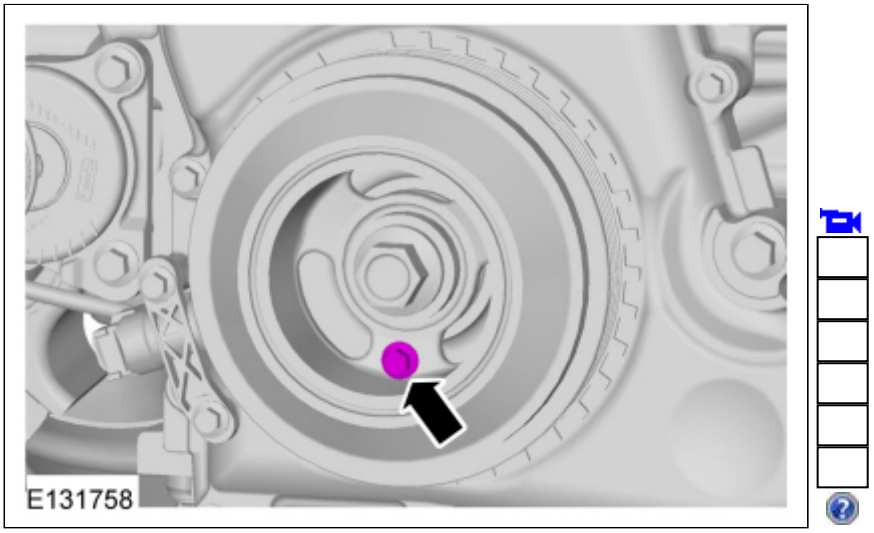


62. **NOTICE: Make sure that a new bolt is installed.**

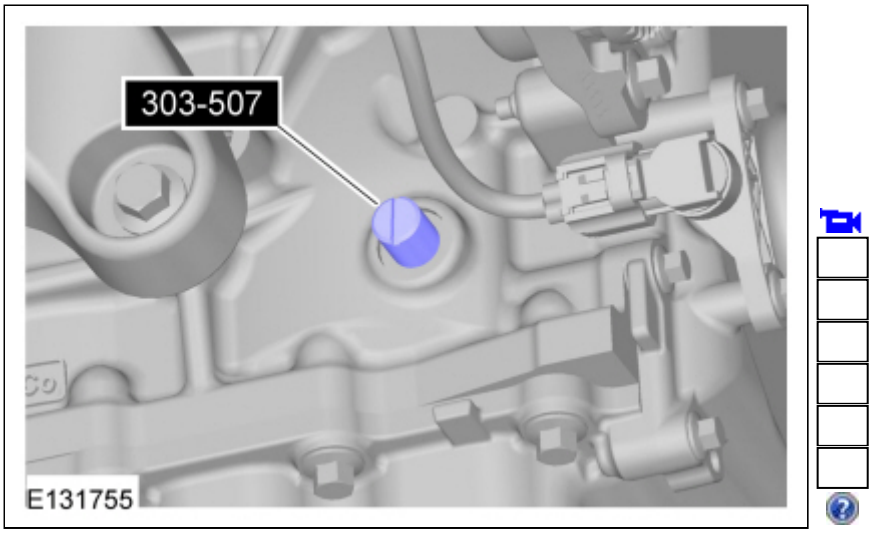
Use Special Service Tool: 303-1416 Tool, Crank Damper Holding.
Torque:
Stage 1: 100 Nm
Stage 2: 90°



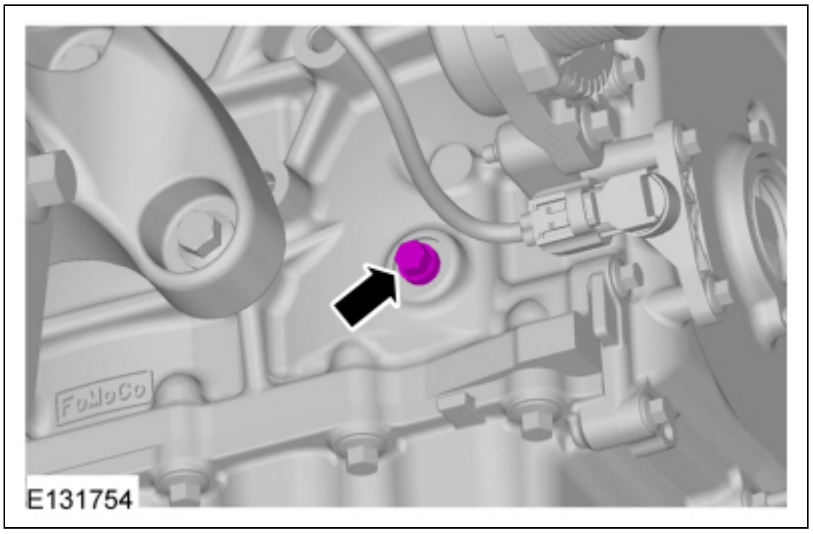
63. Remove the 6 mm x 18 mm bolt.



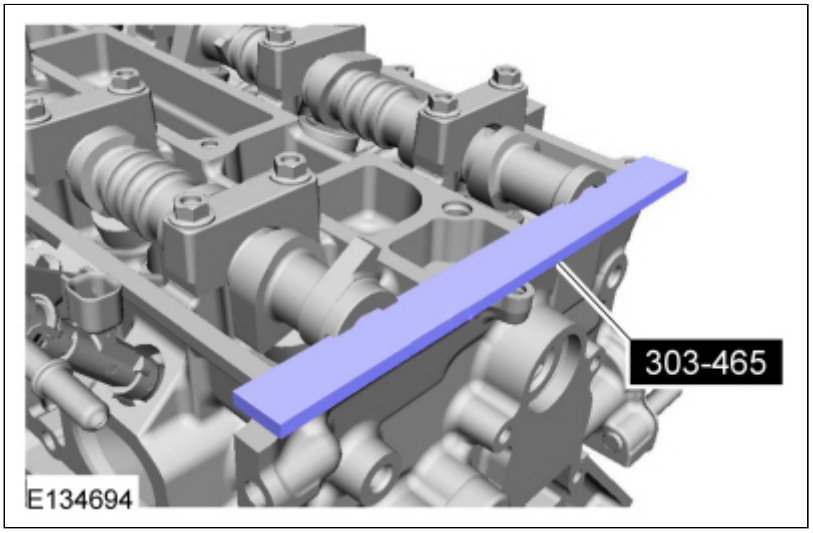
64. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



65. Install the engine plug bolt.
    Torque: 20 Nm

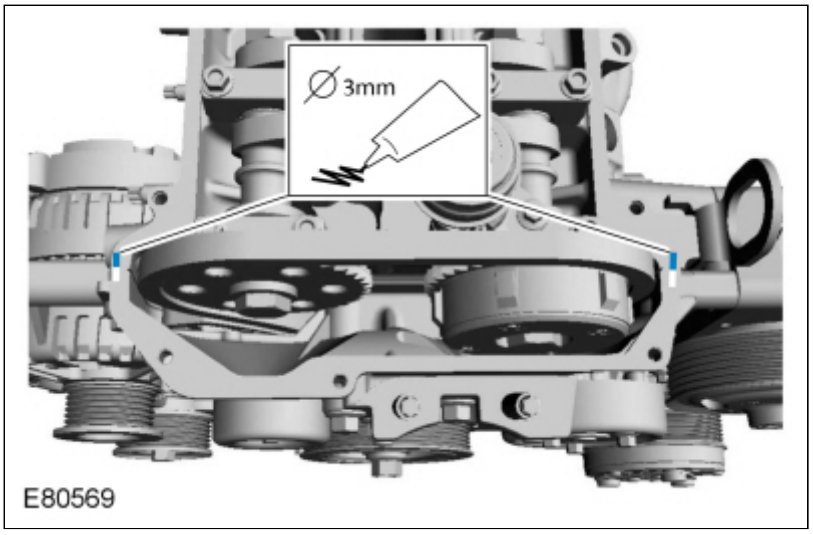


66. Use Special Service Tool: 303-465 Tool, Camshaft Align Timing.



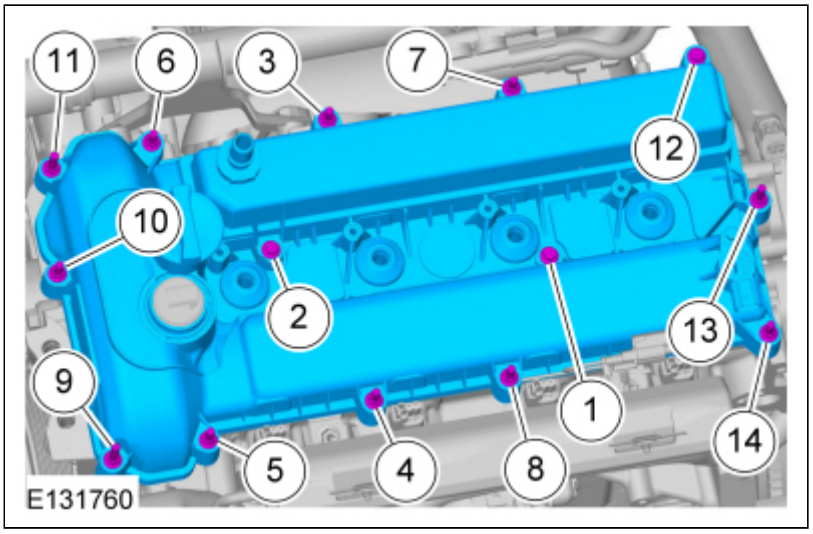
67. **NOTE:** *The valve cover must be secured within 4 minutes of silicone gasket application. If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep.*

    Material: Silicone Sealant (WSE-M4G323-A4)



68. **NOTE:** *The gasket is to be reused unless damaged.*

    Torque: 10 Nm



Copyright © 2016 Ford Motor Company

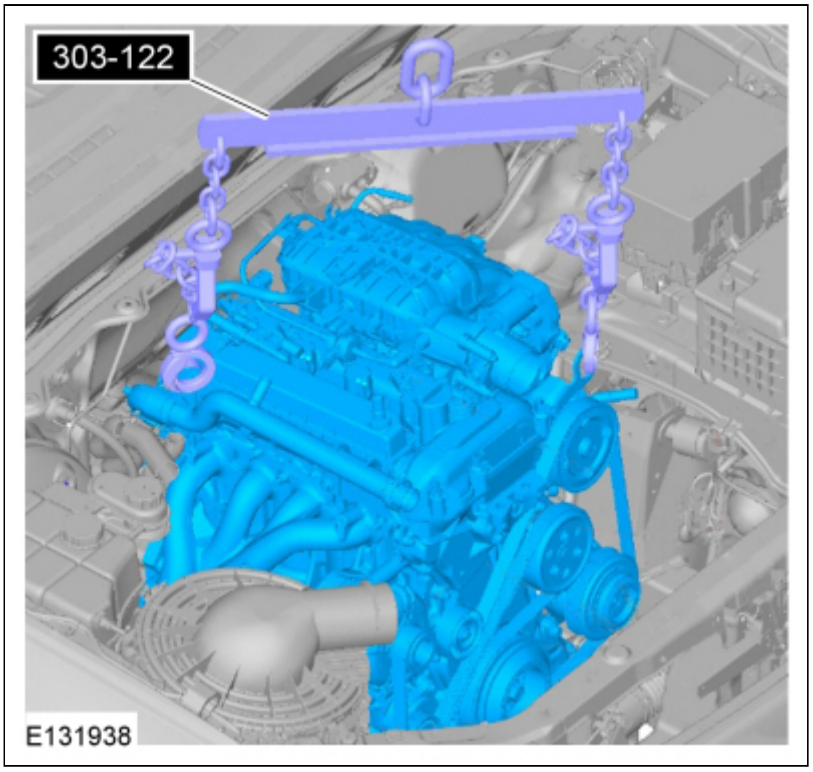
Engine - 5-Speed Manual Transmission - MT75

Base Part Number: 6L084

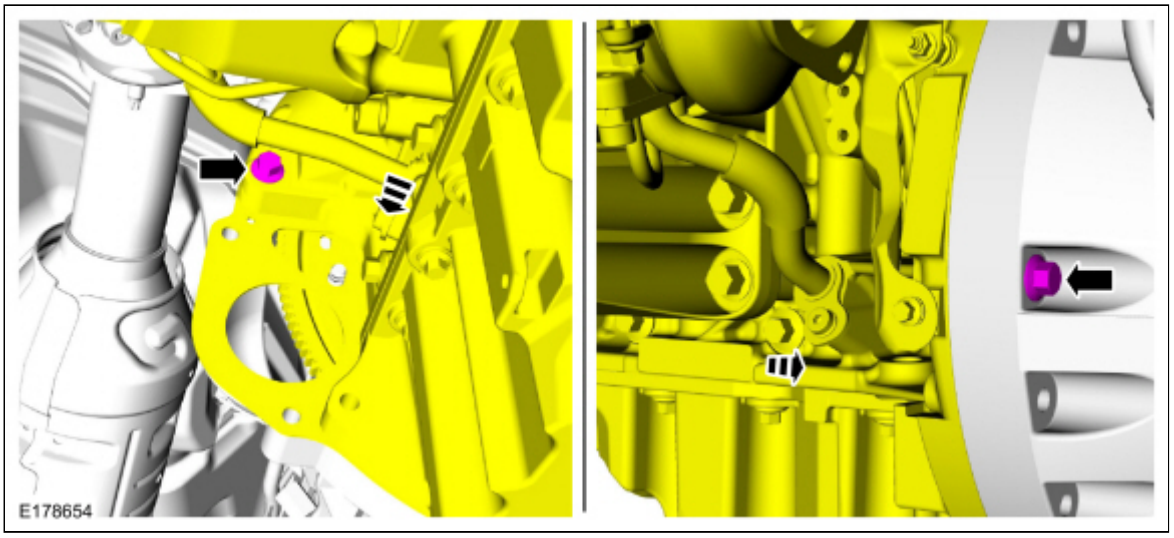
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
Floor Crane	
Transmission Jack	

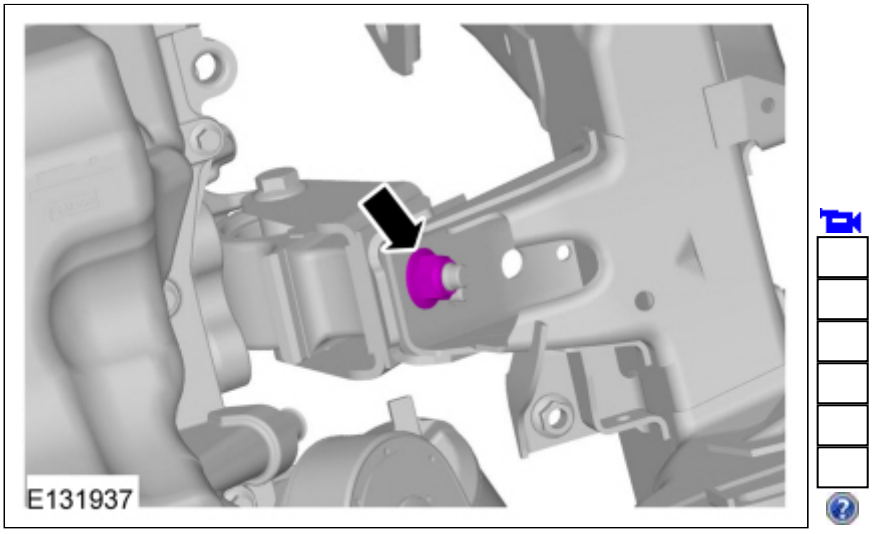
1. Use Special Service Tool: 303-122 Lifting Bracket, Engine.
   Use the General Equipment: Floor Crane



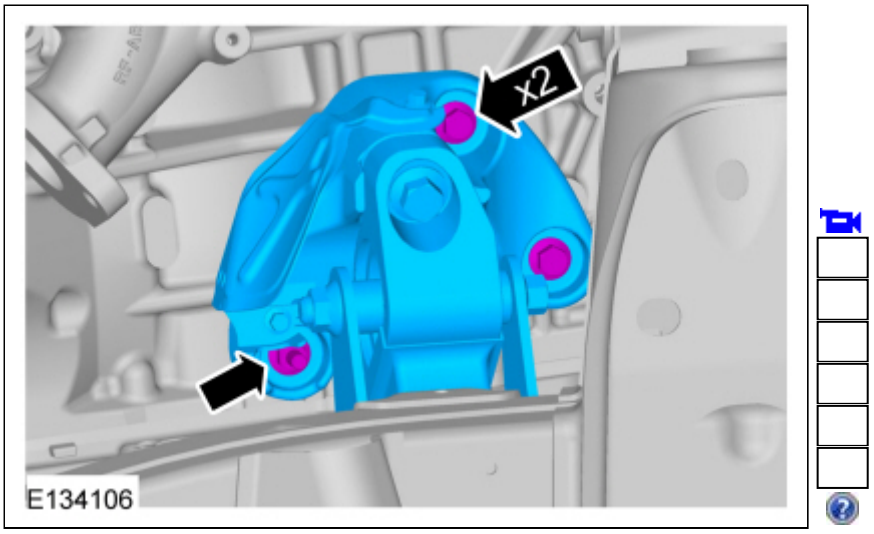
2. **NOTE:** *Hand tighten at this stage.*



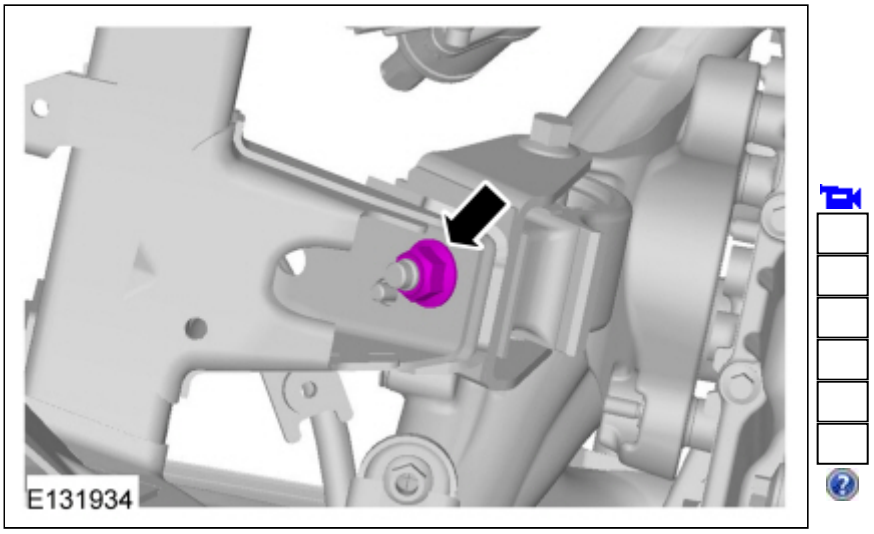
3. **NOTE:** *Hand tighten at this stage.*



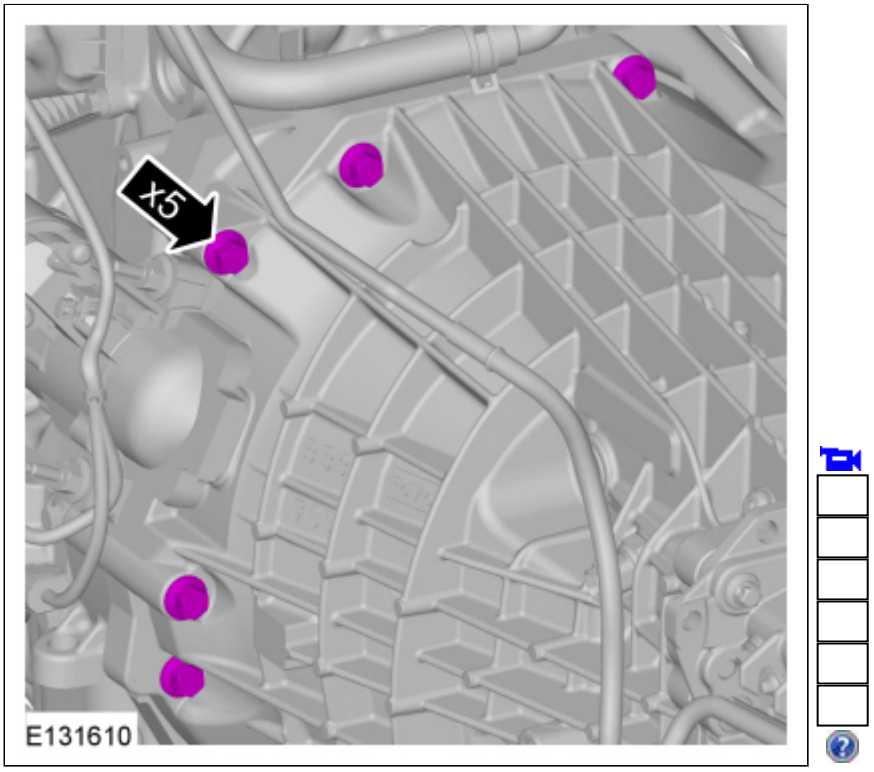
4. **NOTE:** *Hand tighten at this stage.*



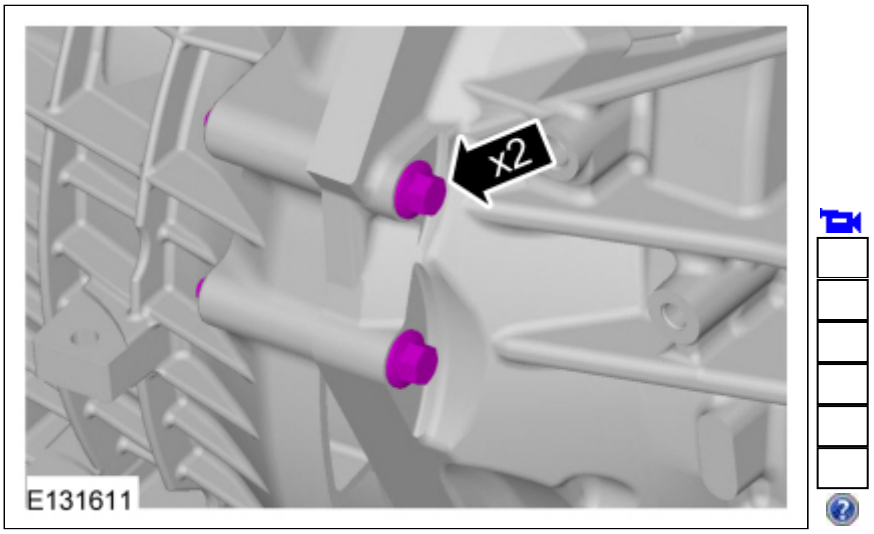
5. **NOTE:** *Hand tighten at this stage.*



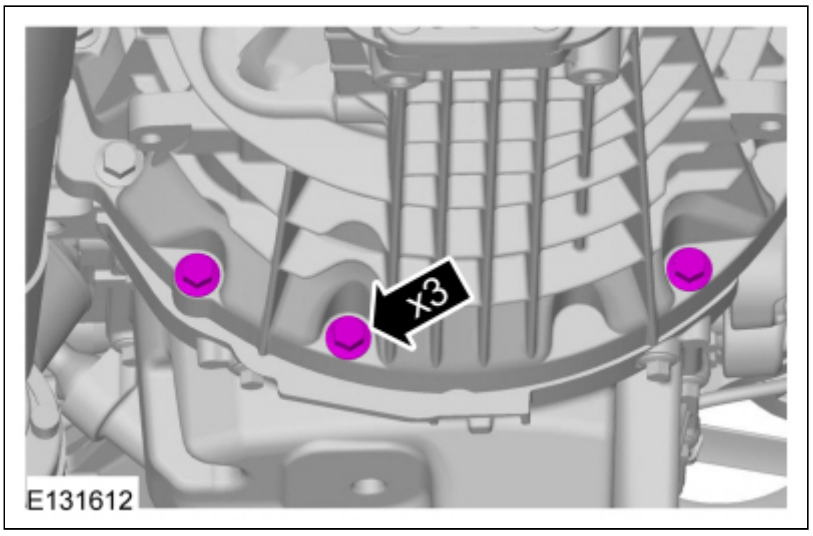
6. *Torque*: 48 Nm



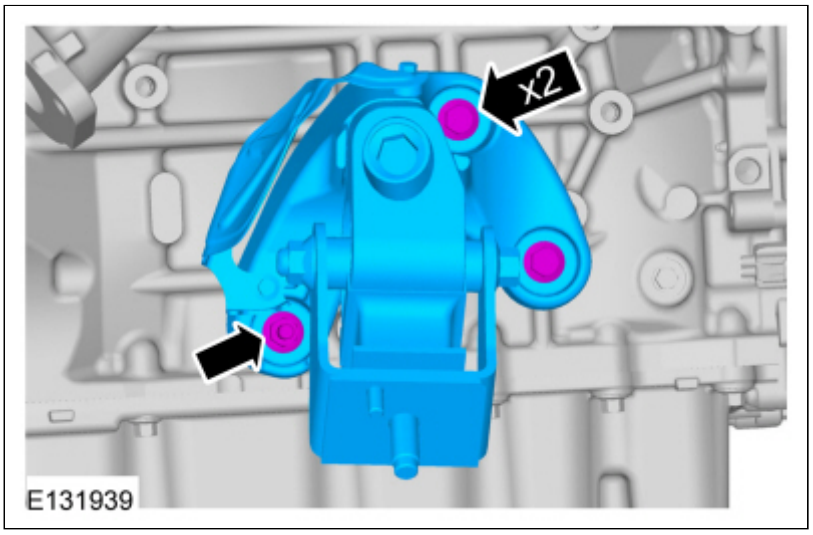
7. *Torque*: 48 Nm



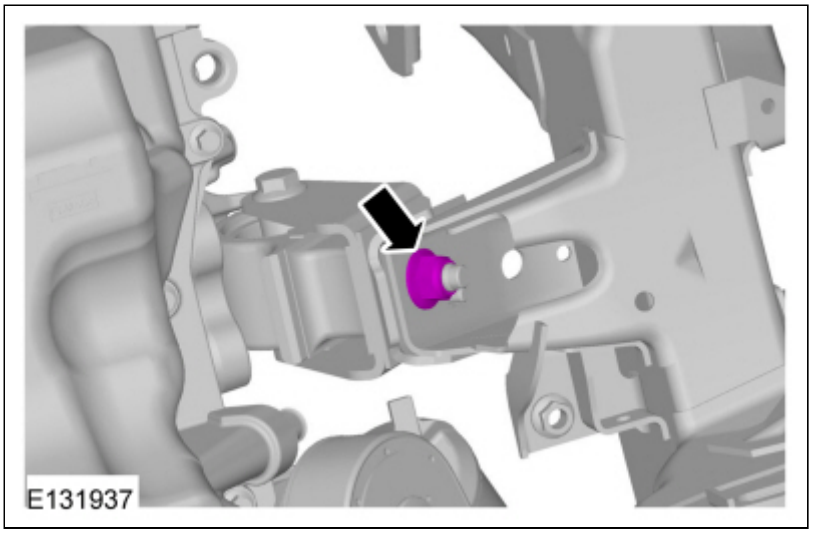
8. *Torque*: 48 Nm



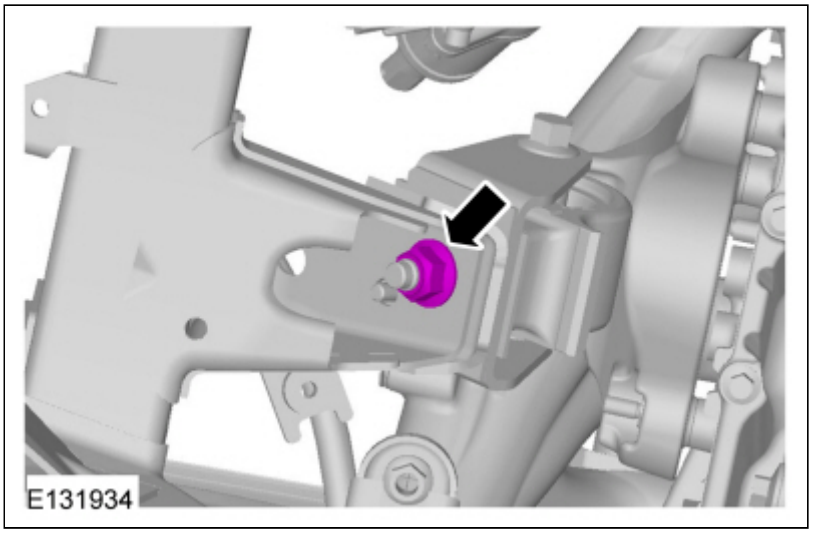
9. *Torque*: 48 Nm



10. *Torque*: 80 Nm

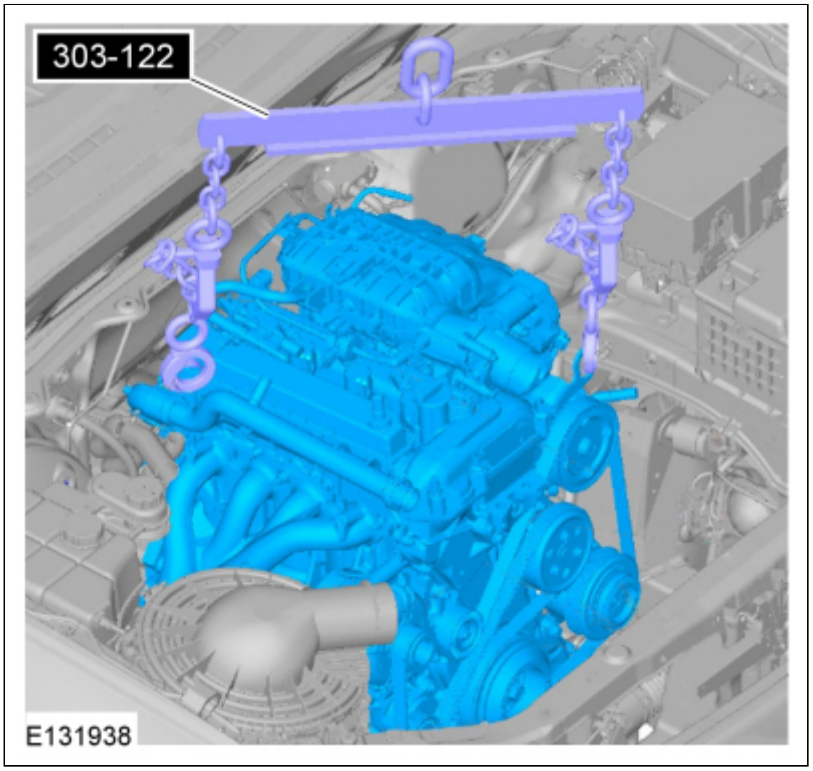


11. *Torque*: 80 Nm

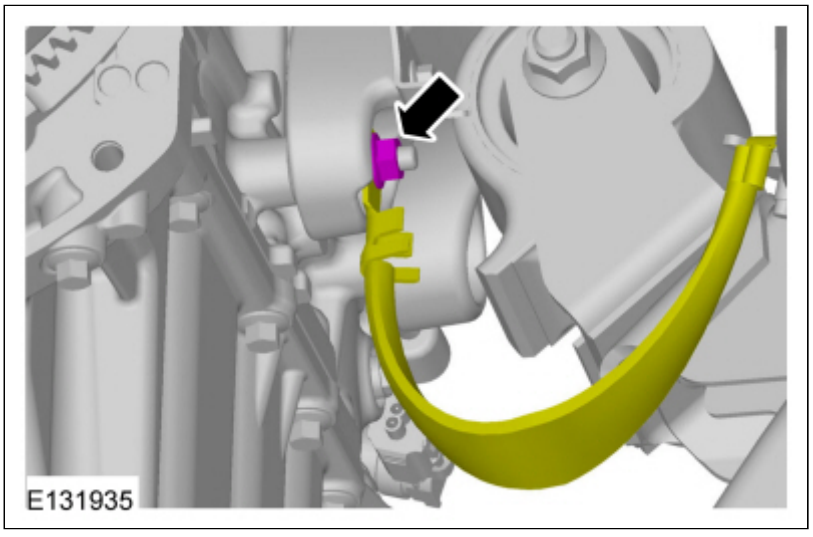


12. **NOTE:** *Remove the tool*

    Use Special Service Tool: 303-122 Lifting Bracket, Engine.



13. *Torque*: 30 Nm

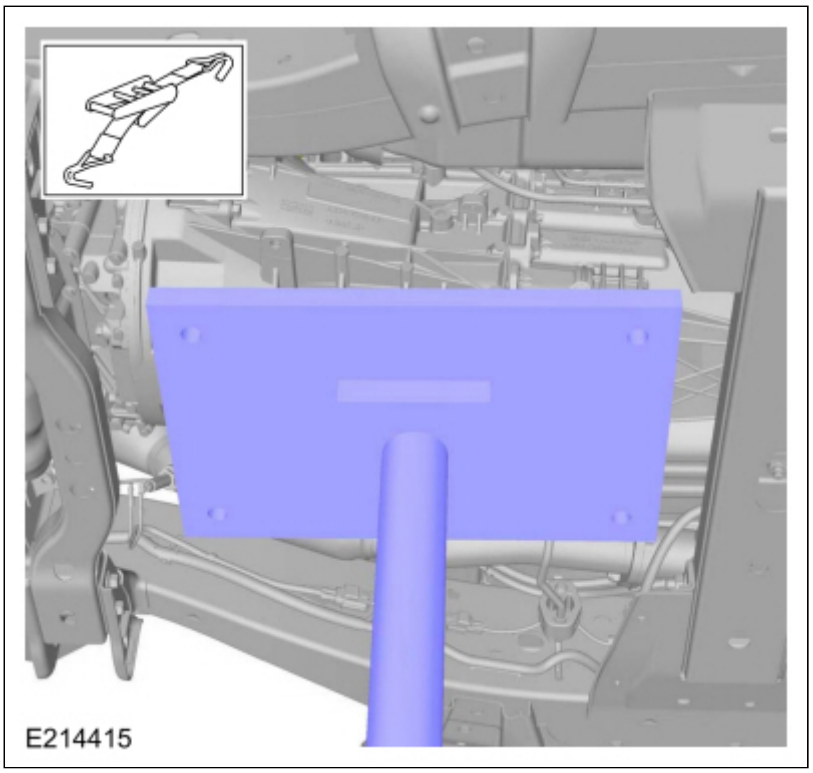


14. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

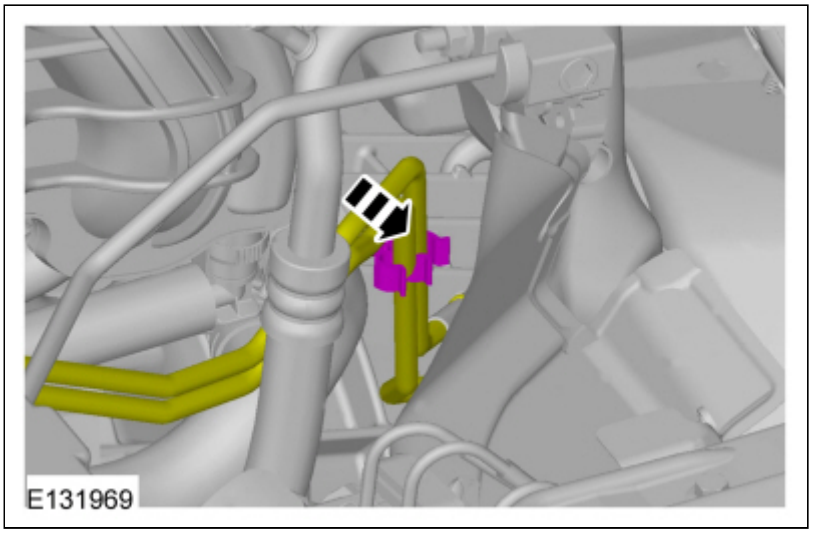
    NOTICE: Do not tilt the transmission. This may cause damage to the pilot bearing.

    NOTE: *Remove transmission jack.*

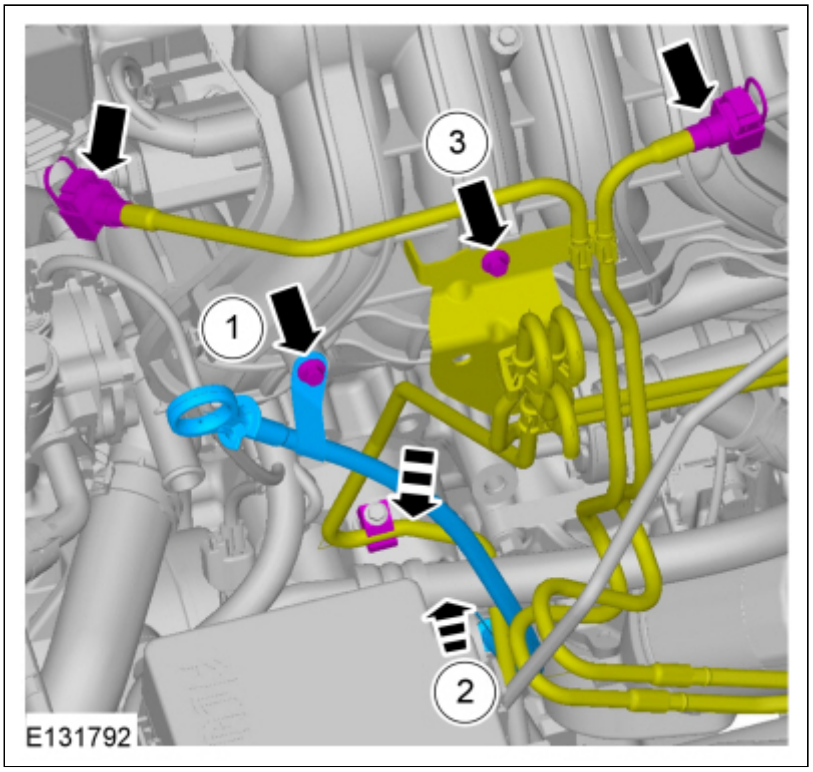
    Use the General Equipment: Transmission Jack



15.



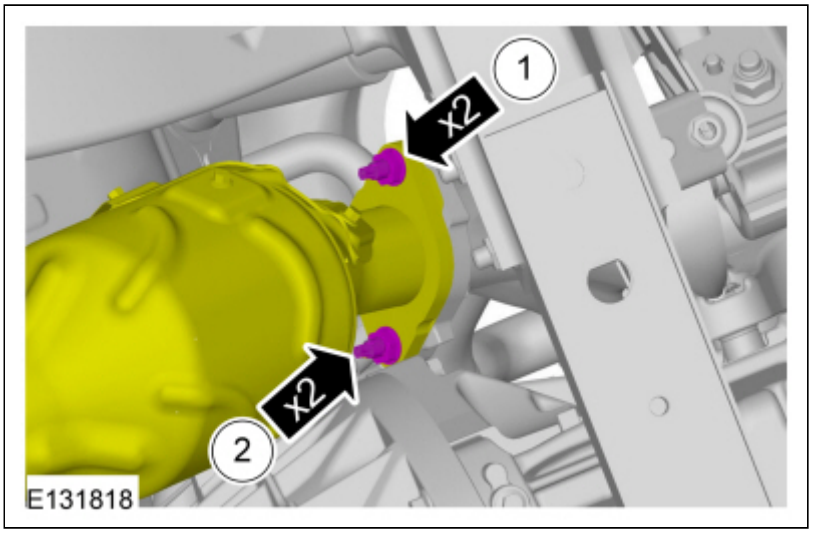
- *Torque*: 10 Nm
- *Torque*: 10 Nm



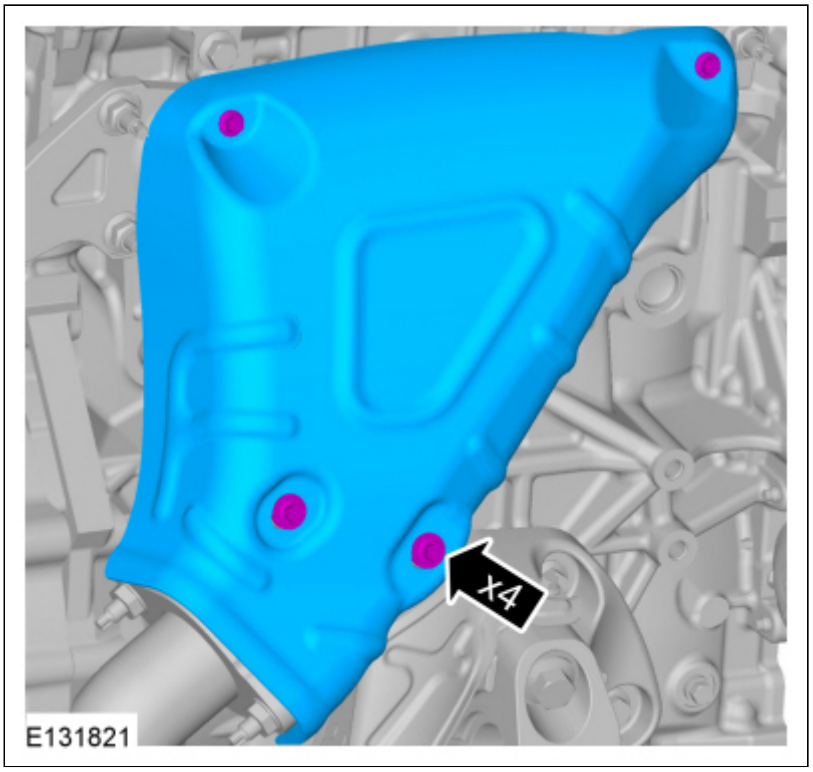
17. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

    NOTICE: Make sure that the catalytic converter is supported with suitable retaining straps.

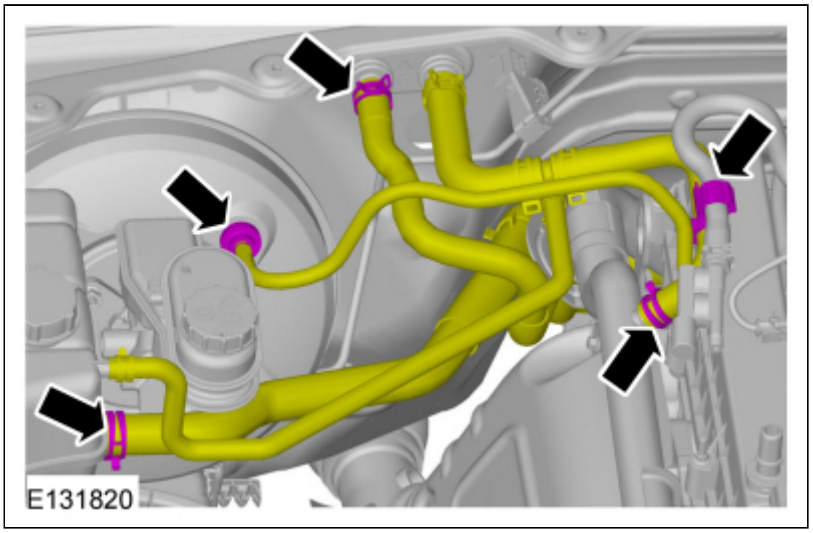
    1. *Torque*: 48 Nm
    2. *Torque*: 25 Nm



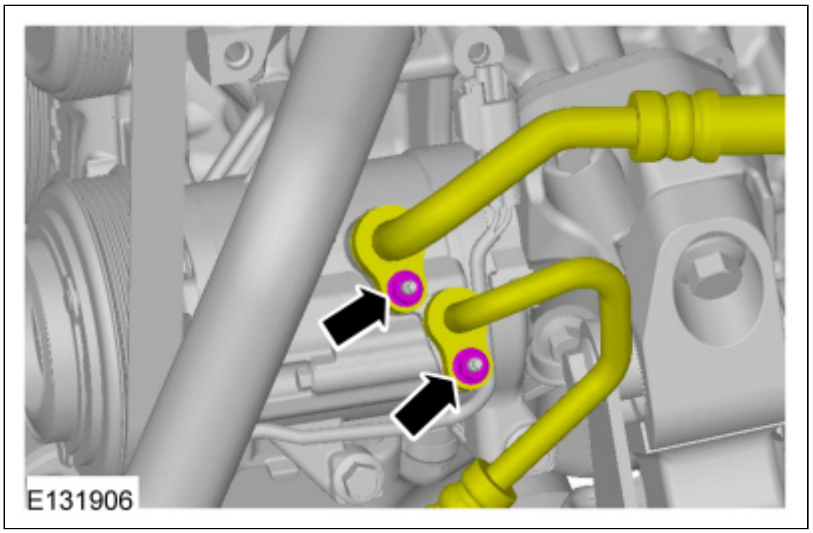
18. *Torque*: 10 Nm



19.

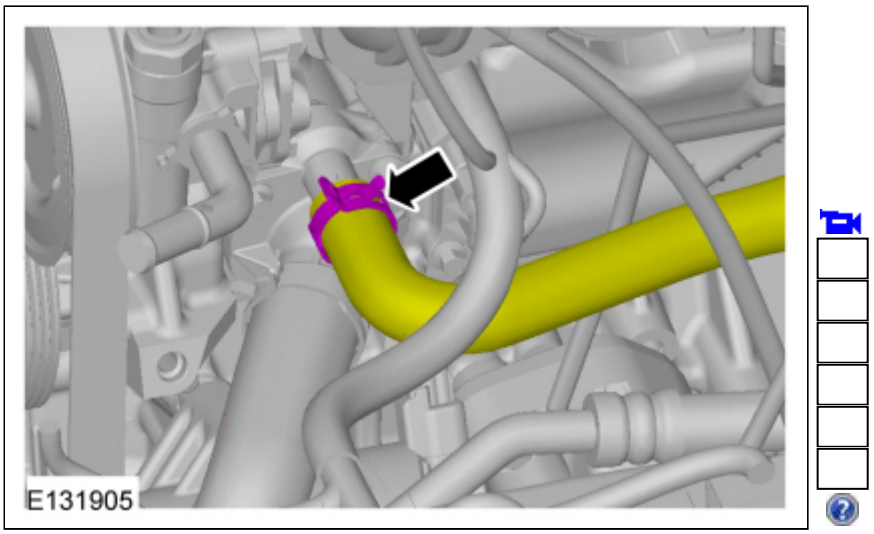


20. *Torque*: 11 Nm



Vehicles With: Hydraulic Power Assist Steering (HPAS)

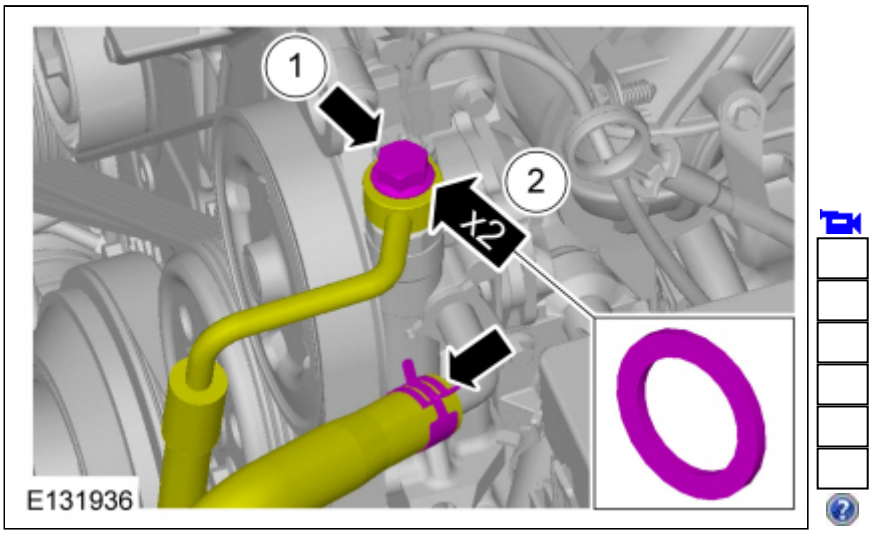
21.



22. **WARNING: Be prepared to collect escaping fluids.**

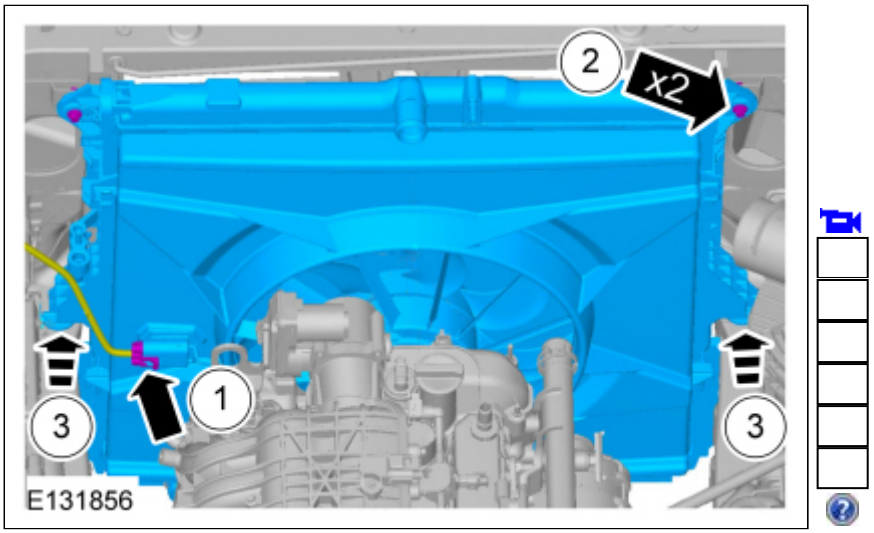
NOTICE: Make sure that all openings are sealed.

Torque: 35 Nm

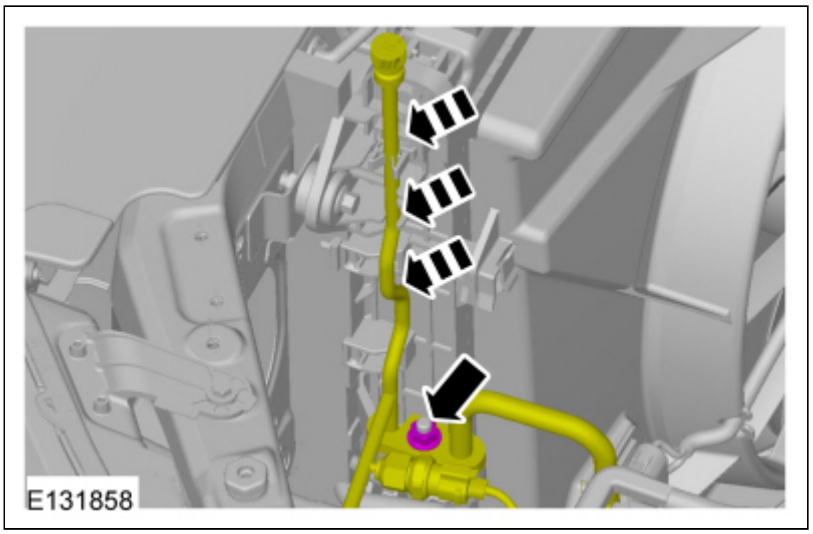


All vehicles

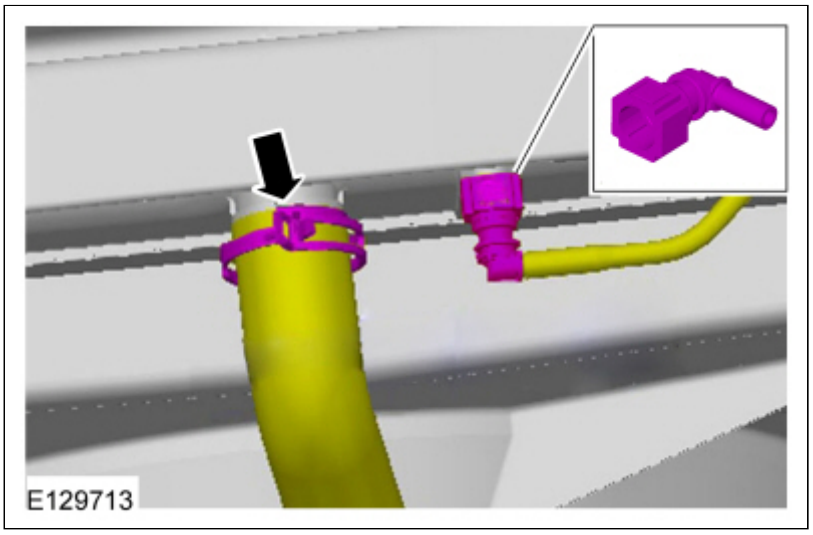
23.



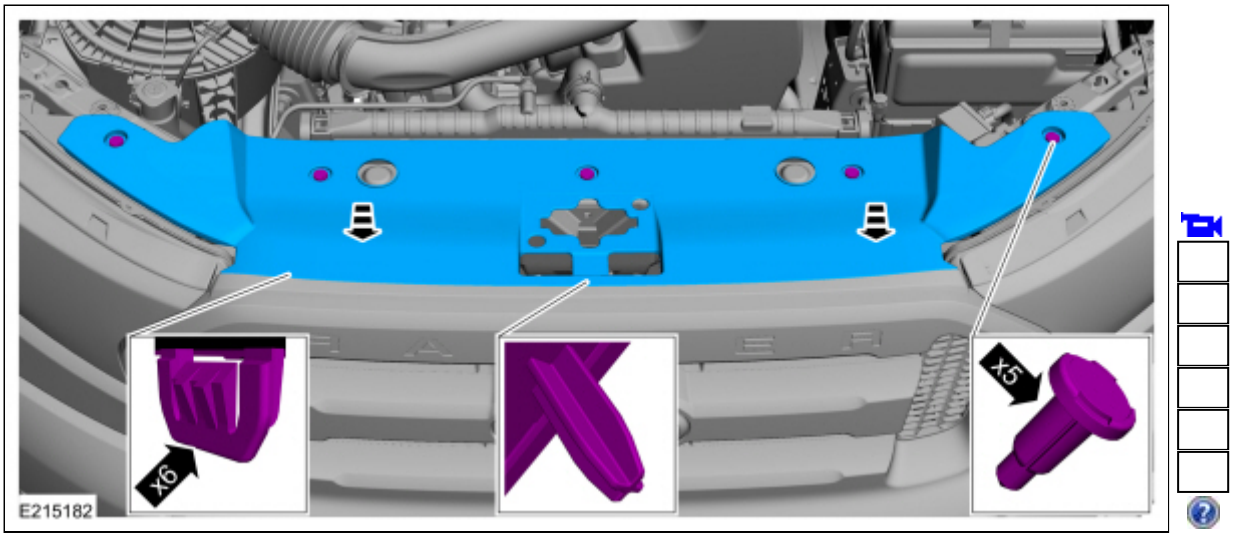
24. *Torque*: 23 Nm



25.

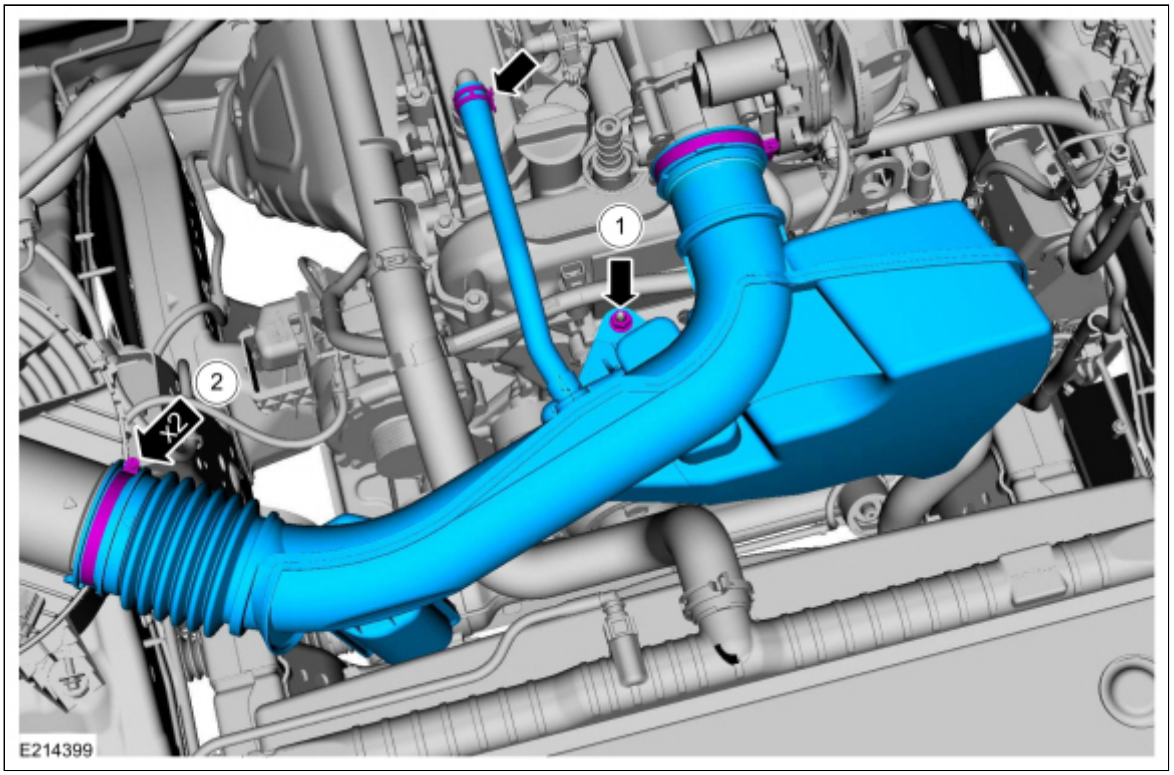


26.

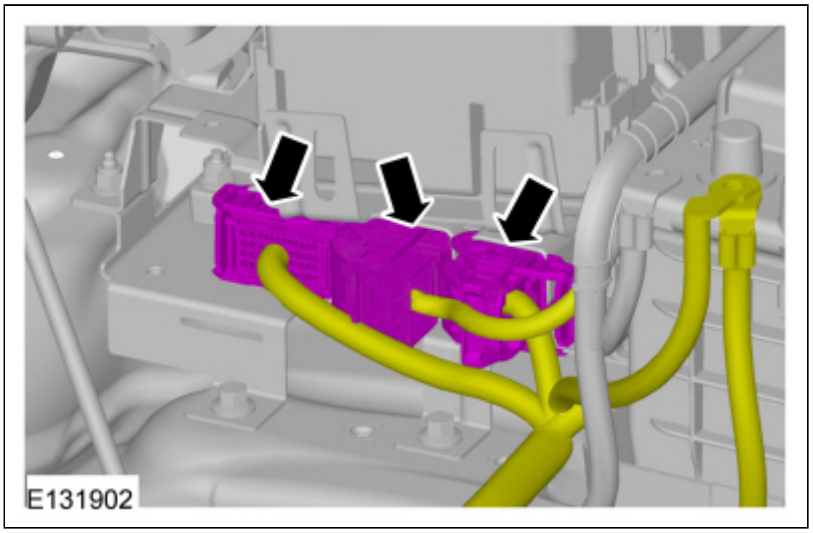


27. **NOTICE: Take extra care not to damage the wiring harnesses.**

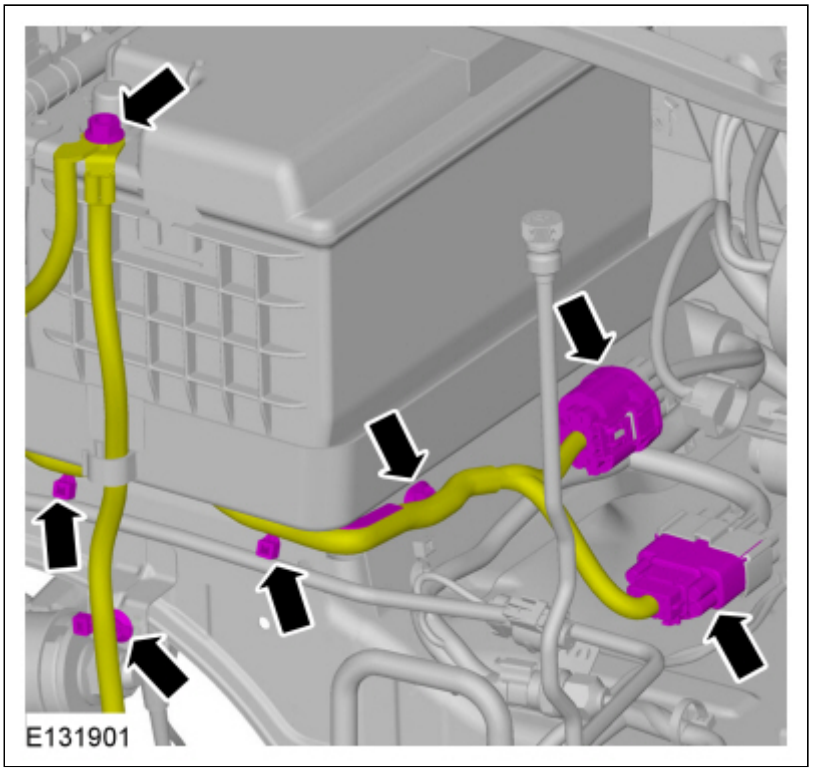
1. *Torque*: 11 Nm
2. *Torque*: 3 Nm



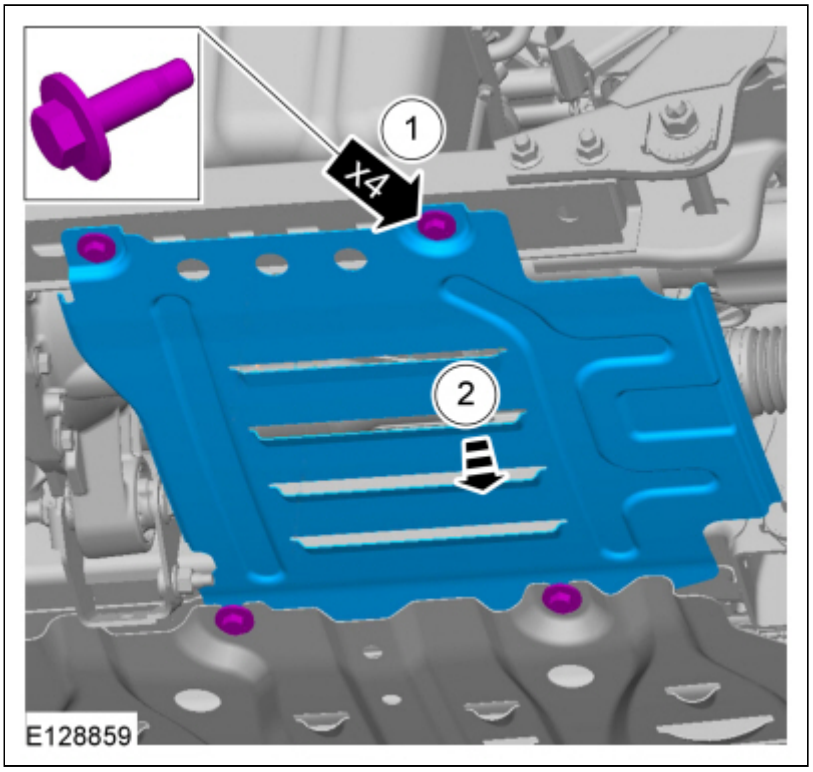
28.



29. *Torque*: 10 Nm



30. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
31. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
32. *Torque*: 30 Nm



33. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
34. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
35. Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
36. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

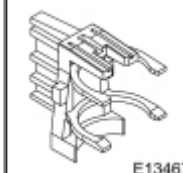
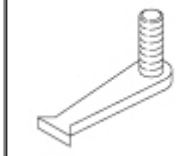
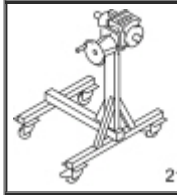
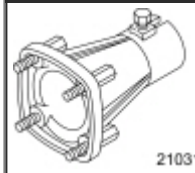
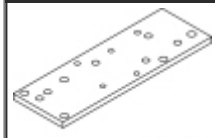
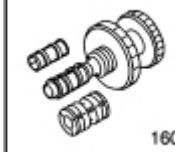
37. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

38. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

Copyright © 2016 Ford Motor Company

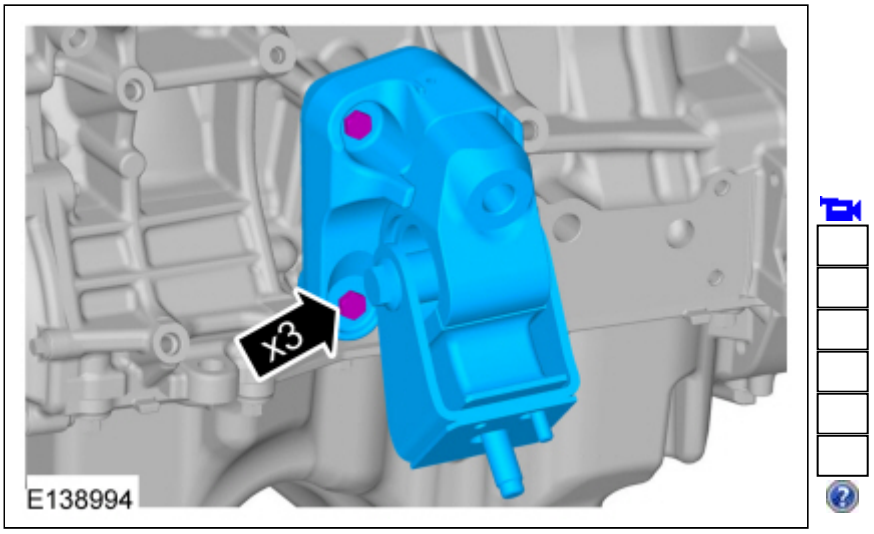
Engine Accessories

Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
 E134676	303-1417 Tool, Crank Sensor Alignment
 21135	303-254 Locking Tool, Flywheel
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E62805	303-435-14B Mounting Plate for 303-435-06
 16067	308-204 Aligner, Clutch Disc
Floor Crane	

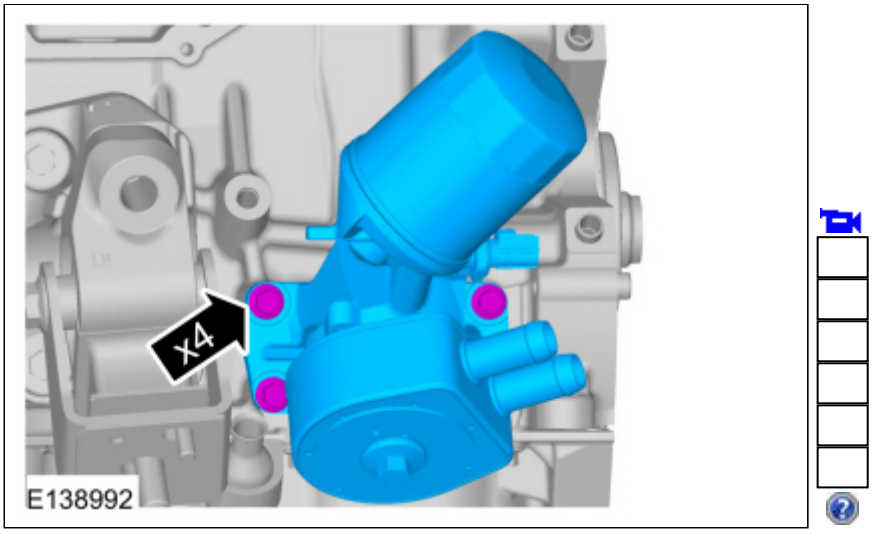
All vehicles

1. *Torque*: 48 Nm



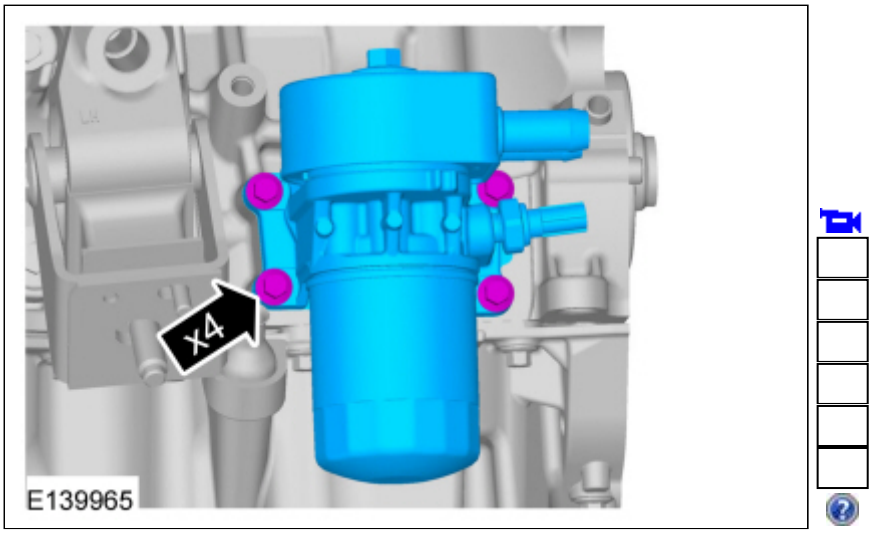
4x4

2. *Torque*: 25 Nm



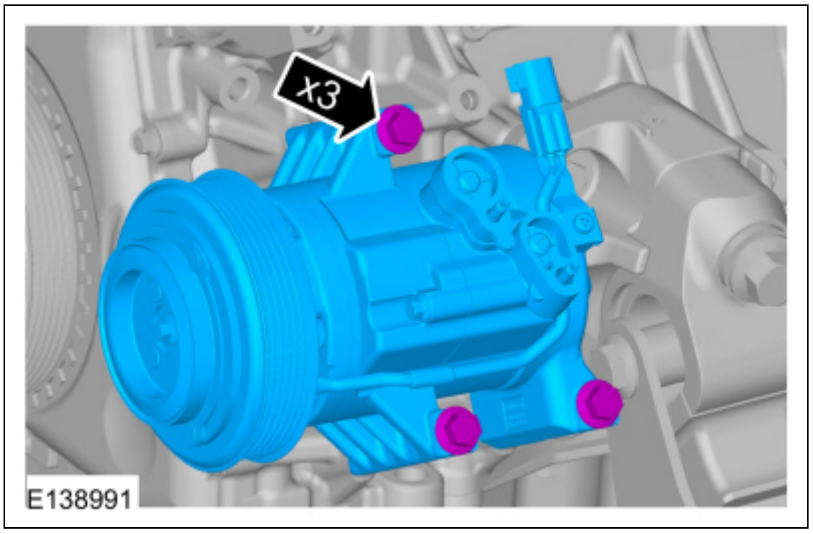
4x2

3. *Torque*: 25 Nm



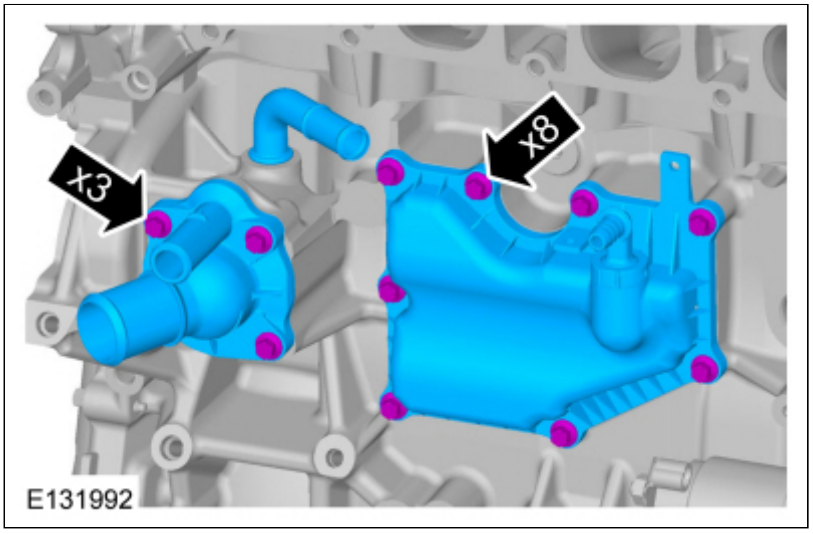
All vehicles

4. *Torque*: 25 Nm



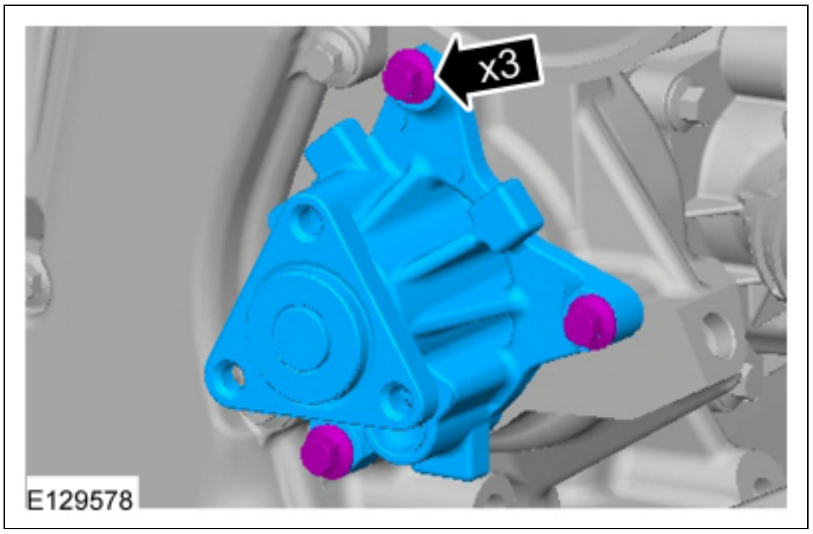
5. **NOTE:** *The gasket is to be reused unless damaged.*

   Torque: 10 Nm



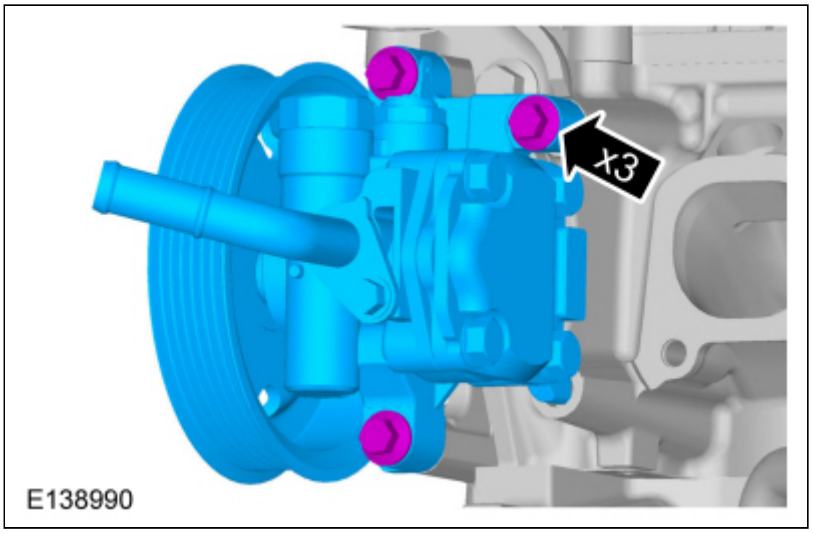
6. **NOTE:** *The gasket is to be reused unless damaged.*

   Torque: 10 Nm

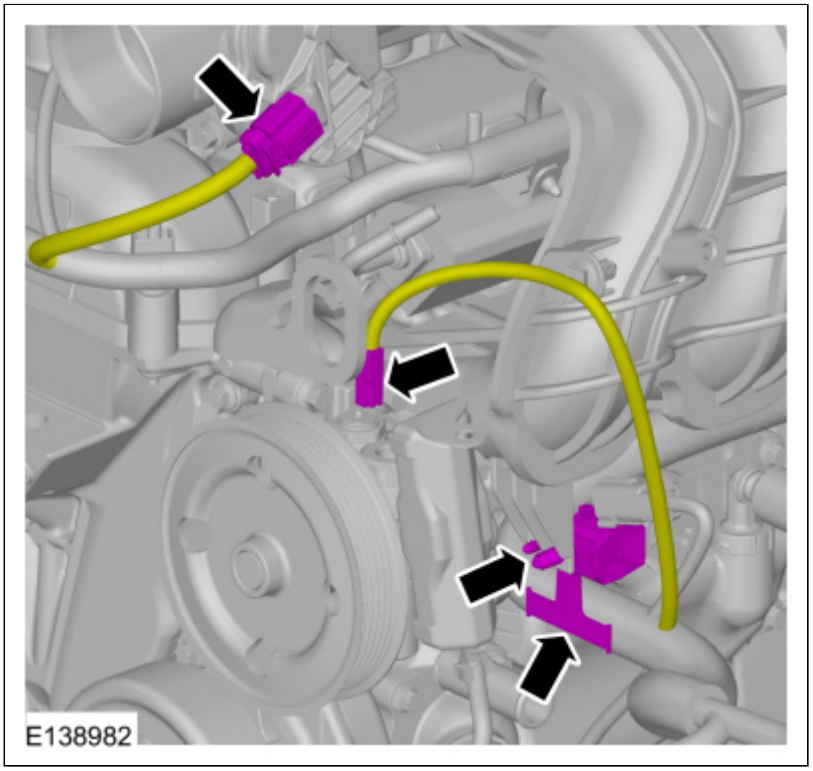


Vehicles With: Hydraulic Power Assist Steering (HPAS)

7.



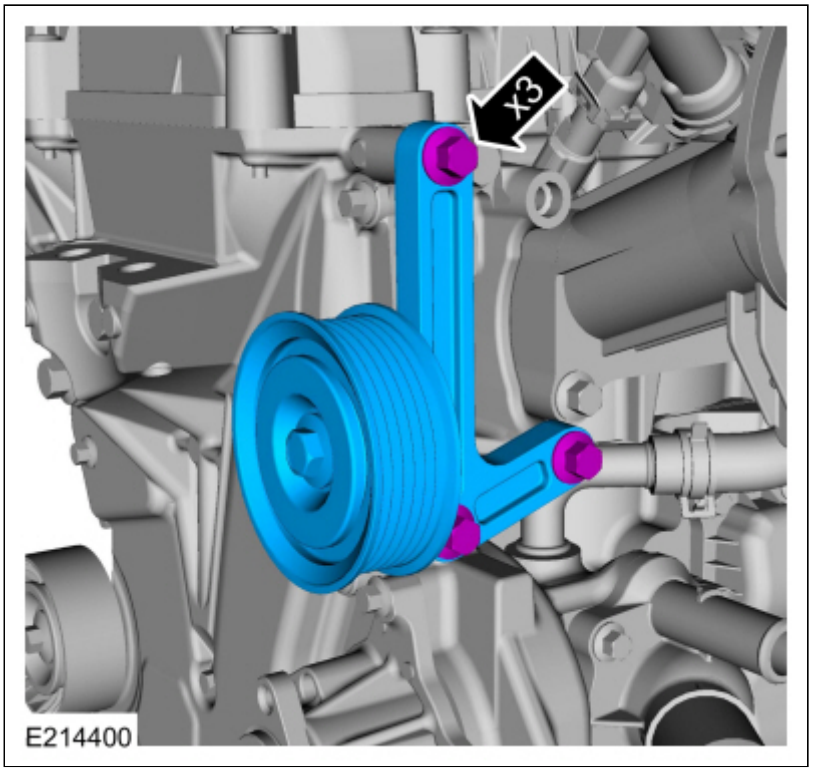
8.



Vehicles With: Electronic Power Assist Steering (EPAS)

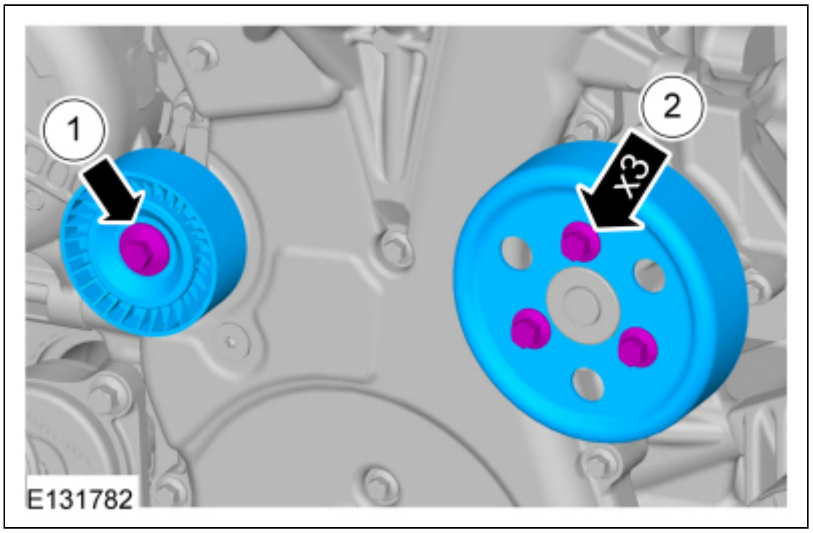
9. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Torque: 25 Nm

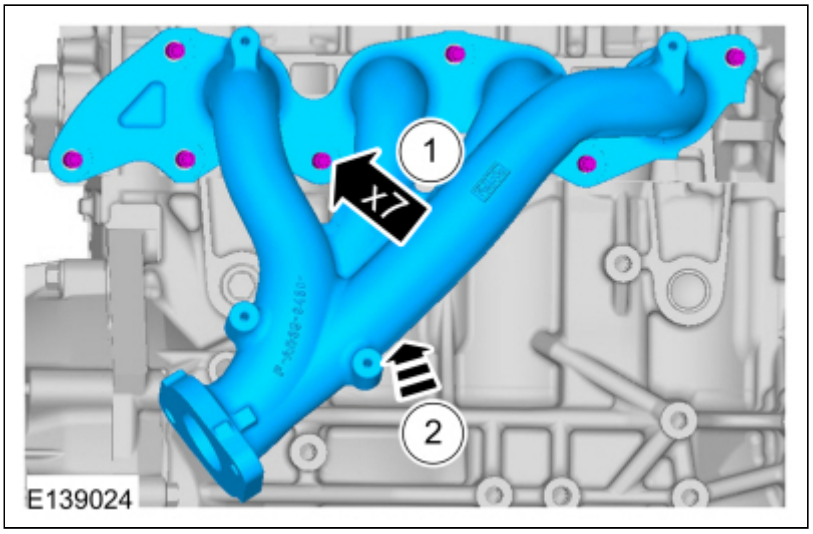


All vehicles

1. *Torque*: 25 Nm
2. **NOTE:** *Install all the bolts finger tight before final tightening.*

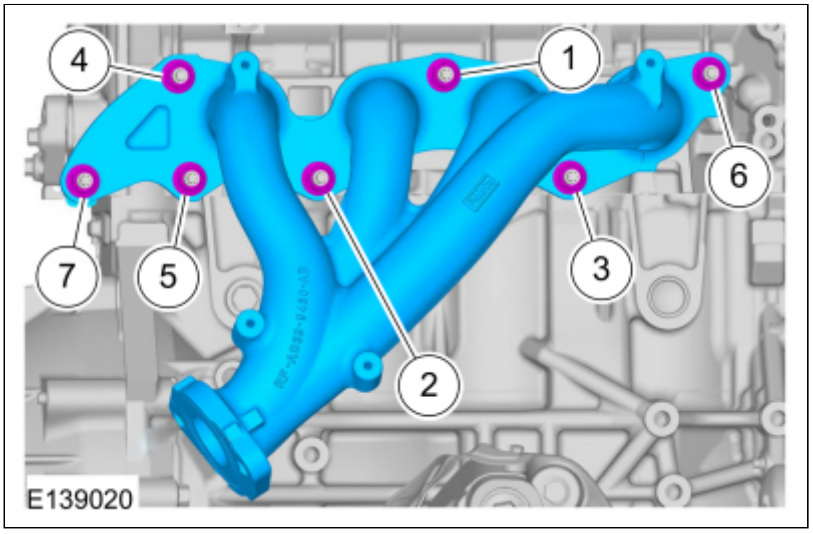


11. *Torque*: 17 Nm



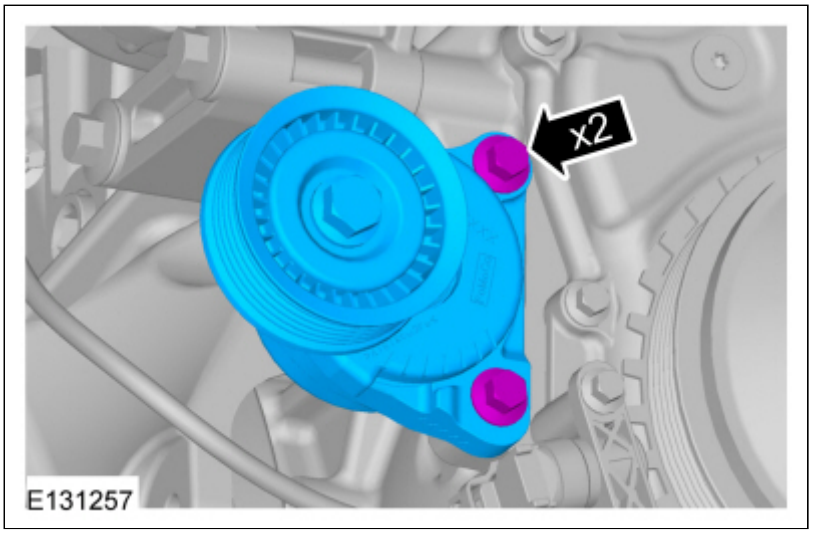
12. **NOTE:** *Make sure that a new exhaust manifold gasket is installed.*

    Torque: 55 Nm

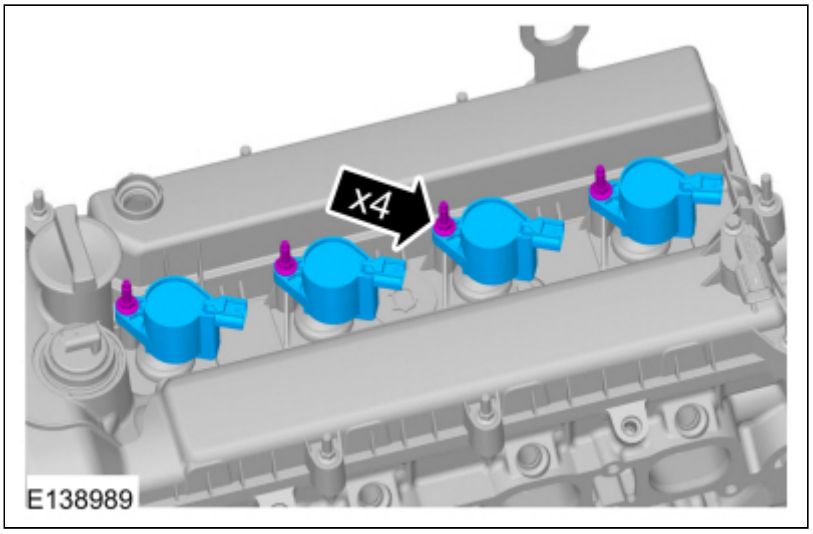


13. **NOTE:** *The accessory drive belt tensioner must be replaced as a complete unit.*

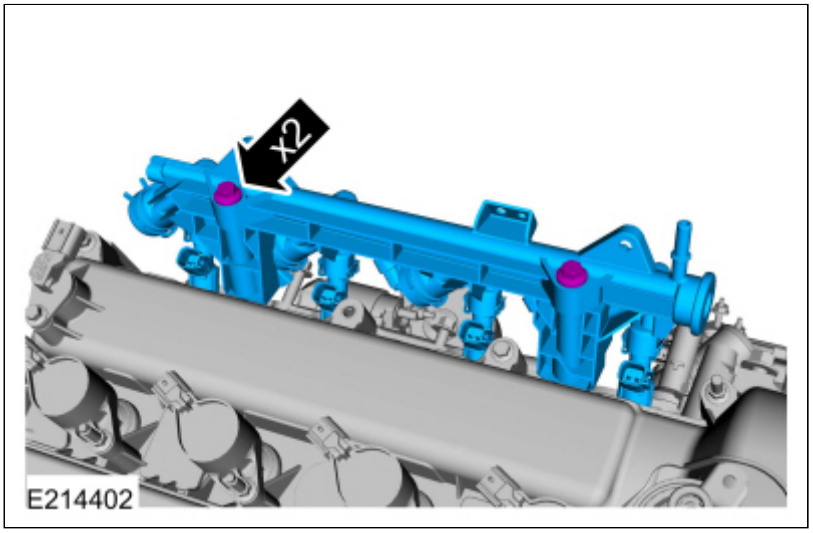
    Torque: 25 Nm



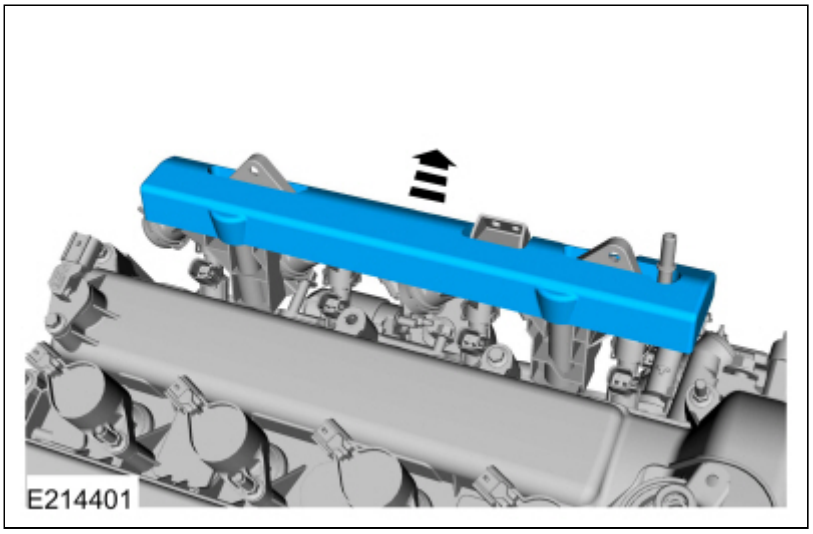
14. *Torque*: 8 Nm



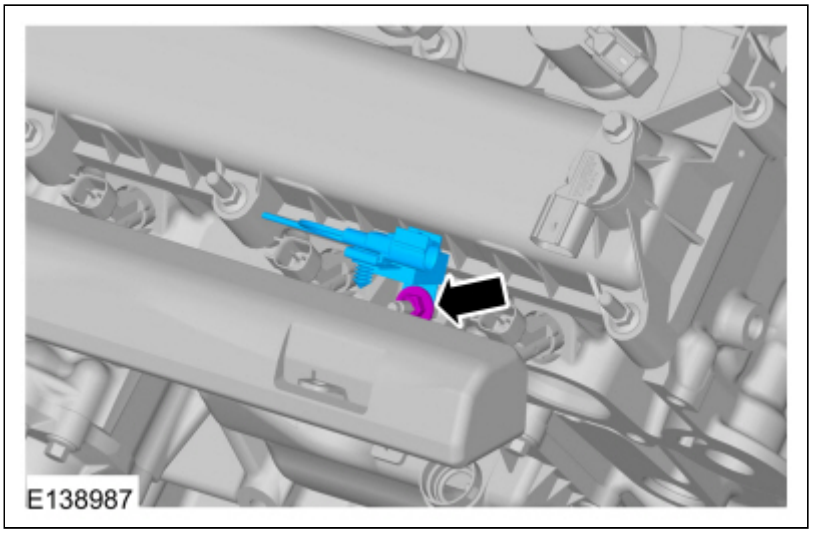
15. *Torque*: 23 Nm



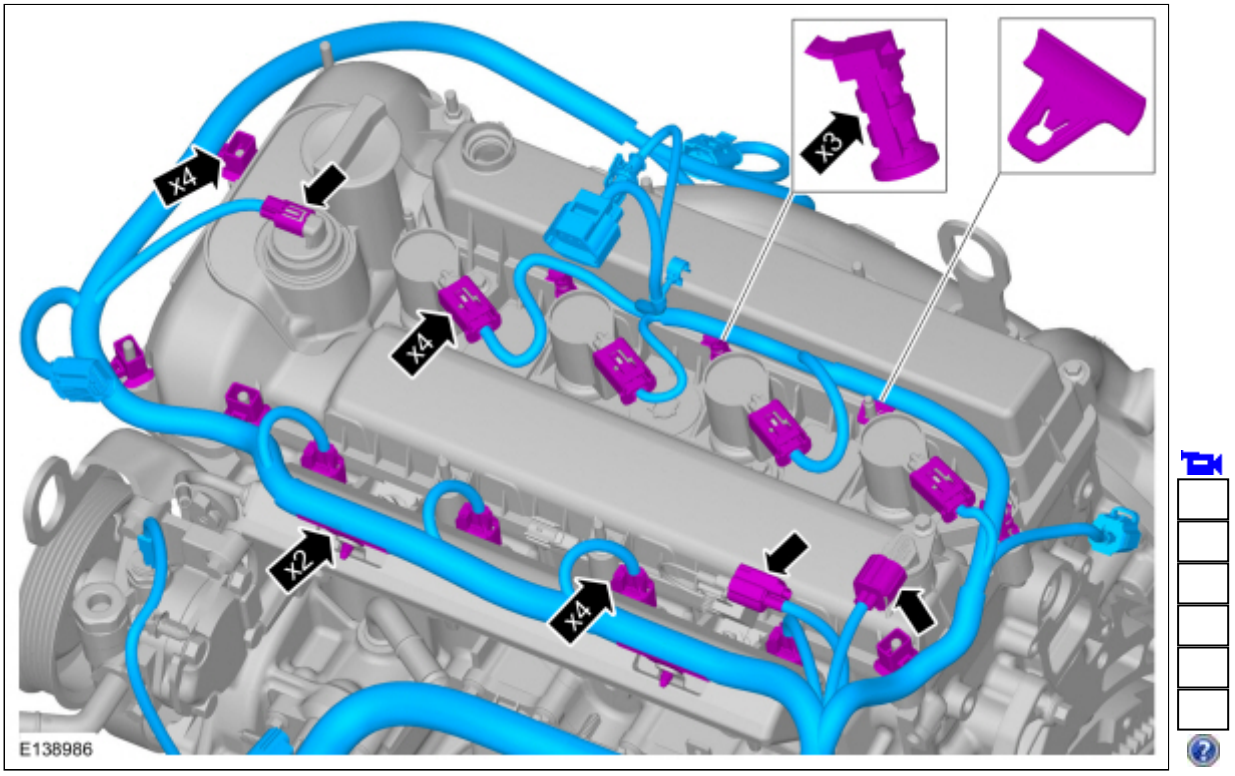
16.



17. *Torque*: 10 Nm



18.

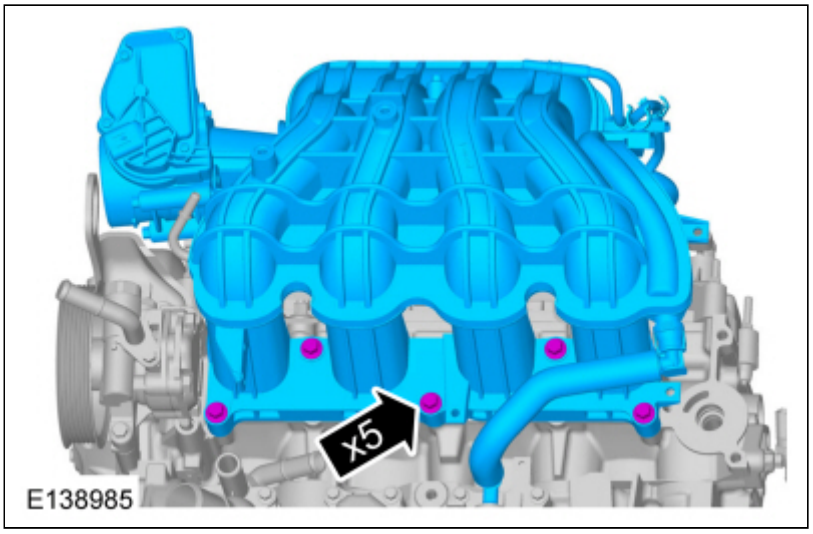


19. **NOTE:** *Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools can cause scratches and gouges which can make leak paths. Use a plastic scraping tool to remove all traces of the old intake manifold gaskets.*

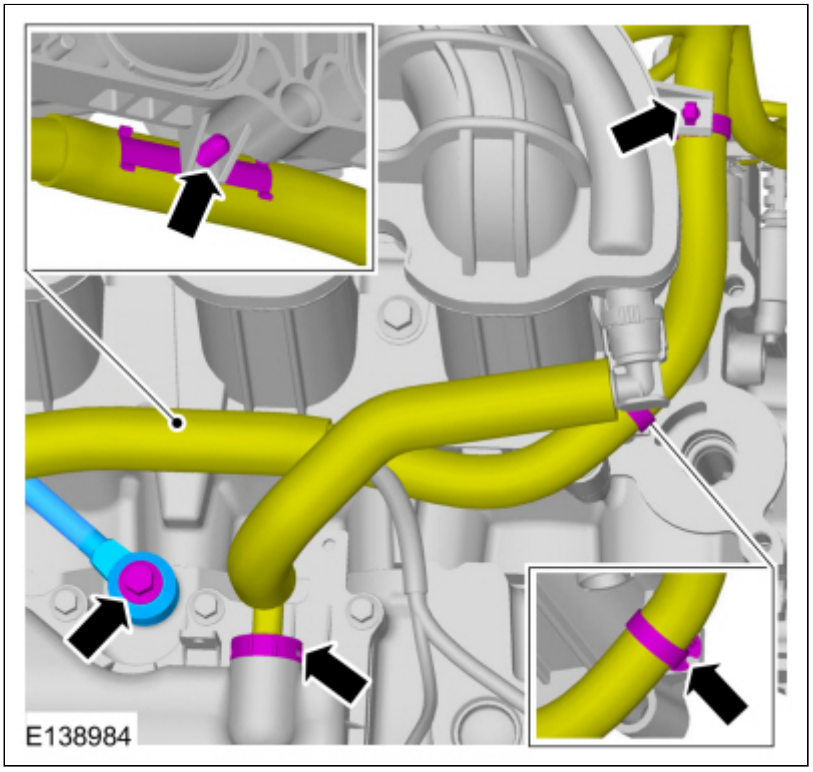
    NOTE: *If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.*

    NOTE: *The gasket is to be reused unless damage.*

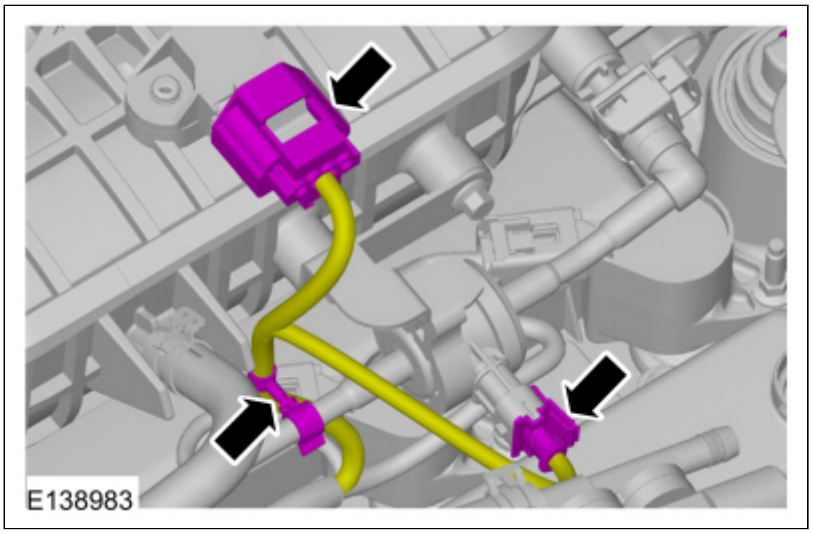
    Clean the sealing surfaces and inspect the gaskets. Install new gaskets if necessary.
    Torque: 19 Nm



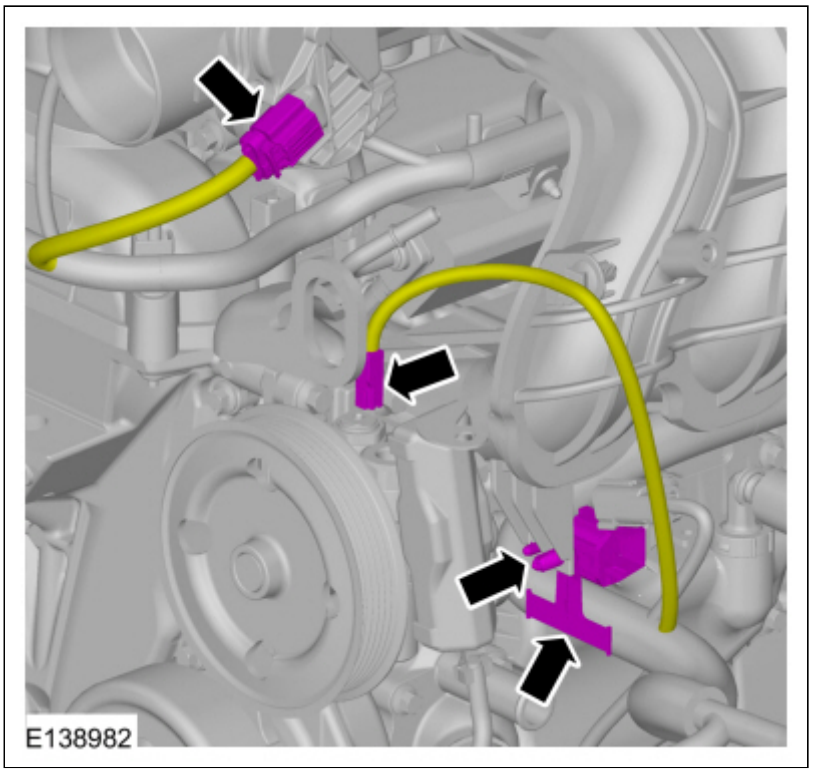
20. *Torque*: 20 Nm



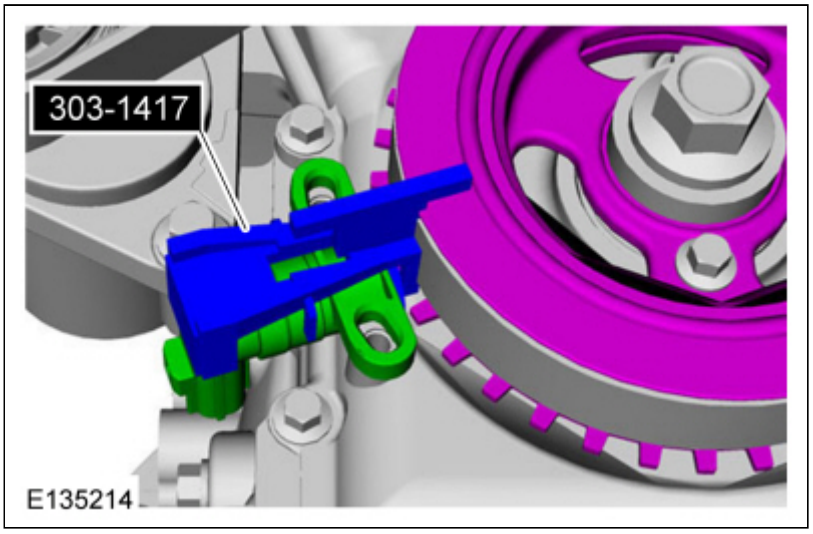
21.



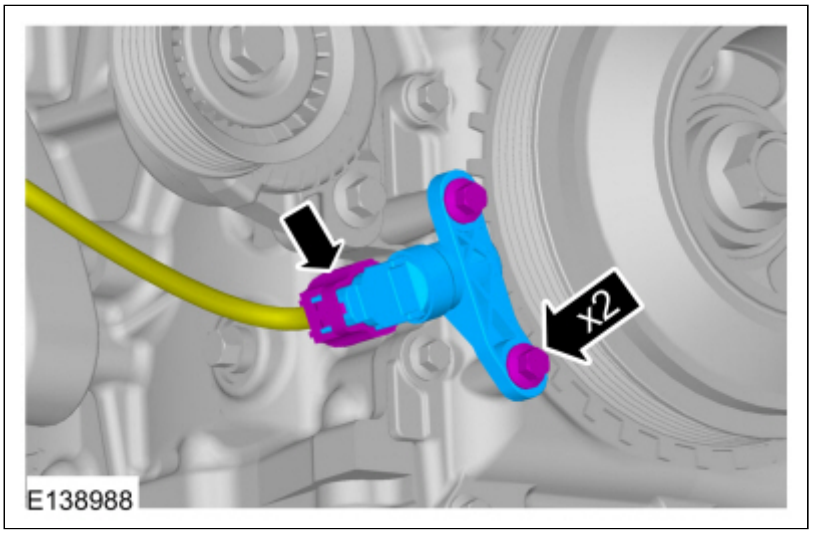
22.



23. Use Special Service Tool: 303-1417 Tool, Crank Sensor Alignment.

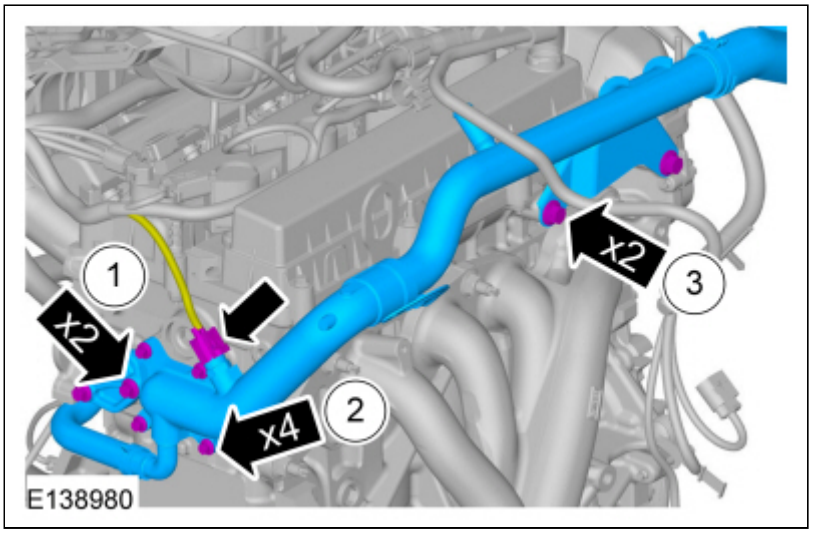


24. *Torque*: 7 Nm

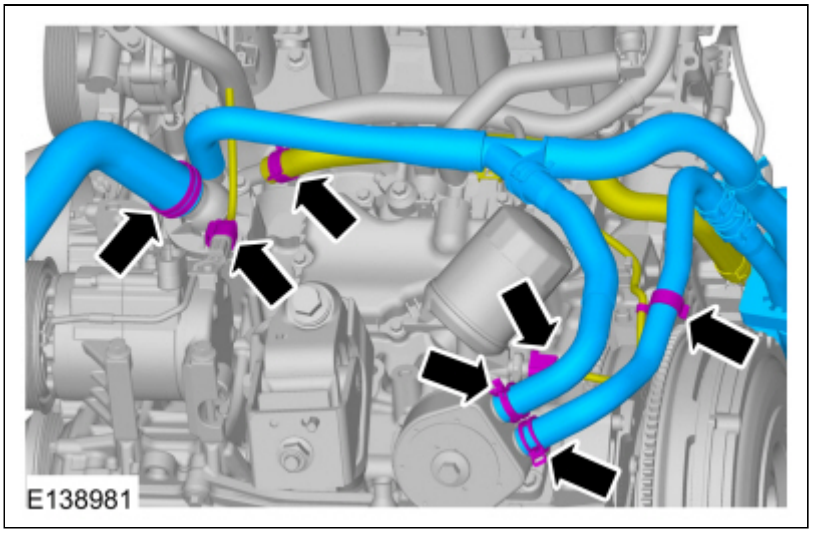


25. **NOTE:** *The gasket is to be reused unless damaged.*

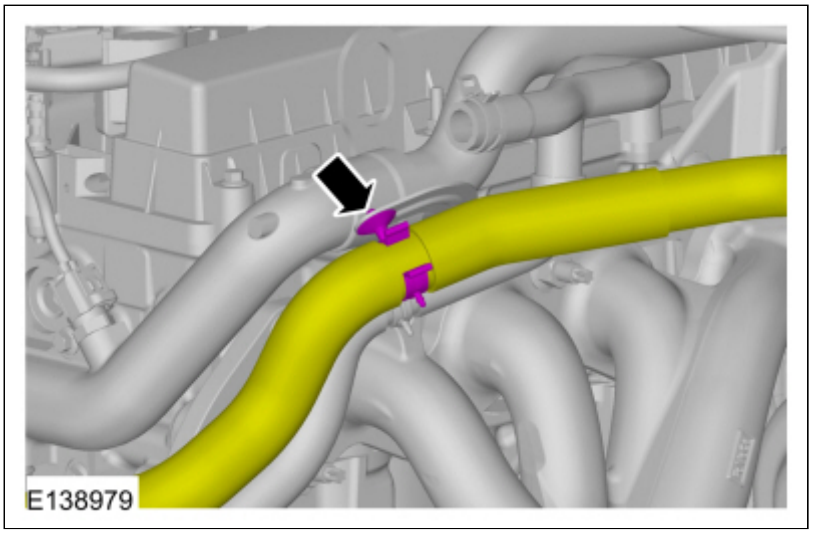
1. *Torque*: 25 Nm
2. *Torque*: 10 Nm
3. *Torque*: 48 Nm



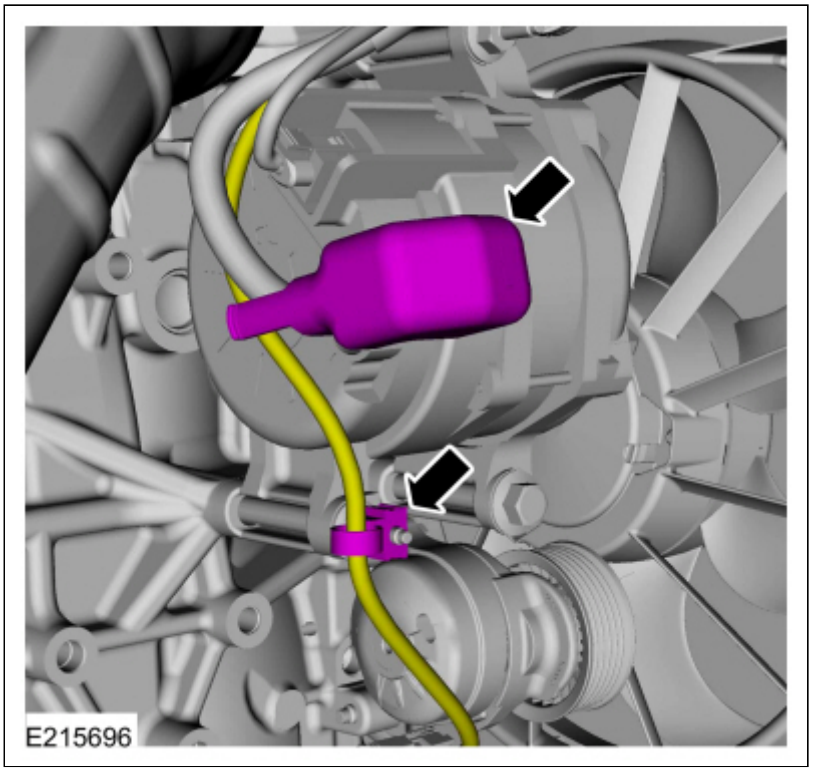
26.



27.

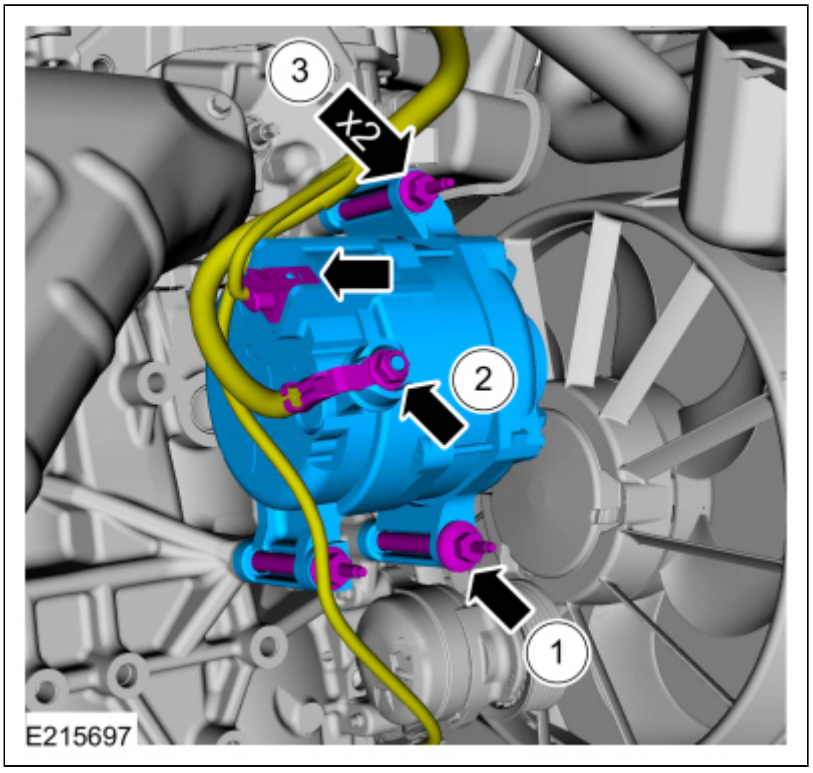


28.

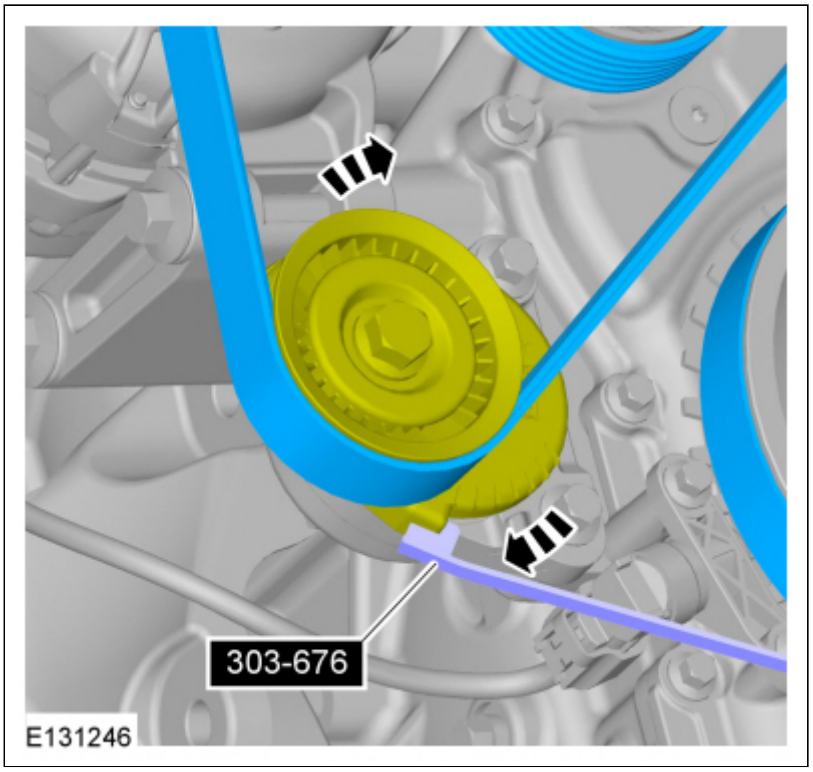


29. **NOTICE: Take extra care not to damage the wiring harnesses.**

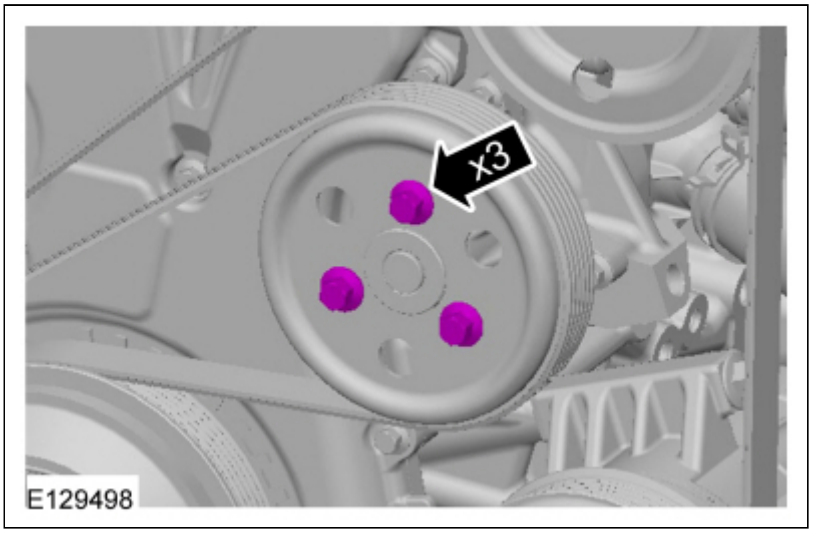
1. *Torque*: 48 Nm
2. *Torque*: 15 Nm
3. *Torque*: 48 Nm



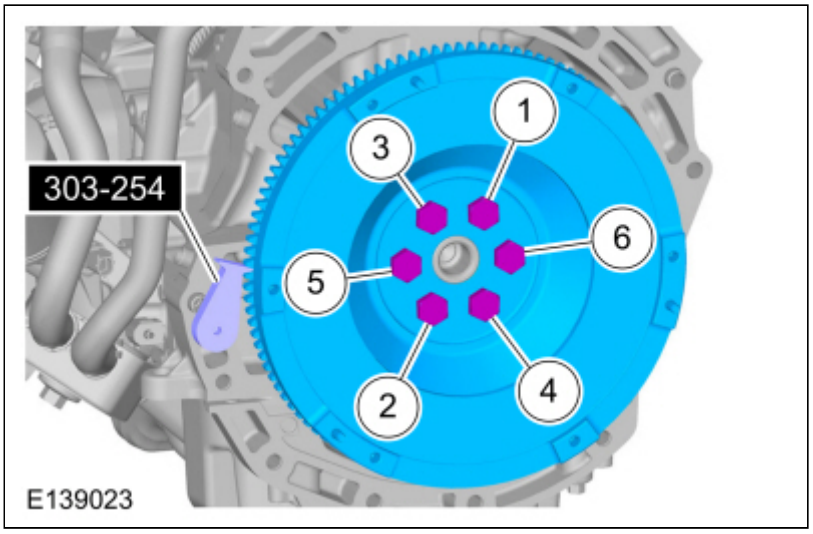
30. Rotate the accessory drive belt tensioner clockwise and install the accessory drive belt.



31. *Torque*: 20 Nm

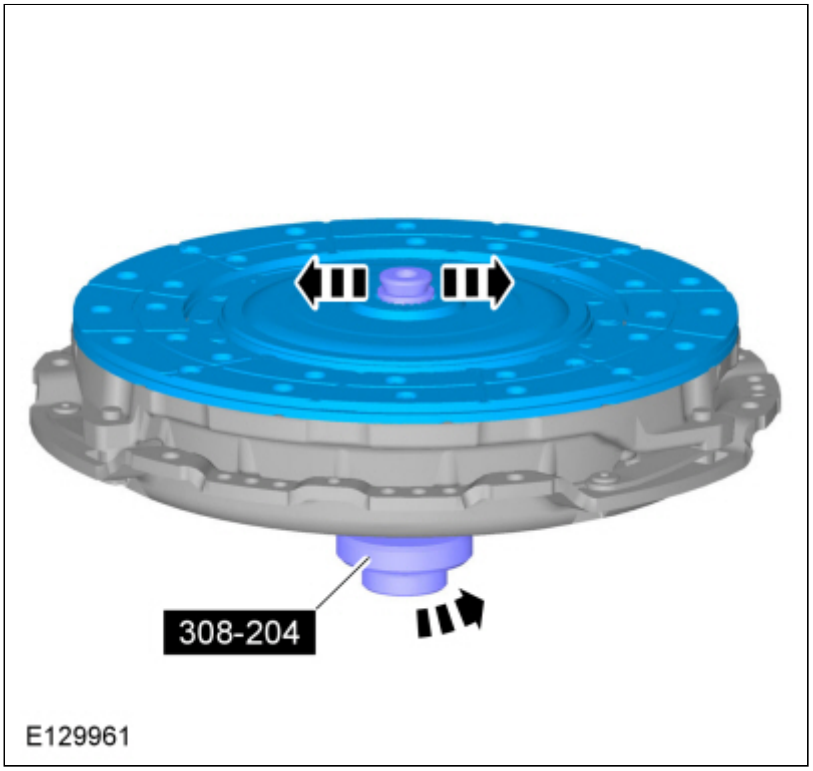


32. Use Special Service Tool: 303-254 Locking Tool, Flywheel.
    Torque:
    Stage 1: 50 Nm
    Stage 2: 80 Nm
    Stage 3: 112 Nm



33. **NOTE:** *The cone on the special tool must only be tightened finger tight to prevent damage to the clutch disc.*

    Use Special Service Tool: 308-204 Aligner, Clutch Disc.

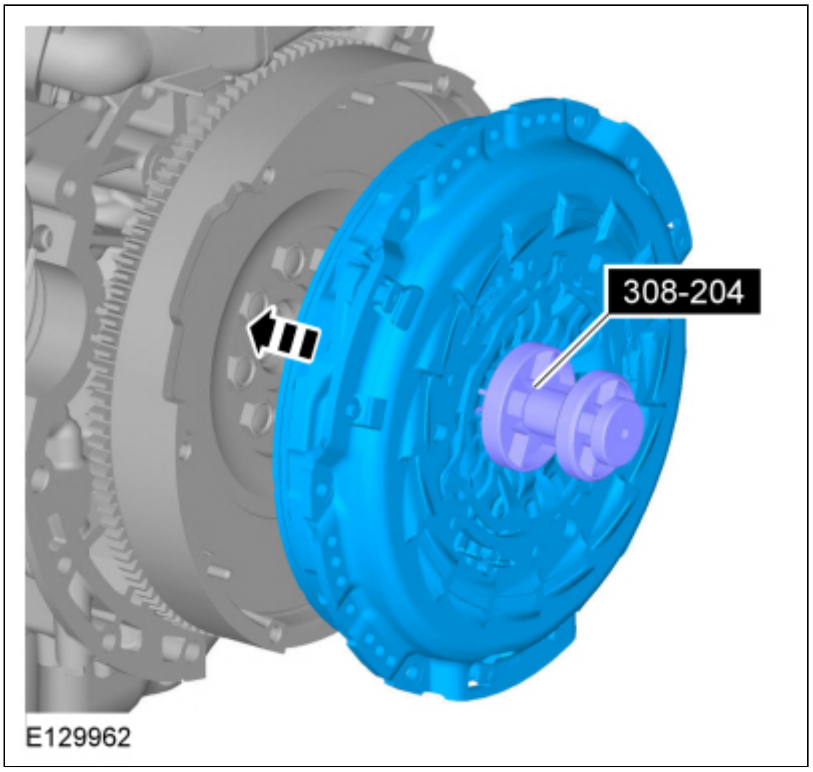


34. **NOTE:** *Check the pilot bearing for damage. Replace it, if necessary.*

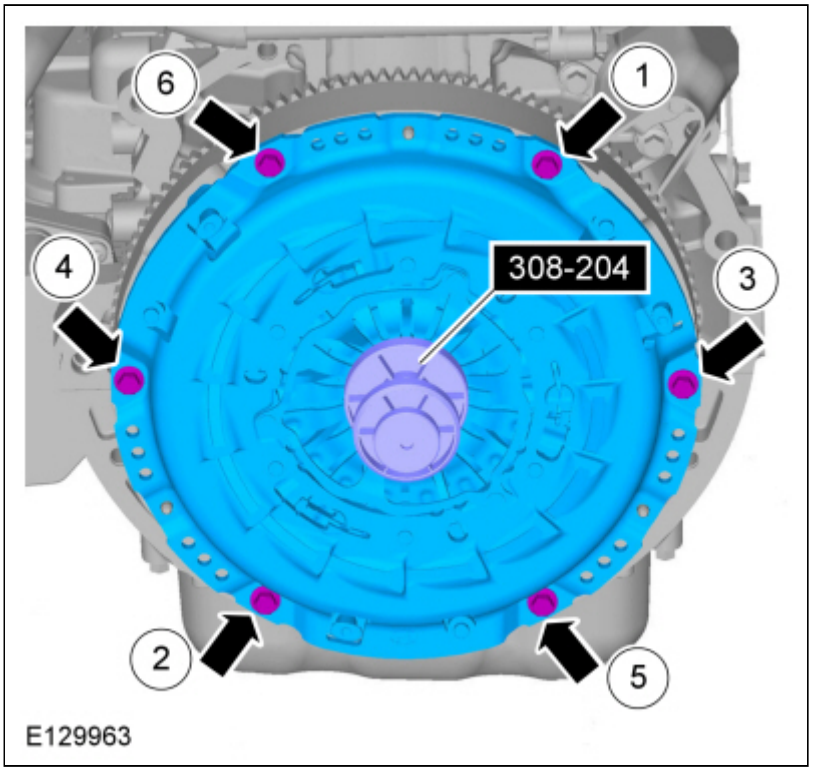
    Refer to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

35. **NOTE:** *Only tighten the bolt finger tight at this stage.*

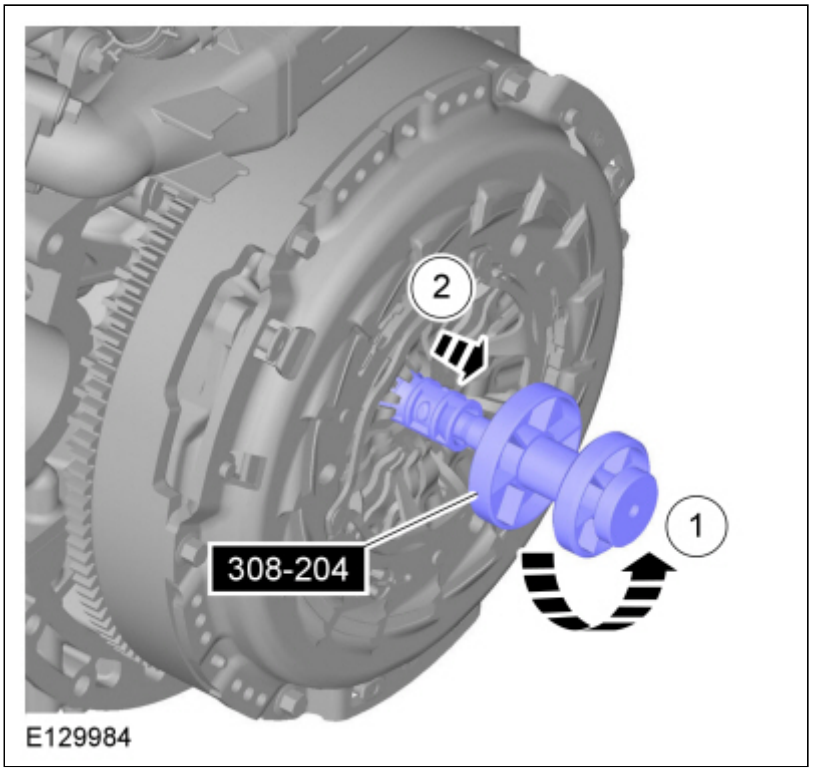
    Use Special Service Tool: 308-204 Aligner, Clutch Disc.



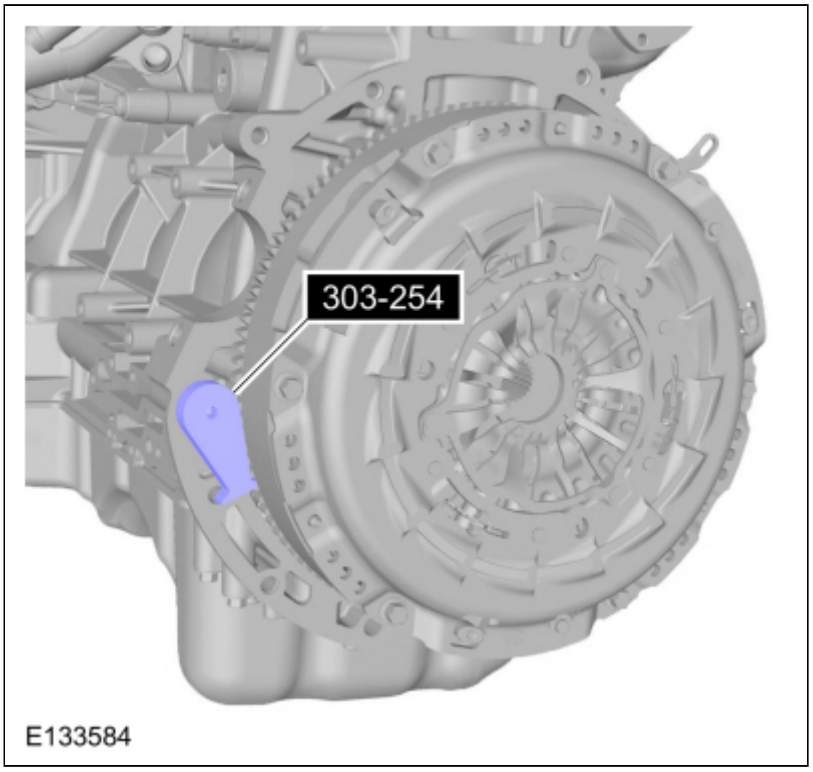
36. Use Special Service Tool: 308-204 Aligner, Clutch Disc.
Torque: 30 Nm



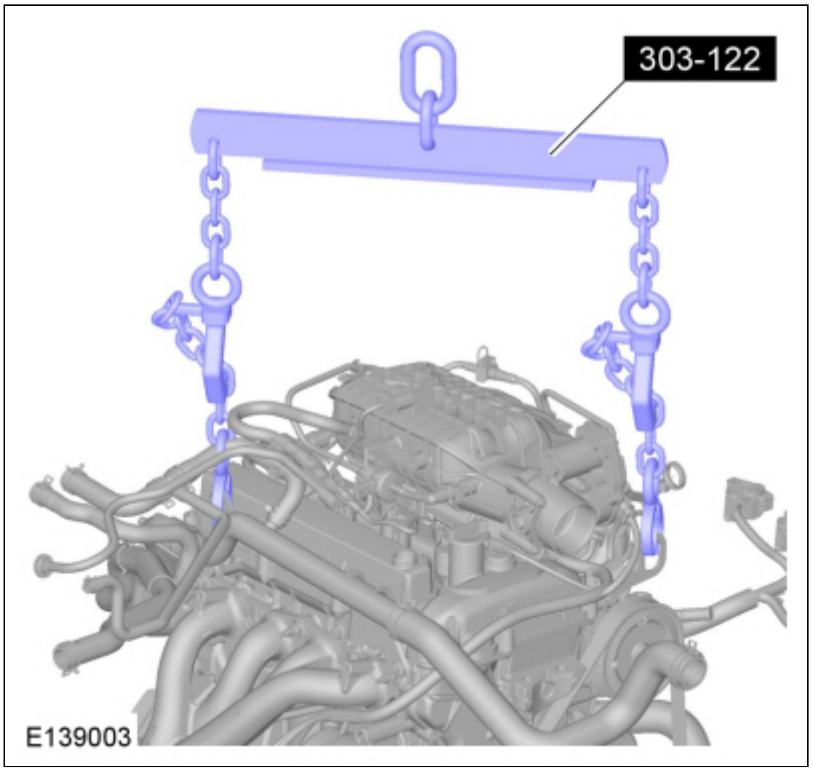
37. Remove Special Service Tool: 308-204 Aligner, Clutch Disc.



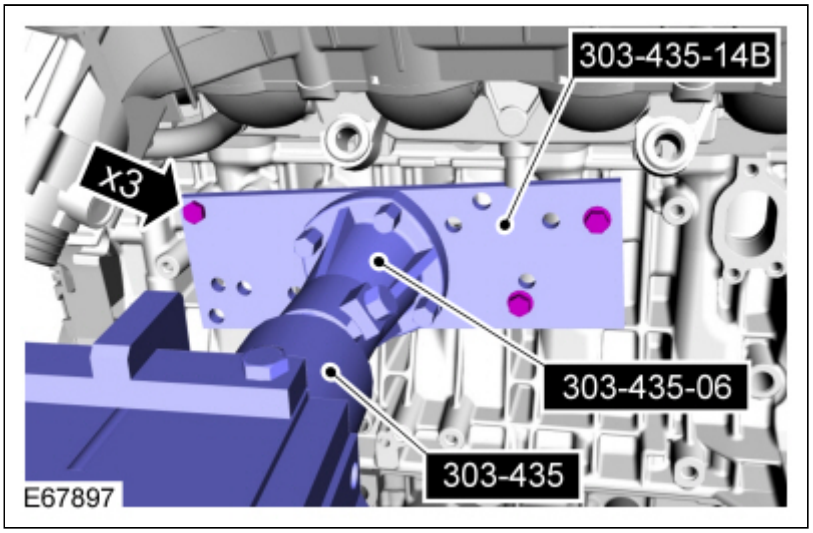
38. Remove Special Service Tool: 303-254 Locking Tool, Flywheel.



39. Use Special Service Tool: 303-122 Lifting Bracket, Engine.
Use the General Equipment: Floor Crane



40. Remove Special Service Tool: 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435. , 303-435-14B Mounting Plate for 303-435-06.



Copyright © 2016 Ford Motor Company

Specifications

Engine Data — 130 PS

Description	
Code	GBVAJQW
Firing order	1-3-4-2
Bore diameter	86 mm
Stroke	94.6 mm
Displacement	2198 cc
Compression ratio	15.6:1
Power output at _3200 rpm	96 kW (130 PS)
Torque between 1600 to 2500 rpm	320 Nm
Idle speed	800 rpm

Engine Data — 160 PS

Description	
Code	GBVAJQJ
Firing order	1-3-4-2
Bore diameter	86 mm
Stroke	94.6 mm
Displacement	2198 cc
Compression ratio	15.6:1
Power output at _3200 rpm	118 kW (160 PS)
Torque between 1600 to 2500 rpm	385 Nm
Idle speed	800 rpm

Engine Oil Capacity

Description	Liters
Initial fill including oil filter	8.9
Service fill including oil filter	8.6
Service fill without oil filter	8.2

Cylinder Block Dimensions

Description	mm
Cylinder bore diameter	86.000-86.020
Main bearings radial clearance	0.028-0.072
Main bearings 1 to 4 parent bore diameter — vertical measurement	69.504-64.520
Main bearing 5 parent bore diameter — vertical measurement	74.504-74.520
Main bearings 1 to 4 parent bore diameter — horizontal measurement	69.502-69.525
Main bearing 5 parent bore diameter — horizontal measurement	74.502-74.525

Piston Dimensions

Description	mm
Piston diameter	85.950-85.934
Piston clearance in cylinder	0.05-0.086
Piston ring end gaps	
— upper compression ring	0.25-0.035
— lower compression ring	0.85-1.1
— oil control ring	0.2-0.4

Piston ring gap position: The piston ring gaps must be distributed evenly around the circumference of the piston. This also applies to the oil control ring elements. Align the piston ring gaps at 120 degrees to each other.

Crankshaft Dimensions

Description	mm
Main bearing journal end float	0.090-0.305
Main bearing journals 1 to 4 diameter	64.950-64.970
Main bearing journal 5 diameter	69.950-69.970
Connecting rod bearing journal diameter	52.980-53.000

Connecting Rod Dimensions

Description	mm
Bearing clearance	0.04-0.09
Large end bore diameter	55.996-56.016
Small end bore diameter	30.010-30.018
Connecting rod bearing shell inner diameter — bearings installed	53.017-53.043
Connecting rod bearing radial clearance	0.034-0.100
Connecting rod bearing axial clearance	0.100-0.320

Connecting Rod Grade Selection

Crank Pin to Cylinder Head Face 'X' (mm)	Connecting Rod Grade	Connecting Rod Length (mm)
176.255-176.319	A	154.905-154.964 (154.94)
176.320-176.365	B	154.965-155.035 (155.00)
176.366-176.369	A	154.905-154.964 (154.94)
176.370-176.440	B	154.965-155.035 (155.00)
176.441-176.460	C	155.036-155.095 (155.06)

Piston Pin Dimensions

Description	mm
Piston pin length	66.85-66.87
Piston pin diameter	29.995-29.999
Piston pin slide clearance	0.013-0.022

Camshaft Dimensions

Description	mm
Camshaft end float	0.014-0.20
Camshaft bearing journal diameter	26.450
Camshaft bearing clearance — radial measurement	0.065

Valve Dimensions

Description	mm
Valve stem to valve guide clearance — intake valve	0.045
Valve stem to valve guide clearance — exhaust valve	0.055
Valve seat width	26

Cylinder Head Dimensions

Description	mm
Maximum distortion — measured longitudinally and diagonally over 25mm,over 150 mm,over distance in excess of 150mm	0.025,0.050,0.10
Peak to valley height of mating surface	0.02
Thickness of cylinder head gasket with piston protrusion of 0.430 - 0.520 mm	0.01
Thickness of cylinder head gasket with piston protrusion of 0.521 - 0.570 mm	1.15(two hole/teeth)

Thickness of cylinder head gasket with piston protrusion of 0.571 - 0.620 mm	1.2(three holes/teeth)

Oil Pressure Specifications

Description	bar
Minimum oil pressure at idle speed	1.25
Minimum oil pressure at 2000 rpm	2.0

Lubricants, Fluids, Sealers and Adhesives (for markets with low sulphur content less than 350 ppm)

Item	Specification
Engine Oil	WSS-M2C913-C
Engine Oil	WSS-M2C913-D
Sealer — oil pan, camshaft carrier and engine front cover	WSE-M4G323-A4

Lubricants, Fluids, Sealers and Adhesives (for markets with high sulphur content greater than 350 ppm)

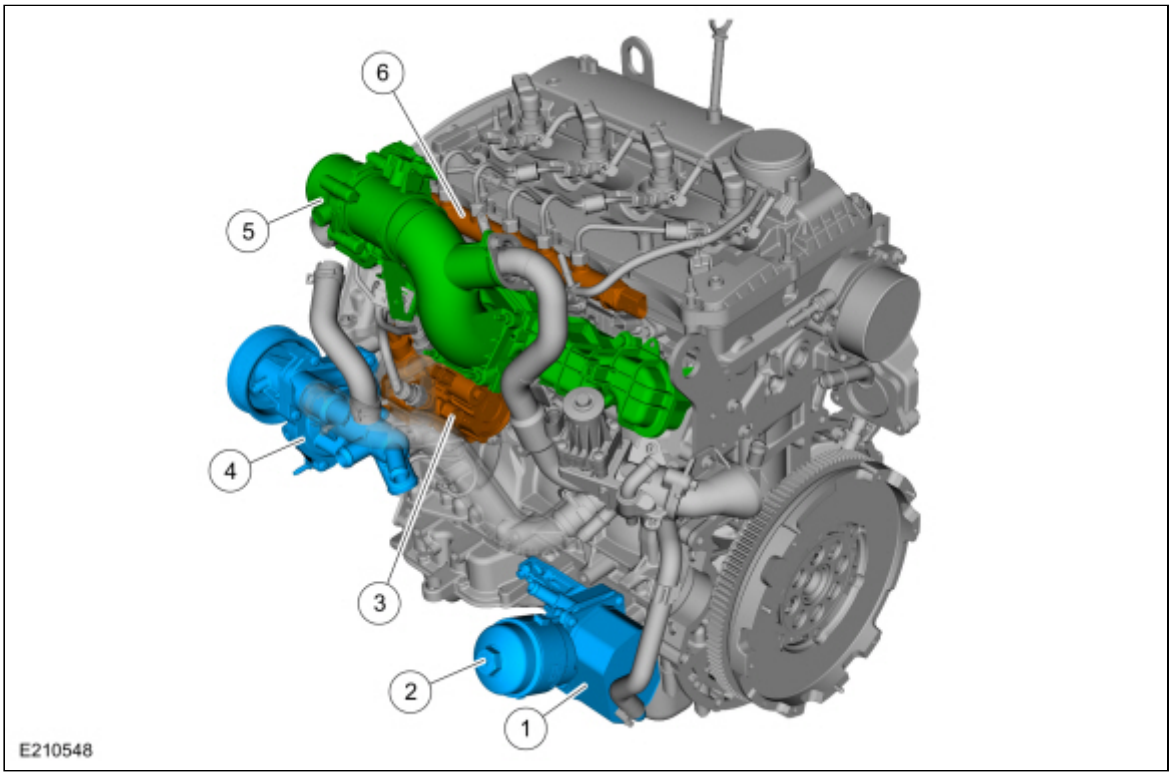
Item	Specification
Engine Oil	WSS-M2C921-A
Engine Oil	WSS-M2C913-D
Sealer — oil pan, camshaft carrier and engine front cover	WSE-M4G323-A4

Copyright © 2016 Ford Motor Company

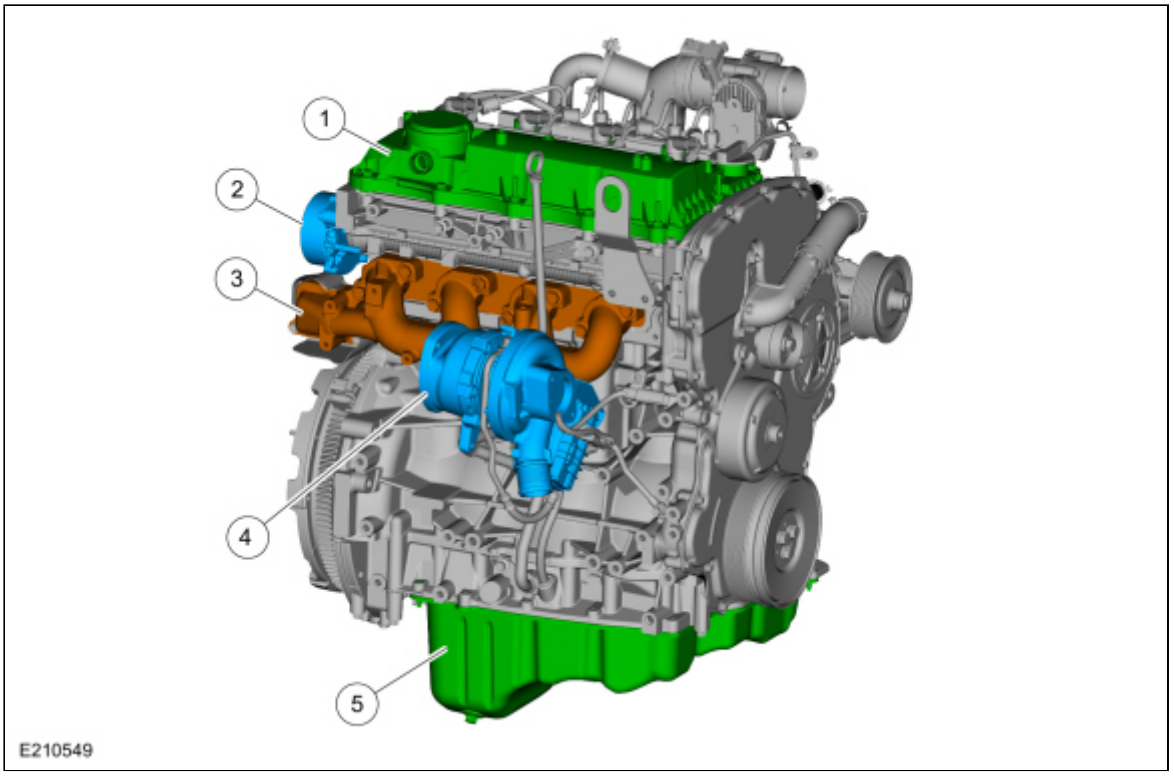
Engine - Component Location

Base Part Number: 6L084

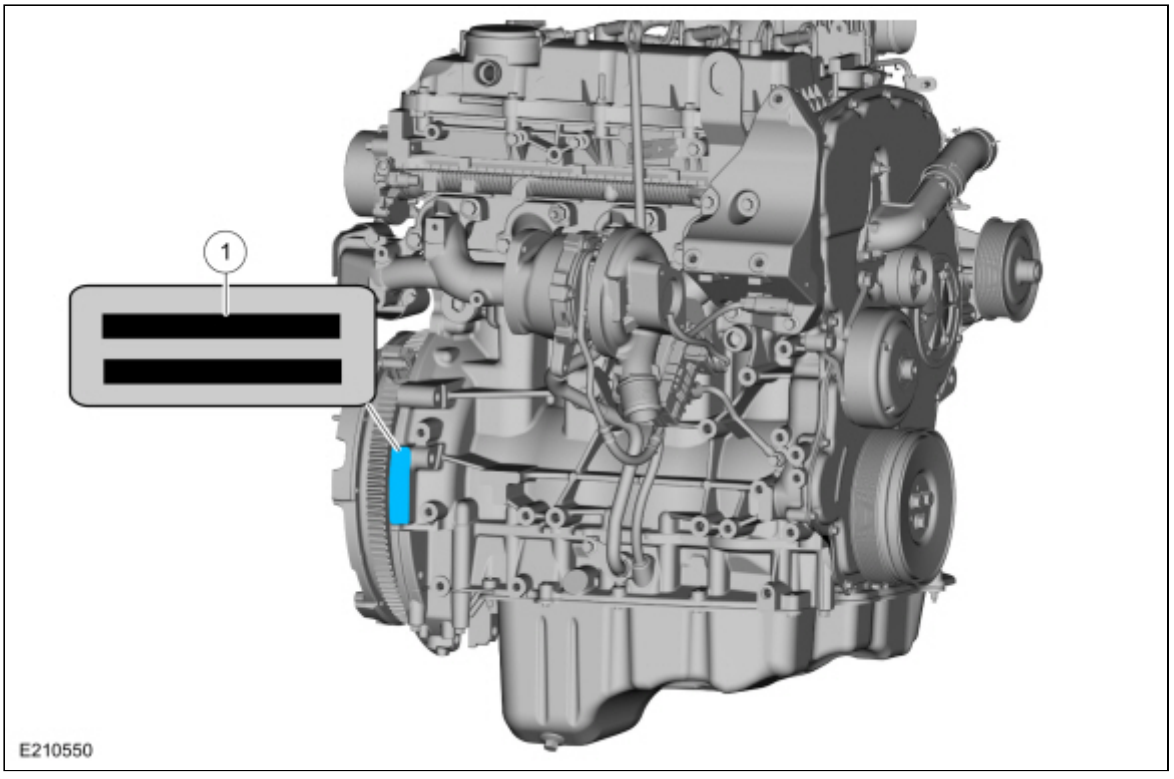
Engine



Item	Part Number	Description
1	—	Oil cooler
2	—	Oil filter
3	—	Fuel pump
4	—	Coolant pump
5	—	Intake manifold
6	—	Fuel injection rail



Item	Part Number	Description
1	—	Valve cover
2	—	Vacuum pump
3	—	Exhaust manifold
4	—	Turbocharger
5	—	Oil pan



Item	Part Number	Description
1	—	VIN (Vehicle identification number)

Copyright © 2016 Ford Motor Company

Engine - Overview

Base Part Number: 6L084

Duratorq-TDCi

NOTE: *The 2.2L and 3.2L Duratorq-TDCi engines are members of the "Global Puma" engine family. The 3.2L engine shares the design of the 2.2L engine with an extra cylinder added.*

The 2.2L Duratorq-TDCi engine is a 4 cylinder common rail, turbo charged diesel engine which delivers a power of 118 kW.

The 3.2L Duratorq TDCi engine is a 5 cylinder common rail, turbo charged diesel engine which delivers a power of 147kW and the maximum torque is 470 Nm.

The engines have a cast iron cylinder block with a ladder frame in order to increase rigidity and reduce vibration.

The engine turbocharger is a variable guide vane type. The guide vanes are electrically adjustable.

Engine Features

- 4 or 5-cylinder turbo diesel in-line engine with two overhead camshafts and 16 valve technology
- Cast iron cylinder block with cast-in cylinder liners
- Ladder frame for extending the cylinder block
- Two-part cylinder head made from aluminium
- Intake and exhaust camshaft and fuel high pressure pump driven a timing chain
- Oil pump drive by chain
- Oil level/oil temperature sensor
- Camshaft driven vacuum pump
- Valves actuated by roller cam followers with hydraulic tappets
- Variable-geometry turbocharger for optimum cylinder charging

Fuel System

- Continental common rail system 1800 bar
- Fuel injectors with piezo technology

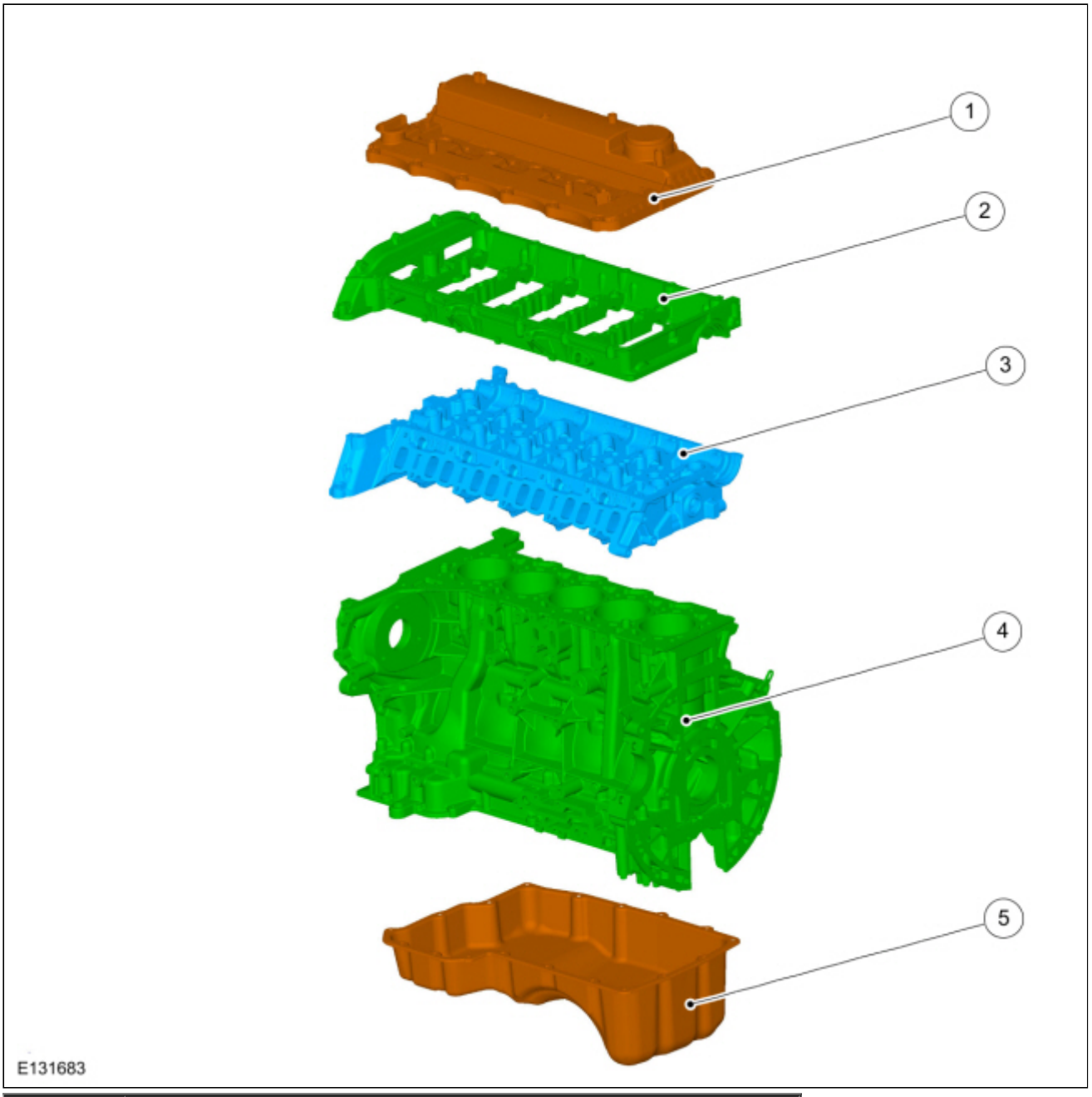
Engine Management

- Continental PCM
- Volume control valve, fuel inlet temperature sensor and fuel rail pressure sensor for efficient regulation of fuel pressure
- Actuator motor-controlled EGR (exhaust gas recirculation) valve

Engine-Emission Control

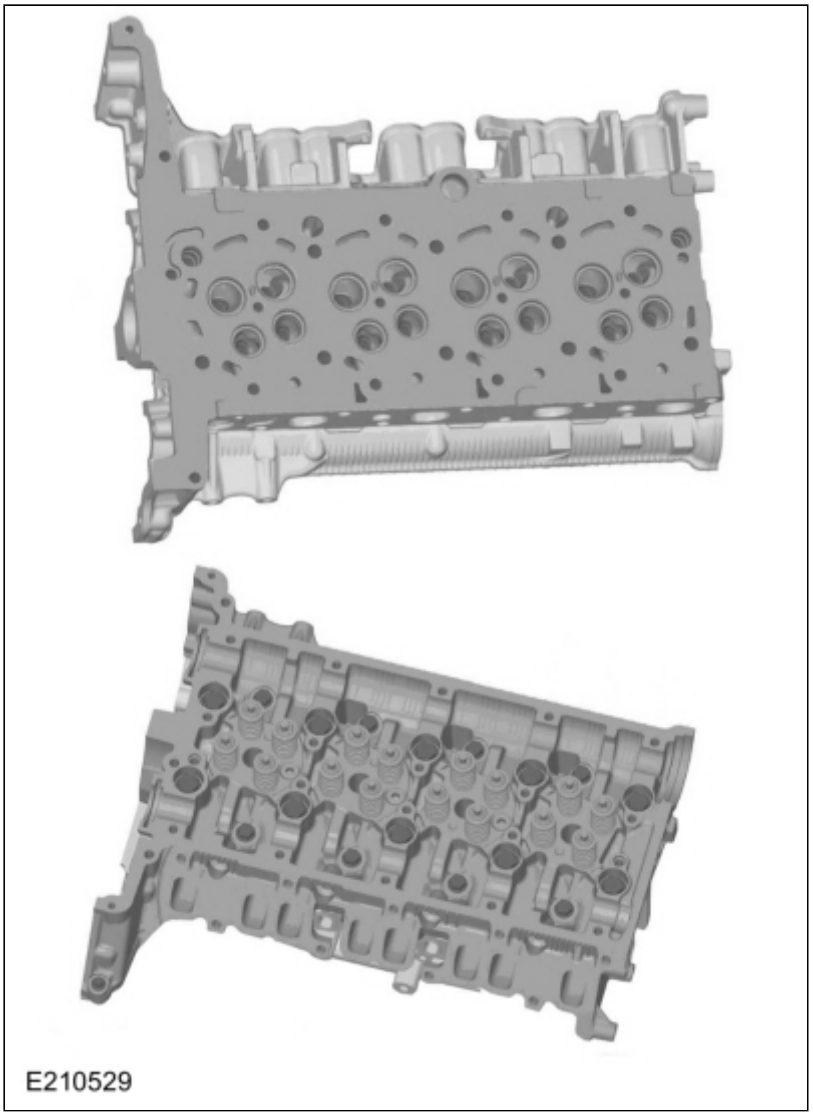
- Depending on region Meets EURO 2,4 or 5
- Actuator motor-controlled EGR valve and cooled by water
- Electronic throttle body with position sensor
- Broadband Lambda probe for correcting the injection volume and for optimizing the EGR
- Coated DPF (diesel particulate filter) to minimize particle emissions (region dependent)

Engine Components



Item	Description
1	Valve cover
2	Housing valve rocker arm
3	Cylinder head
4	Cylinder block and ladder frame
5	Oil pan

Cylinder Head



Cylinder head consists of two parts and is made of aluminum. Both parts are bolted to each other.

Lower part contains four valves for each combustion chamber and the two camshafts.

The upper part houses the rocker arm frame with the roller rocker arms. The hydraulic valve clearance adjustment is integrated in the roller rocker arms.

Camshafts and the fuel injection pump are driven by the crankshaft via the timing chain.

Oil pump is located inside the oil pan and is driven by the crankshaft via a chain.

NOTE: *Cylinder 1 is located on the timing chain end.*

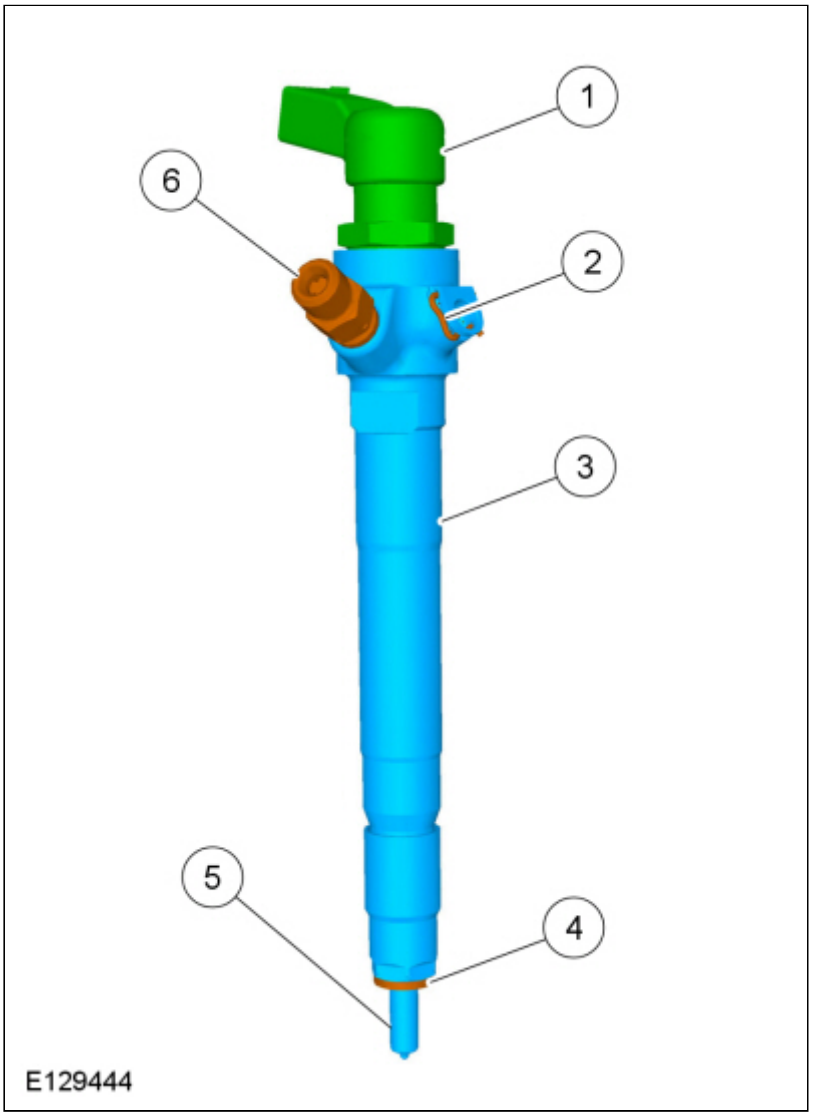
Copyright © 2016 Ford Motor Company

Engine - System Operation and Component Description

Base Part Number: 6L084

System Operation

Continental common rail fuel injection system



Item	Description
1	Electrical connector
2	Fuel return line clip
3	Fuel injector
4	Sealing washer
5	Injector nozzle
6	High pressure fuel supply line union

The continental common rail fuel injection system works in a similar fashion to a petrol fuel injection system where fuel is supplied to the injector via a fuel rail. The injection control occurs at the injector.

NOTE: *Fuel injectors for the 2.2L Duratorq TDCi HP engine have a higher flow rate than for the other two versions.*

The piezo injectors, which are hydraulically connected to the fuel rail, inject the necessary amount of fuel into the combustion chamber for all operating conditions of the engine. The injector is centralized in the combustion chamber. The injection quantity is composed of a pre-injection amount and a main-injection amount. This separation causes a "soft" combustion operation of the diesel engine reducing Diesel 'knock'.

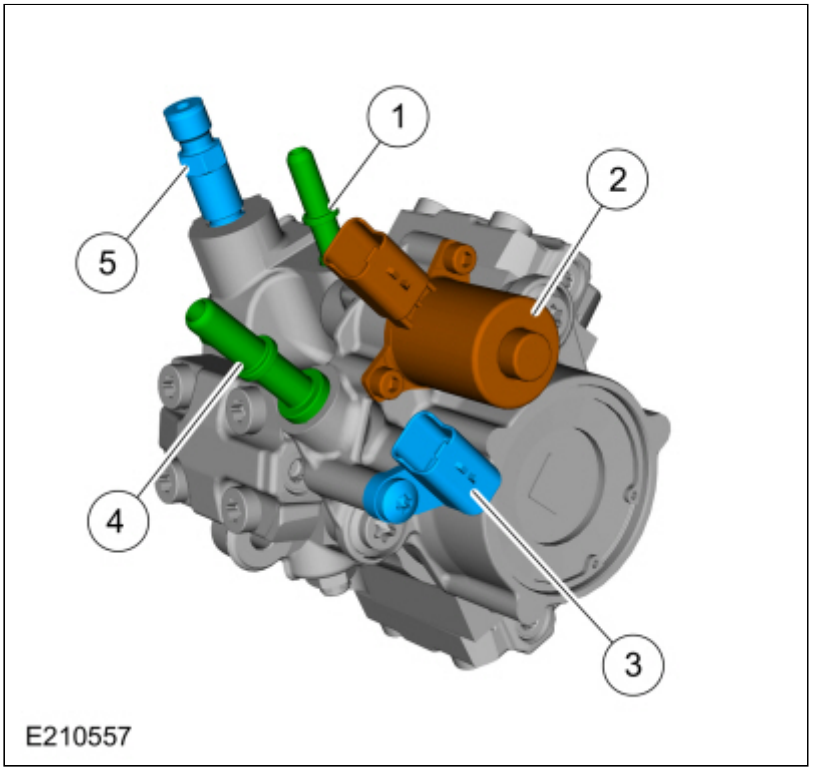
Piezo actuators ensure extremely quick response times are possible, and are faster than solenoid injectors. Because of this, the injected fuel amount and the dosage can be extremely accurately controlled. The injectors are controlled by the PCM.

The fuel rail is made from forged steel and is retained by a support bracket located on the camshaft carrier. The fuel is delivered by one high-pressure fuel supply line from the fuel pump to the fuel rail. From the fuel rail, the fuel travels through high-pressure fuel supply lines to the fuel injectors. At the end of the fuel rail is the fuel pressure sensor.

NOTE: *Whenever a high pressure fuel line is removed it must be replaced with a new part.*

NOTE: *The fuel pressure sensor is never to be removed from the fuel rail. If faulty it must be replaced together with the fuel rail as an assembly.*

Fuel pump



Item	Description
1	Fuel return bleed from injectors
2	Fuel metering valve
3	Fuel temperature sensor
4	Fuel supply from tank
5	High pressure outlet to fuel rail

The high pressure fuel pump is driven via the timing chain, and houses two pumps. A low-pressure vane pump and a three cylinder positive displacement pump. The cylinders are staggered at 120°. The fuel volume flow is variable.

The low pressure part of the pump supplies the high pressure part with fuel for pressure generation. Between the low and high pressure parts of the pump the volumetric control valve is fitted to limit the fuel volume flow.

The fuel enters the high pressure part of the pump where high pressure is generated and the fuel is pumped to the fuel pressure regulator where the pressure is controlled to between 230 bar and 1800 bar. The fuel then leaves the fuel pump and is supplied to the fuel rail.

The combination of piezo injectors and the ability to rapidly increase and decrease the fuel pressure gives the engine

the ability to vary the amount of fuel being injected in a given time, and for the injector to react very quickly. This enables a small pre-injection then a larger main injection. Having a pre-injection and a main injection reduces combustion noise and, emissions while increasing performance and economy. The fuel pressure, injection timing, and duration are all controlled by the PCM.

Vacuum pump

The diesel engines are fitted with a vacuum pump to provide the brake booster with vacuum in order to assist with braking. The vacuum pump is mounted on the rear of the cylinder head and is driven via the exhaust camshaft.

Intake manifold flap

Mounted on the intake manifold is a servo controlled flap. The intake manifold flap unit has the following functions:

- preventing "serious engine judder" when the engine is stopped
- throttling of the intake air during the DPF regeneration process

The intake manifold flap is actuated by a DC motor. Actuation is performed via Pulse Width Modulation (PWM) which is controlled by the PCM. The position of the intake manifold flap is detected by a position sensor (potentiometer). The output signal is an analogue voltage signal.

Engine oil quality

Ranger is fitted with a warning light on the instrument cluster. When illuminated, the PCM has calculated the acceptable level of contaminants and soot in the engine oil has been exceeded. The oil quality calculation strategy is loaded in the PCM software. This strategy calculates the oil quality taking into consideration various engine operating conditions including trip duration, engine speed and load. When the PCM requests an oil change, the warning lamp is activated. This warning lamp signals to the driver that an oil change must be carried out irrespective of the kilometres travelled since the last service. After the oil change, the parameters for the oil quality calculation strategy must be reset.

To reset the oil change warning lamp;

- 1. Push and hold brake pedal and simultaneously hold the accelerator pedal at full throttle.
- 2. Turn the ignition to the 'On' position
- 3. Wait minimum 10 secs.
- 4. Release both brake and accelerator pedals and turn the key to the 'Off' position.

Copyright © 2016 Ford Motor Company

Engine

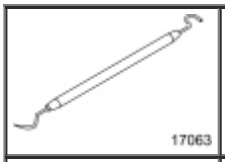
Base Part Number: 6L084

1. For basic mechanical concerns.
   REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
   For driveability concerns. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Copyright © 2016 Ford Motor Company

Camshafts

Special Tool(s) / General Equipment

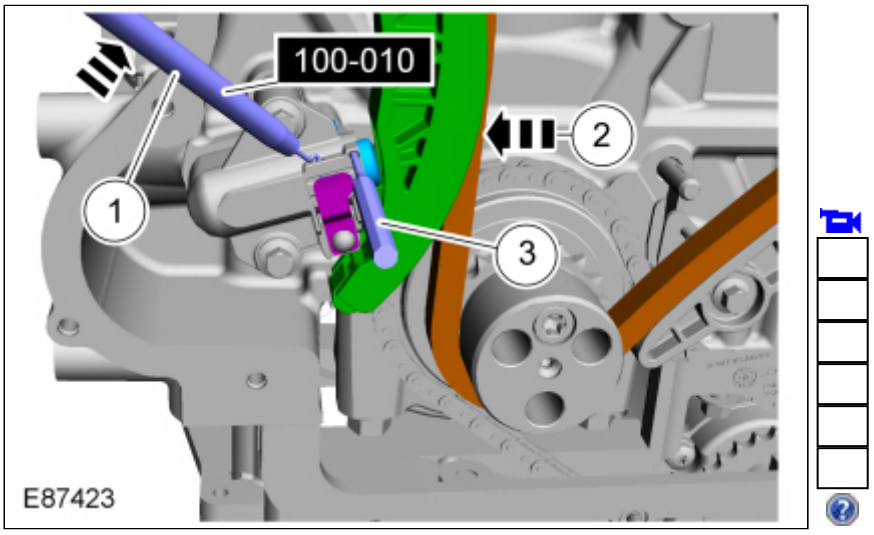
 17063	100-010 Remover, O-Ring Seal
 E139148	303-1587 Timing Tool, Crankshaft
6 mm Drill Bit	
2 mm Punch	

Removal

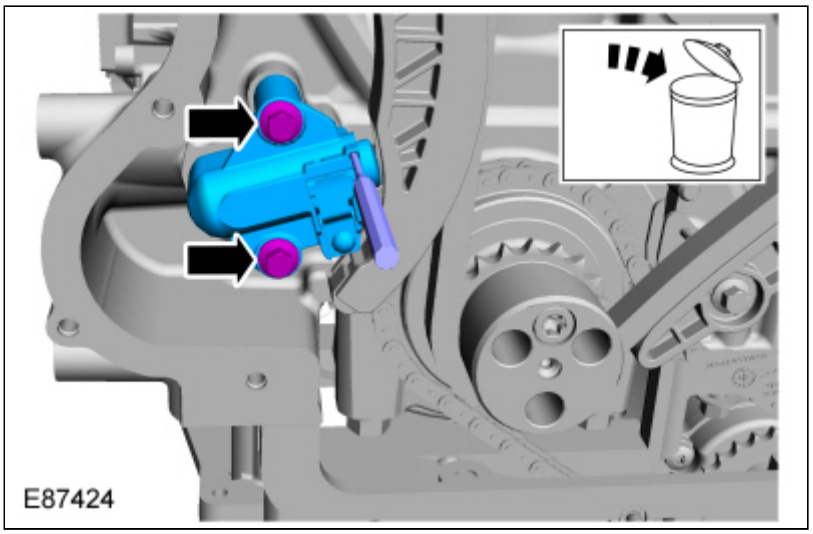
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

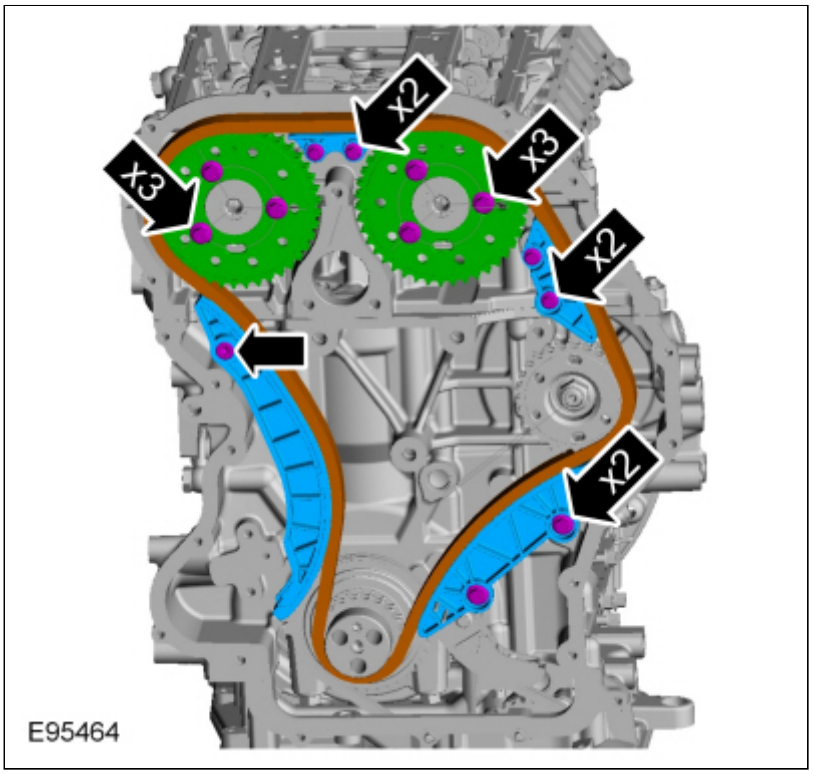
1. Refer to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
2. Refer to: Valve Cover (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
3. Refer to: Timing Cover (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
4. Refer to: Brake Vacuum Pump - RHD (206-07 Power Brake Actuation, Removal and Installation).
5. Use Special Service Tool: 100-010 Remover, O-Ring Seal.
   Use the General Equipment: 2 mm Punch



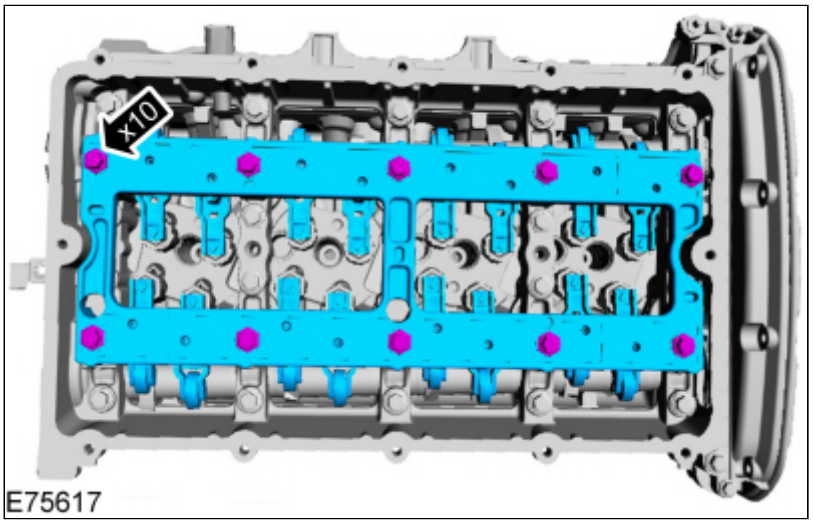
6. Use the General Equipment: 2 mm Punch



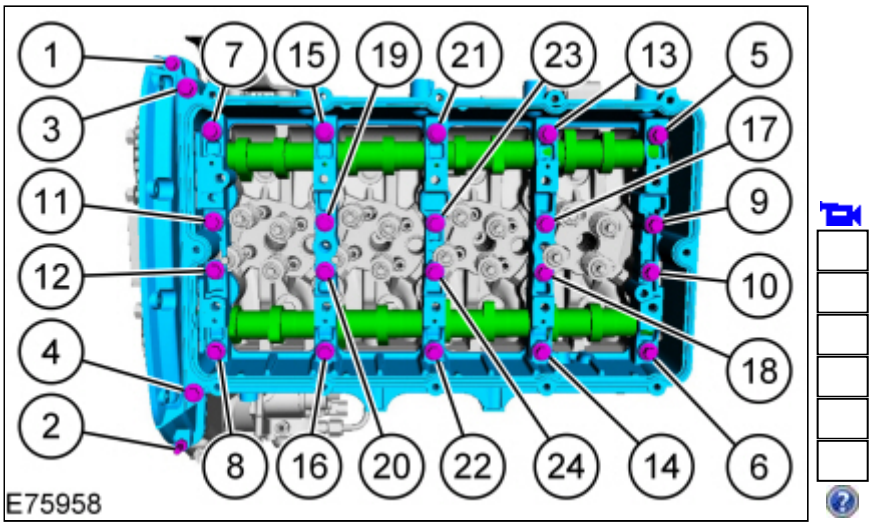
7.



8.



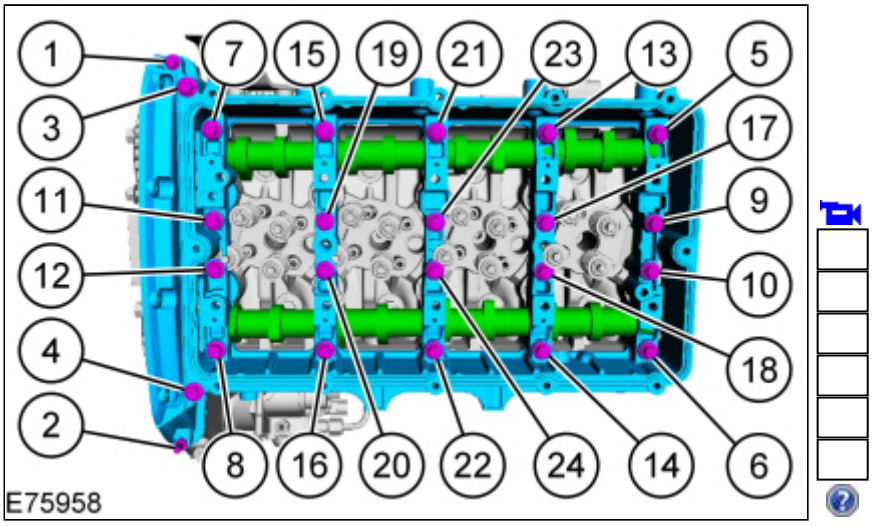
9. **NOTICE: Remove the camshaft carrier bolts in the sequence shown.**



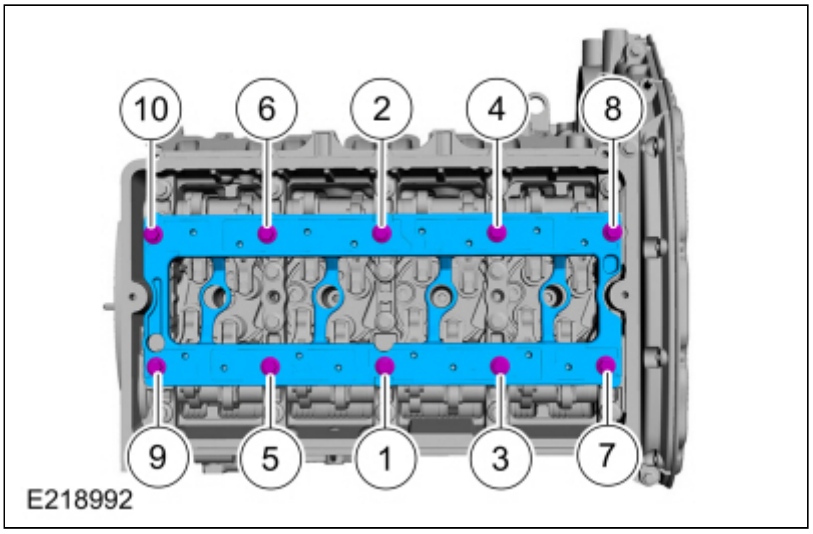
Installation

NOTE: *Clean the mating faces of the camshaft carrier and the cylinder head.*

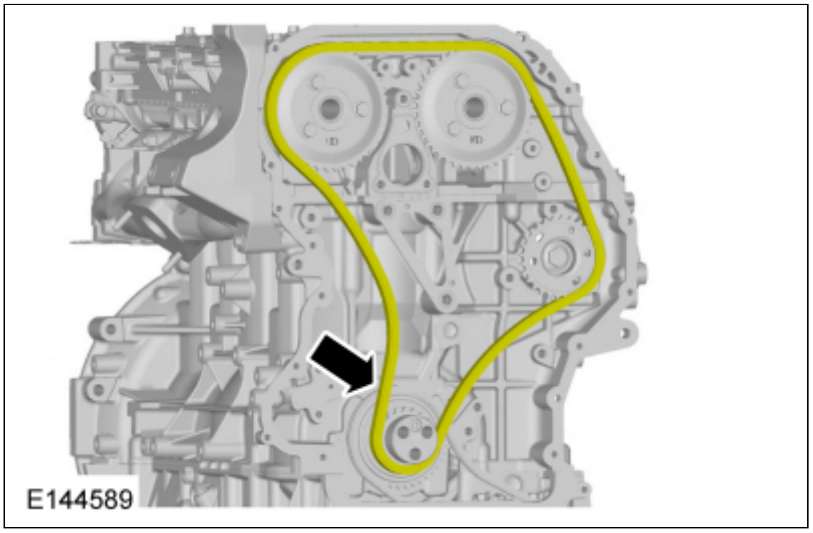
- Bolts 1 to 22
  Torque: 23 Nm
- Bolts 23 to 25
  Torque: 10 Nm



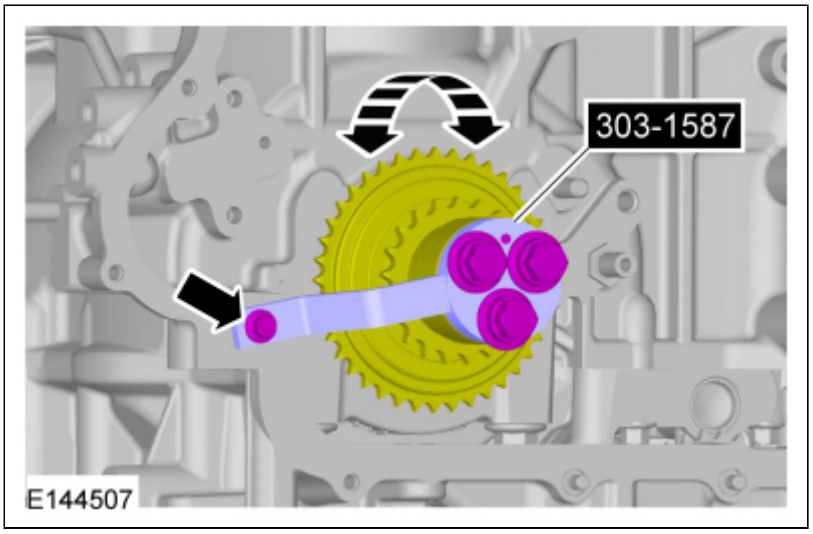
2. Ensure rockers are seating on the valve tip prior to commencing rundown.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 8 Nm
   Stage 3: 10 Nm
   Stage 4: 45°



3.

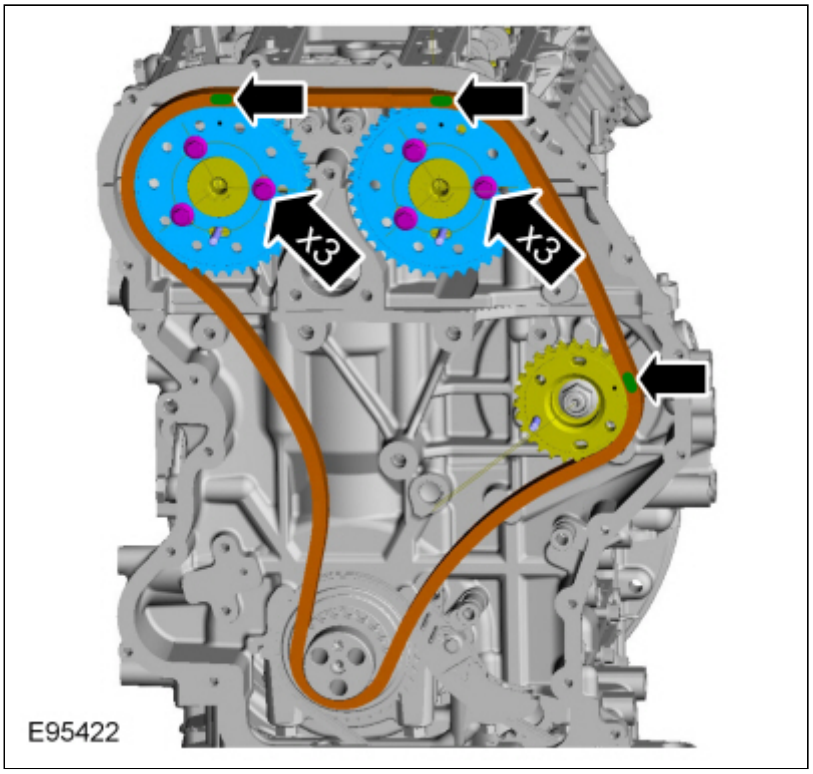


4. Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



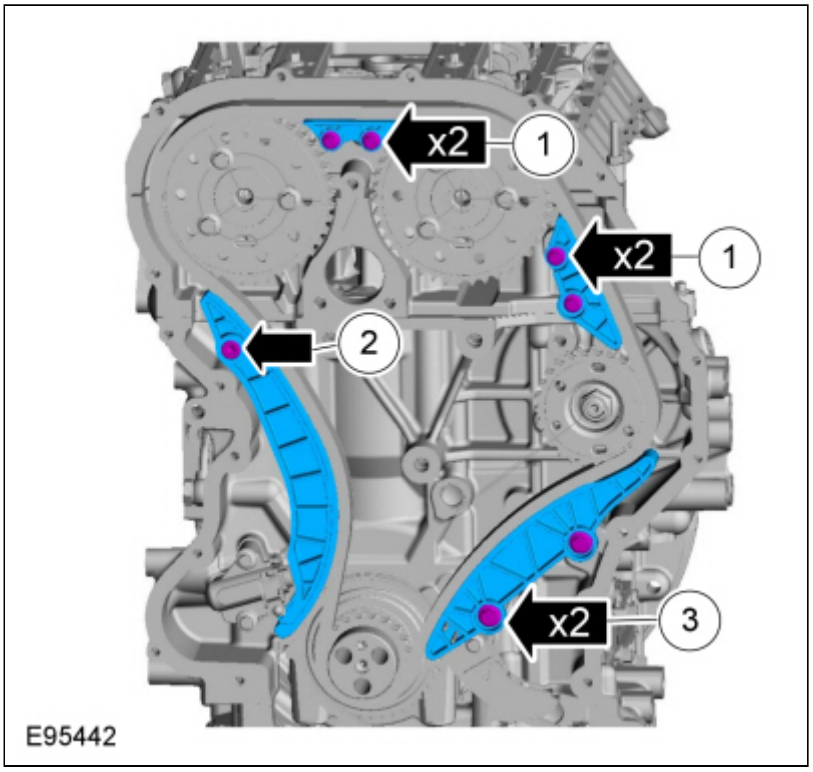
5. **NOTE:** *Make sure that the installation marks are aligned.*

Use the General Equipment: 6 mm Drill Bit
Torque: 33 Nm

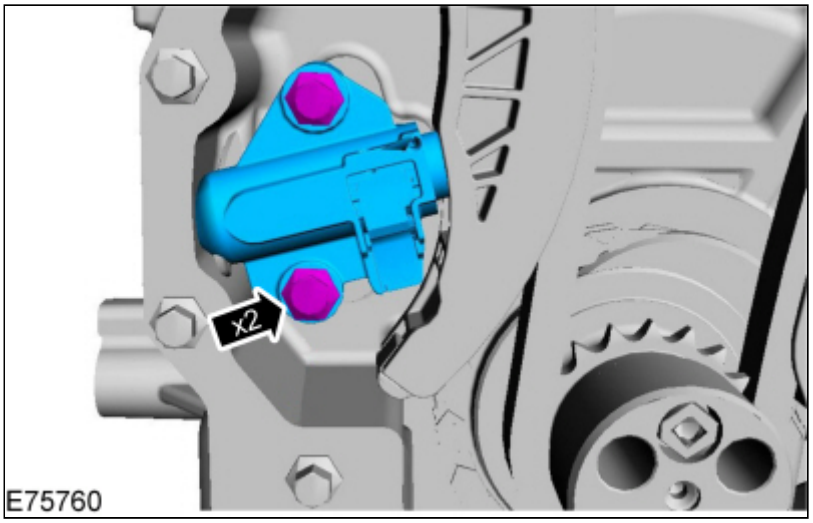


6. Remove the 6 mm drill bits.

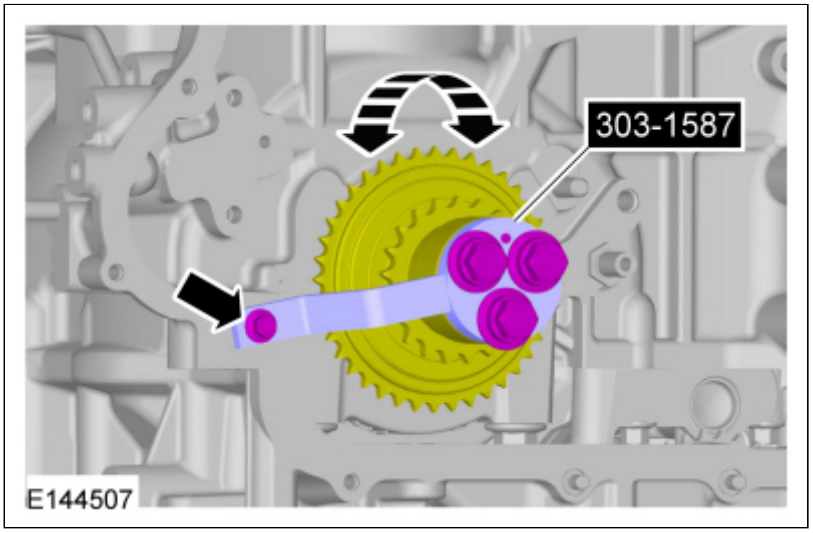
1. *Torque*: 14 Nm
2. *Torque*: 31 Nm
3. *Torque*: 15 Nm



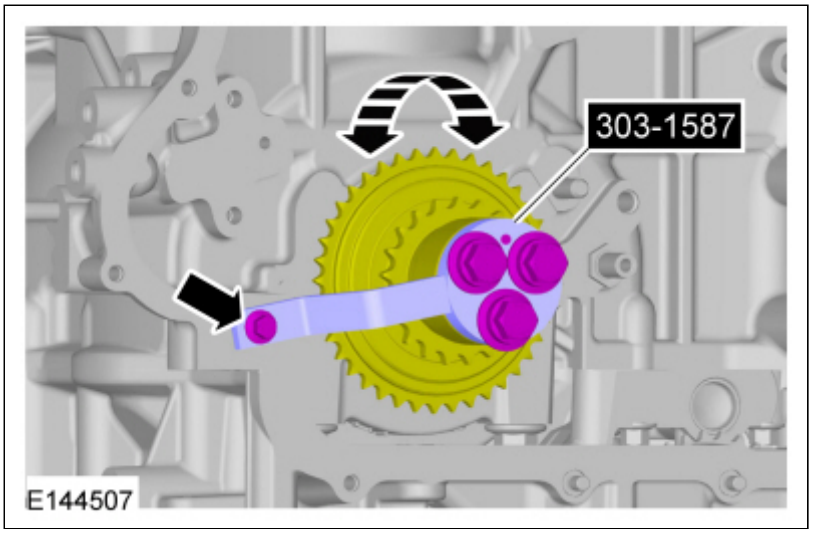
8. **NOTE:** *Make sure that a new component is installed.*



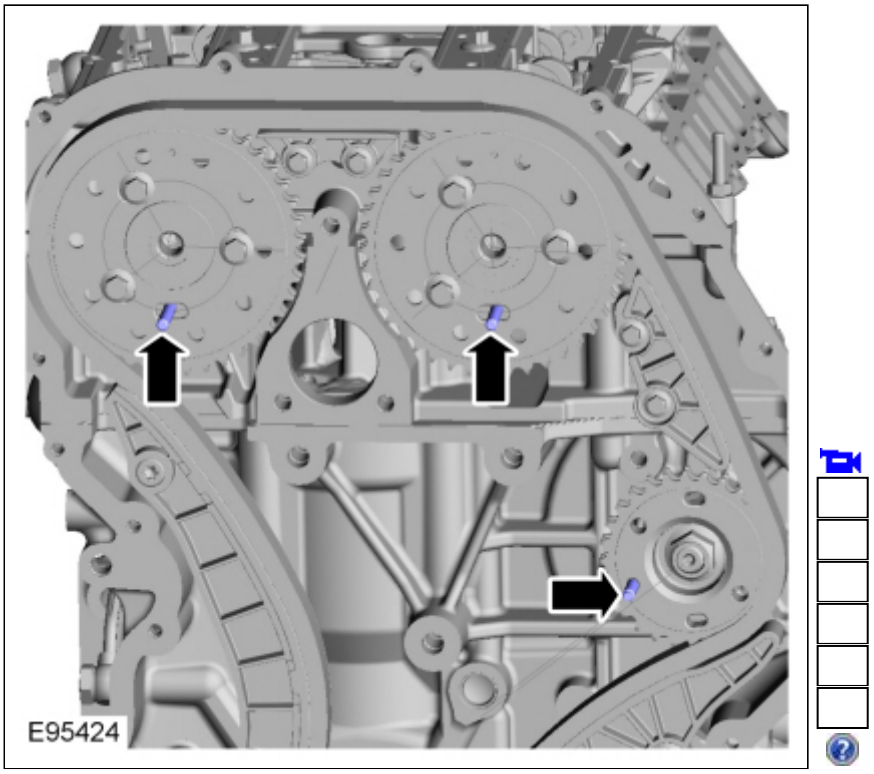
9. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



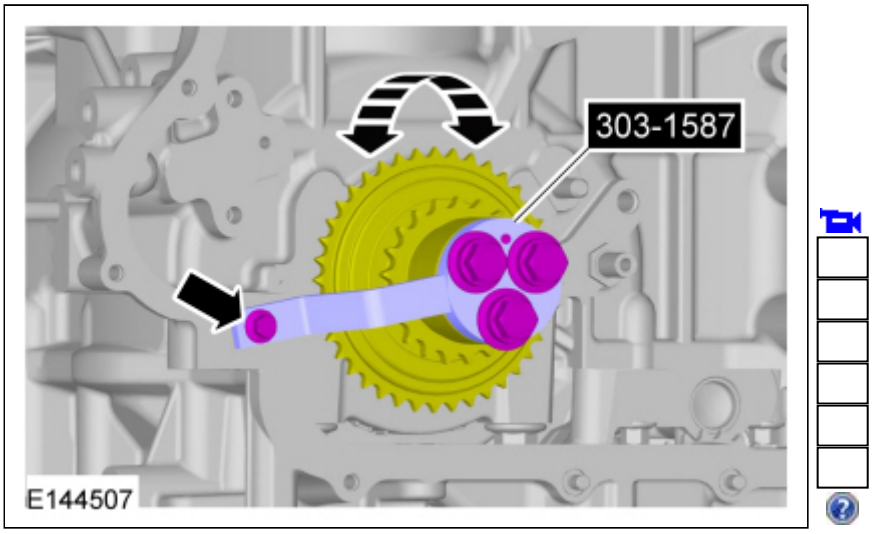
10. Rotate the engine two revolutions.
11. Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



12. Check the valve timing by inserting the drill bits. If the drill bits cannot be inserted repeat the timing steps. Use the General Equipment: 6 mm Drill Bit



13. Remove the 6 mm drill bits.
14. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



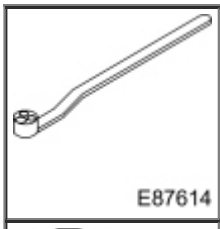
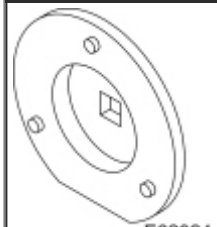
15. Refer to: Brake Vacuum Pump - RHD (206-07 Power Brake Actuation, Removal and Installation).
16. Refer to: Timing Cover (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
17. Refer to: Valve Cover (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
18. Refer to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Crankshaft Front Seal

Base Part Number: 6700

Special Tool(s) / General Equipment

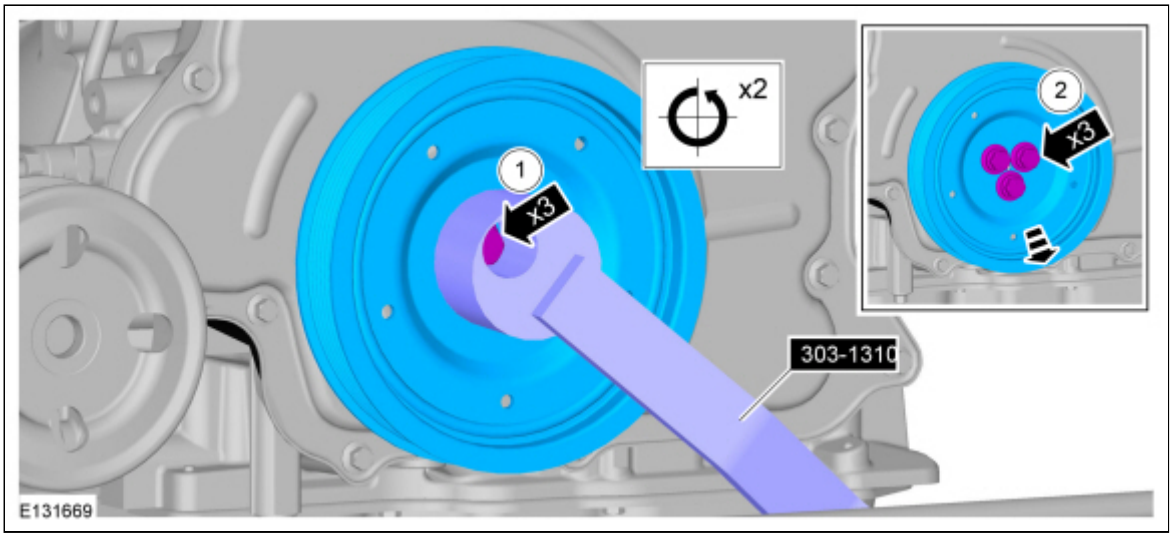
 E87614	303-1310 Holding Wrench, Crankshaft
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate

Removal

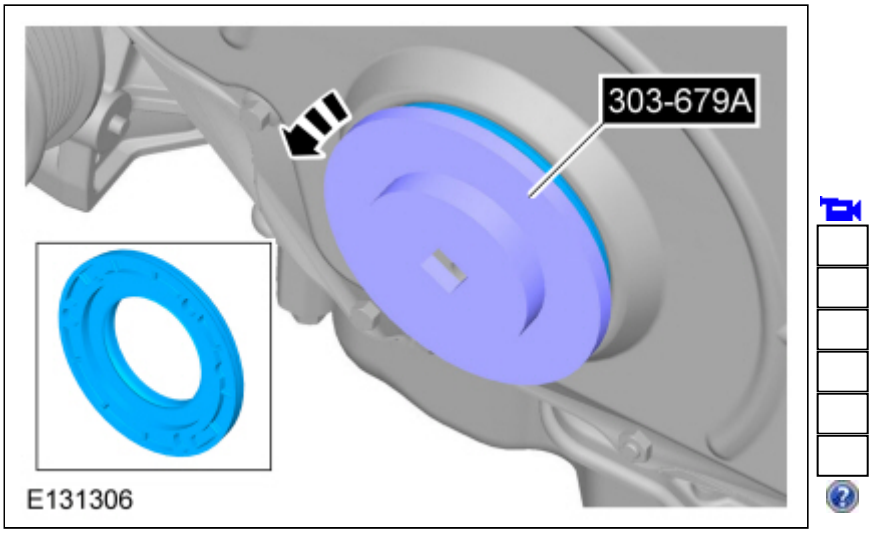
NOTE: *Removal steps in this procedure may contain installation details.*

1.

1. Do not completely loosen the crankshaft pulley bolts.
   Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.

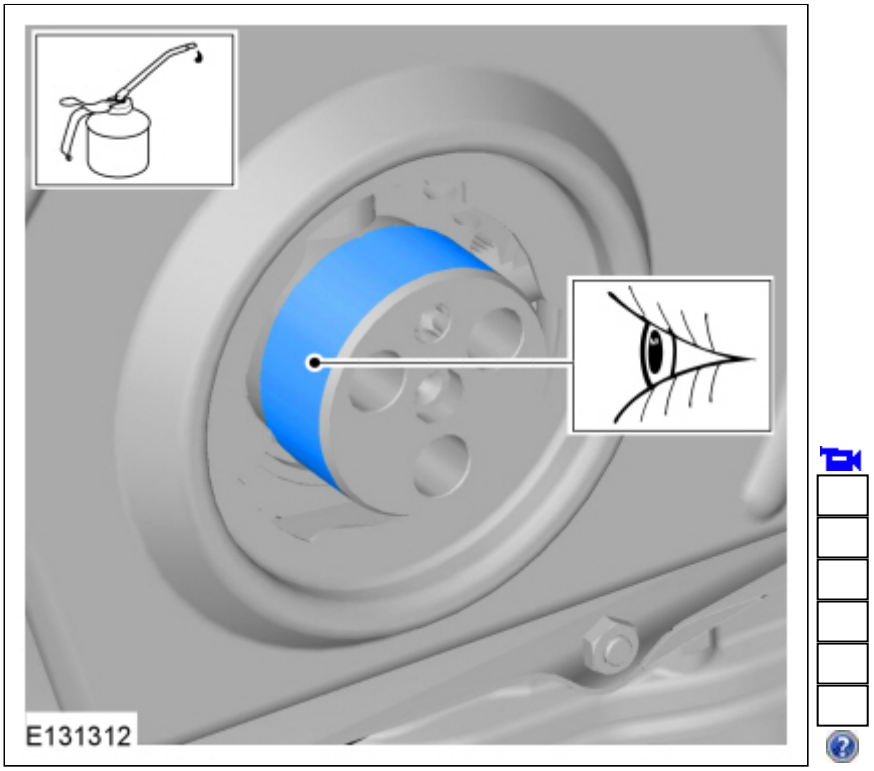


3. Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.

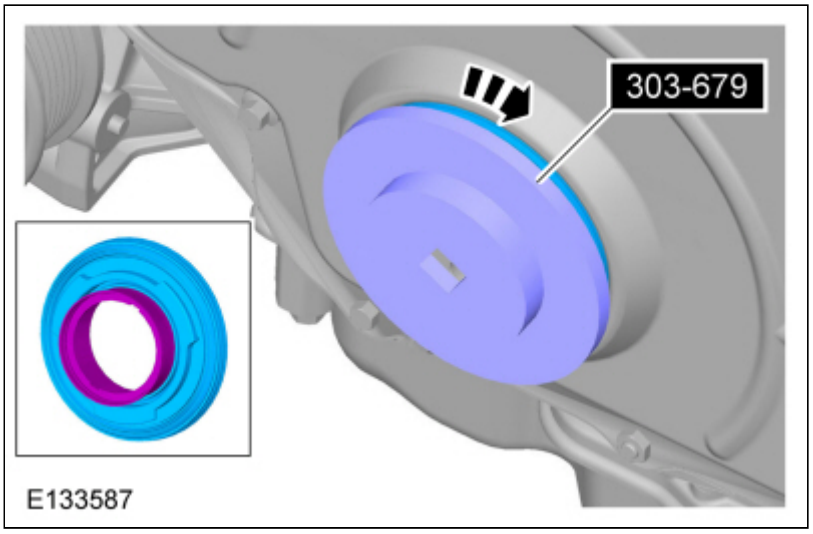


Installation

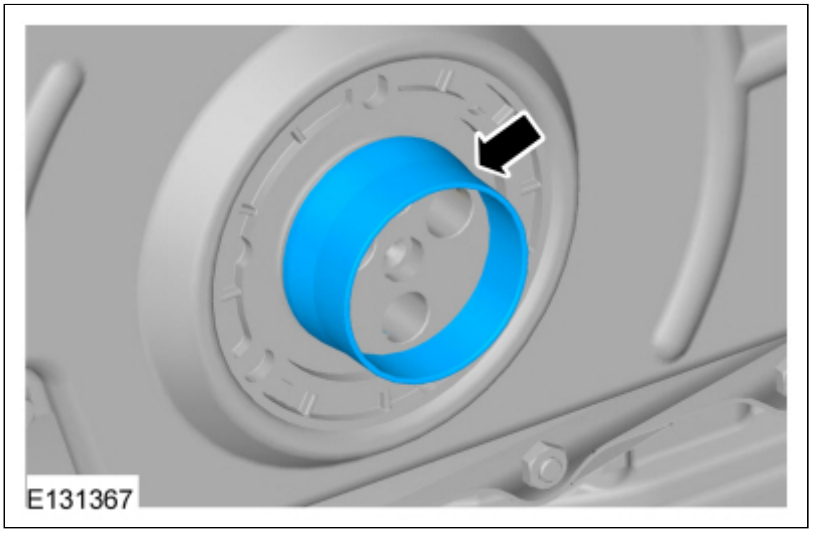
1. **NOTE:** *Make sure that mounting face is clean and lubricated.*



2. **NOTICE: A new crankshaft seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft seal if fully installed. Failure to follow this instruction may result in damage to the crankshaft.**

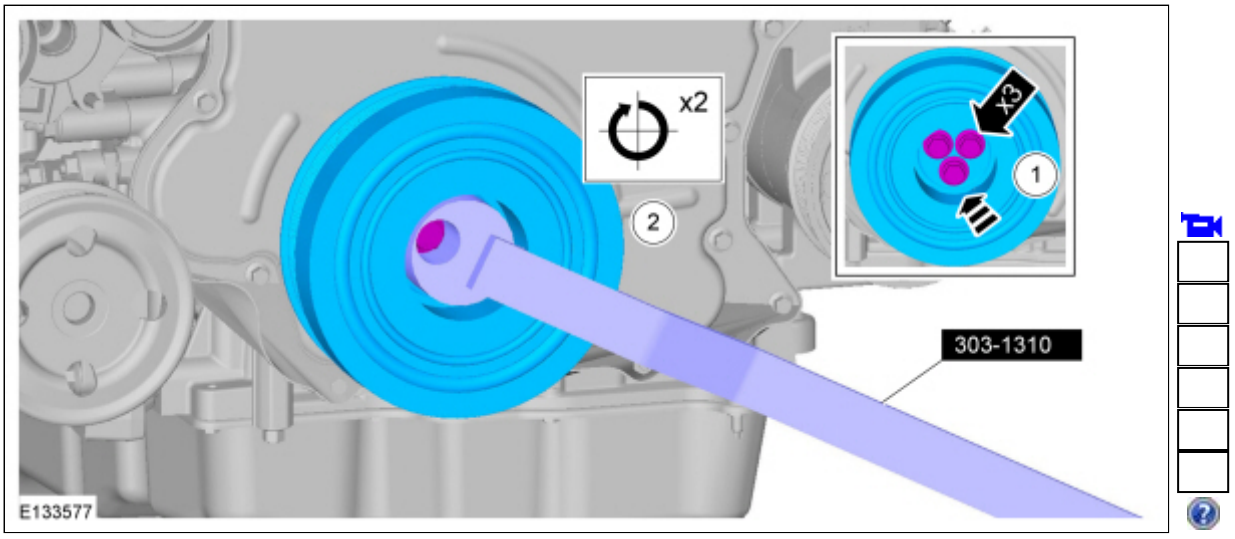


3.



4. **NOTE:** *Initially hand tighten the fastners.*

Torque:
Stage 1: 45 Nm
Stage 2: 120°



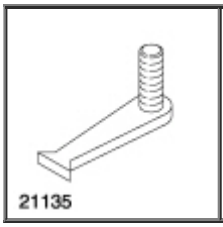
5.

Copyright © 2016 Ford Motor Company

Crankshaft Rear Seal

Base Part Number: 6701

Special Tool(s) / General Equipment

 21135	303-254 Locking Tool, Flywheel

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

Vehicles with automatic transmission

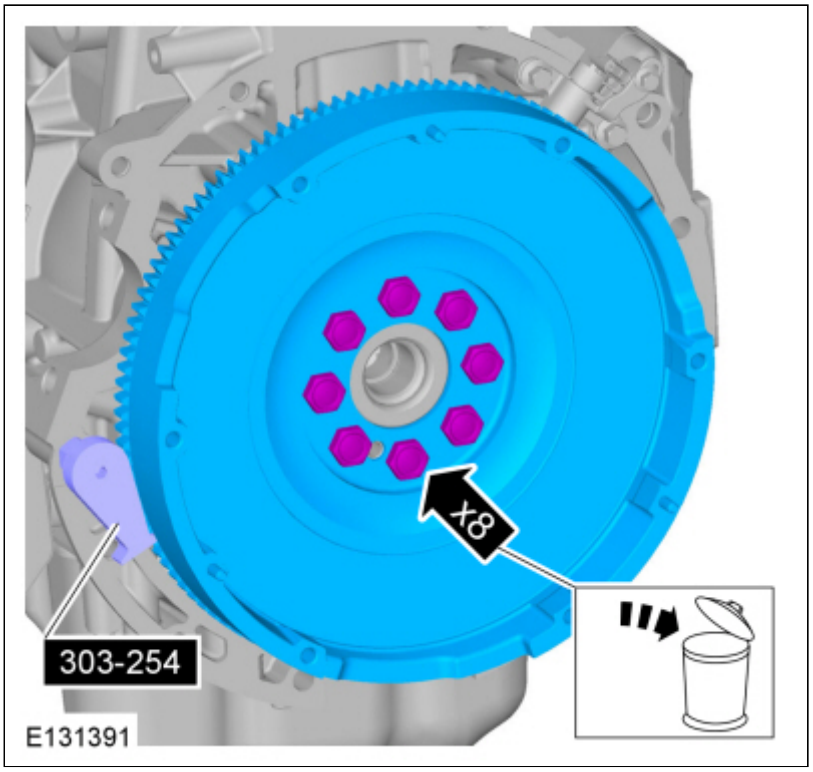
1. Refer to: Transmission - 4x2 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal).
   Refer to: Transmission - 4x4 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal).

Vehicles with manual transmission

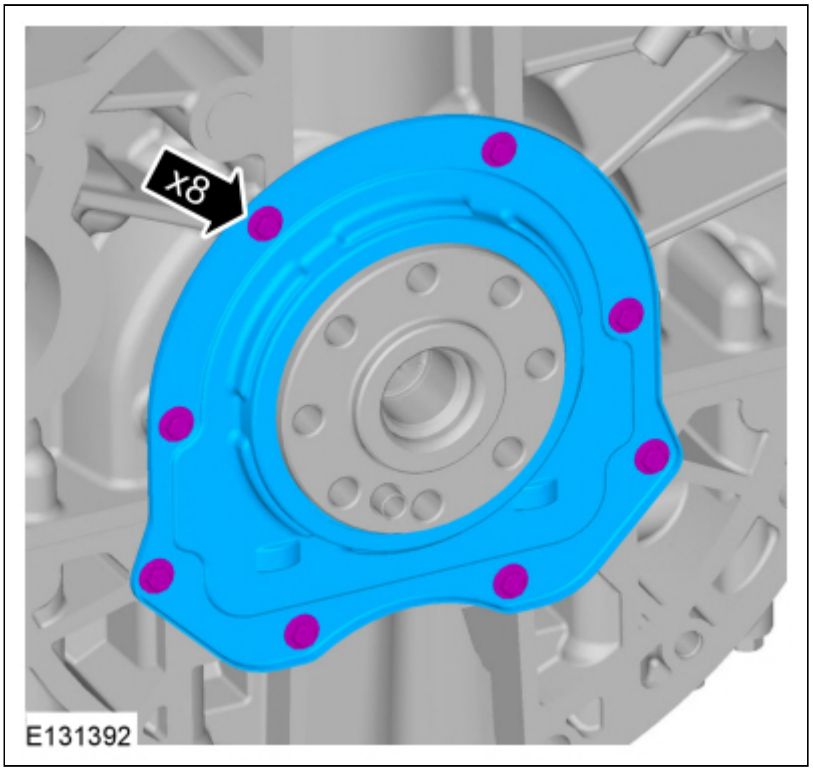
2. Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
   Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

All vehicles

3. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



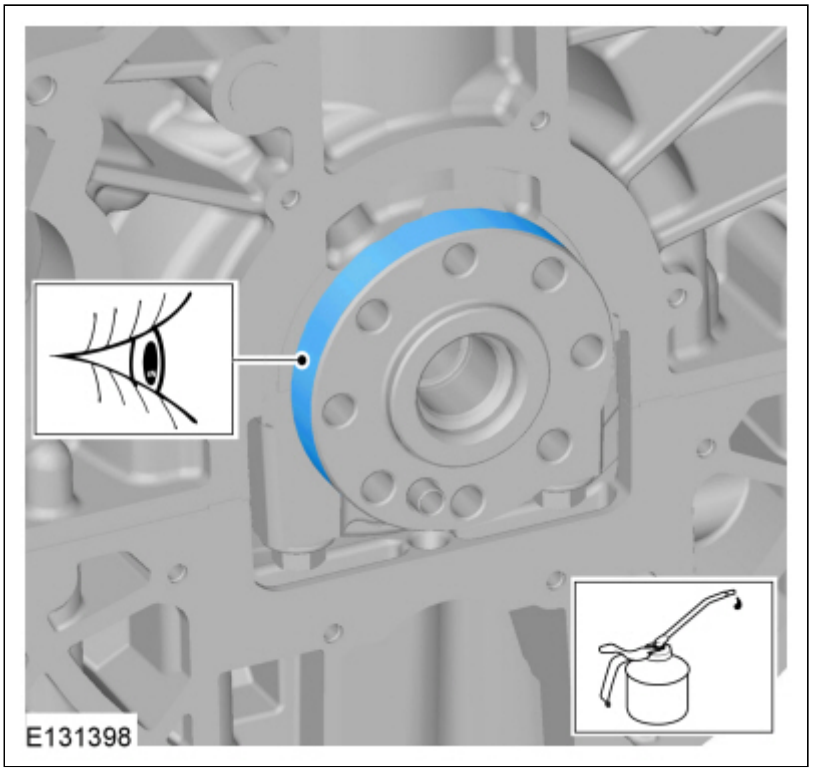
4.



Installation

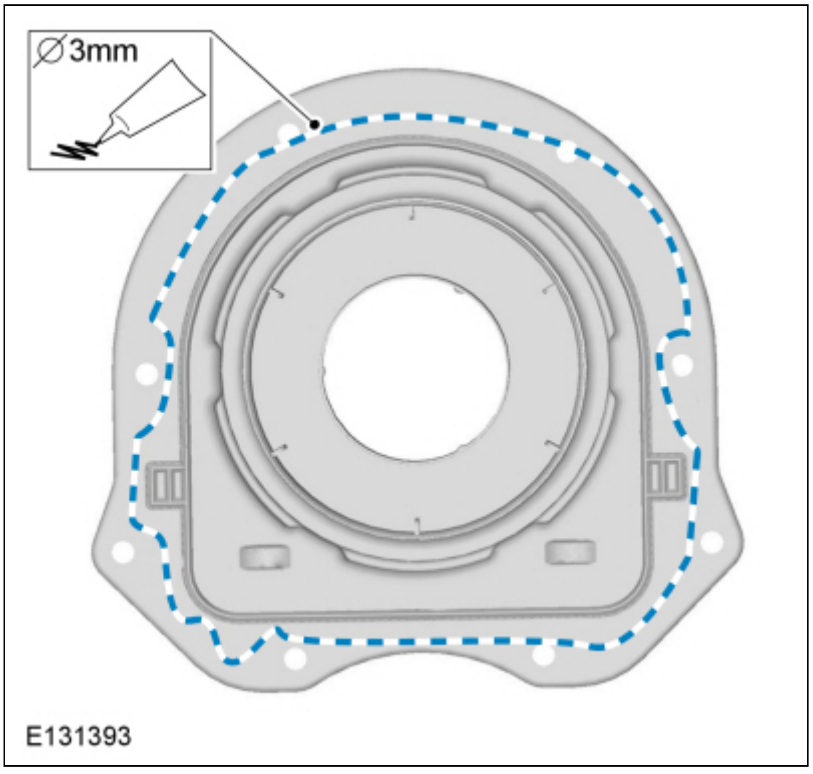
All vehicles

1.



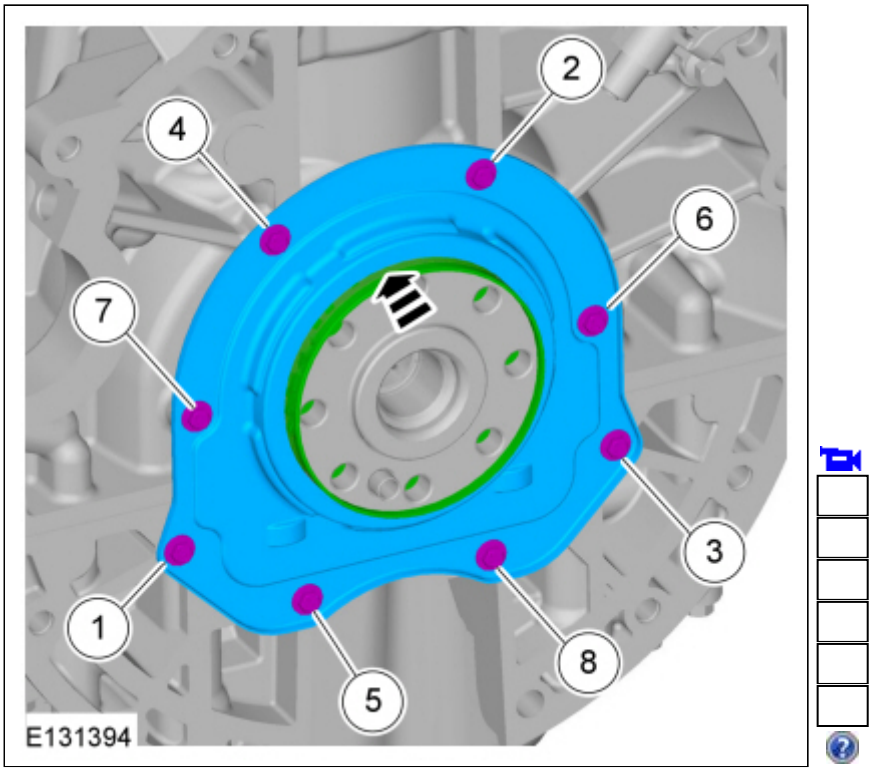
2. **NOTE:** *Install new crankshaft rear seal carrier with in five minutes after applying the recomended sealent.*

   Material: Silicone Sealant (WSE-M4G323-A4)



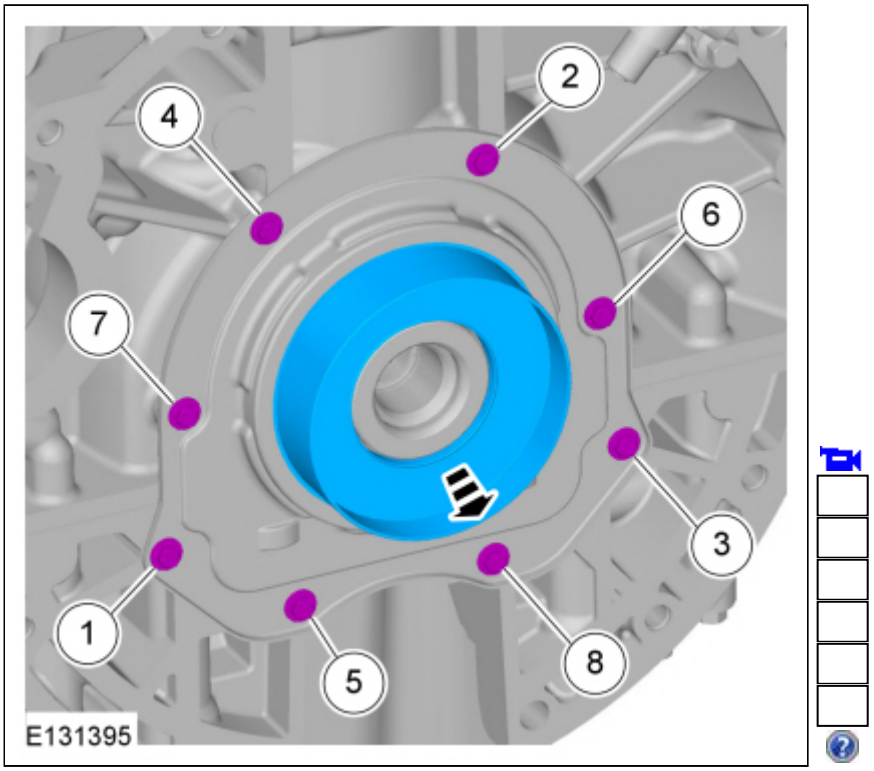
3. **NOTICE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.**

   Hand tighten the bolts at this stage.



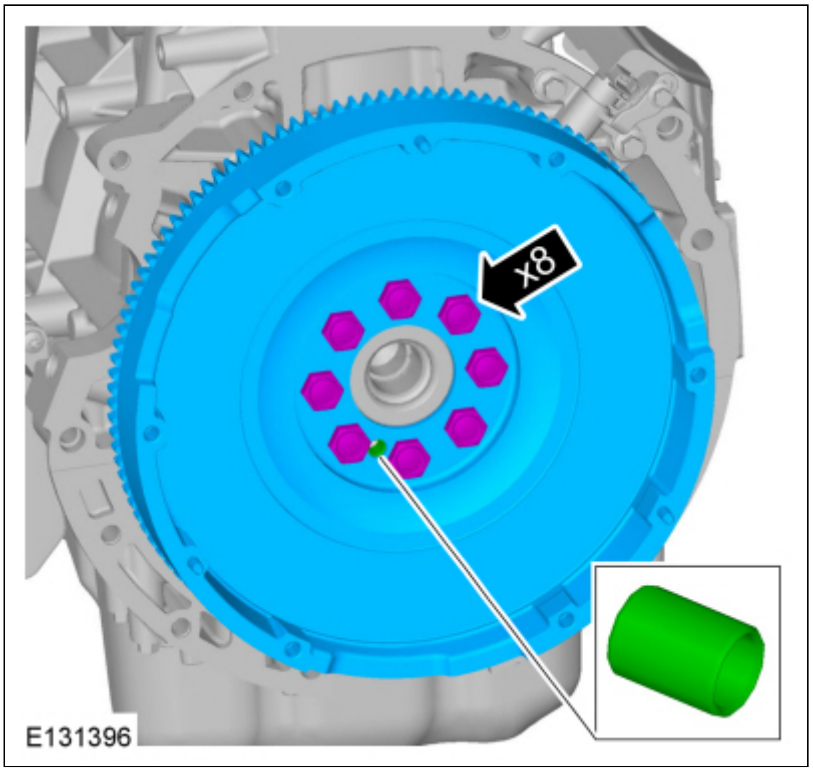
4. **NOTE:** *New crankshaft seal carriers are supplied with an alignment sleeve which must be removed after installation.*

   Torque: 10 Nm

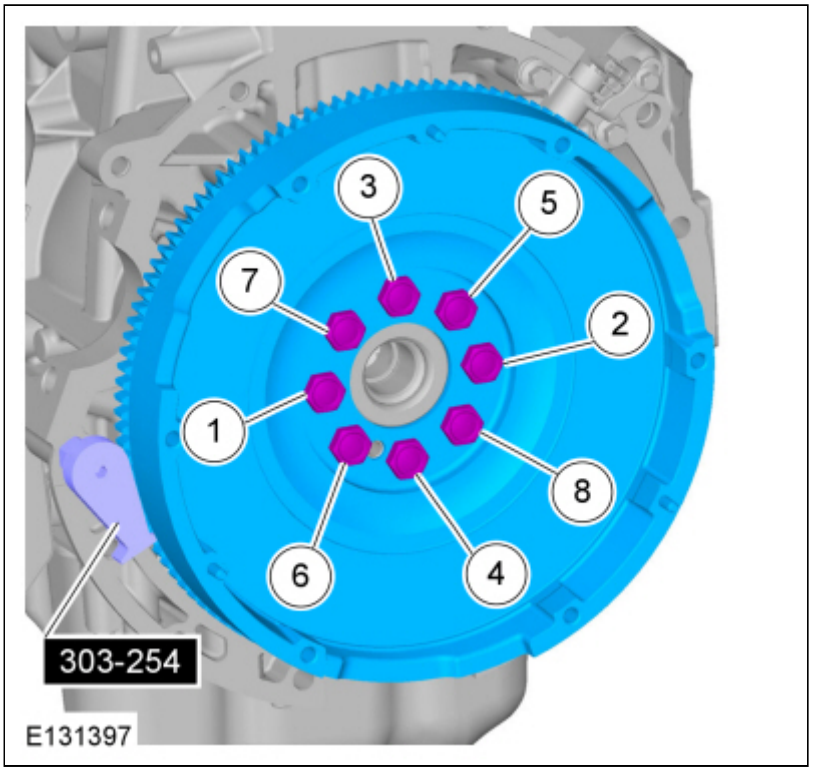


5. **NOTE:** *Make sure that flywheel is in full contact with flywheel flange before installing the flywheel bolts.*

   Hand tighten the bolts at this stage.



6. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 30 Nm
   Stage 3: 75 Nm
   Stage 4: 45°



Vehicles with manual transmission

7. Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
   Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

Vehicles with automatic transmission

8. Refer to: Transmission - 4x2 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80,

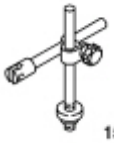
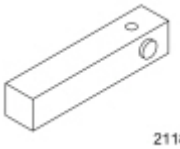
Installation).
Refer to: Transmission - 4x4 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Installation).

Copyright © 2016 Ford Motor Company

Cylinder Head

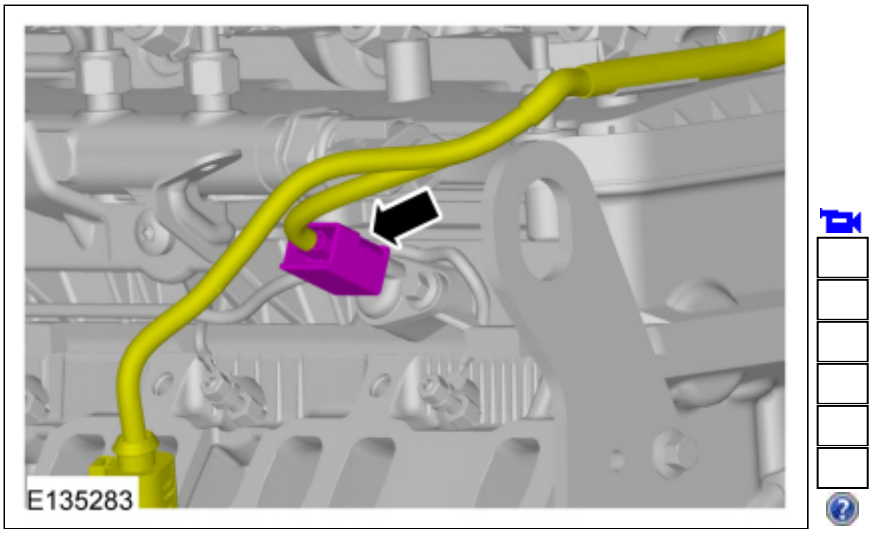
Base Part Number: 6051

Special Tool(s) / General Equipment

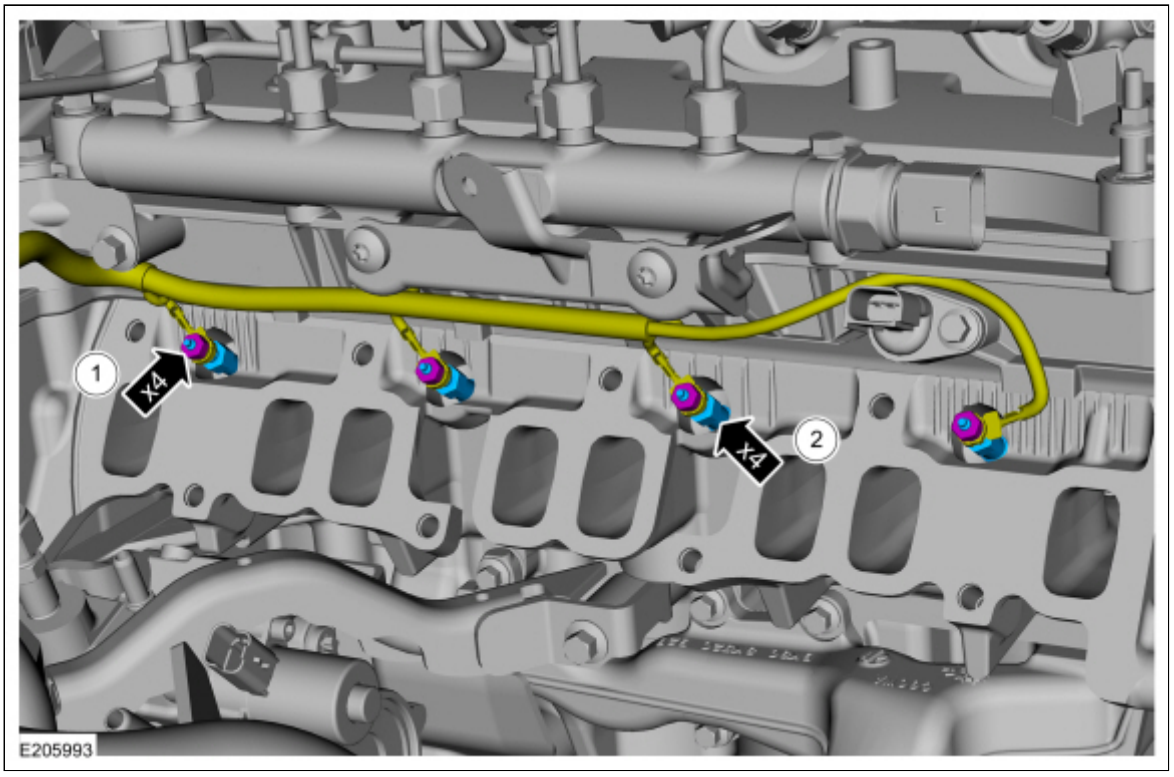
 15046	205-069 Dial Indicator Gauge (Metric)
 15022a	205-070 Holding Fixture, Dial Indicator Gauge
 21183	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion)

Removal

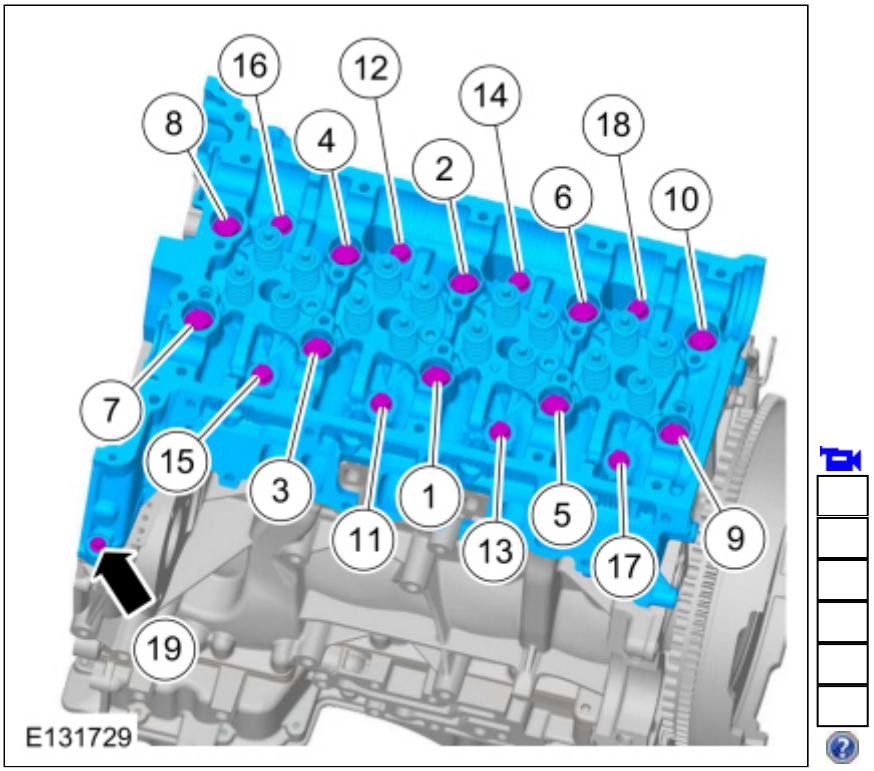
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
2. 

3. *Torque*:
   1: 8 Nm
   2: 13 Nm

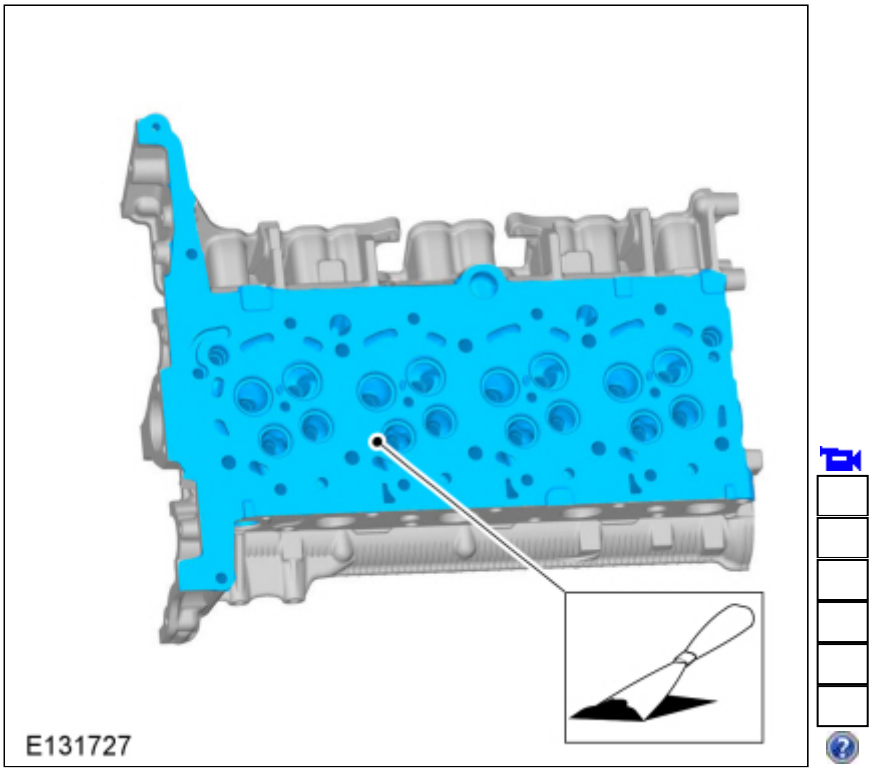


4. Refer to: Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
5. Refer to: Exhaust Manifold (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
6. Refer to: Camshafts (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
7.



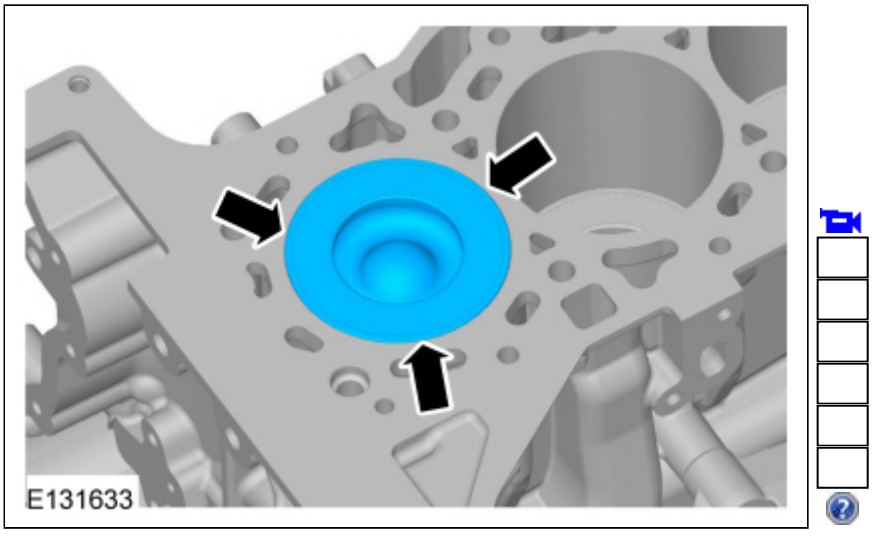
Installation

1. **WARNING: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**



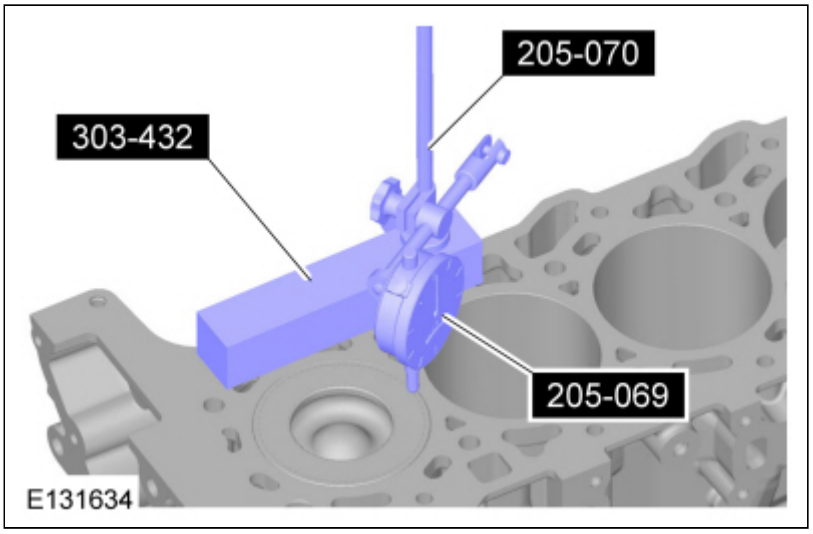
2. **NOTE:** *Measure the piston protrusion of each cylinder at top dead center (TDC)*

   Measure the distance between the piston crown and the cylinder block at the points indicated.

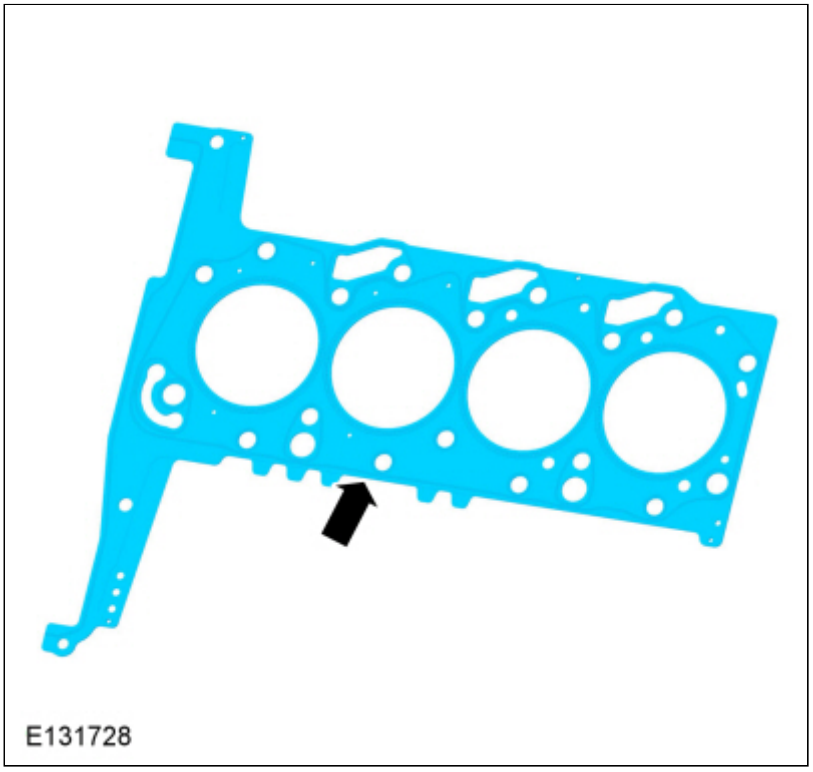


3. **NOTE:** *The largest measurement determines the choice of the cylinder head gasket.*

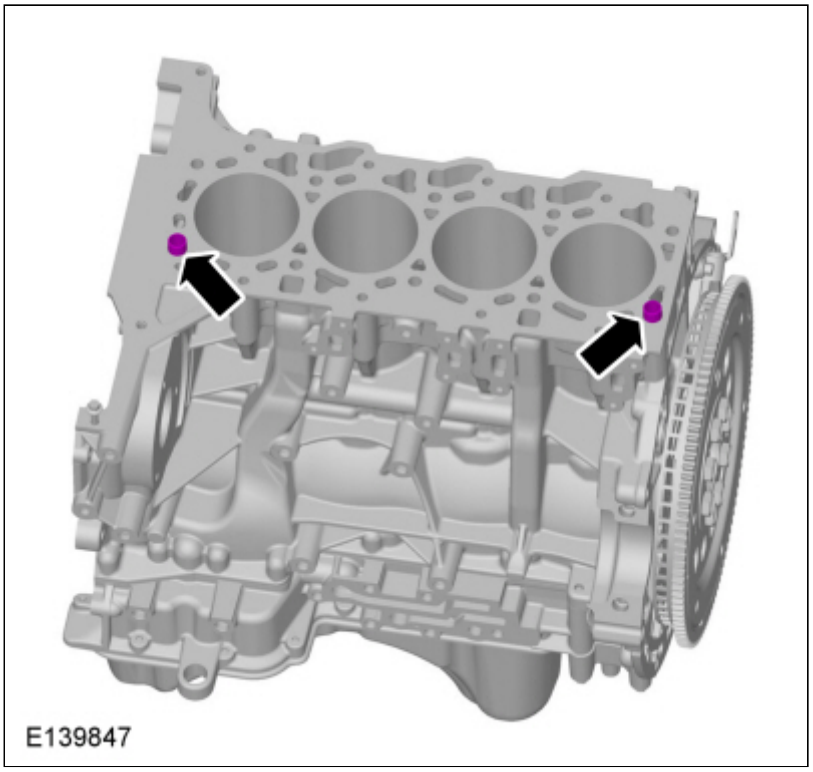
   Use Special Service Tool: 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion). , 205-070 Holding Fixture, Dial Indicator Gauge. , 205-069 Dial Indicator Gauge (Metric).



4. **NOTE:** *Make sure that new component is installed.*



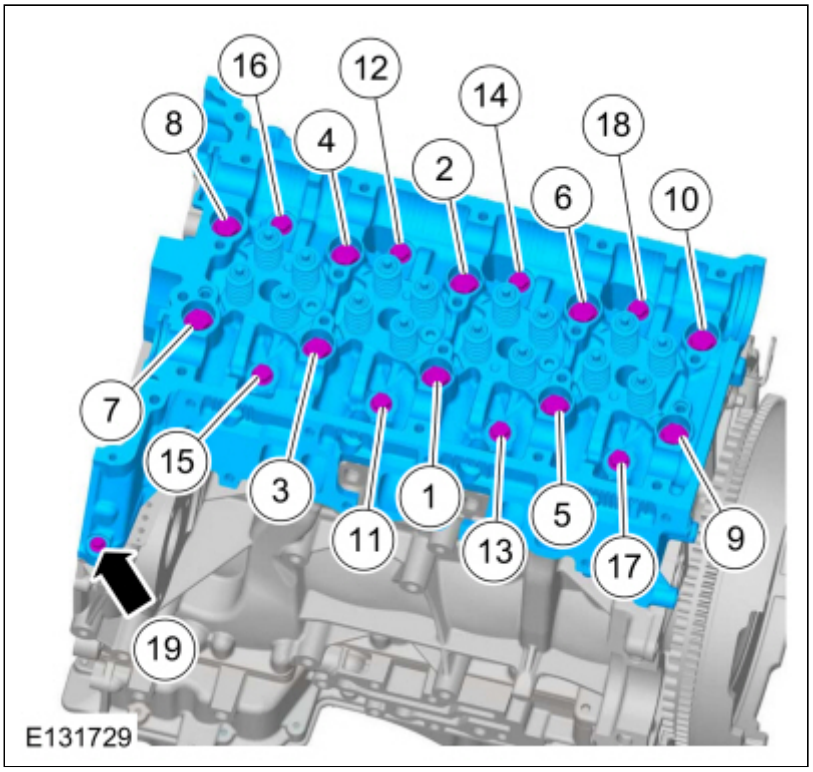
5.



6. **NOTICE: Make sure that new cylinder head bolts are installed.**

   NOTE: *Install all the bolts finger tight before final tightening.*

   Torque:
   Stage 1: 1 -10: 10 Nm
   Stage 2: 11-18: 5 Nm
   Stage 3: 1-10: 20 Nm
   Stage 4: 11-18: 10 Nm
   Stage 5: 1-10: 35 Nm
   Stage 6: 11-18: 20 Nm
   Stage 7: 1-10: 45 Nm
   Stage 8: 11-18: 26 Nm
   Stage 9: 1-10: 90°
   Stage 10: 11-18: 90°
   Stage 11: 1-10: 90°
   Stage 12: 11-18: 90°
   Stage 13: 19: 4 Nm
   Stage 14: 19: 6 Nm
   Stage 15: 19: 10 Nm



7. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

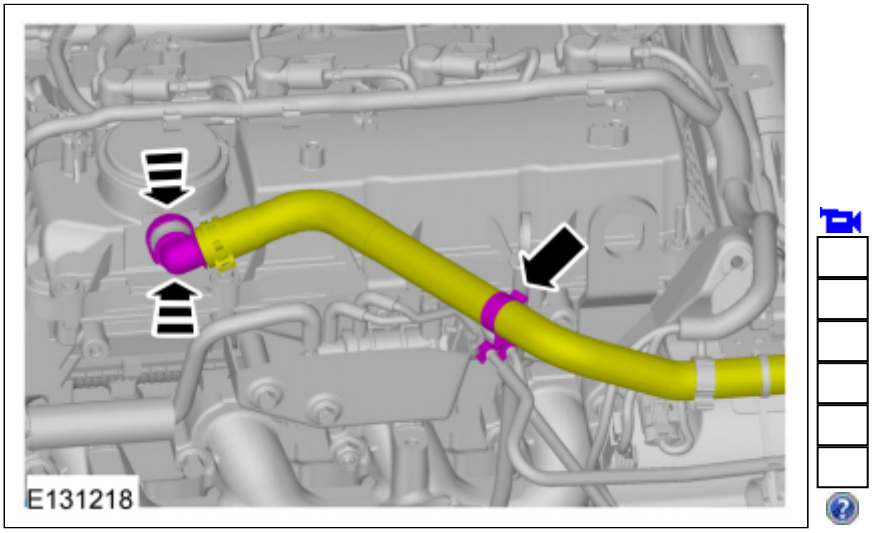
Exhaust Manifold

Base Part Number: 9431

Removal

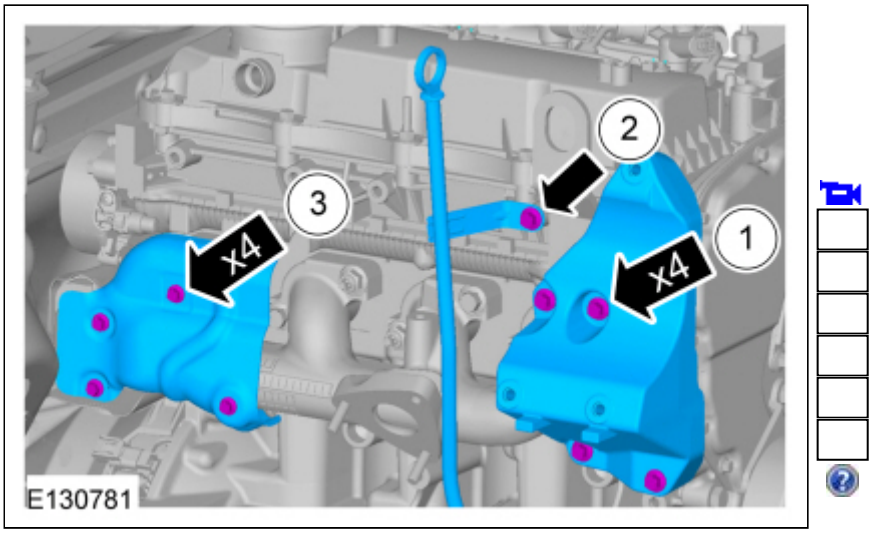
NOTE: *Removal steps in this procedure may contain installation details.*

1.

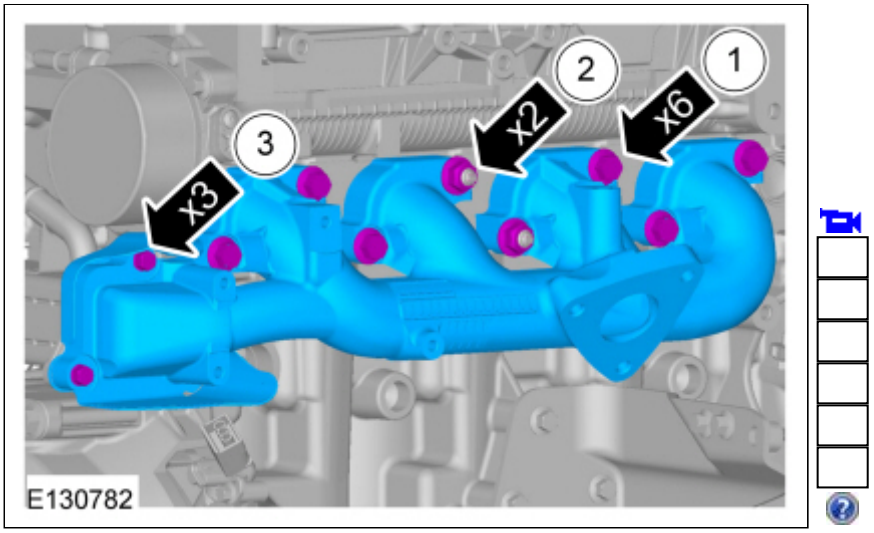


2. Refer to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
   Refer to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

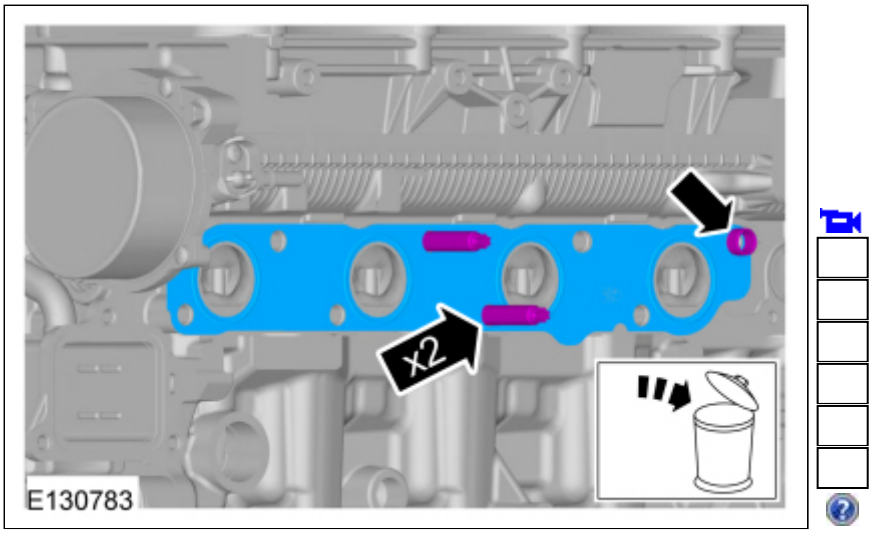
    1. *Torque*: 25 Nm
    2. *Torque*: 23 Nm
    3. *Torque*: 9 Nm



1. *Torque*: 55 Nm
2. *Torque*: 40 Nm
3. *Torque*: 15 Nm



5.



Installation

NOTE: *Install new exhaust manifold studs, bolts, nuts, gaskets and O-ring seals.*

1. To install , reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Intake Manifold - Emission Requirements: EURO Stage V LDT

Base Part Number: 9424

Removal

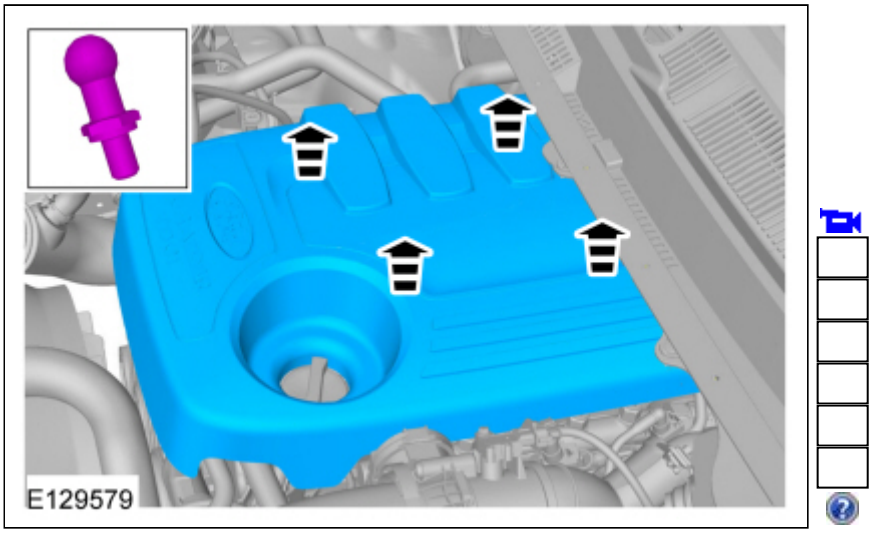
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry out any repairs to the fuel injection system with the engine running. The fuel pressure within the system is approximately 1600 bars. Failure to follow this instruction may result in personal injury.

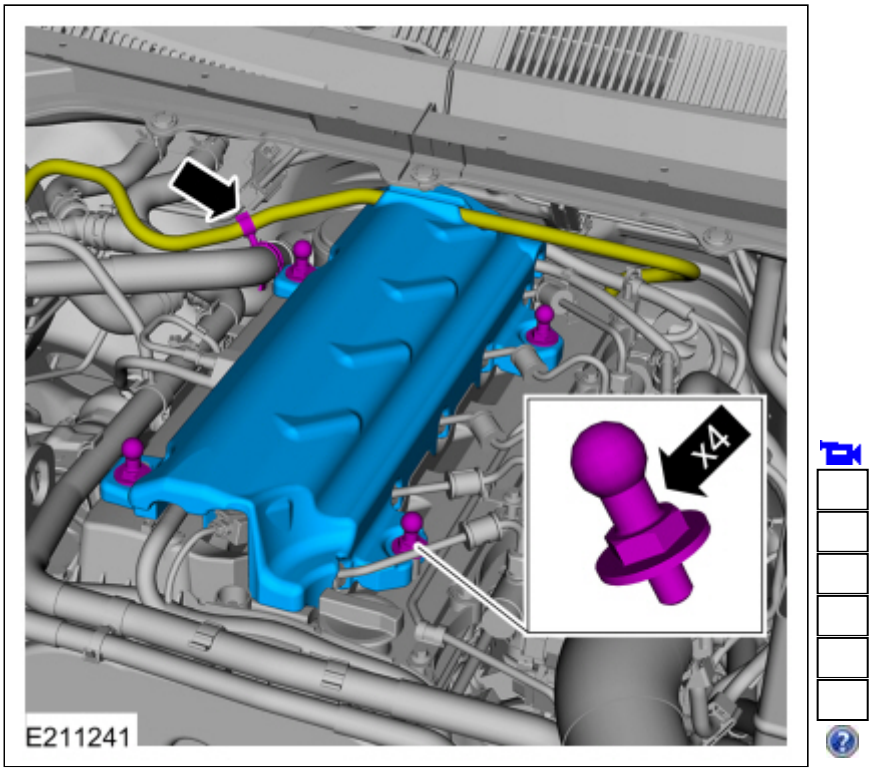
WARNING: Wait at least one minute after the engine stops before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

1.

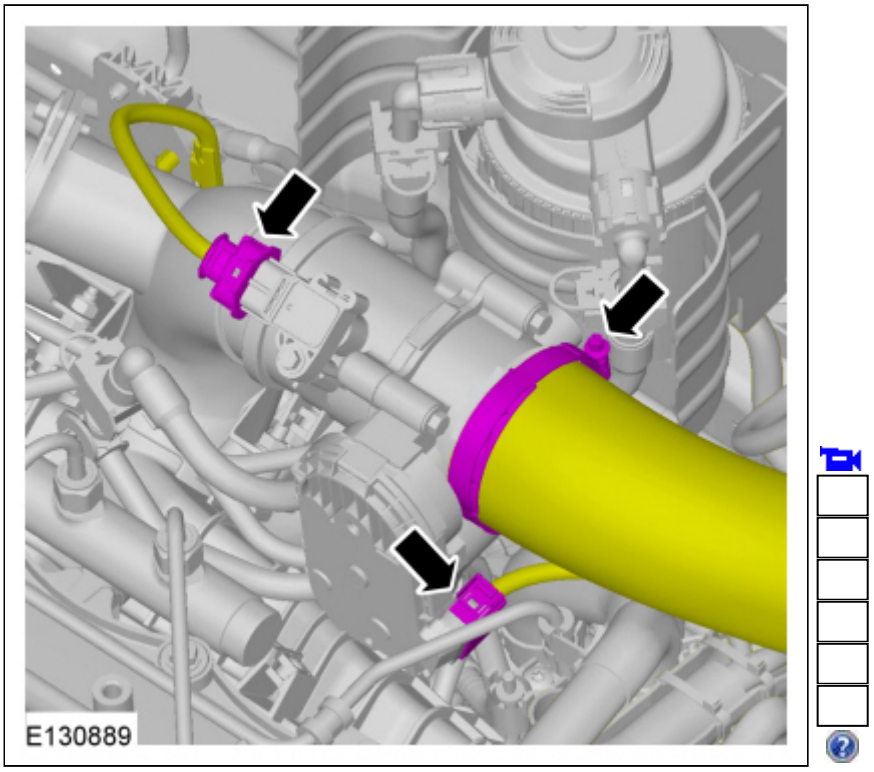


2. *Torque*: 3 Nm

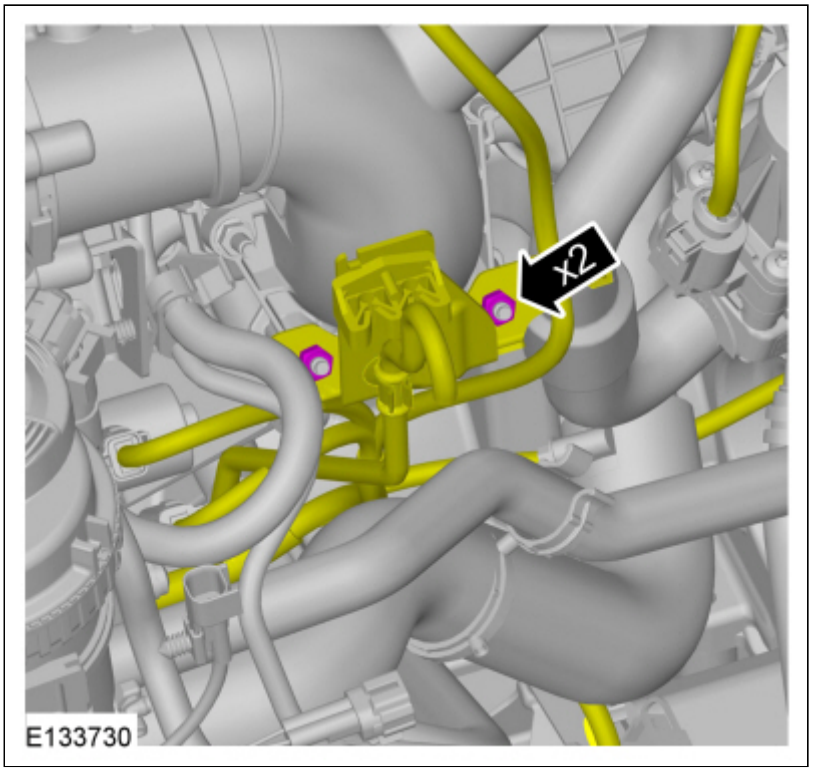


3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

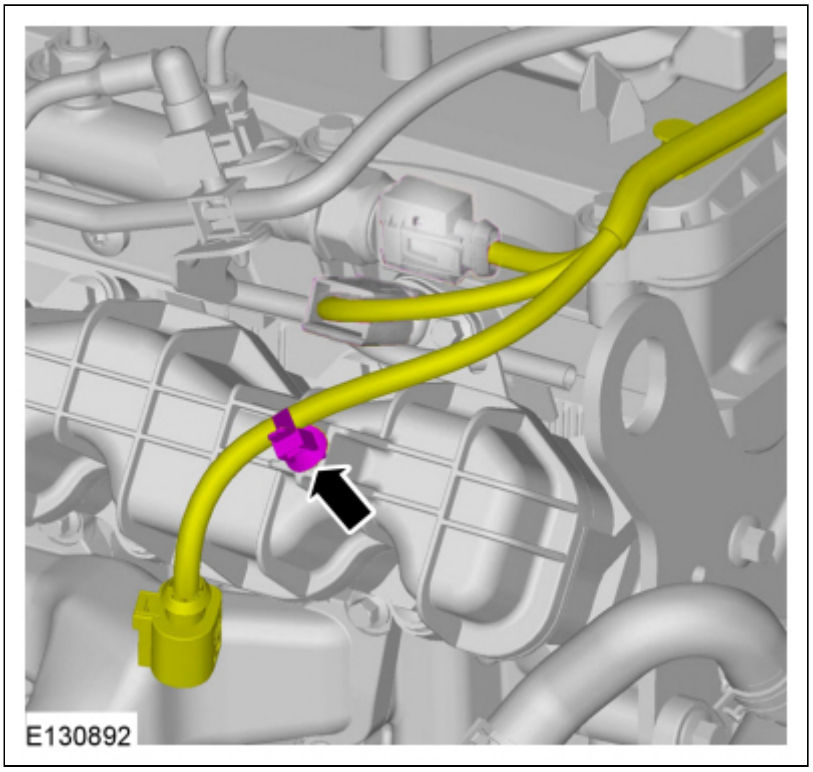
4.



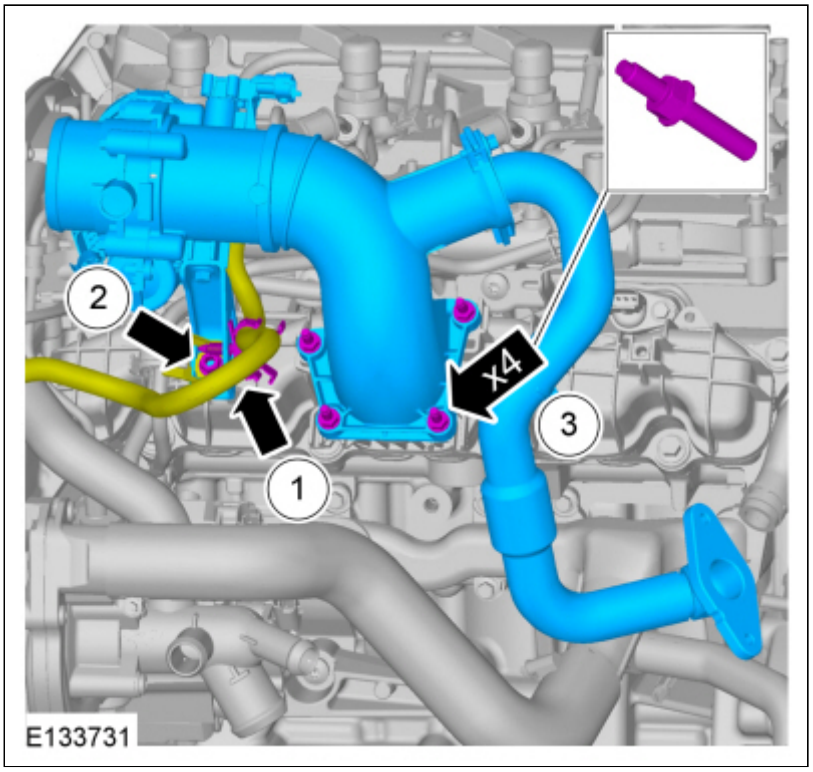
5. *Torque*: 11 Nm



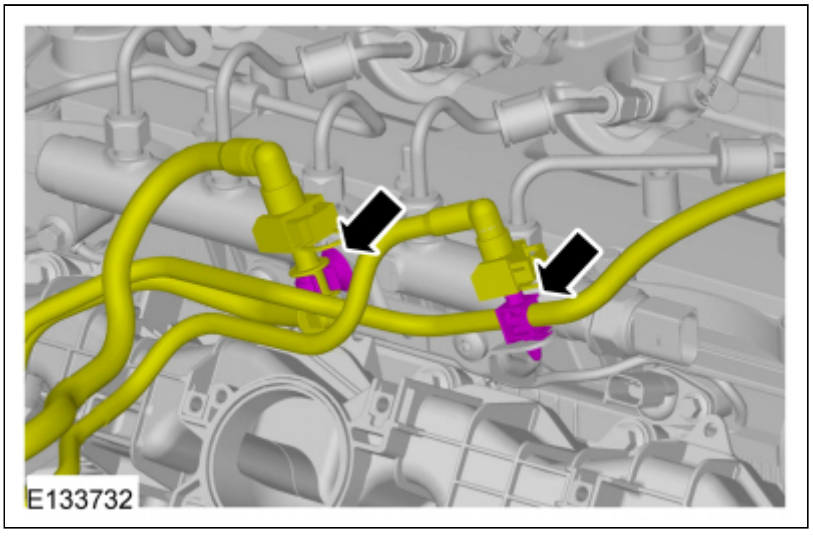
6. Refer to: Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
7.



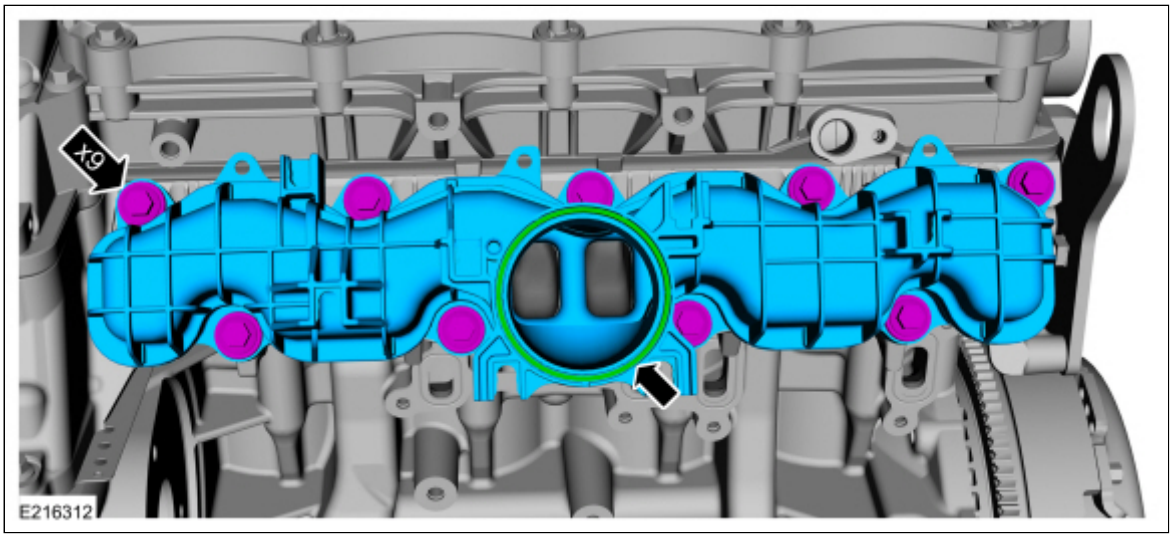
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



9.

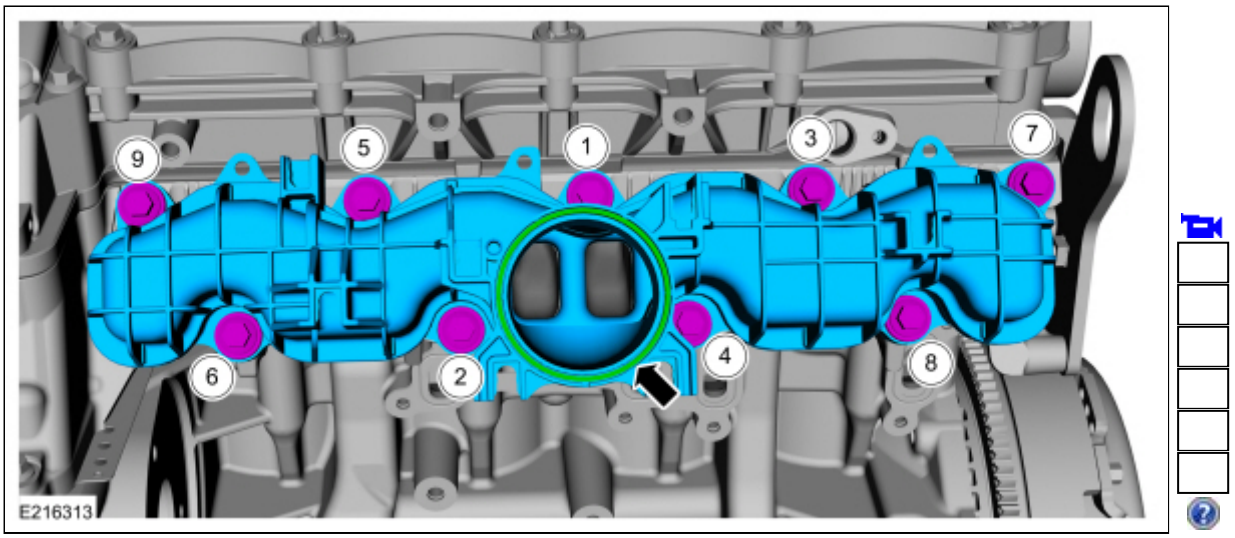


10.



Installation

1. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 13 Nm
   Stage 3: 16 Nm



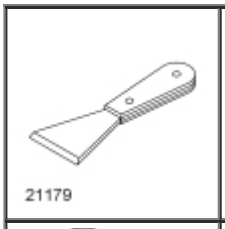
2. **NOTE:** *Inspect the intake manifold gaskets, Install new intake manifold gaskets if necessary.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Timing Cover

Special Tool(s) / General Equipment

 21179	303-428 Separator, Oil Pan
 303682	303-682 Aligner, Engine Front Cover

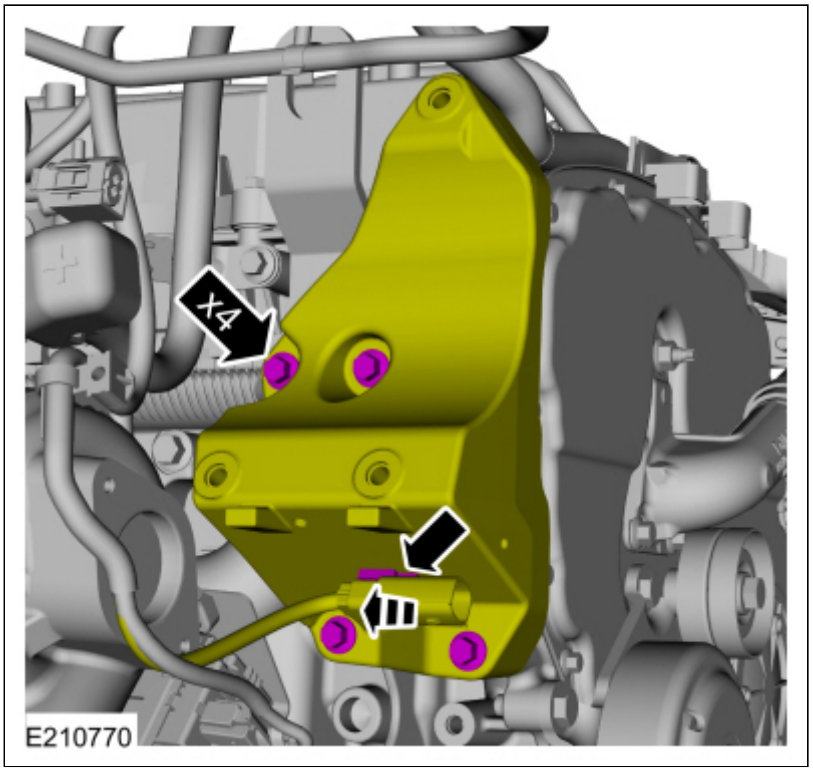
Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

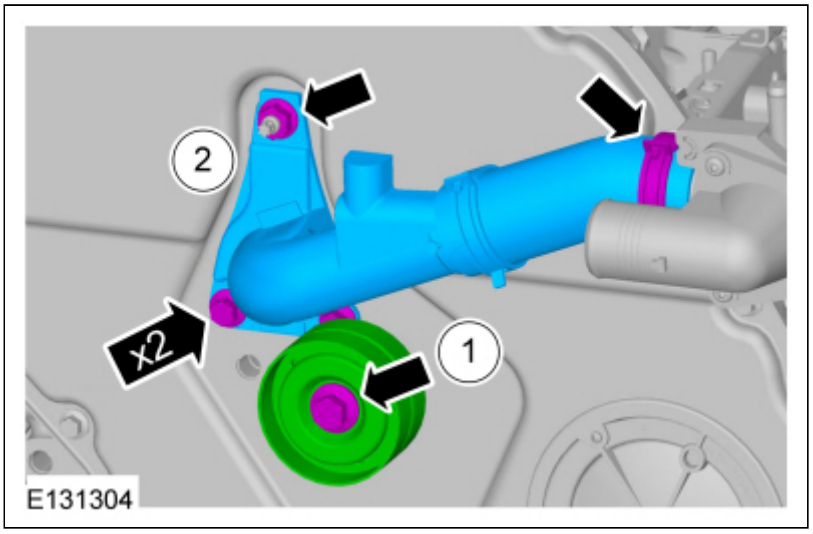
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

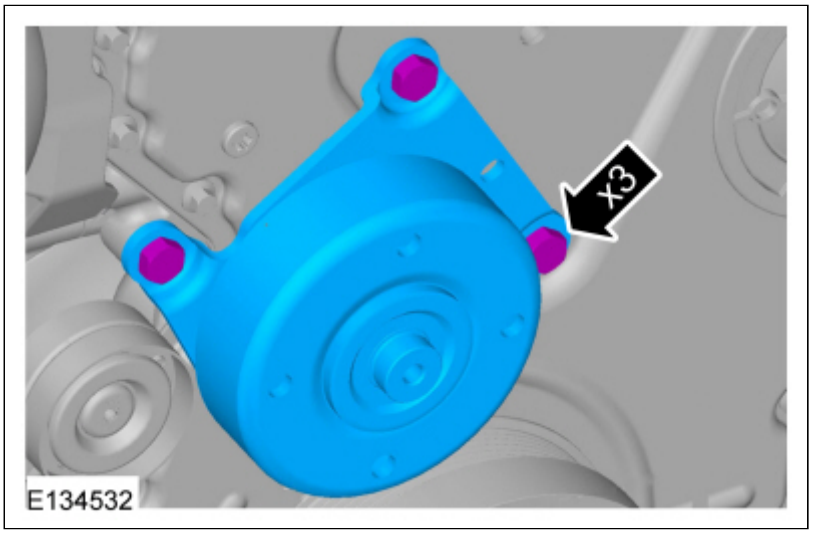
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
3. Refer to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
4. *Torque*: 23 Nm



1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



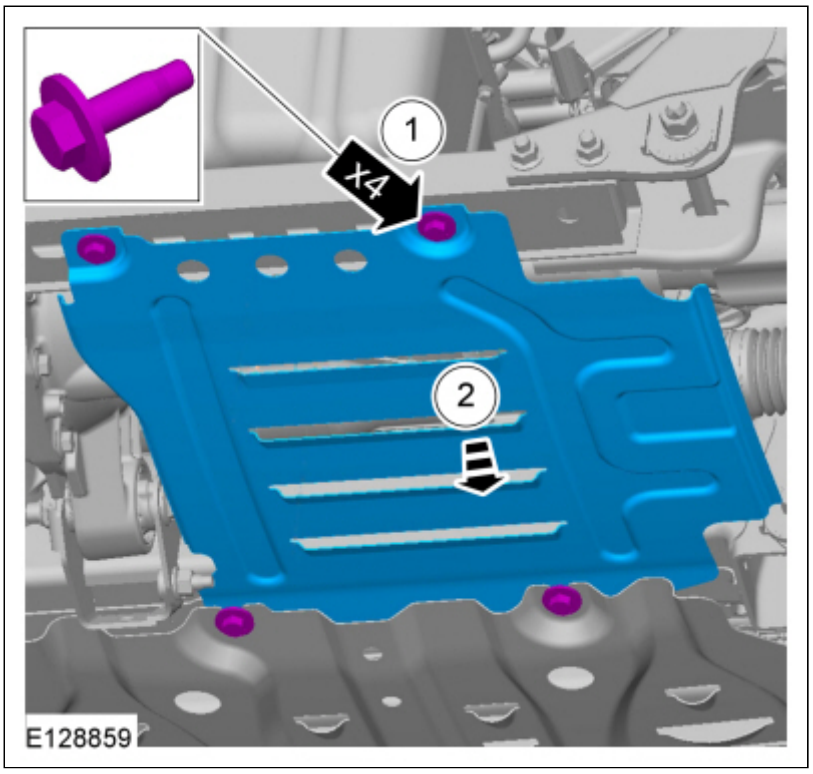
6. *Torque*: 48 Nm



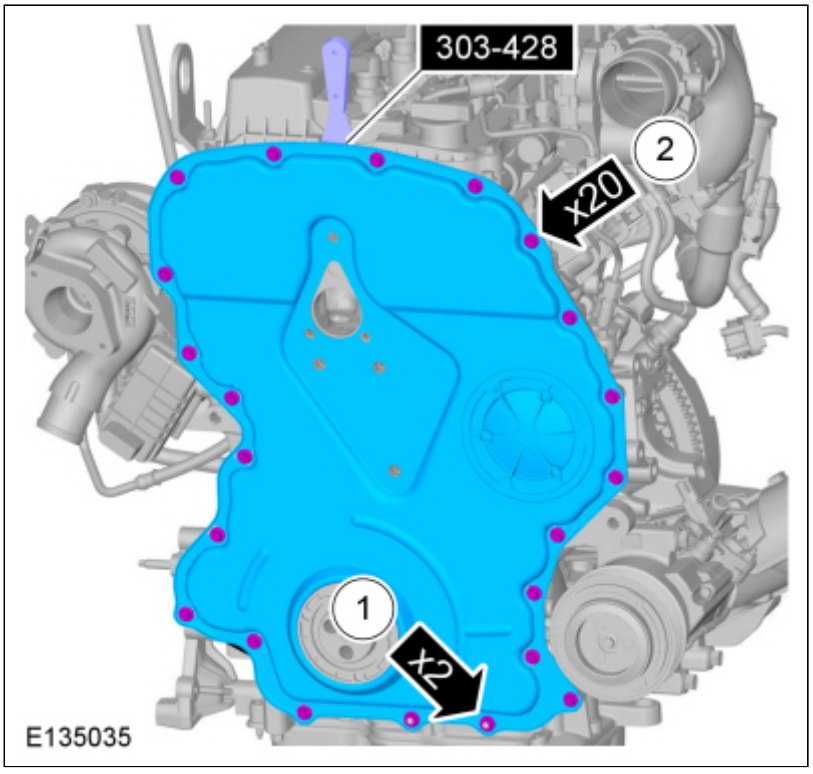
7. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

8. *Torque*: 30 Nm



9. Refer to: Crankshaft Front Seal (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
10. Use Special Service Tool: 303-428 Separator, Oil Pan.



Installation

NOTE: *To remove oil from the cylinder block flange bonderite 1455-w wipes must be used.*

NOTE: *Loctite 7070 or other de-contaminator must not be used on cylinder block flanges.*

NOTE: *Always apply bonderite 1455 wipes to (4) x t-joints(block/head, block/ladderframe).*

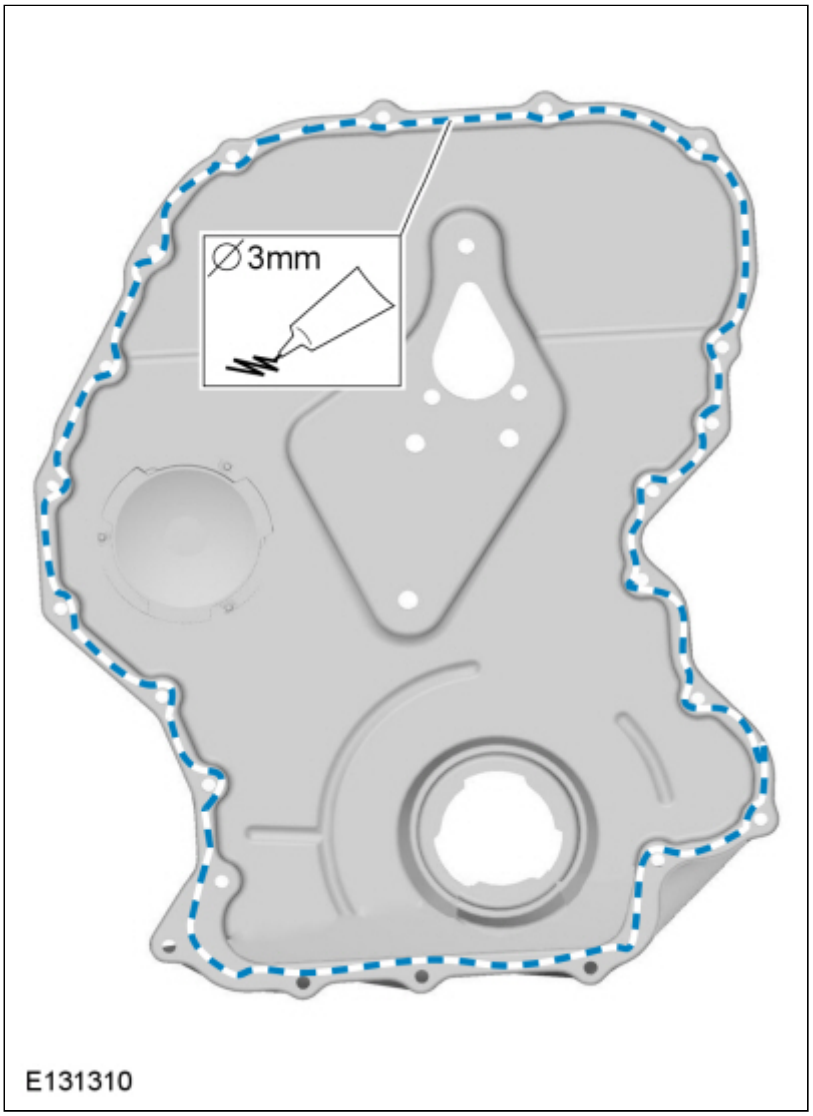
NOTE: *Apply bonderite 1455-w wipes to (2) x t-joints(head/cam-carrier interfaces).*

NOTE: *One minute flash time is recommended after bonderite 1455-w application. apply different section of wipes to each t-joints and do not re-use.*

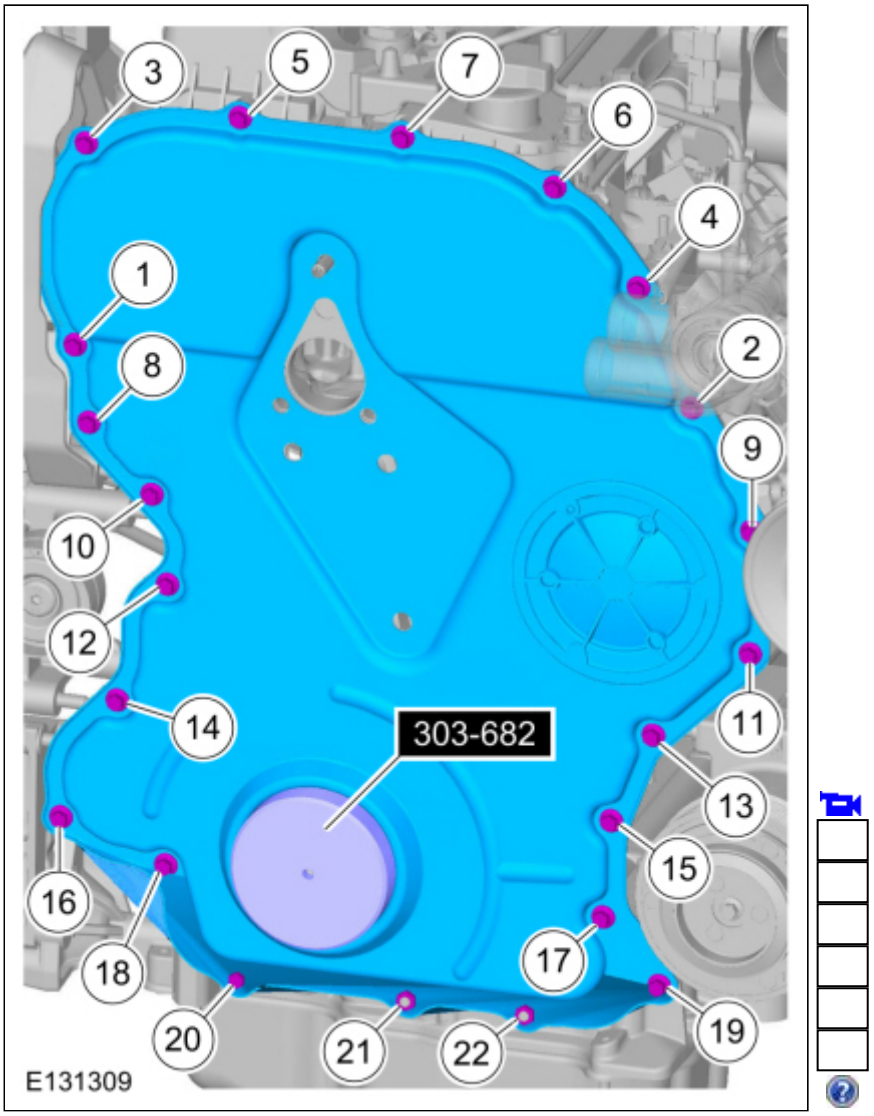
1. **NOTICE: Install timing cover with in five minutes of applying the sealent.**

   NOTE: *Do not damage the mating surfaces.*

   Material: Silicone Sealant (WSE-M4G323-A4)



2. Use Special Service Tool: 303-682 Aligner, Engine Front Cover.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 10 Nm



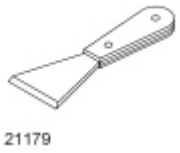
3. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Oil Pan - 4x2

Base Part Number: 6675

Special Tool(s) / General Equipment

 21179	303-428 Separator, Oil Pan
Plastic Scraper	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Vehicles With: Electronic Power Assist Steering (EPAS)

3. Refer to: Steering Gear - RHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
   Refer to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

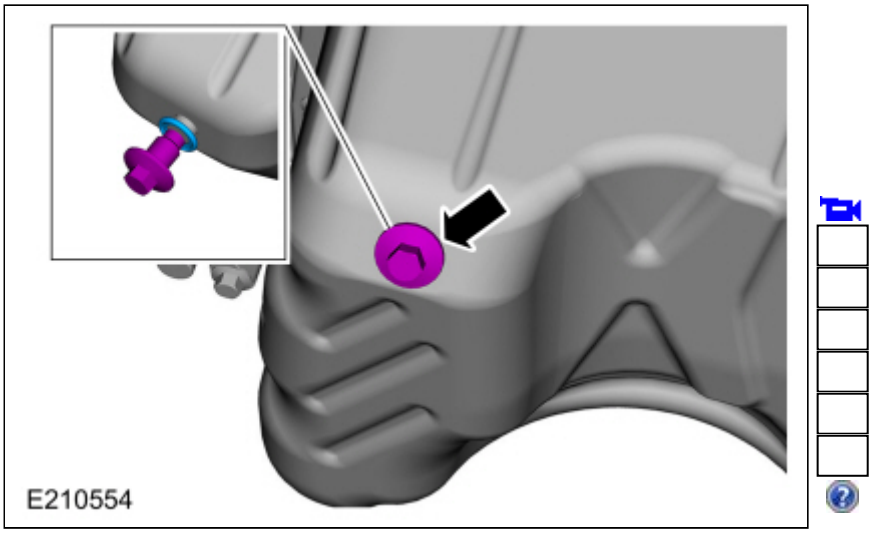
4. Refer to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
   Refer to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

All vehicles

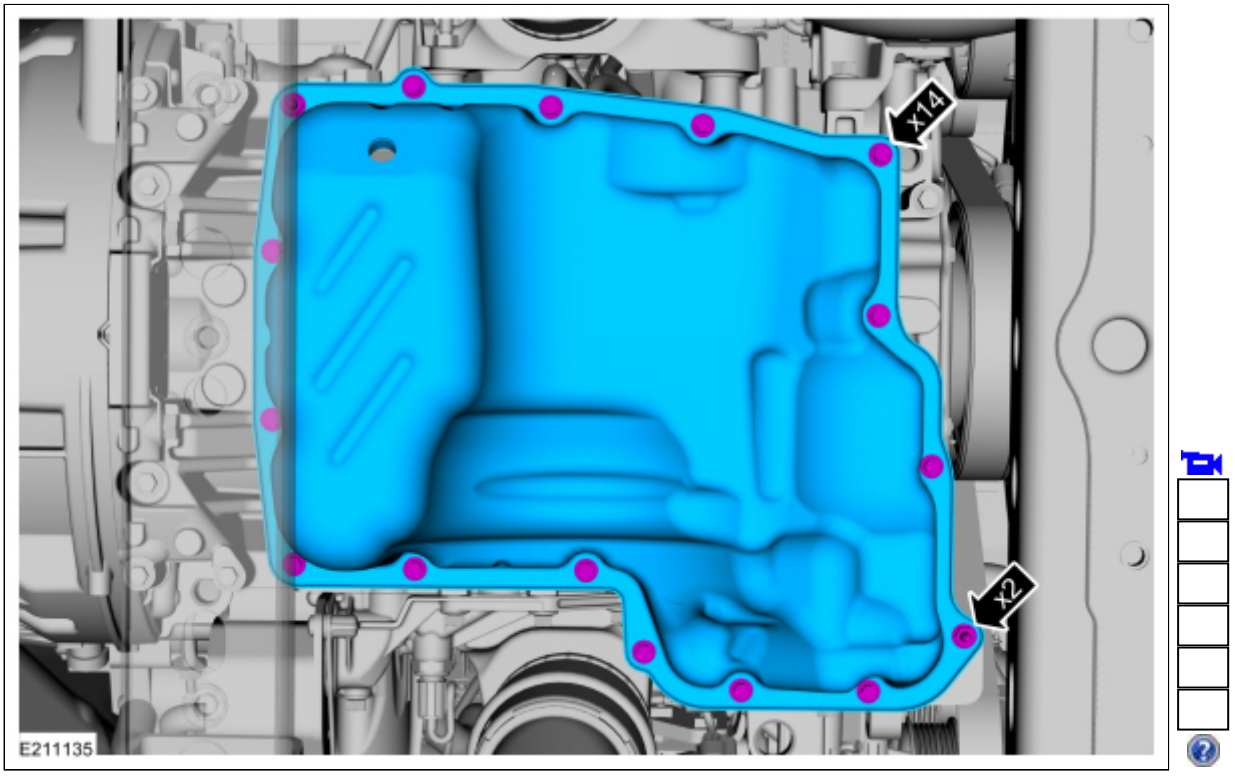
5. Raise the vehicle.
6. **WARNING: Be prepared to collect escaping fluids.**

   NOTE: *The seal is to be reused unless damaged.*

   Drain the oil pan into a suitable container.
   Torque: 39 Nm



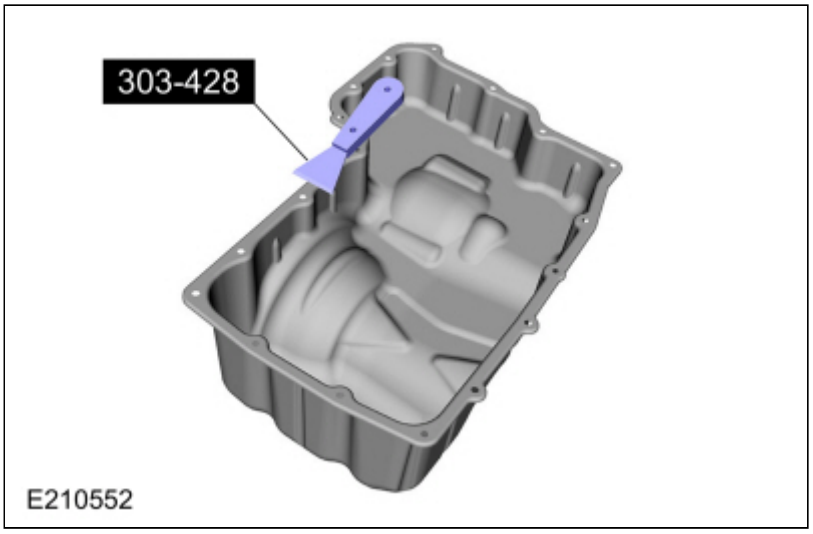
7.



Installation

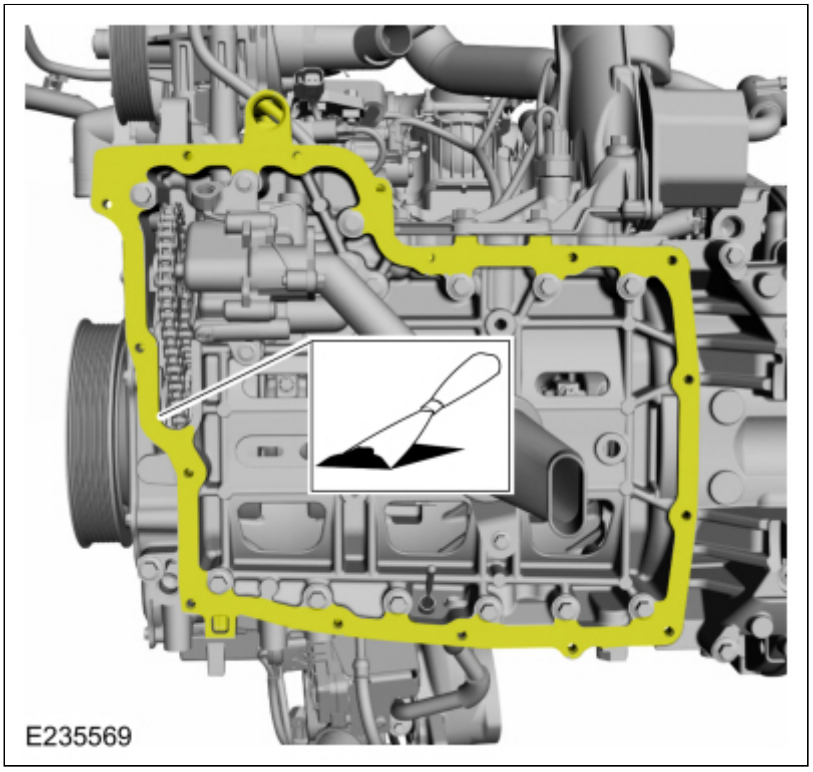
1. **NOTE:** *Do not damage the mating faces.*

   Use Special Service Tool: 303-428 Separator, Oil Pan.



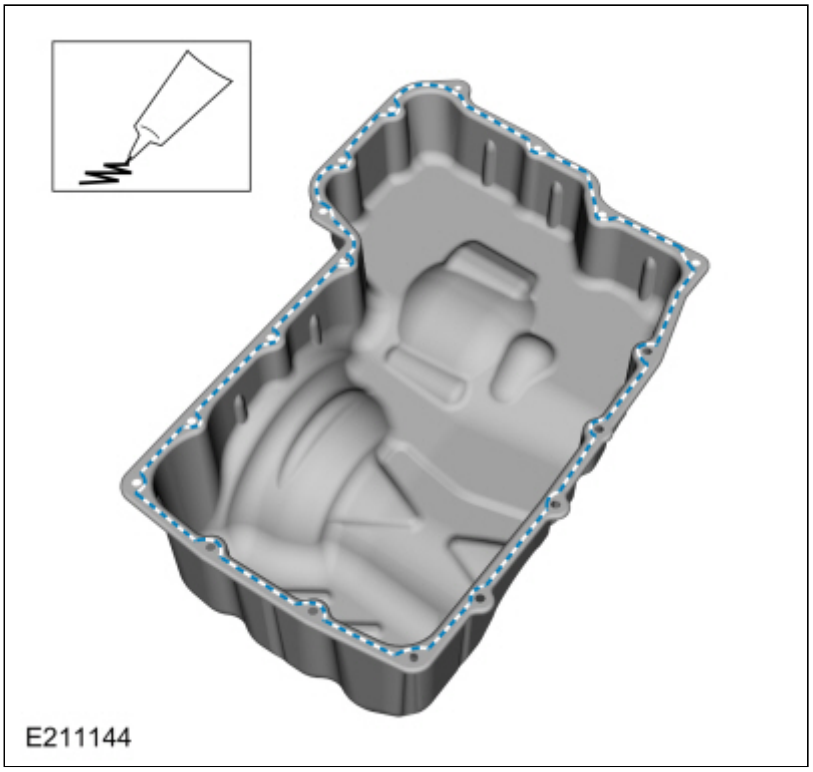
2. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Use the General Equipment: Plastic Scraper

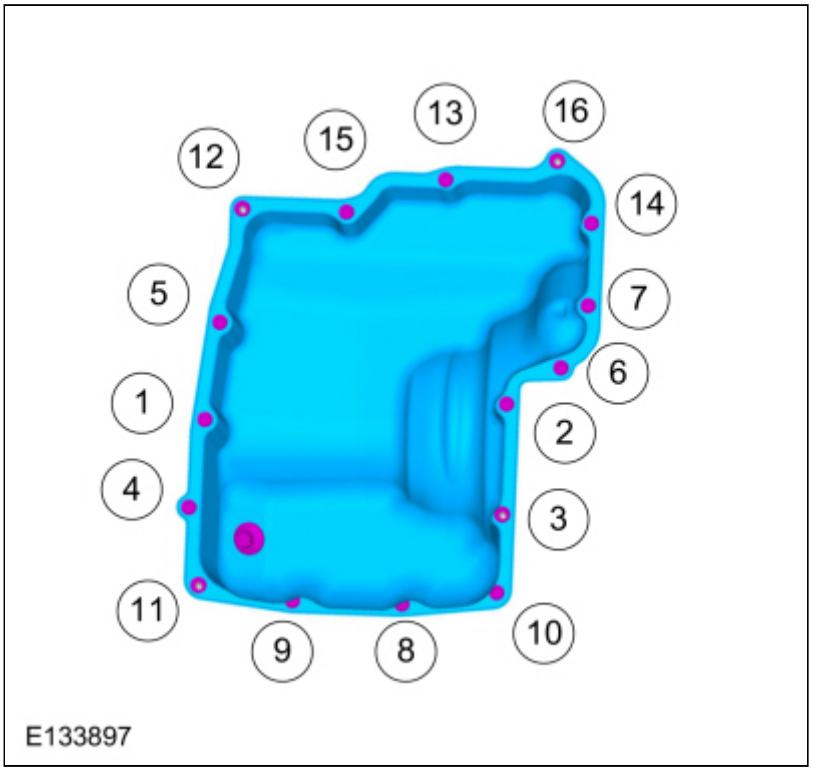


3. **NOTE:** *Do not damage the mating faces.*

   Install the oil pan within five minutes of applying the sealer.
   Material: Silicone Sealant (WSE-M4G323-A4)



4. *Torque*:
   Stage 1: 7 Nm
   Stage 2: 14 Nm



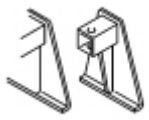
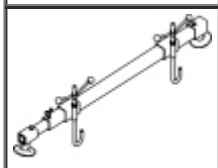
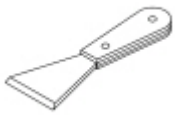
5. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Oil Pan - 4WD

Base Part Number: 6675

Special Tool(s) / General Equipment

 2114001	303-290-01 Adapter for 303-290A
 30329003A	303-290-03A Adapter for 303-290A
 E63421	303-290B Support Bar, Engine
 21179	303-428 Separator, Oil Pan
Plastic Scraper	
Transmission Jack	
Interior Trim Remover	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4
Silicone Sealant	WSS-M4G323-A8

Removal

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Vehicles With: Electronic Power Assist Steering (EPAS)

3. Refer to: Steering Gear - RHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
   Refer to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

4. Refer to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
   Refer to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

All vehicles

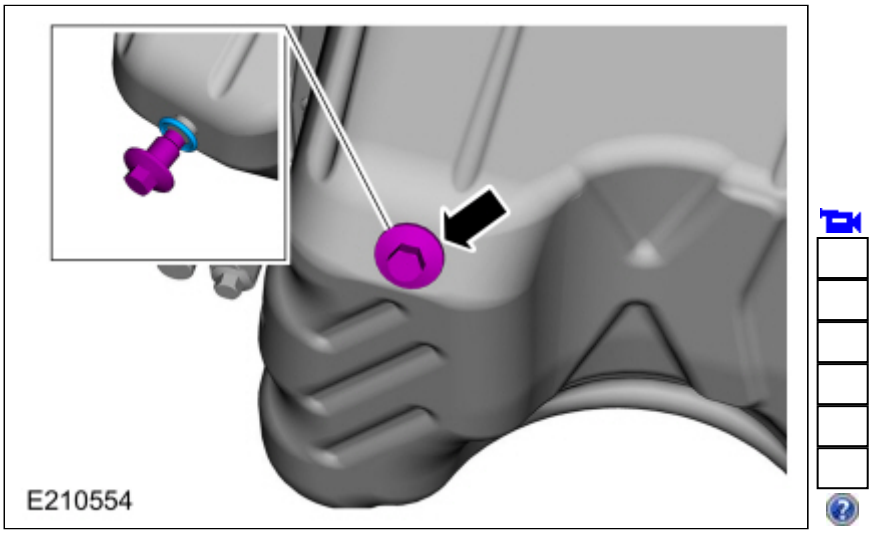
5. Raise the vehicle.

6. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

7. **WARNING: Be prepared to collect escaping fluids.**

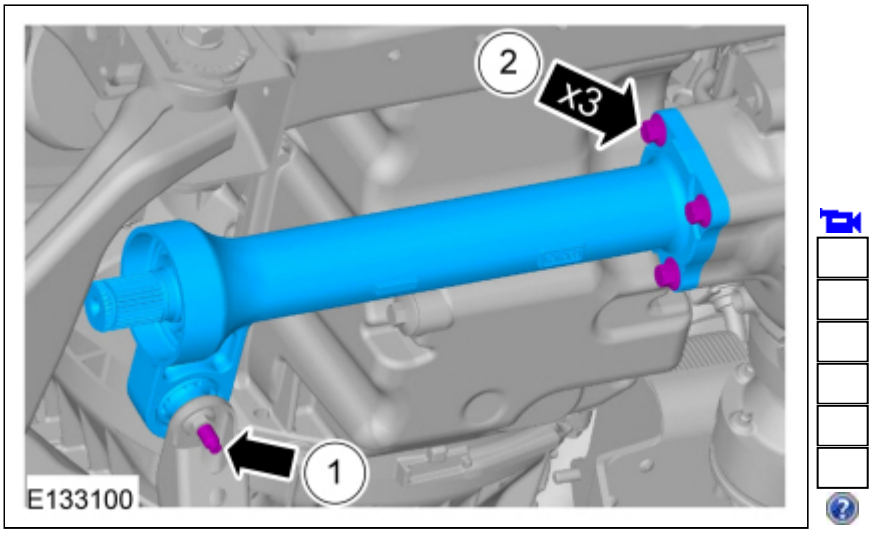
   NOTE: *The seal is to be reused unless damaged.*

   Drain the oil pan into a suitable container.
   Torque: 39 Nm

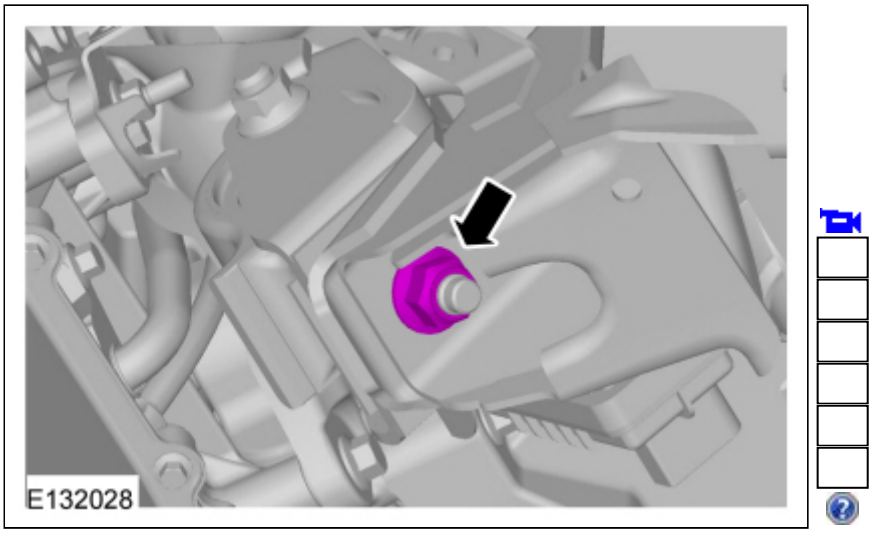


8. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

9.

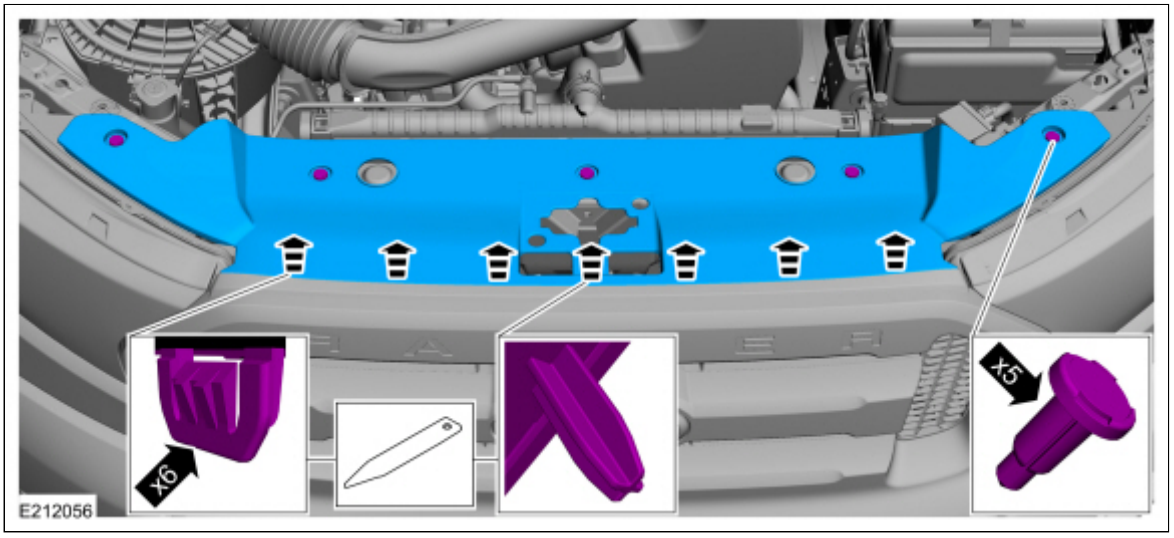


10. On both sides.



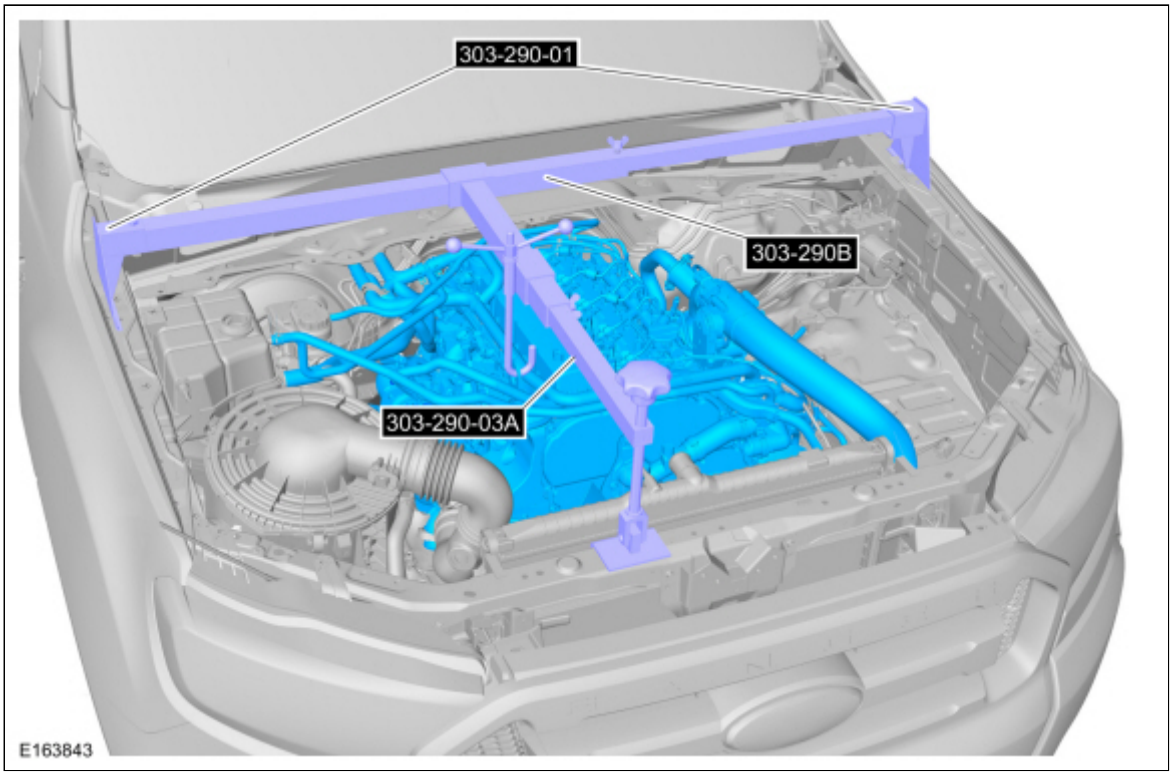
11. Lower the vehicle.

12. Use the General Equipment: Interior Trim Remover



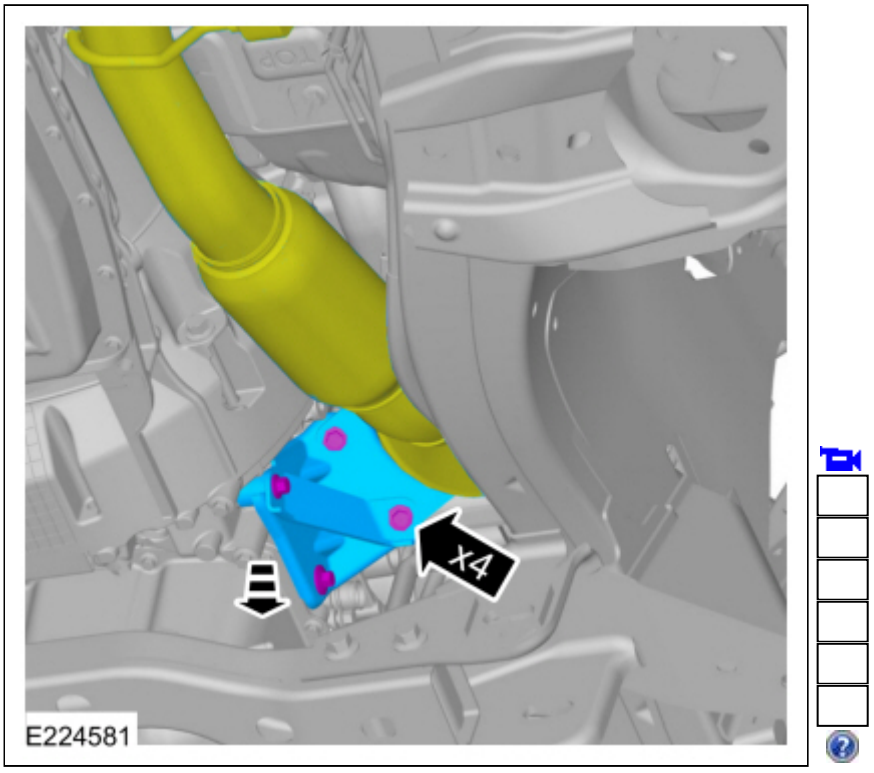
13. Refer to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

14. Install the special tools and lift the engine to 60mm approximately.
    Use Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.



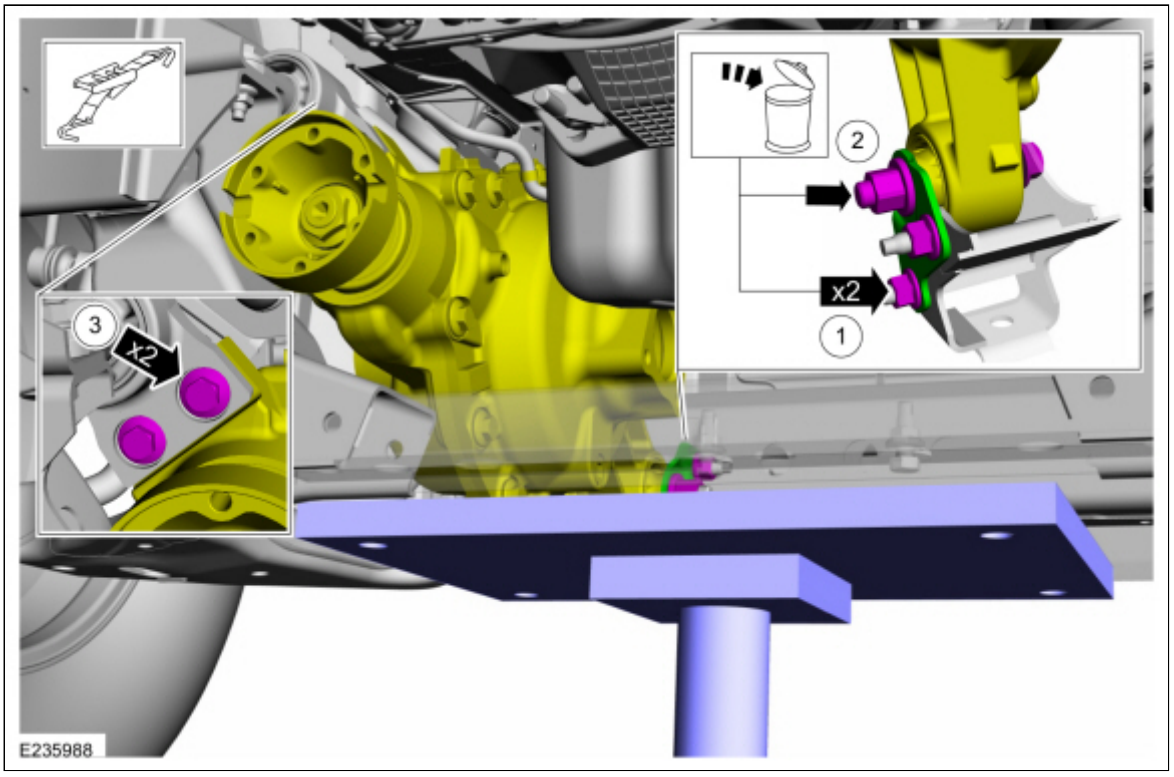
15. Raise the vehicle.

16.

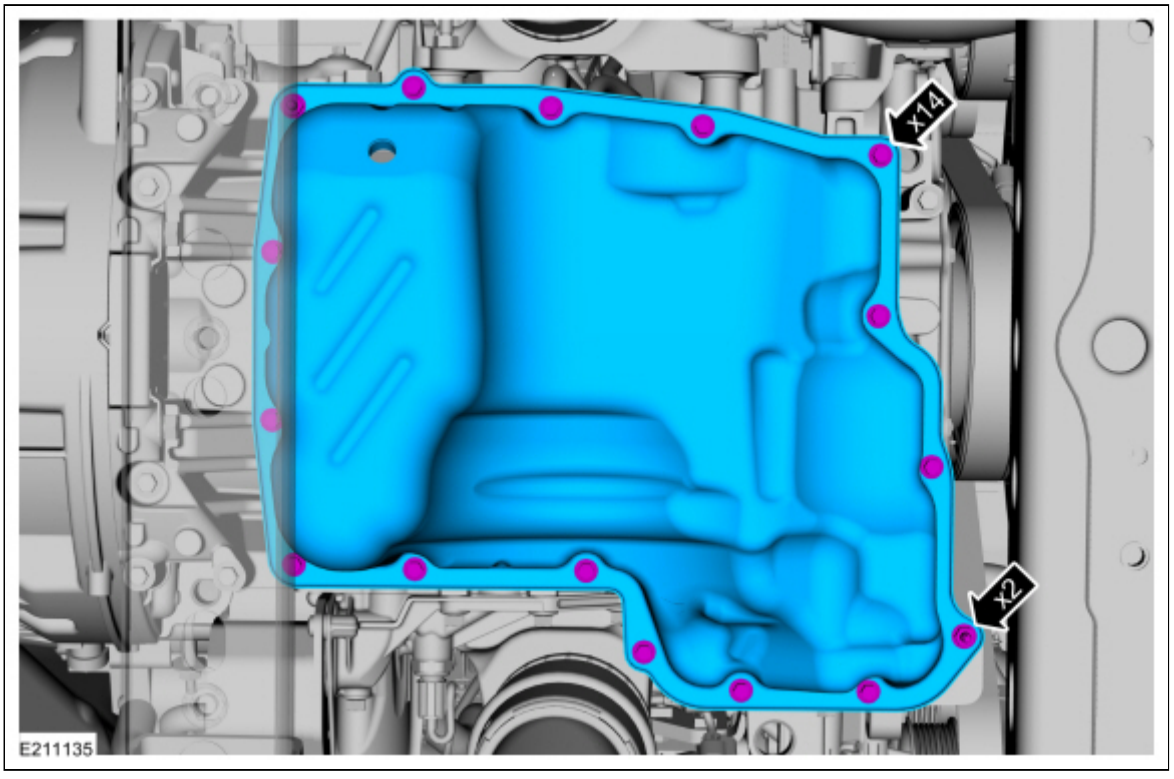


17. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

    Use the General Equipment: Transmission Jack



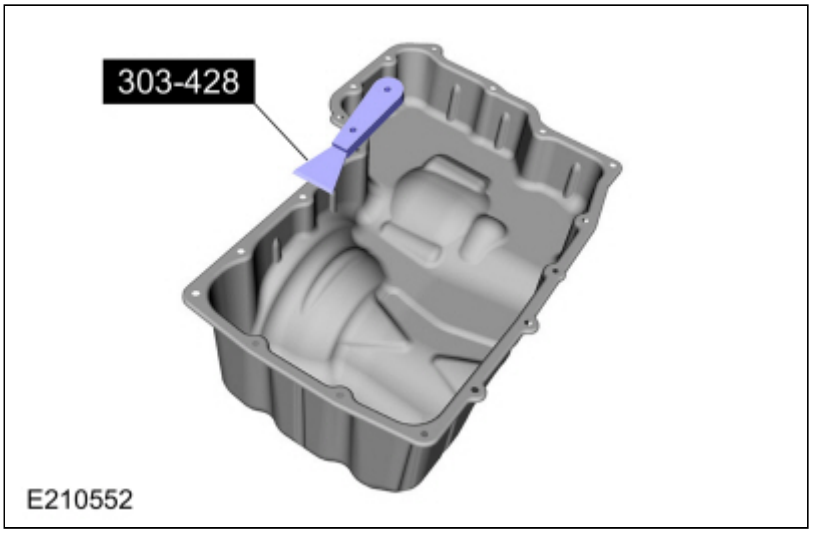
18.



Installation

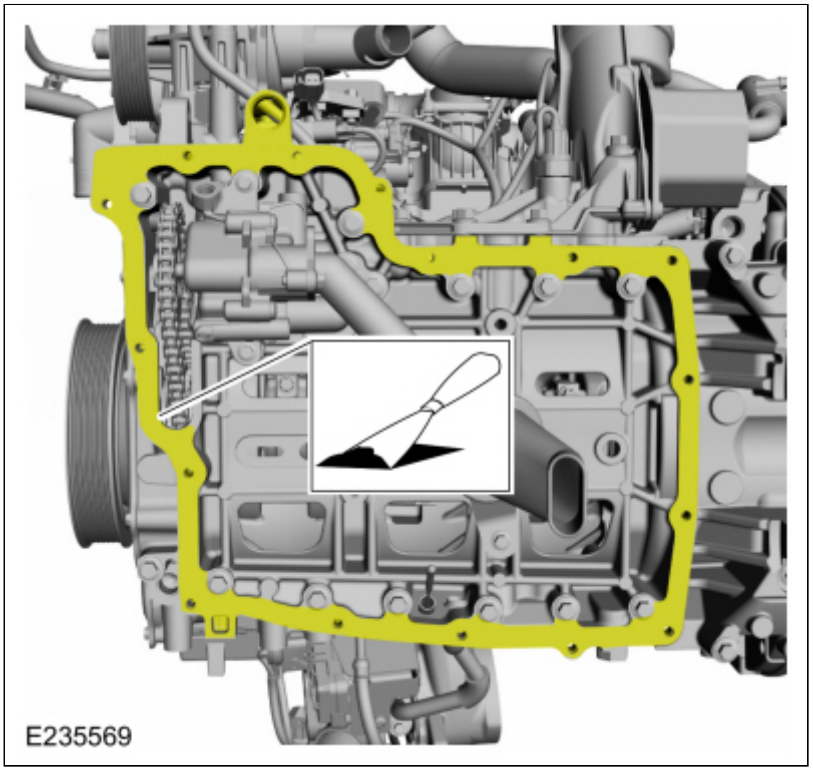
1. **NOTE:** *Do not damage the mating faces.*

   Use Special Service Tool: 303-428 Separator, Oil Pan.



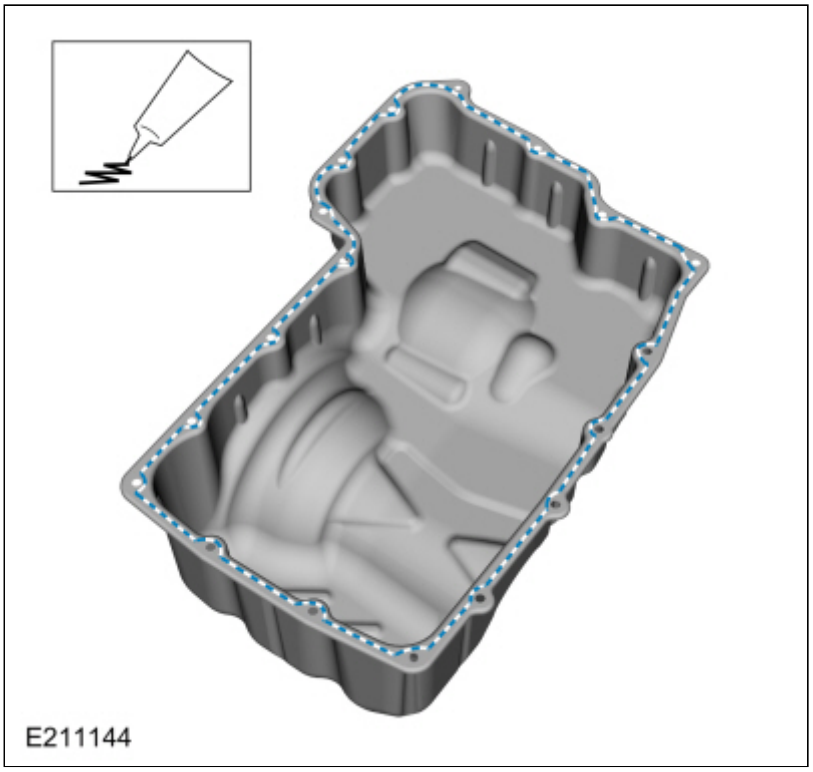
2. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Use the General Equipment: Plastic Scraper

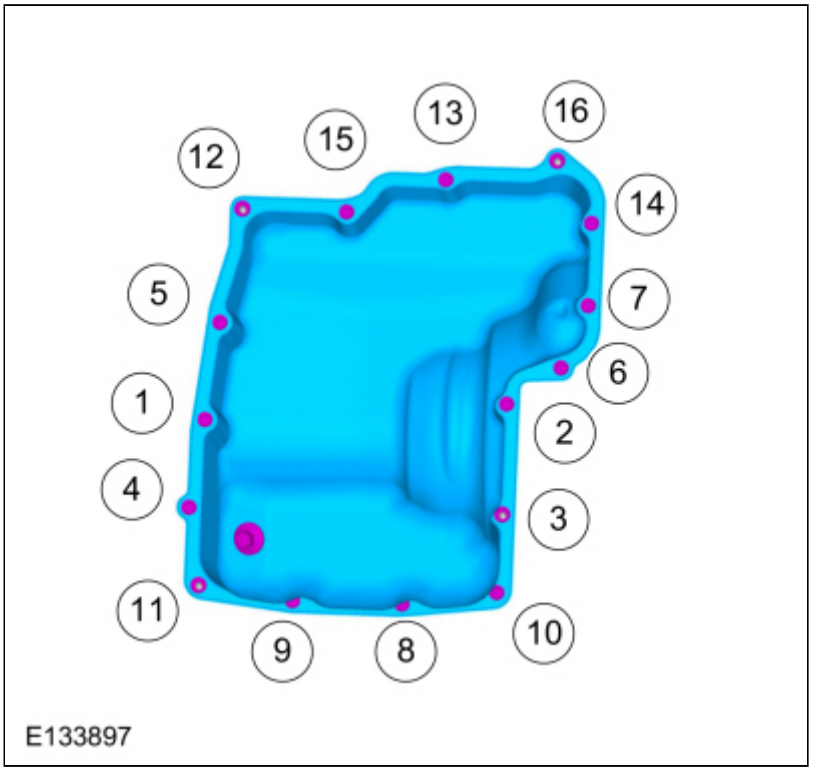


3. **NOTE:** *Do not damage the mating faces.*

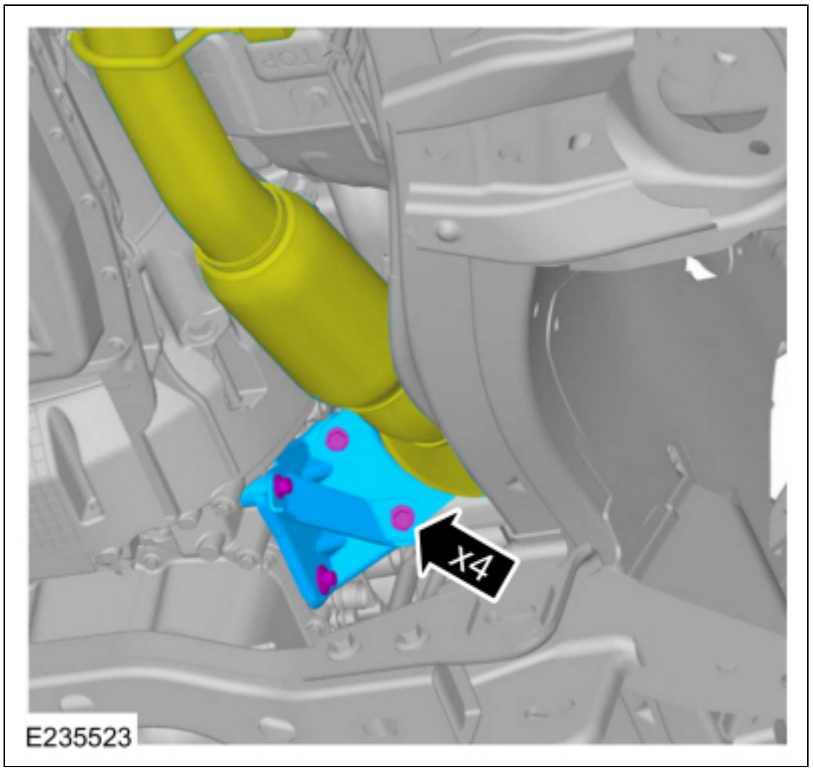
   Install the oil pan within five minutes of applying the sealer.
   Material: Silicone Sealant (WSE-M4G323-A4)



4. *Torque*:
   Stage 1: 7 Nm
   Stage 2: 14 Nm



5. *Torque*: 25 Nm

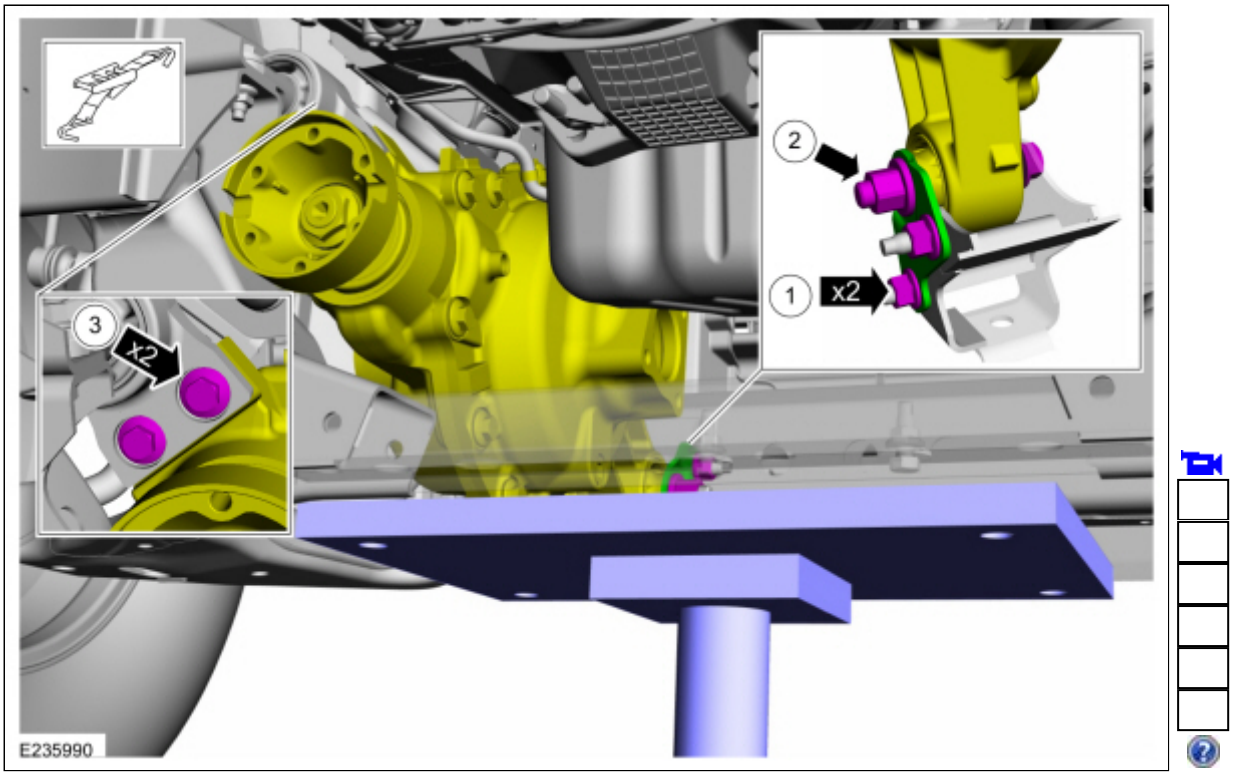


6. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

   NOTE: *Make sure that new nuts are installed.*

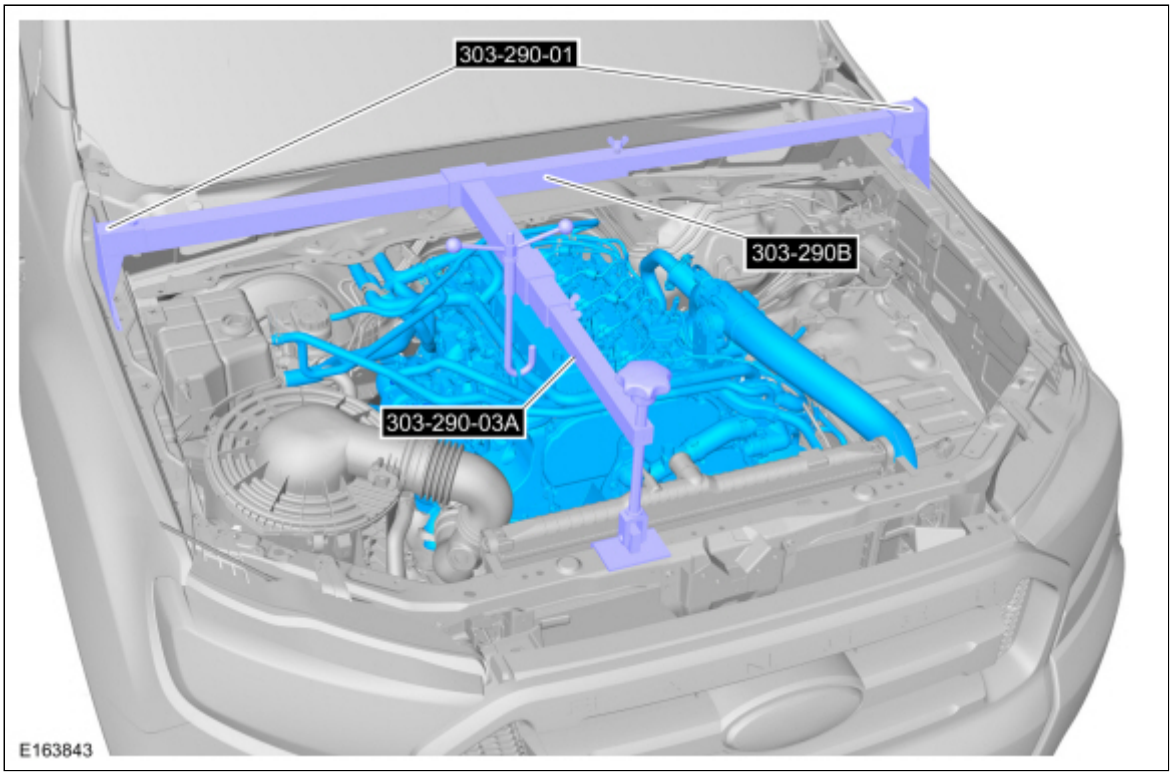
   NOTE: *Make sure that new bolts are installed.*

   Remove the transmission jack.
   Torque:
   1.: 90 Nm
   2.: 265 Nm
   3.: 110 Nm

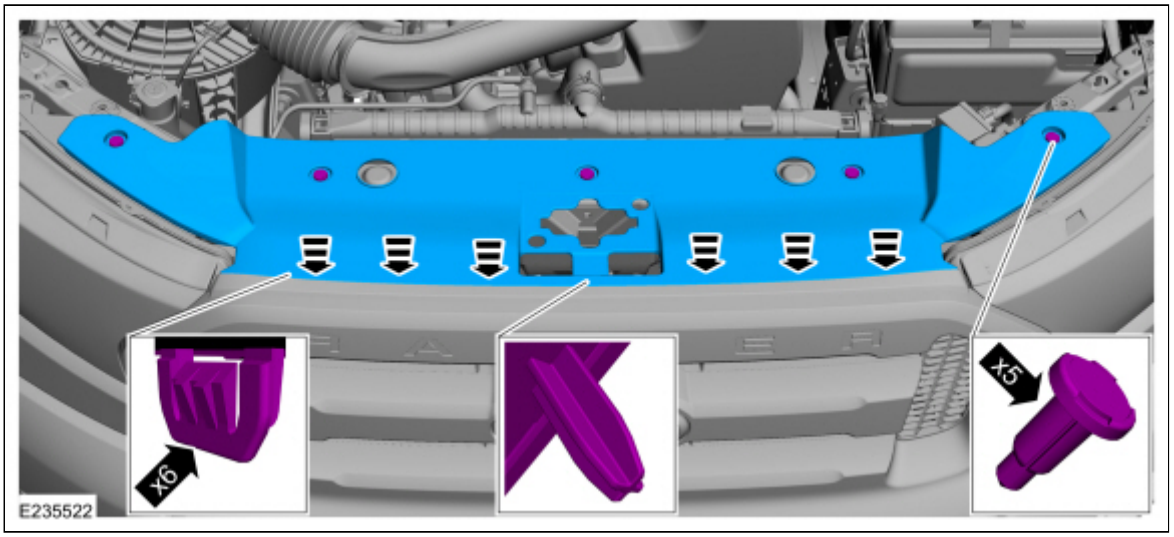


7. Lower the vehicle.

8. Remove the special tools.
   Use Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.

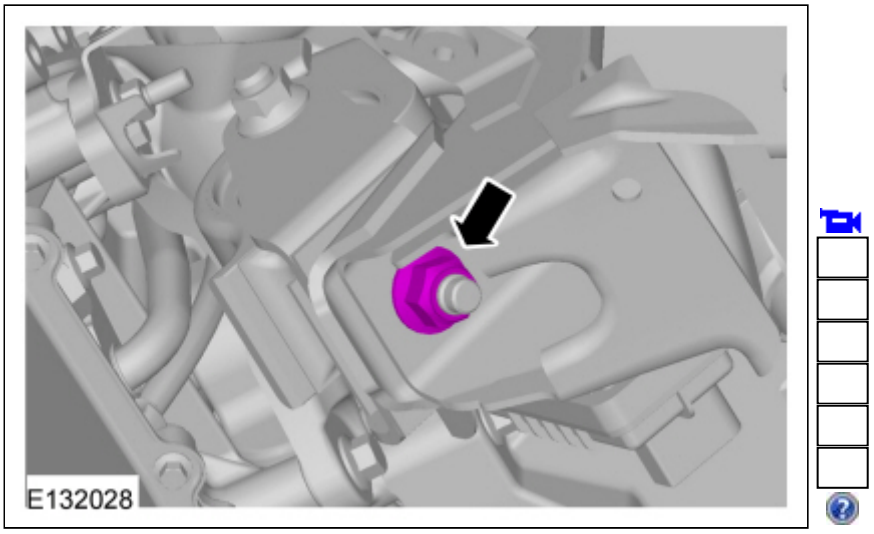


9.



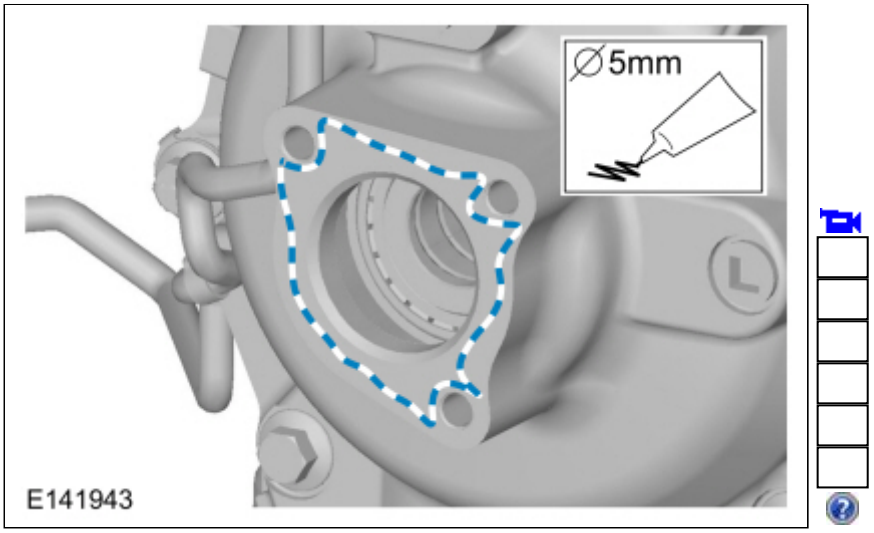
10. Raise the Vehicle.

11. On both sides.
    Torque: 175 Nm

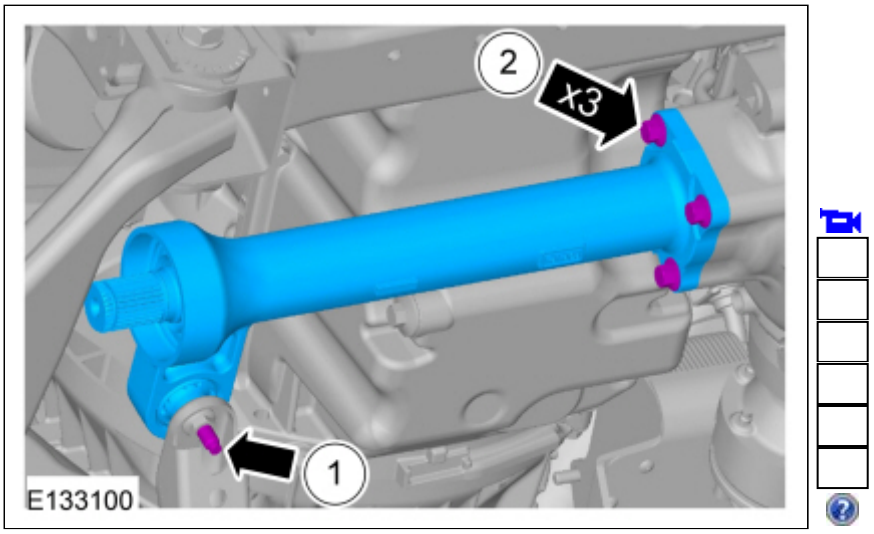


12. **NOTE:** *Do not damage the mating faces.*

    Install the Front axle tube within five minutes of applying the sealer.
    Material: Silicone Sealant (WSS-M4G323-A8)



1. *Torque*: 70 Nm
2. *Torque*: 40 Nm



14. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
15. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

Vehicles With: Electronic Power Assist Steering (EPAS)

16. Refer to: Steering Gear - RHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
    Refer to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

17. Refer to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).
    Refer to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

All vehicles

18. Lower the vehicle.

19. Fill the oil pan with clean engine oil.
    Refer to: Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

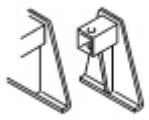
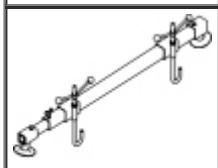
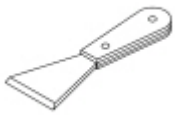
20. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Oil Pan - Base

Base Part Number: 6675

Special Tool(s) / General Equipment

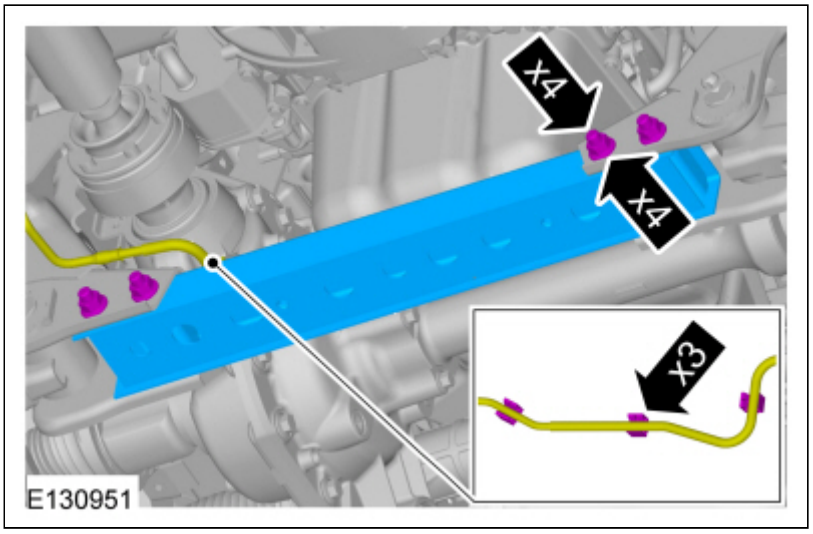
 2114001	303-290-01 Adapter for 303-290A
 30329003A	303-290-03A Adapter for 303-290A
 E63421	303-290B Support Bar, Engine
 21179	303-428 Separator, Oil Pan
Plastic Scraper	
Interior Trim Remover	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

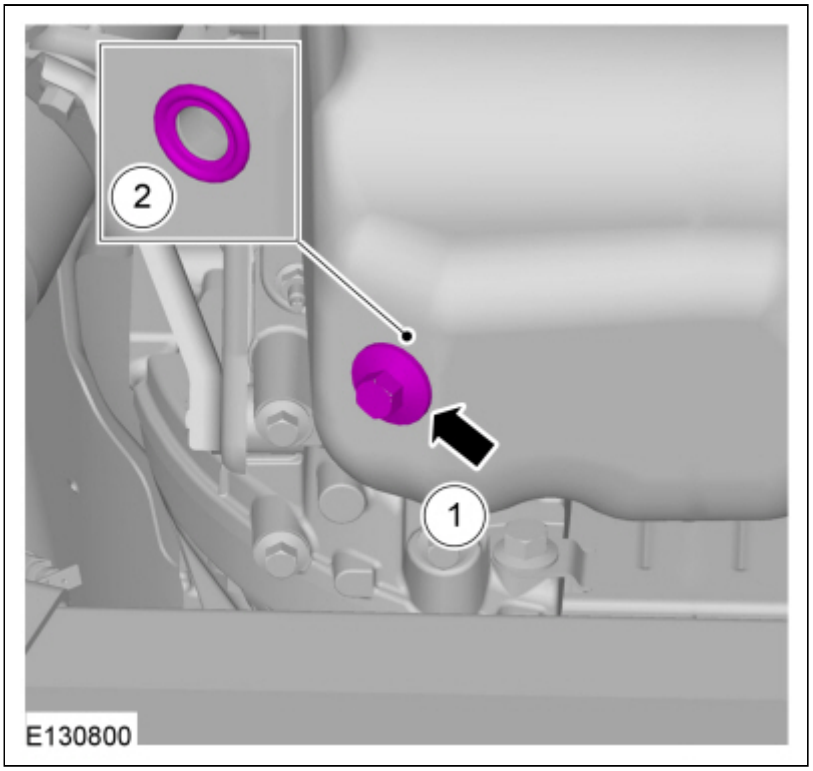
1. Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .
2. Refer to: Jacking - Vehicles Built Up To: 16-08-2015 (100-02 Jacking and Lifting) .
   Refer to: Lifting - Vehicles Built Up To: 16-08-2015 (100-02 Jacking and Lifting) .
3. Raise the vehicle.
4.



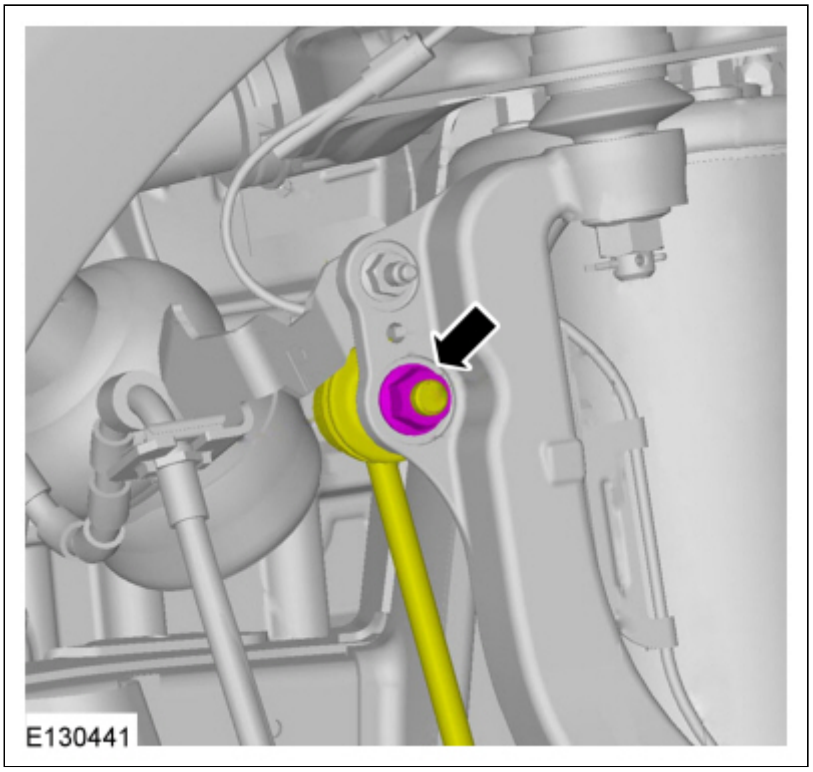
5. **WARNING: Be prepared to collect escaping fluids.**

   NOTE: *The seal is to be reused unless damaged.*

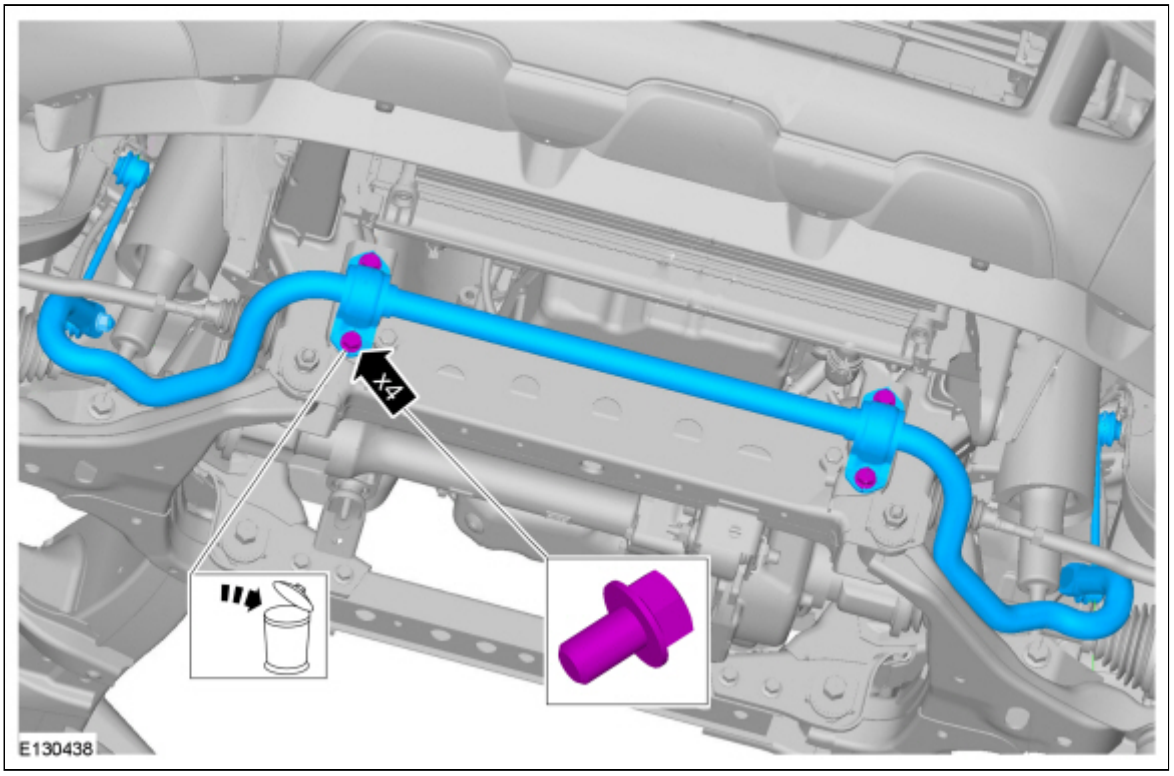
   Drain the oil pan into a suitable container.
   Torque: 39 Nm



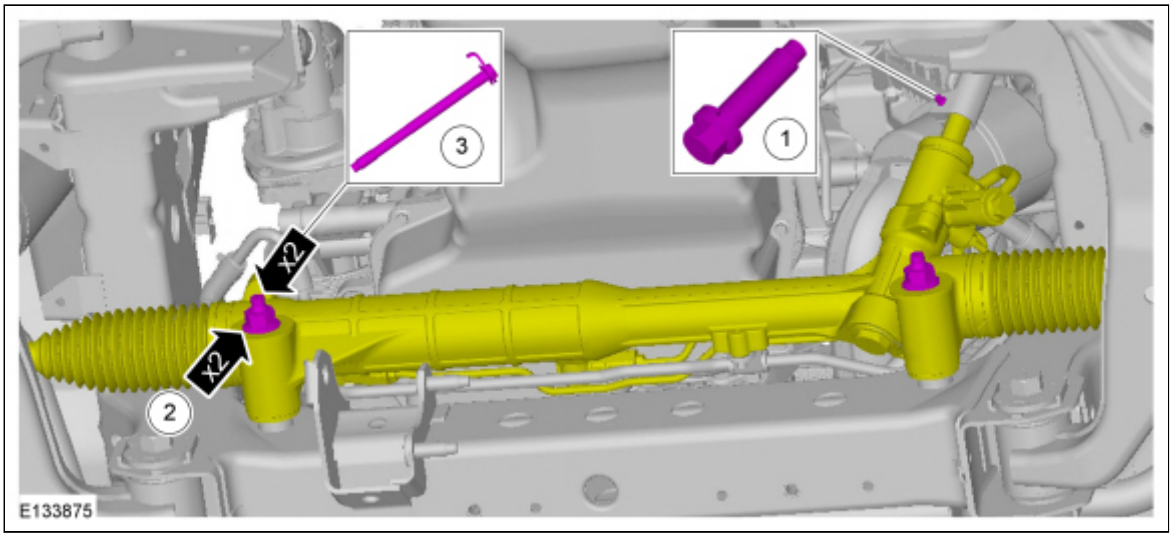
6.



7.

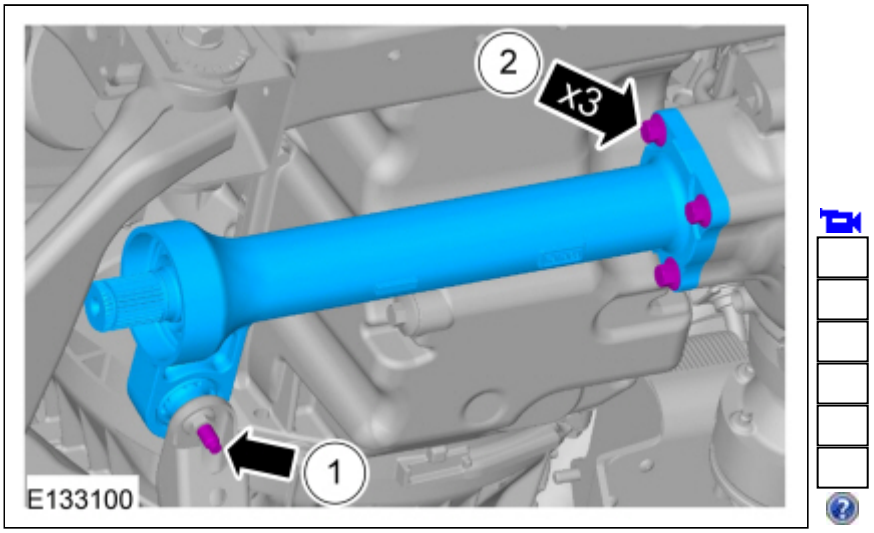


8. **NOTICE: Take extra care when handling steering gear rack.**

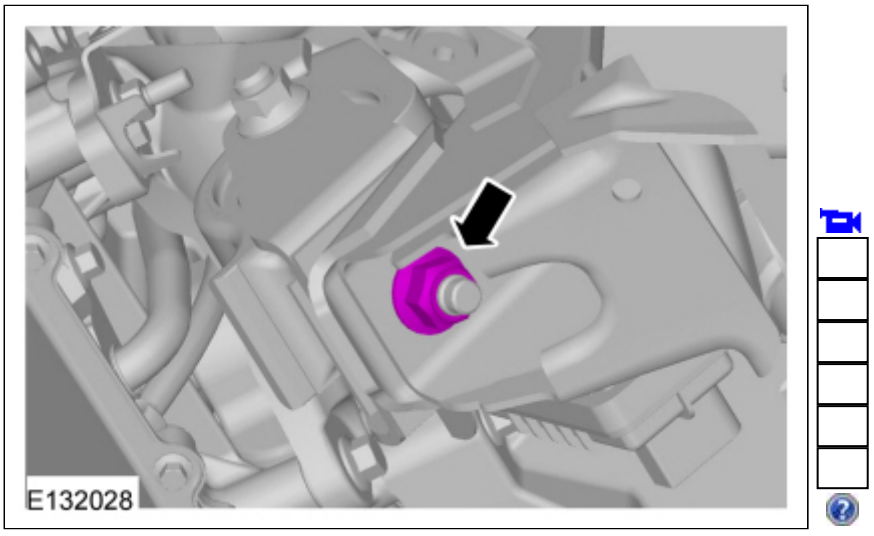


4X4

9. Remove the front wheel.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
10. Refer to: Differential Draining and Filling - Vehicles Built Up To: 16-08-2015 (205-03 Front Drive Axle/Differential) .
11. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
12.

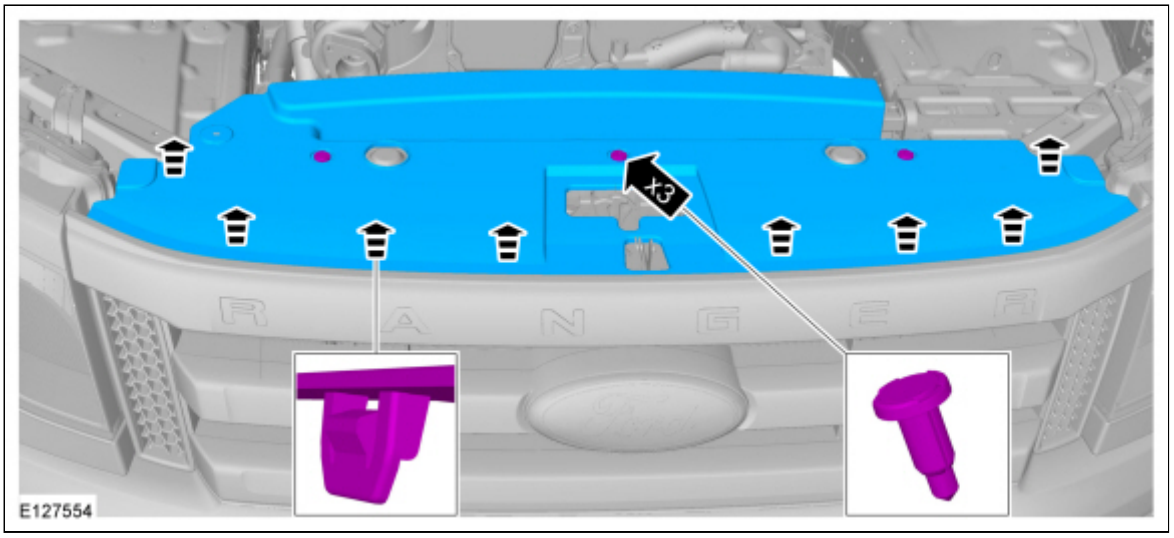


13. On both sides.



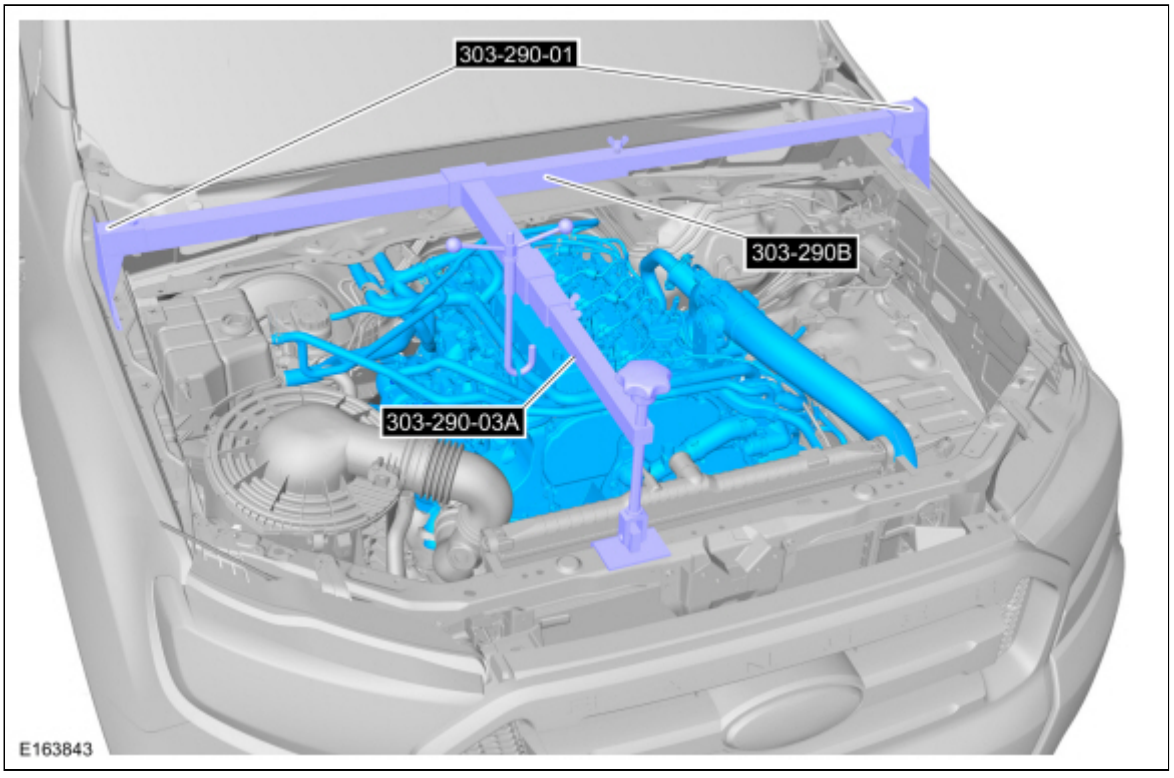
14. Lower the vehicle.

15. Use the General Equipment: Interior Trim Remover



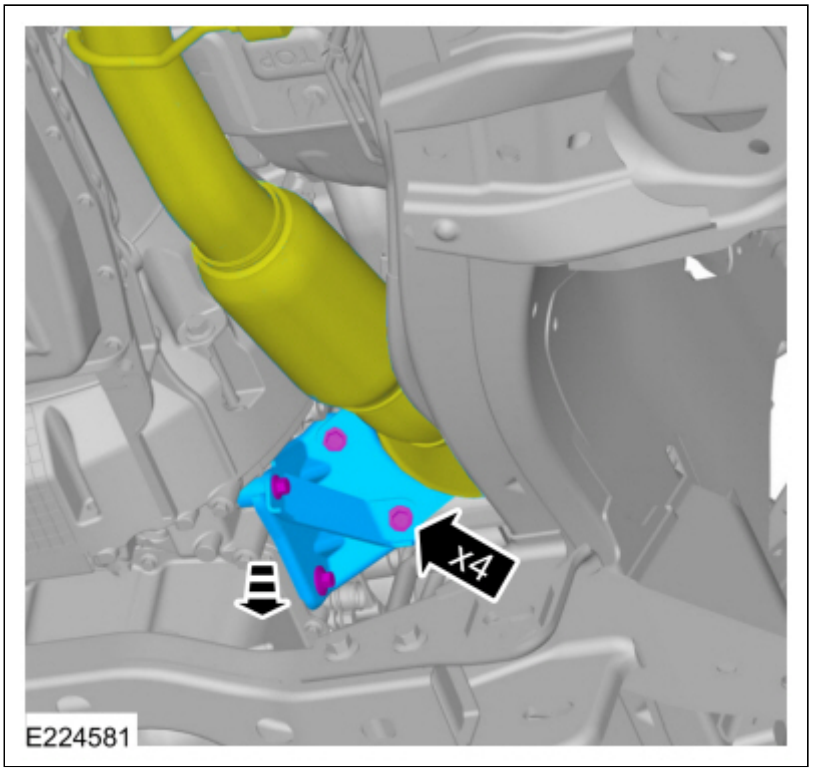
16. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
Refer to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

17. Install the special tools and lift the engine to 60mm approximately.
Use Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.



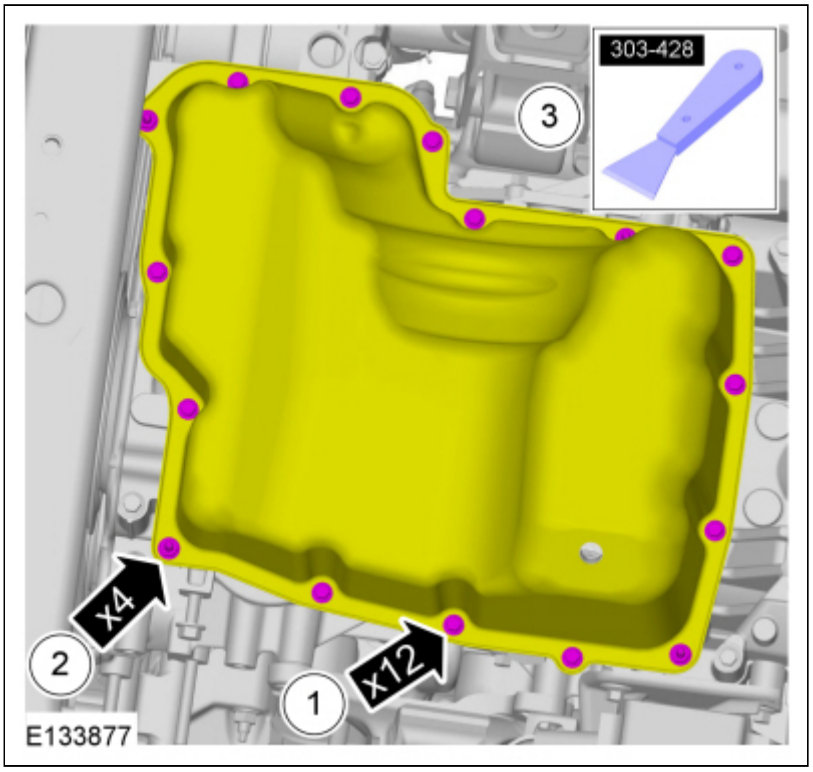
18. Raise the vehicle.

19.

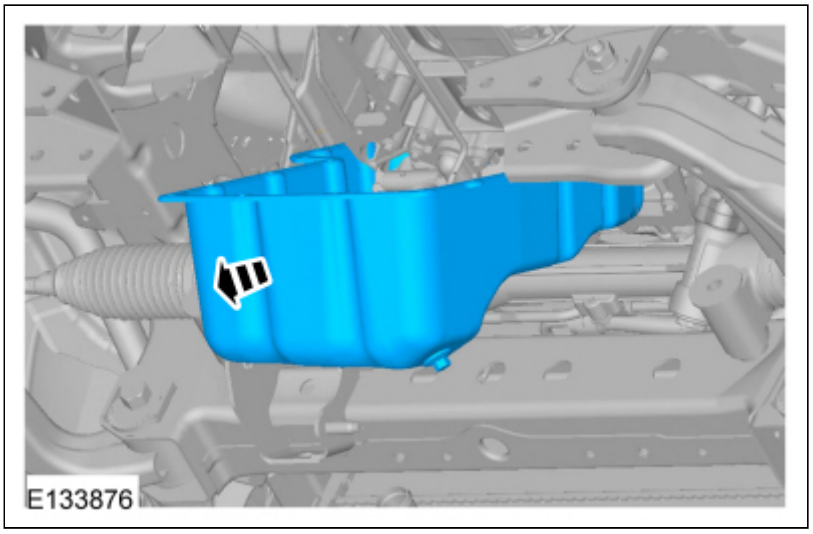


All vehicles

20. Use Special Service Tool: 303-428 Separator, Oil Pan.



21.

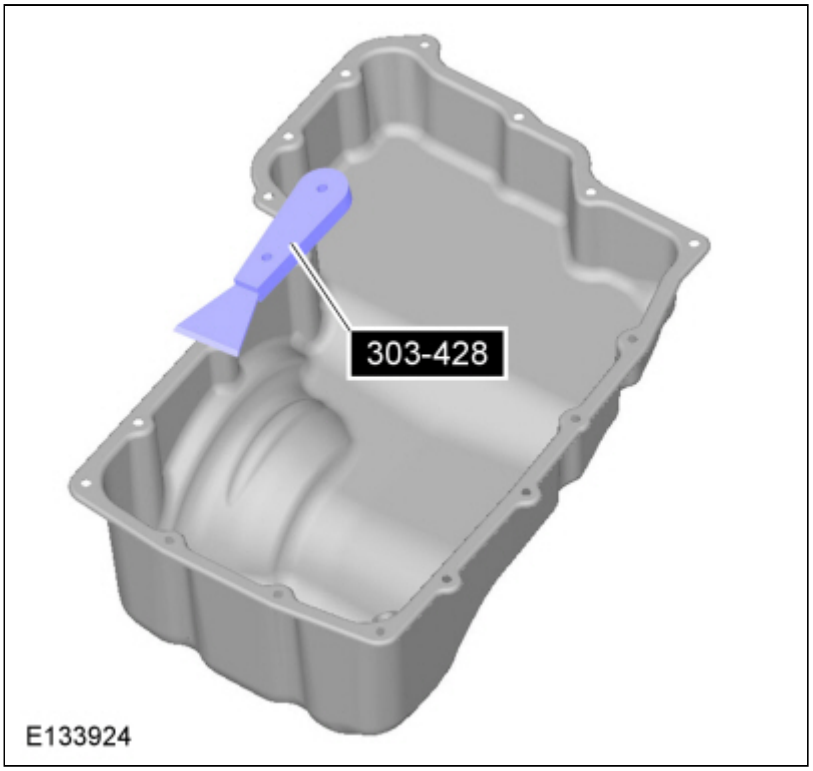


Installation

All vehicles

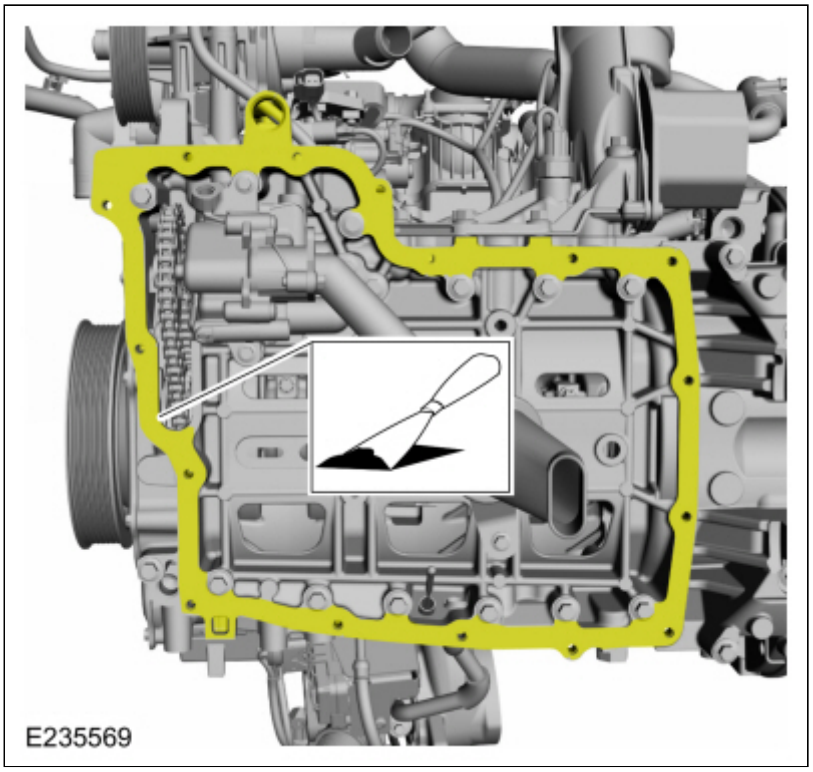
1. **NOTE:** *Do not damage the mating faces.*

   Use Special Service Tool: 303-428 Separator, Oil Pan.



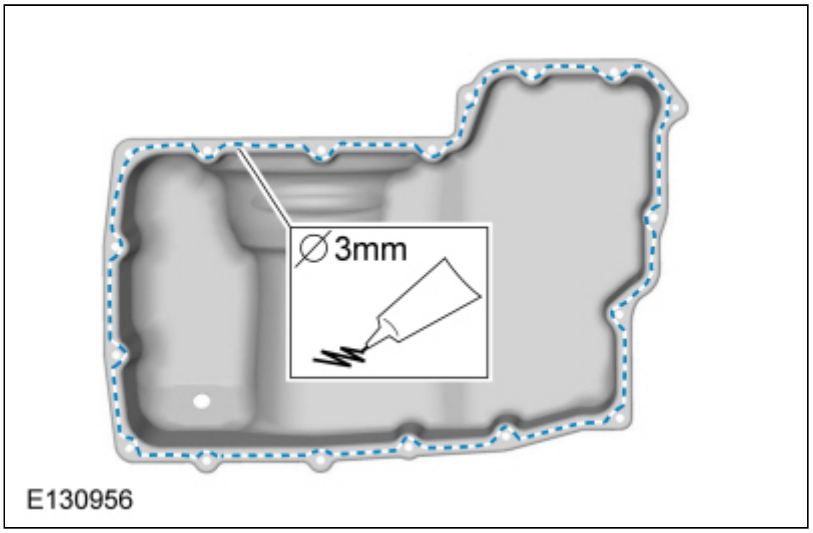
2. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Use the General Equipment: Plastic Scraper

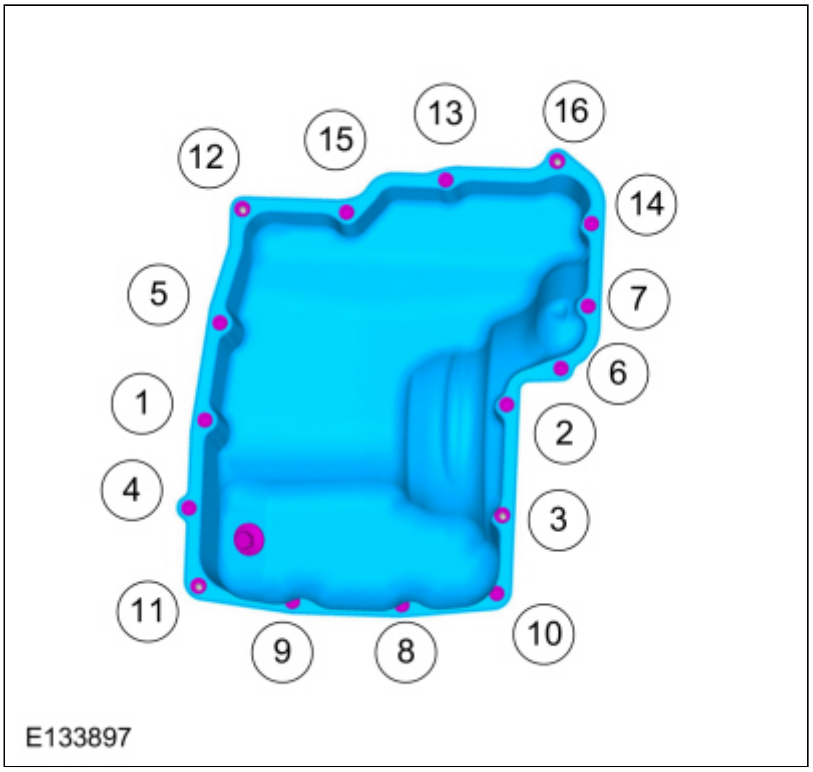


3. **NOTE:** *Do not damage the mating faces.*

   Install the oil pan within five minutes of applying the sealer.
   Material: Silicone Sealant (WSE-M4G323-A4)

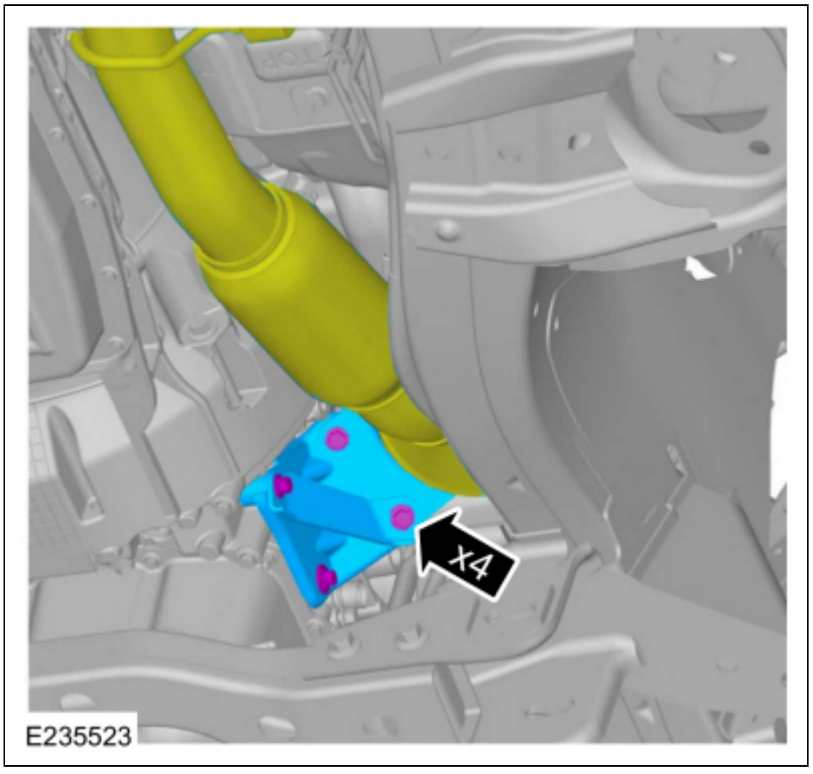


4. *Torque*:
   Stage 1: 7 Nm
   Stage 2: 14 Nm



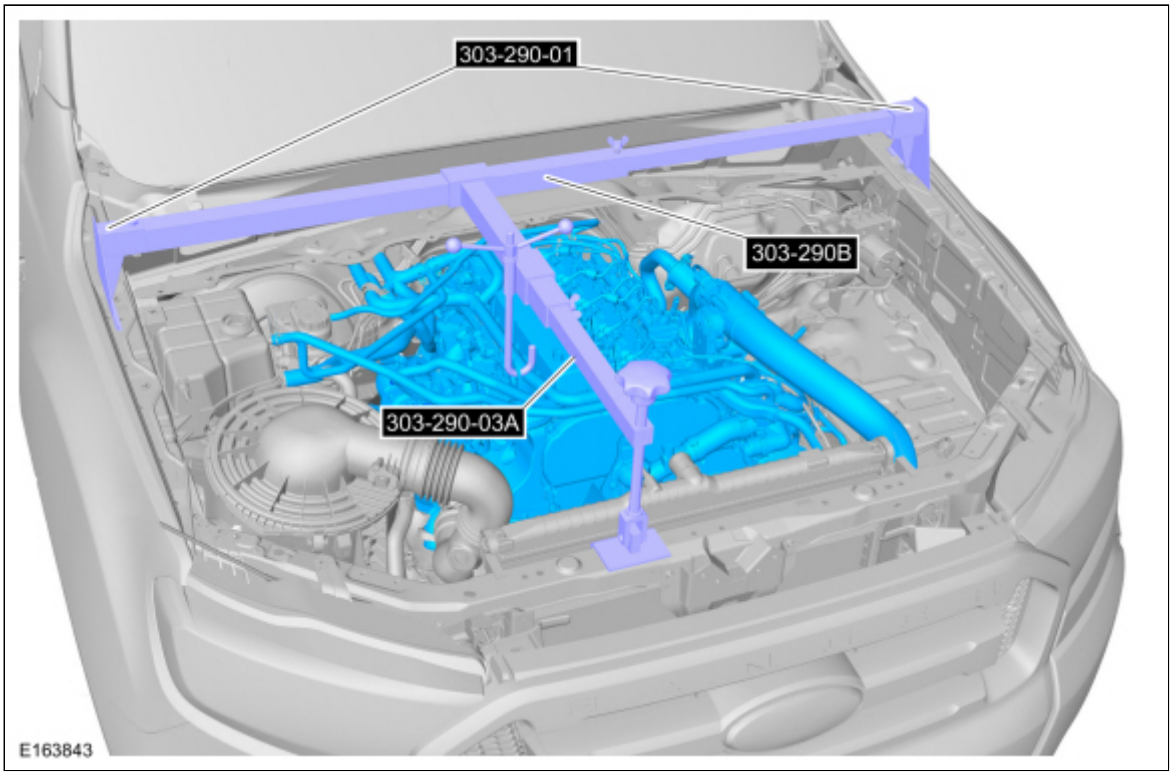
4X4

5. *Torque*: 25 Nm

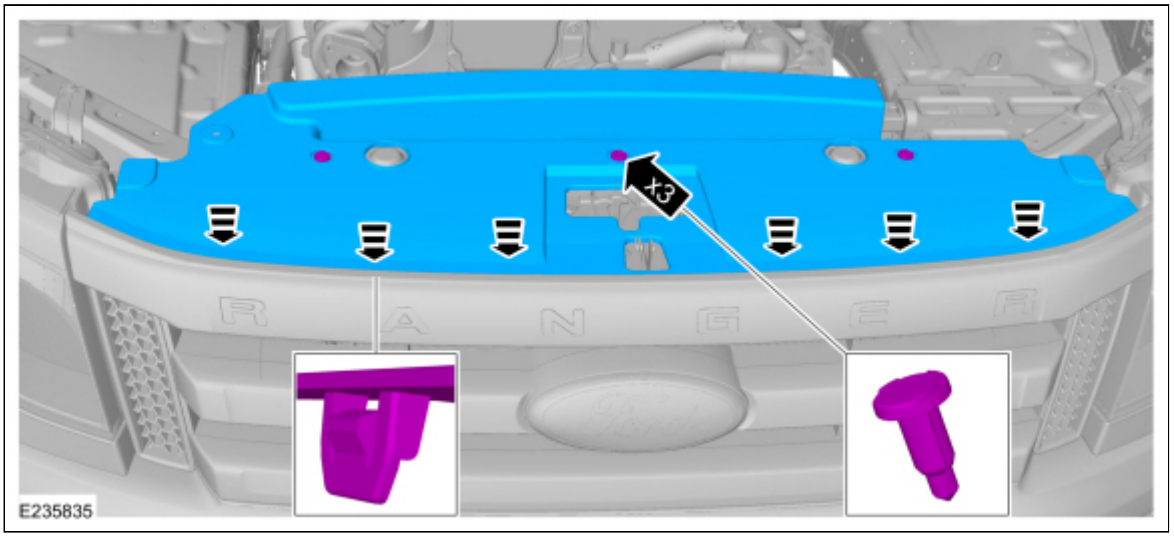


6. Lower the vehicle.

7. Remove the special tools.
   Use Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.

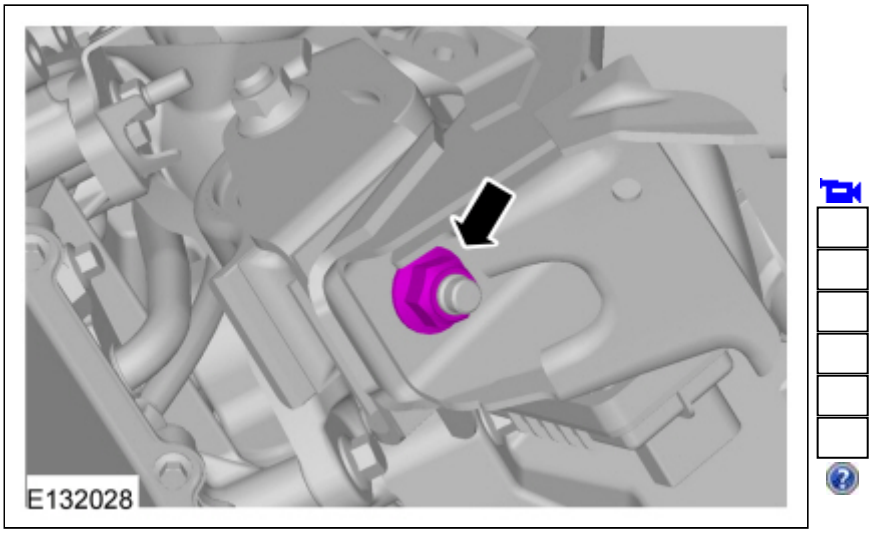


8.



9. Raise the Vehicle.

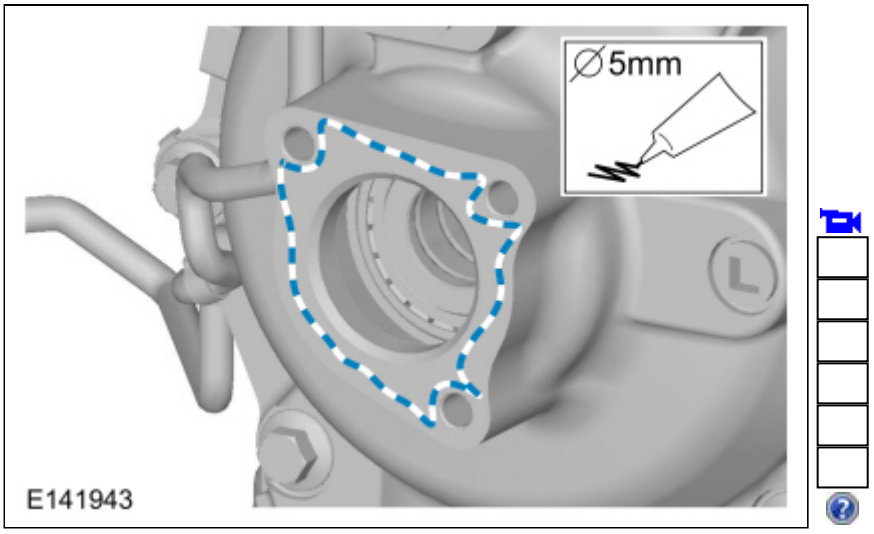
10. On both sides.
    Torque: 175 Nm



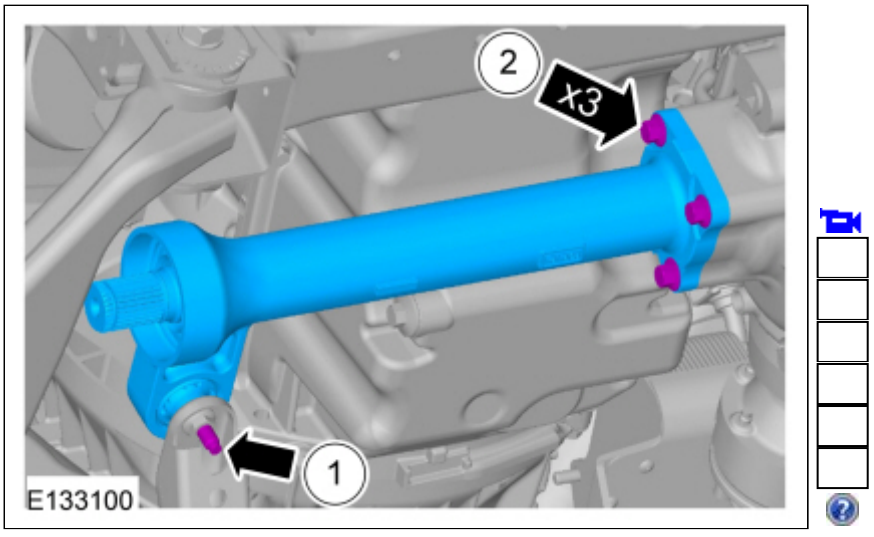
11. **NOTICE: Install the Front axle tube within five minutes of applying the sealer.**

    NOTE: *Do not damage the mating faces.*

    Material: WSS-M4G323-A8



1. *Torque*: 70 Nm
2. *Torque*: 40 Nm



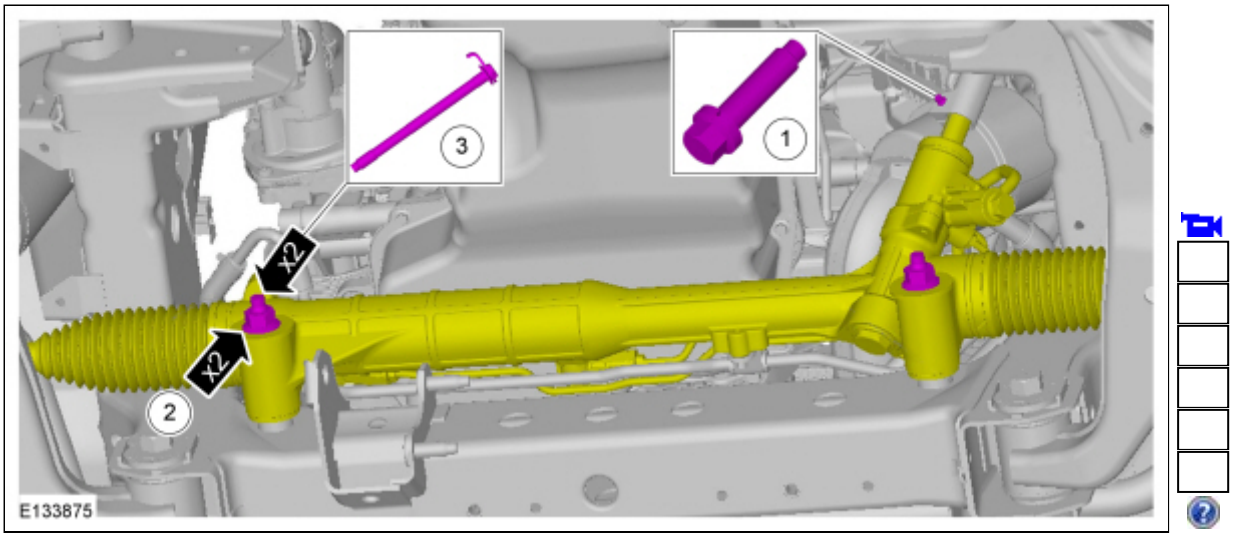
13. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

14. Install the front wheel.
    Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

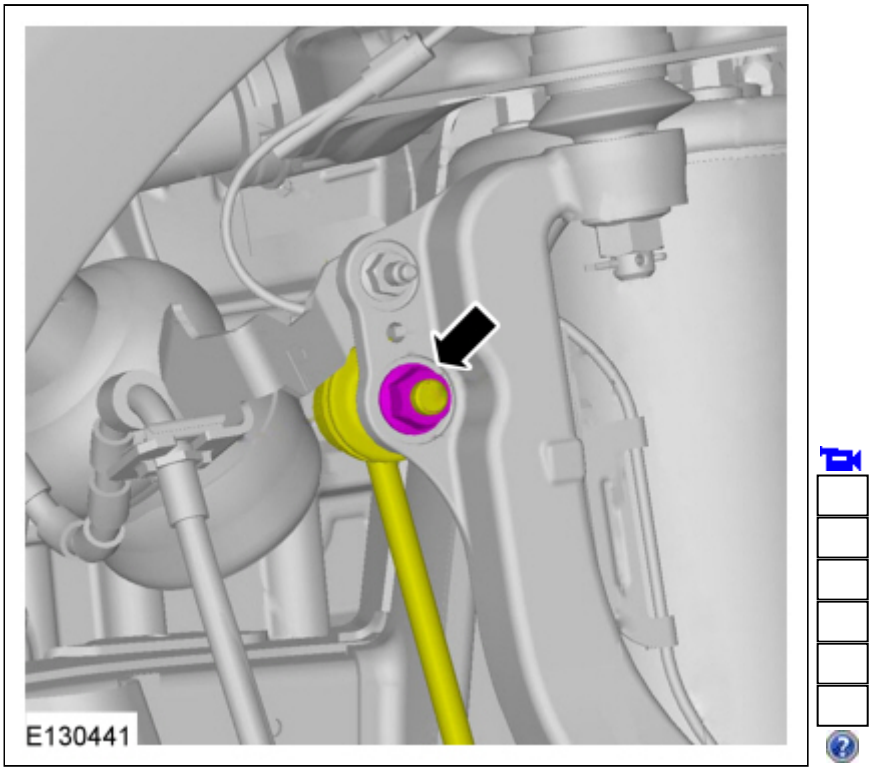
15. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

All vehicles

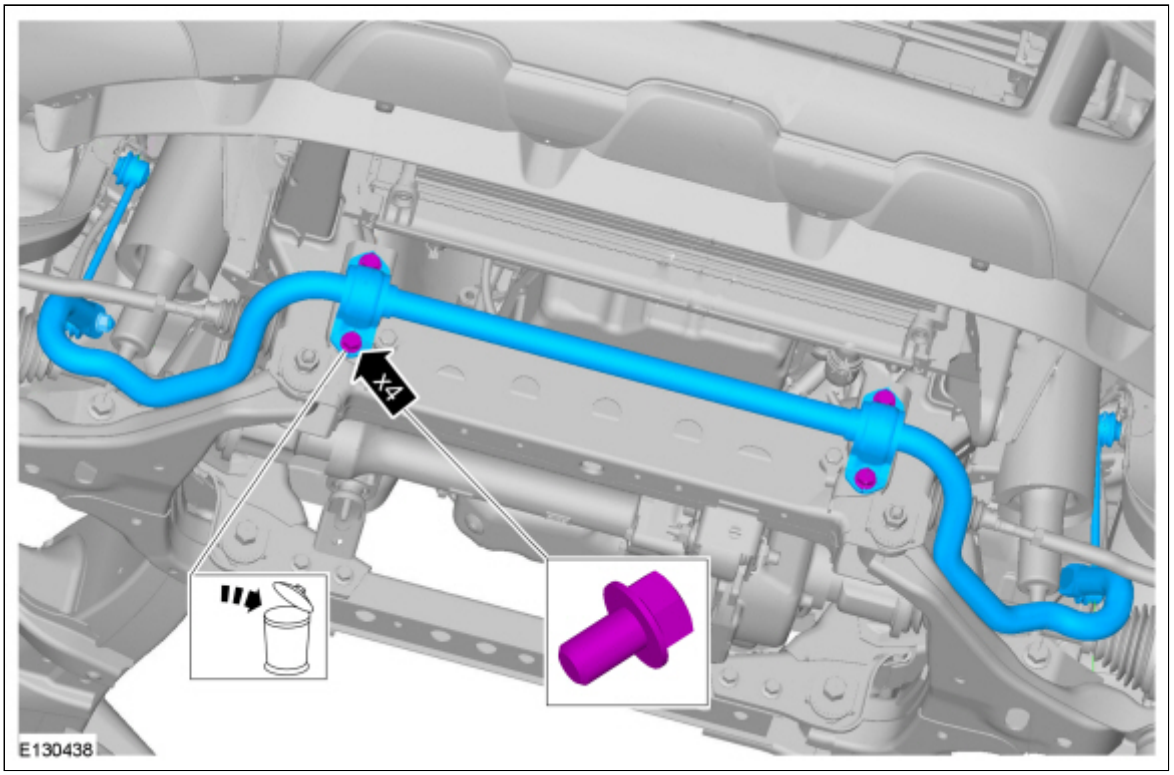
16. *Torque*: 150 Nm



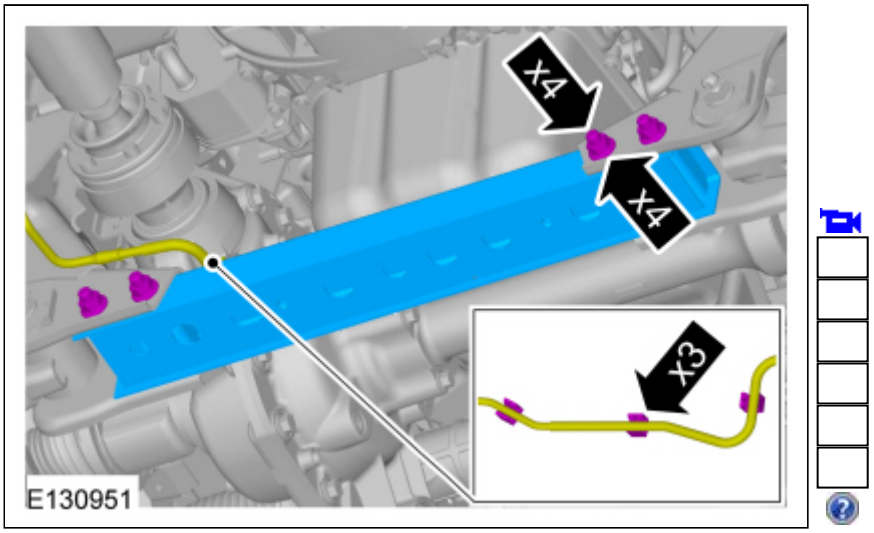
17. *Torque*: 90 Nm



18. *Torque*: 90 Nm



19. *Torque*: 90 Nm



20. Lower the vehicle.

21. Fill the oil pan with clean engine oil.
    Refer to: Specifications - Vehicles Built Up To: 16-08-2015 (303-01 Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) .

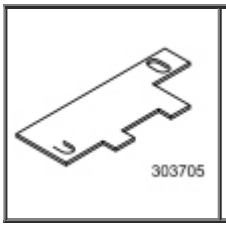
22. Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .

Copyright © 2016 Ford Motor Company

Oil Pump

Base Part Number: 6621

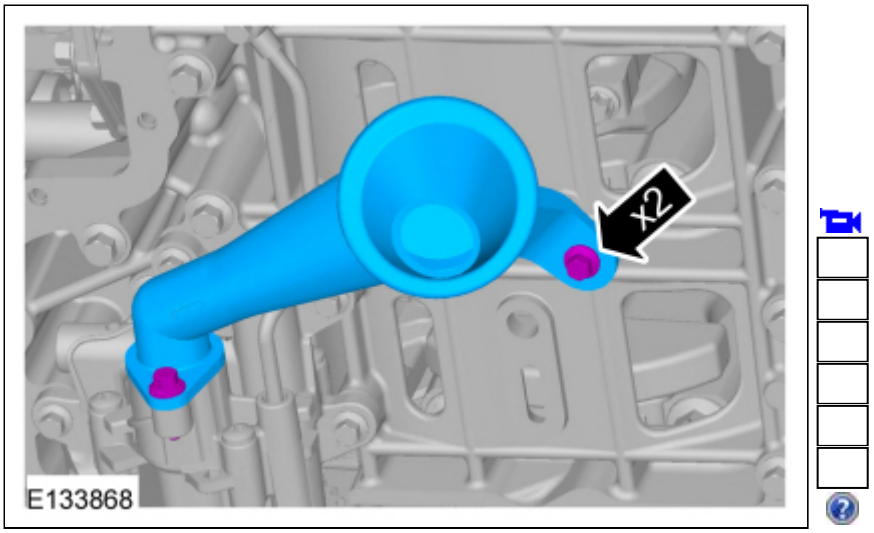
Special Tool(s) / General Equipment

	303-705 Aligner, Oil Pump

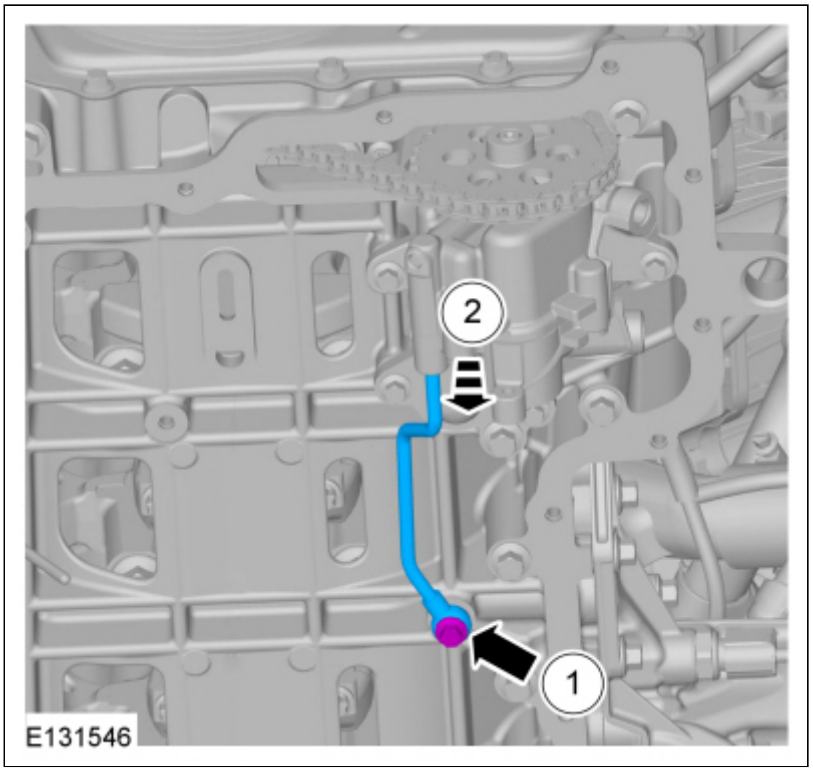
Materials

Name	Specification
Engine Oil - SAE 5W-30	WSS-M2C913-C

Removal

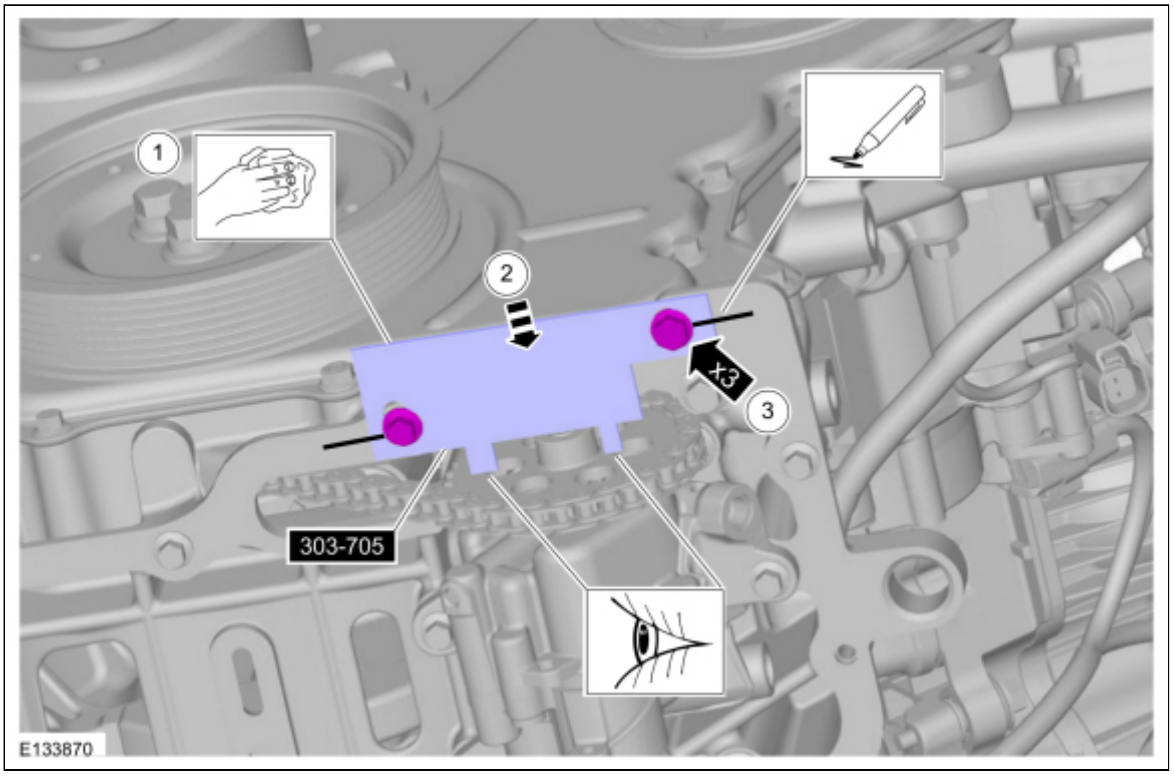
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Oil Pan - 4WD (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Oil Pan - 4x2 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
3. 

4. **WARNING: Be prepared to collect escaping fluids.**



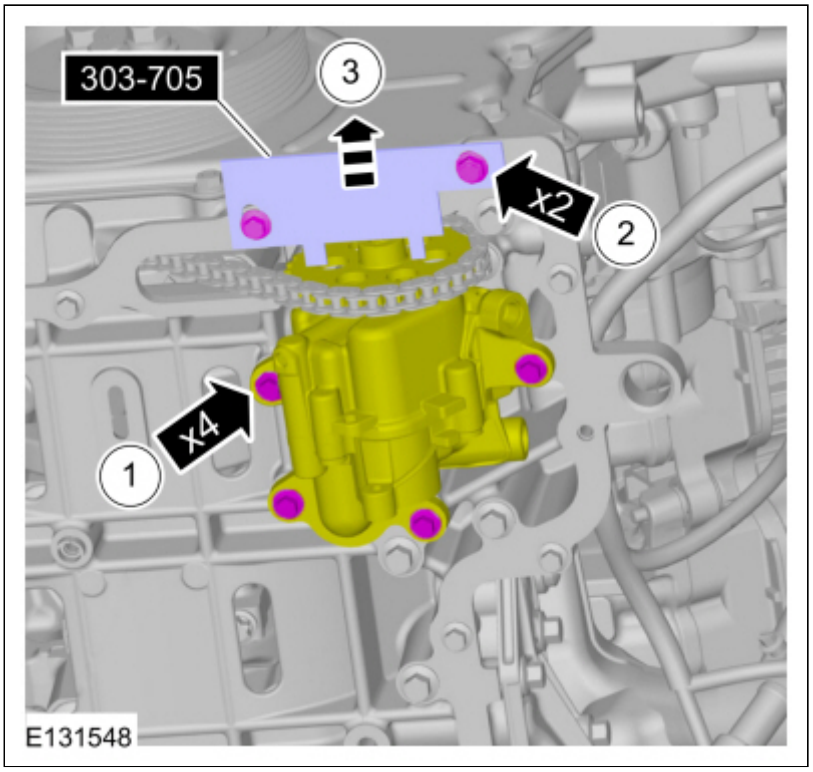
1. **NOTE:** *Make sure that the surface is clean and free of foreign material.*

2. Use Special Service Tool: 303-705 Aligner, Oil Pump.
3. *Torque*: 15 Nm

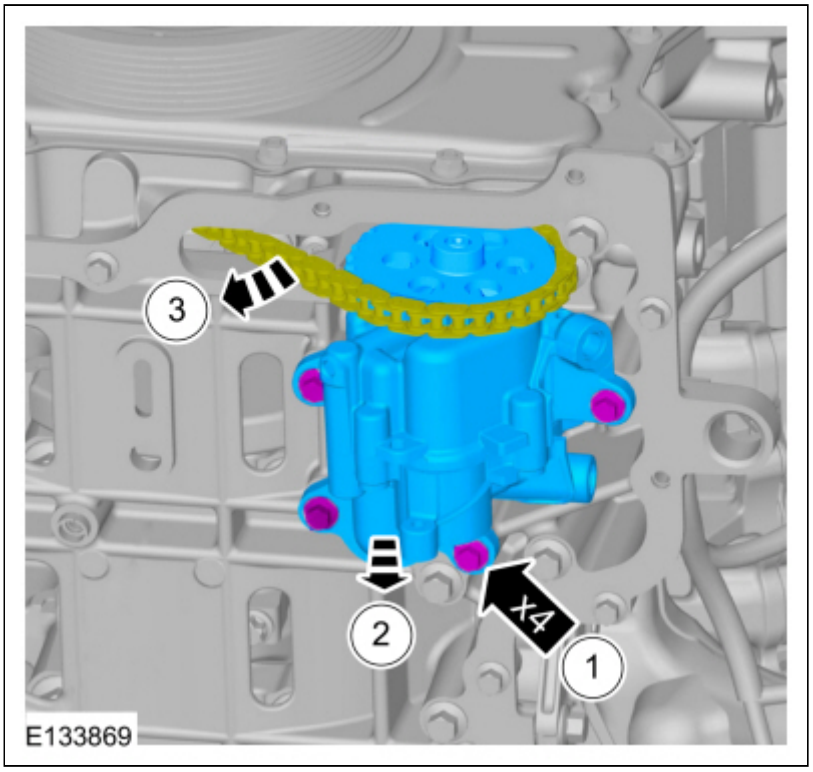


6. **NOTE:** *Do not completely loosen the bolts at this stage.*

   Remove Special Service Tool: 303-705 Aligner, Oil Pump.



7.

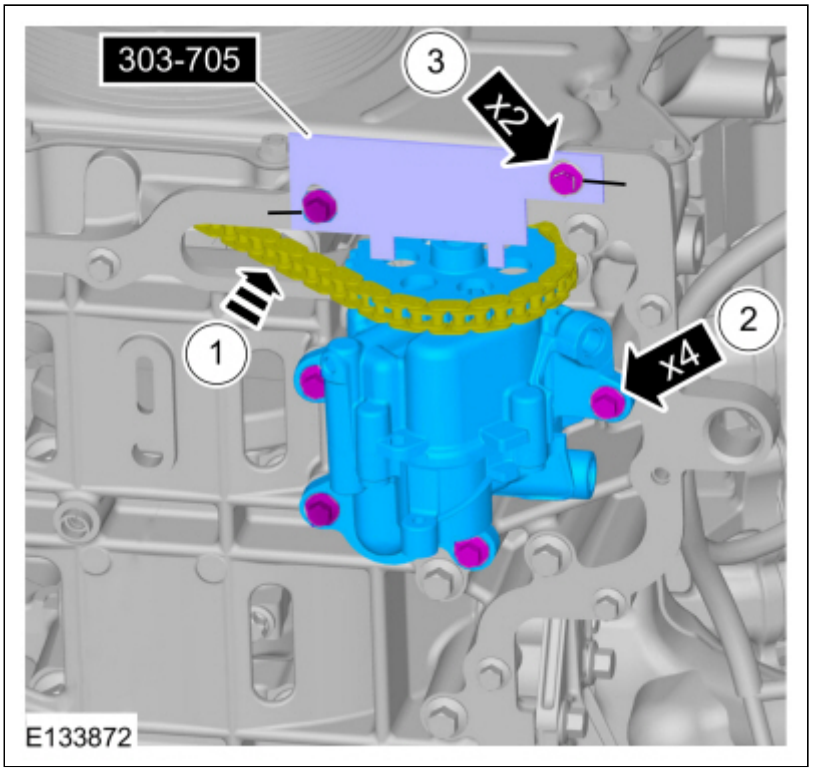


Installation

1. **NOTE:** *Only tighten the bolts finger tight at this stage.*

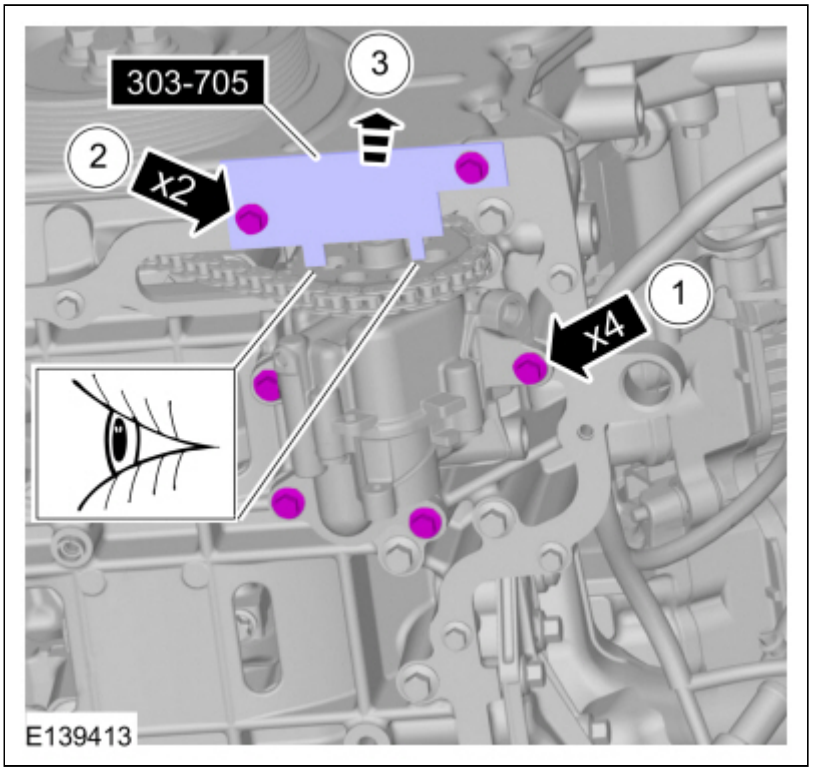
   NOTE: *Make sure that the installation marks are aligned.*

   Use Special Service Tool: 303-705 Aligner, Oil Pump.



2. **NOTE:** *The profile of the special tool must be in contact with the component.*

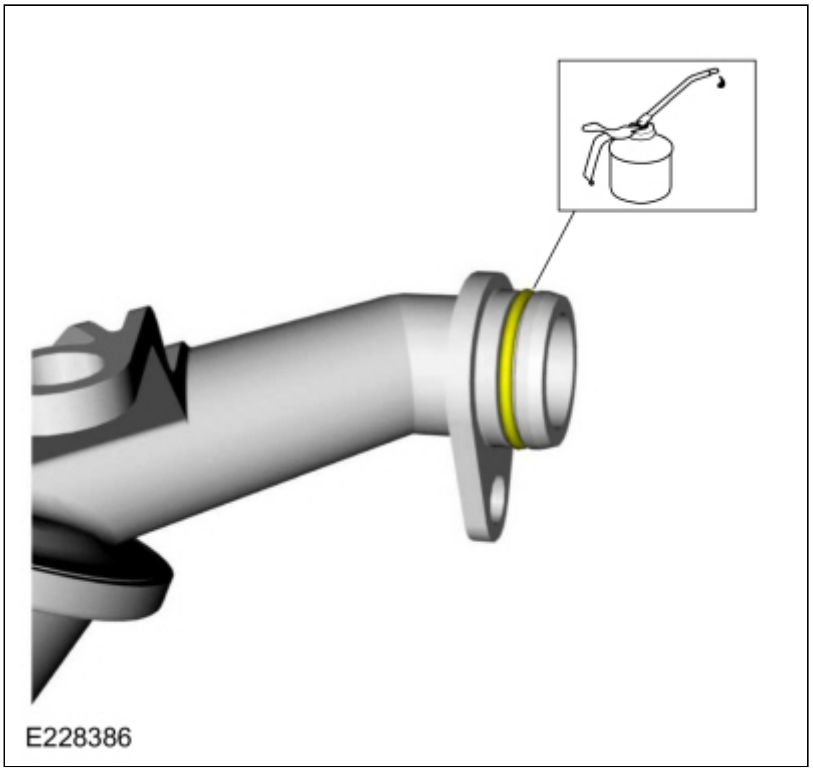
   Remove Special Service Tool: 303-705 Aligner, Oil Pump.
   Torque: 10 Nm



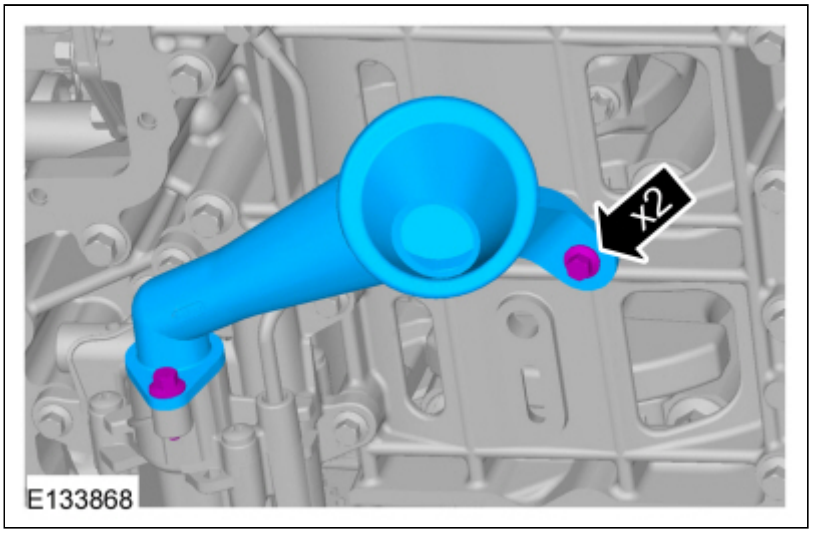
3. **NOTE:** *Lubricate the "O" ring before installing.*

   Make sure that a new component is installed if the O-ring is damaged.

   Inspect the O-ring before installation.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



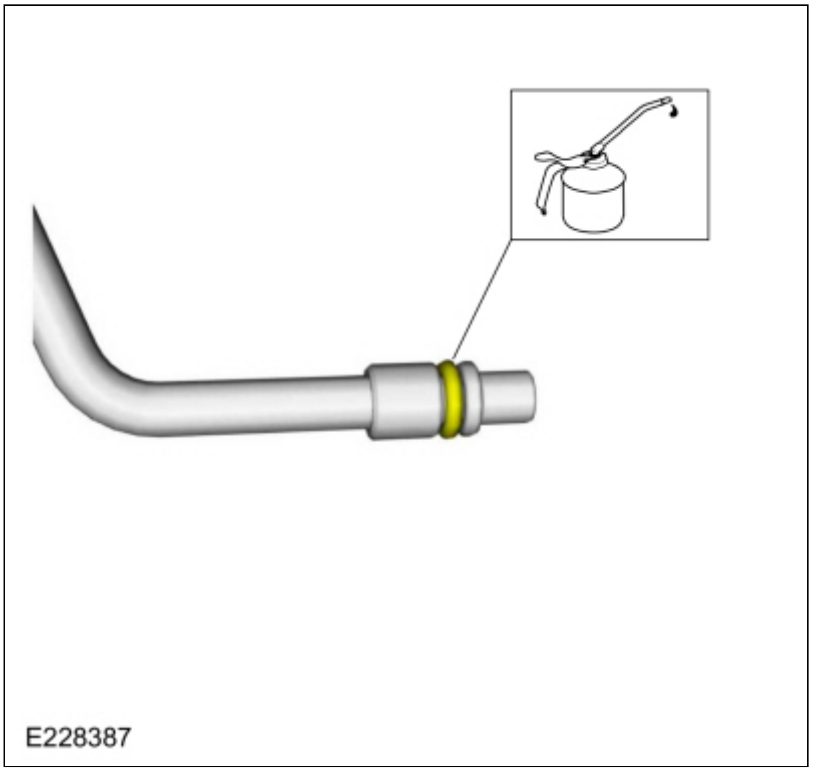
4. *Torque*: 10 Nm



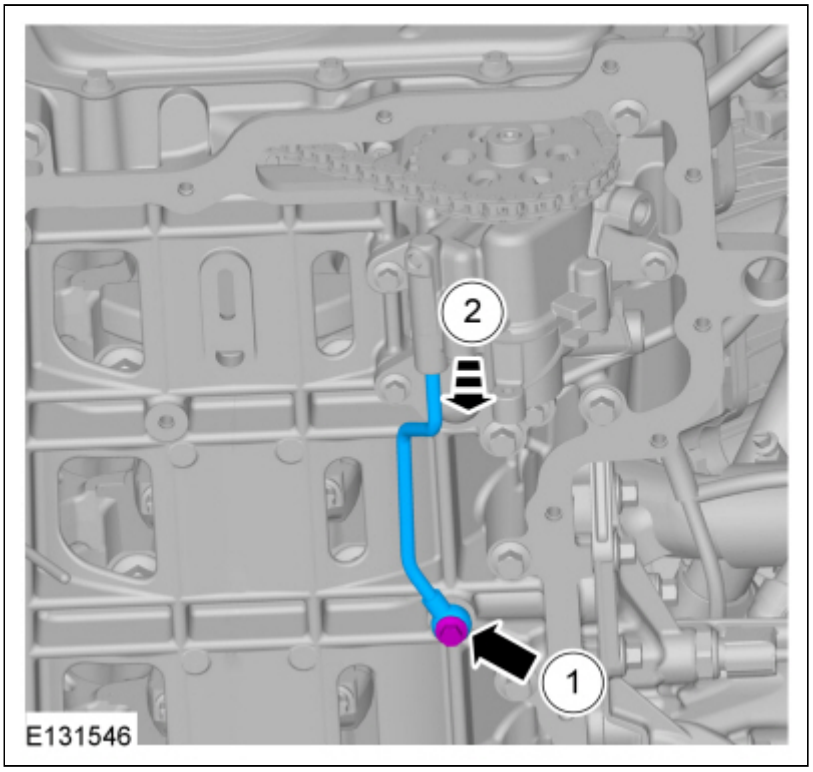
5. **NOTE:** *Lubricate the "O" ring before installing.*

   Make sure that a new component is installed if the O-ring is damaged.

   Inspect the O-ring before installation.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



6. *Torque*: 13 Nm

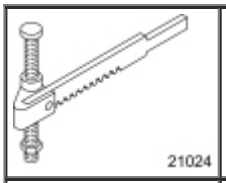
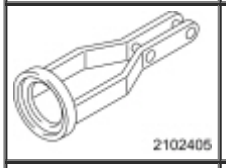
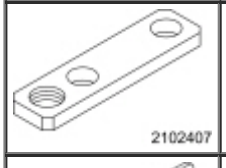
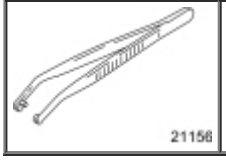


7. Refer to: Oil Pan - 4WD (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Oil Pan - 4x2 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Valves

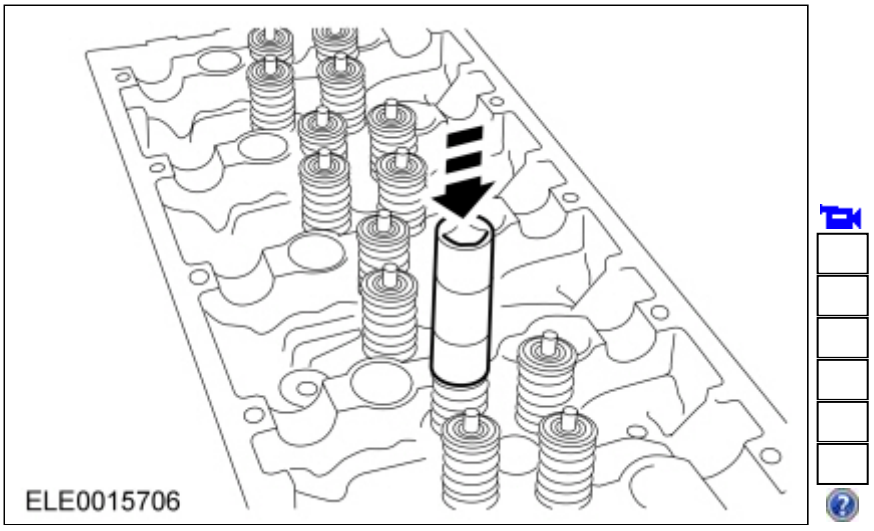
Special Tool(s) / General Equipment

 21024	303-060 Compressor, Valve Spring
 2102405	303-060-05 Adapter for 303-060
 2102407	303-060-07 Adapter for 303-060
 21156	303-362 Installer, Valve Stem Collets

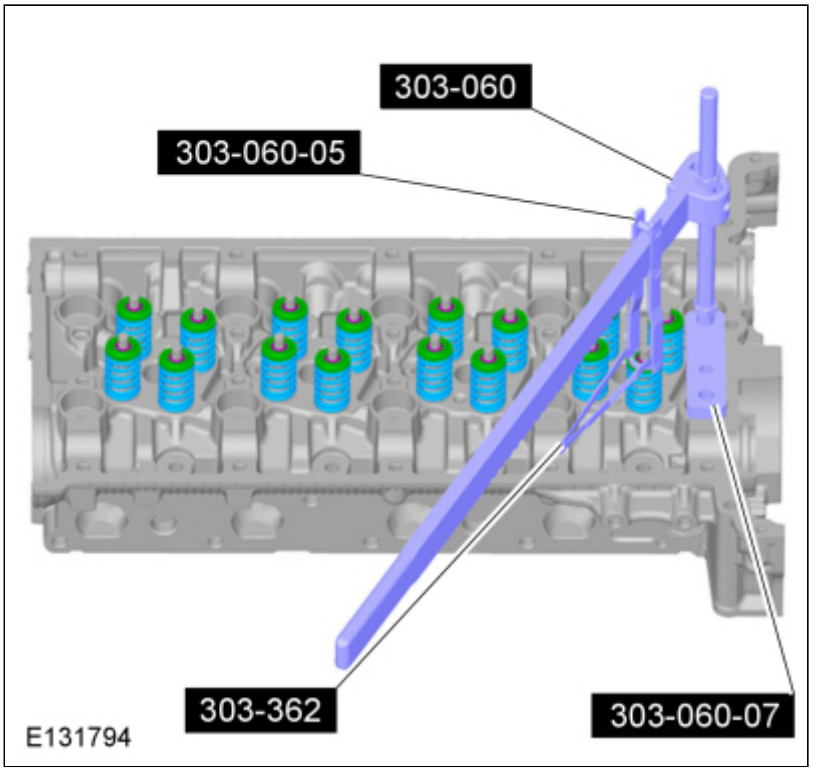
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

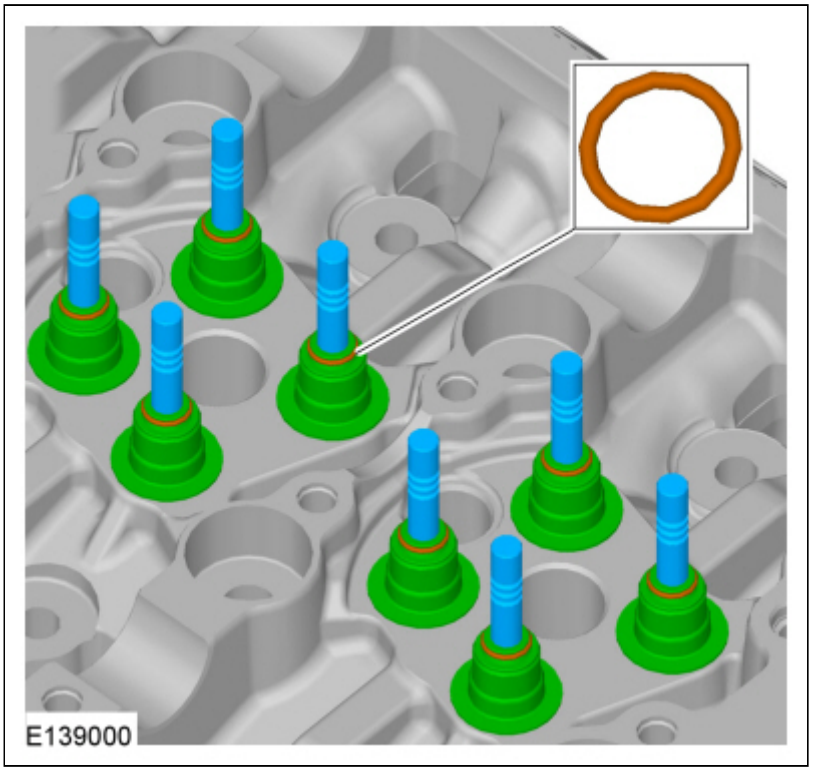
1. Refer to: Cylinder Head (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
2. **NOTE:** *Position a socket on the valve spring seat and gently strike it with a hammer.*



3. Use Special Service Tool: 303-060 Compressor, Valve Spring. , 303-060-05 Adapter for 303-060. , 303-060-07 Adapter for 303-060. , 303-362 Installer, Valve Stem Collets.



4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

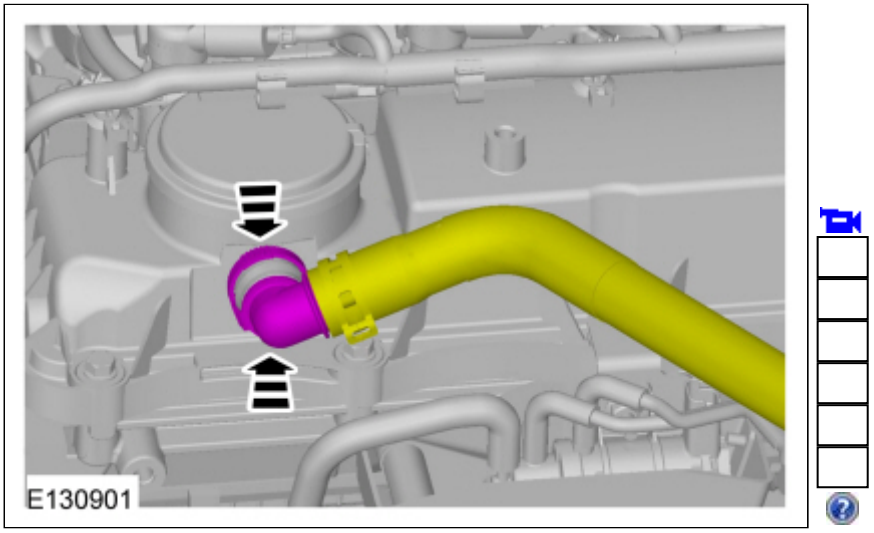
Valve Cover

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

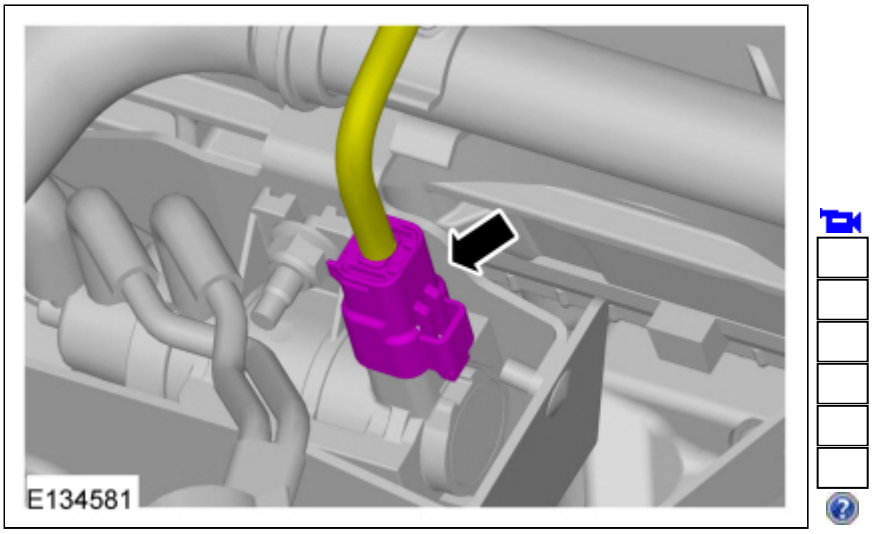
All vehicles

1.

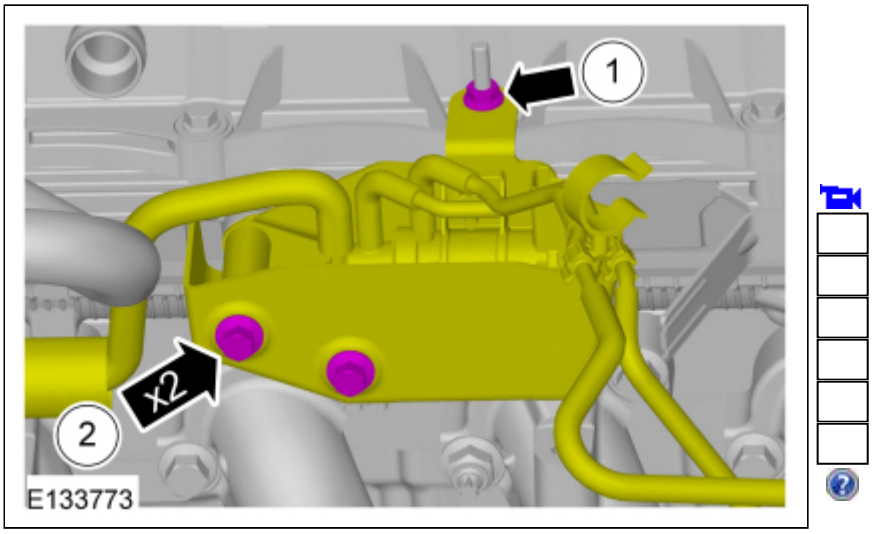


Vehicles with fixed vane turbocharger

2.



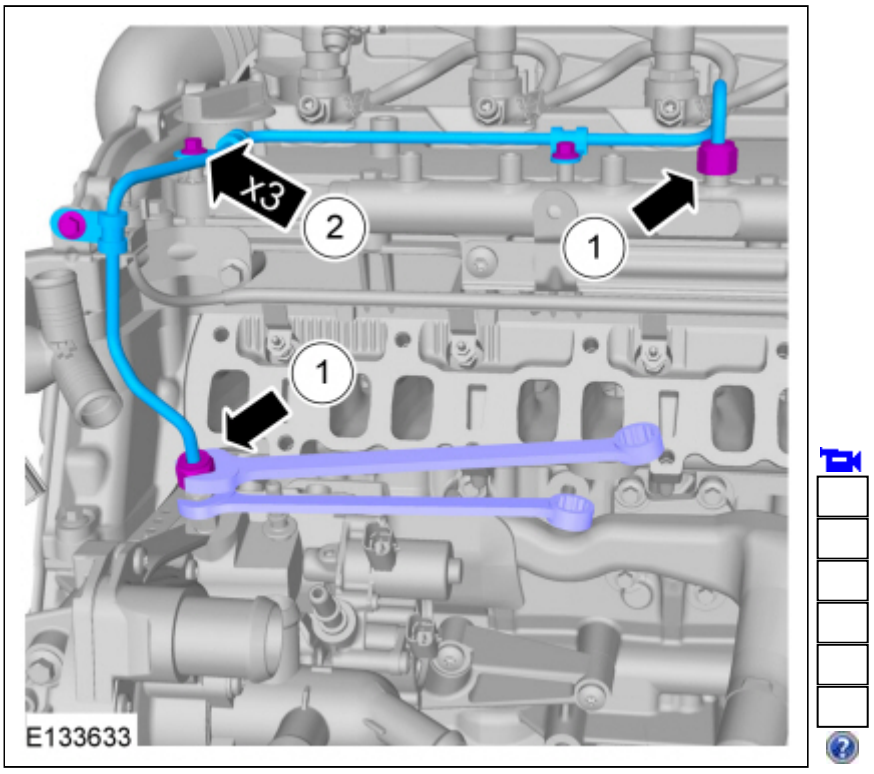
1. *Torque*: 10 Nm
2. *Torque*: 23 Nm



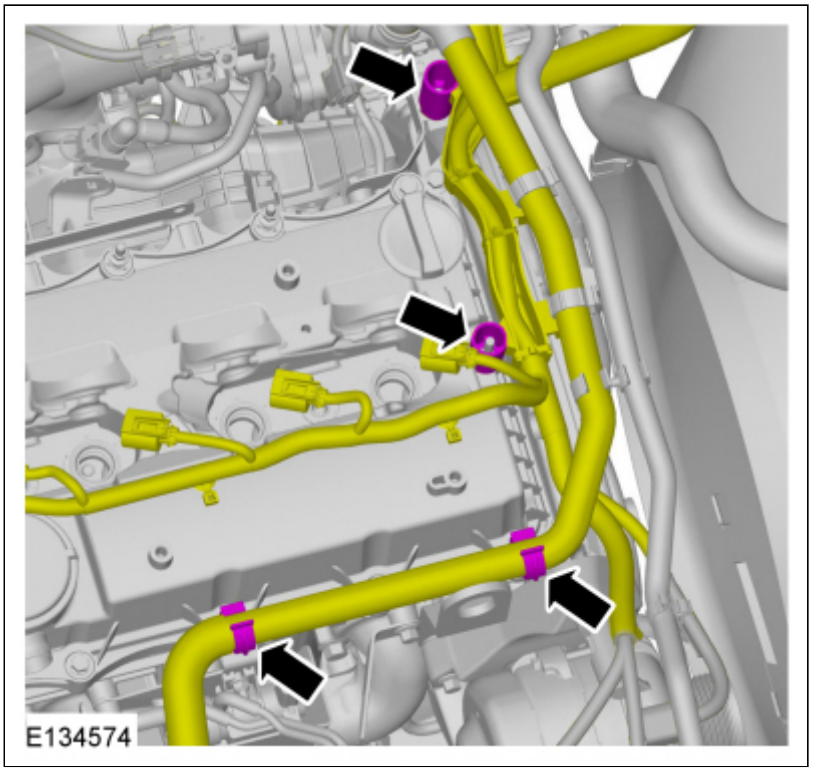
All vehicles

4. Refer to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

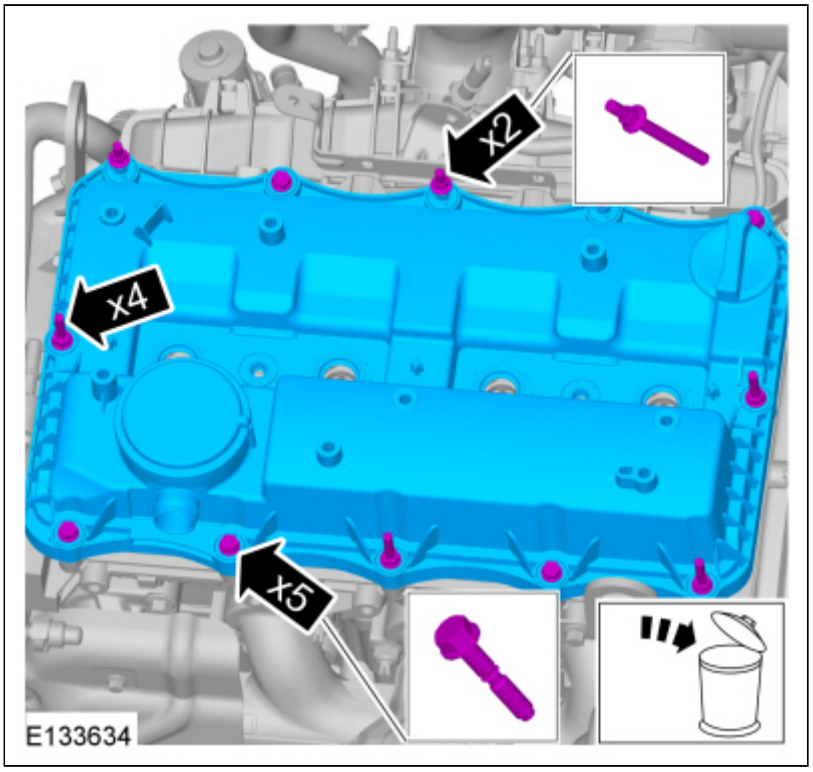
1. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 35 Nm
2. *Torque*: 10 Nm



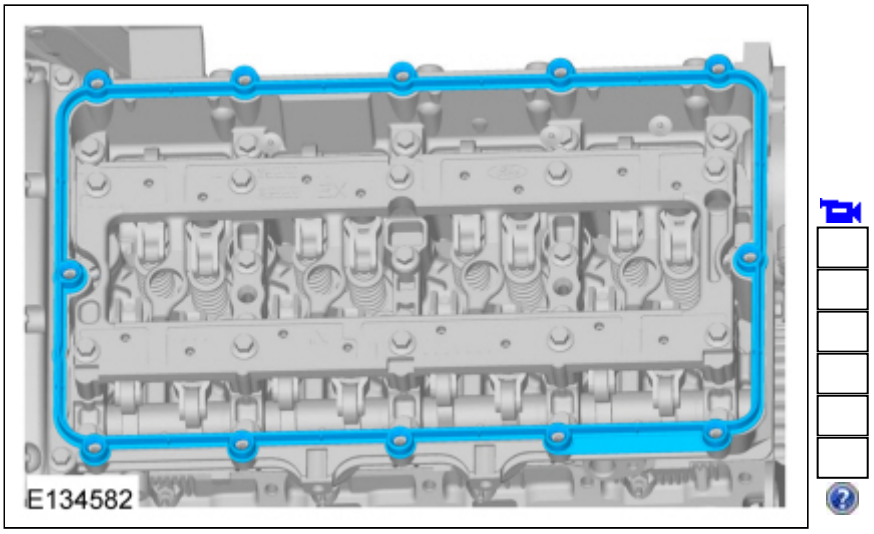
6.



7. *Torque*: 10 Nm



8.



Installation

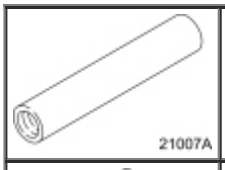
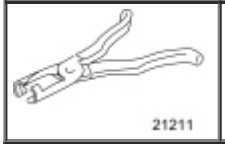
NOTE: *Install a new valve cover gasket as necessary.*

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Valve Stem Seals

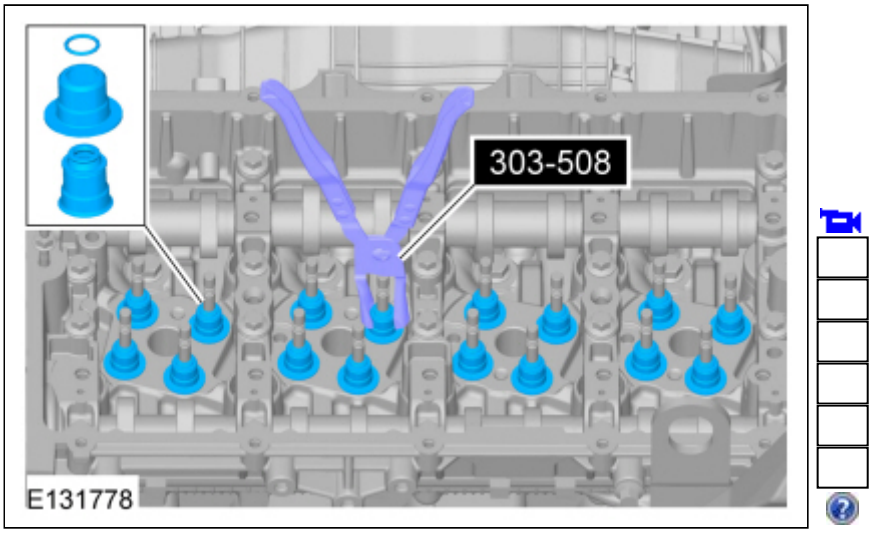
Special Tool(s) / General Equipment

	303-037 Installer, Valve Stem Seal
	303-508 Pliers, Valve Stem Seal

Removal

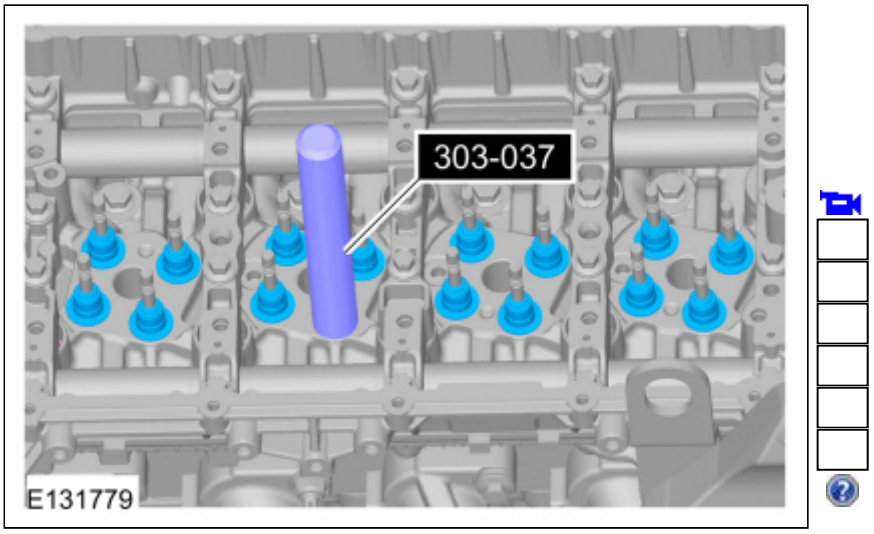
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Valve Springs (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
2. Use Special Service Tool: 303-508 Pliers, Valve Stem Seal.



Installation

1. Use Special Service Tool: 303-037 Installer, Valve Stem Seal.

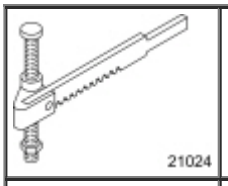
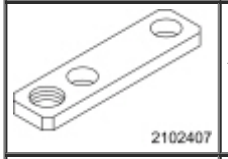
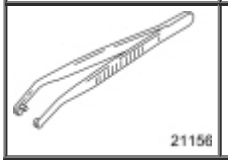


2. Refer to: Valve Springs (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

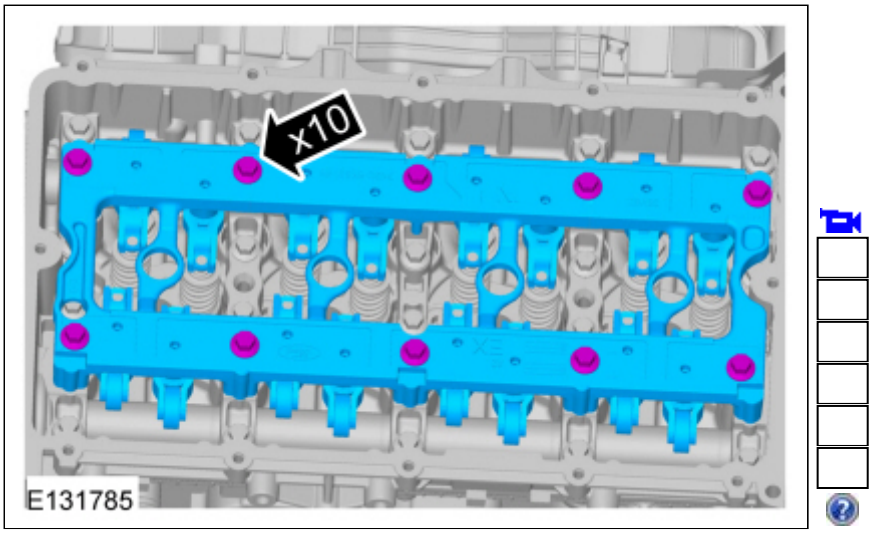
Valve Springs

Special Tool(s) / General Equipment

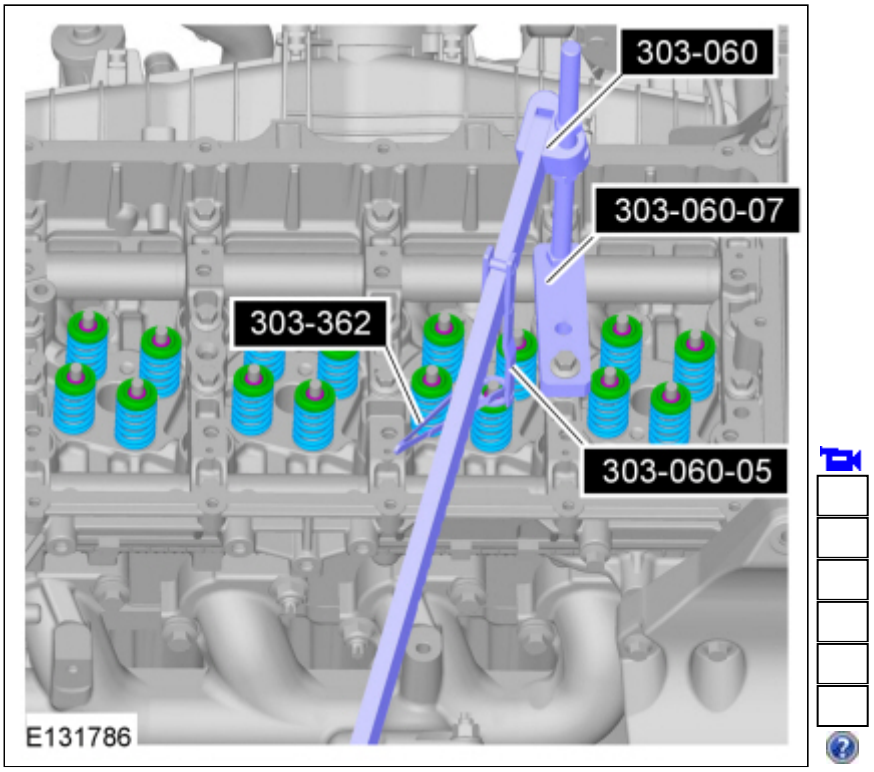
 21024	303-060 Compressor, Valve Spring
 2102405	303-060-05 Adapter for 303-060
 2102407	303-060-07 Adapter for 303-060
 21156	303-362 Installer, Valve Stem Collets

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

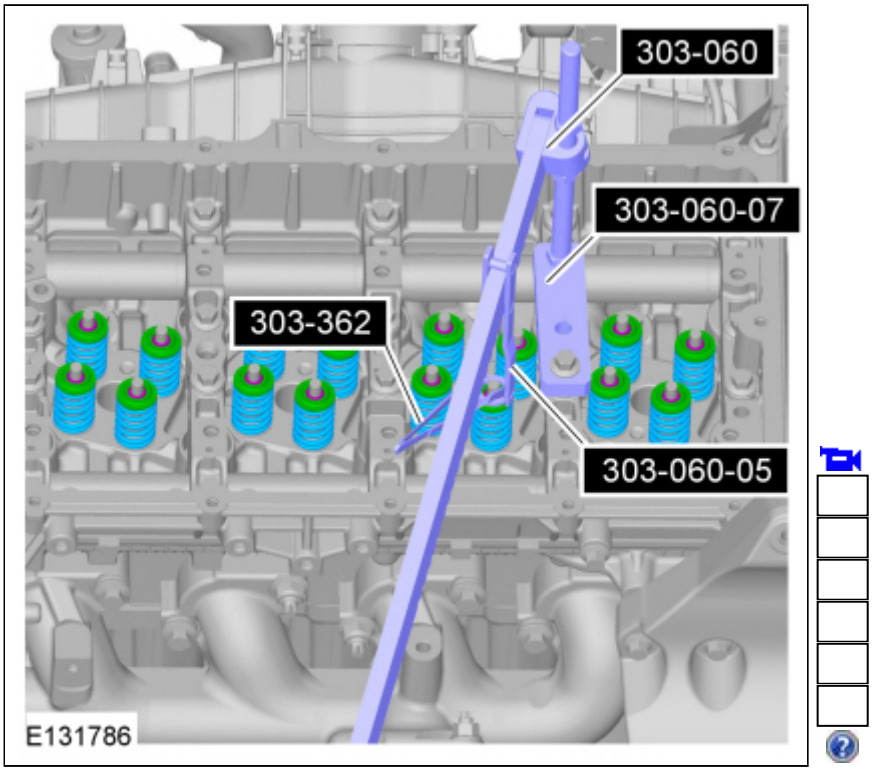
1. Refer to: Valve Cover (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
2. 

3. Position the appropriate piston at top dead center (TDC).
4. Using the special tools, remove the valve collets.
   Use Special Service Tool: 303-060 Compressor, Valve Spring. , 303-060-05 Adapter for 303-060. , 303-060-07 Adapter for 303-060. , 303-362 Installer, Valve Stem Collets.

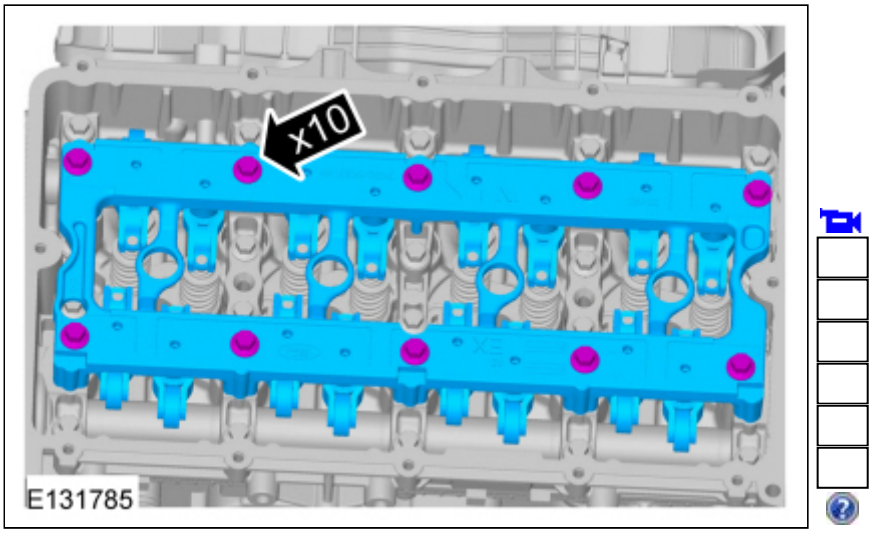


Installation

1.



2. Ensure rockers are seating on the valve tip prior to commencing rundown.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 8 Nm
   Stage 3: 10 Nm
   Stage 4: 45°



3. Refer to: Valve Cover (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Engine - 5-Speed Manual Transmission - MT75

Base Part Number: 6L084

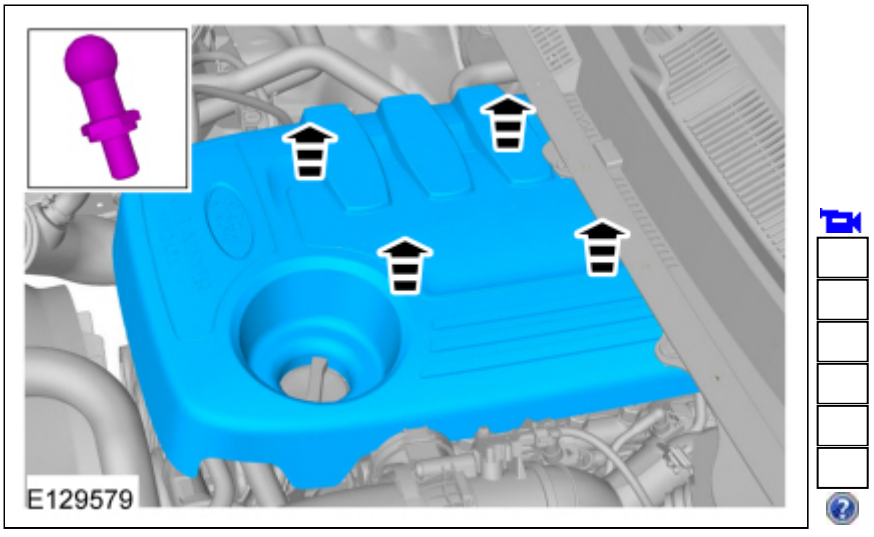
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
Transmission Jack	

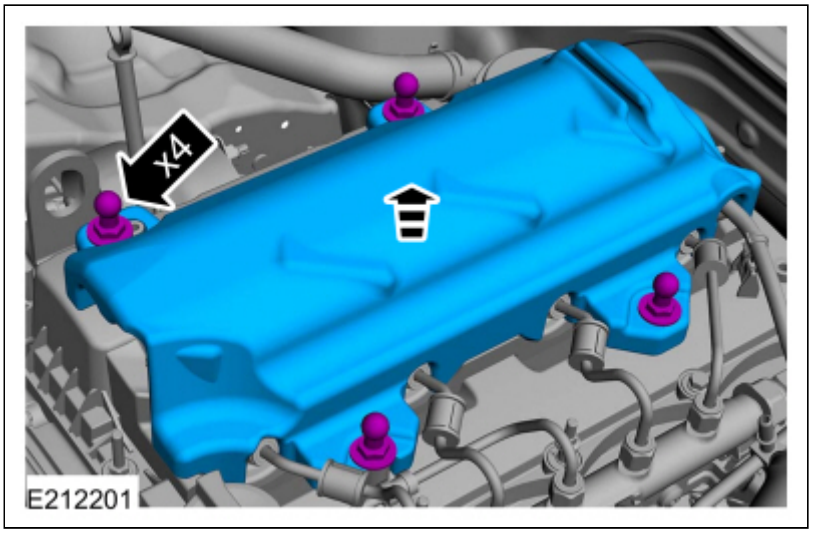
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

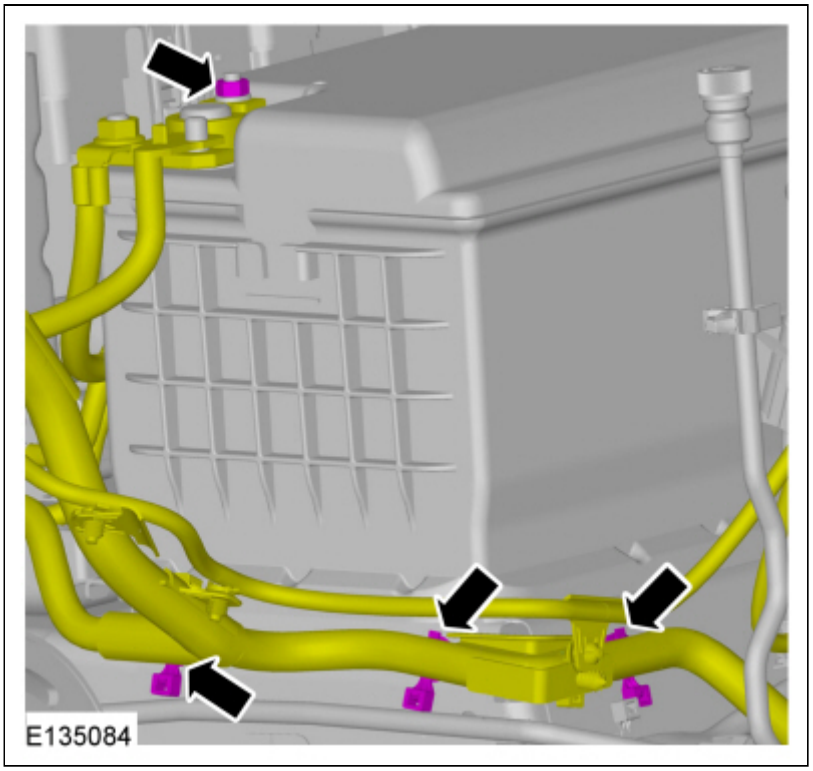
6.



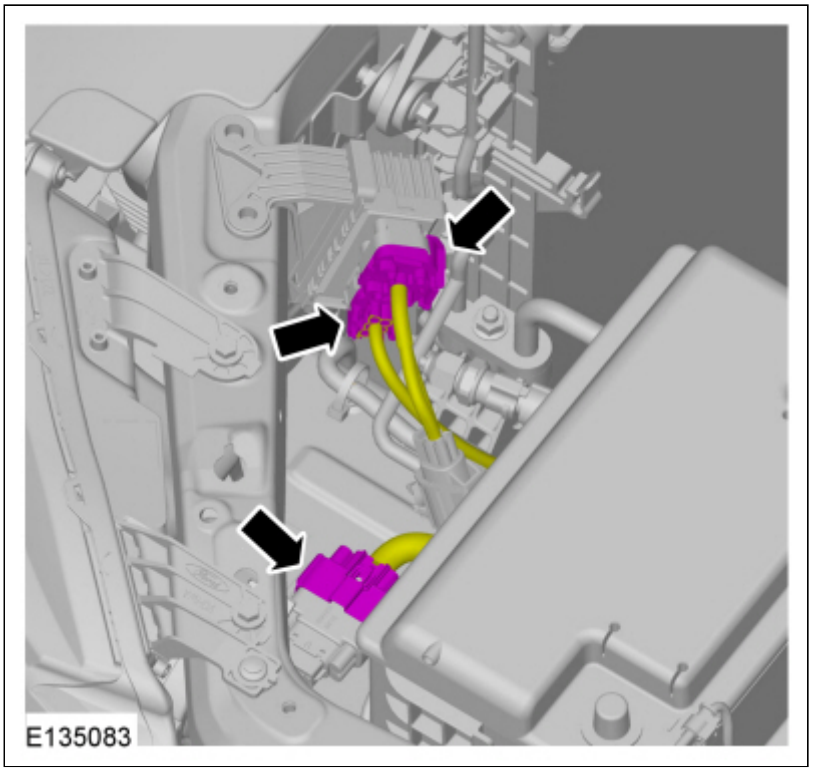
7.



8. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
9. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
10.



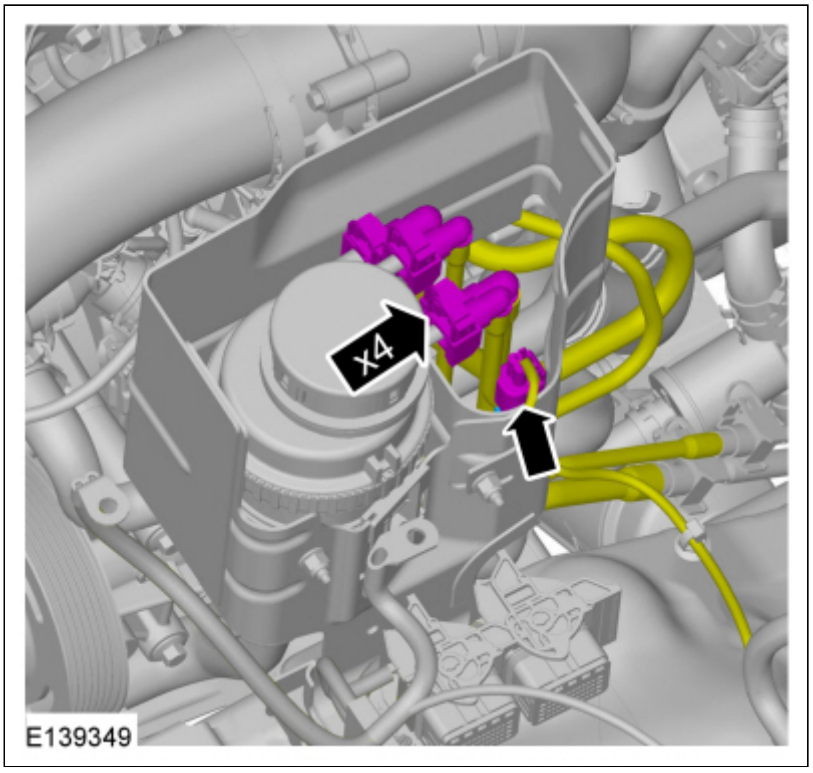
11.



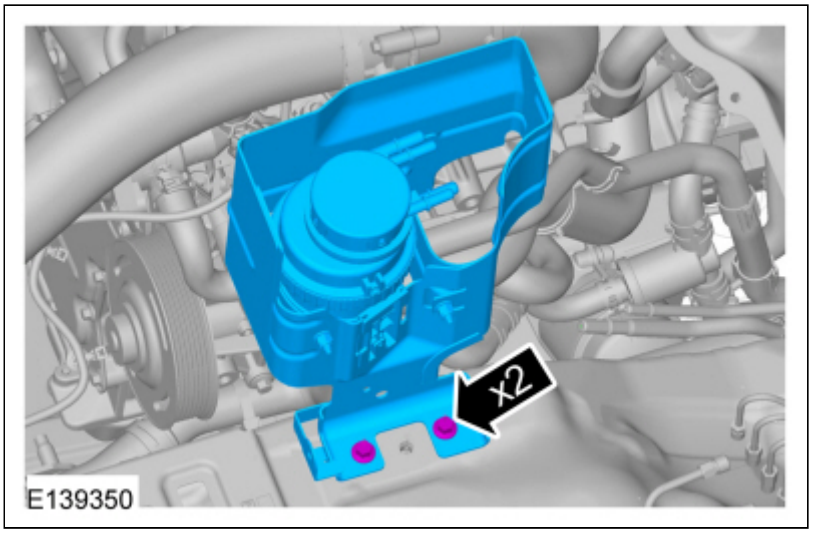
12. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

13. Refer to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
    Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

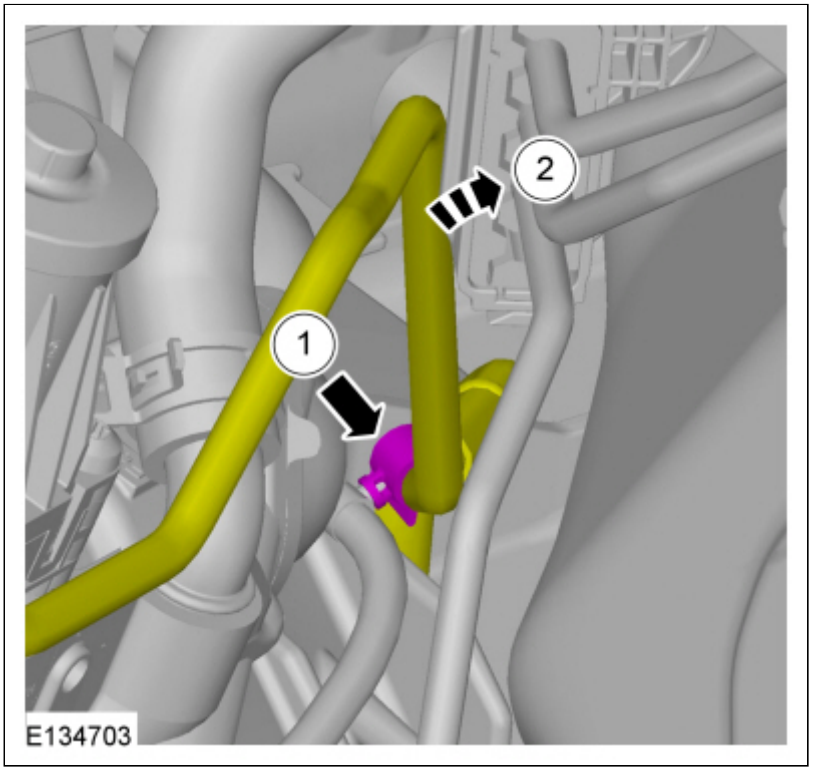
14.



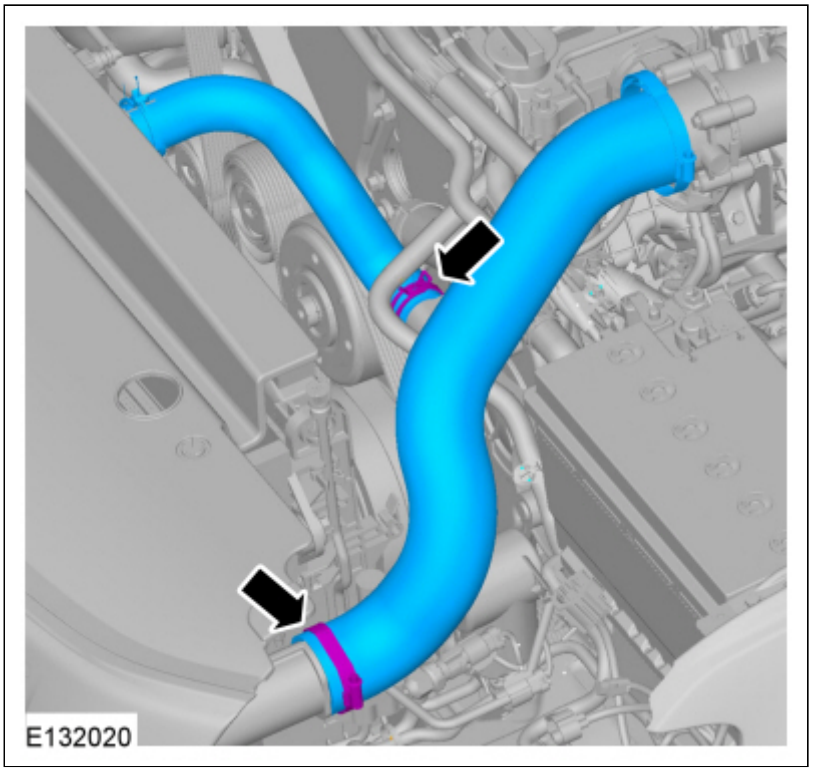
15.



16.



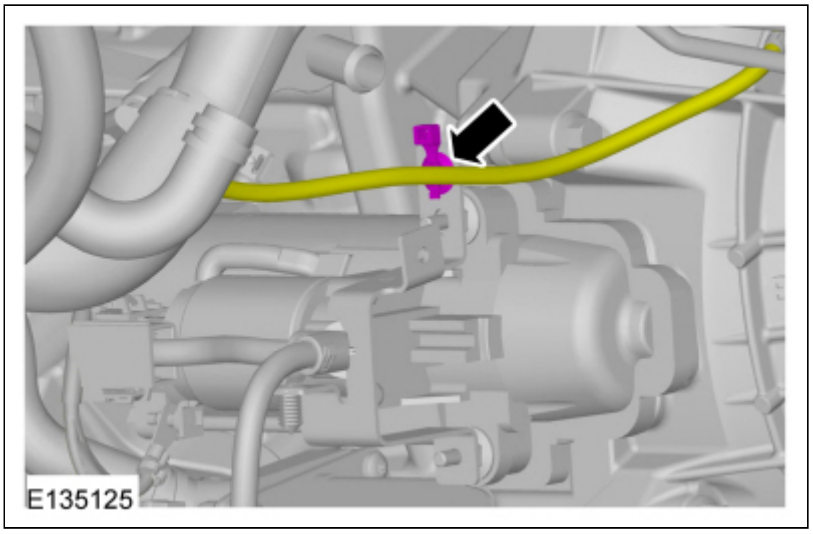
17.



18. Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

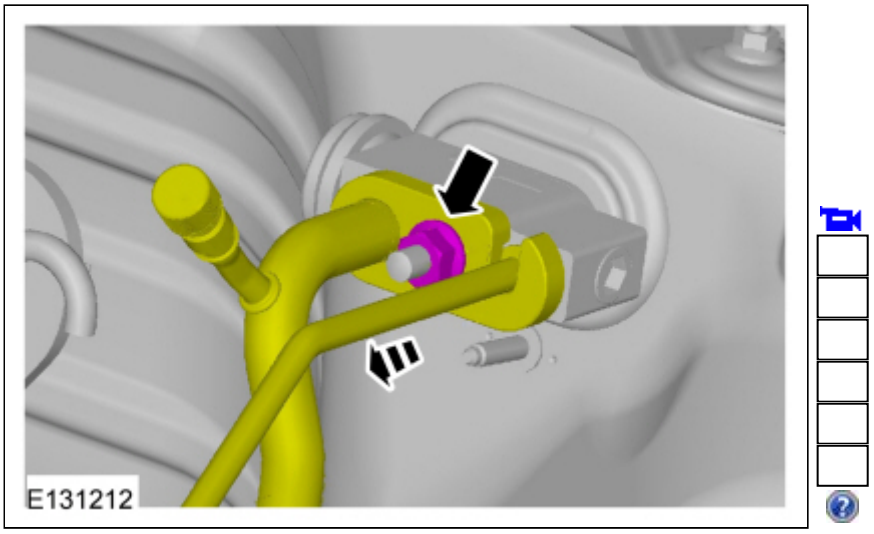
19. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

20.

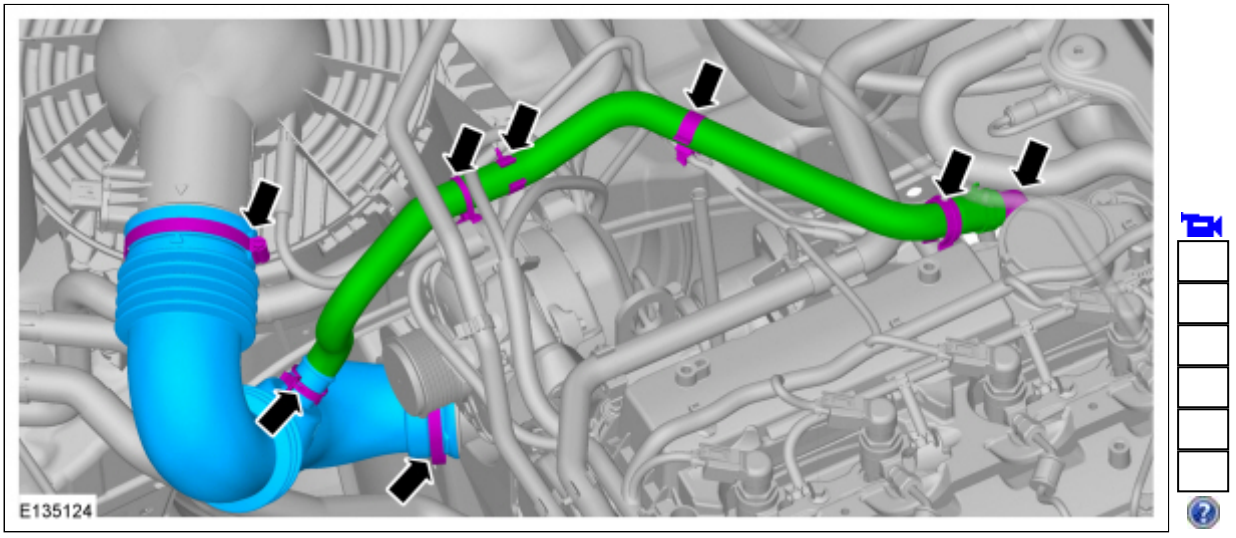


21. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

22.



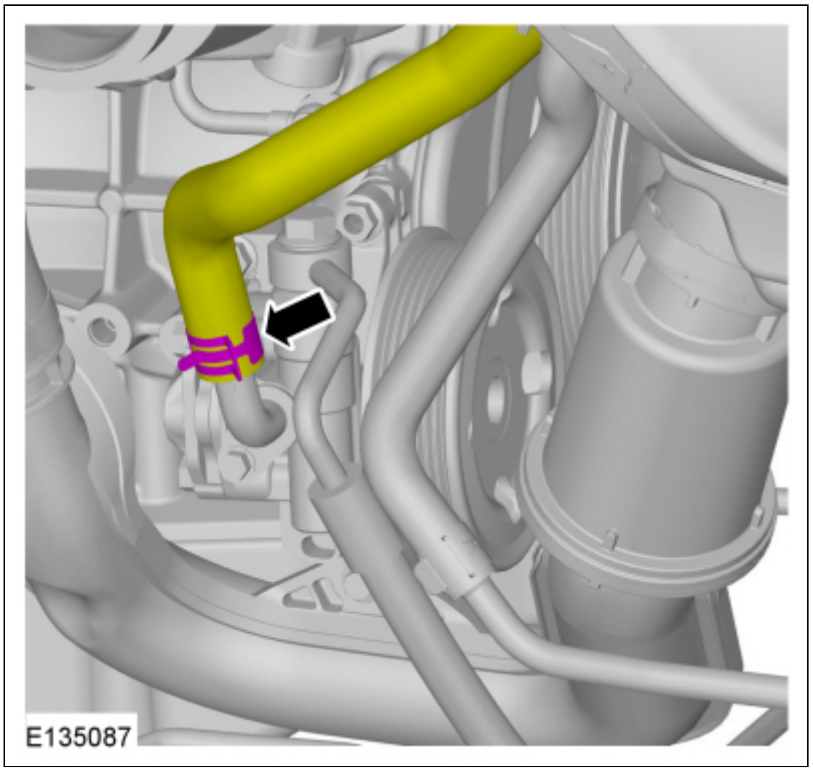
23.



24. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

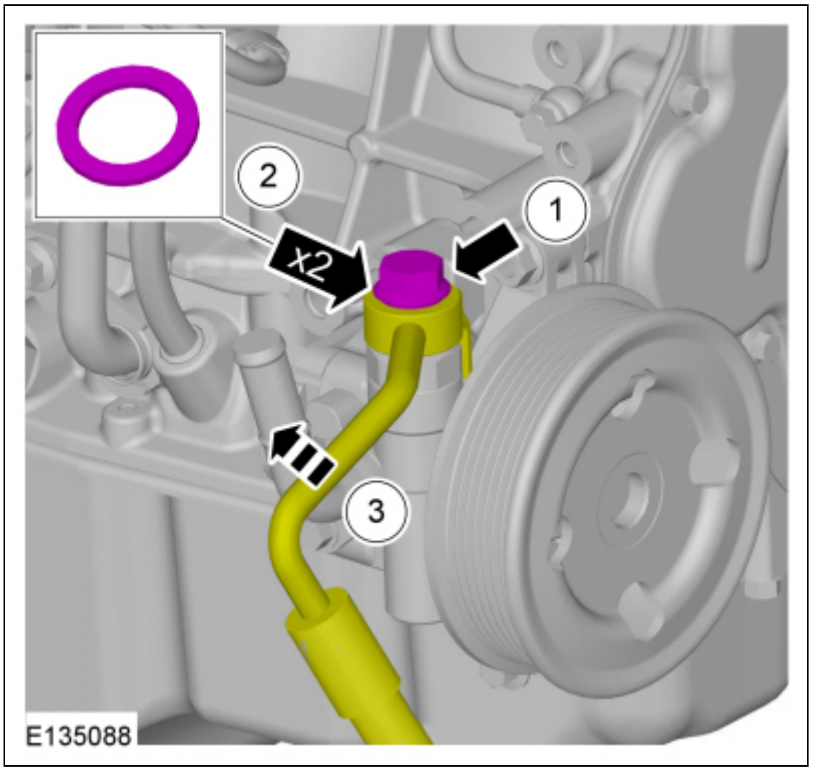
Vehicles With: Hydraulic Power Assist Steering (HPAS)

25. **NOTE:** *Make sure that all openings are sealed.*



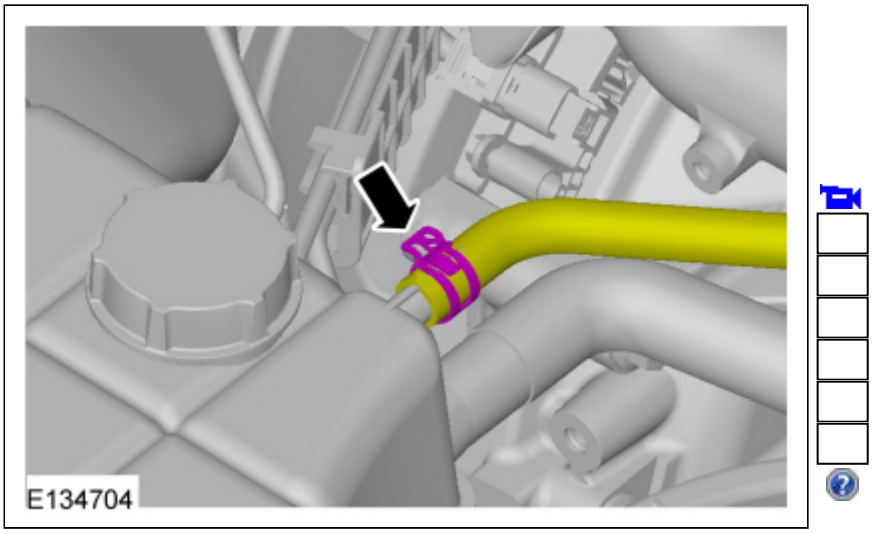
26. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

    NOTE: *The washers can be reused unless damaged.*

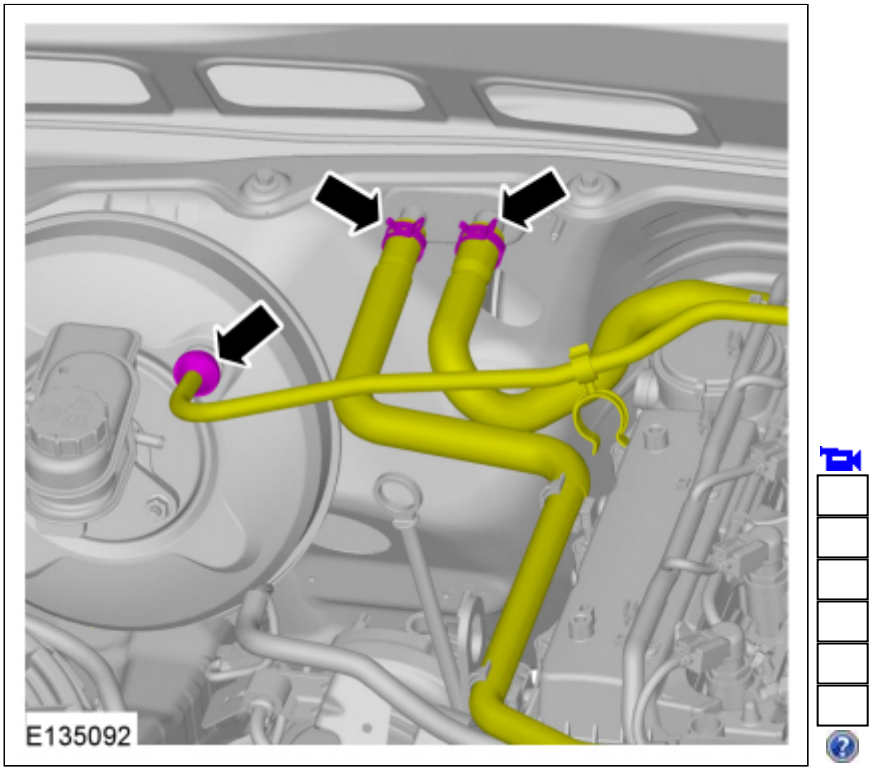


All vehicles

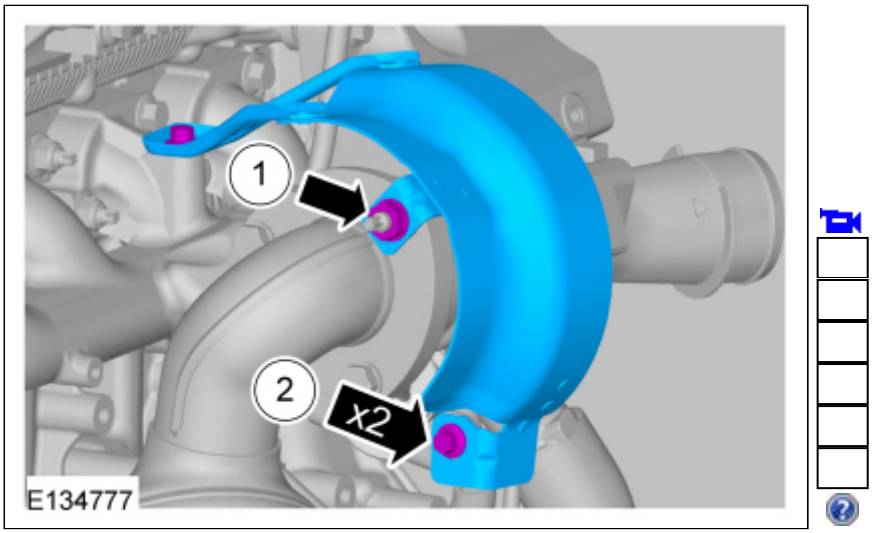
27.



28.



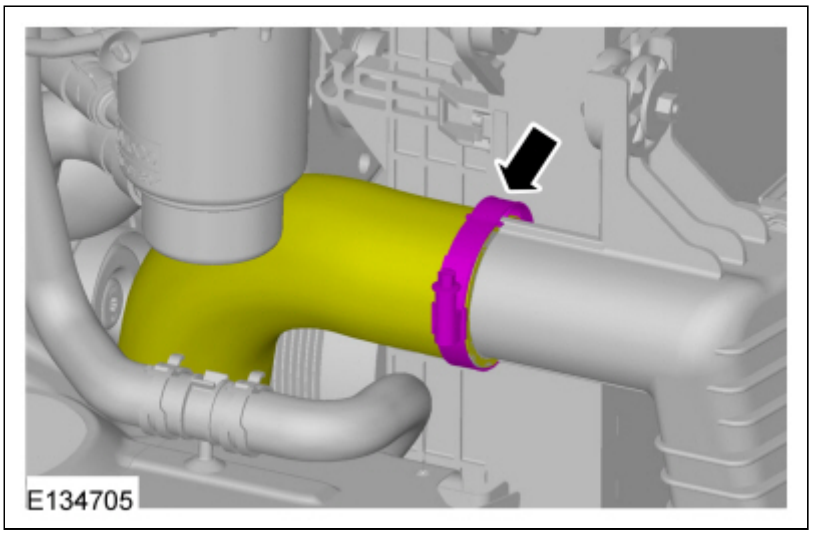
29.



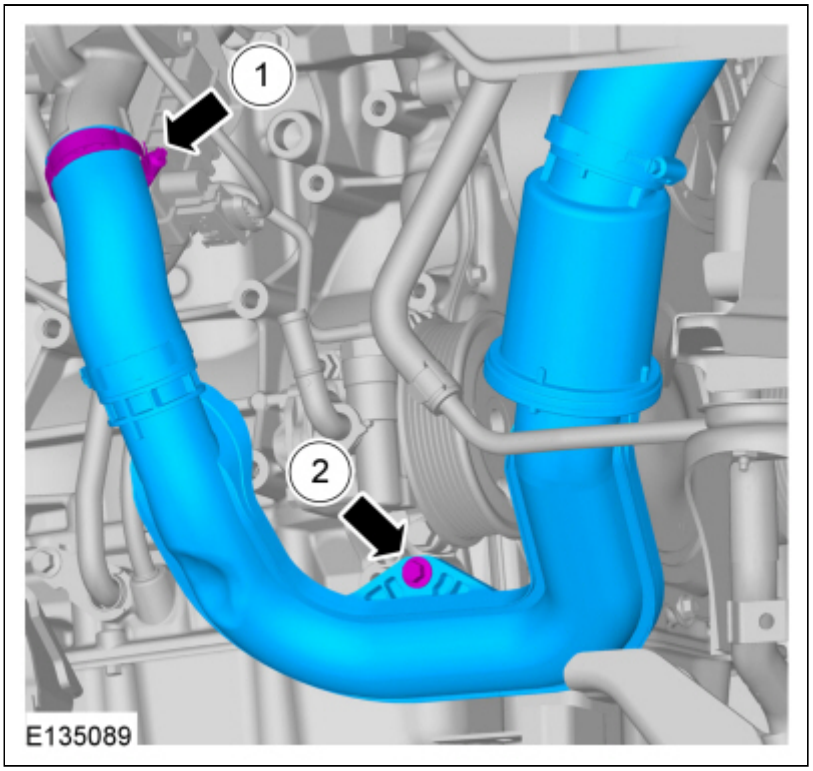
30. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L

Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

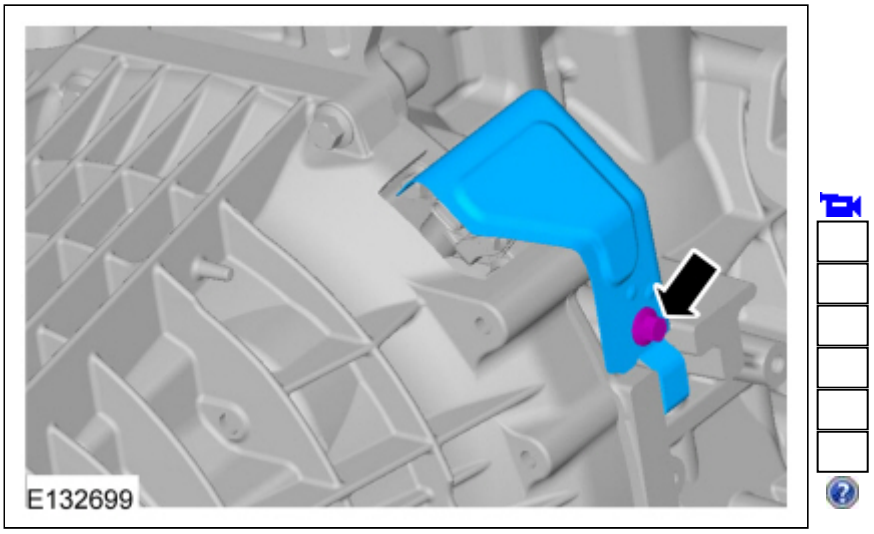
31.



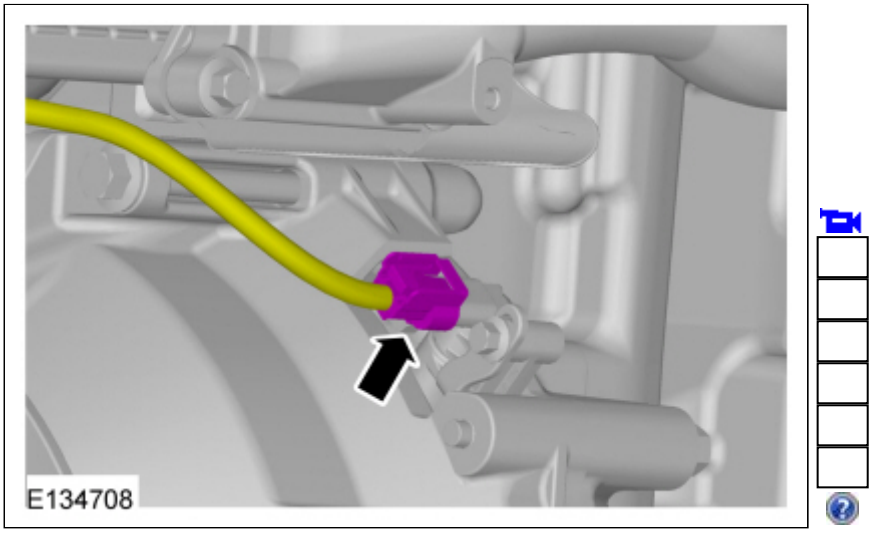
32.



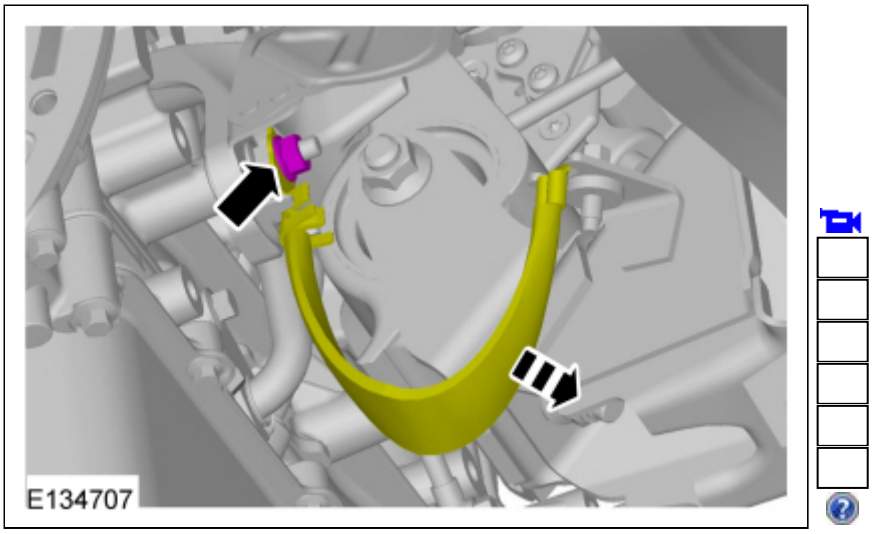
33.



34.



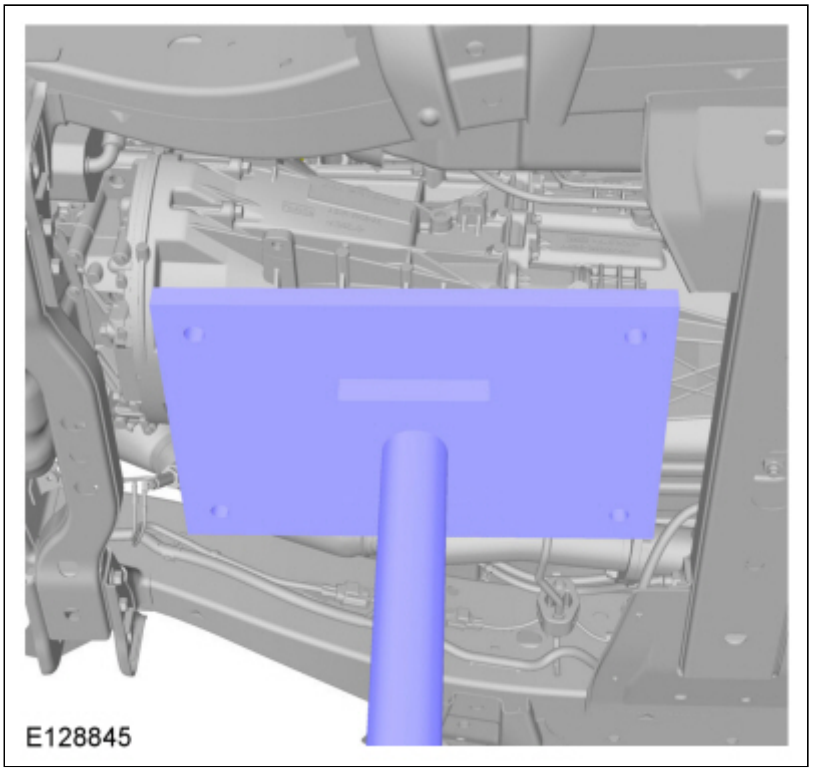
35.



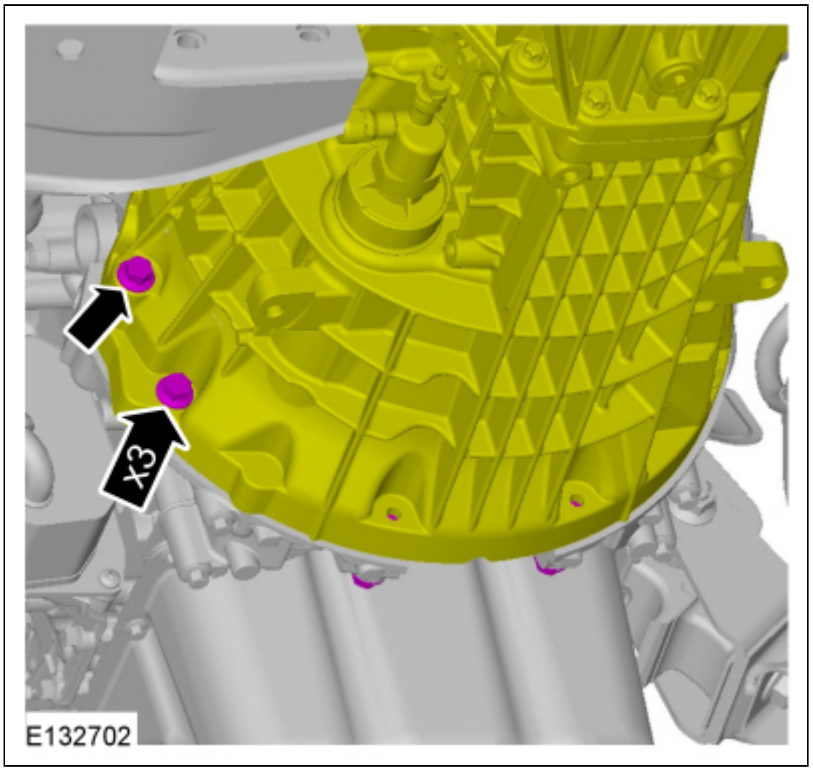
36. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

NOTICE: Do not tilt the transmission.This may cause damage to the pilot bearing.

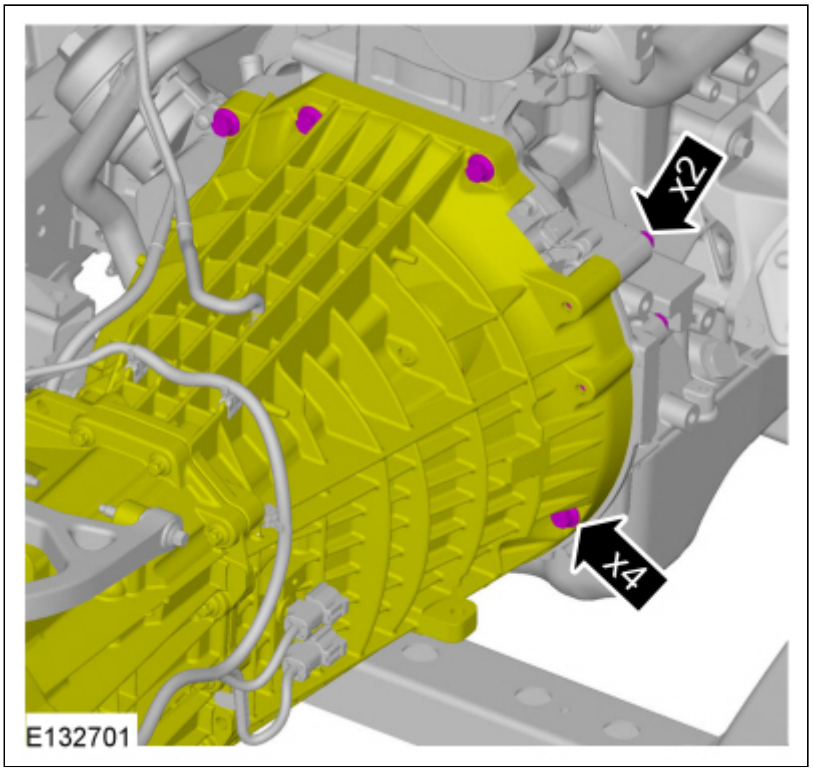
Tie and support the transmission to the chassie with a suitable strap.
Use the General Equipment: Transmission Jack



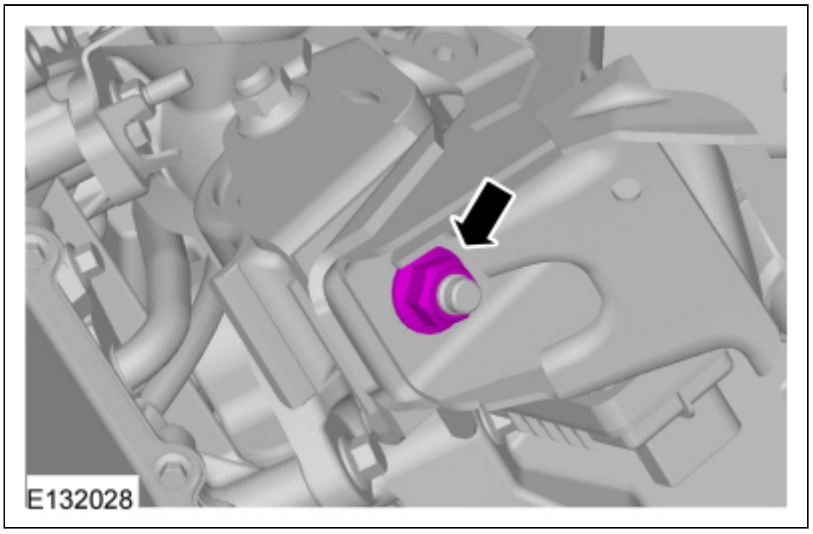
37.



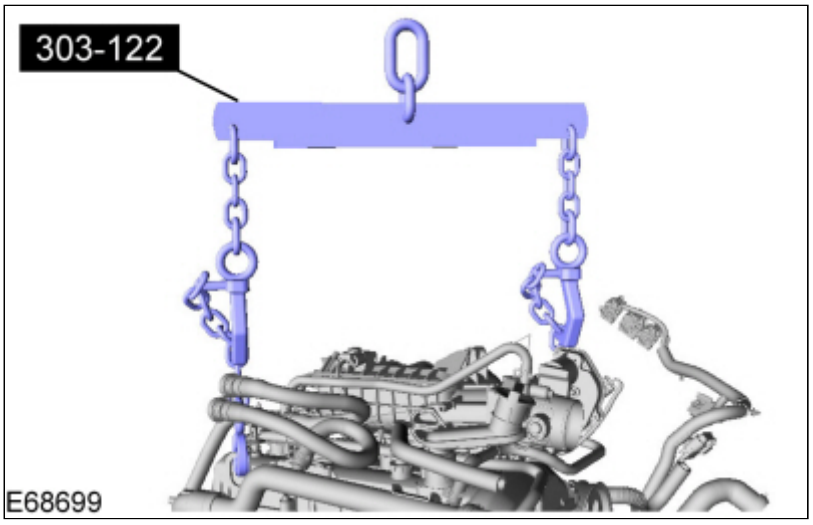
38.



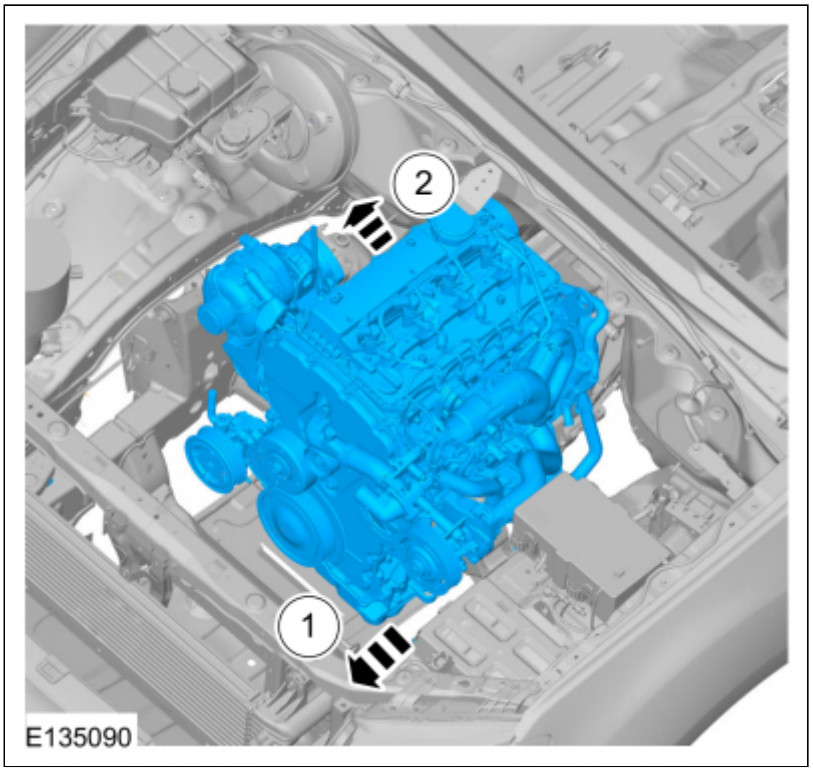
39. On both sides.



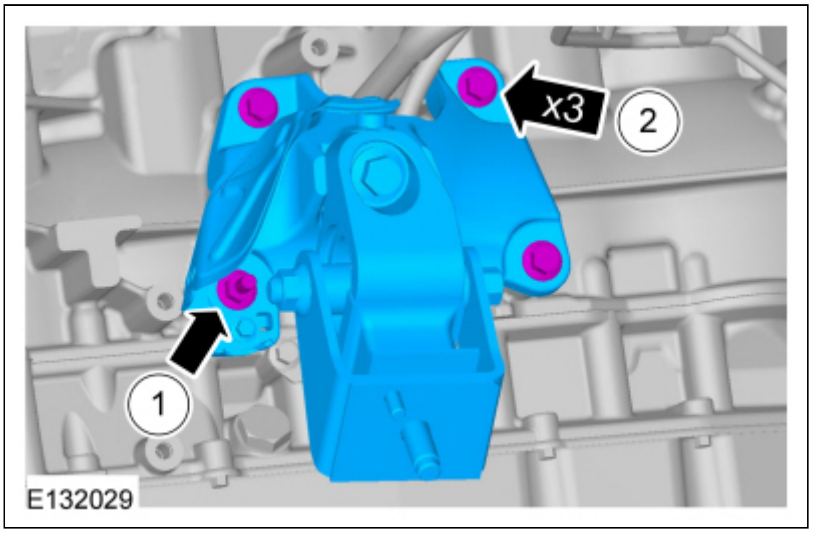
40. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



41.



42.



Copyright © 2016 Ford Motor Company

Engine - 6-Speed Manual Transmission - MT82

Base Part Number: 6L084

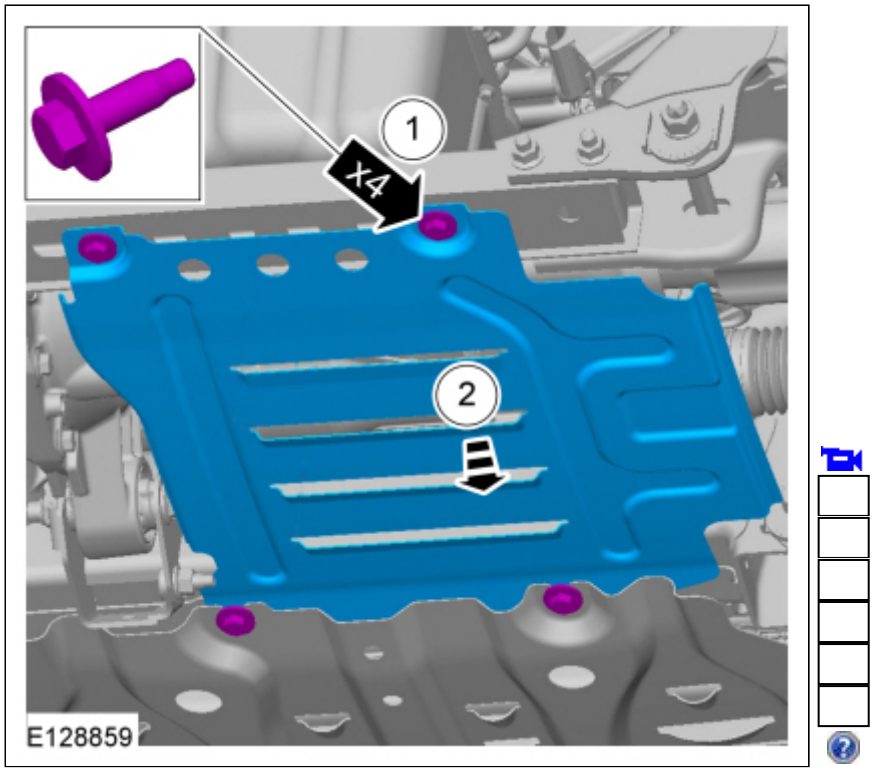
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
Transmission Jack	

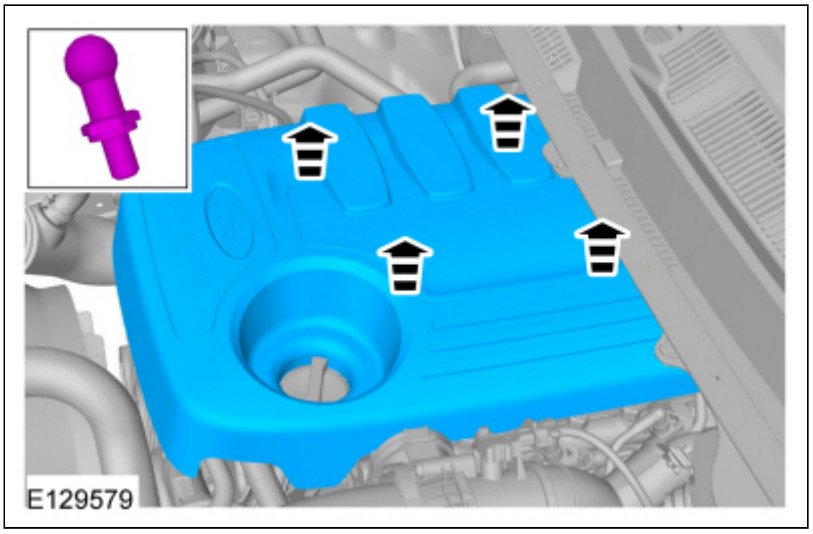
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

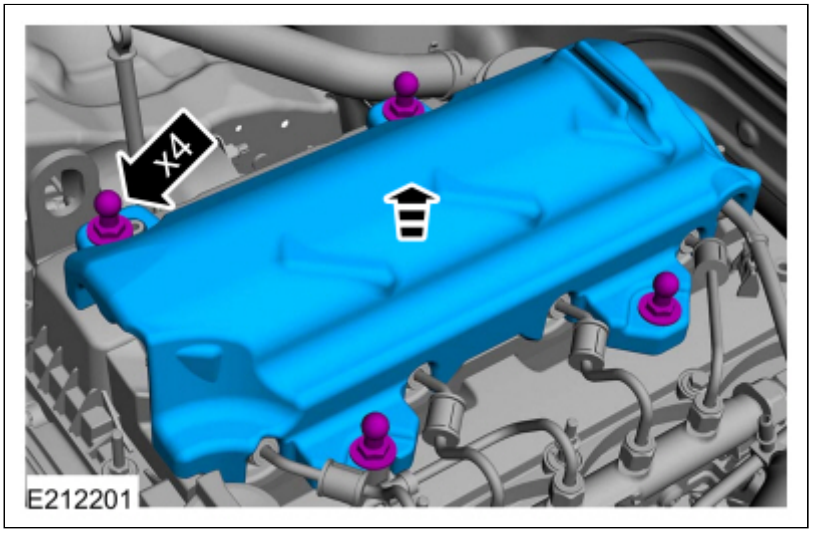
6.



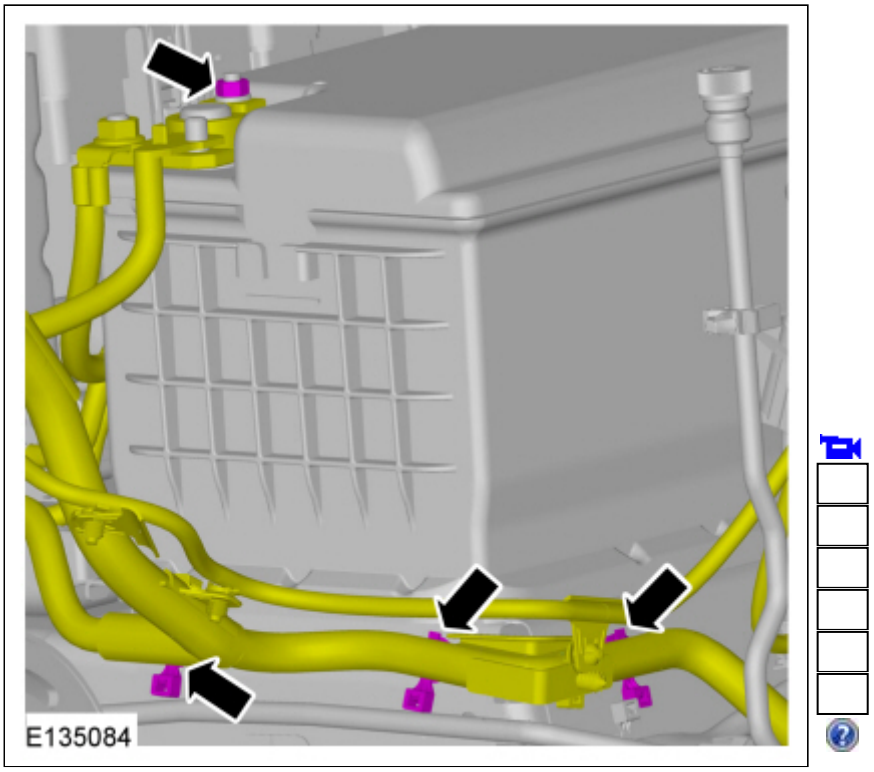
7.



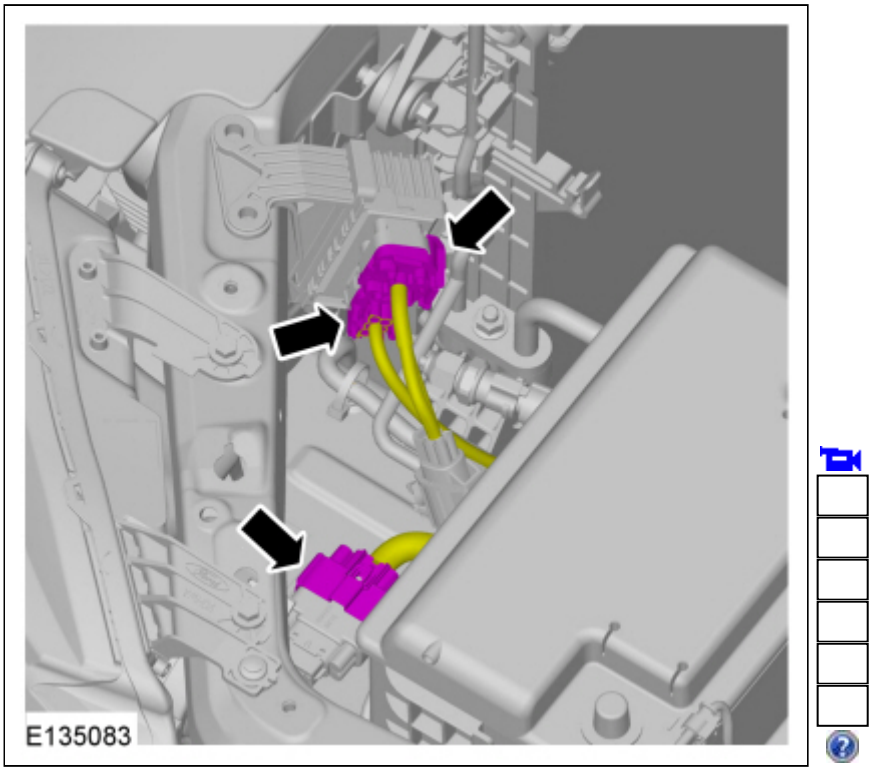
8.



9. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
10. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
11.



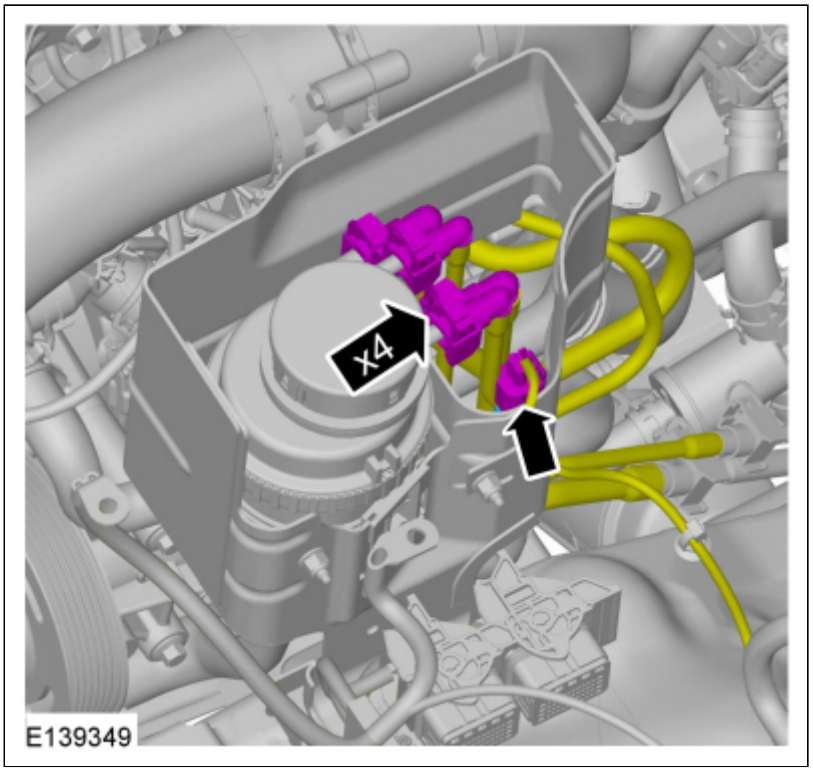
12.



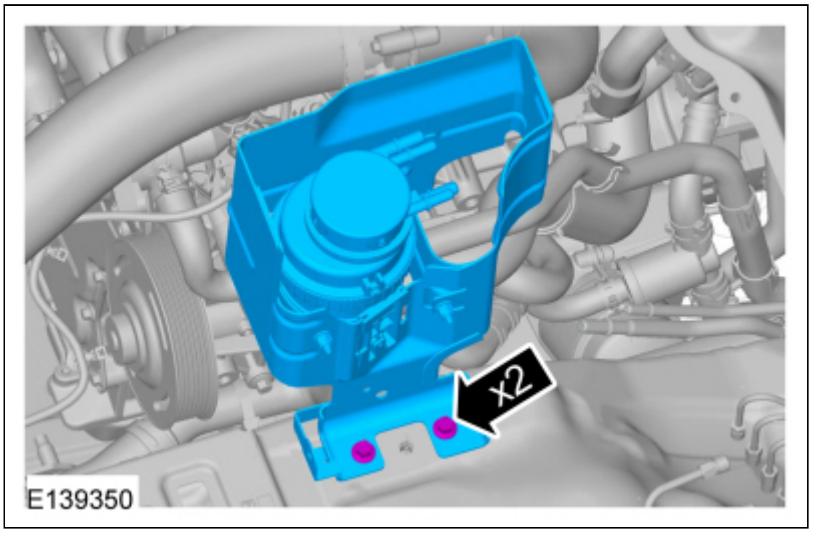
13. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

14. Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

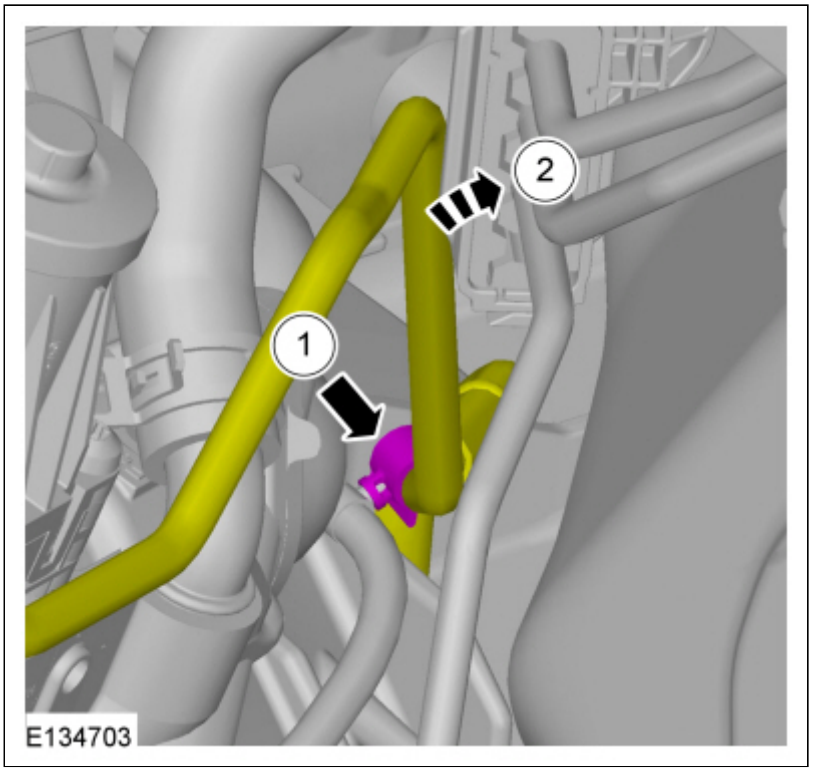
15.



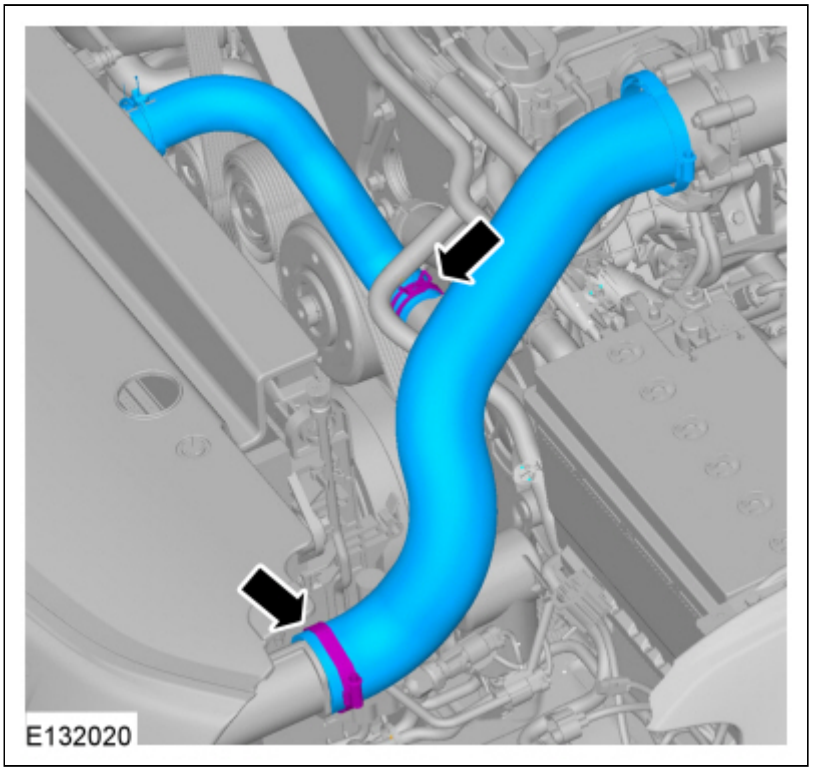
16.



17.



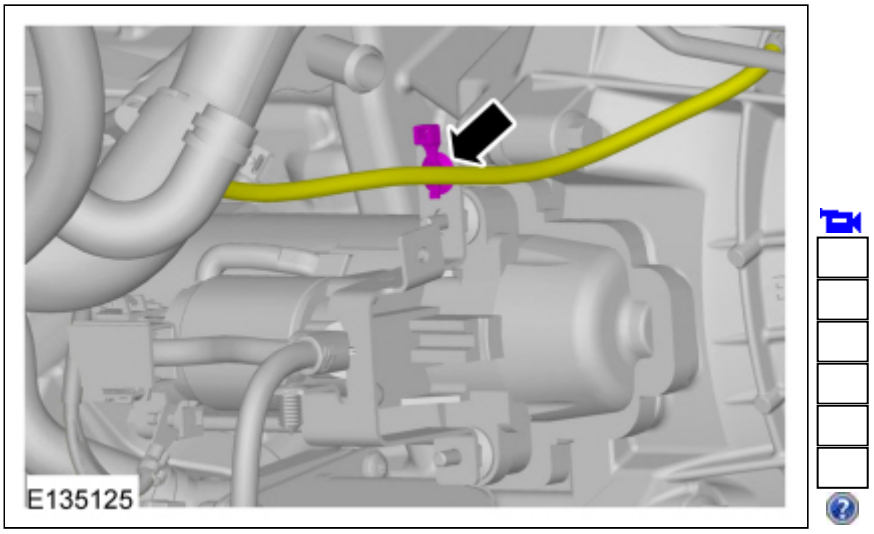
18.



19. Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

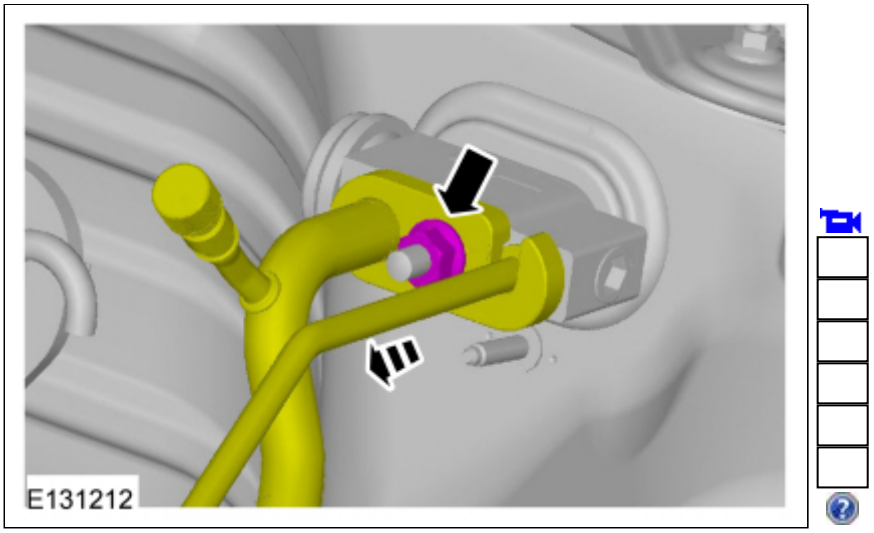
20. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

21.

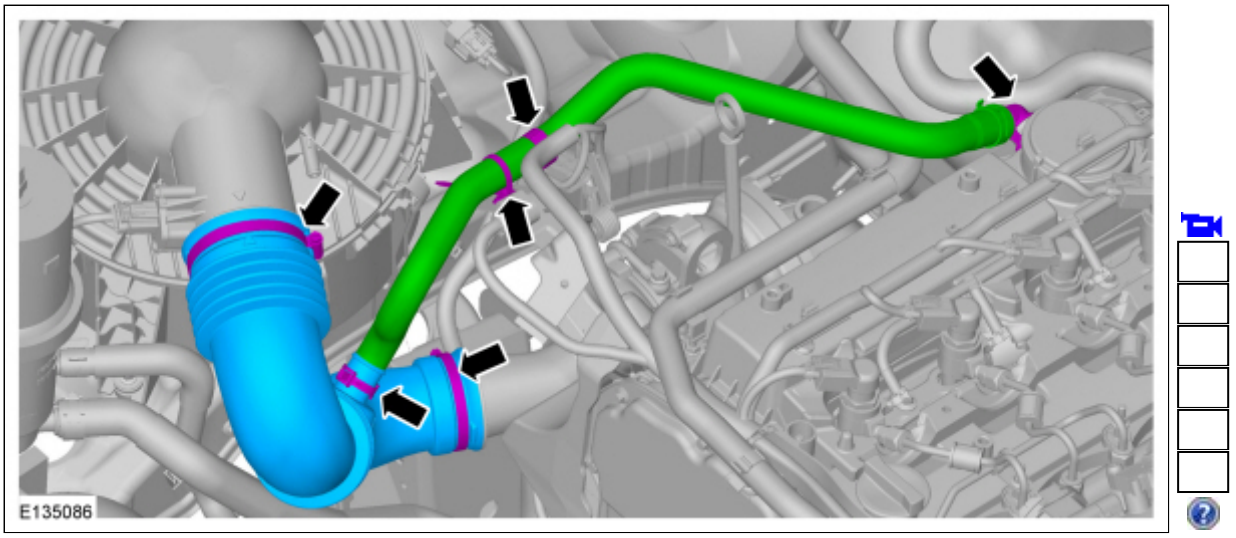


22. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

23.



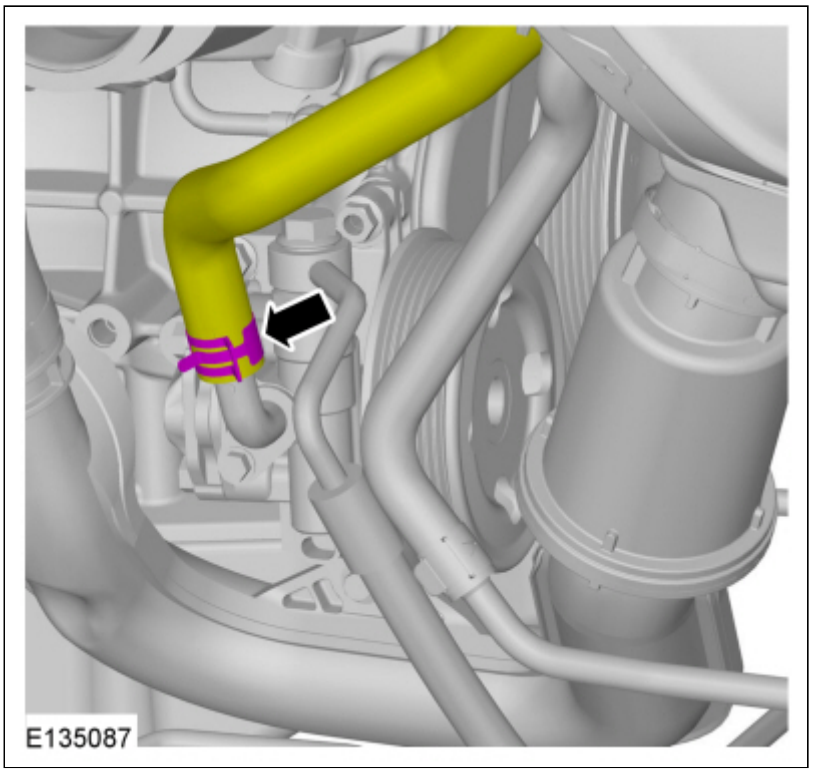
24.



25. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

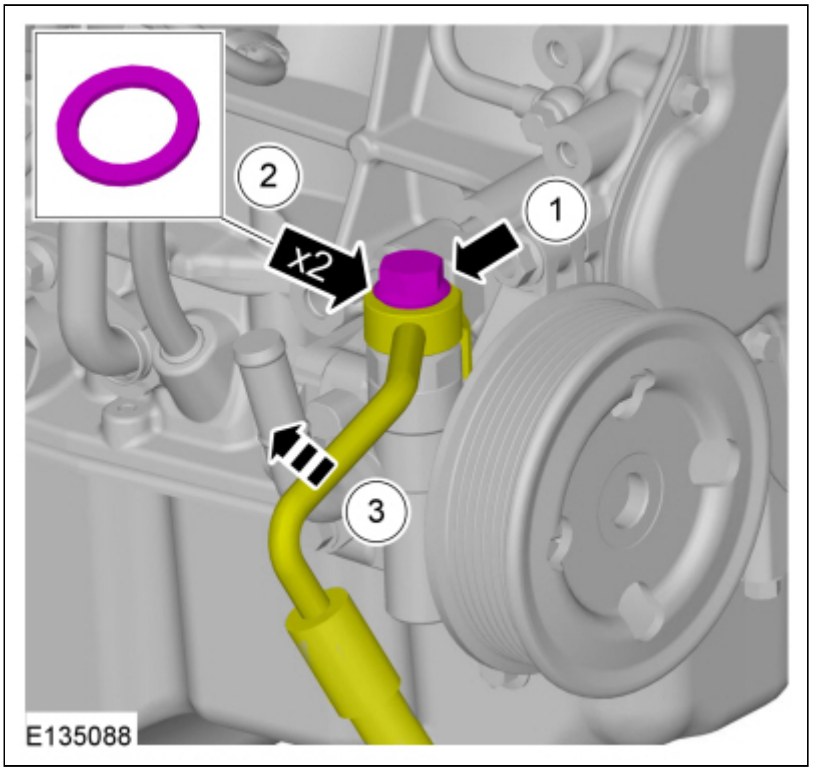
Vehicles With: Hydraulic Power Assist Steering (HPAS)

26. **NOTE:** *Make sure that all openings are sealed.*



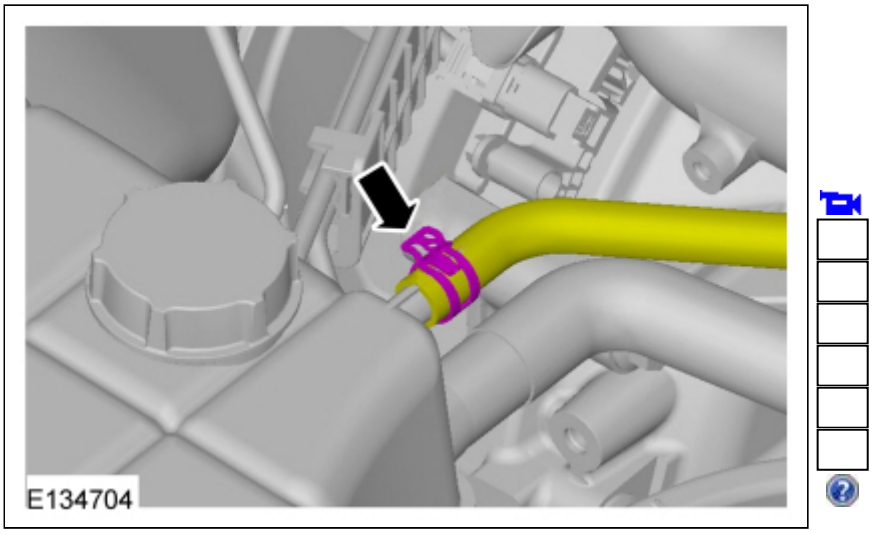
27. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

    NOTE: *The washers can be reused unless damaged.*

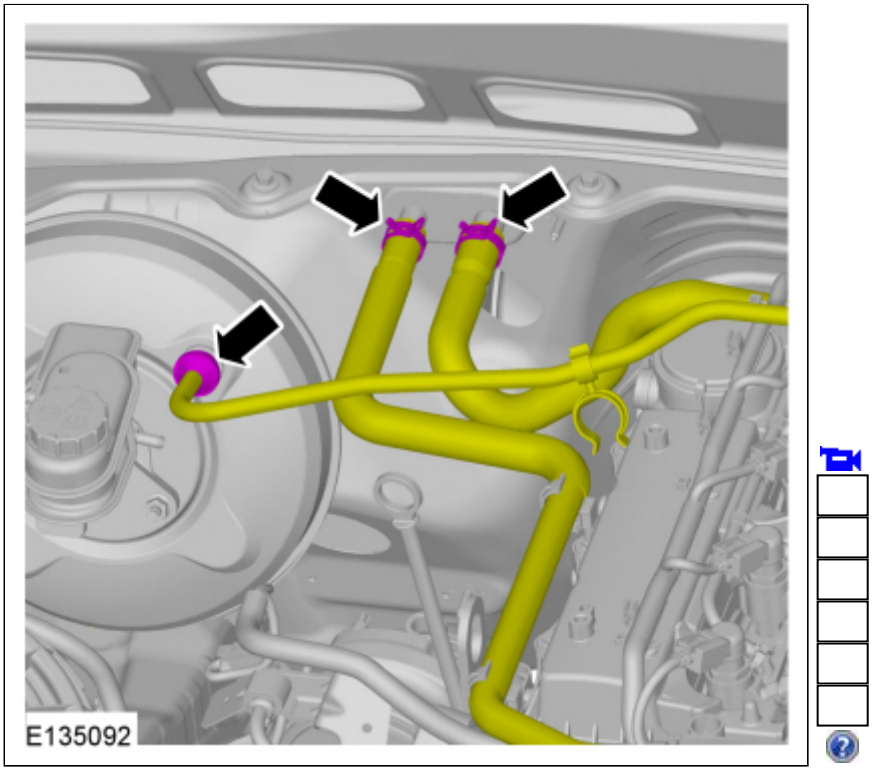


All vehicles

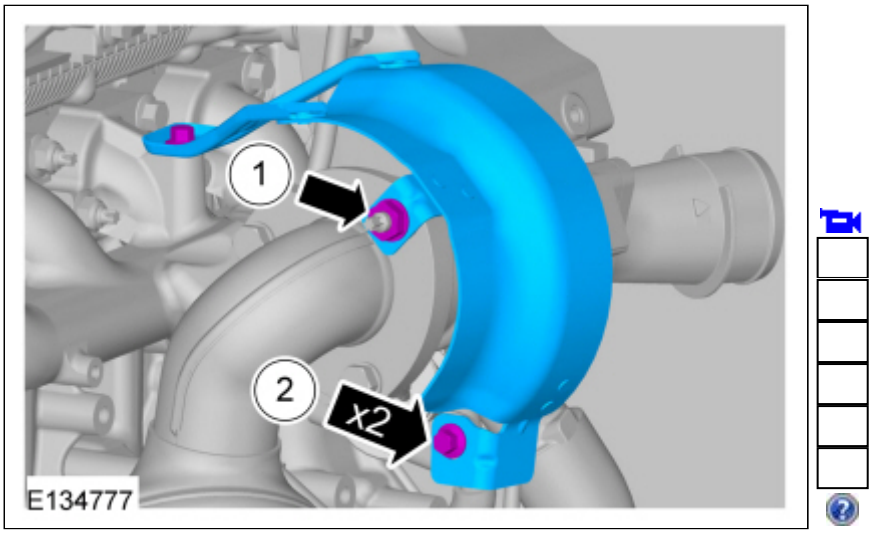
28.



29.



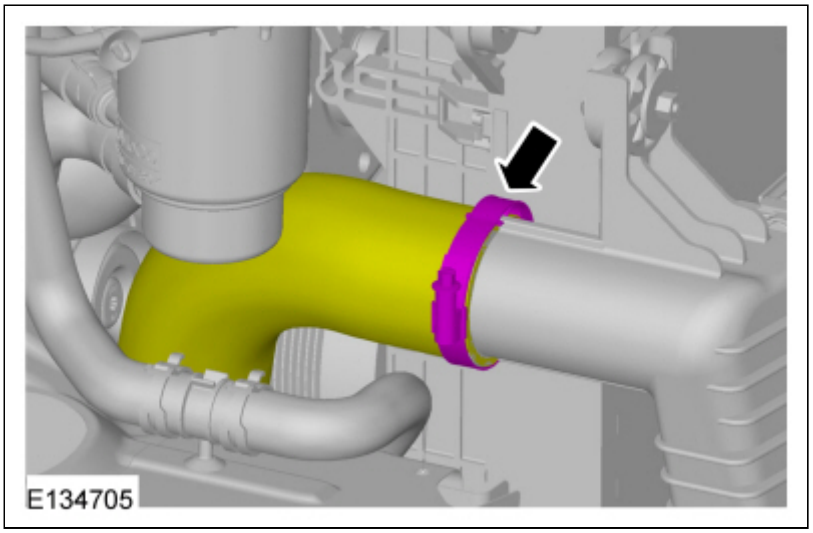
30.



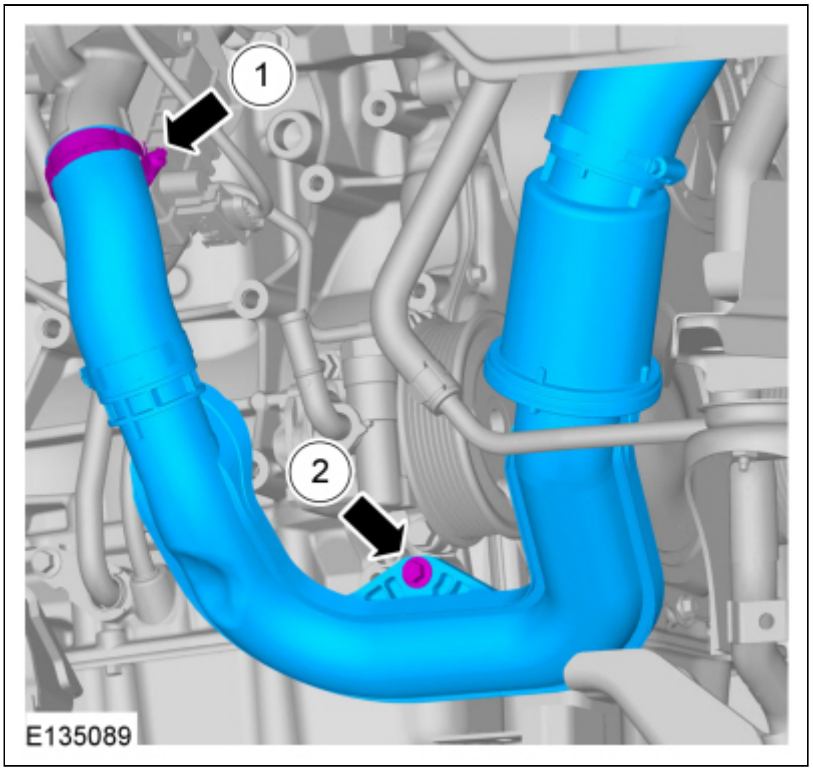
31. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L

Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

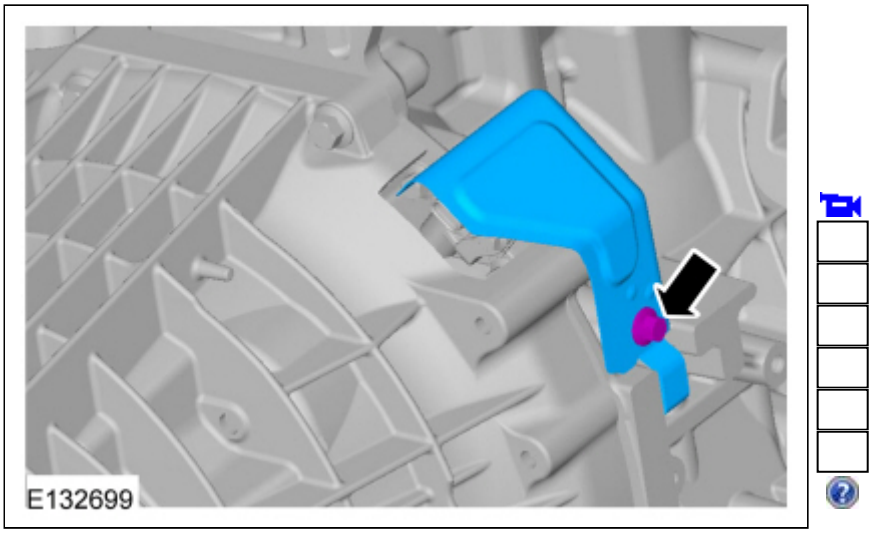
32.



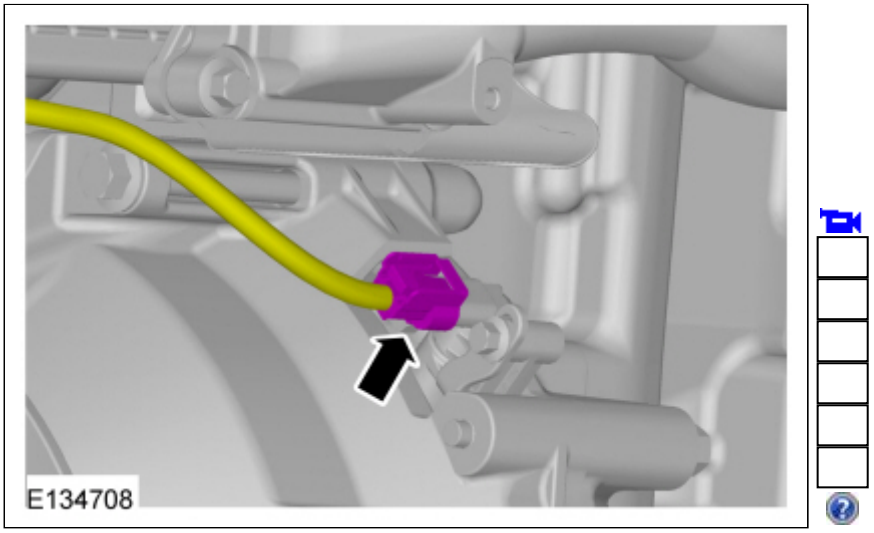
33.



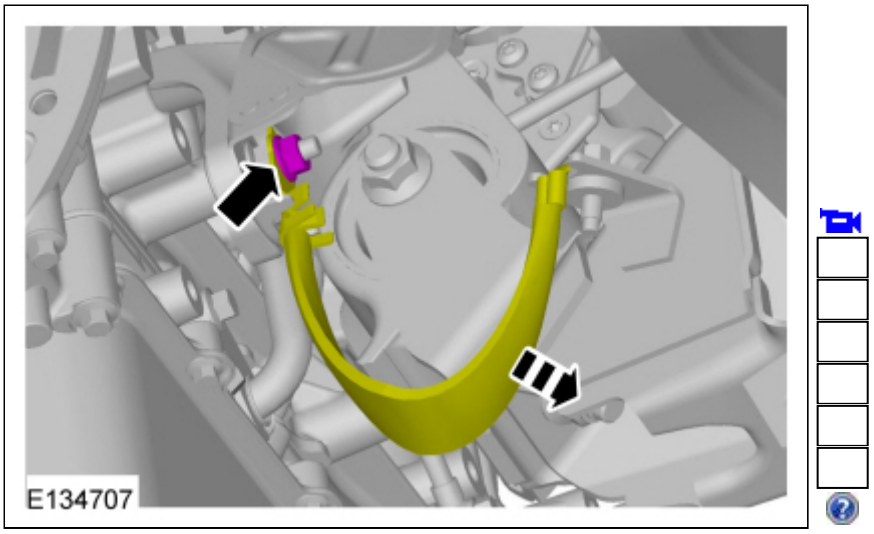
34.



35.



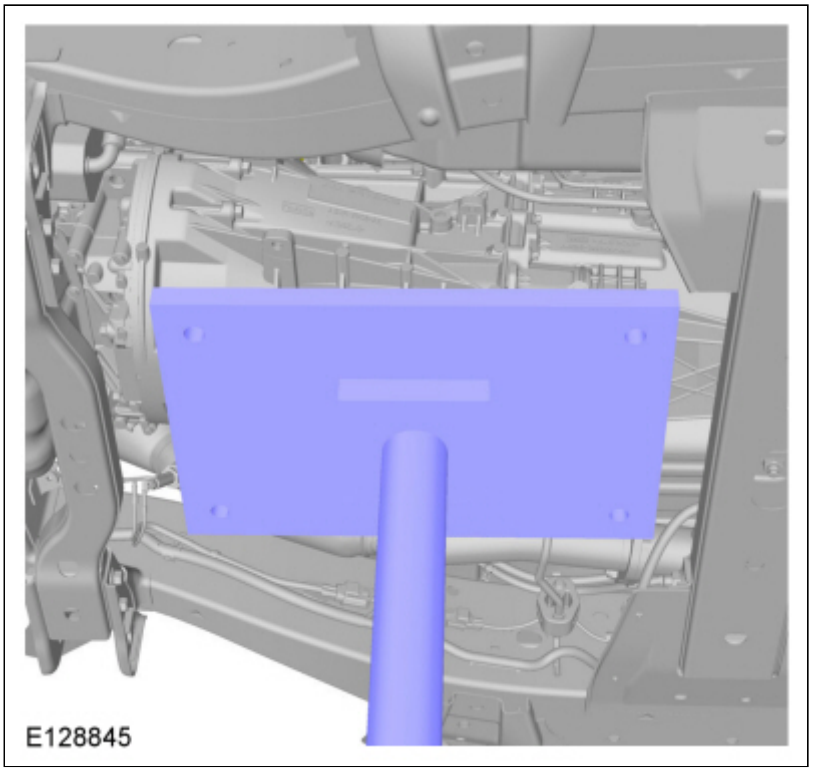
36.



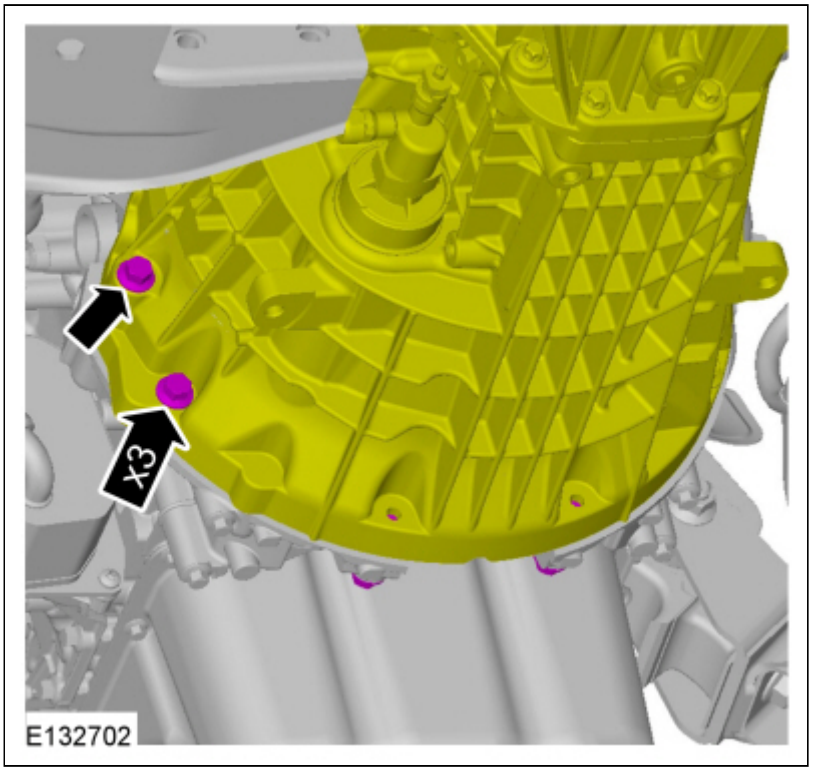
37. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

NOTICE: Do not tilt the transmission.This may cause damage to the pilot bearing.

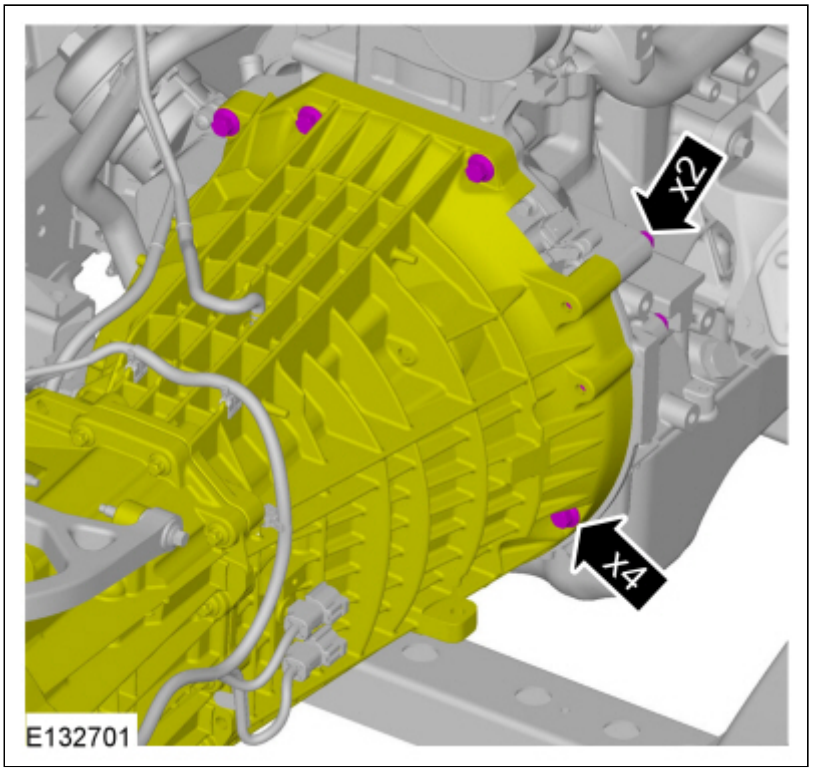
Tie and support the transmission to the chassie with a suitable strap.
Use the General Equipment: Transmission Jack



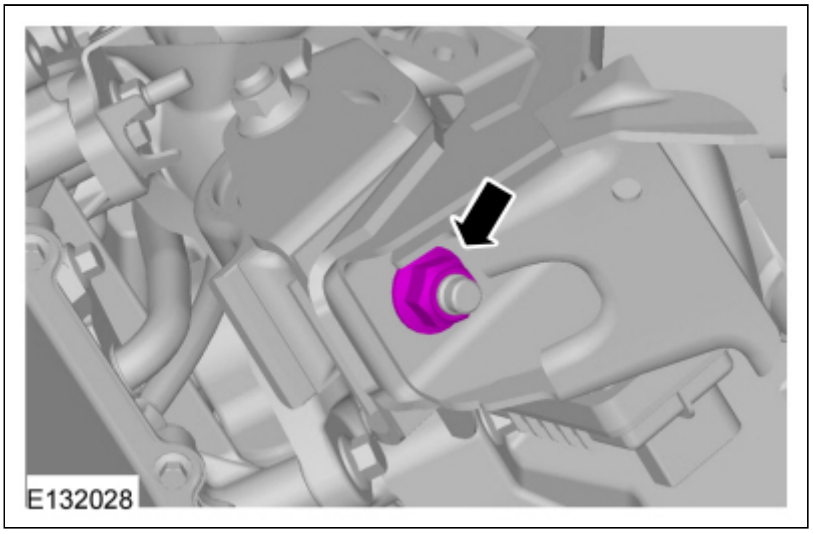
38.



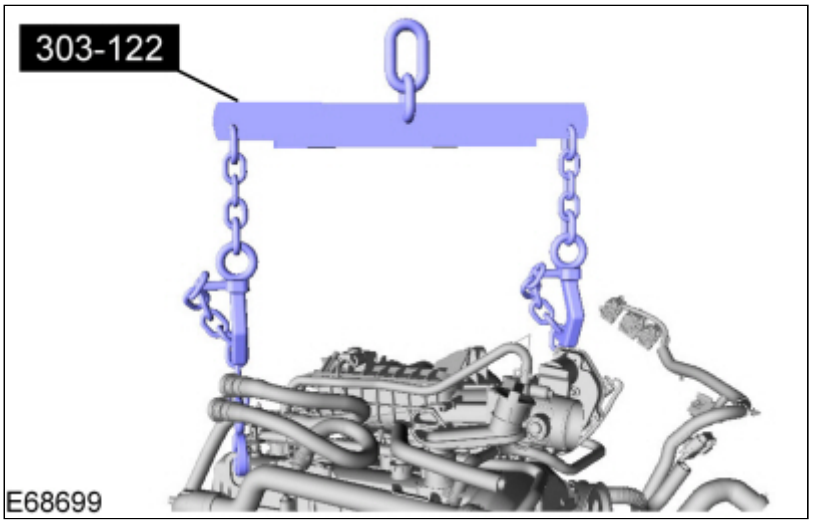
39.



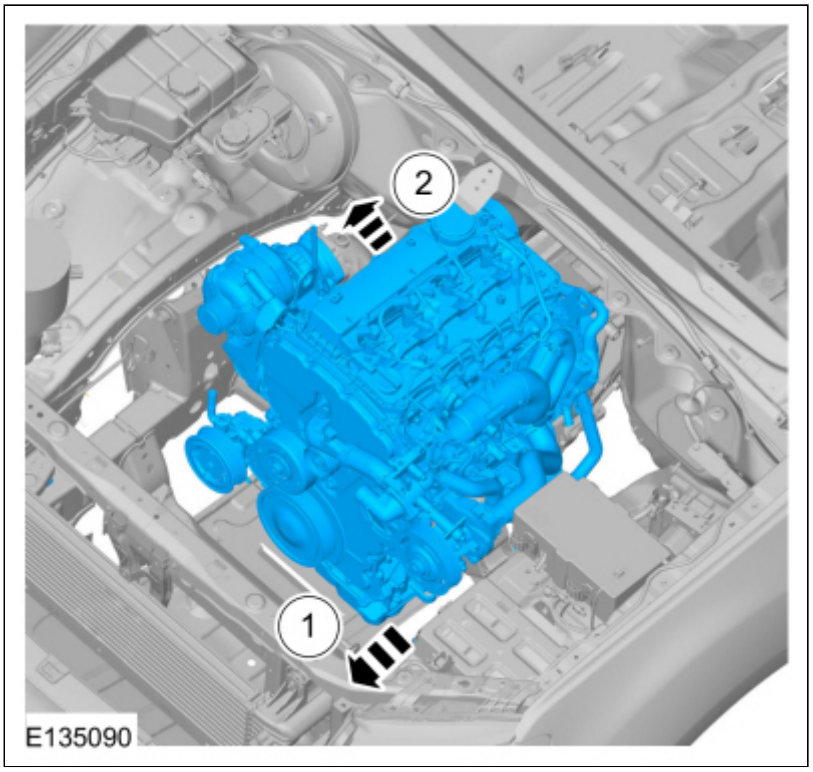
40. On both sides.



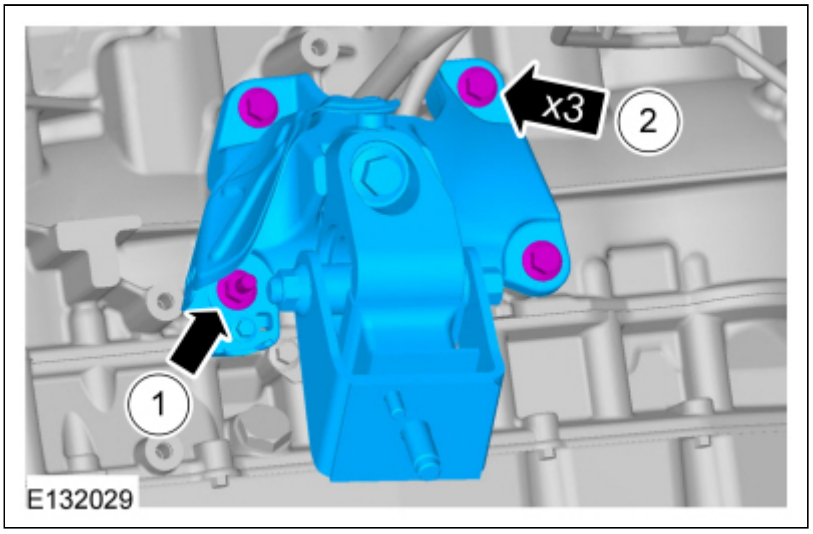
41. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



42.



43.



Copyright © 2016 Ford Motor Company

Engine - 6-Speed Automatic Transmission - 6R80

Base Part Number: 6L084

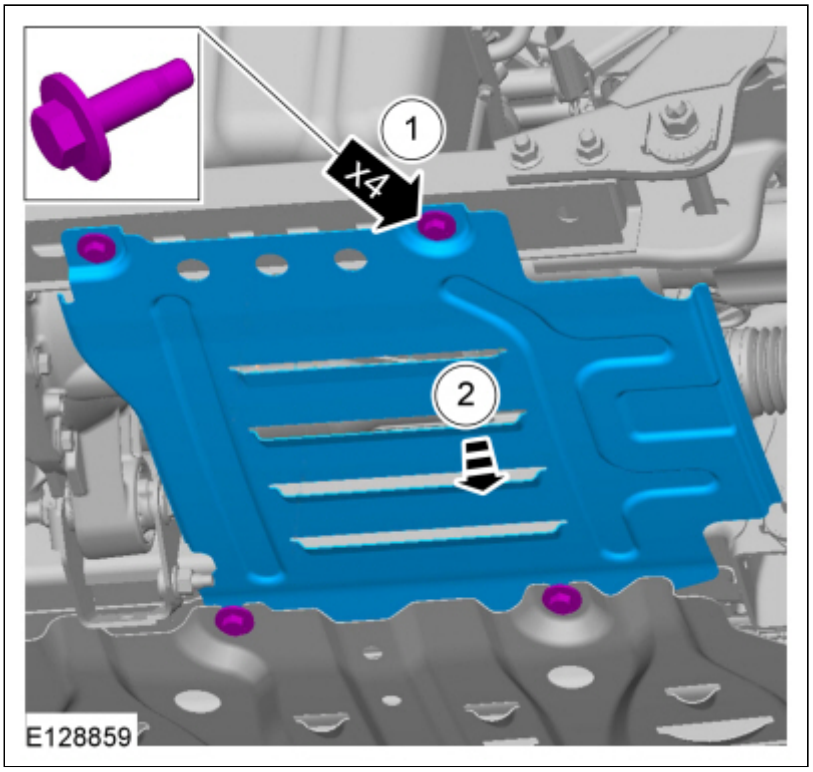
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
 307-346	307-346 (T97T-7902-A) Retainer, Torque Converter
Transmission Jack	

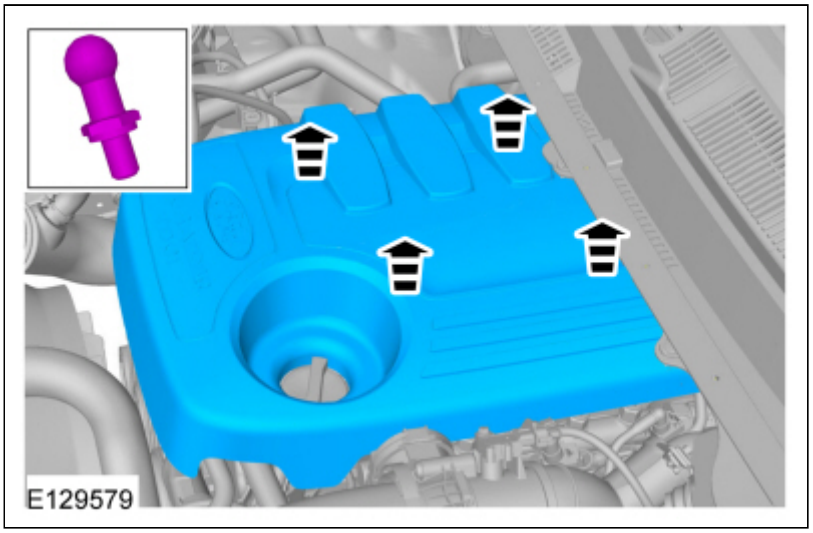
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

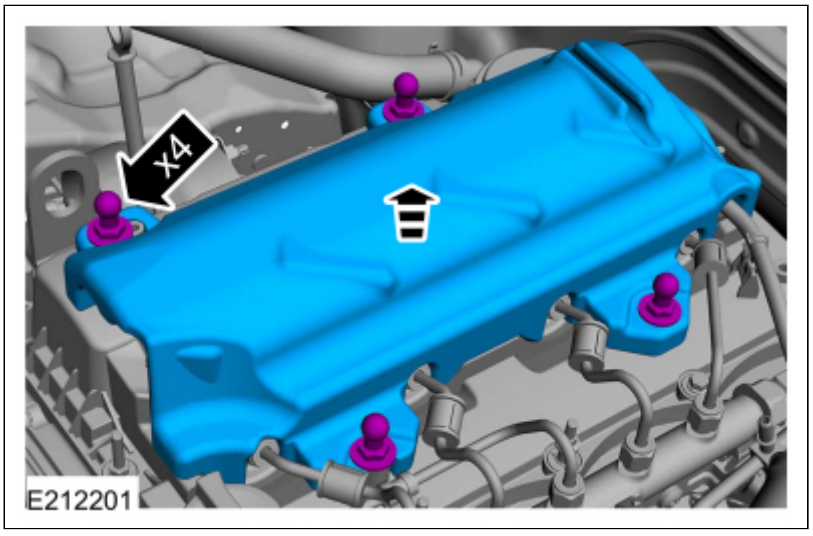
6.



7.



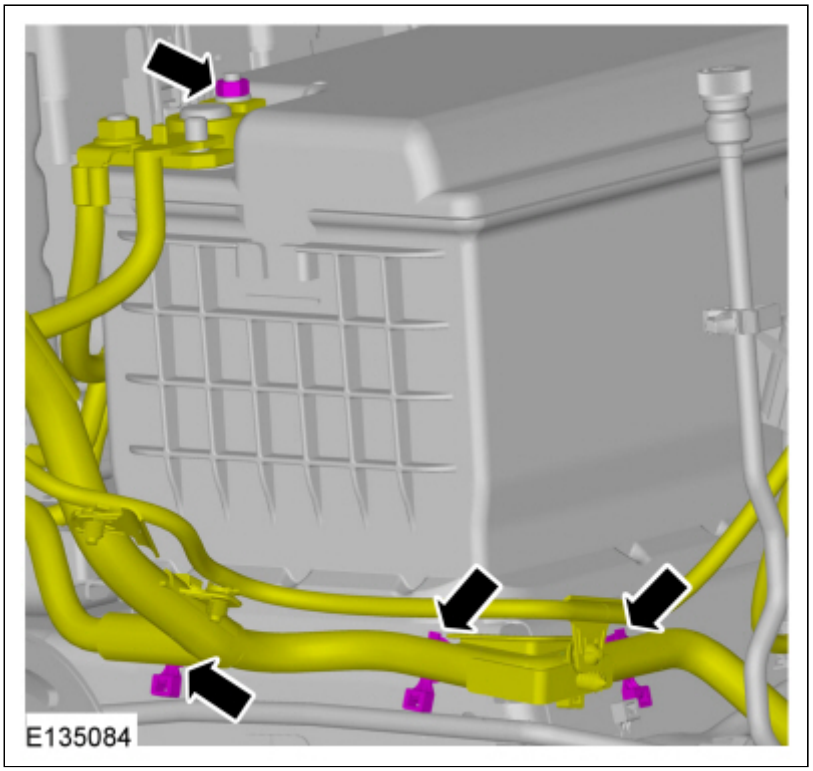
8.



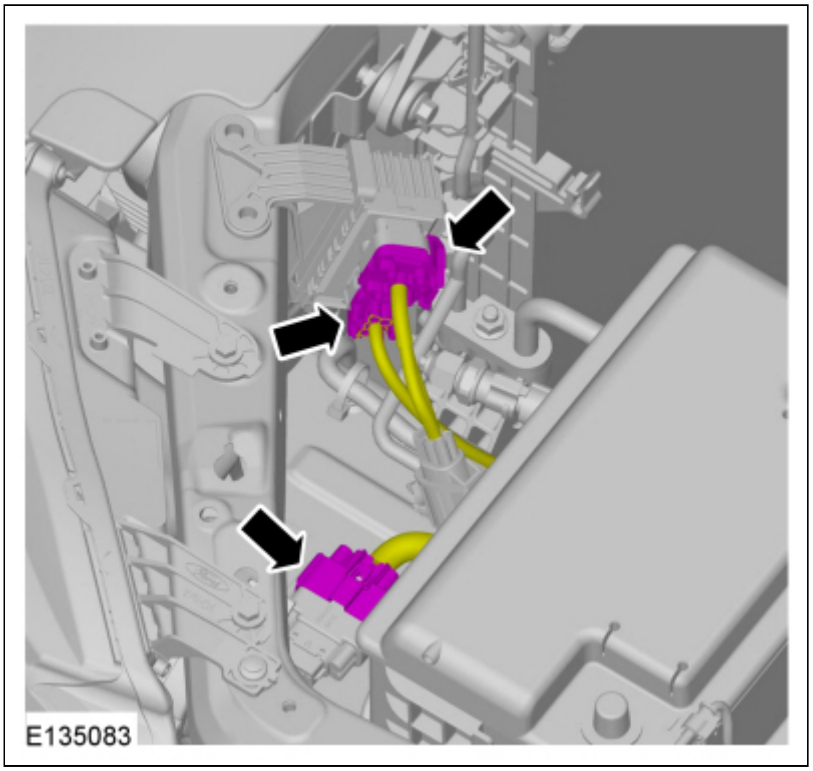
9. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).

10. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).

11.



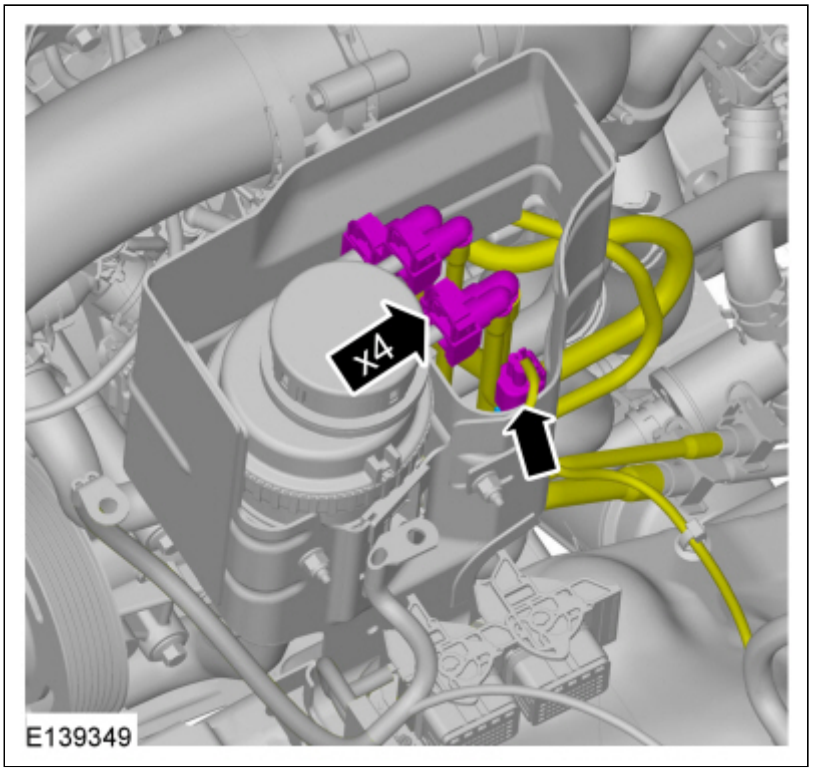
12.



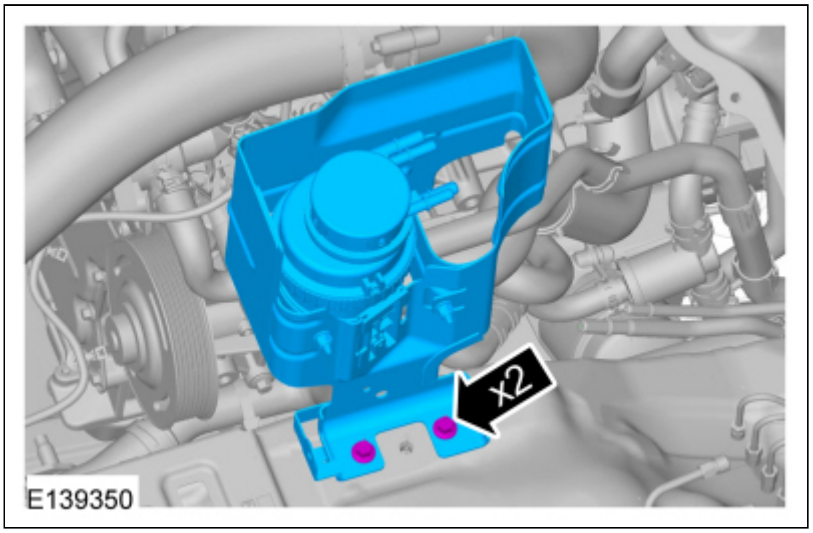
13. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

14. Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

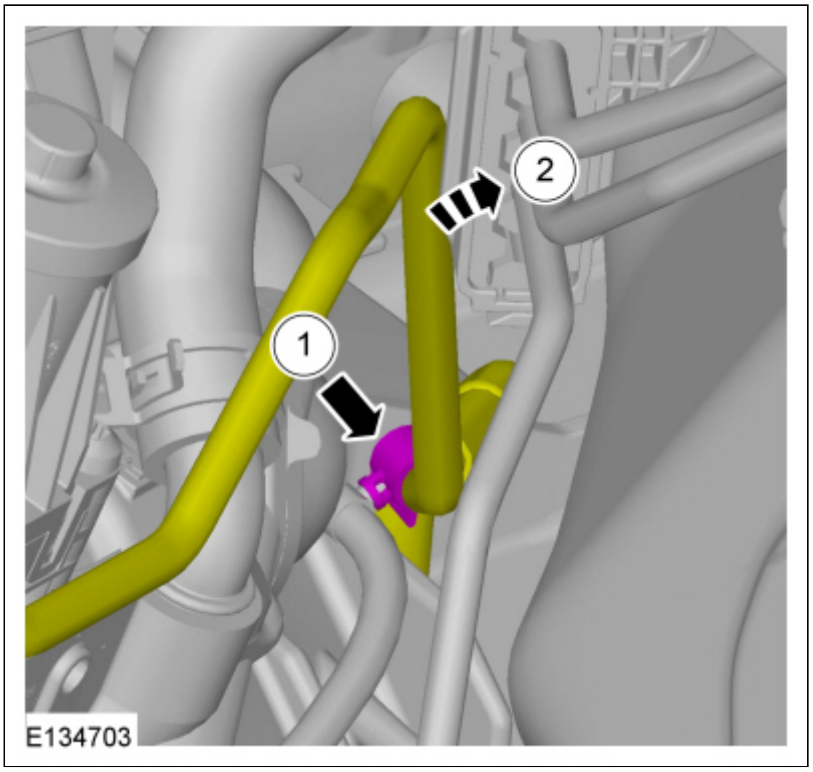
15.



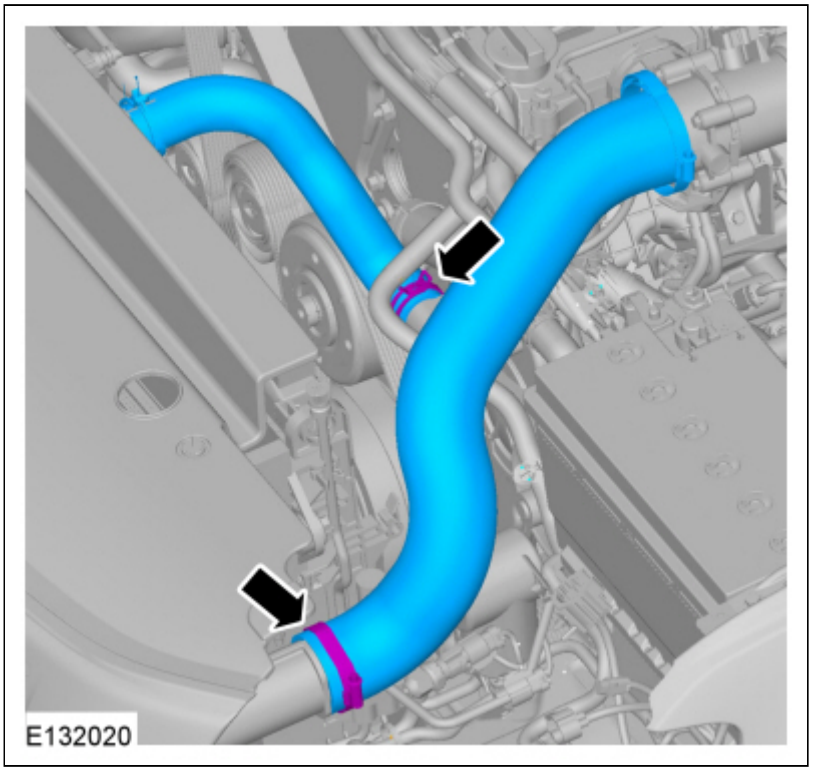
16.



17.



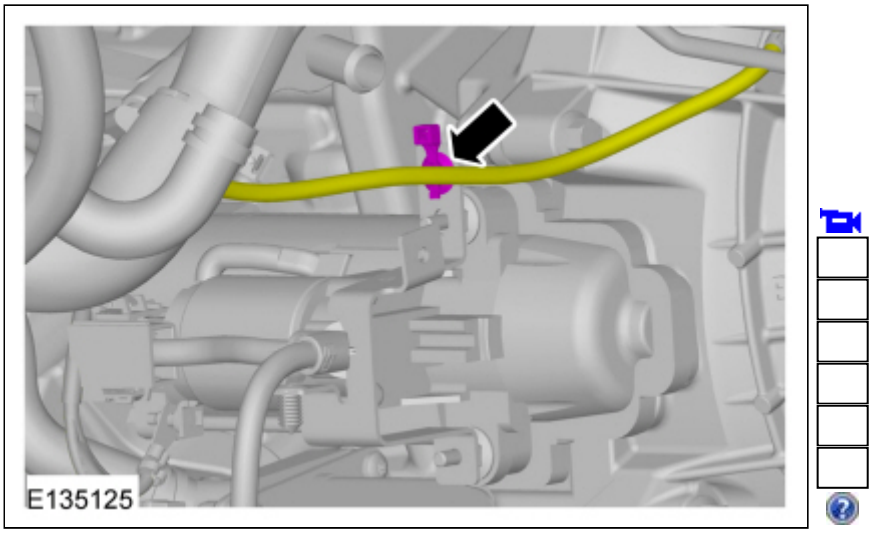
18.



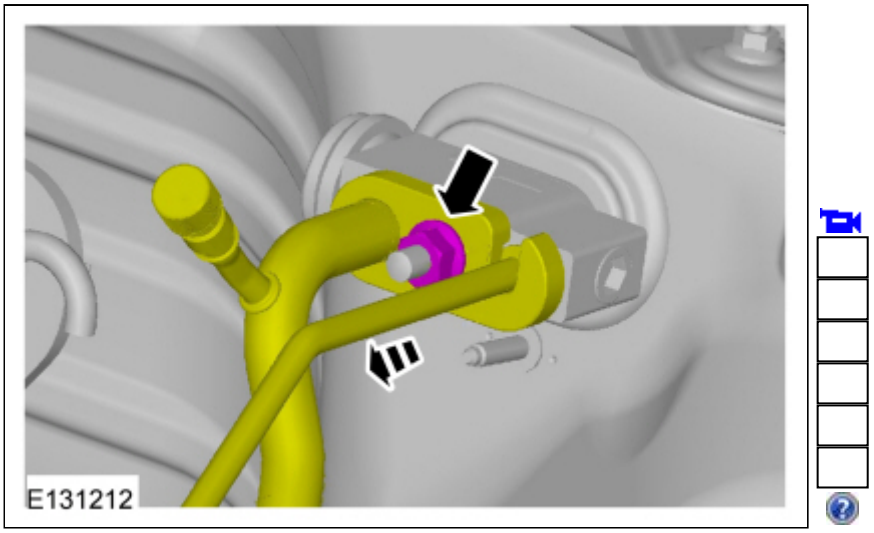
19. Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

20. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

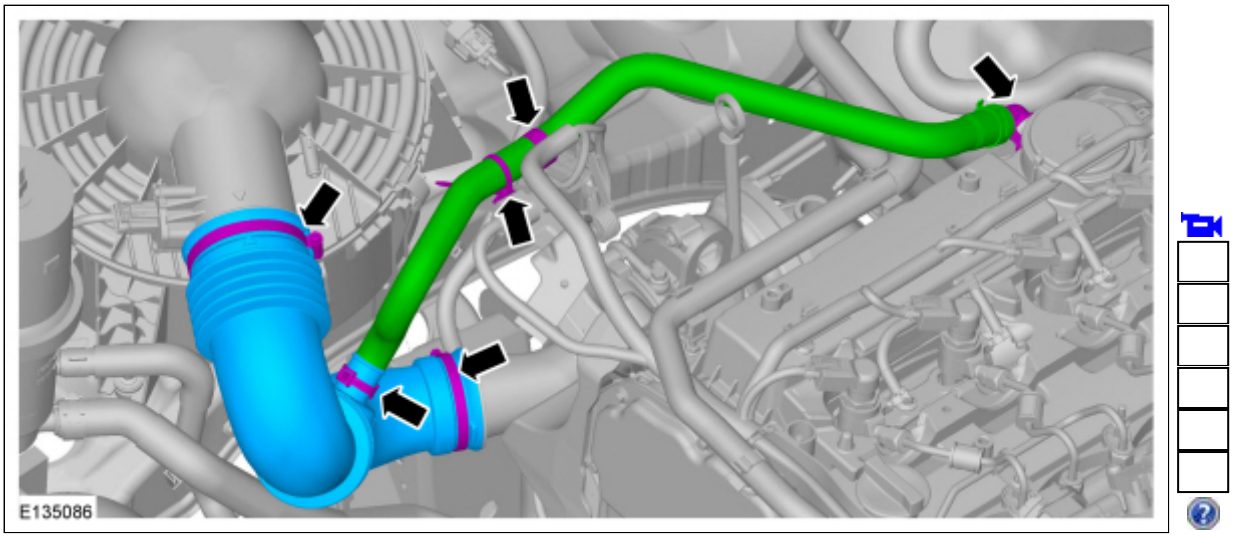
21.



22. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
23. Refer to: Transmission Fluid Cooler (307-02 Transmission Cooling, Removal and Installation).
24.



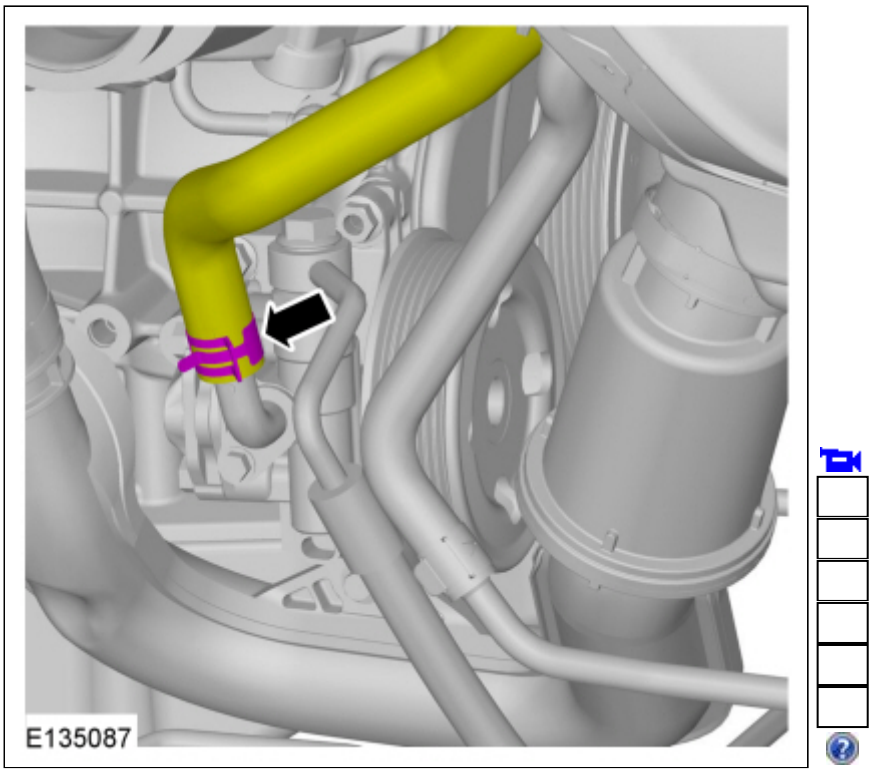
25.



26. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

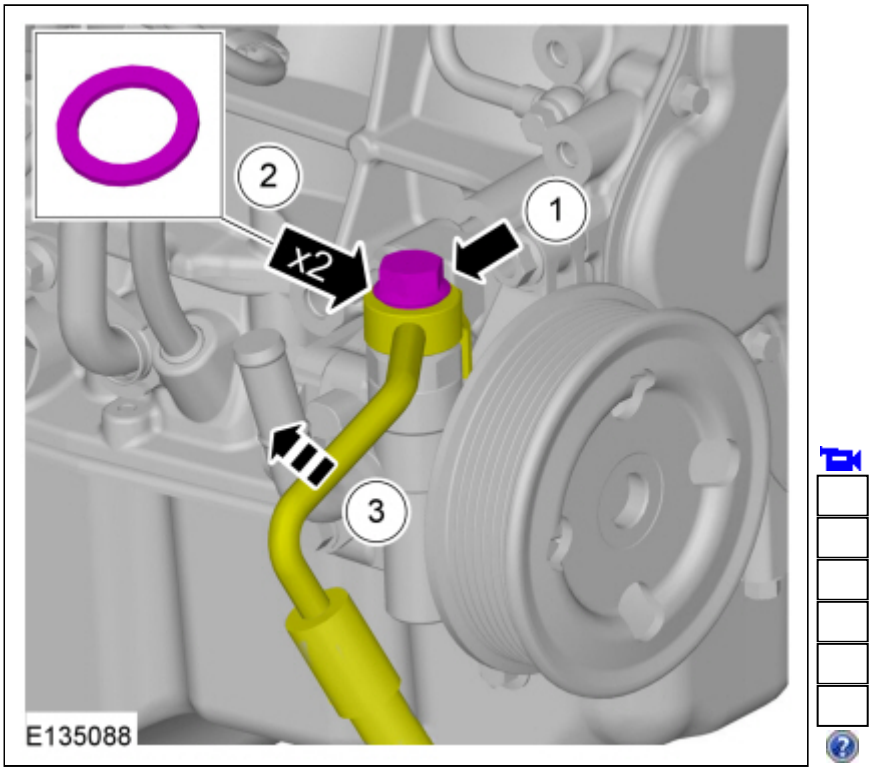
Vehicles With: Hydraulic Power Assist Steering (HPAS)

27. **NOTE:** *Make sure that all openings are sealed.*



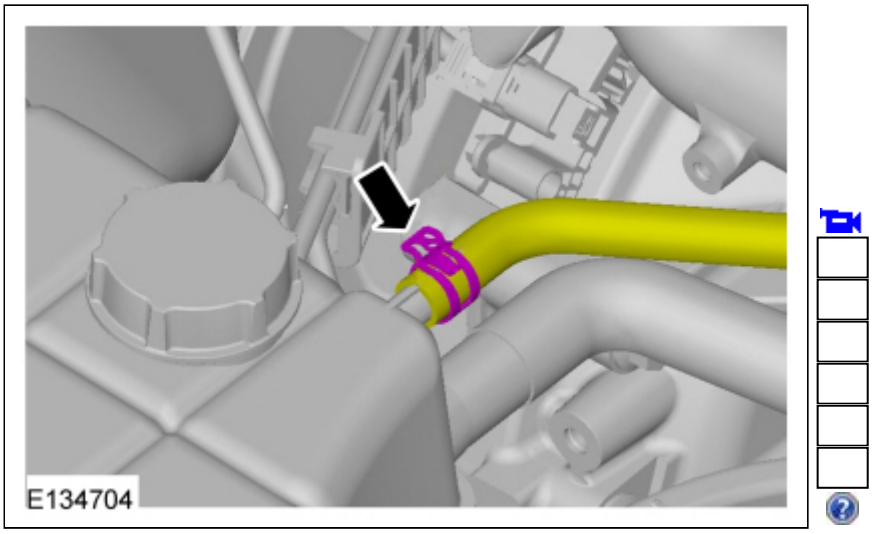
28. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

    NOTE: *The washers can be reused unless damaged.*

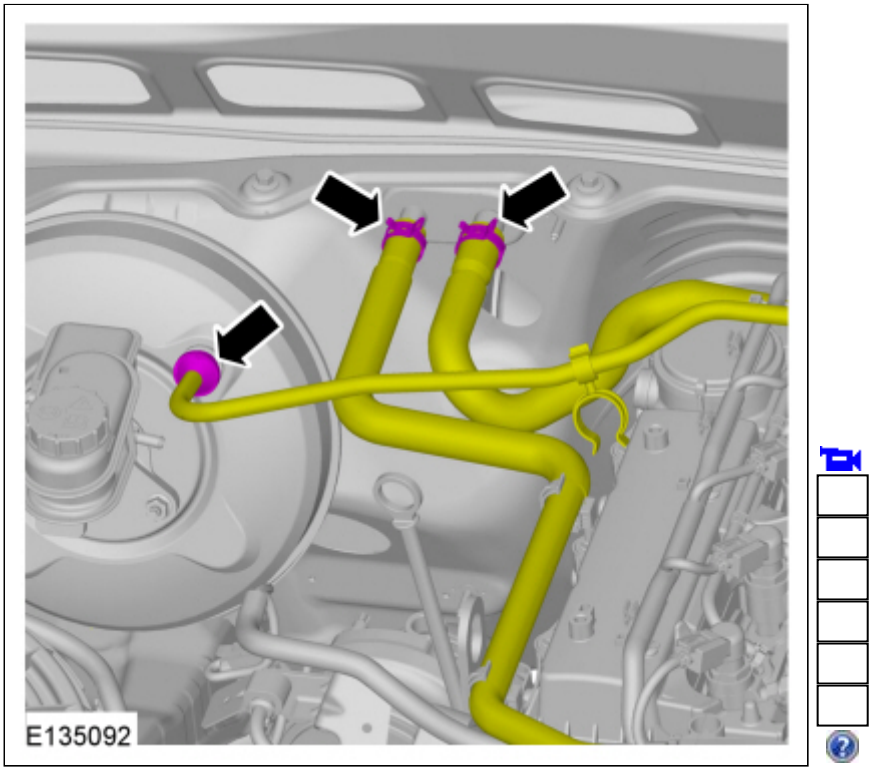


All vehicles

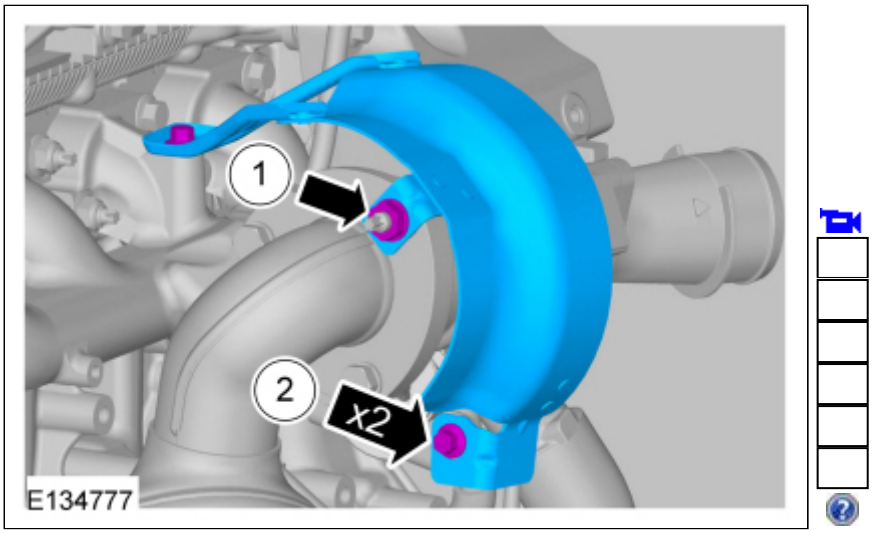
29.



30.



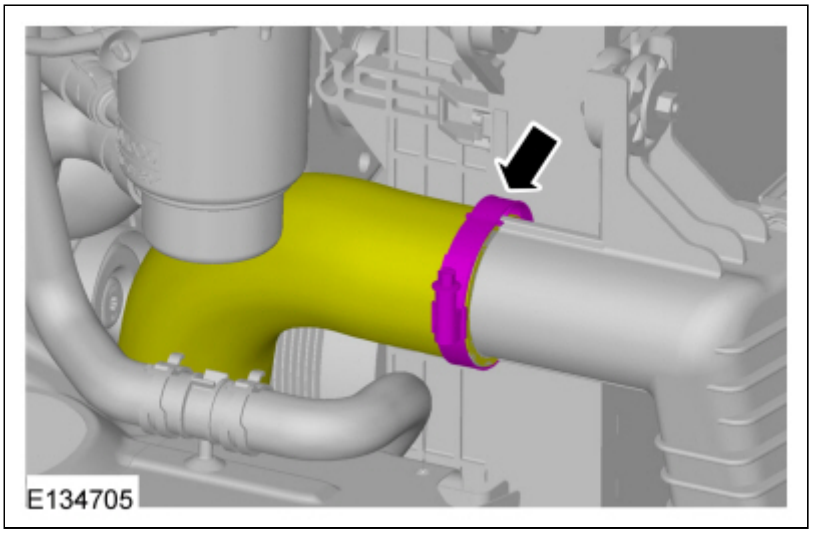
31.



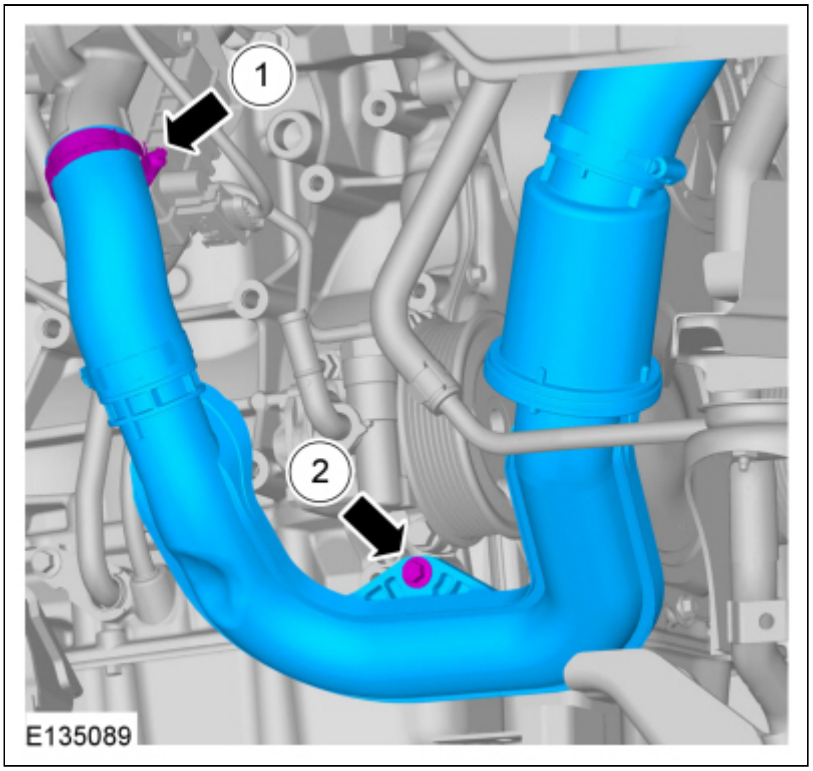
32. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L

Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

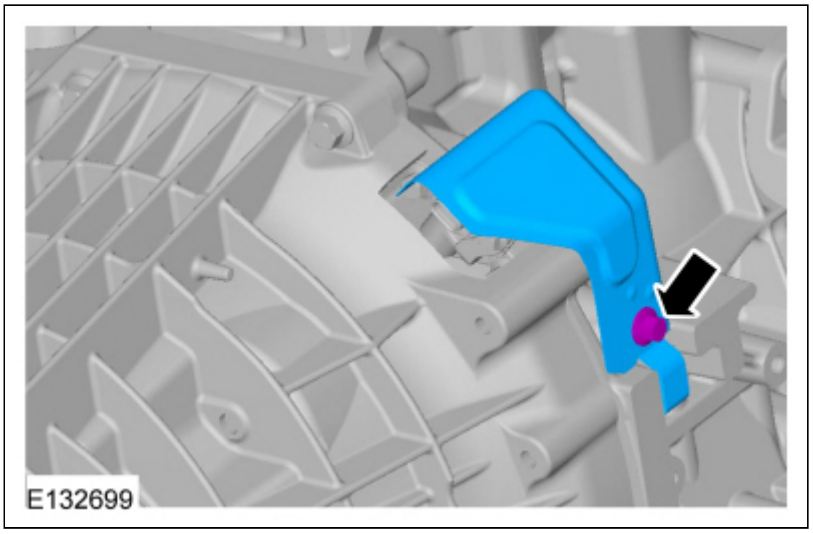
33.



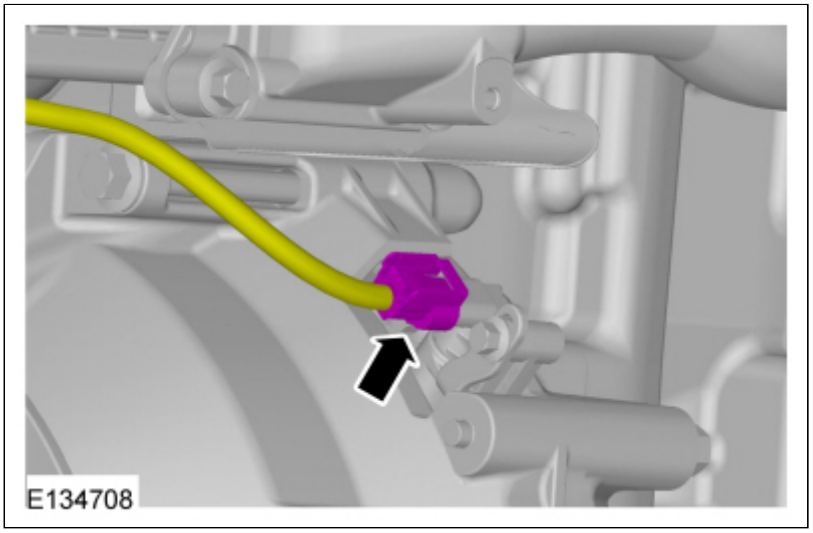
34.



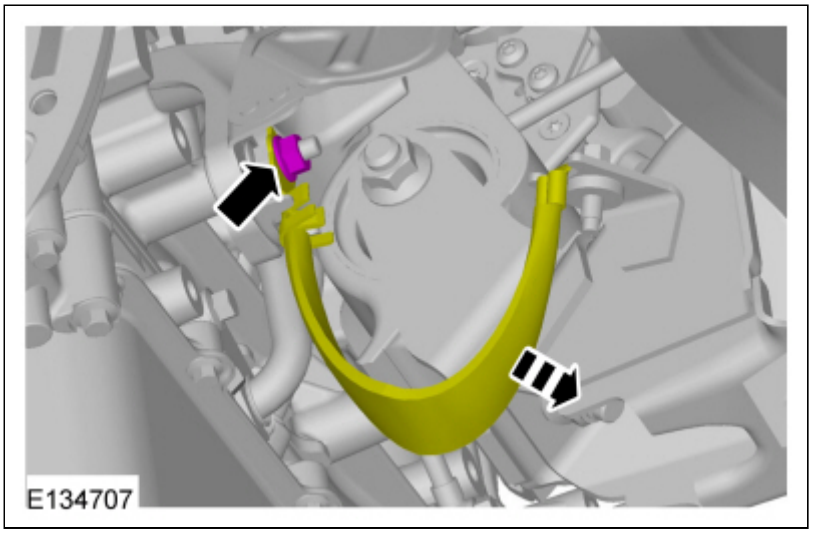
35.



36.



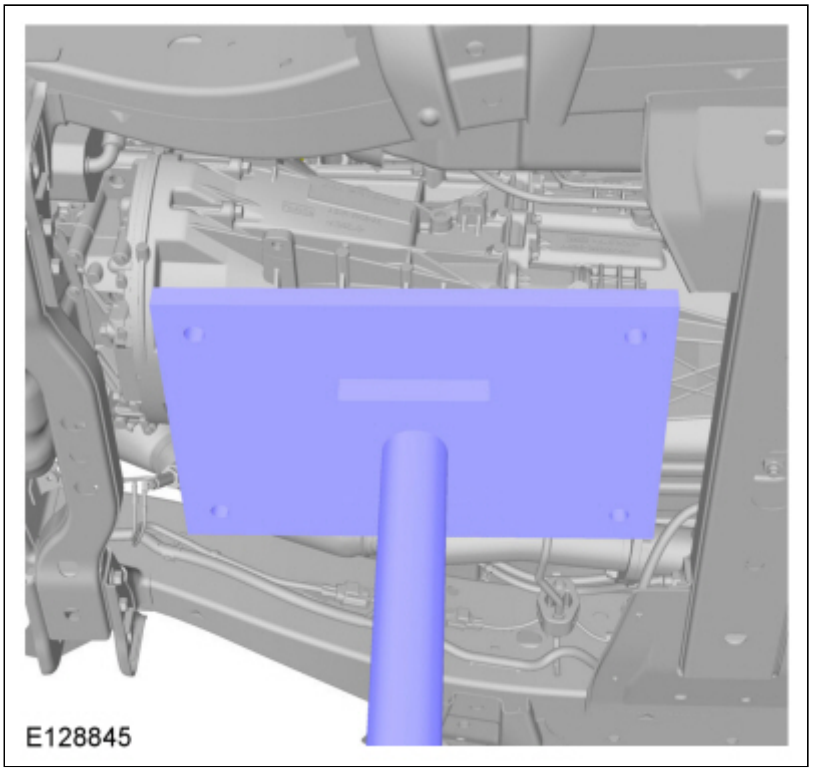
37.



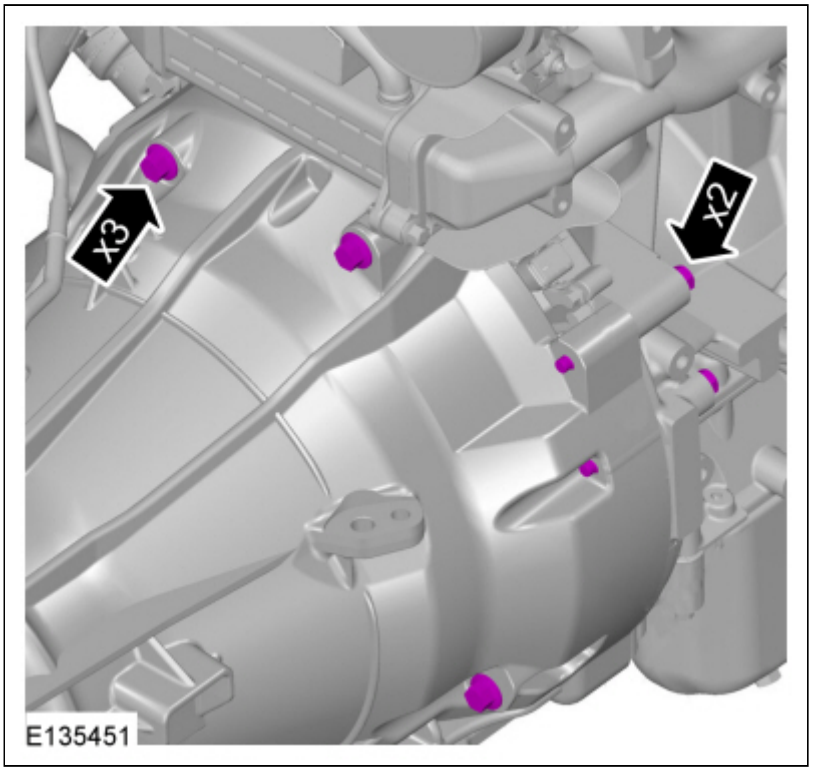
38. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

NOTICE: Do not tilt the transmission. This may cause damage to the pilot bearing.

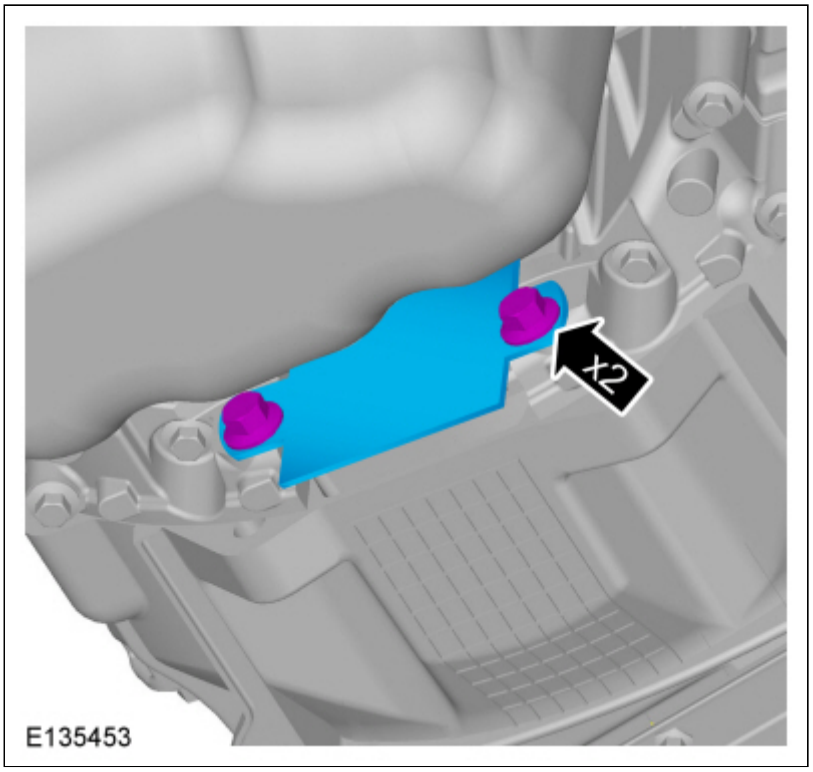
Tie and support the transmission to the chassis with a suitable strap.
Use the General Equipment: Transmission Jack



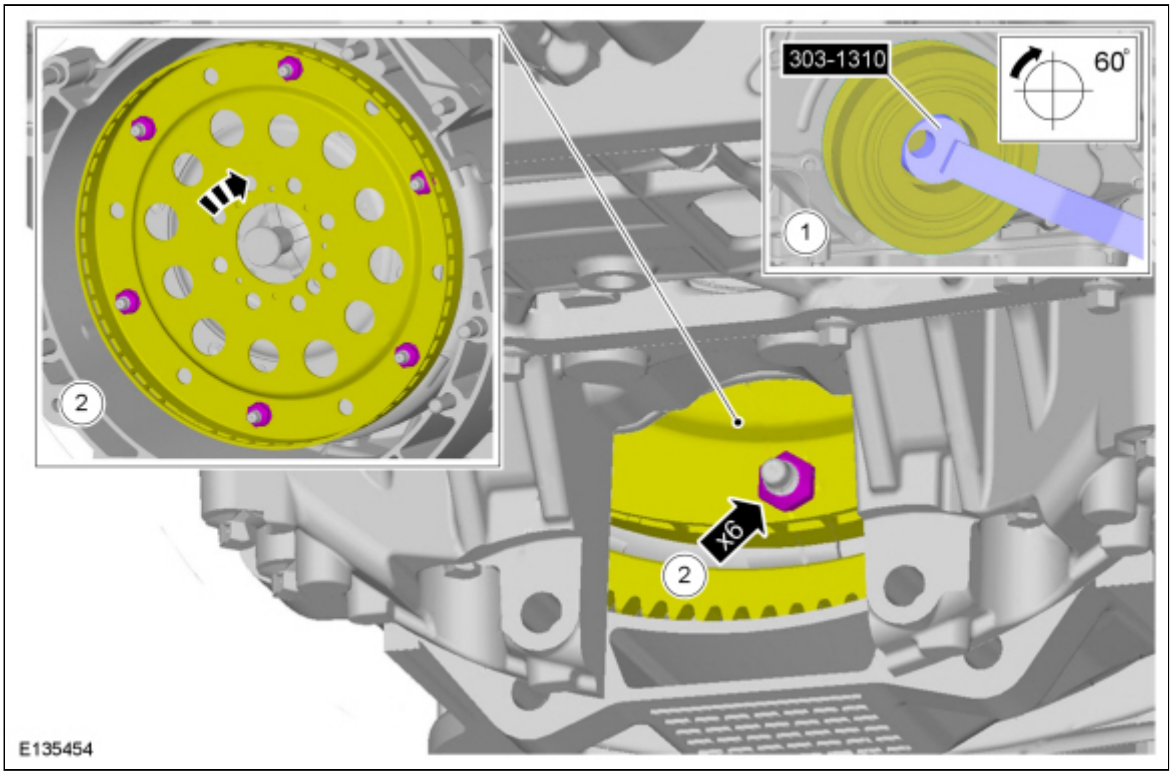
39.



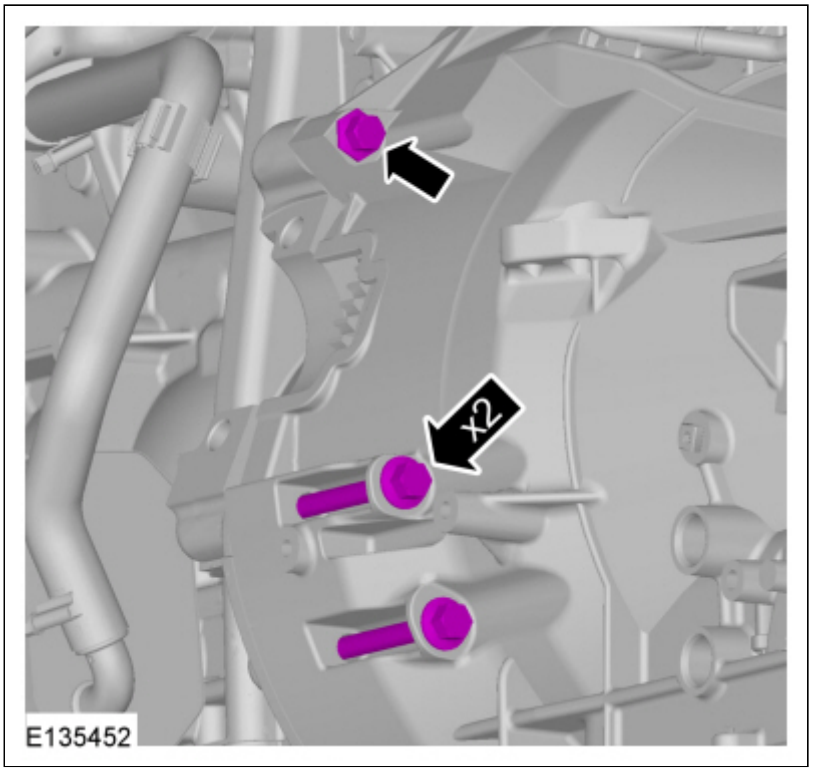
40.



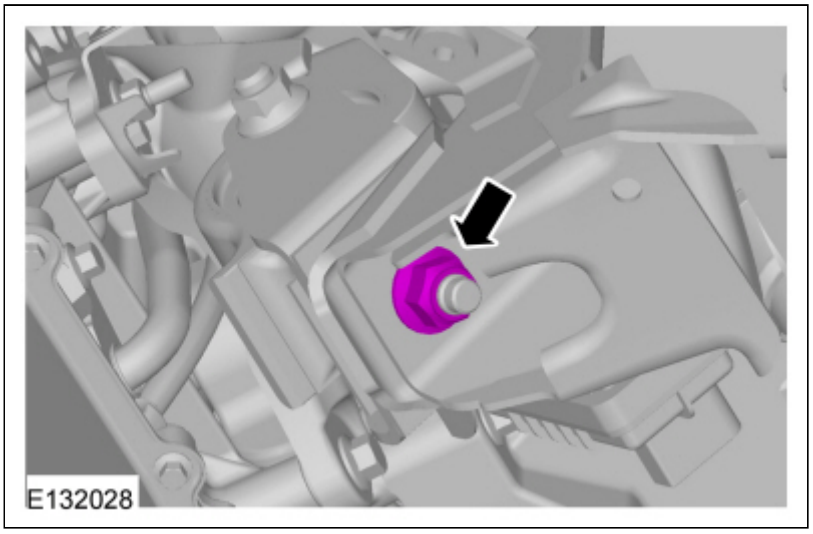
41.



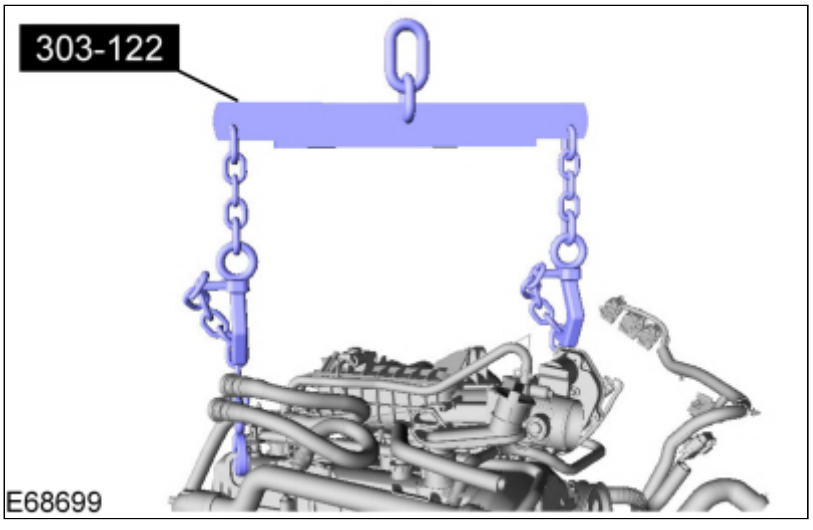
42.



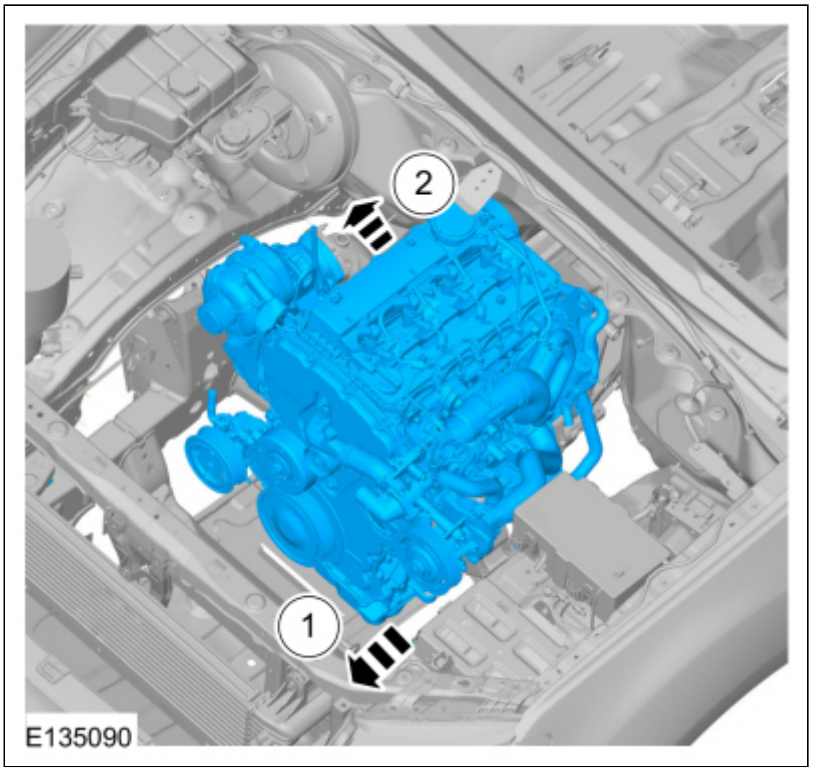
43. On both sides.



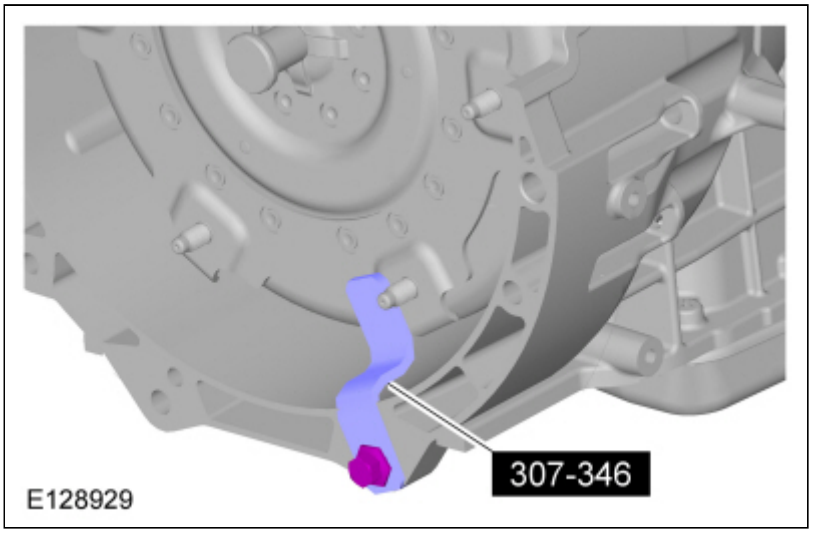
44. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



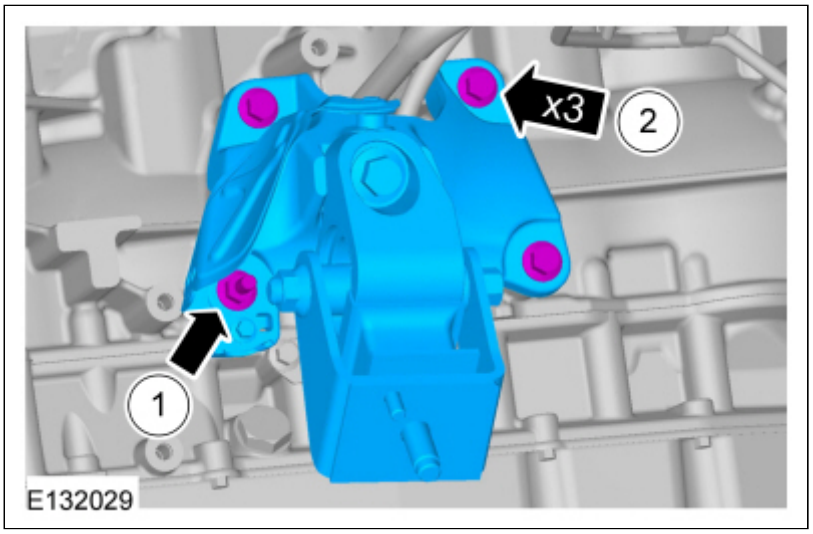
45.



46. Install Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



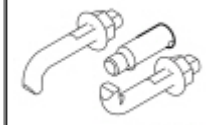
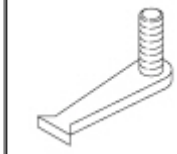
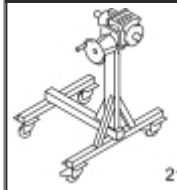
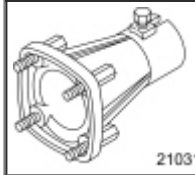
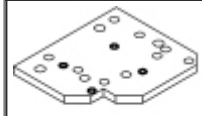
47.

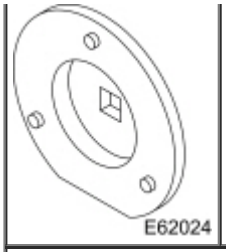


Copyright © 2016 Ford Motor Company

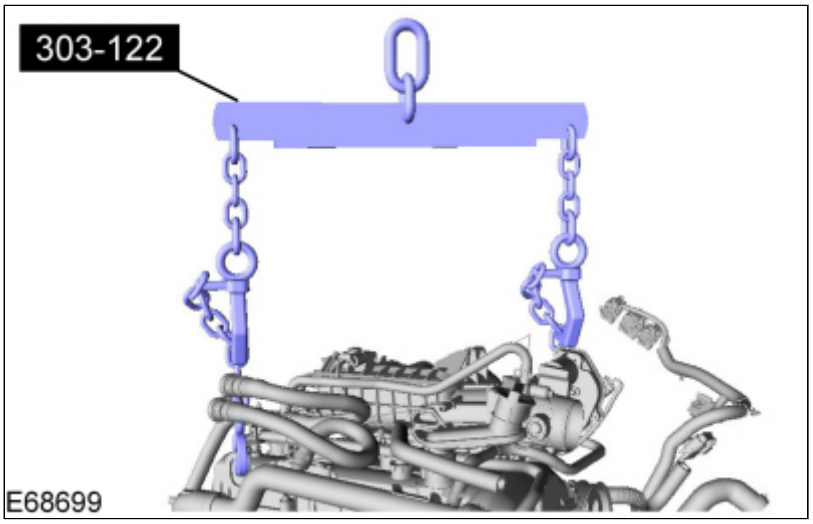
Engine Accessories

Special Tool(s) / General Equipment

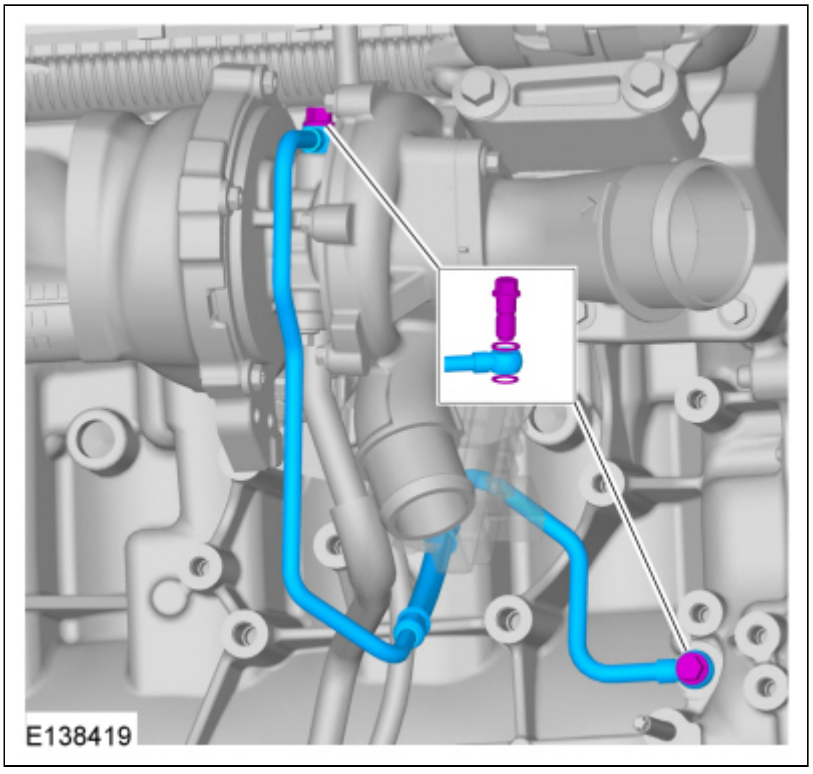
 21068A	303-122 Lifting Bracket, Engine
 E87614	303-1310 Holding Wrench, Crankshaft
 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 E144602	303-249-01 Adapter for 303-249
 21135	303-254 Locking Tool, Flywheel
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E68386	303-435-11B Mounting Plate for 303-435-06
	303-679A Remover/Installer, Engine Front Cover Inspection Plate

	
Dowel with a Diameter of 6 mm	
1/2 Inch Square Drive Breaker Bar	

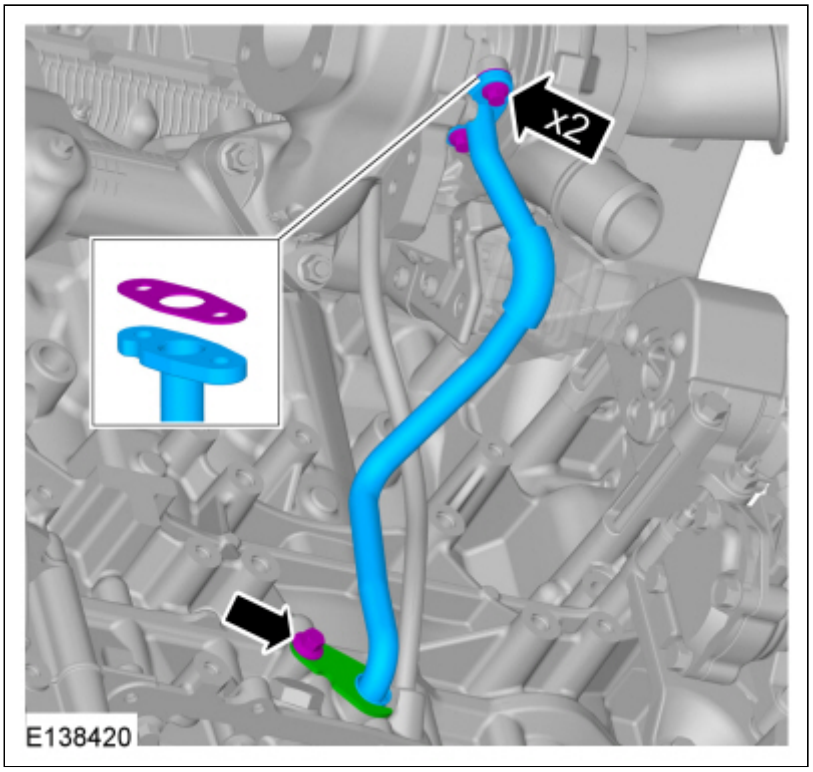
1. Install Special Service Tool: 303-122 Lifting Bracket, Engine.



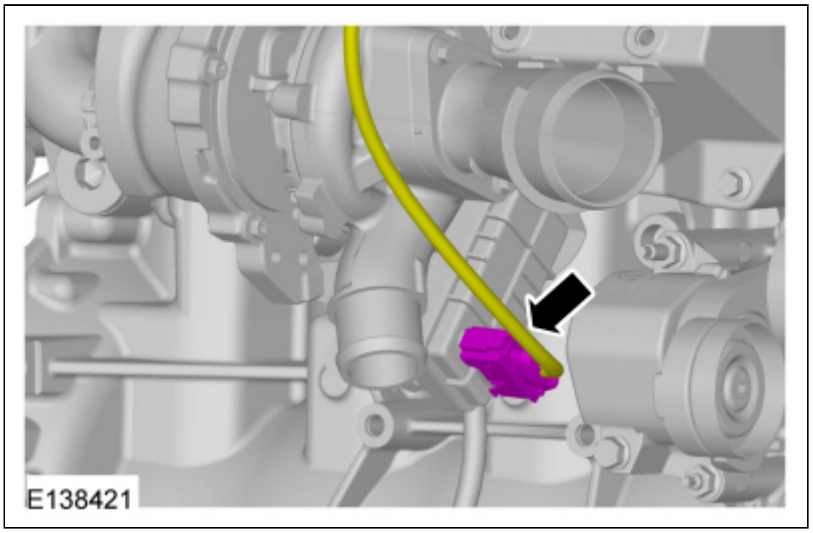
2.



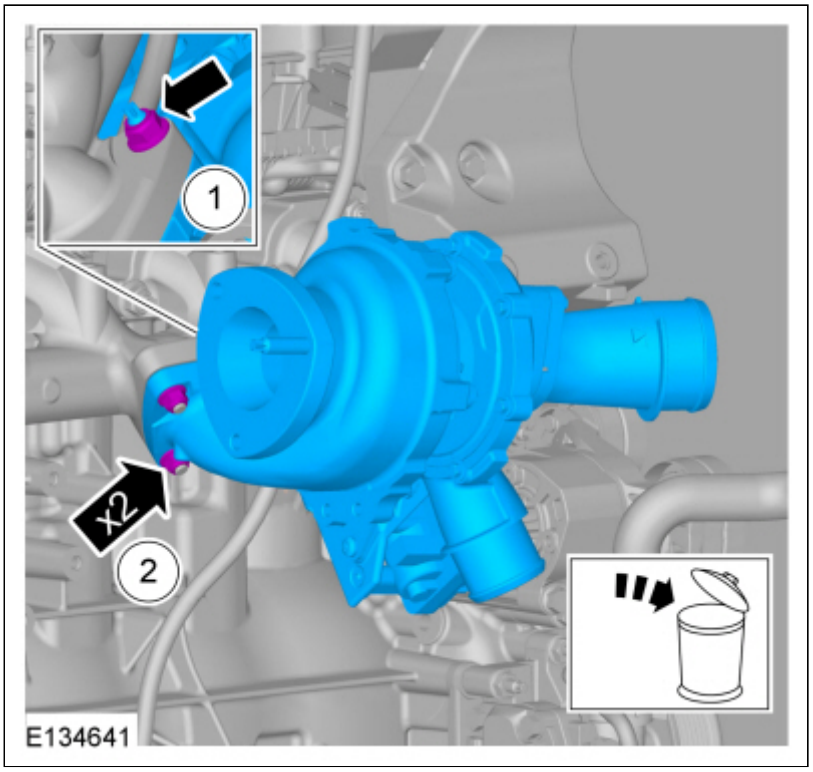
3.



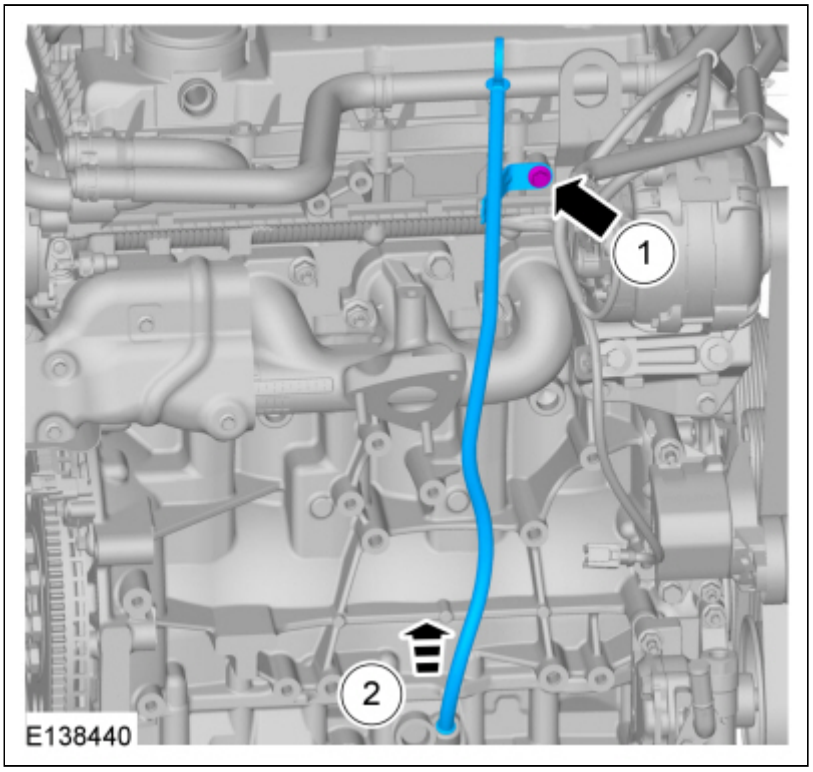
4.



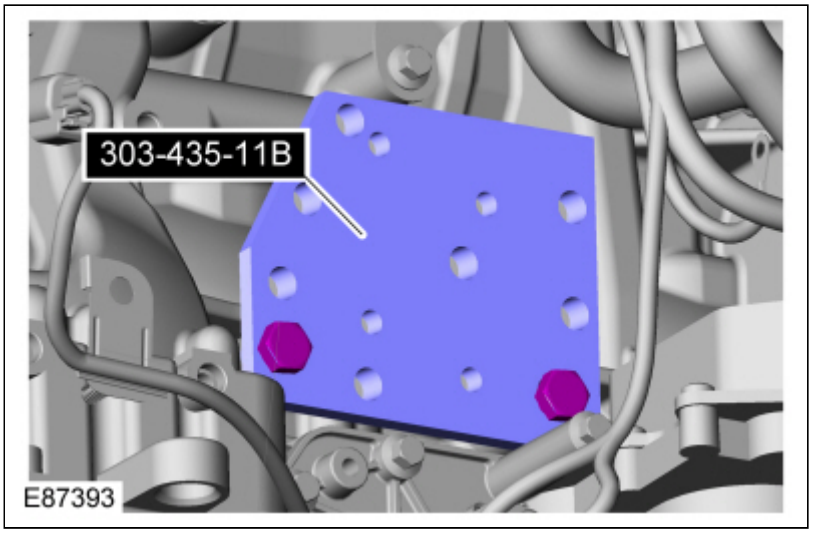
5.



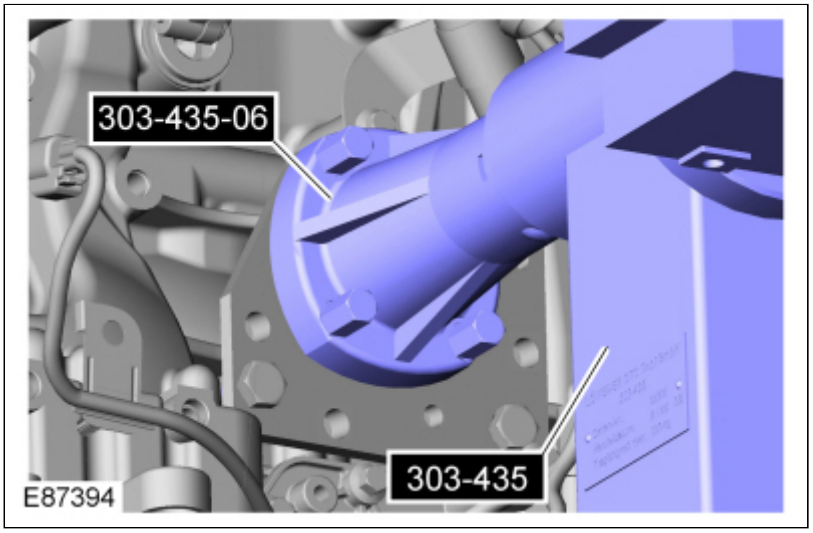
6.



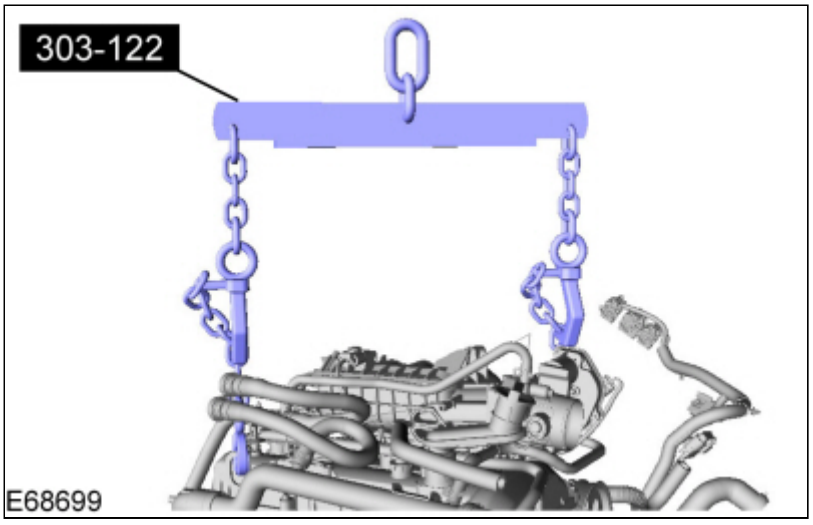
7. Install Special Service Tool: 303-435-11B Mounting Plate for 303-435-06.



8. Install Special Service Tool: 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435.

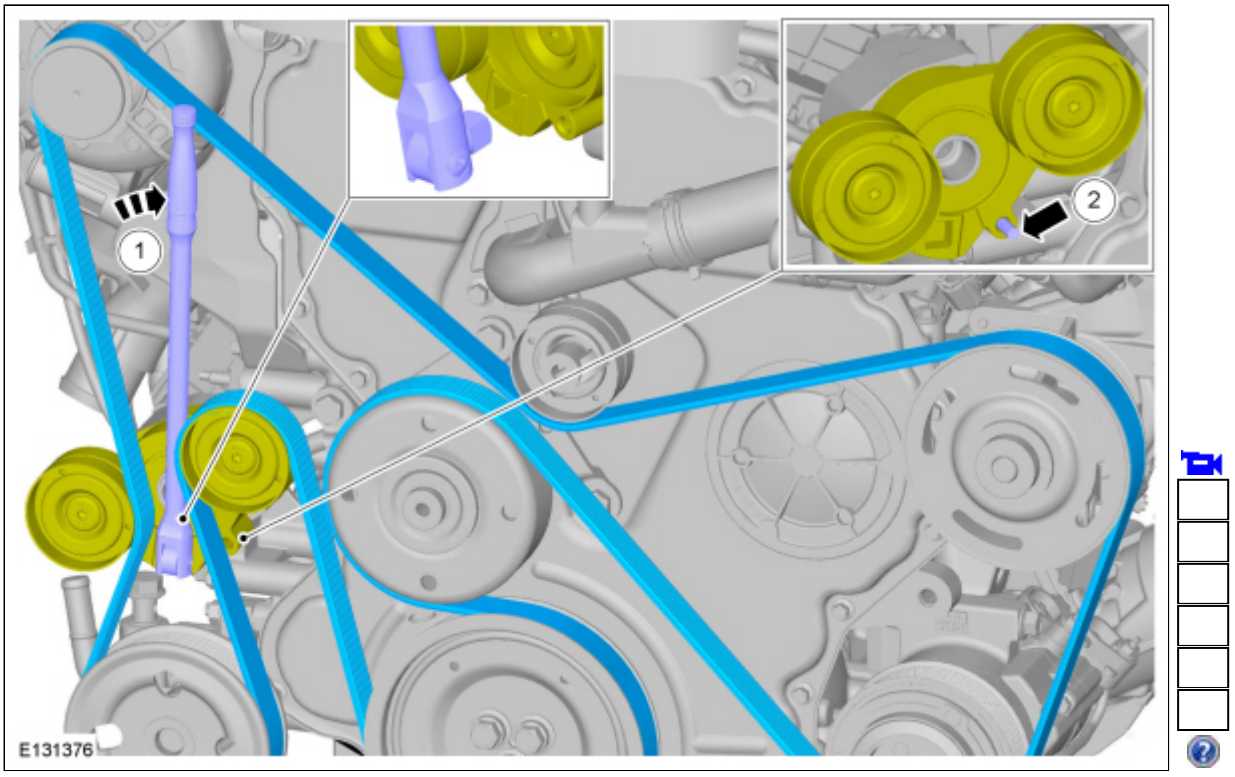


9. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.

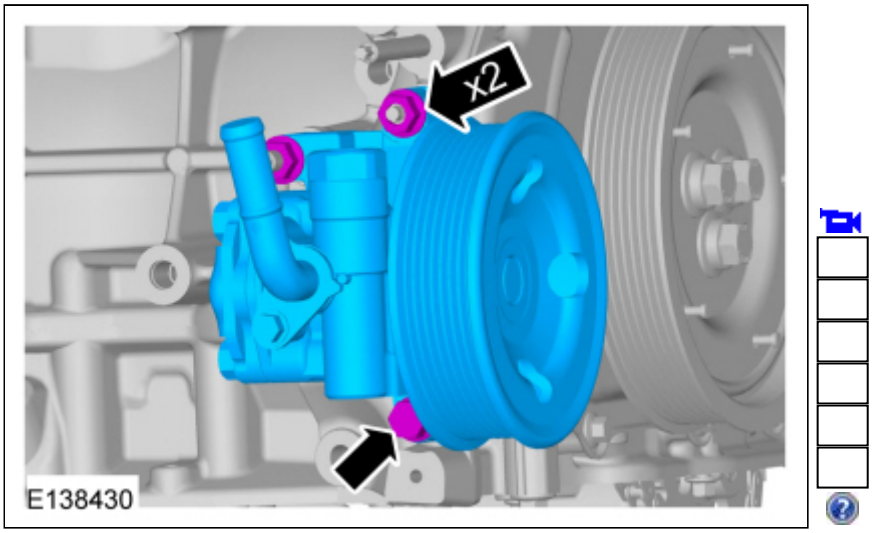


Vehicles With: Hydraulic Power Assist Steering (HPAS)

10. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
    Use the General Equipment: Dowel with a Diameter of 6 mm

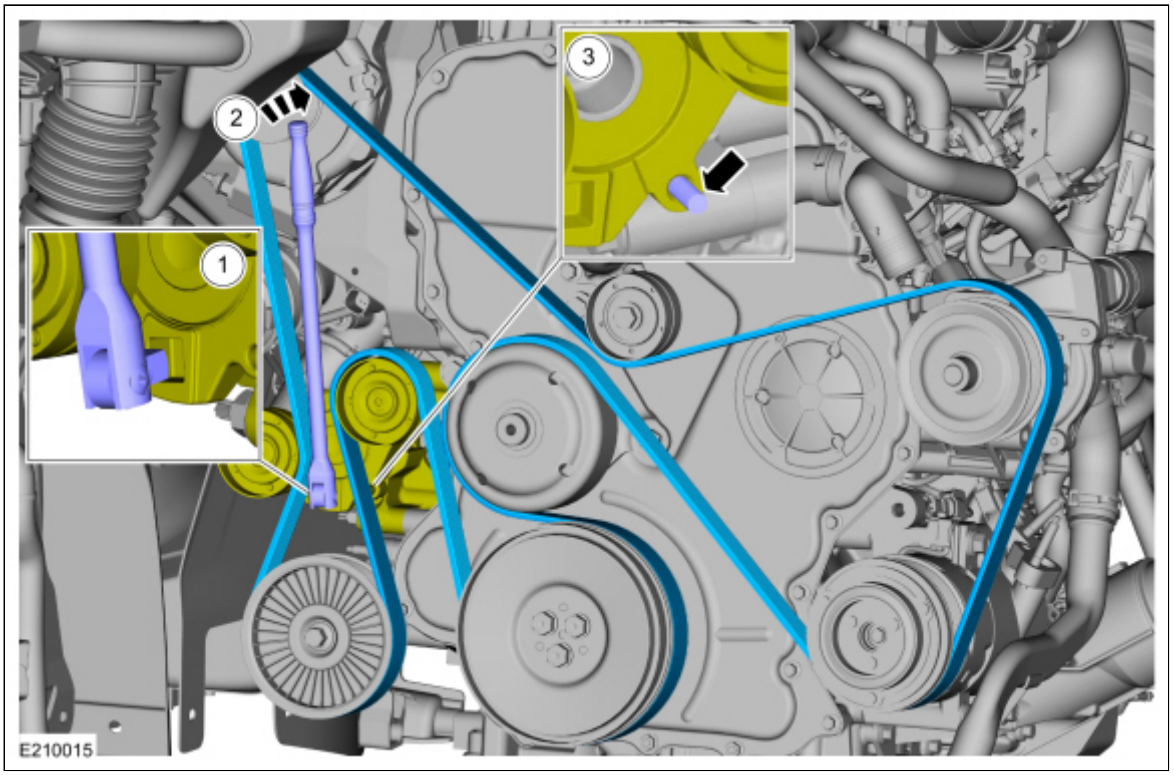


11.



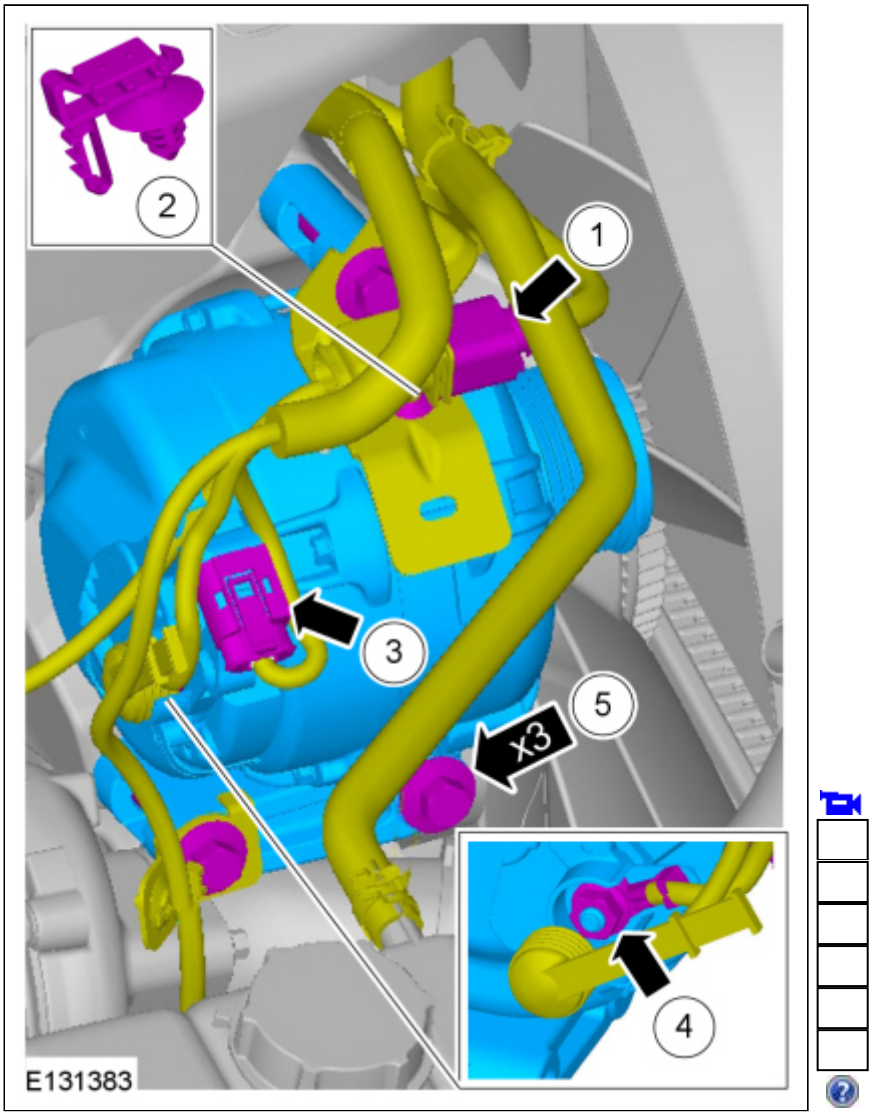
Vehicles With: Electronic Power Assist Steering (EPAS)

1. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. **NOTE:** *Rotate the accessory drive belt tensioner clockwise.*
3. Use the General Equipment: Dowel with a Diameter of 6 mm

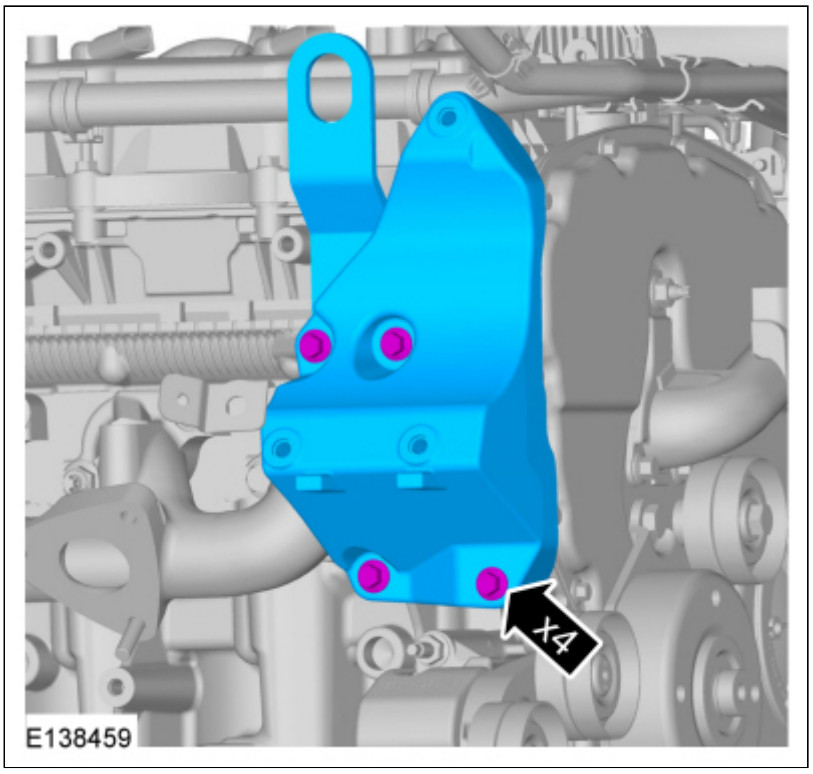


All vehicles

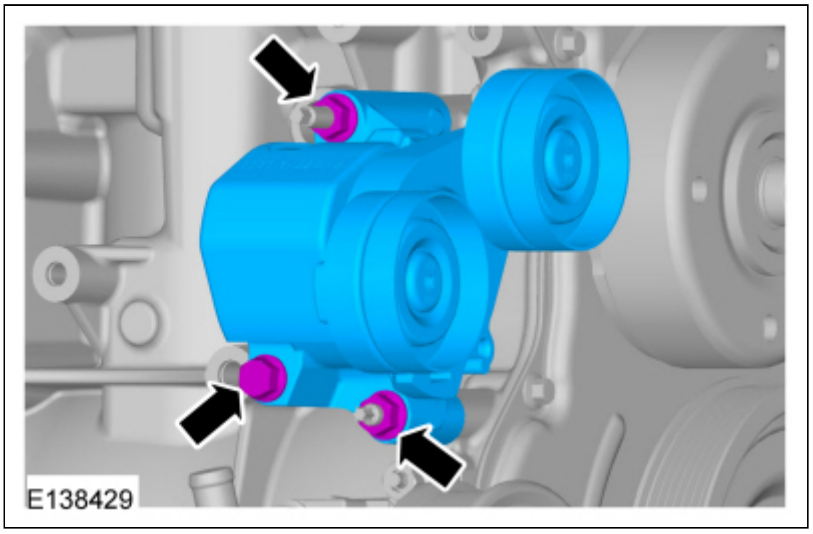
13. **NOTICE: Take extra care not to damage the wiring harnesses.**



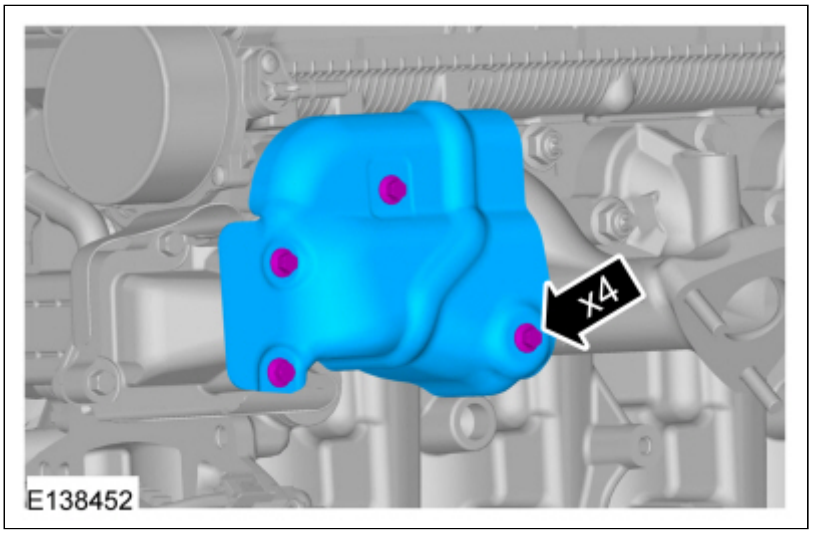
14.



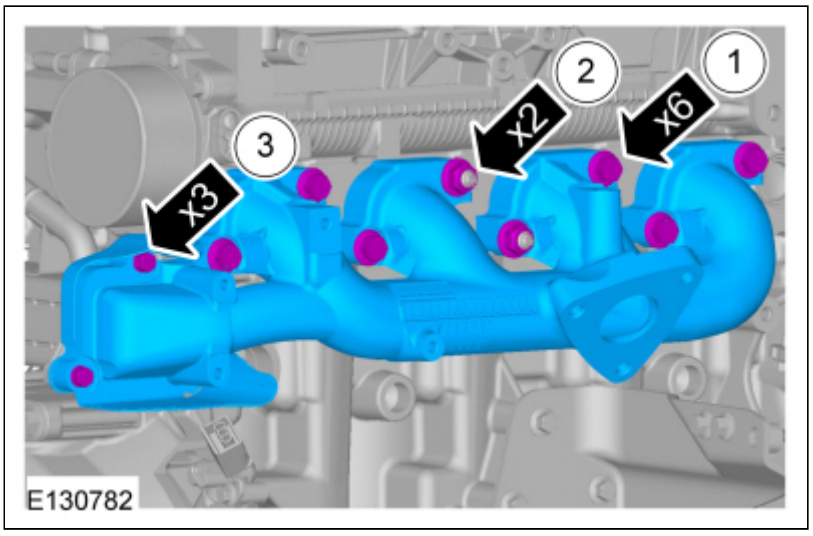
15.



16.

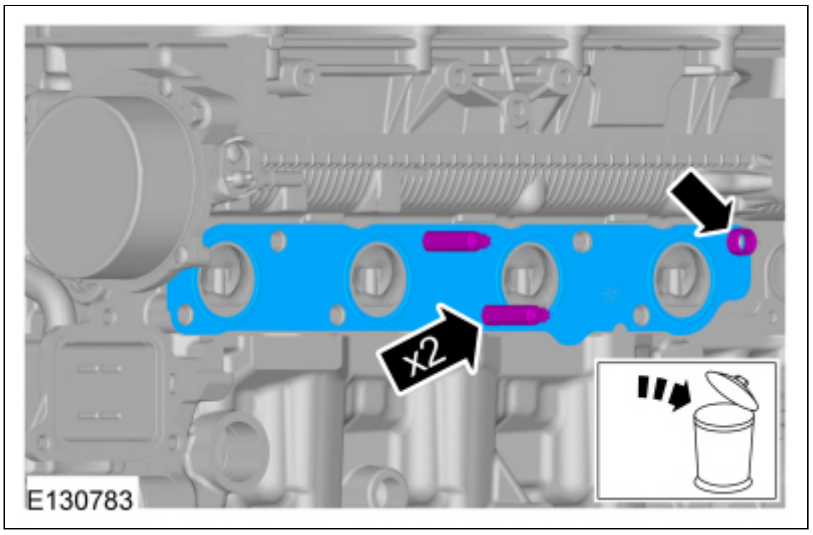


17.

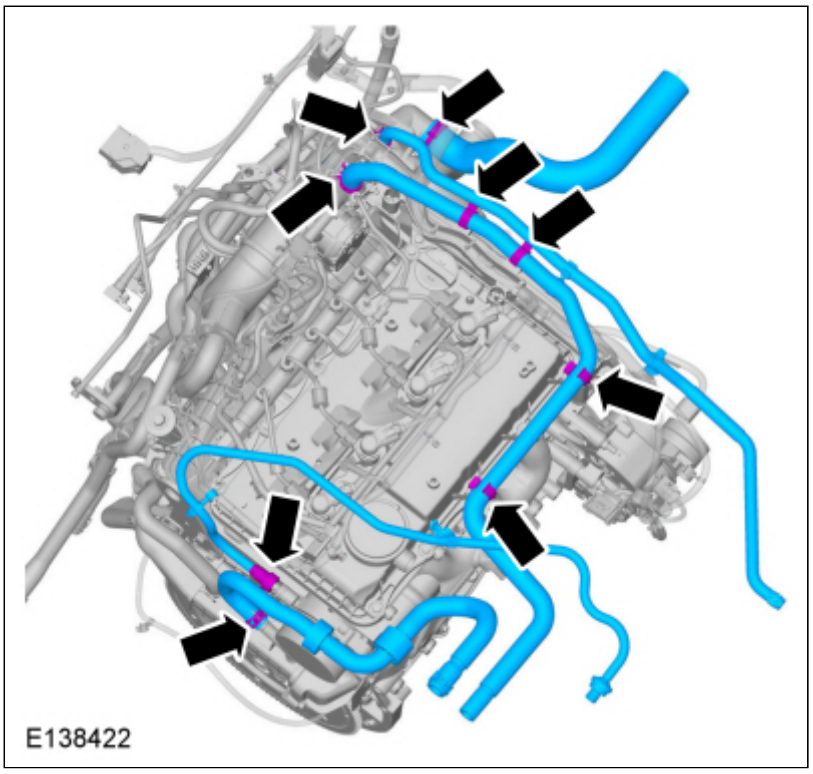


18. **NOTE:** *The gasket is to be reused unless damaged.*

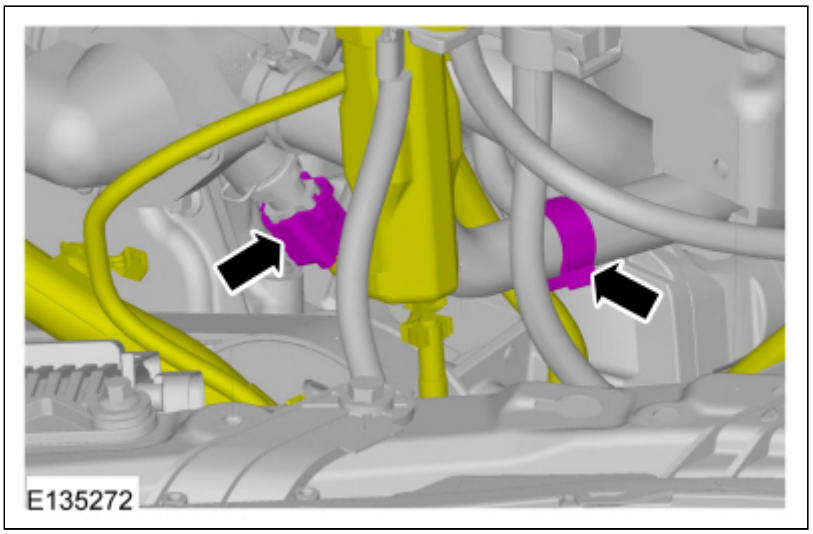
    NOTE: *The studs are to be reused unless damaged.*



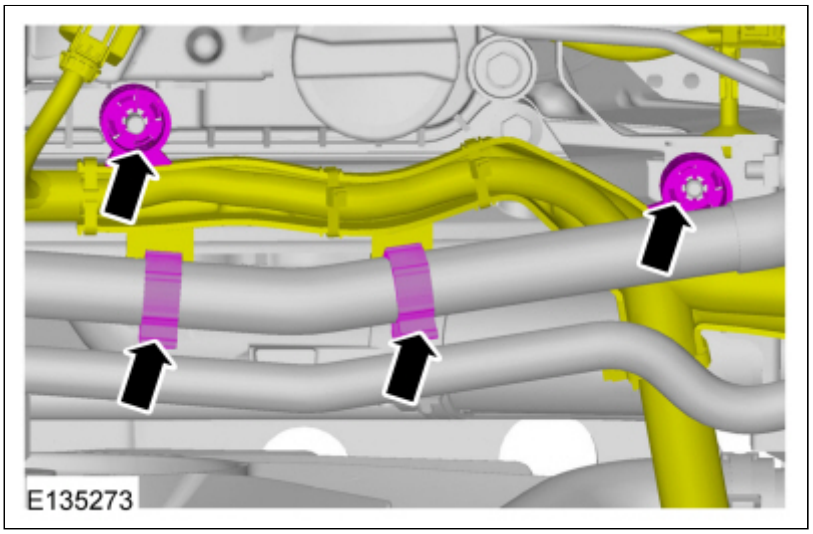
19.



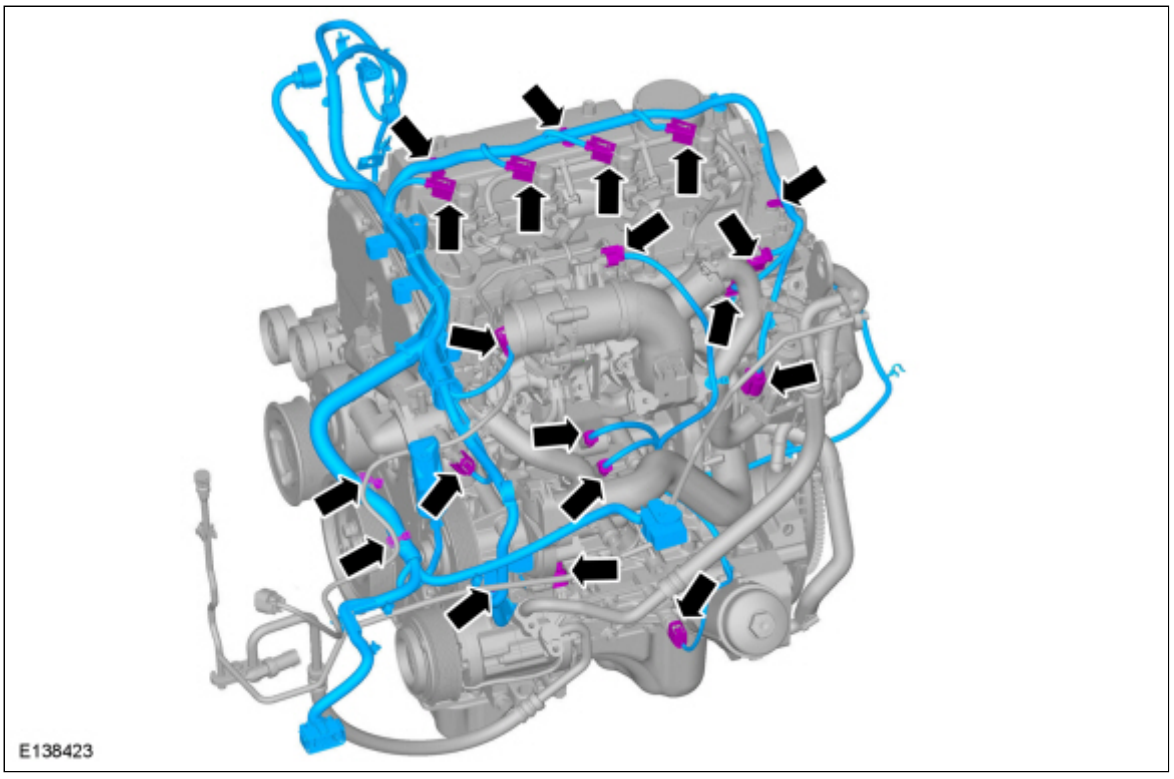
20.



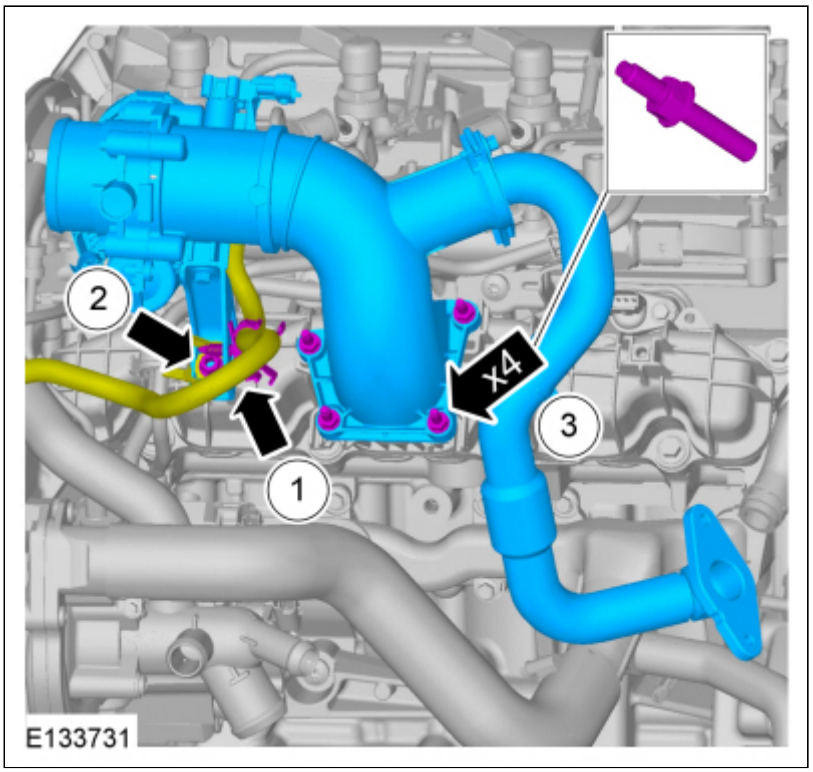
21.



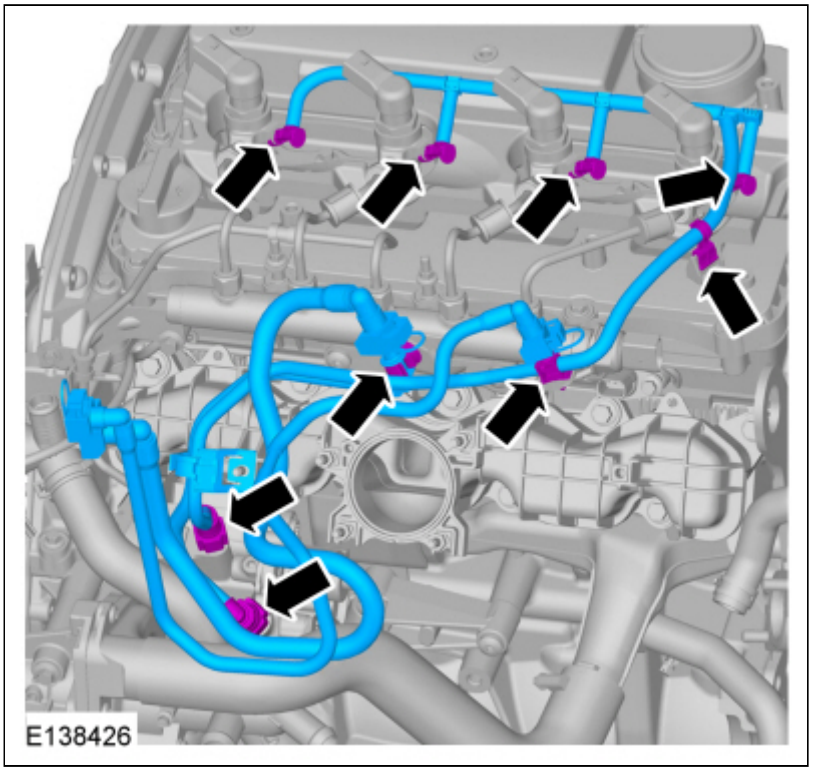
22.



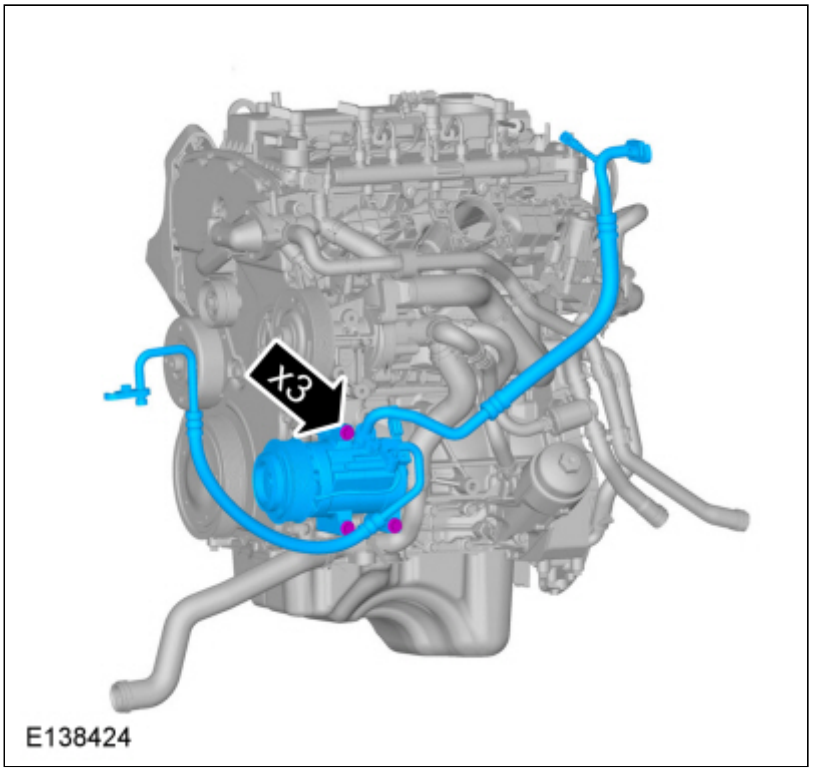
23.



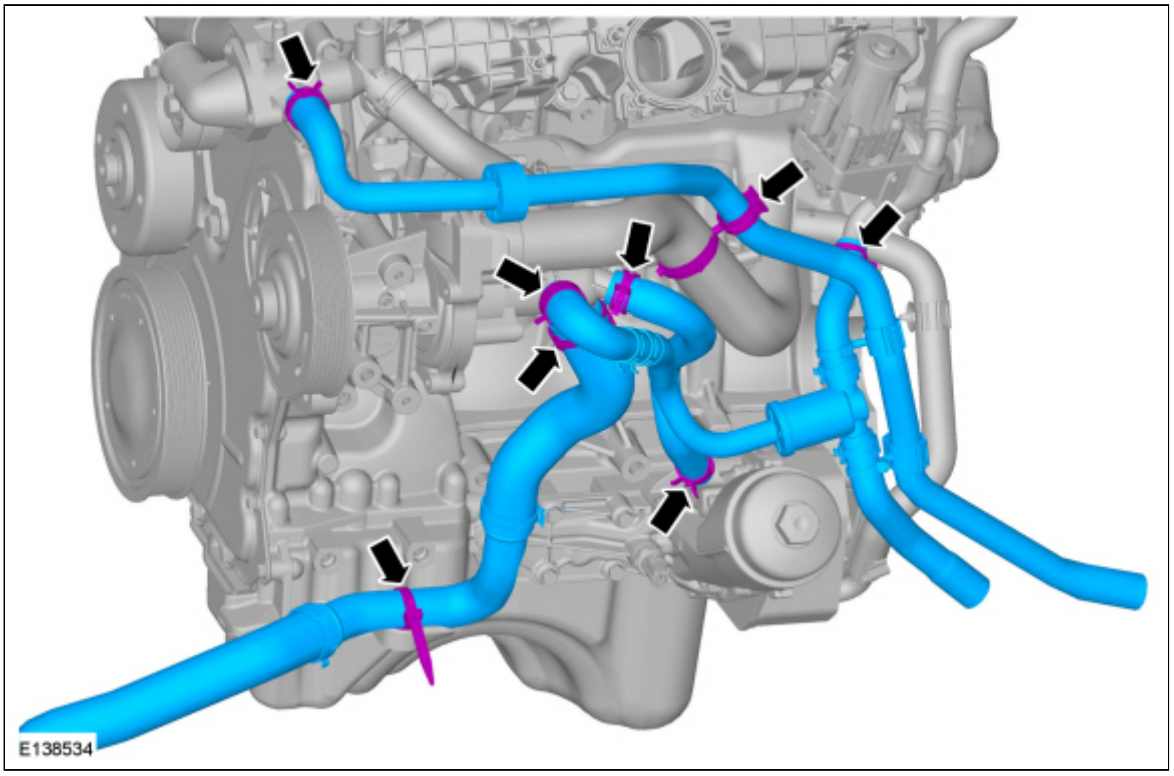
24. **NOTICE: Make sure that all openings are sealed. Use new blanking caps.**



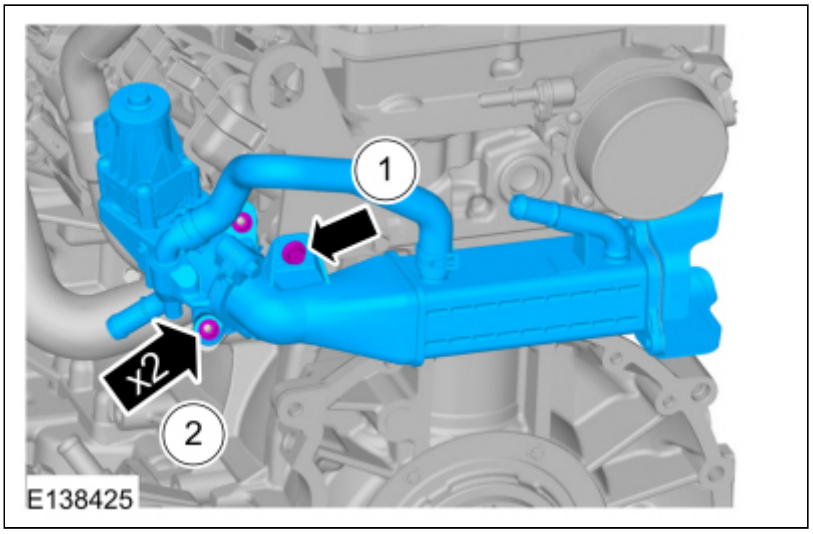
25.



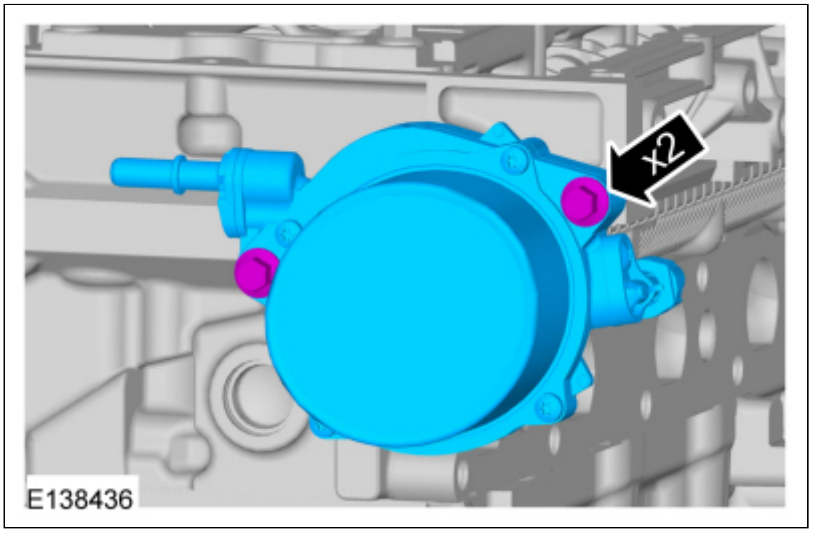
26.



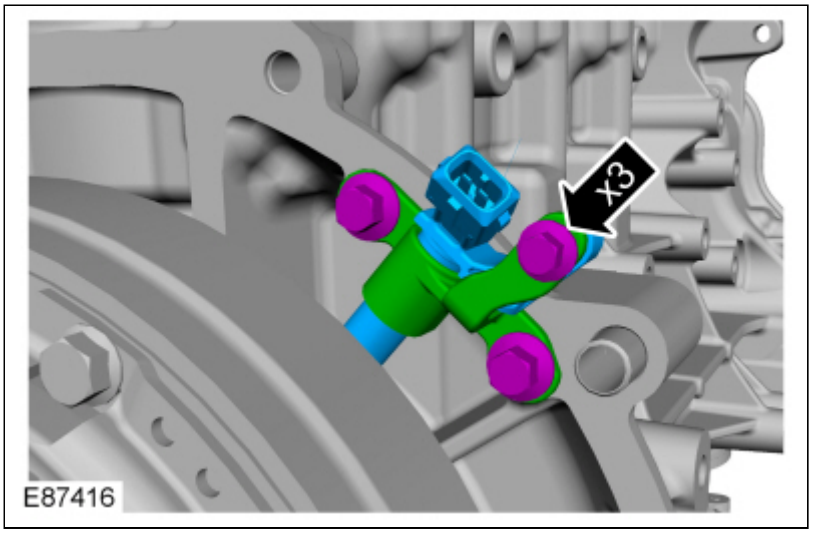
27.



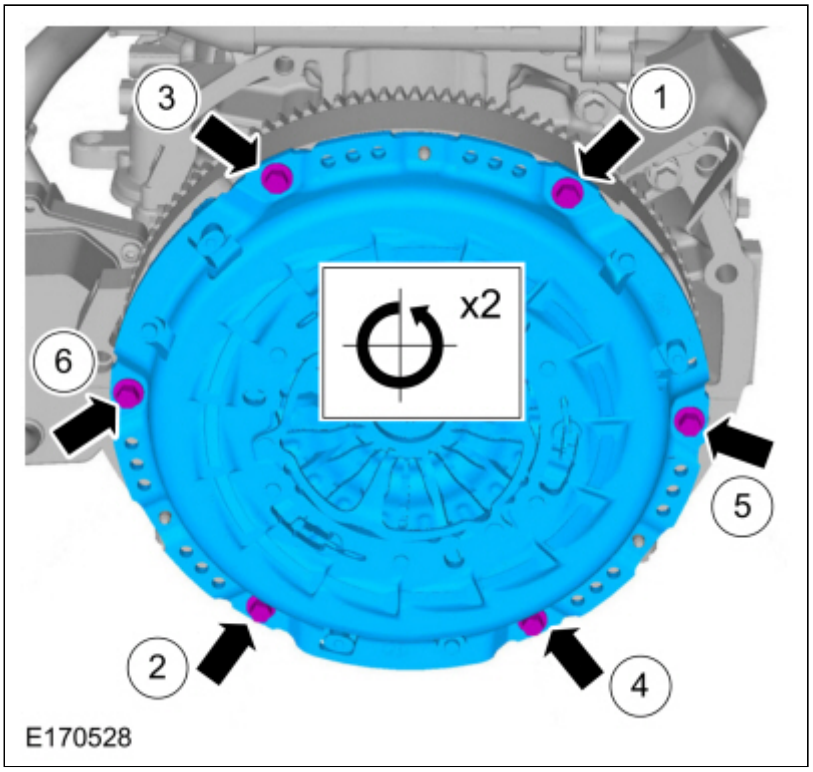
28.



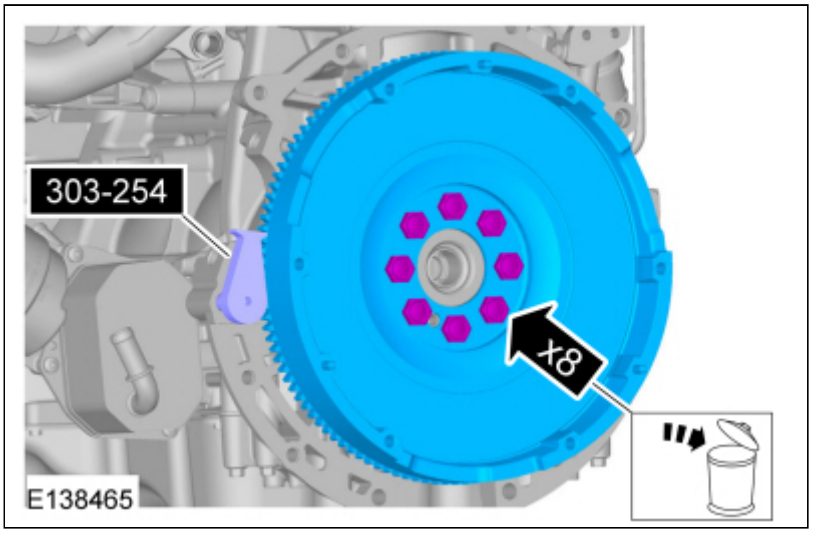
29.



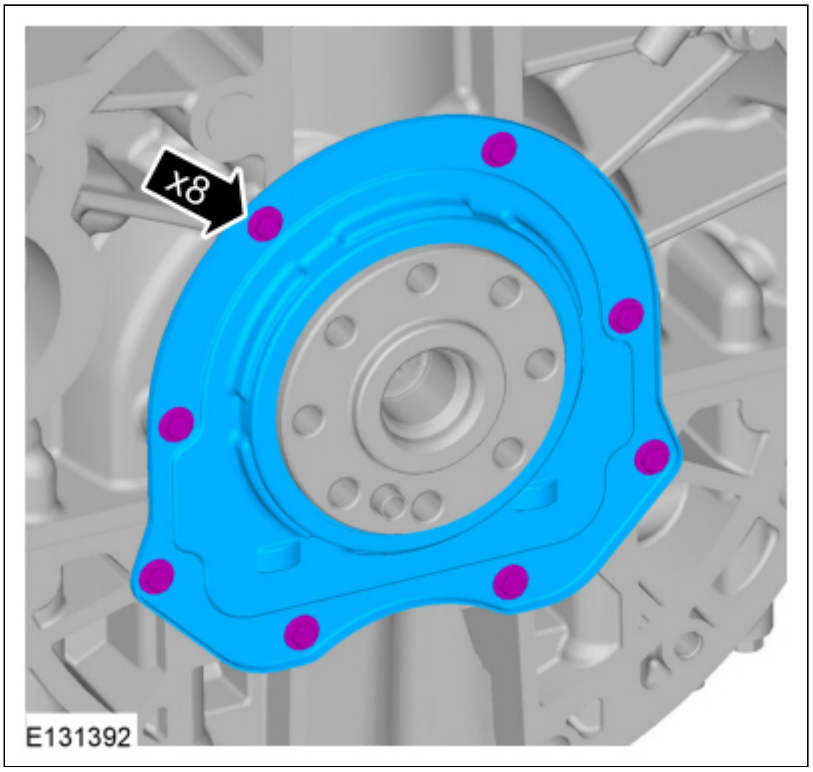
30. **NOTE:** *Do not loosen the bolts more than 2 turns.*



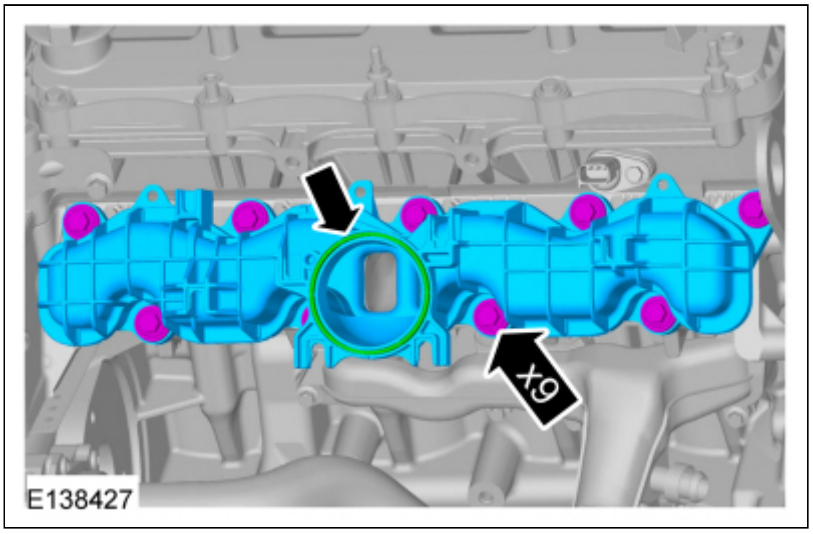
31. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



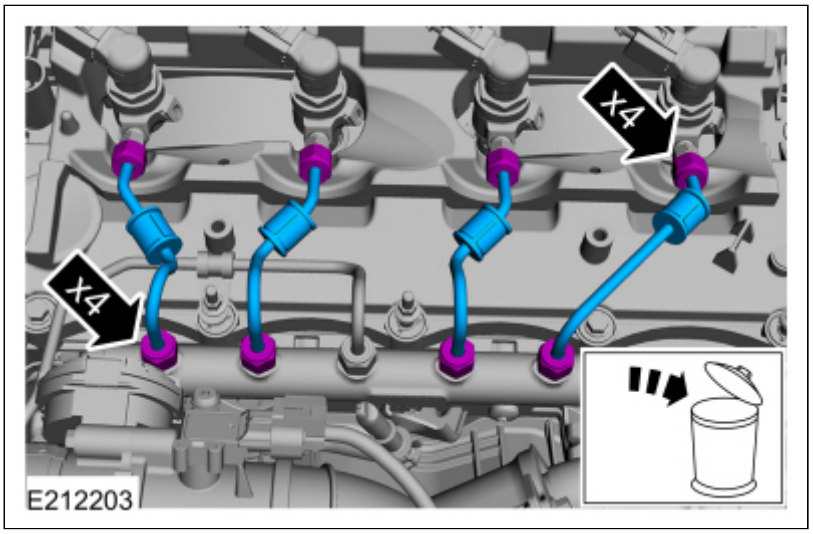
32.



33.



34.

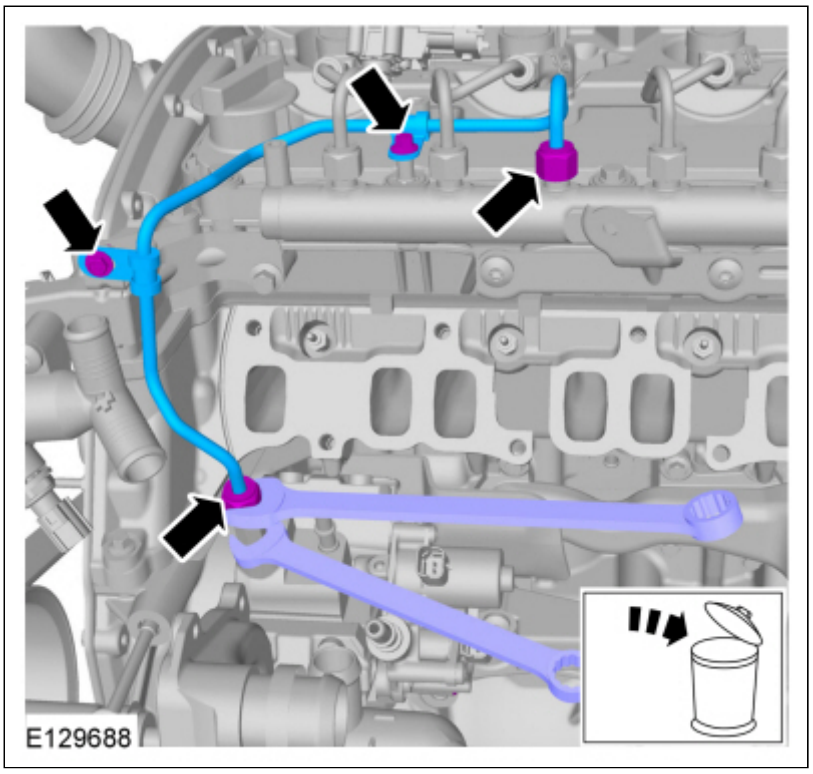


35. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been**

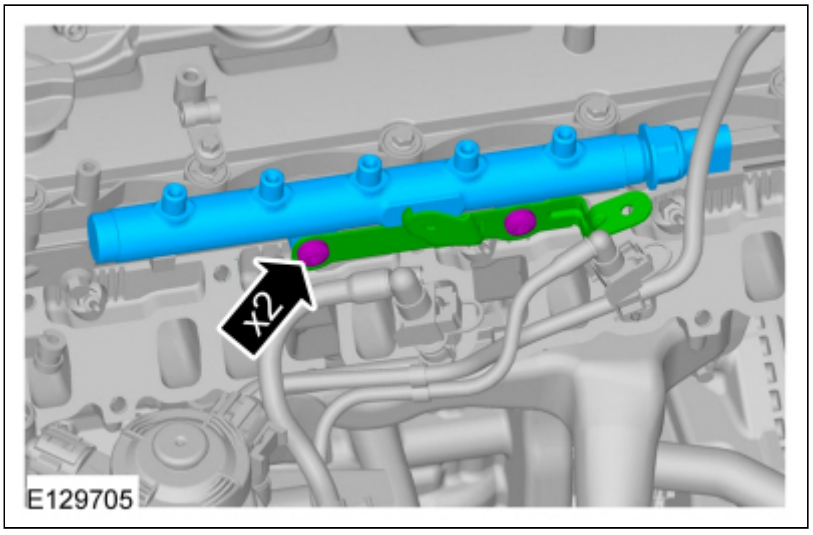
unscrewed and the area around the joints thoroughly cleaned.

NOTICE: Make sure that the high-pressure fuel supply line remains in contact with both the fuel pump and the fuel rail until both unions have been detached and cleaned.

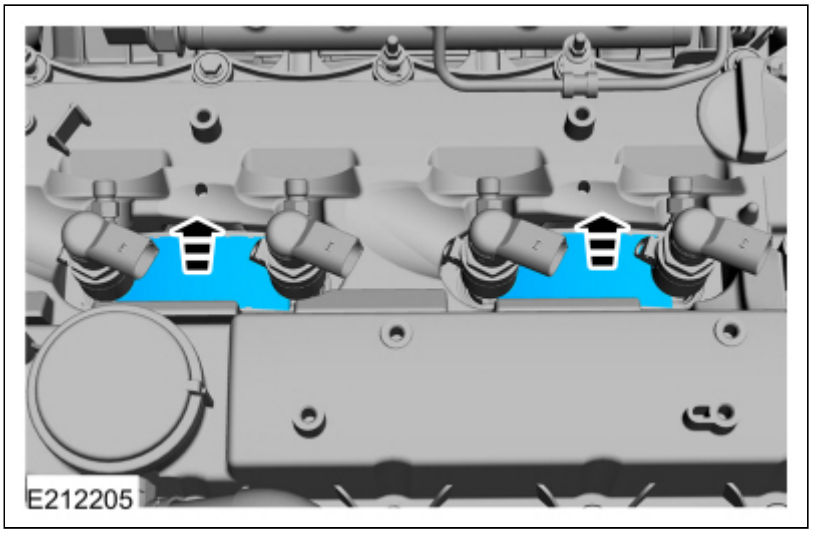
NOTICE: Make sure that all openings are sealed. Use new blanking caps.



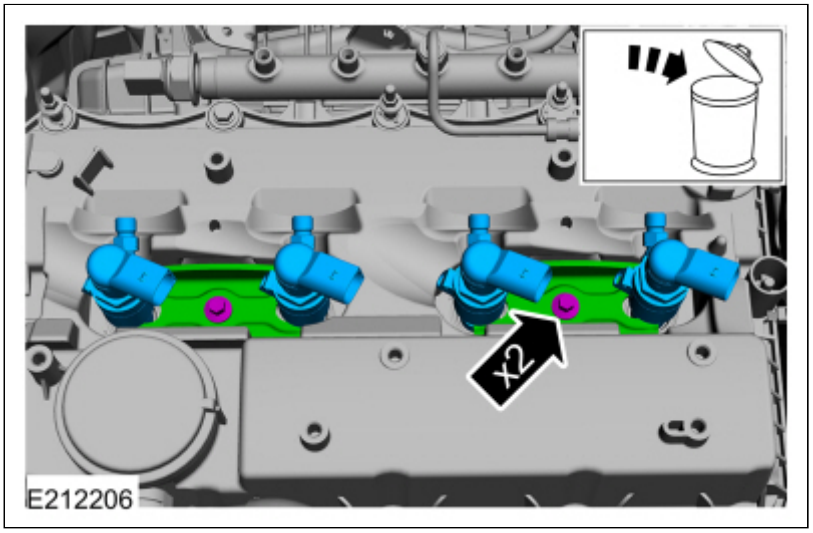
36.



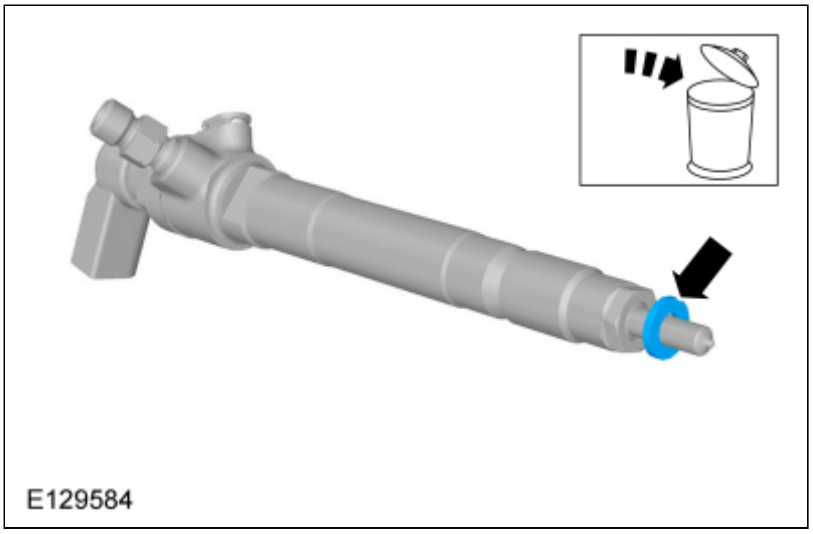
37.



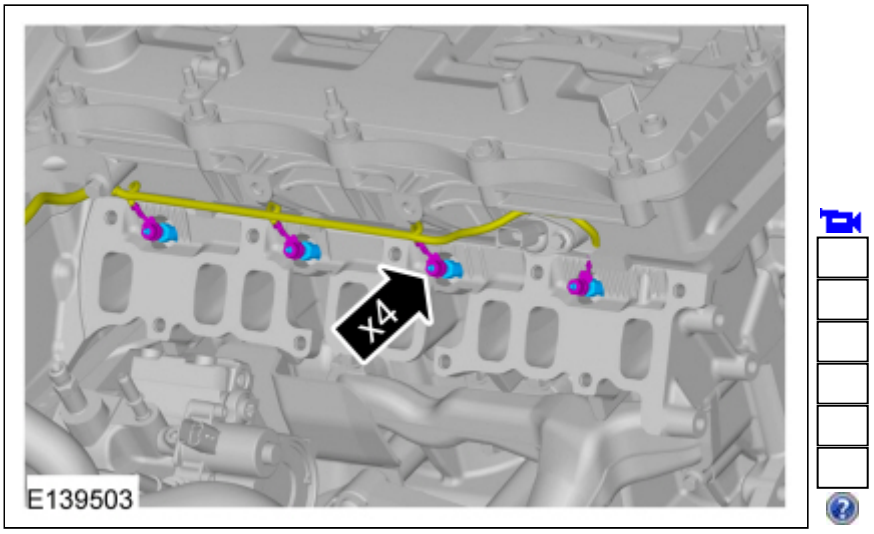
38.



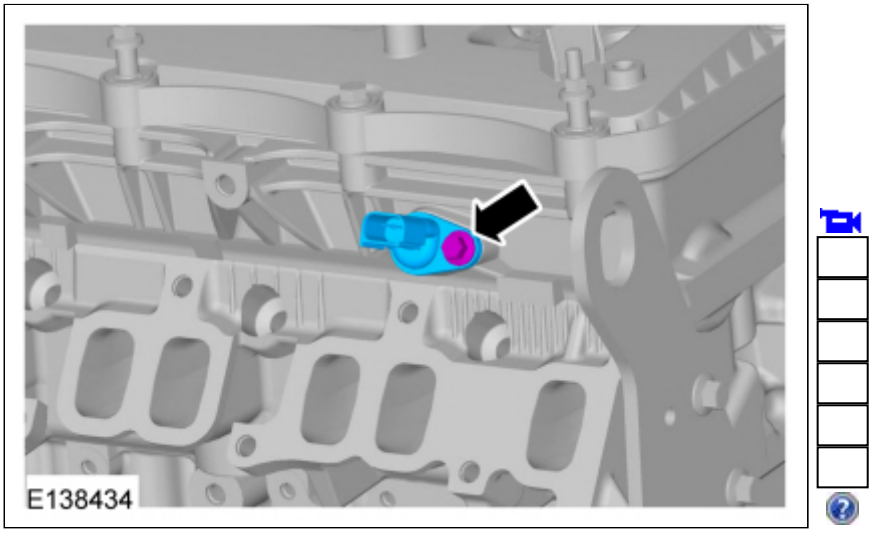
39.



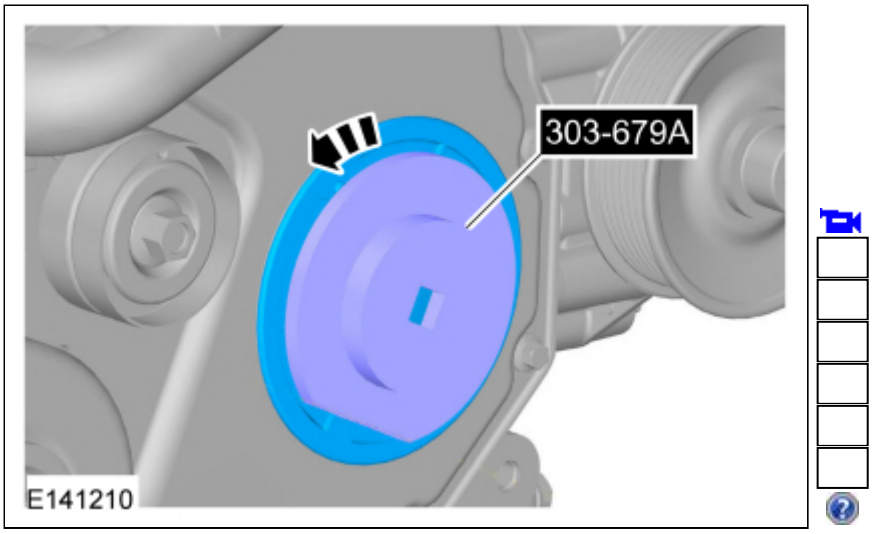
40.



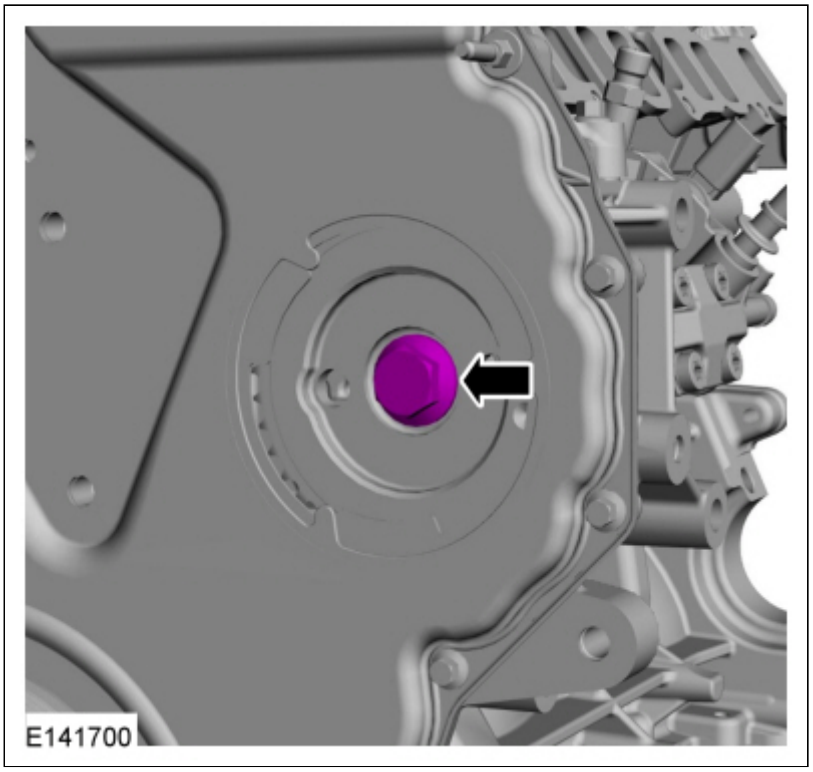
41.



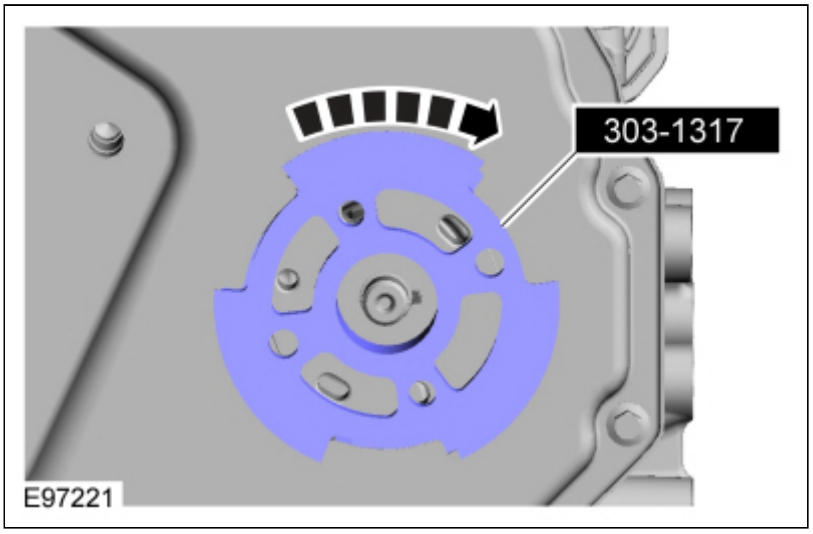
42. Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



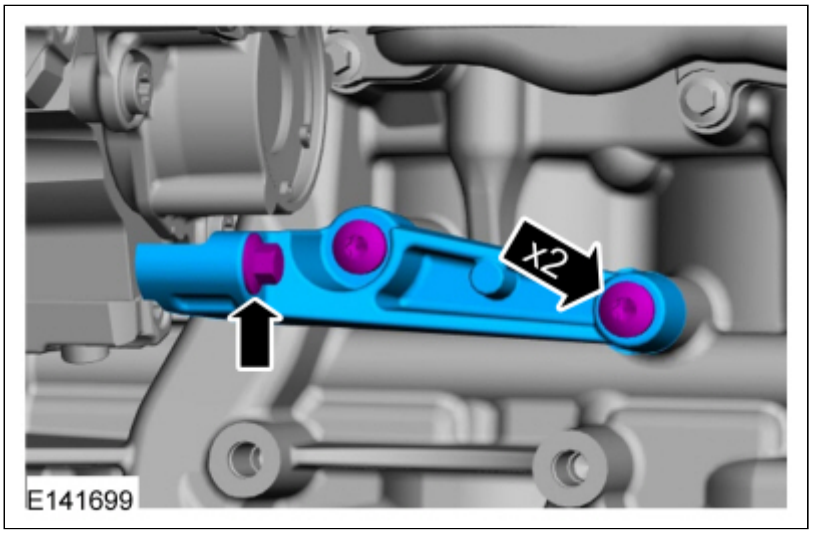
43. **NOTE:** *The component has a left-hand thread.*



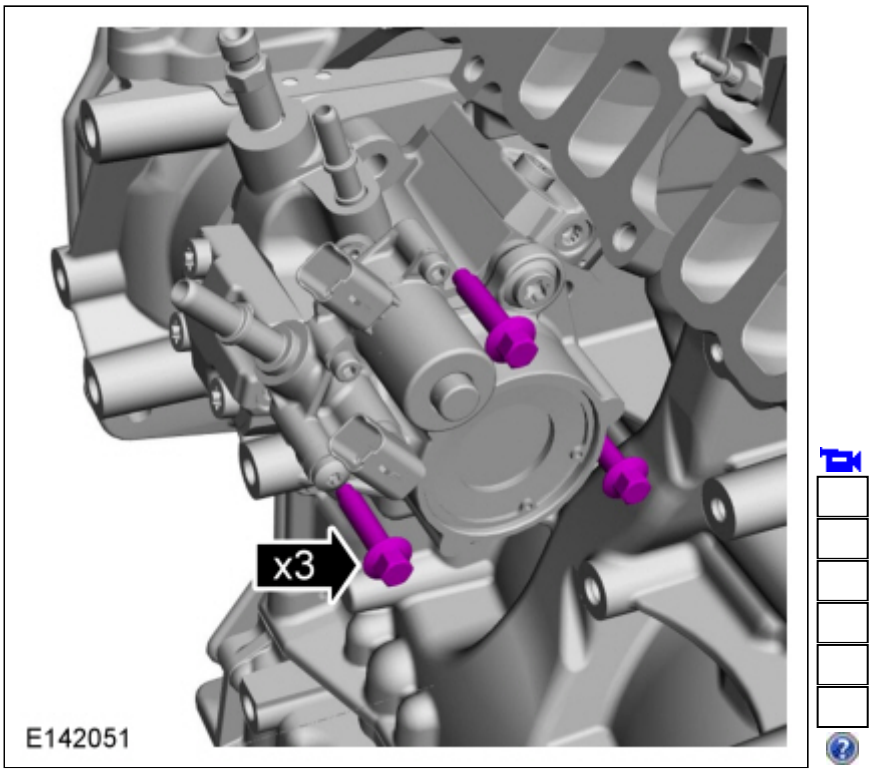
44. Install Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



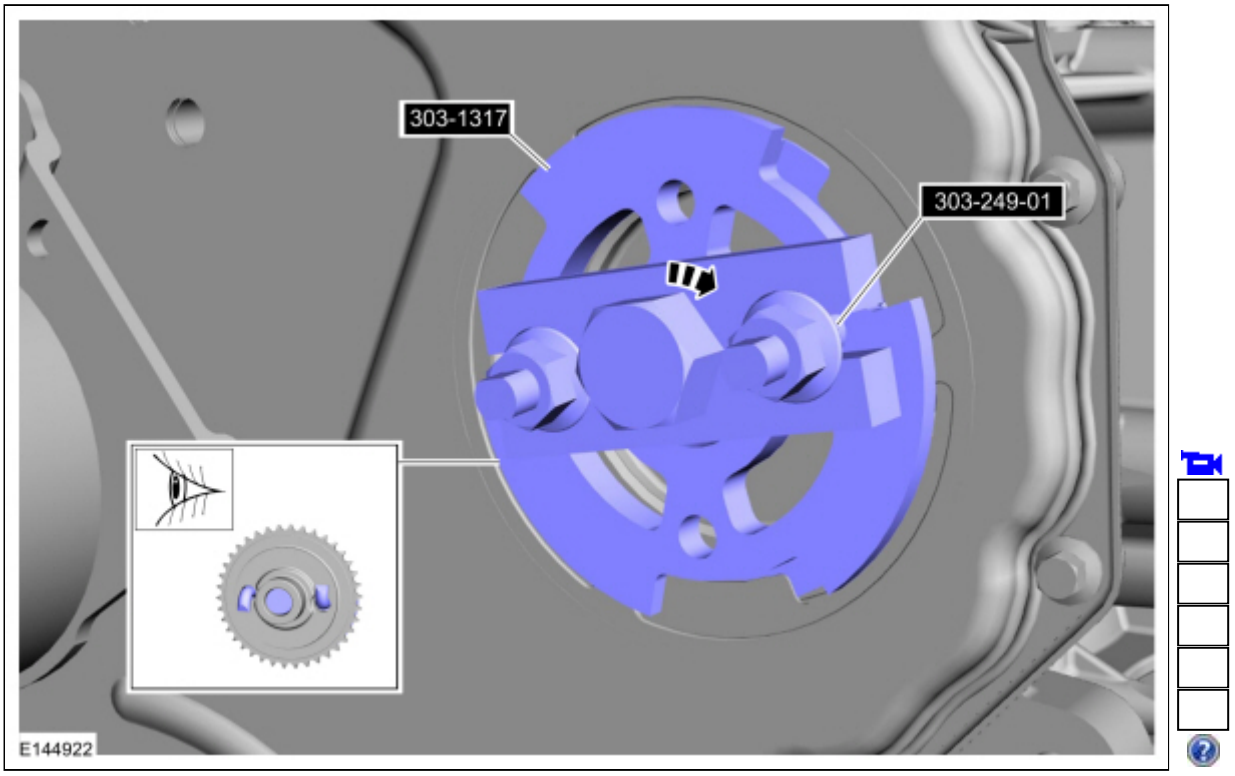
45.



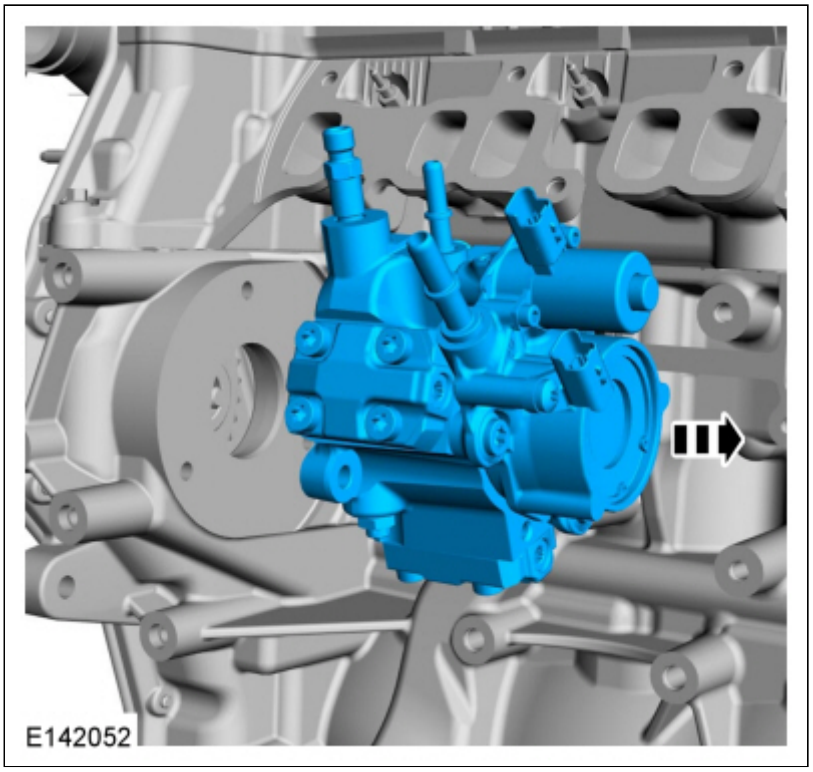
46.



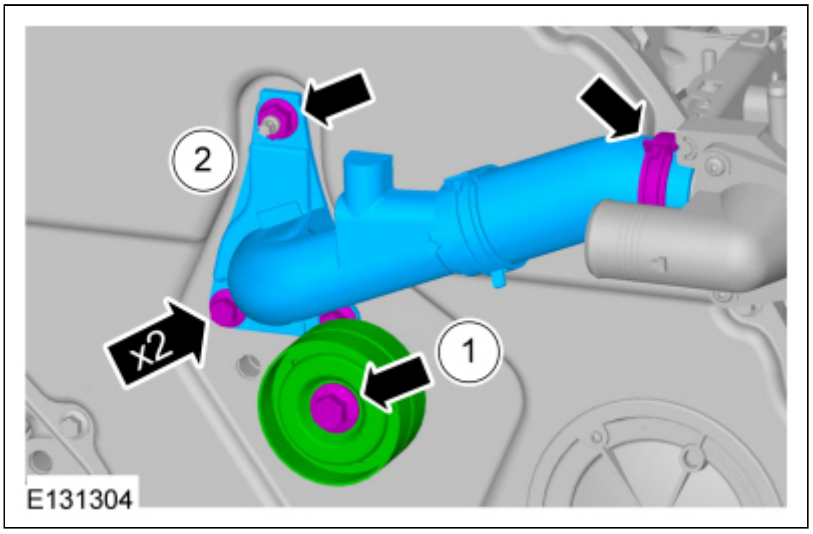
47. Use Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket. , 303-249-01 Adapter for 303-249.



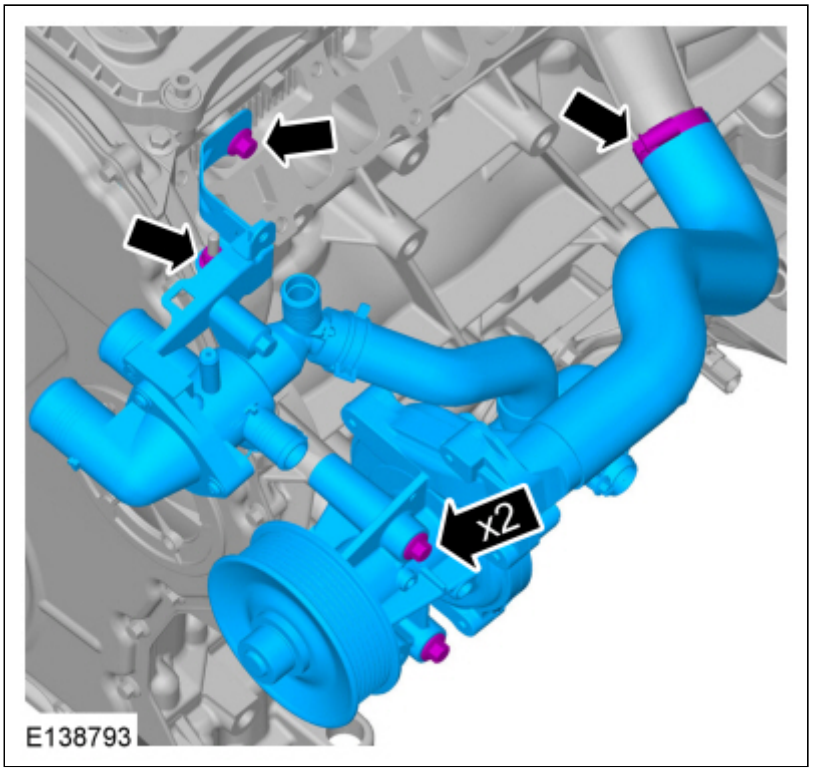
48.



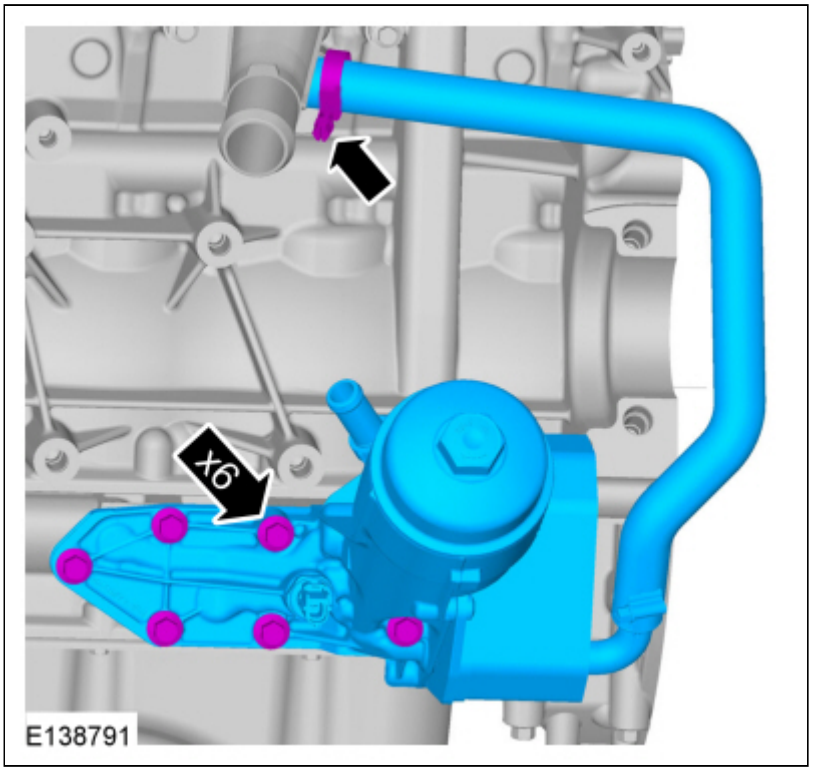
49.



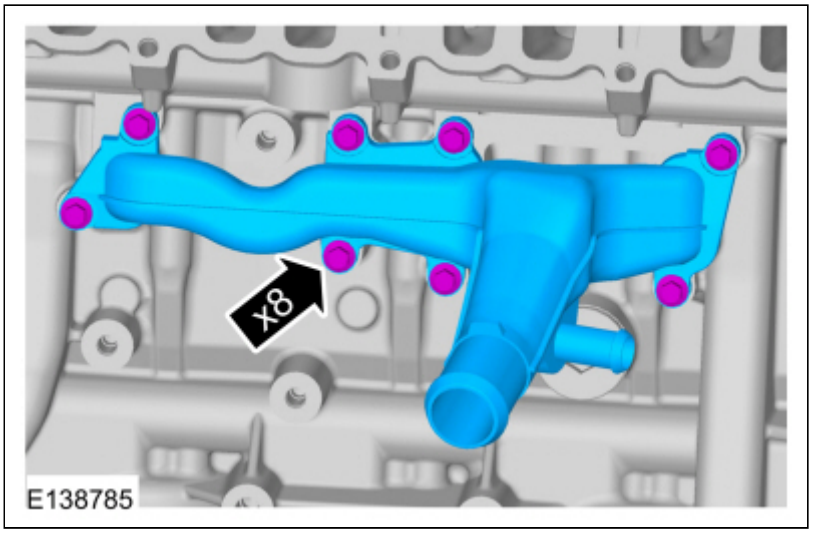
50.



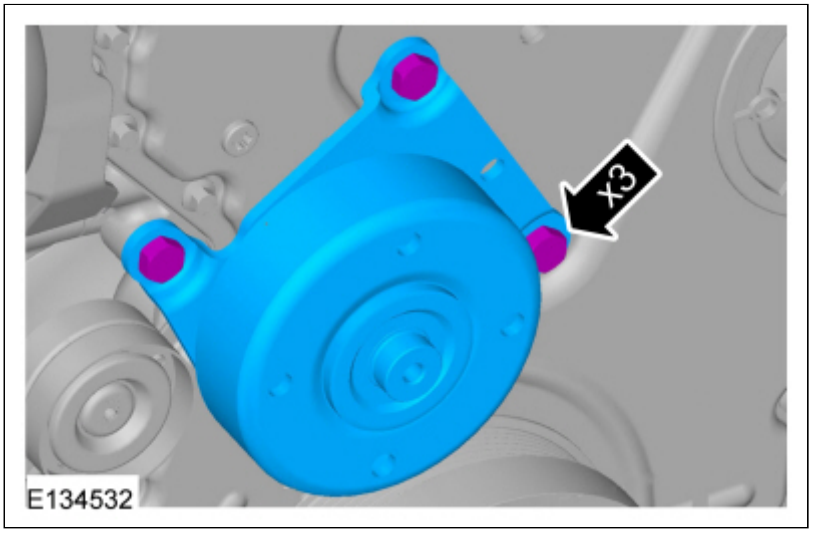
51.



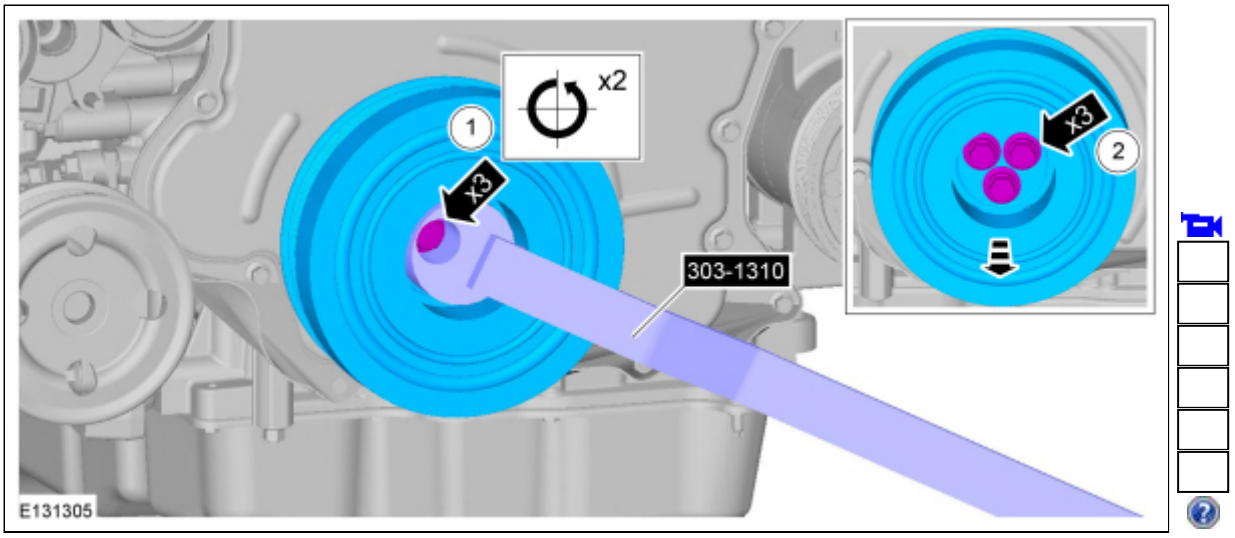
52.



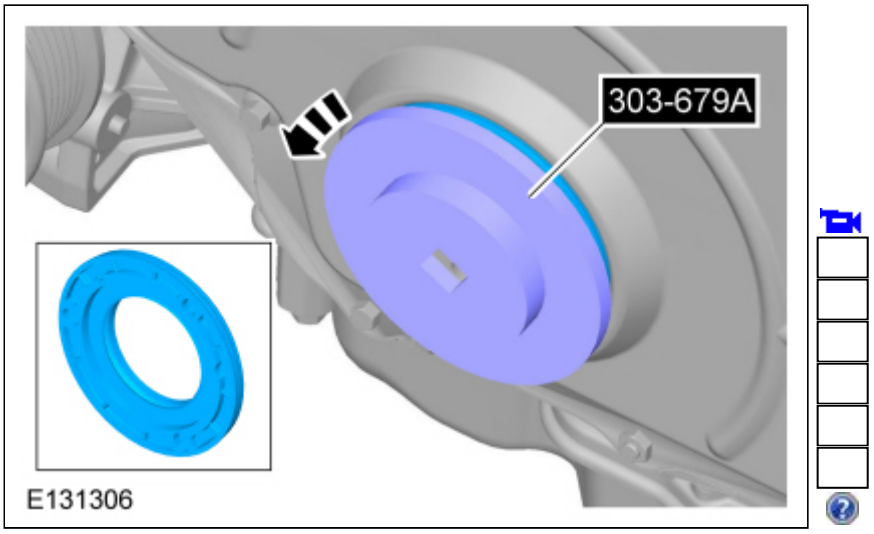
53.



54. Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.



55. Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.

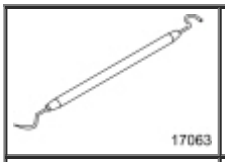
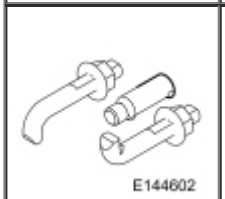
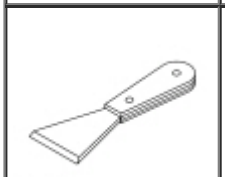
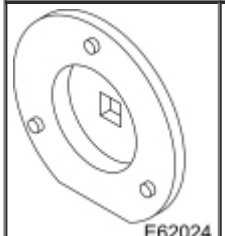


Copyright © 2016 Ford Motor Company

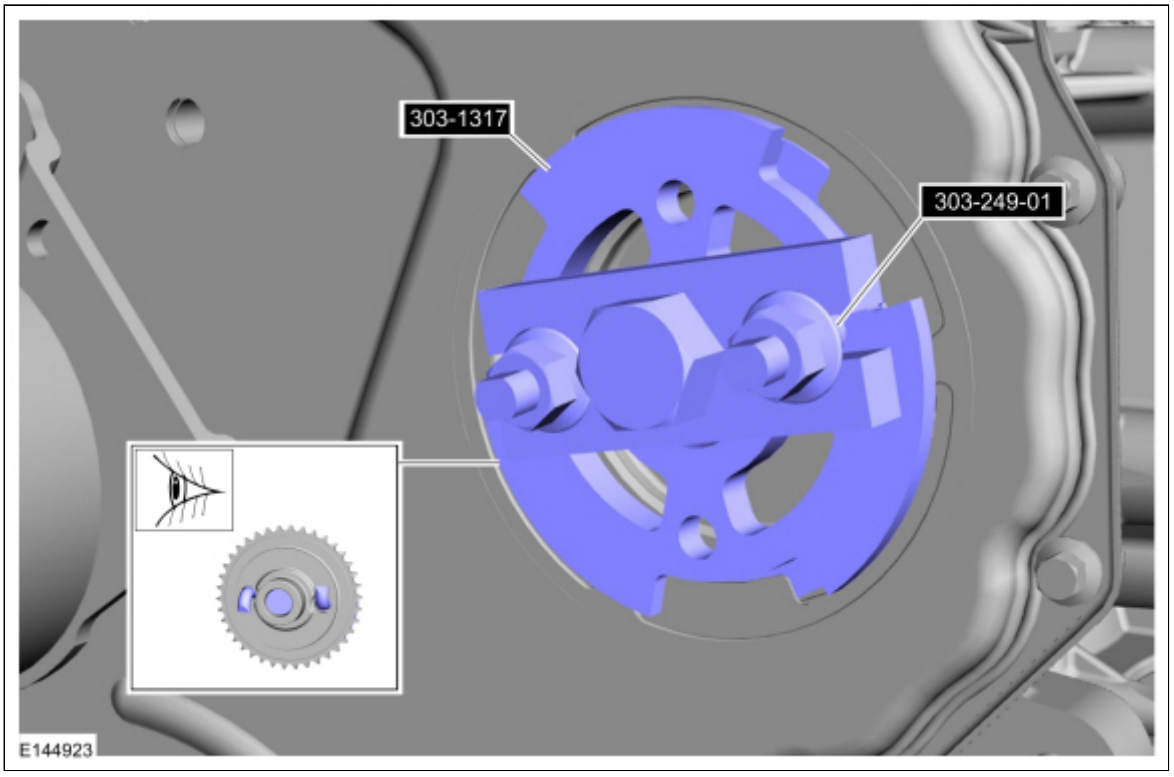
Engine

Base Part Number: 6L084

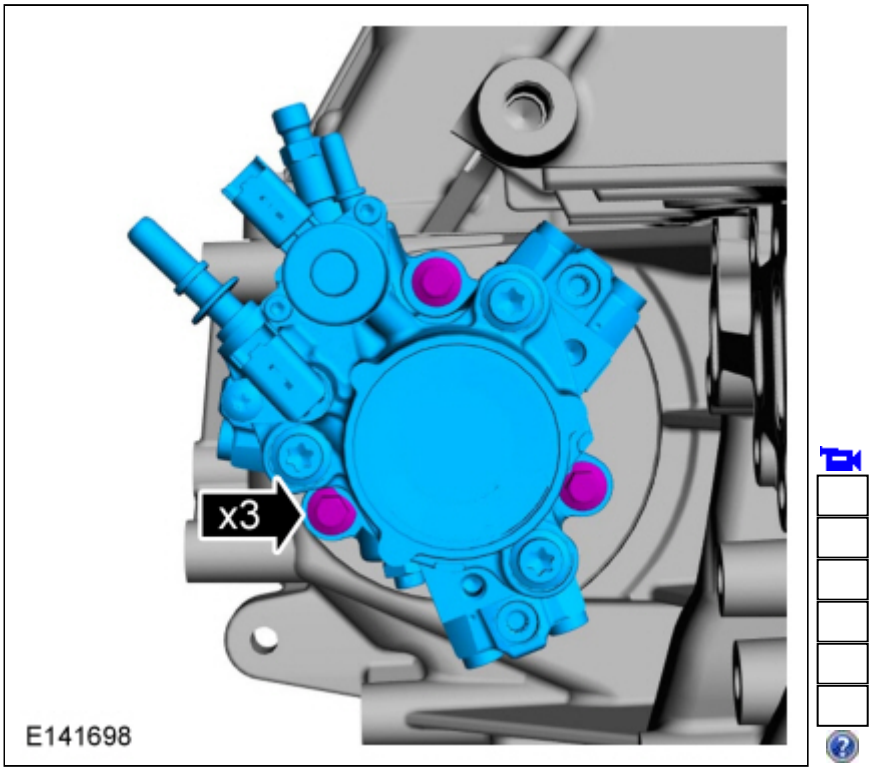
Special Tool(s) / General Equipment

 17063	100-010 Remover, O-Ring Seal
 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 E144602	303-249-01 Adapter for 303-249
 21179	303-428 Separator, Oil Pan
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate
2 mm Punch	

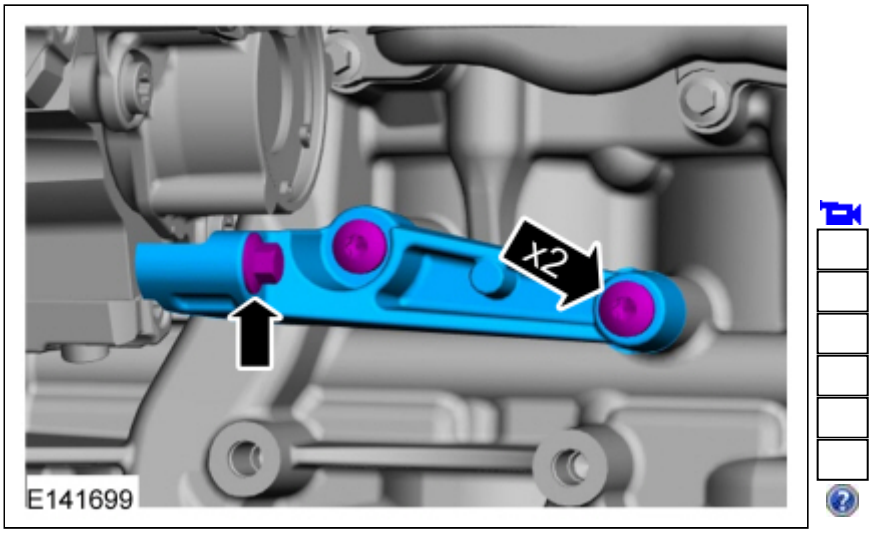
1. Remove Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket. , 303-249-01 Adapter for 303-249.



2.

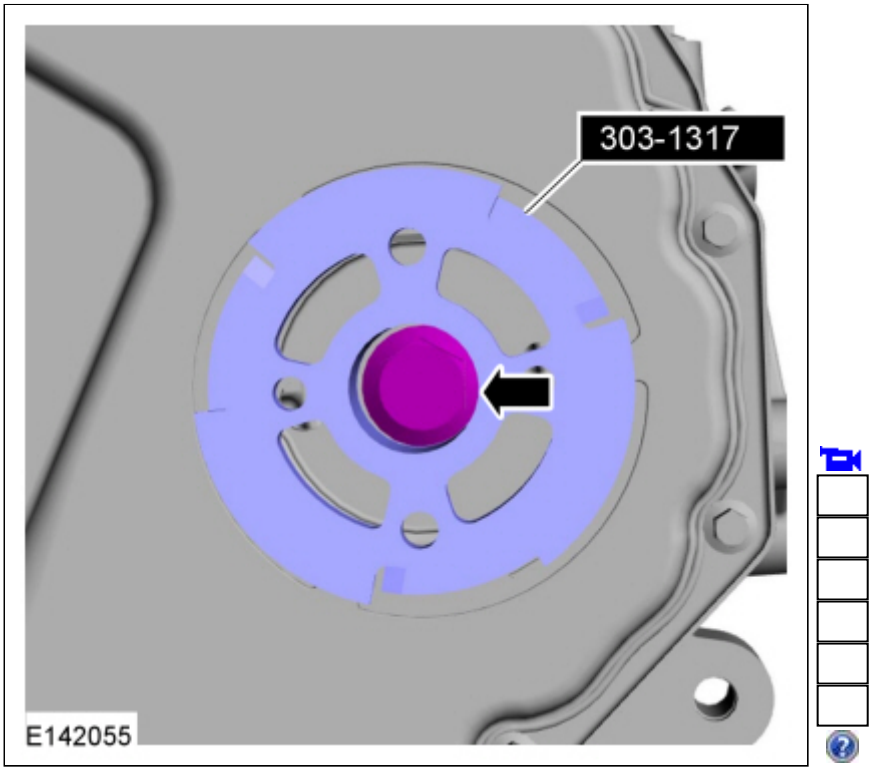


3.

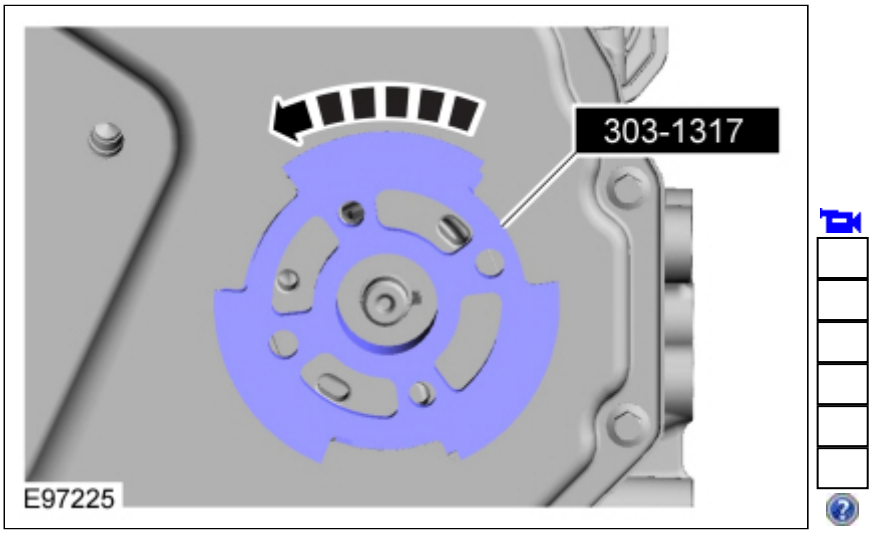


4. **NOTE:** *The component has a left-hand thread.*

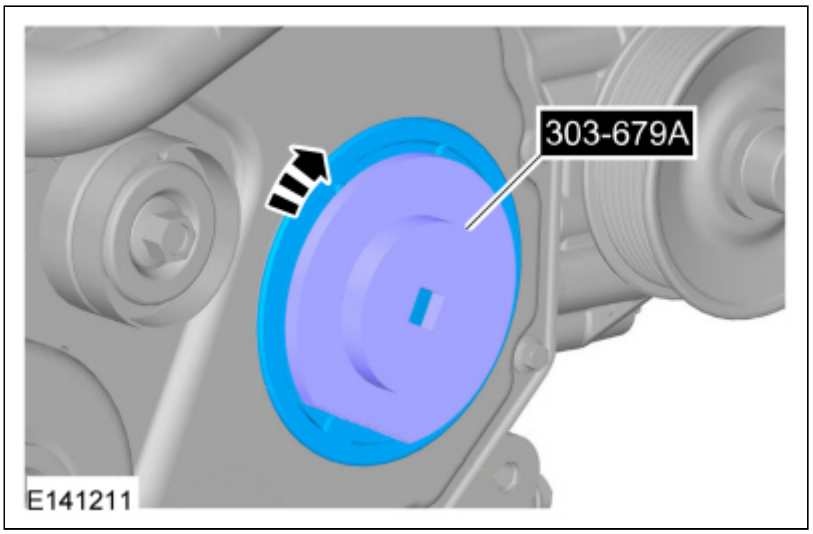
   Torque: 55 Nm



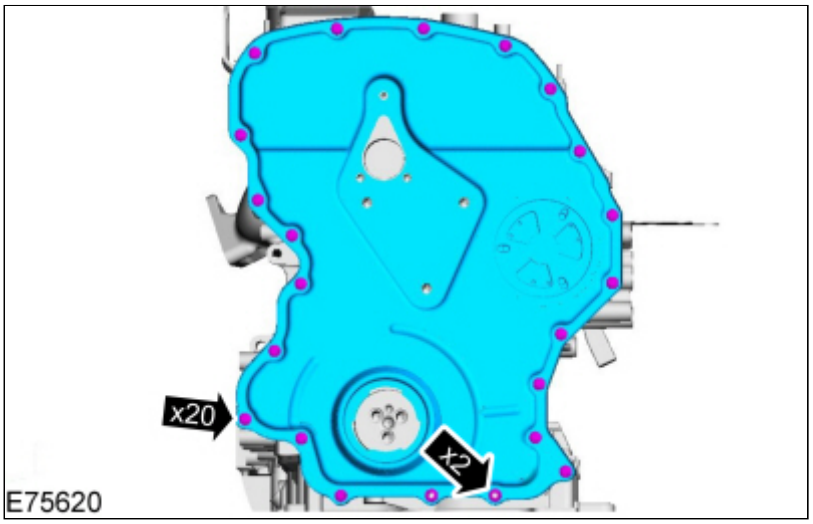
5. Remove Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



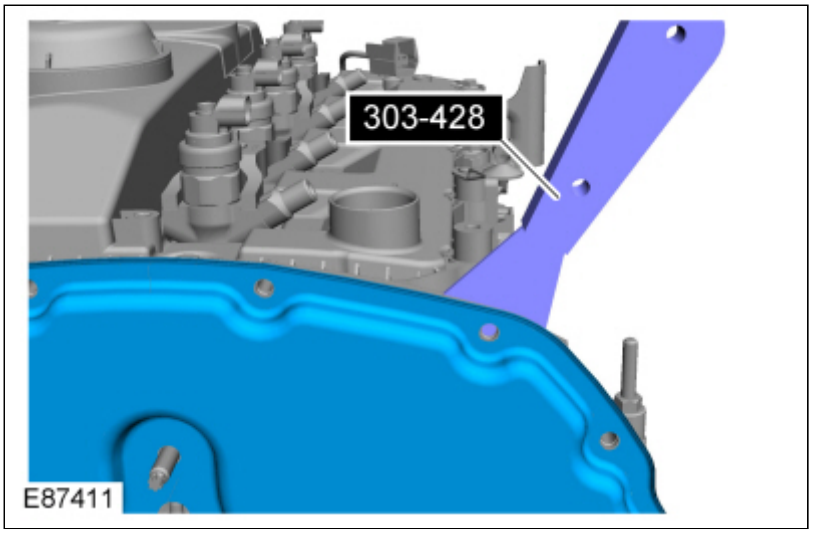
6. Remove Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



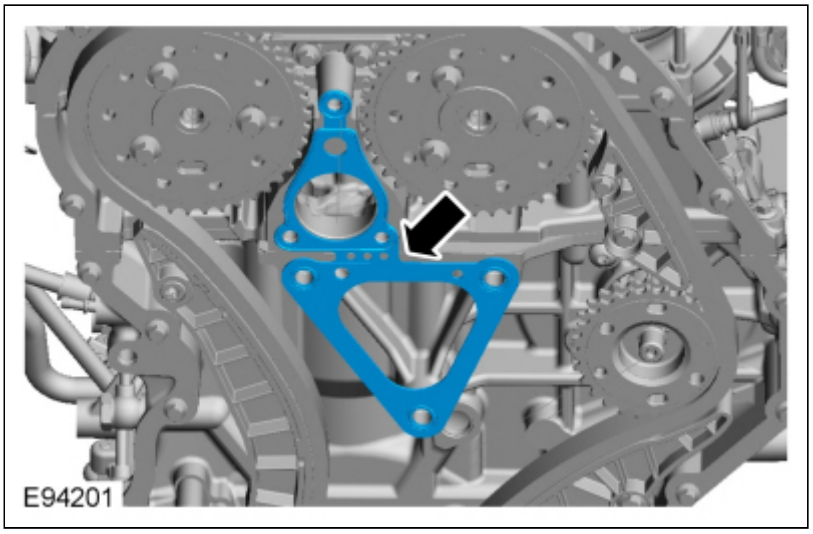
7.



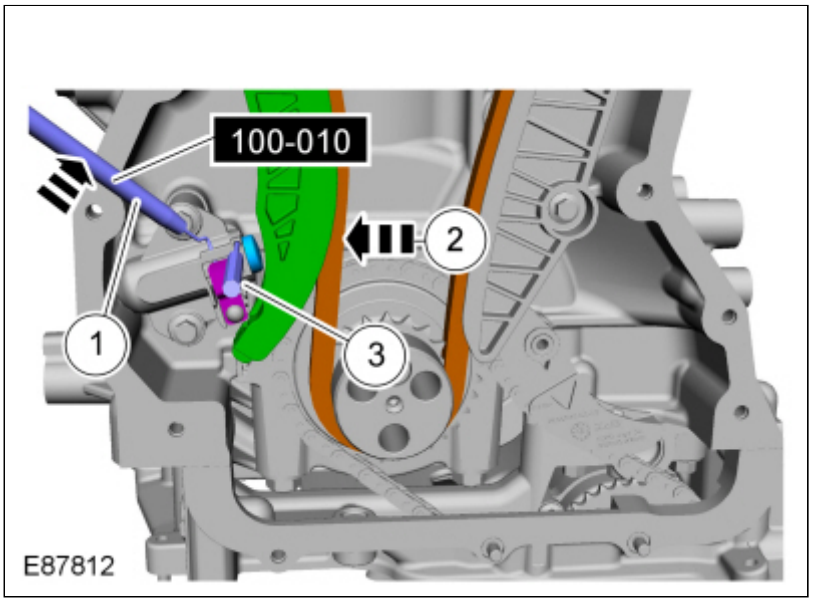
8. Use Special Service Tool: 303-428 Separator, Oil Pan.



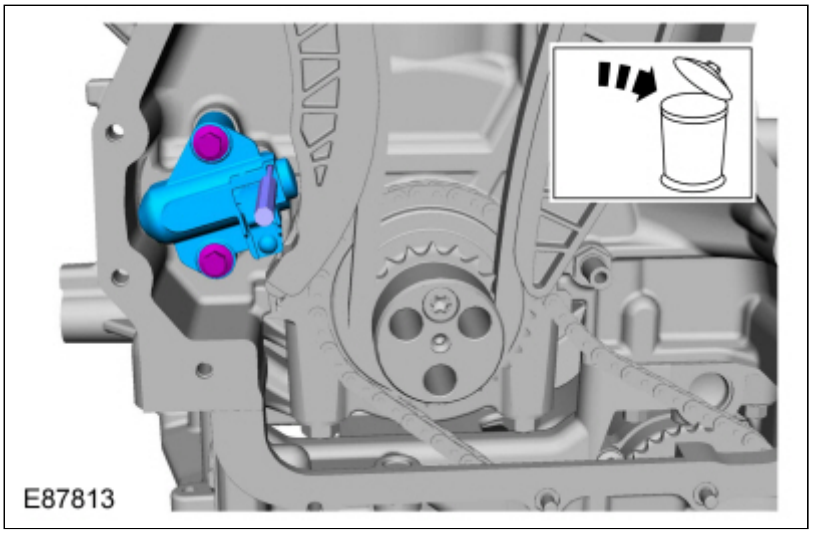
9.



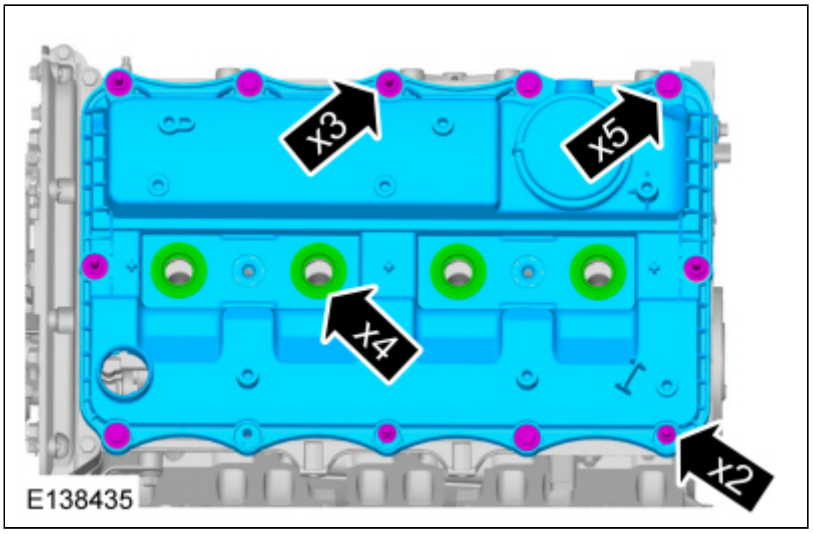
10. Use Special Service Tool: 100-010 Remover, O-Ring Seal.
    Use the General Equipment: 2 mm Punch



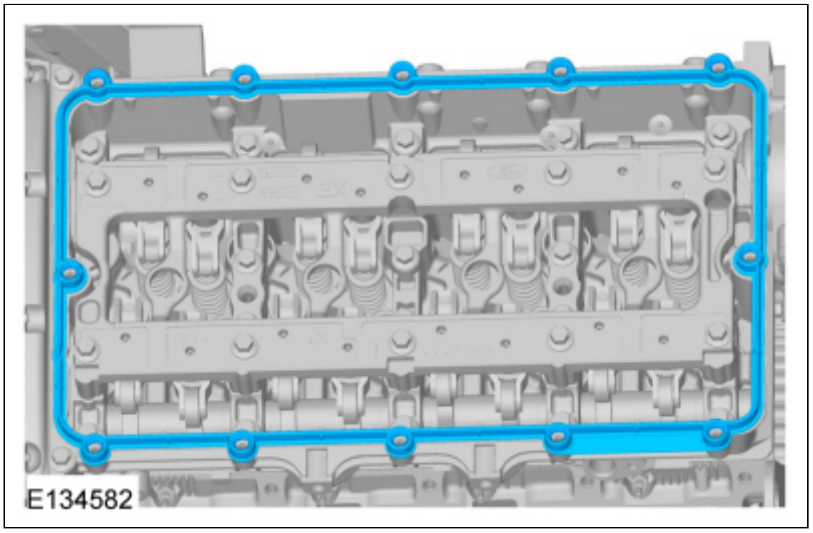
11. Remove and discard the timing chain tensioner.
    Use the General Equipment: 2 mm Punch



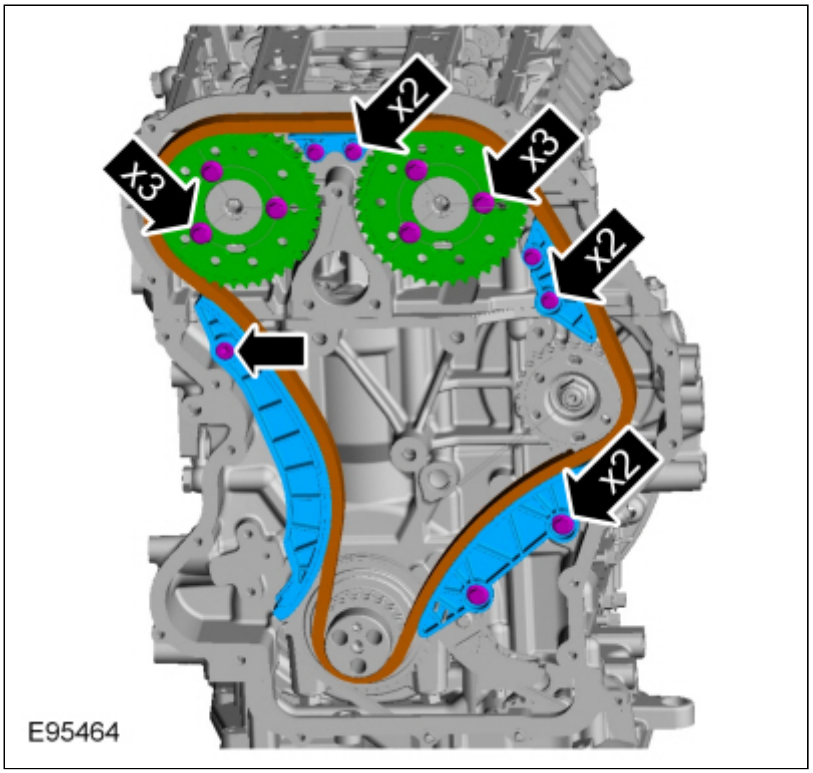
12.



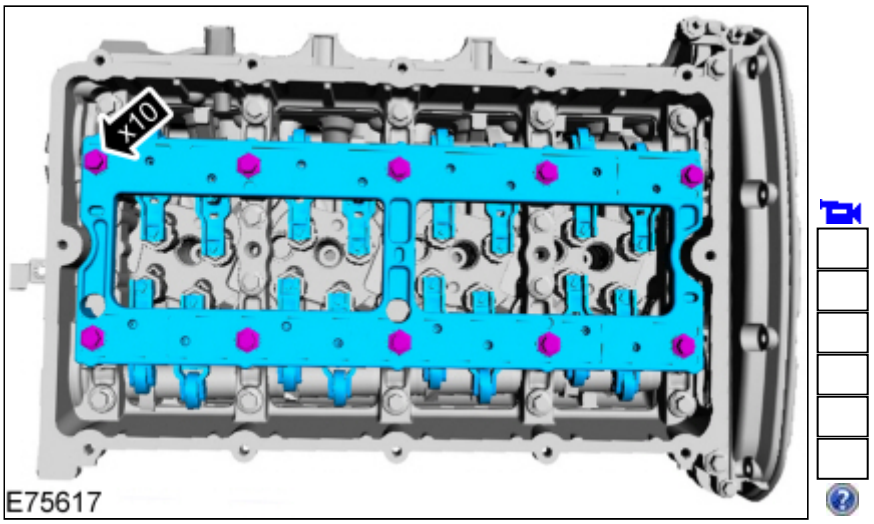
13.



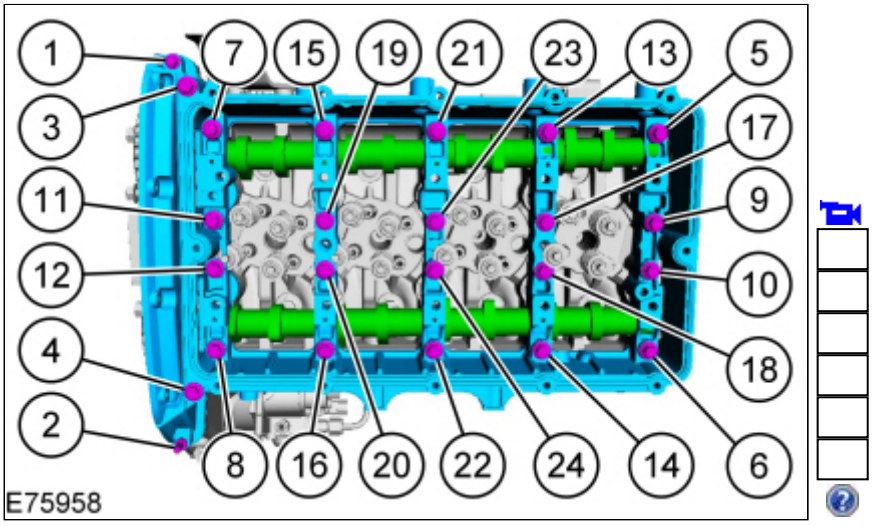
14.



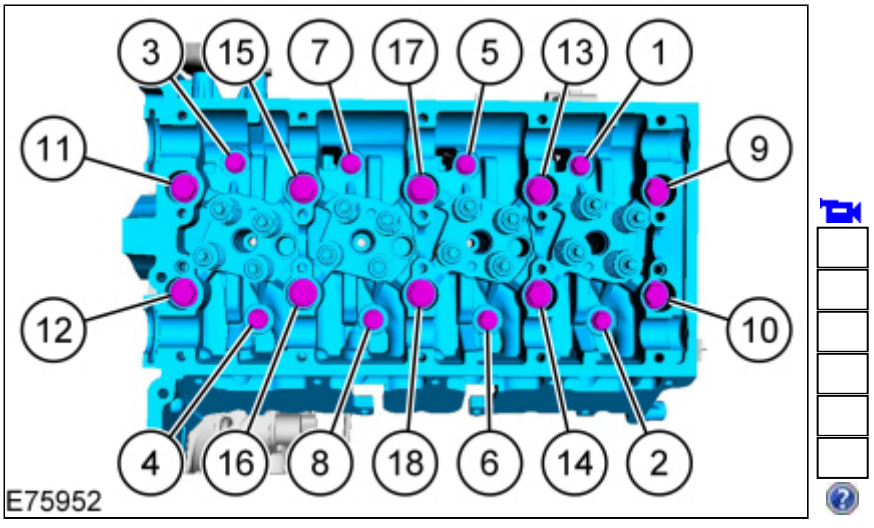
15.


x10
E75617

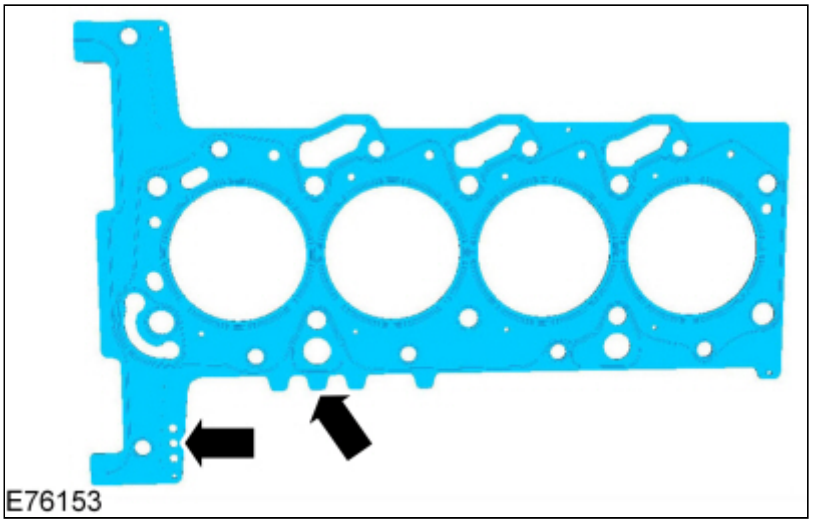
16.


1
7
15
19
21
23
13
5
3
17
11
9
12
10
4
18
2
8
16
20
22
24
14
6
E75958

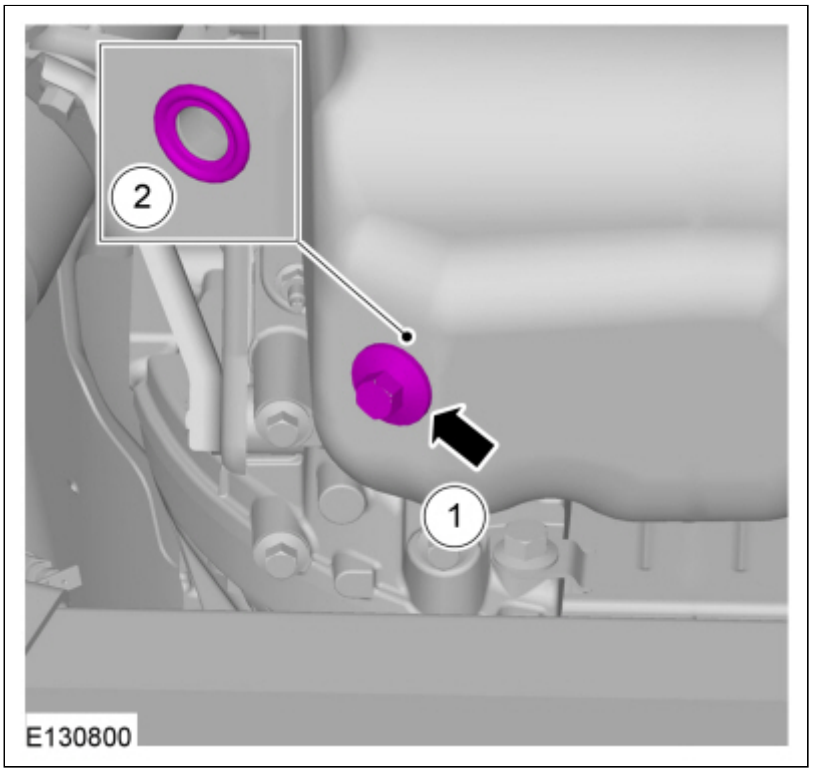
17.


3
15
7
17
5
13
1
11
9
12
10
4
16
8
18
6
14
2
E75952

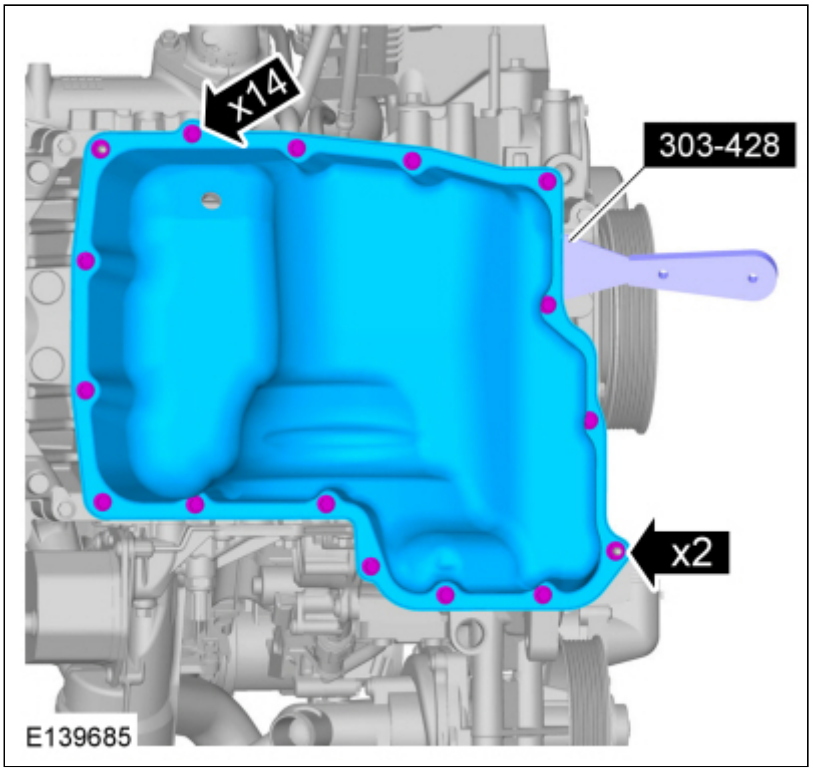
18.



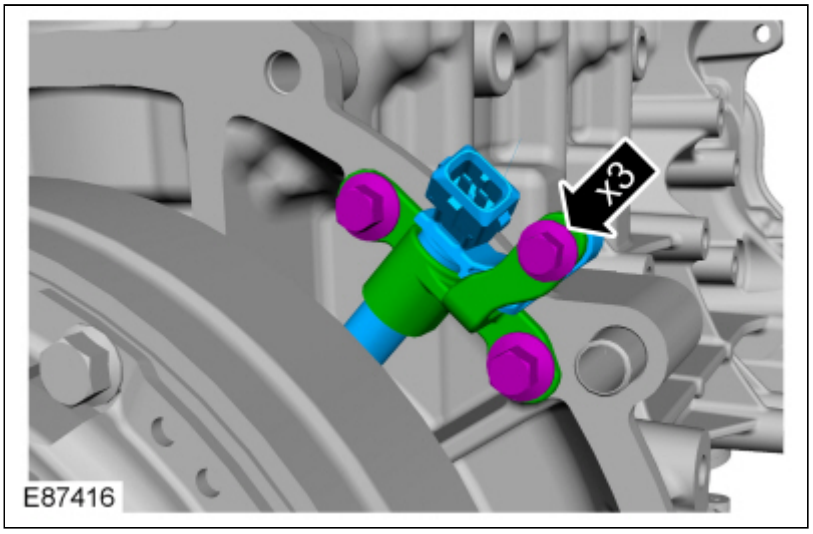
19. **WARNING: Be prepared to collect escaping fluid.**



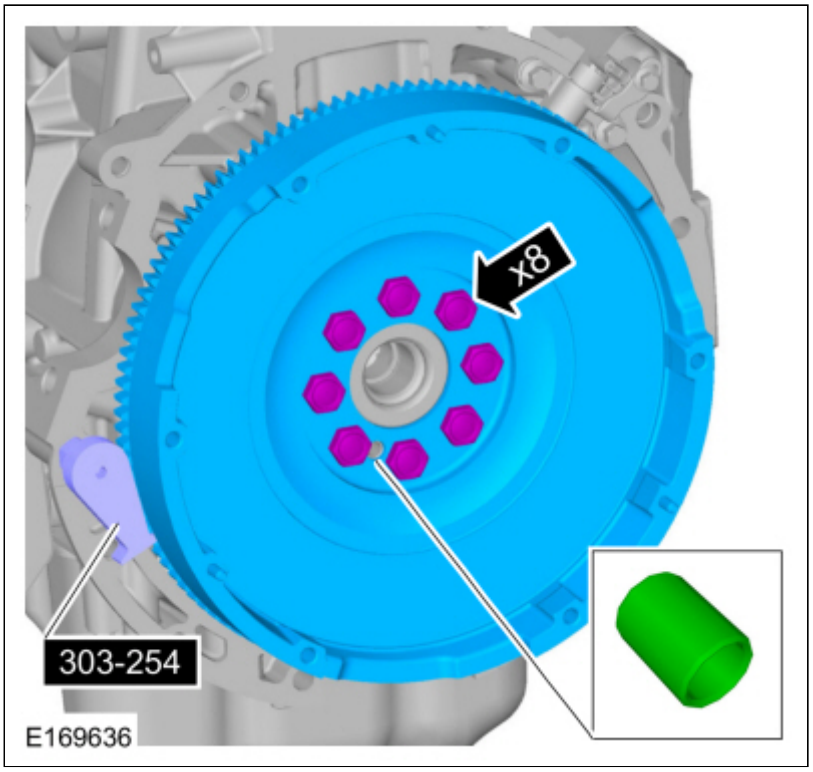
20. Use Special Service Tool: 303-428 Separator, Oil Pan.



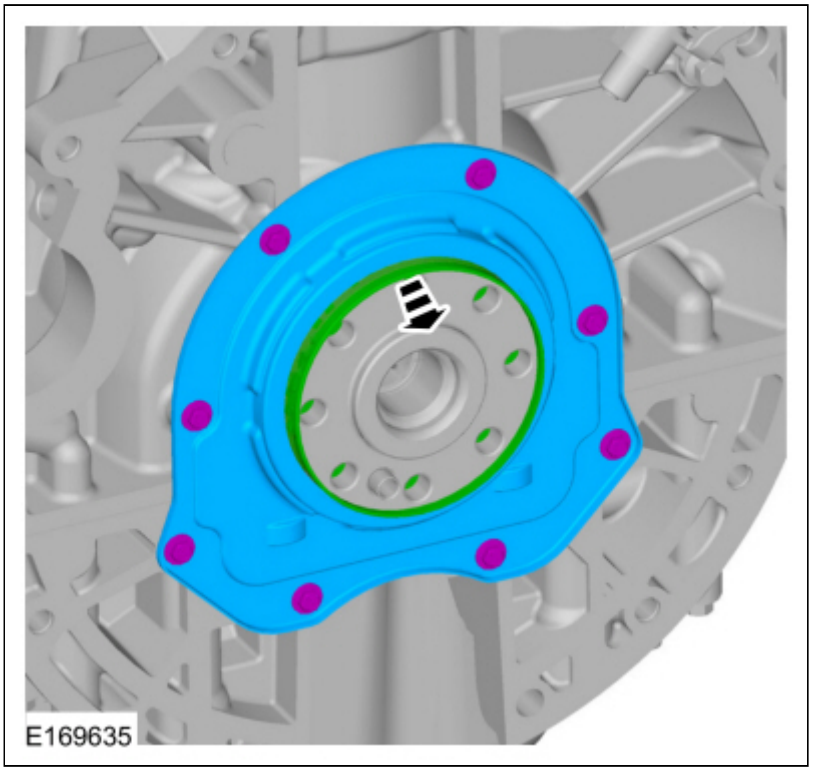
21.



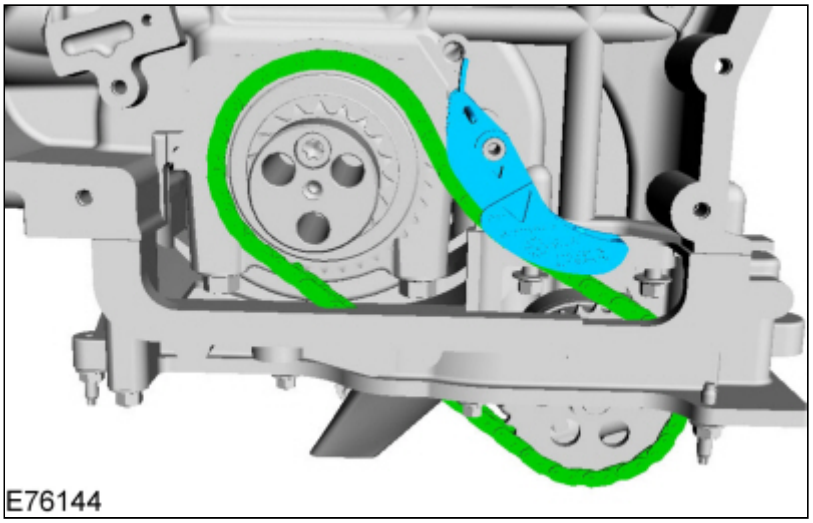
22.



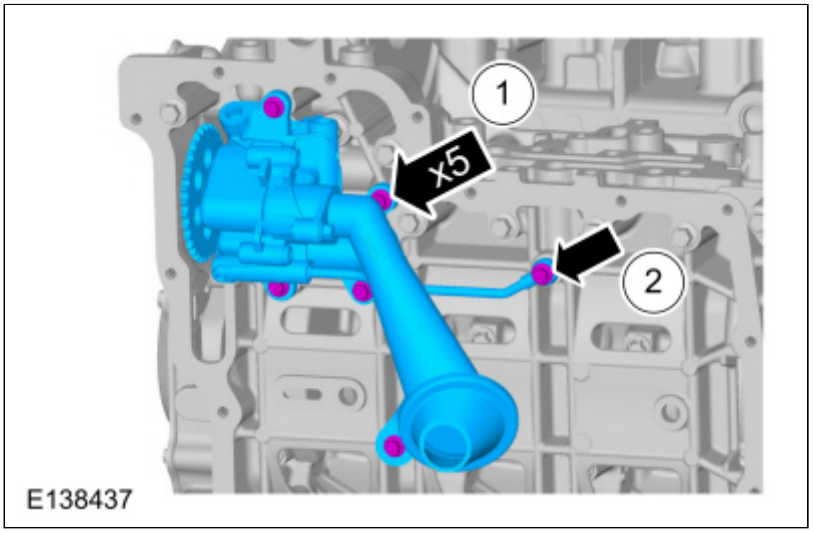
23.



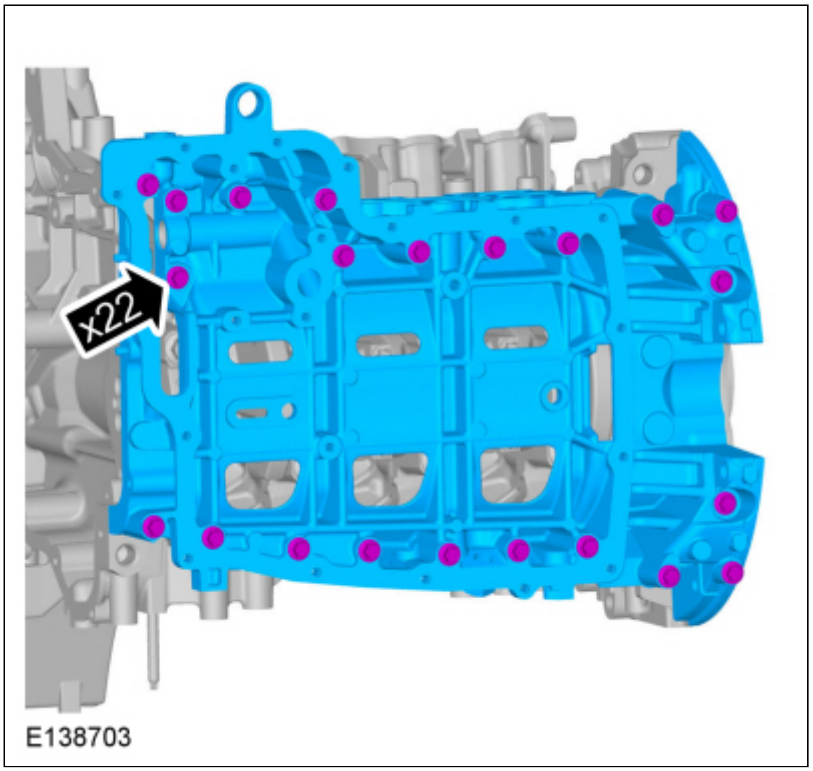
24.



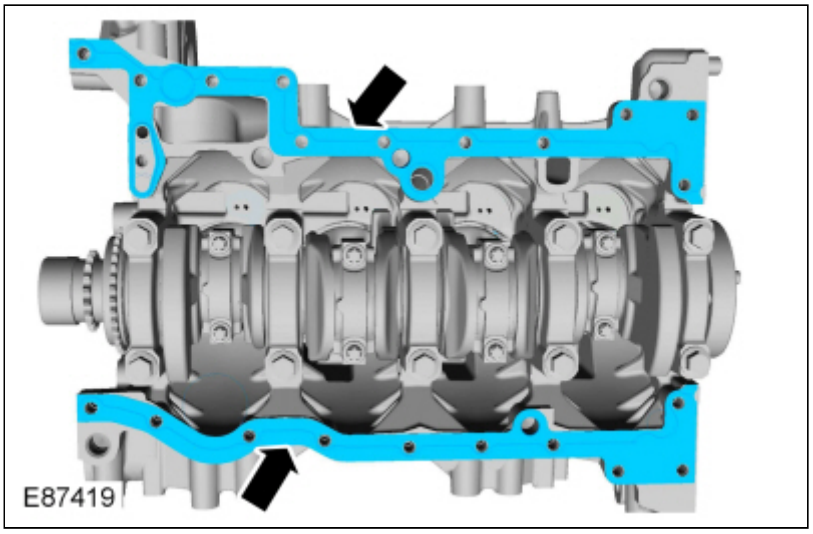
25.



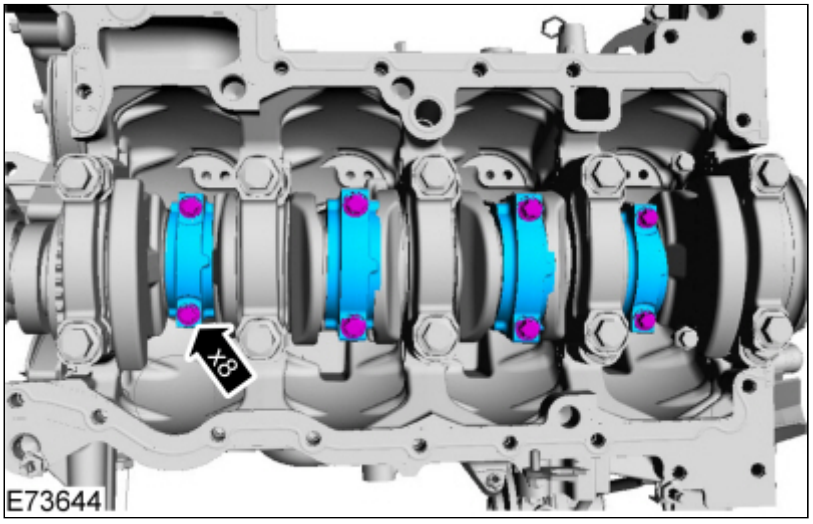
26.



27.



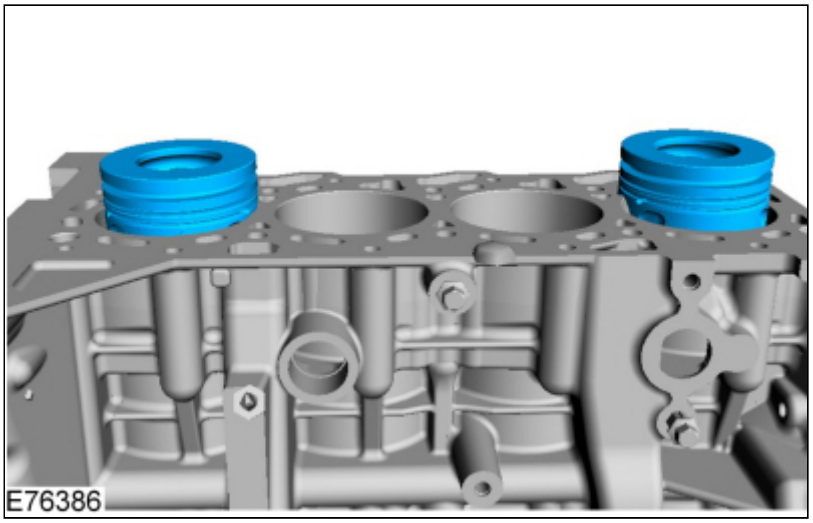
28. **NOTE:** *Note the position of each component before removal.*



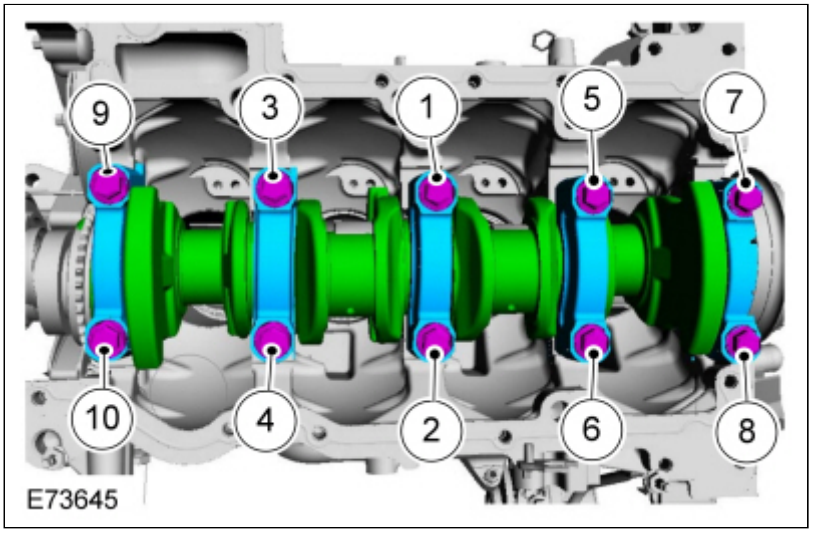
29. **NOTE:** *Note the position of each component before removal.*



30.



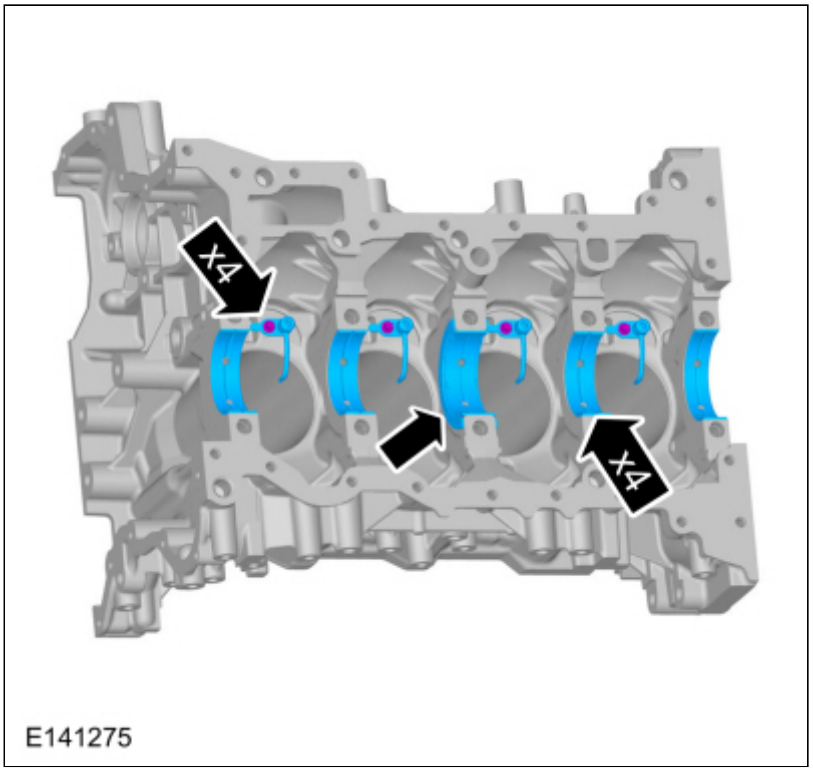
31. **NOTE:** *Note the position of each component before removal.*



32. **NOTE:** *Note the position of each component before removal.*



33. **NOTE:** *Note the position of each component before removal.*



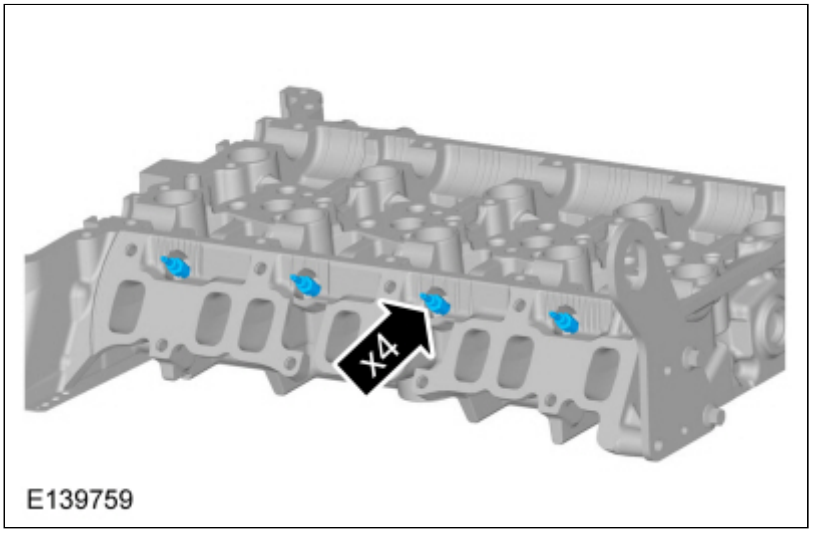
Copyright © 2016 Ford Motor Company

Cylinder Head

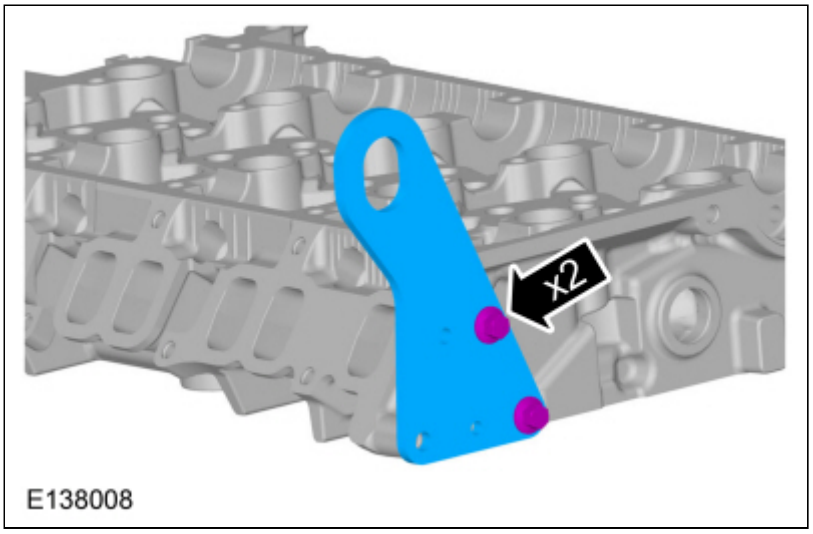
Base Part Number: 6051

Disassembly

1. For additional information, refer to: Valves (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
2. Torque : 13 Nm



3. Torque : 23 Nm



Assembly

1. To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

Piston

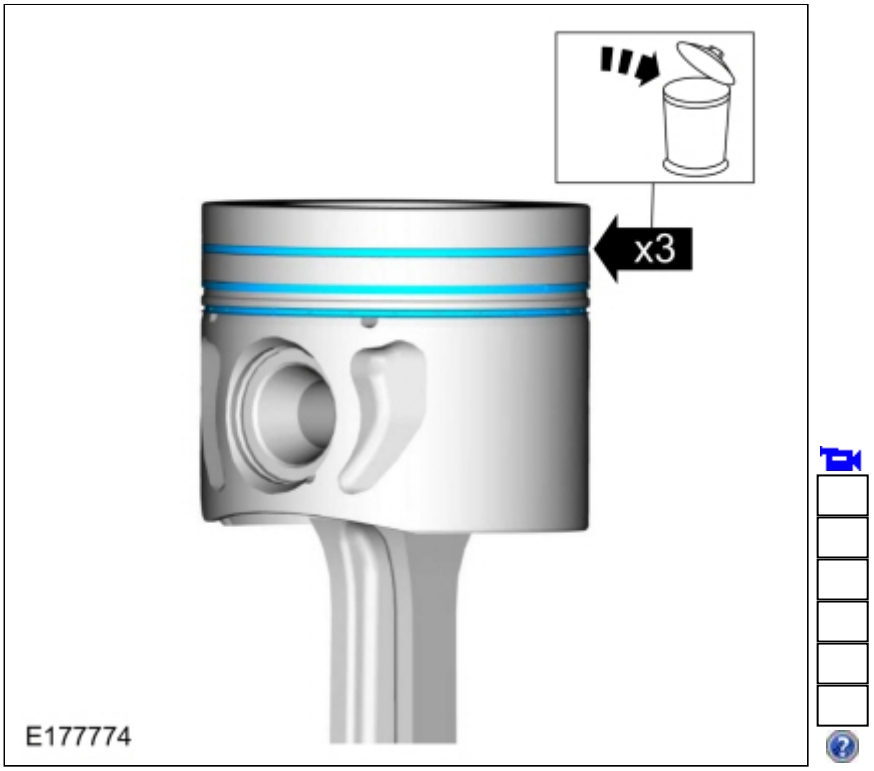
Materials

Name	Specification
Engine Oil - SAE 5W-30	WSS-M2C913-C

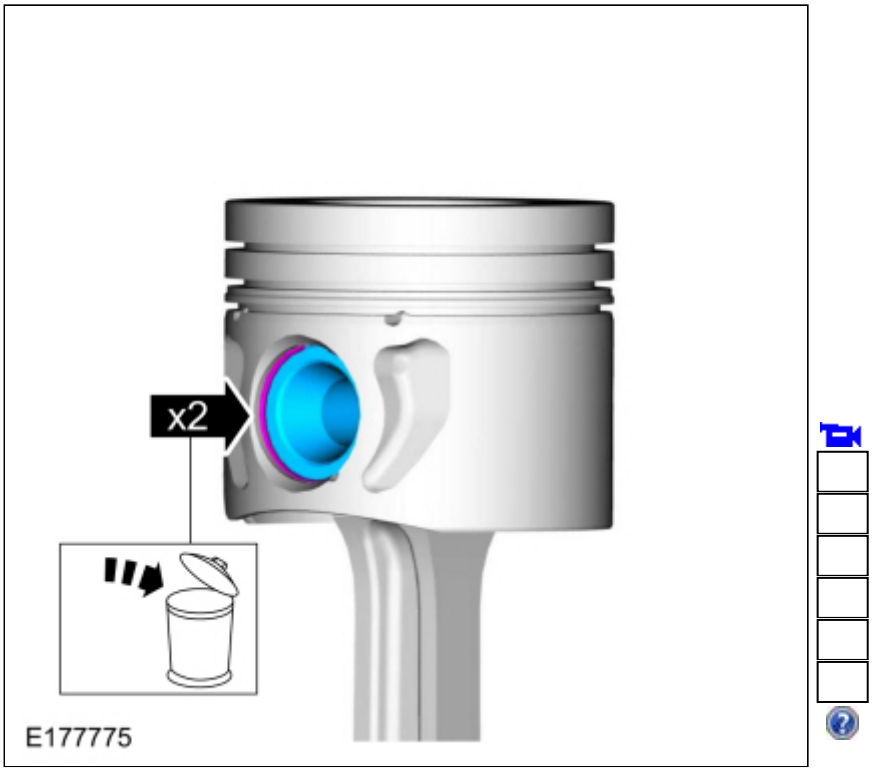
DISASSEMBLY

NOTE: *If the piston and connecting rod are to be reinstalled, they must be assembled in the same orientation. Mark the piston orientation to the connecting rod for reassembly.*

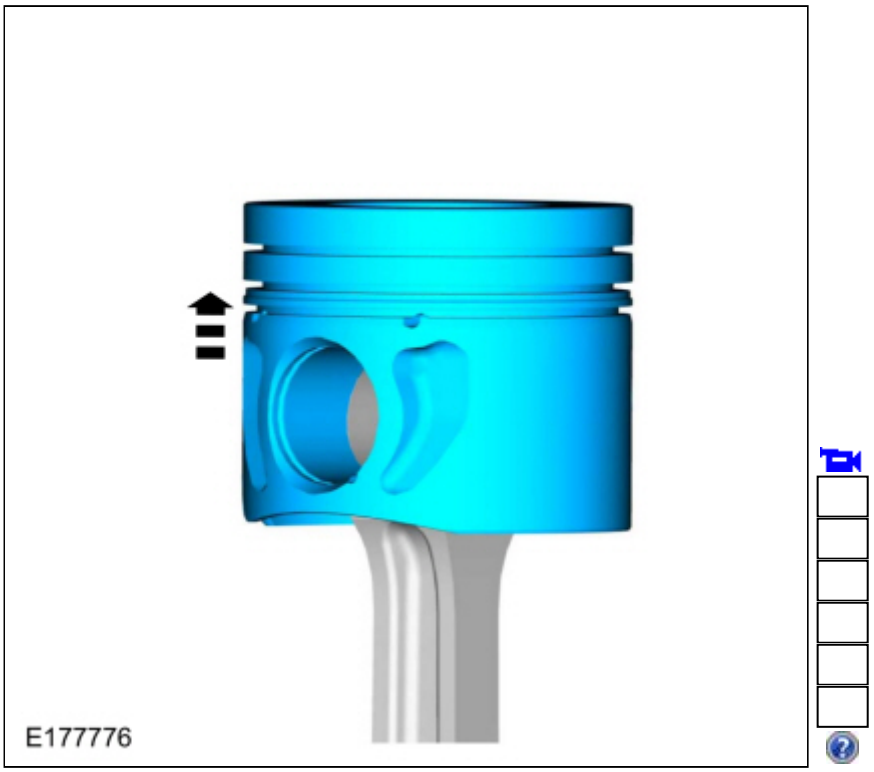
1. Remove and discard the piston rings.



2. Remove and discard the piston pin retainers. Remove the piston pin.



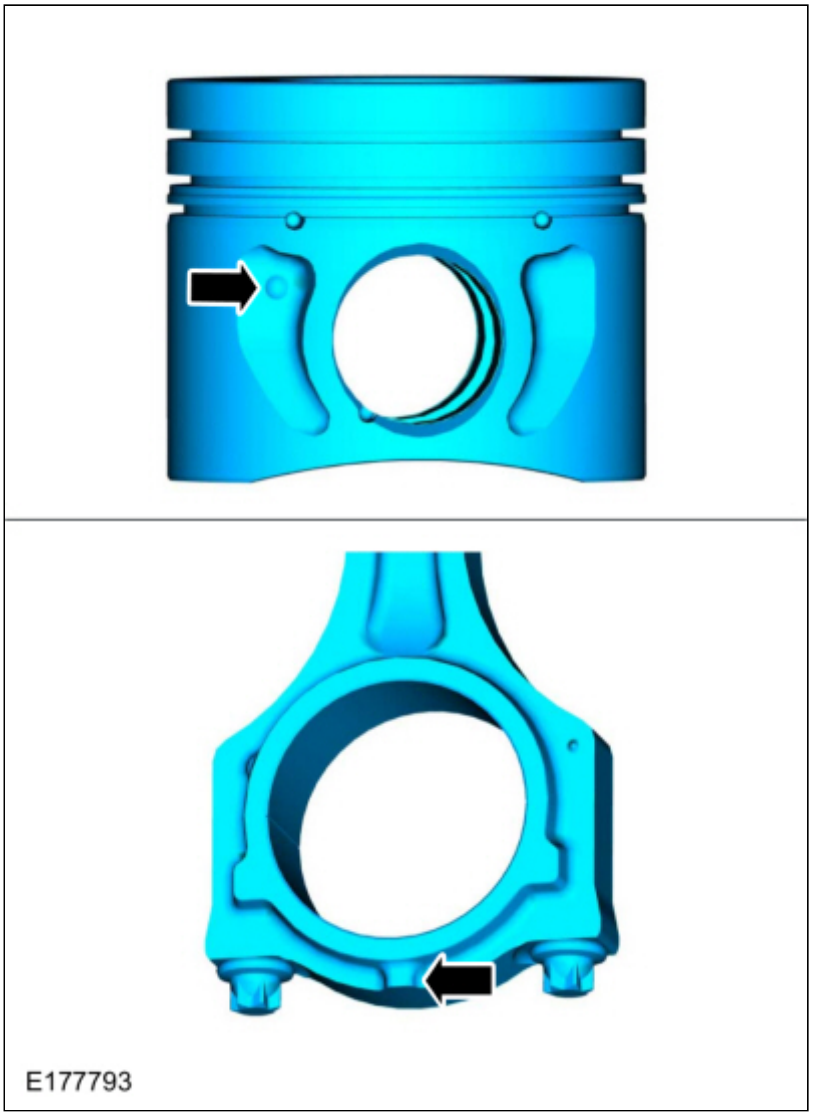
3. Separate the piston from the connecting rod. Clean and inspect the piston.
   Refer to: Piston Inspection (303-00 Engine System - General Information, General Procedures).



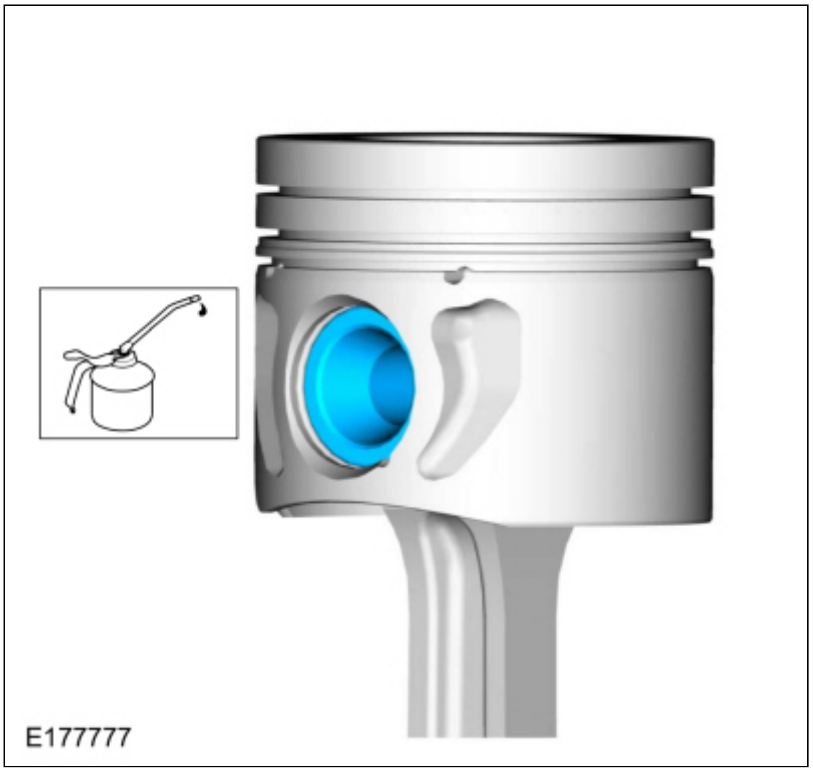
ASSEMBLY

1. **NOTE:** *Align the piston-to-connnecting rod orientation marks made during disassembly.*

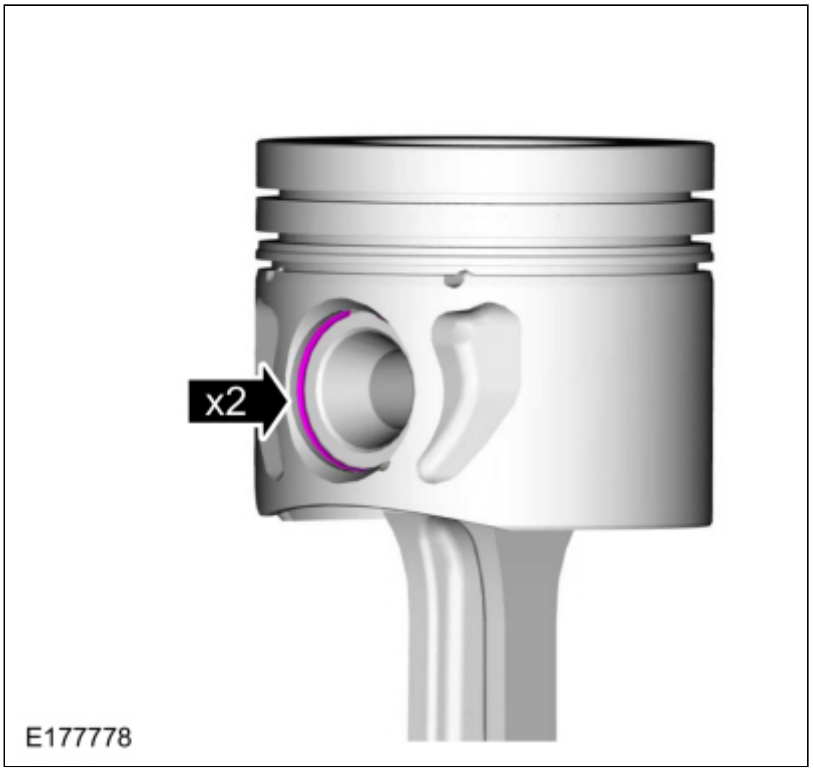
   Align the front of the piston and connecting rod. Assembly the piston and the connecting rod.



2. Lubricate with clean engine oil and install the piston pin.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



3. Install the piston pin retainers.

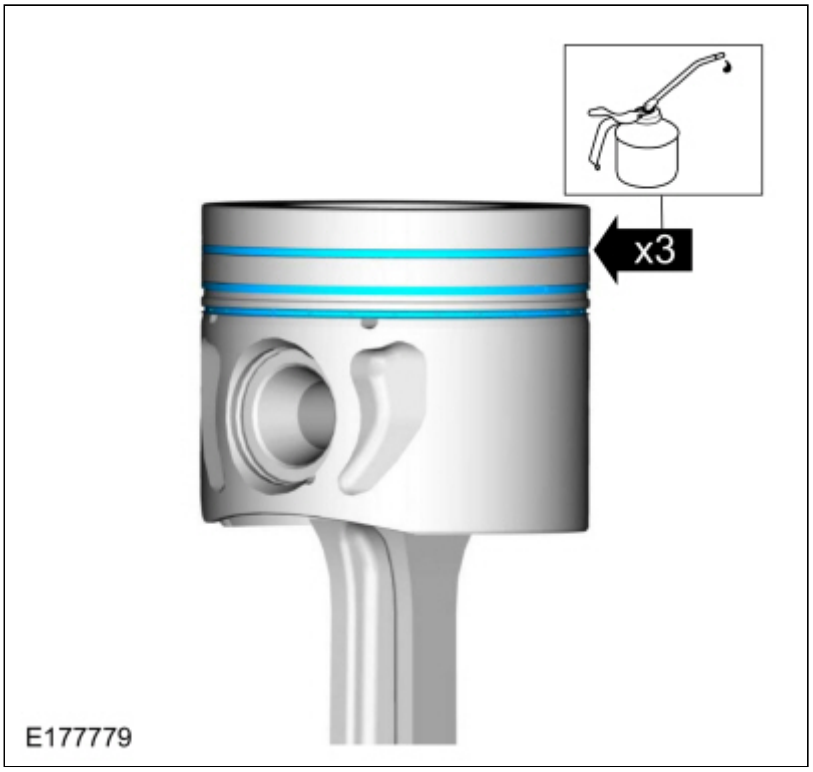


4. **NOTE:** *The rings are to be fitted with the paint mark to the left of the piston ring gap.*

   NOTE: *The upper and lower compression ring gaps are the be installed 180 degrees apart.*

   NOTE: *The oil control ring position is not controlled.*

   Lubricate with clean engine oil and install the piston rings.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)

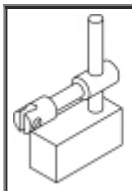
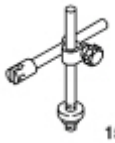
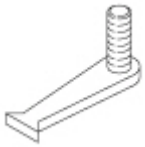
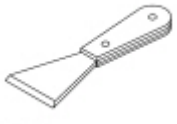
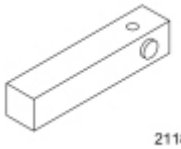


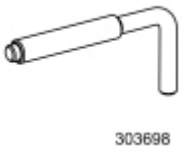
Copyright © 2016 Ford Motor Company

Engine

Base Part Number: 6L084

Special Tool(s) / General Equipment

 15008	205-044 Holding Fixture, Dial Indicator Gauge
 15046	205-069 Dial Indicator Gauge (Metric)
 15022a	205-070 Holding Fixture, Dial Indicator Gauge
 E131853	303-1562 Timing Tool
 E139146	303-1587 Timing Tool, Crankshaft
 21135	303-254 Locking Tool, Flywheel
 21179	303-428 Separator, Oil Pan
 21183	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion)
	303-682 Aligner, Engine Front Cover

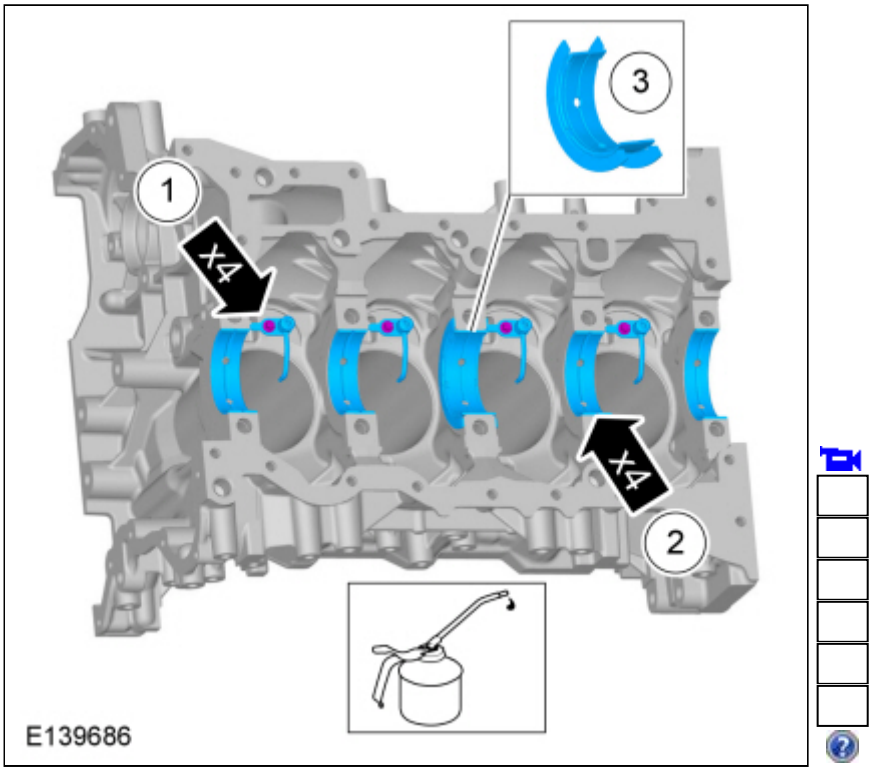
 303682	
 303698	303-698 Timing Tool, Crankshaft
6 mm Drill Bit	
Piston Ring Compressor	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4
Engine Oil - SAE 5W-30	WSS-M2C913-C

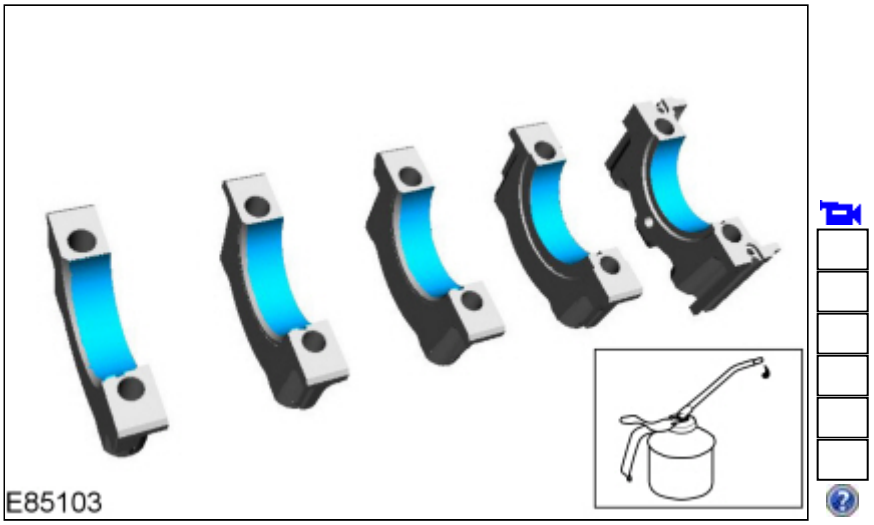
1. **NOTE:** *Make sure that these components are installed to the noted removal position.*

   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)
   Torque: 10 Nm



2. **NOTE:** *Make sure that these components are installed to the noted removal position.*

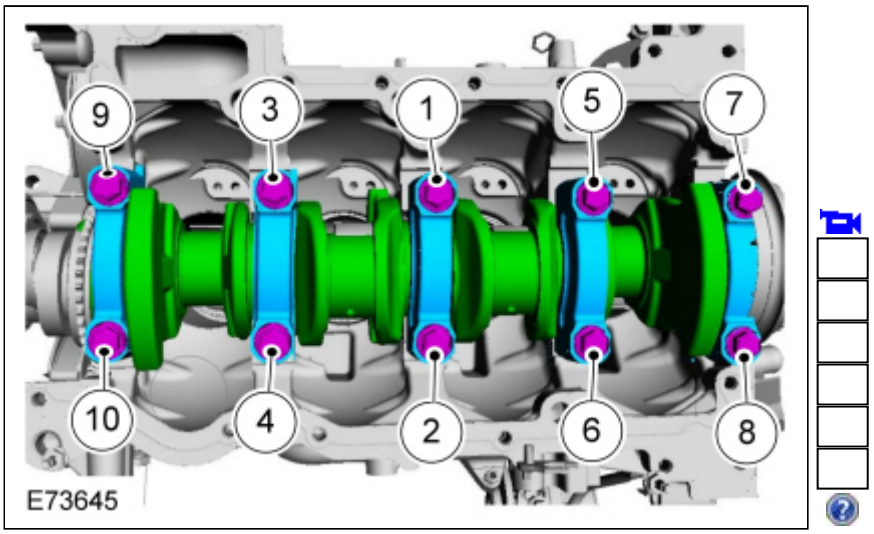
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



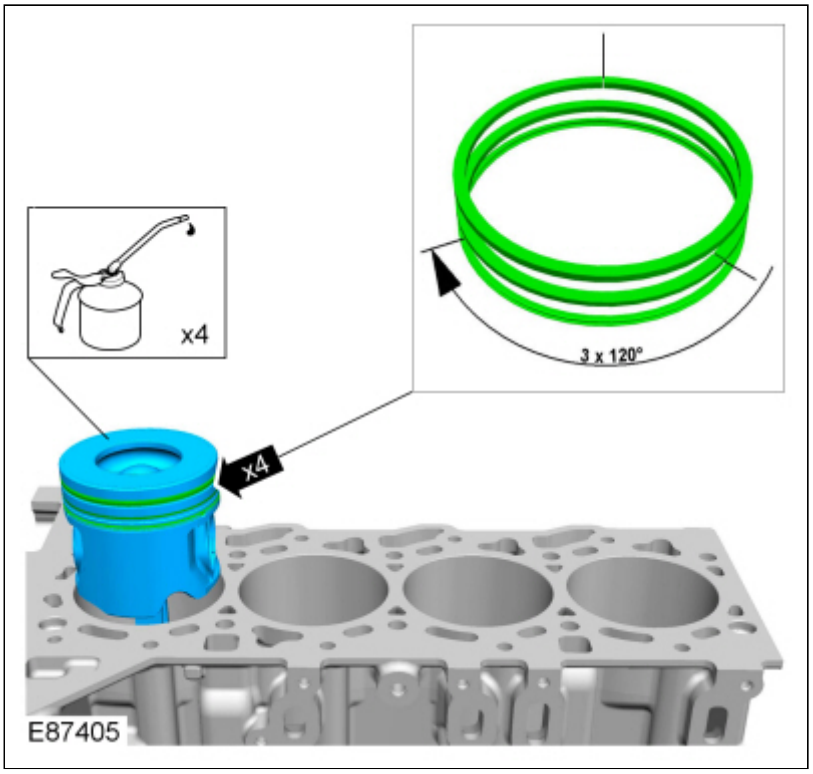
3. **NOTE:** *Make sure that these components are installed to the noted removal position.*

   NOTE: *Install all the bolts finger tight before final tightening.*

   Torque:
   Stage 1: 6 Nm
   Stage 2: 15 Nm
   Stage 3: 20 Nm
   Stage 4: 35 Nm
   Stage 5: 80 Nm
   Stage 6: 90°

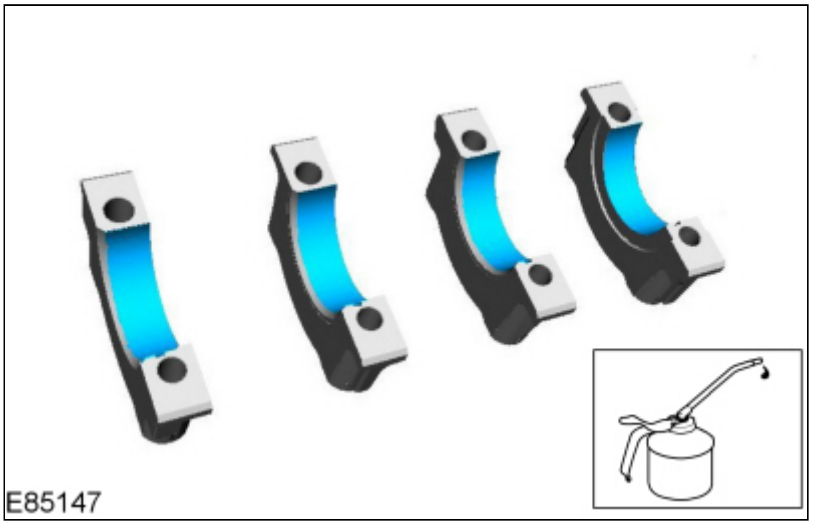


4. Use the General Equipment: Piston Ring Compressor
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



5. **NOTE:** *Make sure that these components are installed to the noted removal position.*

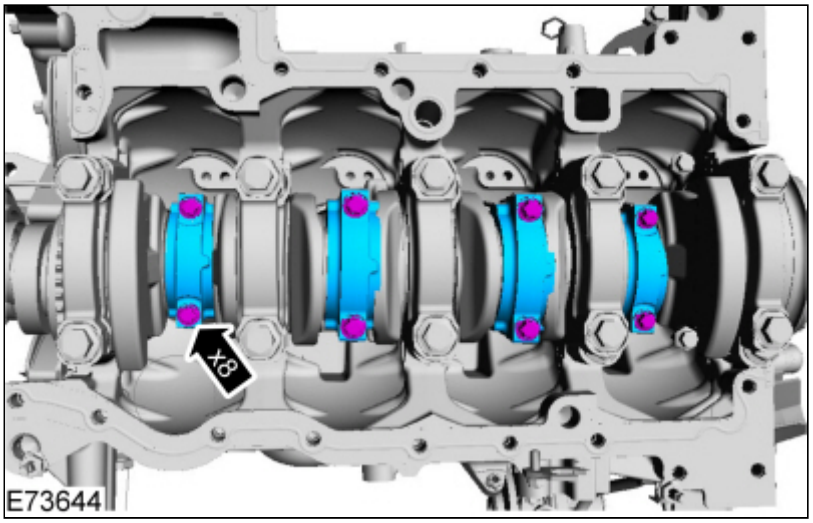
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



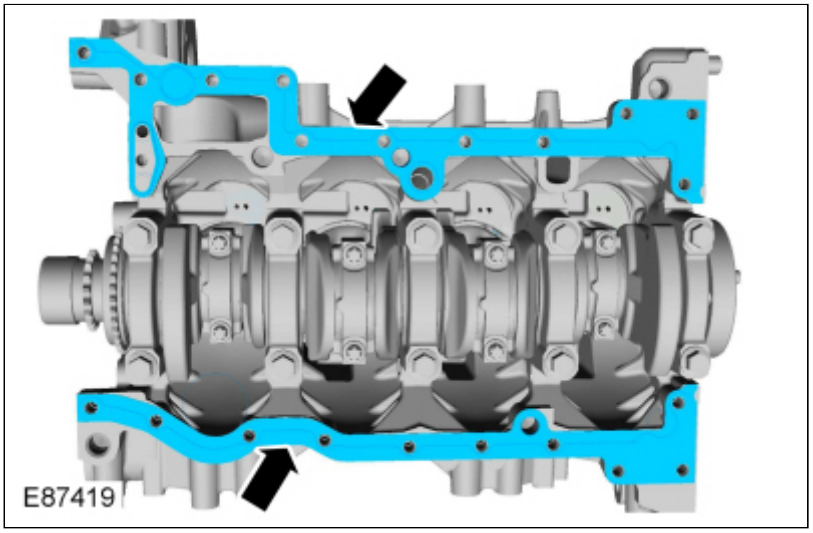
6. **NOTE:** *Make sure that these components are installed to the noted removal position.*

   NOTE: *Install all the bolts finger tight before final tightening.*

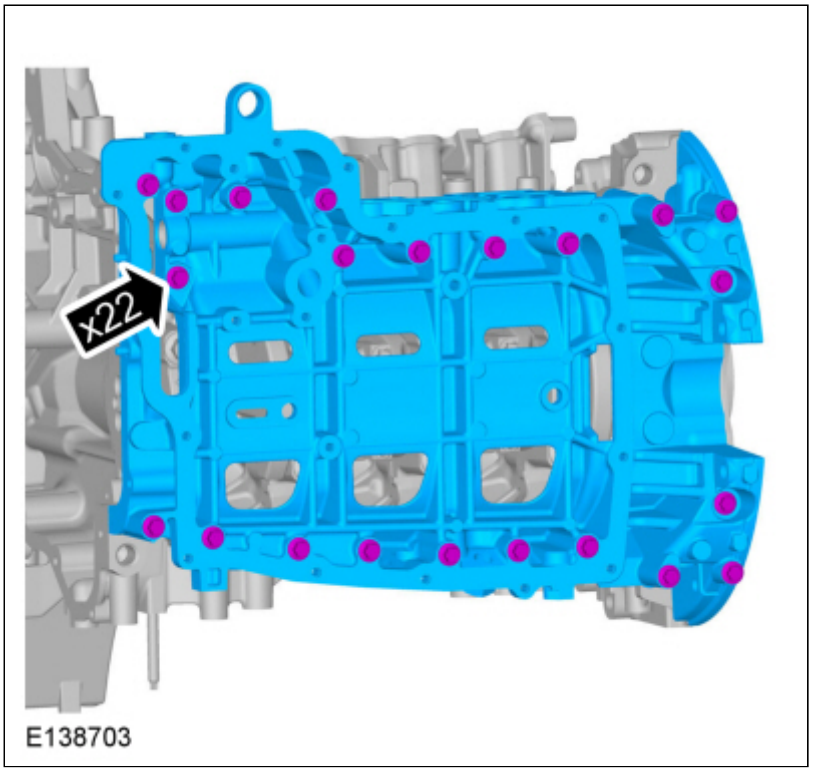
   Torque:
   Stage 1: 4 Nm
   Stage 2: 25 Nm
   Stage 3: 37 Nm
   Stage 4: 90°



7.

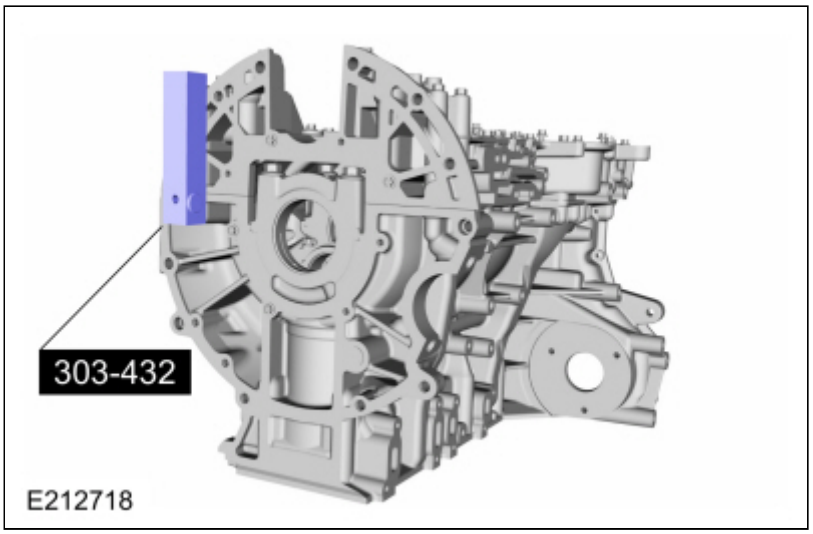


8. **NOTE:** *Only tighten the bolts finger tight at this stage.*

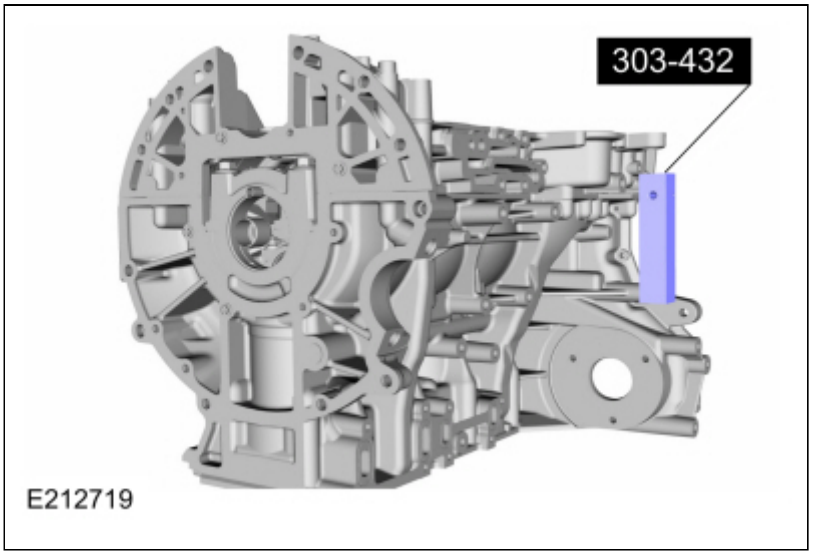


9. Using a straight edge, align the rear surface of the ladderframe with the rear surface of the engine block. The rear clearance does not exceed 0.05 mm gap.

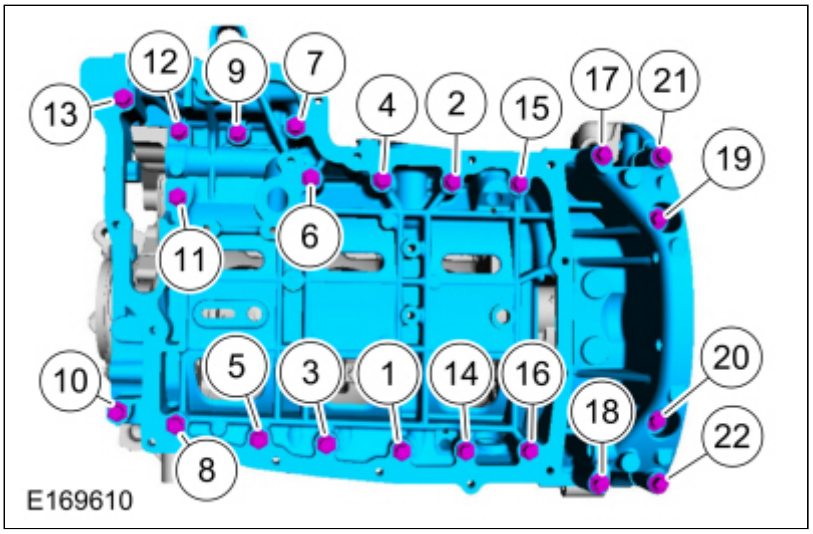
Use Special Service Tool: 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion).



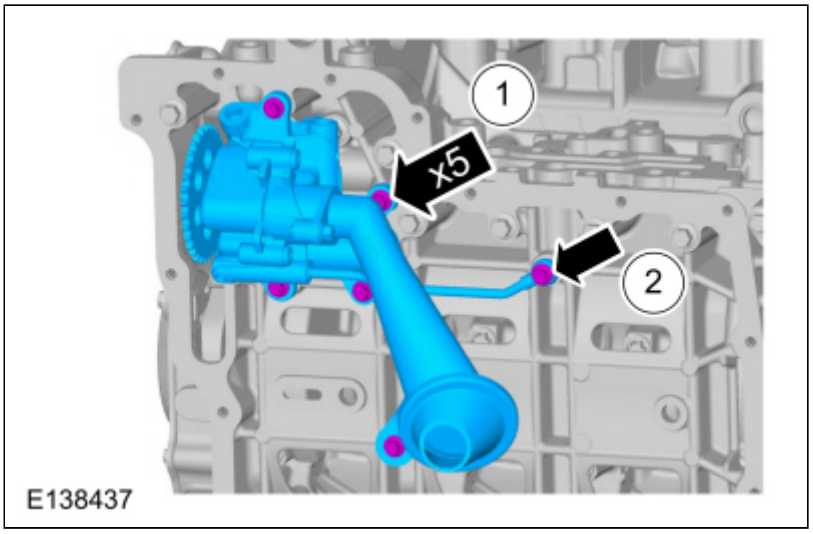
10. Using a straight edge, align the side surface of the ladderframe with the side surface of the engine block. The side clearance does not exceed 0.01mm overlap.
    Use Special Service Tool: 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion).



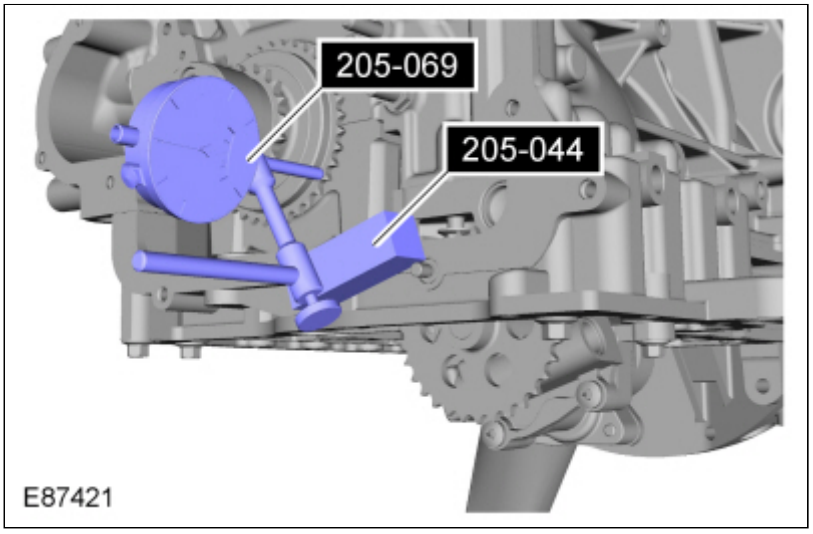
11. *Torque*: 23 Nm



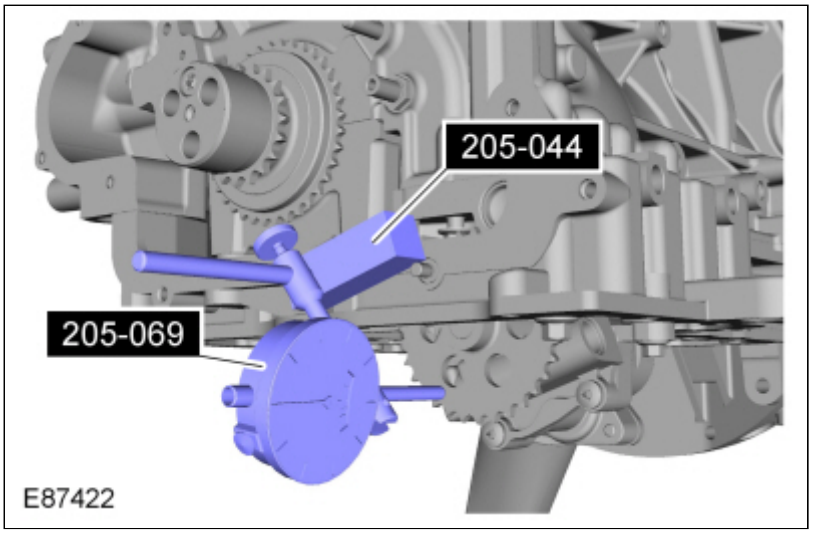
12. **NOTE:** *Only tighten the bolts finger tight at this stage.*



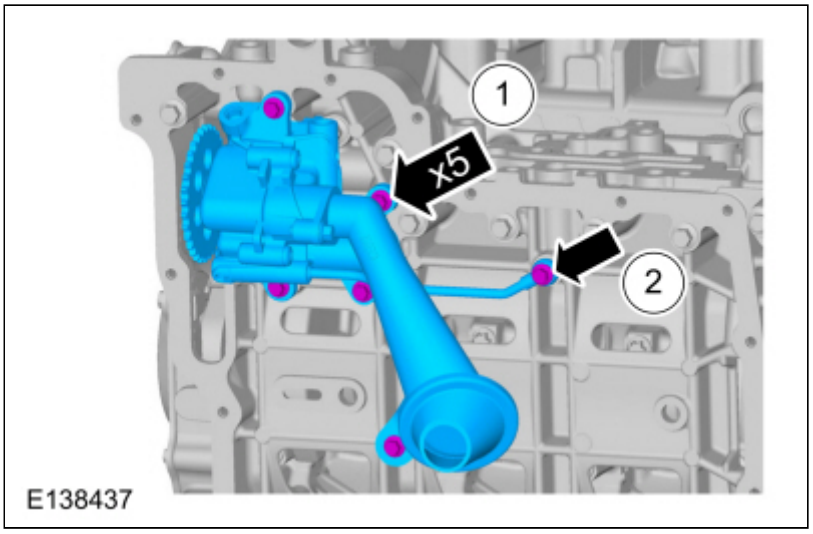
13. Take a reference measurement from the front face of the crankshaft sprocket.
    Use Special Service Tool: 205-044 Holding Fixture, Dial Indicator Gauge. , 205-069 Dial Indicator Gauge (Metric).



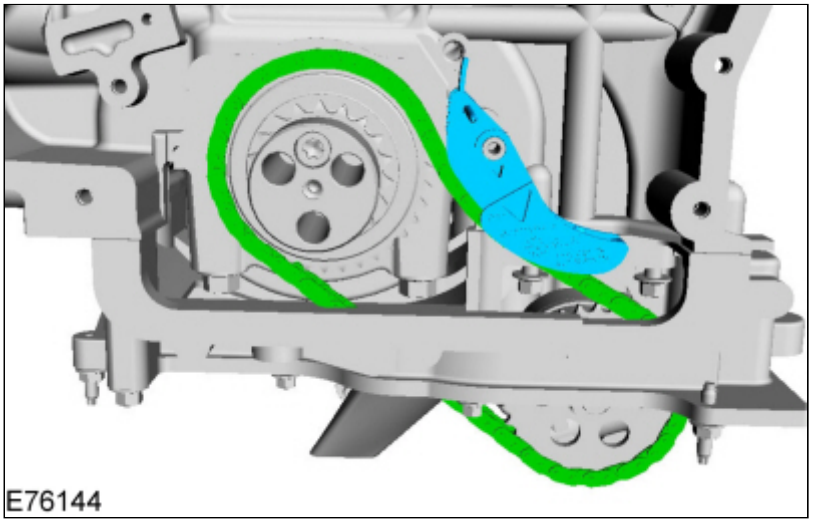
14. Take measurements at two different points on the oil pump sprocket and align the oil pump sprocket.
    Use Special Service Tool: 205-044 Holding Fixture, Dial Indicator Gauge. , 205-069 Dial Indicator Gauge (Metric).



15. *Torque*: 10 Nm

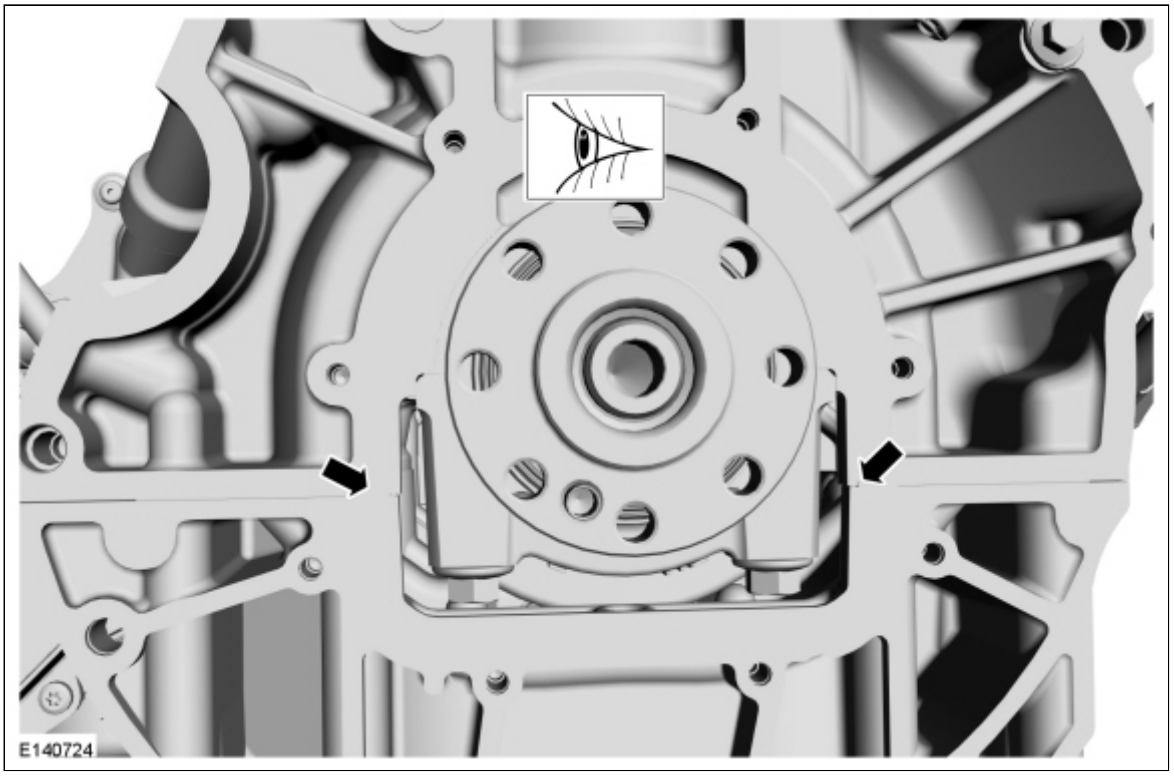


16.

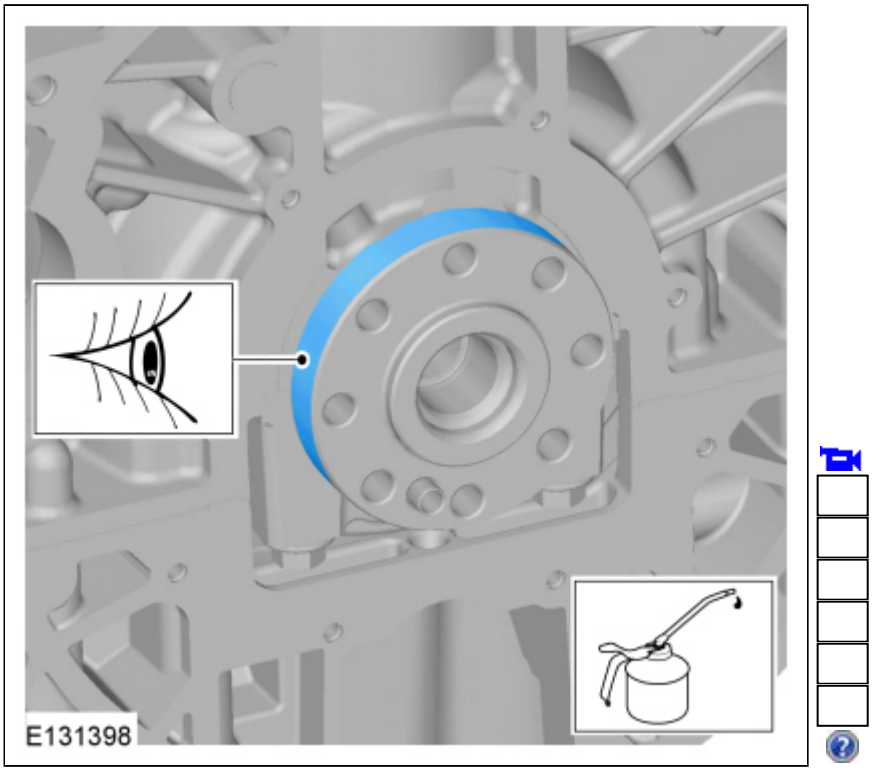


17. **NOTE:** *A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.*

- Clean the area on the engine before installing a new crankshaft rear seal carrier.
- Check the two foam pads are located as shown on the ladder frame gasket.



18.

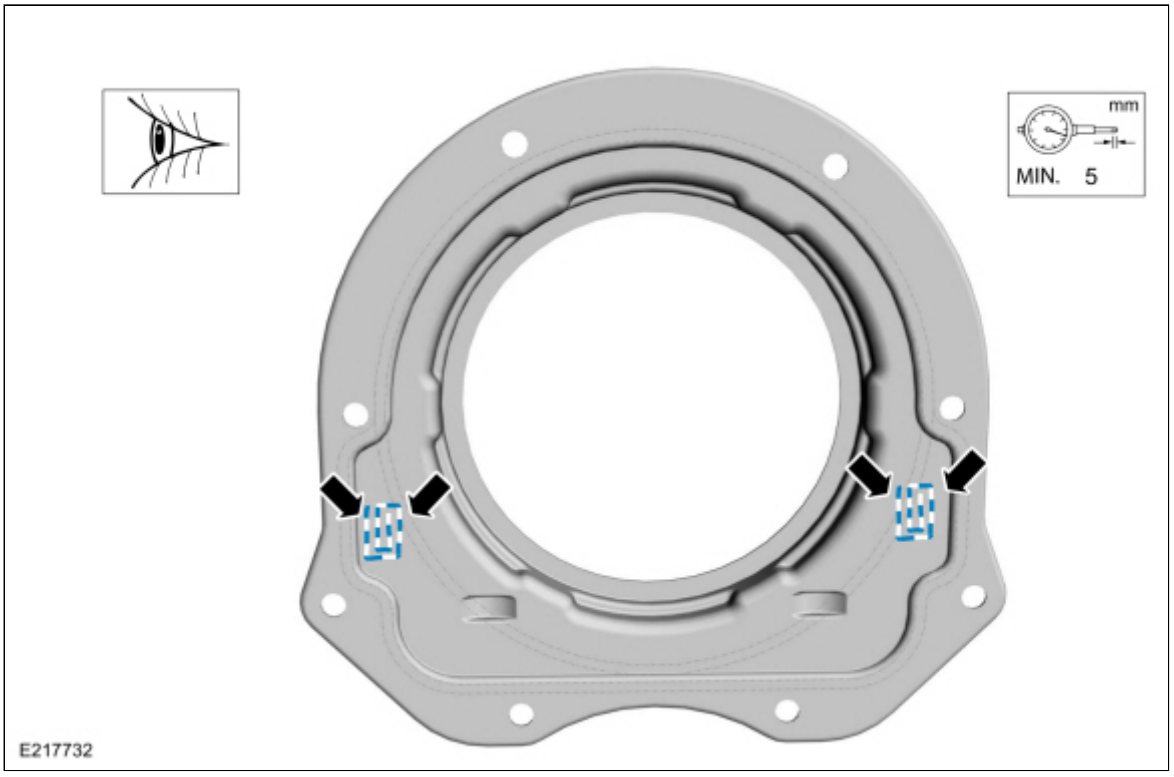


19. **NOTE:** *Install new crankshaft rear seal carrier with in five minutes after applying the recomended sealent. Failure to follow this instruction may result in damage to the vehicle.*

    NOTE: *Do not add any more than the specified quantity of sealant or add the sealant anywhere other than the area shown.*

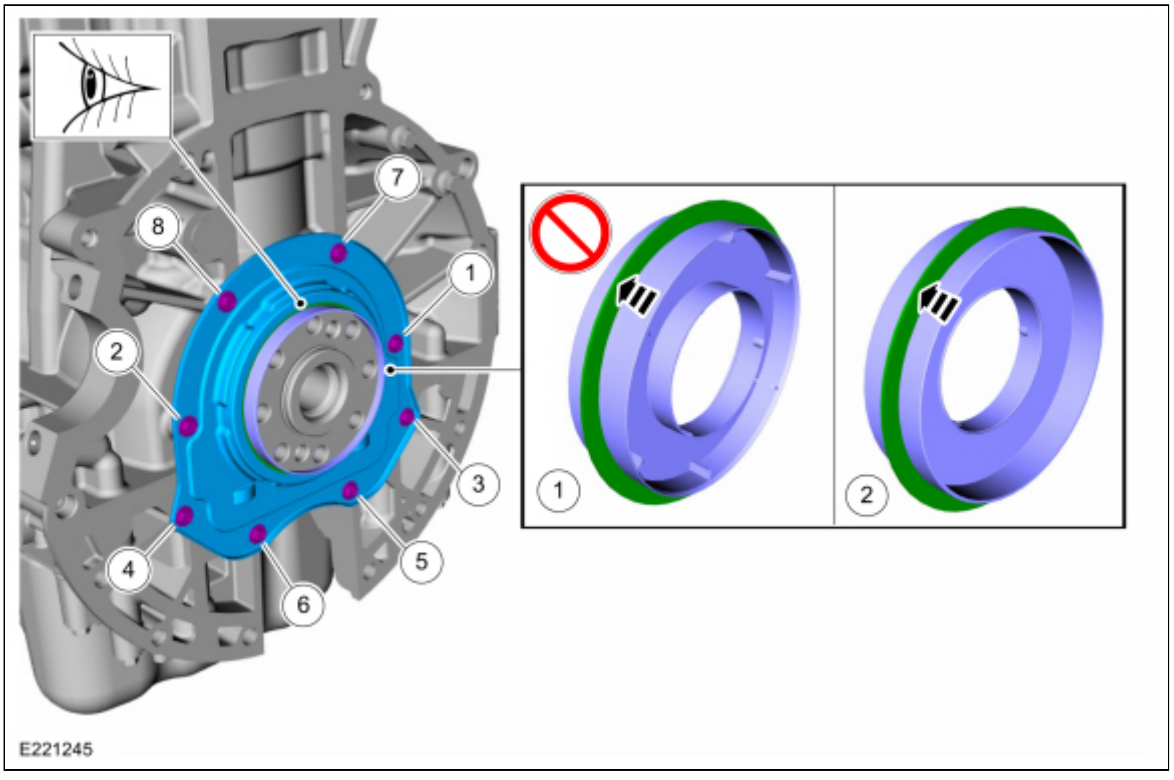
    NOTE: *If the foam pads are not present on inspection, fill the square areas shown with 75% of sealant.*

    Material: Silicone Sealant (WSE-M4G323-A4)



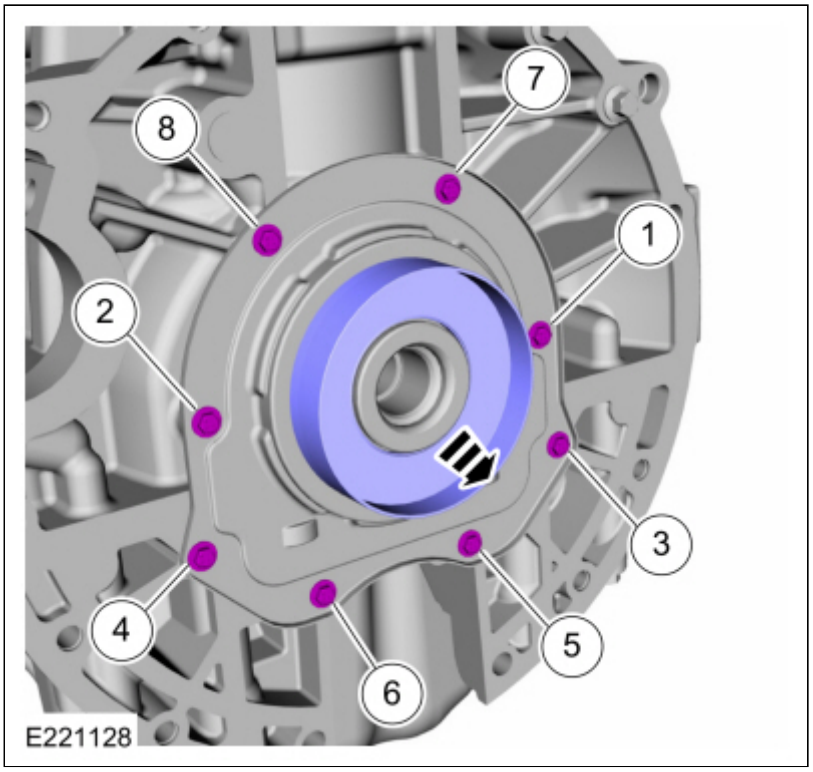
20. **NOTICE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.**

    NOTE: *Initially hand tighten the fasteners.*



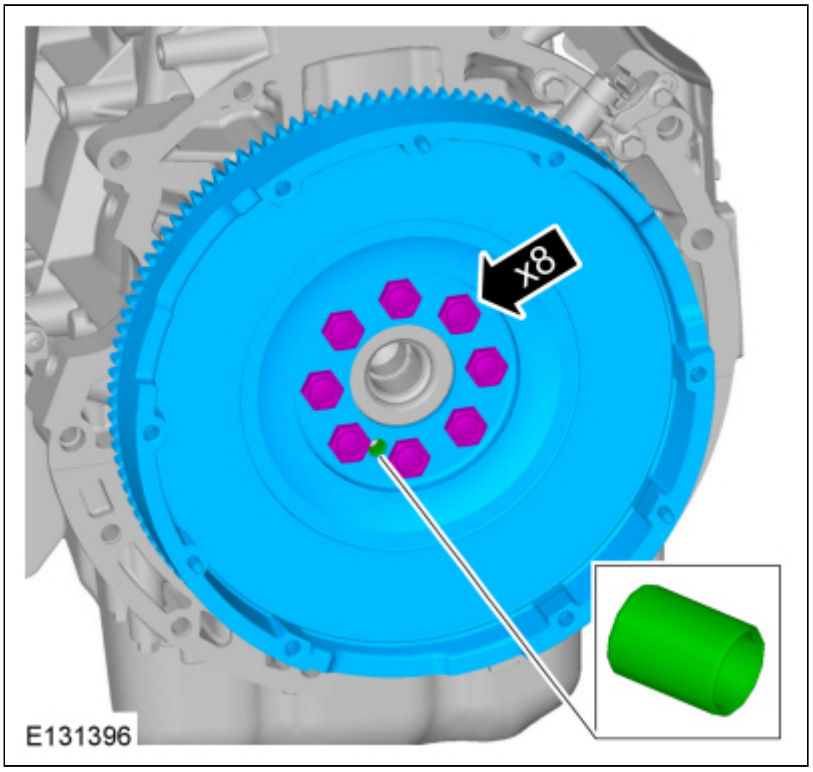
21. **NOTE:** *New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.*

    Torque:
    :
    Stage 1: 5 Nm
    Stage 2: 10 Nm



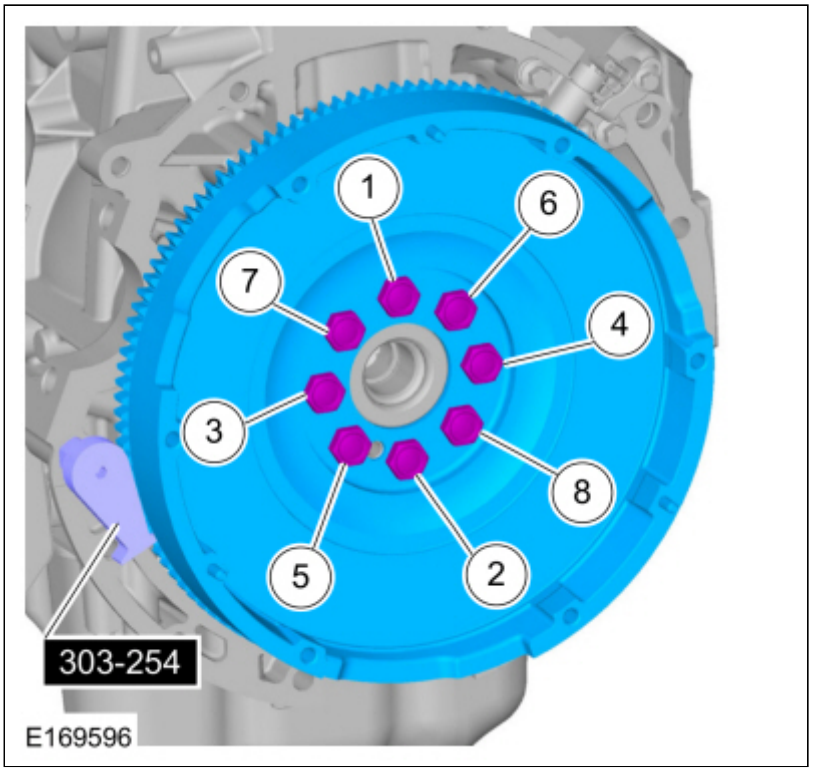
22. **NOTE:** *Make sure that flywheel is in full contact with flywheel flange before installing the flywheel bolts.*

    NOTE: *Only tighten the bolts finger tight at this stage.*

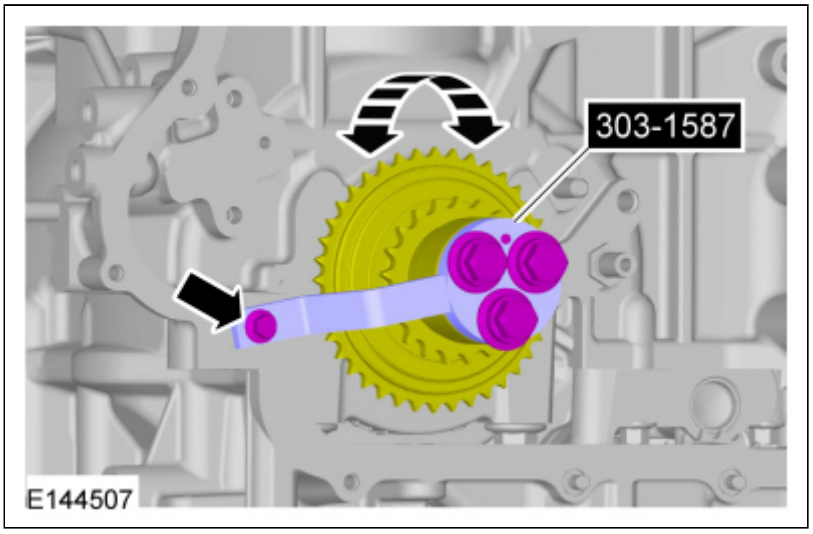


23. **NOTICE: Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.**

    Use Special Service Tool: 303-254 Locking Tool, Flywheel.
    Torque:
    Stage 1: 25 Nm
    Stage 2: 45 Nm
    Stage 3: 45°

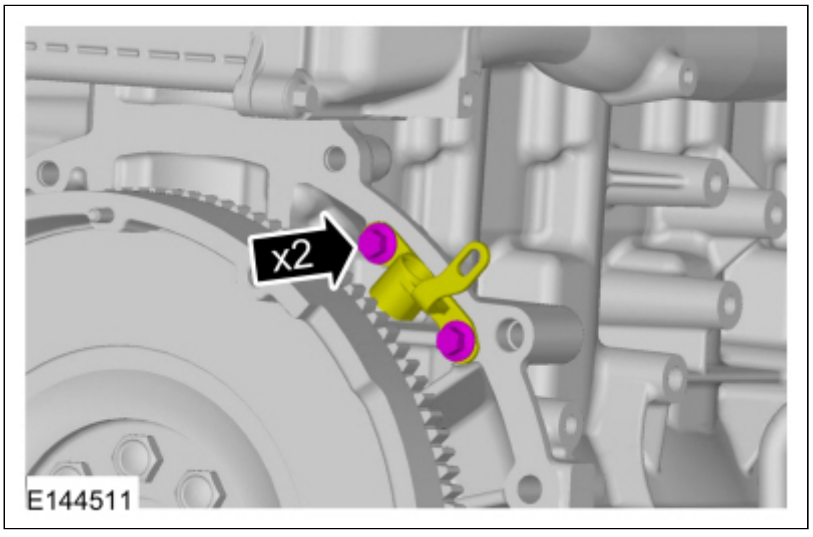


24.



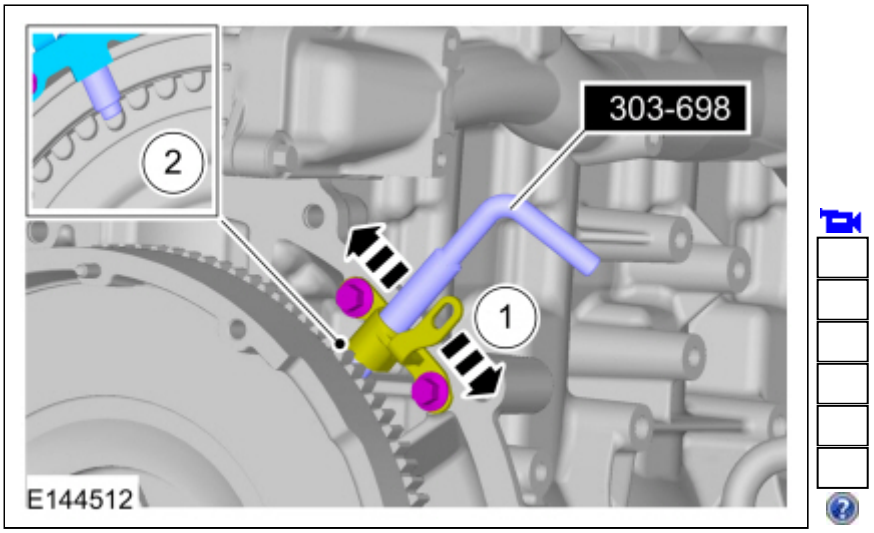
Vehicles with manual transmission

25. Initially hand tighten the fasteners.

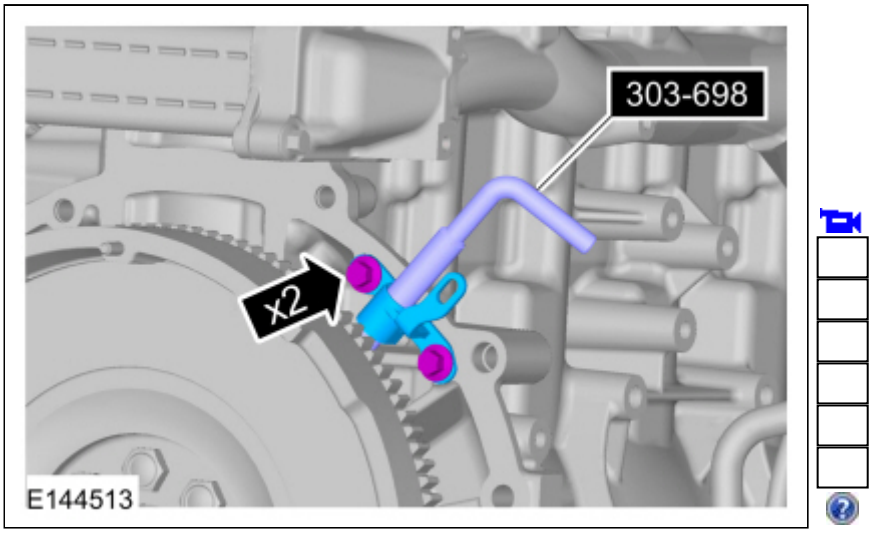


26. **NOTE:** *Make sure that the special tool is located in the flywheel timing slot.*

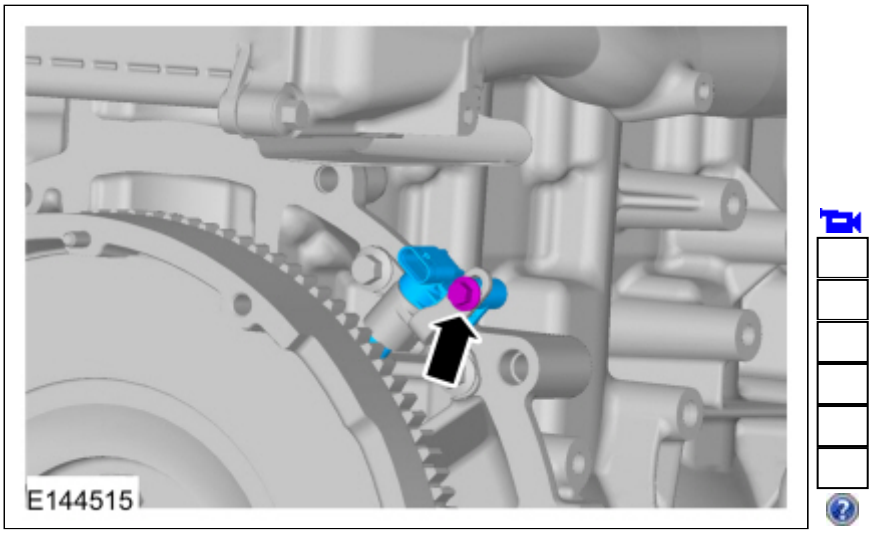
    Use Special Service Tool: 303-698 Timing Tool, Crankshaft.



27. Tighten bolts before removing tool.
    Remove Special Service Tool: 303-698 Timing Tool, Crankshaft.
    Torque: 20 Nm



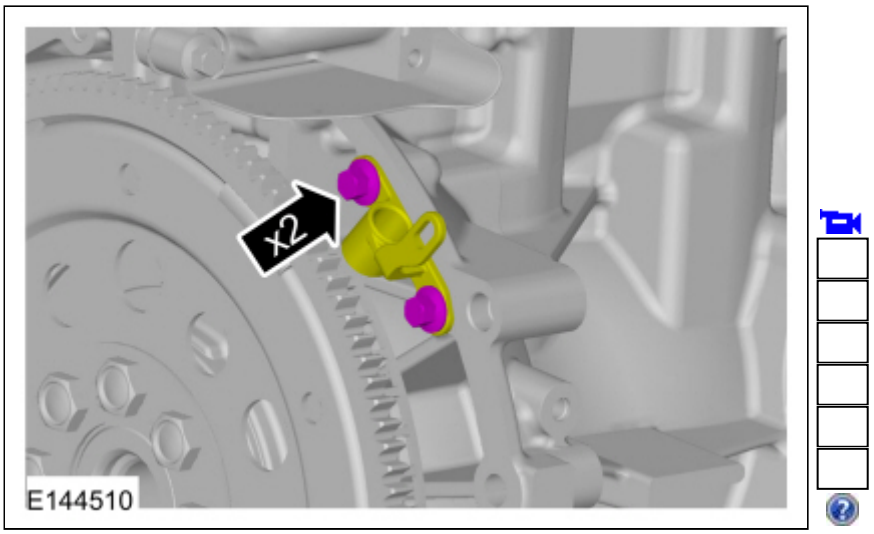
28. *Torque*: 8 Nm



Vehicles with automatic transmission

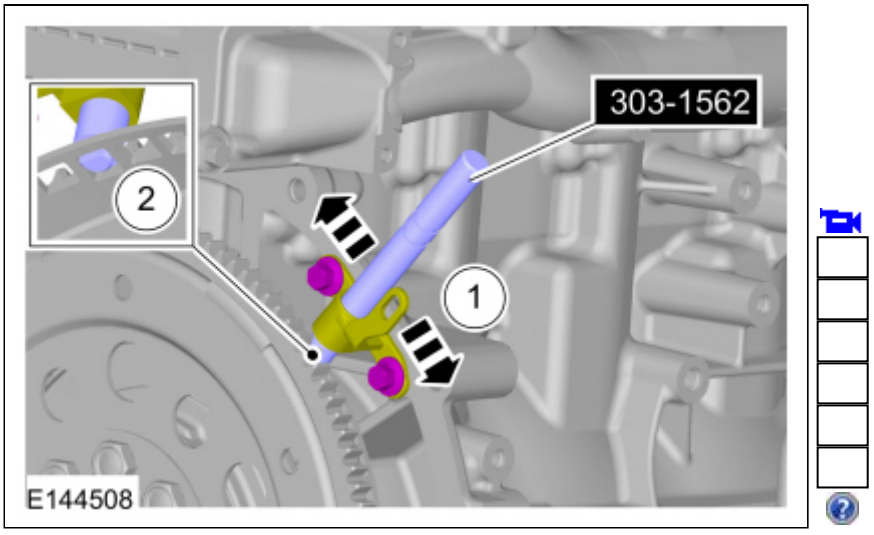
29. Initially hand tighten the fasteners.

Use Special Service Tool: 303-698 Timing Tool, Crankshaft.

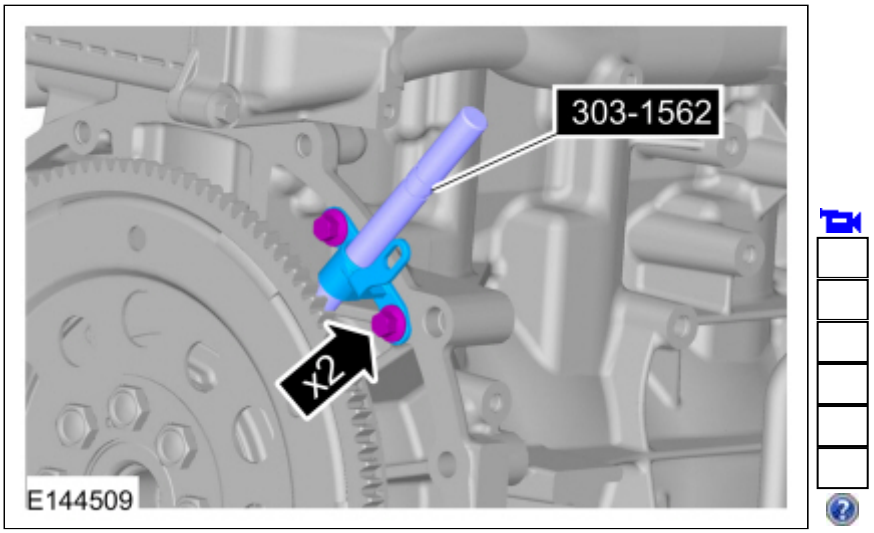


30. **NOTE:** *Make sure that the special tool is located in the flexplate timing slot.*

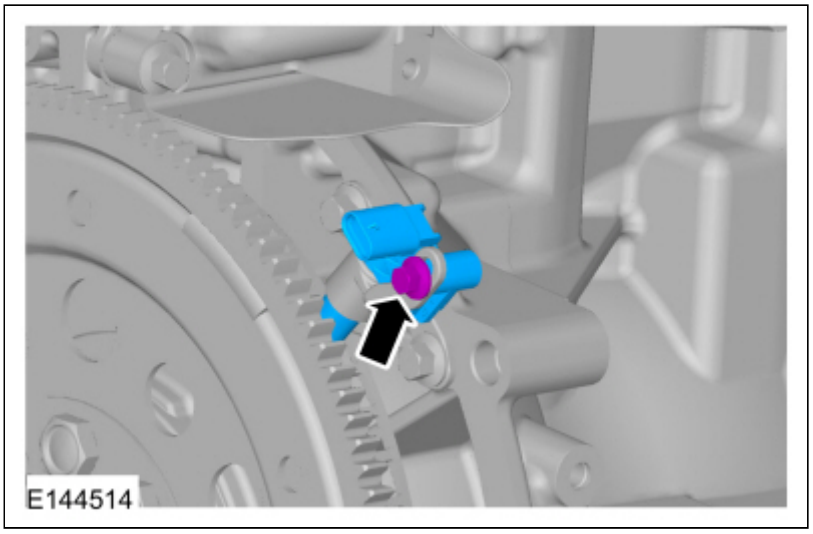
    Use Special Service Tool: 303-1562 Timing Tool.



31. Tighten bolts before removing tool.
    Remove Special Service Tool: 303-1562 Timing Tool.
    Torque: 20 Nm

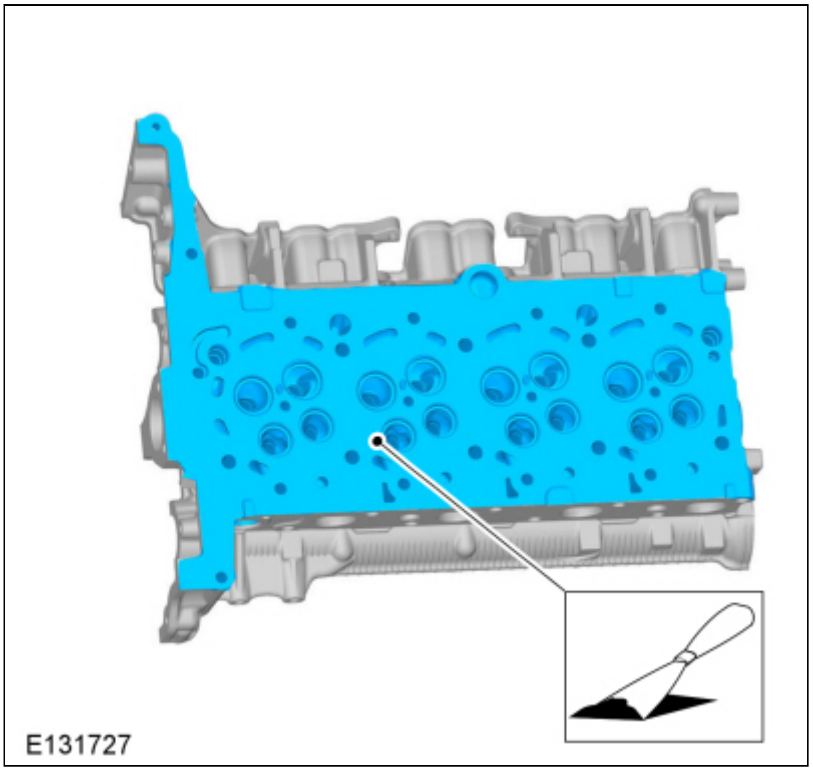


32. *Torque*: 8 Nm



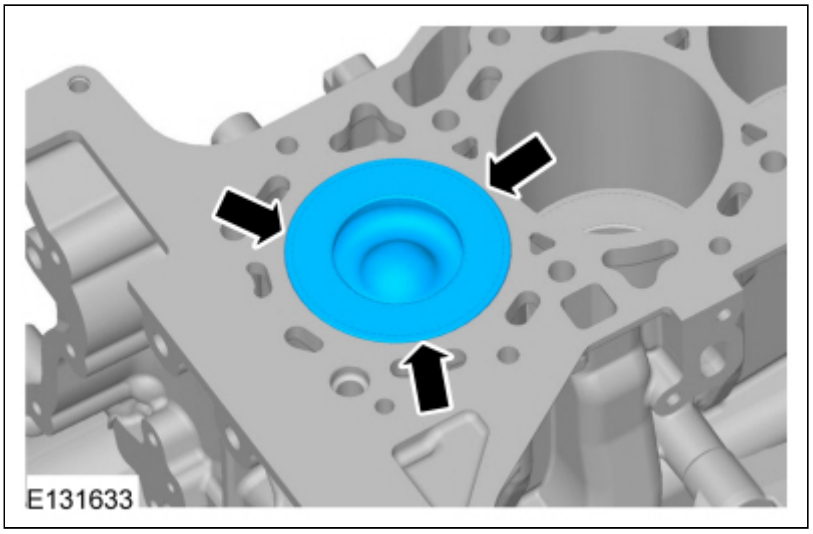
All vehicles

33. **WARNING: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**



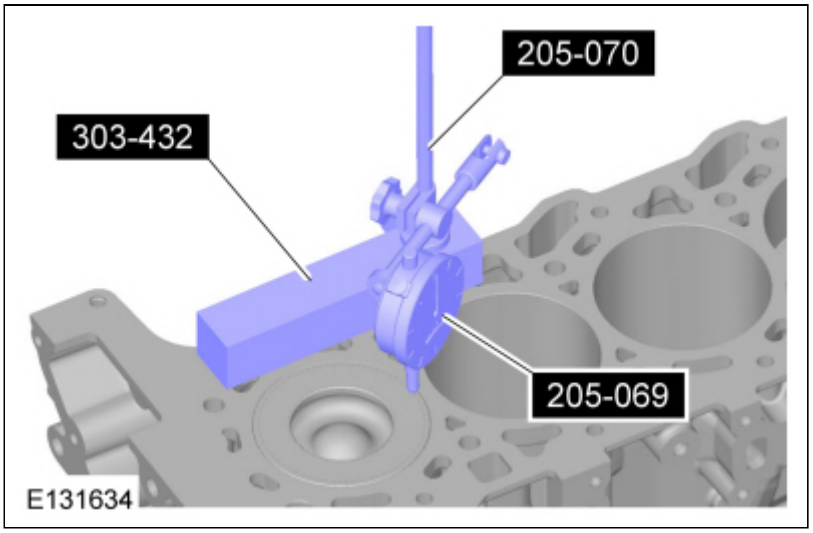
34. **NOTE:** *Measure the piston protrusion of each cylinder at top dead center (TDC).*

    Measure the distance between the piston crown and the cylinder block at the points indicated.



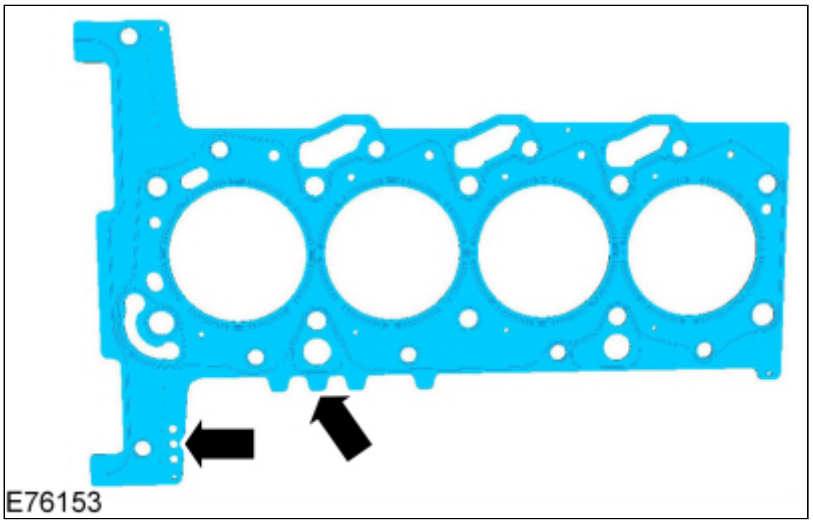
35. **NOTE:** *The largest measurement determines the choice of the cylinder head gasket.*

    - Using the special tools, measure the piston protrusion.
      Use Special Service Tool: 205-070 Holding Fixture, Dial Indicator Gauge. , 205-069 Dial Indicator Gauge (Metric). , 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion).

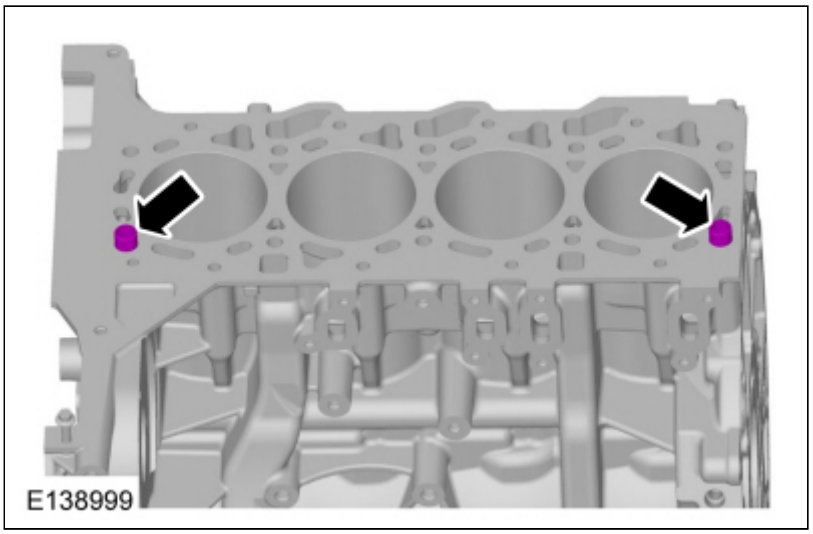


36. Determine the cylinder head gasket.
    Refer to: Specifications (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Specifications).

37. **NOTE:** *Make sure that a new component is installed.*

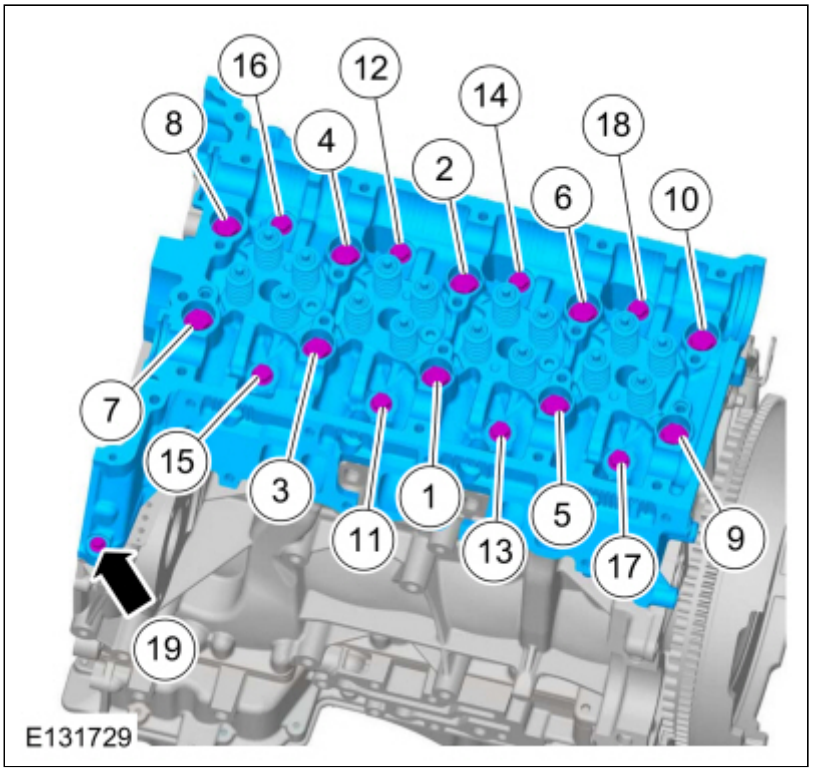


38.

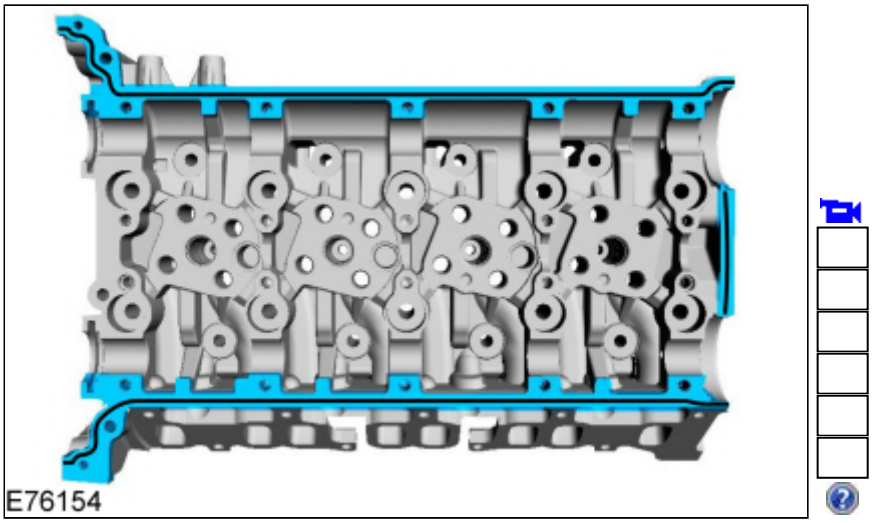


39. **NOTE:** *Install all the bolts finger tight before final tightening.*

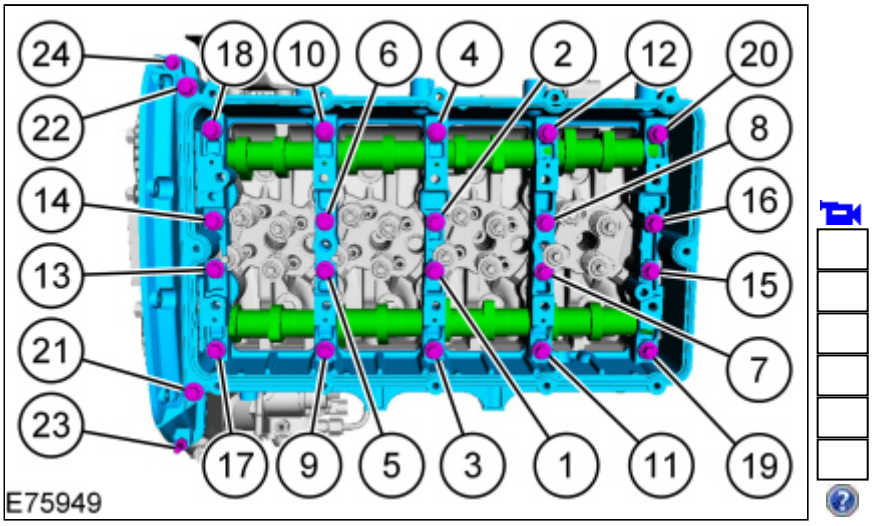
Torque:
Stage 1: 1-10: 10 Nm
Stage 2: 11-18: 5 Nm
Stage 3: 19: 4 Nm
Stage 4: 1-10: 20 Nm
Stage 5: 11-18: 10 Nm
Stage 6: 19: 6 Nm
Stage 7: 1-10: 35 Nm
Stage 8: 11-18: 20 Nm
Stage 9: 19: 10 Nm
Stage 10: 1-10: 45 Nm
Stage 11: 11-18: 26 Nm
Stage 12: 1-10: 90°
Stage 13: 11-18: 90°
Stage 14: 1-10: 90°
Stage 15: 11-18: 90°



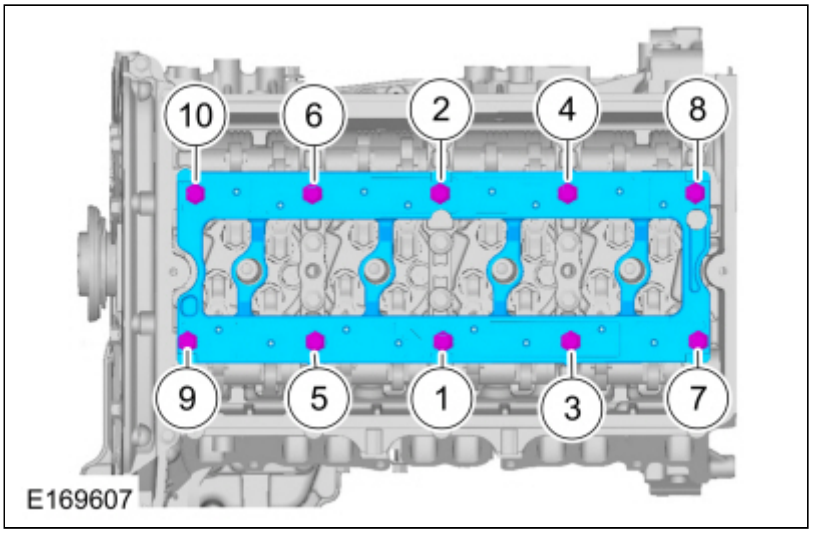
40. *Material*: Silicone Sealant (WSE-M4G323-A4)



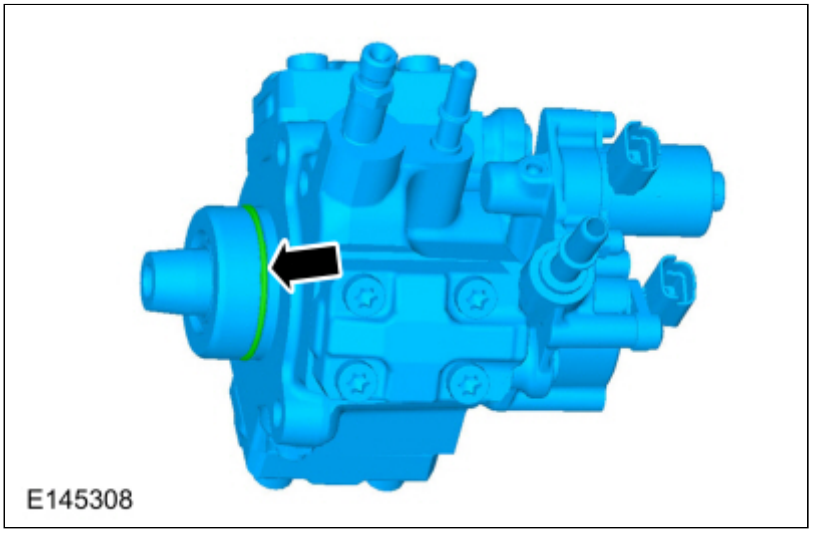
41. *Torque*:
    Bolts 1 to 22:
    Stage 1: 6 Nm
    Stage 2: 15 Nm
    Stage 3: 23 Nm
    Bolts 23 to 24:
    Stage 4: 4 Nm
    Stage 5: 5 Nm
    Stage 6: 10 Nm



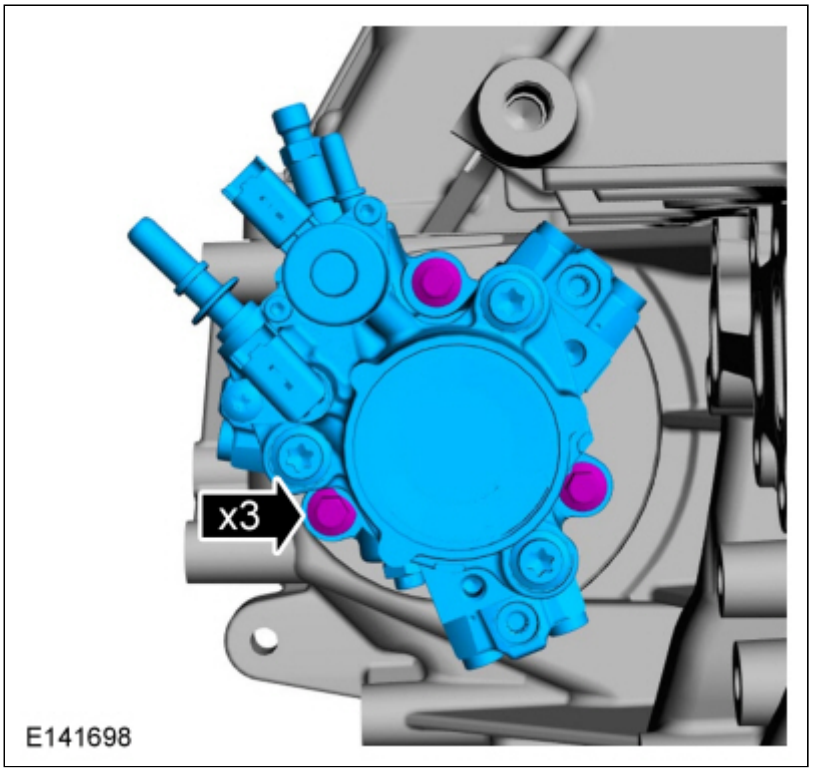
42. *Torque*:
    Stage 1: 5 Nm
    Stage 2: 8 Nm
    Stage 3: 10 Nm
    Stage 4: 45°



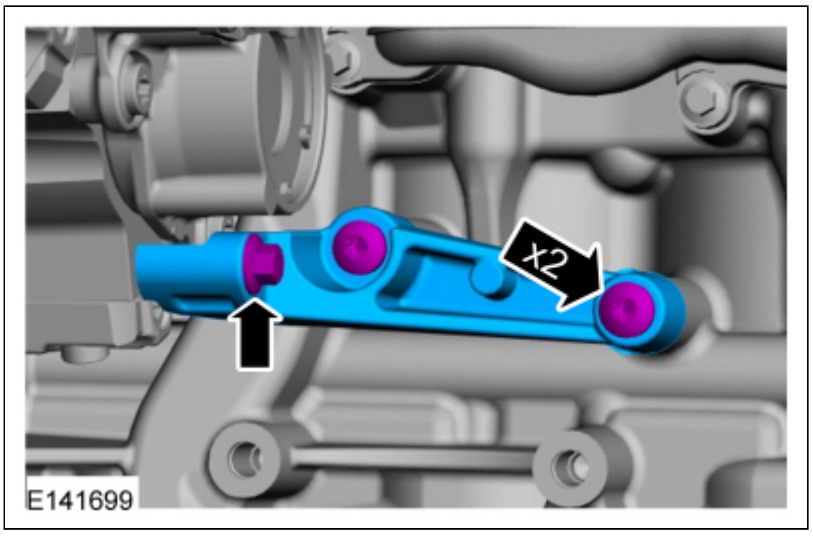
43.



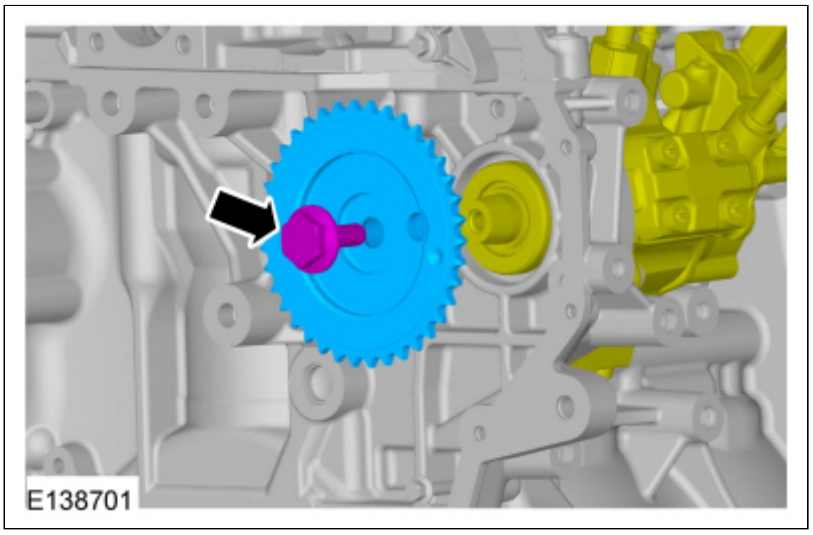
44. *Torque*: 23 Nm



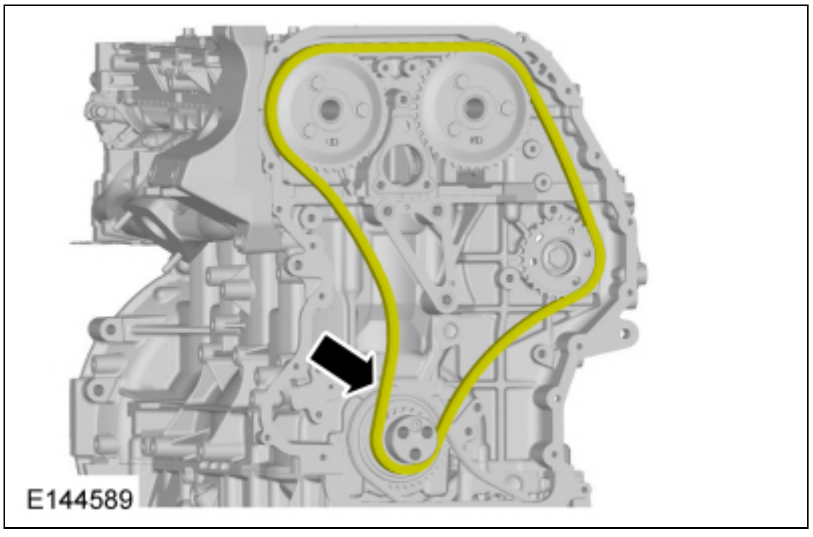
45. *Torque*: 23 Nm



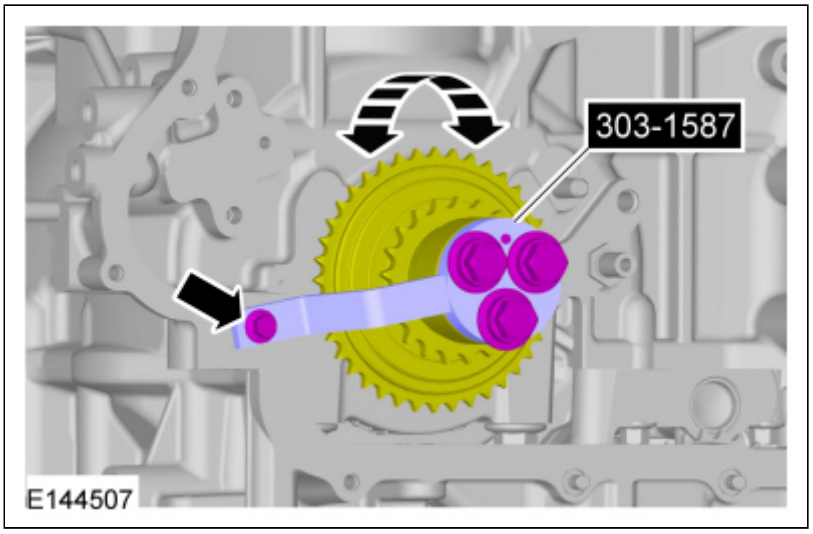
46. *Torque*: 45 Nm



47.

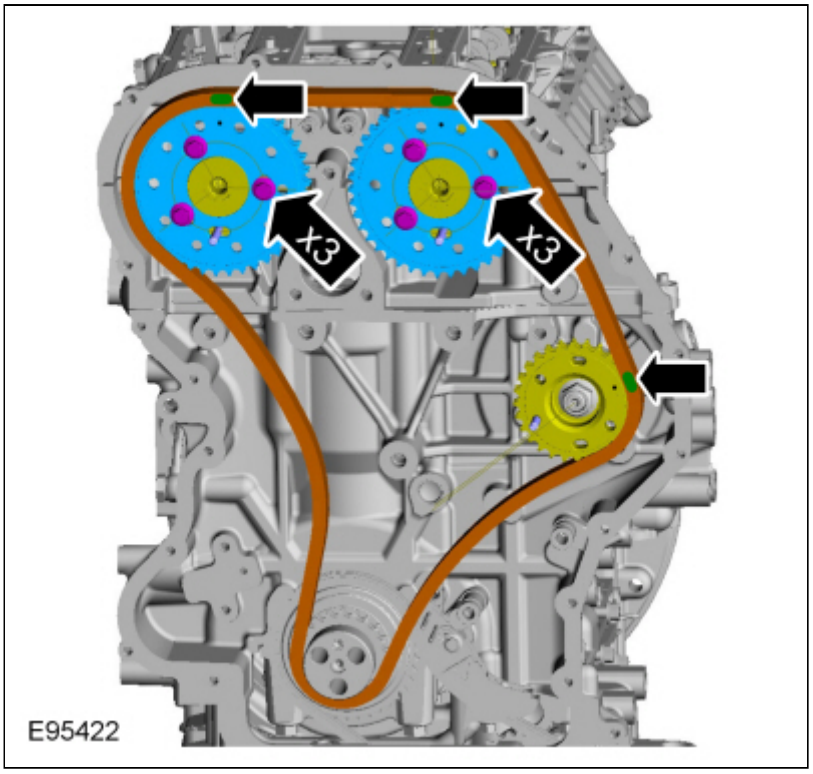


48. Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



49. **NOTE:** *Make sure that the installation marks are aligned.*

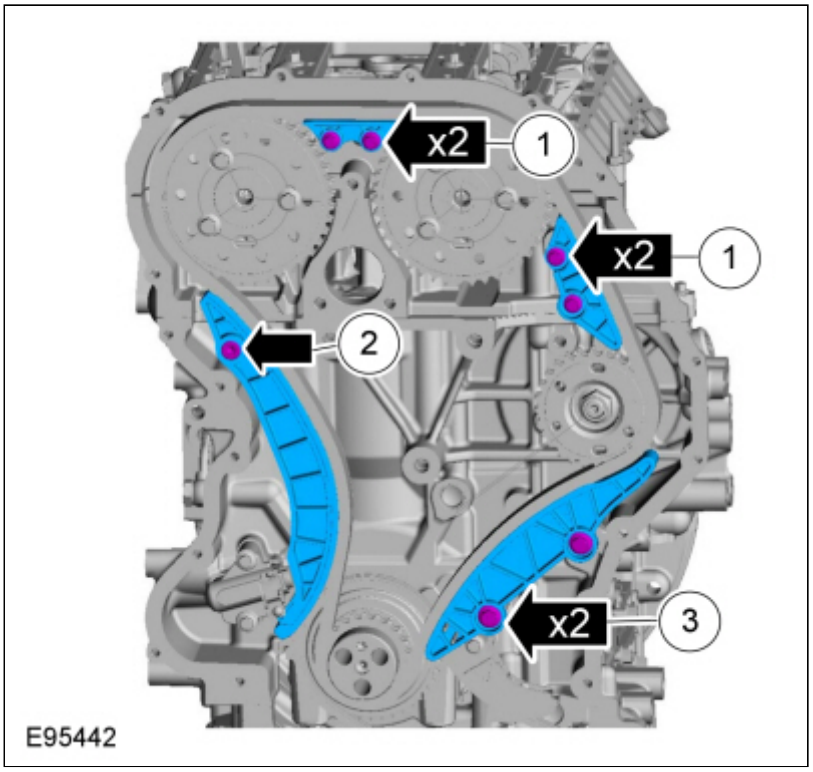
    Use the General Equipment: 6 mm Drill Bit
    Torque:
    stage 1: 12 Nm
    stage 2: 33 Nm



50. Remove the 6 mm drill bits.

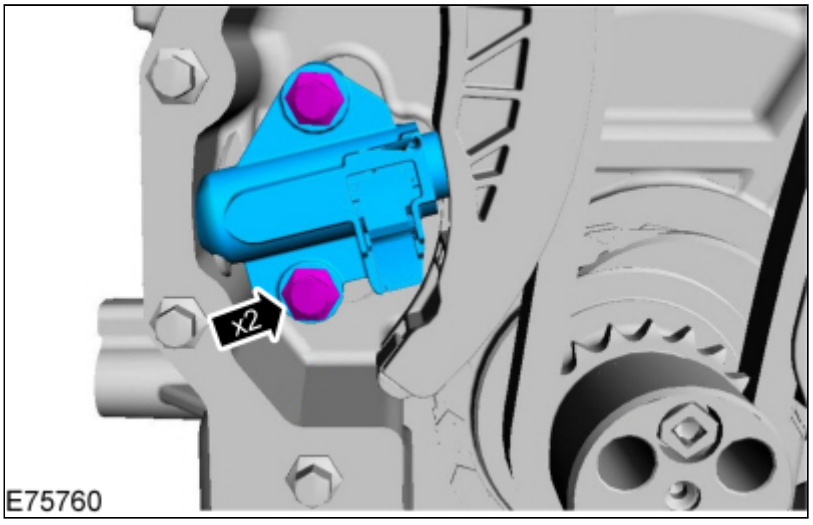
51. **NOTICE: Make sure that new bolts are installed.**

    1. *Torque*: 14 Nm
    2. *Torque*: 31 Nm
    3. *Torque*: 15 Nm

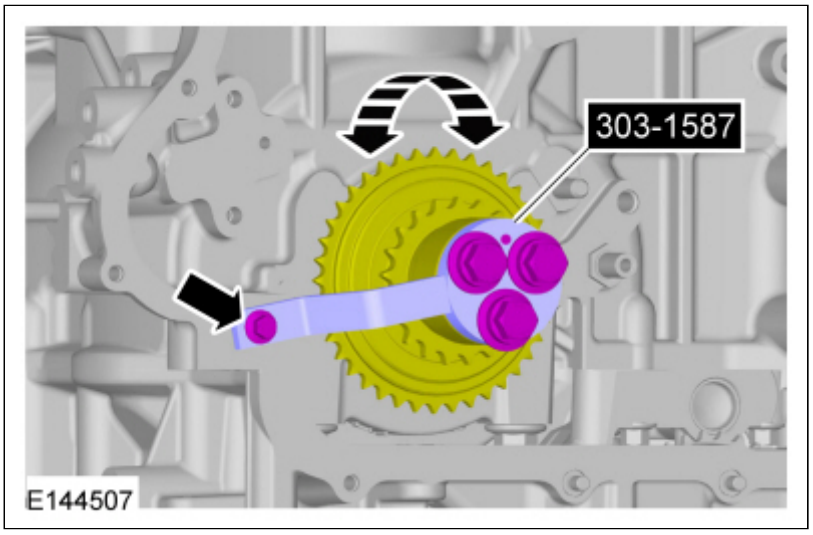


52. **NOTE:** *Make sure that a new component is installed.*

    Torque: 15 Nm

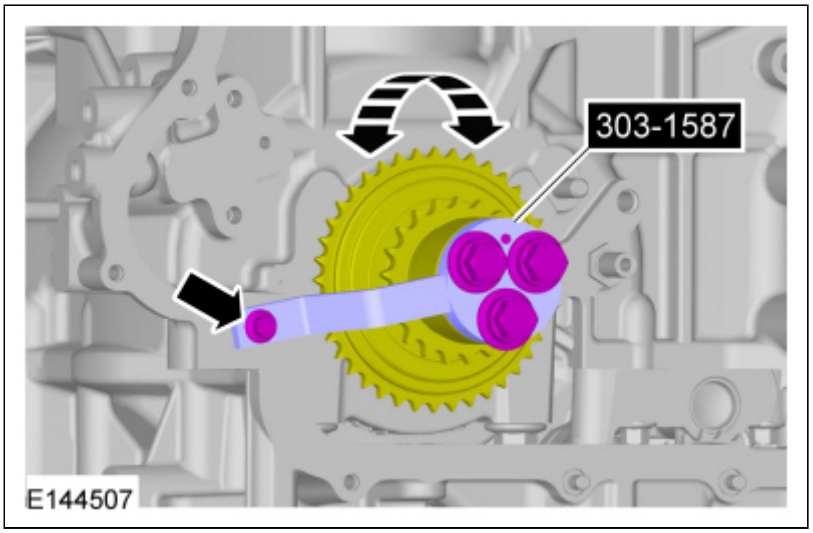


53. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



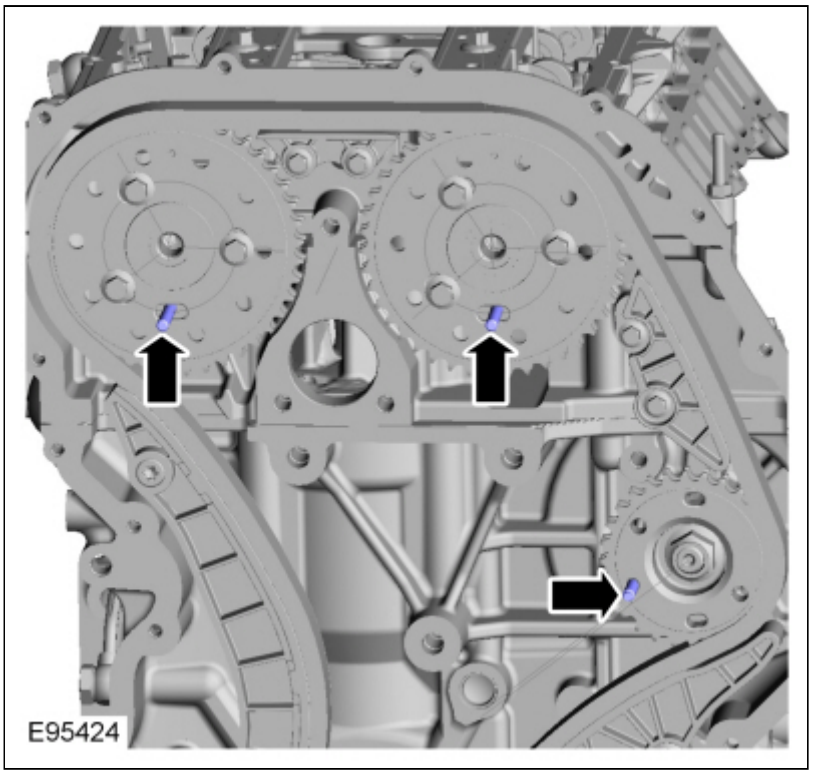
54. Rotate the engine two revolutions.

55. Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.

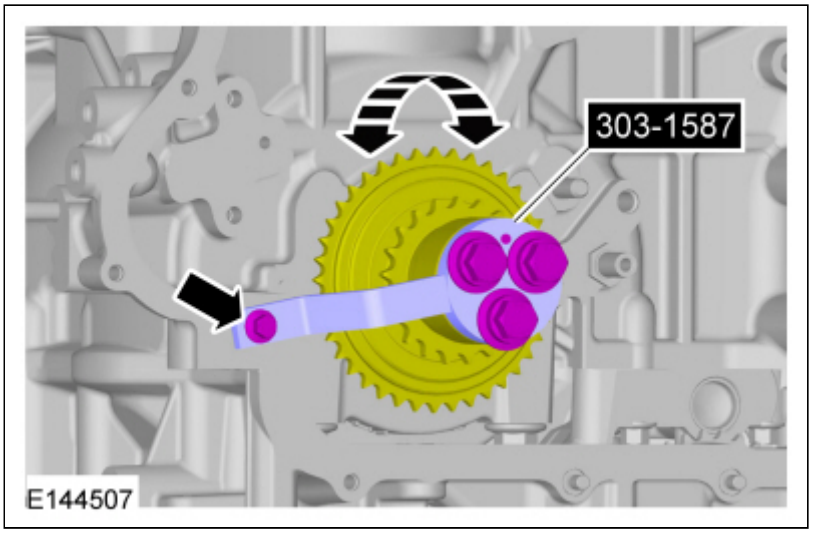


56. Check the position of the timing marks and correct if necessary.

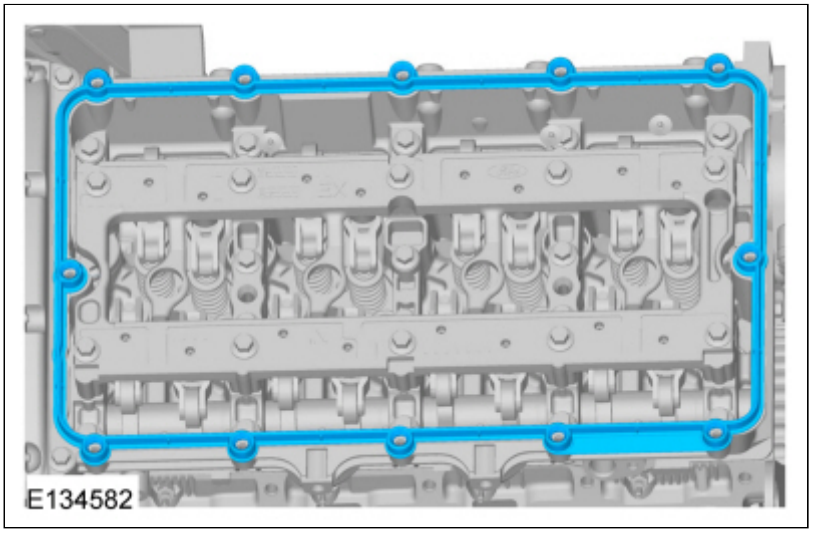
57. Remove the 6 mm drill bits.



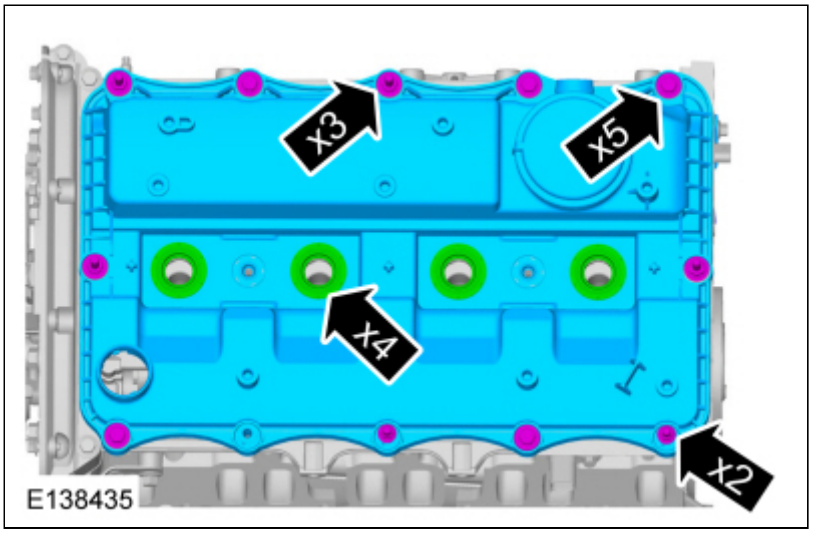
58. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



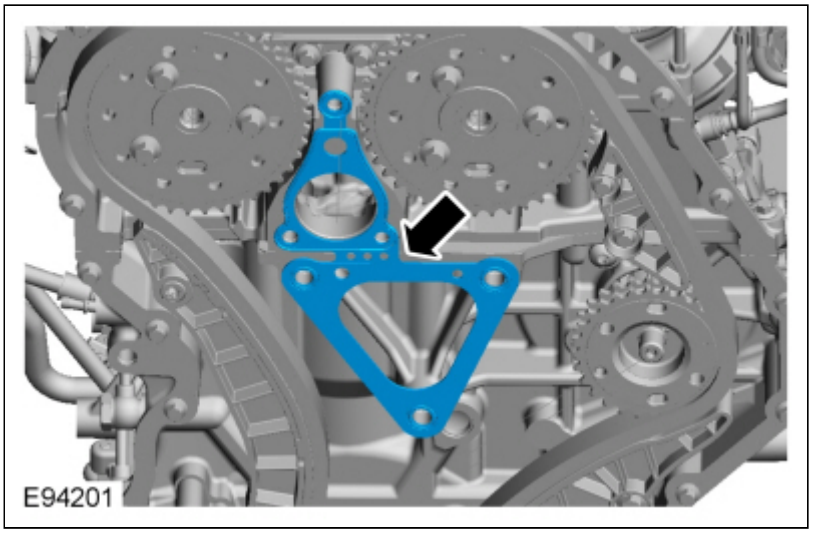
59.



60. *Torque*: 10 Nm



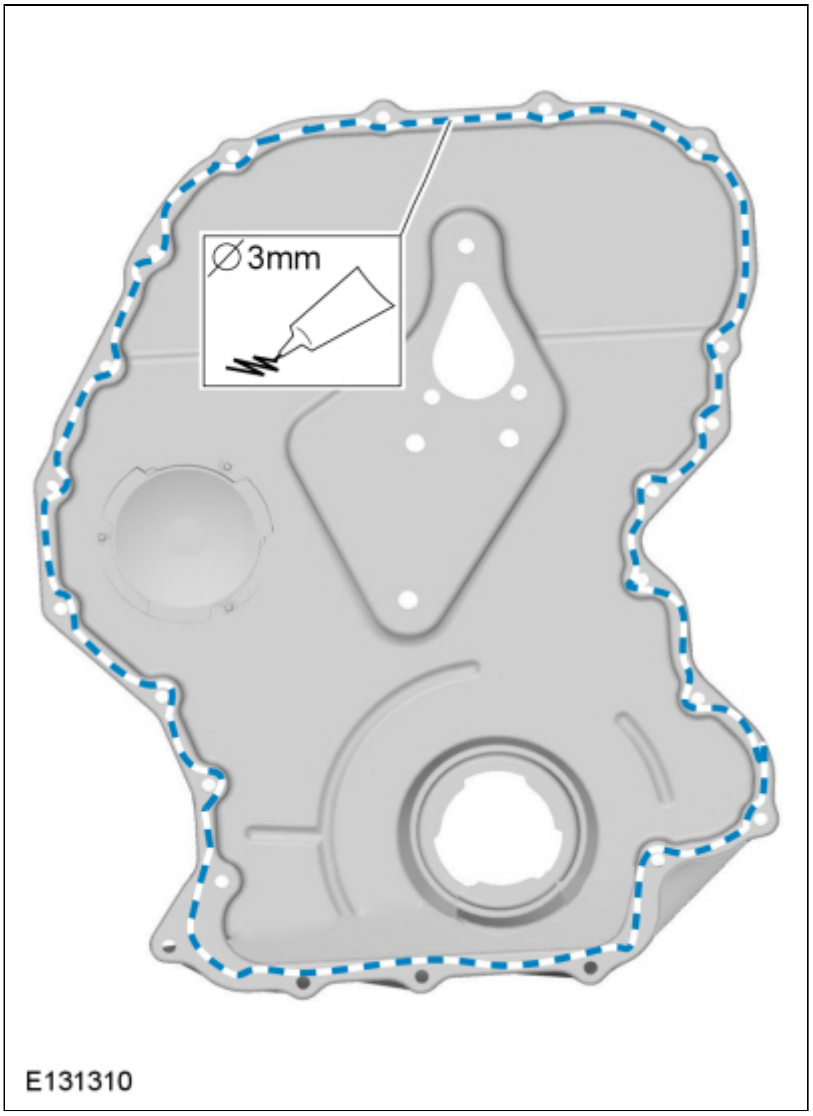
61. **NOTE:** *Make sure that a new component is installed.*



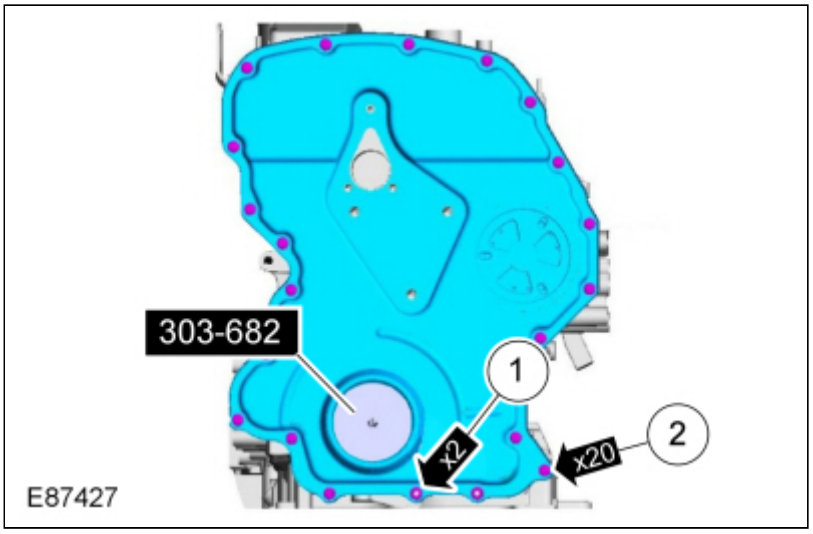
62. **NOTE:** *The component must be installed within 5 minutes of applying the sealant.*

    NOTE: *Make sure that a new component is installed.*

    Material: Silicone Sealant (WSE-M4G323-A4)

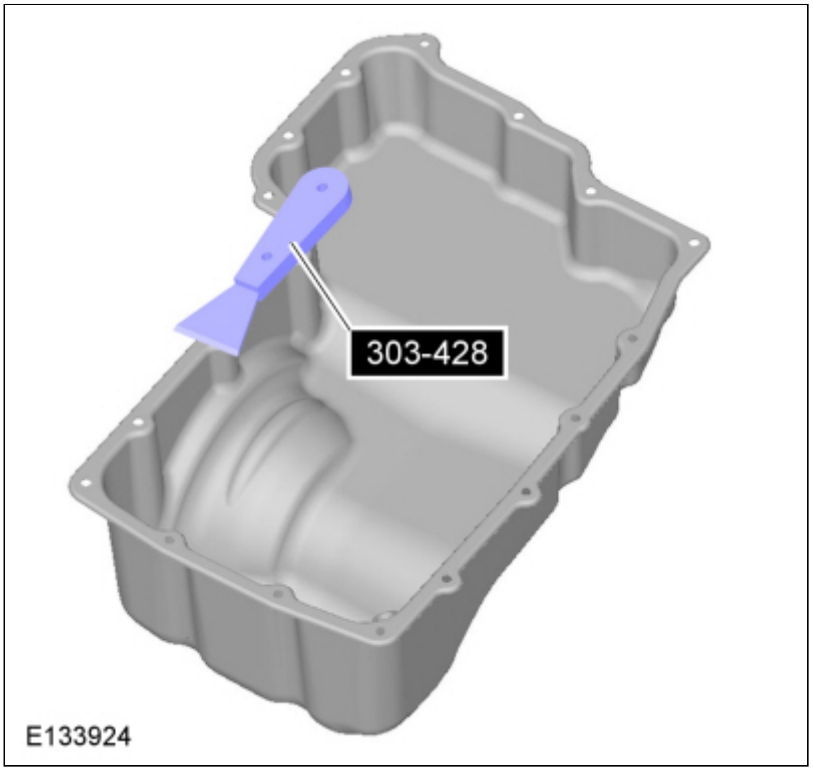


63. Use Special Service Tool: 303-682 Aligner, Engine Front Cover.
    Torque:
    1: 5 Nm
    2: 10 Nm



64. **NOTE:** *Do not damage the mating faces.*

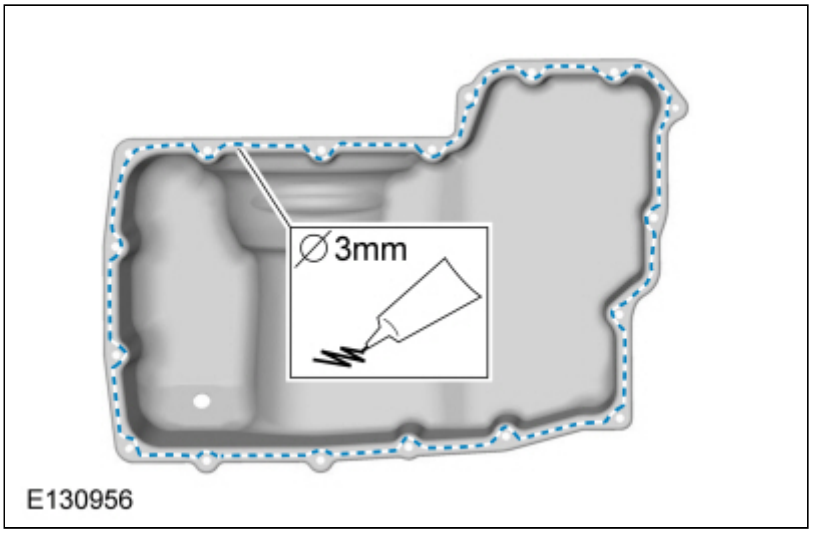
    Use Special Service Tool: 303-428 Separator, Oil Pan.



65. **NOTICE: Install the oil pan within five minutes of applying the sealer.**

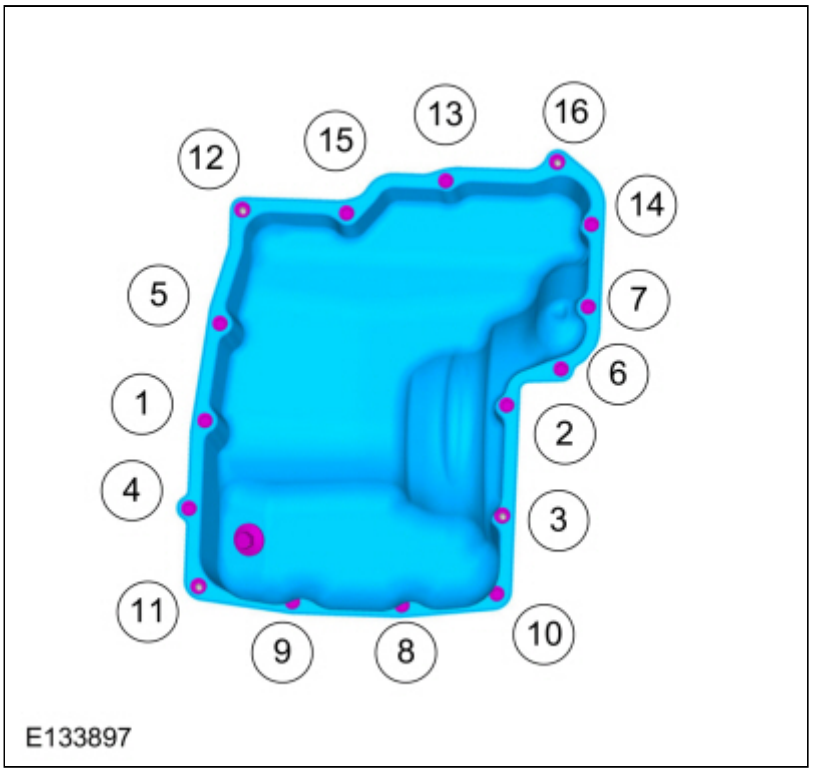
    NOTE: *Do not damage the mating faces.*

    Material: Silicone Sealant (WSE-M4G323-A4)



66. **NOTE:** *The seal is to be reused unless damaged.*

Torque:
Fastners:
Stage 1: 6 Nm
Stage 2: 13 Nm
Seal: 35 Nm



Copyright © 2016 Ford Motor Company

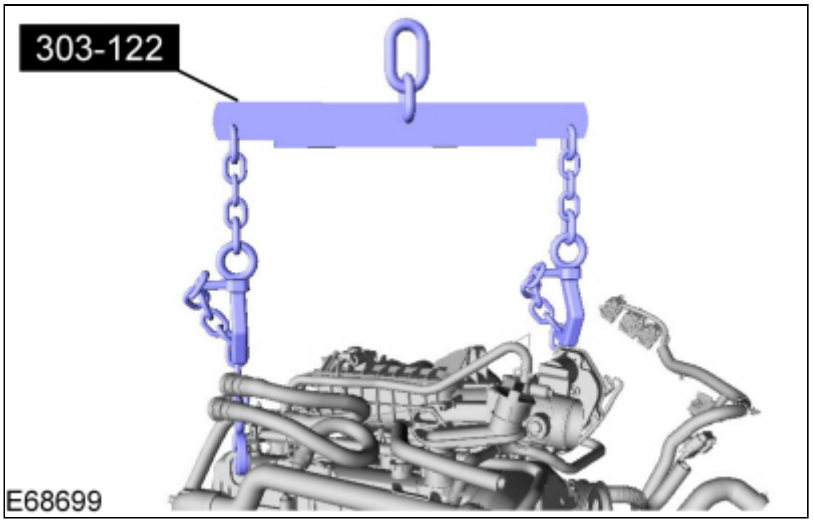
Engine - 5-Speed Manual Transmission - MT75

Base Part Number: 6L084

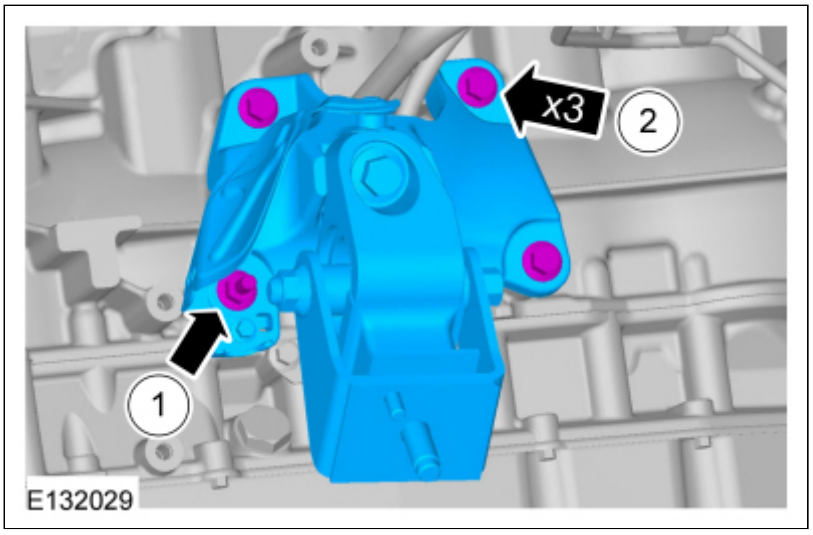
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine

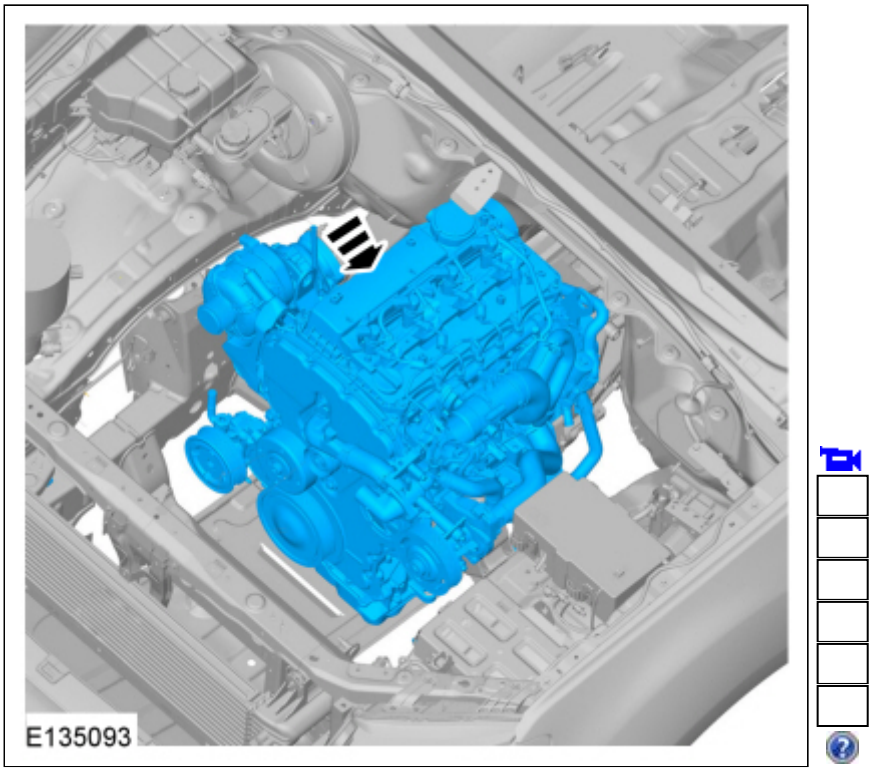
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



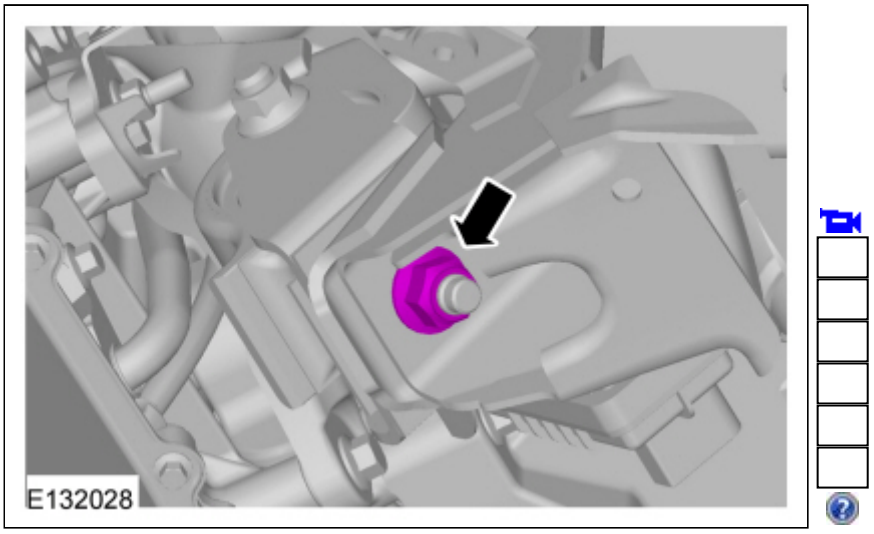
3. **NOTE:** *Hand tighten the nut at this stage.*



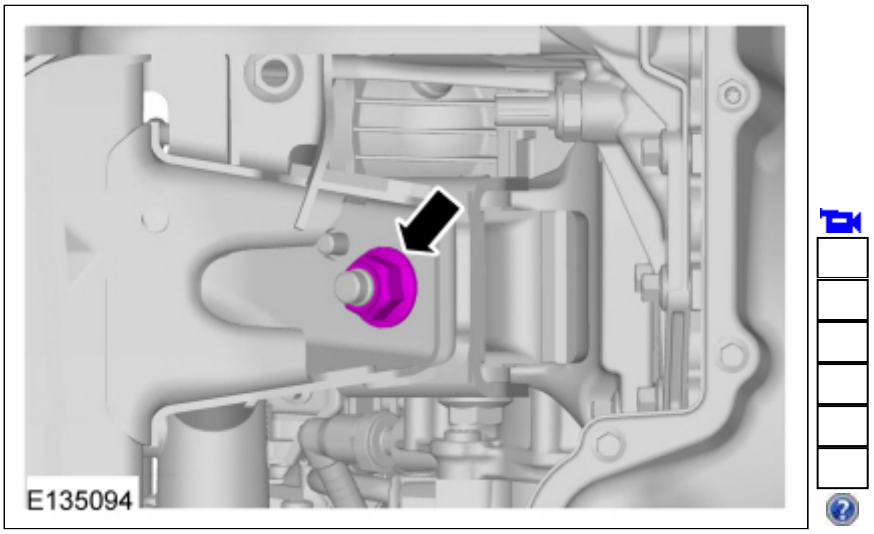
4.



5. **NOTE:** *Hand tighten the nut at this stage.*

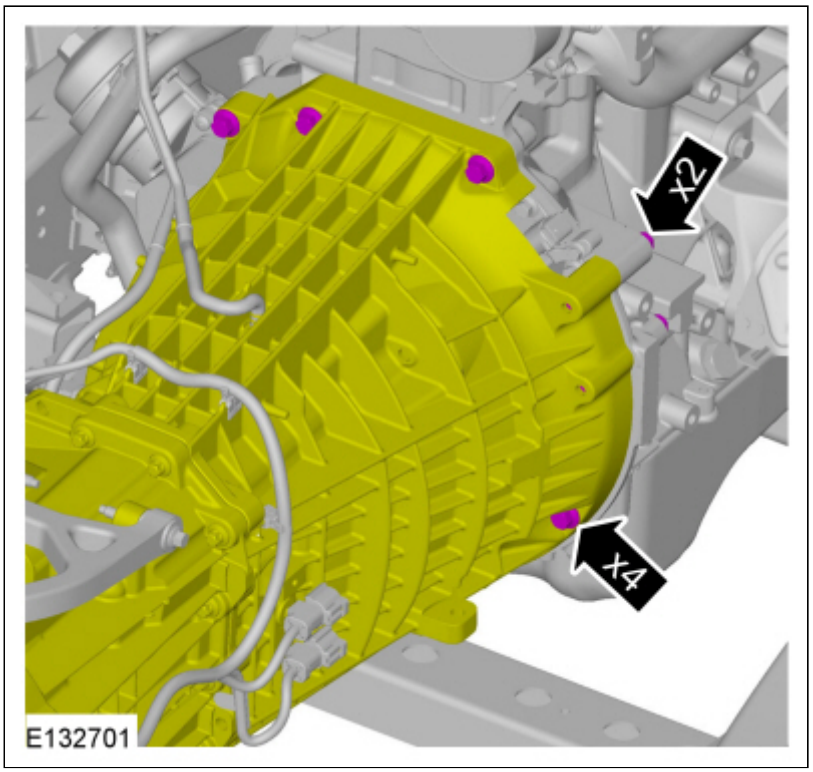


6. **NOTE:** *Hand tighten the nut at this stage.*

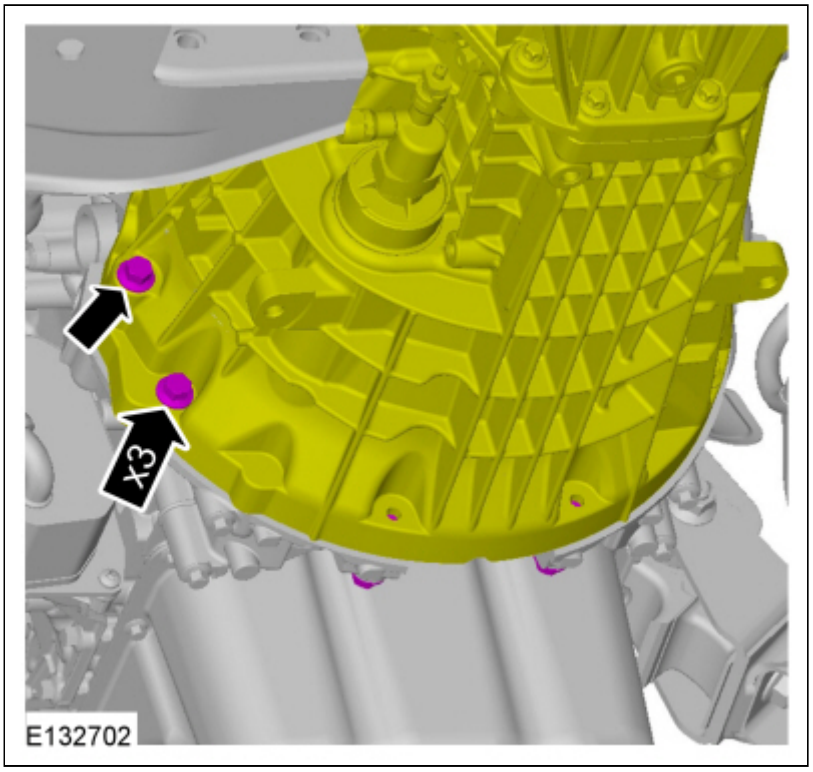


7. Initially hand tighten the fasteners.

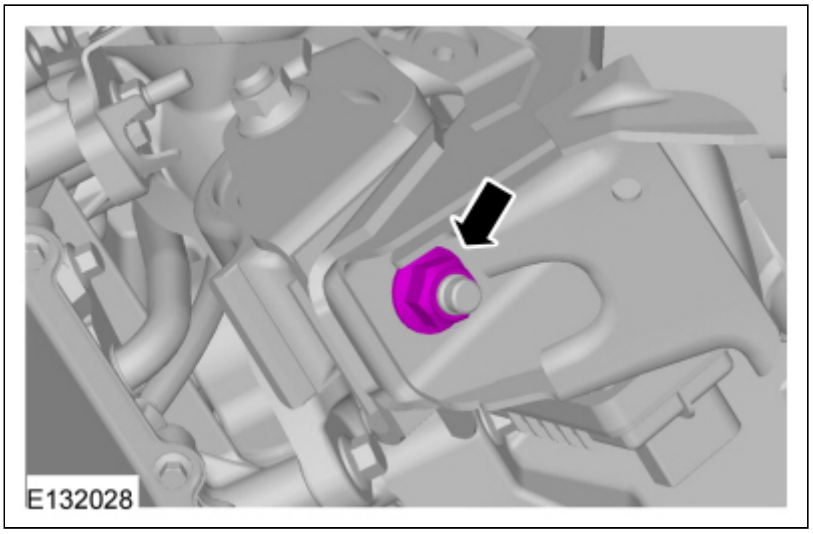
Torque: 48 Nm



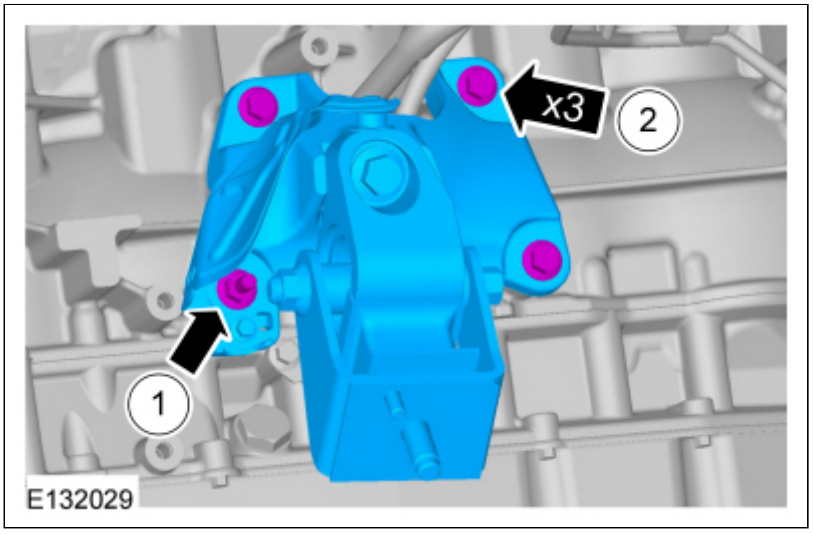
8. Initially hand tighten the fasteners.
   Torque: 48 Nm



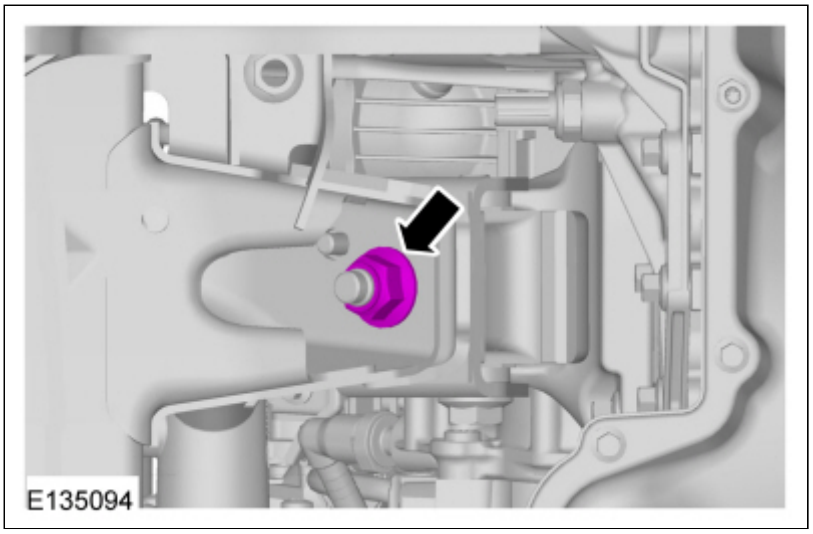
9. *Torque*: 80 Nm



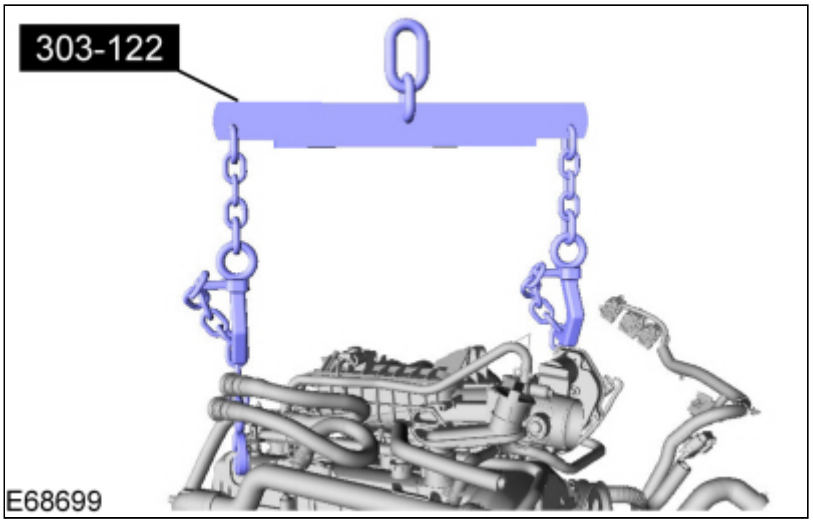
1. *Torque*: 48 Nm
2. *Torque*: 48 Nm



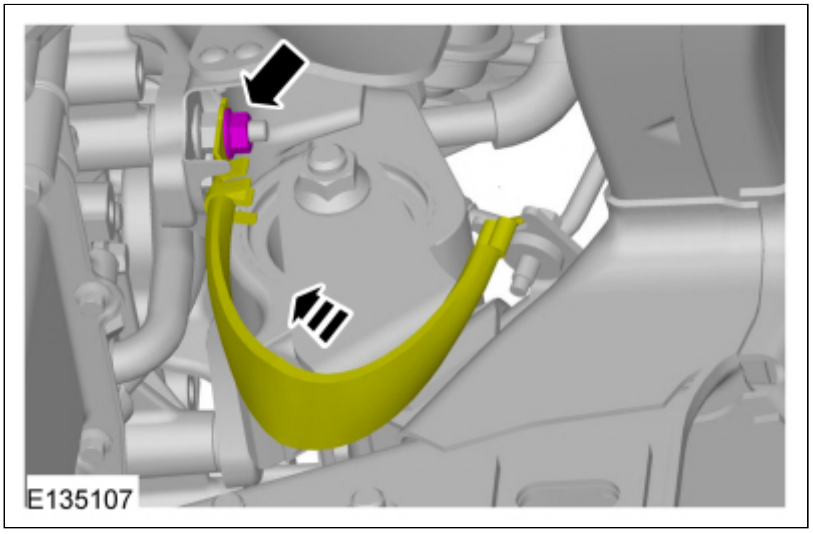
11. *Torque*: 80 Nm



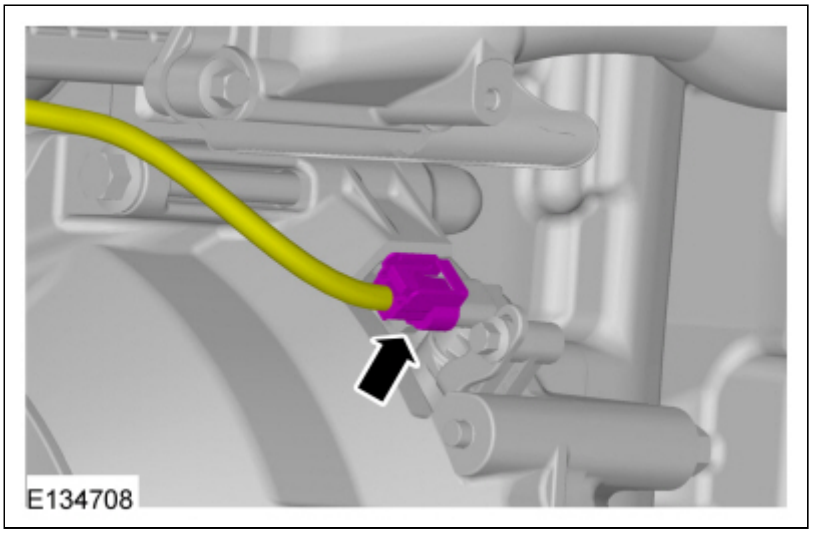
12. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.



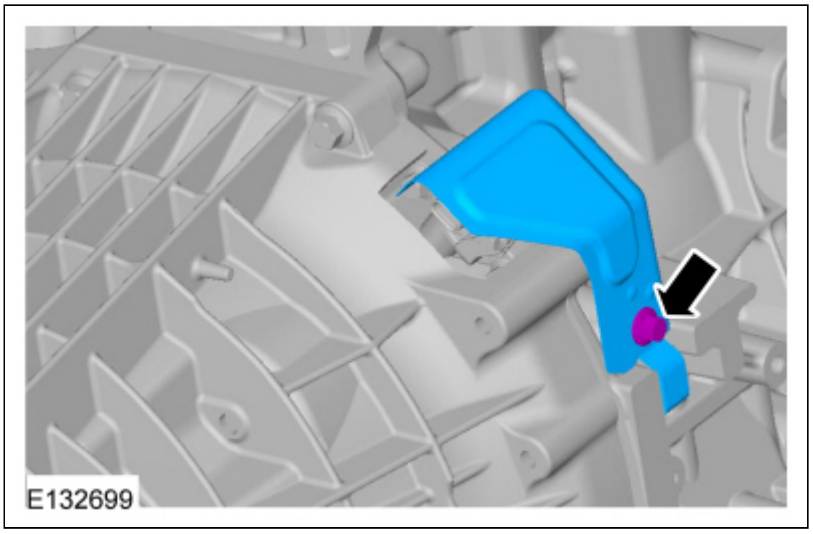
13. *Torque*: 13 Nm



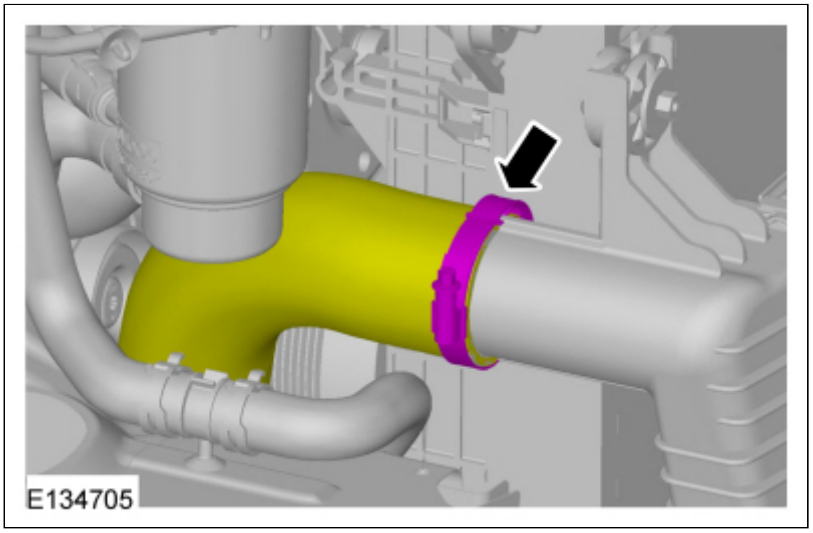
14.



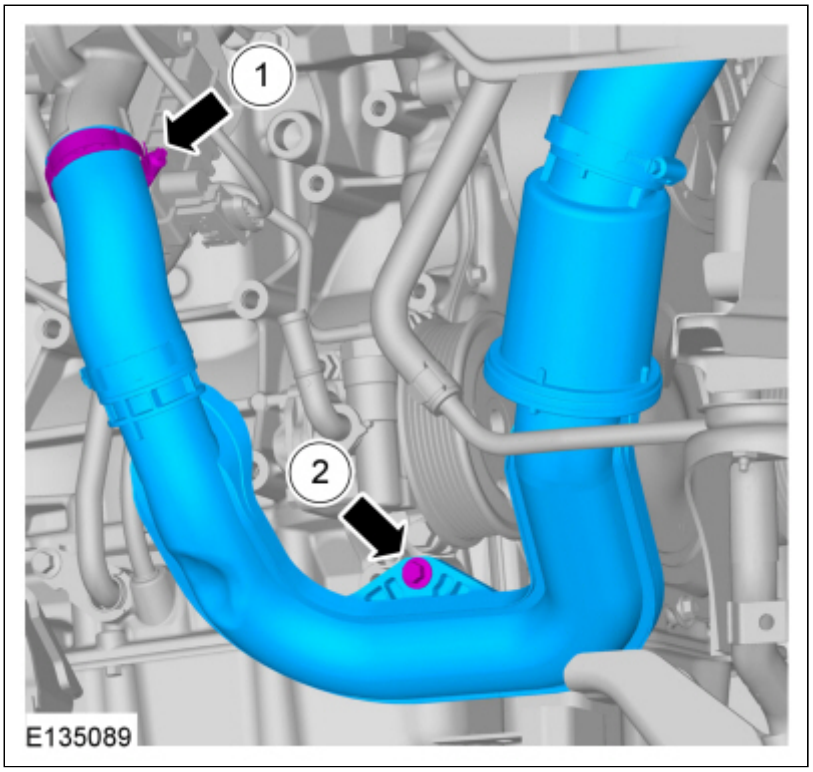
15. *Torque*: 22 Nm



16.

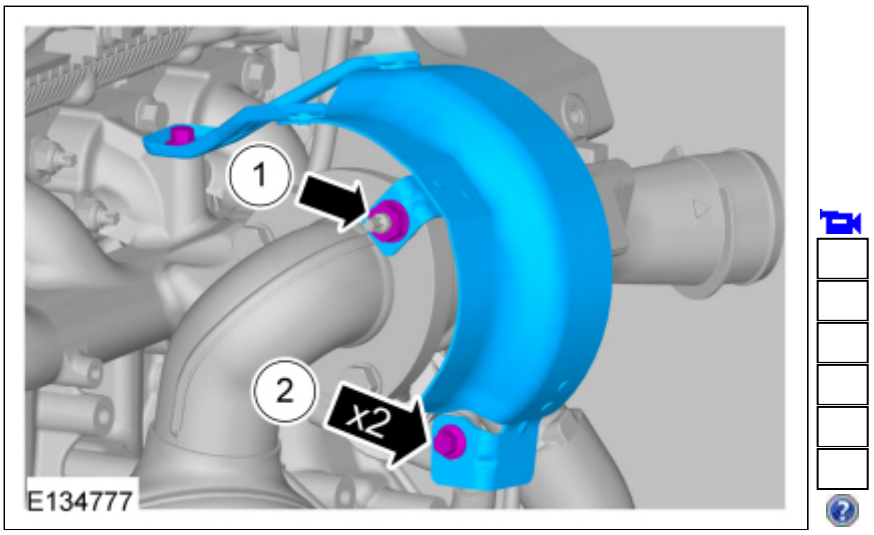


17. *Torque*:
    1: 5 Nm
    2: 10 Nm



18. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

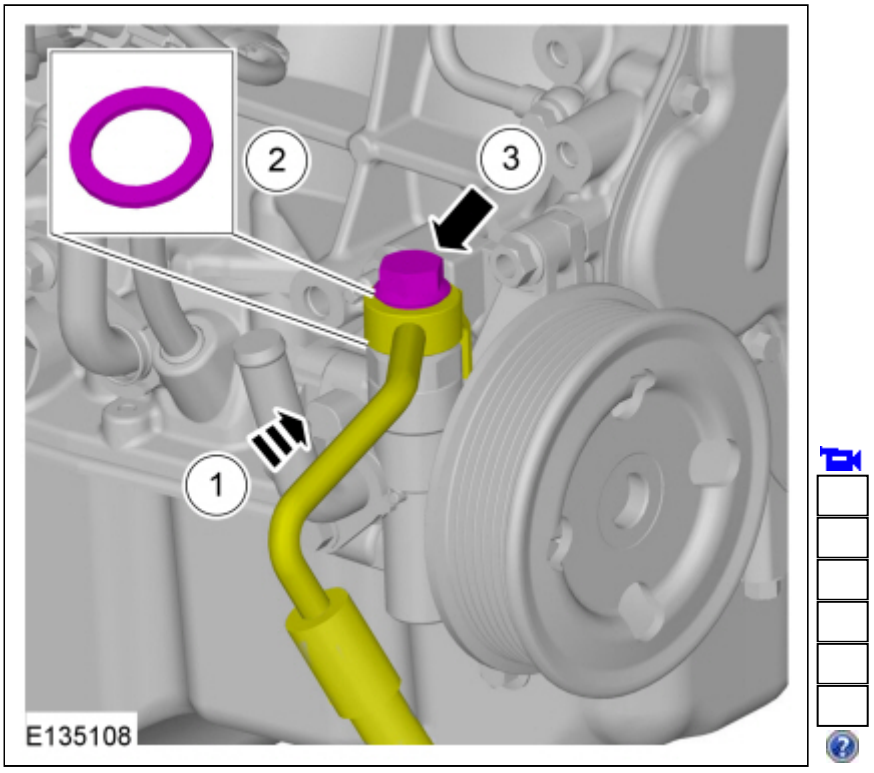
    1. *Torque*: 47 Nm
    2. *Torque*: 22 Nm



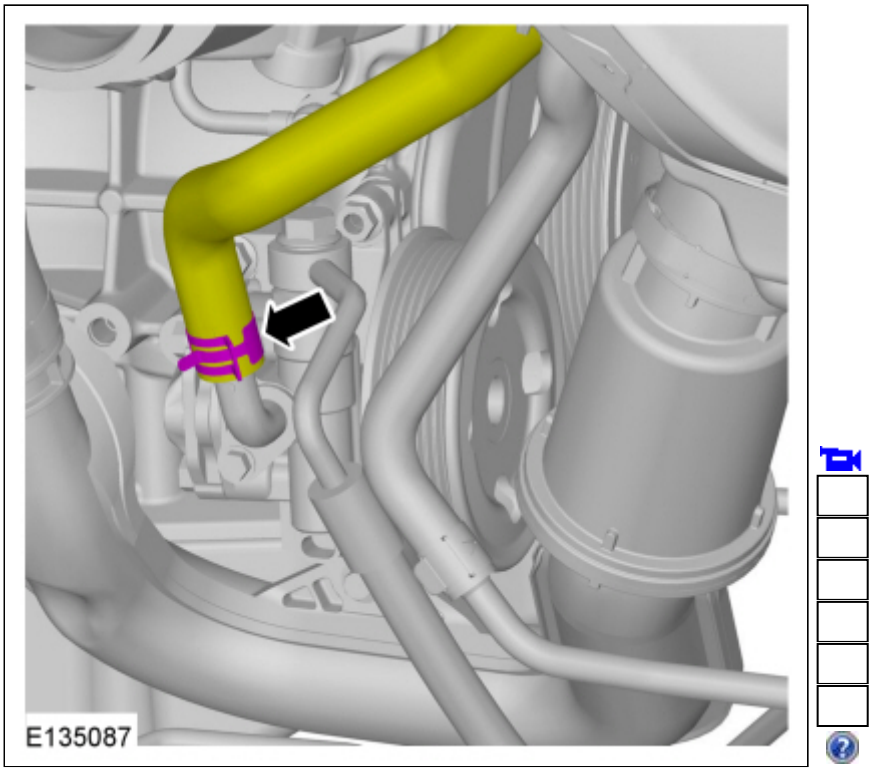
Vehicles With: Hydraulic Power Assist Steering (HPAS)

20. **NOTE:** *The washers can be reused unless damaged.*

    3. *Torque*: 35 Nm

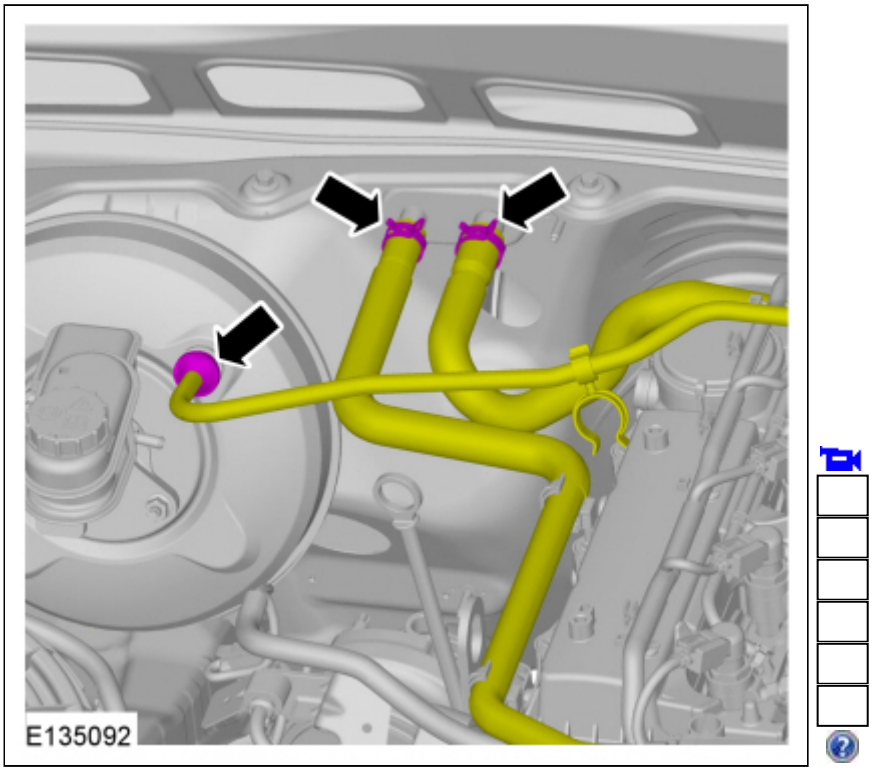


21.

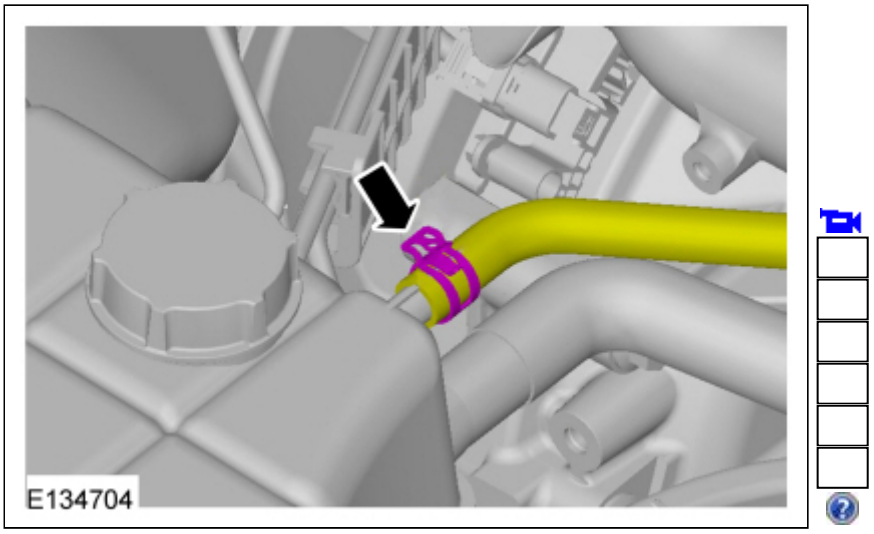


All vehicles

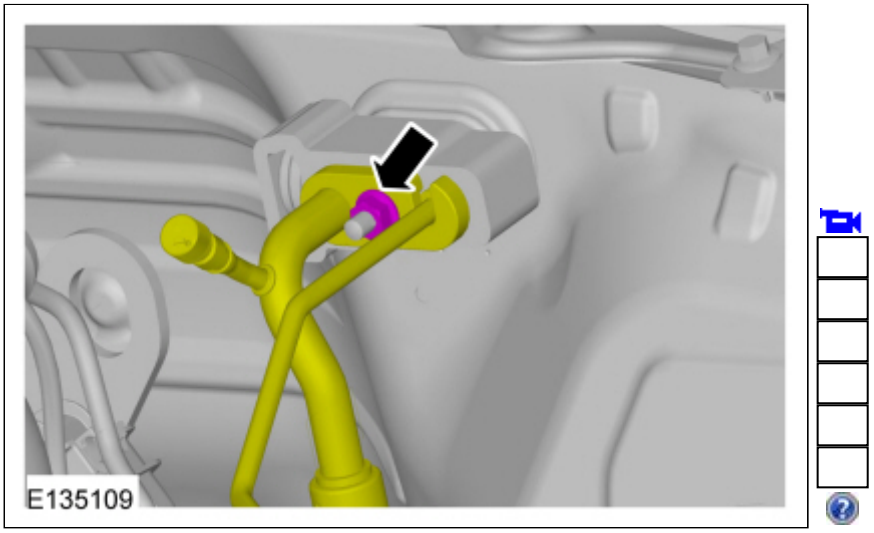
22.



23.

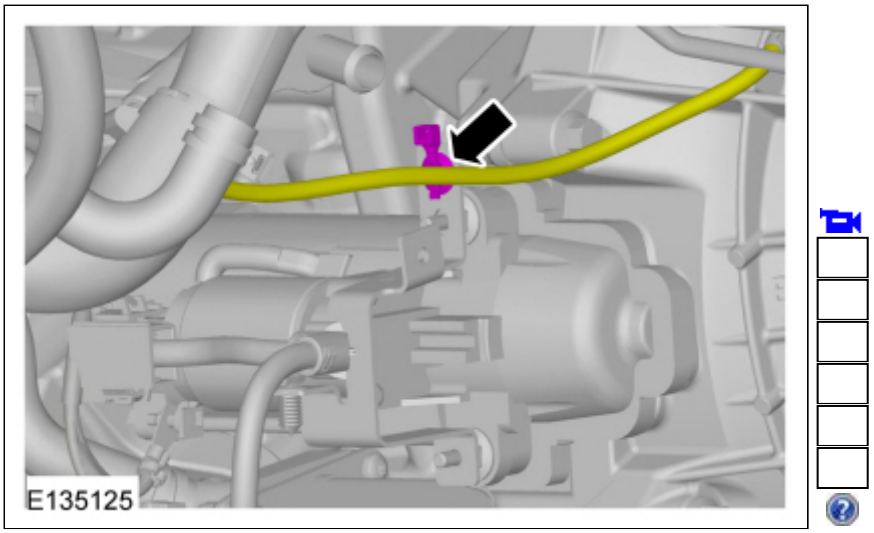


24. *Torque*: 22 Nm



25. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

26.

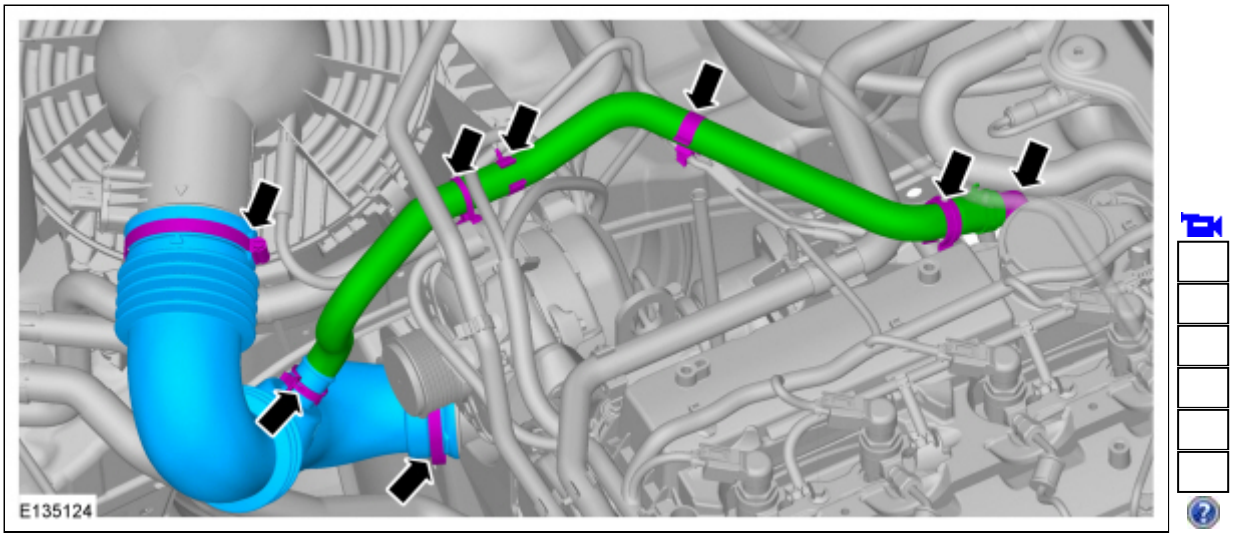


27. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

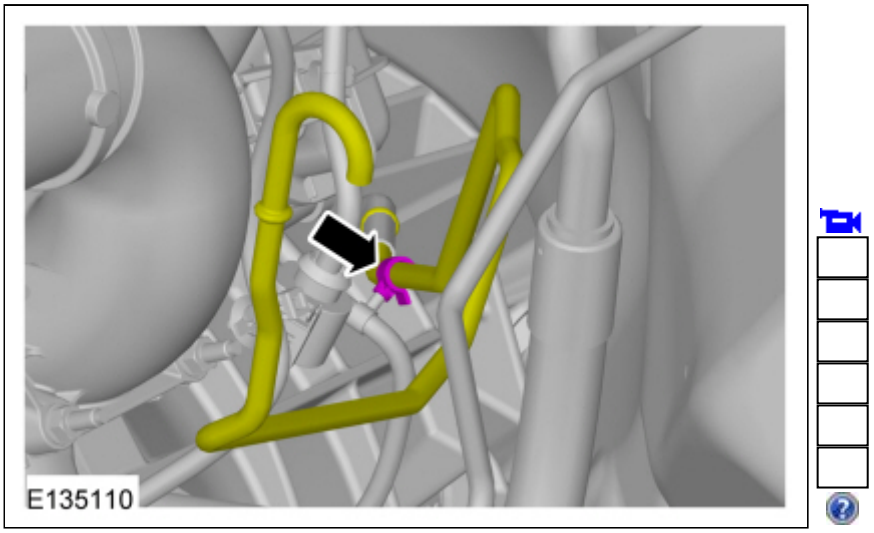
28. Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

29. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

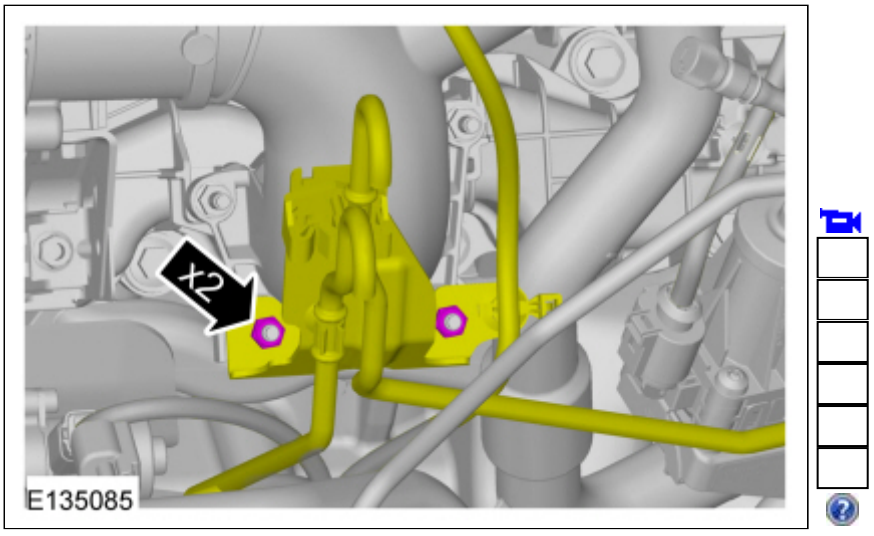
30.



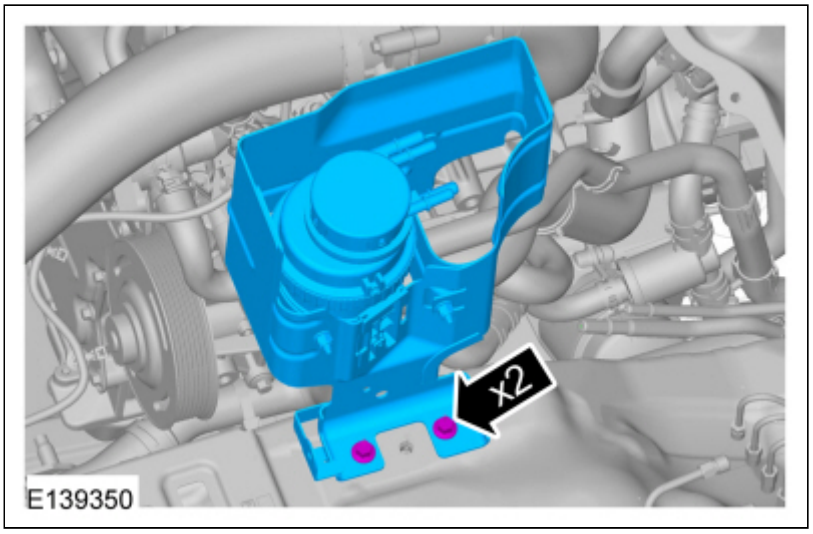
31.



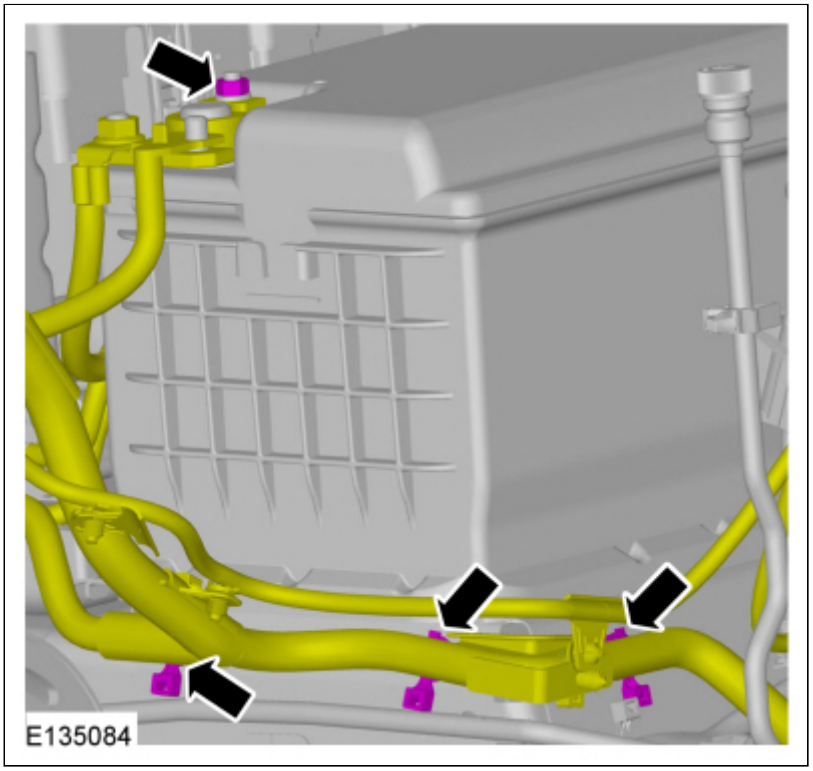
32. *Torque*: 10 Nm



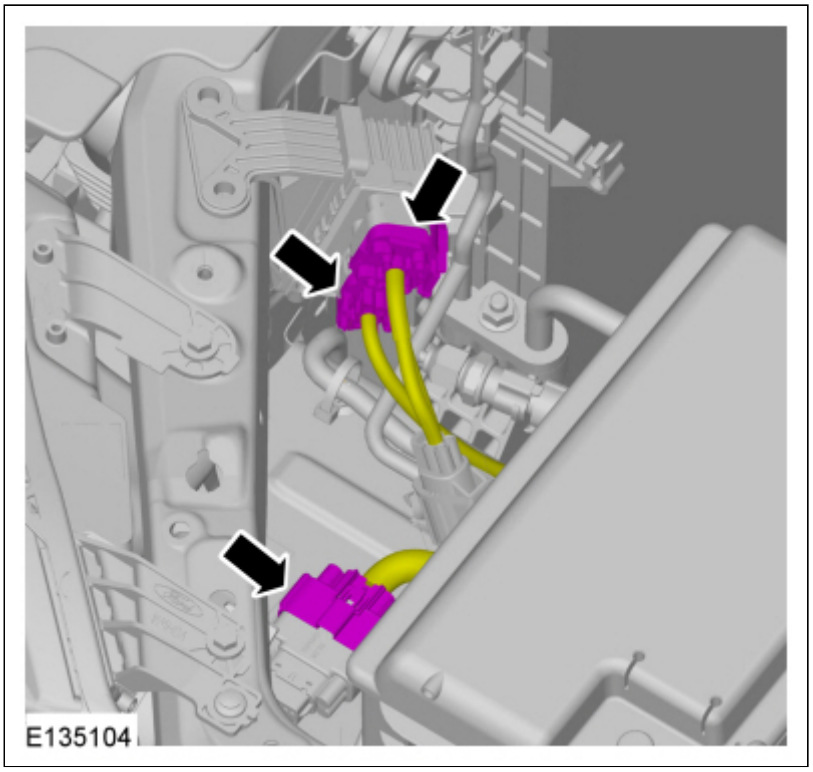
33. *Torque*: 18 Nm



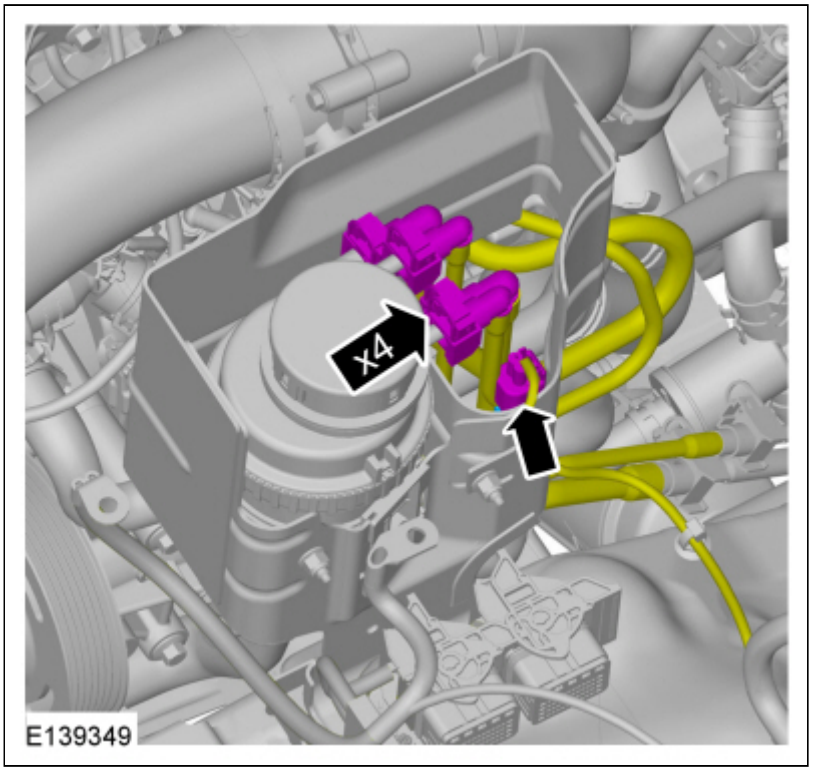
34. *Torque*: 5 Nm



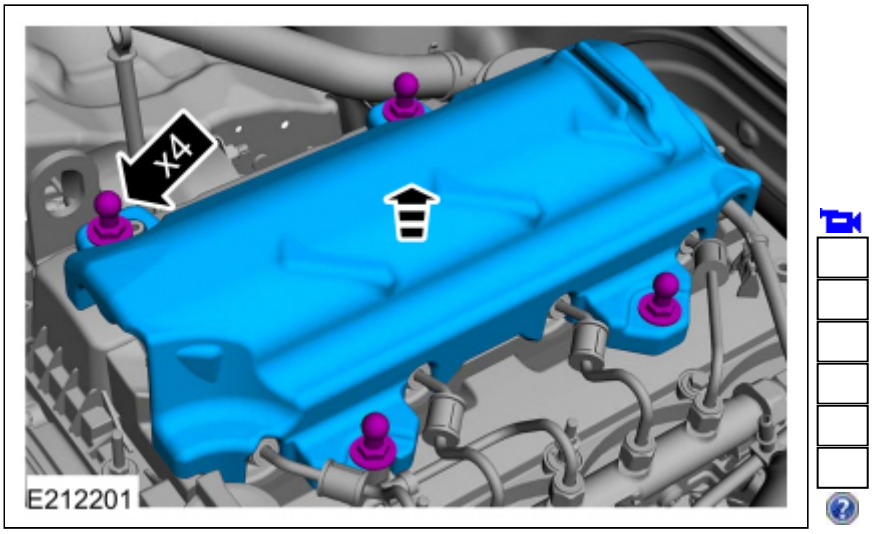
35.



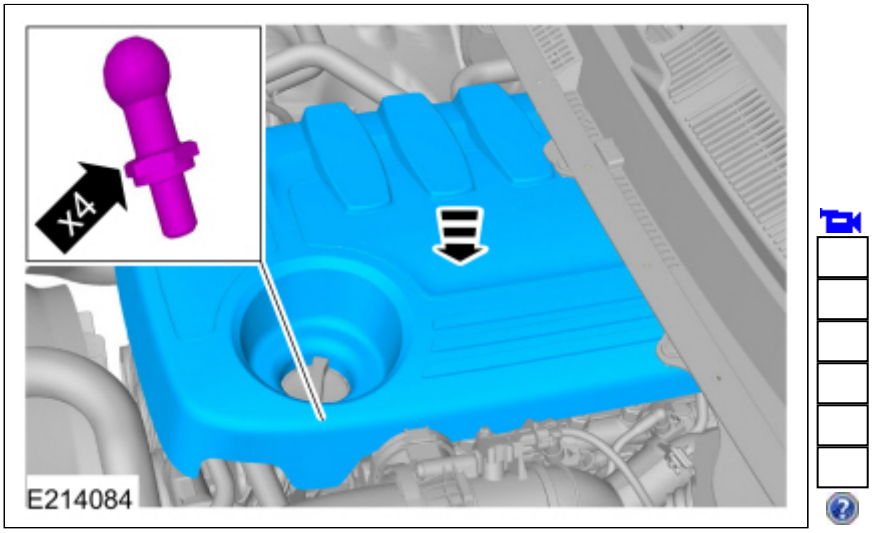
36.



37. Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
38. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
39. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
40. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
41. *Torque*: 3 Nm



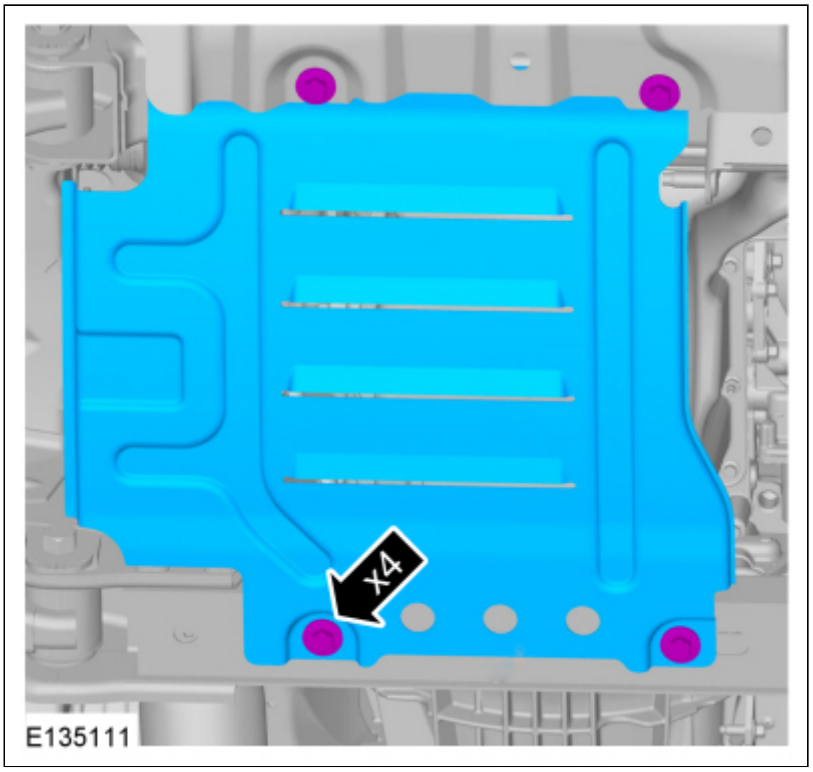
42.



43. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

44. *Torque*: 30 Nm



45. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
46. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
47. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

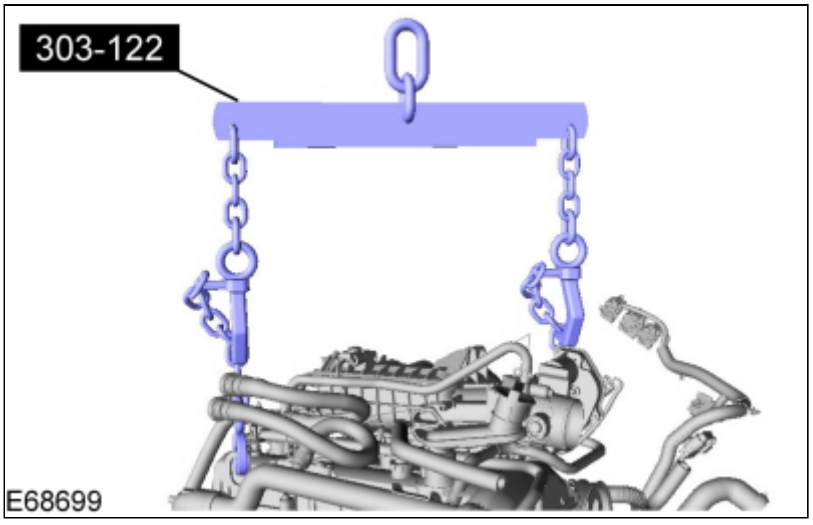
Engine - 6-Speed Manual Transmission - MT82

Base Part Number: 6L084

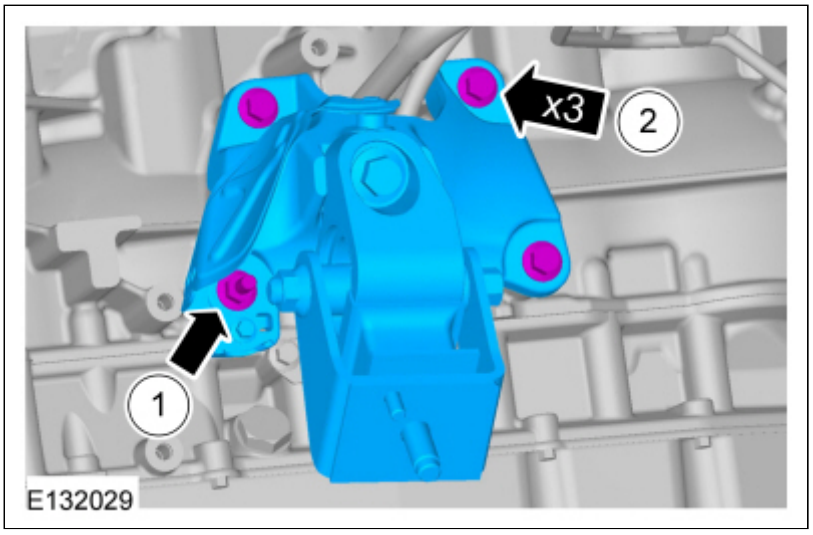
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine

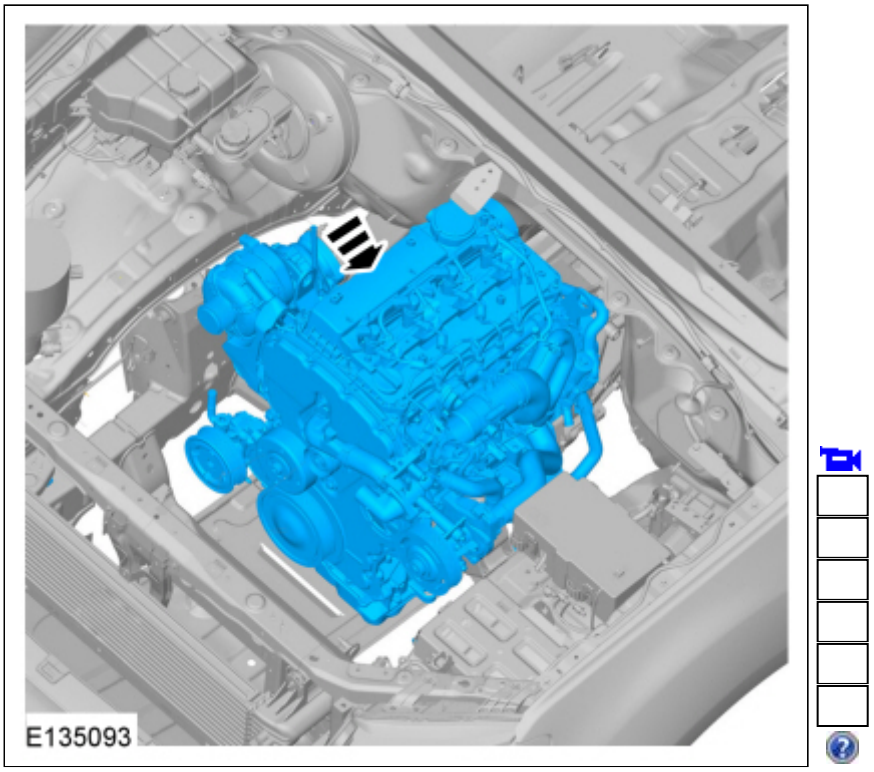
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



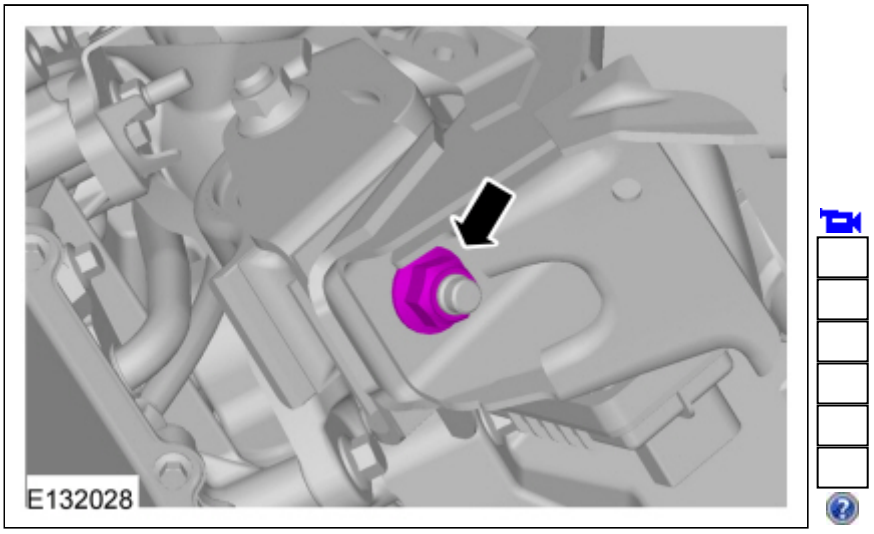
3. **NOTE:** *Hand tighten the nut at this stage.*



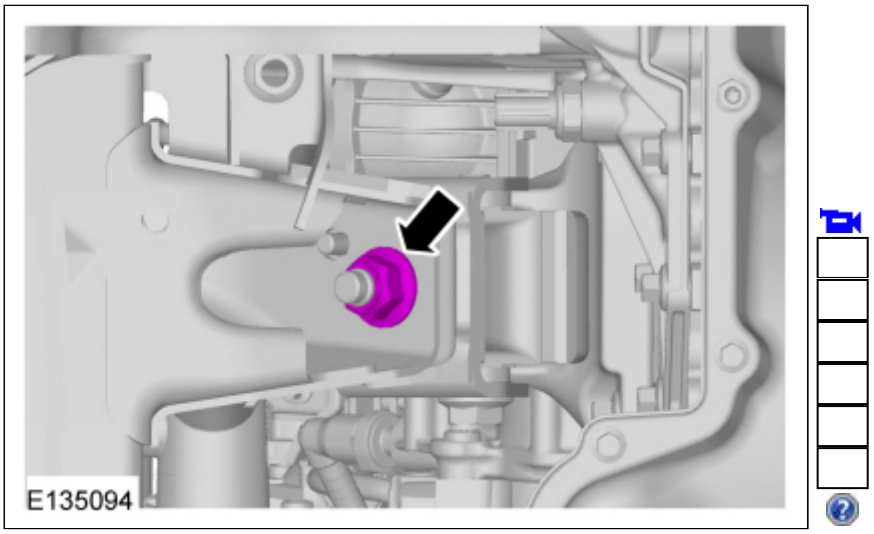
4.



5. **NOTE:** *Hand tighten the nut at this stage.*

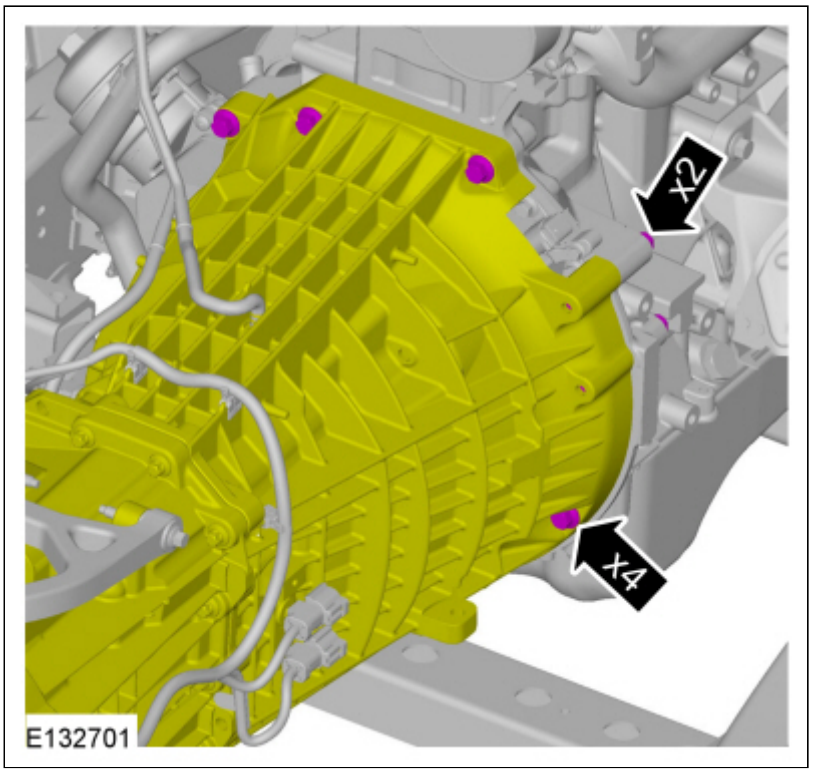


6. **NOTE:** *Hand tighten the nut at this stage.*

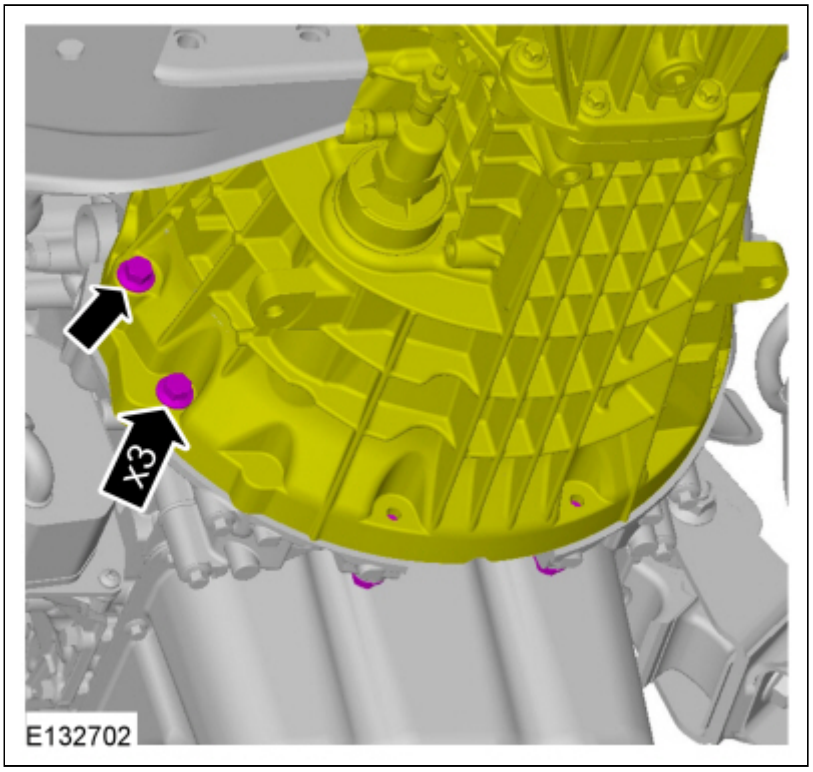


7. Initially hand tighten the fasteners.

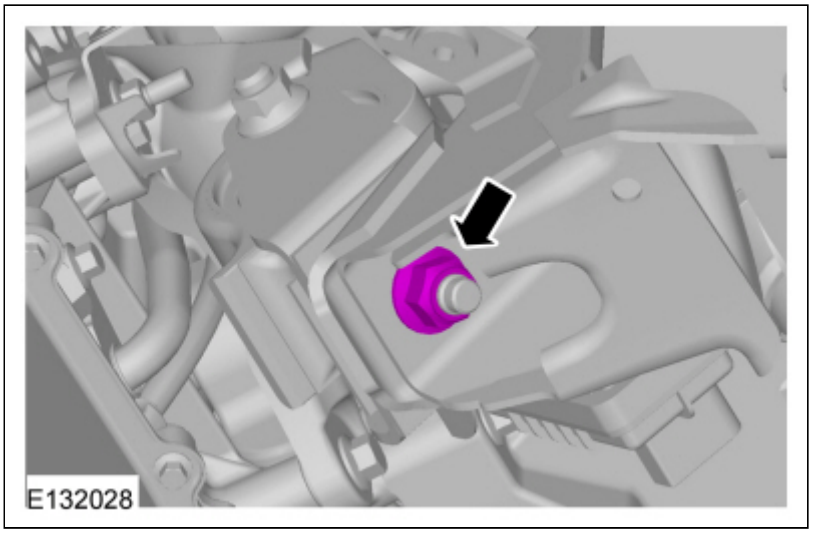
Torque: 48 Nm



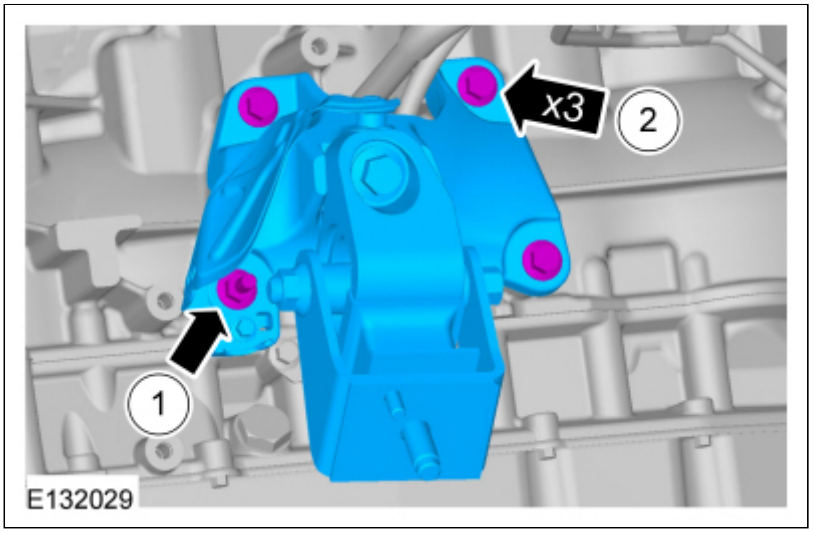
8. Initially hand tighten the fasteners.
   Torque: 48 Nm



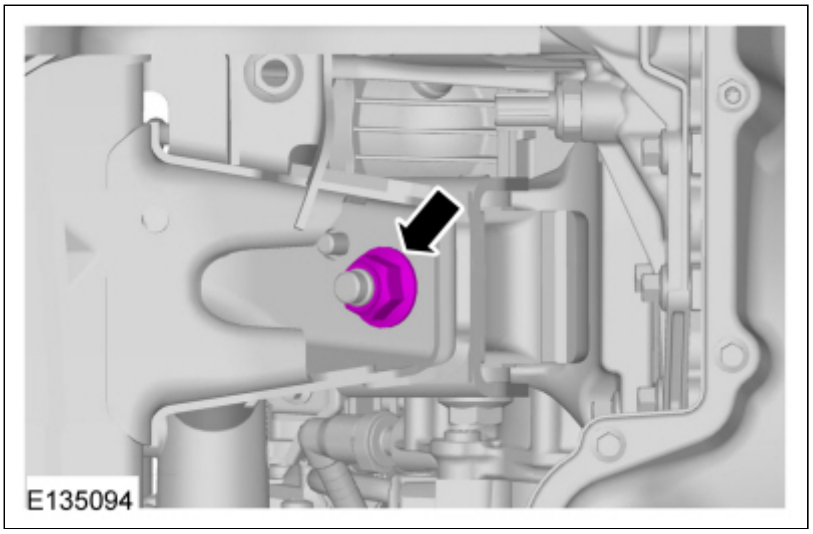
9. *Torque*: 80 Nm



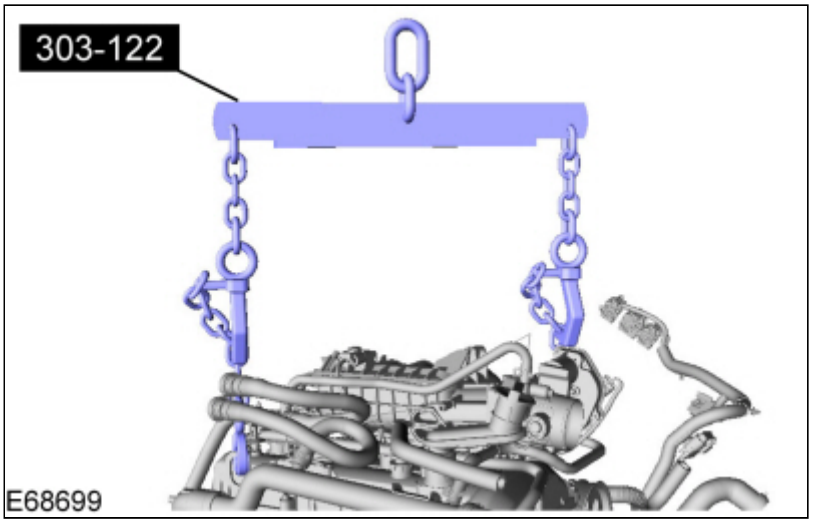
1. *Torque*: 48 Nm
2. *Torque*: 48 Nm



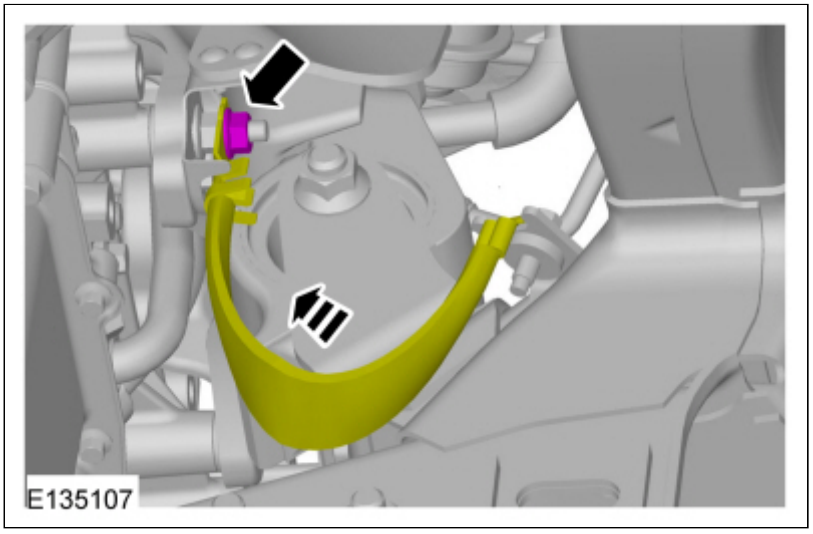
11. *Torque*: 80 Nm



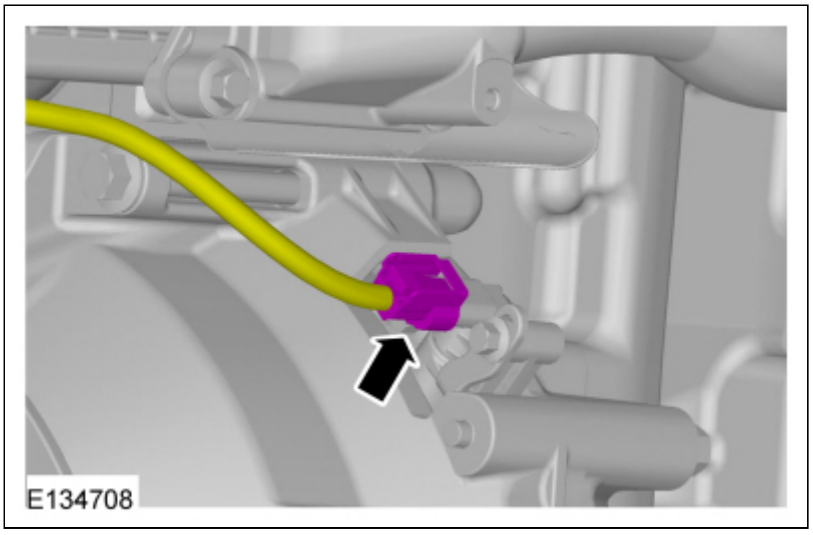
12. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.



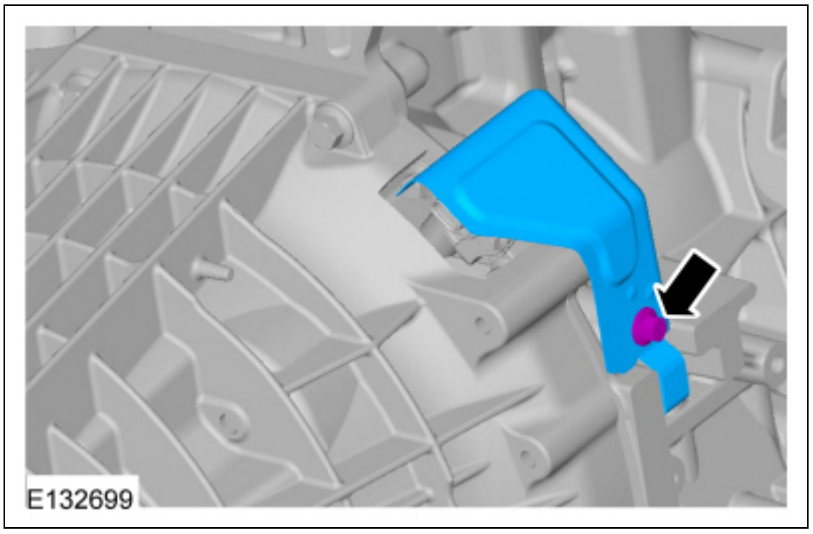
13. *Torque*: 13 Nm



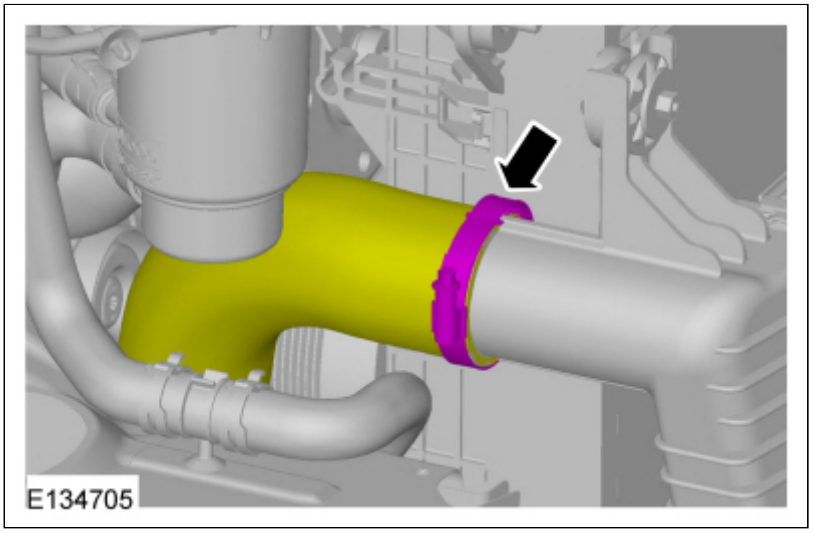
14.



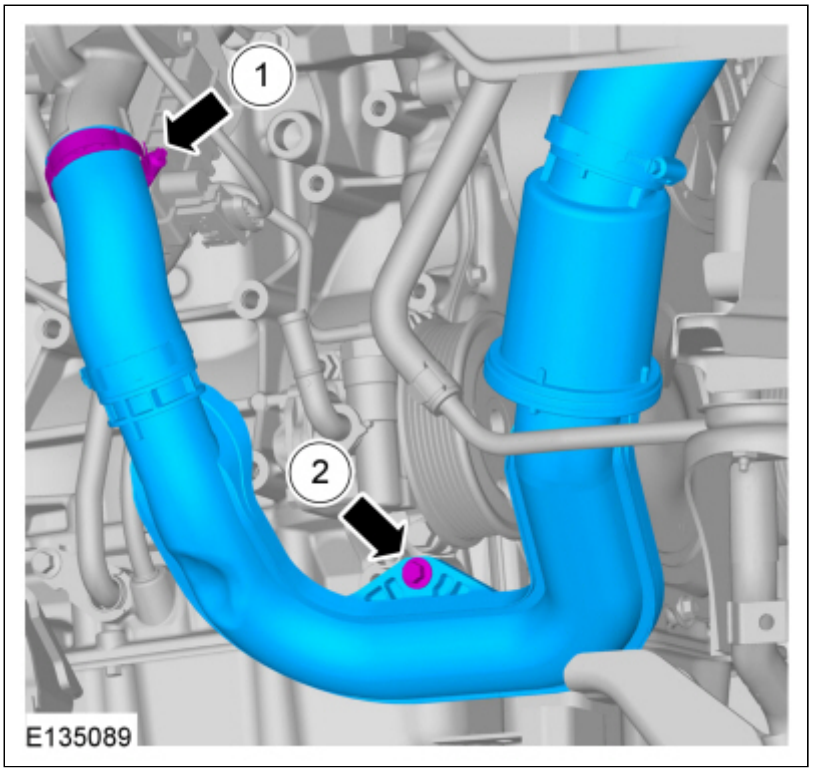
15. *Torque*: 22 Nm



16.

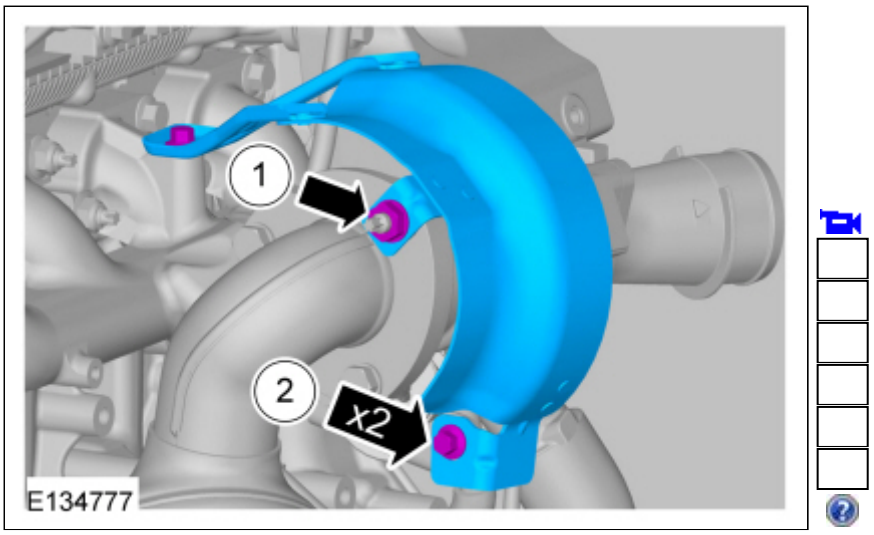


17. *Torque*:
    1: 5 Nm
    2: 10 Nm



18. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

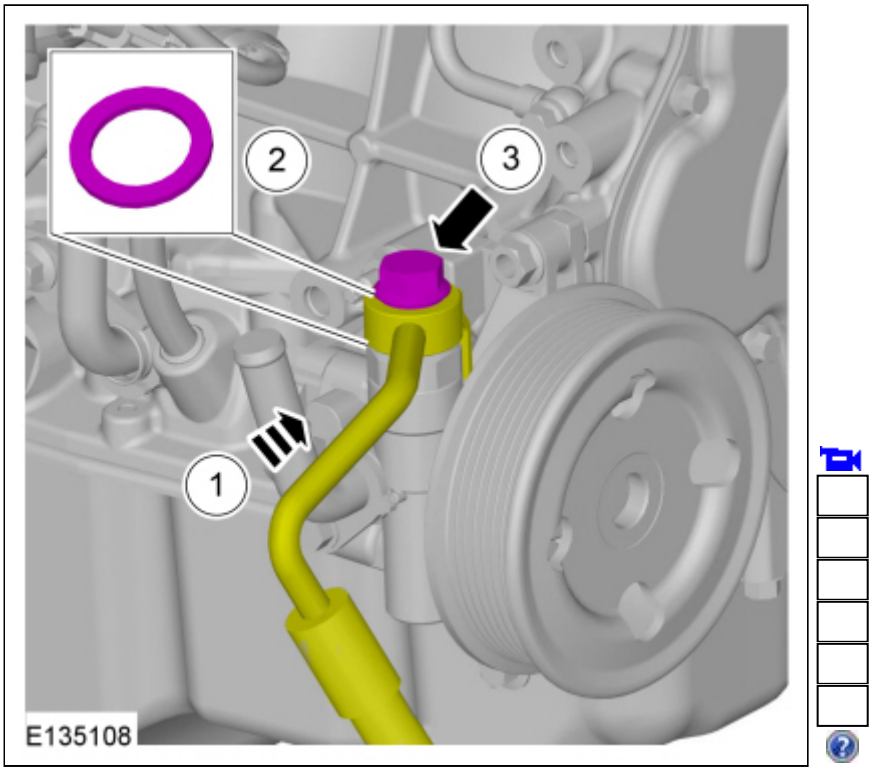
    1. *Torque*: 47 Nm
    2. *Torque*: 22 Nm



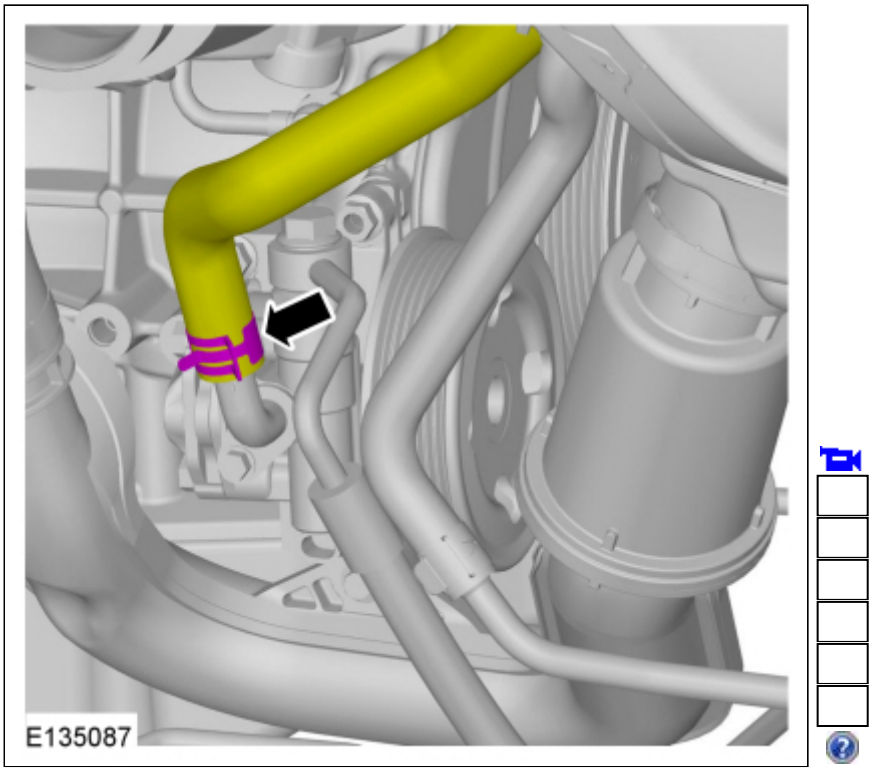
Vehicles With: Hydraulic Power Assist Steering (HPAS)

20. **NOTE:** *The washers can be reused unless damaged.*

    3. *Torque*: 35 Nm

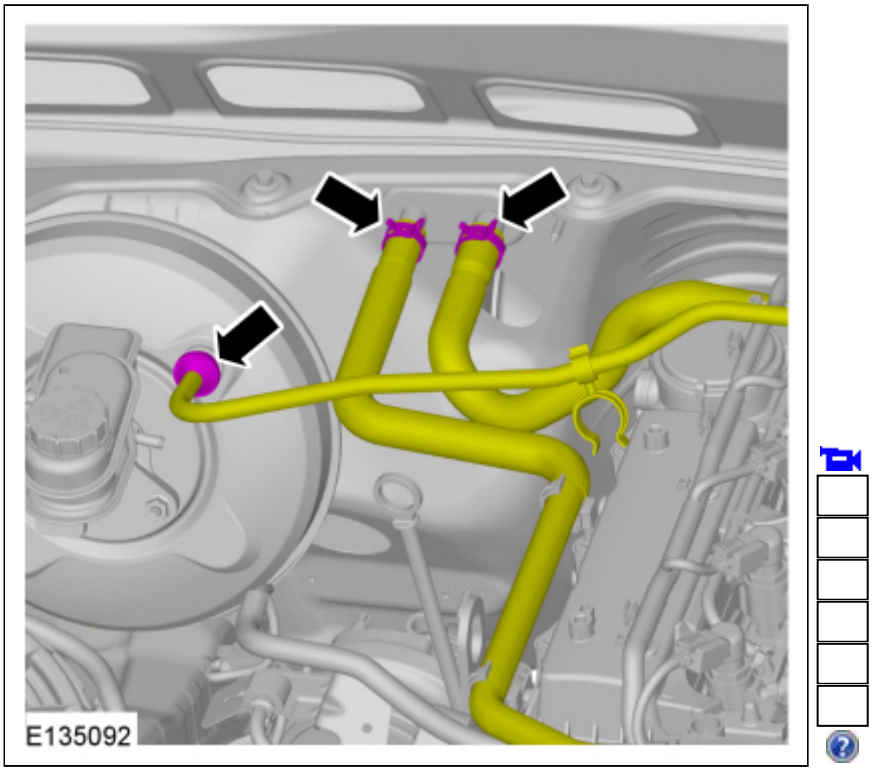


21.

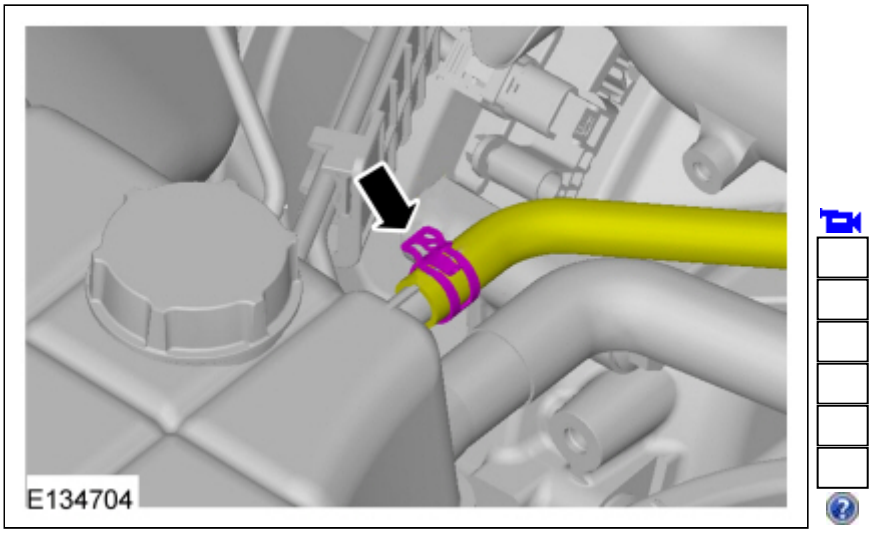


All vehicles

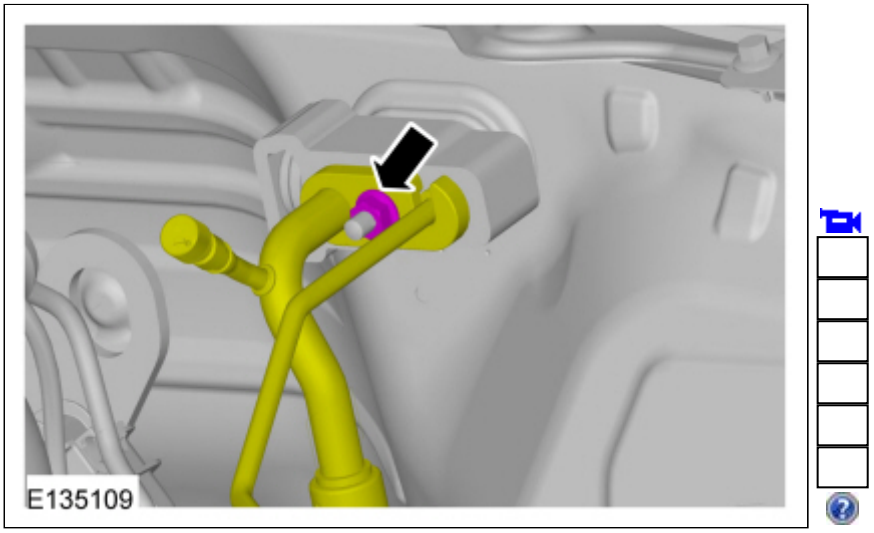
22.



23.

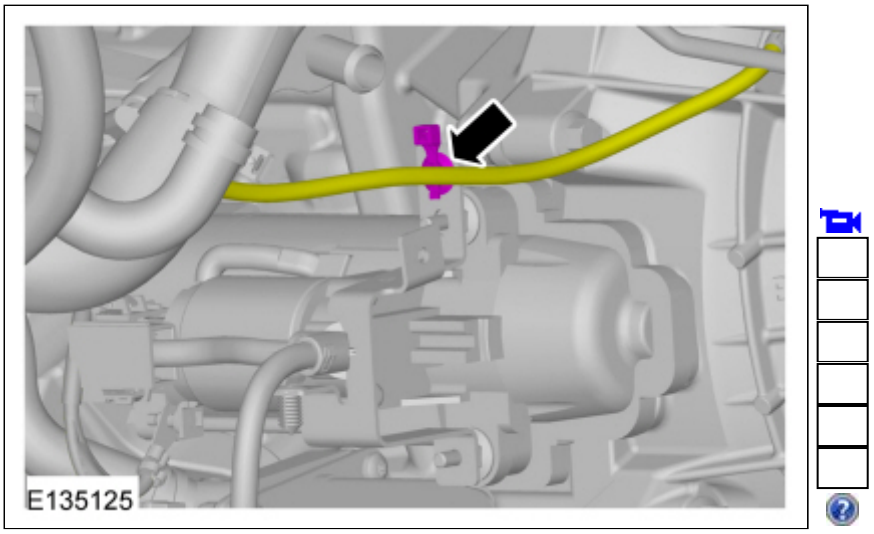


24. *Torque*: 22 Nm



25. Refer to: Starter Motor - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

26.

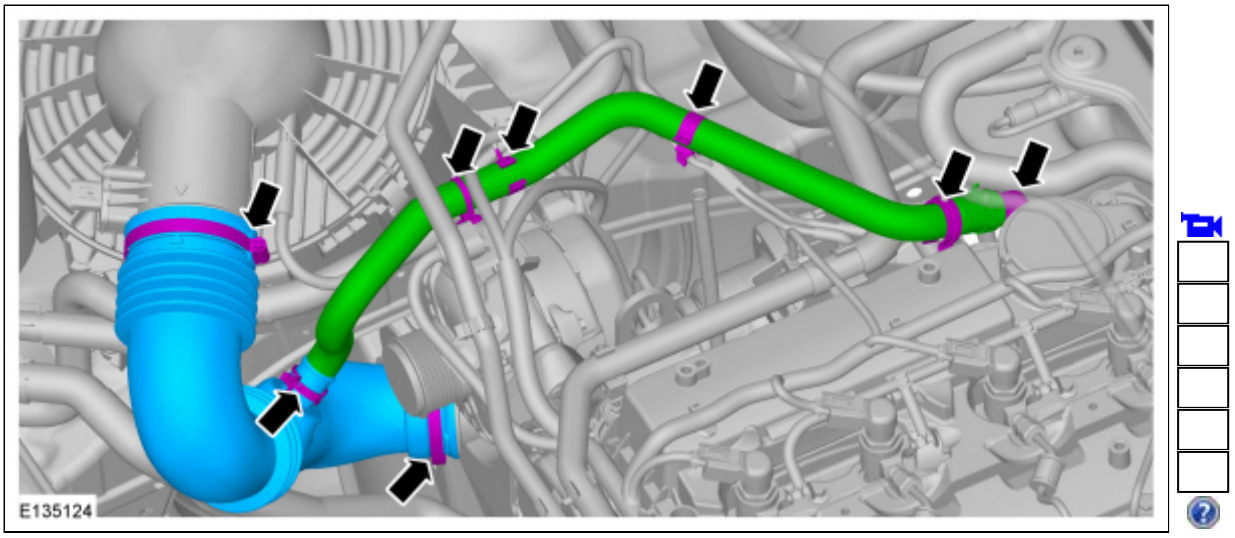


27. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

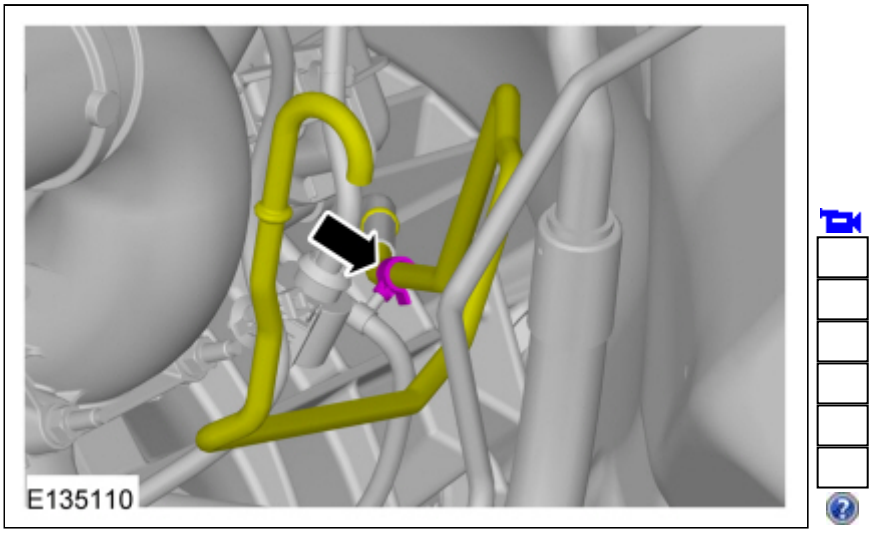
28. Refer to: Radiator (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) .

29. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

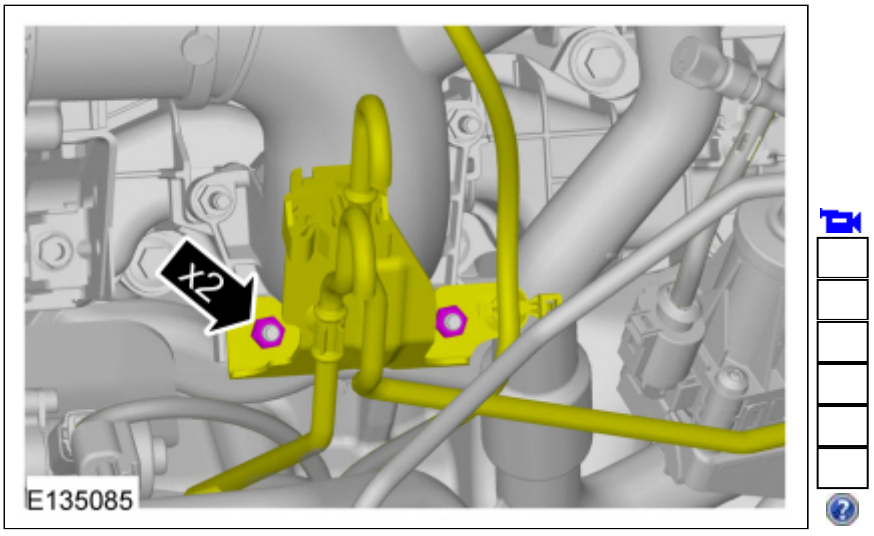
30.



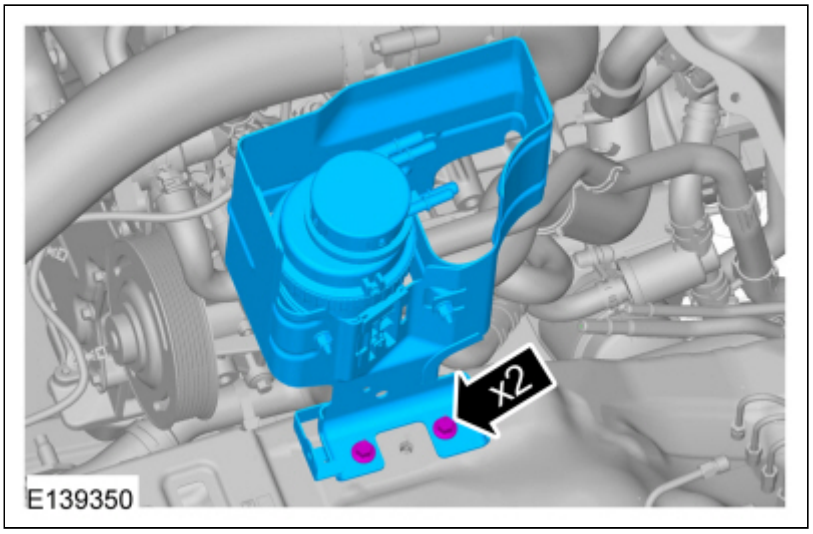
31.



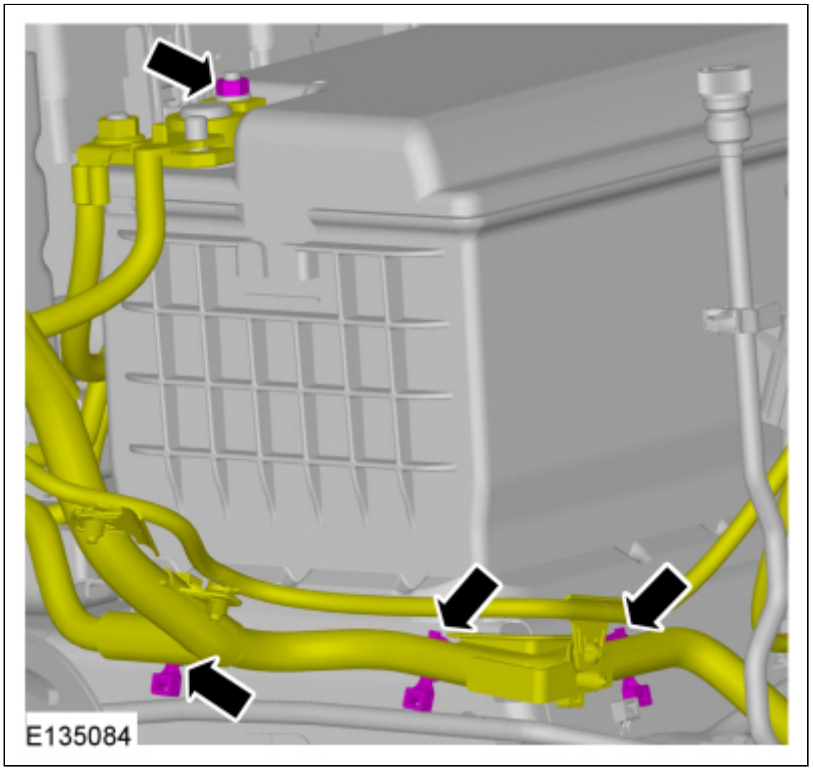
32. *Torque*: 10 Nm



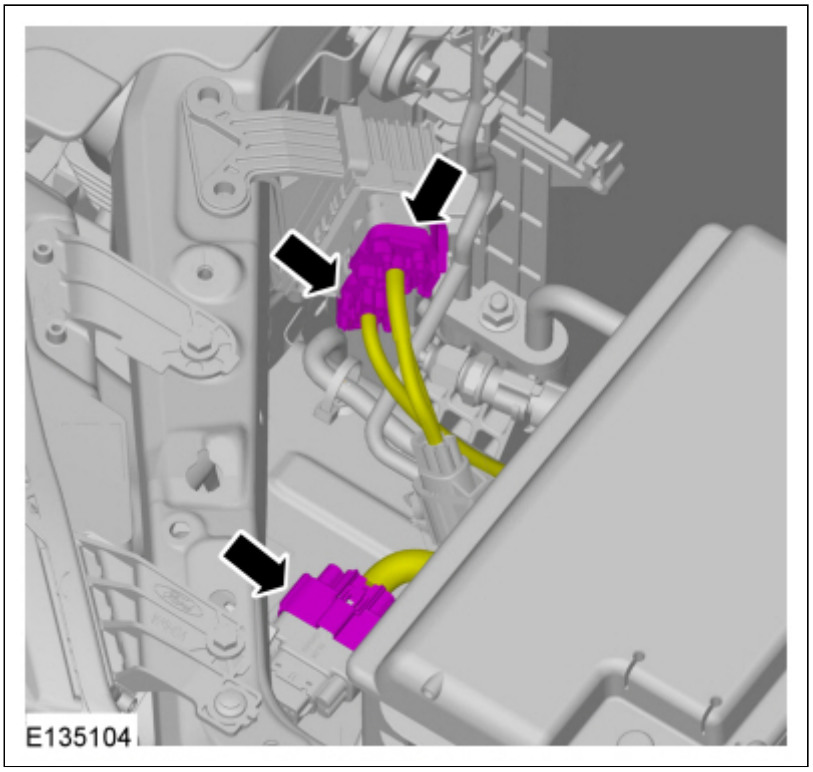
33. *Torque*: 18 Nm



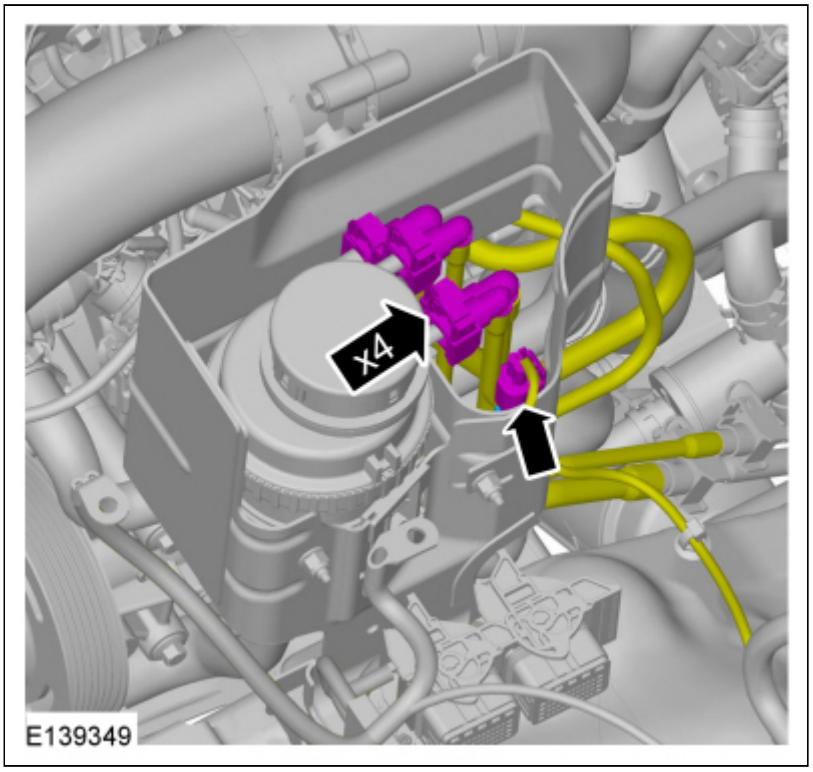
34. *Torque*: 5 Nm



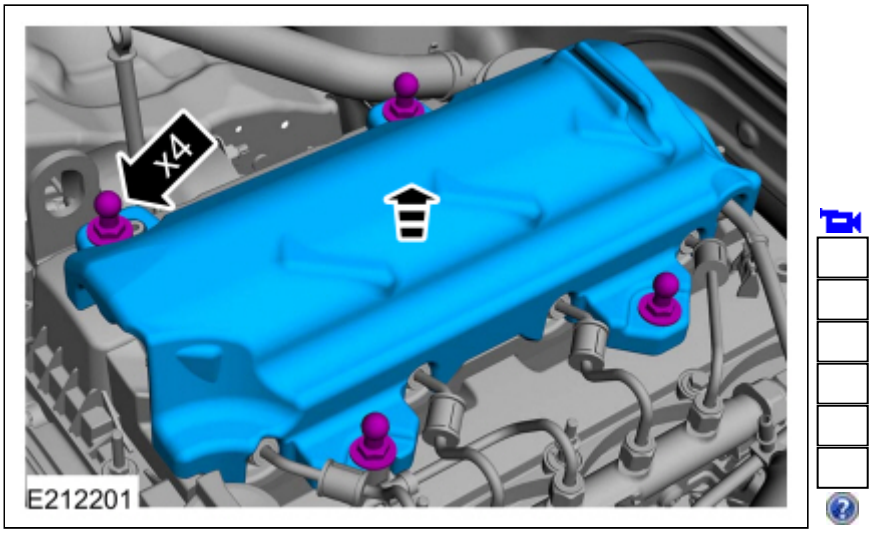
35.



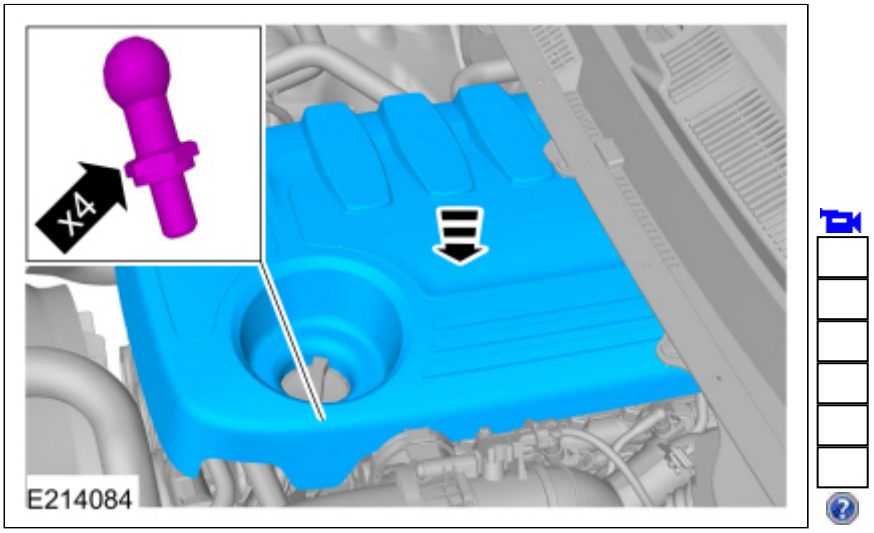
36.



37. Refer to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
38. Refer to: Battery Tray (414-01 Battery, Mounting and Cables) .
39. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
40. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
41. *Torque*: 3 Nm



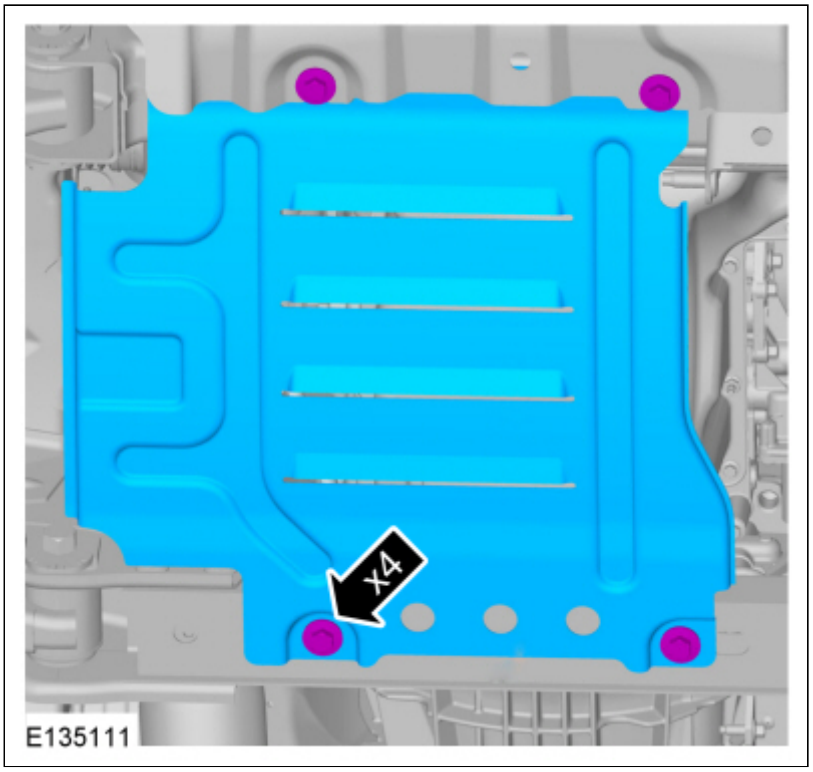
42.



43. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

44. *Torque*: 30 Nm



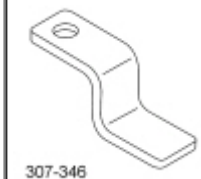
45. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
46. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) .
47. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Engine - 6-Speed Automatic Transmission - 6R80

Base Part Number: 6L084

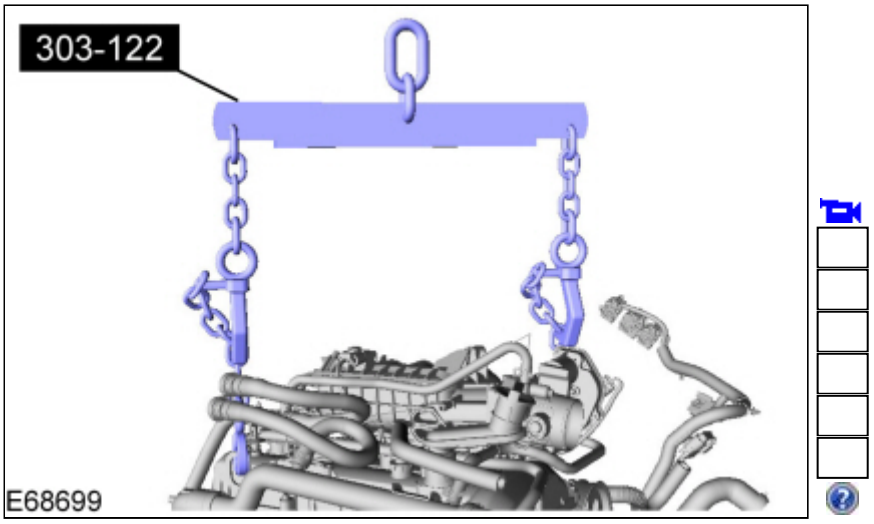
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine
 307-346	307-346 (T97T-7902-A) Retainer, Torque Converter

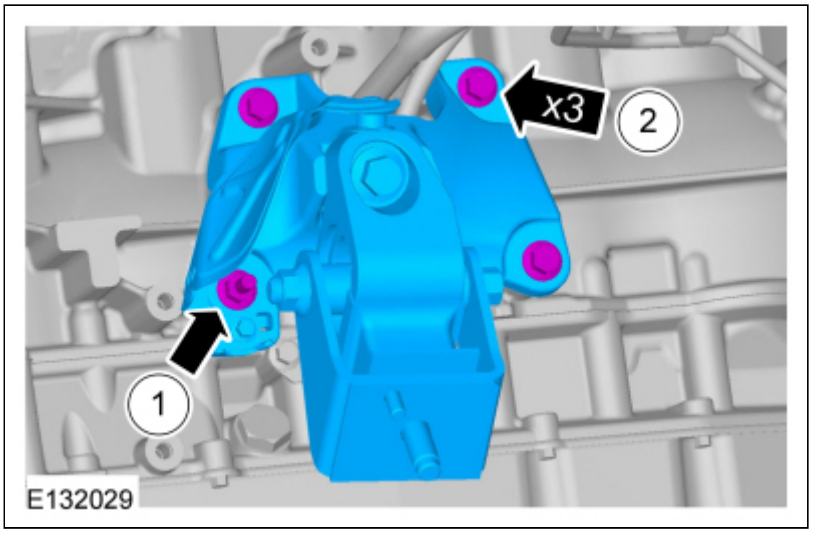
Materials

Name	Specification
Grease - Electrical Contact	WSB-M1C239-A

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Use Special Service Tool: 303-122 Lifting Bracket, Engine.

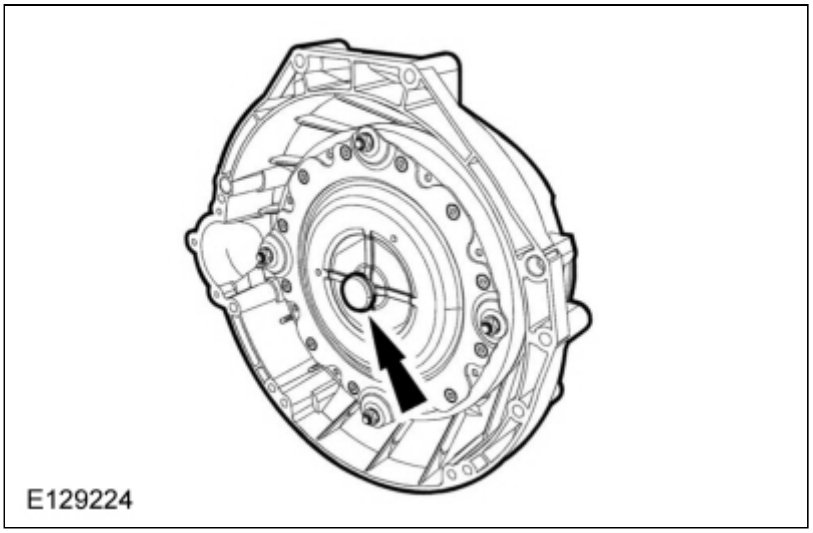


3. **NOTE:** *Only tighten the nut and bolts finger tight at this stage.*

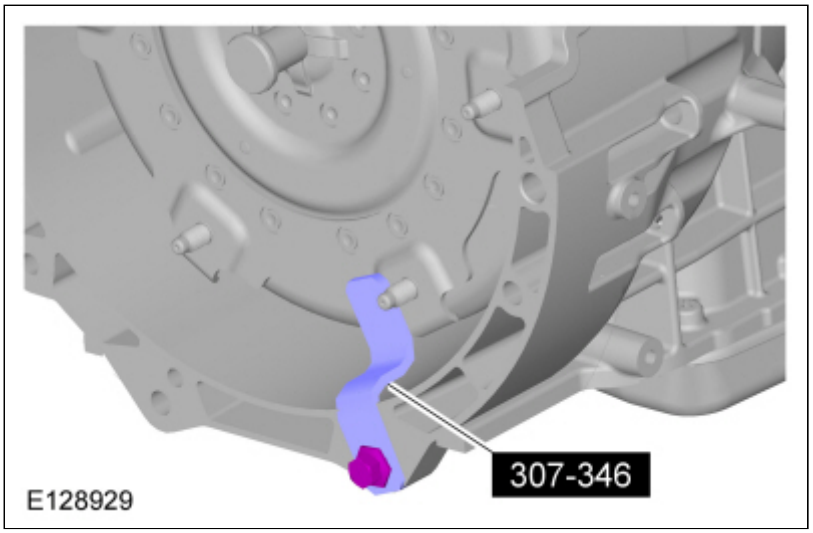


4. **NOTICE: Prior to installation of the engine, the torque converter pilot hub must be lubricated with multipurpose grease or damage to the torque converter or the engine crankshaft can occur.**

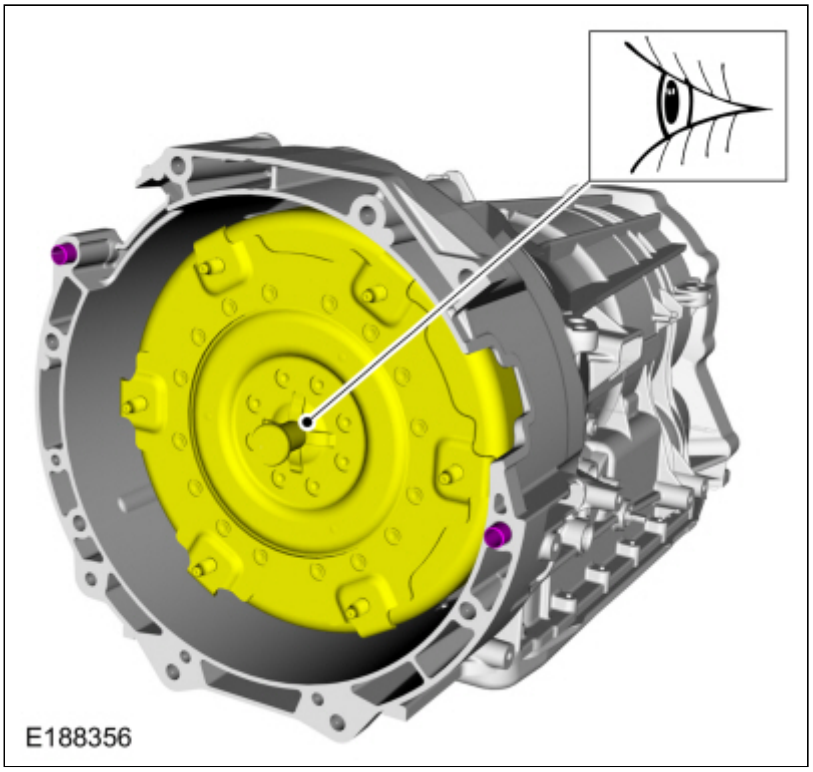
   Lubricate the torque converter pilot hub with multipurpose grease.
   Material: Grease - Electrical Contact (WSB-M1C239-A)



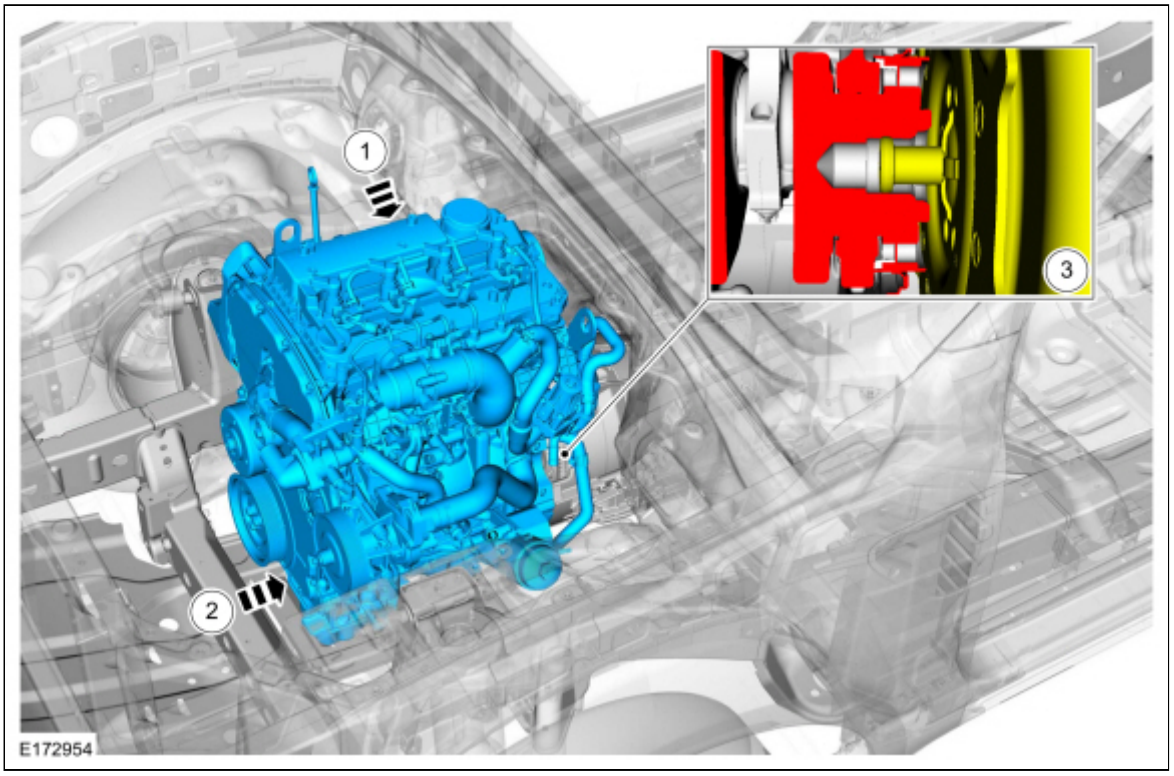
5. Remove Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



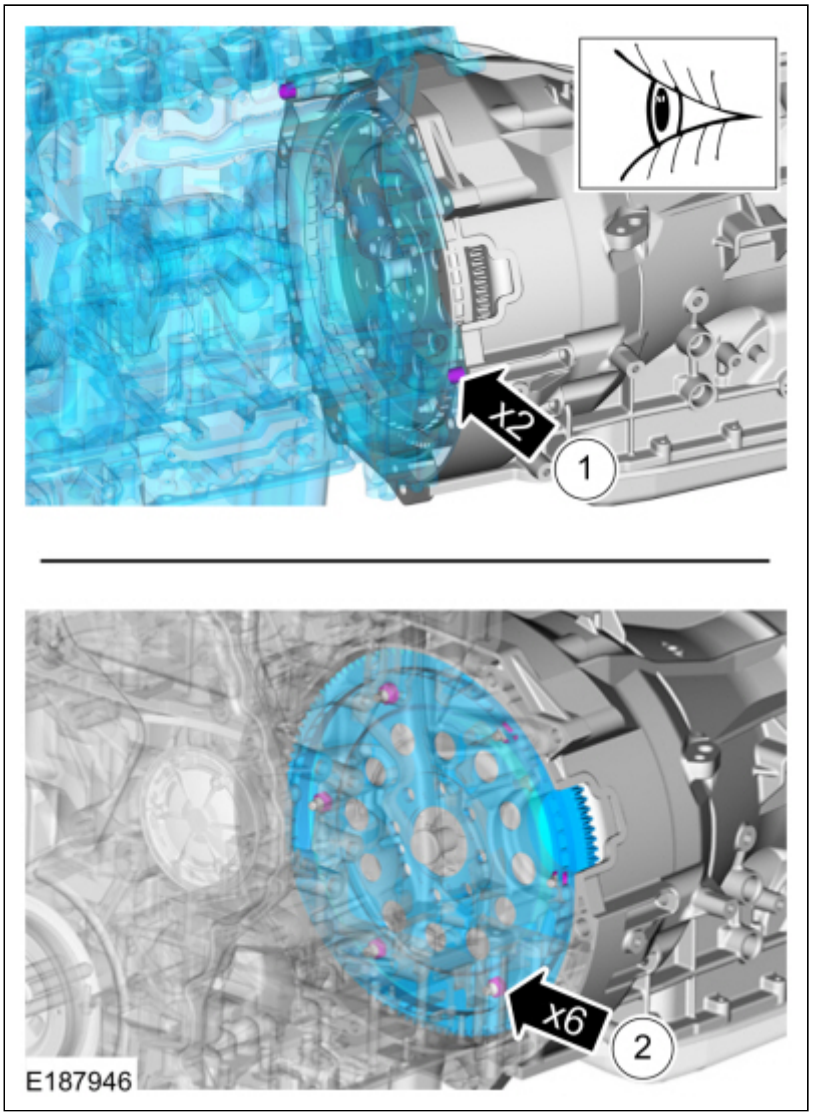
6. **NOTE:** *Make sure that the torque converter remains in the transmission.*



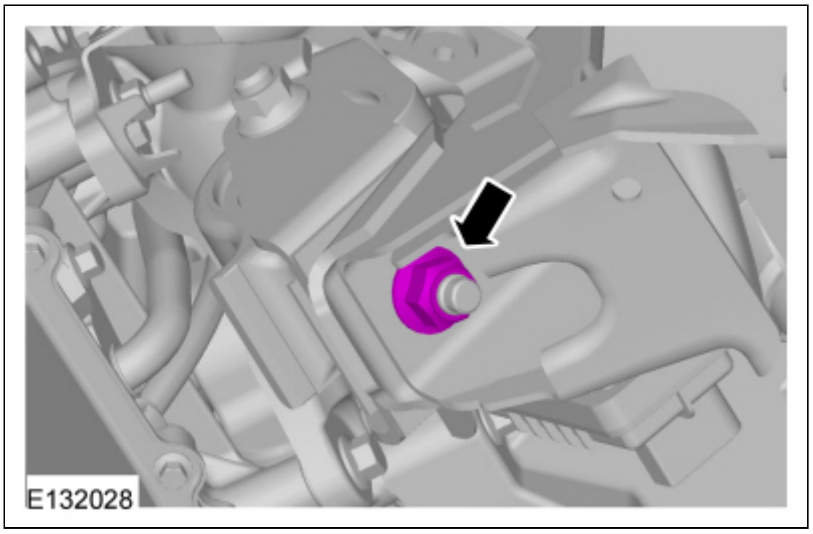
2. **NOTE:** *Make sure that the transmission is installed straight in relation to the engine to prevent damage to the pilot bearing.*



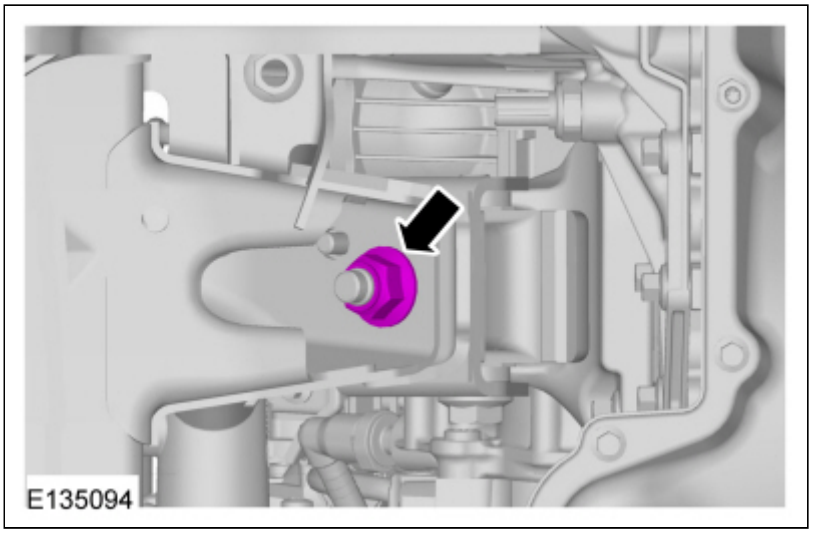
1. **NOTE:** *Make sure that the component is correctly located on the locating dowels.*
2. Only tighten the nut finger tight at this stage.



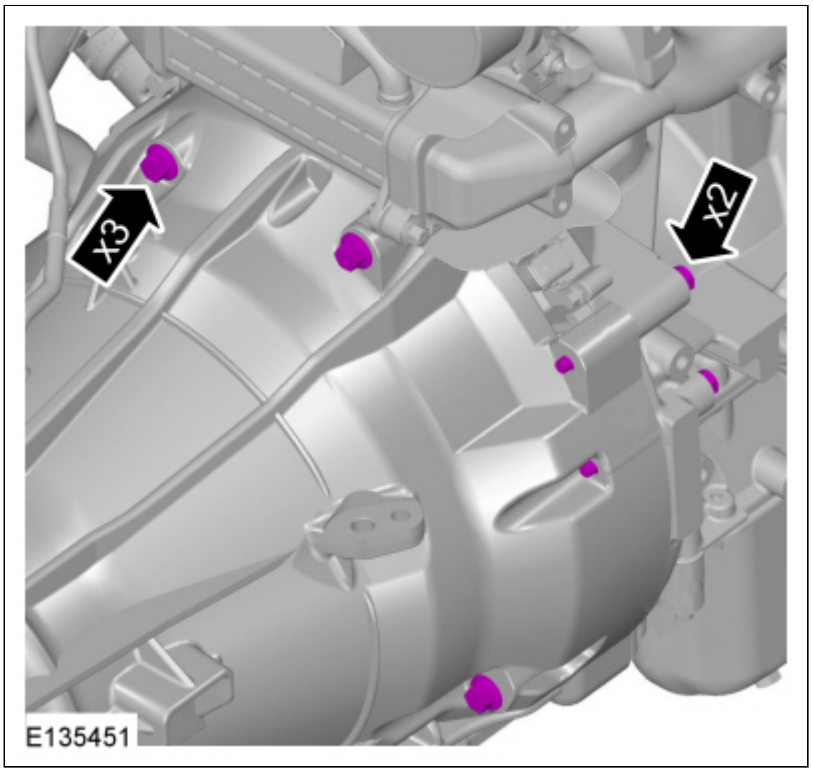
9. **NOTE:** *Only tighten the nut finger tight at this stage.*



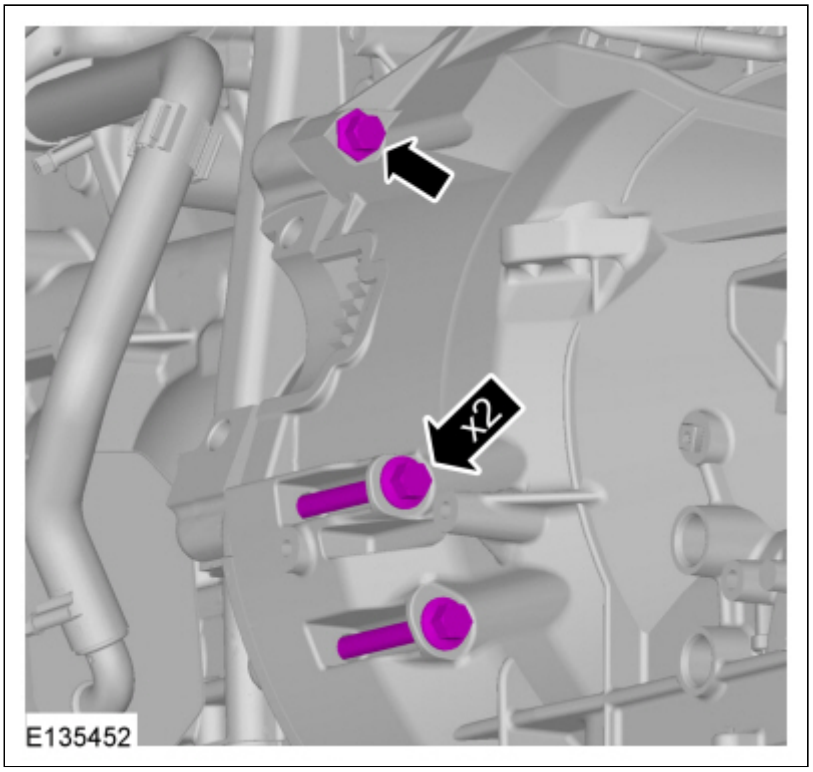
10. **NOTE:** *Only tighten the nut finger tight at this stage.*



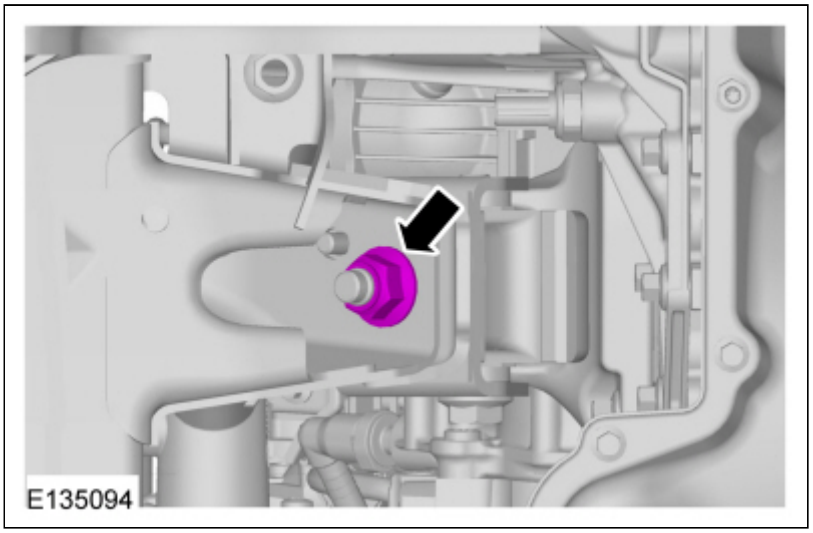
11. Initially hand tighten the fasteners.
    Torque: 48 Nm



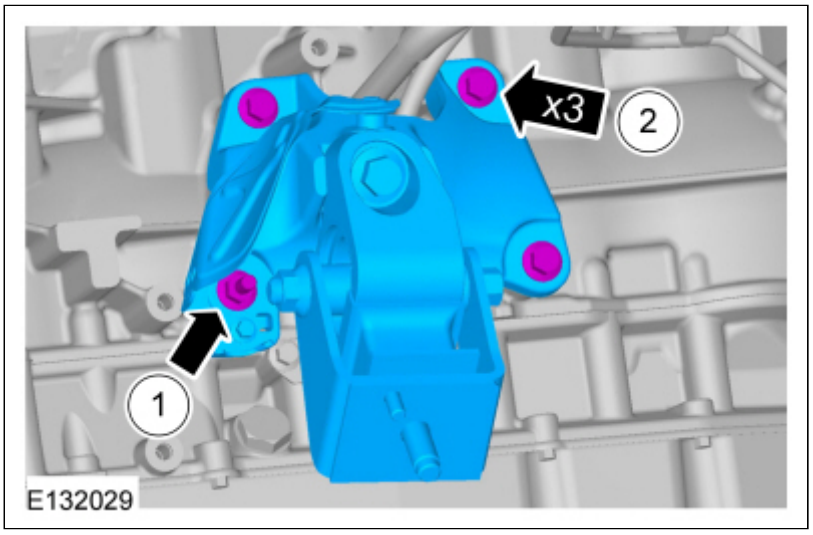
12. Initially hand tighten the fasteners.
    Torque: 48 Nm



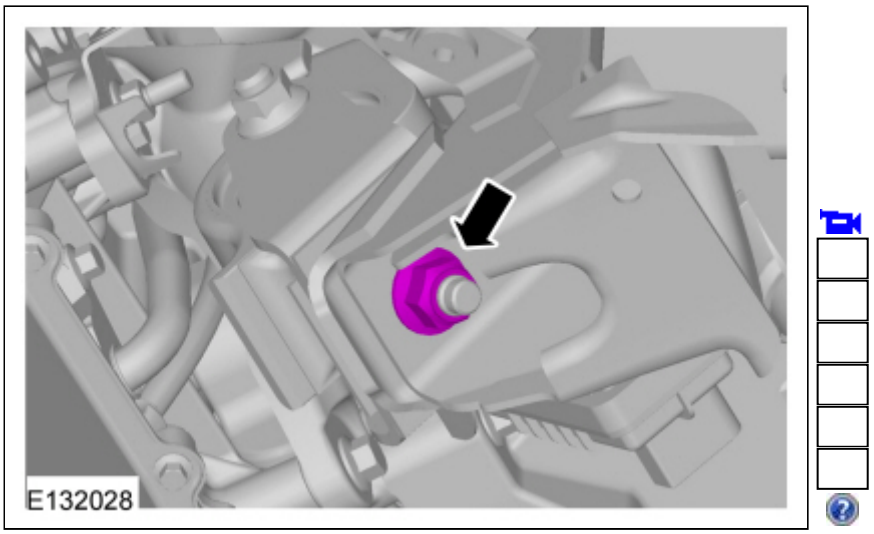
13. *Torque*: 80 Nm



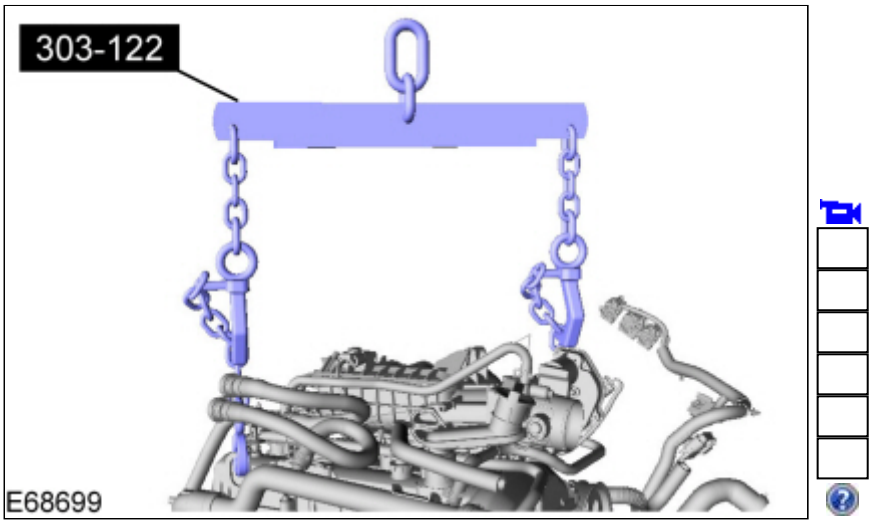
1. *Torque*: 48 Nm
2. *Torque*: 48 Nm



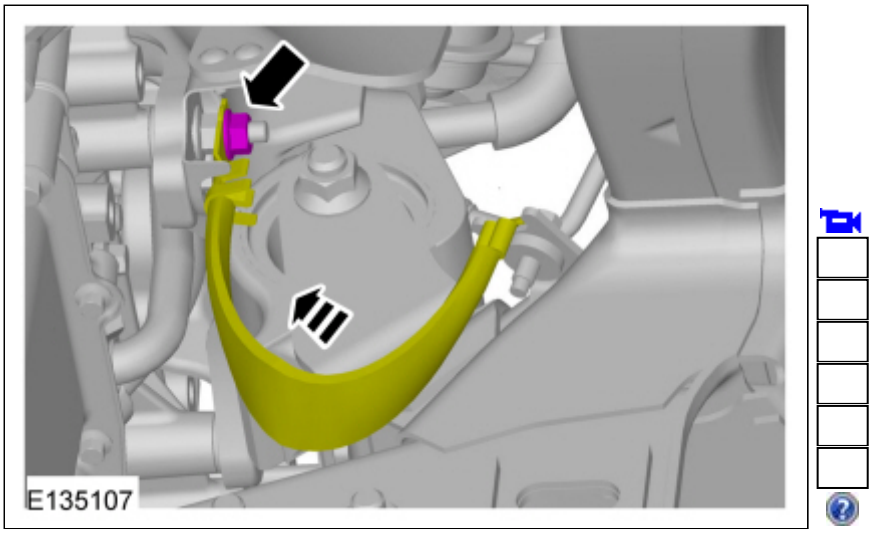
15. *Torque*: 80 Nm



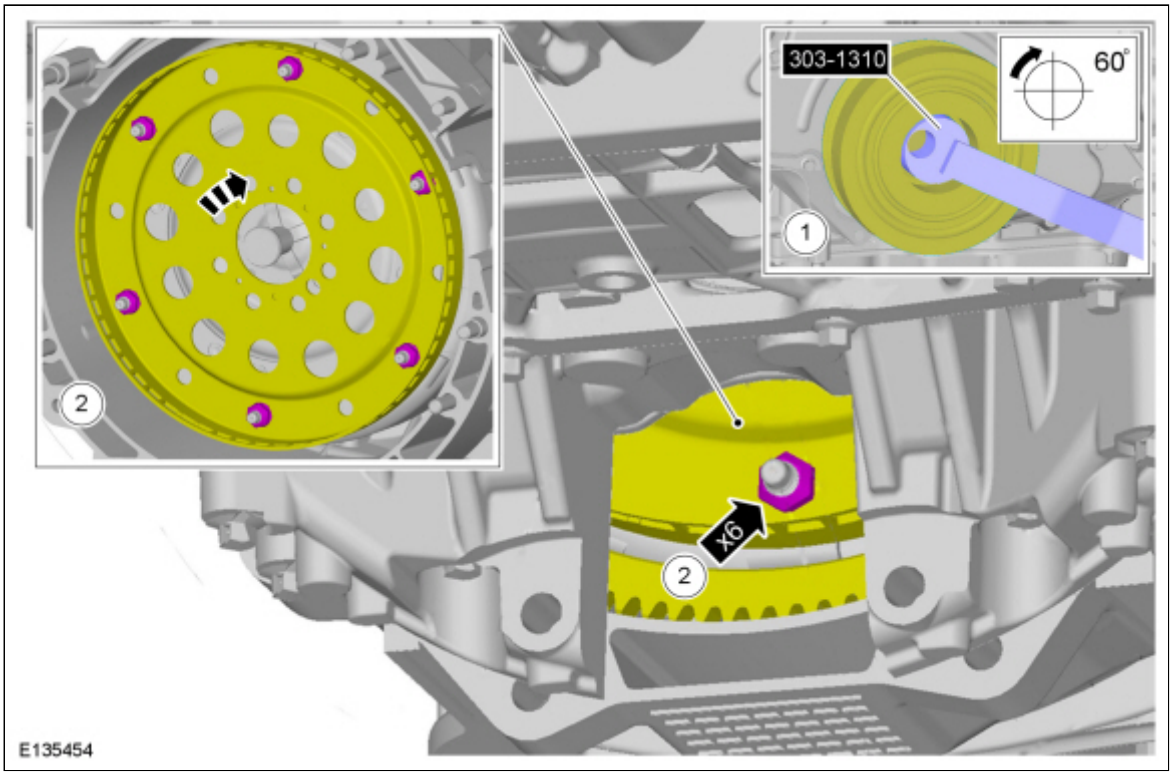
16. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.



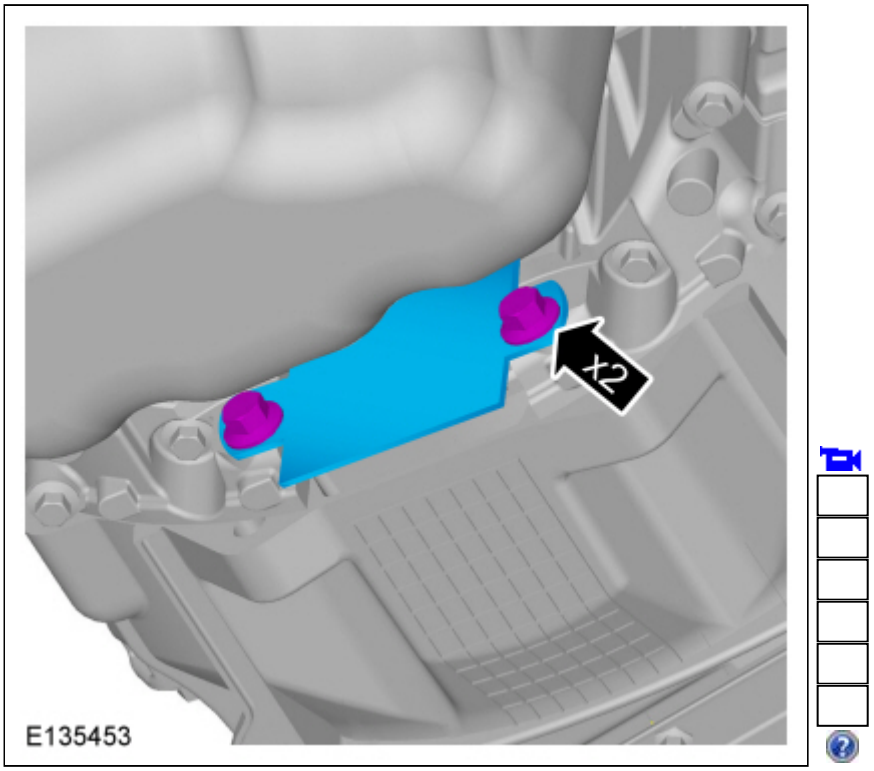
17. *Torque*: 13 Nm



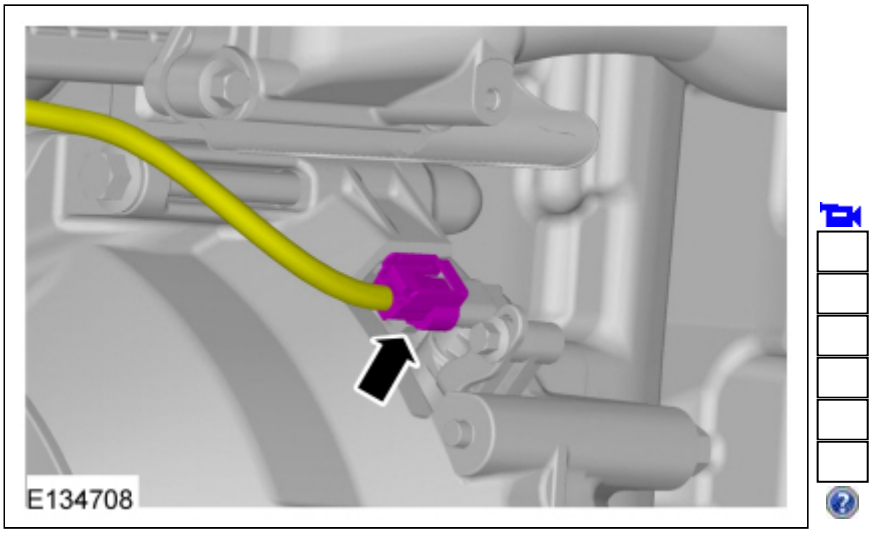
18. *Torque*: 40 Nm



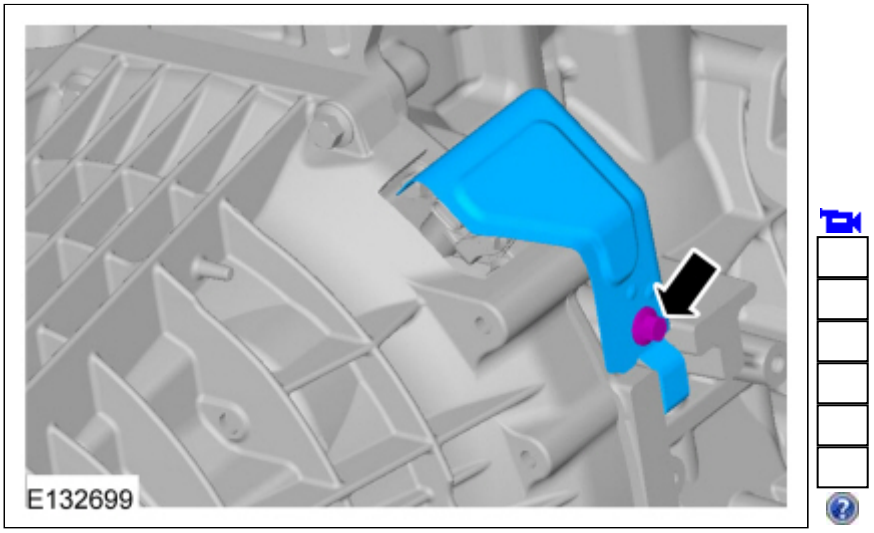
19. *Torque*: 22 Nm



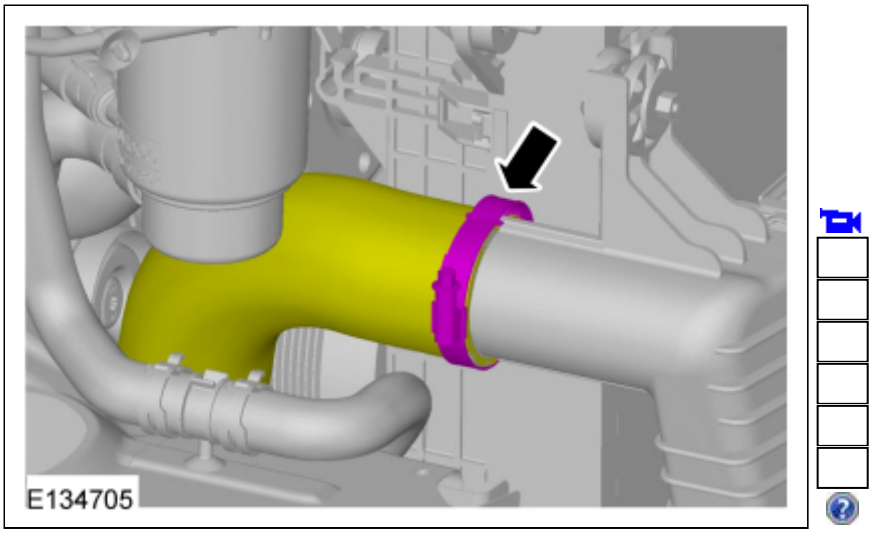
20.



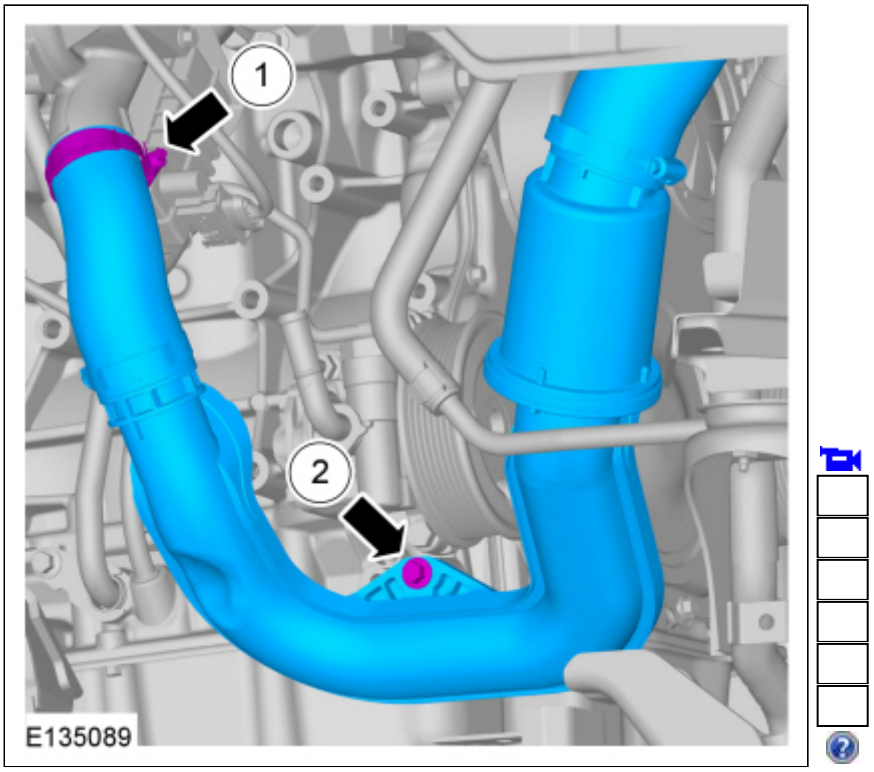
21. *Torque*: 22 Nm



22.

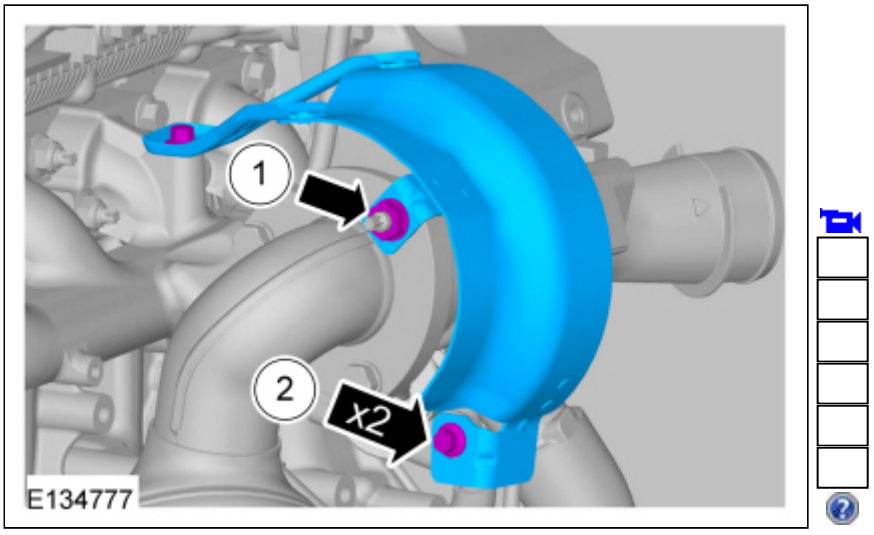


23. *Torque*:
    1: 5 Nm
    2: 10 Nm

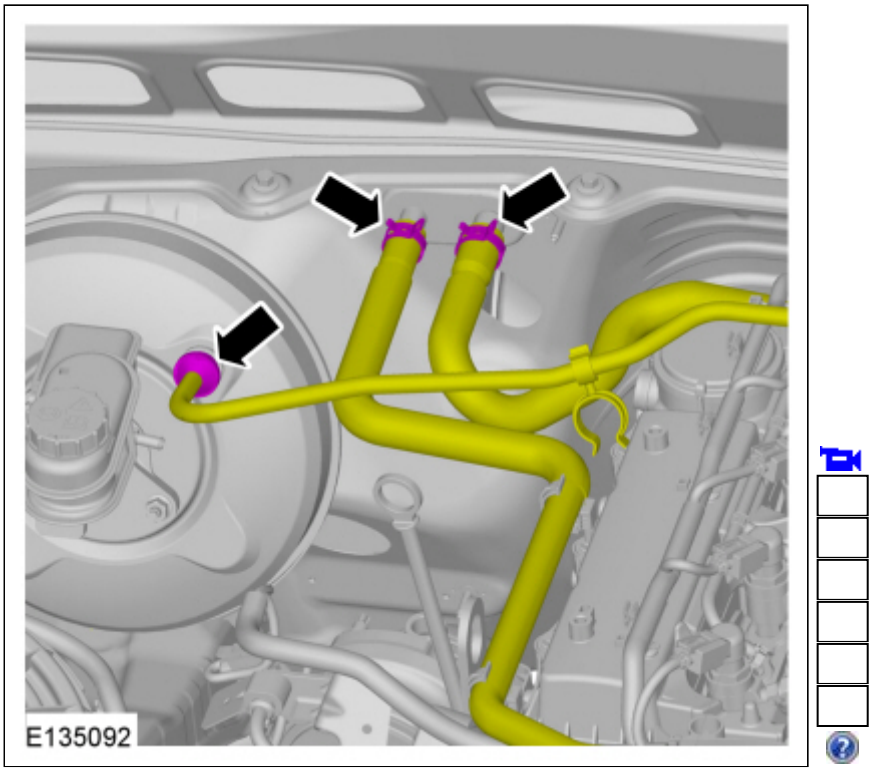


24. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

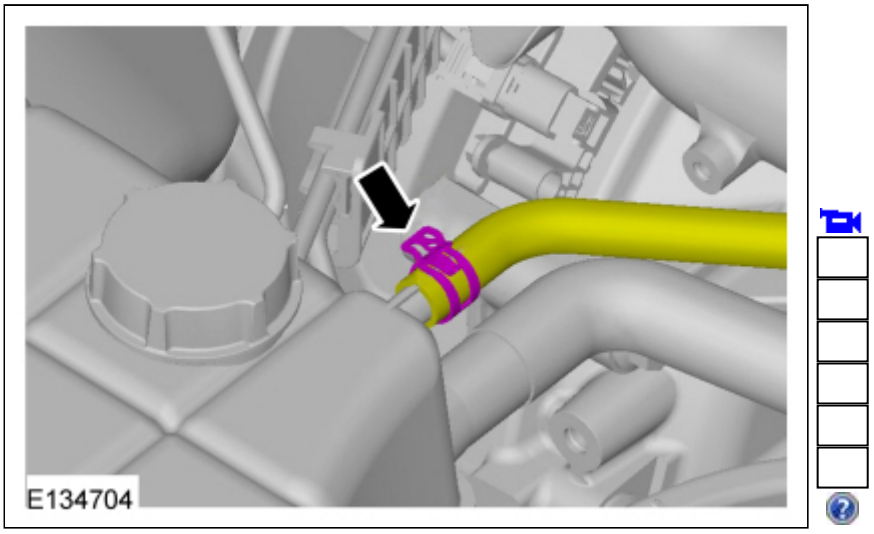
1. *Torque*: 47 Nm
2. *Torque*: 22 Nm



26.



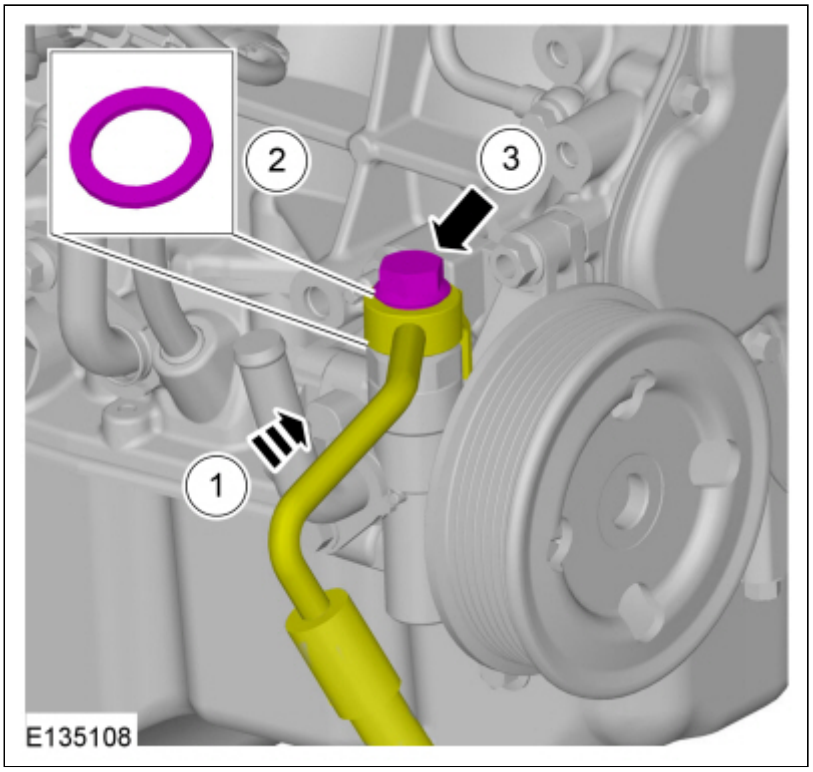
27.



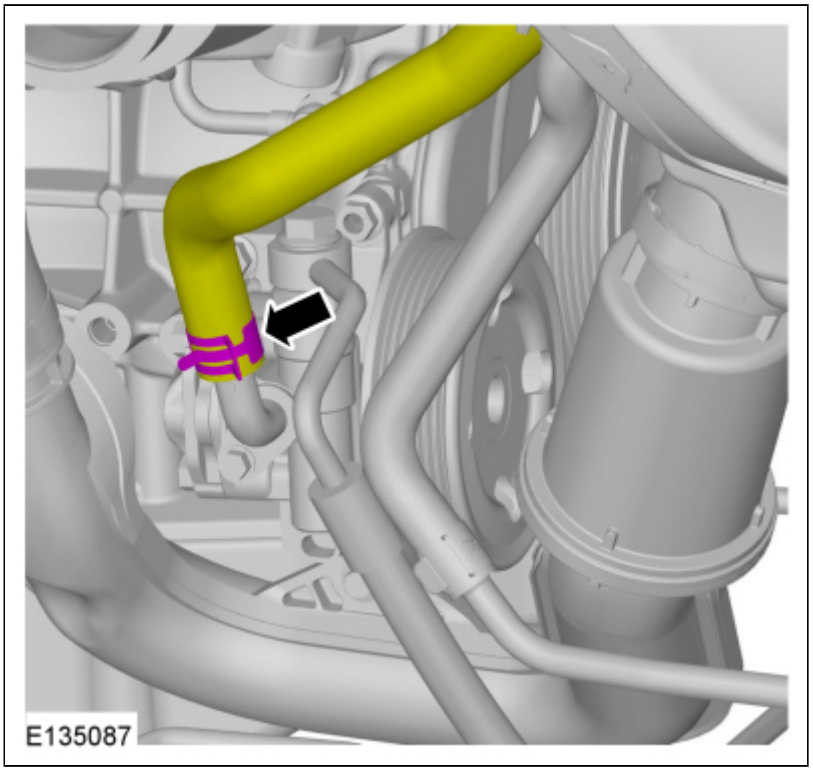
Vehicles With: Hydraulic Power Assist Steering (HPAS)

28. **NOTE:** *The washers can be reused unless damaged.*

    3. *Torque*: 35 Nm

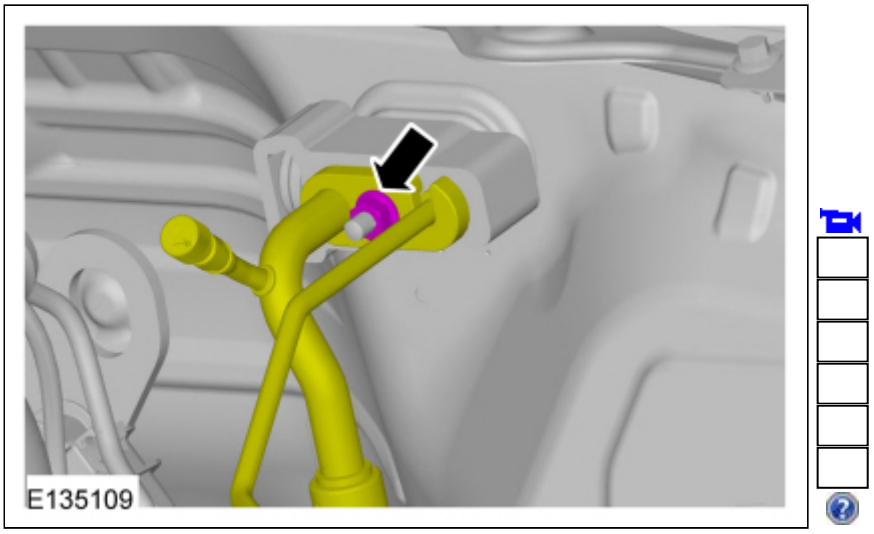


29.



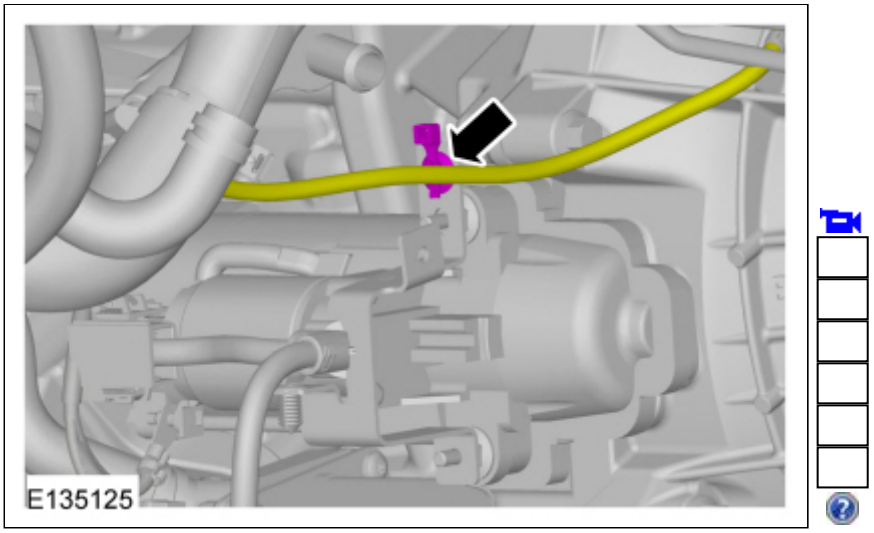
All vehicles

30. *Torque*: 22 Nm



31. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

32.

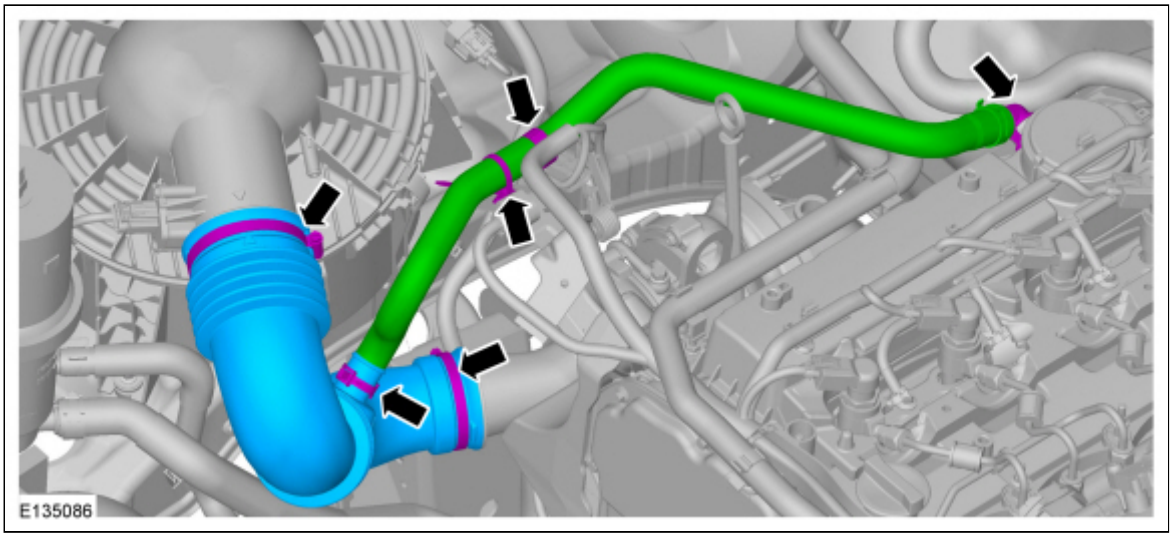


33. Refer to: Transmission Fluid Cooler (307-02 Transmission Cooling, Removal and Installation).

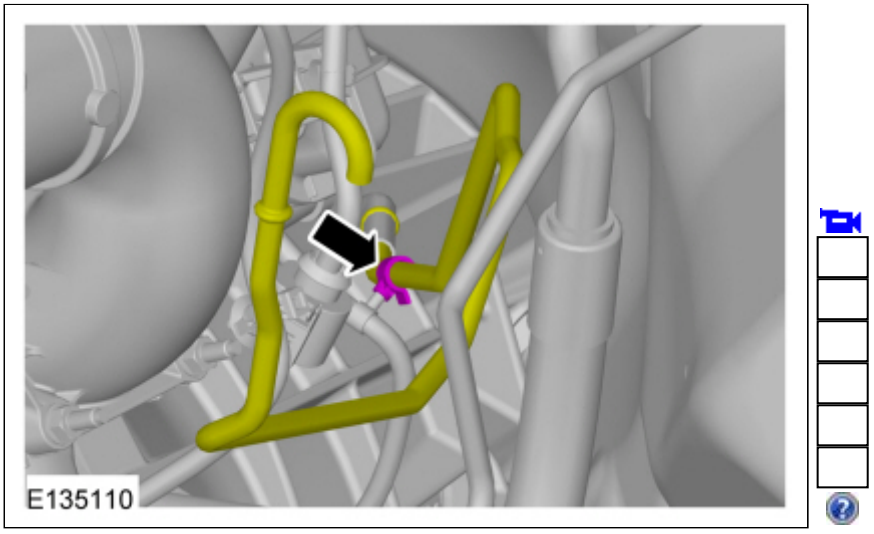
34. Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

35. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

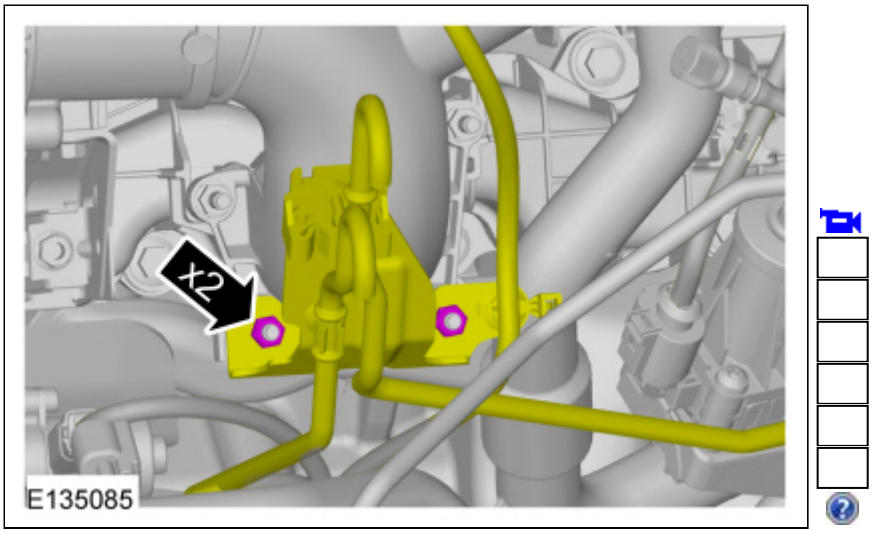
36.



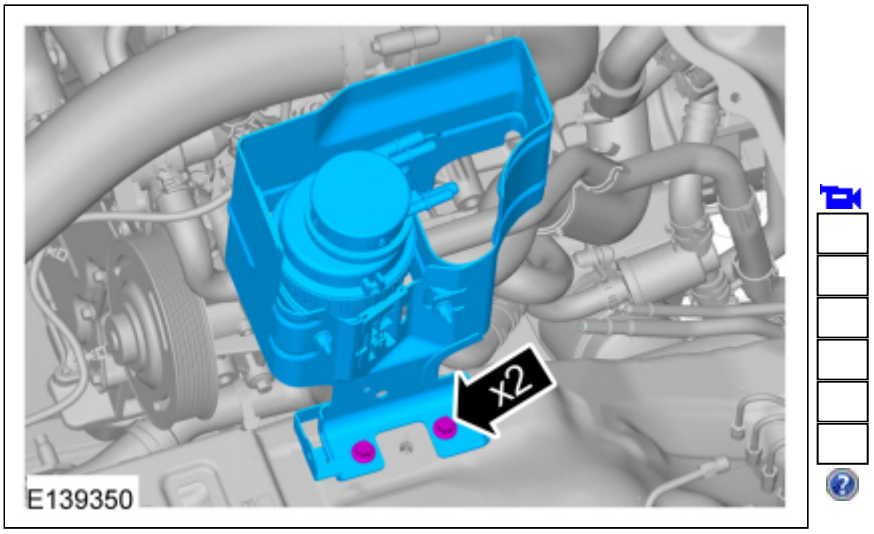
37.



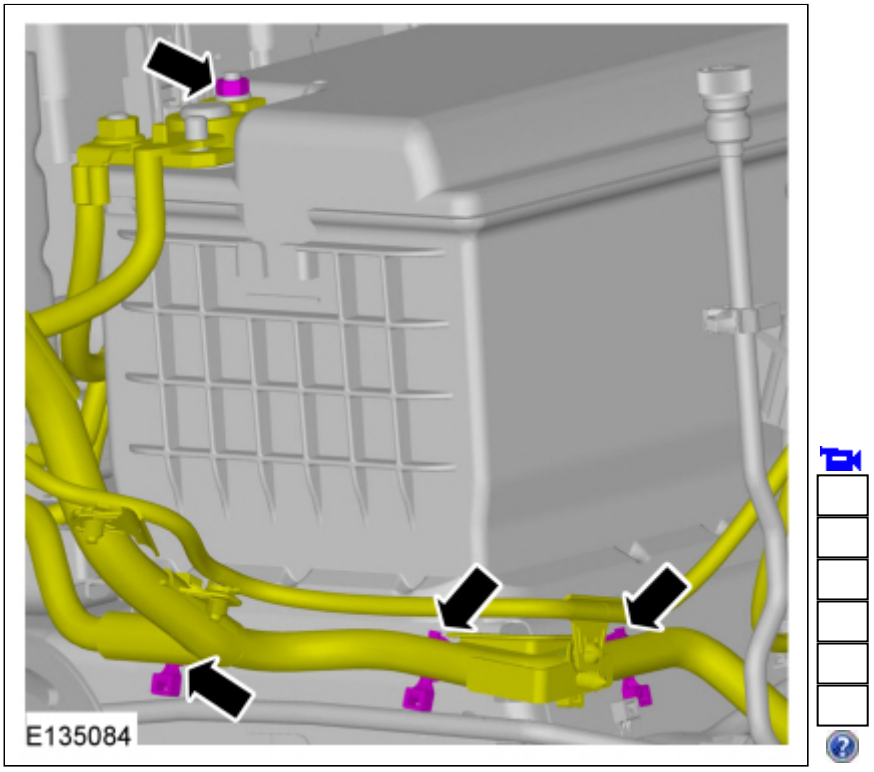
38. *Torque*: 10 Nm



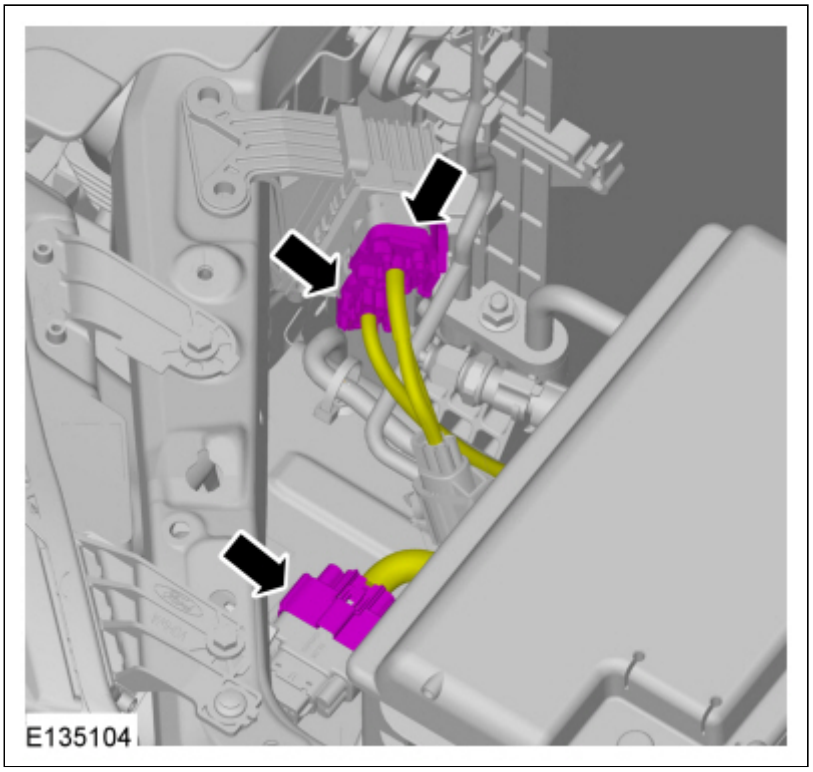
39. *Torque*: 18 Nm



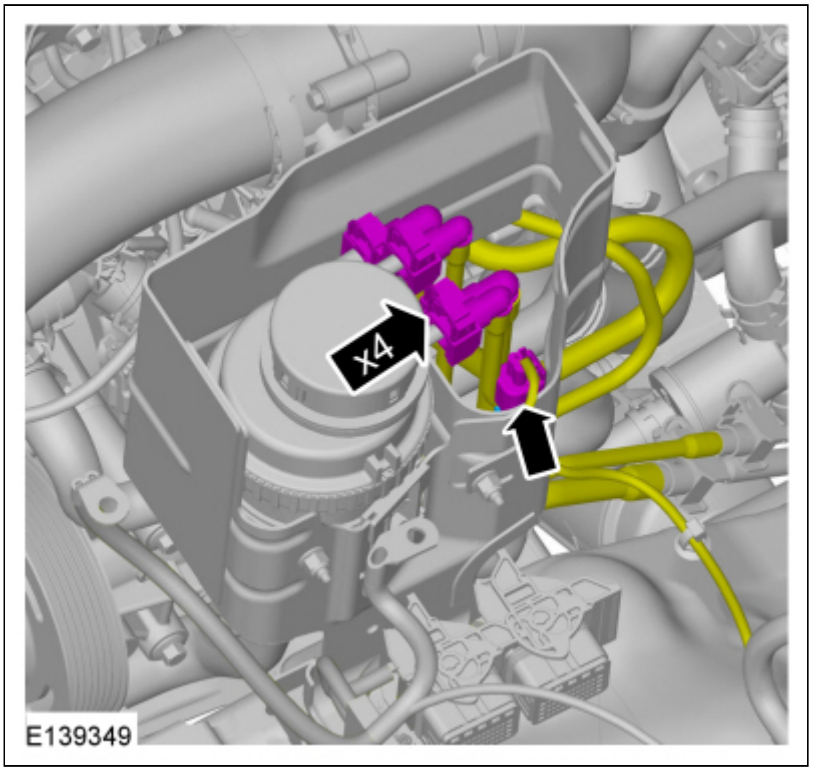
40. *Torque*: 5 Nm



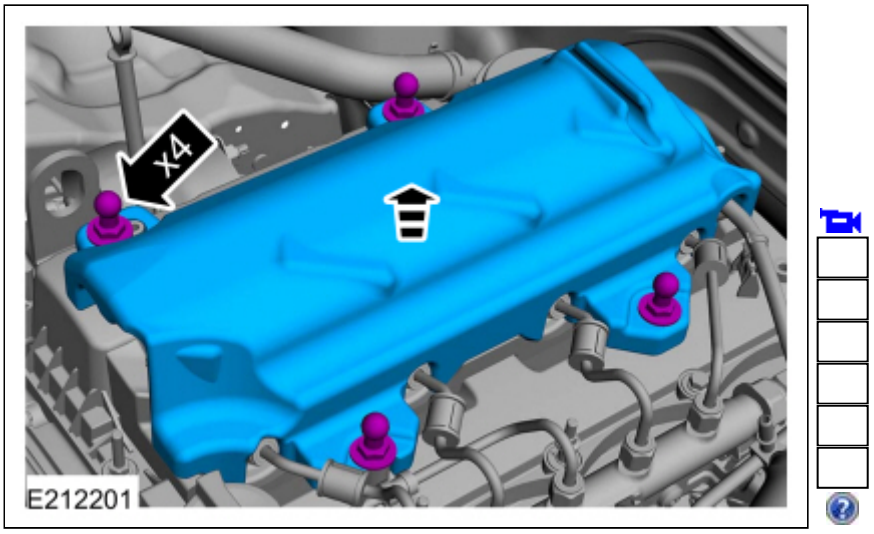
41.



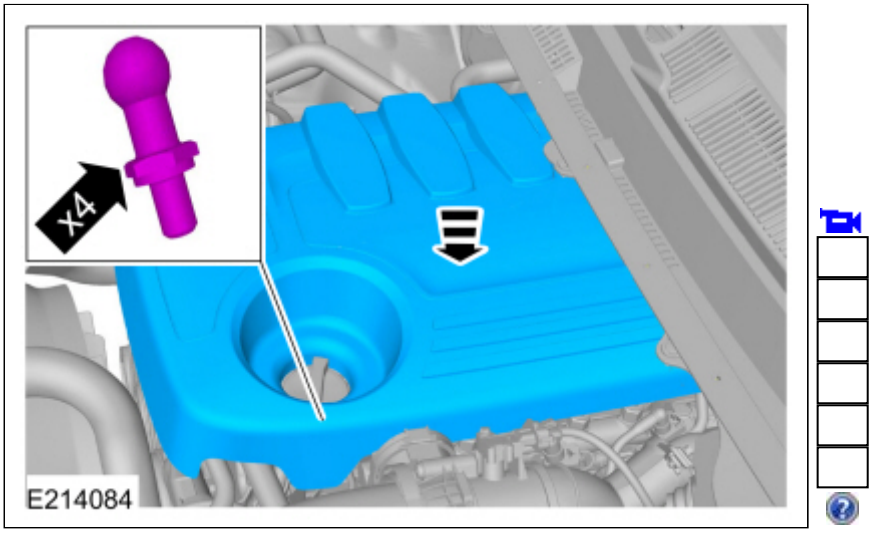
42.



43. Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
44. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
45. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
46. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
47. *Torque*: 3 Nm



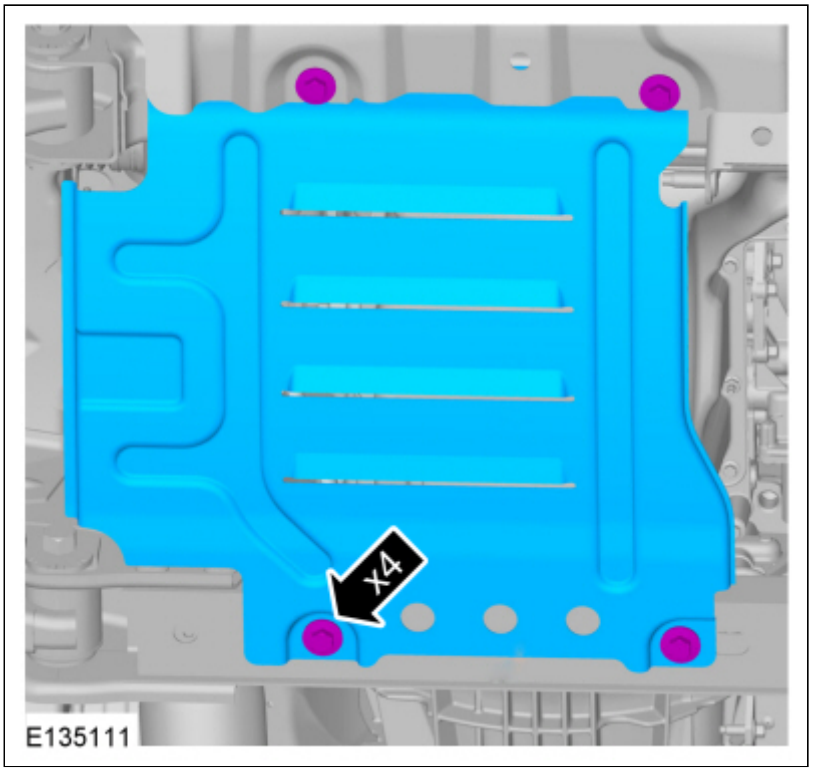
48.



49. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

50. *Torque*: 30 Nm

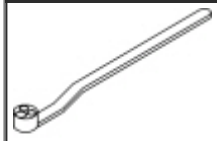
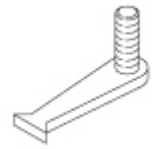
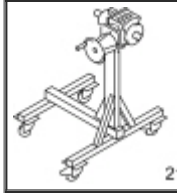
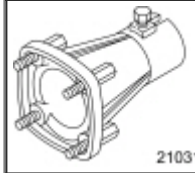
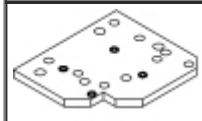


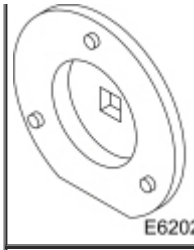
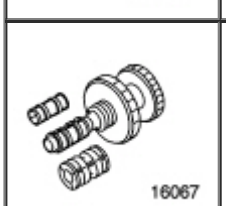
51. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
52. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
53. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Engine Accessories

Special Tool(s) / General Equipment

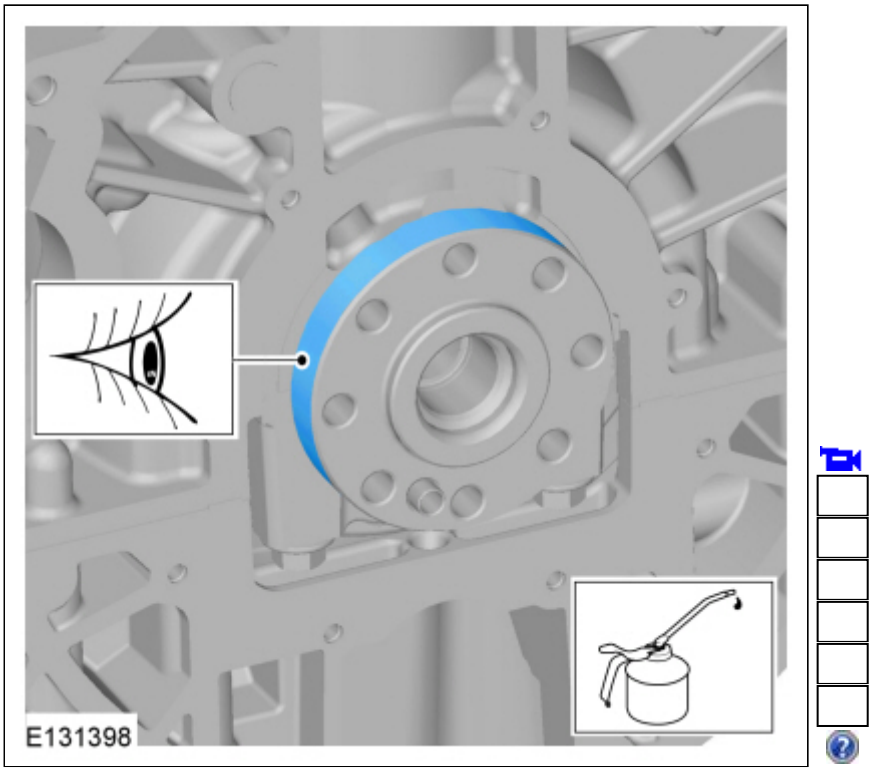
 21068A	303-122 Lifting Bracket, Engine
 E87614	303-1310 Holding Wrench, Crankshaft
 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 E131853	303-1562 Timing Tool
 21135	303-254 Locking Tool, Flywheel
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E68386	303-435-11B Mounting Plate for 303-435-06
	303-679A Remover/Installer, Engine Front Cover Inspection Plate

	
	303-698 Timing Tool, Crankshaft
	308-204 Aligner, Clutch Disc
Dowel with a Diameter of 6 mm	
1/2 Inch Square Drive Breaker Bar	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

1.

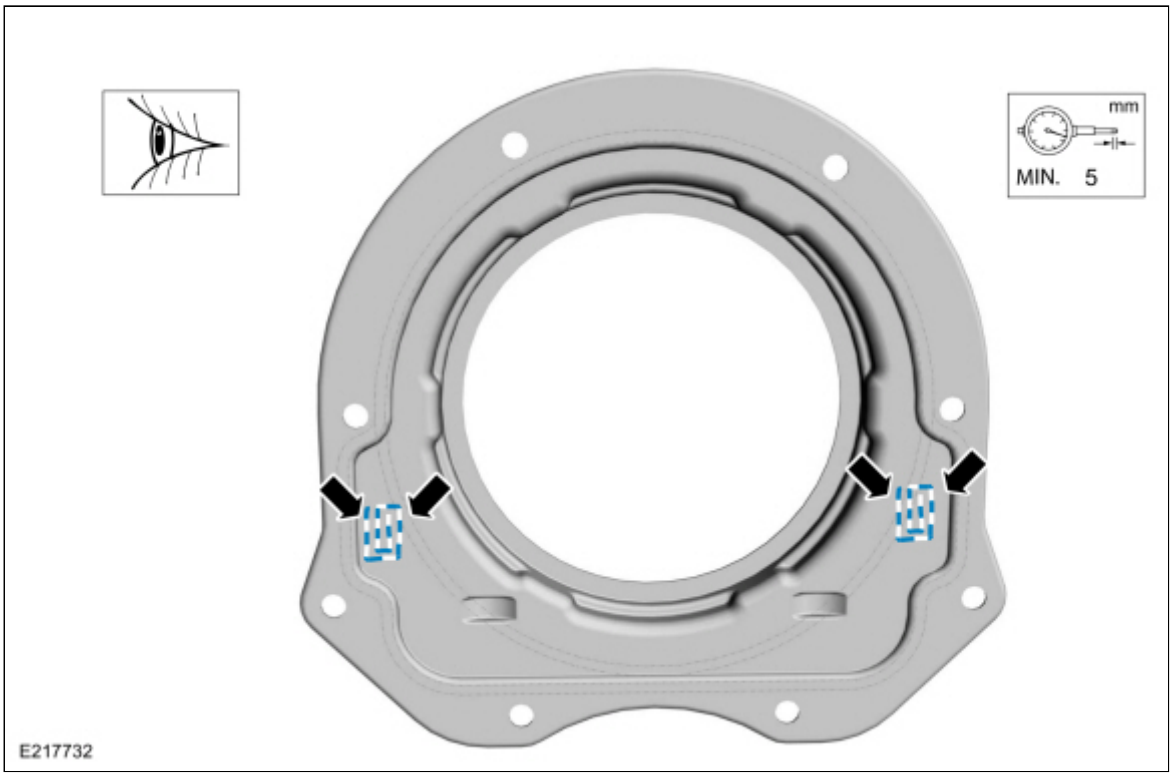


2. **NOTE:** *Install the new crankshaft rear seal carrier within five minutes of applying the recommended sealant.*

   NOTE: *Do not add any more than the specified quantity of sealant or add the sealant anywhere other than the area shown.*

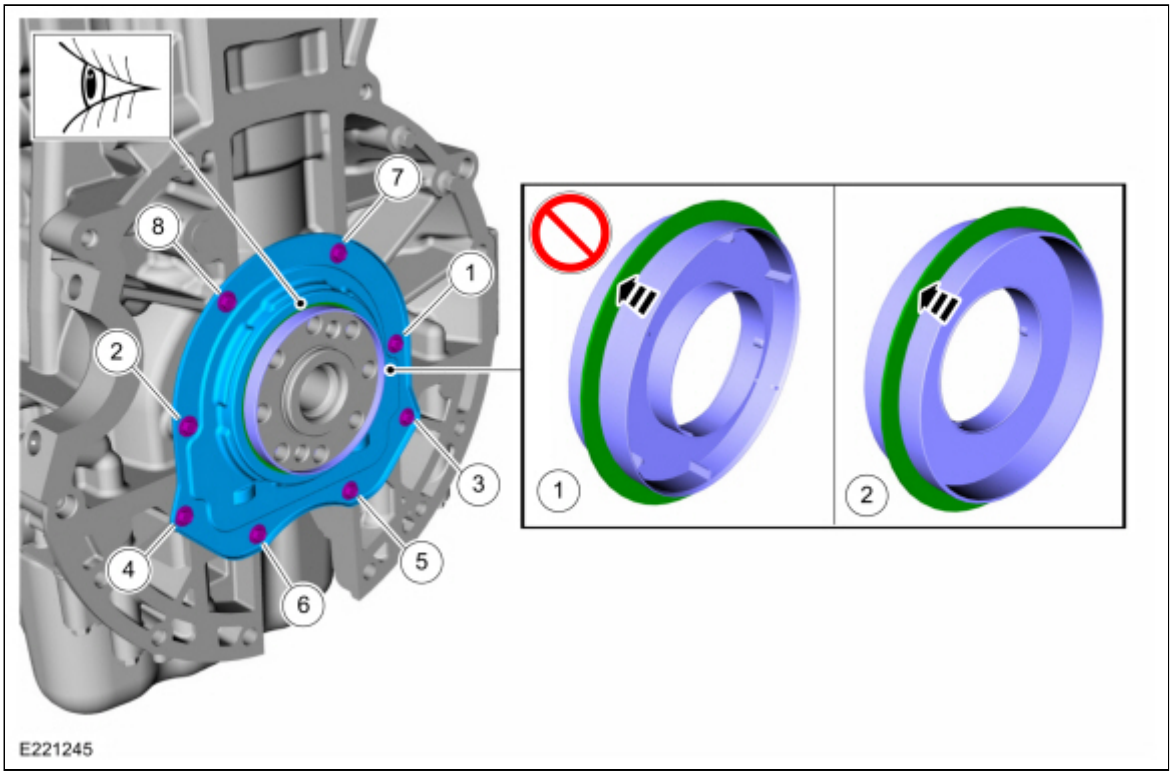
   NOTE: *If the foam pads are not present on inspection, fill the square areas shown with 75% of sealant.*

   Material: Silicone Sealant (WSE-M4G323-A4)



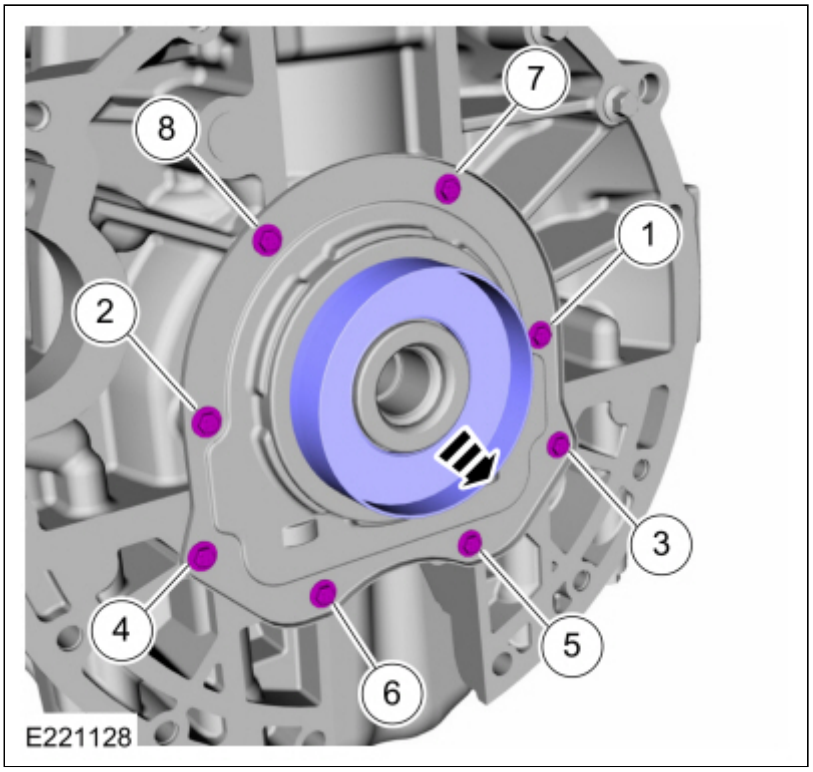
3. **NOTICE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.**

   Initially hand tighten the fasteners.



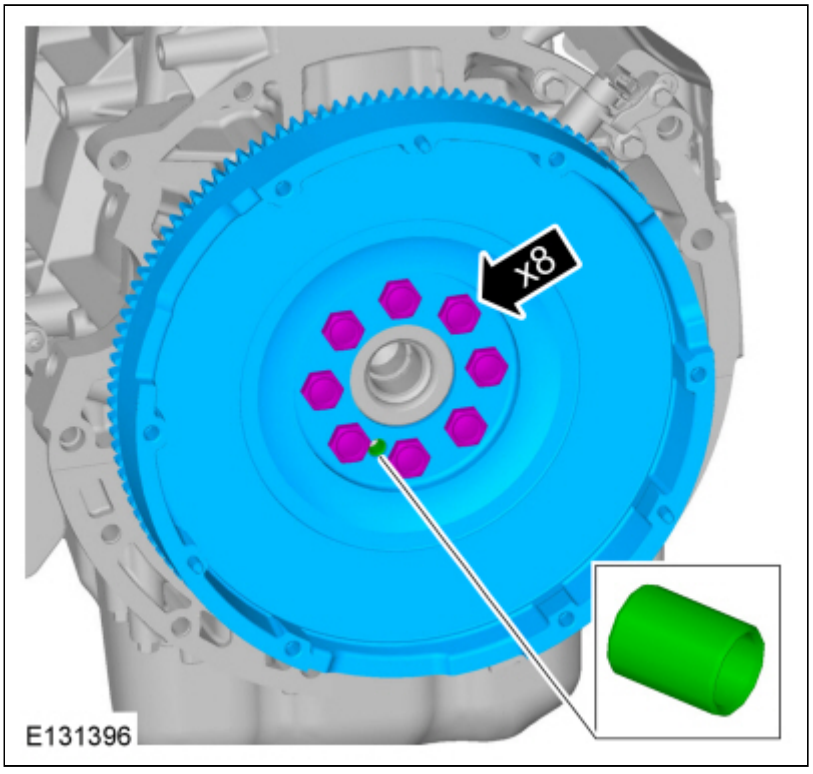
4. **NOTE:** *New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.*

   Torque:
   Stage 1: 5 Nm
   Stage 2: 10 Nm

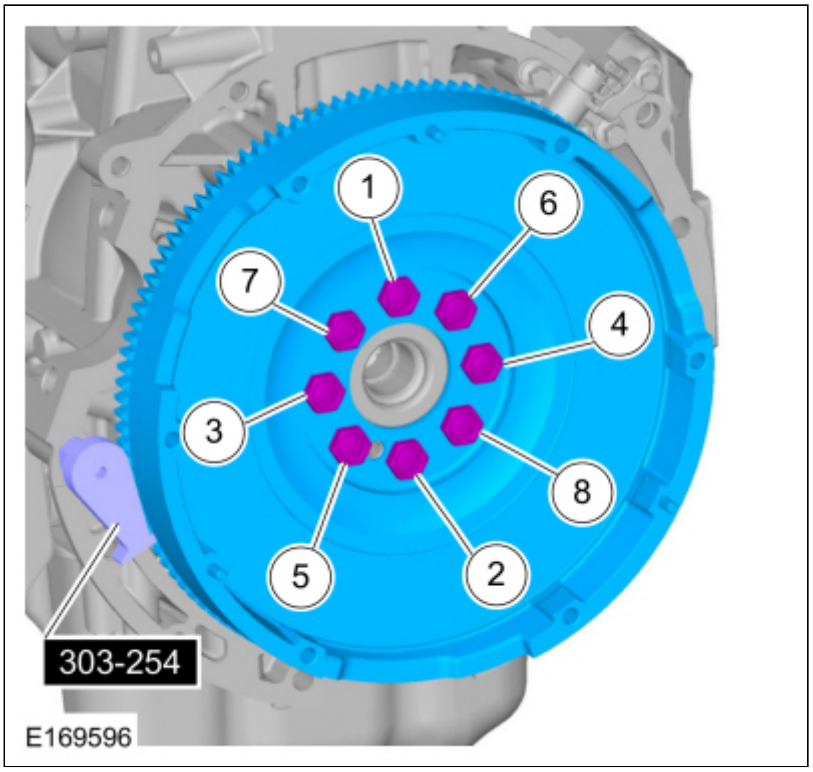


5. **NOTE:** *Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.*

   Initially hand tighten the fasteners.

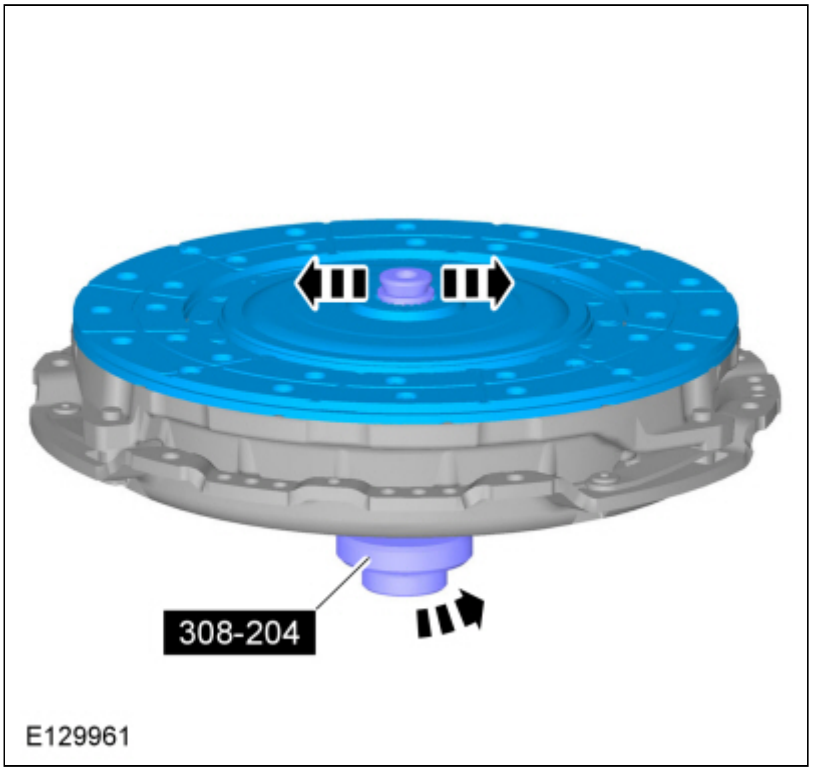


6. Use Special Service Tool: 303-254 Locking Tool, Flywheel.
   Torque:
   Stage 1: 25 Nm
   Stage 2: 45 Nm
   Stage 3: 45°



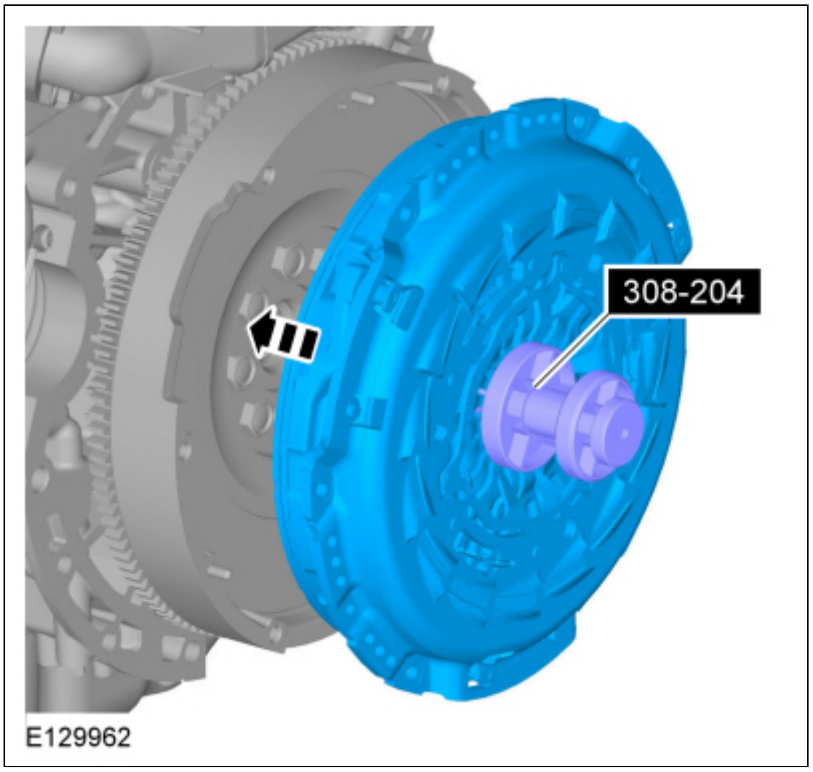
7. **NOTE:** *The cone on the special tool must only be tightened finger tight to prevent damage to the clutch disc.*

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.



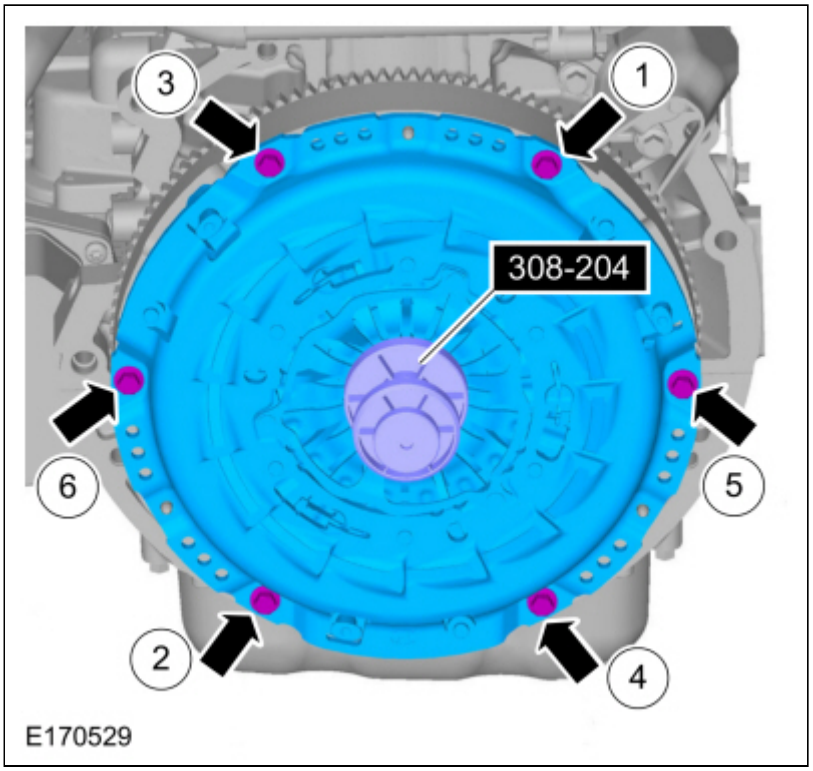
8. **NOTE:** *Only tighten the bolt finger tight at this stage.*

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.

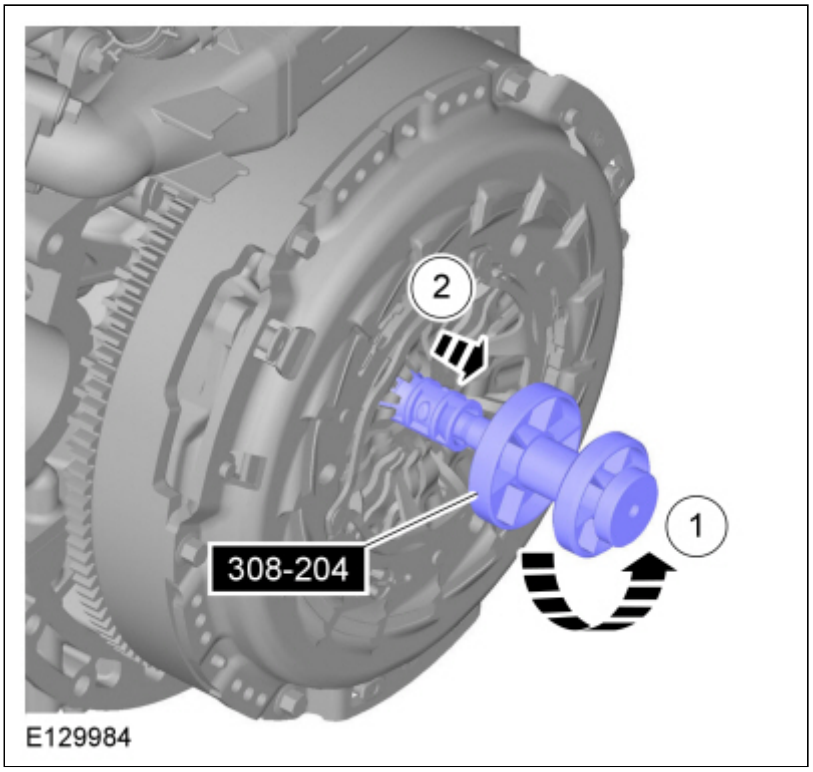


9. **NOTICE: Tighten the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.**

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.
   Torque:
   Stage 1: 6 Nm
   Stage 2: 25 Nm
   Stage 3: 30 Nm

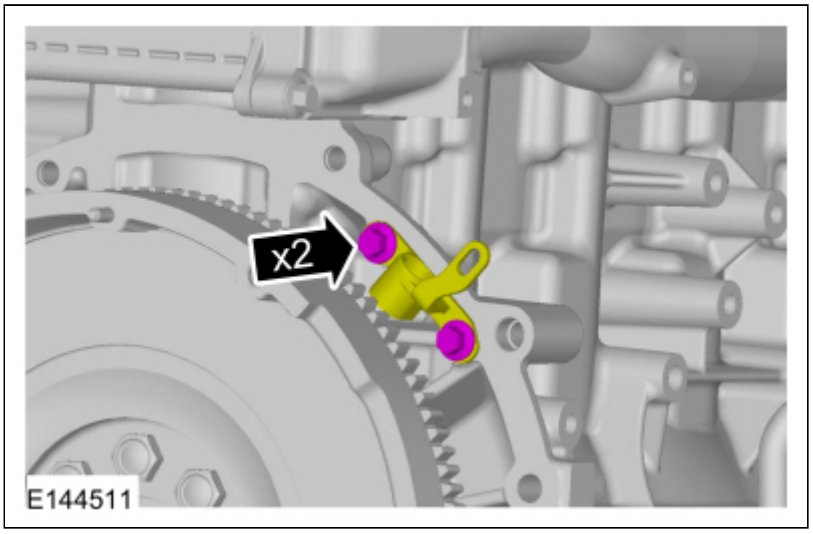


10. Remove Special Service Tool: 308-204 Aligner, Clutch Disc.



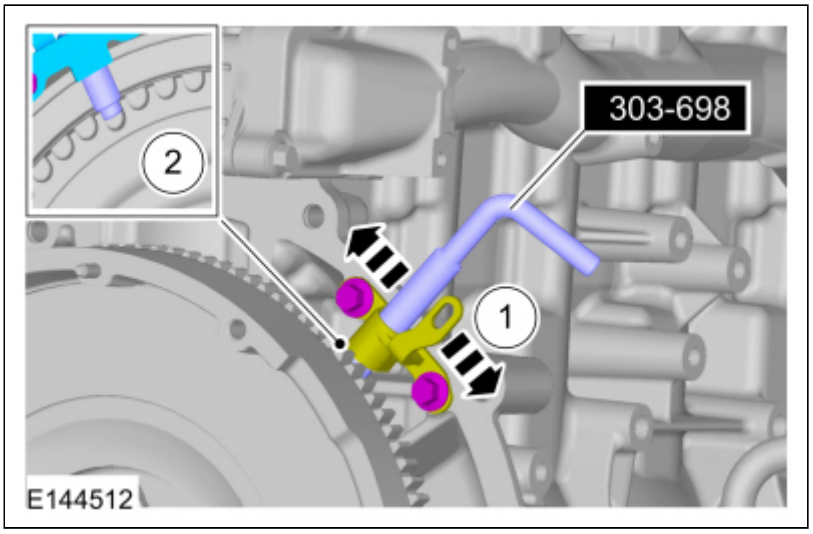
Vehicles with manual transmission

11. Initially hand tighten the fasteners.

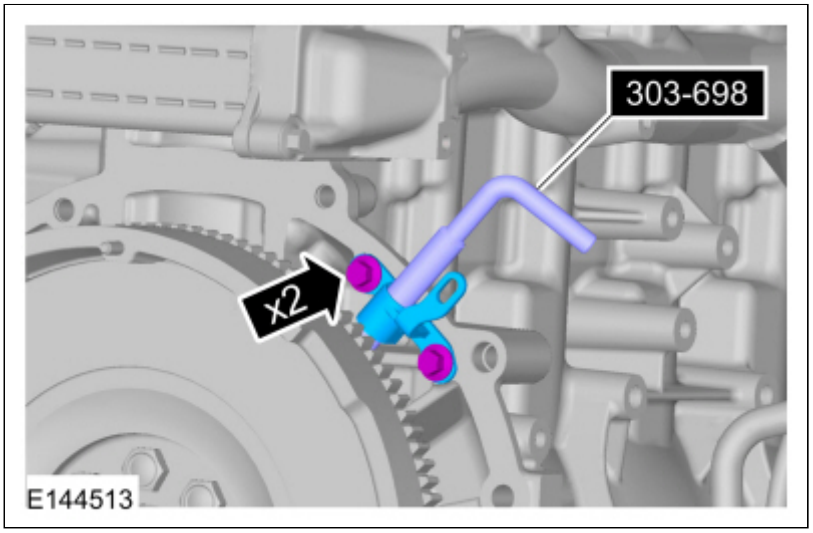


12. **NOTE:** *Make sure that the special tool is located in the flywheel timing slot.*

    Use Special Service Tool: 303-698 Timing Tool, Crankshaft.

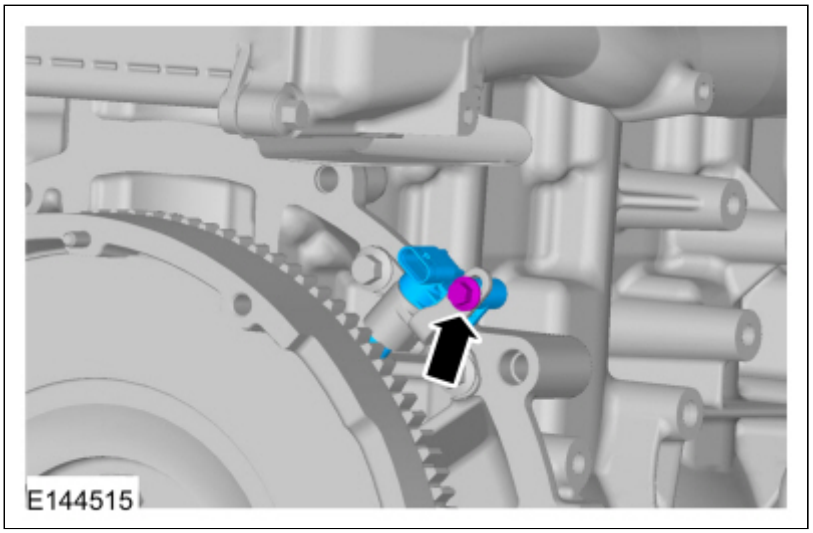


13. Tighten bolts before removing tool.
    Remove Special Service Tool: 303-698 Timing Tool, Crankshaft.
    Torque: 25 Nm



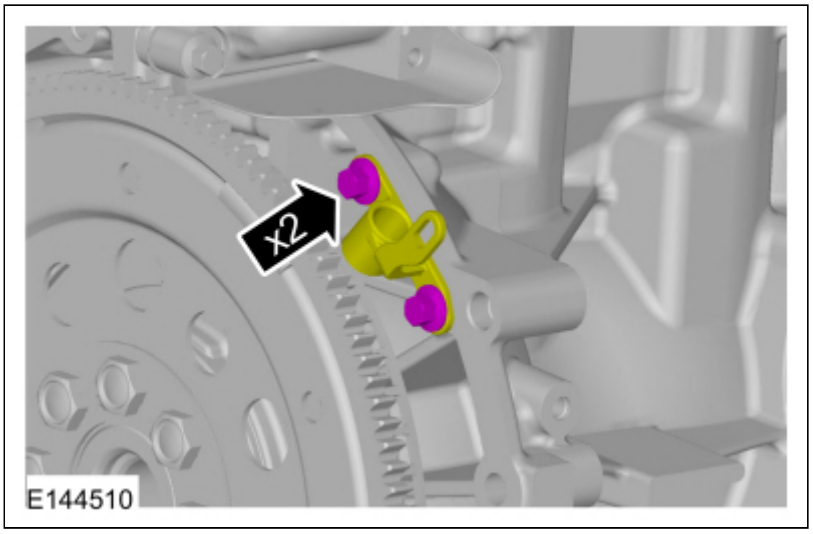
14. **NOTE:** *Make sure that a new component is installed.*

    Torque: 8 Nm



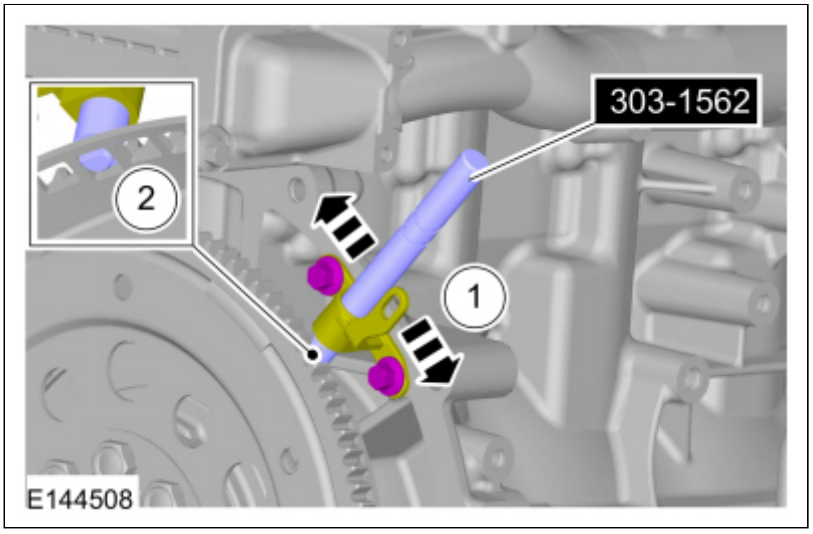
6-Speed Automatic Transmission - 6R80

15. Initially hand tighten the fasteners.

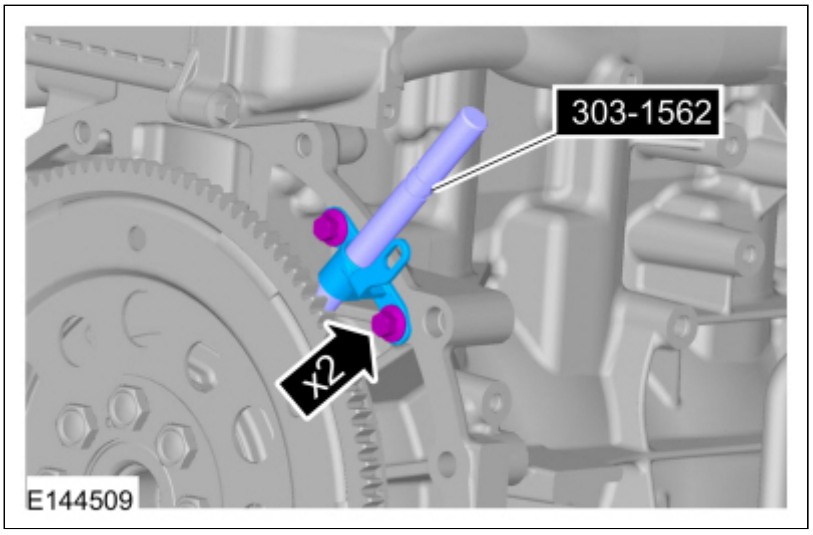


16. **NOTE:** *Make sure that the special tool is located in the flexplate timing slot.*

    Use Special Service Tool: 303-1562 Timing Tool.

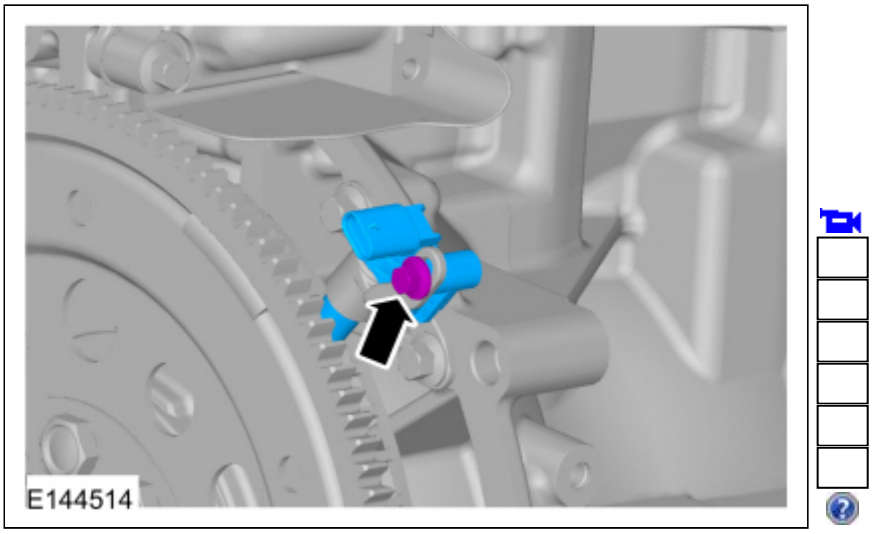


17. Tighten bolts before removing tool.
    Remove Special Service Tool: 303-1562 Timing Tool.
    Torque: 20 Nm



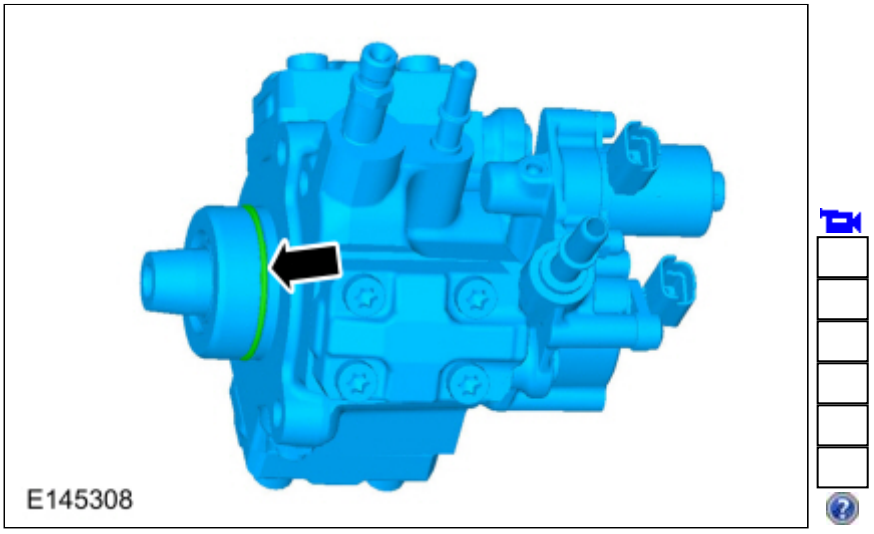
18. **NOTE:** *Make sure that a new component is installed.*

    Torque: 8 Nm

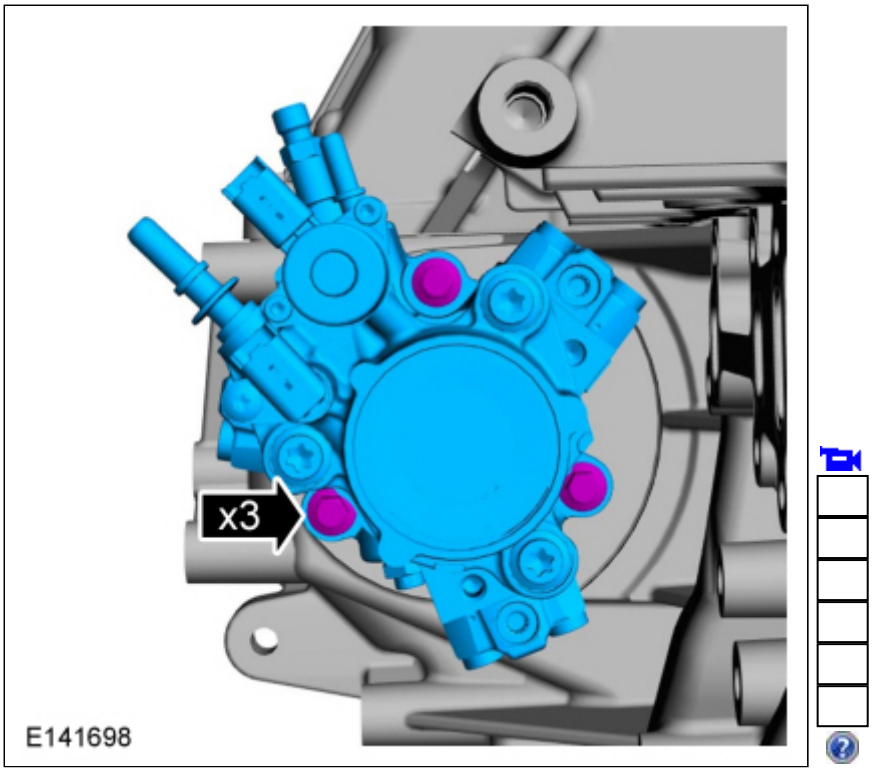


All vehicles

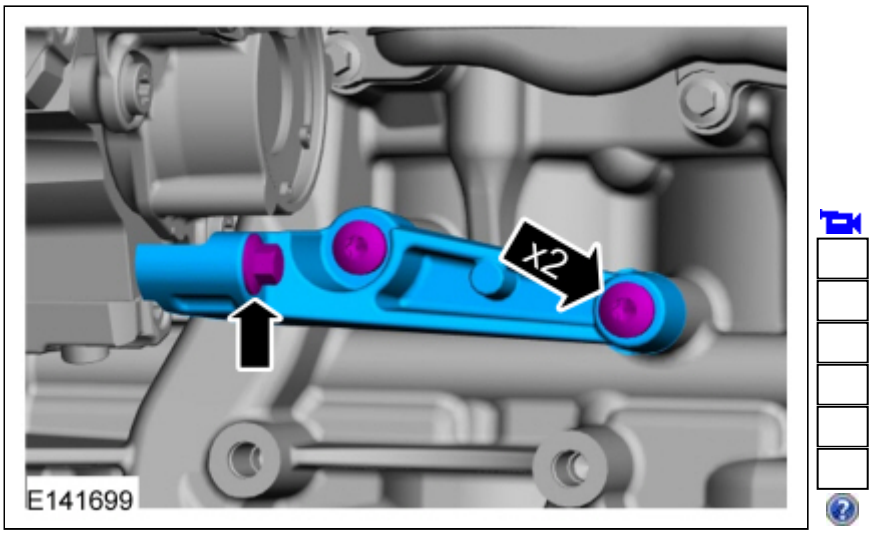
19.



20. *Torque*: 23 Nm

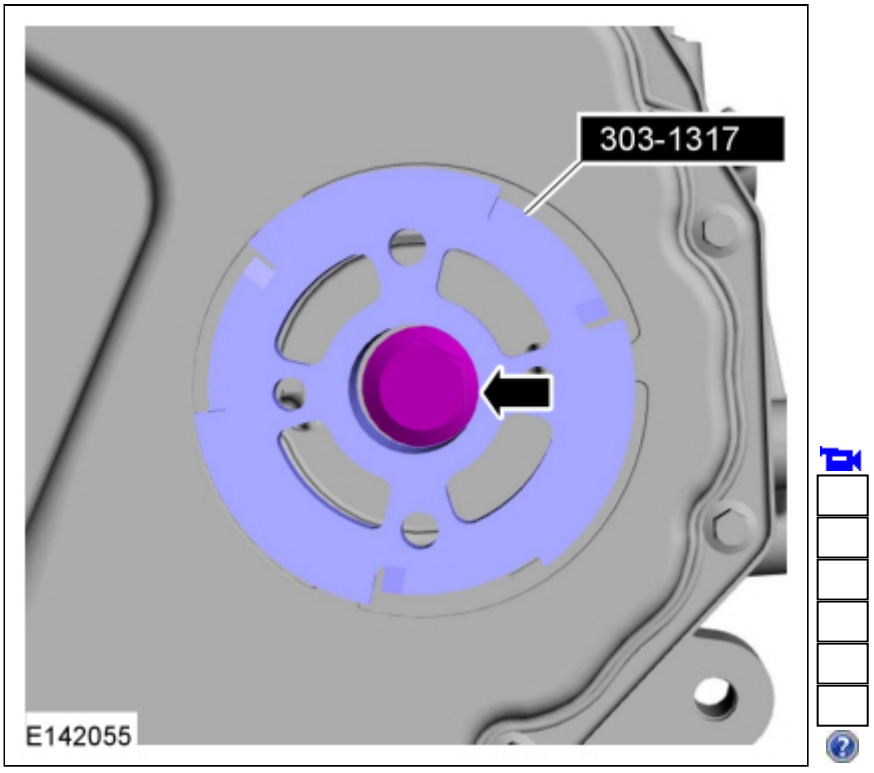


21. *Torque*: 23 Nm

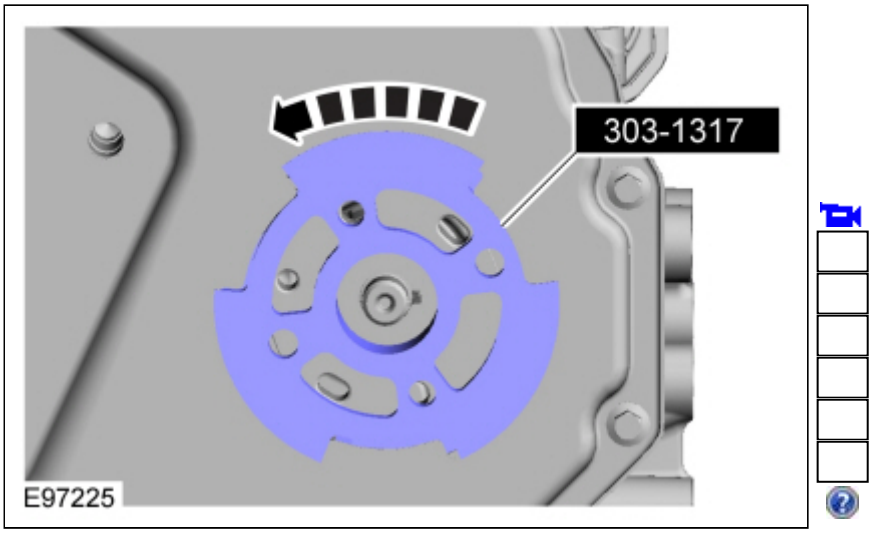


22. **NOTE:** *The component has a left-hand thread.*

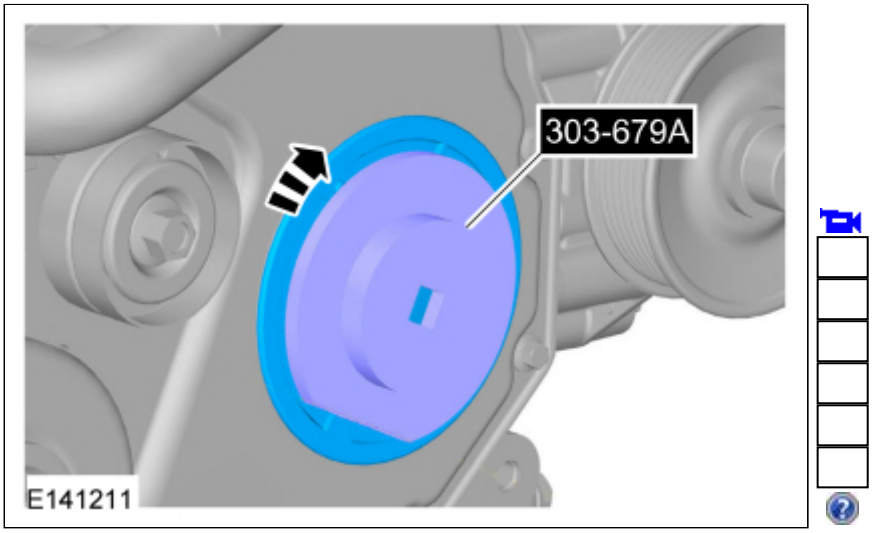
    Torque: 55 Nm



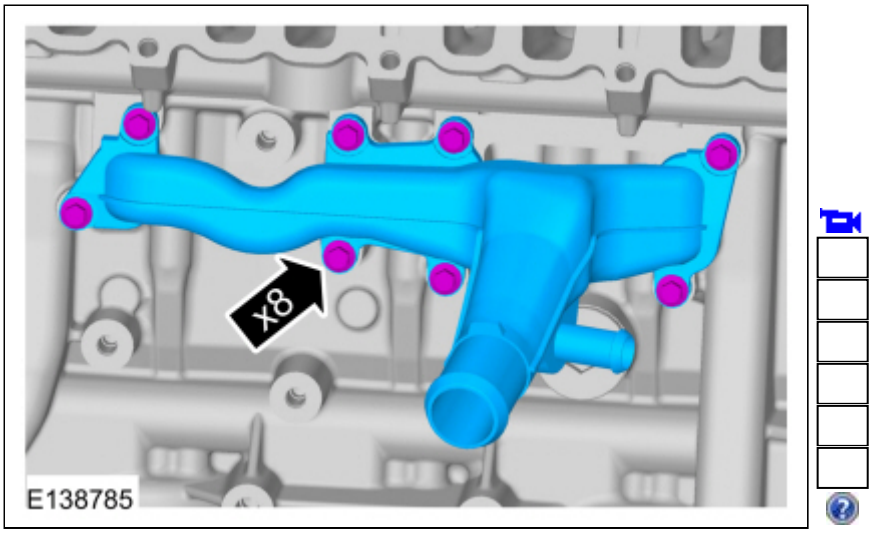
23. Remove Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



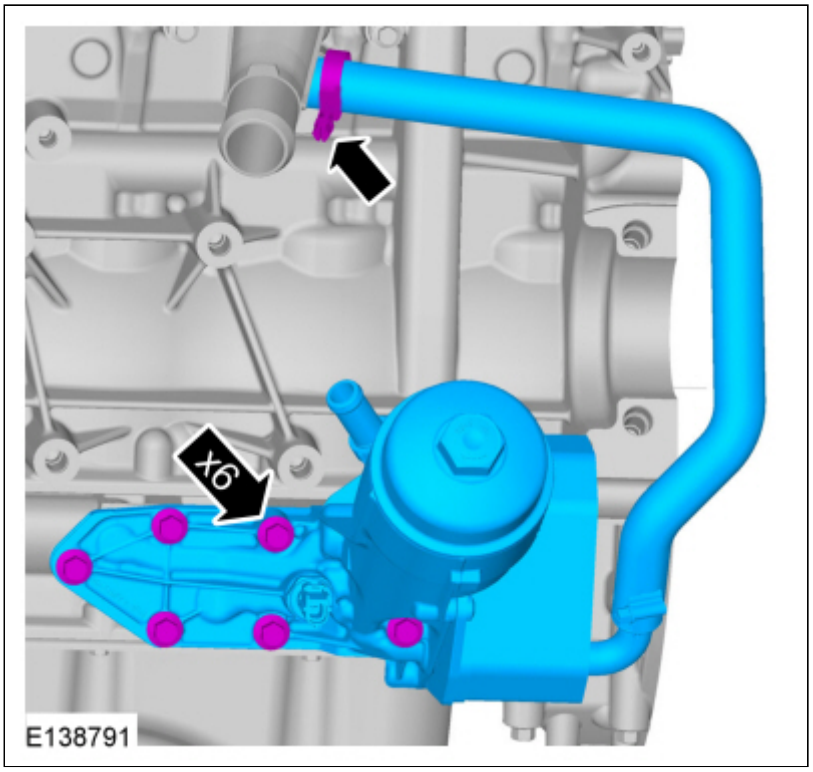
24. Remove Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



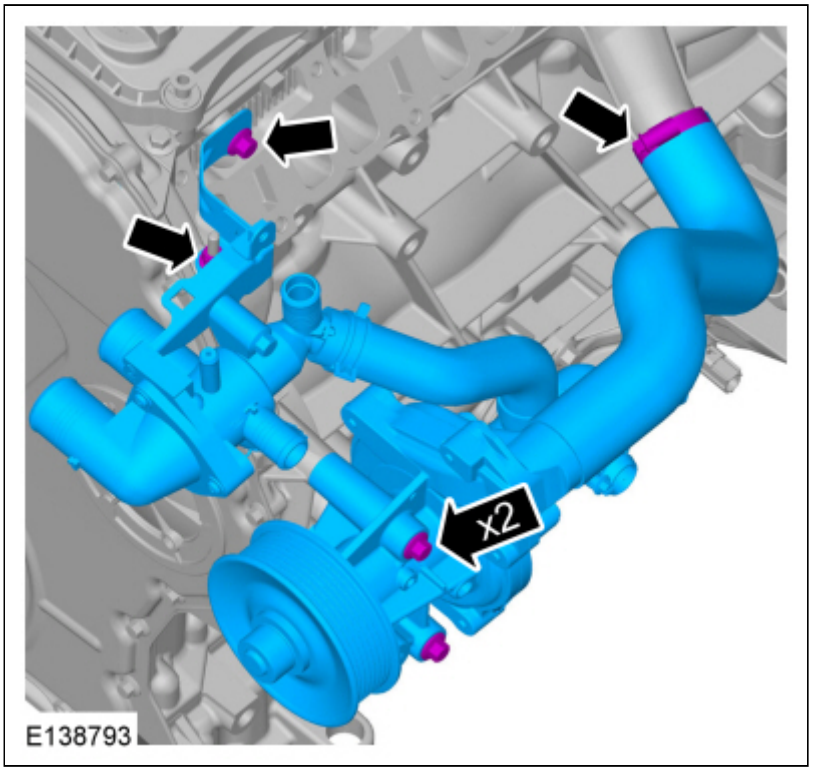
25. *Torque*: 10 Nm



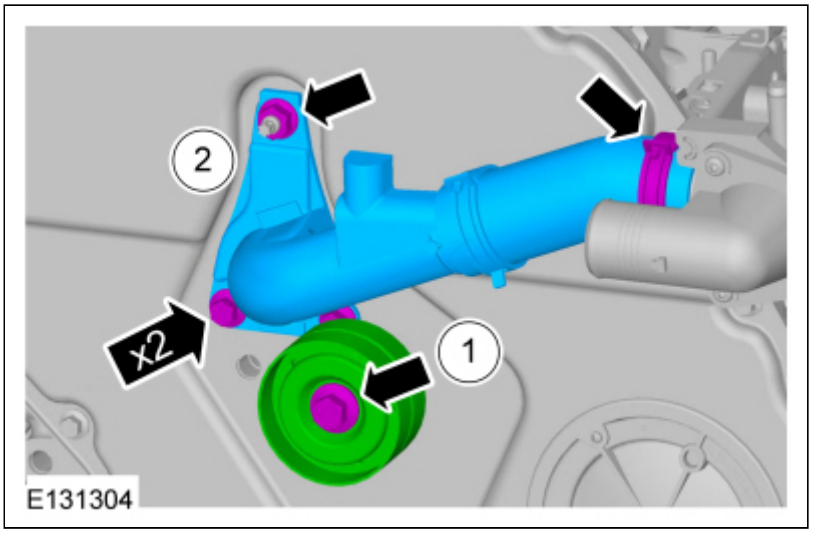
26. *Torque*: 23 Nm



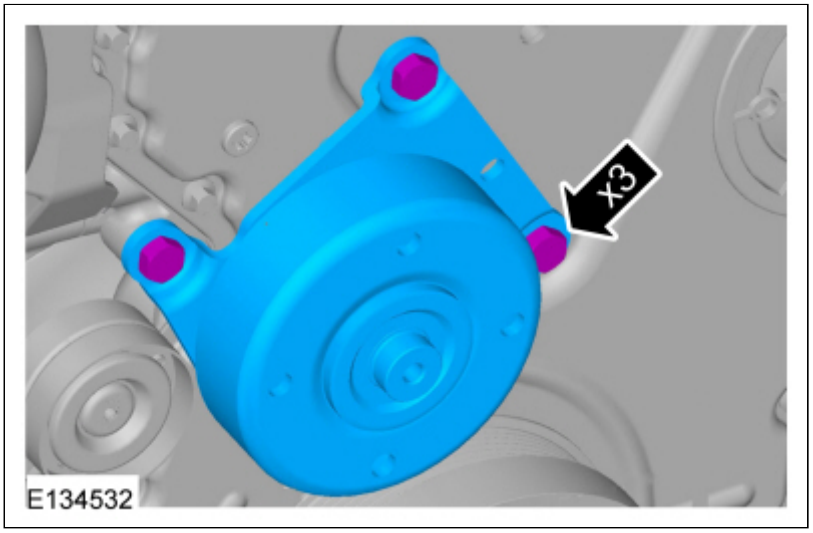
27. *Torque*: 23 Nm



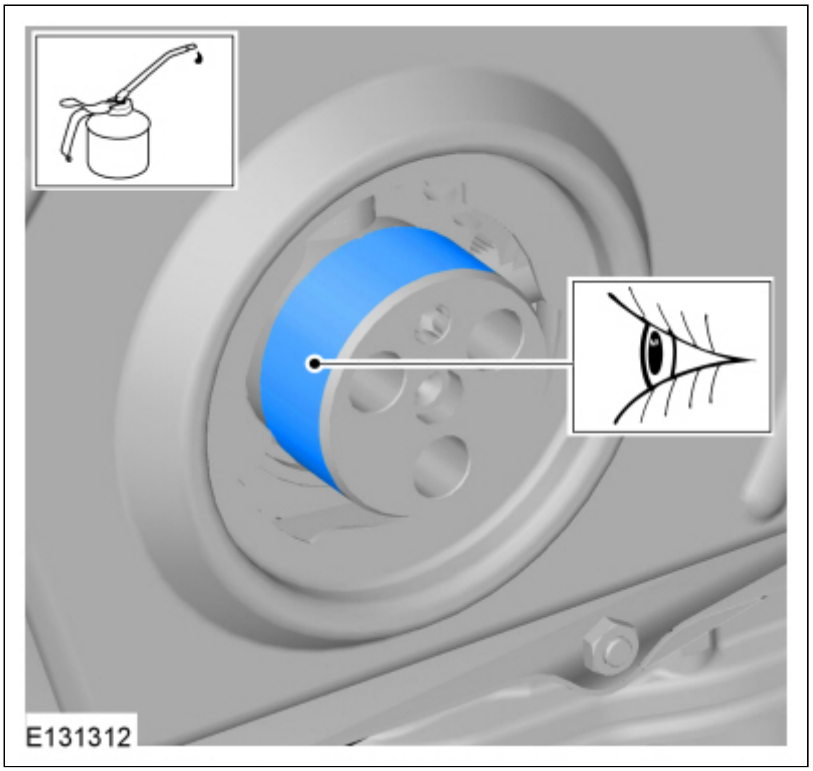
1. *Torque*: 23 Nm
2. *Torque*: 23 Nm



29. *Torque*: 48 Nm



30. **NOTE:** *Make sure that the mounting face is clean and lubricated.*

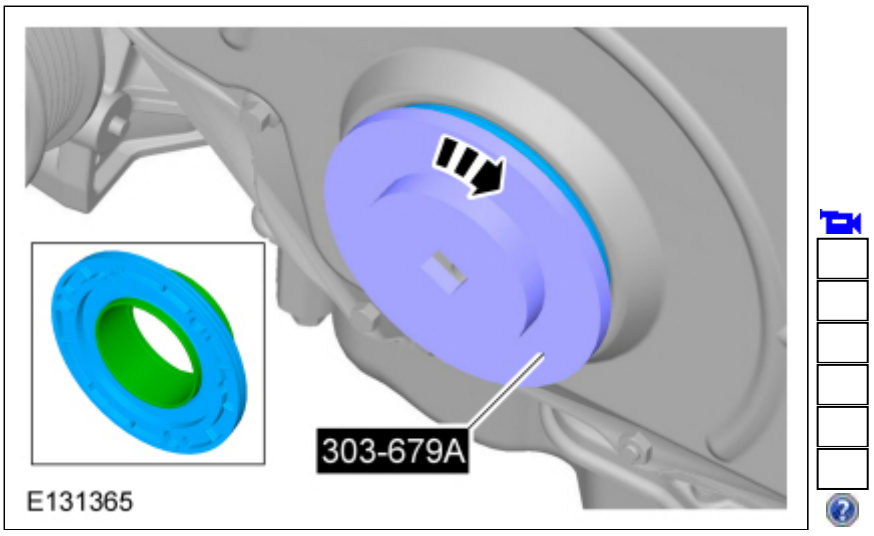


31. **NOTICE: Rotate the seal assembly until it locks. Failure to follow this instruction may result in damage**

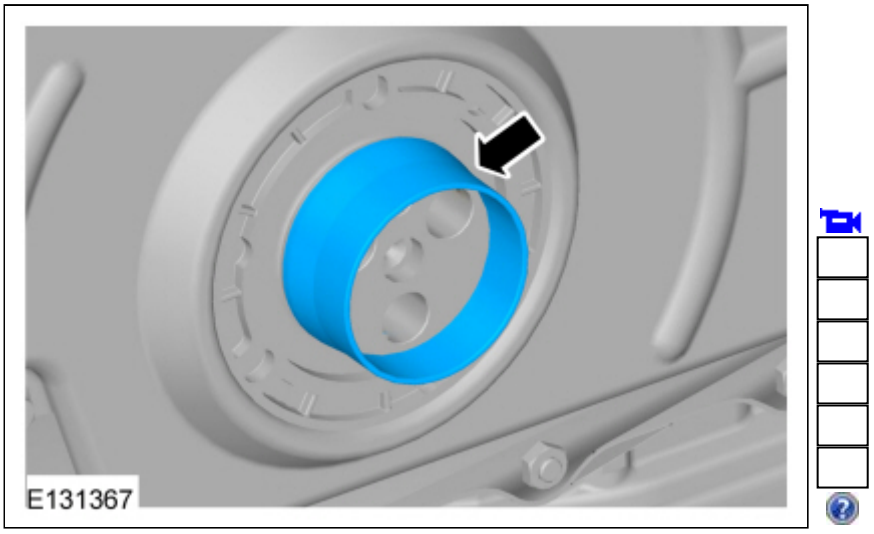
to the seal assembly.

NOTE: *A new crankshaft front seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed.*

Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



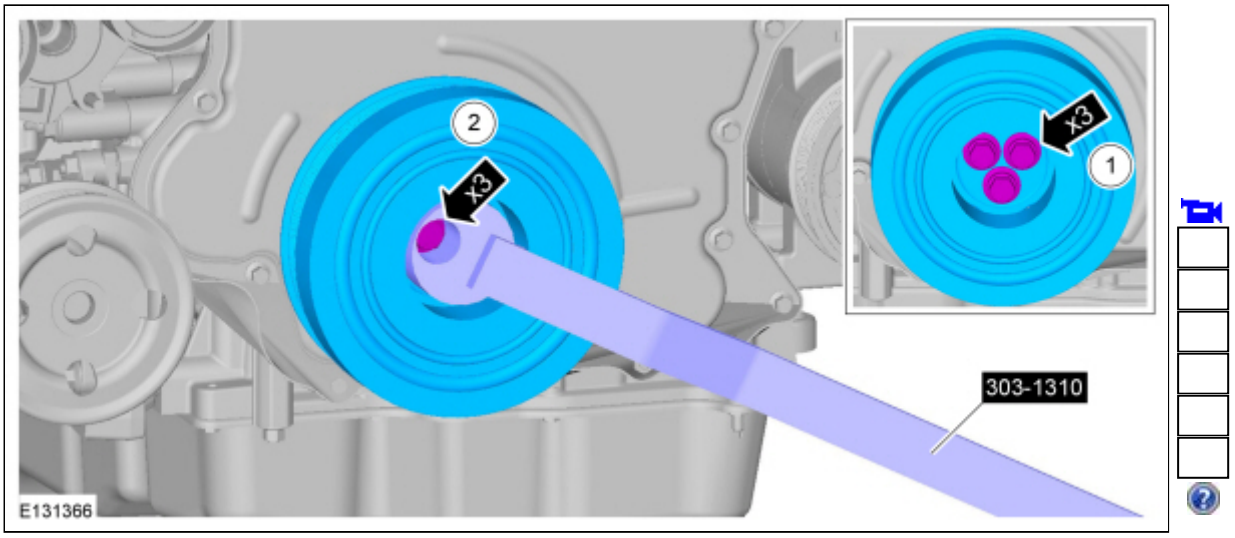
32. Remove the alignment sleeve after the seal is fully installed.



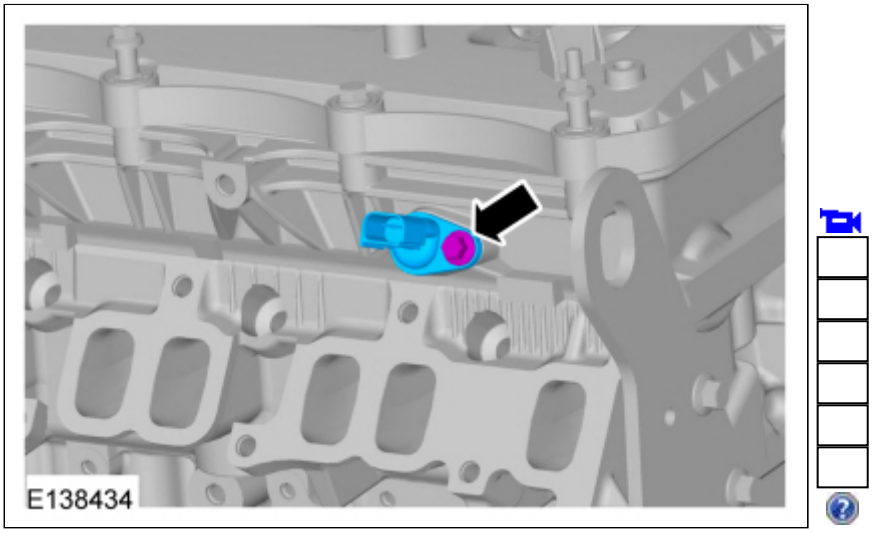
33. **NOTICE: Crankshaft pulley retaining bolts must only be used three times.**

NOTE: *Initially hand tighten the fasteners.*

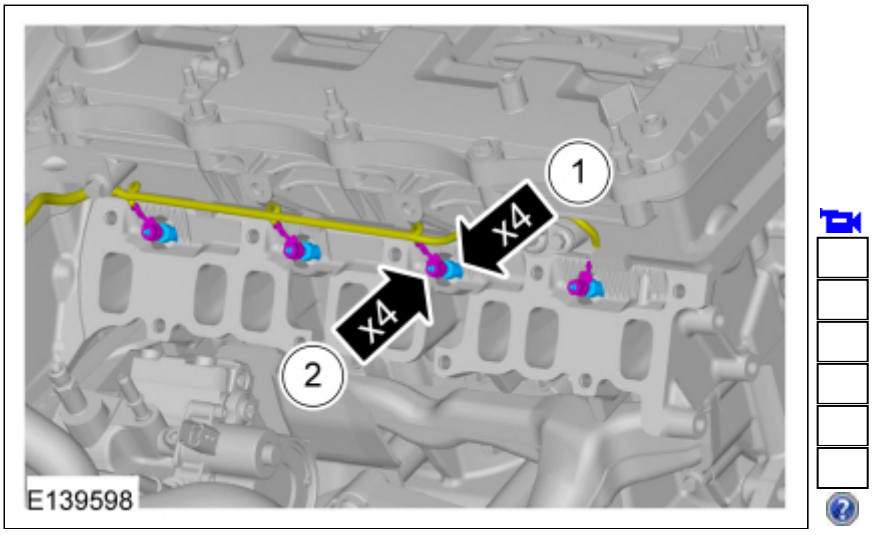
Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
Torque:
Stage 1: 20 Nm
Stage 2: 45 Nm
Stage 3: 90 Nm
Stage 4: 45°



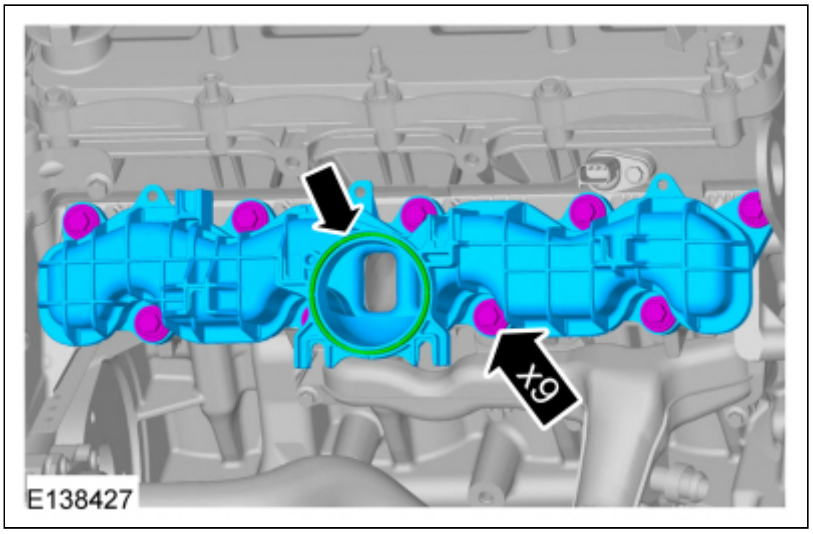
34. *Torque*: 9 Nm



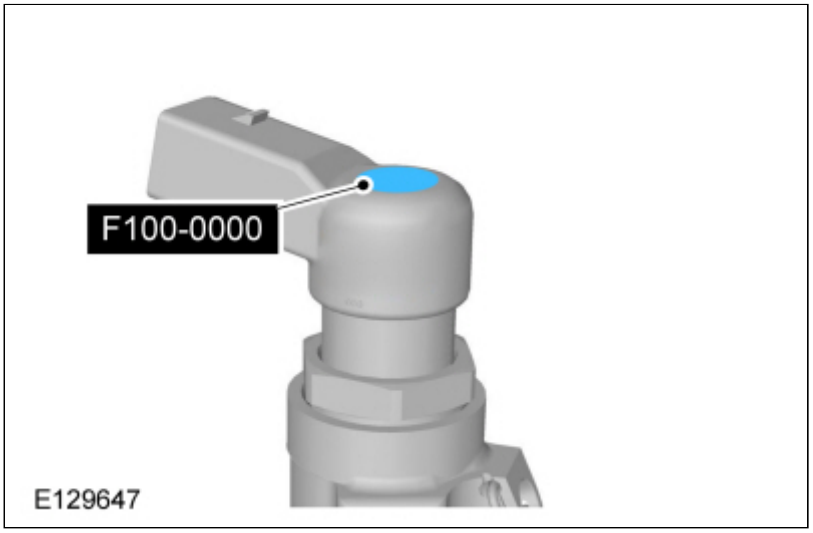
1. *Torque*: 13 Nm
2. *Torque*: 3 Nm



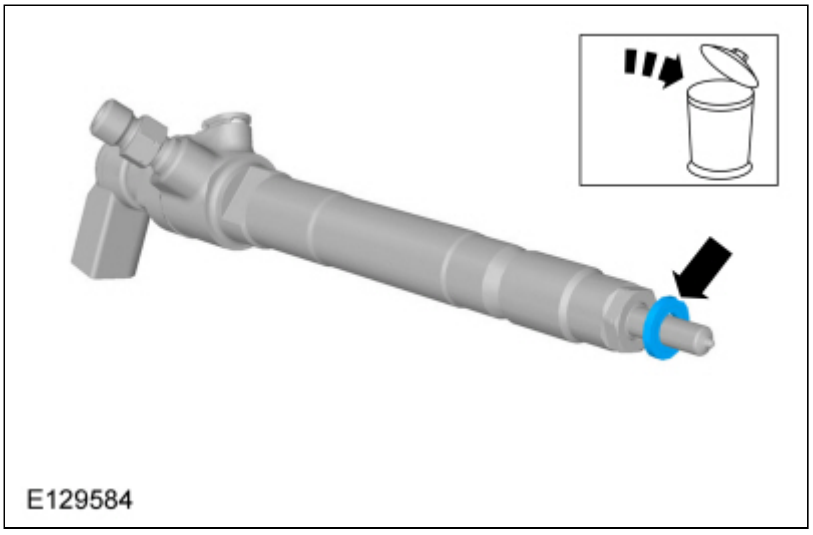
36. *Torque*:
    Stage 1: 5 Nm
    Stage 2: 13 Nm
    Stage 3: 16 Nm



37. Record the new fuel injector correction factor code.

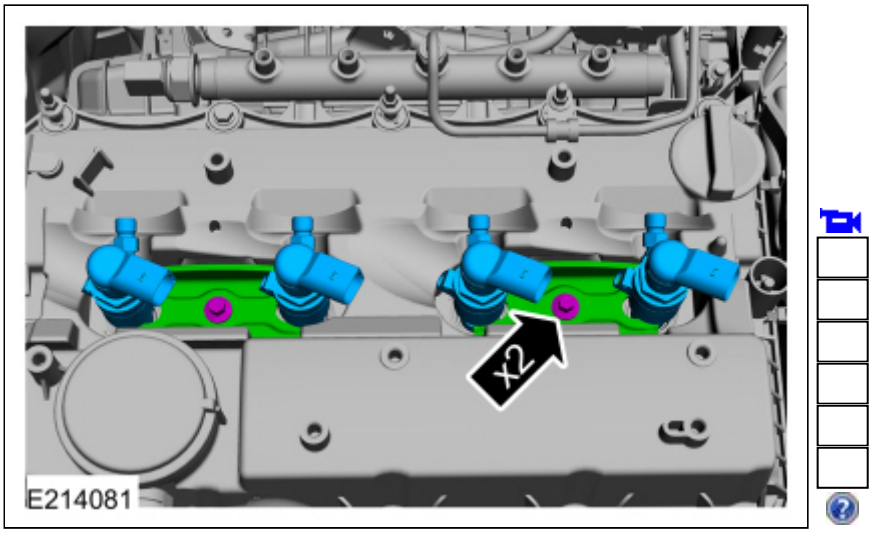


38. **NOTE:** *Using a socket (or similar), press the new fuel injector copper seals onto the fuel injectors making sure that the copper seals are pushed fully home to prevent uneven clamping.*

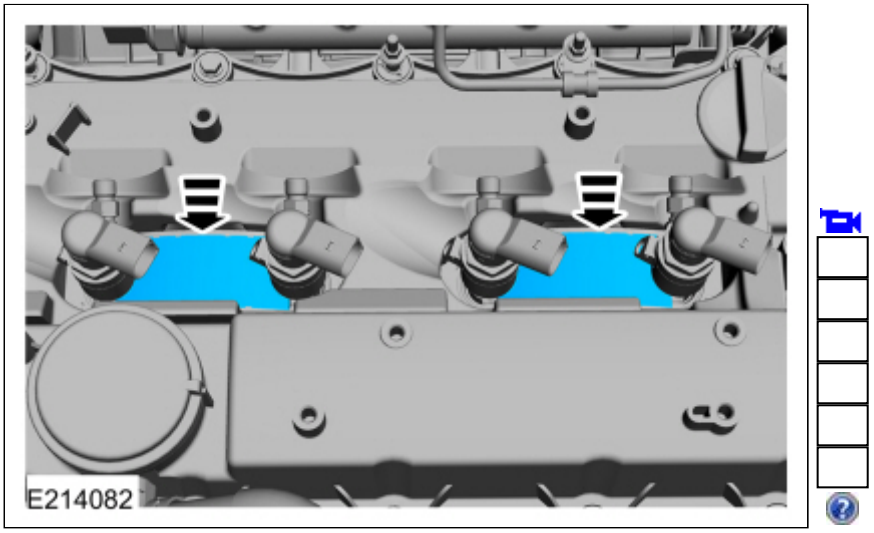


39. **NOTICE: Make sure that new bolts are installed.**

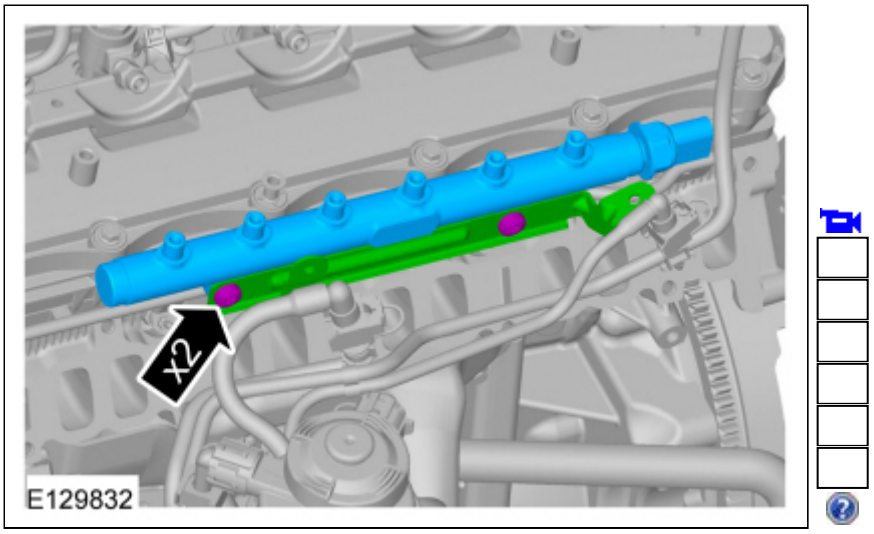
Torque:
Stage 1: 6 Nm
Stage 2: 360°



40. *Torque*: 23 Nm



41. *Torque*: 23 Nm



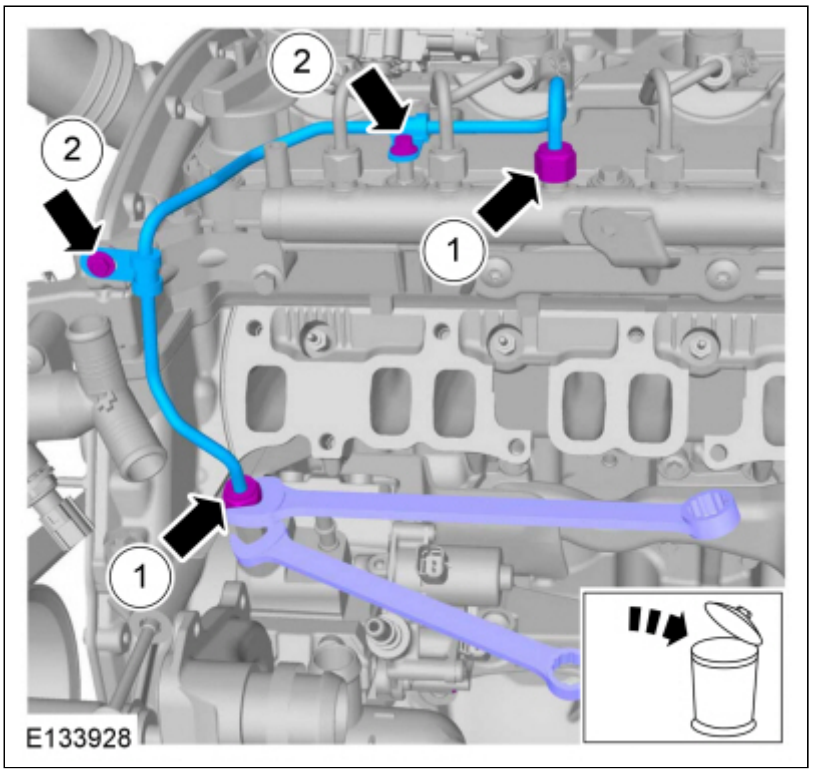
42. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

    NOTICE: Make sure that all openings are sealed. Use new blanking caps.

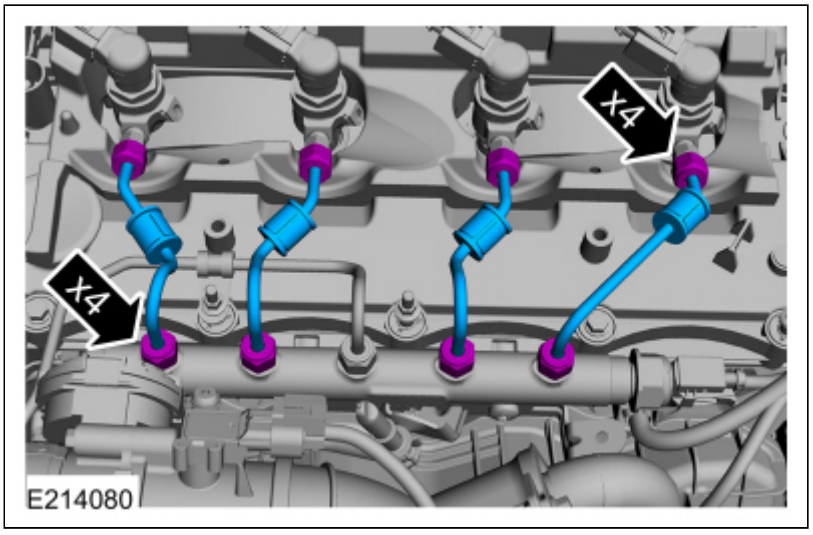
    NOTE: *Vacuum foreign material from the high-pressure fuel supply line, the fuel pump and the fuel rail.*

    1. *Torque*:
       Stage 1: 15 Nm
       Stage 2: 30 Nm

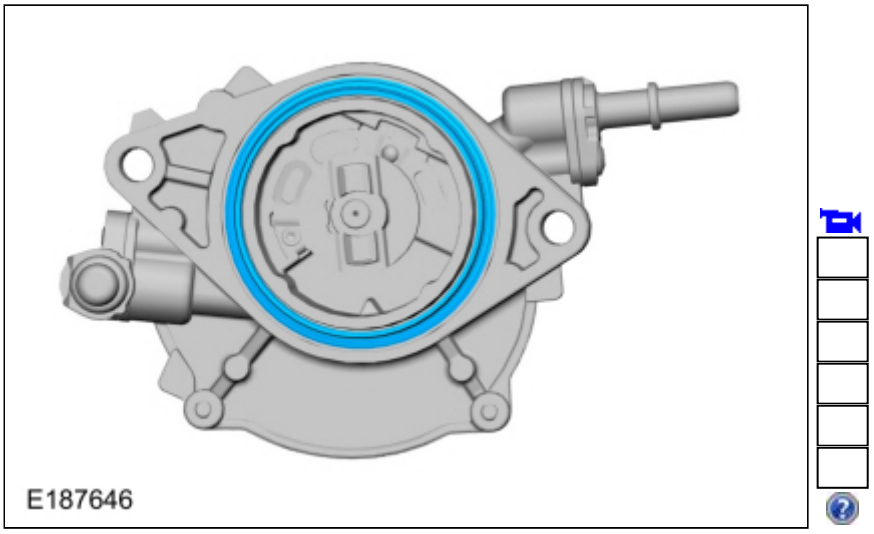
2. Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
Torque: 10 Nm



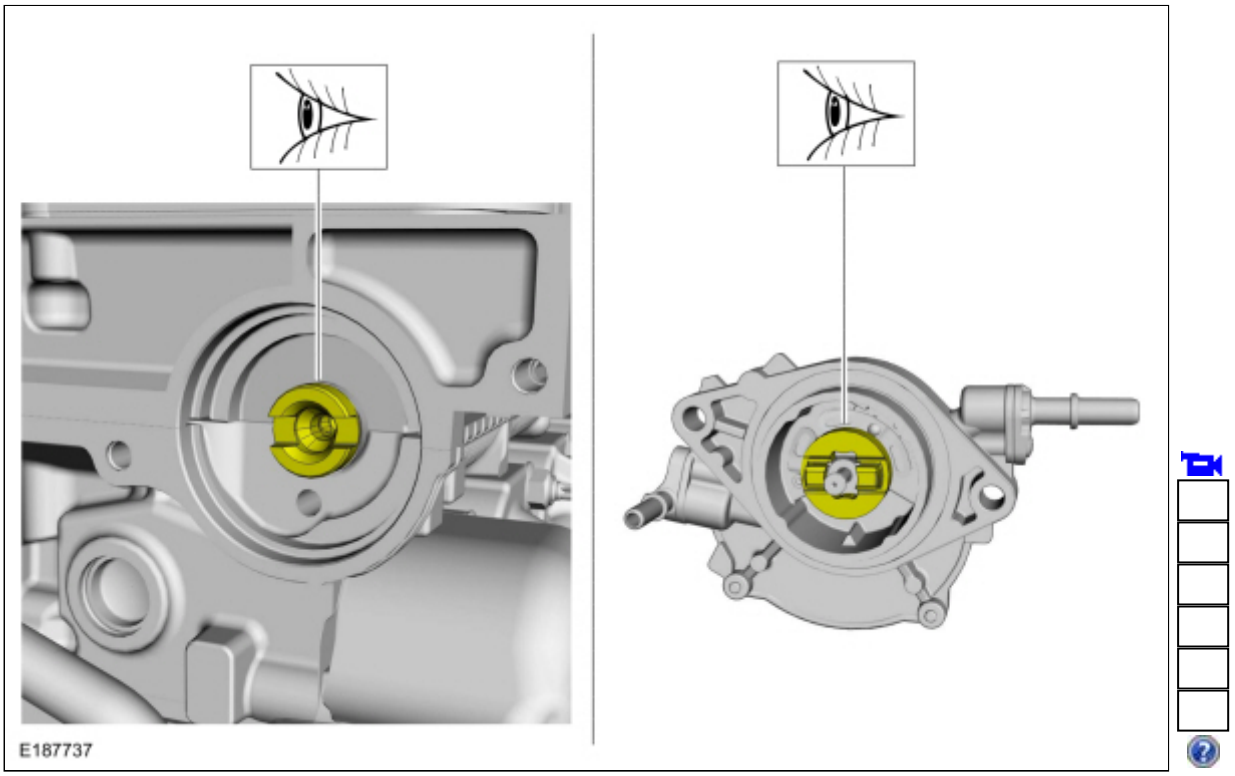
43. *Torque*:
Stage 1: 15 Nm
Stage 2: 30 Nm



44.



45. **NOTICE: Align the camshaft and vacuum pump couplings correctly or damage to the camshaft or vacuum pump may occur.**

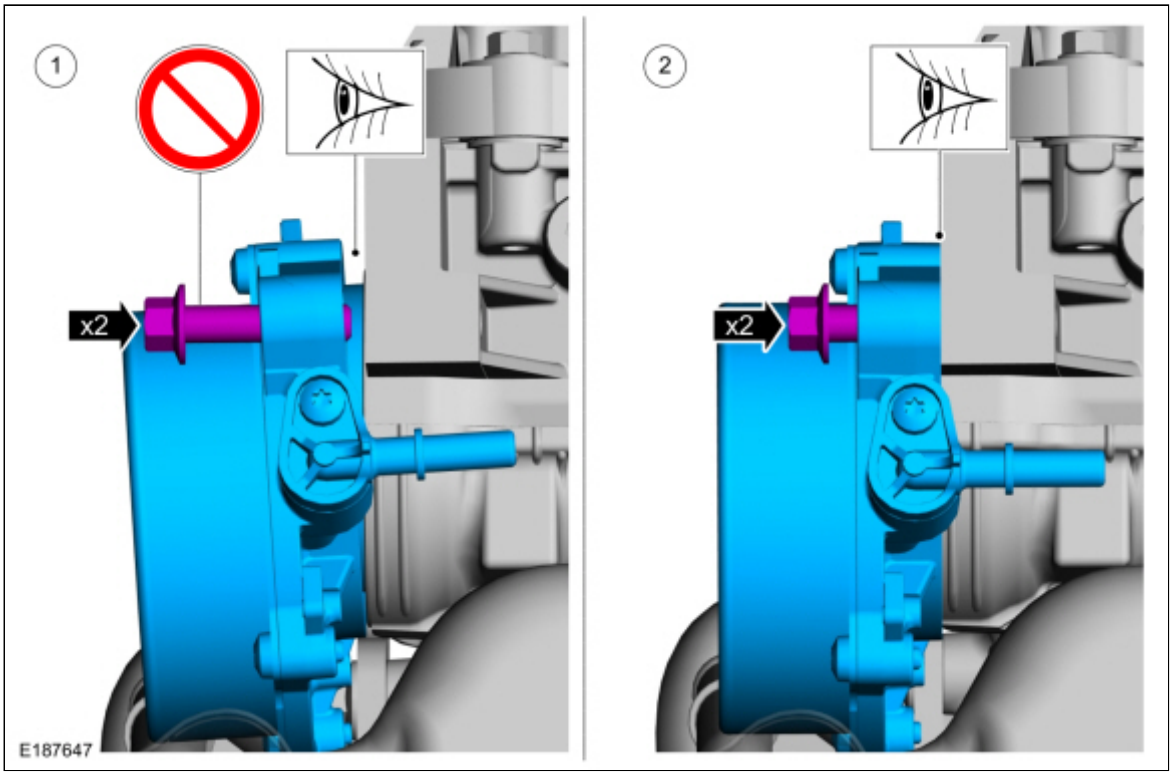


46. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

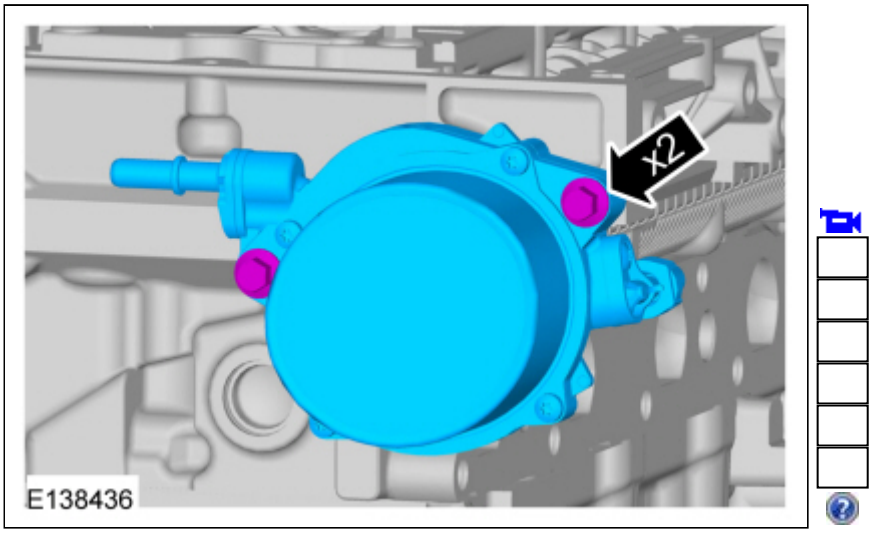
    1. **NOTE:** *Before fitting bolts, check that the vacuum pump couple drive and camshaft keyway are aligned. If a gap is present between vacuum pump and cylinder head, do not fit and run bolts.*

       NOTE: *Under no circumstances should the retaining bolts be tightened if a gap between pump and head faces is present.*

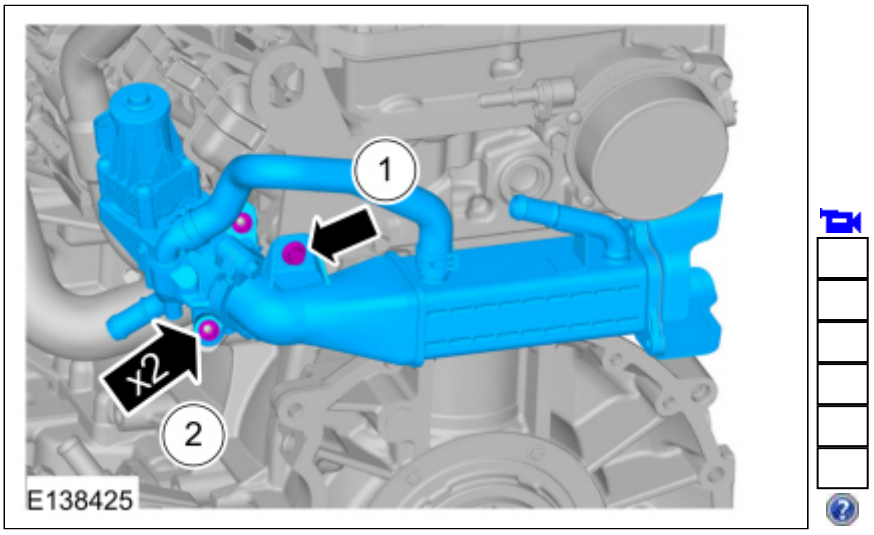
    2. **NOTE:** *Only tighten the bolts finger tight at this stage.*



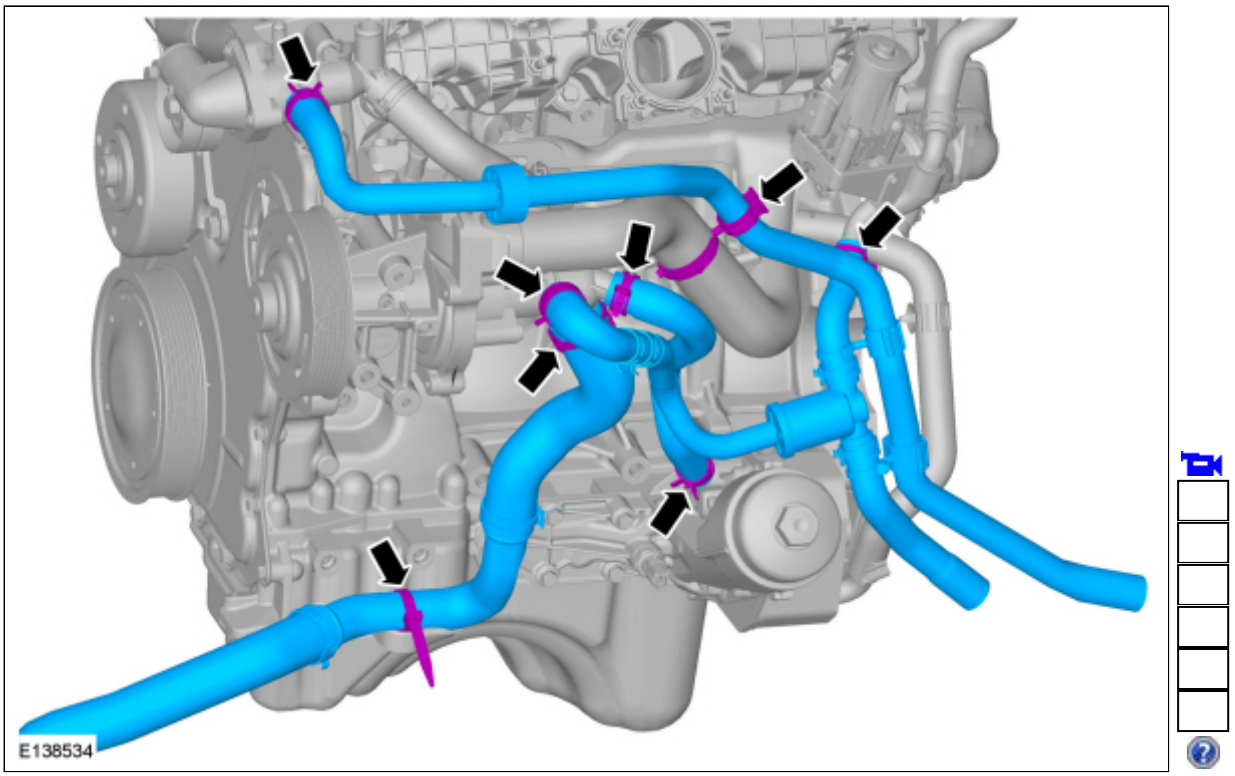
47. *Torque*: 23 Nm



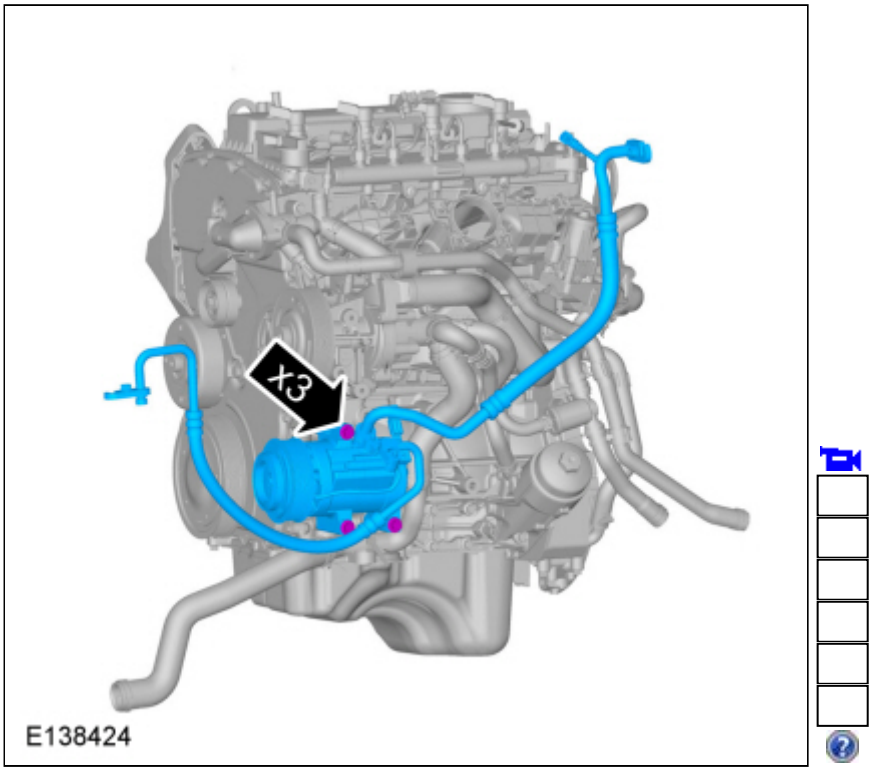
48. *Torque*:
    Stage 1: 5 Nm
    Stage 2: 10 Nm



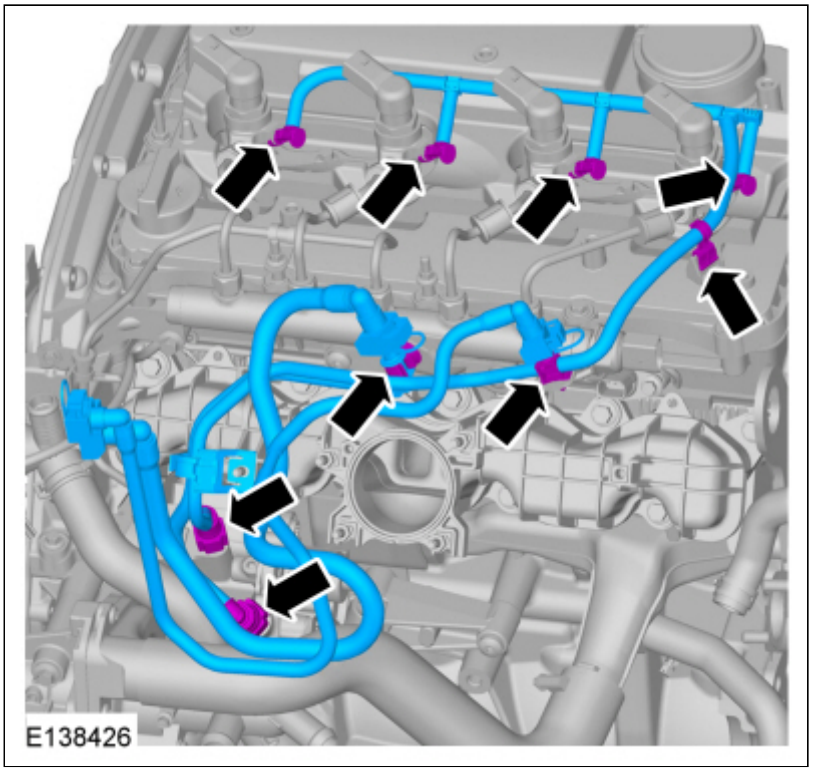
49.



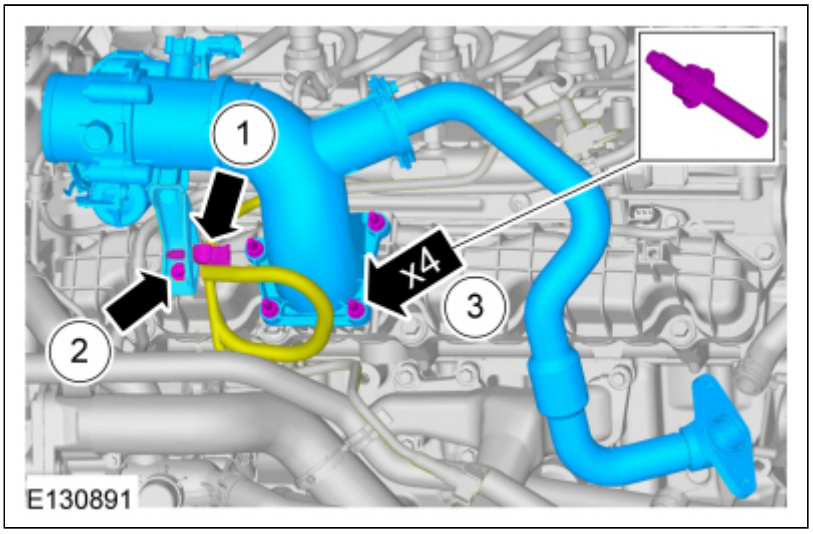
50. *Torque*: 25 Nm



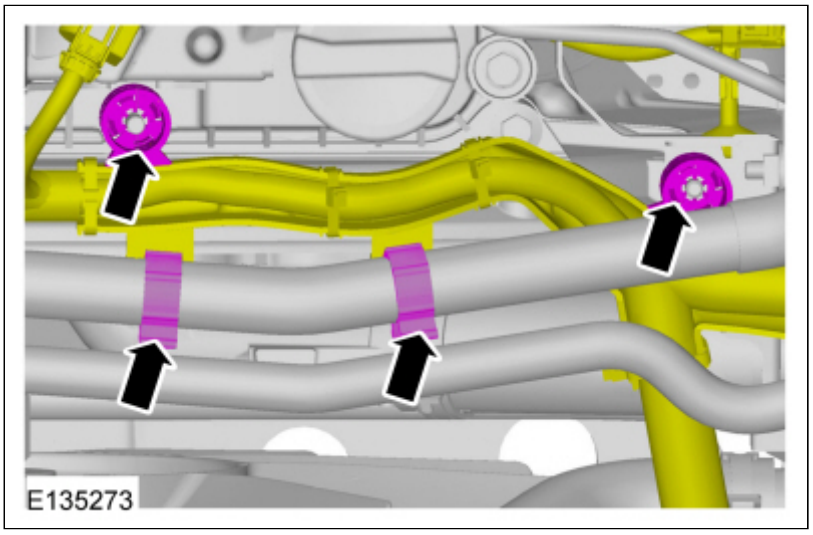
51. **NOTICE: Make sure that all openings are sealed. Use new blanking caps.**



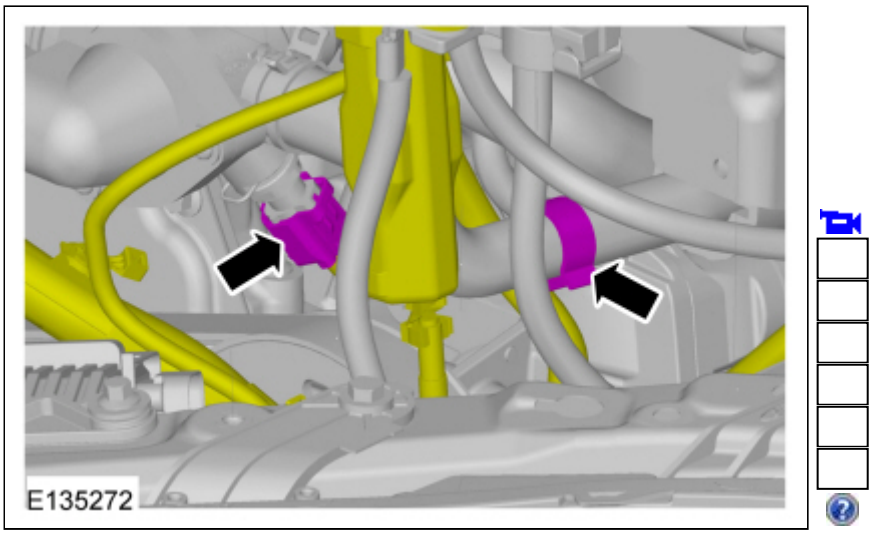
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



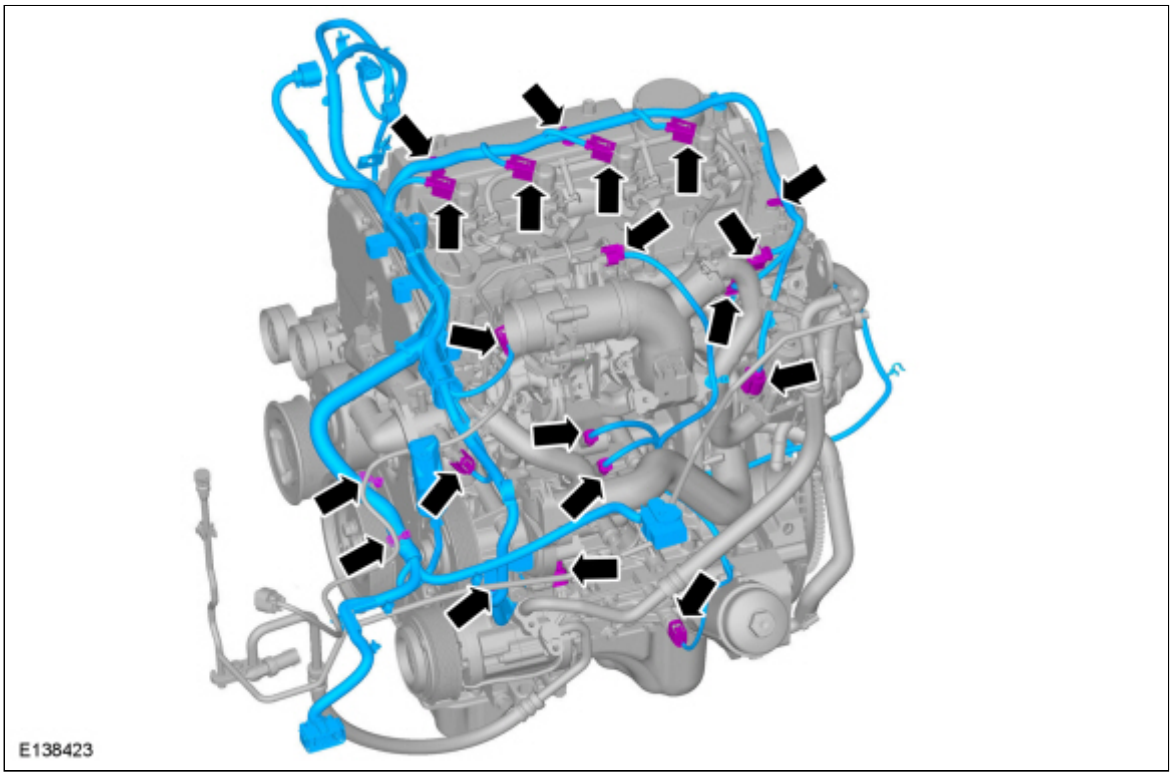
53.



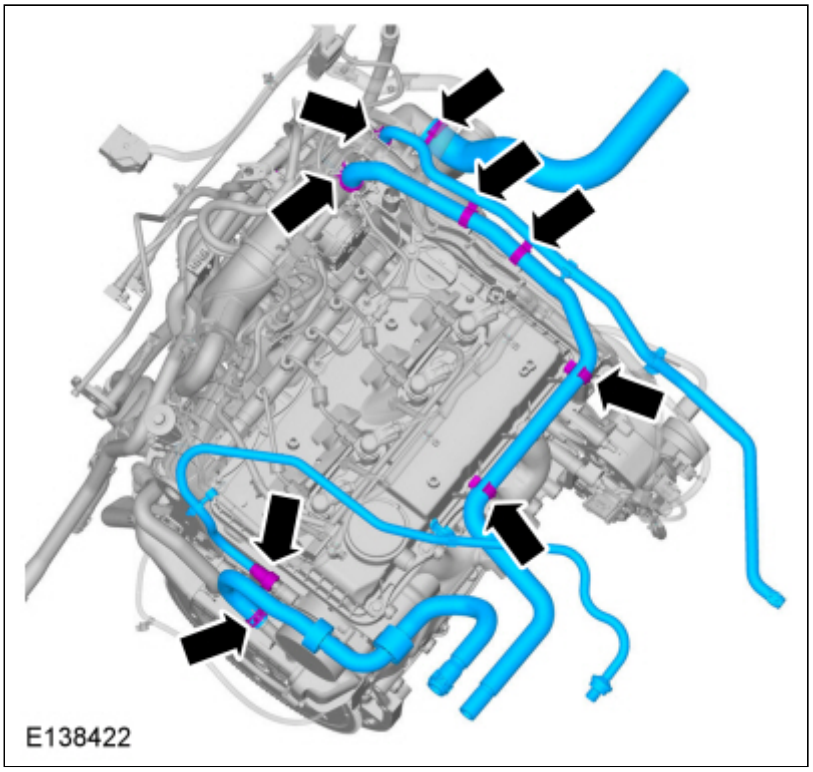
54.



55.

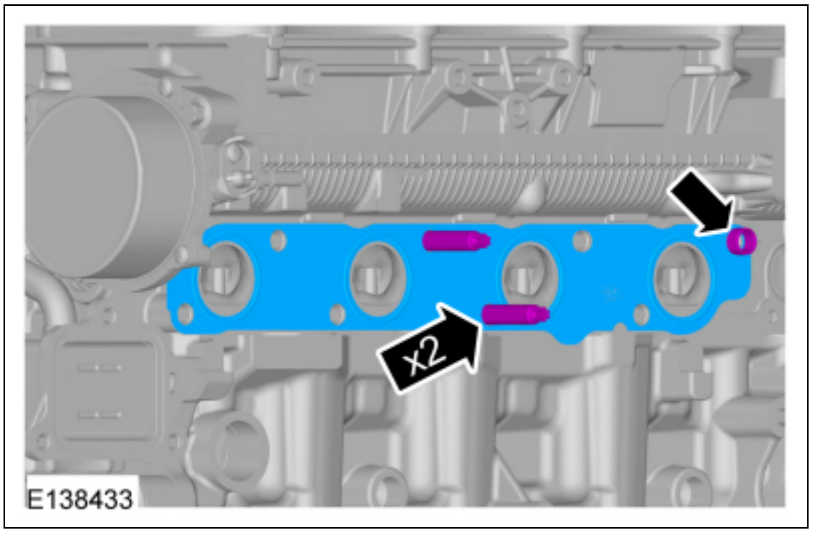


56.

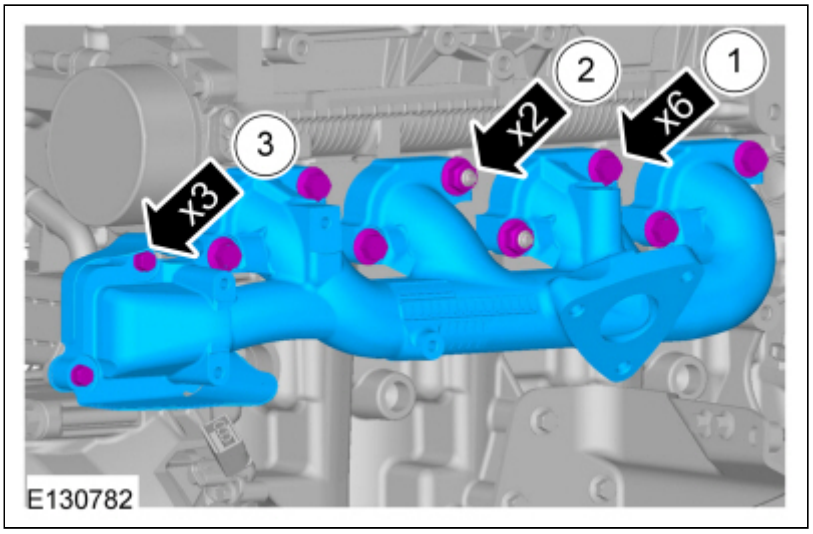


57. **NOTE:** *The gasket is to be reused unless damaged.*

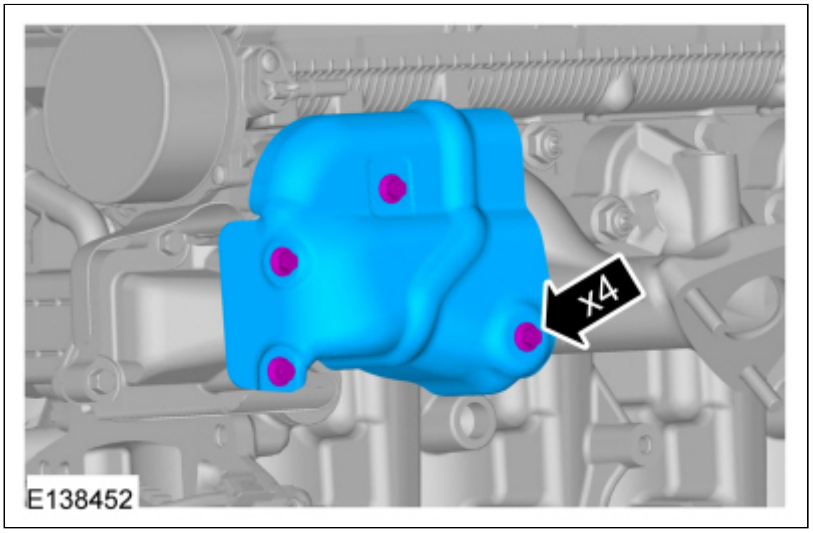
NOTE: *The studs are to be reused unless damaged.*



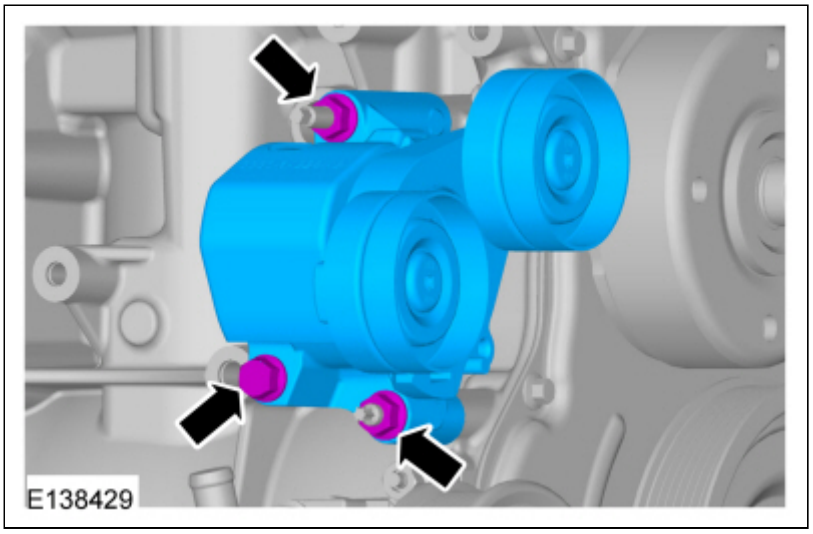
1. *Torque*:
   1:
   Stage 1: 10 Nm
   Stage 2: 20 Nm
   Stage 3: 35 Nm
   2:
   Stage 4: 10 Nm
   Stage 5: 20 Nm
   Stage 6: 35 Nm
   3: 23 Nm



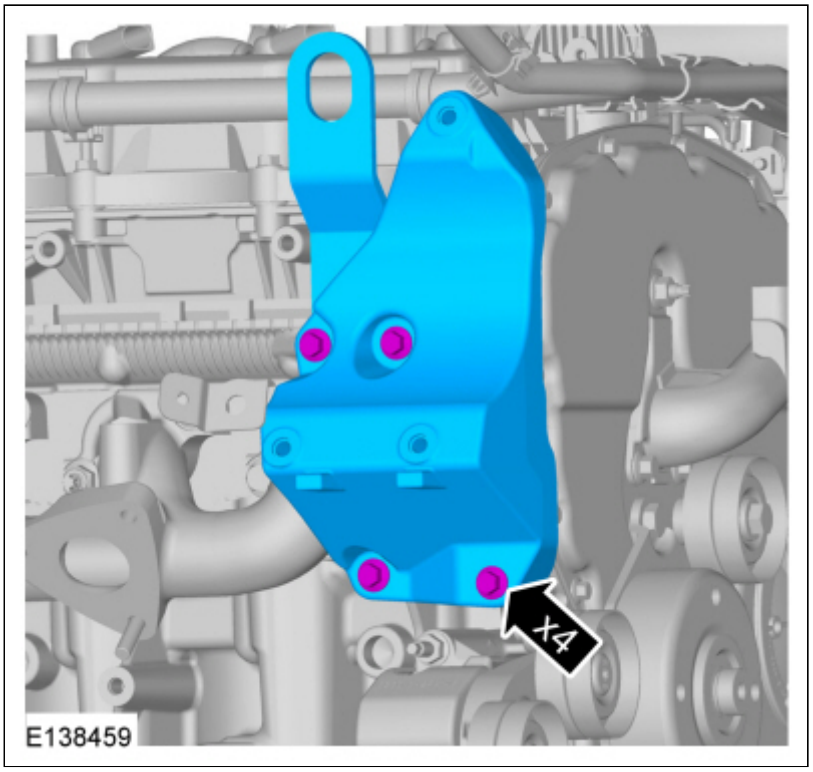
59. *Torque*: 9 Nm



60. *Torque*: 25 Nm

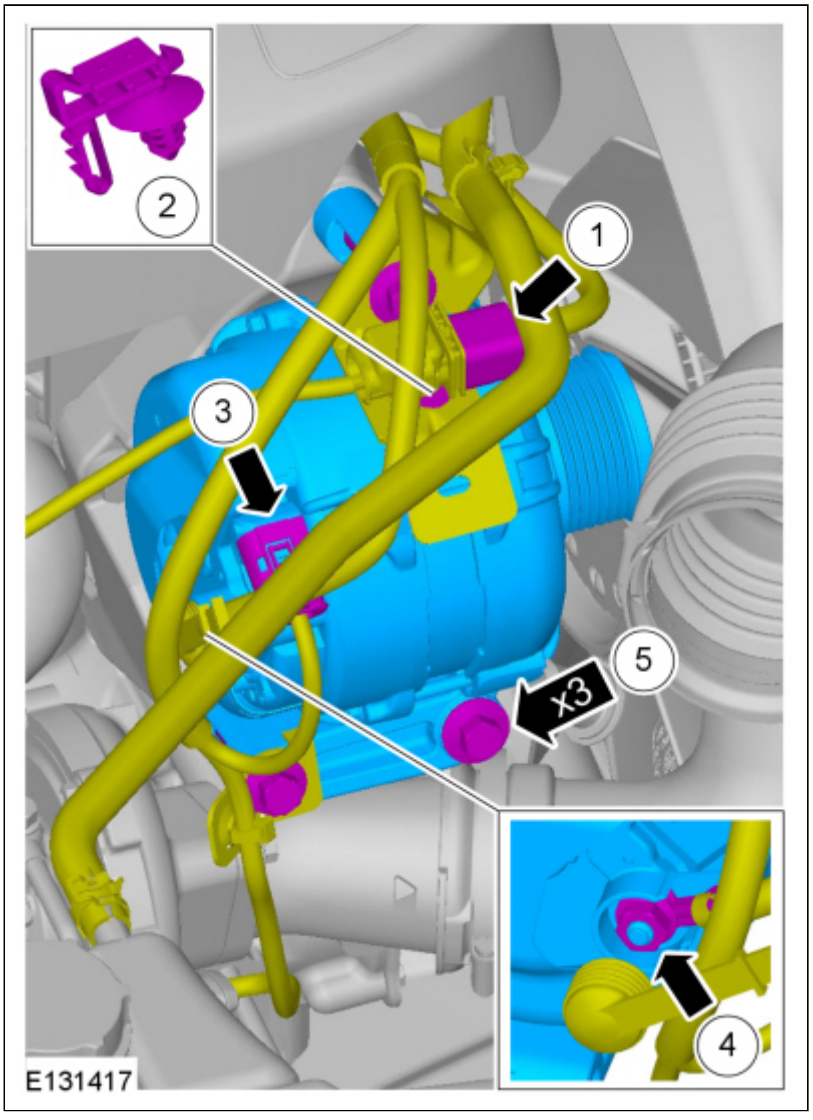


61. *Torque*: 23 Nm



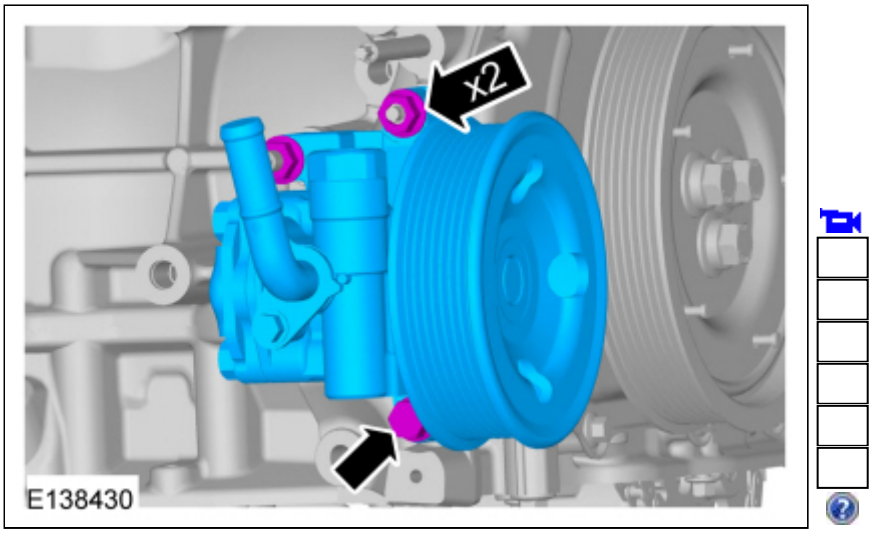
62. **NOTICE: Take extra care not to damage the wiring harnesses.**

4. *Torque*: 15 Nm
5. *Torque*: 48 Nm

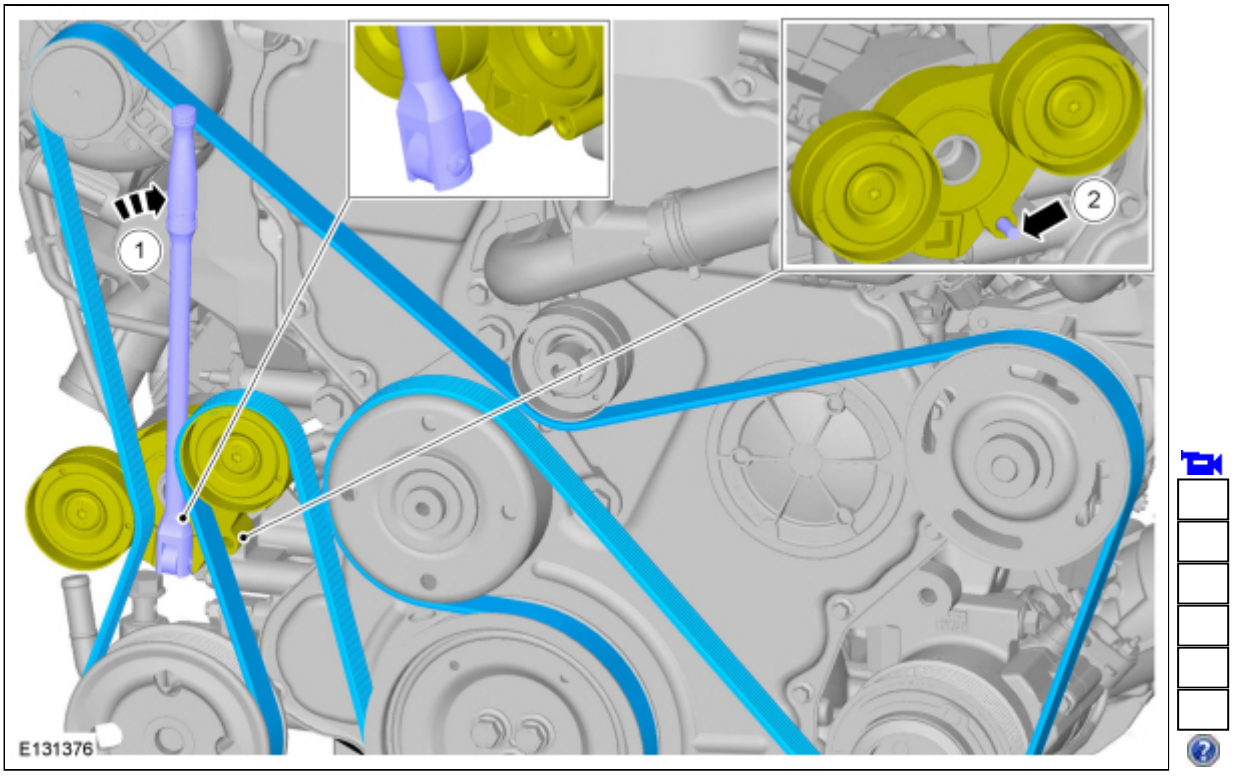


Vehicles With: Hydraulic Power Assist Steering (HPAS)

63. *Torque*: 25 Nm

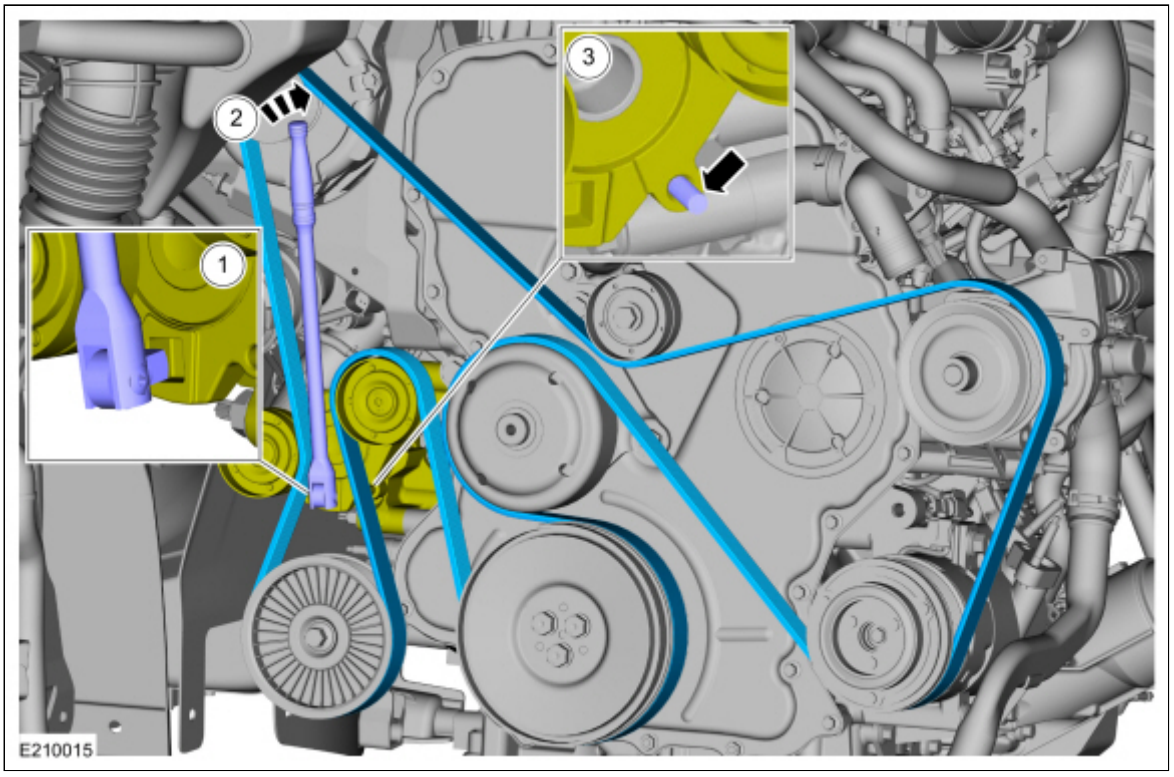


64. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
    Use the General Equipment: Dowel with a Diameter of 6 mm



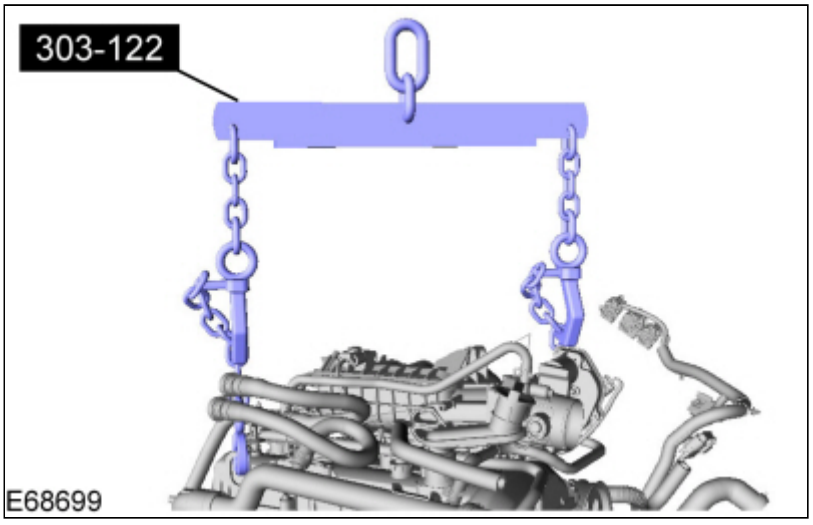
Vehicles With: Electronic Power Assist Steering (EPAS)

1. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. **NOTE:** *Rotate the accessory drive belt tensioner clockwise.*
3. Use the General Equipment: Dowel with a Diameter of 6 mm

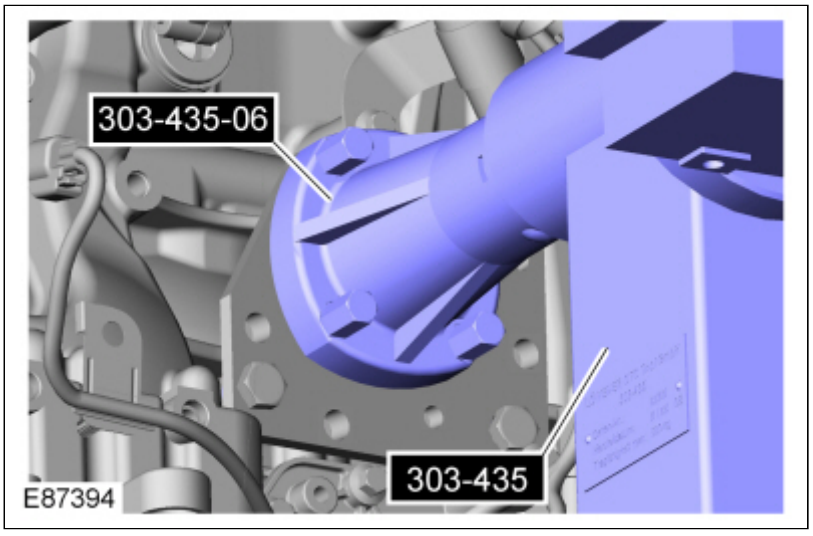


All vehicles

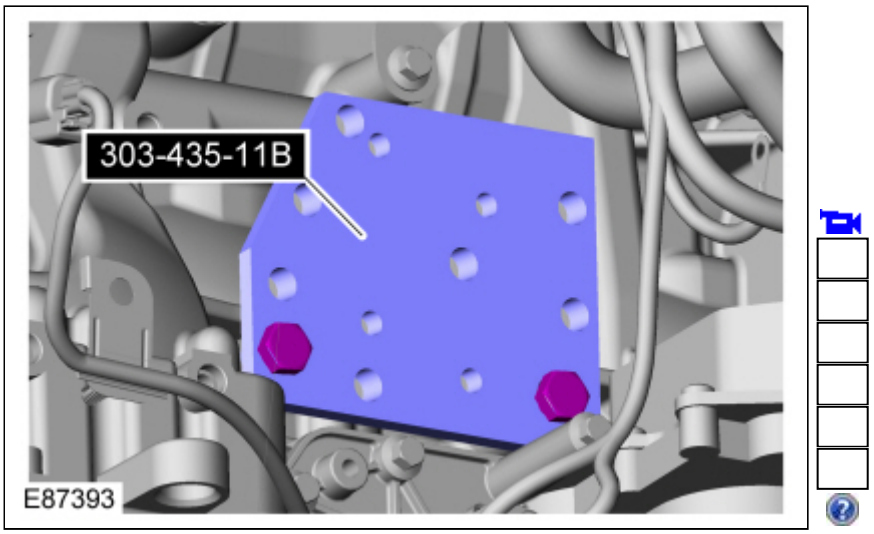
66. Install Special Service Tool: 303-122 Lifting Bracket, Engine.



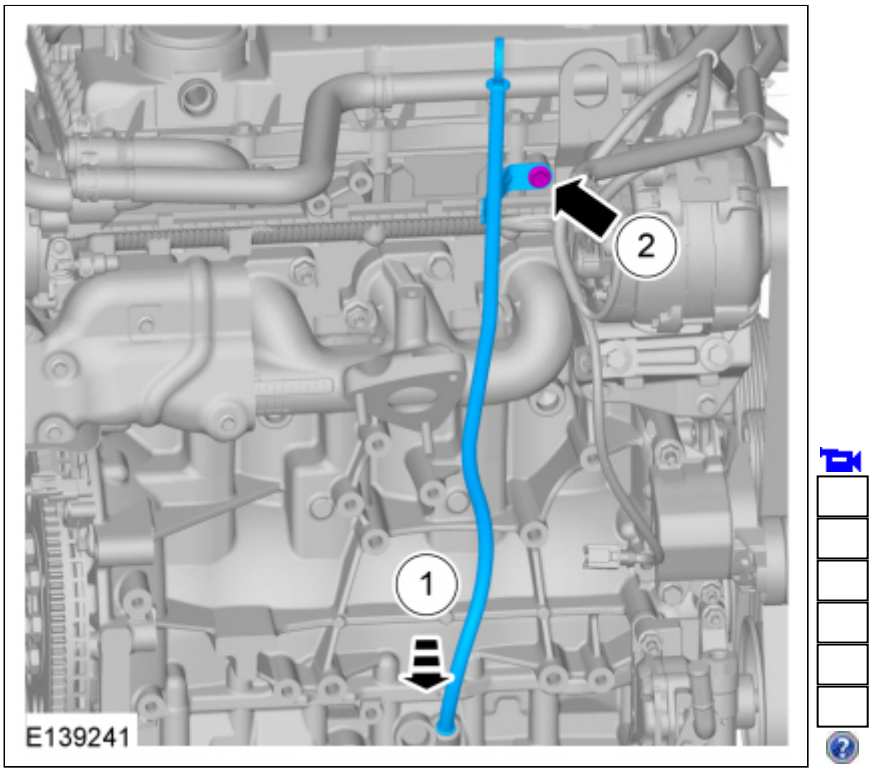
67. Remove Special Service Tool: 303-435-06 Mounting Bracket for 303-435. , 303-435 Mounting Stand.



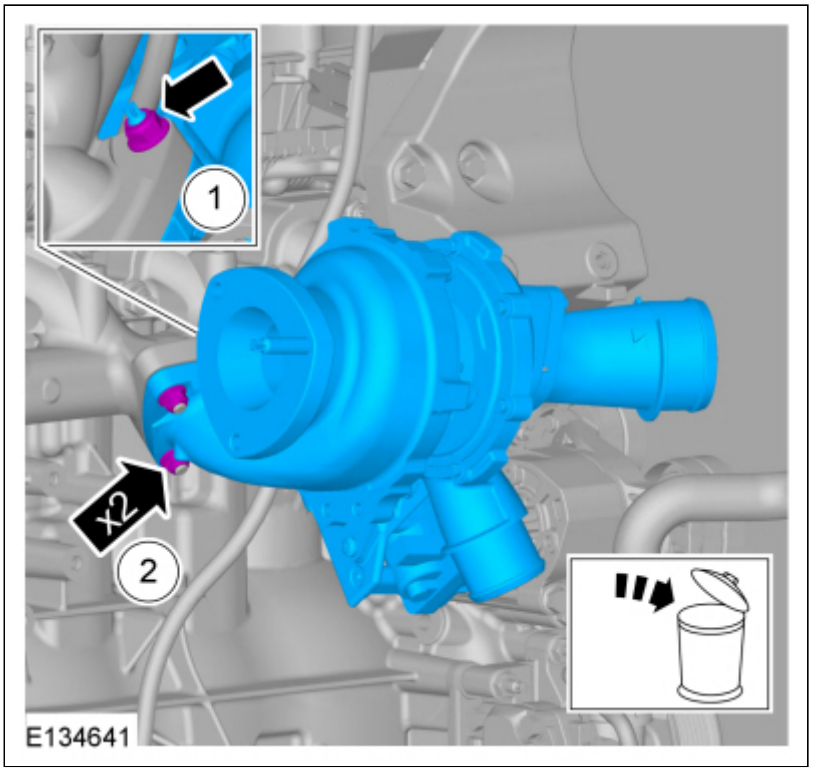
68. Remove Special Service Tool: 303-435-11B Mounting Plate for 303-435-06.



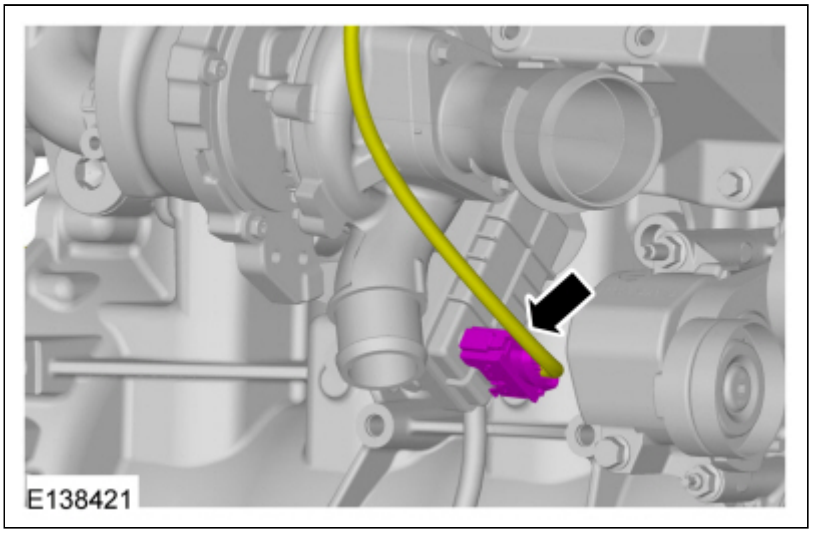
69. *Torque*: 9 Nm



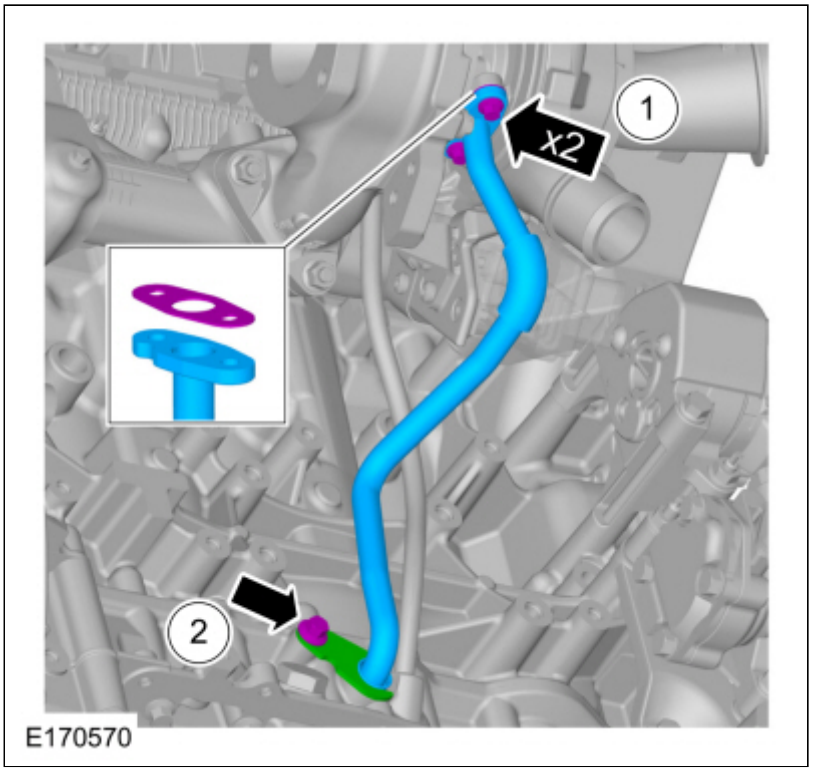
70. *Torque*: 23 Nm



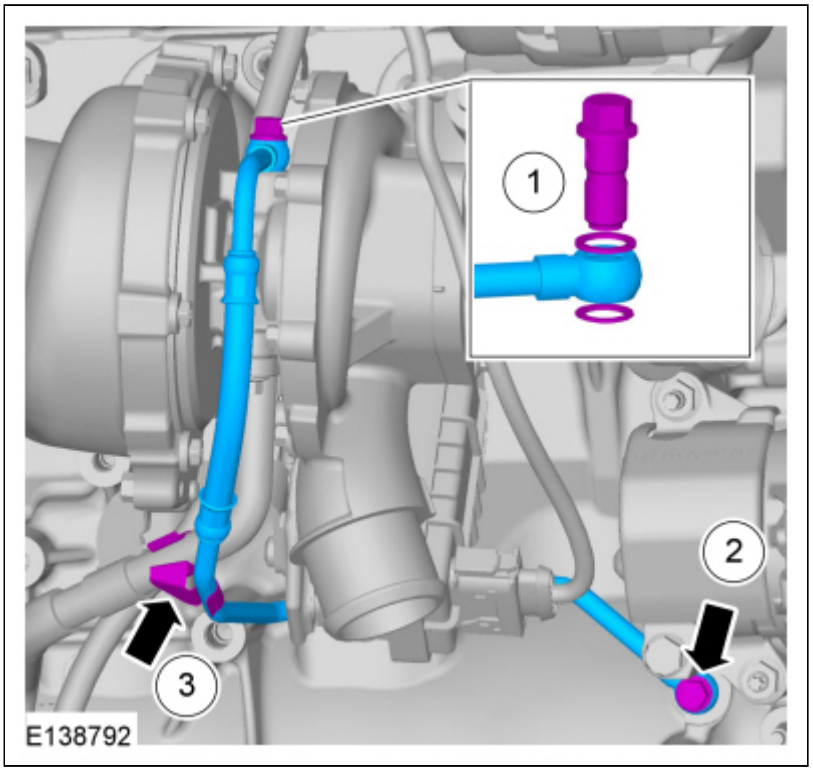
71.



72. *Torque*:
    1: 10 Nm
    2: 23 Nm



1. *Torque*: 35 Nm
2. *Torque*: 32 Nm



Copyright © 2016 Ford Motor Company

Specifications

Engine Data

Description	
Code	ENSA
Firing order	1-2-4-5-3
Bore diameter	89.9 mm
Stroke	100.76 mm
Displacement	3198 cc
Compression ratio	15.6:1
Power output at 3000 rpm	143.5 KW (194 PS)
Torque between 1750 to 2500 rpm	470 Nm
Idle speed	700 rpm
Maximum oil consumption	0.1L / 1000 Km

Engine Oil Capacity

Description	Liters
Initial fill including oil filter	10.1
Service fill including oil filter	9.8
Service fill without oil filter	9.4

Cylinder Block Dimensions

Description	mm
Cylinder bore diameter — Class 1	89.900 - 89.910
Cylinder bore diameter — Class 2	89.910 - 89.920
Cylinder bore diameter — Class 3	89.920 - 89.930
Main bearing shells 1 to 5 inner diameter — bearings installed	64.994 - 65.022
Main bearing shell 6 inner diameter — bearings installed	69.994- 70.022
Main bearings 1 to 5 radial clearance	0.028 - 0.072
Main bearing 6 radial clearance	0.028 - 0.072
Main bearings 1 to 5 parent bore diameter — vertical measurement	69.504 - 64.520
Main bearing 6 parent bore diameter — vertical measurement	74.504 - 74.520
Main bearings 1 to 5 parent bore diameter — horizontal measurement	69.502 - 69.525
Main bearing 6 parent bore diameter — horizontal measurement	74.502 - 74.525

Piston Dimensions

Description	mm
Piston diameter	89.850 - 89.934
Piston clearance in cylinder	0.05-0.086
Piston ring end gaps	
— upper compression ring	0.25-0.35
— lower compression ring	0.50 - 0.75
— oil control ring	0.25 - 0.50

Piston ring gap position: The piston ring end gaps must be distributed evenly around the circumference of the piston. This also applies to the oil control ring elements. Align the piston ring end gaps at 120 degrees to each other.

Crankshaft Dimensions

Description	mm
Main bearing journal end float	0.090 - 0.305
Main bearing journals 1 to 5 diameter	64.950 - 64.970
Main bearing journal 6 diameter	69.950 - 69.970
Connecting rod bearing journal diameter	52.980 - 53.000

Connecting Rod Dimensions

Description	mm
Bearing clearance	0.04-0.09
Large end bore diameter	55.996 - 56.016
Small end bore diameter	32.010 - 32.018
Connecting rod bearing shell inner diameter — bearings installed	53.016 - 53.046
Connecting rod bearing radial clearance	0.026 - 0.084
Connecting rod bearing axial clearance	0.100 - 0.320

Connecting Rod Grade Selection

Crank Pin to Cylinder Head Face 'X' (mm)	Connecting Rod Grade	Connecting Rod Length (mm)
173.180-173.209	A	151.915-151.964 (151.94)
173.210-173.255	B	151.965-152.035 (152.00)
173.256-173.259	A	151.915-151.964 (151.94)
173.260-173.330	B	151.965-152.035 (152.00)
173.331-173.335	C	152.036-152.095 (152.06)
173.336-173.380	B	151.965-152.035 (152.00)
173.381-173.415	C	152.036-152.095 (152.06)

173.381-173.415	C	152.036-152.095 (152.06)

Piston Pin Dimensions

Description	mm
Piston pin length	73.8-74.1
Piston pin diameter	31.995-32.001
Piston pin slide clearance	0.012-0.023

Camshaft Dimensions

Description	mm
Camshaft end float	0.014 - 0.200
Camshaft bearing journal diameter	26.440 - 26.465
Camshaft bearing clearance — radial measurement	0.04 - 0.09

Valve Dimensions

Description	mm
Valve stem to valve guide clearance — intake valve	0.0625 - 0.0275
Valve stem to valve guide clearance — exhaust valve	0.0725 - 0.0375
Valve seat width	26

Cylinder Head Dimensions

Description	mm
Maximum distortion over 25 mm — measured longitudinally and diagonally	0.025
Maximum distortion over 150 mm — measured longitudinally and diagonally	0.050
Maximum distortion over distance in excess of 150 mm — measured longitudinally and diagonally	0.10
Peak to valley height of mating surface	0.01
Cylinder head gasket thickness Piston protrusion of 0.430 - 0.520 mm Piston protrusion of 0.521 - 0.570 mm	 1.1 (one hole/tooth) 1.15 (two holes/teeth)
Piston protrusion of 0.571-0.620 mm	1.2 (three holes/teeth)

Oil Pressure Specifications

Description	bar
Minimum oil pressure at idle speed	1.25
Minimum oil pressure at 2000 rpm	2.5

Lubricants, Fluids, Sealers and Adhesives (for markets with low sulphur content less than 350 ppm)

Item	Specification
Engine Oil	WSS-M2C913-C
Engine Oil	WSS-M2C913-D
Sealer — oil pan, camshaft carrier and engine front cover	WSE-M4G323-A4

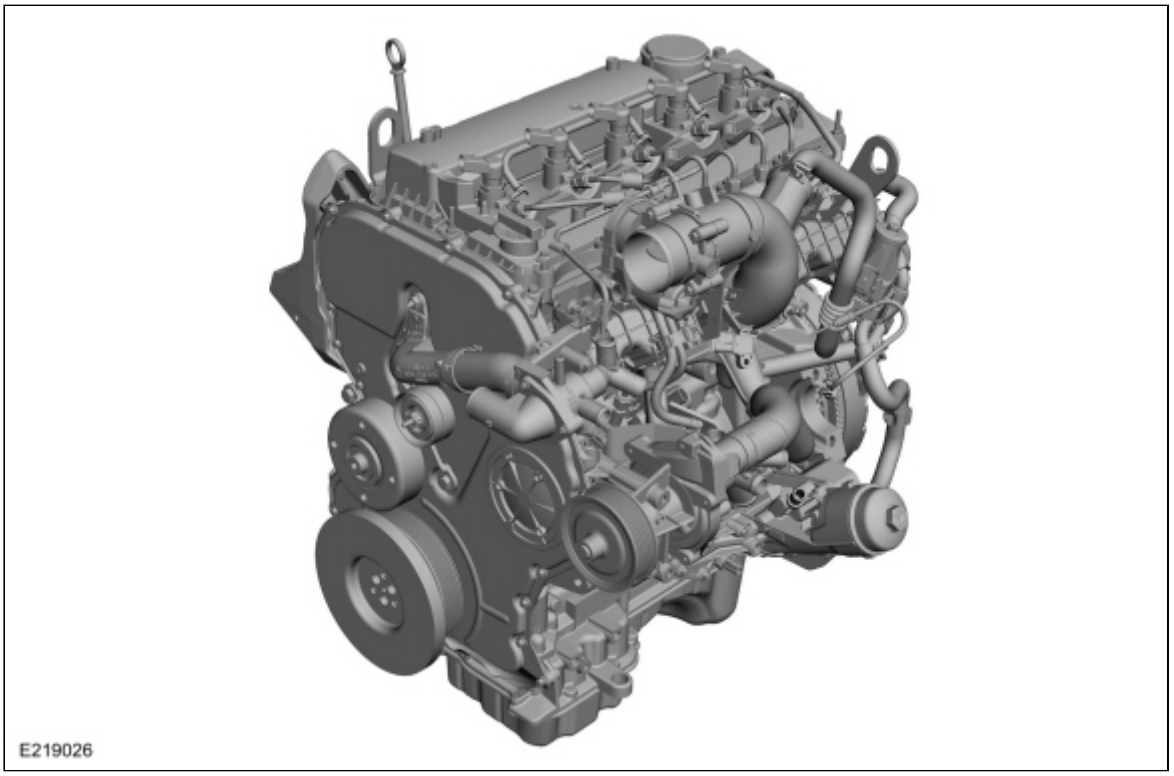
Lubricants, Fluids, Sealers and Adhesives (for markets with high sulphur content greater than 350 ppm)

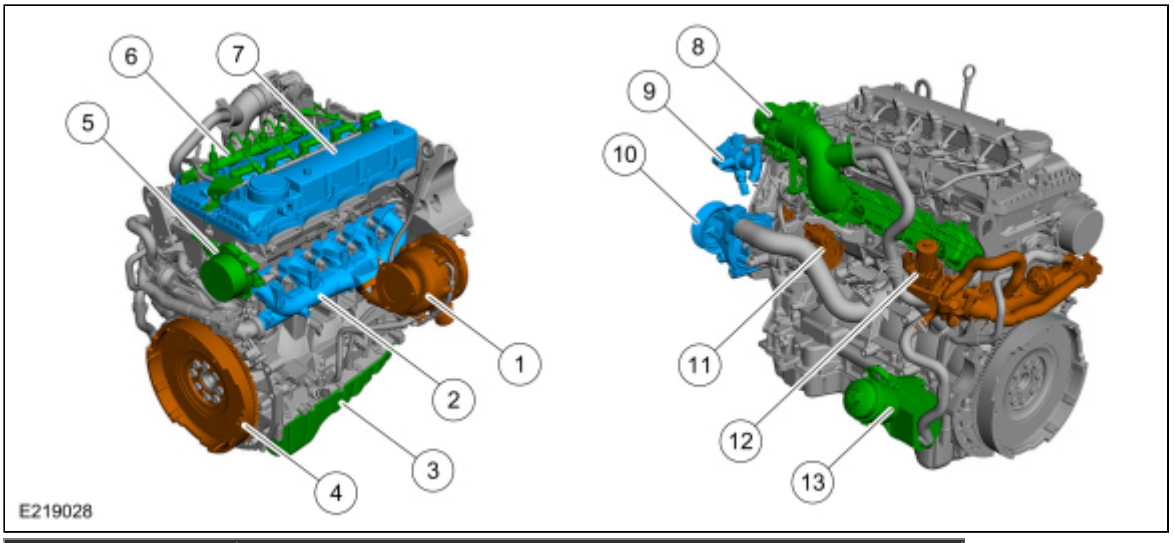
Item	Specification
Engine Oil	WSS-M2C921-A
Engine Oil	WSS-M2C913-D
Sealer — oil pan, camshaft carrier and engine front cover	WSE-M4G323-A4

Copyright © 2016 Ford Motor Company

Engine - Component Location

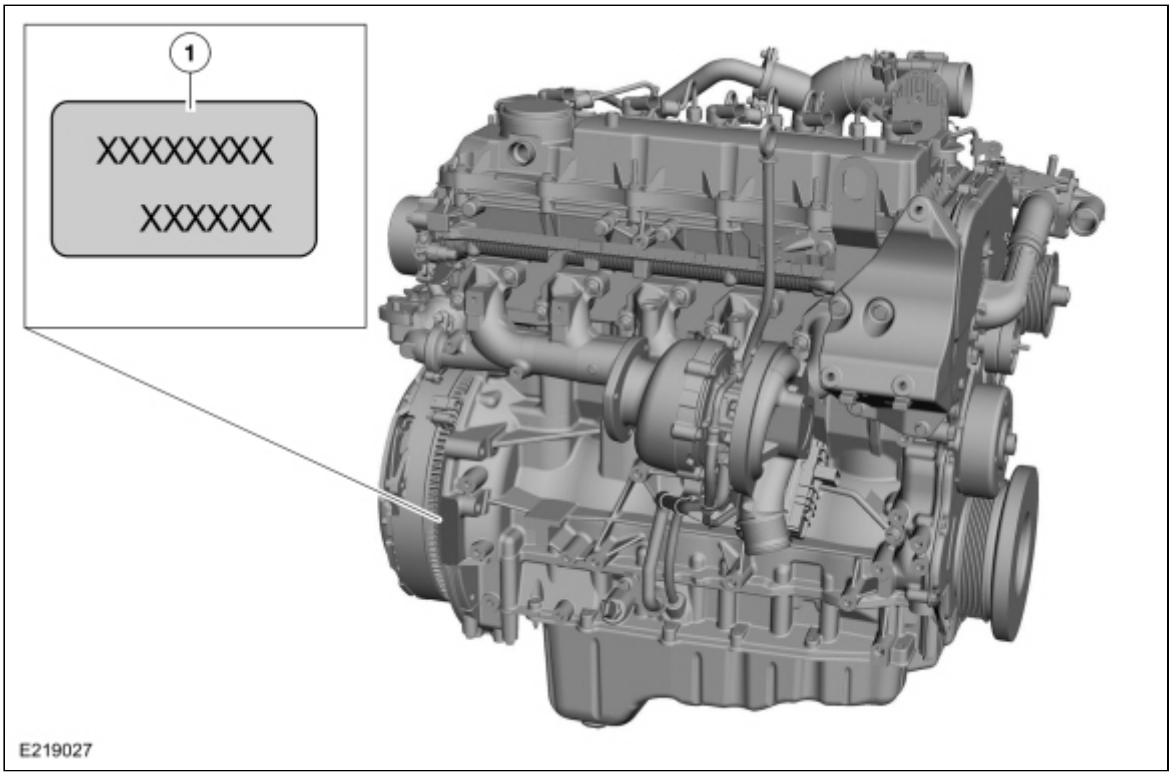
Base Part Number: 6L084





Item	Description
1	Turbocharger
2	Exhaust manifold
3	Oil pan
4	Flywheel
5	Vacuum pump
6	Fuel rail
7	Valve cover
8	Intake manifold
9	Thermostat

10	Coolant pump
11	Fuel pump
12	EGR valve
13	Oil cooler



Item	Description
1	VIN (Vehicle identification number)

Copyright © 2016 Ford Motor Company

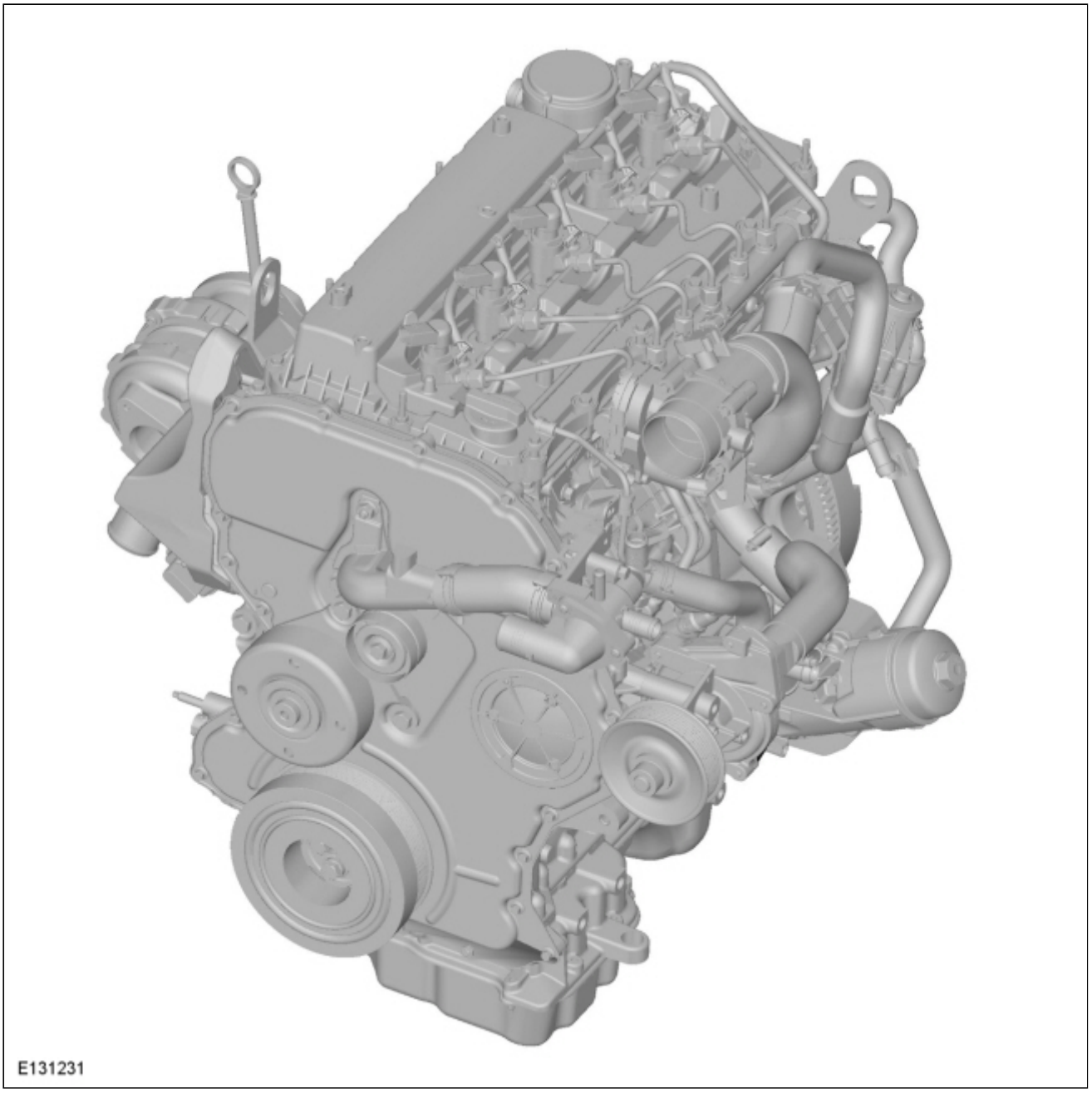
Engine - Overview

Base Part Number: 6L084

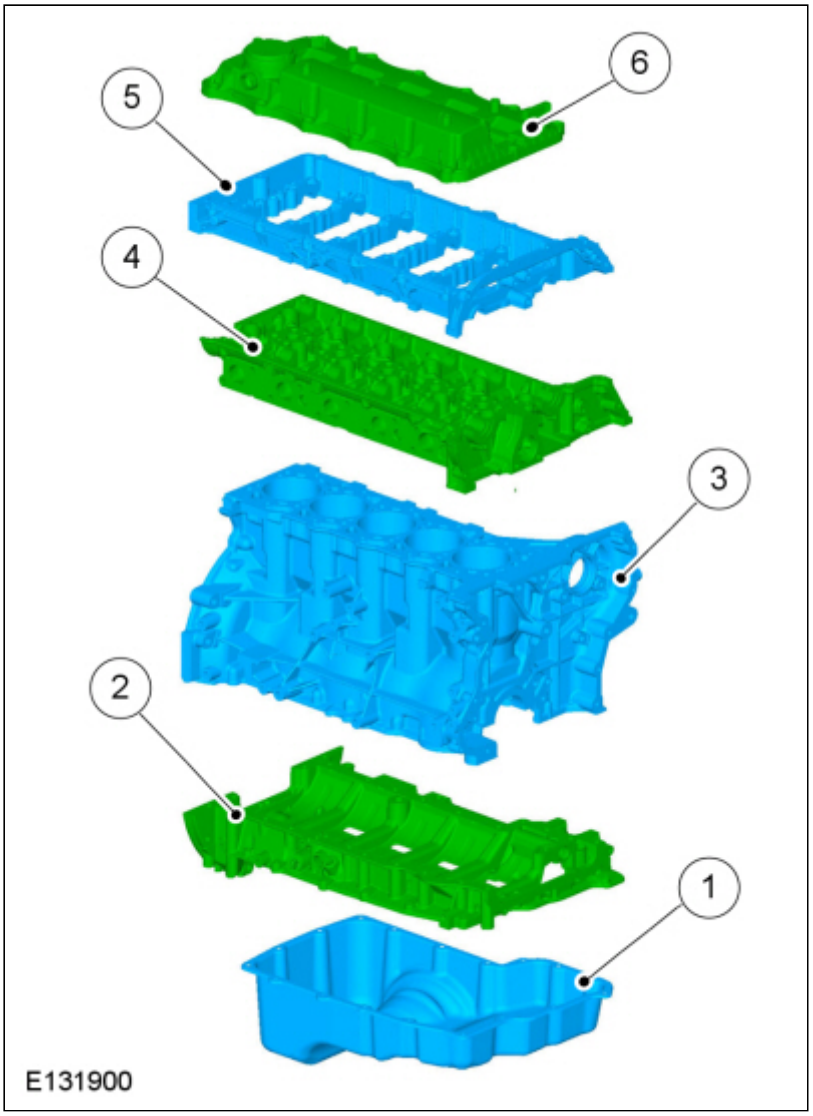
General View

- The 3.2L Duratorq-TDCi (Puma) diesel engine is a five-cylinder inline engine which delivers a power of 147kW (200 PS).
- The engine is additionally equipped with an oil level/oil temperature sensor .
- The cylinder head consists of two parts and is made of aluminum. Both parts are bolted to each other.
- The lower part contains four valves for each combustion chamber and the two camshafts.
- The upper part houses the rocker arm frame with the roller rocker arms. The hydraulic valve clearance adjustment is integrated in the roller rocker arms.
- The camshafts and the fuel injection pump are driven by the crankshaft via the timing chain.
- The oil pump is located inside the oil pan and is driven by the crankshaft via a chain.

NOTE: *Cylinder 1 is located on the timing chain end.*

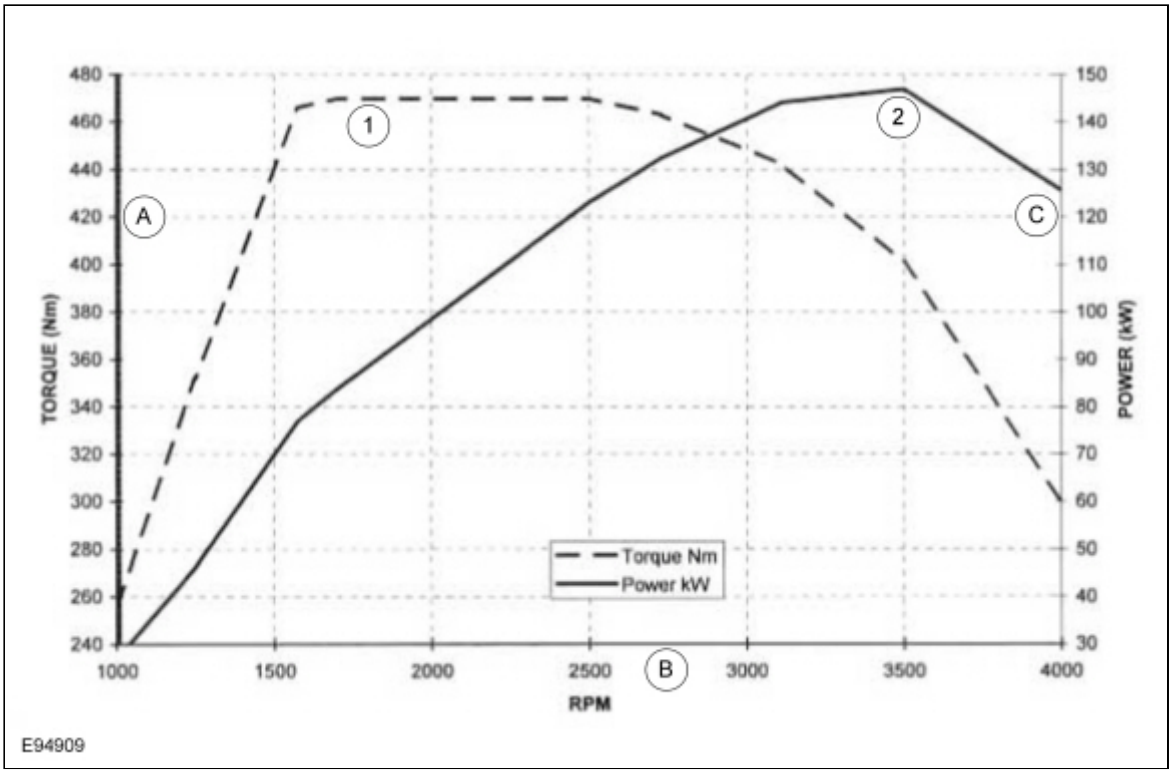


Engine overview



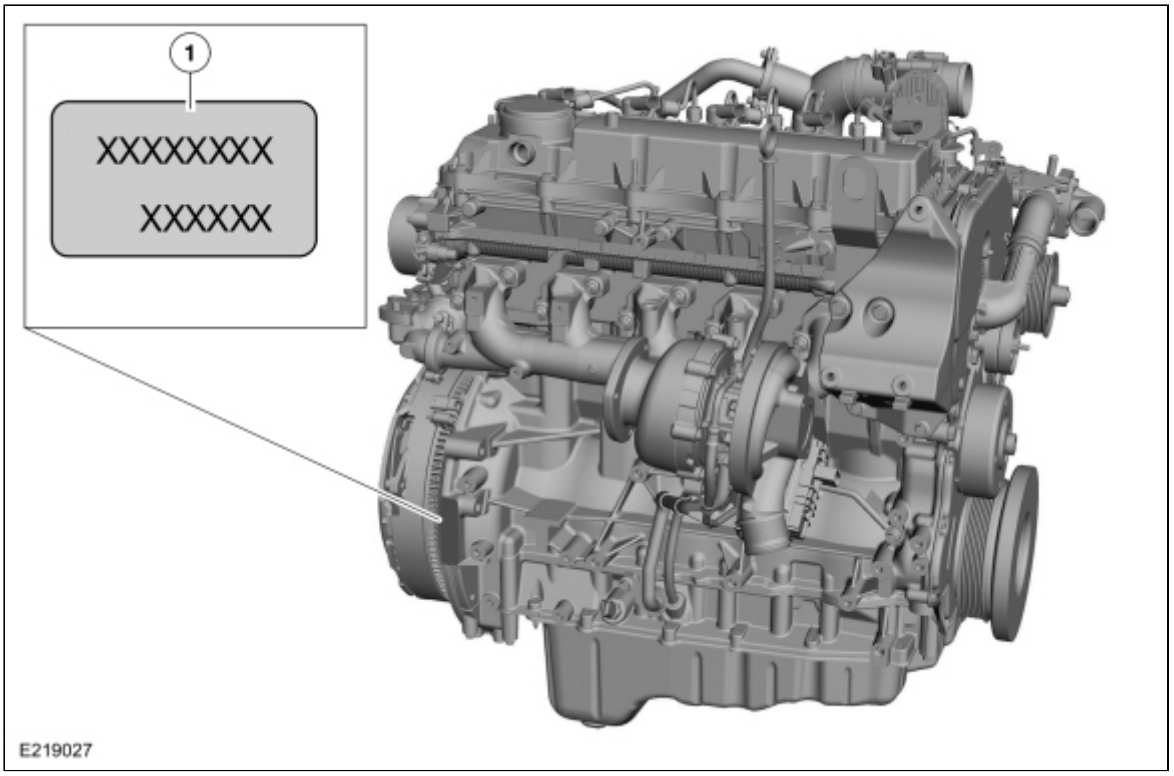
Item	Description
1	Oil pan
2	Oil pan extension
3	Cylinder block
4	Cylinder head lower part
5	Cylinder head upper part
6	Valve cover

Power and torque curves



Item	Description
A	Torque (Nm)
B	Engine speed (rpm)
C	Power (kW)
1	Torque curve for the 147 kW engine (200 PS)
2	Power curve for the 147 kW engine (200 PS)

Engine type identification

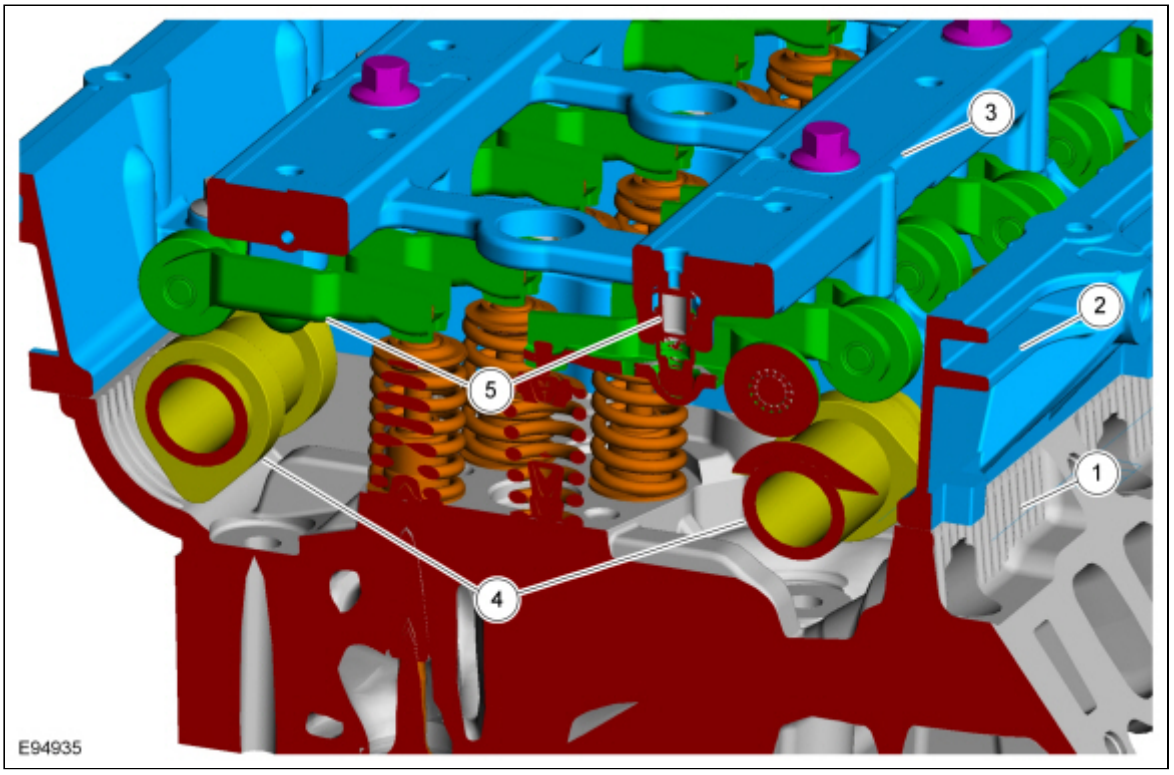


Item	Description
1	VIN (Vehicle identification number)

On the 3.2L engine the engine code (4 digits) and the engine serial number (2 letters for the year and month and 5 figures for the serial number) are stamped in the cylinder block on the exhaust side (in line with cylinder no. 5).

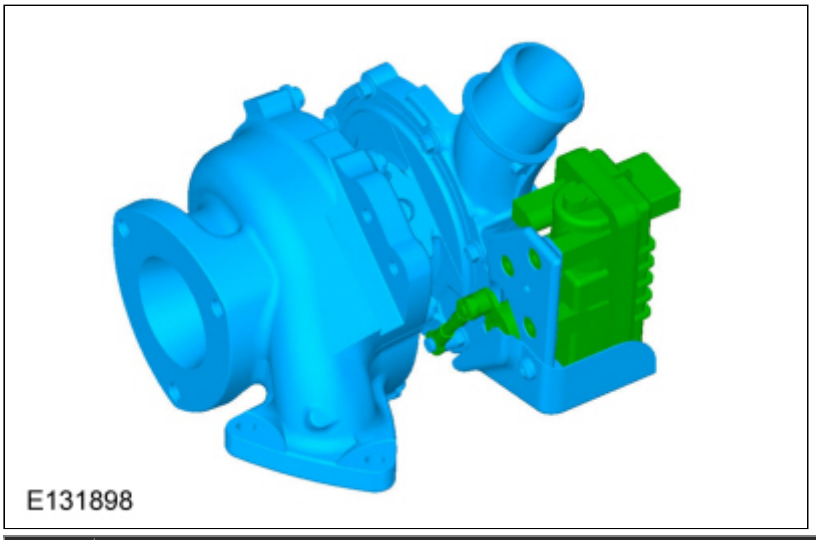
If the engine or cylinder block is changed, the vehicle identification number must be stamped in the indicated location.

Cylinder head



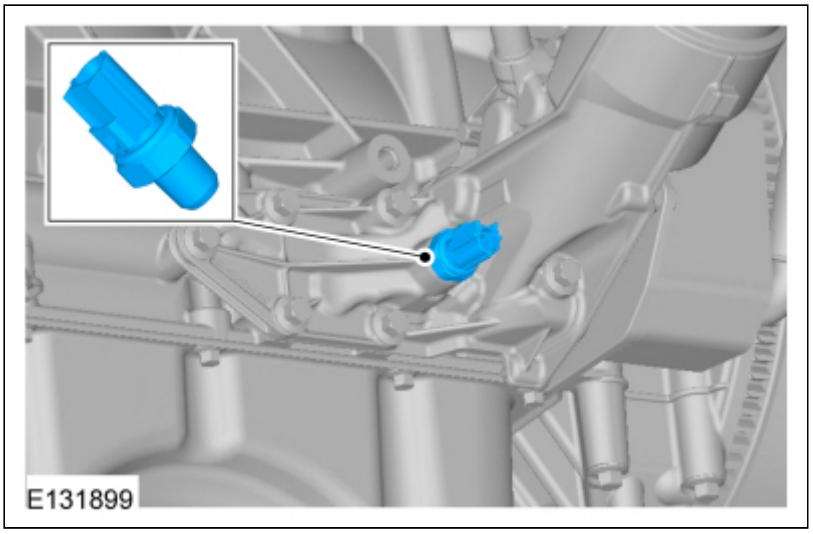
Item	Description
1	Cylinder head lower part
2	Cylinder head upper part
3	Rocker arm frame
4	Camshafts
5	Roller rocker arms with hydraulic valve clearance adjustment

Electronic turbocharger guide vane adjustment



Item	Description
1	Electric actuator for turbocharger guide vane adjustment

Oil level/temperature sensor



An oil level/temperature sensor located on the front of the engine directly beside the engine oil dipstick is provided for the service interval indicator.

A wire coil that is fitted inside the sensor and continuously supplied with current is used to measure the oil level.

The resistance of the wire coil changes according to how deeply the sensor is immersed in the oil. The measurement values are registered by the Powertrain Control Module (PCM).

The change in the voltage drop serves as an input variable for calculating the oil level. The oil temperature is sensed simultaneously via the integrated temperature sensor. The temperature is used as a corrective factor in the calculation.

The PCM calculates the next oil change on the basis of an integrated strategy (which also takes into consideration the mileage and engine operating conditions) and displays it in the instrument panel.

In addition, a separate indicator in conjunction with a corresponding message in the instrument cluster display warns the driver when the oil quantity falls below the minimum level.

Service instruction

The interval indicator must be reset after an oil change on all vehicles with a diesel engine.

It must be ensured that the vehicle is standing on level ground.

Copyright © 2016 Ford Motor Company

Engine

Base Part Number: 6L084

For additional information, refer to Section 303-00.

Copyright © 2016 Ford Motor Company

Intake Manifold

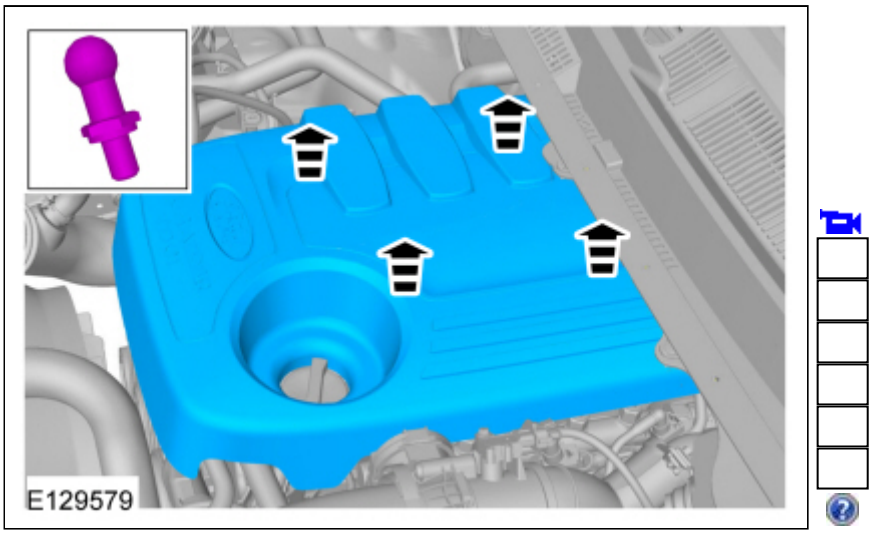
Base Part Number: 9424

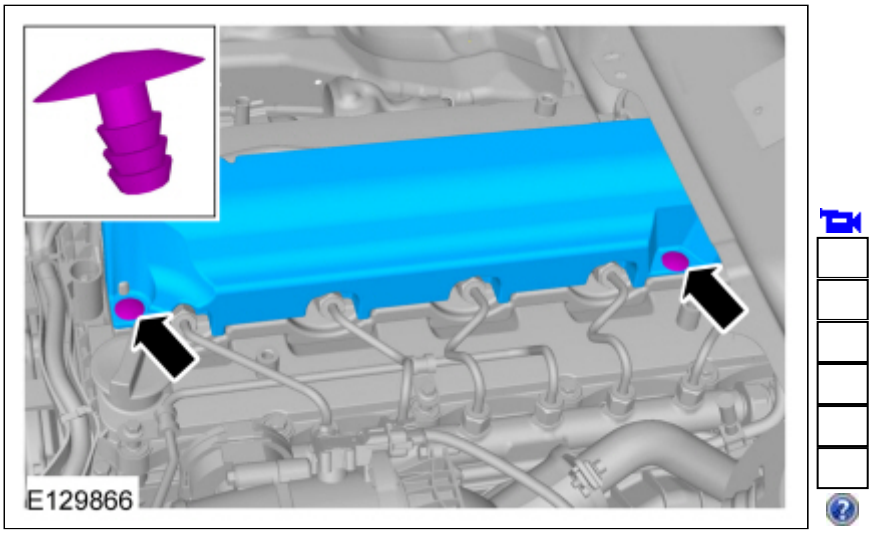
Removal

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

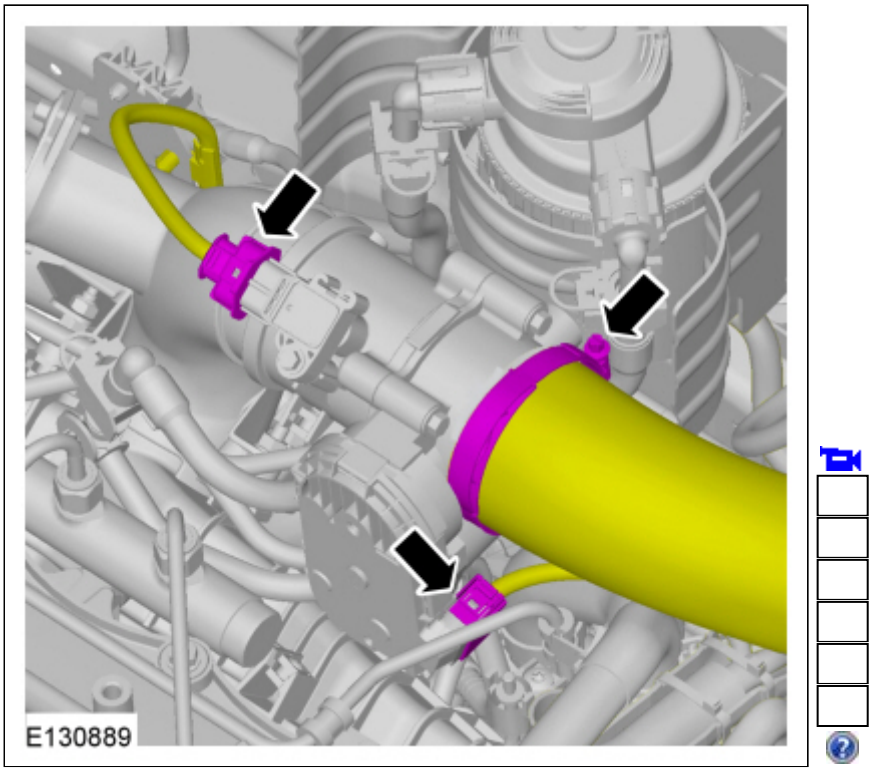
WARNING: Wait at least one minute after the engine stops before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

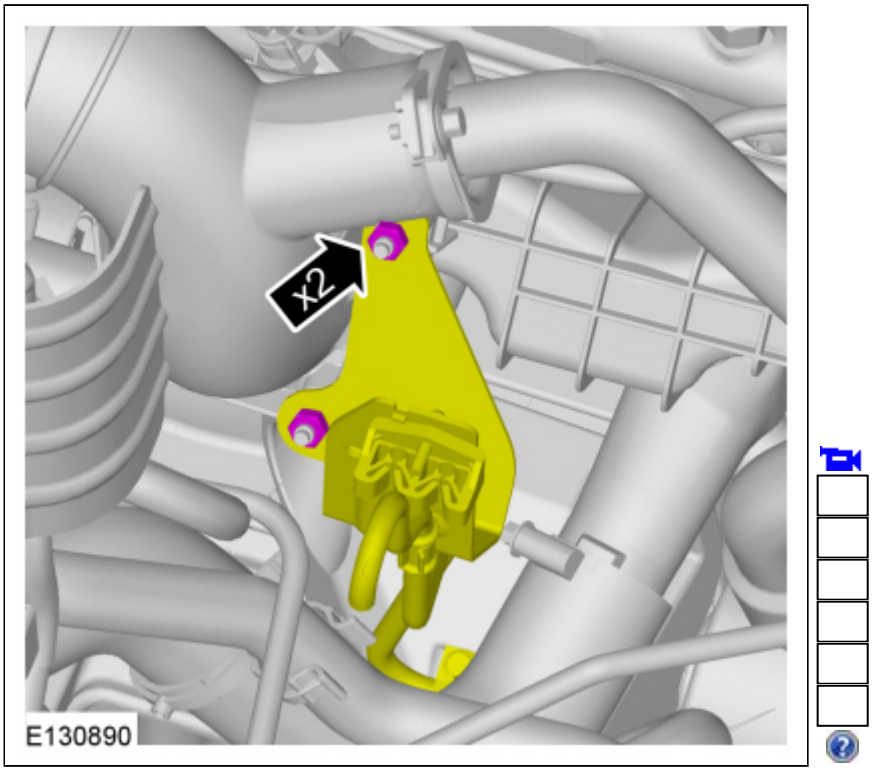
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

4. 

5.

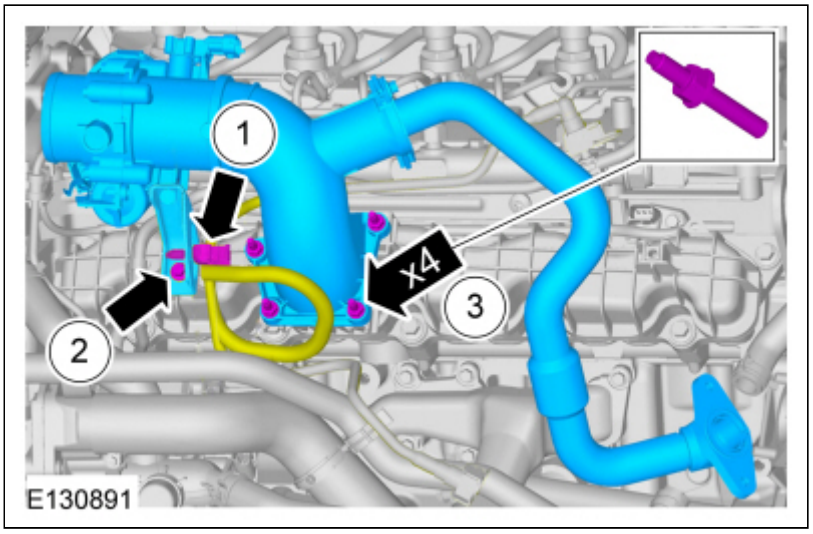


6. *Torque*: 11 Nm

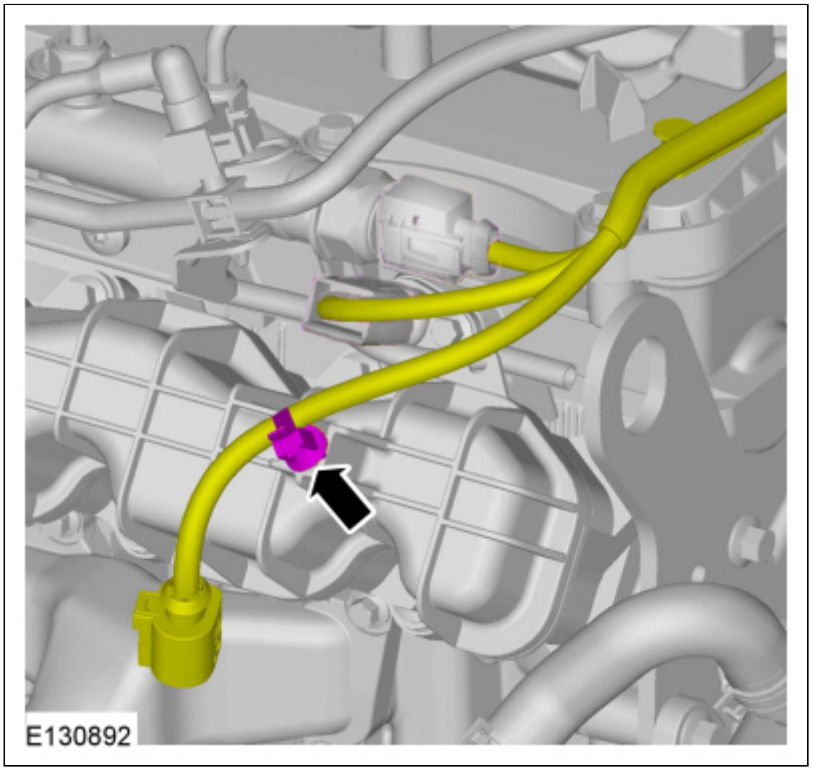


7. Refer to: Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

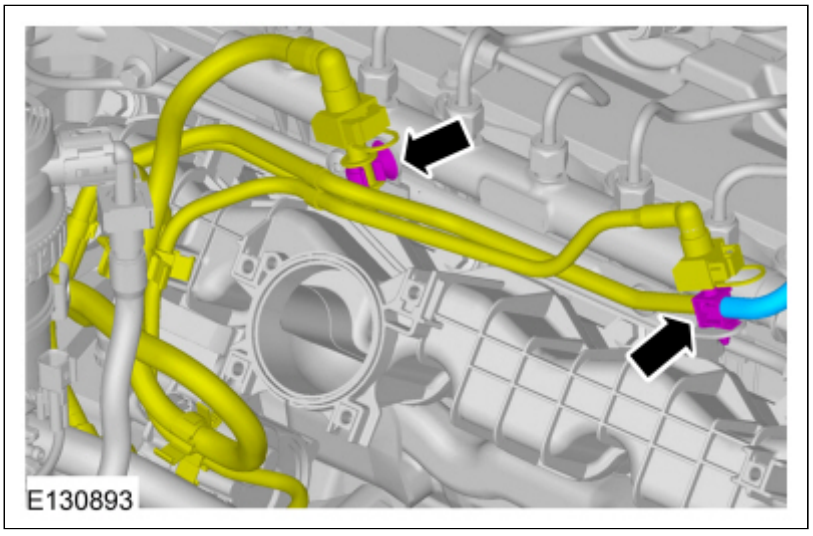
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



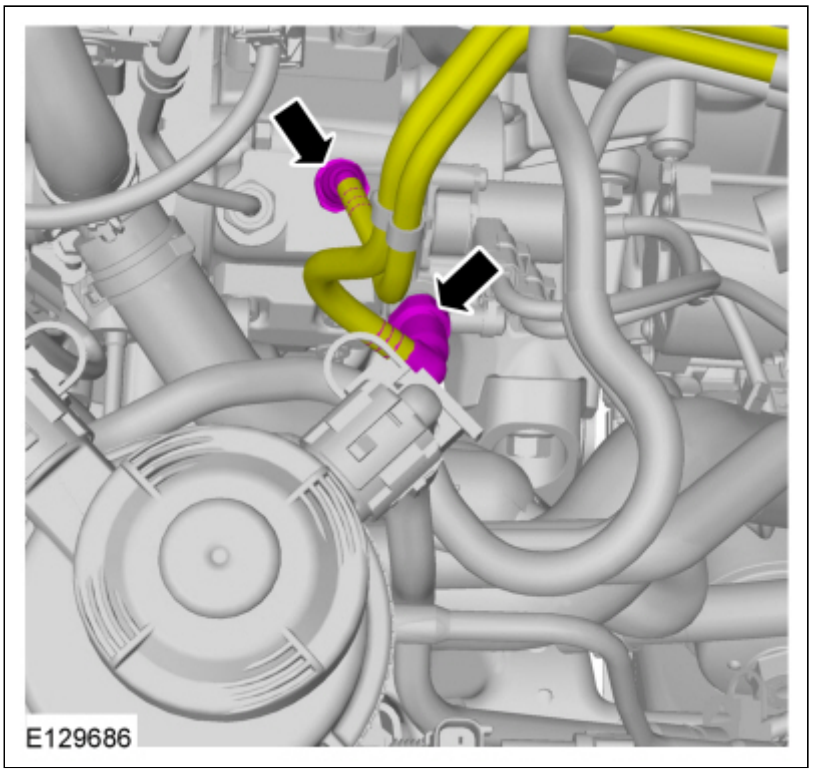
9.



10.



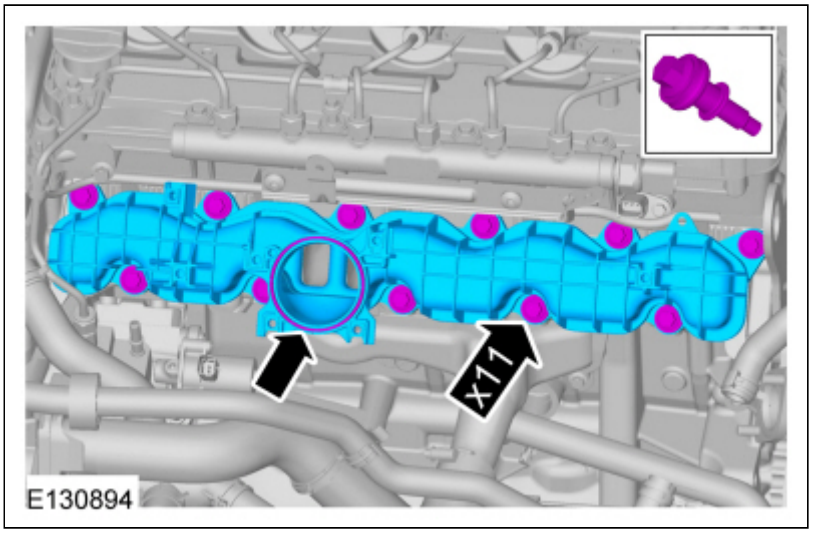
11.



12. **NOTE:** *Replace the o-ring, if necessary.*

    NOTE: *The gasket is to be reused unless damaged.*

    Torque: 15 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Intake Manifold

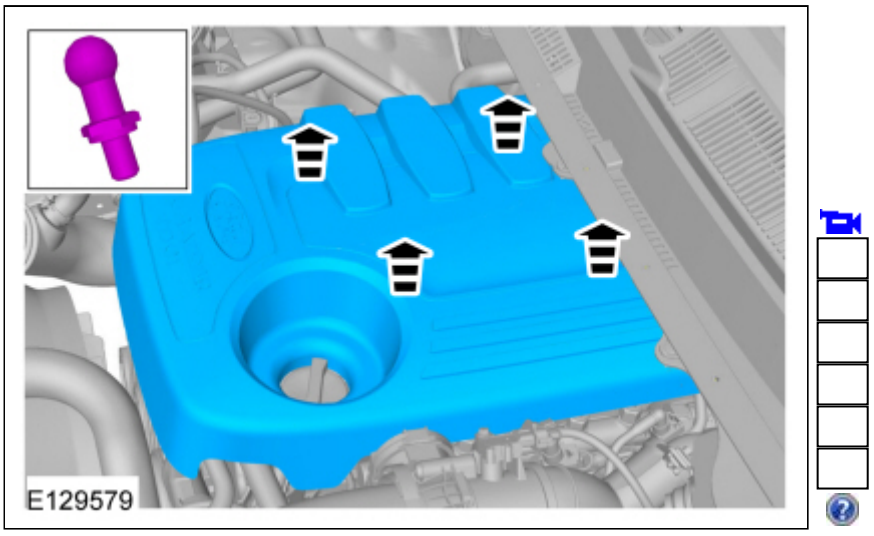
Base Part Number: 9424

Removal

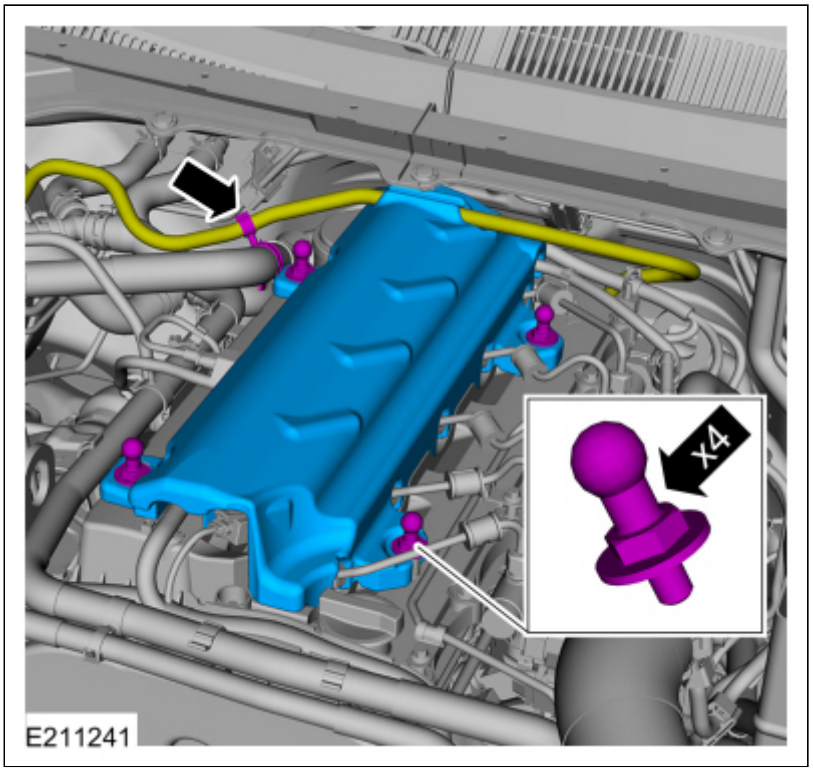
WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: Wait at least one minute after the engine stops before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

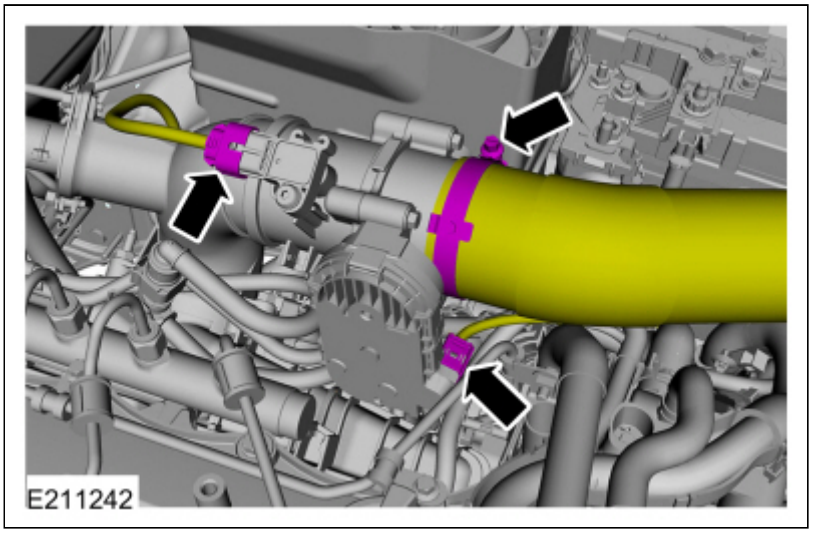
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

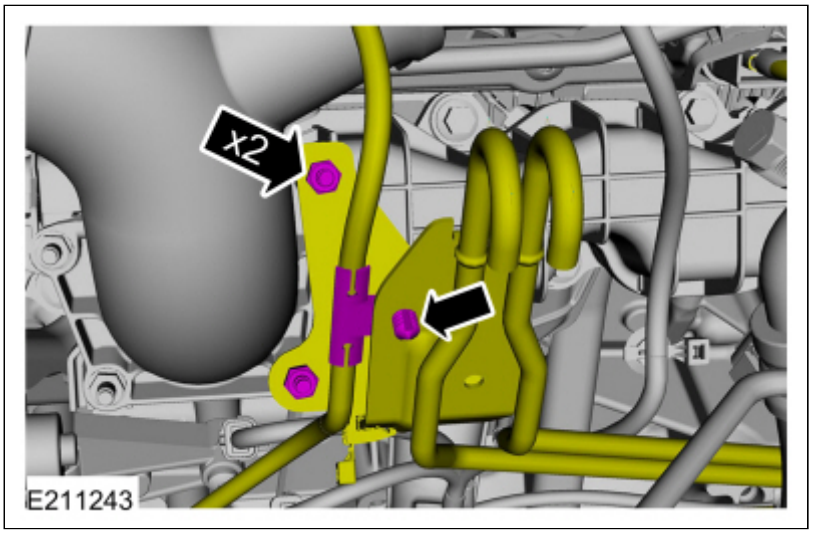
4. *Torque*: 3 Nm



5. *Torque*: 5 Nm



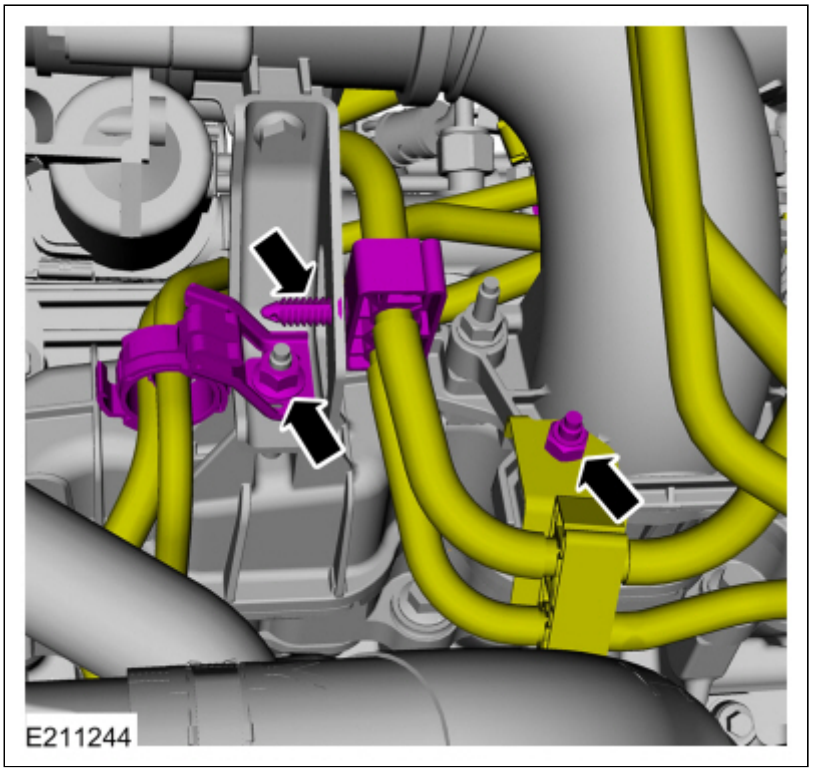
6. *Torque*: 11 Nm



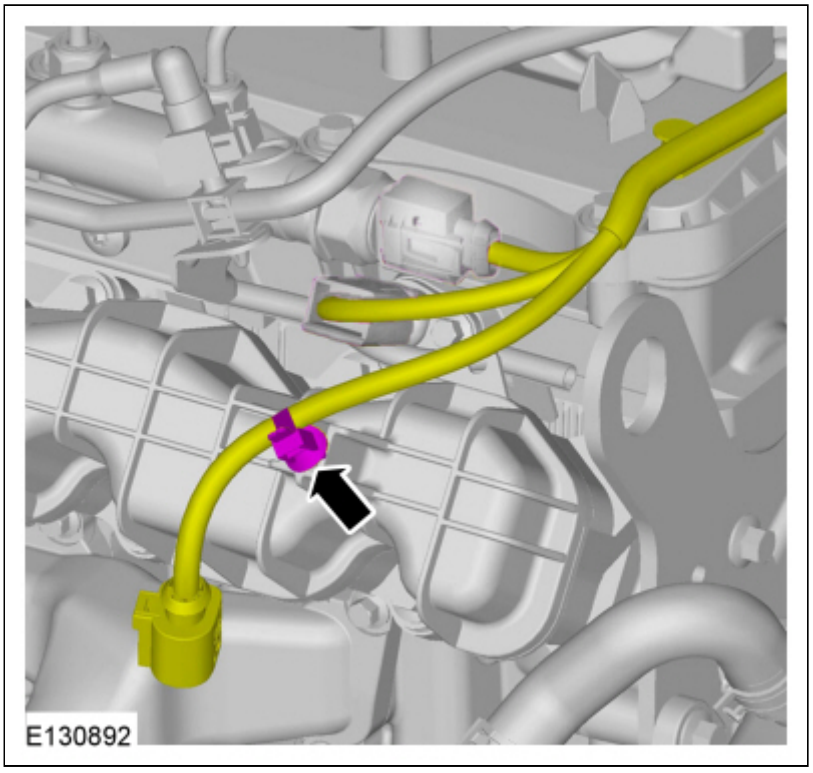
7. Refer to: Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-08C

Engine Emission Control - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

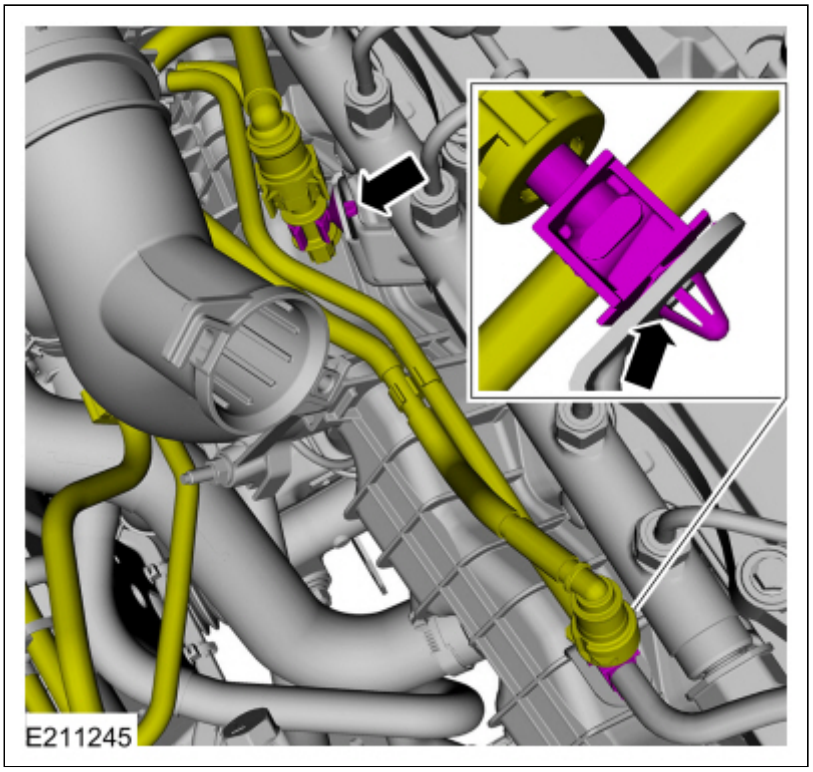
8. *Torque*: 10 Nm



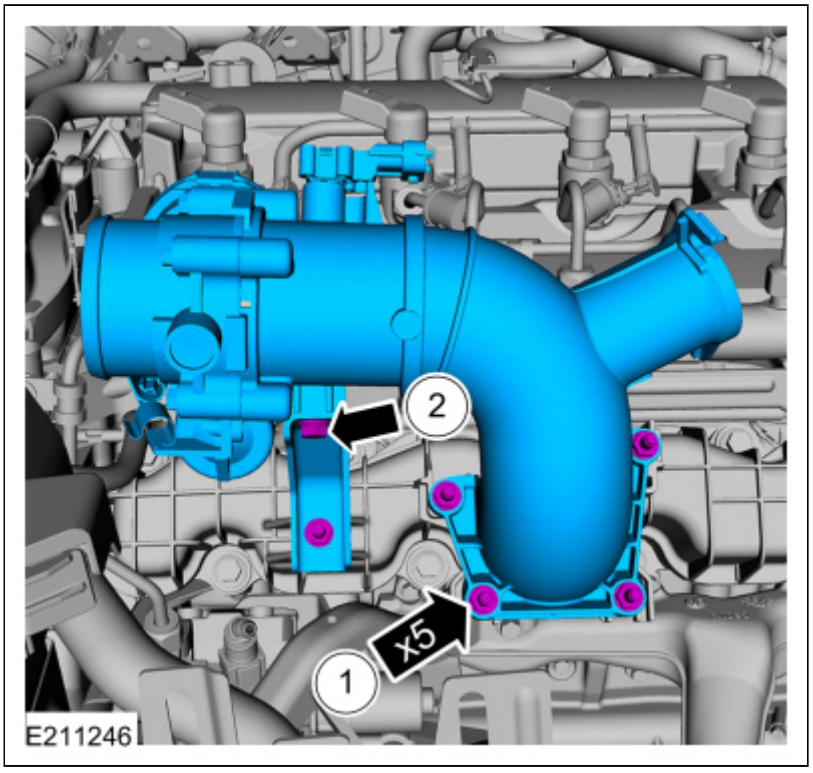
9.



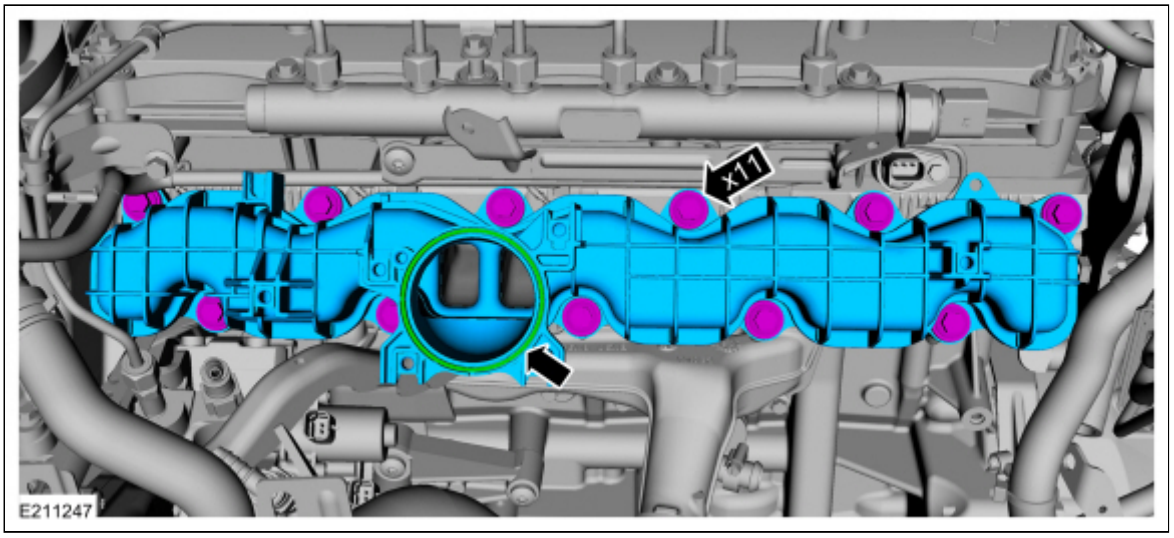
10.



1. *Torque*: 10 Nm
2. *Torque*: 10 Nm



12.

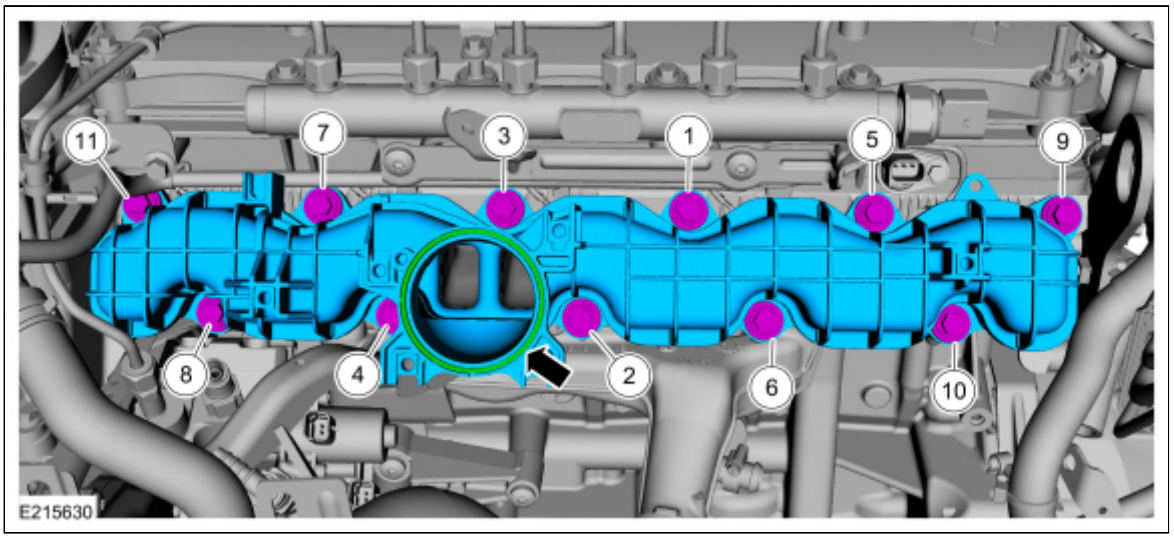


Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *Replace the o-ring, if necessary.*

   NOTE: *The gasket is to be reused unless damaged.*

   Torque: 16 Nm



Copyright © 2016 Ford Motor Company

Camshafts

Special Tool(s) / General Equipment

Plastic Scraper

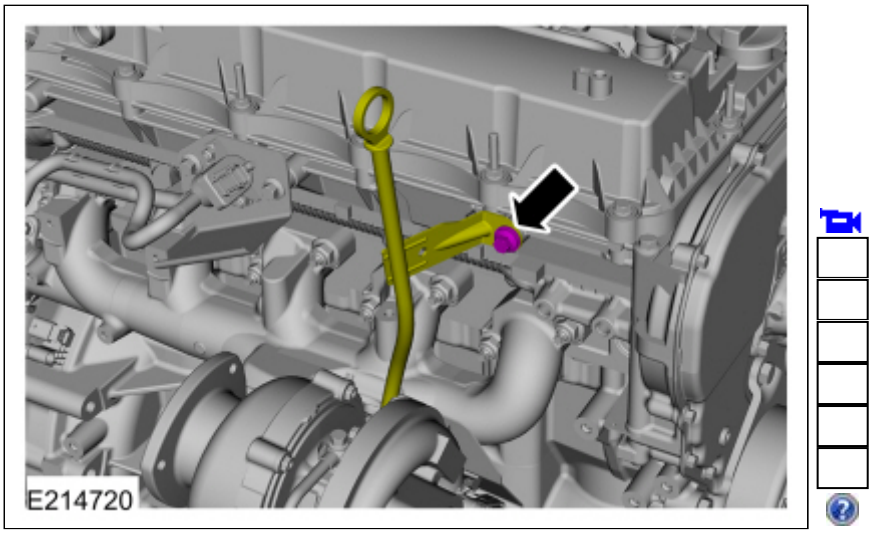
Materials

Name	Specification
Gasket Remover	-
Primer	-
Engine Oil - SAE 5W-40	WSS-M2C171-E
Silicone Sealant	WSE-M4G323-A4
Brake Cleaner	-

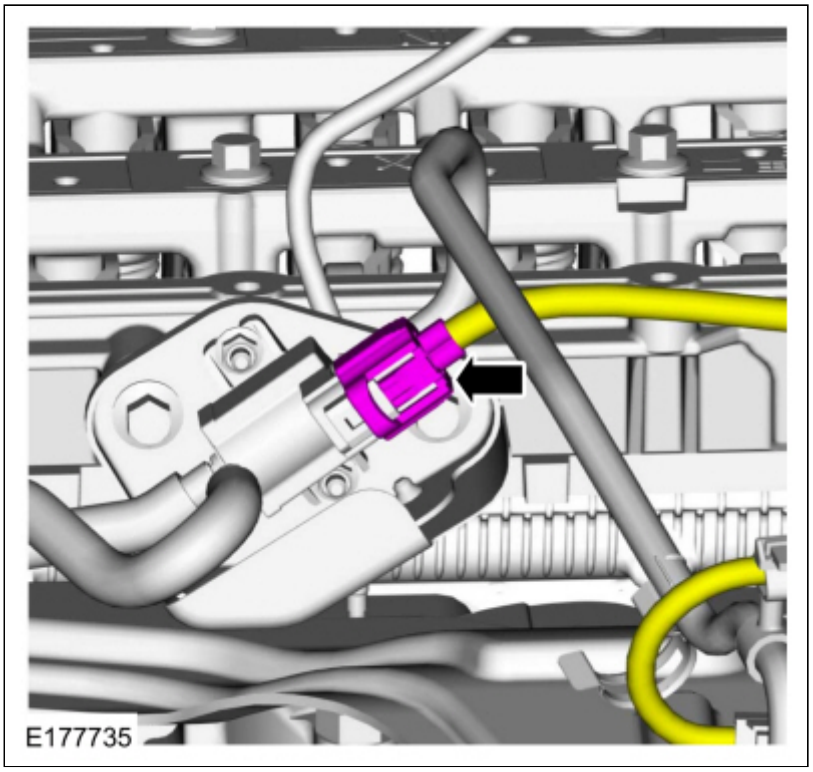
Removal

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

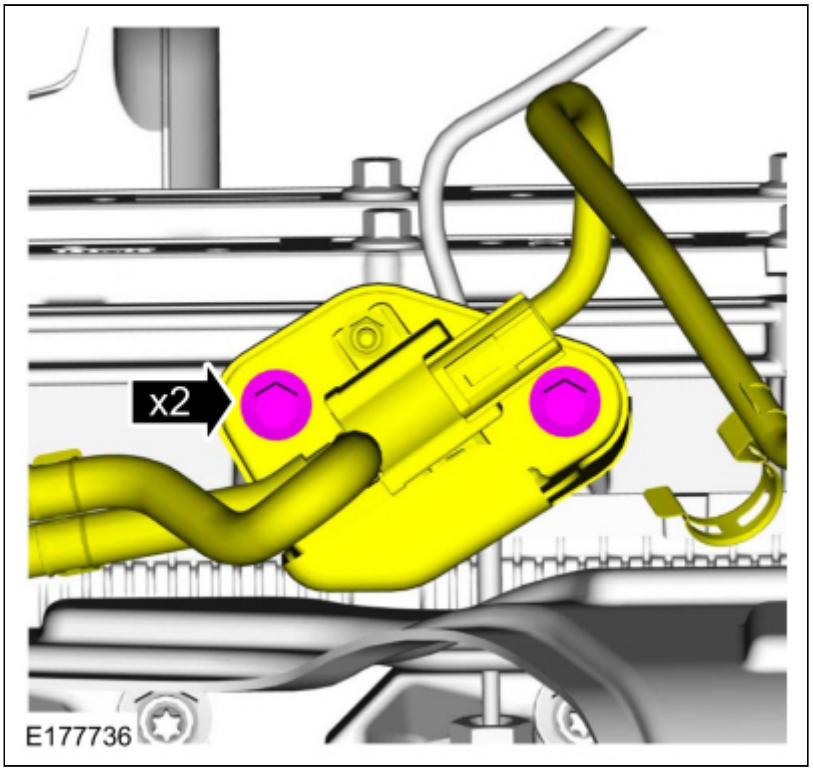
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Fuel Rail (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Valve Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Timing Chain (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Brake Vacuum Pump - RHD (206-07 Power Brake Actuation, Removal and Installation).
2. 

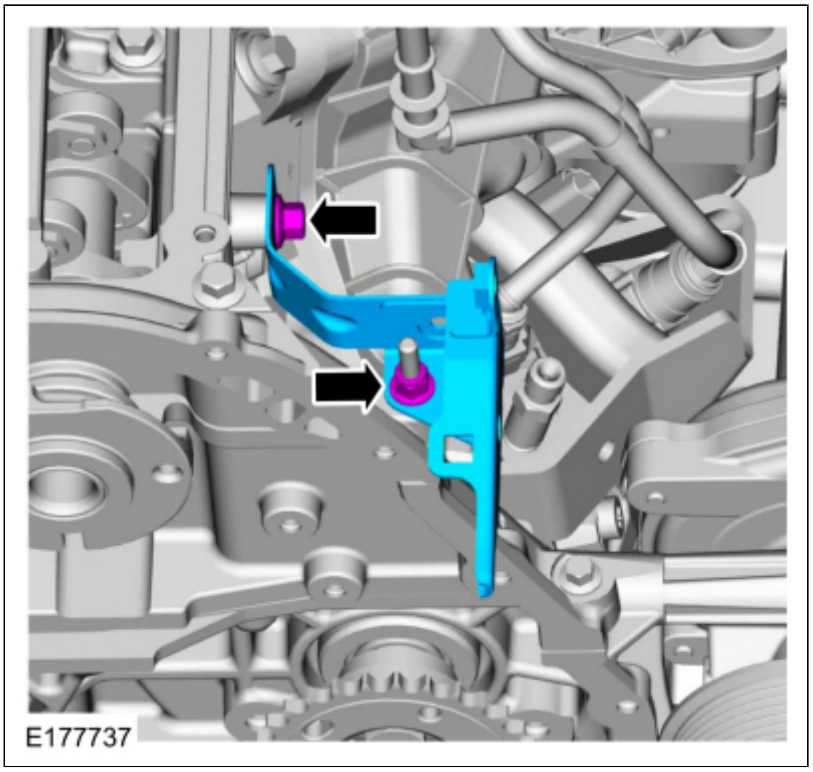
3.



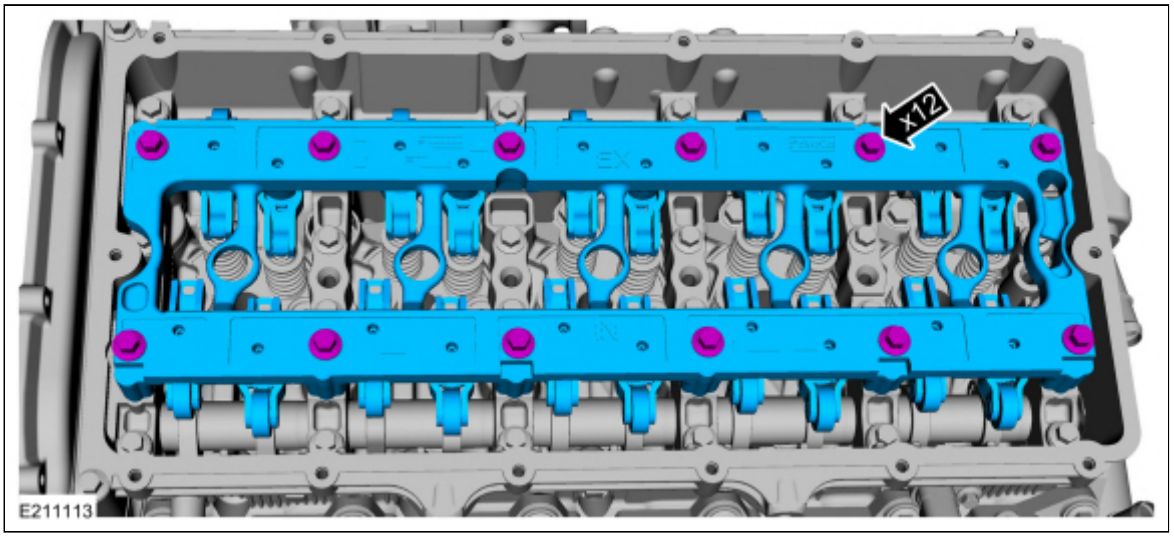
4.



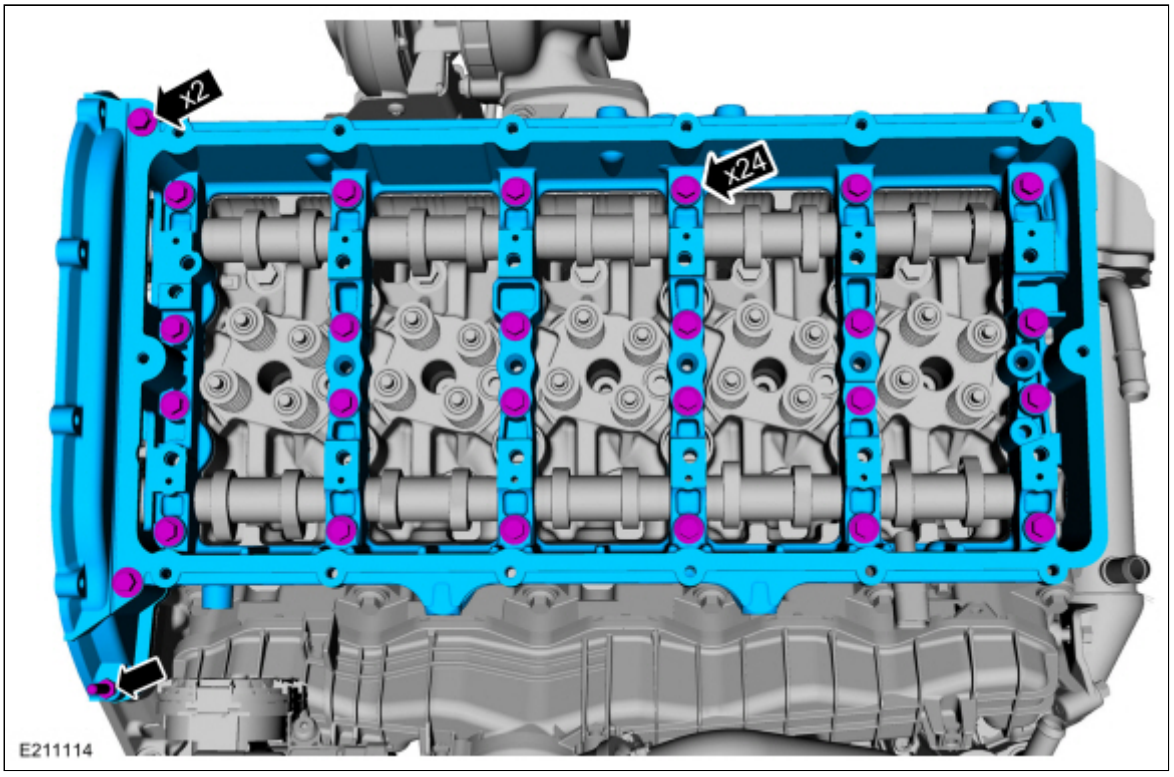
5.



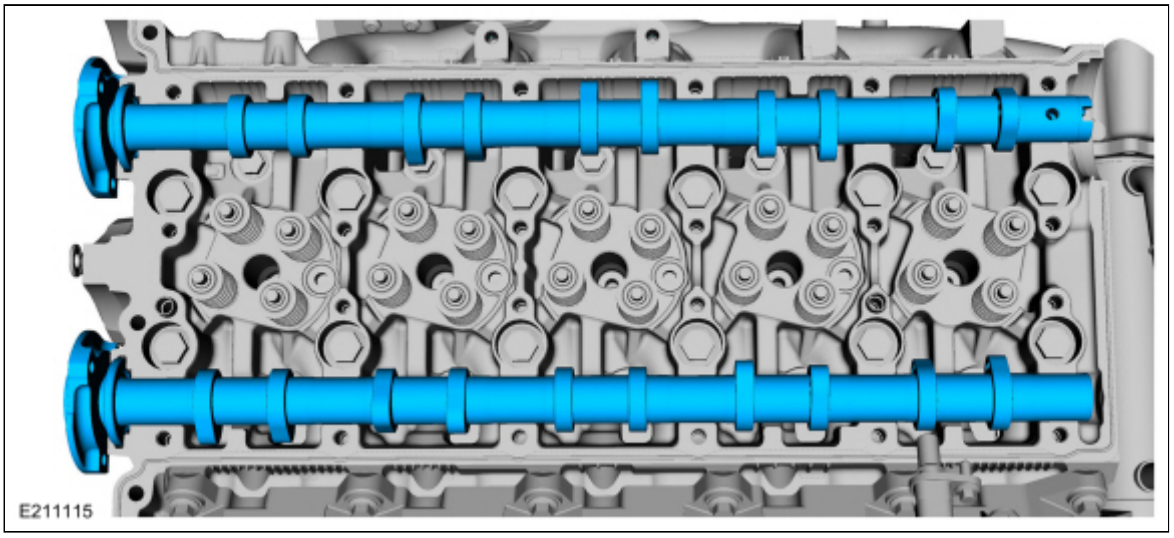
6.



7.

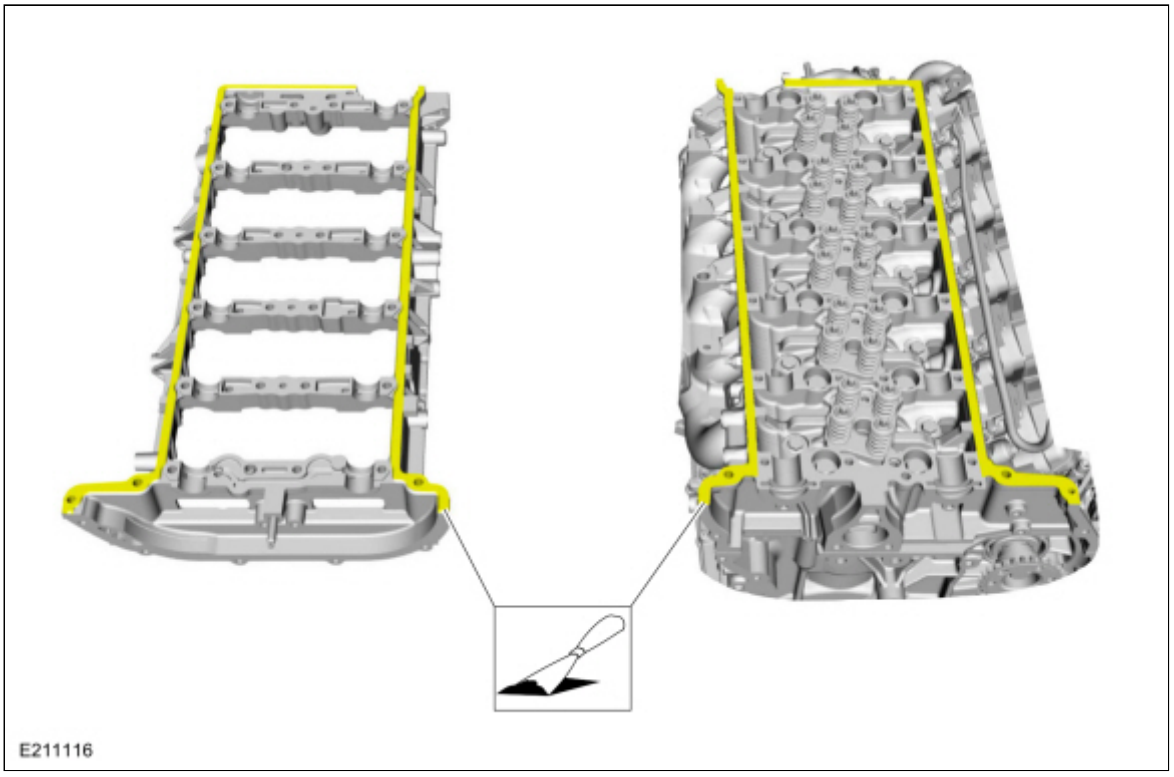


8.



9. **NOTICE: Do not use wire brushes, power abrasive discs or 3M™ Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. They also cause contamination that causes premature engine failure. Remove all traces of the gasket.**

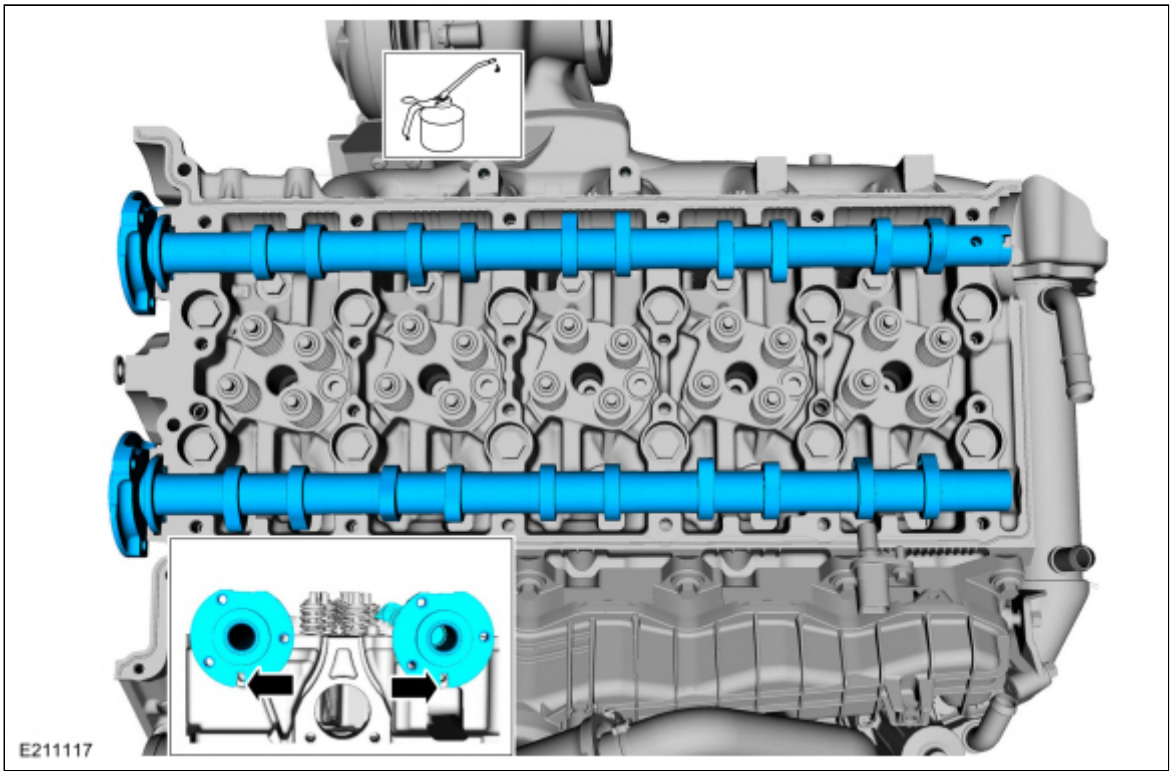
   Make sure that the mating surface is clean and free of foreign material.
   Use the General Equipment: Plastic Scraper
   Material: Gasket Remover
   Material: Brake Cleaner
   Material: Primer



Installation

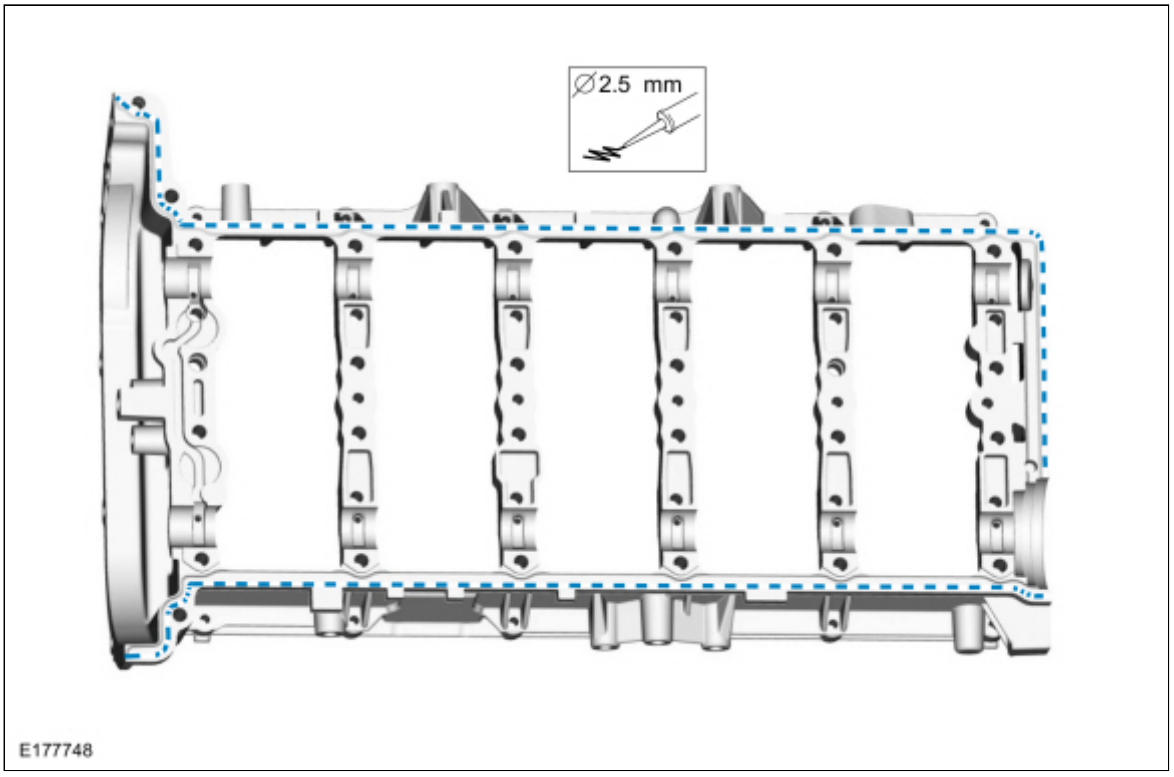
1. **NOTE:** *The camshafts need to be installed with the slots down aligning with the timing pin holes in the cylinder head.*

   Lubricate the camshafts with clean engine oil and install the camshafts.
   Material: Engine Oil - SAE 5W-40 (WSS-M2C171-E)



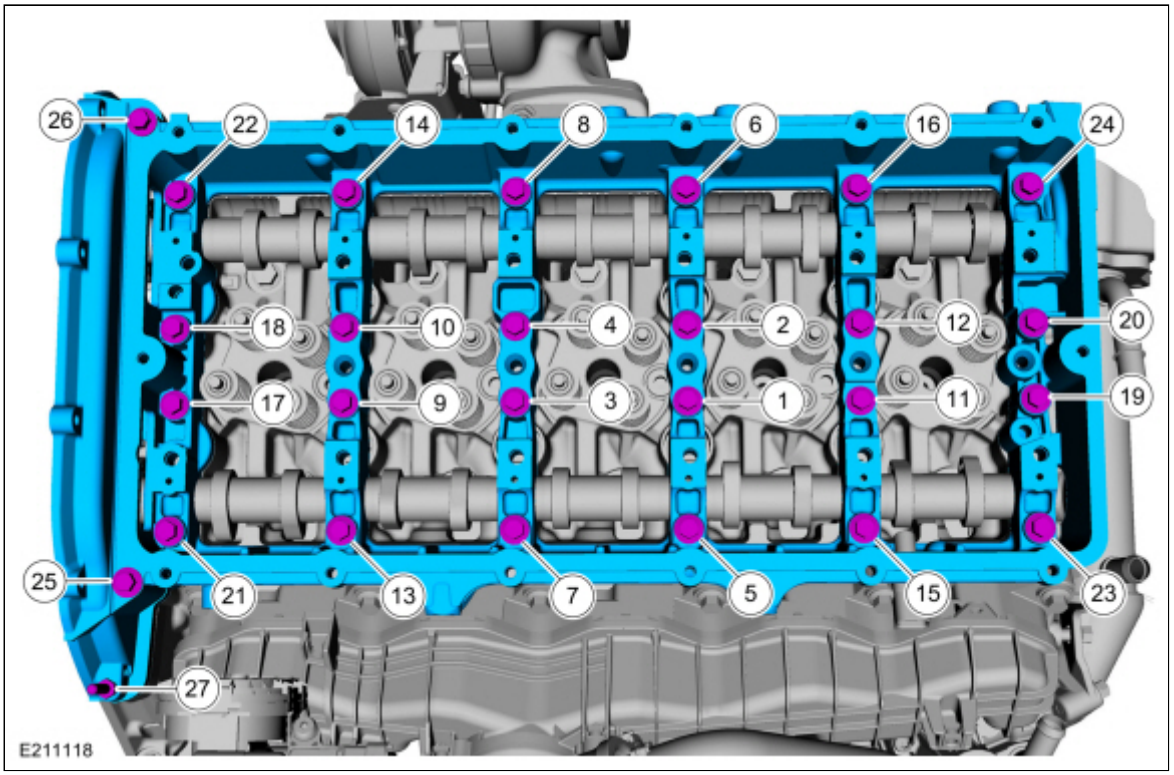
2. **NOTE:** *If the upper cylinder head is not secured within 5 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 10 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.*

   Apply a 2 mm bead of silicone sealant on the upper cylinder head.
   Material: Silicone Sealant (WSE-M4G323-A4)
   Material: Primer



3. **NOTE:** *The component must be installed within 5 minutes of applying the sealant.*

Torque:
Stage 1: 1 - 26 : 7 Nm
Stage 2: 27 : 4 Nm
Stage 3: 1 - 26 : 15 Nm
Stage 4: 27 : 6 Nm
Stage 5: 1 - 26 : 23 Nm
Stage 6: 27 : 10 Nm

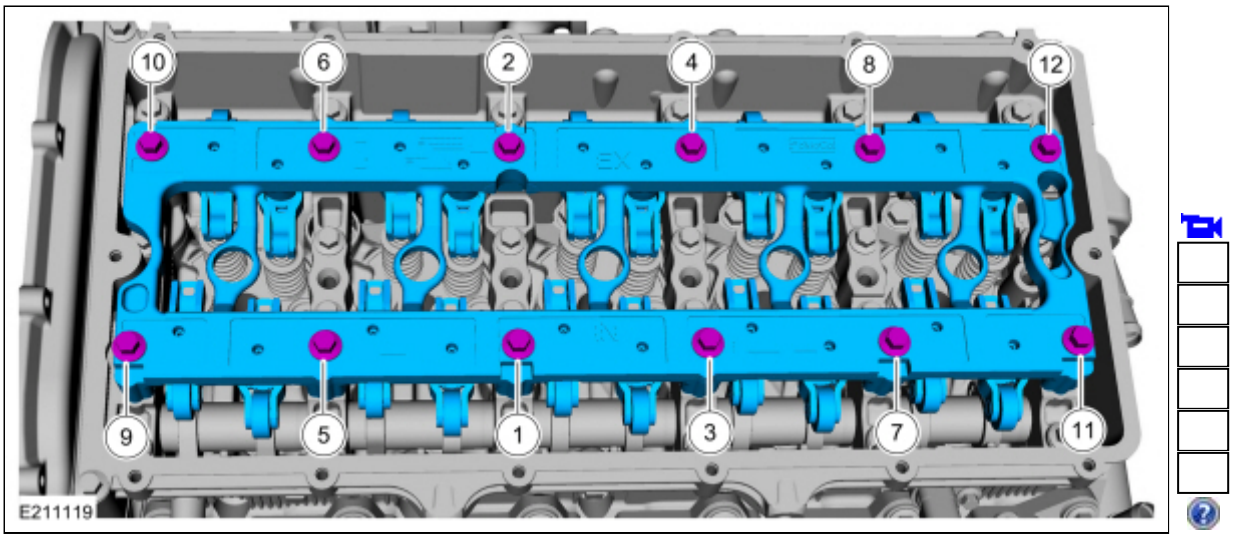


4. **NOTE:** *Make sure that the rocker arms do not separate.*

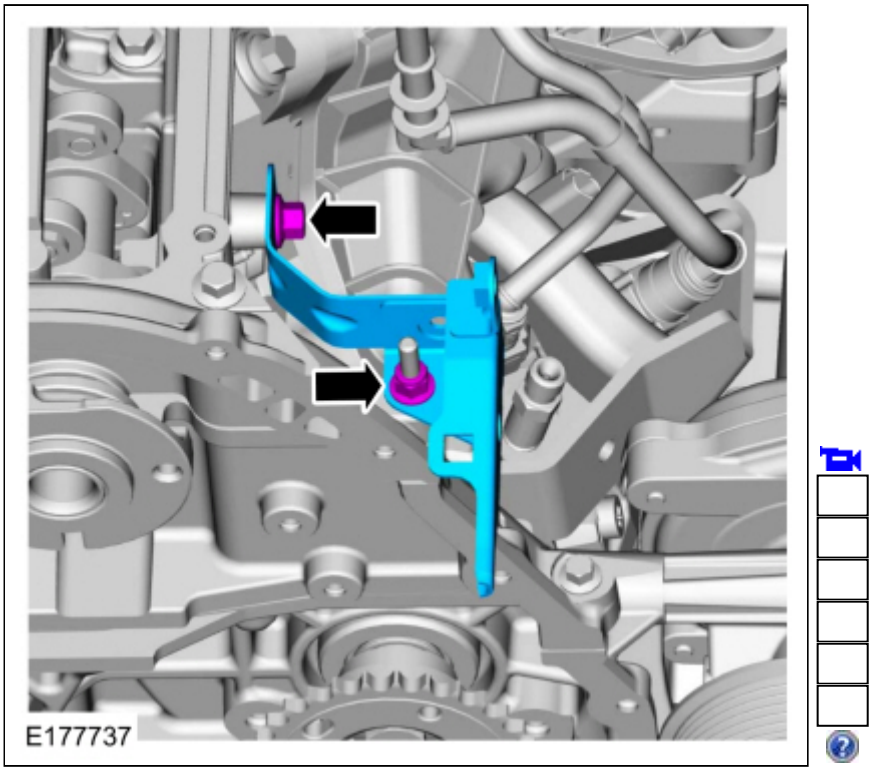
NOTE: *After the rocker arm assembly is installed, verify that the rocker arms are properly aligned with the camshafts and the valve stems.*

Torque:

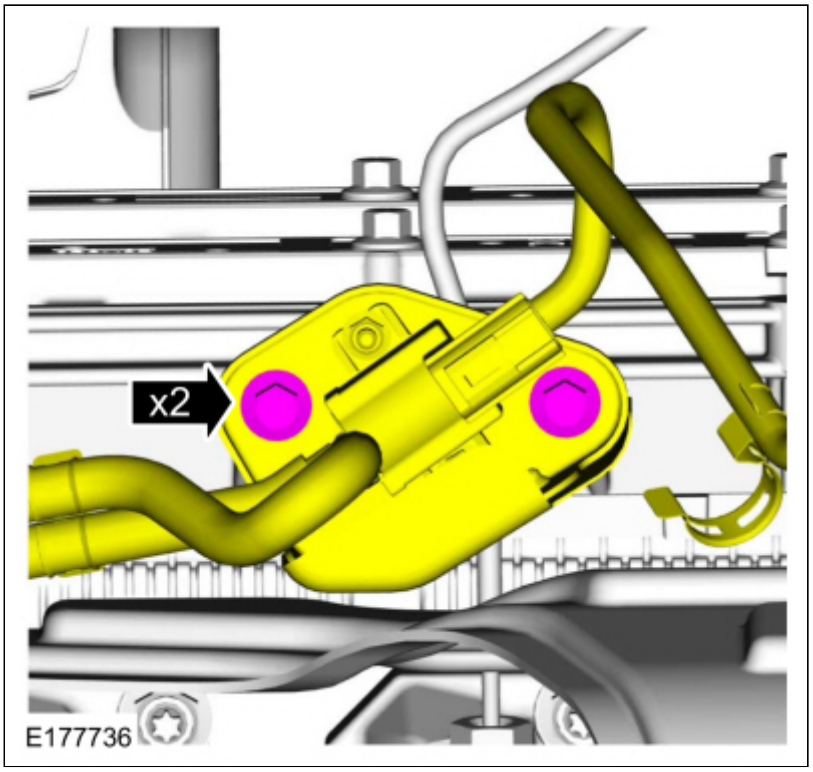
Stage 1: 5 Nm
Stage 2: 8 Nm
Stage 3: 10 Nm
Stage 4: 45 °



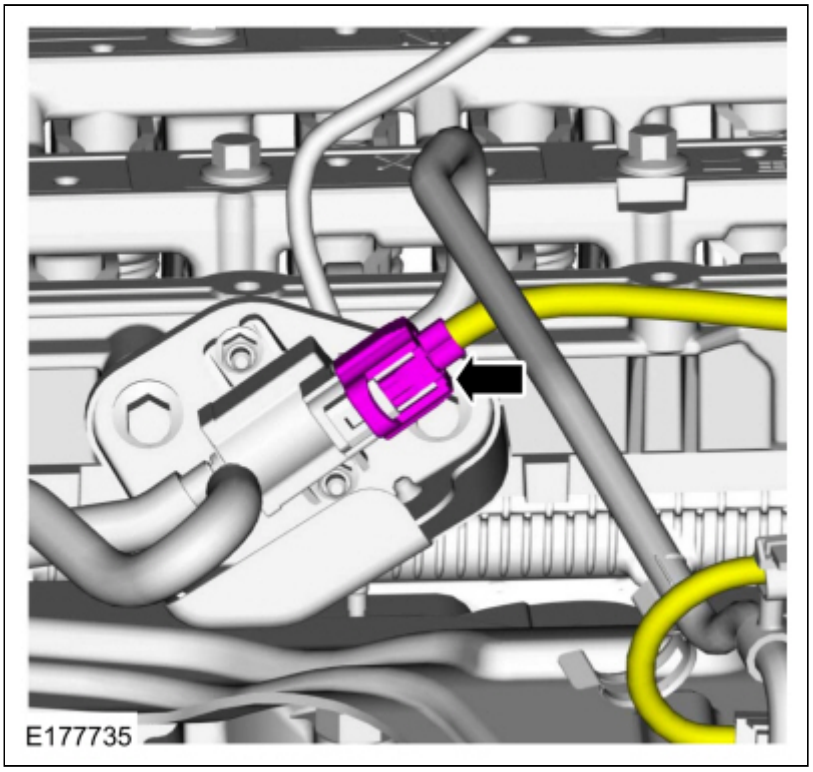
5. *Torque*:
   M8 bolt : 23 Nm
   M6 nut : 10 Nm



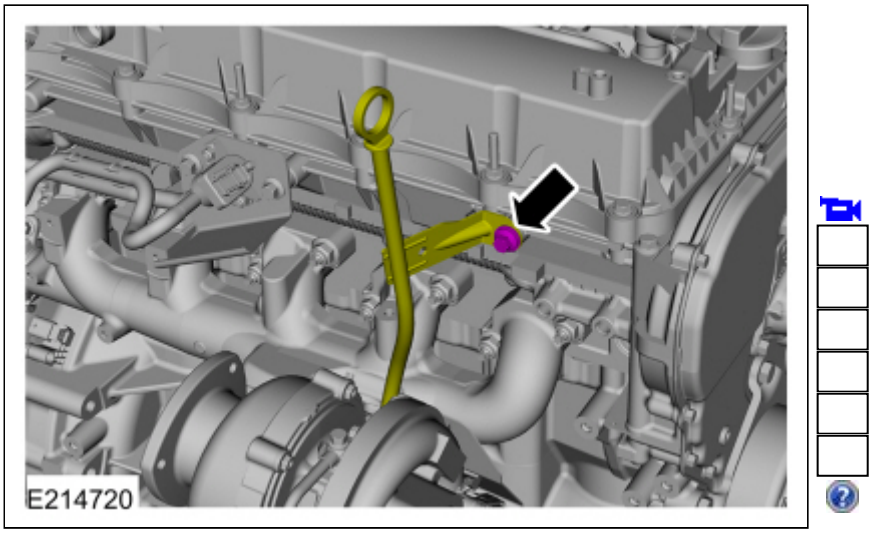
6. *Torque*: 25 Nm



7.



8. *Torque*: 23 Nm



9. Refer to: Fuel Rail (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Valve Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Timing Chain (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Brake Vacuum Pump - RHD (206-07 Power Brake Actuation, Removal and Installation).

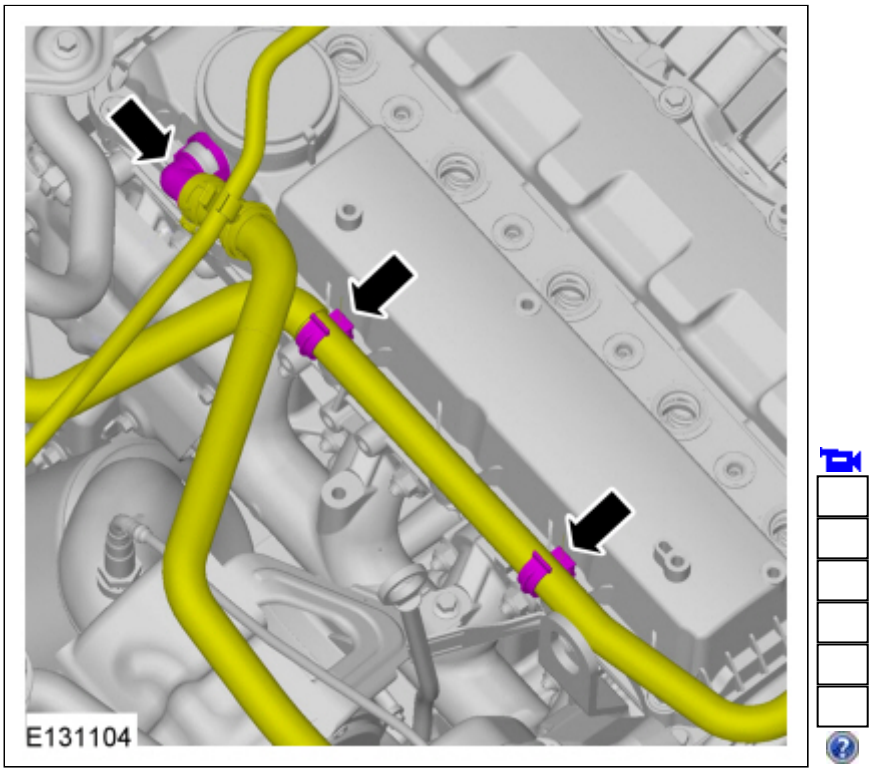
Copyright © 2016 Ford Motor Company

Exhaust Manifold

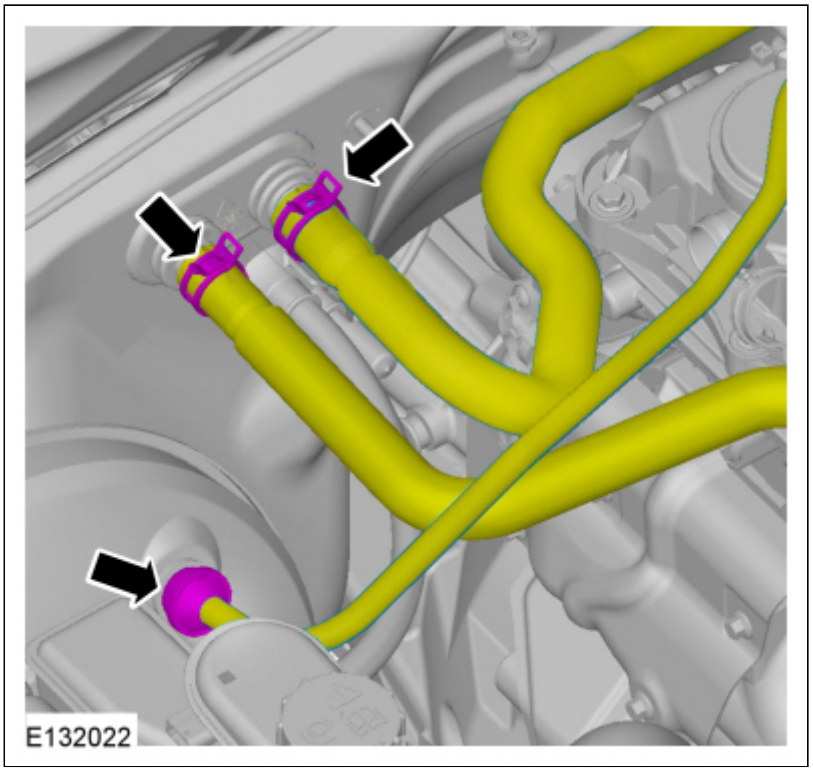
Base Part Number: 9431

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

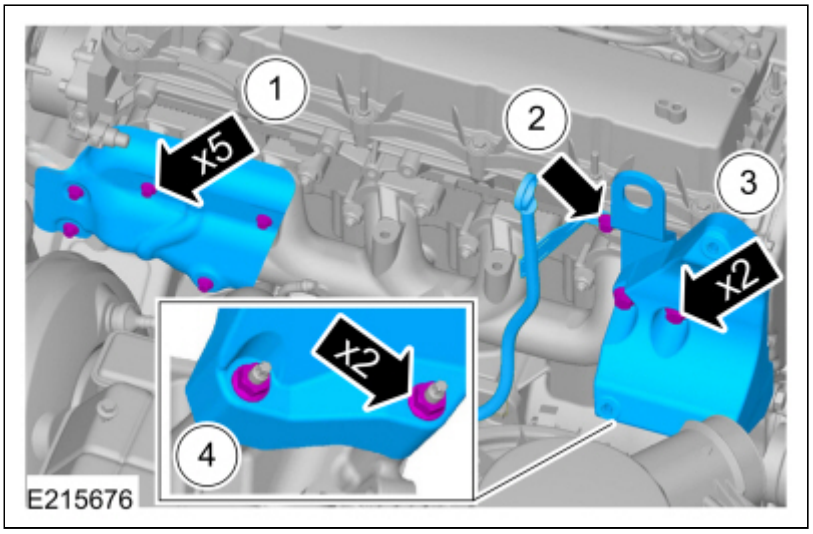
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

4.



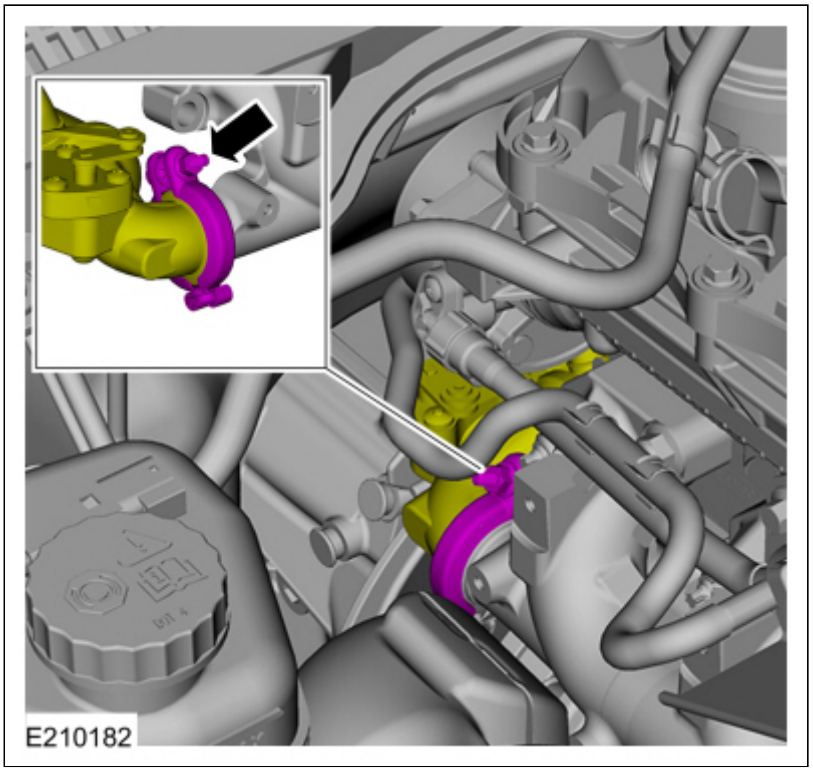
5. Refer to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).

   1. *Torque*: 9 Nm
   2. *Torque*: 23 Nm
   3. *Torque*: 48 Nm
   4. *Torque*: 23 Nm



7. Remove front RH side wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

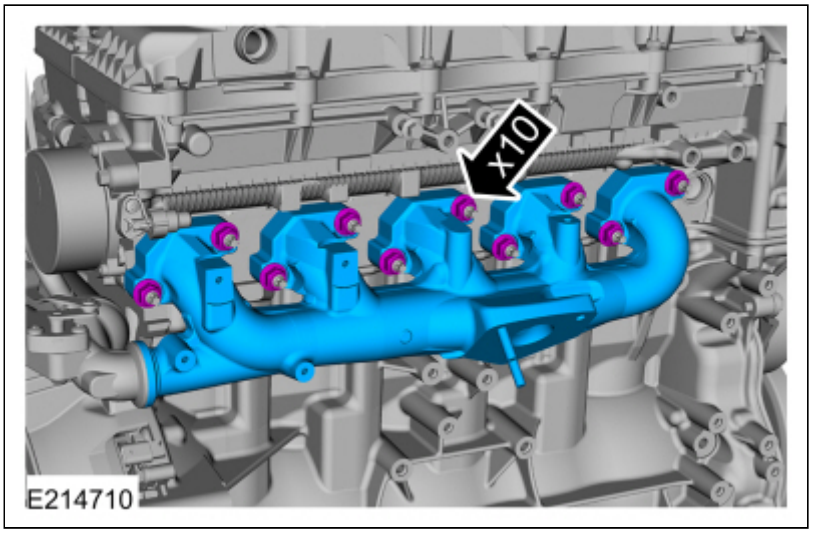
8. *Torque*: 10 Nm



9. **NOTICE: Make sure that new nuts are installed.**

   NOTICE: Make sure that new bolts are installed.

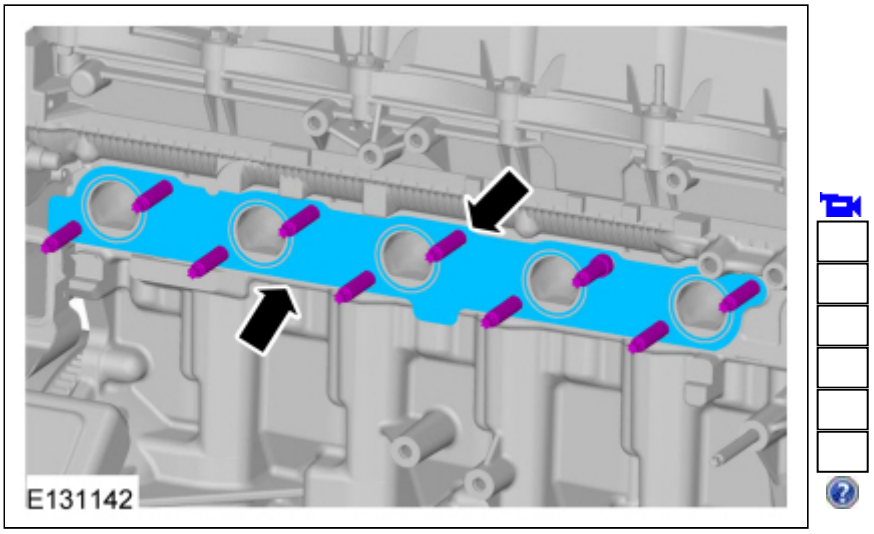
   1. *Torque*:
      Stage 1: 10 Nm
      Stage 2: 20 Nm
      Stage 3: 35 Nm



10. **NOTICE: Make sure that new studs are installed.**

    NOTE: *The gasket is to be reused unless damaged.*

    Torque: 15 Nm



Installation

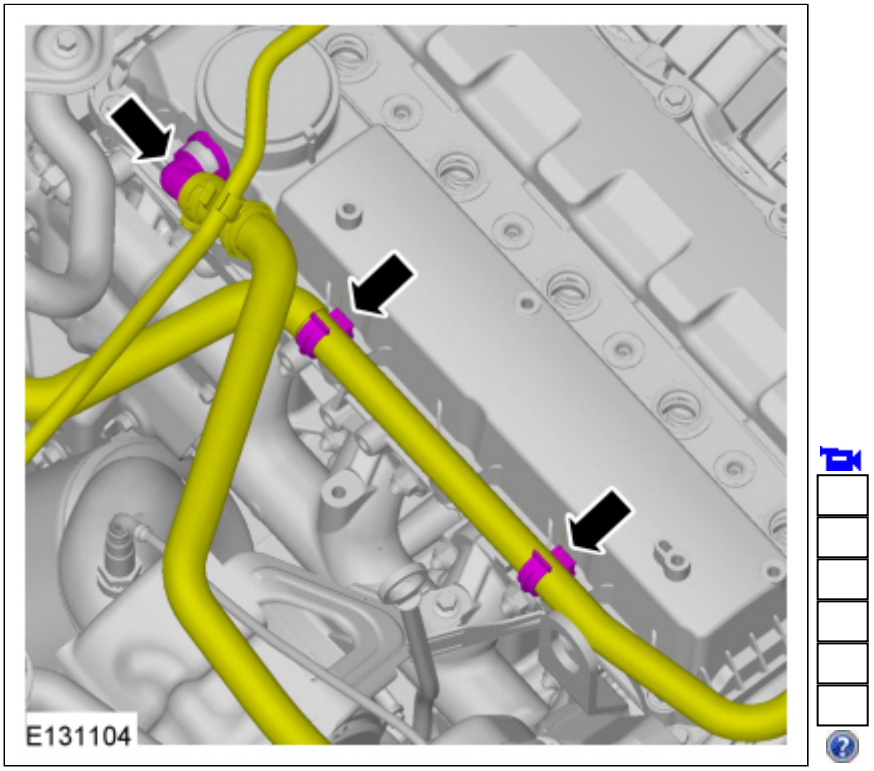
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Valve Cover

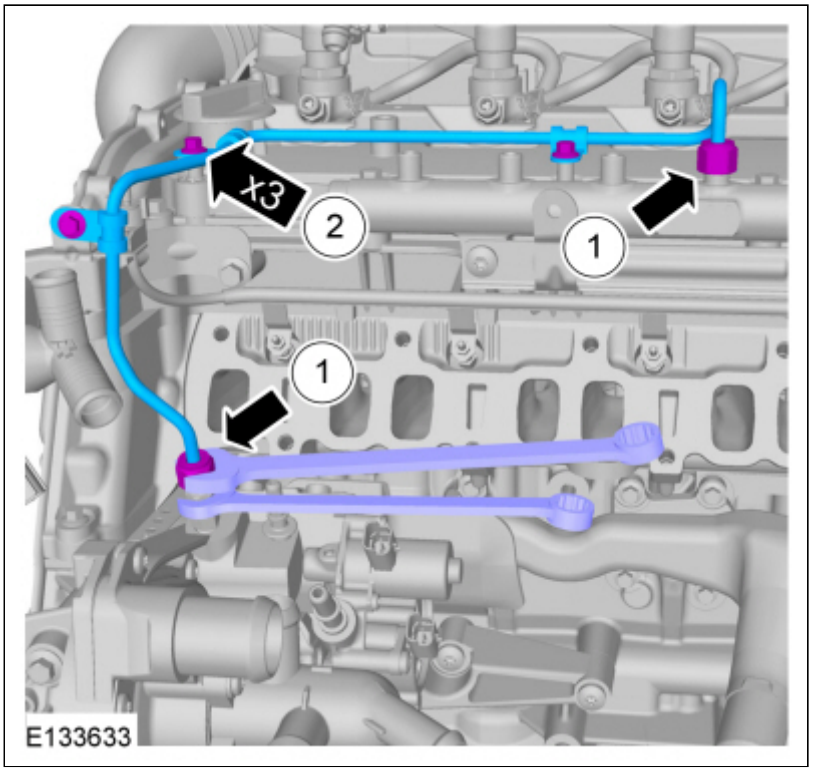
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

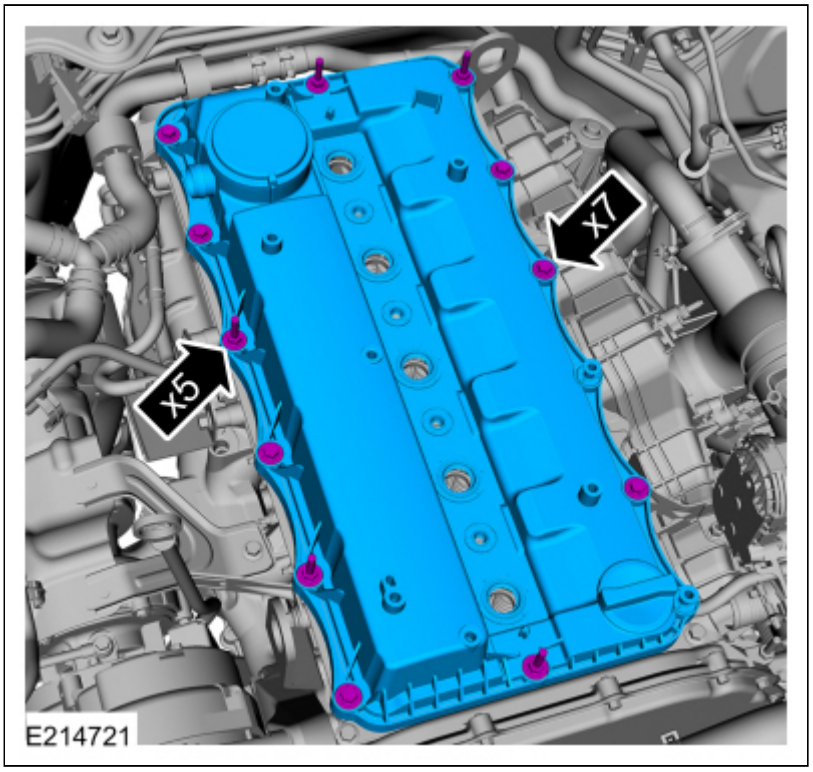
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3. Refer to: Fuel Injectors (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

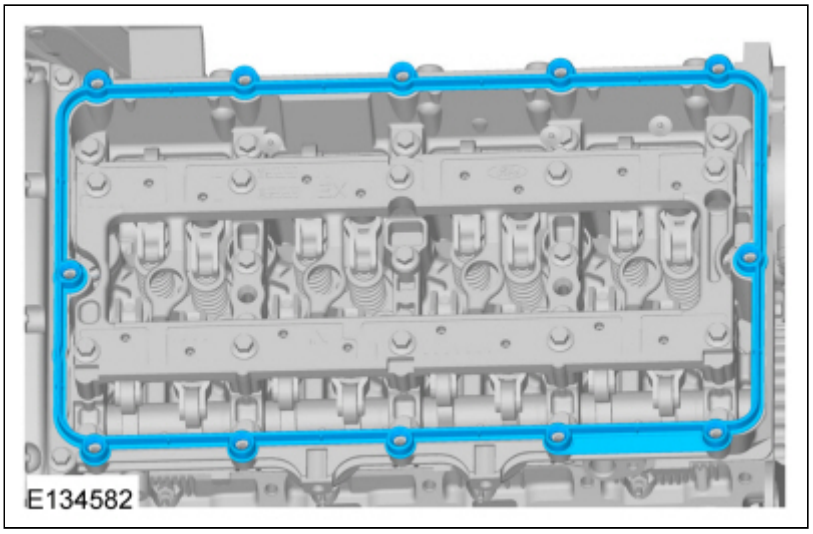
1. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 30 Nm
2. *Torque*: 10 Nm



5.

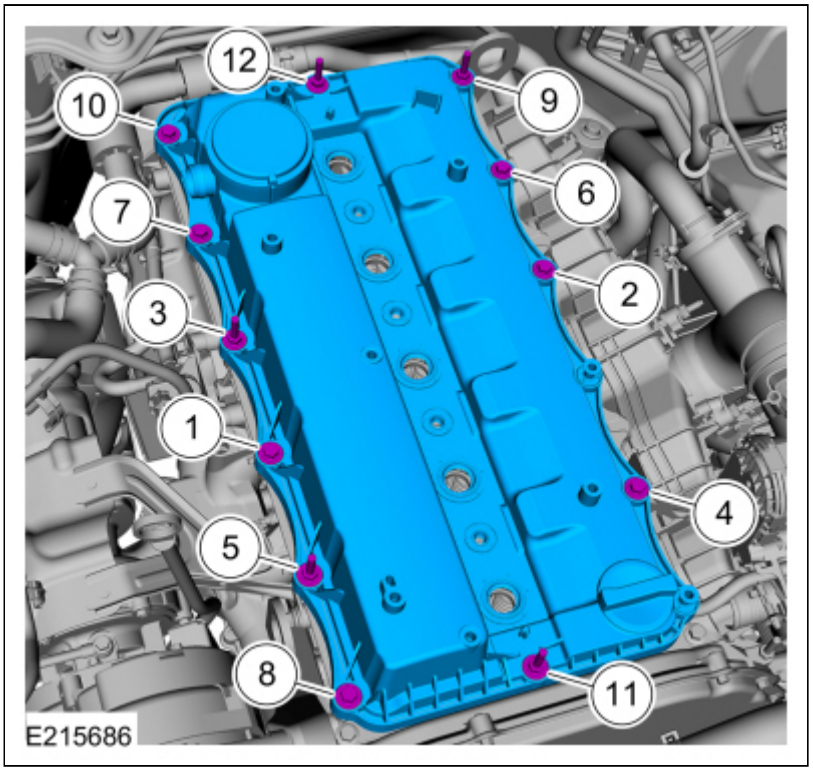


6. **NOTE:** *The gasket is to be reused unless damaged.*



Installation

1. To install, reverse the removal procedure.
2. *Torque*:
   Stage 1: 4 Nm
   Stage 2: 10 Nm

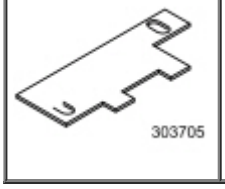


Copyright © 2016 Ford Motor Company

Oil Pump

Base Part Number: 6621

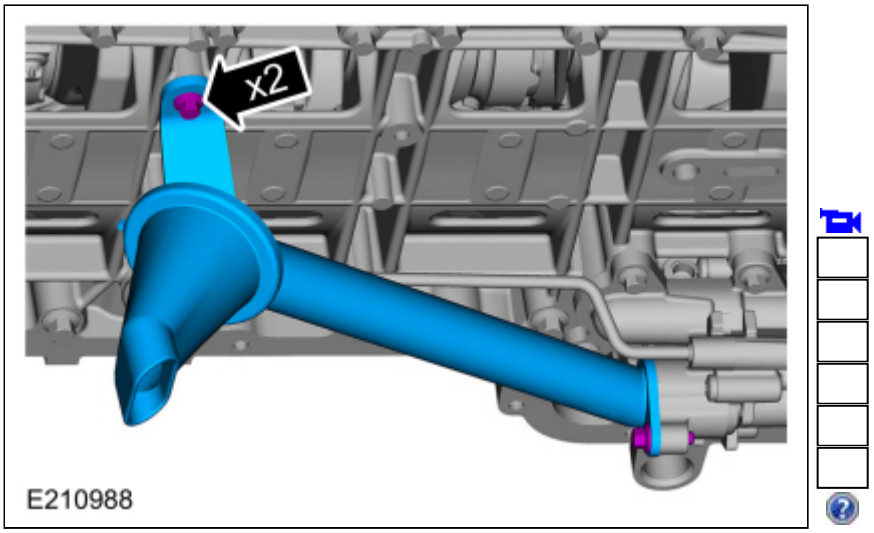
Special Tool(s) / General Equipment

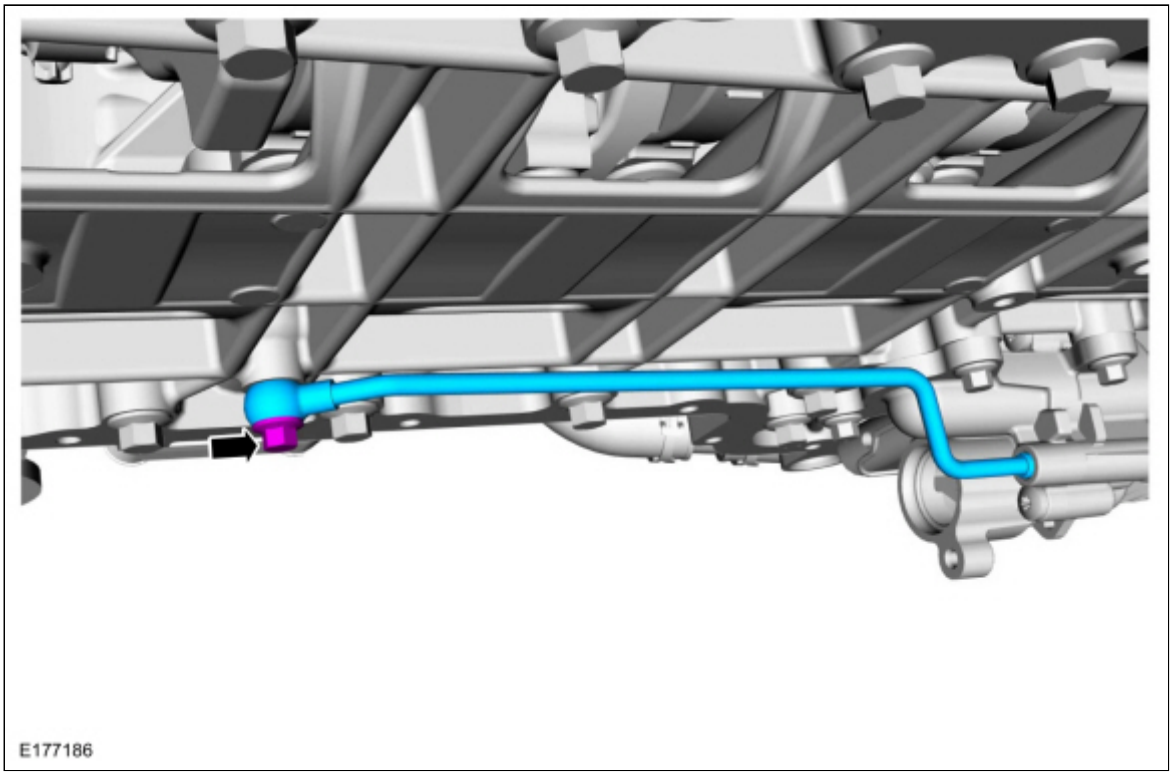
	303-705 Aligner, Oil Pump

Materials

Name	Specification
Engine Oil - SAE 5W-30	WSS-M2C913-C

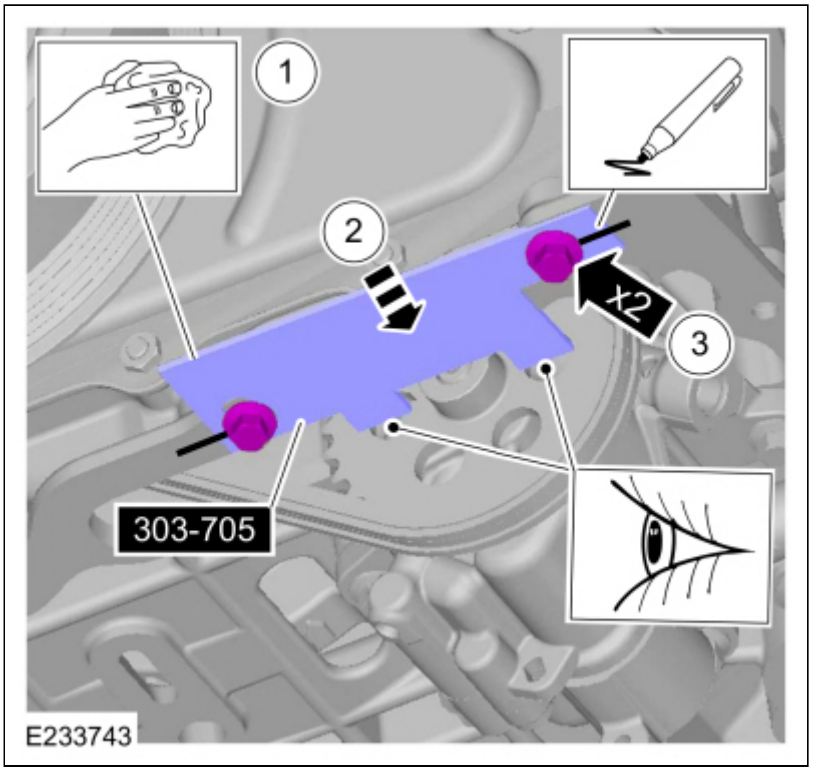
Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Oil Pan - 4WD (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Oil Pan - 4x2 (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
3. 
4. **WARNING: Be prepared to collect escaping fluids.**



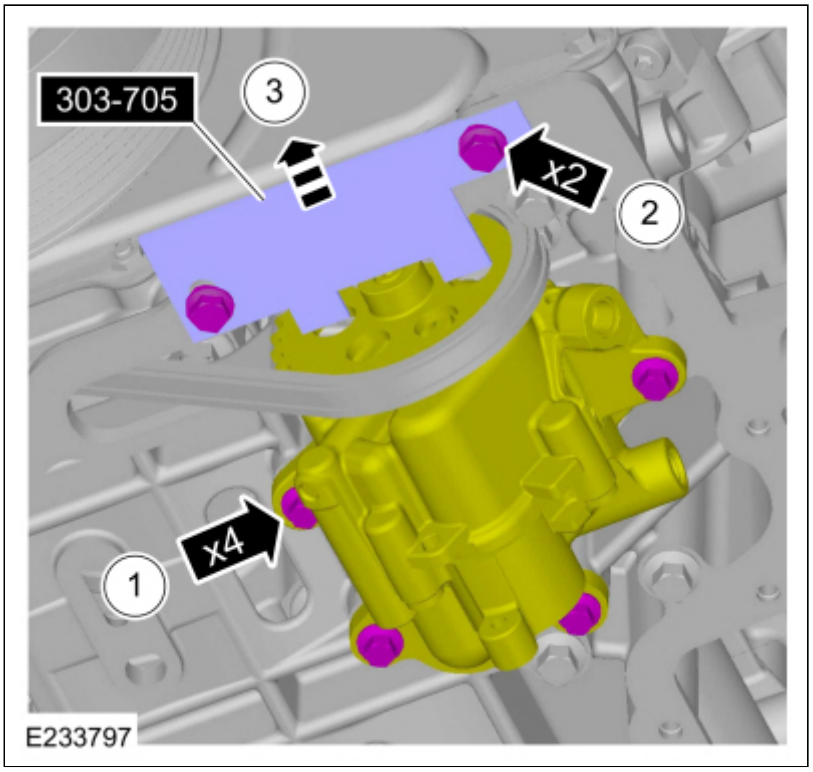
1. **NOTE:** *Make sure that the surface is clean and free of foreign material.*

2. Install Special Service Tool: 303-705 Aligner, Oil Pump.
3. *Torque*: 15 Nm

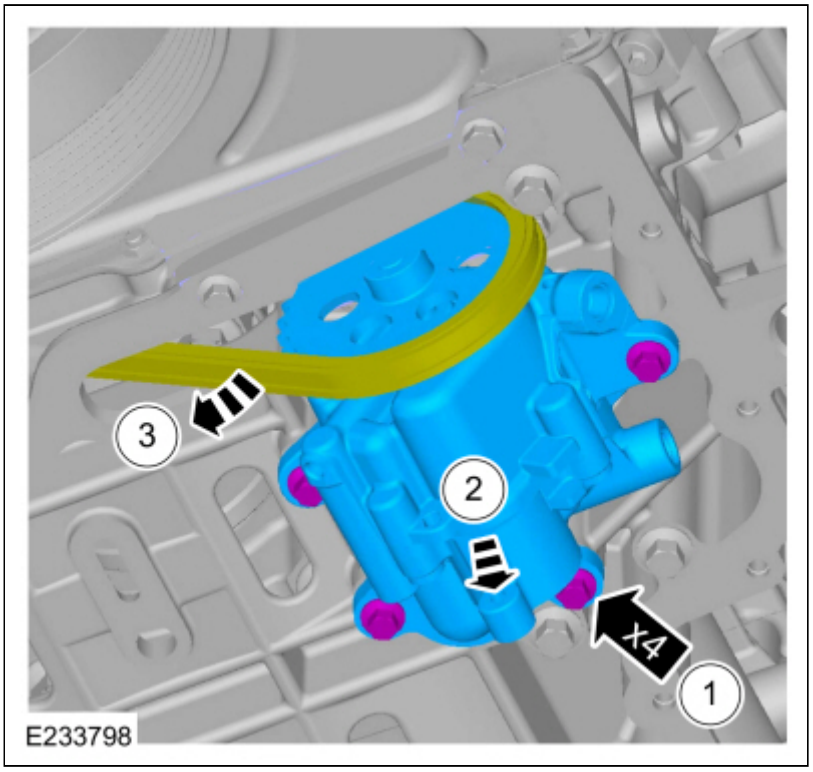


6. **NOTE:** *Do not completely loosen the bolt at this stage.*

   Remove Special Service Tool: 303-705 Aligner, Oil Pump.



7.

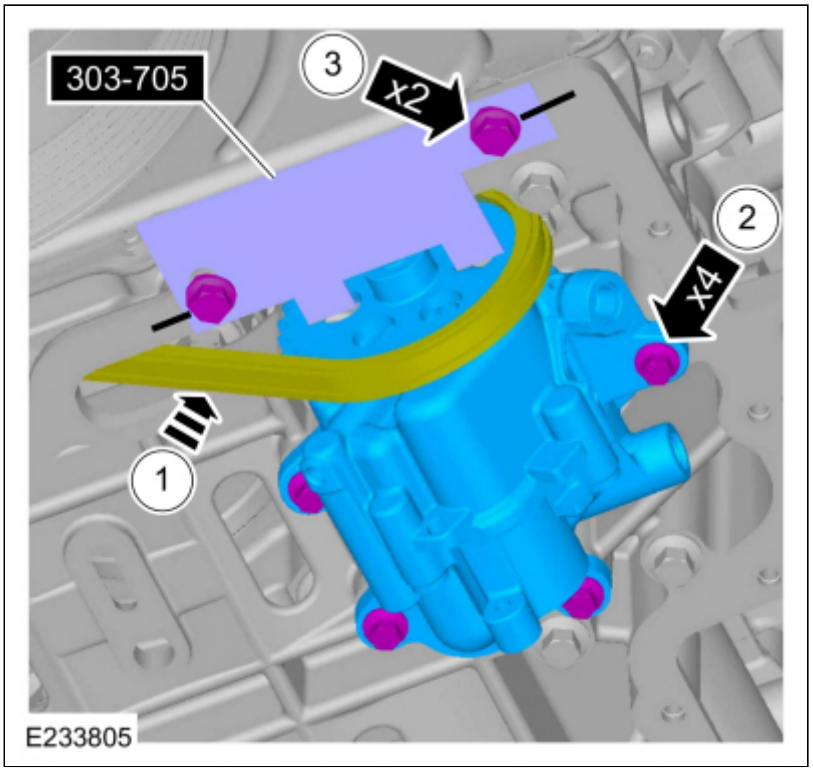


Installation

1. **NOTE:** *Only tighten the bolts finger tight at this stage.*

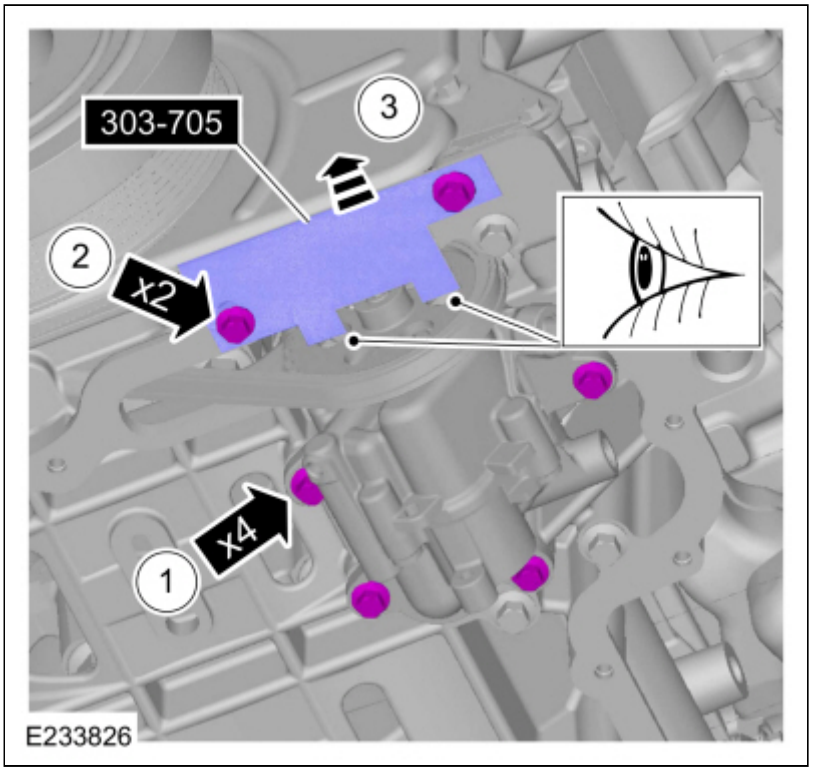
   NOTE: *Make sure that the installation marks are aligned.*

   Use Special Service Tool: 303-705 Aligner, Oil Pump.



2. **NOTE:** *The profile of the special tool must be in contact with the component.*

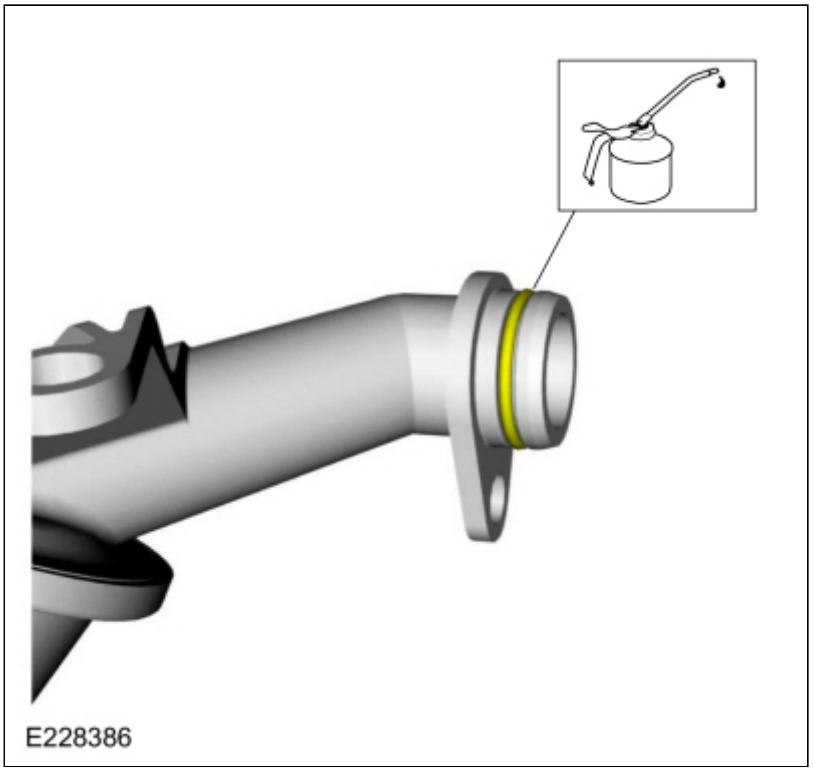
   Remove Special Service Tool: 303-705 Aligner, Oil Pump.
   Torque: 10 Nm



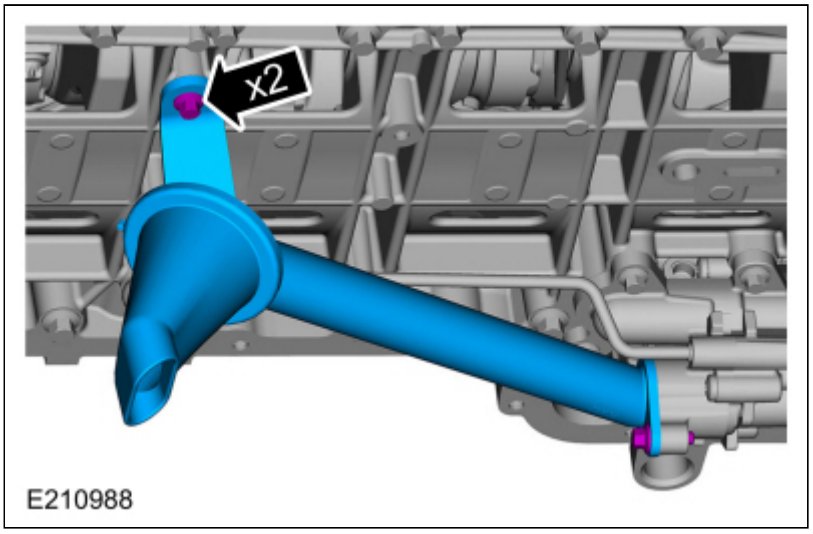
3. **NOTE:** *Lubricate the "O" ring before installing.*

   NOTE: *Make sure that a new component is installed if the O-ring is damaged.*

   Inspect the O-ring before installation.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



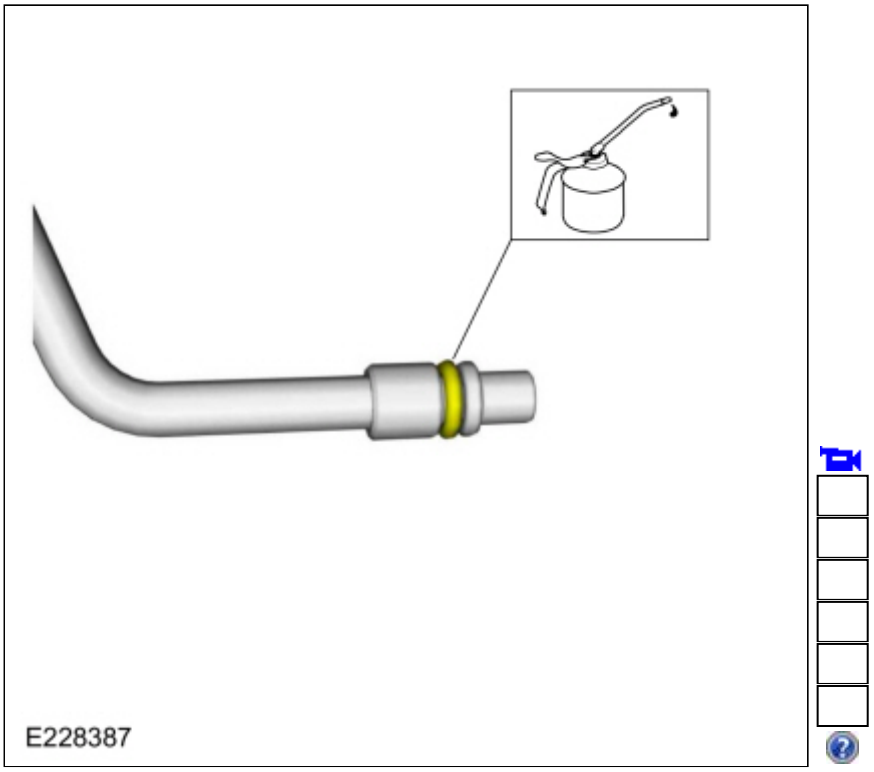
4. *Torque*: 10 Nm



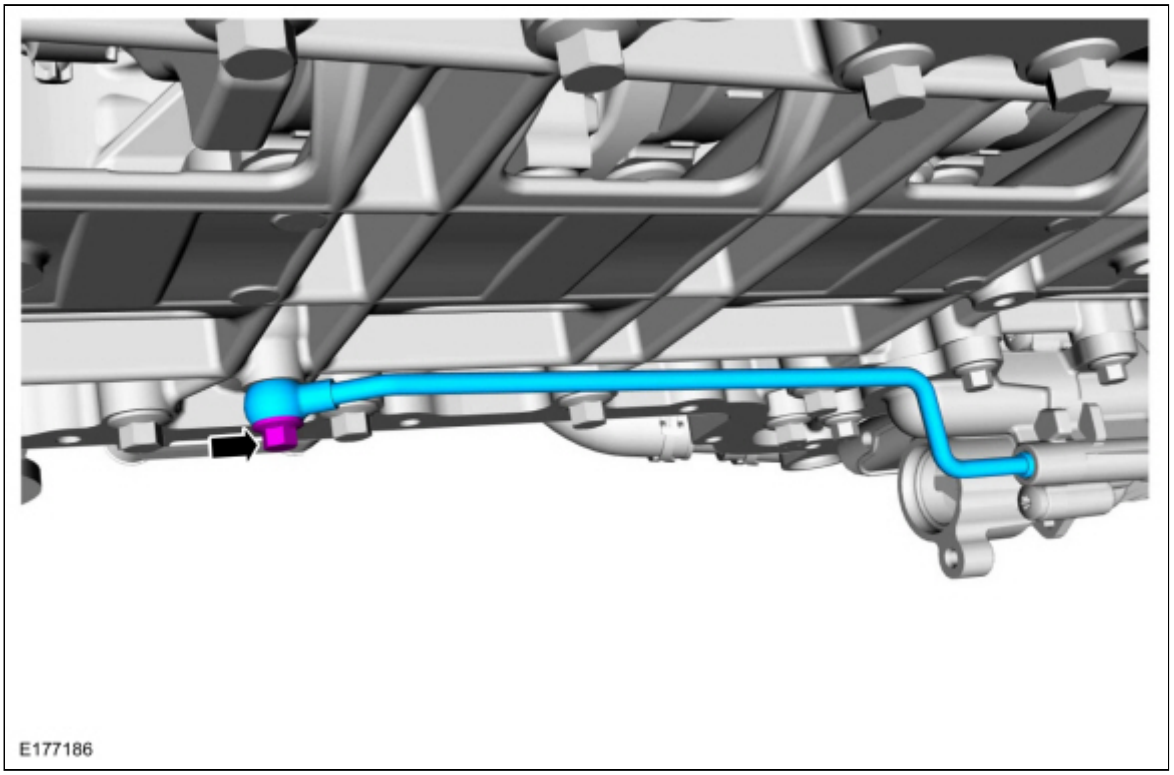
5. **NOTE:** *Lubricate the "O" ring before installing.*

   NOTE: *Make sure that a new component is installed if the O-ring is damaged.*

   Inspect the O-ring before installation.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



6. *Torque*: 13 Nm

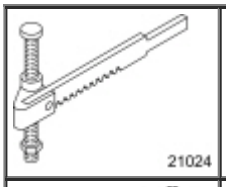
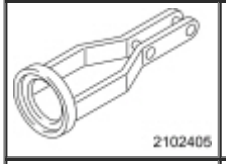
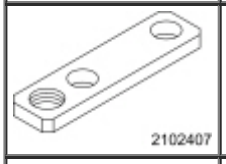
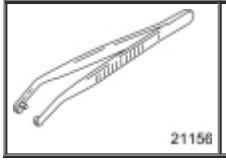


7. Refer to: Oil Pan - 4WD (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Oil Pan - 4x2 (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

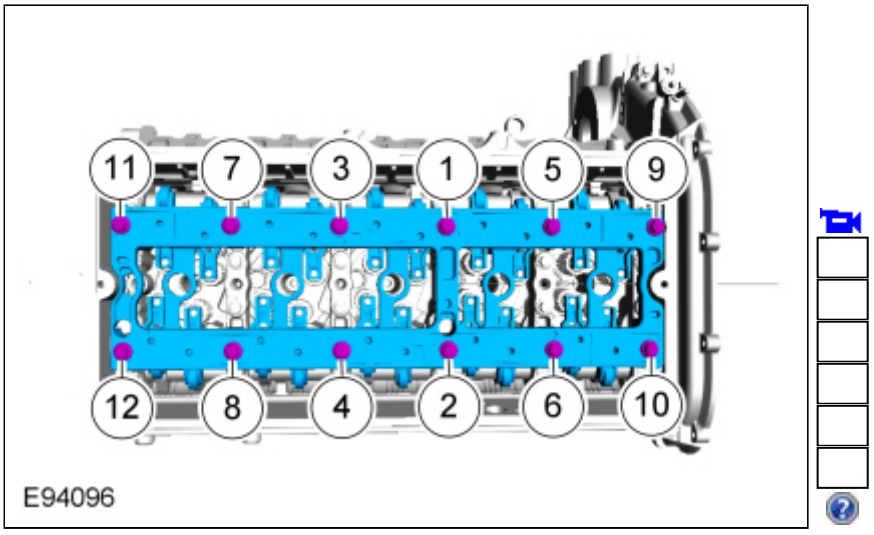
Copyright © 2016 Ford Motor Company

Valve Springs

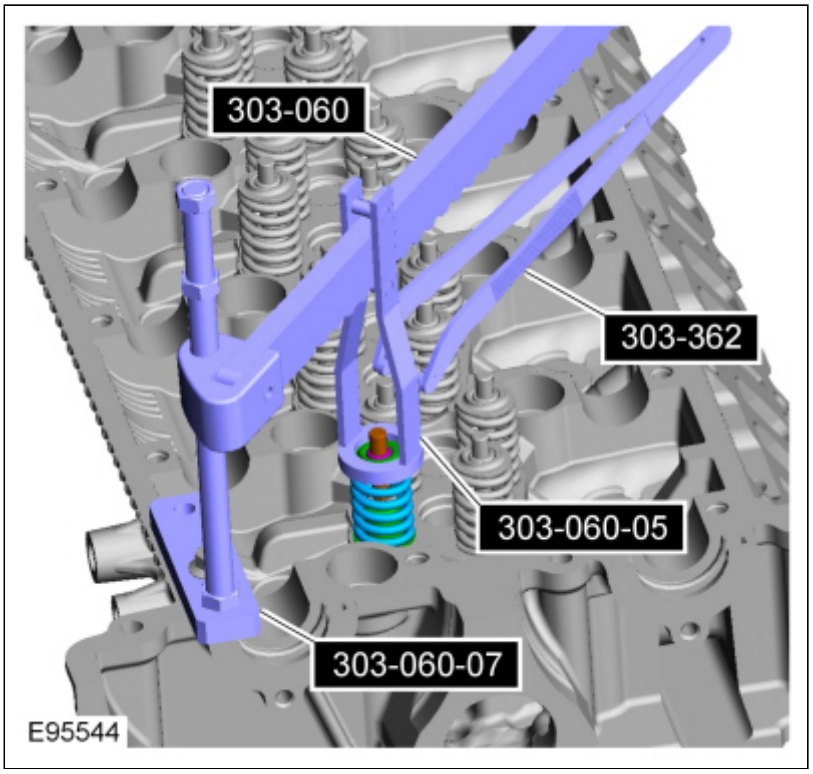
Special Tool(s) / General Equipment

 21024	303-060 Compressor, Valve Spring
 2102405	303-060-05 Adapter for 303-060
 2102407	303-060-07 Adapter for 303-060
 21156	303-362 Installer, Valve Stem Collets

Removal

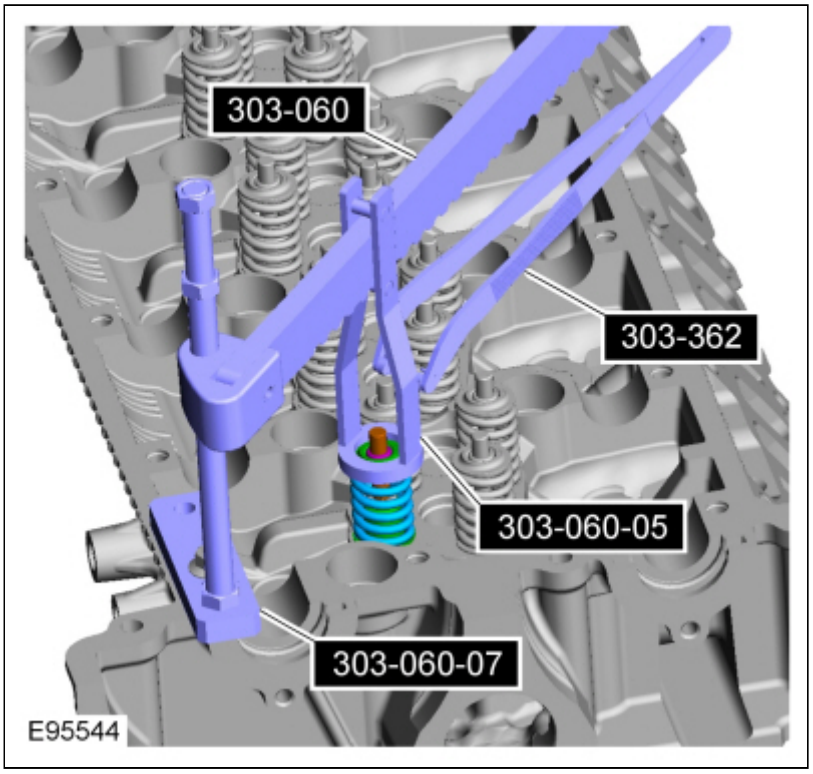
1. Refer to: Valve Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. 

3. Position the appropriate piston at top dead center (TDC).
4. Use Special Service Tool: 303-060 Compressor, Valve Spring. , 303-060-05 Adapter for 303-060. , 303-060-07 Adapter for 303-060. , 303-362 Installer, Valve Stem Collets.

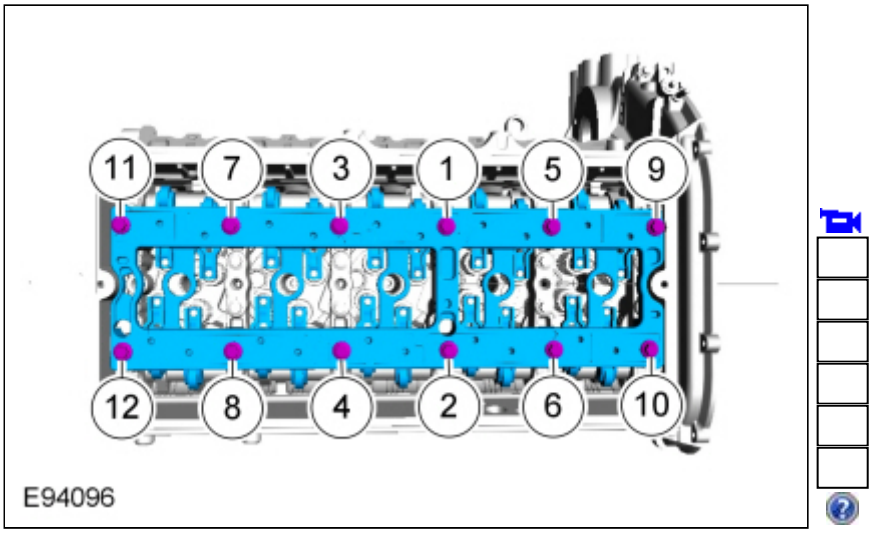


Installation

1. Use Special Service Tool: 303-060 Compressor, Valve Spring. , 303-060-05 Adapter for 303-060. , 303-060-07 Adapter for 303-060. , 303-362 Installer, Valve Stem Collets.



2. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 8 Nm
   Stage 3: 10 Nm
   Stage 4: 45°



3. Refer to: Valve Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Timing Cover

Special Tool(s) / General Equipment

 21179	303-428 Separator, Oil Pan
 303682	303-682 Aligner, Engine Front Cover

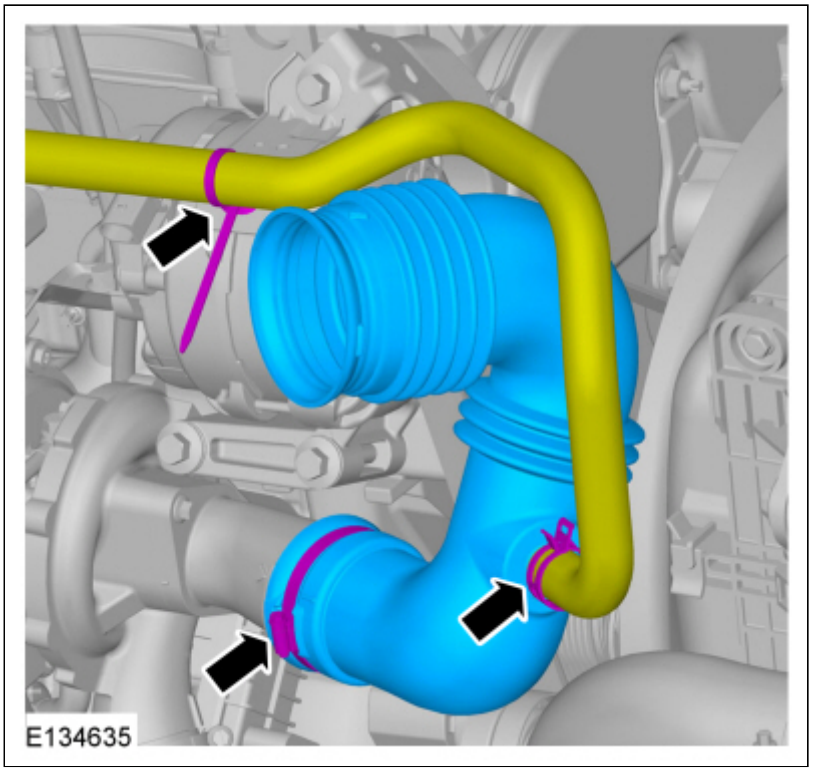
Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

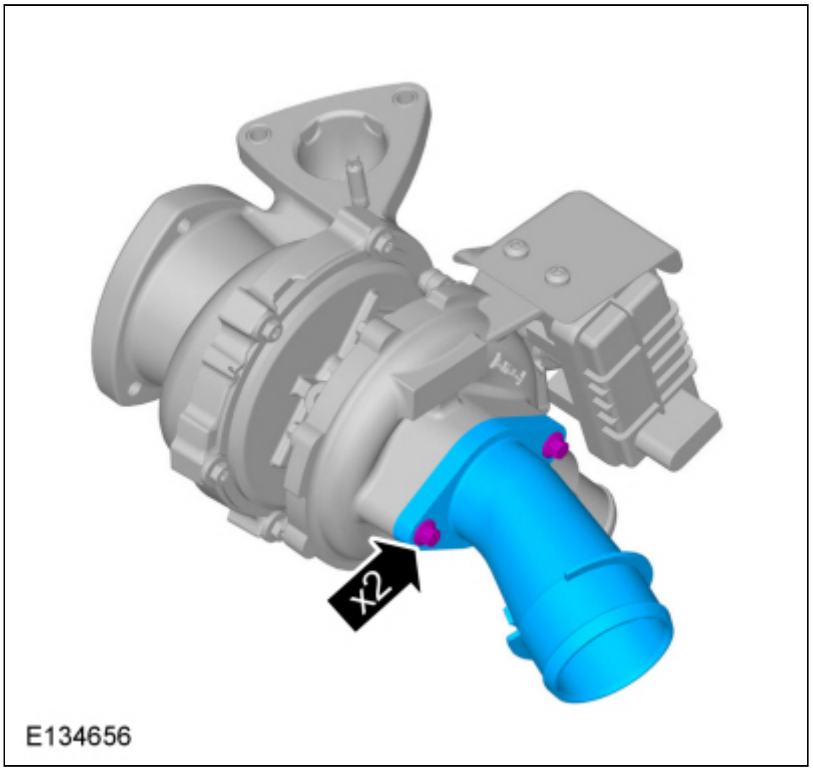
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

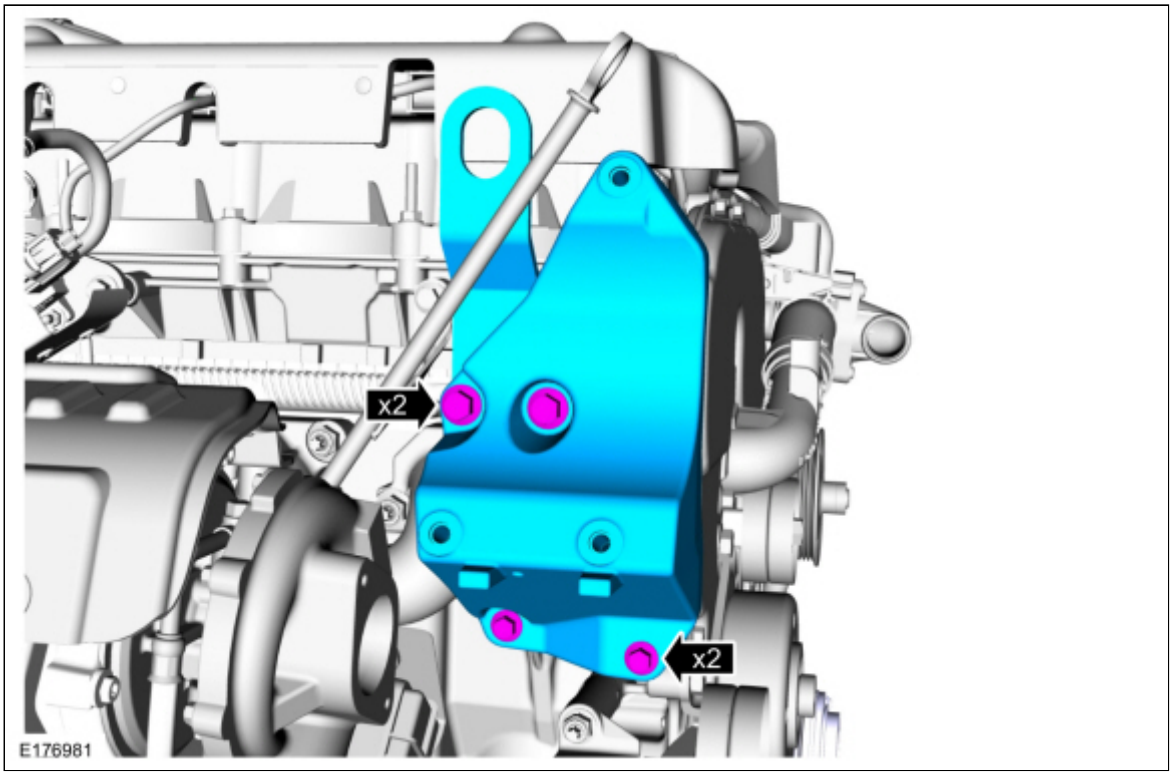
1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Air Cleaner - 3.2L Duratorq-TDCi (Puma) Diesel (303-12C Intake Air Distribution and Filtering - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
4. Refer to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
5. Refer to: Engine Front Seal (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
6.



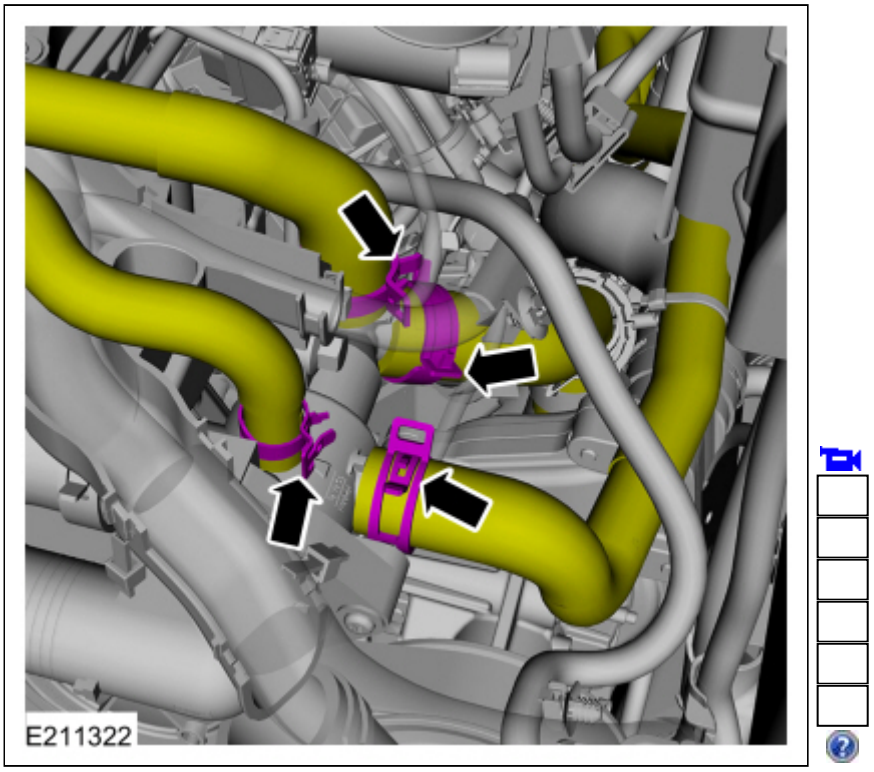
7.



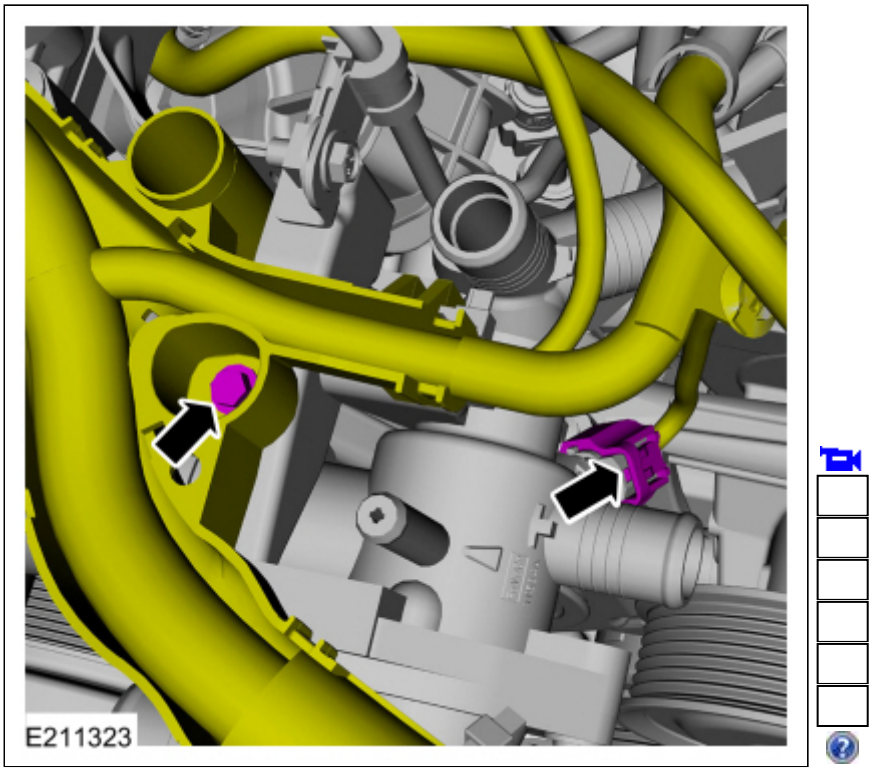
8.



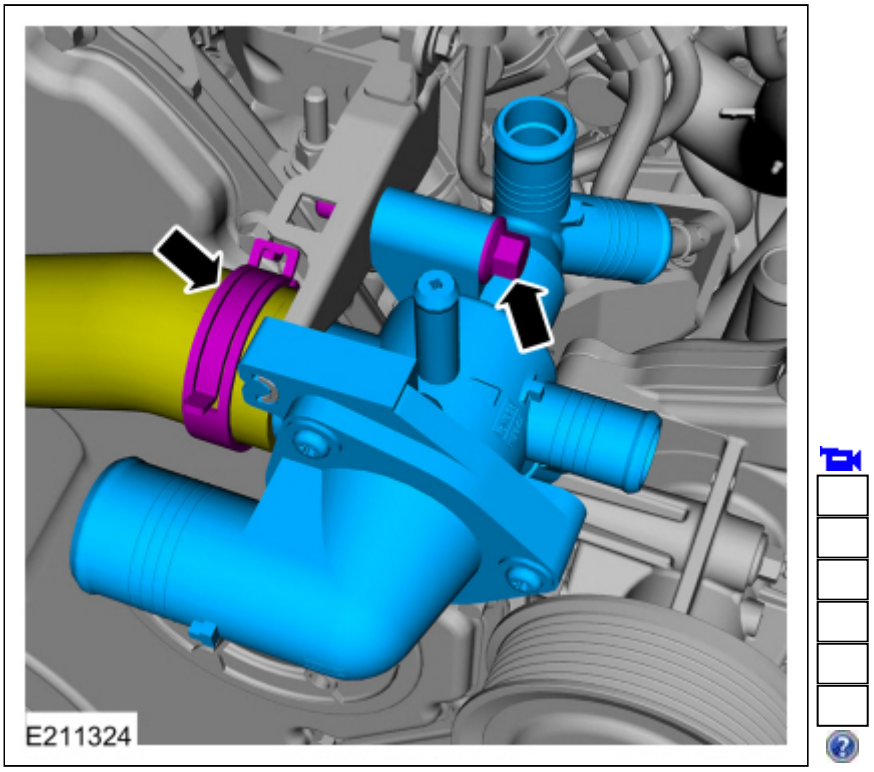
9.



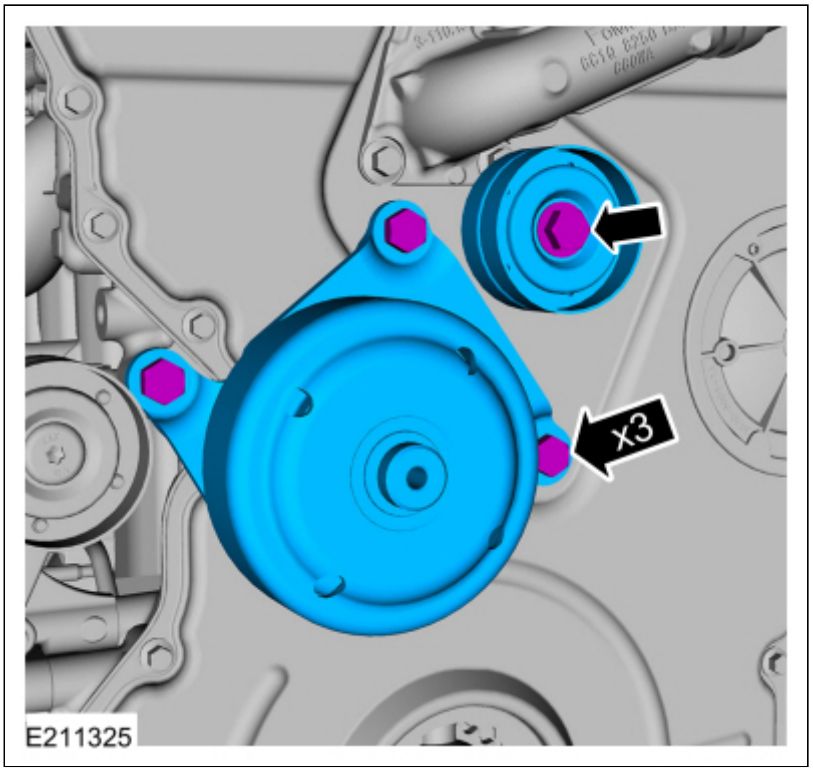
10.



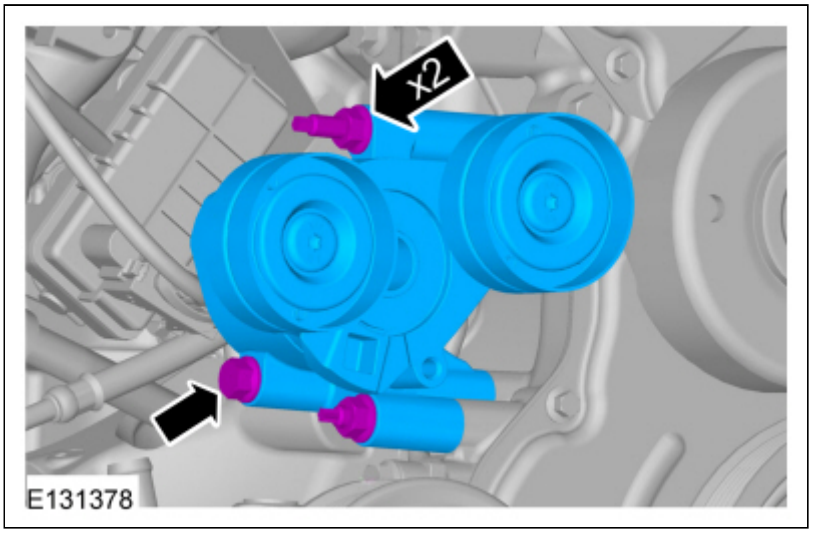
11. *Torque*: 23 Nm



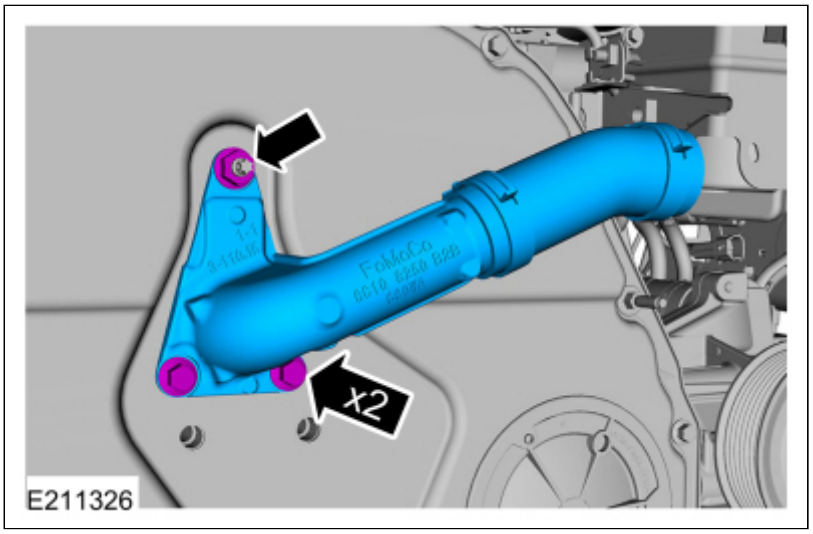
12. *Torque*: 48 Nm



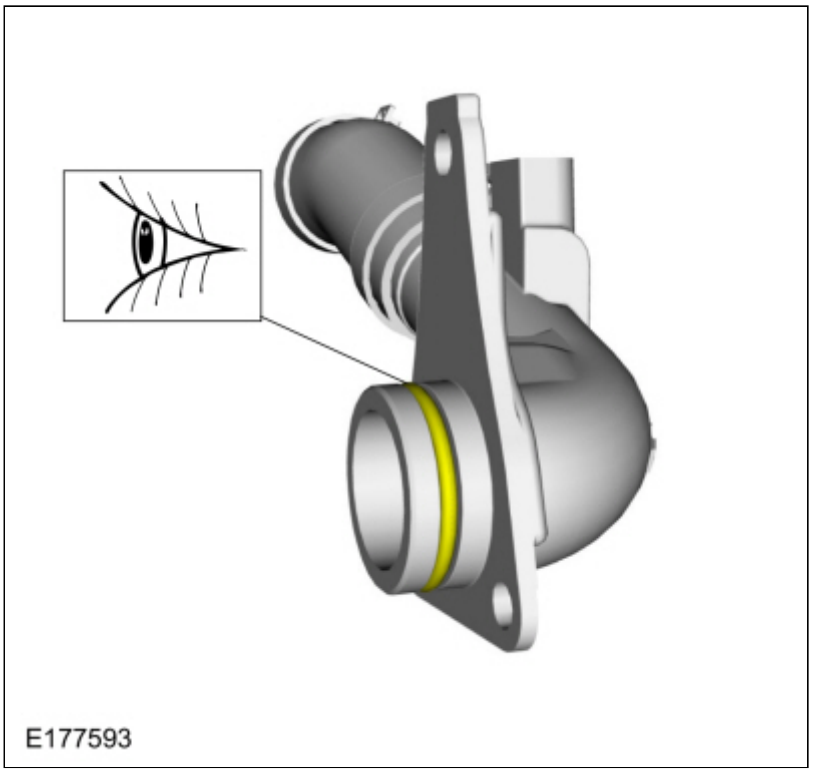
13.



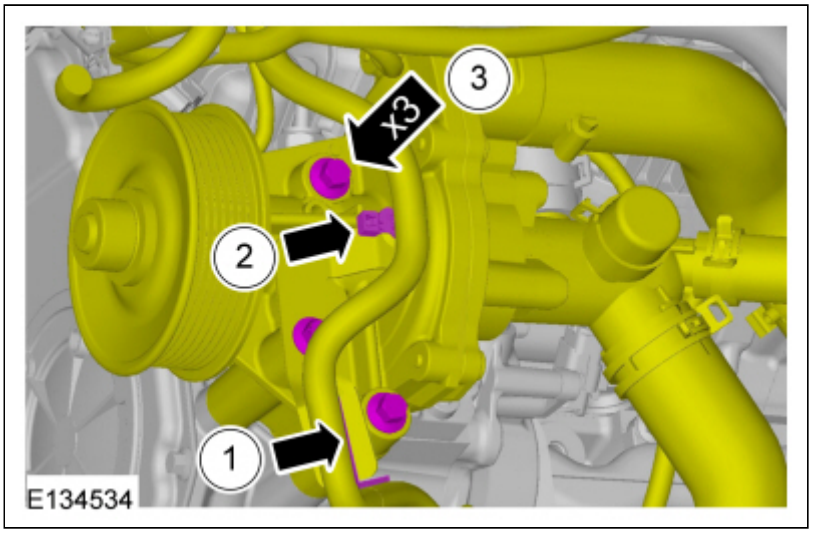
14. *Torque*: 23 Nm



15.



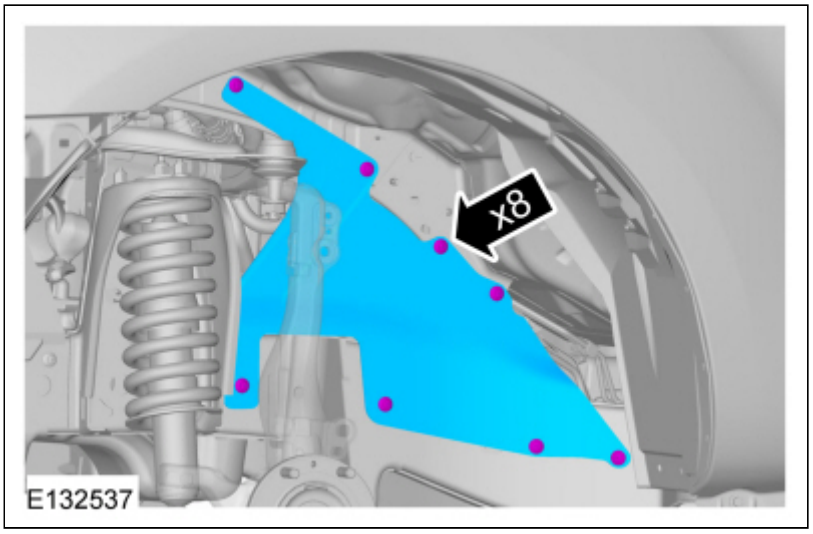
16. *Torque*:
    1: Nm
    2: Nm
    3: 23 Nm



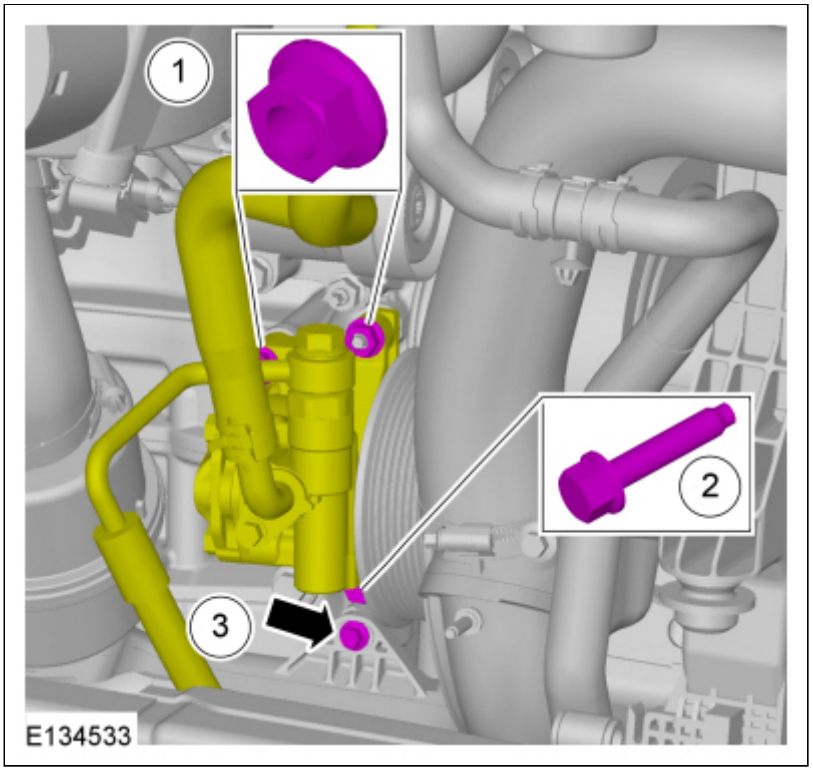
17. **NOTE:** *Remove RH side wheel only.*

    Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

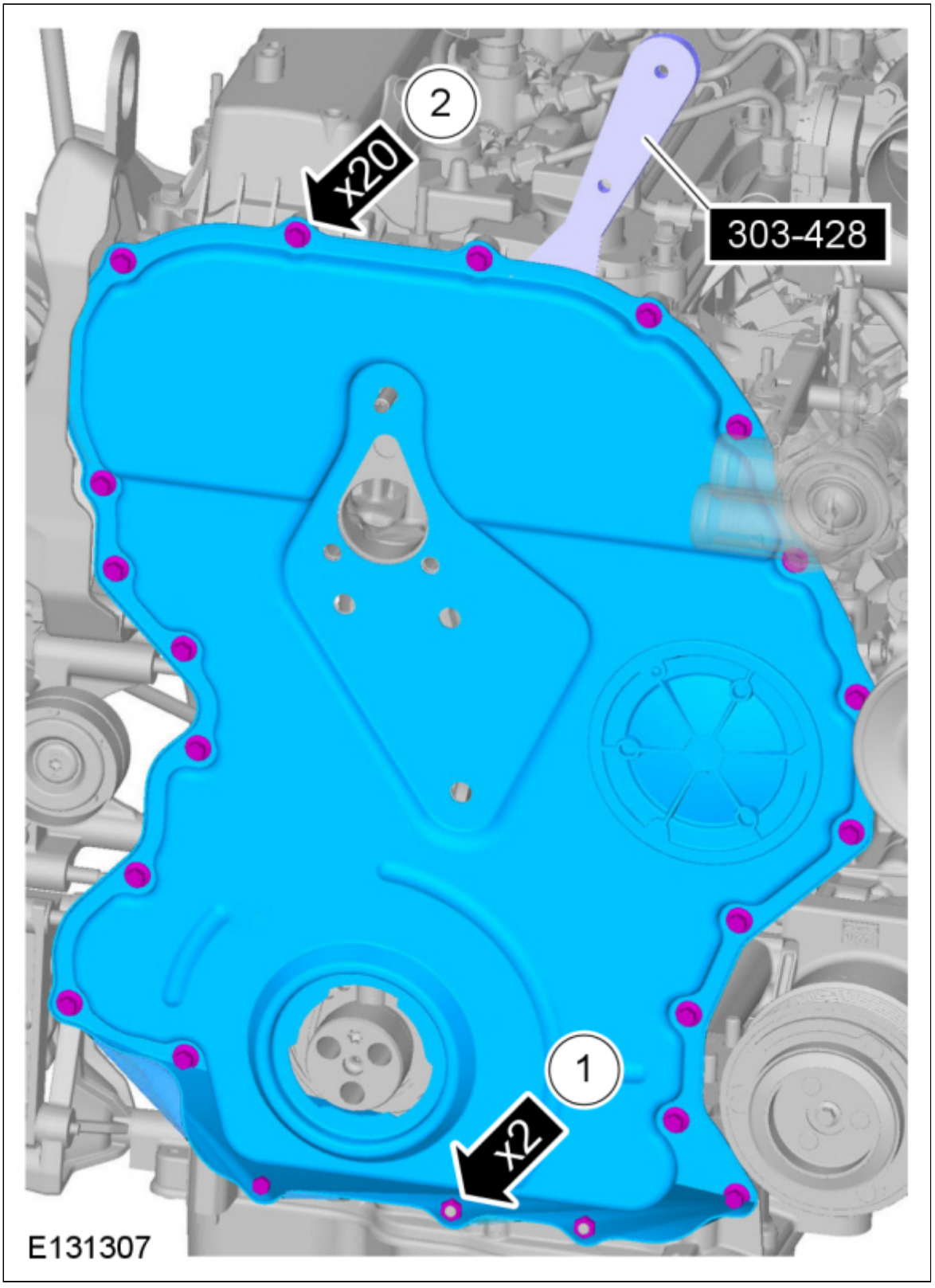
18.



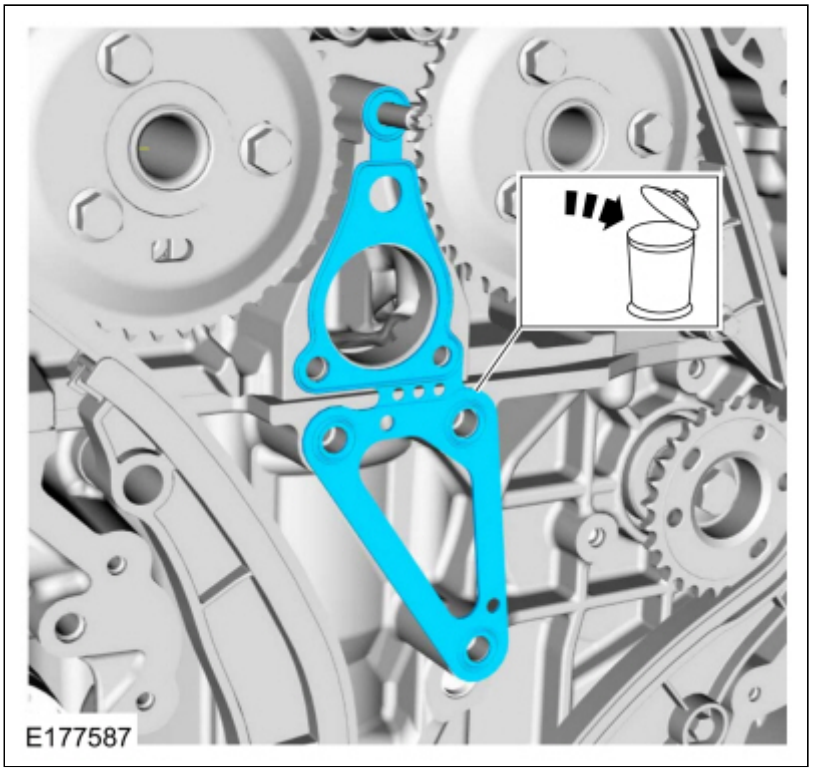
19. *Torque*:
    - : 20 Nm
    - : 20 Nm
    - : 10 Nm



20. Use Special Service Tool: 303-428 Separator, Oil Pan.



21.



Installation

1. **NOTICE: Install the timing cover within five minutes of applying the sealer.**

   NOTE: *Do not damage the mating faces.*

   NOTE: *To remove oil from the cylinder block flange bonderite 1455-w wipes must be used*

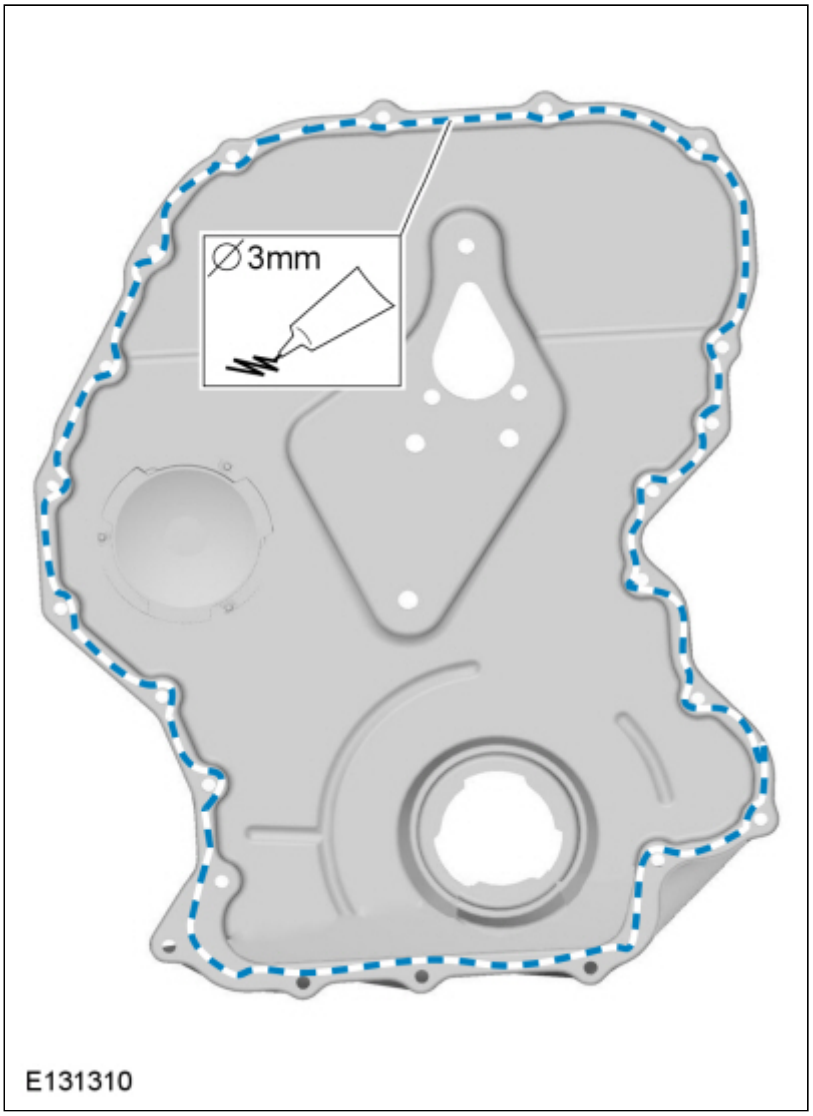
   NOTE: *Loctite 7070 or other de-contaminator must not be used on cylinder block flanges.*

   NOTE: *Always apply bonderite 1455 wipes to (4) x t-joints(block/head, block/ladderframe)*

   NOTE: *Apply bonderite 1455-w wipes to (2) x t-joints(head/cam-carrier interfaces)*

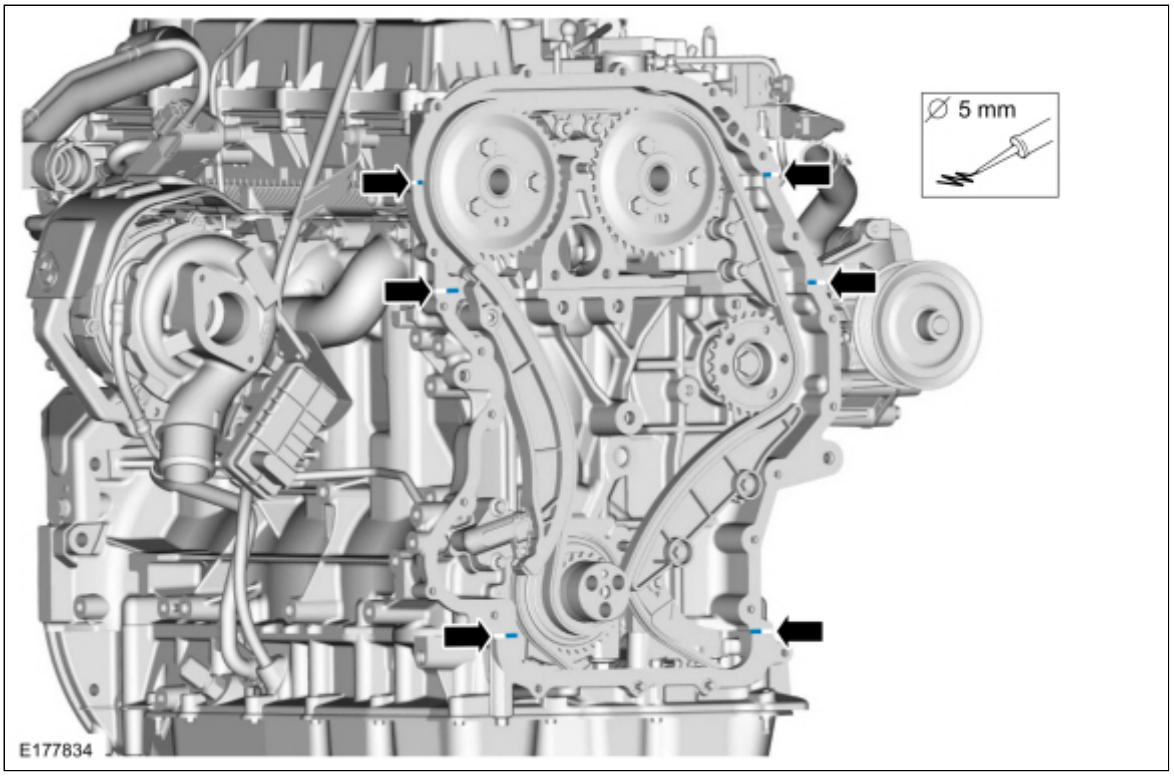
   NOTE: *One minute flash time is recommended after bonderite 1455-w application. apply different section of wipes to each t-joints and do not re-use.*

   Material: Silicone Sealant (WSE-M4G323-A4)

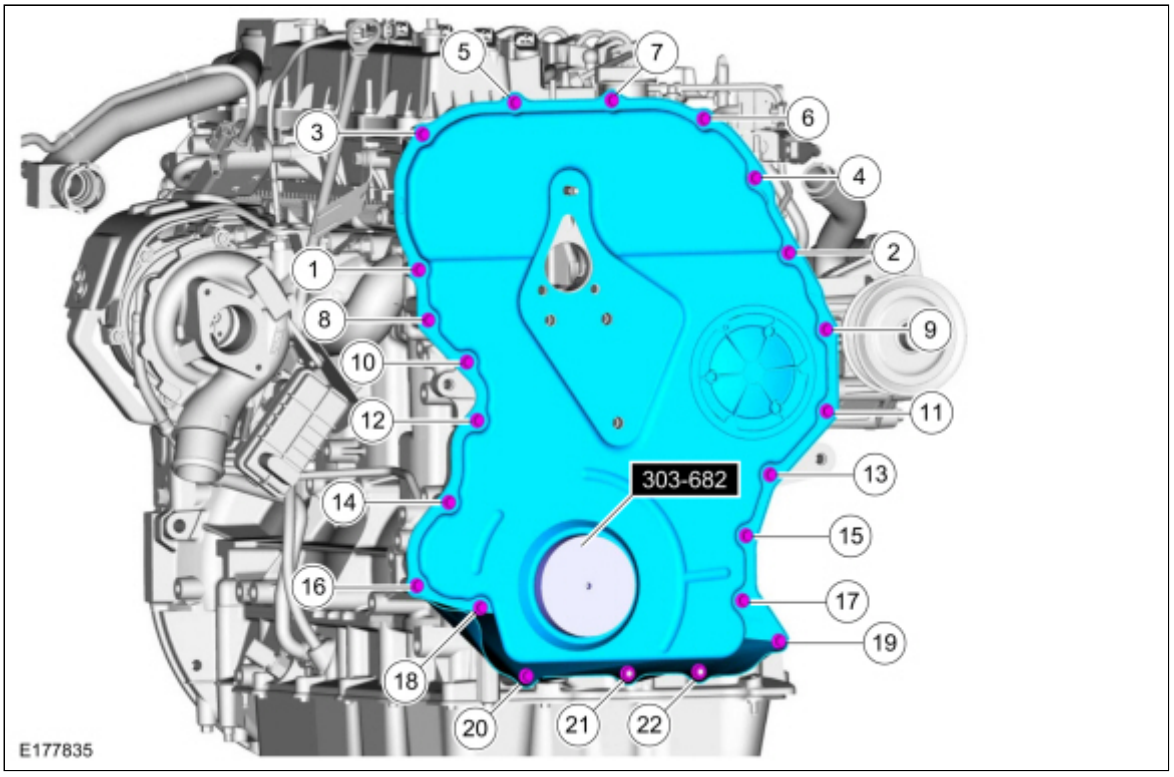


2. **NOTE:** *The component must be installed within 5 minutes of applying the sealant.*

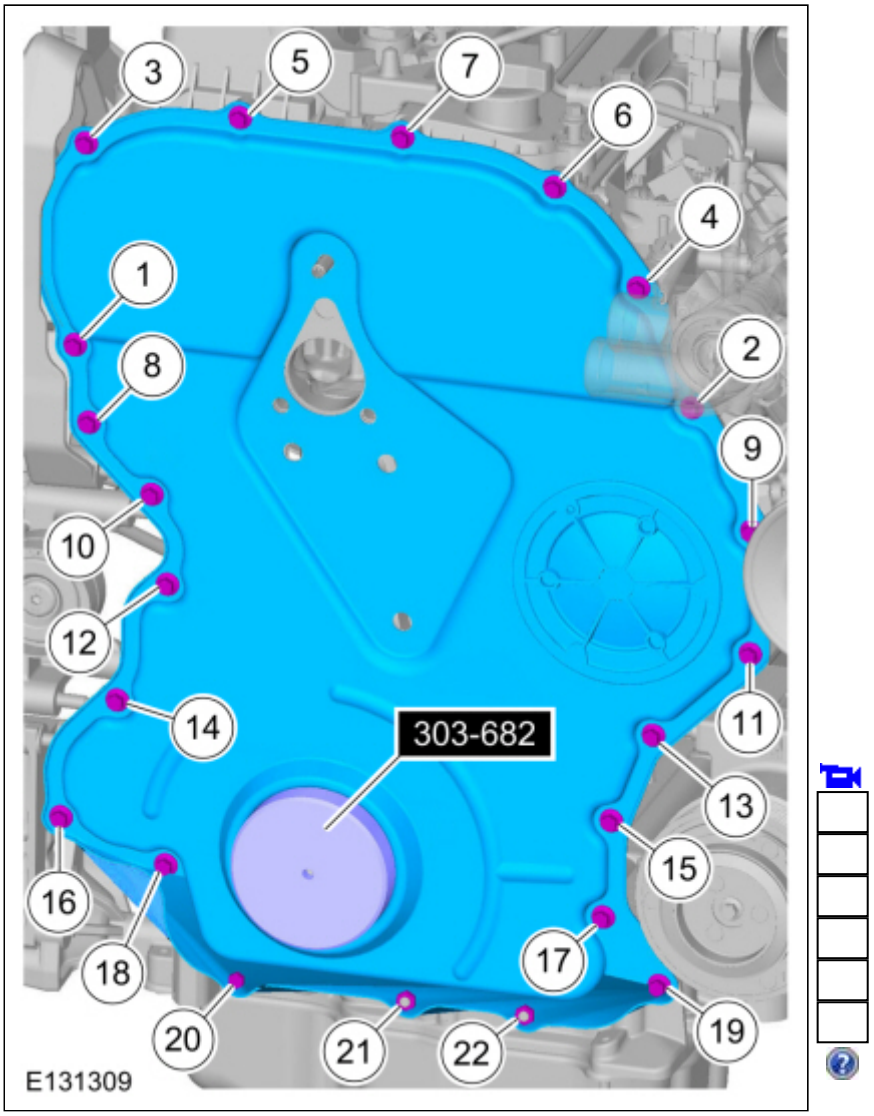
   Install a 3 mm bead of silicone sealant to the T-joints .
   Material: Silicone Sealant (WSE-M4G323-A4)



3. Using the special tool to align the engine front cover. Install the engine front cover, nuts and bolts.
   Use Special Service Tool: 303-682 Aligner, Engine Front Cover.



4. Use Special Service Tool: 303-682 Aligner, Engine Front Cover.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 10 Nm
   Stage 3: 10 Nm

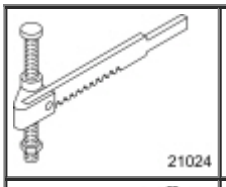
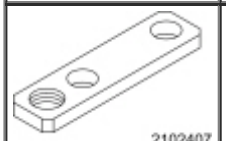
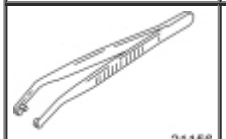


5. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Valves

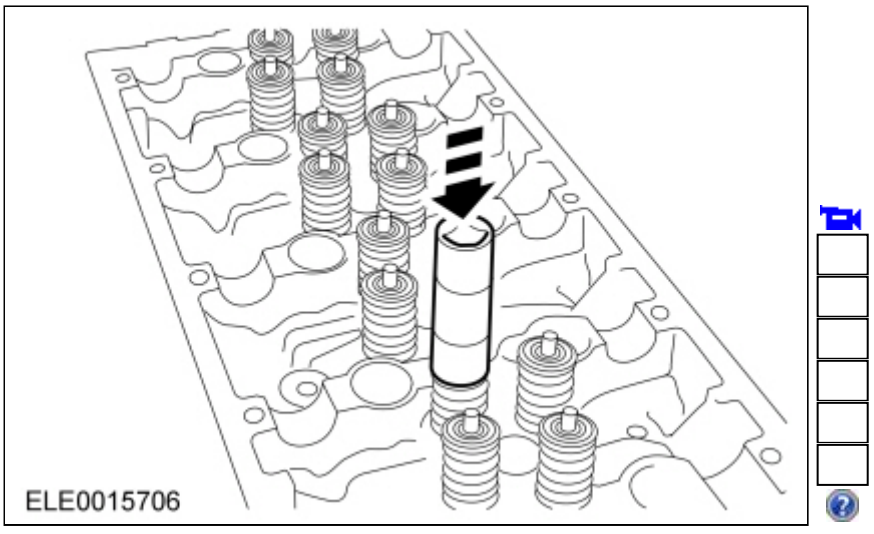
Special Tool(s) / General Equipment

 21024	303-060 Compressor, Valve Spring
 2102405	303-060-05 Adapter for 303-060
 2102407	303-060-07 Adapter for 303-060
 21156	303-362 Installer, Valve Stem Collets

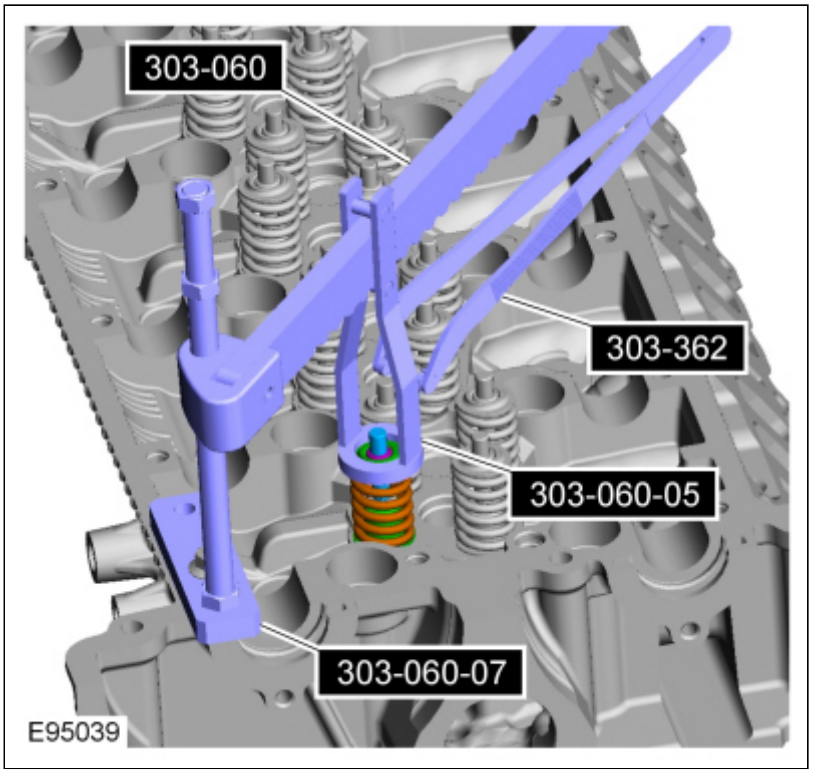
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

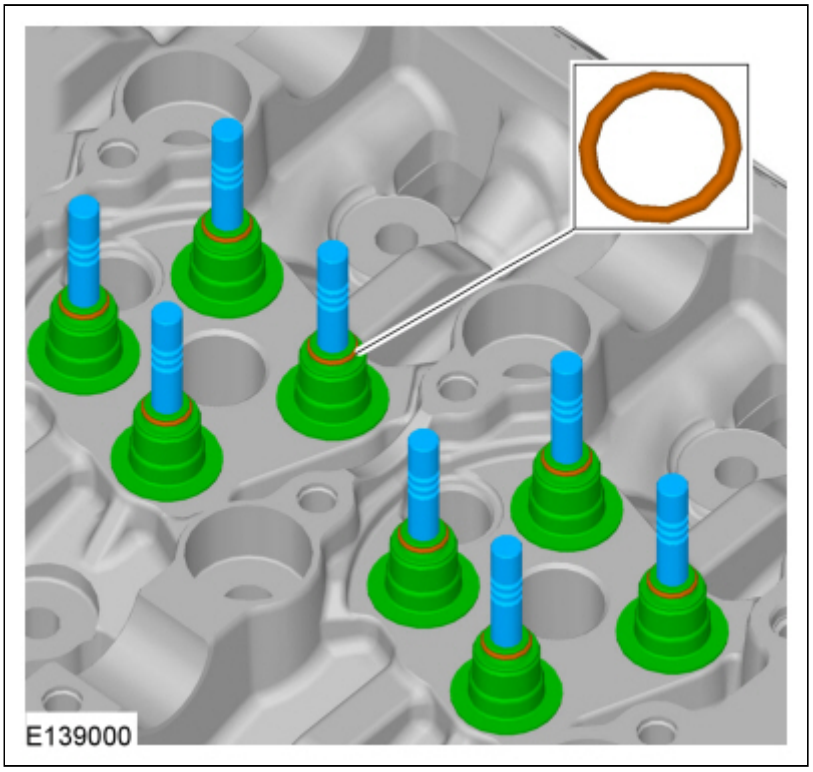
1. Refer to: Cylinder Head (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. **NOTE:** *Position a socket on the valve spring seat and gently strike it with a hammer.*



3. Use Special Service Tool: 303-060 Compressor, Valve Spring. , 303-060-05 Adapter for 303-060. , 303-060-07 Adapter for 303-060. , 303-362 Installer, Valve Stem Collets.



4.



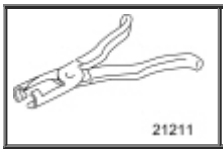
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Valve Stem Seals

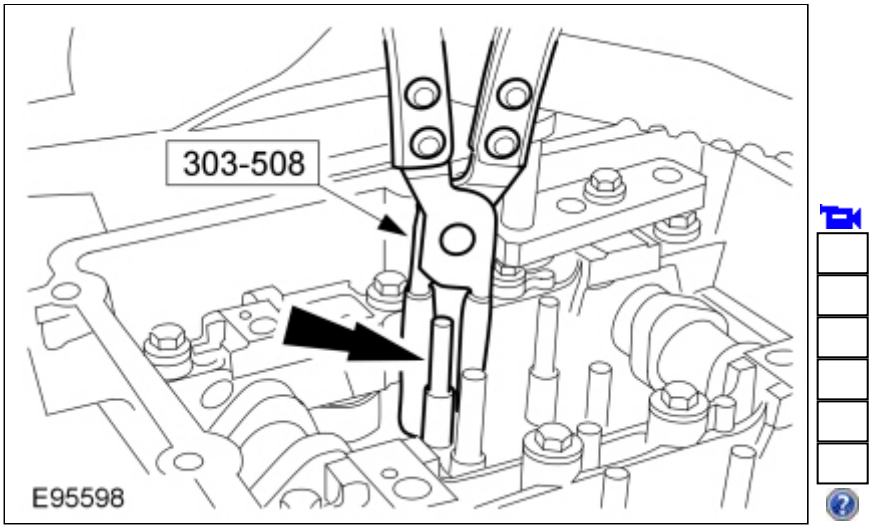
Special Tool(s) / General Equipment

	303-508 Pliers, Valve Stem Seal

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Valve Springs (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. Use Special Service Tool: 303-508 Pliers, Valve Stem Seal.



Installation

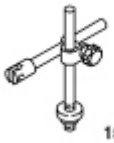
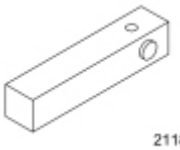
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Cylinder Head

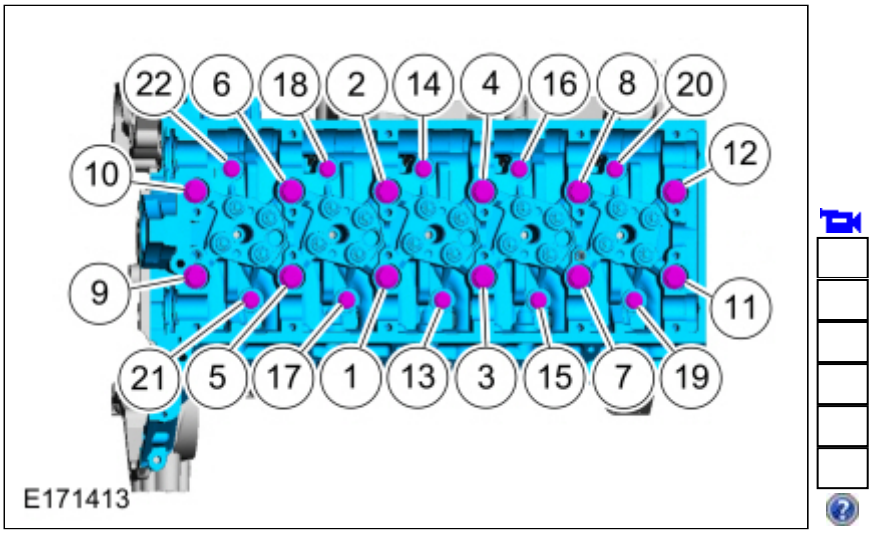
Base Part Number: 6051

Special Tool(s) / General Equipment

 15046	205-069 Dial Indicator Gauge (Metric)
 15022a	205-070 Holding Fixture, Dial Indicator Gauge
 21183	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion)

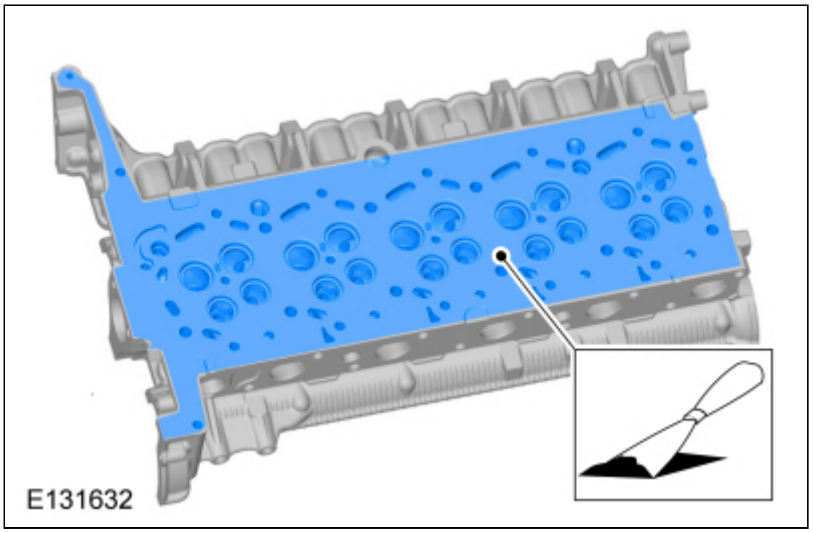
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Brake Vacuum Pump - RHD (206-07 Power Brake Actuation, Removal and Installation).
   Refer to: Exhaust Gas Recirculation (EGR) Cooler - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Exhaust Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Camshafts (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. 

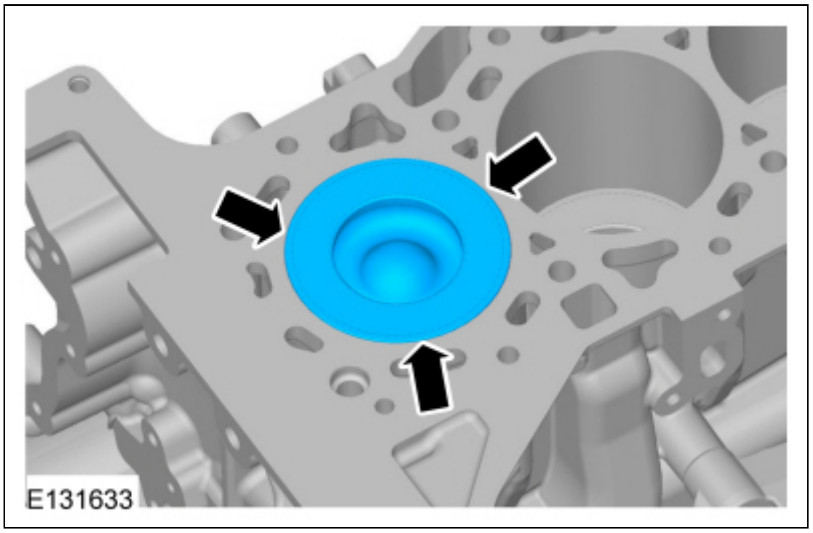
Installation

1. **WARNING: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**



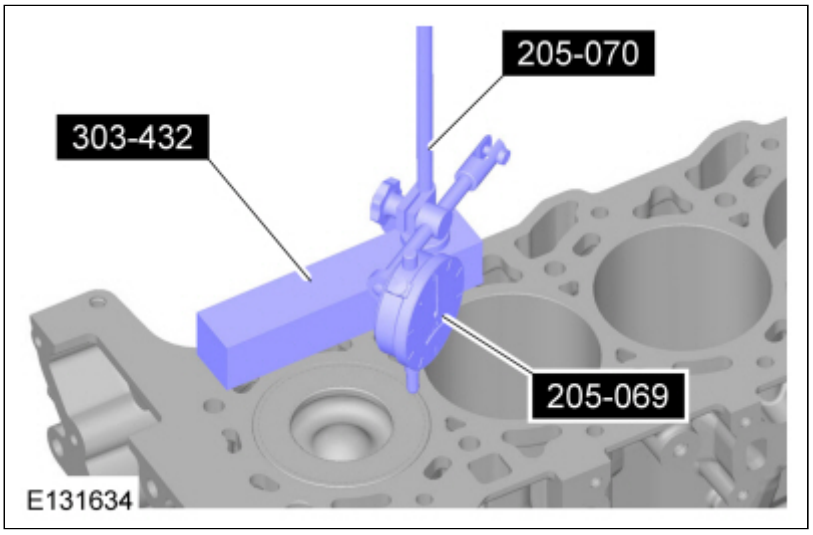
2. **NOTE:** *Measure the piston protrusion of each cylinder at top dead center (TDC).*

   Measure the distance between the piston crown and the cylinder block at the points indicated.



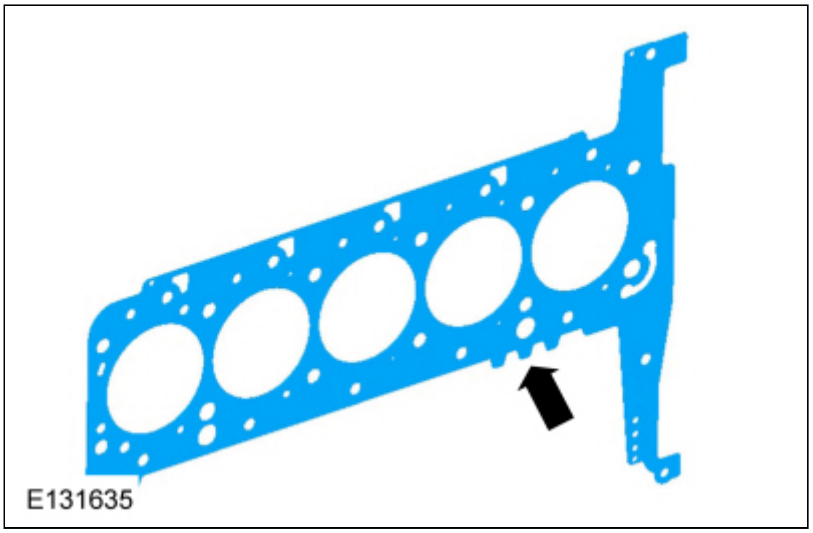
3. **NOTE:** *The largest measurement determines the choice of the cylinder head gasket.*

   Use Special Service Tool: 205-069 Dial Indicator Gauge (Metric). , 205-070 Holding Fixture, Dial Indicator Gauge. , 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion).

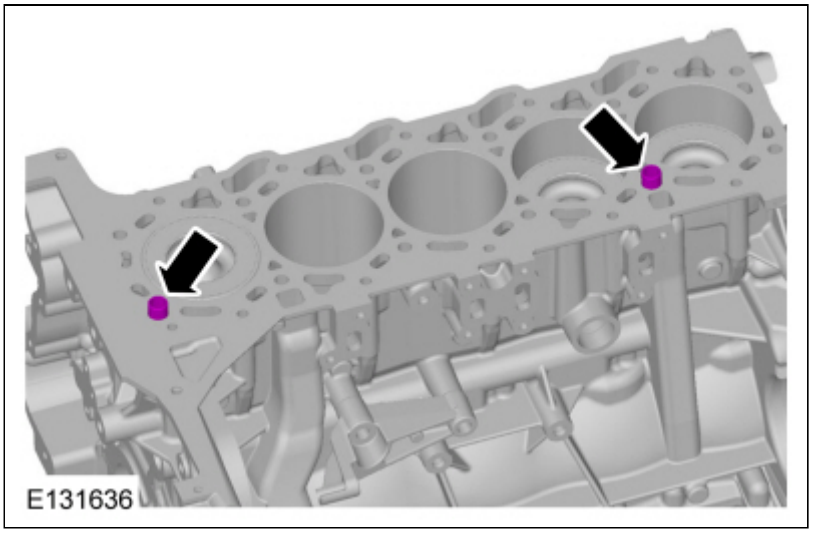


4. **NOTE:** *Note the thickness of the gasket.*

   NOTE: *Make sure that a new component is installed.*



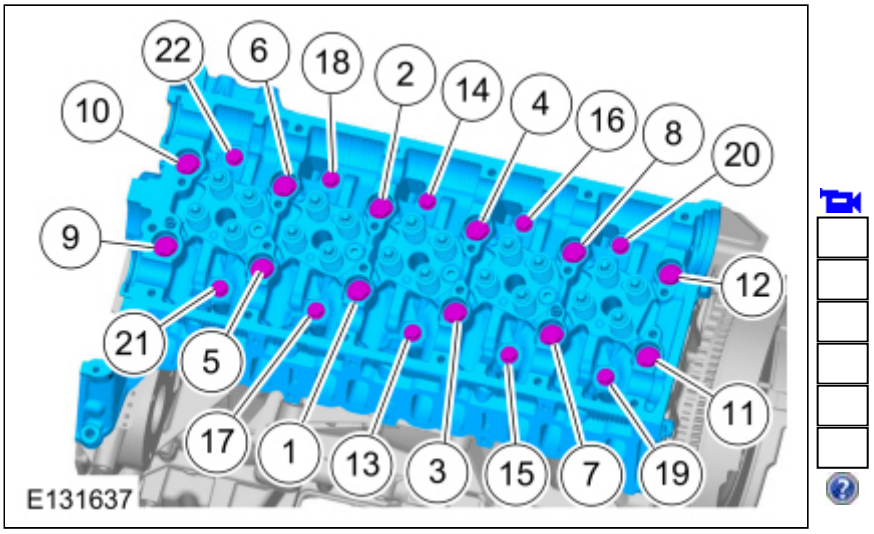
5.



6. **NOTICE: Make sure that new cylinder head bolts are installed.**

   NOTE: *Install all the bolts finger tight before final tightening.*

   Torque:
   Bolts 1 to 12: 10 Nm
   Bolts 13 to 22: 5 Nm
   Bolts 1 to 12: 20 Nm
   Bolts 13 to 22: 10 Nm
   Bolts 1 to 12: 35 Nm
   Bolts 13 to 22: 20 Nm
   Bolts 1 to 12: 45 Nm
   Bolts 13 to 22: 26 Nm
   Bolts 1 to 12: 90°
   Bolts 13 to 22: 90°
   Bolts 1 to 12: 90°
   Bolts 13 to 22: 90°



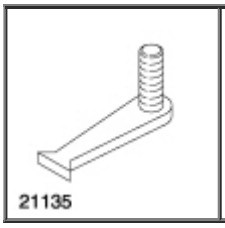
7. Refer to: Camshafts (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Exhaust Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Exhaust Gas Recirculation (EGR) Cooler - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Brake Vacuum Pump - RHD (206-07 Power Brake Actuation, Removal and Installation).
   Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Crankshaft Rear Seal

Base Part Number: 6701

Special Tool(s) / General Equipment

 21135	303-254 Locking Tool, Flywheel

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. With the vehicle in NEUTRAL, position it on a hoist.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

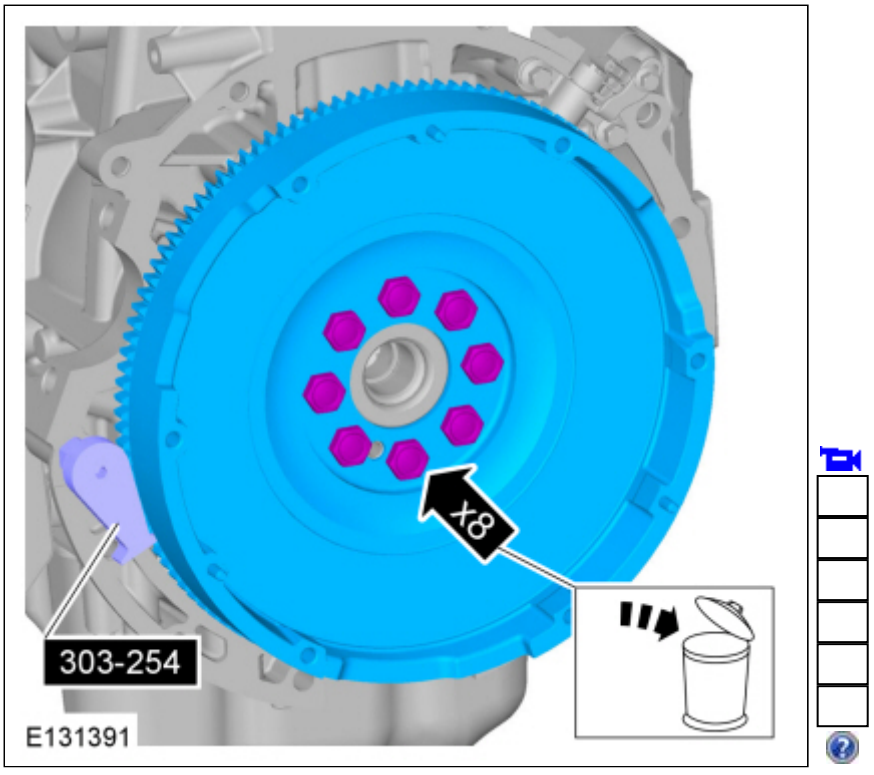
Vehicles with automatic transmission

2. Refer to: Flexplate (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Vehicles with manual transmission

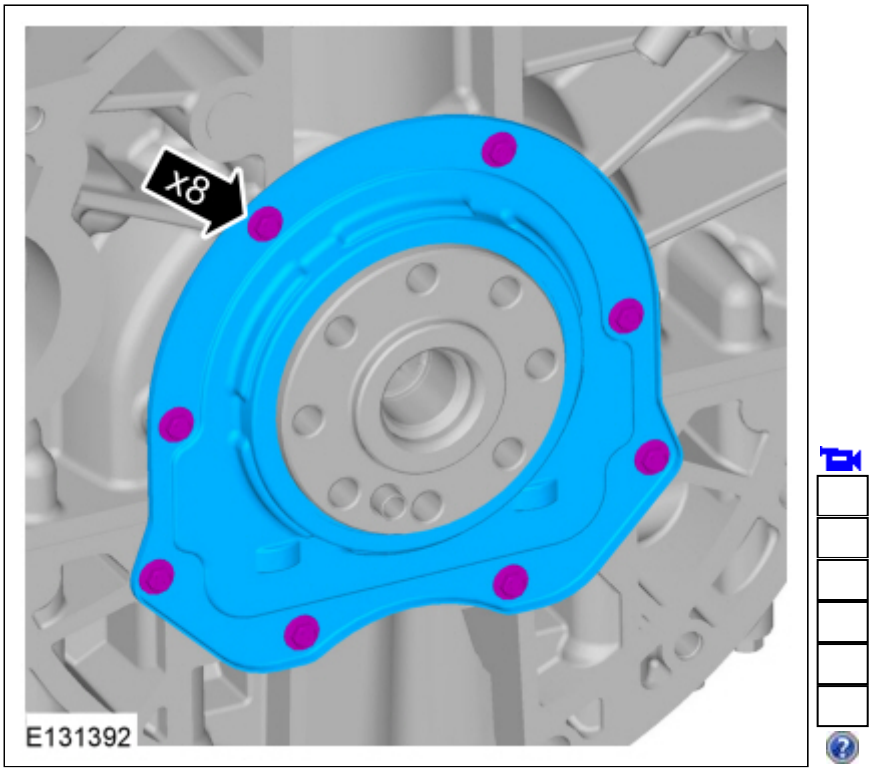
3. Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

4. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



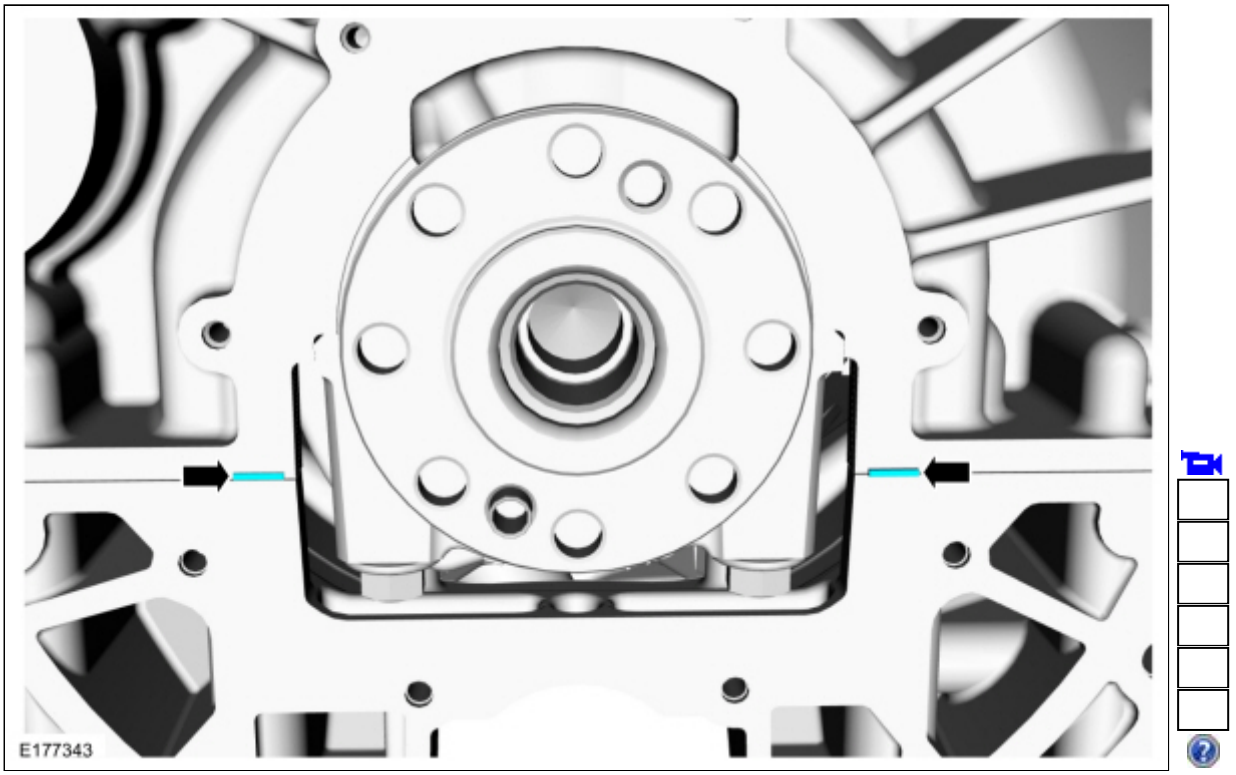
All vehicles

5.



6. **NOTICE: Use care when cleaning the sealing surfaces or damage to the foam pads can occur.**

   Inspect the two foam pads on the ladder frame gaskets.

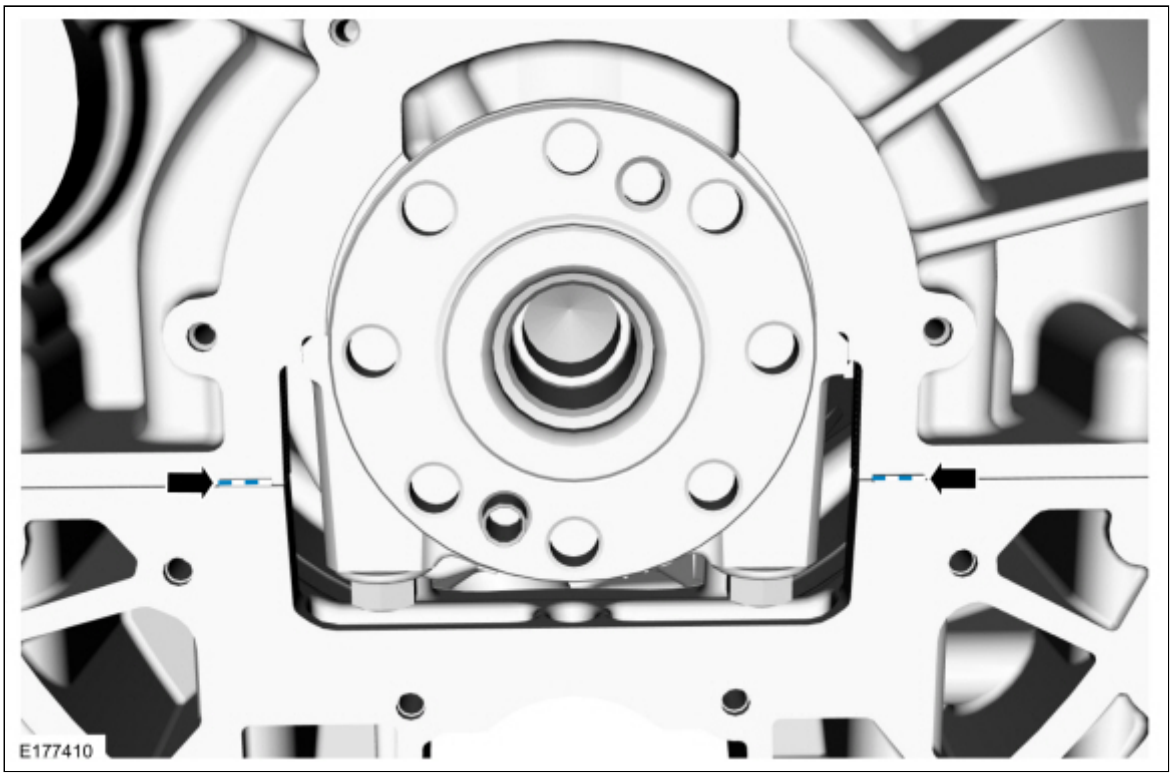


Installation

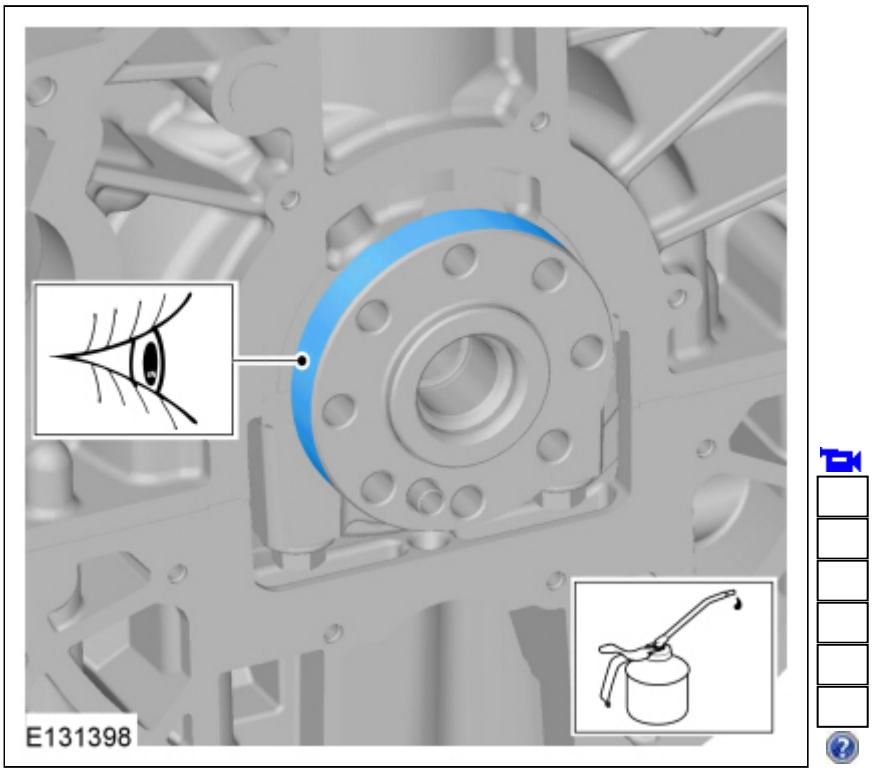
All vehicles

1. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   If the foam pads are not present on inspection, apply a bead of Silicone Sealant in the location.
   Material: Silicone Sealant (WSE-M4G323-A4)

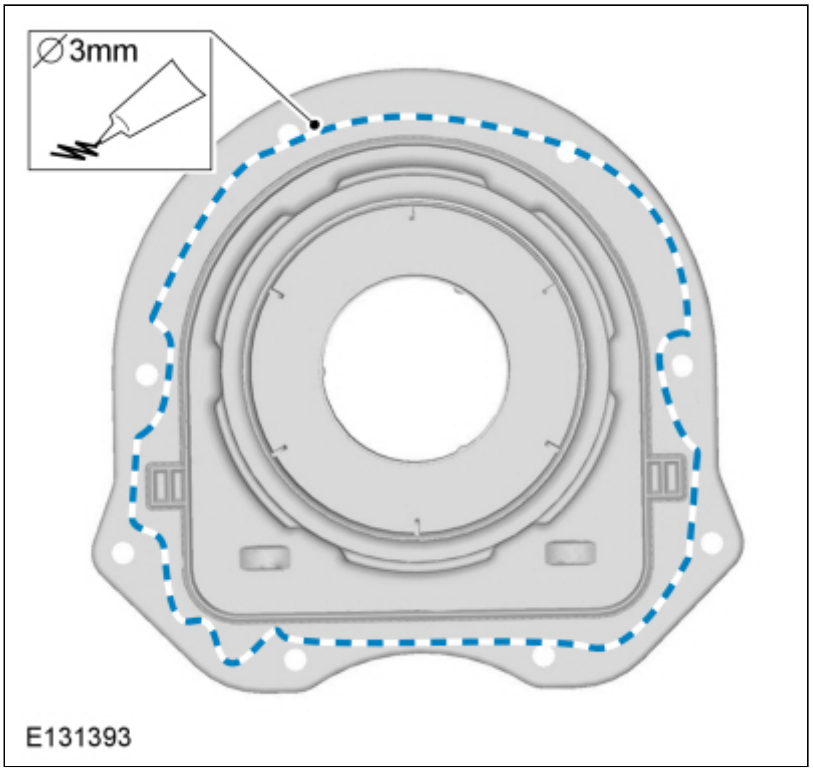


2.



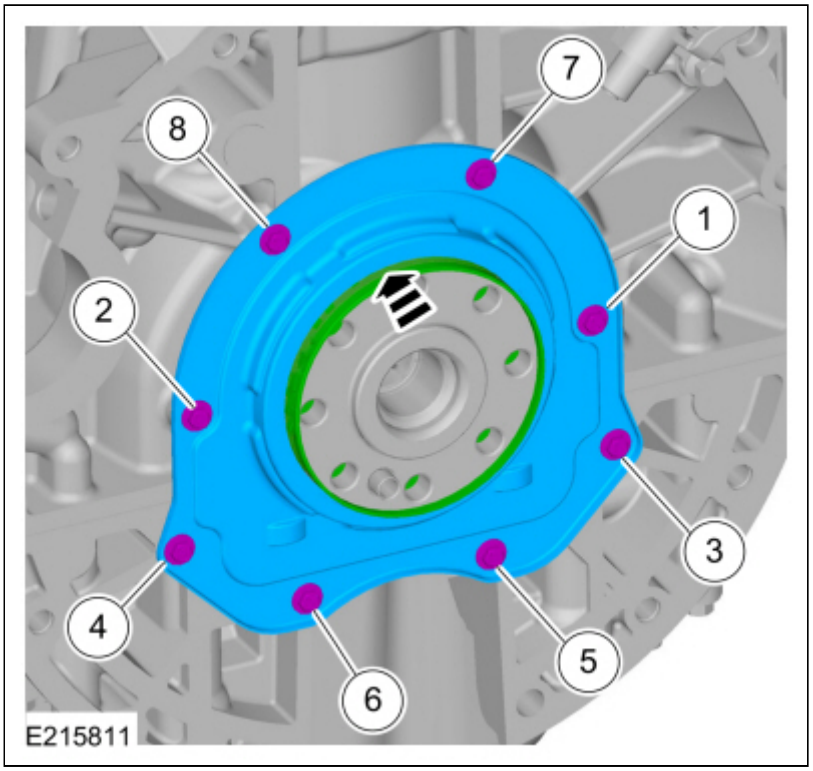
3. **NOTE:** *Install the new crankshaft rear seal carrier within five minutes of applying the recommended sealant.*

   Material: Silicone Sealant (WSE-M4G323-A4)



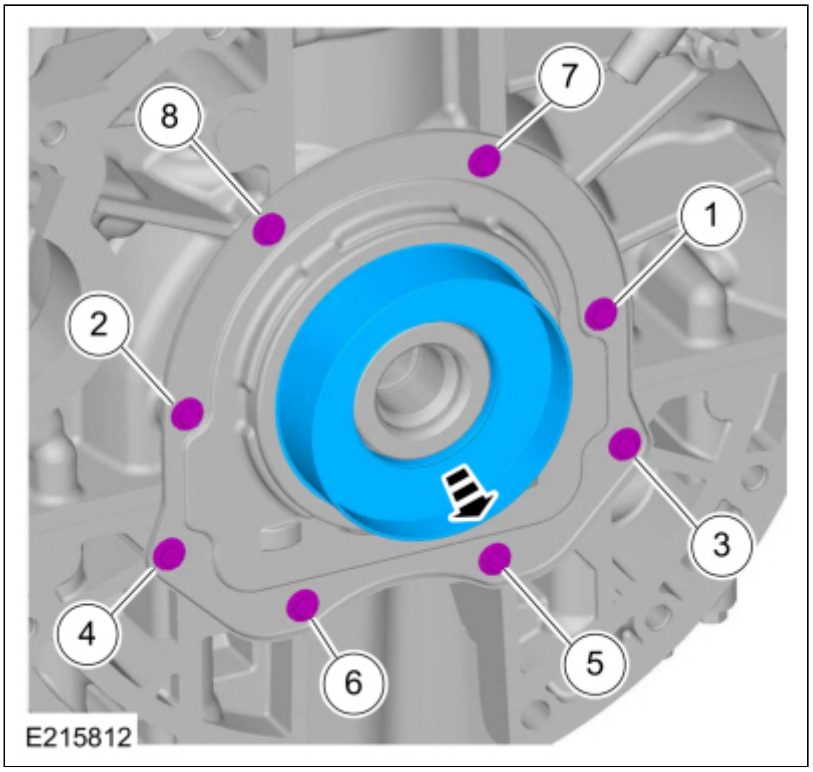
4. **NOTICE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.**

   Hand tighten the bolts at this stage.



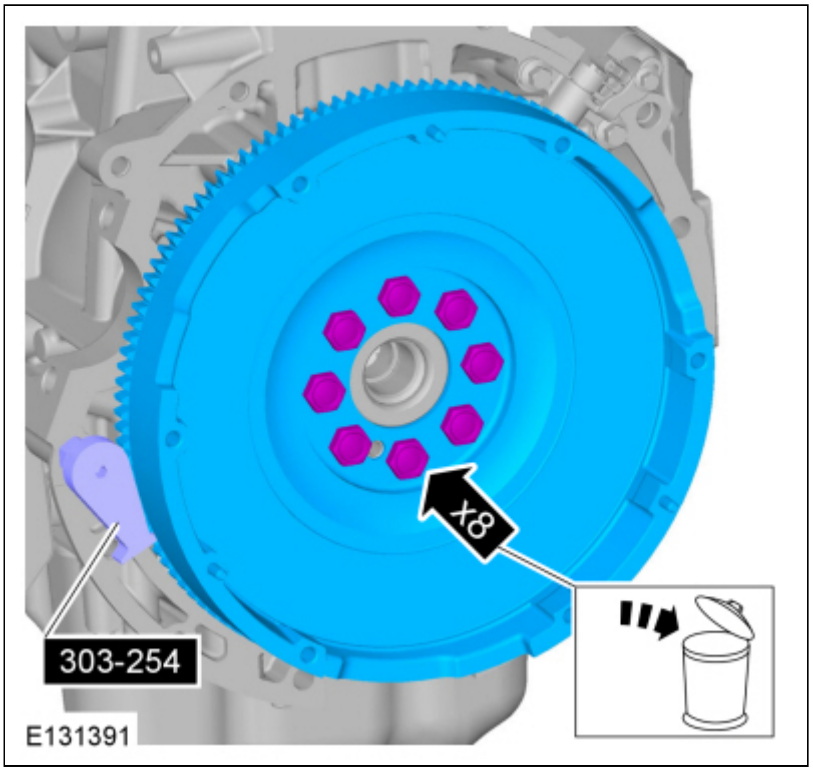
5. **NOTE:** *New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.*

   Torque: 10 Nm



Vehicles with manual transmission

6. Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
7. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



Vehicles with automatic transmission

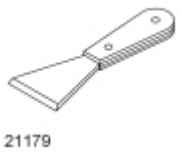
8. Refer to: Flexplate (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Oil Pan - 4x2

Base Part Number: 6675

Special Tool(s) / General Equipment

 21179	303-428 Separator, Oil Pan
Plastic Scraper	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Vehicles With: Electronic Power Assist Steering (EPAS)

3. Refer to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
   Refer to: Steering Gear - RHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

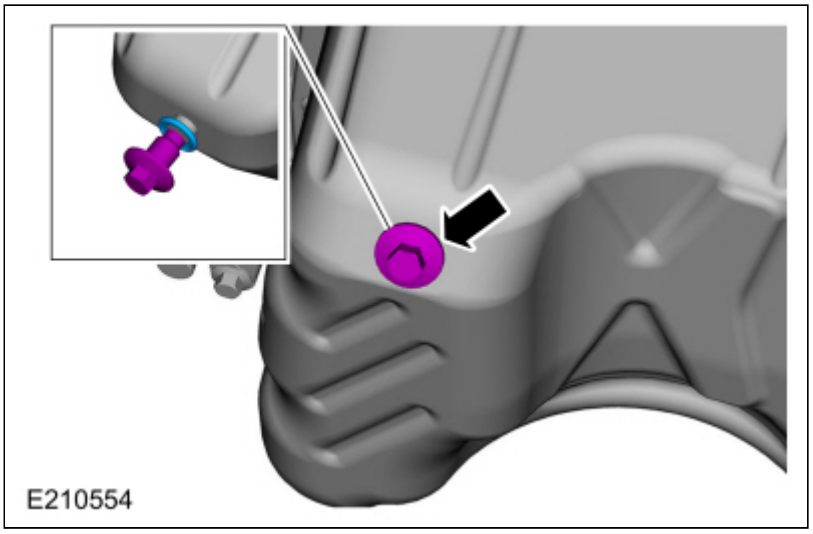
Vehicles With: Hydraulic Power Assist Steering (HPAS)

4. Refer to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
   Refer to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).

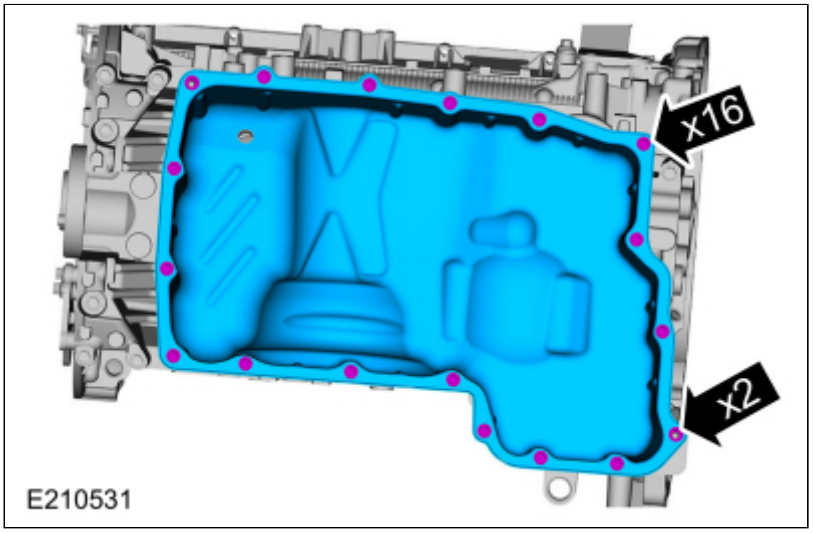
All vehicles

5. Raise the vehicle.
6. **WARNING: Be prepared to collect escaping fluids.**

   Drain the oil pan into a suitable container.



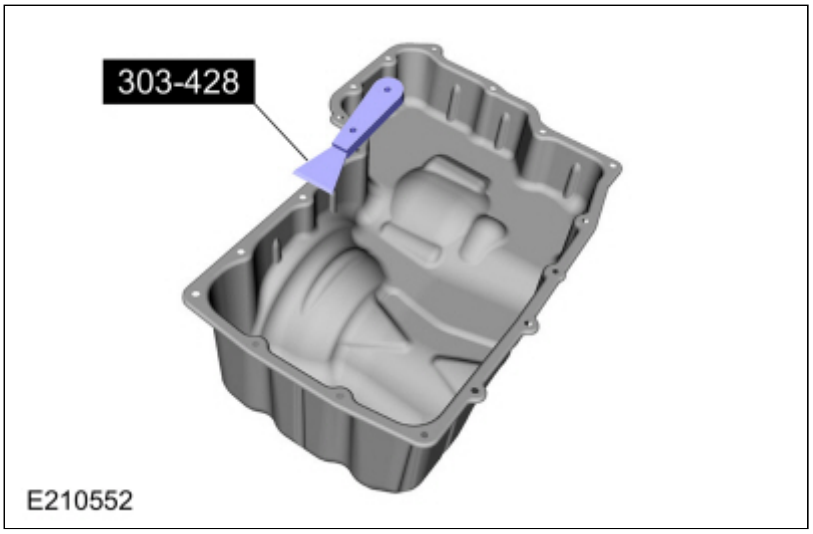
7.



Installation

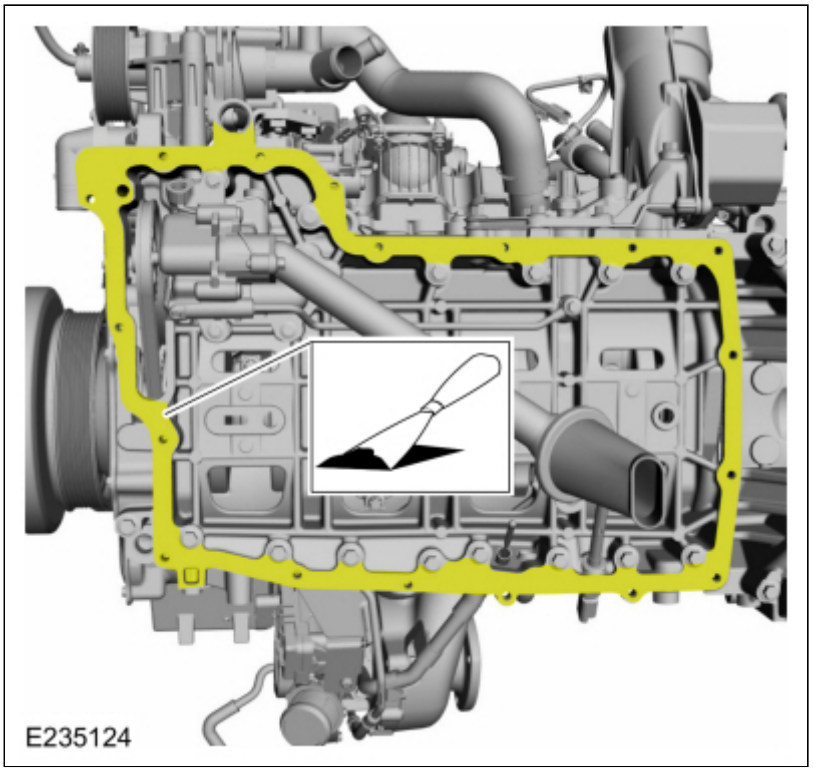
1. **NOTE:** *Do not damage the mating faces.*

   Use Special Service Tool: 303-428 Separator, Oil Pan.



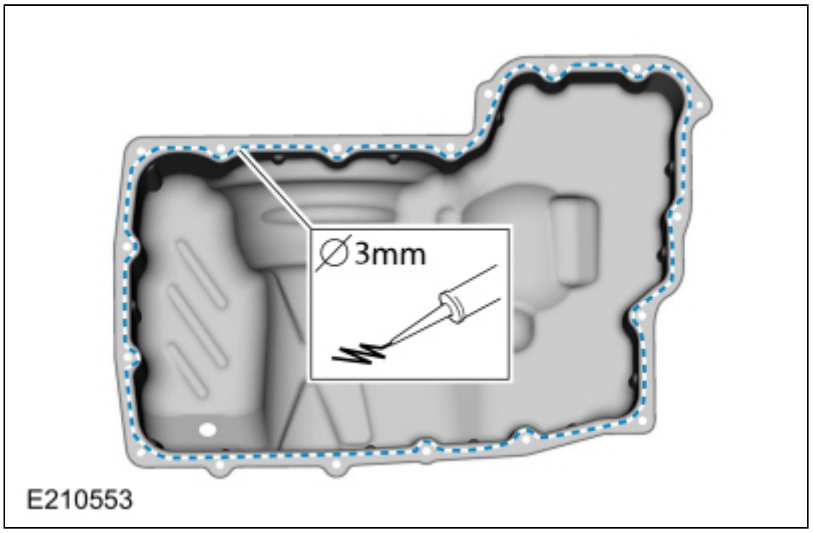
2. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Use the General Equipment: Plastic Scraper

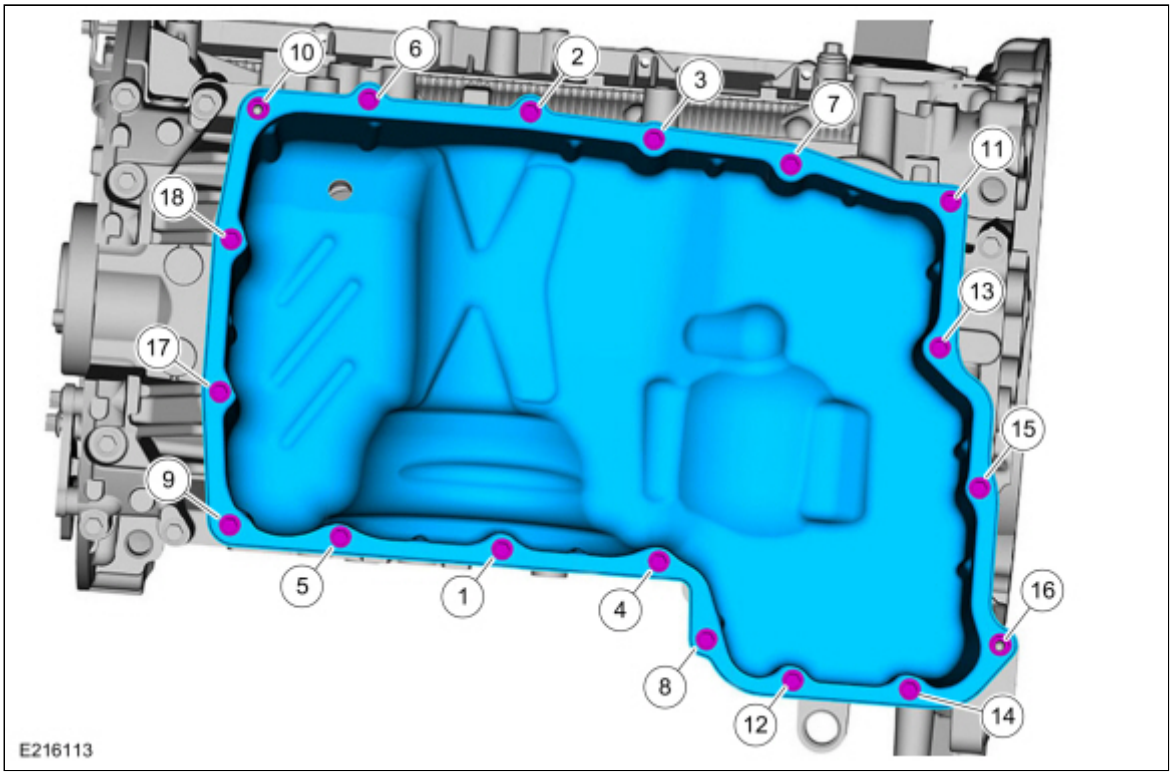


3. **NOTE:** *Do not damage the mating faces.*

   Install the oil pan within five minutes of applying the sealer.
   Material: Silicone Sealant (WSE-M4G323-A4)

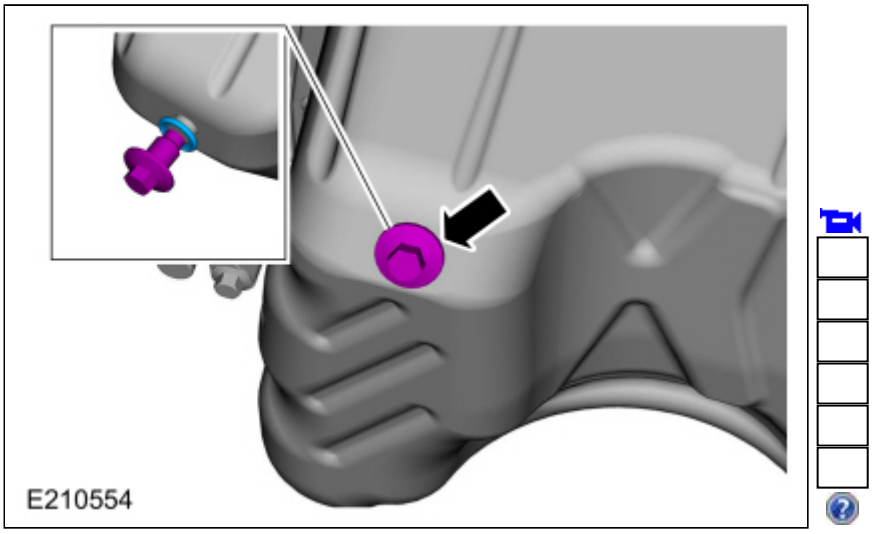


4. *Torque*:
   Stage 1: 7 Nm
   Stage 2: 14 Nm



5. **NOTE:** *The seal is to be reused unless damaged.*

   Torque: 39 Nm



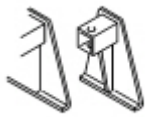
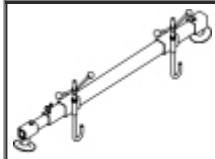
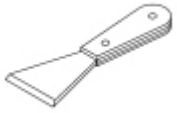
6. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Oil Pan - 4WD

Base Part Number: 6675

Special Tool(s) / General Equipment

 2114001	303-290-01 Adapter for 303-290A
 30329003A	303-290-03A Adapter for 303-290A
 E63421	303-290B Support Bar, Engine
 21179	303-428 Separator, Oil Pan
Plastic Scraper	
Transmission Jack	
Interior Trim Remover	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4
Silicone Sealant	WSS-M4G323-A8

Removal

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Vehicles With: Electronic Power Assist Steering (EPAS)

3. Refer to: Steering Gear - RHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
   Refer to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

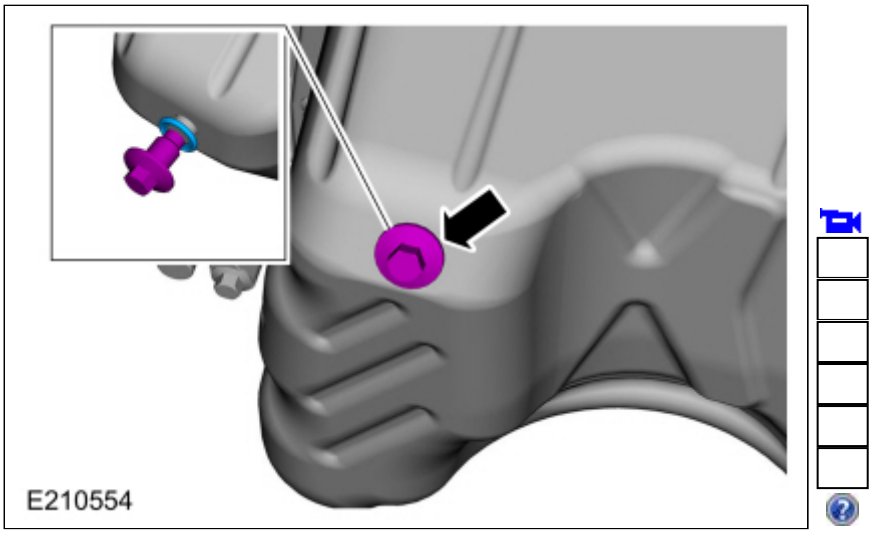
4. Refer to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).

Refer to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).

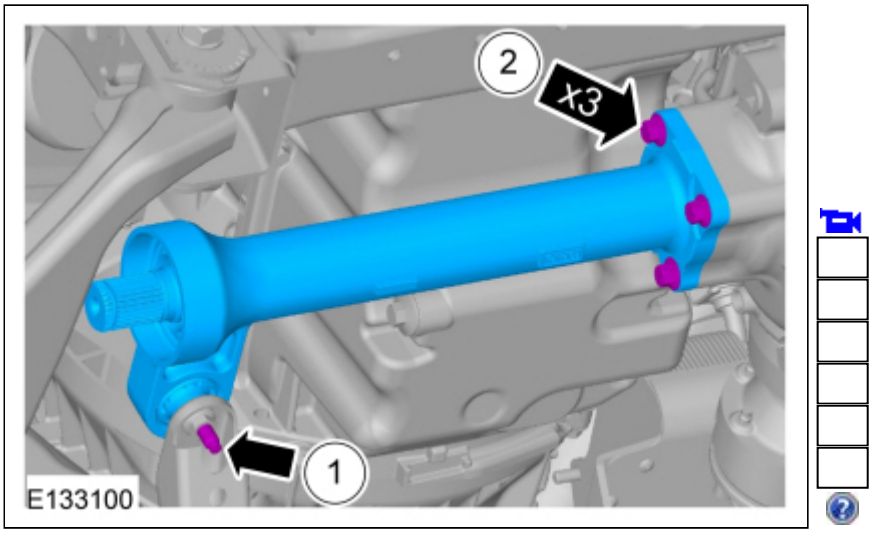
All vehicles

5. Raise the vehicle.
6. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
7. **WARNING: Be prepared to collect escaping fluids.**

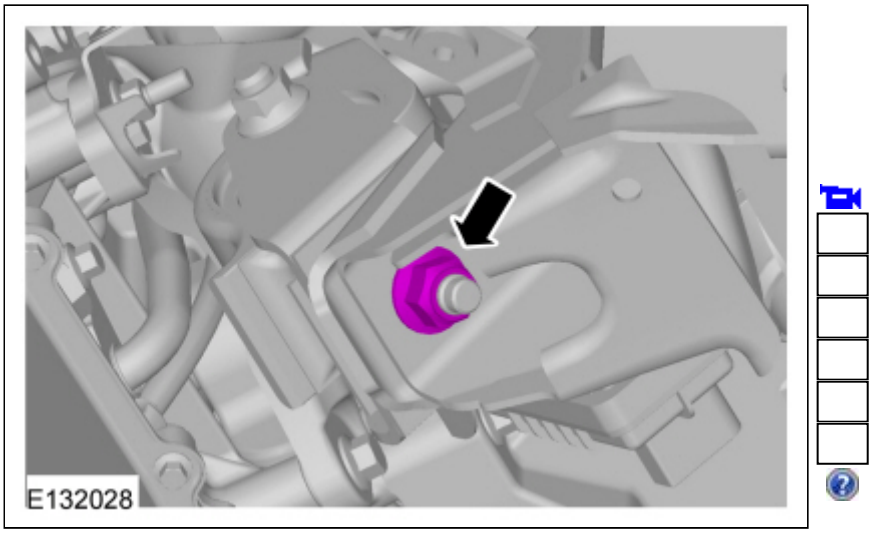
   Drain the oil pan into a suitable container.



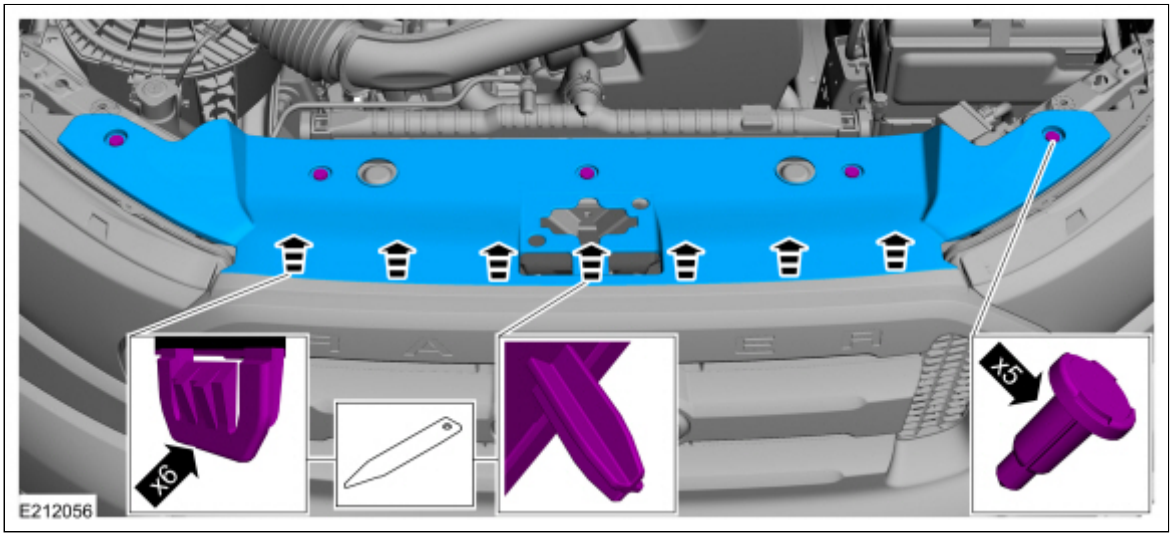
8. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
9.



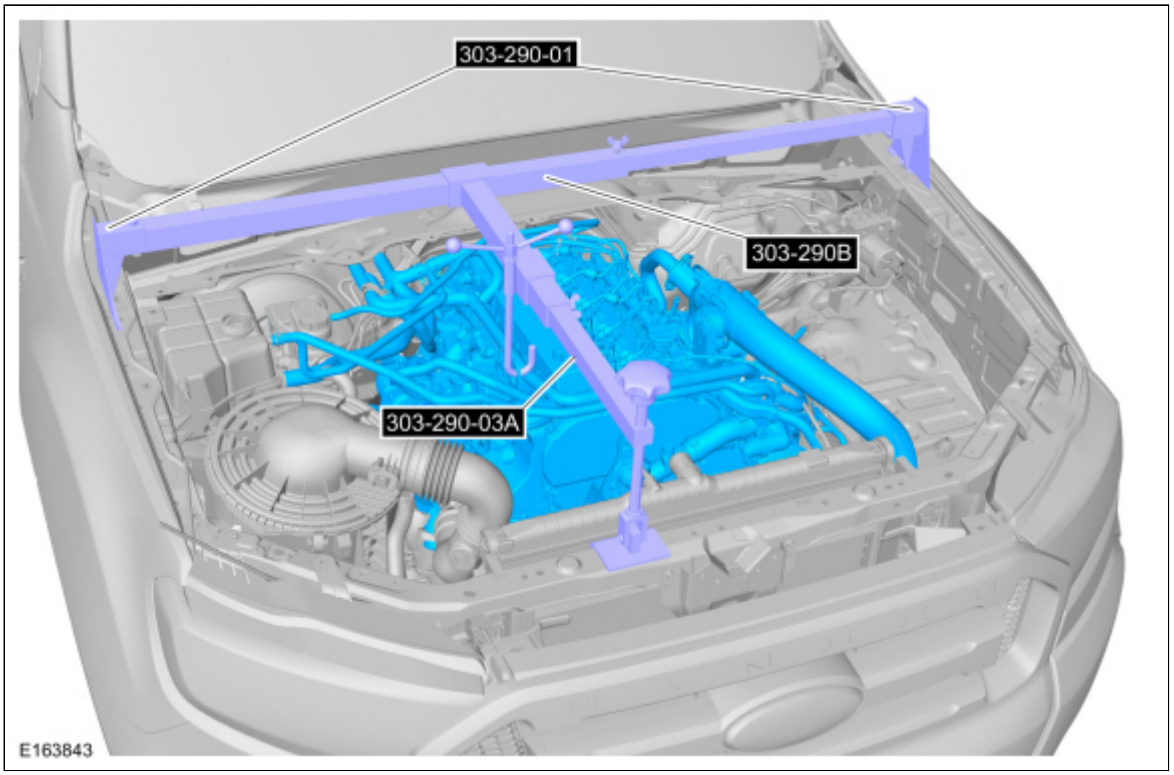
10. On both sides.



11. Lower the vehicle.
12. Use the General Equipment: Interior Trim Remover

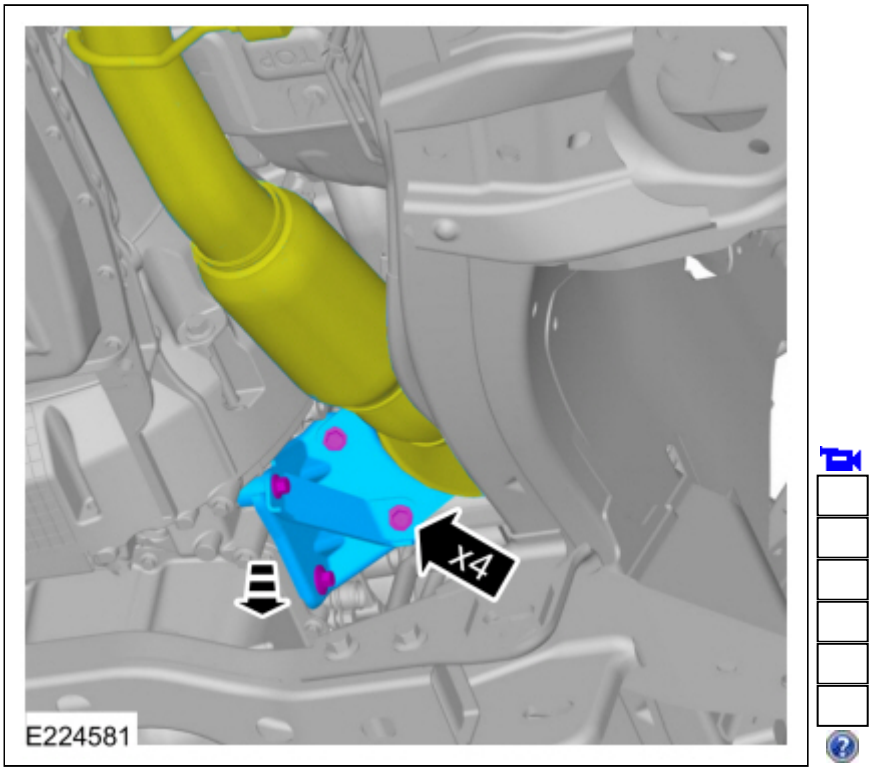


13. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
14. Install the special tools and lift the engine to 60mm approximately.
    Use Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.



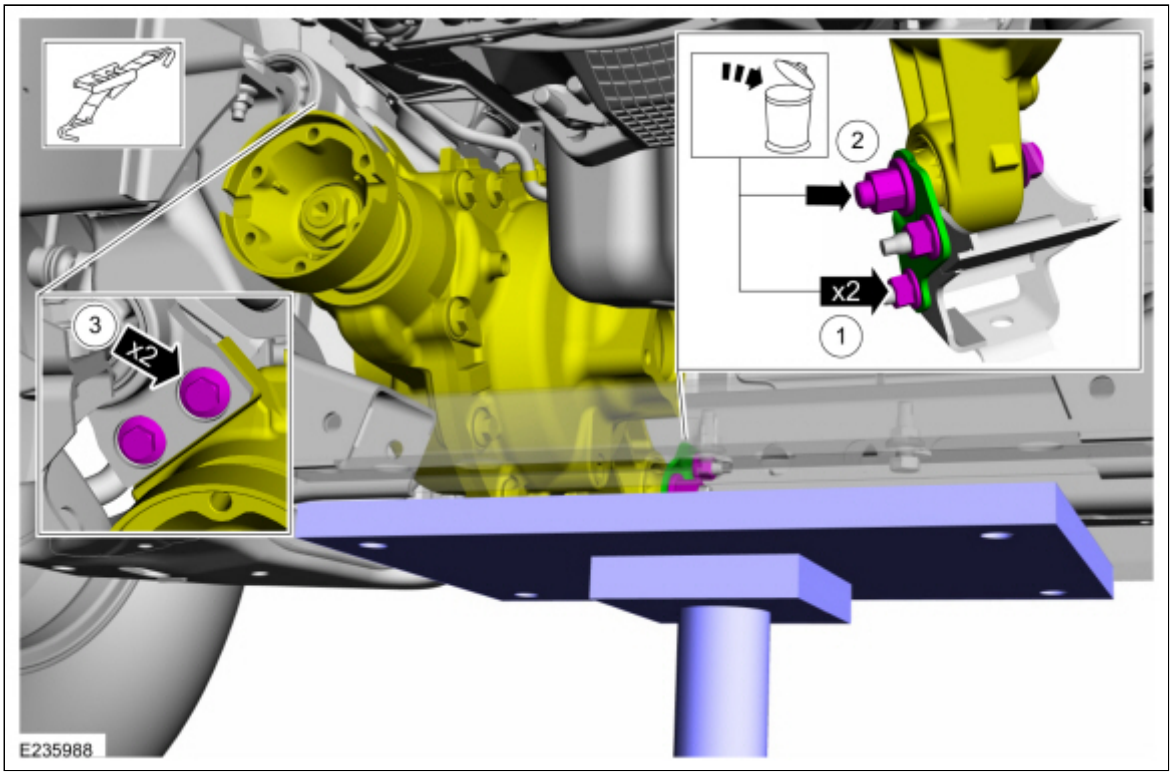
15. Raise the vehicle.

16.

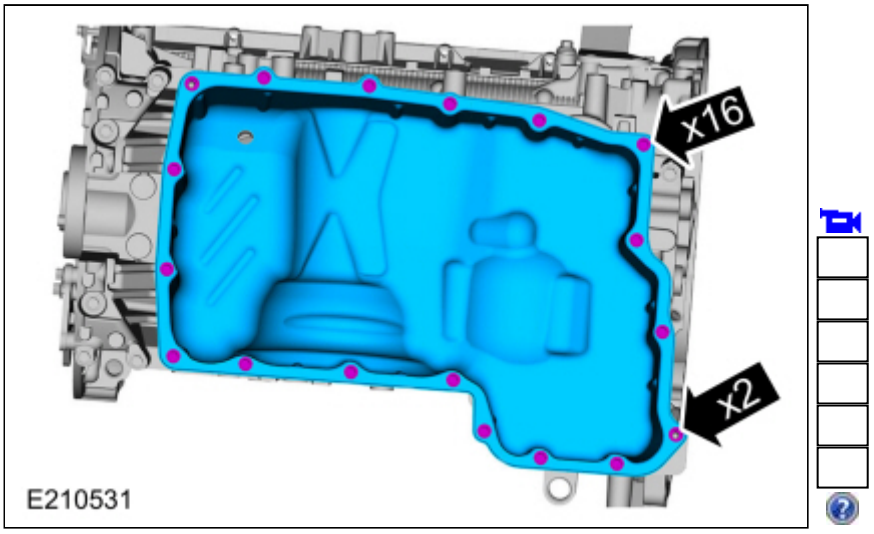


17. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

    Use the General Equipment: Transmission Jack



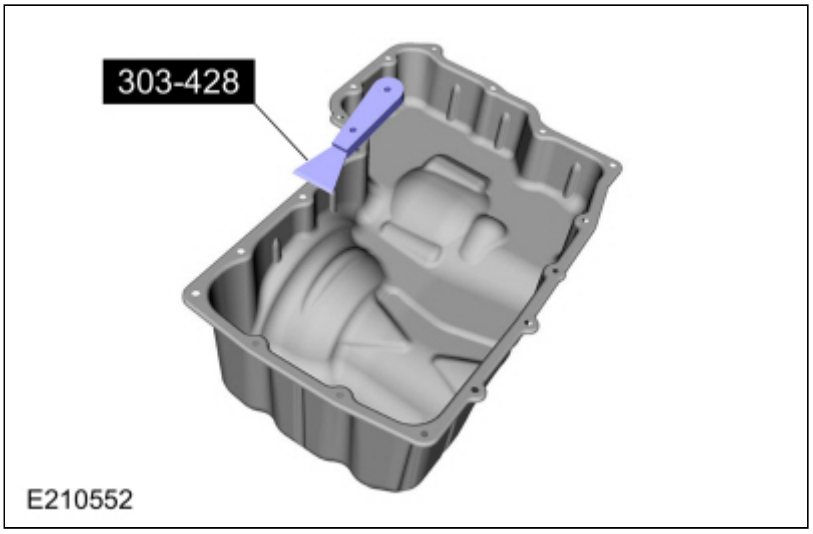
18.



Installation

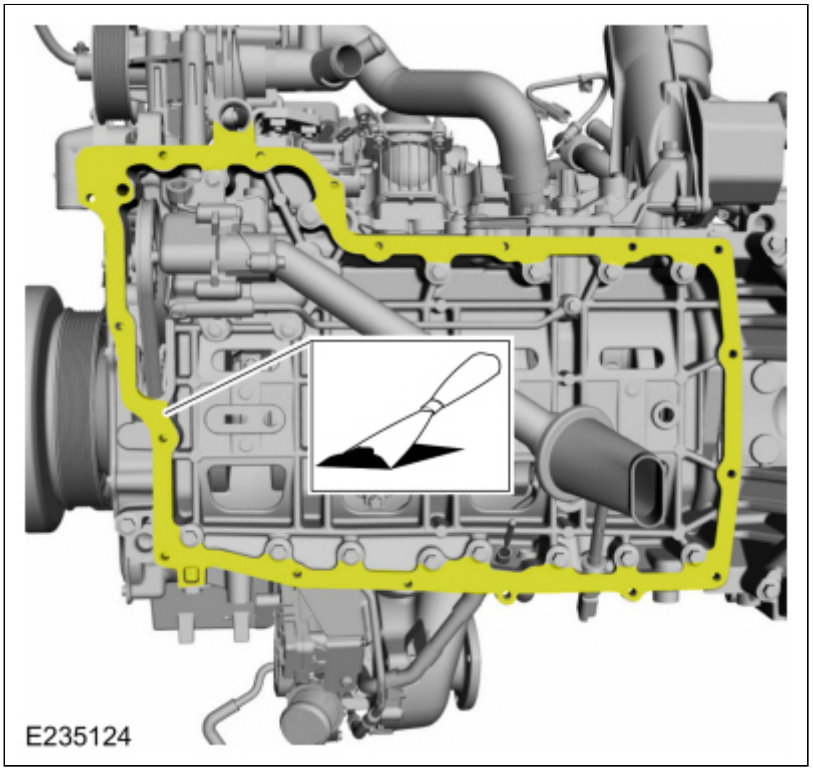
1. **NOTE:** *Do not damage the mating faces.*

   Use Special Service Tool: 303-428 Separator, Oil Pan.



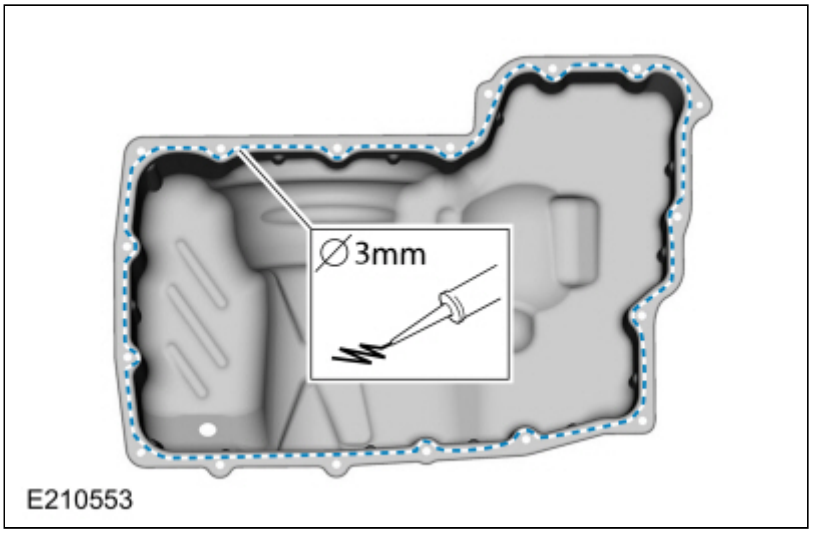
2. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Use the General Equipment: Plastic Scraper

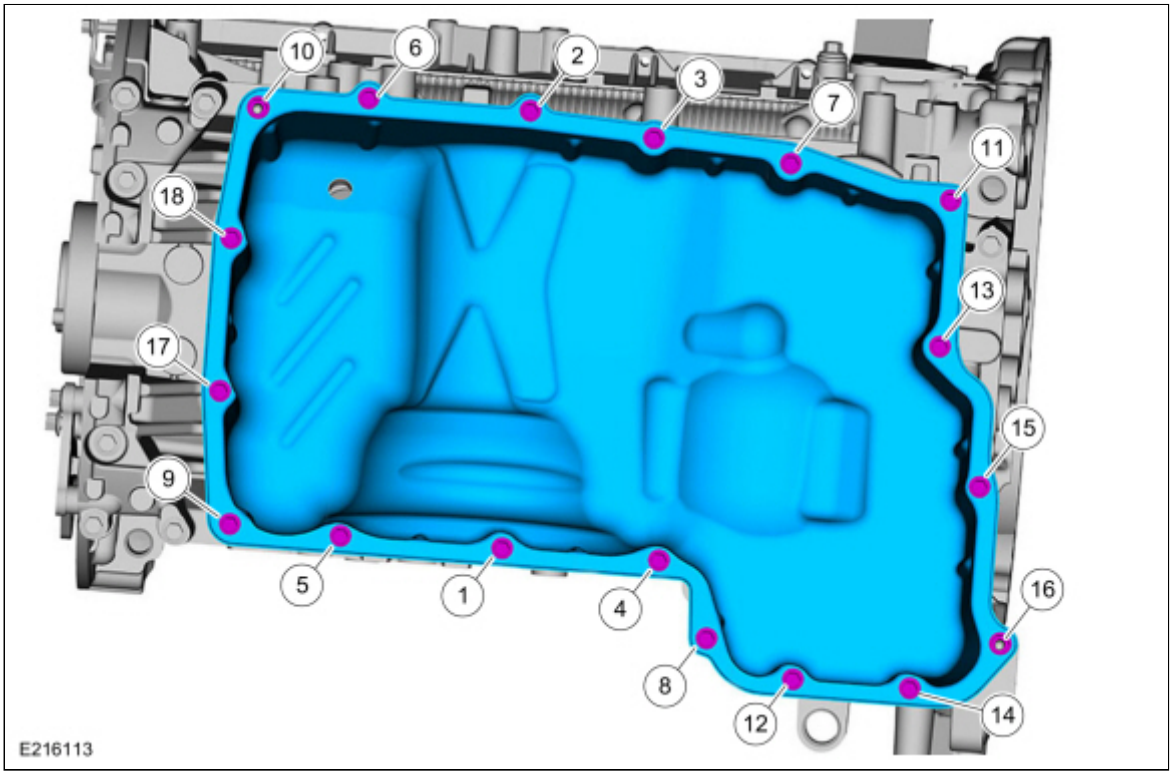


3. **NOTE:** *Do not damage the mating faces.*

   Install the oil pan within five minutes of applying the sealer.
   Material: Silicone Sealant (WSE-M4G323-A4)

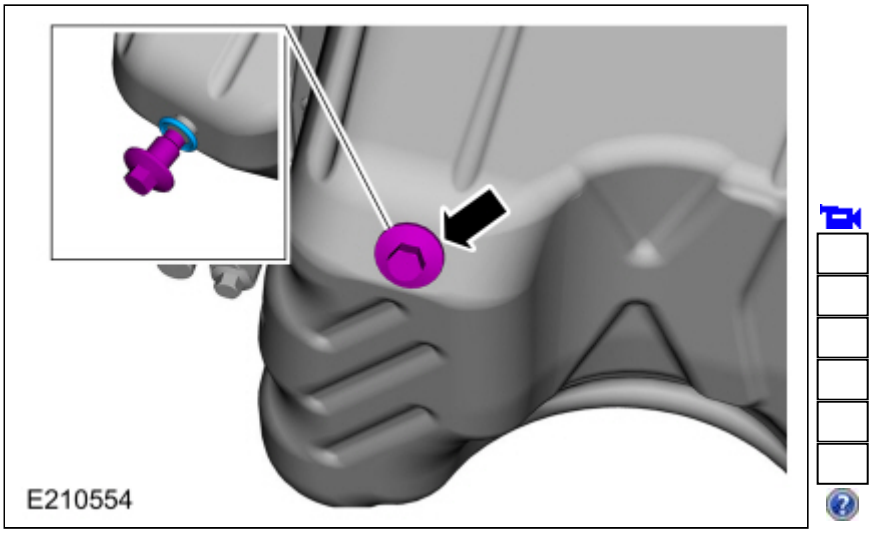


4. *Torque*:
   Stage 1: 7 Nm
   Stage 2: 14 Nm

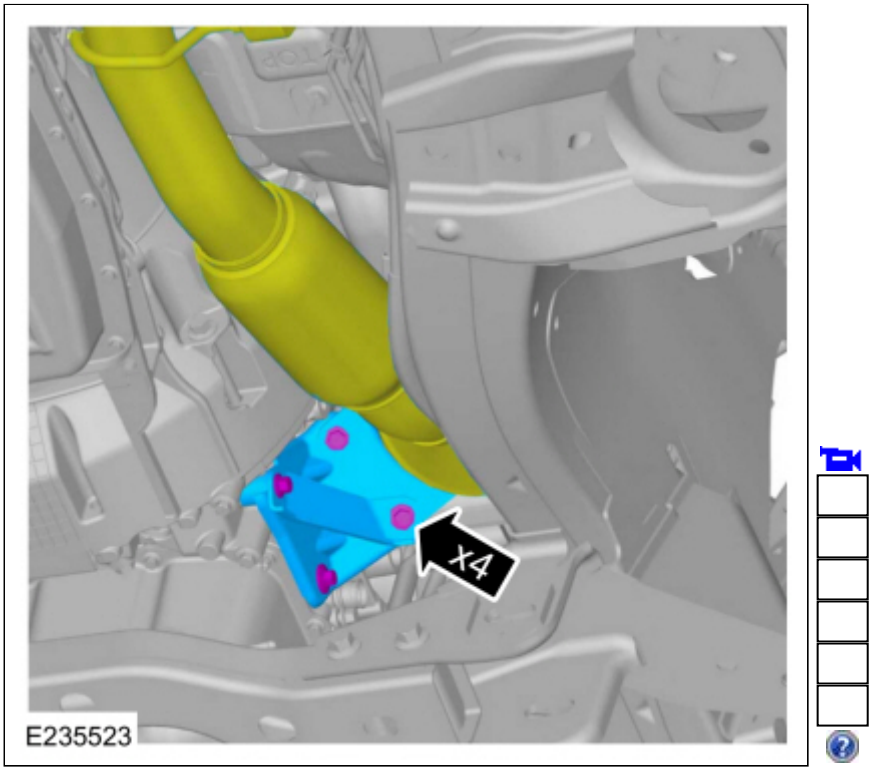


5. **NOTE:** *The seal is to be reused unless damaged.*

   Torque: 39 Nm



6. *Torque*: 25 Nm

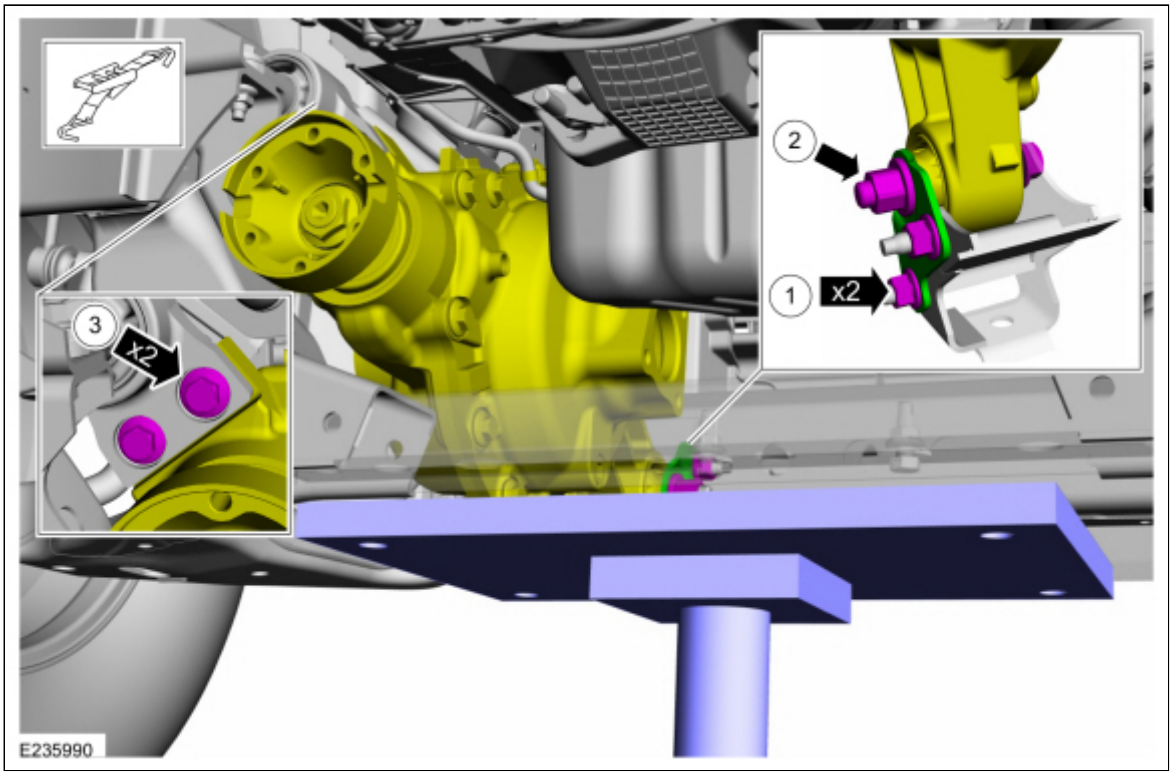


7. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

   NOTE: *Make sure that new nuts are installed.*

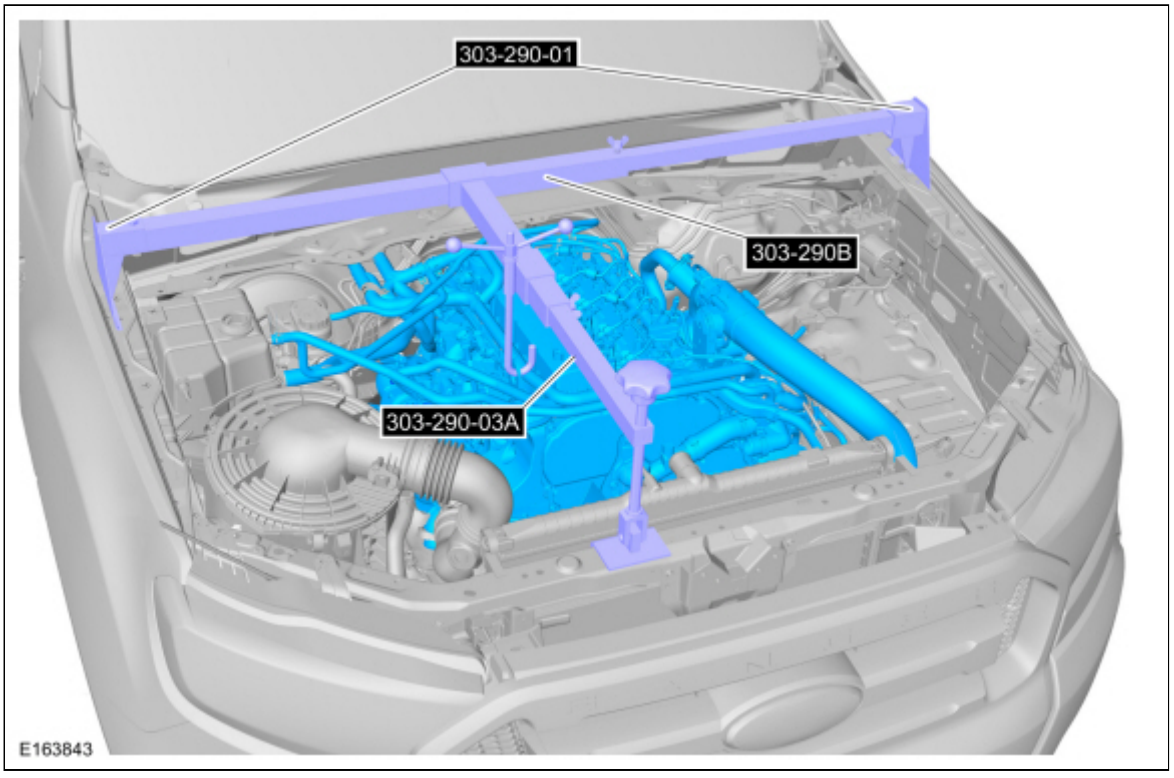
   NOTE: *Make sure that new bolts are installed.*

   Remove the transmission jack.
   Torque:
   1.: 90 Nm
   2.: 265 Nm
   3.: 110 Nm

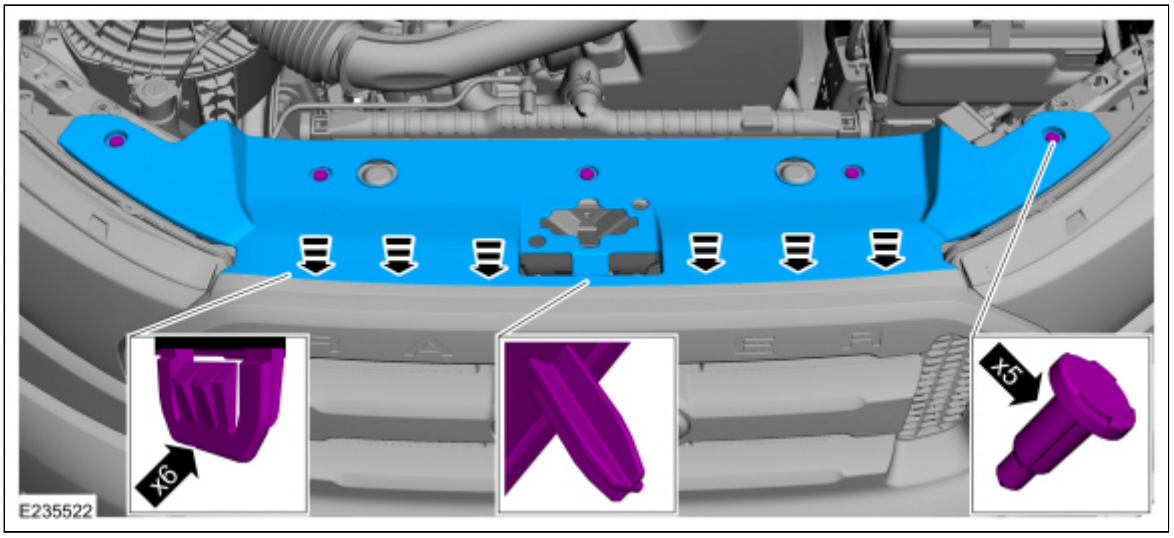


8. Lower the vehicle.

9. Remove the special tools.
   Use Special Service Tool: 303-290-01 Adapter for 303-290A. , 303-290B Support Bar, Engine. , 303-290-03A Adapter for 303-290A.

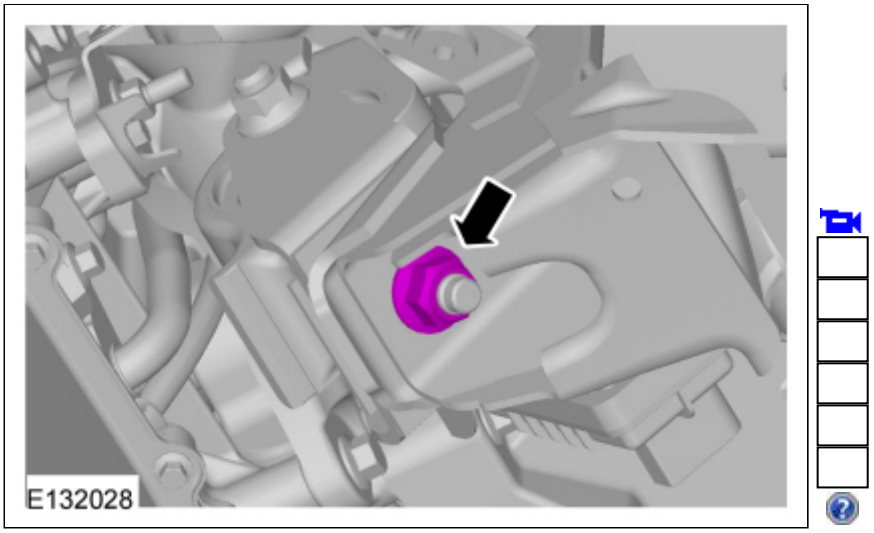


10.



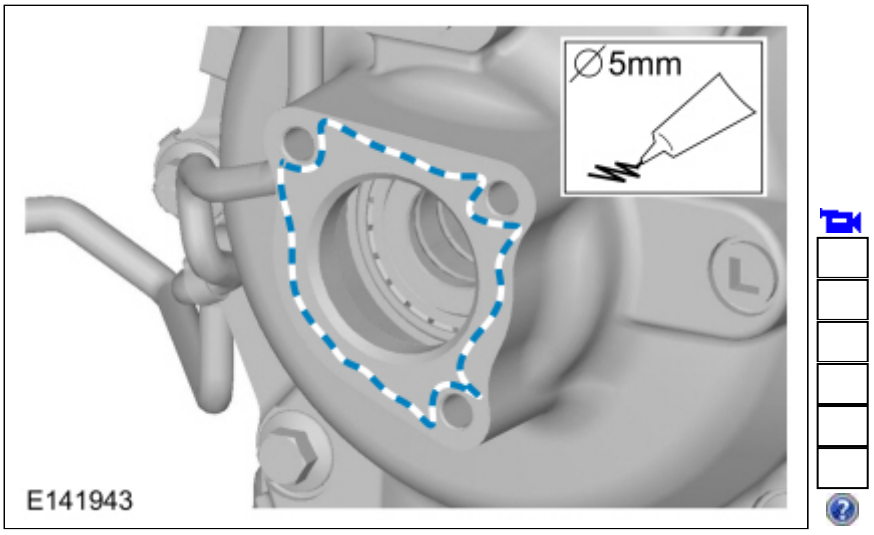
11. Raise the Vehicle.

12. On both sides.
    Torque: 175 Nm

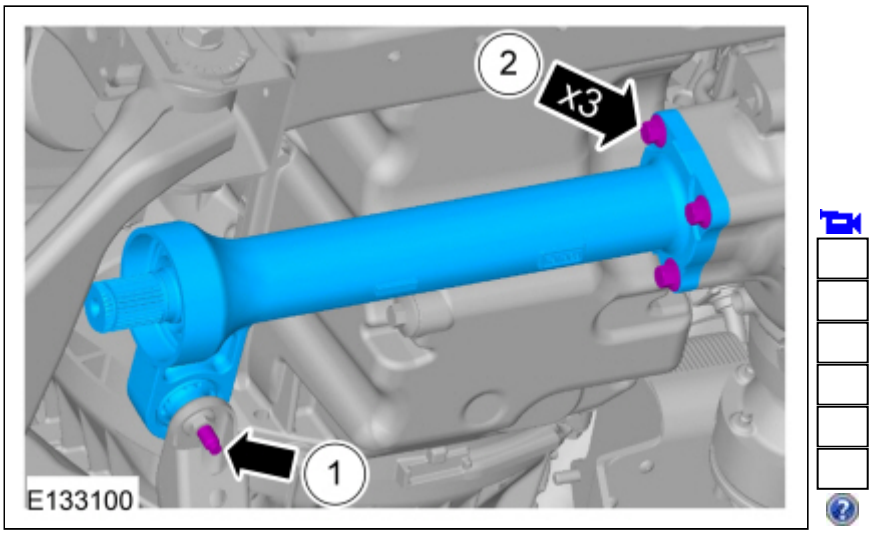


13. **NOTE:** *Do not damage the mating faces.*

    Install the Front axle tube within five minutes of applying the sealer.
    Material: Silicone Sealant (WSS-M4G323-A8)



1. *Torque*: 70 Nm
2. *Torque*: 40 Nm



15. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

16. Refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

Vehicles With: Electronic Power Assist Steering (EPAS)

17. Refer to: Steering Gear - RHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
    Refer to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

18. Refer to: Steering Gear - LHD 4WD/LHD RWD (211-02A Power Steering, Removal and Installation).
    Refer to: Steering Gear - RHD 4WD/RHD RWD/RHD (211-02A Power Steering, Removal and Installation).

All vehicles

19. Lower the vehicle.

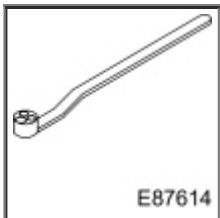
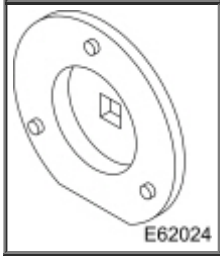
20. Fill the oil pan with clean engine oil.
    Refer to: Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

21. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Engine Front Seal

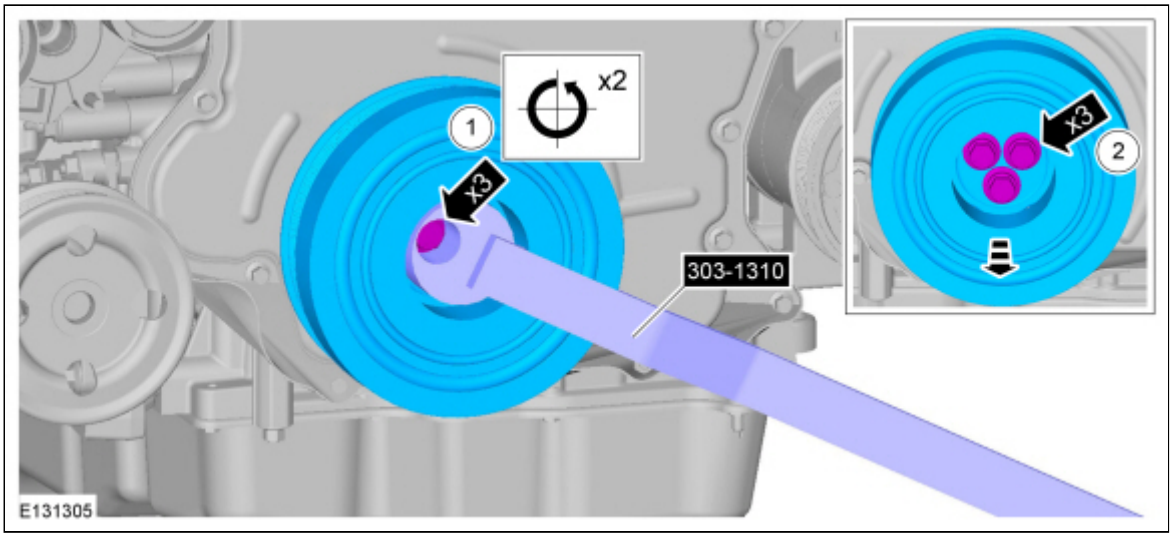
Special Tool(s) / General Equipment

 E87614	303-1310 Holding Wrench, Crankshaft
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate

Removal

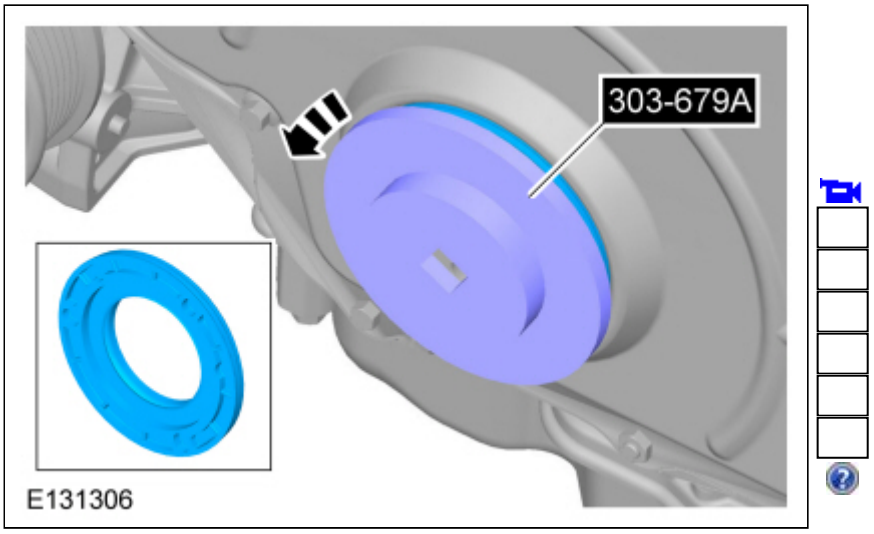
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. 1.Do not completely loosen the crankshaft pulley bolts.
   Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.



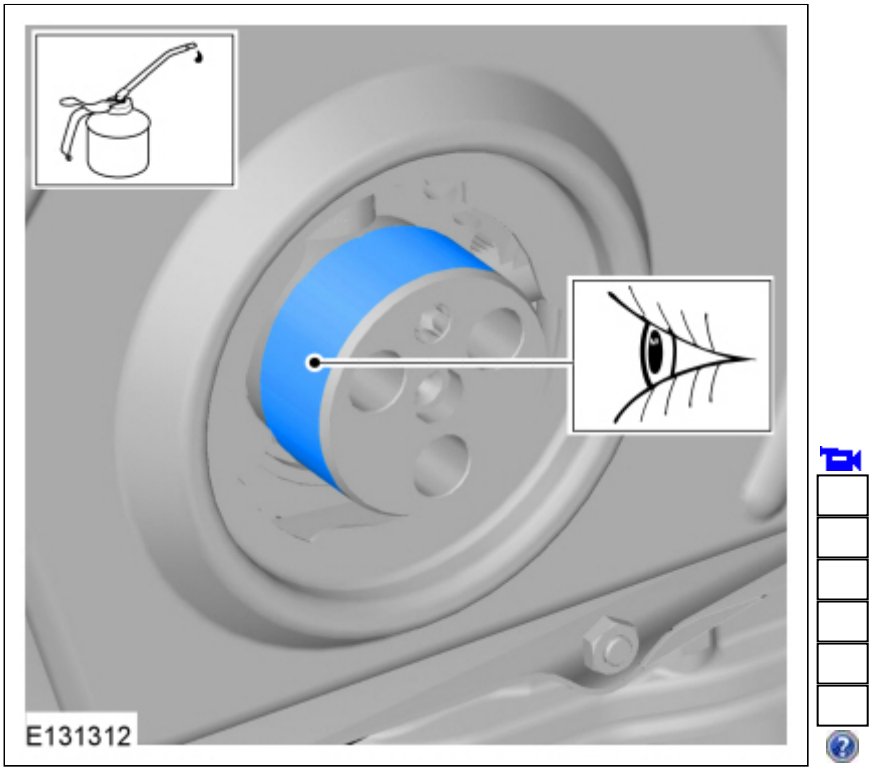
3. **NOTICE: Rotate the seal assembly until it releases. Failure to follow this instruction may result in damage to the seal assembly.**

   Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



Installation

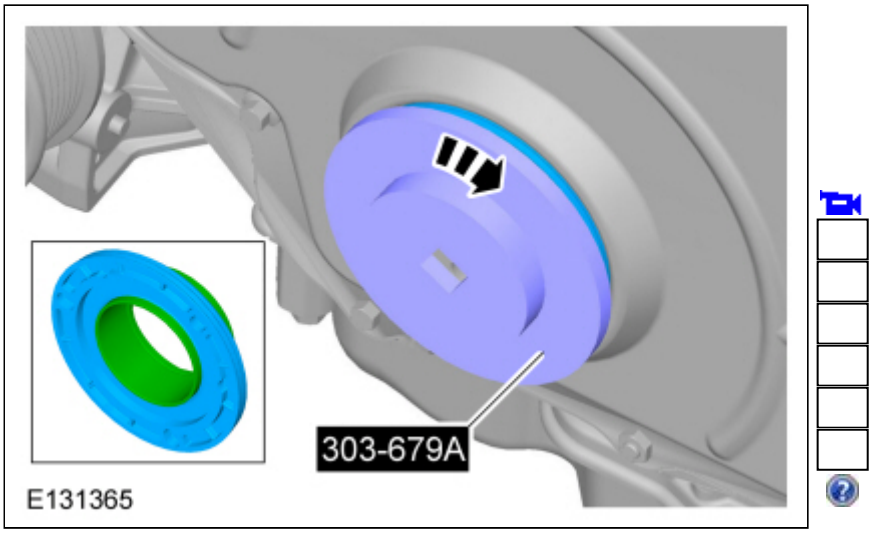
1. **NOTE:** *Make sure that the mounting face is clean and lubricated.*



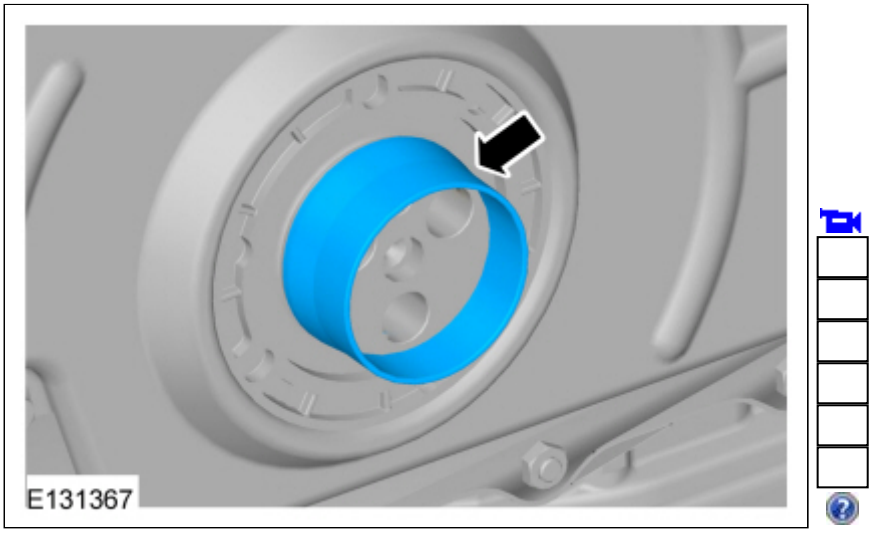
2. **NOTICE: Rotate the seal assembly until it locks. Failure to follow this instruction may result in damage to the seal assembly.**

   NOTE: *A new crankshaft front seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed.*

   Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.

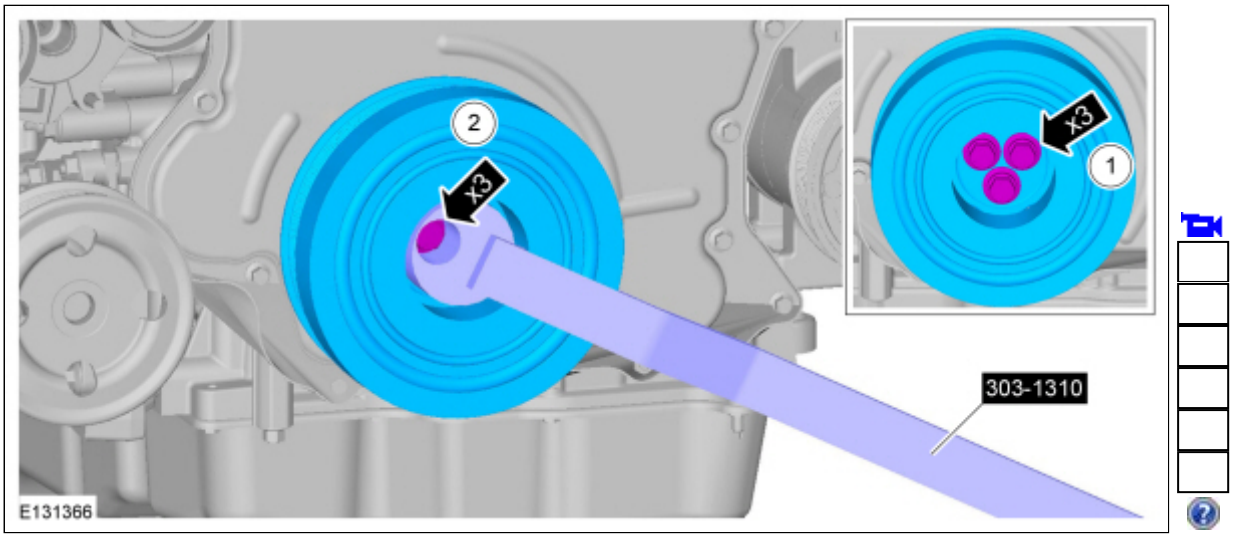


3. Remove the alignment sleeve after the seal is fully installed.



4. **NOTICE: The crankshaft pulley bolts must not be used more than 3 times.**

   Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
   Torque:
   Stage 1: 20 Nm
   Stage 2: 45 Nm
   Stage 3: 90 Nm
   Stage 4: 45°
   Stage 5: 45°



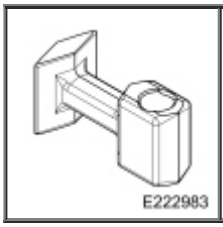
5. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and

Installation).

Copyright © 2016 Ford Motor Company

Flexplate

Special Tool(s) / General Equipment

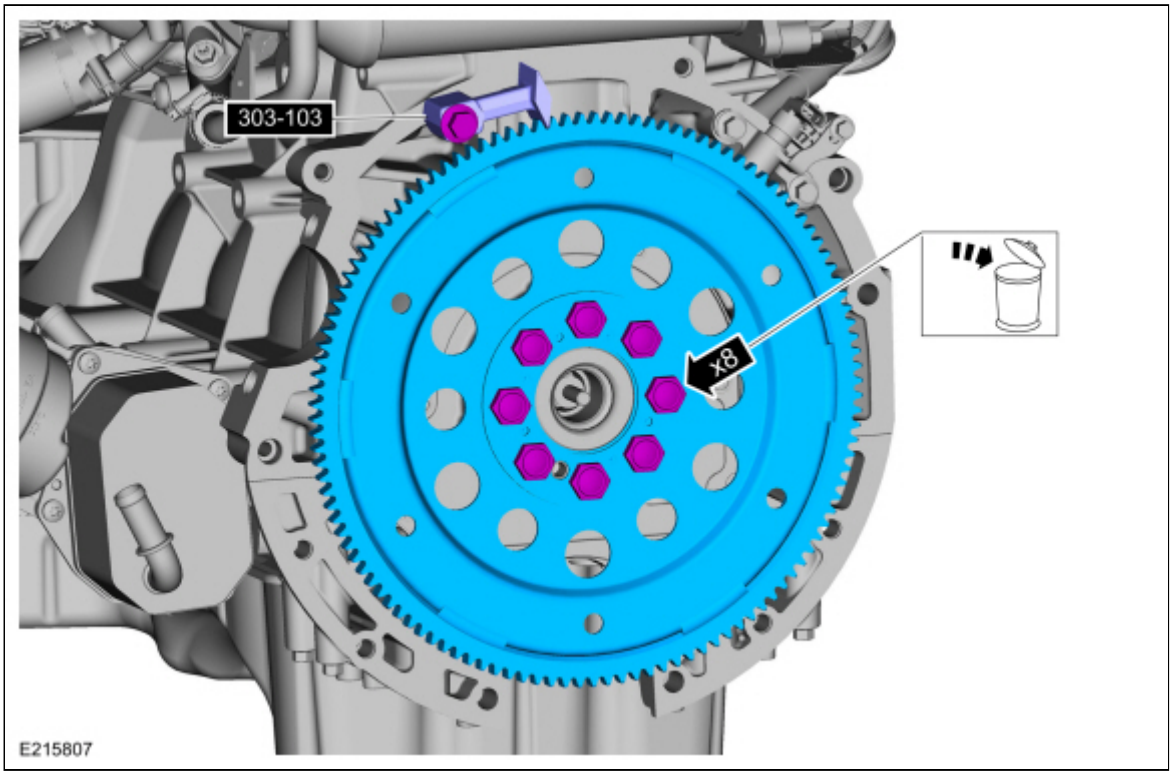
 E222983	303-103 (T74P-6375-A) Holding Tool, Flywheel

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

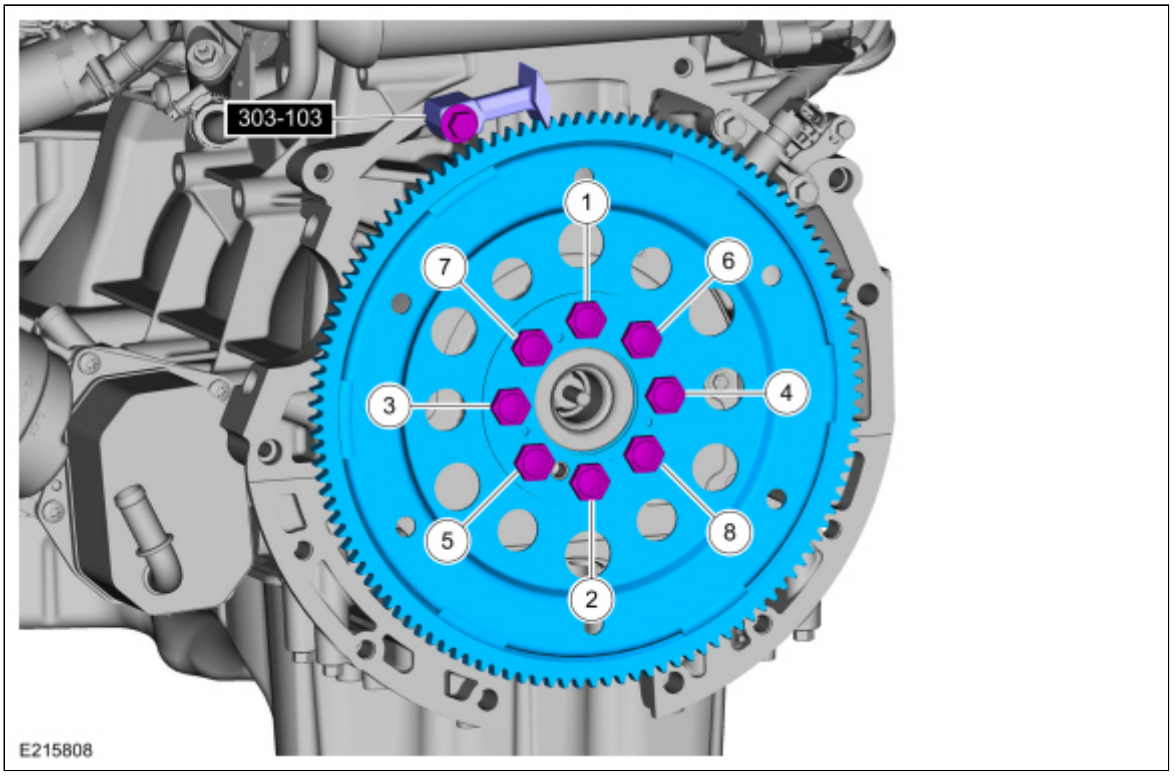
2. Refer to: Transmission - 4x2 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal).
   Refer to: Transmission - 4x4 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal).

- Install Special Service Tool: 303-103 (T74P-6375-A) Holding Tool, Flywheel.



Installation

- Install the flexplate and the new bolts. Tighten in the sequence shown in 3 stages.
  Torque:
  Stage 1: 25 Nm
  Stage 2: 45 Nm
  Stage 3: 45 °
- Remove Special Service Tool: 303-103 (T74P-6375-A) Holding Tool, Flywheel.

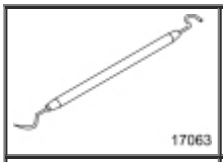


2. Refer to: Transmission - 4x2 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Installation).
   Refer to: Transmission - 4x4 (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Installation).

Copyright © 2016 Ford Motor Company

Timing Chain

Special Tool(s) / General Equipment

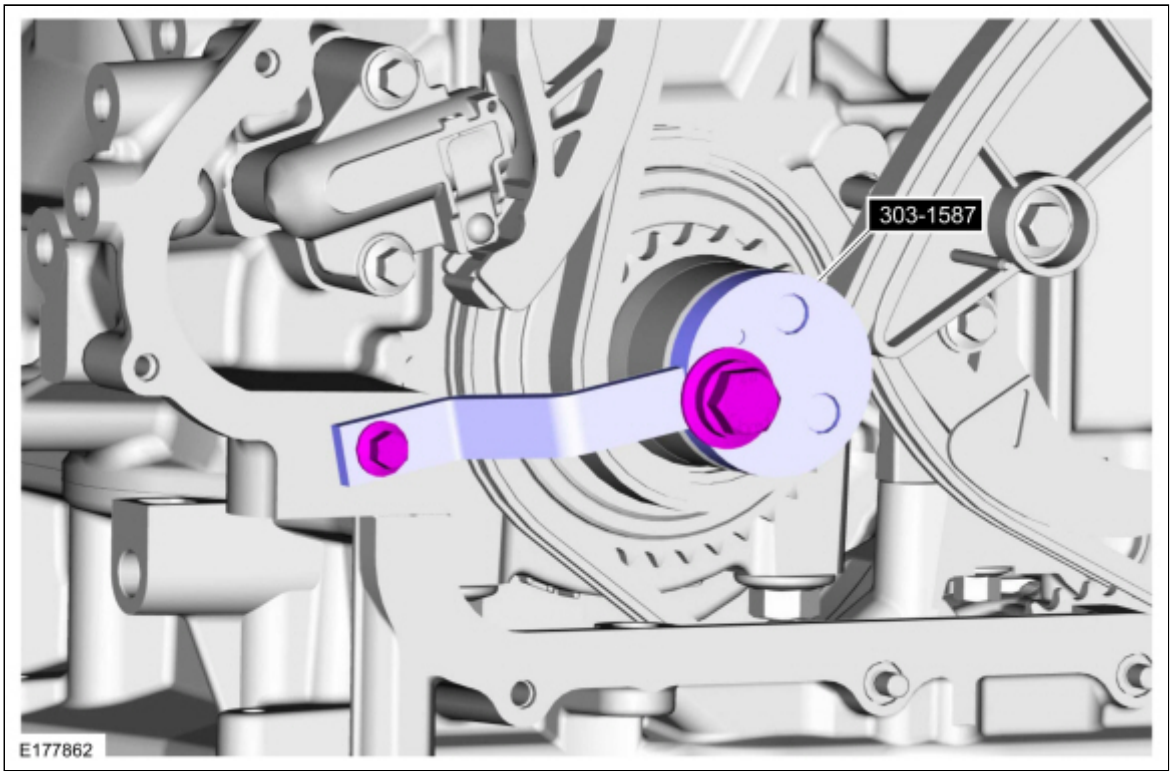
 17063	100-010 Remover, O-Ring Seal
 E139146	303-1587 Timing Tool, Crankshaft
6 mm Drill Bit	
2 mm Punch	

Removal

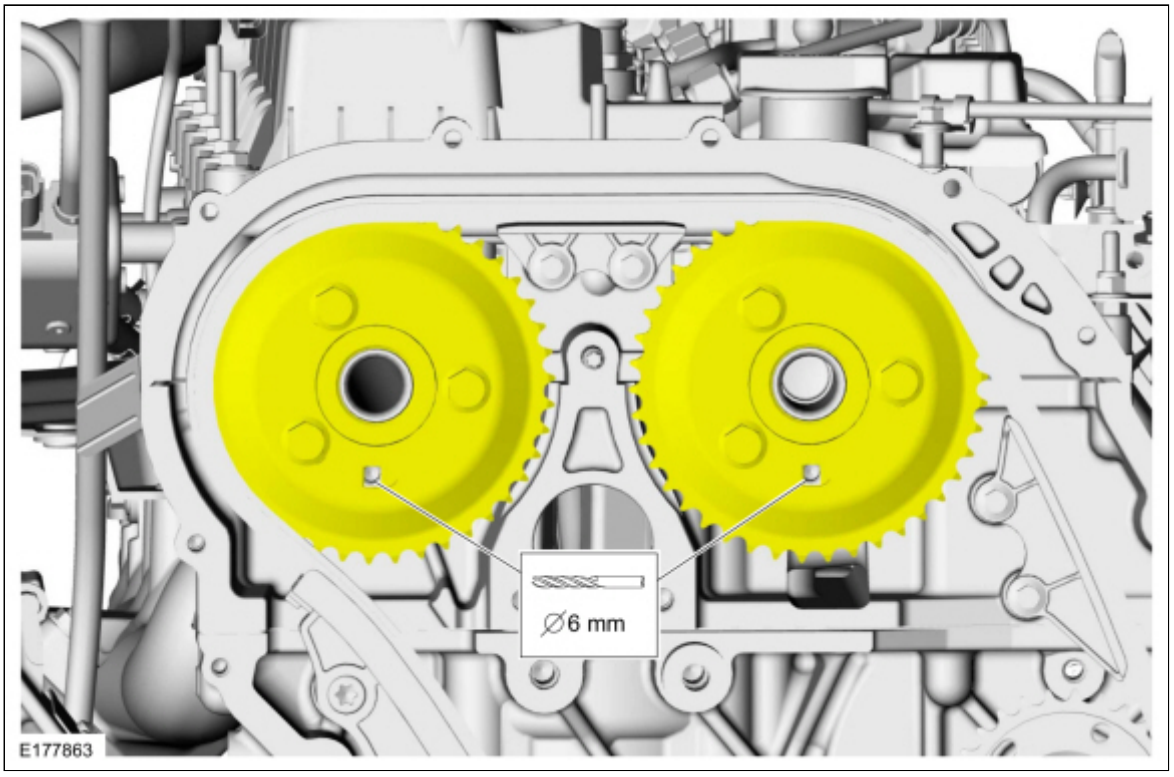
1. Refer to: Timing Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

2. **NOTE:** *When the tool is properly installed, the locating pin will be approximately at the 10 o'clock position.*

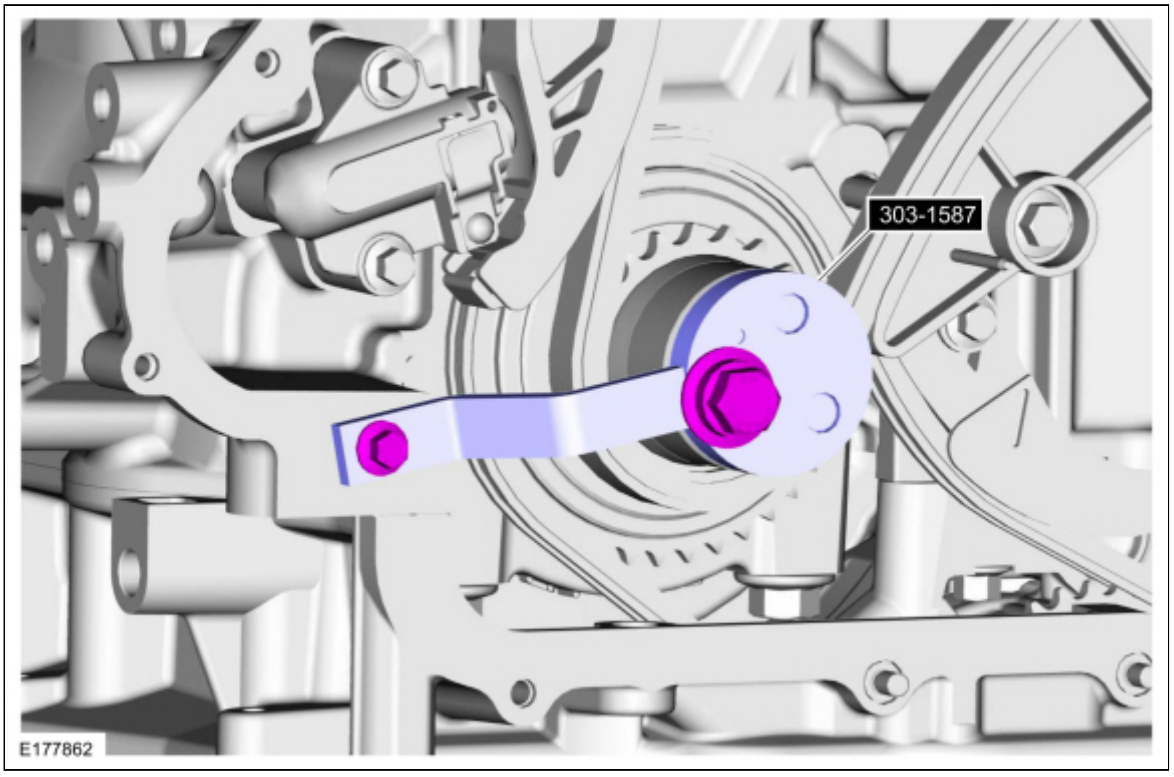
   Using the special tool, set the crankshaft and camshaft positions.
   Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



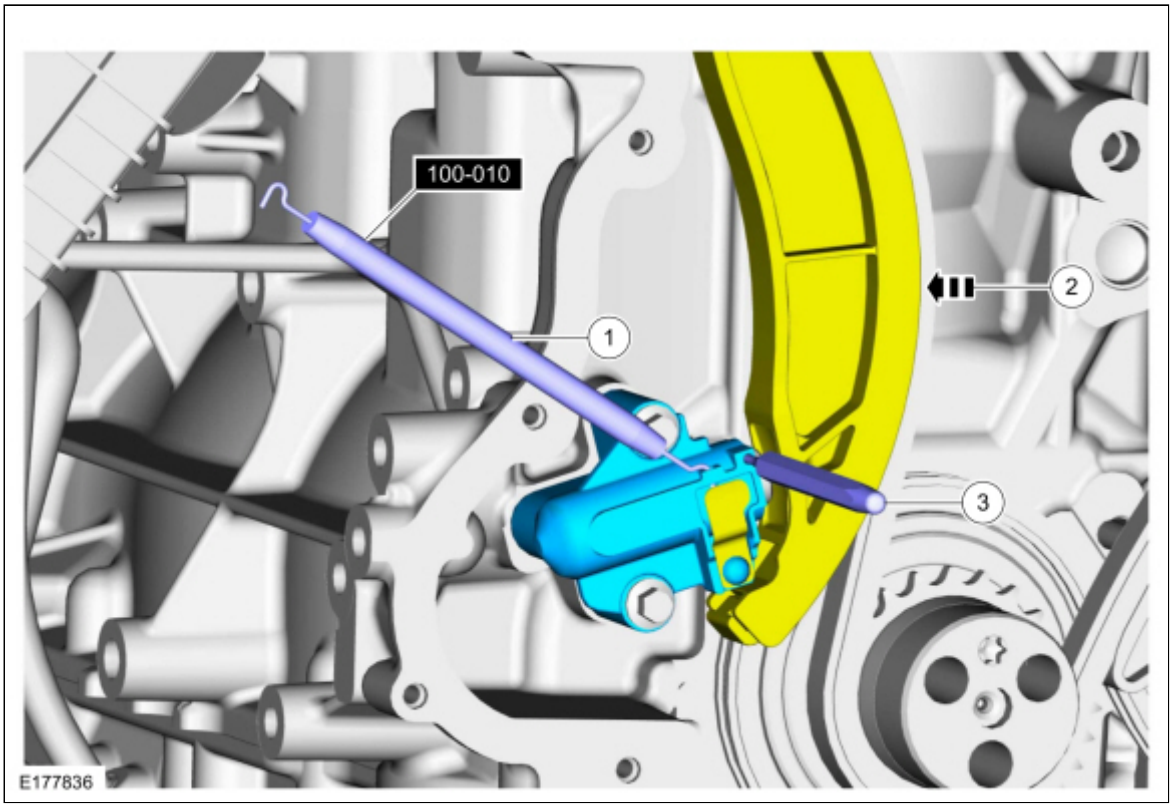
3. Check the valve timing by inserting the end of 2 drill bits through the sprocket holes into the timing pin holes in the cylinder head.
   Use the General Equipment: 6 mm Drill Bit



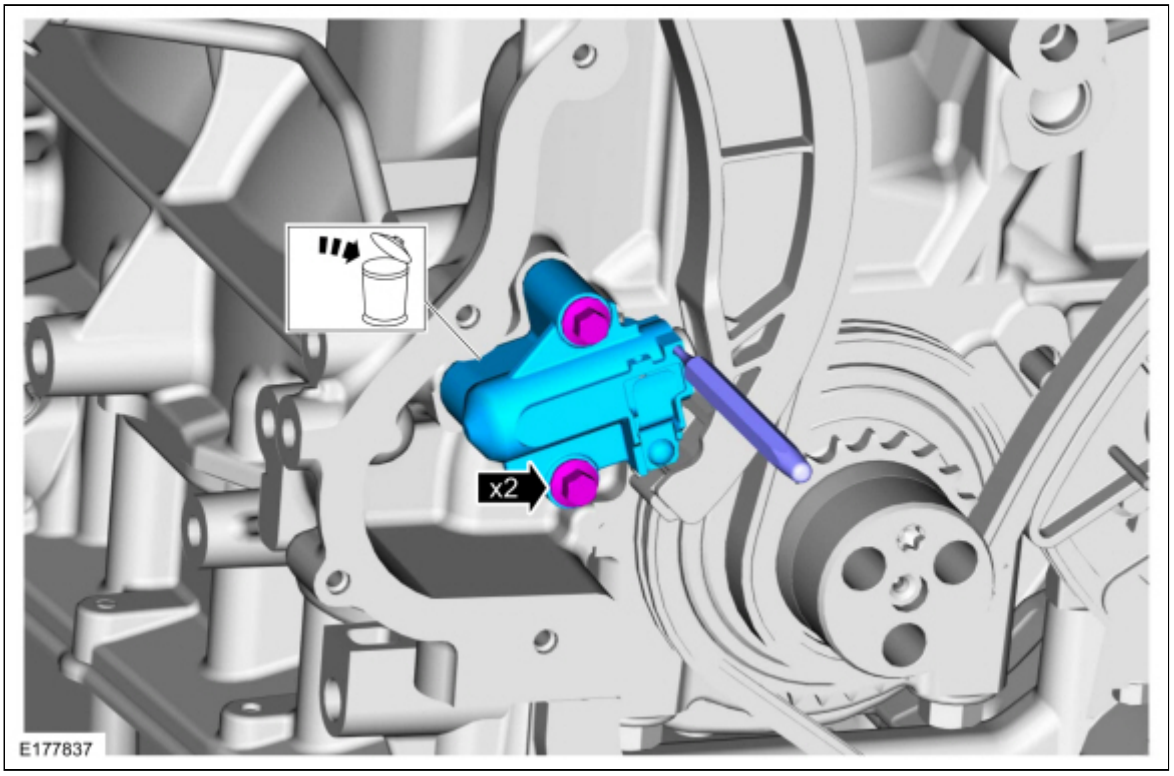
4. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



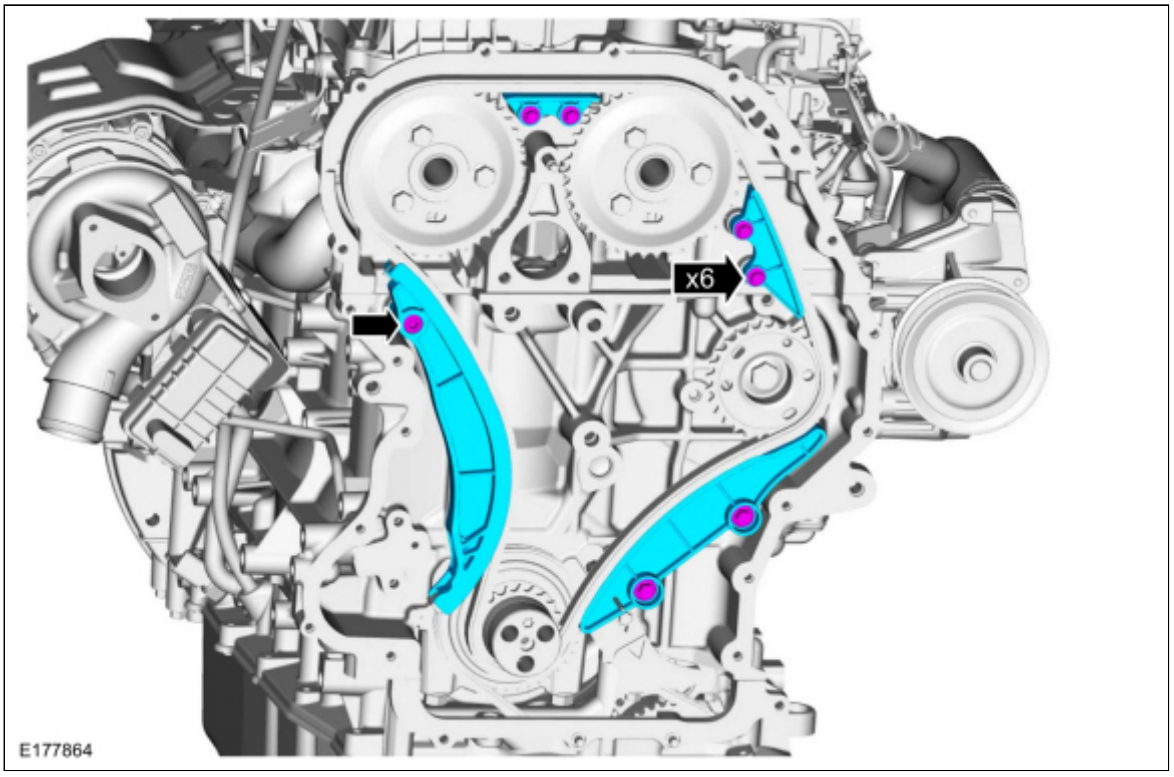
1. Using the special tool, release and hold the ratchet mechanism.
   Use Special Service Tool: 100-010 Remover, O-Ring Seal.
2. Compress the tensioner by pushing the timing chain tensioner arm toward the tensioner.
3. Insert the punch into the hole to retain the tensioner.
   Use the General Equipment: 2 mm Punch



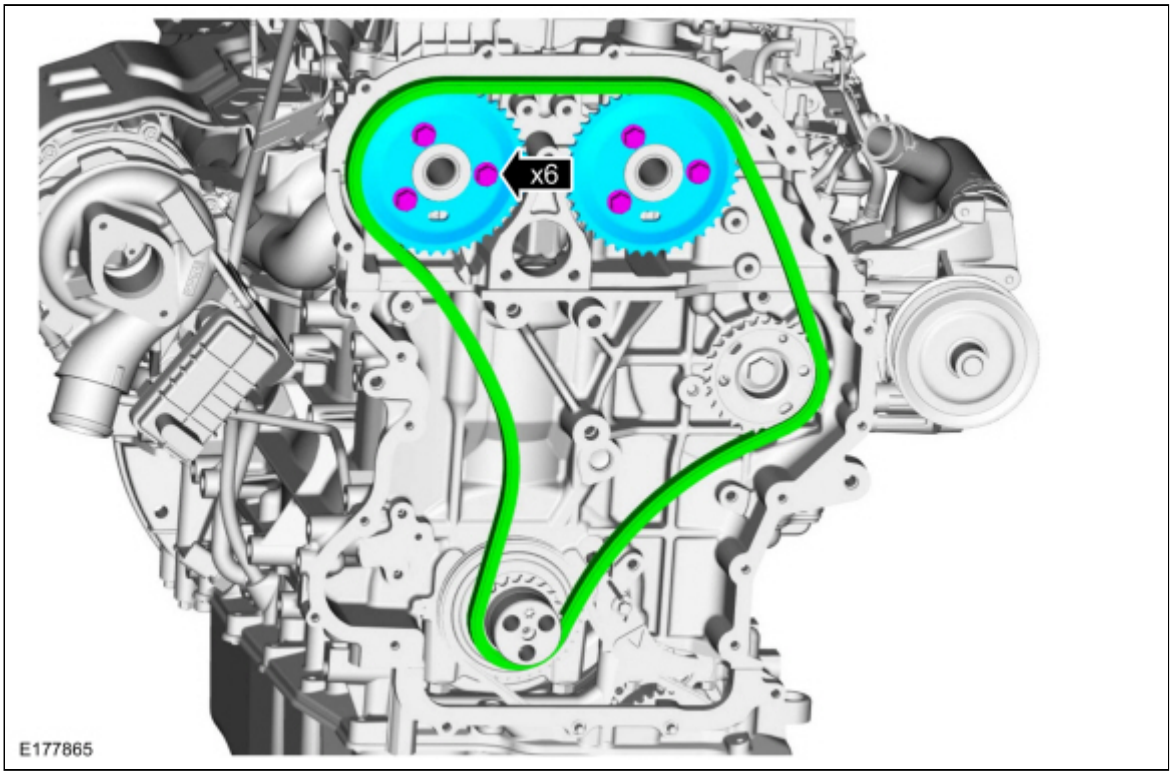
6. Remove the bolts and the timing chain tensioner. Discard the timing chain tensioner.



7. Remove the bolts, timing chain tensioner arm and the timing chain guides.



8. Remove the bolts, camshaft sprockets and the timing chain.

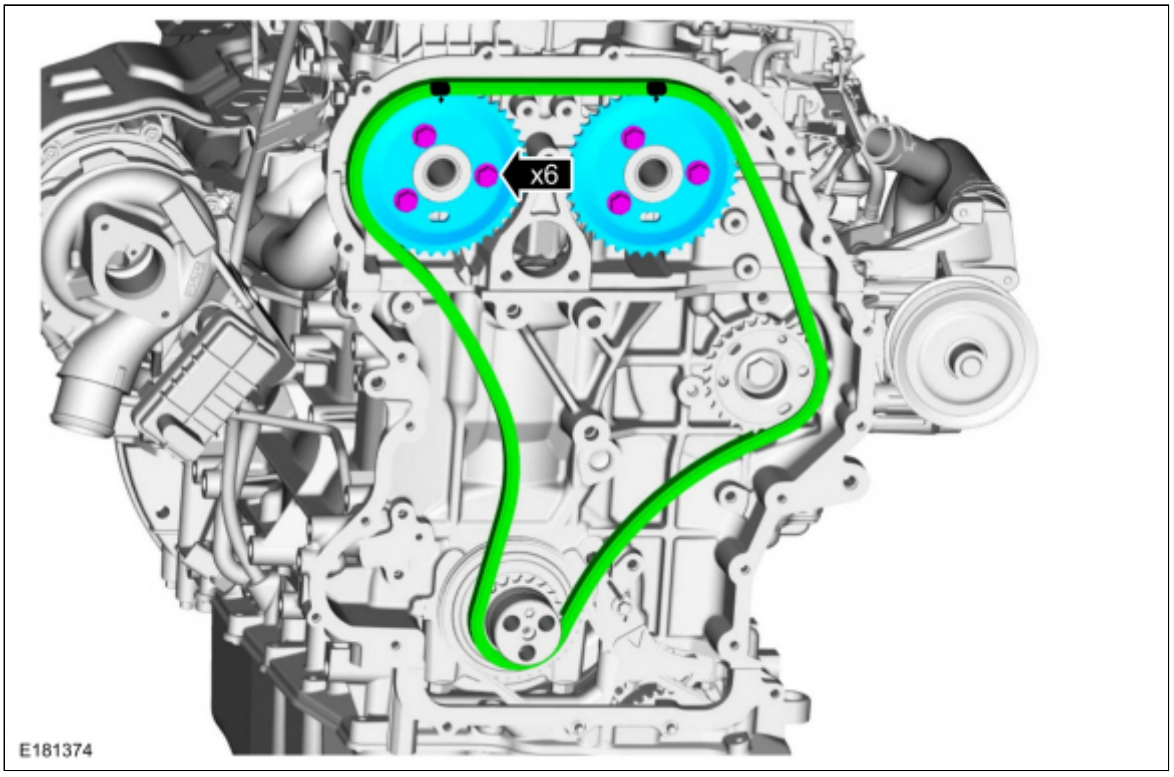


Installation

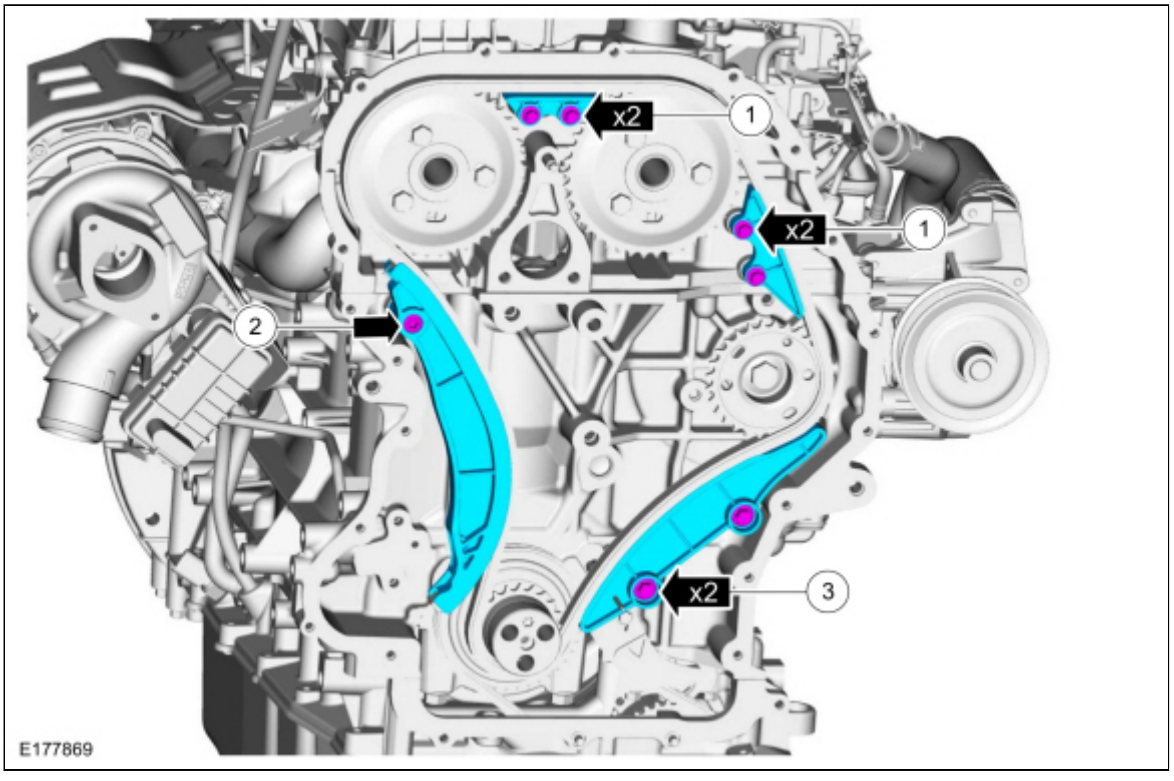
1. **NOTE:** *Make sure that the timing marks are aligned.*

   NOTE: *Do not tighten the bolts at this time.*

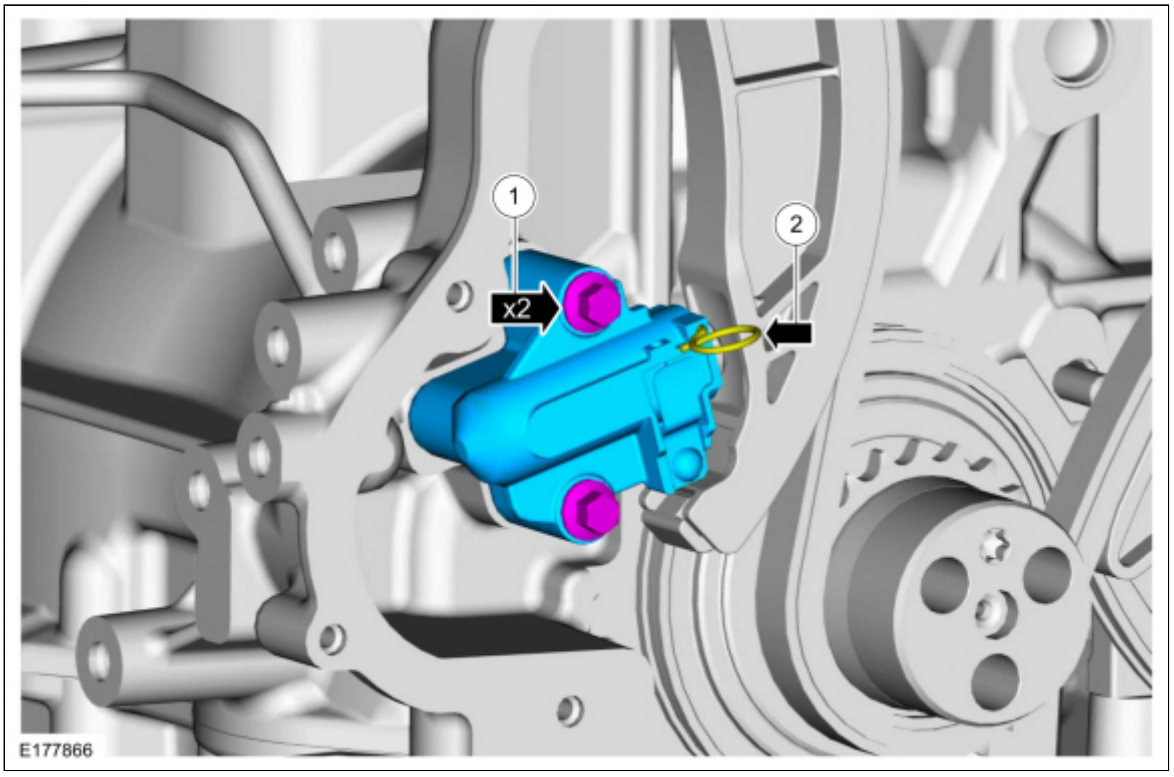
   Install the timing chain, camshaft sprockets and the bolts.



2. Install the timing chain tensioner arm and the timing chain guides and the bolts.
   Torque:
   1: 14 Nm
   2: 31 Nm
   3: 40 Nm

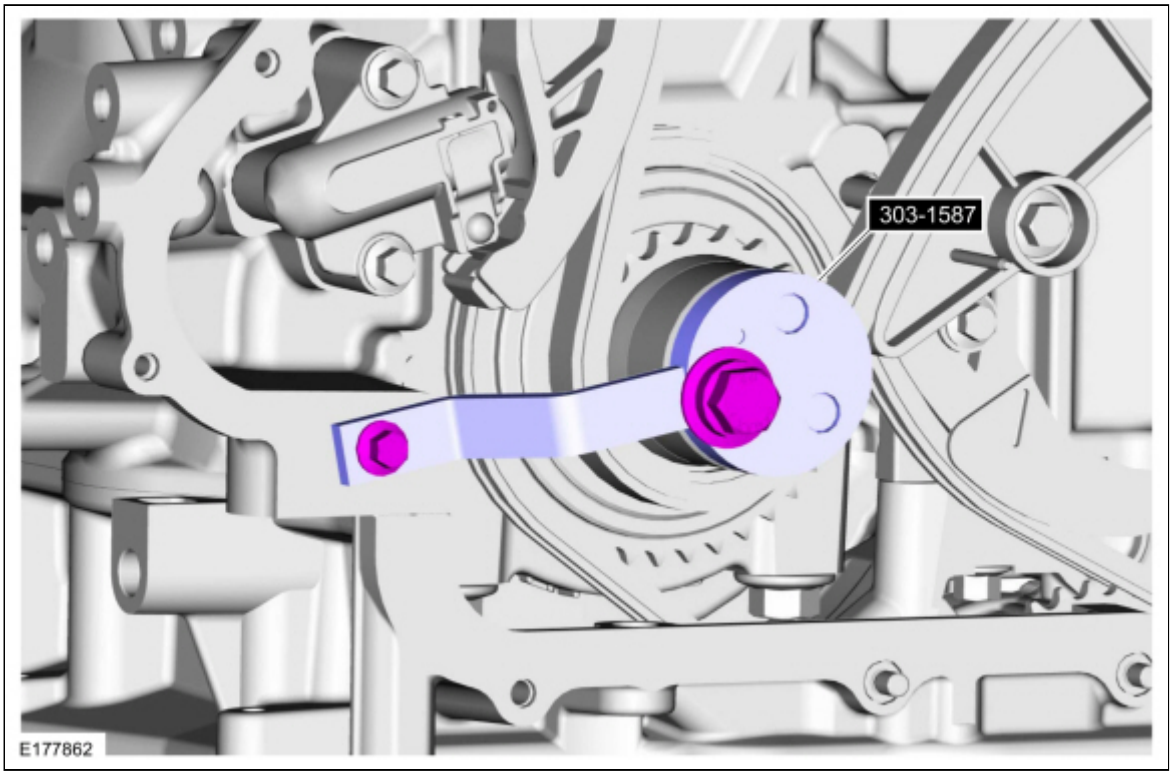


3. Install the timing chain tensioner and bolts. Remove the retaining pin.
   Torque: 15 Nm

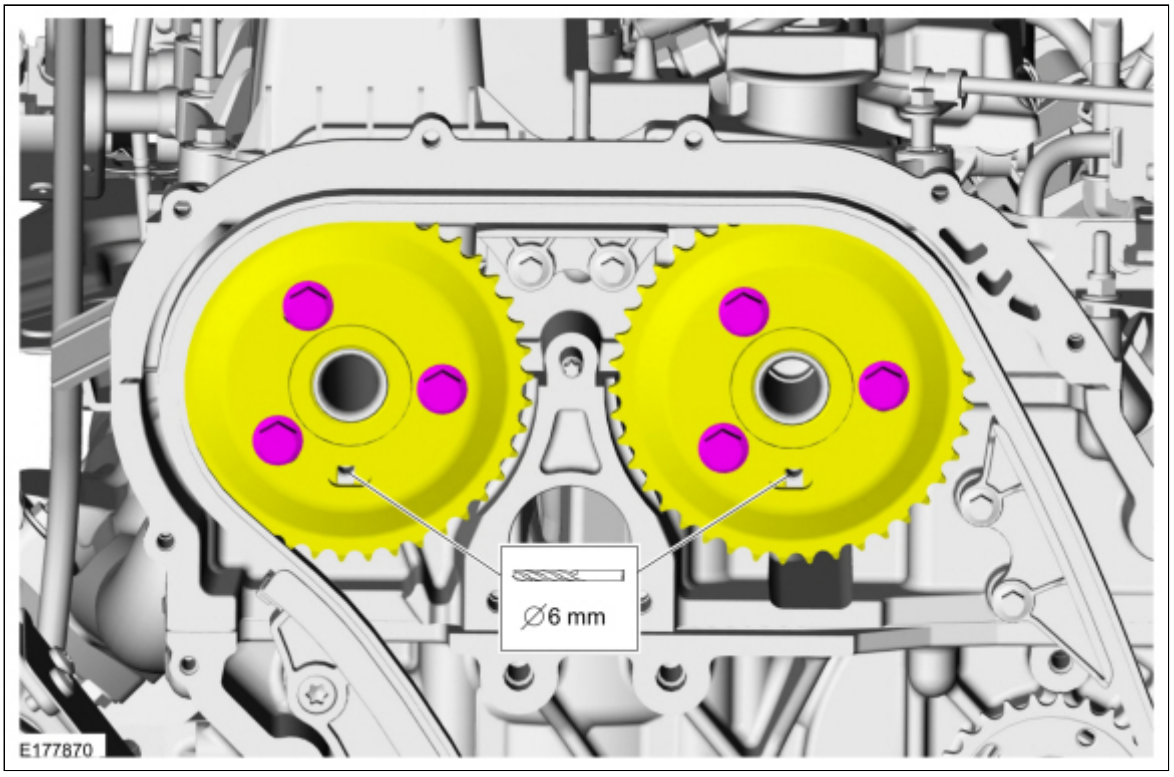


4. **NOTE:** *When the tool is properly installed, the locating pin will be approximately at the 10 o'clock position.*

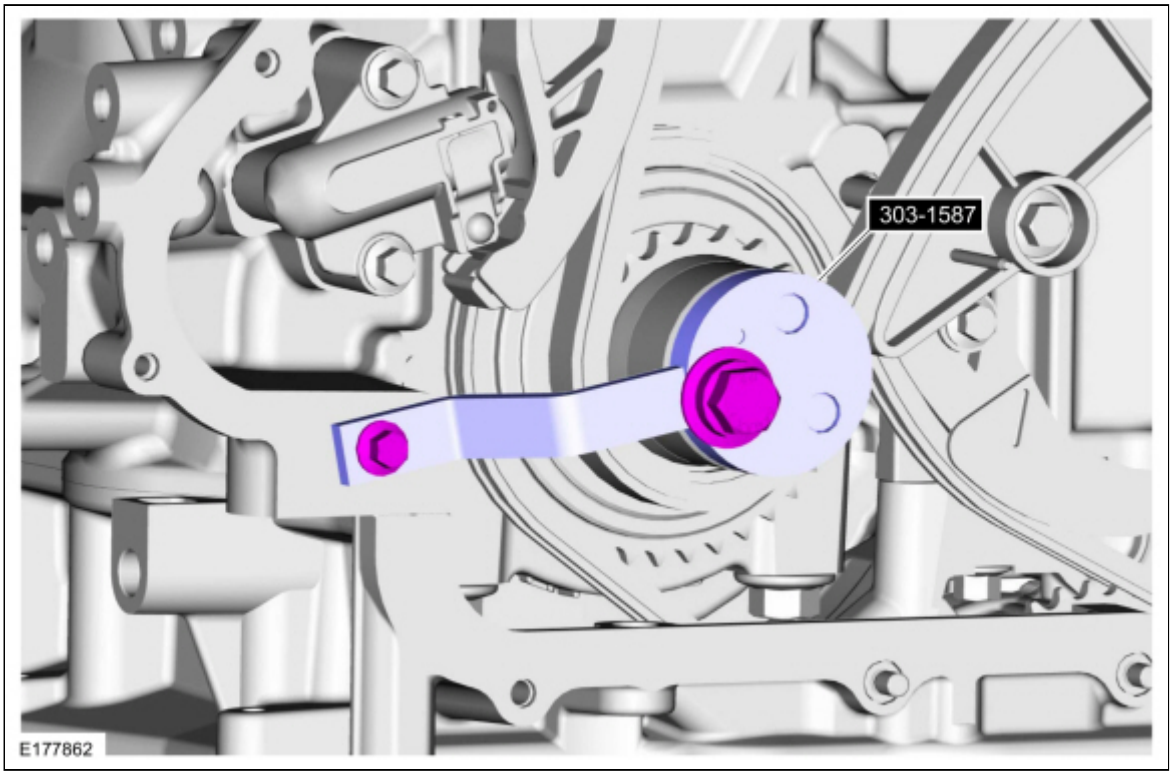
   Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



5. Check the valve timing by inserting the end of 2 drill bits through the sprocket holes into the timing pin holes in the cylinder head. Tighten the bolts for the camshaft sprockets.
   Use the General Equipment: 6 mm Drill Bit
   Torque:
   Stage 1: 12 Nm
   Stage 2: 33 Nm



6. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.

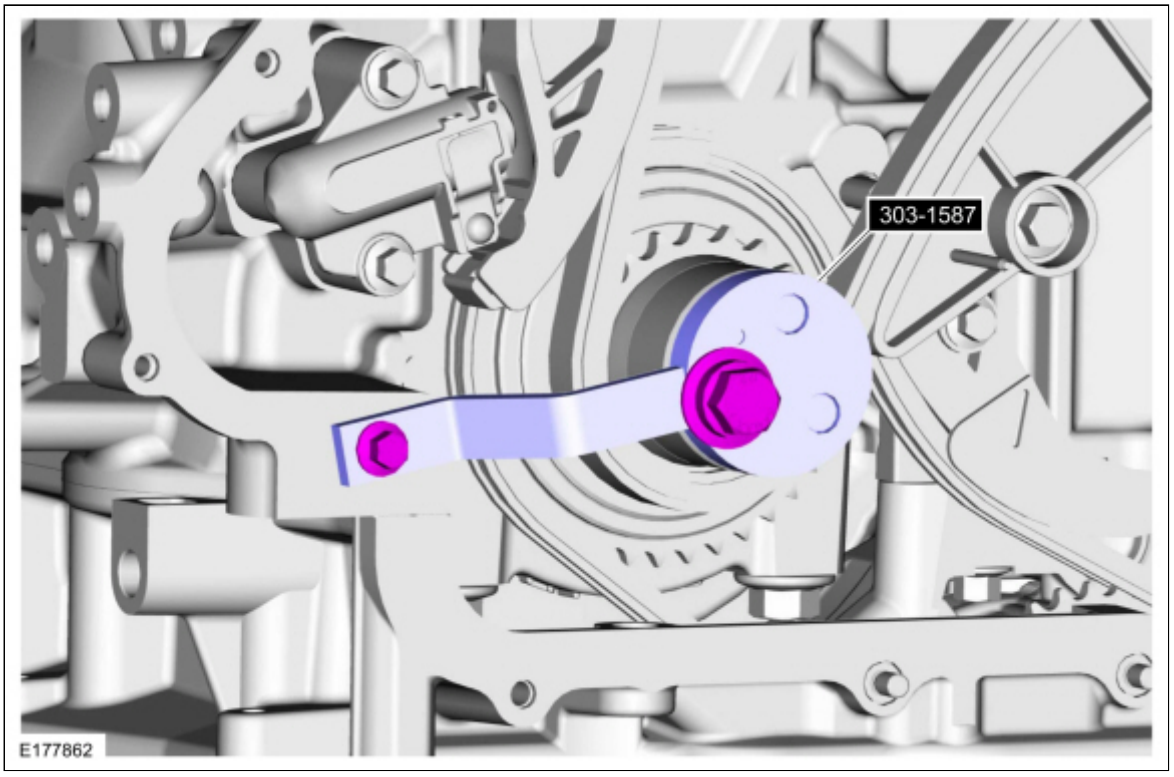


7. **NOTICE: Only rotate the crankshaft clockwise.**

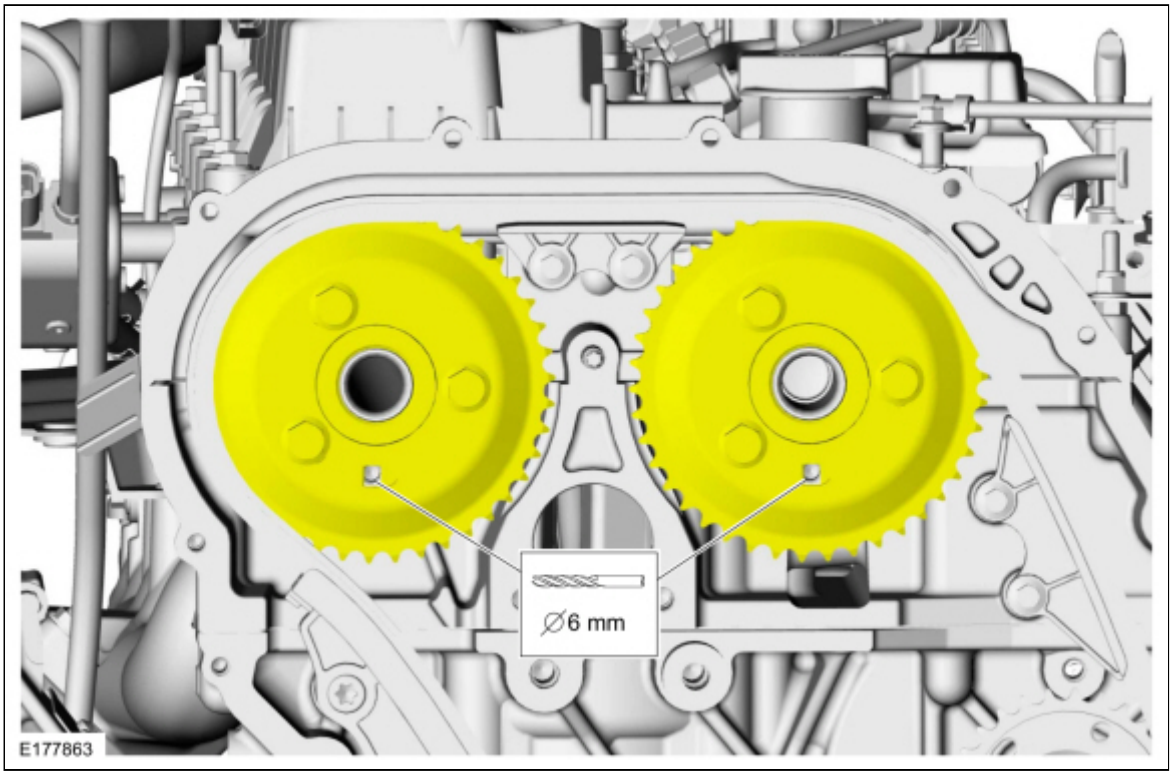
   Rotate the engine two revolutions.

8. **NOTE:** *When the tool is properly installed, the locating pin will be approximately at the 10 o'clock position.*

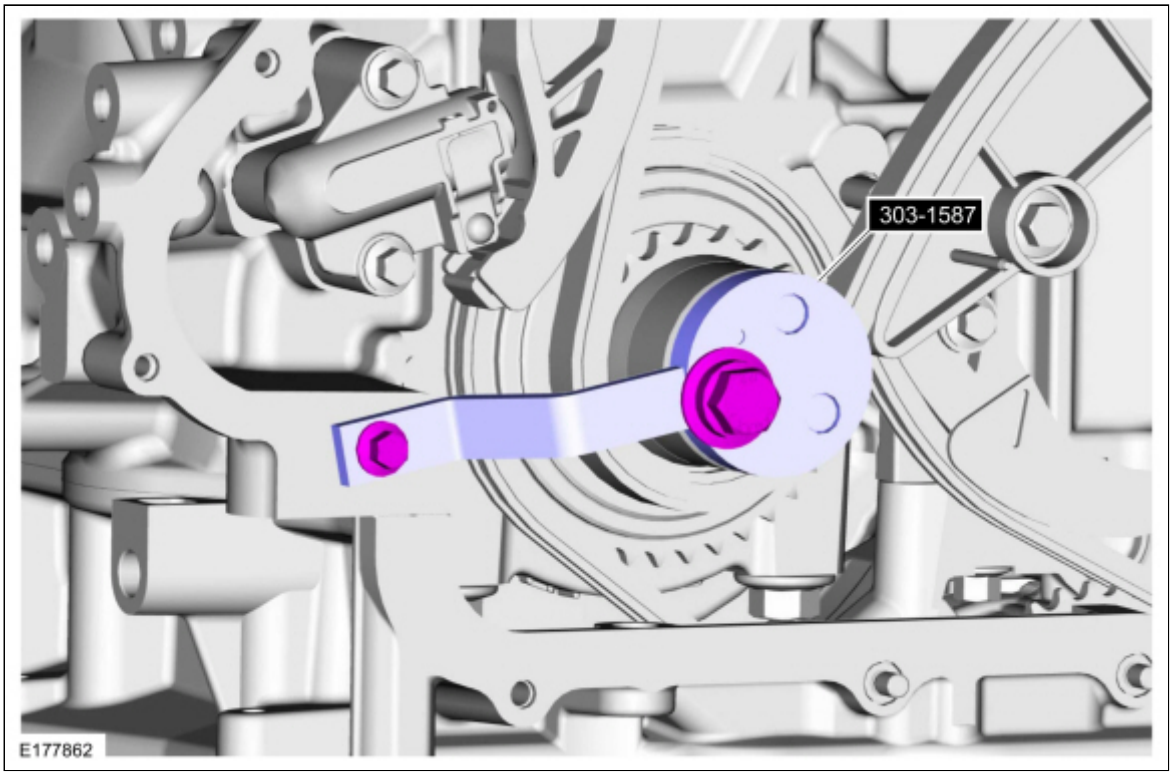
   Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



9. Check the valve timing by inserting the end of 2 drill bits through the sprocket holes into the timing pin holes in the cylinder head. If the drill bit ends can not be inserted repeat the timing steps.
   Use the General Equipment: 6 mm Drill Bit



10. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



11. Refer to: Timing Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

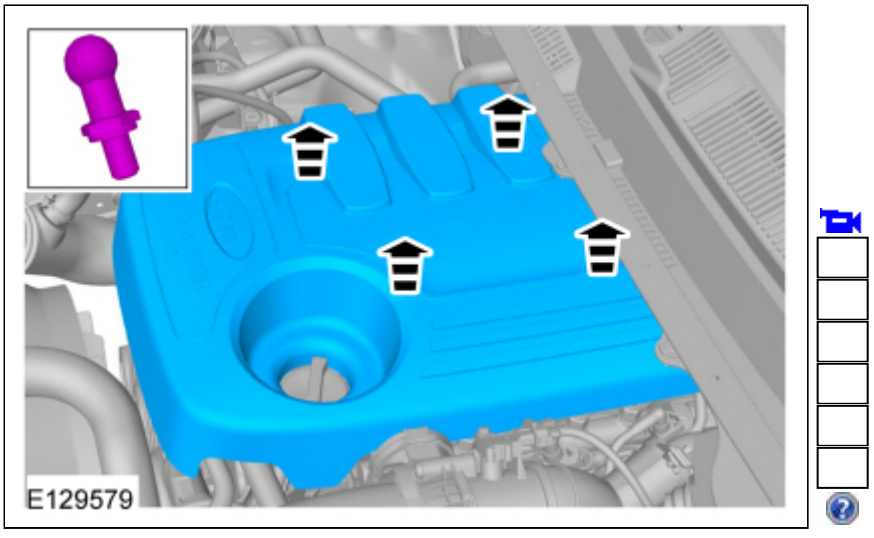
Copyright © 2016 Ford Motor Company

Engine - 6-Speed Manual Transmission - MT82

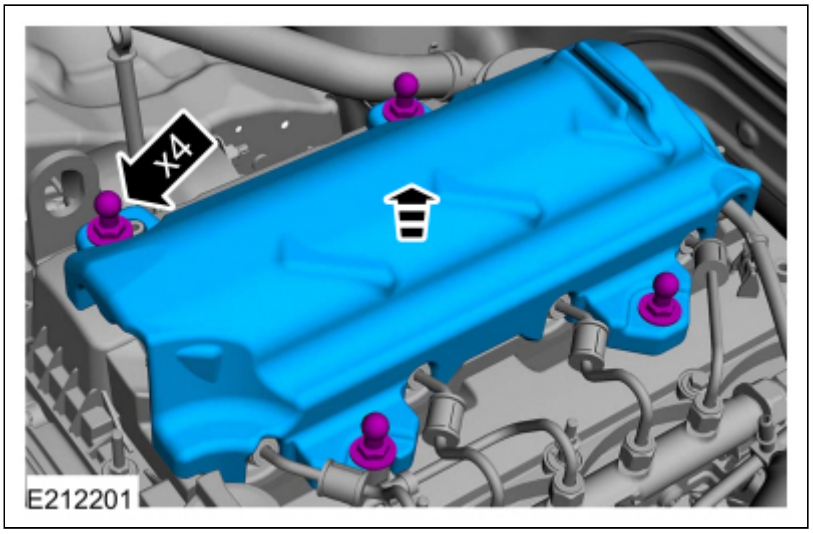
Base Part Number: 6L084

Special Tool(s) / General Equipment

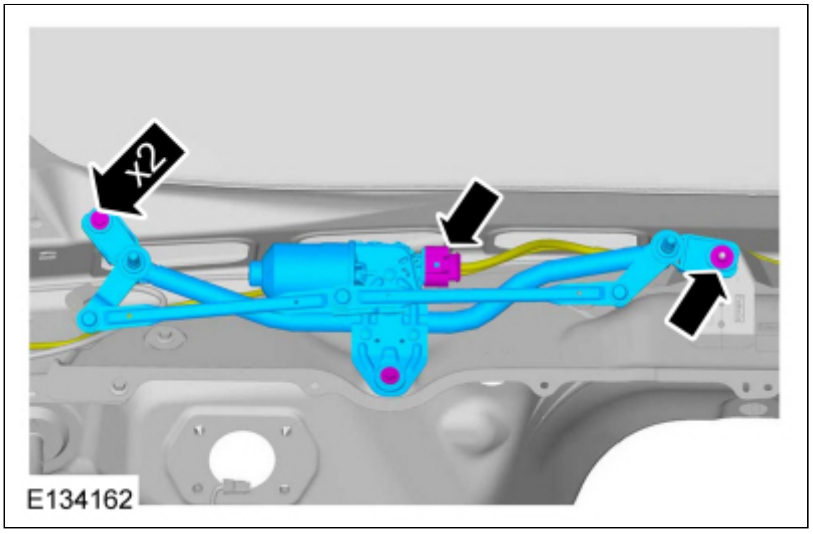
 21068A	303-122 Lifting Bracket, Engine
Transmission Jack	

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
7. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
8. 

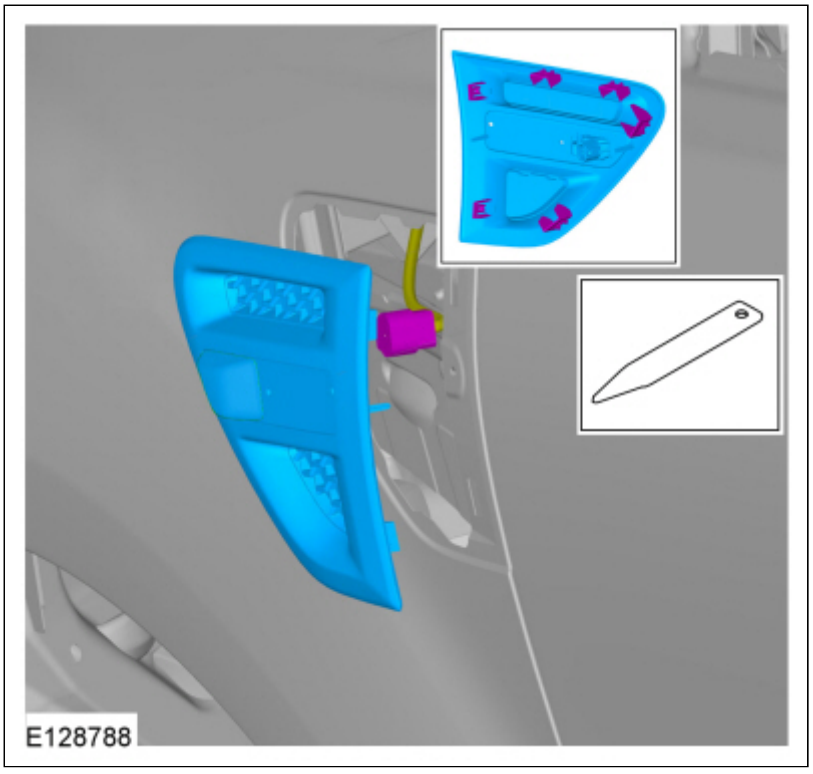
9.



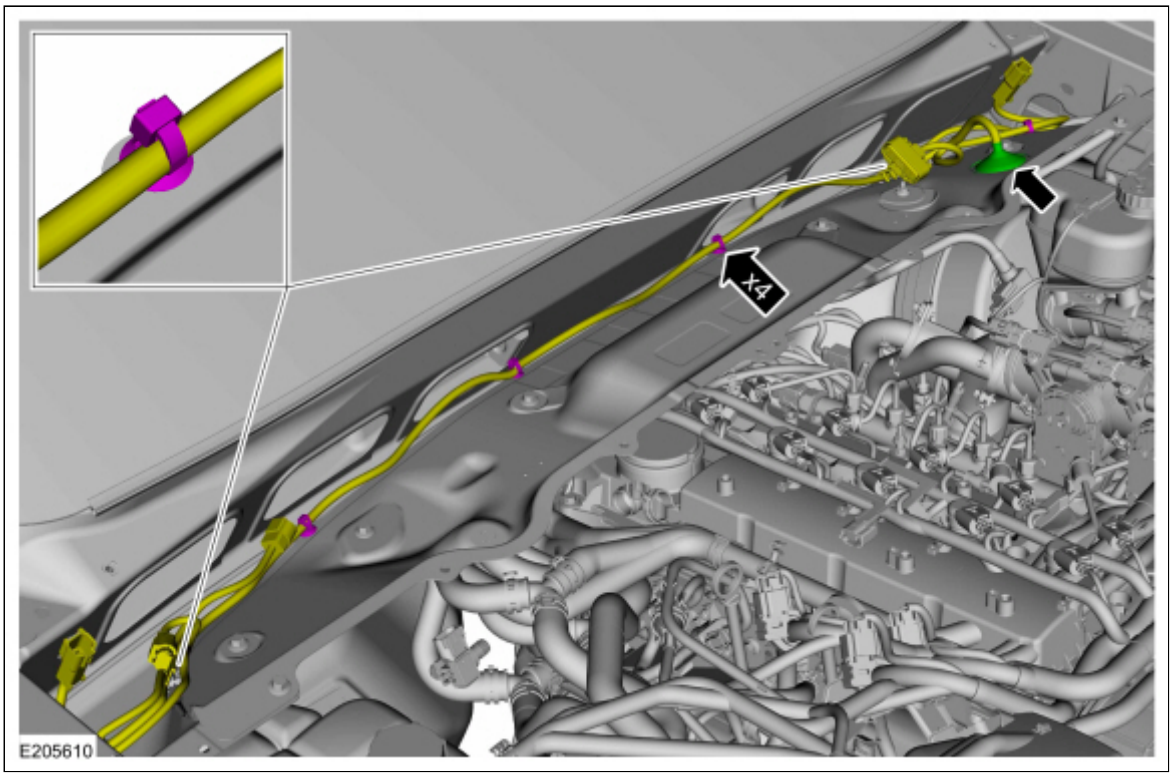
10. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
11.



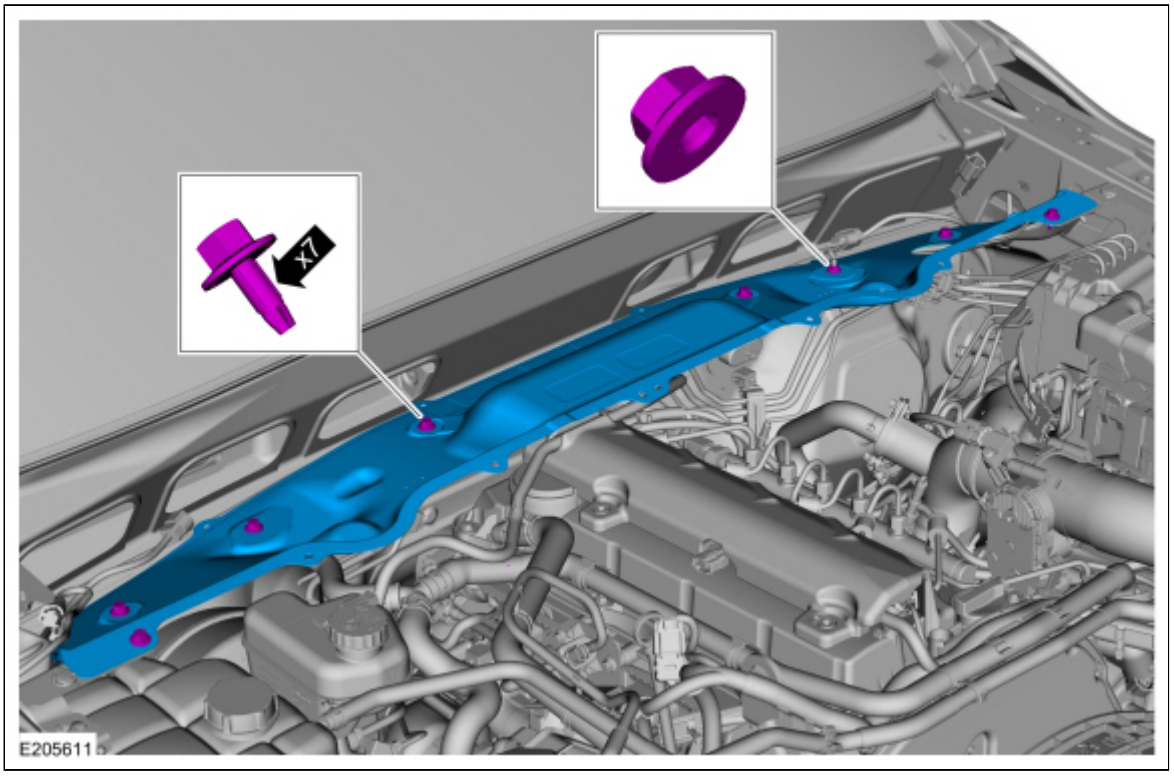
12. On both sides.



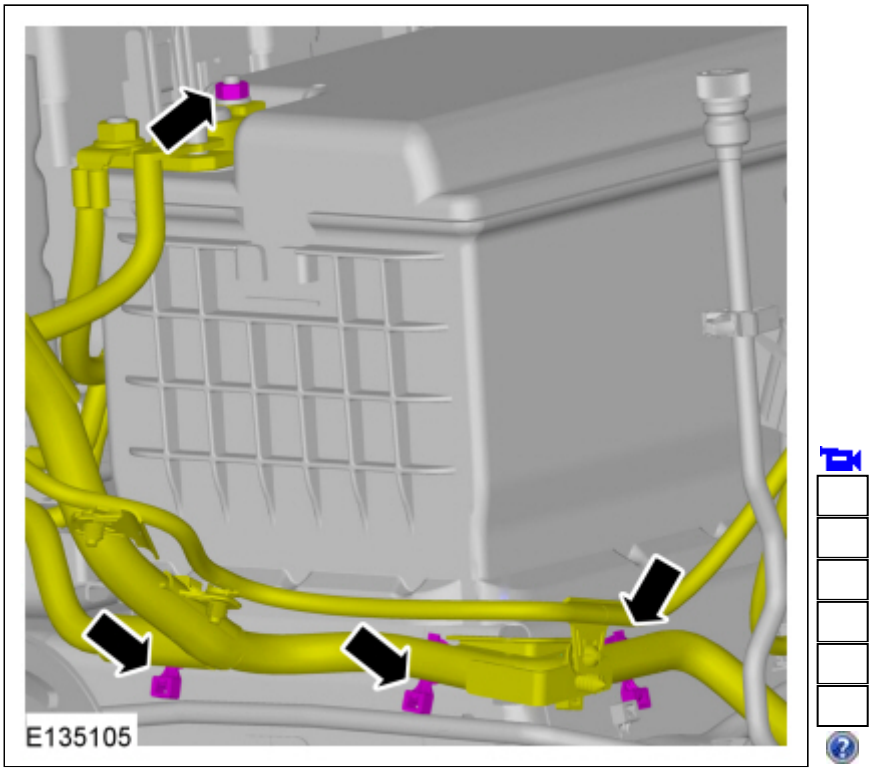
13.



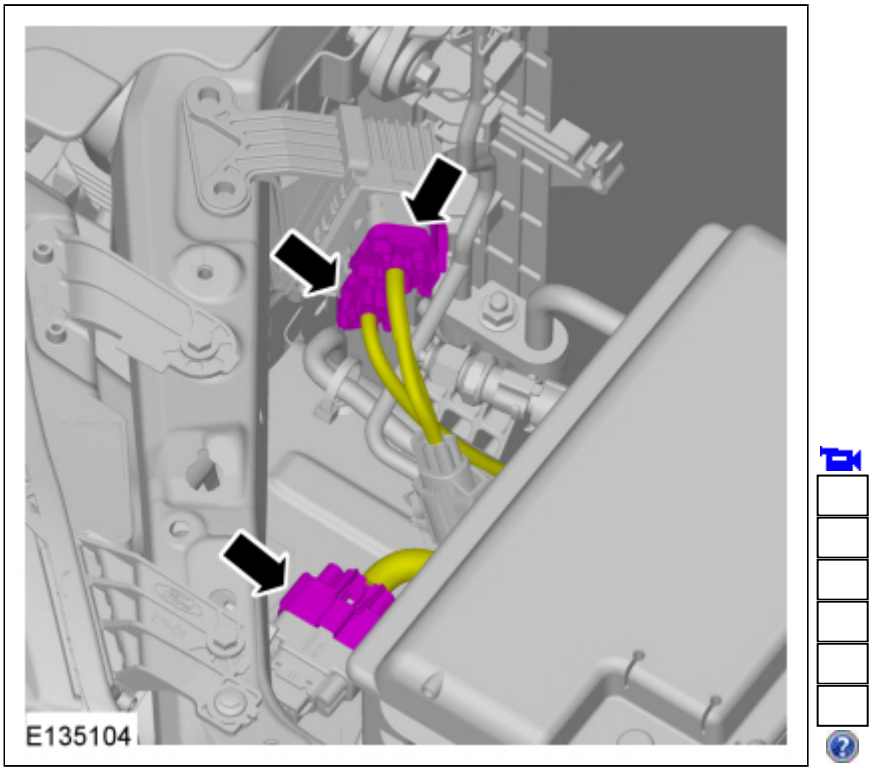
14.



15.



16.

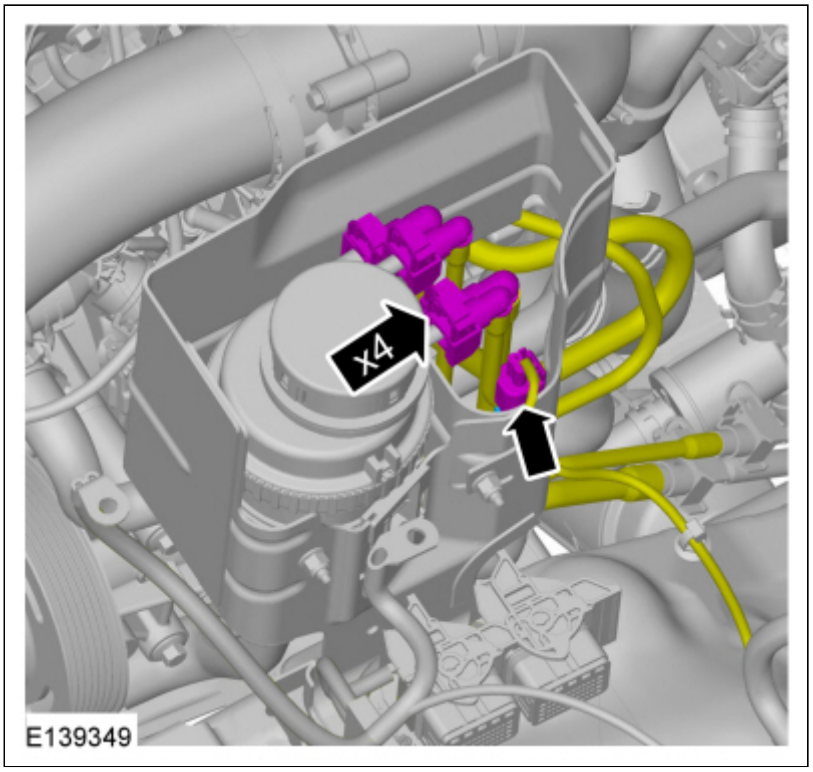


17. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

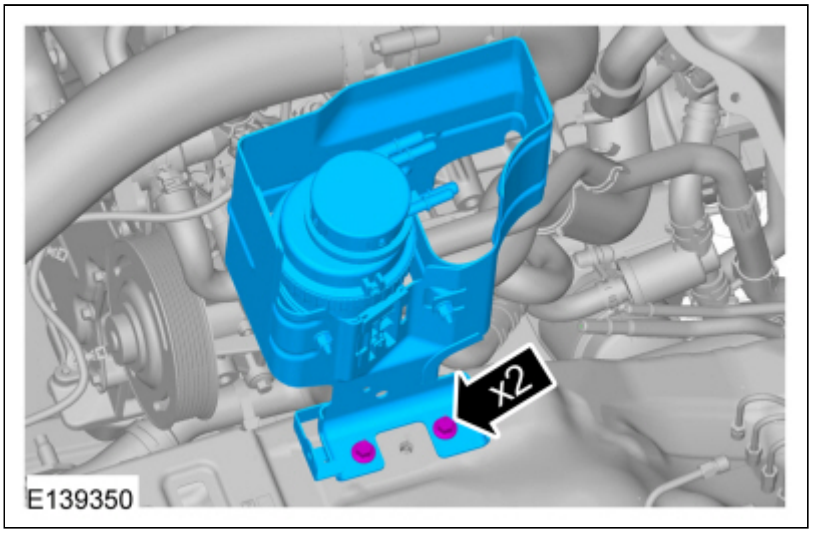
18. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

19. Refer to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
    Refer to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

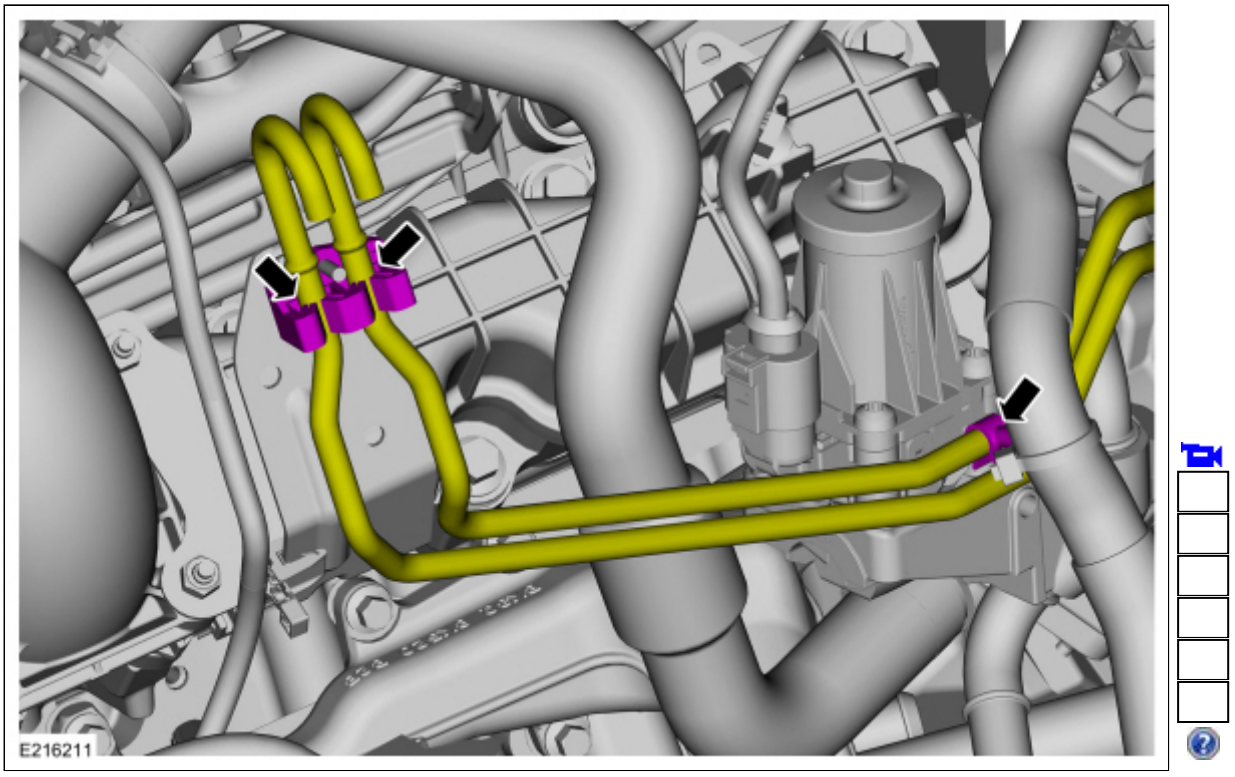
20.



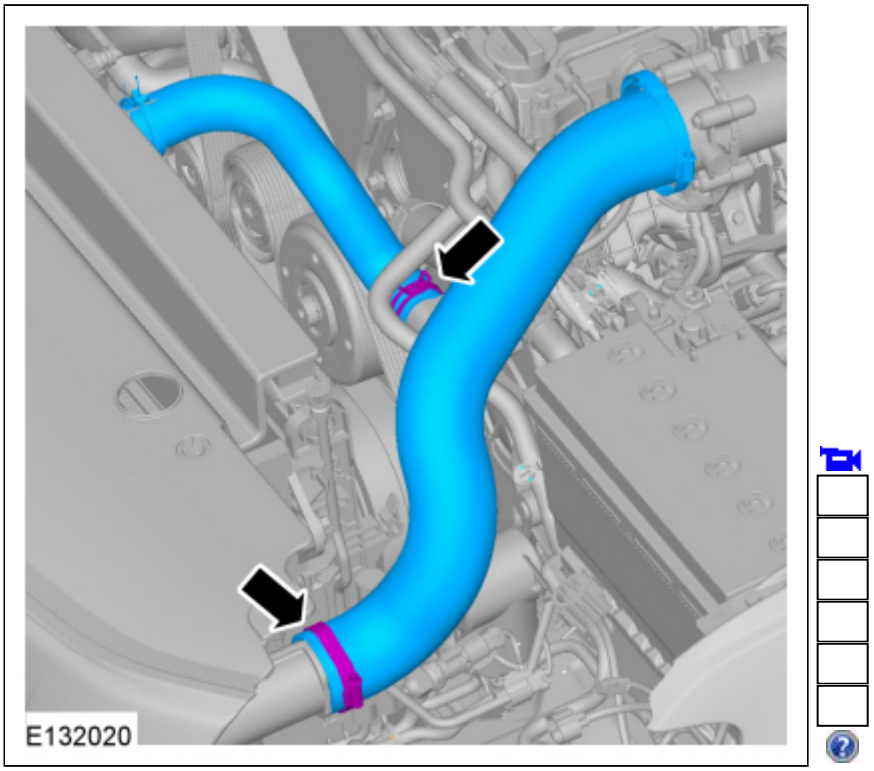
21.



22.



23. *Torque*: 5 Nm

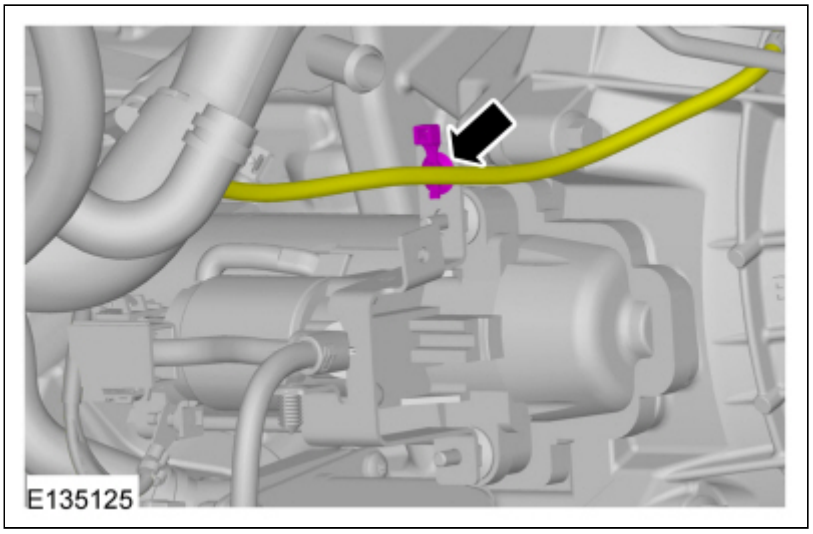


24. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

25. Refer to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

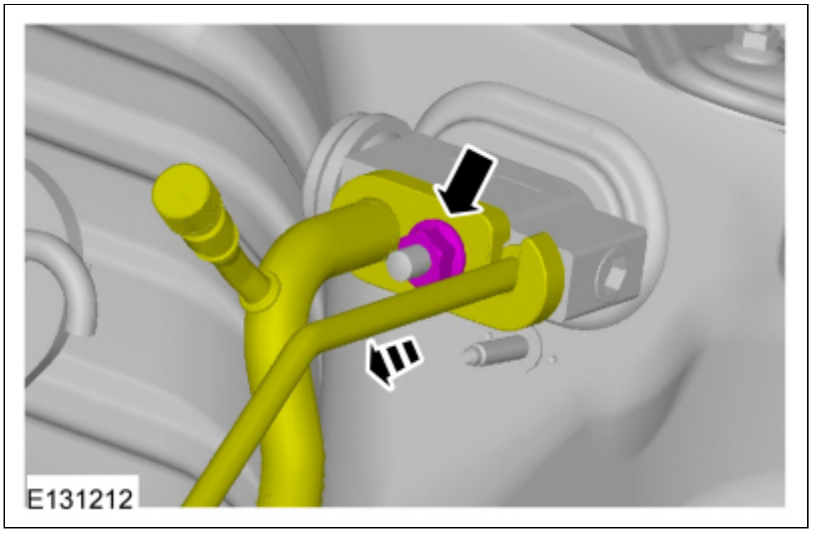
26. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

27.

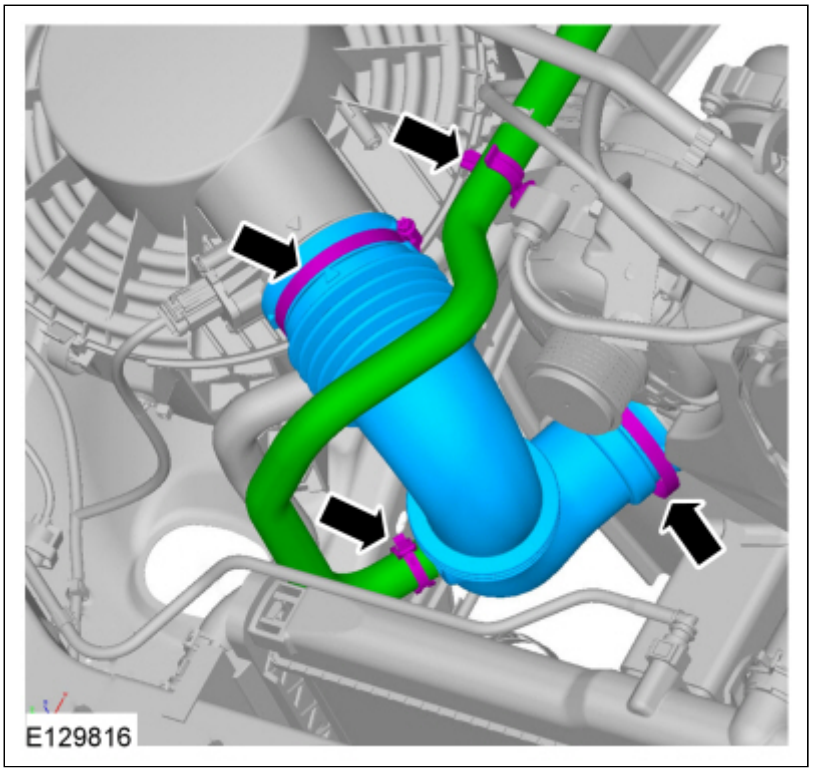


28. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

29.



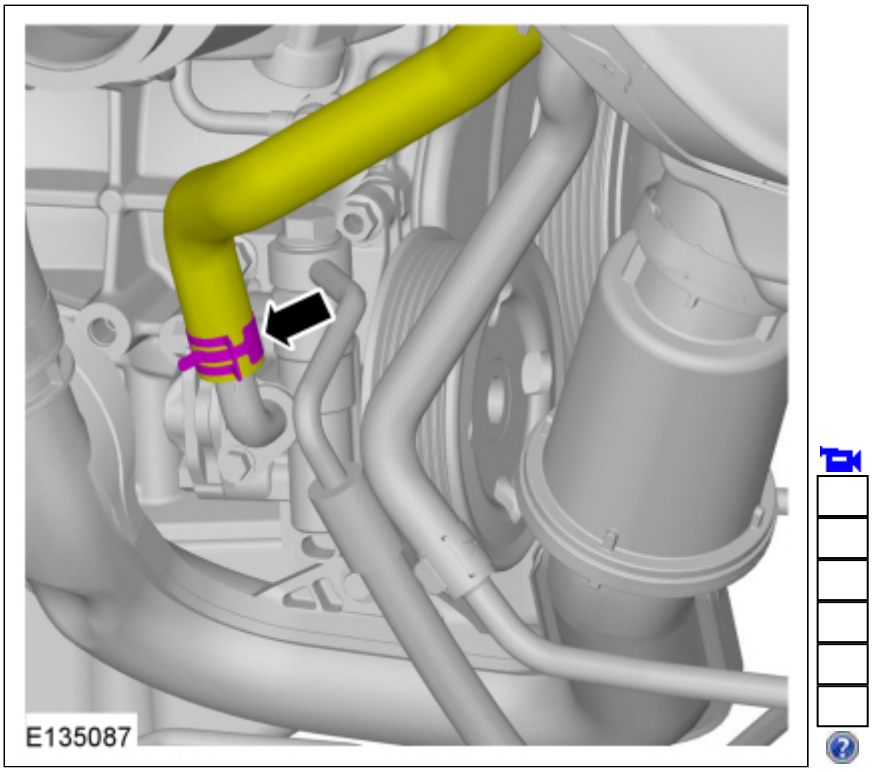
30.



31. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

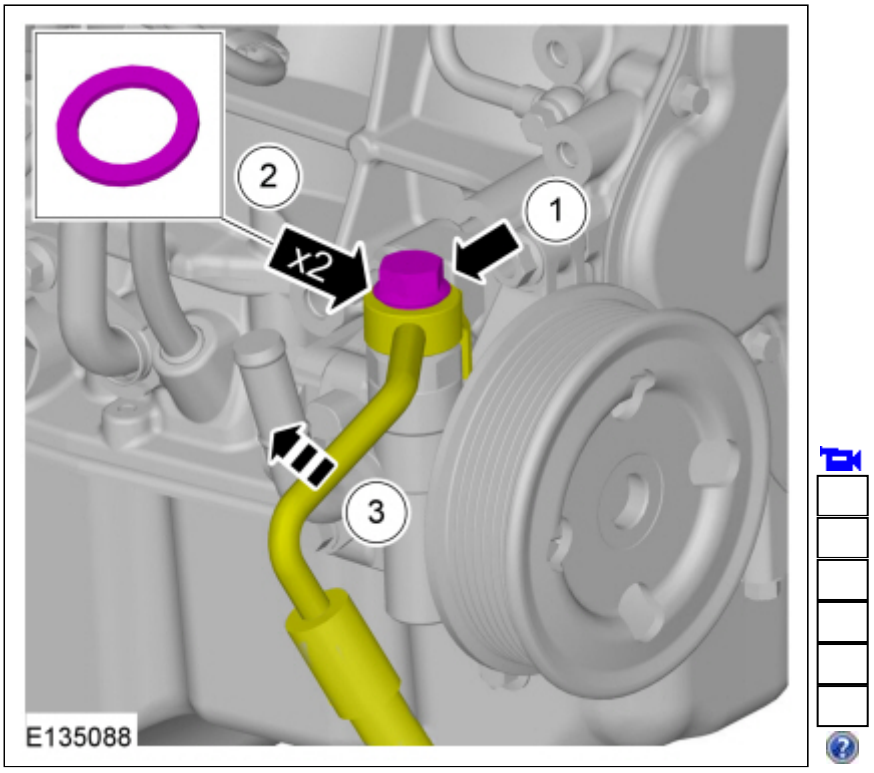
Vehicles With: Hydraulic Power Assist Steering (HPAS)

32. **NOTE:** *Make sure that all openings are sealed.*



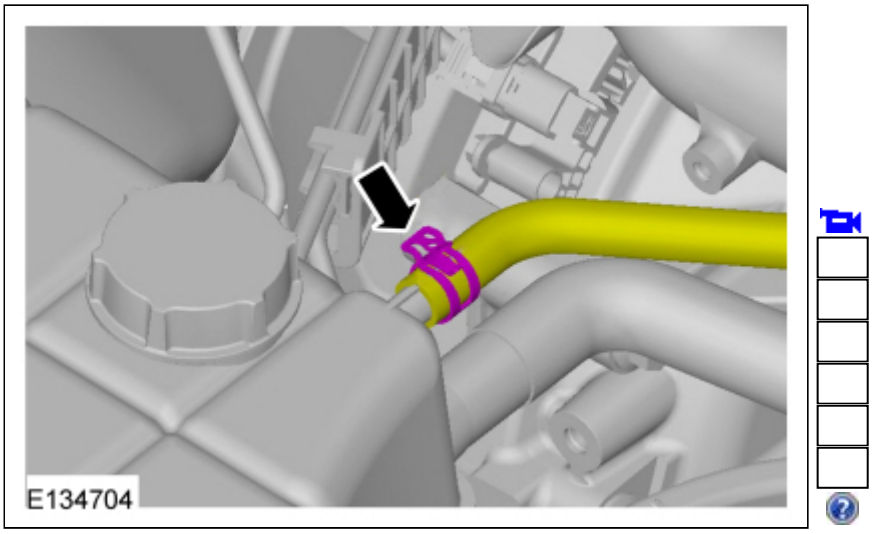
33. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**

    NOTE: *The washers can be reused unless damaged.*

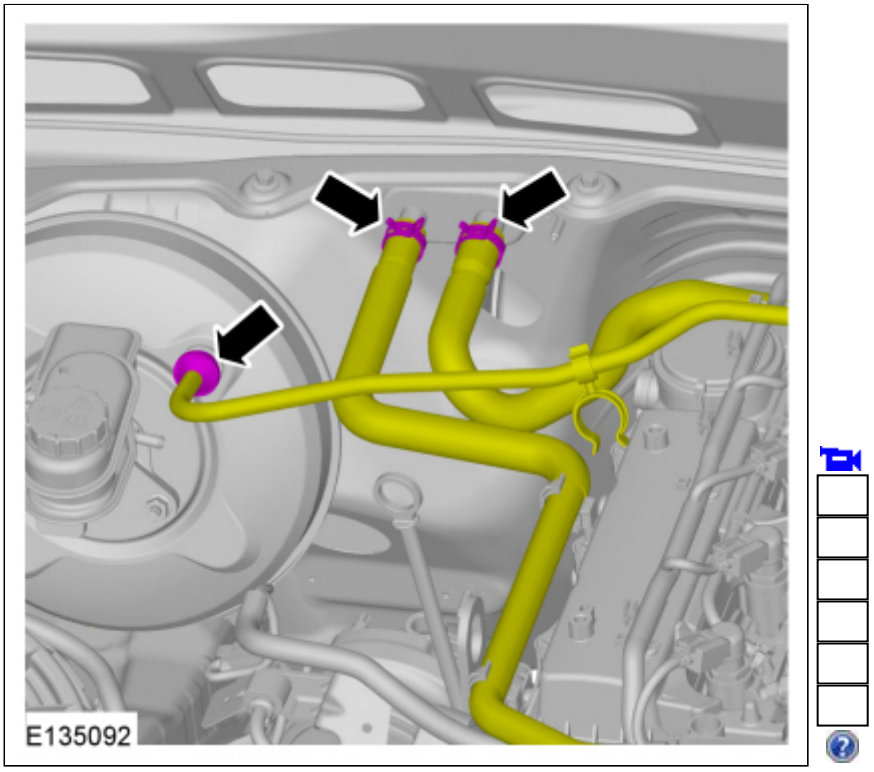


All vehicles

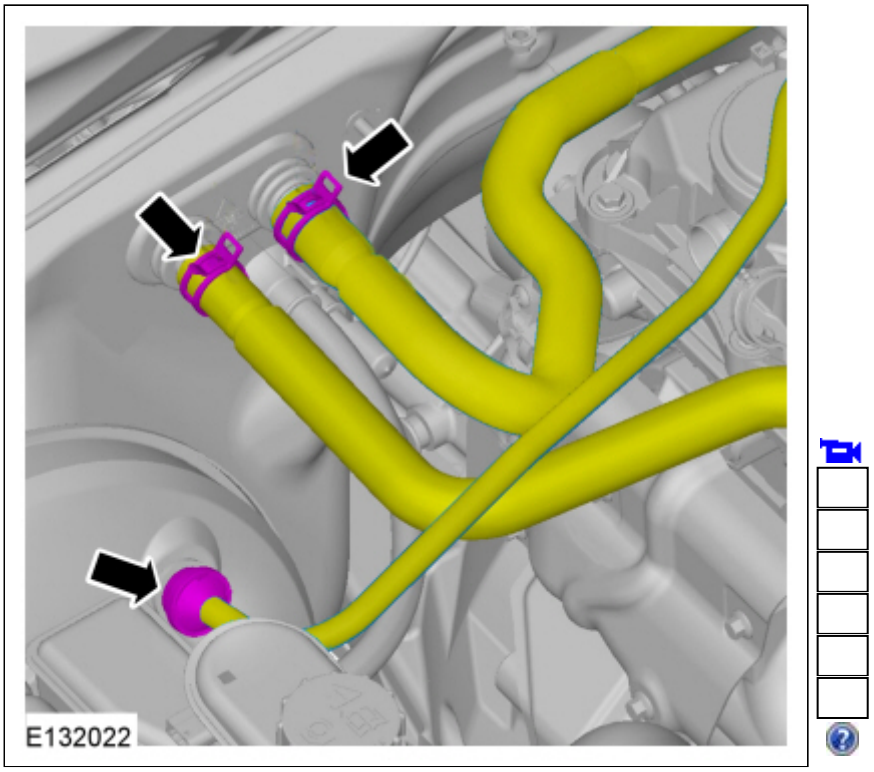
34.



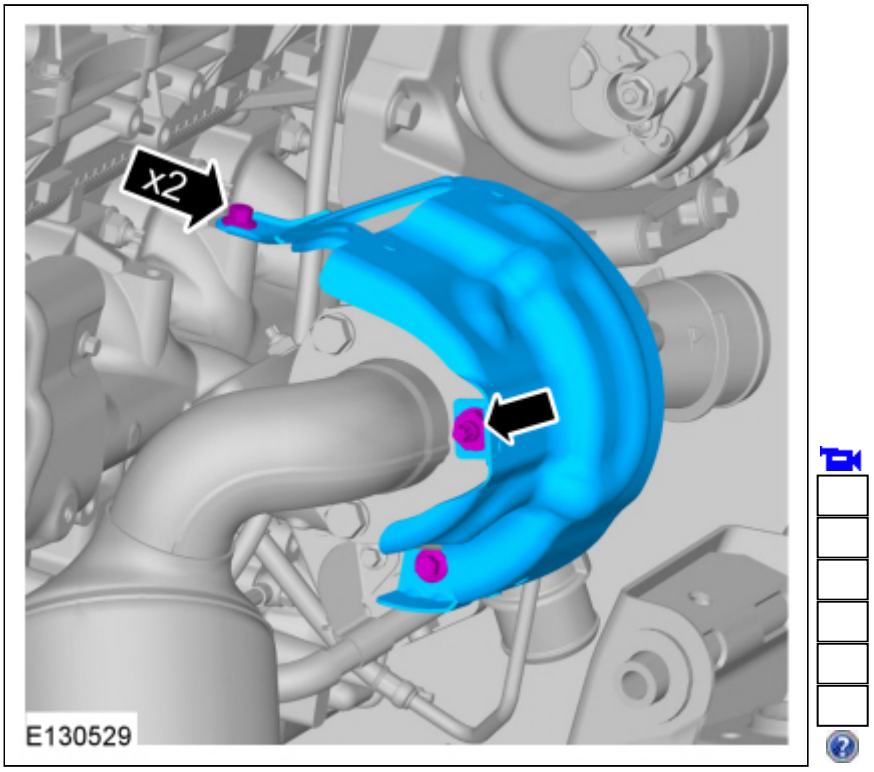
35. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**



36.

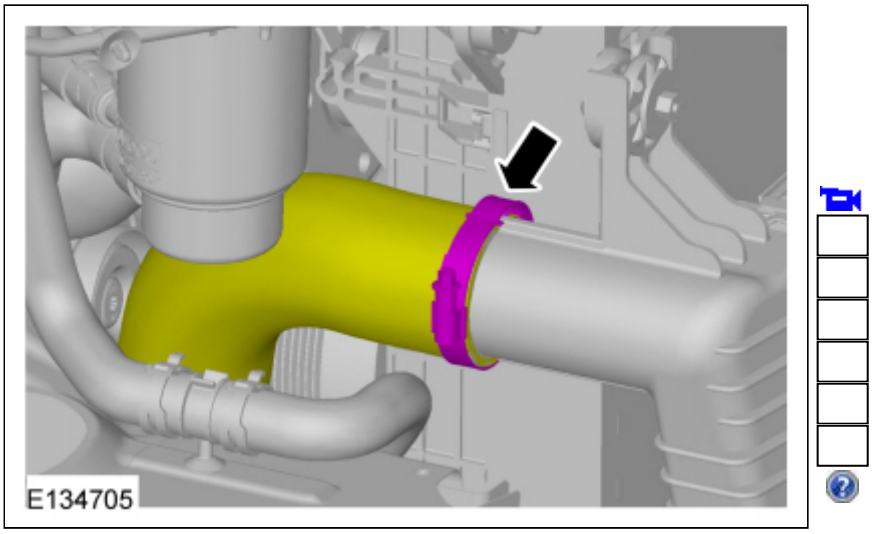


37.

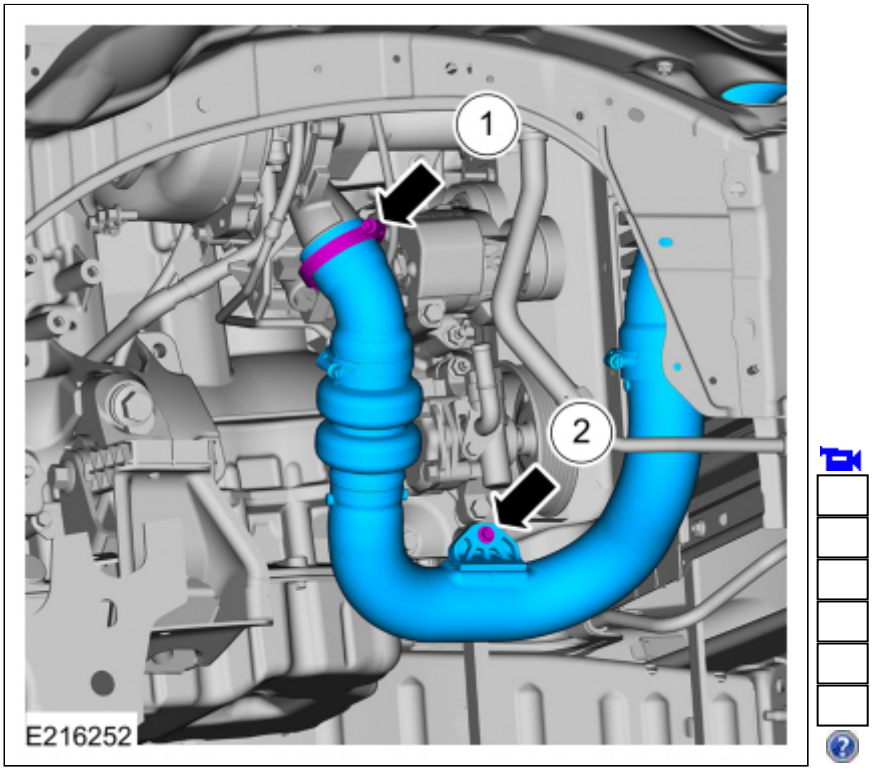


38. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

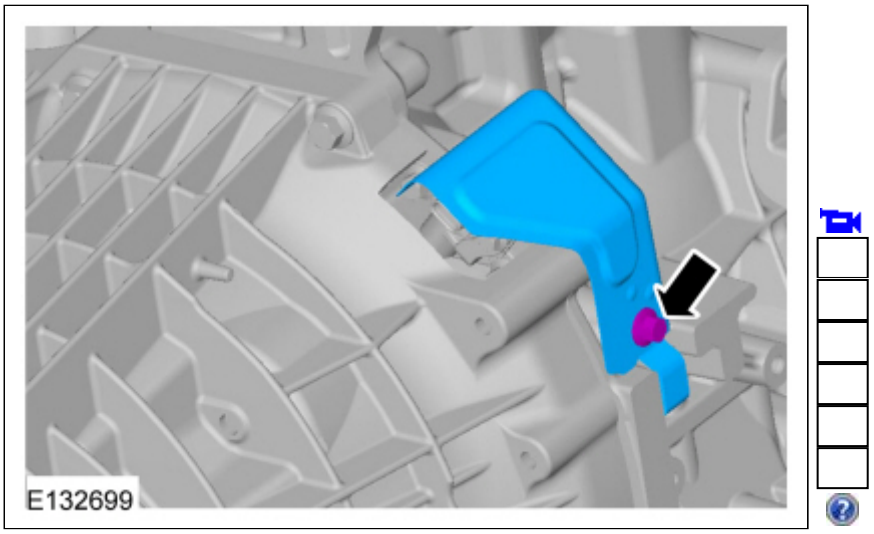
39. *Torque*: 4 Nm



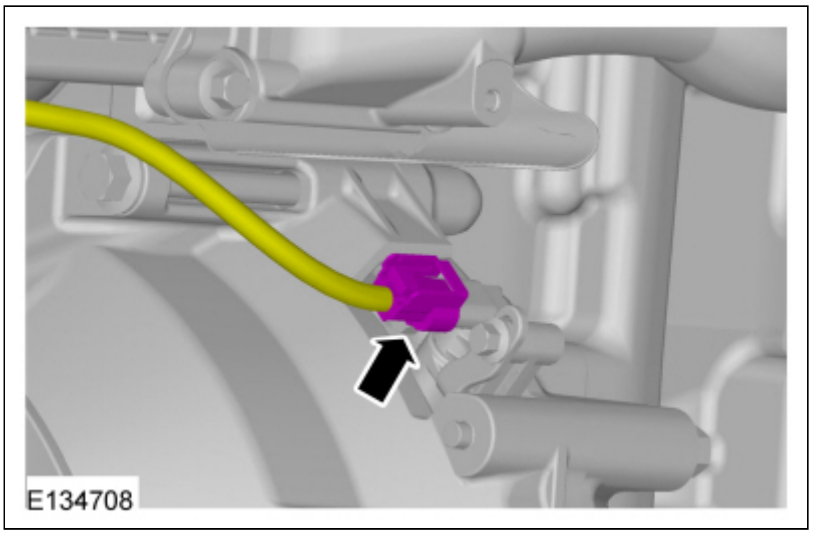
40. *Torque*: 10 Nm



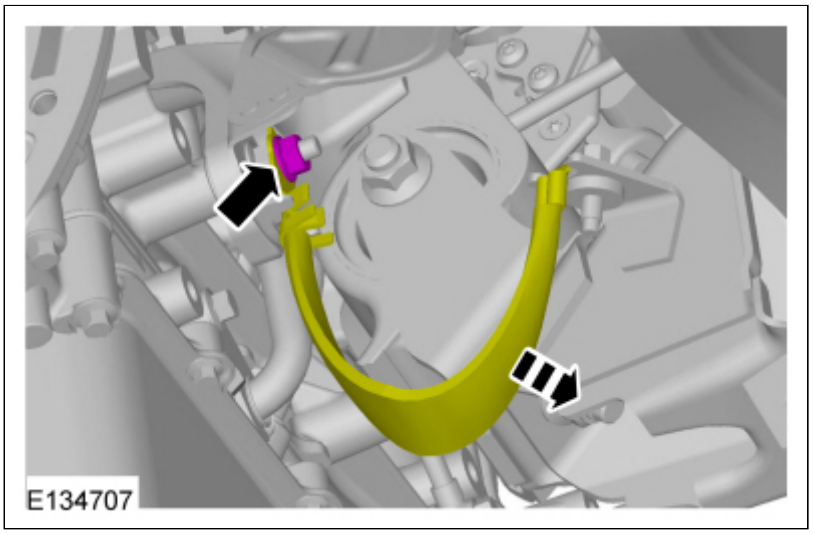
41.



42.



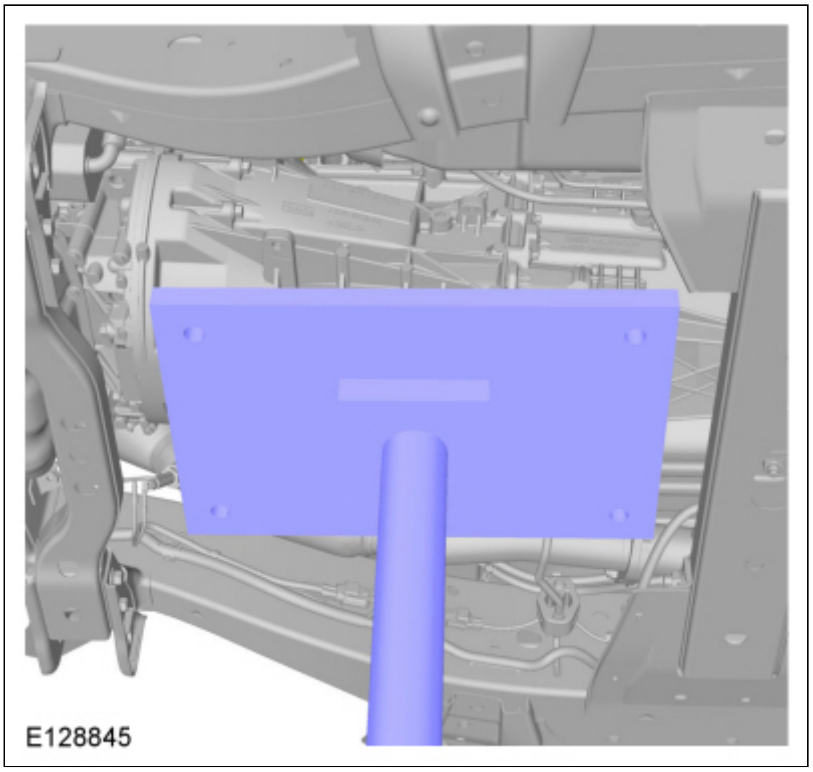
43.



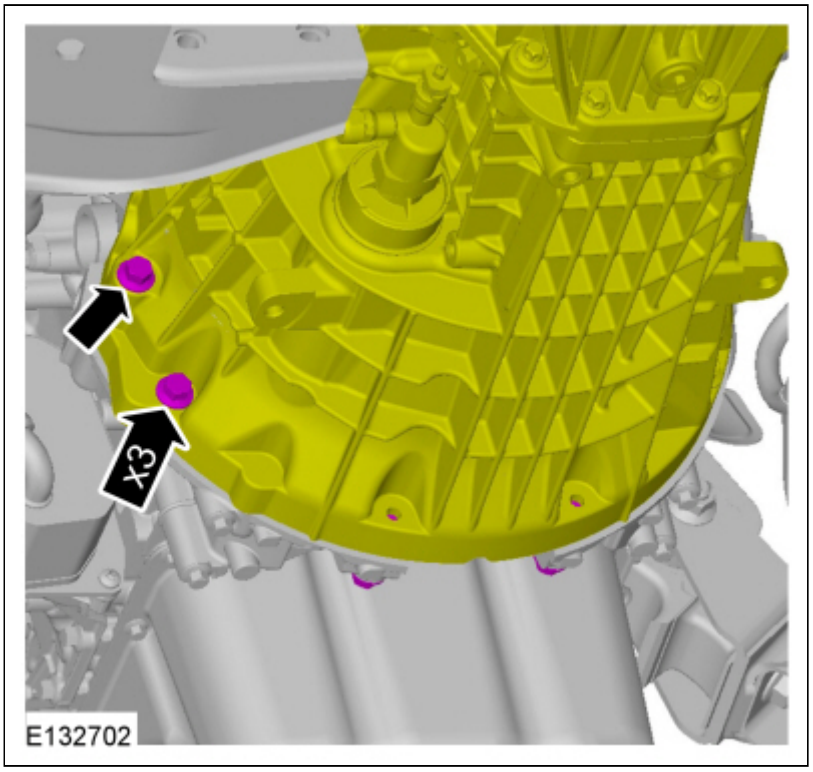
44. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

NOTICE: Do not tilt the transmission. This may cause damage to the pilot bearing.

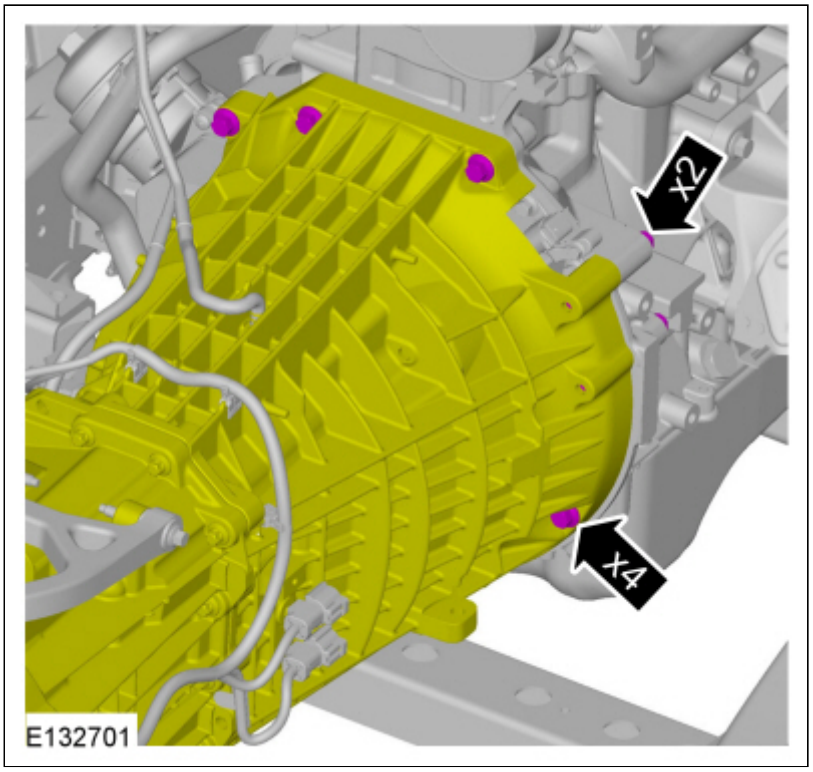
Tie and support the transmission to the chassis with a suitable strap.
Use the General Equipment: Transmission Jack



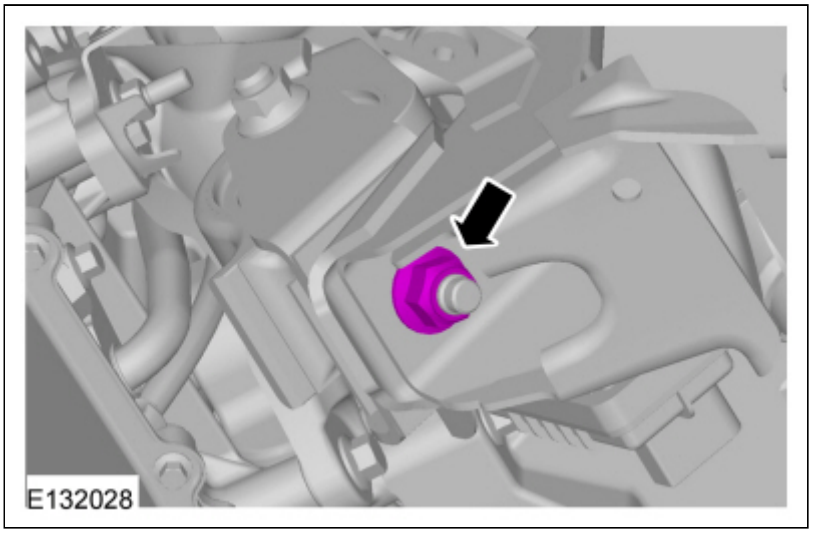
45.



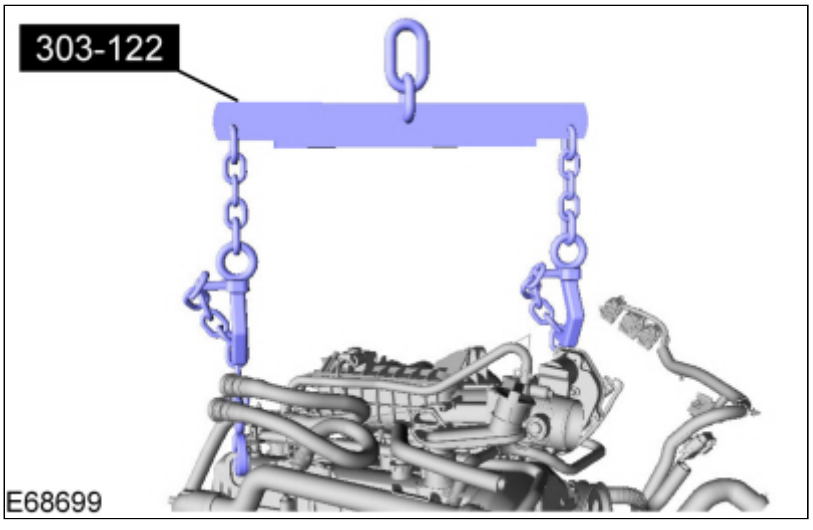
46.



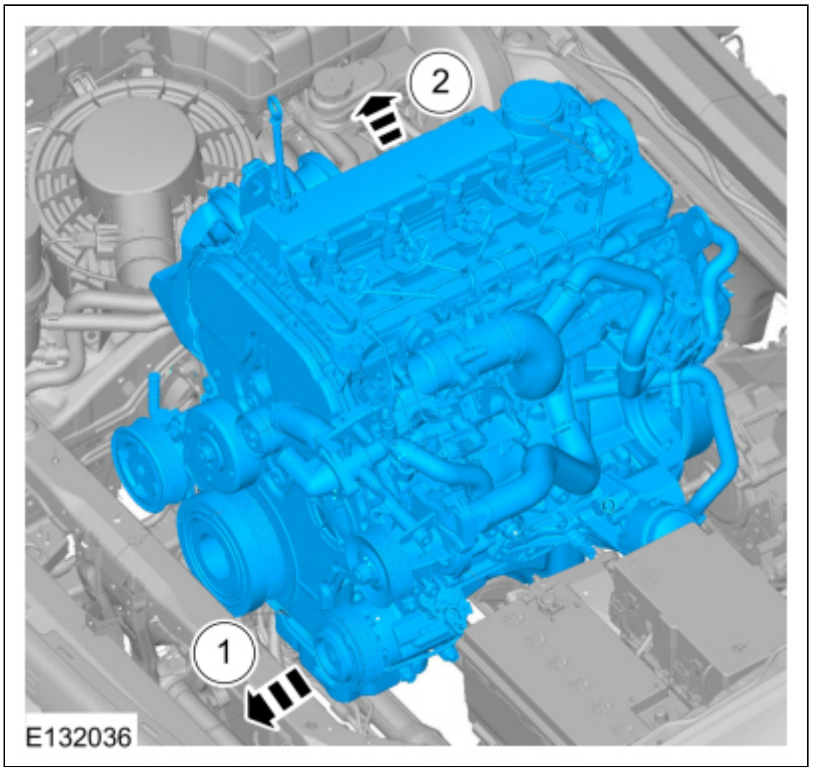
47. On both sides.



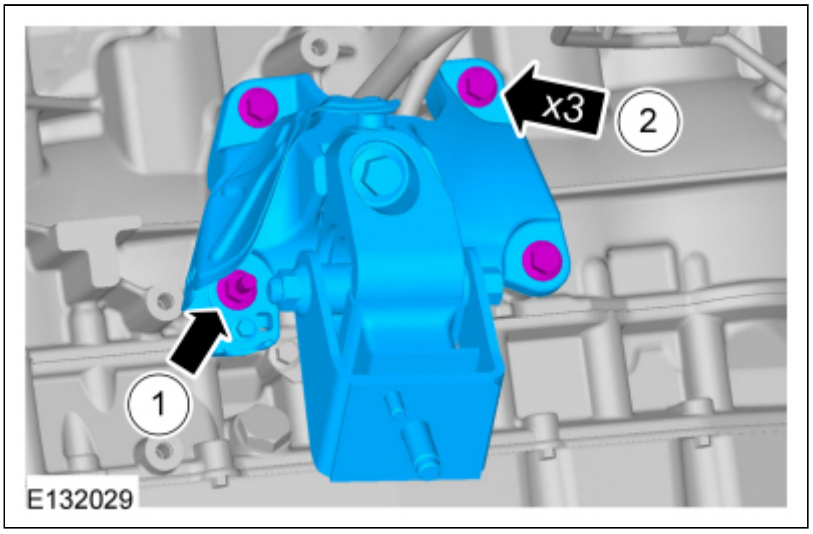
48. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



49.



50.



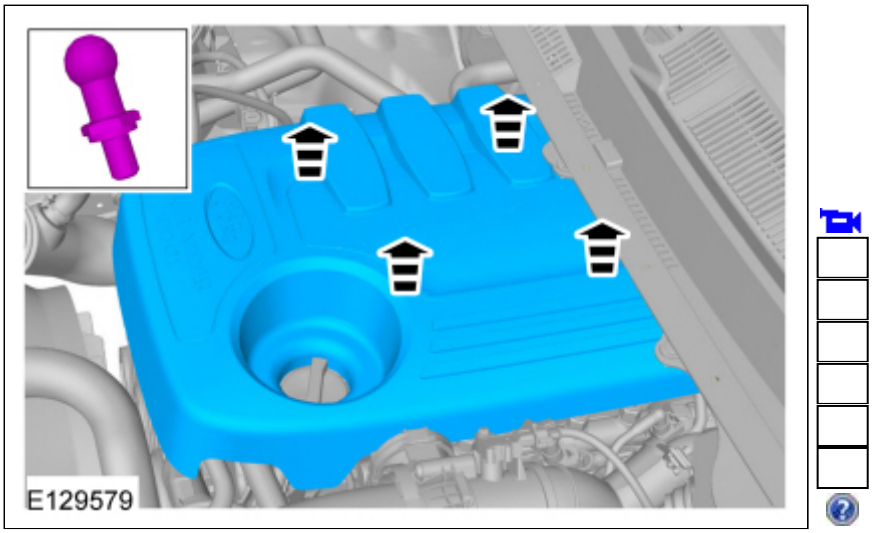
Copyright © 2016 Ford Motor Company

Engine - 6-Speed Automatic Transmission - 6R80

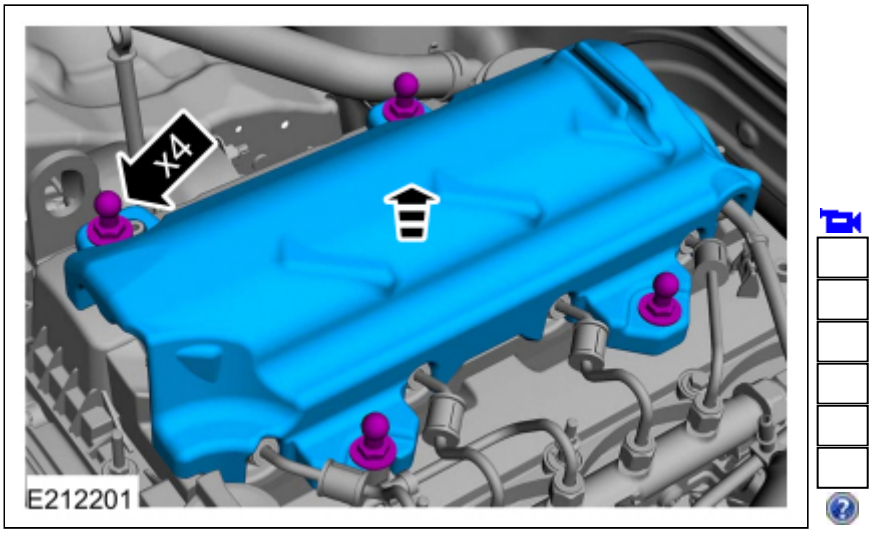
Base Part Number: 6L084

Special Tool(s) / General Equipment

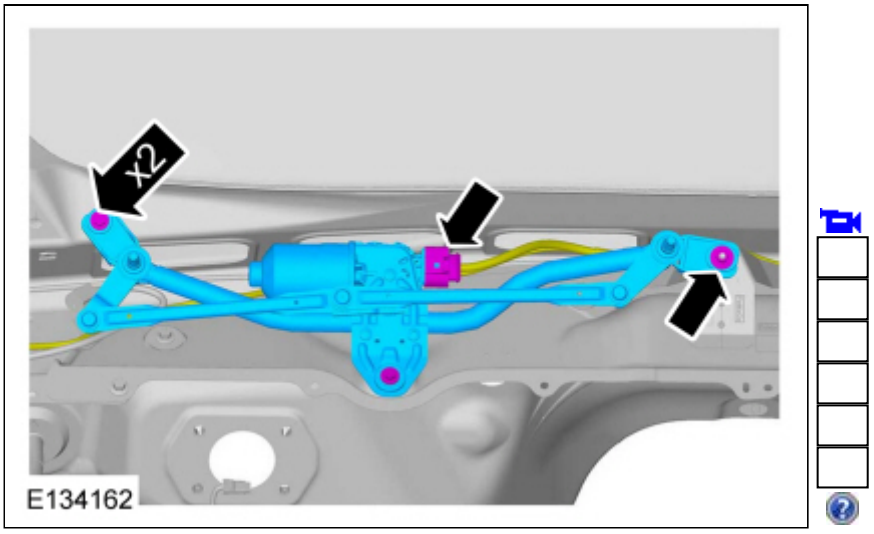
 21068A	303-122 Lifting Bracket, Engine
 307-346	307-346 (T97T-7902-A) Retainer, Torque Converter
Transmission Jack	

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
7. 

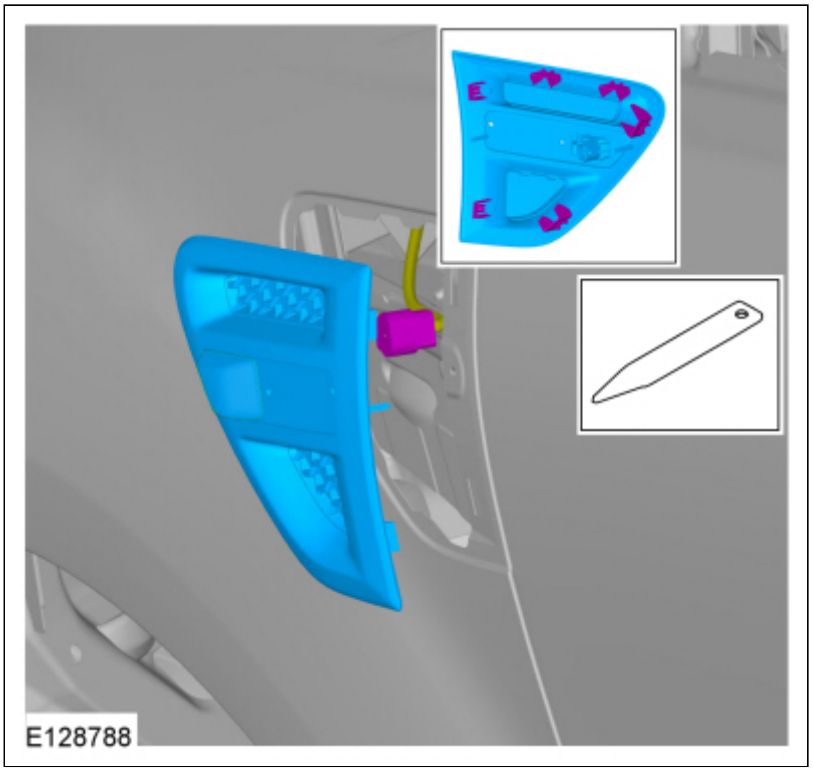
8.



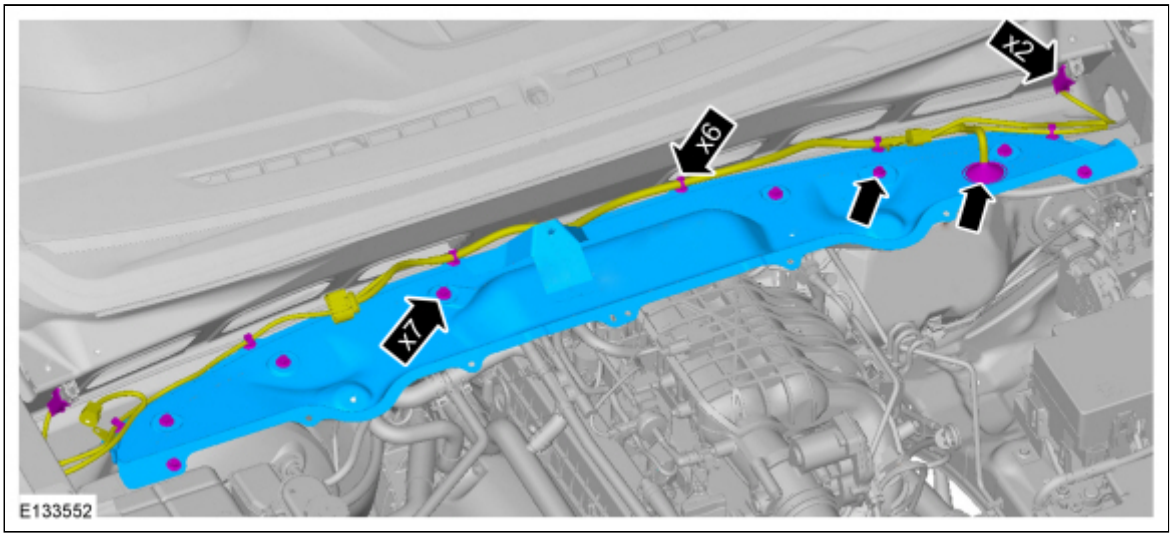
9. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
10. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
11.



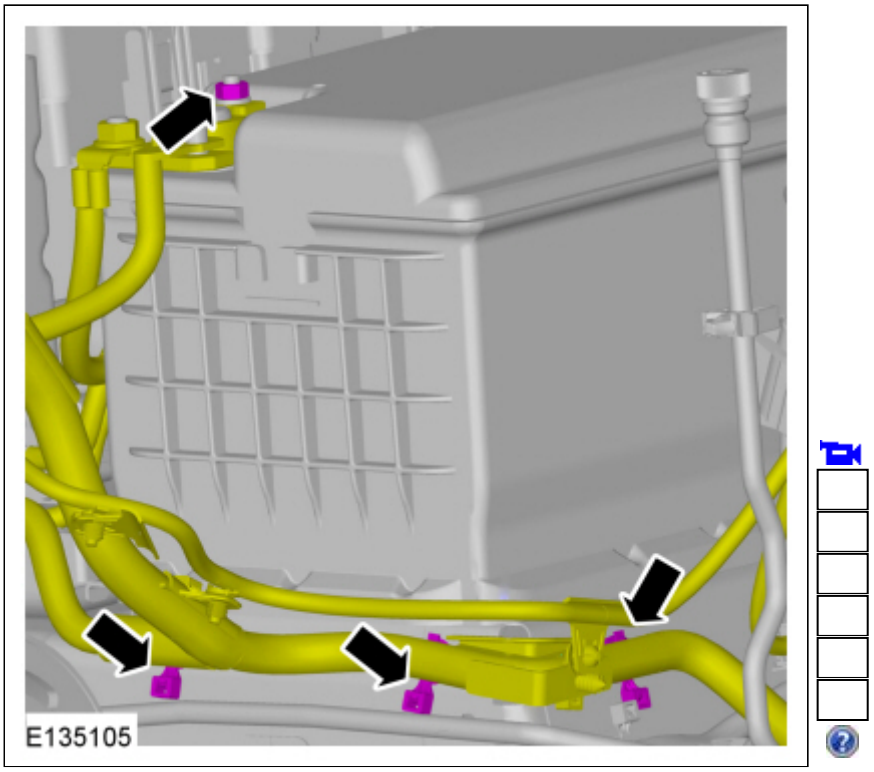
12. On both sides.



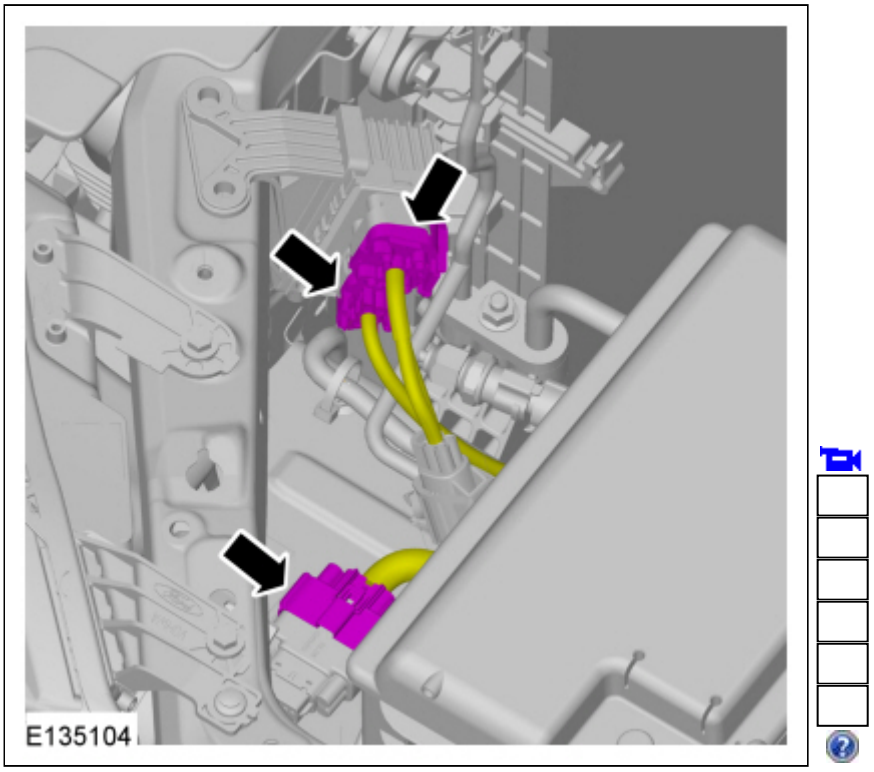
13.



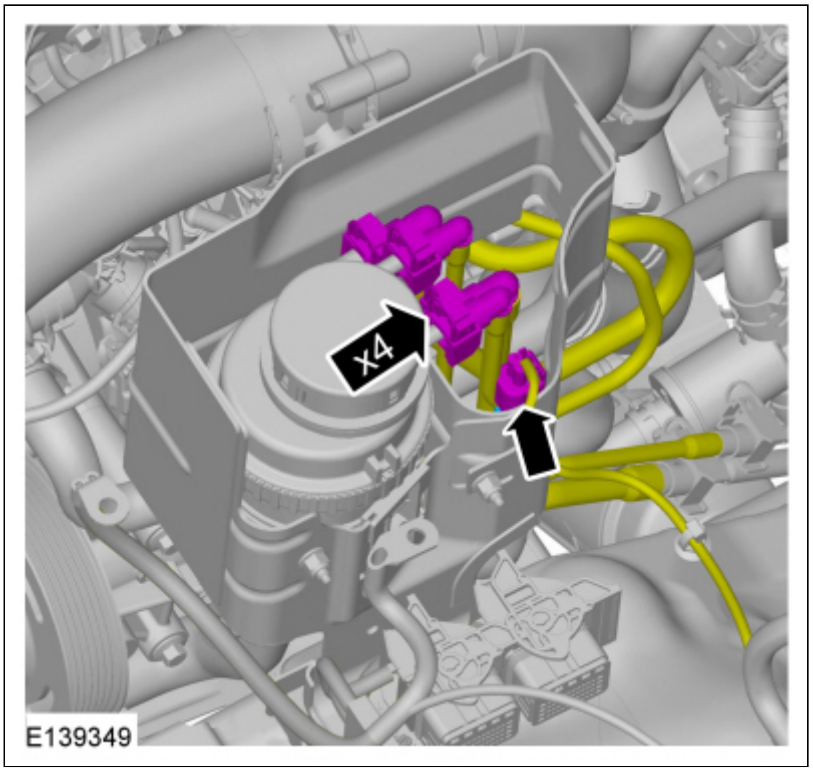
14.



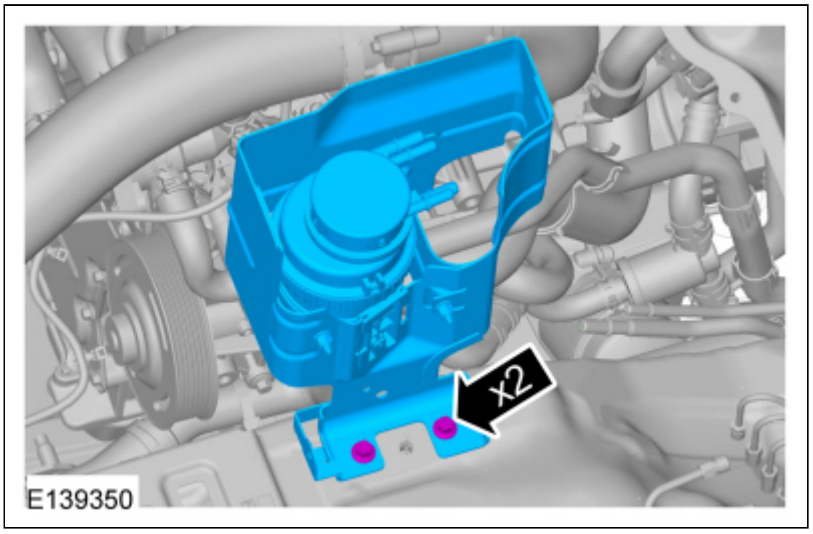
15.



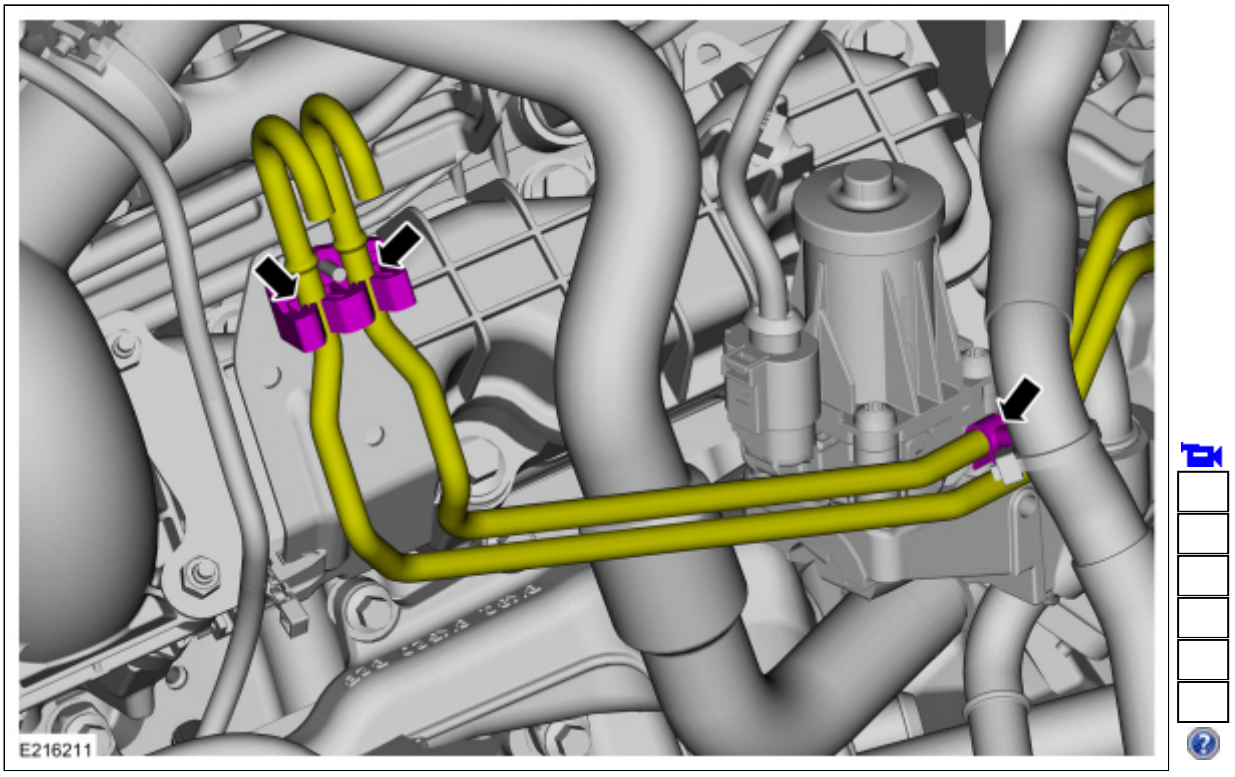
16. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
17. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
18. Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
19.



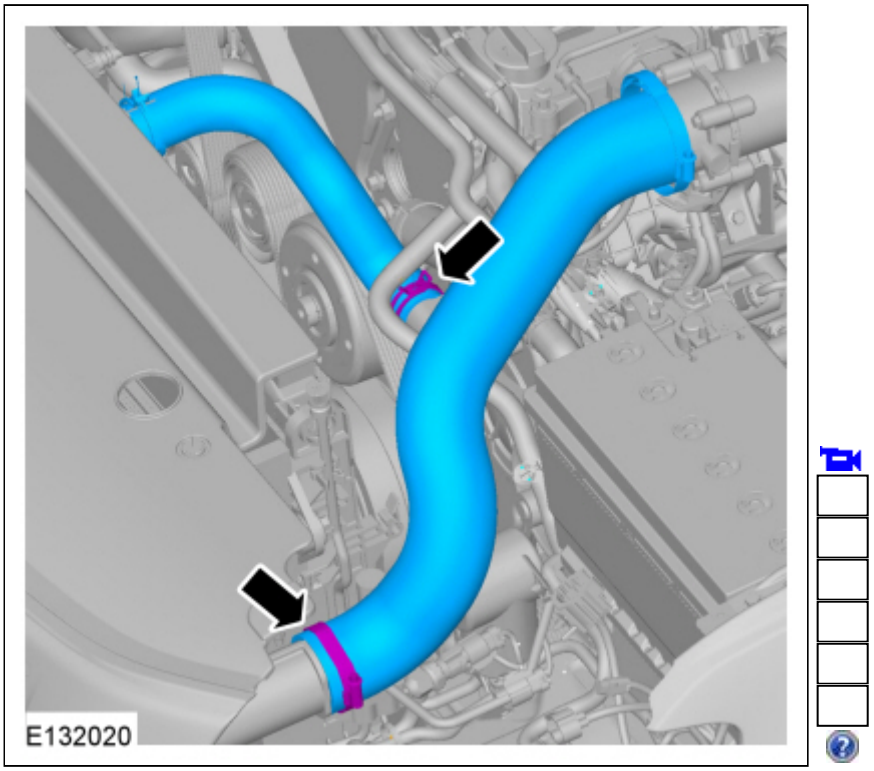
20.



21.



22. *Torque*: 5 Nm

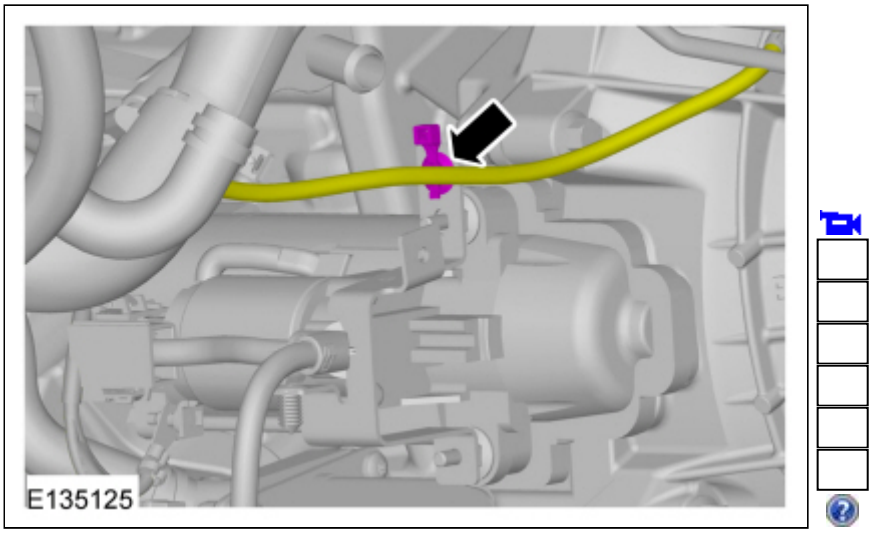


23. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

24. Refer to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

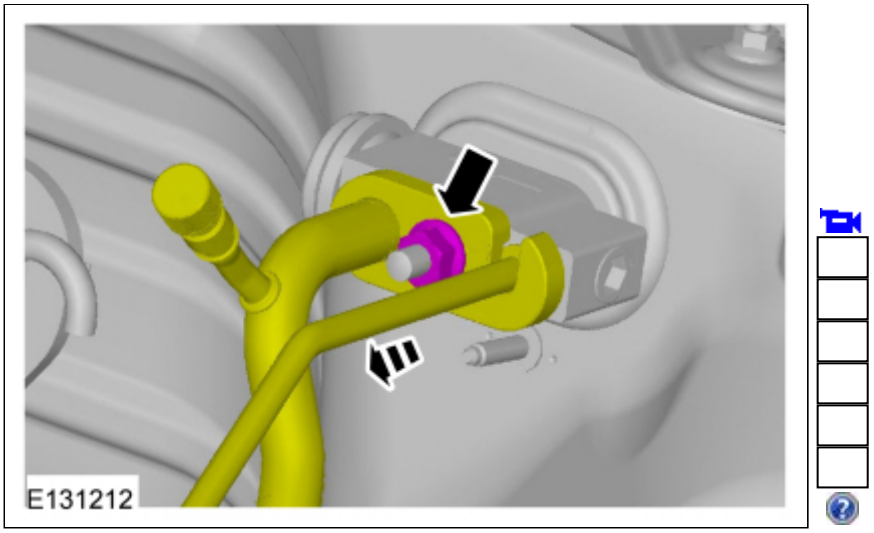
25. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

26.



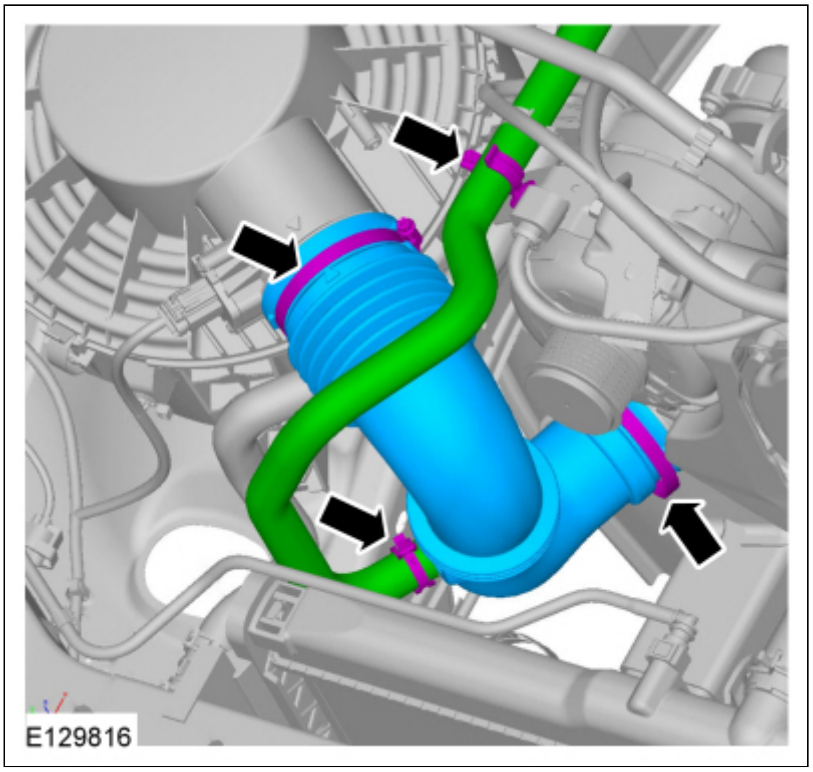
27. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

28.

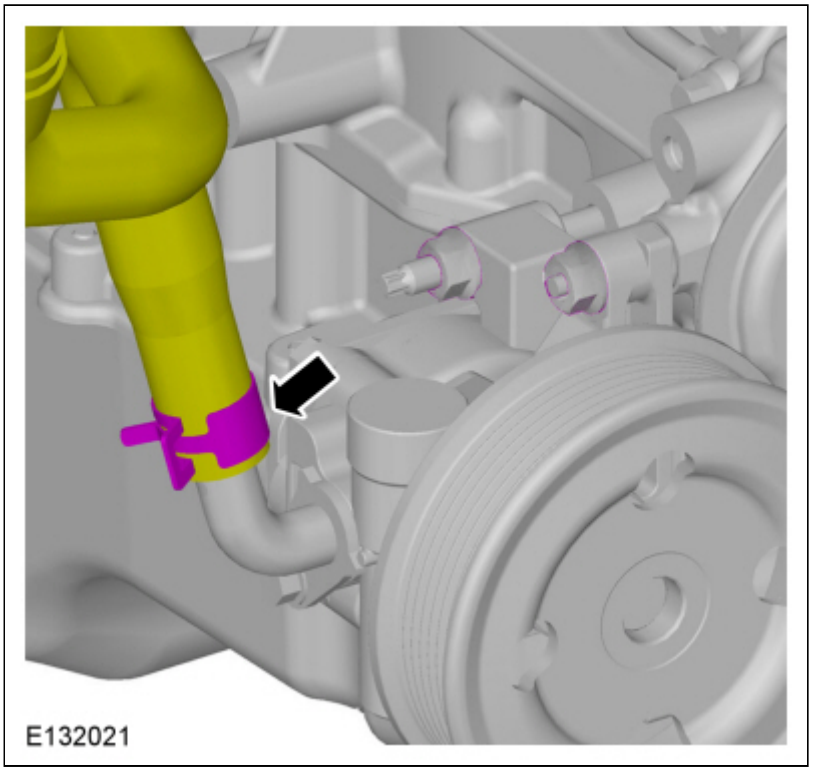


29. Refer to: Transmission Fluid Cooler (307-02 Transmission Cooling, Removal and Installation).

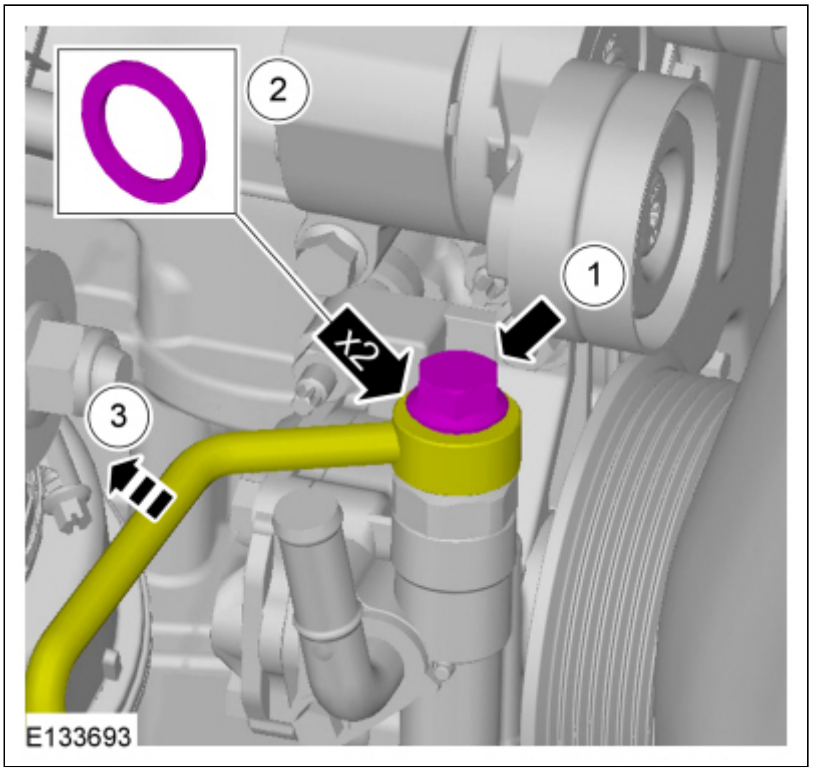
30.



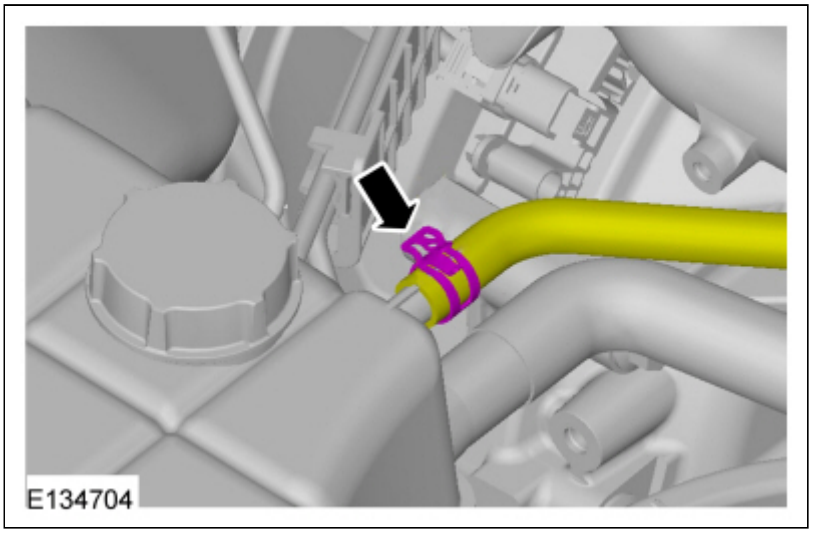
31. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
32. **NOTE:** *Make sure that all openings are sealed.*



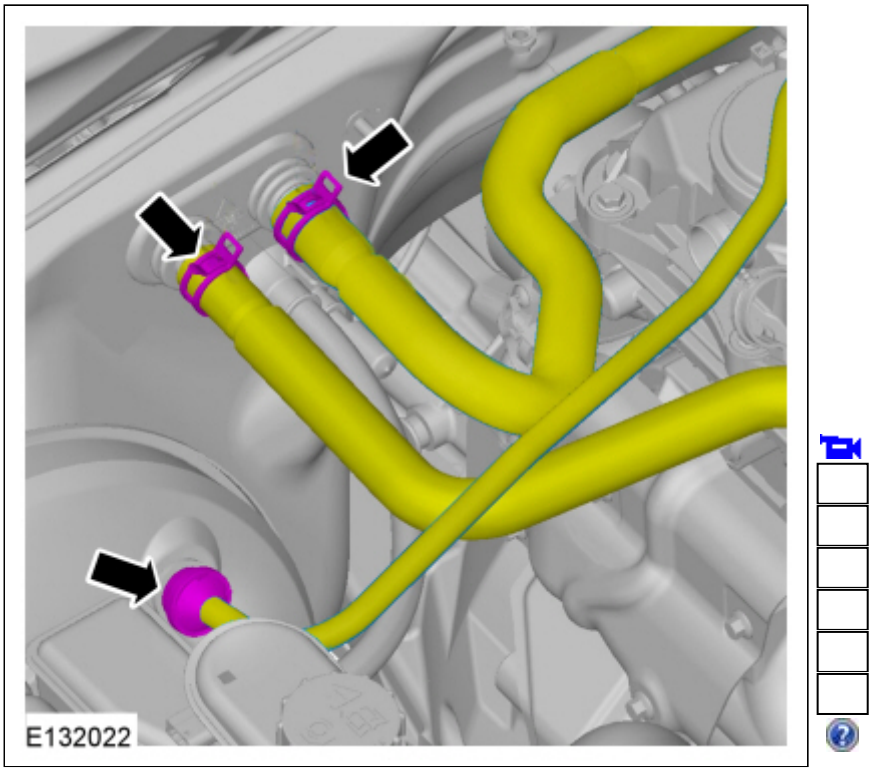
33. **NOTICE: Cap the power steering line to prevent fluid loss or dirt ingress.**



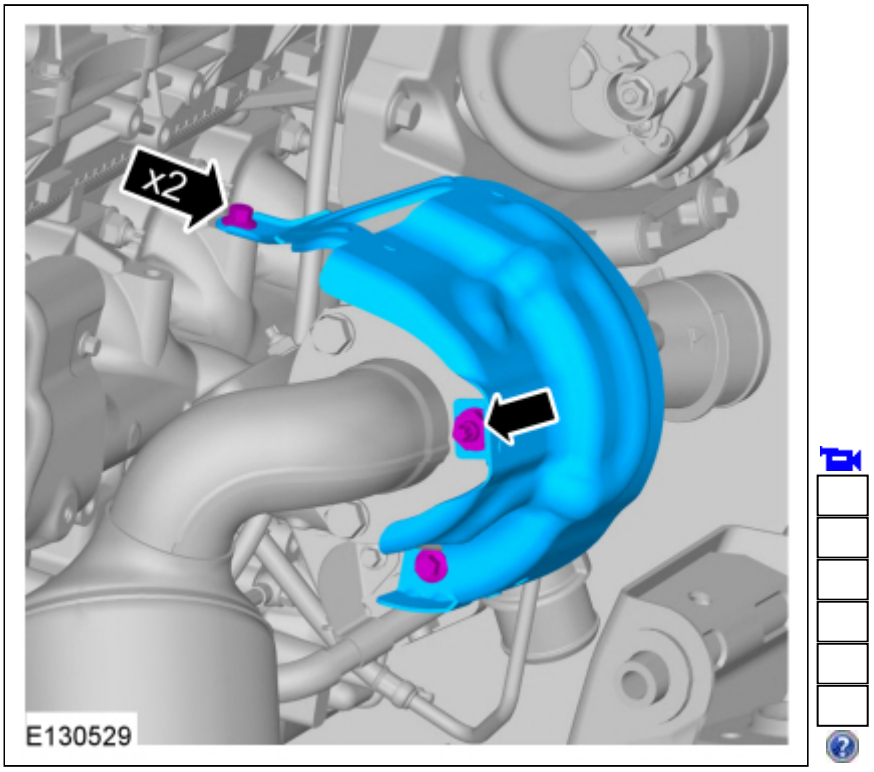
34.



35.

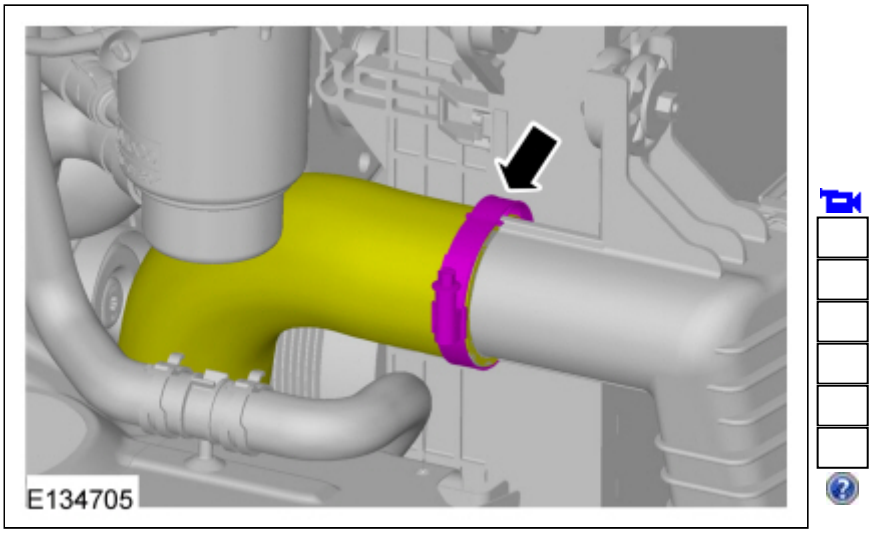


36.

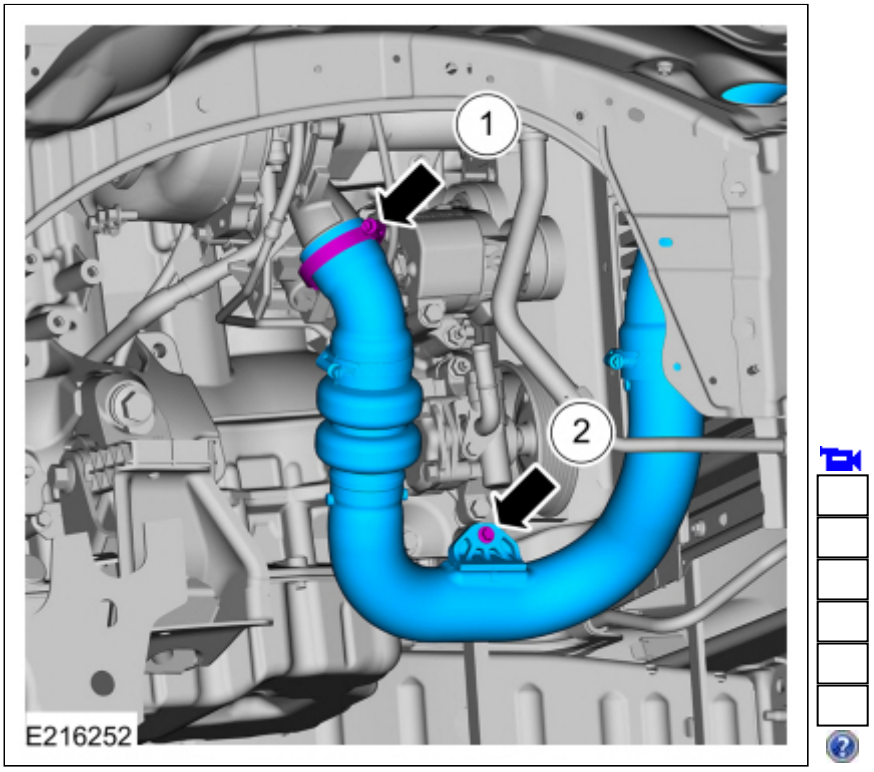


37. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

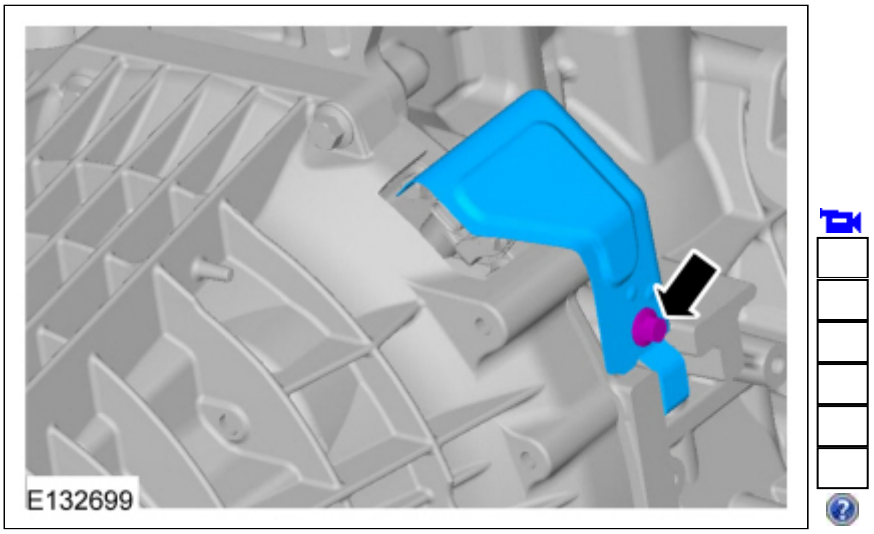
38. *Torque*: 4 Nm



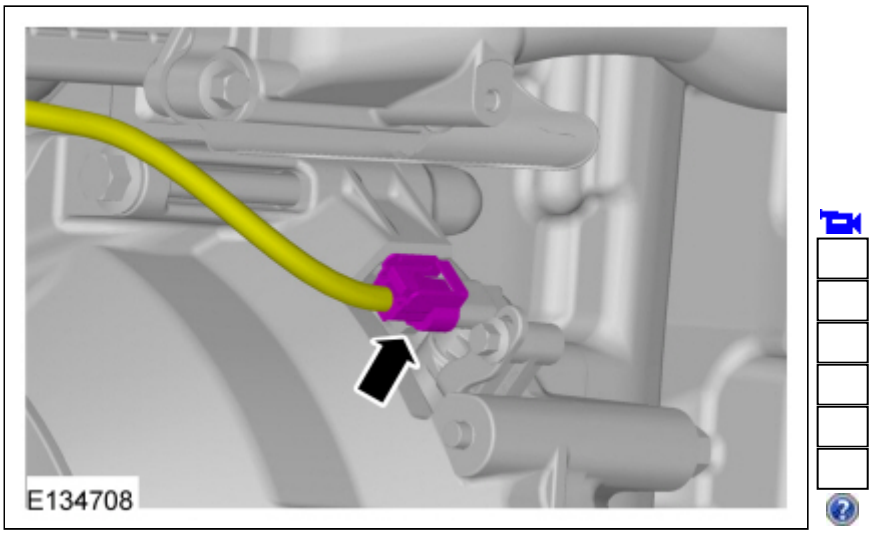
39. *Torque*: 10 Nm



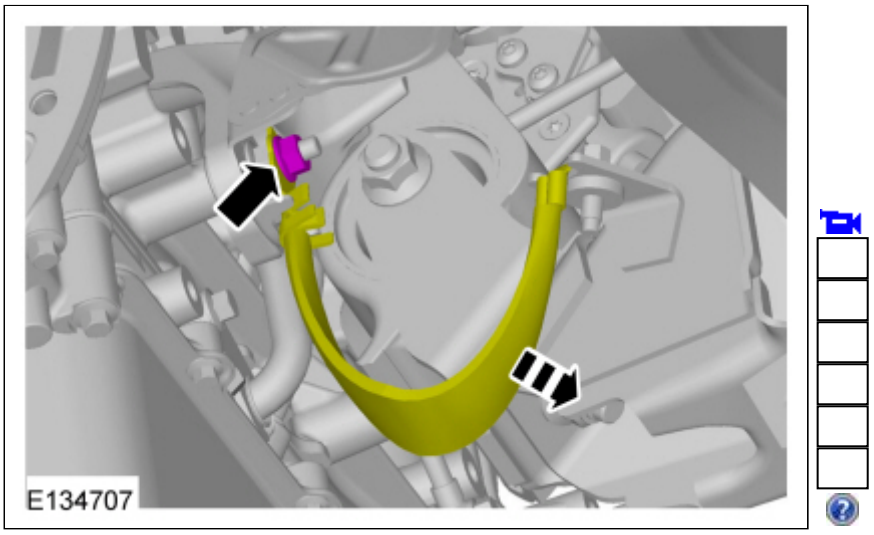
40.



41.



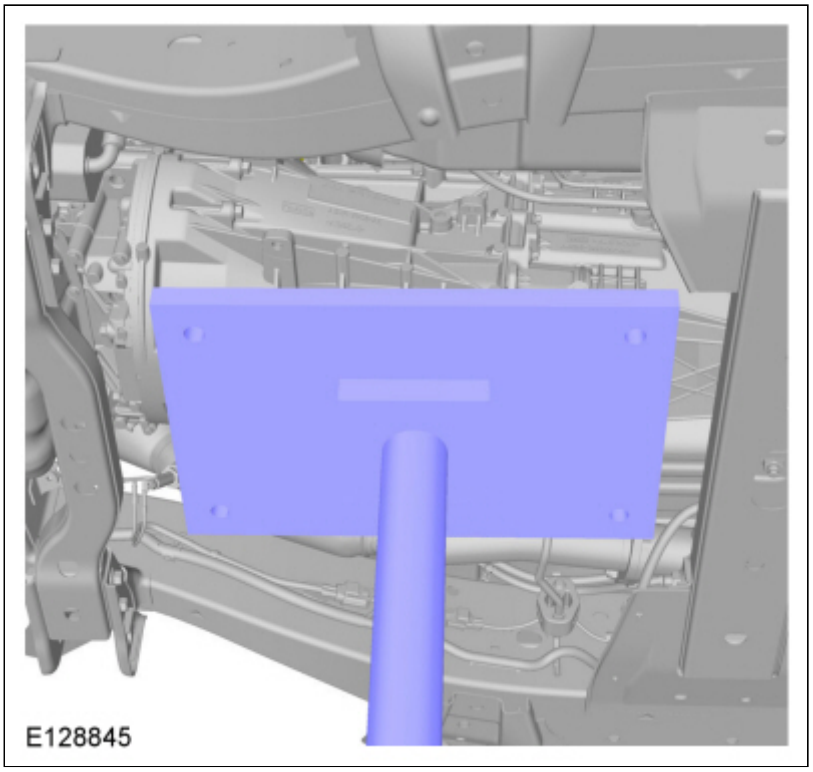
42.



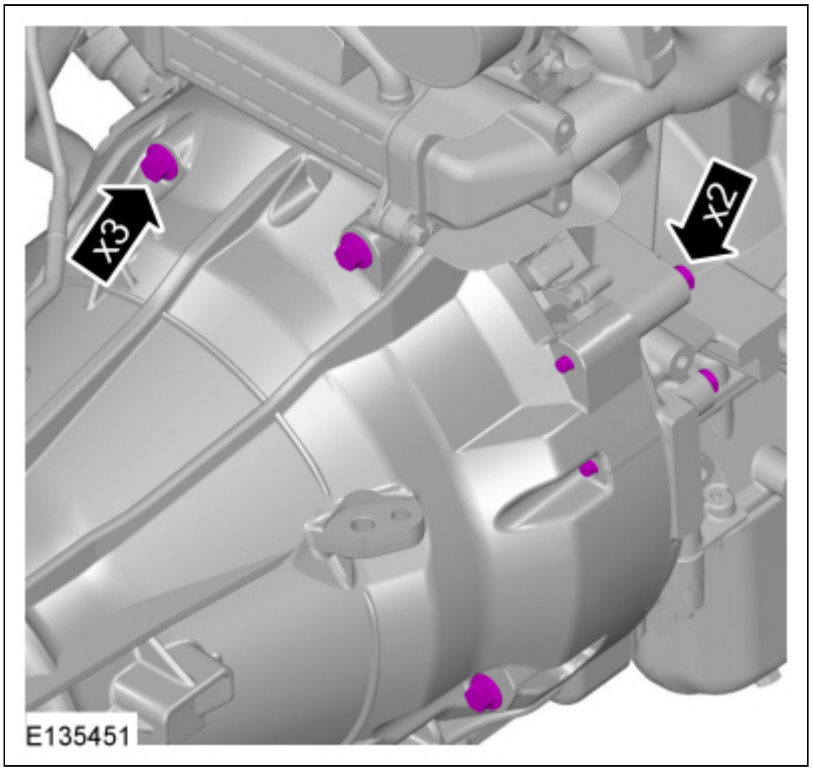
43. **WARNING: Make sure that transmission assembly is on wooden blocks and secured with suitable retaining straps.**

NOTICE: Do not tilt the transmission. This may cause damage to the pilot bearing.

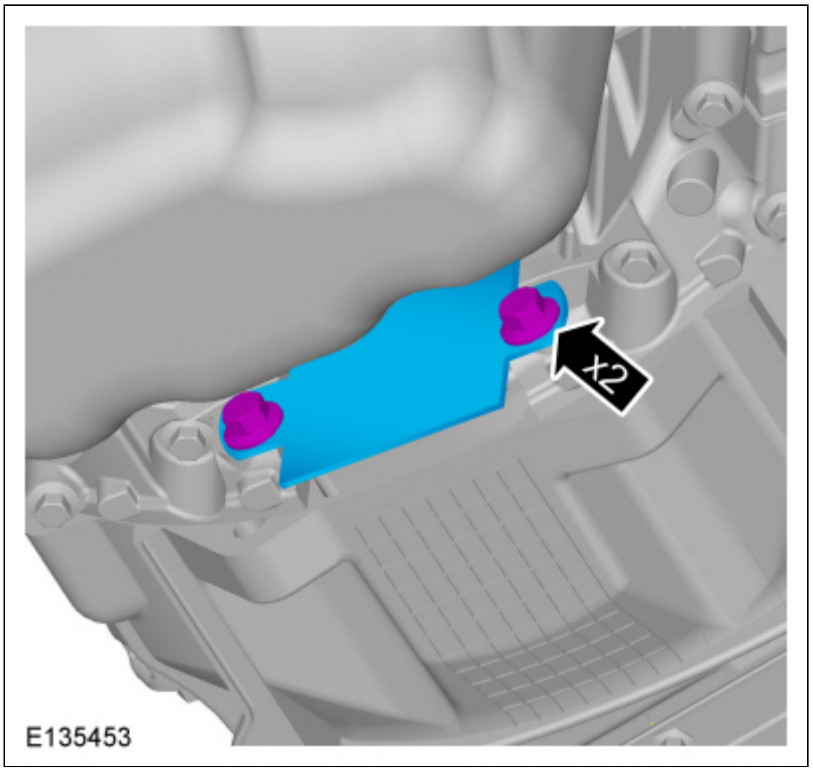
Tie and support the transmission to the chassis with a suitable strap.
Use the General Equipment: Transmission Jack



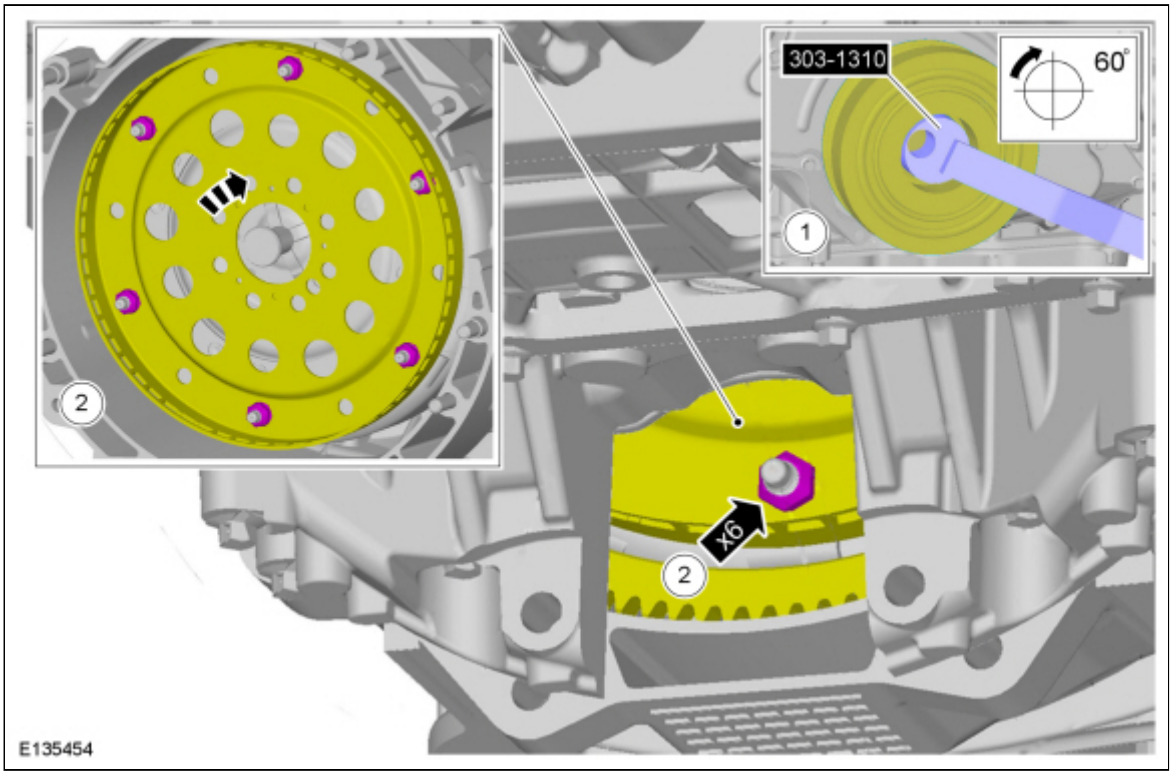
44.



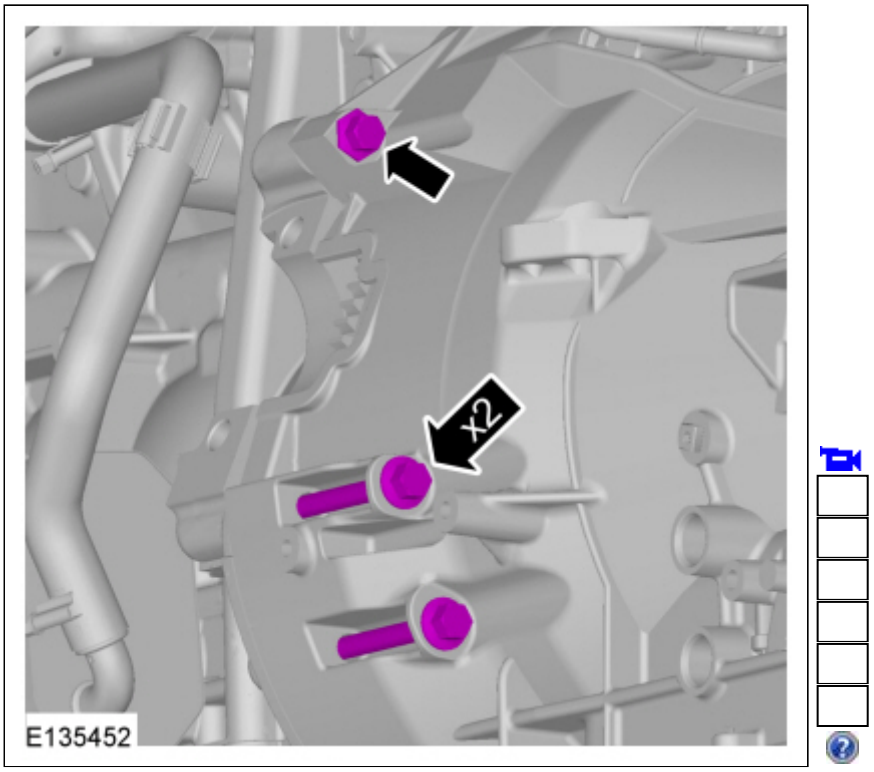
45.



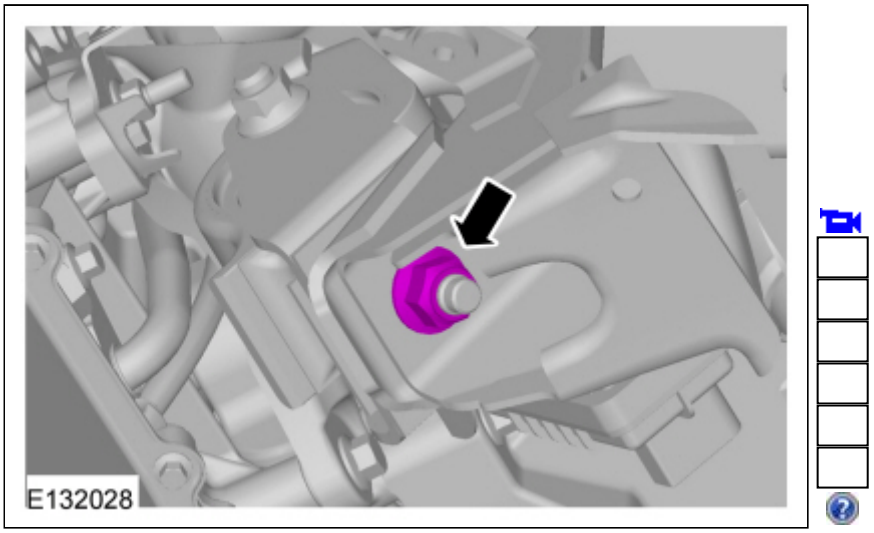
46.



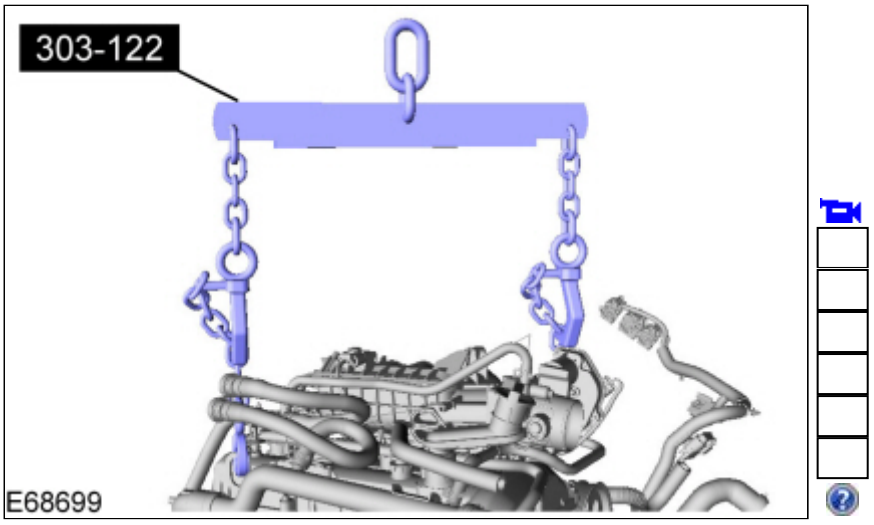
47.



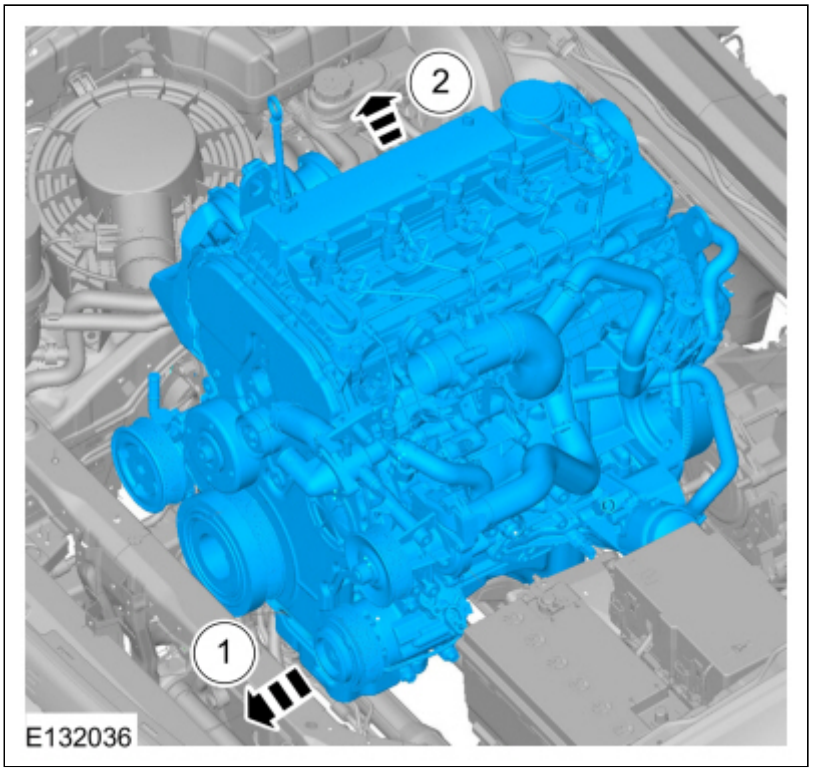
48. On both sides.



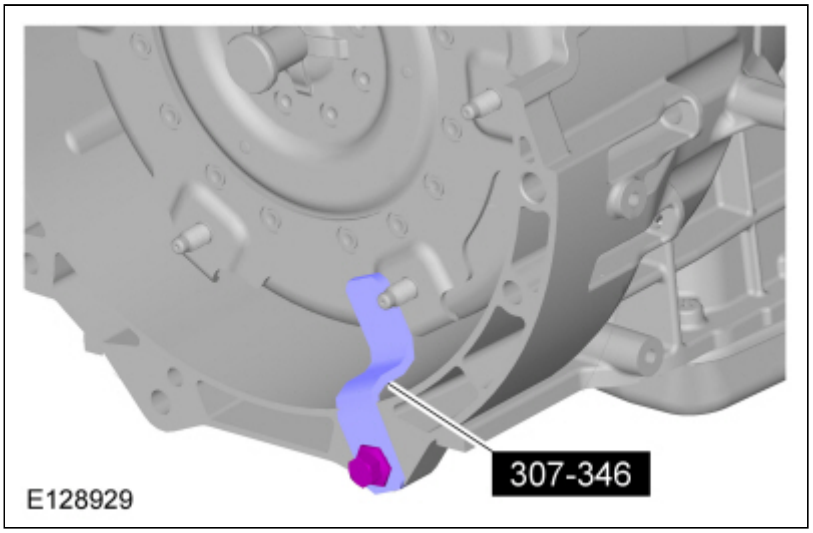
49. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



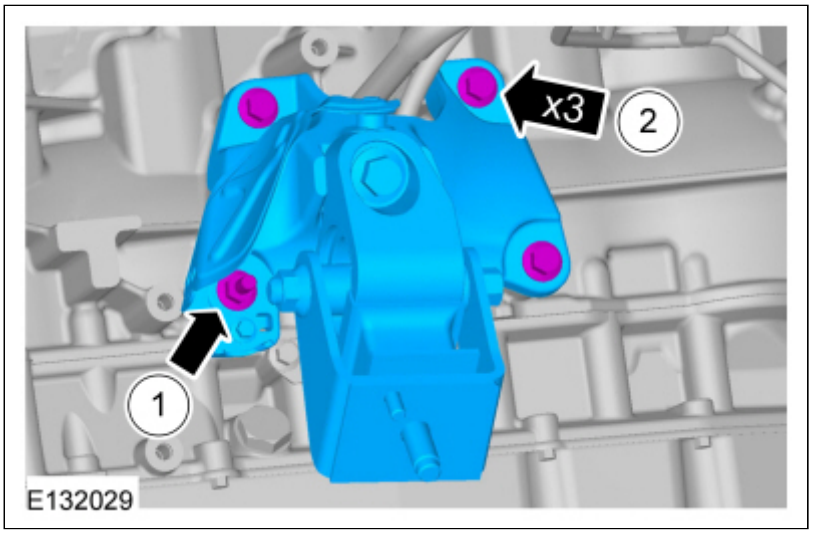
50.



51. Install Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



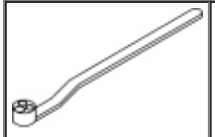
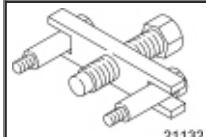
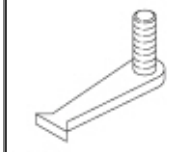
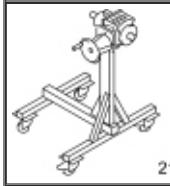
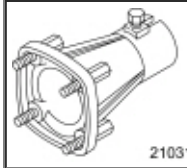
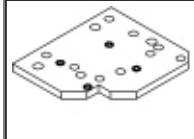
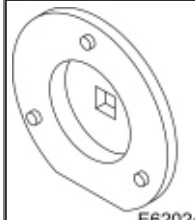
52.



Copyright © 2016 Ford Motor Company

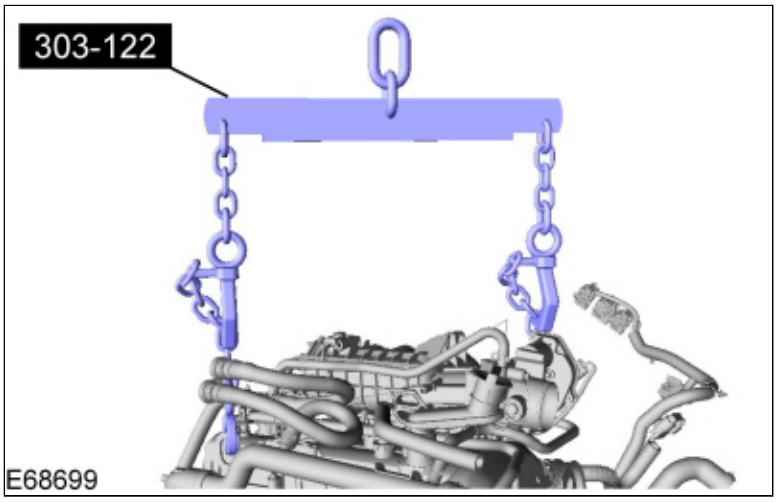
Engine Accessories

Special Tool(s) / General Equipment

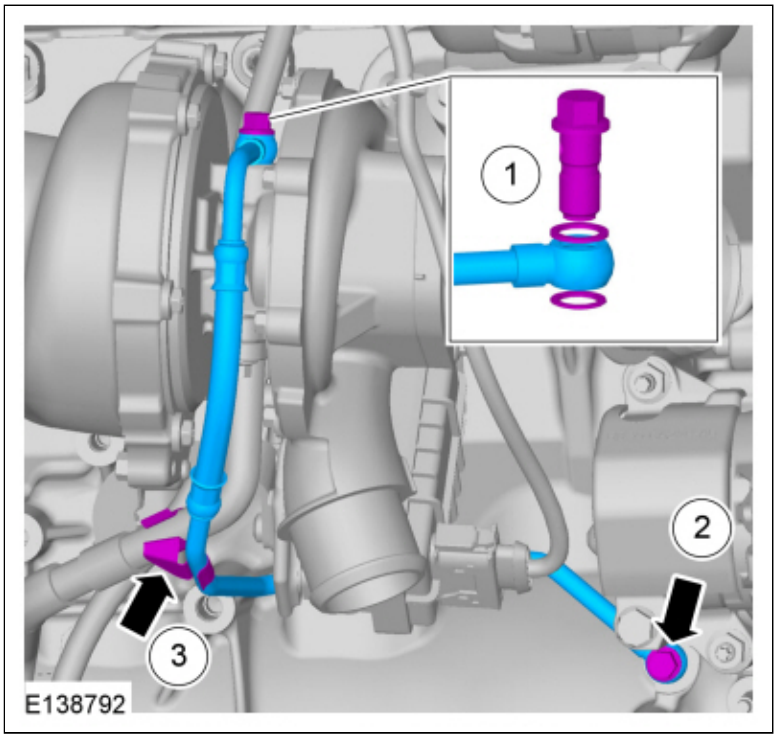
 21068A	303-122 Lifting Bracket, Engine
 E87614	303-1310 Holding Wrench, Crankshaft
 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 21132	303-249 Remover, Crankshaft Timing Pulley
 21135	303-254 Locking Tool, Flywheel
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E68386	303-435-11B Mounting Plate for 303-435-06
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate
Dowel with a Diameter of 6 mm	

1/2 Inch Square Drive Breaker Bar

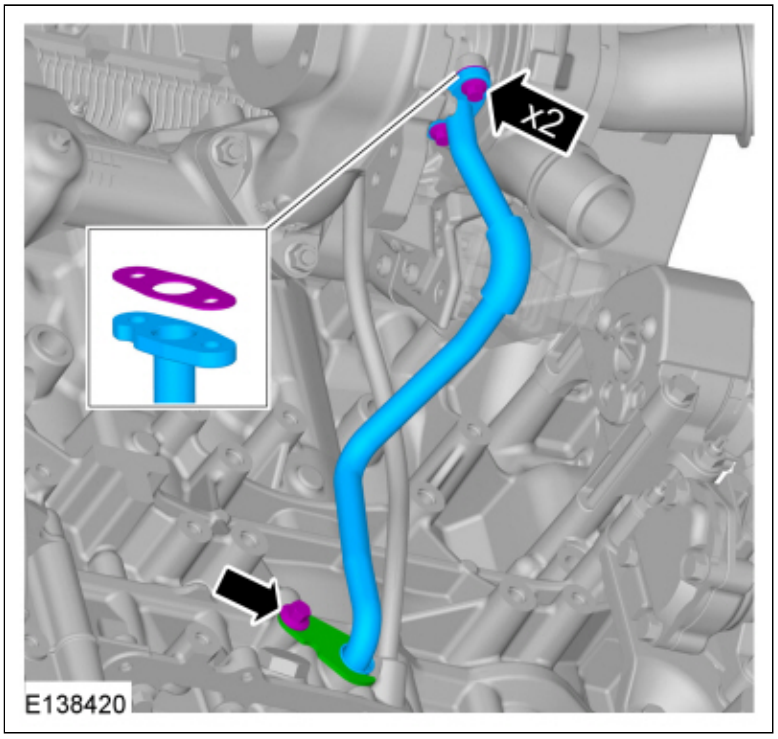
1. Install Special Service Tool: 303-122 Lifting Bracket, Engine.



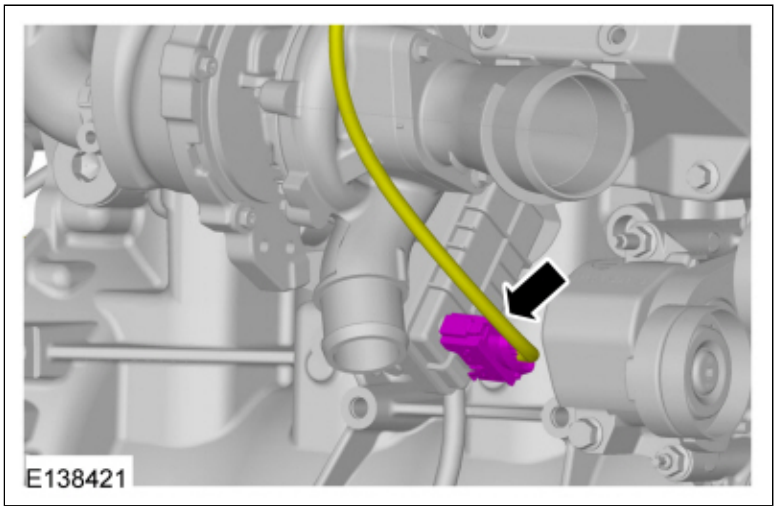
2.



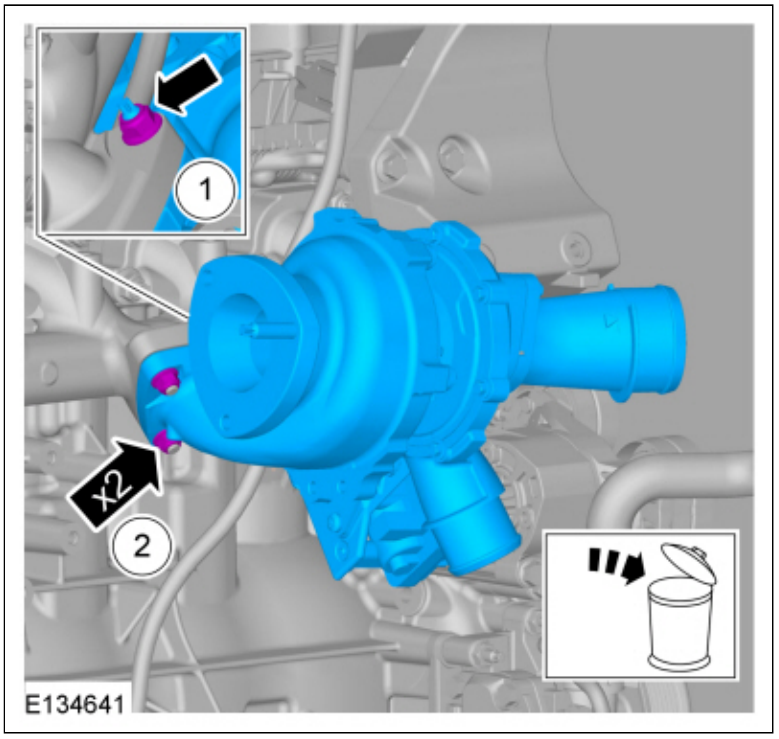
3.



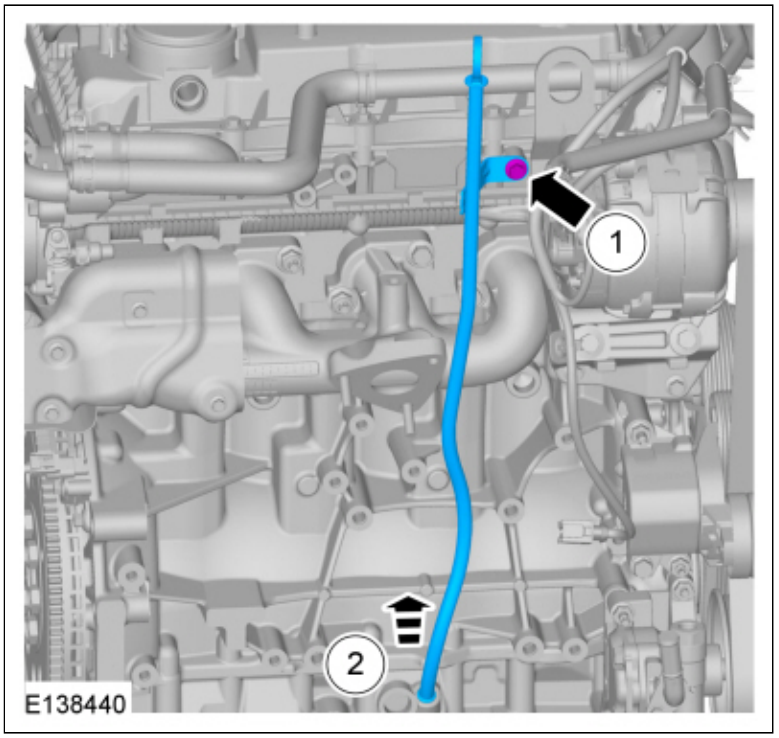
4.



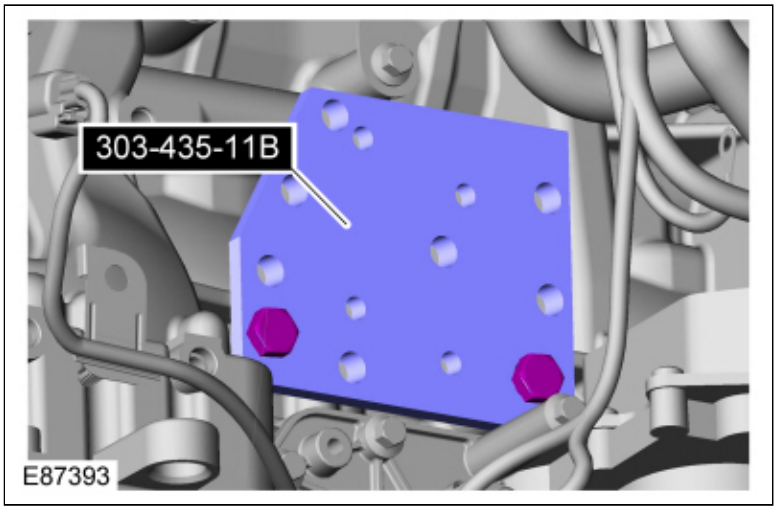
5.



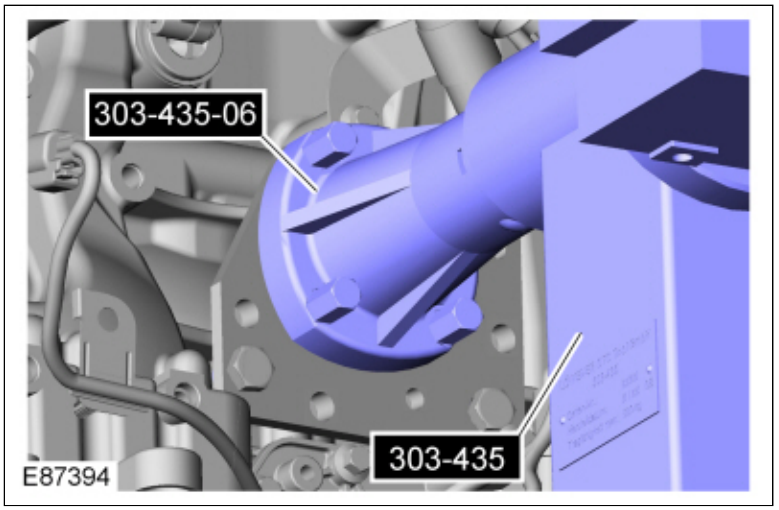
6.



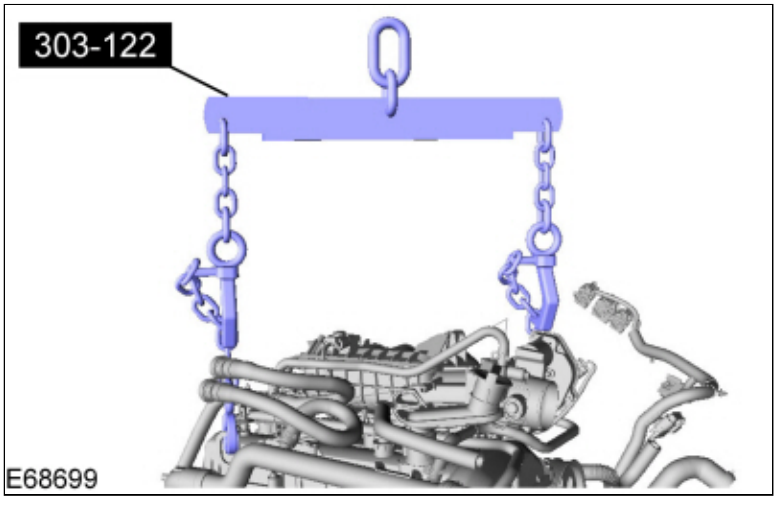
7. Install Special Service Tool: 303-435-11B Mounting Plate for 303-435-06.



8. Install Special Service Tool: 303-435-06 Mounting Bracket for 303-435. , 303-435 Mounting Stand.

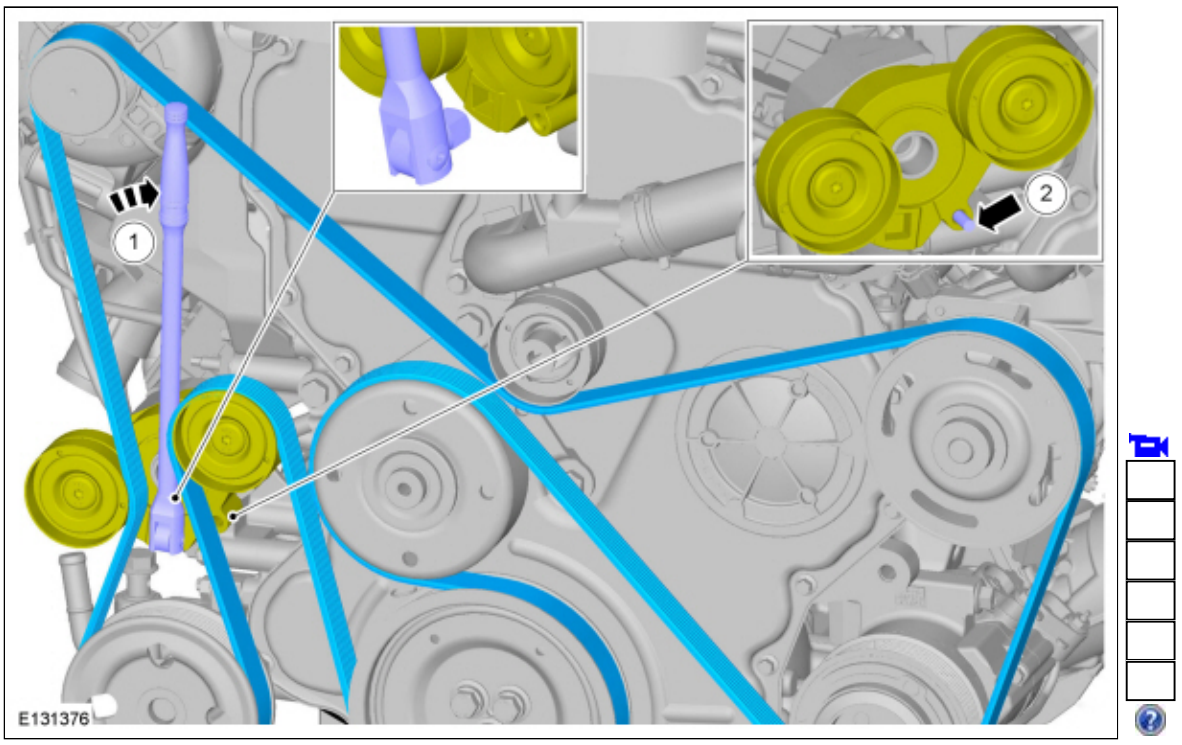


9. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.

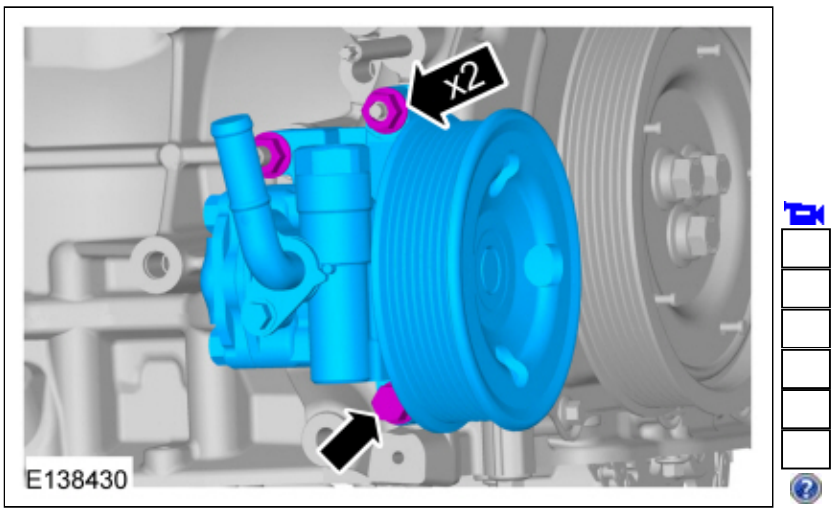


Vehicles With: Hydraulic Power Assist Steering (HPAS)

10. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
    Use the General Equipment: Dowel with a Diameter of 6 mm

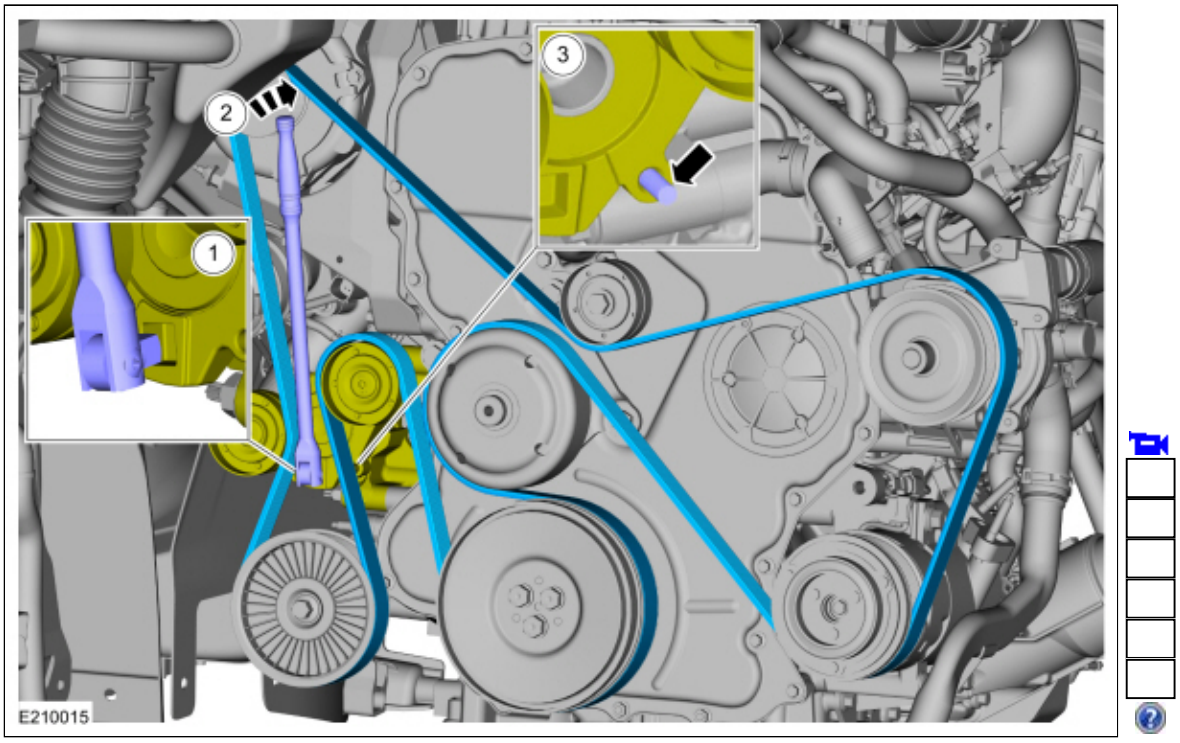


11.

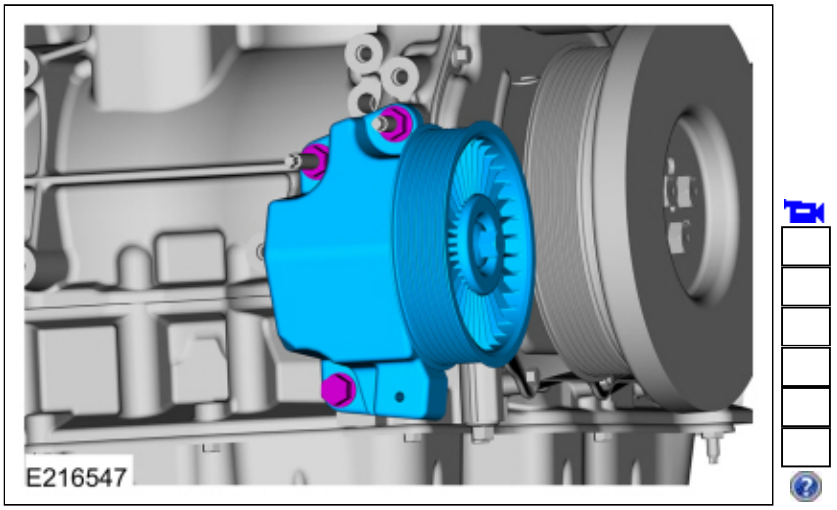


Vehicles With: Electronic Power Assist Steering (EPAS)

1. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. **NOTE:** *Rotate the accessory drive belt tensioner clockwise.*
3. Use the General Equipment: Dowel with a Diameter of 6 mm

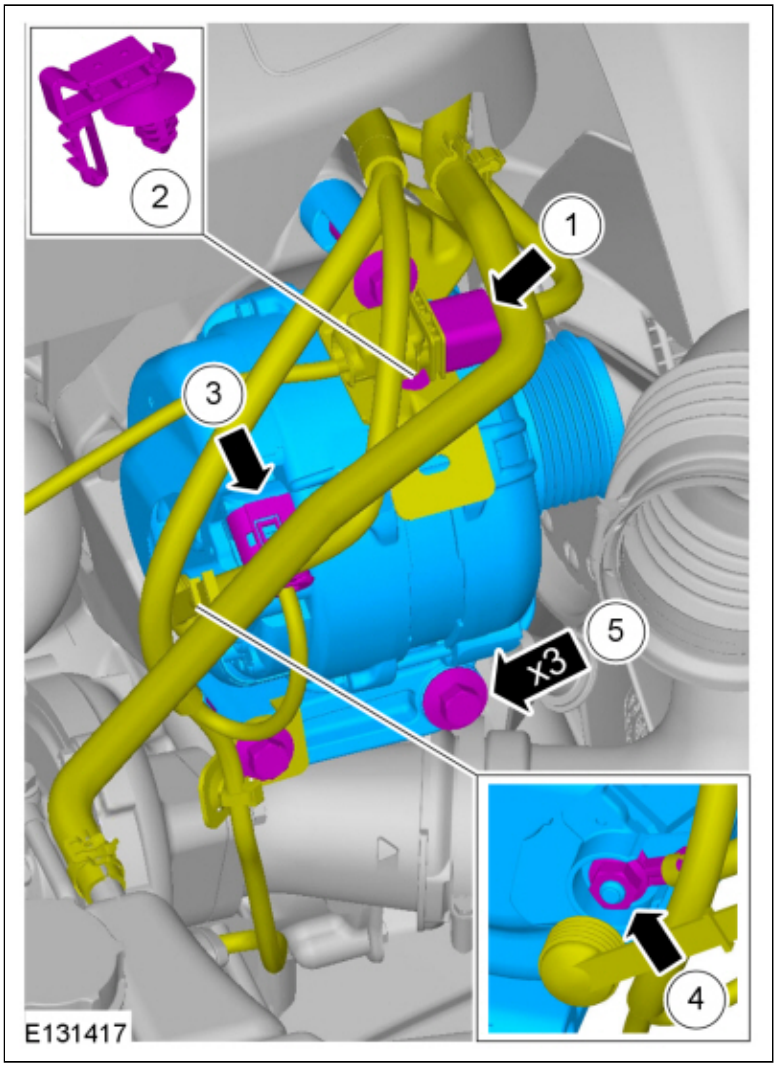


13.

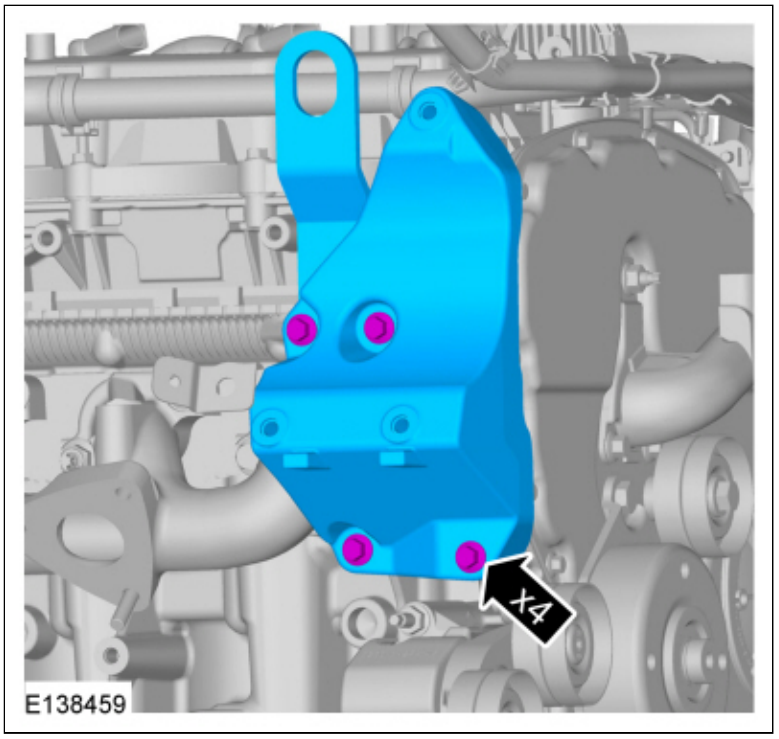


All vehicles

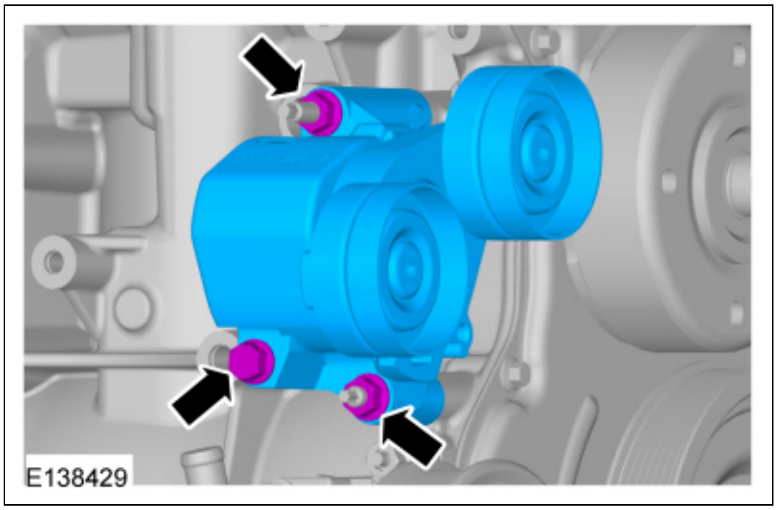
14. **NOTICE: Take extra care not to damage the wiring harnesses.**



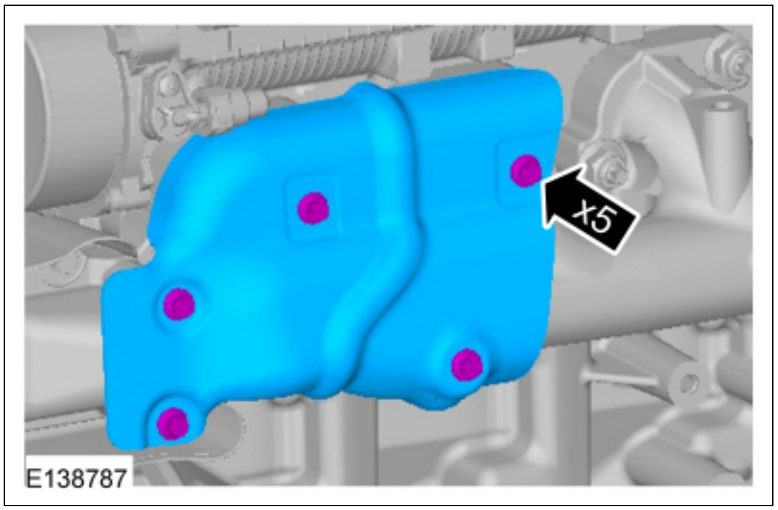
15.



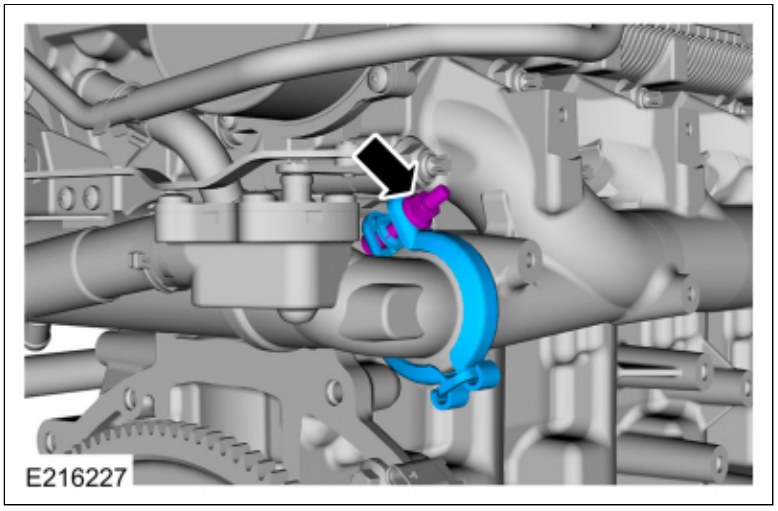
16.



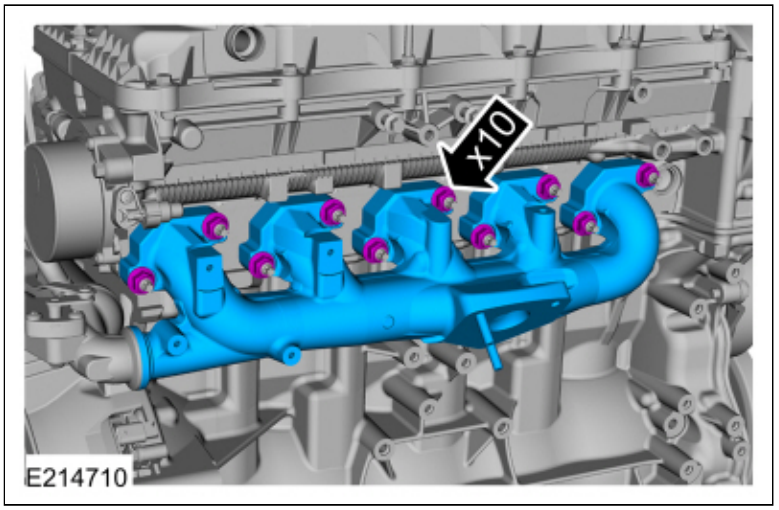
17.



18.

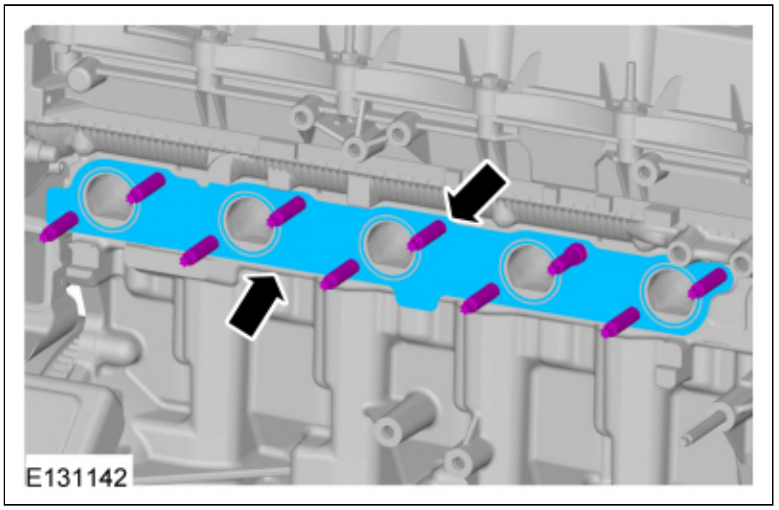


19.

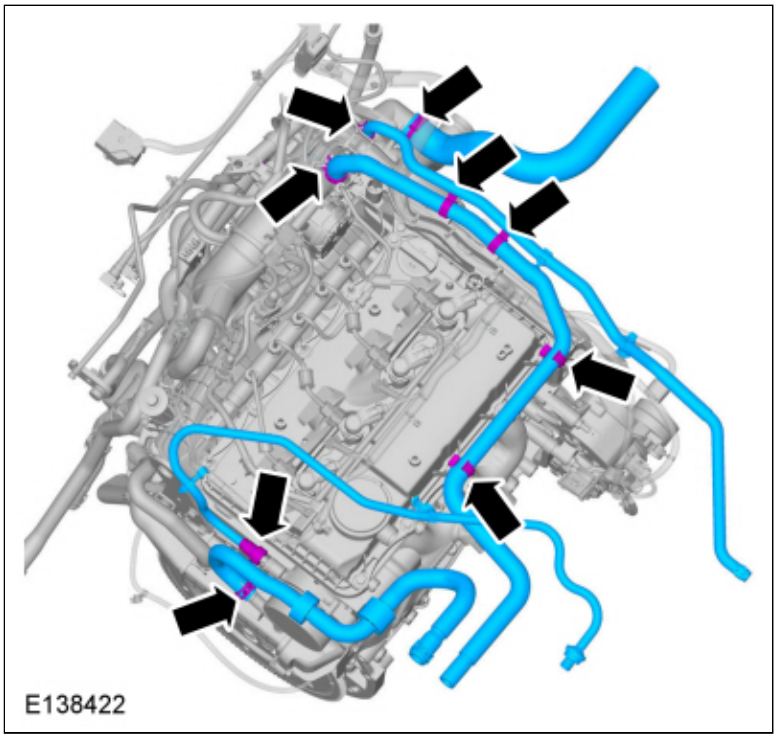


20. **NOTE:** *The gasket is to be reused unless damaged.*

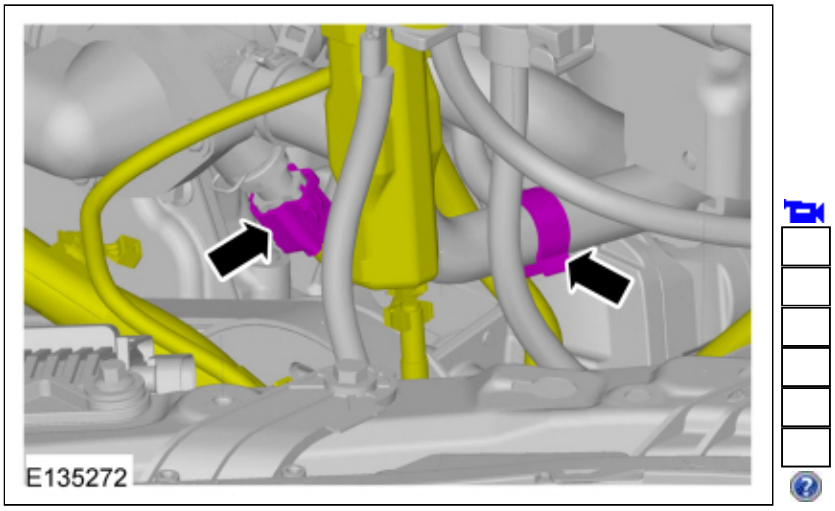
    NOTE: *The studs are to be reused unless damaged.*



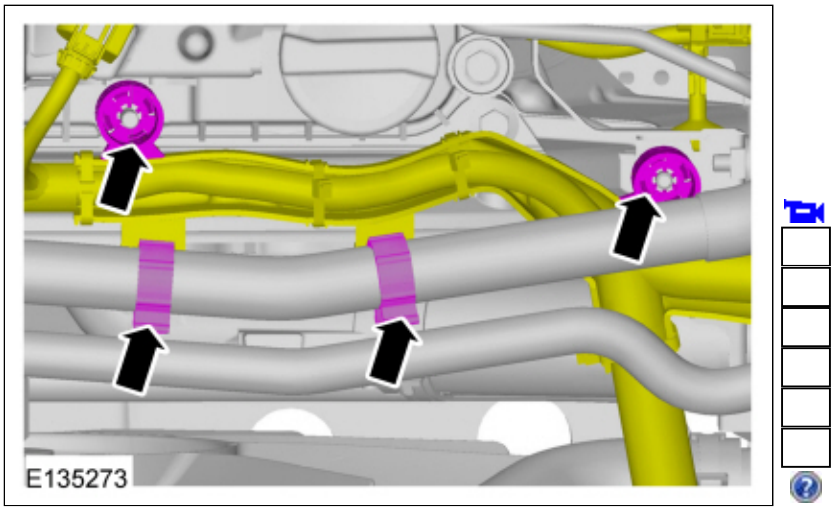
21.



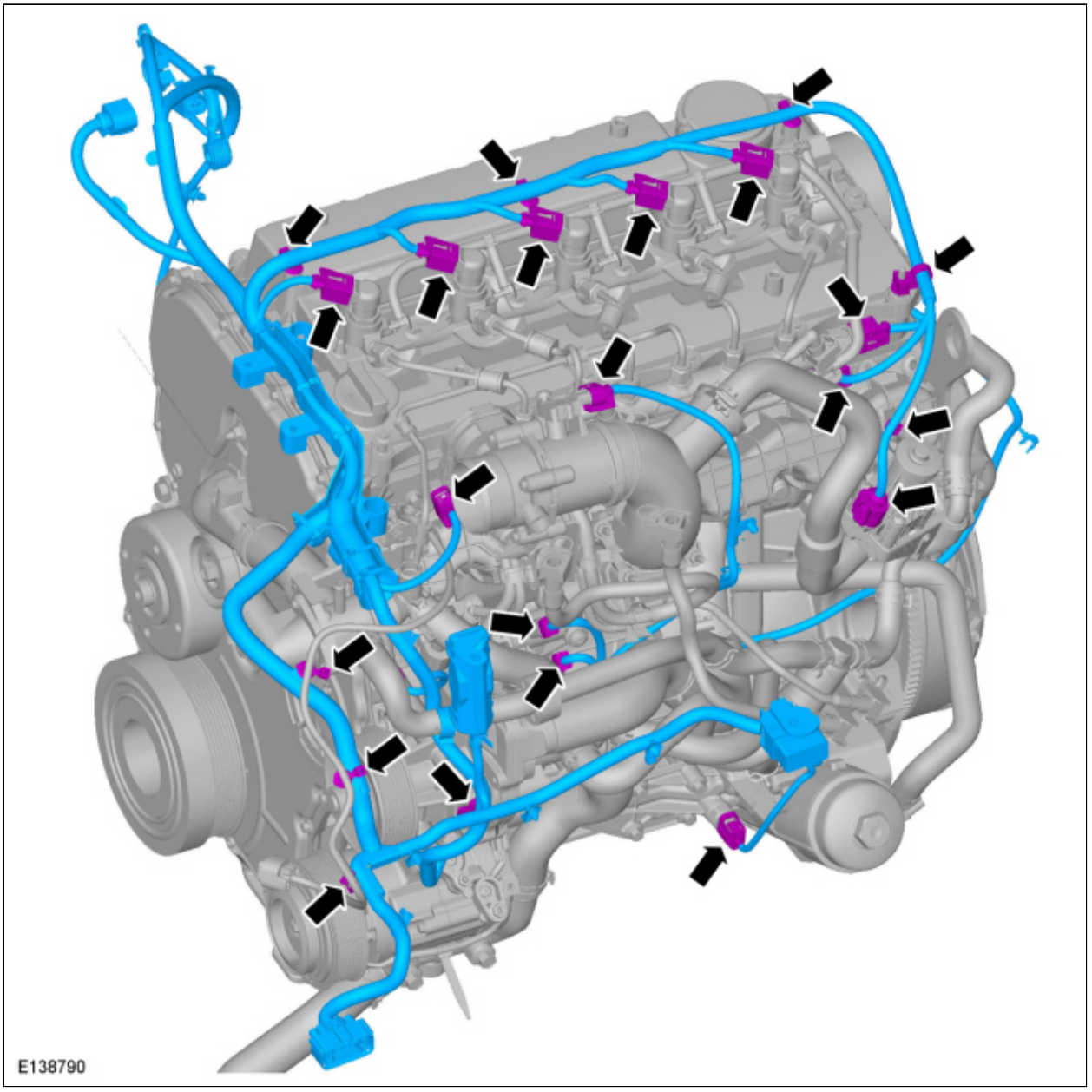
22.



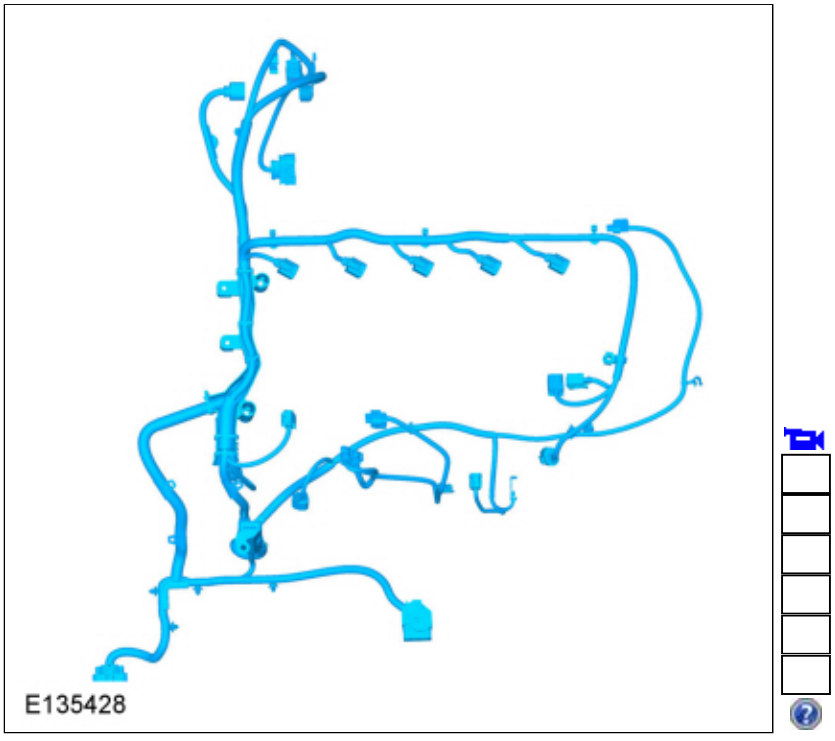
23.



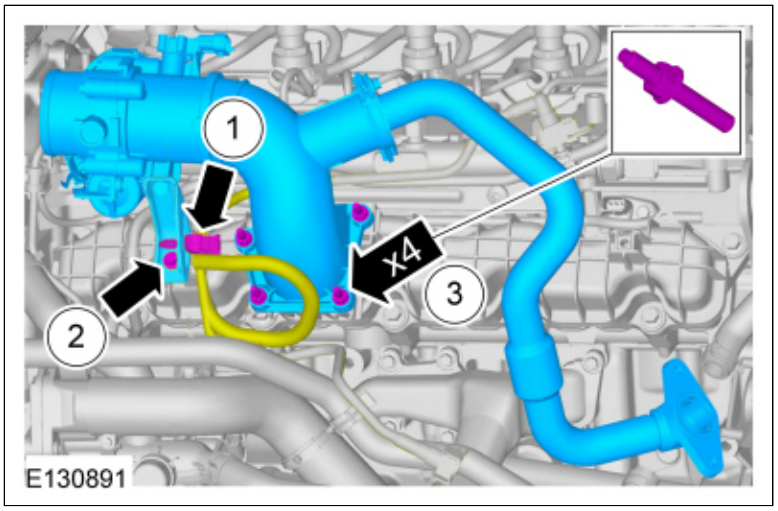
24.



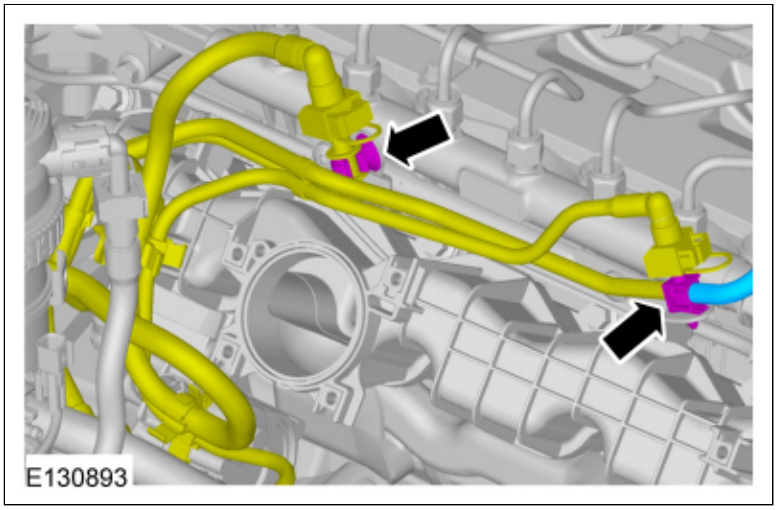
25.



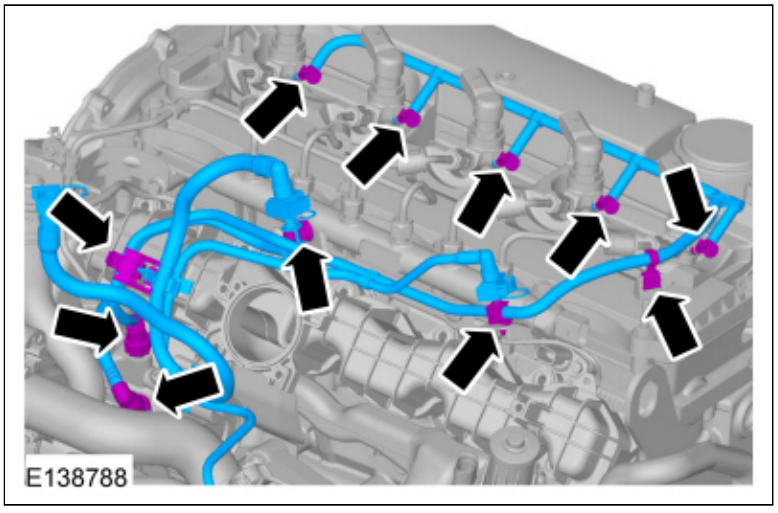
26.



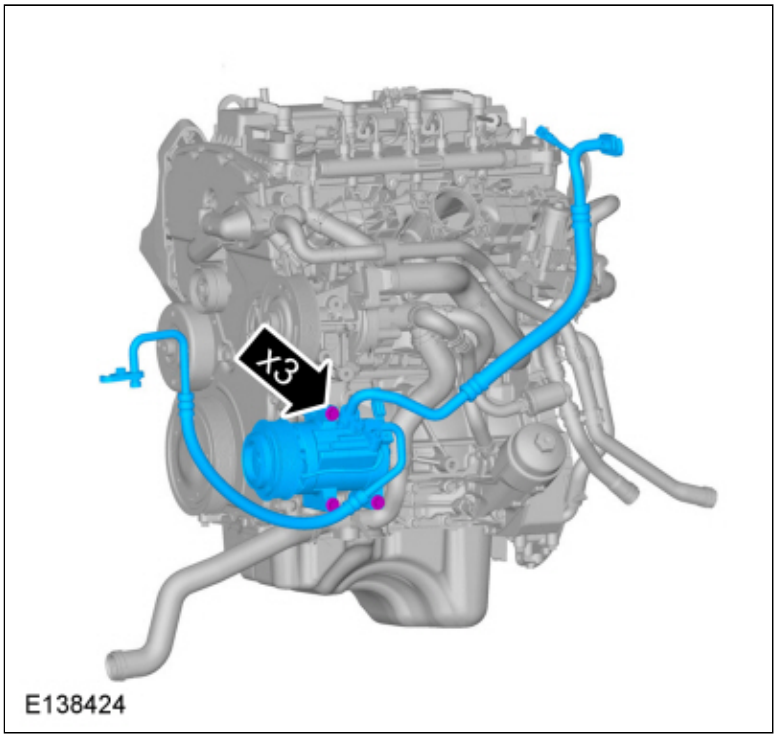
27.



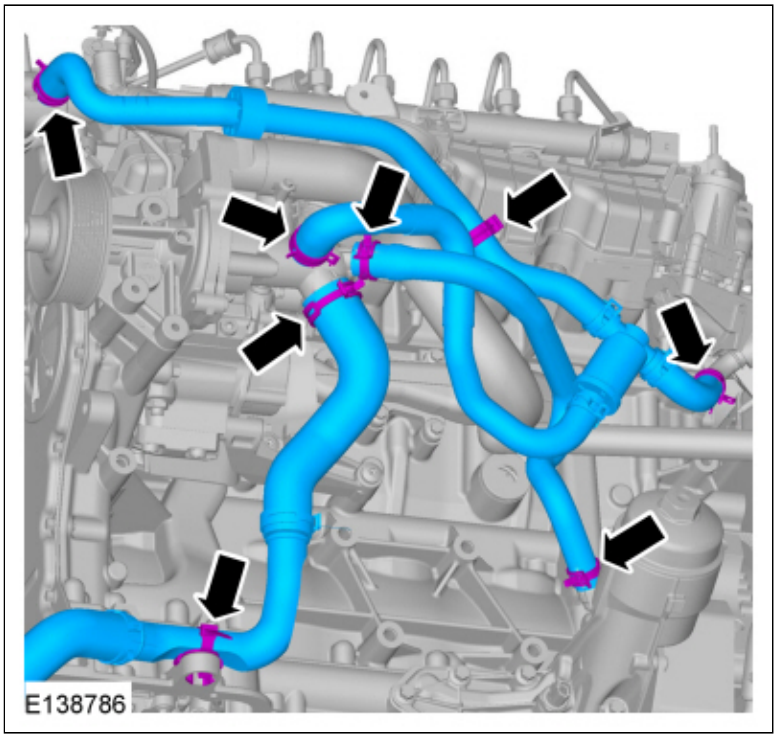
28. **NOTICE: Make sure that all openings are sealed. Use new blanking caps.**



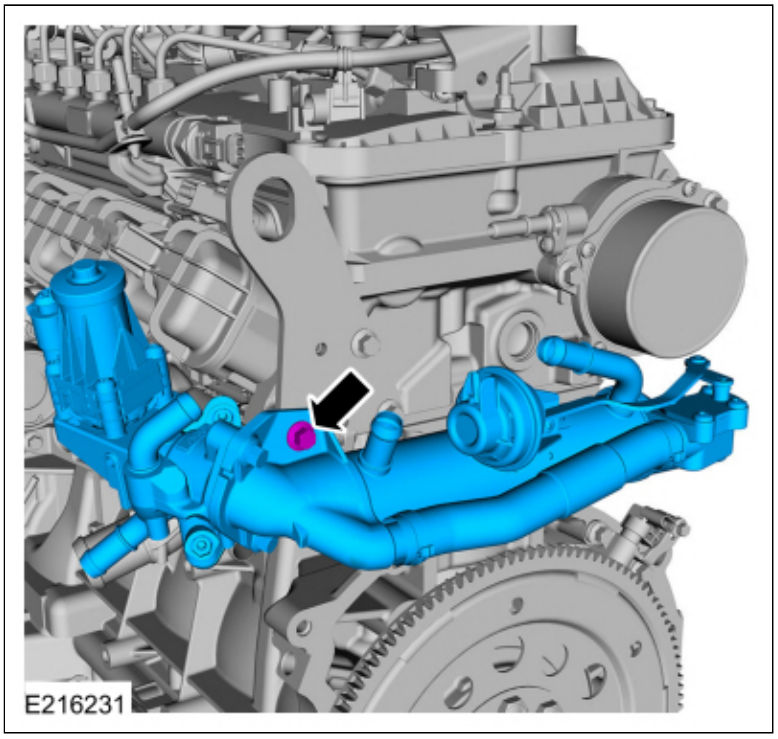
29.



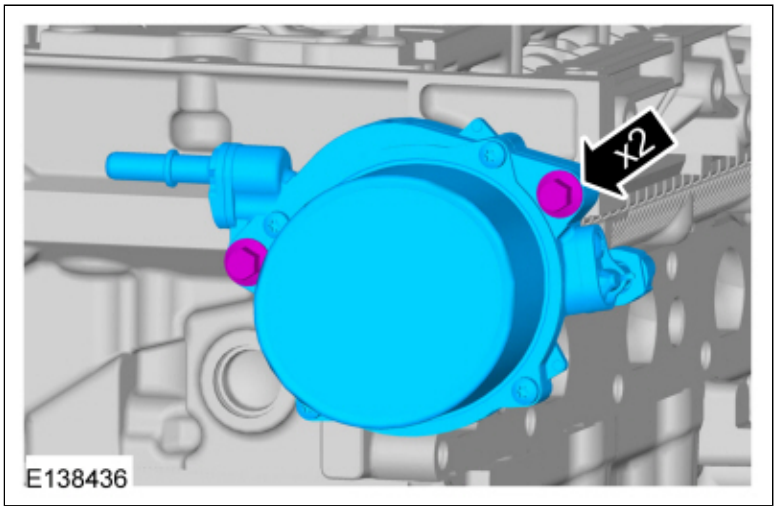
30.



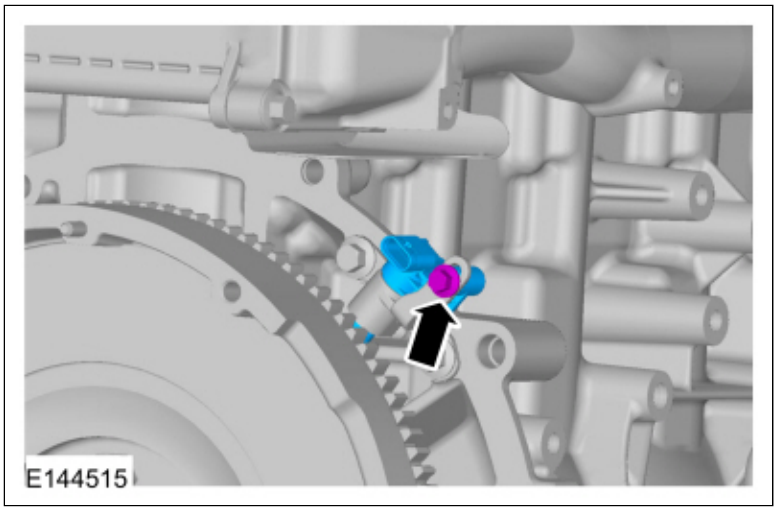
31.



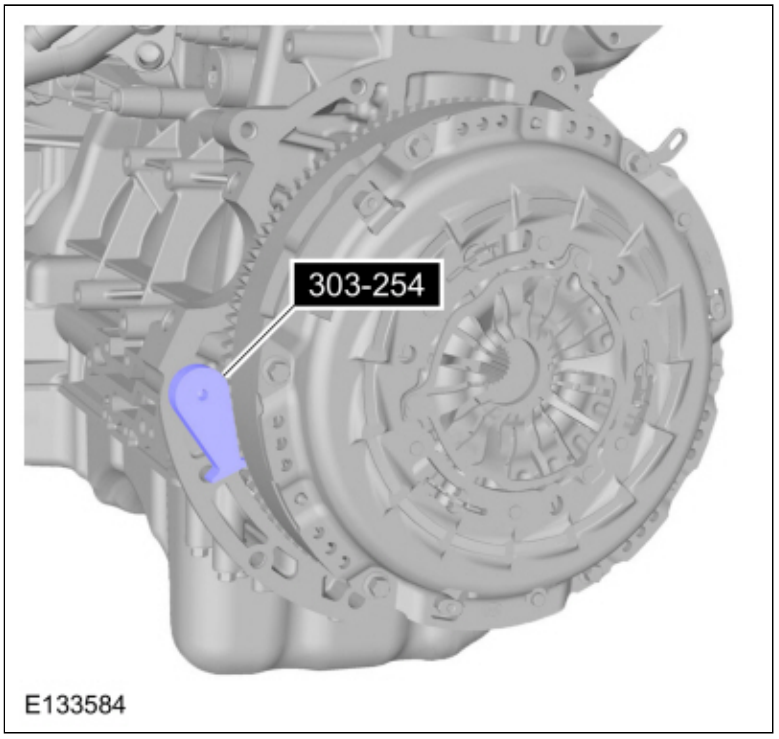
32.



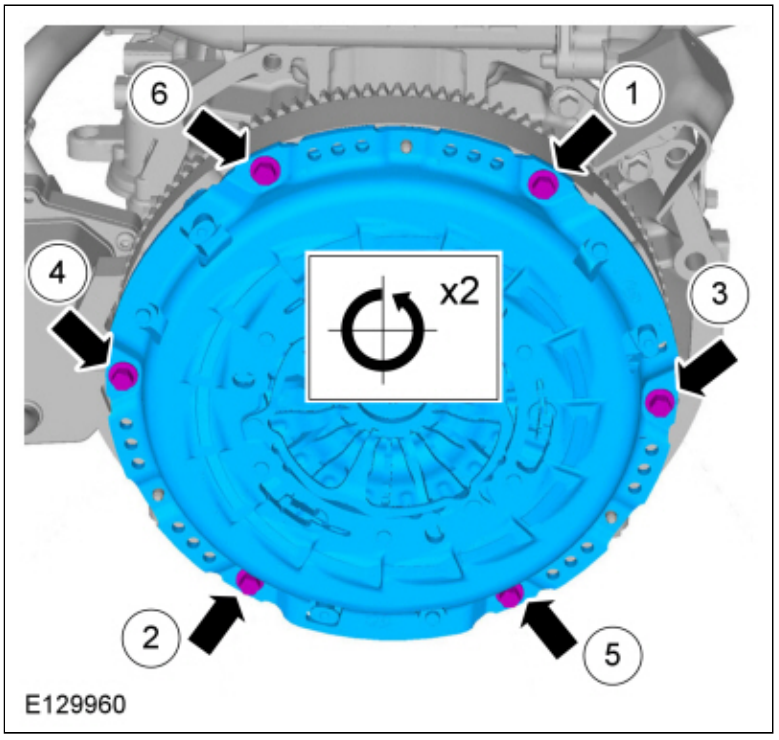
33.



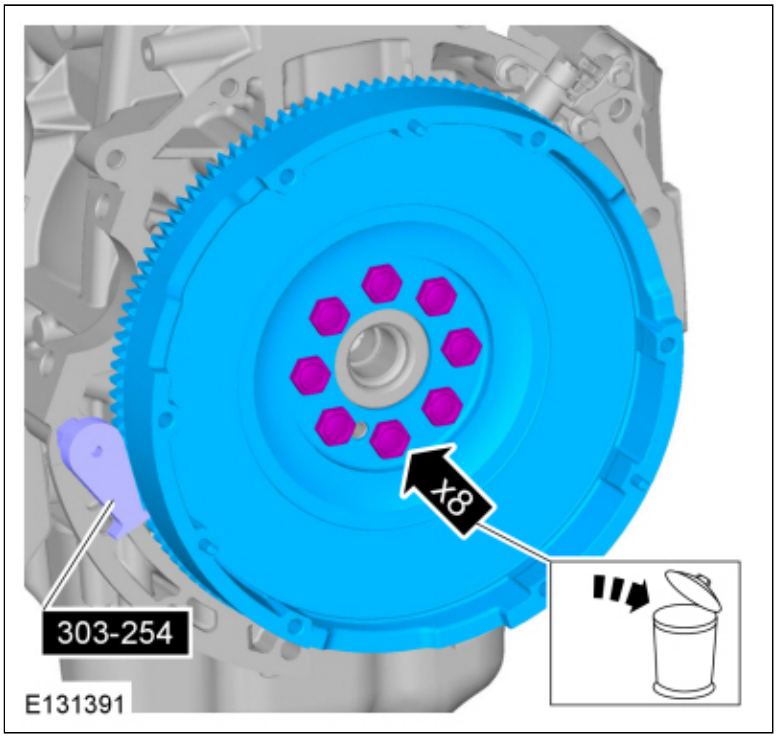
34. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



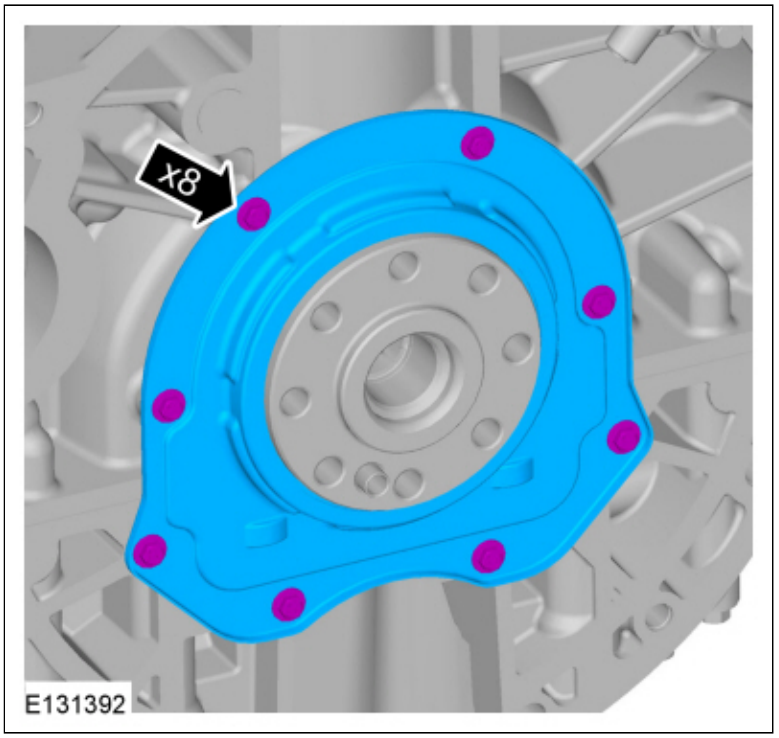
35. **NOTE:** *Do not loosen the bolts more than 2 turns.*



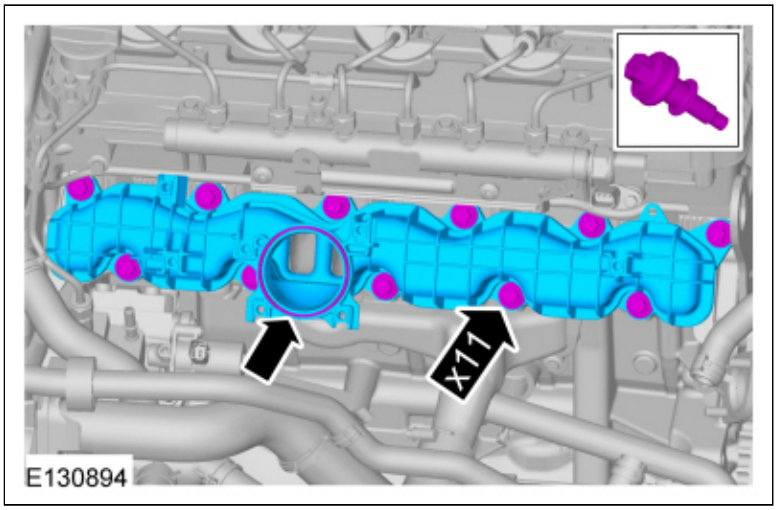
36. Use Special Service Tool: 303-254 Locking Tool, Flywheel.



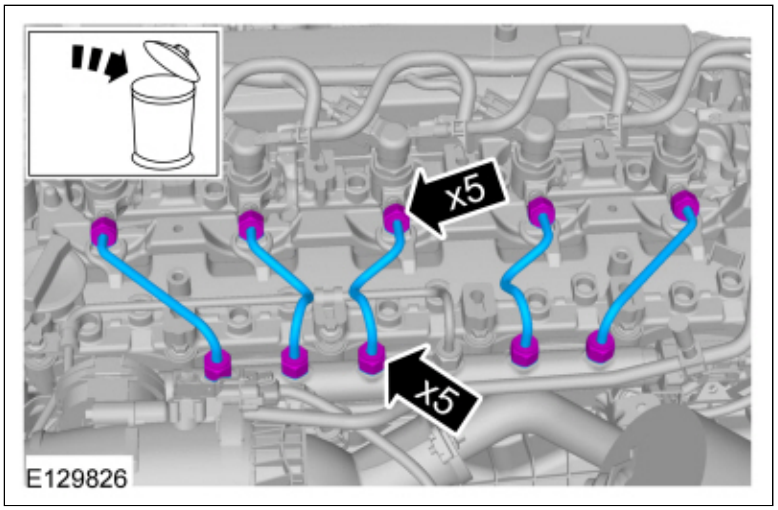
37.



38.



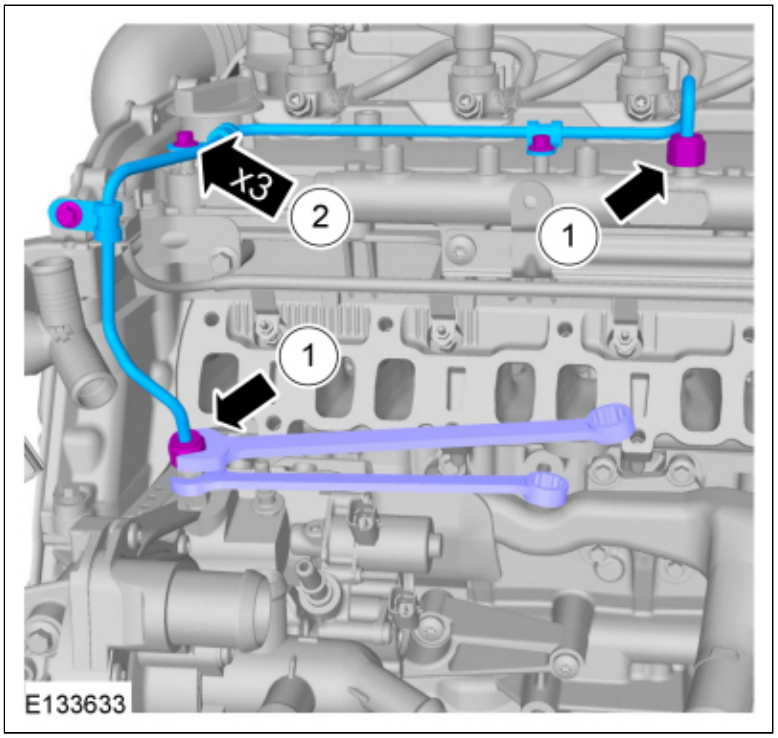
39.



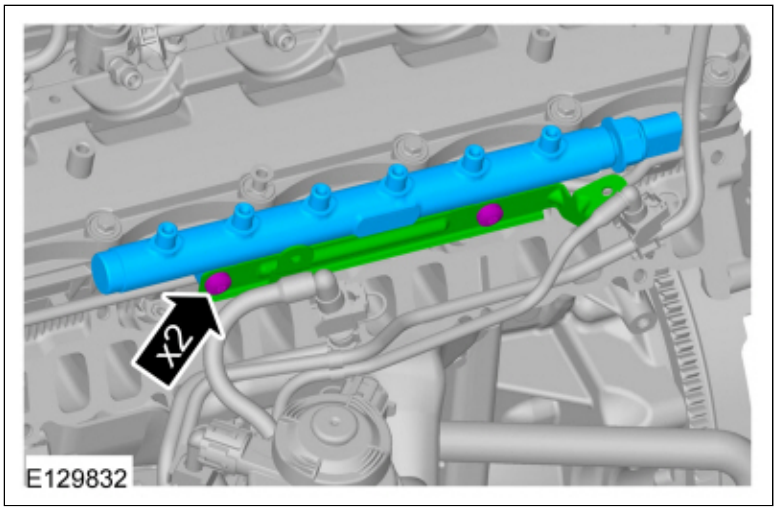
40. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

NOTICE: Make sure that the high-pressure fuel supply line remains in contact with both the fuel pump and the fuel rail until both unions have been detached and cleaned.

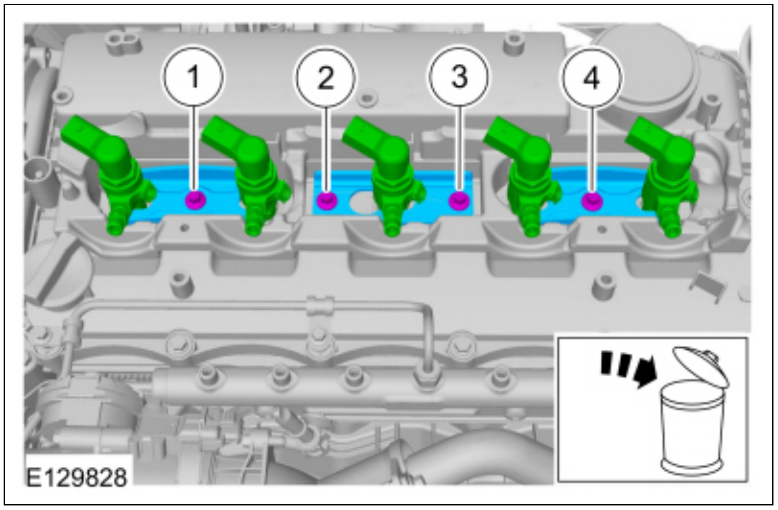
NOTICE: Make sure that all openings are sealed. Use new blanking caps.



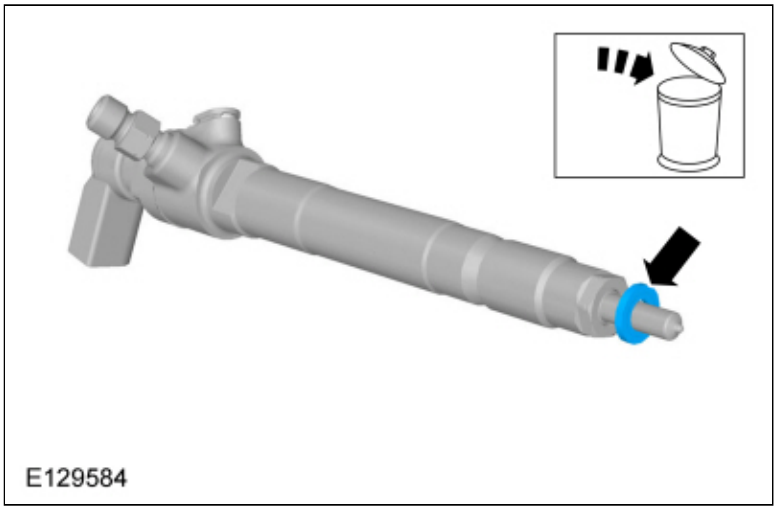
41.



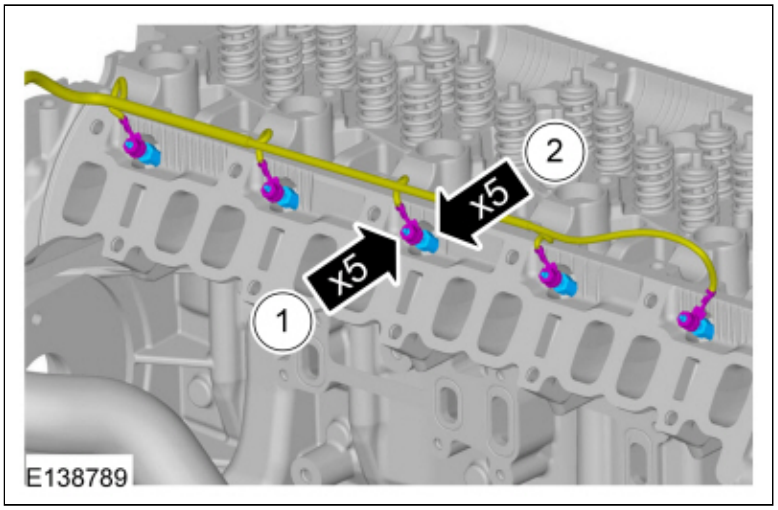
42.



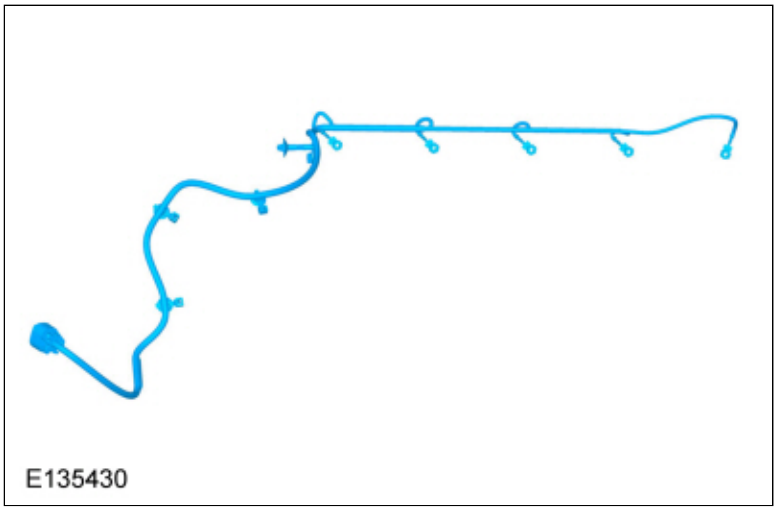
43.



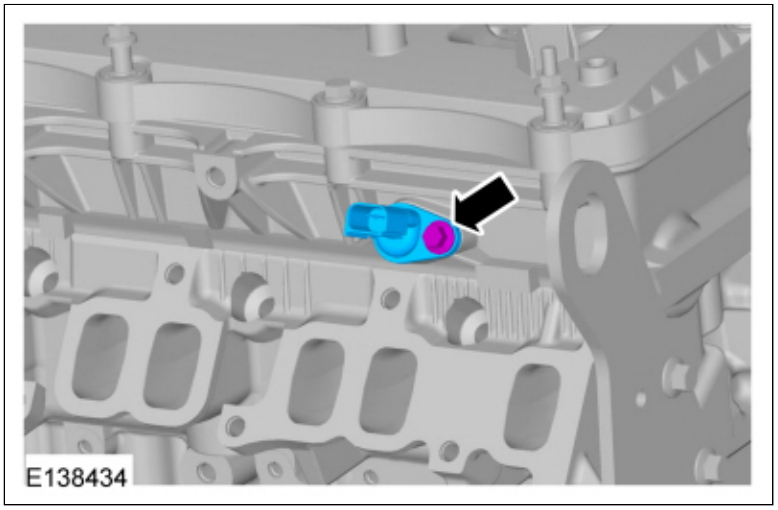
44.



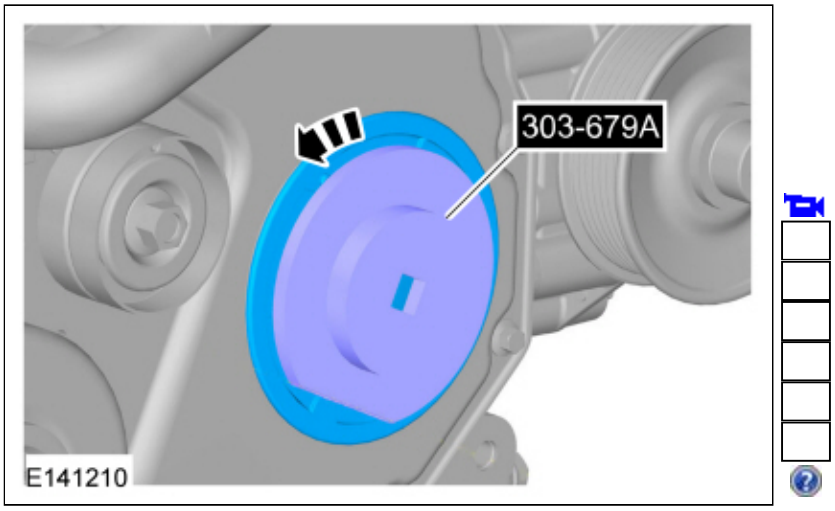
45.



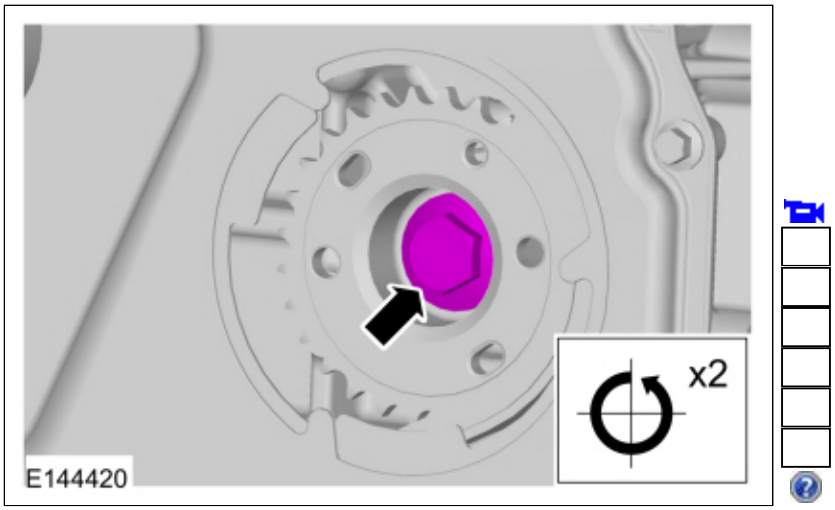
46.



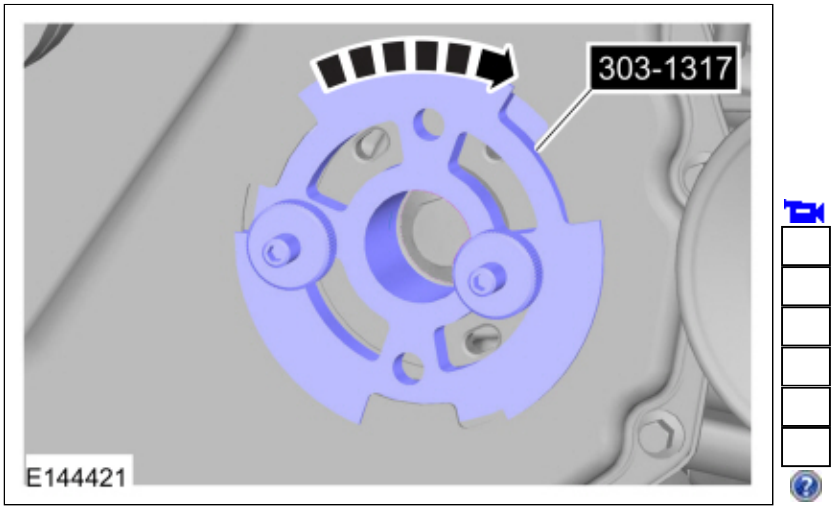
47. Remove Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



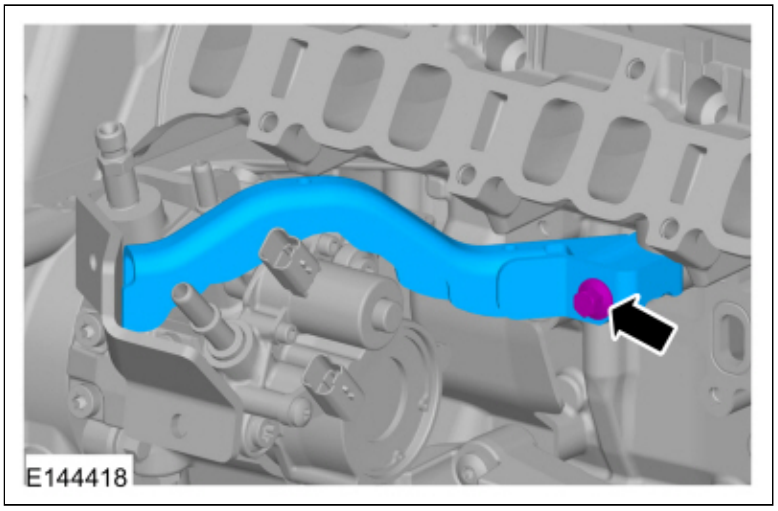
48.



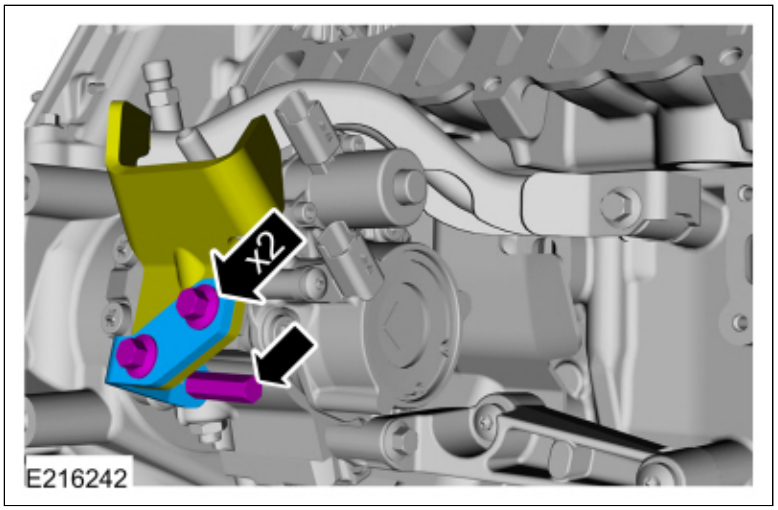
49. Use Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



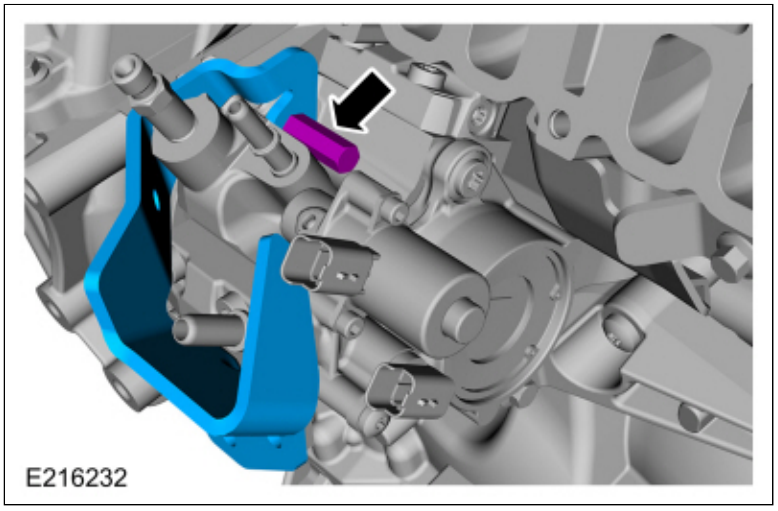
50.



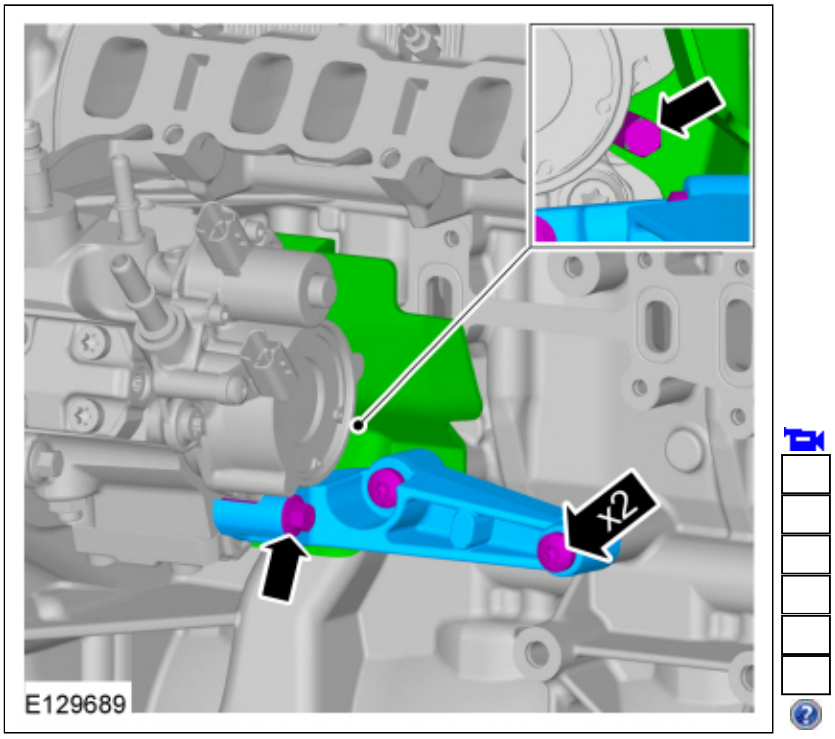
51.



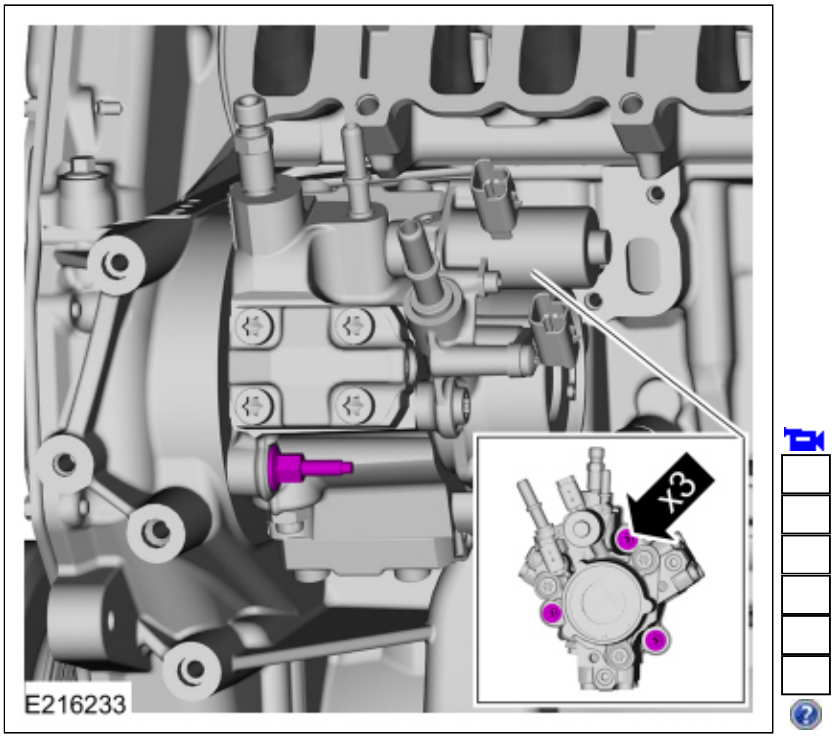
52.



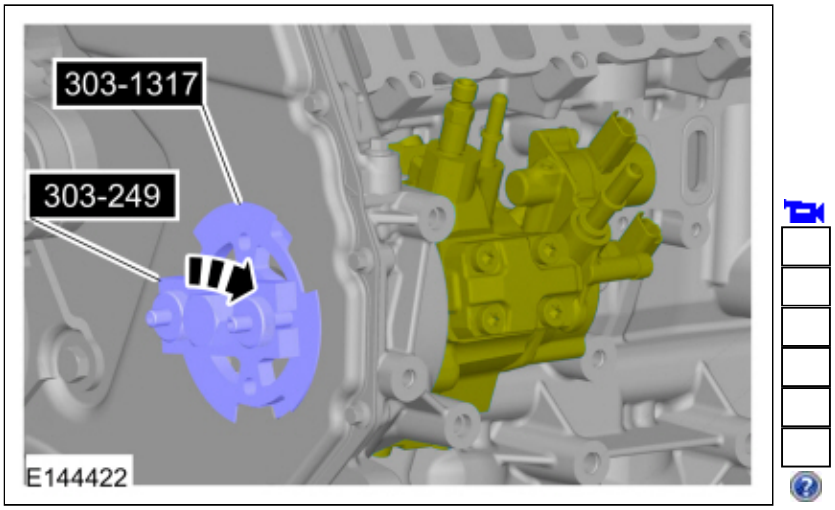
53.



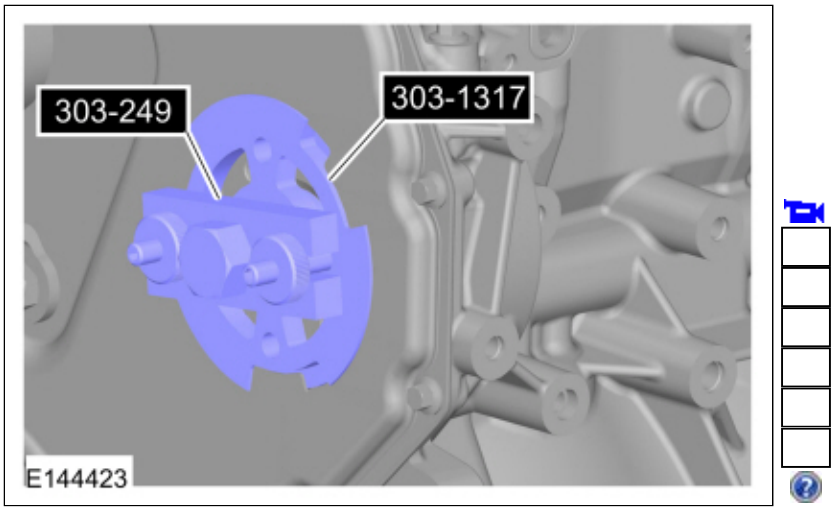
54.



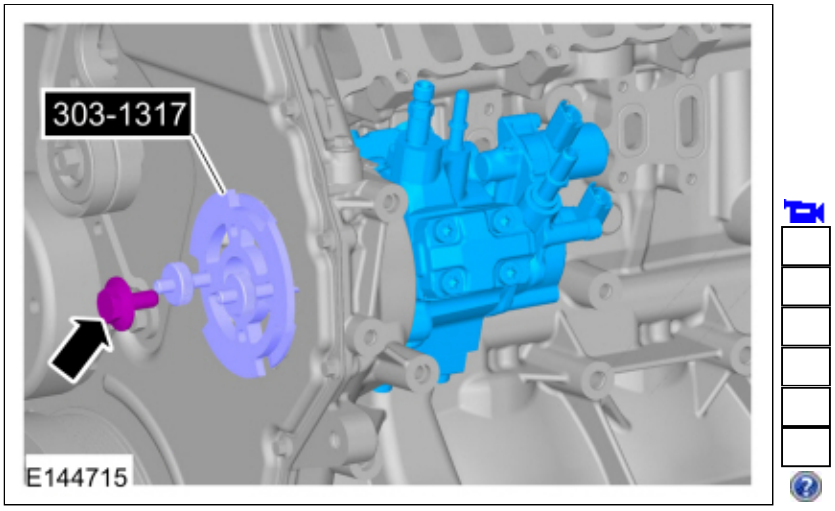
55. Use Special Service Tool: 303-249 Remover, Crankshaft Timing Pulley. , 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



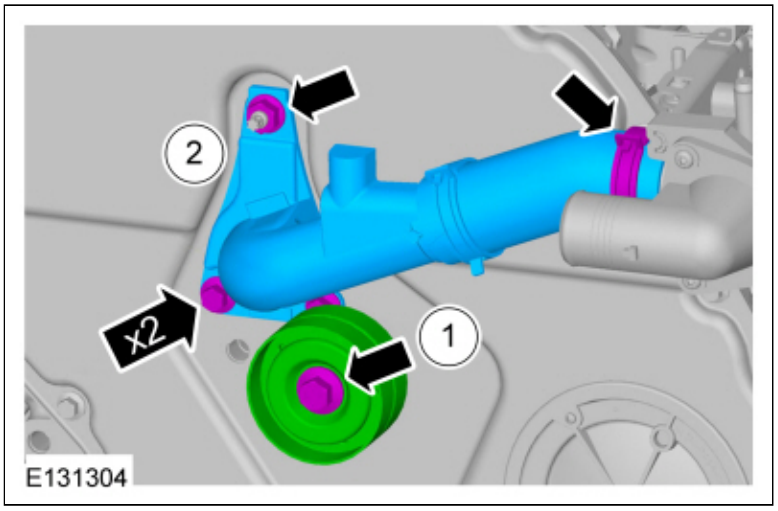
56. Remove Special Service Tool: 303-249 Remover, Crankshaft Timing Pulley.



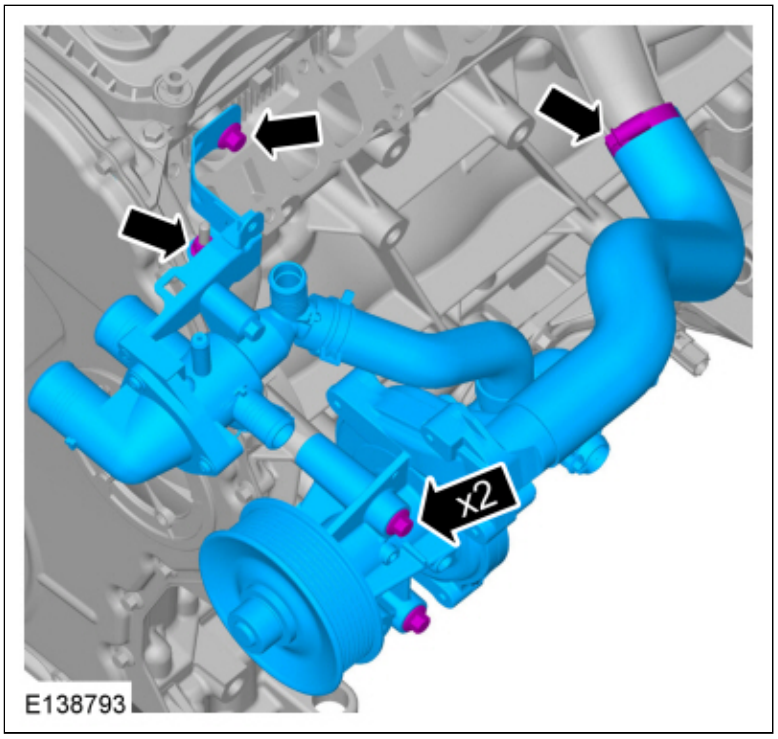
57. Use Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



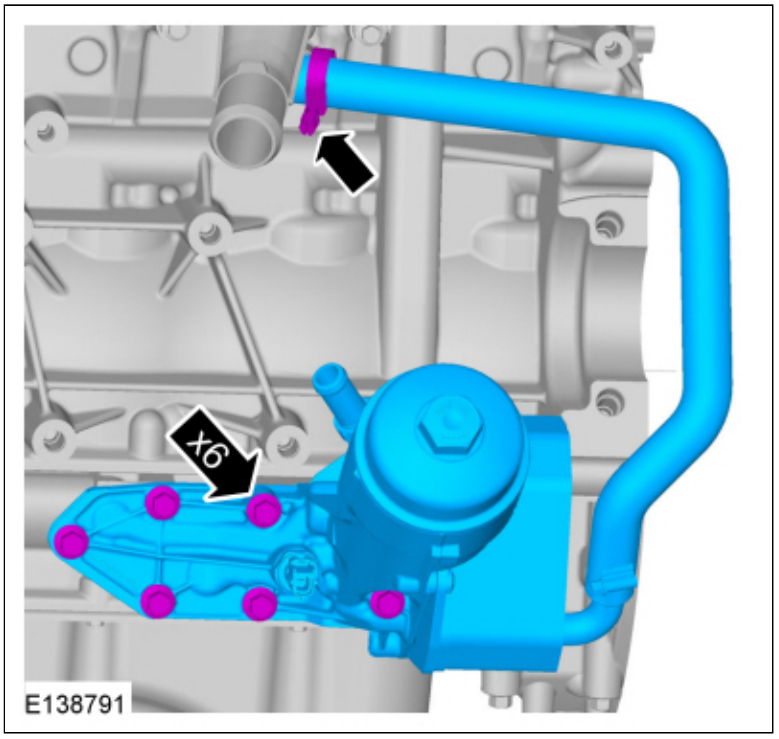
58.



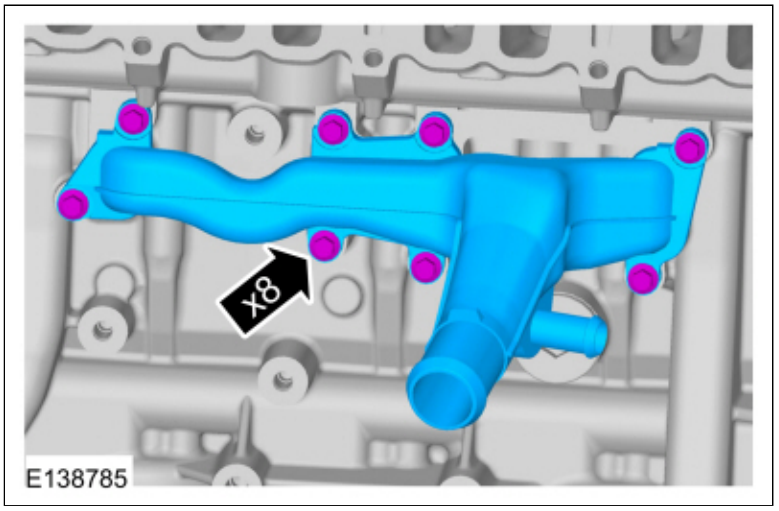
59.



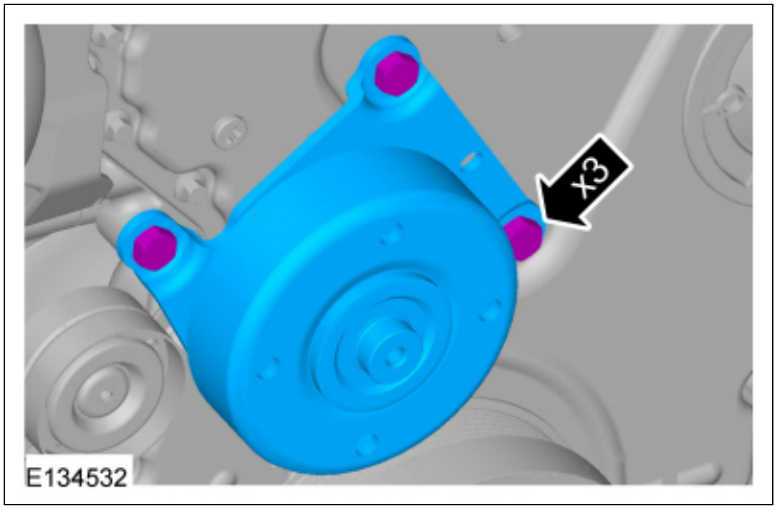
60.



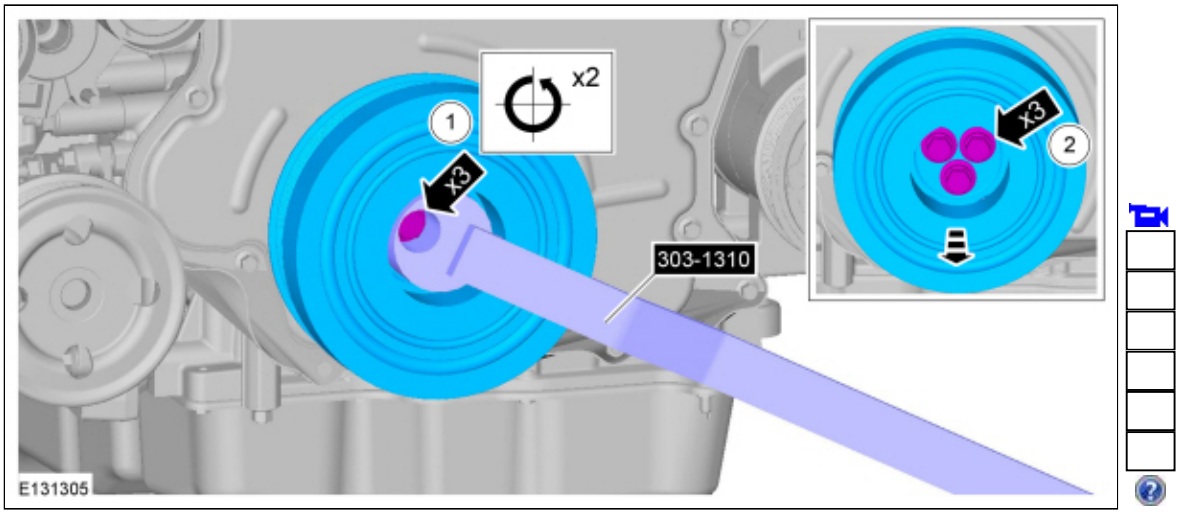
61.



62.

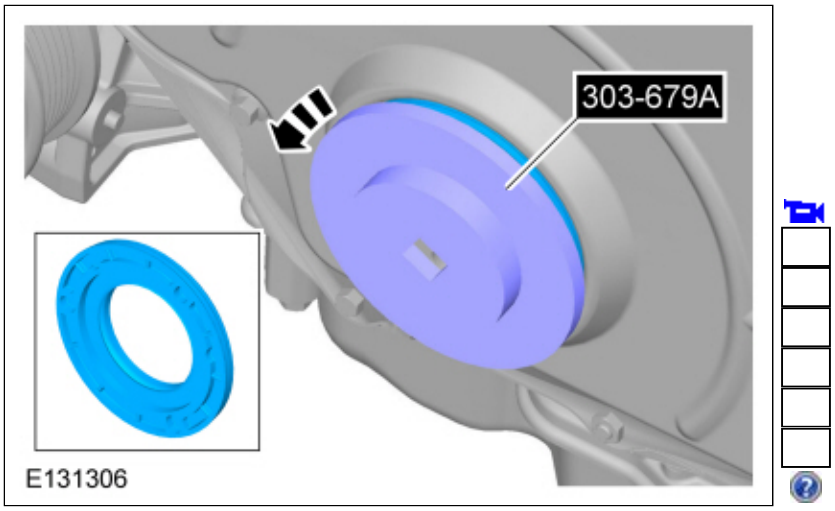


63. Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.



64. **NOTICE: Rotate the seal assembly until it releases. Failure to follow this instruction may result in damage to the seal assembly.**

    Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.

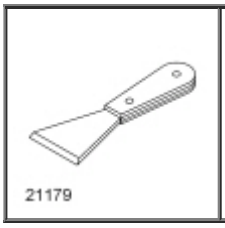


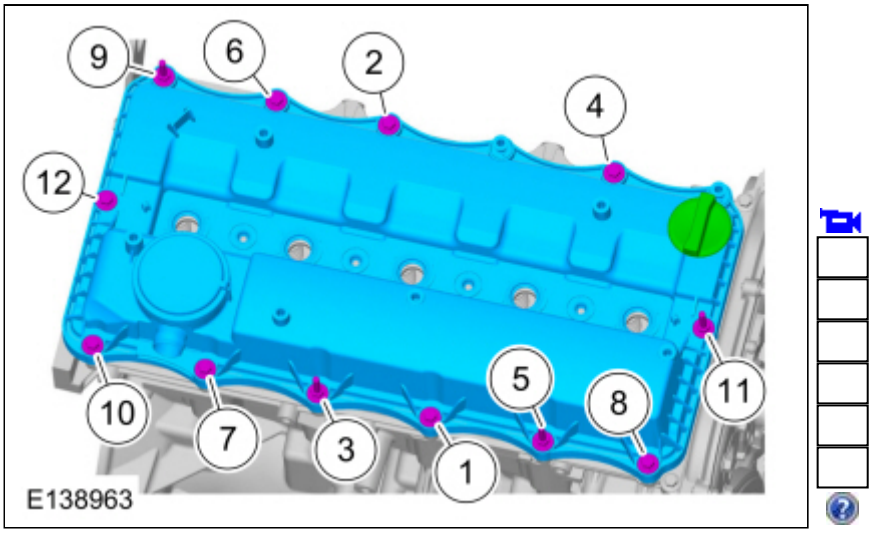
Copyright © 2016 Ford Motor Company

Engine

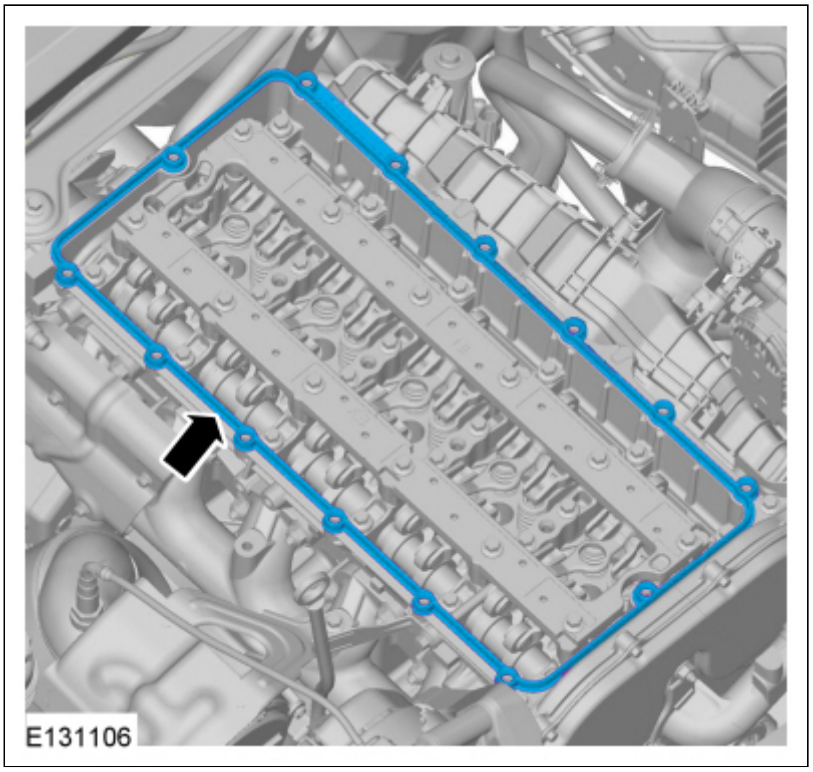
Base Part Number: 6L084

Special Tool(s) / General Equipment

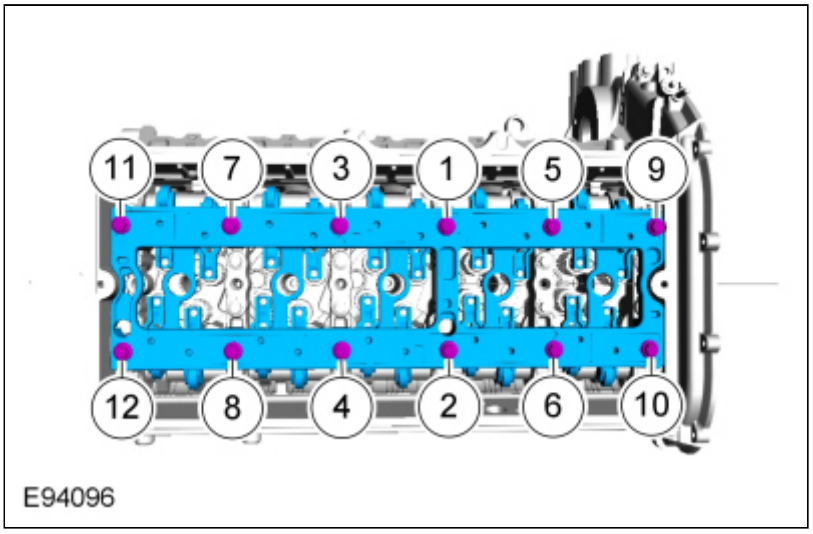
 21179	303-428 Separator, Oil Pan

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Engine Accessories (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Installation).
3. 

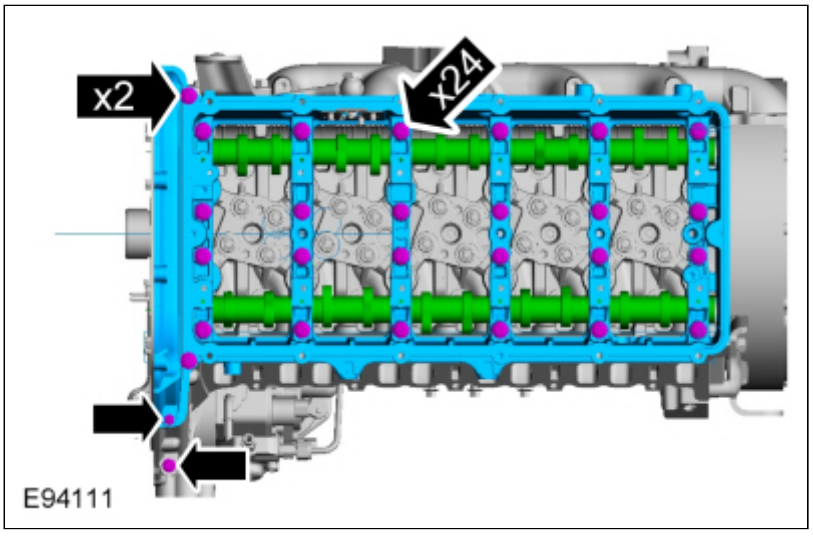
4. **NOTE:** *The gasket is to be reused unless damaged.*



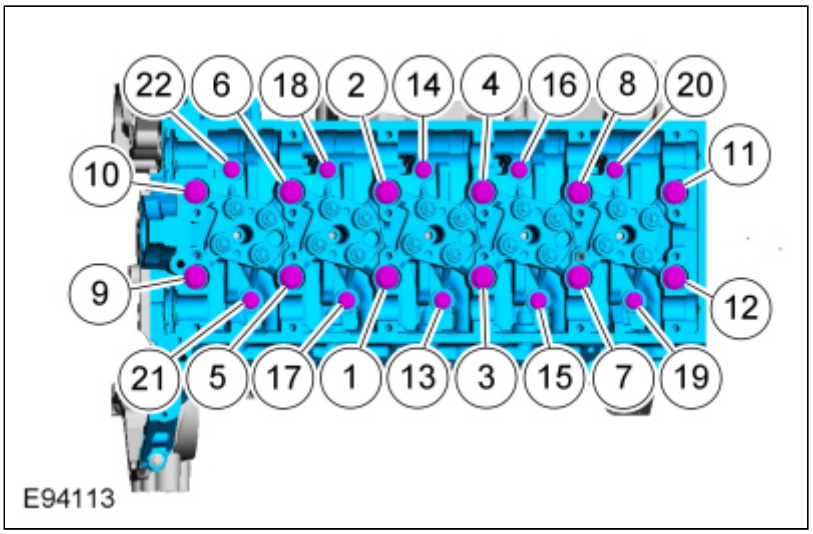
5.



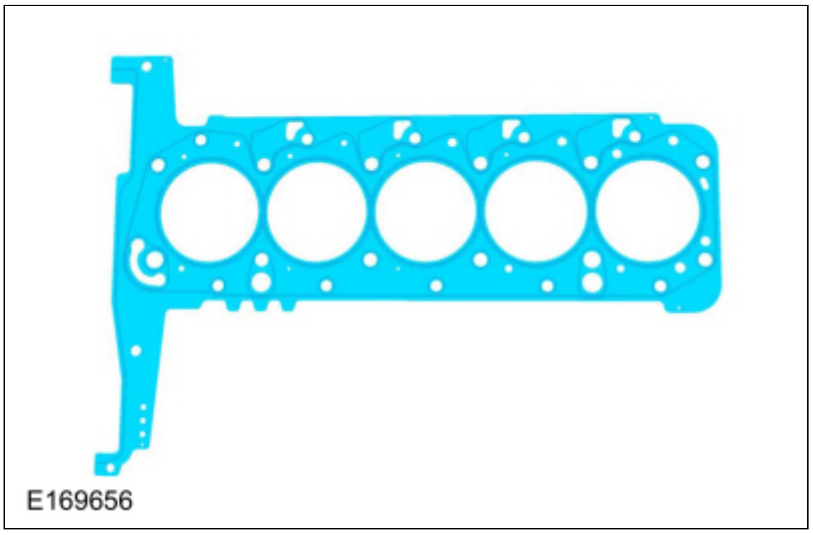
6.



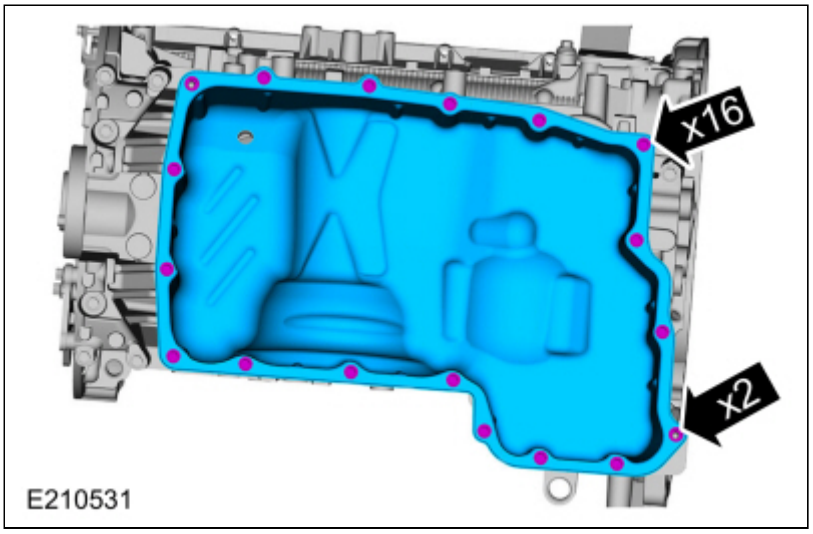
7.



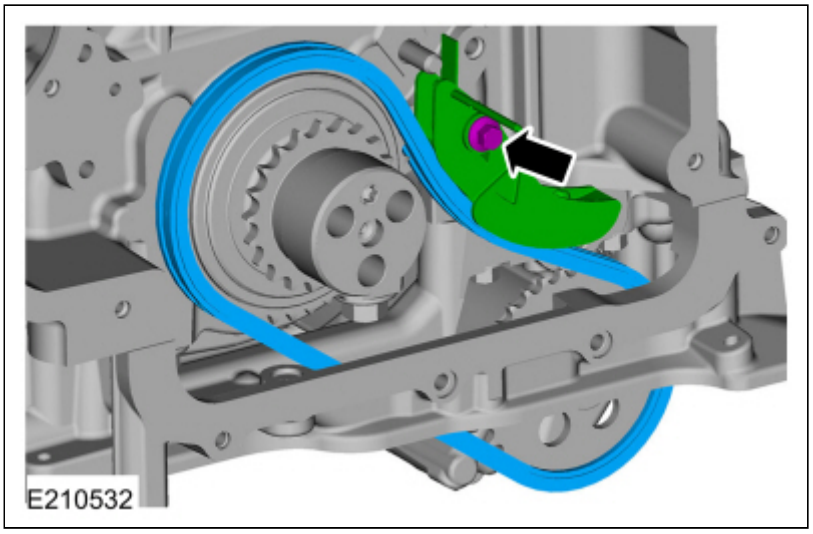
8.



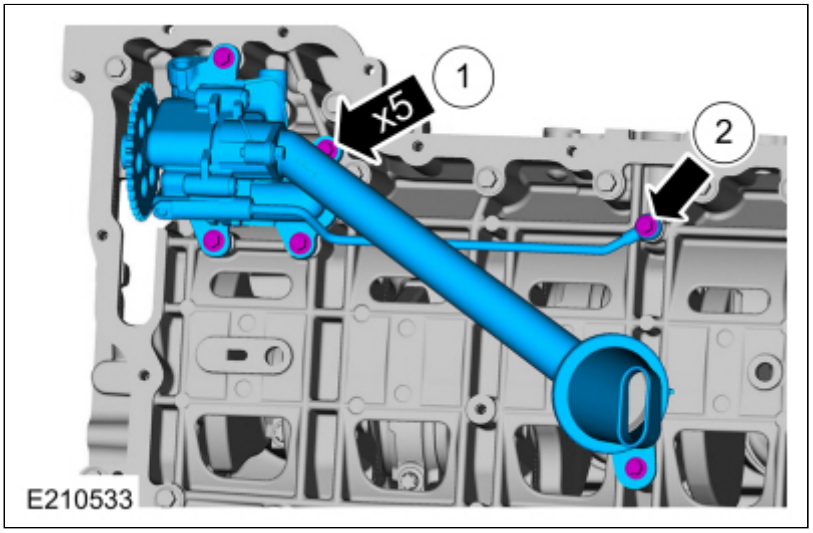
9. Use Special Service Tool: 303-428 Separator, Oil Pan.



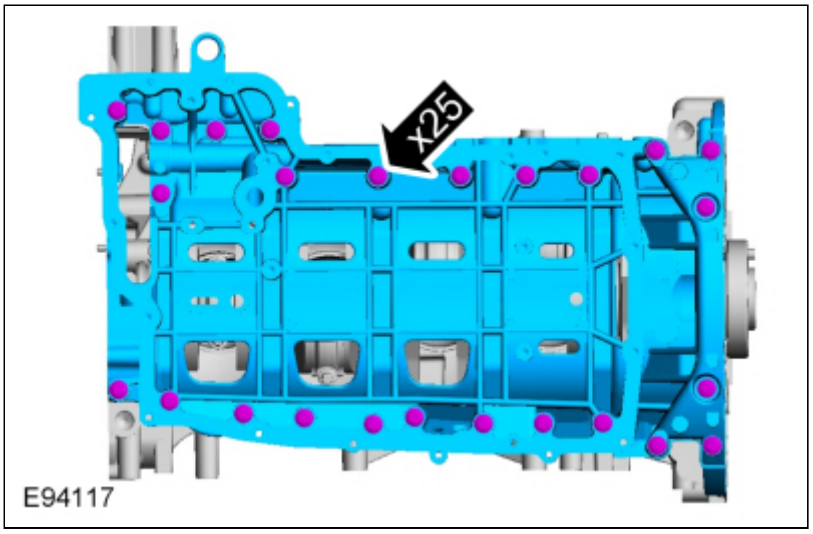
10.



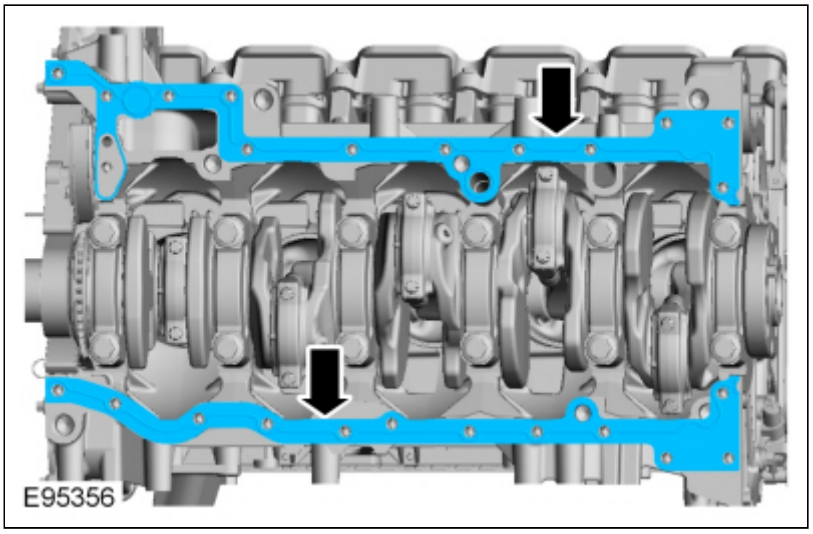
11.



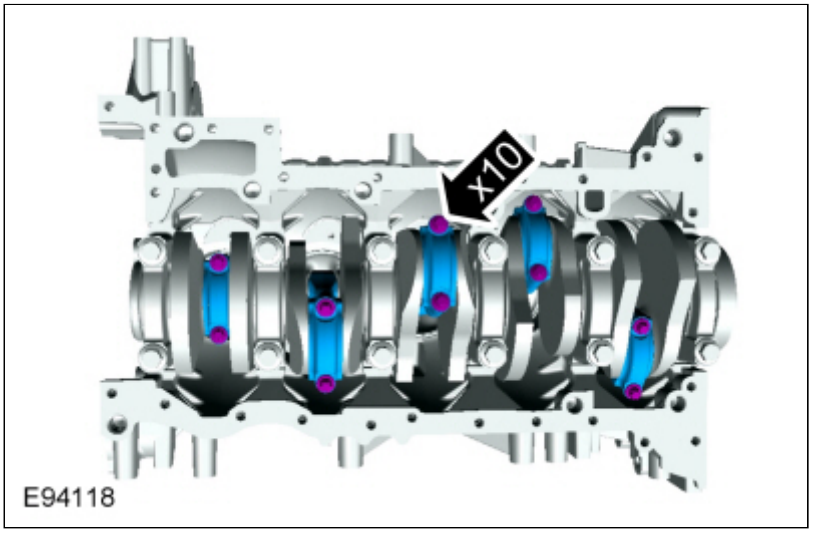
12.



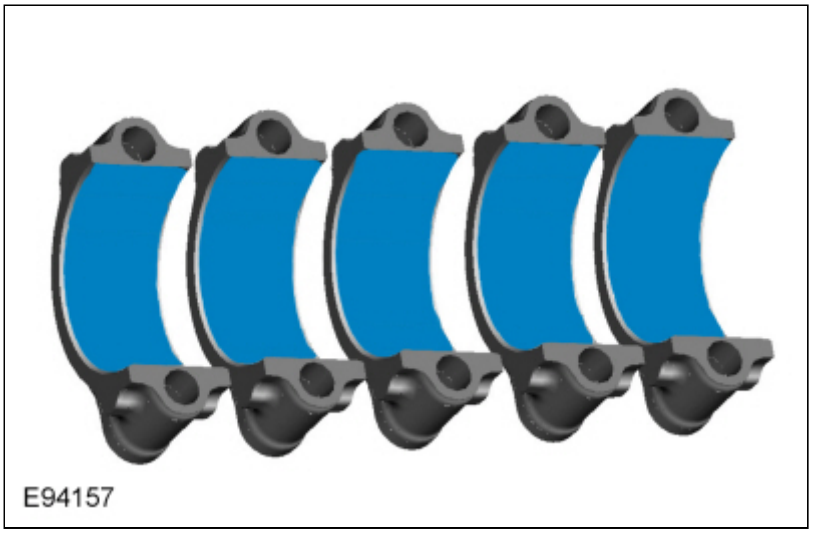
13.



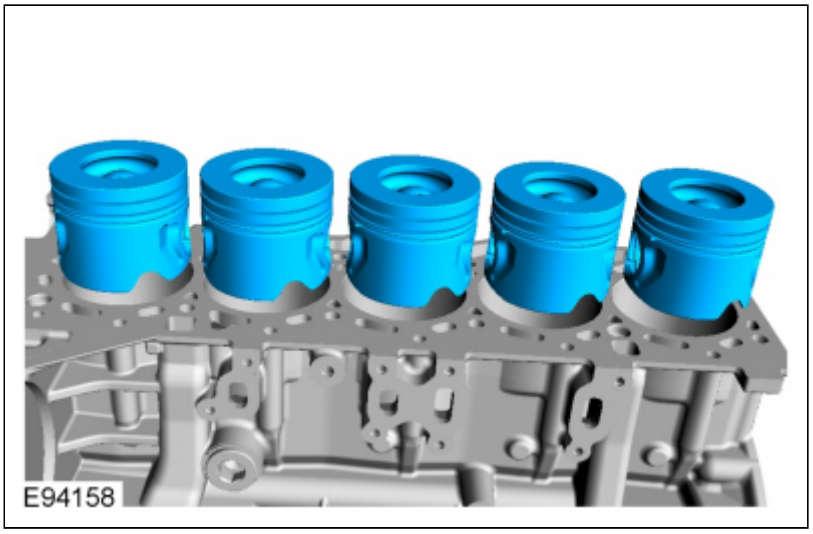
14. **NOTE:** *Note the position of each component before removal.*



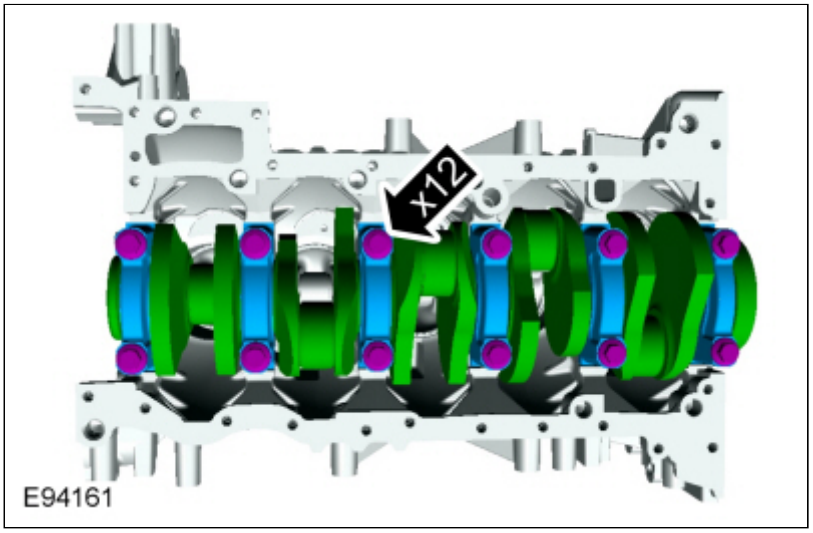
15. **NOTE:** *Note the position of each component before removal.*



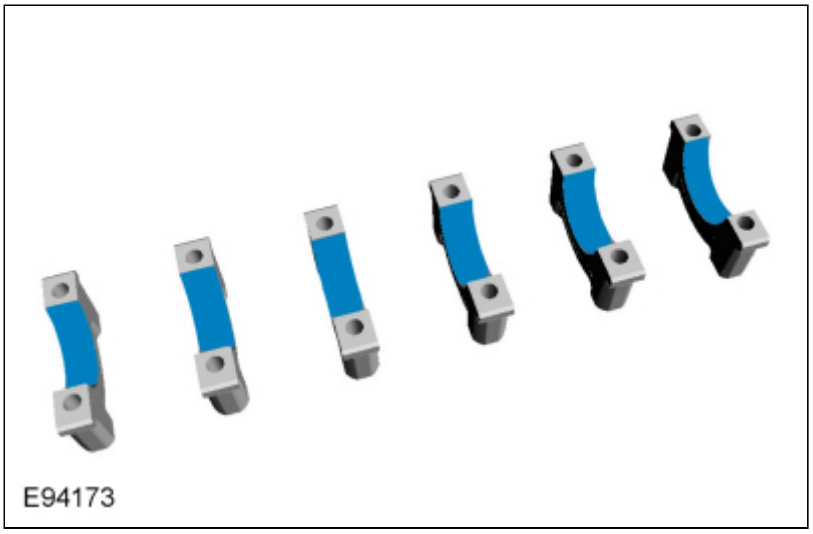
16. **NOTE:** *Note the position of each component before removal.*



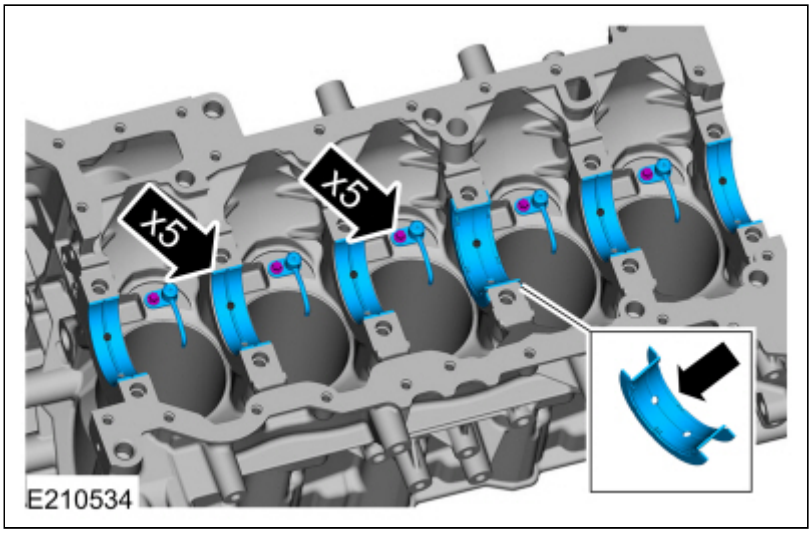
17. **NOTE:** *Note the position of each component before removal.*



18. **NOTE:** *Note the position of each component before removal.*



19. **NOTE:** *Note the position of each component before removal.*



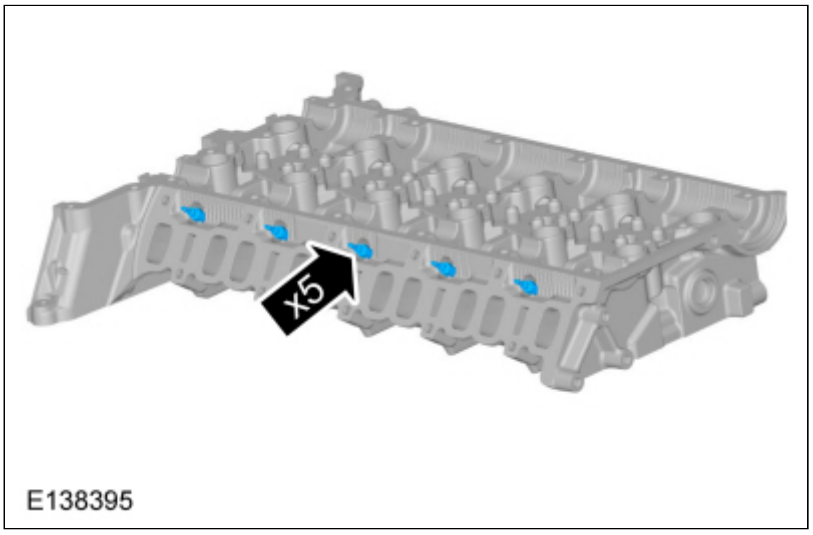
Copyright © 2016 Ford Motor Company

Cylinder Head

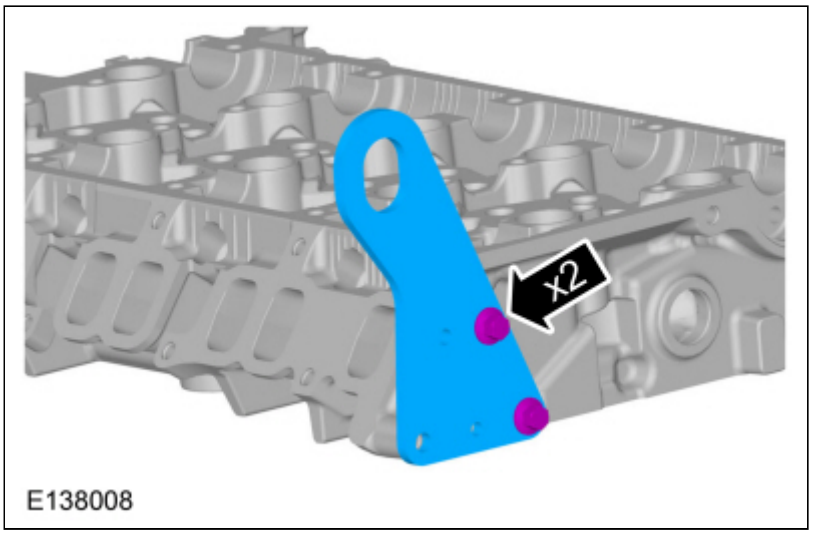
Base Part Number: 6051

Disassembly

1. For additional information, refer to: Valves (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. Torque : 13Nm



3. Torque : 23Nm



Assembly

1. To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

Piston

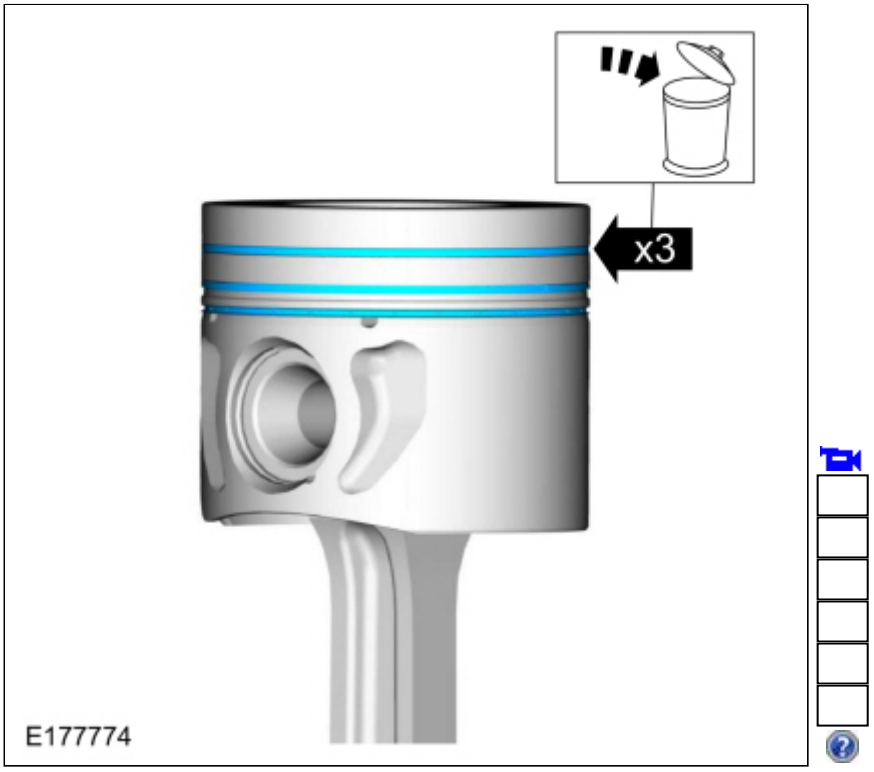
Materials

Name	Specification
Engine Oil - SAE 5W-30	WSS-M2C913-C

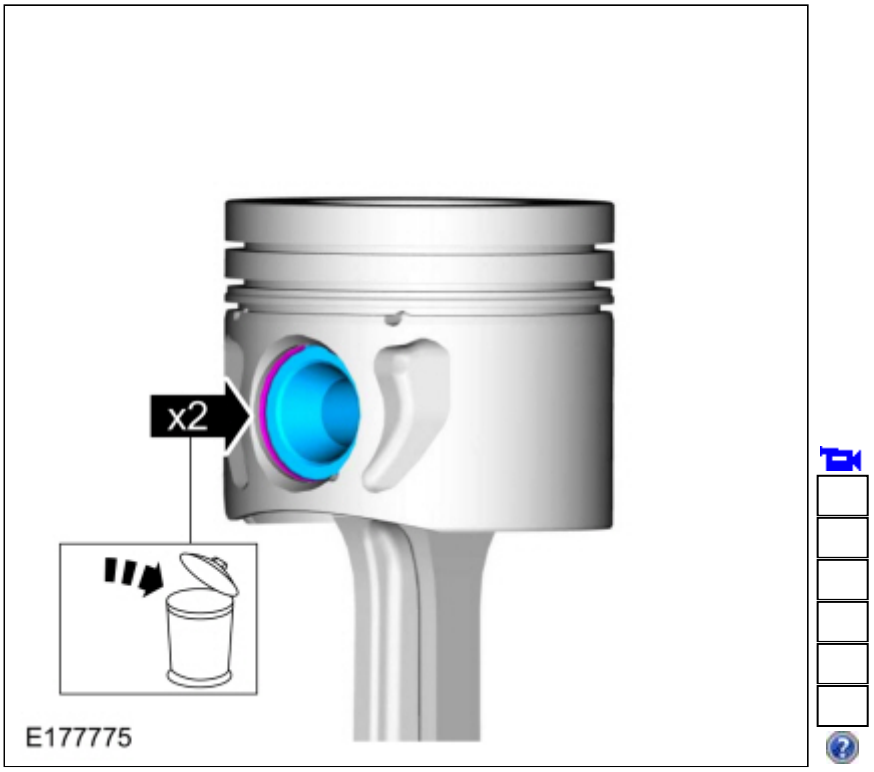
DISASSEMBLY

NOTE: *If the piston and connecting rod are to be reinstalled, they must be assembled in the same orientation. Mark the piston orientation to the connecting rod for reassembly.*

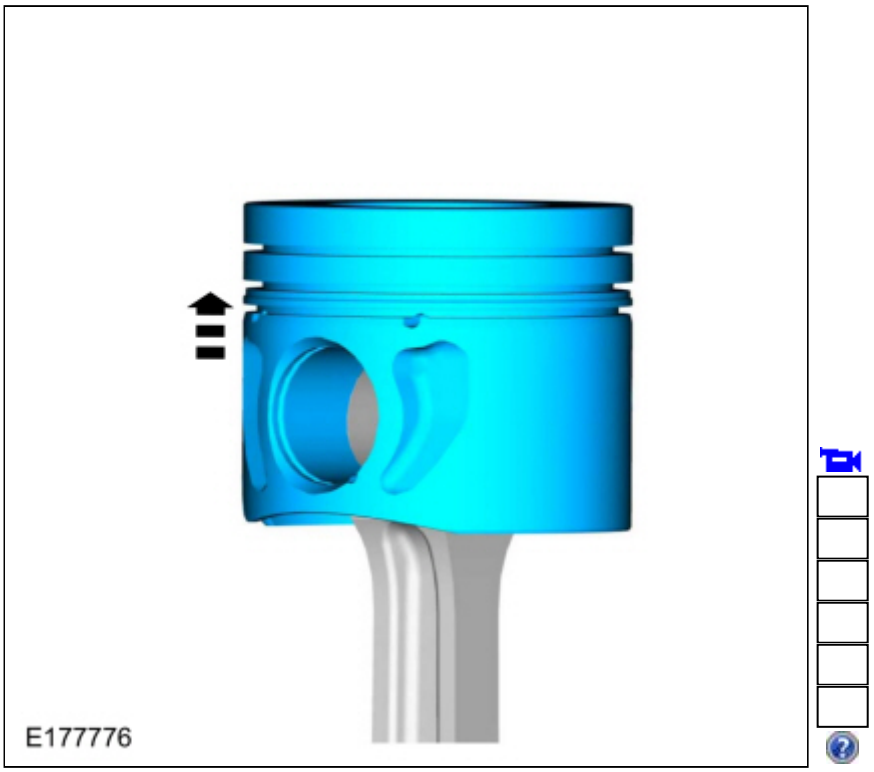
1. Remove and discard the piston rings.



2. Remove and discard the piston pin retainers. Remove the piston pin.



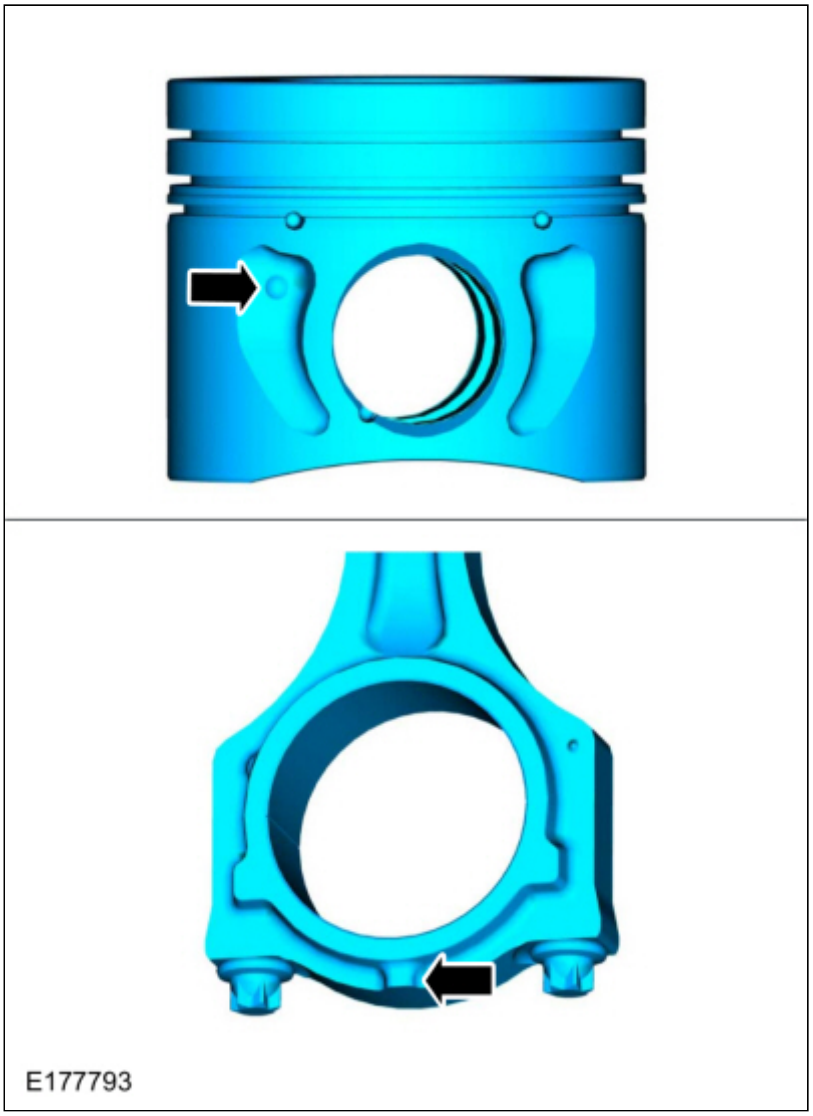
3. Separate the piston from the connecting rod. Clean and inspect the piston.
   Refer to: Piston Inspection (303-00 Engine System - General Information, General Procedures).



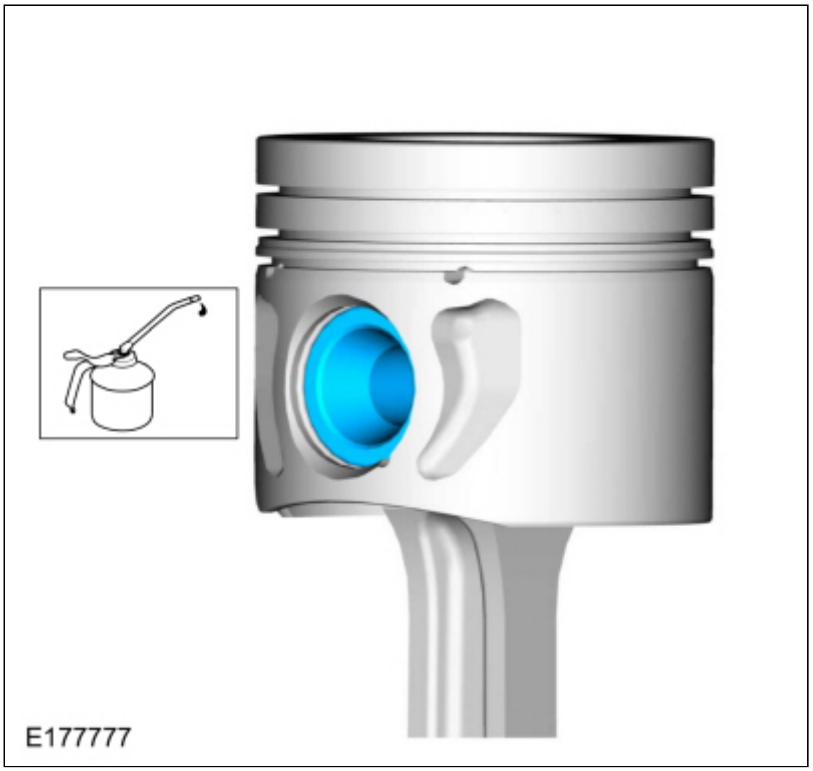
ASSEMBLY

1. **NOTE:** *Align the piston-to-connnecting rod orientation marks made during disassembly.*

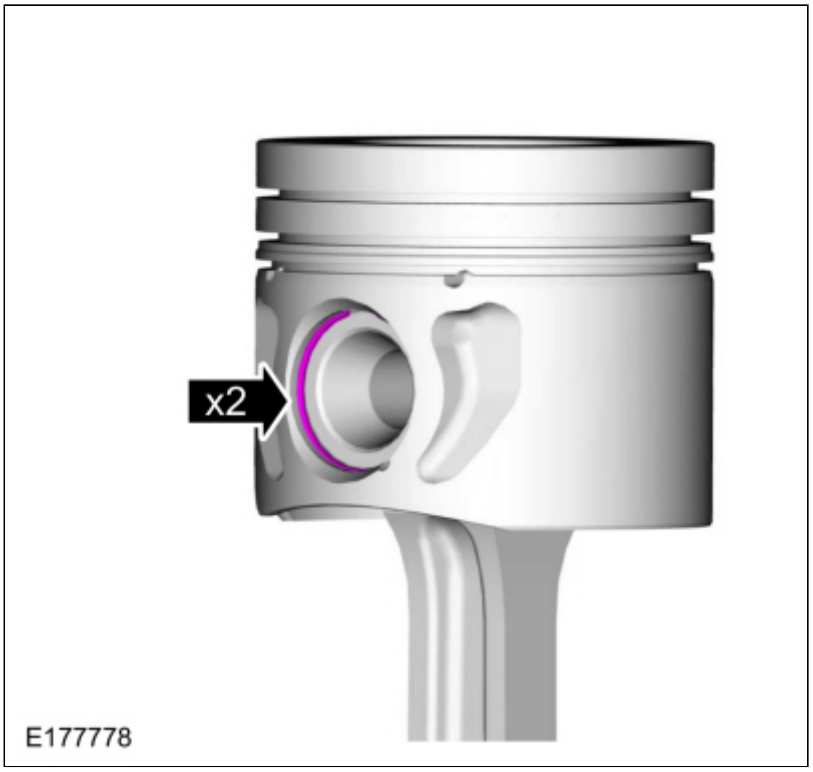
   Align the front of the piston and connecting rod. Assembly the piston and the connecting rod.



2. Lubricate with clean engine oil and install the piston pin.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



3. Install the piston pin retainers.

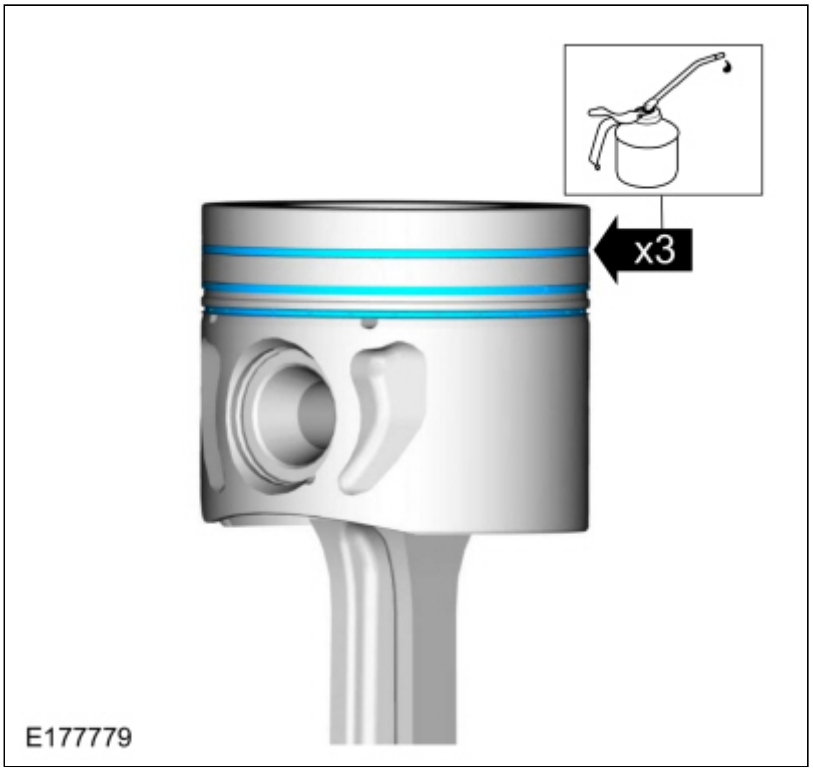


4. **NOTE:** *The rings are to be fitted with the paint mark to the left of the piston ring gap.*

   NOTE: *The upper and lower compression ring gaps are the be installed 180 degrees apart.*

   NOTE: *The oil control ring position is not controlled.*

   Lubricate with clean engine oil and install the piston rings.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)

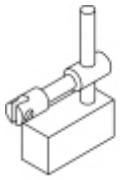
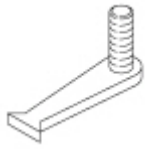
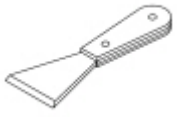
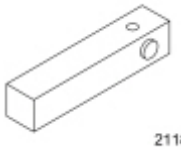


Copyright © 2016 Ford Motor Company

Engine

Base Part Number: 6L084

Special Tool(s) / General Equipment

 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 15008	205-044 Holding Fixture, Dial Indicator Gauge
 15046	205-069 Dial Indicator Gauge (Metric)
 E131853	303-1562 Timing Tool
 E139146	303-1587 Timing Tool, Crankshaft
 21135	303-254 Locking Tool, Flywheel
 21179	303-428 Separator, Oil Pan
 21183	303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion)
	303-682 Aligner, Engine Front Cover

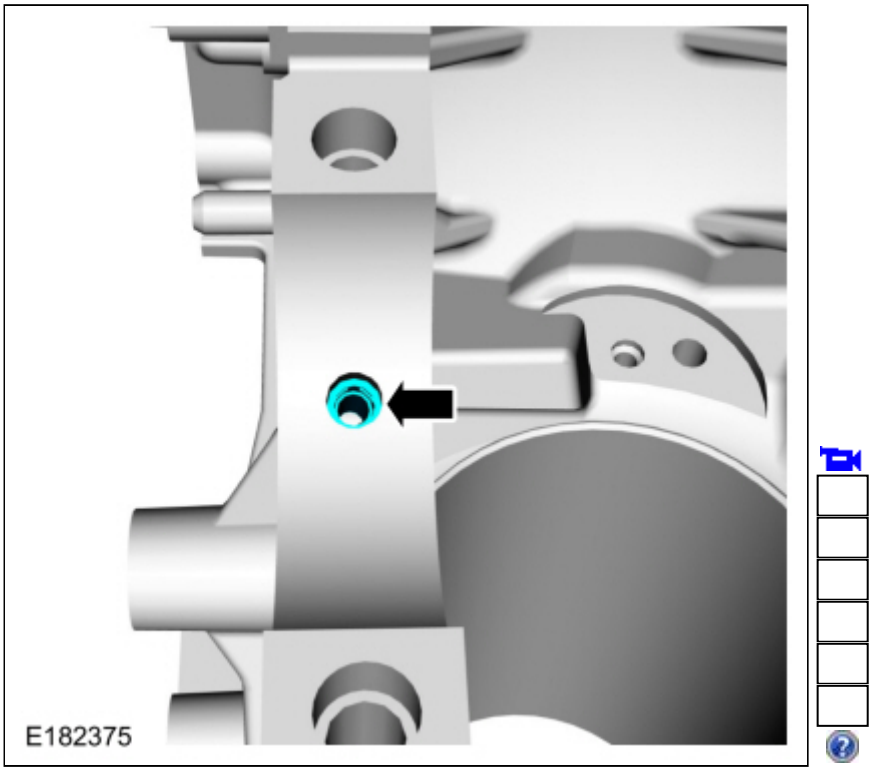
 303682	
 303698	303-698 Timing Tool, Crankshaft
Piston Ring Compressor	

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4
Engine Oil - SAE 5W-30	WSS-M2C913-C

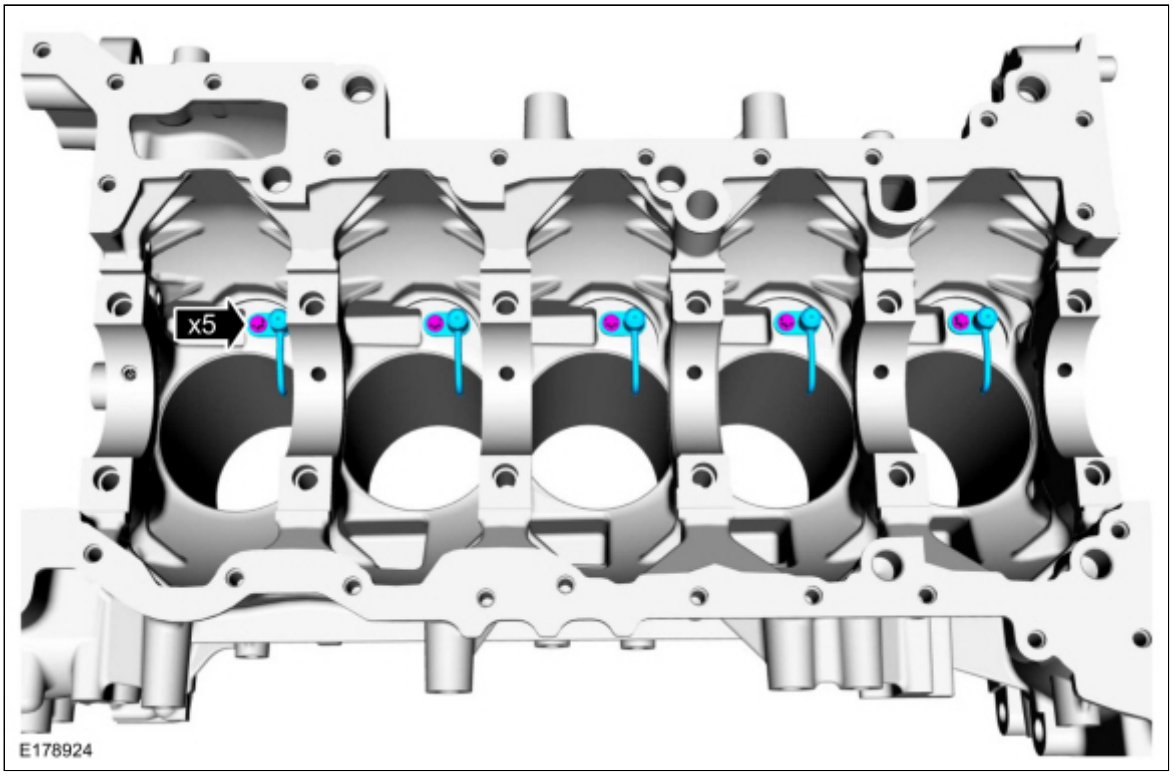
1. **NOTE:** *The cylinder block oil filter must be installed flush to 0.04 inch (1 mm) underflush.*

   Install the cylinder block oil filter.



2. **NOTE:** *The piston cooling nozzles must be fully inserted before installing the bolt.*

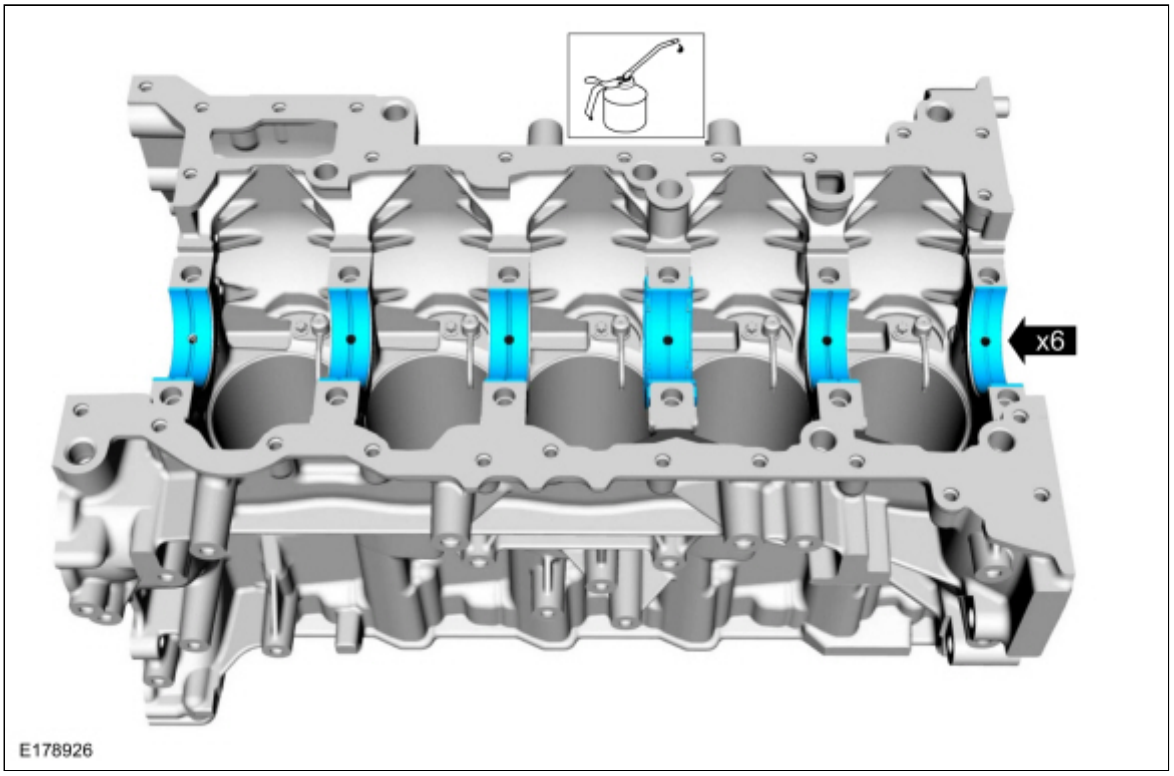
   Install the piston cooling nozzles and new bolts.
   Torque: 10 Nm



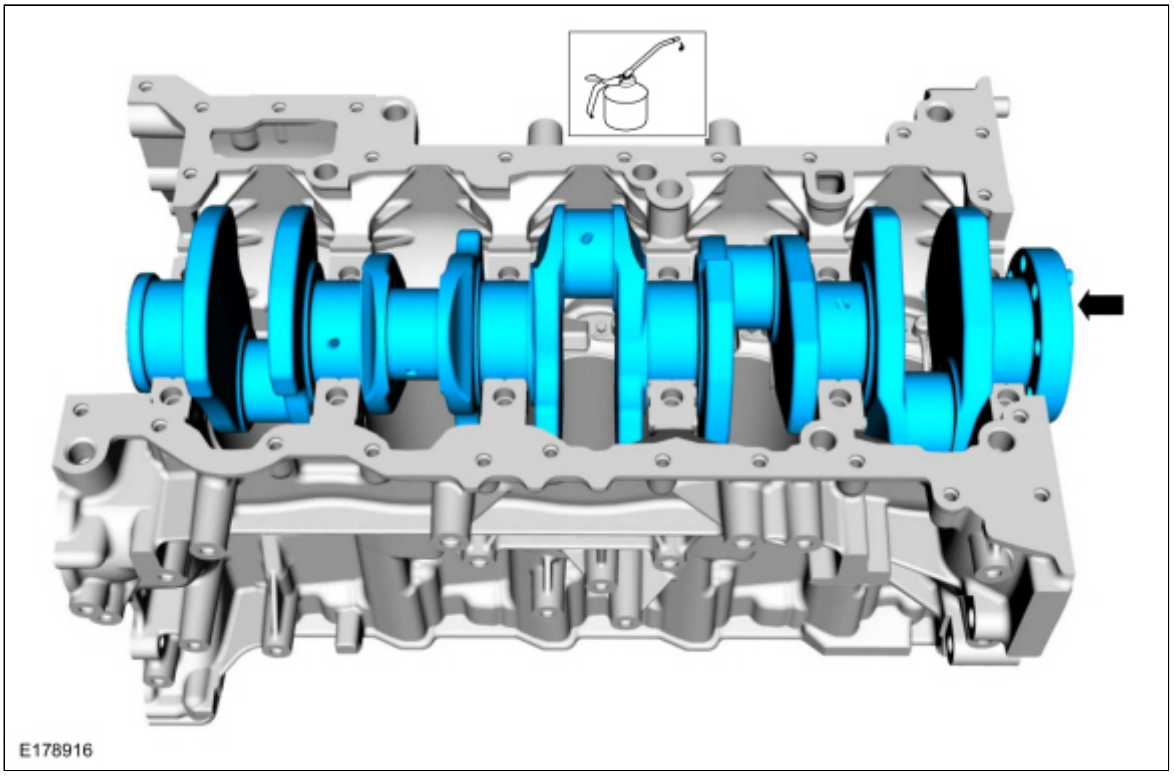
3. **NOTE:** *If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.*

   NOTE: *Verify that the hole in the bearings aligns with the oil gallery in the cylinder block.*

   Install the crankshaft upper bearings. Lubricate with clean engine oil
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)

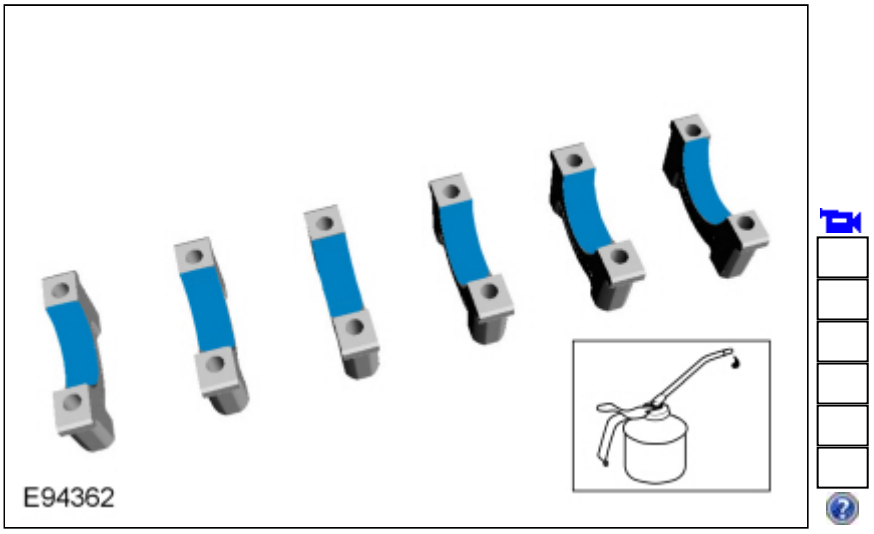


4. Lubricate with clean engine oil and install the crankshaft.
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



5. **NOTE:** *Make sure that these components are installed to the noted removal position.*

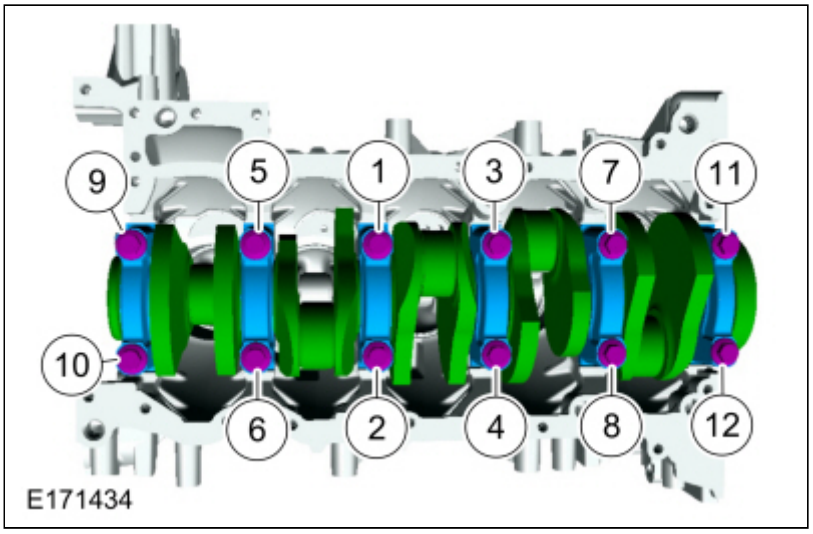
   Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



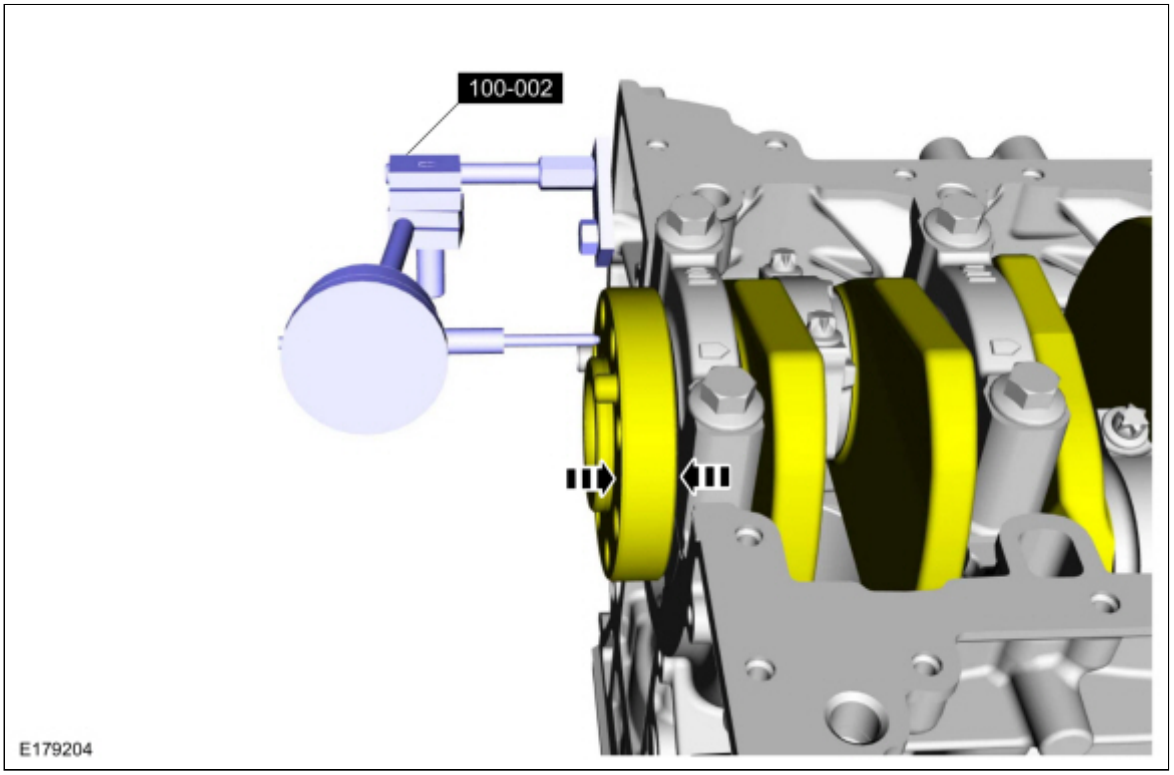
6. **NOTE:** *Make sure that these components are installed to the noted removal position.*

   NOTE: *Install all the bolts finger tight before final tightening.*

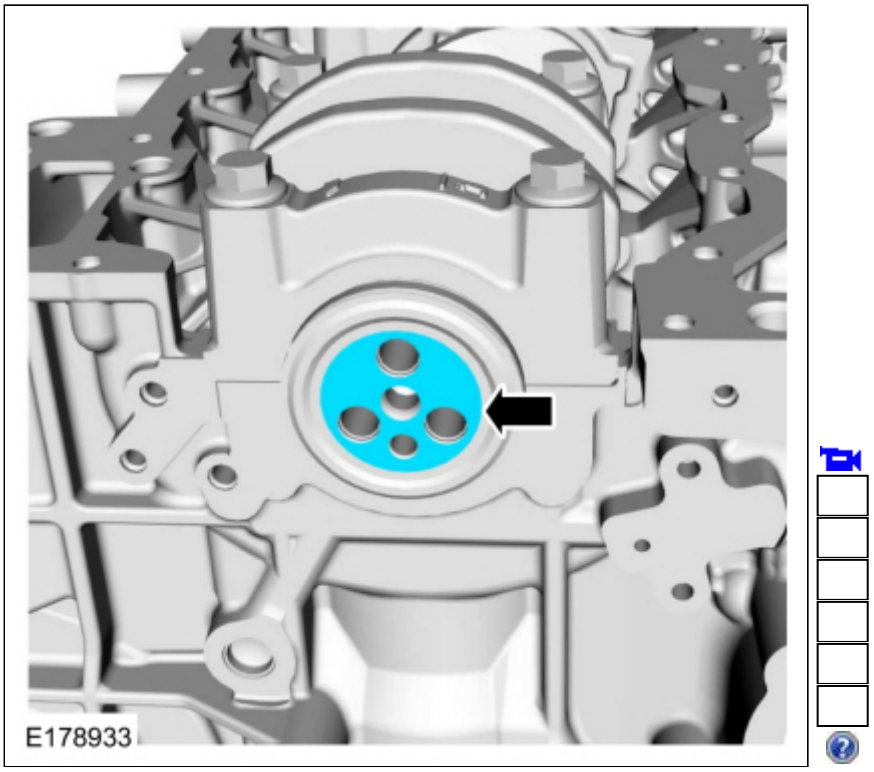
   Torque:
   Stage 1: 6 Nm
   Stage 2: 15 Nm
   Stage 3: 20 Nm
   Stage 4: 35 Nm
   Stage 5: 80 Nm
   Stage 6: 90°



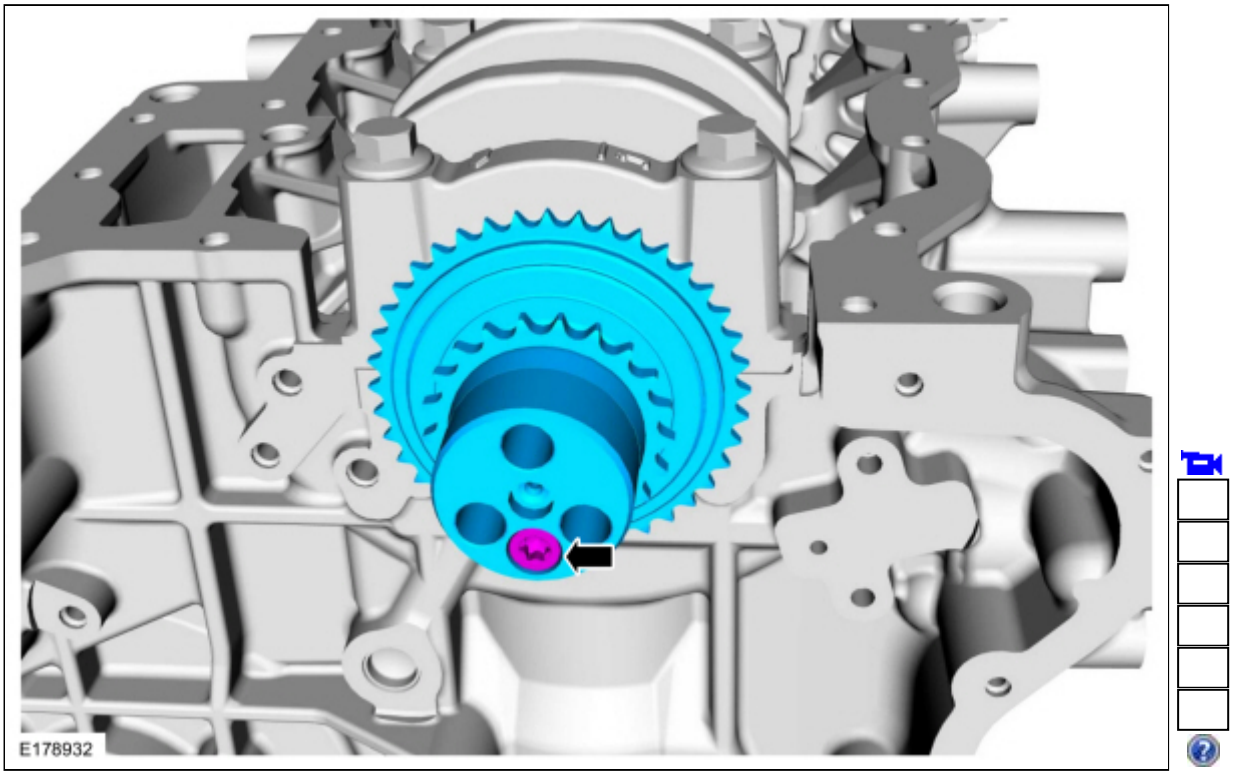
7. Using the special tool, check the crankshaft end play.
   Refer to: Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).
   Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



8. If necessary, position the crankshaft sprocket washer.



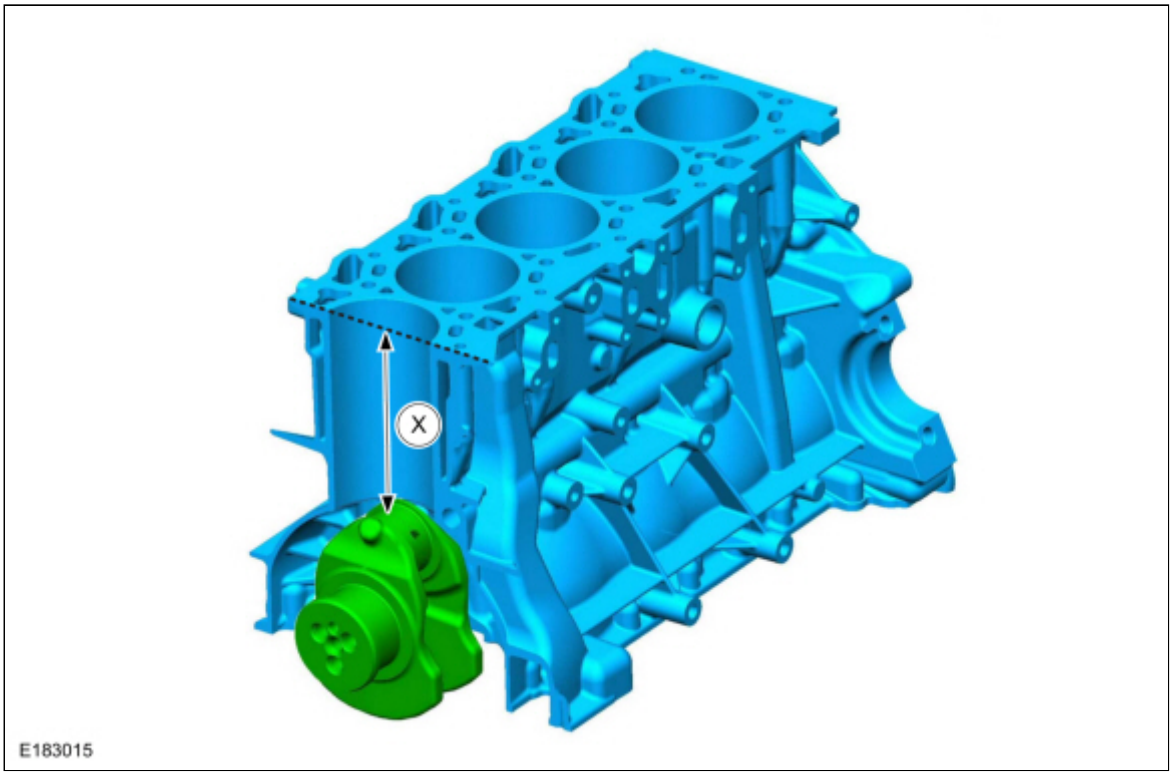
9. If necessary, install the crankshaft sprocket and bolt.
   Torque: 36 Nm



10. **NOTE:** *Care must be taken not to damage the piston cooling nozzles while doing the measuring.*

    NOTE: *Failure to have the crankshaft connecting rod journal at TDC (top dead center) may result in the incorrect selection of connecting rod.*

    Position the crankshaft connecting rod journal at TDC for the cylinder that is being measured. Using a commercially available Depth Gauge, measure the crankshaft connecting rod journal to cylinder block deck measurement on all cylinder bores.

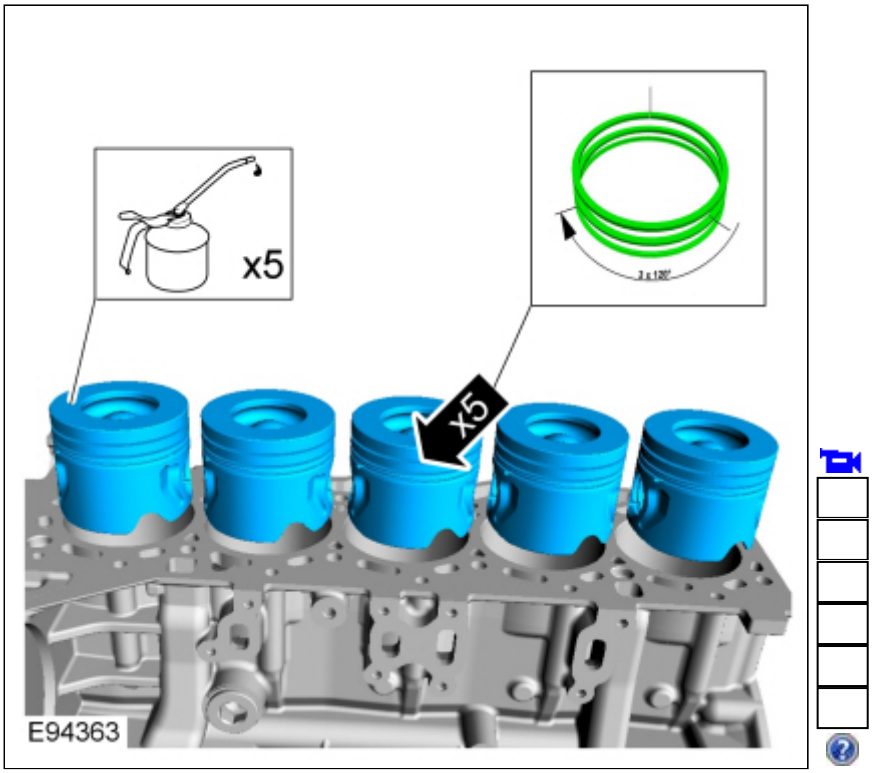


11. Select the appropriate connecting rod grade using the crank pin to cylinder head face value 'X' from the Connecting Rod Grade Selection table.
    Refer to: Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

12. If any of the connecting rods need to be replaced.
    Refer to: Piston (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Disassembly and Assembly of Subassemblies).

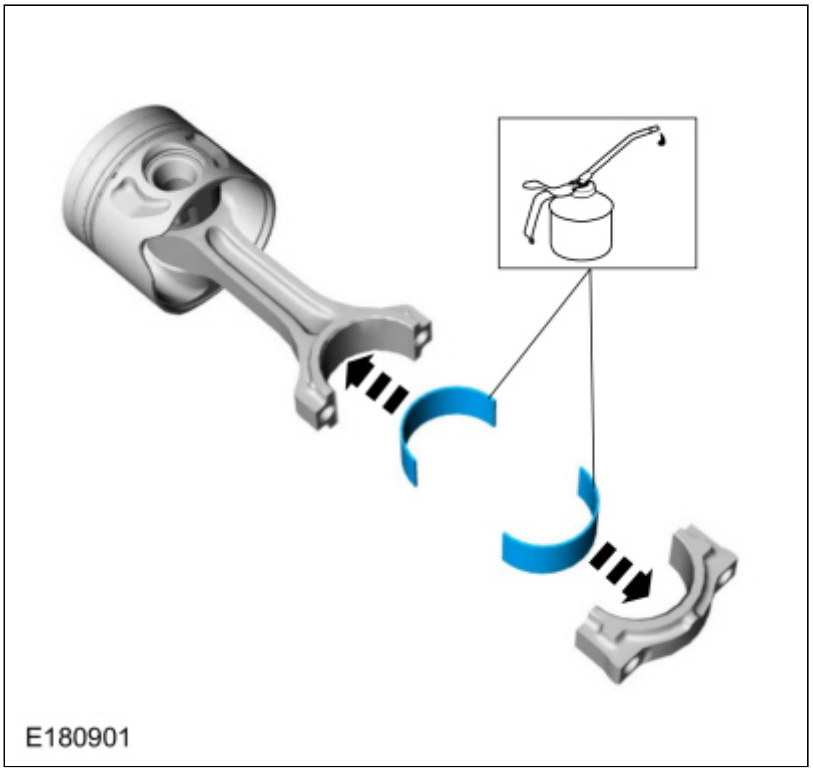
13. **NOTE:** *Make sure that these components are installed to the noted removal position.*

    Use the General Equipment: Piston Ring Compressor
    Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



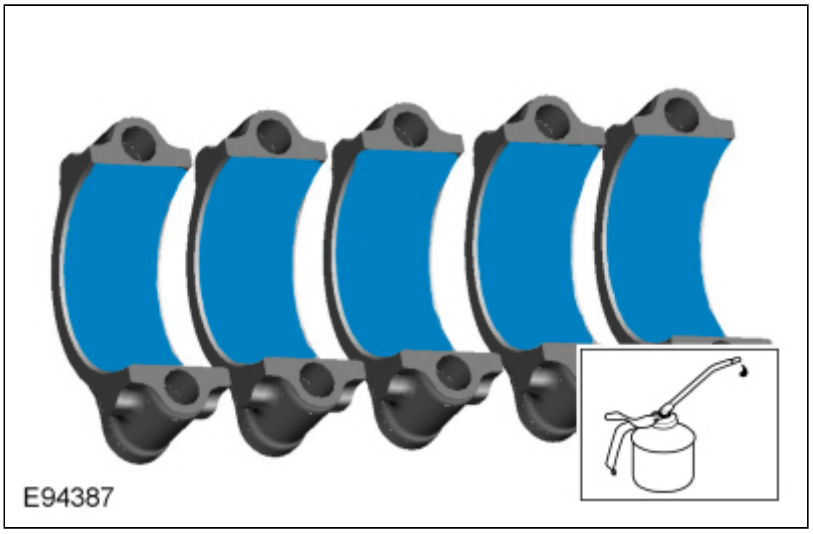
14. **NOTE:** *If reusing the connecting rod bearings, install them in their original positions and orientation as noted during disassembly.*

Install the connecting rod bearings. Lubricate with clean engine oil.
Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



15. **NOTE:** *Make sure that these components are installed to the noted removal position.*

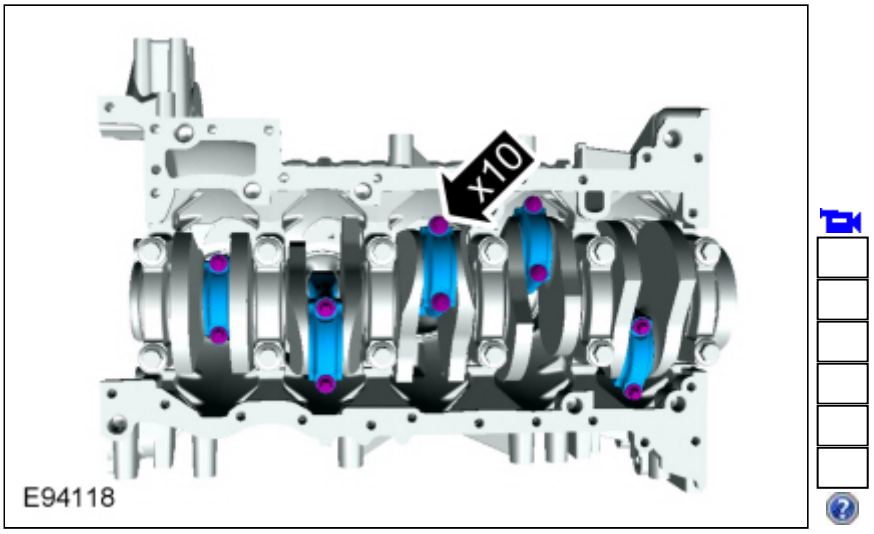
    Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



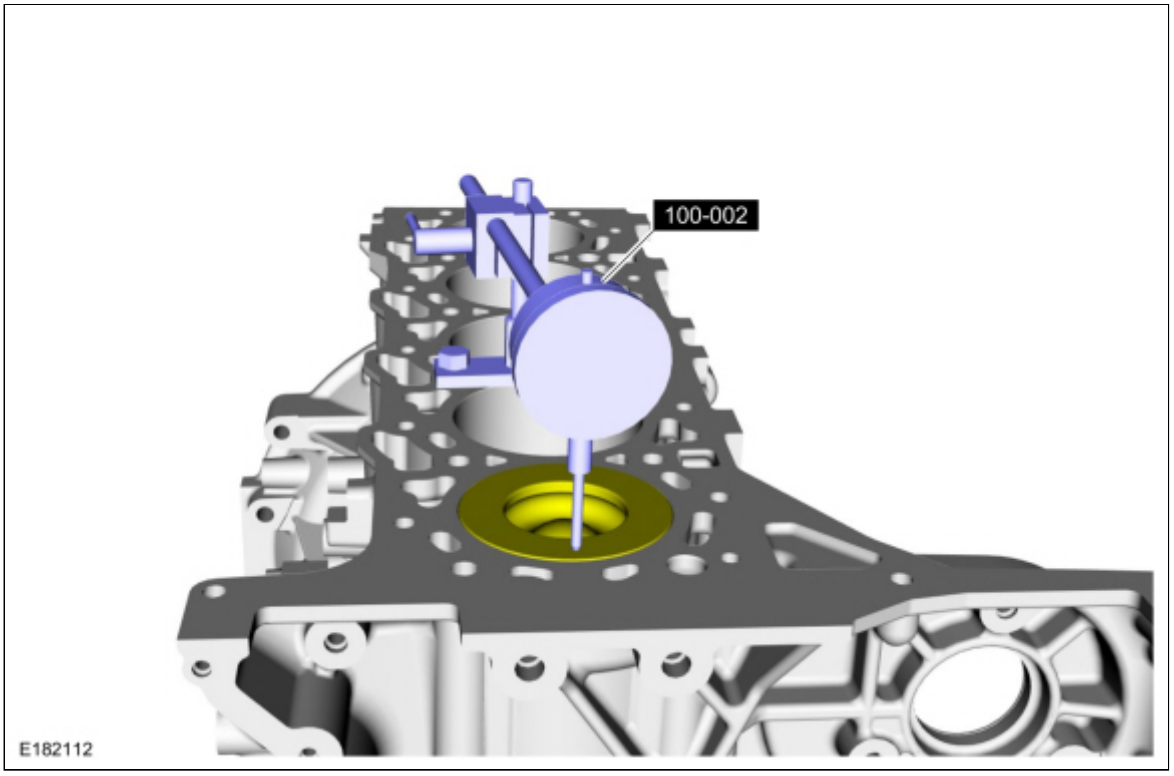
16. **NOTE:** *Make sure that these components are installed to the noted removal position.*

    NOTE: *Install all the bolts finger tight before final tightening.*

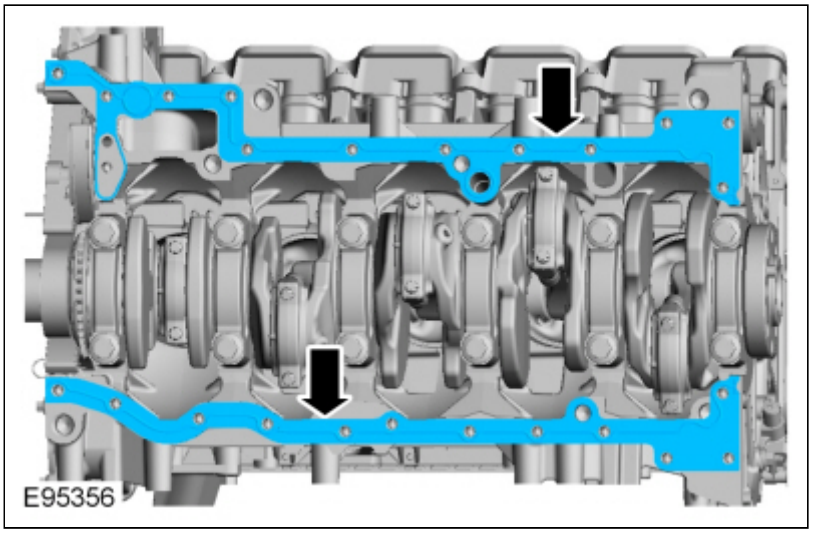
    Torque:
    Stage 1: 8 Nm
    Stage 2: 25 Nm
    Stage 3: 60 Nm
    Stage 4: 90°



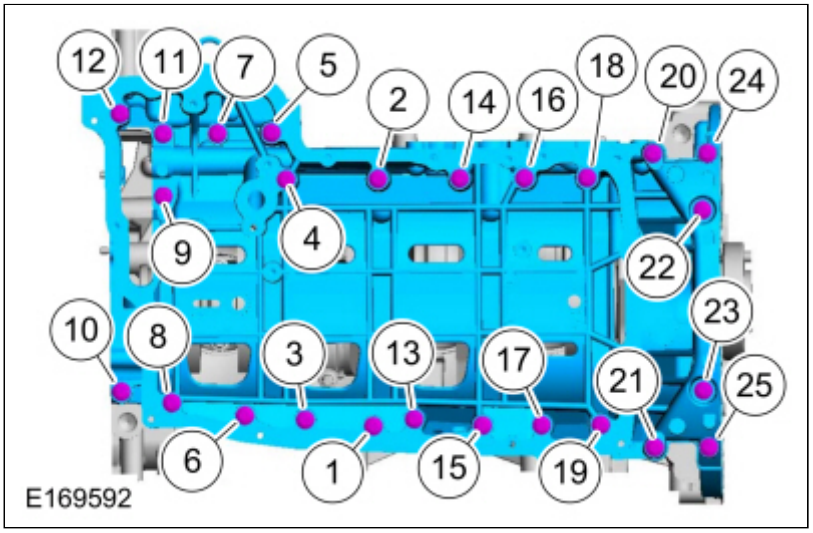
17. Using the special tool, check the piston protrusion. If not within specifications, repeat the connecting rod length calculation.
    Refer to: Specifications (303-01B) .
    Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



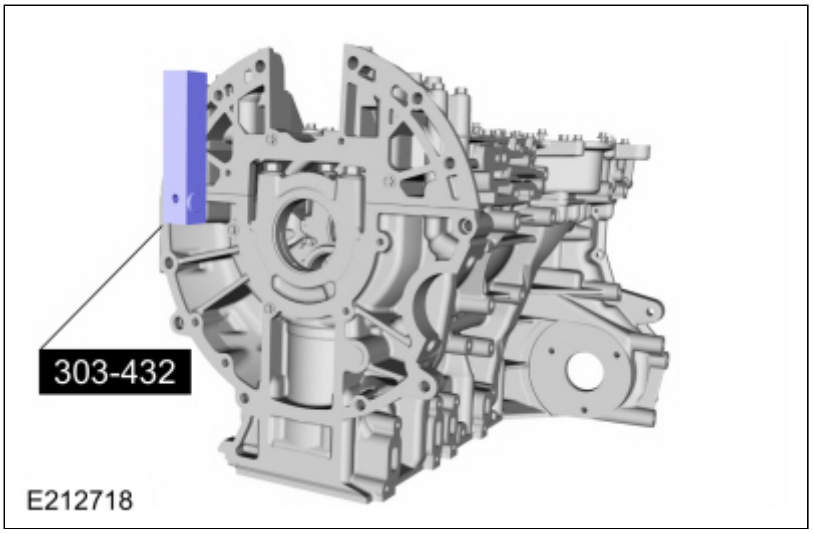
18.



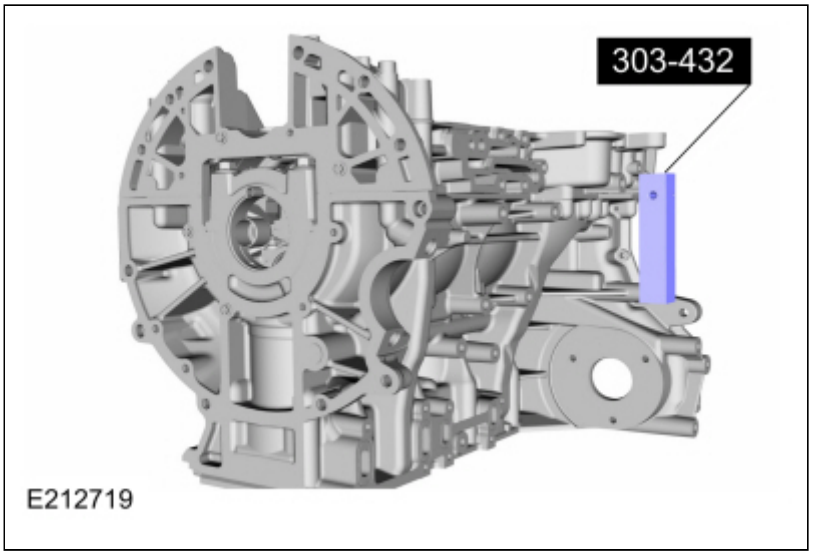
19. **NOTE:** *Only tighten the bolts finger tight at this stage.*



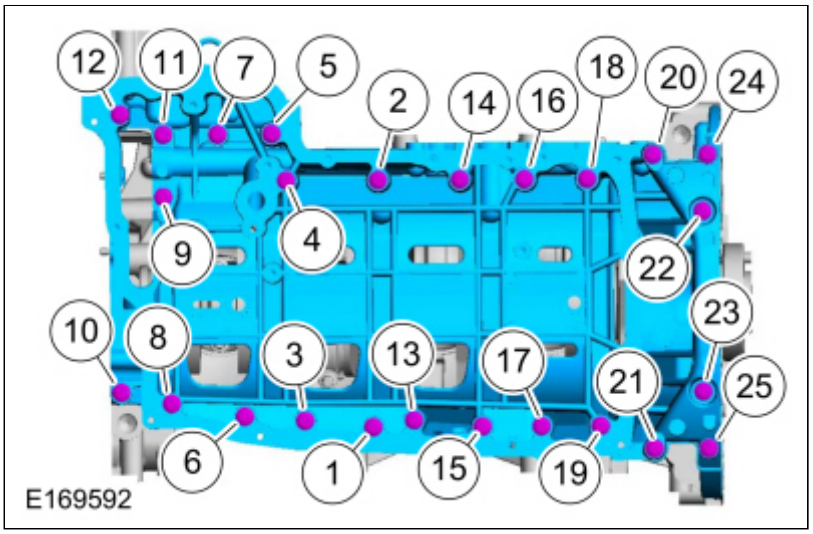
20. Using a straight edge, align the rear surface of the ladderframe with the rear surface of the engine block. The rear clearance does not exceed 0.05 mm gap.
    Use Special Service Tool: 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion).



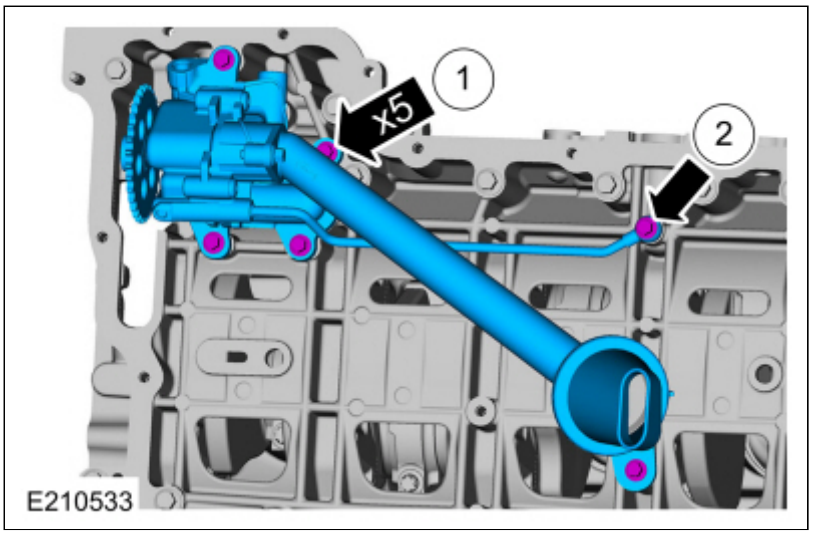
21. Using a straight edge, align the side surface of the ladderframe with the side surface of the engine block. The side clearance does not exceed 0.01mm overlap.
    Use Special Service Tool: 303-432 Holding Fixture, Dial Indicator Gauge (Cylinder Liner Protrusion).



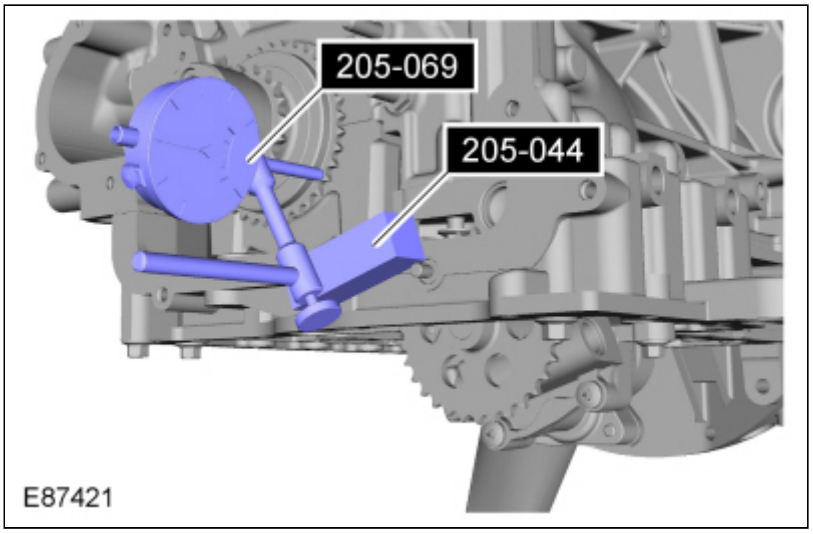
22. *Torque*:
    Stage 1: 6 Nm
    Stage 2: 23 Nm



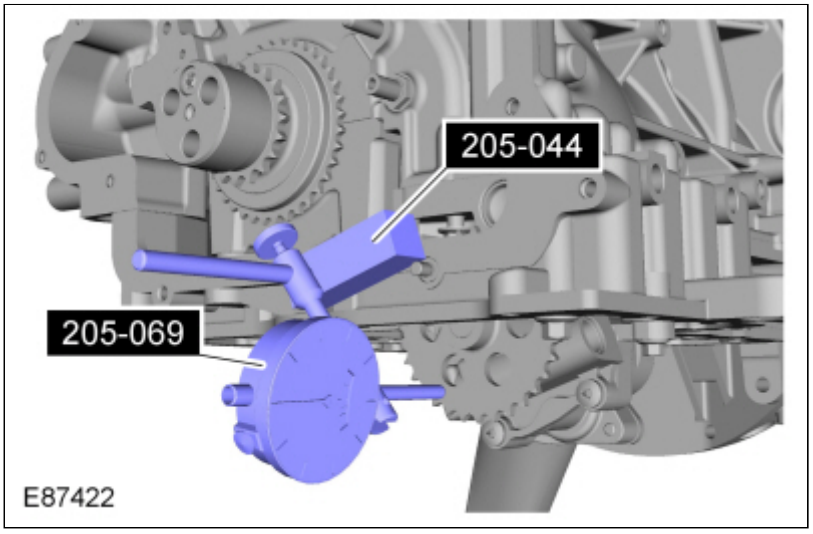
23. **NOTE:** *Only tighten the bolts finger tight at this stage.*



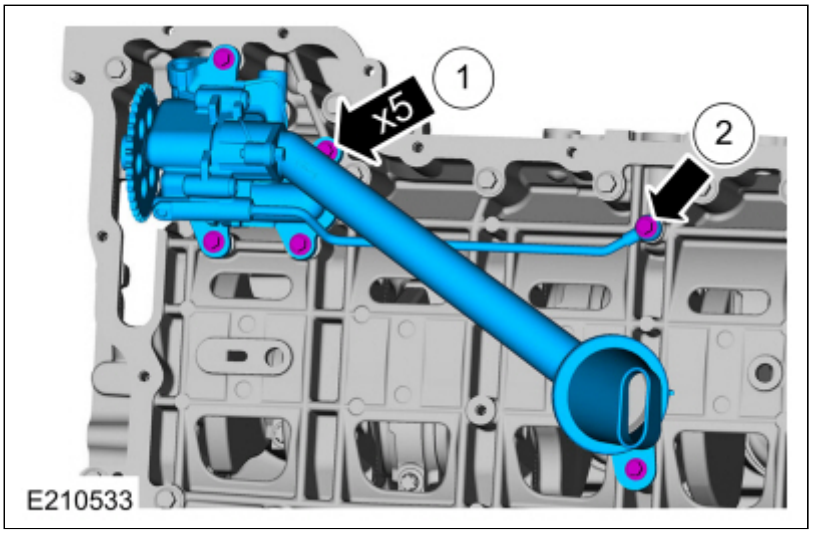
24. Take a reference measurement from the front face of the crankshaft sprocket.
    Use Special Service Tool: 205-044 Holding Fixture, Dial Indicator Gauge. , 205-069 Dial Indicator Gauge (Metric).



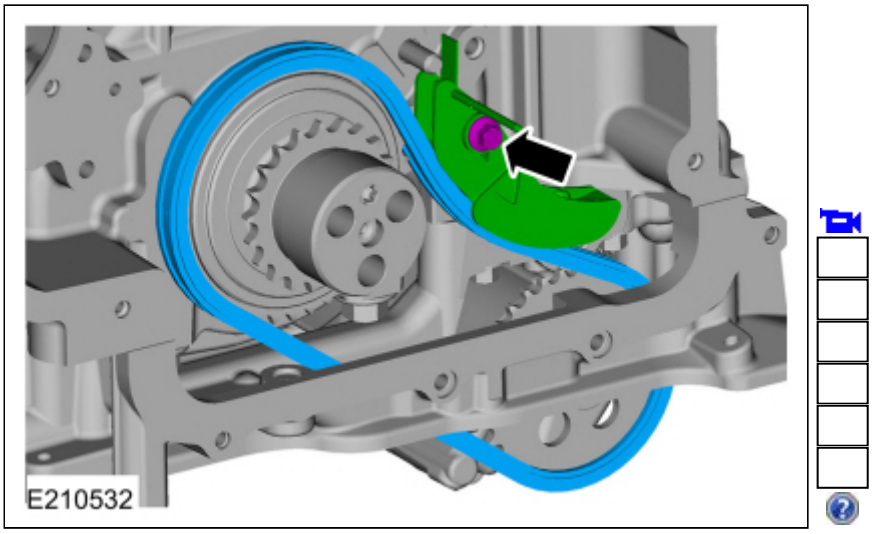
25. Take measurements at two different points on the oil pump sprocket and align the oil pump sprocket.
    Use Special Service Tool: 205-044 Holding Fixture, Dial Indicator Gauge. , 205-069 Dial Indicator Gauge (Metric).



26. *Torque*:
    1: 10 Nm
    2: 13 Nm

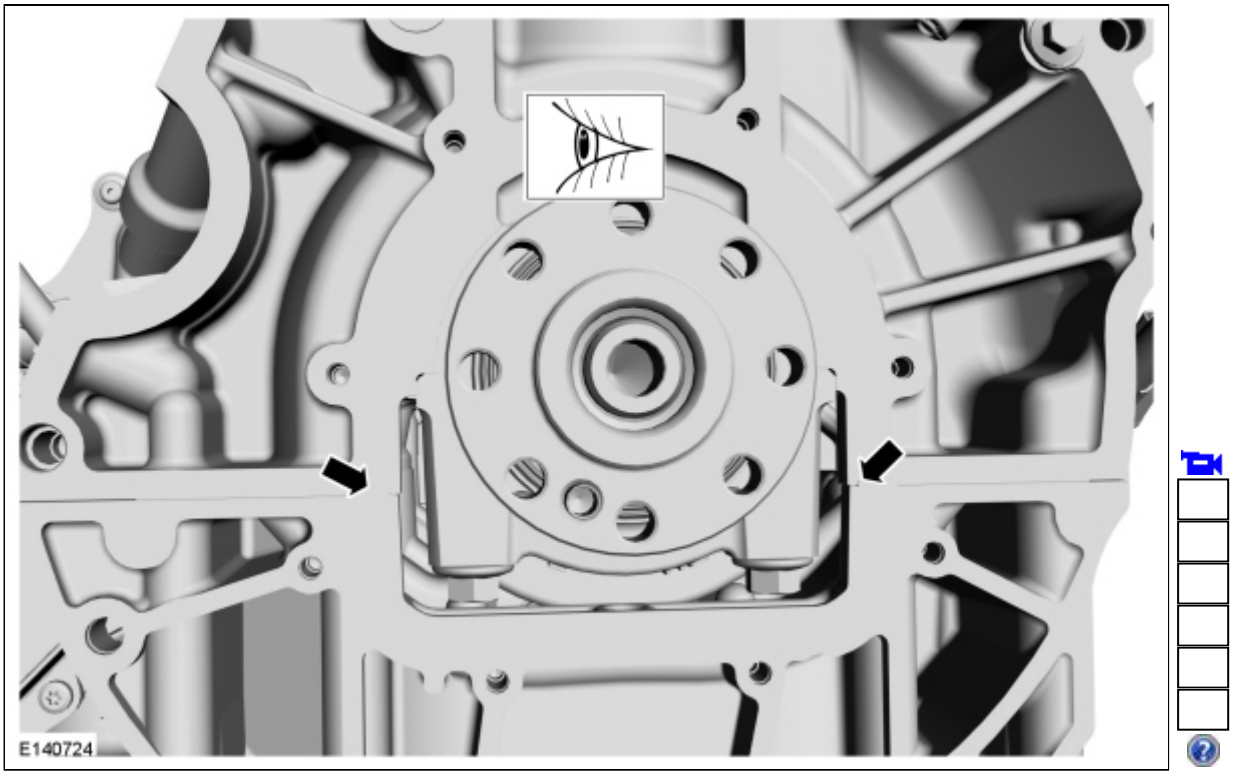


27. *Torque*: 10 Nm

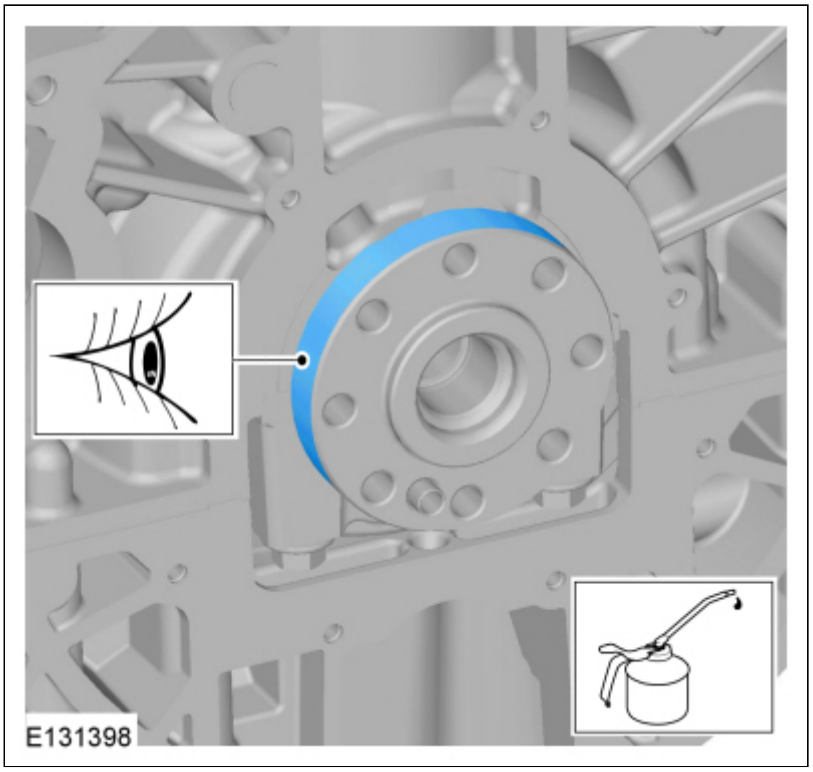


28. **NOTE:** *A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.*

    - Clean the area on the engine before installing a new crankshaft rear seal carrier.
    - Check the two foam pads are located as shown on the ladder frame gasket.



29. *Material*: Engine Oil - SAE 5W-30 (WSS-M2C913-C)

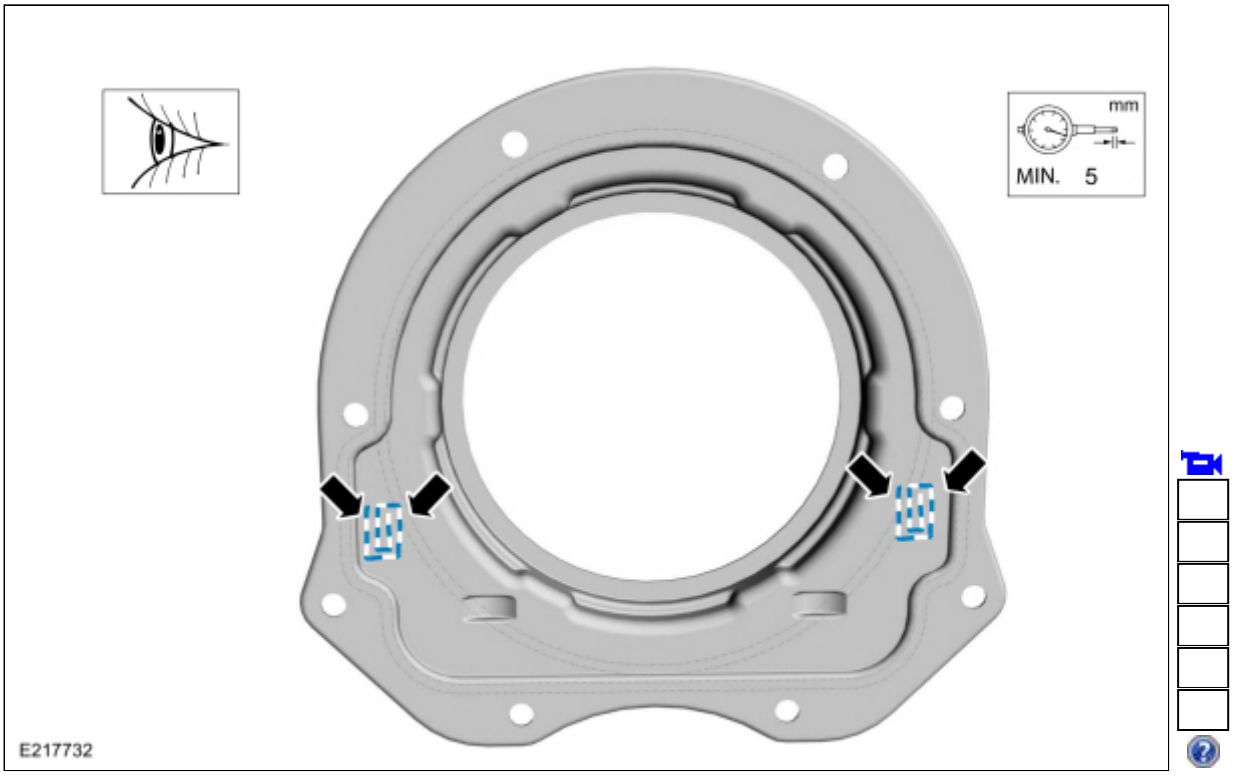


30. **NOTE:** *Install new crankshaft rear seal carrier with in five minutes after applying the recomended sealent. Failure to follow this instruction may result in damage to the vehicle.*

    NOTE: *Do not add any more than the specified quantity of sealant or add the sealant anywhere other than the area shown.*

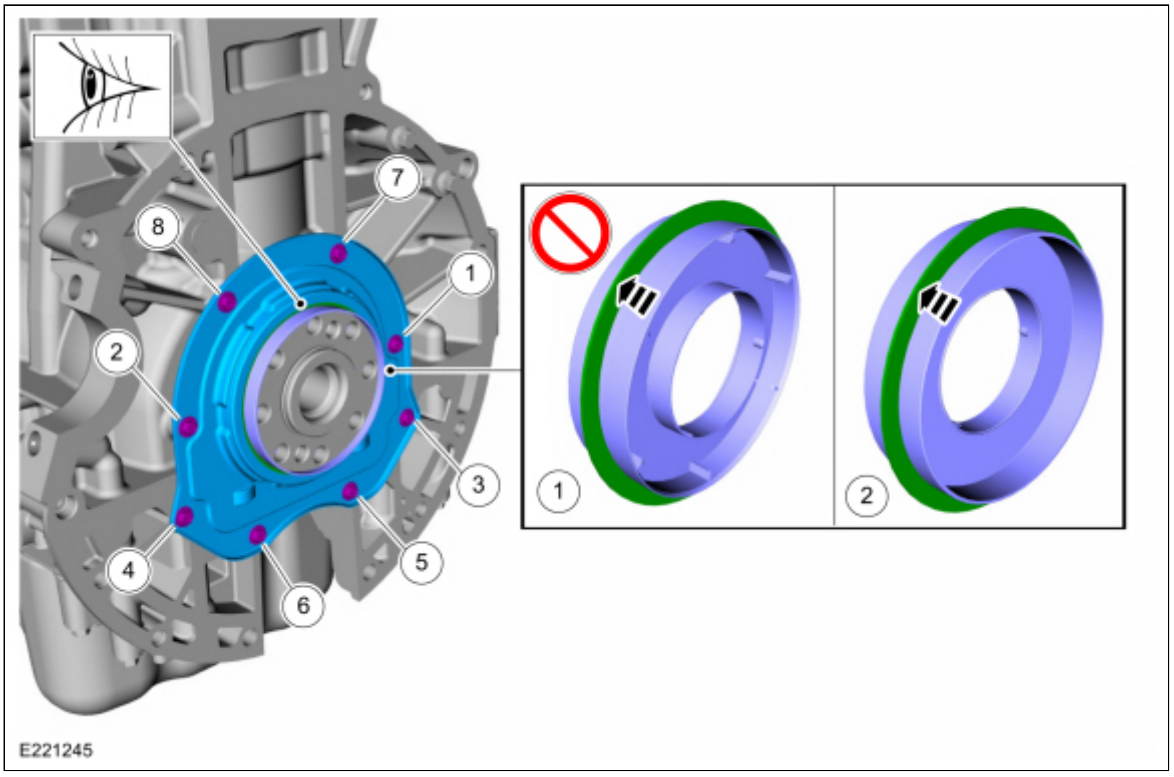
    NOTE: *If the foam pads are not present on inspection, fill the square areas shown with 75% of sealant.*

    Material: Silicone Sealant (WSE-M4G323-A4)



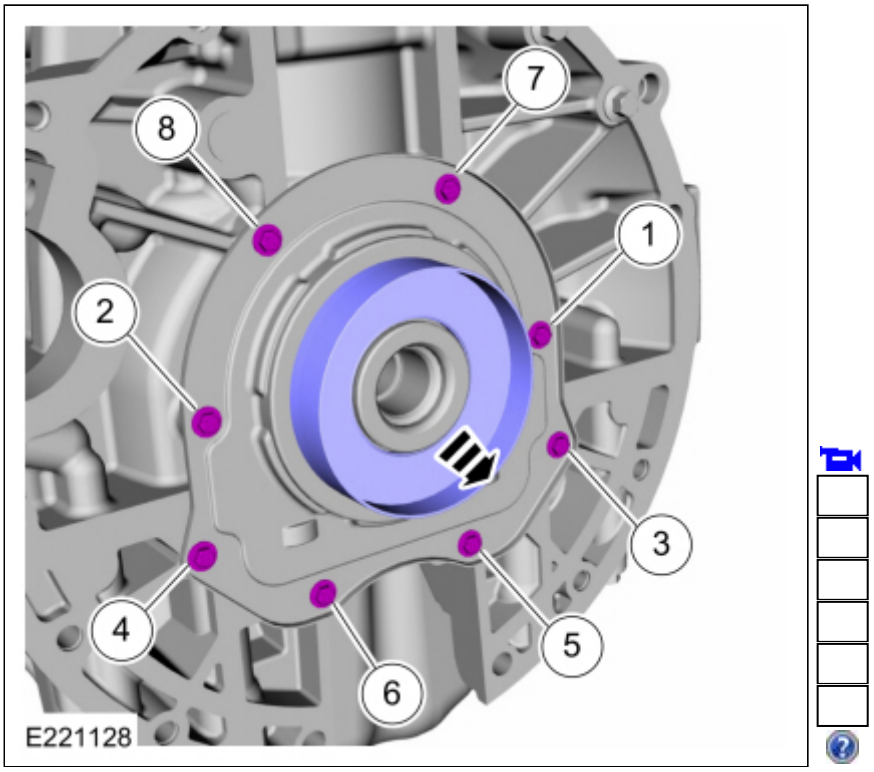
31. **NOTICE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.**

    NOTE: *Initially hand tighten the fasteners.*



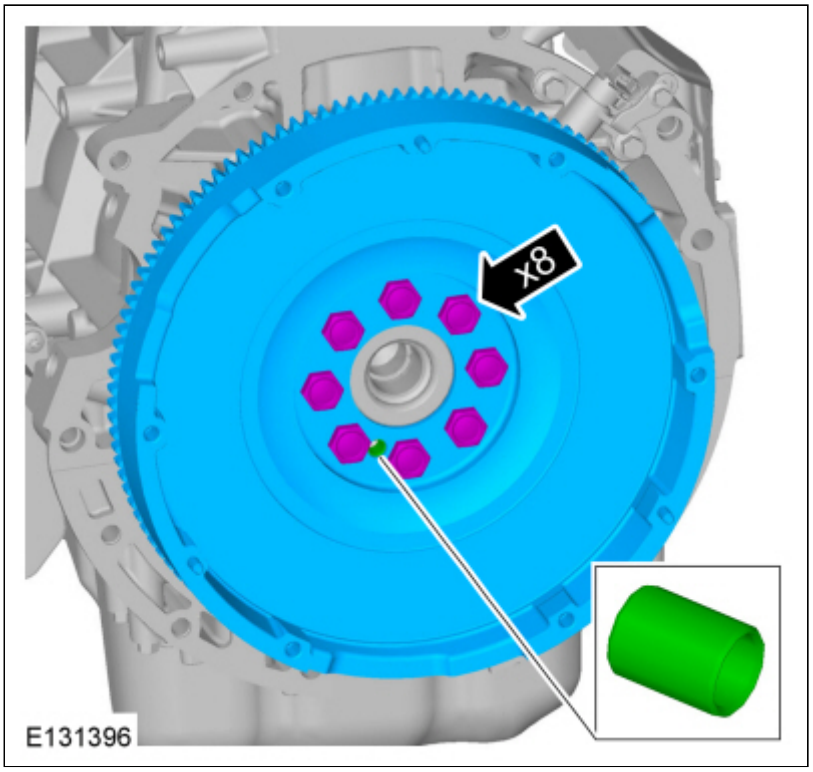
32. **NOTE:** *New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.*

Torque:
:
Stage 1: 5 Nm
Stage 2: 10 Nm



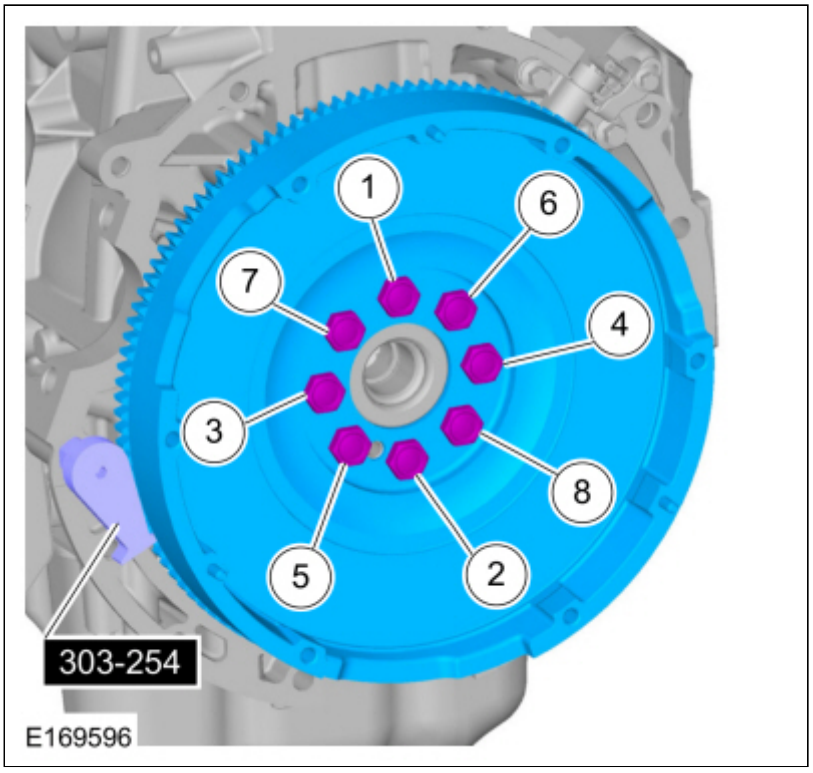
33. **NOTE:** *Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.*

Initially hand tighten the fasteners.

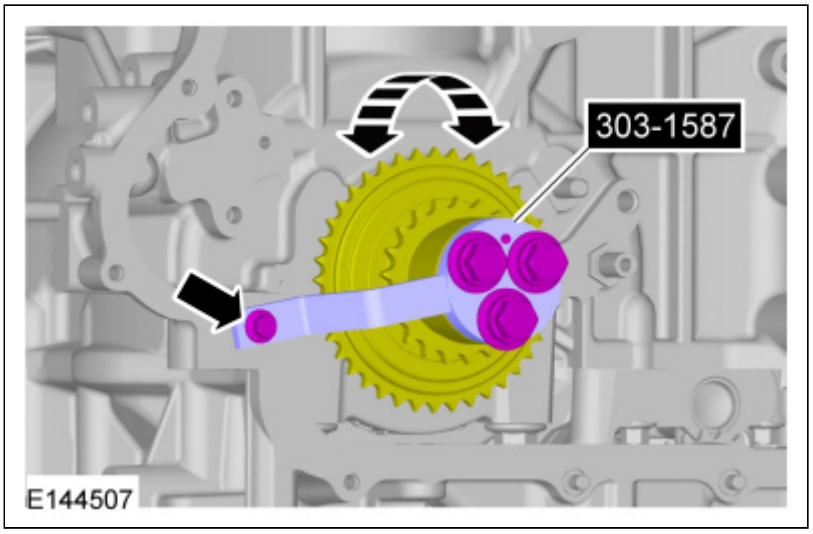


34. **NOTICE: Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.**

    Use Special Service Tool: 303-254 Locking Tool, Flywheel.
    Torque:
    Stage 1: 25 Nm
    Stage 2: 40 Nm
    Stage 3: 45°

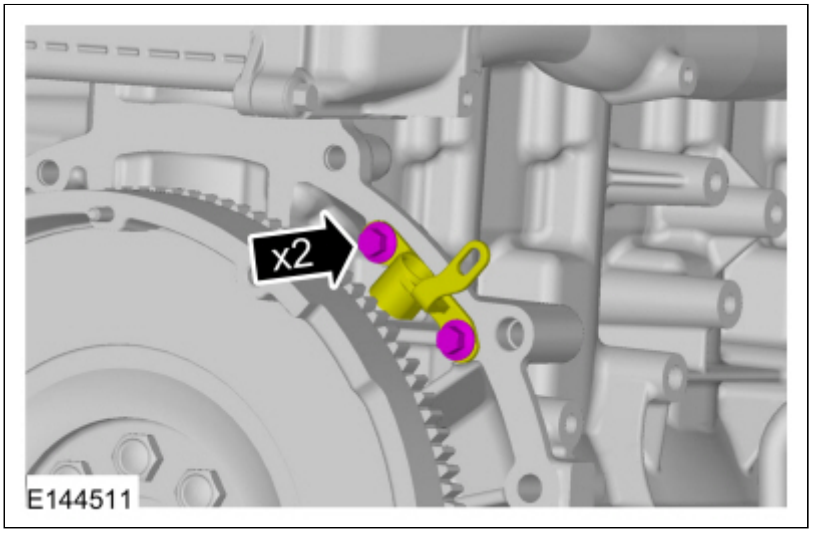


35. Use Special Service Tool: 303-1587 Timing Tool, Crankshaft.



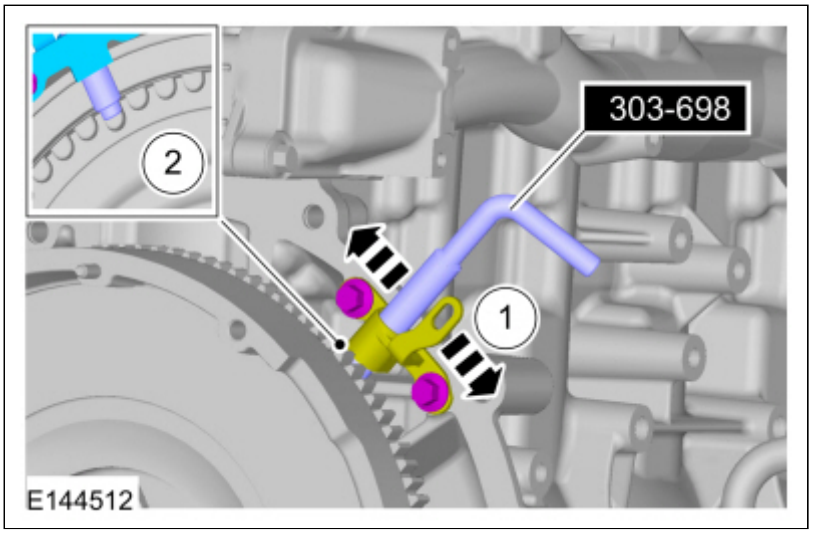
Vehicles with manual transmission

36. Initially hand tighten the fasteners.

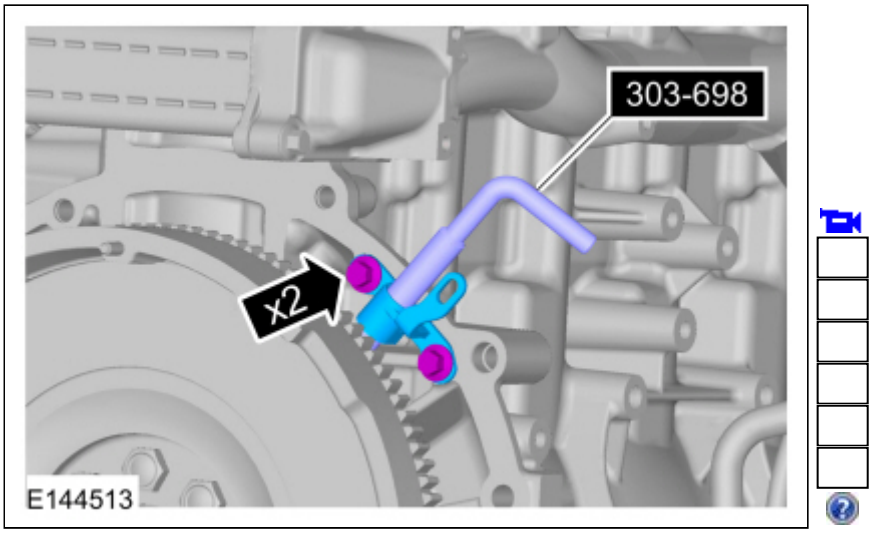


37. **NOTE:** *Make sure that the special tool is located in the flywheel timing slot.*

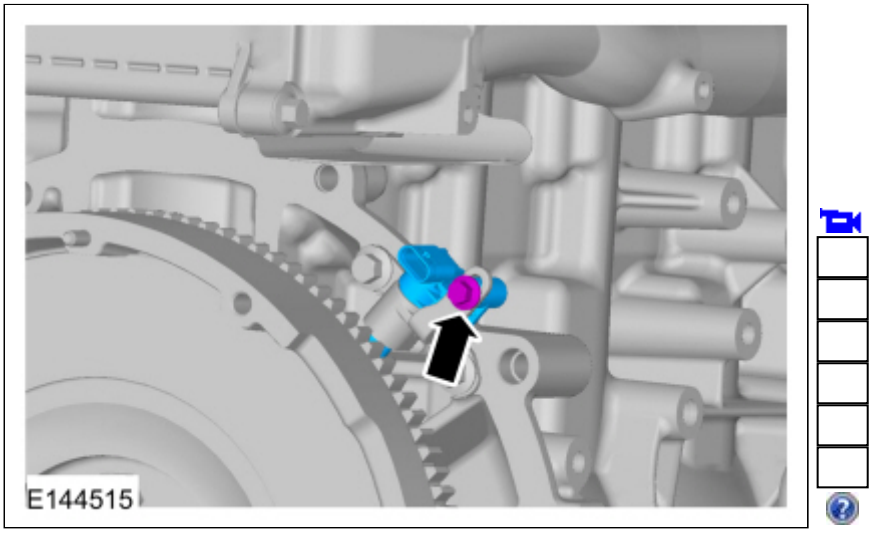
    Use Special Service Tool: 303-698 Timing Tool, Crankshaft.



38. Tighten bolts before removing tool.
    Remove Special Service Tool: 303-698 Timing Tool, Crankshaft.
    Torque: 20 Nm

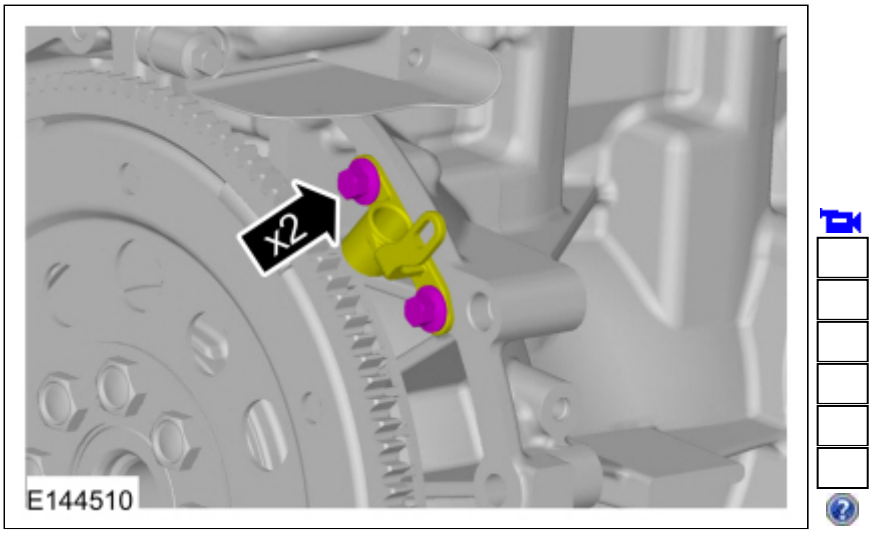


39. *Torque*: 8 Nm



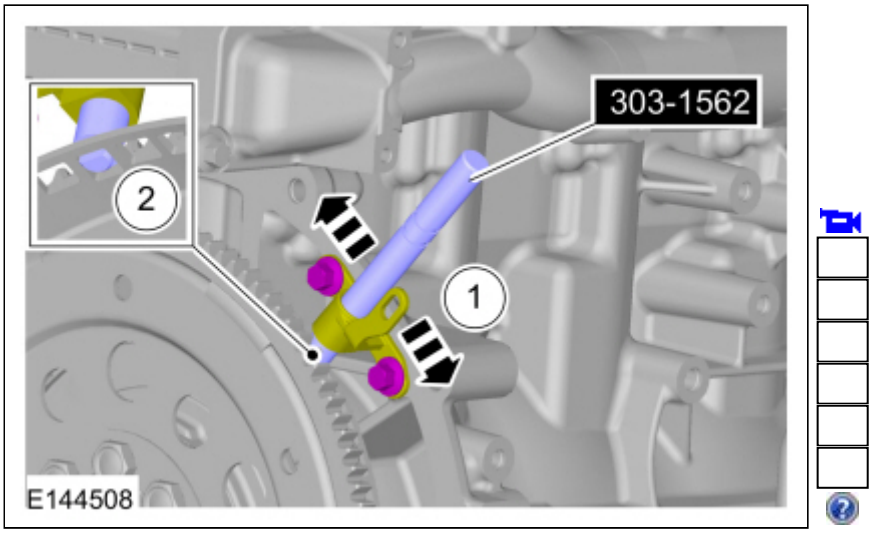
Vehicles with automatic transmission

40. Initially hand tighten the fasteners.
    Use Special Service Tool: 303-698 Timing Tool, Crankshaft.

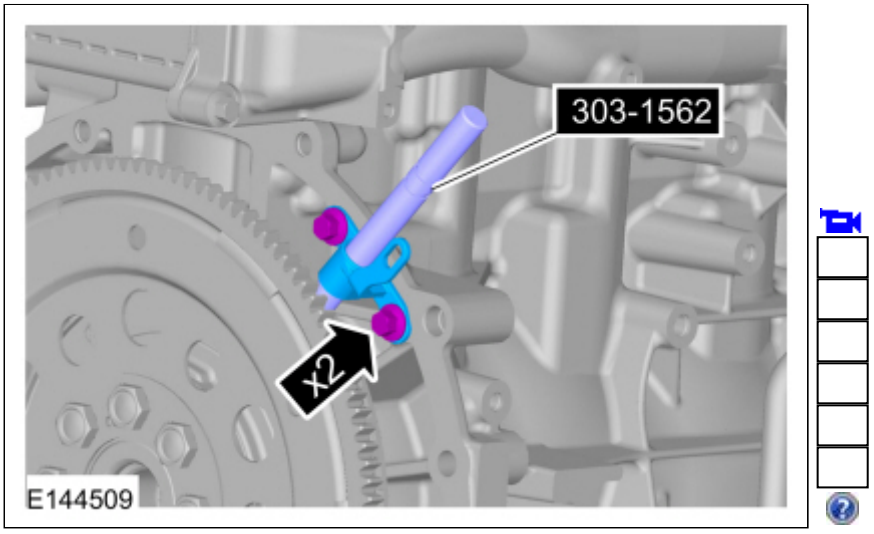


41. **NOTE:** *Make sure that the special tool is located in the flexplate timing slot.*

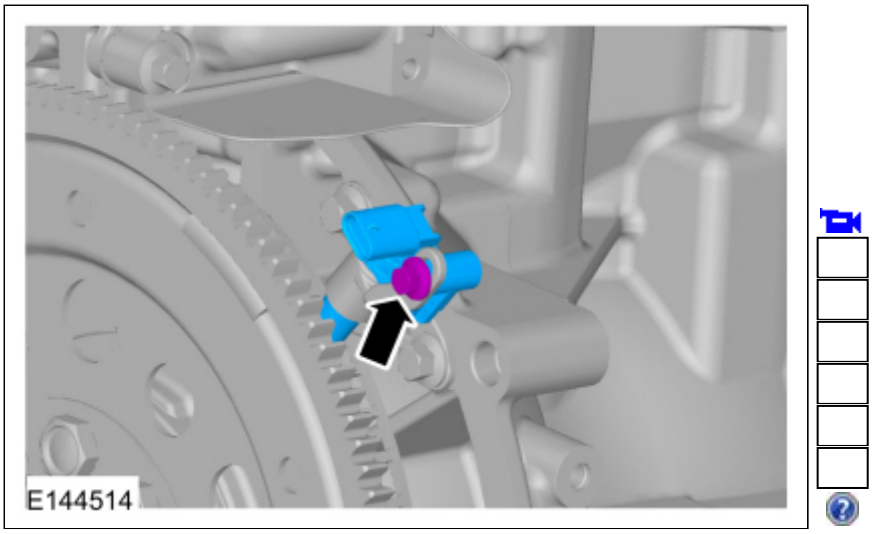
    Use Special Service Tool: 303-1562 Timing Tool.



42. Tighten bolts before removing tool.
    Remove Special Service Tool: 303-1562 Timing Tool.
    Torque: 20 Nm

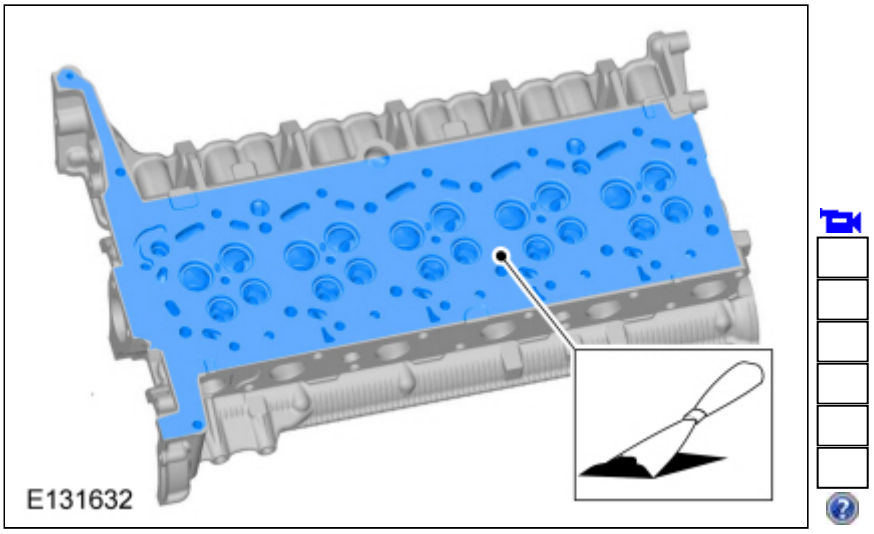


43. *Torque*: 8 Nm



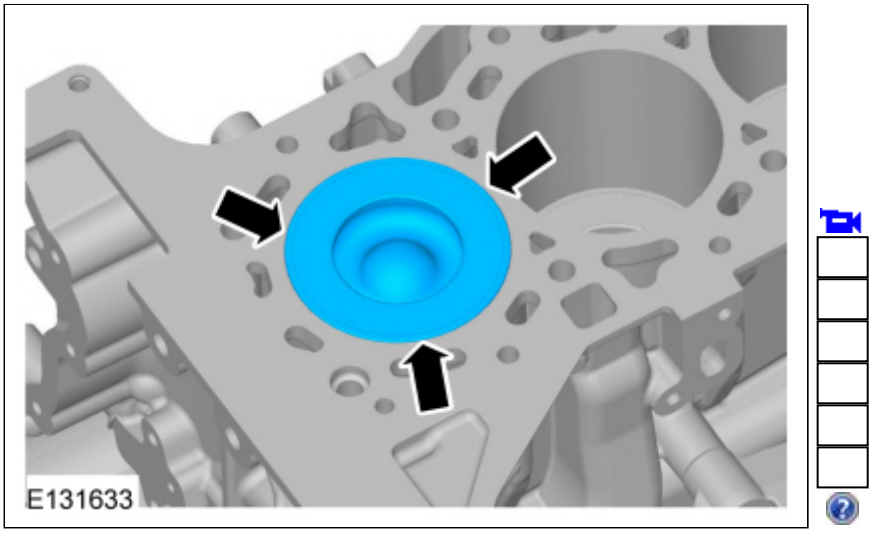
All vehicles

44. **WARNING: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**



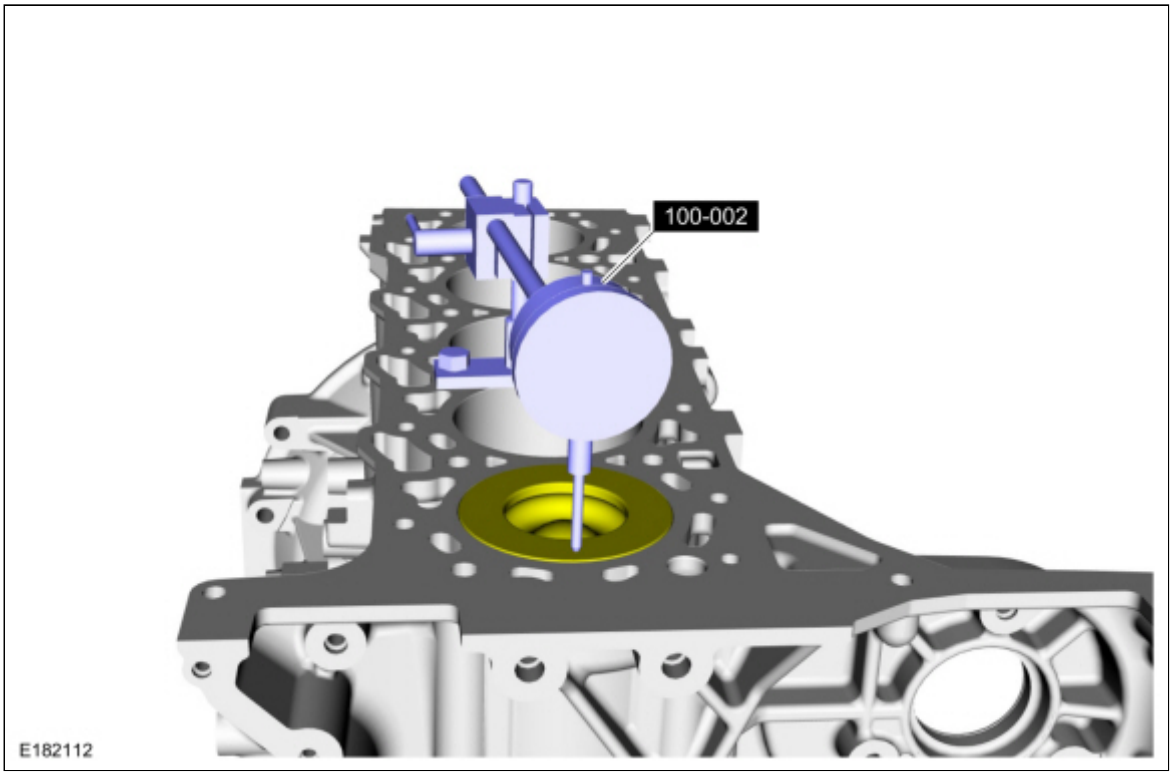
45. **NOTE:** *Measure the piston protrusion of each cylinder at top dead center (TDC).*

    Measure the distance between the piston crown and the cylinder block at the points indicated.



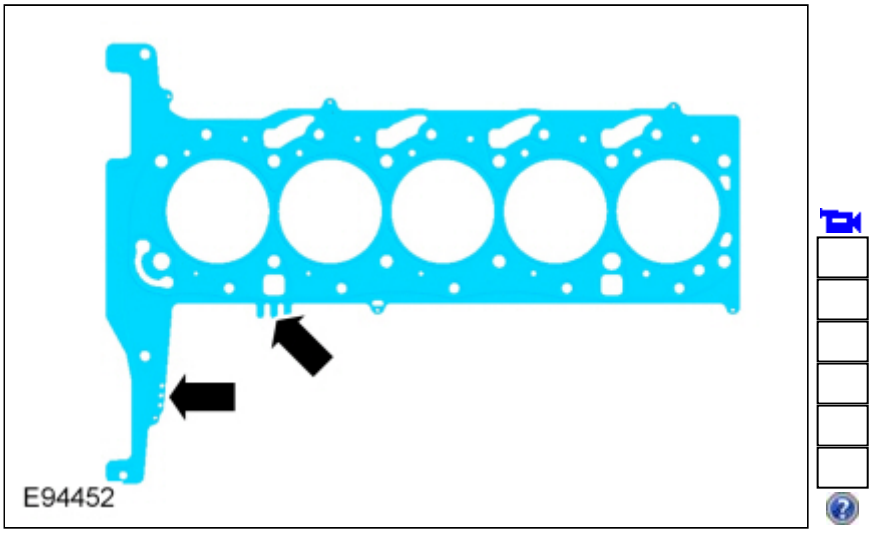
46. **NOTE:** *The largest measurement determines the choice of the cylinder head gasket.*

    - Using the special tools, measure the piston protrusion.
      Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.

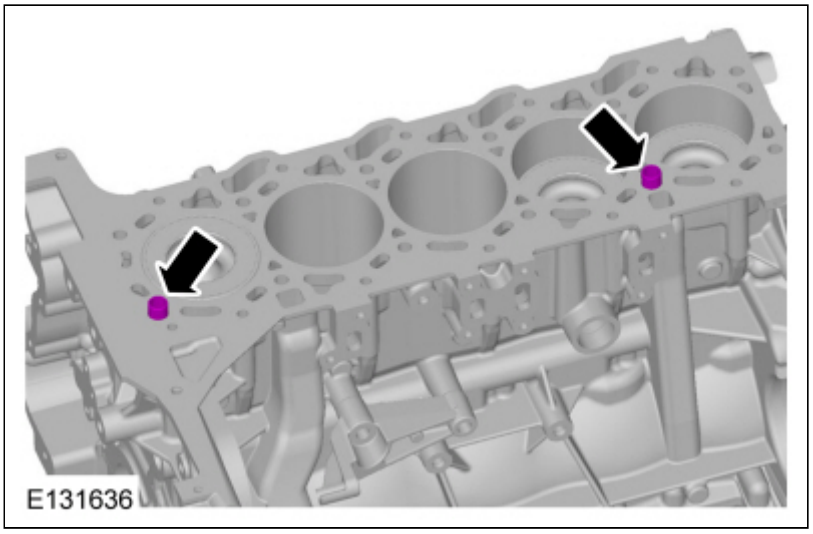


47. Determine the cylinder head gasket.
    Refer to: Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

48. **NOTE:** *Make sure that a new component is installed.*

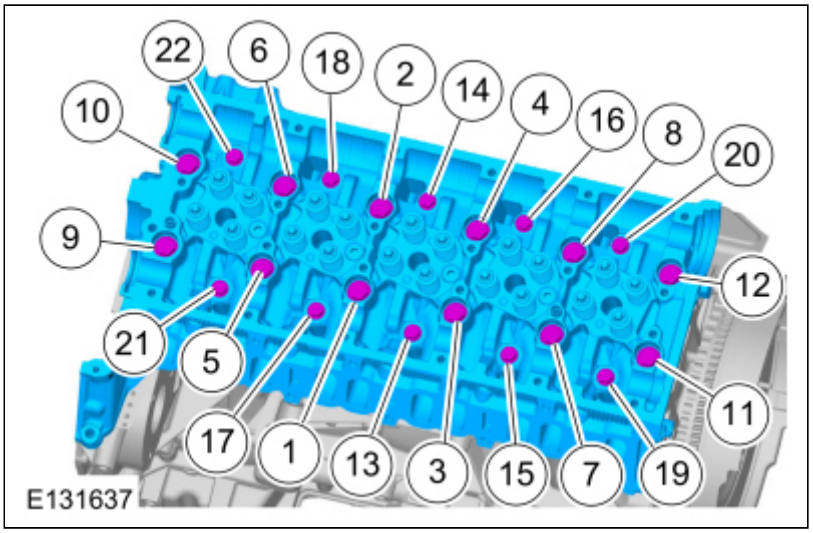


49.

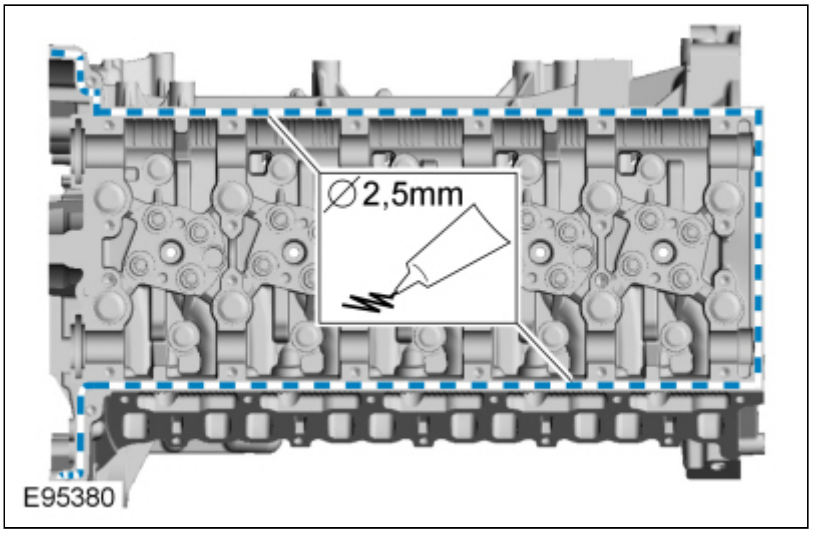


50. **NOTICE: Make sure that new cylinder head bolts are installed.**

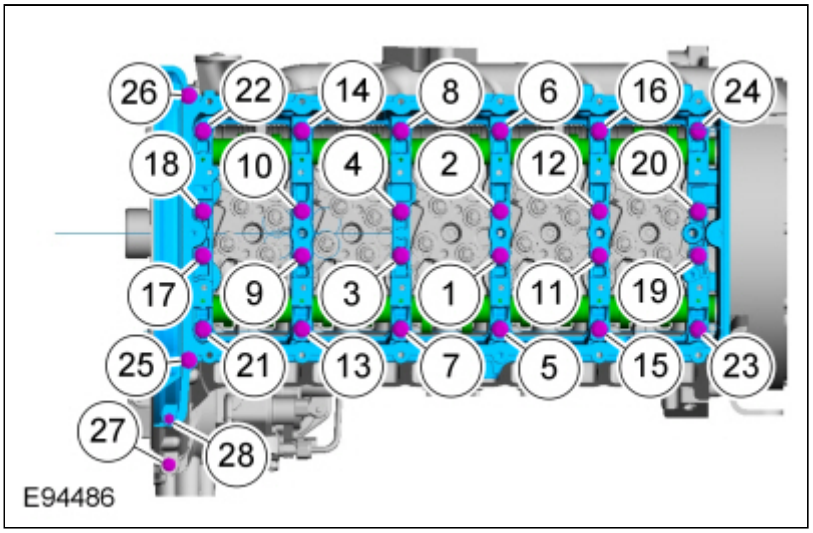
Torque:
Stage 1: 1-12: 10 Nm
Stage 2: 13-22: 5 Nm
Stage 3: 1-12: 20 Nm
Stage 4: 13-22: 10 Nm
Stage 5: 1-12: 35 Nm
Stage 6: 13-22: 20 Nm
Stage 7: 1-12: 45 Nm
Stage 8: 13-22: 26 Nm
Stage 9: 1-12: 90°
Stage 10: 13-22: 90°
Stage 11: 1-12: 90°
Stage 12: 13-22: 90°



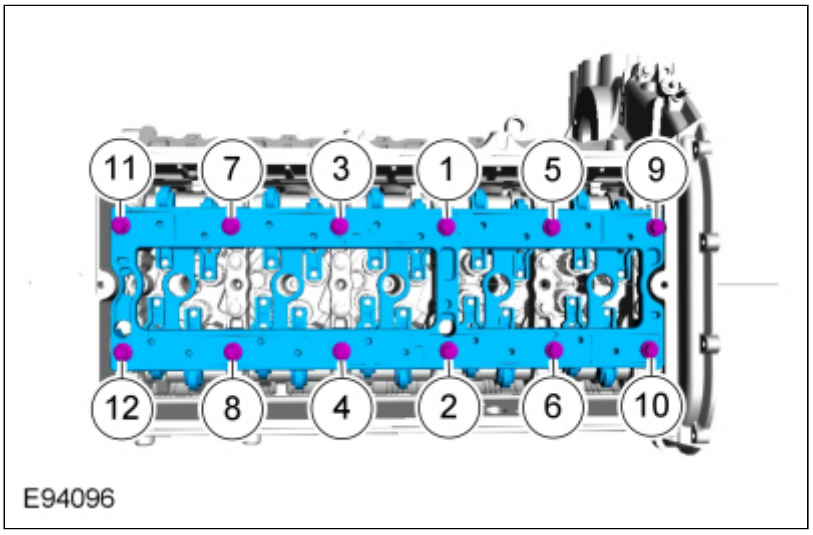
51. *Material*: Silicone Sealant (WSE-M4G323-A4)



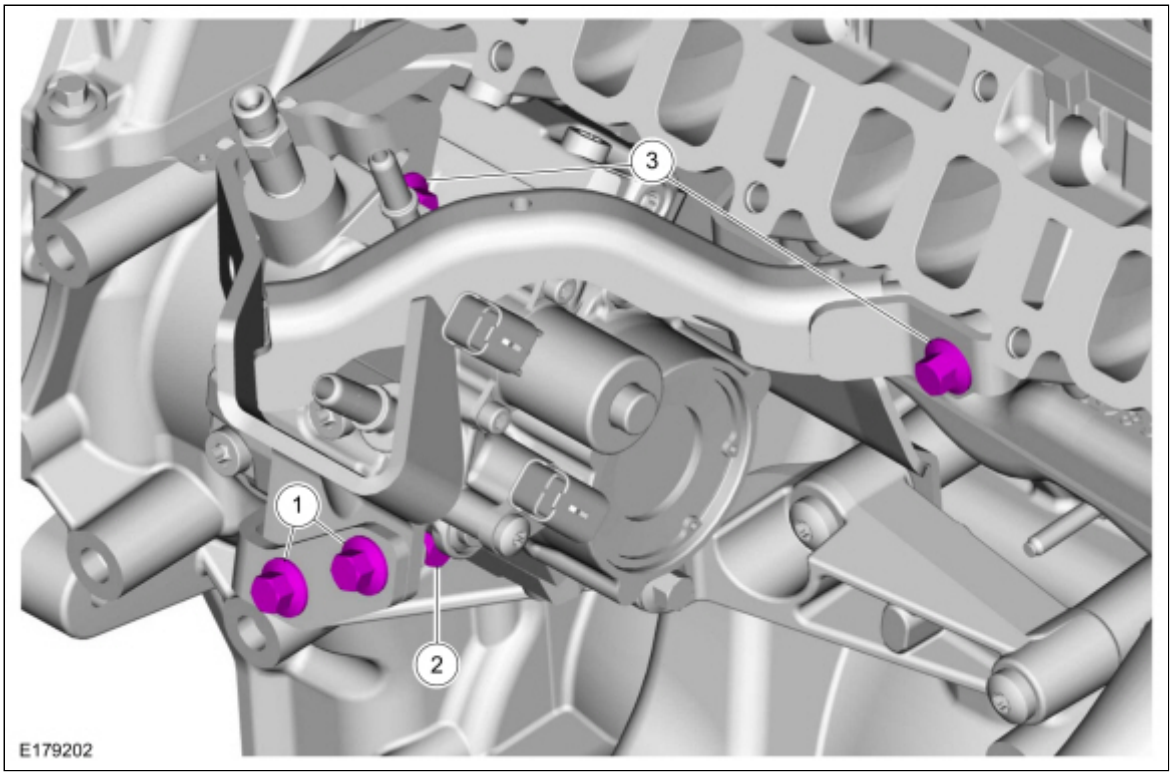
52. *Torque*:
    Stage 1: 1-26: 7 Nm
    Stage 2: 27-28: 4 Nm
    Stage 3: 1-26: 15 Nm
    Stage 4: 27-28: 6 Nm
    Stage 5: 1-26: 23 Nm
    Stage 6: 27-28: 10 Nm



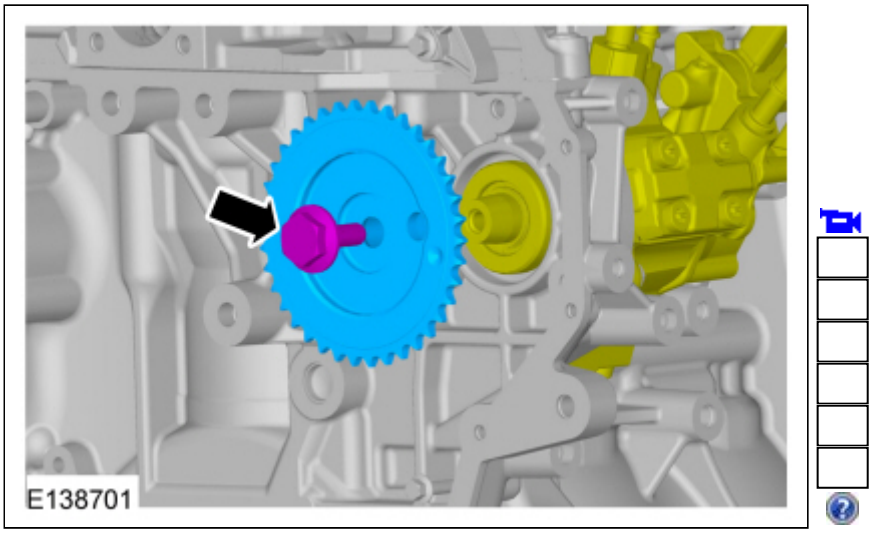
53. *Torque*:
    Stage 1: 5 Nm
    Stage 2: 8 Nm
    Stage 3: 10 Nm
    Stage 4: 45°



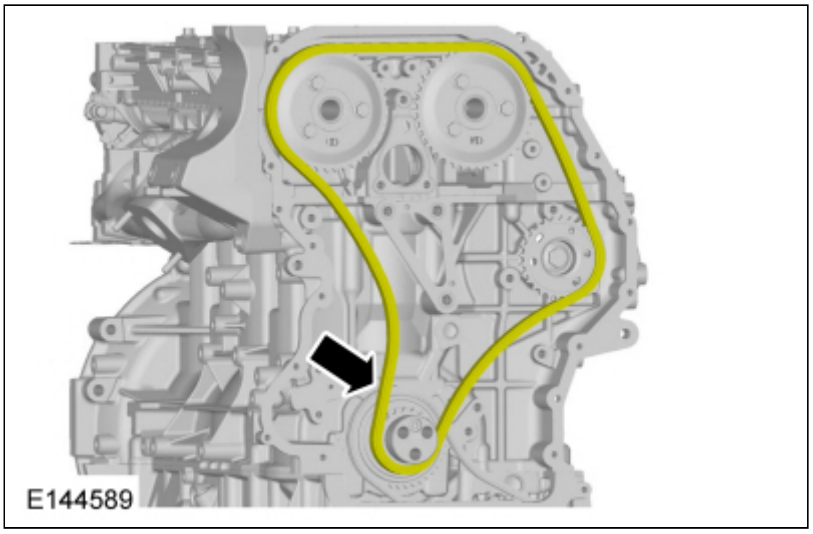
54. Tighten the fuel injection pump bracket nut and bolts. Tighten in the sequence shown.
Torque:
Stage 1: 22 Nm
Stage 2: 10 Nm
Stage 3: 22 Nm



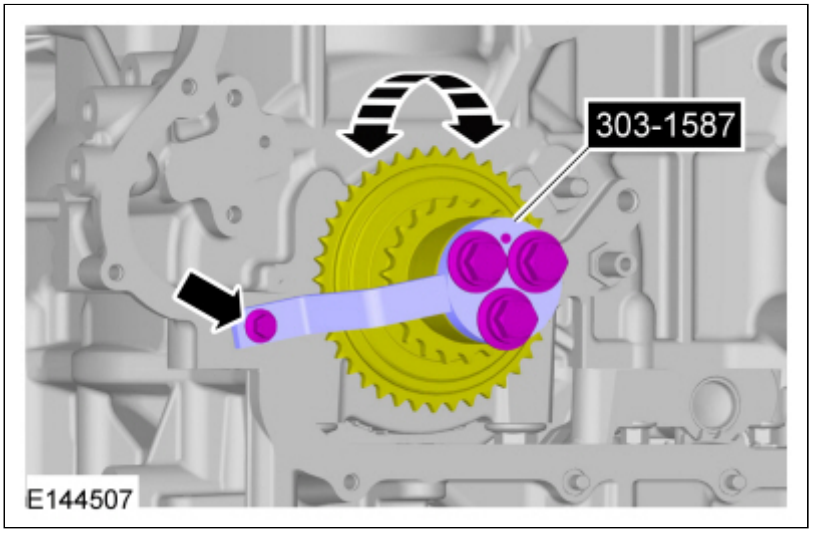
55. *Torque*: 45 Nm



56.

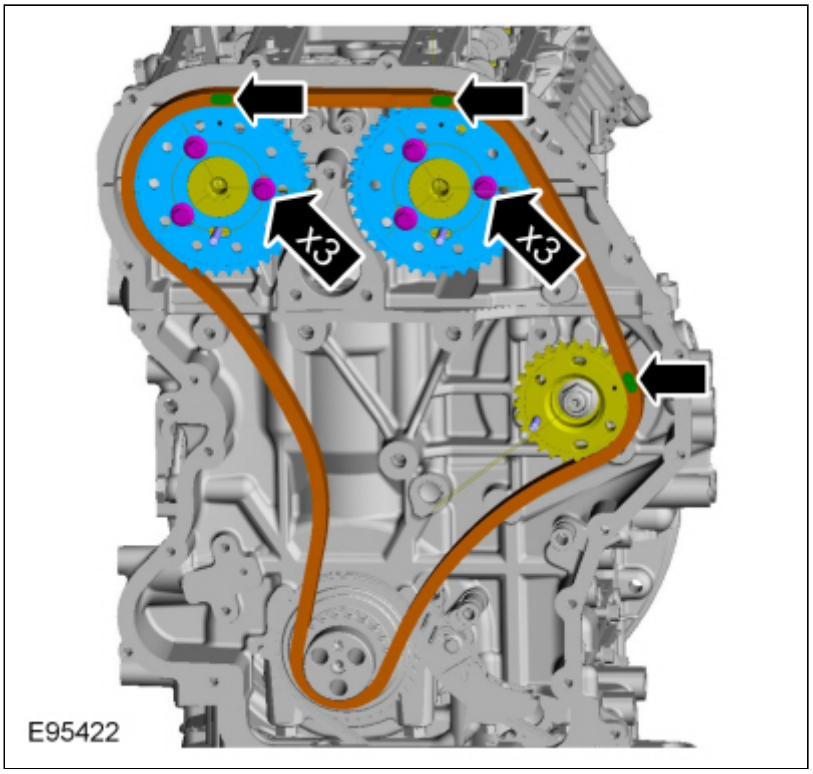


57. Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.



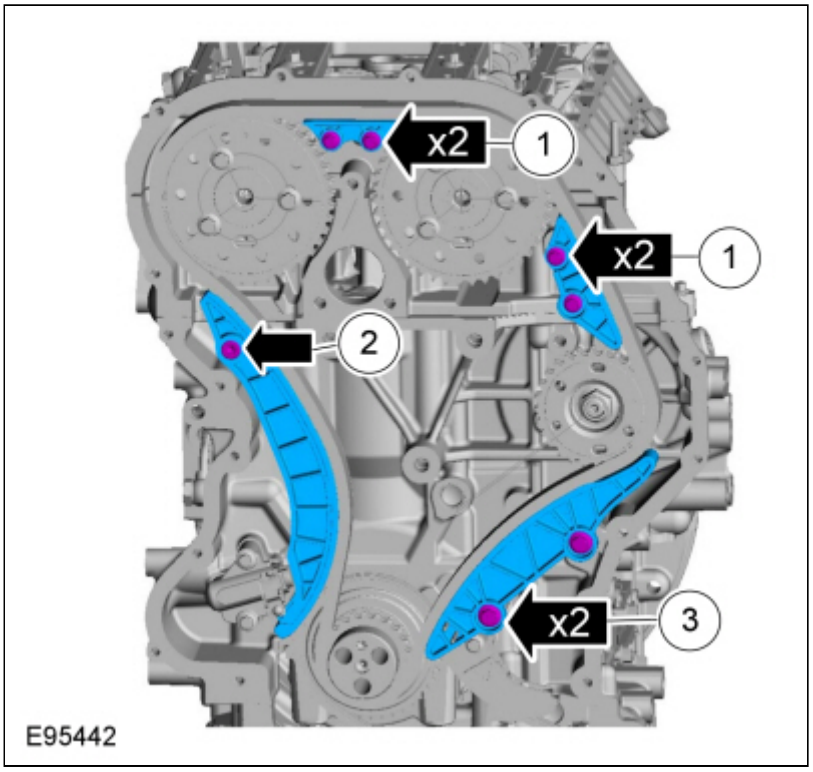
58. **NOTE:** *Make sure that the installation marks are aligned.*

Use the General Equipment: 6 mm Drill Bit
Torque:
Stage 1: 12 Nm
Stage 2: 24 Nm



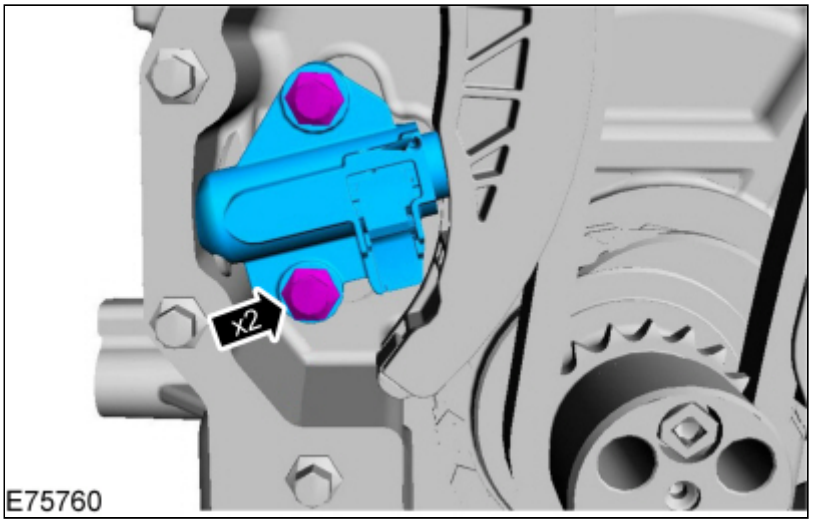
59. **NOTE:** *Make sure that new bolts are installed.*

Torque:
1: 14 Nm
2: 31 Nm
3: 15 Nm

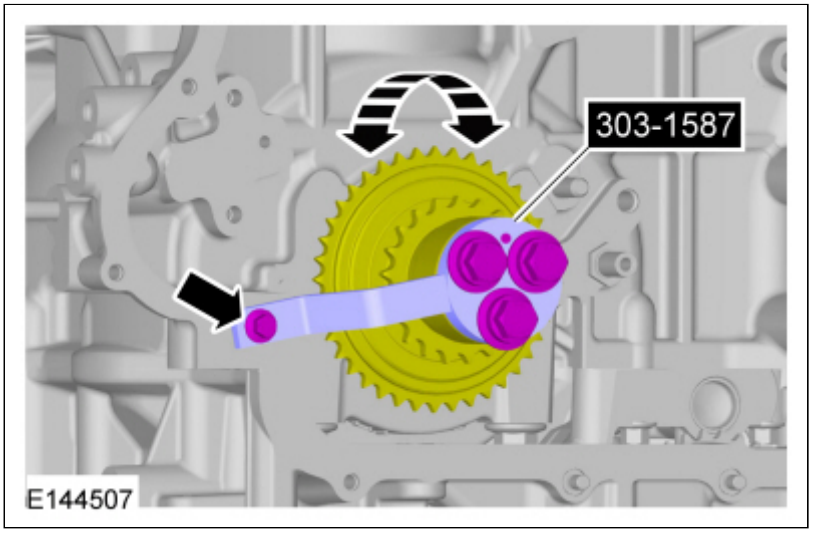


60. **NOTE:** *Make sure that a new component is installed.*

Torque: 15 Nm

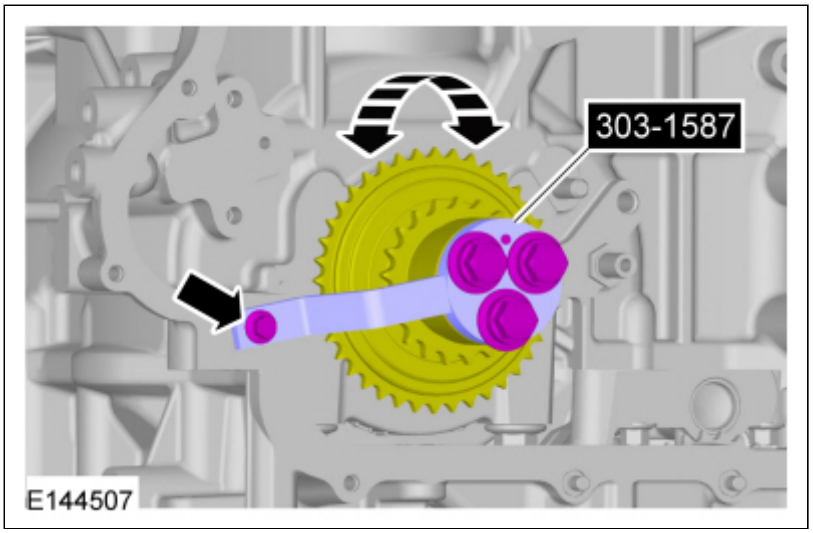


61. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



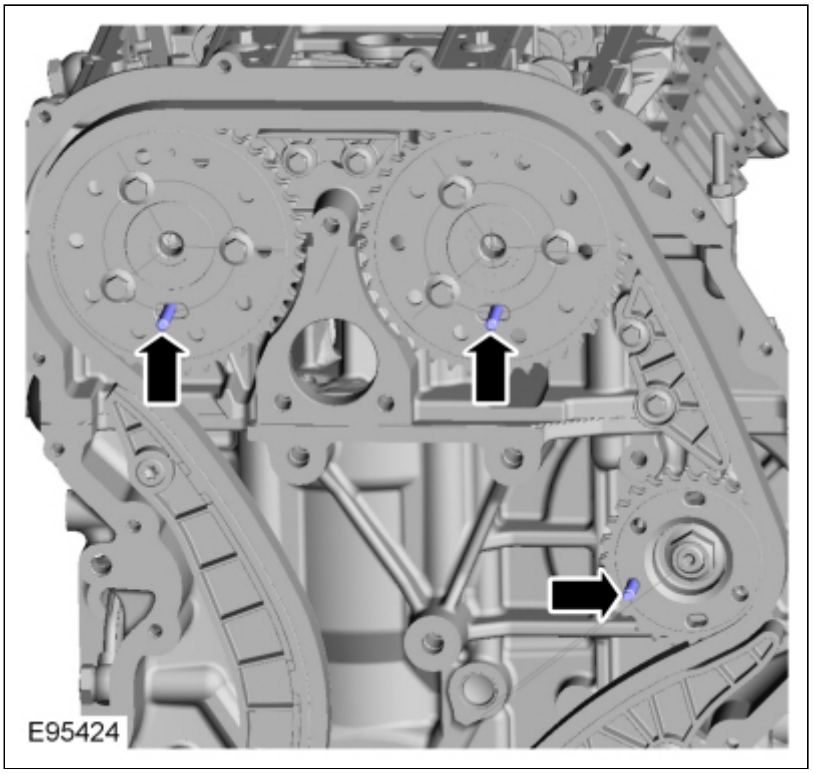
62. Rotate the engine two revolutions.

63. Install Special Service Tool: 303-1587 Timing Tool, Crankshaft.

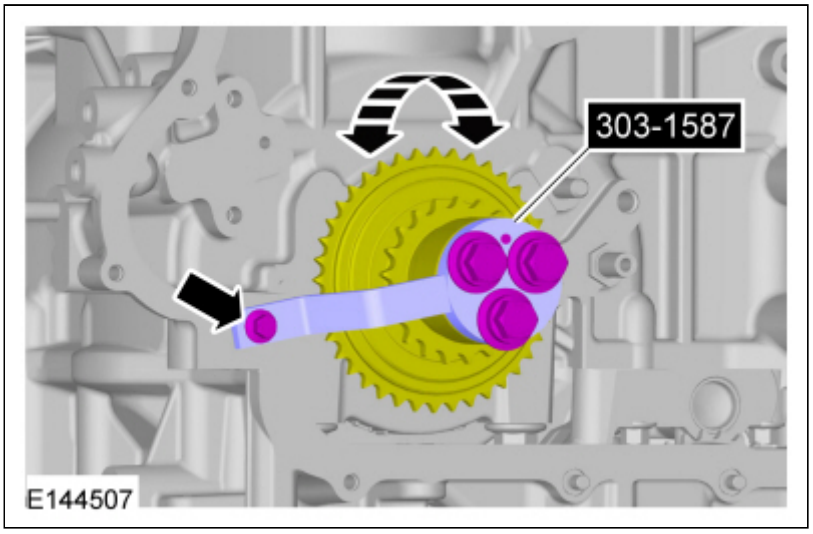


64. Check the position of the timing marks and correct if necessary.

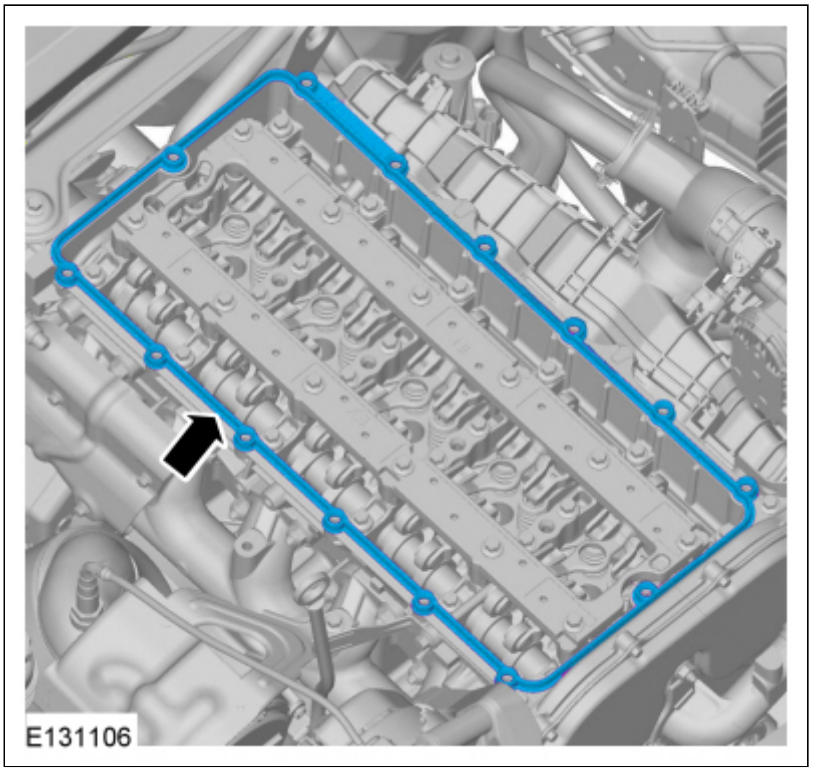
65. Remove the 6 mm drill bits.



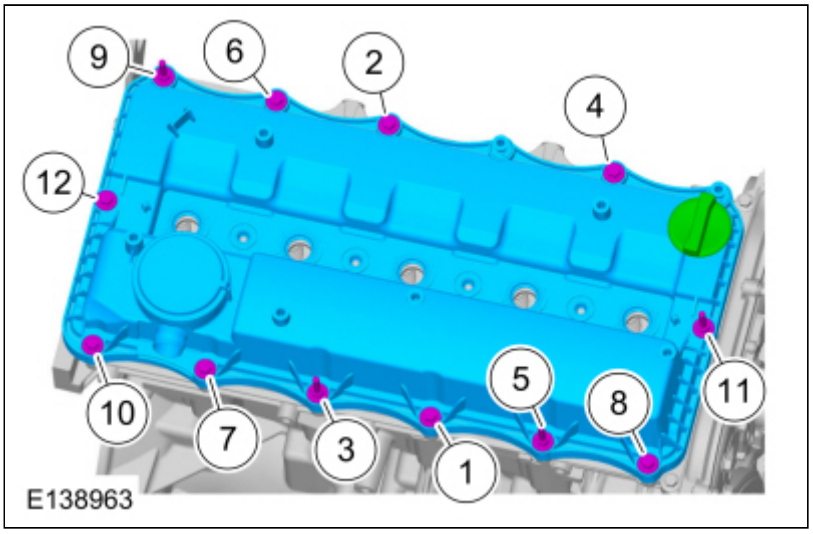
66. Remove Special Service Tool: 303-1587 Timing Tool, Crankshaft.



67.

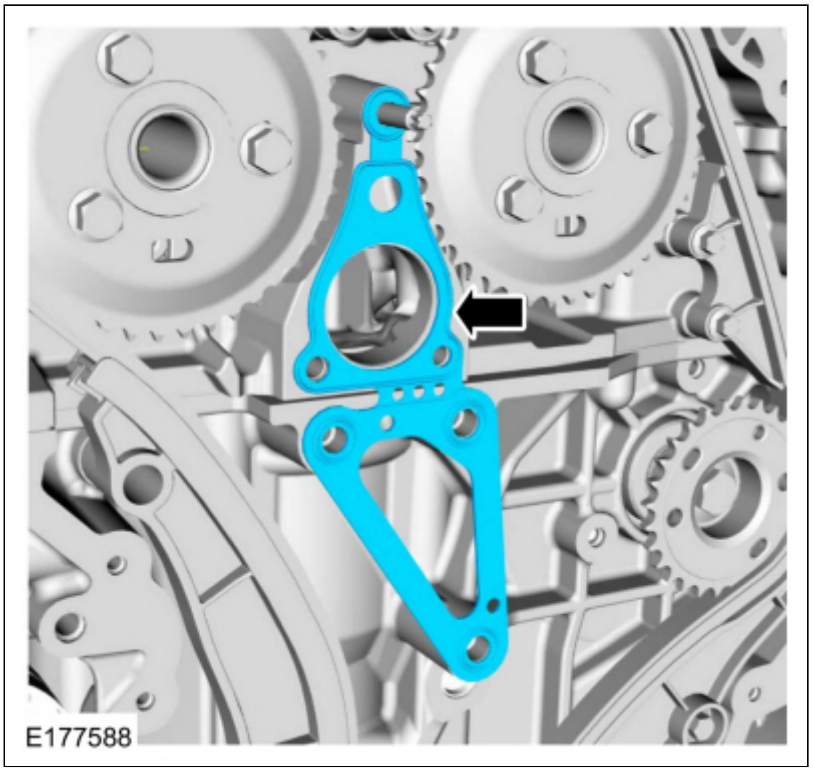


68. *Torque*:
    stage 1: 4 Nm
    stage 2: 10 Nm



69. **NOTE:** *Make sure that a new component is installed.*

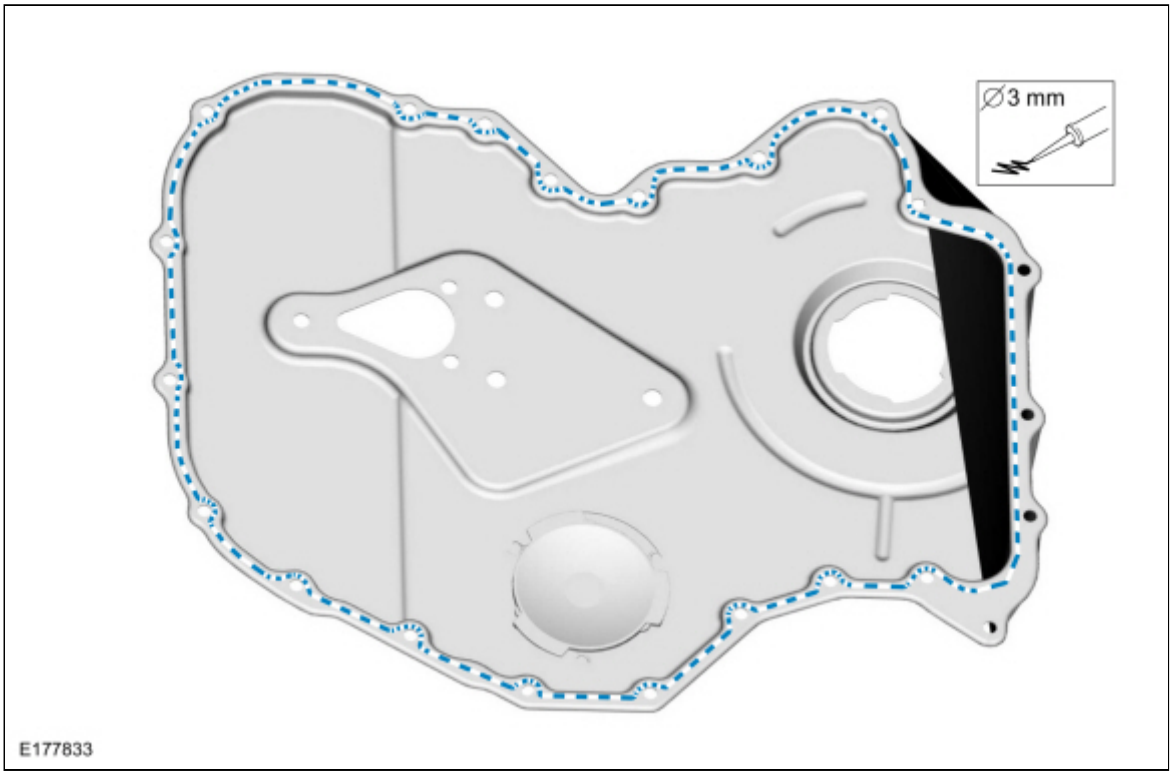
    Install the new engine front cover gasket.



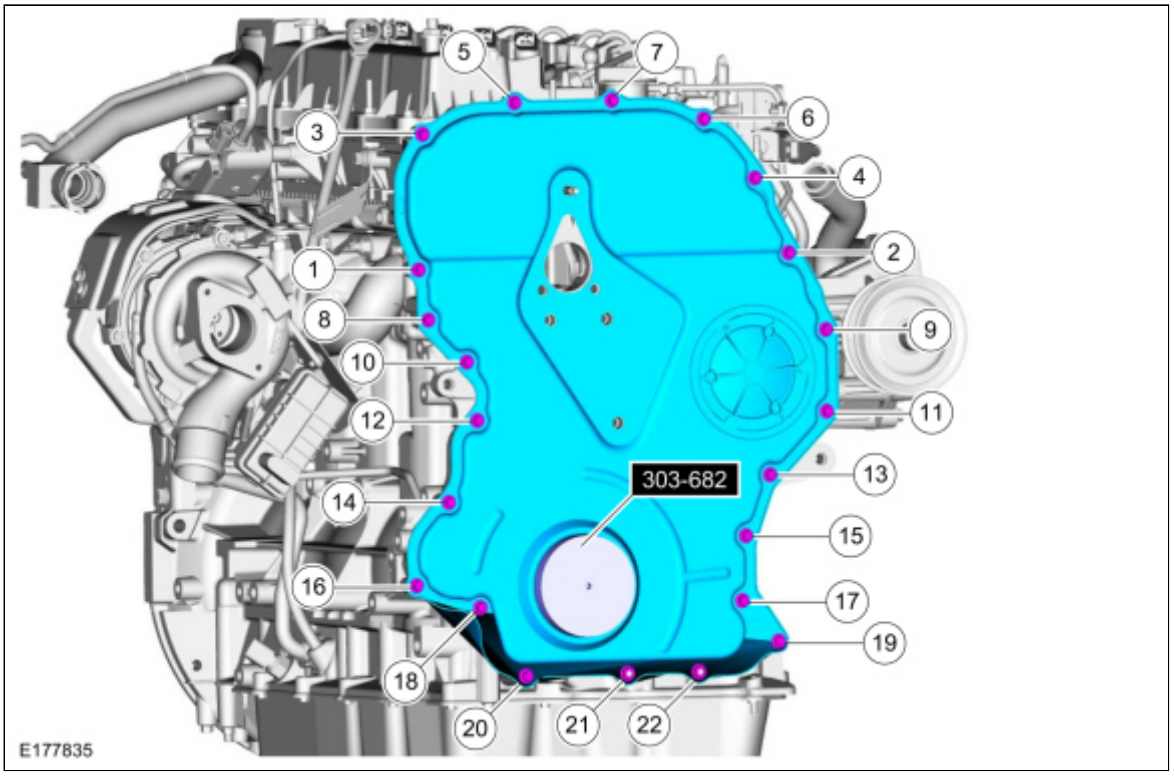
70. **NOTE:** *The component must be installed within 5 minutes of applying the sealant.*

    NOTE: *Make sure that a new component is installed.*

    Material: Silicone Sealant (WSE-M4G323-A4)

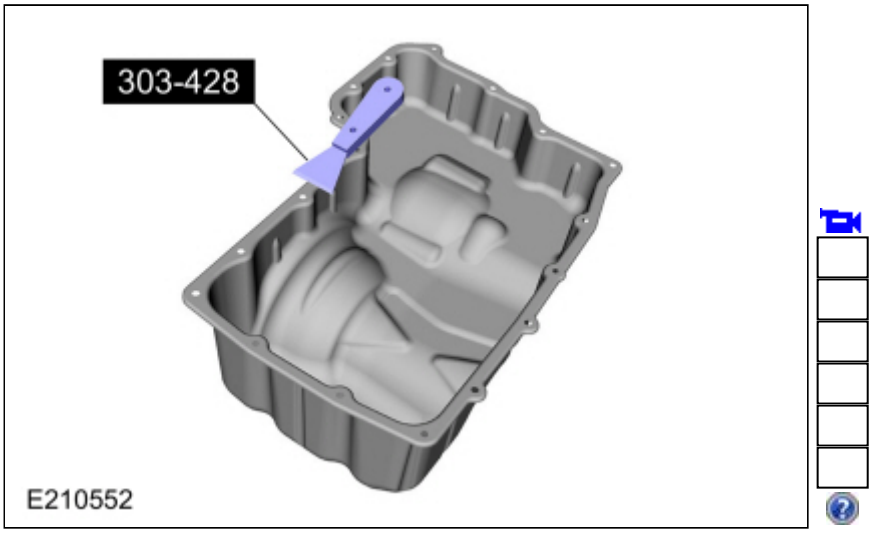


71. Use Special Service Tool: 303-682 Aligner, Engine Front Cover.
    Torque:
    Stage 1: 5 Nm
    Stage 2: 10 Nm



72. **NOTE:** *Do not damage the mating faces.*

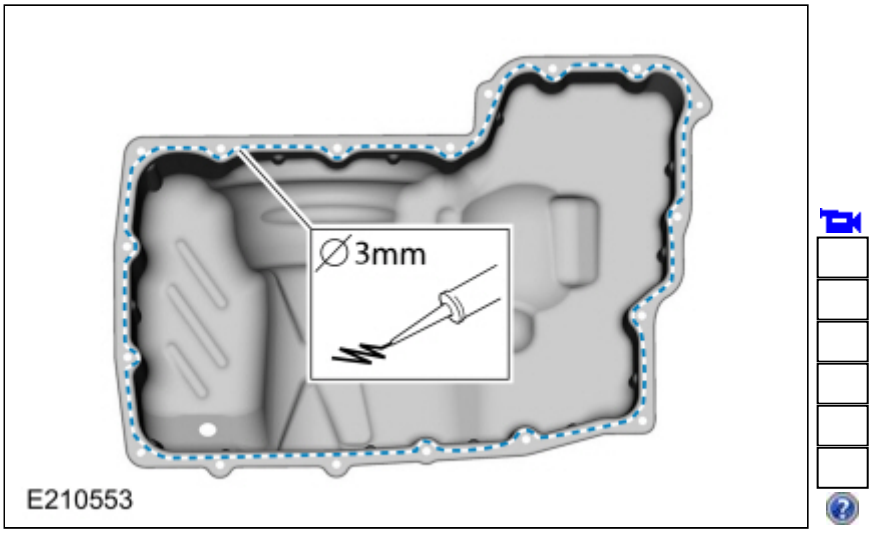
    Use Special Service Tool: 303-428 Separator, Oil Pan.



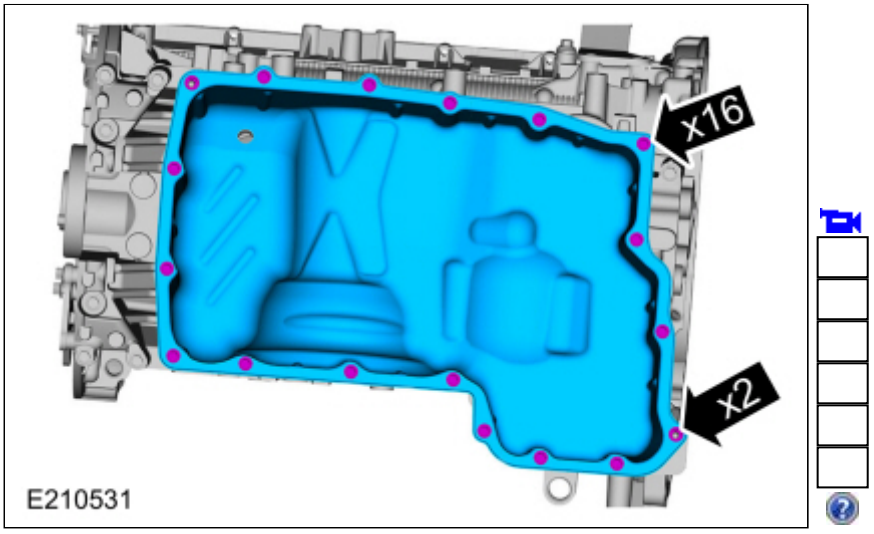
73. **NOTICE: Install the oil pan within five minutes of applying the sealer.**

    NOTE: *Do not damage the mating faces.*

    Material: Silicone Sealant (WSE-M4G323-A4)

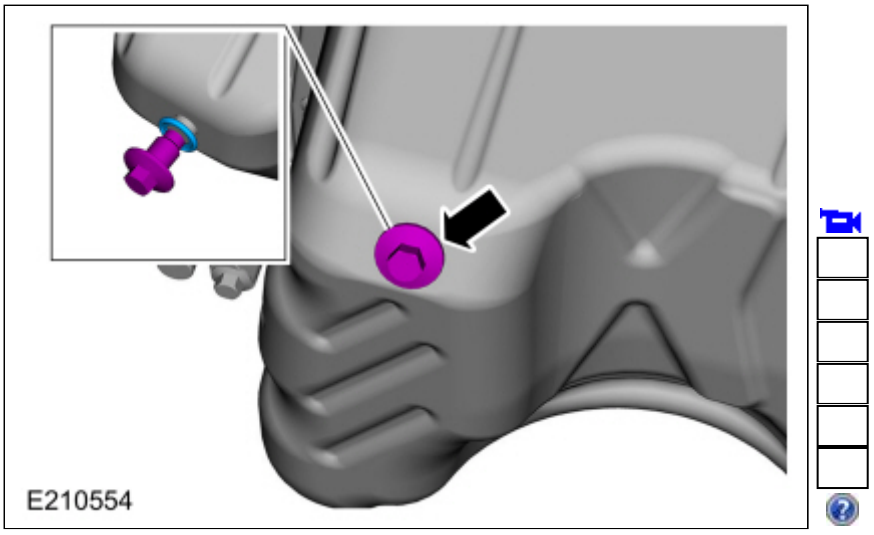


74. *Torque*:
Stage 1: 6 Nm
Stage 2: 13 Nm



75. **NOTE:** *The seal is to be reused unless damaged.*

Torque: 35 Nm



76. Refer to: Engine Accessories (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Installation).

Copyright © 2016 Ford Motor Company

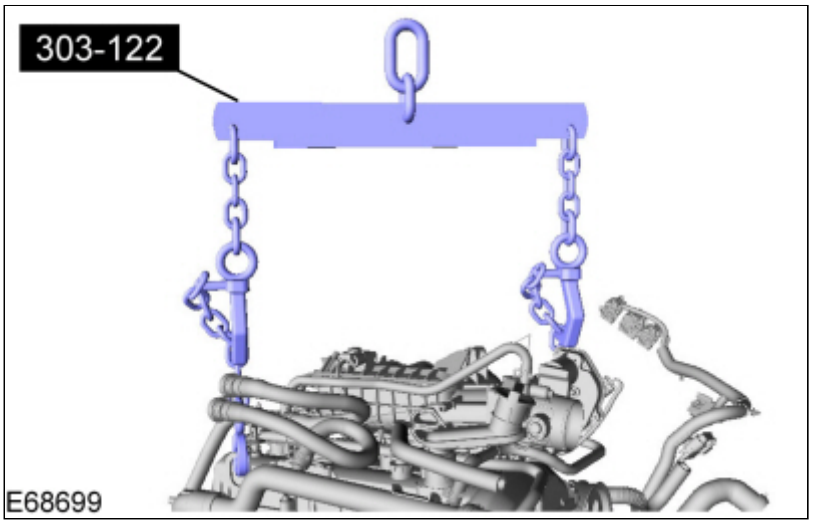
Engine - 6-Speed Manual Transmission - MT82

Base Part Number: 6L084

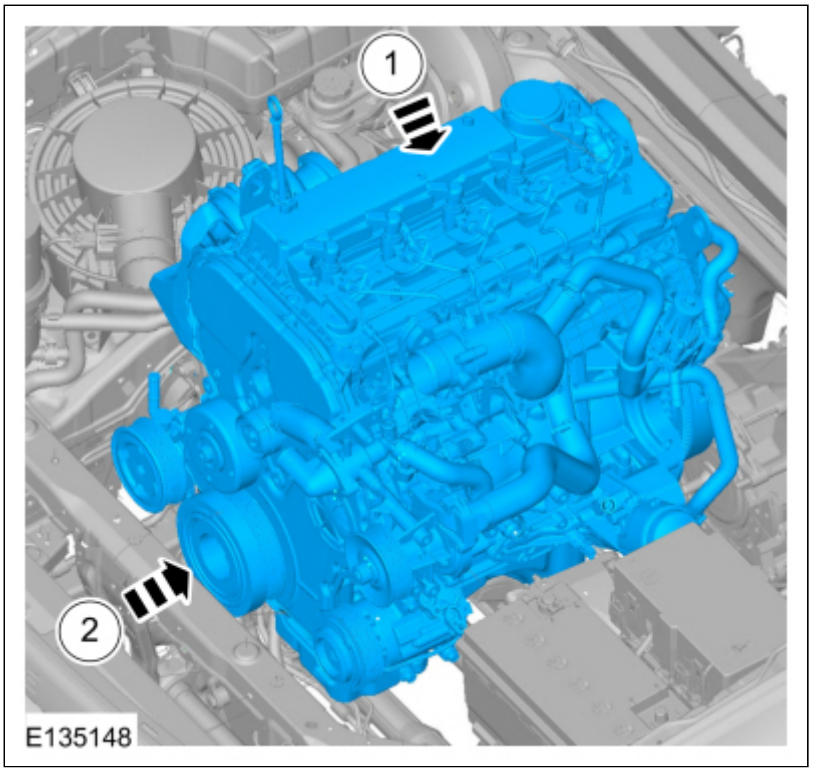
Special Tool(s) / General Equipment

 21068A	303-122 Lifting Bracket, Engine

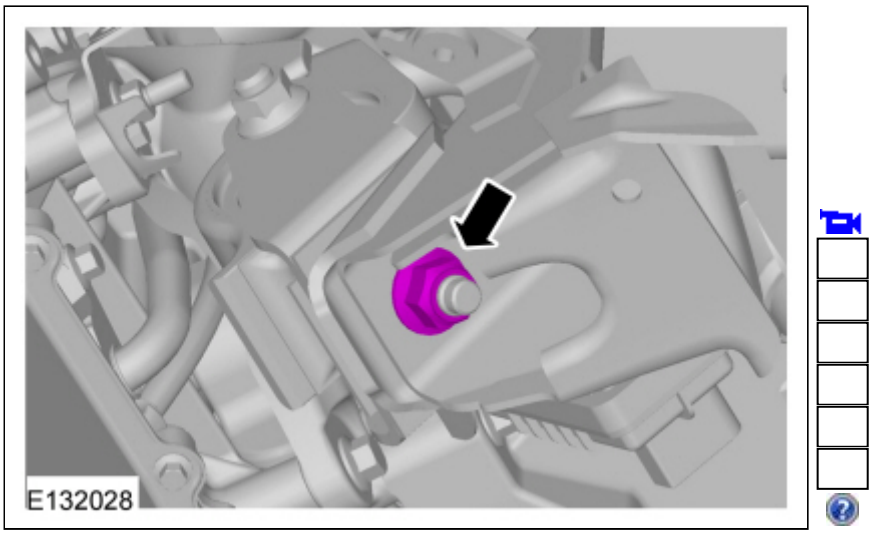
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Use Special Service Tool: 303-122 Lifting Bracket, Engine.



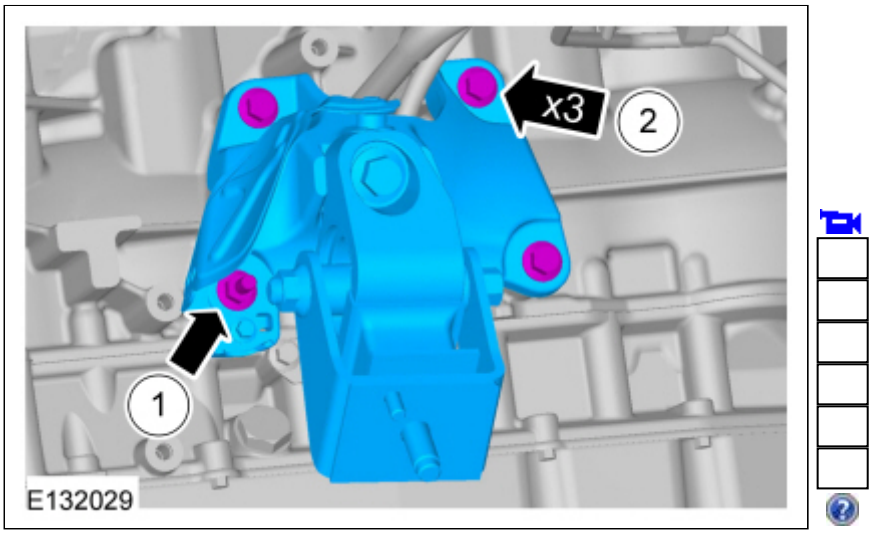
3.



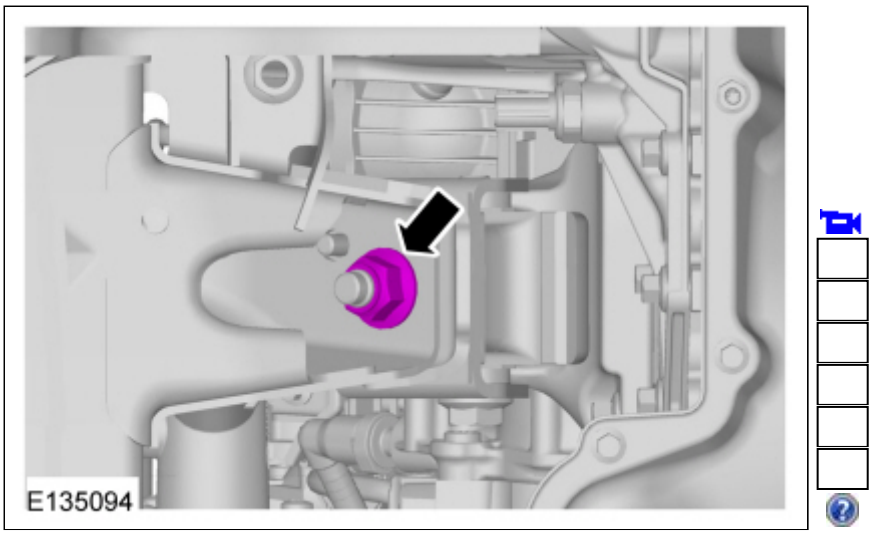
4. **NOTE:** *Hand tighten the nut at this stage.*



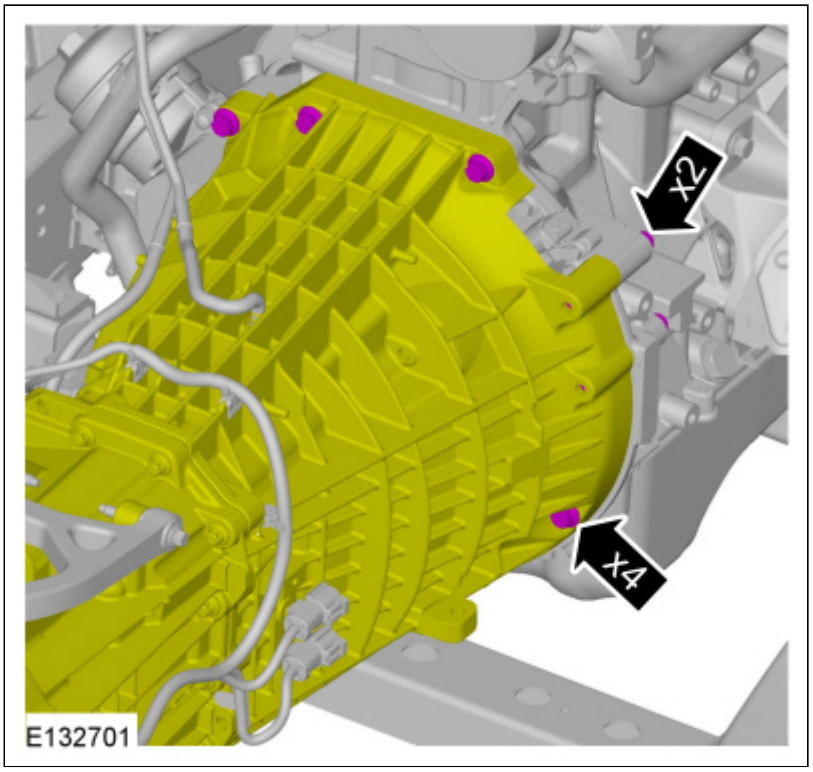
5. **NOTE:** *Hand tighten the nuts at this stage.*



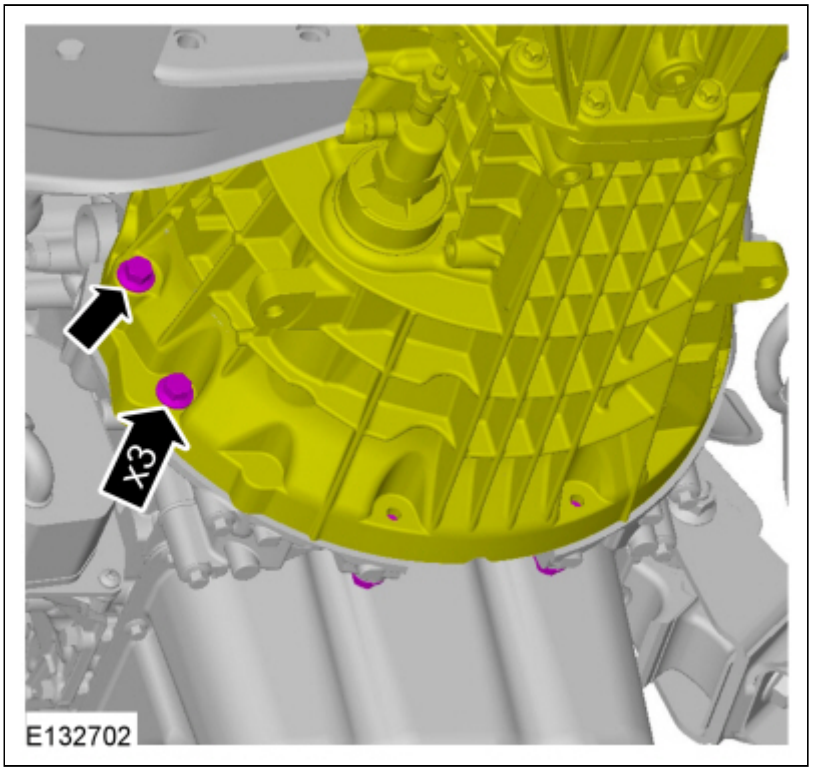
6. **NOTE:** *Hand tighten the nut at this stage.*



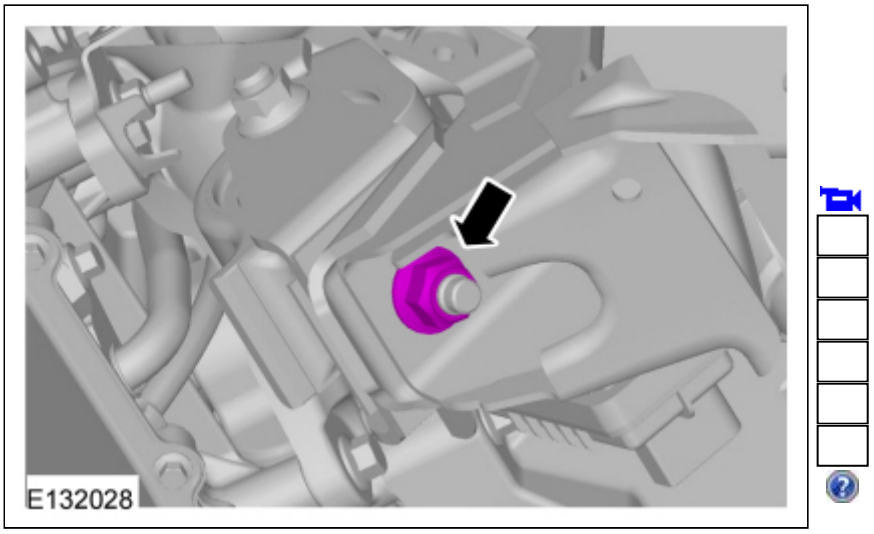
7. Initially hand tighten the fasteners.
   Torque: 48 Nm



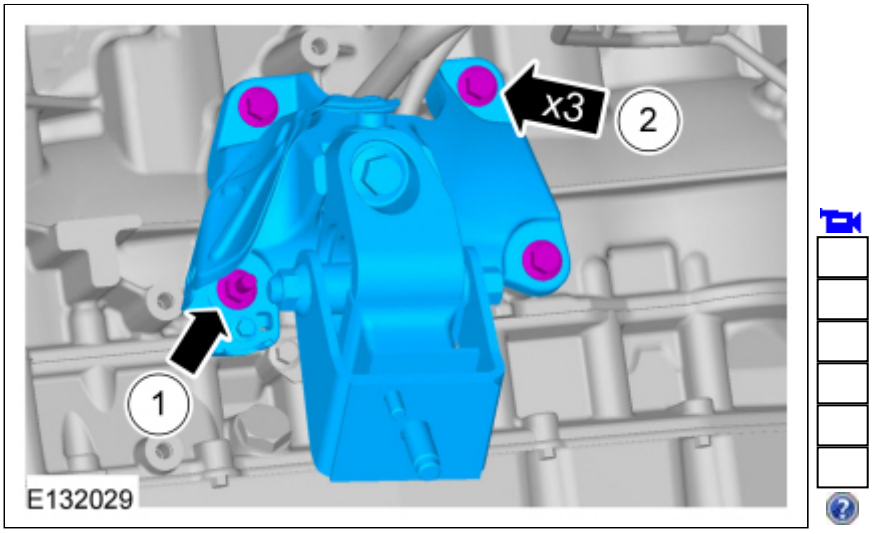
8. Initially hand tighten the fasteners.
   Torque: 48 Nm



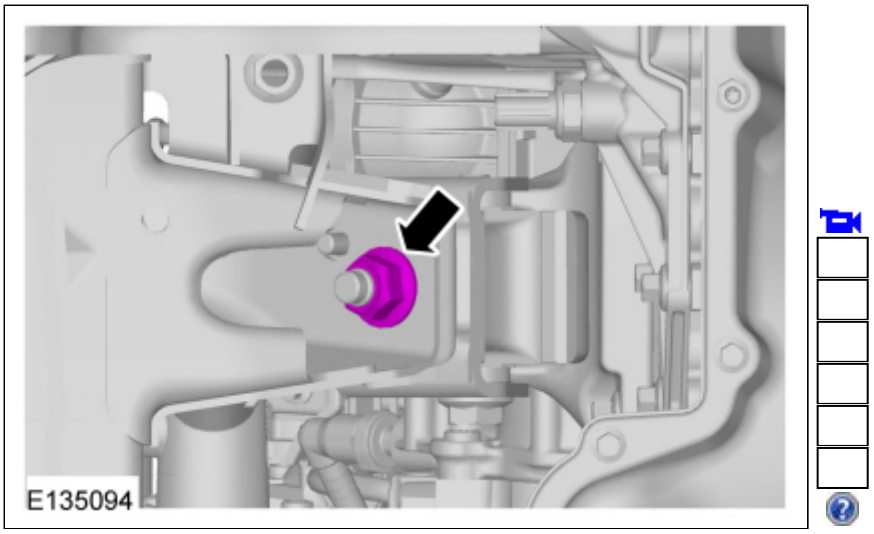
9. *Torque*: 80 Nm



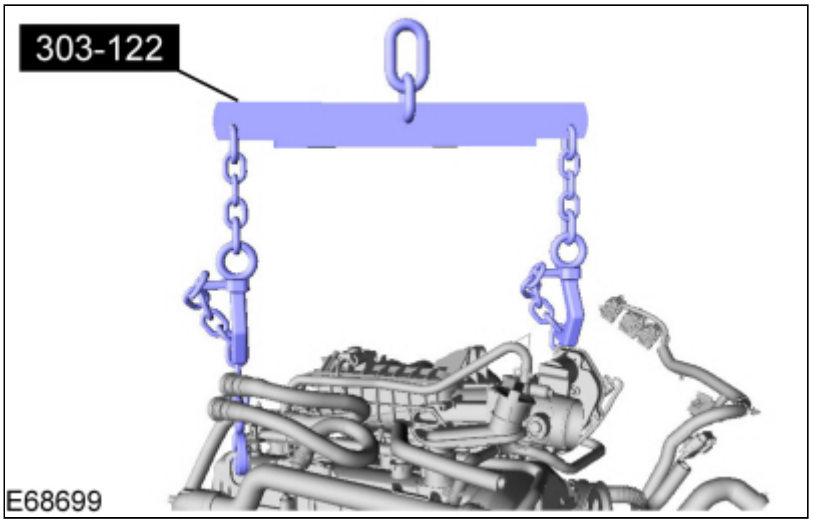
1. *Torque*: 48 Nm
2. *Torque*: 25 Nm



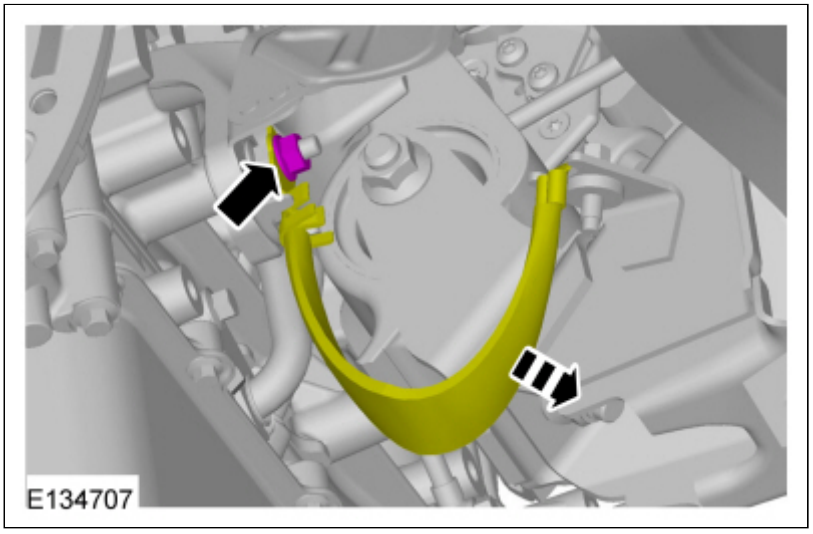
11. *Torque*: 80 Nm



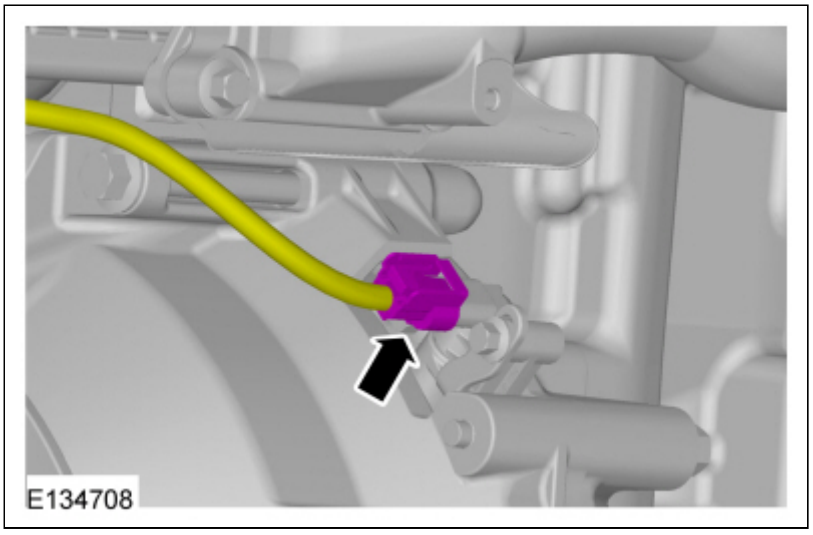
1. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.



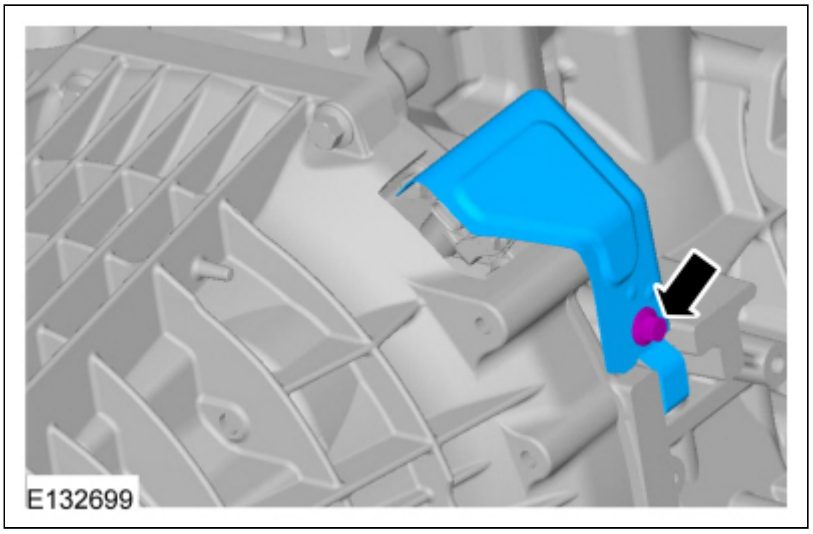
13. *Torque*: 13 Nm



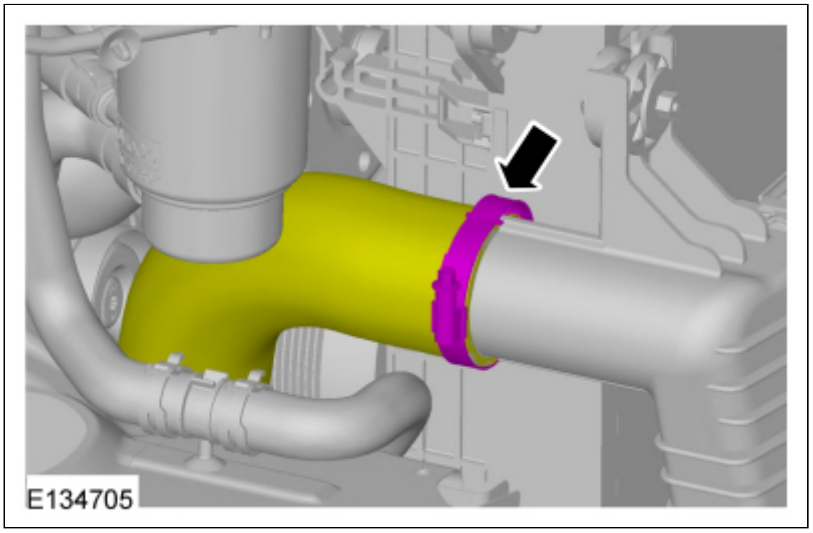
14.



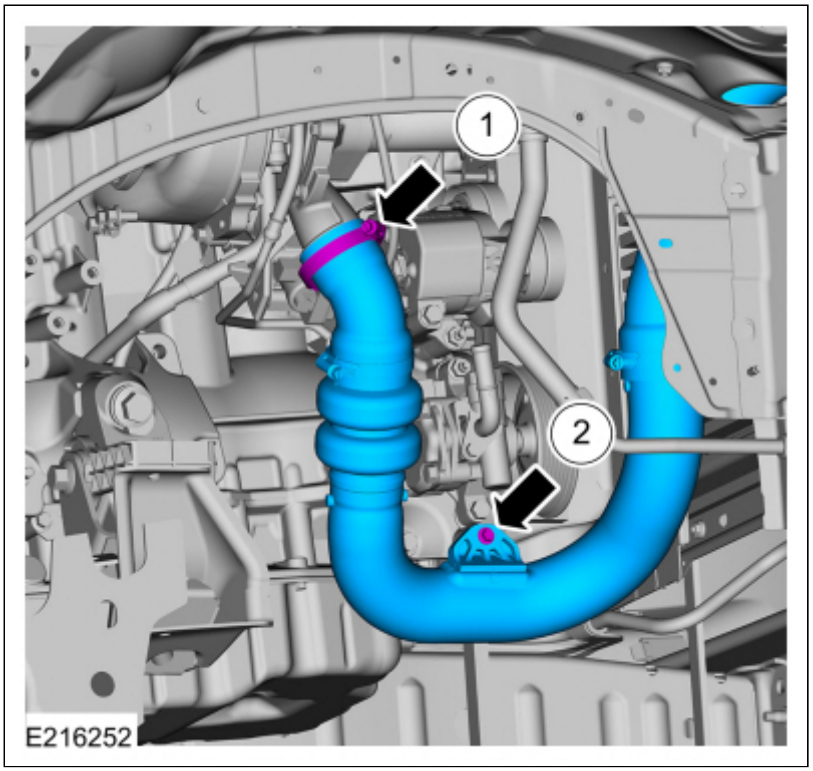
15. *Torque*: 12 Nm



16. *Torque*: 4 Nm



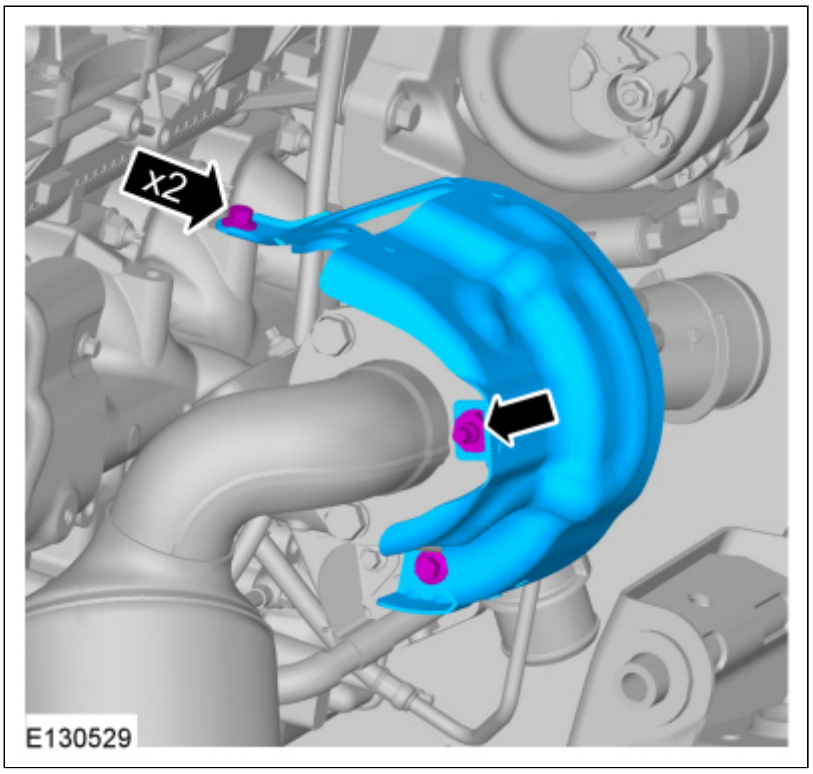
17. *Torque*: 10 Nm



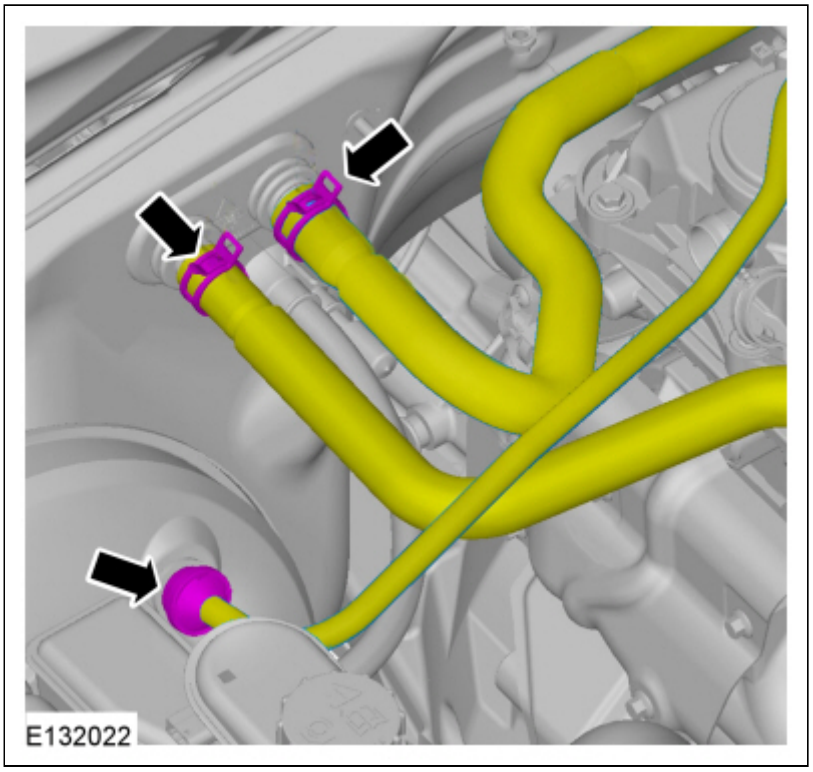
18. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L

Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

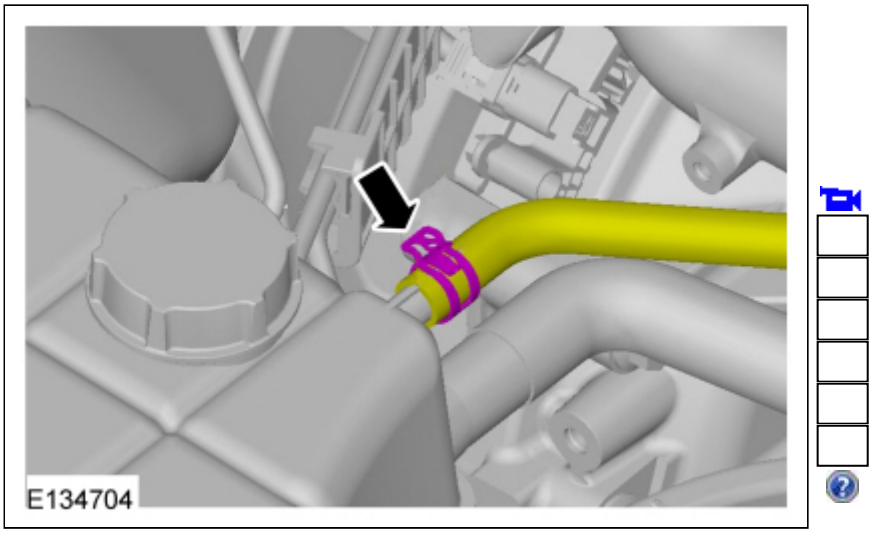
19. *Torque*: 22 Nm



20.



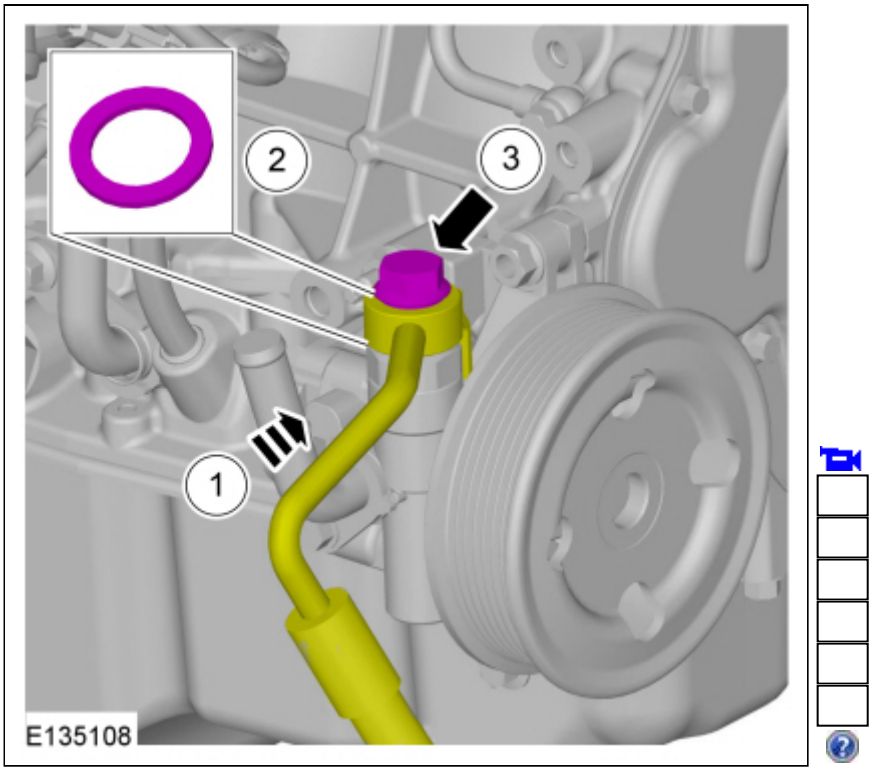
21.



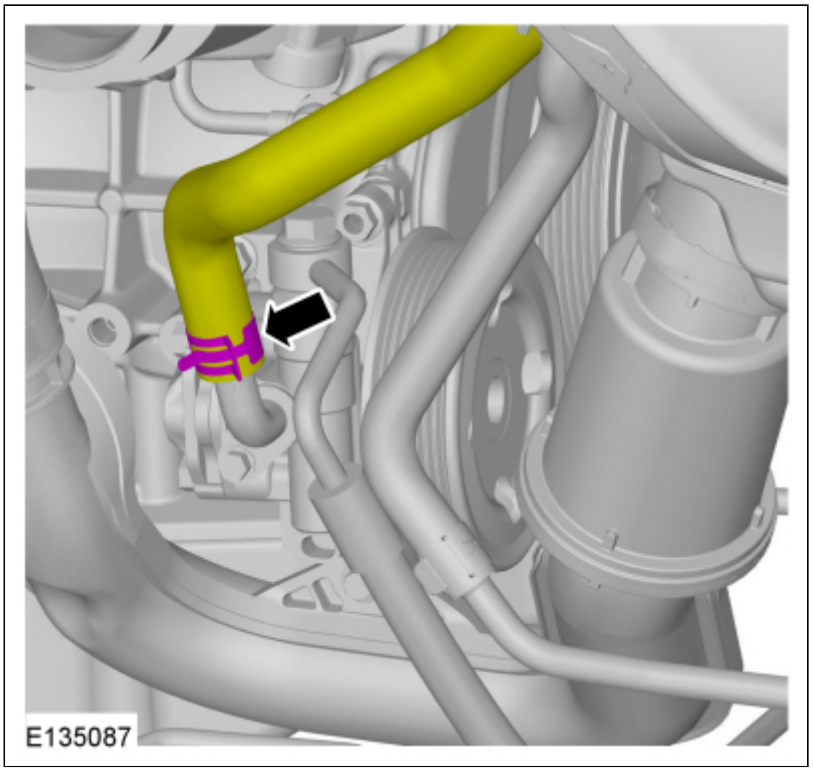
Vehicles With: Hydraulic Power Assist Steering (HPAS)

22. **NOTE:** *The washers can be reused unless damaged.*

    3. *Torque*: 35 Nm

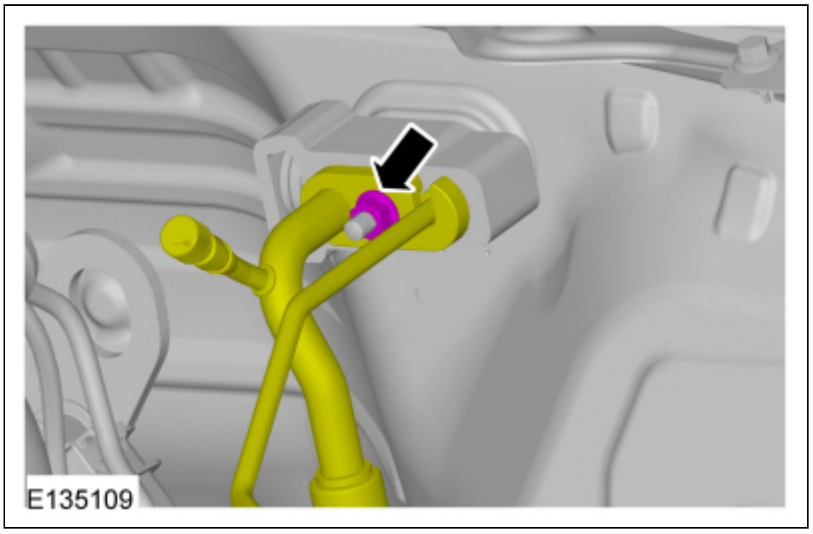


23.



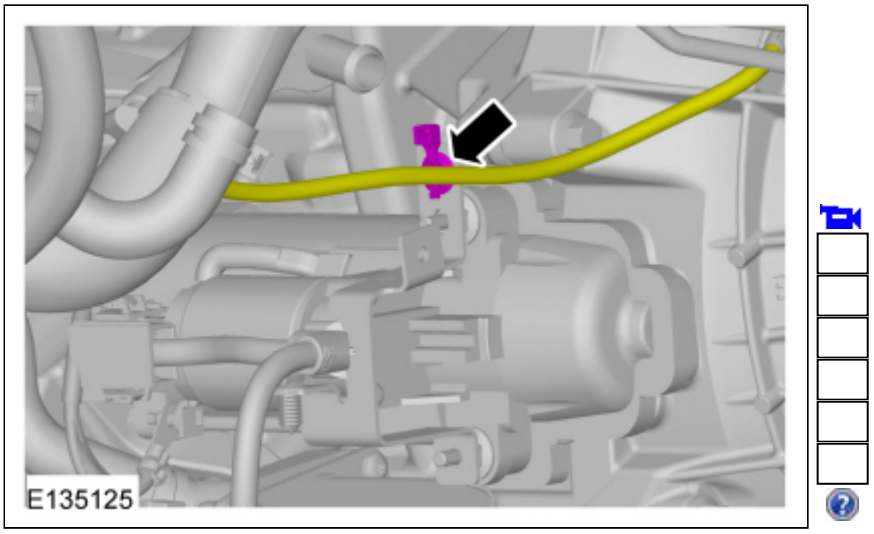
All vehicles

24. *Torque*: 22 Nm



25. Refer to: Starter Motor - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

26.

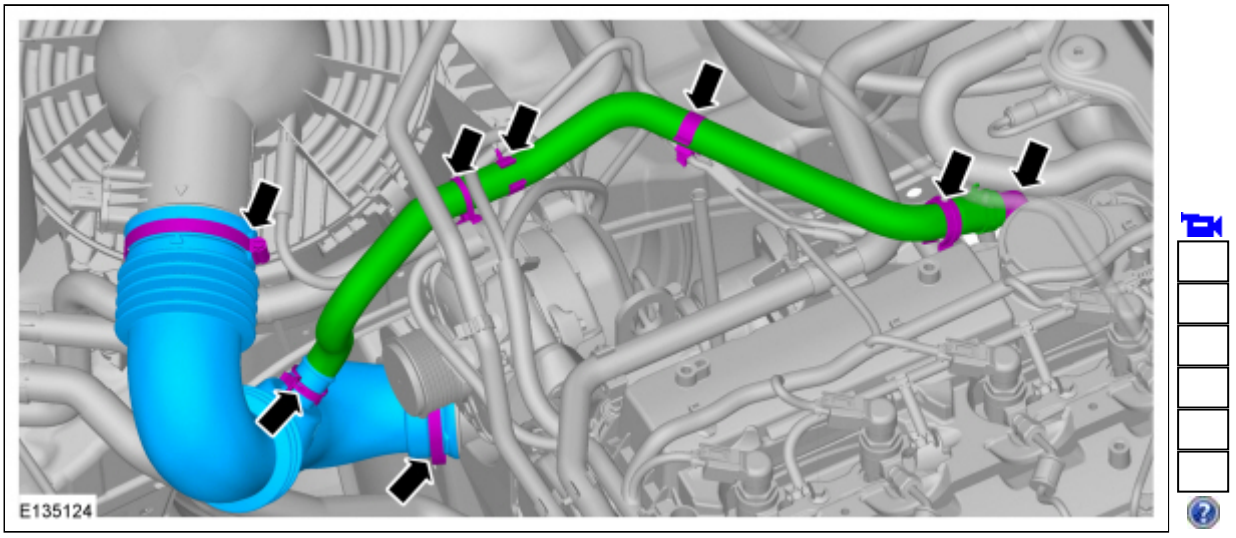


27. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

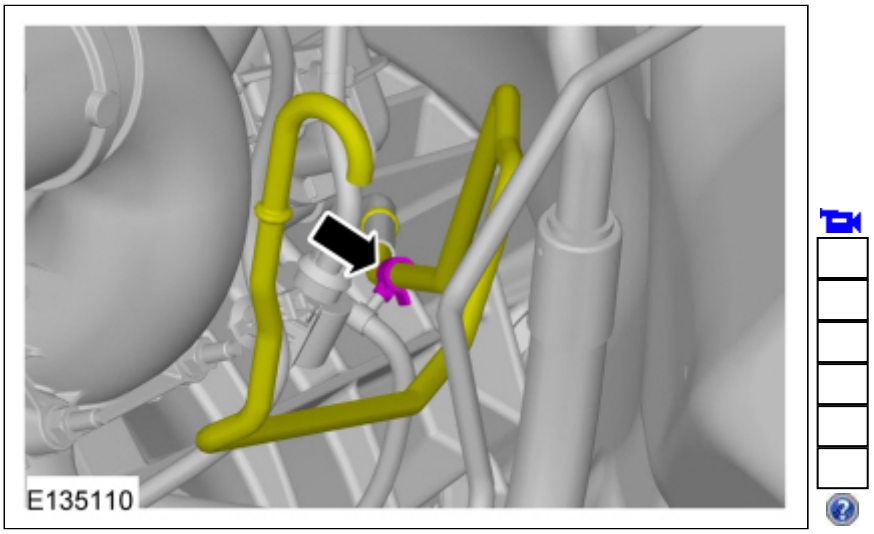
28. Refer to: Radiator (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) .

29. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

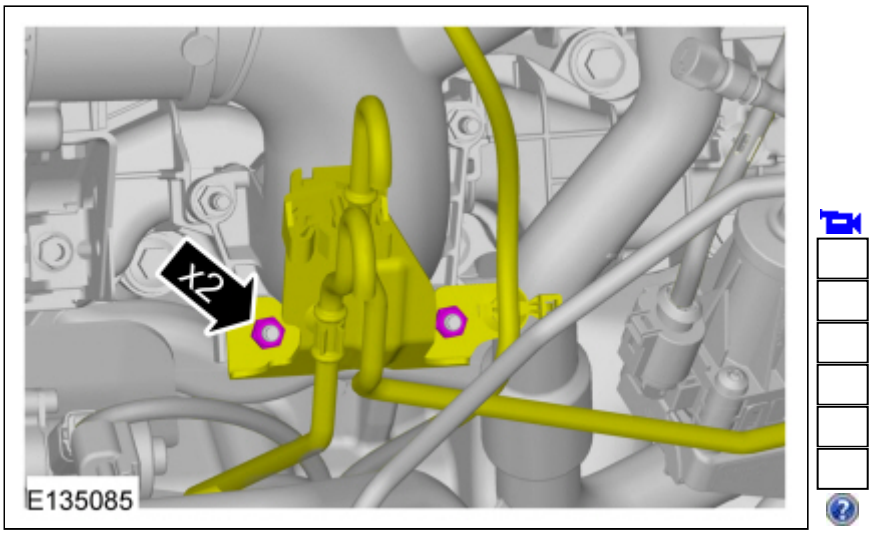
30.



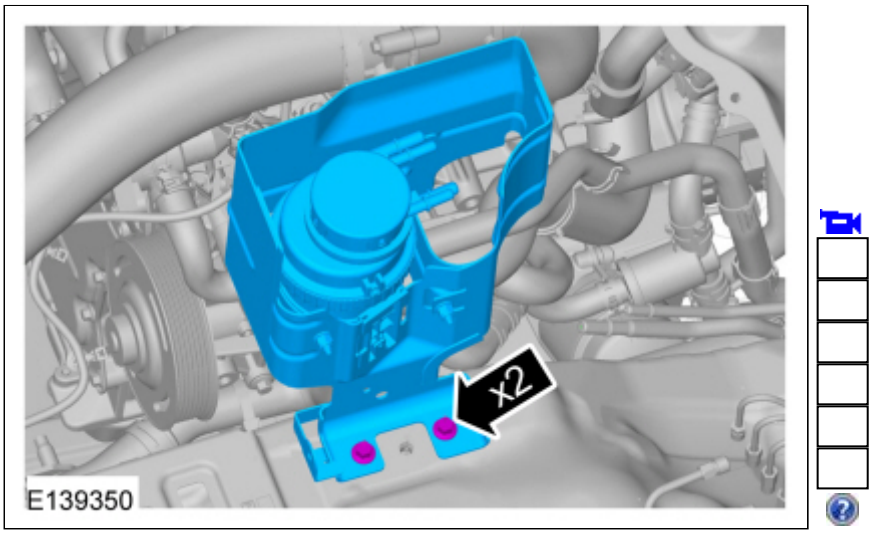
31.



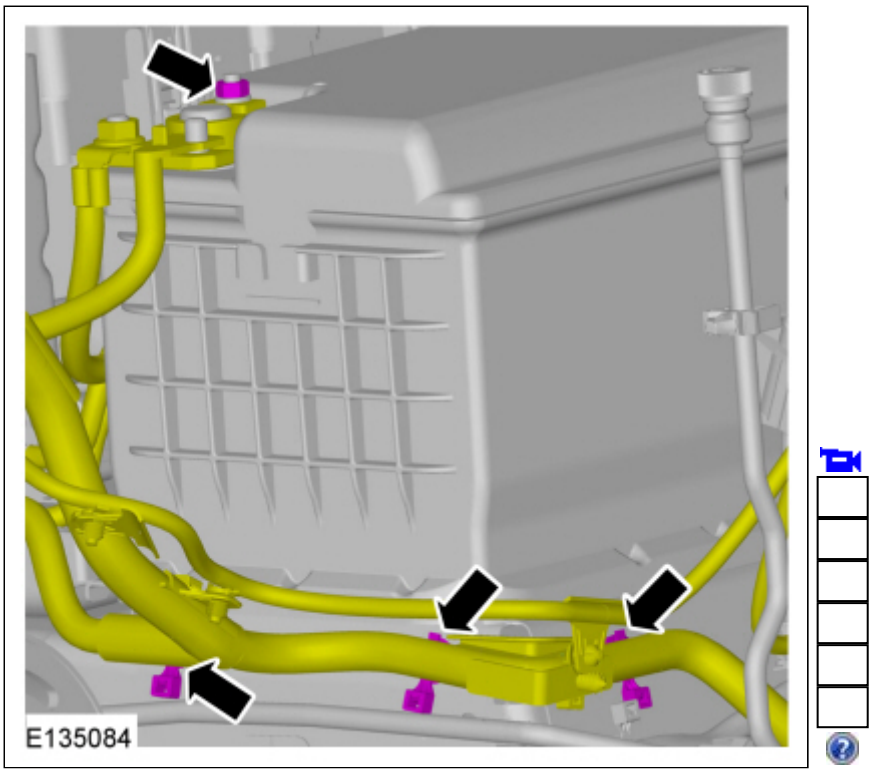
32. *Torque*: 10 Nm



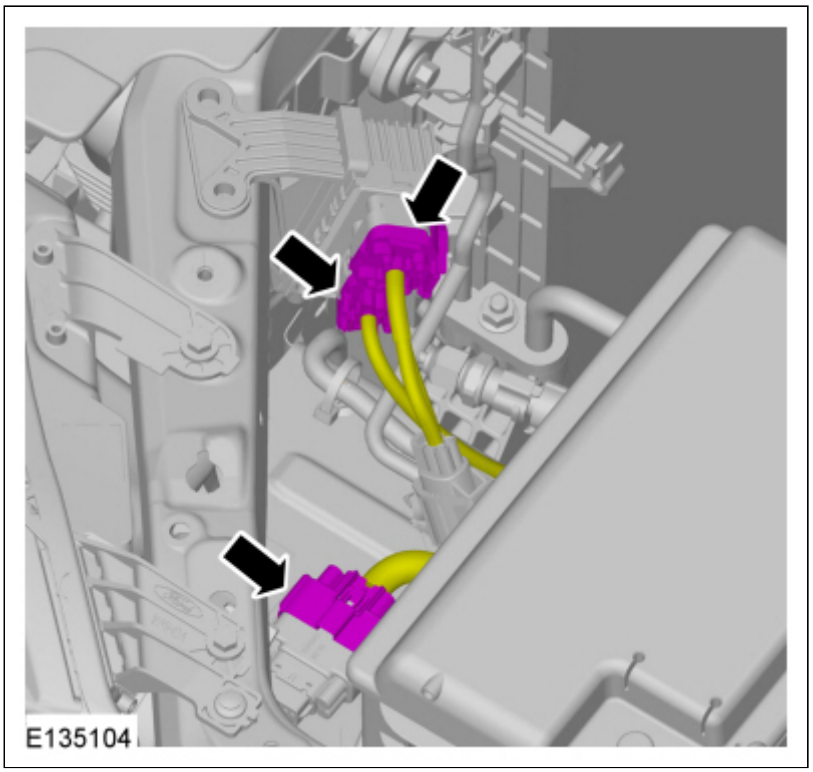
33. *Torque*: 18 Nm



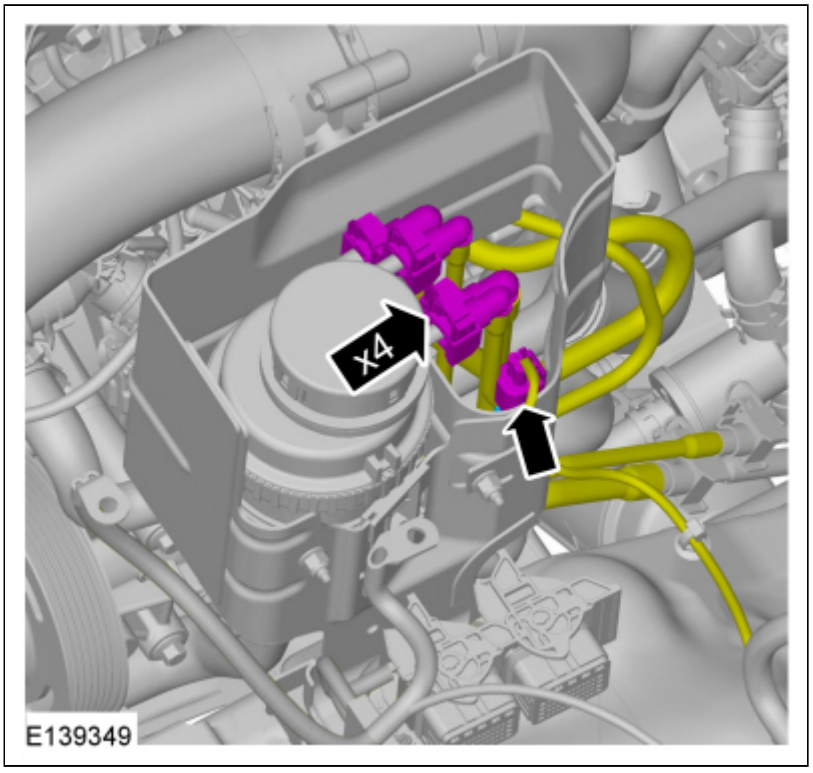
34. *Torque*: 5 Nm



35.



36.

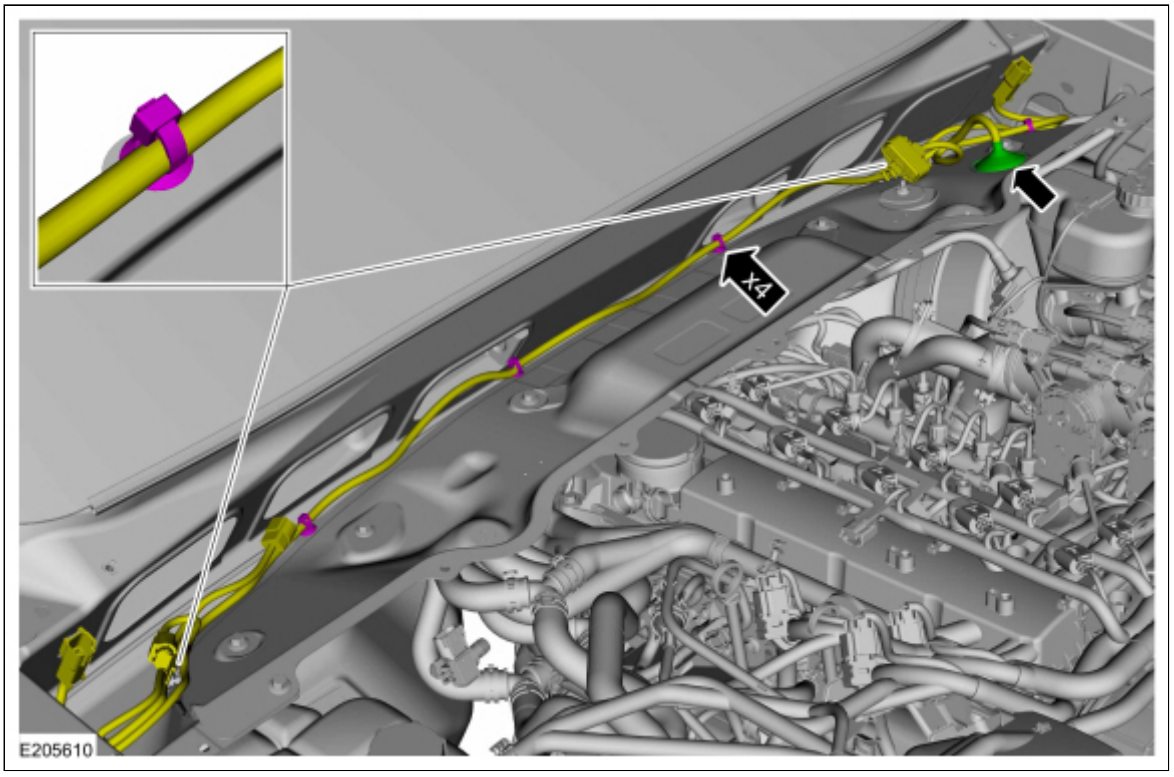


37. Refer to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

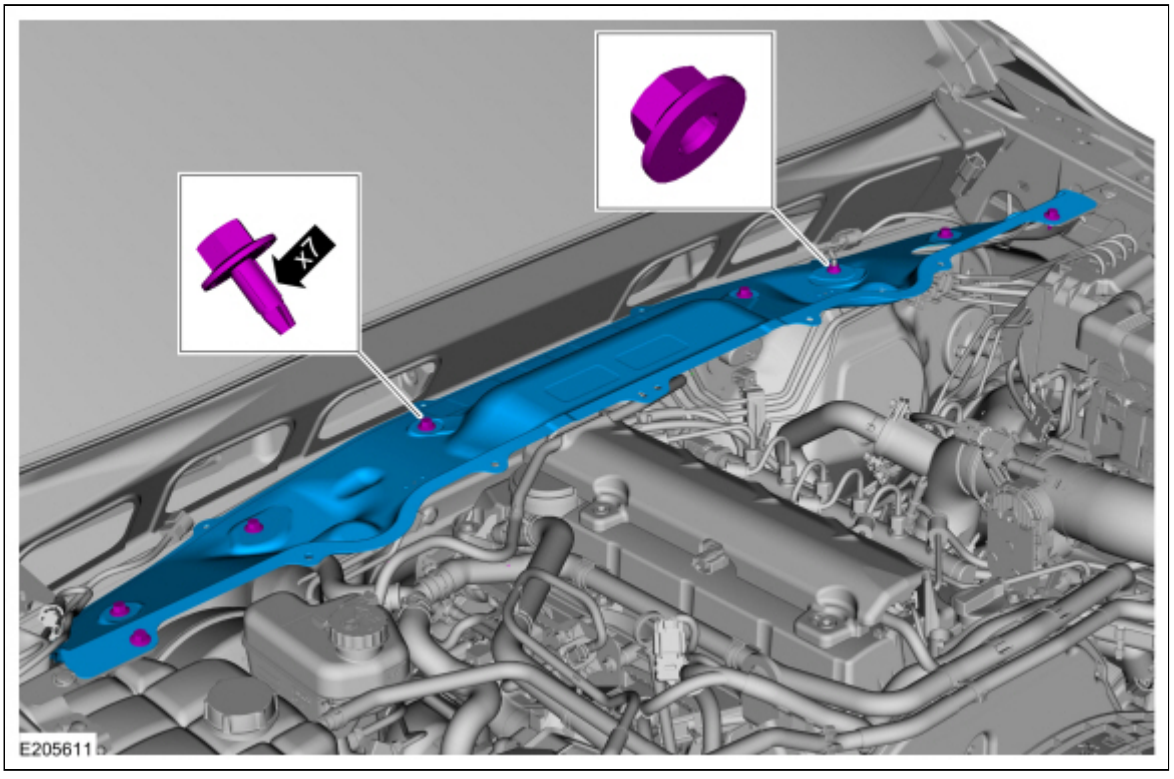
38. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

39. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

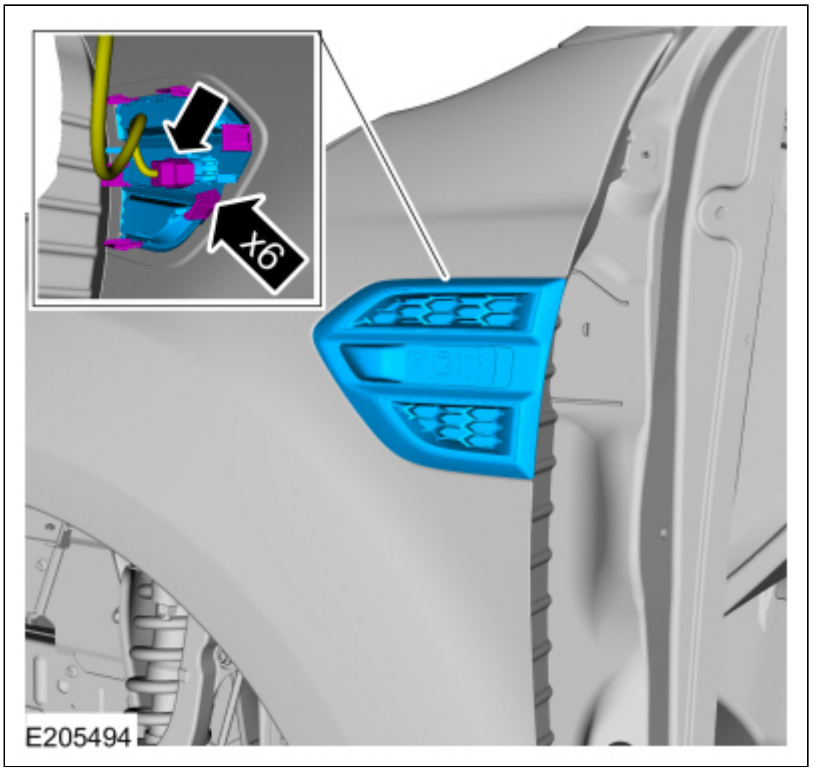
40. *Torque*: 10 Nm



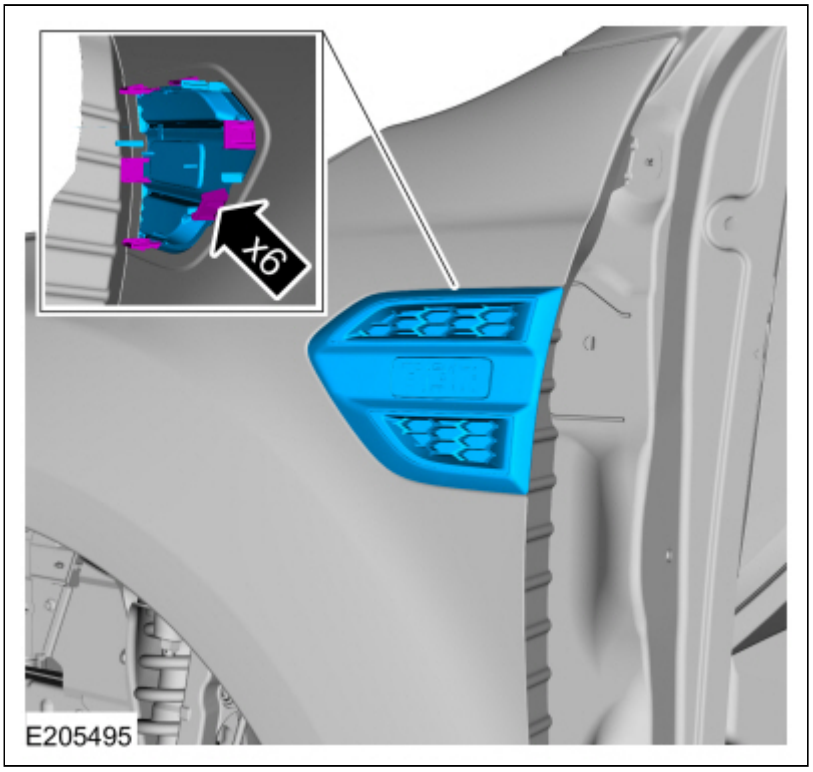
41. *Torque*: 10 Nm



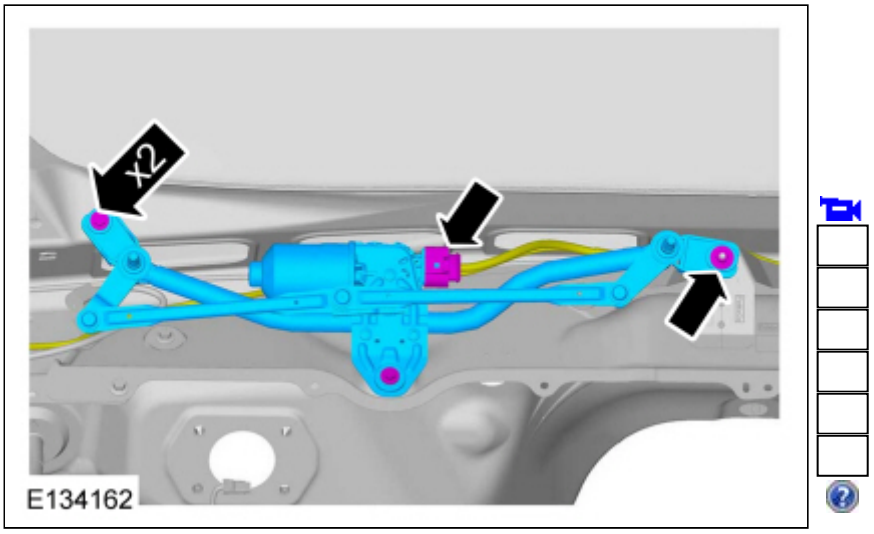
42. On both sides.



43. On both sides.



44. *Torque*: 10 Nm



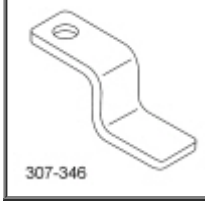
45. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
46. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
47. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
48. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
49. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
50. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
51. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
52. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures). Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
53. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Engine - 6-Speed Automatic Transmission - 6R80

Base Part Number: 6L084

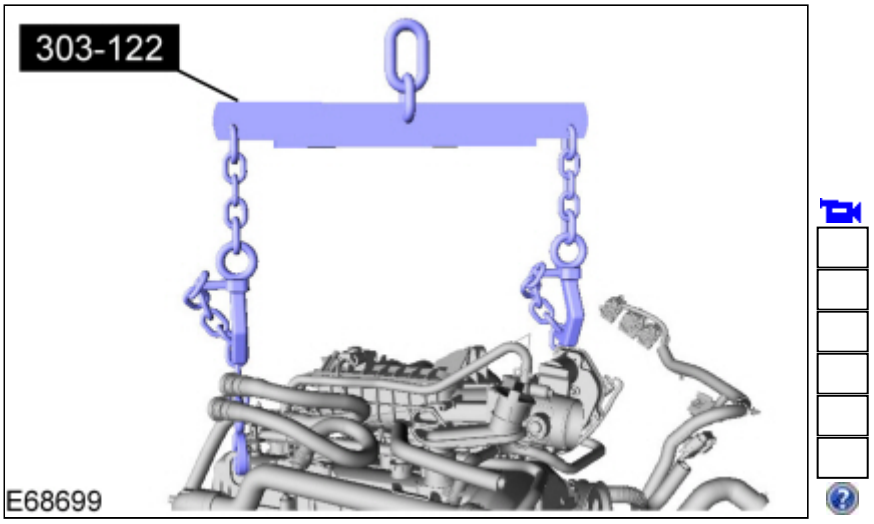
Special Tool(s) / General Equipment

	303-122 Lifting Bracket, Engine
	307-346 (T97T-7902-A) Retainer, Torque Converter

Materials

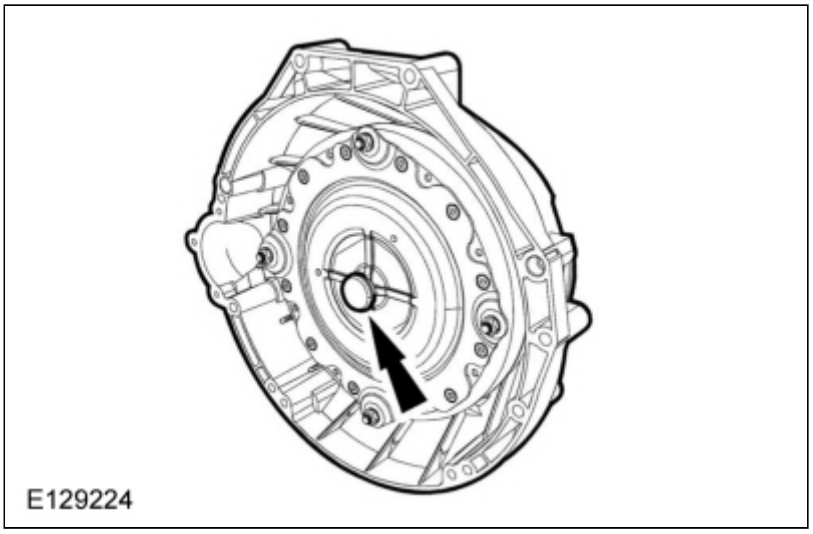
Name	Specification
Grease - Electrical Contact	WSB-M1C239-A

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Use Special Service Tool: 303-122 Lifting Bracket, Engine.

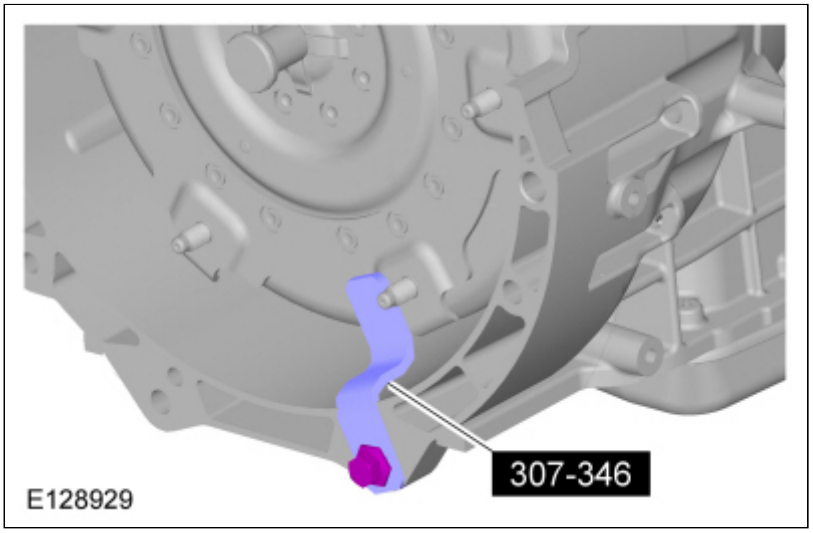


3. **NOTICE: Prior to installation of the engine, the torque converter pilot hub must be lubricated with multipurpose grease or damage to the torque converter or the engine crankshaft can occur.**

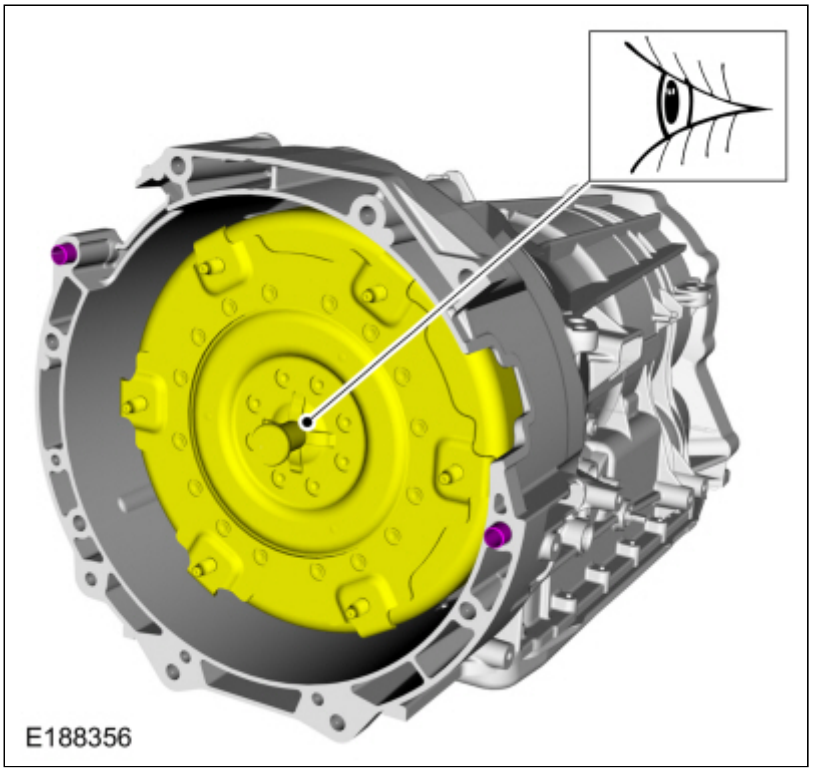
   Lubricate the torque converter pilot hub with multipurpose grease.
   Material: Grease - Electrical Contact (WSB-M1C239-A)



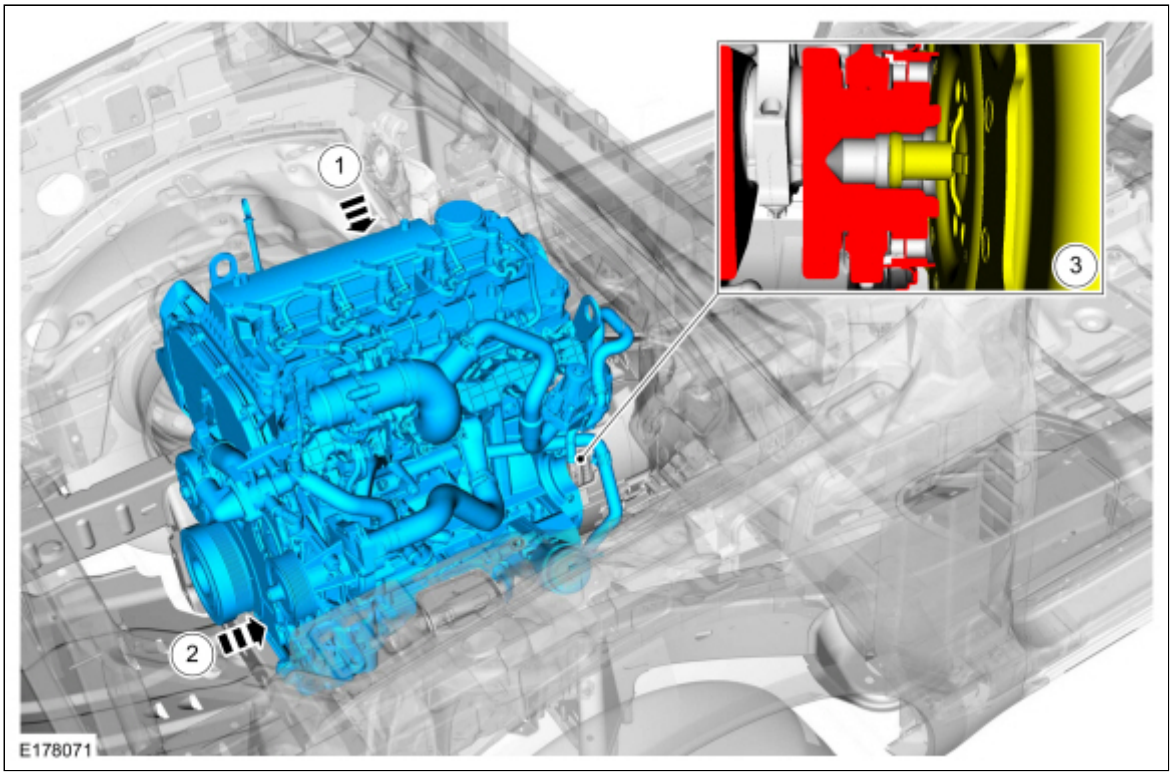
4. Remove Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



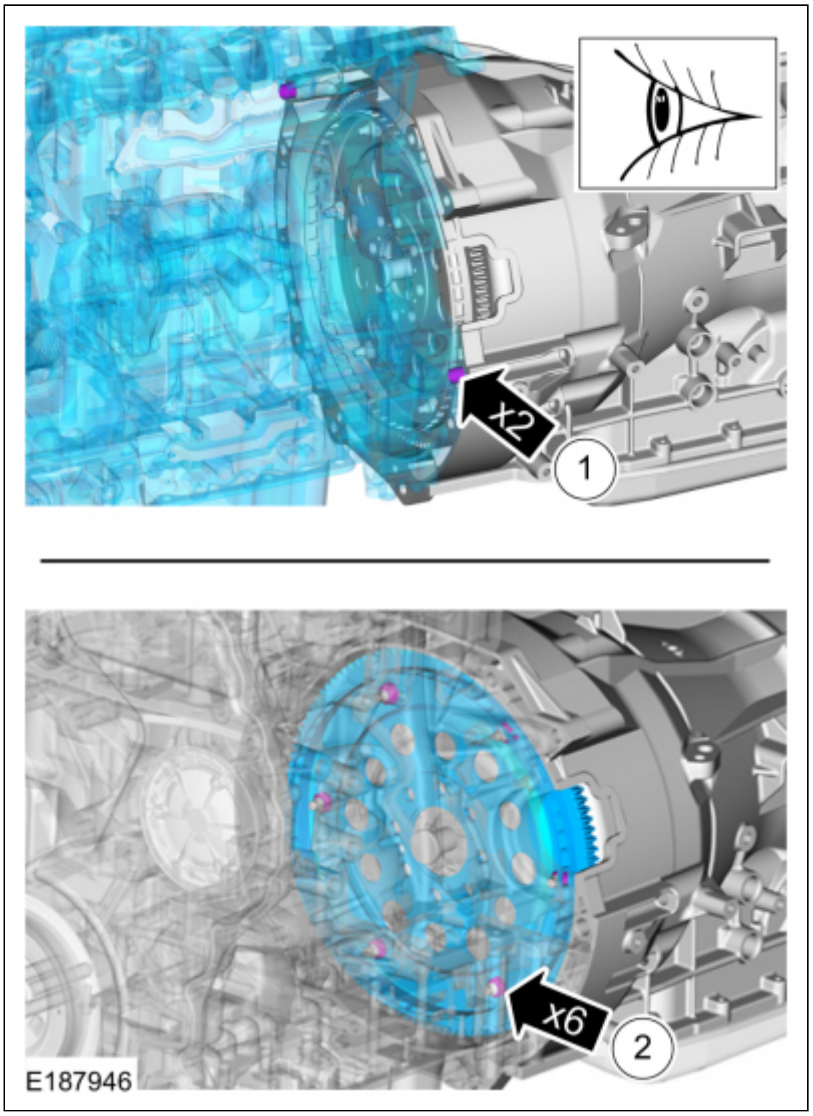
5. **NOTE:** *Make sure that the torque converter remains in the transmission.*



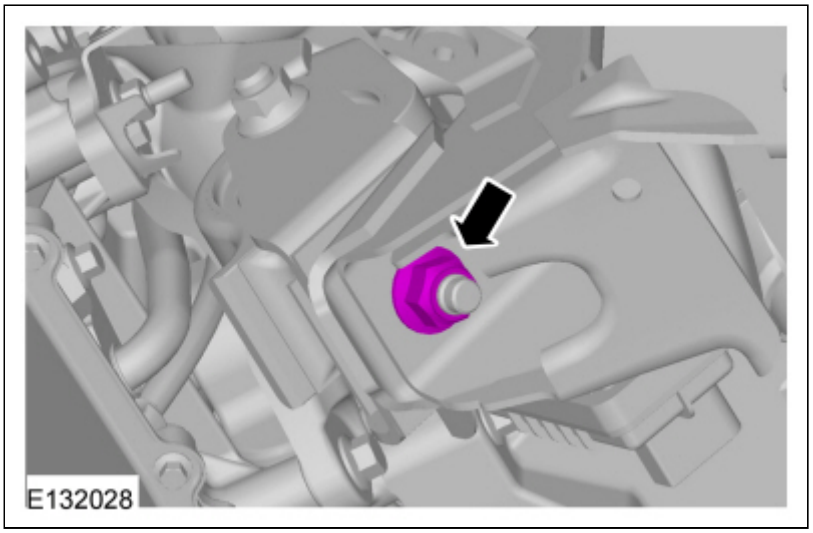
2. **NOTE:** *Make sure that the transmission is installed straight in relation to the engine to prevent damage to the pilot bearing.*



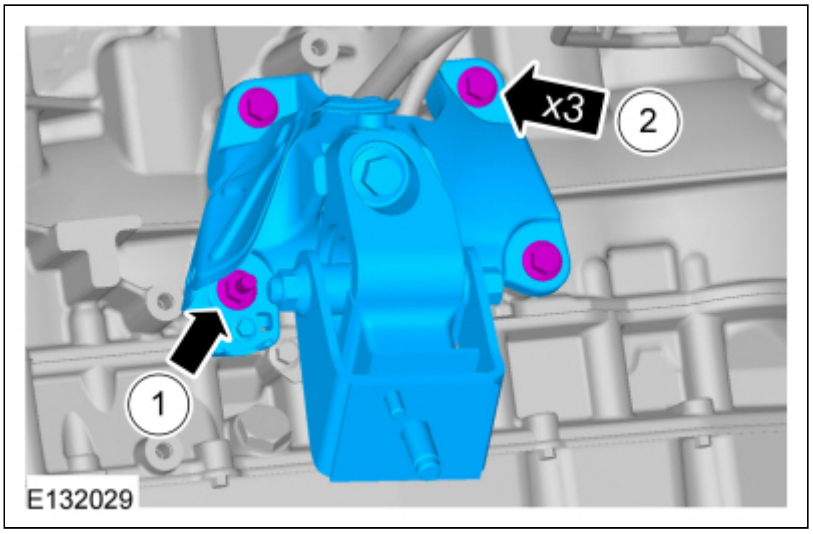
1. **NOTE:** *Make sure that the component is correctly located on the locating dowels.*
2. Only tighten the nut finger tight at this stage.



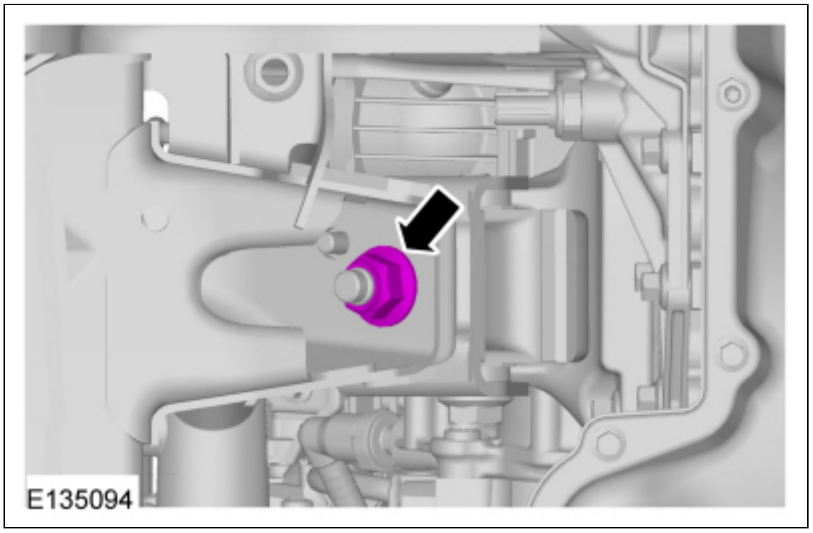
8. **NOTE:** *Only tighten the nut finger tight at this stage.*



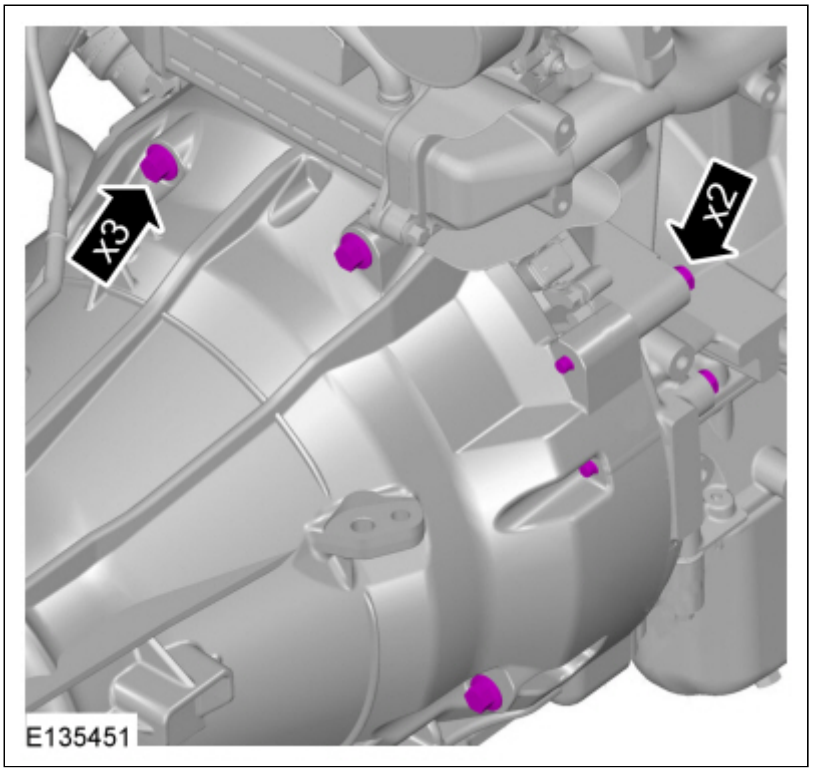
9. **NOTE:** *Only tighten the nut and bolts finger tight at this stage.*



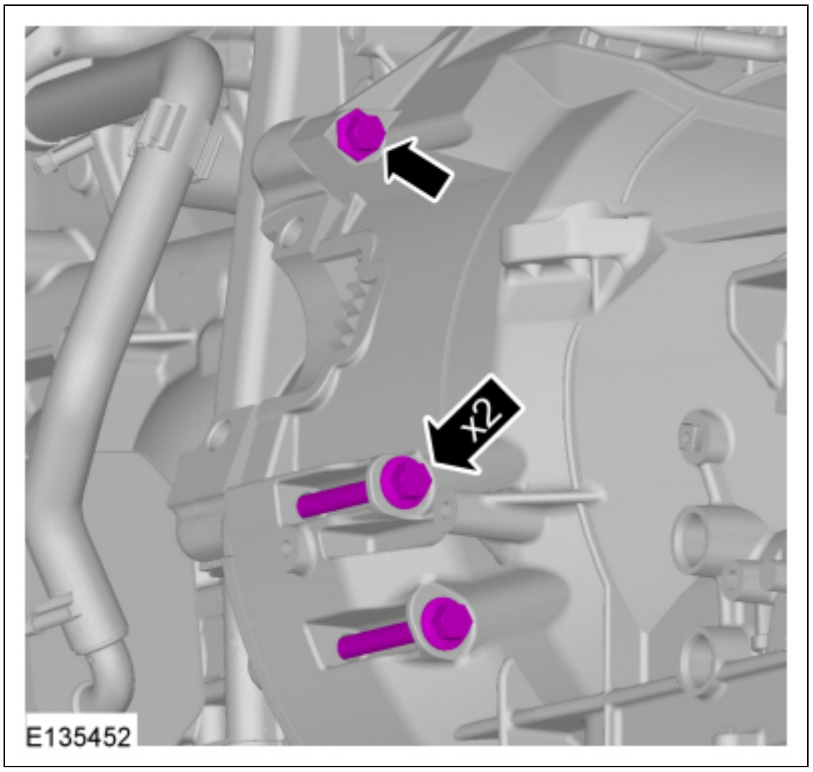
10. **NOTE:** *Only tighten the nut finger tight at this stage.*



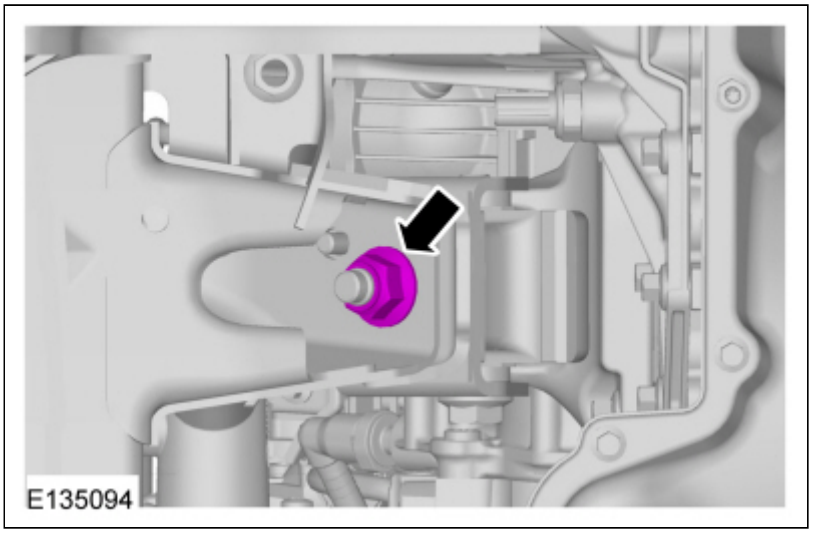
11. Initially hand tighten the fasteners.
    Torque: 48 Nm



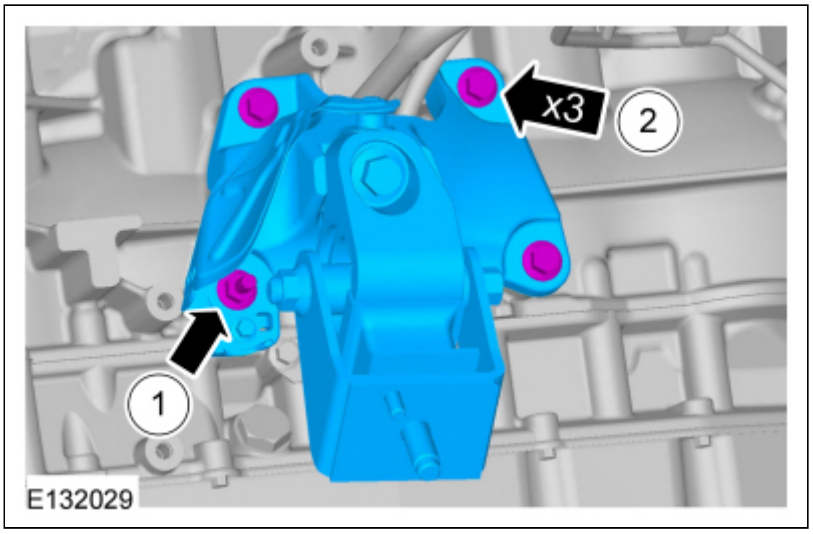
12. Initially hand tighten the fasteners.
    Torque: 48 Nm



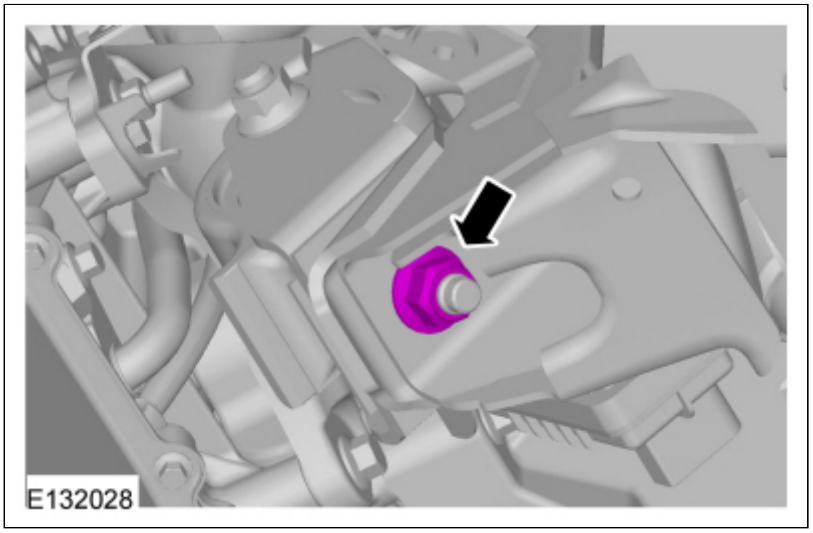
13. *Torque*: 80 Nm



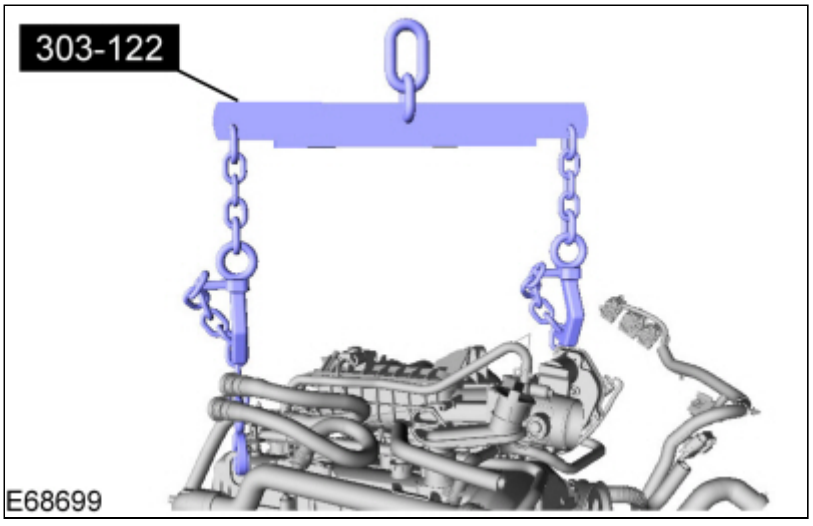
1. *Torque*: 48 Nm
2. *Torque*: 48 Nm



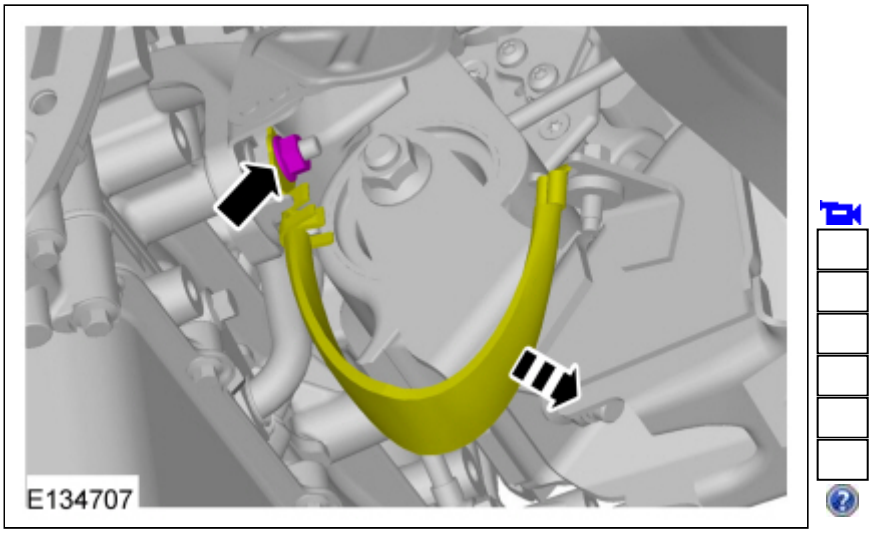
15. *Torque*: 80 Nm



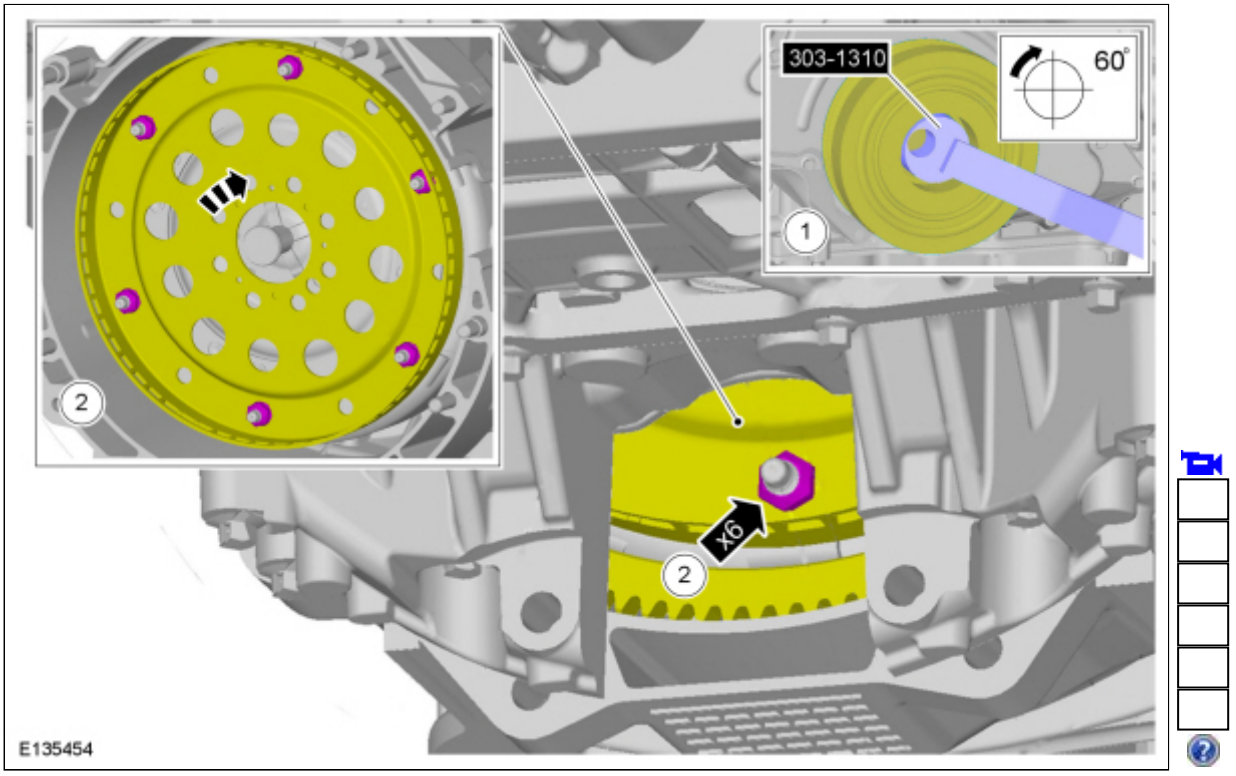
1. Remove Special Service Tool: 303-122 Lifting Bracket, Engine.



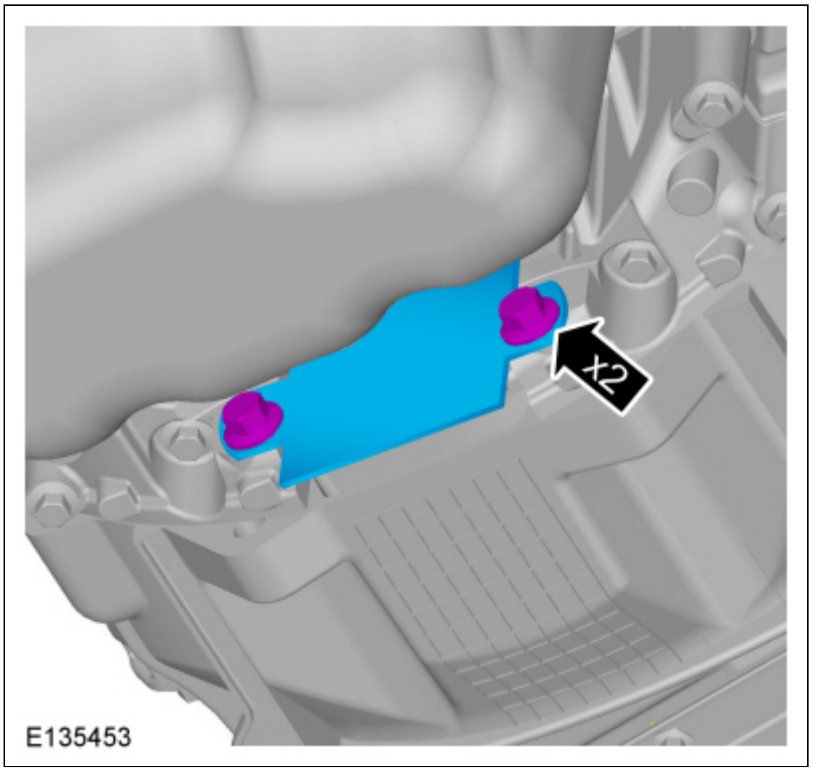
17. *Torque*: 13 Nm



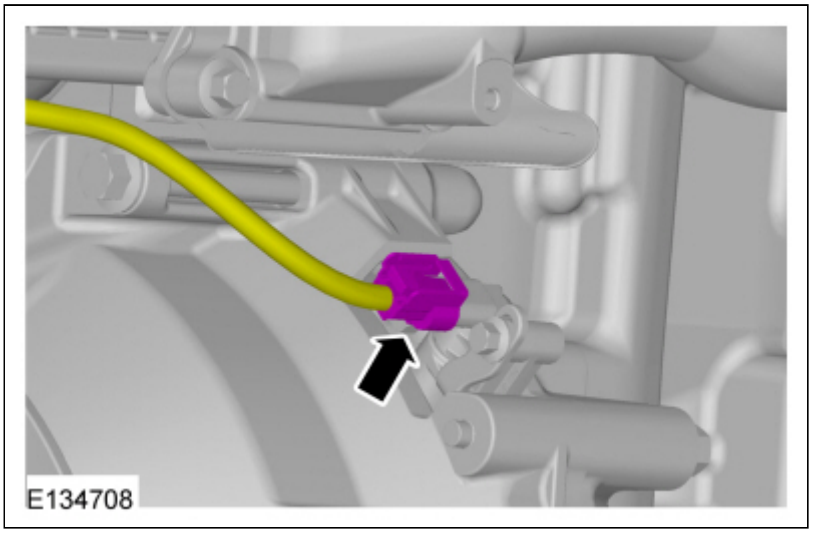
18. *Torque*: 40 Nm



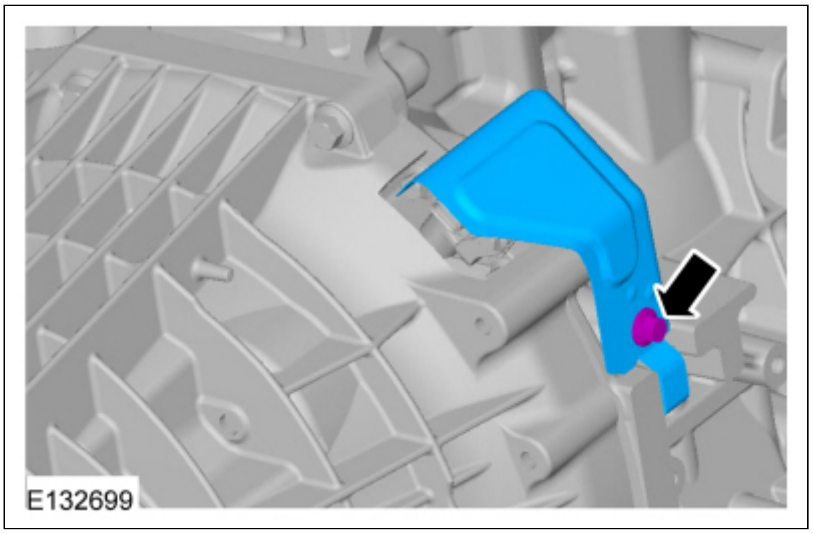
19. *Torque*: 22 Nm



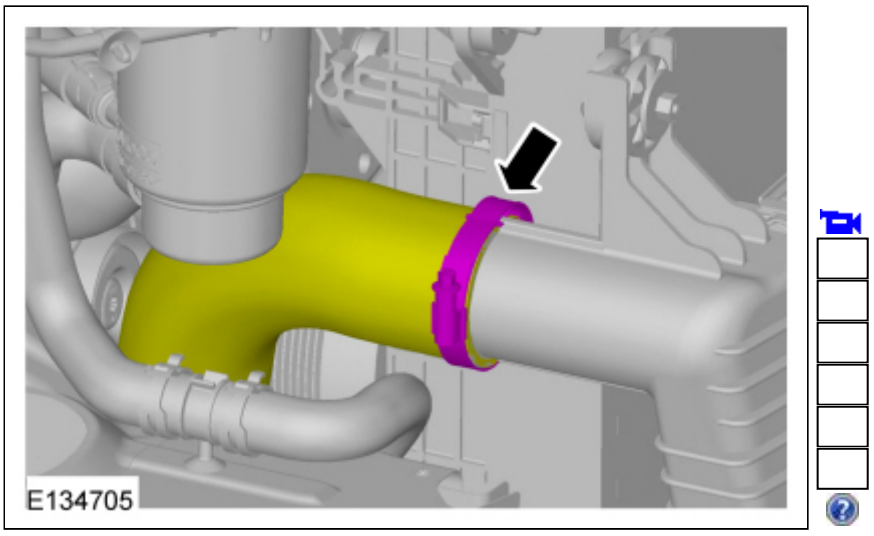
20.



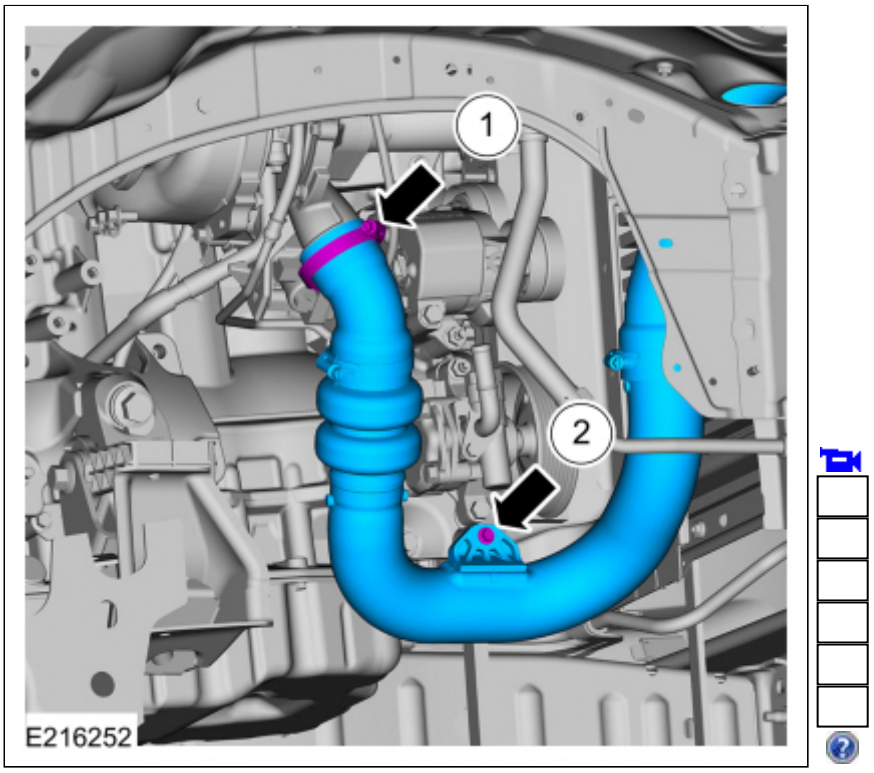
21. *Torque*: 12 Nm



22. *Torque*: 4 Nm

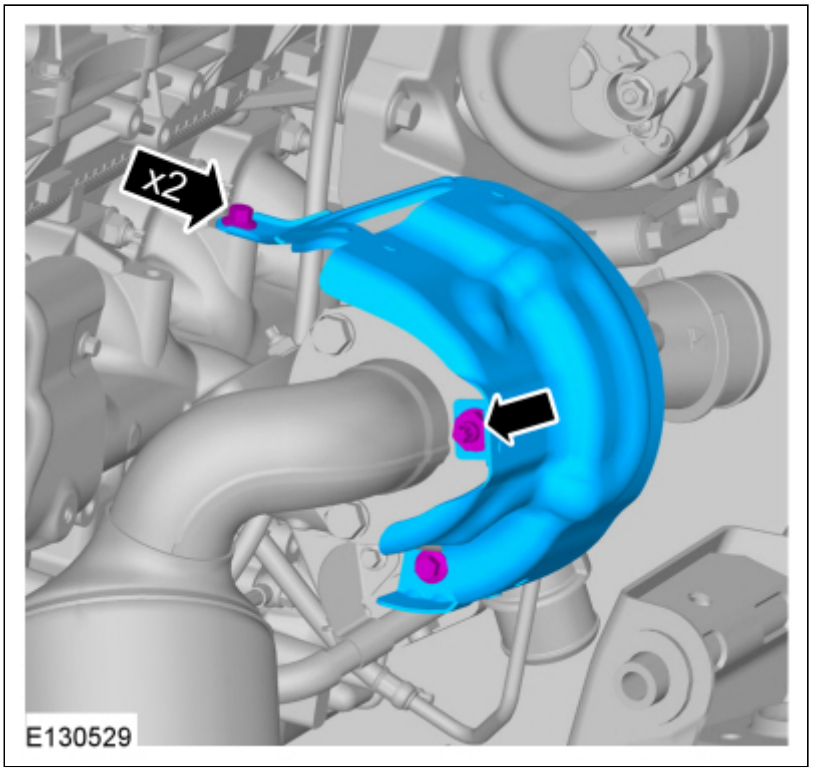


23. *Torque*: 10 Nm

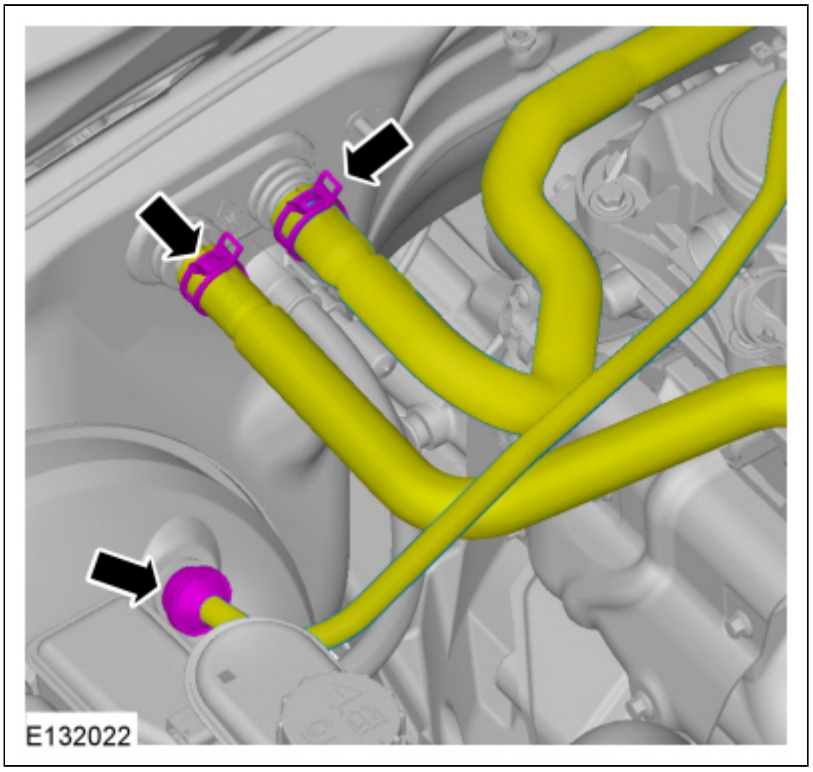


24. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

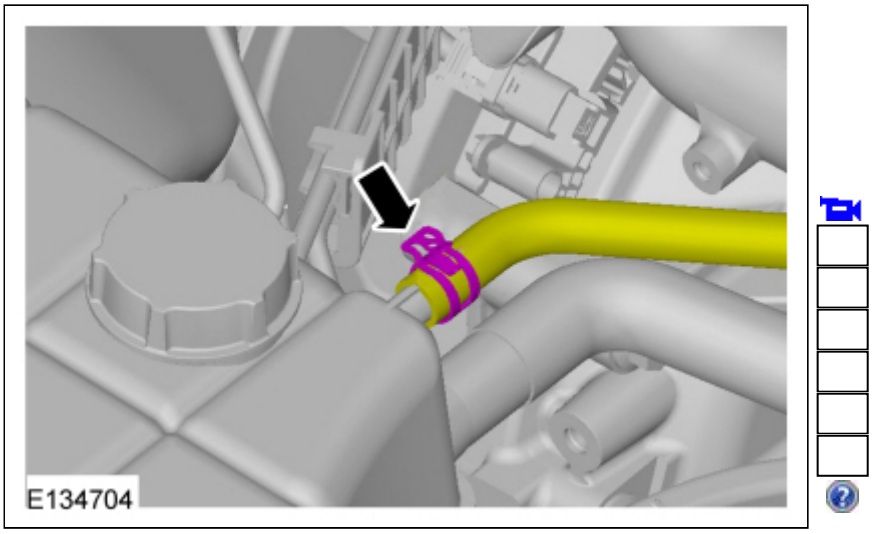
25. *Torque*: 22 Nm



26.



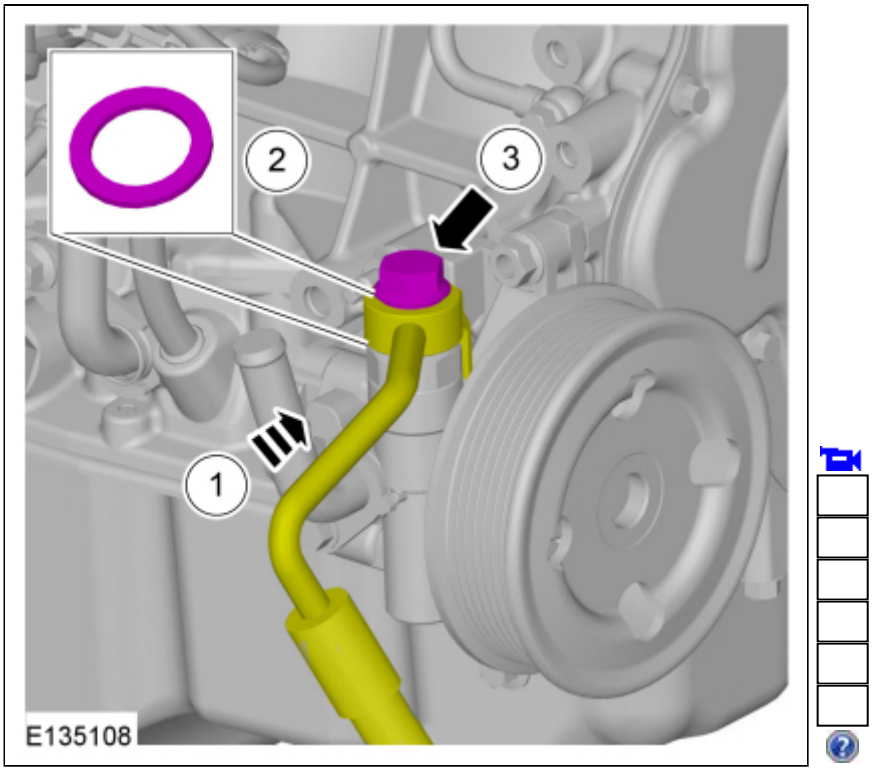
27.



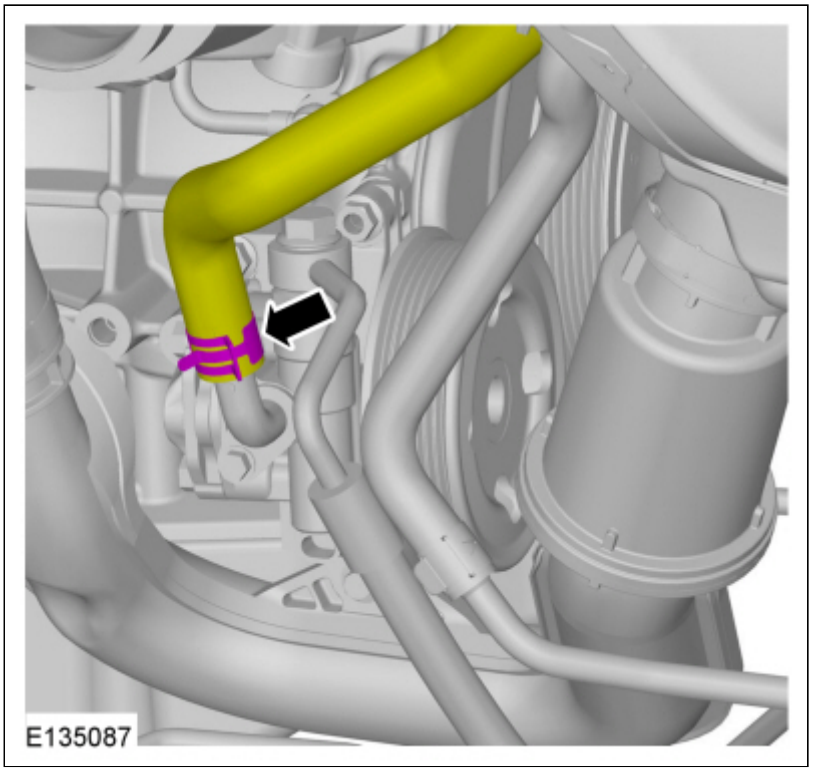
Vehicles With: Hydraulic Power Assist Steering (HPAS)

28. **NOTE:** *The washers can be reused unless damaged.*

    3. *Torque*: 35 Nm

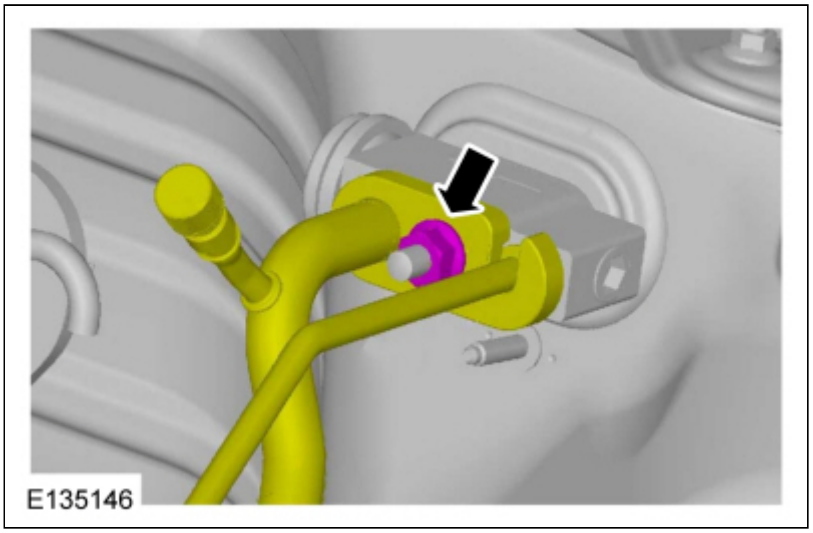


29.



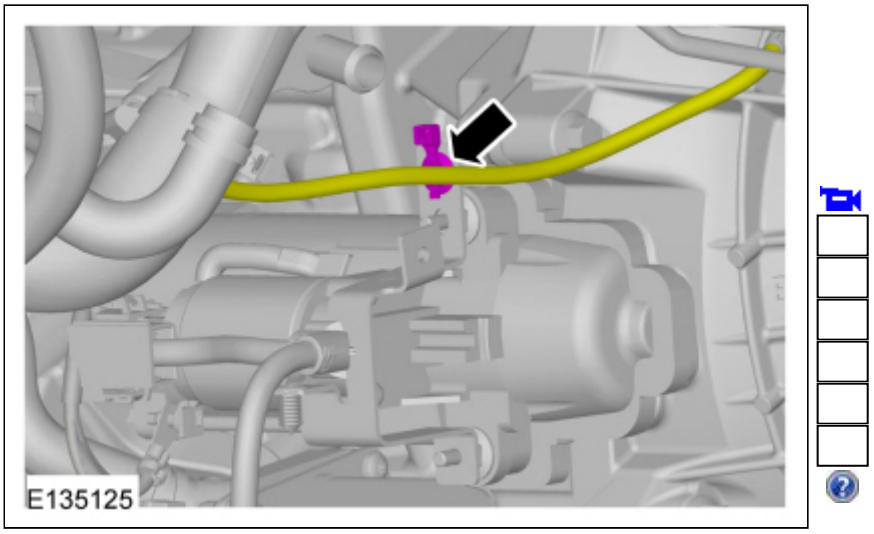
All vehicles

30. *Torque*: 22 Nm

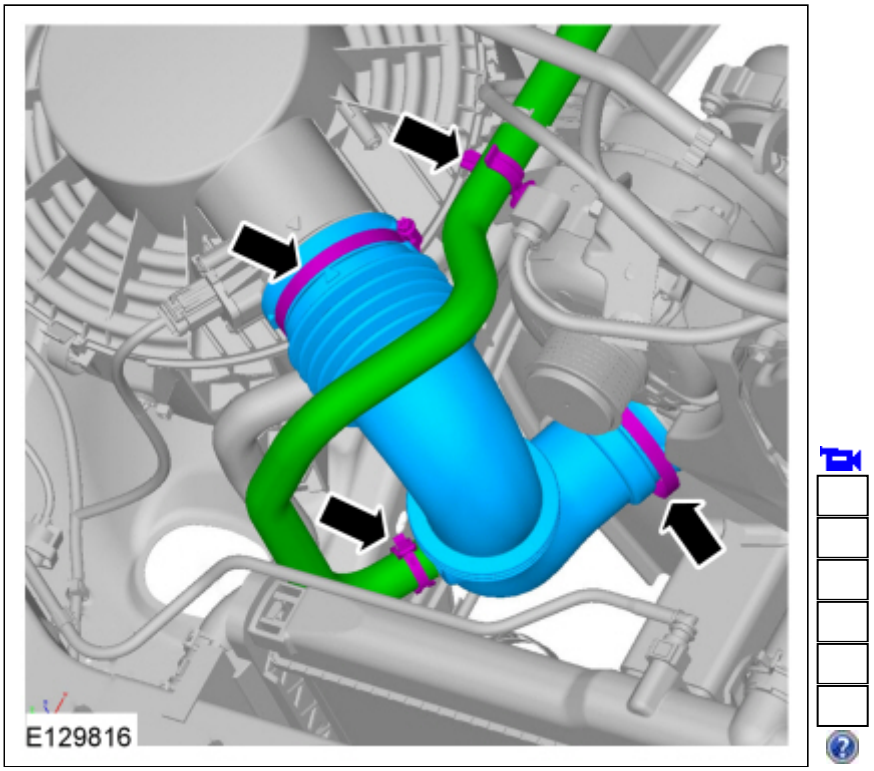


31. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

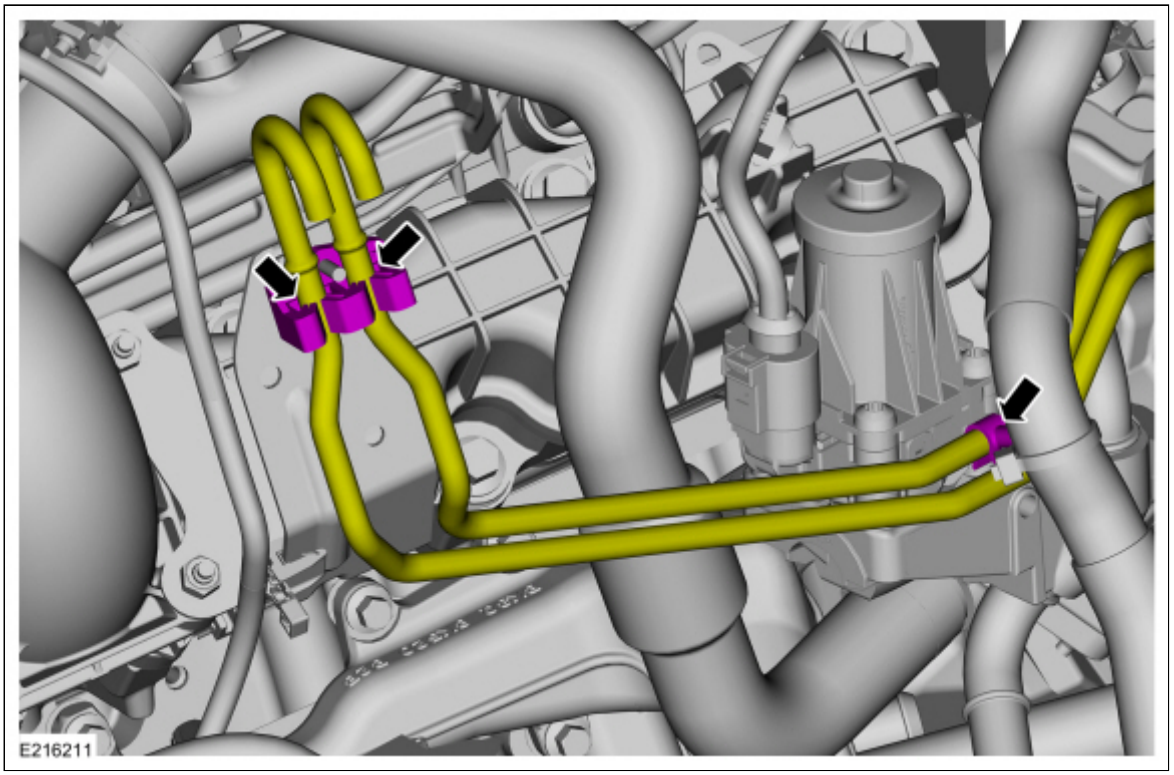
32.



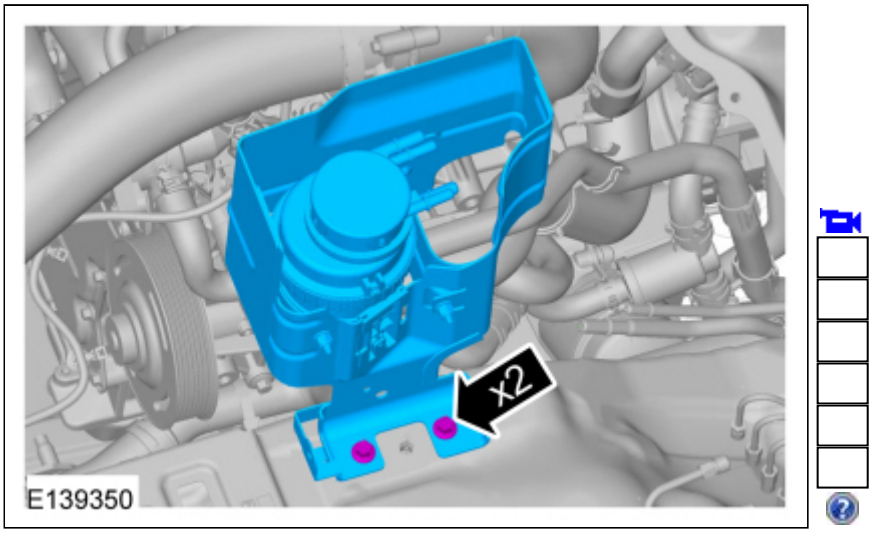
33. Refer to: Transmission Fluid Cooler (307-02 Transmission Cooling, Removal and Installation).
34. Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
35. Refer to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
36. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
37. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
38.



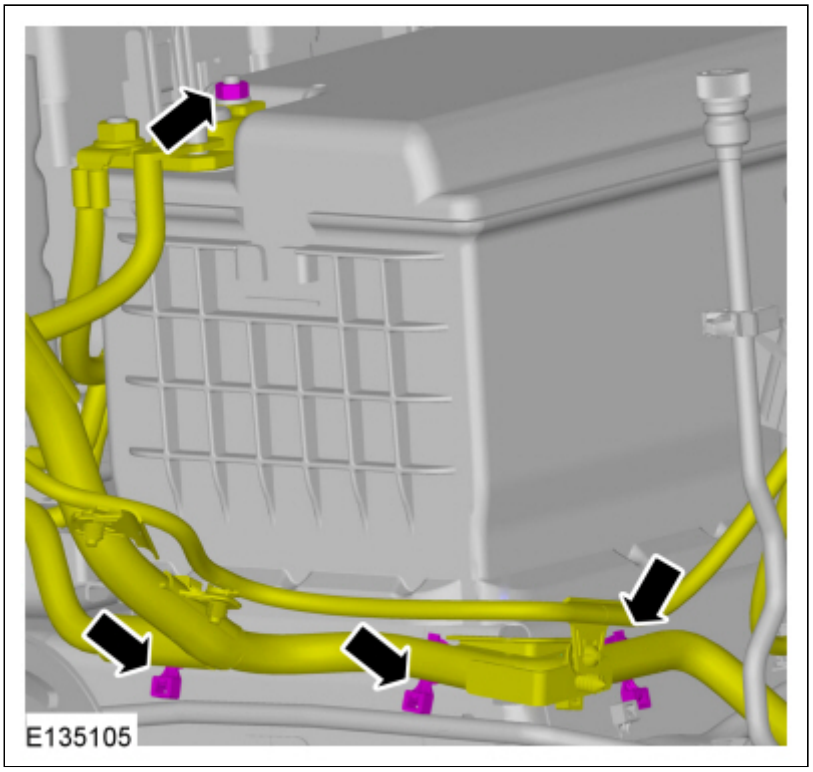
39.



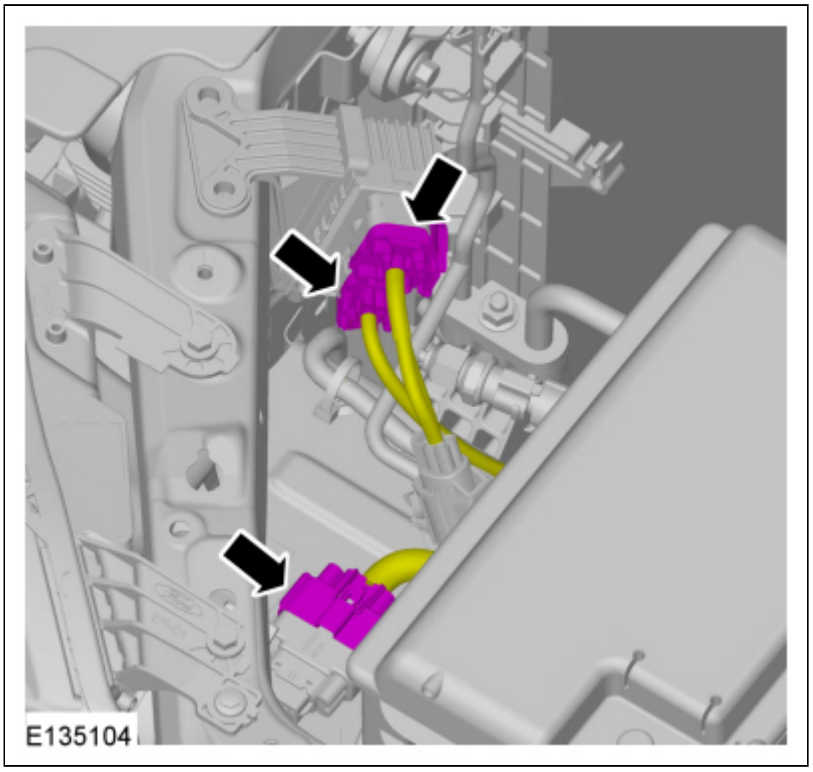
40. *Torque*: 18 Nm



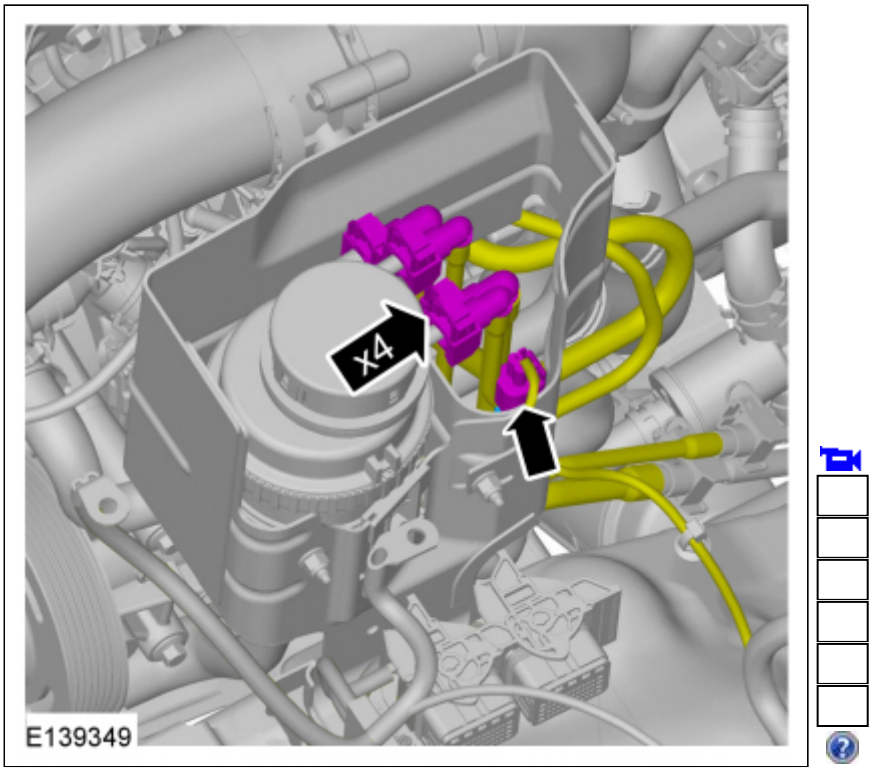
41. *Torque*: 5 Nm



42.



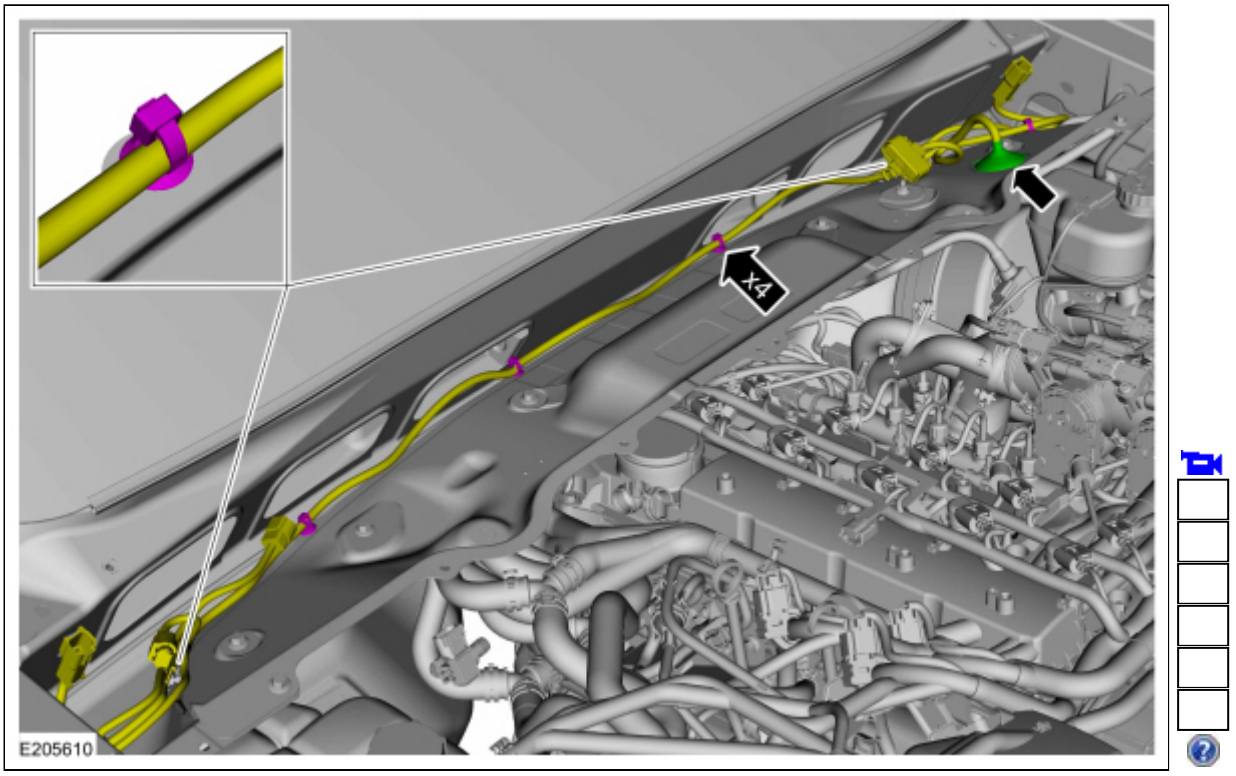
43.



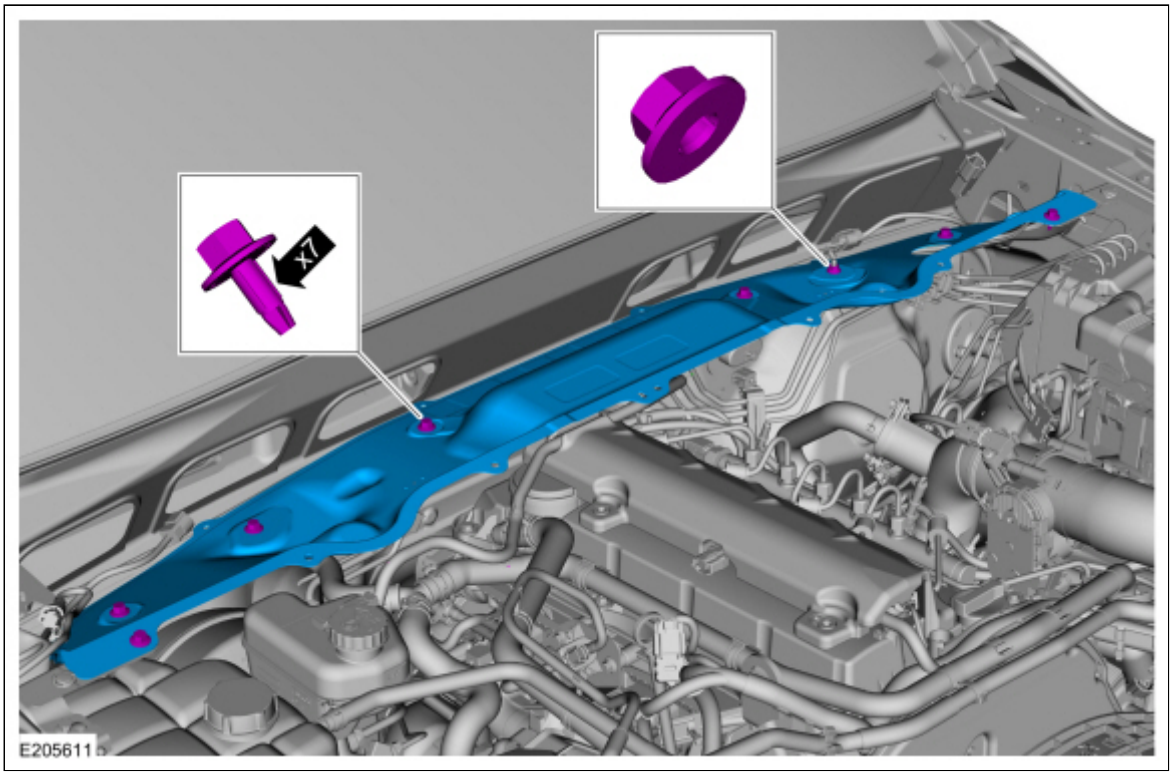
44. Refer to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

45. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

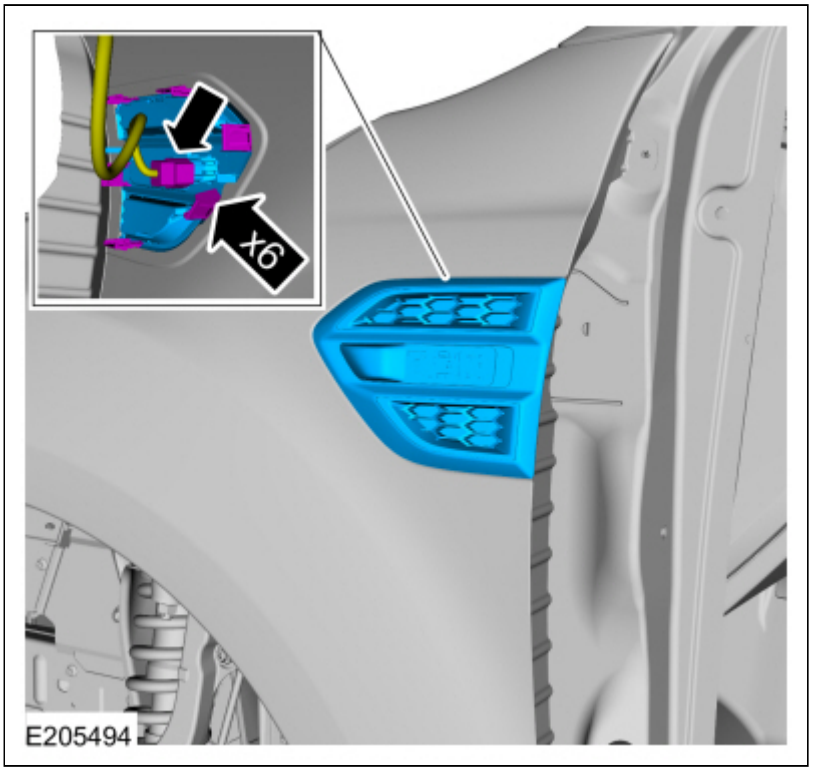
46. *Torque*: 10 Nm



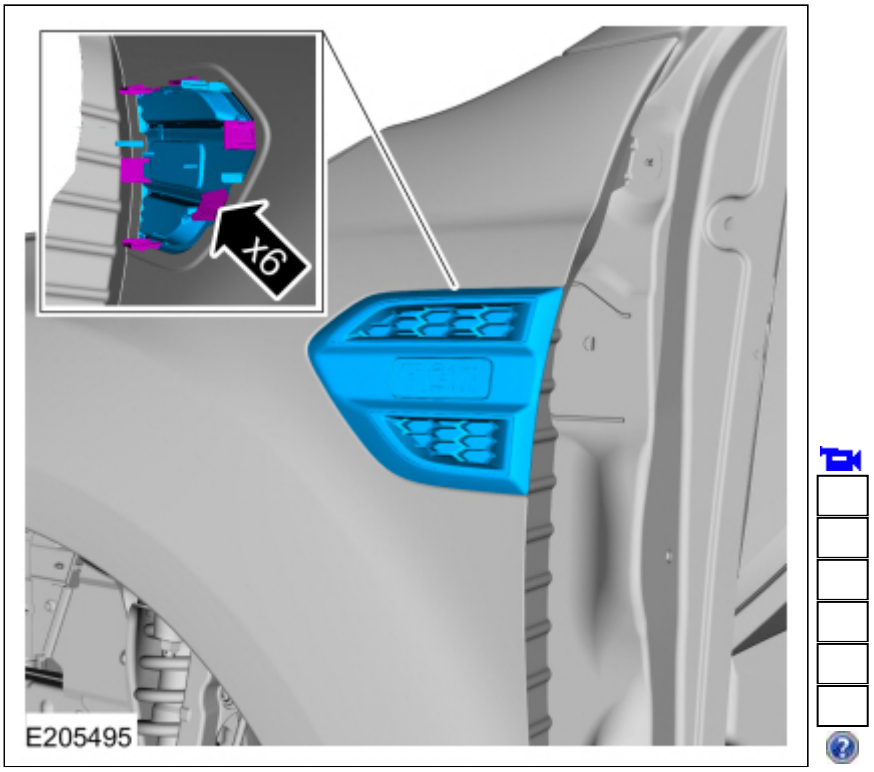
47. *Torque*: 10 Nm



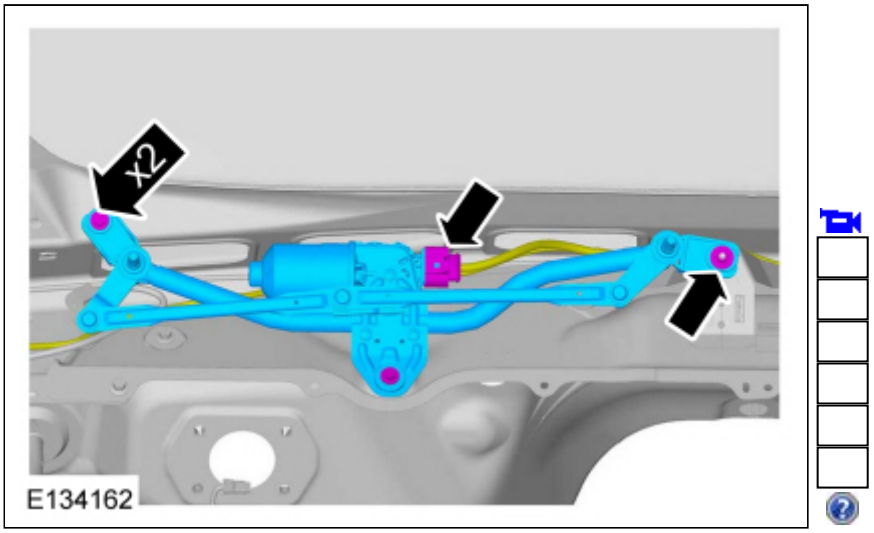
48. On both sides.



49. On both sides.



50. *Torque*: 10 Nm

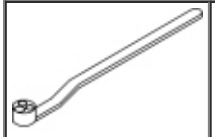
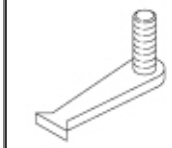
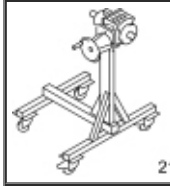
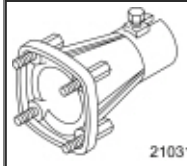
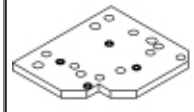
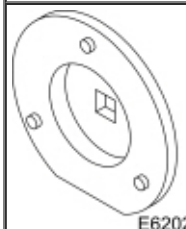
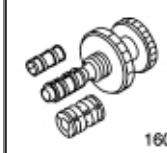


51. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
52. Refer to: Hood (501-02 Front End Body Panels, Removal and Installation).
53. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
54. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
55. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
56. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
57. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
58. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Engine Accessories

Special Tool(s) / General Equipment

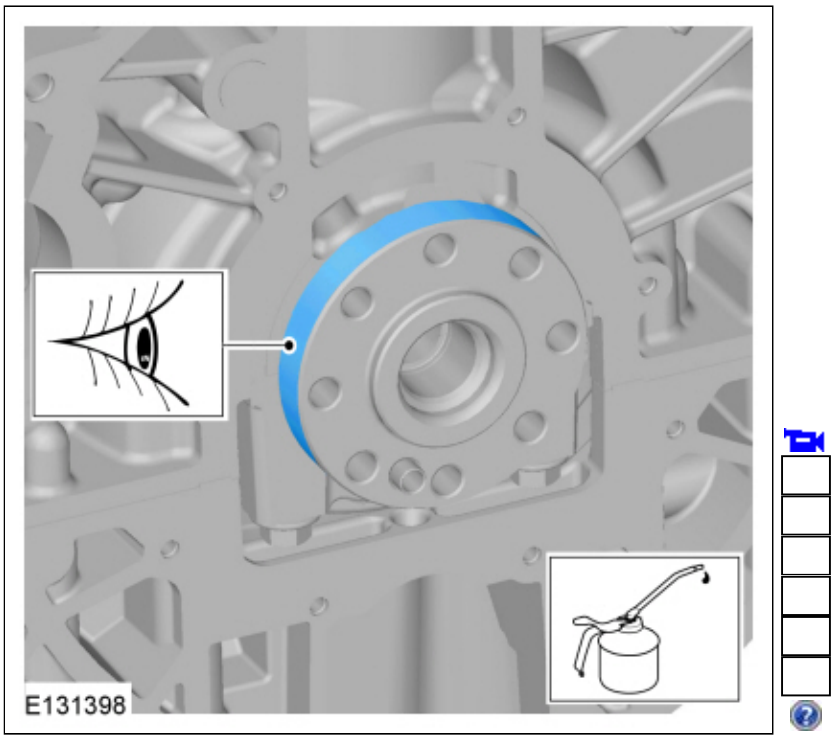
 21068A	303-122 Lifting Bracket, Engine
 E87614	303-1310 Holding Wrench, Crankshaft
 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 21135	303-254 Locking Tool, Flywheel
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E68386	303-435-11B Mounting Plate for 303-435-06
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate
 16067	308-204 Aligner, Clutch Disc

Dowel with a Diameter of 6 mm
1/2 Inch Square Drive Breaker Bar

Materials

Name	Specification
Silicone Sealant	WSE-M4G323-A4

1.

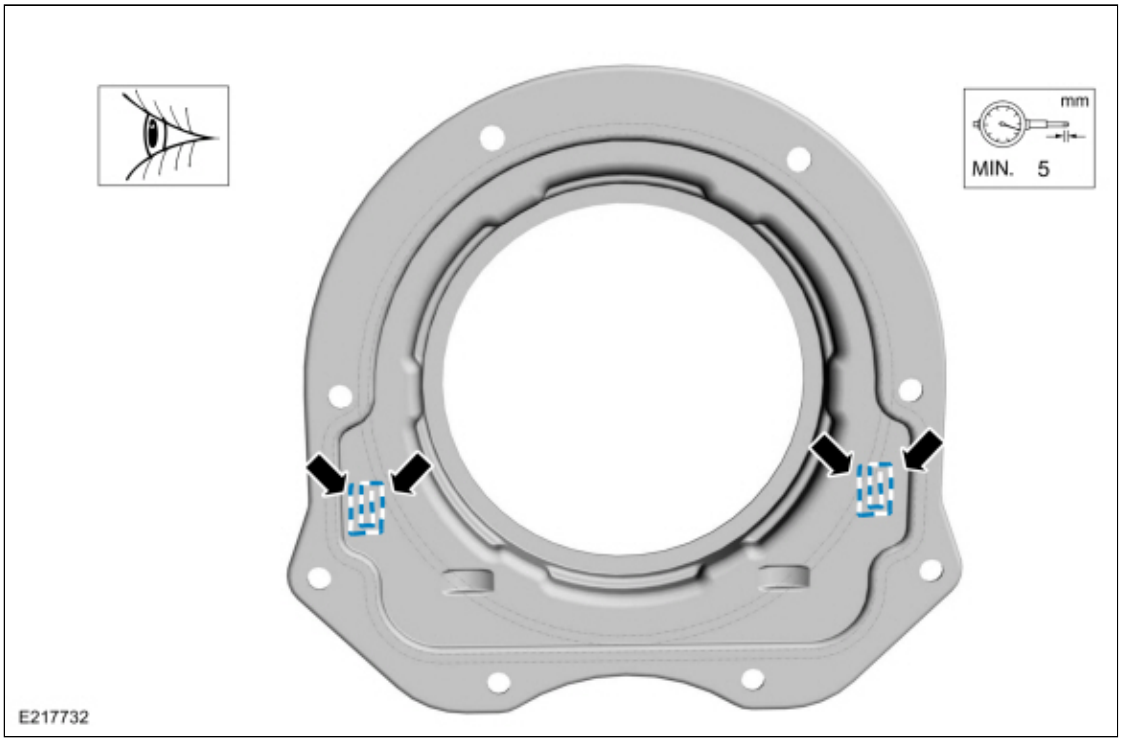


2. **NOTE:** *Install new crankshaft rear seal carrier with in five minutes after applying the recomended sealent. Failure to follow this instruction may result in damage to the vehicle.*

   NOTE: *Do not add any more than the specified quantity of sealant or add the sealant anywhere other than the area shown.*

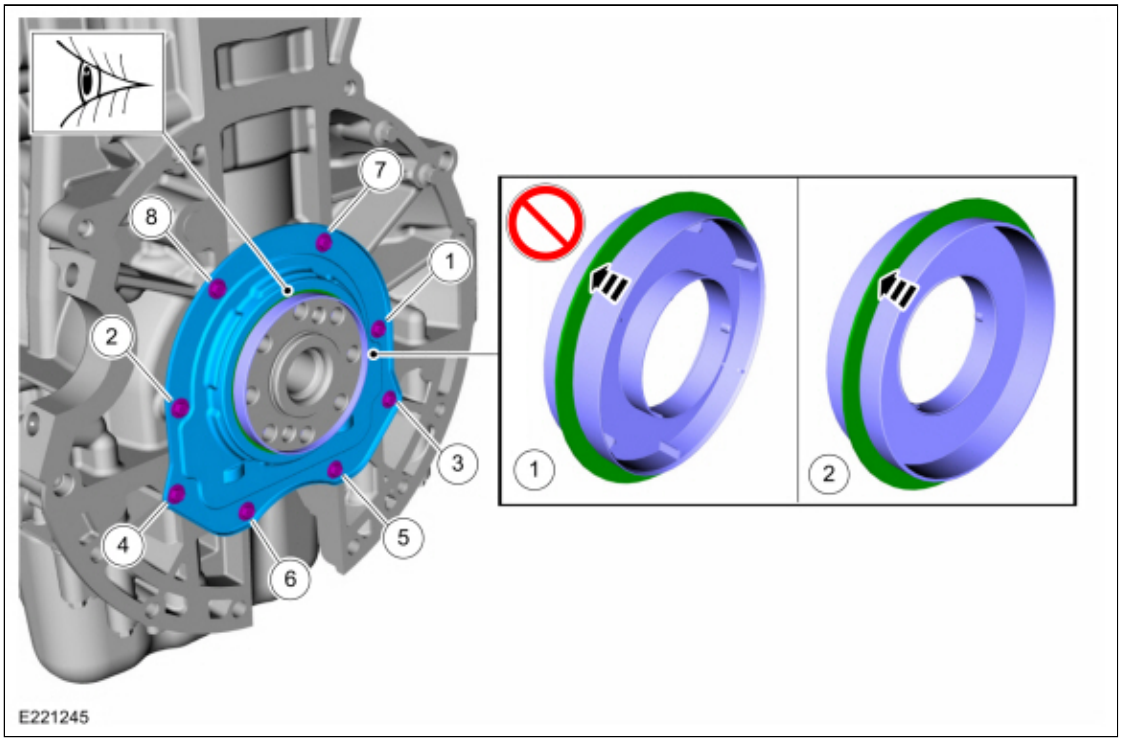
   NOTE: *If the foam pads are not present on inspection, fill the square areas shown with 75% of sealant.*

   Material: Silicone Sealant (WSE-M4G323-A4)



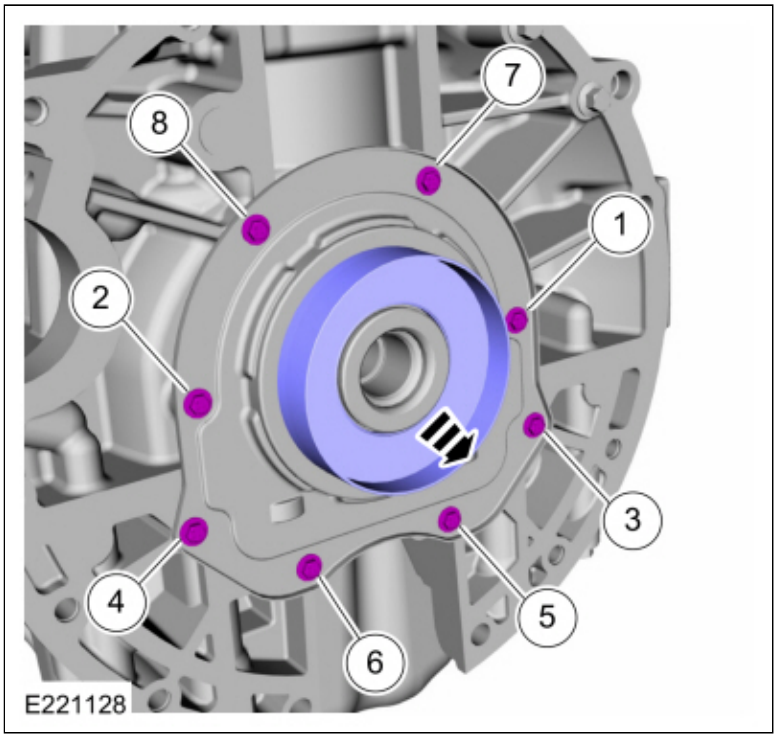
3. **NOTICE: A new crankshaft rear seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed. Failure to follow this instruction may result in damage to the vehicle.**

   Initially hand tighten the fasteners.

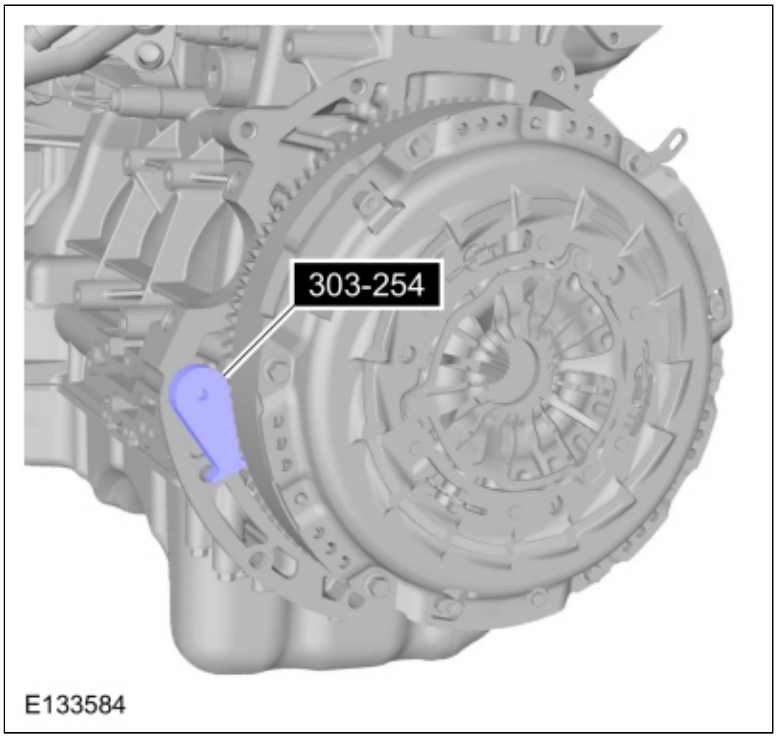


4. **NOTE:** *New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.*

   Torque:
   Stage 1: 5 Nm
   Stage 2: 10 Nm

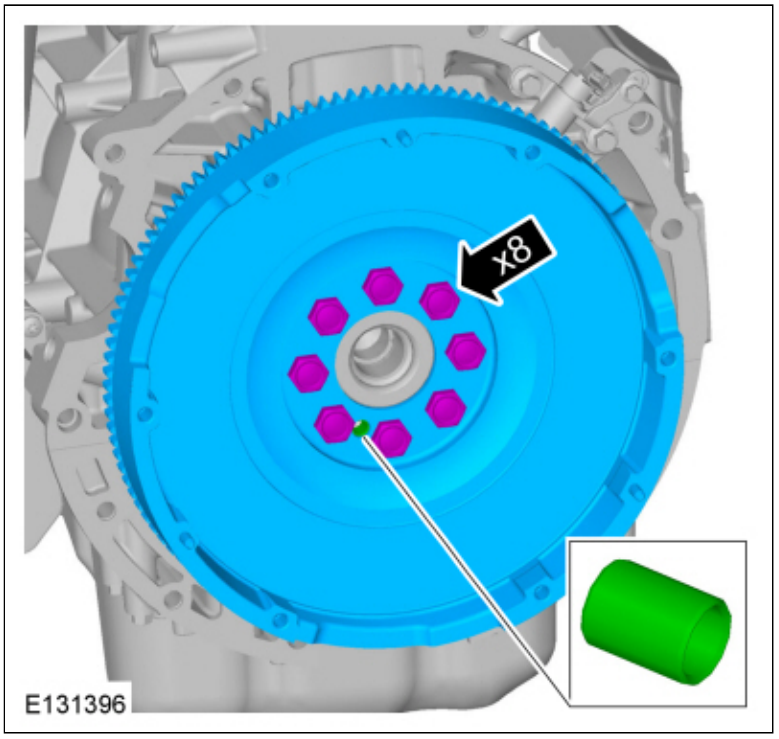


5. Use Special Service Tool: 303-254 Locking Tool, Flywheel.

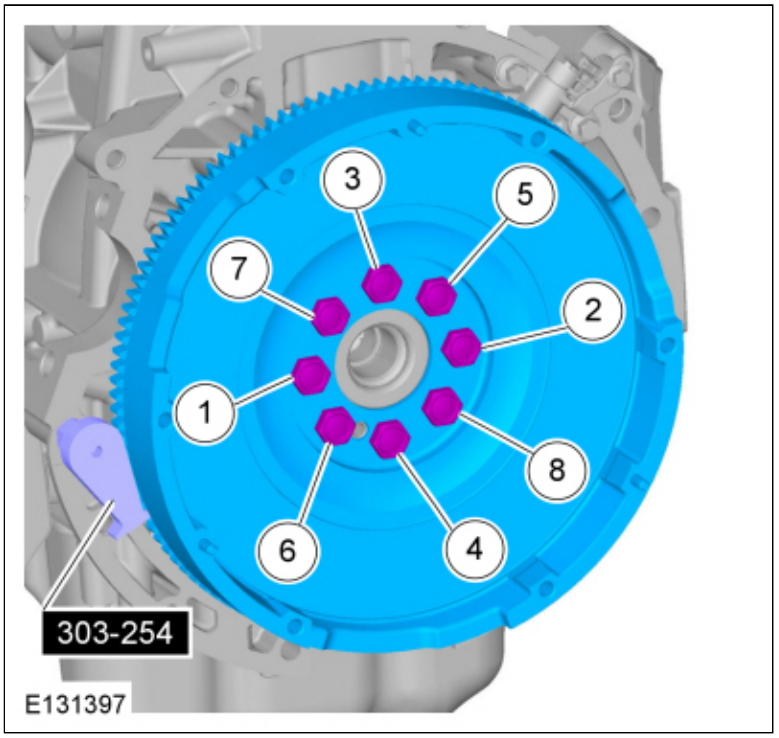


6. **NOTE:** *Make sure that the flywheel is in full contact with the crankshaft flange before installing the flywheel bolts.*

   Initially hand tighten the fasteners.

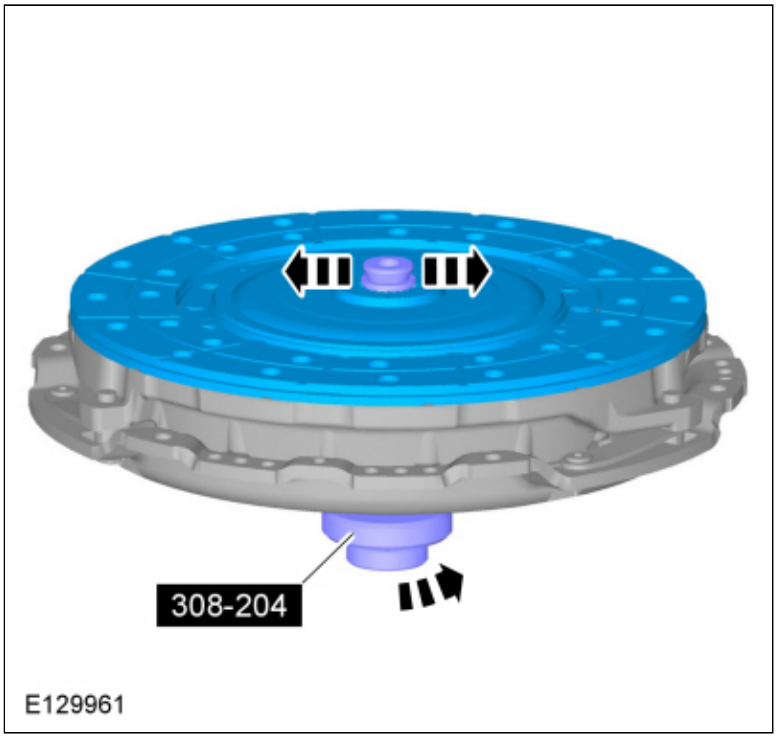


7. Use Special Service Tool: 303-254 Locking Tool, Flywheel.
   Torque:
   Stage 1: 25 Nm
   Stage 2: 45 Nm
   Stage 3: 45°



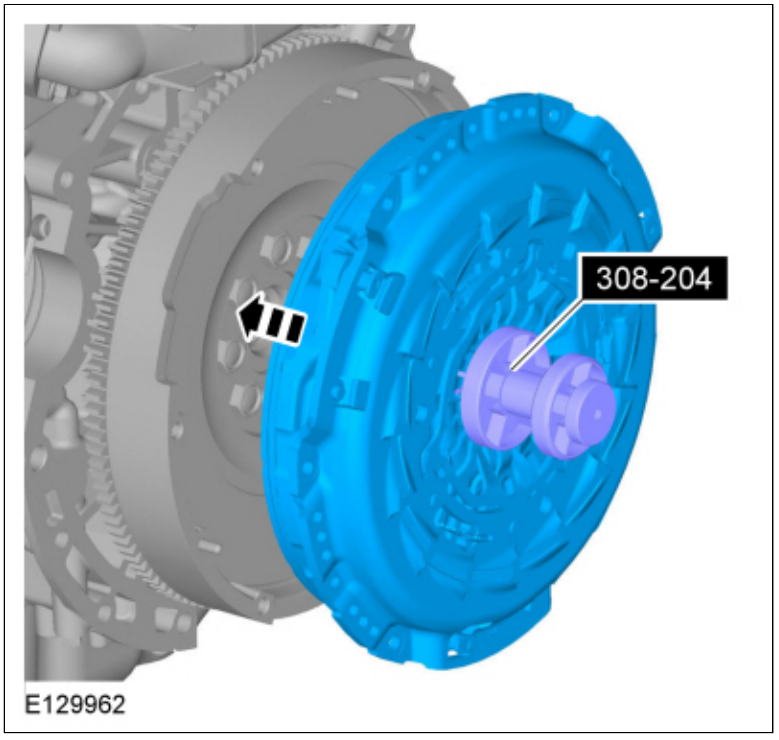
8. **NOTE:** *The cone on the special tool must only be tightened finger tight to prevent damage to the clutch disc.*

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.



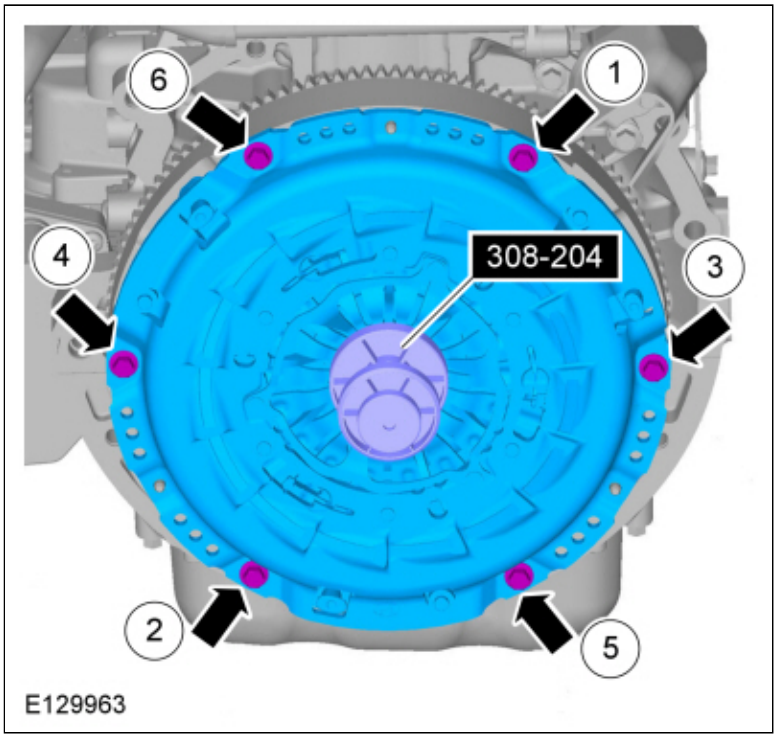
9. **NOTE:** *Only tighten the bolt finger tight at this stage.*

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.

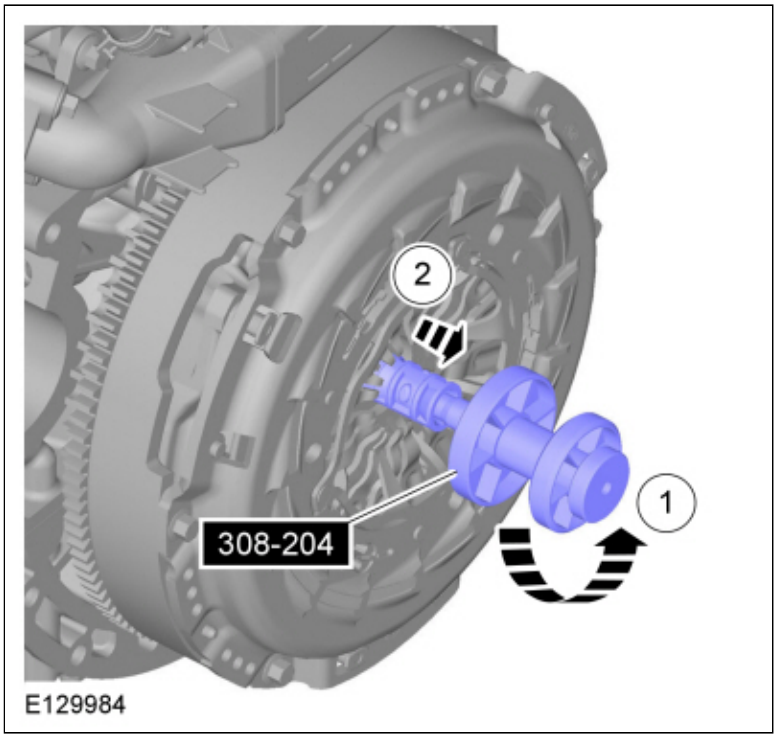


10. **NOTICE: Tighten the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.**

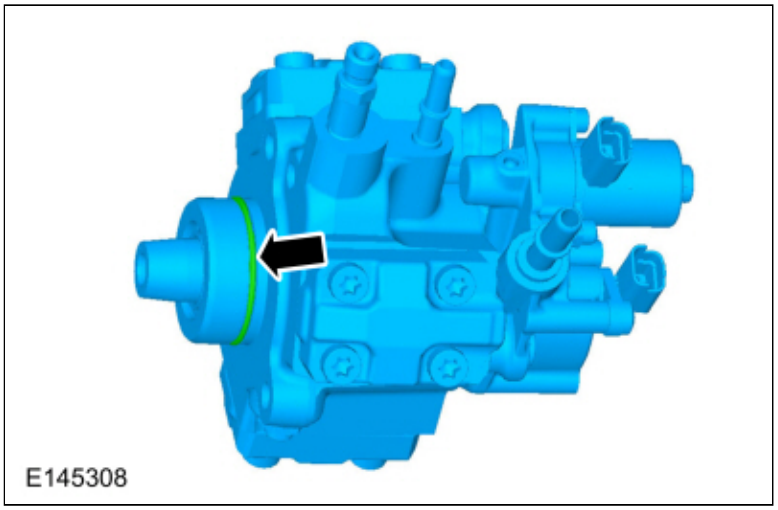
    Use Special Service Tool: 308-204 Aligner, Clutch Disc.
    Torque: 30 Nm



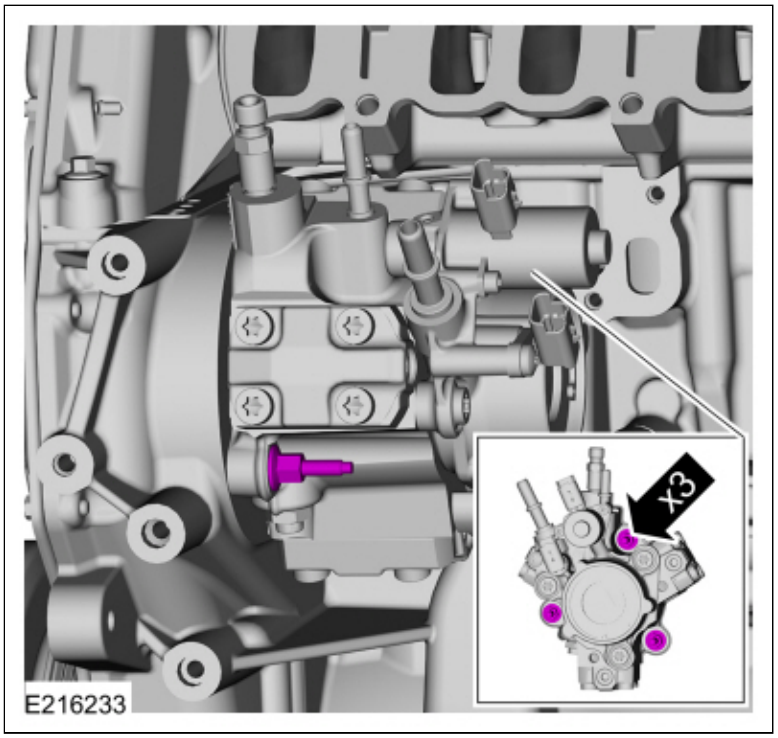
11. Remove Special Service Tool: 308-204 Aligner, Clutch Disc.



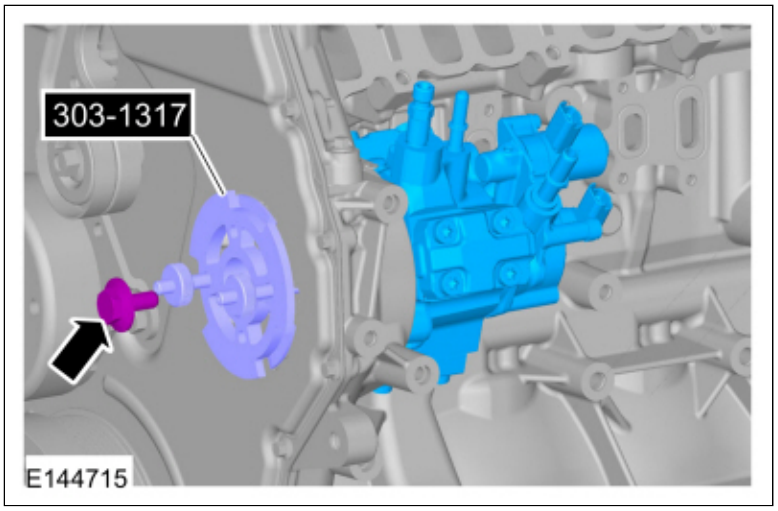
12.



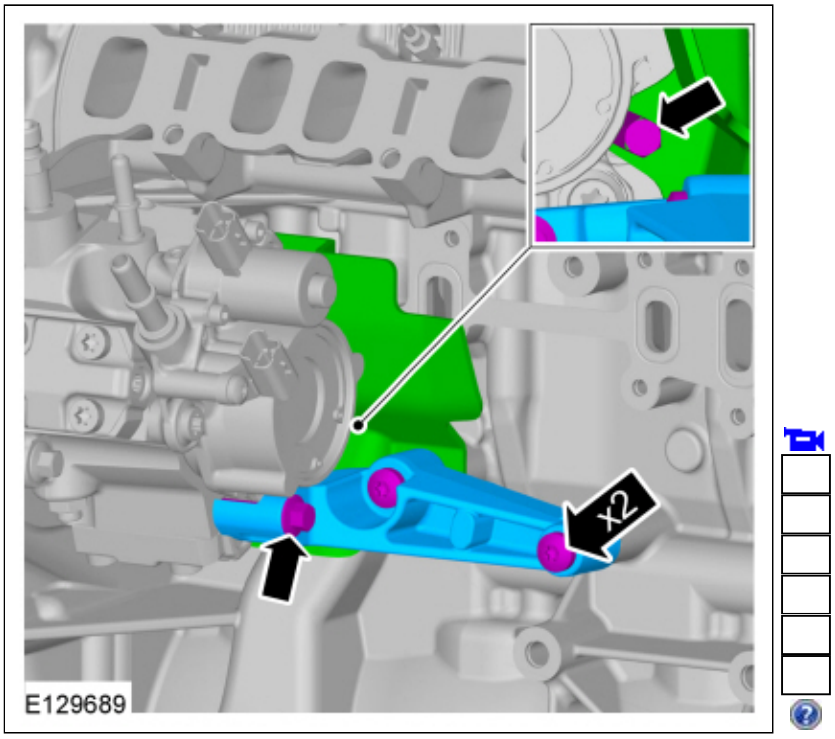
13. *Torque*: 23 Nm



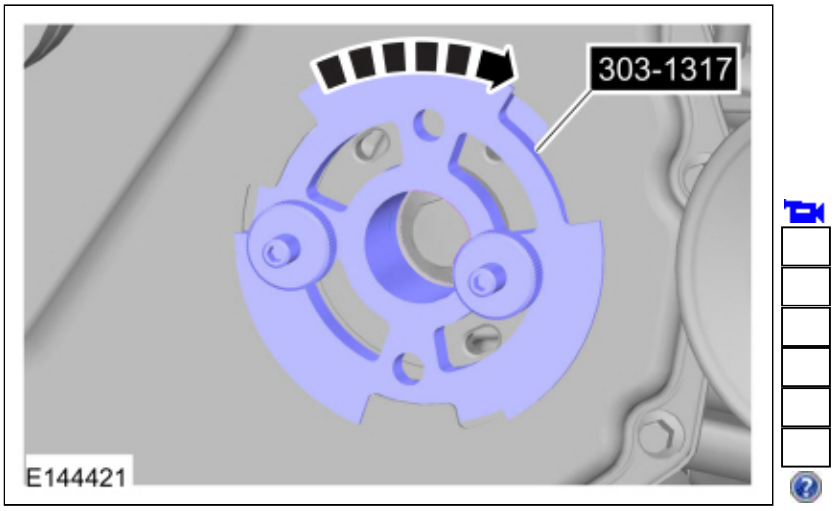
14.



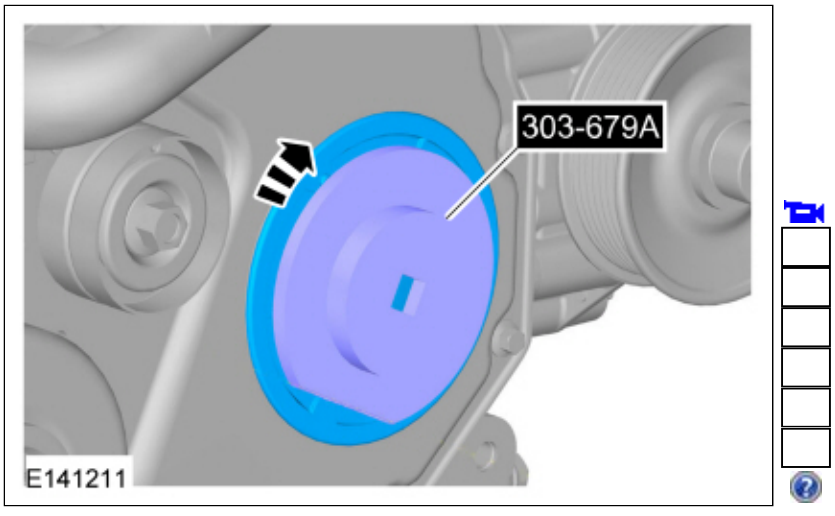
15. *Torque*: 23 Nm



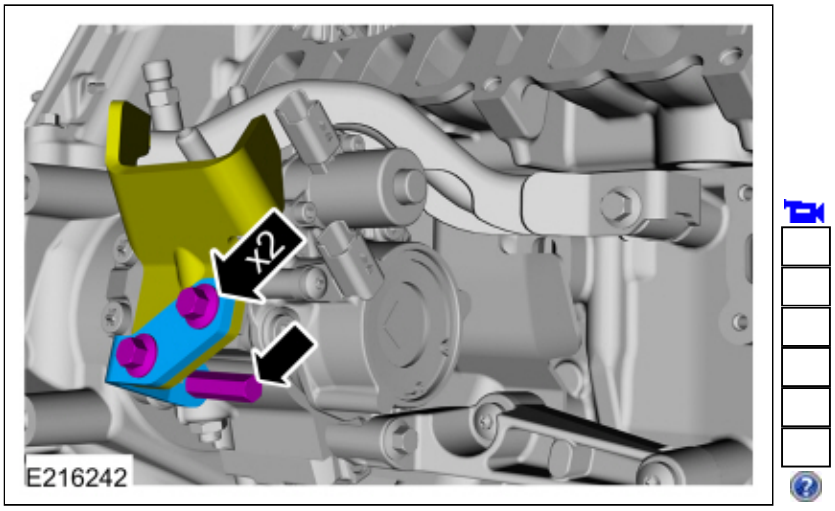
16. Remove Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



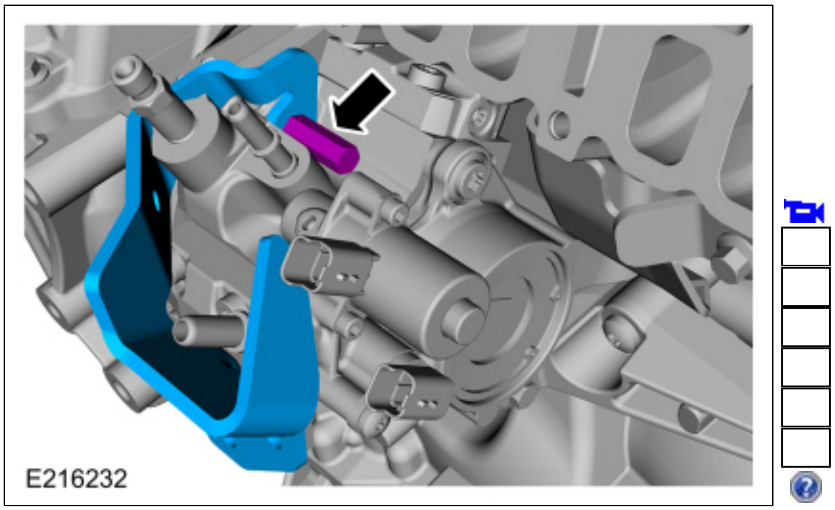
17. Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



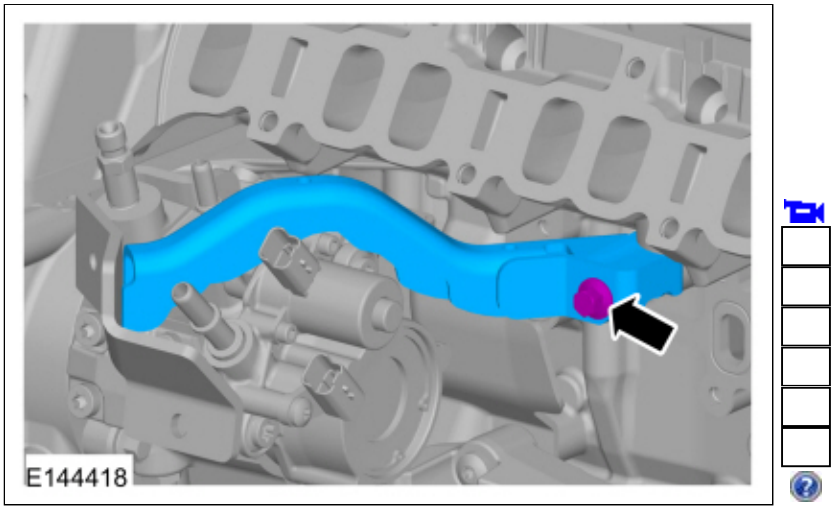
18.



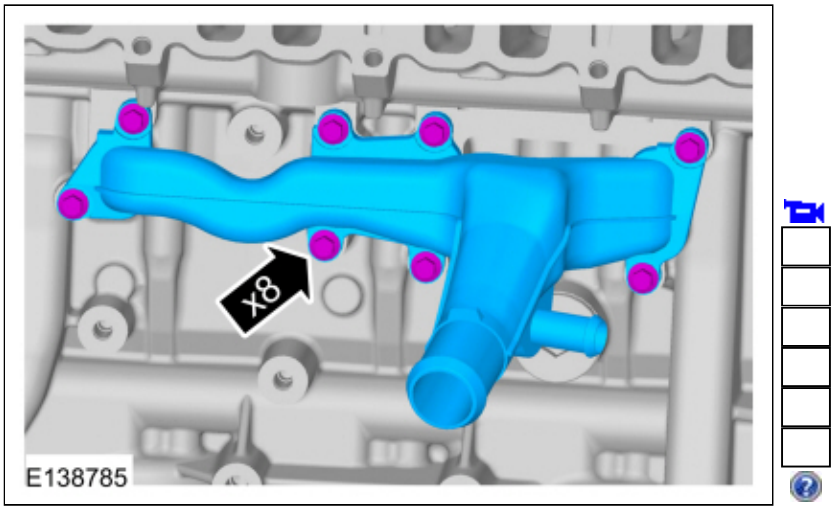
19.



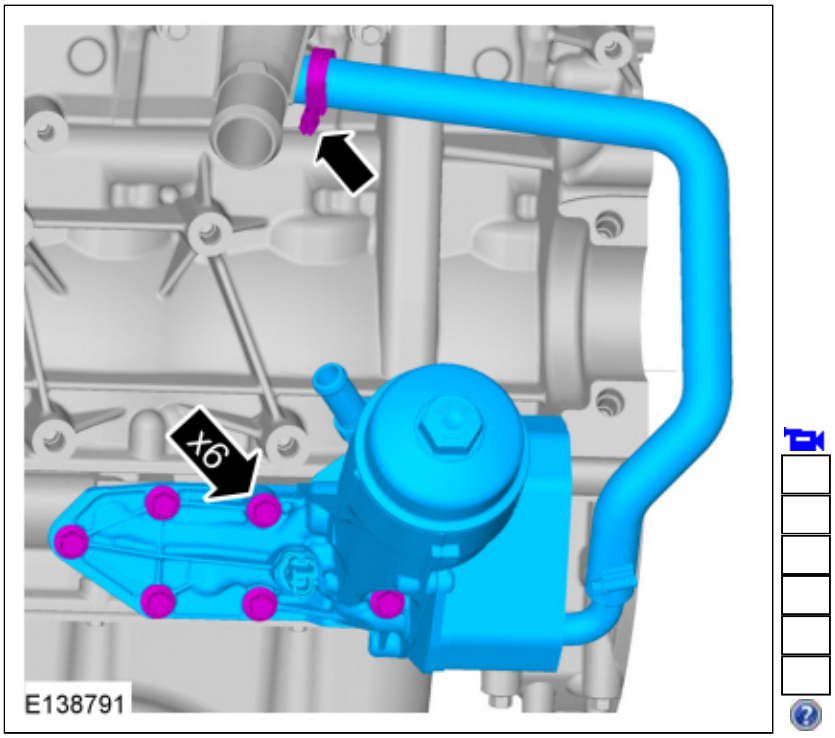
20. *Torque*: 23 Nm



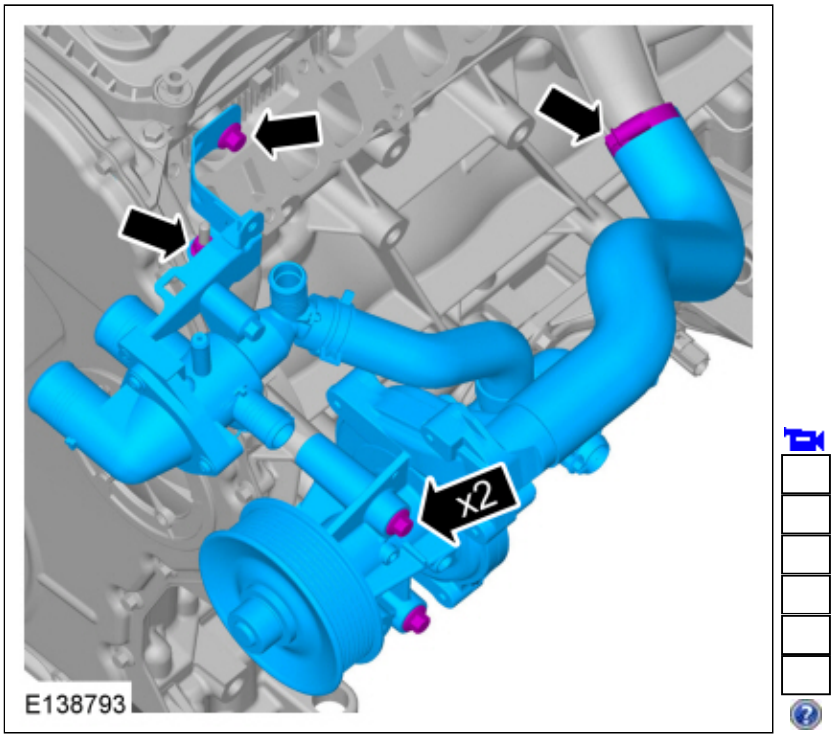
21. *Torque*: 10 Nm



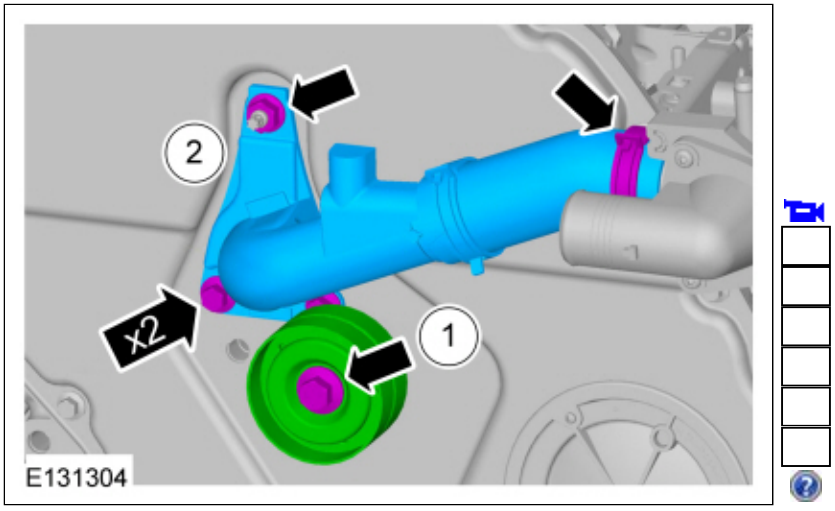
22. *Torque*: 23 Nm



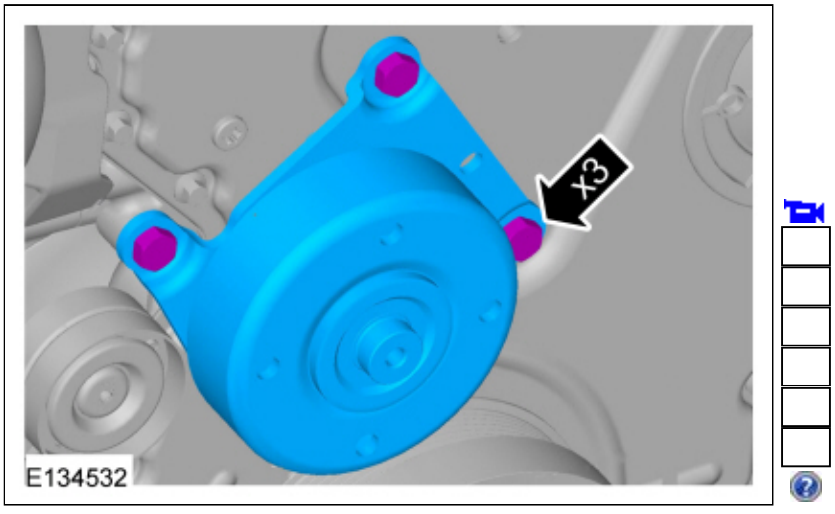
23. *Torque*: 23 Nm



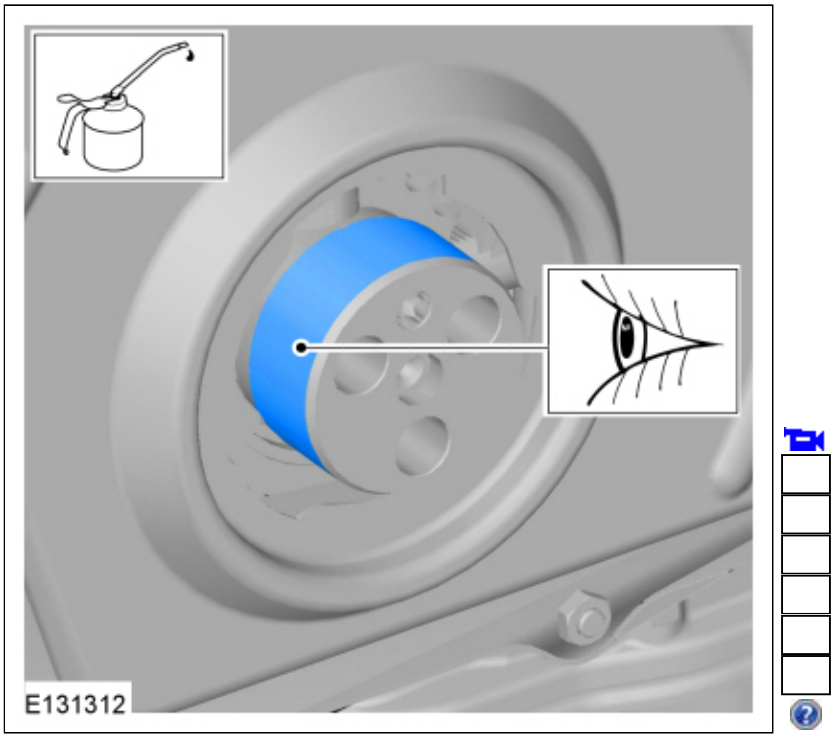
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



25. *Torque*: 48 Nm



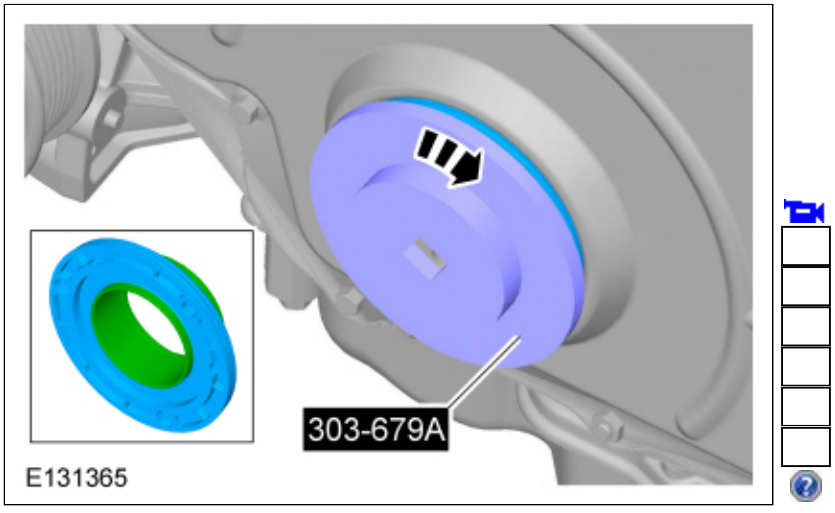
26. **NOTE:** *Make sure that the mounting face is clean and lubricated.*



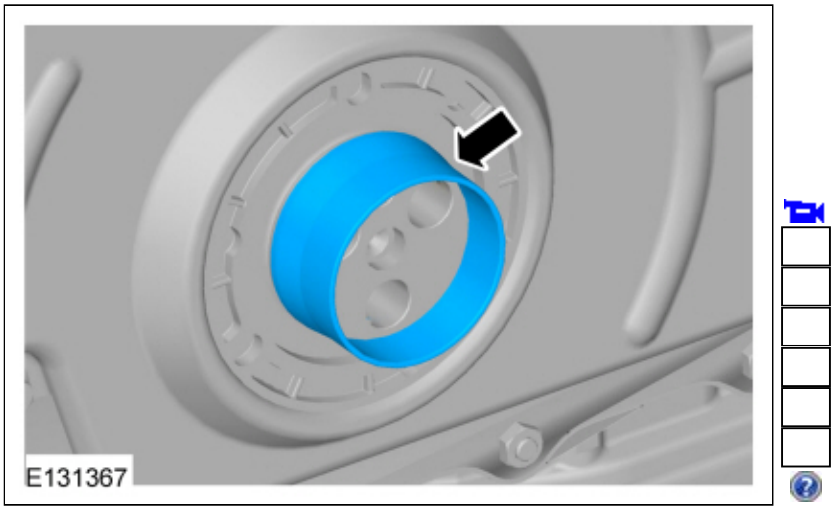
27. **NOTICE: Rotate the seal assembly until it locks. Failure to follow this instruction may result in damage to the seal assembly.**

    NOTE: *A new crankshaft front seal carrier is supplied with an alignment sleeve that must not be removed until the crankshaft rear seal is fully installed.*

    Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



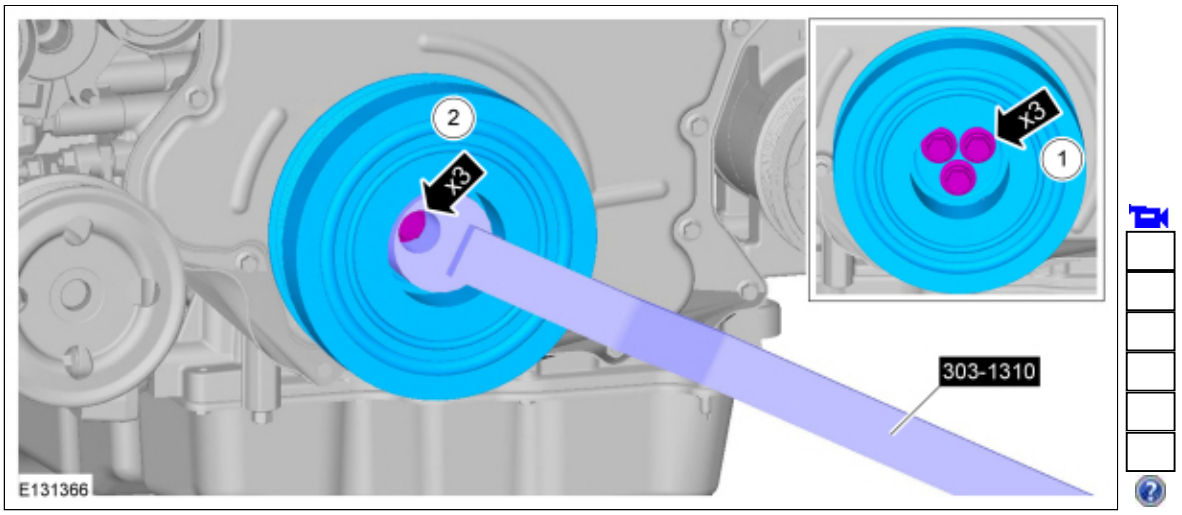
28. Remove the alignment sleeve after the seal is fully installed.



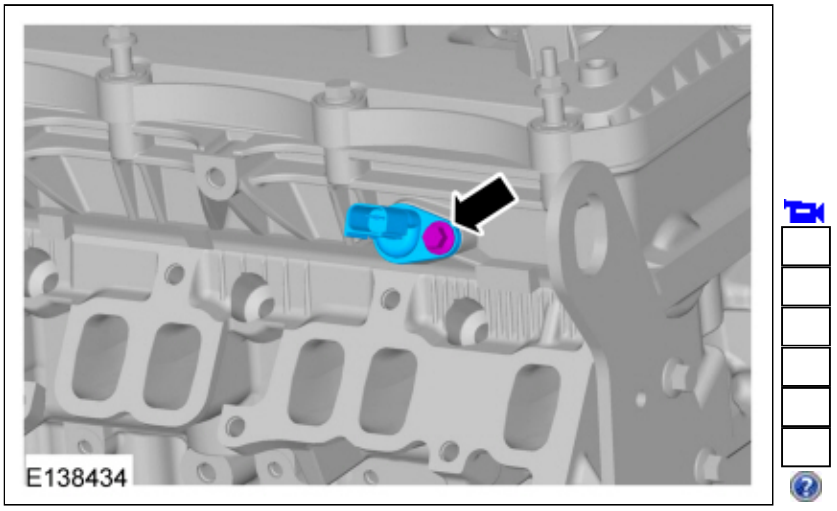
29. **NOTICE: Crankshaft pulley retaining bolts must only be used three times.**

    NOTE: *Initially hand tighten the fasteners.*

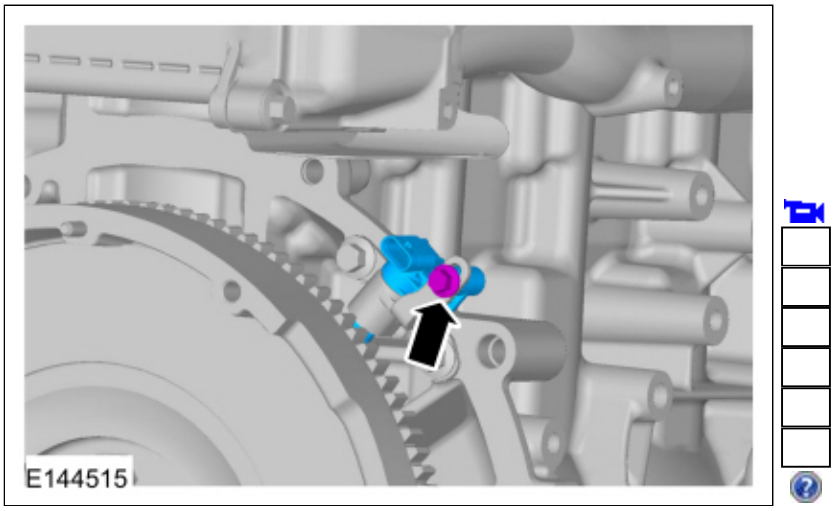
    Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
    Torque:
    Stage 1: 20 Nm
    Stage 2: 45 Nm
    Stage 3: 90 Nm
    Stage 4: 45°
    Stage 5: 45°



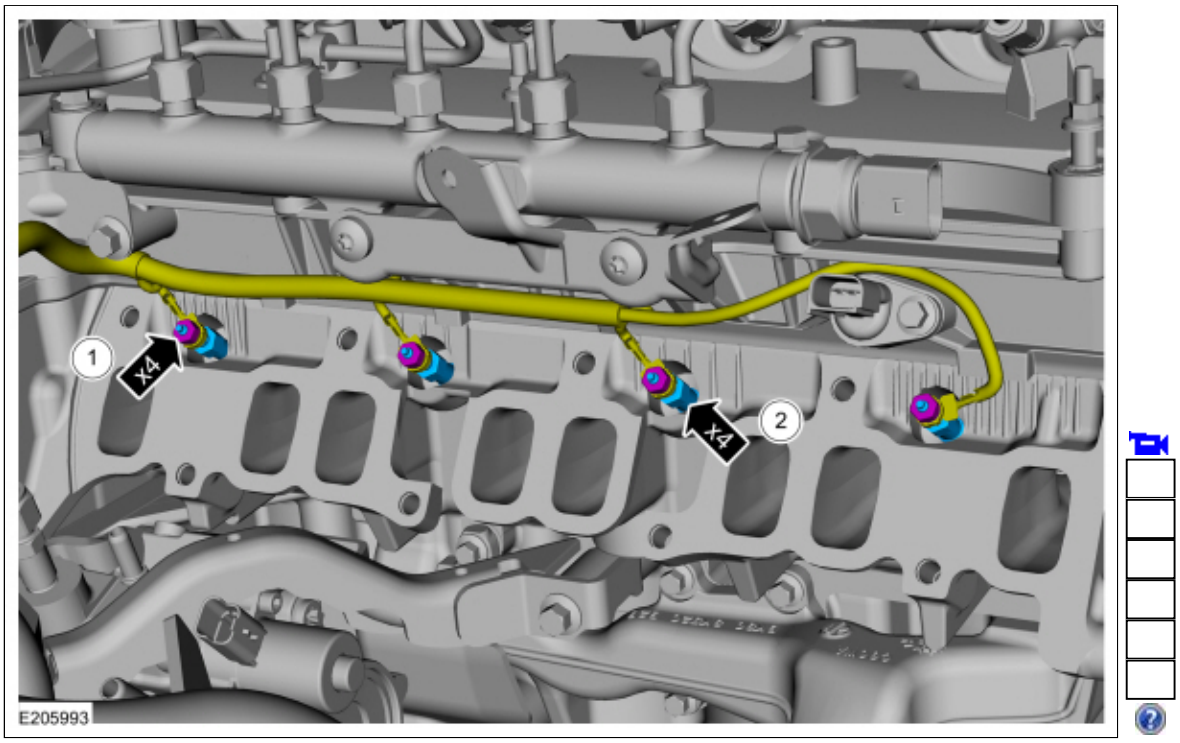
30. *Torque*: 10 Nm



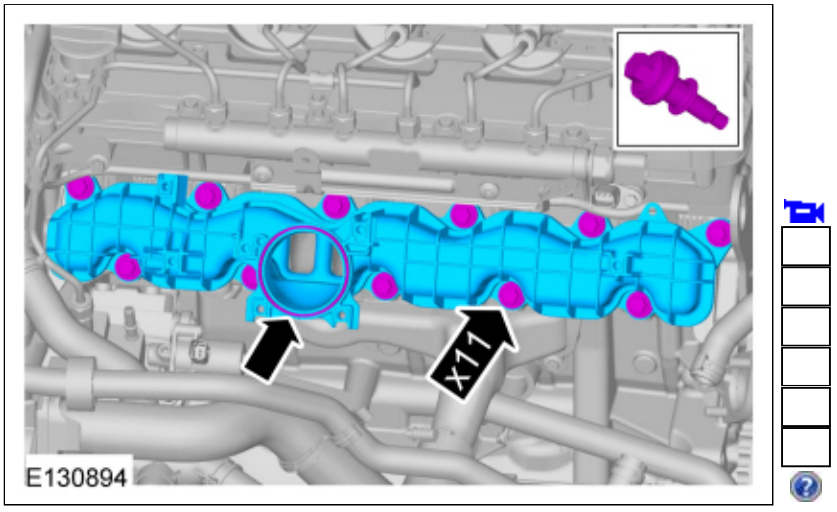
31. *Torque*: 8 Nm



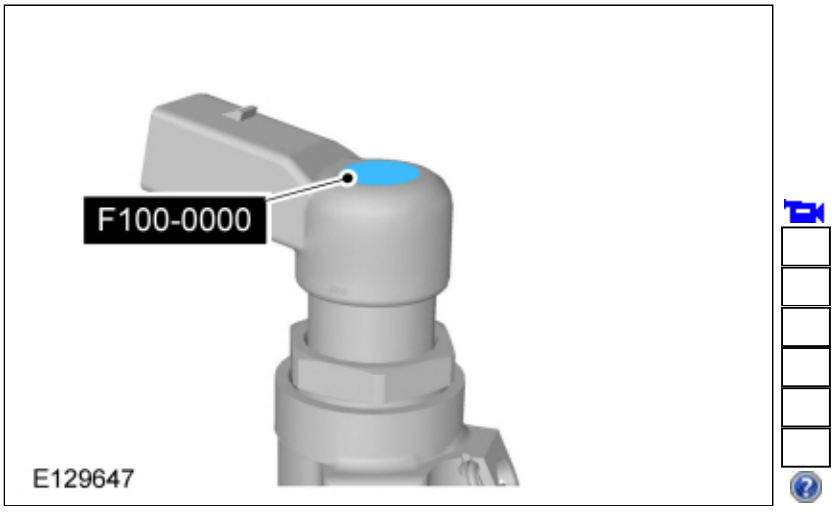
32.



33. *Torque*:
    Stage 1: 5 Nm
    Stage 2: 13 Nm
    Stage 3: 16 Nm

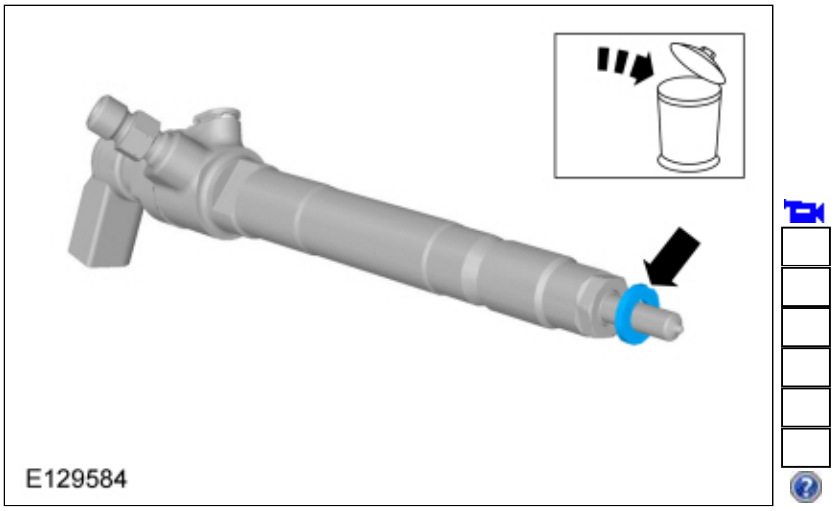


34. Record the new fuel injector correction factor code.



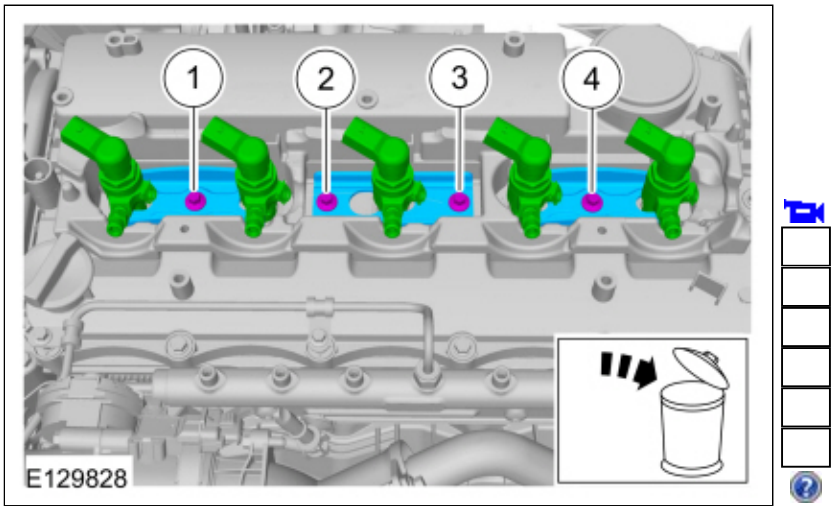
35. **NOTE:** *Using a socket (or similar), press the new fuel injector copper seals onto the fuel injectors making sure that*

the copper seals are pushed fully home to prevent uneven clamping.

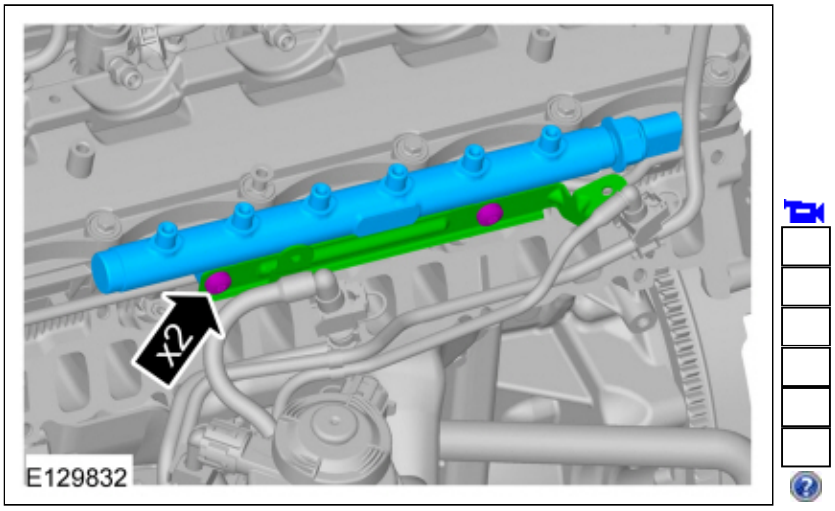


36. **NOTICE: Make sure that new bolts are installed.**

Torque:
Bolt 1 and 4.:
Stage 1: 6 Nm
Stage 2: 360°
Bolt 2.: 3 Nm
Bolt 3.:
Stage 3: 4 Nm
Stage 4: 360°



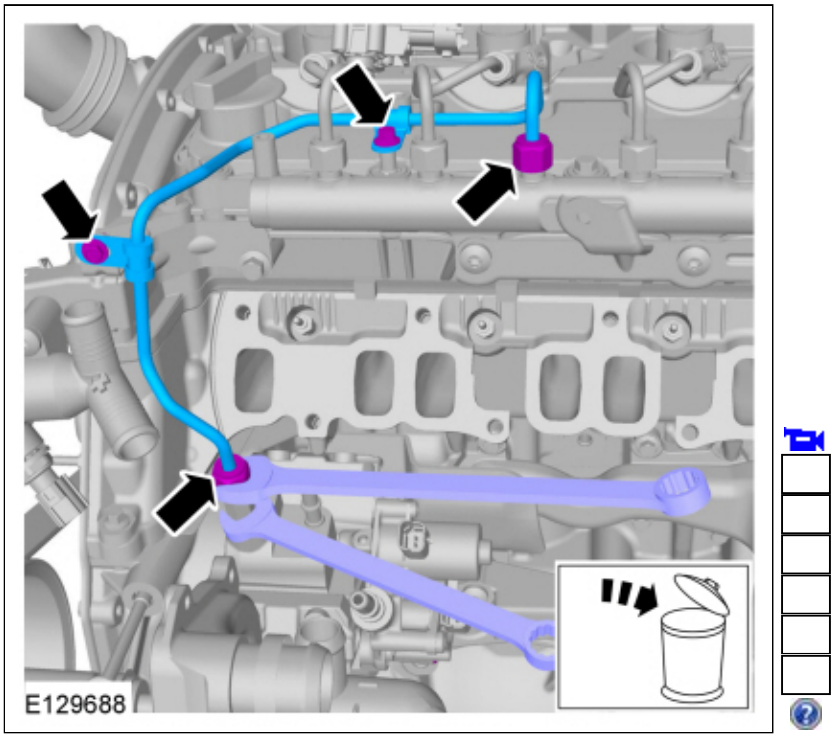
37. *Torque*:
Stage 1: 720°
Stage 2: 23 Nm



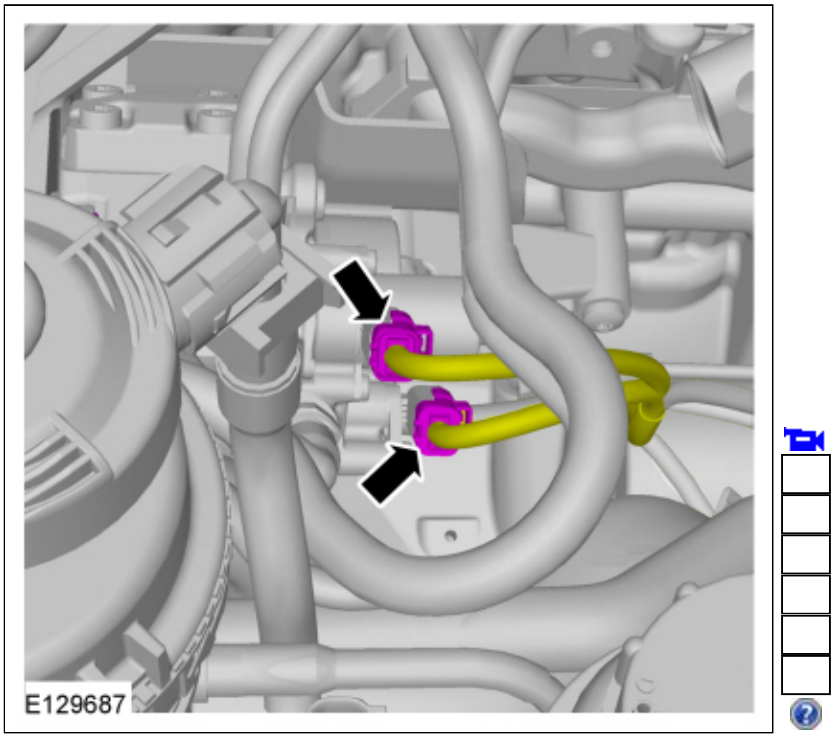
38. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

    NOTICE: Make sure that all openings are sealed. Use new blanking caps.

    Vacuum foreign material from the high-pressure fuel supply line, the fuel pump and the fuel rail.
    Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
    Torque:
    Fuel rail high-pressure fuel supply line unions:
    Stage 1: 5 Nm
    Stage 2: 35 Nm
    Fuel rail high-pressure fuel supply line bracket bolt: 10 Nm



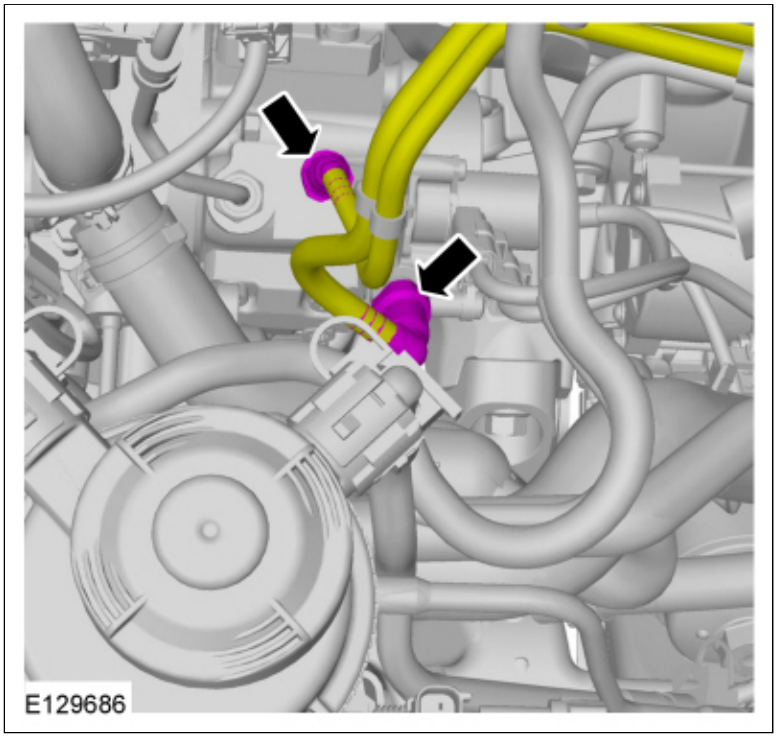
39.



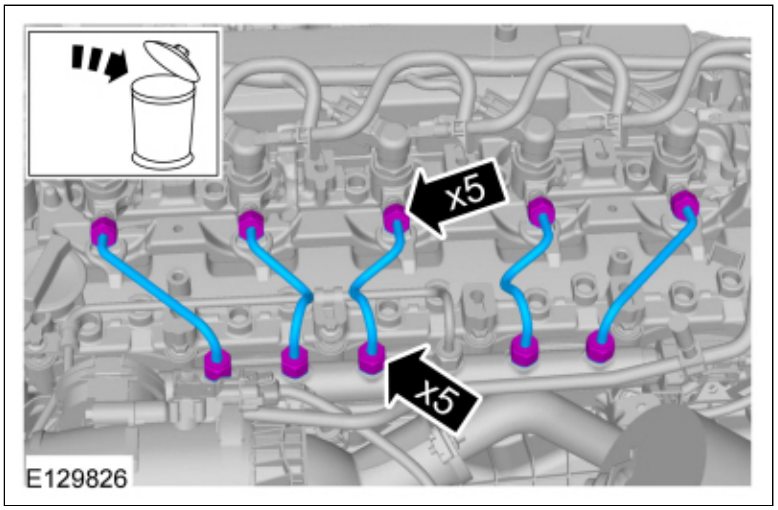
40. **NOTICE: Make sure that all openings are sealed. Use new blanking caps.**

    Vacuum foreign material from the low-pressure fuel supply line and fuel return line.

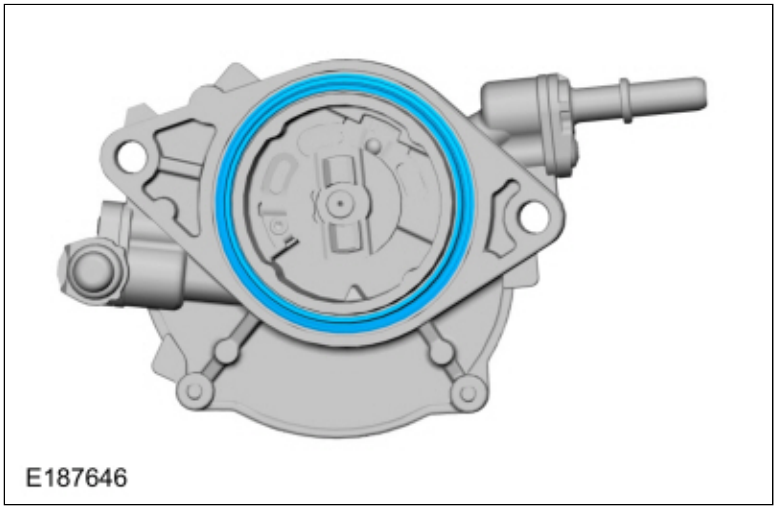
Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



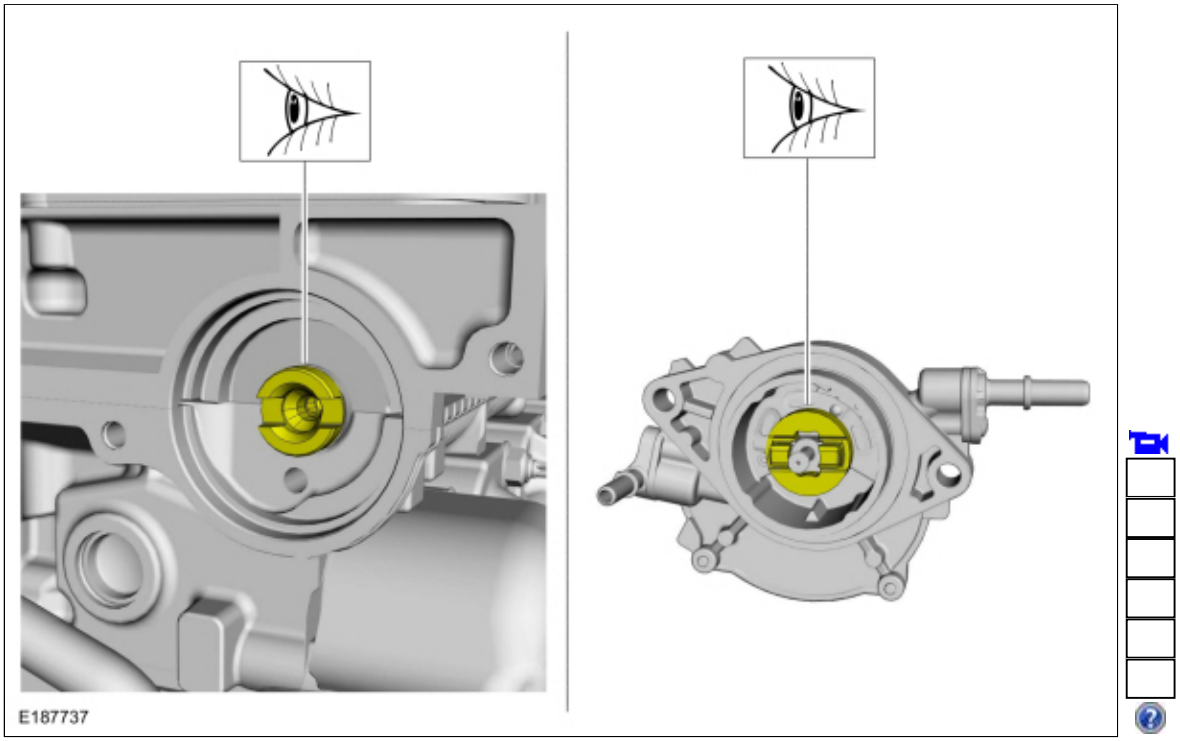
41. *Torque*:
    Stage 1: 15 Nm
    Stage 2: 30 Nm



42.



43. **NOTICE: Align the camshaft and vacuum pump couplings correctly or damage to the camshaft or vacuum pump may occur.**

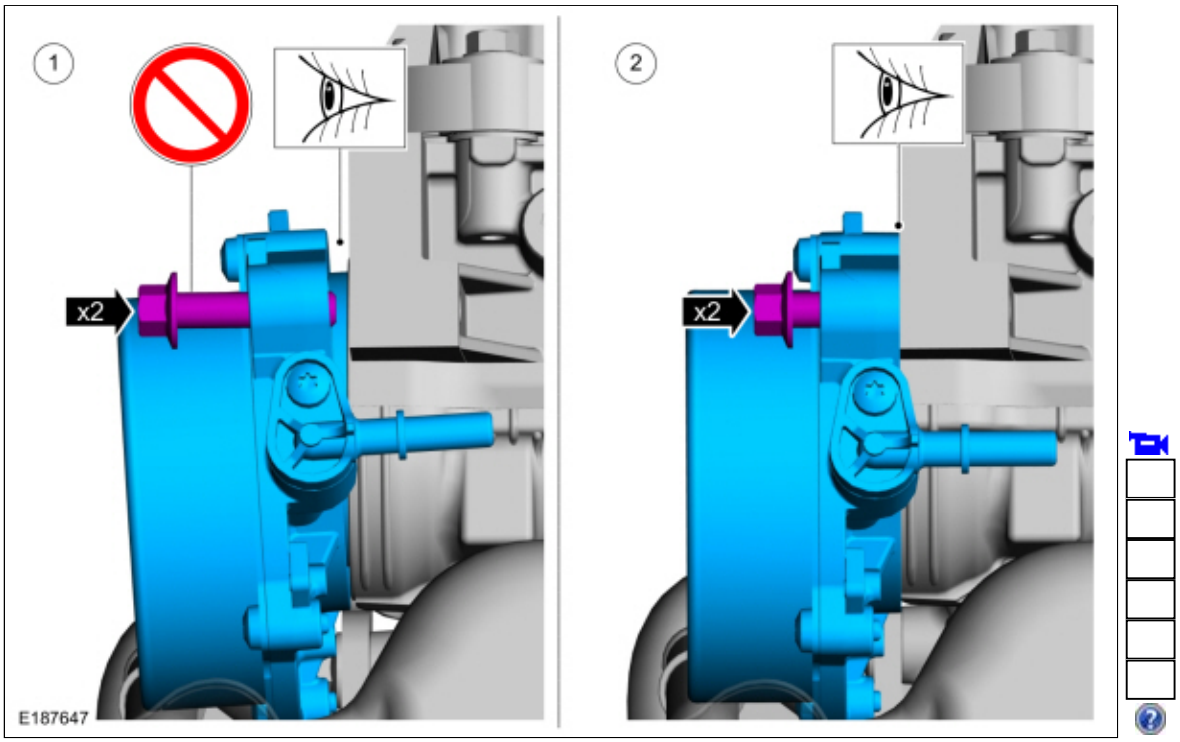


44. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

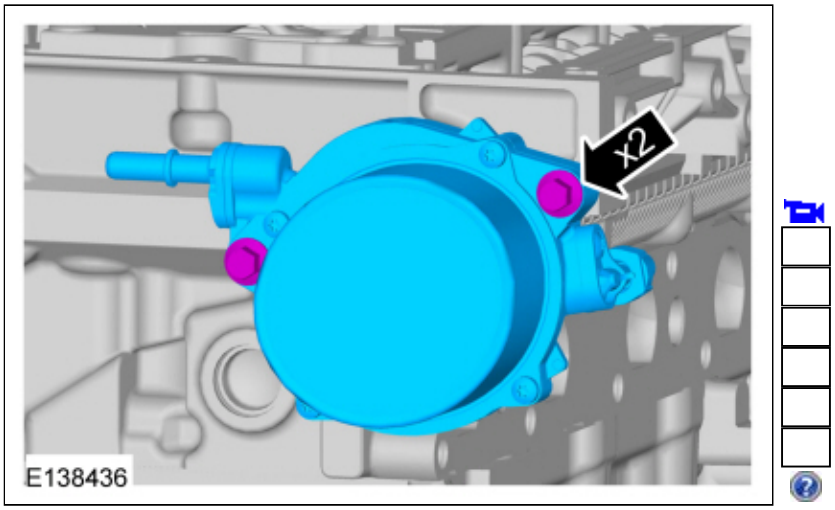
    1. **NOTE:** *Before fitting bolts, check that the vacuum pump couple drive and camshaft keyway are aligned. If a gap is present between vacuum pump and cylinder head, do not fit and run bolts.*

       NOTE: *Under no circumstances should the retaining bolts be tightened if a gap between pump and head faces is present.*

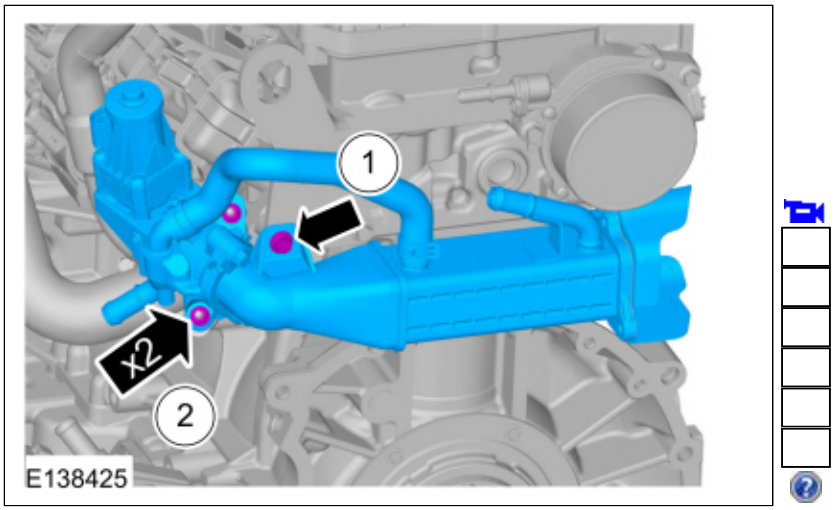
    2. **NOTE:** *Only tighten the bolts finger tight at this stage.*



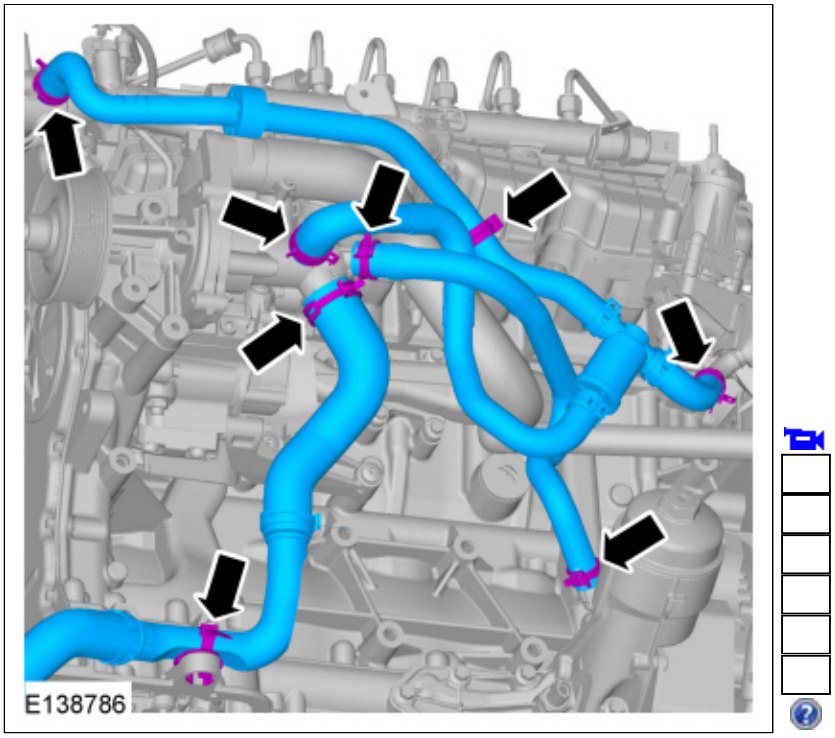
45. *Torque*: 23 Nm



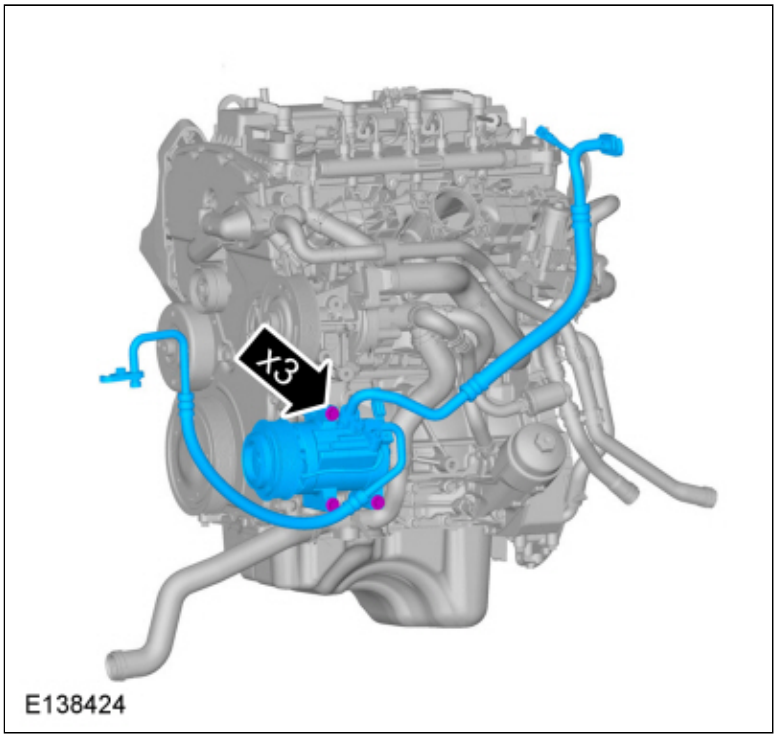
46. *Torque*: 23 Nm



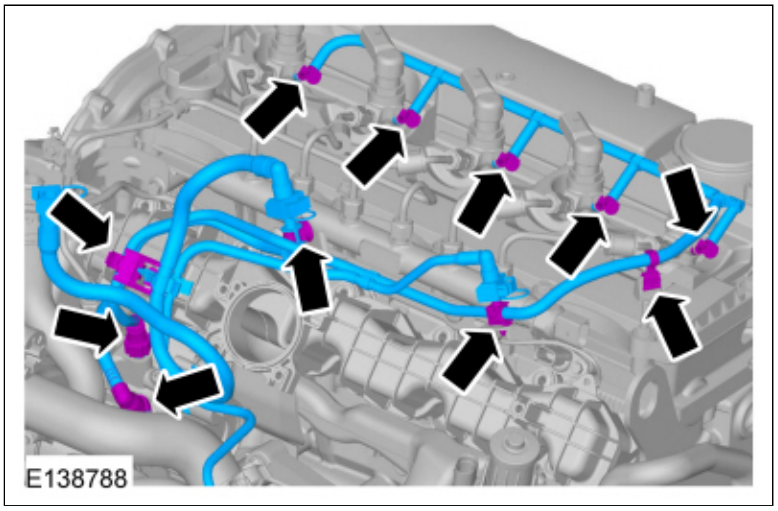
47.



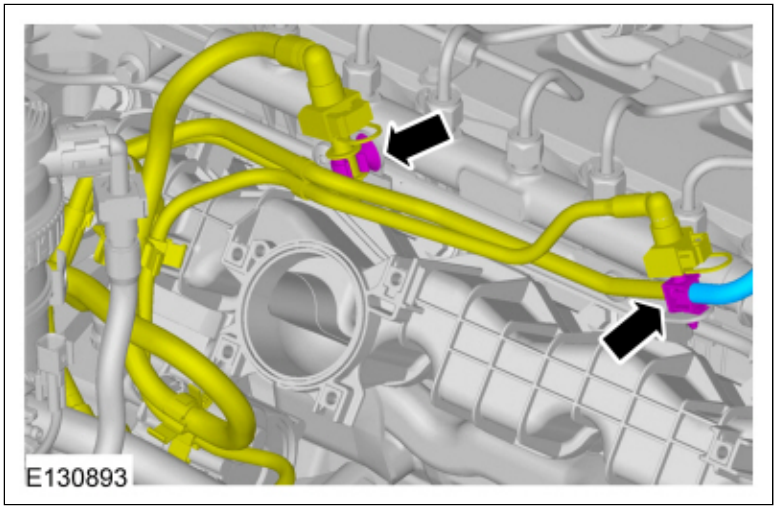
48. *Torque*: 10 Nm



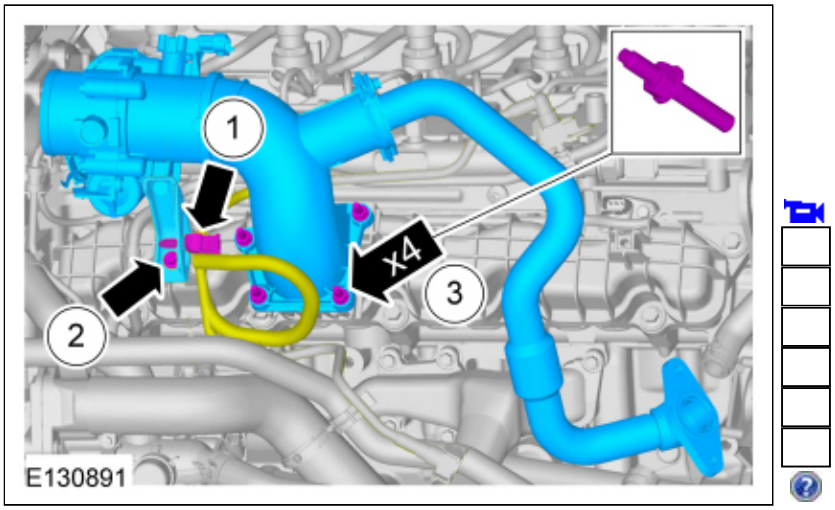
49. **NOTICE: Make sure that all openings are sealed. Use new blanking caps.**



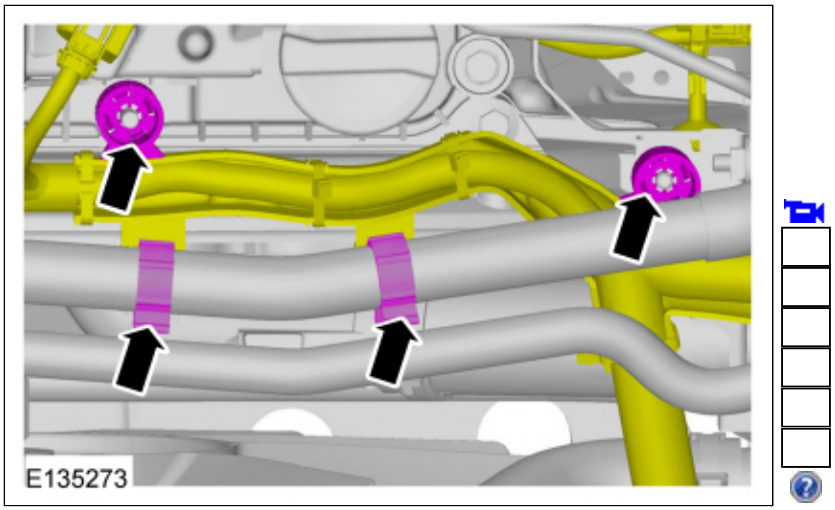
50.



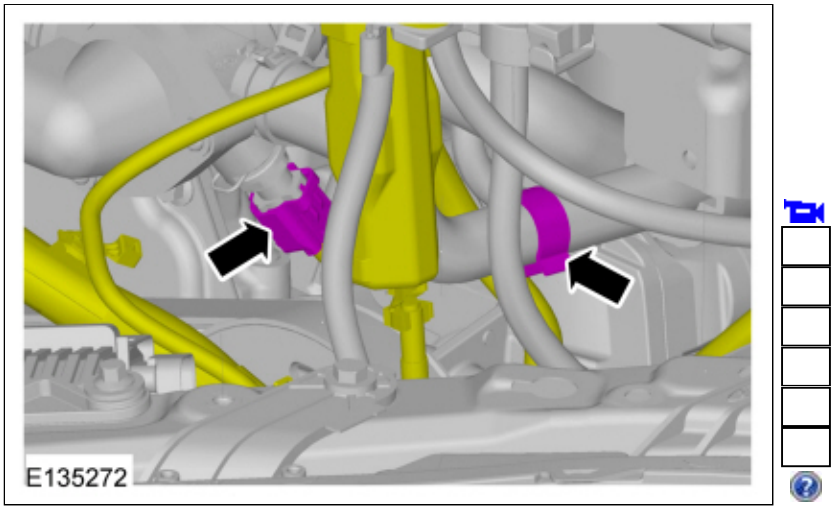
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



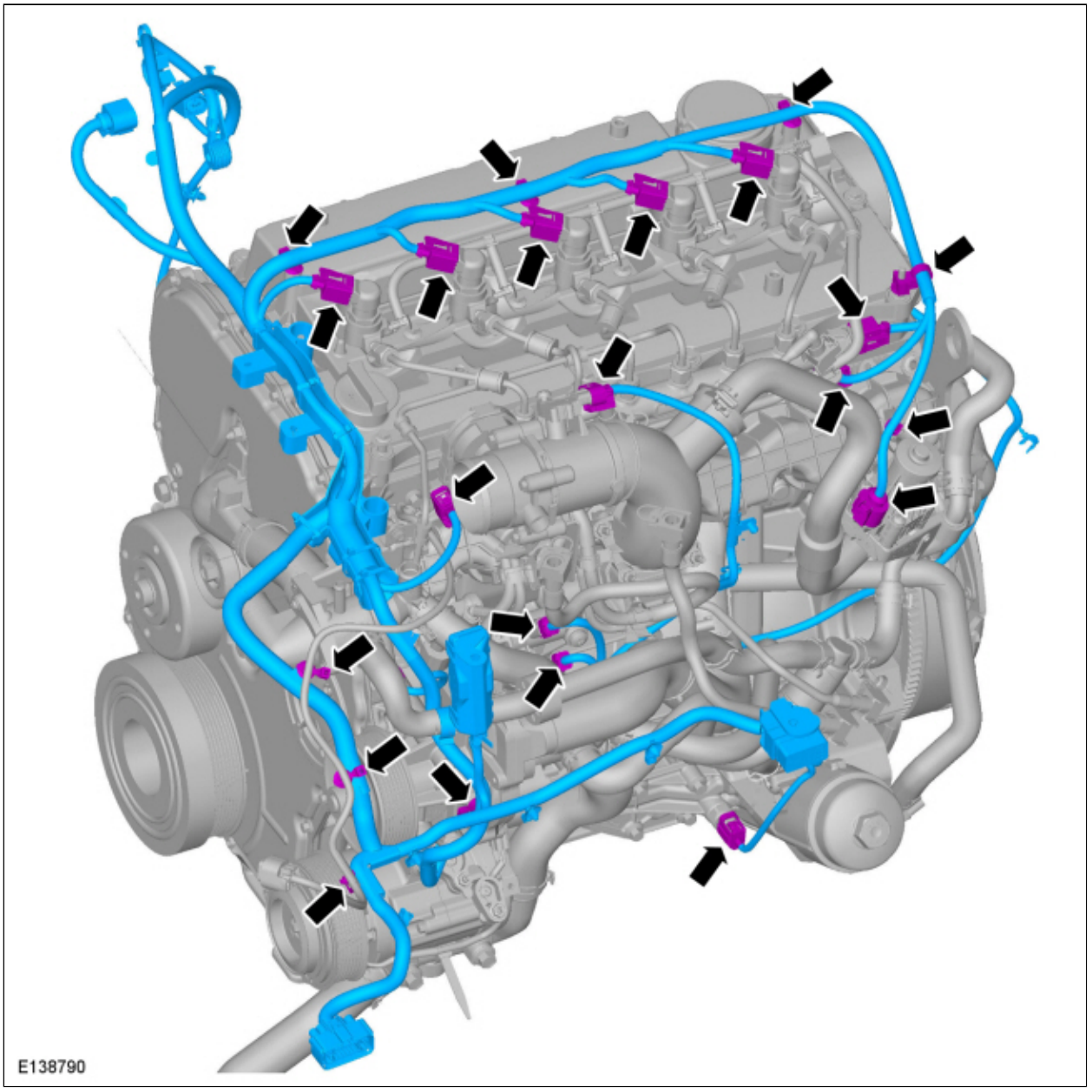
52.



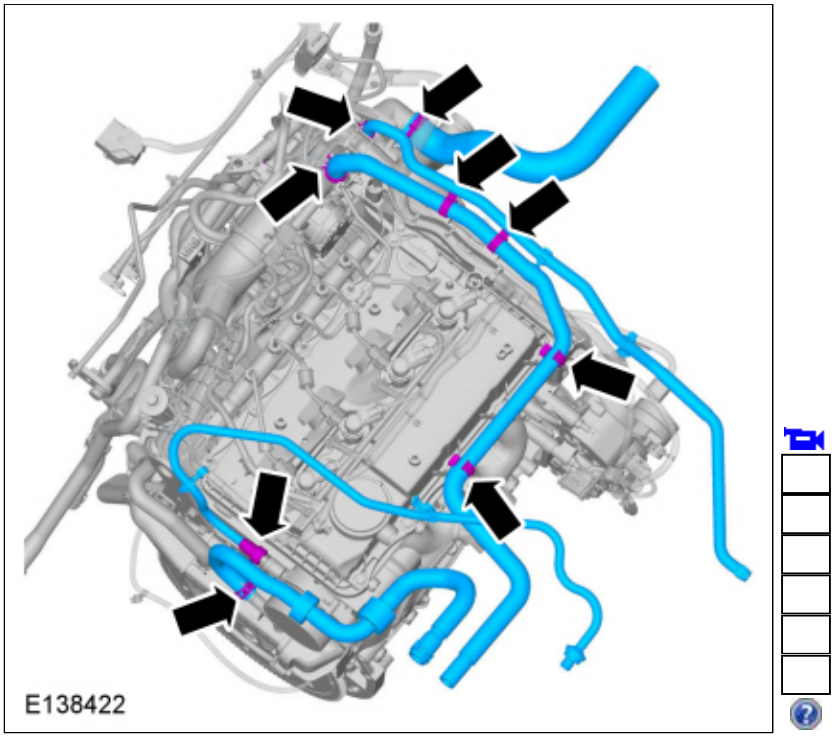
53.



54.

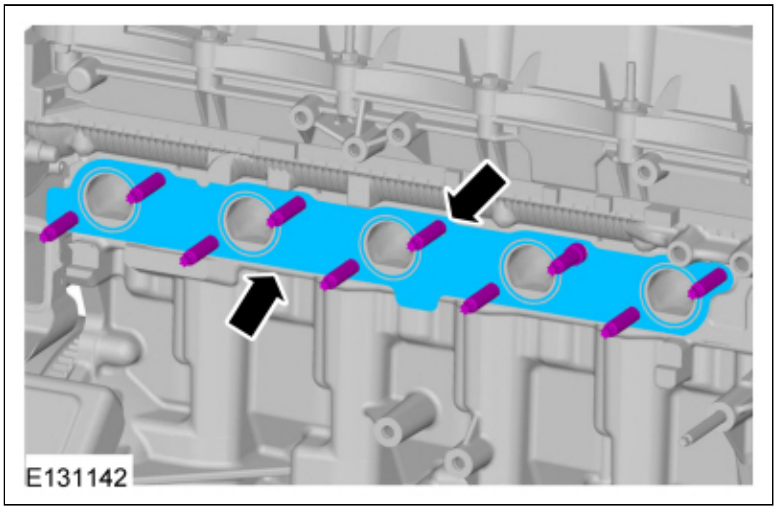


55.

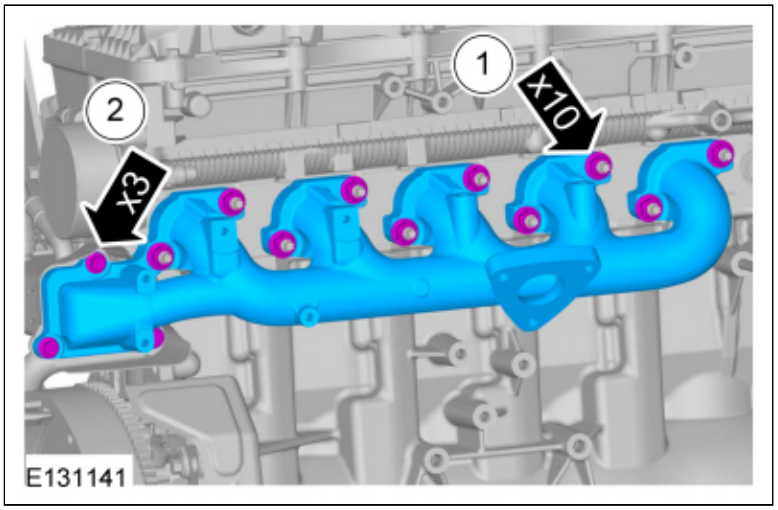


56. **NOTE:** *The gasket is to be reused unless damaged.*

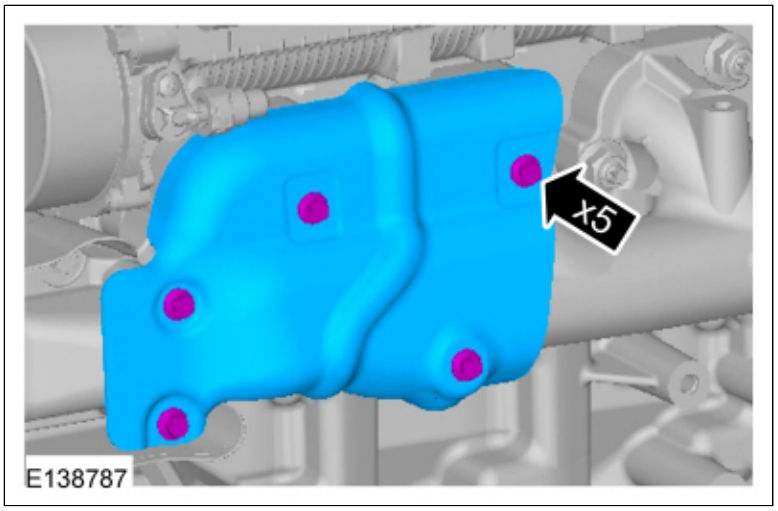
NOTE: *The studs are to be reused unless damaged.*



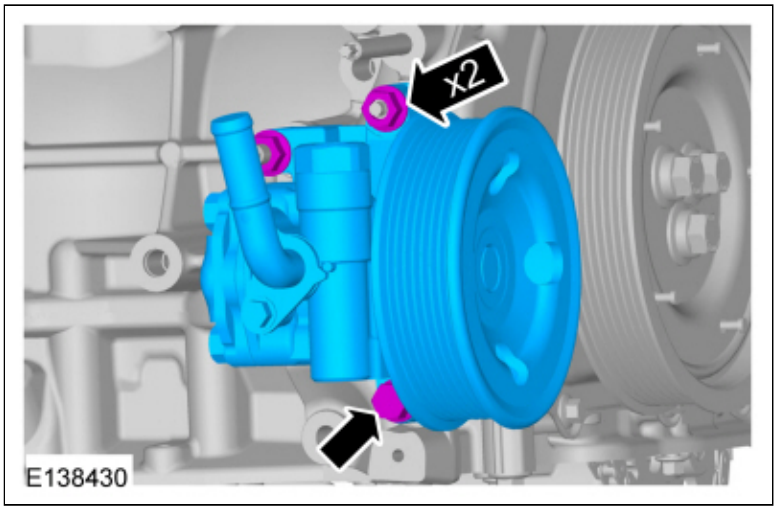
57. *Torque*:
Bolt 1.:
Stage 1: 10 Nm
Stage 2: 20 Nm
Stage 3: 35 Nm



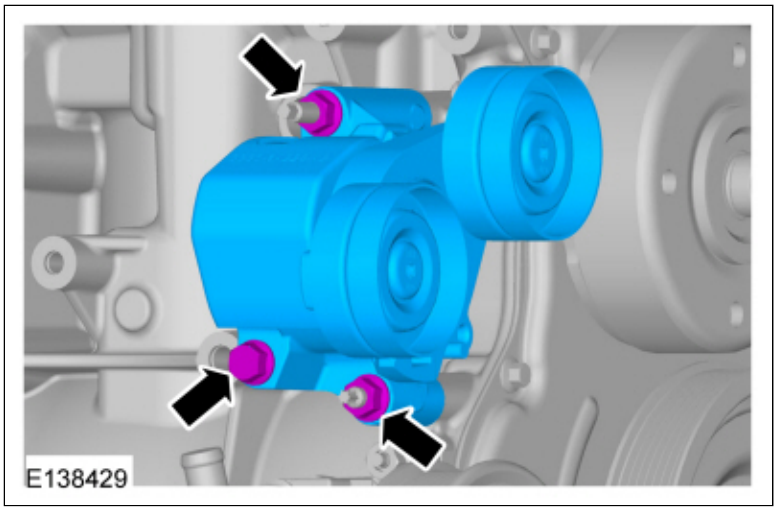
58. *Torque*: 9 Nm



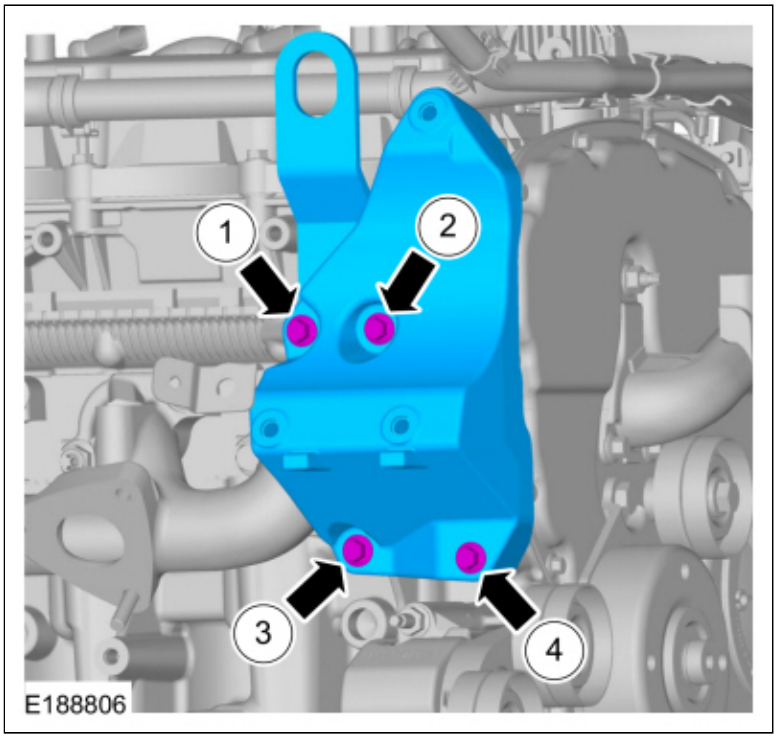
59. *Torque*: 20 Nm



60. *Torque*: 25 Nm



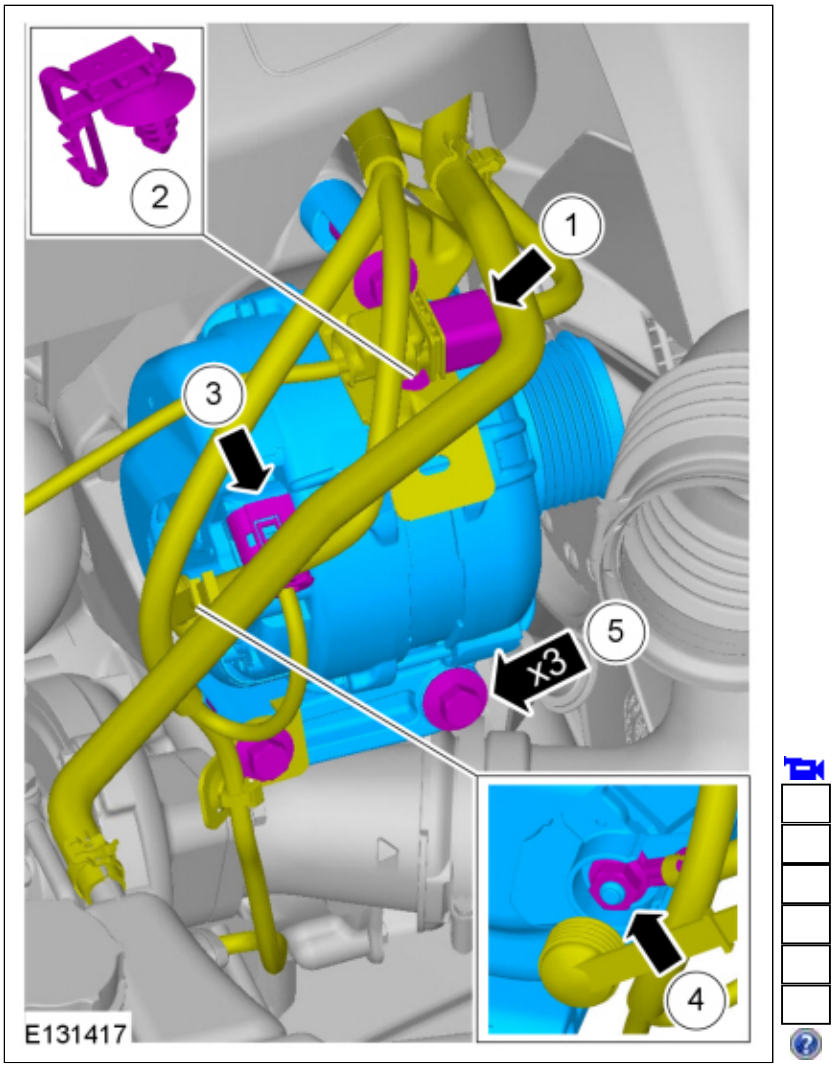
61. *Torque*:
    Bolt 1 and 2.: 48 Nm
    Bolt 3 and 4.: 23 Nm



62. **NOTICE: Take extra care not to damage the wiring harnesses.**

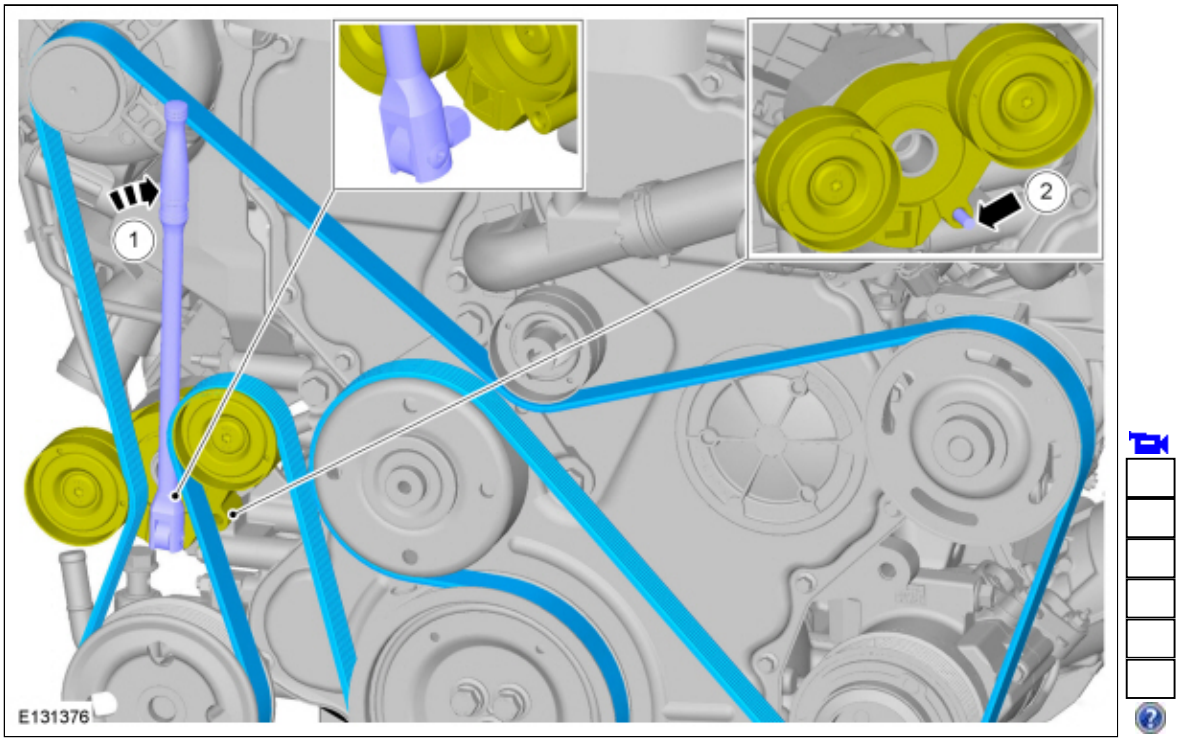
    4. *Torque*: 15 Nm

5. *Torque*: 48 Nm

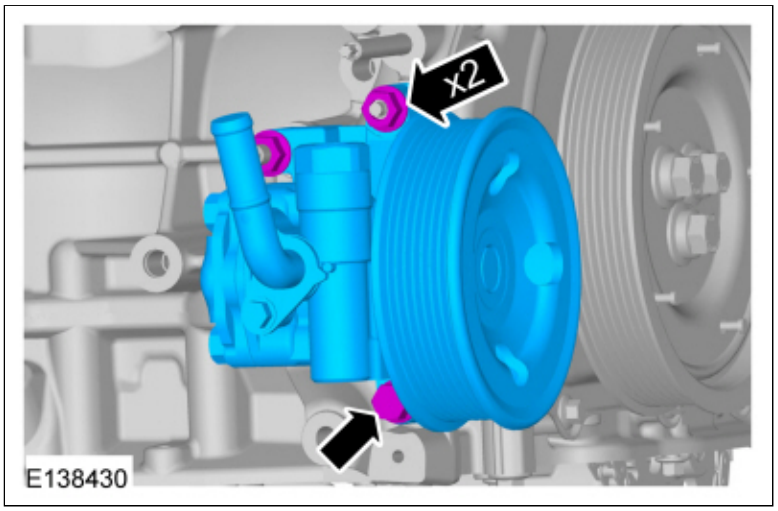


Vehicles With: Hydraulic Power Assist Steering (HPAS)

63. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
Use the General Equipment: Dowel with a Diameter of 6 mm

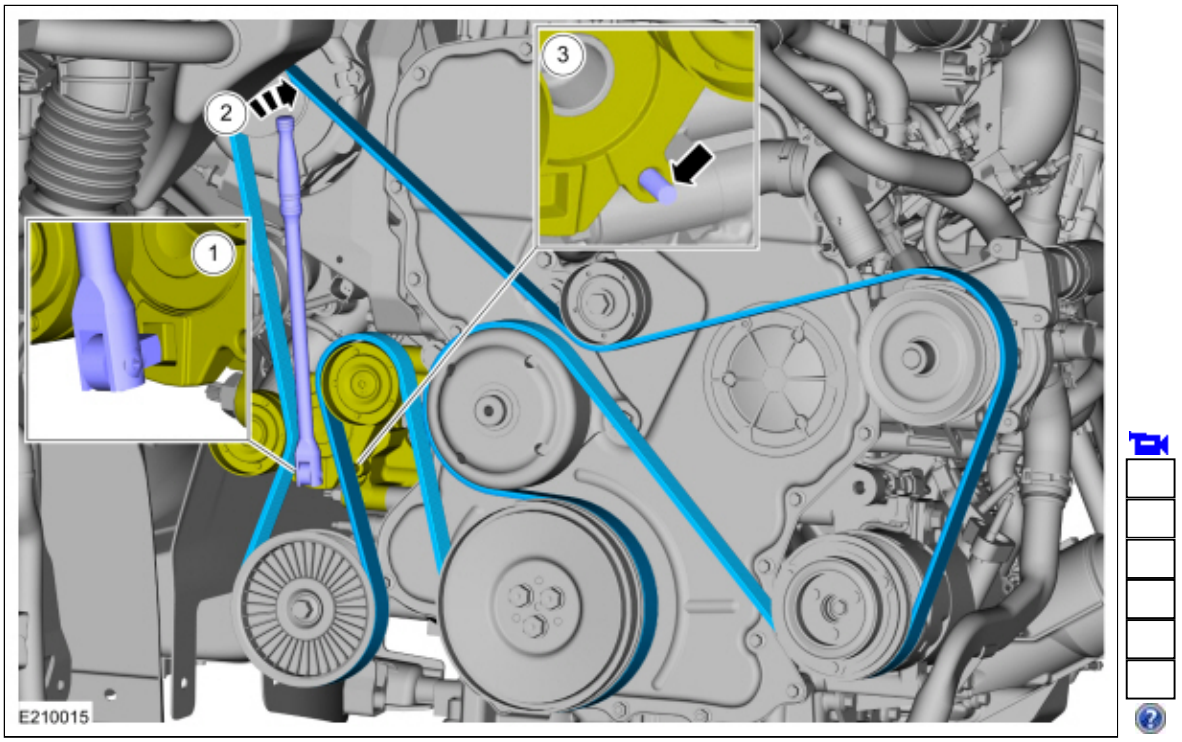


64.

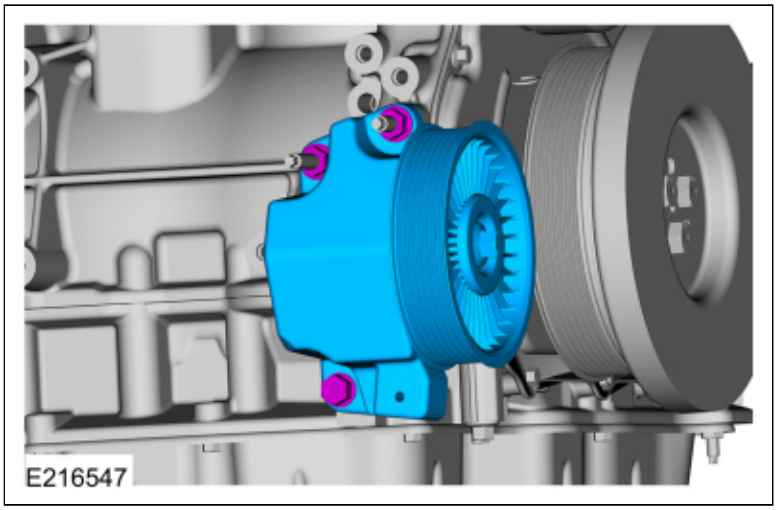


Vehicles With: Electronic Power Assist Steering (EPAS)

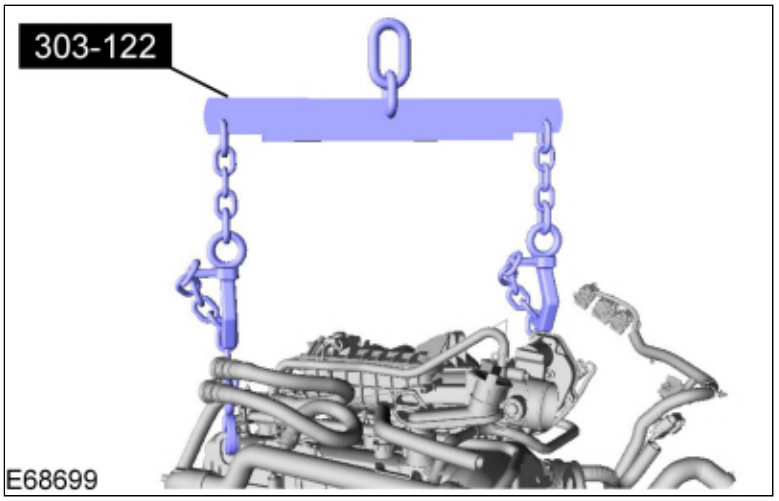
1. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. **NOTE:** *Rotate the accessory drive belt tensioner clockwise.*
3. Use the General Equipment: Dowel with a Diameter of 6 mm



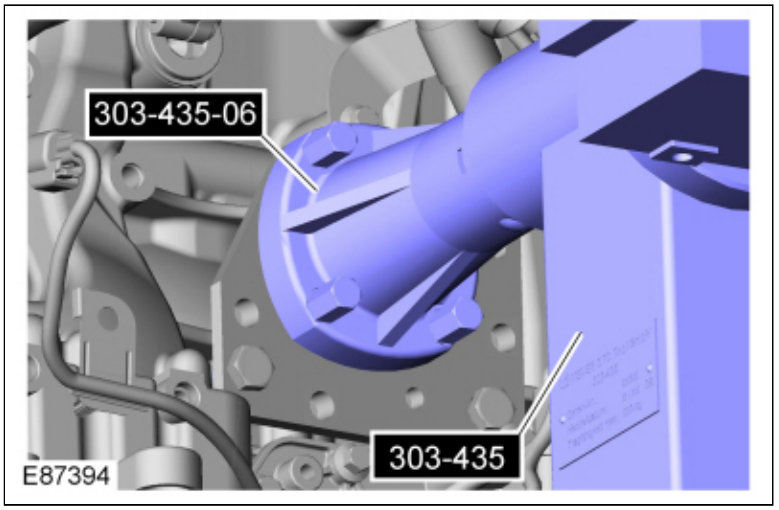
66.



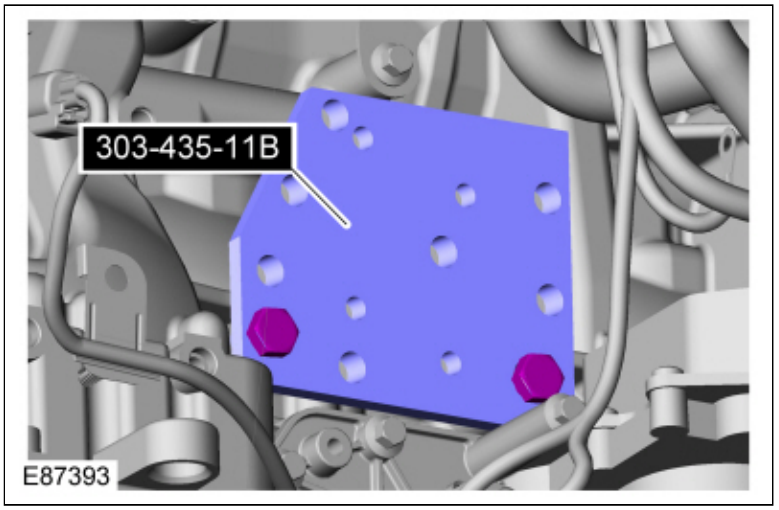
67. Install Special Service Tool: 303-122 Lifting Bracket, Engine.



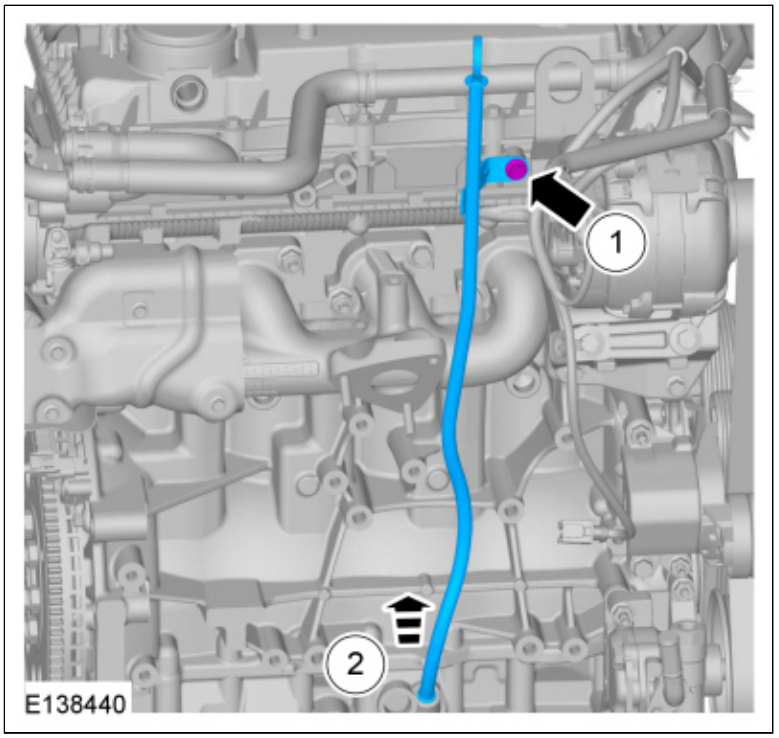
68. Remove Special Service Tool: 303-435-06 Mounting Bracket for 303-435. , 303-435 Mounting Stand.



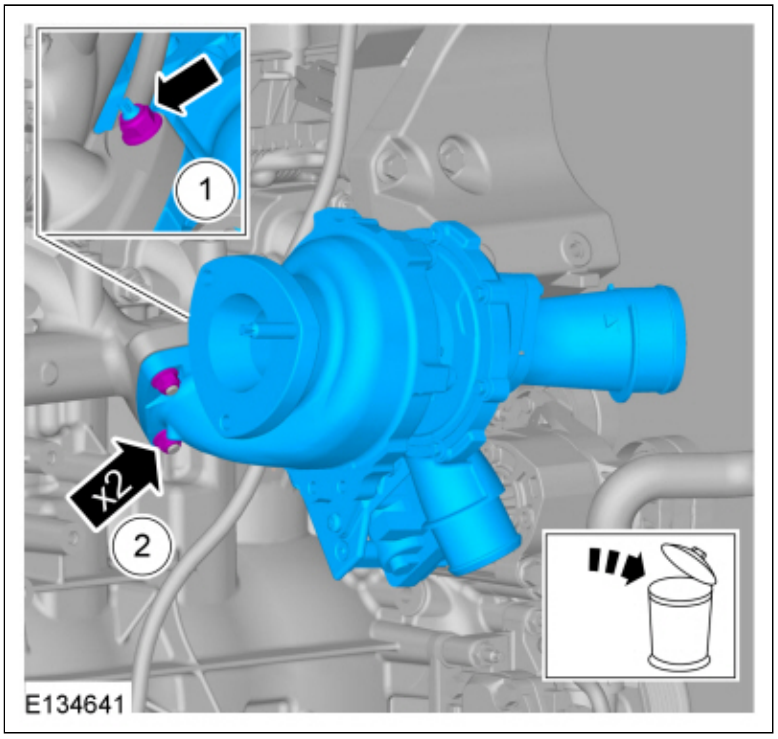
69. Remove Special Service Tool: 303-435-11B Mounting Plate for 303-435-06.



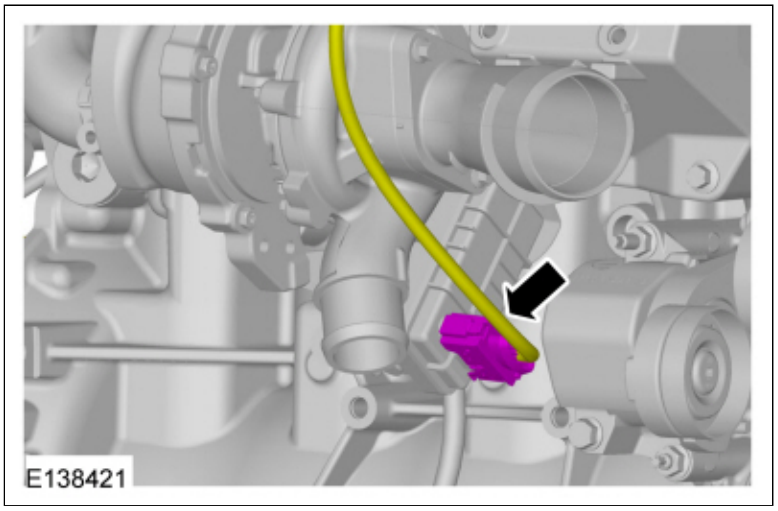
70. *Torque*: 10 Nm



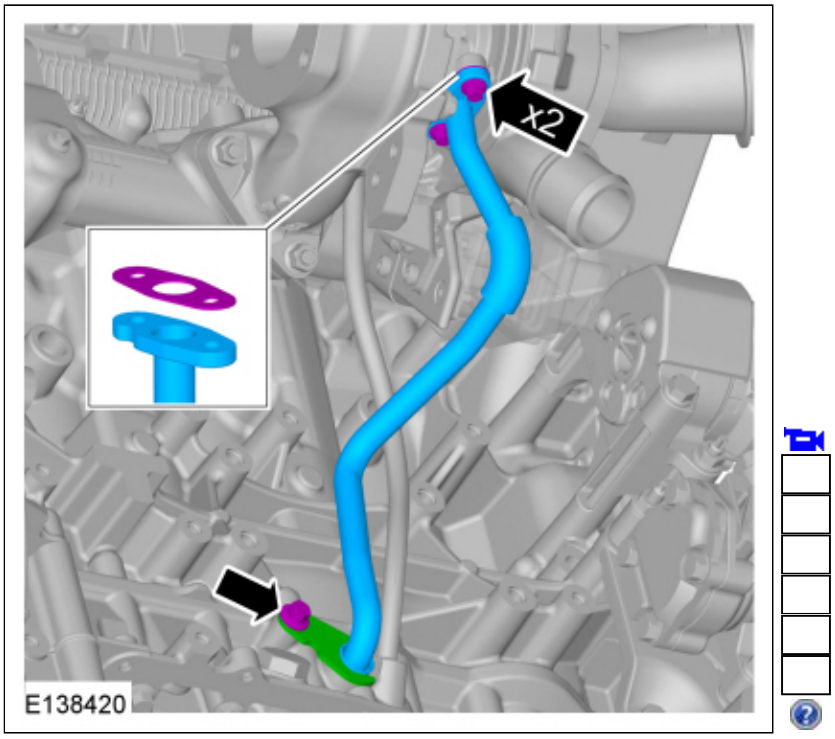
71. *Torque*: 23 Nm



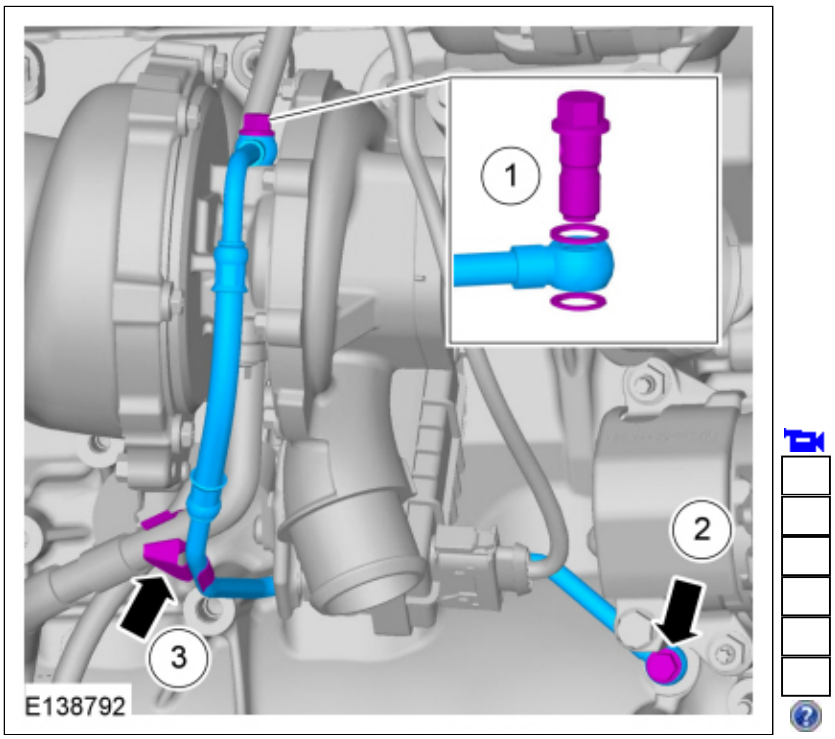
72.



73. *Torque*: 10 Nm



1. *Torque*: 20 Nm
2. *Torque*: 20 Nm



Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus Antifreeze	WSS-M97B44–D2

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.068 at +15°C	50%	–30°C (–22°F)	–35°C (–31°F)

Cooling System Refill Capacity - Vehicles with 2.5L Duratec-HE (MI4) engine

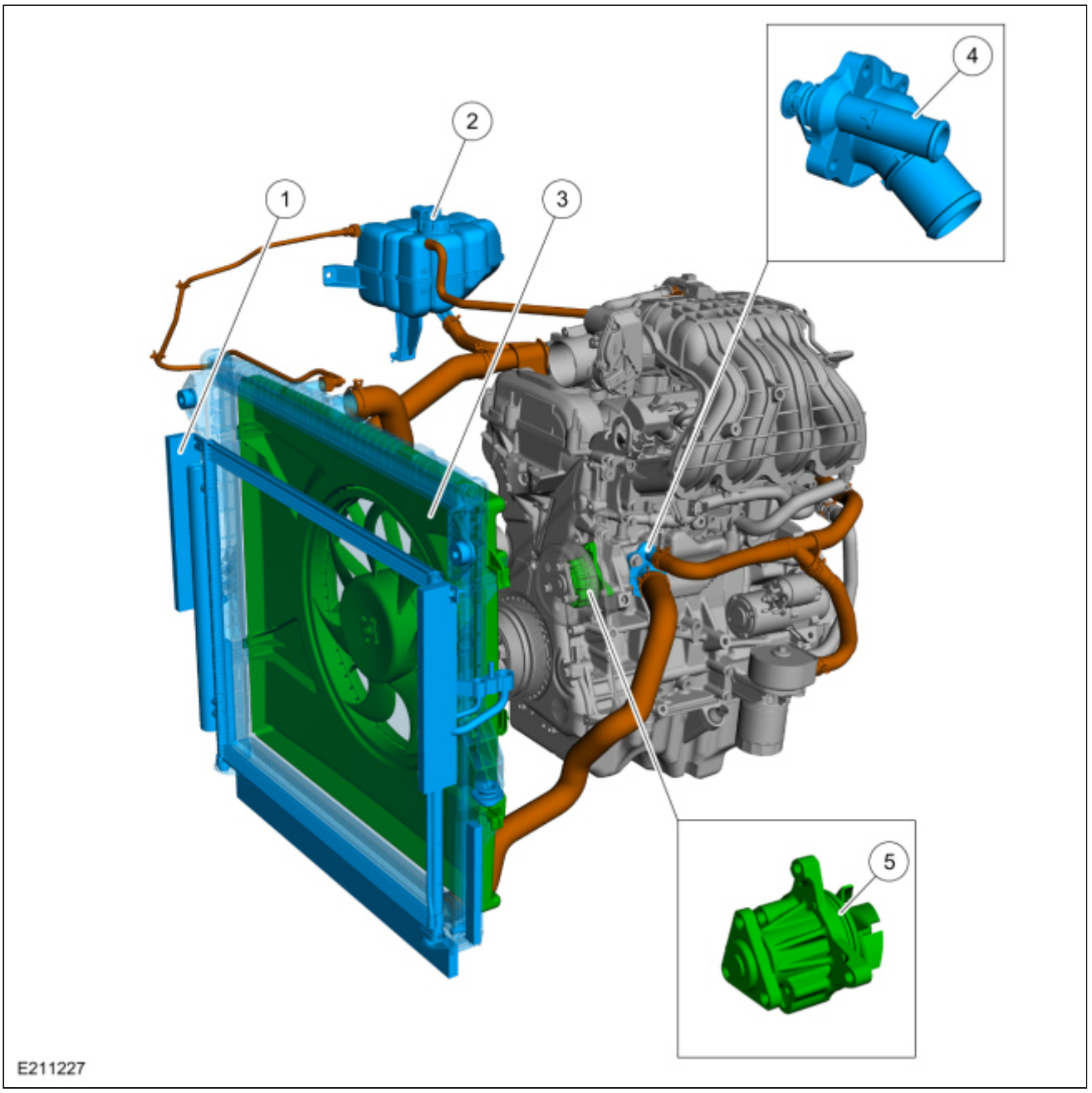
Description	Liters
Cooling system and heater	11.0

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135 to 155 (19 to 22)

Copyright © 2016 Ford Motor Company

Engine Cooling - Component Location



Item	Part Number	Description
1	—	Radiator
2	—	Coolant expansion tank
3	—	Cooling fan motor and shroud
4	—	Thermostat
5	—	Coolant pump

Copyright © 2016 Ford Motor Company

Engine Cooling - System Operation and Component Description

System Operation

Fail Safe Cooling

A strategy called Fail Safe Cooling is built into the PCM that will control the engine if it starts to overheat.

Stage 1 of the strategy commences if the engine starts to overheat. The CHT sensor transmits a signal to the PCM, which moves the temperature gauge pointer into the red zone.

If the engine is not switched off and the temperature continues to rise, the Powertrain Check Lamp is illuminated. This indicates to the driver that the engine is approaching critical limits and should be stopped. At this point DTC P1285 is set in the PCM which can be retrieved using a scan tool.

Stage 2 of the strategy commences if the lamp and temperature gauge are ignored by the driver. The PCM will start to control the engine by cutting out 2 cylinders and restricting the RPM to below 3,000 RPM. Simultaneously the MIL illuminates. This indicates that long term engine damage can occur and vehicle emissions will be affected. At this point DTC P1299 is set in the PCM which can be retrieved using a scan tool.

Air is drawn into the deactivated cylinders. This helps to control the temperature of the engine internal components. The deactivated cylinders are alternated to allow even cooling of all the cylinders.

NOTE: *If the driver is using a high percentage of throttle travel (for example, an overtaking maneuver) when the PCM starts engine deactivation (Stage 2), the deactivation will be delayed for 10 seconds.*

NOTE: *After 2-cylinder operation has begun, the engine will not revert to 4-cylinder operation, even if the temperature should fall, until the ignition is switched off and then on again.*

NOTE: *The MIL can only be extinguished by using a scan tool after the fault has been rectified and the DTC cleared.*

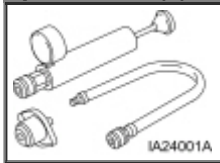
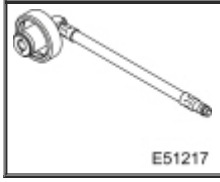
Stage 3 of the strategy will commence if the engine temperature continues to rise. This results in the engine being totally disabled before major engine damage or seizure occurs. The Powertrain Check Lamp will begin to flash, indicating to the driver that the engine will be switched off after 30 seconds. This allows the driver time to choose a suitable parking place.

Copyright © 2016 Ford Motor Company

Engine Cooling

Refer to Wiring Diagrams Section 303-14B for schematic and connector information.

Special Tool(s)

 IA24001A	Pressure Tester, Cooling System 303-396 (24-001A)
 E51217	Adapter for 303-396 303-396-08

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Coolant hose(s) − Gaskets/seals − Coolant expansion tank cap and seal − Coolant expansion tank − Radiator − Coolant pump − Thermostat − Thermostat housing − Cooling fan and cooling fan clutch − Accessory drive belt − Engine oil cooler	− Fuse(s) − Wiring harness − Electrical connector(s) − Engine coolant temperature (ECT) sensor − Engine cooling fan motor(s) − Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Loss of coolant	• Radiator.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary. REFER to: Radiator (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Coolant pump.	• CARRY OUT the Pressure Test Component Test in this section.

		INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Thermostat housing.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing as necessary. REFER to: Thermostat (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Coolant expansion tank cap.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	• Coolant expansion tank.	• CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	• Engine oil cooler.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new engine oil cooler as necessary.
	• Heater core.	• CHECK the heater core for leaks. REFER to: Heater Core (412-00 Climate Control System - General Information, Removal and Installation).
	• Engine.	• CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
• The engine overheats	• Cooling system does not hold pressure.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section. • CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary. • CHECK the coolant pump for damage. INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
	• Air in system.	• BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
	• Coolant expansion tank cap.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	• Coolant expansion tank.	• CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	• Coolant level/condition.	• CHECK the coolant level/condition. REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
	• Coolant concentration.	• REFER to: Specifications (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).
	• Radiator grille.	• CHECK the radiator grille for air restrictions/damage. REPAIR as necessary.
	• Coolant pump.	• CHECK the coolant pump for leaks. INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Thermostat.	• CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Accessory drive belt.	• CHECK the accessory drive belt for correct operation. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

	• Cooling fan.	• CHECK operation of the cooling fan. INSTALL a new cooling fan as necessary. REFER to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Engine.	• CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
• The engine does not reach normal operating temperature.	• Thermostat.	• CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• ECT sensor.	• CHECK the ECT sensor for correct operation. REFER to the Ford diagnostic equipment.
	• Circuit(s).	• CHECK the circuit(s). REFER to the Ford diagnostic equipment.

Component Tests

Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank cap.
2. Install the special tools to the coolant expansion tank.
3. Pressurize the system to the coolant expansion tank cap release pressure.
   REFER to: Specifications (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).
4. Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the system holds pressure, proceed to step 7. If the system does not hold pressure, check it thoroughly for coolant leaks.
5. If a coolant leak cannot be found, check the EGR cooler (this may leak internally), engine oil cooler (this may produce oil in the coolant expansion tank) and the engine for cylinder leakage. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
6. Recheck the system by repeating steps 3 and 4 at least twice.

Radiator Leak Test, Removed From Vehicle

NOTICE: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.

Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank cap.
2. Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: *If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.*

3. Slowly depress the plunger of the pressure test pump until the pressure test gauge reading stops increasing, and note the highest pressure reading obtained.

4. Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure that the pressure test gauge reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

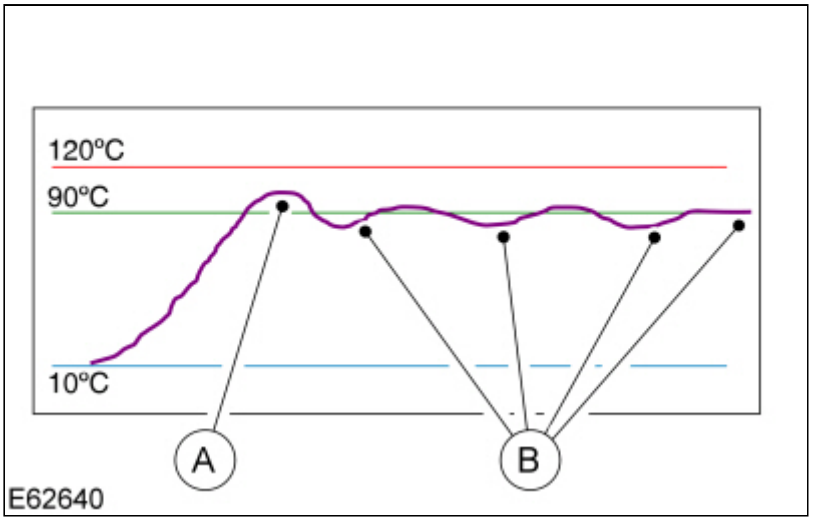
1. Connect the Ford Diagnostic Equipment to the data link connector (DLC).

2. Using the datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	—	Thermostat opens
B	—	Thermostat settles into a cyclic open and closure pattern

NOTICE: If the ECT sensor output reaches the 120°C default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100°C which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.

If the Ford diagnostic equipment only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	°Celsius
1.33	60
1.02	70
0.78	80

0.60	90
0.46	100
0.35	110
0.27	120

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford diagnostic equipment in data logger mode, the signals recorded should remain within the DEFAULT values set by the Ford diagnostic equipment.

3. **WARNING: Make sure that the Ford diagnostic equipment is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford diagnostic equipment in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.**

   NOTE: *The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford diagnostic equipment can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.*

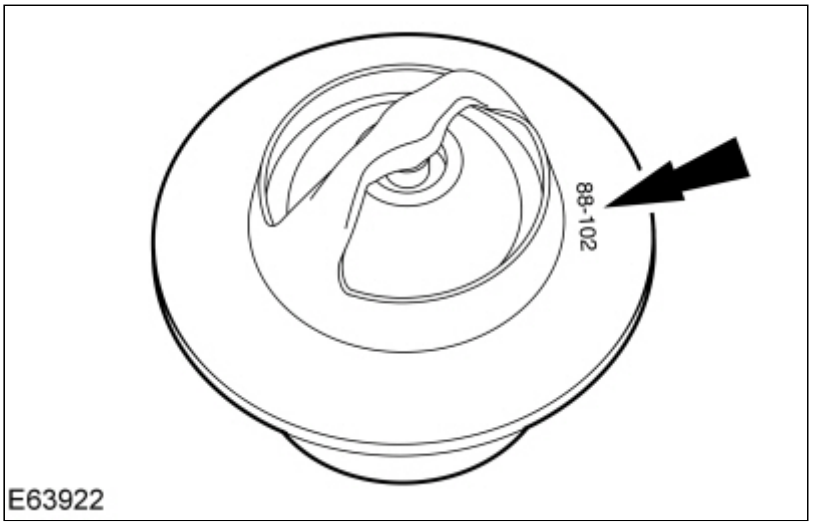
   NOTE: *The results from the test are more conclusive if the engine is cold when the test is started.*

   Carry out a road test.

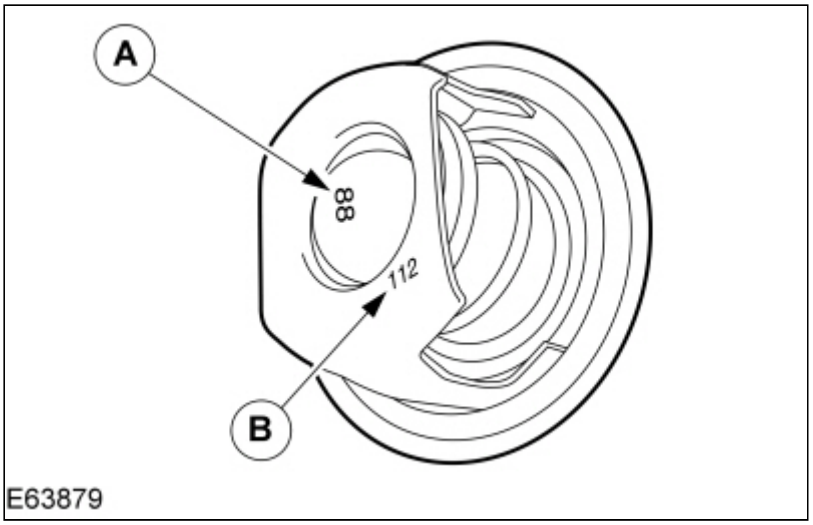
4. Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: *Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.*

The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	—	Opening temperature
B	—	Fully open temperature

NOTE: *Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.*

The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. INSTALL a new thermostat.
   REFER to: Thermostat (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

6. Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. Using the Ford diagnostic equipment, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

Copyright © 2016 Ford Motor Company

Cooling System Draining, Filling and Bleeding

Special Tool(s) / General Equipment

Cooling System Vacuum Tester and Refiller

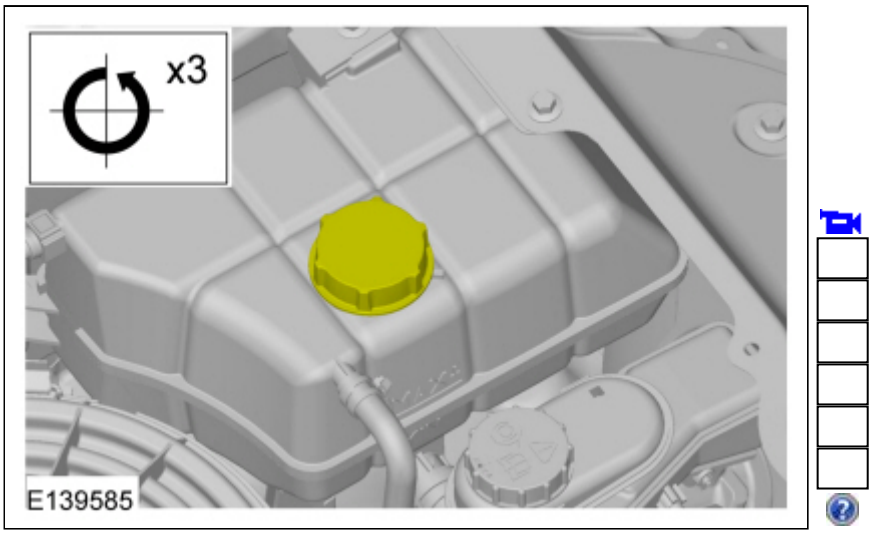
Materials

Name	Specification
Antifreeze	WSS-M97B44-D2

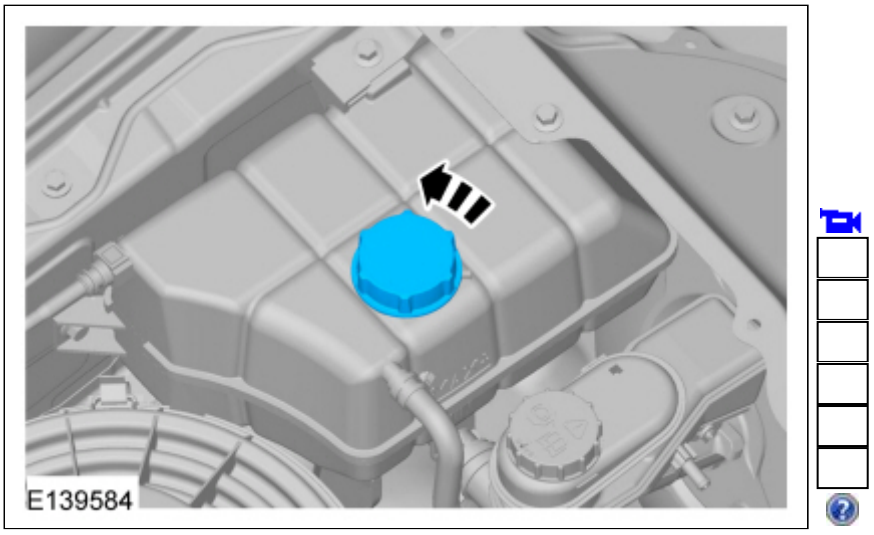
Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

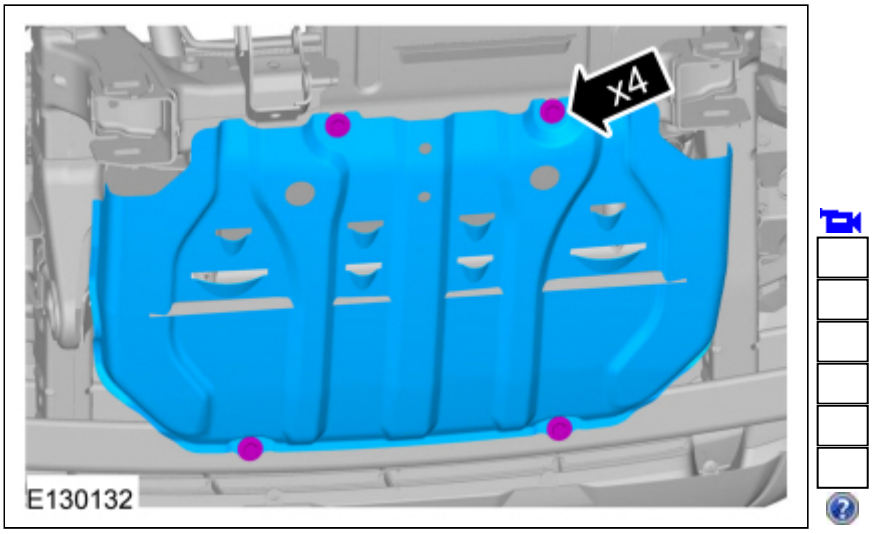


2.

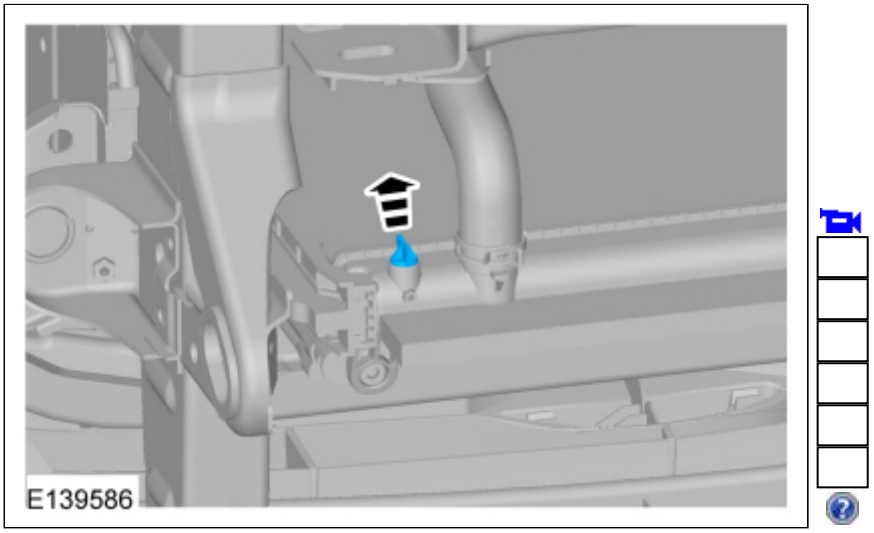


3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4.



5. Remove the radiator drain plug and drain the coolant.



6. Install the radiator drain plug.
7. Lower the vehicle.

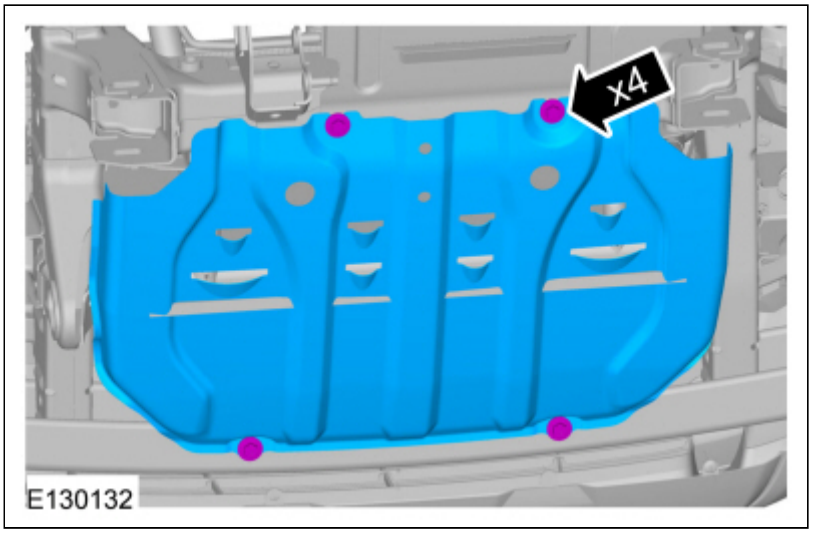
Filling

1. Refill the coolant to the expansion tank to maximum line (+15mm).
   Use the General Equipment: Cooling System Vacuum Tester and Refiller
   Material: Antifreeze (WSS-M97B44-D2)

Bleeding

NOTICE: The fluid level must remain between the MAX and MIN marks.

1. Run the engine for 5 minutes at idle rpm.
2. Install the coolant expansion tank cap.
3. Run the engine speed to 2500 RPM and maintain it for approximately 15 minutes.
4. Run the engine for 5minutes at idle rpm.
5. Switch the engine off.
6. Check the cooling system for leaks.
7. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
8. *Torque*: 30 Nm



9. Lower the vehicle.
10. Allow the engine to cool and maintain close to room temperature.
11. Fill the coolant to the expansion tank max fill line, if required.
    Use the General Equipment: Cooling System Vacuum Tester and Refiller
    Material: Antifreeze (WSS-M97B44-D2)

Copyright © 2016 Ford Motor Company

Cooling System Draining and Vacuum Filling

Special Tool(s) / General Equipment

Fluid Container
Cooling System Vacuum Tester and Refiller

Materials

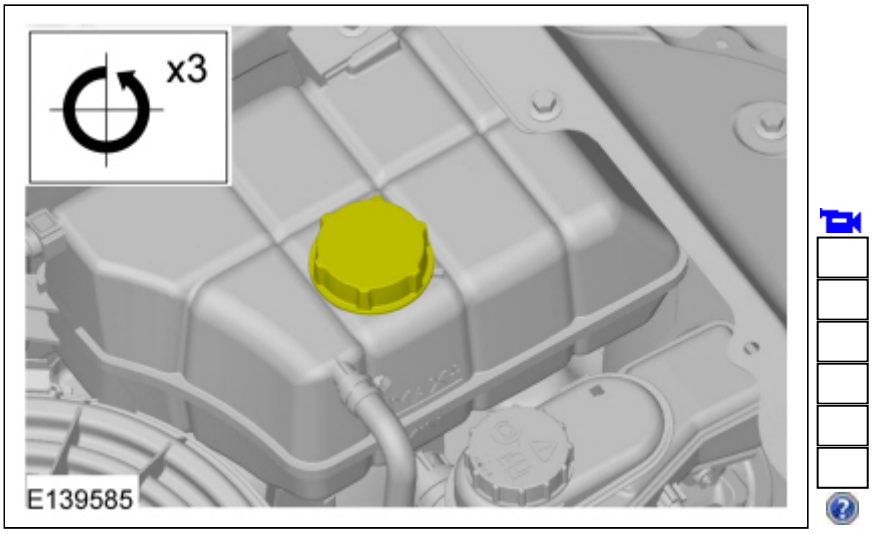
Name	Specification
Antifreeze	WSS-M97B44-D2

Draining

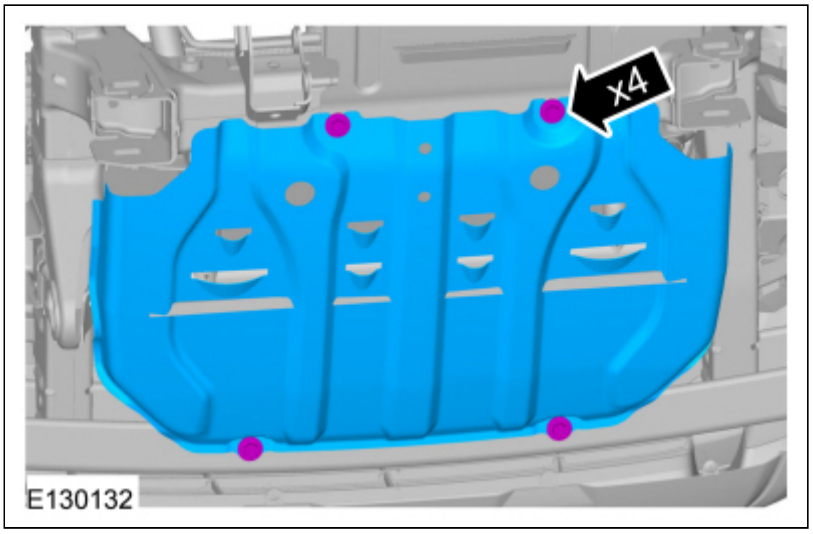
WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

NOTE: *Always follow the manufacturer's instructions when handling the equipment.*

1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 
   Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.



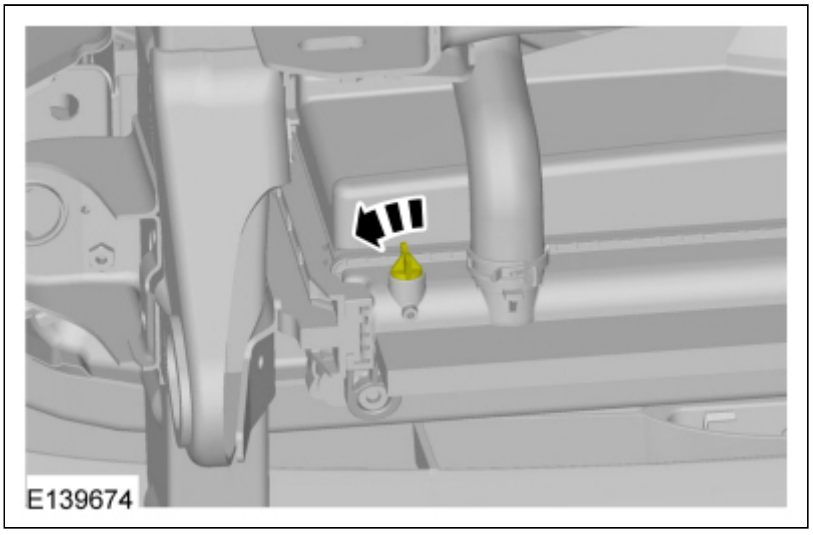
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.

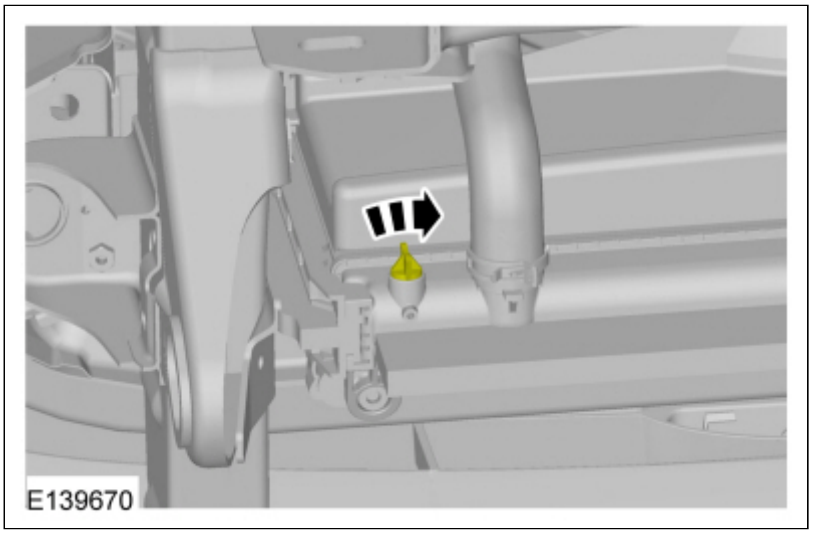


5. 

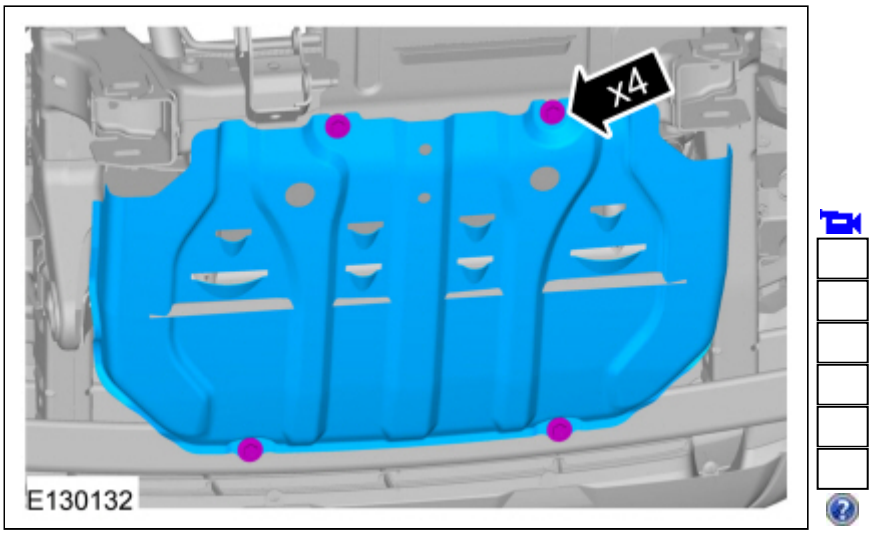
WARNING: Be prepared to collect escaping fluid.

Connect a hose to drain the coolant. Open the radiator drain valve and drain the engine coolant in a suitable, clean container.
Use the General Equipment: Fluid Container
Loosen: 4 turn(s)



6. 

7. *Torque*: 30 Nm



Evacuating and Filling

NOTICE: The cooling system is filled with Motorcraft® Orange Antifreeze/Coolant. Do not mix coolant types. Mixing coolant types degrades the corrosion protection of the coolant. Failure to follow these instructions may damage the engine or cooling system.

NOTICE: Engine coolant provides boil protection, corrosion protection, freeze protection, and cooling efficiency to the engine and cooling components. In order to obtain these protections, maintain the engine coolant at the correct concentration and fluid level in the degas bottle.

NOTE: *Add Motorcraft® Orange Antifreeze/Coolant or equivalent.*

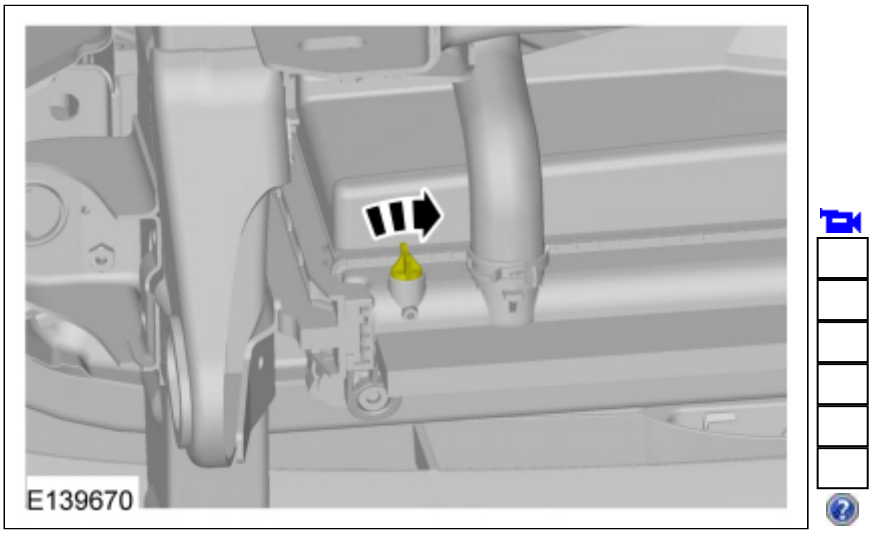
NOTE: *Do not add or mix with any other type of engine coolant. Mixing coolants may degrade the coolant's corrosion protection.*

NOTE: *Do not add alcohol, methanol, or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.*

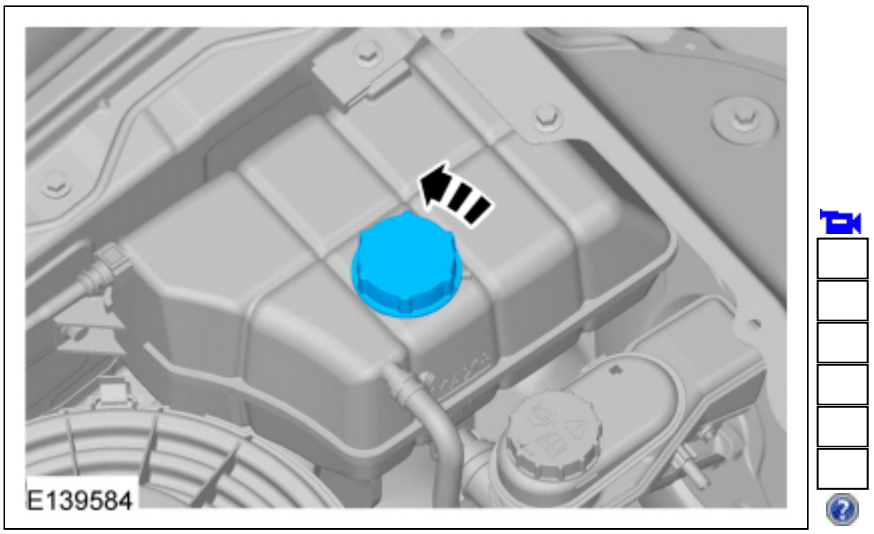
NOTE: *Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft® Orange Antifreeze/Coolant since a Ford-approved recycling process is not yet available.*

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
  Material: Antifreeze (WSS-M97B44-D2)
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.
  Material: Antifreeze (WSS-M97B44-D2)

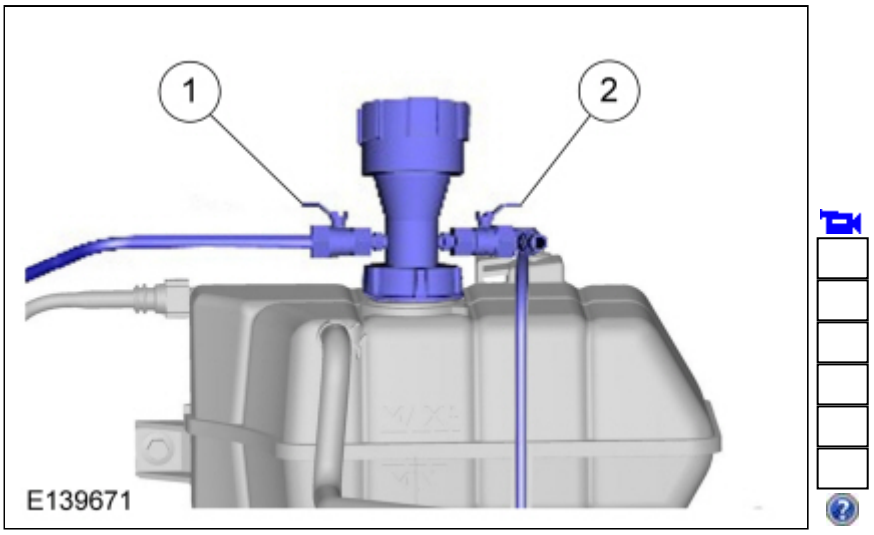
2. Close the radiator drain plug.



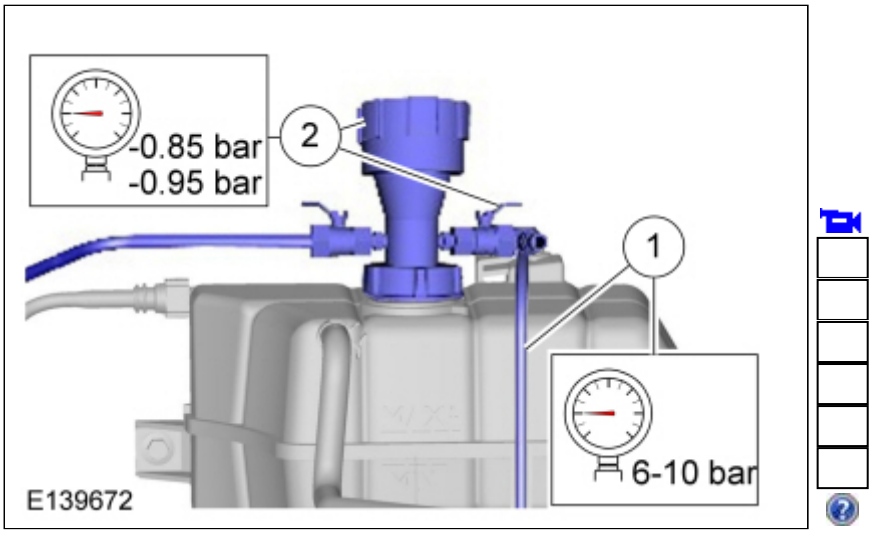
3. Remove the coolant expansion tank cap.



1. Close the valve, install the coolant hose and place it into the fluid container.
   Use the General Equipment: Cooling System Vacuum Tester and Refiller
2. Close the valve and connect the compressed air hose.



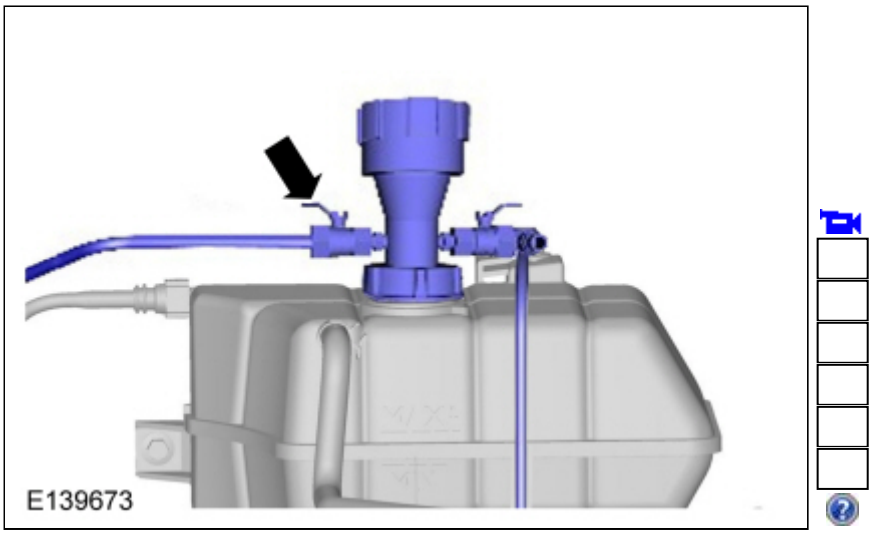
1. Use the General Equipment: Cooling System Vacuum Tester and Refiller
2. Open the valve until the specificied vacuum is achieved.



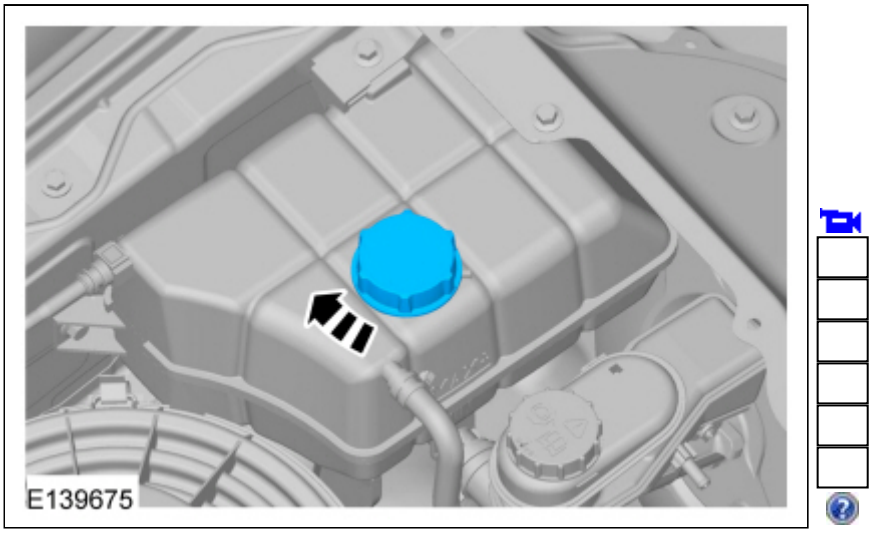
- Open the valve until the coolant reservoir fluid level is at the MAX mark.

Use the General Equipment: Cooling System Vacuum Tester and Refiller

- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.
  Material: Antifreeze (WSS-M97B44-D2)



7. Install the pressure relief cap until it contacts the hard stop.



Copyright © 2016 Ford Motor Company

Thermostat

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

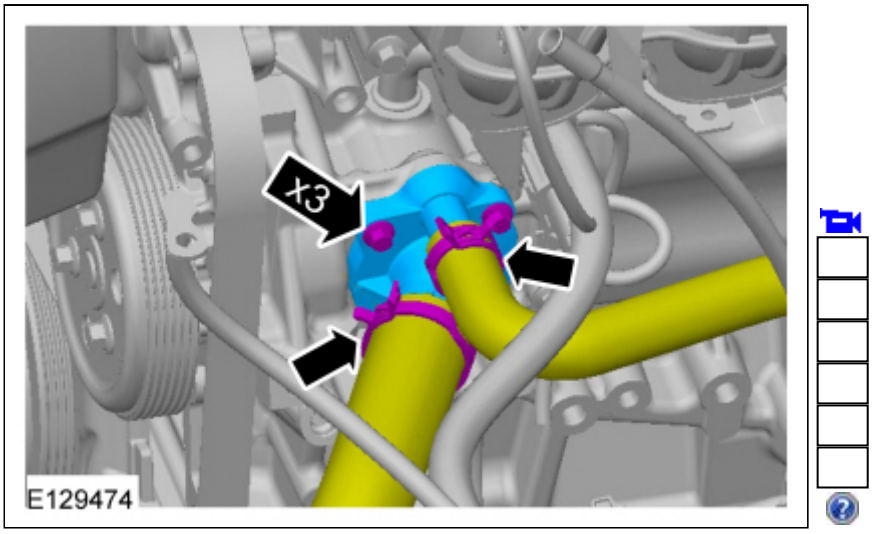
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

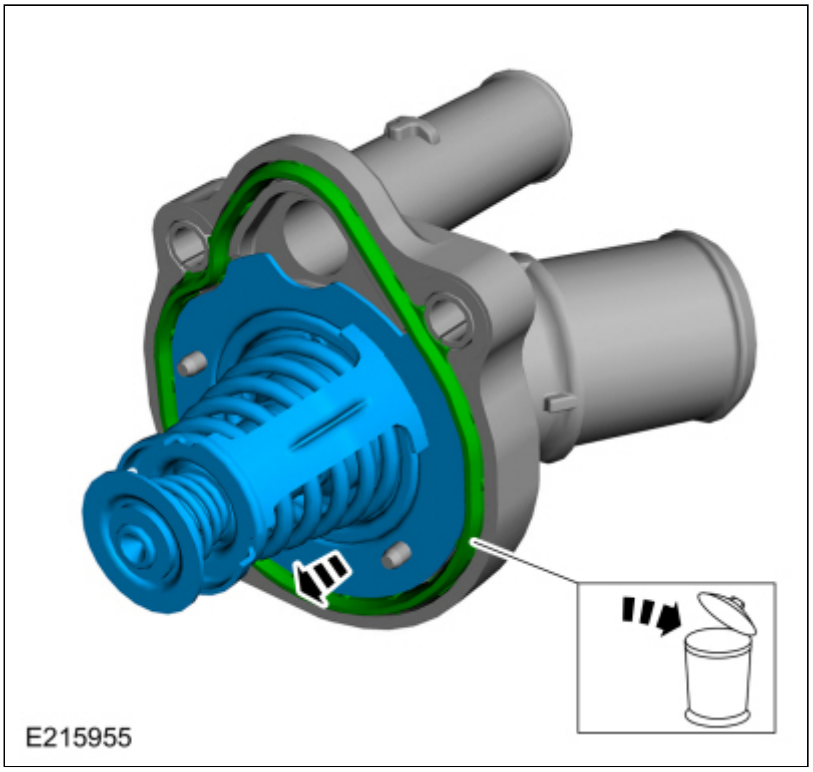
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

3. **NOTE:** *The gasket is to be reused unless damaged.*

   Torque: 10 Nm



4.



Installation

1. To install, reverse the removal procedure.
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

Copyright © 2016 Ford Motor Company

Coolant Pump

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

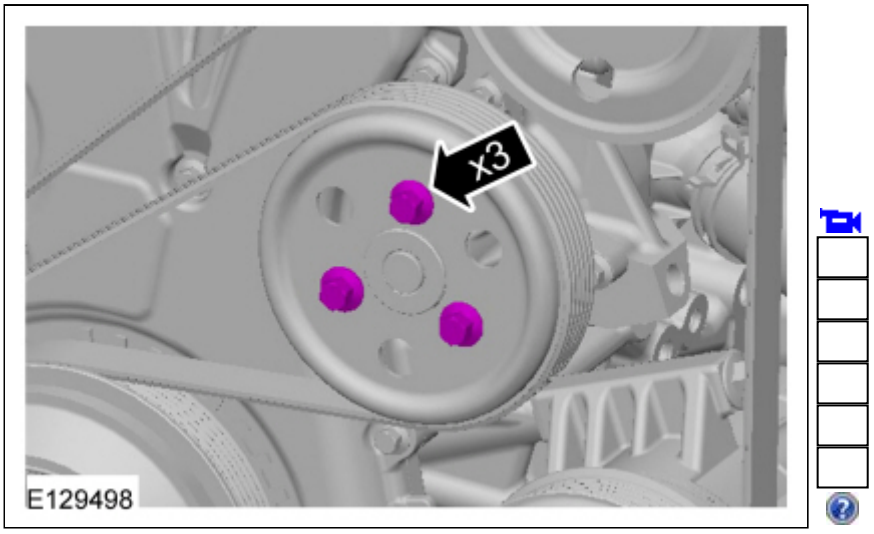
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

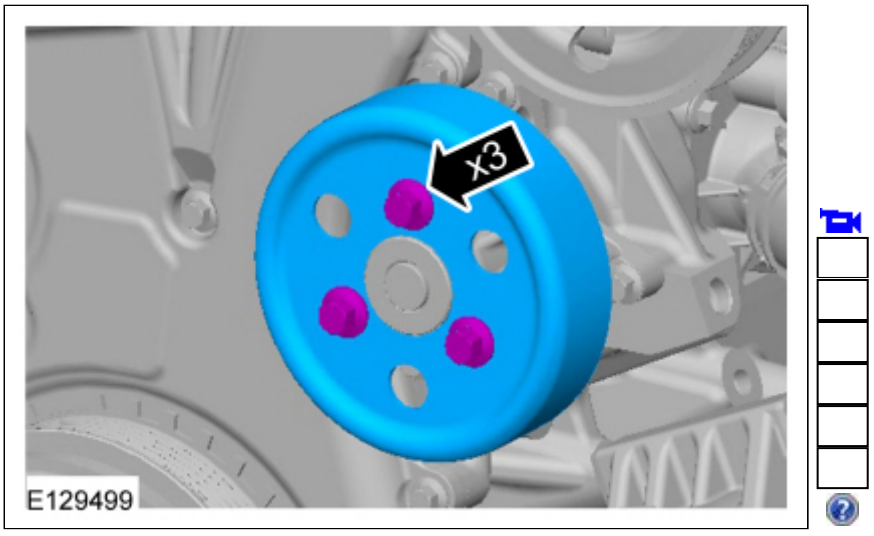
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Loosen: 3 turn(s)



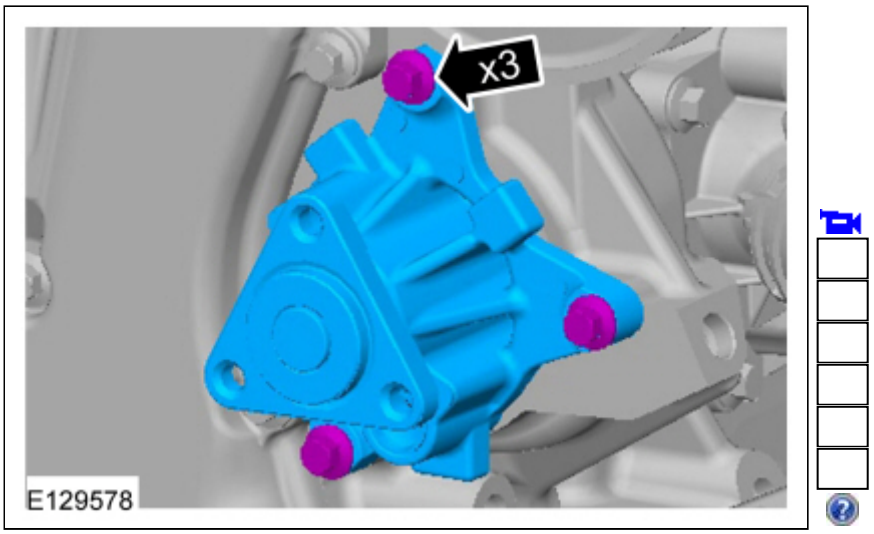
5. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

6. *Torque*: 20 Nm



7. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

Torque: 10 Nm



Installation

1. **NOTE:** *Install all the bolts finger tight before final tightening.*

   To install, reverse the removal procedure.

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

Copyright © 2016 Ford Motor Company

Radiator

Base Part Number: 8005

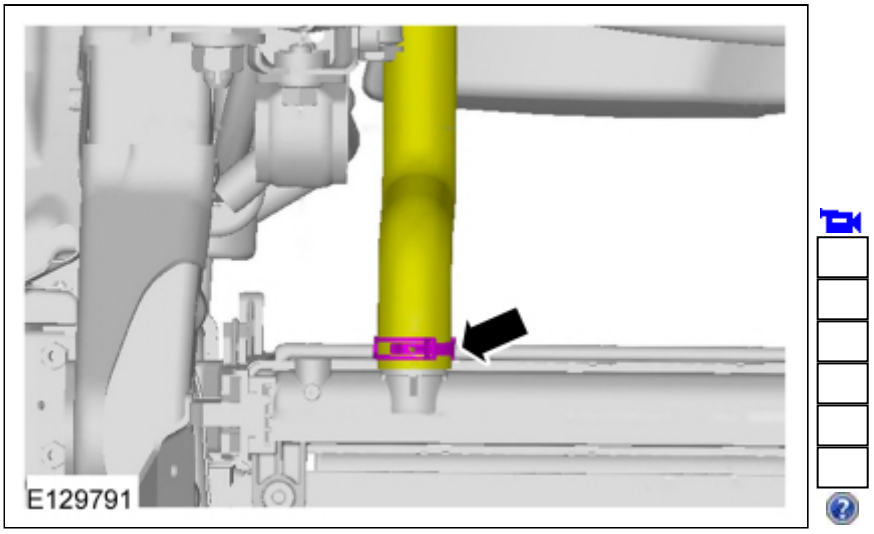
Removal

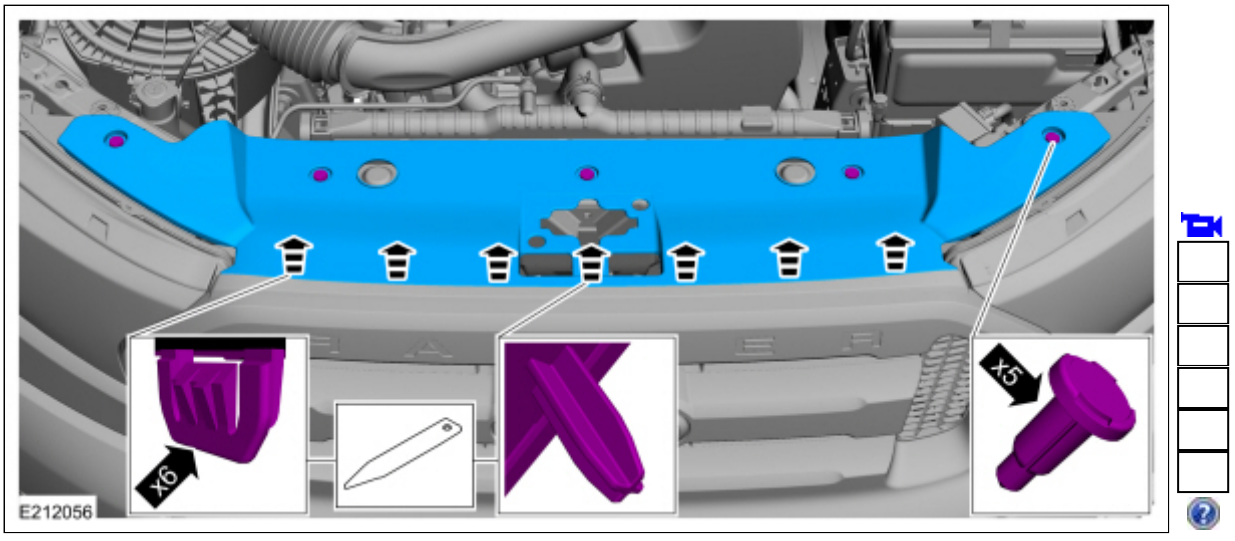
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

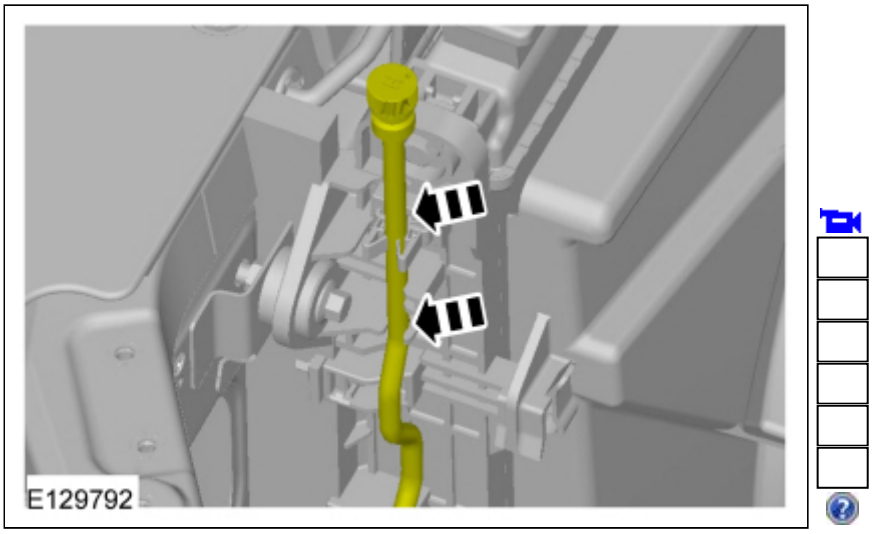
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

3. 

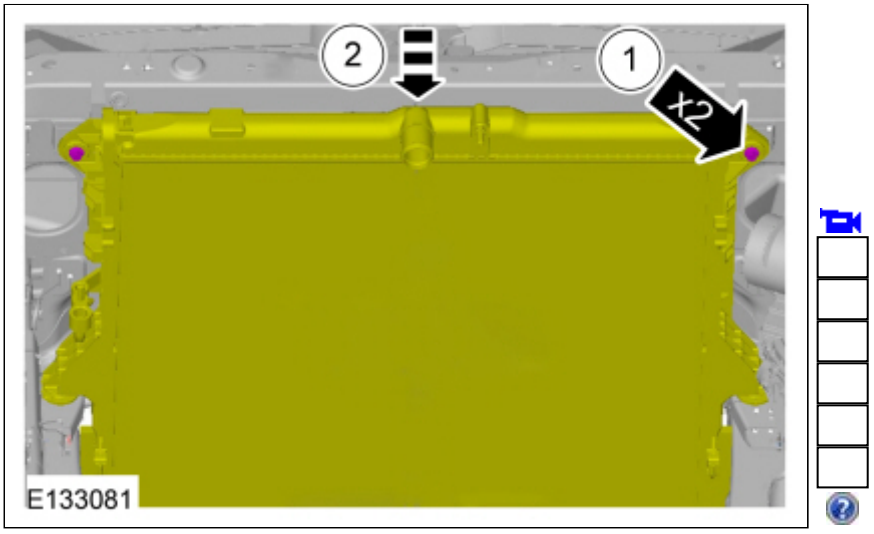
4. 

5. **NOTE:** *Take extra care not to damage the A/C refrigerant filling pipe.*

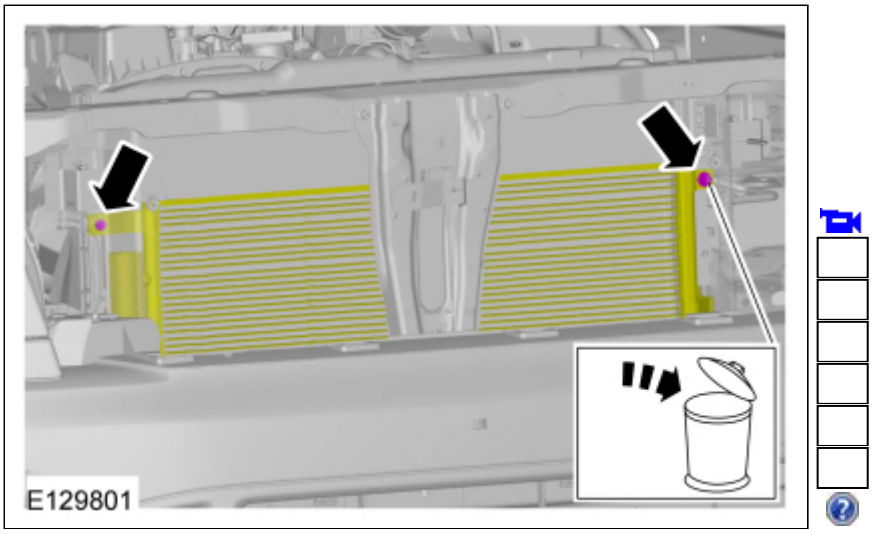


6. **NOTE:** *Take extra care not to bend the radiator.*

   Torque: 20 Nm

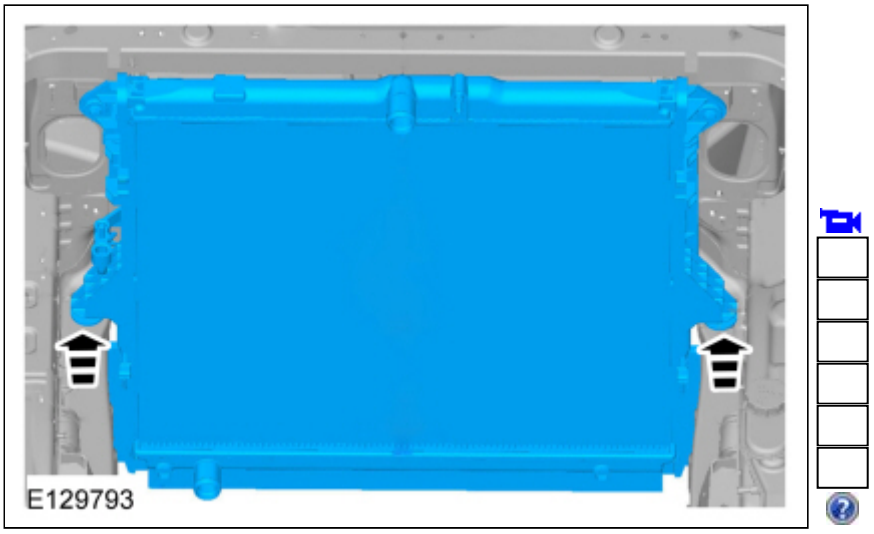


7. *Torque*: 7 Nm



8. **NOTE:** *Radiator insulators are to be reused unless damaged.*

   NOTE: *Take extra care not to damage the radiator during removal.*



Installation

1. **NOTE:** *Make sure that no components catch when installing the radiator.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Cooling Fan Motor and Shroud

Base Part Number: 8C607

Removal

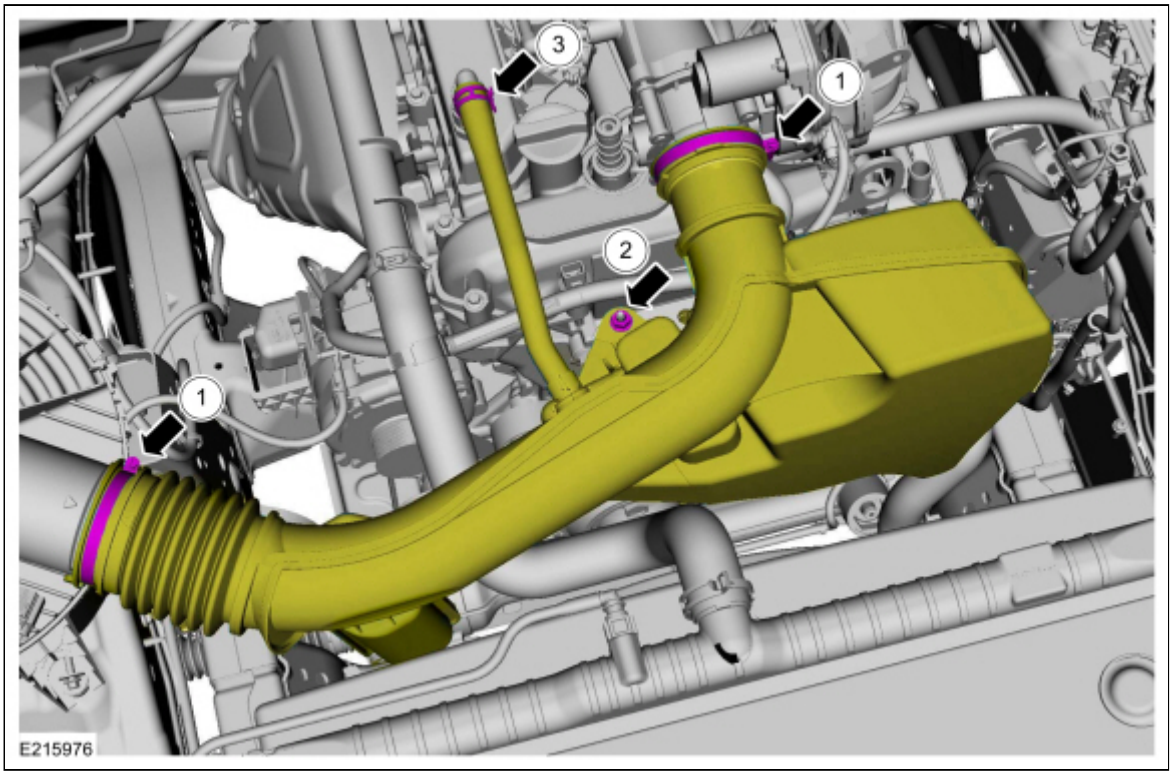
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

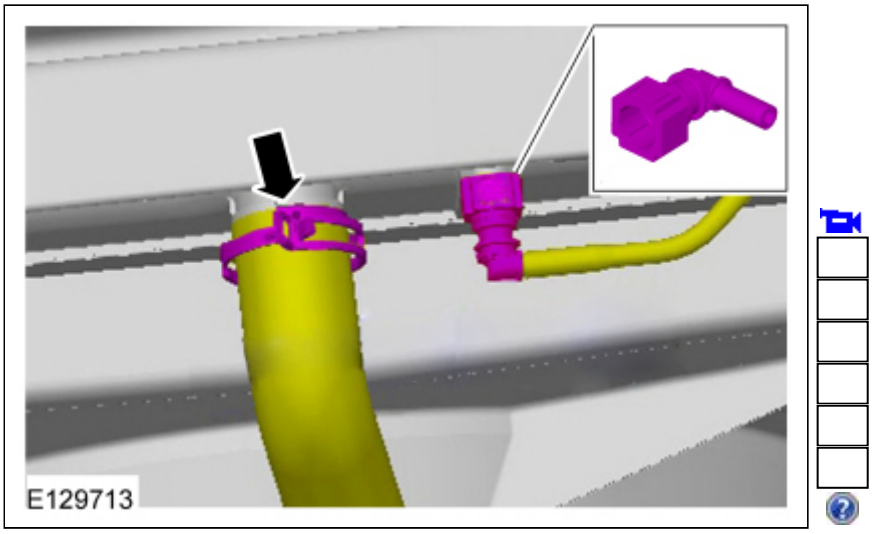
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

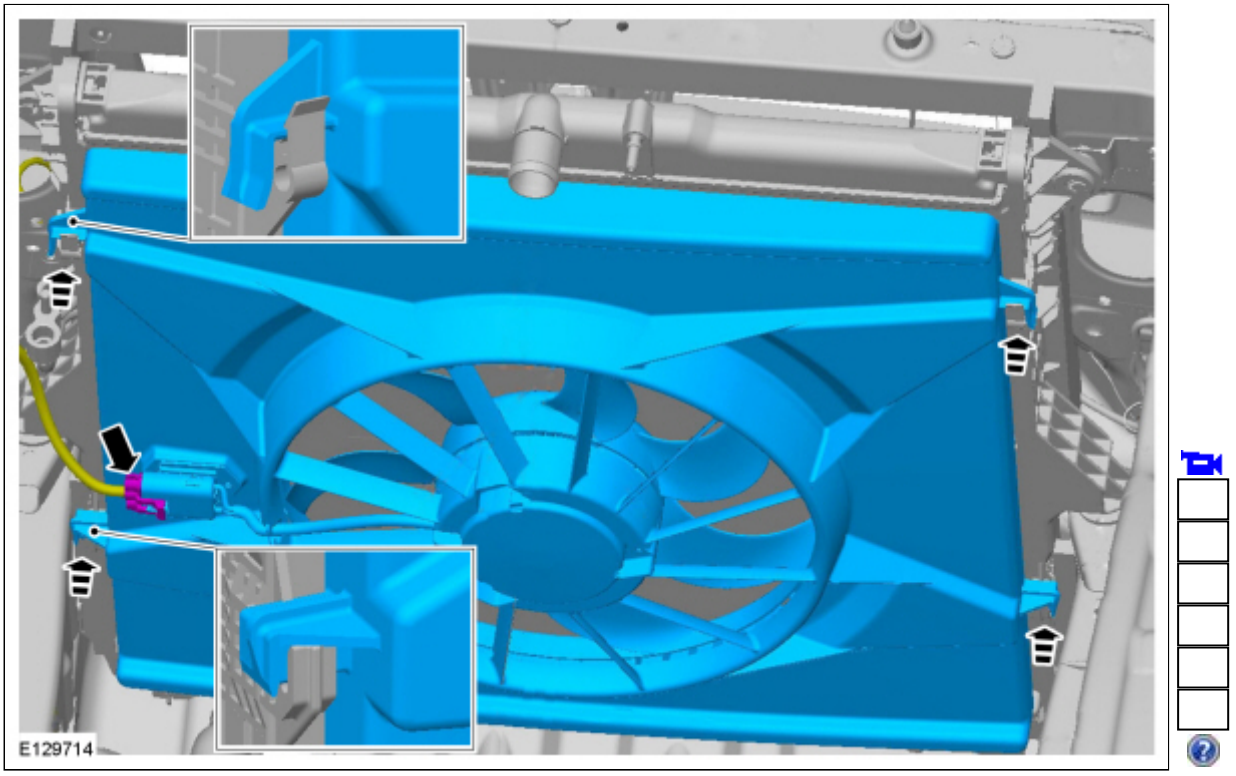
3. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 11 Nm



4.



5.



Installation

1. To install, reverse the removal procedure.
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

Copyright © 2016 Ford Motor Company

Coolant Outlet Connector

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

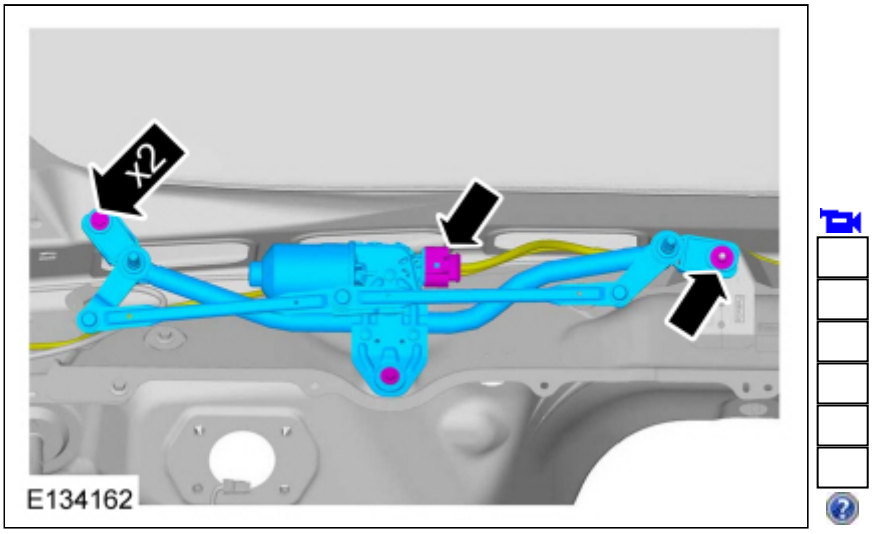
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

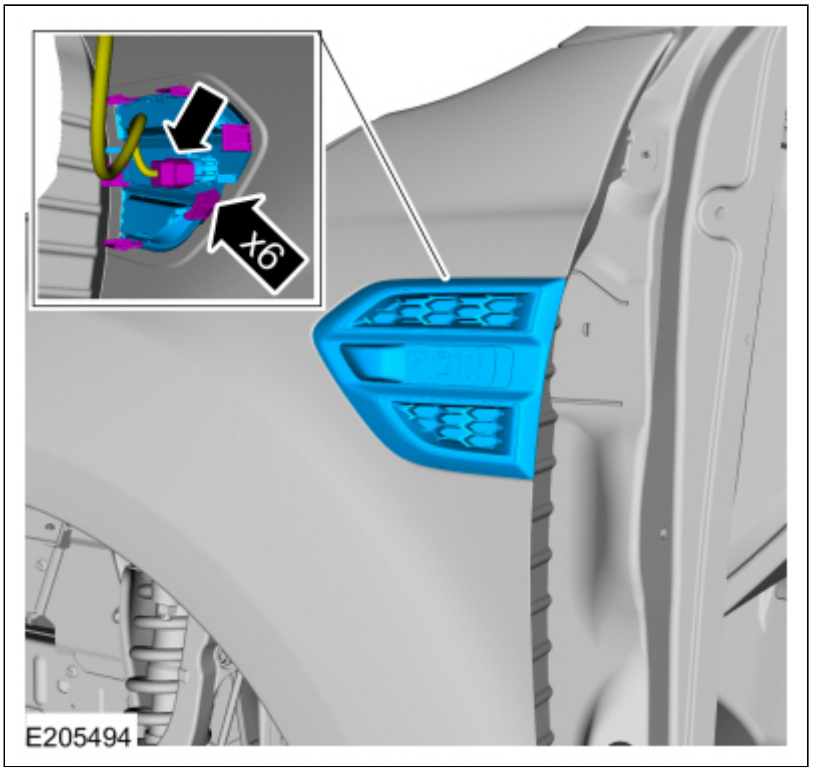
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

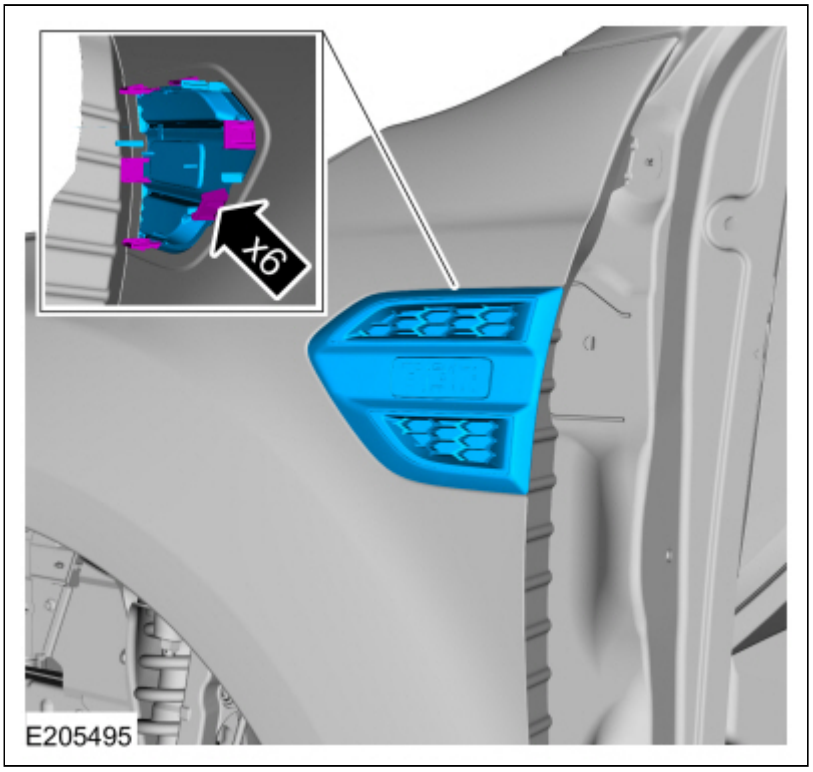
5. *Torque*: 11 Nm



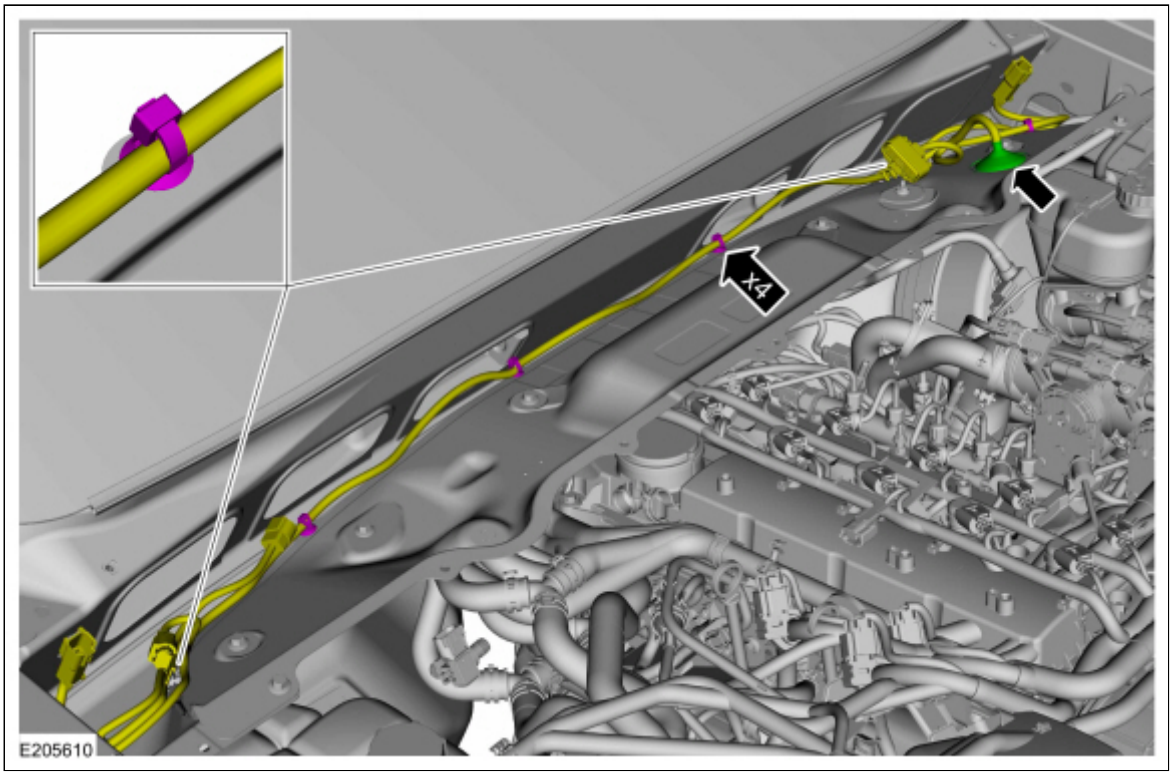
6. On both sides. Type 1.



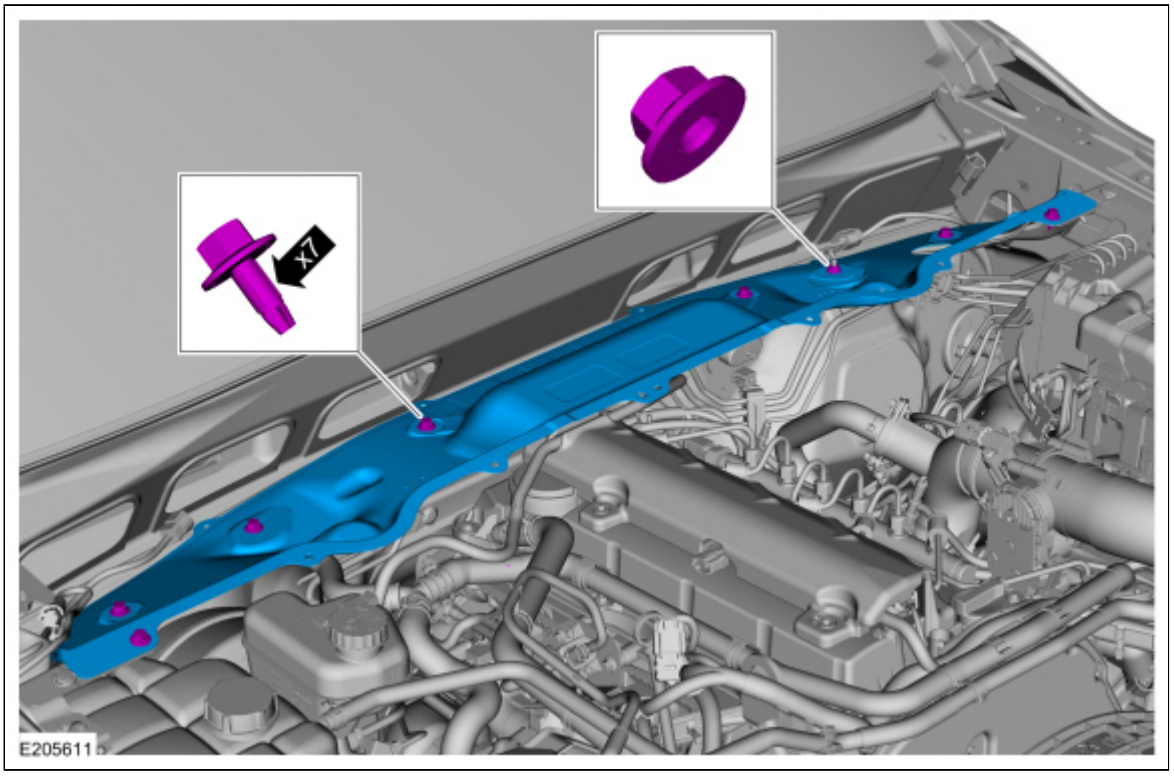
7. On both sides. Type 2.



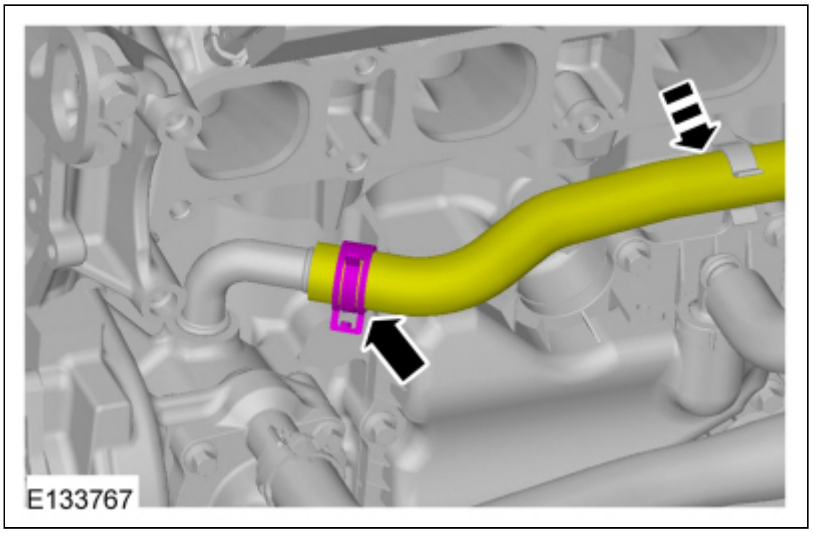
8.



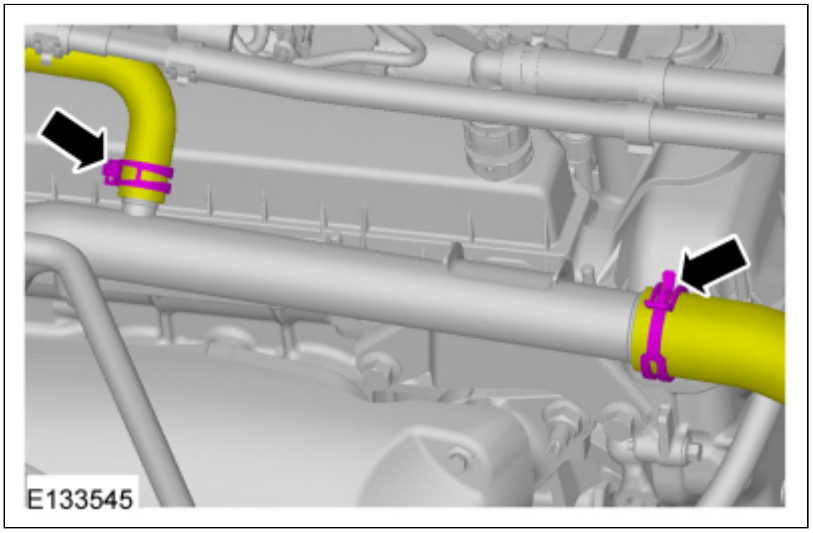
9. *Torque*: 14 Nm



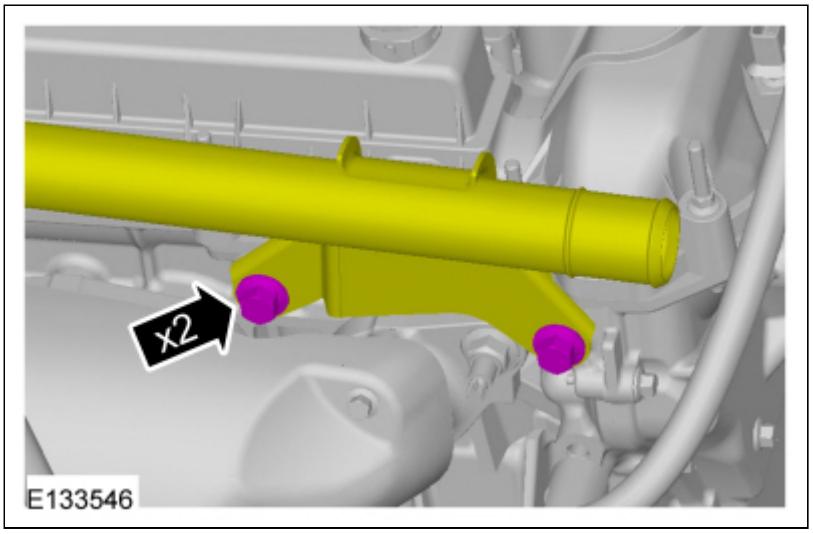
10.



11.



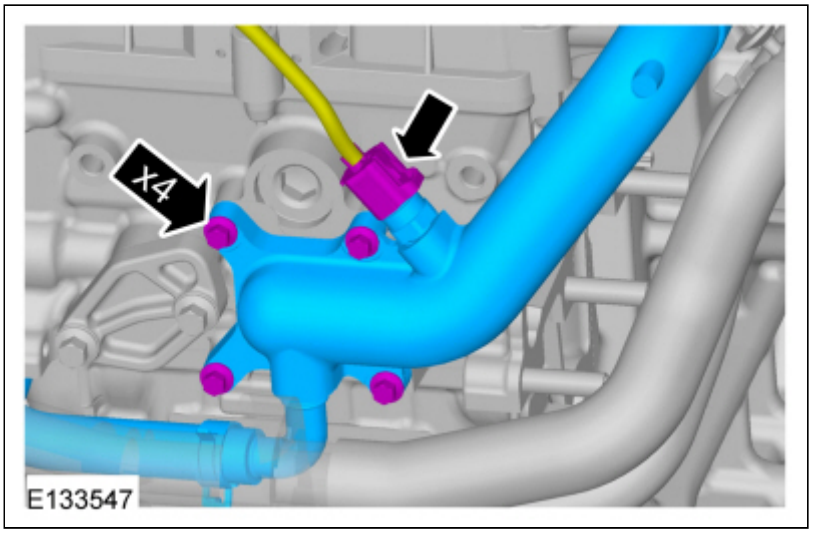
12. *Torque*: 48 Nm



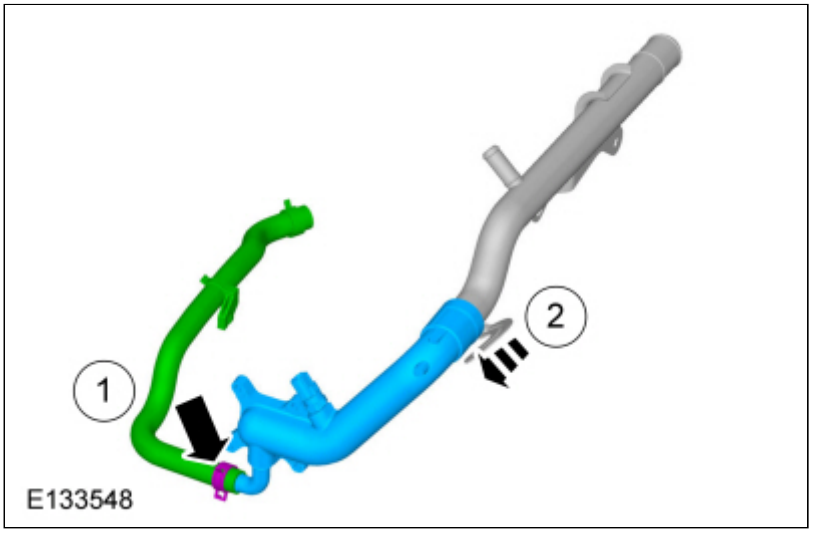
13. **NOTE:** *Make sure that these components are installed to the noted removal position.*

NOTE: *The gasket is to be reused unless damaged.*

Torque: 10 Nm

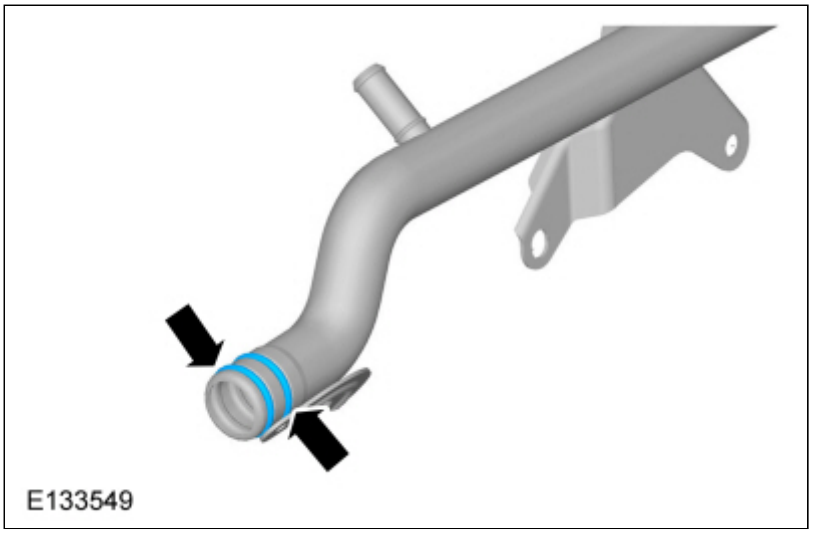


14.



15. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

    NOTE: *The O-ring seal is to be reused unless damaged.*



Installation

1. To install, reverse the removal procedure.
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

Copyright © 2016 Ford Motor Company

Specifications

Antifreeze Specifications

Description	Specification
Motorcraft Super Plus 2000	WSS-M97B44-D2
Specific gravity (providing no other additive is in the coolant)	1.068 at +15°C
Approximate percentage of antifreeze (by volume)	50%
Coolant remains fluid to	-30°C (-22°F)
Coolant solidifies at	-35°C (-31°F)

Cooling System Capacities — Vehicles with 2.2L Diesel Engine

Description	Liters
Vehicles with front heater only	11.5

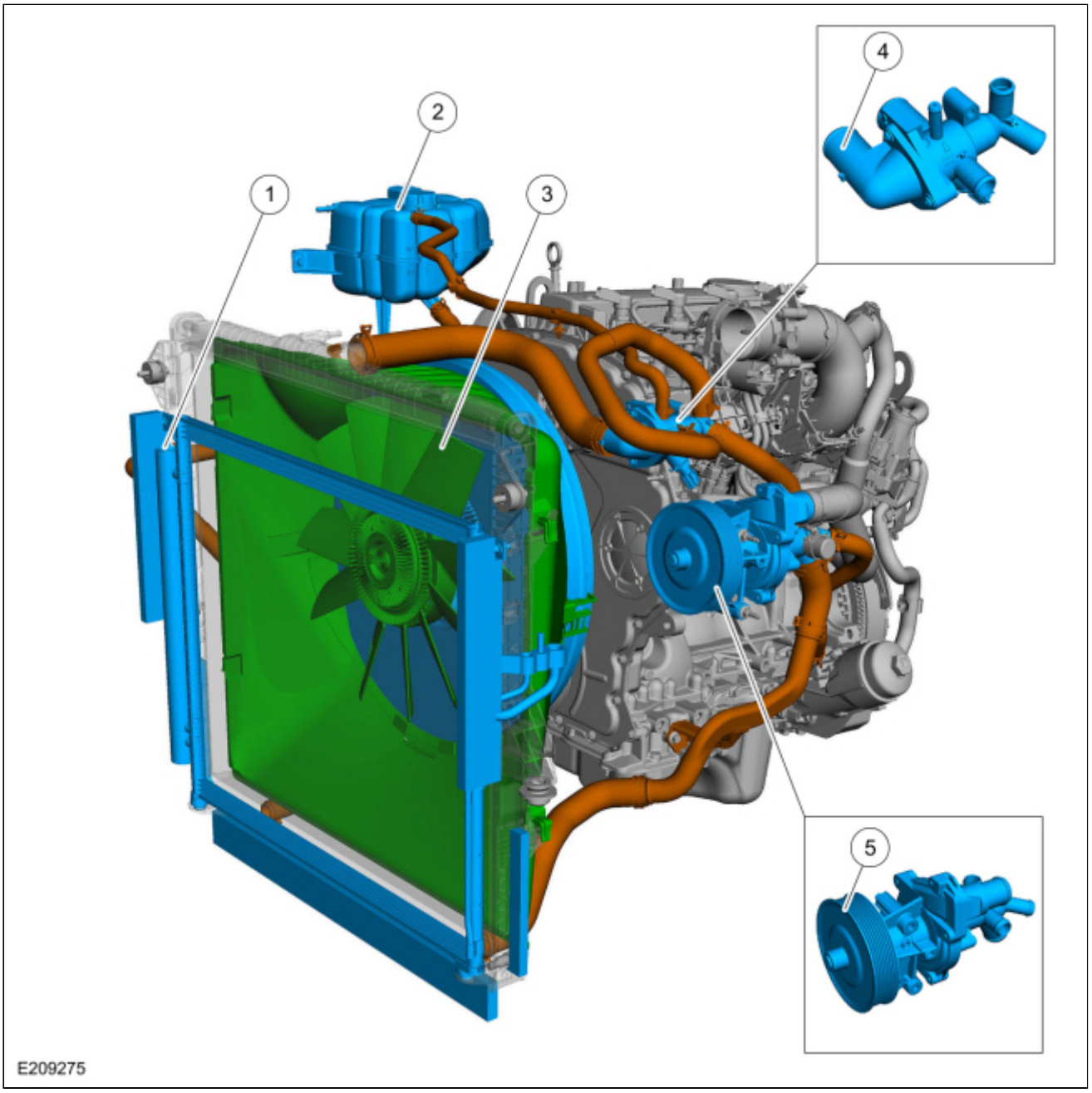
Cooling System Pressure Specification

Description	Pressure kPa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135-155 (19-22)

Copyright © 2016 Ford Motor Company

Engine Cooling - Component Location

2.2L Duratorq



Item	Description
1	Radiator
2	Coolant expansion tank
3	Cooling fan and shroud
4	Thermostat housing
5	Coolant pump

Copyright © 2016 Ford Motor Company

Engine Cooling - Overview

2.2L Duratorq

- Engine driven coolant pump
- Engine driven cooling fan with viscous coupling
- Maximum operating pressure 155 kPa

Engine coolant requires periodic replacement. It is important that when replaced or if the level is rectified after leak repair that the coolant type and concentration is correct. Incorrect coolant specification can lead to engine damage through; corrosion, freezing, or boiling.

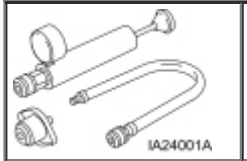
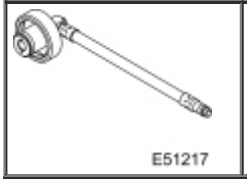
NOTE: *Please consult the warranty and service information guide for engine coolant specification and quantites.*

Copyright © 2016 Ford Motor Company

Engine Cooling

Refer to Wiring Diagrams Section 303-14B for schematic and connector information.

Special Tool(s)

 IA24001A	Pressure Tester, Cooling System 303-396 (24-001A)
 E51217	Adapter for 303-396 303-396-08

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Coolant hose(s) − Gaskets/seals − Coolant expansion tank cap and seal − Coolant expansion tank − Radiator − Coolant pump − Thermostat − Thermostat housing − Cooling fan and cooling fan clutch − Accessory drive belt − Power steering pump belt − Exhaust gas recirculation (EGR) cooler − Engine oil cooler	− Fuse(s) − Wiring harness − Electrical connector(s) − Engine coolant temperature (ECT) sensor − Engine cooling fan motor(s) − Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action

• Loss of coolant	• Radiator.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary. REFER to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Coolant pump.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Thermostat housing.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing as necessary. REFER to: Thermostat Housing (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Coolant expansion tank cap.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	• Coolant expansion tank.	• CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	• EGR cooler.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new EGR cooler as necessary. REFER to: Exhaust Gas Recirculation (EGR) Cooler - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Engine oil cooler.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new engine oil cooler as necessary.
	• Heater core.	• CHECK the heater core for leaks. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).
	• Engine.	• CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
• The engine overheats.	• Cooling system does not hold pressure.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section. • CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary. • CHECK the coolant pump for damage. INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). • CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
	• Air in system.	• BLEED the cooling system. REFER to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
	• Coolant expansion tank cap.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	• Coolant	• CHECK the coolant expansion tank for damage. INSTALL a new

	• Coolant expansion tank.	• CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	• Coolant level/condition.	• CHECK the coolant level/condition. REFILL the cooling system. REFER to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
	• Coolant concentration.	• REFER to: Specifications (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Specifications).
	• Radiator grille.	• CHECK the radiator grille for air restrictions/damage. REPAIR as necessary.
	• Coolant pump.	• CHECK the coolant pump for leaks. INSTALL a new coolant pump as necessary. REFER to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
	• Thermostat.	• CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Accessory drive belt.	• CHECK the accessory drive belt for correct operation. REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Power steering pump belt.	• CHECK the power steering pump belt for correct operation. REFER to: Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Cooling fan and cooling fan clutch.	• CHECK operation of the cooling fan and cooling fan clutch. INSTALL a new cooling fan and cooling fan clutch as necessary. REFER to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Engine.	• CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
• The engine does not reach normal operating temperature.	• Thermostat.	• CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• ECT sensor.	• CHECK the ECT sensor for correct operation. REFER to the Ford diagnostic equipment.
	• Circuit(s).	• CHECK the circuit(s). REFER to the Ford diagnostic equipment.

Component Tests

Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank cap.

2. Install the special tools to the coolant expansion tank.

3. Pressurize the system to the coolant expansion tank cap release pressure.
   REFER to: Specifications (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Specifications).

4. Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the system holds pressure, proceed to step 7. If the system does not hold pressure, check it thoroughly for coolant leaks.

5. If a coolant leak cannot be found, check the EGR cooler (this may leak internally), engine oil cooler (this may produce oil in the coolant expansion tank) and the engine for cylinder leakage. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

6. Recheck the system by repeating steps 3 and 4 at least twice.

Radiator Leak Test, Removed From Vehicle

NOTICE: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.

Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank cap.

2. Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: *If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.*

3. Slowly depress the plunger of the pressure test pump until the pressure test gauge reading stops increasing, and note the highest pressure reading obtained.

4. Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure that the pressure test gauge reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

1. Connect the Ford Diagnostic Equipment to the data link connector (DLC).

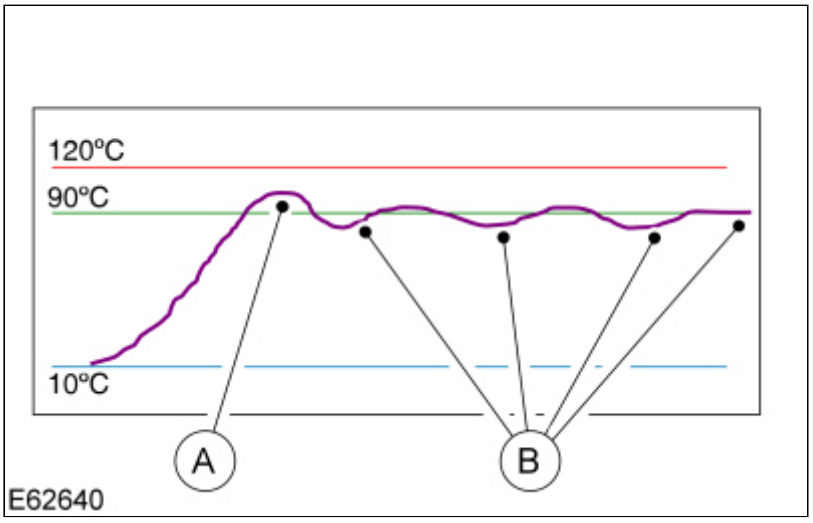
2. Using the datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)

- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	—	Thermostat opens
B	—	Thermostat settles into a cyclic open and closure pattern

NOTICE: If the ECT sensor output reaches the 120°C default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100°C which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.

If the Ford diagnostic equipment only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	°Celsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford diagnostic equipment in data logger mode, the signals recorded should remain within the DEFAULT values set by the Ford diagnostic equipment.

3. **WARNING: Make sure that the Ford diagnostic equipment is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford diagnostic equipment in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.**

   NOTE: *The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford diagnostic equipment can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.*

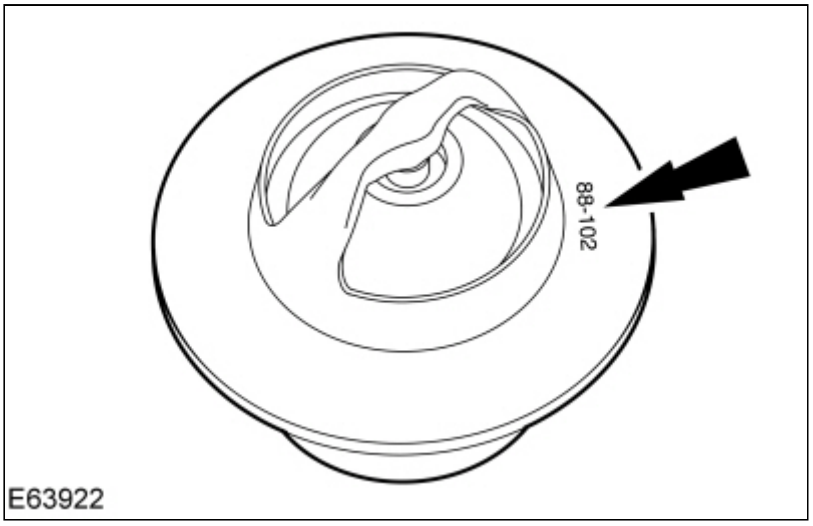
   NOTE: *The results from the test are more conclusive if the engine is cold when the test is started.*

   Carry out a road test.

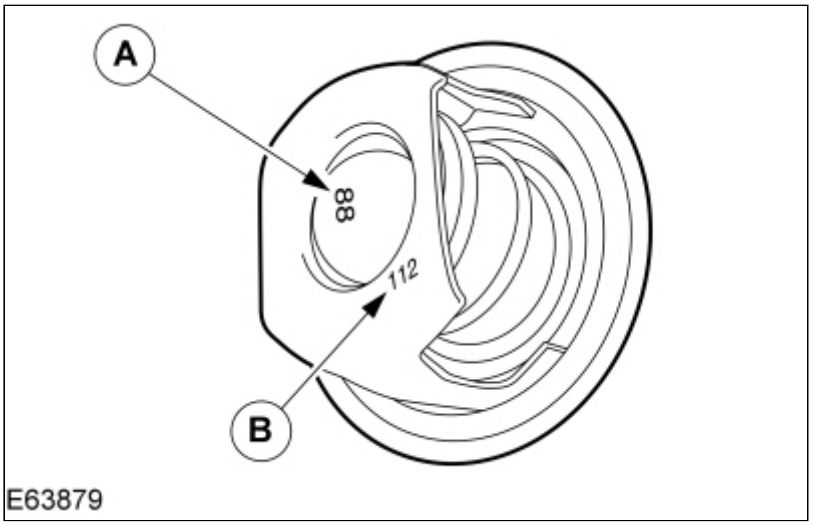
4. Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: *Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.*

The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	—	Opening temperature

B	—	Fully open temperature

NOTE: *Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.*

The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. INSTALL a new thermostat.
   REFER to: Thermostat (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

6. Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. Using the Ford diagnostic equipment, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

Fan Clutch Test

1. Turn the engine OFF and wait until the fan comes to a complete stop.

2. Spin the fan blade by hand. A light resistance should be felt. If there is no resistance or very high resistance, the minimum and maximum fan speeds must be checked. Carry out the following:

Fan Clutch Test — Minimum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.

2. Make sure the A/C is OFF, if equipped.

3. Start the engine and run it at approximately 2,000 rpm for 5 minutes or until there is a noticeable reduction in fan noise to allow the fan clutch to go into disengaged mode.

4. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 rpm at the coolant pump or fan pulley.

5. With the coolant pump or fan pulley at 3,000 rpm, aim the laser photo tachometer at the fan blade. Monitor and record fan speed.

6. The fan blade speed must be less than the specified rpm at 3,000 rpm coolant pump or fan pulley rpm.

7. Turn the engine off.

8. If the fan blade speed was greater than specified, install a new fan clutch.
   REFER to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Fan Clutch Test — Maximum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.

2. Block off areas on each side of the radiator in the engine compartment, the front of the radiator grille and the bumper. Close the hood. This will raise the temperature of the air striking the fan clutch and should cause the fan blade to operate at maximum speed.

3. Place the climate control function selector switch in the MAX A/C position and the blower motor switch in the HI position, if equipped.

4. **NOTE:** *Do not open the hood to check the coolant pump or fan pulley temperature. This will lower the*

temperature of the air reaching the fan clutch and void the test. Aim the infrared thermometer through the wheel well or from under the vehicle.

Start the engine and run it at approximately 2,000 rpm until normal operating temperature has been achieved. Using an infrared thermometer, monitor the coolant pump or fan pulley. Run the engine until the coolant pump or fan pulley is at least 96°C (205°F).

5. **NOTE:** *Do not open the hood to check the coolant pump or fan pulley or fan blade speed. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the laser photo tachometer through the wheel well or from under the vehicle.*

   Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 rpm at the coolant pump or fan pulley.

6. With the coolant pump or fan pulley at 3,000 rpm, aim the laser photo tachometer at the fan blade. Monitor and record fan blade speed.

7. The fan blade speed must be greater than the specified rpm at 3,000 rpm coolant pump or fan pulley rpm.

8. Open the hood and allow the engine to idle momentarily to lower engine temperature. Turn the engine off and remove the blocks from the radiator, grille and bumper.

9. If the fan blade speed is less than specified, install a new fan clutch.
   REFER to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Cooling System Draining, Filling and Bleeding

Special Tool(s) / General Equipment

Cooling System Vacuum Tester and Refiller

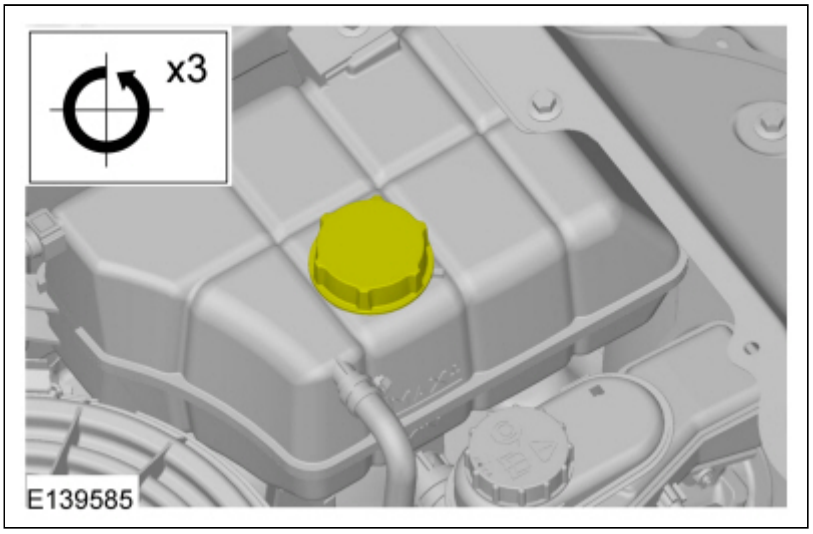
Materials

Name	Specification
Antifreeze	WSS-M97B44-D2

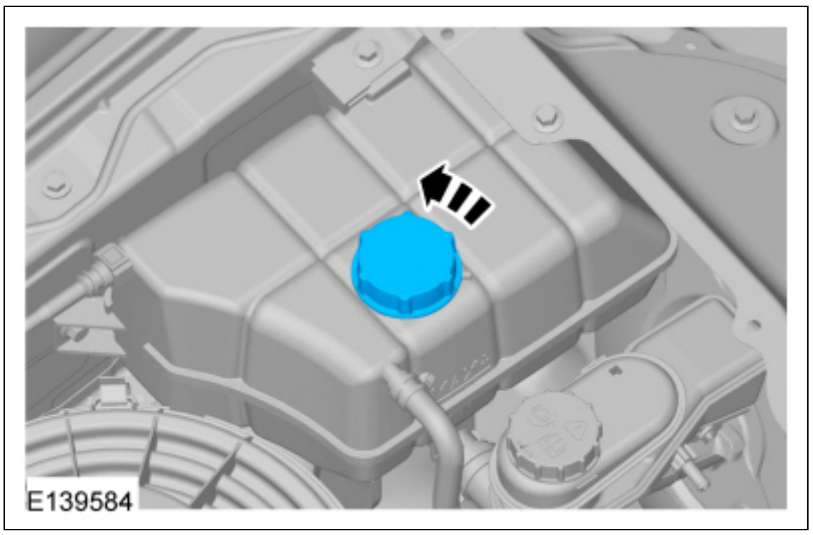
Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

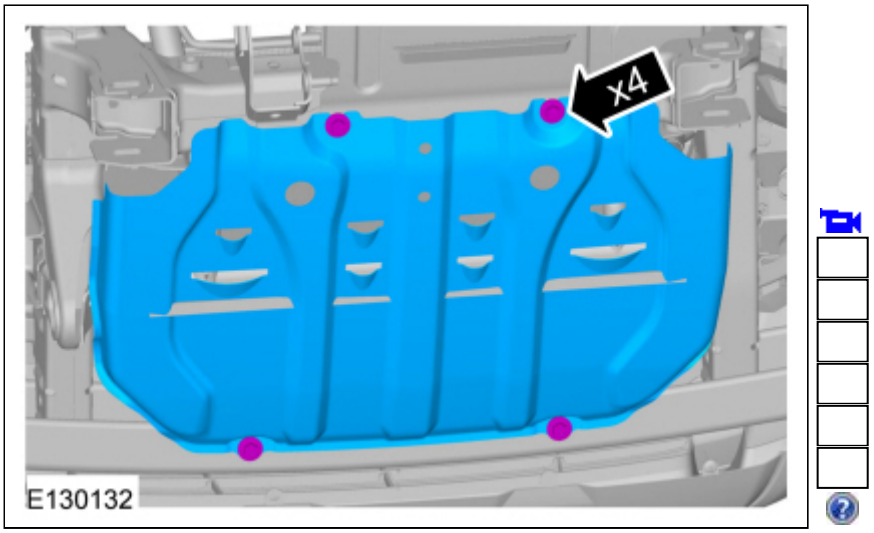
1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.



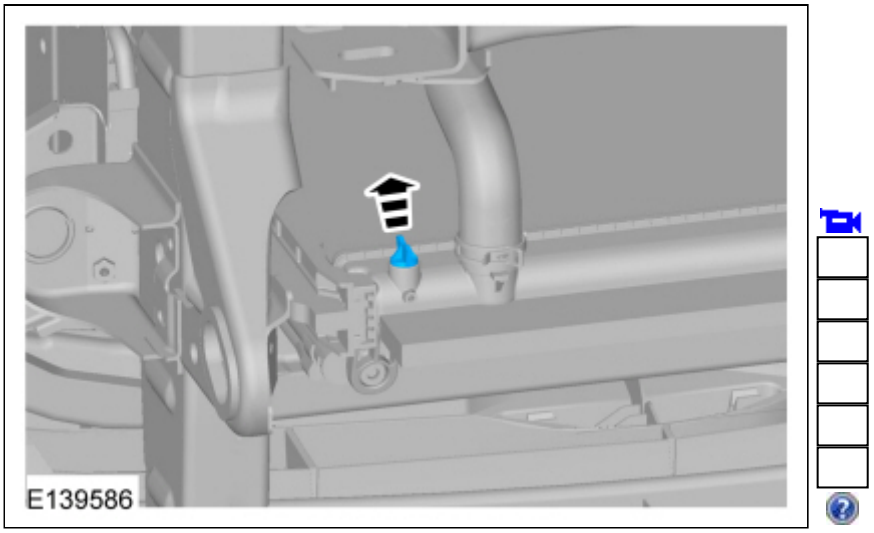
2.



3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.



5. Remove the radiator drain plug and drain the coolant.



6. Install the radiator drain plug.
7. Lower the vehicle.

Filling

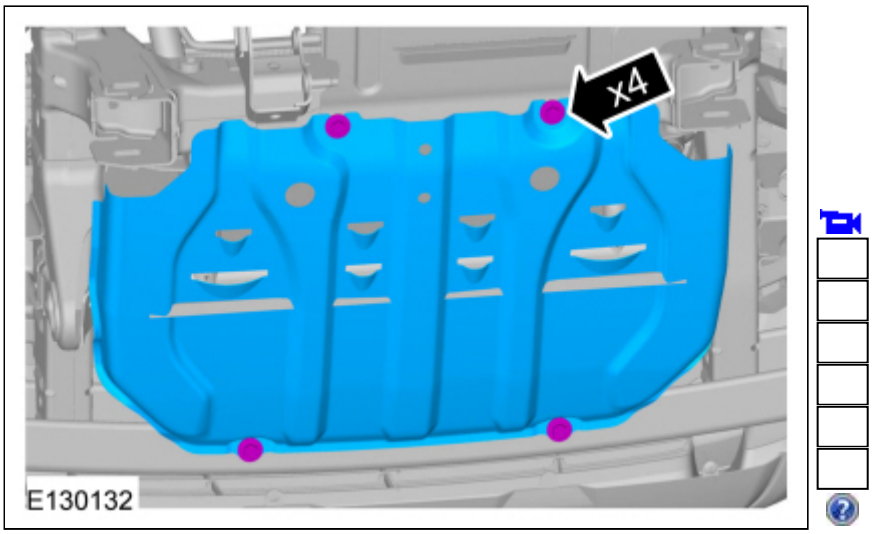
1. Refill the coolant to the expansion tank to maximum line (+15mm).
   Use the General Equipment: Cooling System Vacuum Tester and Refiller
   Material: Antifreeze (WSS-M97B44-D2)

Bleeding

NOTICE: The fluid level must remain between the MAX and MIN marks.

1. Run the engine for 5 minutes at idle rpm.
2. Install the coolant expansion tank cap.
3. Run the engine speed to 2500 RPM and maintain it for approximately 15 minutes.
4. Run the engine for 5minutes at idle rpm.
5. Switch the engine off.
6. Check the cooling system for leaks.
7. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

8. *Torque*: 30 Nm



9. Lower the vehicle.
10. Allow the engine to cool and maintain close to room temperature.
11. Fill the coolant to the expansion tank max fill line, if required.
    Use the General Equipment: Cooling System Vacuum Tester and Refiller
    Material: Antifreeze (WSS-M97B44-D2)

Copyright © 2016 Ford Motor Company

Cooling System Draining and Vacuum Filling

Special Tool(s) / General Equipment

Fluid Container
Cooling System Vacuum Tester and Refiller

Materials

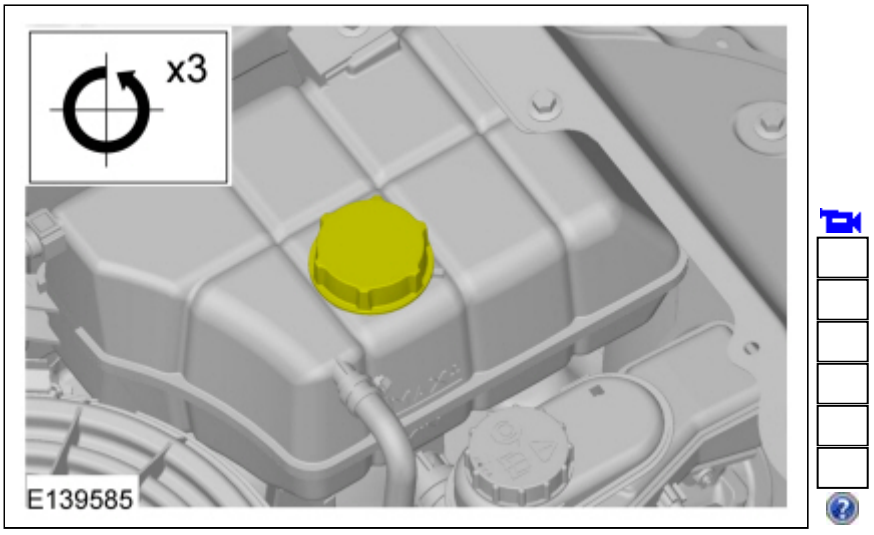
Name	Specification
Antifreeze	WSS-M97B44-D2

Draining

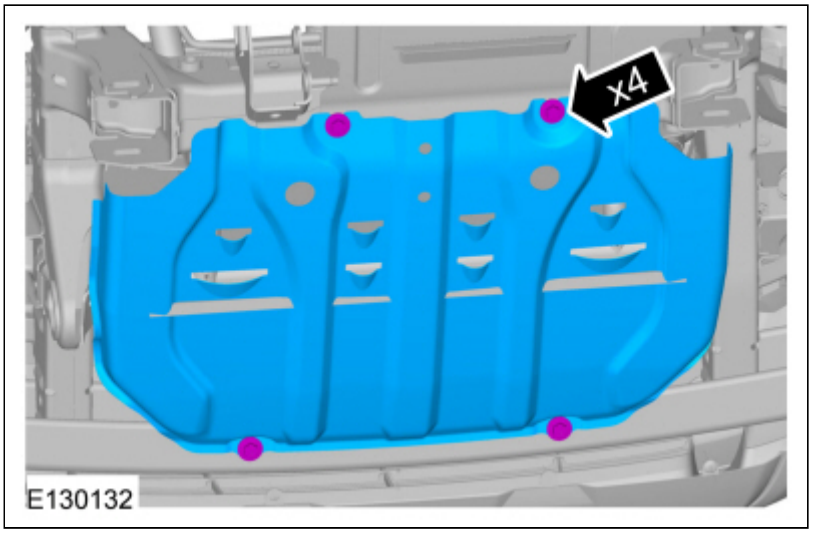
WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

NOTE: *Always follow the manufacturer's instructions when handling the equipment.*

1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.



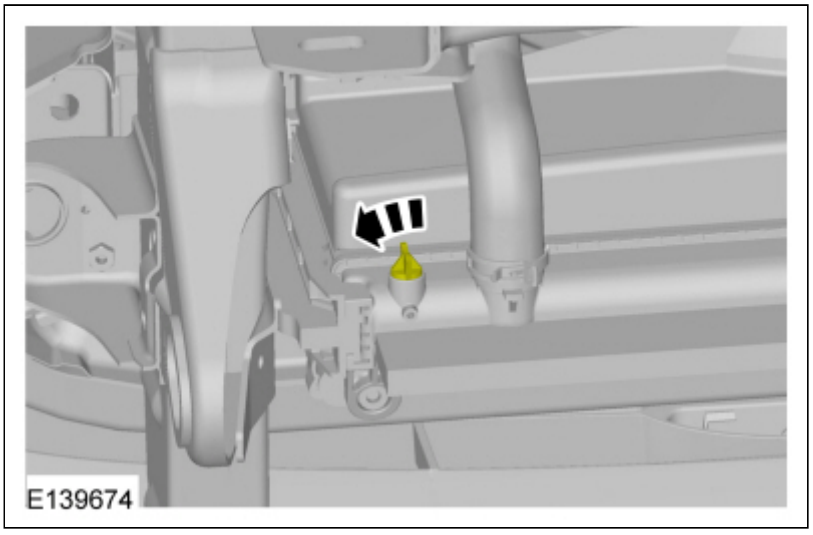
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.

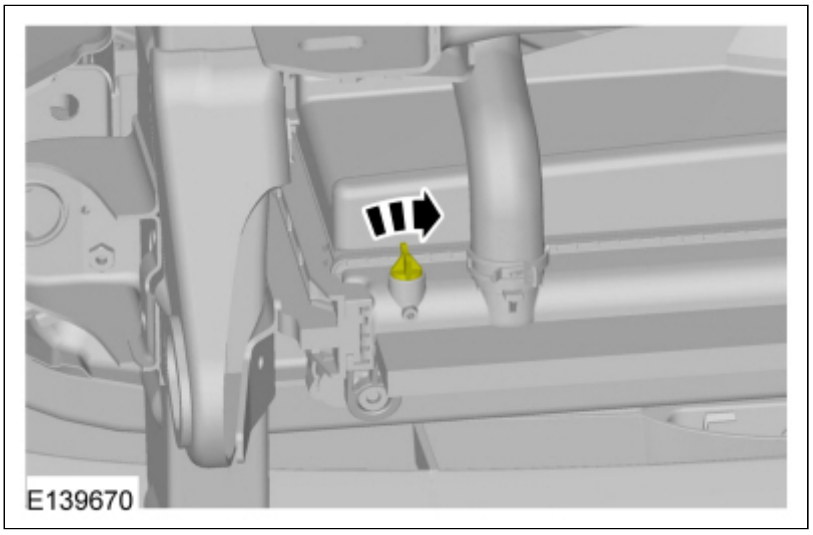


5. 

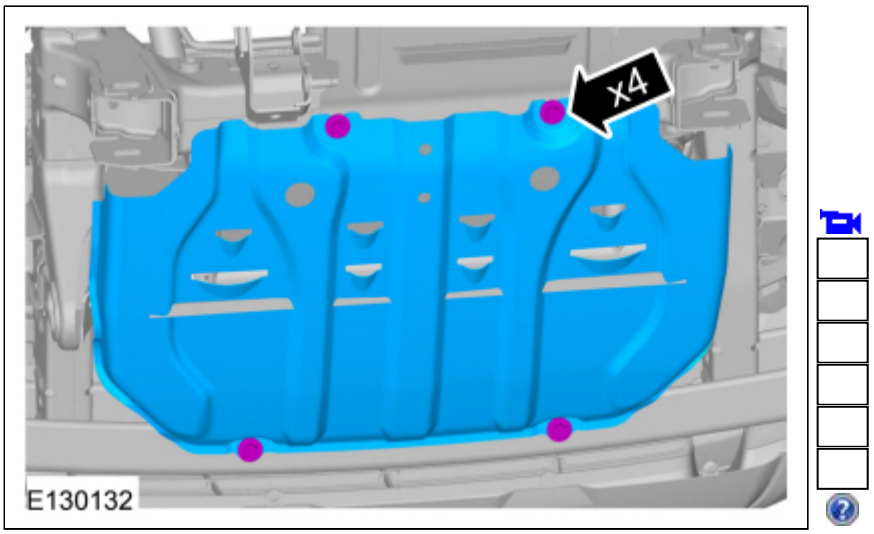
WARNING: Be prepared to collect escaping fluid.

Connect a hose to drain the coolant. Open the radiator drain valve and drain the engine coolant in a suitable, clean container.
Use the General Equipment: Fluid Container
Loosen: 4 turn(s)



6. 

7. *Torque*: 30 Nm



Evacuating and Filling

NOTICE: The cooling system is filled with Motorcraft® Orange Antifreeze/Coolant. Do not mix coolant types. Mixing coolant types degrades the corrosion protection of the coolant. Failure to follow these instructions may damage the engine or cooling system.

NOTICE: Engine coolant provides boil protection, corrosion protection, freeze protection, and cooling efficiency to the engine and cooling components. In order to obtain these protections, maintain the engine coolant at the correct concentration and fluid level in the degas bottle.

NOTE: *Add Motorcraft® Orange Antifreeze/Coolant or equivalent.*

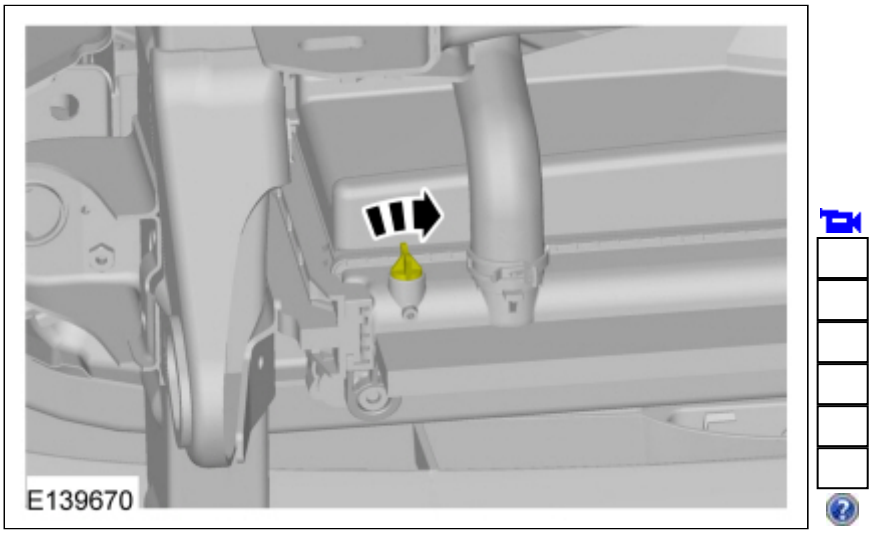
NOTE: *Do not add or mix with any other type of engine coolant. Mixing coolants may degrade the coolant's corrosion protection.*

NOTE: *Do not add alcohol, methanol, or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.*

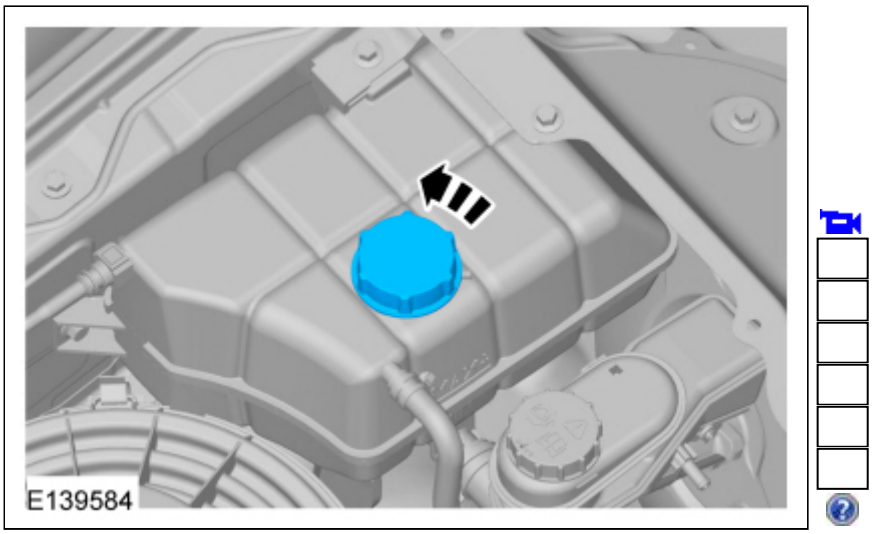
NOTE: *Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft® Orange Antifreeze/Coolant since a Ford-approved recycling process is not yet available.*

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
  Material: Antifreeze (WSS-M97B44-D2)
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.
  Material: Antifreeze (WSS-M97B44-D2)

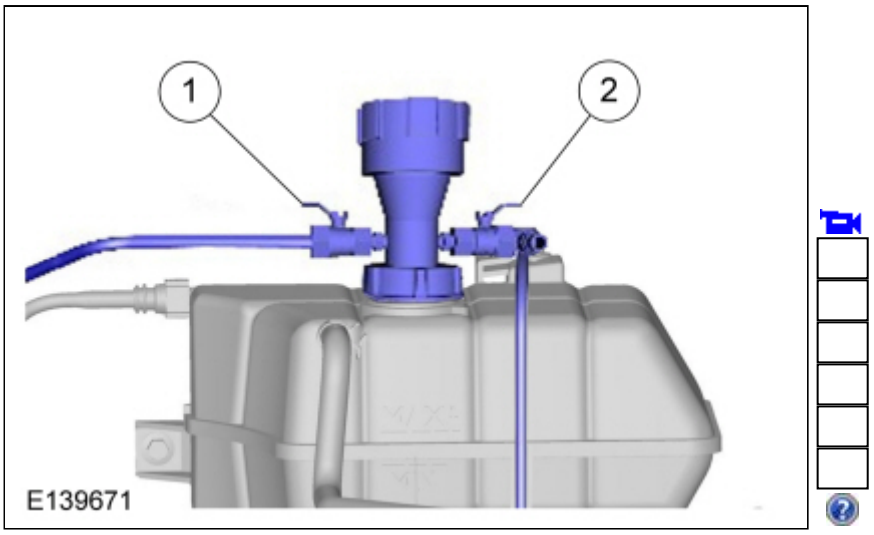
2. Close the radiator drain plug.



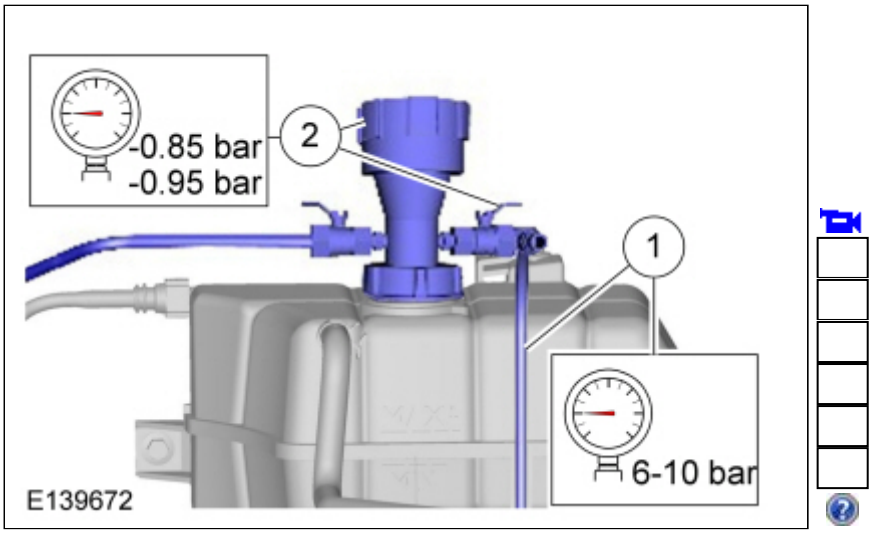
3. Remove the coolant expansion tank cap.



1. Close the valve, install the coolant hose and place it into the fluid container.
   Use the General Equipment: Cooling System Vacuum Tester and Refiller
2. Close the valve and connect the compressed air hose.



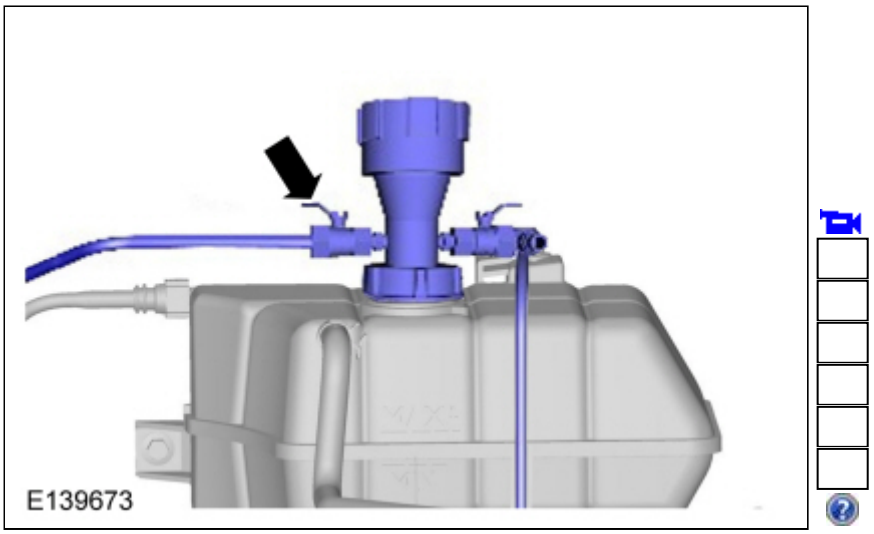
1. Use the General Equipment: Cooling System Vacuum Tester and Refiller
2. Open the valve until the specificied vacuum is achieved.



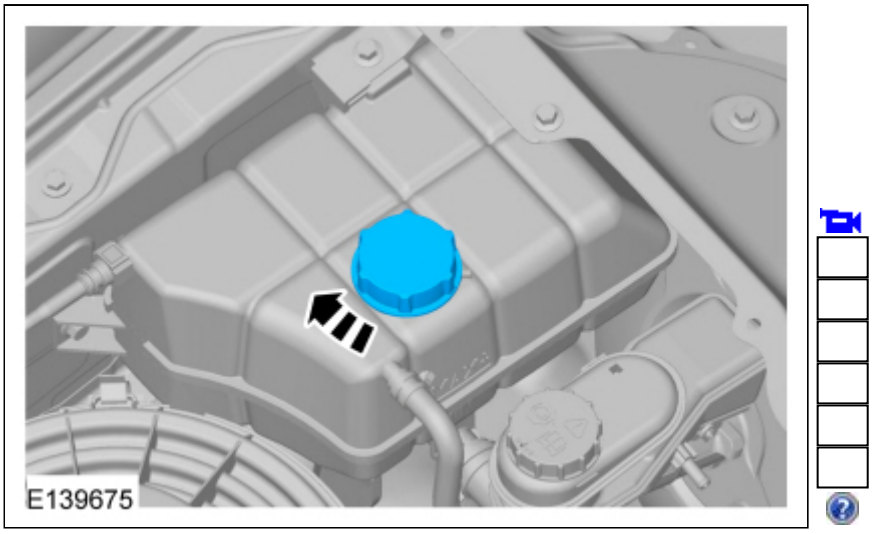
- Open the valve until the coolant reservoir fluid level is at the MAX mark.

Use the General Equipment: Cooling System Vacuum Tester and Refiller

- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.
  Material: Antifreeze (WSS-M97B44-D2)



7. Install the pressure relief cap until it contacts the hard stop.



Copyright © 2016 Ford Motor Company

Thermostat

Removal

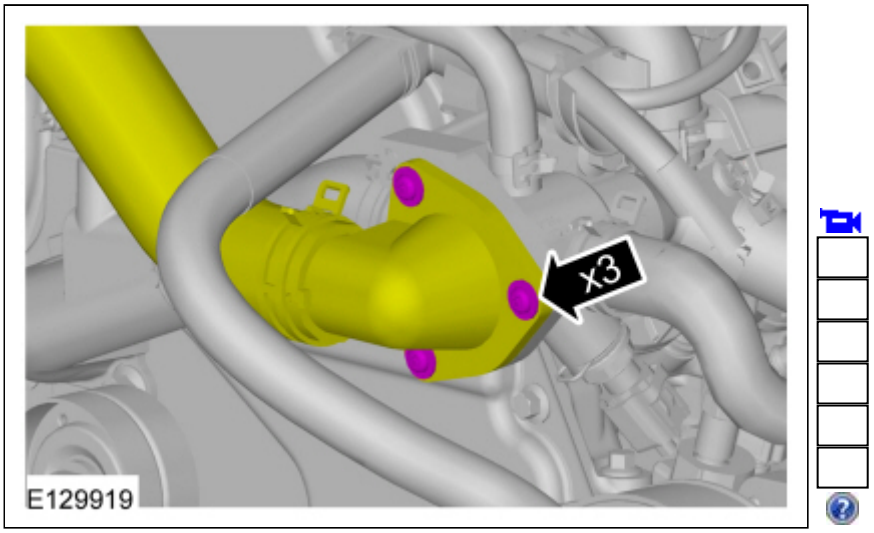
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

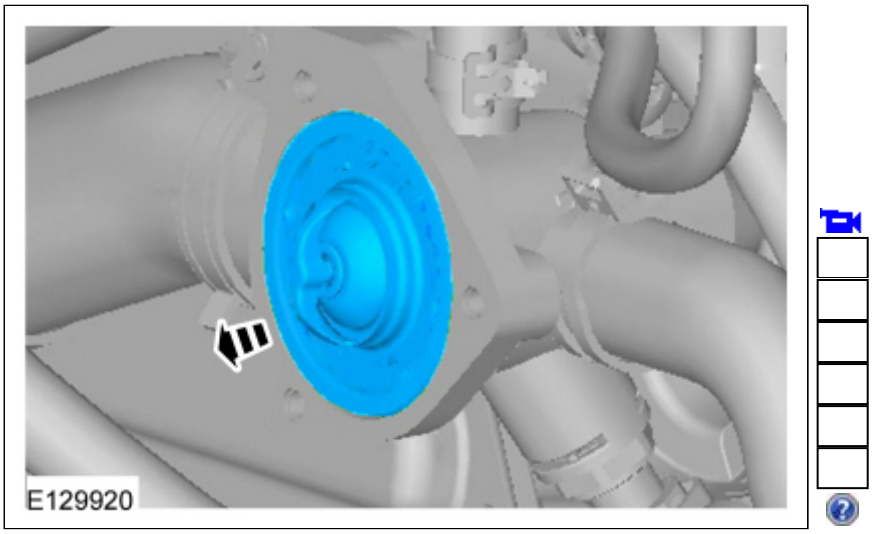
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

3. *Torque*: 10 Nm



4.



Installation

1. **NOTE:** *Inspect the thermostat housing cover O-ring seal. Install a new O-ring seal if necessary.*

   To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Thermostat Housing

Removal

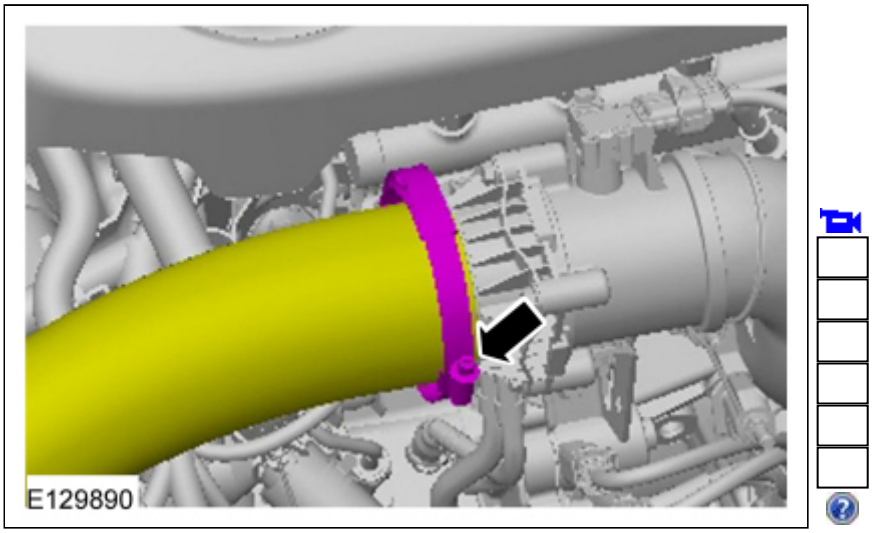
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

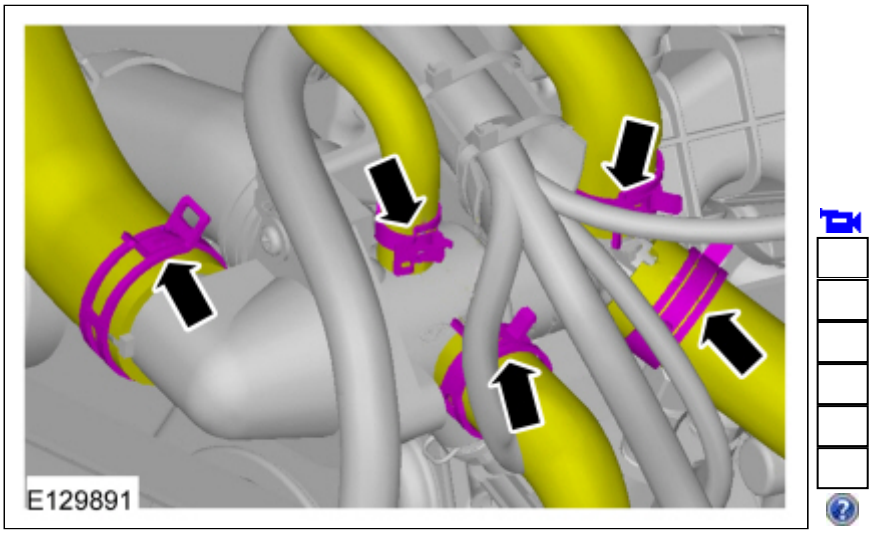
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

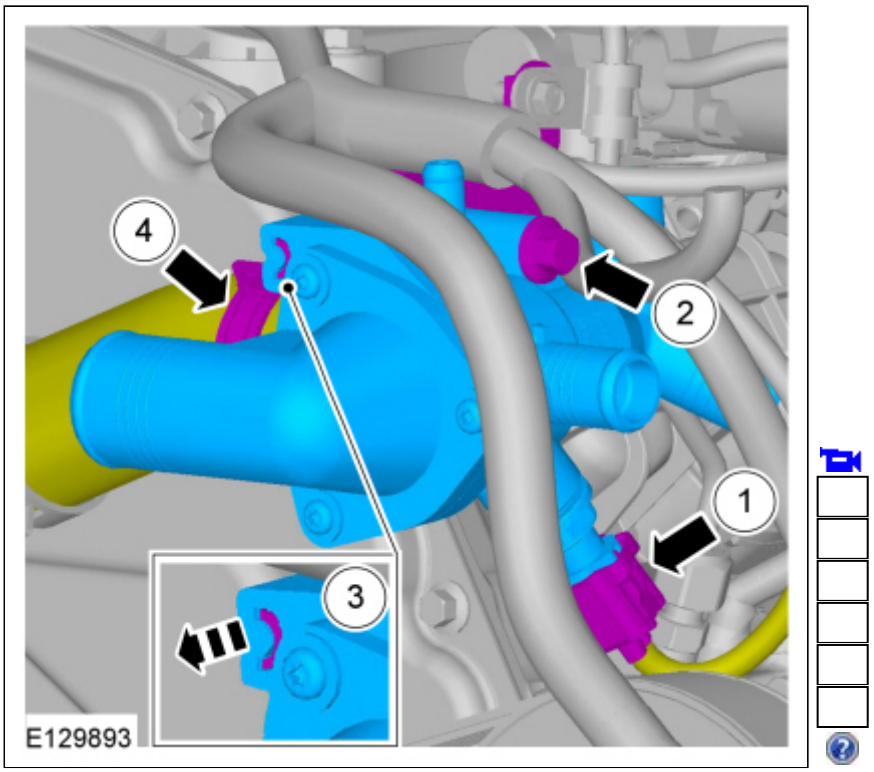
3. *Torque*: 5 Nm



4.



5. *Torque*: 23 Nm



Installation

1. To install, reverse the removal procedure.
2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Coolant Pump

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

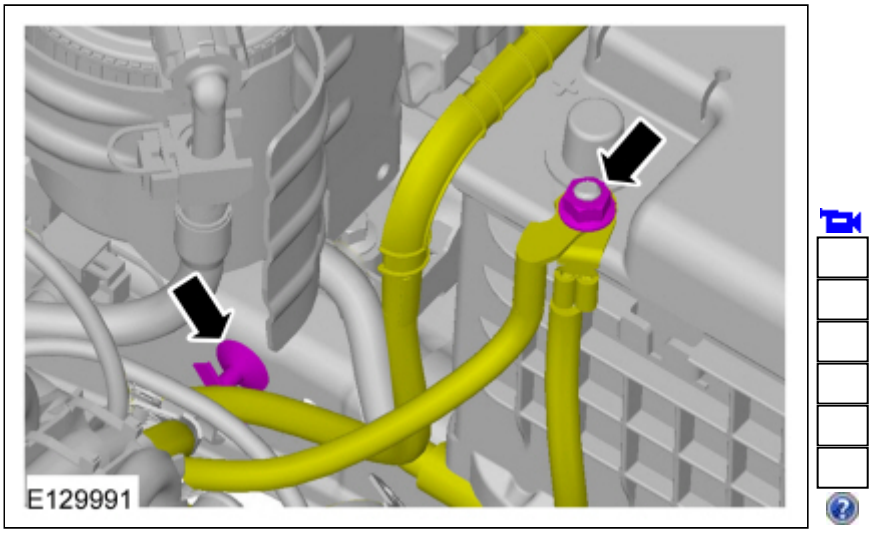
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

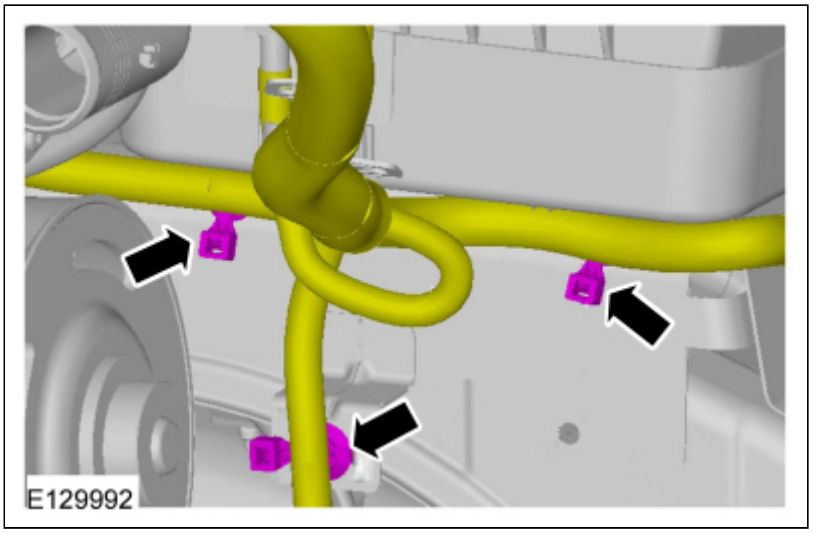
2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

3. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

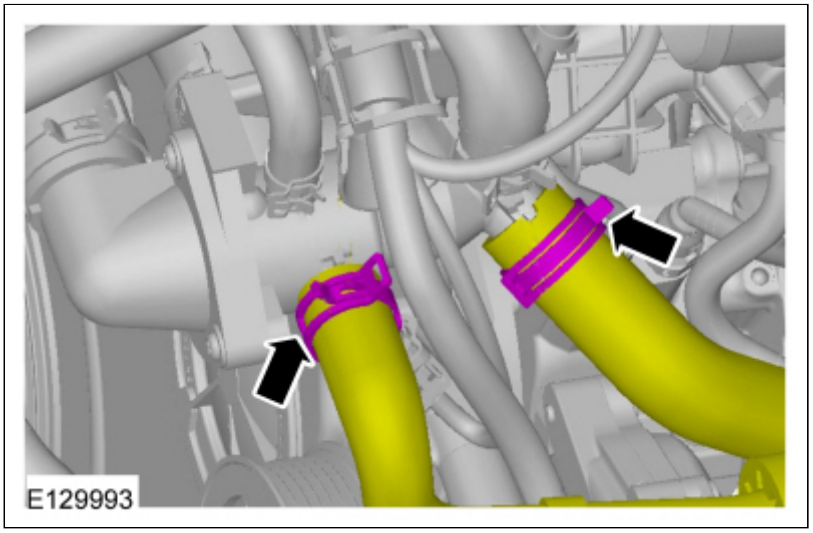
4. *Torque*: 14 Nm



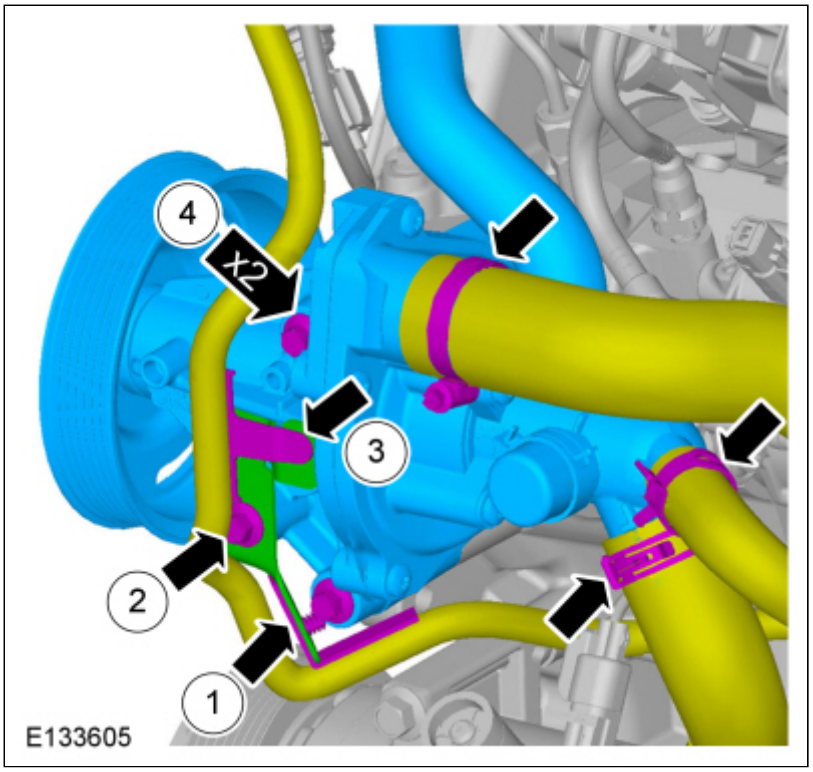
5.



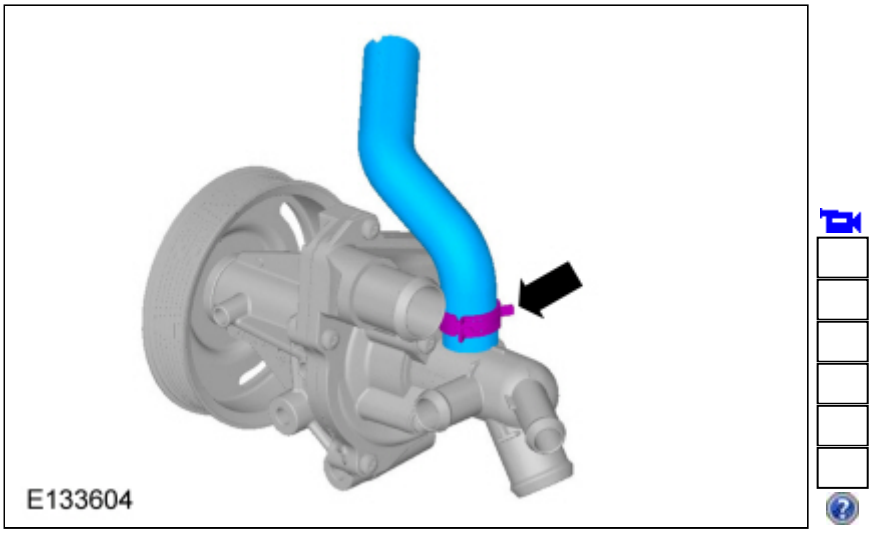
6.



2. *Torque*: 23 Nm
4. *Torque*: 23 Nm



8. **NOTE:** *Use care when cleaning the water pump gasket mating surfaces. Gouges in the aluminum could form leak paths.*



Installation

1. To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Cooling Fan

Base Part Number: 8600

Special Tool(s) / General Equipment

 E62783	303-1196 Holding Wrench, Pulley
 24002	303-378 Wrench, Fan Hub

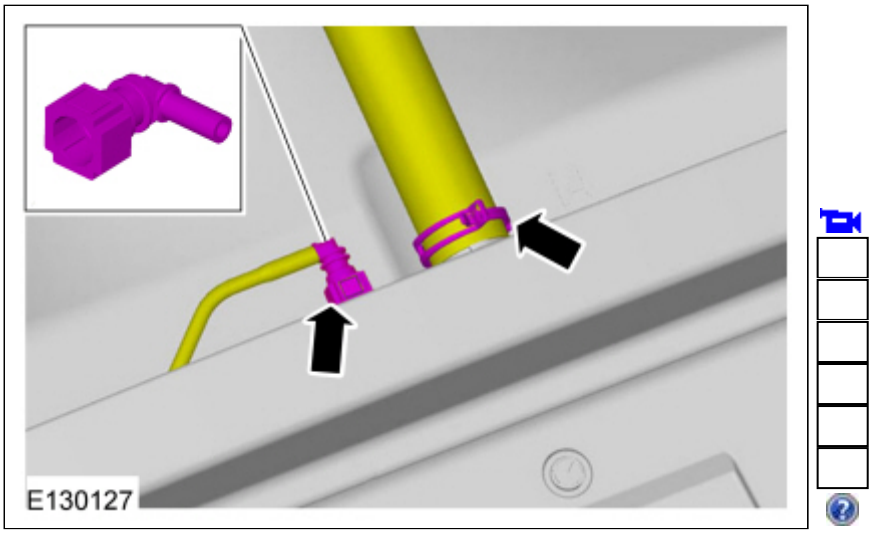
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

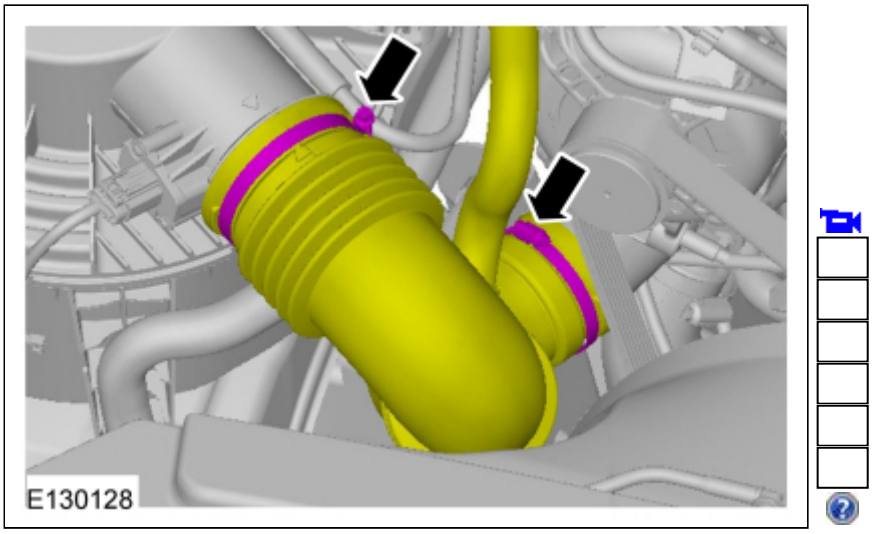
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

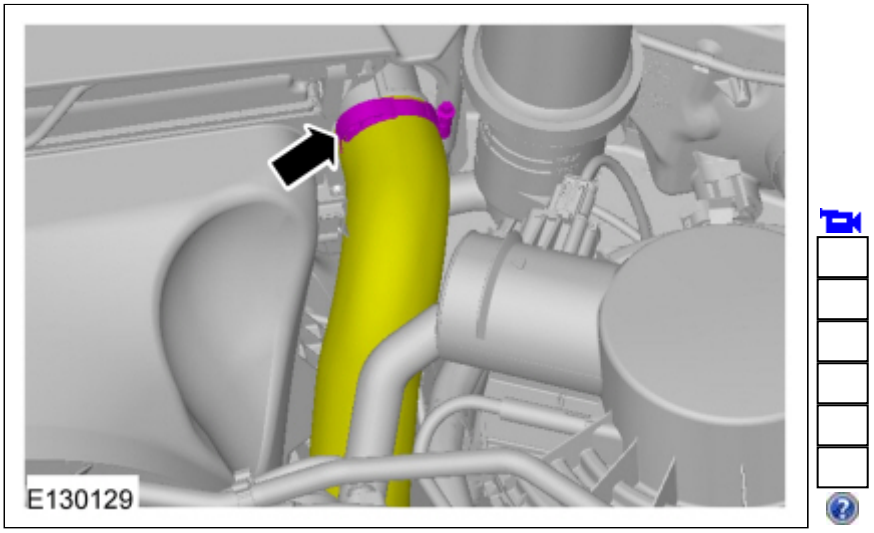
2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

3. 

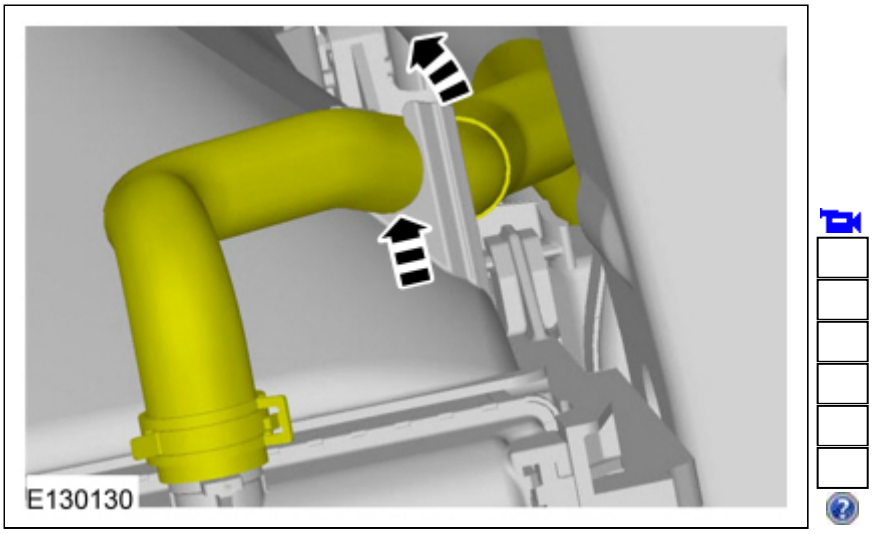
4. *Torque*: 4 Nm



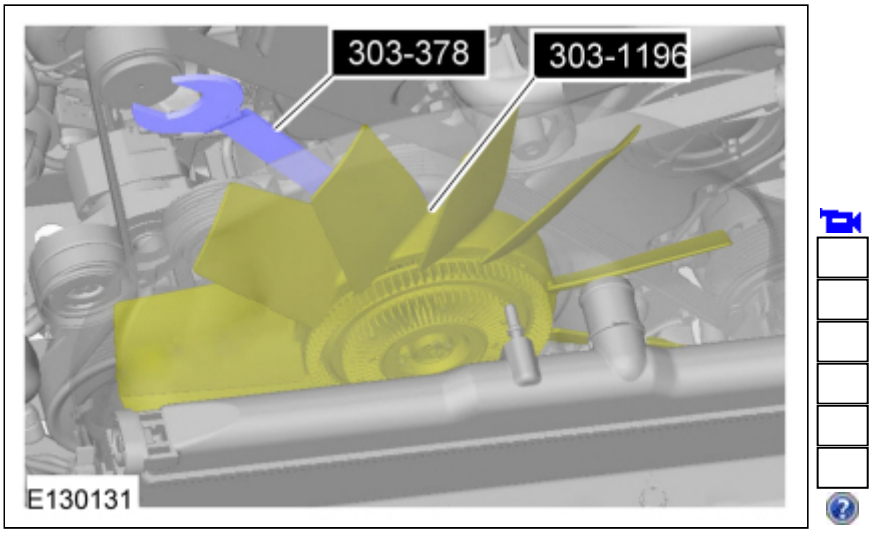
5. *Torque*: 4 Nm



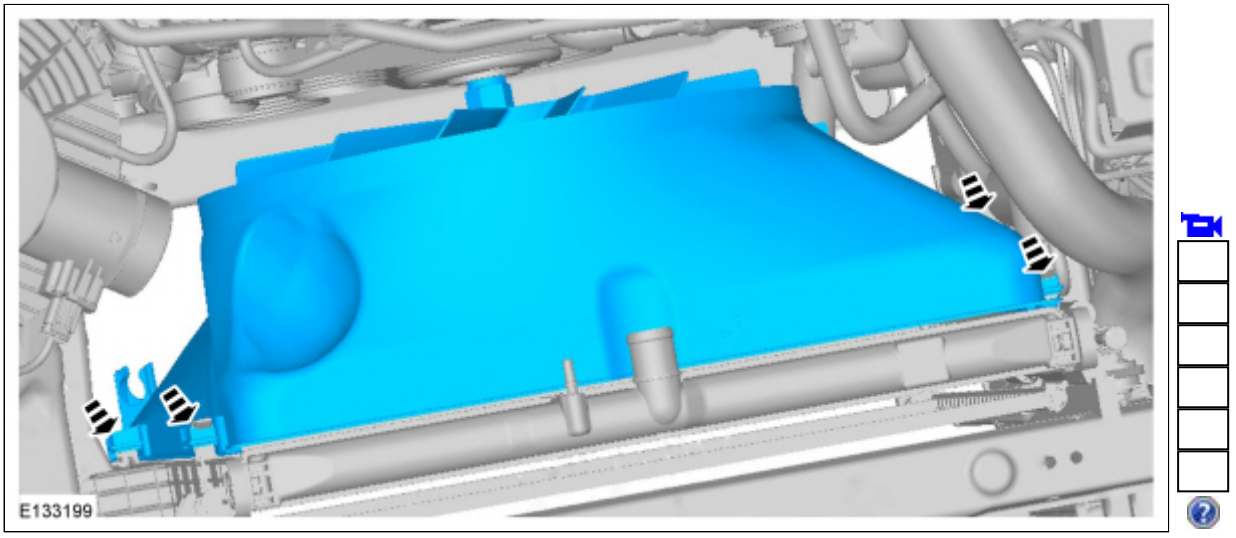
6.



7. Use Special Service Tool: 303-378 Wrench, Fan Hub. , 303-1196 Holding Wrench, Pulley.
   Torque: 105 Nm



8. Remove the fan and position it inside the shroud. Lift the fan and shroud together and remove from the vehicle.



Installation

1. To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Coolant Outlet Connector

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

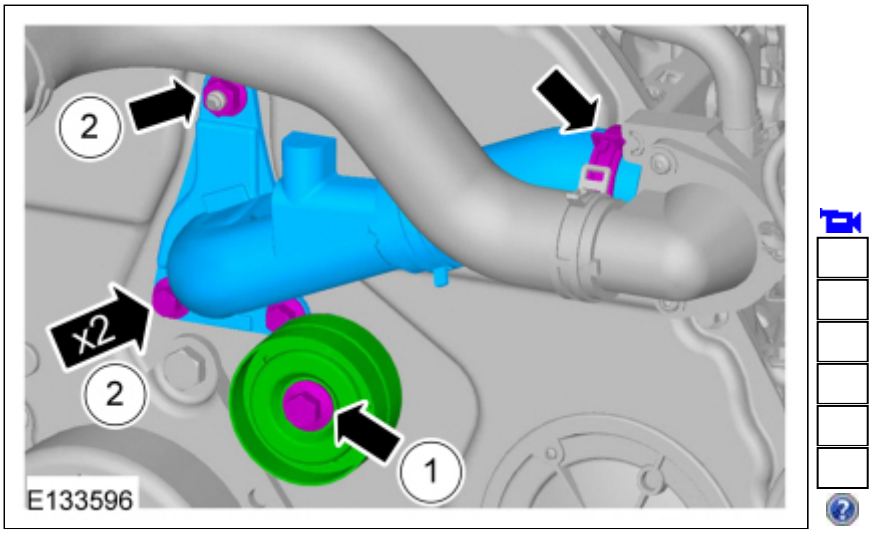
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

5. **NOTE:** *Make sure that these components are installed to the noted removal position.*

   NOTE: *The gasket is to be reused unless damaged.*

   1. *Torque*: 23 Nm
   2. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) -

Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Radiator

Base Part Number: 8005

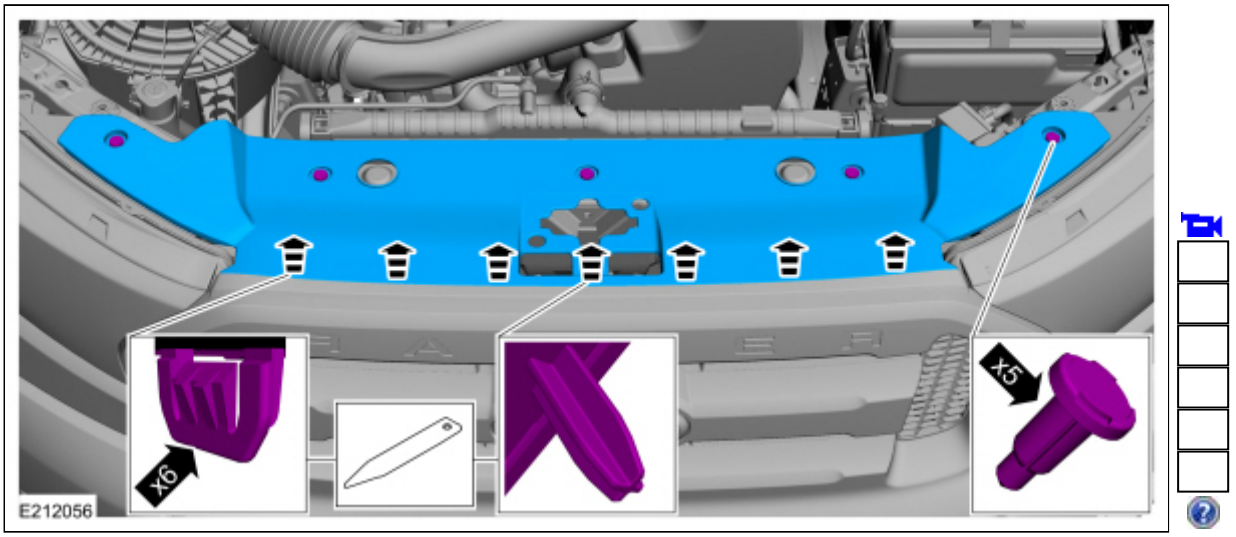
Removal

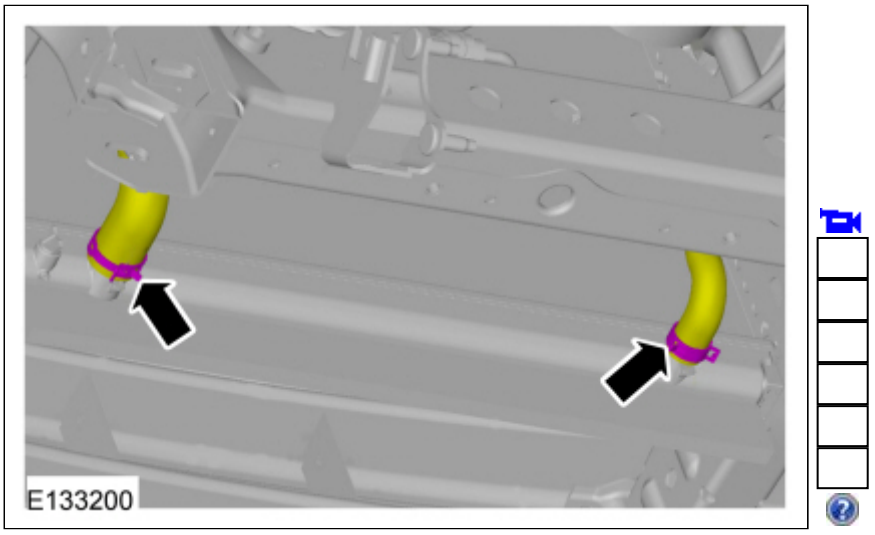
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

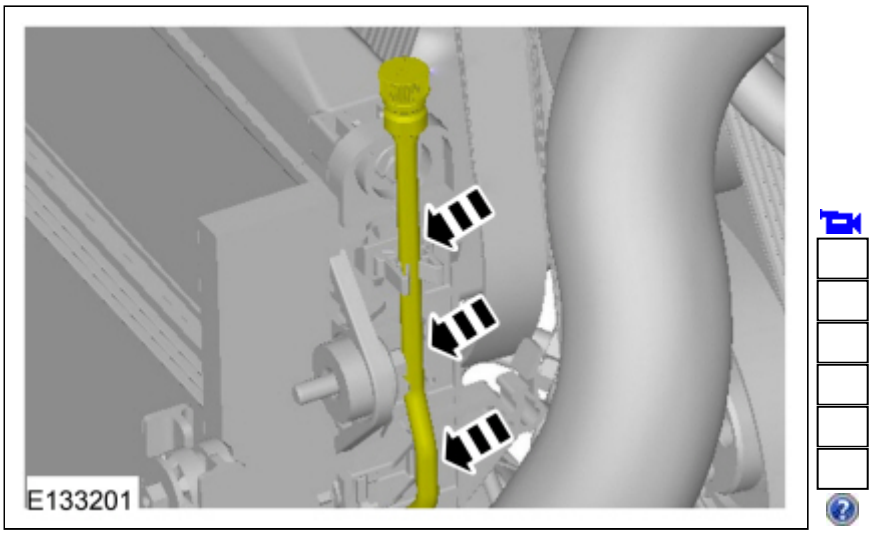
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

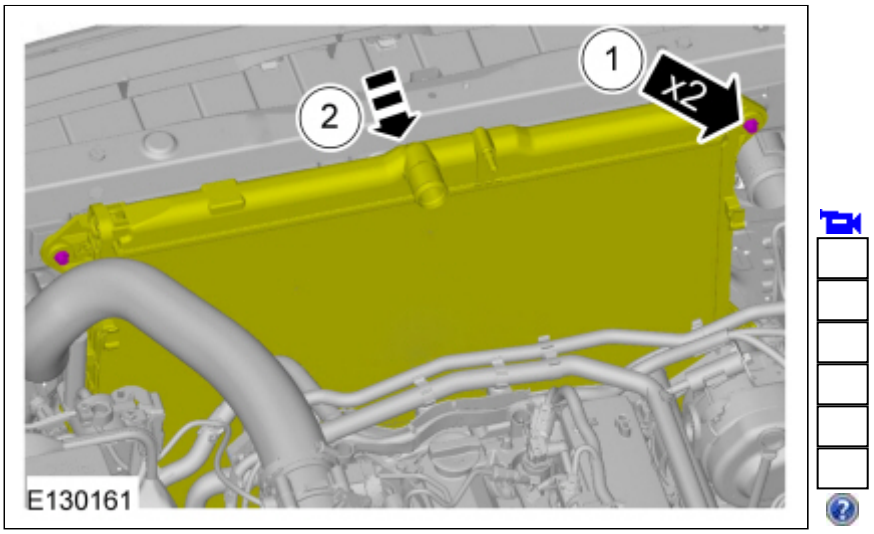
3. 

4. 

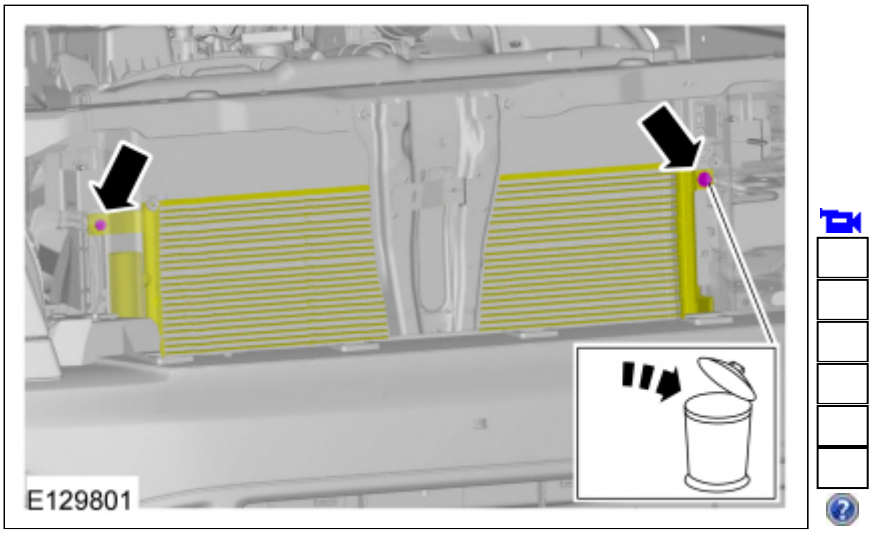
5. **NOTE:** *Take extra care not to damage the A/C refrigerant filling pipe.*



6. *Torque*: 20 Nm

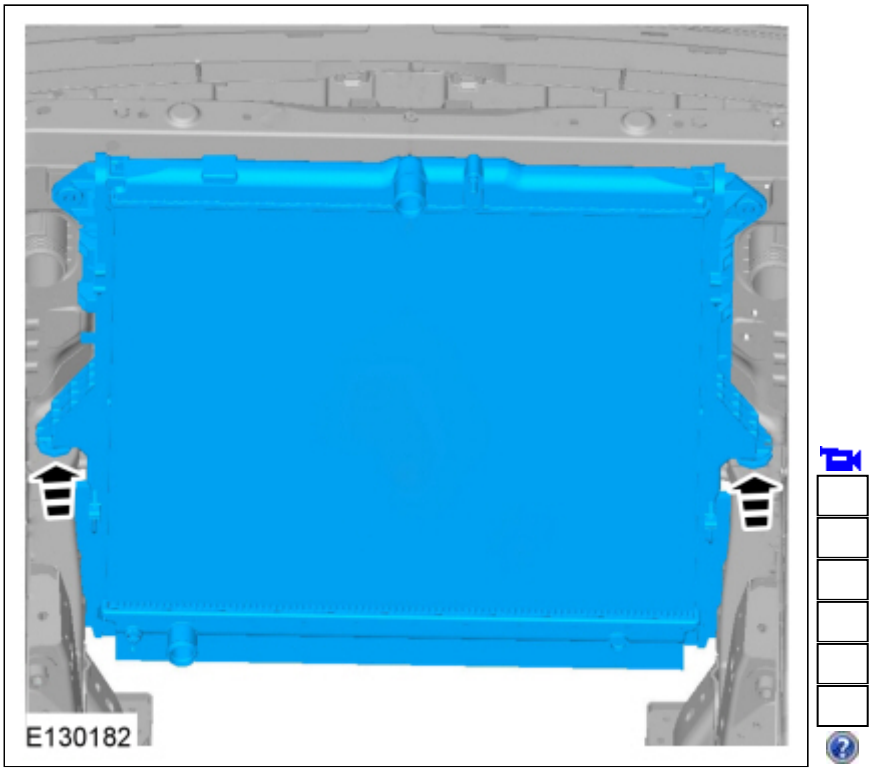


7. Lift the A/C condenser off the supports and move the A/C condenser toward the front of the vehicle and securely strap the A/C condenser on the grill support.
   Torque: 7 Nm



8. **NOTE:** *Radiator insulators are to be reused unless damaged.*

   NOTE: *Take extra care not to damage the radiator during removal.*



Installation

1. **NOTE:** *Make sure that no components catch when installing the radiator.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Antifreeze Specifications

Description	Specification
Motorcraft Super Plus 2000	WSS-M97B44-D2
Specific gravity (providing no other additive is in the coolant)	1.068 at +15°C
Approximate percentage of antifreeze (by volume)	50%
Coolant remains fluid to	-30°C (-22°F)
Coolant solidifies at	-35°C (-31°F)

Cooling System Capacities — Vehicles with 3.2L Diesel Engine

Description	Liters
Vehicles with front heater only	12.9

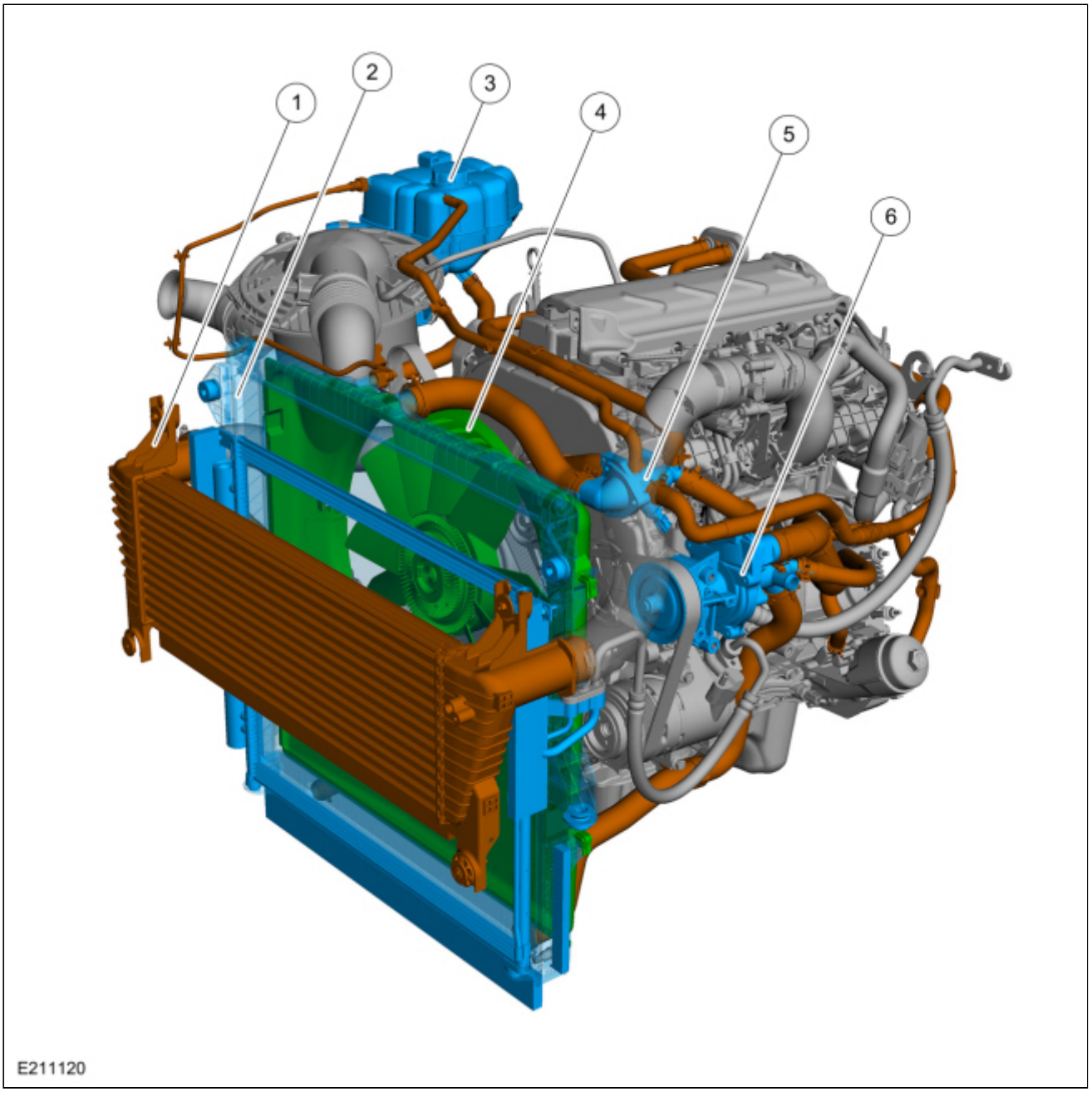
Cooling System Pressure Specification

Description	Pressure kPa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135-155 (19-22)

Copyright © 2016 Ford Motor Company

Engine Cooling - Component Location

3.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Intercooler
2	—	Radiator
3	—	Coolant expansion tank
4	—	Cooling fan motor and shroud
5	—	Thermostat housing
6	—	Coolant pump

Copyright © 2016 Ford Motor Company

Engine Cooling - Overview

2.2L Duratorq

- Engine driven coolant pump
- Engine driven cooling fan with viscous coupling
- Maximum operating pressure 155 kPa

Engine coolant requires periodic replacement. It is important that when replaced or if the level is rectified after leak repair that the coolant type and concentration is correct. Incorrect coolant specification can lead to engine damage through; corrosion, freezing, or boiling.

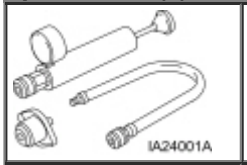
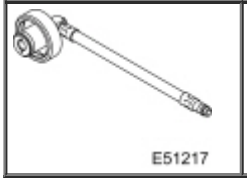
NOTE: *Please consult the warranty and service information guide for engine coolant specification and quantites.*

Copyright © 2016 Ford Motor Company

Engine Cooling

Refer to Wiring Diagrams Section 303-14B for schematic and connector information.

Special Tool(s)

 IA24001A	Pressure Tester, Cooling System 303-396 (24-001A)
 E51217	Adapter for 303-396 303-396-08

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Coolant hose(s) – Gaskets/seals – Coolant expansion tank cap and seal – Coolant expansion tank – Radiator – Coolant pump – Thermostat – Thermostat housing – Cooling fan and cooling fan clutch – Accessory drive belt – Power steering pump belt – Exhaust gas recirculation (EGR) cooler – Engine oil cooler	– Fuse(s) – Wiring harness – Electrical connector(s) – Engine coolant temperature (ECT) sensor – Engine cooling fan motor(s) – Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Loss of coolant	• Radiator.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary. REFER to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi

		(148kW/200PS) - Puma, Removal and Installation).
	• Coolant pump.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Thermostat housing.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing as necessary. REFER to: Thermostat Housing (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Coolant expansion tank cap.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	• Coolant expansion tank.	• CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	• EGR cooler.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new EGR cooler as necessary. REFER to: Exhaust Gas Recirculation (EGR) Cooler - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Engine oil cooler.	• CARRY OUT the Pressure Test Component Test in this section. INSTALL a new engine oil cooler as necessary.
	• Heater core.	• CHECK the heater core for leaks. REFER to: Heater Core (412-00 Climate Control System - General Information, Removal and Installation).
	• Engine.	• CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
• The engine overheats.	• Cooling system does not hold pressure.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section. • CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary. • CHECK the coolant pump for damage. INSTALL a new coolant pump as necessary. REFER to: Coolant Pump (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation). • CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
	• Air in system.	• BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
	• Coolant expansion tank cap.	• CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	• Coolant expansion tank.	• CHECK the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	• Coolant level/condition.	• CHECK the coolant level/condition. REFILL the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
	• Coolant concentration.	• REFER to: Specifications (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).
	• Radiator grille.	• CHECK the radiator grille for air restrictions/damage. REPAIR as necessary.
	• Coolant pump.	• CHECK the coolant pump for leaks. INSTALL a new coolant pump as necessary.

		as necessary. REFER to: Coolant Pump (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Thermostat.	• CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Accessory drive belt.	• CHECK the accessory drive belt for correct operation. REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Power steering pump belt.	• CHECK the power steering pump belt for correct operation. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Cooling fan and cooling fan clutch.	• CHECK operation of the cooling fan and cooling fan clutch. INSTALL a new cooling fan and cooling fan clutch as necessary. REFER to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Engine.	• CHECK the engine, cylinder head, coolant manifold, cylinder block and cylinder head gasket.
• The engine does not reach normal operating temperature.	• Thermostat.	• CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• ECT sensor.	• CHECK the ECT sensor for correct operation. REFER to the Ford diagnostic equipment.
	• Circuit(s).	• CHECK the circuit(s). REFER to the Ford diagnostic equipment.

Component Tests

Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank cap.
2. Install the special tools to the coolant expansion tank.
3. Pressurize the system to the coolant expansion tank cap release pressure.
   REFER to: Specifications (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).
4. Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the system holds pressure, proceed to step 7. If the system does not hold pressure, check it thoroughly for coolant leaks.
5. If a coolant leak cannot be found, check the EGR cooler (this may leak internally), engine oil cooler (this may produce oil in the coolant expansion tank) and the engine for cylinder leakage. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
6. Recheck the system by repeating steps 3 and 4 at least twice.

Radiator Leak Test, Removed From Vehicle

NOTICE: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.

Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.

1. Remove the coolant expansion tank cap.

2. Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: *If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.*

3. Slowly depress the plunger of the pressure test pump until the pressure test gauge reading stops increasing, and note the highest pressure reading obtained.

4. Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure that the pressure test gauge reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

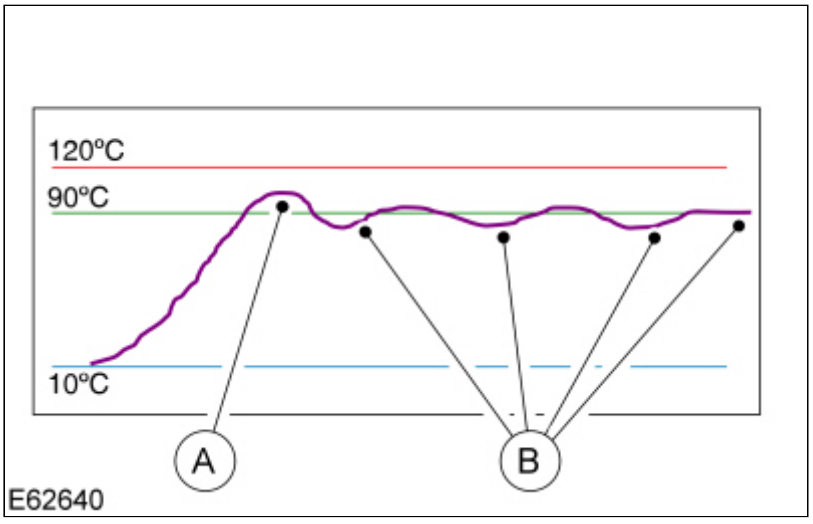
1. Connect the Ford Diagnostic Equipment to the data link connector (DLC).

2. Using the datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	—	Thermostat opens

B	—	Thermostat settles into a cyclic open and closure pattern

NOTICE: If the ECT sensor output reaches the 120ºC default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100ºC which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.

If the Ford diagnostic equipment only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	ºCelsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford diagnostic equipment in data logger mode, the signals recorded should remain within the DEFAULT values set by the Ford diagnostic equipment.

3. **WARNING: Make sure that the Ford diagnostic equipment is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford diagnostic equipment in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.**

   NOTE: *The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford diagnostic equipment can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.*

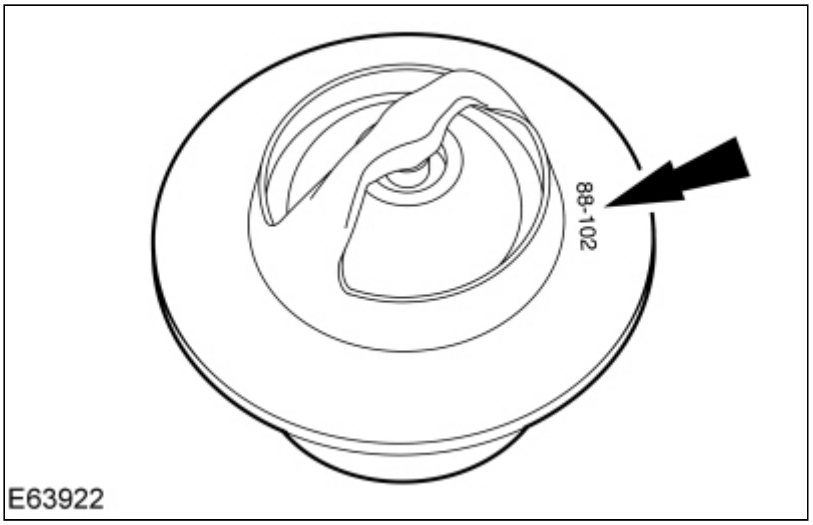
   NOTE: *The results from the test are more conclusive if the engine is cold when the test is started.*

   Carry out a road test.

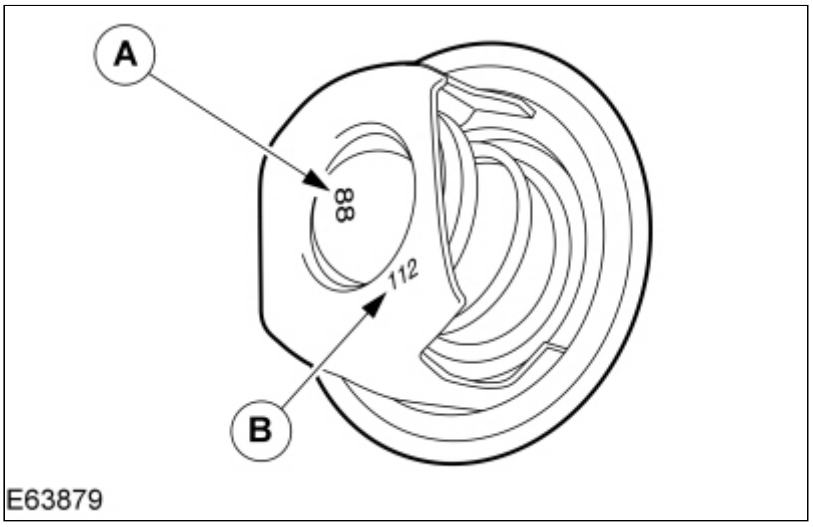
4. Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: *Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.*

The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	—	Opening temperature
B	—	Fully open temperature

NOTE: *Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.*

The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. INSTALL a new thermostat.
   REFER to: Thermostat (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

6. Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. Using the Ford diagnostic equipment, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

Fan Clutch Test

1. Turn the engine OFF and wait until the fan comes to a complete stop.
2. Spin the fan blade by hand. A light resistance should be felt. If there is no resistance or very high resistance, the minimum and maximum fan speeds must be checked. Carry out the following:

Fan Clutch Test — Minimum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.
2. Make sure the A/C is OFF, if equipped.
3. Start the engine and run it at approximately 2,000 rpm for 5 minutes or until there is a noticeable reduction in fan noise to allow the fan clutch to go into disengaged mode.
4. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 rpm at the coolant pump or fan pulley.
5. With the coolant pump or fan pulley at 3,000 rpm, aim the laser photo tachometer at the fan blade. Monitor and record fan speed.
6. The fan blade speed must be less than the specified rpm at 3,000 rpm coolant pump or fan pulley rpm.
7. Turn the engine off.
8. If the fan blade speed was greater than specified, install a new fan clutch.
   REFER to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Fan Clutch Test — Maximum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.
2. Block off areas on each side of the radiator in the engine compartment, the front of the radiator grille and the bumper. Close the hood. This will raise the temperature of the air striking the fan clutch and should cause the fan blade to operate at maximum speed.
3. Place the climate control function selector switch in the MAX A/C position and the blower motor switch in the HI position, if equipped.
4. **NOTE:** *Do not open the hood to check the coolant pump or fan pulley temperature. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the infrared thermometer through the wheel well or from under the vehicle.*

   Start the engine and run it at approximately 2,000 rpm until normal operating temperature has been achieved. Using an infrared thermometer, monitor the coolant pump or fan pulley. Run the engine until the coolant pump or fan pulley is at least 96°C (205°F).
5. **NOTE:** *Do not open the hood to check the coolant pump or fan pulley or fan blade speed. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the laser photo tachometer through the wheel well or from under the vehicle.*

   Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 rpm at the coolant pump or fan pulley.
6. With the coolant pump or fan pulley at 3,000 rpm, aim the laser photo tachometer at the fan blade. Monitor and record fan blade speed.
7. The fan blade speed must be greater than the specified rpm at 3,000 rpm coolant pump or fan pulley rpm.
8. Open the hood and allow the engine to idle momentarily to lower engine temperature. Turn the engine off and remove the blocks from the radiator, grille and bumper.
9. If the fan blade speed is less than specified, install a new fan clutch.
   REFER to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Cooling System Draining, Filling and Bleeding

Special Tool(s) / General Equipment

Cooling System Vacuum Tester and Refiller

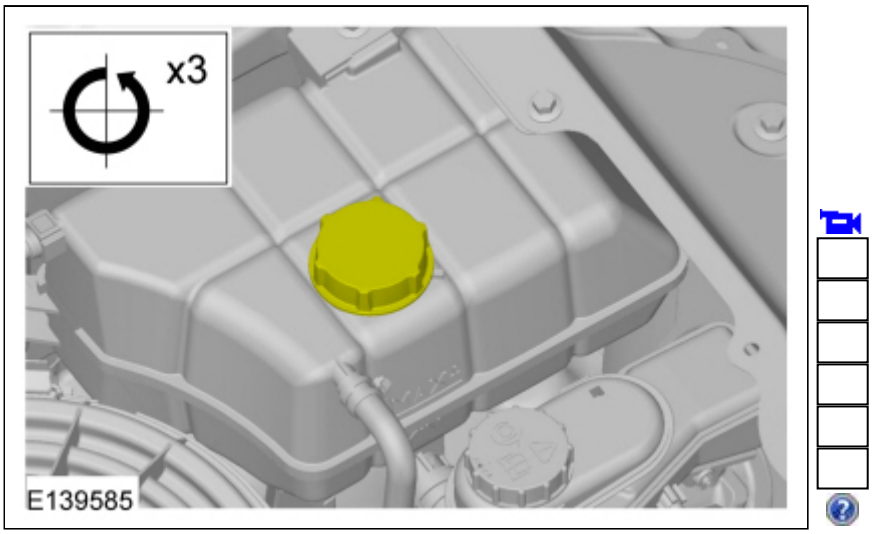
Materials

Name	Specification
Antifreeze	WSS-M97B44-D2

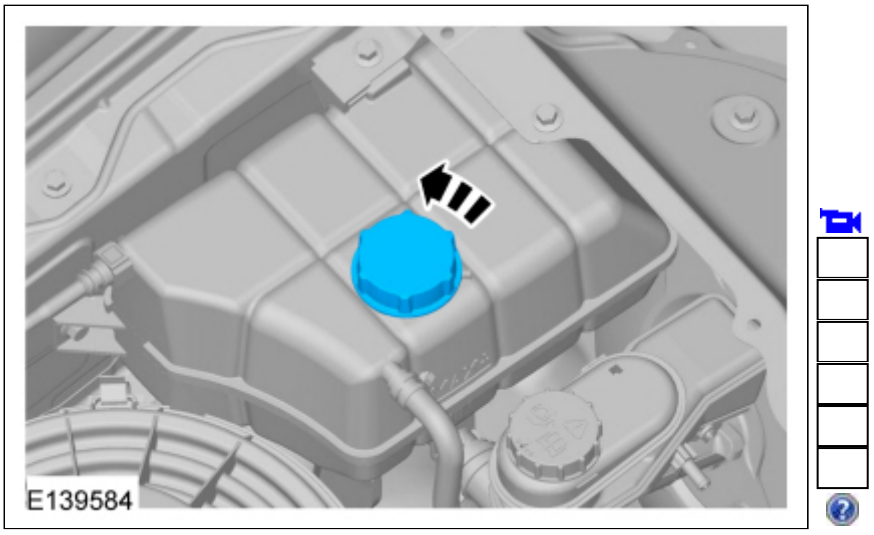
Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

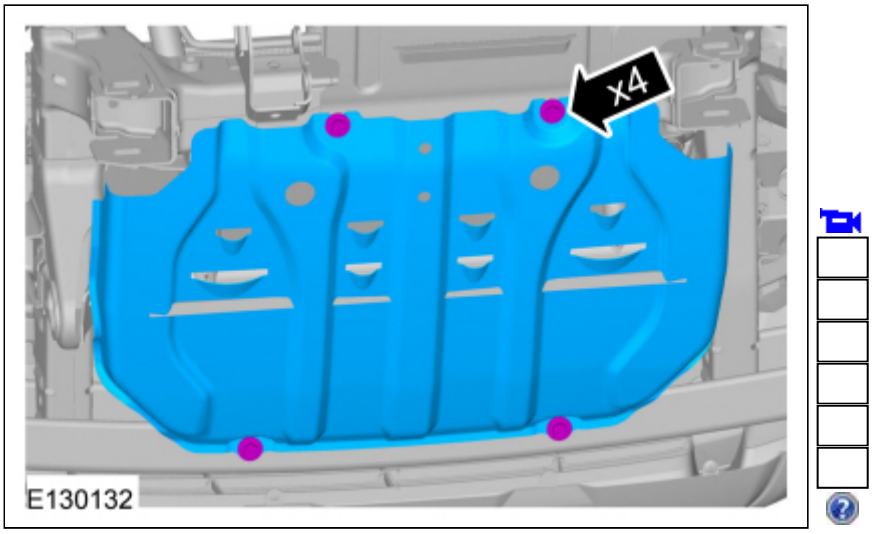


2.

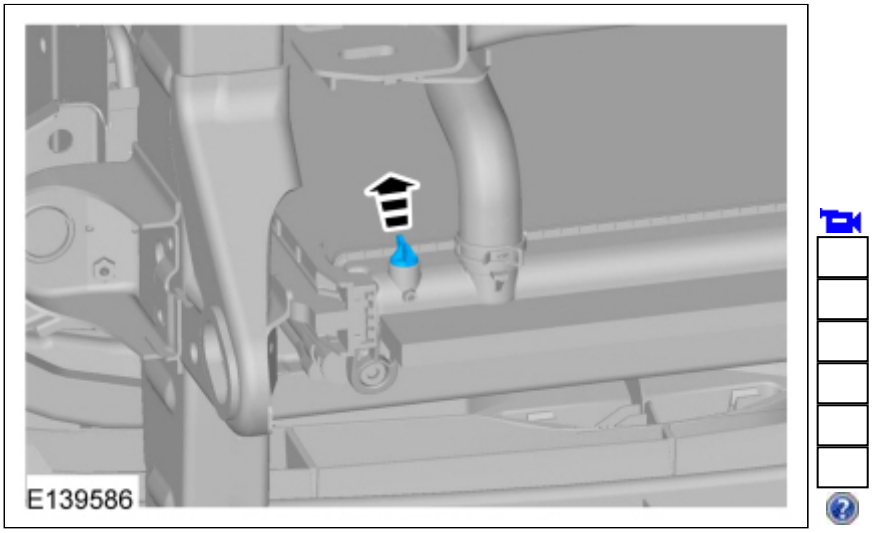


3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4.



5. Remove the radiator drain plug and drain the coolant.



6. Install the radiator drain plug.
7. Lower the vehicle.

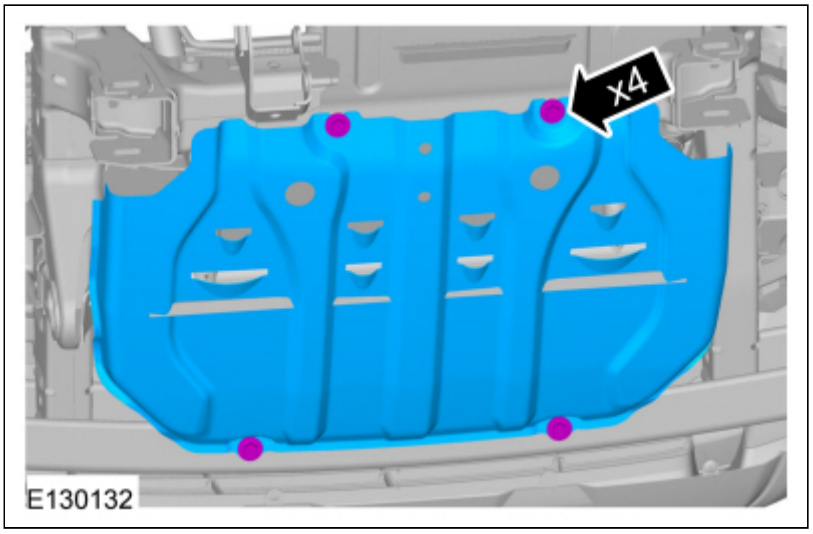
Filling

1. Refill the coolant to the expansion tank to maximum line (+15mm).
   Use the General Equipment: Cooling System Vacuum Tester and Refiller
   Material: Antifreeze (WSS-M97B44-D2)

Bleeding

NOTICE: The fluid level must remain between the MAX and MIN marks.

1. Run the engine for 5 minutes at idle rpm.
2. Install the coolant expansion tank cap.
3. Run the engine speed to 2500 RPM and maintain it for approximately 15 minutes.
4. Run the engine for 5minutes at idle rpm.
5. Switch the engine off.
6. Check the cooling system for leaks.
7. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
8. *Torque*: 30 Nm



9. Lower the vehicle.
10. Allow the engine to cool and maintain close to room temperature.
11. Fill the coolant to the expansion tank max fill line, if required.
    Use the General Equipment: Cooling System Vacuum Tester and Refiller
    Material: Antifreeze (WSS-M97B44-D2)

Copyright © 2016 Ford Motor Company

Cooling System Draining and Vacuum Filling

Special Tool(s) / General Equipment

Fluid Container
Cooling System Vacuum Tester and Refiller

Materials

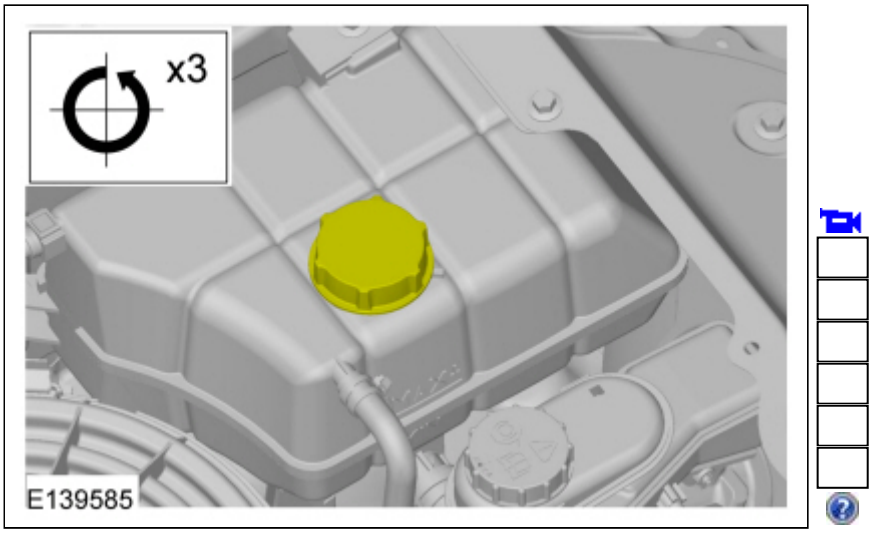
Name	Specification
Antifreeze	WSS-M97B44-D2

Draining

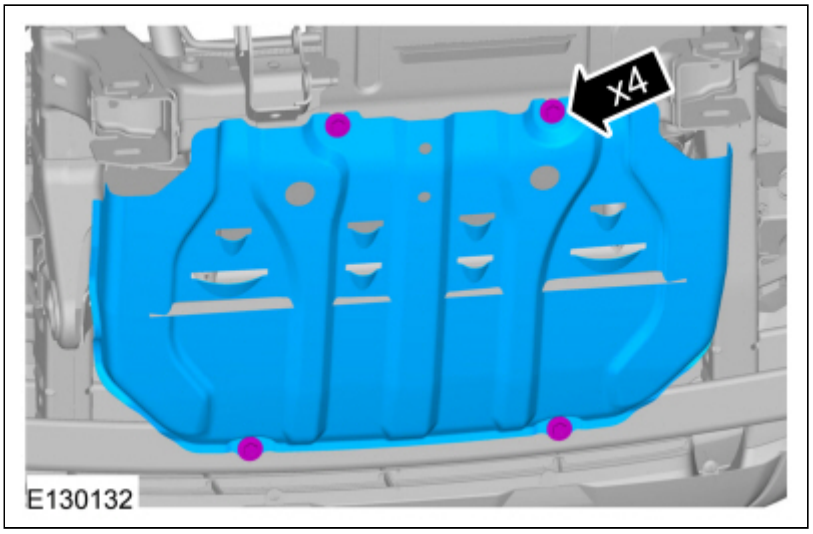
WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

NOTE: *Always follow the manufacturer's instructions when handling the equipment.*

1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 
   Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.



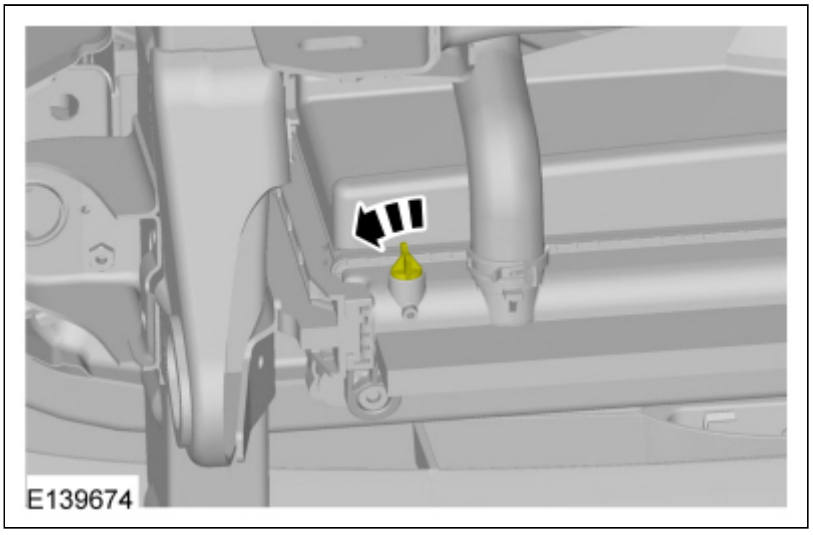
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.

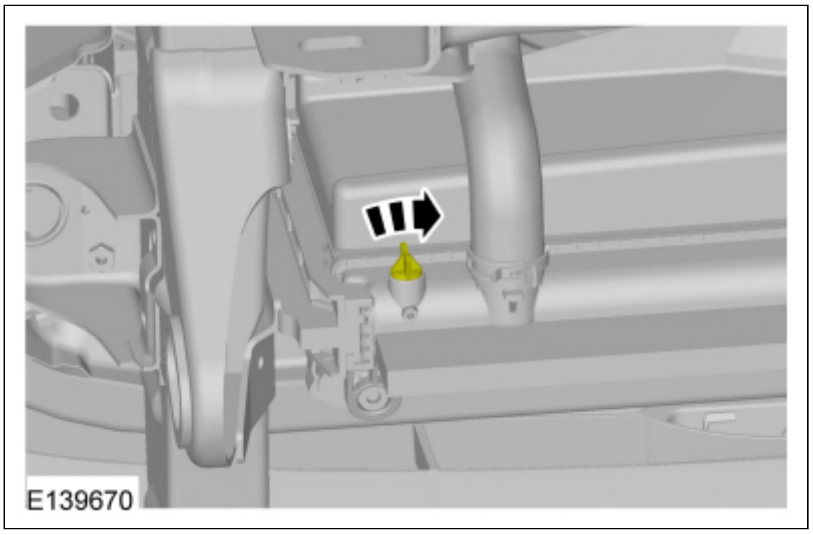


5. 

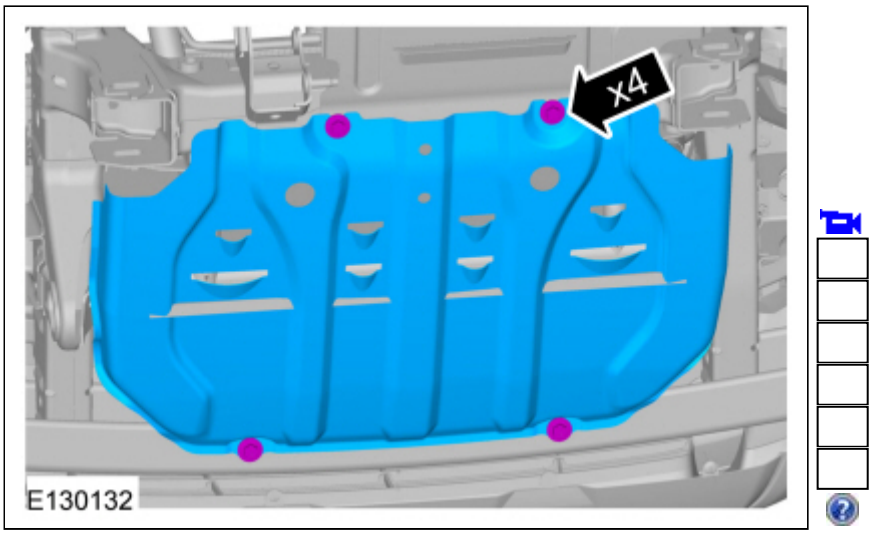
WARNING: Be prepared to collect escaping fluid.

Connect a hose to drain the coolant. Open the radiator drain valve and drain the engine coolant in a suitable, clean container.
Use the General Equipment: Fluid Container
Loosen: 4 turn(s)



6. 

7. *Torque*: 30 Nm



Evacuating and Filling

NOTICE: The cooling system is filled with Motorcraft® Orange Antifreeze/Coolant. Do not mix coolant types. Mixing coolant types degrades the corrosion protection of the coolant. Failure to follow these instructions may damage the engine or cooling system.

NOTICE: Engine coolant provides boil protection, corrosion protection, freeze protection, and cooling efficiency to the engine and cooling components. In order to obtain these protections, maintain the engine coolant at the correct concentration and fluid level in the degas bottle.

NOTE: *Add Motorcraft® Orange Antifreeze/Coolant or equivalent.*

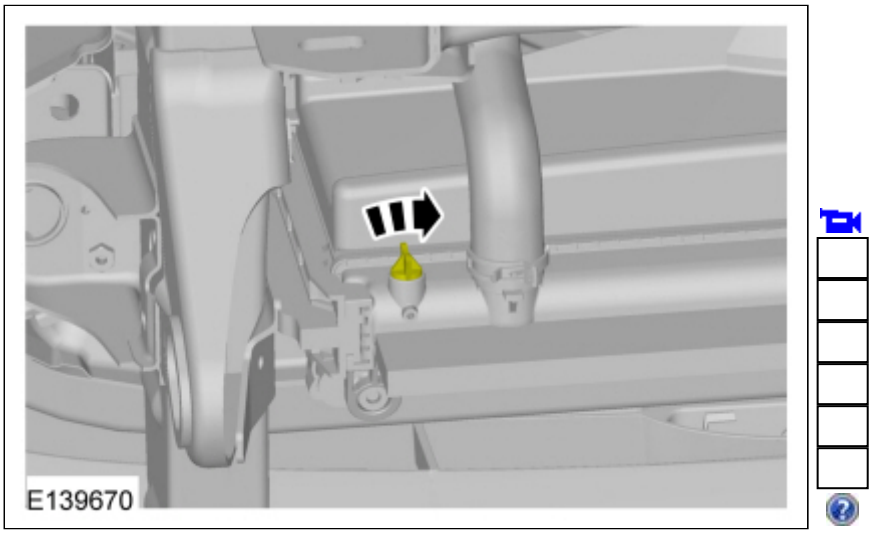
NOTE: *Do not add or mix with any other type of engine coolant. Mixing coolants may degrade the coolant's corrosion protection.*

NOTE: *Do not add alcohol, methanol, or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.*

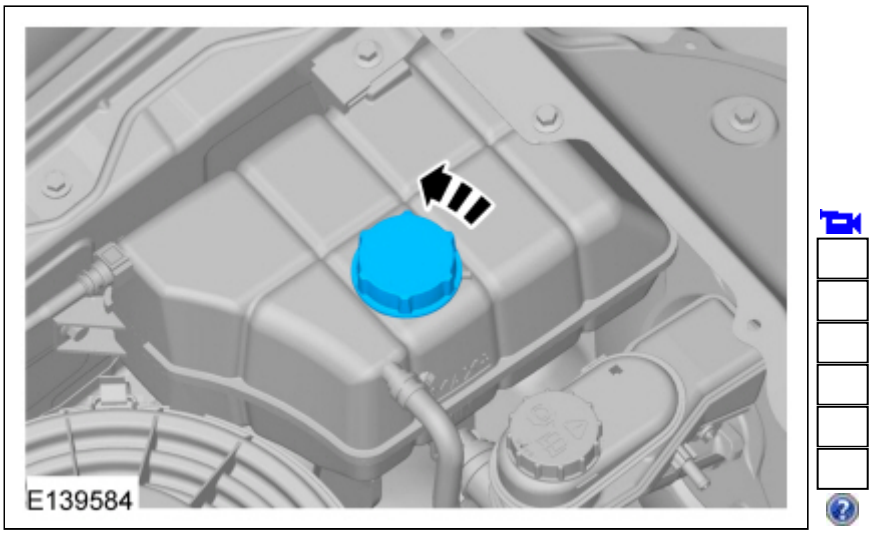
NOTE: *Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft® Orange Antifreeze/Coolant since a Ford-approved recycling process is not yet available.*

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
  Material: Antifreeze (WSS-M97B44-D2)
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.
  Material: Antifreeze (WSS-M97B44-D2)

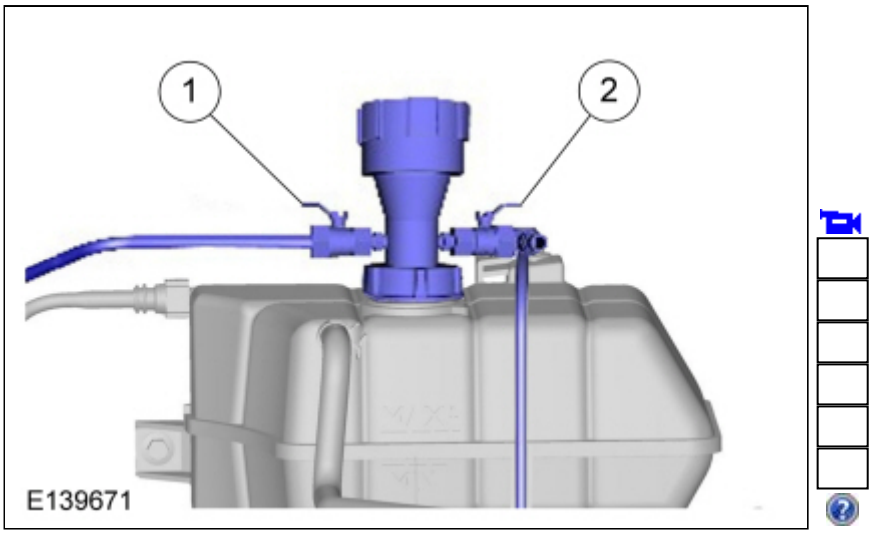
2. Close the radiator drain plug.



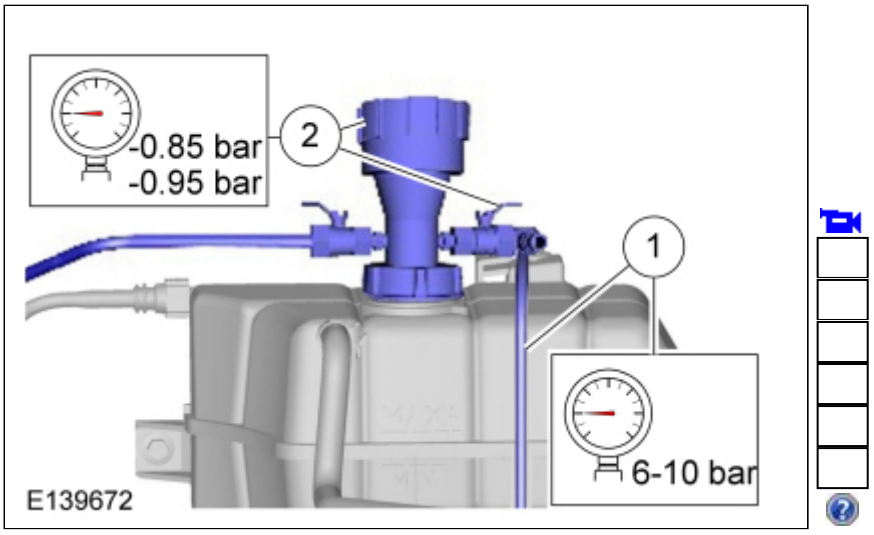
3. Remove the coolant expansion tank cap.



1. Close the valve, install the coolant hose and place it into the fluid container.
   Use the General Equipment: Cooling System Vacuum Tester and Refiller
2. Close the valve and connect the compressed air hose.



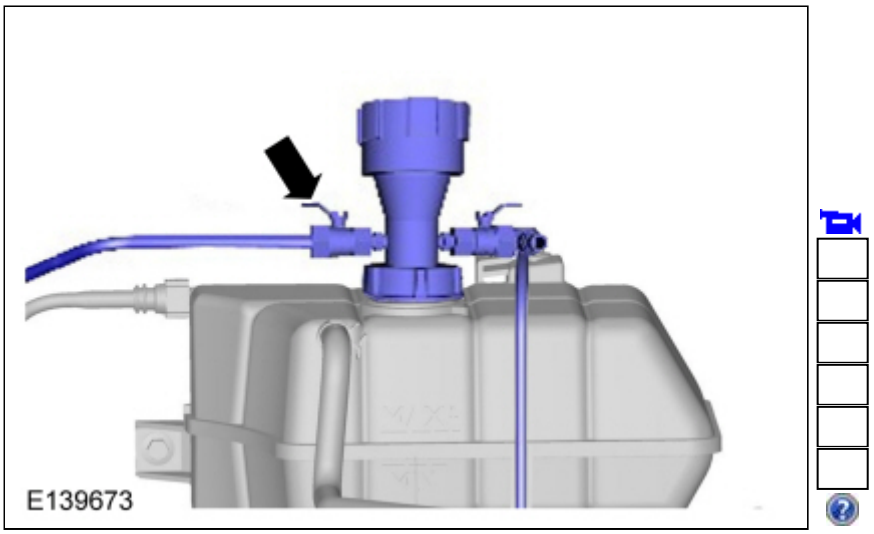
1. Use the General Equipment: Cooling System Vacuum Tester and Refiller
2. Open the valve until the specificied vacuum is achieved.



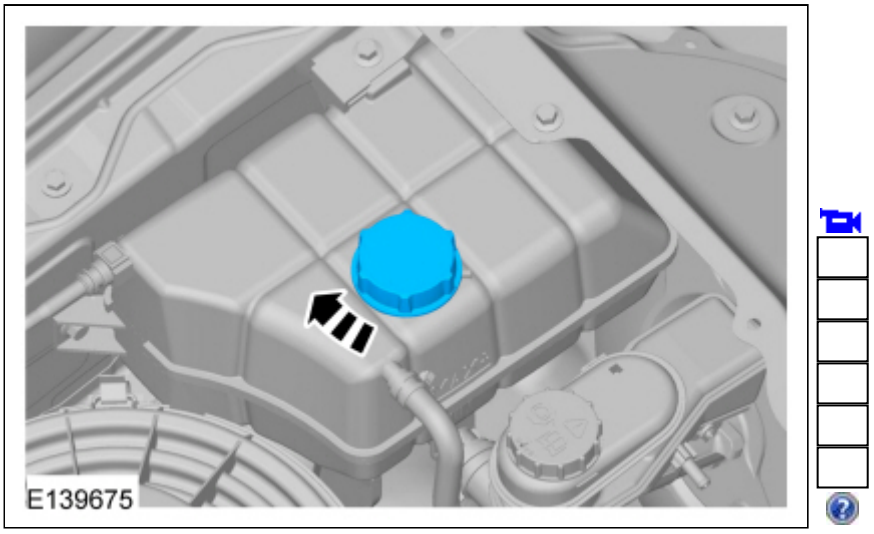
- Open the valve until the coolant reservoir fluid level is at the MAX mark.

Use the General Equipment: Cooling System Vacuum Tester and Refiller

- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.
  Material: Antifreeze (WSS-M97B44-D2)



7. Install the pressure relief cap until it contacts the hard stop.



Copyright © 2016 Ford Motor Company

Thermostat

Removal

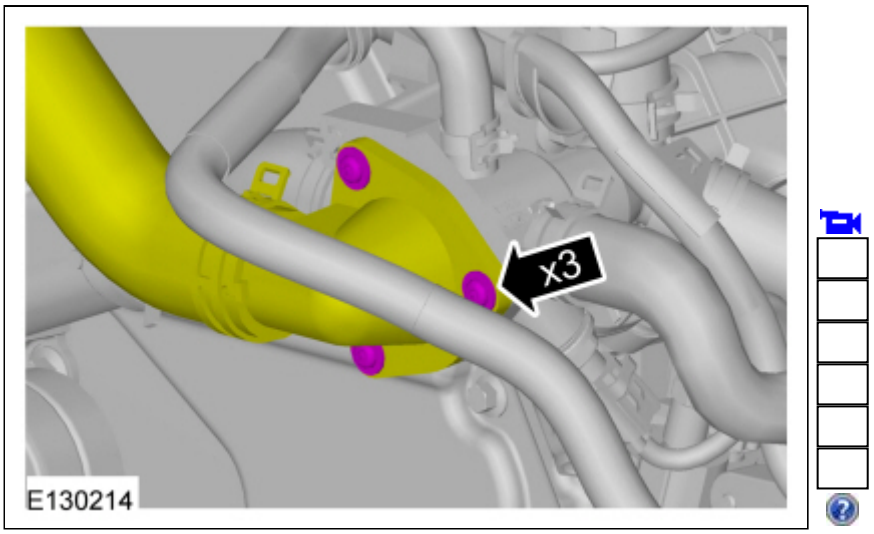
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

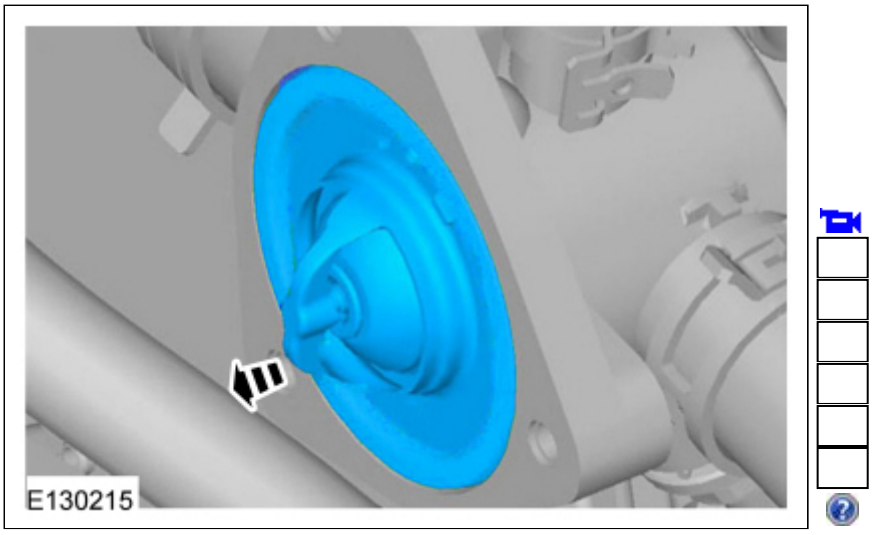
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

3. *Torque*: 10 Nm



4.



Installation

1. **NOTE:** *Inspect the thermostat housing cover O-ring seal. Install a new O-ring seal if necessary.*

   To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Thermostat Housing

Removal

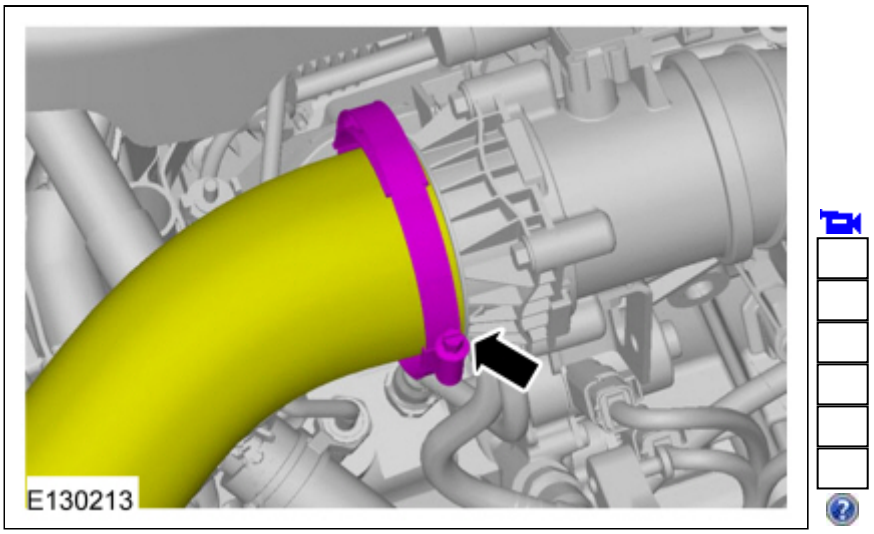
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

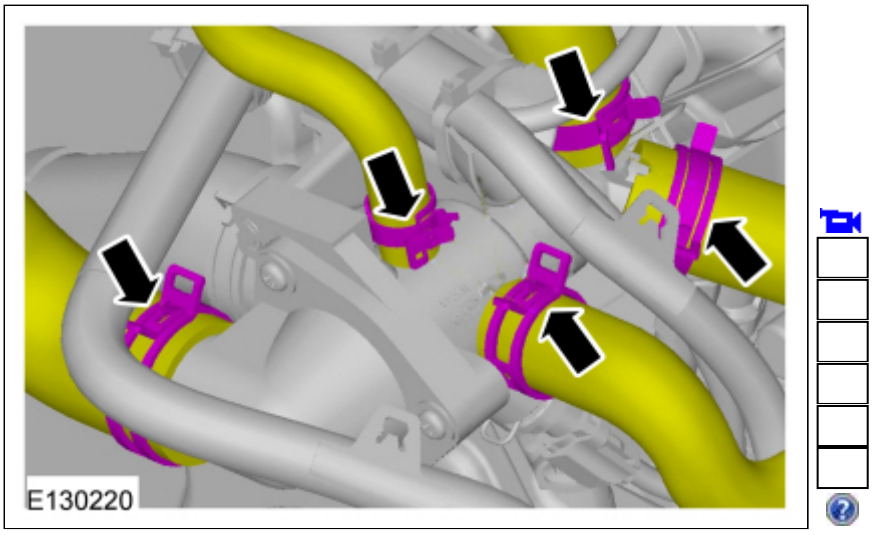
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

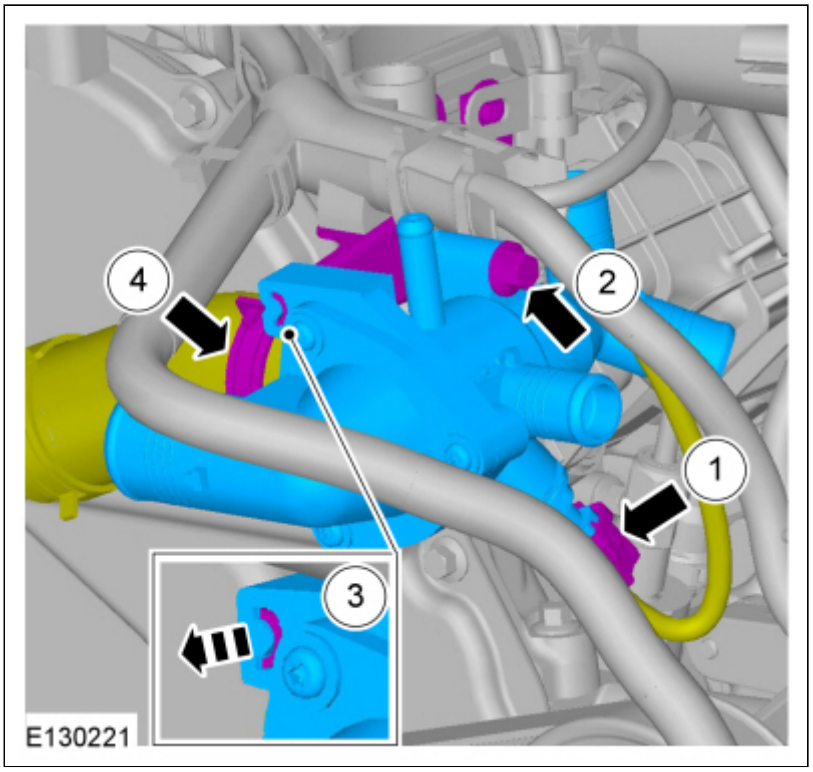
3. *Torque*: 5 Nm



4.



5. *Torque*: 23 Nm



Installation

1. To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Coolant Pump

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

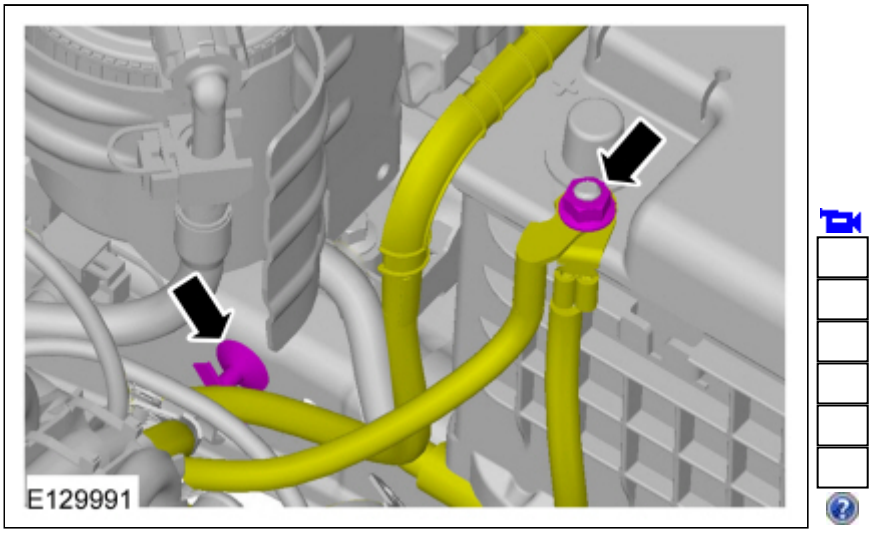
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

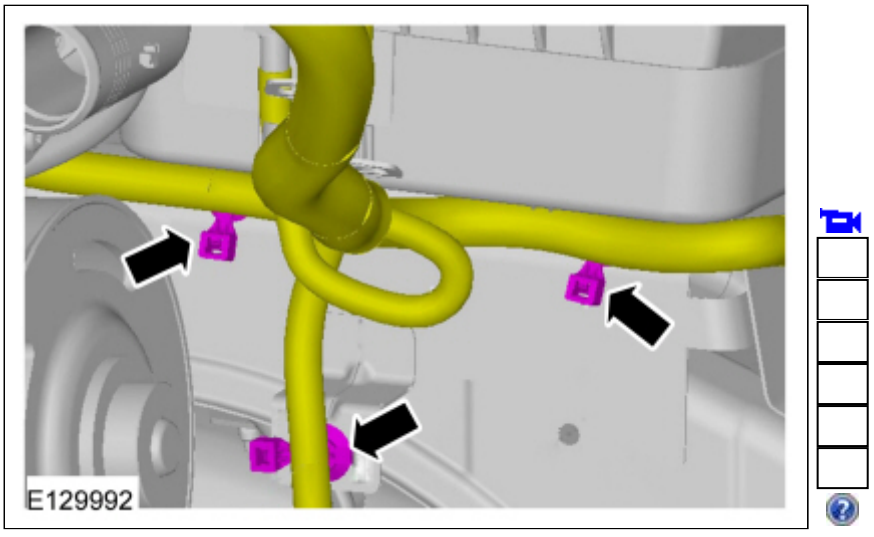
2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

3. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

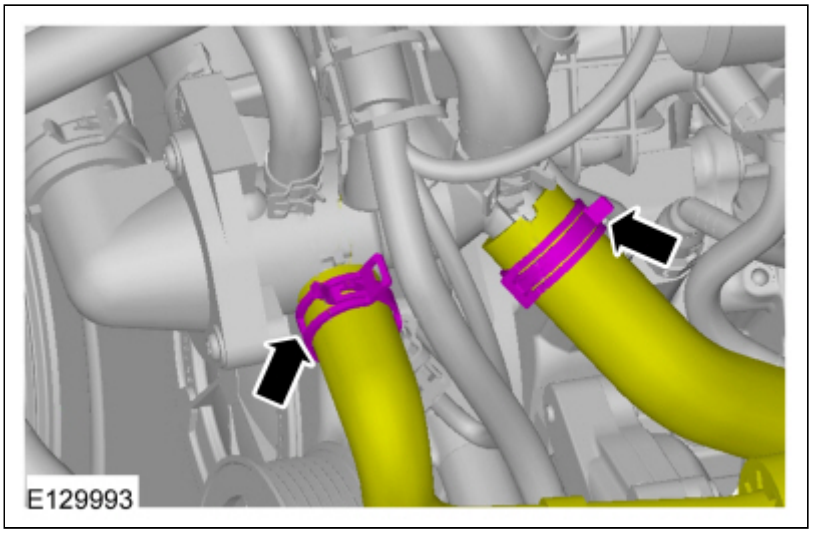
4. *Torque*: 14 Nm



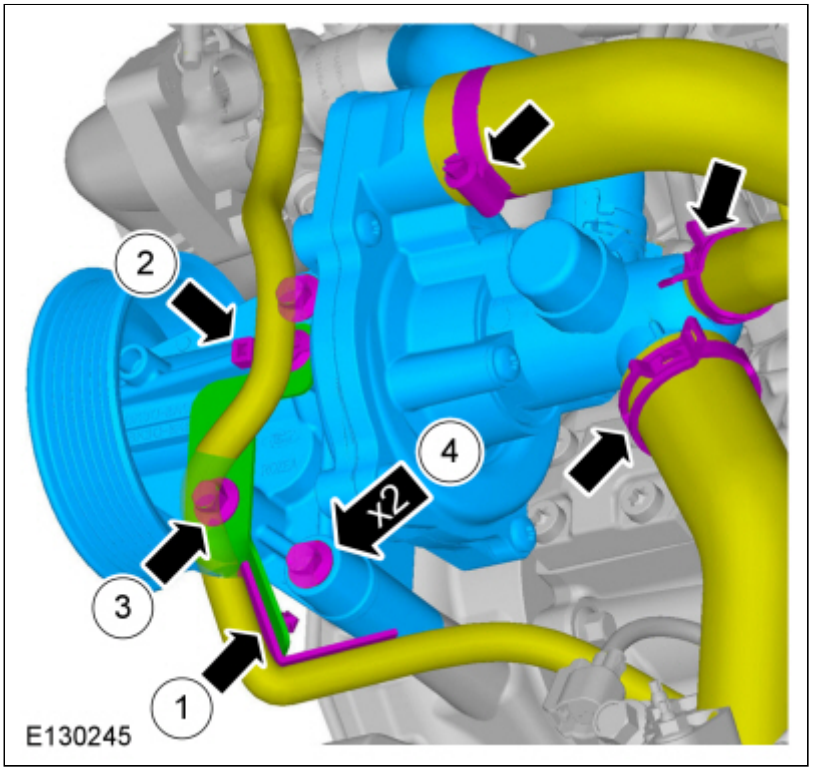
5.



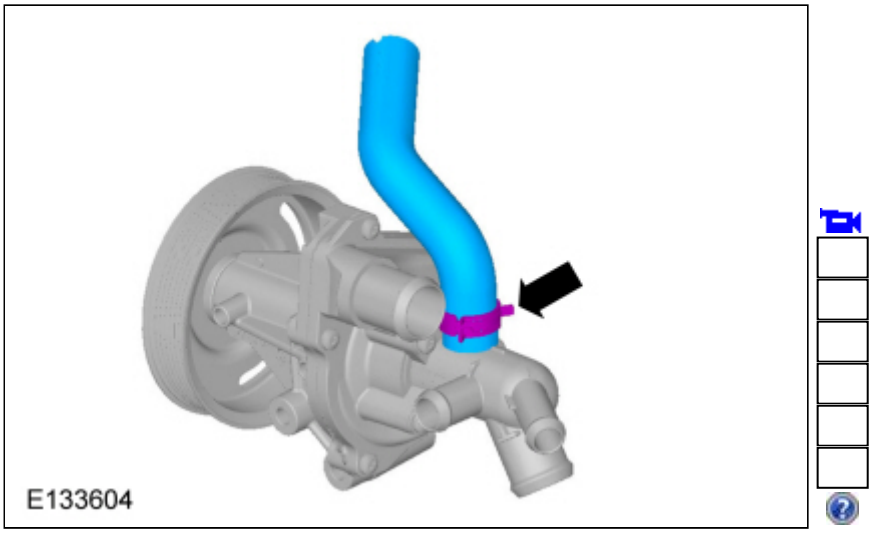
6.



3. *Torque*: 23 Nm
4. *Torque*: 23 Nm



8. **NOTE:** *Use care when cleaning the water pump gasket mating surfaces. Gouges in the aluminum could form leak paths.*



Installation

1. To install, reverse the removal procedure.
2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Cooling Fan

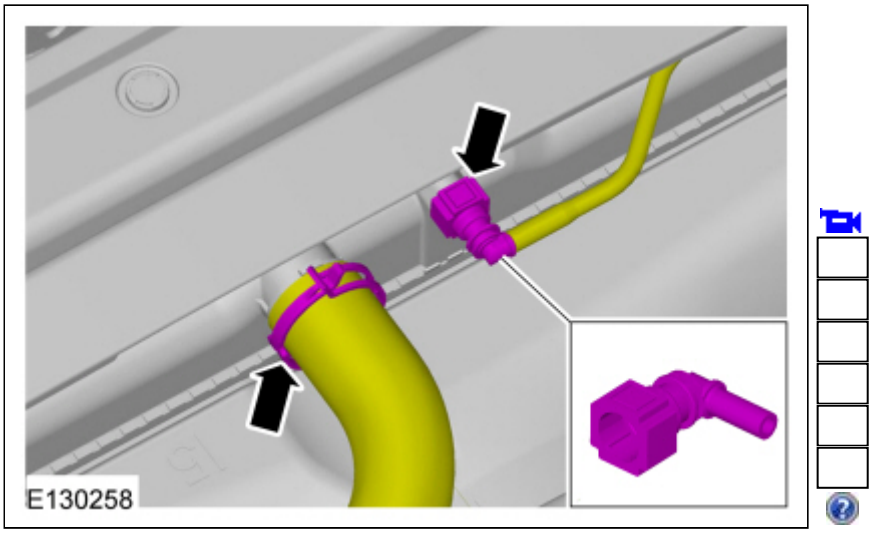
Base Part Number: 8600

Special Tool(s) / General Equipment

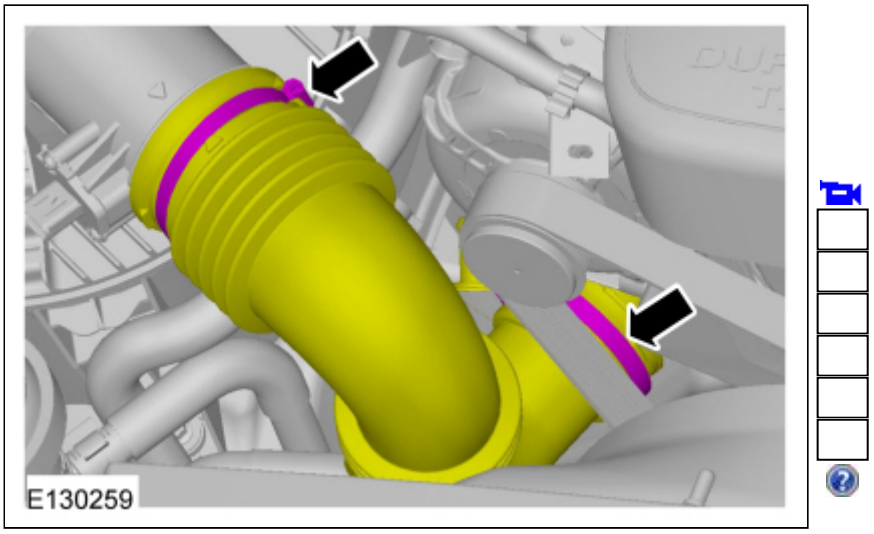
 E62783	303-1196 Holding Wrench, Pulley
 24002	303-378 Wrench, Fan Hub

Removal

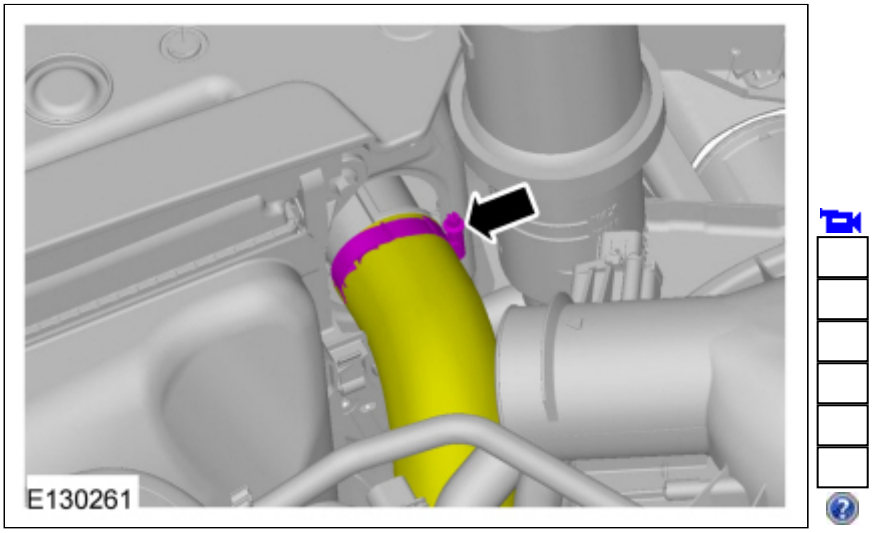
NOTE: *Removal steps in this procedure may contain installation details.*

1. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
2. 

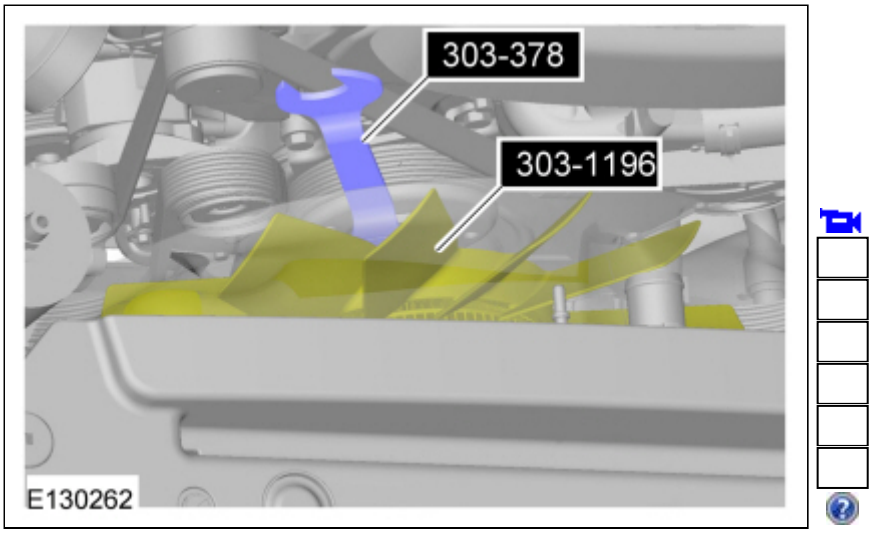
3. *Torque*: 4 Nm



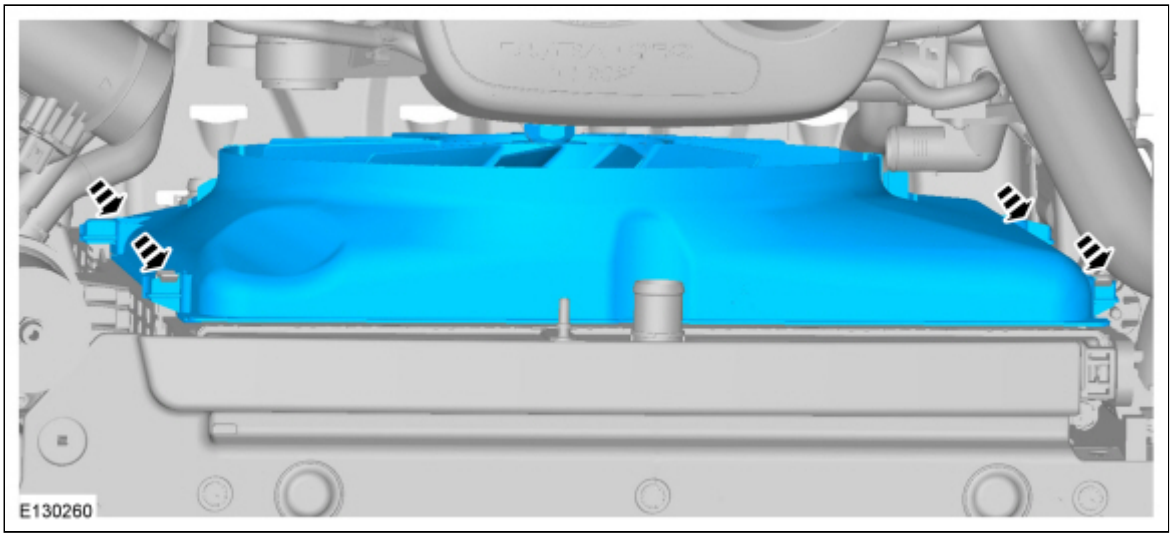
4. *Torque*: 4 Nm



5. Use Special Service Tool: 303-378 Wrench, Fan Hub. , 303-1196 Holding Wrench, Pulley.
   Torque: 105 Nm



6. Remove the fan and position it inside the shroud. Lift the fan and shroud together and remove from the vehicle.



Installation

1. To install, reverse the removal procedure.
2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Coolant Outlet Connector

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Drain the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

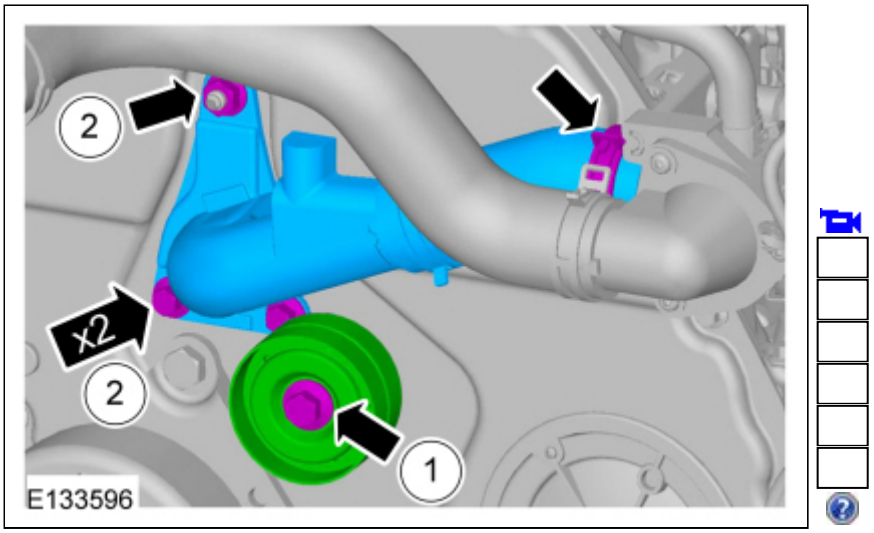
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

5. **NOTE:** *Make sure that these components are installed to the noted removal position.*

   NOTE: *The gasket is to be reused unless damaged.*

   1. *Torque*: 23 Nm
   2. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

2. Bleed the cooling system.
   Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Radiator

Base Part Number: 8005

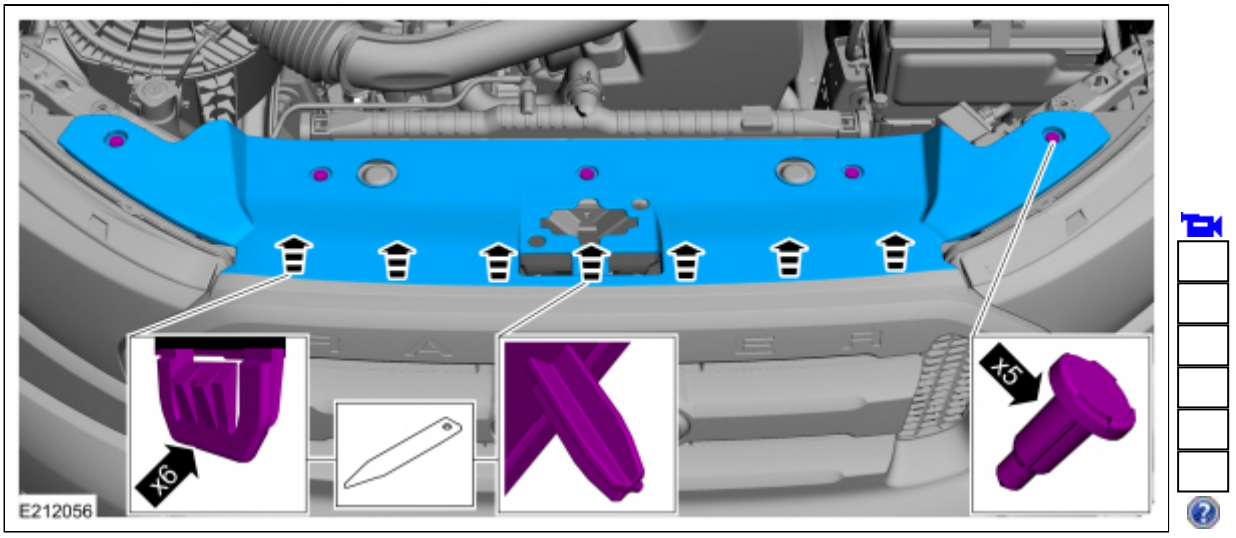
Removal

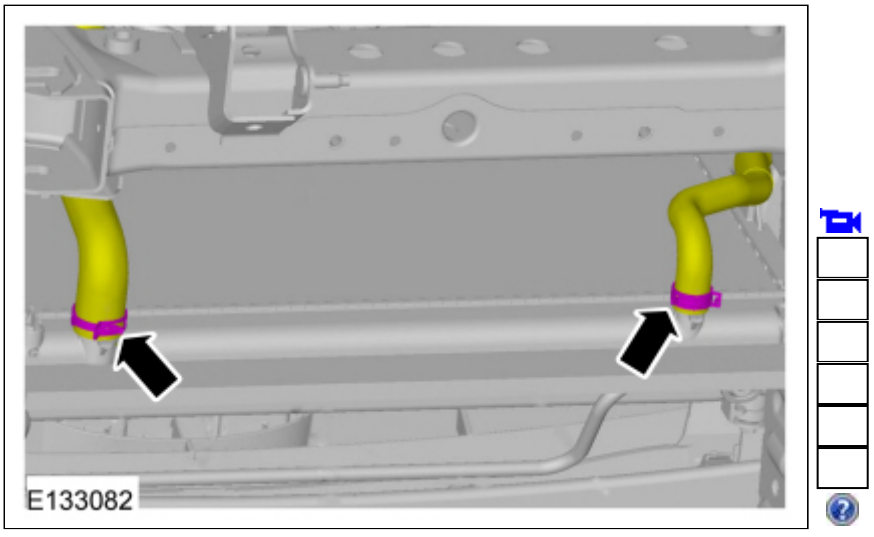
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

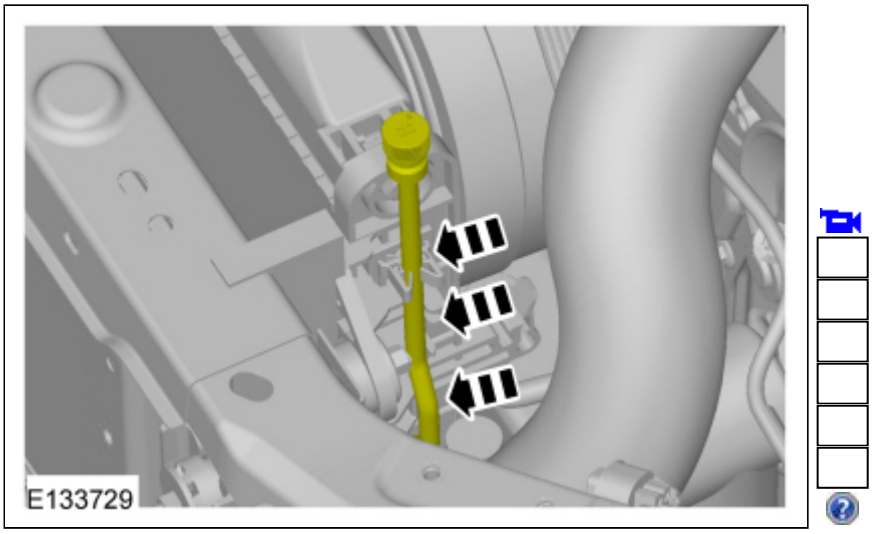
   Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

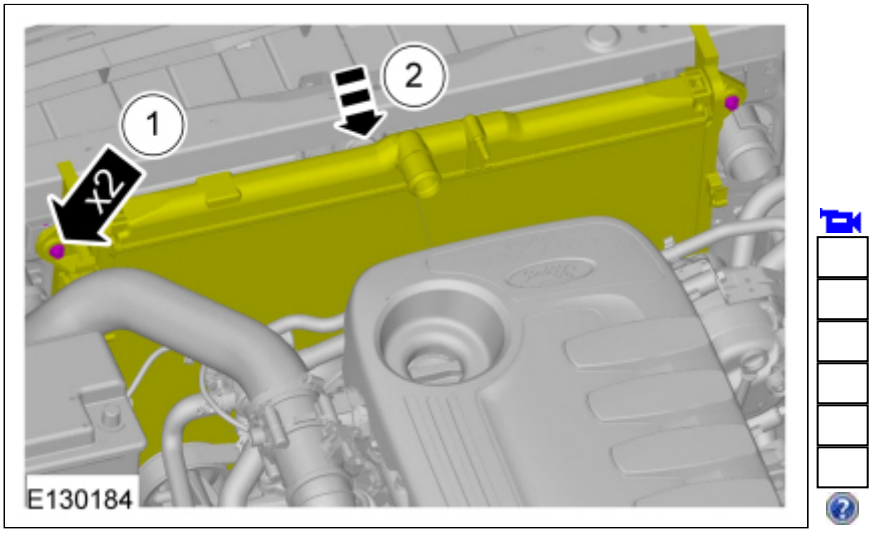
3. 

4. 

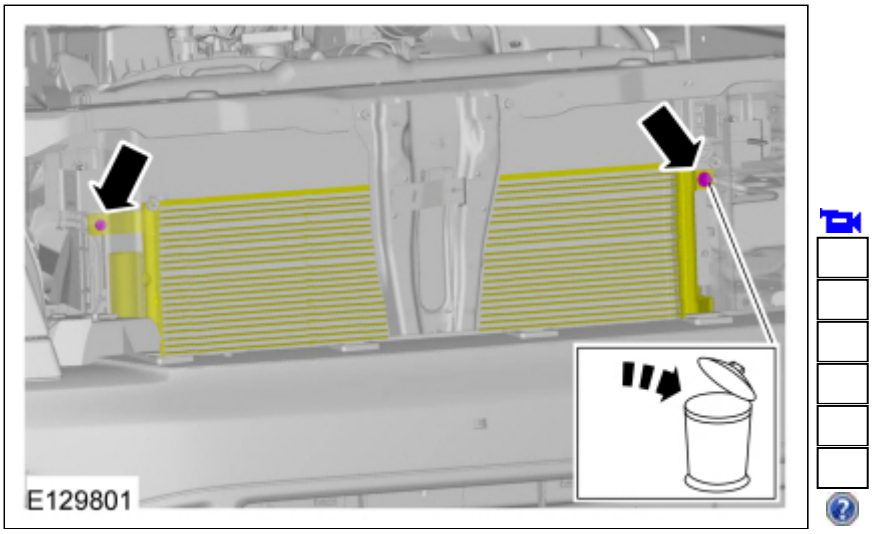
5. **NOTICE: Take extra care not to damage the component.**



6. *Torque*: 20 Nm

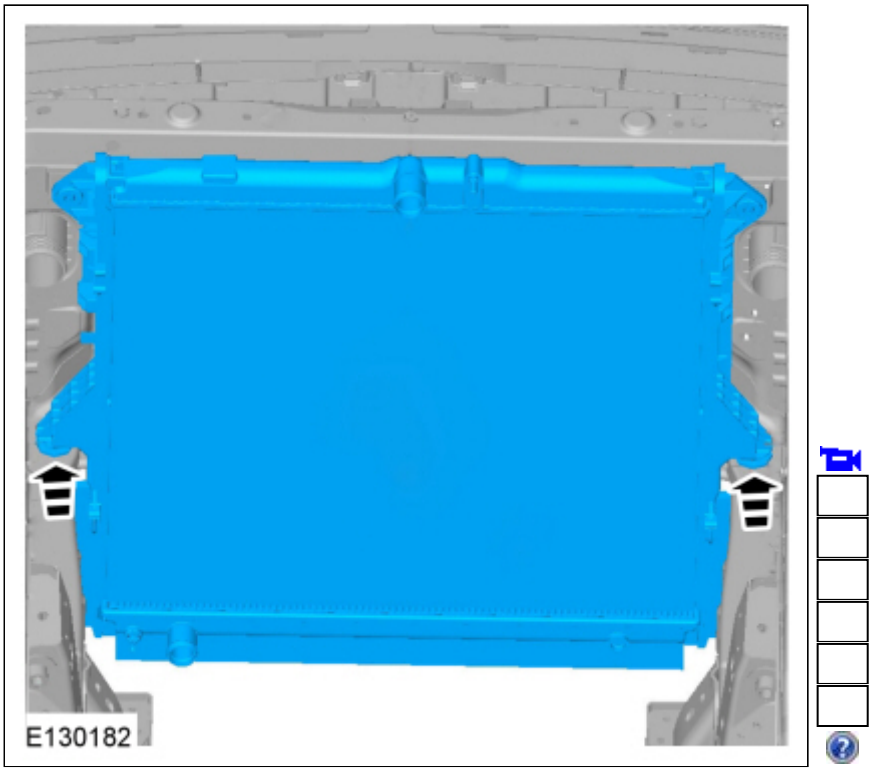


7. Lift the A/C condenser off the supports and move the A/C condenser toward the front of the vehicle and securely strap the A/C condenser on the grill support.
   Torque: 7 Nm



8. **NOTICE: Take extra care not to damage the component.**

   NOTE: *Radiator insulators are to be reused unless damaged.*



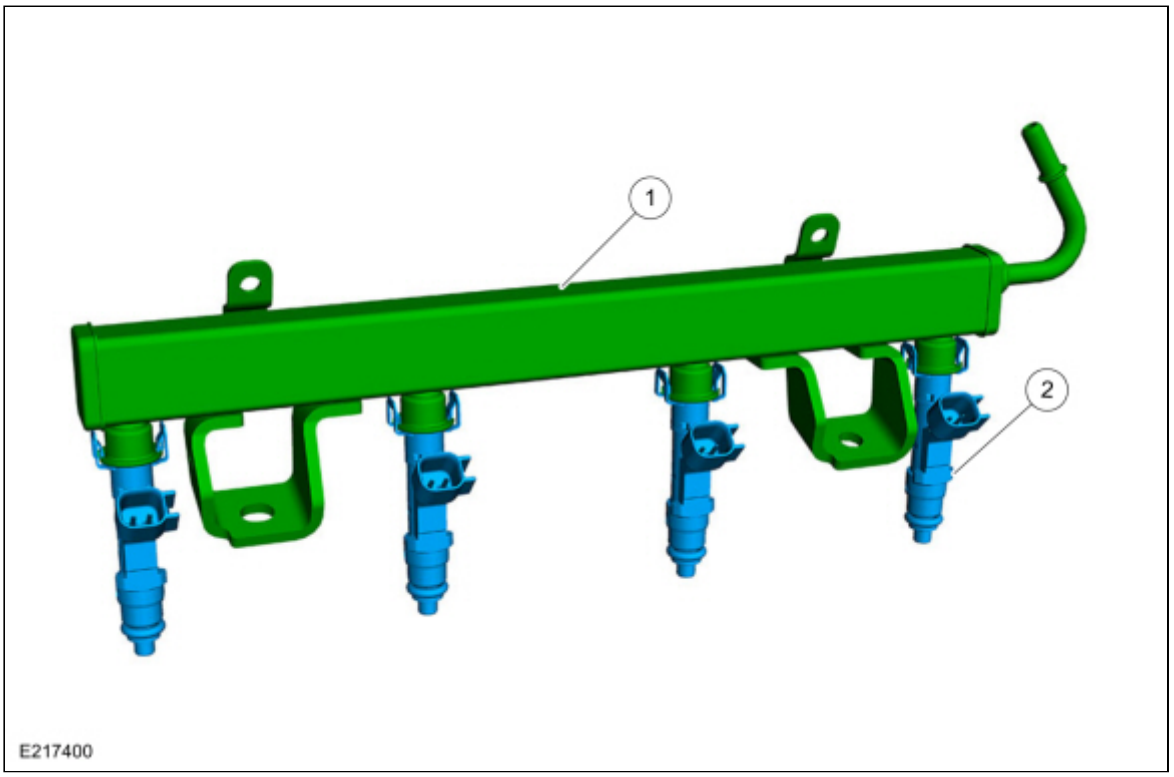
Installation

NOTICE: Make sure that no components catch.

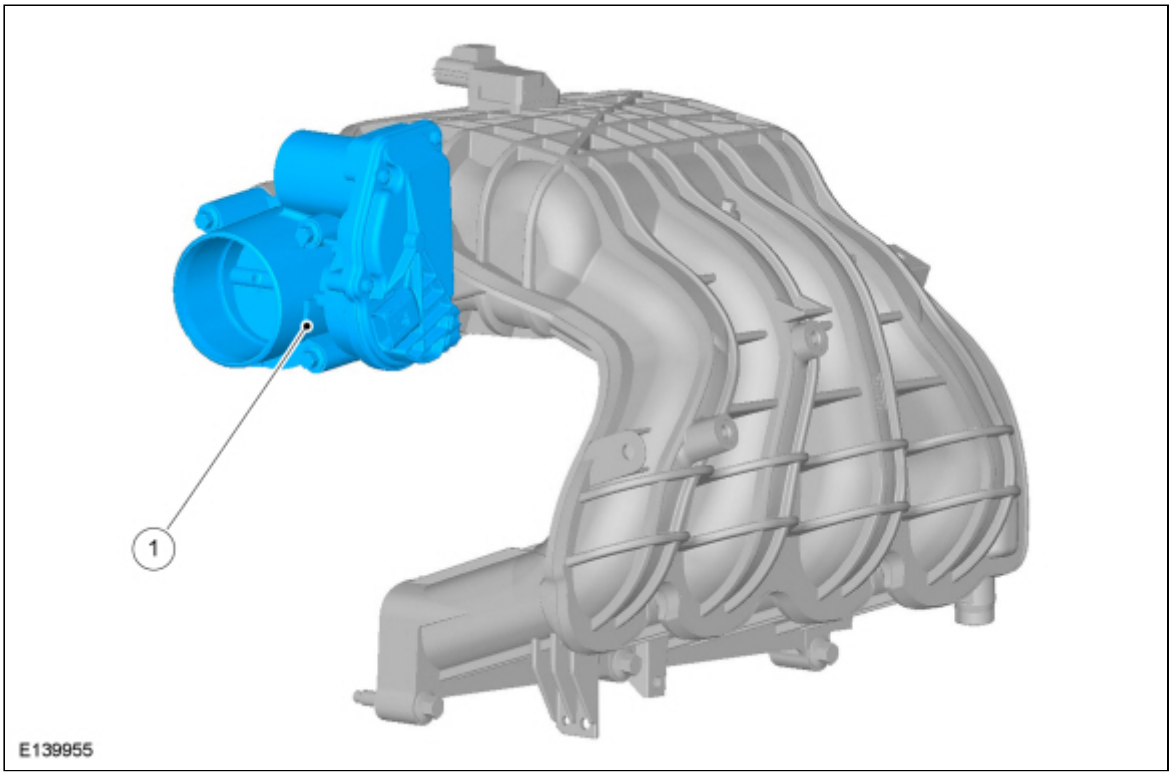
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls - Component Location



Item	Part Number	Description
1	—	Fuel rail
2	—	Fuel injector



Item	Part Number	Description
1	—	Throttle body

Throttle Body

The throttle plate position is controlled by a signal from the powertrain control module (PCM) which receives an input from the accelerator pedal position (APP) sensor. The system is fully electronic and does not use any cables. The signal from the PCM is used to control a DC motor within the throttle body which is connected to the throttle plate through gears. The throttle body also gives inputs back to the PCM. This information allows the PCM to compensate for factors such as carbon build up within the throttle body and throttle body wear. The throttle body also provides information to the PCM to enable the flagging of a diagnostic trouble code (DTC).

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls

General Equipment

Ford approved diagnostic tool

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Fuel leak(s) • Vacuum line(s) • Gasket(s) • Seal(s) • Fuel injector(s) • Fuel rail • Fuel supply line	• Fuse(s) • Wiring harness • Electrical connector(s) • Fuel injector(s) • Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.
5. For drivabilty symptoms without DTCs, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.. For PCM DTCs,
   REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) .

Symptom Chart

Symptom	Possible Sources	Action
• Engine does not crank	• Passive anti-theft system (PATS).	• CHECK the PATS LED extinguishes within 3 seconds when the ignition is turned on. REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
	• Starting system.	• REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
	• Ignition switch.	• REFER to the Wiring Diagrams.
	• Powertrain control module (PCM).	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.

• Engine cranks but does not start	• Inertia fuel shutoff (IFS) switch.	• RESET the IFS switch.
	• Low fuel system pressure.	• Check the fuel system pressure.
	• Fuel lines damaged or blocked.	• INSPECT the fuel lines. INSTALL new components as necessary. TEST the system for normal operation.
	• Fuel filter blocked.	• INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Fuel pump and sender unit.	• REFER to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Crankshaft position (CKP) sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Camshaft position (CMP) sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• PCM.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel rail pressure (FRP) sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Low cylinder compression.	• TEST the cylinder compression.
• Poor starting	• Low fuel system pressure.	• Check the fuel system pressure.
	• Fuel system leak.	• CHECK the system for fuel leak(s). REPAIR the system as necessary.
	• Fuel system restriction.	• INSPECT the fuel system. INSTALL new components as necessary. TEST the system for normal operation.
	• Fuel filter blocked.	• INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Incorrect engine oil.	• INSTALL a new engine oil filter and engine oil.
	• Incorrect power	• DRAIN and REFILL the power steering system with the correct fluid. REFER to:

	steering fluid.	(211-00 Steering System - General Information) Power Steering System Bleeding (General Procedures), Power Steering System Flushing (General Procedures), Power Steering System Filling (General Procedures).
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Engine coolant temperature (ECT) sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injector(s).	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Low cylinder compression.	• TEST the engine cylinder compression.
• Engine starts but immediately stops	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• CMP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• PCM.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Low fuel system pressure.	• Check the fuel system pressure.
	• Fuel system restriction.	• INSPECT the fuel system. INSTALL new components as necessary. TEST the system for normal operation.
	• Fuel filter blocked.	• INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• Poor idling	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of

		fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Low fuel system pressure.	• Check the fuel system pressure.
	• Fuel filter blocked.	• INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Knock sensor (KS).	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
• Engine stumbling	• Engine ignition.	• Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• Low fuel system pressure.	• Check the fuel system pressure.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
• Engine lacks power	• Engine ignition.	• Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	• Brakes binding.	• CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	• Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	• ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Low fuel system pressure.	• Check the fuel system pressure.
	• Kinked or restricted fuel	• INSPECT the fuel lines. INSTALL new components as necessary. TEST the

	lines.	system for normal operation.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Fuel filter blocked.	• INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Vehicle speed sensor (VSS).	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• ECT sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Low cylinder compression.	• CHECK the cylinder compression.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• Black smoke at idle	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• ECT sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Catalytic	• REMOVE and visually INSPECT th

	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Incorrect valve timing.	• CHECK the valve timing.
• Excessive black smoke during acceleration	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• KS.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• Black smoke at cruising speeds	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• ECT sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.

	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• Blue smoke	• Engine burning oil.	• CARRY OUT a controlled oil consumption test over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 litre per 1000 km (600 miles).
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Positive crankcase ventilation (PCV) system.	• INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	• Worn or damaged valve guide(s), piston ring(s), cylinder bore(s), cylinder head or gasket.	• REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• White smoke	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Coolant in the	• CARRY OUT a cooling system pressure

	combustion chamber.	test. REFER to: Engine Cooling (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• Engine misfire	• Engine ignition.	• Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Low fuel system pressure.	• Check the fuel system pressure.
	• Engine operating temperature too high.	• REFER to: Engine Cooling (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
	• ECT sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• CMP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• KS.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Low cylinder compression.	• CHECK the engine compression.
	• Worn or	• REMOVE the cylinder head. INSPECT

	damaged valve(s), tappet(s) or camshaft(s).	the cylinder head, valves, tappets and camshafts for signs of wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Damaged cylinder head gasket.	• REMOVE the cylinder head. INSPECT the cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
• Engine knock at idle	• Low engine oil level.	• CHECK the engine oil level. REFILL as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odors from the fuel tank. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. • INSTALL a new fuel rail. REFER to: Fuel Rail (303-04A Fuel Charging and Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• KS.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injector(s).	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Excessive carbon build up.	• REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up. REFER to: Cylinder Head (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Worn or damaged oil pump. • Worn or damaged timing chain or sprocket. • Major mechanical engine failure.	• INSPECT the engine components.
• Engine knock during acceleration	• KS.	• Carry out a full engine diagnosis using

		the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• Major mechanical engine failure.	• REFER to: Engine (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
• **NOTE:** *Before proceeding with any of the actions in relation to the possible sources for excessive fuel consumption, a fuel consumption test located in the toolbox menu of the Ford approved diagnostic tool must be carried out.* • Excessive fuel consumption	• Brakes binding.	• CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	• Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	• ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Fuel system leak(s).	• CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	• Fuel filter blocked.	• INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• Incorrect engine oil.	• INSTALL a new oil filter and engine oil.
	• Generator.	• REFER to the Ford approved diagnostic tool.
	• Slipping clutch (if equipped).	• REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).
	• ECT sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Fuel injectors.	• INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	• PCM calibration.	• Using the Ford approved diagnostic tool, CHECK for the availability of a calibration update.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Low cylinder compression.	• CHECK the engine compression.
• Engine cuts out during hard acceleration	• CMP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.

		approved diagnostic tool.
	• CKP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• FRP sensor.	• Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	• Low fuel system pressure.	• Check the fuel system pressure.

Copyright © 2016 Ford Motor Company

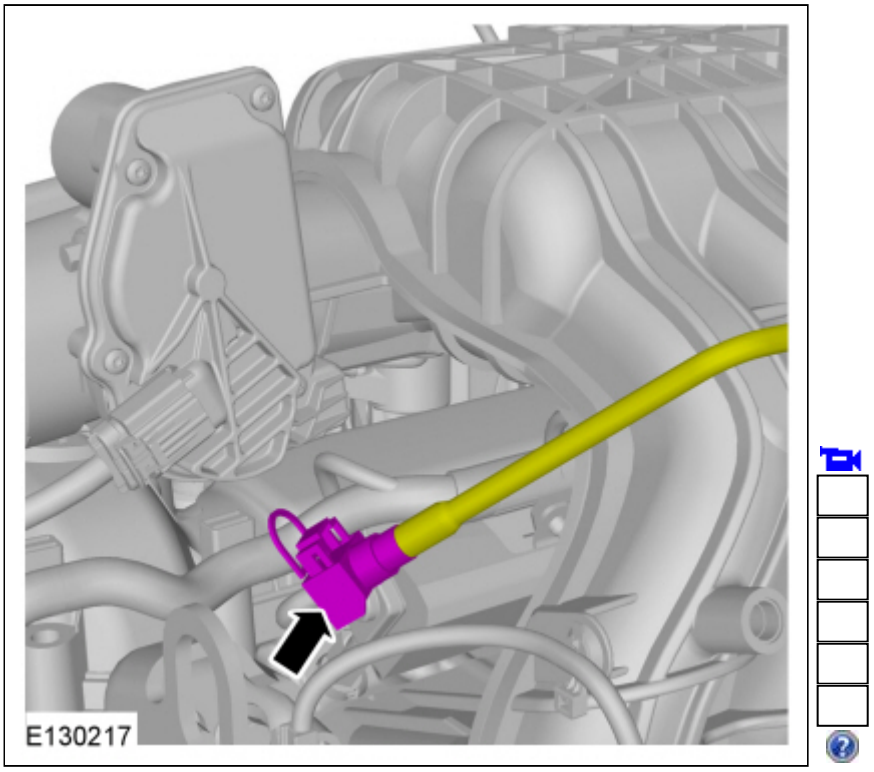
Fuel Rail

Materials

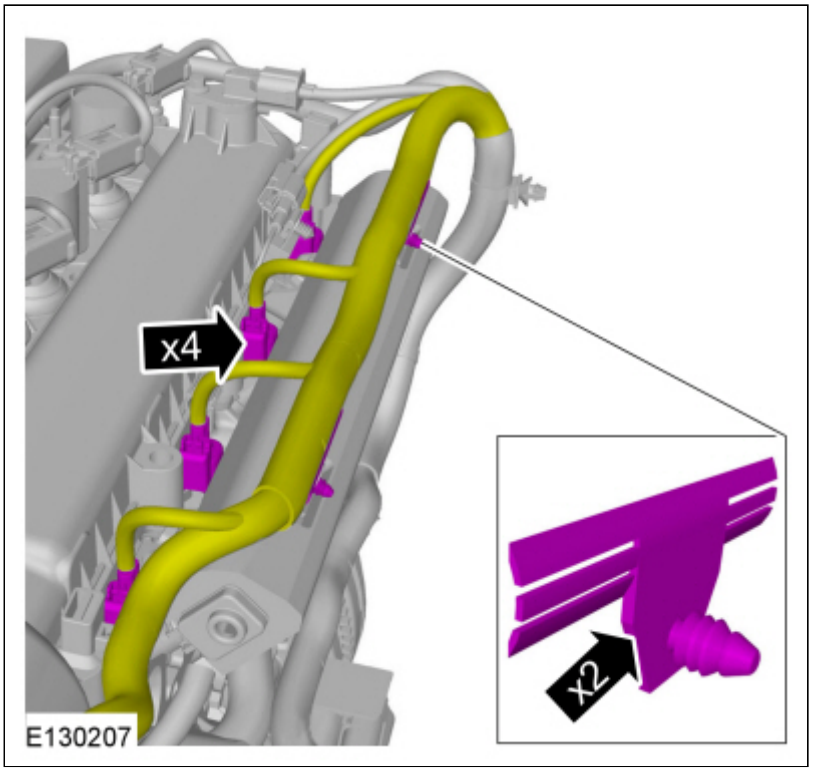
Name	Specification
Engine Oil - SAE 5W-30	WSS-M2C913-C

Removal

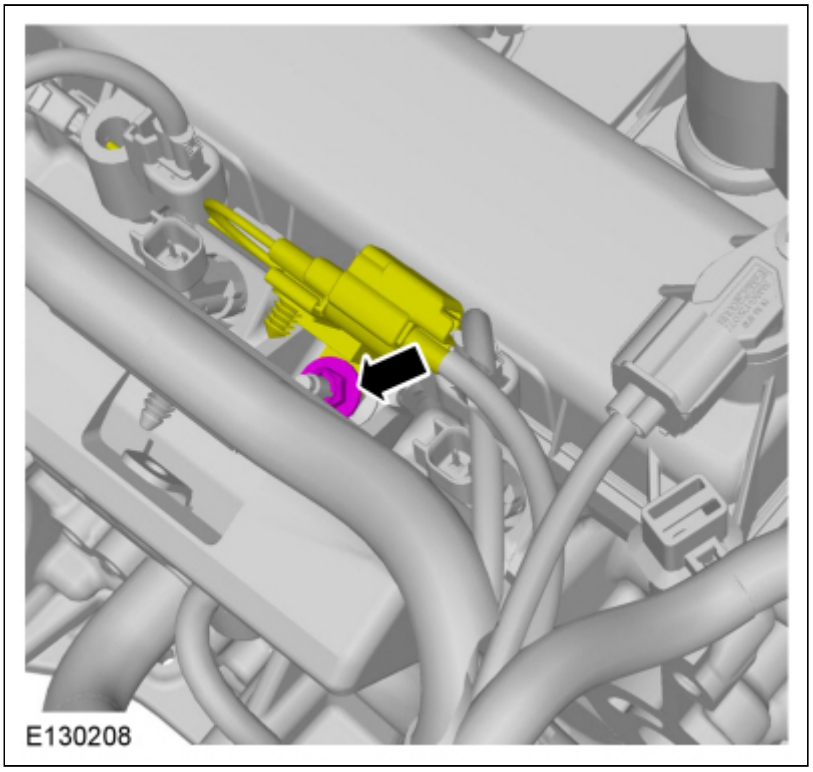
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. 

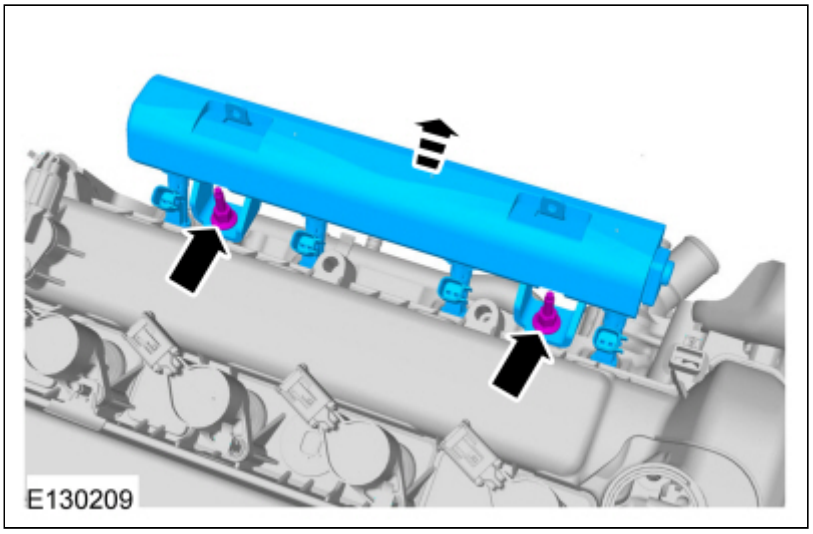
5. Refer to: Intake Manifold (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
6.



7. *Torque*: 10 Nm

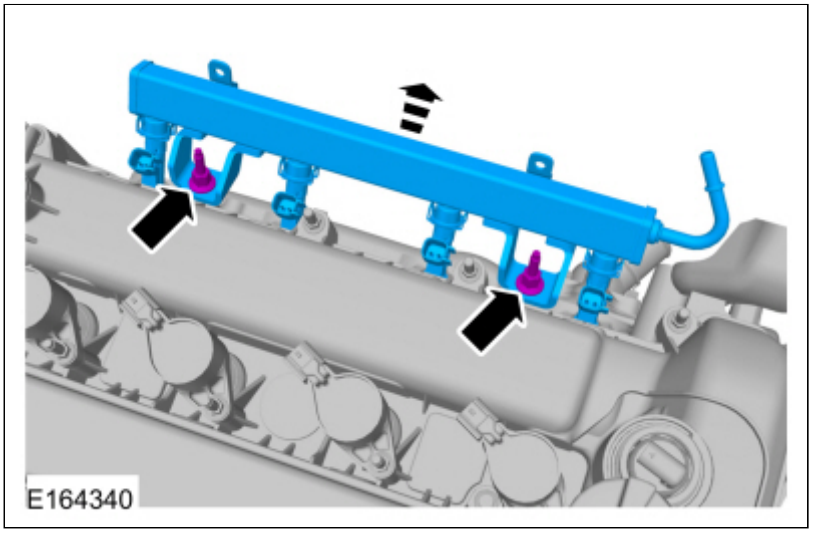


8. *Torque*: 23 Nm

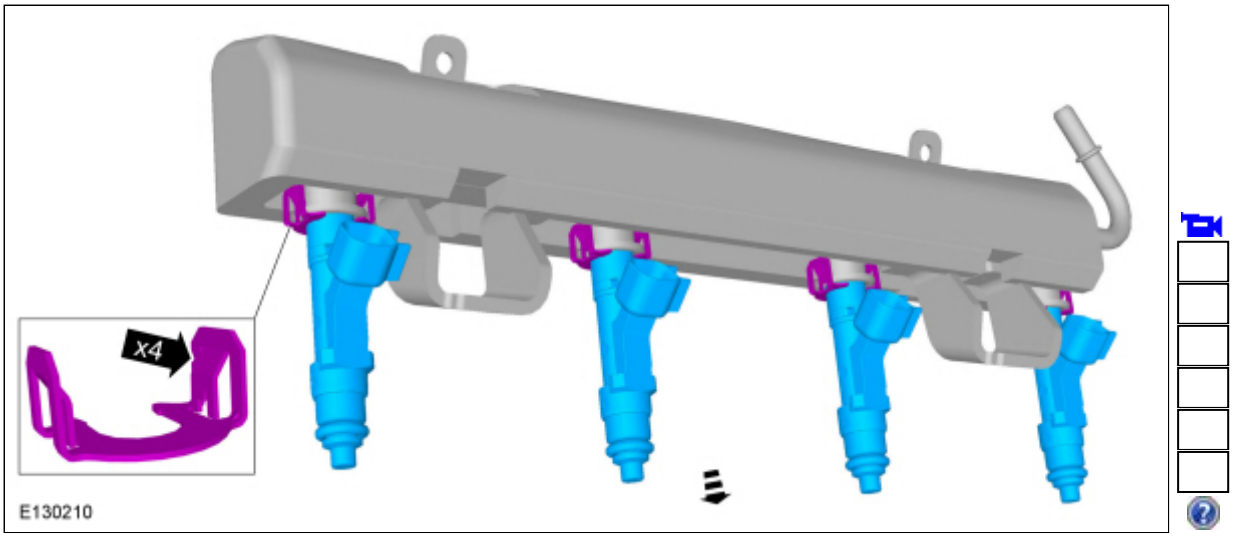


9. **NOTE:** *This step is applicable for base series vehicles.*

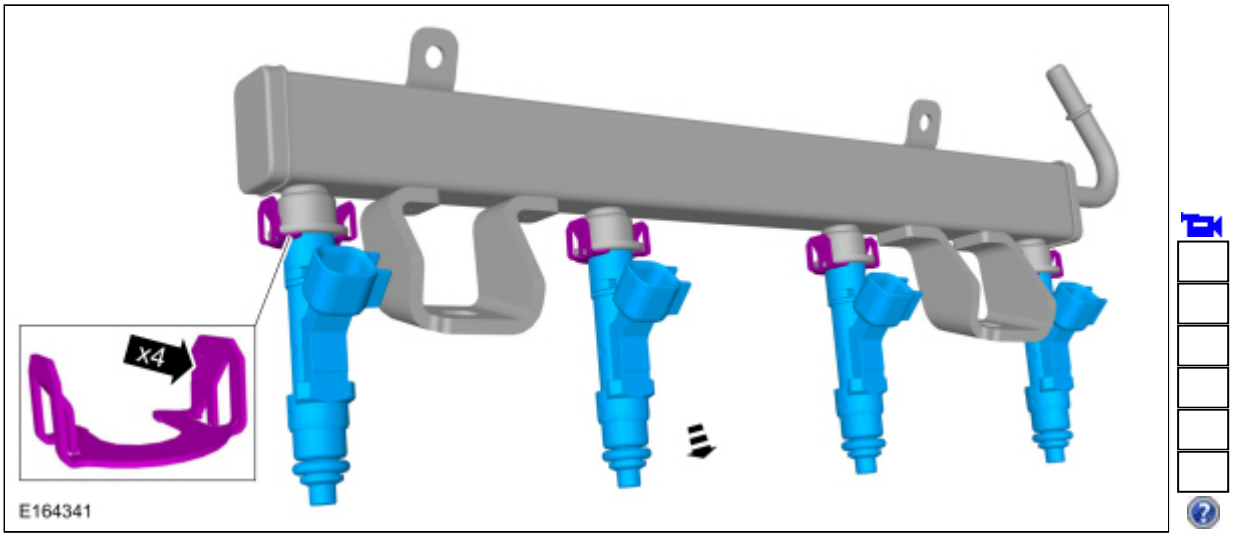
   Torque: 23 Nm



10.

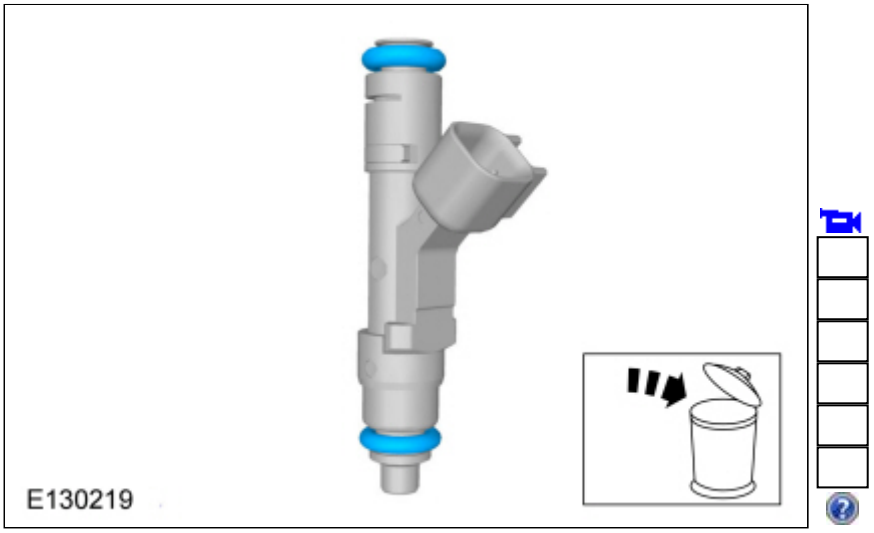


11. **NOTE:** *This step is applicable for base series vehicles.*



12. **NOTICE: Only use the specified material to lubricate the seals.**

    Material: Engine Oil - SAE 5W-30 (WSS-M2C913-C)



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

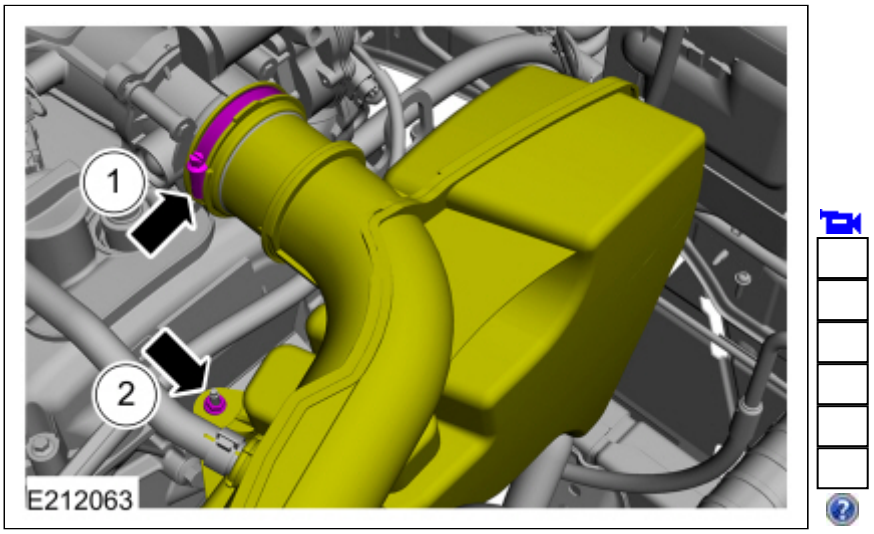
Throttle Body

Base Part Number: 9F991

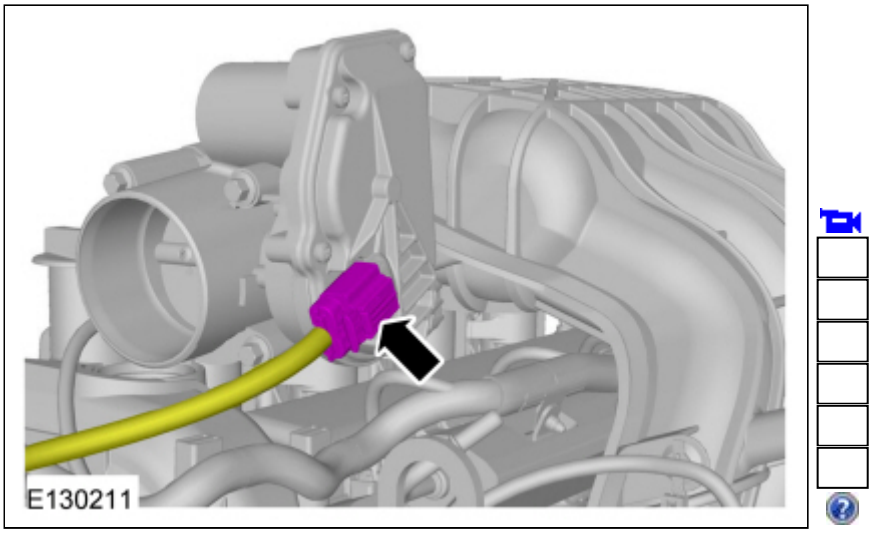
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 11 Nm

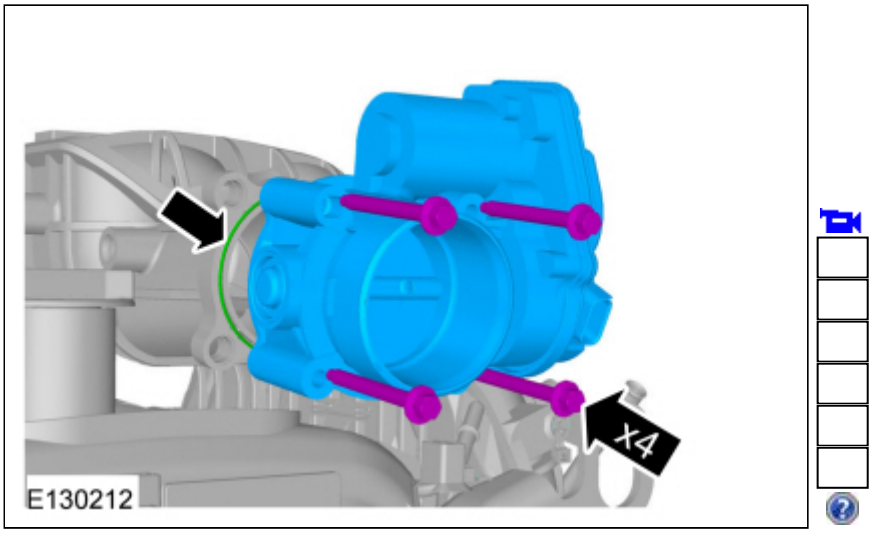


2.



3. **NOTE:** *The gasket is to be reused unless damaged.*

   Torque: 10 Nm



Installation

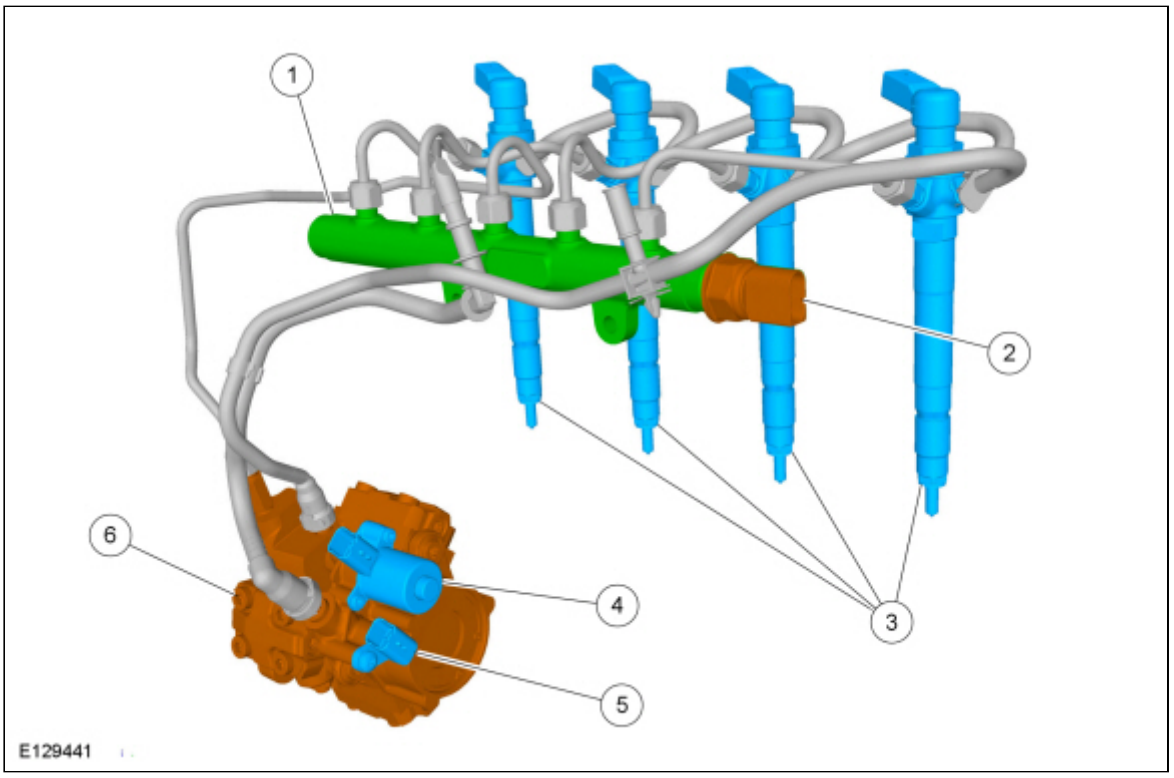
1. To install, reverse the removal procedure.
2. **NOTE:** *Make sure that the pedals remain in the rest position during the initialization.*

   Turn the ignition key to position II and wait for one minute to initialize the throttle body.
3. Turn the ignition key to the OFF position.

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls

Overview



Item	Part Number	Description
1	—	Fuel rail
2	—	Fuel rail pressure (FRP) sensor
3	—	Fuel Injector(s)
4	—	Fuel metering valve
5	—	Fuel temperature sensor
6	—	Fuel pump

General

A continental common rail fuel injection system is used on the 2.2L Duratorq-TDCi (Puma) diesel engine.

Within the fuel pump there is an integral fuel transfer pump which draws the fuel from the fuel tank to the fuel pump.

A fuel metering valve is located in the supply port to the high-pressure chamber of the fuel pump. The fuel metering valve varies the quantity of fuel supplied to the fuel rail and fuel injector(s), in relation to the driving conditions.

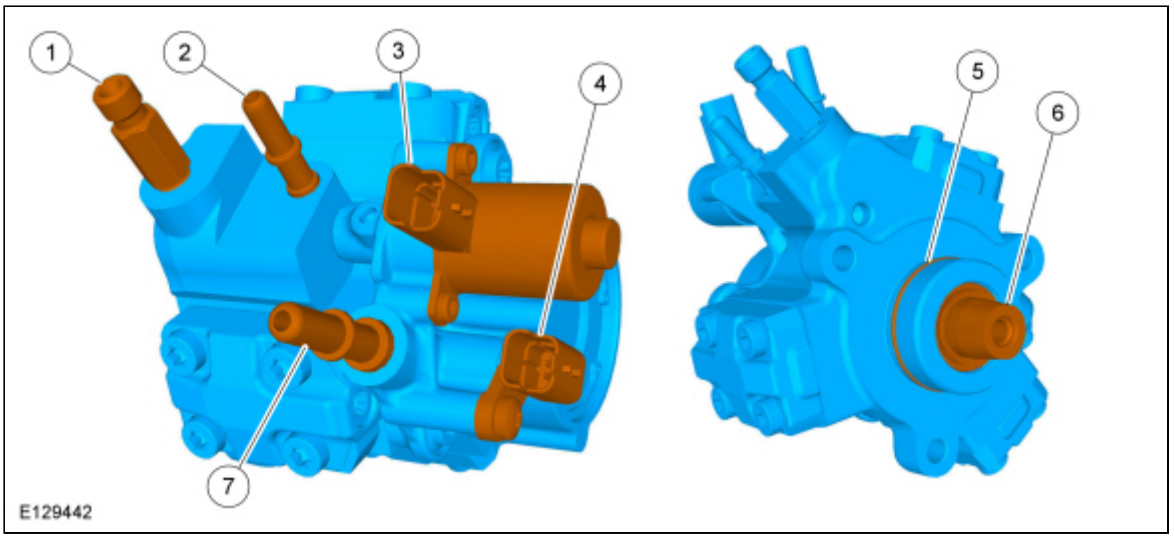
The fuel is supplied at high-pressure to the fuel rail and to the fuel injectors ready for injection. Depending on engine operating conditions, the fuel injection pressure varies between 230 bar and 1800 bar.

Fuel system pressure is measured using an FRP sensor located in the fuel rail. The FRP sensor converts the fuel system pressure into a voltage signal. This voltage signal acts as an input signal to the powertrain control module (PCM) for calculation of the fuel injection quantity.

The power train control module (PCM) calculates the time of fuel injection and the fuel injection quantity depending on various input variables. The specified quantity of fuel is injected into the respective combustion chamber through the solenoid actuated fuel injector(s). In doing so, a pre-injection and a main injection occur each time.

The excess fuel is returned to the fuel tank through the fuel return line.

Fuel pump



Item	Part Number	Description
1	—	Fuel pump high-pressure outlet union
2	—	Fuel pump fuel return union
3	—	Fuel metering valve
4	—	Fuel temperature sensor
5	—	Fuel pump O-ring seal
6	—	Fuel pump input drive
7	—	Fuel pump fuel supply union

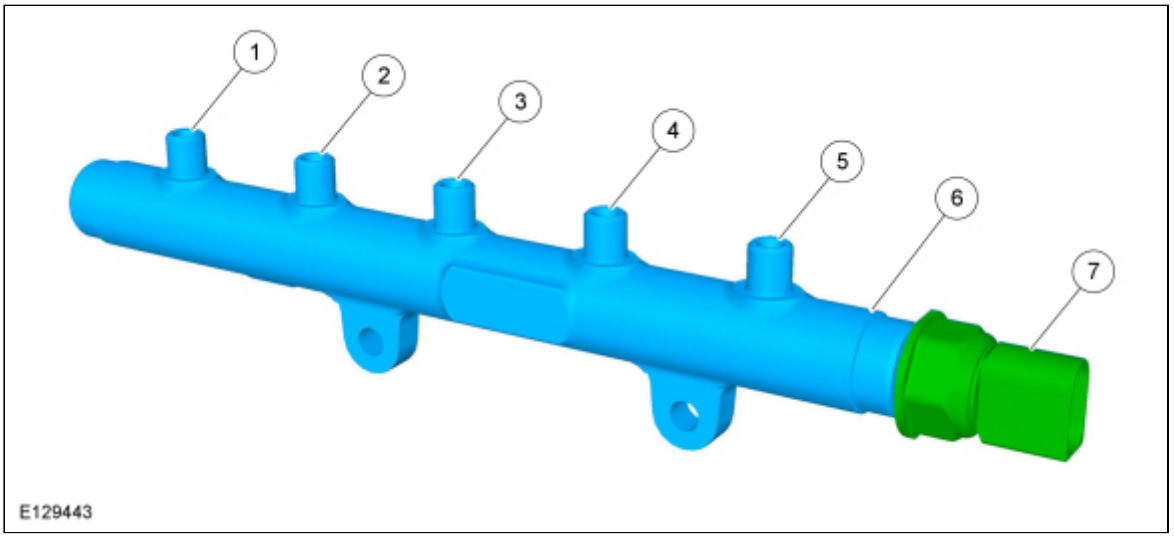
The fuel pump is driven by the timing chain and is mounted on the LHS of the cylinder block.

The fuel pump has three pump elements, each offset from each other by 120 degrees.

The fuel transfer pump is incorporated into the fuel pump and is located on the drive flange. The fuel transfer pump is a cycloid type pump.

The fuel metering valve is actuated by the PCM using pulse width modulation.

Fuel rail



Item	Part Number	Description

1	—	Fuel rail to fuel injector number 1 high-pressure fuel supply line union
2	—	Fuel rail to fuel injector number 2 high-pressure fuel supply line union
3	—	Fuel pump to fuel rail high-pressure fuel supply line union
4	—	Fuel rail to fuel injector number 3 high-pressure fuel supply line union
5	—	Fuel rail to fuel injector number 4 high-pressure fuel supply line union
6	—	Fuel rail
7	—	FRP sensor

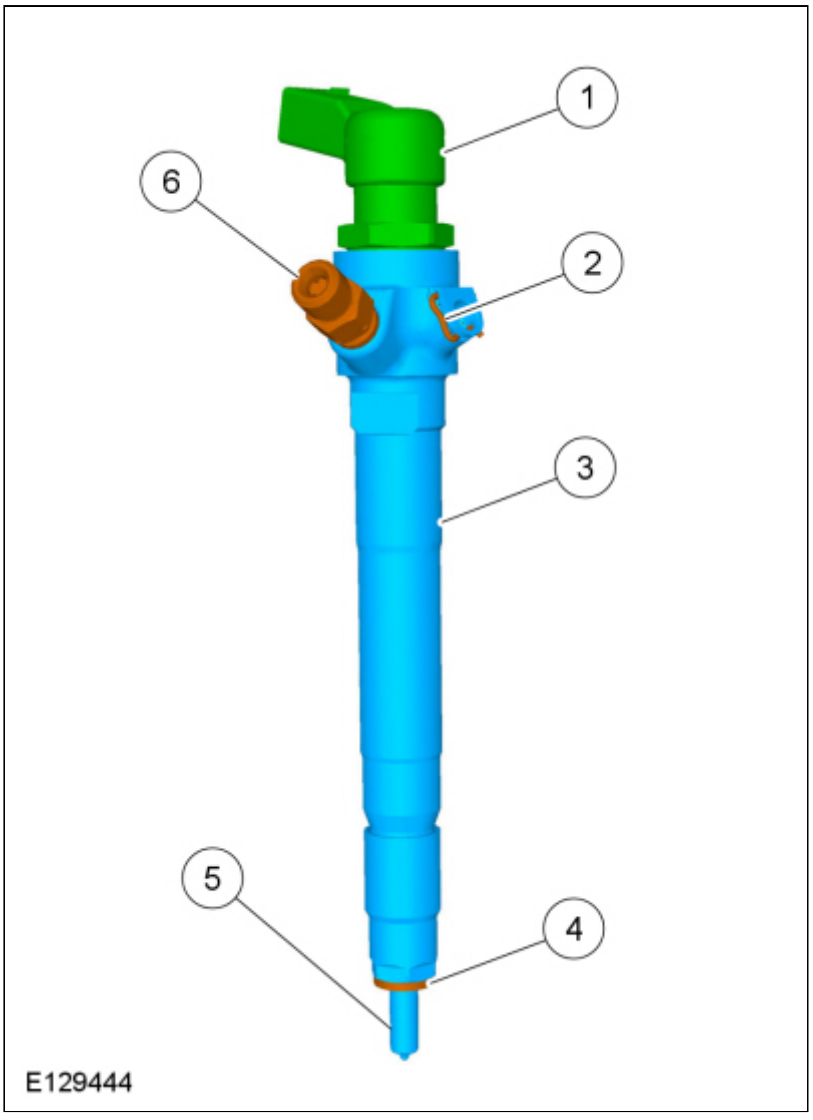
NOTICE: The FRP sensor must not be detached or removed from the fuel rail.

The fuel rail is made from forged steel and is retained by a support bracket located on the camshaft carrier .

The fuel is delivered by one high-pressure fuel supply line from the fuel pump to the fuel rail.

From the fuel rail, the fuel travels through high-pressure fuel supply line(s) to the fuel injector(s).

Fuel injectors



Item	Part Number	Description
1	—	Fuel injector electrical connector
2	—	Fuel injector fuel return line clip

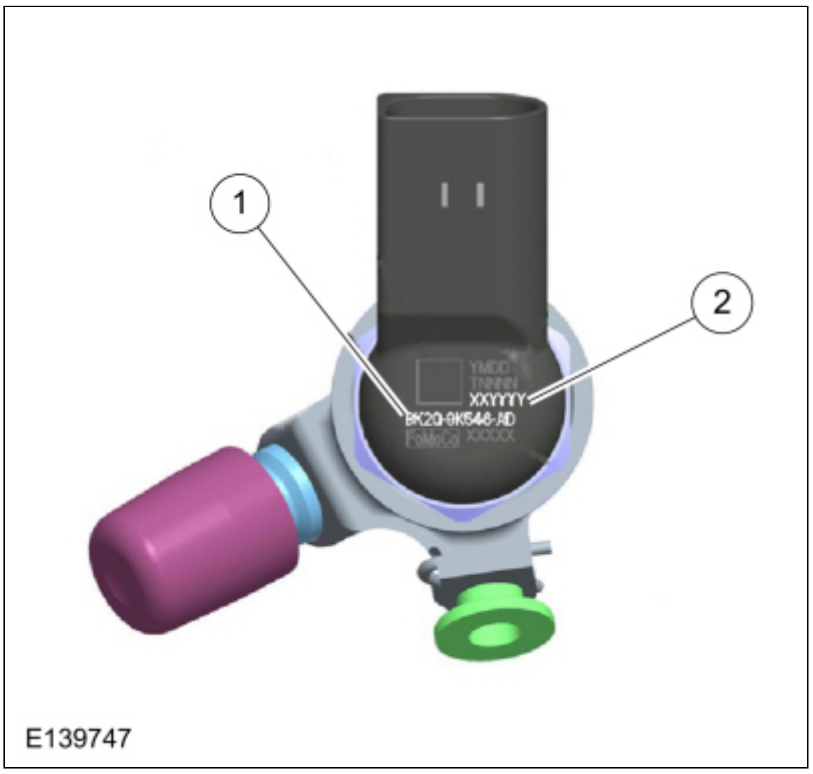
3	—	Fuel injector
4	—	Fuel injector sealing washer
5	—	Fuel injector nozzle
6	—	Fuel injector high-pressure fuel supply line union

The fuel injector(s) are located centrally on the cylinder head upper section and are attached by means of retaining clamps.

The fuel injector(s) are sealed from the combustion chamber by means of a copper sealing washer located between the fuel injector and the cylinder head. A new sealing washer must always be installed when carrying out installation work.

The fuel injectors are controlled directly by the PCM.

The fuel return line(s) are attached to the top of the fuel injector and are connected in series.



Item	Part Number	Description
1	—	Ford part number
2	—	Injector correction factor number

When installing new fuel injectors, the injector correction factor from the new fuel injector(s) must be recorded and uploaded using the Worldwide Diagnostic System (WDS).

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls

Refer to Wiring Diagrams Section 303-14B for schematic and connector information.

Refer to Wiring Diagrams Section 310-00B for schematic and connector information.

Special Tool(s)

 310110	Hand Pressure Pump with Adapter Kit 310-110
 31002518	Test Hose for 310-025 310-025-18
 31002519	Test Hose for 310-025 310-025-19A

General Equipment

Ford diagnostic equipment
Pneumatic vacuum gun

Inspection and Verification

WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times. Failure to follow this instruction may result in personal injury.

NOTICE: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always fit blanking plugs to any open orifices or lines.

NOTE: *As well as carrying out its normal function the glow plug indicator also acts as an engine check lamp which will flash continuously when a hard DTC is detected by the PCM. Soft DTCs are also stored by the PCM but will only be known if the system is checked for DTCs using the Ford diagnostic equipment.*

NOTE: *If a DTC is detected, all DTCs must be cleared after the concern is repaired. Failure to clear all DTCs may cause driveability concerns.*

NOTE: *If the fuel level in the fuel tank drops below approximately four liters, rough running will occur. This is to signal to the driver that the vehicle requires refuelling in order to prevent the fuel system from running dry.*

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Fuel leak(s) – Fuel filter – Air cleaner element – Vacuum line(s)/vacuum connectors – Hose(s)/hose connectors – Tube(s)/tube connectors – Contaminated fuel – Fuel supply line(s) – Fuel return line(s) – High-pressure fuel supply line(s) – Fuel injectors – Fuel rail – Fuel pump	– Fuse(s) – Relay(s) – Wiring harness – Electrical connector(s) – Fuel injectors – Fuel temperature sensor – Fuel rail pressure sensor – Fuel metering valve – Passive anti-theft system (PATS) LED operation – Glow plug indicator – PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:** *A PCM calibration update should only be carried out if it is applicable to the symptoms exhibited by the vehicle.*

   If the cause is not visually evident, verify the symptom and refer to the Ford diagnostic equipment. Check for the availability of an applicable PCM calibration update. Continue using the Ford diagnostic equipment and retrieve the DTCs and refer to the DTC Index Chart.

DTC Index Chart

DTC	Description/Condition	Possible Source	Action
P1250	Fuel metering valve controllability failure (displayed in addition to DTC P0089)	Circuit(s), air ingress into the fuel lines, fuel metering valve	GO to Pinpoint Test B

5. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Symptom Chart

Symptom	Possible Sources	Action
• Engine does not crank and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine does not crank	• Passive anti-theft system (PATS).	• CHECK the PATS LED extinguishes within 3 seconds when the ignition is turned on. REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).
	• Starting system.	• REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Ignition switch.	• REFER to the Wiring Diagrams.
	• PCM.	• REFER to the Ford diagnostic equipment.
	• Engine locked	•

	• Engine locked.	• REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Accessories locked.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
• Engine cranks but does not start and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine cranks but does not start	• Low fuel tank fuel level.	• CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	• Inertia fuel shutoff (IFS) switch.	• RESET the IFS switch.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injectors.	• REFER to the Ford diagnostic equipment.
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Fuel lines damaged or blocked.	• GO to Pinpoint Test A
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Glow plug relay.	• REFER to the Ford diagnostic equipment.
	• Glow plugs.	• REFER to the Ford diagnostic equipment.
	• Crankshaft position (CKP) sensor.	• REFER to the Ford diagnostic equipment.
	• Camshaft position (CMP) sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Low cylinder compression.	• TEST the cylinder compression. REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system.

		complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Air intake blocked.	• REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
	• PCM.	• REFER to the Ford diagnostic equipment.
• Poor starting and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Poor starting	• Low fuel tank fuel level.	• CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi

		(88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Glow plug relay.	• REFER to the Ford diagnostic equipment.
	• Glow plug module.	• REFER to the Ford diagnostic equipment.
	• Glow plugs.	• REFER to the Ford diagnostic equipment.
	• Fuel system leak.	• CHECK the system for fuel leak(s). REPAIR the system as necessary.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Fuel system restriction.	• GO to Pinpoint Test A
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect engine oil.	• INSTALL a new engine oil filter and engine oil. CARRY OUT the oil reset procedure. REFER to the Service interval indicator lamp section within the Owner's Guide.
	• Incorrect power steering fluid.	• DRAIN and REFILL the power steering system with the correct fluid. REFER to: (211-00 Steering System - General Information) Power Steering System Flushing (General Procedures), Power Steering System Filling (General Procedures).

		Power Steering System Bleeding (General Procedures).
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• Manifold absolute pressure (MAP) sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Low cylinder compression.	• TEST the cylinder compression. REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
• Engine starts but immediately stops and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine starts but immediately stops	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Air cleaner	• INSTALL a new air cleaner element.

	element blocked. • Air ingress into the fuel lines. • Accessories load. • CKP sensor. • CMP sensor. • Fuel metering valve. • PCM. • Dual mass flywheel.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). • REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing). • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
• Poor idling and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Poor idling	• Low fuel tank fuel level. • Air cleaner element blocked. • Accessories load. • Fuel filter blocked. • Fuel injector(s). • Incorrect or contaminated fuel.	• CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel. • INSTALL a new air cleaner element. • REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing). • GO to Pinpoint Test A • REFER to the Ford diagnostic equipment. • CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation)

		Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
• Engine stumbling and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine stumbling	• Low fuel level.	• CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

		REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Accelerator pedal position (APP) sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• CMP sensor.	• REFER to the Ford diagnostic equipment.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
• Engine lacks power and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine lacks power	• Low fuel level.	• CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	• Fuel system leak(s).	• Carry out a Fuel System Leak Test using the Ford diagnostic equipment menu options: ToolBox/Powertrain/Service Functions. REFER to the Ford diagnostic equipment.
	• Brakes binding.	• CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	• Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	• ADVISE the customer about the effects of overloading the vehicle and wind resistance on the performance.
	• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Kinked or restricted fuel lines.	• GO to Pinpoint Test A
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi

		(88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Turbocharger. • Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Charge air cooler blocked or cracked. • Charge air cooler pipes split or cracked. • Charge air cooler retaining clips missing or loose.	• INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Vehicle speed sensor (VSS).	• REFER to the Ford diagnostic equipment.

	• MAP sensor. • MAFT sensor. • APP sensor. • CKP sensor. • FRP sensor. • Fuel metering valve. • Incorrect valve timing. • Low cylinder compression. • Catalytic converter blocked. • Wiring harness/connector. • PCM.	• REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment. • CHECK the valve timing. • CHECK the cylinder compression. REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing). • REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). • REFER to the Ford diagnostic equipment. • REFER to the Ford diagnostic equipment.
• Black smoke at idle and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Black smoke at idle	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi

		and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Glow plug module.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Excessive black smoke during acceleration and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Excessive black smoke during acceleration	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines.

		REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• APP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Black smoke at cruising speeds and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Black smoke at cruising speeds	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and

		Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Blue smoke and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Blue smoke	• Engine burning oil.	• CARRY OUT a controlled oil consumption test

		over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 litre per 1000 km (600 miles).
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Positive crankcase ventilation (PCV) system.	• INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	• Turbocharger oil return tube blocked or damaged.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Worn or damaged valve guide(s), piston ring(s), cylinder bore(s), cylinder head or gasket.	• REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage. REFER to: Cylinder Head (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• White smoke and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• White smoke	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system

		through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect valve timing.	• CHECK the valve timing.
	• Coolant in the combustion chamber.	• CARRY OUT a cooling system pressure test. REFER to: Engine Cooling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.

• Engine misfire and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine misfire	• Low fuel tank level.	• CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Engine operating	•

	Engine operating temperature too high.	REFER to: Engine Cooling (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• CMP sensor.	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Low cylinder compression.	• CHECK the cylinder compression. REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Worn or damaged valve(s), tappet(s), camshaft(s) or cylinder head gasket.	• REMOVE the cylinder head. INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage. REFER to: Cylinder Head (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine knock at idle and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine knock at idle	• Low engine oil level.	• CHECK the engine oil level. REFILL as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging

		REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Excessive carbon build up.	• REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up. REFER to: Cylinder Head (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Worn or damaged oil pump. • Worn or damaged timing chain or sprocket. • Major mechanical engine failure.	• INSPECT the engine components.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine knock during acceleration and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine knock during acceleration	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Major mechanical engine failure.	• REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.

• Excessive fuel consumption and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• **NOTE:** *Before proceeding with any of the actions in relation to the possible sources for excessive fuel consumption, a fuel consumption test must be carried out using the Ford diagnostic equipment.* • Excessive fuel consumption	• Brakes binding.	• CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	• Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	• ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Injectors (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation). REFER to: Fuel Rail (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel system leak(s).	• CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	• Incorrect engine	• INSTALL a new oil filter and engine oil.

	oil.	
	• Generator.	• REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Turbocharger.	• REFER to: Turbocharger (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect valve timing.	• CHECK the valve timing.
	• Slipping clutch.	• REFER to: Clutch (308-01A Clutch - 5-Speed Manual Transmission - MT75, Diagnosis and Testing), Clutch (308-01B Clutch - 6-Speed Manual Transmission - MT82, Diagnosis and Testing).
	• Low cylinder compression.	• CHECK the cylinder compression. REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine cuts out during hard	• CMP sensor.	• REFER to the Ford diagnostic equipment.

acceleration	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• Incorrect pilot learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect pump learn.	
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.

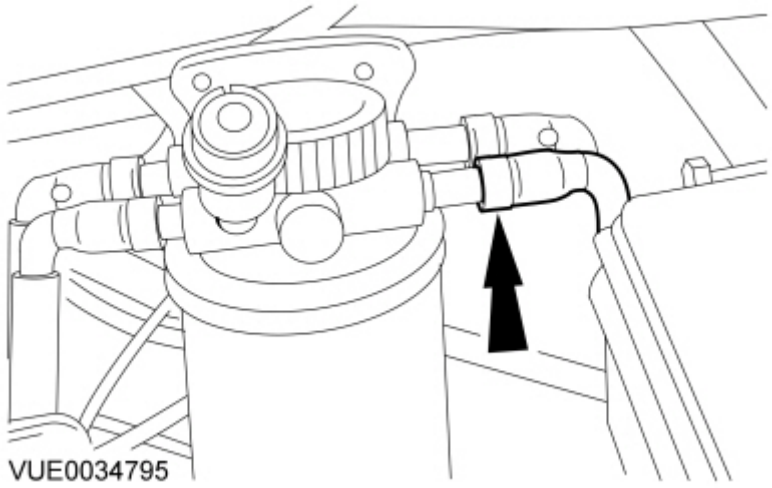
Pinpoint Tests

PINPOINT TEST A : FUEL PUMP FUEL SUPPLY TEST

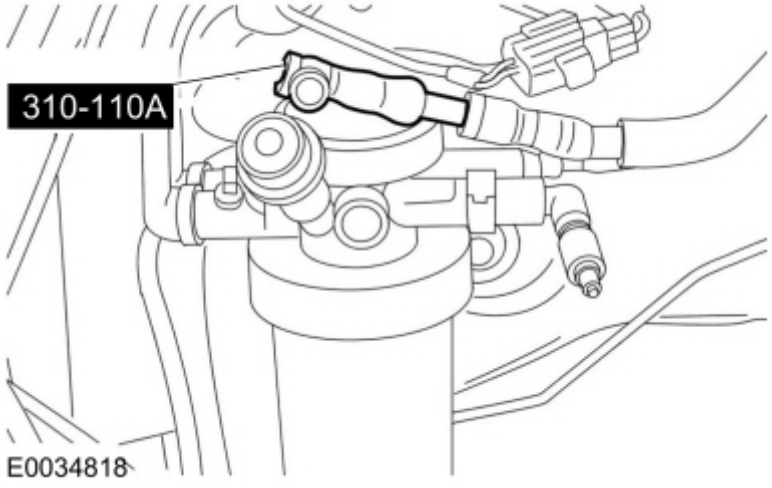
A1 CHECK THE FUEL PUMP FUEL SUPPLY PRESSURE

- **NOTE:** *The graphics used are for illustration purposes only.*

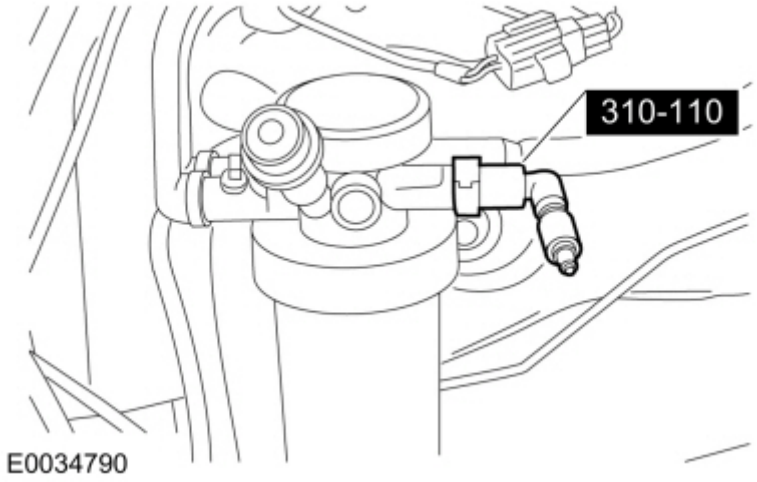
  Clean the area around the fuel filter quick release couplings.
  REFER to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Disconnect the fuel tank to fuel filter fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



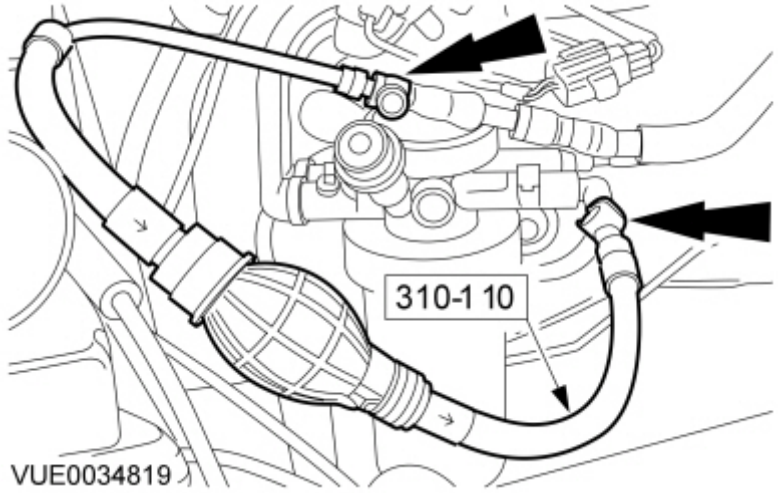
- Install the special tool adapter to the fuel tank to fuel filter fuel supply line.



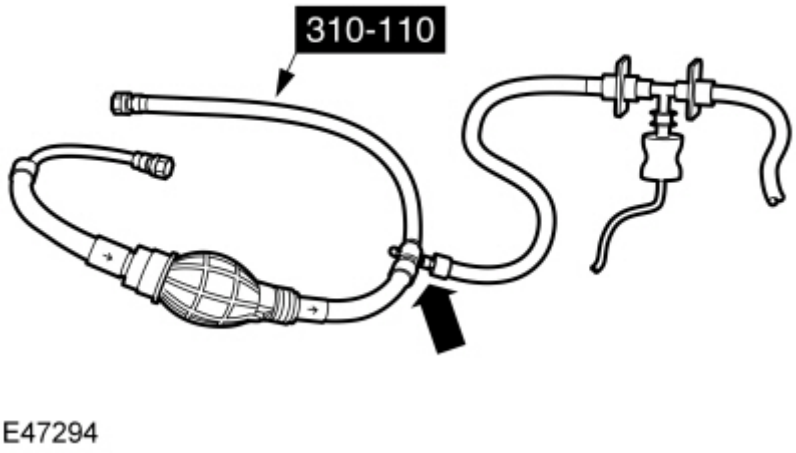
- Install the special tool adapter to the fuel filter.



- **NOTE:** *Make sure that the hand primer arrow indicating the fuel flow is pointing towards the fuel filter.* Install the special tool between the special tool adapters.



- Connect the Ford diagnostic equipment pressure transducer to the special tool.



- Using the Ford diagnostic equipment, select the digital multi meter (DMM) function from the toolbox menu. Select the pressure vacuum transducer (PVT) function and configure the DMM to display pressure/vacuum.
- Start the engine.
- Allow the engine to idle for at least one minute.
- Make a note of the value displayed by the Ford diagnostic equipment.

Is the value displayed between -50 mB and -250 mB?

Yes	GO to A3
No	If the displayed value is between 0 mB and -50 mB, GO to A2

	If the displayed value is -250 mB or a greater negative value, GO to A4

A2 CHECK THE FUEL SYSTEM FOR AIR INGRESS

- **NOTE:** *A small amount of air bubbles in the fuel supply line is acceptable.*

  Observe the flow of fuel through the clear plastic pipe of the hand pressure pump.

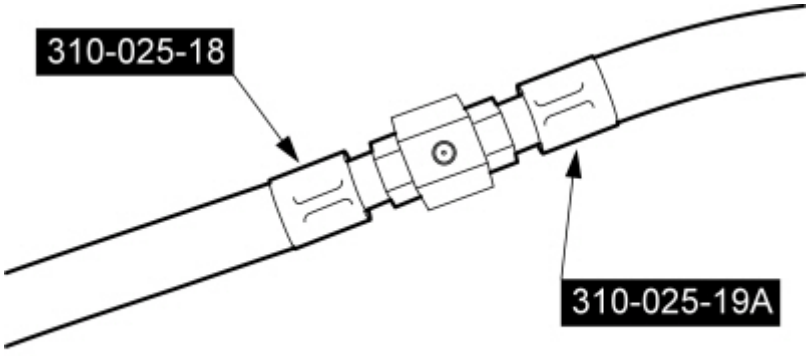
Is the hand pressure pump clear plastic pipe free from an excessive volume of air bubbles?

Yes	Using the Ford diagnostic equipment, guided diagnostic, run the fuel system pressure test, CHECK the fuel pump high-pressure fuel supply pressure.
No	CHECK for air ingress into the fuel lines. REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

A3 CHECK THE FUEL PUMP FUEL RETURN PRESSURE

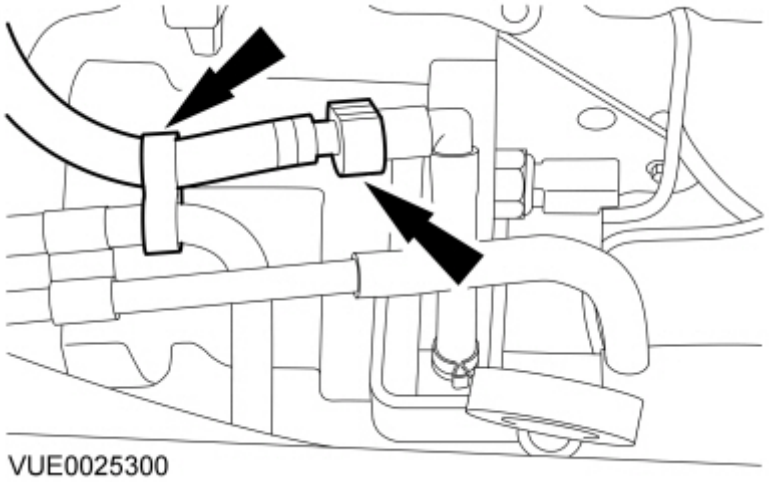
NOTE: *Before this test can be carried out, the latest calibration must be programmed into the PCM.*

- Clean the area around the fuel injector to fuel pump fuel return line quick release coupling.
  REFER to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Connect special tools 310-025-18 and 310-025-19A to the Ford diagnostic equipment pressure transducer adaptor GV2323.



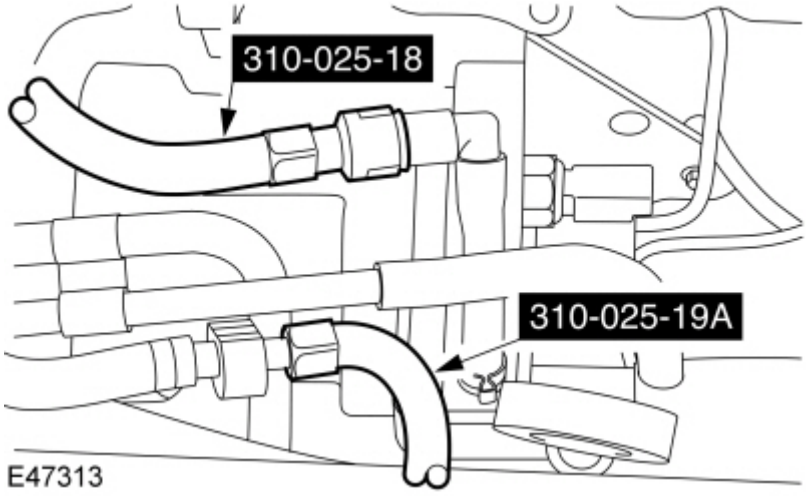
E46840

- Disconnect the fuel injector to fuel pump fuel return line quick release coupling.

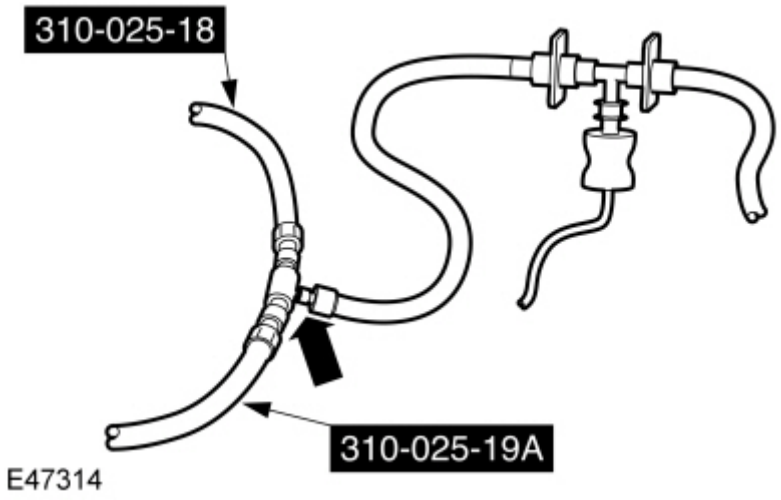


VUE0025300

- Connect the special tools between the fuel injector to fuel pump fuel return line and the fuel pump.



- Start the engine.
- Using the Ford diagnostic equipment data logger function, monitor the fuel system temperature until a temperature of over 50°C is obtained.
- Stop the engine.
- Disconnect the Ford diagnostic equipment pressure transducer from the special tool 310-110.
- Connect the Ford diagnostic equipment pressure transducer to the Ford diagnostic equipment pressure transducer adaptor GV2323.



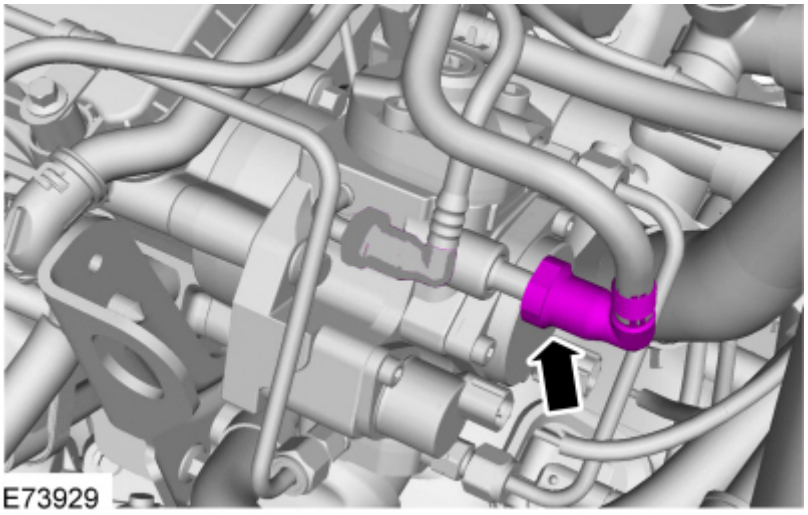
- Using the Ford diagnostic equipment, select the digital multimeter (DMM) function from the toolbox menu. Select the pressure vacuum transducer (PVT) function and configure the DMM to display pressure/vacuum.
- Start the engine.
- Make a note of the value displayed by the Ford diagnostic equipment with the engine at idle.

Is the value displayed less than 400mB at idle.

Yes	Using the Ford diagnostic equipment fuel system fuel pressure test. CHECK the fuel pump high-pressure fuel supply pressure. If no fault is indicated with the fuel pump high-pressure fuel supply pressure, RETURN to the Symptom Chart.
No	CHECK the fuel return system for damage or restriction. REPAIR or INSTALL new components as required. TEST the system for normal operation.

A4 CHECK THE FUEL PUMP FUEL SUPPLY SYSTEM FOR RESTRICTION

- Clean the area around the fuel pump fuel supply line quick release coupling.
  REFER to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Disconnect the fuel pump fuel supply line.
  - Install a blanking plug to the open end of the fuel pump union.



- Place the open end of the fuel pump fuel supply line into a clean container.
- Operate the hand pressure pump at least three times in rapid succession and observe the value displayed by the Ford diagnostic equipment.

Does the fuel pressure indicated by the Ford diagnostic equipment when operating the hand pressure pump instantly fall to zero when the hand pressure pump is released?

Yes	CHECK the fuel level sensor and fuel tank fuel supply line for restriction. REPAIR or INSTALL new components as required.
No	INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). Test the system for normal operation.

PINPOINT TEST B : DTC P1250 - FUEL METERING VALVE CONTROLLABILITY FAILURE

B1 CHECK FOR AIR INGRESS INTO THE FUEL LINES

- Check for air ingress into the fuel system.
  REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

Are there signs of air ingress into the fuel system?

Yes	REPAIR the system as recommended in the fuel system diagnostic. CLEAR the DTCs. TEST the system for normal operation.
No	GO to B2

B2 CHECK THE FUEL RAIL PRESSURE SENSOR CIRCUIT

- Using the wiring diagrams, CHECK the fuel rail pressure sensor circuit wiring harnesses and electrical connectors for electrical shorts or damage.

Is the fuel rail pressure sensor circuit shorted or damaged?

Yes	REPAIR the circuit as necessary. TEST the system for normal operation.

No	GO to B3

B3 CHECK THE FUEL METERING VALVE CIRCUIT

- Using the wiring diagrams, CHECK the fuel metering valve circuit wiring harnesses and electrical connectors for electrical shorts or damage.

Is the fuel metering valve circuit shorted or damaged?

Yes	REPAIR the circuit as necessary. TEST the system for normal operation.
No	GO to B4

B4 CHECK THE OPERATION OF THE FUEL METERING VALVE

NOTE: *This test requires the aid of another technician.*

- Connect the Ford diagnostic equipment.
- Start the engine.
- Using the Ford diagnostic equipment, DATALOGGER, set the parameters FRP, FRP_DSD, VSS, RPM, MFDES,SCV_DC, SCV_AMP.
- Carry out a road test.
- Select second gear.
- Release the accelerator pedal and allow the engine speed to decrease to idle while the vehicle is moving with second gear engaged.
- Rapidly apply full throttle until the engine speed reaches 4,000 RPM and then immediately release the accelerator pedal, allowing the engine speed to return to idle while the vehicle is moving with second gear engaged.
- Repeat step 7 approximately four times consecutively.
- Observe the recorded data from the tests.

Is the value for the FRP parameter data either staying constant or not changing with the FRP_DSD parameter data?

Yes	This indicates that the fuel metering valve is either stuck or not responding. INSTALL a new fuel metering valve. TEST the system for normal operation.
No	CLEAR the DTC and REPEAT the test. If the concern persists, INSTALL a new fuel metering valve. TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Fuel Injection Component Cleaning

General Equipment

Pneumatic vacuum gun

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry out any repairs to the fuel injection system with the engine running. The fuel pressure within the system can be as high as 1600 bar. Failure to follow this instruction may result in personal injury.

WARNING: Eye protection must be worn at all times when working on or near any fuel related components. Failure to follow this instruction may result in personal injury.

NOTICE: Make sure that the workshop area in which the vehicle is being worked on is as clean and dust-free as possible. Areas in which work on clutches, brakes or where welding or machining are carried out are not suitable in view of the risk of contamination to the fuel system.

NOTICE: Make sure that clean non-plated tools are used. Clean tools using a new brush that will not lose its bristles and fresh suitable evaporative cleaning agent, prior to starting work on the vehicle.

NOTICE: Use a steel topped workbench and cover it with clean, lint-free non-flocking material.

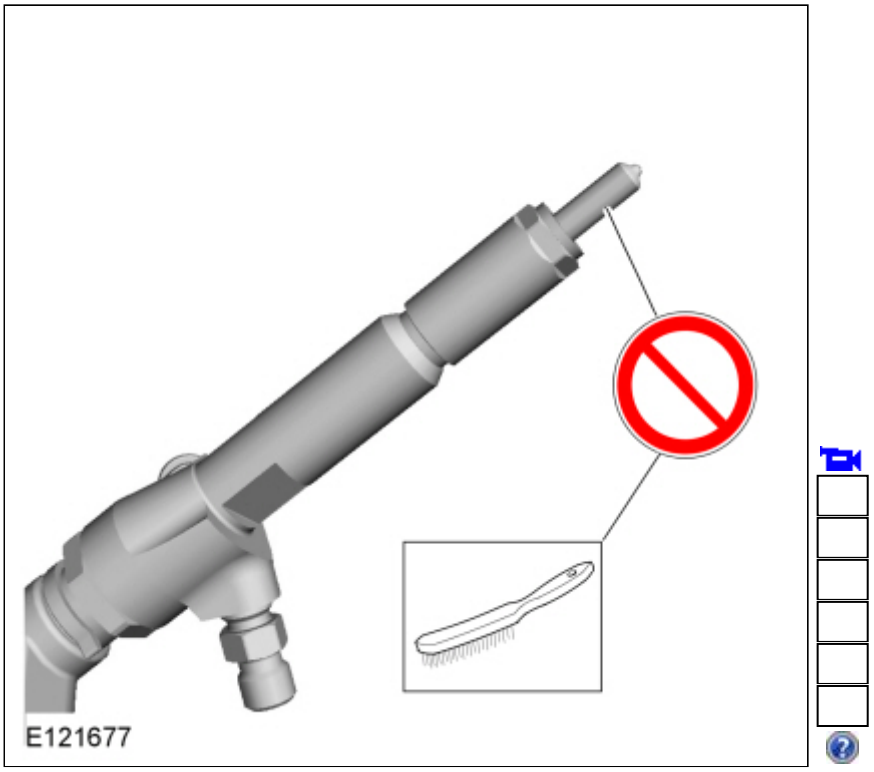
NOTICE: Make sure that all parts removed from the vehicle are placed on the lint-free non-flocking material.

NOTICE: Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.

NOTICE: Make sure that any protective gloves worn are new and are of the non-powdered latex type.

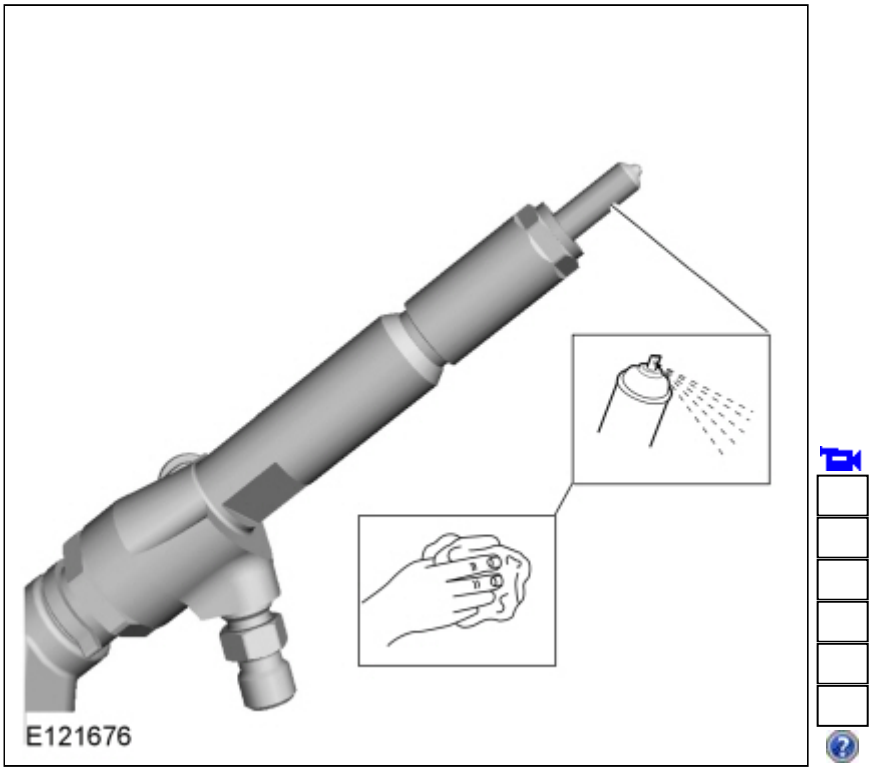
NOTICE: Before using the suitable evaporative cleaning agent, protect all electrical components and connectors with lint-free non-flocking material.

1. For additional information, refer to: Solvents, Sealants and Adhesives (100-00 General Information, Description and Operation).
   For additional information, refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2.



NOTICE: Use lint free cloth.

3. Using Brake Cleaner: 3U7J-2C410-AA



4. Using a new brush that will not lose its bristles, brush a suitable evaporative cleaning agent onto the components being removed and onto the surrounding area.
5. Using the pneumatic vacuum gun, remove all traces of evaporative cleaning agent and foreign material.
6. Dispose of any unused evaporative cleaning agent and the brush after completing the repair.

Copyright © 2016 Ford Motor Company

Fuel Injection Pump Washer

Special Tool(s) / General Equipment

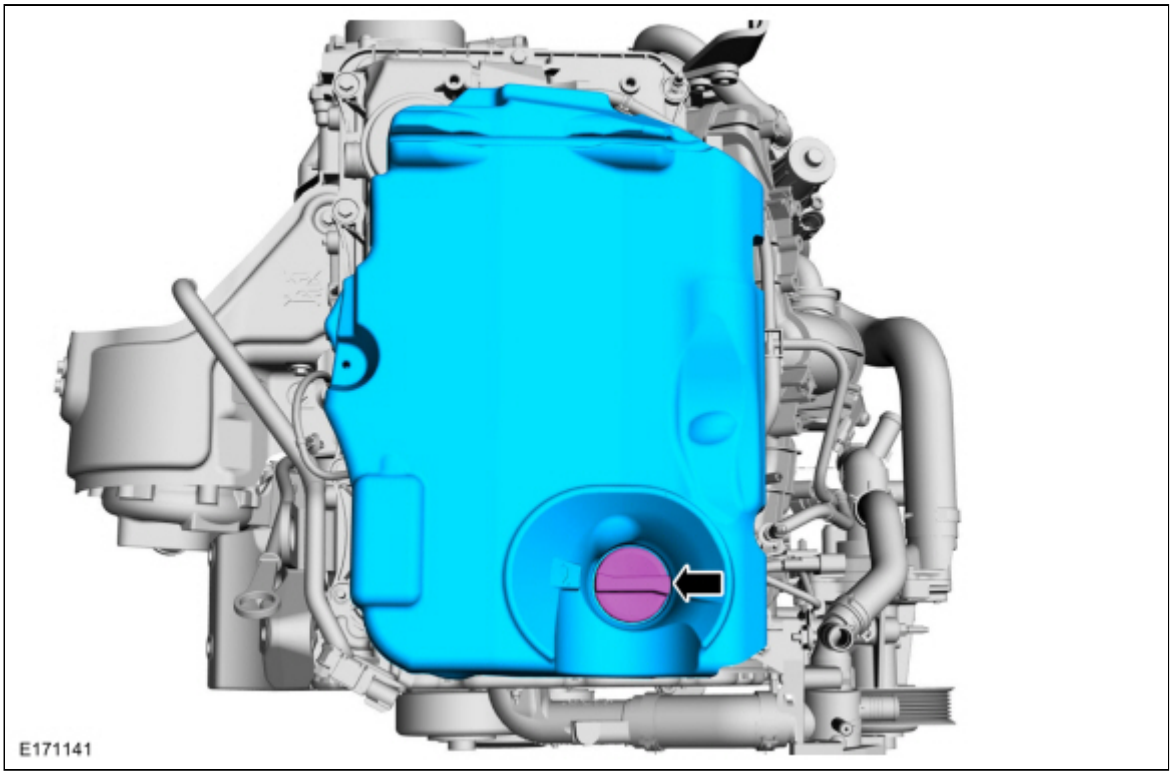
Magnetic Socket
Cable Ties

Materials

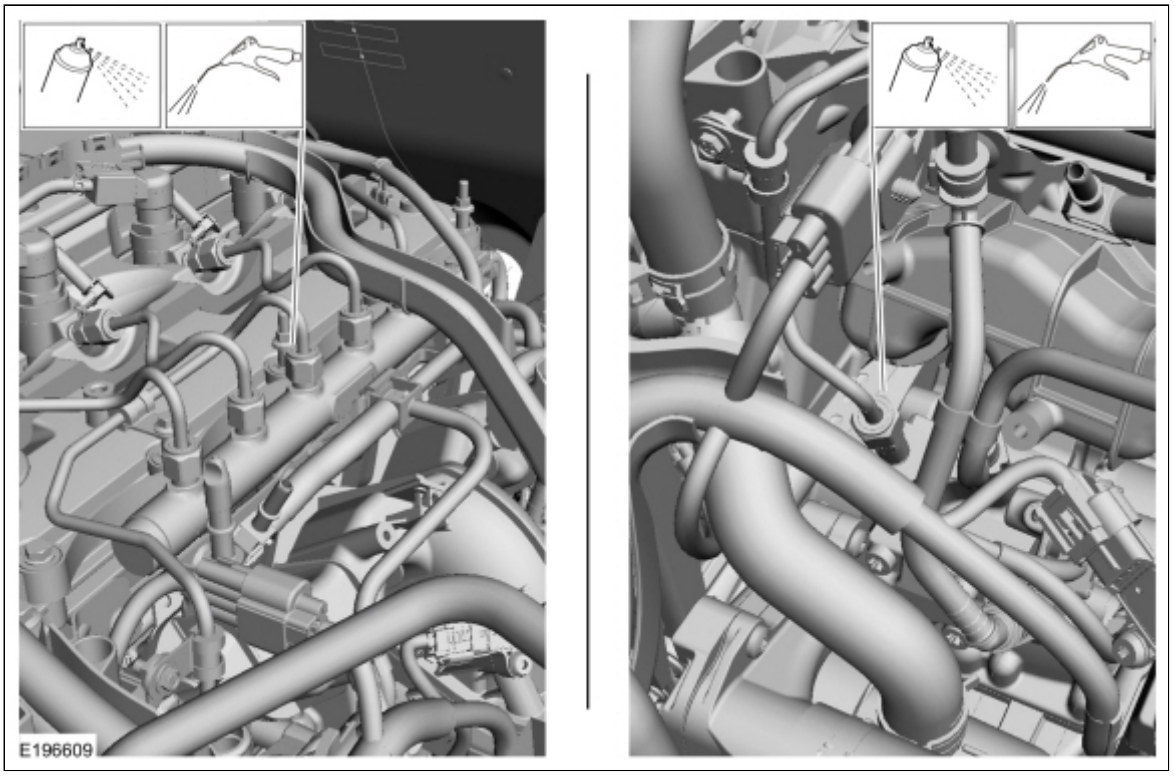
Name	Specification
Brake Cleaner	-

Removal

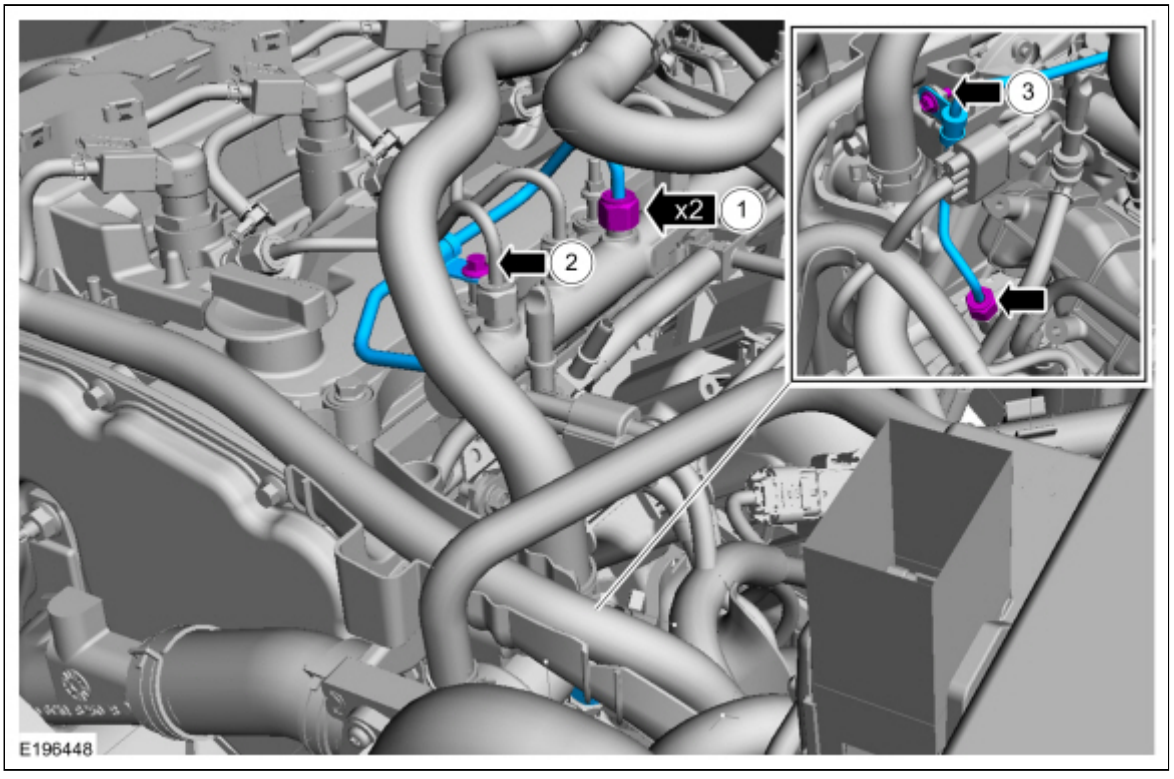
1.



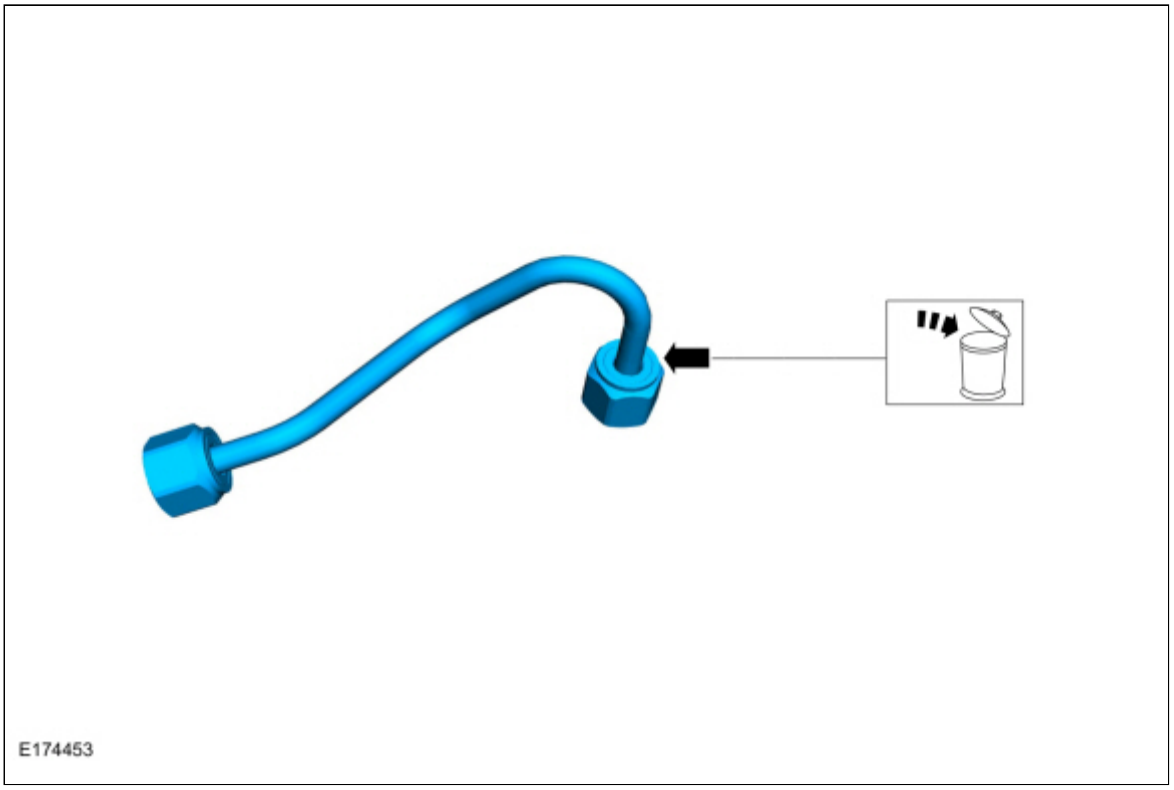
2. Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



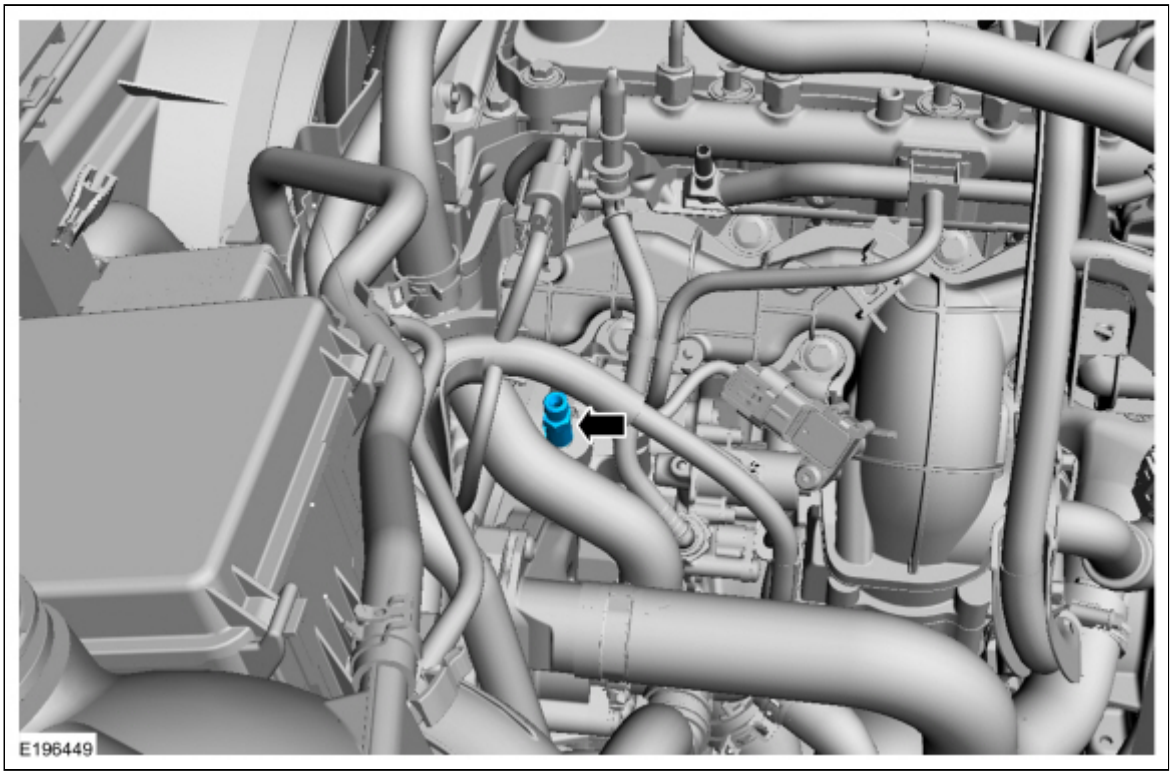
3. **NOTE:** *Be prepared to collect escaping fluid.*



4.



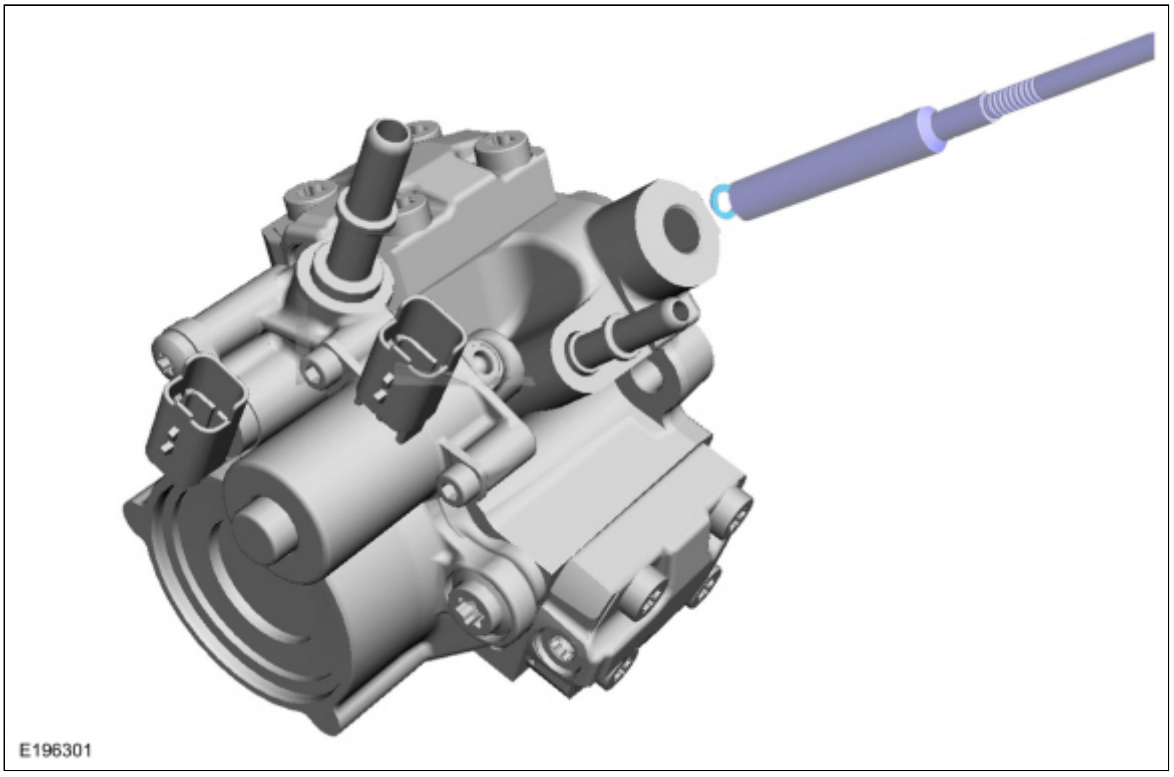
5.



6. **NOTICE: Only use the specified special tool.**

   NOTICE: Make sure that tools and equipment are clean, free of foreign material and lubricant.

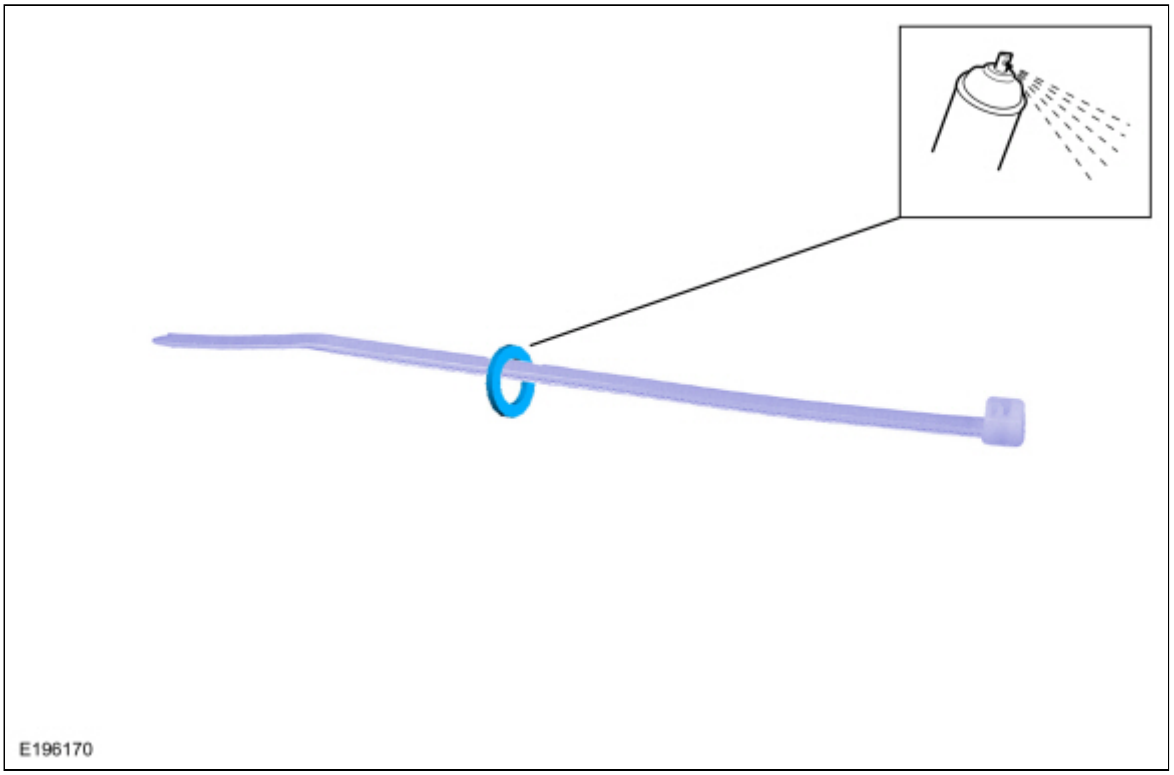
   Use the General Equipment: Magnetic Socket



Installation

1. **NOTE:** *Make sure that a new component is installed.*

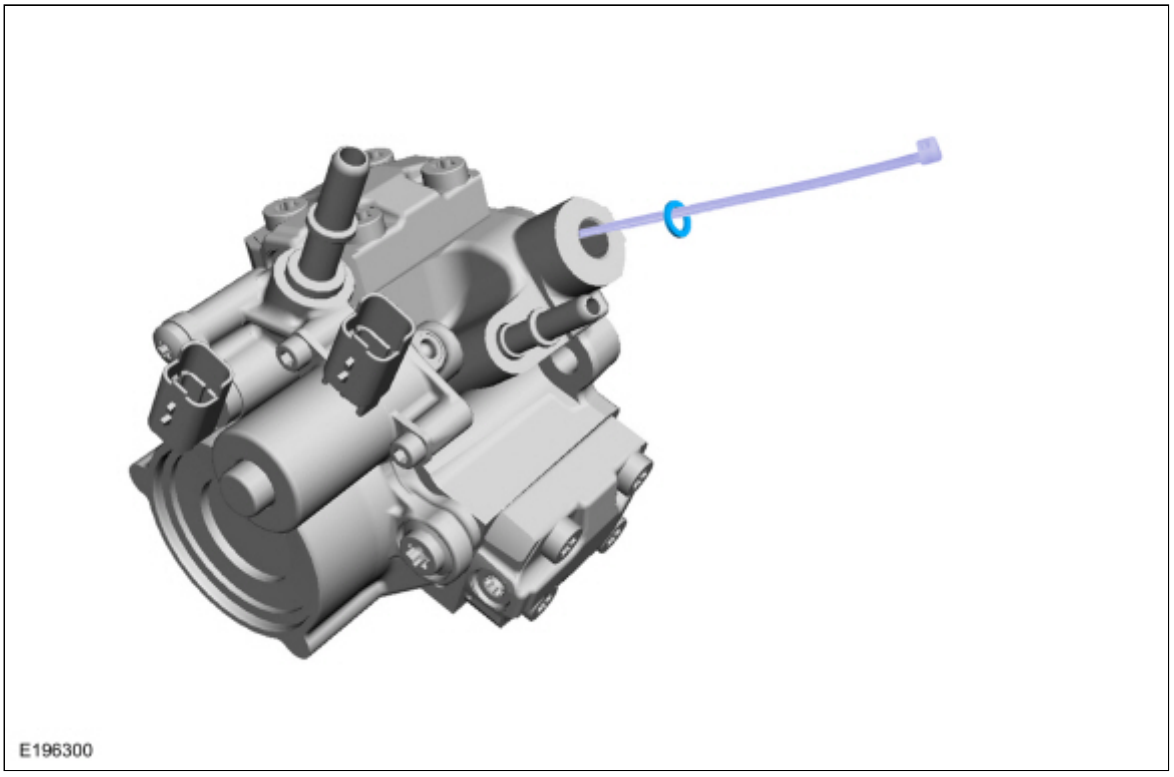
   Use the General Equipment: Cable Ties
   Material: Brake Cleaner



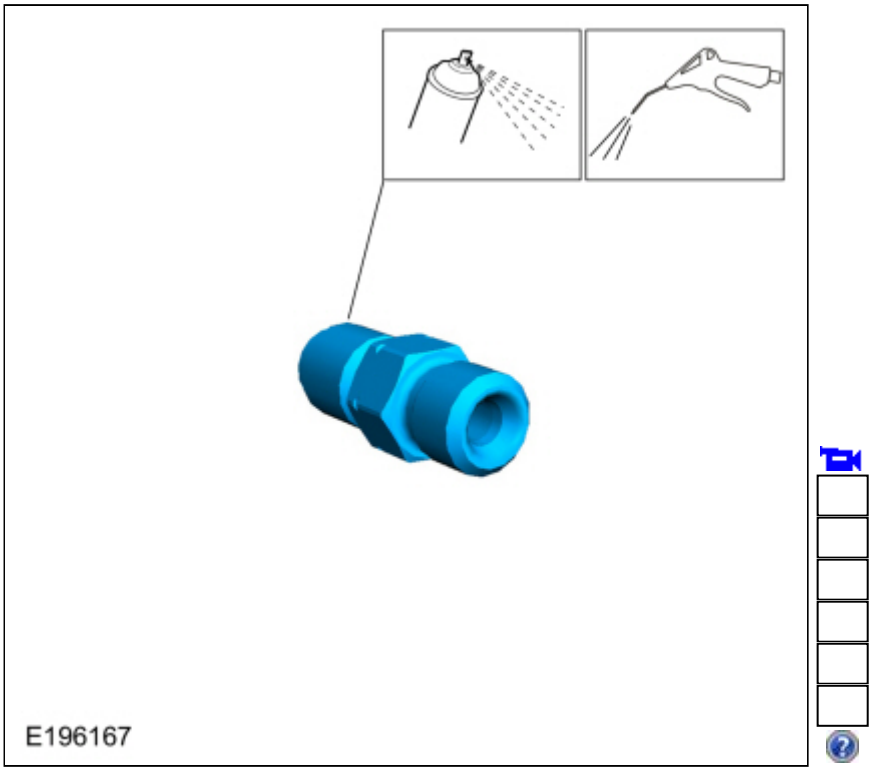
2. **NOTICE: Only use the specified special tool.**

   NOTE: *Make sure that a new component is installed.*

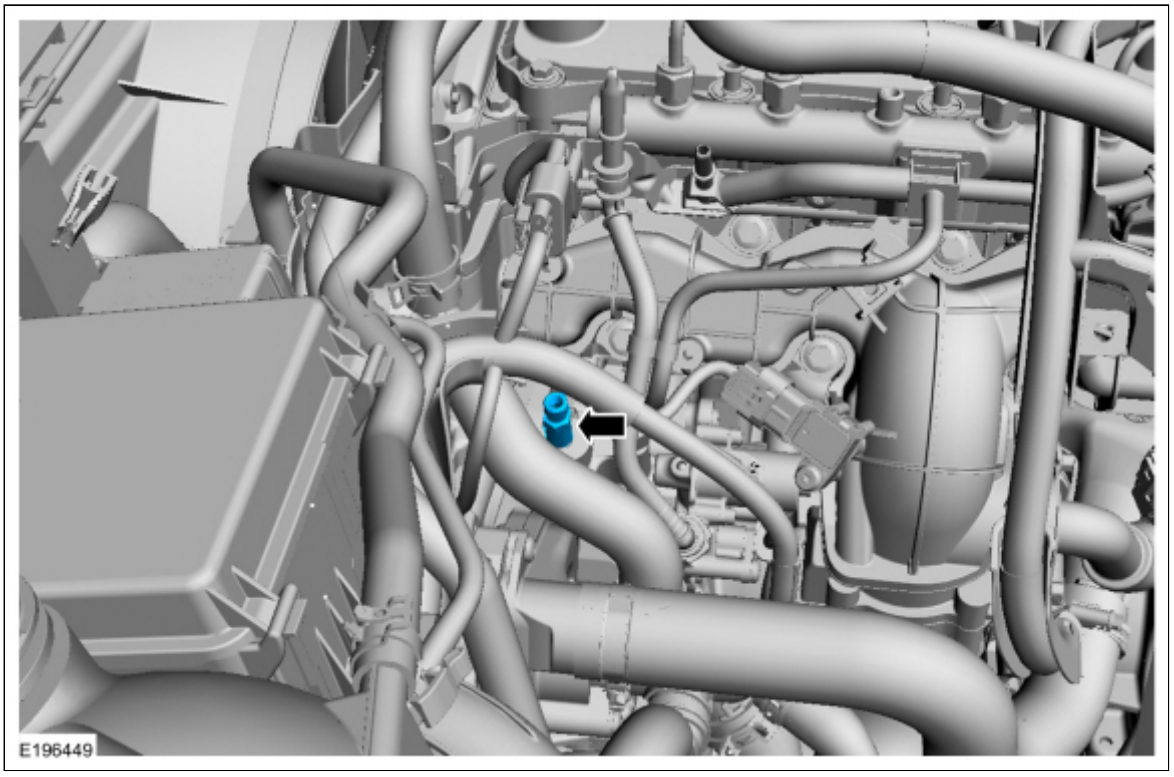
   Use the General Equipment: Cable Ties



3. *Material*: Brake Cleaner

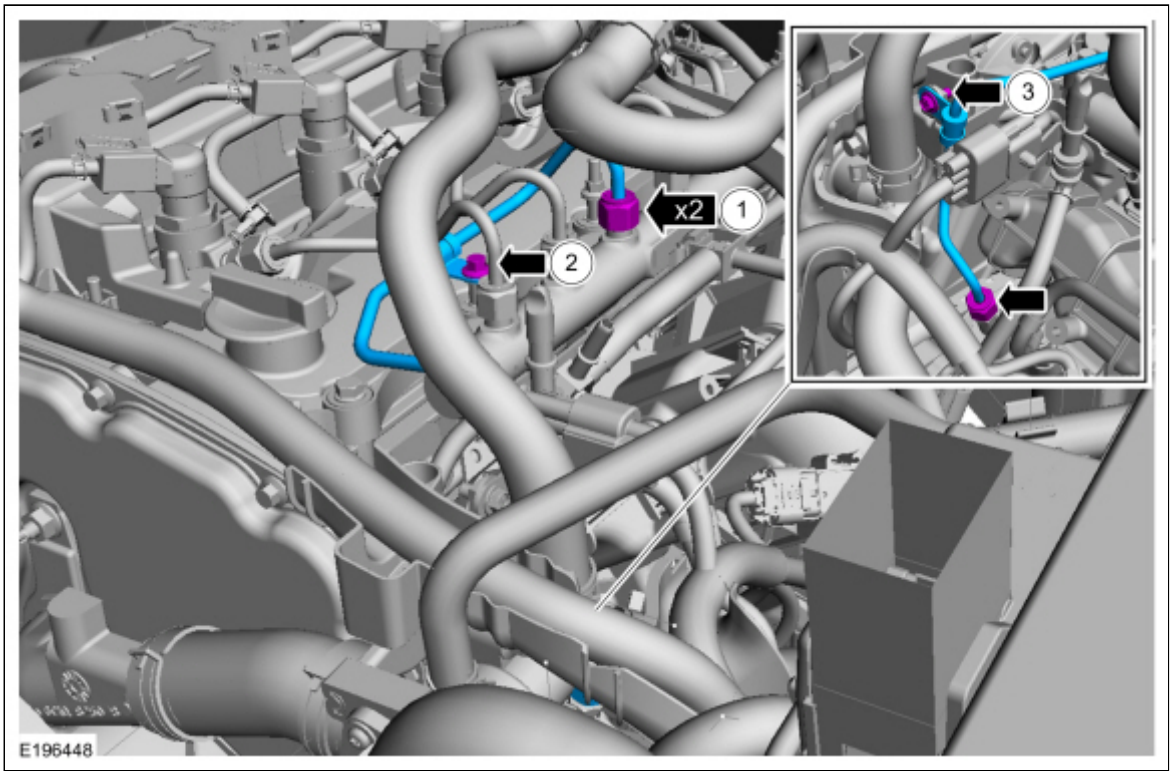


1. *Torque*: 27 Nm
2. Wait 5 seconds.
3. *Torque*: 37 Nm

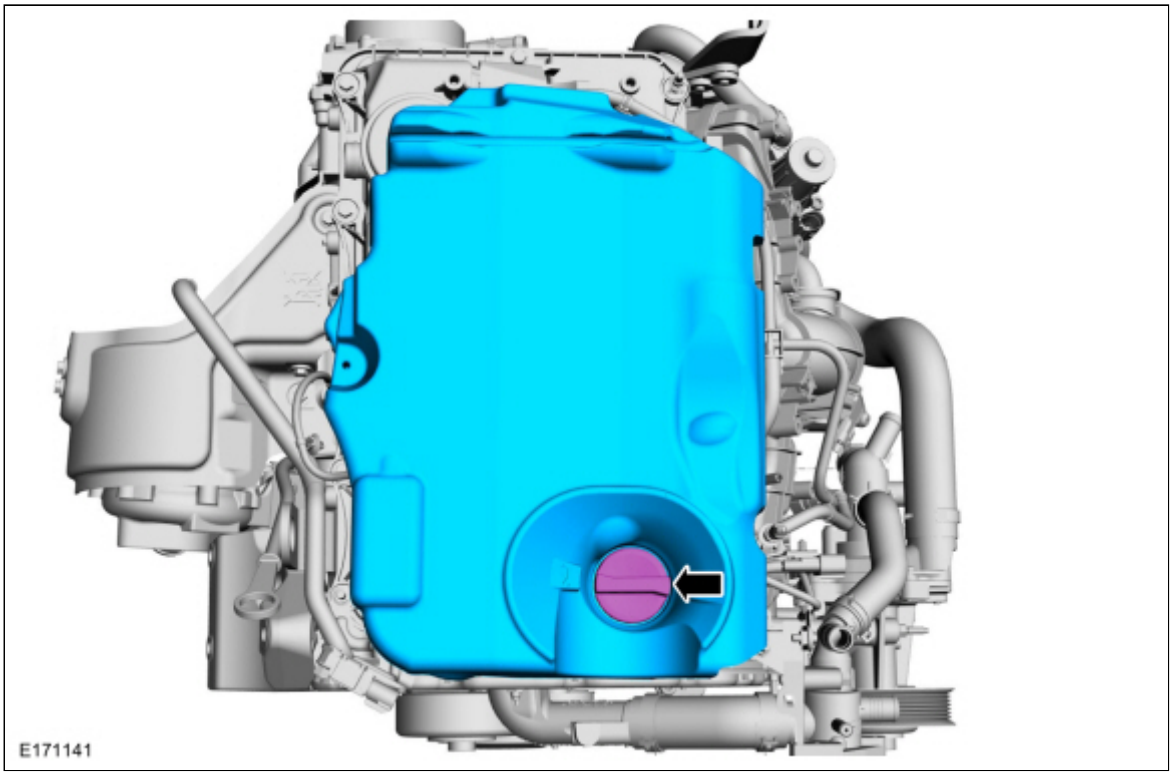


5. **NOTE:** *Make sure that a new component is installed.*

1. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 30 Nm
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



6.



Copyright © 2016 Ford Motor Company

Fuel Injector Washer

Special Tool(s) / General Equipment

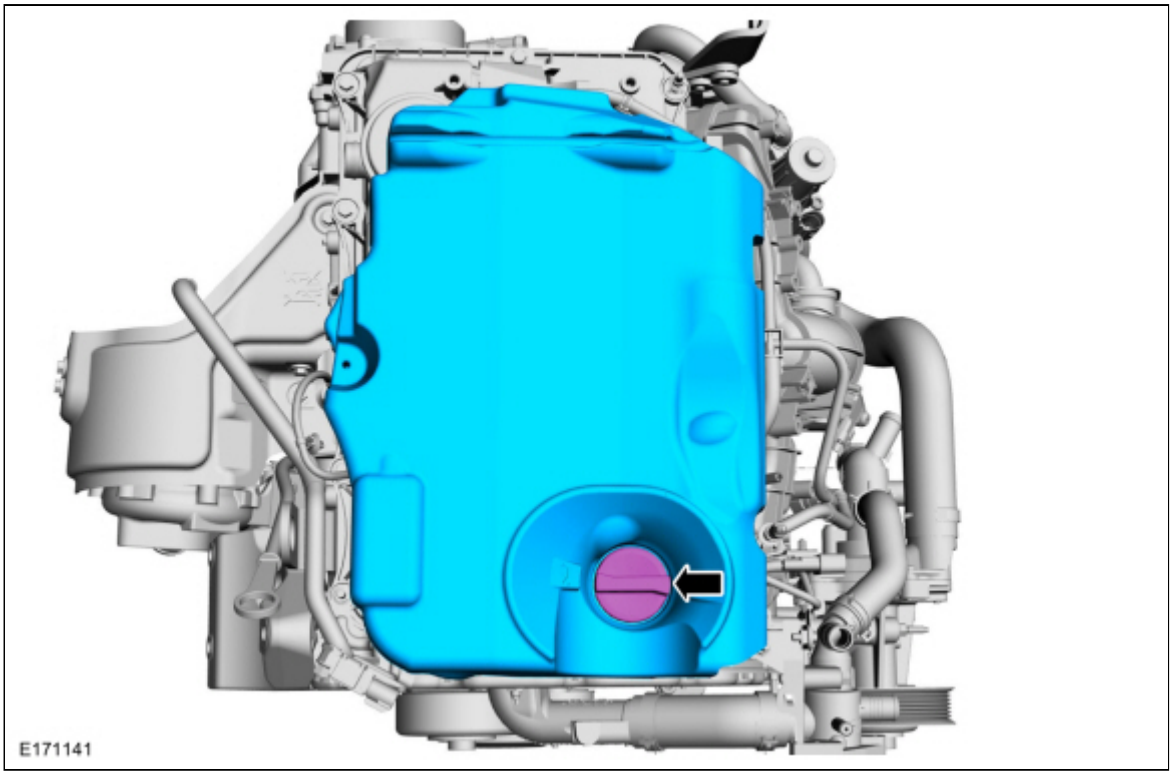
Magnetic Socket
Cable Ties

Materials

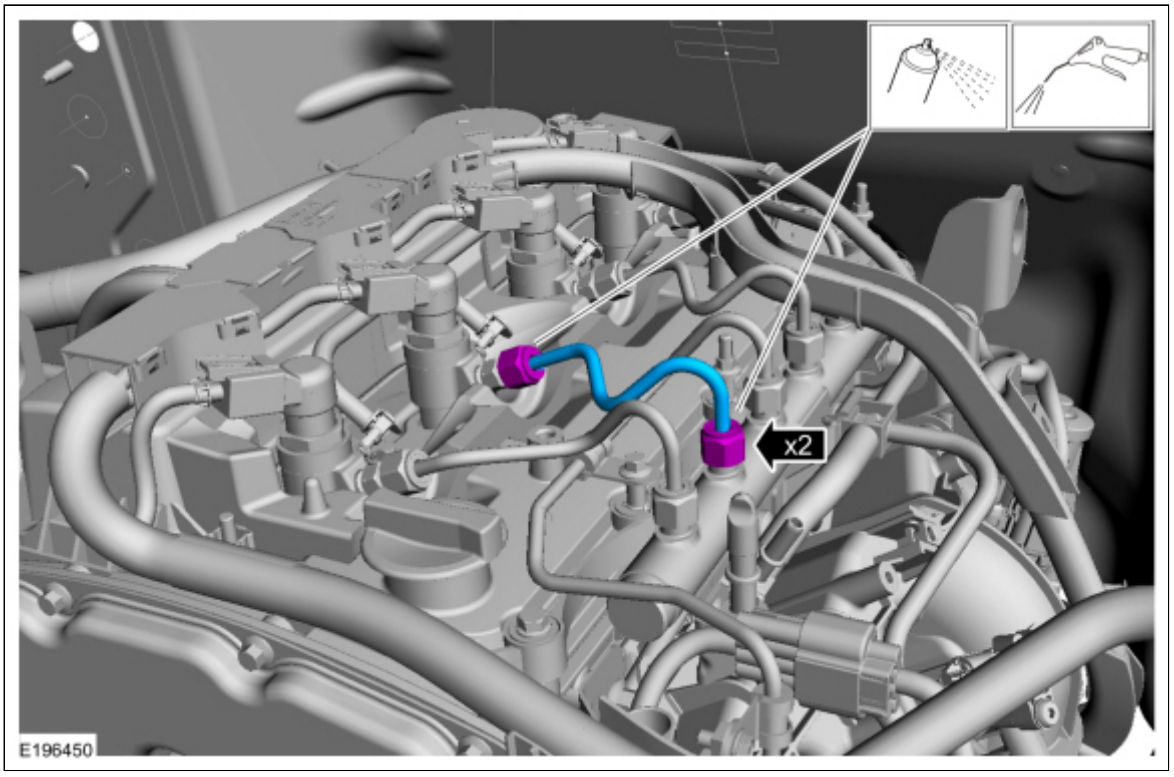
Name	Specification
Brake Cleaner	-

Removal

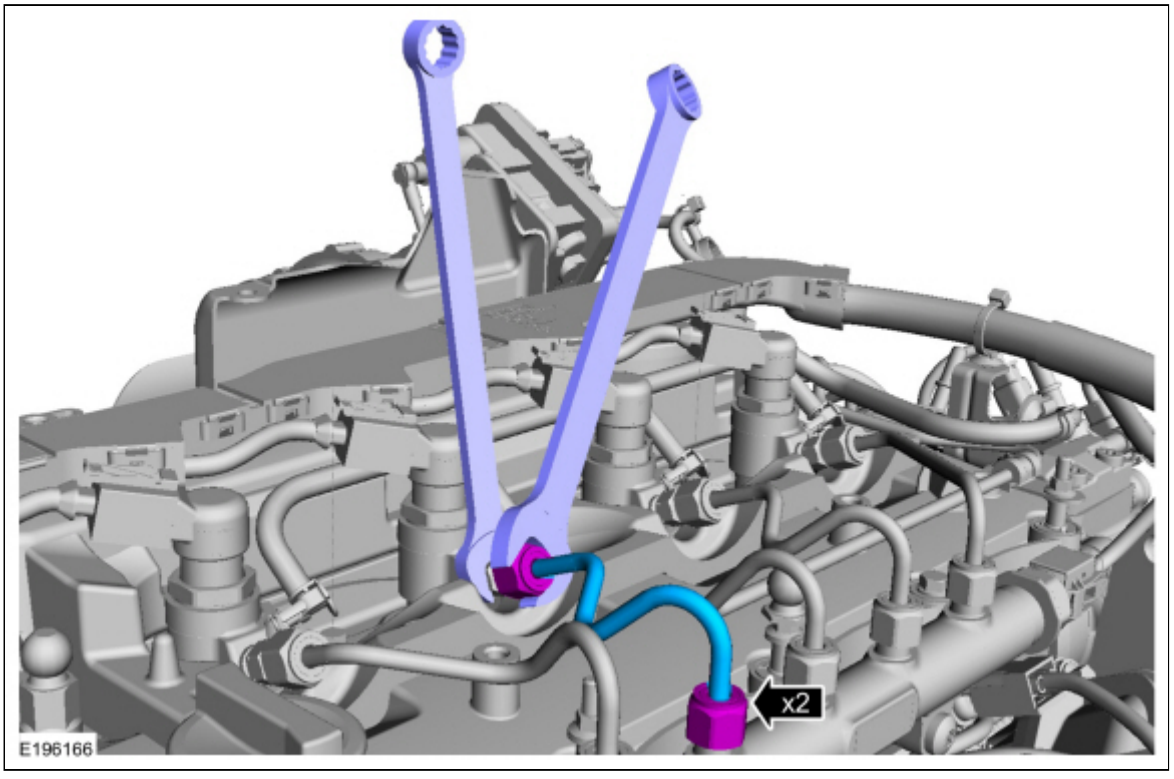
1.



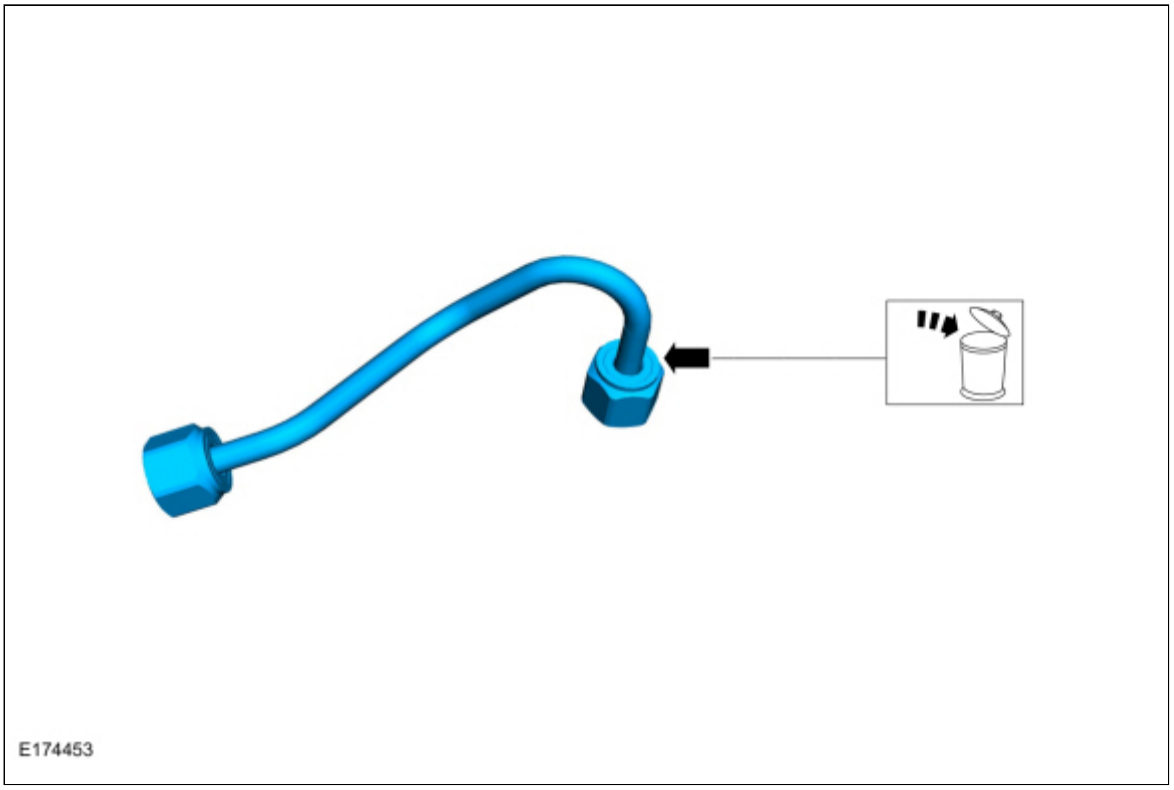
2. Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



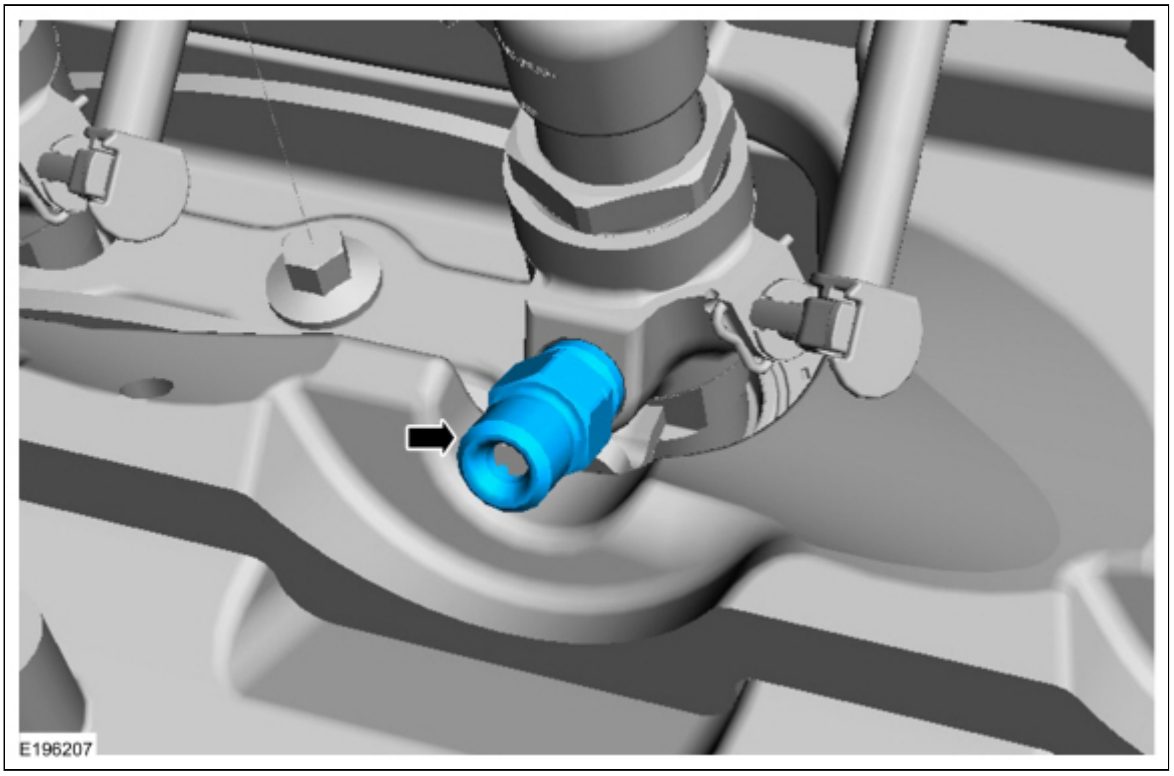
3. **NOTE:** *Use suitable paper to absorb any escaping fluid.*



4.



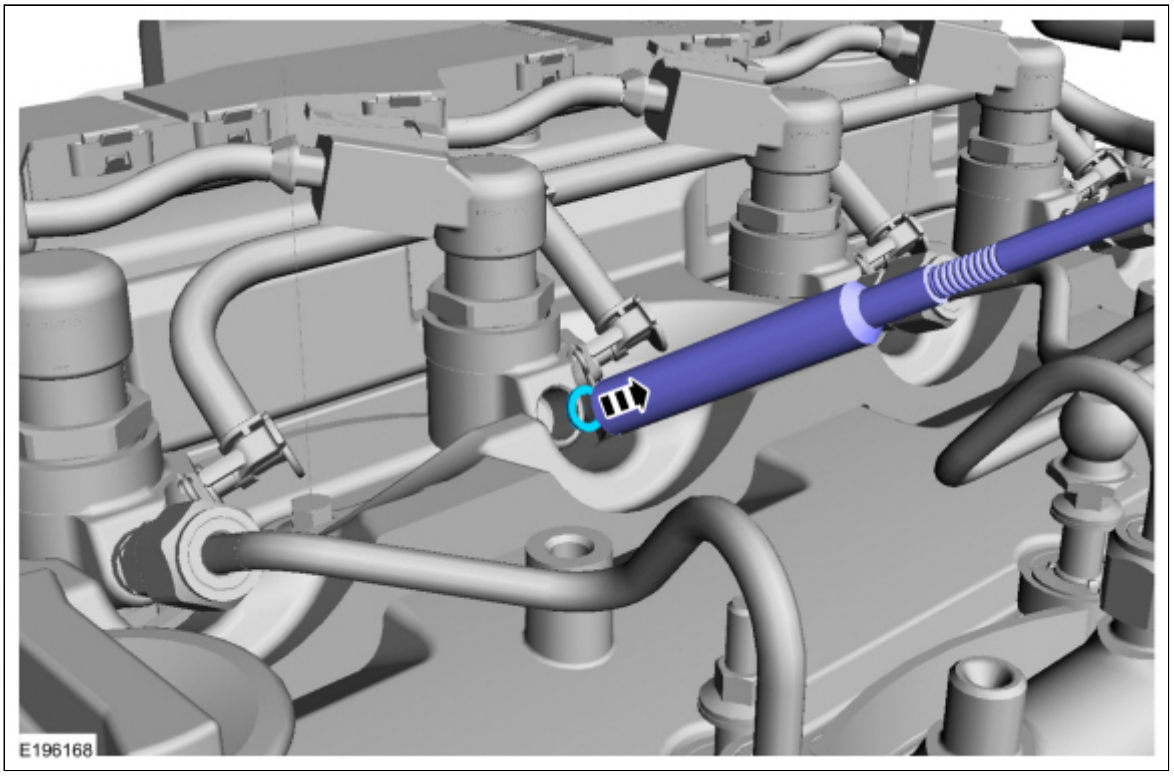
5.



6. **NOTICE: Only use the specified special tool.**

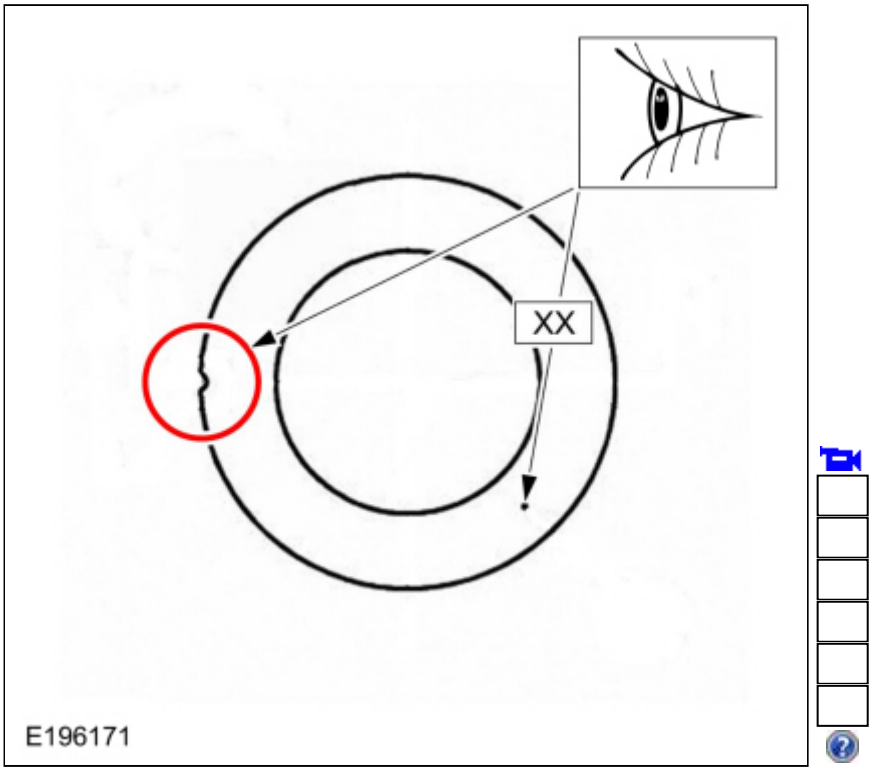
   NOTICE: Make sure that tools and equipment are clean, free of foreign material and lubricant.

   Use the General Equipment: Magnetic Socket



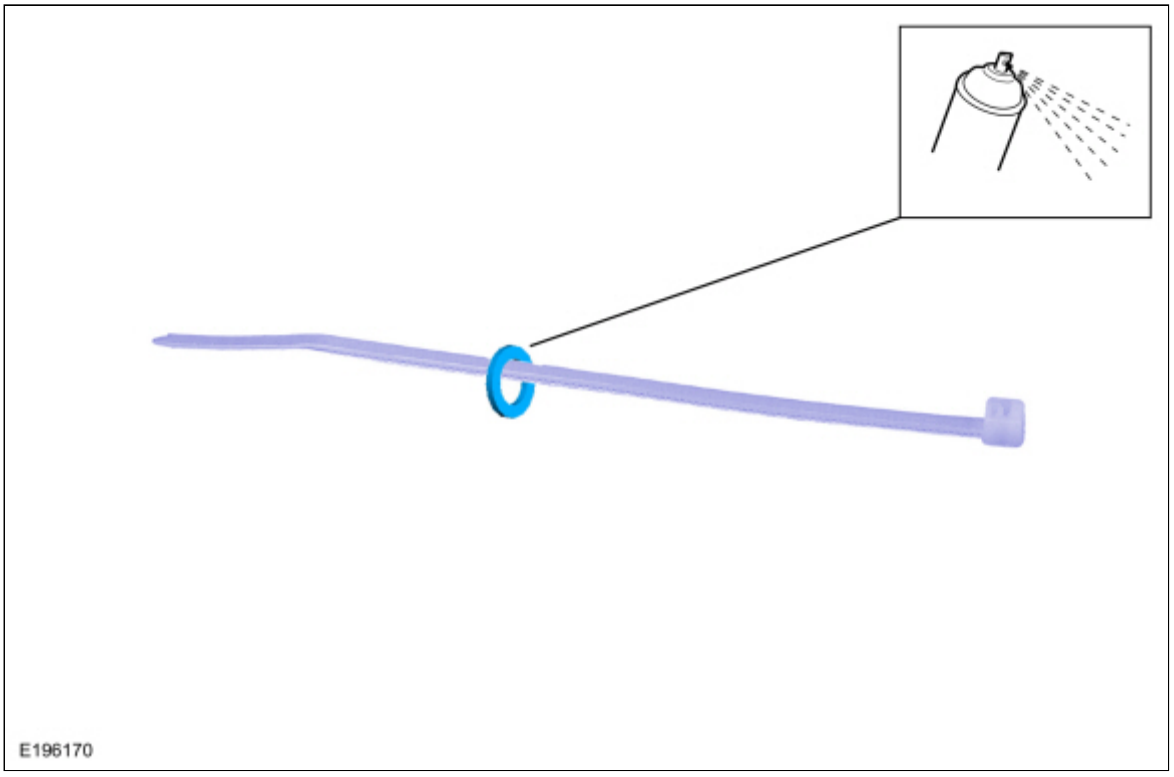
Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. **NOTE:** *Make sure that a new component is installed.*

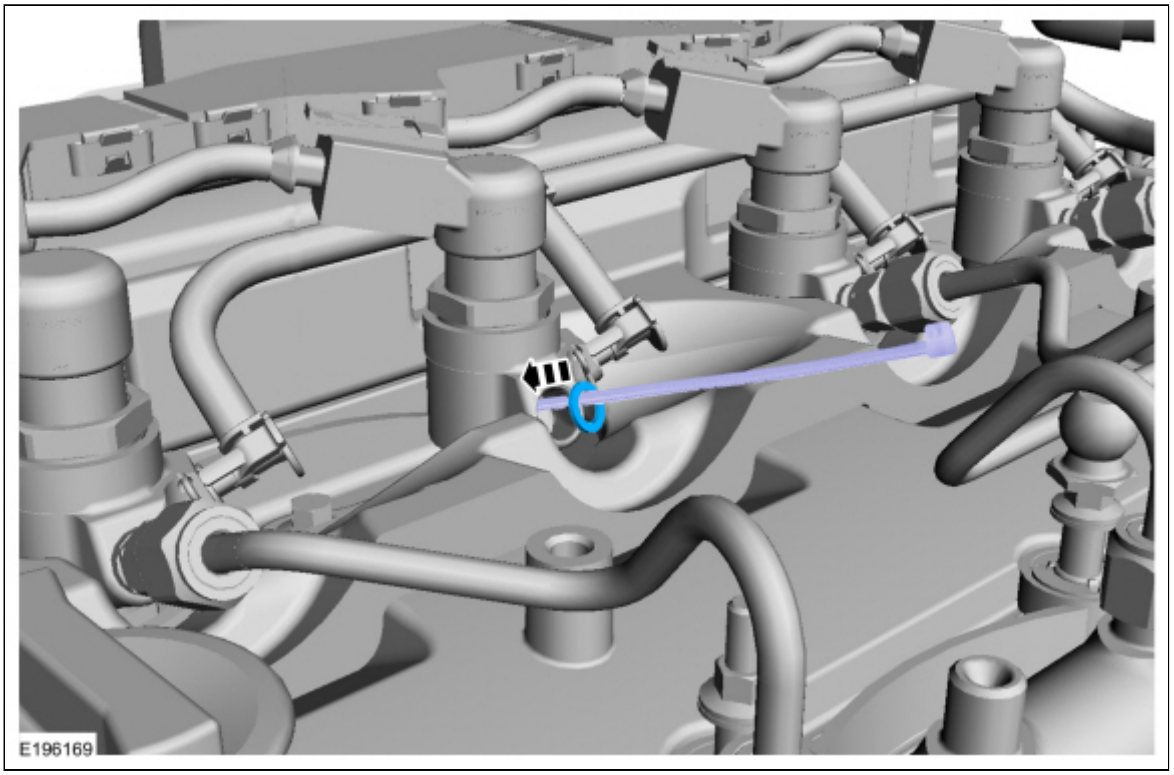
   Use the General Equipment: Cable Ties
   Material: Brake Cleaner



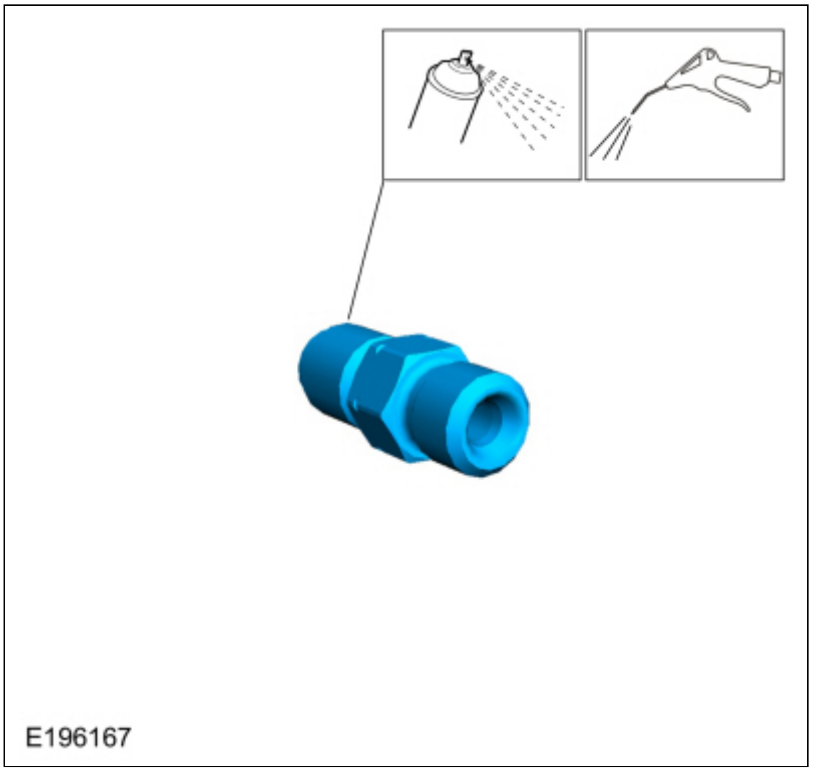
3. **NOTICE: Only use the specified special tool.**

   NOTE: *Make sure that a new component is installed.*

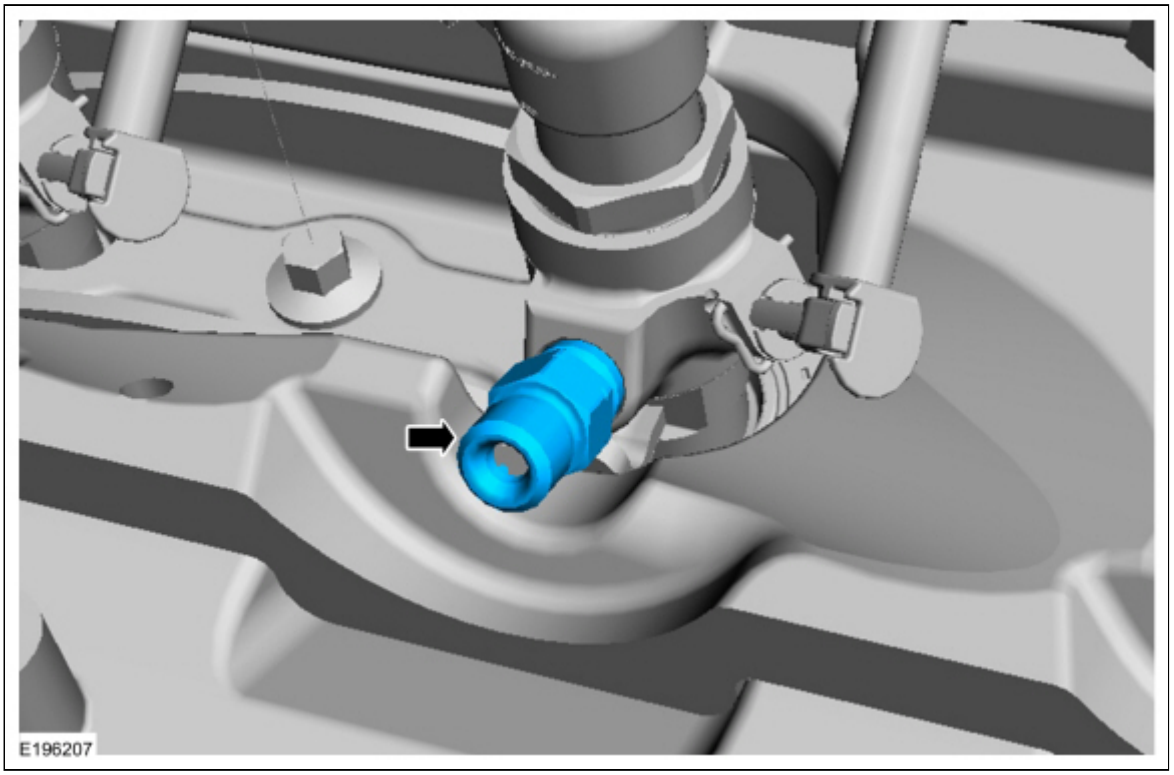
   Use the General Equipment: Cable Ties



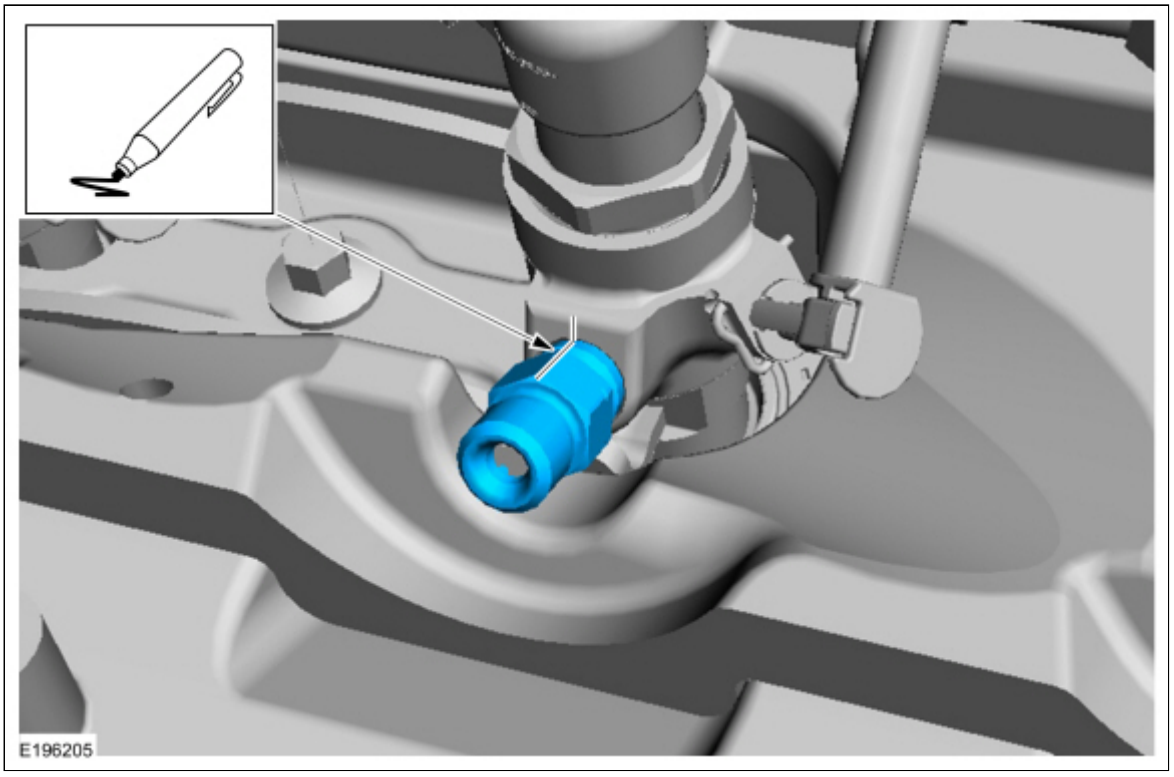
4. *Material*: Brake Cleaner



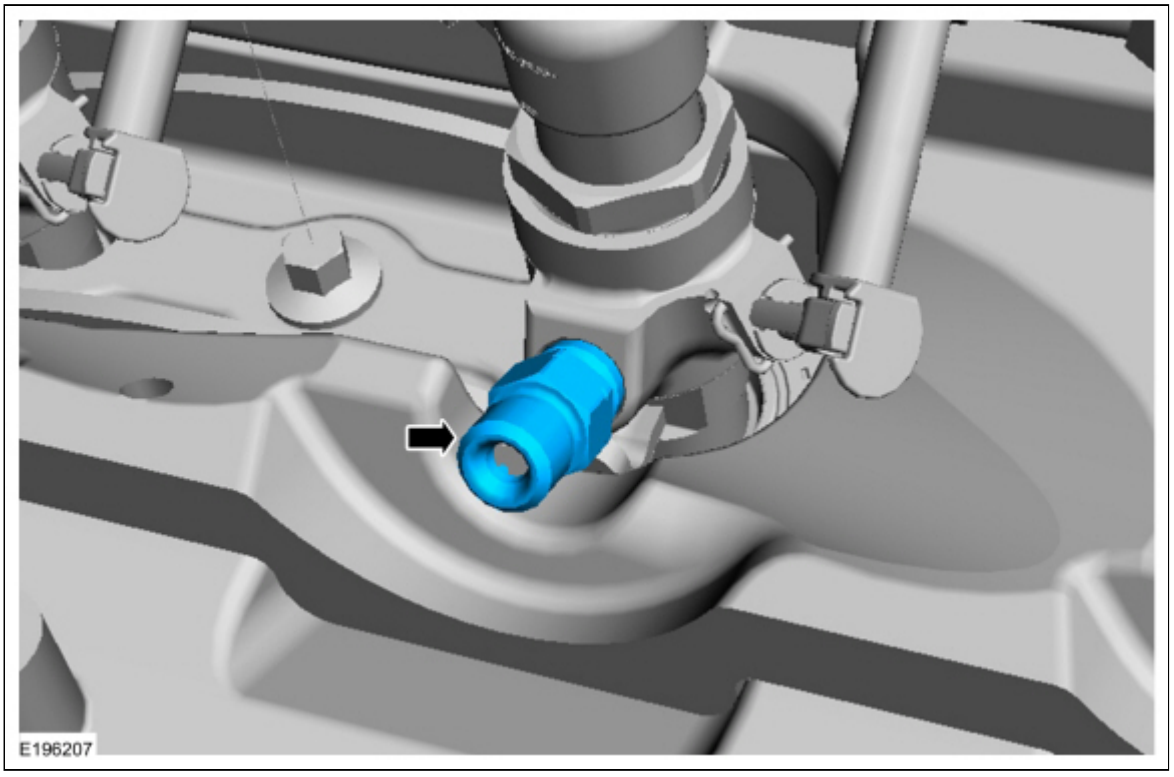
5. *Torque*: 10 Nm



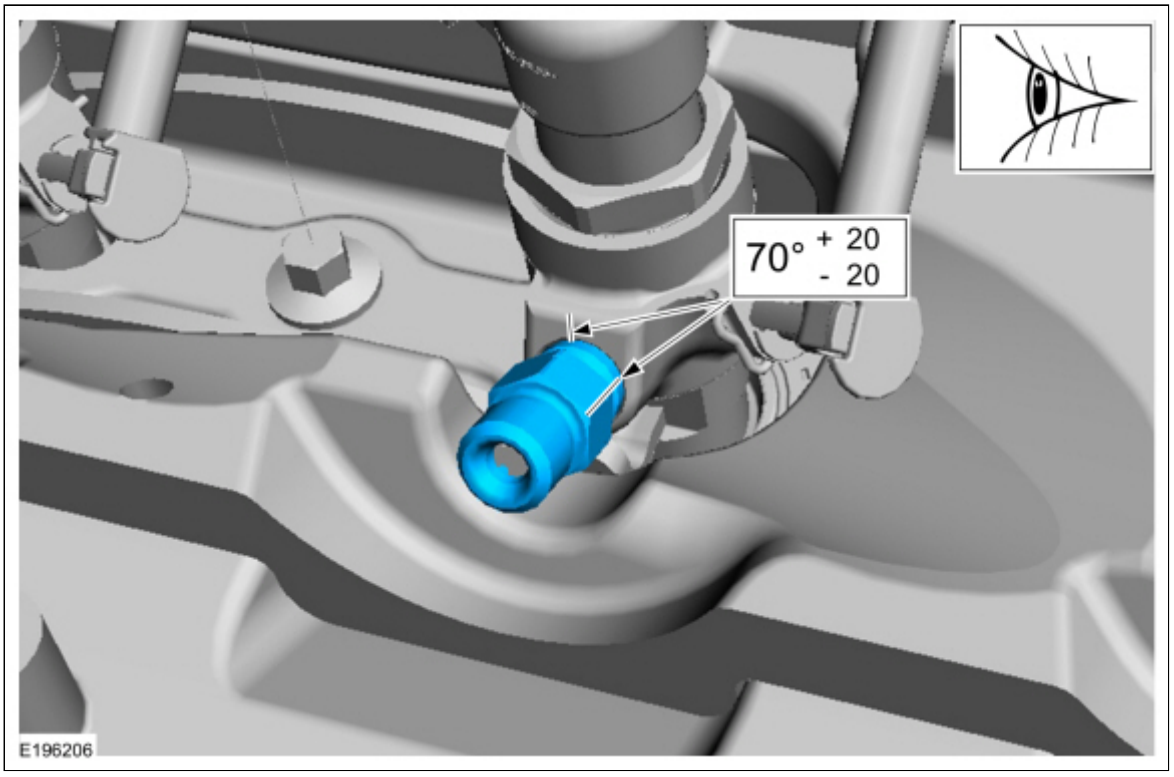
6.



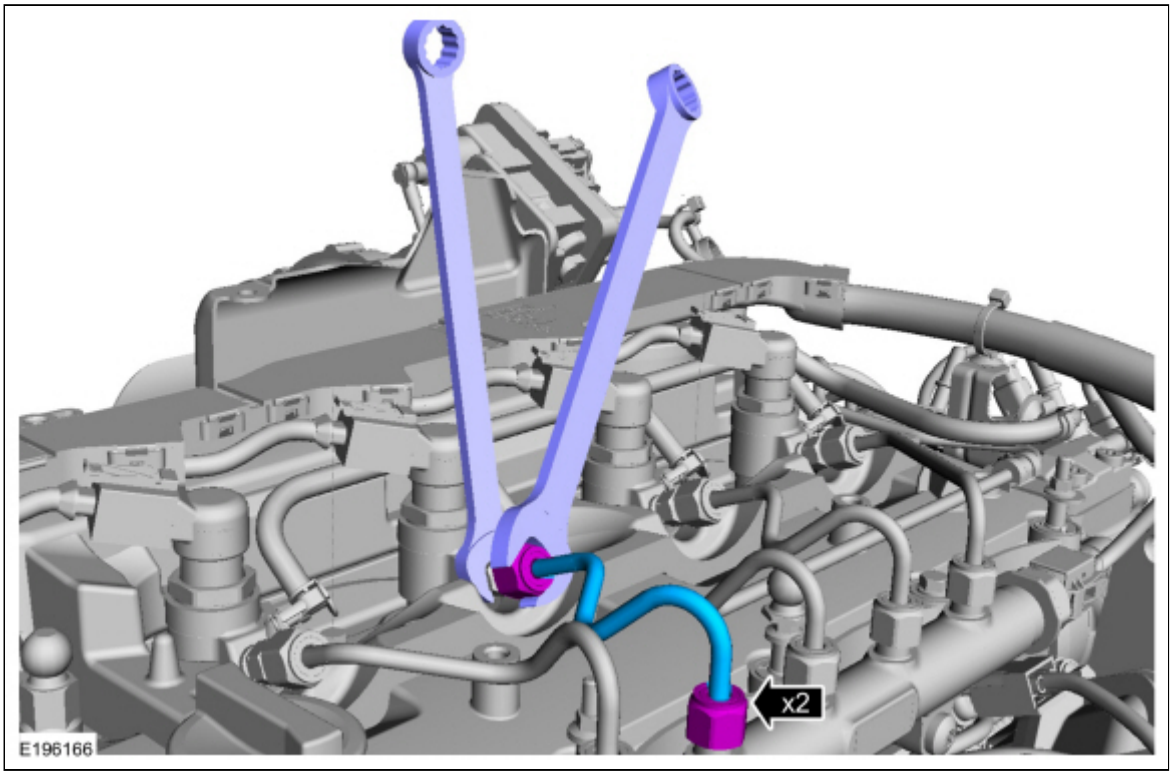
7. *Torque*: 45 Nm



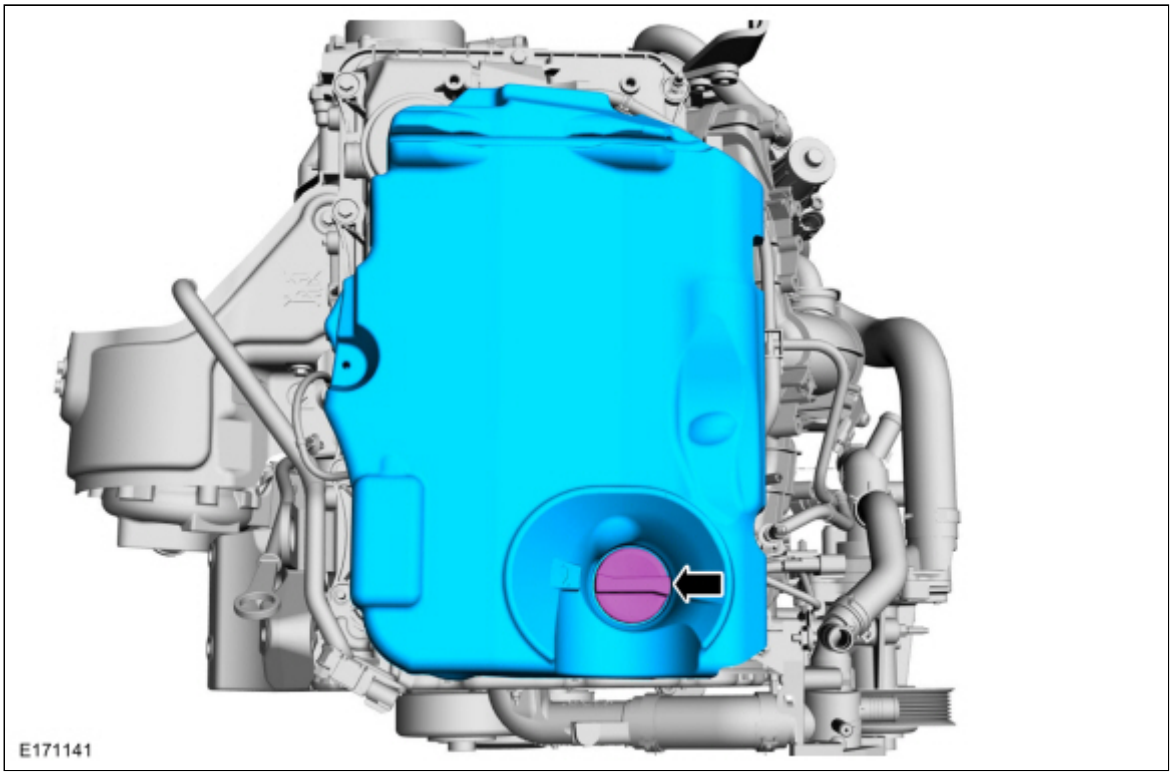
8. If the angle does not reach 50°, increase the applied torque by 5Nm steps until 50° is achieved. If over 90° is achieved, the screw thread was wet. Start again at point 1 with a new sealing washer.



9. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 30 Nm



10.



Copyright © 2016 Ford Motor Company

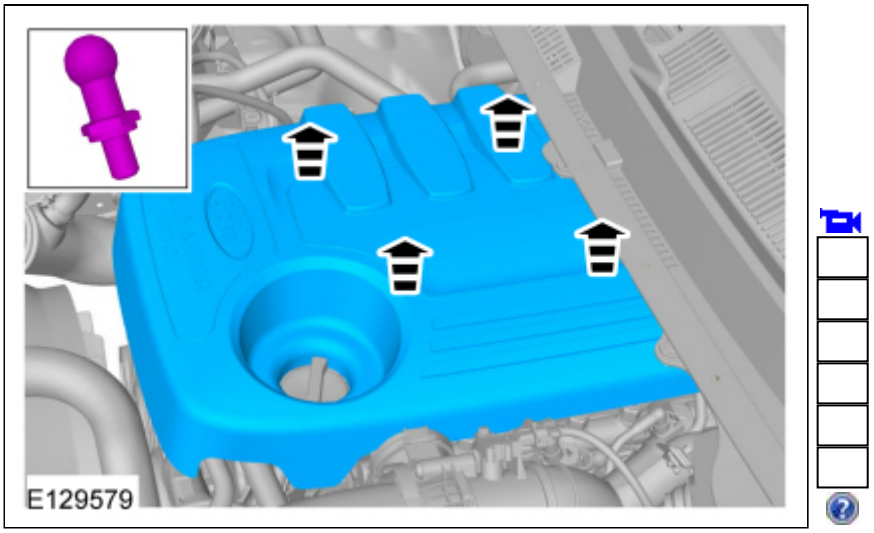
Fuel Injector Fuel Return Line

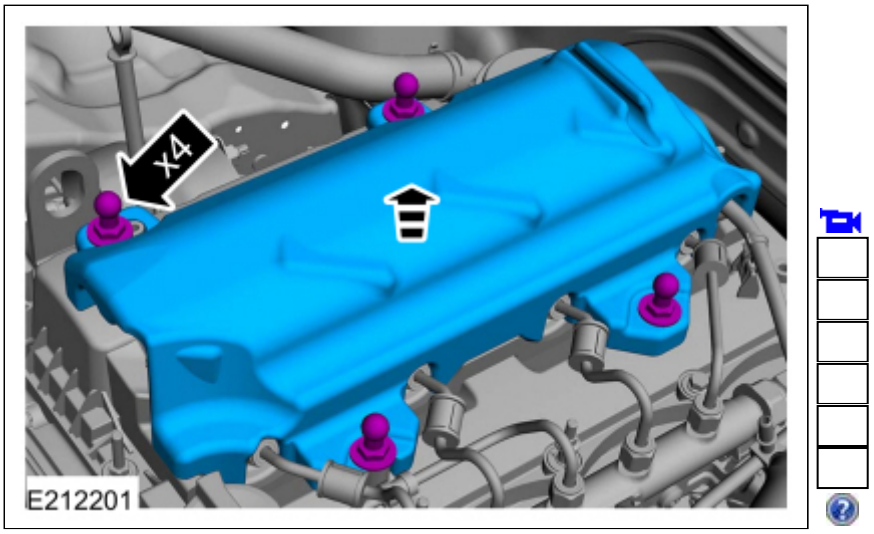
Materials

Name	Specification
Grease - High Temperature	WSD-M1C228-A

Removal

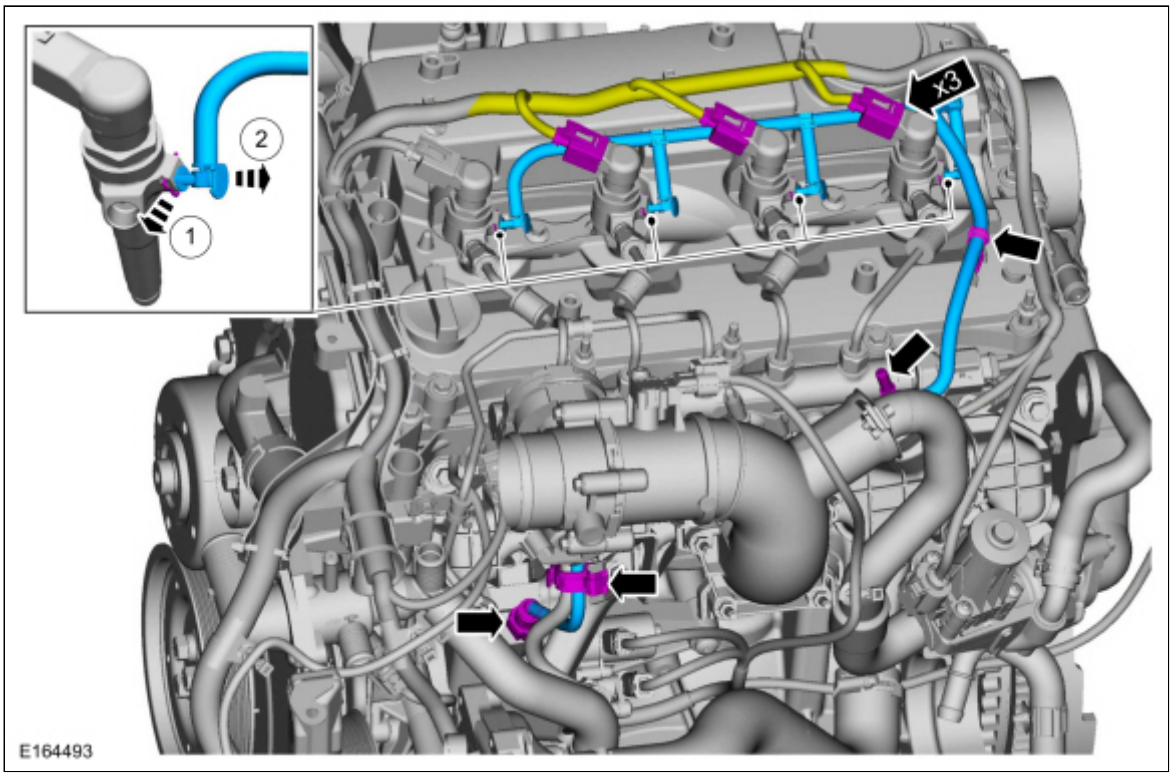
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

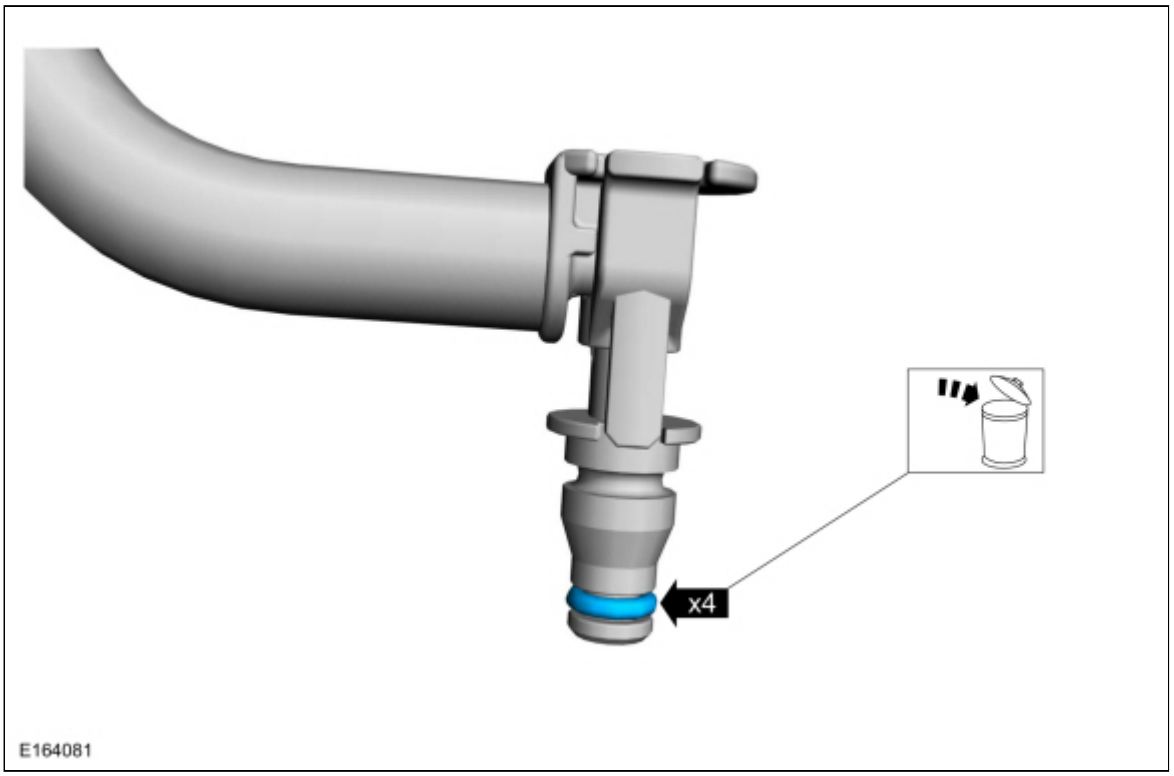
3. *Torque*: 3 Nm


4. **NOTE:** *Be prepared to collect escaping fluid.*

   Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



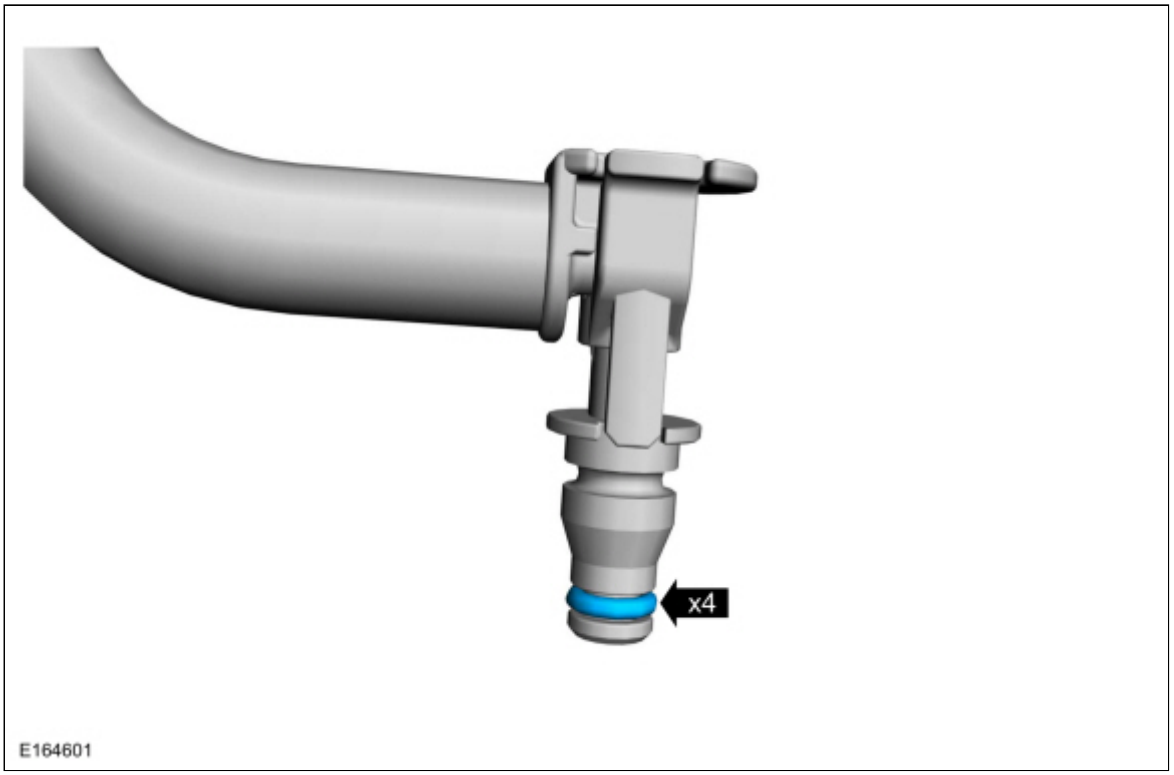
5.



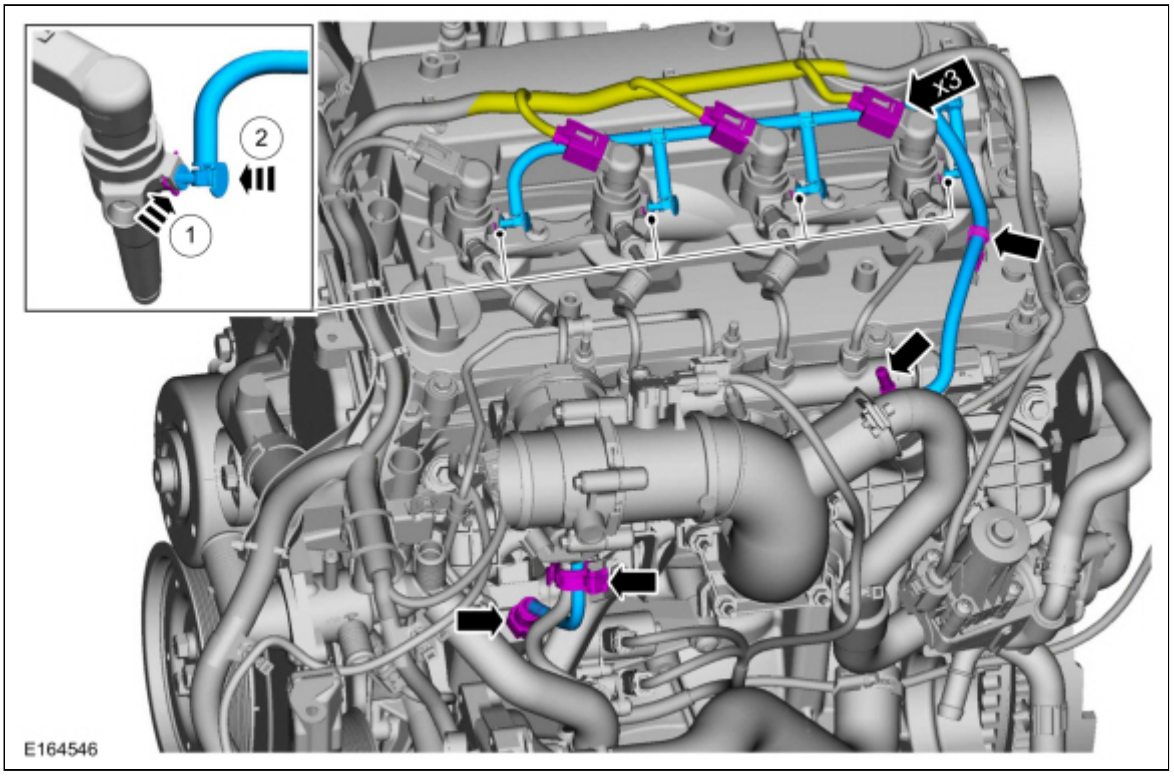
Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *Make sure that new components are installed.*

   Apply a thin coating.
   Material: Grease - High Temperature (WSD-M1C228-A)



3. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



Copyright © 2016 Ford Motor Company

Fuel Injectors

Special Tool(s) / General Equipment

Ford Diagnostic Equipment
Long Nose Pliers

Removal

WARNING: Make sure that the engine is switched off.

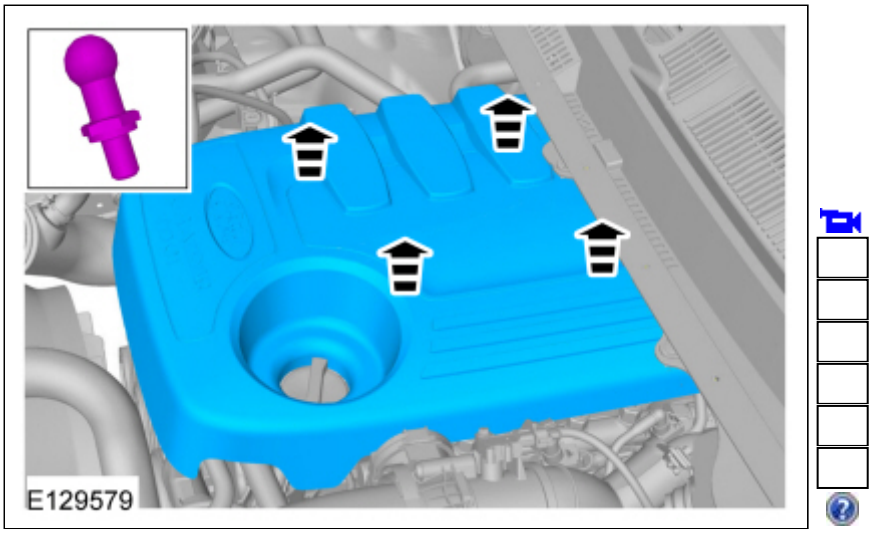
WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

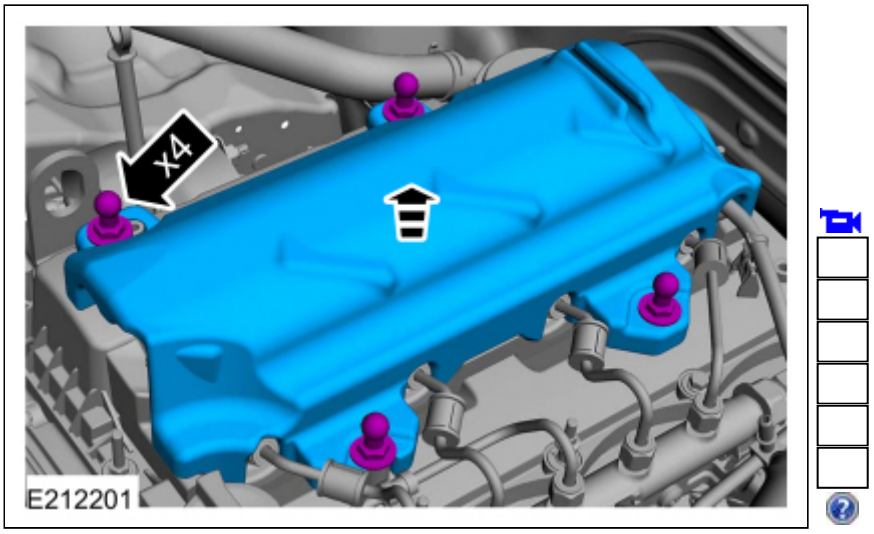
NOTICE: Fuel injectors sharing a common fuel injector clamp must be removed in pairs.

NOTE: *The component should be reused unless damaged or has excessive wear.*

NOTE: *Removal steps in this procedure may contain installation details.*

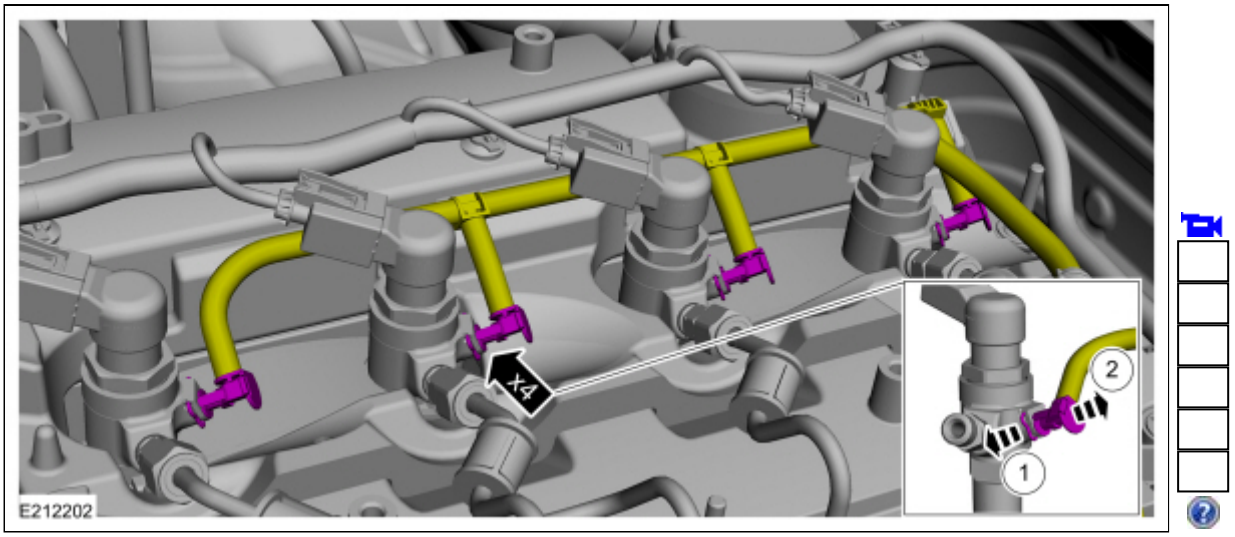
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Within the datalogger function of WDS, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30ºC whichever is the greater.
   Use the General Equipment: Ford Diagnostic Equipment
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. 

5. *Torque*: 3 Nm



6. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

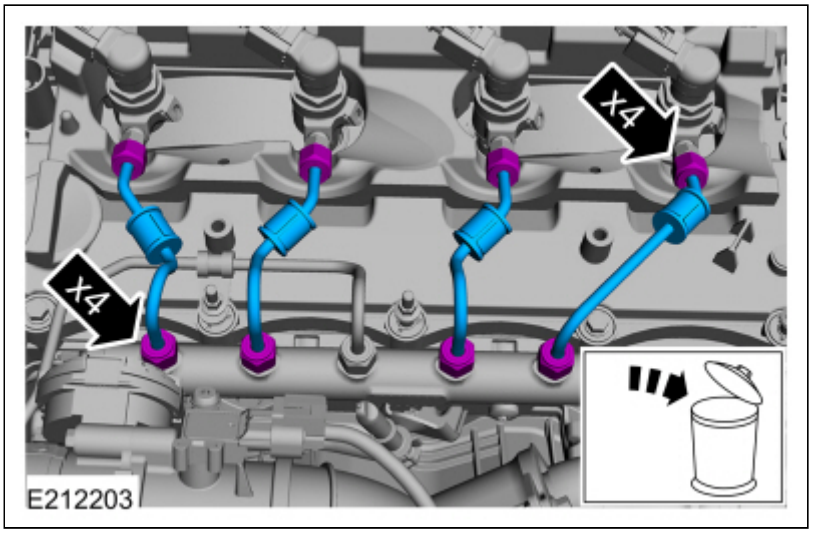
   Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



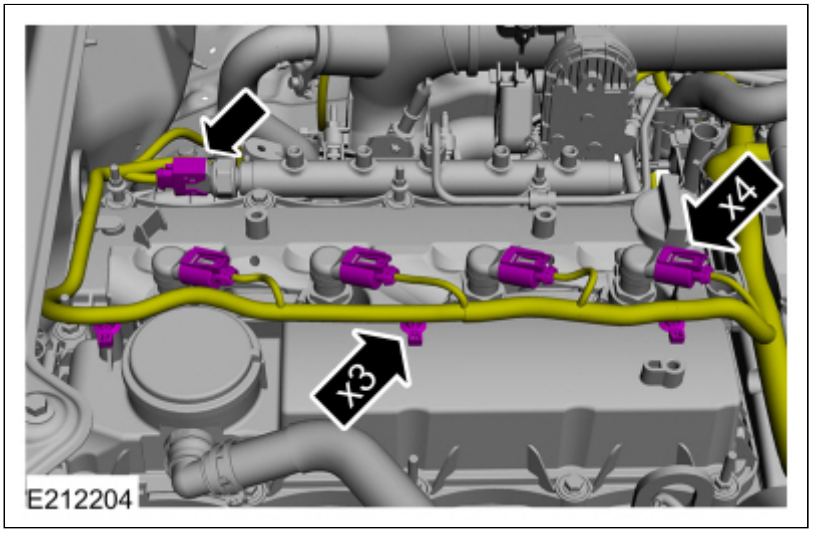
7. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

   NOTICE: Make sure that all openings are sealed with new blanking caps.

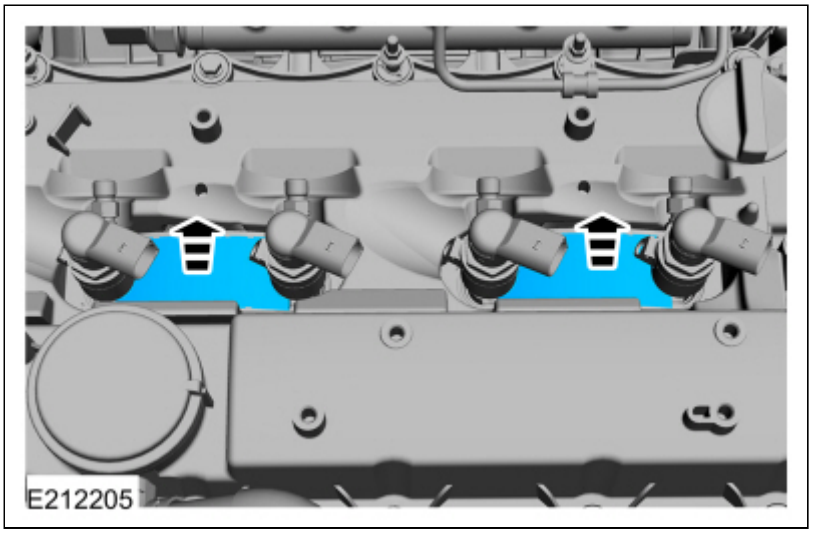
   Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Torque:
   Stage 1: 15 Nm
   Stage 2: 30 Nm



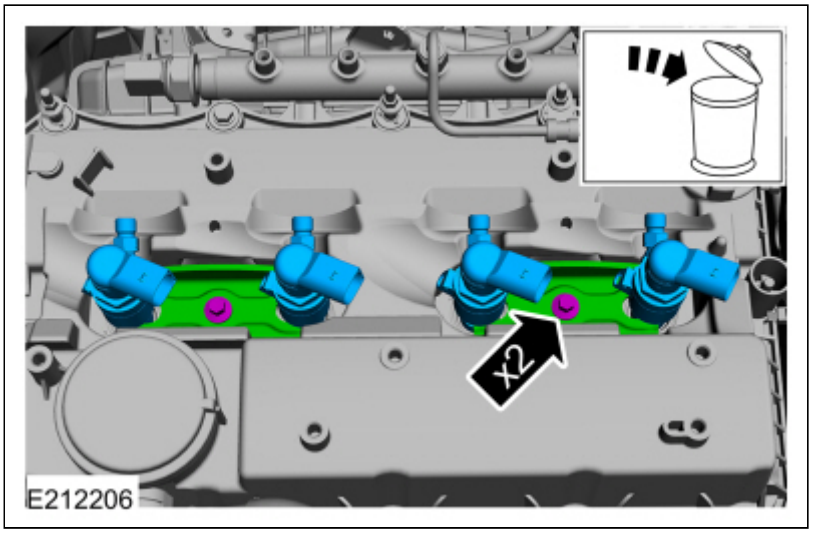
8.



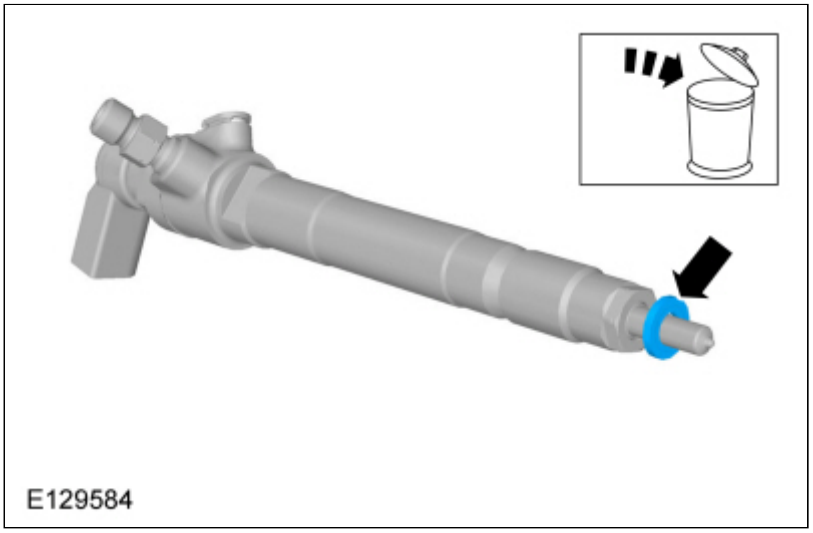
9.



10. *Torque*: 25 Nm

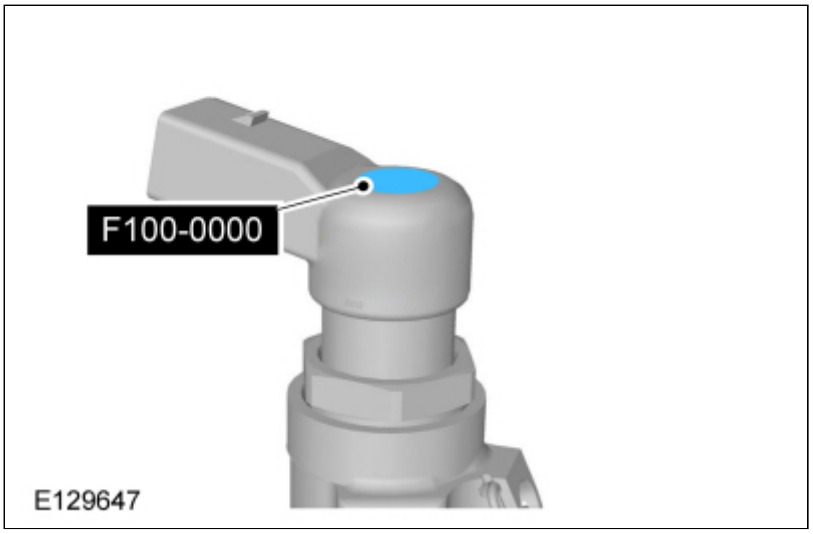


11. Use the General Equipment: Long Nose Pliers



Installation

1. To install, reverse the removal procedure.
2. Record the new fuel injector correction factor code.



3. Input the new Injector Correction Factors using the following WDS menu options: ToolBox/Powertrain/Service Functions
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Fuel Metering Valve

Materials

Name	Specification
Brake Cleaner	-

Removal

WARNING: Make sure that the engine is switched off.

WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.

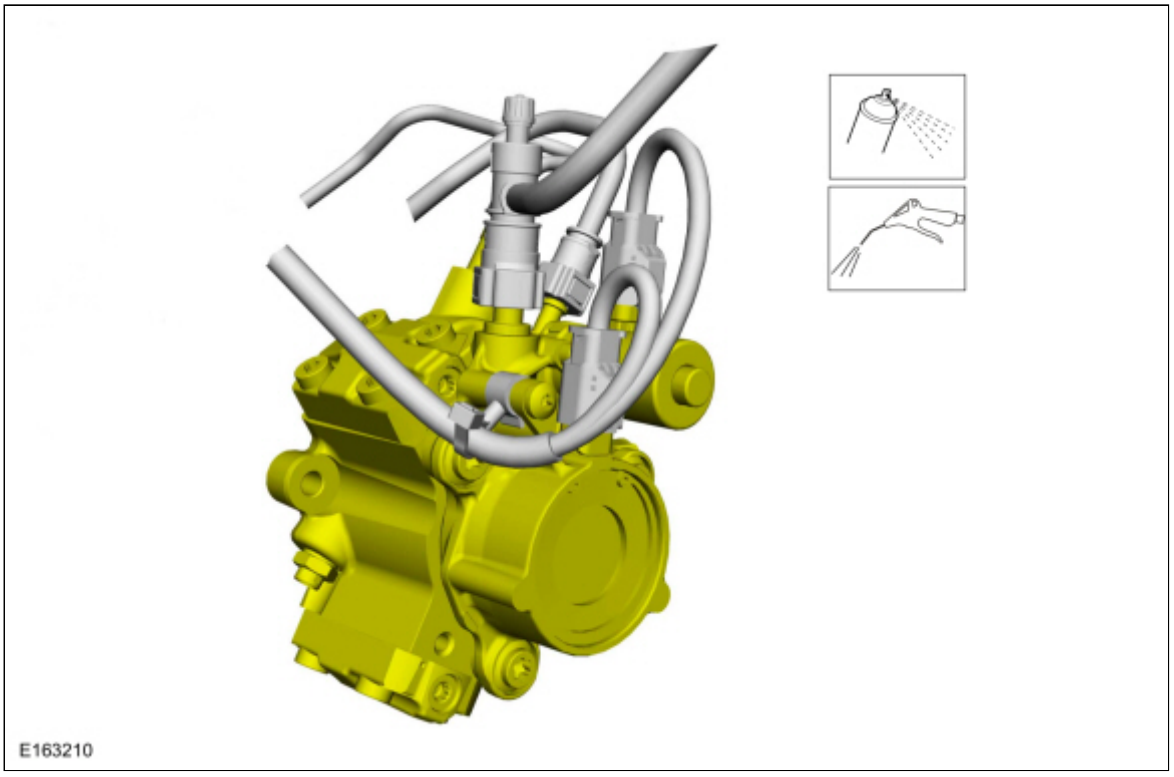
WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

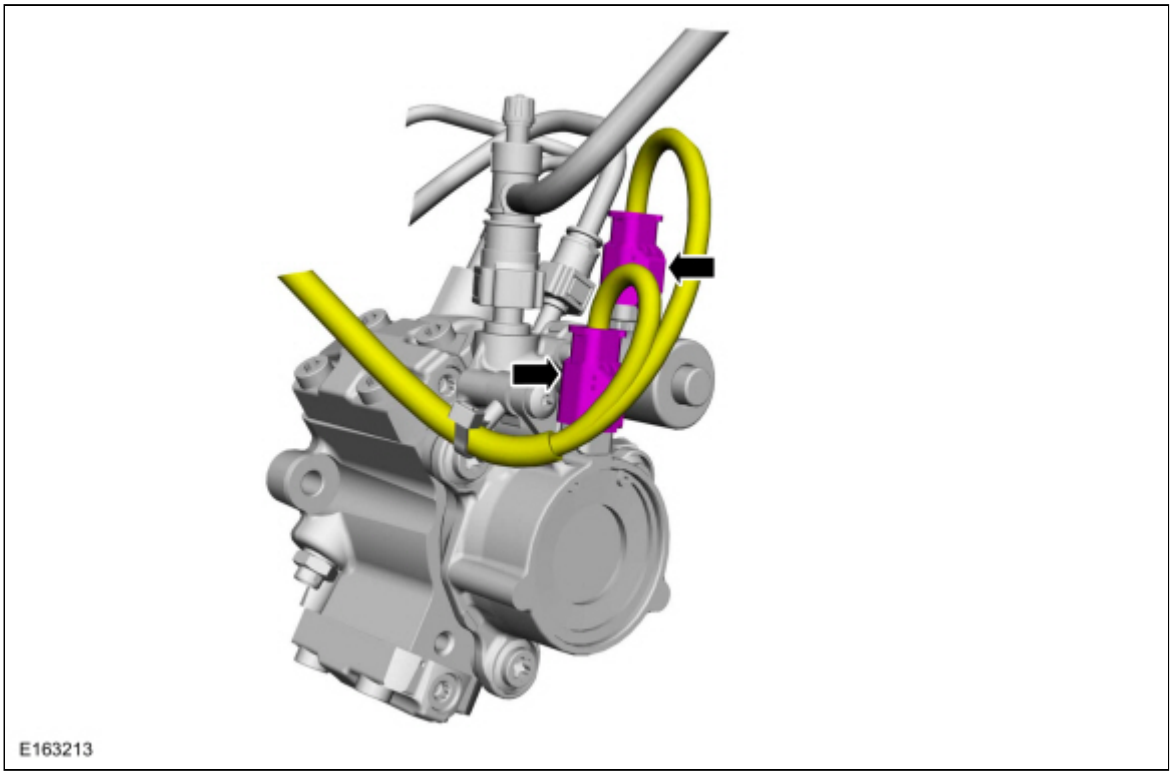
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
3. 

   NOTICE: Extreme cleanliness must be exercised when handling the components.

   Material: Brake Cleaner



4.



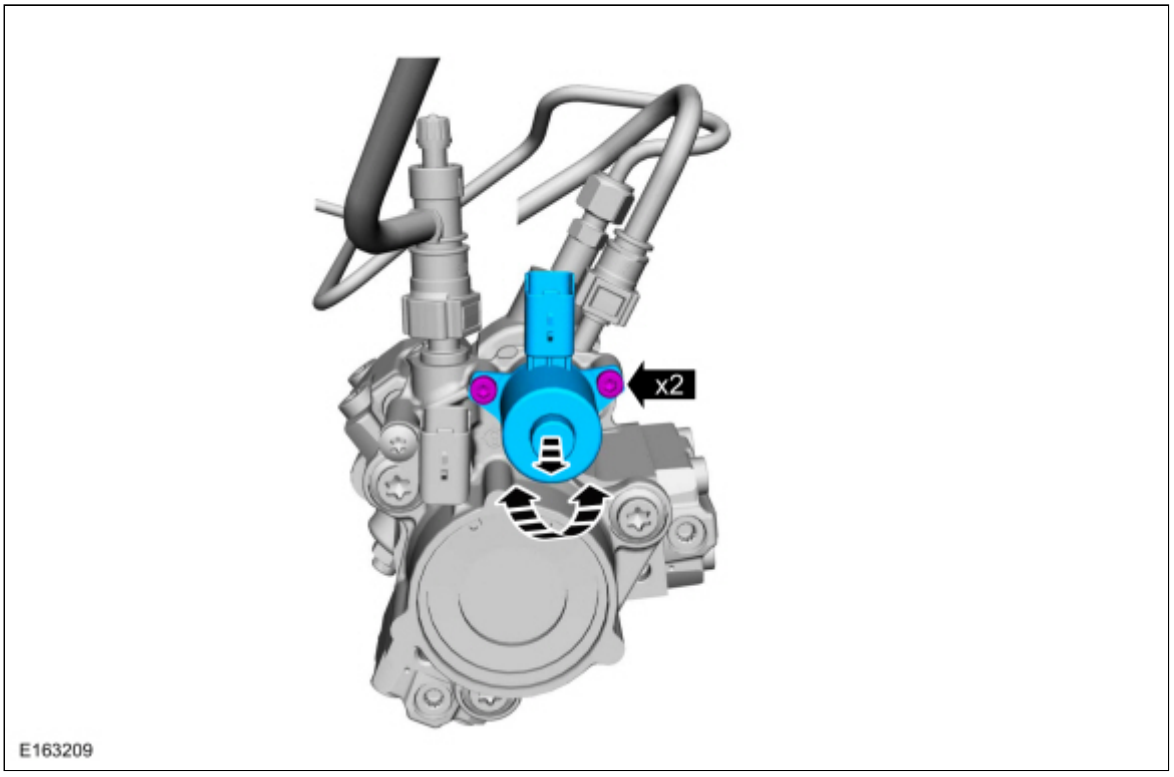
5. **NOTICE: Take extra care when handling the component.**

   NOTICE: Extreme cleanliness must be exercised when handling the component.

   NOTICE: The component must be removed by hand, the use of tools is prohibited.

   NOTE: *Make sure that a new component is installed.*

   Torque: 6 Nm

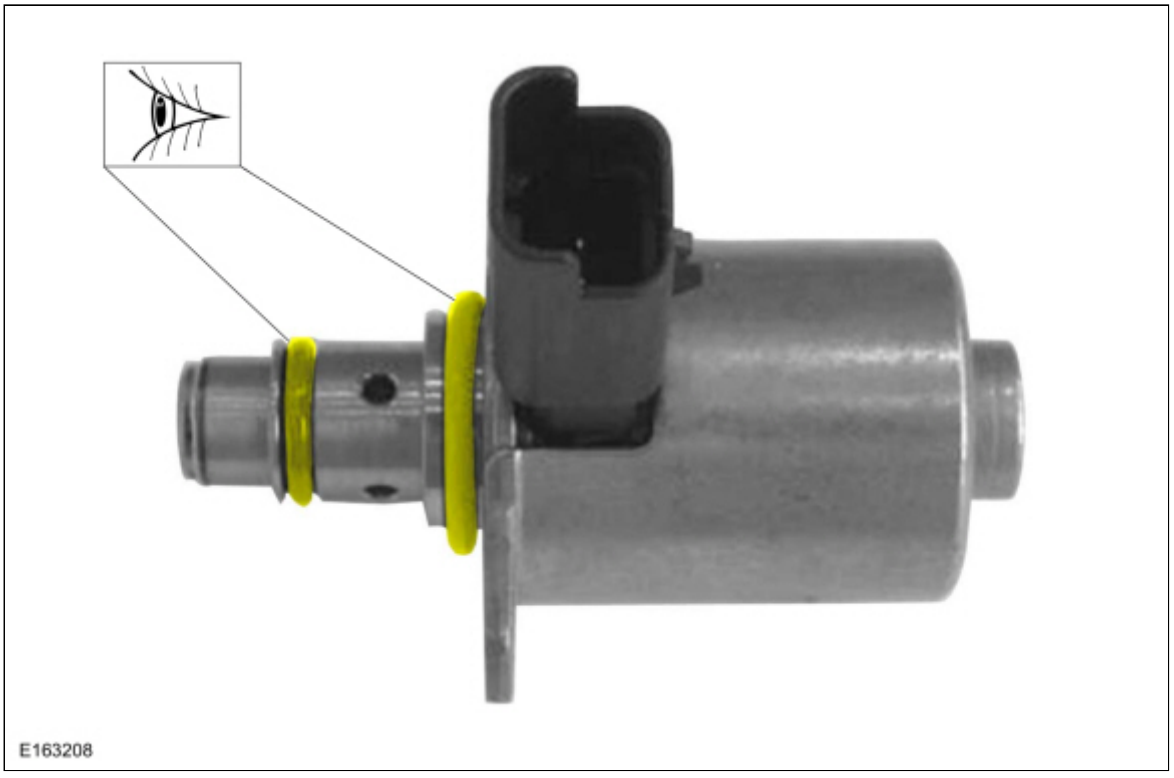


Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Extreme cleanliness must be exercised when handling the component.**

   NOTICE: Take extra care when handling the component.

   NOTE: *Make sure that the seal is correctly located.*



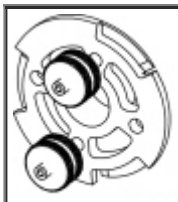
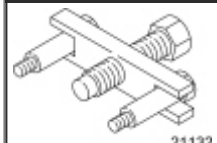
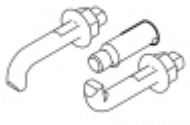
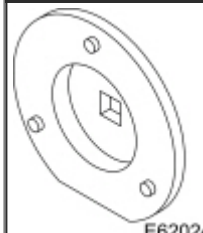
3. Carry out a reset of the High Pressure Fuel System Learned Values using the following menu options:
   ToolBox/Powertrain/Service Functions/PCM
   General Equipment: Ford approved diagnostic tool

Copyright © 2016 Ford Motor Company

Fuel Pump

Base Part Number: 9H307

Special Tool(s) / General Equipment

 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 21132	303-249 Remover, Crankshaft Timing Pulley
 E144602	303-249-01 Adapter for 303-249
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate
Ford Diagnostic Equipment	

Removal

WARNING: Make sure that the engine is switched off.

WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

NOTE: *Vacuum any foreign material from the fuel pump and fuel rail unions before sealing the unions with blanking caps.*

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Within the datalogger function, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30ºC whichever is the greater.
   Use the General Equipment: Ford Diagnostic Equipment
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

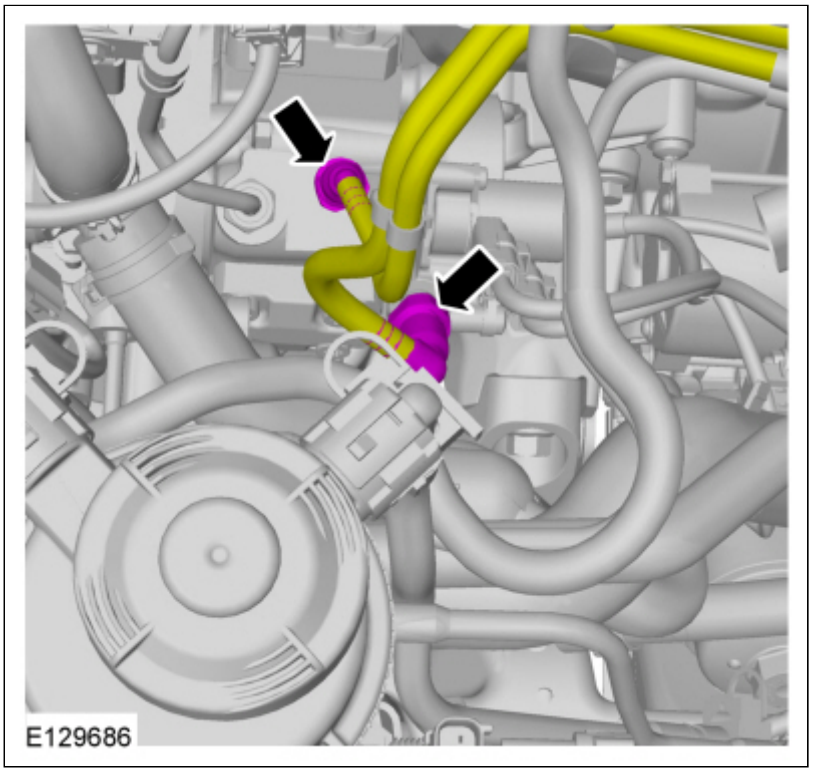
4. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

5. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

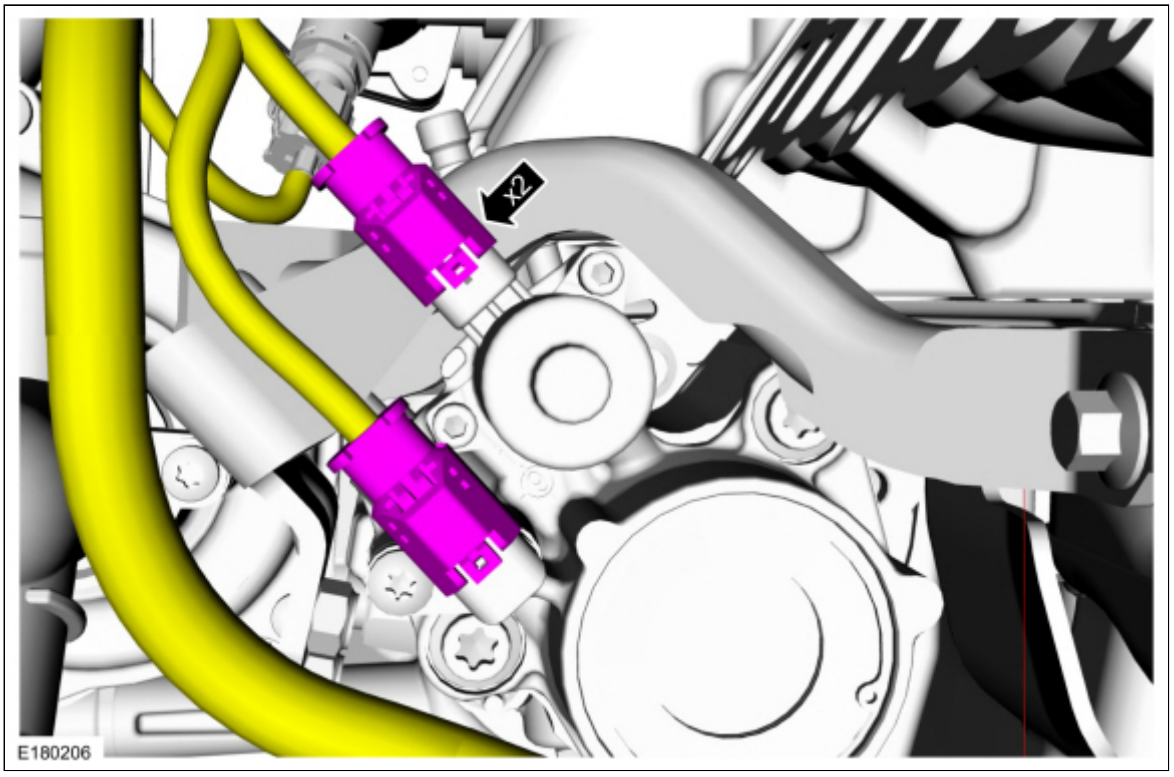
6. Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

7. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

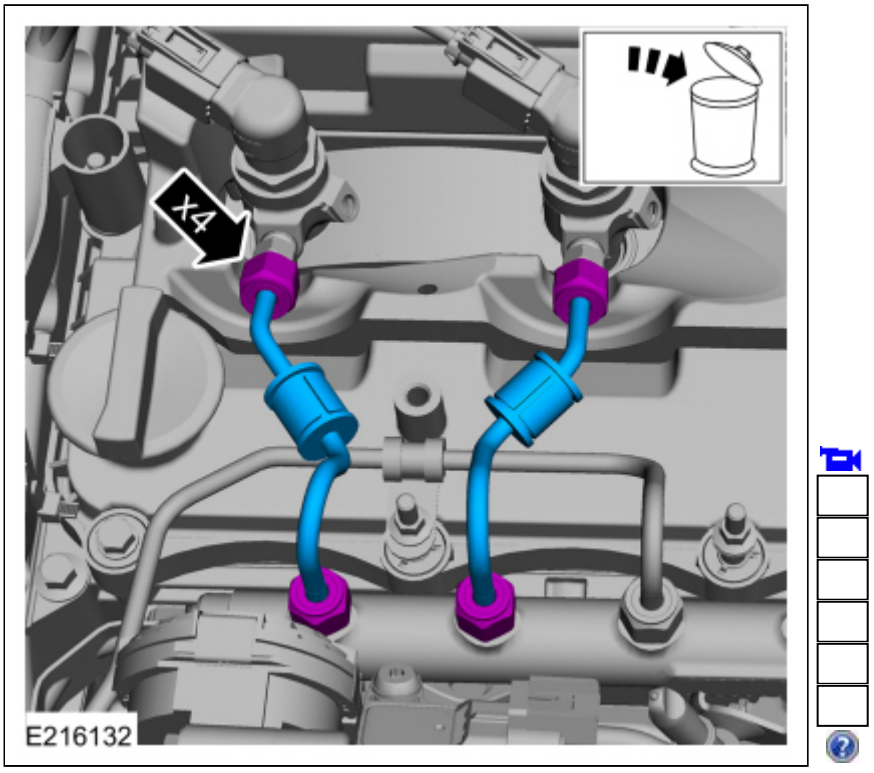
   Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



8.



9. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 30 Nm

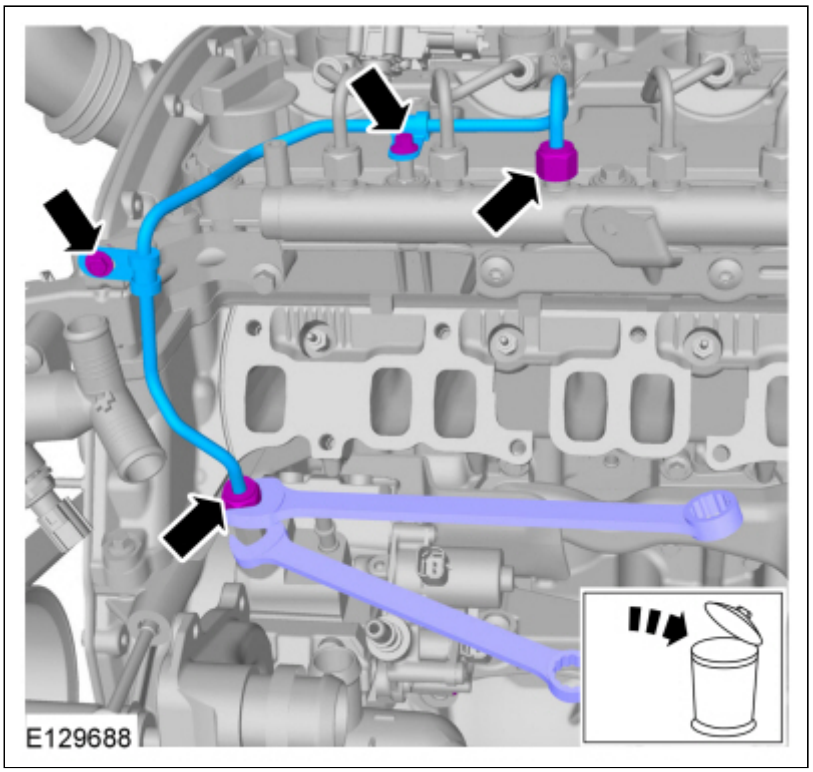


10. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

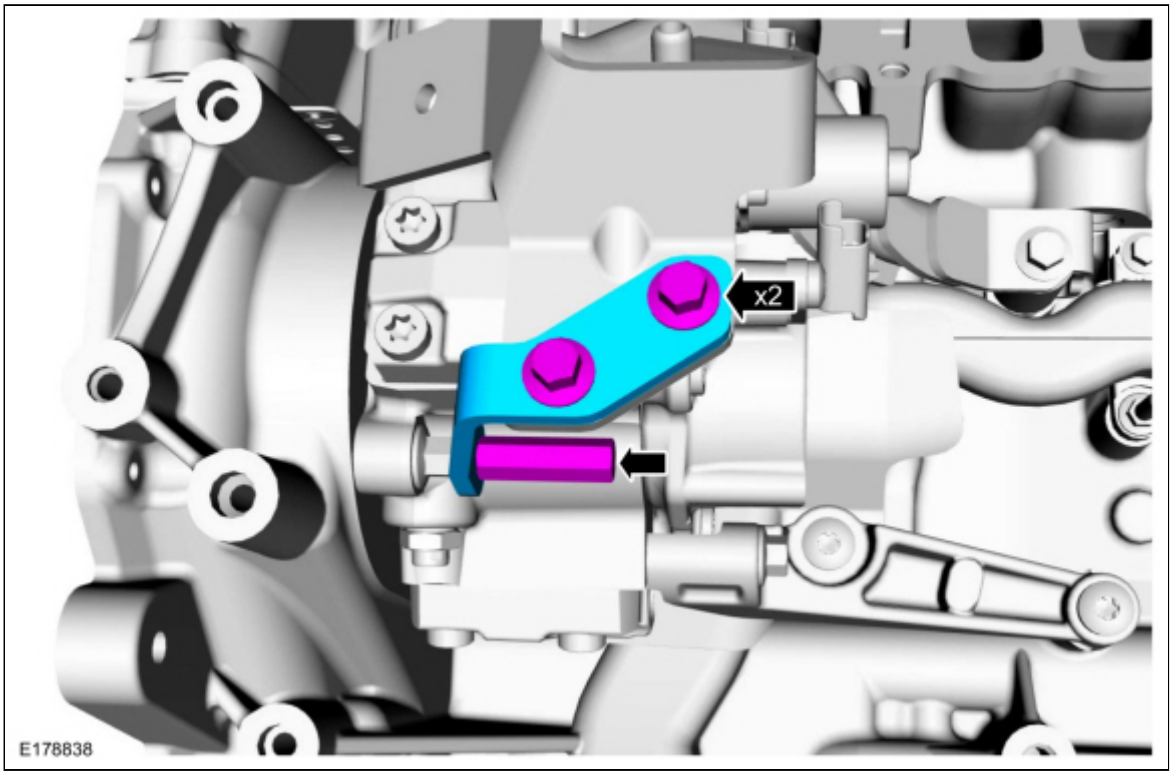
    NOTICE: Make sure that all openings are sealed with new blanking caps.

    Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
    Torque:
    Fuel rail high-pressure fuel supply line unions:
    Stage 1: 15 Nm
    Stage 2: 30 Nm

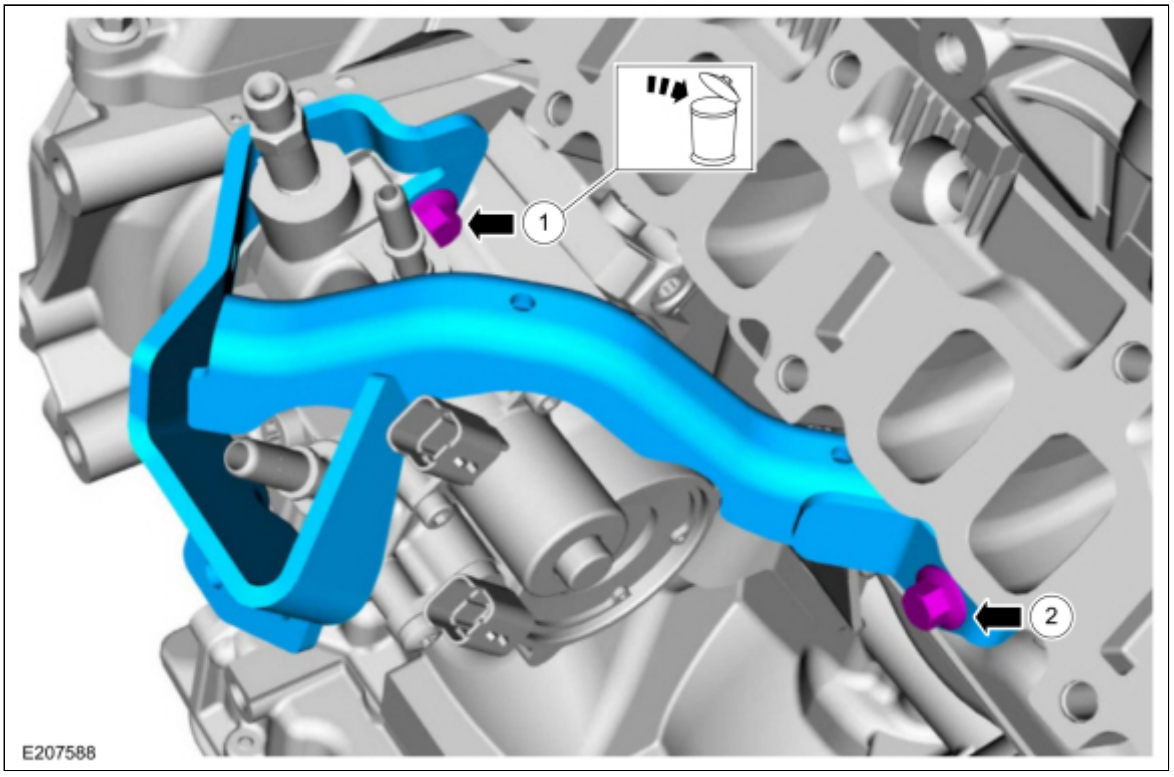
Fuel rail high-pressure fuel supply line bracket bolt: 10 Nm



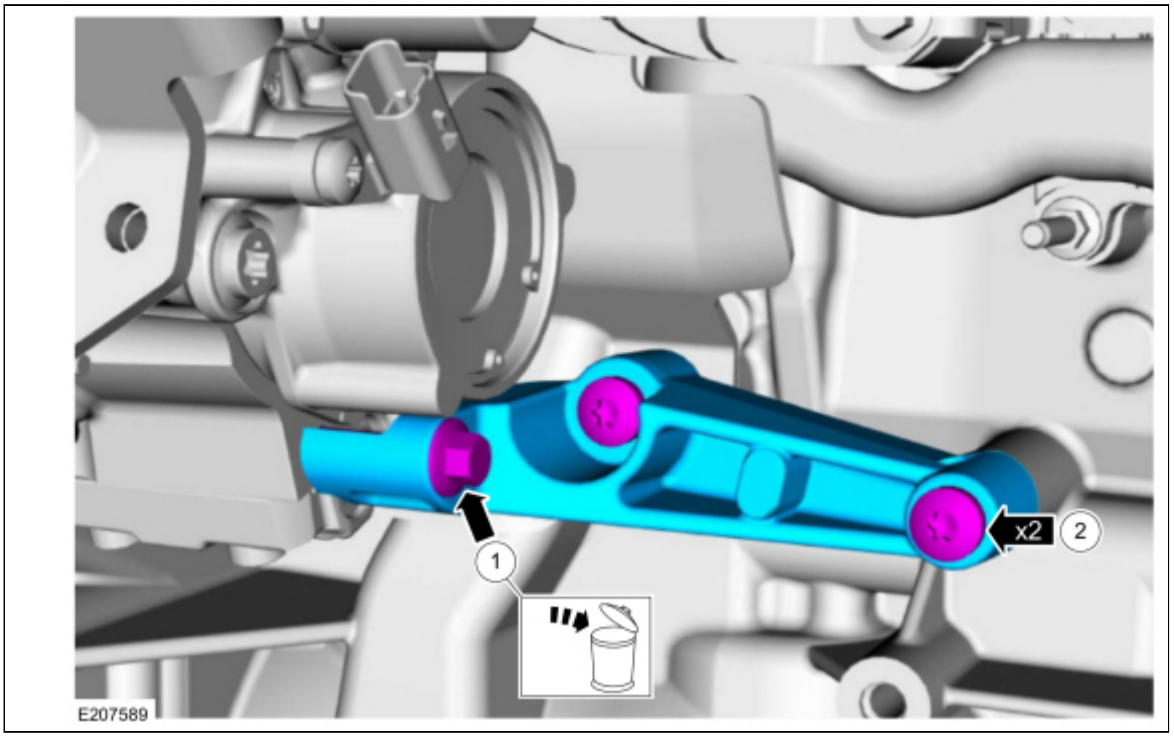
11. *Torque*: 10 Nm



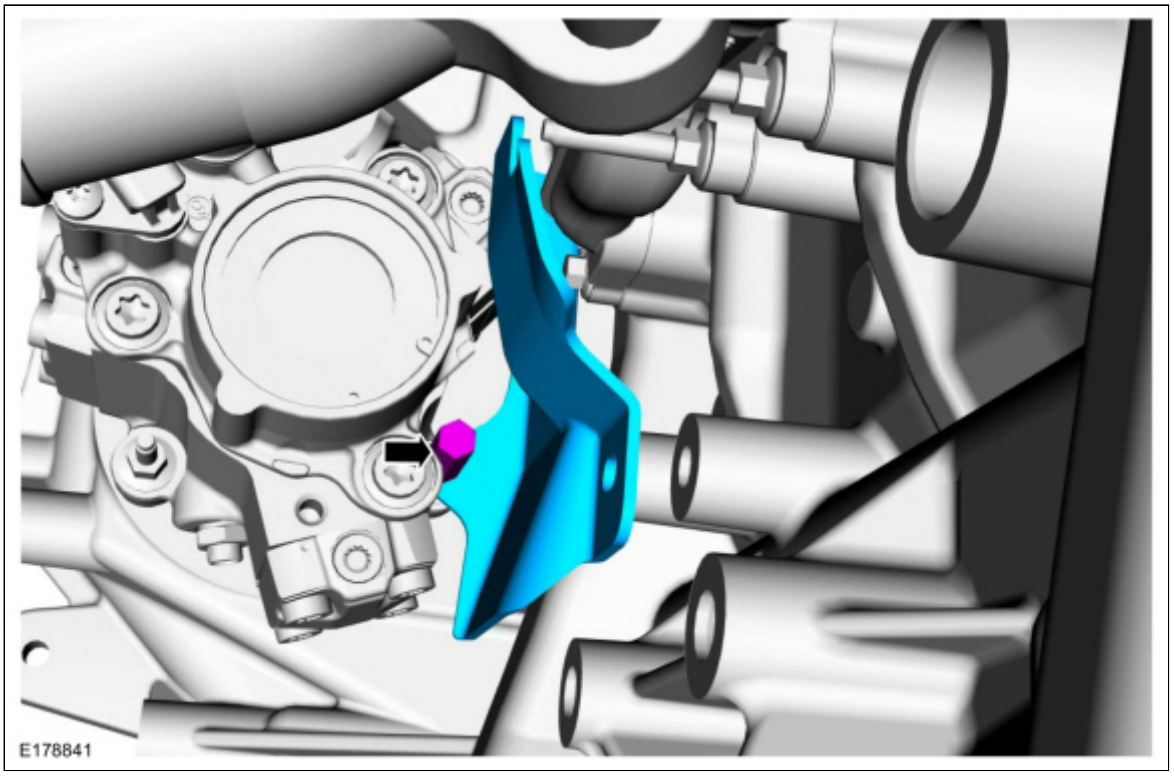
12. *Torque*:
    Stage 1: 10 Nm
    Stage 2: 23 Nm



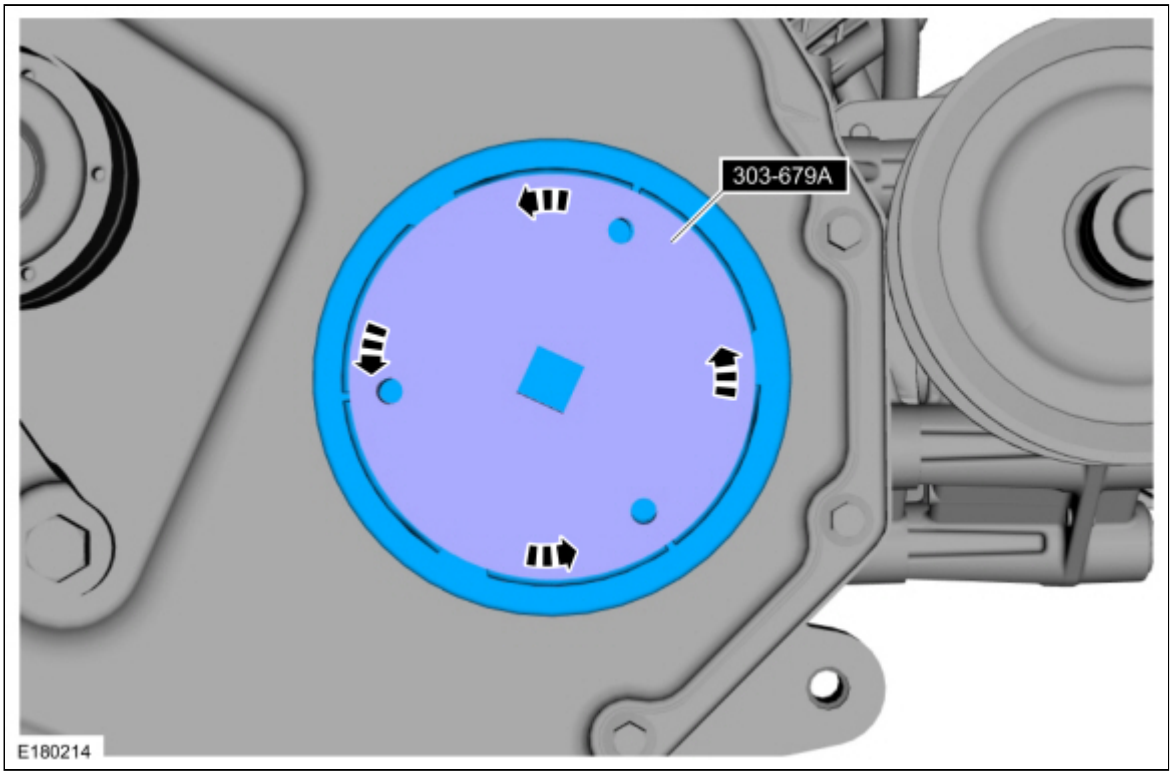
13. *Torque*: 23 Nm



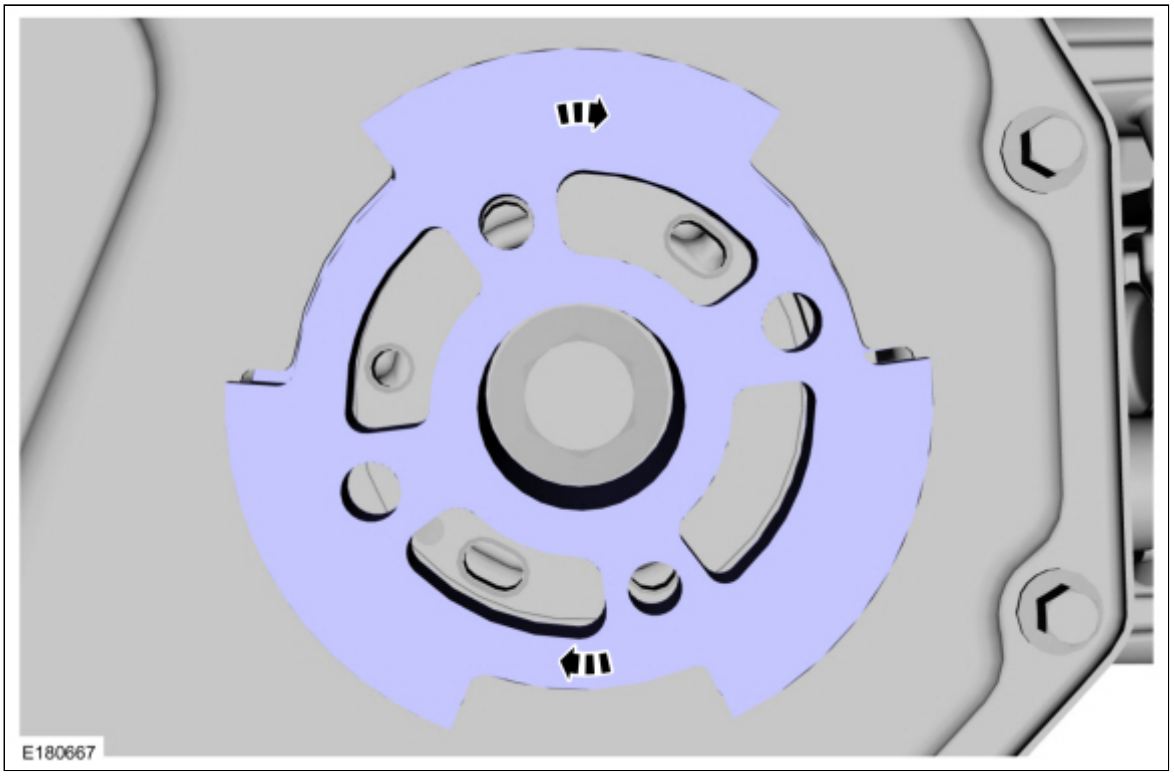
14. *Torque*: 10 Nm



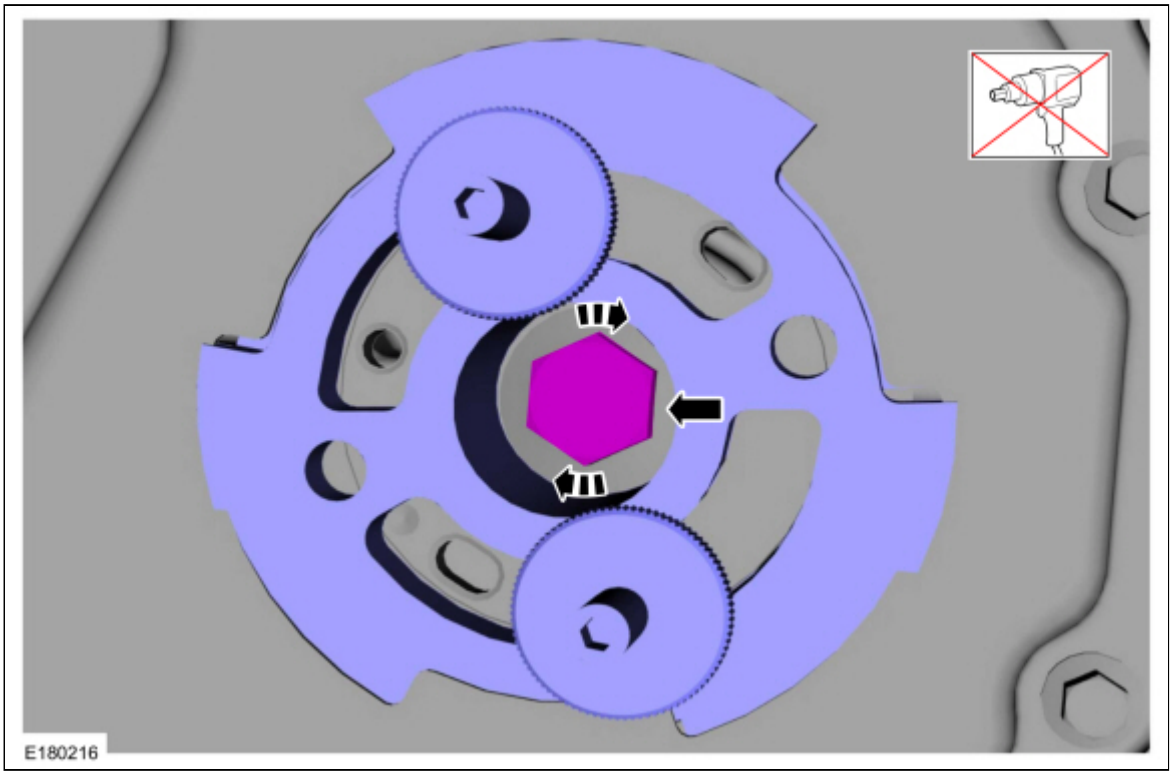
15. Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



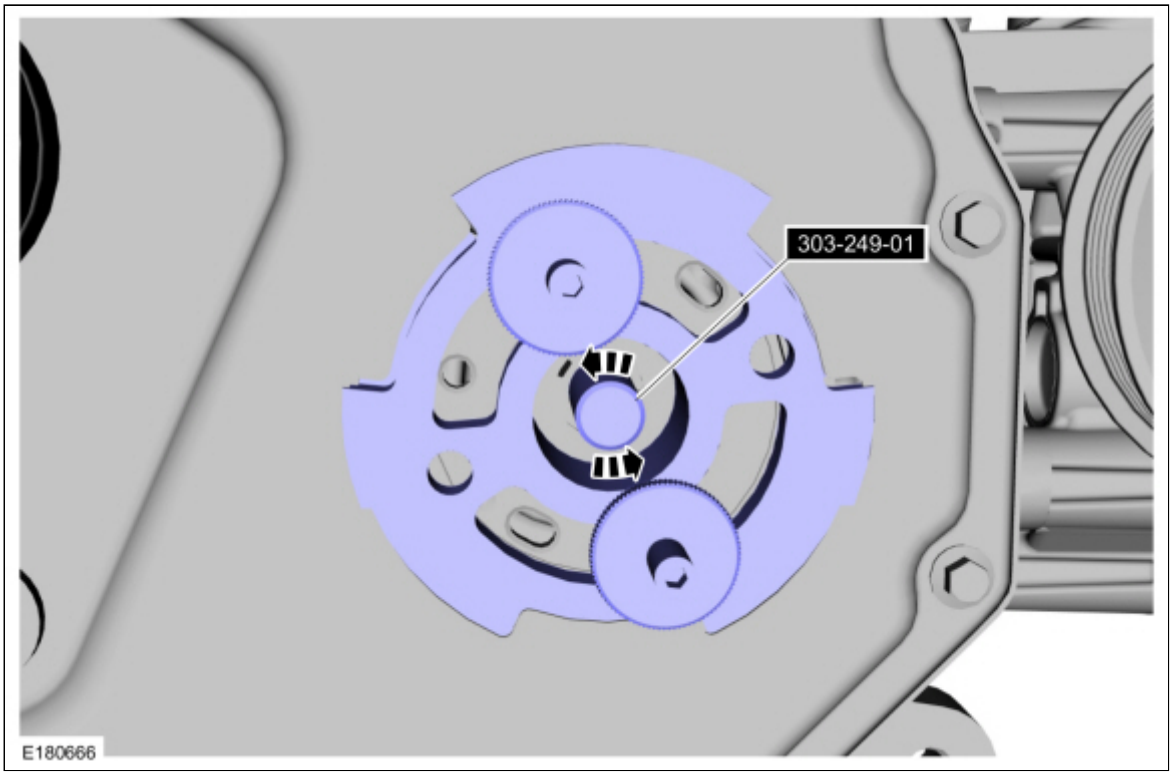
16. Install Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



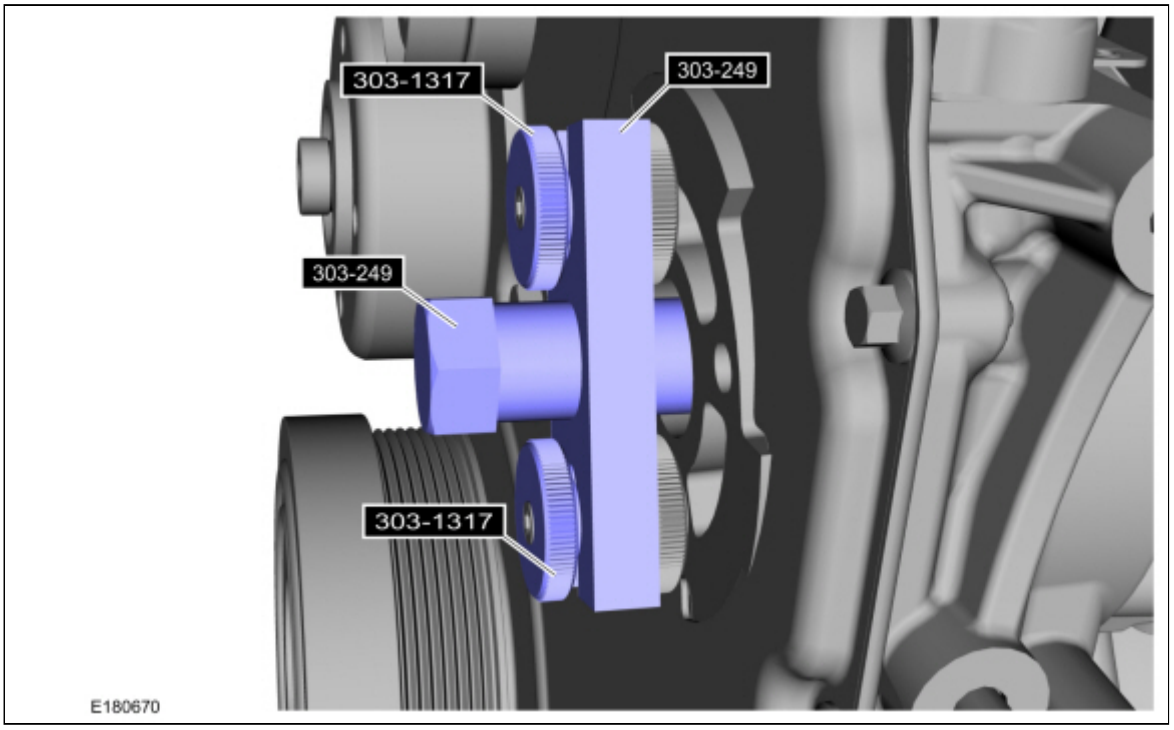
17. *Torque*: 64 Nm



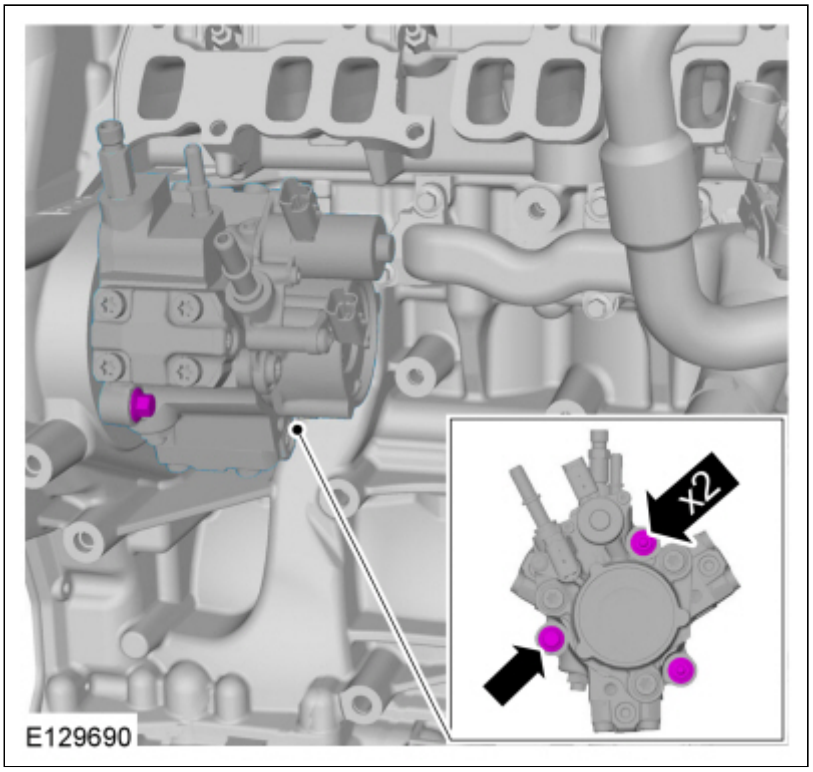
18. Install Special Service Tool: 303-249-01 Adapter for 303-249.



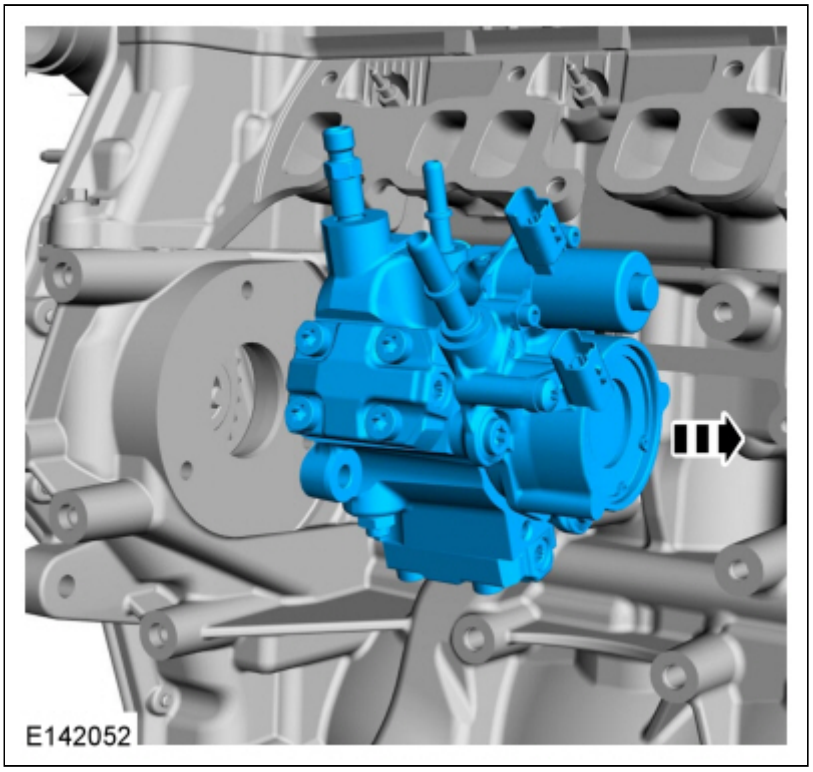
19. Install Special Service Tool: 303-249 Remover, Crankshaft Timing Pulley.



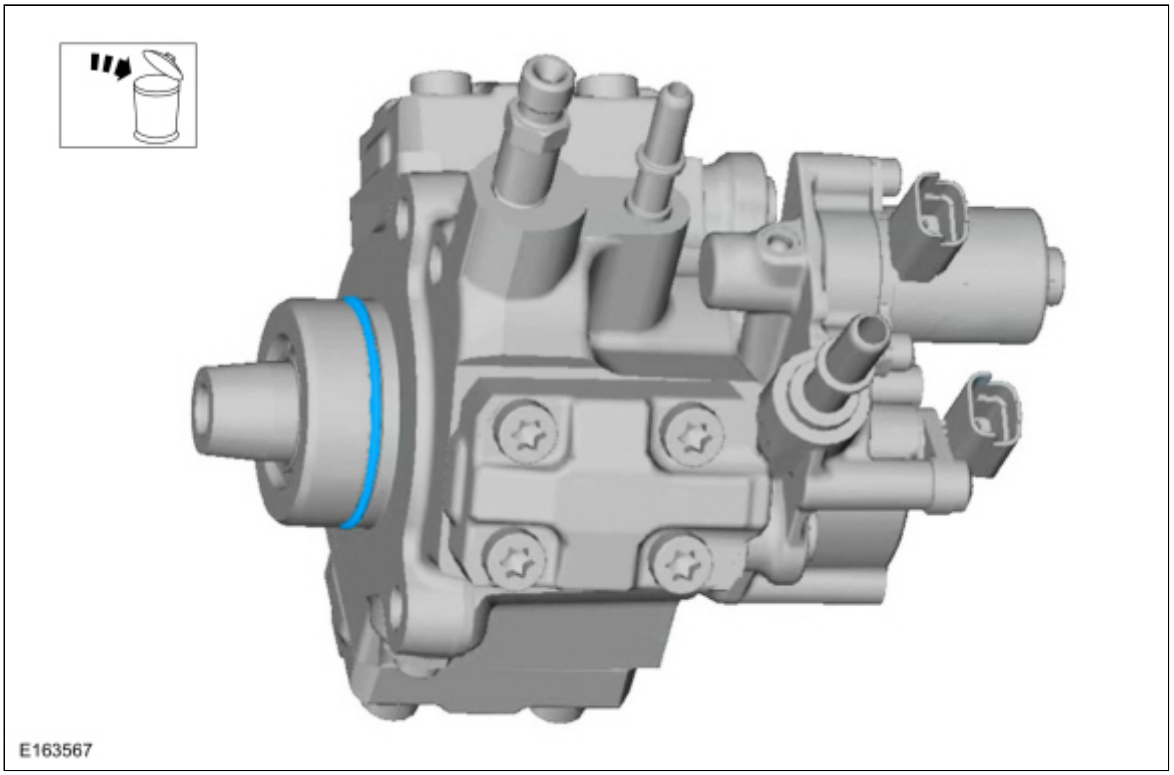
20. *Torque*: 23 Nm



21.



22.



Installation

1. To install, reverse the removal procedure.
2. Carry out a Fuel System Leak Test using the following menu options: ToolBox/Powertrain/Service Functions Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Fuel Rail

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

WARNING: Make sure that the engine is switched off.

WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

NOTE: *Always follow the cleaning process prior to carrying out any repairs to the components.*

NOTE: *Removal steps in this procedure may contain installation details.*

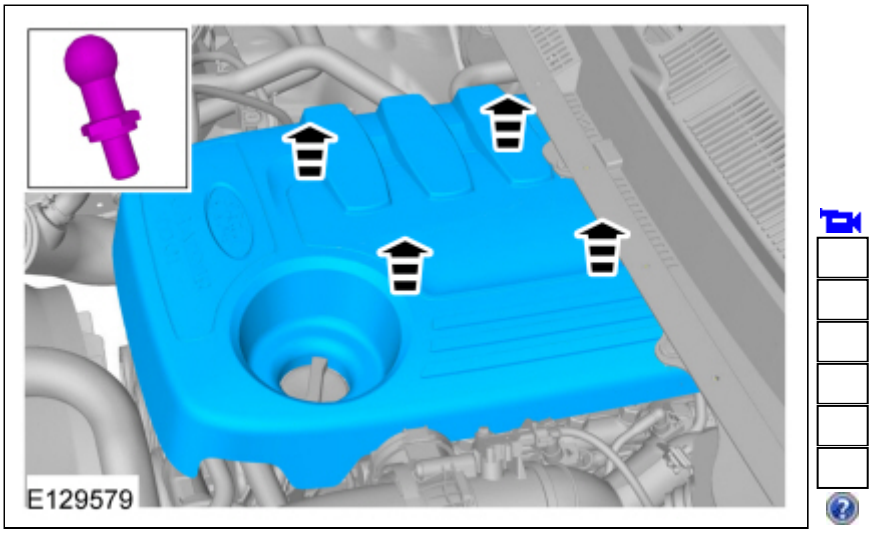
1.

2. Within the datalogger function of WDS, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30ºC whichever is the greater.
   Use the General Equipment: Ford Diagnostic Equipment

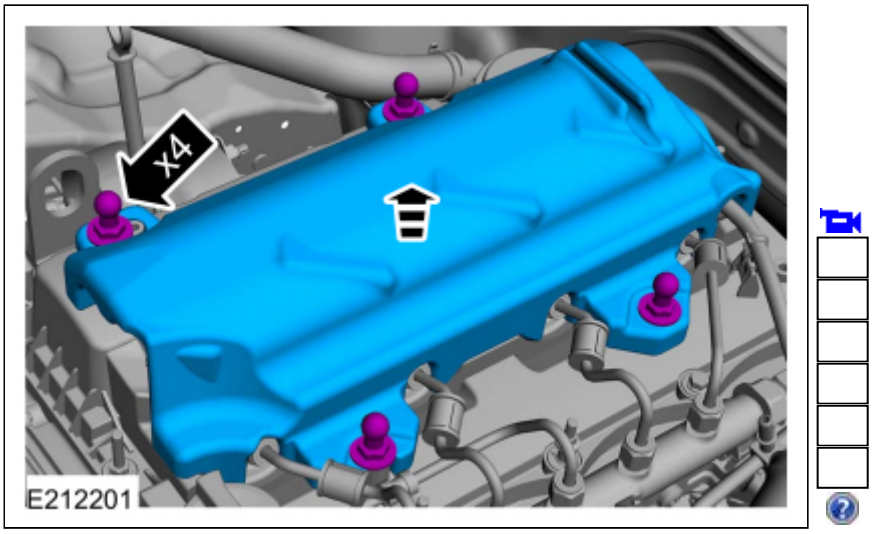
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

4. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

5.



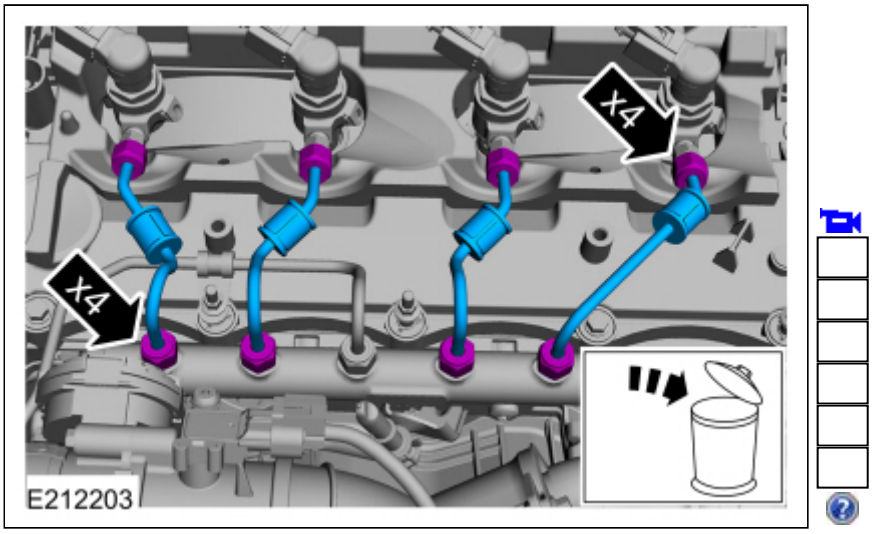
6. *Torque*: 3 Nm



7. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

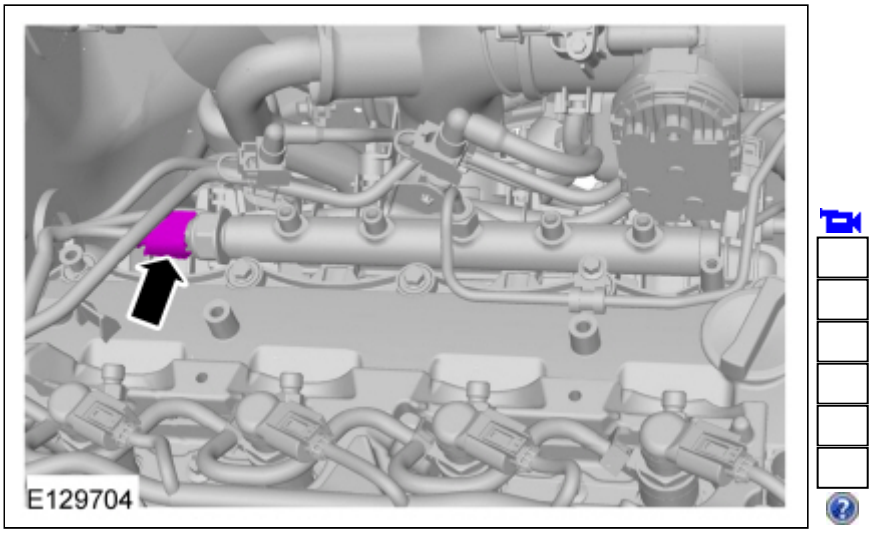
   NOTICE: Make sure that all openings are sealed with new blanking caps.

   Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Torque:
   Stage 1: 15 Nm
   Stage 2: 30 Nm



8. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

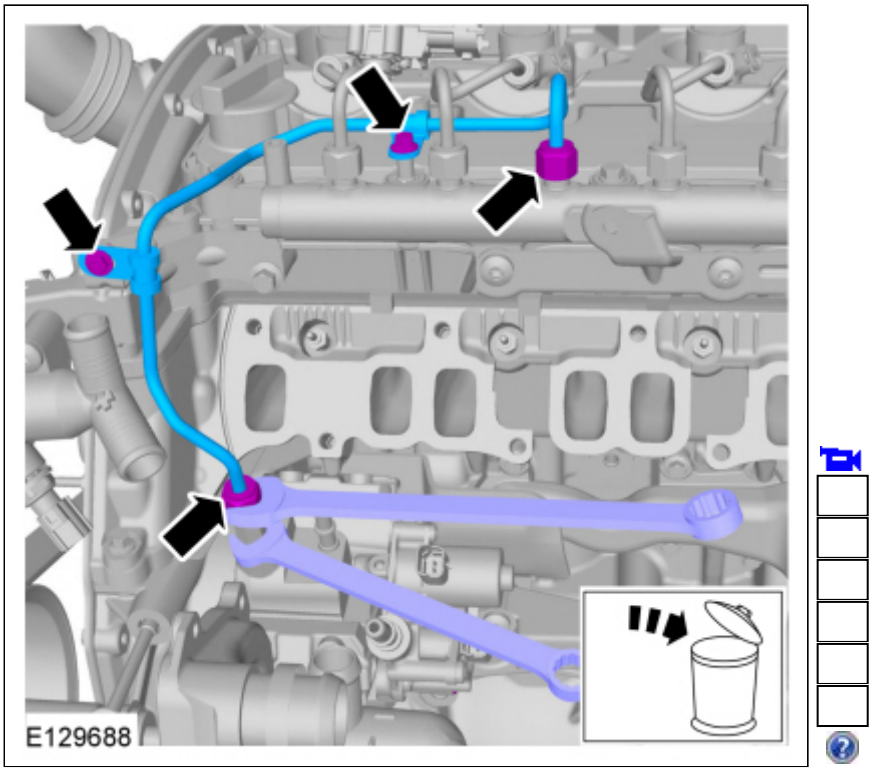
   Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



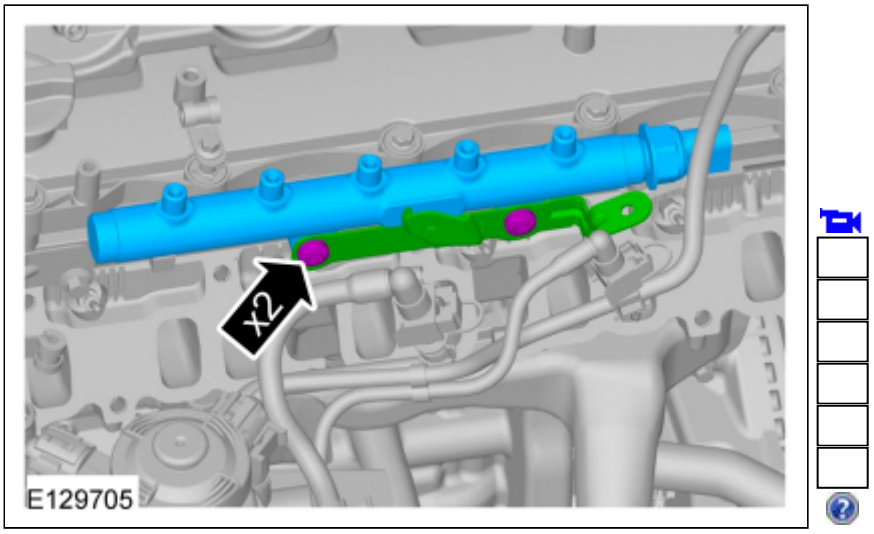
9. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
10. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

    NOTICE: Make sure that all openings are sealed with new blanking caps.

    Refer to: Fuel Injection Component Cleaning (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
    Torque:
    Fuel rail high-pressure fuel supply line unions:
    Stage 1: 15 Nm
    Stage 2: 30 Nm
    Fuel rail high-pressure fuel supply line bracket bolt: 10 Nm



11. Fuel rail bolts
    Torque:
    Stage 1: 6 Nm
    Stage 2: 23 Nm



Installation

1. To install, reverse the removal procedure.
2. Carry out a Fuel System Leak Test using the following WDS menu options: ToolBox/Powertrain/Service Functions
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

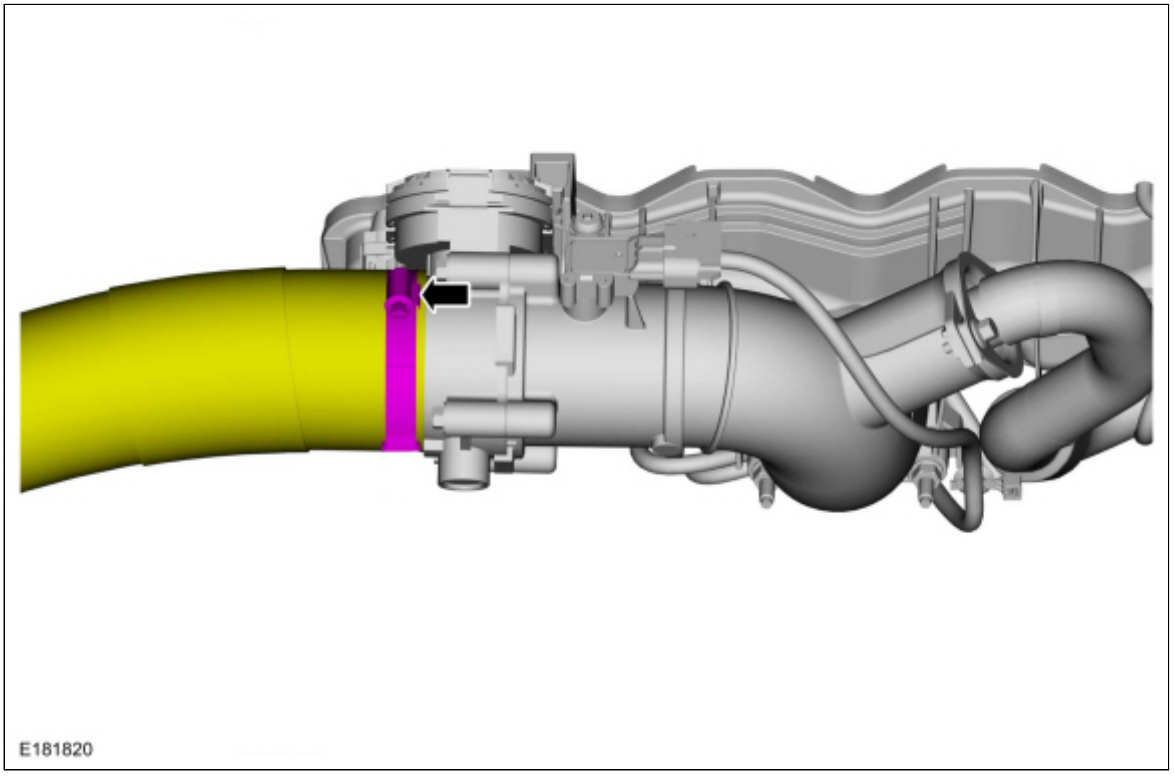
Throttle Body

Base Part Number: 9F991

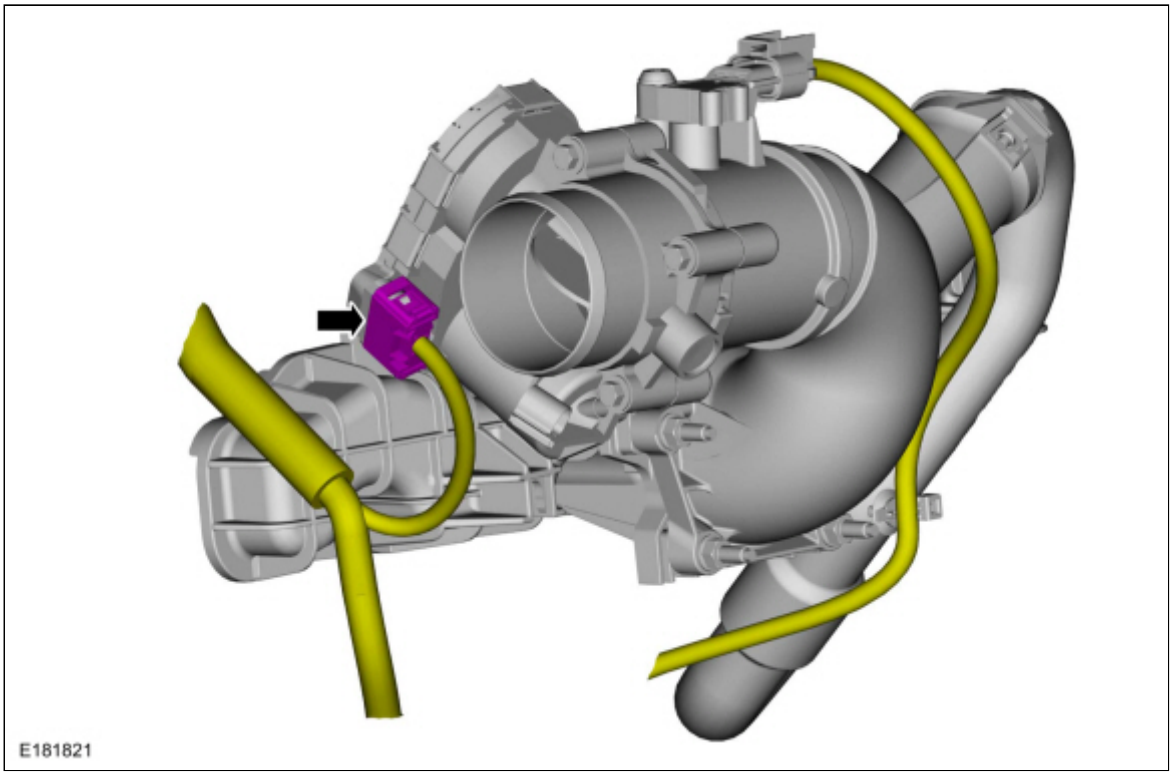
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



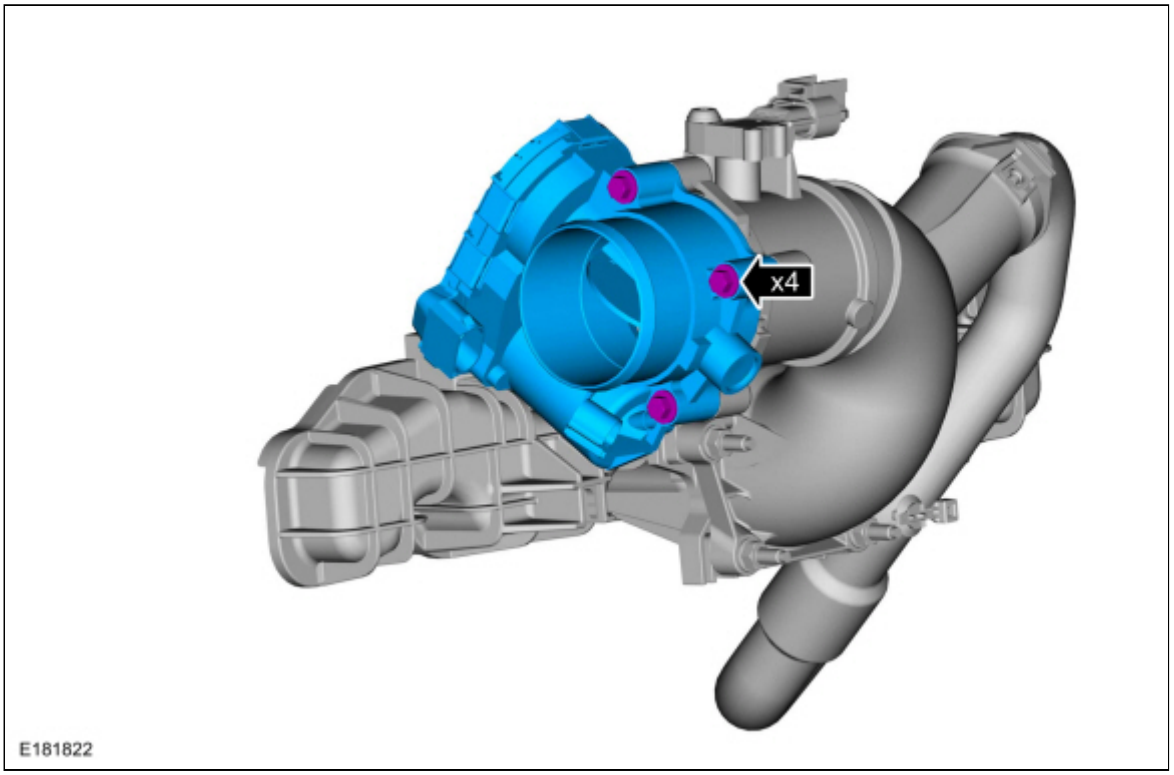
2.



3. **NOTICE: Make sure that the seal remains correctly located.**

   NOTE: *The O-ring seal is to be reused unless damaged.*

   Torque: 7 Nm



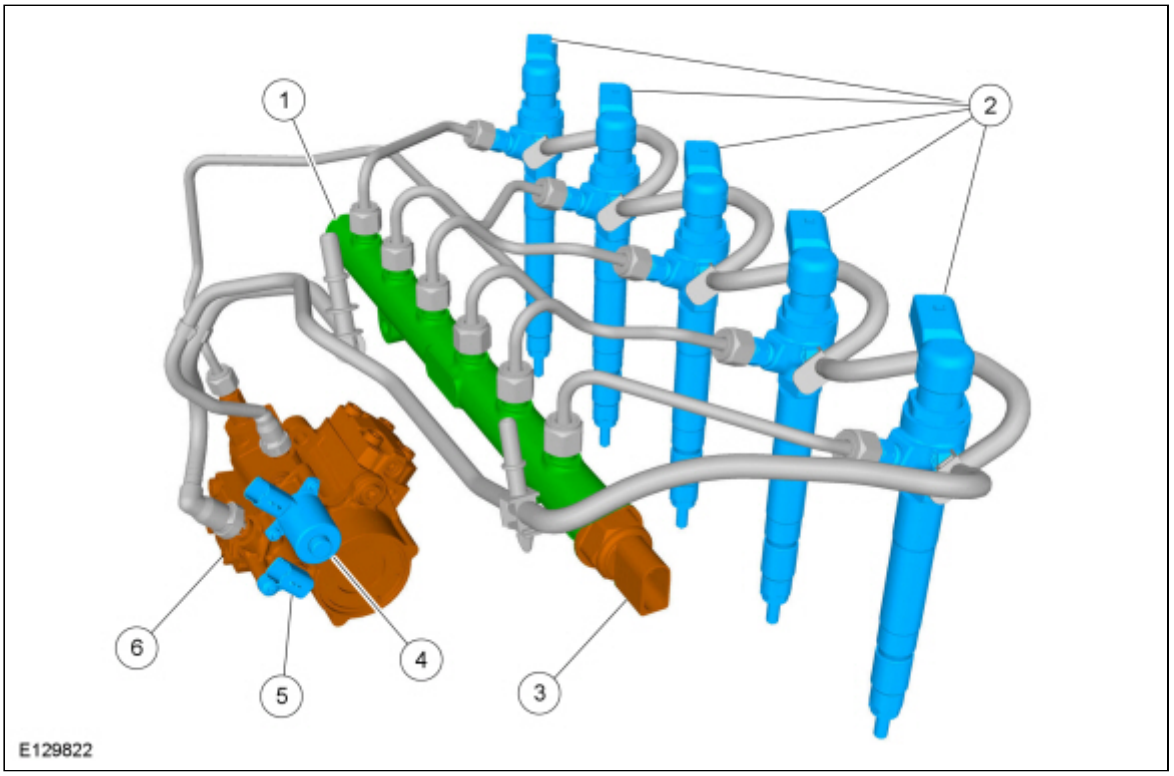
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls

Overview



Item	Part Number	Description
1	—	Fuel rail
2	—	Fuel injector(s)
3	—	Fuel pressure (FRP) sensor
4	—	Fuel metering valve
5	—	Fuel temperature sensor
6	—	Fuel pump

General

A common rail fuel injection system is used on the 3.2L Duratorq-TDCi (Puma) diesel engine.

Within the fuel pump there is an integral fuel transfer pump which draws the fuel from the fuel tank to the fuel pump.

A fuel metering valve is located in the supply port to the high-pressure chamber of the fuel pump. The fuel metering valve varies the quantity of fuel supplied to the fuel rail and fuel injector(s), in relation to the driving conditions.

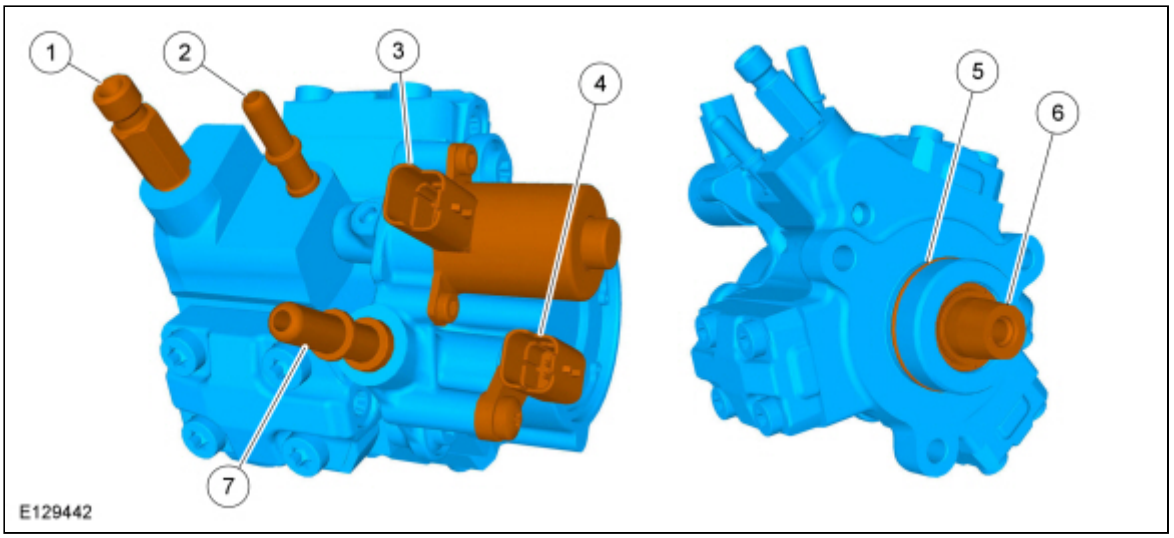
The fuel is supplied at high-pressure to the fuel rail and to the fuel injectors ready for injection. Depending on engine operating conditions, the fuel injection pressure varies between 230 bar and 1800 bar.

Fuel system pressure is measured using an FRP sensor located in the fuel rail. The FRP sensor converts the fuel system pressure into a voltage signal. This voltage signal acts as an input signal to the powertrain control module (PCM) for calculation of the fuel injection quantity.

The power train control module (PCM) calculates the time of fuel injection and the fuel injection quantity depending on various input variables. The specified quantity of fuel is injected into the respective combustion chamber through the solenoid actuated fuel injector(s). In doing so, a pre-injection and a main injection occur each time.

The excess fuel is returned to the fuel tank through the fuel return line.

Fuel pump



Item	Part Number	Description
1	—	Fuel pump high-pressure outlet union
2	—	Fuel pump fuel return union
3	—	Fuel metering valve
4	—	Fuel temperature sensor
5	—	Fuel pump O-ring seal
6	—	Fuel pump input drive
7	—	Fuel pump fuel supply union

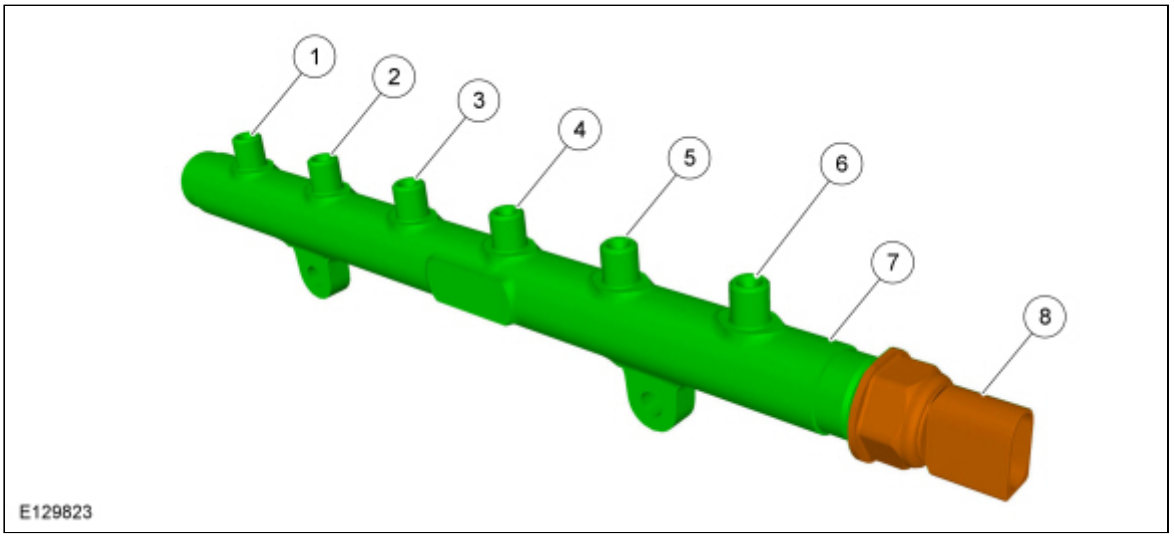
The fuel pump is driven by the timing chain and is mounted on the LHS of the cylinder block.

The fuel pump has three pump elements, each offset from each other by 120 degrees.

The fuel transfer pump is incorporated into the fuel pump and is located on the drive flange. The fuel transfer pump is a cycloid type pump.

The fuel metering valve is actuated by the PCM using pulse width modulation.

Fuel rail



Item	Part Number	Description
1	—	Fuel rail to fuel injector number 1 high-pressure fuel supply line union

2	—	Fuel rail to fuel injector number 2 high-pressure fuel supply line union
3	—	Fuel rail to fuel injector number 3 high-pressure fuel supply line union
4	—	Fuel pump to fuel rail high-pressure fuel supply line union
5	—	Fuel rail to fuel injector number 4 high-pressure fuel supply line union
6	—	Fuel rail to fuel injector number 5 high-pressure fuel supply line union
7	—	Fuel rail
8	—	FRP sensor

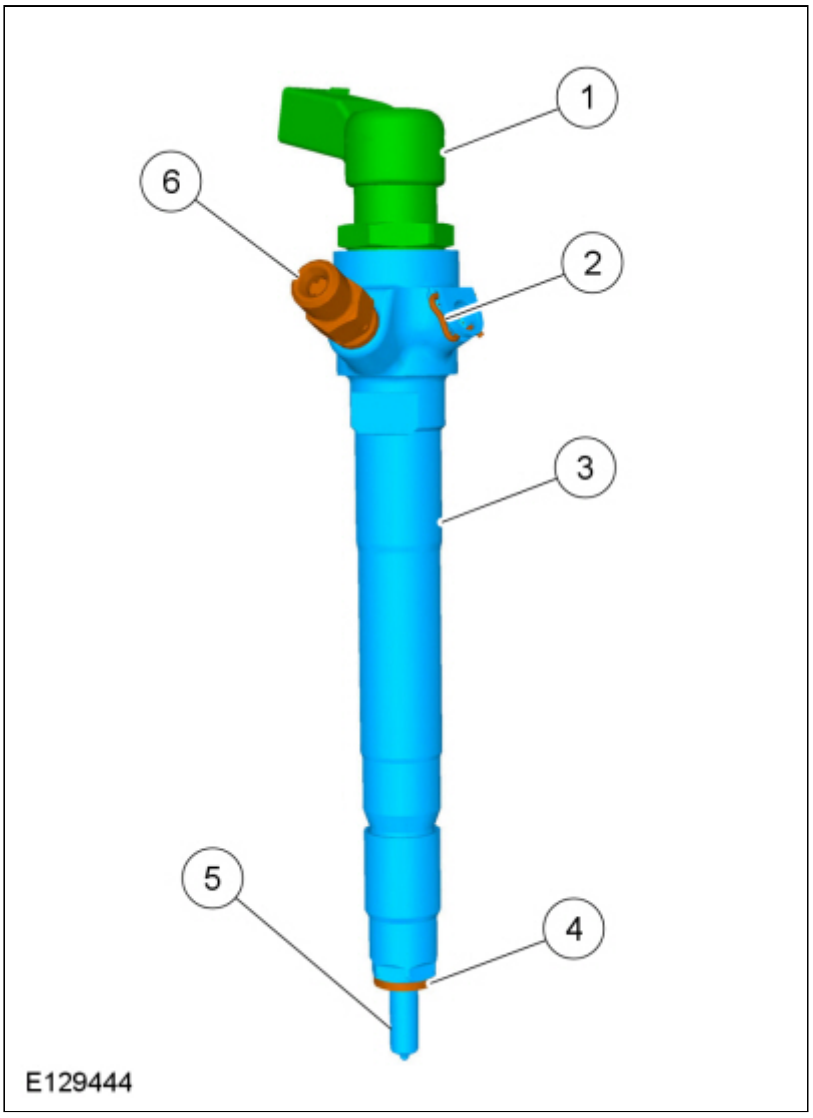
NOTICE: The FRP sensor must not be detached or removed from the fuel rail.

The fuel rail is made from forged steel and is retained by a support bracket located on the camshaft carrier.

The fuel is delivered by one high-pressure fuel supply line from the fuel pump to the fuel rail.

From the fuel rail, the fuel travels through the high-pressure fuel supply line(s) to the fuel injector(s).

Fuel injectors



Item	Part Number	Description
1	—	Fuel injector electrical connector
2	—	Fuel injector fuel return line clip

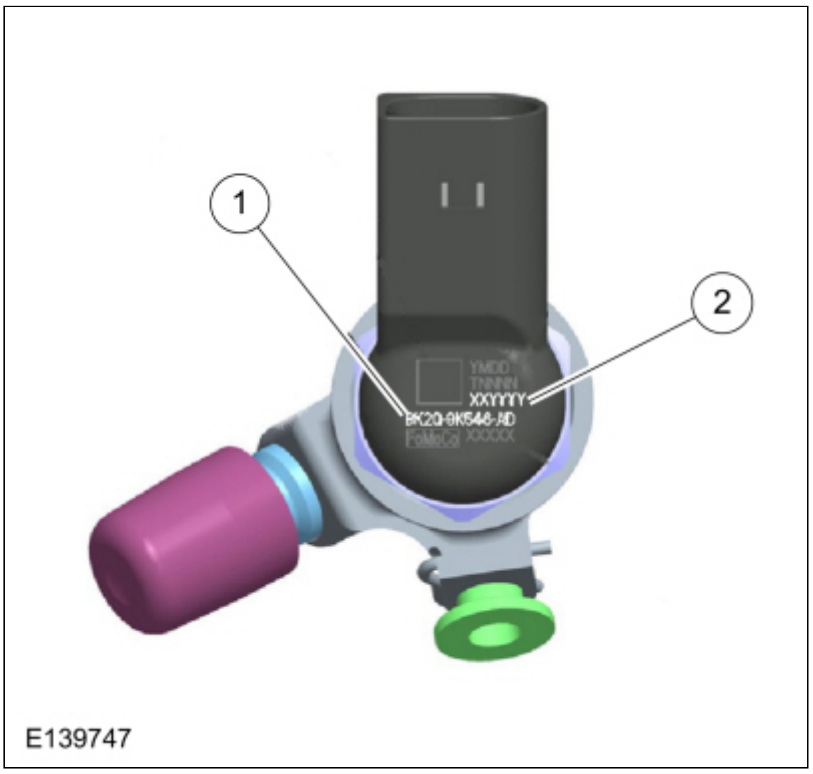
3	—	Fuel injector
4	—	Fuel injector sealing washer
5	—	Fuel injector nozzle
6	—	Fuel injector high-pressure fuel supply line union

The fuel injector(s) are located centrally on the cylinder head upper section and are attached by means of retaining clamps.

The fuel injector(s) are sealed from the combustion chamber by means of a copper sealing washer located between the fuel injector and the cylinder head. A new sealing washer must always be installed when carrying out installation work.

The fuel injectors are controlled directly by the PCM.

The fuel return line(s) are attached to the top of the fuel injector and are connected in series.



Item	Part Number	Description
1	—	Ford part number
2	—	Injector correction factor number

When installing new fuel injectors, the injector correction factor from the new fuel injector(s) must be recorded and uploaded using the Worldwide Diagnostic System (WDS).

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Fuel Charging and Controls

Refer to Wiring Diagrams Section 303-14B for schematic and connector information.

Refer to Wiring Diagrams Section 310-00B for schematic and connector information.

Special Tool(s)

	Hand Pressure Pump with Adapter Kit 310-110
	Test Hose for 310-025 310-025-18
	Test Hose for 310-025 310-025-19A

General Equipment

Ford approved diagnostic tool
Pneumatic vacuum gun

Inspection and Verification

WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times. Failure to follow this instruction may result in personal injury.

NOTICE: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always fit blanking plugs to any open orifices or lines.

NOTE: *As well as carrying out its normal function the glow plug indicator also acts as an engine check lamp which will flash continuously when a hard DTC is detected by the PCM. Soft DTCs are also stored by the PCM but will only be known if the system is checked for DTCs using the Ford diagnostic equipment.*

NOTE: *If a DTC is detected, all DTCs must be cleared after the concern is repaired. Failure to clear all DTCs may cause driveability concerns.*

NOTE: *If the fuel level in the fuel tank drops below approximately four liters, rough running will occur. This is to signal to the driver that the vehicle requires refuelling in order to prevent the fuel system from running dry.*

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Fuel leak(s) – Fuel filter – Air cleaner element – Vacuum line(s)/vacuum connectors – Hose(s)/hose connectors – Tube(s)/tube connectors – Contaminated fuel – Fuel supply line(s) – Fuel return line(s) – High-pressure fuel supply line(s) – Fuel injectors – Fuel rail – Fuel pump	– Fuse(s) – Relay(s) – Wiring harness – Electrical connector(s) – Fuel injectors – Fuel temperature sensor – Fuel rail pressure sensor – Fuel metering valve – Passive anti-theft system (PATS) LED operation – Glow plug indicator – PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:** *A PCM calibration update should only be carried out if it is applicable to the symptoms exhibited by the vehicle.*

   If the cause is not visually evident, verify the symptom and refer to the Ford diagnostic equipment. Check for the availability of an applicable PCM calibration update. Continue using the Ford diagnostic equipment and retrieve the DTCs and refer to the DTC Index Chart.

DTC Index Chart

DTC	Description/Condition	Possible Source	Action
P1250	Fuel metering valve controllability failure (displayed in addition to DTC P0089)	Circuit(s), air ingress into the fuel lines, fuel metering valve	GO to Pinpoint Test B

5. If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Symptom Chart

Symptom	Possible Sources	Action
• Engine does not crank and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine does not crank	• Passive anti-theft system (PATS).	• CHECK the PATS LED extinguishes within 3 seconds when the ignition is turned on. REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).
	• Starting system.	• REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Ignition switch.	• REFER to the Wiring Diagrams.
	• PCM.	• REFER to the Ford diagnostic equipment.
	• Engine locked.	• REFER to: Engine (303-01C Engine - 3.2L

		REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Accessories locked.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
• Engine cranks but does not start and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine cranks but does not start	• Low fuel tank fuel level.	• CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	• Inertia fuel shutoff (IFS) switch.	• RESET the IFS switch.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injectors.	• REFER to the Ford diagnostic equipment.
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Fuel lines damaged or blocked.	• GO to Pinpoint Test A
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Glow plug relay.	• REFER to the Ford diagnostic equipment.
	• Glow plugs.	• REFER to the Ford diagnostic equipment.
	• Crankshaft position (CKP) sensor.	• REFER to the Ford diagnostic equipment.
	• Camshaft position (CMP) sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Low cylinder compression.	• TEST the cylinder compression. REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi

		(118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Air intake blocked.	• REFER to: Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• PCM.	• REFER to the Ford diagnostic equipment.
• Poor starting and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Poor starting	• Low fuel tank fuel level.	• CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and

	Fuel Rail (Removal and Installation).
• Fuel filter blocked.	• GO to Pinpoint Test A
• Air cleaner element blocked.	• INSTALL a new air cleaner element.
• Glow plug relay.	• REFER to the Ford diagnostic equipment.
• Glow plug module.	• REFER to the Ford diagnostic equipment.
• Glow plugs.	• REFER to the Ford diagnostic equipment.
• Fuel system leak.	• CHECK the system for fuel leak(s). REPAIR the system as necessary.
• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
• Fuel system restriction.	• GO to Pinpoint Test A
• Fuel pump.	• REFER to the Ford diagnostic equipment.
• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
• Incorrect engine oil.	• INSTALL a new engine oil filter and engine oil. CARRY OUT the oil reset procedure. REFER to the Service interval indicator lamp section within the Owner's Guide.
• Incorrect power steering fluid.	• DRAIN and REFILL the power steering system with the correct fluid. REFER to: (211-00 Steering System - General Information) Power Steering System Flushing (General Procedures), Power Steering System Filling (General Procedures), Power Steering System Bleeding (General Procedures).
• CKP sensor.	• REFER to the Ford diagnostic equipment.
• Manifold absolute pressure (MAP) sensor.	• REFER to the Ford diagnostic equipment.
• FRP sensor.	• REFER to the Ford diagnostic equipment.
• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Low cylinder compression	• TEST the cylinder compression. REFER to: Engine (303-01C Engine - 3.2L

	compression.	REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
• Engine starts but immediately stops and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine starts but immediately stops	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• CMP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
• Poor idling and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Poor idling	• Low fuel tank fuel level.	• CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	• Air cleaner	• INSTALL a new air cleaner element

	element blocked.	INSTALL a new air cleaner element.
	• Accessories load.	• REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
• Engine stumbling and glow plug	• DTC detected	• REFER to the Ford diagnostic equipment

• Engine stumbling and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine stumbling	• Low fuel level.	• CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Accelerator pedal position (APP) sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• CMP sensor.	• REFER to the Ford diagnostic equipment.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
• Engine lacks power and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine lacks power	• Low fuel level.	• CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	• Fuel system leak(s).	• Carry out a Fuel System Leak Test using the Ford diagnostic equipment menu options: ToolBox/Powertrain/Service Functions. REFER to the Ford diagnostic equipment.
	• Brakes binding.	• CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	• Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	• ADVISE the customer about the effects of overloading the vehicle and wind resistance on the performance.
	• Accessories load.	• REFER to: Accessory Drive (303-05B

		REFER to: Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Kinked or restricted fuel lines.	• GO to Pinpoint Test A
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Turbocharger. • Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Charge air cooler blocked or cracked. • Charge air cooler pipes split or cracked. • Charge air cooler retaining clips missing or loose.	• INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and

		Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Vehicle speed sensor (VSS).	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• MAFT sensor.	• REFER to the Ford diagnostic equipment.
	• APP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Low cylinder compression.	• CHECK the cylinder compression. REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Black smoke at idle and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Black smoke at idle	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and

		Fuel Rail (Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Glow plug module.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Excessive black smoke during acceleration and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Excessive black smoke during acceleration	• Air cleaner element blocked.	• INSTALL a new air cleaner element as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma)

		Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• APP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Black smoke at cruising speeds and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Black smoke at cruising speeds	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).

	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Turbocharger wastegate position sensor • Turbocharger variable vane actuator.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Catalytic converter blocked.	• REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Blue smoke and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Blue smoke	• Engine burning oil.	• CARRY OUT a controlled oil consumption test over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 litre per 1000 km (600 miles).
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and

		REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Positive crankcase ventilation (PCV) system.	• INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	• Turbocharger oil return tube blocked or damaged.	• REFER to: Turbocharger (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Worn or damaged valve guide(s), piston ring(s), cylinder bore(s), cylinder head or gasket.	• REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage. REFER to: Cylinder Head (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
• White smoke and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• White smoke	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L

		Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect valve timing.	• CHECK the valve timing.
	• Coolant in the combustion chamber.	• CARRY OUT a cooling system pressure test. REFER to: Engine Cooling (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine misfire and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine misfire	• Low fuel tank level.	• CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L

		Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Engine operating temperature too high.	• REFER to: Engine Cooling (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• CMP sensor.	• REFER to the Ford diagnostic equipment.
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Low cylinder compression.	• CHECK the cylinder compression. REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Worn or damaged valve(s), tappet(s), camshaft(s) or cylinder head gasket.	• REMOVE the cylinder head. INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage. REFER to: Cylinder Head (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine knock at idle and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine knock at idle	• Low engine oil level.	• CHECK the engine oil level. REFILL as necessary.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and

		Installation), Fuel Rail (Removal and Installation).
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• Incorrect valve timing.	• CHECK the valve timing.
	• Excessive carbon build up.	• REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up. REFER to: Cylinder Head (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Worn or damaged oil pump. • Worn or damaged timing chain or sprocket. • Major mechanical engine failure.	• INSPECT the engine components.
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine knock during acceleration and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• Engine knock during acceleration	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.
	• Major mechanical engine failure.	• REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Excessive fuel consumption and glow plug indicator is flashing	• DTC detected.	• REFER to the Ford diagnostic equipment.
• **NOTE:** *Before proceeding with any of the actions in relation to the possible sources for*	• Brakes binding.	• CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis

excessive fuel consumption, a fuel consumption test must be carried out using the Ford *diagnostic equipment.* • Excessive fuel consumption		and Testing).
	• Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	• ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	• Incorrect or contaminated fuel.	• CHECK for signs of contamination such as strange odours from the fuel tank. • CHECK for signs of water or petrol in the diesel. • If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	• Air cleaner element blocked.	• INSTALL a new air cleaner element.
	• Fuel filter blocked.	• GO to Pinpoint Test A
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• Incorrect engine timing.	• REFER to the Ford diagnostic equipment.
	• Fuel system leak(s).	• CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	• Incorrect engine oil.	• INSTALL a new oil filter and engine oil.
	• Generator.	• REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
	• EGR valve sticking open.	• REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Turbocharger	• REFER to the Ford diagnostic equipment.

	wastegate position sensor • Turbocharger variable vane actuator.	
	• Air ingress into the fuel lines.	• REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).
	• MAP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel injector(s).	• REFER to the Ford diagnostic equipment.
	• Turbocharger.	• REFER to: Turbocharger (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Incorrect valve timing.	• CHECK the valve timing.
	• Slipping clutch.	• REFER to: Clutch (308-01A Clutch - 5-Speed Manual Transmission - MT75, Diagnosis and Testing), Clutch (308-01B Clutch - 6-Speed Manual Transmission - MT82, Diagnosis and Testing).
	• Low cylinder compression.	• CHECK the cylinder compression. REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Dual mass flywheel.	• Visually INSPECT the dual mass flywheel for damage. INSTALL new parts as necessary.
	• Wiring harness/connector.	• REFER to the Ford diagnostic equipment.
	• PCM.	• REFER to the Ford diagnostic equipment.
• Engine cuts out during hard acceleration	• CMP sensor.	• REFER to the Ford diagnostic equipment.
	• CKP sensor.	• REFER to the Ford diagnostic equipment.
	• Incorrect pilot learn. • Incorrect pump learn.	• REFER to the Ford diagnostic equipment.
	• FRP sensor.	• REFER to the Ford diagnostic equipment.
	• Fuel metering valve.	• REFER to the Ford diagnostic equipment.
	• Fuel pump.	• REFER to the Ford diagnostic equipment.

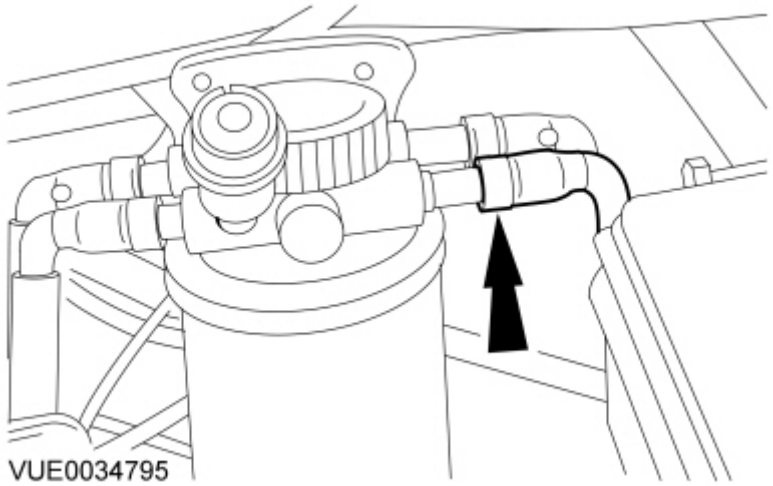
Pinpoint Tests

PINPOINT TEST A : FUEL PUMP FUEL SUPPLY TEST

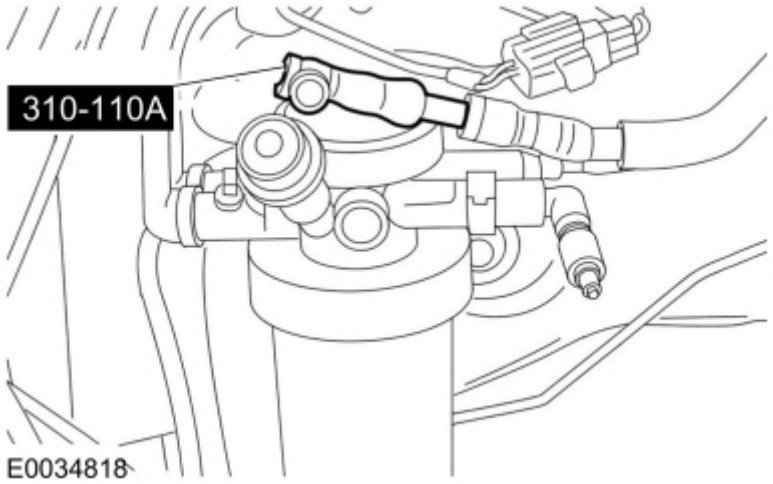
A1 CHECK THE FUEL PUMP FUEL SUPPLY PRESSURE
• **NOTE:** *The graphics used are for illustration purposes only.* Clean the area around the fuel filter quick release couplings.

REFER to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

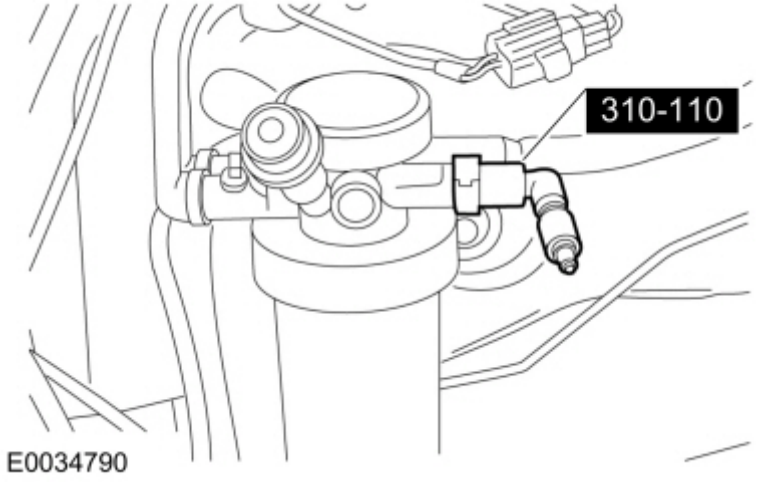
- Disconnect the fuel tank to fuel filter fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).



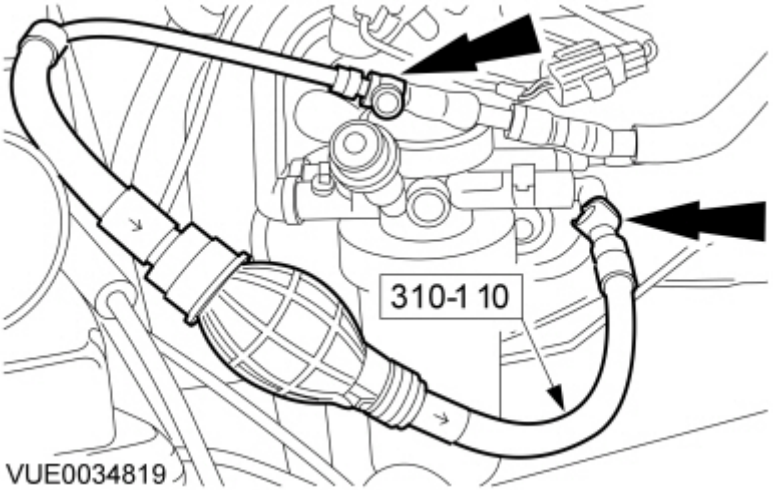
- Install the special tool adapter to the fuel tank to fuel filter fuel supply line.



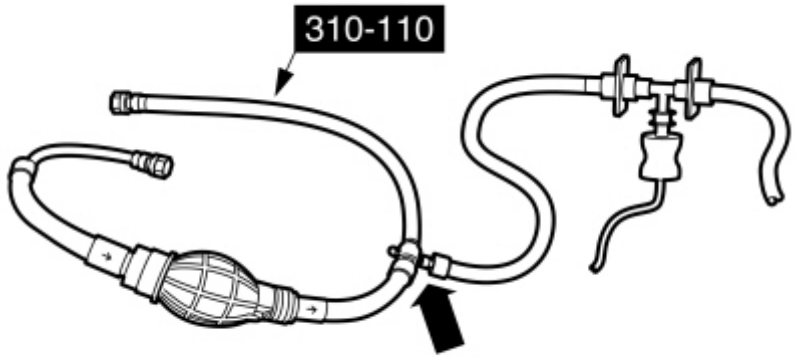
- Install the special tool adapter to the fuel filter.



- **NOTE:** *Make sure that the hand primer arrow indicating the fuel flow is pointing towards the fuel filter.*
  Install the special tool between the special tool adapters.



- Connect the Ford diagnostic equipment pressure transducer to the special tool.



- Using the Ford diagnostic equipment, select the digital multi meter (DMM) function from the toolbox menu. Select the pressure vacuum transducer (PVT) function and configure the DMM to display pressure/vacuum.
- Start the engine.
- Allow the engine to idle for at least one minute.
- Make a note of the value displayed by the Ford diagnostic equipment.

Is the value displayed between -50 mB and -250 mB?

Yes	GO to A3
No	If the displayed value is between 0 mB and -50 mB, GO to A2 If the displayed value is -250 mB or a greater negative value, GO to A4

A2 CHECK THE FUEL SYSTEM FOR AIR INGRESS

- **NOTE:** *A small amount of air bubbles in the fuel supply line is acceptable.*

  Observe the flow of fuel through the clear plastic pipe of the hand pressure pump.

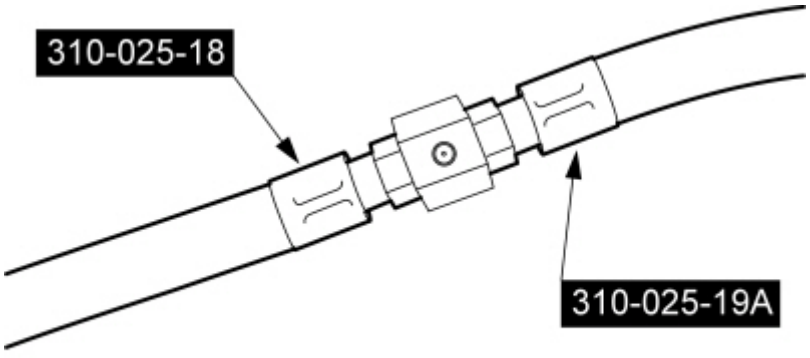
Is the hand pressure pump clear plastic pipe free from an excessive volume of air bubbles?

Yes	Using the Ford diagnostic equipment, guided diagnostic, run the fuel system pressure test, CHECK the fuel pump high-pressure fuel supply pressure.
No	CHECK for air ingress into the fuel lines. REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

A3 CHECK THE FUEL PUMP FUEL RETURN PRESSURE

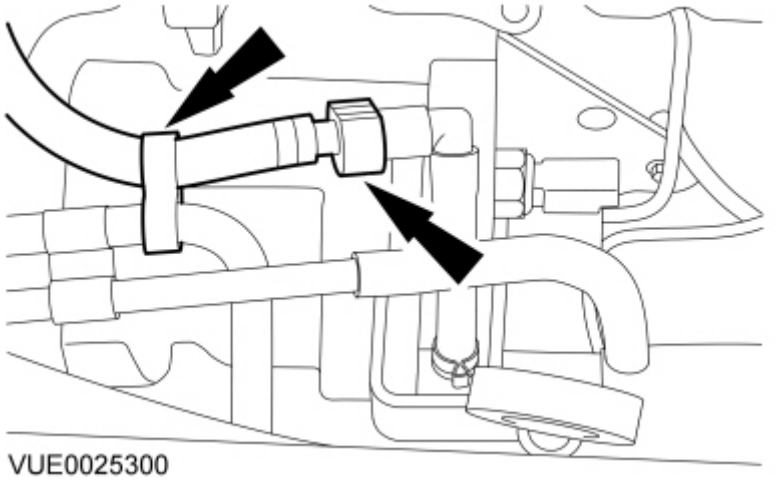
NOTE: *Before this test can be carried out, the latest calibration must be programmed into the PCM.*

- Clean the area around the fuel injector to fuel pump fuel return line quick release coupling. REFER to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
- Connect special tools 310-025-18 and 310-025-19A to the Ford diagnostic equipment pressure transducer adaptor GV2323.



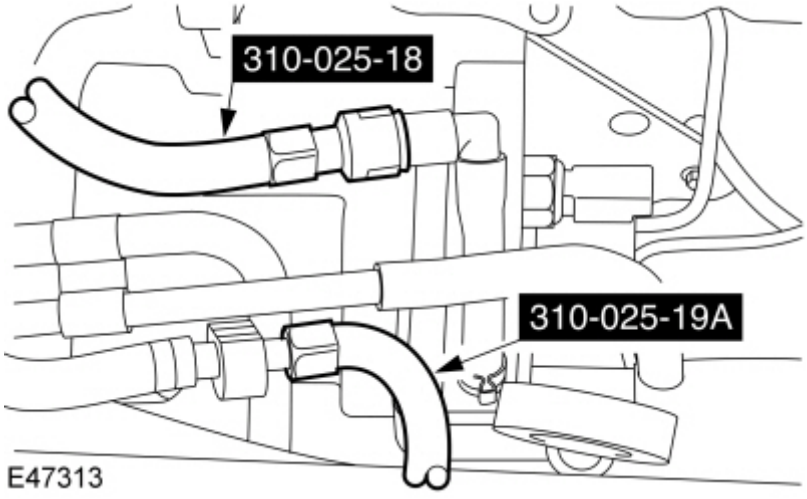
E46840

- Disconnect the fuel injector to fuel pump fuel return line quick release coupling.



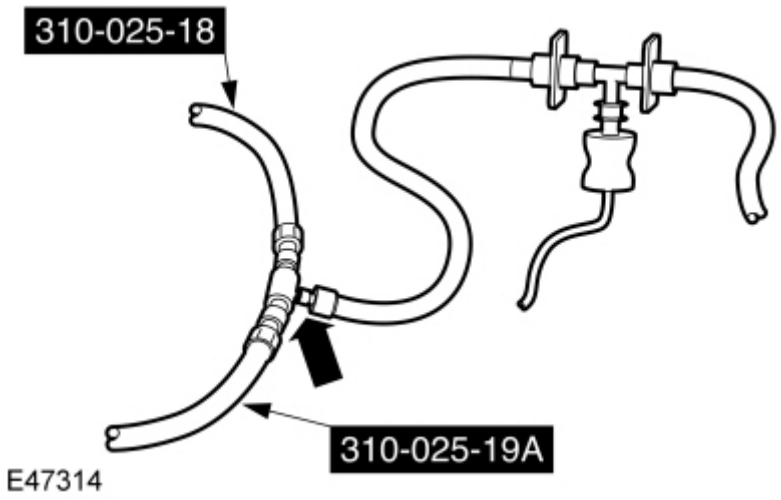
VUE0025300

- Connect the special tools between the fuel injector to fuel pump fuel return line and the fuel pump.



E47313

- Start the engine.
- Using the Ford diagnostic equipment data logger function, monitor the fuel system temperature until a temperature of over 50°C is obtained.
- Stop the engine.
- Disconnect the Ford diagnostic equipment pressure transducer from the special tool 310-110.
- Connect the Ford diagnostic equipment pressure transducer to the Ford diagnostic equipment pressure transducer adaptor GV2323.



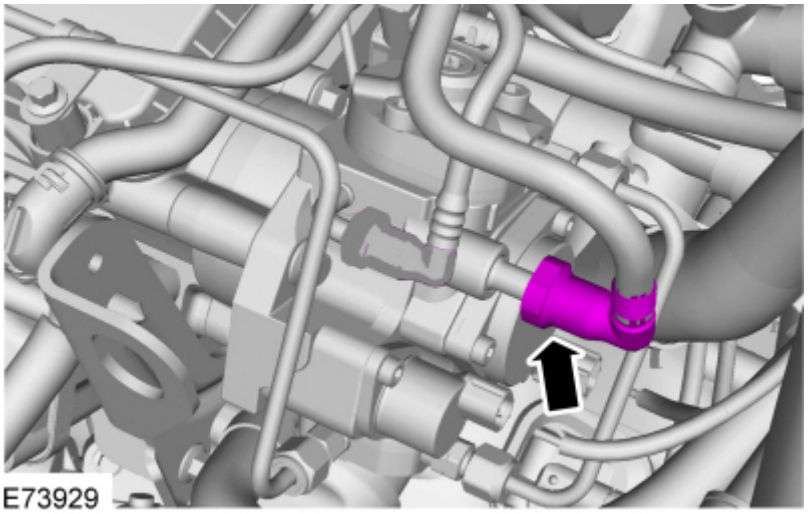
- Using the Ford diagnostic equipment, select the digital multimeter (DMM) function from the toolbox menu. Select the pressure vacuum transducer (PVT) function and configure the DMM to display pressure/vacuum.
- Start the engine.
- Make a note of the value displayed by the Ford diagnostic equipment with the engine at idle.

Is the value displayed less than 400mB at idle.

Yes	Using the Ford diagnostic equipment fuel system fuel pressure test. CHECK the fuel pump high-pressure fuel supply pressure. If no fault is indicated with the fuel pump high-pressure fuel supply pressure, RETURN to the Symptom Chart.
No	CHECK the fuel return system for damage or restriction. REPAIR or INSTALL new components as required. TEST the system for normal operation.

A4 CHECK THE FUEL PUMP FUEL SUPPLY SYSTEM FOR RESTRICTION

- Clean the area around the fuel pump fuel supply line quick release coupling.
  REFER to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
- Disconnect the fuel pump fuel supply line.
  - Install a blanking plug to the open end of the fuel pump union.



- Place the open end of the fuel pump fuel supply line into a clean container.
- Operate the hand pressure pump at least three times in rapid succession and observe the value displayed by the Ford diagnostic equipment.

Does the fuel pressure indicated by the Ford diagnostic equipment when operating the hand pressure pump instantly fall to zero when the hand pressure pump is released?

Yes	CHECK the fuel level sensor and fuel tank fuel supply line for restriction. REPAIR or INSTALL new components as required.
No	INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). Test the system for normal operation.

PINPOINT TEST B : DTC P1250 - FUEL METERING VALVE CONTROLLABILITY FAILURE

B1 CHECK FOR AIR INGRESS INTO THE FUEL LINES

- Check for air ingress into the fuel system.
  REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

Are there signs of air ingress into the fuel system?

Yes	REPAIR the system as recommended in the fuel system diagnostic. CLEAR the DTCs. TEST the system for normal operation.
No	GO to B2

B2 CHECK THE FUEL RAIL PRESSURE SENSOR CIRCUIT

- Using the wiring diagrams, CHECK the fuel rail pressure sensor circuit wiring harnesses and electrical connectors for electrical shorts or damage.

Is the fuel rail pressure sensor circuit shorted or damaged?

Yes	REPAIR the circuit as necessary. TEST the system for normal operation.
No	GO to B3

B3 CHECK THE FUEL METERING VALVE CIRCUIT

- Using the wiring diagrams, CHECK the fuel metering valve circuit wiring harnesses and electrical connectors for electrical shorts or damage.

Is the fuel metering valve circuit shorted or damaged?

Yes	REPAIR the circuit as necessary. TEST the system for normal operation.
No	GO to B4

B4 CHECK THE OPERATION OF THE FUEL METERING VALVE

NOTE: *This test requires the aid of another technician.*

- Connect the Ford diagnostic equipment.
- Start the engine.
- Using the Ford diagnostic equipment, DATALOGGER, set the parameters FRP, FRP_DSD, VSS, RPM, MFDES,SCV_DC, SCV_AMP.
- Carry out a road test.
- Select second gear.
- Release the accelerator pedal and allow the engine speed to decrease to idle while the vehicle is moving with second gear engaged.
- Rapidly apply full throttle until the engine speed reaches 4,000 RPM and then immediately release the accelerator pedal, allowing the engine speed to return to idle while the vehicle is moving with second gear engaged.
- Repeat step 7 approximately four times consecutively.
- Observe the recorded data from the tests.

Is the value for the FRP parameter data either staying constant or not changing with the FRP_DSD parameter data?

Yes	This indicates that the fuel metering valve is either stuck or not responding. INSTALL a new fuel metering valve. TEST the system for normal operation.
No	CLEAR the DTC and REPEAT the test. If the concern persists, INSTALL a new fuel metering valve. TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Fuel Injection Component Cleaning

General Equipment

Pneumatic vacuum gun

WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: Do not carry out any repairs to the fuel injection system with the engine running. The fuel pressure within the system can be as high as 1600 bar. Failure to follow this instruction may result in personal injury.

WARNING: Eye protection must be worn at all times when working on or near any fuel related components. Failure to follow this instruction may result in personal injury.

NOTICE: Make sure that the workshop area in which the vehicle is being worked on is as clean and dust-free as possible. Areas in which work on clutches, brakes or where welding or machining are carried out are not suitable in view of the risk of contamination to the fuel system.

NOTICE: Make sure that clean non-plated tools are used. Clean tools using a new brush that will not lose its bristles and fresh suitable evaporative cleaning agent, prior to starting work on the vehicle.

NOTICE: Use a steel topped workbench and cover it with clean, lint-free non-flocking material.

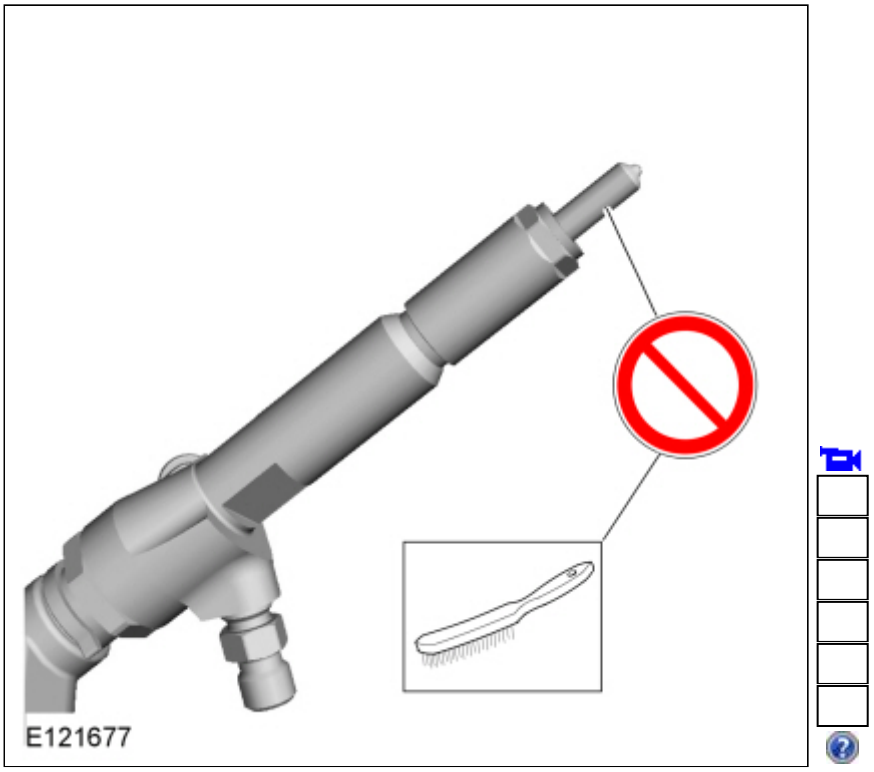
NOTICE: Make sure that all parts removed from the vehicle are placed on the lint-free non-flocking material.

NOTICE: Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.

NOTICE: Make sure that any protective gloves worn are new and are of the non-powdered latex type.

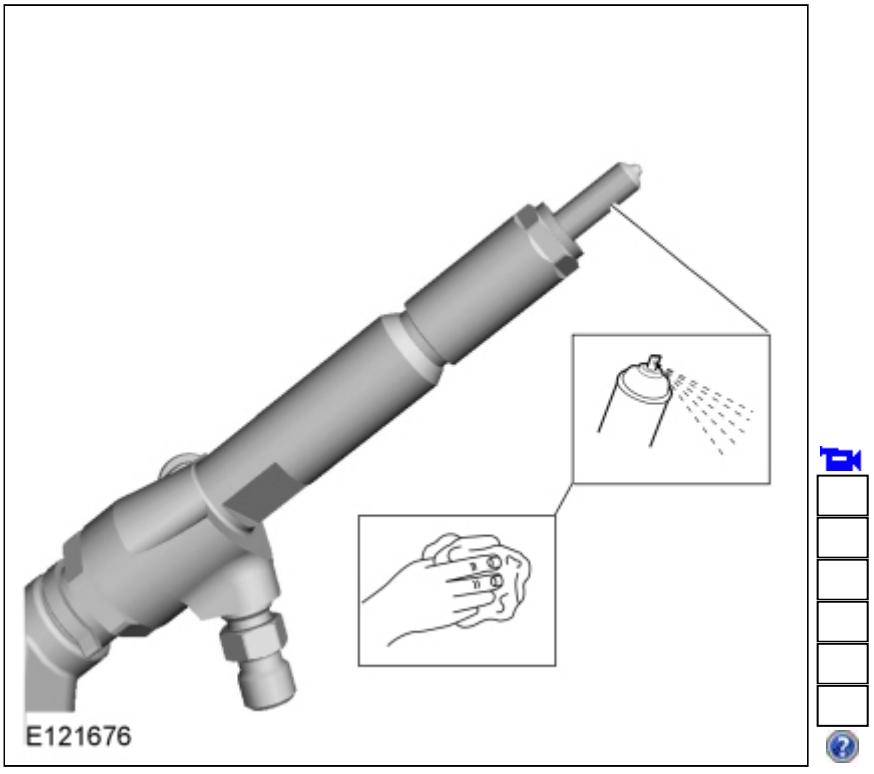
NOTICE: Before using the suitable evaporative cleaning agent, protect all electrical components and connectors with lint-free non-flocking material.

1. For additional information, refer to: Solvents, Sealants and Adhesives (100-00 General Information, Description and Operation).
   For additional information, refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2.



NOTICE: Use lint free cloth.

3. Using Brake Cleaner: 3U7J-2C410-AA



4. Using a new brush that will not lose its bristles, brush a suitable evaporative cleaning agent onto the components being removed and onto the surrounding area.
5. Using the pneumatic vacuum gun, remove all traces of evaporative cleaning agent and foreign material.
6. Dispose of any unused evaporative cleaning agent and the brush after completing the repair.

Copyright © 2016 Ford Motor Company

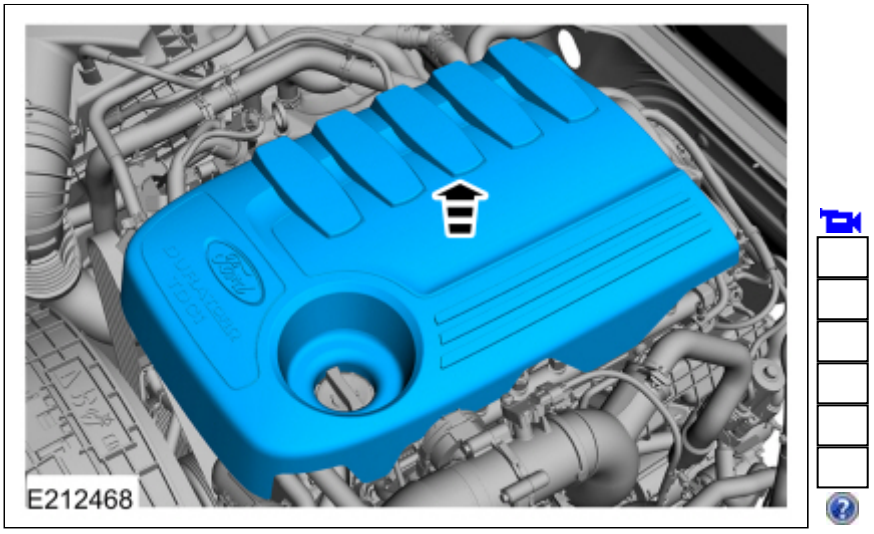
Fuel Injector Fuel Return Line

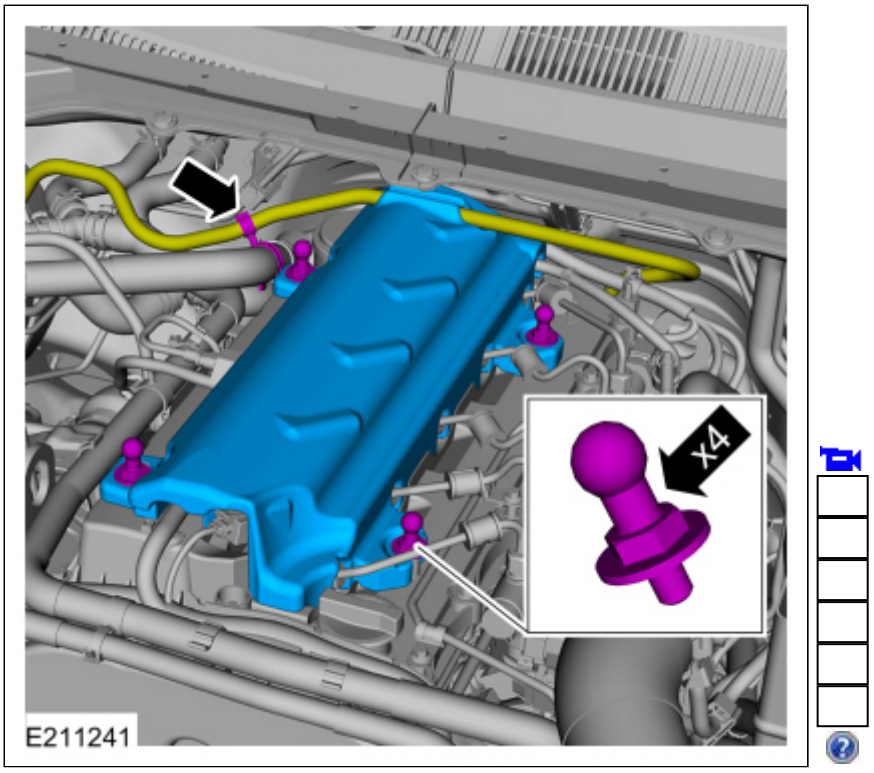
Materials

Name	Specification
Grease - High Temperature	WSD-M1C228-A

Removal

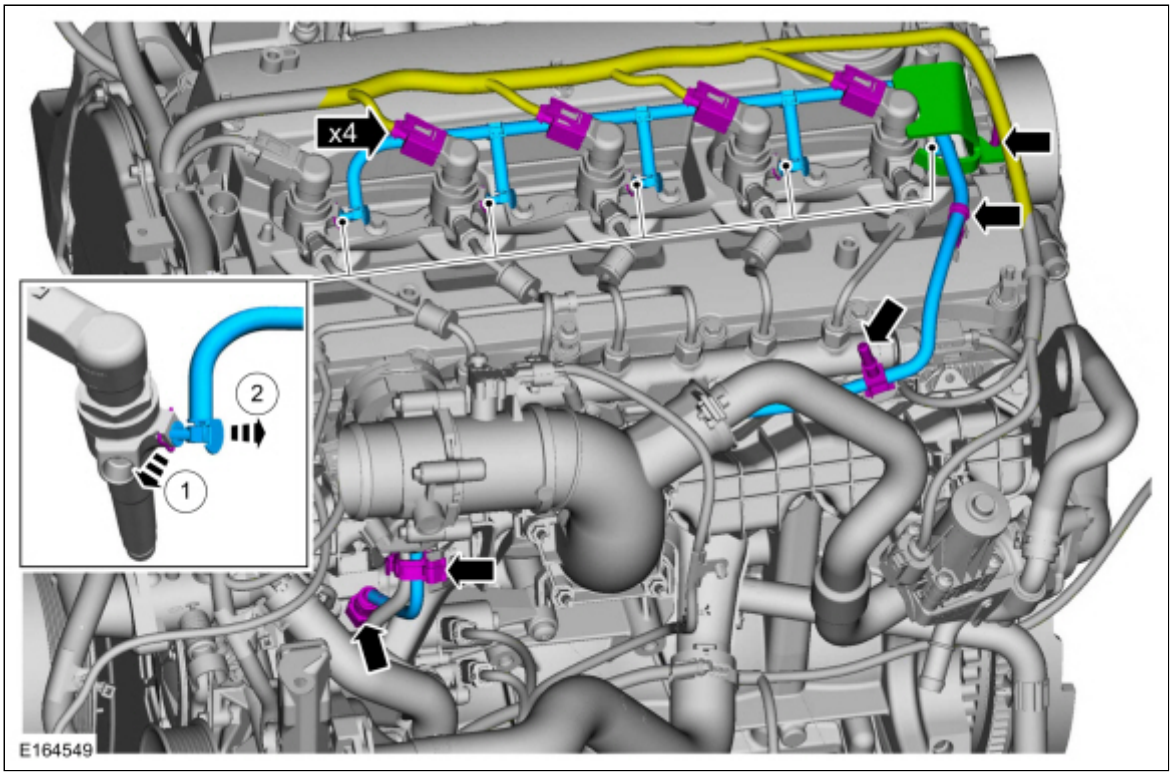
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

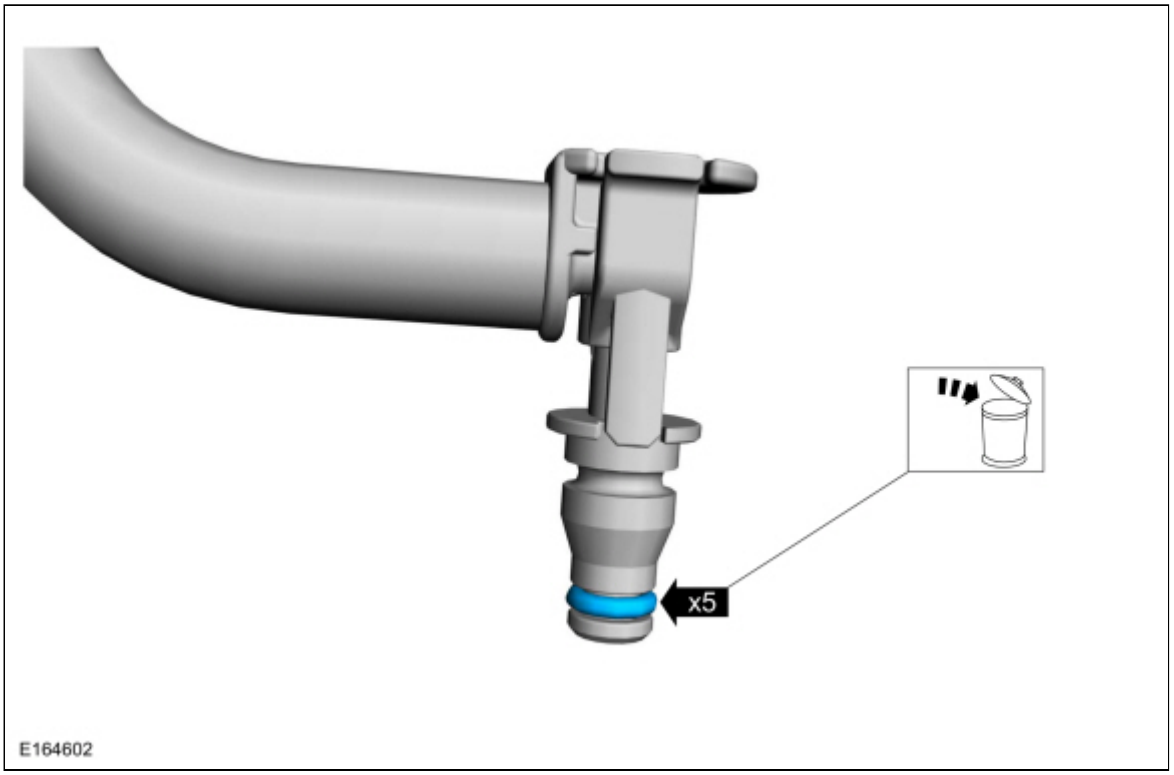
3. *Torque*: 3 Nm


4. **NOTE:** *Be prepared to collect escaping fluid.*

   Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).



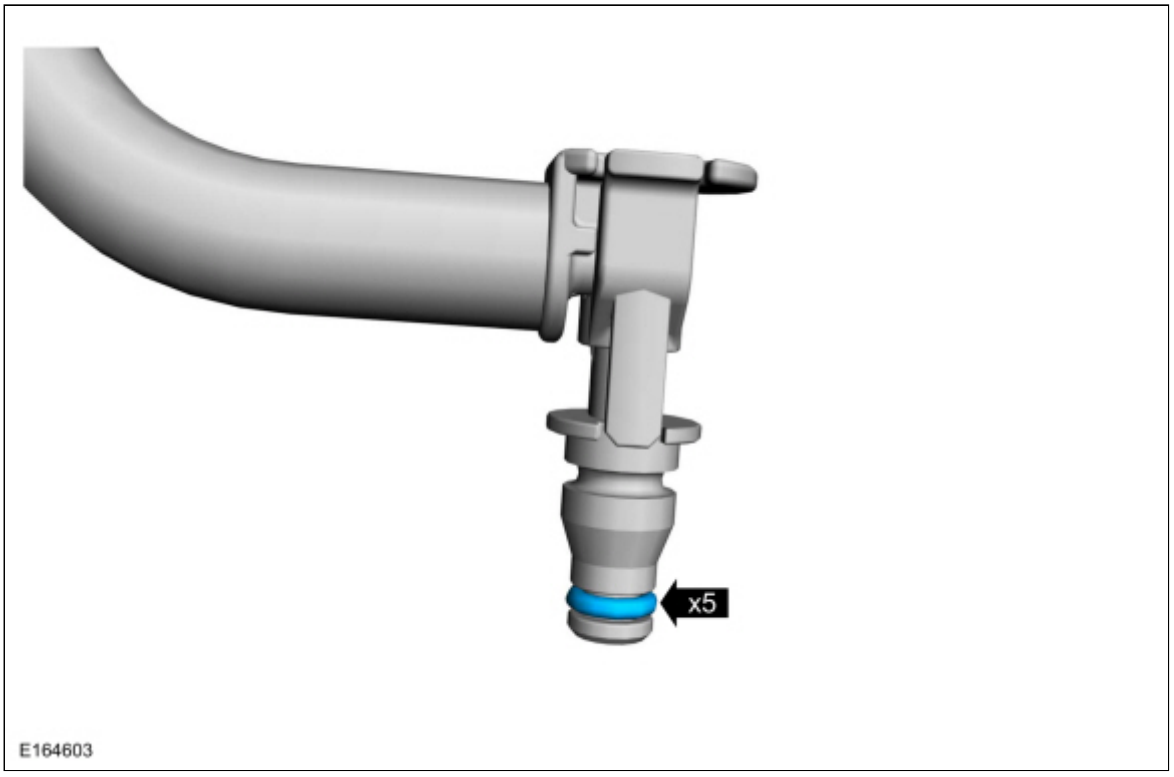
5.



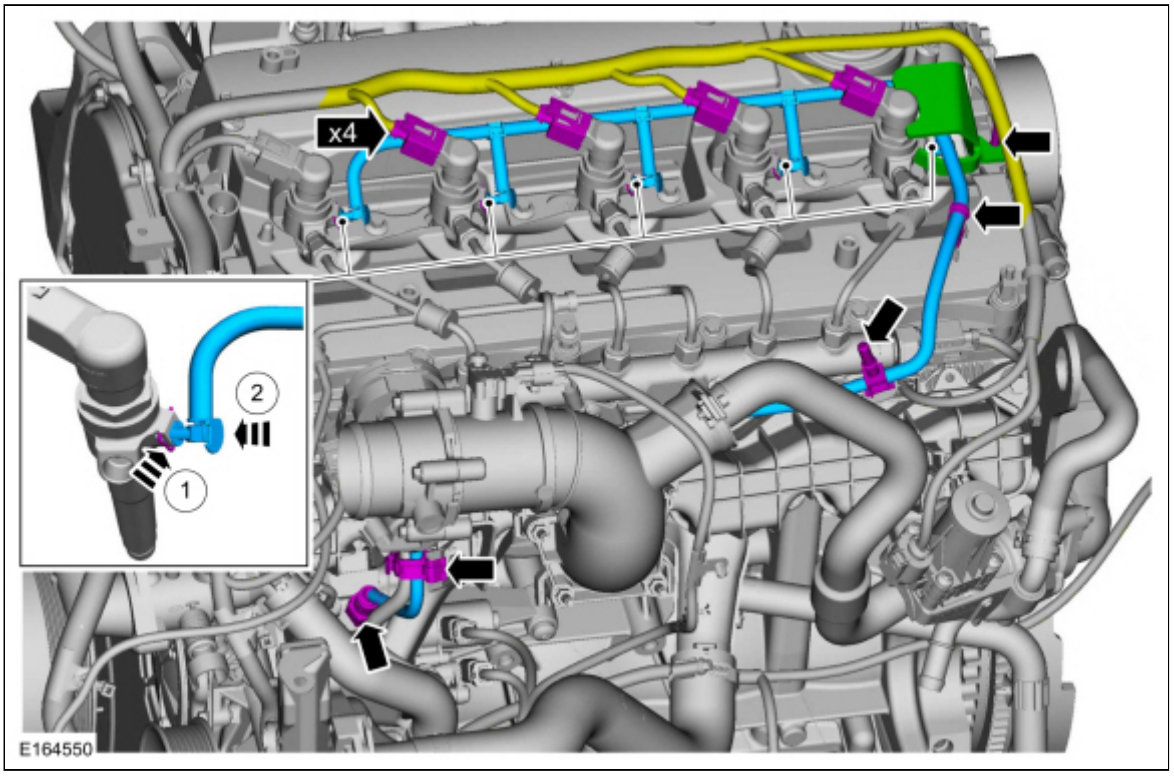
Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *Make sure that new components are installed.*

   Apply a thin coating.
   Material: Grease - High Temperature (WSD-M1C228-A)



3. Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).



Copyright © 2016 Ford Motor Company

Fuel Injectors

Special Tool(s) / General Equipment

Ford Diagnostic Equipment
Long Nose Pliers

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Make sure that the engine is switched off.**

   WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

   WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

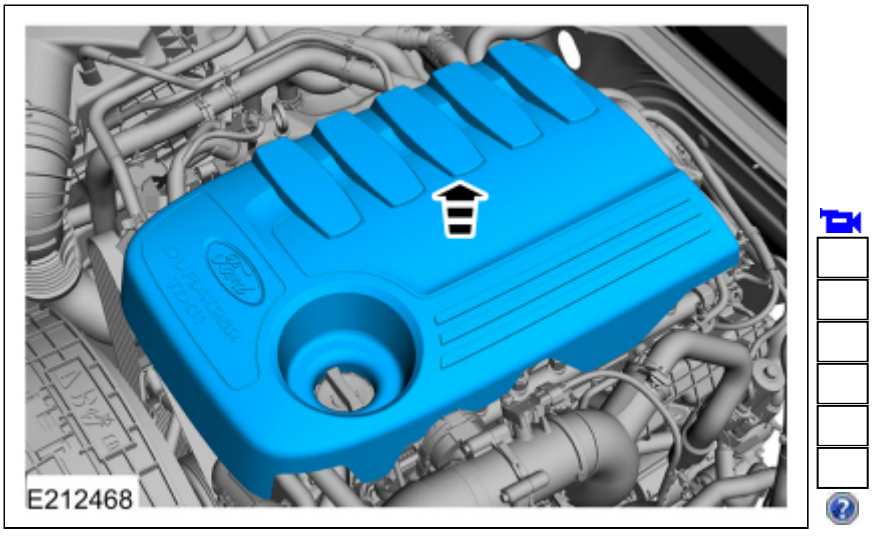
   NOTICE: Fuel injectors sharing a common fuel injector clamp must be removed in pairs.

   NOTE: *The component should be reused unless damaged or has excessive wear.*

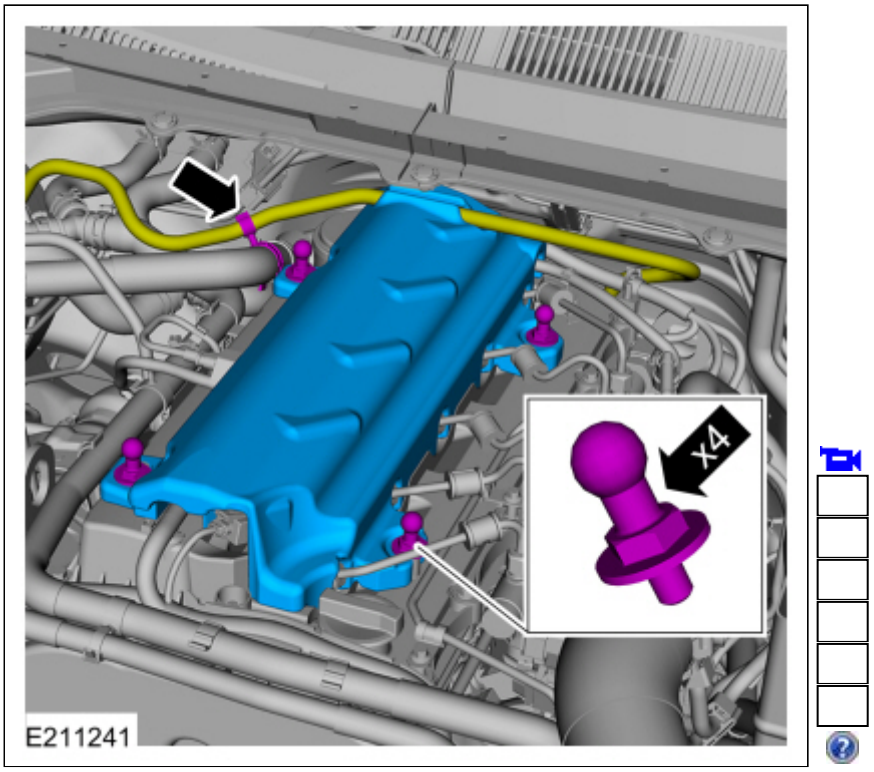
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Within the datalogger function of WDS, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30ºC whichever is the greater.
   Use the General Equipment: Ford Diagnostic Equipment

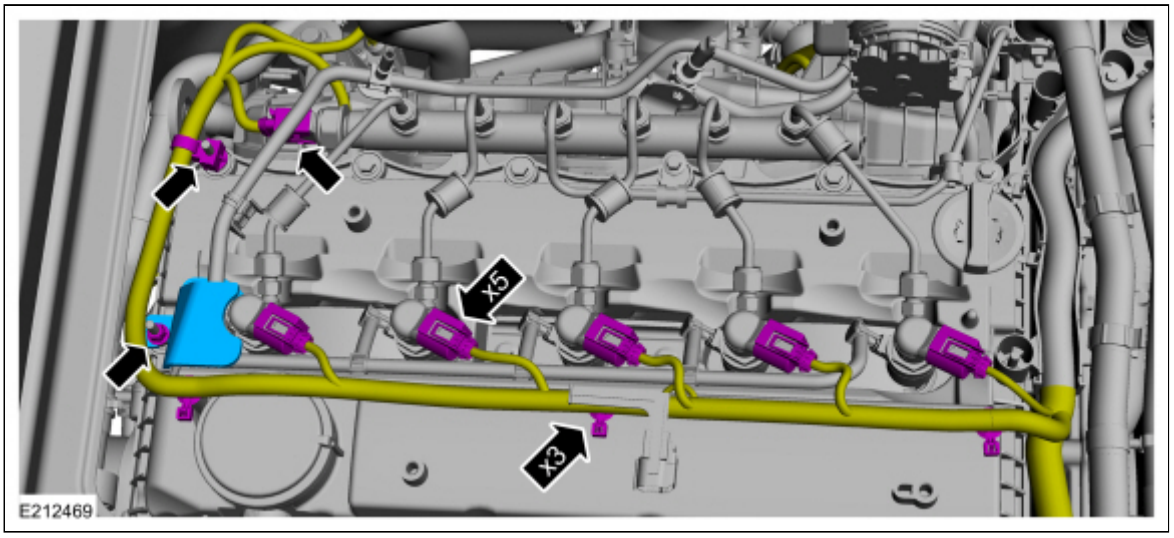
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

4. 

5. *Torque*: 3 Nm

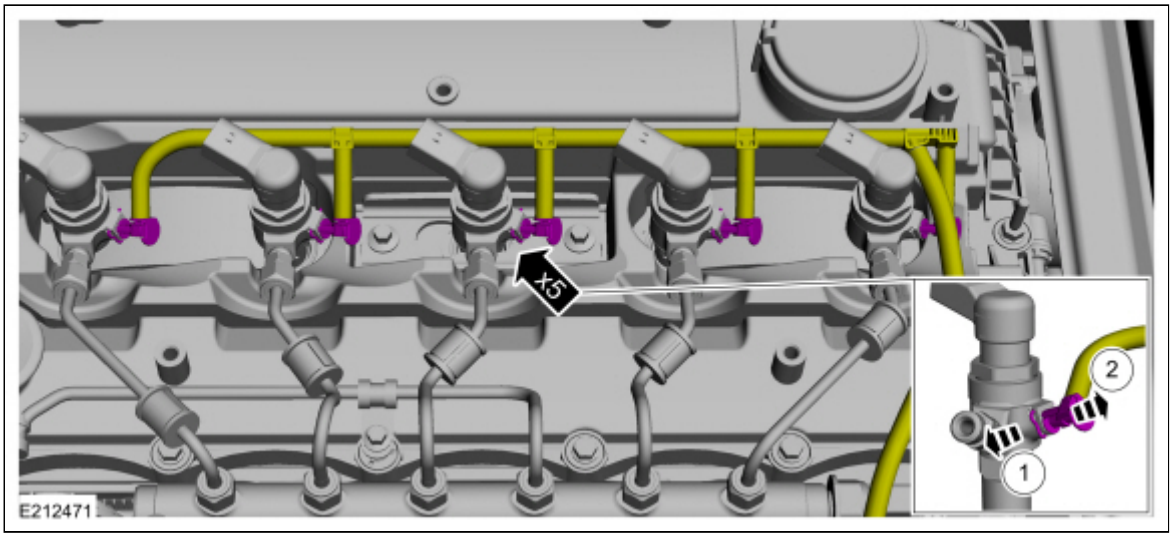


6. *Torque*: 10 Nm



7. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

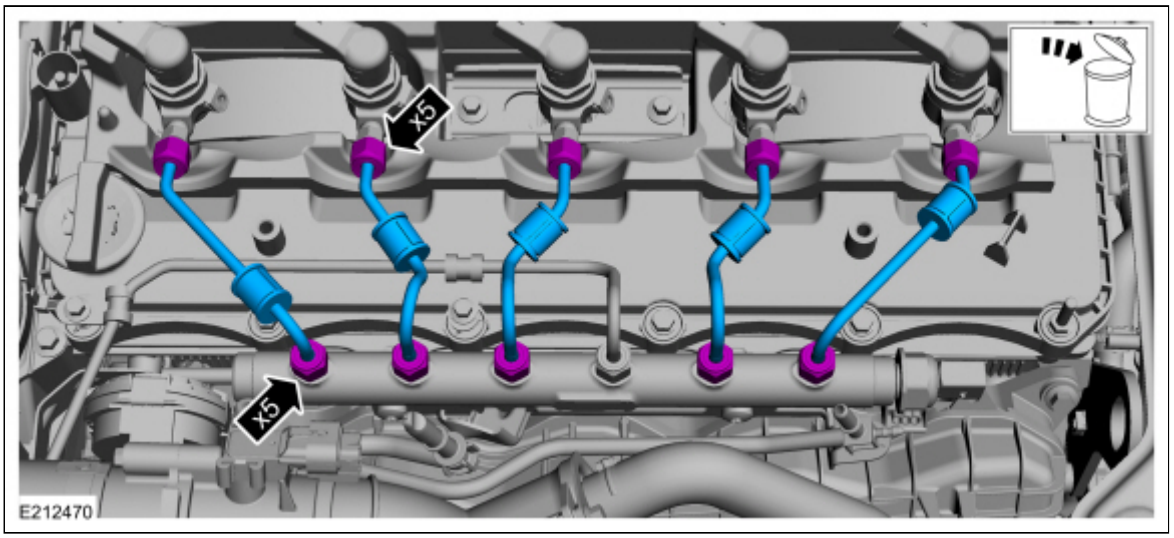
   Refer to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



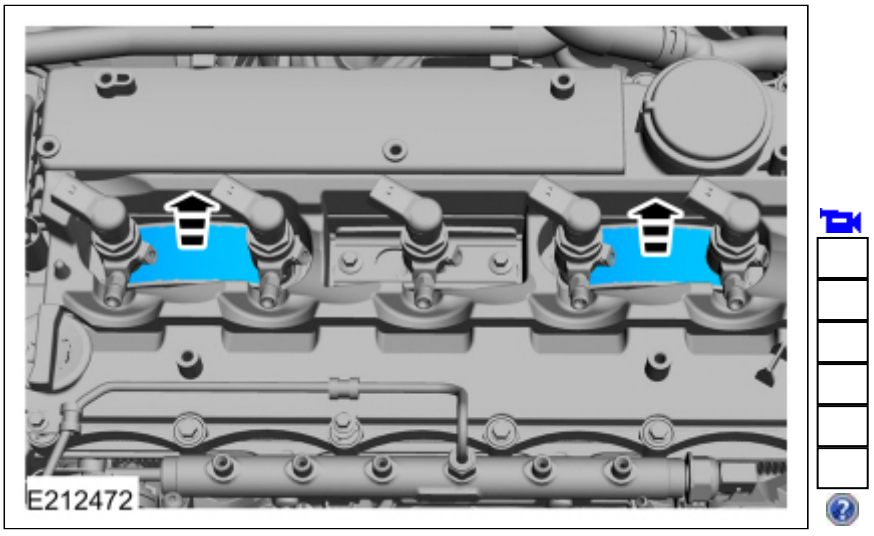
8. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

   NOTICE: Make sure that all openings are sealed with new blanking caps.

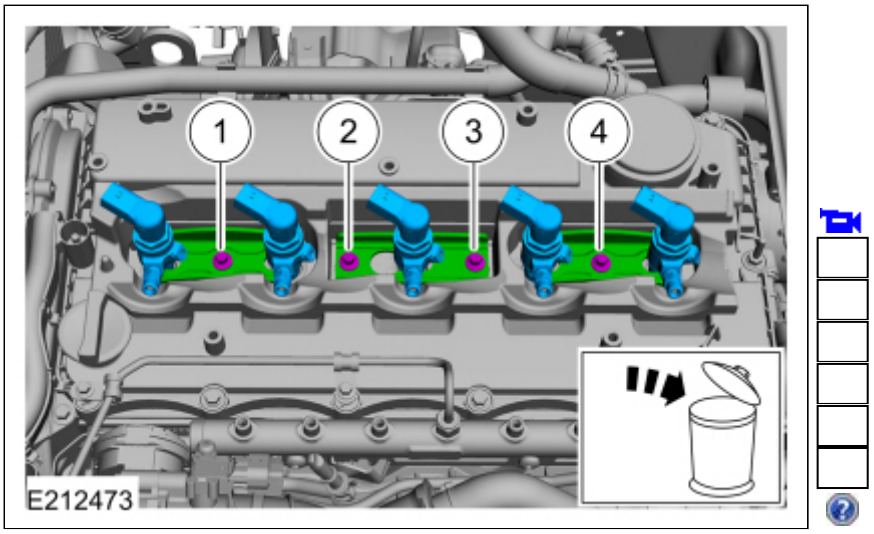
   Refer to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
   Torque:
   Stage 1: 15 Nm
   Stage 2: 30 Nm



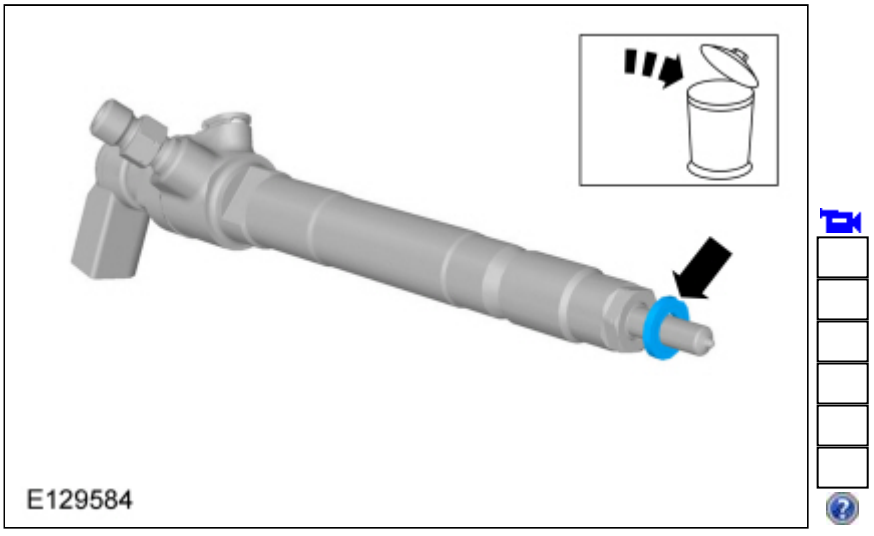
9.



10. *Torque*:
    Bolt 1 and 4:
    Stage 1: 6 Nm
    Stage 2: 360°
    Bolt 2: 3 Nm
    Bolt 3:
    Stage 3: 4 Nm
    Stage 4: 360°

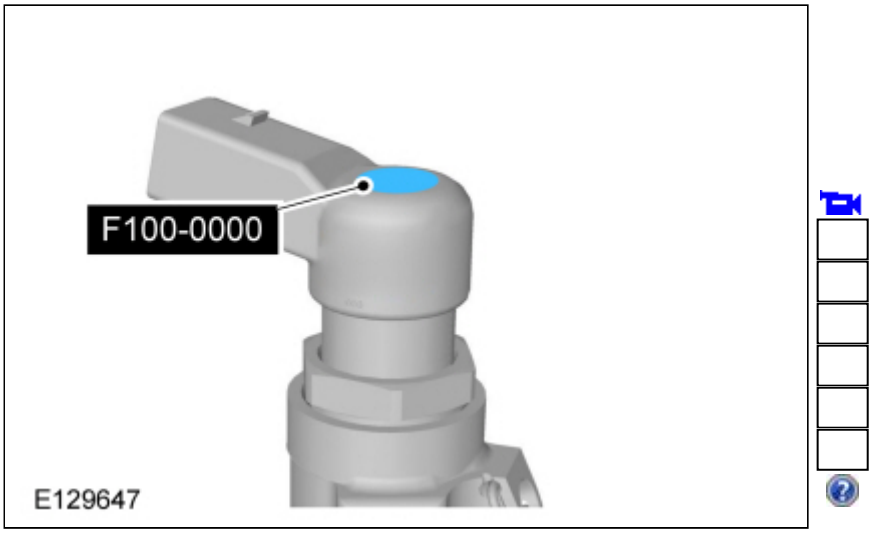


11. Use the General Equipment: Long Nose Pliers



Installation

1. To install, reverse the removal procedure.
2. Record the new fuel injector correction factor code.



3. Input the new Injector Correction Factors using the following WDS menu options: ToolBox/Powertrain/Service Functions
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Fuel Metering Valve

Materials

Name	Specification
Brake Cleaner	-

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Make sure that the engine is switched off.**

   WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.

   WARNING: Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

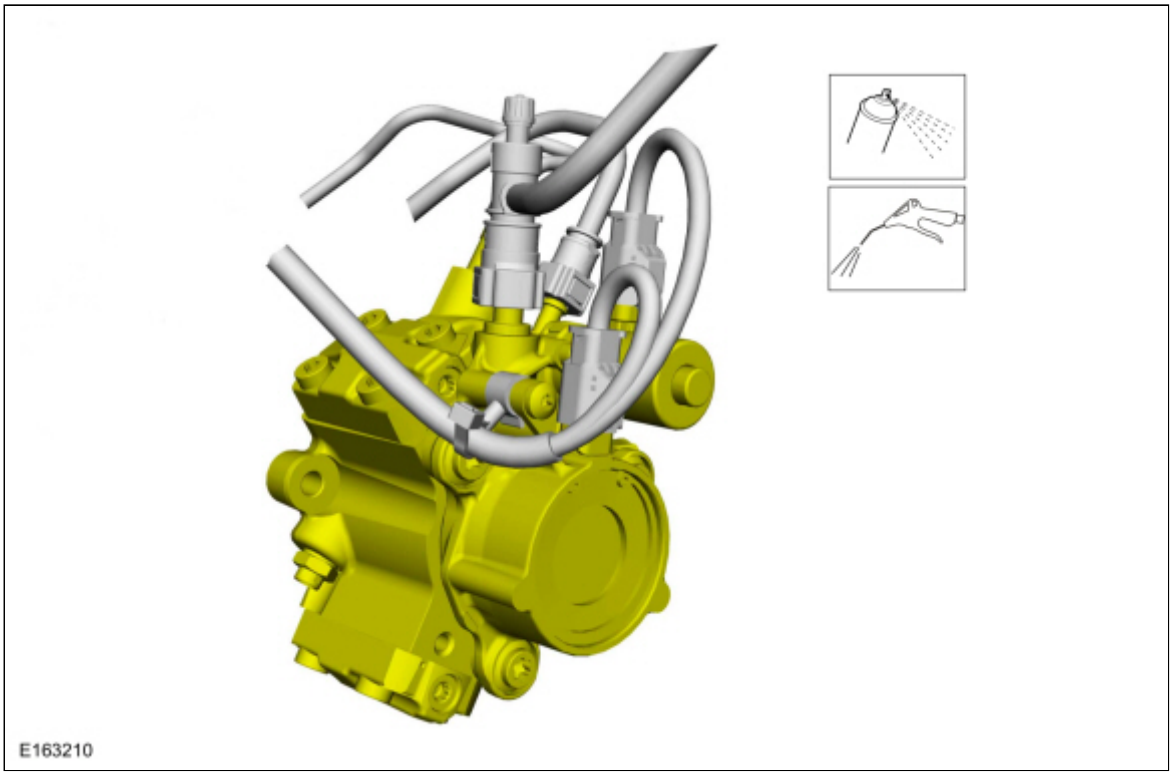
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

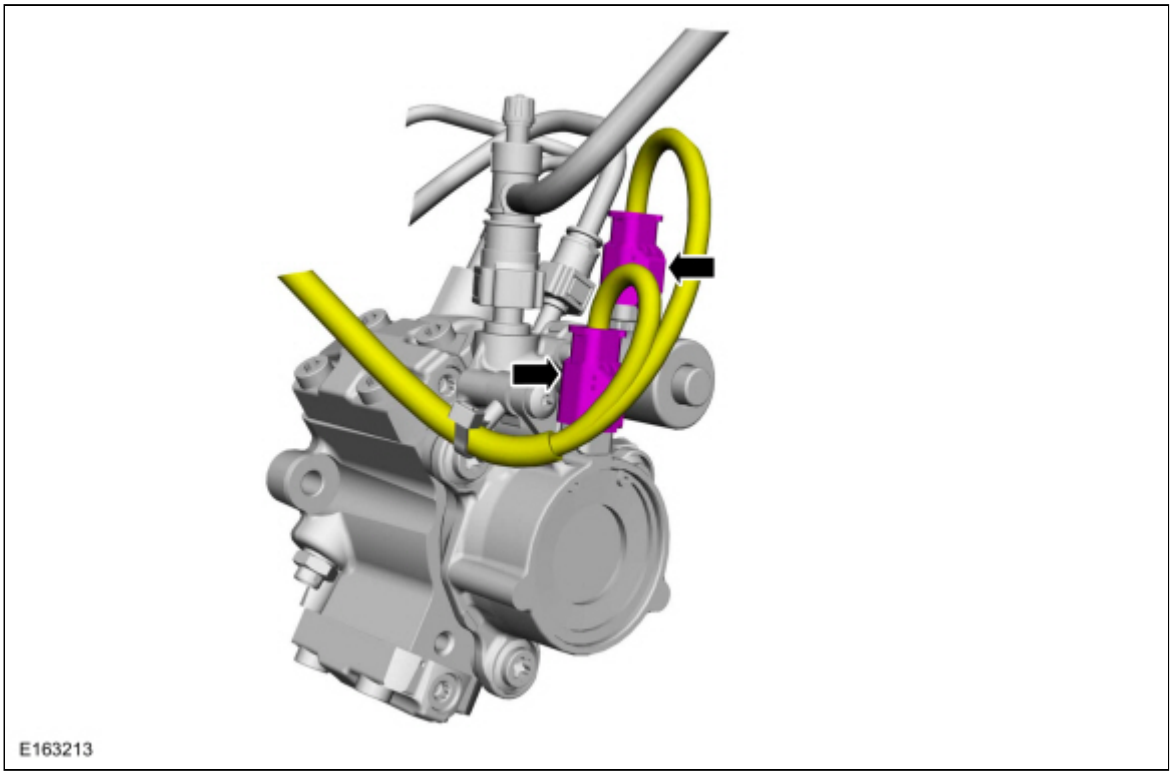
3. 

   NOTICE: Extreme cleanliness must be exercised when handling the components.

   Material: Brake Cleaner



4.



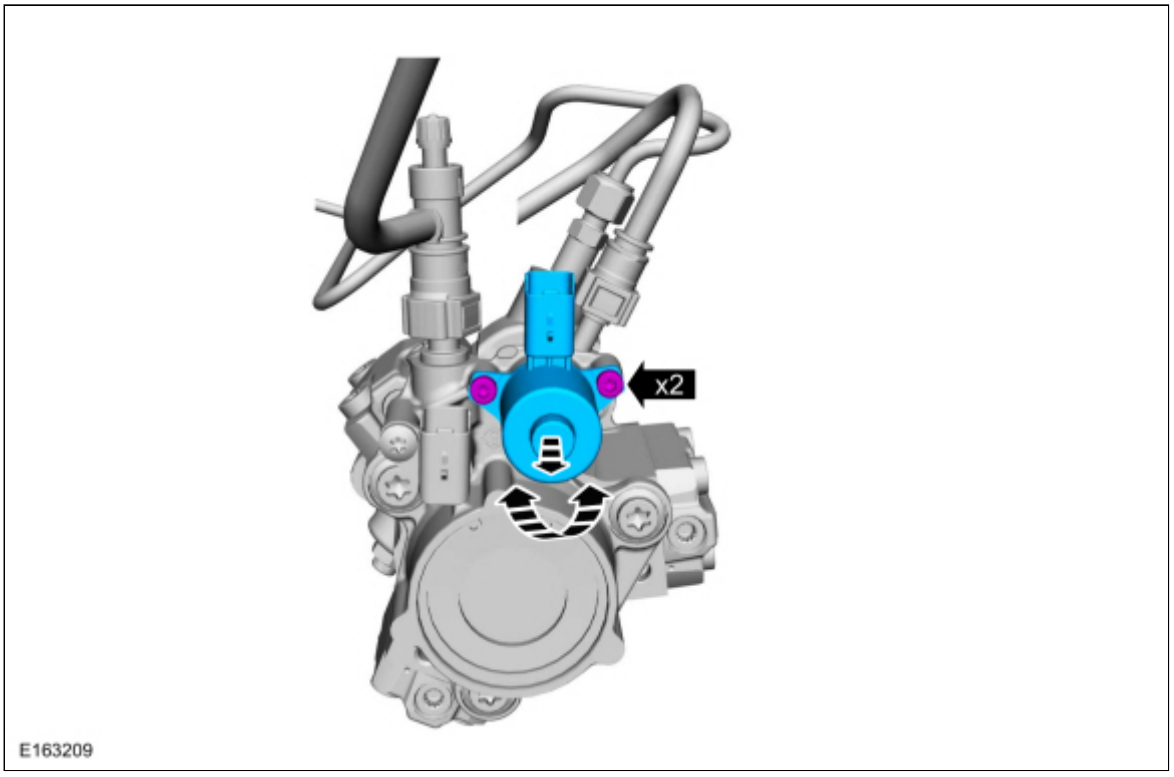
5. **NOTICE: Take extra care when handling the component.**

   NOTICE: Extreme cleanliness must be exercised when handling the component.

   NOTICE: The component must be removed by hand, the use of tools is prohibited.

   NOTE: *Make sure that a new component is installed.*

   Torque: 6 Nm

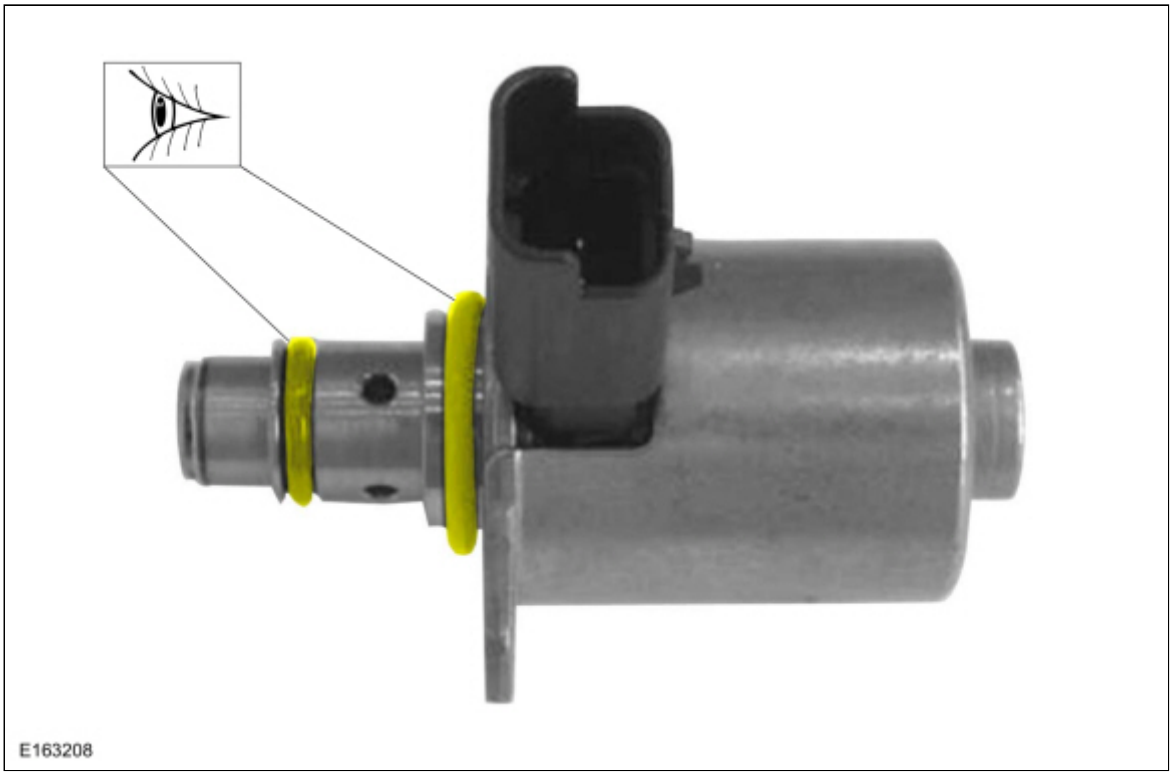


Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Extreme cleanliness must be exercised when handling the component.**

   NOTICE: Take extra care when handling the component.

   NOTE: *Make sure that the seal is correctly located.*



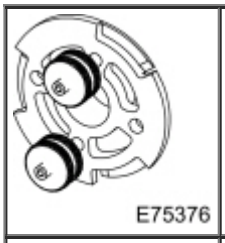
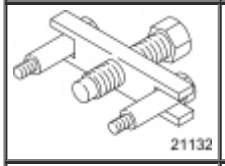
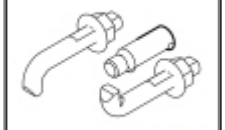
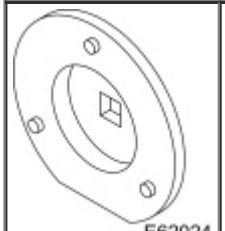
3. Carry out a reset of the High Pressure Fuel System Learned Values using the following menu options:
   ToolBox/Powertrain/Service Functions/PCM
   General Equipment: Ford approved diagnostic tool

Copyright © 2016 Ford Motor Company

Fuel Pump

Base Part Number: 9H307

Special Tool(s) / General Equipment

 E75376	303-1317 Locking Tool, Fuel Injection Pump Sprocket
 21132	303-249 Remover, Crankshaft Timing Pulley
 E144602	303-249-01 Adapter for 303-249
 E62024	303-679A Remover/Installer, Engine Front Cover Inspection Plate

Removal

WARNING: Make sure that the engine is switched off.

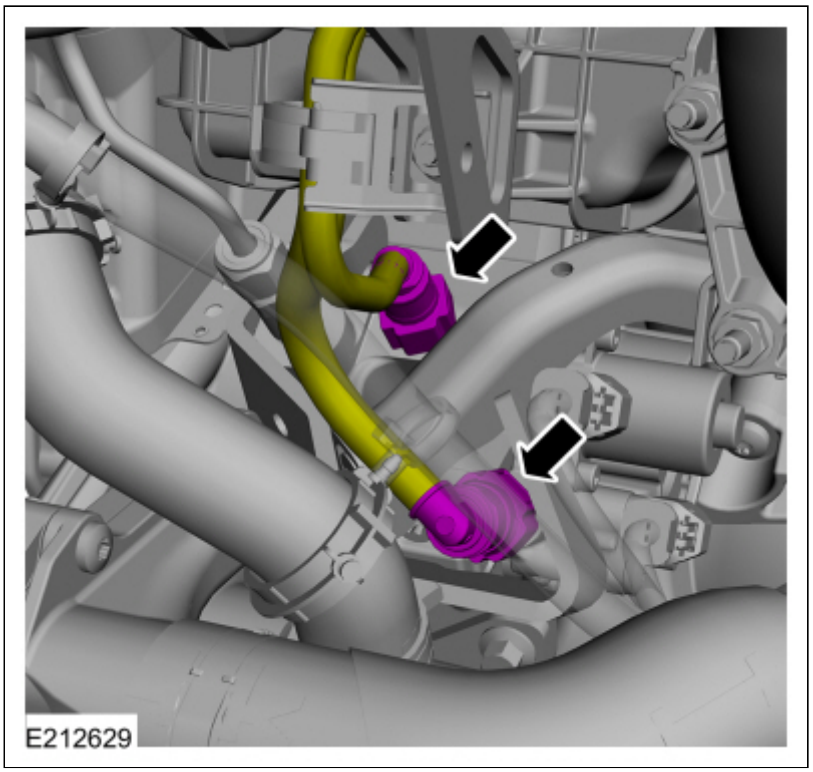
WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

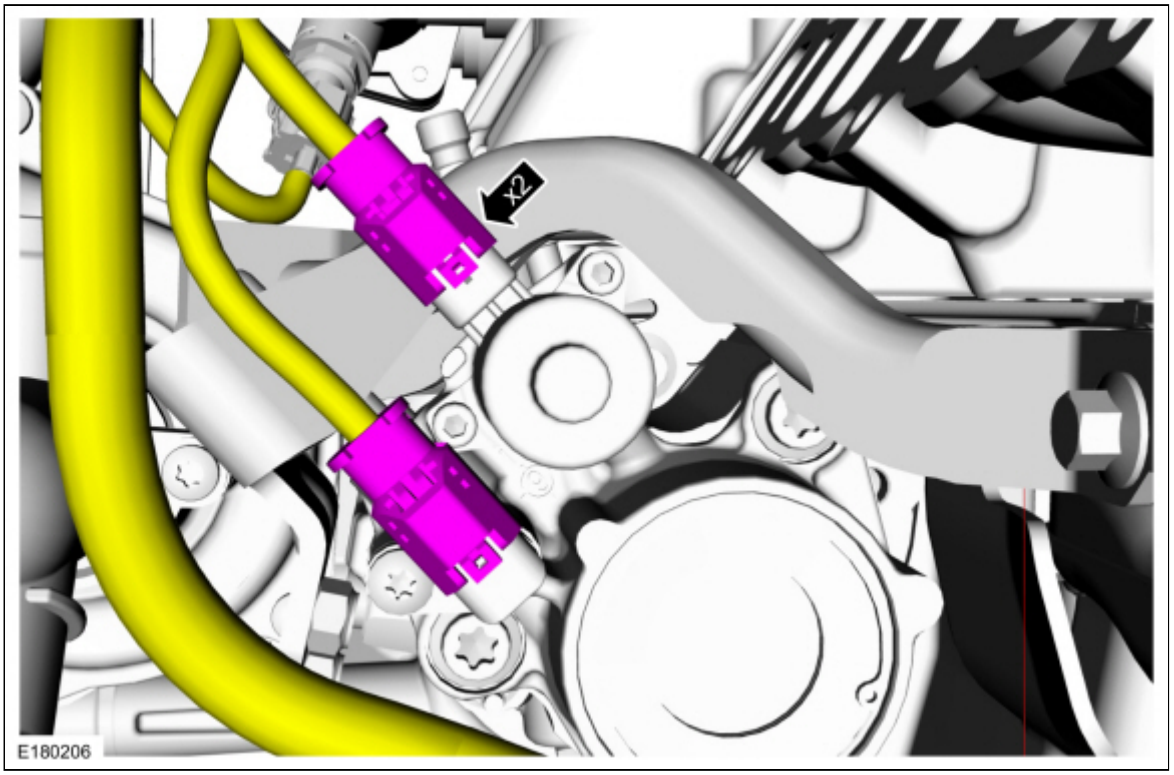
NOTICE: Extreme cleanliness must be exercised when handling these components.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
4. Refer to: Cooling Fan (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
5. Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
6.



7.



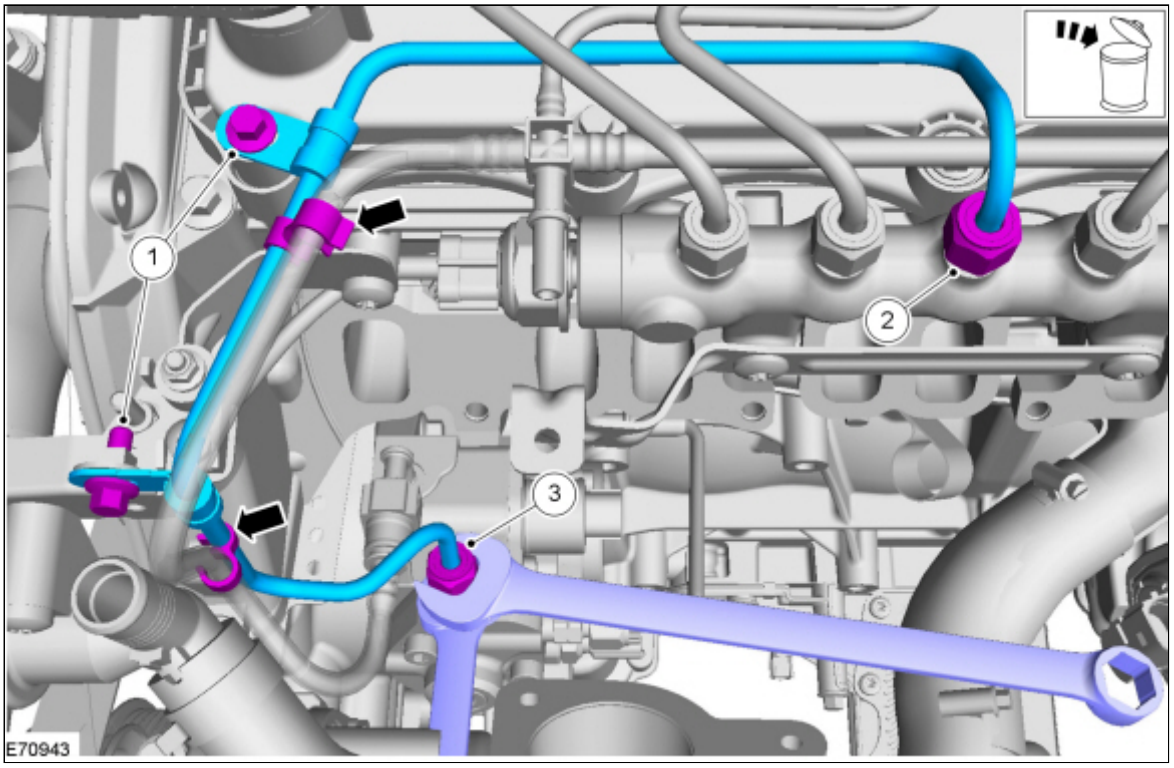
8. **NOTICE: Make sure that all openings are sealed with clean blanking caps.**

   NOTICE: Make sure that the area around the component is clean and free of foreign material.

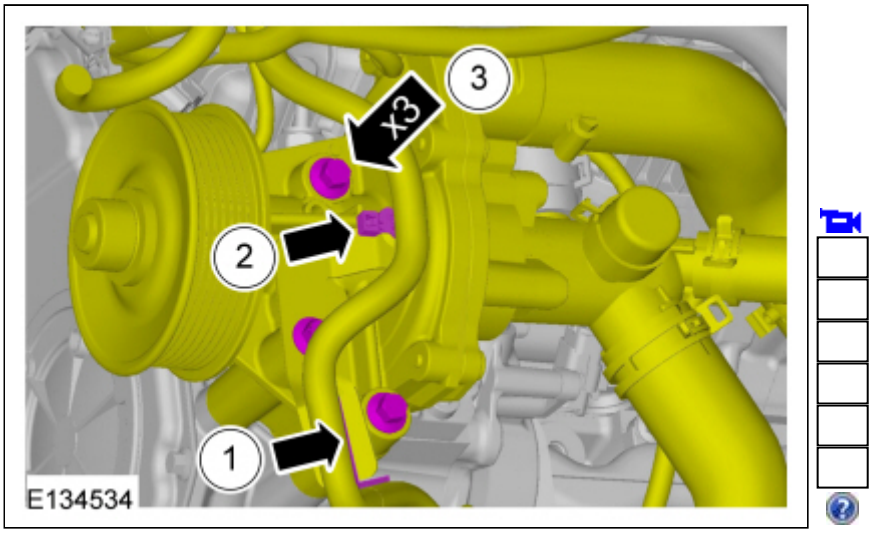
   NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

   NOTICE: Use an open-ended wrench to prevent the component from turning.

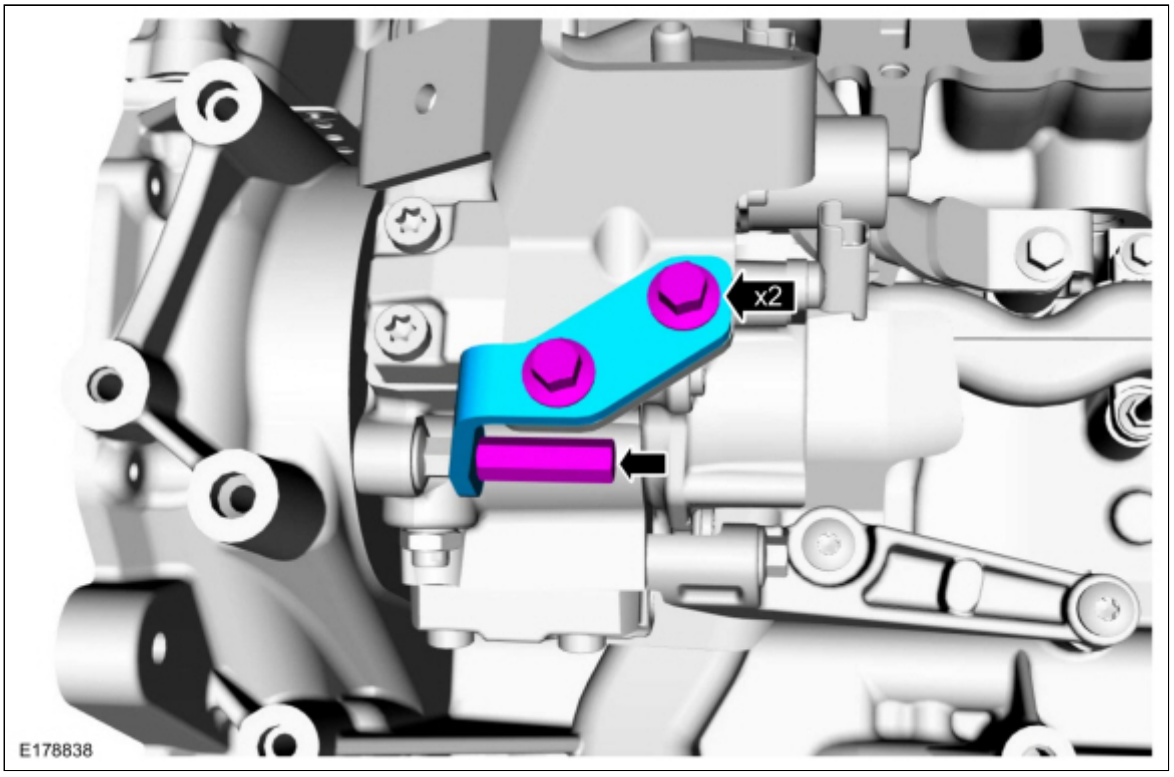
   Torque:
   1: 15 Nm
   2: 30 Nm
   3: 30 Nm



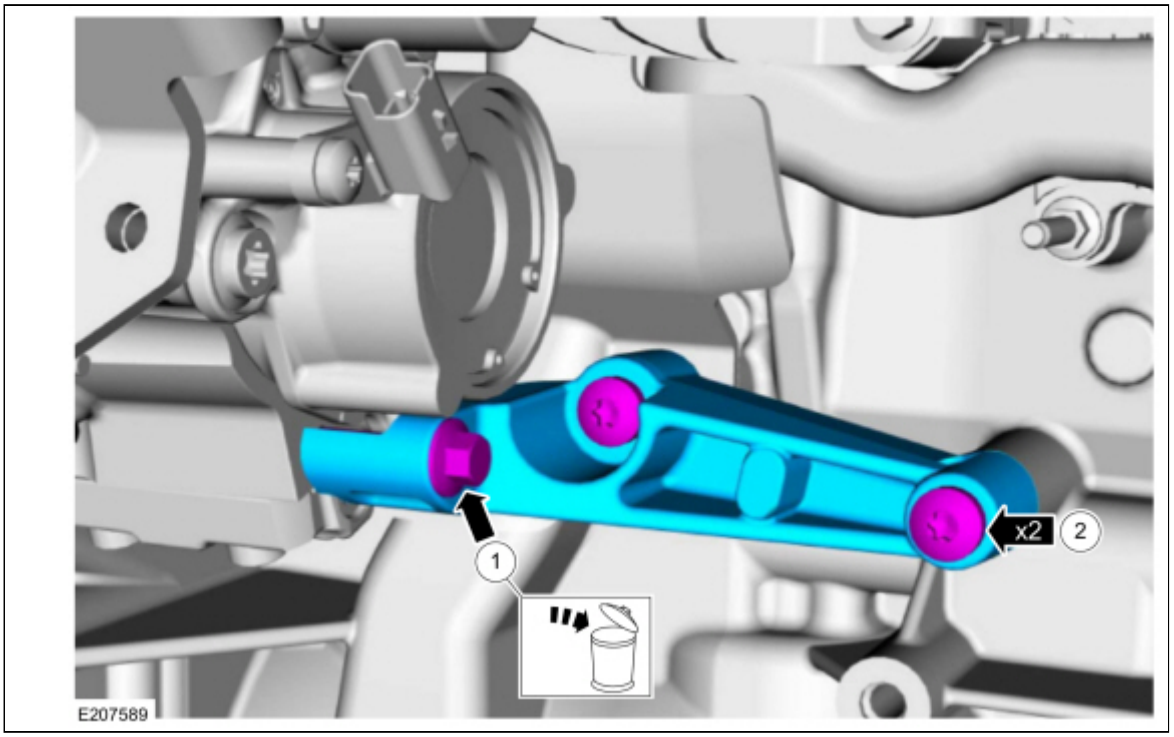
9. *Torque*:
   3: 23 Nm



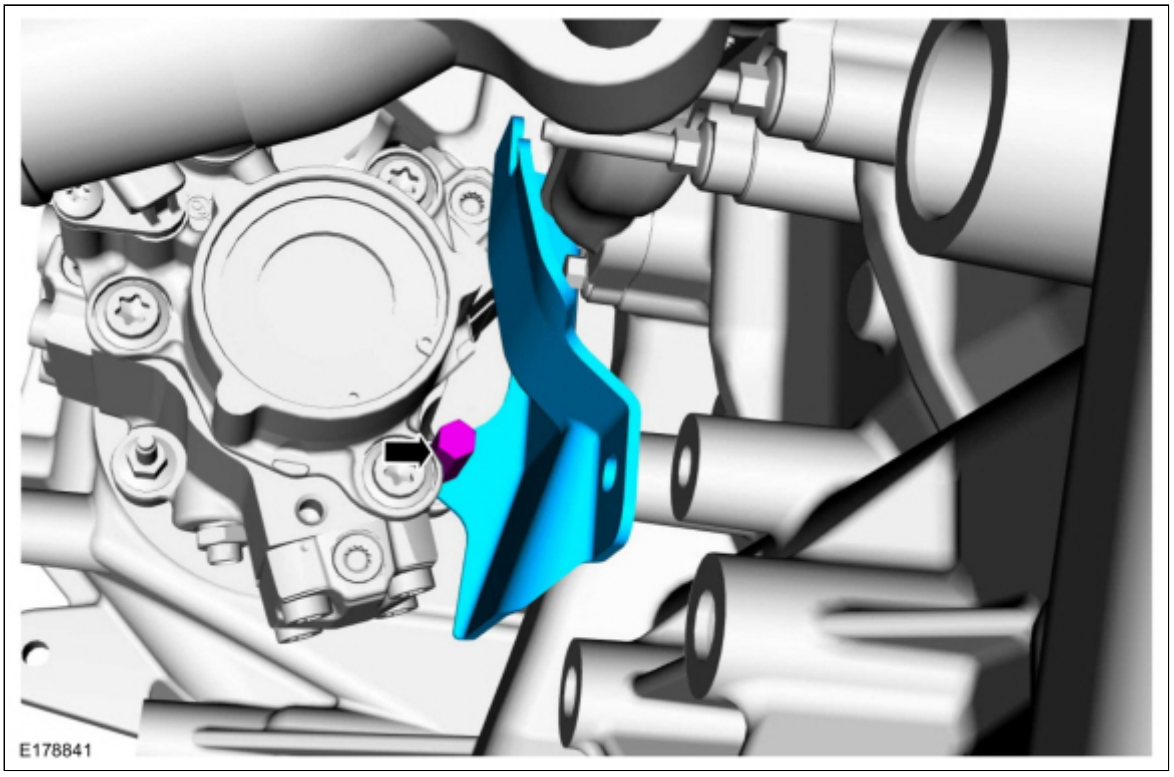
10. *Torque*: 10 Nm



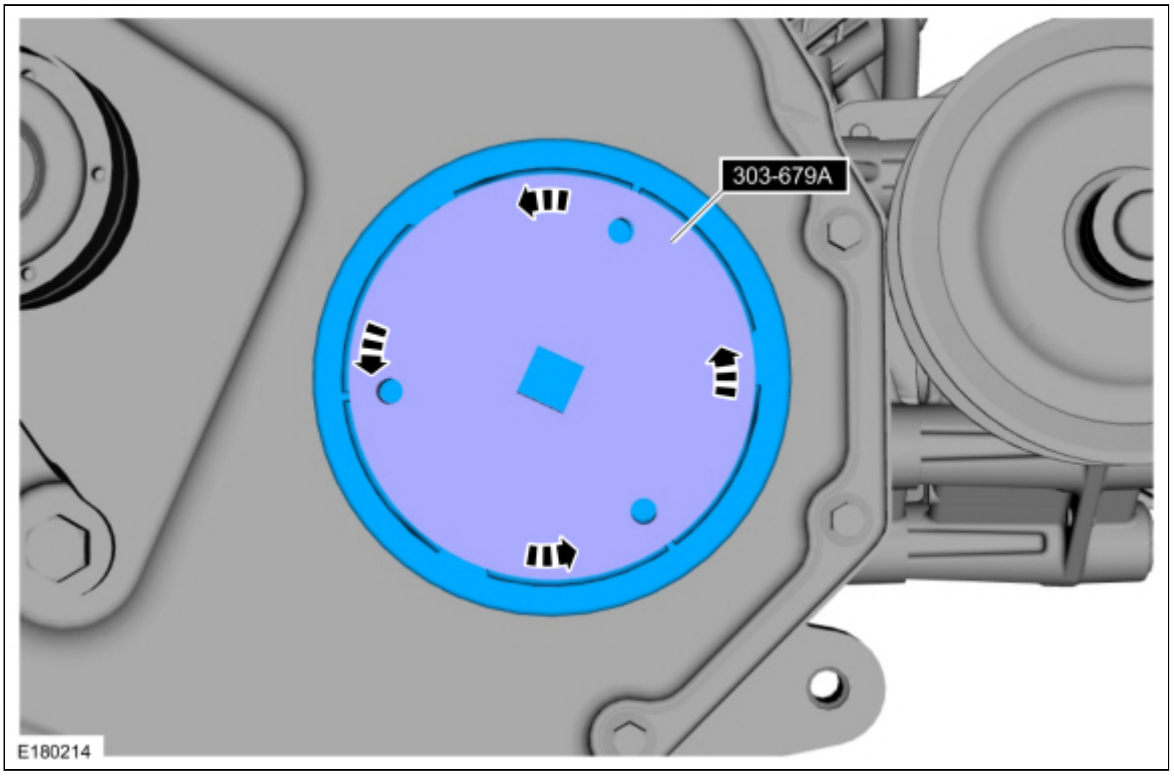
11. *Torque*: 23 Nm



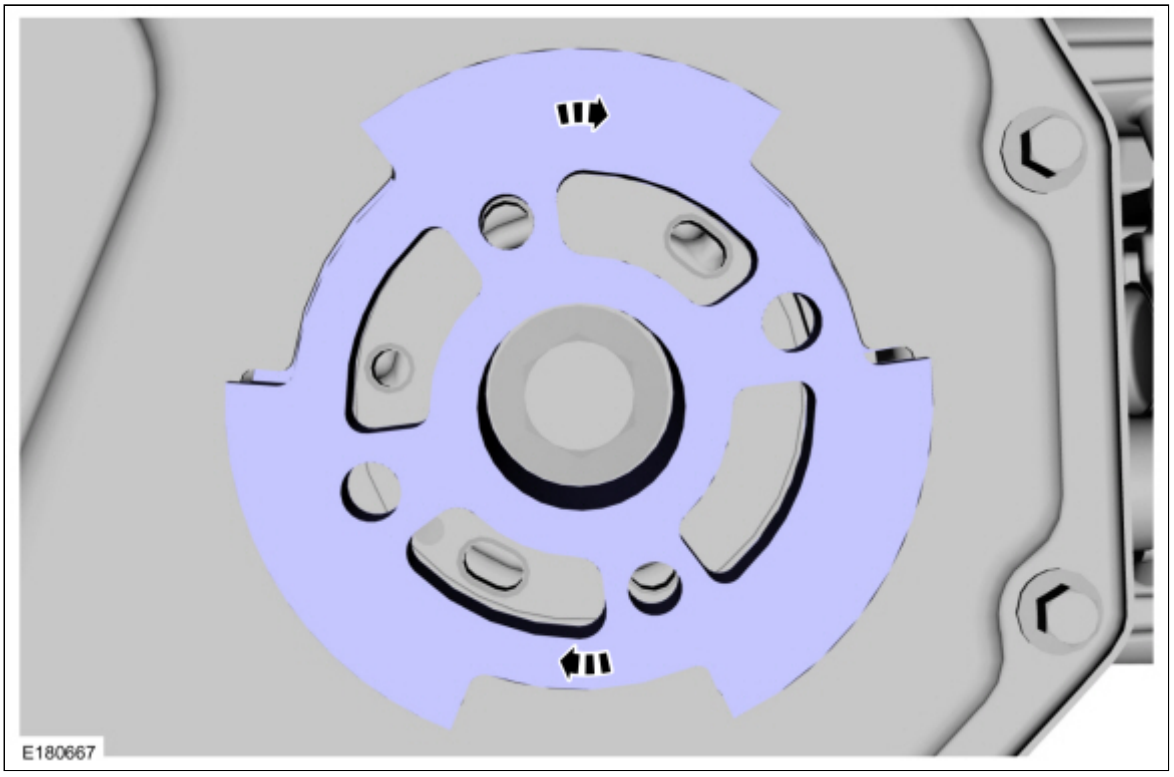
12. *Torque*: 10 Nm



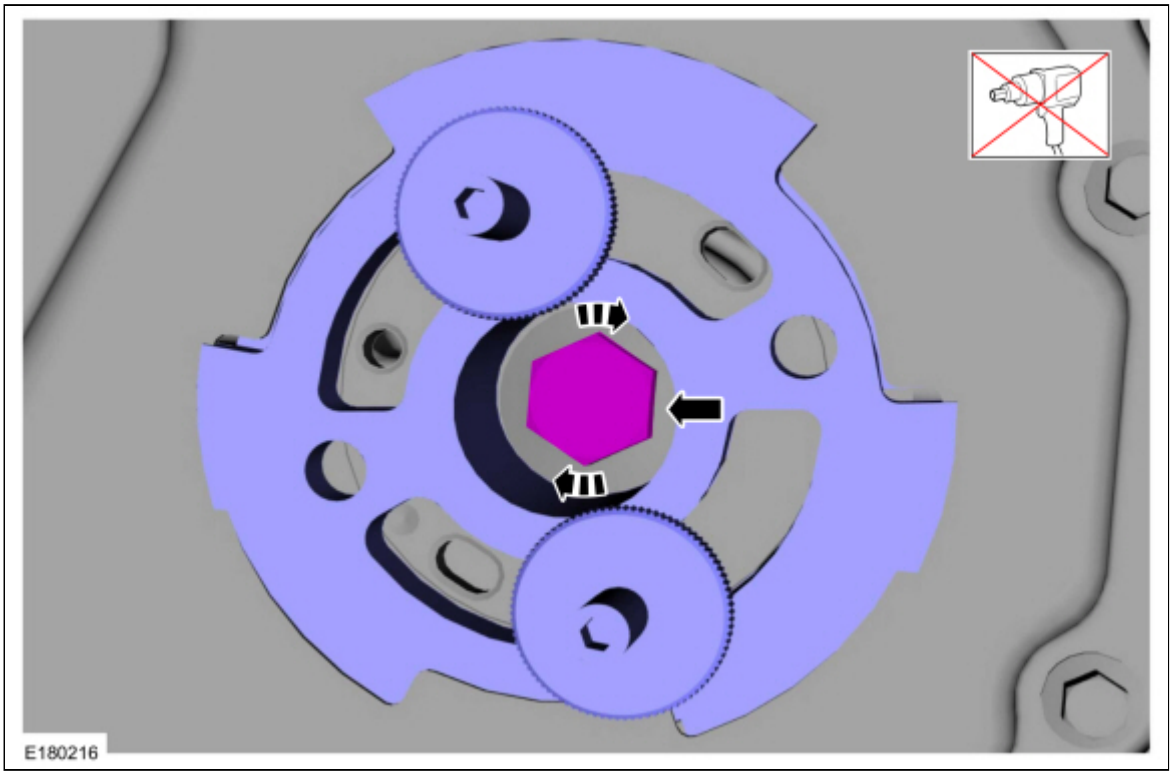
13. Use Special Service Tool: 303-679A Remover/Installer, Engine Front Cover Inspection Plate.



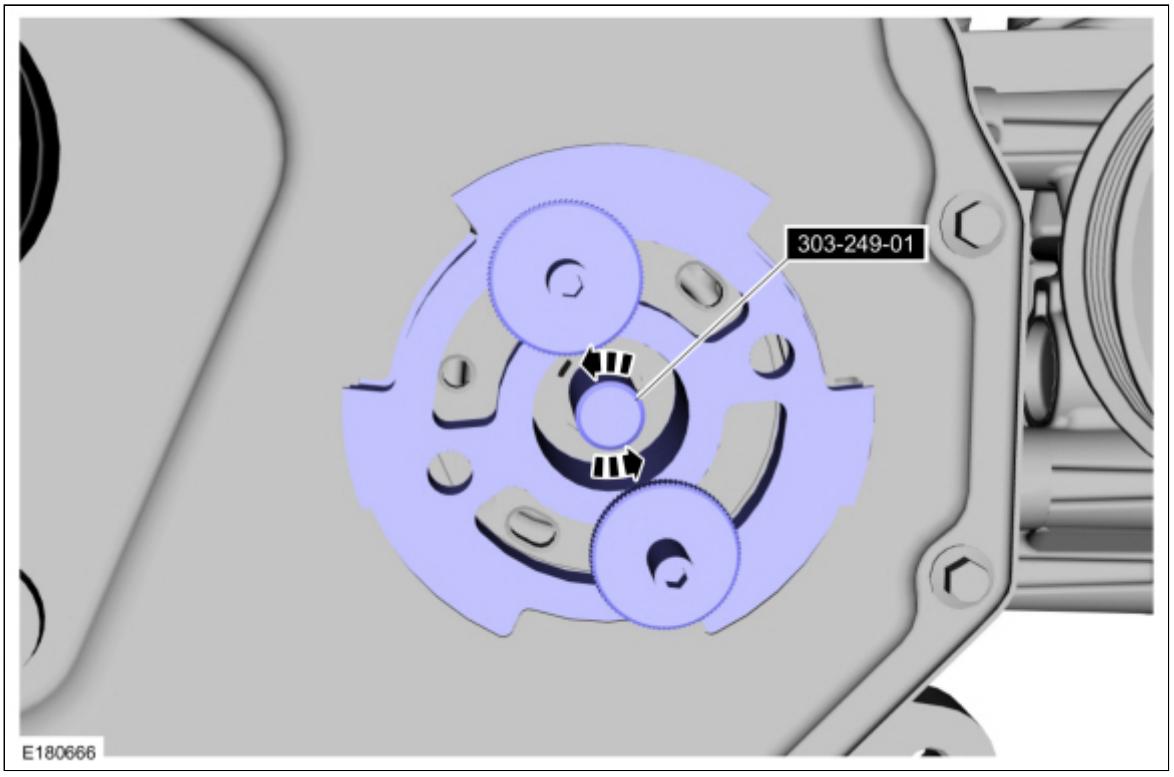
14. Install Special Service Tool: 303-1317 Locking Tool, Fuel Injection Pump Sprocket.



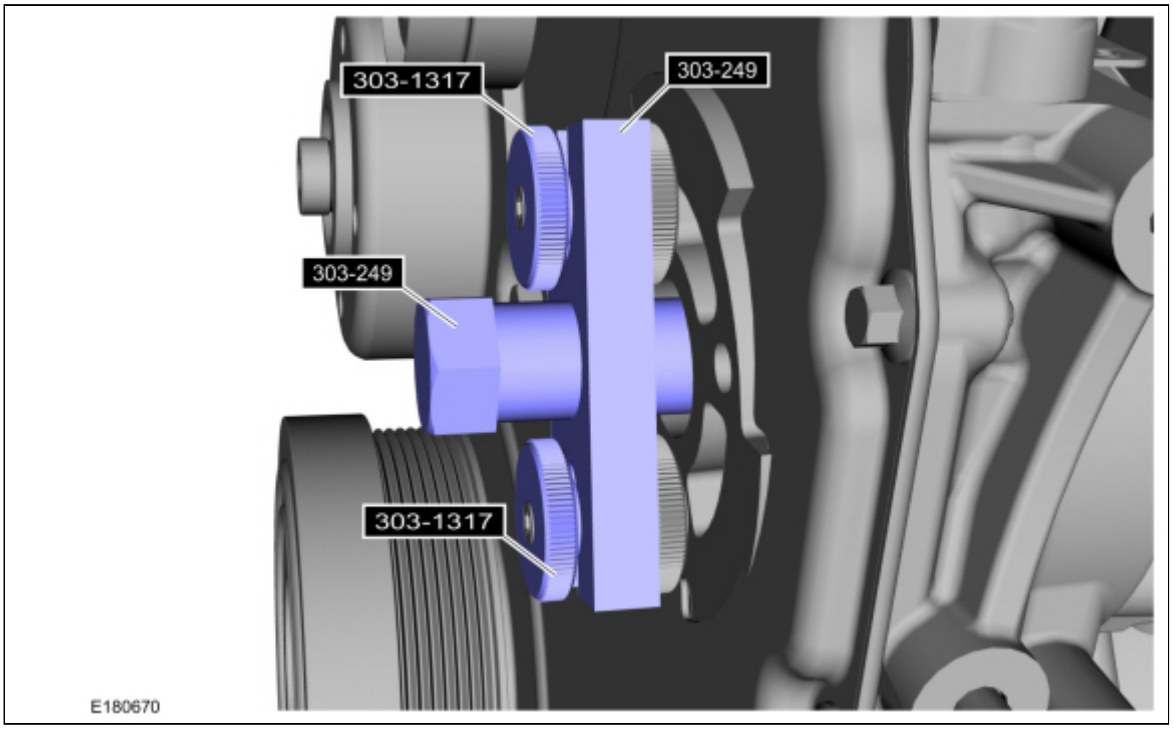
15. *Torque*: 75 Nm



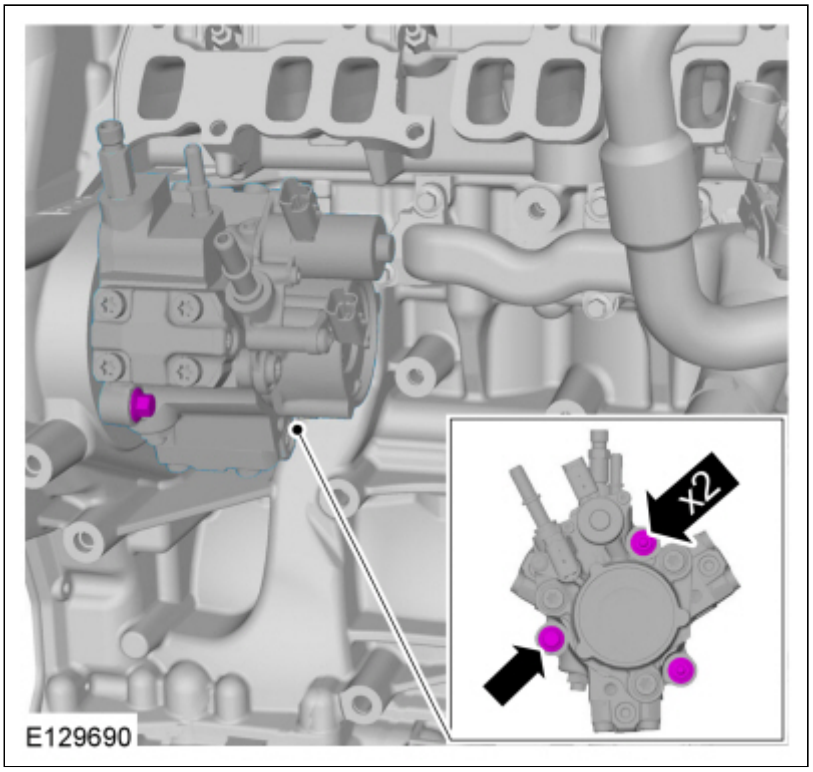
16. Install Special Service Tool: 303-249-01 Adapter for 303-249.



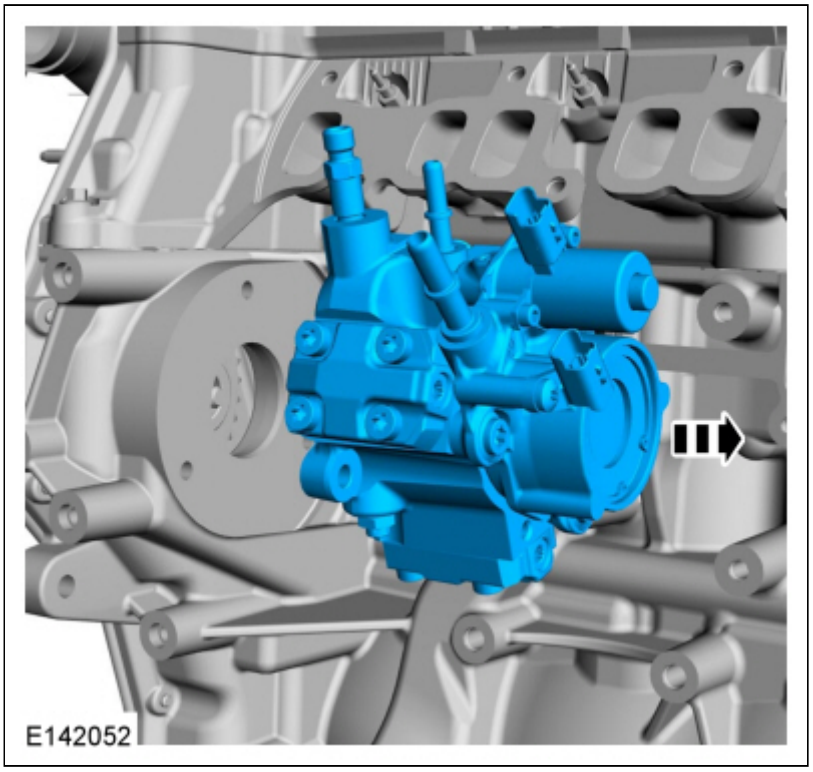
17. Install Special Service Tool: 303-249 Remover, Crankshaft Timing Pulley.



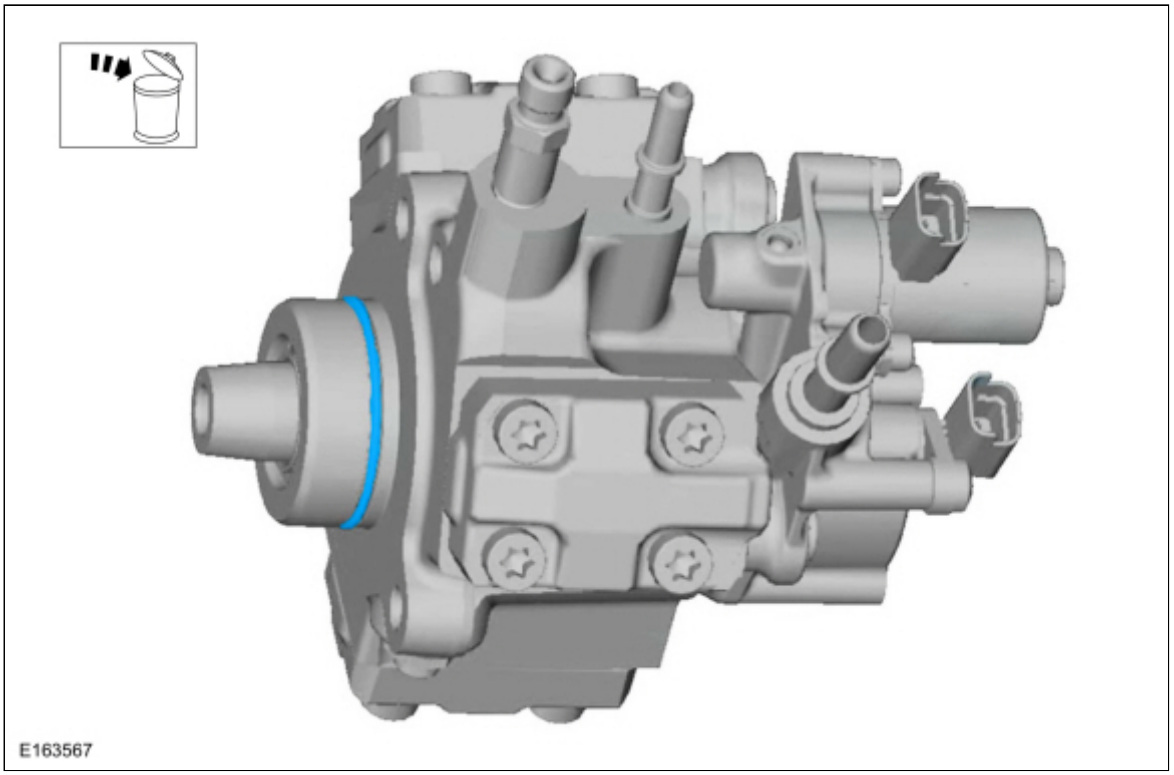
18. *Torque*: 23 Nm



19.



20.



Installation

1. To install, reverse the removal procedure.
2. Carry out a reset of the High Pressure Fuel System Learned Values using the following menu options:
   ToolBox/Powertrain/Service Functions/PCM
   General Equipment: Ford approved diagnostic tool

Copyright © 2016 Ford Motor Company

Fuel Rail

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

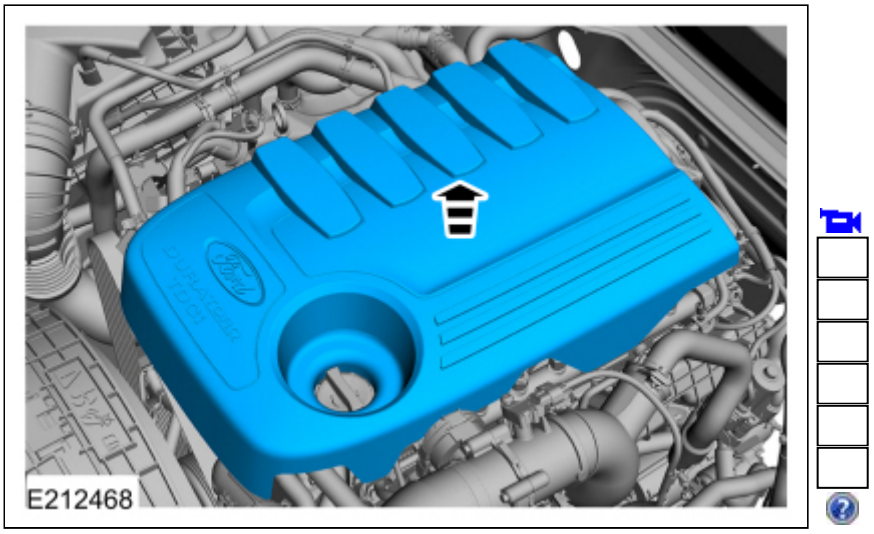
WARNING: Make sure that the engine is switched off.

WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

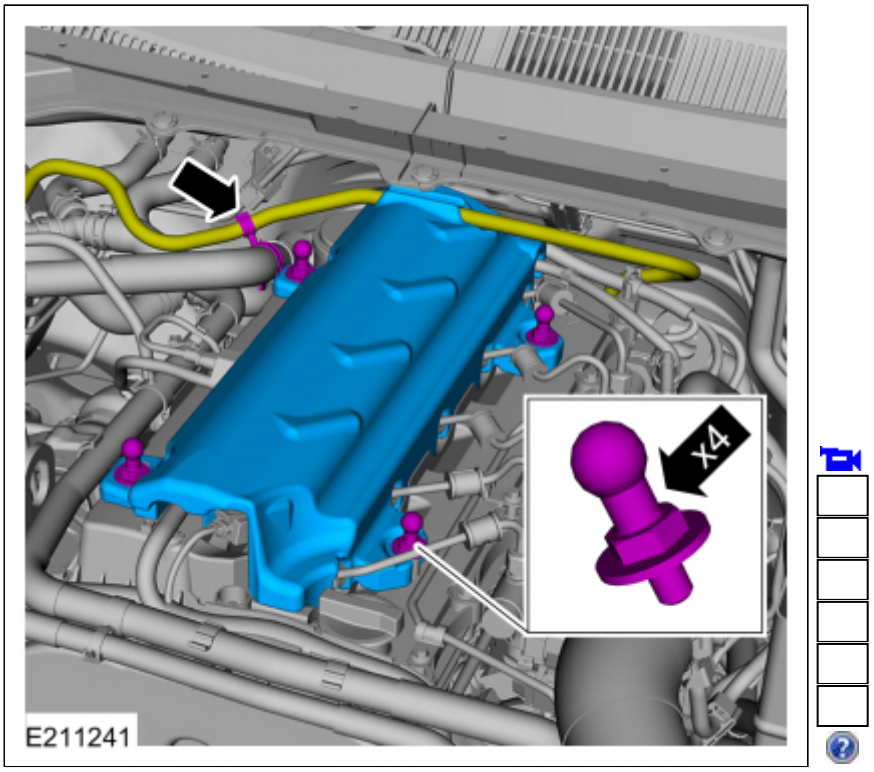
WARNING: Wait at least one minute from when the engine is switched off before commencing any repair to the fuel injection system. Failure to follow this instruction may result in personal injury.

NOTE: *Always follow the cleaning process prior to carrying out any repairs to the components.*

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Within the datalogger function, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30ºC whichever is the greater.
   Use the General Equipment: Ford Diagnostic Equipment
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. 

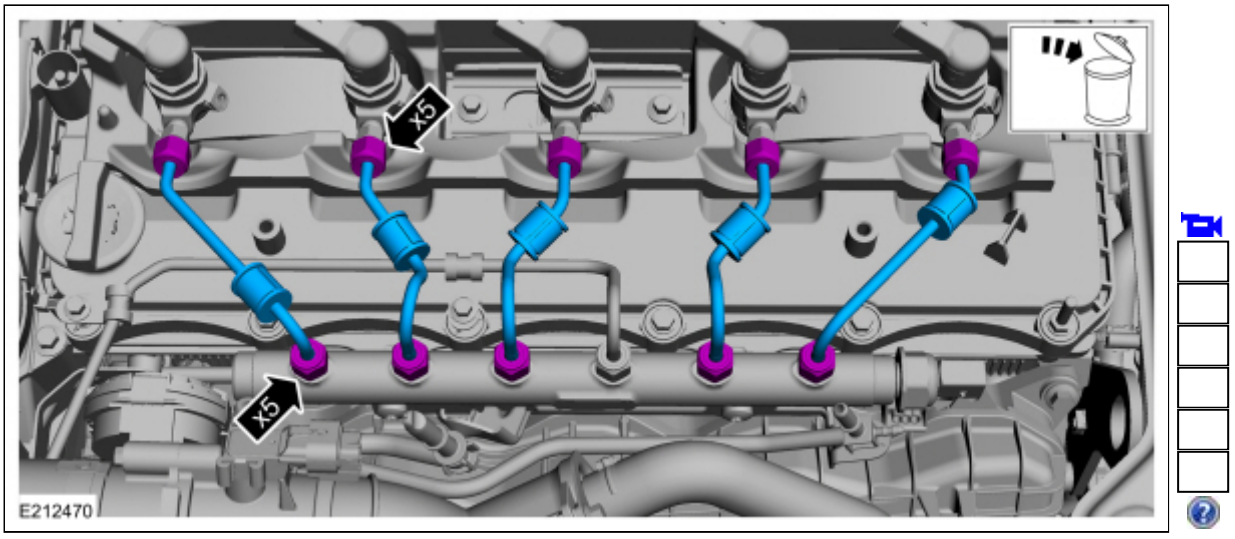
5. *Torque*: 3 Nm



6. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

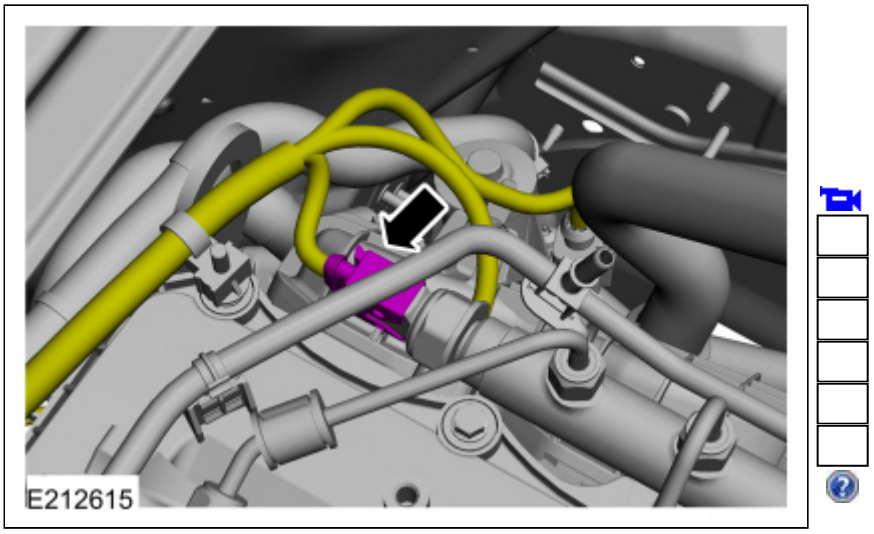
   NOTICE: Make sure that all openings are sealed with new blanking caps.

   Refer to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
   Torque:
   Stage 1: 15 Nm
   Stage 2: 30 Nm



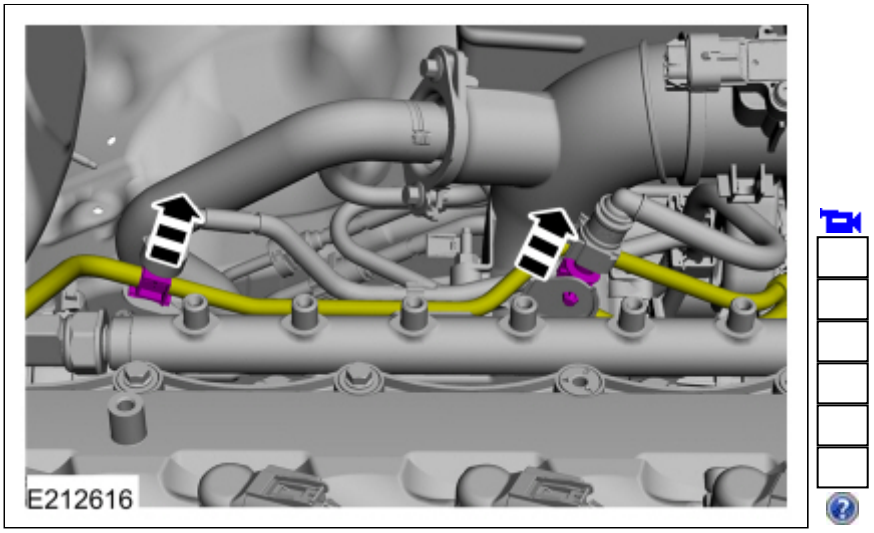
7. **NOTICE: Make sure that all openings are sealed with new blanking caps.**

   Refer to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



8. Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

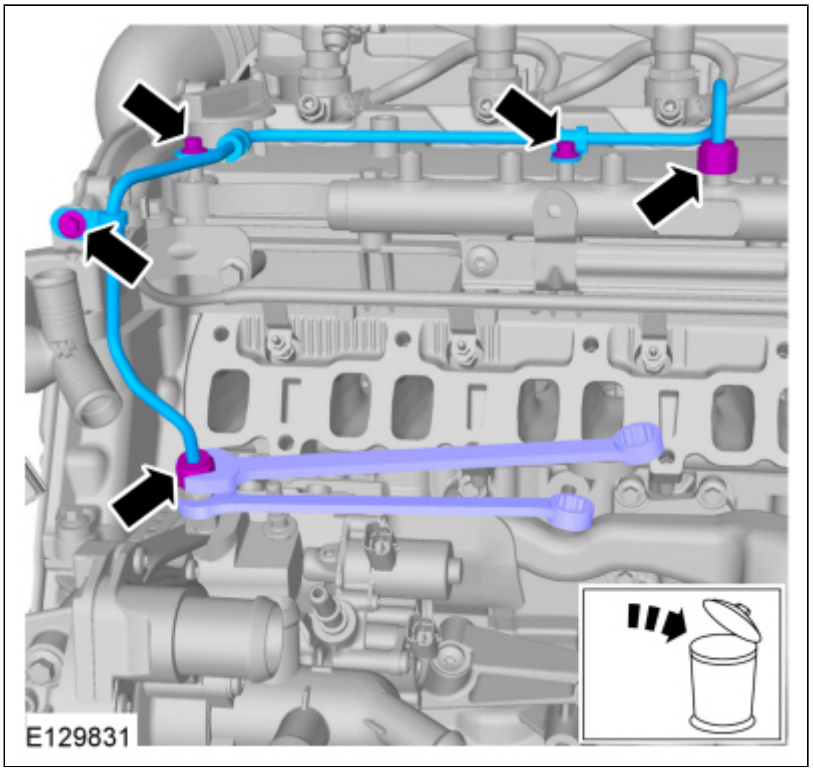
9.



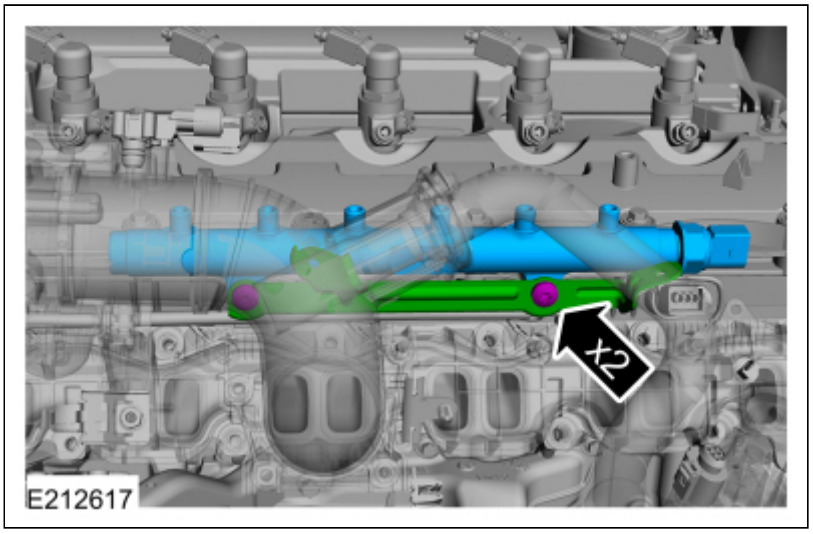
10. **NOTICE: Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.**

    NOTICE: Make sure that all openings are sealed with new blanking caps.

    Refer to: Fuel Injection Component Cleaning (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
    Torque:
    Fuel rail high-pressure fuel supply line unions:
    Stage 1: 15 Nm
    Stage 2: 30 Nm
    Fuel rail high-pressure fuel supply line bracket bolt: 10 Nm



11. *Torque*:
    Stage 1: 6 Nm
    Stage 2: 23 Nm



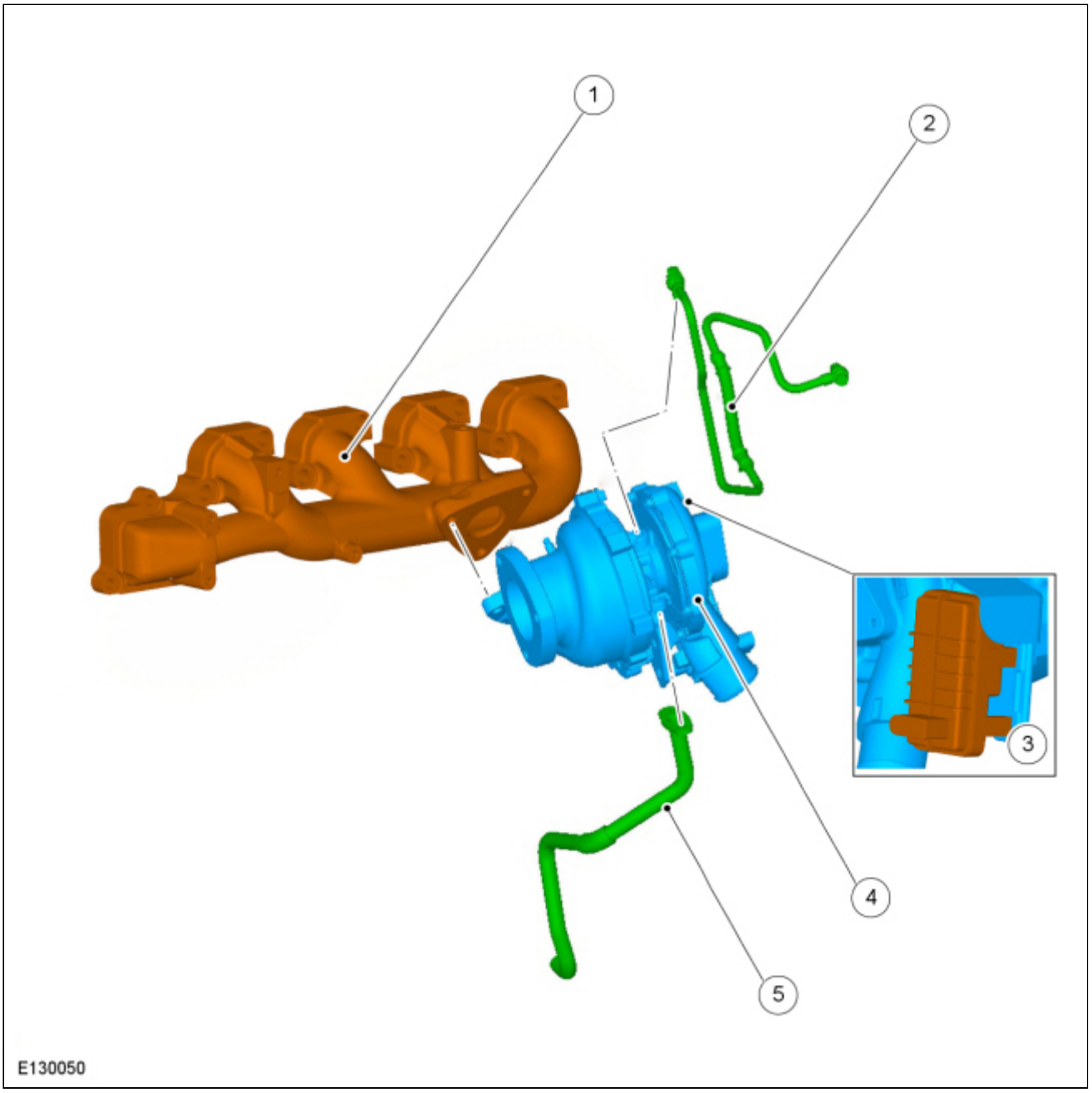
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Turbocharger - Component Location

2.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Exhaust manifold
2	—	Oil supply tube
3	—	Electronic turbocharger guide vane adjuster
4	—	Turbocharger
5	—	Oil drain tube

Copyright © 2016 Ford Motor Company

Turbocharger - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

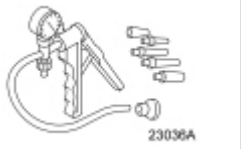
Turbocharger - Overview

All three versions of the 2.2L Duratorq TDCi engines have turbochargers. The 88kW and 96kW versions have turbochargers fitted with a wastegate, while the 118kW version has a variable vane turbocharger. Both these turbocharger features vary the pressure boost to the intake system. The variable vane type being more efficient. The charge air passes through an intercooler after leaving the turbocharger to improve volumetric efficiency by increasing air density.

Copyright © 2016 Ford Motor Company

Turbocharger

Special Tool(s)

 23036A	Hand Vacuum/Pressure Pump 416-D001 (23-036A)

General Equipment

Ford diagnostic equipment

Inspection and Verification

NOTE: *The turbocharger uses engine oil as a lubricant and coolant. Due to the high operating temperatures of the turbocharger and with the expansion and contraction of the internal components a proportion of engine oil may enter the air intake system. This is not an indication that the turbocharger oil seal has failed. The turbocharger oil seal will not fail unless the bearings fail first, which will cause the turbocharger to become noisy. Do not install a new turbocharger due to oil inside the turbocharger or the air intake components. If a leak is detected in the supply or return tubes or connections, locate and rectify the source. Do not install a new turbocharger due to an oil leak.*

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Oil leak(s) − Air cleaner element − Air cleaner outlet pipe − Air cleaner intake pipe − Turbocharger oil supply tube − Turbocharger oil return tube − Wastegate control valve - vehicles with fixed vane turbocharger − Turbocharger housing − Charge air cooler − Charger air cooler intake pipe − Charger air cooler outlet pipe	− Wiring harness(es) − Electrical connector(s) − Variable vane electric actuator − PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

NOTICE: The variable vane electric actuator must not be transferred between the old and new turbochargers. Failure to follow this instruction may result in incorrect calibration, exhaust emissions and engine operation.

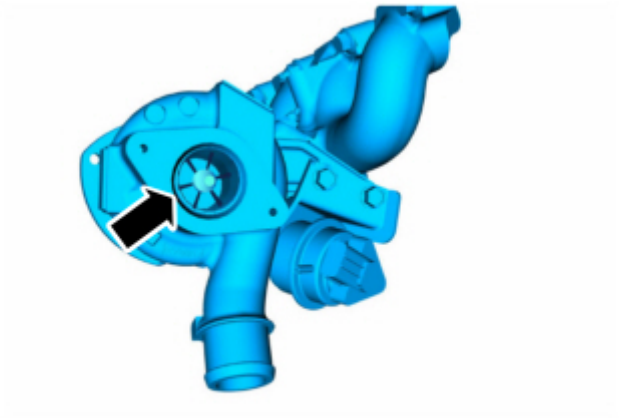
NOTICE: On vehicles with a fixed vane turbocharger the wastegate control valve and actuator rod are fixed parts of the turbocharger and must not be adjusted or renewed separately.

Symptom	Possible Sources	Action
• Blue smoke with excessive turbocharger noise	• Turbocharger compressor rubbing on housing walls. • Turbocharger turbine rubbing on housing walls. • Turbocharger bearings and oil seal(s). • Turbocharger oil supply tube blocked or damaged.	• Vehicles with fixed vane turbocharger. GO to Pinpoint Test A Vehicles with variable vane turbocharger. GO to Pinpoint Test B
• Blue smoke without excessive turbocharger noise	• Turbocharger oil return tube blocked or damaged.	• GO to Pinpoint Test C
• Poor engine performance	• Charge air cooler system.	• CHECK the charge air cooler and charge air cooler pipe(s) for leaks and obstructions. REPAIR as necessary.
	• Air cleaner intake pipe.	• CHECK the air cleaner intake pipe for obstructions. REPAIR as necessary.
	• Unauthorized adjustment of the wastegate control valve actuator rod - vehicles with fixed vane turbocharger.	• The wastegate control valve actuator rod is factory set and must not be adjusted. CHECK the paint seal on the wastegate control valve actuator rod has not been broken. If the paint seal has been broken, INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation).
	• Wastegate control valve actuator - vehicles with fixed vane turbocharger.	• GO to Pinpoint Test D
	• Variable vane electric actuator.	• REFER to the Ford diagnostic equipment.

Pinpoint Tests

PINPOINT TEST A : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE - VEHICLES WITH FIXED VANE TURBOCHARGER

A1 INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE
• Disconnect the air cleaner outlet pipe from the turbocharger. • Inspect the turbocharger rotor vanes for damage.



E201976

Is there visible damage to the rotor vanes?

Yes	GO to A2
No	GO to A3

A2 CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

- Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes	CLEAN the intake air system components. INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.
No	GO to A4

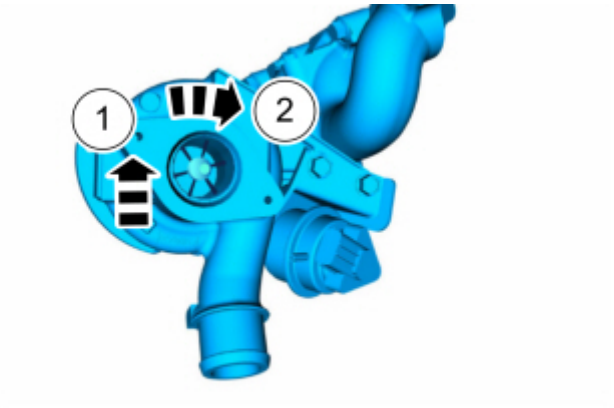
A3 CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: *A small amount of movement in the bearings is normal.*

NOTE: *The initial rotor rotation of a cold turbocharger may feel rough and uneven but should rotate freely after a few turns.*

- **NOTE:** *Make sure that the turbocharger rotor should be rotated by fingertips only and not any other tool.*

  Make sure that the turbocharger rotor spins freely within the housing.
  - 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
  - 2. Make sure that the rotor spins freely within the housing.



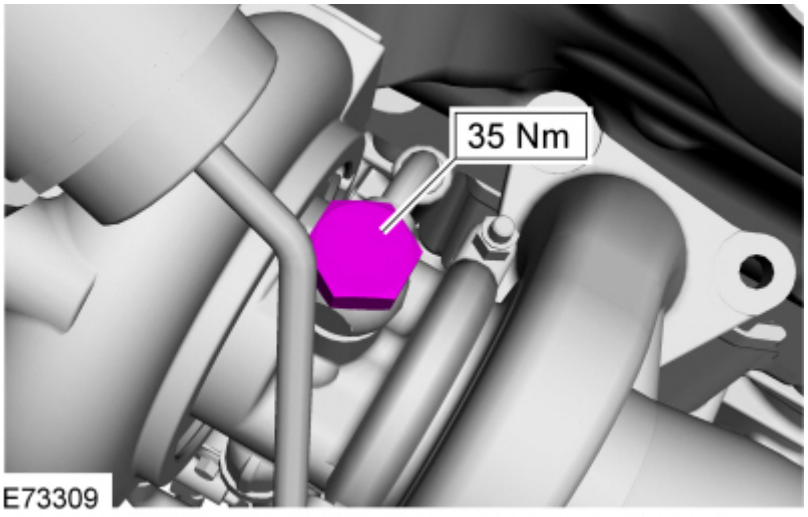
E201977

Does the rotor spin freely within the housing?

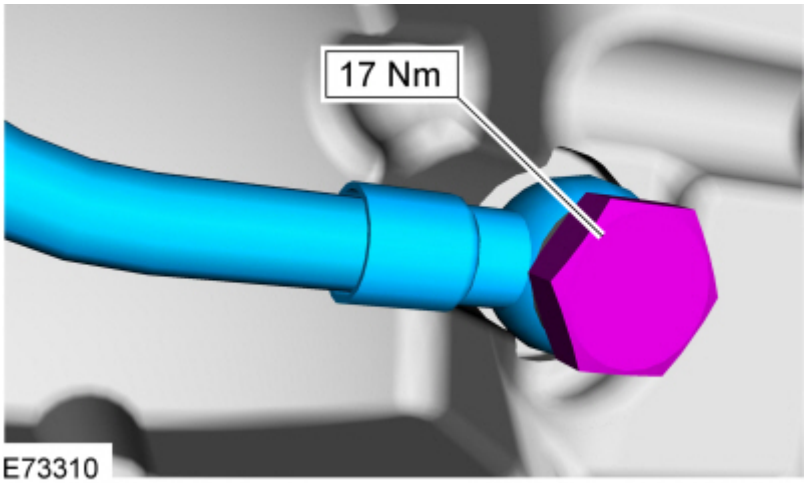
Yes	GO to A4
No	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

A4 CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

- Disconnect the turbocharger oil supply tube from the turbocharger.



- Remove the turbocharger oil supply tube.



- Using workshop compressed air and a compressed air nozzle, check the oil supply tube for blockage.

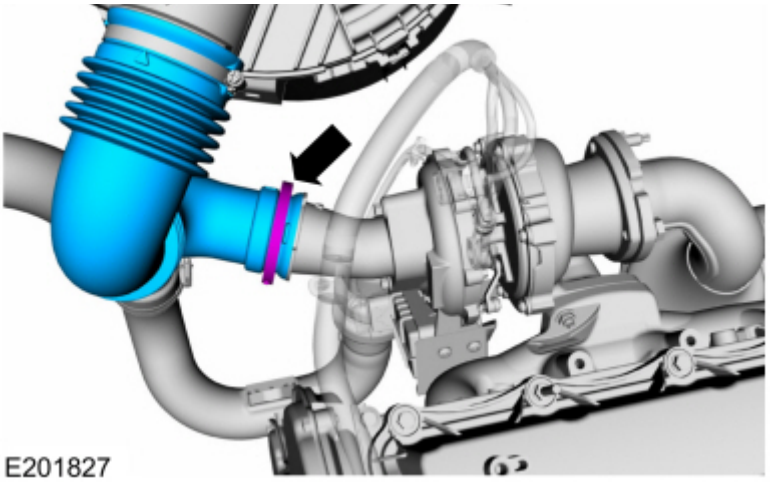
Is the oil supply tube free from blockage?

Yes	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.
No	INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

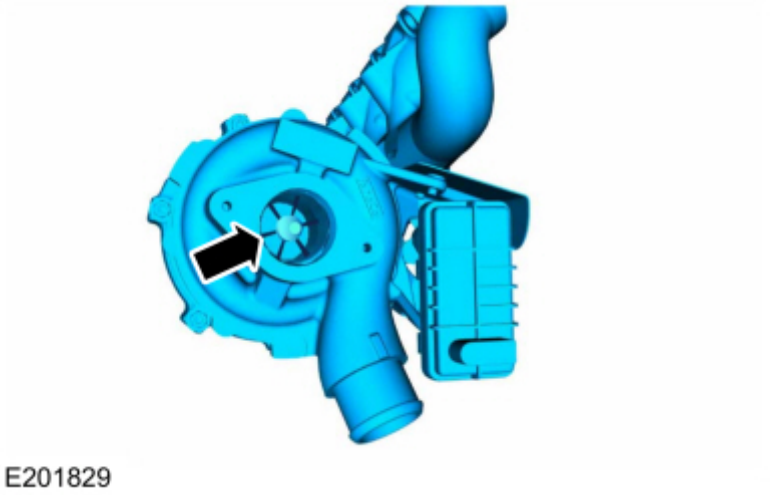
PINPOINT TEST B : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE - VEHICLES WITH VARIABLE VANE TURBOCHARGER

B1 INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE

- Disconnect the air cleaner outlet pipe from the turbocharger.



- Inspect the turbocharger rotor vanes for damage.



Is there visible damage to the rotor vanes?

Yes	GO to B2
No	GO to B3

B2 CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

- Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes	CLEAN the intake air system components. INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.
No	GO to B4

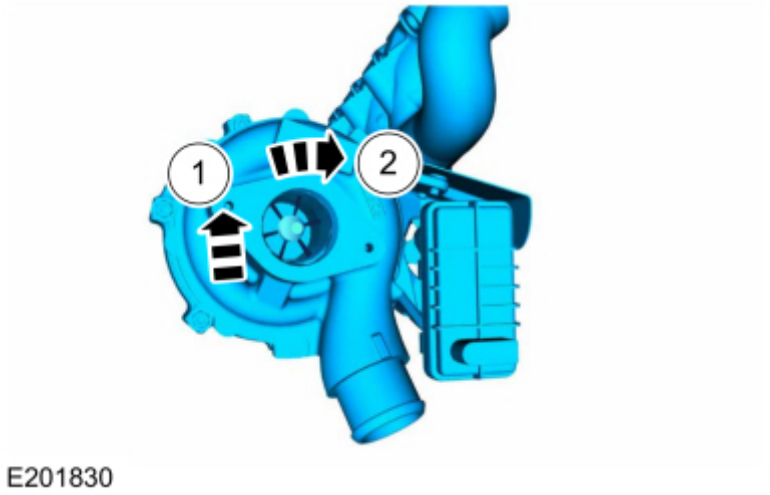
B3 CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: *A small amount of movement in the bearings is normal.*

NOTE: *The initial rotor rotation of a cold turbocharger may feel rough and uneven but should rotate freely after a few turns.*

- **NOTE:** *Make sure that the turbocharger rotor should be rotated by fingertips only and not any other tool.*

  Make sure the turbocharger rotor spins freely within the housing.
  - 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
  - 2. Make sure the rotor spins freely within the housing.



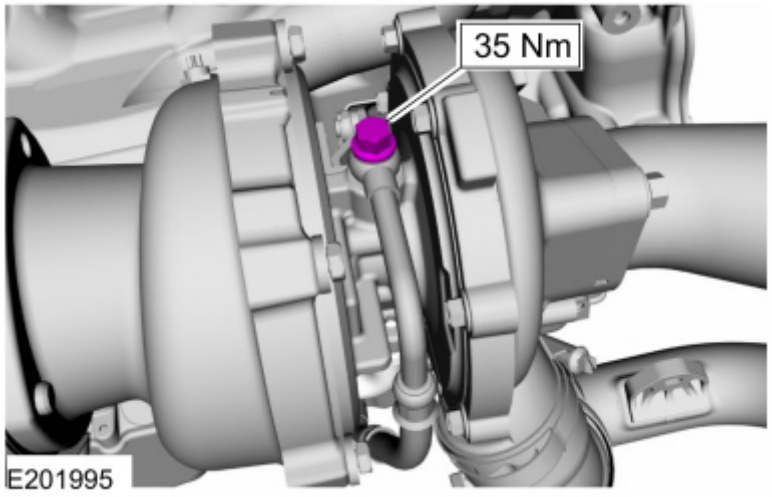
E201830

Does the rotor spin freely within the housing?

Yes	GO to B4
No	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

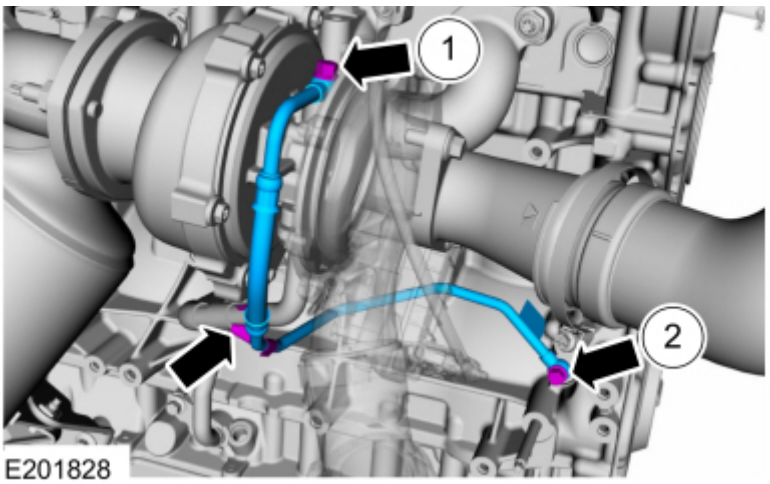
B4 CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

- Disconnect the turbocharger oil supply tube from the turbocharger.



E201995

- Remove the turbocharger oil supply tube.



- Using workshop compressed air and a compressed air nozzle, check the oil supply tube for blockage.

Is the oil supply tube free from blockage?

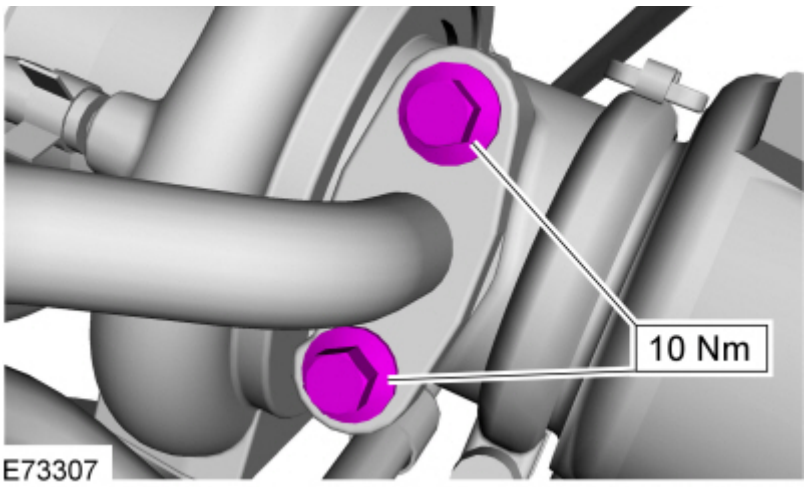
Yes	INSTALL a new turbocharger. REFER to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

PINPOINT TEST C : BLUE SMOKE WITHOUT EXCESSIVE TURBOCHARGER NOISE

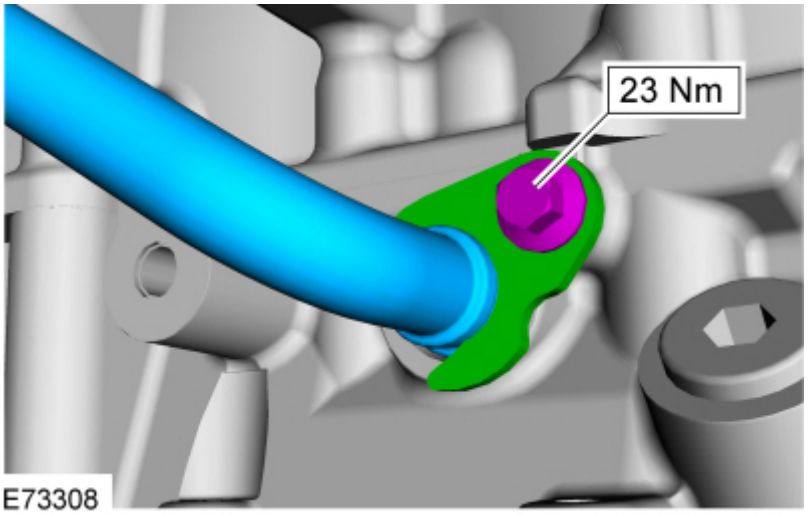
C1 CHECK THE TURBOCHARGER OIL RETURN TUBE

- Disconnect the turbocharger oil return tube from the turbocharger.





- Remove the turbocharger oil return tube.



- Check the turbocharger oil return tube for a blockage or signs of damage.

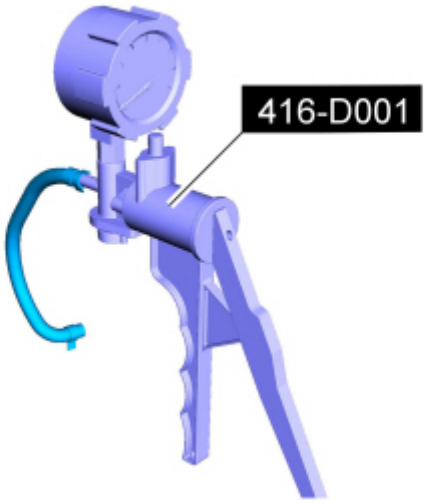
Is the turbocharger oil return tube blocked?

Yes	GO to Fuel Charging and Controls for further blue smoke diagnostics. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Charging and Controls (Diagnosis and Testing).
No	INSTALL a new turbocharger oil return tube. TEST the system for normal operation.

PINPOINT TEST D : POOR ENGINE PERFORMANCE - VEHICLES WITH FIXED VANE TURBOCHARGER.

D1 CHECK THE WASTEGATE ACTUATOR CONTROL LINE FOR BLOCKAGE

- Remove the wastegate actuator control line.
- Install the special tool to one end of the wastegate actuator control line.



E73312

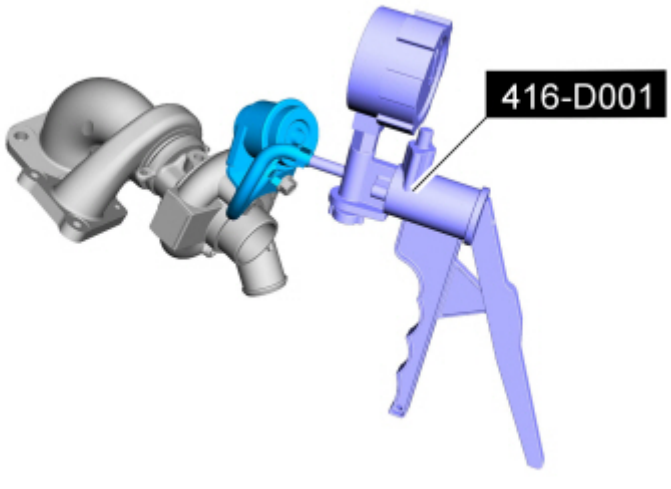
- Operate the hand vacuum pump and observe the reading.

Is a reading present?

Yes	INSTALL a new wastegate actuator control line. TEST the system for normal operation.
No	GO to D2

D2 CHECK THE WASTEGATE ACTUATOR DIAPHRAGM FOR LEAKS

- Connect the free end of the wastegate control line to the wastegate actuator.



E73311

- Operate the hand vacuum pump and observe the reading.

Does the pump hold vacuum?

Yes	GO to Fuel Charging and Controls for further diagnostics. REFER to: (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) Fuel Charging and Controls (Diagnosis and Testing).
No	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

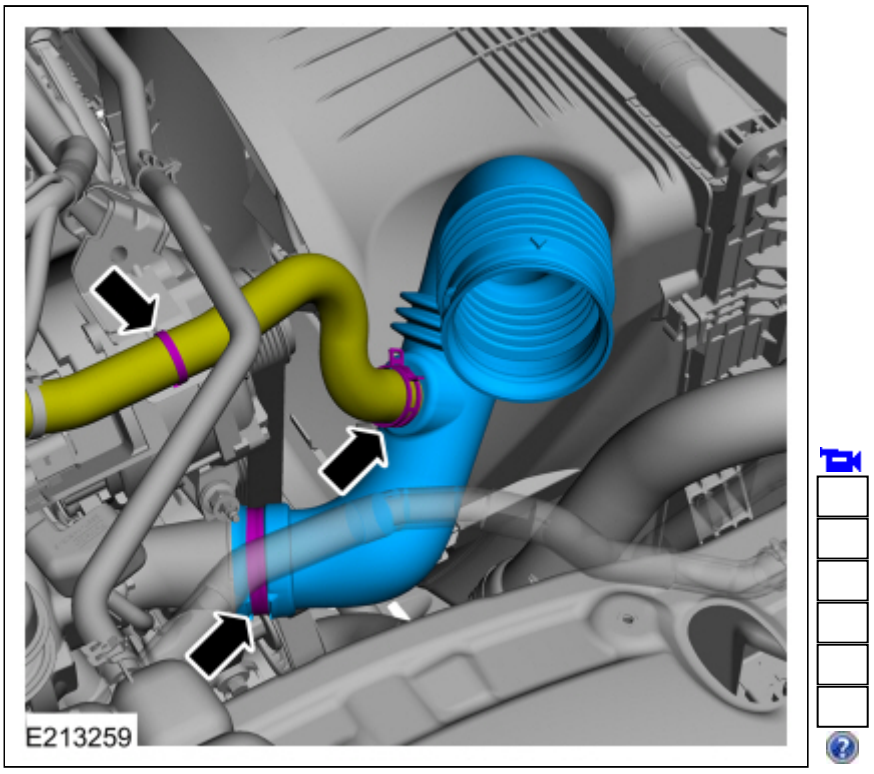
Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma

Removal

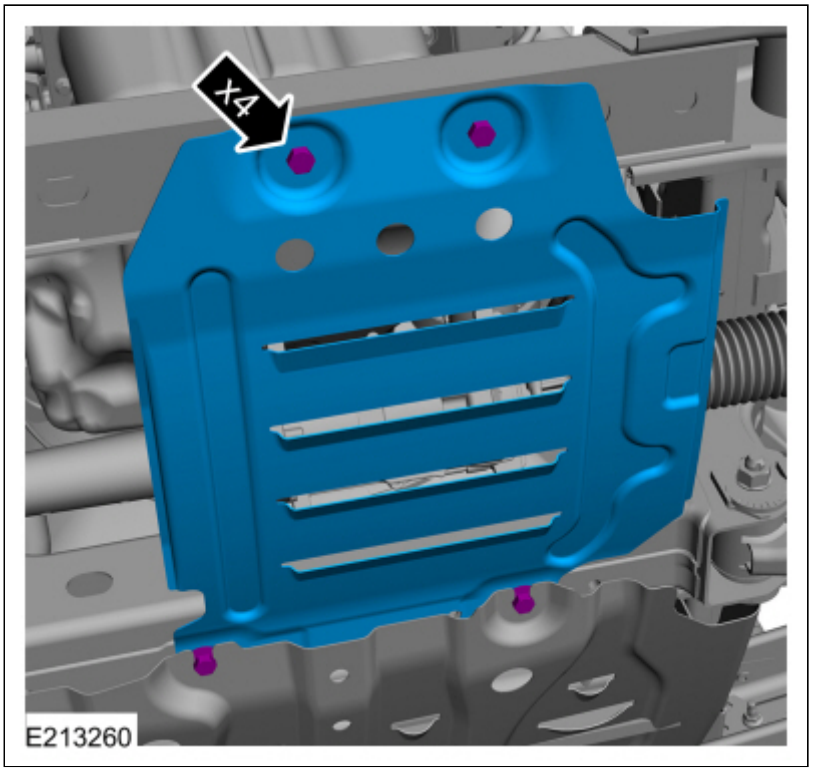
WARNING: Make sure that the engine and exhaust system are cool before removing any components. Failure to follow this instruction may result in serious personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

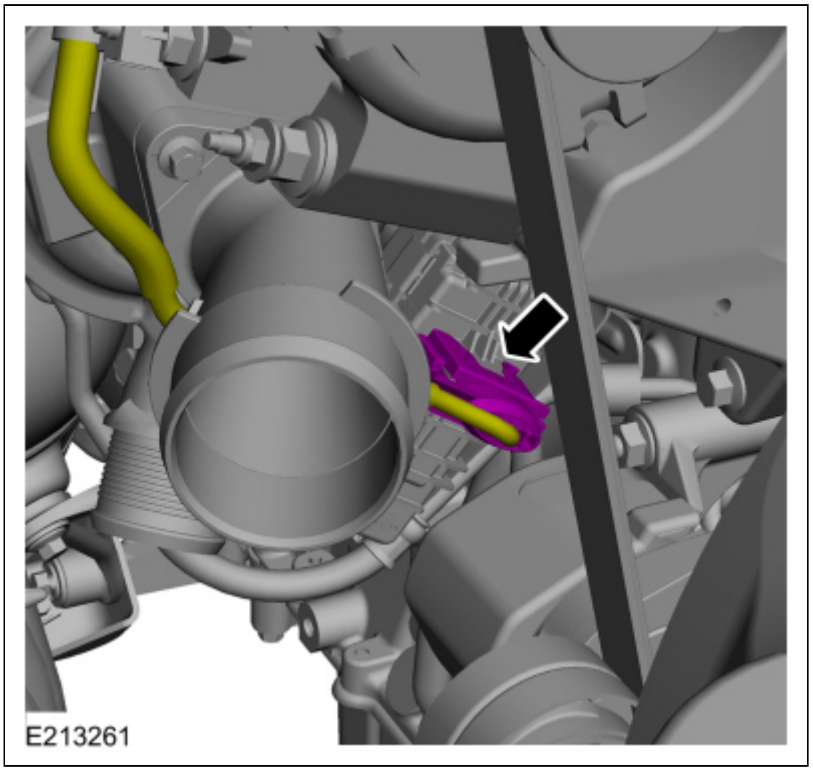
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
3. *Torque*: 4 Nm



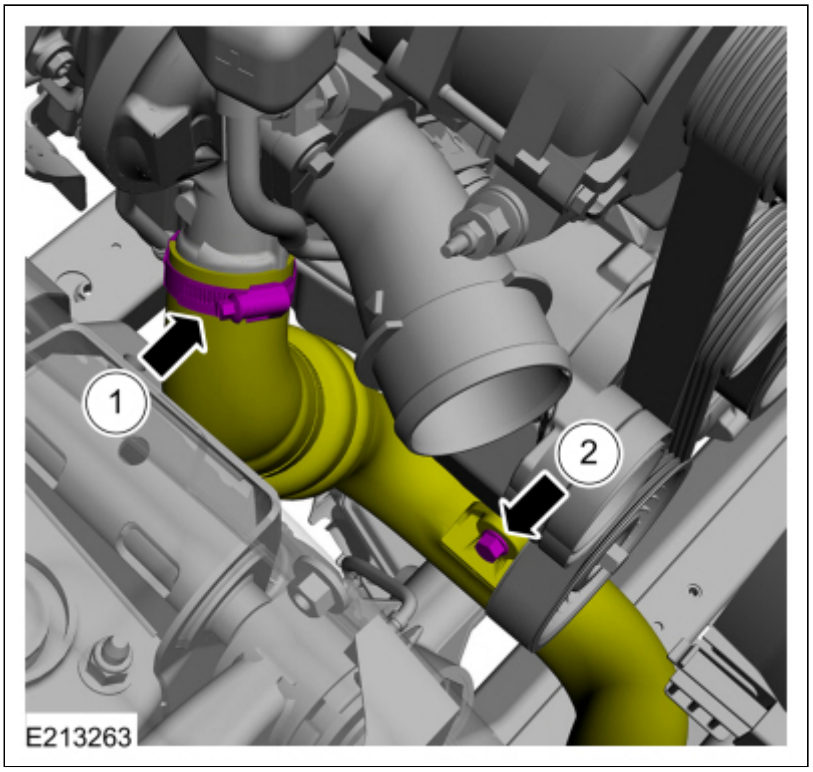
4. Refer to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. *Torque*: 30 Nm



7.

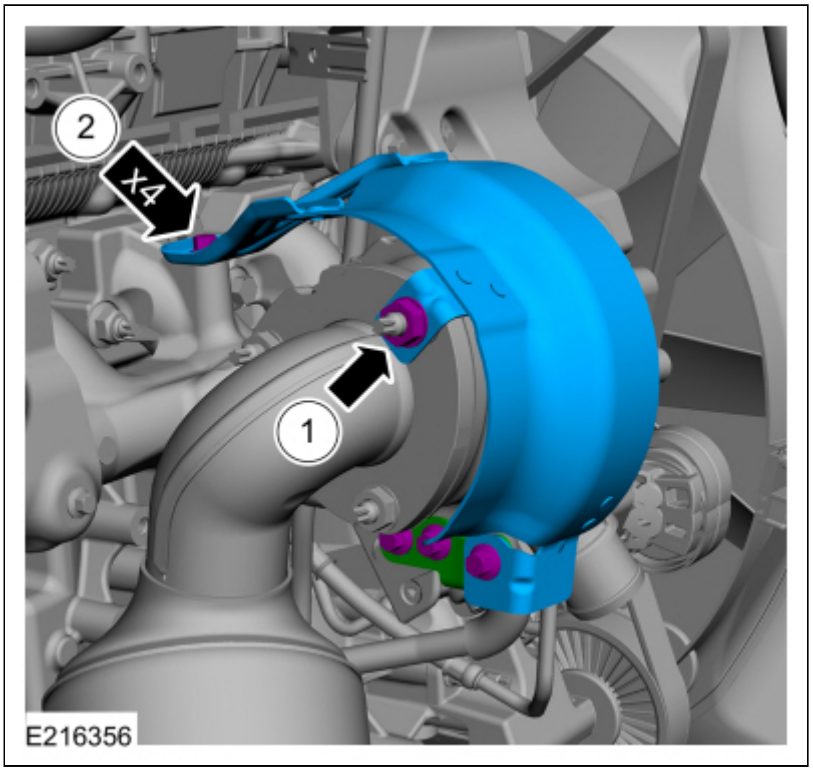


1. *Torque*: 4 Nm
2. *Torque*: 11 Nm



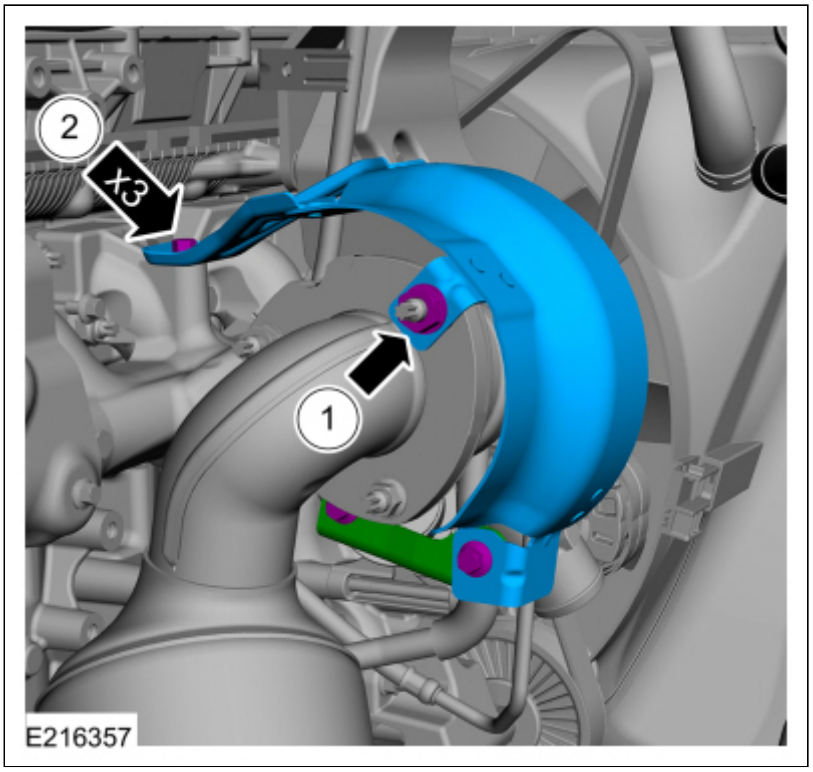
Type 1

1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



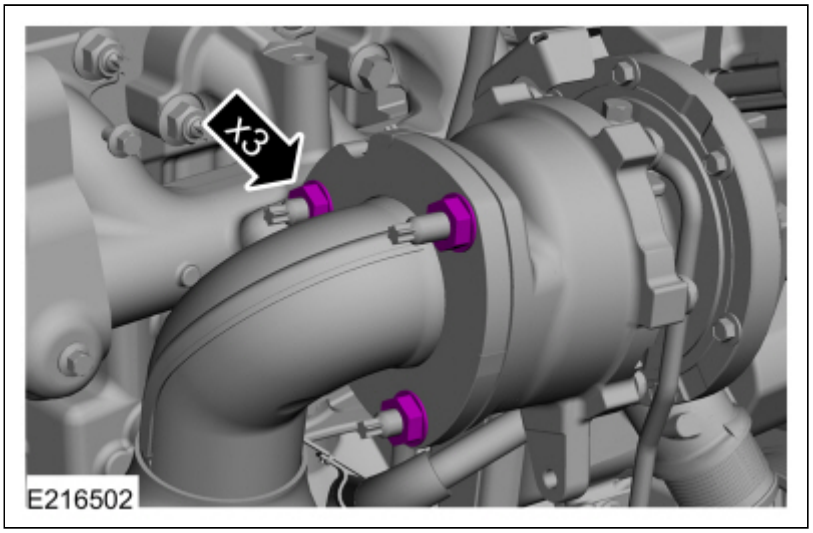
Type 2

1. *Torque*: 48 Nm
2. *Torque*: 23 Nm

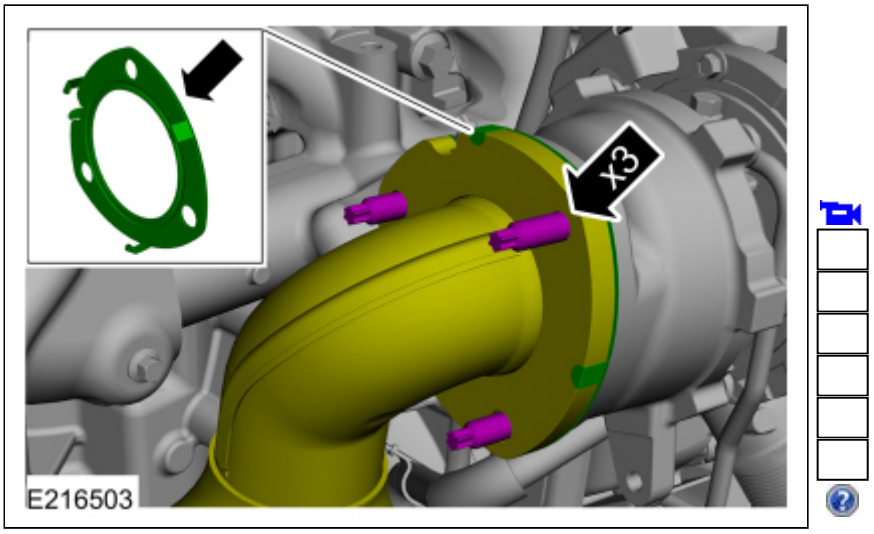


All vehicles

1. *Torque*: 48 Nm



1. *Torque*: 25 Nm

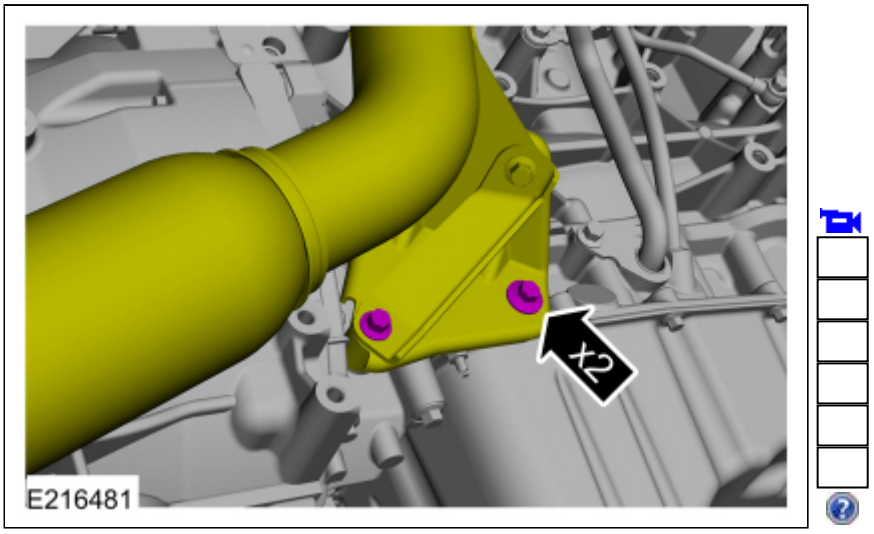


Emission Requirements: EURO Stage I LDT

13. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**

    NOTE: *Make sure that the components are appropriately secured.*

    Torque: 25 Nm

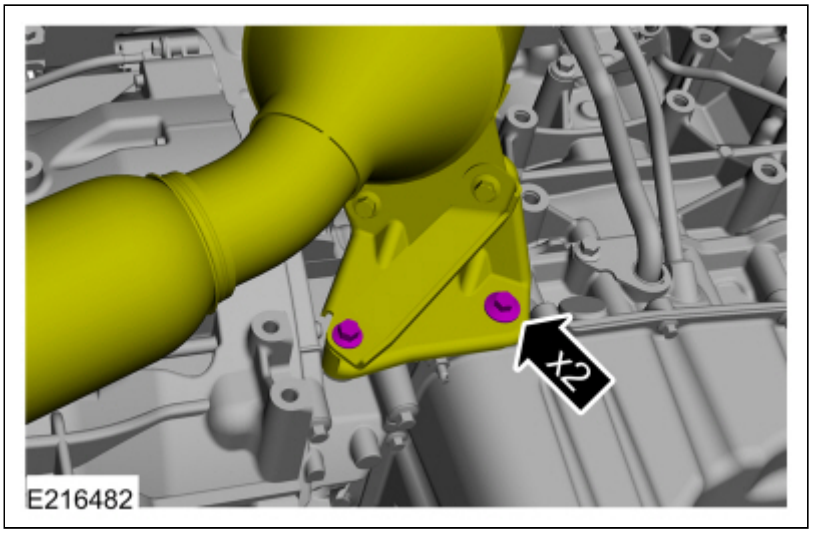


Emission Requirements: EURO Stage II LDT/EURO Stage III LDT/EURO Stage IV LDT

14. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**

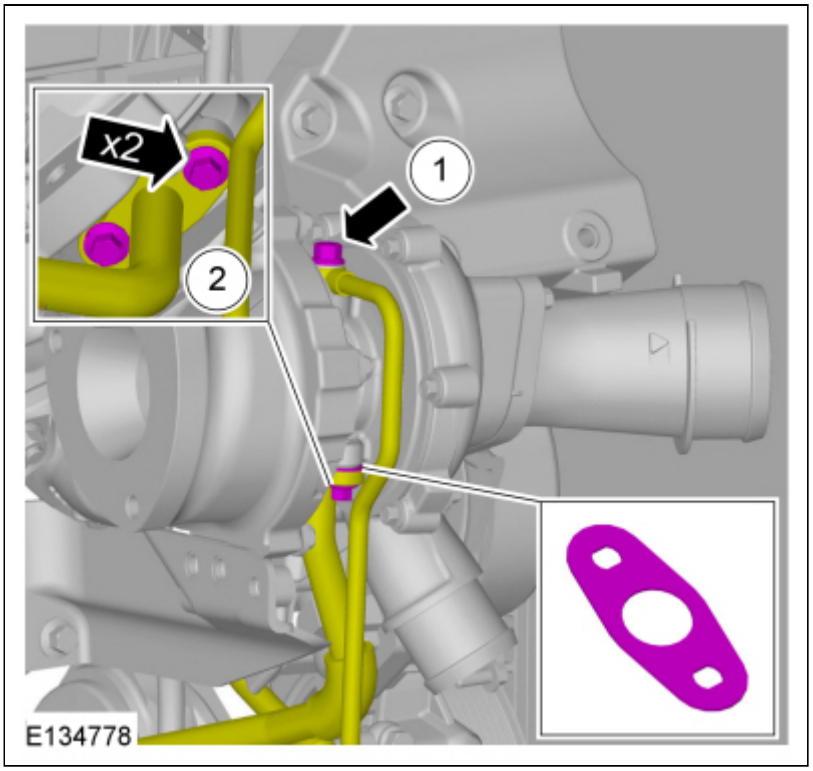
    NOTE: *Make sure that the components are appropriately secured.*

    Torque: 25 Nm

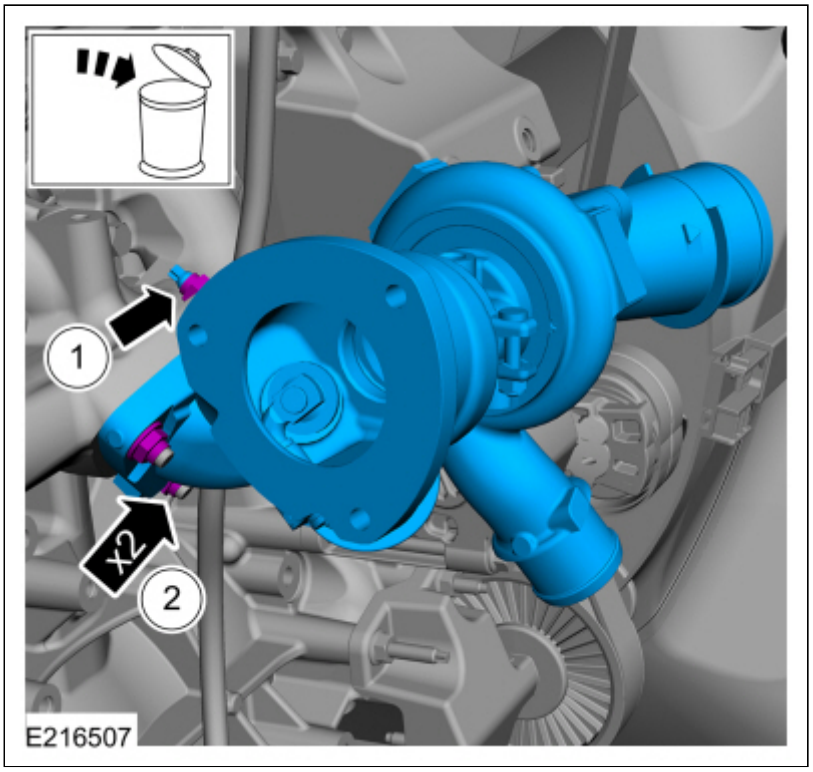


Vehicles with fixed vane turbocharger

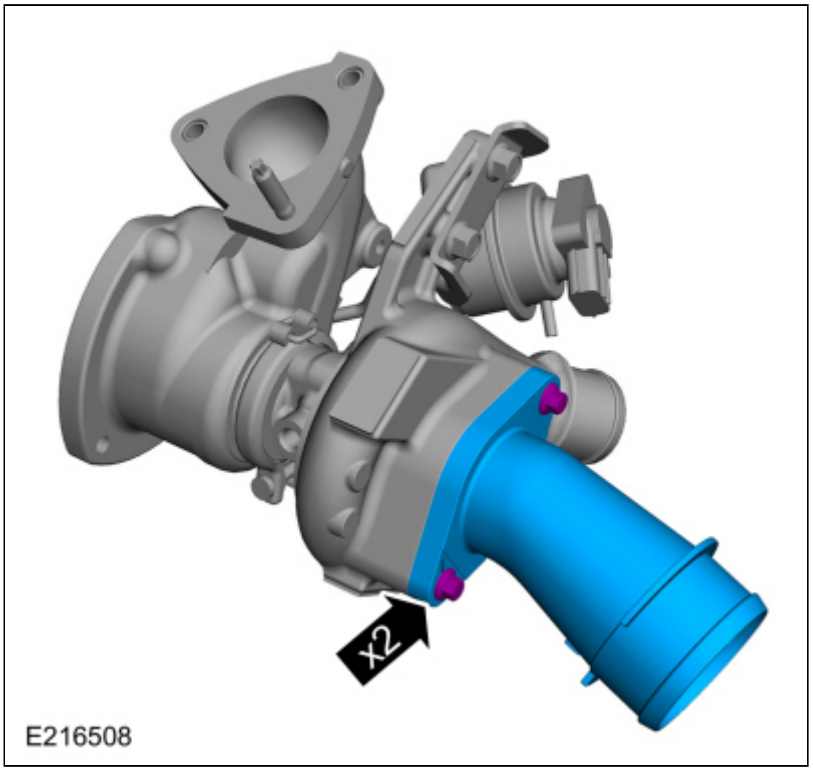
1. *Torque*: 35 Nm
2. *Torque*: 10 Nm



1. *Torque*: 23 Nm
2. *Torque*: 23 Nm

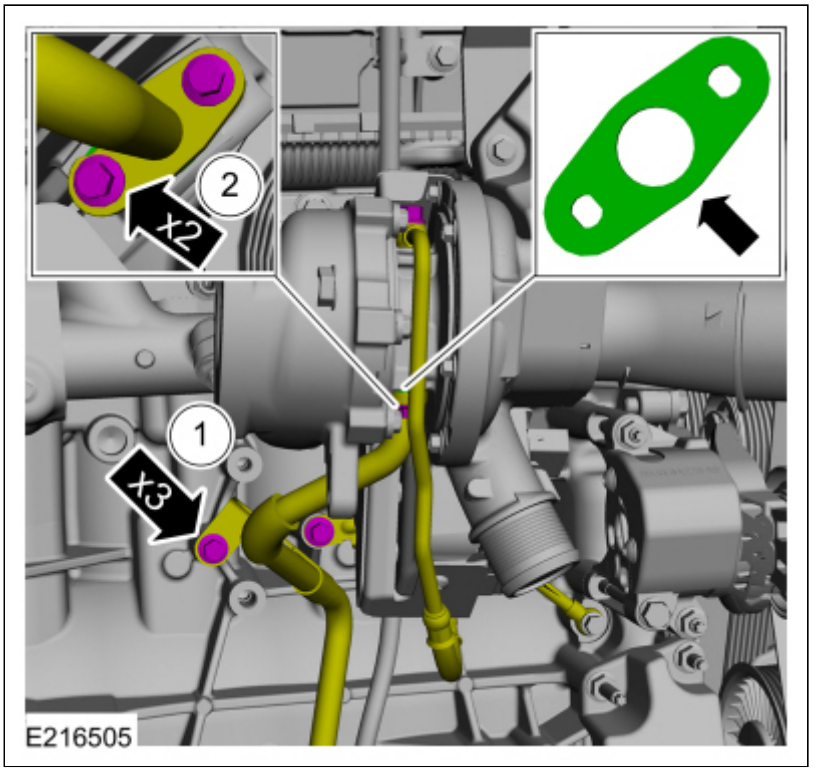


17. *Torque*: 10 Nm

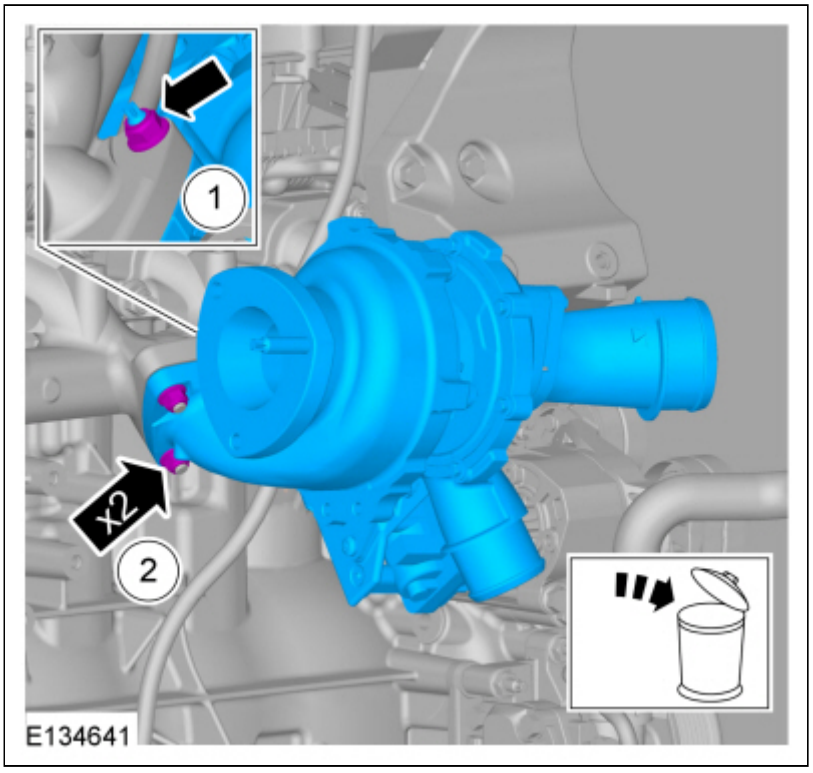


All vehicles

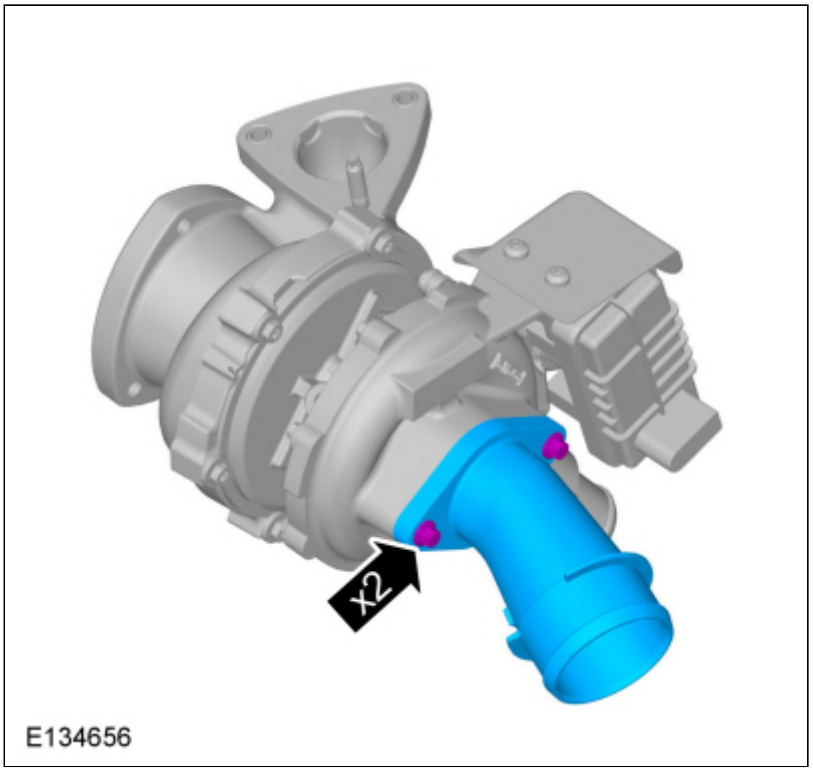
1. *Torque*: 35 Nm
2. *Torque*: 10 Nm



1. *Torque*: 23 Nm
2. *Torque*: 23 Nm



20. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

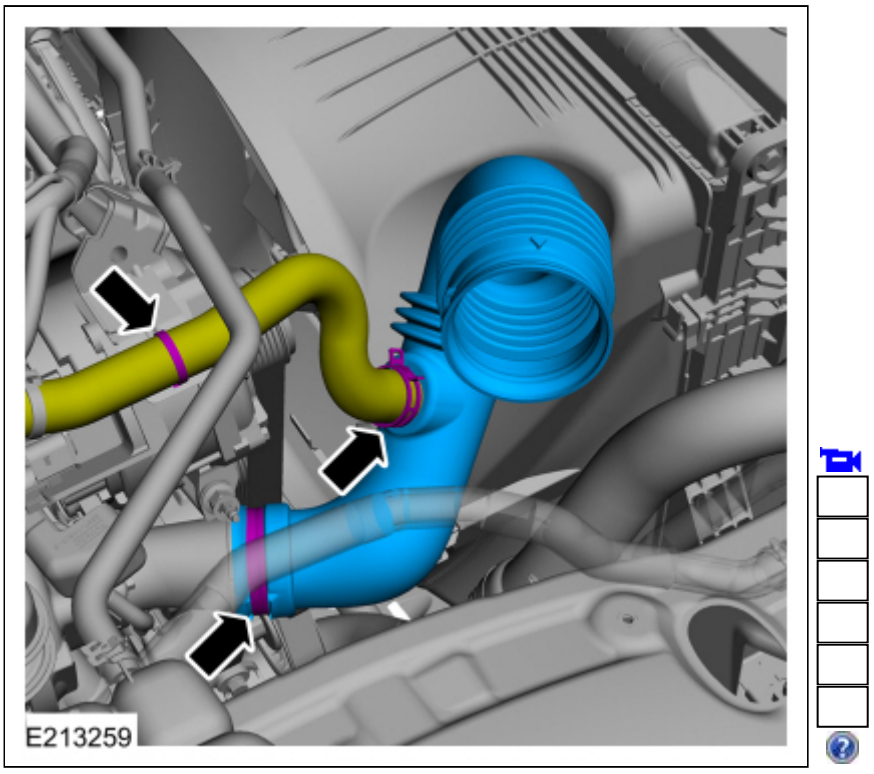
Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT

Removal

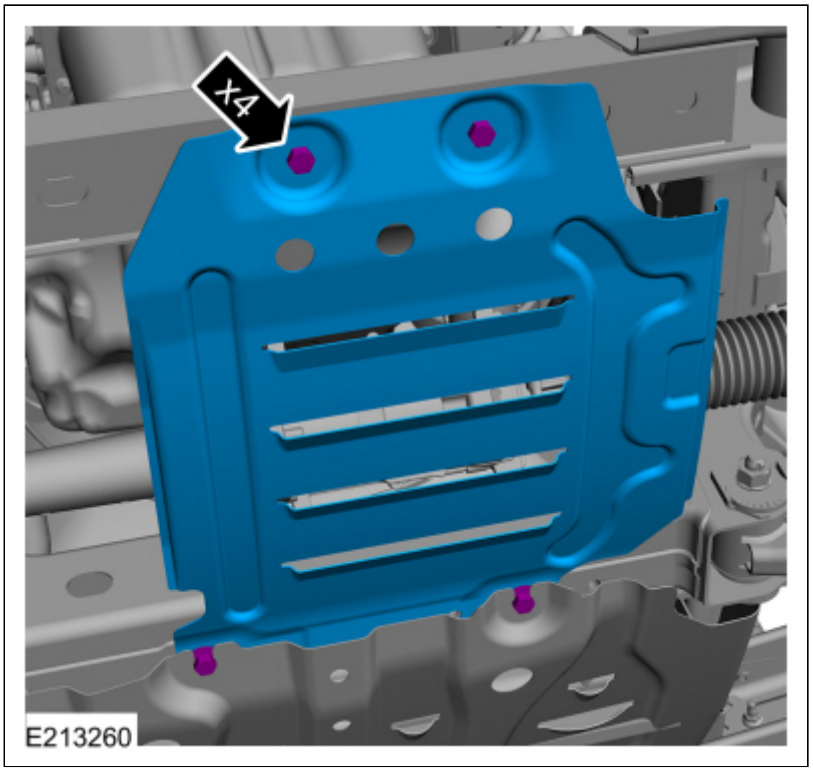
WARNING: Make sure that the engine and exhaust system are cool before removing any components. Failure to follow this instruction may result in serious personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

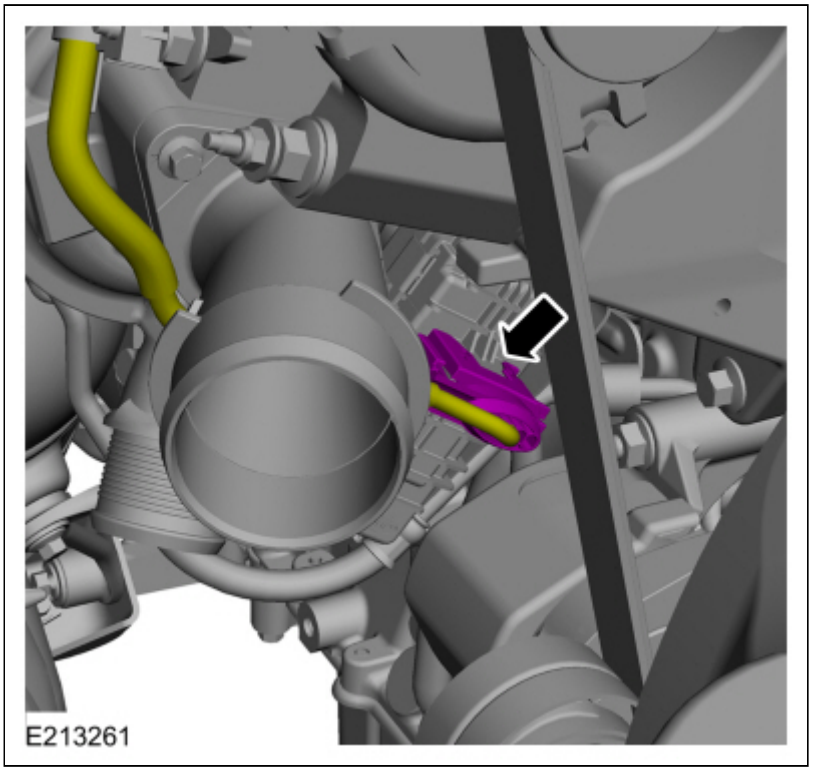
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
3. *Torque*: 4 Nm



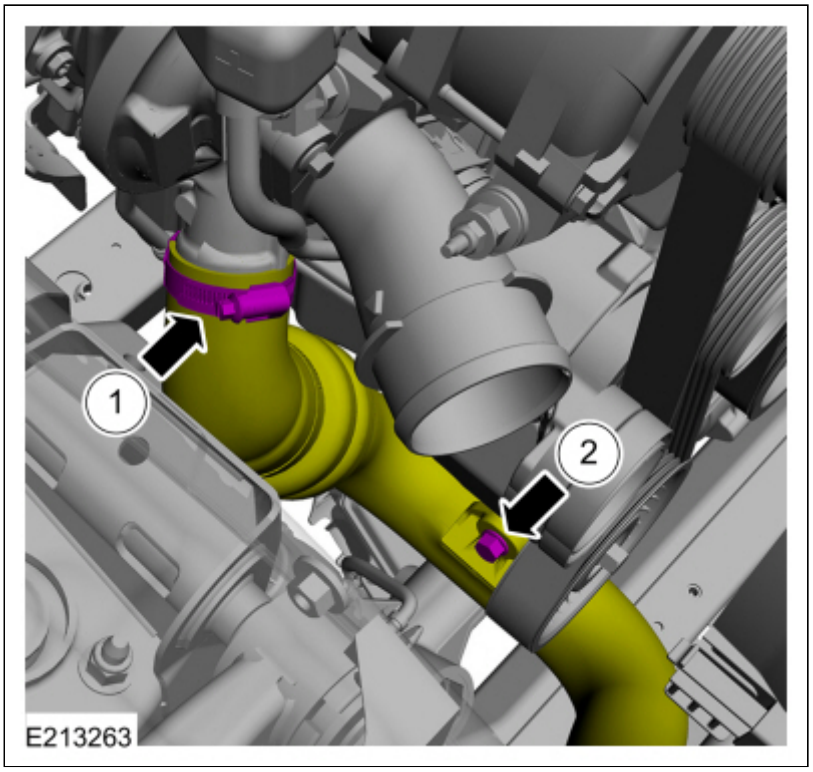
4. Refer to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. *Torque*: 30 Nm



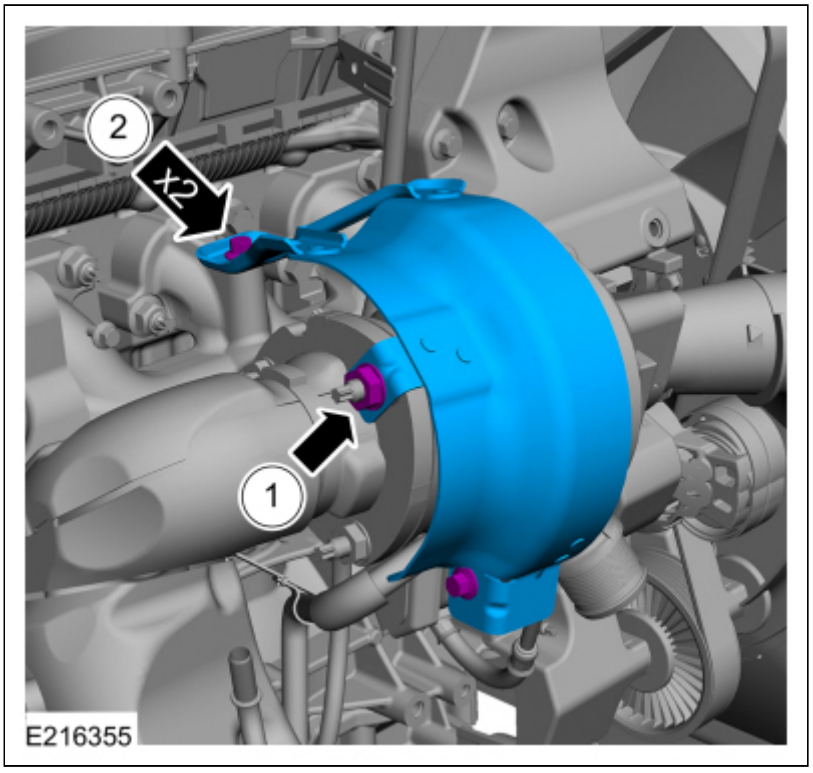
7.



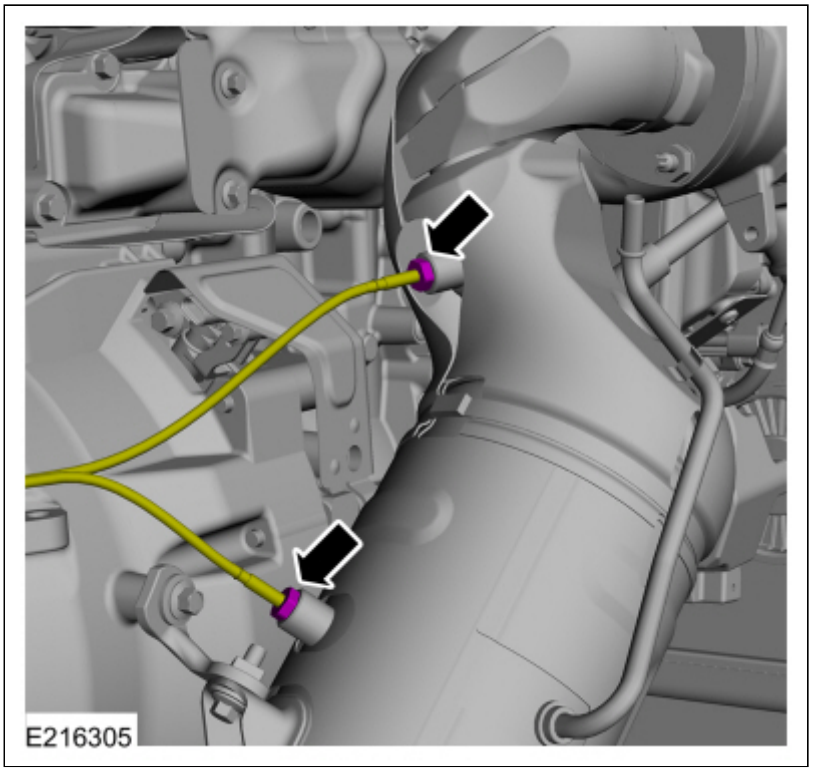
1. *Torque*: 4 Nm
2. *Torque*: 11 Nm



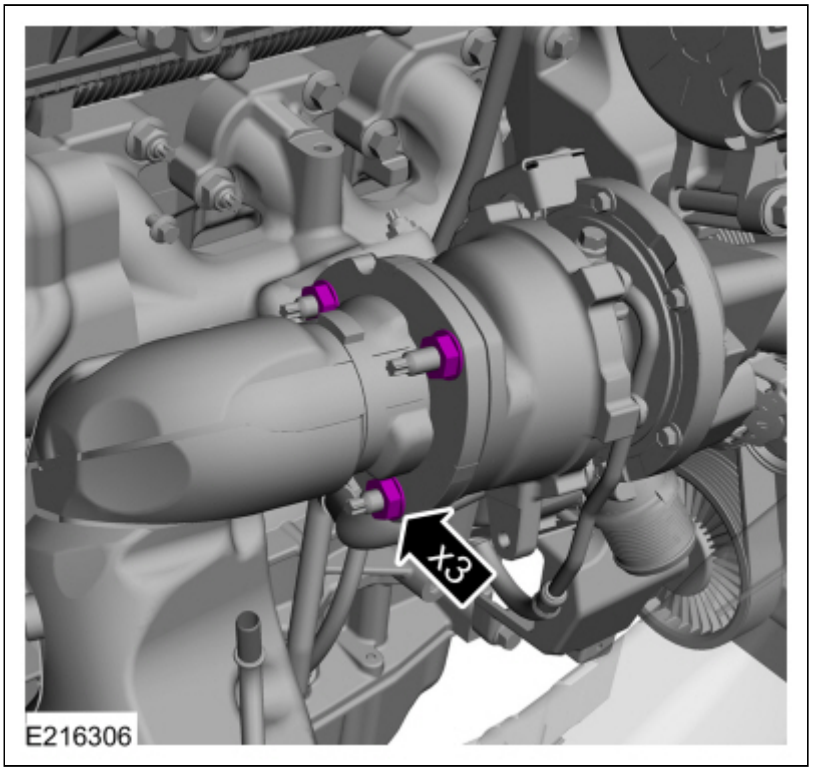
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



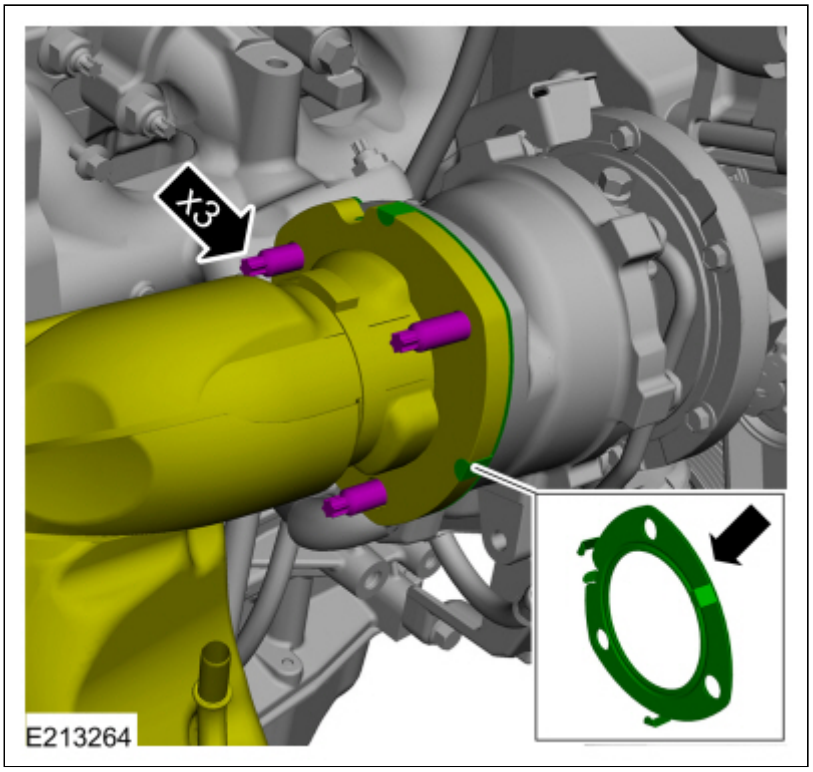
1. *Torque*: 35 Nm



1. *Torque*: 48 Nm



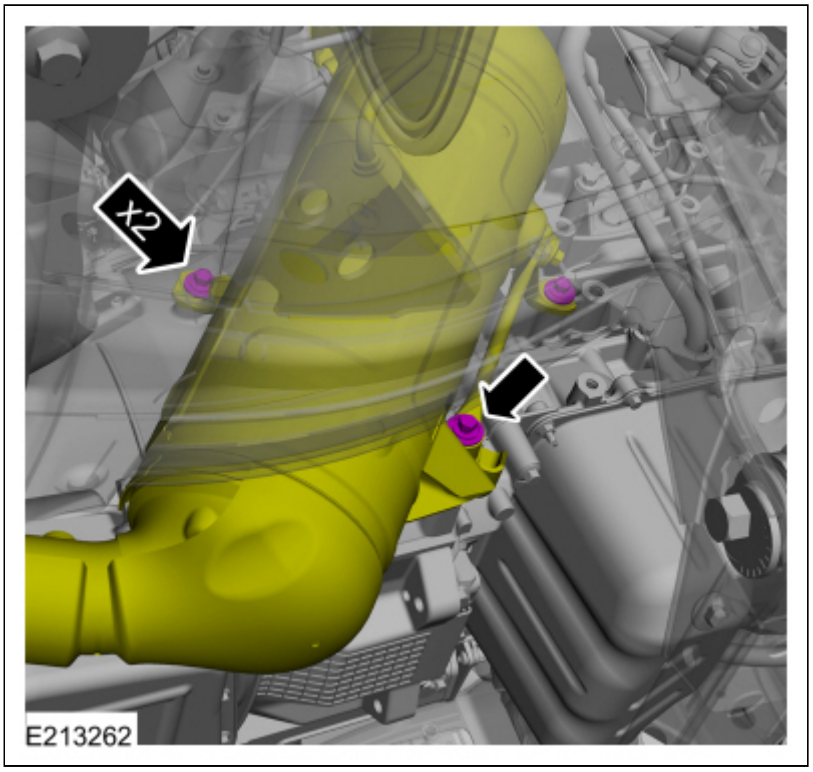
1. *Torque*: 25 Nm



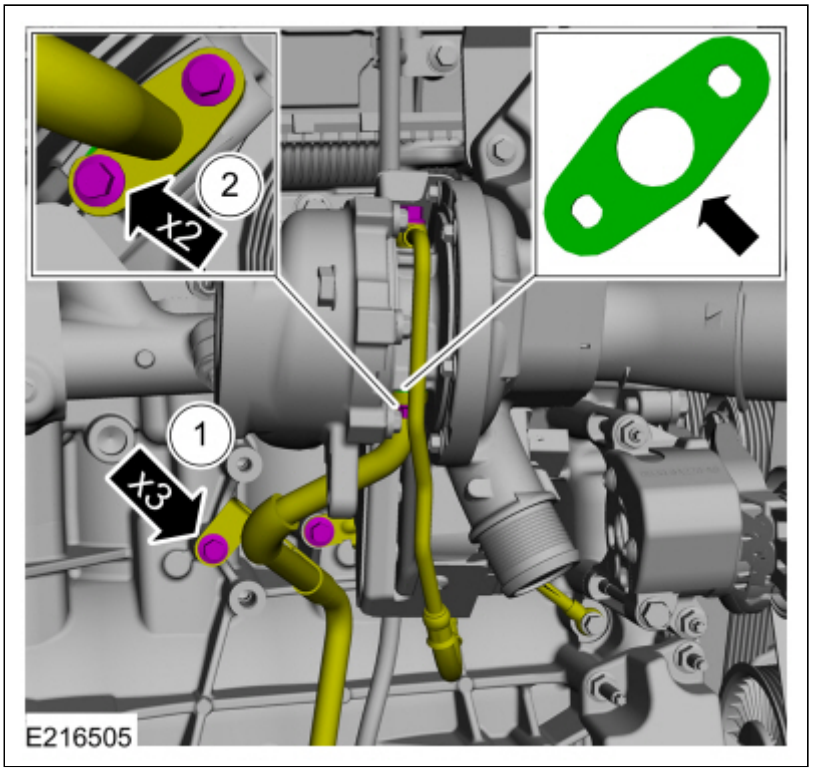
13. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**

    NOTE: *Make sure that the components are appropriately secured.*

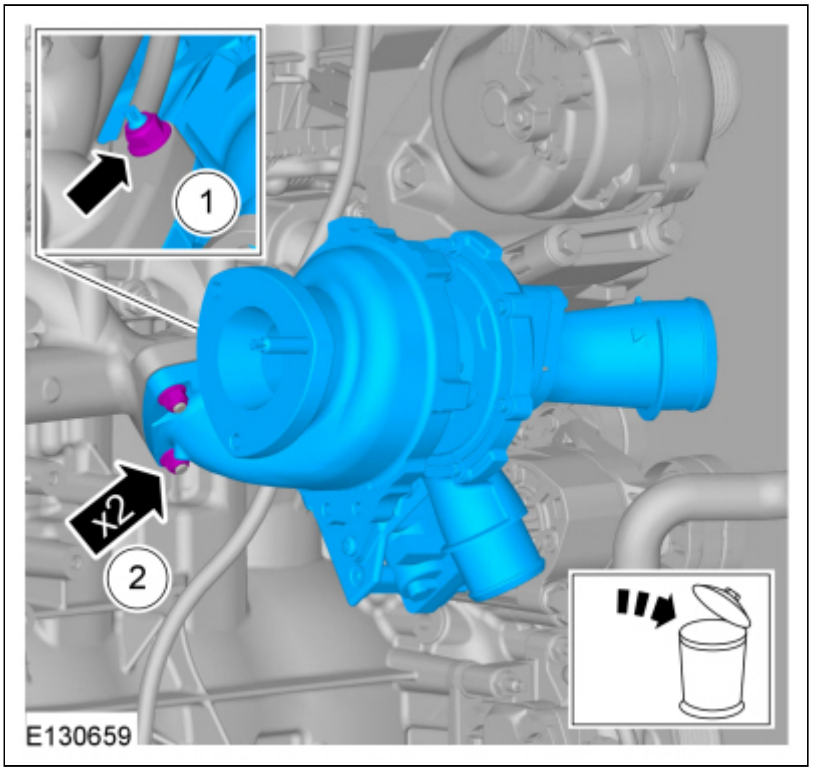
    Torque: 25 Nm



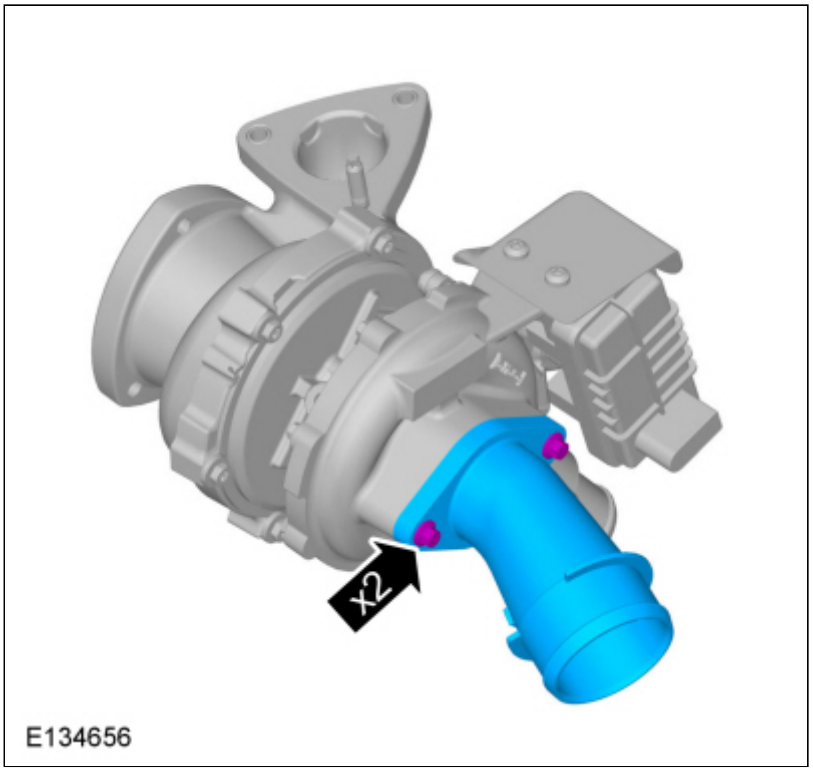
1. *Torque*: 35 Nm
2. *Torque*: 10 Nm



1. *Torque*: 23 Nm
2. *Torque*: 23 Nm

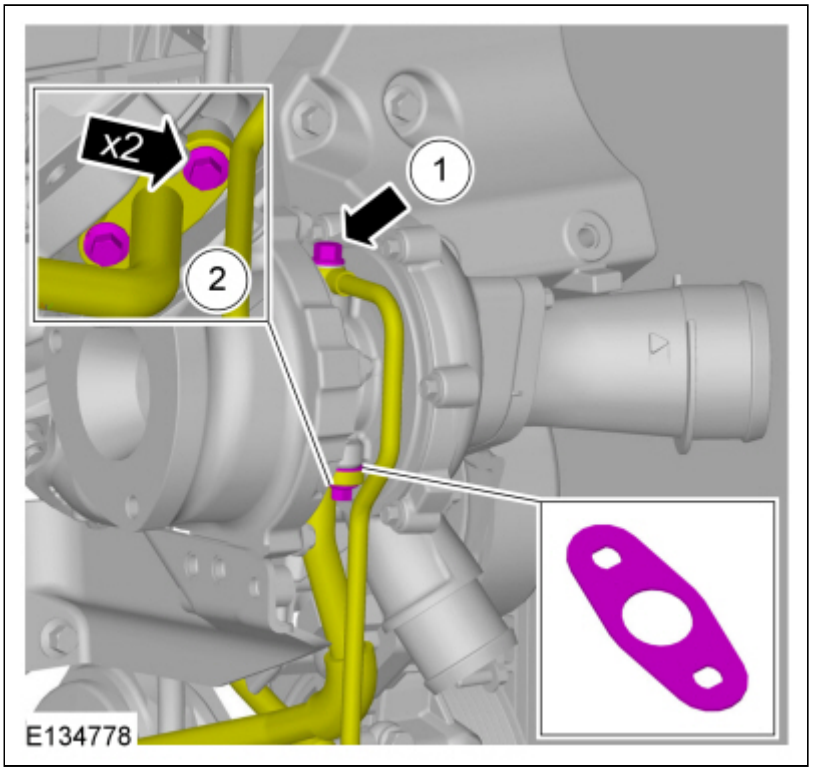


16. *Torque*: 10 Nm

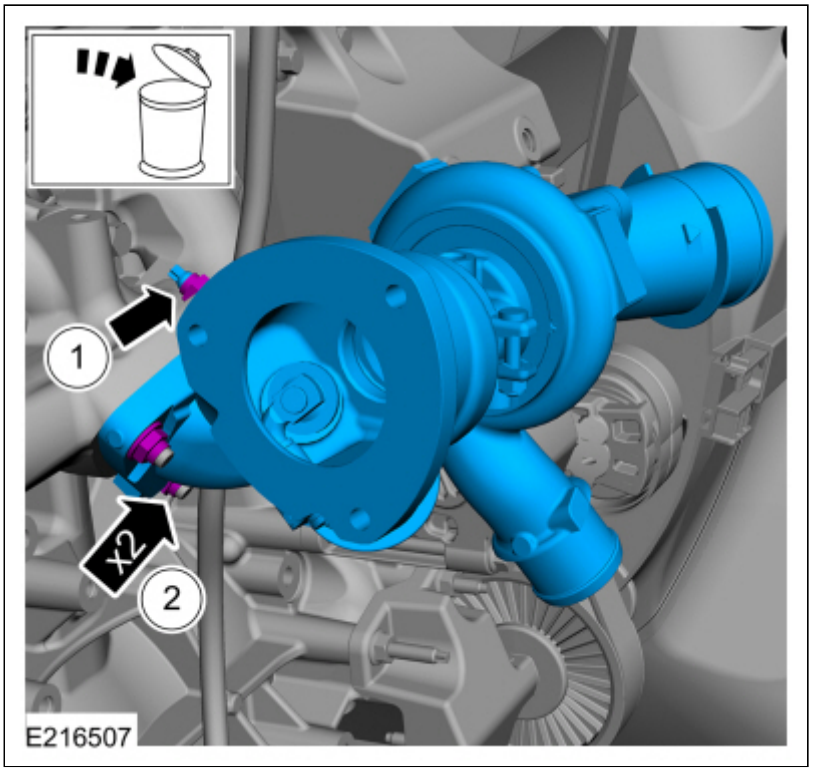


Vehicles with fixed vane turbocharger

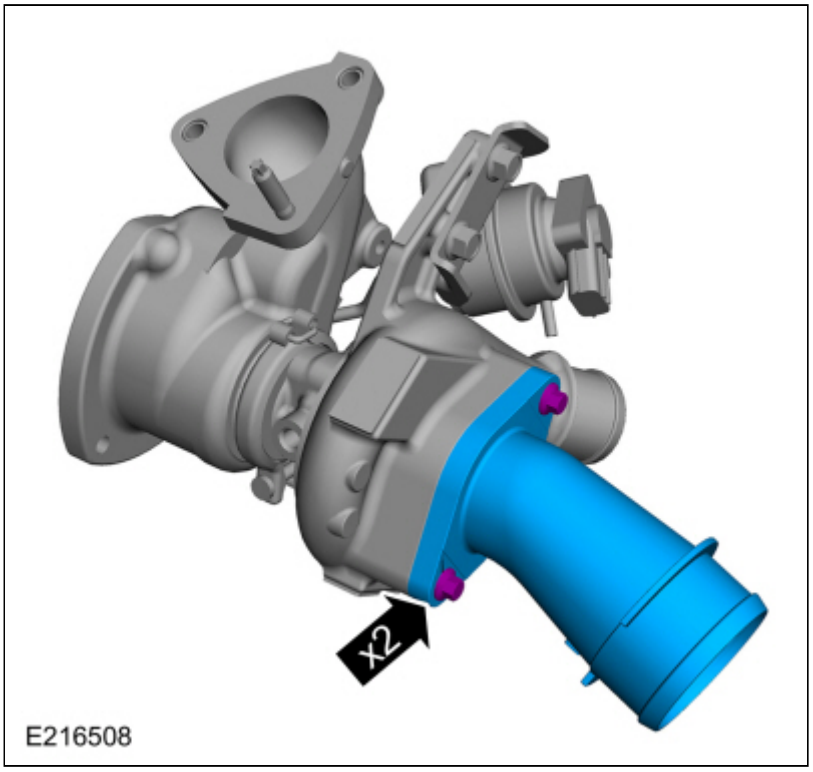
1. *Torque*: 35 Nm
2. *Torque*: 10 Nm



1. *Torque*: 23 Nm
2. *Torque*: 23 Nm



19. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

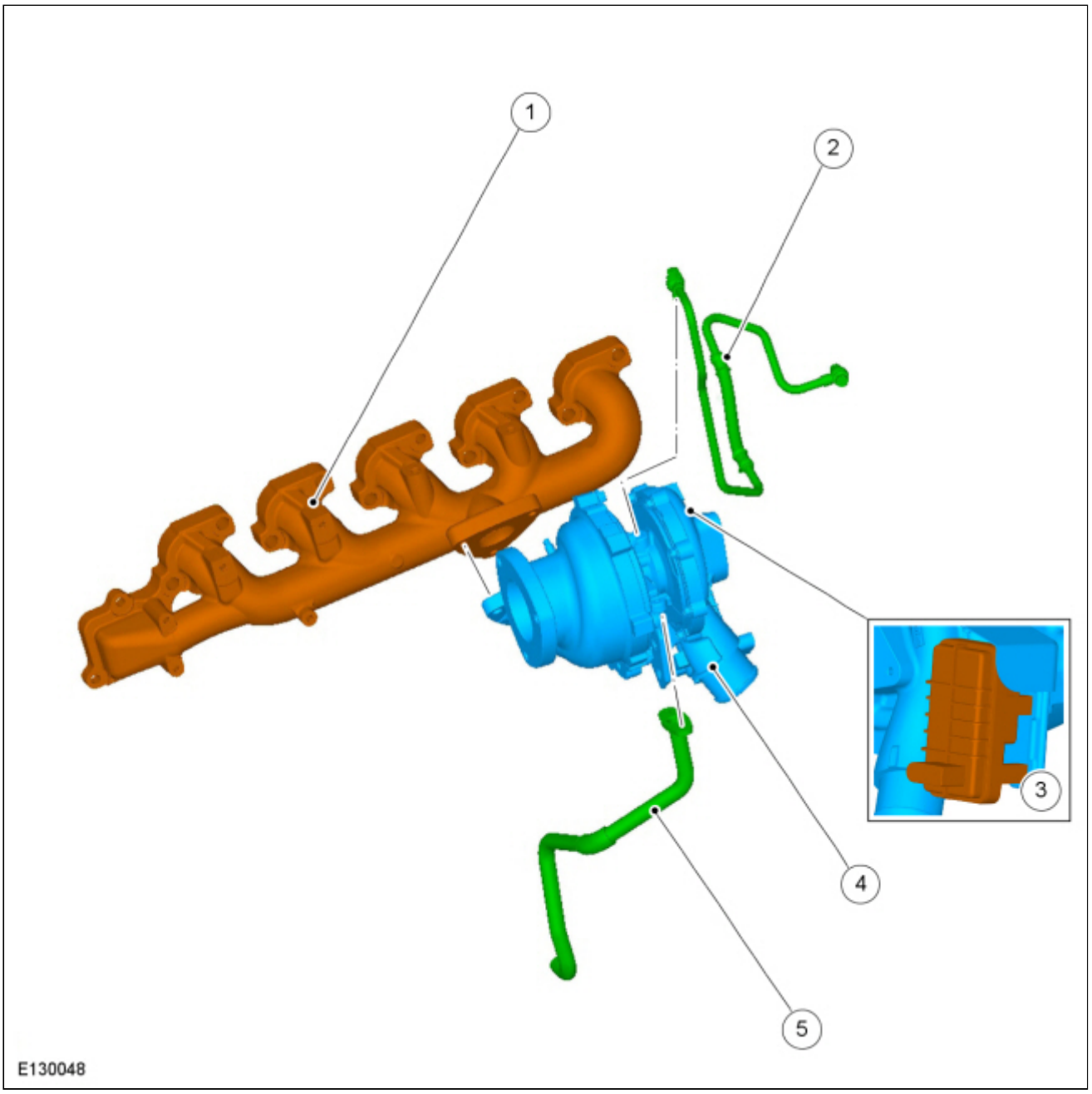
Torque Specifications

Turbocharger wastegate regulating valve solenoid bracket assembly bolts : 7 Nm
Turbocharger wastegate vacuum sensor bolt : 7 Nm

Copyright © 2016 Ford Motor Company

Turbocharger - Component Location

3.2 L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Exhaust manifold
2	—	Oil supply tube
3	—	Electronic turbocharger guide vane adjuster
4	—	Turbocharger
5	—	Oil drain tube

Copyright © 2016 Ford Motor Company

Turbocharger - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Turbocharger - Overview

Overview

NOTICE: Whenever turbocharger air intake system components are removed, always cover open ports to protect from debris. It is important that no foreign material enter the system. The turbocharger compressor vanes are susceptible to damage from even small particles. All components should be inspected and cleaned, if necessary, prior to installation or reassembly.

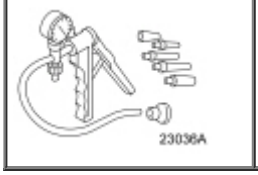
The turbocharger is an exhaust-driven centrifugal air compressor used to increase power output by supplying compressed air to the engine. The internal components are oil and air cooled. Engine oil and coolant are circulated through the center housing which acts as a heat barrier between the hot turbine and the cold compressor. Bearings are semi-floating journal and lubricated by engine oil. Oil is circulated to the turbocharger center housing and returned to the sump through an oil drain attached to the center housing.

The expanding exhaust gases drive the turbine shaft assembly to speeds up to 200,000 rpm. Filtered air entering the compressor side of the turbocharger is compressed and delivered through a CAC. The very hot compressed air is cooled by the CAC, then continues on to fill the intake manifold at a higher pressure than atmospheric pressure. Because more air is forced into the intake manifold, the results are increased power, fuel efficiency and the ability to maintain power at higher altitudes.

Copyright © 2016 Ford Motor Company

Turbocharger

Special Tool(s)

	Hand Vacuum/Pressure Pump 416-D001 (23-036A)

General Equipment

Ford diagnostic equipment

Inspection and Verification

NOTE: *The turbocharger uses engine oil as a lubricant and coolant. Due to the high operating temperatures of the turbocharger and with the expansion and contraction of the internal components a proportion of engine oil may enter the air intake system. This is not an indication that the turbocharger oil seal has failed. The turbocharger oil seal will not fail unless the bearings fail first, which will cause the turbocharger to become noisy. Do not install a new turbocharger due to oil inside the turbocharger or the air intake components. If a leak is detected in the supply or return tubes or connections, locate and rectify the source. Do not install a new turbocharger due to an oil leak.*

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Oil leak(s) − Air cleaner element − Air cleaner outlet pipe − Air cleaner intake pipe − Turbocharger oil supply tube − Turbocharger oil return tube − Wastegate control valve - vehicles with fixed vane turbocharger − Turbocharger housing − Charge air cooler − Charger air cooler intake pipe − Charger air cooler outlet pipe	− Wiring harness(es) − Electrical connector(s) − Variable vane electric actuator − PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

NOTICE: The variable vane electric actuator must not be transferred between the old and new turbochargers. Failure to follow this instruction may result in incorrect calibration, exhaust emissions and engine operation.

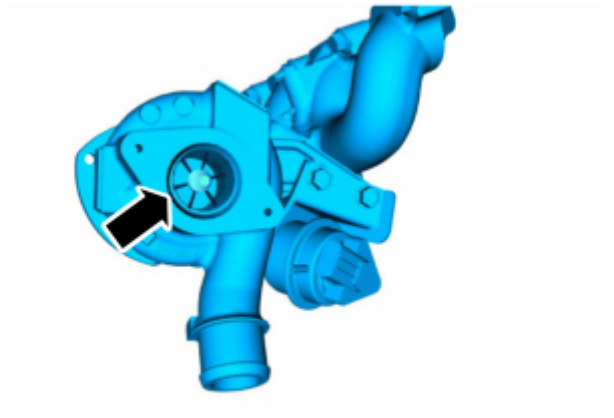
NOTICE: On vehicles with a fixed vane turbocharger the wastegate control valve and actuator rod are fixed parts of the turbocharger and must not be adjusted or renewed separately.

Symptom	Possible Sources	Action
• Blue smoke with excessive turbocharger noise	• Turbocharger compressor rubbing on housing walls. • Turbocharger turbine rubbing on housing walls. • Turbocharger bearings and oil seal(s). • Turbocharger oil supply tube blocked or damaged.	• Vehicles with fixed vane turbocharger. GO to Pinpoint Test A Vehicles with variable vane turbocharger. GO to Pinpoint Test B
• Blue smoke without excessive turbocharger noise	• Turbocharger oil return tube blocked or damaged.	• GO to Pinpoint Test C
• Poor engine performance	• Charge air cooler system.	• CHECK the charge air cooler and charge air cooler pipe(s) for leaks and obstructions. REPAIR as necessary.
	• Air cleaner intake pipe.	• CHECK the air cleaner intake pipe for obstructions. REPAIR as necessary.
	• Unauthorized adjustment of the wastegate control valve actuator rod - vehicles with fixed vane turbocharger.	• The wastegate control valve actuator rod is factory set and must not be adjusted. CHECK the paint seal on the wastegate control valve actuator rod has not been broken. If the paint seal has been broken, INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation).
	• Wastegate control valve actuator - vehicles with fixed vane turbocharger.	• GO to Pinpoint Test D
	• Variable vane electric actuator.	• REFER to the Ford diagnostic equipment.

Pinpoint Tests

PINPOINT TEST A : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE - VEHICLES WITH FIXED VANE TURBOCHARGER

A1 INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE
• Disconnect the air cleaner outlet pipe from the turbocharger. • Inspect the turbocharger rotor vanes for damage.



E201976

Is there visible damage to the rotor vanes?

Yes	GO to A2
No	GO to A3

A2 CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

- Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes	CLEAN the intake air system components. INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.
No	GO to A4

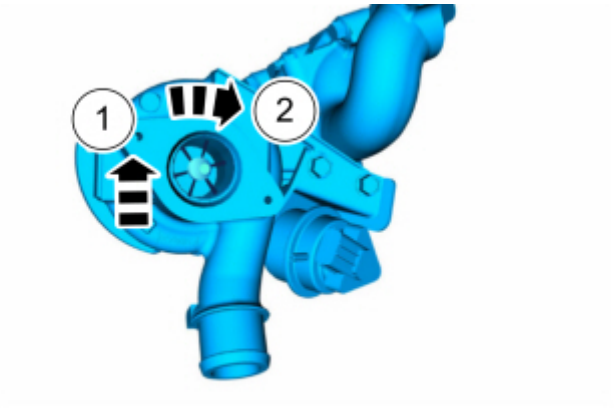
A3 CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: *A small amount of movement in the bearings is normal.*

NOTE: *The initial rotor rotation of a cold turbocharger may feel rough and uneven but should rotate freely after a few turns.*

- **NOTE:** *Make sure that the turbocharger rotor should be rotated by fingertips only and not any other tool.*

  Make sure that the turbocharger rotor spins freely within the housing.
  - 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
  - 2. Make sure that the rotor spins freely within the housing.



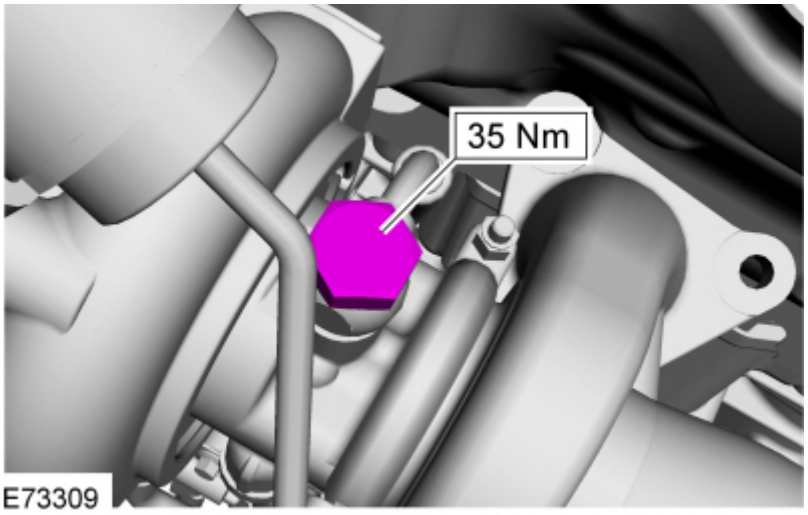
E201977

Does the rotor spin freely within the housing?

Yes	GO to A4
No	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

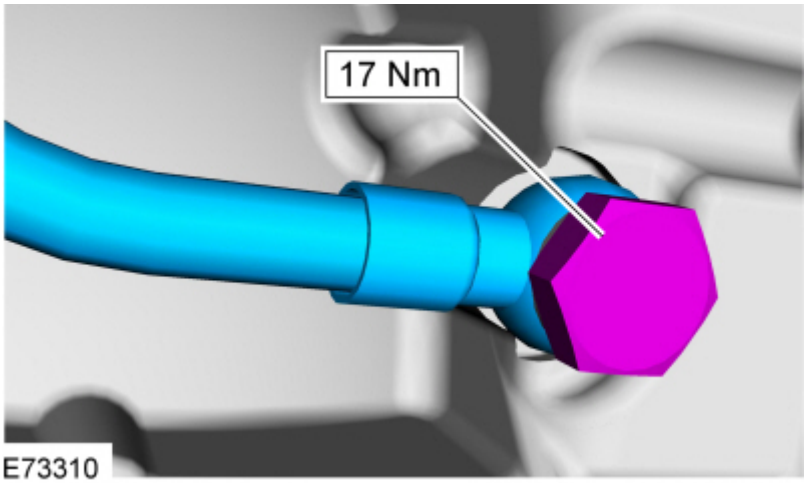
A4 CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

- Disconnect the turbocharger oil supply tube from the turbocharger.



E73309

- Remove the turbocharger oil supply tube.



- Using workshop compressed air and a compressed air nozzle, check the oil supply tube for blockage.

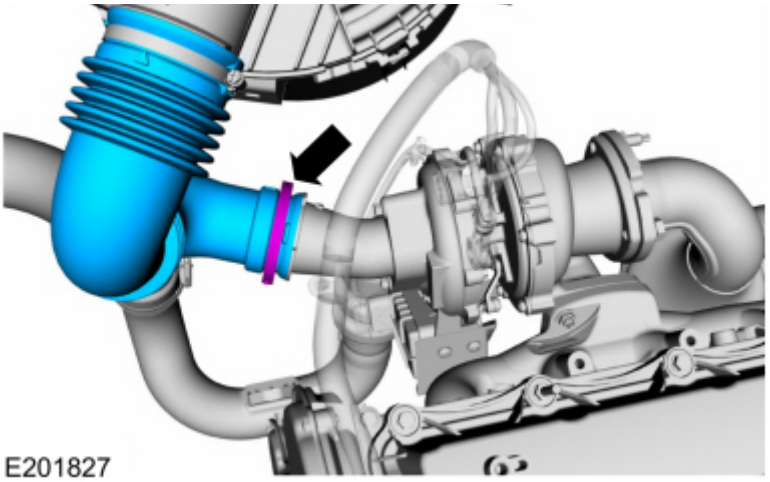
Is the oil supply tube free from blockage?

Yes	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.
No	INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

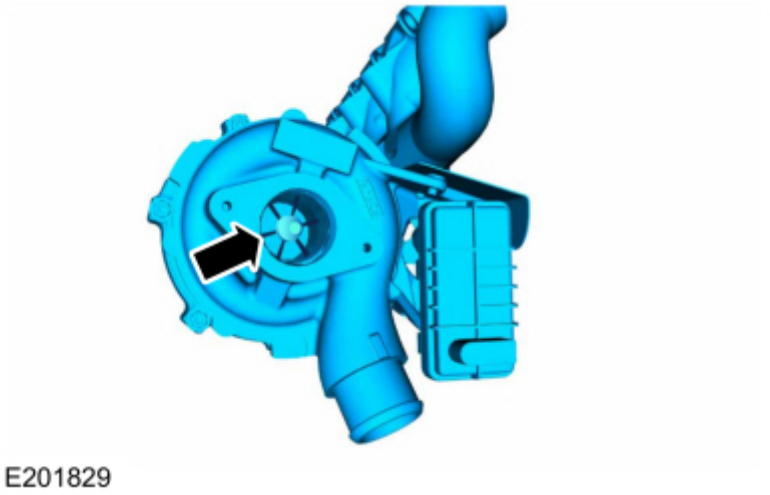
PINPOINT TEST B : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE - VEHICLES WITH VARIABLE VANE TURBOCHARGER

B1 INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE

- Disconnect the air cleaner outlet pipe from the turbocharger.



- Inspect the turbocharger rotor vanes for damage.



Is there visible damage to the rotor vanes?

Yes	GO to B2
No	GO to B3

B2 CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

- Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes	CLEAN the intake air system components. INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.
No	GO to B4

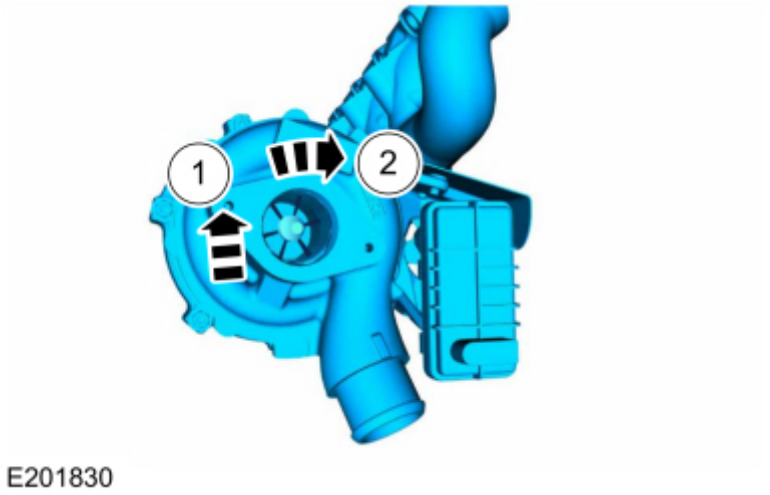
B3 CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: *A small amount of movement in the bearings is normal.*

NOTE: *The initial rotor rotation of a cold turbocharger may feel rough and uneven but should rotate freely after a few turns.*

- **NOTE:** *Make sure that the turbocharger rotor should be rotated by fingertips only and not any other tool.*

  Make sure the turbocharger rotor spins freely within the housing.
  - 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
  - 2. Make sure the rotor spins freely within the housing.



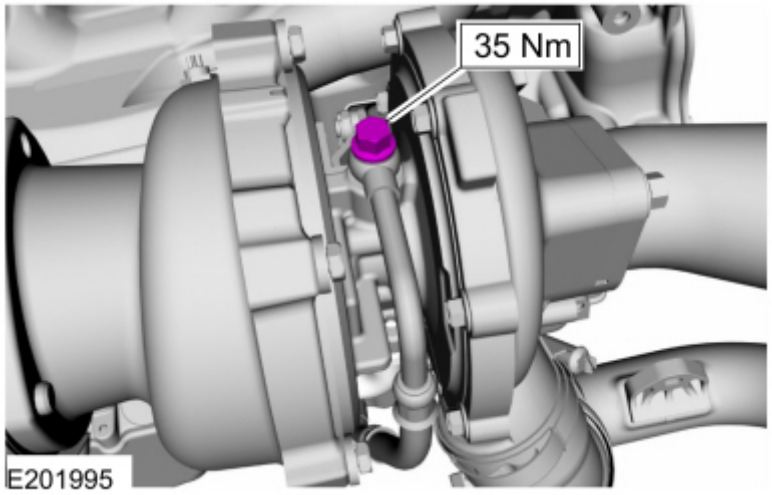
E201830

Does the rotor spin freely within the housing?

Yes	GO to B4
No	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

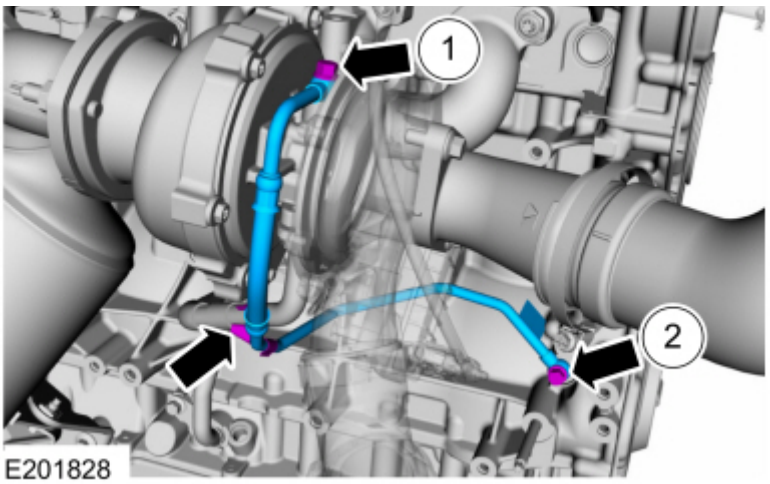
B4 CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

- Disconnect the turbocharger oil supply tube from the turbocharger.



E201995

- Remove the turbocharger oil supply tube.



- Using workshop compressed air and a compressed air nozzle, check the oil supply tube for blockage.

Is the oil supply tube free from blockage?

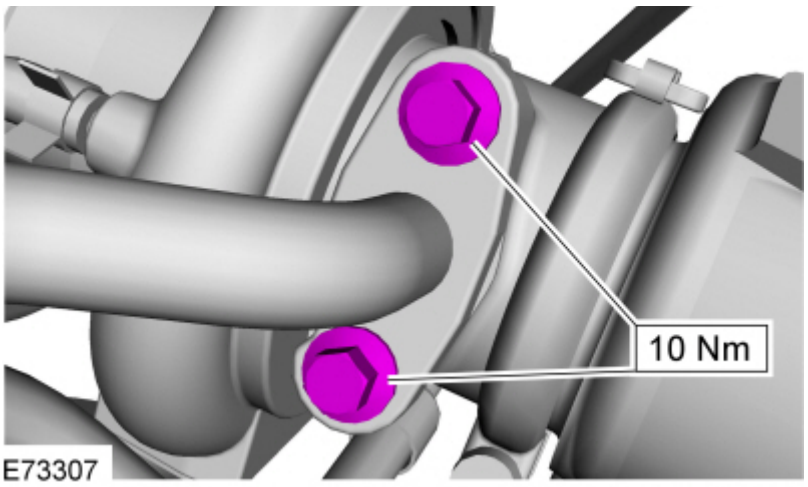
Yes	INSTALL a new turbocharger. REFER to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

PINPOINT TEST C : BLUE SMOKE WITHOUT EXCESSIVE TURBOCHARGER NOISE

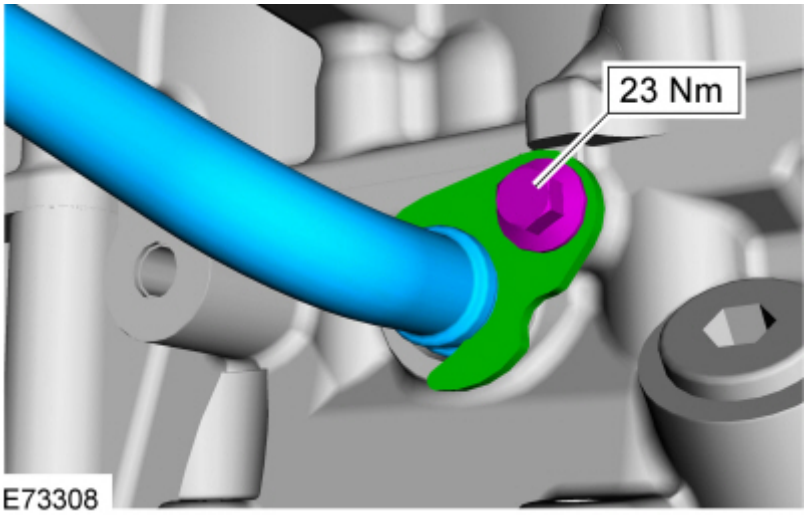
C1 CHECK THE TURBOCHARGER OIL RETURN TUBE

- Disconnect the turbocharger oil return tube from the turbocharger.





- Remove the turbocharger oil return tube.



- Check the turbocharger oil return tube for a blockage or signs of damage.

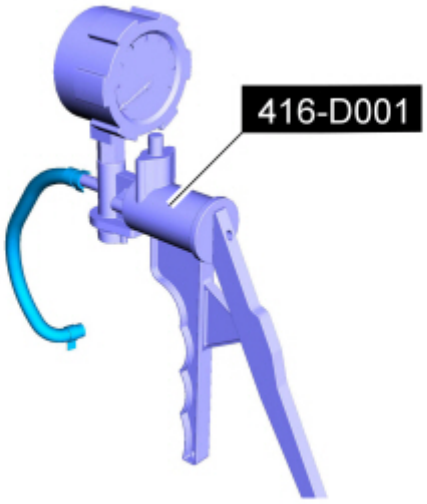
Is the turbocharger oil return tube blocked?

Yes	GO to Fuel Charging and Controls for further blue smoke diagnostics. REFER to: (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) Fuel Charging and Controls (Diagnosis and Testing).
No	INSTALL a new turbocharger oil return tube. TEST the system for normal operation.

PINPOINT TEST D : POOR ENGINE PERFORMANCE - VEHICLES WITH FIXED VANE TURBOCHARGER.

D1 CHECK THE WASTEGATE ACTUATOR CONTROL LINE FOR BLOCKAGE

- Remove the wastegate actuator control line.
- Install the special tool to one end of the wastegate actuator control line.



E73312

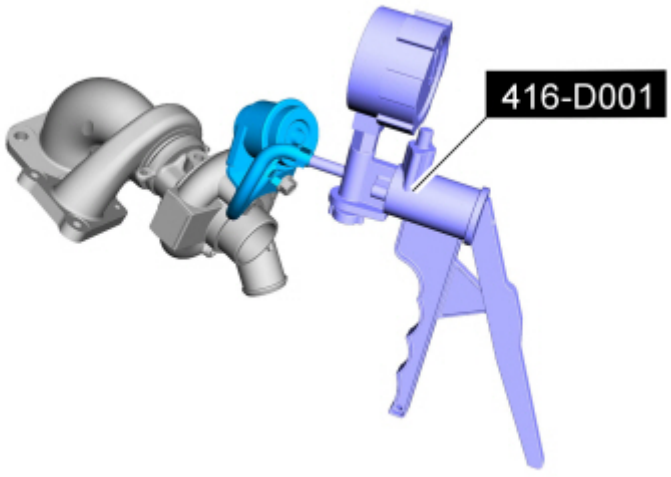
- Operate the hand vacuum pump and observe the reading.

Is a reading present?

Yes	INSTALL a new wastegate actuator control line. TEST the system for normal operation.
No	GO to D2

D2 CHECK THE WASTEGATE ACTUATOR DIAPHRAGM FOR LEAKS

- Connect the free end of the wastegate control line to the wastegate actuator.



E73311

- Operate the hand vacuum pump and observe the reading.

Does the pump hold vacuum?

Yes	GO to Fuel Charging and Controls for further diagnostics. REFER to: (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) Fuel Charging and Controls (Diagnosis and Testing).
No	INSTALL a new turbocharger. REFER to: (303-04D Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (Removal and Installation), Turbocharger - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Emission Requirements: EURO Stage V LDT (Removal and Installation). TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

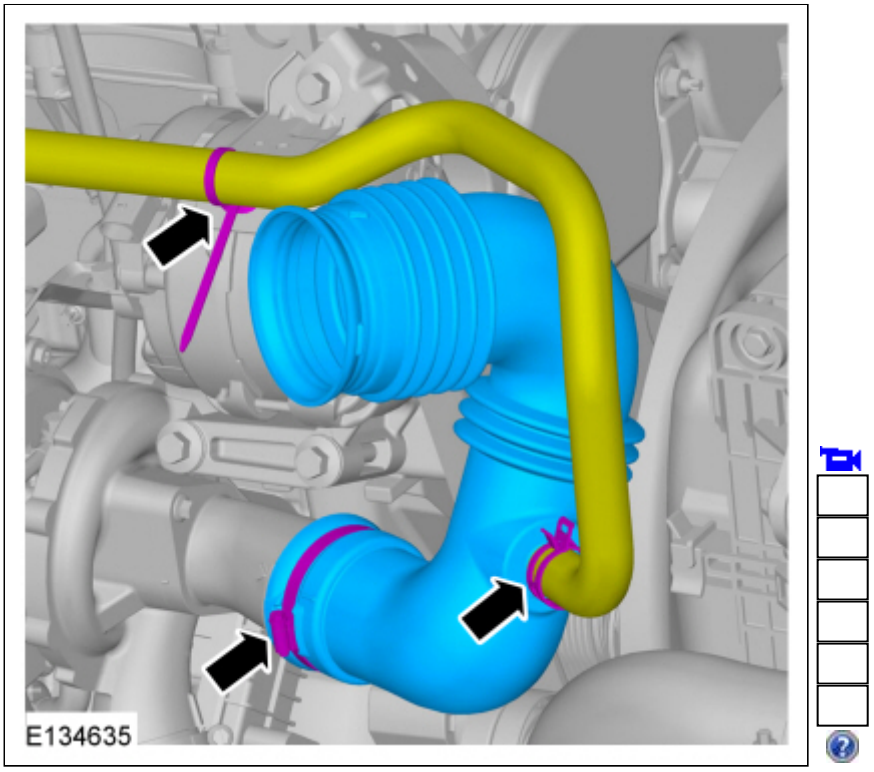
Turbocharger - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

Removal

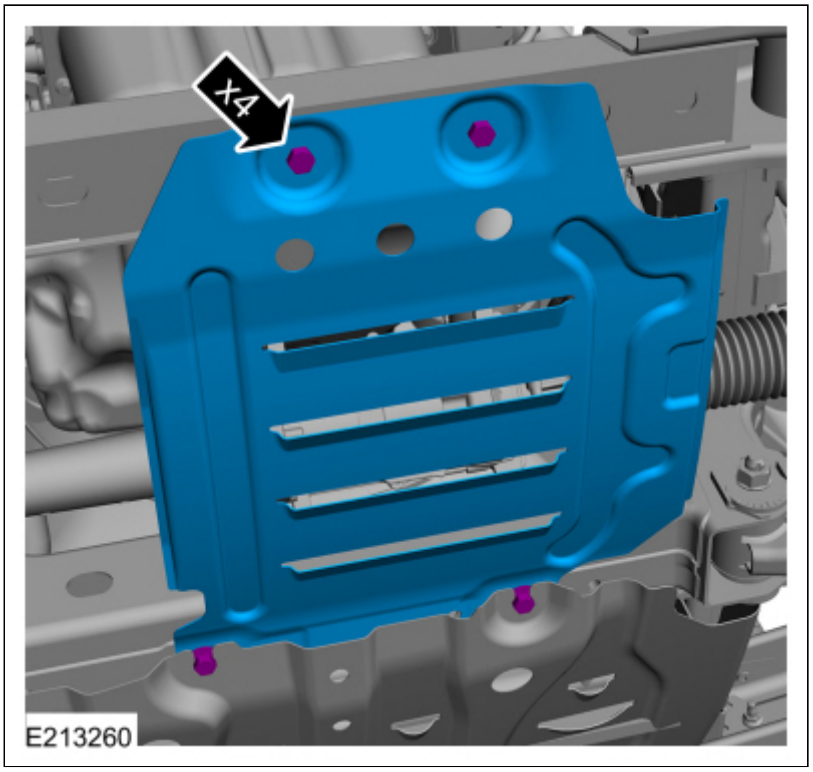
WARNING: Make sure that the engine and exhaust system are cool before removing any components. Failure to follow this instruction may result in serious personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

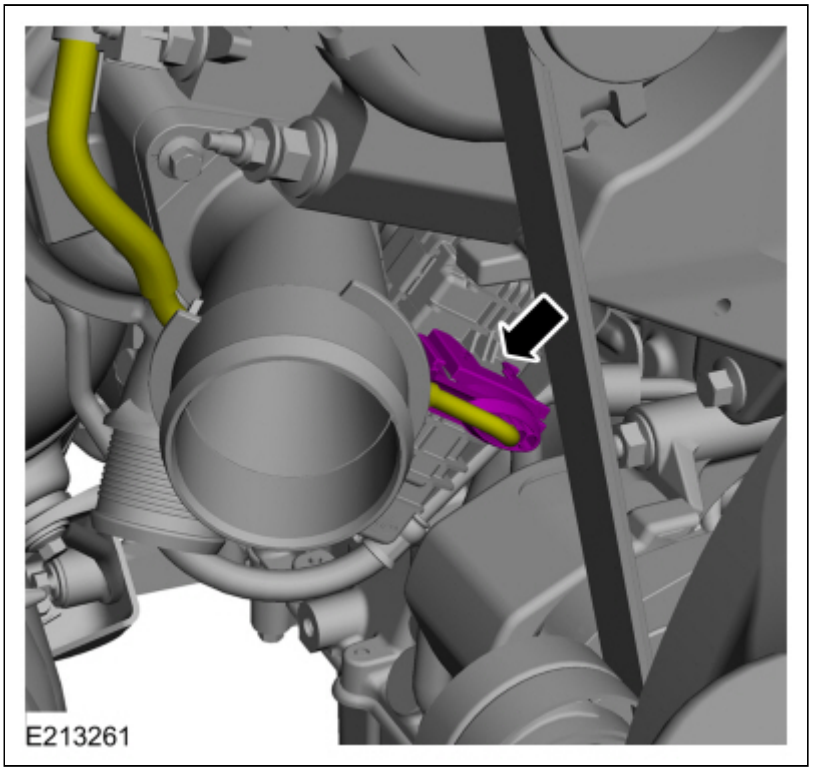
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner - 3.2L Duratorq-TDCi (Puma) Diesel (303-12C Intake Air Distribution and Filtering - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
3. *Torque*: 4 Nm



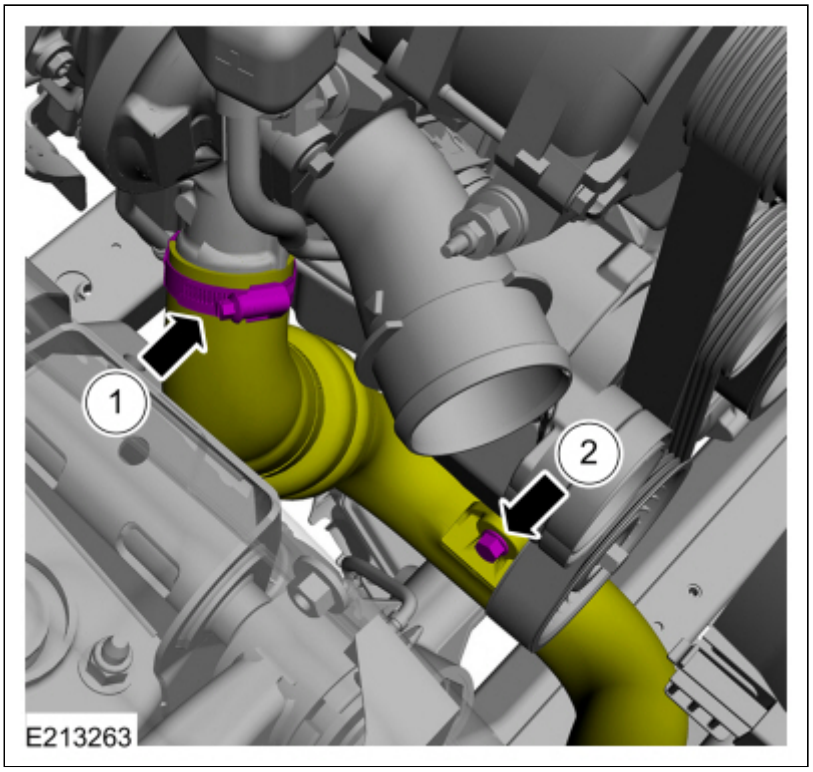
4. Refer to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. *Torque*: 30 Nm



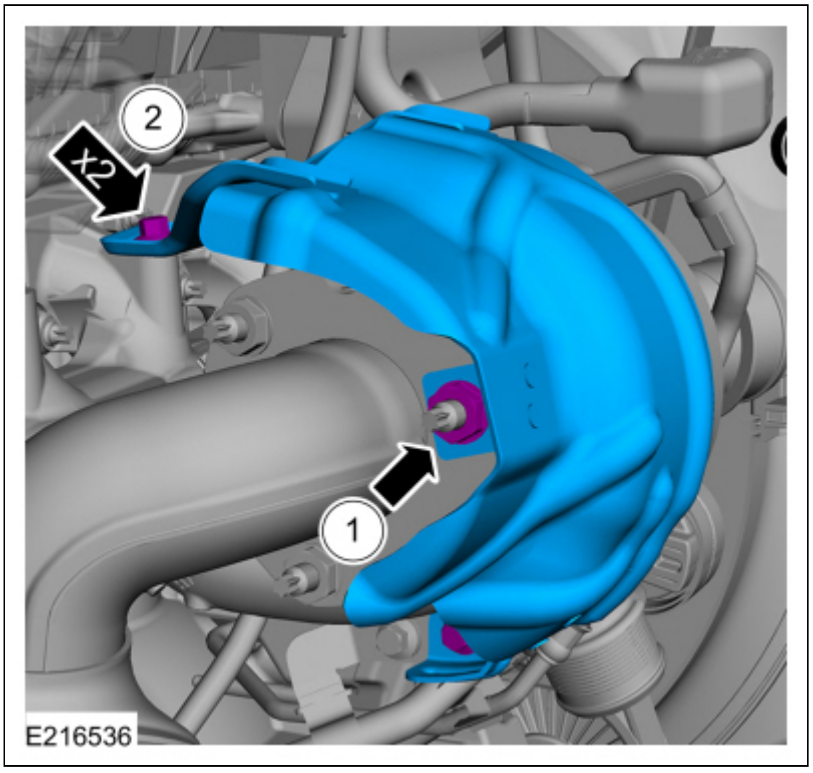
7.



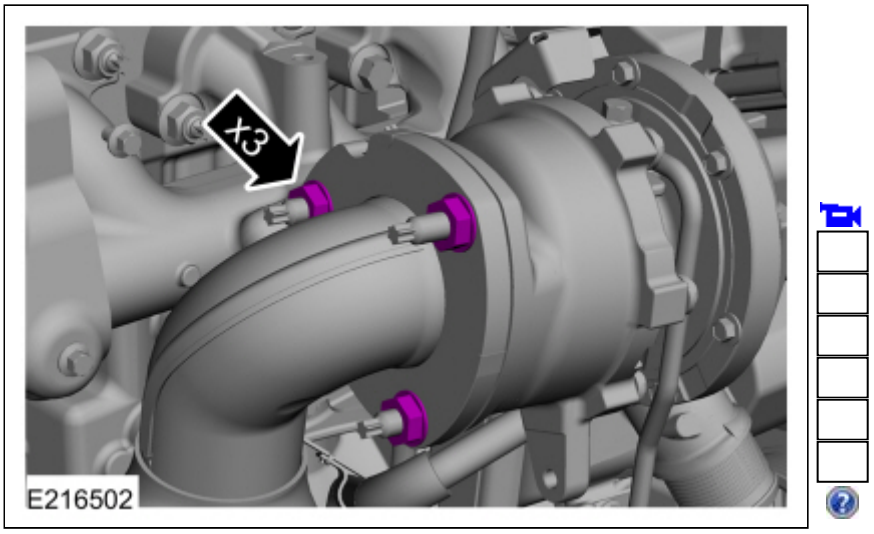
1. *Torque*: 4 Nm
2. *Torque*: 11 Nm



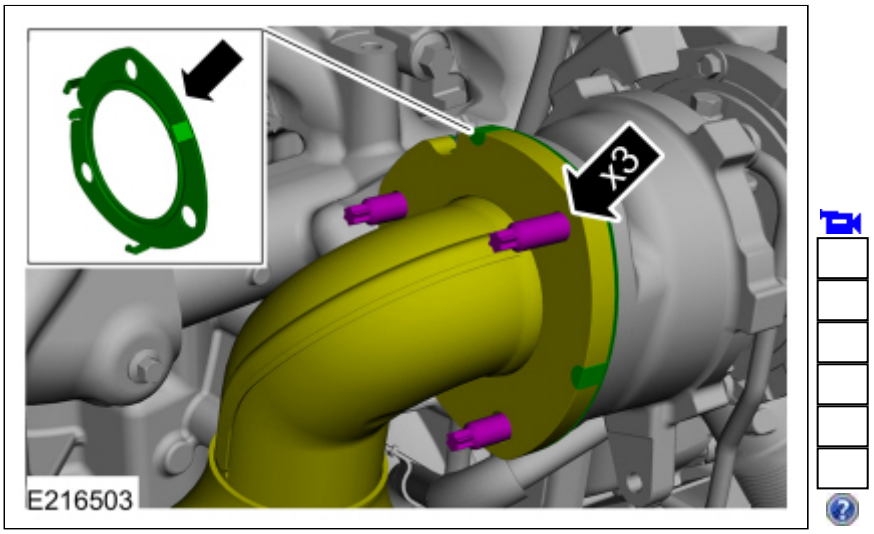
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



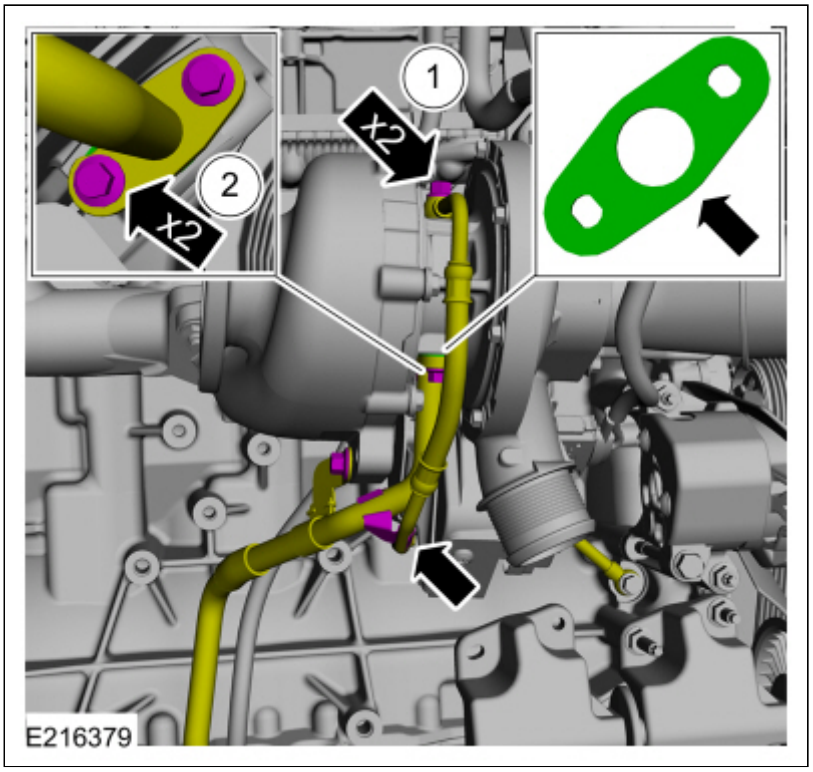
1. *Torque*: 48 Nm



1. *Torque*: 25 Nm



1. *Torque*: 35 Nm
2. *Torque*: 10 Nm

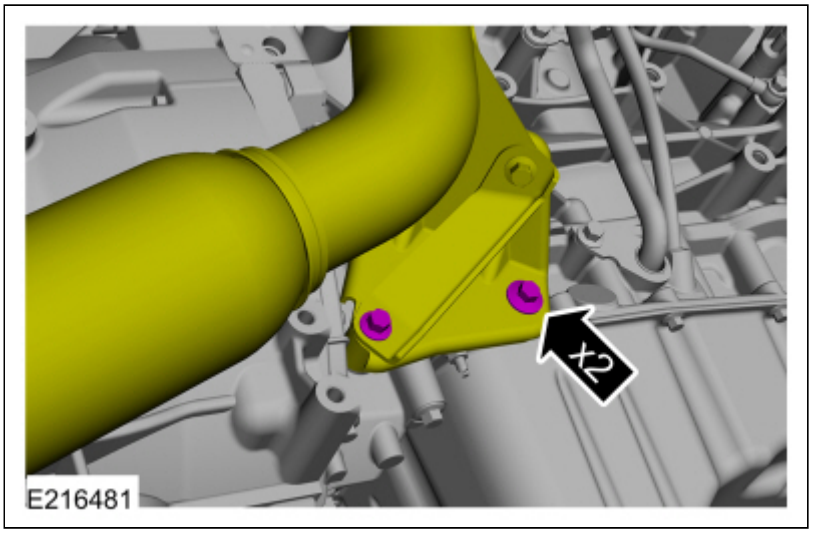


Emission Requirements: EURO Stage I LDT

13. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**

    NOTE: *Make sure that the components are appropriately secured.*

    Torque: 25 Nm

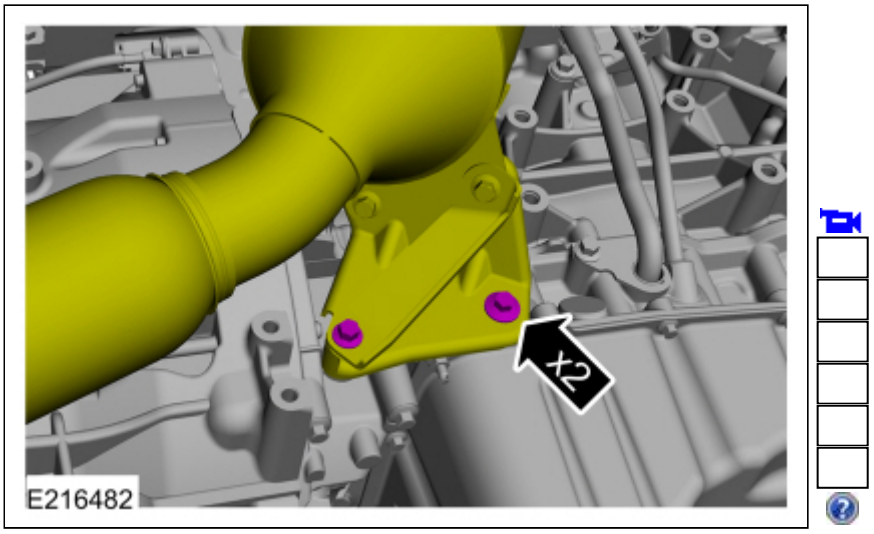


Emission Requirements: EURO Stage II LDT/EURO Stage III LDT/EURO Stage IV LDT

14. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**

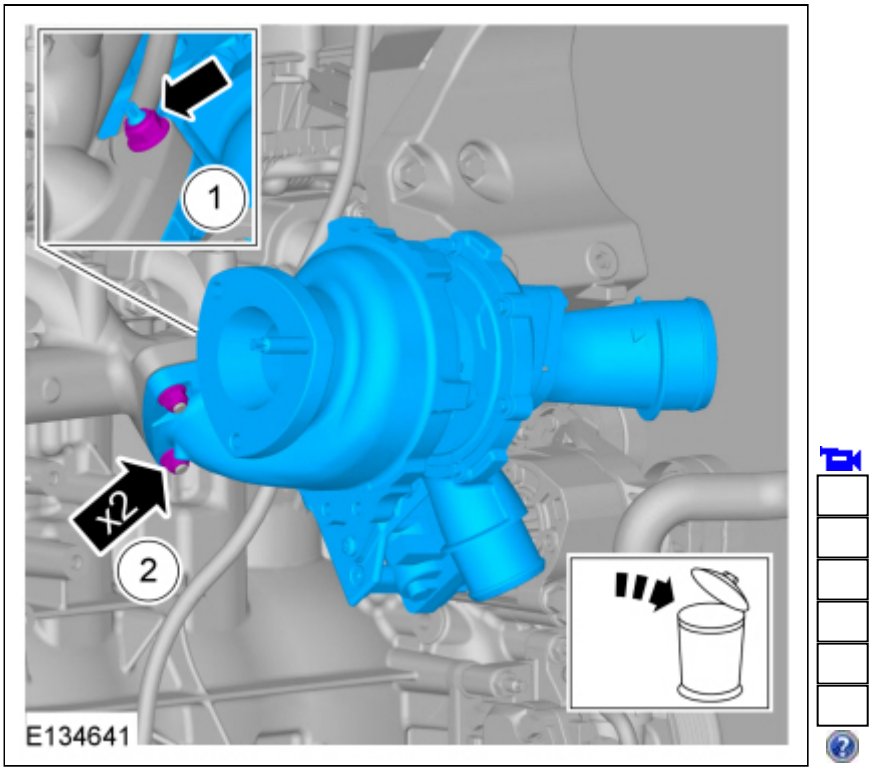
    NOTE: *Make sure that the components are appropriately secured.*

    Torque: 25 Nm

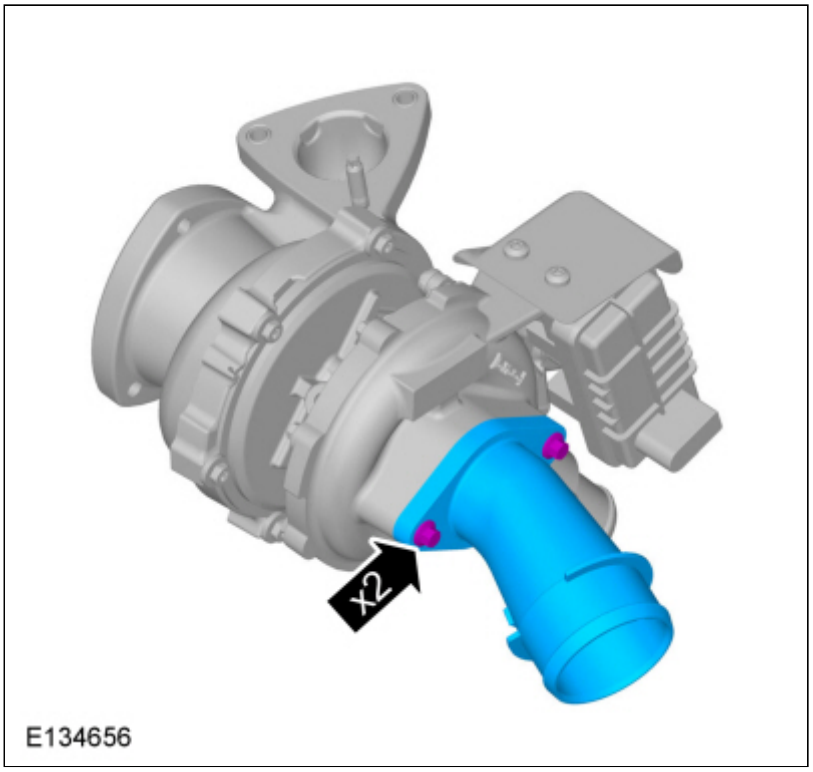


All vehicles

1. *Torque*: 23 Nm
2. *Torque*: 23 Nm



16. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

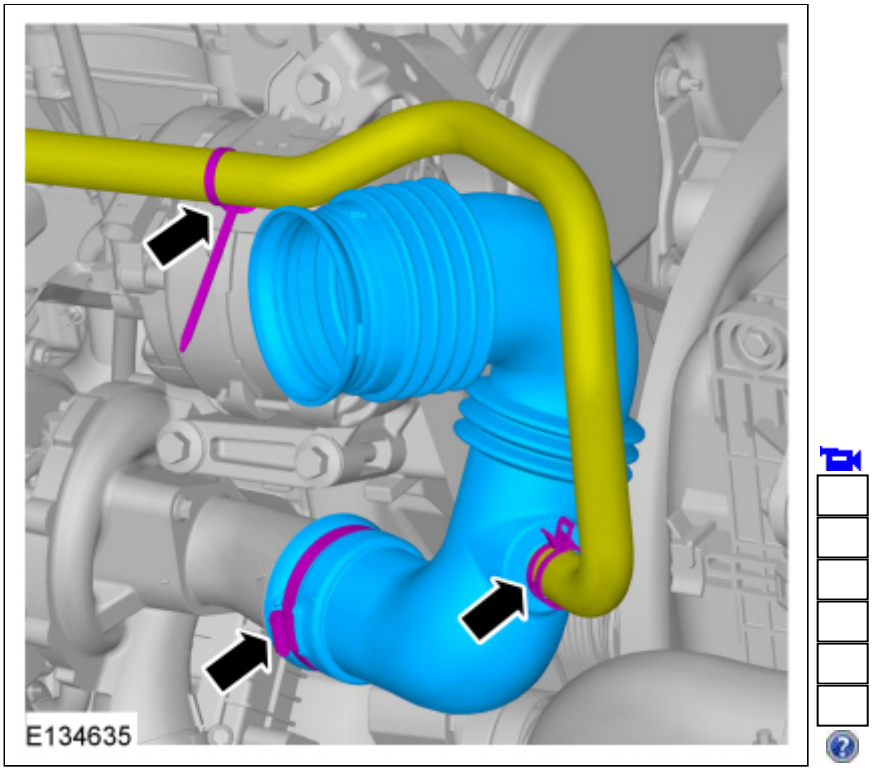
Turbocharger - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Emission Requirements: EURO Stage V LDT

Removal

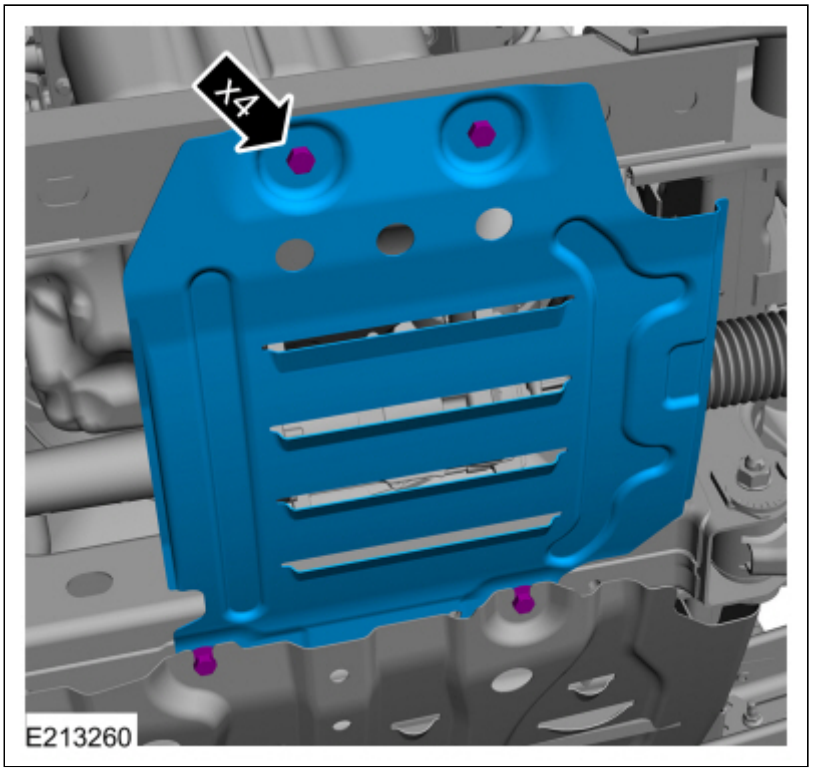
WARNING: Make sure that the engine and exhaust system are cool before removing any components. Failure to follow this instruction may result in serious personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

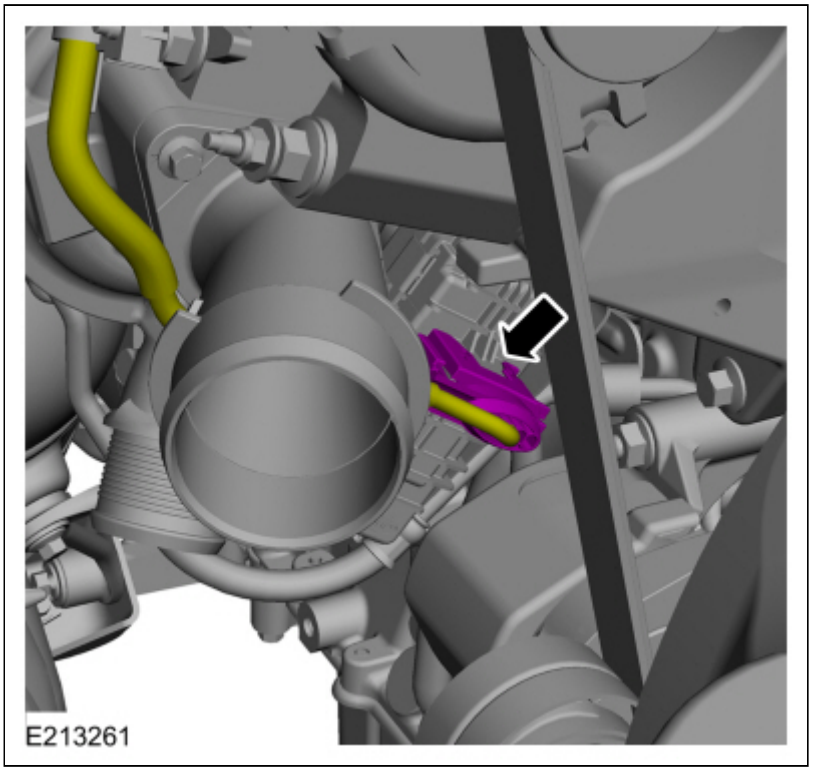
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner - 3.2L Duratorq-TDCi (Puma) Diesel (303-12C Intake Air Distribution and Filtering - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
3. *Torque*: 4 Nm



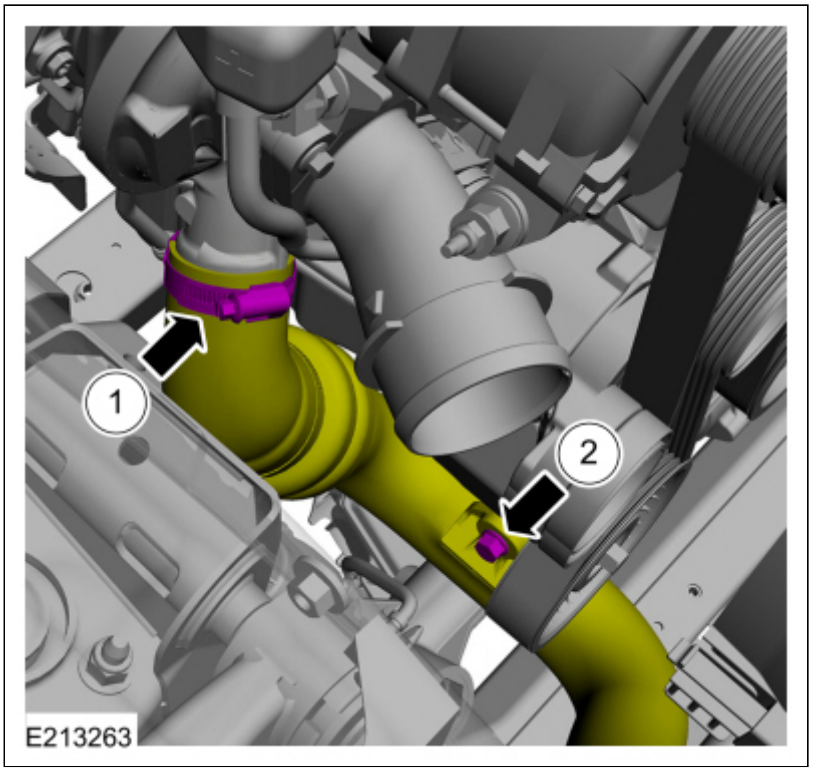
4. Refer to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. *Torque*: 30 Nm



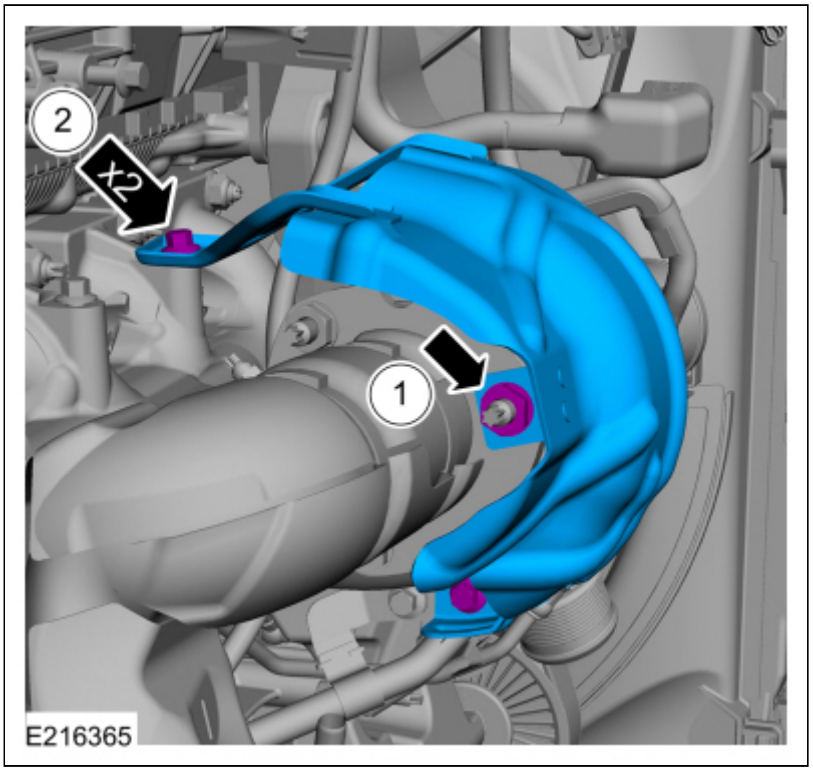
7.



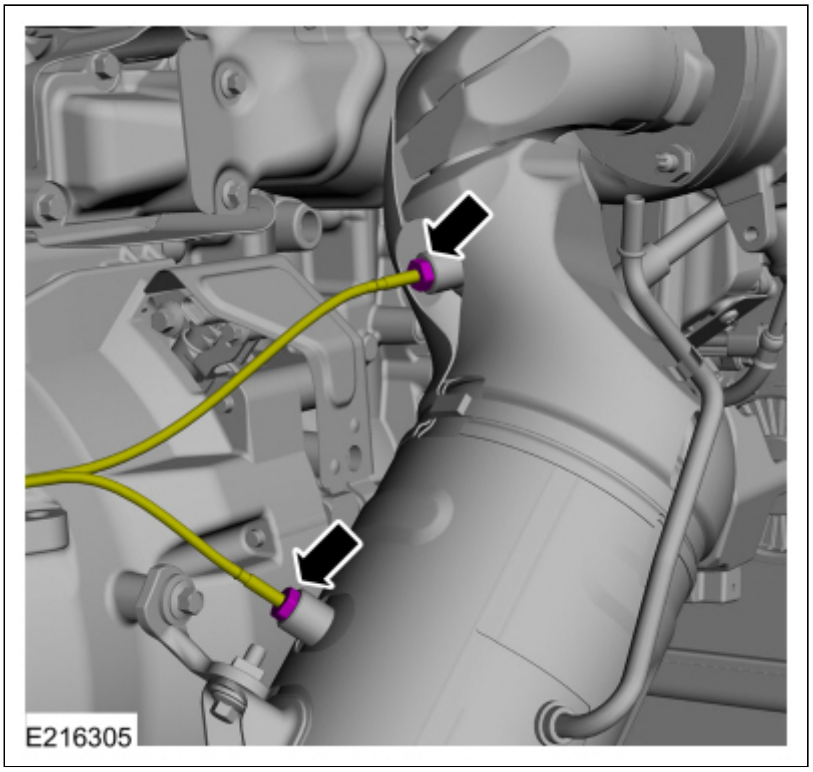
1. *Torque*: 4 Nm
2. *Torque*: 11 Nm



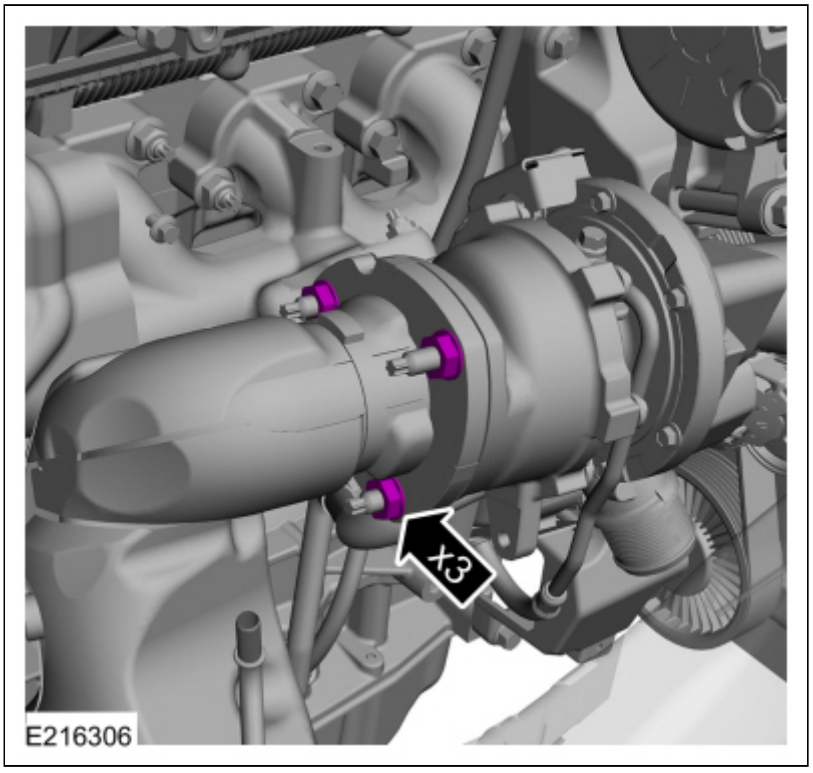
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



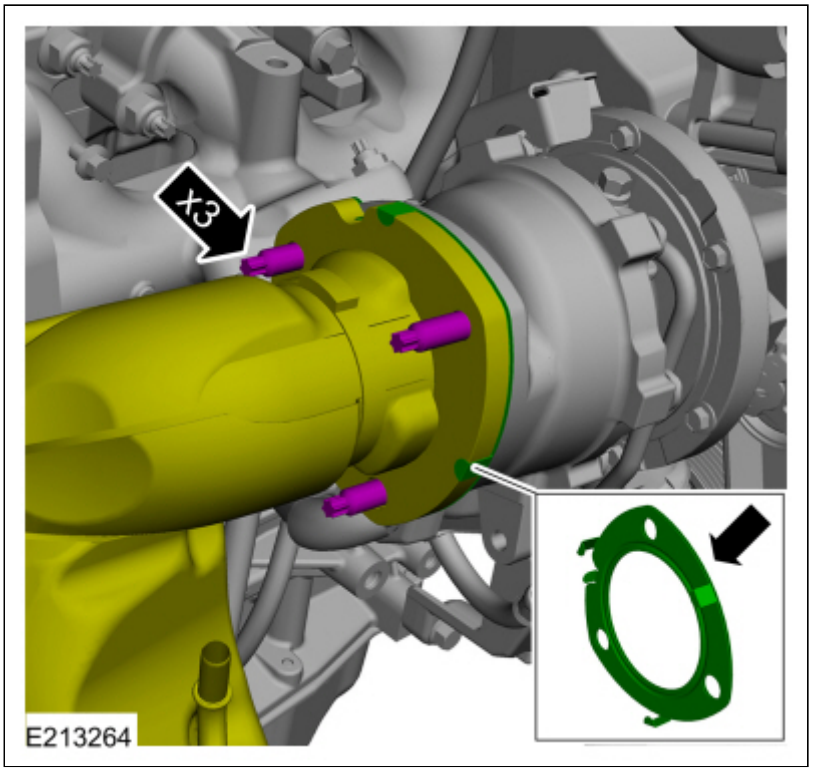
1. *Torque*: 35 Nm



1. *Torque*: 48 Nm



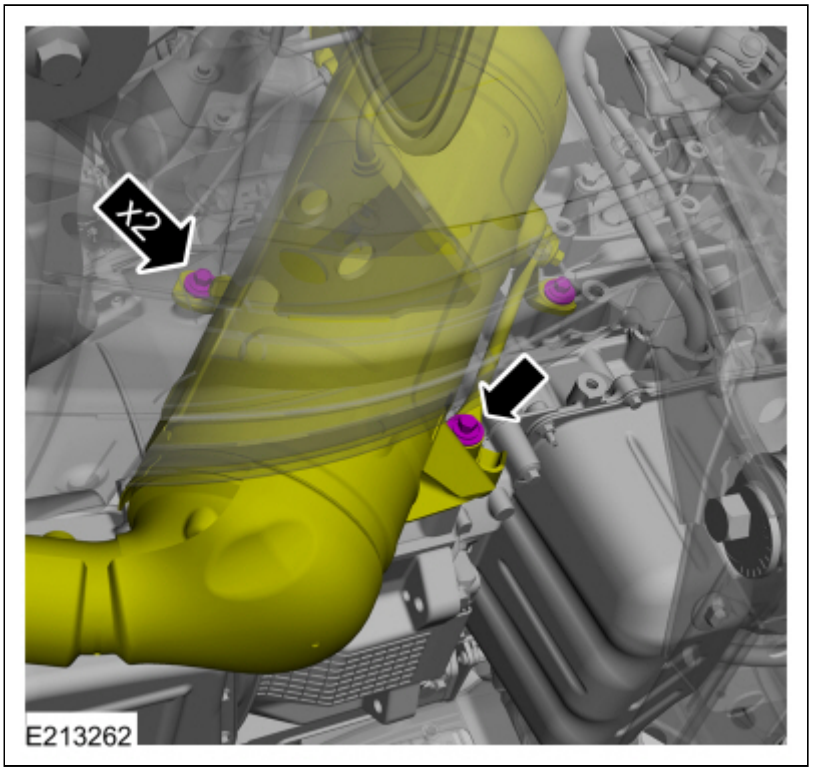
1. *Torque*: 25 Nm



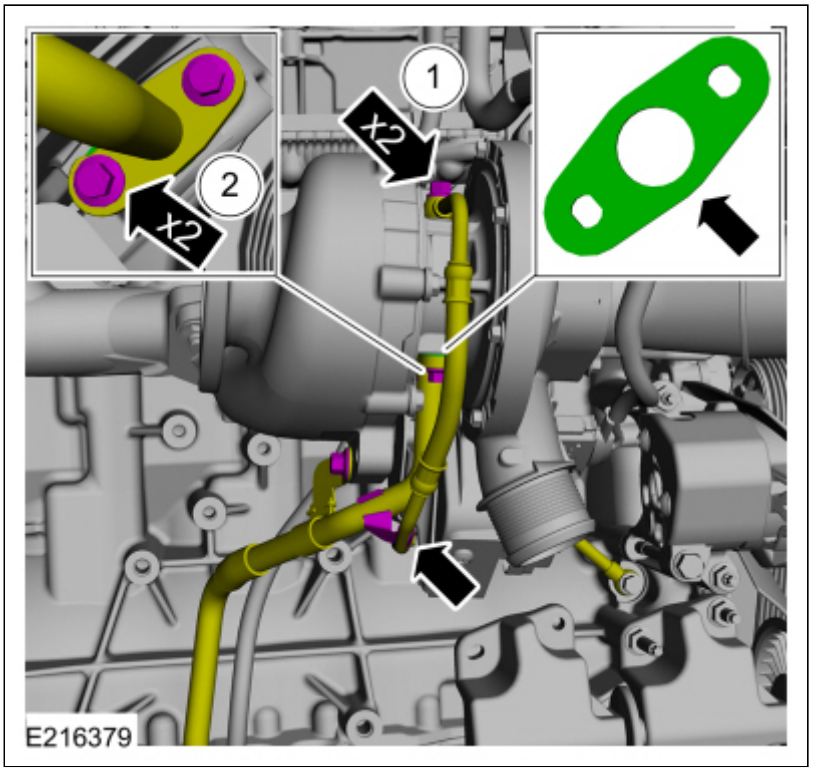
13. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.**

    NOTE: *Make sure that the components are appropriately secured.*

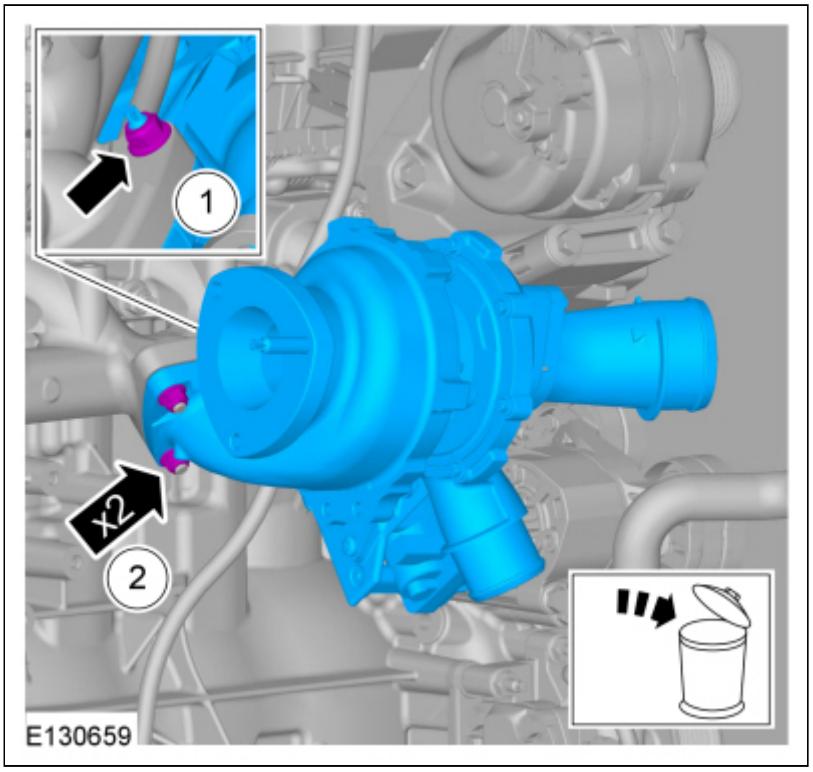
    Torque: 25 Nm



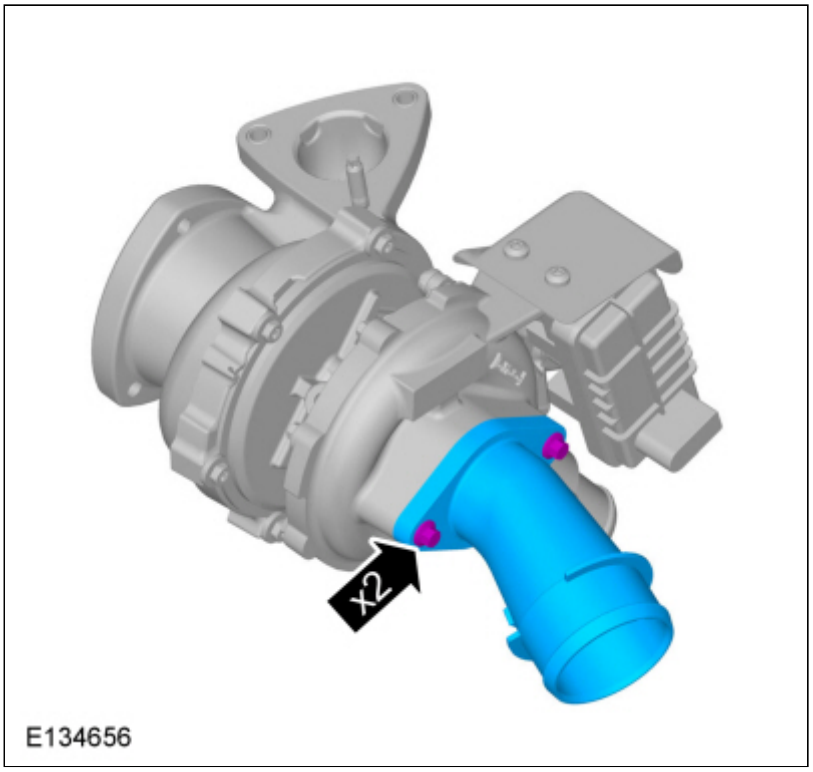
1. *Torque*: 35 Nm
2. *Torque*: 10 Nm



1. *Torque*: 23 Nm
2. *Torque*: 23 Nm



16. *Torque*: 10 Nm



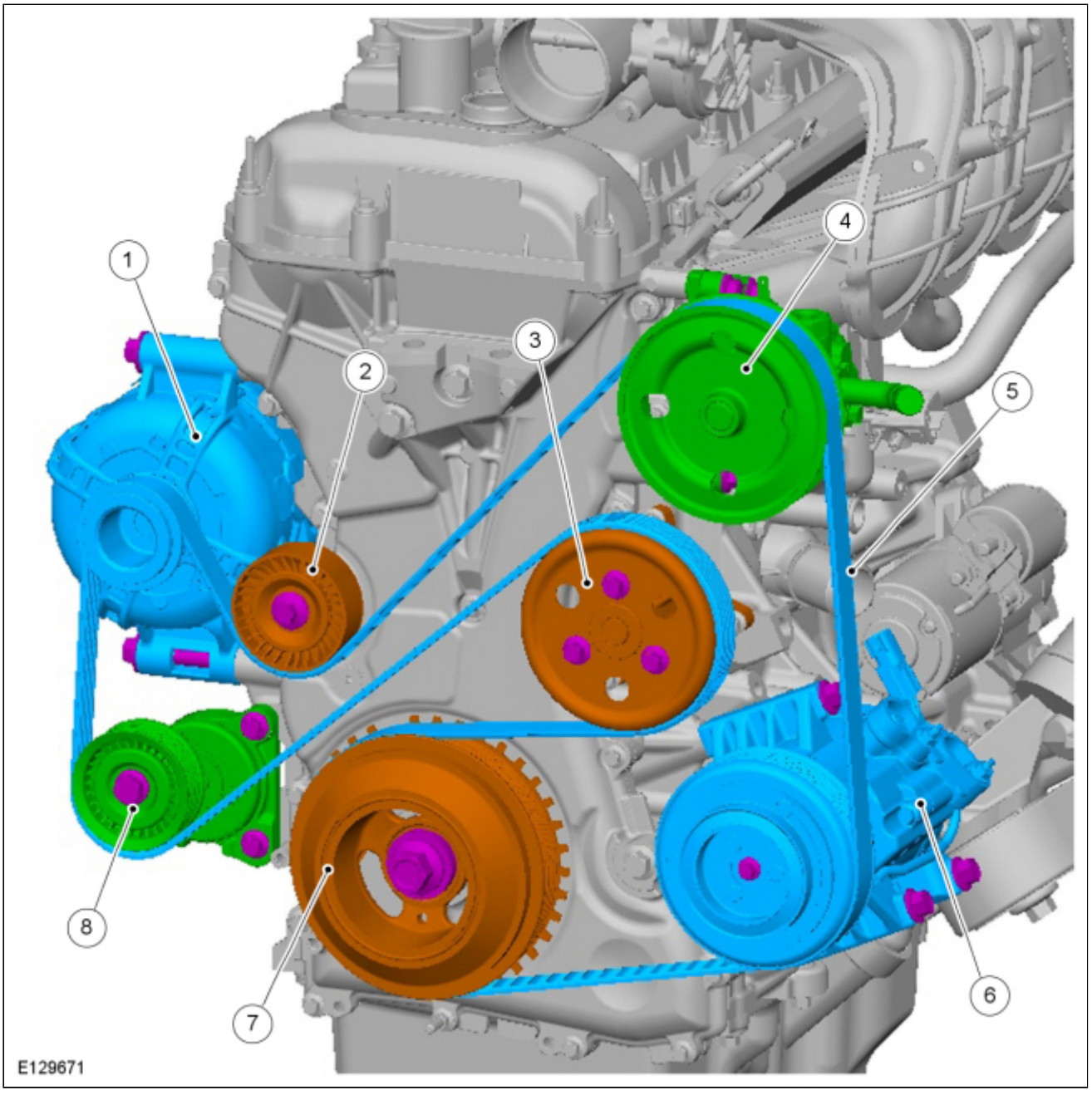
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

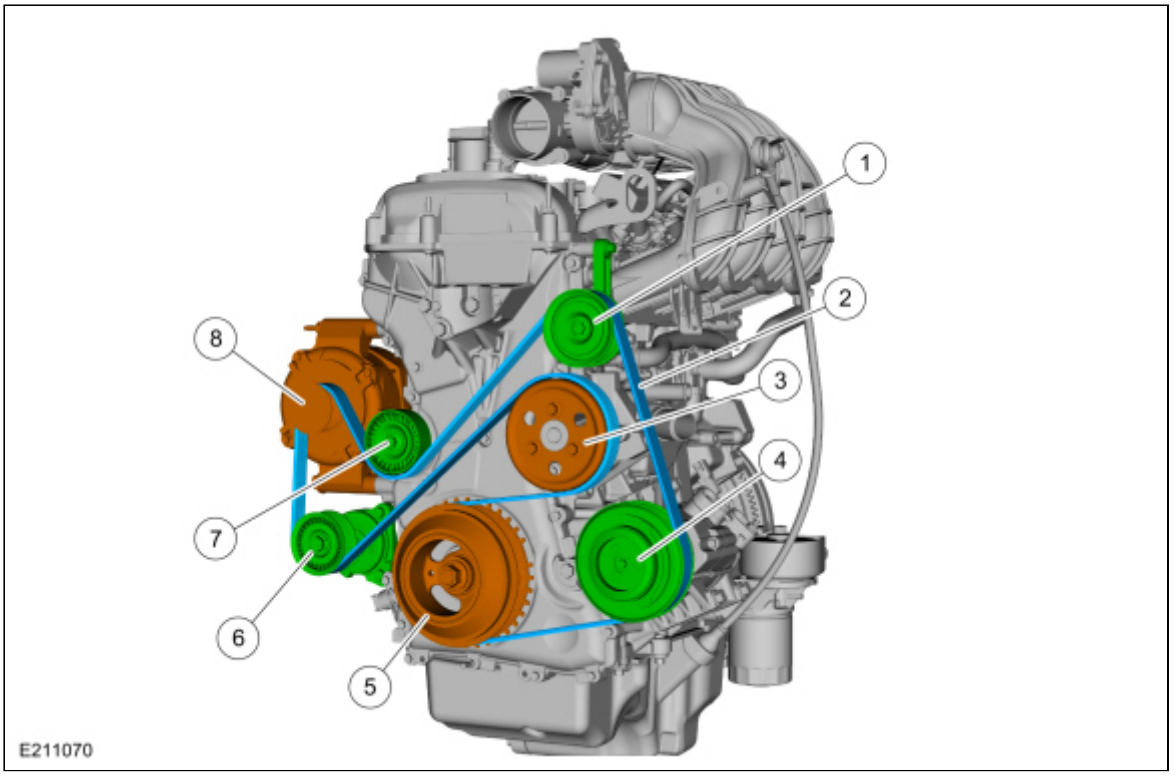
Accessory Drive - Component Location

Vehicles With: HPAS



Item	Part Number	Description
1	—	Alternator
2	—	Accessory drive belt idler pulley
3	—	Coolant pump pulley
4	—	Power steering pump pulley
5	—	Accessory drive belt
6	—	Air conditioning (A/C) compressor
7	—	Crankshaft pulley
8	—	Accessory drive belt tensioner pulley

Vehicles With: EPAS



Item	Part Number	Description
1	—	Accessory Drive Belt Idler Pulley
2	—	Accessory Drive Belt
3	—	Coolant pump pulley
4	—	Air Conditioning A/C Compressor
5	—	Crank Shaft Pulley
6	—	Accessory drive belt tensioner pulley
7	—	Accessory Drive Belt Idler Pulley
8	—	Alternator

Copyright © 2016 Ford Motor Company

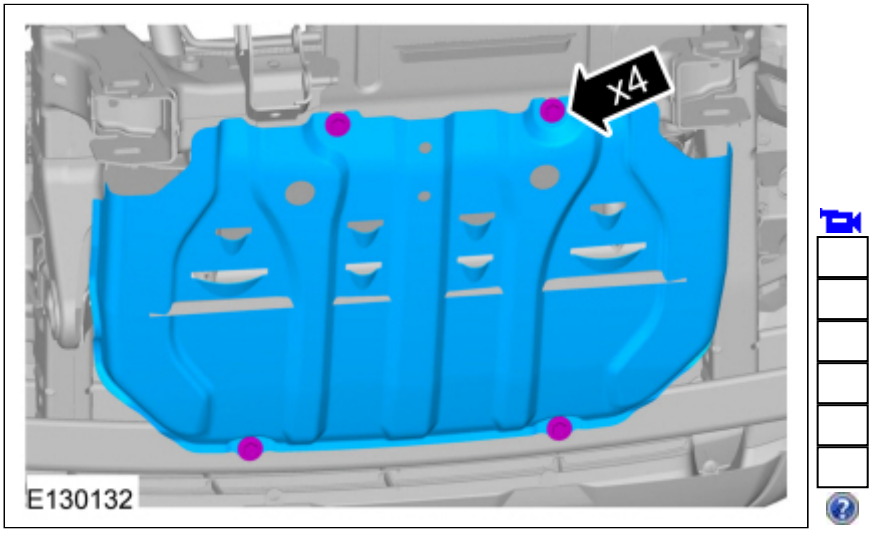
Accessory Drive Belt

Base Part Number: 8620

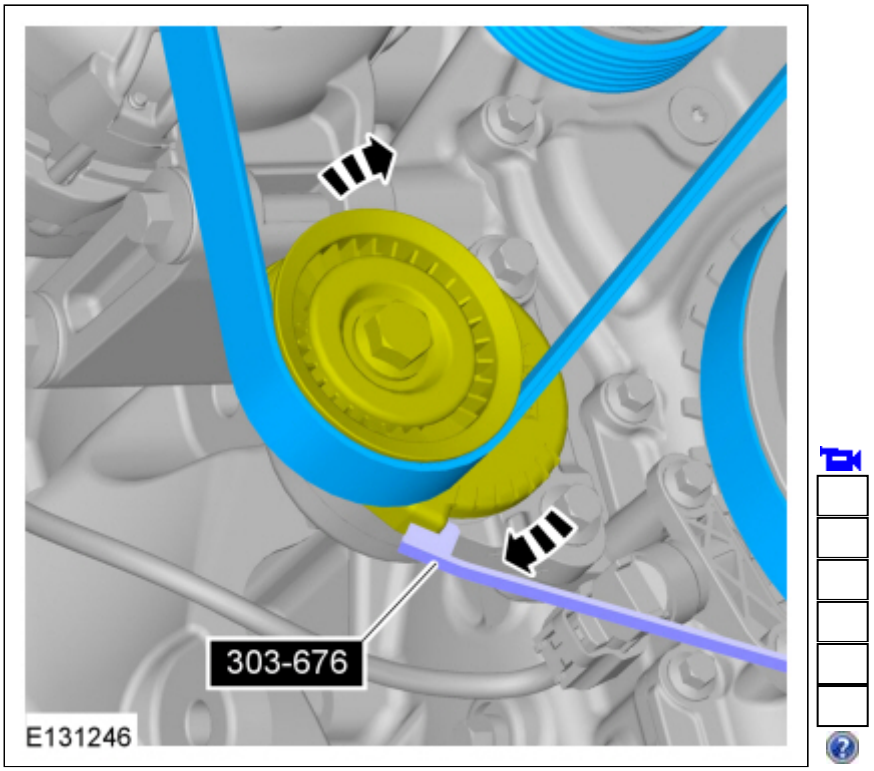
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. *Torque*: 30 Nm



3. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.



Installation

1. To install, reverse the removal procedure.
   Refer to: Accessory Drive - Component Location (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Description and Operation).

Copyright © 2016 Ford Motor Company

Accessory Drive Belt Tensioner

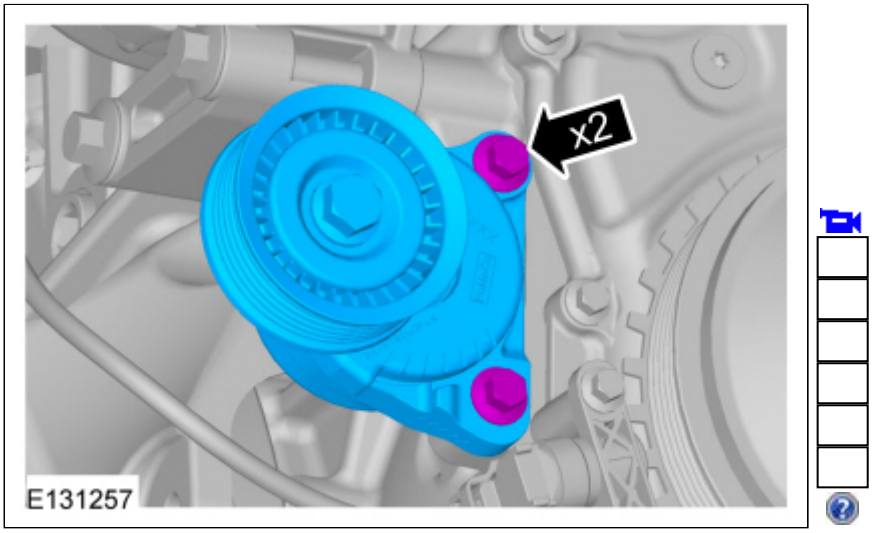
Base Part Number: 6B209

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. **NOTE:** *The accessory drive belt tensioner must be replaced as a complete unit.*

   Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

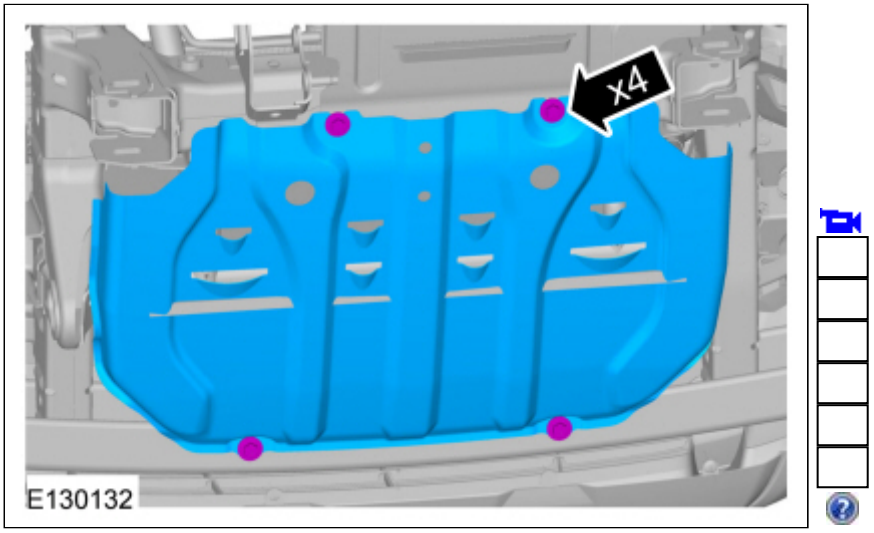
Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS)

Base Part Number: 8620

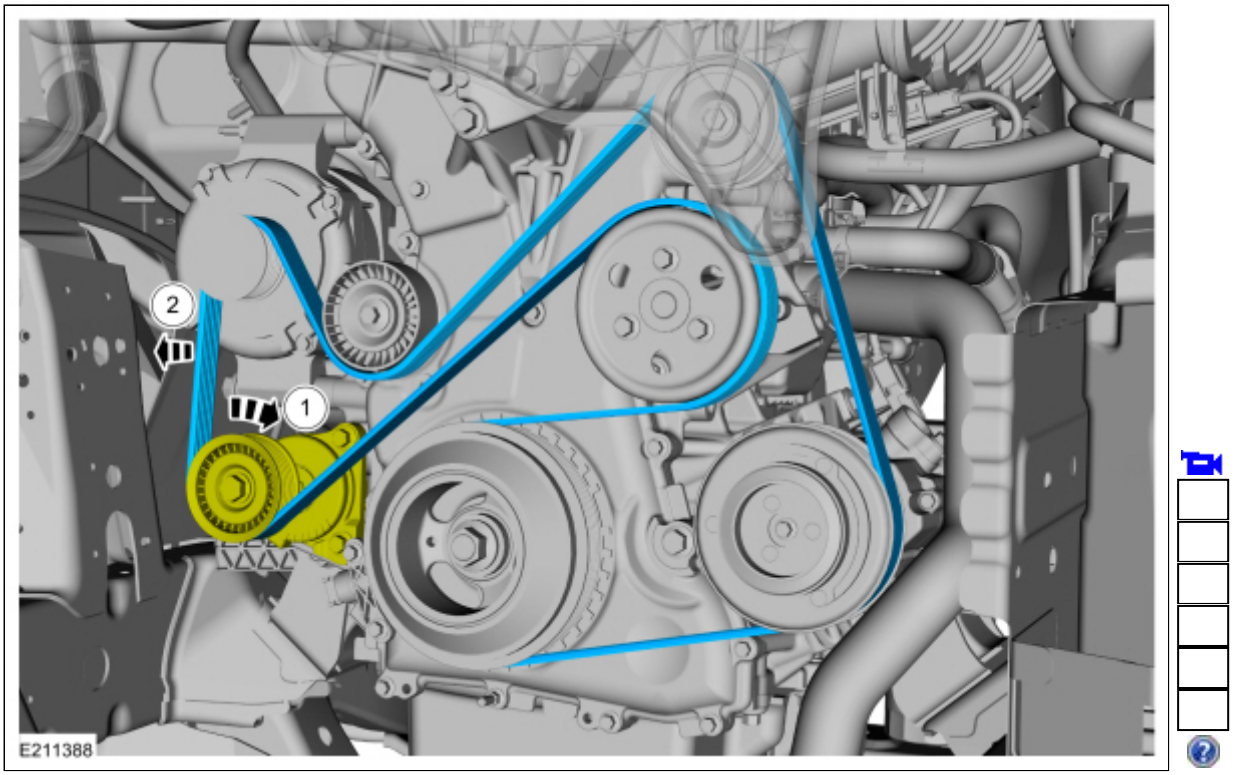
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. *Torque*: 30 Nm



3.



Installation

1. To install, reverse the removal procedure.
   Refer to: Accessory Drive - Component Location (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Description and Operation).

Copyright © 2016 Ford Motor Company

Accessory Drive Belt Tensioner - Vehicles With: Electronic Power Assist Steering (EPAS)

Base Part Number: 6B209

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

2. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

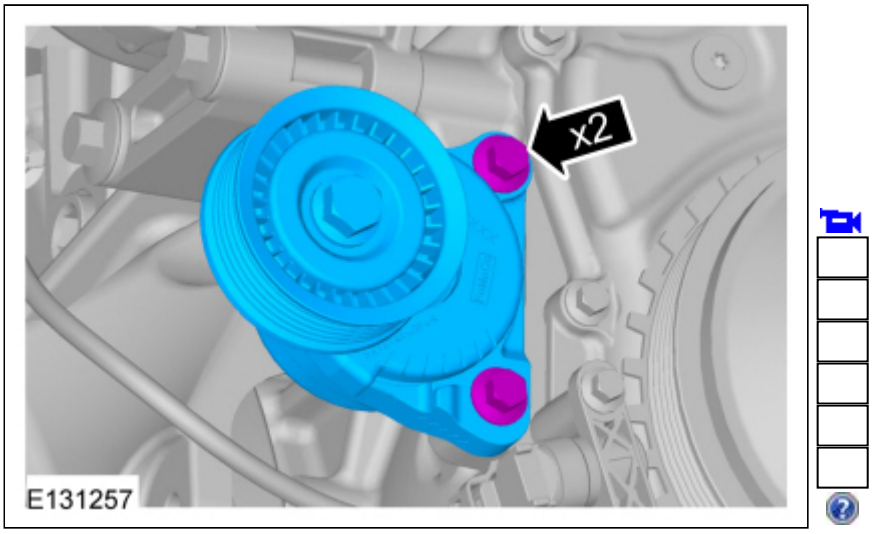
Vehicles With: Electronic Power Assist Steering (EPAS)

3. Refer to: Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS) (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

All vehicles

4. **NOTE:** *The accessory drive belt tensioner must be replaced as a complete unit.*

   Torque: 25 Nm



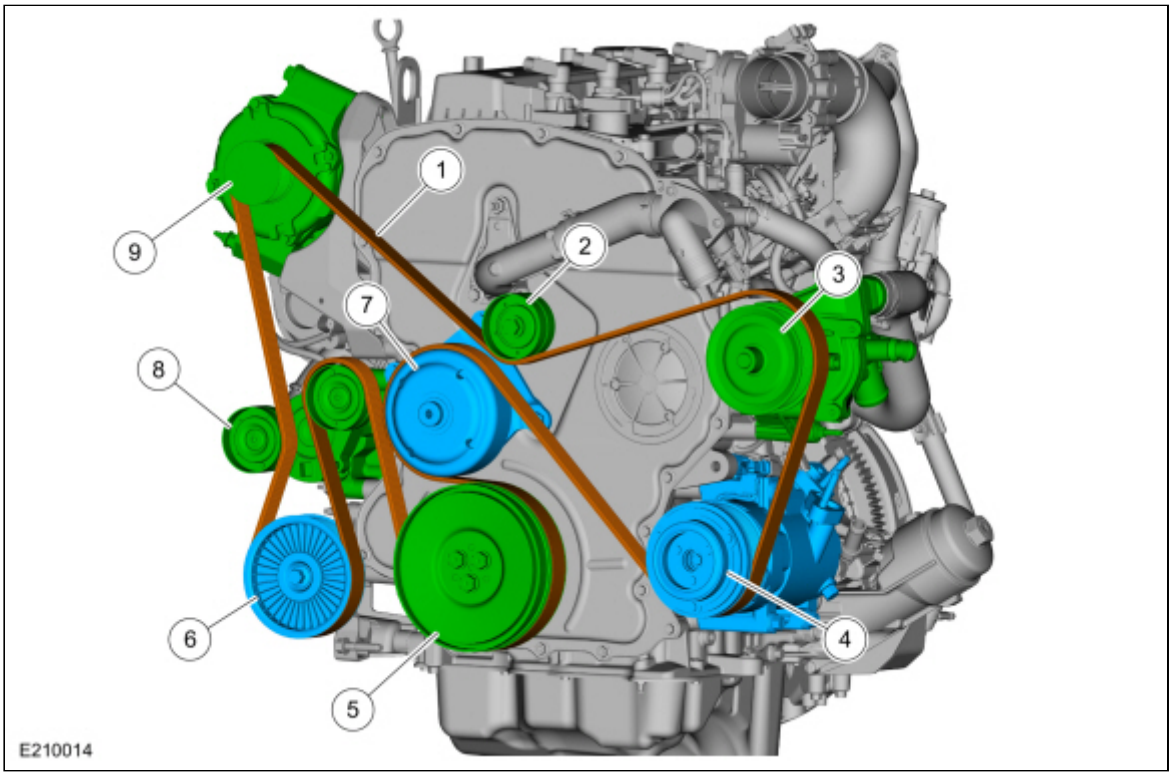
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

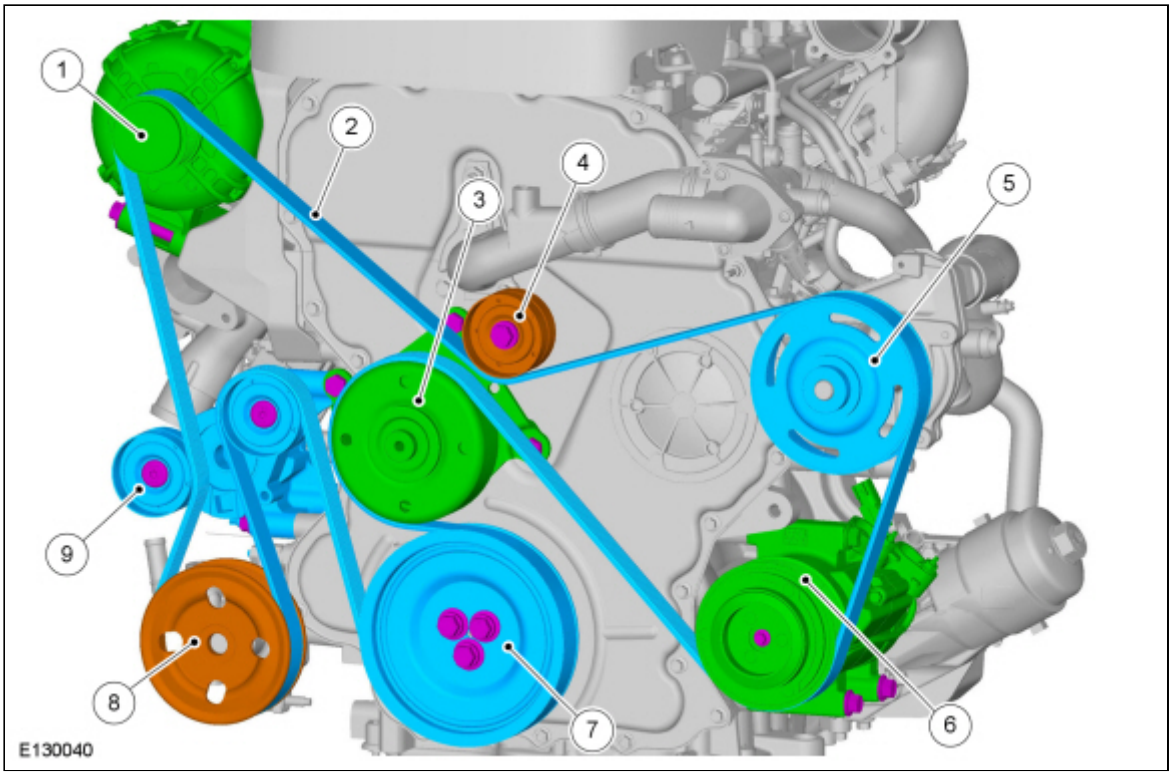
Accessory Drive - Component Location

Vehicles With: EPAS



Item	Part Number	Description
1	—	Accessory drive belt
2	—	Accessory drive belt idler pulley
3	—	Coolant pump pulley
4	—	Air conditioning (A/C) compressor
5	—	Crankshaft pulley
6	—	Accessory drive belt idler pulley
7	—	Cooling fan pulley
8	—	Accessory drive belt tensioner pulley
9	—	Alternator

Vehicles With: HPAS



Item	Part Number	Description
1	—	Alternator
2	—	Accessory drive belt
3	—	Cooling fan pulley
4	—	Accessory drive belt idler pulley
5	—	Coolant pump pulley
6	—	Air conditioning (A/C) compressor
7	—	Crankshaft pulley
8	—	Hydraulic power assist steering (HPAS) pump pulley
9	—	Accessory drive belt tensioner pulley

Copyright © 2016 Ford Motor Company

Accessory Drive

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
– Damaged or contaminated accessory drive belt – Damaged or contaminated pulley(s) – Incorrect accessory drive belt – Incorrect installation of the accessory drive belt – Accessory drive belt tensioner – Accessory drive belt idler pulley(s) – Generator – Coolant pump – Power steering pump – Power steering pump leakage – Air conditioning (A/C) compressor – Pulley(s) – Loose hardware

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

NOTICE: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

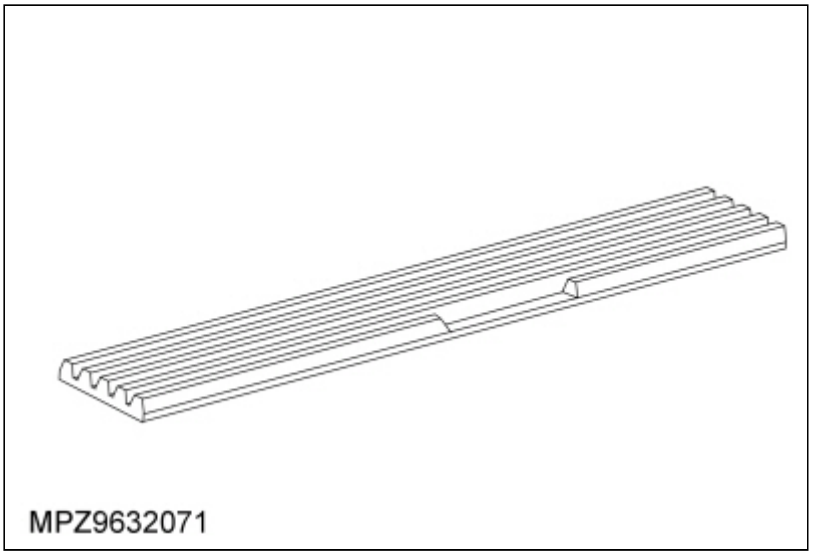
Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt.
   REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Chunking

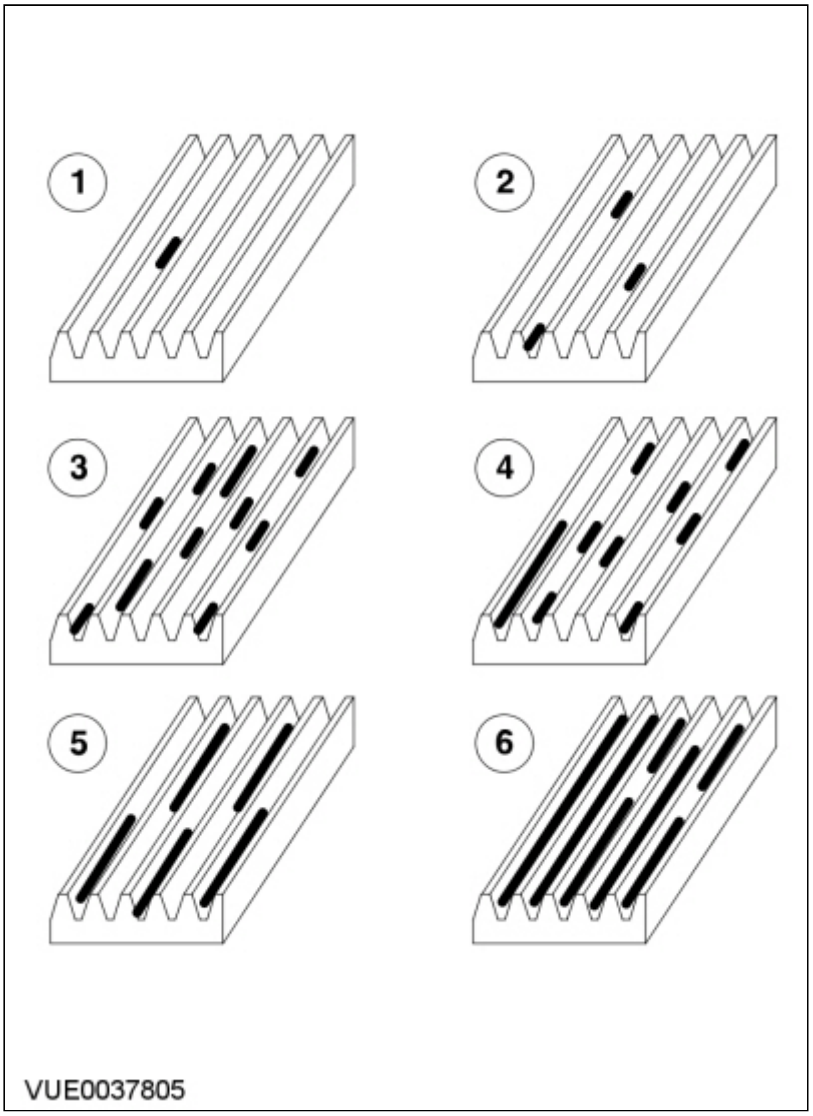
Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



2. Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt.
   REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Pilling

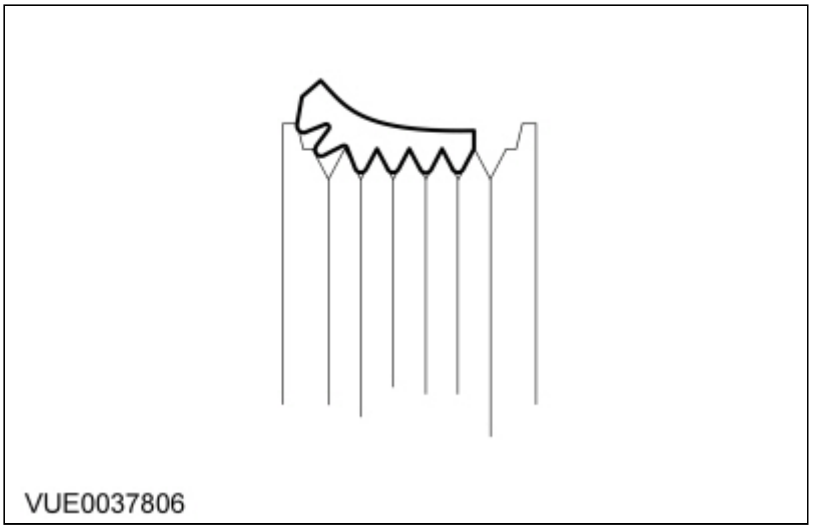
Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.



3. Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Incorrect installation

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Accessory drive belt noise	• Accessory drive system	• CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of

		the noise. INSTALL new components as necessary. TEST the system for normal operation.
	• Accessory drive belt incorrectly installed.	• CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
	• Pulley(s).	• CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	• Lubricant or other contamination.	• CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
• **NOTE:** *Squeal is defined as a continuous shriek, most noticeable when the engine is being accelerated or with electrical load.* • Accessory drive belt squeal	• Accessory drive belt tensioner worn, damaged or contaminated with oil.	• CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
• **NOTE:** *Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys.* • Accessory drive belt whine	• Poor surface finish on accessory drive belt idler pulley flat surface(s).	• REMOVE the accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	• Accessory drive belt idler pulley bearing failure.	• REMOVE the accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
• **NOTE:** *Chirp is defined as a twittering noise, often intermittent* • Accessory drive belt chirp	• Pulley misalignment (usually evident at idle).	• CHECK that the accessory drive belt is running centrally on the flat pulleys. TEST the system for normal operation. • CHECK the pulleys for excessive end float and bent flanges. • With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
• **NOTE:** *Rattle is*	• Accessory	• CHECK the accessory drive belt tensioner for correct operation

defined as a metallic knocking noise • Accessory drive belt rattle	drive belt tensioner hitting the end stops.	or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
	• Loose components or hardware.	• CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

2. Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. **NOTE:** *The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.*

   Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

5. If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

The accessory drive belt tensioner may be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

2. Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive

belt.
REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS)

Base Part Number: 8620

Special Tool(s) / General Equipment

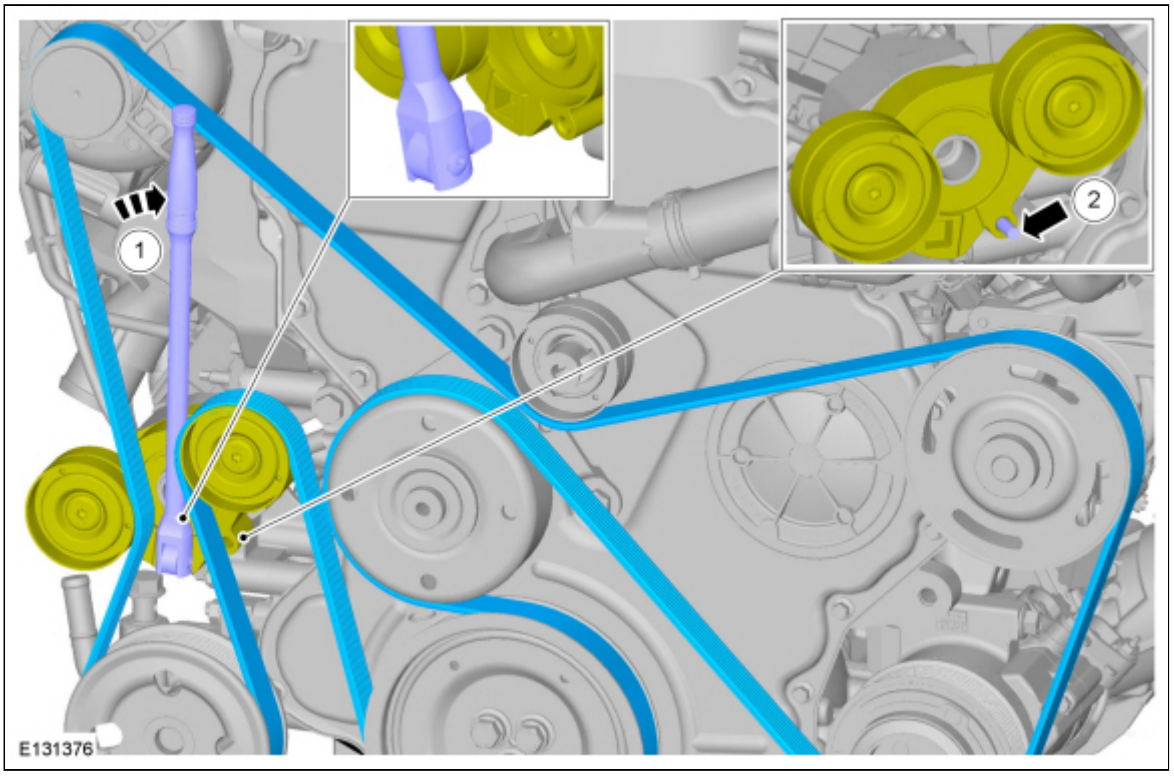
Dowel with a Diameter of 6 mm
1/2 Inch Square Drive Breaker Bar

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. Use the General Equipment: Dowel with a Diameter of 6 mm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS)

Base Part Number: 8620

Special Tool(s) / General Equipment

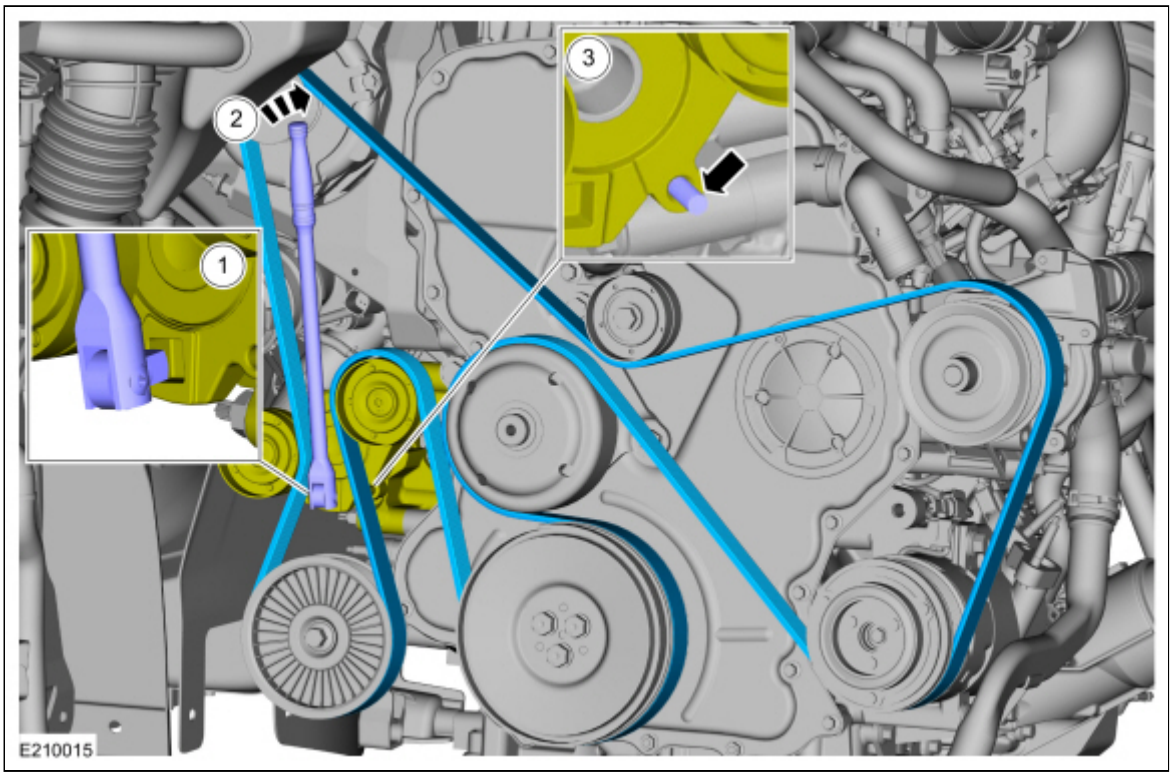
Dowel with a Diameter of 6 mm
1/2 Inch Square Drive Breaker Bar

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

    1. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
    2. **NOTE:** *Rotate the accessory drive belt tensioner clockwise.*
    3. Use the General Equipment: Dowel with a Diameter of 6 mm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Accessory Drive Belt Tensioner

Base Part Number: 6B209

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

Vehicles With: Hydraulic Power Assist Steering (HPAS)

1. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

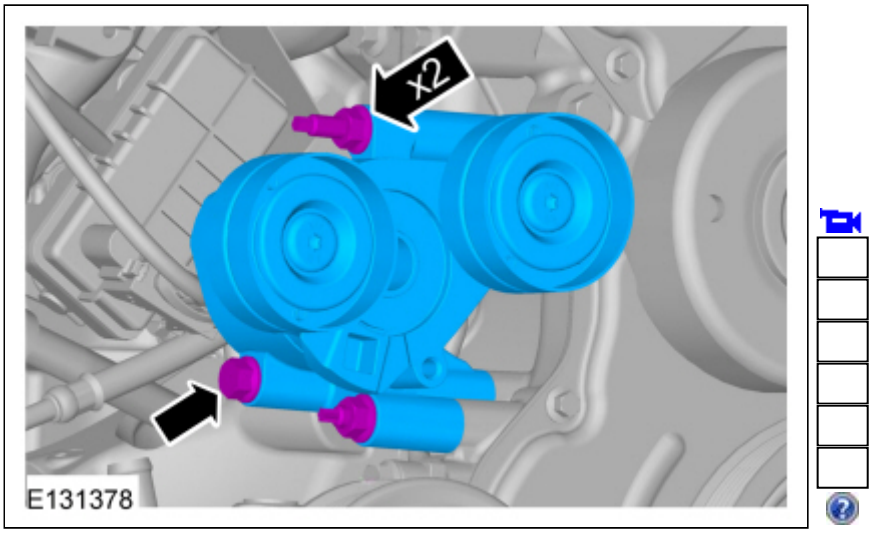
Vehicles With: Electronic Power Assist Steering (EPAS)

2. Refer to: Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

All vehicles

3. **NOTE:** *The accessory drive belt tensioner must be replaced as a complete unit.*

   Torque: 25 Nm



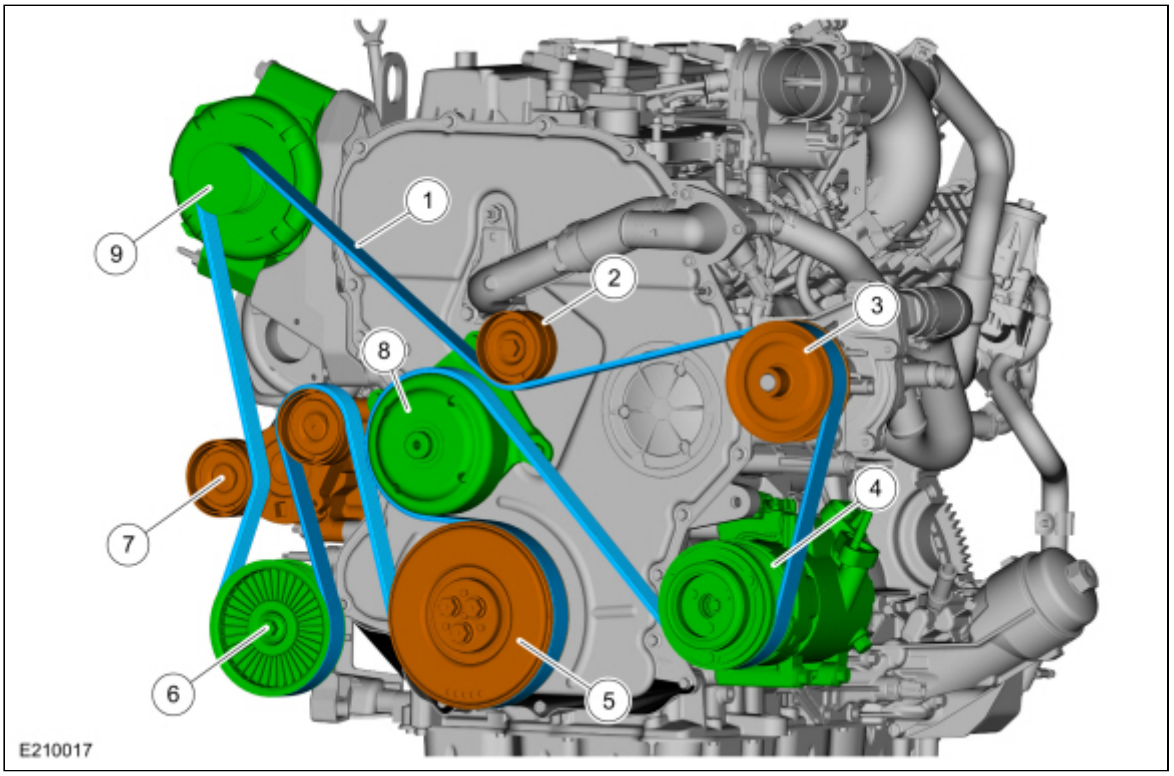
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

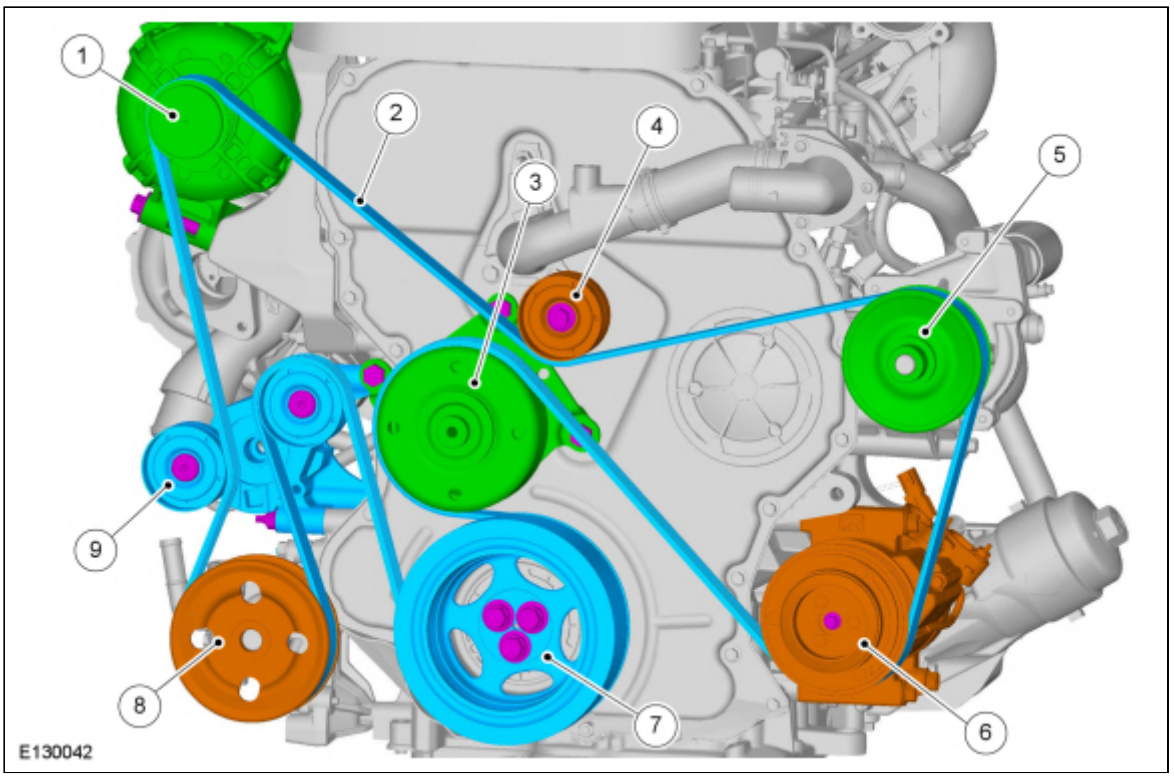
Accessory Drive - Component Location

Vehicles With: EPAS



Item	Part Number	Description
1	—	Accessory drive belt
2	—	Accessory drive belt idler pulley
3	—	Coolant pump pulley
4	—	Air conditioning (A/C) compressor
5	—	Crankshaft pulley
6	—	Accessory drive belt idler pulley
7	—	Accessory drive belt tensioner pulley
8	—	Cooling fan pulley
9	—	Alternator

Vehicles With: HPAS



Item	Part Number	Description
1	—	Alternator
2	—	Accessory drive belt
3	—	Cooling fan pulley
4	—	Accessory drive belt idler pulley
5	—	Coolant pump pulley
6	—	Air conditioning (A/C) compressor
7	—	Crankshaft pulley
8	—	Hydraulic power assist steering (HPAS) pump pulley
9	—	Accessory drive belt tensioner pulley

Copyright © 2016 Ford Motor Company

Accessory Drive

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
– Damaged or contaminated accessory drive belt – Damaged or contaminated pulley(s) – Incorrect accessory drive belt – Incorrect installation of the accessory drive belt – Accessory drive belt tensioner – Accessory drive belt idler pulley(s) – Generator – Coolant pump – Power steering pump – Power steering pump leakage – Air conditioning (A/C) compressor – Pulley(s) – Loose hardware

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

NOTICE: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

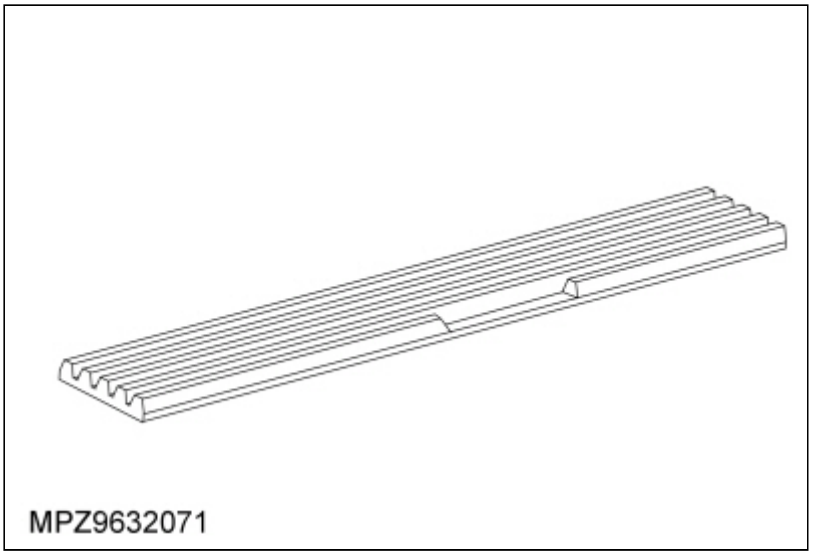
Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt.
   REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Chunking

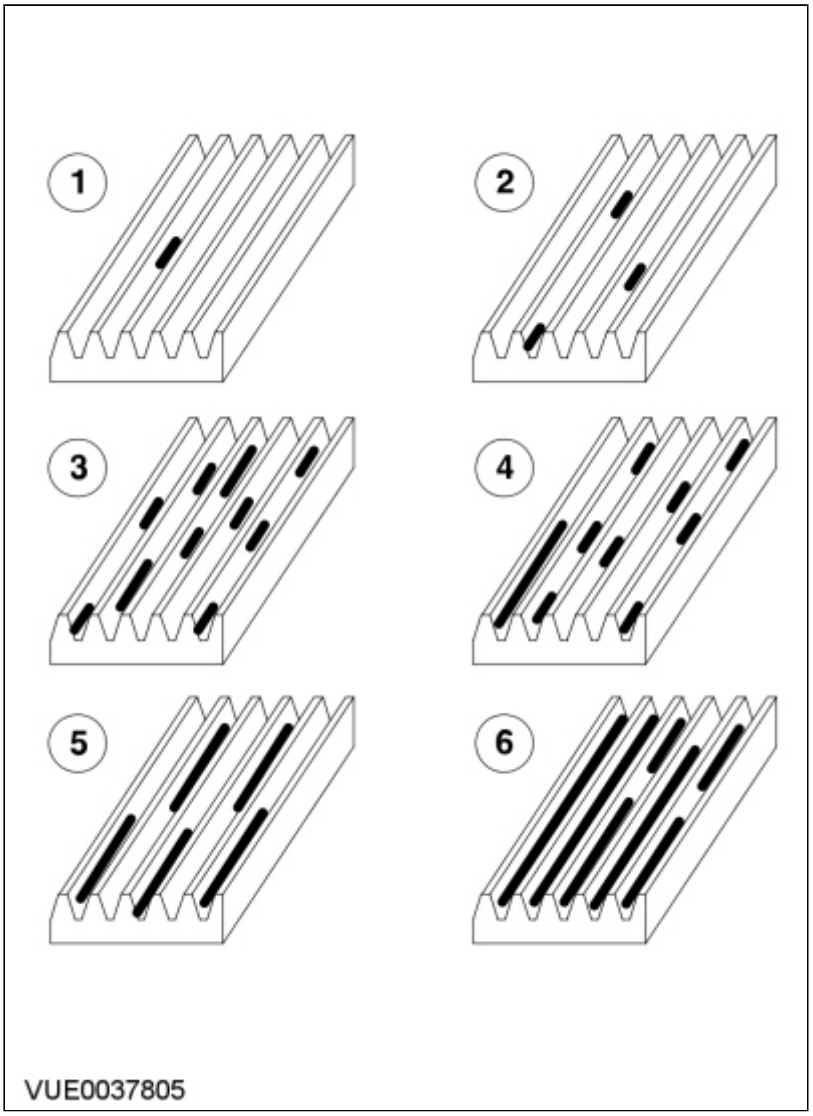
Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



2. Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt.
   REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Pilling

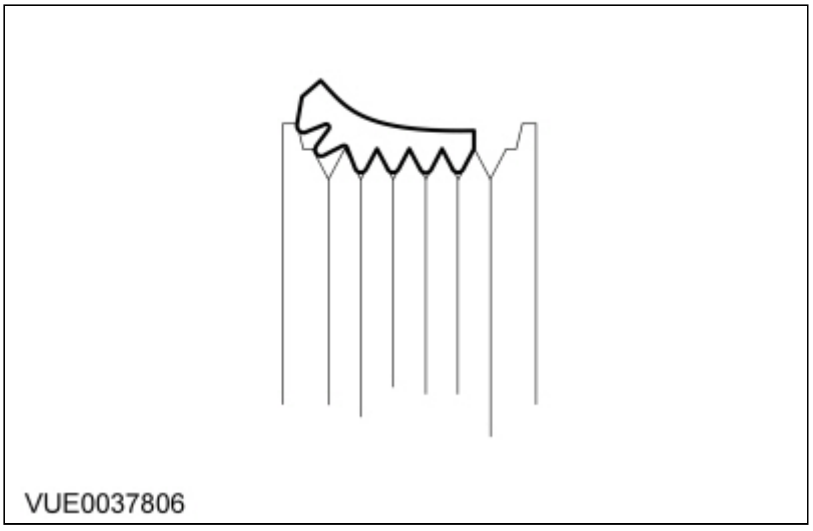
Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.



3. Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt.
       REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Incorrect installation

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Accessory drive belt noise	• Accessory drive system	• CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of

		the noise. INSTALL new components as necessary. TEST the system for normal operation.
	• Accessory drive belt incorrectly installed.	• CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
	• Pulley(s).	• CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	• Lubricant or other contamination.	• CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
• **NOTE:** *Squeal is defined as a continuous shriek, most noticeable when the engine is being accelerated or with electrical load.* • Accessory drive belt squeal	• Accessory drive belt tensioner worn, damaged or contaminated with oil.	• CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
• **NOTE:** *Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys.* • Accessory drive belt whine	• Poor surface finish on accessory drive belt idler pulley flat surface(s).	• REMOVE the accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	• Accessory drive belt idler pulley bearing failure.	• REMOVE the accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
• **NOTE:** *Chirp is defined as a twittering noise, often intermittent* • Accessory drive belt chirp	• Pulley misalignment (usually evident at idle).	• CHECK that the accessory drive belt is running centrally on the flat pulleys. TEST the system for normal operation. • CHECK the pulleys for excessive end float and bent flanges. • With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
• **NOTE:** *Rattle is*	• Accessory	• CHECK the accessory drive belt tensioner for correct operation

defined as a metallic knocking noise • Accessory drive belt rattle	drive belt tensioner hitting the end stops.	or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). TEST the system for normal operation.
	• Loose components or hardware.	• CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

2. Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. **NOTE:** *The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.*

   Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

5. If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

The accessory drive belt tensioner may be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary.
   REFER to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   TEST the system for normal operation.

2. Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive

belt.
REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Accessory Drive Belt

Base Part Number: 8620

Special Tool(s) / General Equipment

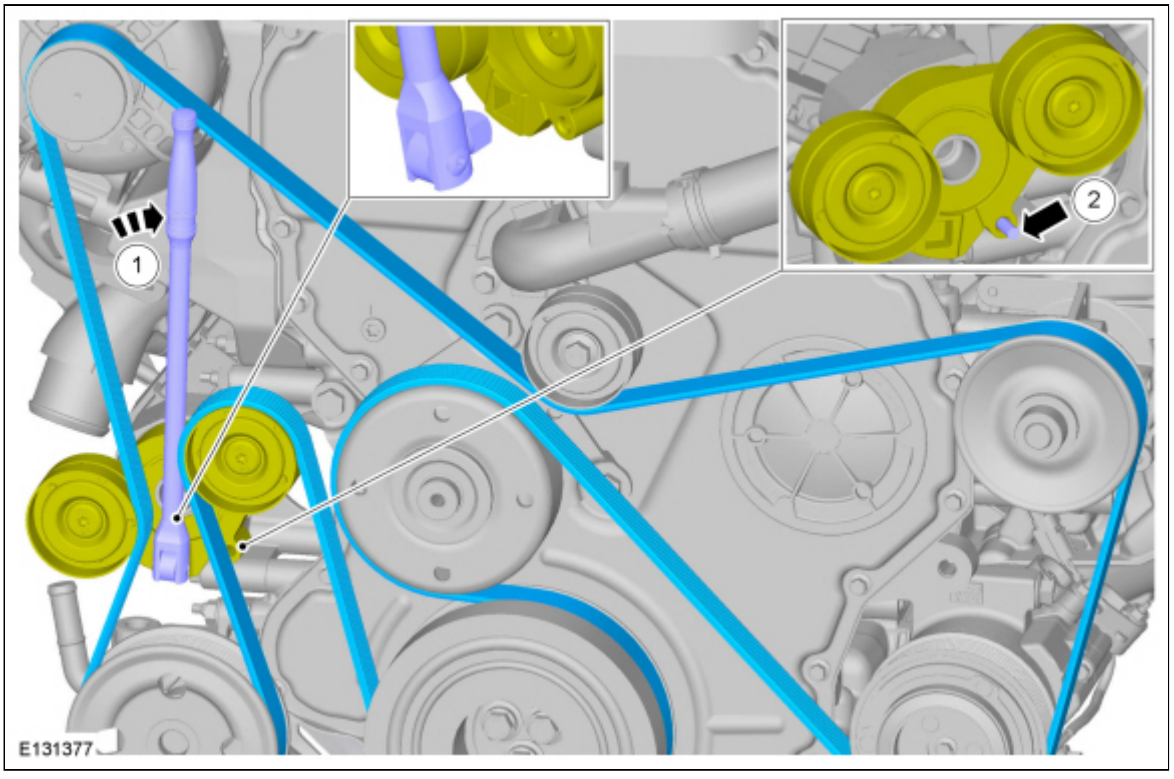
Dowel with a Diameter of 6 mm
1/2 Inch Square Drive Breaker Bar

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.
   Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. Use the General Equipment: Dowel with a Diameter of 6 mm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS)

Base Part Number: 8620

Special Tool(s) / General Equipment

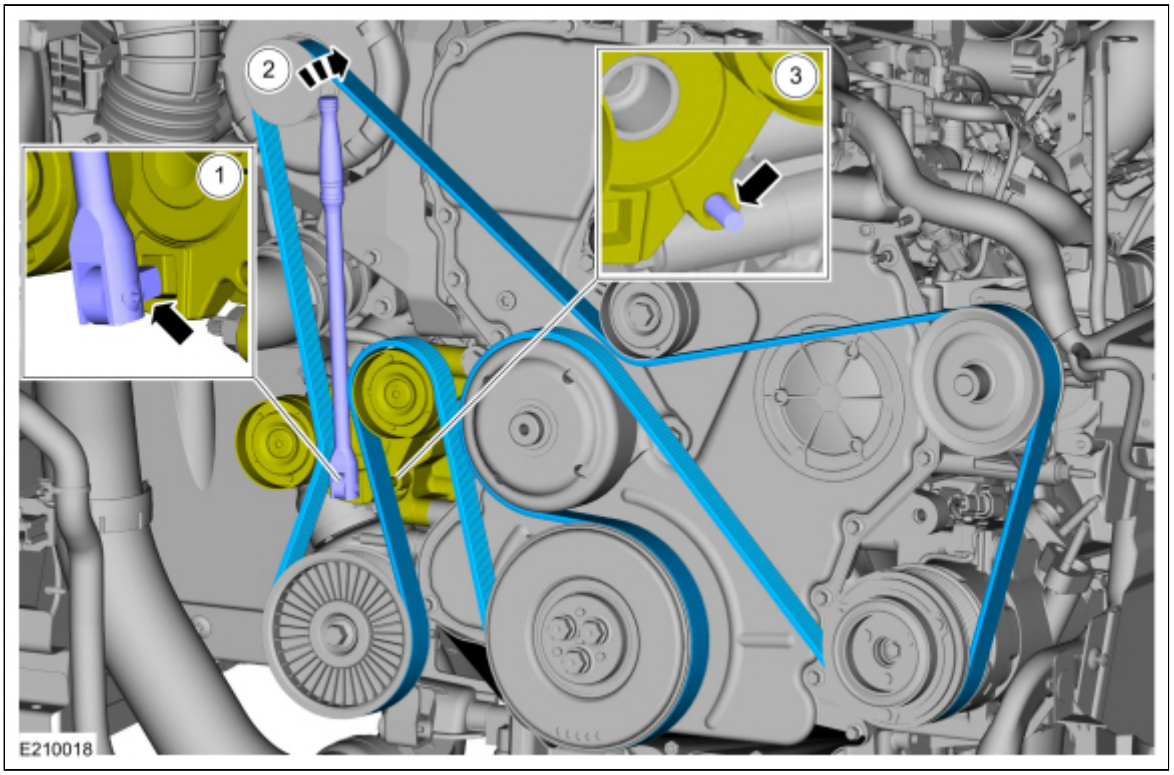
Dowel with a Diameter of 6 mm
1/2 Inch Square Drive Breaker Bar

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Use the General Equipment: 1/2 Inch Square Drive Breaker Bar
2. **NOTE:** *Rotate the accessory drive belt tensioner clockwise.*
3. Use the General Equipment: Dowel with a Diameter of 6 mm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Accessory Drive Belt Tensioner - Vehicles With: Electronic Power Assist Steering (EPAS)

Base Part Number: 6B209

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

Vehicles With: Hydraulic Power Assist Steering (HPAS)

2. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

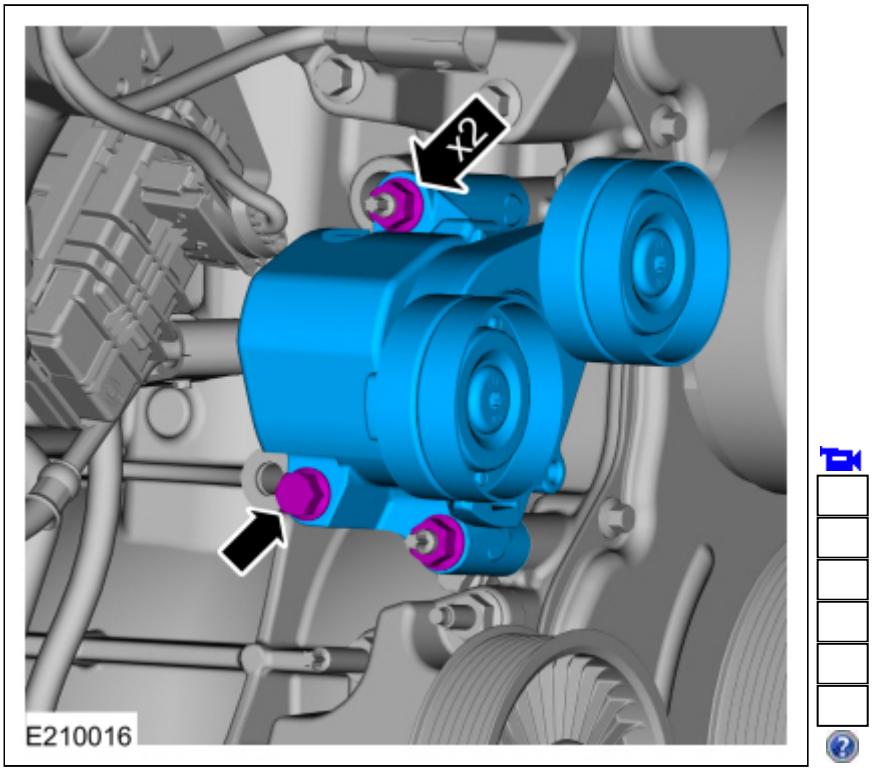
Vehicles With: Electronic Power Assist Steering (EPAS)

3. Refer to: Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS) (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

All vehicles

4. **NOTE:** *The accessory drive belt tensioner must be replaced as a complete unit.*

   Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Starting System - Overview

Starting System

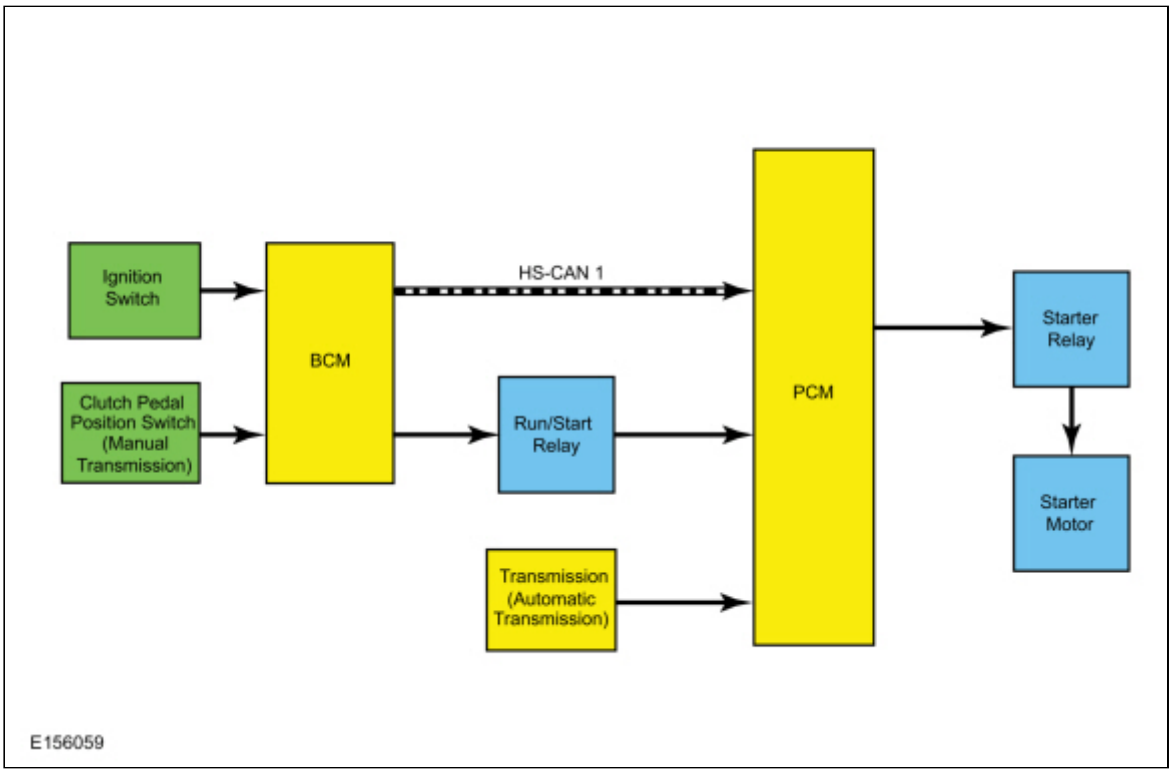
The starting system controls the cranking of the engine. The starter motor is enabled by the starter relay when the relay is activated by the PCM. The PCM receives inputs from the ignition switch, transmission and the BCM before activating the starter relay to initiate cranking of the engine.

Copyright © 2016 Ford Motor Company

Starting System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages Powertrain Control Module (PCM)

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	Provides the PCM with ignition mode.

Starting System

This vehicle is equipped with a PATS that disables the engine from starting if an unprogrammed PATS key is used or an invalid PCM ID is received. The PATS is controlled by the BCM. If there is a PATS concern that disables the engine, the IPC displays the corresponding message in the message center.
Refer to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

Under normal operation, when the ignition is turned to START, the PCM receives the following inputs:

- Request to crank engine message from the BCM
- PATS enable message from the BCM
- Voltage from the run/start relay
- Correct transmission park or neutral input from the automatic transmission

When the PCM receives the correct inputs, voltage and ground is supplied to the starter relay coil. When the starter relay coil is energized, it provides voltage to the starter solenoid, allowing the starter motor to crank the engine.

The PCM disengages the starter once an engine Revolutions Per Minute (RPM) threshold is reached, a set crank time is exceeded or the ignition is turned OFF.

Component Description

Integrated Keyhead Transmitter (IKT)

Refer to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

Passive Anti-Theft Transceiver

Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Ignition Switch

Refer to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) .

Powertrain Control Module (PCM)

The PCM provides power and ground to the starter relay to initiate cranking of the engine.

Copyright © 2016 Ford Motor Company

Starting System

Inspection and Verification

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

1. Verify the customer concern.
2. Check the battery for loose, damaged or corroded connections.
3. Check the starter for loose, damaged or corroded connections.
4. Check the battery condition and state of charge.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
5. Remove the accessory drive belt.
   REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
   Verify the crankshaft and each of the components driven by the accessory drive belt rotate and are not seized or damaged.
6. If any aftermarket accessories have been added to the vehicle, make sure they are properly wired.
7. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action
P06E9	Engine Starter Performance	If the engine cranks, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. If the engine does not crank, GO to Pinpoint Test A
P0830	Clutch Pedal "A" Circuit	GO to Pinpoint Test A
P162F	Starter Motor Disabled - Engine Crank Time Too Long	This DTC sets in the PCM when the engine has been cranked for more than a total of 60 seconds without allowing sufficient time for the starter to cool. Diagnose all other DTCs and symptoms. Check the charging system voltage and correct as necessary. Clear the DTC.
P2535	Ignition Switch Run/Start Position Circuit High	GO to Pinpoint Test C
All Other DTCs	-	REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) .

BCM DTC Chart

DTC	Description	Action
C113A:11	PCM Wake-up Signal: Circuit Short to Ground	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
C113A:15	PCM Wake-up Signal: Circuit Short to Battery or Open	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
All Other DTCs	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Starting System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The engine does not crank	Refer to the Pinpoint Test.	GO to Pinpoint Test A
The engine cranks slowly	Refer to the Pinpoint	PERFORM the starter system component test. REFER to Starter Motor - Positive Circuit Test in this

The engine cranks slowly	Refer to the Pinpoint Test.	PERFORM the starter system component test. REFER to Starter Motor - Positive Circuit Test in this section.
The engine cranks but will not start	• Fuses • PCM • Fuel pump • Fuel pump relay • Run/start relay • Starter • Wiring	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Unusual starter noise	Refer to the Pinpoint Test.	GO to Pinpoint Test B
The starter spins but the engine does not crank	Starter motor	INSPECT the starter motor mounting and engagement. REPAIR as necessary.
	Damaged flexplate	INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as necessary.
The starter does not disengage from the flexplate	• Starter relay • Wiring, terminals or connectors	REMOVE the starter relay. If the engine stops cranking, INSTALL a new relay. If the engine continues to crank, REPAIR circuit CBB13 (GY/BN) for a short to voltage.

Pinpoint Test(s)

Engine Does Not Crank

Refer to Wiring Diagrams Cell 20 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Starting System - System Operation and Component Description (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P06E9	Engine Starter Performance	No engine rotation detected during crank event.
P0830	Clutch Pedal "A" Circuit	Sets when the PCM receives vehicle speed input, indicating vehicle movement and does not detect the switching input from the clutch pedal position switch.

Possible Sources

- Battery
- Battery cables
- Starter motor
- BJB starter relay

Visual Inspection and Diagnostic Pre-checks

- Inspect the Run/start relay.
- Inspect the high current BJB connections.
- Verify the BJB fuse 13 (20A).
- Verify the BCM fuse 78 (5A).
- Inspect the Integrated Keyhead Transmitter (IKT).

PINPOINT TEST A : ENGINE DOES NOT CRANK

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

A1 PERFORM INSPECTION AND VERIFICATION

- Perform Inspection and Verification procedure in this section.

Was an obvious cause for an observed or reported concern found?

Yes	Correct the cause as necessary.
No	GO to A2

A2 VERIFY THE BCM (BODY CONTROL MODULE) AND PCM (POWERTRAIN CONTROL MODULE) PASS THE NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the Network Test.

Did the BCM and PCM pass the Network Test?

Yes	GO to A3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A3 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform BCM and PCM self-tests.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	For all BCM Diagnostic Trouble Codes (DTCs), refer to the BCM DTC Chart in this section. For PCM DTC P06E9, GO to A4 For PCM DTC P0830, GO to A17 For all other PCM Diagnostic Trouble Codes (DTCs), REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) .
No	GO to A4

A4 CHECK BCM (BODY CONTROL MODULE) IGN_SW_STATE PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Monitor the BCM PID IGN_SW_STATE while turning the ignition switch from OFF to START.

Does the PID change from Off to Start when the ignition switch is turned from OFF to START?

Yes	GO to A5
No	DIAGNOSE No power in Start. REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

A5 CHECK THE PCM (POWERTRAIN CONTROL MODULE) IN GEAR-TRANSMISSION IS APPLYING A LOAD TO ENGINE (IN_GEAR) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Monitor the PCM PID IN_GEAR, while placing the gear selector in PARK and then NEUTRAL.

Does the PID read No in both positions?

Yes	GO to A6
No	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

A6 CHECK THE PCM (POWERTRAIN CONTROL MODULE) ENGINE CRANKING (ENG_CRANK) PID (PARAMETER IDENTIFICATION)

- Make sure the transmission is in PARK or NEUTRAL.
- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Monitor the PCM PID ENG_CRANK while turning the ignition switch to the START position.

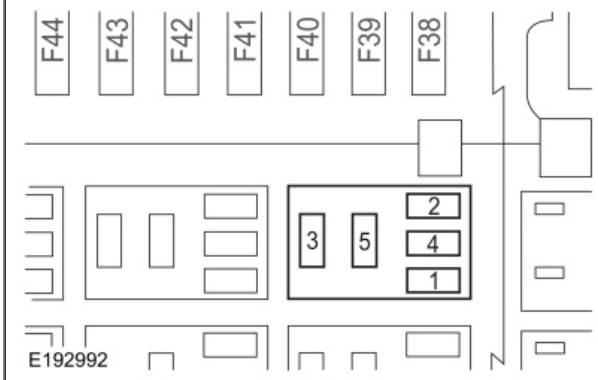
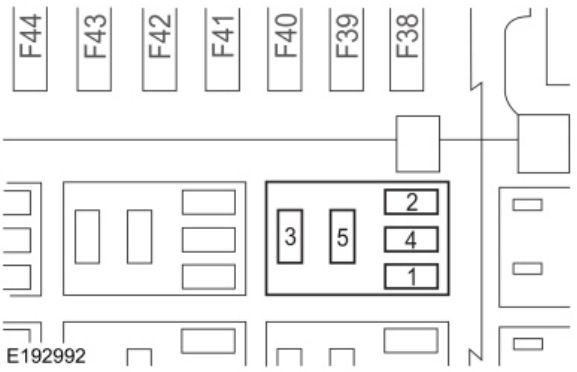
Does the PID change from Inactive to Active?

Yes	GO to A7
No	GO to A20

A7 CHECK THE STARTER RELAY CONTROL OPERATION

NOTICE: The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

- Remove the BJB starter relay.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
 BJB starter relay pin 1		 BJB starter relay pin 2

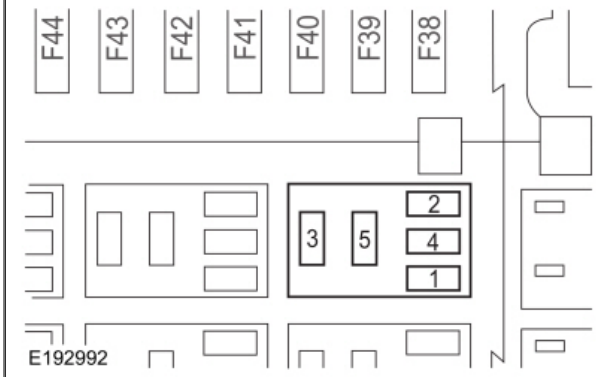
- For automatic transmission, make sure the transmission is in PARK or NEUTRAL.
- For manual transmission, fully apply the clutch pedal.
- While holding the key in the START position, observe the test light.

Does the test light illuminate when the key is in the START position?

Yes	GO to A8
No	GO to A15

A8 CHECK THE VOLTAGE TO THE STARTER RELAY

- Measure:

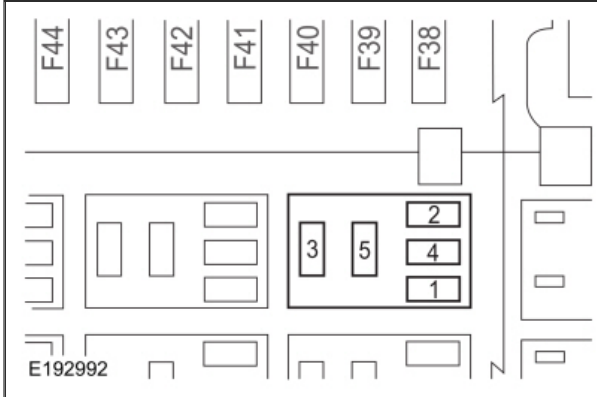
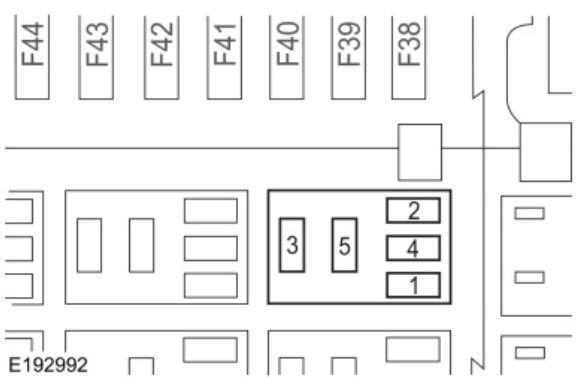
Positive Lead	Measurement / Action	Negative Lead
 BJB starter relay pin 3		Ground

Is the voltage greater than 11 volts?

Yes	GO to A9
No	VERIFY the BJB fuse 13 (20A) is OK. If OK, REPAIR the circuit for an open. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A9 CHECK THE STARTER MOTOR OPERATION AT THE STARTER RELAY

- Ignition OFF.
- With the transmission in PARK or NEUTRAL, momentarily connect a fused jumper wire:

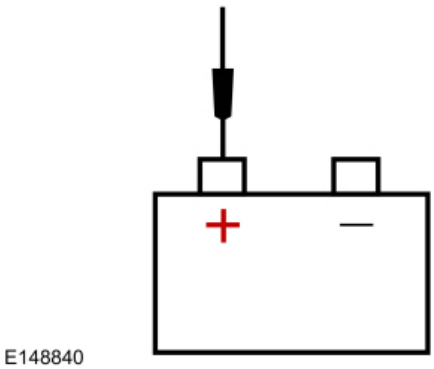
Positive Lead	Measurement / Action	Negative Lead
 BJB starter relay pin 3		 BJB starter relay pin 5

Did the starter engage and the engine crank?

Yes	INSTALL a new starter relay.
No	GO to A10

A10 CHECK THE BATTERY GROUND CABLES

- Measure:

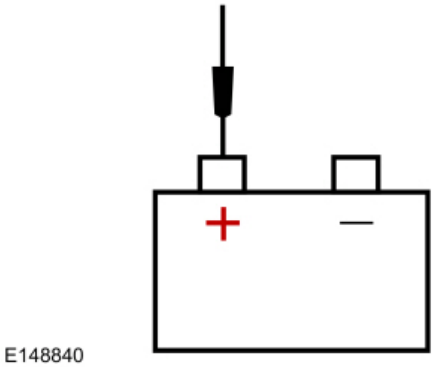
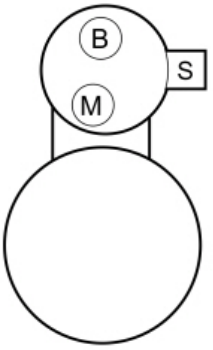
Positive Lead	Measurement / Action	Negative Lead
 E148840		Ground C1100G

Are the voltages greater than 11 volts?

Yes	GO to A11
No	CLEAN or INSTALL new negative battery cables as necessary. Refer to Battery Cables

A11 CHECK THE STARTER MOTOR GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148837 Starter motor case

Is the voltage greater than 11 volts?

Yes	GO to A12
No	CLEAN the starter motor mounting flange and MAKE SURE the starter motor is correctly mounted.

A12 CHECK THE VOLTAGE TO THE STARTER MOTOR

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C197A ("B" terminal)		Ground

Is the voltage greater than 11 volts?

Yes	GO to A13
No	INSTALL a new positive battery cable. Refer to Battery Cables

A13 CHECK THE STARTER MOTOR FOR CORRECT OPERATION

- Perform Starter Motor - Positive Circuit Test in this section.

Was an obvious cause found?

Yes	Correct the cause as necessary.
No	GO to A14

A14 CHECK FOR START INPUT AT THE STARTER

- Connect BJB starter relay.
- Disconnect Starter solenoid C197C.
- **NOTE:** *For manual transmission, fully apply the clutch pedal.*

While holding the key in the START position, measure:

Positive Lead	Measurement / Action	Negative Lead
C197C-1 ("S" terminal)		Ground

Is the voltage greater than 11 volts?

Yes	CLEAN the starter solenoid "S" terminal and starter solenoid connector. CHECK the wiring and the starter motor for a loose or intermittent connection.
No	REPAIR the circuit for an open.

A15 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CONTROL CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect PCM C175B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-24	Ω	Ground
C175B-9	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A16
No	REPAIR the affected circuit.

A16 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CONTROL CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-24	Ω	BJB starter relay pin 1
C175B-9	Ω	BJB starter relay pin 2

Are the resistances less than 3 ohms?

Yes	GO to A20
No	REPAIR the affected circuit.

A17 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH

- Ignition OFF.
- Disconnect PCM C175B.
- While fully applying the clutch pedal, measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-7	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A20
No	GO to A18

A18 CHECK THE CPP (CLUTCH PEDAL POSITION) GROUND CIRCUIT FOR AN OPEN

- Disconnect CPP switch C2353..
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2353-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A19
No	REPAIR the circuit.

A19 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-7	Ω	C2353-1

Is the resistance less than 3 ohms?

Yes	INSTALL a new CPP switch.
No	REPAIR the circuit.

A20 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Unusual Starter Noise

Normal Operation and Fault Conditions

Correct starter operation relies on correct mounting of the starter to the engine, alignment of the starter ring gear to the flexplate and correct functioning of the starter assembly (internal gears, bearings).

Possible Sources

- Engine
- Starter motor
- Starter motor mounting

Visual Inspection and Diagnostic Pre-checks

- Inspect the starter motor.
- Inspect the starter motor mounting.

PINPOINT TEST B : UNUSUAL STARTER NOISE

B1 CHECK THE STARTER MOUNTING

- Inspect the starter mounting bolts for looseness.

Is the starter motor mounted correctly?

Yes	GO to B2
No	INSTALL the starter motor correctly. REFER to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

B2 CHECK FOR STARTER NOISE

- Ignition OFF.
- Connect a remote starter switch between the starter solenoid C197A ("B" terminal) and C197C-1 ("S" terminal).
- Engage the starter and verify the noise is due to starter operation.

Is the noise due to the starter engagement?

Yes	REFER to: Starter Motor Drive Gear and Flywheel Ring Gear Inspection (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
No	REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). to continue diagnosis.

P2535

Refer to Wiring Diagrams Cell 20 for schematic and connector information.

Normal Operation and Fault Conditions

When the ignition is turned to the START position the PCM receives a voltage signal on the crank detect circuit. The PCM then supplies voltage and ground to the starter relay coil when the required inputs have been received.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P2535	Ignition Switch Run/Start Position Circuit High	This DTC sets when the PCM detects voltage on the crank detect circuit while the engine is running.

Possible Sources

- BCM
- Ignition switch
- PCM
- Wiring, terminals or connectors

PINPOINT TEST C : DTC P2535

C1 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform PCM self-tests.

Is DTC P2535 recorded?

Yes	GO to C2
No	For all PCM Diagnostic Trouble Codes (DTCs), refer to the PCM DTC Chart in this section.

C2 CHECK THE CRANK DETECT CIRCUIT FOR A SHORT TO VOLTAGE WITH PCM (POWERTRAIN CONTROL MODULE) DISCONNECTED

- Ignition OFF.
- Disconnect PCM C175B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-9	V	Ground

Is any voltage present?

Yes	GO to C3
No	GO to C5

C3 CHECK THE CRANK DETECT CIRCUIT FOR A SHORT TO VOLTAGE WITH IGNITION SWITCH DISCONNECTED

- Ignition OFF.
- Disconnect Ignition switch C250.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-9		Ground

Is any voltage present?

Yes	GO to C4
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

C4 CHECK THE CRANK DETECT CIRCUIT FOR A SHORT TO VOLTAGE WITH BCM (BODY CONTROL MODULE) DISCONNECTED

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-9		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C6

C5 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect all connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect all connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Component Test(s)

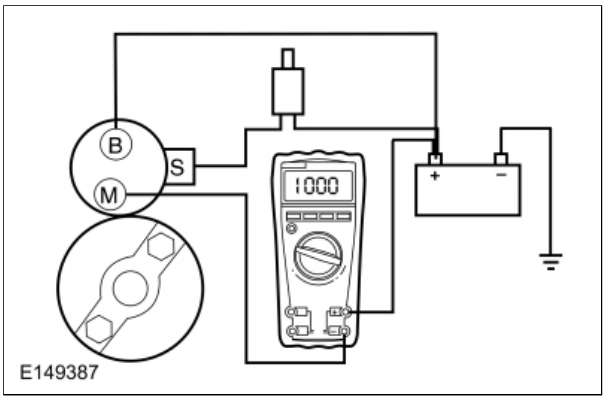
Starter Motor - Positive Circuit Test

NOTE: *Always make the multimeter connection at the component terminal rather than at the wiring end of the connector. Making a connection at the wiring end of the connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and component.*

1. Make sure the battery is fully charged.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

2. Perform a battery drain test.

3. Connect a remote starter switch between starter solenoid “S” terminal and the battery positive terminal.
4. Connect the multimeter positive lead to the battery positive post. Connect the negative lead to the starter solenoid "M" terminal.

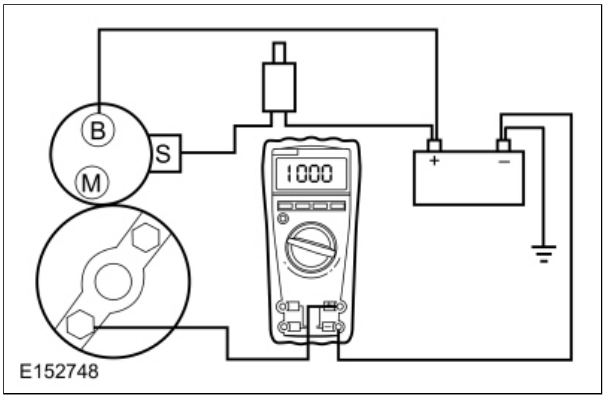


5. Place gear selector lever in Park or Neutral.
6. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
7. If the voltage reading is 0.5 volt or less, perform Starter Motor - Ground Circuit Test in this section.
8. A voltage reading greater than 0.5 volt is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Remove the cables from the solenoid "B", "S" and "M" terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6.
9. If the voltage reading is still greater than 0.5 volt when checked at the "M" terminal, move the multimeter negative lead to the starter solenoid “B” terminal.
10. With the gear selector lever in Park or Neutral, engage the remote starter switch. Read and record the voltage.
11. If the voltage reading at the "B" terminal is lower than 0.5 volt, the concern is in the connections at the starter solenoid or in the solenoid contacts. Install a new starter motor.
REFER to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
12. If the voltage reading taken at the solenoid "B" terminal is greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is in the positive battery cable connection or in the positive battery cable itself. Clean the positive battery cable connection. If this does not resolve the concern, install a new positive battery cable.

Starter Motor - Ground Circuit Test

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. This procedure checks the voltage drop in the ground circuit.

1. Connect a remote starter switch between starter solenoid "S" terminal and the battery positive terminal.
2. Connect the multimeter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative battery terminal.
3. Place gear selector lever in Park or Neutral.
4. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.



5. If the voltage reading is greater than 0.5 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connection. Retest.
6. If the voltage reading is greater than 0.5 volt, install a new negative battery cable.
7. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.
REFER to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Copyright © 2016 Ford Motor Company

Starter Motor Drive Gear and Flywheel Ring Gear Inspection

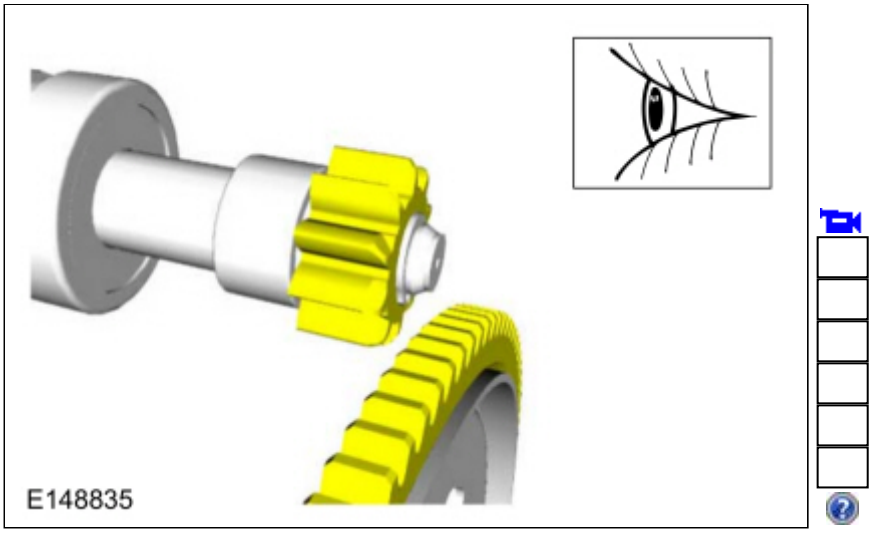
Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

3. Check the wear patterns on the starter drive gear and the flywheel or flexplate ring gear. If the wear pattern is normal, install the starter motor.
   Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).



4. If the starter drive gear and the flywheel or flexplate ring gear are not fully meshing and the gears are scored or damaged, install a new starter motor.
   Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

5. If necessary, install a new flywheel or flexplate.

Copyright © 2016 Ford Motor Company

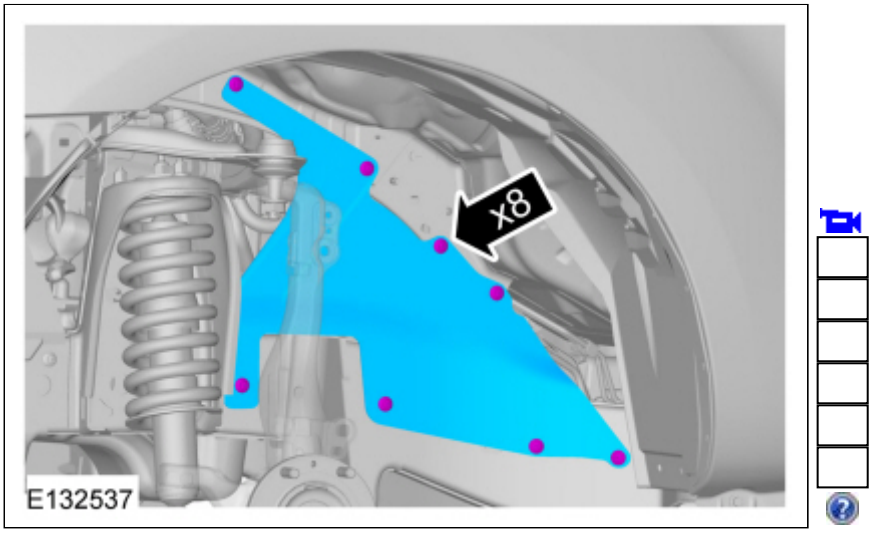
Starter Motor

Base Part Number: 11000

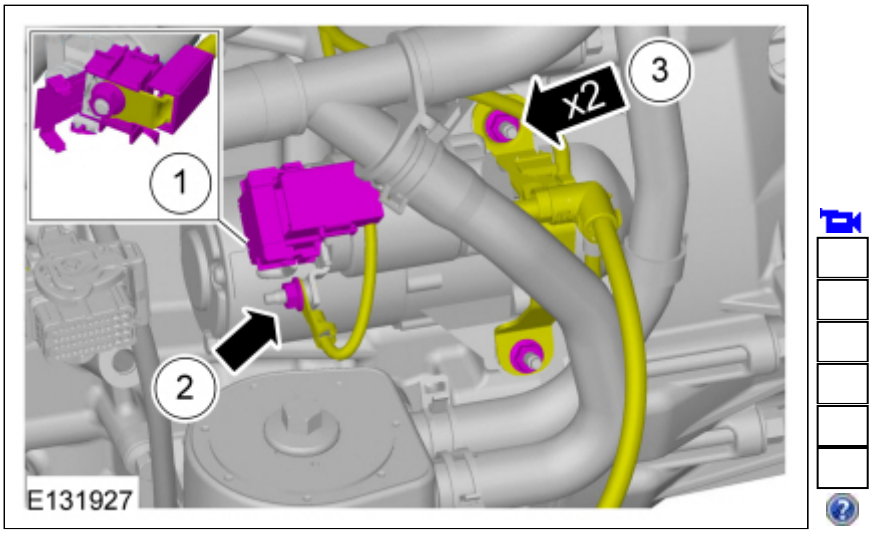
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

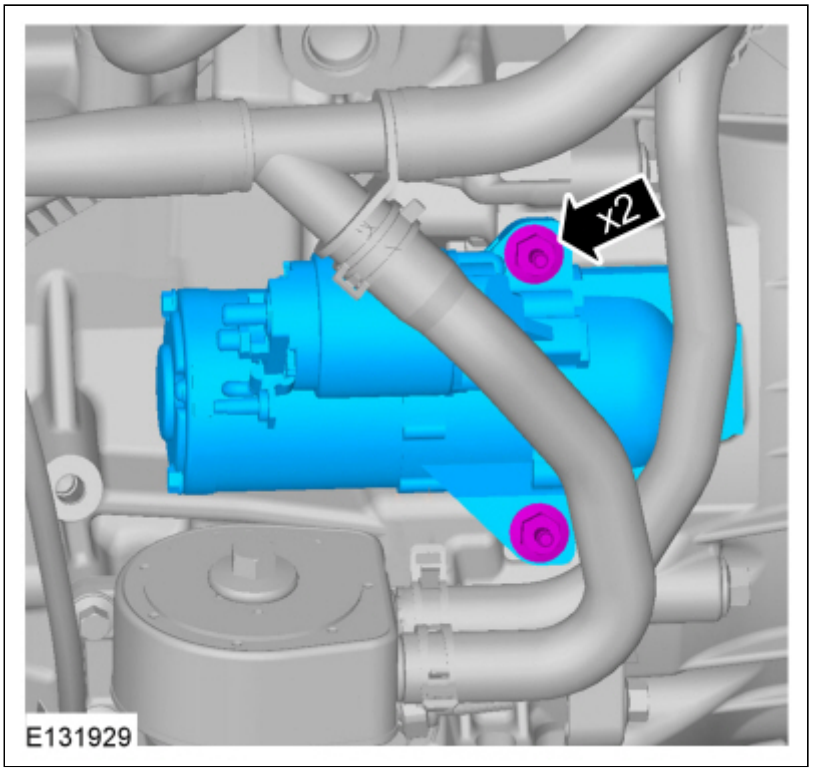
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove Front LH wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.



1. *Torque*: 10 Nm
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



6. *Torque*: 35 Nm



Installation

1. To install, reverse the removal procedure.

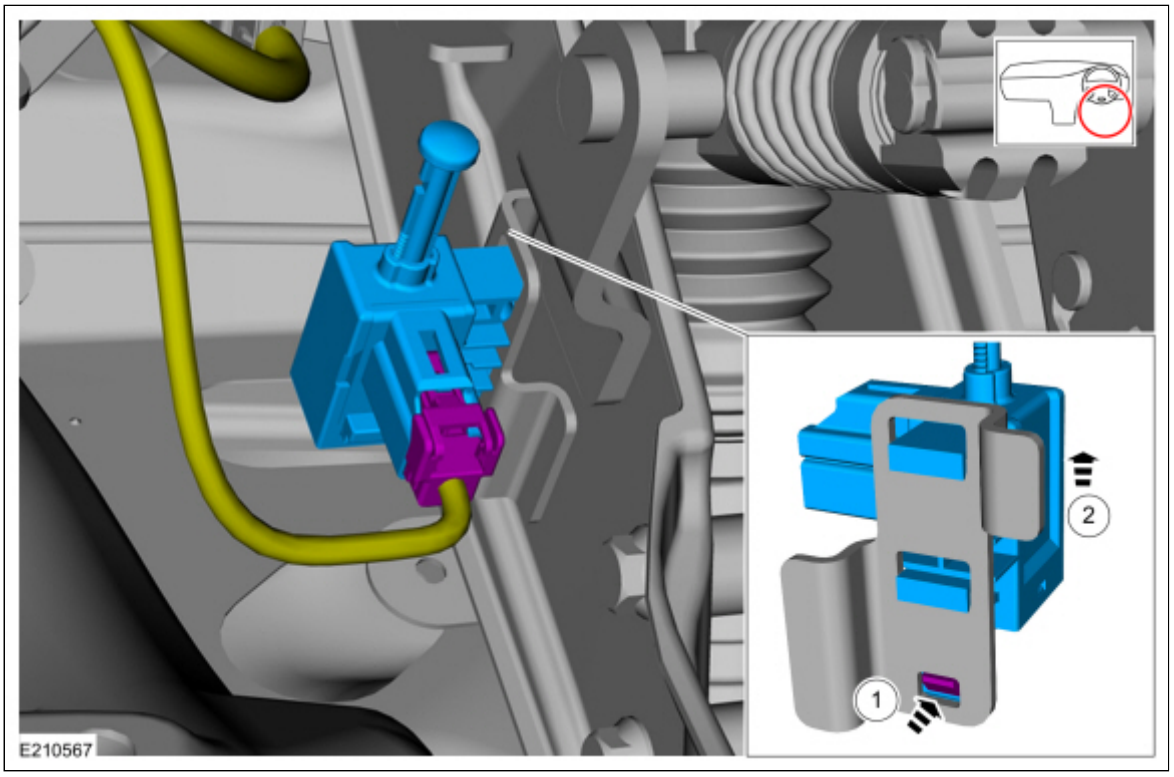
Copyright © 2016 Ford Motor Company

Start Inhibit Switch

Removal

NOTICE: Make sure that the clutch pedal remains in the rest position.

1.



Installation

1. **NOTICE: Make sure that the clutch pedal remains in the rest position.**

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Starting System - Overview

Starting System

The starting system controls the cranking of the engine. The starter motor is enabled by the starter relay when the relay is activated by the PCM. The PCM receives inputs from the ignition switch, TCM automatic transmission, CPP manual transmission and the BCM before activating the starter relay to initiate cranking of the engine.

Starting System-with Auto-Start-Stop

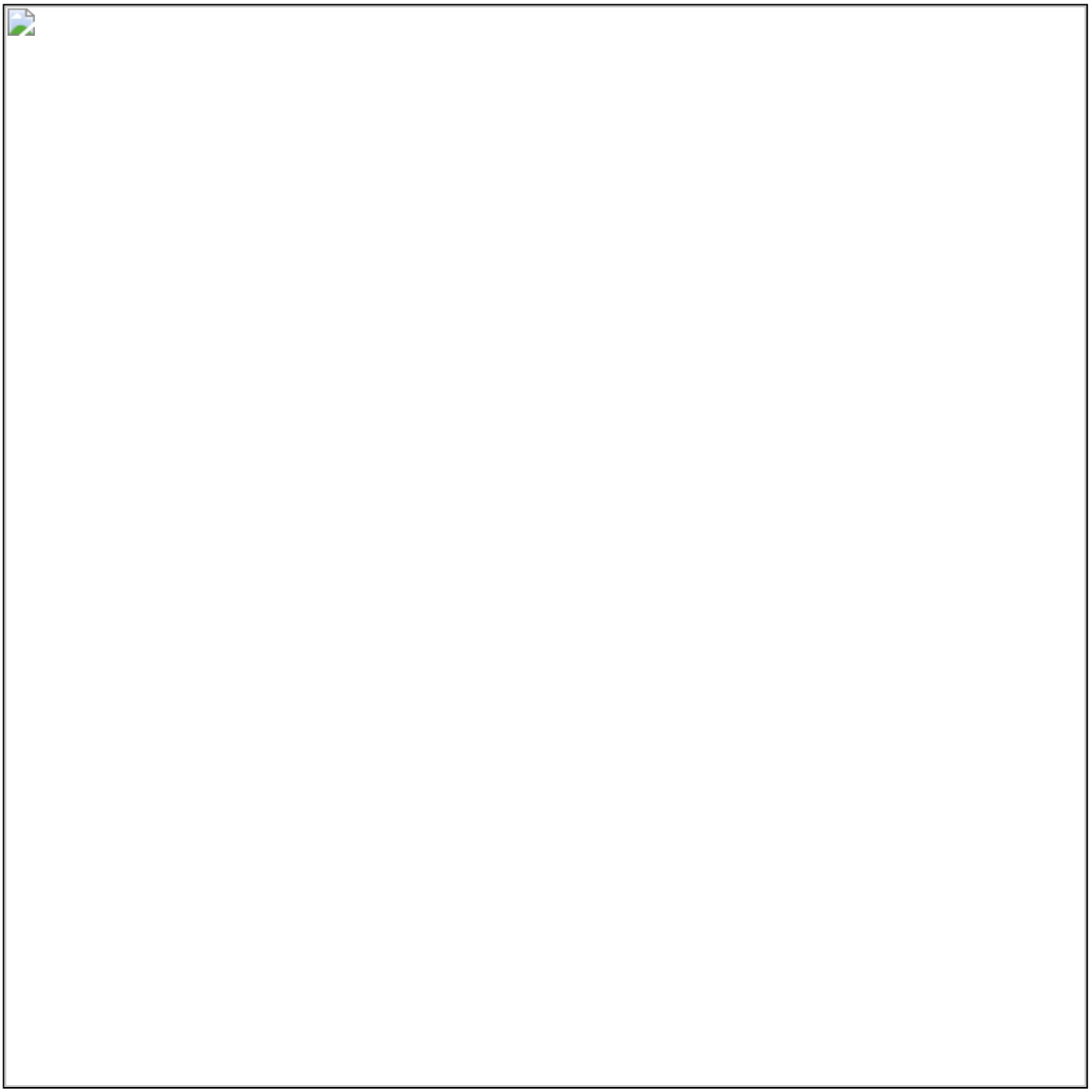
The Auto-Start-Stop system helps reduce fuel consumption by automatically shutting off the vehicle’s engine while the vehicle is at a complete stop and restarting the engine when the clutch pedal is pressed. The Auto-Start-Stop system is automatically enabled whenever the ignition is turned on. The vehicle may restart automatically in order to maintain interior comfort or to recharge the battery. Refer to the Owner's Literature for additional information.

Copyright © 2016 Ford Motor Company

Starting System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages Powertrain Control Module (PCM)

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	Provides the PCM with ignition mode.

Starting System

The starting system controls the cranking of the engine. Under normal operation, when the ignition is turned to START, the PCM receives the following inputs:

- Request to crank engine message from the BCM .
- Voltage signal on the crank detect circuit from the ignition switch.
- PATS enable message from the BCM .
- Correct transmission park or neutral input from the automatic transmission
- Correct bottom of travel input from the CPP switch (manual transmission).

When the PCM receives the correct inputs, voltage and ground is supplied to the starter relay coil. When the starter relay coil is energized, it provides voltage to the starter solenoid, allowing the starter motor to crank the engine.

The PCM disengages the starter once an engine Revolutions Per Minute (RPM) threshold is reached, a set crank time is exceeded or the ignition is turned OFF.

Auto-Start-Stop System

The Auto-start-stop system helps reduce fuel consumption by automatically shutting off the vehicle's engine while the vehicle is idling at a complete stop, and restarting the engine when the clutch pedal is pressed. The system can be disabled through the auto-start-stop control switch. The Auto-start-stop system is automatically enabled whenever the ignition is turned on.

The engine automatically **stops** when:

- the vehicle is stopped, and
- the transmission is in neutral, and
- the clutch pedal and accelerator pedals are released.

The engine automatically **restarts** when:

- the clutch pedal is pressed.
- the Auto-start-stop system is disabled through the auto-start-stop control switch.
- the battery has a low state of charge.
- it is necessary to maintain interior comfort.
- the blower fan speed is increased or the climate control temperature is changed.
- an electrical accessory is turned on or plugged in.
- there is low brake vacuum.

The Auto-start-stop system may **not** turn the engine off under these conditions:

- the HVAC system is in A/C, heat or defrost modes.
- the rear defroster is on.
- the battery has a low state of charge.
- the battery temperature is below 5°C (41°F) or above 60°C (140°F).
- the engine temperature is below 46°C (115°F).
- the engine temperature is below 60°C (140°F) and the HVAC system is in heat mode.
- the steering wheel is turned rapidly or is at a sharp angle.
- vehicle speed of greater than 4 km/h (2.5 mph) for more than 2 seconds has not occurred.
- the vehicle is on a steep road grade.
- elevation is approximately above 3,048 meters (10,000 feet).

If the system detects a malfunction, it turns off and the OFF lamp on the auto-start-stop control switch illuminates continuously. If the OFF lamp remains on after an ignition cycle, a malfunction is indicated.

Refer to the Owner's Literature for additional information.

Passive Anti-theft System (PATS)

This vehicle may be equipped with PATS. PATS disables the engine from starting if an unprogrammed PATS key is used or an invalid PCM ID is received. The PATS is controlled by the BCM. If there is a PATS concern that disables the engine, the IPC displays a corresponding message in the message center.
Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Component Description

Body Control Module (BCM)

Refer to: Module Controlled Functions - Component Location (419-10 Multifunction Electronic Modules, Description and Operation).

Passive Anti-Theft Transceiver

If equipped with PATS,
Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Integrated Keyhead Transmitter (IKT)

If equipped with PATS,
Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Ignition Switch

Refer to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Powertrain Control Module (PCM)

The PCM provides power and ground to the starter relay to initiate cranking of the engine.

Copyright © 2016 Ford Motor Company

Starting System

Inspection and Verification

1. Verify the customer concern by operating the starting system.
2. Before diagnosing or repairing the starting system inspect the following items:

- Check the battery for loose, damaged or corroded connections.
- Check the generator for loose, damaged or corroded connections.
- Check engine and battery grounds for loose, damaged or corroded connections.
- Check high current BJB for loose or corroded connections.
- Verify fuses or fusible links.
- Inspect wiring, terminals and connectors.

3. Check the battery condition and state of charge.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
4. Check for abnormal ignition-off current drain(s). Refer to section 414-01 Battery Drain Check
5. Remove the accessory drive belt.
   REFER to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Verify the crankshaft and each of the components driven by the accessory drive belt rotate and are not seized or damaged.
6. If any aftermarket accessories have been added to the vehicle, make sure they are properly wired.
7. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.
8. Using the diagnostic scan tool, retrieve all Diagnostic Trouble Codes (DTCs). Refer to the appropriate DTC Chart in this section.

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action
P06E9	Engine Starter Performance	If the engine cranks, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. GO to Pinpoint Test A
P0850	Park / Neutral Switch Input Circuit	GO to Pinpoint Test A
All Other DTCs	—	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

BCM DTC Chart

DTC	Description	Action
B10E5:11	PCM Wake-up Signal: Circuit Short to Ground	GO to Pinpoint Test C
All Other DTCs	—	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Starting System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The engine does not crank	Refer to the Pinpoint Test	GO to Pinpoint Test A
The engine cranks slowly	Refer to the Pinpoint Test	CARRY OUT the starter system component test. Refer to Starter Motor - Positive Circuit Test in this section.
The engine cranks but will not start	Ignition fault	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Unusual starter noise	Refer to the Pinpoint Test	GO to Pinpoint Test B
The starter spins but the engine does not crank	Starter motor	INSPECT the starter motor mounting and engagement. REPAIR as necessary.
	Damaged flexplate	INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as necessary.
The starter does not disengage from the flexplate	• Starter relay • Wiring, terminals or connectors	REMOVE the starter relay. If the engine stops cranking, INSTALL a new relay. If the engine continues to crank, REPAIR circuit CDC25AB (BN/GN) for a short to voltage.

Pinpoint Tests

Engine Does Not Crank

Refer to Wiring Diagrams Cell 20 for schematic and connector information.

Normal Operation and Fault Conditions

For more information,
REFER to: Starting System - System Operation and Component Description (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P06E9	Engine Starter Performance	This DTC sets in the PCM when no engine rotation is detected during crank event.

Possible Sources

- Battery
- Battery cables
- Starter motor
- BJB starter relay

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse 84 (30A).
- Verify the high current BJB fuse 1 (470A).
- Verify the BCM fuse 3 (15A).

PINPOINT TEST A : ENGINE DOES NOT CRANK

A1 PERFORM INSPECTION AND VERIFICATION

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *If it is necessary to leave the battery charger connected during testing, do not leave it on its highest or boost setting. The highest settings can exceed 16 volts, resulting in false test results and setting of Diagnostic Trouble Codes (DTCs).*

- Perform Inspection and Verification procedure in this section.

Was an obvious cause for an observed or reported concern found?

Yes	Correct the cause as necessary.
No	GO to A2

A2 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform self-tests for:
  - BCM
  - TCM
  - PCM

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	For all TCM Diagnostic Trouble Codes (DTCs), REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). For all PCM Diagnostic Trouble Codes (DTCs), GO to A3 For all BCM Diagnostic Trouble Codes (DTCs), REFER to the BCM DTC Chart in this section.
No	GO to A3

A3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) ENGINE CRANKING (ENG_CRANK) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Make sure the transmission is in PARK or NEUTRAL.
- Using a diagnostic scan tool, view the PCM PID ENG_CRANK, with the key in the START position.

Does the PCM PID ENG_CRANK change from Inactive to Active?

Yes	GO to A6
No	GO to A4

A4 CHECK THE CRANK DETECT CIRCUIT FOR VOLTAGE AT THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition OFF.
- Disconnect PCM C1232A.
- With the key in the START position, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-47		Ground

Is the voltage greater than 11 volts?

Yes	GO to A19
No	GO to A5

A5 CHECK THE IGNITION SWITCH

- Ignition OFF.
- Carry out the Ignition Switch Component Test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the ignition switch pass the component test?

Yes	REPAIR circuit CDC35DA (BU/WH) for an open.
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

A6 CHECK THE TCM (TRANSMISSION CONTROL MODULE) TR_CRANK PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, while viewing the TCM PID TR_CRANK, place the gear selector in PARK and then NEUTRAL.

Does the TCM PID TR_CRANK read YES in both positions?

Yes	GO to A8
No	DIAGNOSE the TR sensor, REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

A7 CHECK THE PCM (POWERTRAIN CONTROL MODULE) IN_GEAR PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- While observing the PCM PID IN_GEAR, place the gear selector in PARK and then NEUTRAL.

Does the PID read No in both positions?

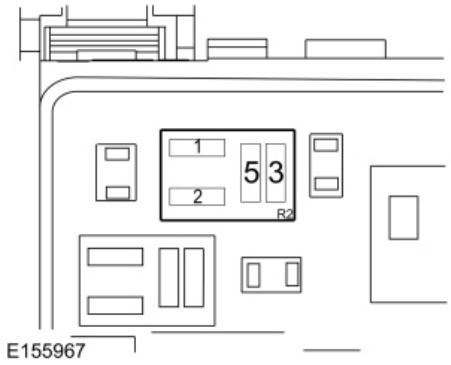
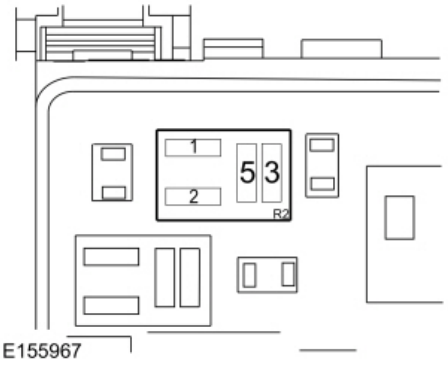
Yes	GO to A8
No	Diagnose the TR sensor, REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

A8 CHECK THE STARTER RELAY CONTROL OPERATION

NOTICE: The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

- Remove the BJB starter relay.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

 BJB starter relay pin 1		 BJB starter relay pin 2

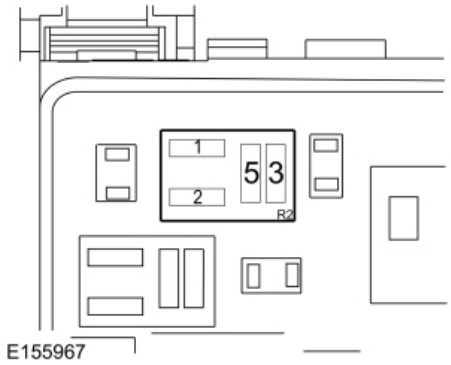
- Make sure the transmission is in PARK or NEUTRAL.
- With the key in the START position, observe the test light.

Does the test light illuminate when the key is in the START position?

Yes	GO to A9
No	GO to A16

A9 CHECK THE VOLTAGE TO THE STARTER RELAY

- Measure:

Positive Lead	Measurement / Action	Negative Lead
 BJB starter relay pin 3		Ground

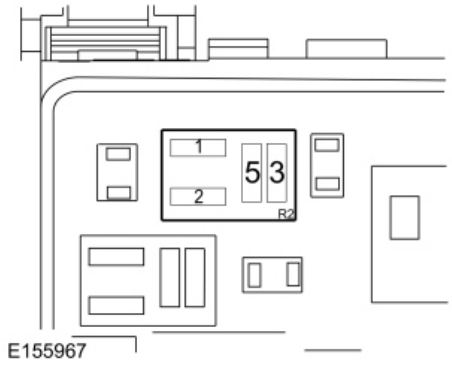
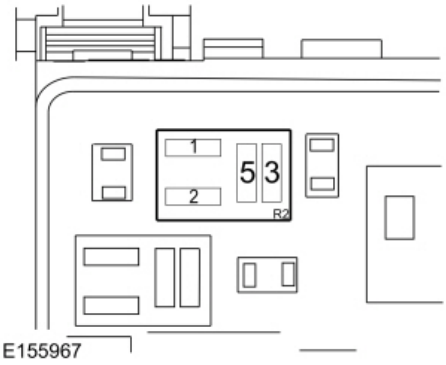
Is the voltage greater than 11 volts?

Yes	GO to A10
No	VERIFY BJB fuse 84 (30A) is OK. If OK, REPAIR the circuit for an open. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A10 CHECK THE STARTER MOTOR OPERATION AT THE STARTER RELAY

- Ignition OFF.
- With the transmission in PARK or NEUTRAL, momentarily connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead

 BJB starter relay pin 3		 BJB starter relay pin 5

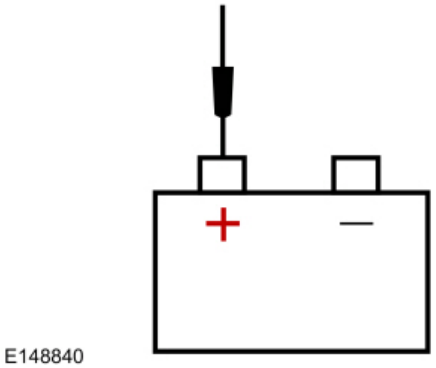
-

Did the starter engage and the engine crank?

Yes	INSTALL a new starter relay.
No	GO to A11

A11 CHECK THE BATTERY GROUND CABLE

- Measure:

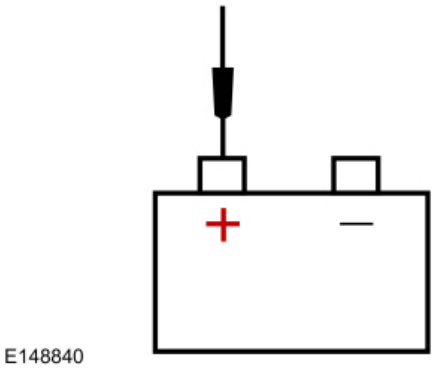
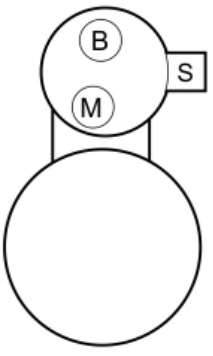
Positive Lead	Measurement / Action	Negative Lead
		Ground C1100

Are the voltages greater than 11 volts?

Yes	GO to A12
No	CLEAN or INSTALL a new negative battery cable as necessary.

A12 CHECK THE STARTER MOTOR GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
		 Starter motor case

Is the voltage greater than 11 volts?

Yes	GO to A13
No	CLEAN the starter motor mounting flange and MAKE SURE the starter motor is correctly mounted.

A13 CHECK THE VOLTAGE TO THE STARTER MOTOR

- Measure:

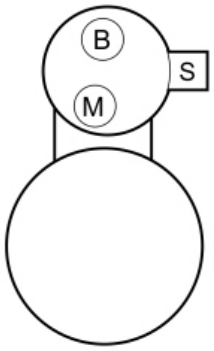
Positive Lead	Measurement / Action	Negative Lead
C197C	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A14
No	CLEAN the high current BJB connection to the battery post. CLEAN or REPAIR a positive battery cable as necessary.

A14 CHECK THE STARTER MOTOR FOR CORRECT OPERATION

- Ignition OFF.
- Connect a remote starter switch between the starter solenoid C1715A-1 ("B" terminal) and C1715B-1 ("S" terminal).



E148837

- With the transmission in PARK or NEUTRAL, momentarily engage the starter.

Did the starter engage and the engine crank?

Yes	GO to A15
No	INSTALL a new starter, REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

A15 CHECK FOR START INPUT AT THE STARTER

- Connect BJB starter relay.
- Disconnect Starter solenoid C197C.
- With the key in the START position, measure:

Positive Lead	Measurement / Action	Negative Lead
C197C-1	V	Ground

Is the voltage greater than 11 volts?

Yes	CLEAN the starter solenoid "S" terminal and starter solenoid connector. CHECK the wiring and the starter motor for a loose or intermittent connection.
No	REPAIR the circuit for an open.

A16 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CIRCUITS FOR A SHORT TO POWER

- Ignition OFF.
- Disconnect PCM C1232A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-37	V	Ground

C1232A-25		Ground

Is any voltage present?

Yes	REPAIR the affected circuit.
No	GO to A17

A17 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-37	Ω	Ground
C1232A-25	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A18
No	REPAIR the affected circuit.

A18 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-37	Ω	BJB start relay pin 1
C1232A-25	Ω	BJB start relay pin 2

Are the resistances less than 3 ohms?

Yes	GO to A19
No	REPAIR the affected circuit.

A19 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Unusual Starter Noise

Normal Operation and Fault Conditions

Correct starter operation relies on correct mounting of the starter to the engine, alignment of the starter ring gear to the flexplate and correct functioning of the starter assembly (internal gears, bearings).

Possible Sources

- Engine
- Starter motor
- Starter motor mounting

Visual Inspection and Diagnostic Pre-checks

- Inspect the starter motor.
- Inspect the starter motor mounting.

PINPOINT TEST B : UNUSUAL STARTER NOISE

B1 CHECK THE STARTER MOUNTING

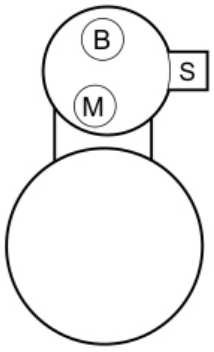
- Inspect the starter mounting bolts for looseness.

Is the starter motor mounted securely?

Yes	GO to B2
No	INSTALL the starter motor securely. REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

B2 CHECK FOR ENGINE NOISE

- Ignition OFF.
- Connect a remote starter switch between the starter solenoid C197C ("B" terminal) and C197C-1 ("S" terminal).



E148837

- Engage the starter and verify the noise is due to starter operation.

Is the noise due to the starter engagement?

Yes	REFER to: Starter Motor Drive Gear and Flywheel Ring Gear Inspection (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
No	REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). to continue diagnosis.

B10E5:11

Refer to Wiring Diagrams Cell 23 for schematic and connector information.

Normal Operation and Fault Conditions

The wake-up control circuit wakes up the PCM prior to engine cranking to allow it time to initialize. The wake-up control circuit is activated by the BCM when the driver door is opened, a key is inserted into the ignition, or when the ignition is in the ON or START position.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10E5:11	PCM Wake-up Signal: Circuit Short to Ground	This DTC sets in the BCM when a short to ground is detected on the wake-up control circuit.

Possible Sources

- BCM
- PCM
- Wiring, terminals or connectors

PINPOINT TEST C : B10E5:11

C1 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect PCM C1232A.
- Ignition ON.
- Using a diagnostic scan tool, clear the BCM Continuous Diagnostic Trouble Codes (DTCs).
- Using a diagnostic scan tool, perform BCM self-test.

Is BCM DTC B10E5:11 present?

Yes	GO to C2
No	GO to C6

C2 CHECK THE PCM (POWERTRAIN CONTROL MODULE) WAKE-UP SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280C.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-28		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C3

C3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) WAKE-UP SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-28	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE PCM (POWERTRAIN CONTROL MODULE) WAKE-UP SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-28	Ω	C2280C-18

Is the resistance less than 3 ohms?

Yes	GO to C5
No	REPAIR the circuit.

C5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

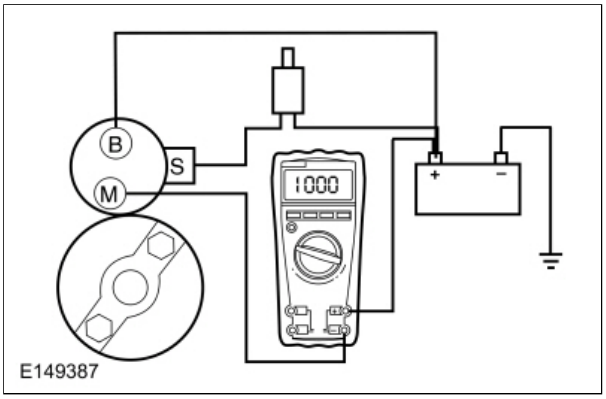
Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Component Test(s)

Starter Motor - Positive Circuit Test

NOTE: *Always make the multimeter connection at the component terminal rather than at the wiring end of the connector. Making a connection at the wiring end of the connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and component.*

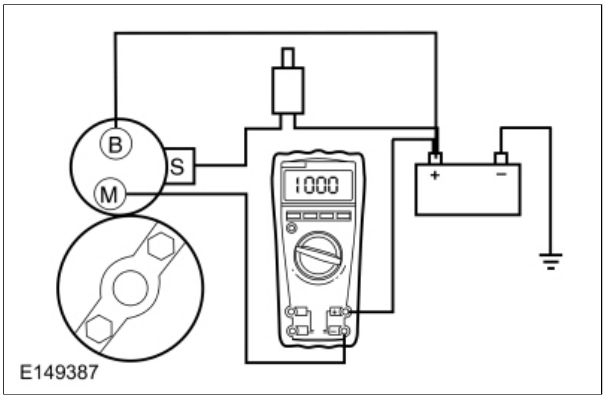
1. Make sure the battery is fully charged. Refer to 414-01
2. Perform a battery drain test. Refer to 414-01
3. Connect a remote starter switch between starter solenoid “S” terminal and the battery positive terminal.
4. Connect the multimeter positive lead to the battery positive post. Connect the negative lead to the starter solenoid "M" terminal.



5. Place gear selector lever in Park or Neutral.
6. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
7. If the voltage reading is 0.5 volt or less, perform Starter Motor - Ground Circuit Test in this section.
8. A voltage reading greater than 0.5 volt is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Remove the cables from the solenoid "B", "S" and "M" terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6.
9. If the voltage reading is still greater than 0.5 volt when checked at the "M" terminal, move the multimeter negative lead to the starter solenoid “B” terminal.
10. With the gear selector lever in Park or Neutral, engage the remote starter switch. Read and record the voltage.
11. If the voltage reading at the "B" terminal is lower than 0.5 volt, the concern is in the connections at the starter solenoid or in the solenoid contacts. Install a new starter motor.
    REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
12. If the voltage reading taken at the solenoid "B" terminal is greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is in the positive battery cable connection or in the positive battery cable itself. Clean the positive battery cable connections. If this does not resolve the concern, install a new positive battery cable. 414–01

Starter Motor - Positive Circuit Test

1. Connect the multimeter positive lead to the battery positive post. Connect the negative lead to the starter solenoid "M" terminal.

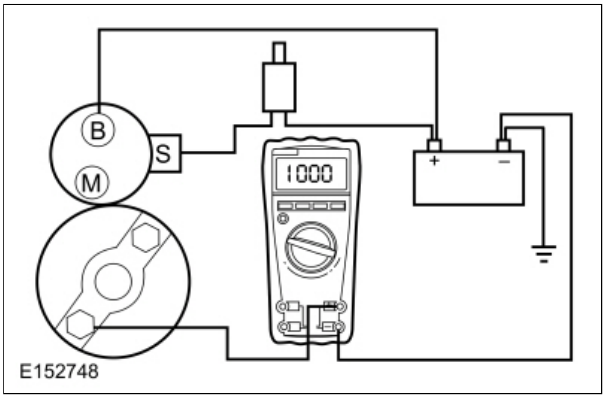


2. Place gear selector lever in Park or Neutral.
3. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
4. If the voltage reading is 0.5 volt or less, perform Starter Motor - Ground Circuit Test in this section.
5. A voltage reading greater than 0.5 volt is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Remove the cables from the solenoid "B", "S" and "M" terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6.
6. If the voltage reading is still greater than 0.5 volt when checked at the "M" terminal, move the multimeter negative lead to the starter solenoid “B” terminal and repeat Step 5.
7. If the voltage reading at the "B" terminal is lower than 0.5 volt, the concern is in the connections at the starter solenoid or in the solenoid contacts. Install a new starter motor.
   REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
8. If the voltage reading taken at the solenoid "B" terminal is greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is in the positive battery cable connection or in the positive battery cable itself. Clean the positive battery cable connections. If this does not resolve the concern, install a new positive battery cable.

Starter Motor - Ground Circuit Test

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. This procedure checks the voltage drop in the ground circuit.

1. Connect a remote starter switch between starter solenoid "S" terminal and the battery positive terminal.
2. Connect the multimeter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative battery terminal.
3. Place gear selector lever in Park or Neutral.
4. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.



5. If the voltage reading is greater than 0.5 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connections. Retest.
6. If the voltage reading is greater than 0.5 volt, install a new negative battery cable.
7. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.
   REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

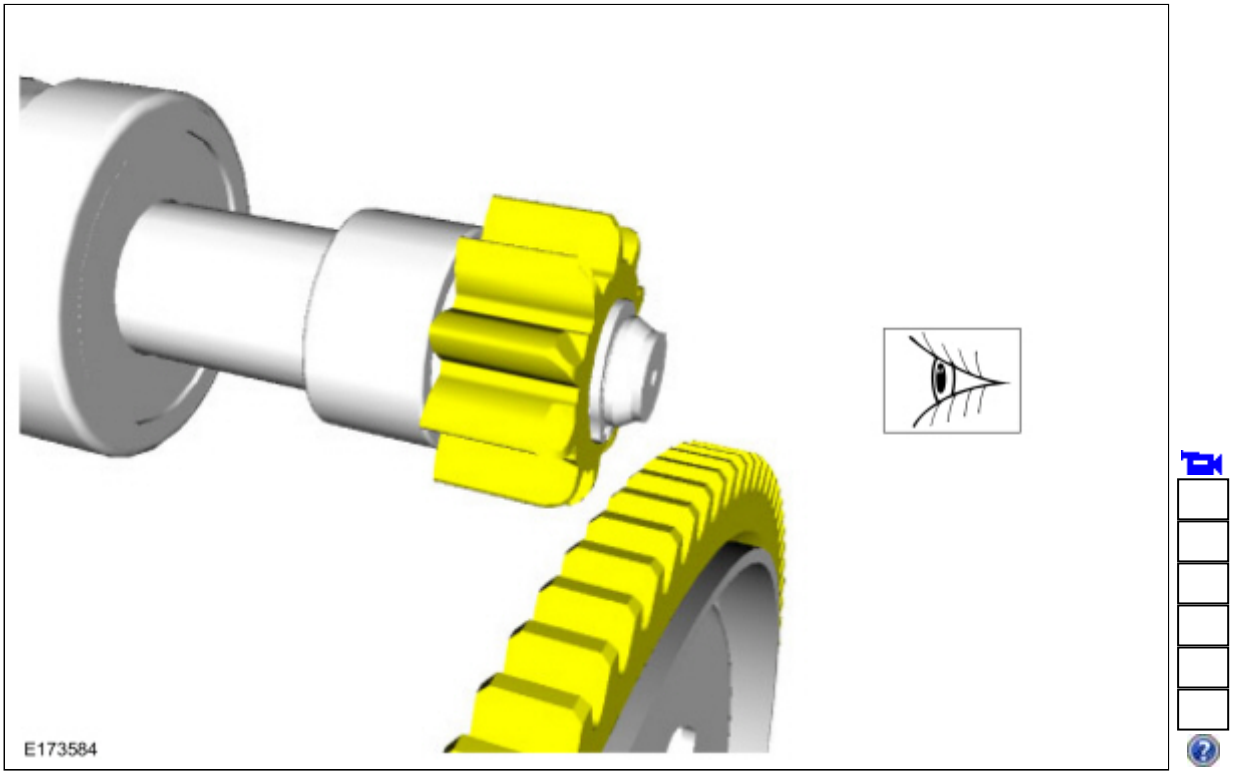
Copyright © 2016 Ford Motor Company

Starter Motor Drive Gear and Flywheel Ring Gear Inspection

Inspection

1. Remove the starter motor.
   Refer to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

2. Check the wear patterns on the starter drive gear and the flywheel or flexplate ring gear. If the wear pattern is normal, then install the starter motor.
   Refer to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).



3. If the starter motor drive gear and the flywheel or flexplate ring gear are not fully engaging and the starter motor drive gear is scored or damaged, then install a new starter motor.
   Refer to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

4. If the teeth on the flywheel or flexplate ring gear are scored or damaged, then install a new flywheel or flexplate.

Copyright © 2016 Ford Motor Company

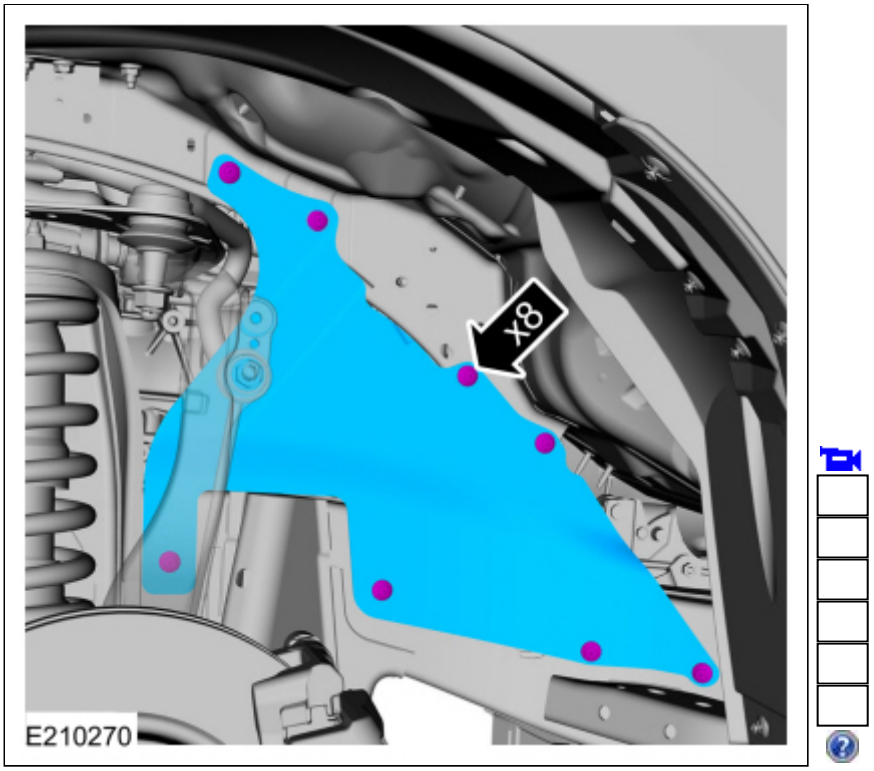
Starter Motor

Base Part Number: 11000

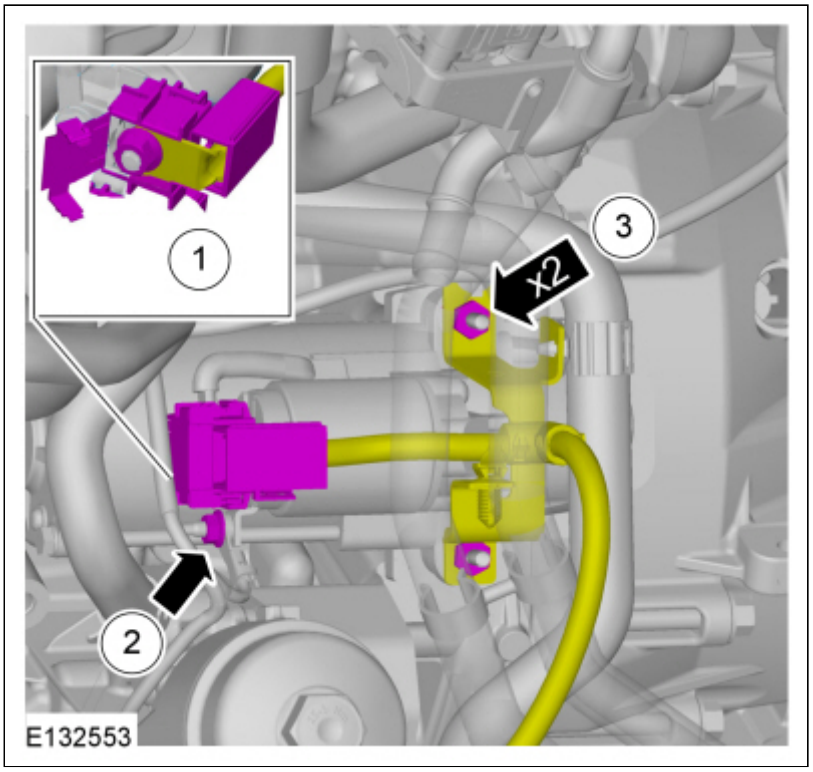
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

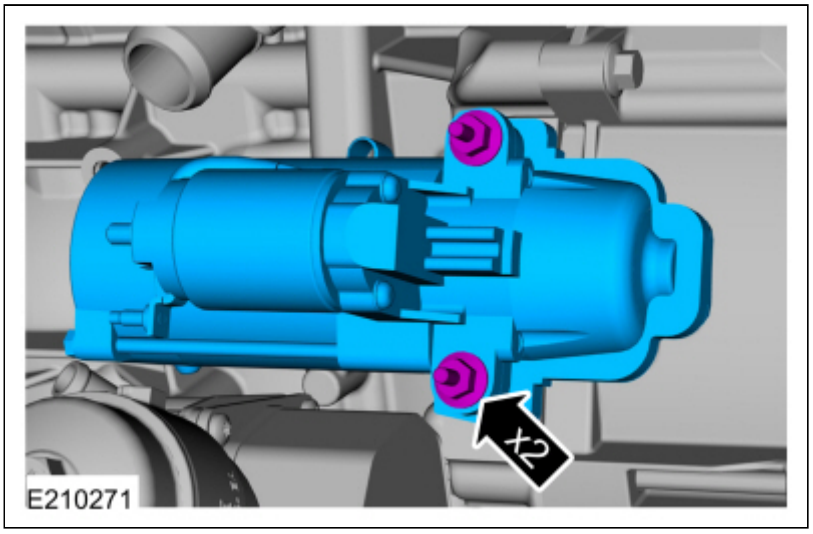
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove Front LH Wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.



1. *Torque*: 10 Nm
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



6. *Torque*: 35 Nm



7. Inspect the starter motor drive gear and flywheel ring gear.
   Refer to: Starter Motor Drive Gear and Flywheel Ring Gear Inspection (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Installation

1. To install, reverse the removal procedure.

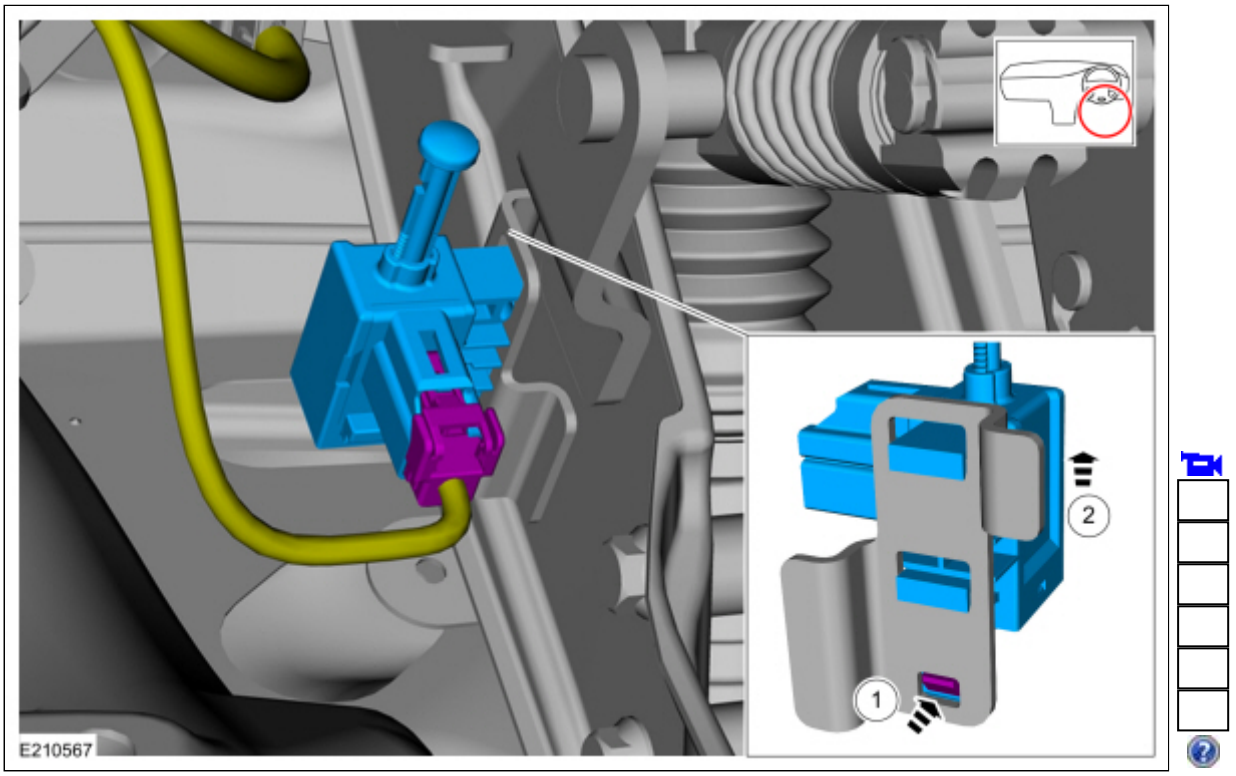
Copyright © 2016 Ford Motor Company

Start Inhibit Switch

Removal

NOTICE: Make sure that the clutch pedal remains in the rest position.

1.



Installation

1. **NOTICE: Make sure that the clutch pedal remains in the rest position.**

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Starting System - Overview

Starting System

The starting system controls the cranking of the engine. The starter motor is enabled by the starter relay when the relay is activated by the PCM. The PCM receives inputs from the ignition switch, TCM automatic transmission, CPP manual transmission and the BCM before activating the starter relay to initiate cranking of the engine.

Starting System-with Auto-Start-Stop

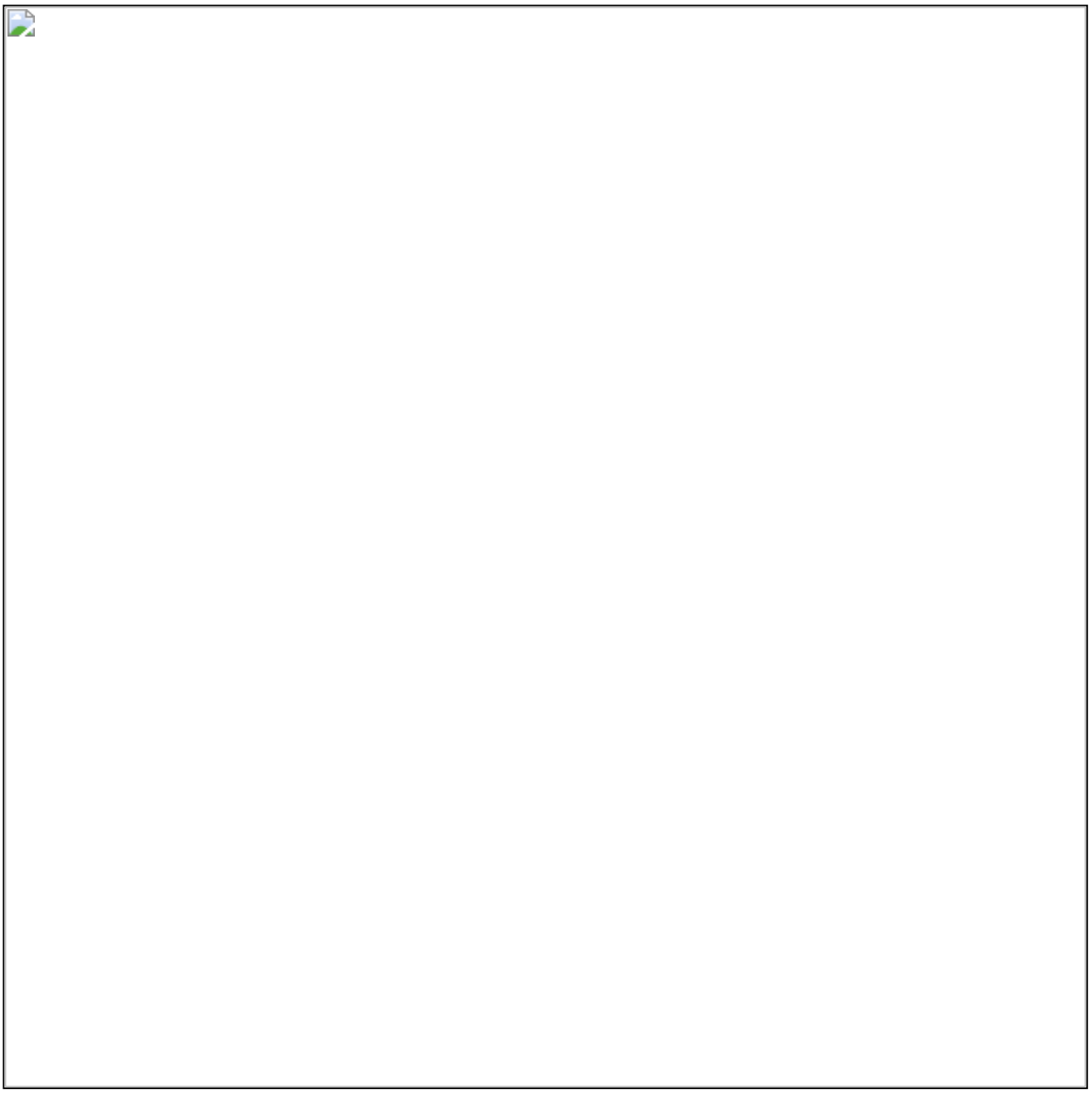
The Auto-Start-Stop system helps reduce fuel consumption by automatically shutting off the vehicle’s engine while the vehicle is at a complete stop and restarting the engine when the clutch pedal is pressed. The Auto-Start-Stop system is automatically enabled whenever the ignition is turned on. The vehicle may restart automatically in order to maintain interior comfort or to recharge the battery. Refer to the Owner's Literature for additional information.

Copyright © 2016 Ford Motor Company

Starting System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages Powertrain Control Module (PCM)

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	Provides the PCM with ignition mode.

Starting System

The starting system controls the cranking of the engine. Under normal operation, when the ignition is turned to

START, the PCM receives the following inputs:

- Request to crank engine message from the BCM .
- Voltage signal on the crank detect circuit from the ignition switch.
- PATS enable message from the BCM .
- Correct transmission park or neutral input from the automatic transmission
- Correct bottom of travel input from the CPP switch (manual transmission).

When the PCM receives the correct inputs, voltage and ground is supplied to the starter relay coil. When the starter relay coil is energized, it provides voltage to the starter solenoid, allowing the starter motor to crank the engine.

The PCM disengages the starter once an engine Revolutions Per Minute (RPM) threshold is reached, a set crank time is exceeded or the ignition is turned OFF.

Auto-Start-Stop System

The Auto-start-stop system helps reduce fuel consumption by automatically shutting off the vehicle's engine while the vehicle is idling at a complete stop, and restarting the engine when the clutch pedal is pressed. The system can be disabled through the auto-start-stop control switch. The Auto-start-stop system is automatically enabled whenever the ignition is turned on.

The engine automatically **stops** when:

- the vehicle is stopped, and
- the transmission is in neutral, and
- the clutch pedal and accelerator pedals are released.

The engine automatically **restarts** when:

- the clutch pedal is pressed.
- the Auto-start-stop system is disabled through the auto-start-stop control switch.
- the battery has a low state of charge.
- it is necessary to maintain interior comfort.
- the blower fan speed is increased or the climate control temperature is changed.
- an electrical accessory is turned on or plugged in.
- there is low brake vacuum.

The Auto-start-stop system may **not** turn the engine off under these conditions:

- the HVAC system is in A/C, heat or defrost modes.
- the rear defroster is on.
- the battery has a low state of charge.
- the battery temperature is below 5°C (41°F) or above 60°C (140°F).
- the engine temperature is below 46°C (115°F).
- the engine temperature is below 60°C (140°F) and the HVAC system is in heat mode.
- the steering wheel is turned rapidly or is at a sharp angle.
- vehicle speed of greater than 4 km/h (2.5 mph) for more than 2 seconds has not occurred.
- the vehicle is on a steep road grade.
- elevation is approximately above 3,048 meters (10,000 feet).

If the system detects a malfunction, it turns off and the OFF lamp on the auto-start-stop control switch illuminates continuously. If the OFF lamp remains on after an ignition cycle, a malfunction is indicated.

Refer to the Owner's Literature for additional information.

Passive Anti-theft System (PATS)

This vehicle may be equipped with PATS. PATS disables the engine from starting if an unprogrammed PATS key is used or an invalid PCM ID is received. The PATS is controlled by the BCM. If there is a PATS concern that disables the engine, the IPC displays a corresponding message in the message center.
Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Component Description

Body Control Module (BCM)

Refer to: Module Controlled Functions - Component Location (419-10 Multifunction Electronic Modules, Description and Operation).

Passive Anti-Theft Transceiver

If equipped with PATS,
Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Integrated Keyhead Transmitter (IKT)

If equipped with PATS,
Refer to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Ignition Switch

Refer to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Powertrain Control Module (PCM)

The PCM provides power and ground to the starter relay to initiate cranking of the engine.

Copyright © 2016 Ford Motor Company

Starting System

Inspection and Verification

1. Verify the customer concern by operating the starting system.
2. Before diagnosing or repairing the starting system inspect the following items:

- Check the battery for loose, damaged or corroded connections.
- Check the generator for loose, damaged or corroded connections.
- Check engine and battery grounds for loose, damaged or corroded connections.
- Check high current BJB for loose or corroded connections.
- Verify fuses or fusible links.
- Inspect wiring, terminals and connectors.

3. Check the battery condition and state of charge.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
4. Check for abnormal ignition-off current drain(s). Refer to section 414-01 Battery Drain Check
5. Remove the accessory drive belt.
   REFER to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Verify the crankshaft and each of the components driven by the accessory drive belt rotate and are not seized or damaged.
6. If any aftermarket accessories have been added to the vehicle, make sure they are properly wired.
7. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.
8. Using the diagnostic scan tool, retrieve all Diagnostic Trouble Codes (DTCs). Refer to the appropriate DTC Chart in this section.

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action
P06E9	Engine Starter Performance	If the engine cranks, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. GO to Pinpoint Test A
P0850	Park / Neutral Switch Input Circuit	GO to Pinpoint Test A
All Other DTCs	—	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

BCM DTC Chart

DTC	Description	Action
B10E5:11	PCM Wake-up Signal: Circuit Short to Ground	GO to Pinpoint Test C
All Other DTCs	—	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Starting System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The engine does not crank	Refer to the Pinpoint Test	GO to Pinpoint Test A
The engine cranks slowly	Refer to the Pinpoint Test	CARRY OUT the starter system component test. Refer to Starter Motor - Positive Circuit Test in this section.
The engine cranks but will not start	Ignition fault	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Unusual starter noise	Refer to the Pinpoint	GO to Pinpoint Test B

	Test	
The starter spins but the engine does not crank	Starter motor	INSPECT the starter motor mounting and engagement. REPAIR as necessary.
	Damaged flexplate	INSPECT the flexplate for damaged, missing or worn teeth. REPAIR as necessary.
The starter does not disengage from the flexplate	• Starter relay • Wiring, terminals or connectors	REMOVE the starter relay. If the engine stops cranking, INSTALL a new relay. If the engine continues to crank, REPAIR circuit CDC25AB (BN/GN) for a short to voltage.

Pinpoint Tests

Engine Does Not Crank

Refer to Wiring Diagrams Cell 20 for schematic and connector information.

Normal Operation and Fault Conditions

For more information,
REFER to: Starting System - System Operation and Component Description (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P06E9	Engine Starter Performance	This DTC sets in the PCM when no engine rotation is detected during crank event.

Possible Sources

- Battery
- Battery cables
- Starter motor
- BJB starter relay

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse 84 (30A).
- Verify the high current BJB fuse 1 (470A).
- Verify the BCM fuse 3 (15A).

PINPOINT TEST A : ENGINE DOES NOT CRANK

A1 PERFORM INSPECTION AND VERIFICATION

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *If it is necessary to leave the battery charger connected during testing, do not leave it on its highest or boost setting. The highest settings can exceed 16 volts, resulting in false test results and setting of Diagnostic Trouble Codes (DTCs).*

- Perform Inspection and Verification procedure in this section.

Was an obvious cause for an observed or reported concern found?

Yes	Correct the cause as necessary.
No	GO to A2

A2 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform self-tests for:
  - BCM
  - TCM
  - PCM

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	For all TCM Diagnostic Trouble Codes (DTCs), REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). For all PCM Diagnostic Trouble Codes (DTCs), GO to A3 For all BCM Diagnostic Trouble Codes (DTCs), REFER to the BCM DTC Chart in this section.
No	GO to A3

A3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) ENGINE CRANKING (ENG_CRANK) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Make sure the transmission is in PARK or NEUTRAL.
- Using a diagnostic scan tool, view the PCM PID ENG_CRANK, with the key in the START position.

Does the PCM PID ENG_CRANK change from Inactive to Active?

Yes	GO to A6
No	GO to A4

A4 CHECK THE CRANK DETECT CIRCUIT FOR VOLTAGE AT THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition OFF.
- Disconnect PCM C1232A.
- With the key in the START position, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-47		Ground

Is the voltage greater than 11 volts?

Yes	GO to A19
No	GO to A5

A5 CHECK THE IGNITION SWITCH

- Ignition OFF.
- Carry out the Ignition Switch Component Test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the ignition switch pass the component test?

Yes	REPAIR circuit CDC35DA (BU/WH) for an open.
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

A6 CHECK THE TCM (TRANSMISSION CONTROL MODULE) TR_CRANK PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, while viewing the TCM PID TR_CRANK, place the gear selector in PARK and then NEUTRAL.

Does the TCM PID TR_CRANK read YES in both positions?

Yes	GO to A8
No	DIAGNOSE the TR sensor, REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

A7 CHECK THE PCM (POWERTRAIN CONTROL MODULE) IN_GEAR PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- While observing the PCM PID IN_GEAR, place the gear selector in PARK and then NEUTRAL.

Does the PID read No in both positions?

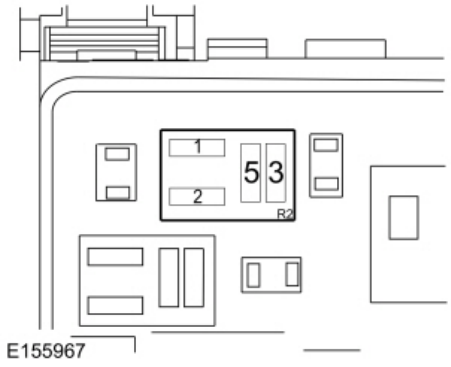
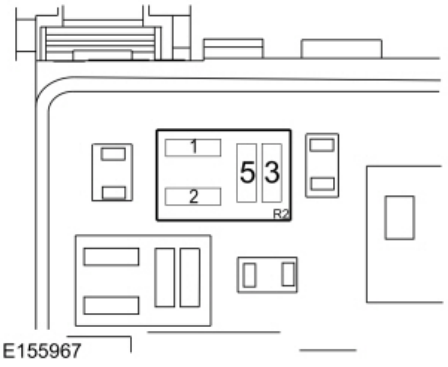
Yes	GO to A8
No	Diagnose the TR sensor, REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

A8 CHECK THE STARTER RELAY CONTROL OPERATION

NOTICE: The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

- Remove the BJB starter relay.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

 BJB starter relay pin 1		 BJB starter relay pin 2

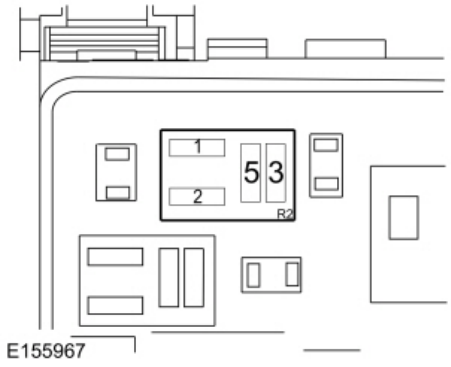
- Make sure the transmission is in PARK or NEUTRAL.
- With the key in the START position, observe the test light.

Does the test light illuminate when the key is in the START position?

Yes	GO to A9
No	GO to A16

A9 CHECK THE VOLTAGE TO THE STARTER RELAY

- Measure:

Positive Lead	Measurement / Action	Negative Lead
 BJB starter relay pin 3		Ground

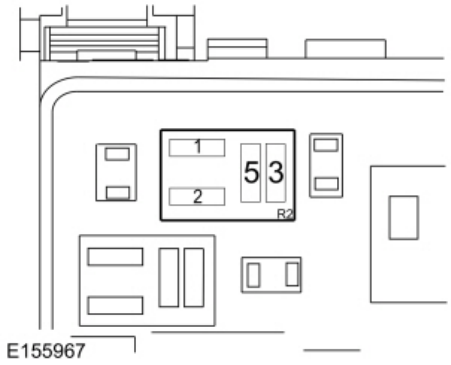
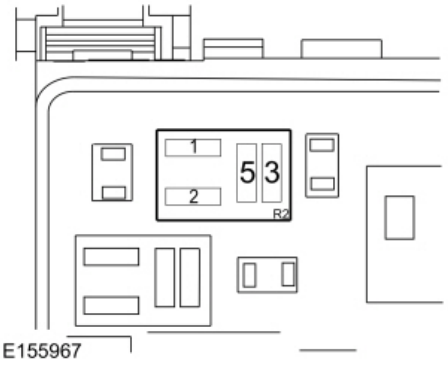
Is the voltage greater than 11 volts?

Yes	GO to A10
No	VERIFY BJB fuse 84 (30A) is OK. If OK, REPAIR the circuit for an open. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A10 CHECK THE STARTER MOTOR OPERATION AT THE STARTER RELAY

- Ignition OFF.
- With the transmission in PARK or NEUTRAL, momentarily connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead

 BJB starter relay pin 3		 BJB starter relay pin 5

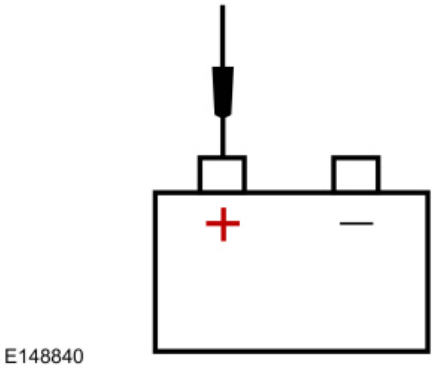
-

Did the starter engage and the engine crank?

Yes	INSTALL a new starter relay.
No	GO to A11

A11 CHECK THE BATTERY GROUND CABLE

- Measure:

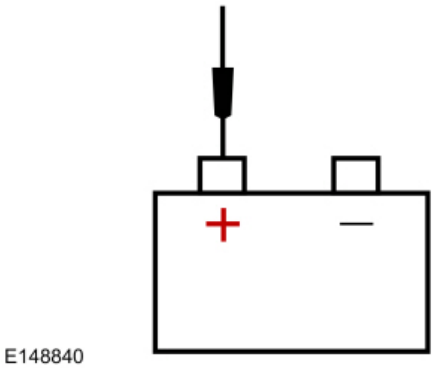
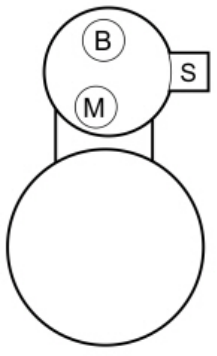
Positive Lead	Measurement / Action	Negative Lead
		Ground C1100

Are the voltages greater than 11 volts?

Yes	GO to A12
No	CLEAN or INSTALL a new negative battery cable as necessary.

A12 CHECK THE STARTER MOTOR GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
		 Starter motor case

Is the voltage greater than 11 volts?

Yes	GO to A13
No	CLEAN the starter motor mounting flange and MAKE SURE the starter motor is correctly mounted.

A13 CHECK THE VOLTAGE TO THE STARTER MOTOR

- Measure:

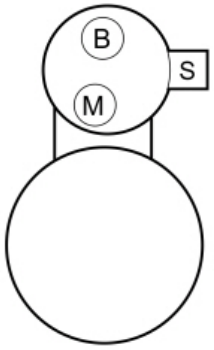
Positive Lead	Measurement / Action	Negative Lead
C197C	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A14
No	CLEAN the high current BJB connection to the battery post. CLEAN or REPAIR a positive battery cable as necessary.

A14 CHECK THE STARTER MOTOR FOR CORRECT OPERATION

- Ignition OFF.
- Connect a remote starter switch between the starter solenoid C1715A-1 ("B" terminal) and C1715B-1 ("S" terminal).



E148837

- With the transmission in PARK or NEUTRAL, momentarily engage the starter.

Did the starter engage and the engine crank?

Yes	GO to A15
No	INSTALL a new starter, REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

A15 CHECK FOR START INPUT AT THE STARTER

- Connect BJB starter relay.
- Disconnect Starter solenoid C197C.
- With the key in the START position, measure:

Positive Lead	Measurement / Action	Negative Lead
C197C-1	V	Ground

Is the voltage greater than 11 volts?

Yes	CLEAN the starter solenoid "S" terminal and starter solenoid connector. CHECK the wiring and the starter motor for a loose or intermittent connection.
No	REPAIR the circuit for an open.

A16 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CIRCUITS FOR A SHORT TO POWER

- Ignition OFF.
- Disconnect PCM C1232A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-37	V	Ground

C1232A-25		Ground

Is any voltage present?

Yes	REPAIR the affected circuit.
No	GO to A17

A17 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-37	Ω	Ground
C1232A-25	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A18
No	REPAIR the affected circuit.

A18 CHECK THE PCM (POWERTRAIN CONTROL MODULE) STARTER RELAY CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-37	Ω	BJB start relay pin 1
C1232A-25	Ω	BJB start relay pin 2

Are the resistances less than 3 ohms?

Yes	GO to A19
No	REPAIR the affected circuit.

A19 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Unusual Starter Noise

Normal Operation and Fault Conditions

Correct starter operation relies on correct mounting of the starter to the engine, alignment of the starter ring gear to the flexplate and correct functioning of the starter assembly (internal gears, bearings).

Possible Sources

- Engine
- Starter motor
- Starter motor mounting

Visual Inspection and Diagnostic Pre-checks

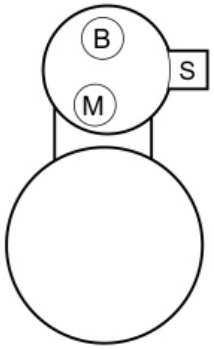
- Inspect the starter motor.
- Inspect the starter motor mounting.

PINPOINT TEST B : UNUSUAL STARTER NOISE

B1 CHECK THE STARTER MOUNTING
• Inspect the starter mounting bolts for looseness. **Is the starter motor mounted securely?**

Yes	GO to B2
No	INSTALL the starter motor securely. REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

B2 CHECK FOR ENGINE NOISE
• Ignition OFF. • Connect a remote starter switch between the starter solenoid C197C ("B" terminal) and C197C-1 ("S" terminal).



E148837

- Engage the starter and verify the noise is due to starter operation.

Is the noise due to the starter engagement?

Yes	REFER to: Starter Motor Drive Gear and Flywheel Ring Gear Inspection (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
No	REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). to continue diagnosis.

B10E5:11

Refer to Wiring Diagrams Cell 23 for schematic and connector information.

Normal Operation and Fault Conditions

The wake-up control circuit wakes up the PCM prior to engine cranking to allow it time to initialize. The wake-up control circuit is activated by the BCM when the driver door is opened, a key is inserted into the ignition, or when the ignition is in the ON or START position.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10E5:11	PCM Wake-up Signal: Circuit Short to Ground	This DTC sets in the BCM when a short to ground is detected on the wake-up control circuit.

Possible Sources

- BCM
- PCM
- Wiring, terminals or connectors

PINPOINT TEST C : B10E5:11

C1 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR A SHORT TO GROUND
• Ignition OFF. • Disconnect PCM C1232A. • Ignition ON. • Using a diagnostic scan tool, clear the BCM Continuous Diagnostic Trouble Codes (DTCs). • Using a diagnostic scan tool, perform BCM self-test. **Is BCM DTC B10E5:11 present?**

Yes	GO to C2
No	GO to C6

C2 CHECK THE PCM (POWERTRAIN CONTROL MODULE) WAKE-UP SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280C.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-28		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C3

C3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) WAKE-UP SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-28	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE PCM (POWERTRAIN CONTROL MODULE) WAKE-UP SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-28	Ω	C2280C-18

Is the resistance less than 3 ohms?

Yes	GO to C5
No	REPAIR the circuit.

C5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

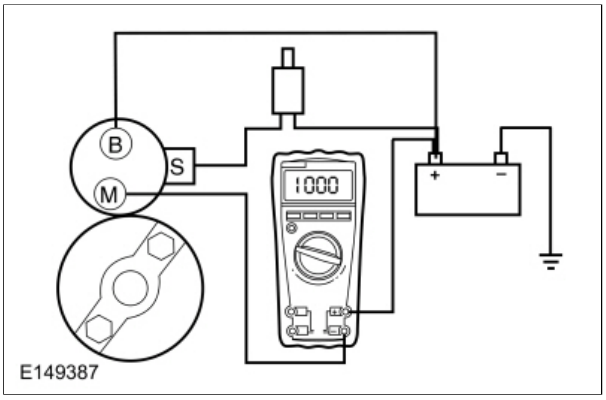
Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Component Test(s)

Starter Motor - Positive Circuit Test

NOTE: *Always make the multimeter connection at the component terminal rather than at the wiring end of the connector. Making a connection at the wiring end of the connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and component.*

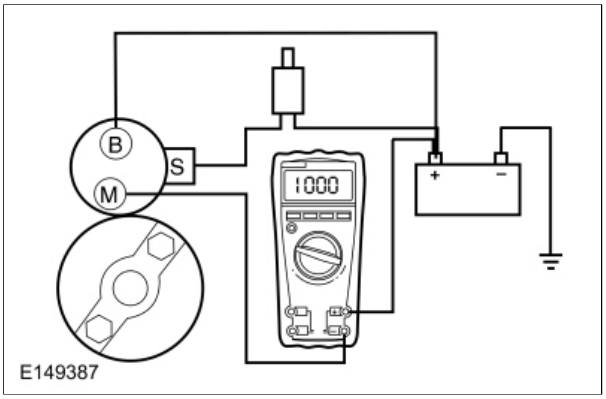
1. Make sure the battery is fully charged. Refer to 414-01
2. Perform a battery drain test. Refer to 414-01
3. Connect a remote starter switch between starter solenoid “S” terminal and the battery positive terminal.
4. Connect the multimeter positive lead to the battery positive post. Connect the negative lead to the starter solenoid "M" terminal.



5. Place gear selector lever in Park or Neutral.
6. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
7. If the voltage reading is 0.5 volt or less, perform Starter Motor - Ground Circuit Test in this section.
8. A voltage reading greater than 0.5 volt is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Remove the cables from the solenoid "B", "S" and "M" terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6.
9. If the voltage reading is still greater than 0.5 volt when checked at the "M" terminal, move the multimeter negative lead to the starter solenoid “B” terminal.
10. With the gear selector lever in Park or Neutral, engage the remote starter switch. Read and record the voltage.
11. If the voltage reading at the "B" terminal is lower than 0.5 volt, the concern is in the connections at the starter solenoid or in the solenoid contacts. Install a new starter motor.
    REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
12. If the voltage reading taken at the solenoid "B" terminal is greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is in the positive battery cable connection or in the positive battery cable itself. Clean the positive battery cable connections. If this does not resolve the concern, install a new positive battery cable. 414–01

Starter Motor - Positive Circuit Test

1. Connect the multimeter positive lead to the battery positive post. Connect the negative lead to the starter solenoid "M" terminal.

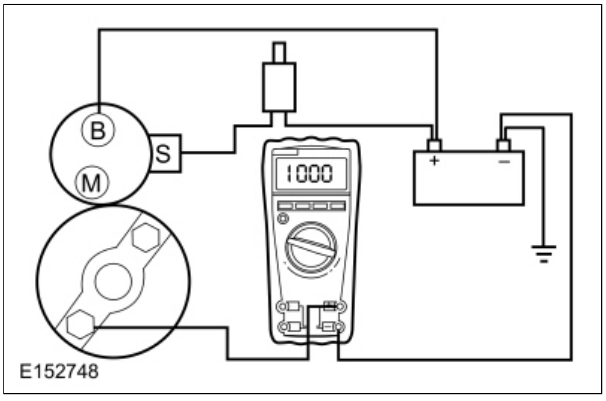


2. Place gear selector lever in Park or Neutral.
3. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.5 volt or less.
4. If the voltage reading is 0.5 volt or less, perform Starter Motor - Ground Circuit Test in this section.
5. A voltage reading greater than 0.5 volt is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Remove the cables from the solenoid "B", "S" and "M" terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6.
6. If the voltage reading is still greater than 0.5 volt when checked at the "M" terminal, move the multimeter negative lead to the starter solenoid “B” terminal and repeat Step 5.
7. If the voltage reading at the "B" terminal is lower than 0.5 volt, the concern is in the connections at the starter solenoid or in the solenoid contacts. Install a new starter motor.
   REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
8. If the voltage reading taken at the solenoid "B" terminal is greater than 0.5 volt after cleaning the cables and connections at the solenoid, the concern is in the positive battery cable connection or in the positive battery cable itself. Clean the positive battery cable connections. If this does not resolve the concern, install a new positive battery cable.

Starter Motor - Ground Circuit Test

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. This procedure checks the voltage drop in the ground circuit.

1. Connect a remote starter switch between starter solenoid "S" terminal and the battery positive terminal.
2. Connect the multimeter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative battery terminal.
3. Place gear selector lever in Park or Neutral.
4. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.



5. If the voltage reading is greater than 0.5 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connections. Retest.
6. If the voltage reading is greater than 0.5 volt, install a new negative battery cable.
7. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.
   REFER to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

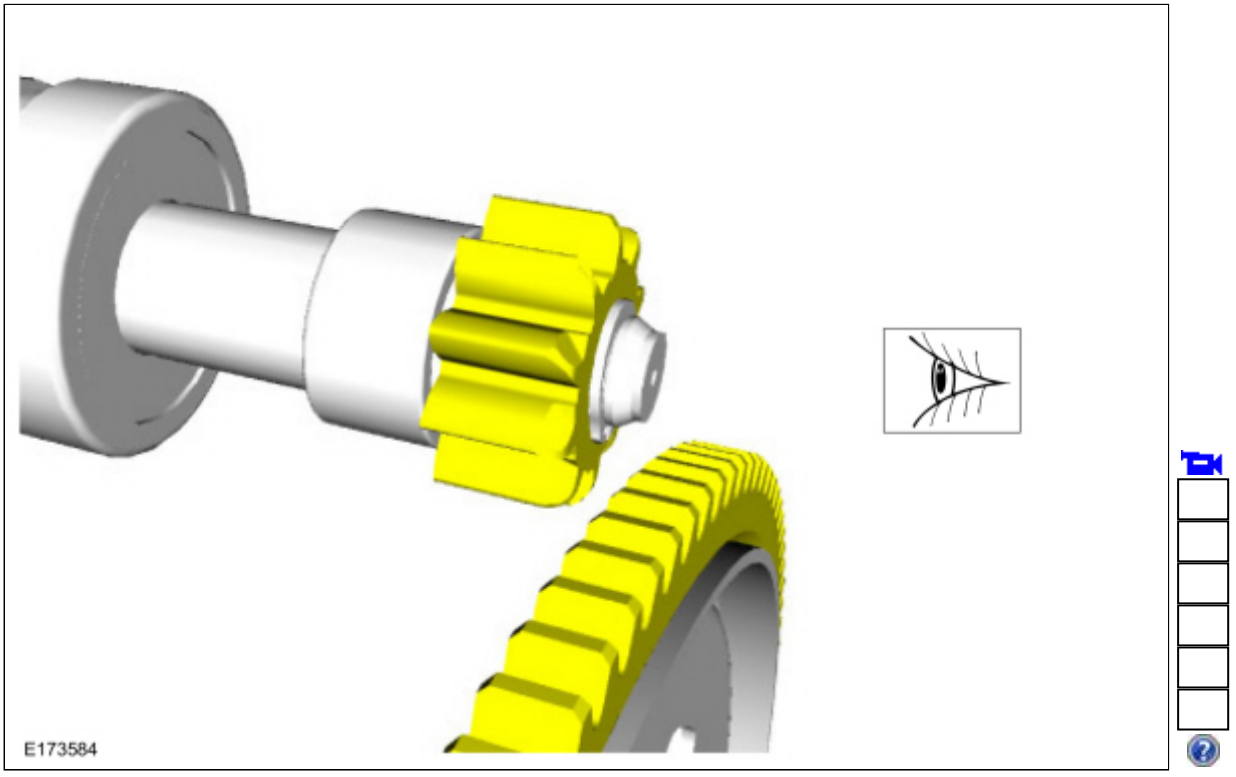
Copyright © 2016 Ford Motor Company

Starter Motor Drive Gear and Flywheel Ring Gear Inspection - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

Inspection

1. Remove the starter motor.
   Refer to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

2. Check the wear patterns on the starter drive gear and the flywheel or flexplate ring gear. If the wear pattern is normal, then install the starter motor.
   Refer to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).



3. If the starter motor drive gear and the flywheel or flexplate ring gear are not fully engaging and the starter motor drive gear is scored or damaged, then install a new starter motor.
   Refer to: Starter Motor (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

4. If the teeth on the flywheel or flexplate ring gear are scored or damaged, then install a new flywheel or flexplate.

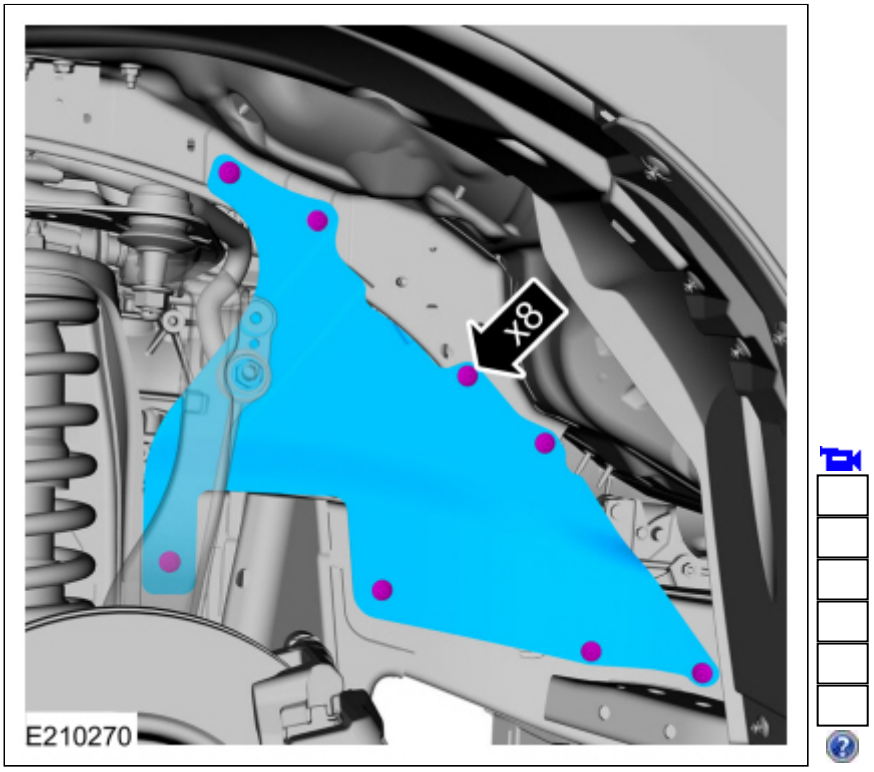
Copyright © 2016 Ford Motor Company

Starter Motor

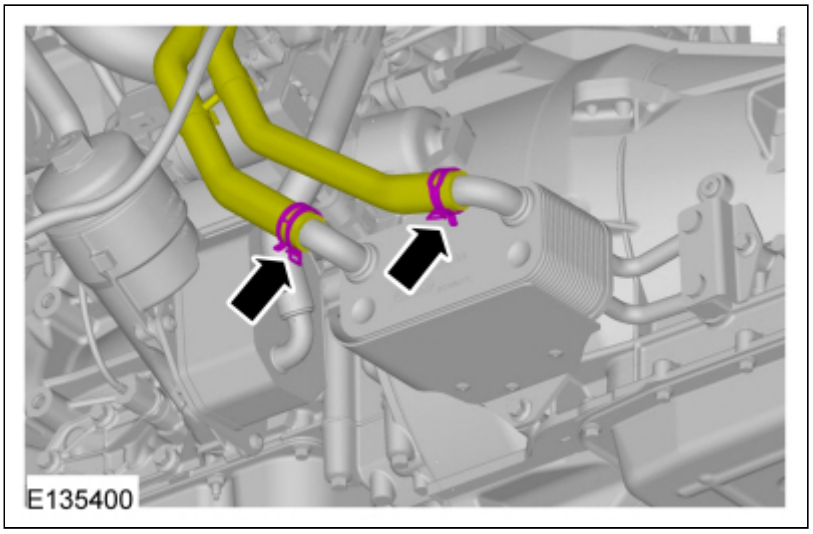
Base Part Number: 11000

Removal

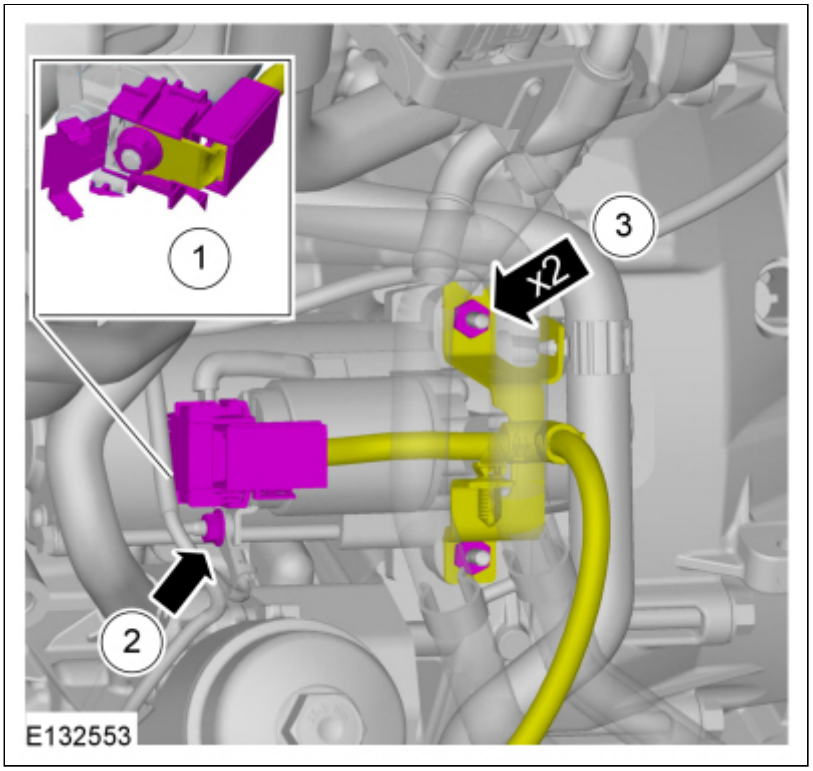
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove Front LH Wheel only.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

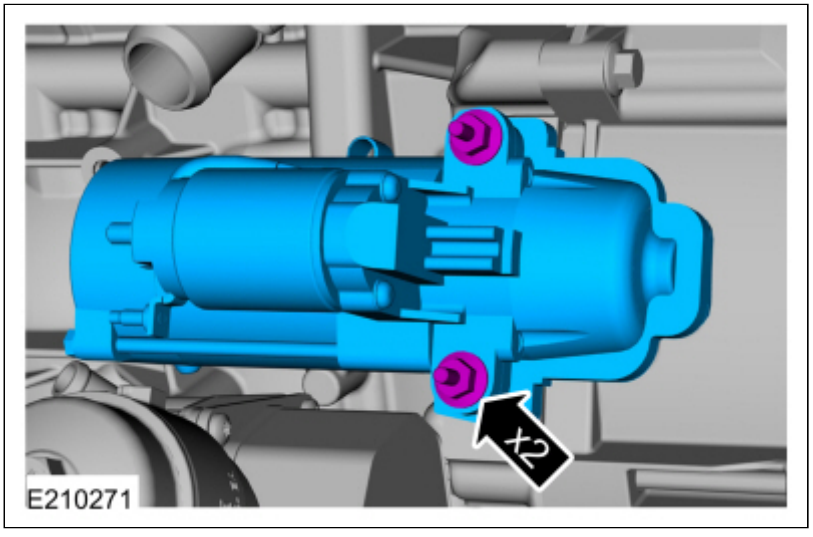
5. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
6.



1. *Torque*: 10 Nm
2. *Torque*: 10 Nm
3. *Torque*: 10 Nm



8. *Torque*: 35 Nm



9. Inspect the starter motor drive gear and flywheel ring gear.
   Refer to: Starter Motor Drive Gear and Flywheel Ring Gear Inspection (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Installation

1. To install, reverse the removal procedure.

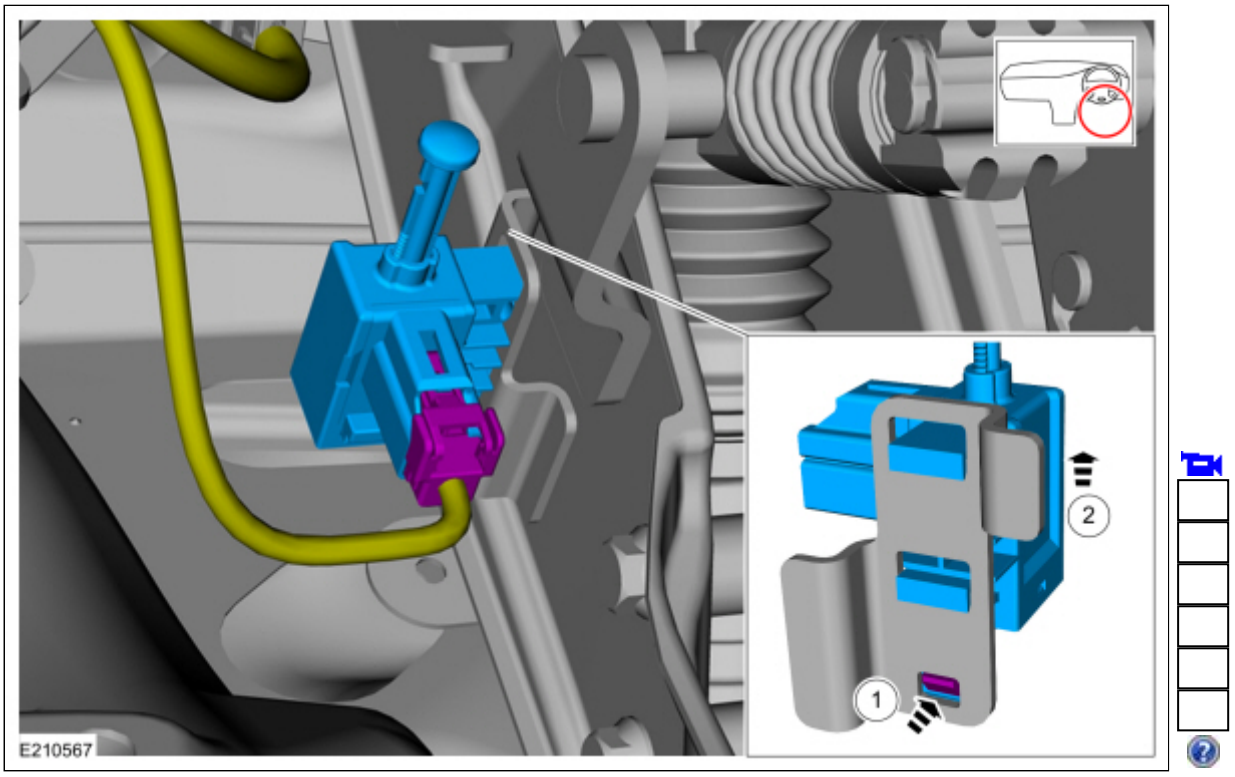
Copyright © 2016 Ford Motor Company

Start Inhibit Switch

Removal

NOTICE: Make sure that the clutch pedal remains in the rest position.

1.



Installation

1. **NOTICE: Make sure that the clutch pedal remains in the rest position.**

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Torque Specifications

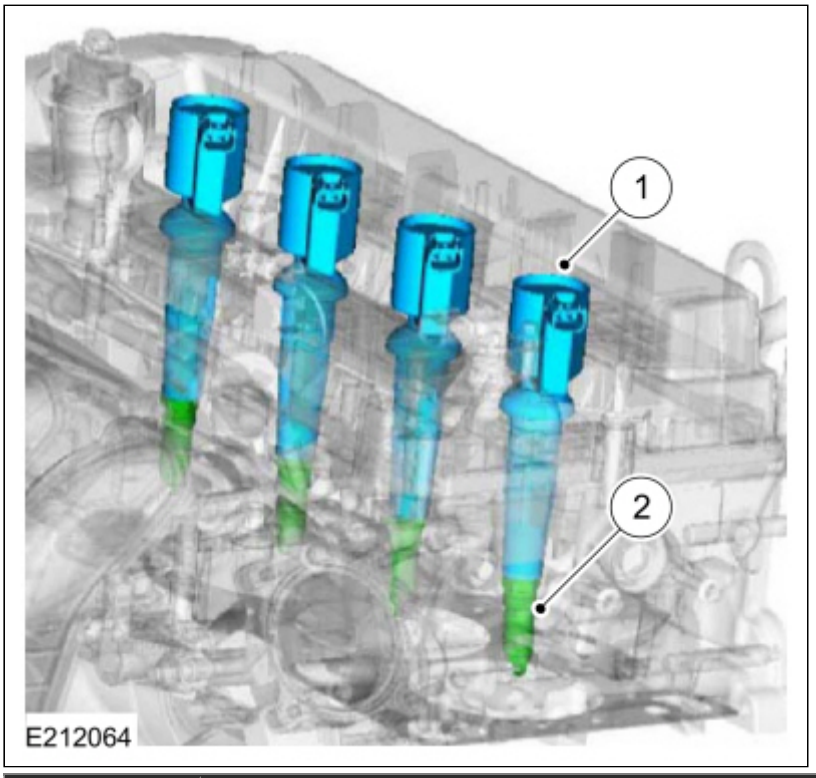
Item	Nm	lb-ft	lb-in
Ignition coil-on-plug retaining bolt(s)	8	-	71
Spark plug(s)	12	-	106

Item	mm
Spark plug gap	1,3

Copyright © 2016 Ford Motor Company

Engine Ignition - Component Location

Component Location - 2.5L Duratec



Item	Description
1	Ignition coil-on-plug(s)
2	Spark plug(s)

Copyright © 2016 Ford Motor Company

Engine Ignition - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Engine Ignition

Refer to Wiring Diagrams Section 303-14A for schematic and connector information.

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Circuit(s) • Wiring harness • Electrical connector(s) • Spark plug(s) • Ignition coil-on-plug(s) • Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Engine misfire	• Spark plug(s). • Ignition coil-on-plug(s) • PCM. • PCM calibration.	• REFER to the Ford diagnostic equipment.
	• Low cylinder compression.	• CARRY OUT an engine compression test. REFER to: Engine (303-01A) .
	• Worn or damaged valve(s), tappet(s) or camshaft(s).	• REMOVE the cylinder head. REFER to: Cylinder Head (303-01A) . INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage.
	• Low fuel pressure. • Fuel injector(s) • Fuel rail. • Fuel pressure sensor.	• REFER to: Fuel Charging and Controls (303-04A) .
• Engine stumbling	• Spark plug(s). • Ignition coil-on-plug(s) • PCM. • PCM calibration.	• REFER to the Ford diagnostic equipment.
	• Low cylinder compression.	• CARRY OUT a engine compression test. REFER to: Engine (303-01A) .
	• Worn or damaged valve(s),	• REMOVE the cylinder head.

	tappet(s) or camshaft(s).	REFER to: Cylinder Head (303-01A) . INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage.
	• Low fuel pressure. • Fuel injector(s) • Fuel rail. • Fuel pressure sensor.	• REFER to: Fuel Charging and Controls (303-04A) .
• Engine lacks power	• Spark plug(s). • Ignition coil-on-plug(s)	• REFER to the Ford diagnostic equipment.
	• Low cylinder compression.	• CARRY OUT an engine compression test. REFER to: Engine (303-01A) .
	• Worn or damaged valve(s), tappet(s) or camshaft(s).	• REMOVE the cylinder head. REFER to: Cylinder Head (303-01A) . INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage.
	• Low fuel pressure. • Fuel injector(s) • Fuel rail. • Fuel pressure sensor.	• REFER to: Fuel Charging and Controls (303-04A) .

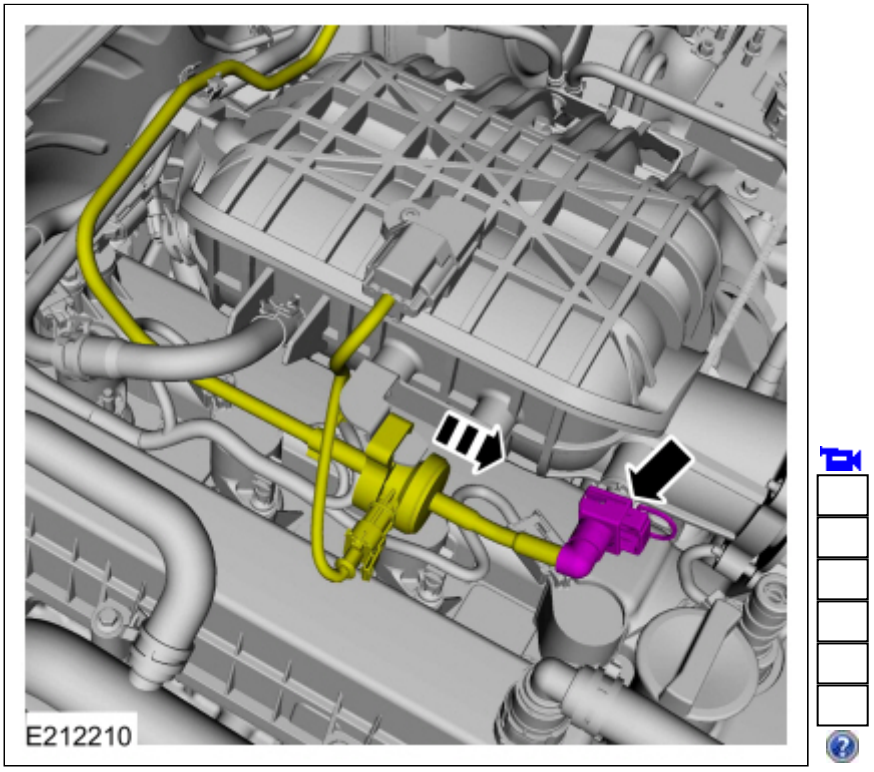
Copyright © 2016 Ford Motor Company

Ignition Coil-On-Plug

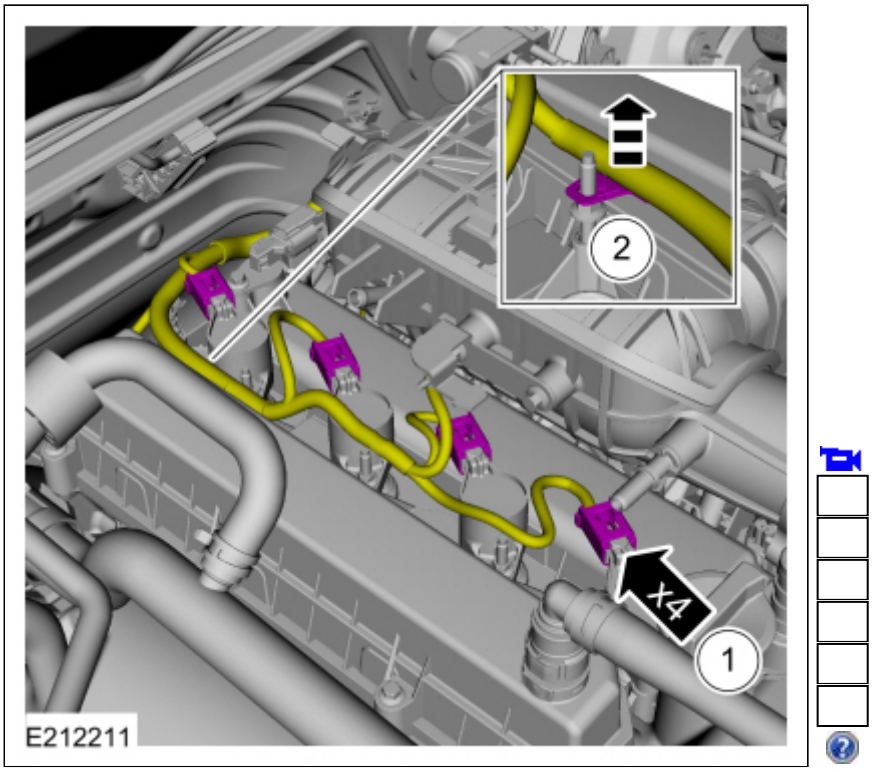
Base Part Number: 12A366

Removal

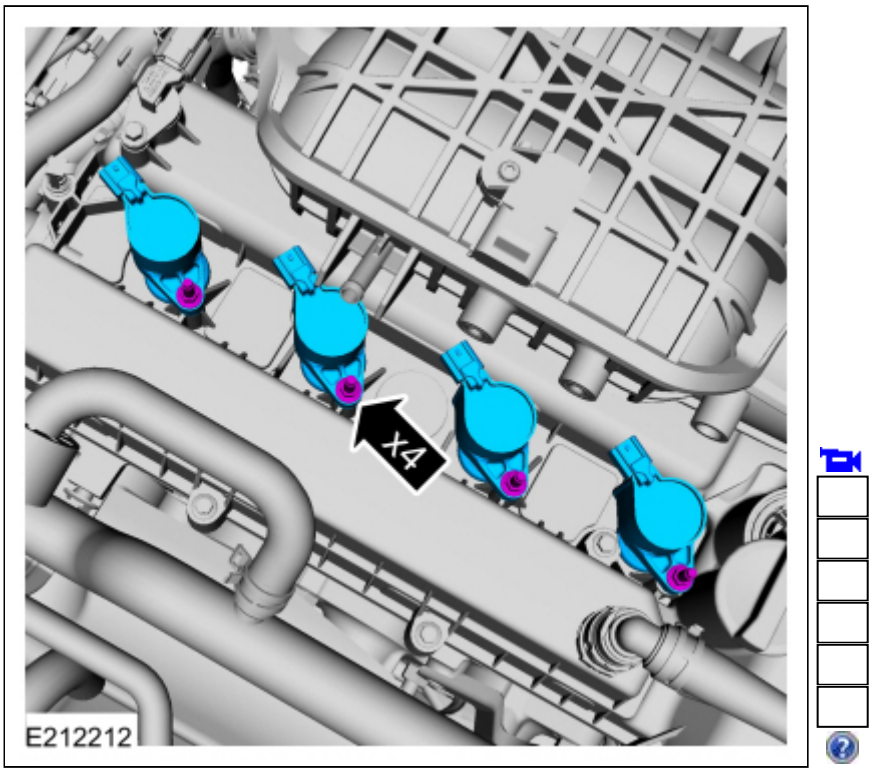
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3.



1. *Torque*: 8 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Spark Plugs

Base Part Number: 12405

Removal

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Ignition Coil-On-Plug (303-07A Engine Ignition - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. **NOTICE: Do not remove the spark plugs when the engine is hot or cold soaked. Spark plug thread or cylinder head damage can occur. Make sure the engine is warm (hand touch after cooling down) prior to spark plug removal.**

   NOTICE: Only use hand tools when removing or installing the spark plugs, or damage can occur to the cylinder head or spark plug.

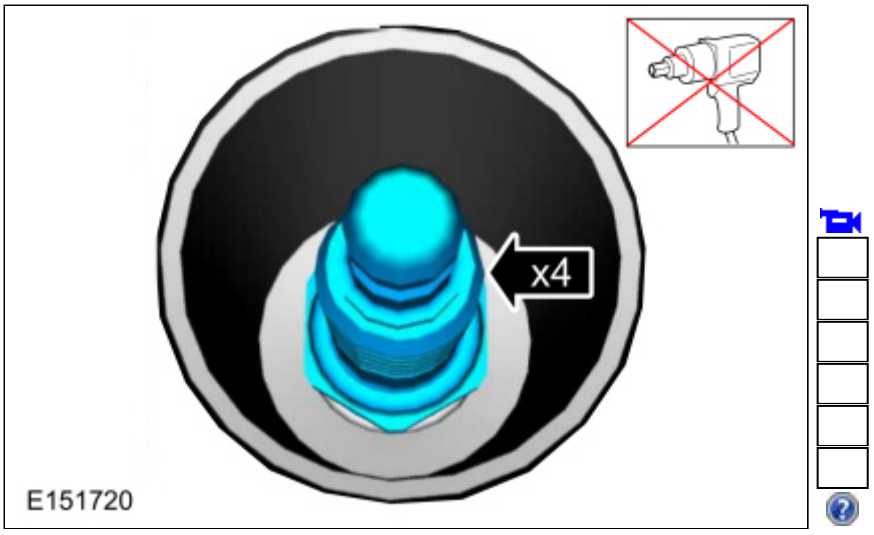
   NOTICE: The spark plug procedure must be followed exactly or damage to the cylinder head and spark plug will result.

   NOTICE: The spark plug must be securely held in an assembly aid or tool to prevent the spark plug from falling into the spark plug well which may damage the spark plug or the cylinder head.

   NOTICE: If a spark plug is dropped, internal damage may result and the spark plug must be discarded. The use of a damaged spark plug may cause engine damage to occur.

   NOTE: *Use compressed air to remove any foreign material in the spark plug well before removing the spark plugs.*

   Torque: 12 Nm

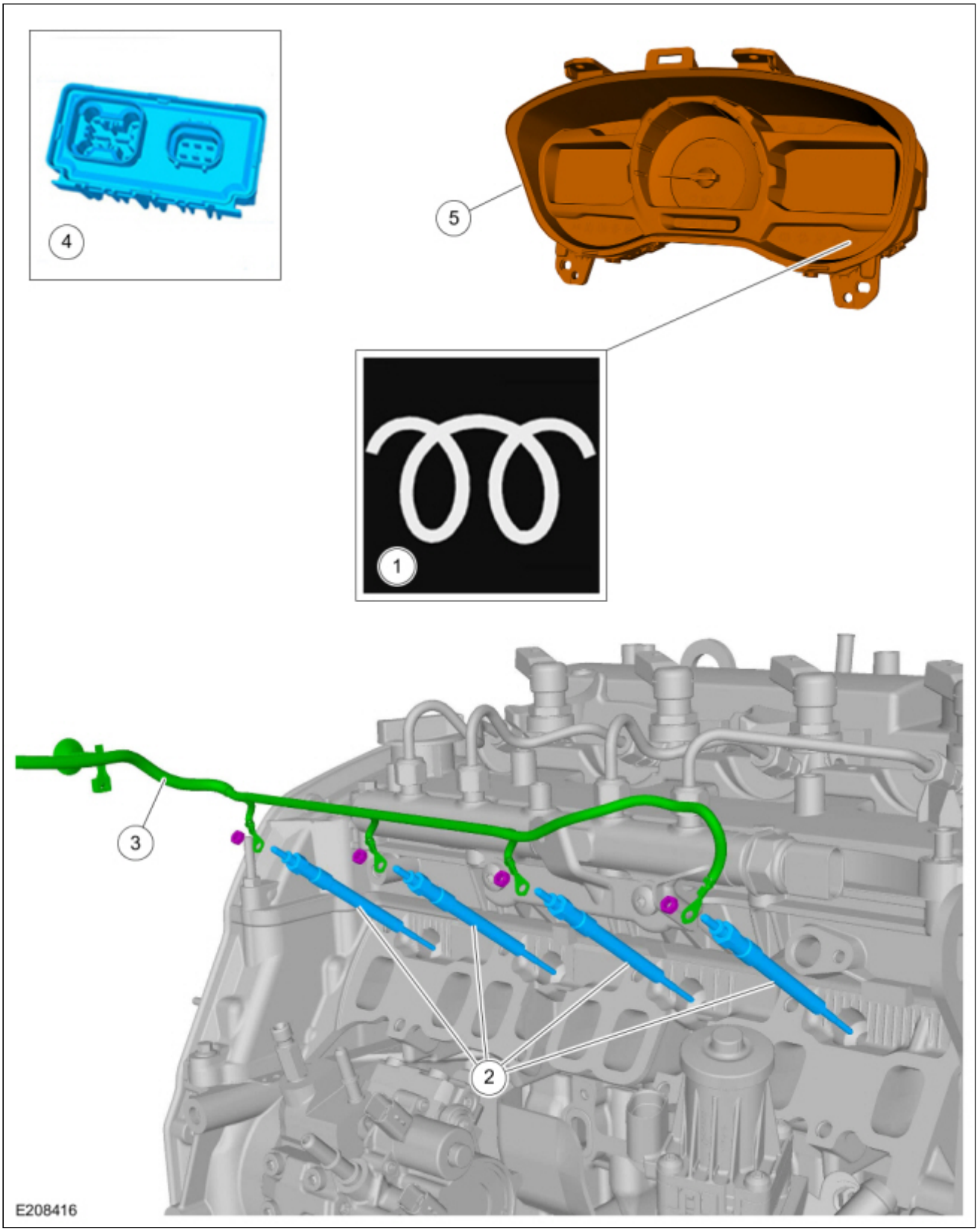


Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Glow Plug System - Component Location



Item	Part Number	Description

1	—	Glow plug indicator lamp
2	—	Glow plug(s)
3	—	Glow plug wire
4	—	Glow plug relay
5	—	Instrument cluster

Glow Plugs

The glow plugs are located in the side of the cylinder head and aid engine starting and efficiency. The glow plugs and the glow plug indicator lamp are controlled by the powertrain control module (PCM).

The glow plugs preheat the combustion chambers, which aids cold starting. During the preheat stage, the PCM receives an engine temperature signal from the cylinder head temperature (CHT) sensor and this determines the preheat time. The lower the temperature, the longer the preheat time. There is a maximum preheat time of 8 seconds at -20°C or lower. At temperatures above 80°C there is no preheat phase.

Once the engine has started, the glow plugs enter an after-glow phase. The after-glow phase helps to improve idling and reduce hydrocarbon emissions through more efficient combustion just after starting. The after-glow phase only operates at engine speeds below 2500 RPM, above that, the after-glow phase is interrupted to increase the durability of the glow plugs. There is a maximum after-glow time of 30 seconds at -20°C or lower. At temperatures above 50°C there is no after-glow phase.

Copyright © 2016 Ford Motor Company

Glow Plug System - System Operation and Component Description

System Operation

Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Glow Plug System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. For information about these,
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

For PCM DTC,
REFER to: Electronic Engine Controls (303-14B) .
REFER to: Electronic Engine Controls (303-14C) .
See DTC Chart: PCM Code List.

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Glow Plugs

Base Part Number: 6M090

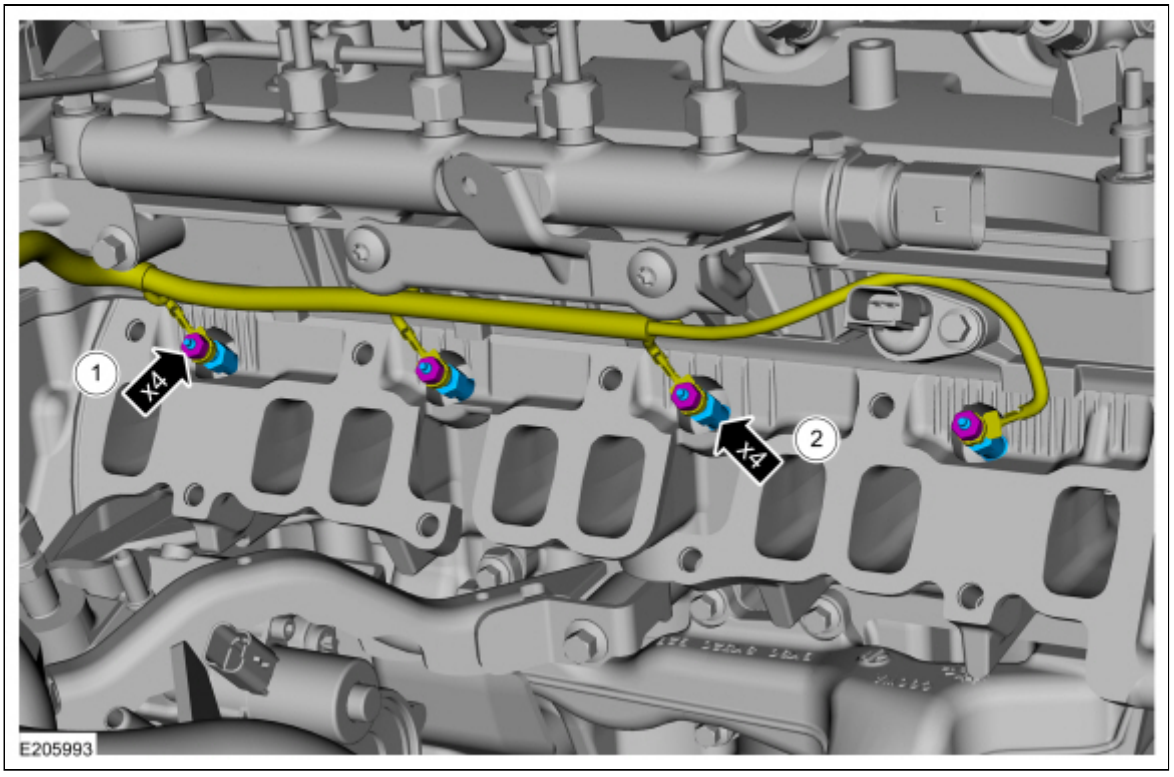
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

NOTICE: Make sure that all openings are sealed.

2. *Torque*:
   1: 2 Nm
   2: 13 Nm

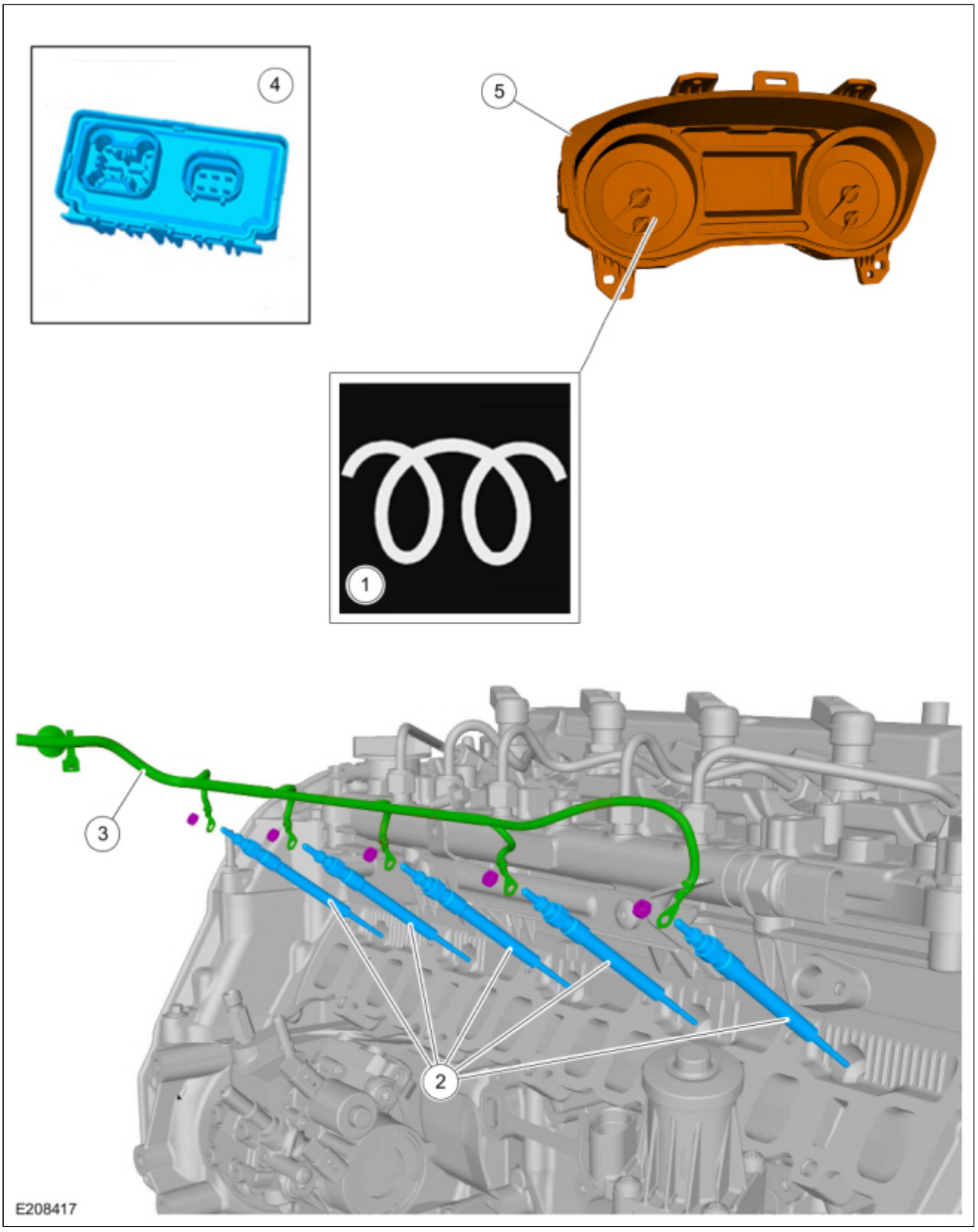


Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Glow Plug System - Component Location



Item	Part Number	Description
1	—	Glow plug indicator lamp
2	—	Glow plug(s)

3	—	Glow plug wire
4	—	Glow plug relay
5	—	Instrument cluster

Glow Plugs

The glow plugs are located in the side of the cylinder head and aid engine starting and efficiency. The glow plugs and the glow plug indicator lamp are controlled by the powertrain control module (PCM).

The glow plugs preheat the combustion chambers, which aids cold starting. During the preheat stage, the PCM receives an engine temperature signal from the cylinder head temperature (CHT) sensor and this determines the preheat time. The lower the temperature, the longer the preheat time. There is a maximum preheat time of 8 seconds at -20°C or lower. At temperatures above 80°C there is no preheat phase.

Once the engine has started, the glow plugs enter an after-glow phase. The after-glow phase helps to improve idling and reduce hydrocarbon emissions through more efficient combustion just after starting. The after-glow phase only operates at engine speeds below 2500 RPM, above that, the after-glow phase is interrupted to increase the durability of the glow plugs. There is a maximum after-glow time of 30 seconds at -20°C or lower. At temperatures above 50°C there is no after-glow phase.

Copyright © 2016 Ford Motor Company

Glow Plug System - System Operation and Component Description

System Operation

Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Glow Plug System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. For information about these,
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

For PCM DTC,
REFER to: Electronic Engine Controls (303-14B) .
REFER to: Electronic Engine Controls (303-14C) .
See DTC Chart: PCM Code List.

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Glow Plugs

Base Part Number: 6M090

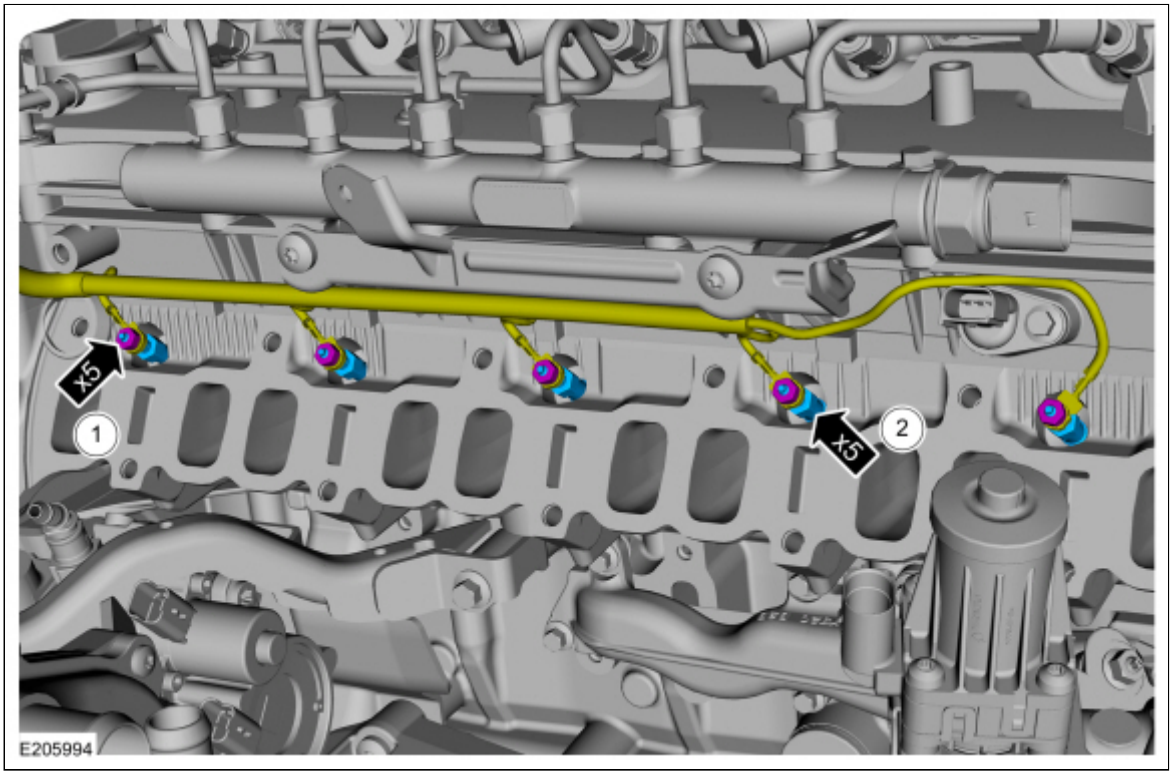
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

NOTICE: Make sure that all openings are sealed.

2. *Torque*:
   1: 2 Nm
   2: 13 Nm



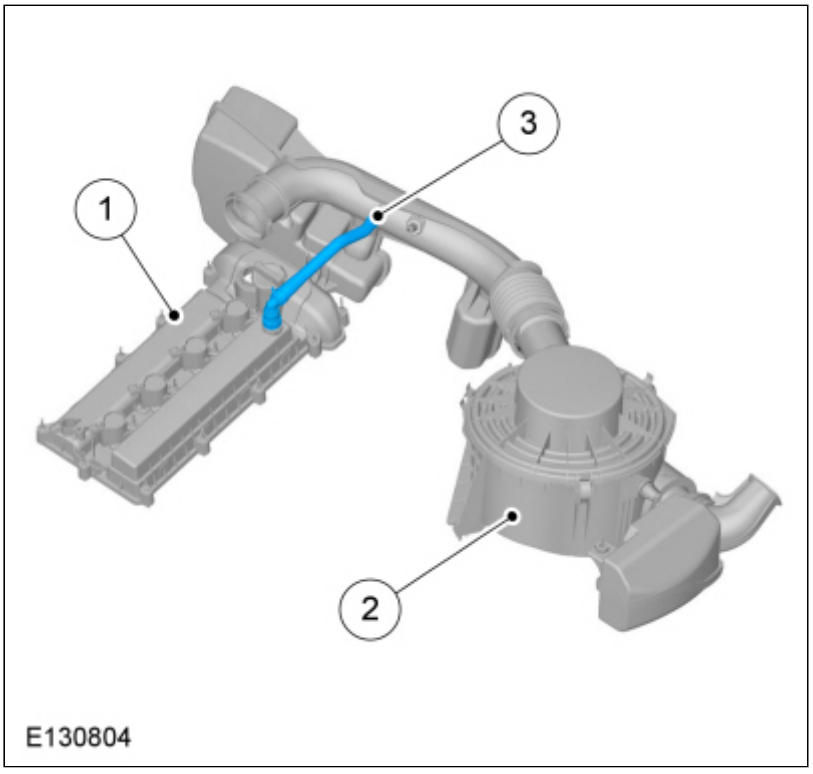
Installation

1. To install, reverse the removal procedure.

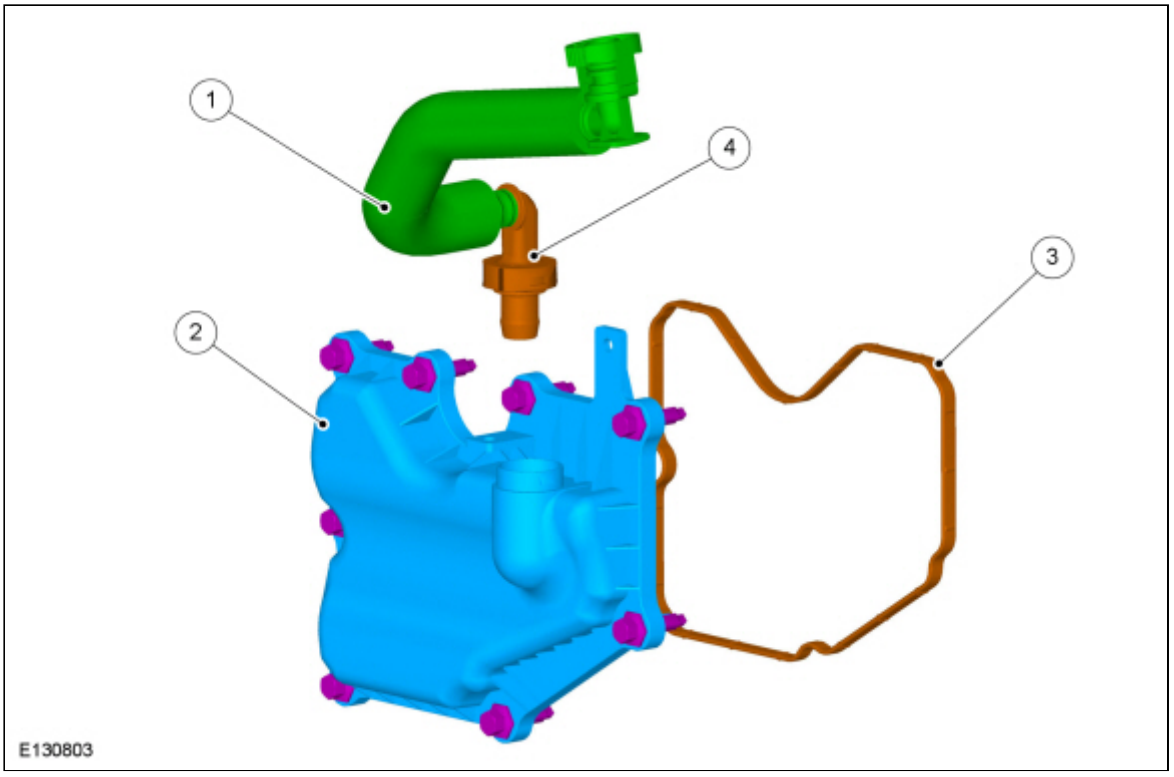
Copyright © 2016 Ford Motor Company

Engine Emission Control

Vehicles with 2.5L Duratec-HE engine



Item	Part Number	Description
1	—	Valve cover
2	—	Air cleaner assembly
3	—	Valve cover to air cleaner outlet pipe positive crankcase ventilation (PCV) hose



Item	Part Number	Description
1	—	PCV valve to intake manifold PCV hose
2	—	Crankcase vent oil separator
3	—	Crankcase vent oil separator gasket
4	—	PCV valve

PCV System

The PCV system consists of a valve mounted in the crankcase vent oil separator (attached to the cylinder block) and two hoses. One PCV hose connects the PCV valve to the intake manifold, the other PCV hose connects the valve cover to the air cleaner outlet pipe.

Under idle and part throttle conditions, the crankcase vapor flows from the crankcase vent oil separator to the intake manifold and into the combustion chambers where the vapor is burnt during combustion.

Under full throttle conditions, the crankcase vapor flows from the valve cover into the air cleaner outlet pipe through the PCV hose.

Copyright © 2016 Ford Motor Company

Engine Emission Control - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Engine Emission Control

General Equipment

Ford diagnostic equipment

For PCM DTC,
REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) .

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Crankcase Vent Oil Separator - 2.5L Duratec-HE (122kW/165PS) - MI4

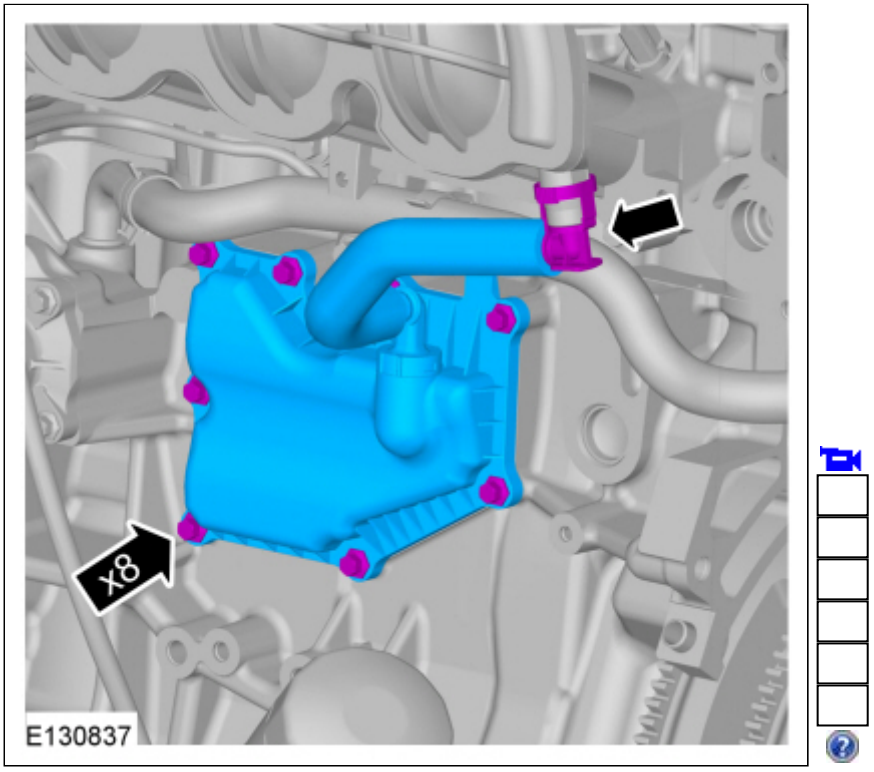
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *The gasket is to be reused unless damaged.*

   NOTE: *Make sure that the mating faces are clean and free of foreign material.*

   Torque: 11 Nm



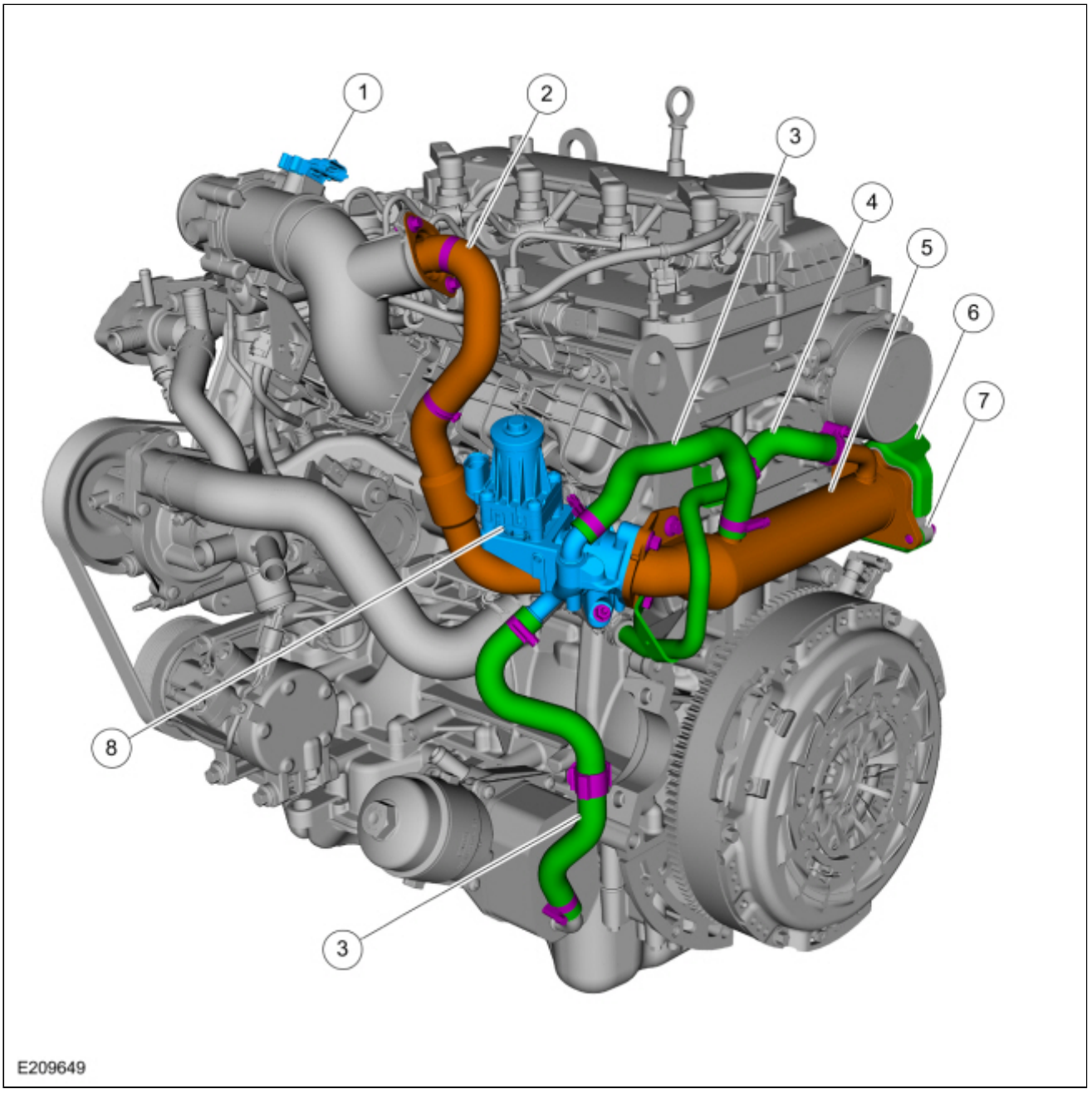
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Engine Emission Control - Component Location

Vehicles with 2.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Intake air temperature (IAT) sensor
2	—	Exhaust gas recirculation (EGR) valve outlet tube
3	—	EGR cooler outlet hose
4	—	EGR cooler inlet hose
5	—	EGR cooler
6	—	Heat shield

7	—	Exhaust manifold flange
8	—	EGR valve

Copyright © 2016 Ford Motor Company

Engine Emission Control - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Engine Emission Control

General Equipment

Ford diagnostic equipment

For PCM DTC,
REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) .

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Cooled Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (Puma) Diesel

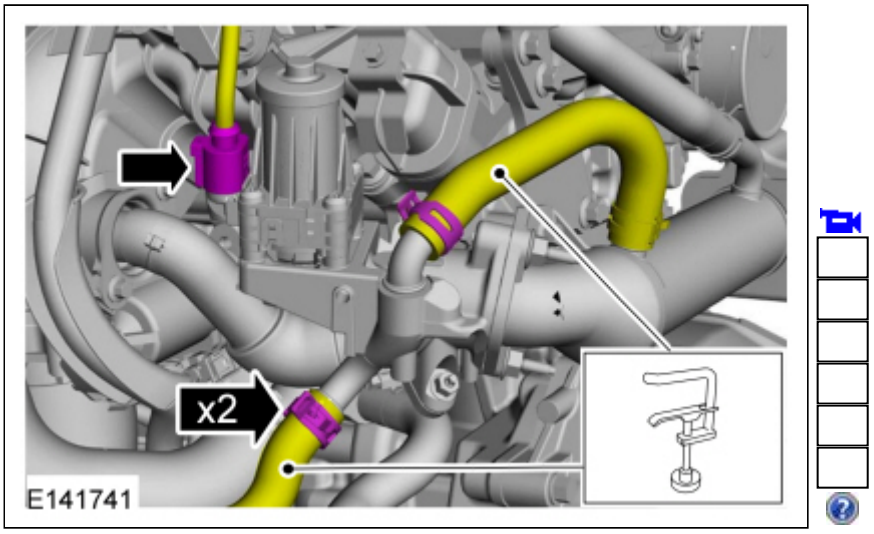
Special Tool(s) / General Equipment

Hose Clamp(s)
Hose Clamp Remover/Installer

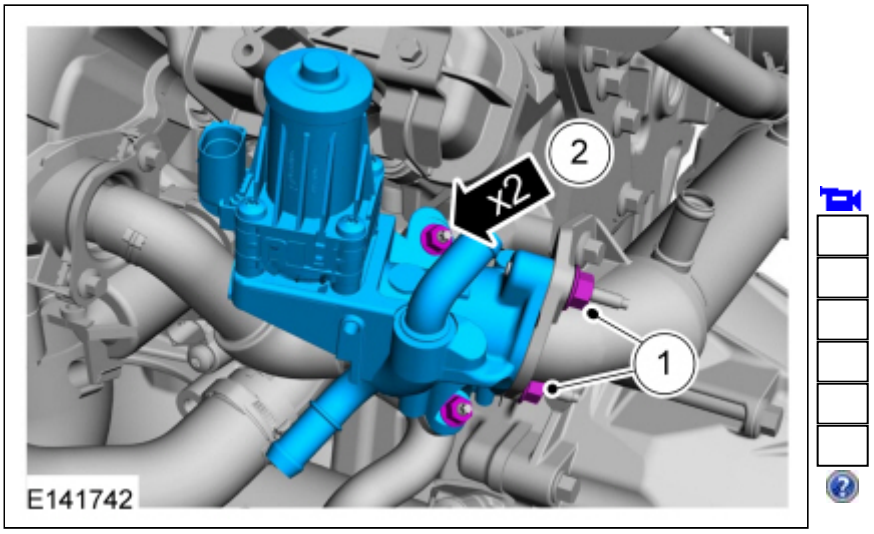
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Use the General Equipment: Hose Clamp Remover/Installer
   Use the General Equipment: Hose Clamp(s)



4. *Torque*:
   1:
   Stage 1: 5 Nm
   Stage 2: 23 Nm
   2:
   Stage 3: 5 Nm
   Stage 4: 10 Nm



Installation

1. **NOTE:** *Install all the bolts finger tight before final tightening.*

   To install, reverse the removal procedure.

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

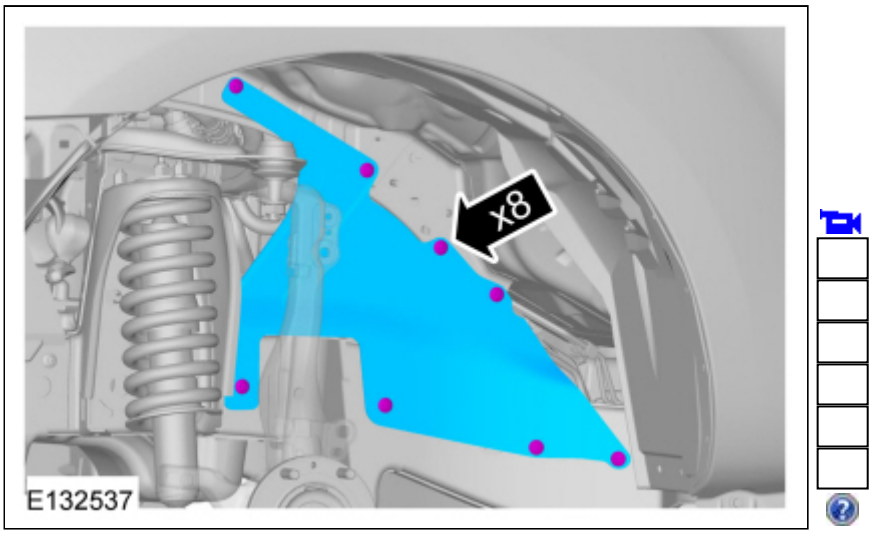
Exhaust Gas Recirculation (EGR) Cooler - 2.2L Duratorq-TDCi (118kW/160PS) - Puma

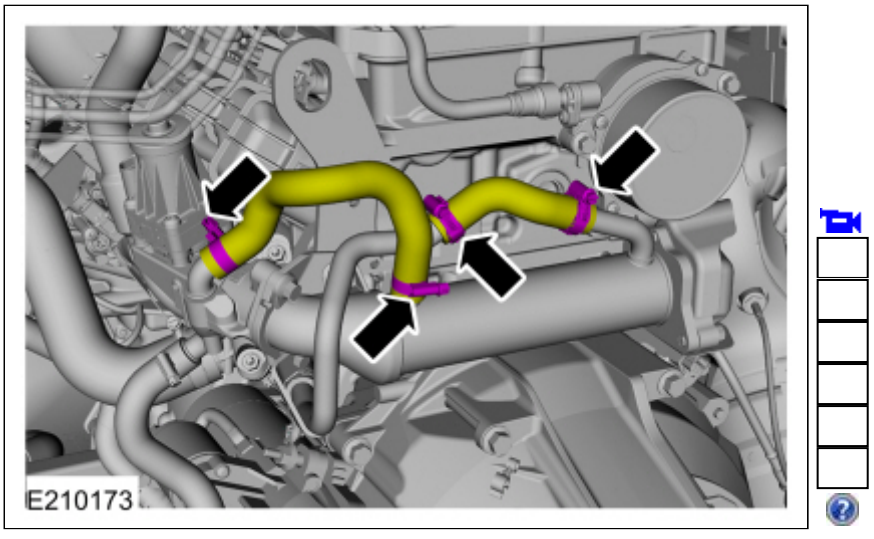
Special Tool(s) / General Equipment

Hose Clamp Remover/Installer

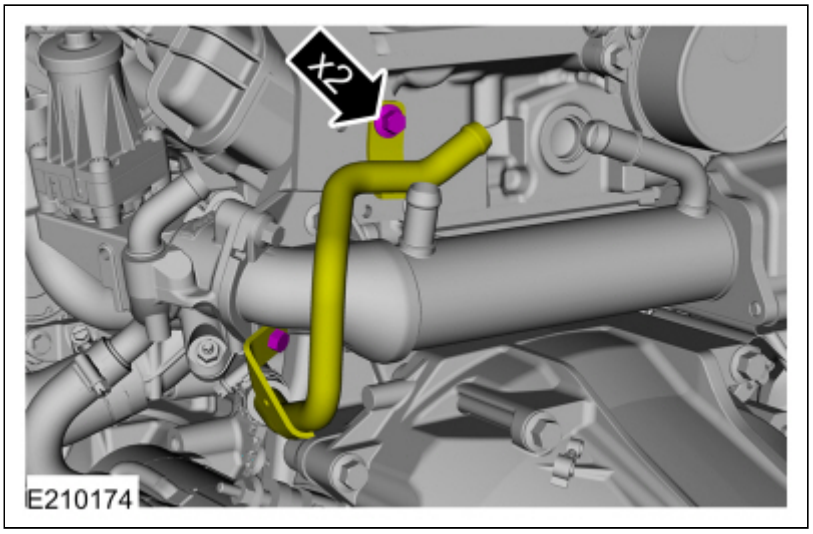
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

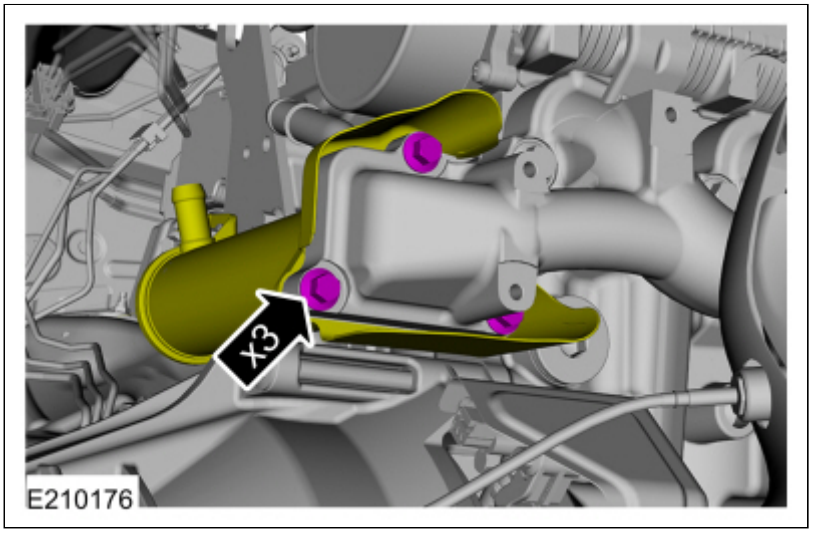
1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) .
3. 

4. Use the General Equipment: Hose Clamp Remover/Installer
   Torque: 4 Nm


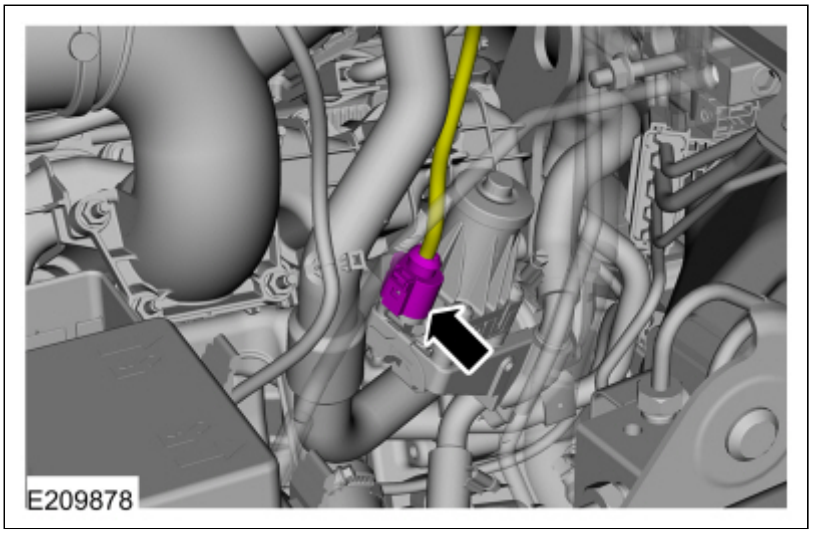
5. *Torque*: 23 Nm



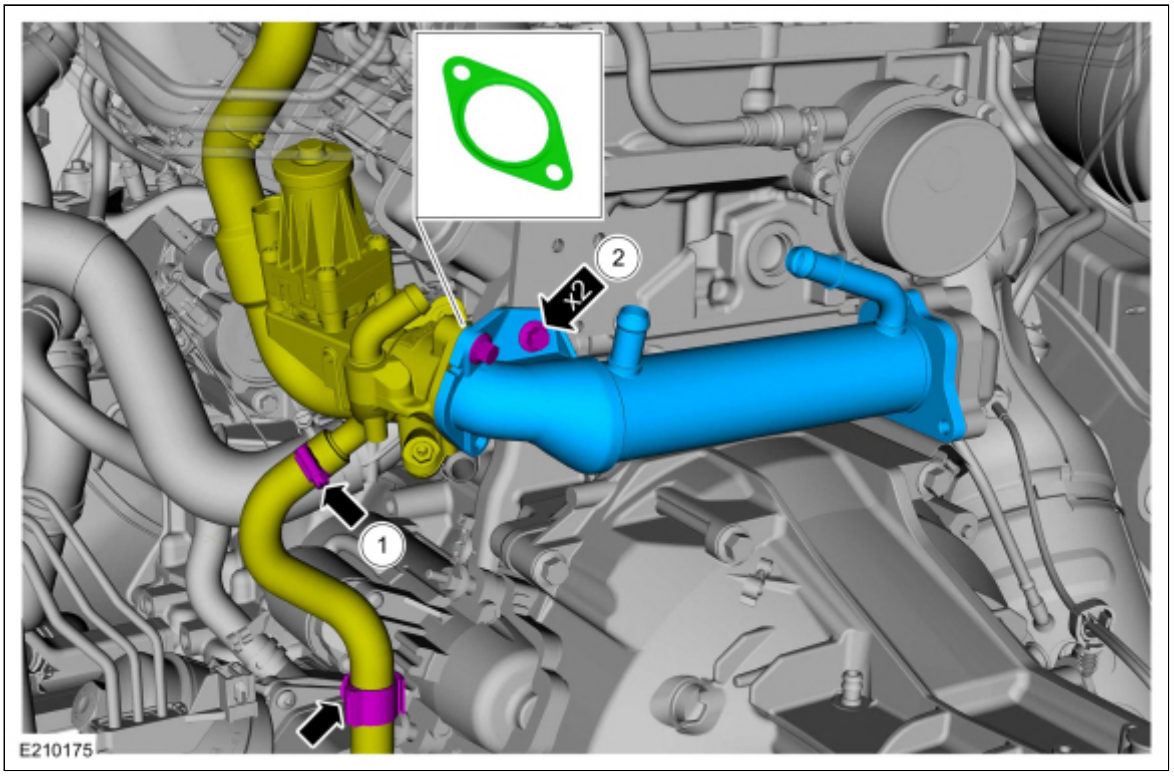
6. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 23 Nm



7.



8. *Torque*:
   1: 4 Nm
   2: 23 Nm



Installation

1. **NOTE:** *Make sure that new gaskets are installed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (118kW/160PS) - Puma

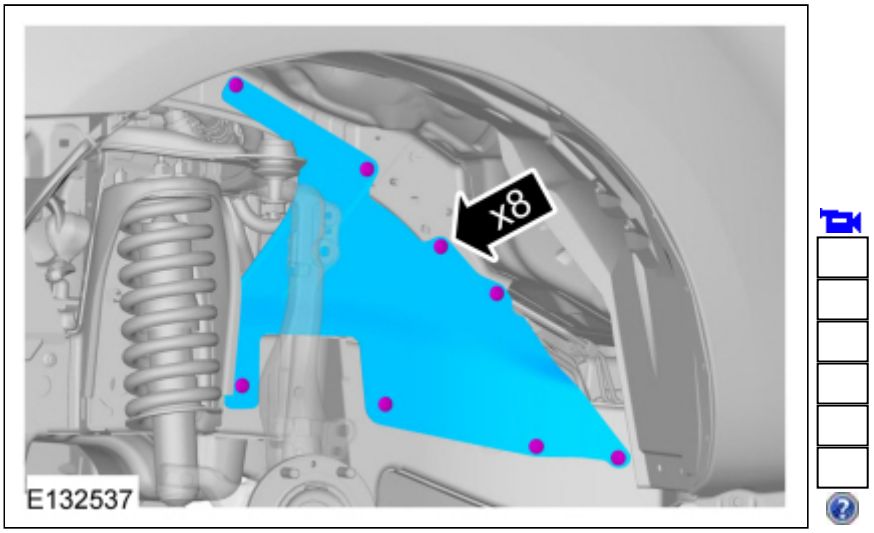
Base Part Number: 9D475

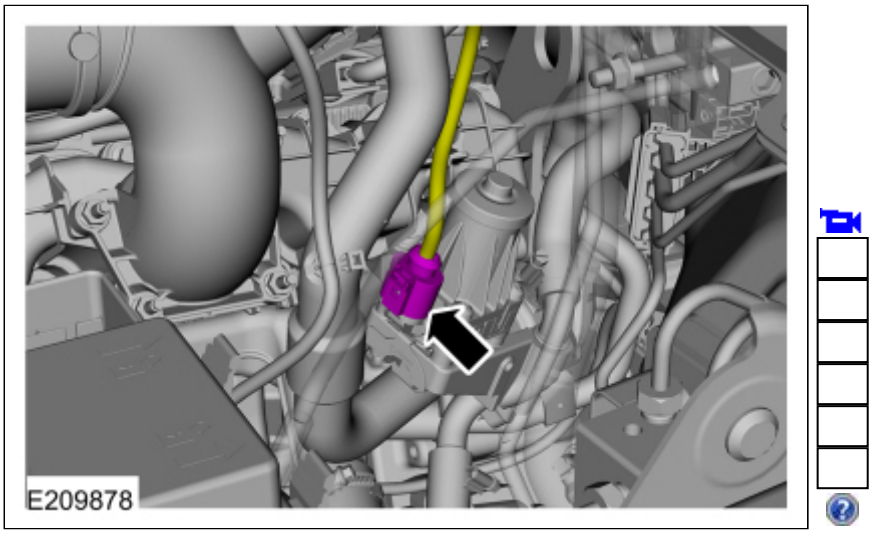
Special Tool(s) / General Equipment

Hose Clamp Remover/Installer

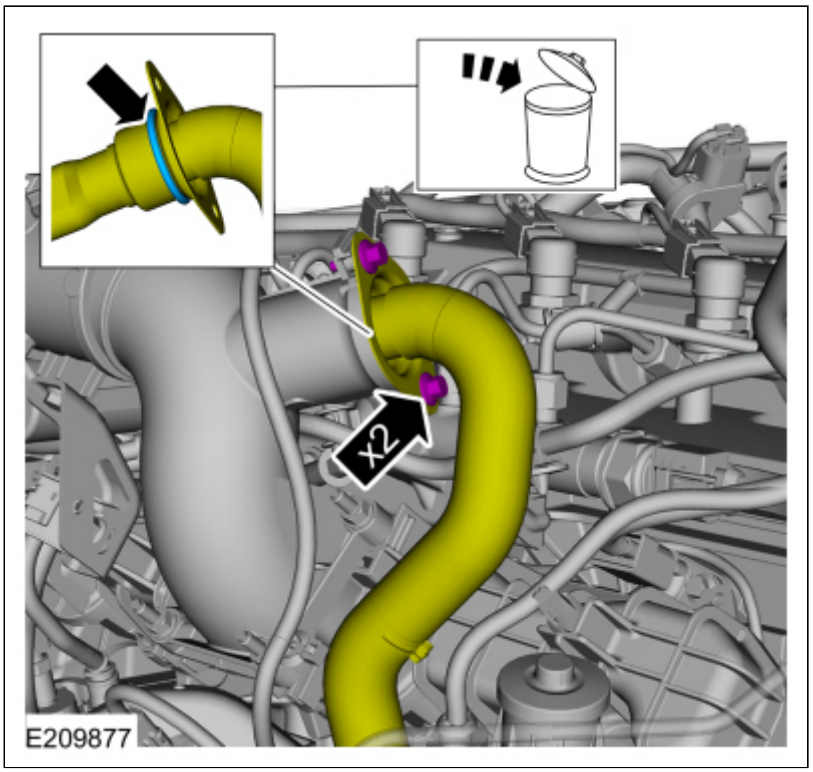
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

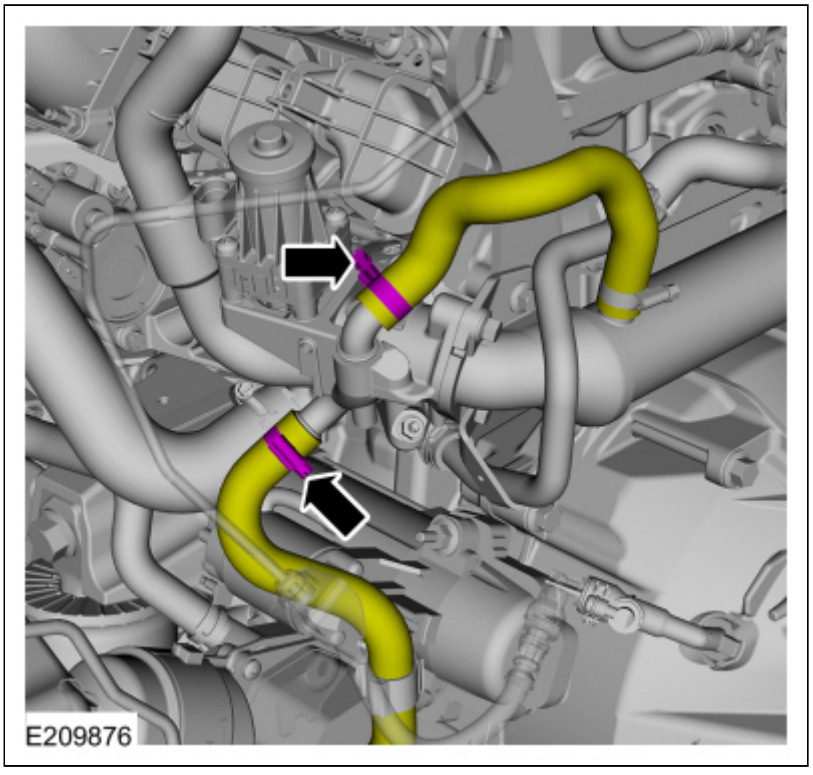
1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) .
3. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
4. 

5. 

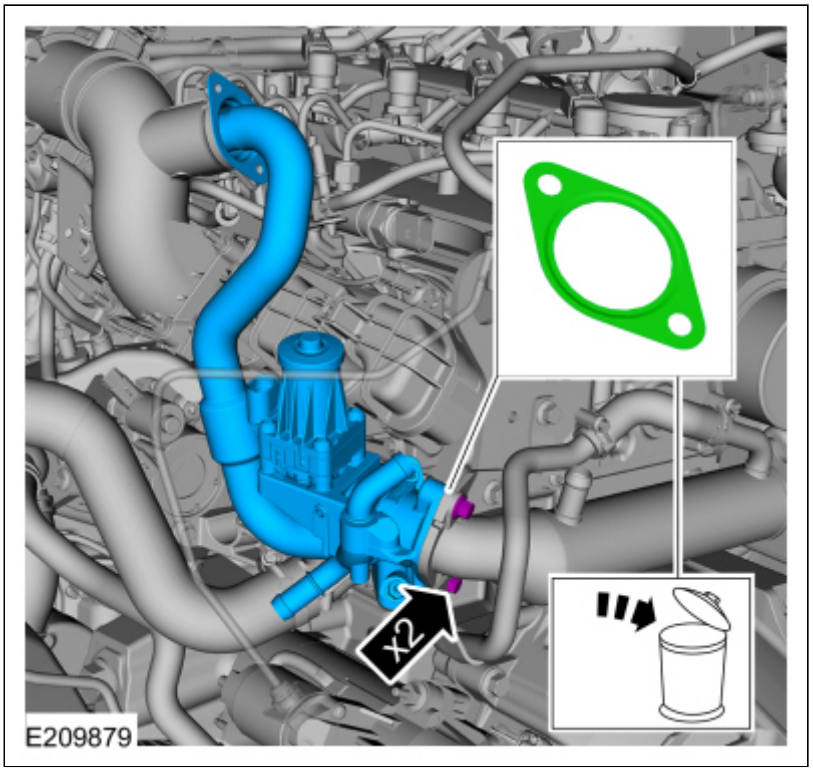
6.



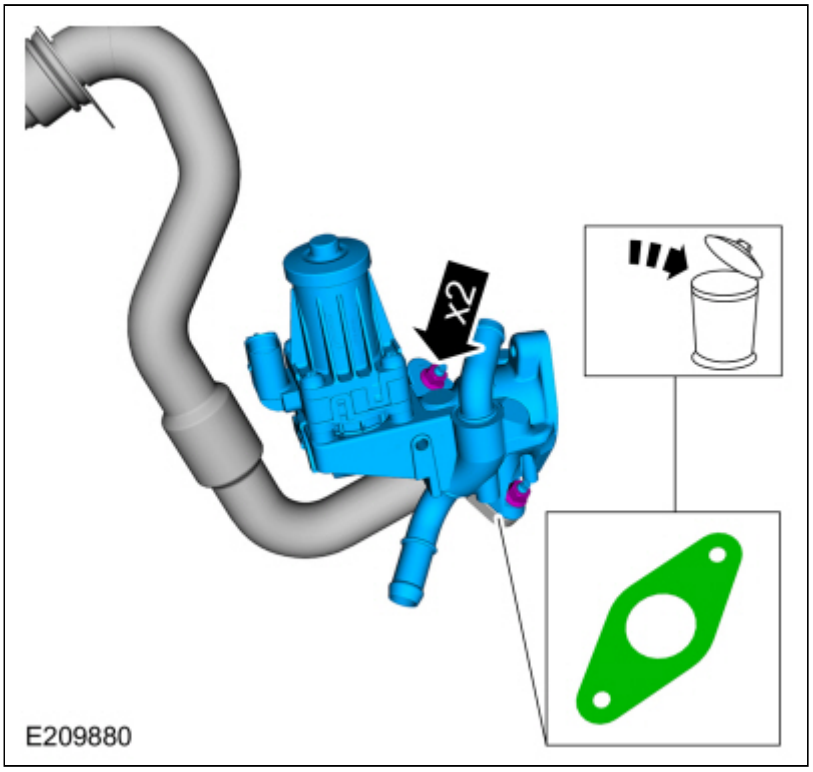
7.



8.



9.

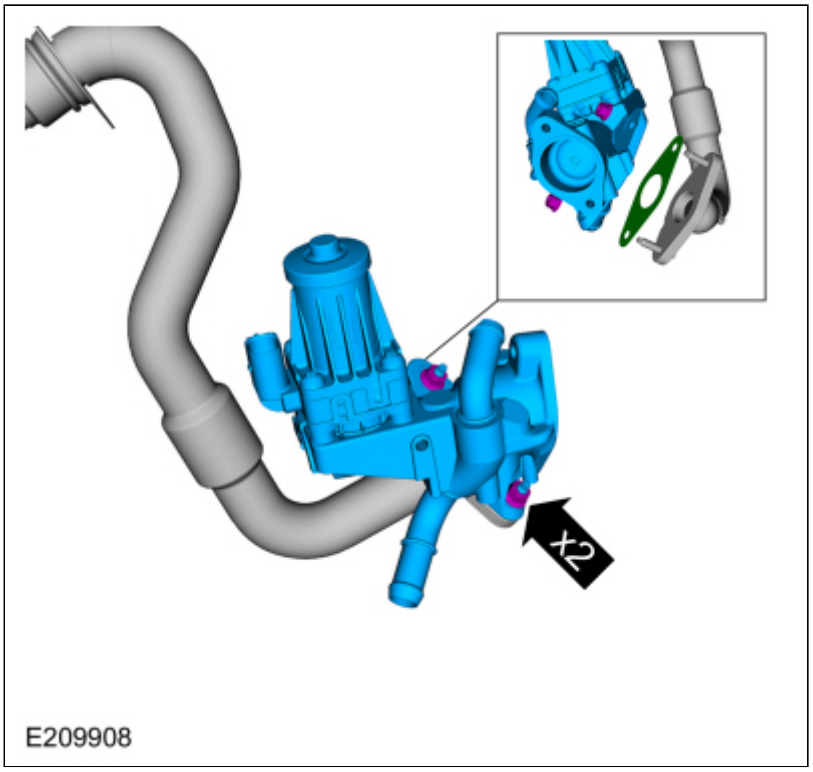


Installation

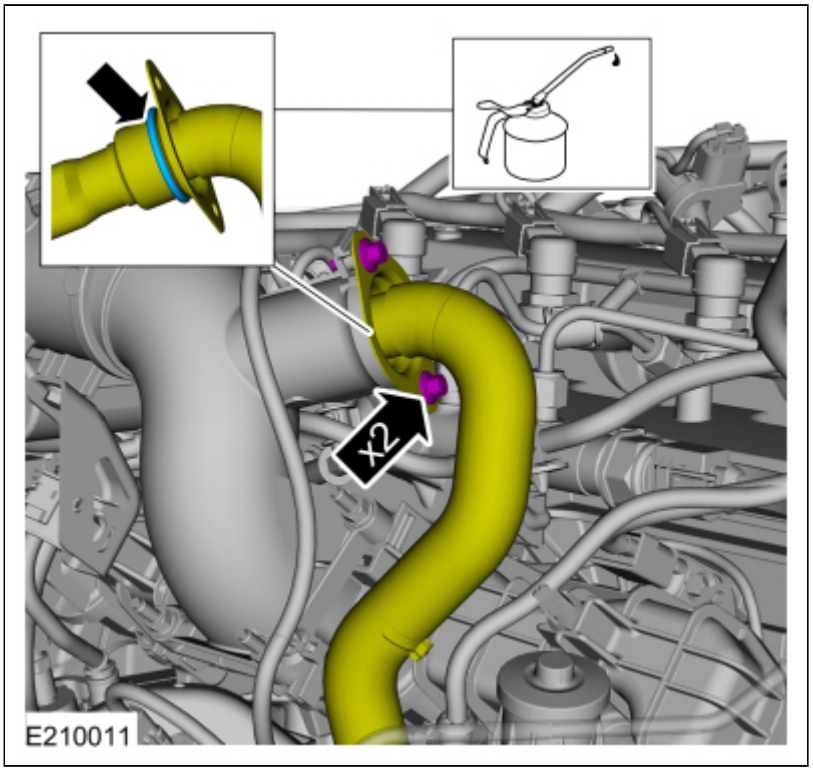
NOTE: *Install all the bolts finger tight before final tightening.*

NOTE: *Make sure that new gaskets are installed.*

1. To install, reverse the removal procedure.
2. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 10 Nm

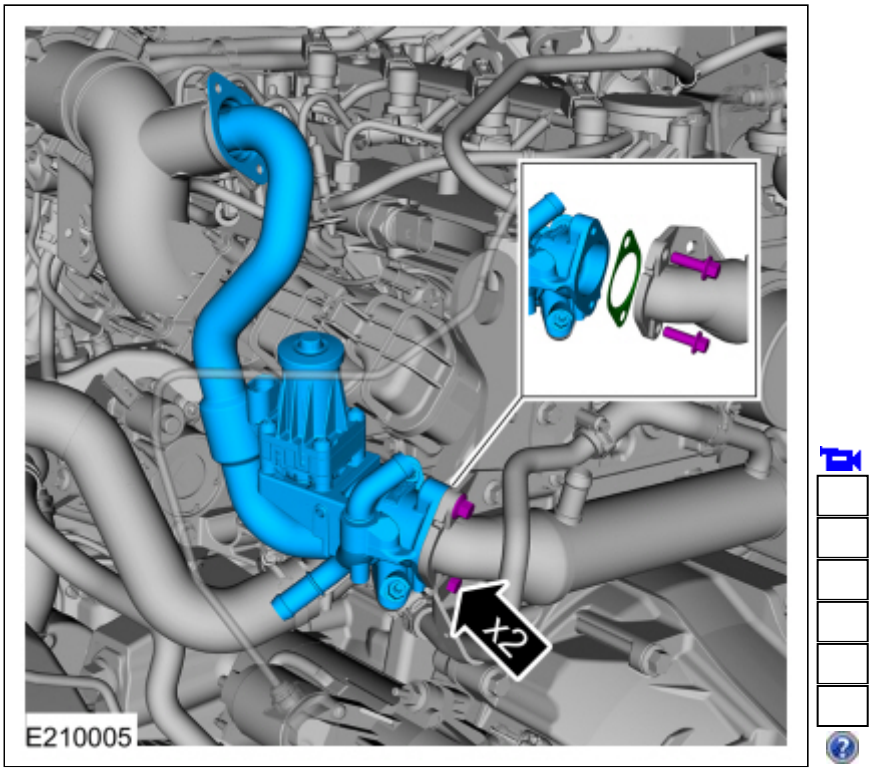


3. **NOTE:** *Install all the bolts finger tight before final tightening.*

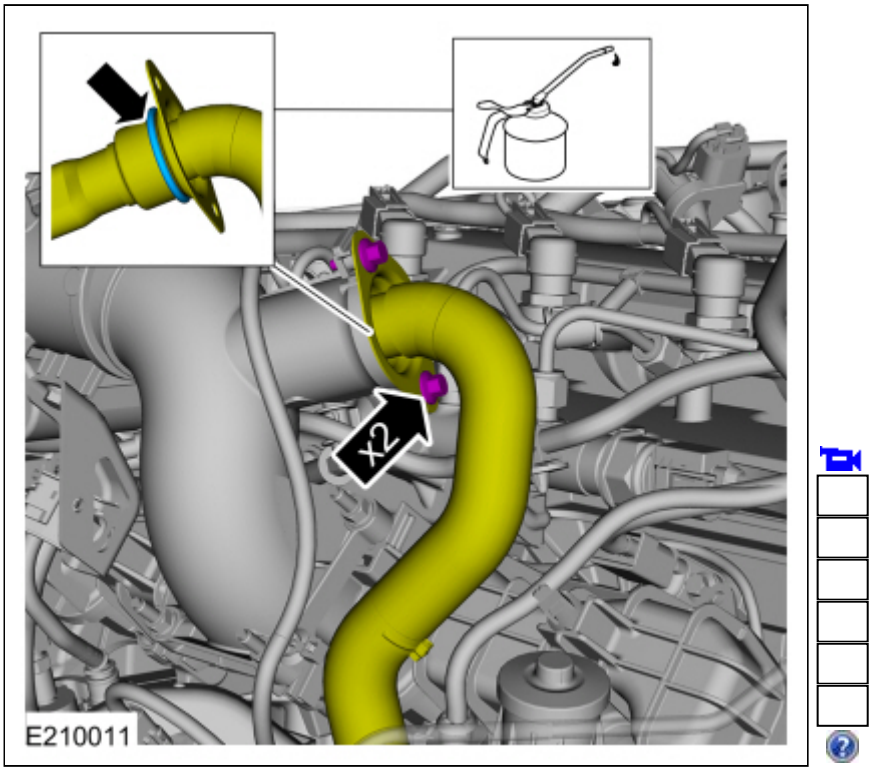


4. **NOTE:** *Make sure that new gaskets are installed.*

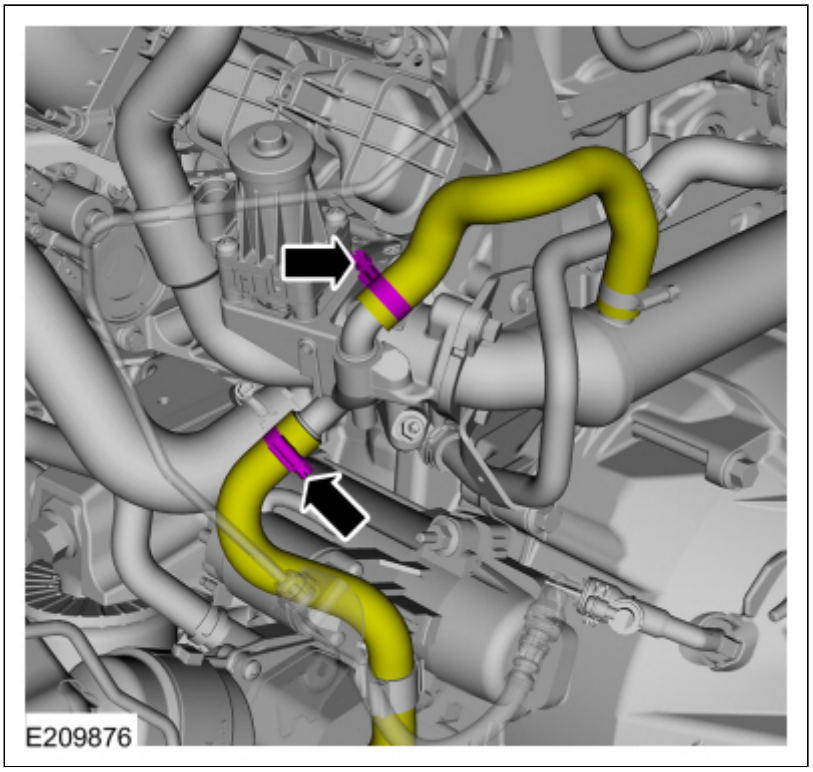
   Torque: 23 Nm



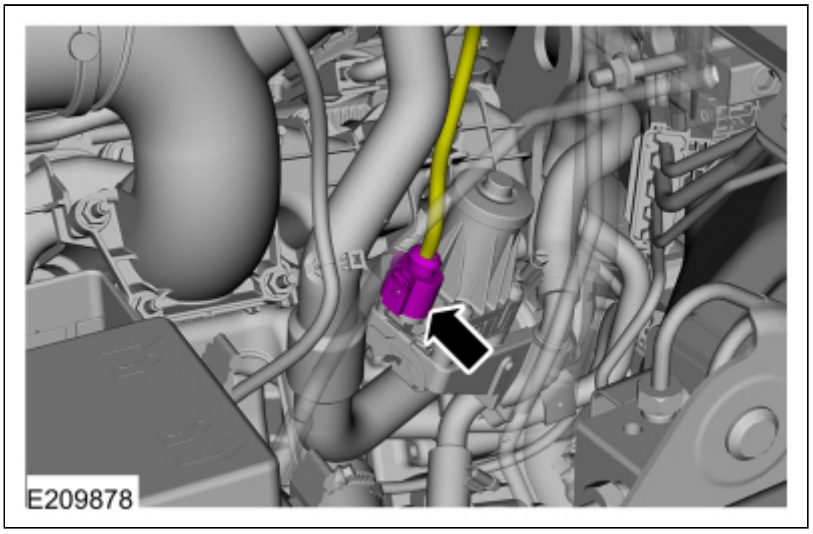
5. *Torque*: 10 Nm



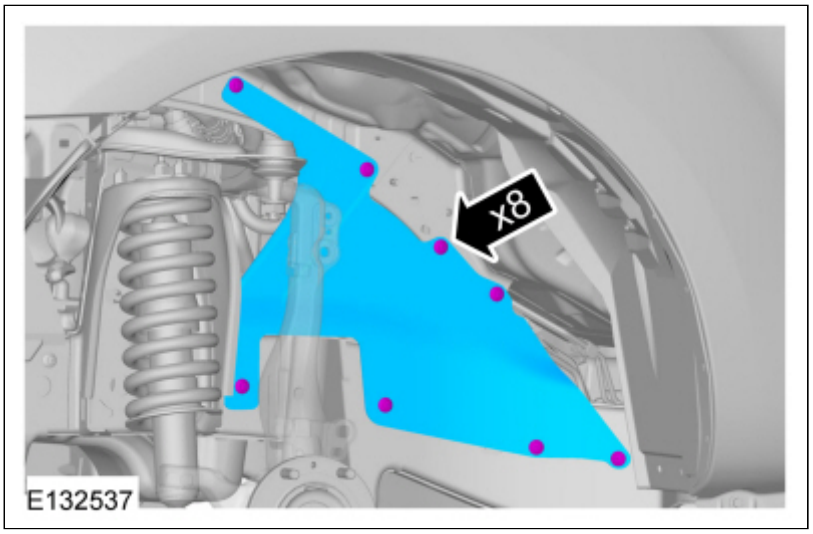
1. *Torque*: 4 Nm



7. Use the General Equipment: Hose Clamp Remover/Installer



8.



9. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

10. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
11. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma) .

Copyright © 2016 Ford Motor Company

Exhaust Gas Recirculation (EGR) Valve Outlet Tube - 2.2L Duratorq-TDCi (118kW/160PS) - Puma

Removal

1. Refer to: Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

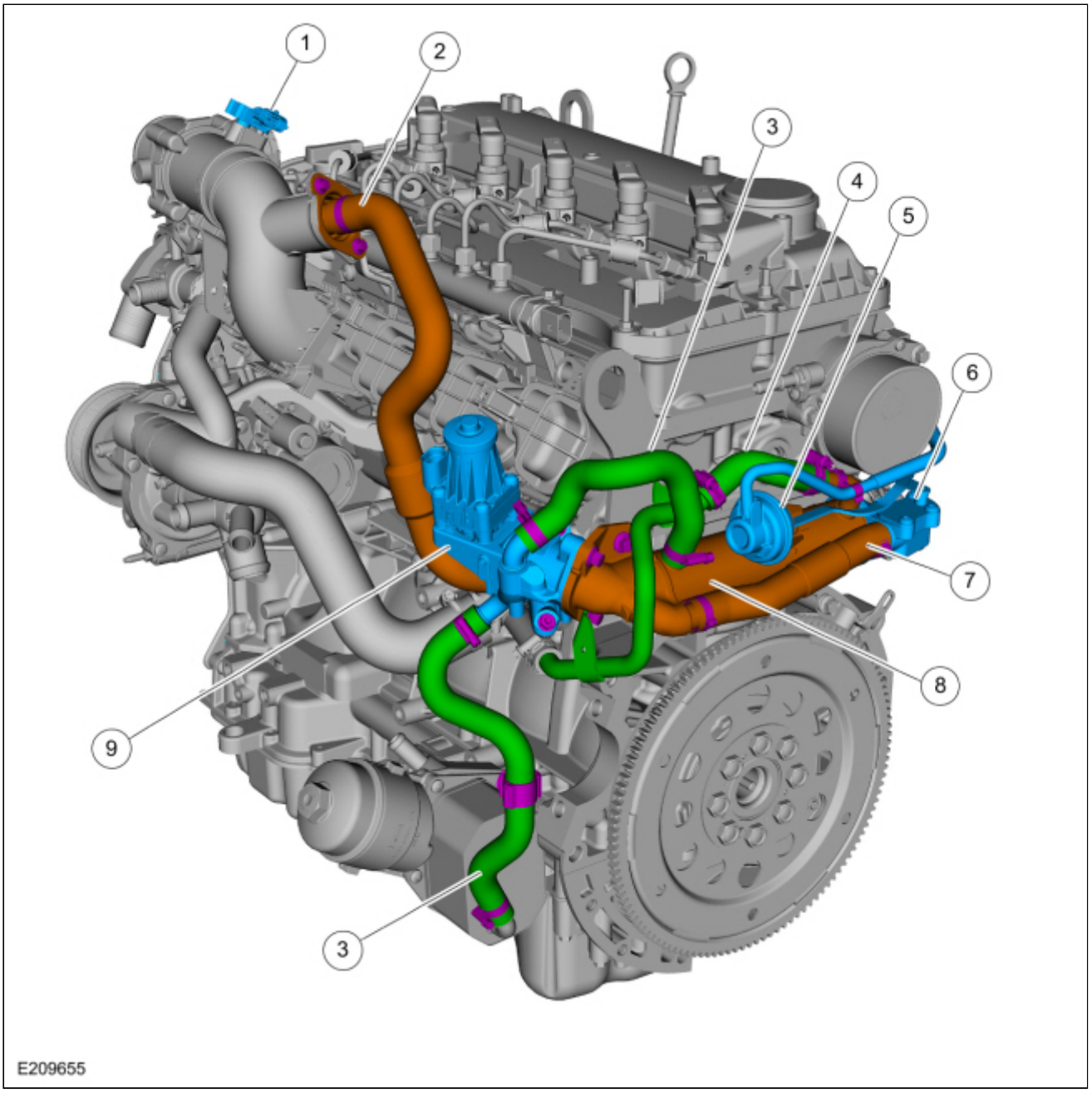
Installation

1. Refer to: Exhaust Gas Recirculation (EGR) Valve - 2.2L Duratorq-TDCi (118kW/160PS) - Puma (303-08B Engine Emission Control - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Engine Emission Control - Component Location

Vehicles with 3.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Intake air temperature (IAT) sensor
2	—	Exhaust gas recirculation (EGR) valve outlet tube
3	—	EGR cooler outlet hose
4	—	EGR cooler inlet hose
5	—	Actuator
6	—	Bypass valve
7	—	Bypass hose
8	—	Cooler
9	—	EGR valve

Copyright © 2016 Ford Motor Company

Engine Emission Control - System Operation and Component Description

System Operation

For System Operation, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Component Description

For Component Description, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 1 Description and Operation.

Copyright © 2016 Ford Motor Company

Engine Emission Control

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Exhaust gas recirculation (EGR) valve • EGR valve outlet tube • EGR cooler • Gaskets/seals • Hose(s)/hose joints	• Fuse(s) • Wiring harness • Electrical connector(s) • Relay(s) • Sensor(s) • Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Ford diagnostic equipment to diagnose the system.

Copyright © 2016 Ford Motor Company

Engine Emission Control

General Equipment

Ford diagnostic equipment

For PCM DTC,
REFER to: Electronic Engine Controls (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Cooled Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (Puma) Diesel

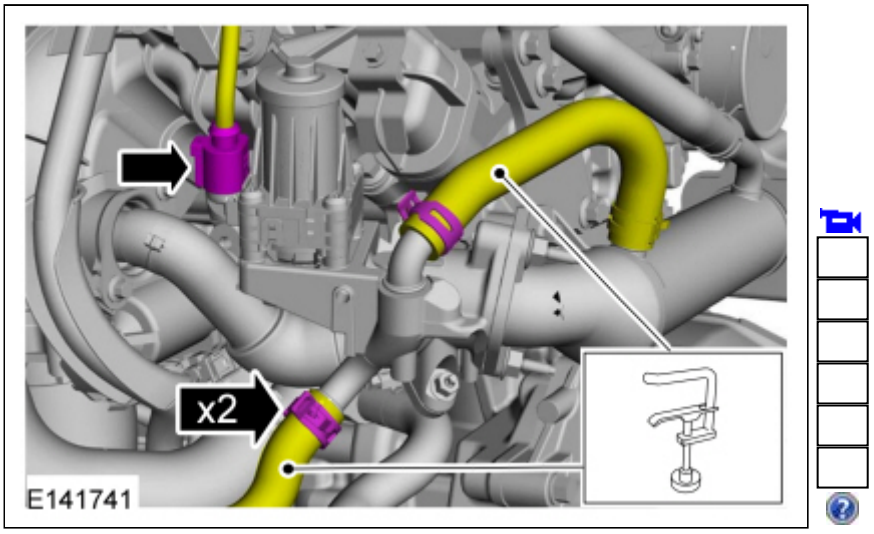
Special Tool(s) / General Equipment

Hose Clamp(s)
Hose Clamp Remover/Installer

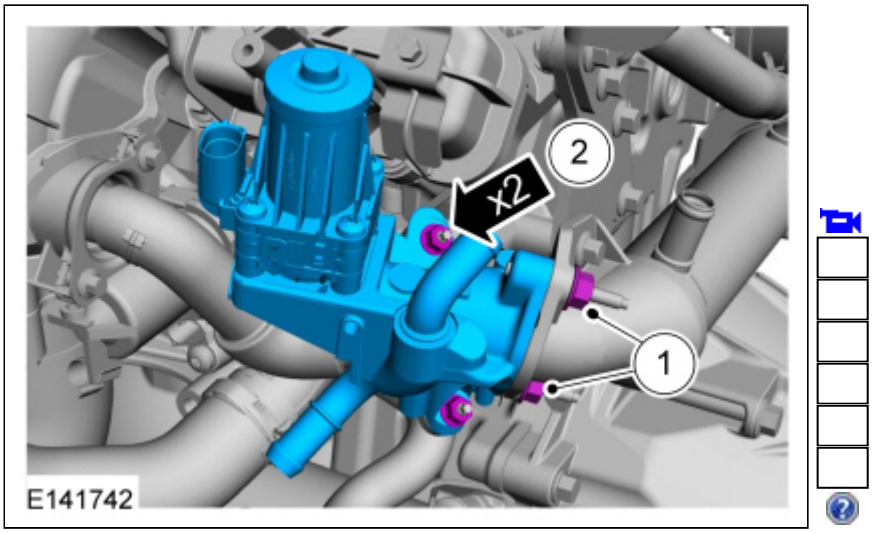
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Use the General Equipment: Hose Clamp Remover/Installer
   Use the General Equipment: Hose Clamp(s)



4. *Torque*:
   1:
   Stage 1: 5 Nm
   Stage 2: 23 Nm
   2:
   Stage 3: 5 Nm
   Stage 4: 10 Nm



Installation

1. **NOTE:** *Install all the bolts finger tight before final tightening.*

   To install, reverse the removal procedure.

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Cooled Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

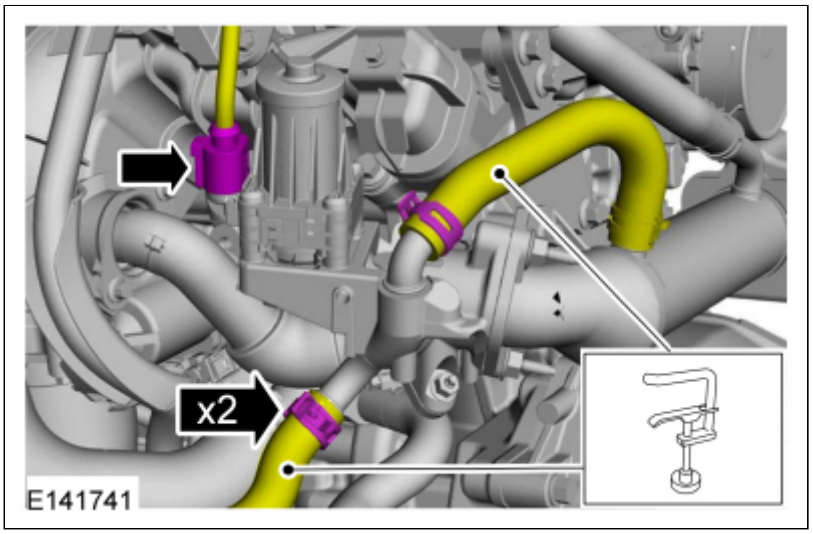
Special Tool(s) / General Equipment

Hose Clamp(s)
Hose Clamp Remover/Installer

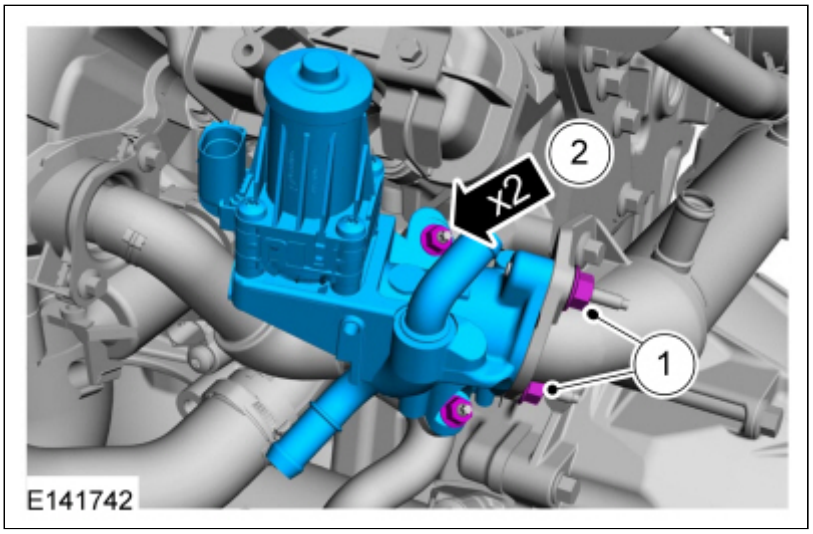
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Use the General Equipment: Hose Clamp Remover/Installer
   Use the General Equipment: Hose Clamp(s)



3. *Torque*:
   1::
   Stage 1: 5 Nm
   Stage 2: 23 Nm
   2:: 5 Nm



Installation

1. **NOTE:** *Install all the bolts finger tight before final tightening.*

To install, reverse the removal procedure.

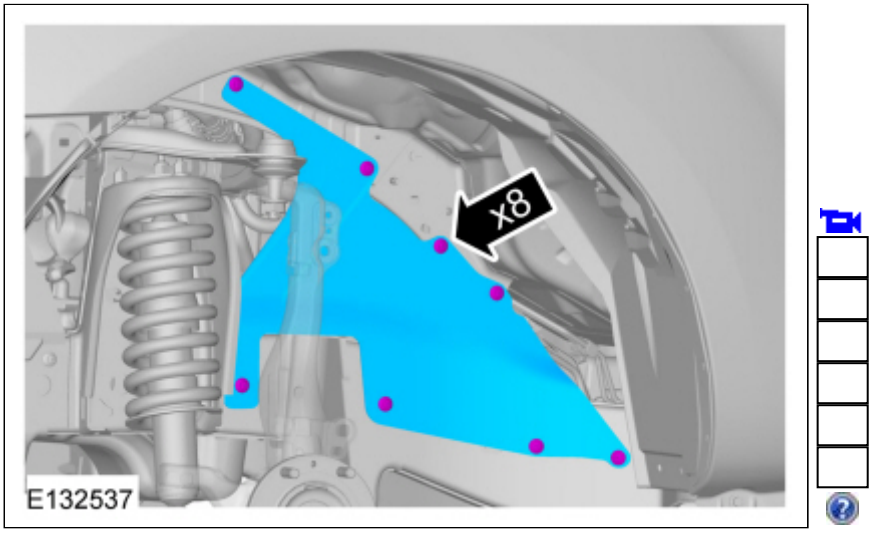
2. Refer to: Cooling System Draining and Vacuum Filling (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
Refer to: Cooling System Draining and Vacuum Filling (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

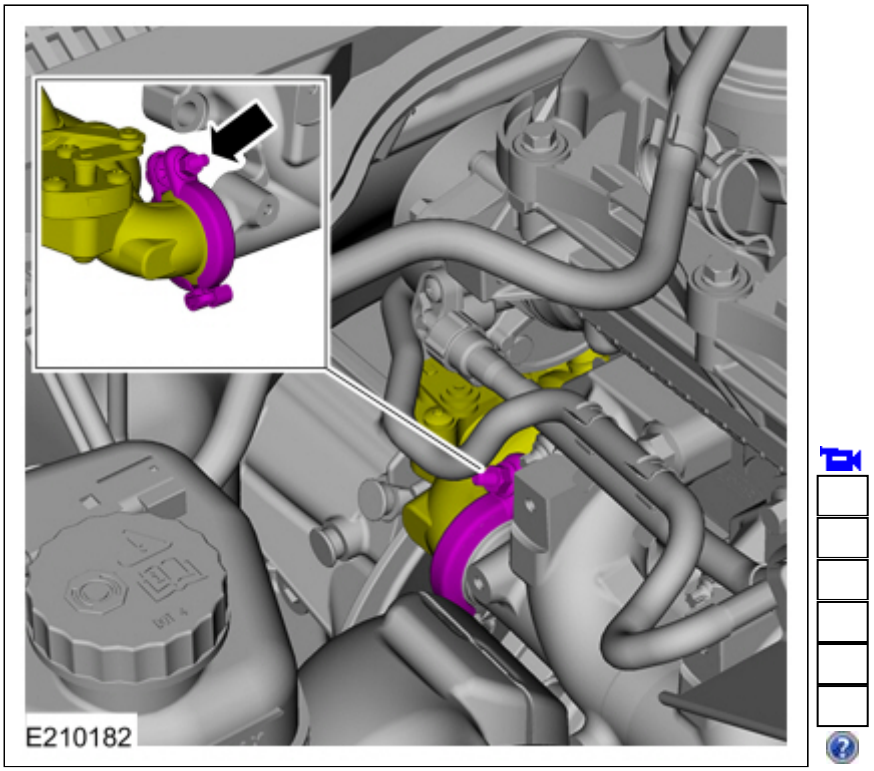
Copyright © 2016 Ford Motor Company

Exhaust Gas Recirculation (EGR) Cooler - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

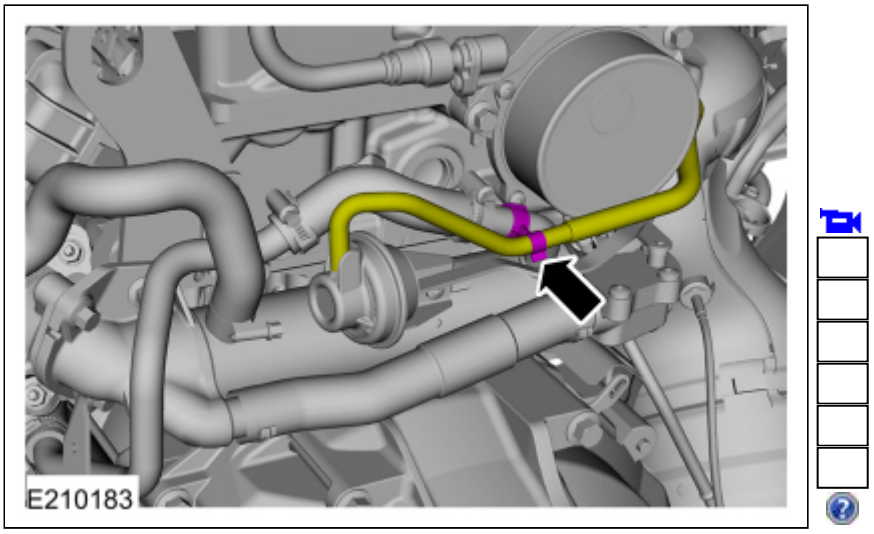
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

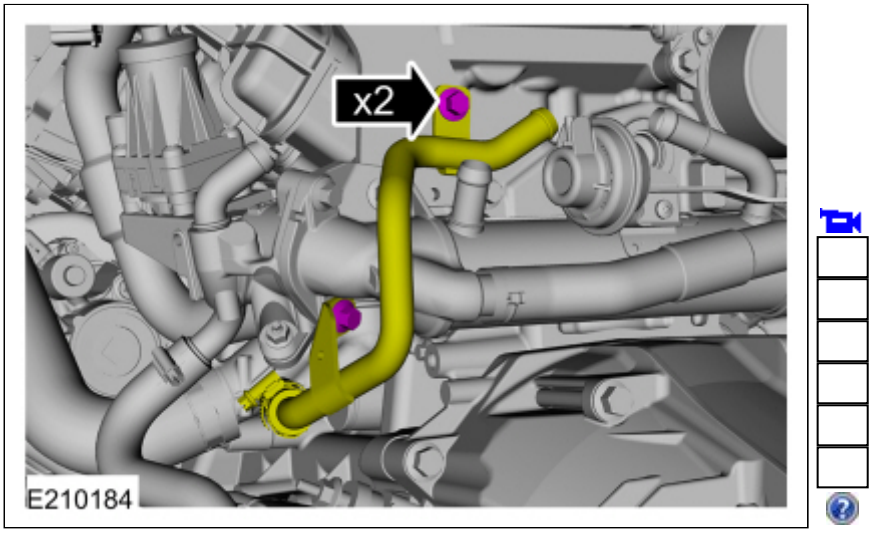
1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
3. 

4. *Torque*: 25 Nm


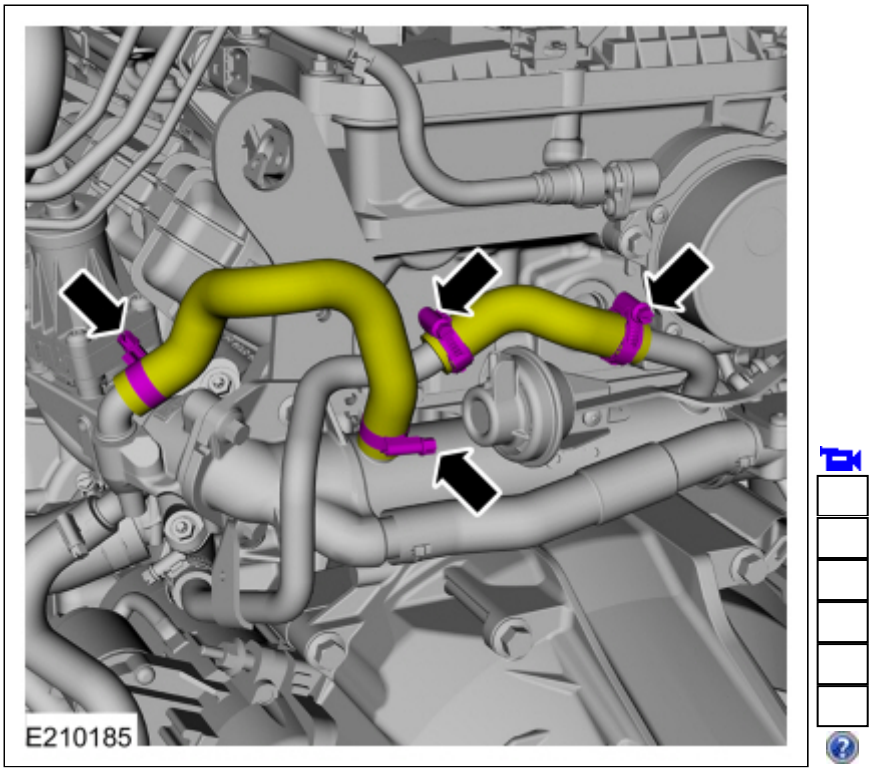
5.



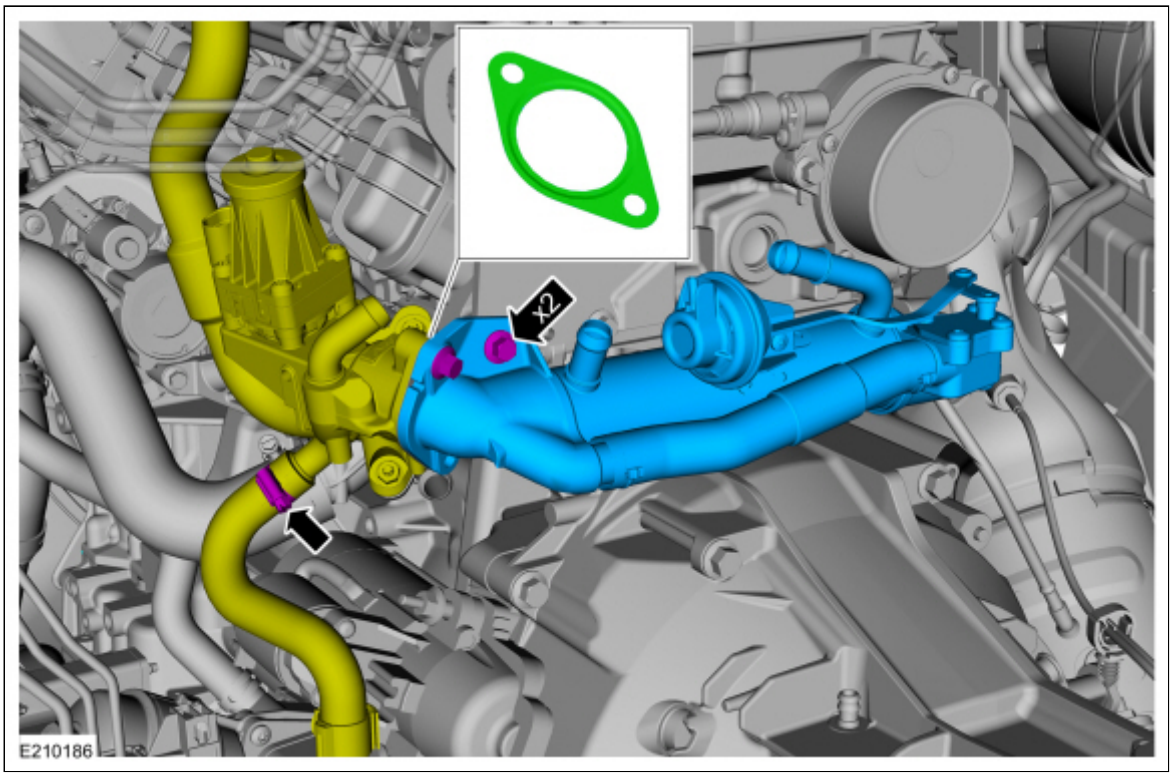
6. *Torque*: 23 Nm



7. *Torque*: 5 Nm



8. *Torque*: 23 Nm



Installation

1. **NOTE:** *Make sure that new gaskets are installed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

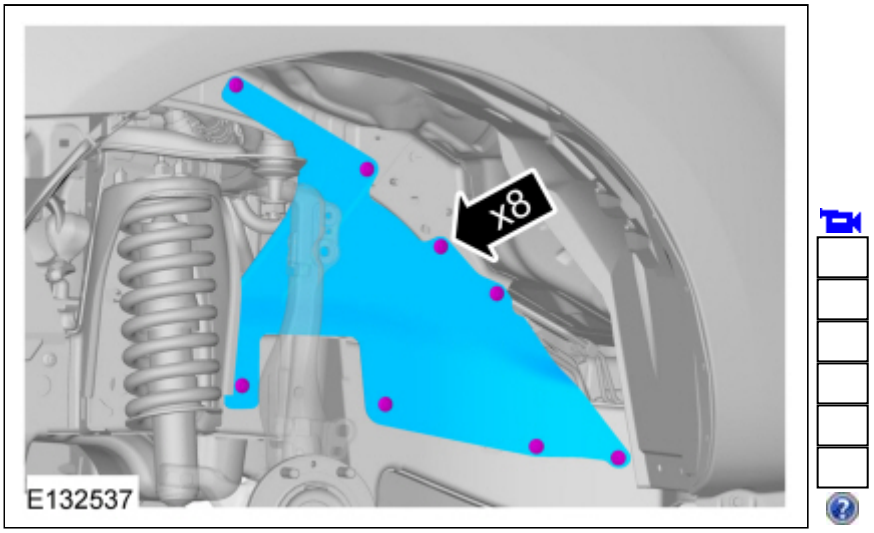
Base Part Number: 9D475

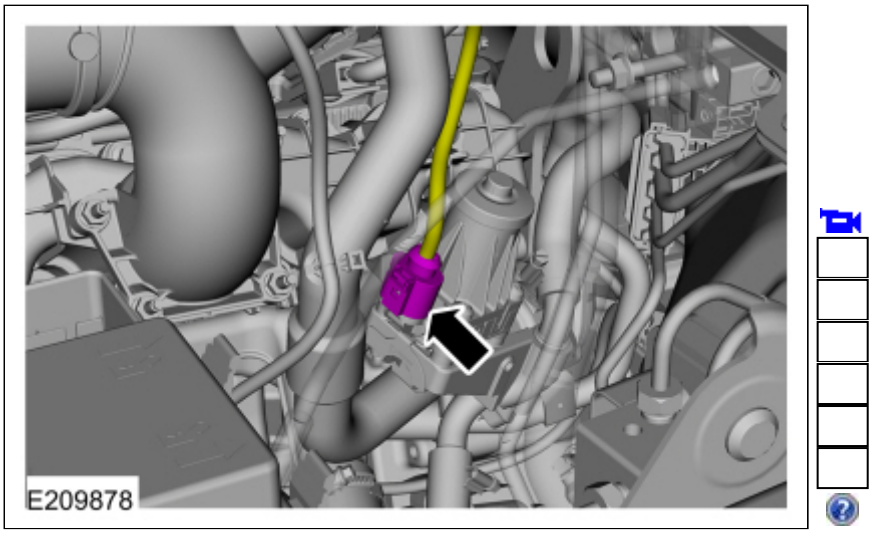
Special Tool(s) / General Equipment

Hose Clamp Remover/Installer

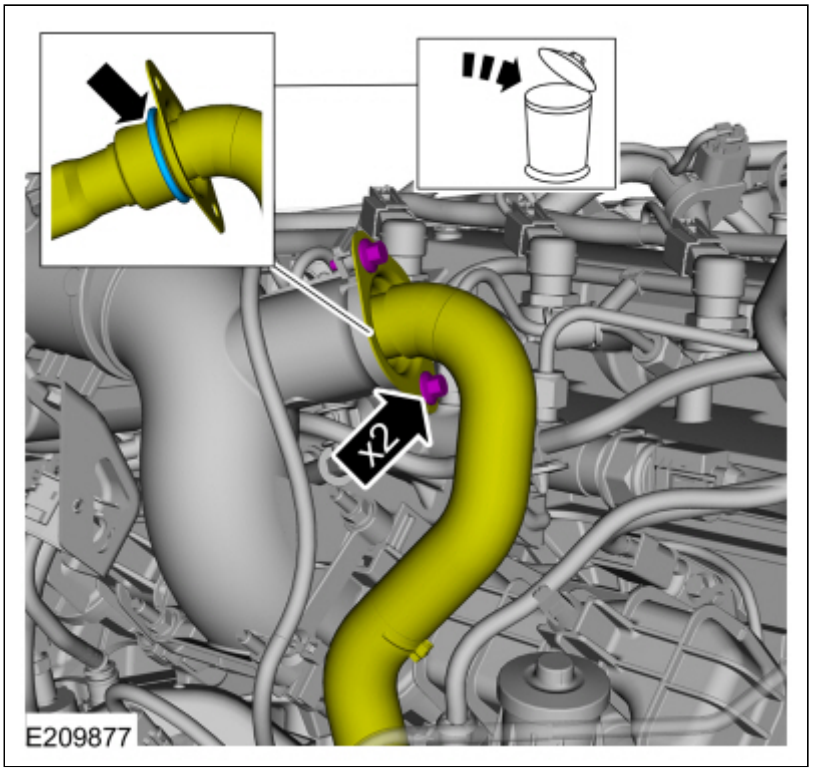
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

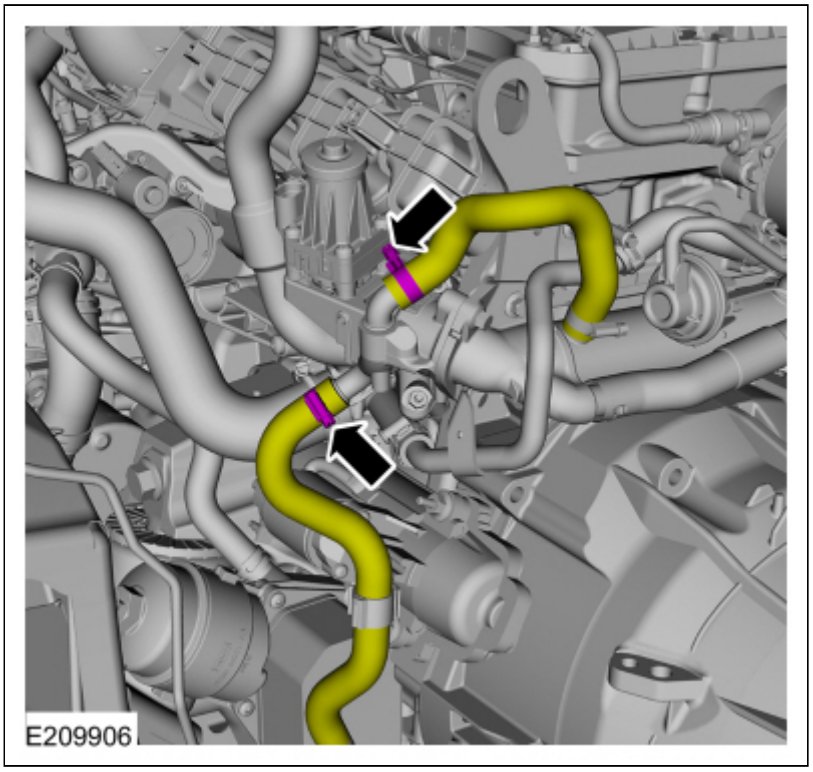
1. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
4. 

5. 

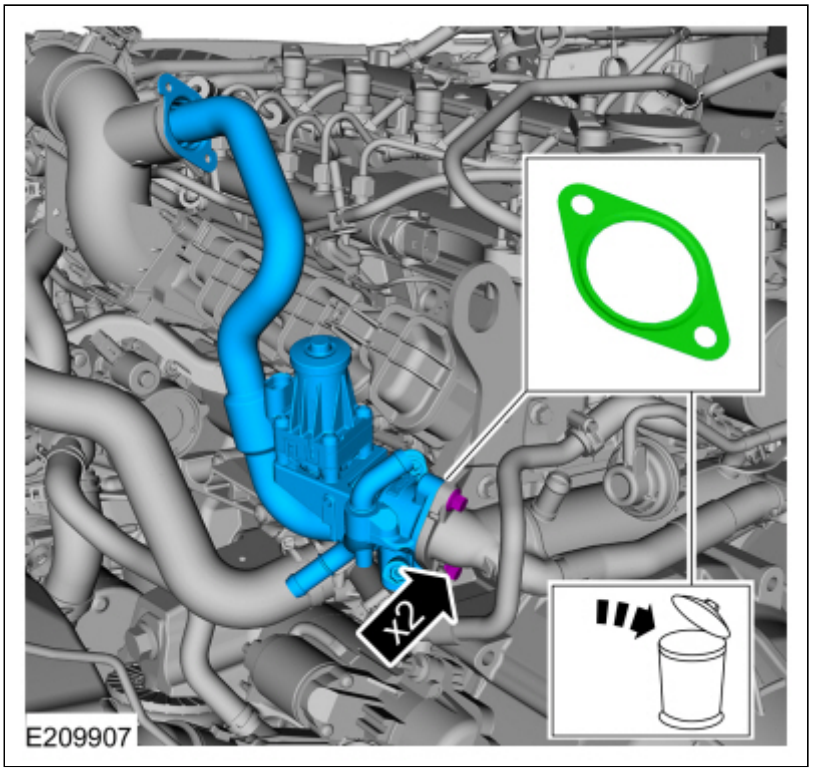
6.



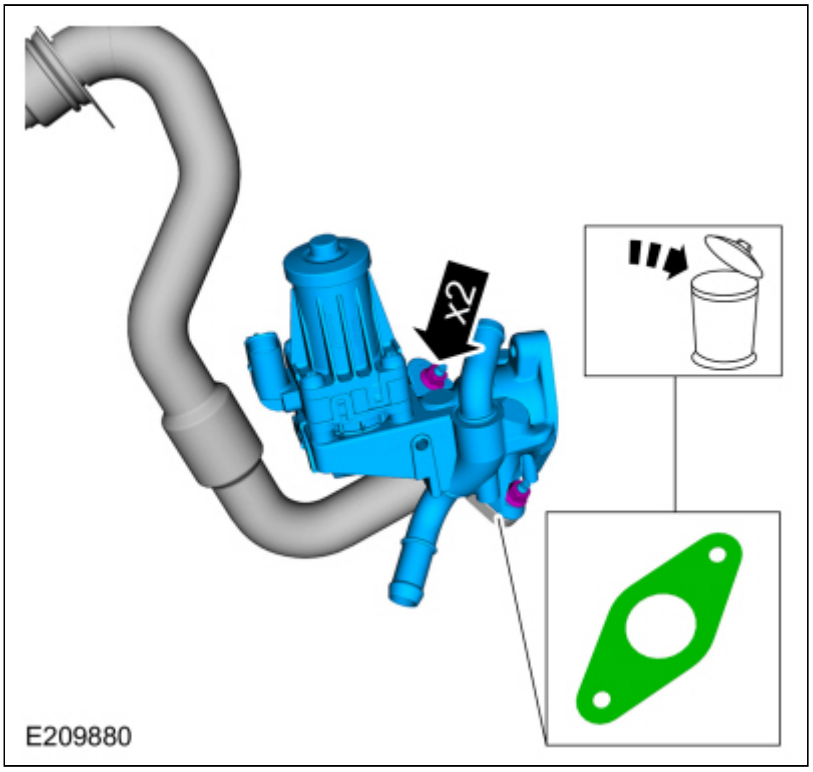
7.



8.

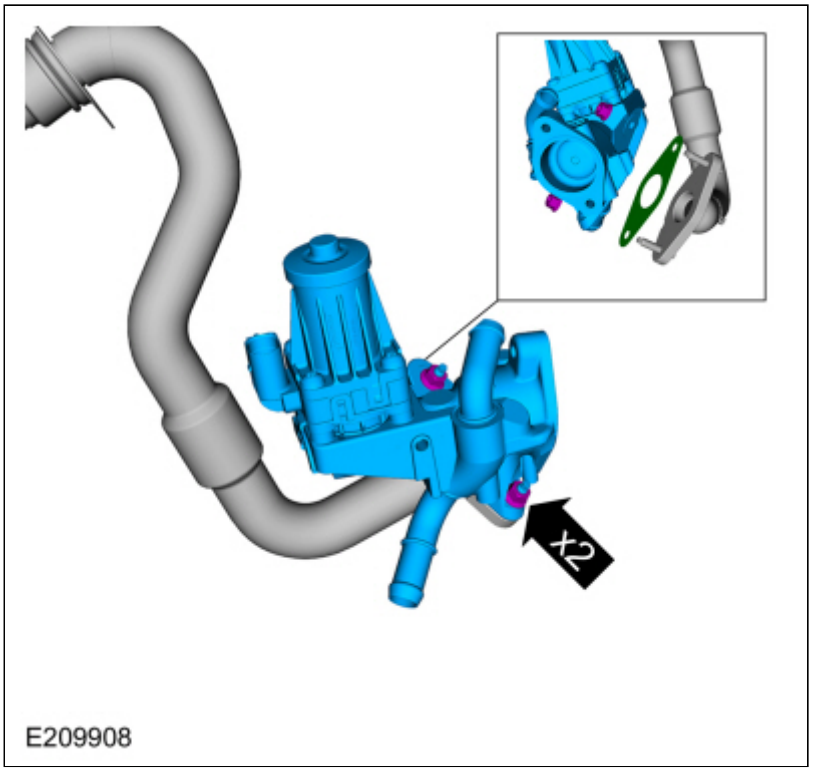


9.

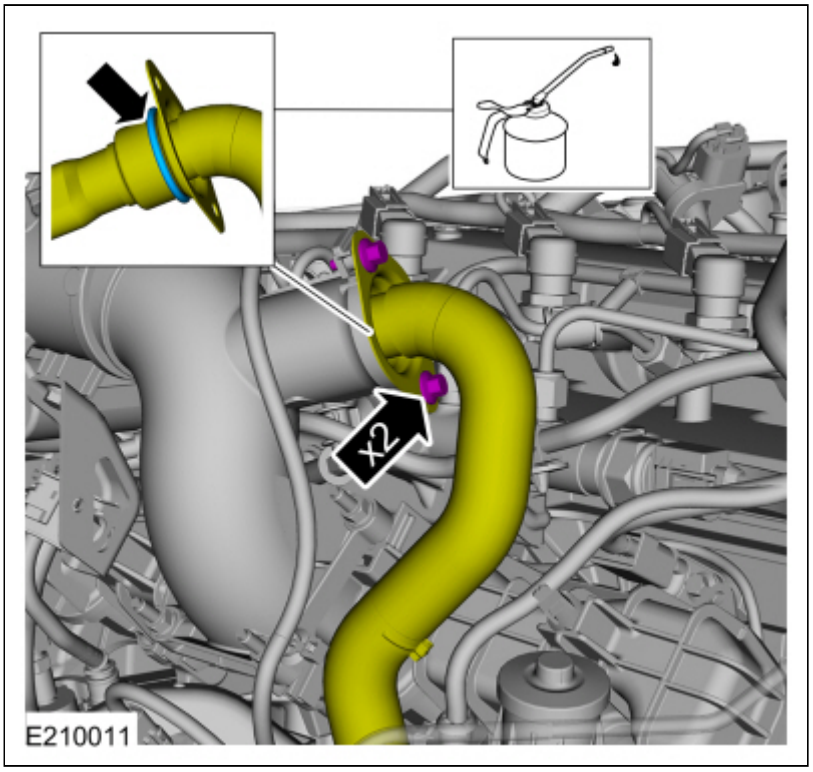


Installation

1. *Torque*:
   Stage 1: 5 Nm
   Stage 2: 10 Nm

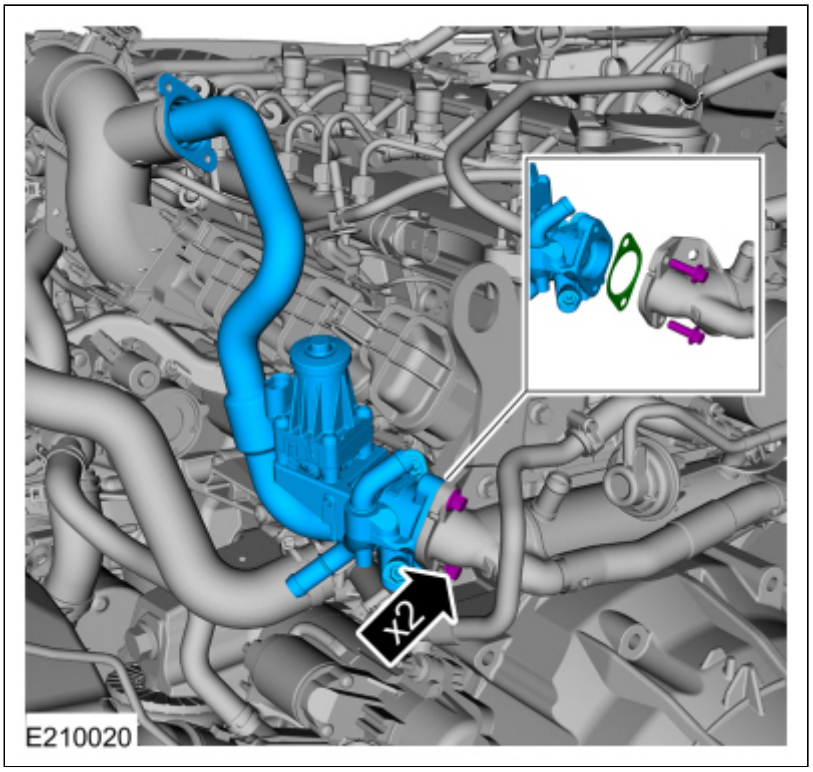


2. **NOTE:** *Install all the bolts finger tight before final tightening.*

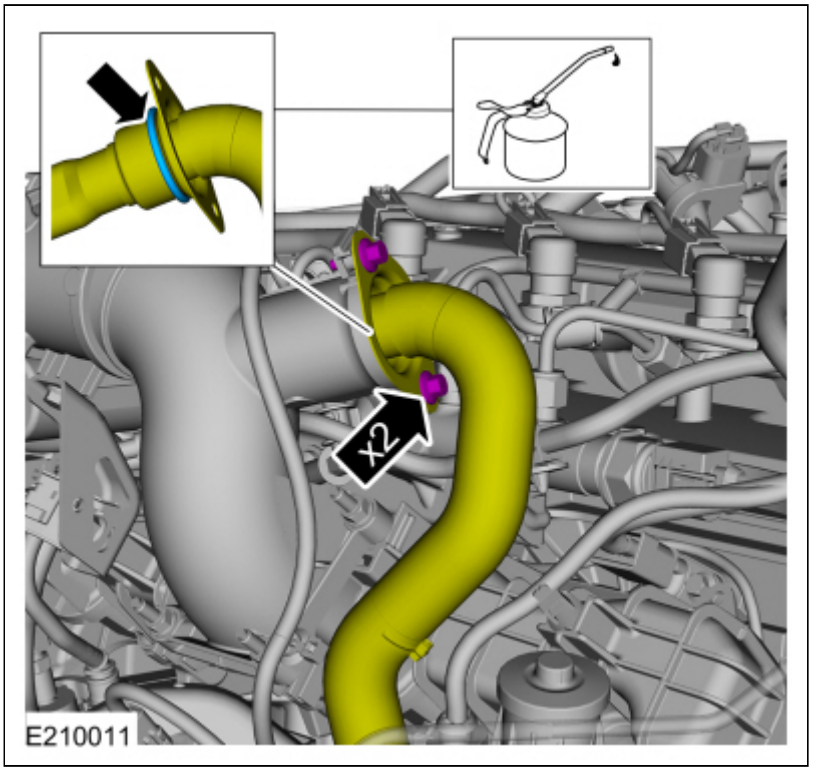


3. **NOTE:** *Make sure that new gaskets are installed.*

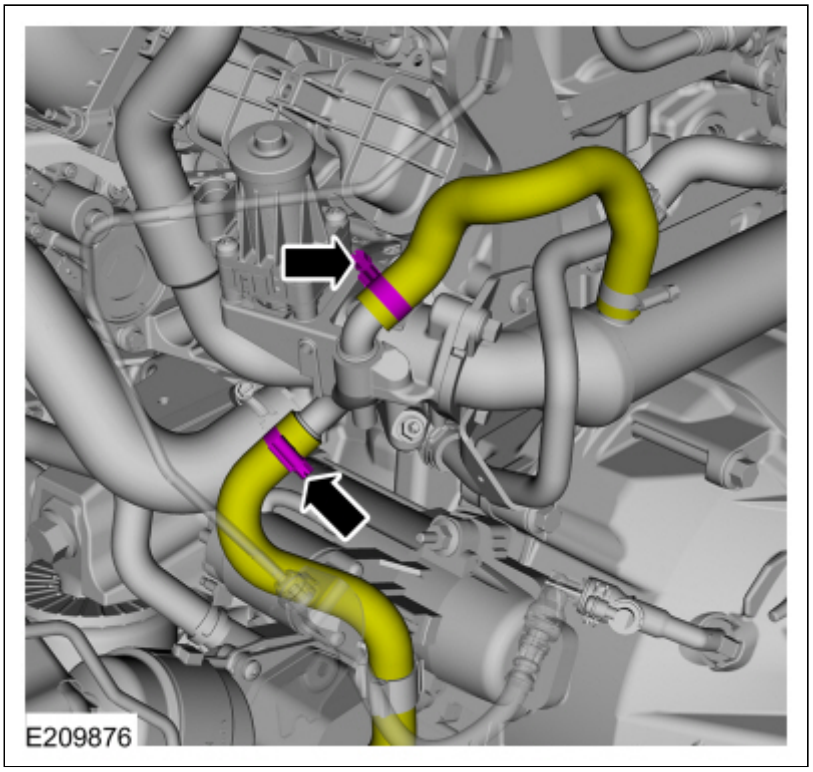
   Torque: 23 Nm



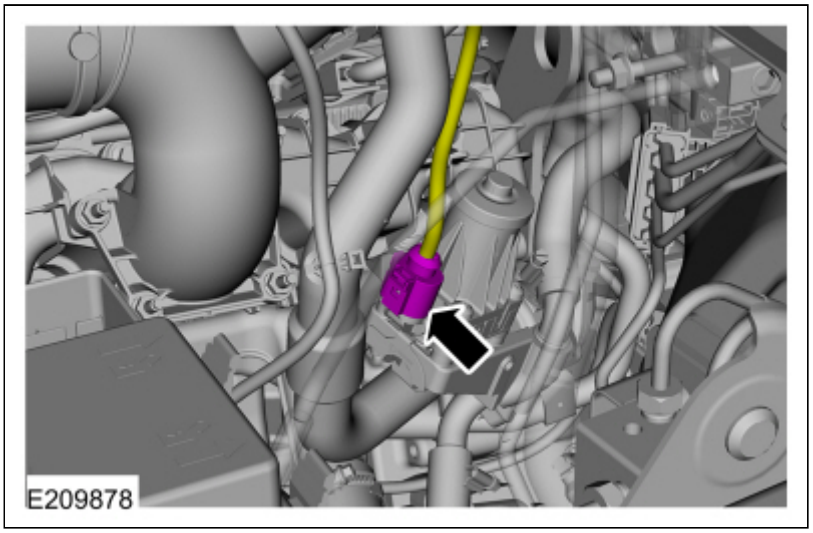
4. *Torque*: 10 Nm



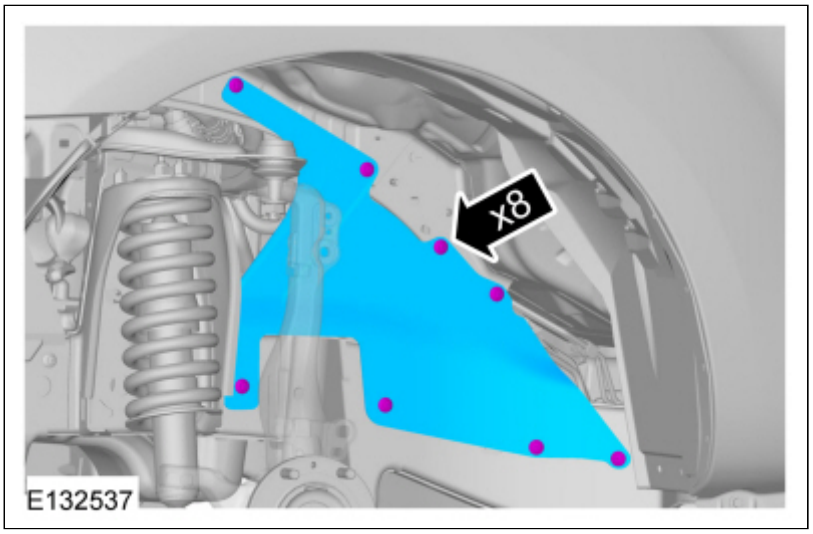
1. *Torque*: 4 Nm



6. Use the General Equipment: Hose Clamp Remover/Installer



7.



8. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi

(148kW/200PS) - Puma, General Procedures).

9. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
10. Refer to: Cowl Panel (501-02 Front End Body Panels, Removal and Installation).

Copyright © 2016 Ford Motor Company

Exhaust Gas Recirculation (EGR) Valve Outlet Tube - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

Removal

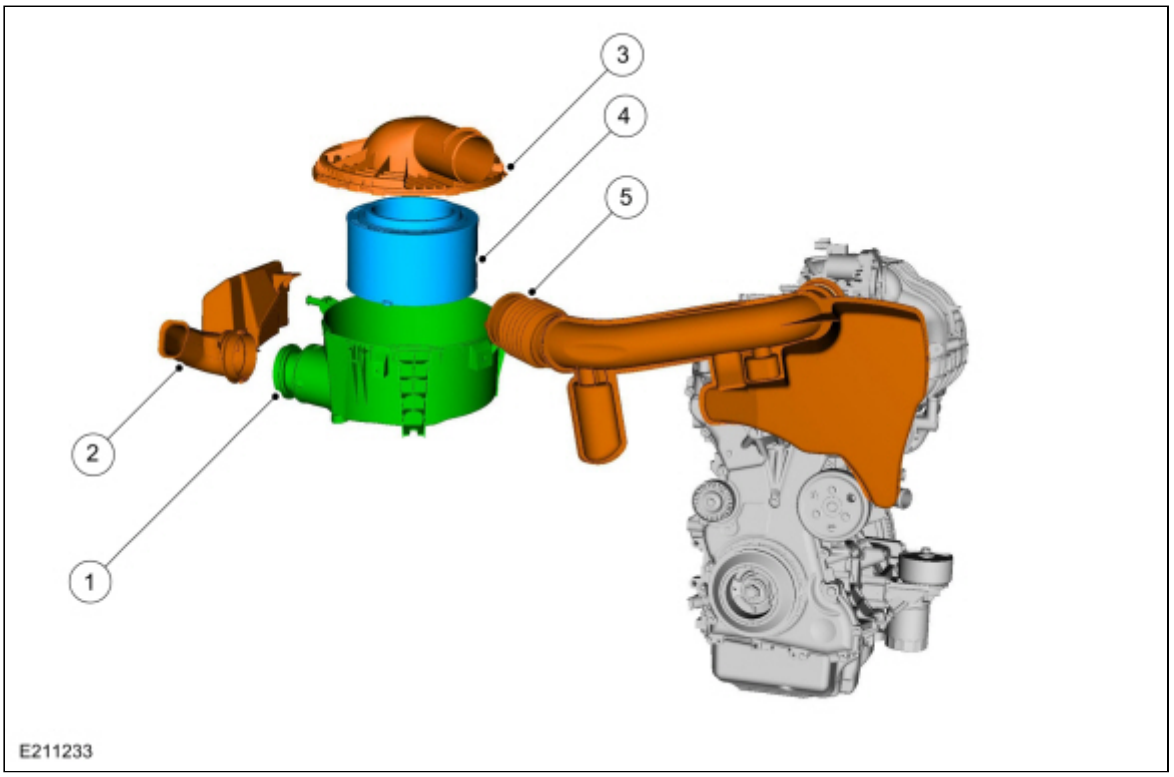
1. Refer to: Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-08C Engine Emission Control - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Installation

1. Refer to: Exhaust Gas Recirculation (EGR) Valve - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-08C Engine Emission Control - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering - Component Location



Item	Part Number	Description
1.	—	Air cleaner housing
2.	—	Air cleaner intake pipe
3.	—	Air cleaner housing cover
4.	—	Air cleaner element
5.	—	Air cleaner outlet pipe

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering - Overview

Overview

The air intake system cleans intake air with a replaceable, dry-type engine Air Cleaner (ACL) element made of treated, pleated paper. A new Air Cleaner (ACL) element must be installed periodically as scheduled. Engine performance and fuel economy are adversely affected when maximum restriction of the Air Cleaner (ACL) element is reached.

The air intake system measures airflow with the MAF sensor.

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. For information about these,
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

For PCM DTC,
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.0L EcoBoost (177kW/240PS) - MI4) .
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (118kW/160PS) - Puma) .
REFER to: Electronic Engine Controls (303-14C) .

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

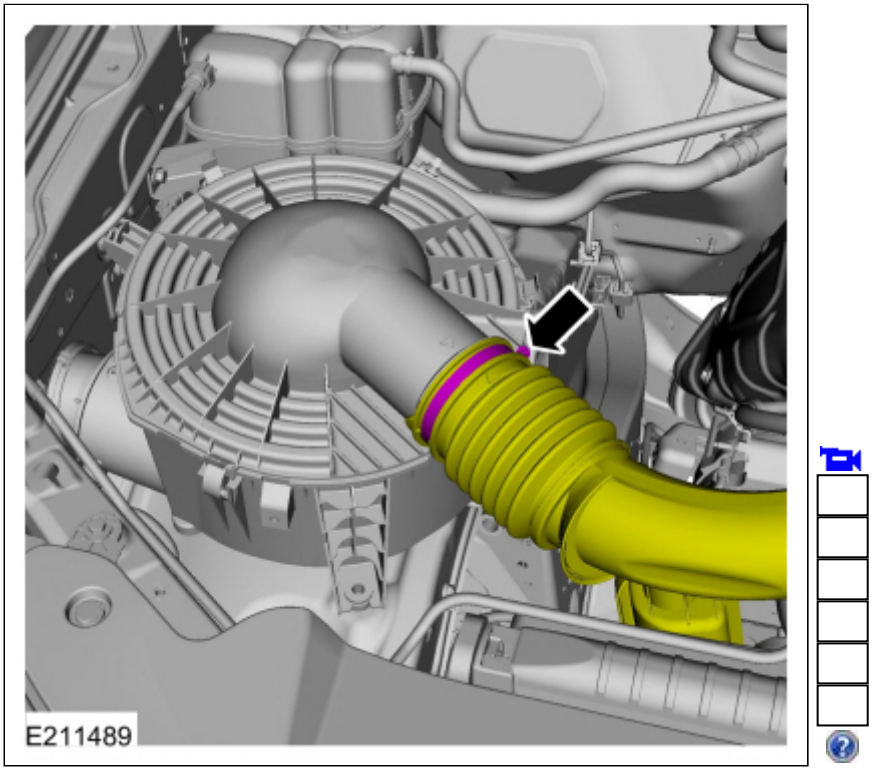
Air Cleaner

Removal

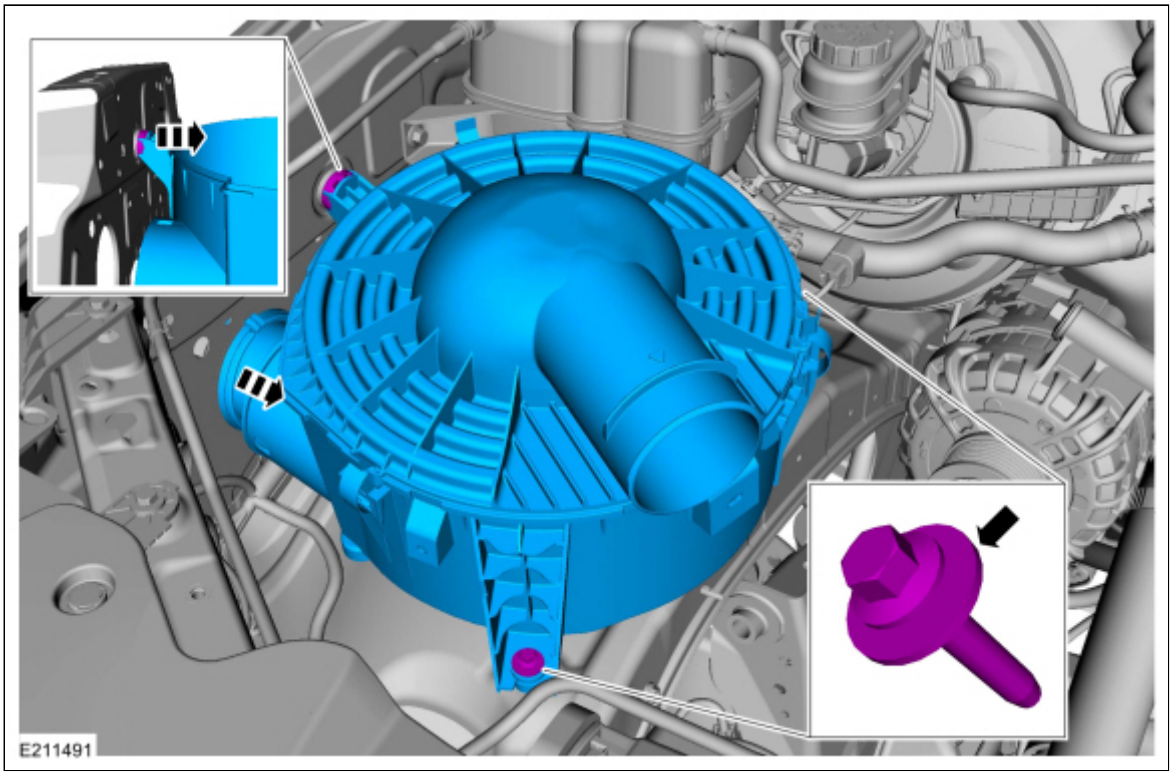
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *Make sure that the positive crankcase ventilation (PCV) hose and the turbocharger intake pipe are not disturbed.*

   Torque: 4 Nm



2. *Torque*: 11 Nm



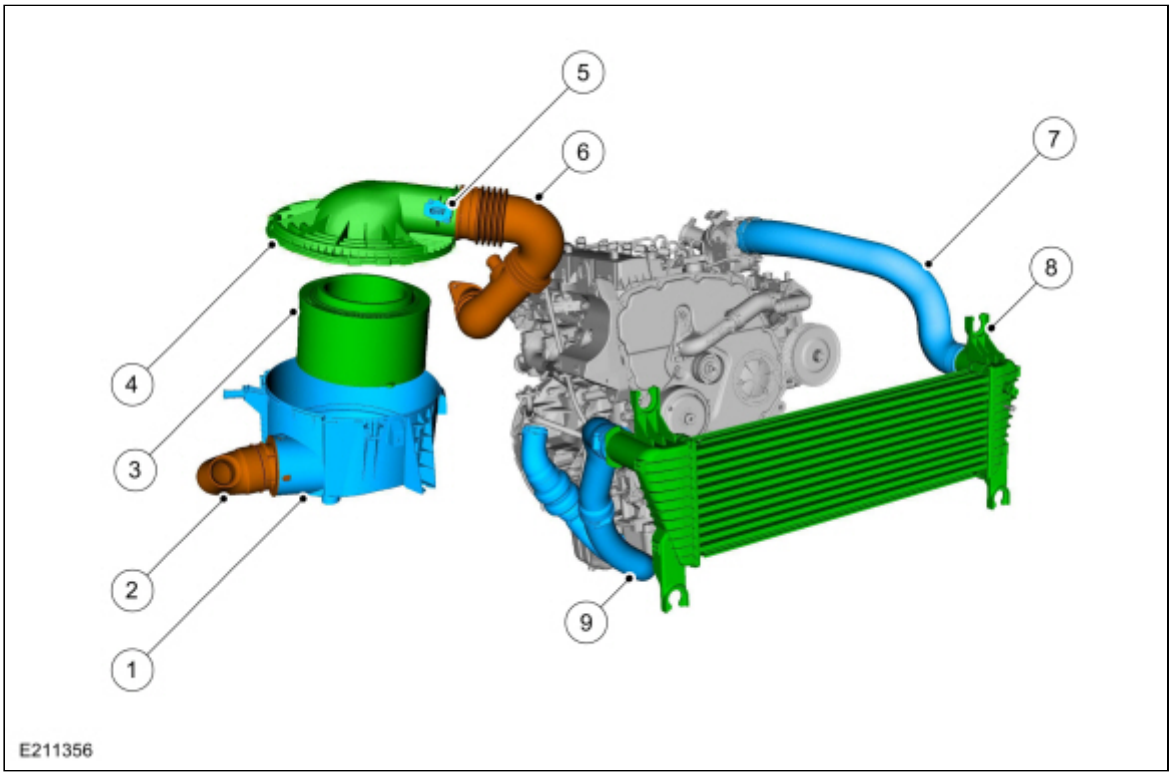
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering - Component Location

Vehicles with 2.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Air cleaner housing
2	—	Air cleaner intake pipe
3	—	Air cleaner element
4	—	Air cleaner housing cover
5	—	Mass air flow (MAF) sensor
6	—	Air cleaner outlet pipe
7	—	Charge air cooler outlet pipe
8	—	Charge air cooler
9	—	Charge air cooler intake pipe

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering - Overview

Overview

The air intake system cleans intake air with a replaceable, dry-type engine air cleaner element made of treated, pleated paper. A new air cleaner element must be installed periodically as scheduled. Engine performance and fuel economy are adversely affected when maximum restriction of the air cleaner element is reached.

The CAC subsystem cools and increases the density of the compressed turbocharged air.

The air intake system measures air flow and air temperature into the engine with the MAF and IAT sensor.

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. For information about these,
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

For PCM DTC,
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.0L EcoBoost (177kW/240PS) - MI4) .
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (118kW/160PS) - Puma) .
REFER to: Electronic Engine Controls (303-14C) .

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Charge Air Cooler (CAC) Cleaning

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *Do not use a high-pressure power washer to clean the CAC (Charge Air Cooler) or damage to the CAC may occur.*

   NOTE: *Drain all contaminates such as coolant, fuel and oil prior to cleaning the CAC.*

   NOTE: *Thoroughly clean the joint clamp areas as well as the turbocharger connection, engine connection and the CAC connections, using metal brake parts cleaner.*

   Lay the CAC flat with the inlet and outlet ports pointing up.

3. **NOTE:** *Plug or cap the CAC openings prior to agitating.*

4. Add an appropriate amount of commercially available detergent cleaner such as Simple Green Pro HD, or equivalent to the CAC. Follow the manufacturer's directions for cleaning. Fill the CAC to 40% of its volume with water.

5. Raise one end of the CAC and agitate it by hand for at least 5 minutes.

6. Raise the opposite end of the CAC and agitate it by hand for at least 5 minutes.

7. Drain the CAC.

8. Flush the CAC thoroughly with clean water.

9. Repeat Steps 2 through 7 until no contaminates are found in the flush water.

10. Allow the CAC to air dry.

11. **NOTE:** *The following leak test steps must be performed prior to installing the CAC.*

    NOTE: *Use a commercially available kit, such as the Johnson Manufacturing Company Charge Air Cooler Test Set Part No. 351-CAS, or equivalent.*

    Install the commercially available CAC cooler tester on the CAC following the manufacturer's installation instructions.

12. Tighten the clamps to 5 Nm (44 lb-in).

13. **WARNING: Never exceed the specified pressure. Excessive pressure may cause the test adapter to blow off or may damage the charge air cooler (CAC). Failure to follow this instruction may result in serious personal injury.**

    Slowly apply air pressure to 150 kPa (22 psi).

14. Let the CAC stand for a few minutes and note any loss in pressure.

15. Release the air pressure.

16. Repeat Steps 13 through 15 as many times as necessary to verify the readings. The reading is considered verified when 3 consecutive tests show approximately the same pressure drop.

17. If the pressure loss exceeds 10 kPa (1.5 psi) per minute, install a new CAC.

Refer to: Charge Air Cooler (CAC) (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
Refer to: Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel (303-12B Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

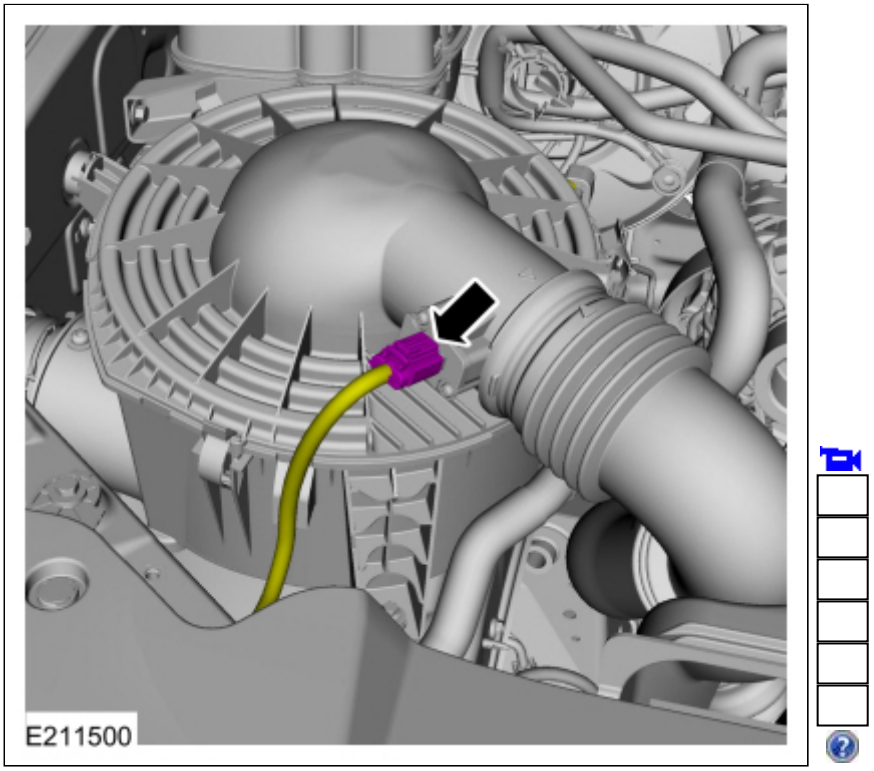
Air Cleaner - 2.2L Duratorq-TDCi (Puma) Diesel

Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

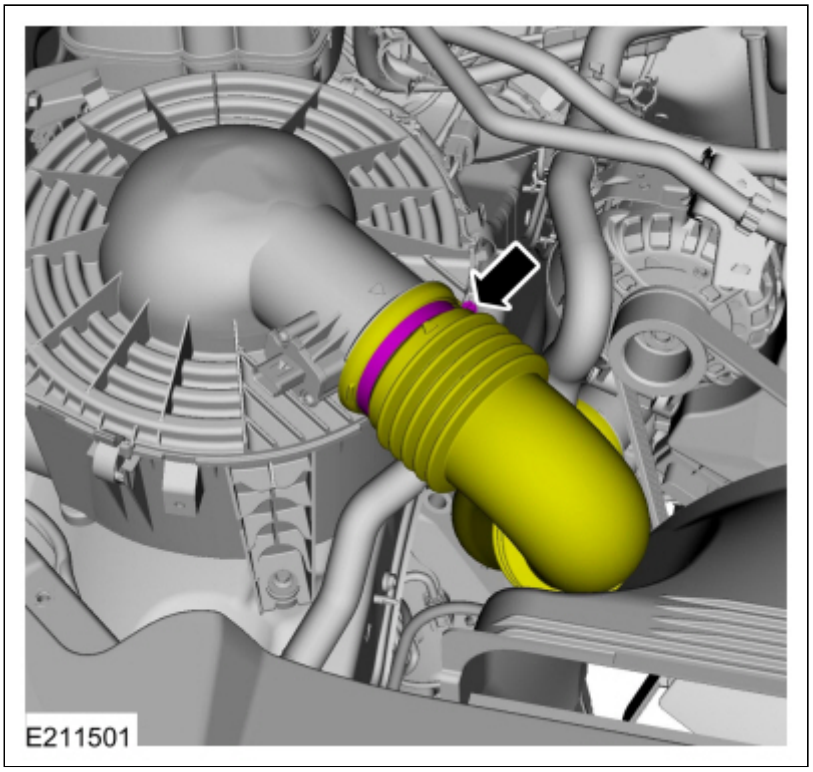
NOTE: *Removal steps in this procedure may contain installation details.*

2.

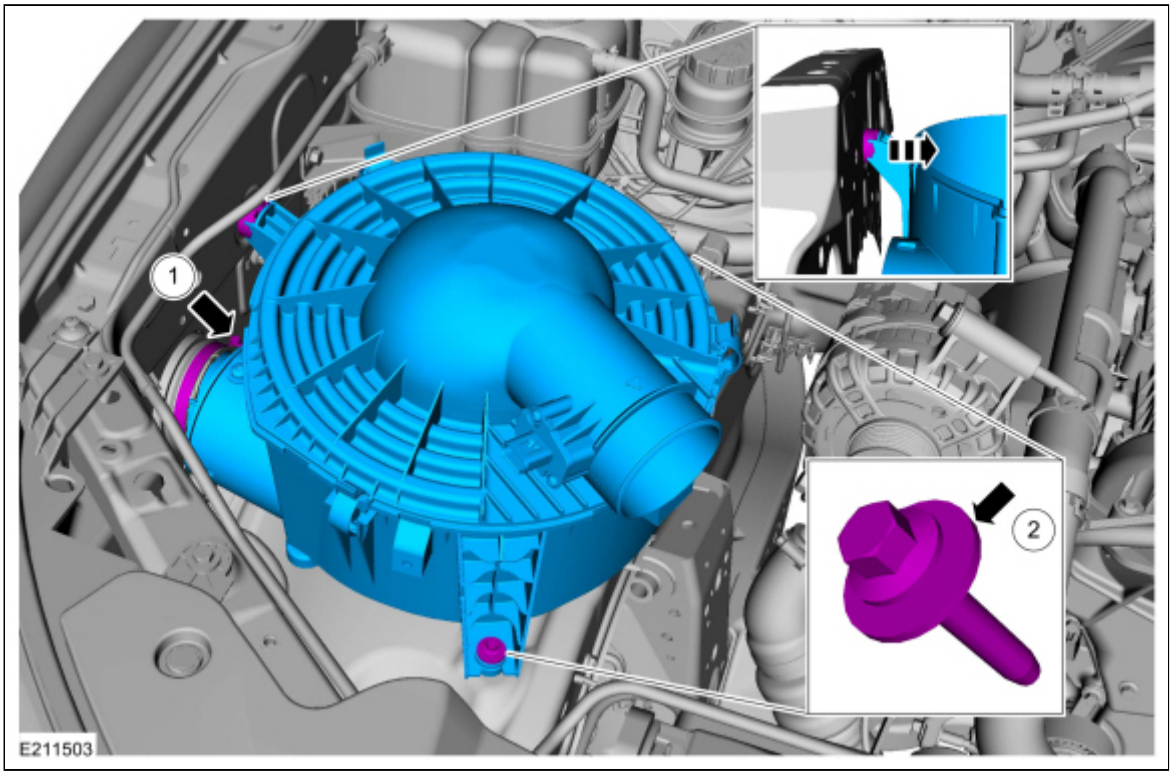


3. **NOTE:** *Make sure that the positive crankcase ventilation (PCV) hose and the turbocharger intake pipe are not disturbed.*

   Torque: 4 Nm



1. *Torque*: 4 Nm
2. *Torque*: 11 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

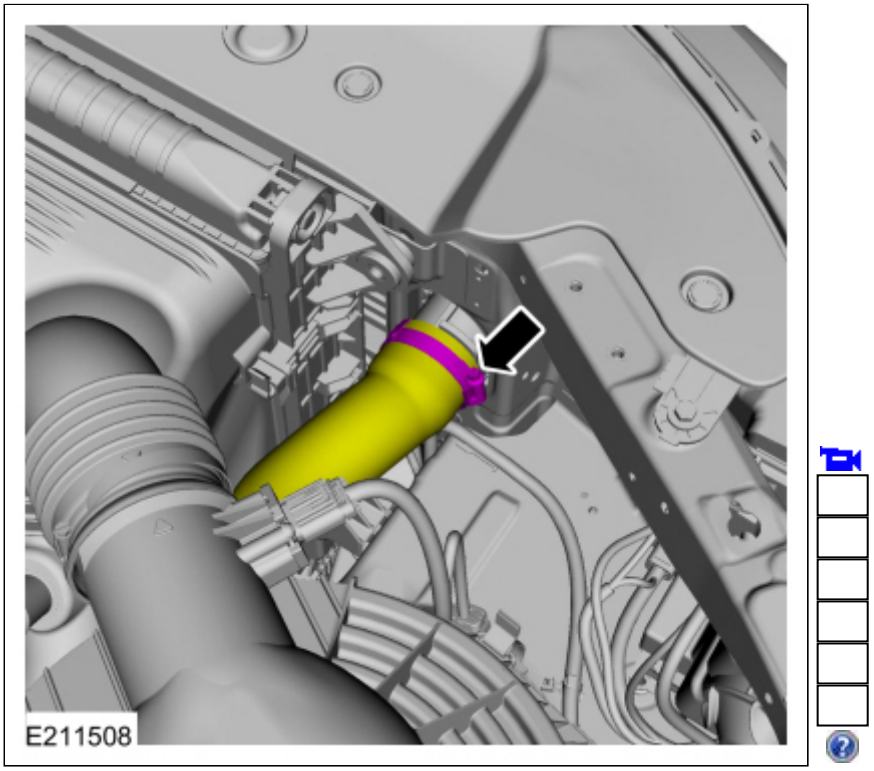
Charge Air Cooler (CAC)

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

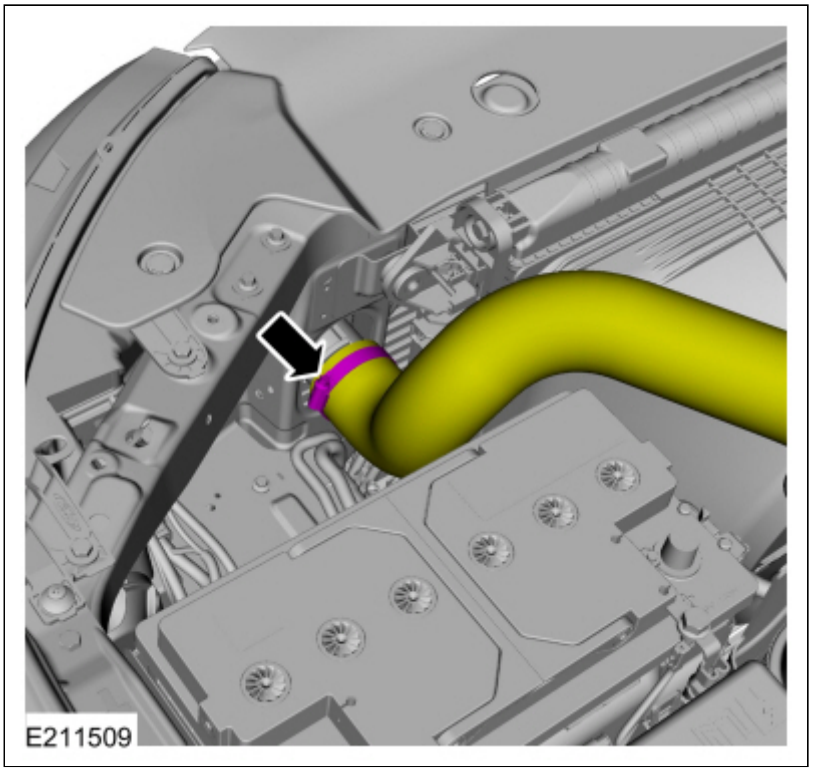
1. **NOTICE: Make sure that the inside of the pipe ends are clean and free of oil residue.**

   Torque: 5 Nm

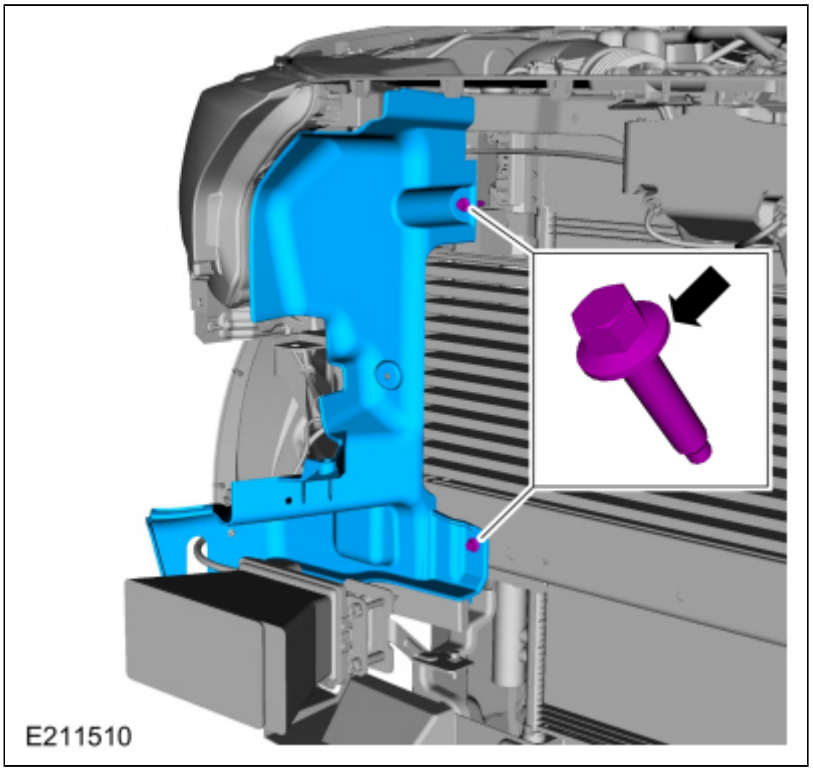


2. **NOTICE: Make sure that the inside of the pipe ends are clean and free of oil residue.**

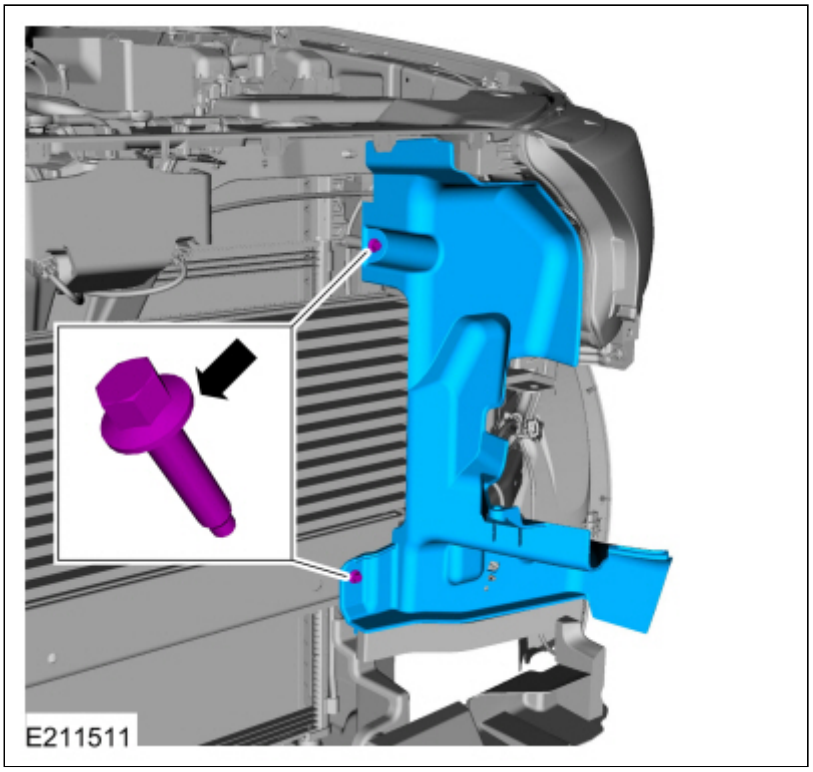
   Torque: 5 Nm



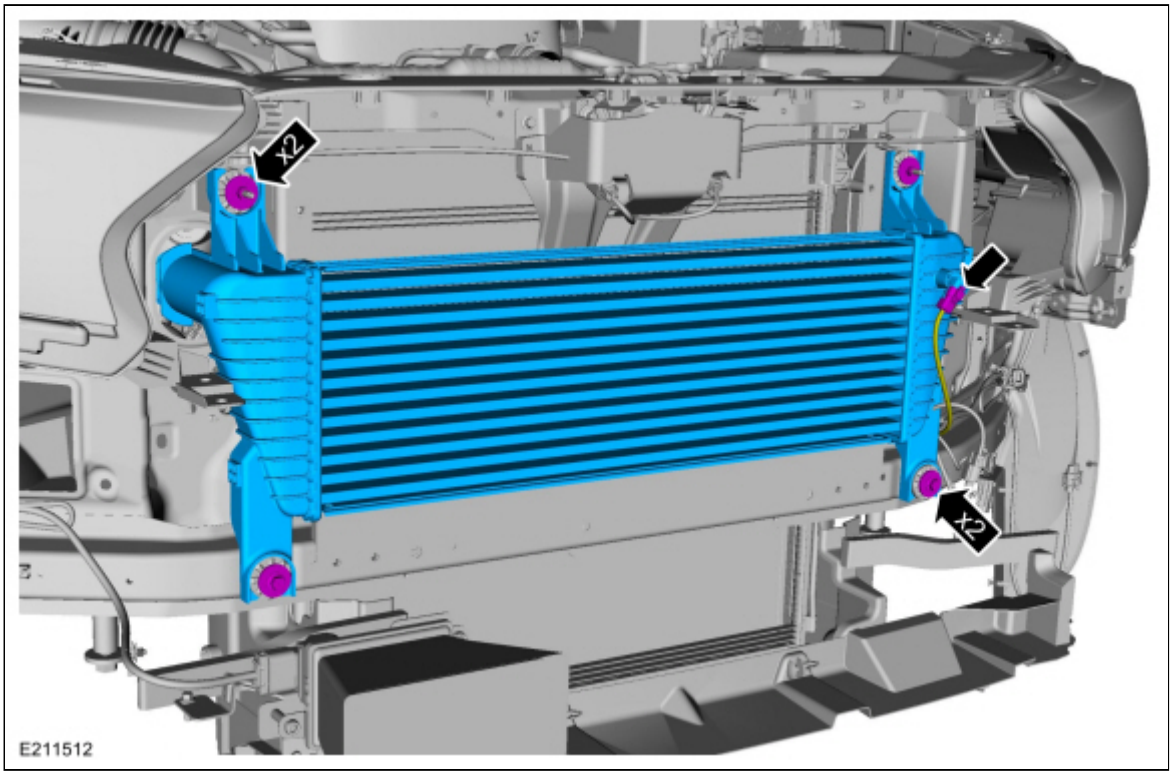
3. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
4. *Torque*: 10 Nm



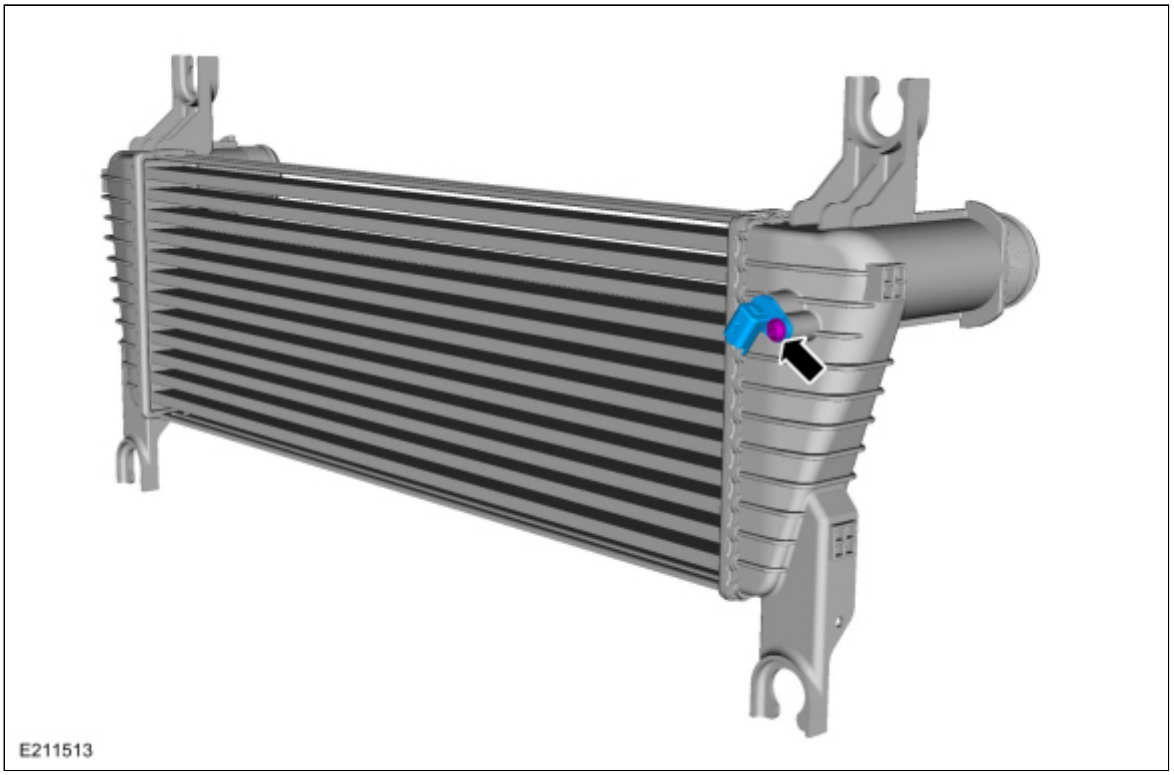
5. *Torque*: 10 Nm



6. *Torque*: 11 Nm



7. *Torque*: 7 Nm



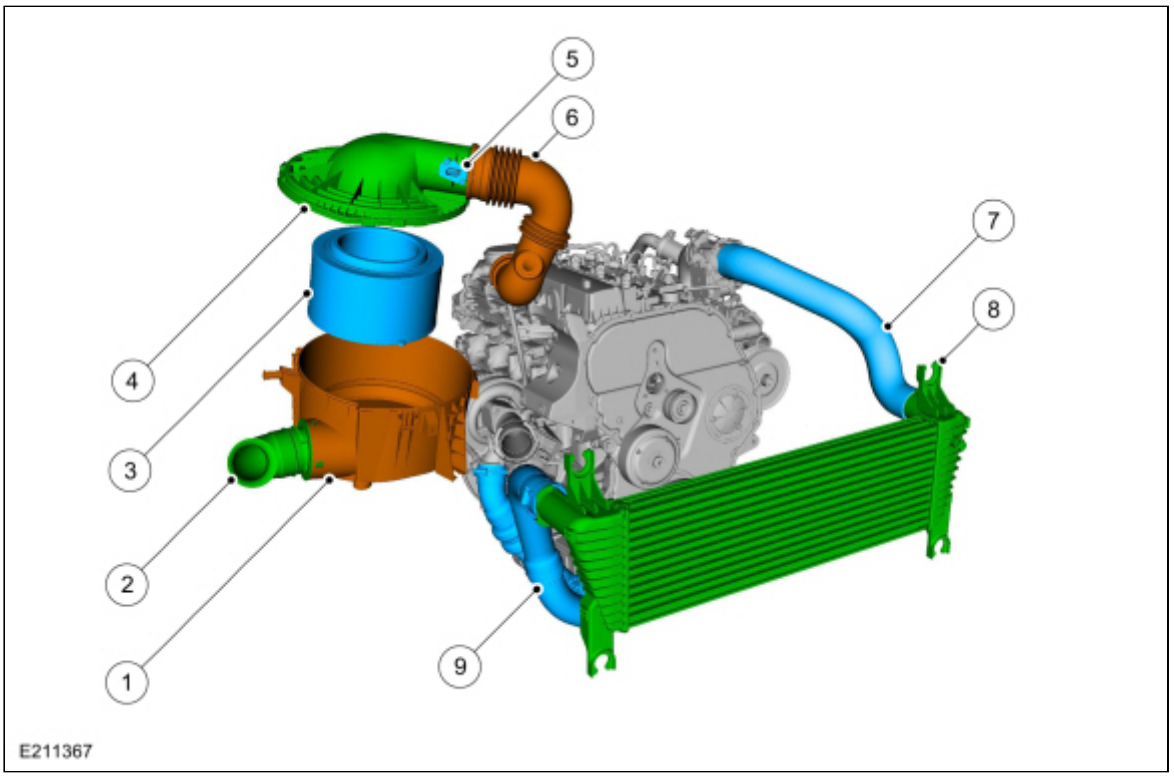
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering - Component Location

Vehicles with 2.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Air cleaner housing
2	—	Air cleaner intake pipe
3	—	Air cleaner element
4	—	Air cleaner housing cover
5	—	Mass air flow (MAF) sensor
6	—	Air cleaner outlet pipe
7	—	Charge air cooler outlet pipe
8	—	Charge air cooler
9	—	Charge air cooler intake pipe

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering - Overview

Overview

The air intake system cleans intake air with a replaceable, dry-type engine air cleaner element made of treated, pleated paper. A new air cleaner element must be installed periodically as scheduled. Engine performance and fuel economy are adversely affected when maximum restriction of the air cleaner element is reached.

The CAC subsystem cools and increases the density of the compressed turbocharged air.

The air intake system measures air flow and air temperature into the engine with the MAF and IAT sensor.

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering

Refer to Wiring Diagrams Section 303-14B for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
− Air cleaner intake pipe − Air cleaner outlet pipe − Air cleaner − Air cleaner element − Charge air cooler intake pipe − Charge air cooler outlet pipe − Charge air cooler	− Fuse(s) − Wiring harness − Electrical connector(s) − Mass air flow and temperature (MAFT) sensor − Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Ford diagnostic equipment to diagnose the system.

Copyright © 2016 Ford Motor Company

Intake Air Distribution and Filtering

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. For information about these,
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

For PCM DTC,
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.0L EcoBoost (177kW/240PS) - MI4) .
REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (118kW/160PS) - Puma) .
REFER to: Electronic Engine Controls (303-14C) .

For driveability symptoms without DTC, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. See Section 3, Symptom Charts.

Copyright © 2016 Ford Motor Company

Charge Air Cooler (CAC) Cleaning

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *Do not use a high-pressure power washer to clean the CAC (Charge Air Cooler) or damage to the CAC may occur.*

   NOTE: *Drain all contaminates such as coolant, fuel and oil prior to cleaning the CAC.*

   NOTE: *Thoroughly clean the joint clamp areas as well as the turbocharger connection, engine connection and the CAC connections, using metal brake parts cleaner.*

   Lay the CAC flat with the inlet and outlet ports pointing up.

3. **NOTE:** *Plug or cap the CAC openings prior to agitating.*

4. Add an appropriate amount of commercially available detergent cleaner such as Simple Green Pro HD, or equivalent to the CAC. Follow the manufacturer's directions for cleaning. Fill the CAC to 40% of its volume with water.

5. Raise one end of the CAC and agitate it by hand for at least 5 minutes.

6. Raise the opposite end of the CAC and agitate it by hand for at least 5 minutes.

7. Drain the CAC.

8. Flush the CAC thoroughly with clean water.

9. Repeat Steps 2 through 7 until no contaminates are found in the flush water.

10. Allow the CAC to air dry.

11. **NOTE:** *The following leak test steps must be performed prior to installing the CAC.*

    NOTE: *Use a commercially available kit, such as the Johnson Manufacturing Company Charge Air Cooler Test Set Part No. 351-CAS, or equivalent.*

    Install the commercially available CAC cooler tester on the CAC following the manufacturer's installation instructions.

12. Tighten the clamps to 5 Nm (44 lb-in).

13. **WARNING: Never exceed the specified pressure. Excessive pressure may cause the test adapter to blow off or may damage the charge air cooler (CAC). Failure to follow this instruction may result in serious personal injury.**

    Slowly apply air pressure to 150 kPa (22 psi).

14. Let the CAC stand for a few minutes and note any loss in pressure.

15. Release the air pressure.

16. Repeat Steps 13 through 15 as many times as necessary to verify the readings. The reading is considered verified when 3 consecutive tests show approximately the same pressure drop.

17. If the pressure loss exceeds 10 kPa (1.5 psi) per minute, install a new CAC.
    Refer to: Charge Air Cooler (CAC) (303-12C Intake Air Distribution and Filtering - 3.2L Duratorq-TDCi

(148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

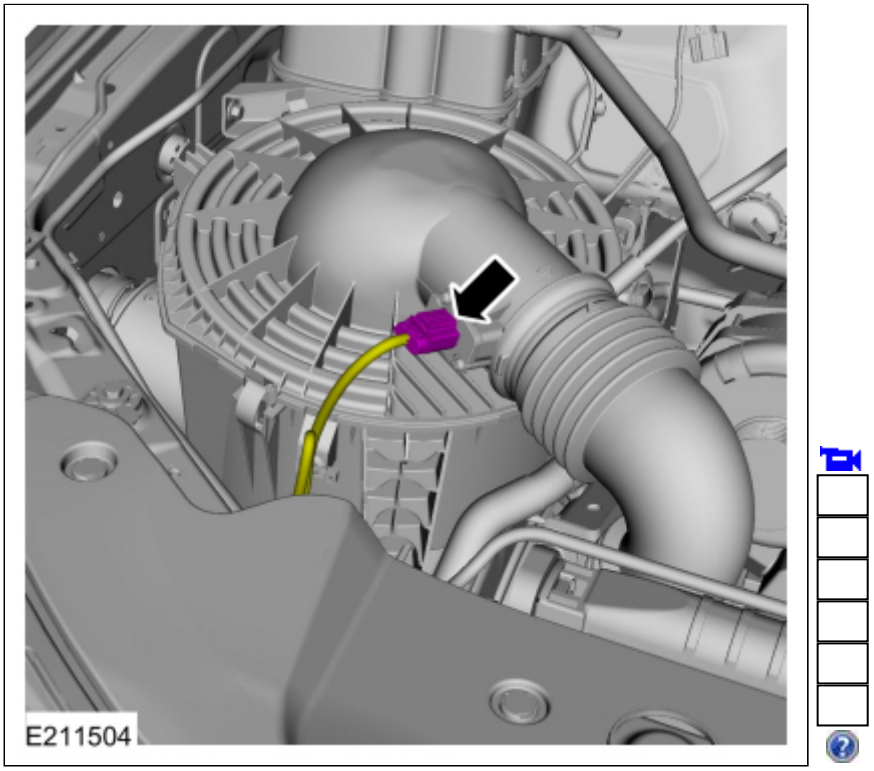
Air Cleaner - 3.2L Duratorq-TDCi (Puma) Diesel

Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

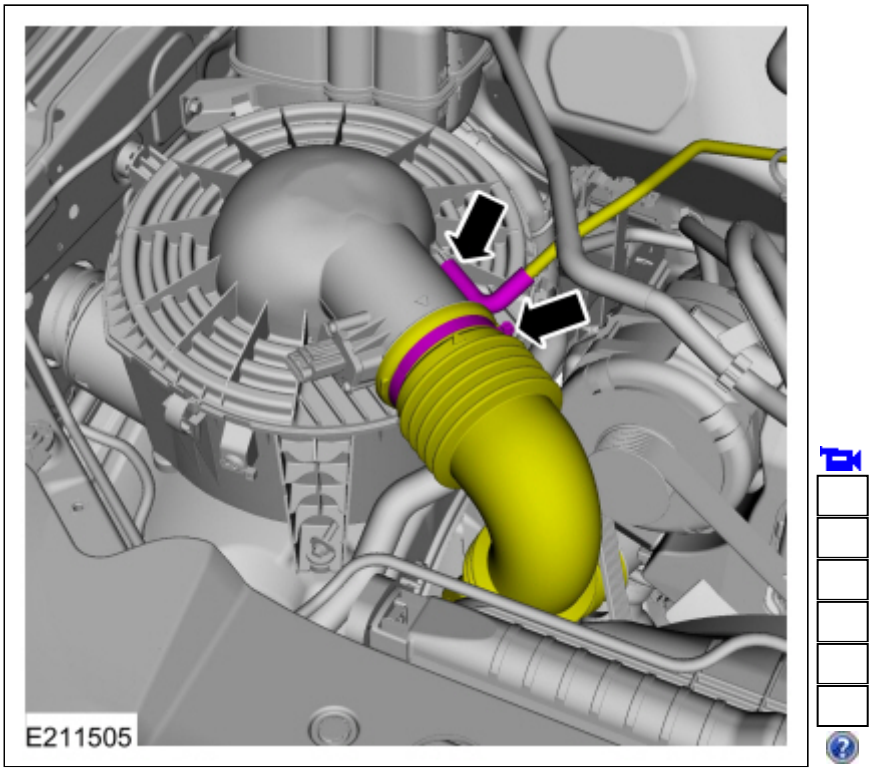
NOTE: *Removal steps in this procedure may contain installation details.*

2.

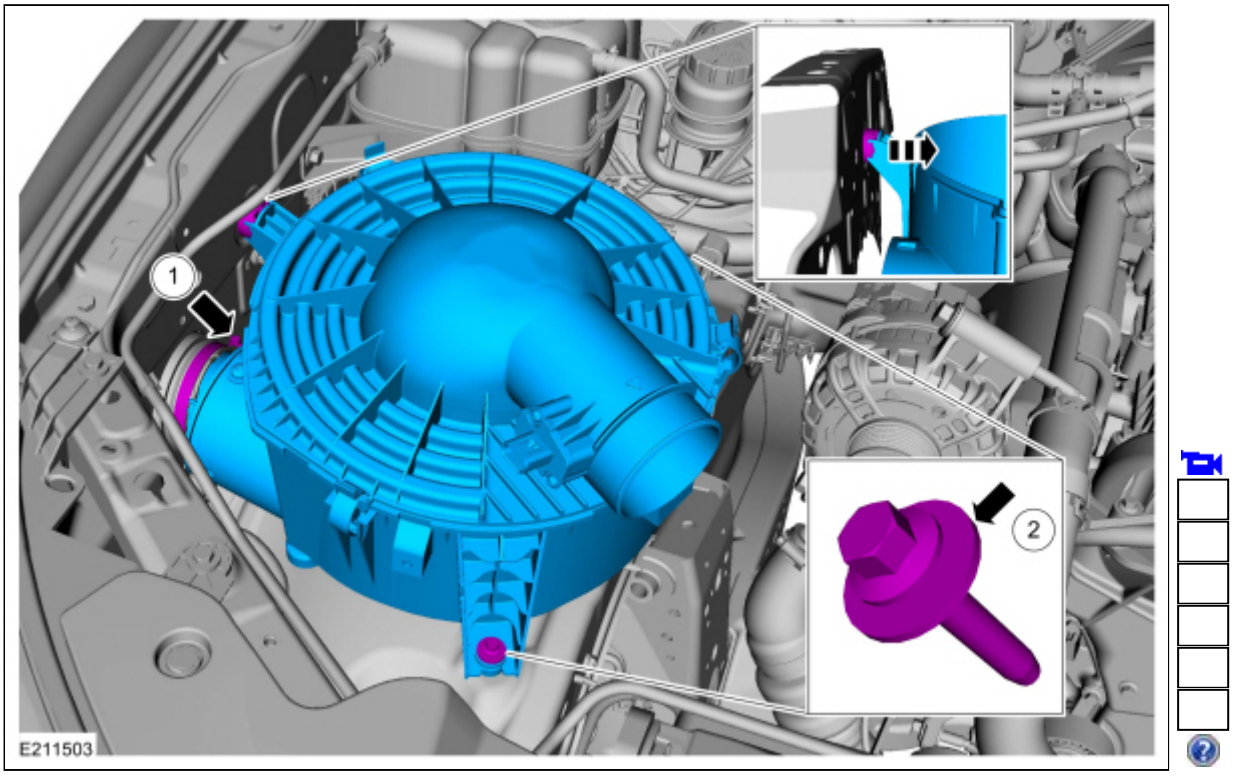


3. **NOTE:** *Make sure that the positive crankcase ventilation (PCV) hose and the turbocharger intake pipe are not disturbed.*

   Torque: 4 Nm



1. *Torque*: 4 Nm
2. *Torque*: 11 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

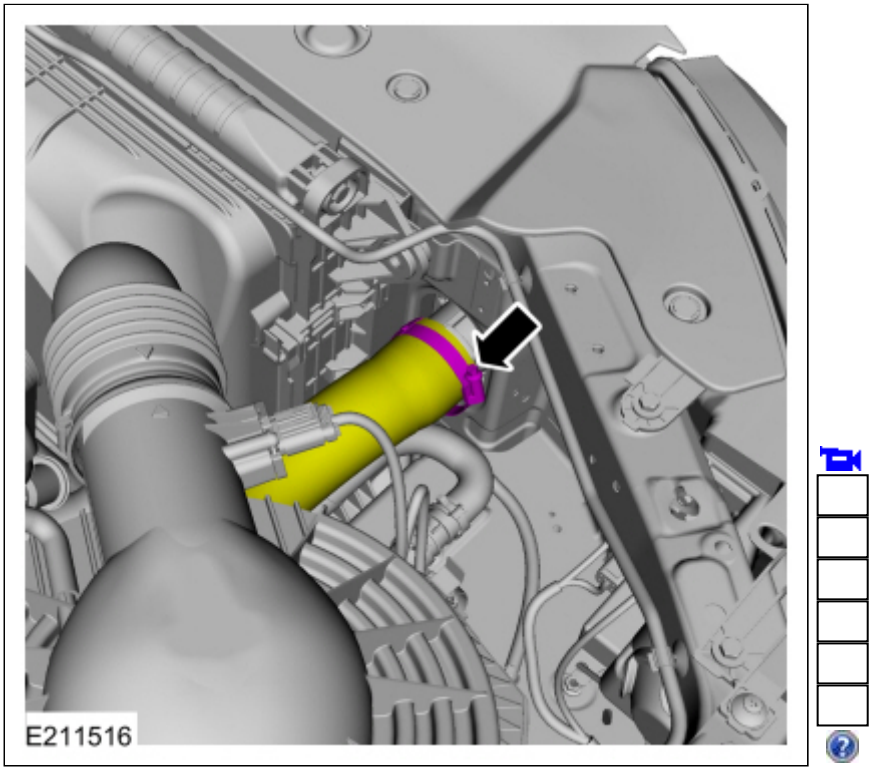
Charge Air Cooler (CAC)

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

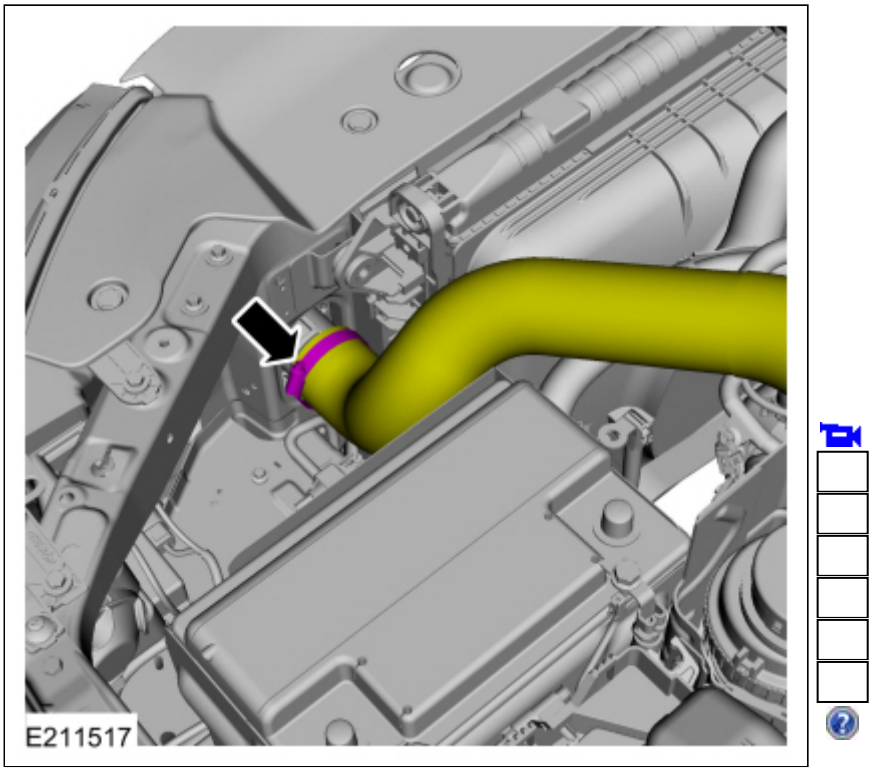
1. **NOTICE: Make sure that the inside of the pipe ends are clean and free of oil residue.**

   Torque: 5 Nm

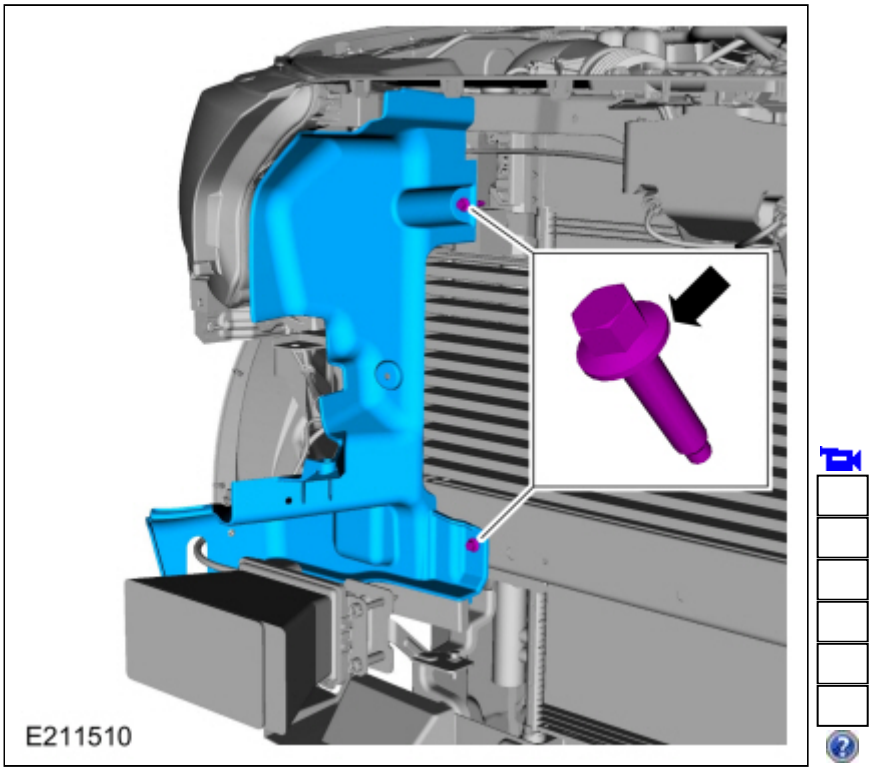


2. **NOTICE: Make sure that the inside of the pipe ends are clean and free of oil residue.**

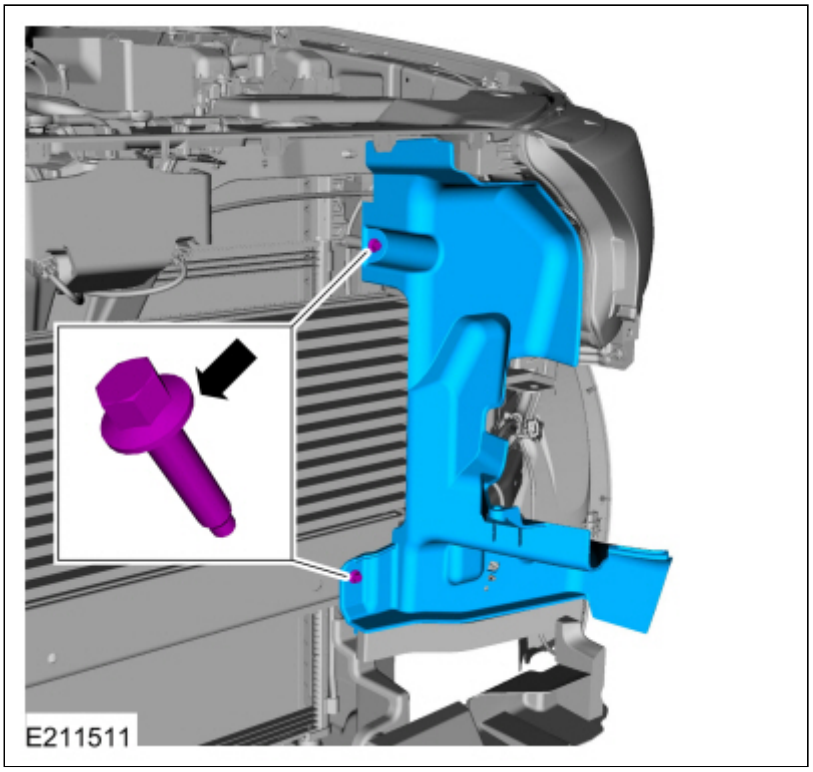
   Torque: 5 Nm



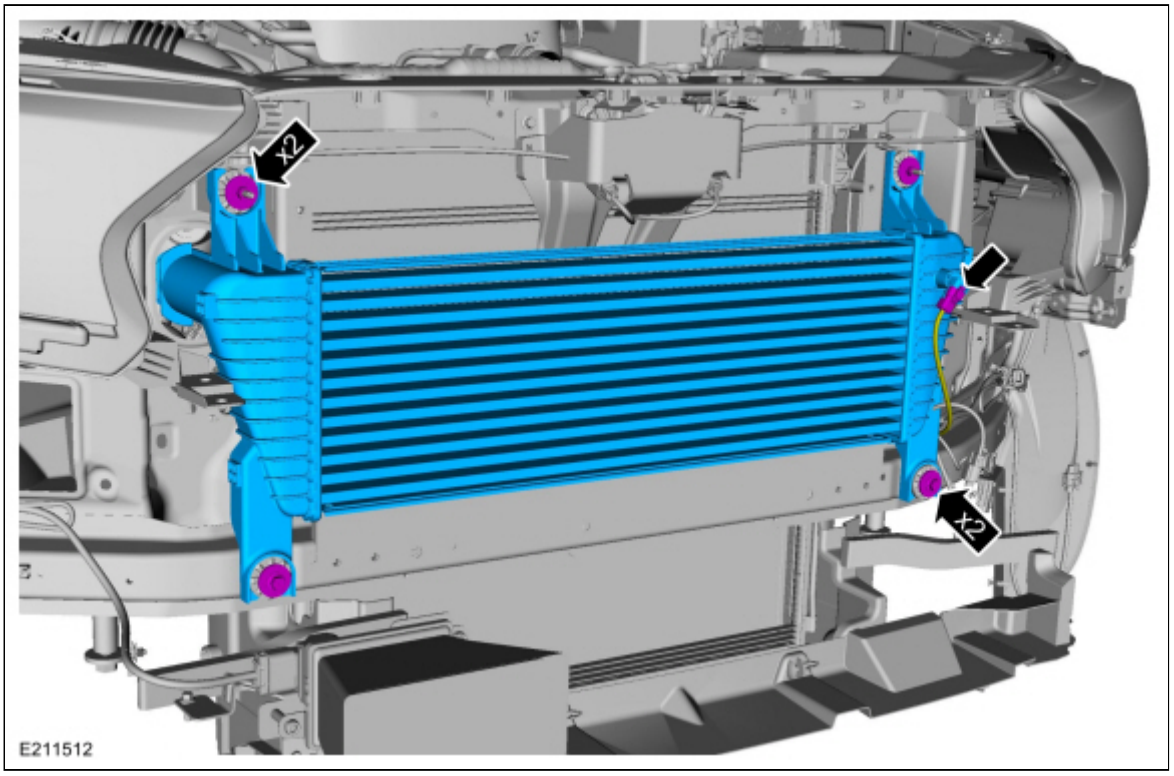
3. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
4. *Torque*: 10 Nm



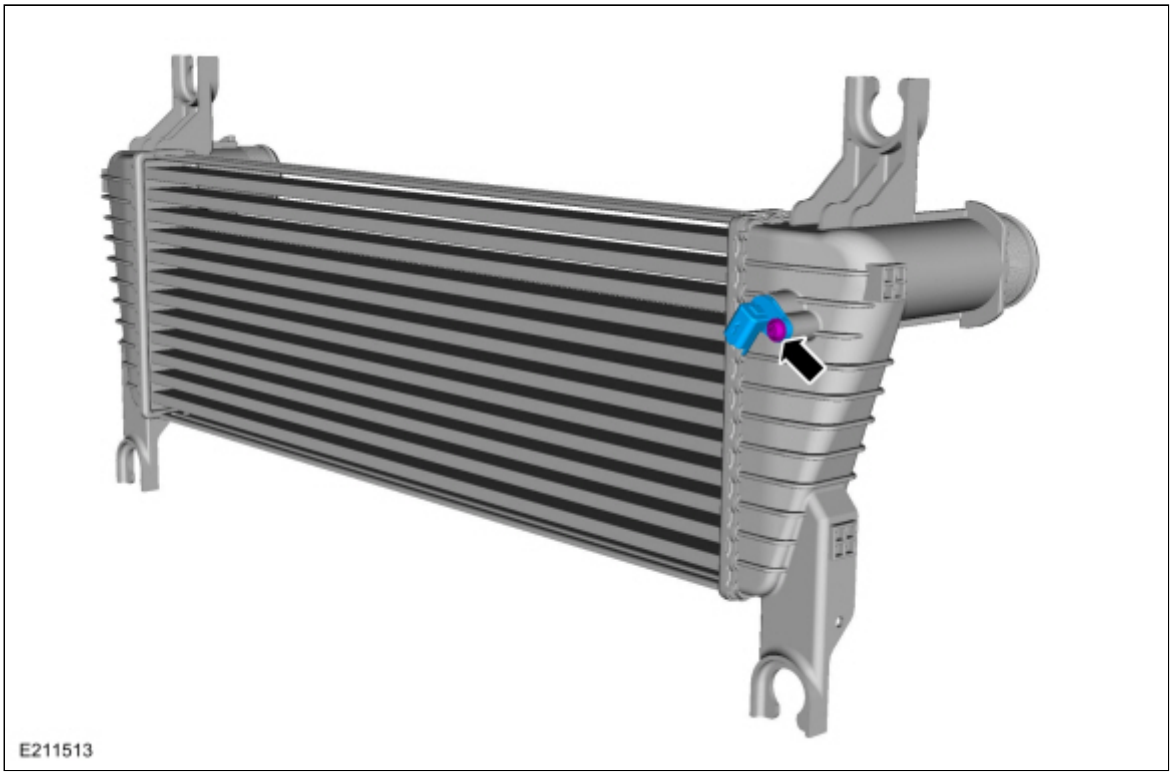
5. *Torque*: 10 Nm



6. *Torque*: 11 Nm



7. *Torque*: 7 Nm

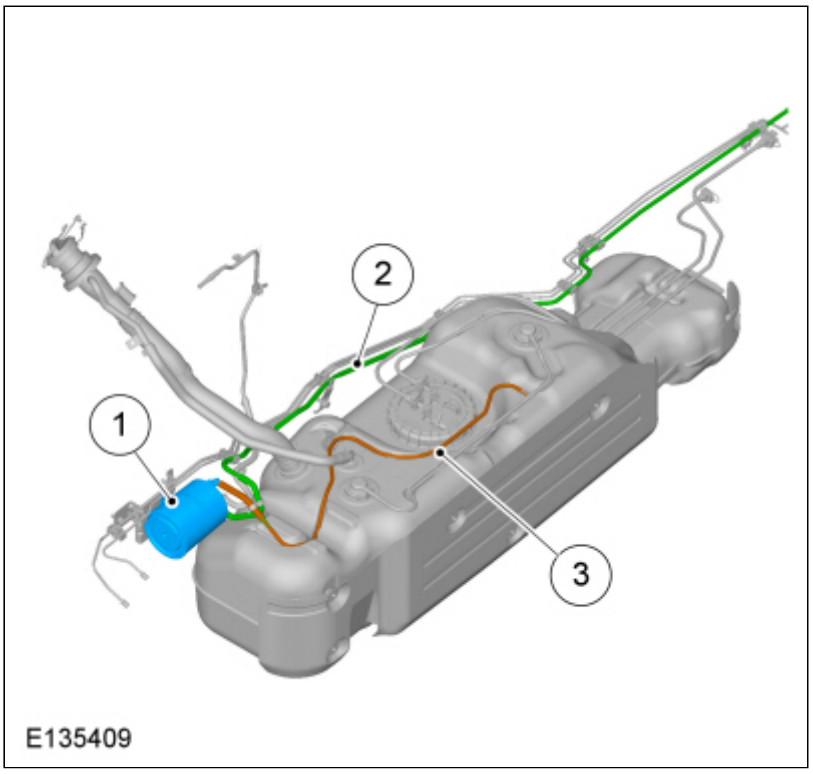


Installation

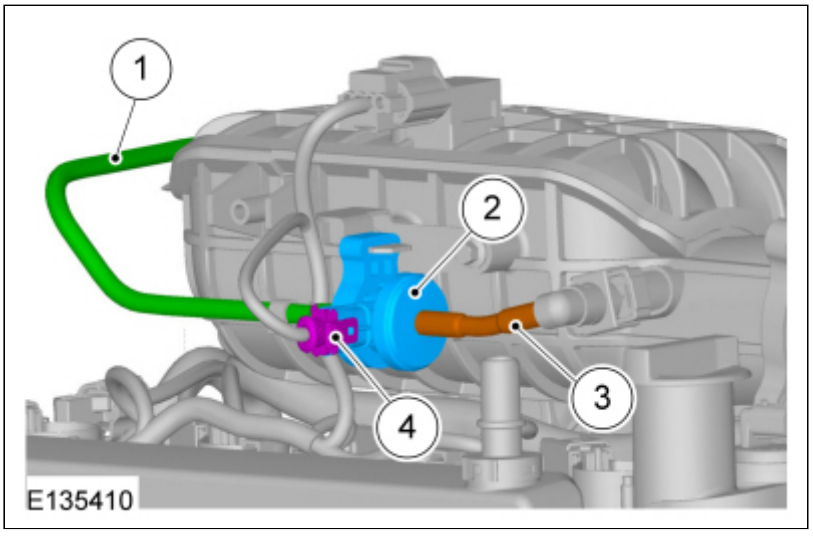
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Evaporative Emissions



Item	Part Number	Description
1	—	Evaporative emission canister
2	—	Evaporative emission canister to evaporative emission canister purge valve vapor line
3	—	Fuel tank vent to evaporative emission canister line



Item	Part Number	Description
1	—	Evaporative emission canister to evaporative emission canister purge valve vapor line

2	—	Evaporative emission canister purge valve
3	—	Evaporative emission canister purge valve to intake manifold vapor line
4	—	Evaporative emission canister purge valve electrical connector

Copyright © 2016 Ford Motor Company

Evaporative Emissions

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Vacuum line(s) – Evaporative emission (EVAP) system canister – EVAP system hose(s) – EVAP system canister purge valve	– Fuse(s) – Wiring harness – Electrical connector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the diagnostic tab within the Ford diagnostic equipment.

Copyright © 2016 Ford Motor Company

Evaporative Emission Canister

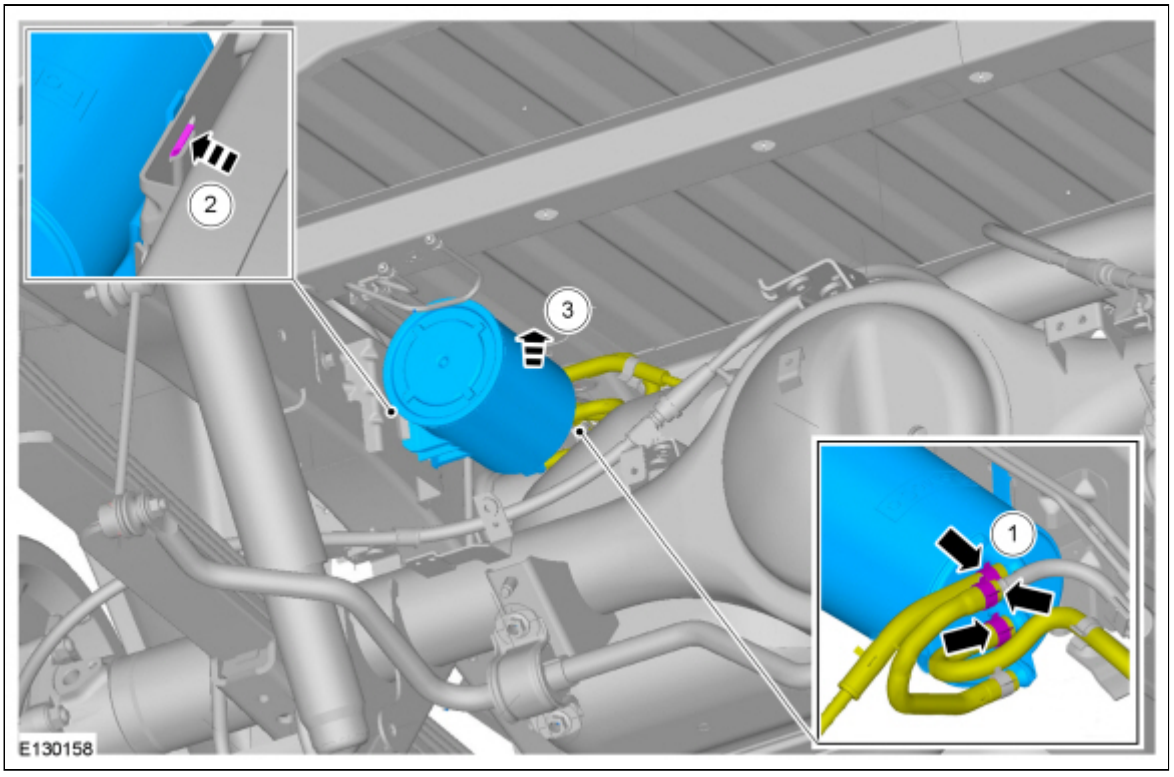
Base Part Number: 9E857

Removal

NOTICE: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. **WARNING: Be prepared to collect escaping fluids.**



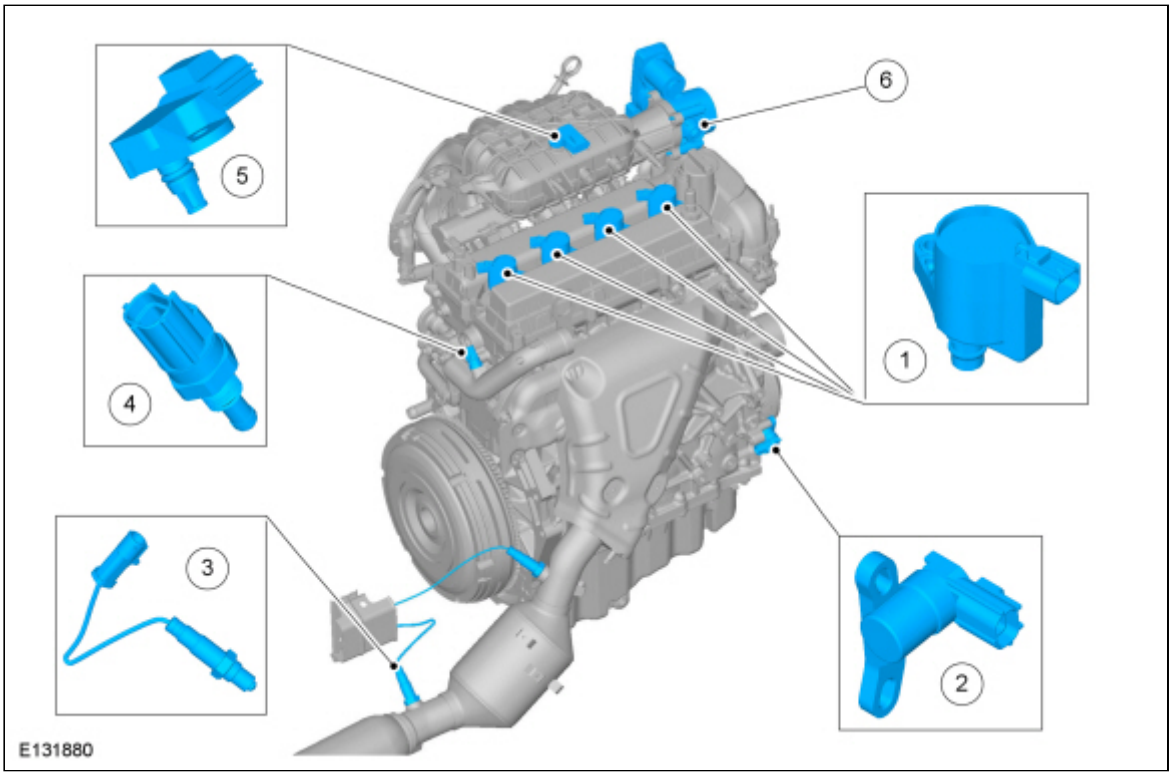
Installation

1. To install, reverse the removal procedure.

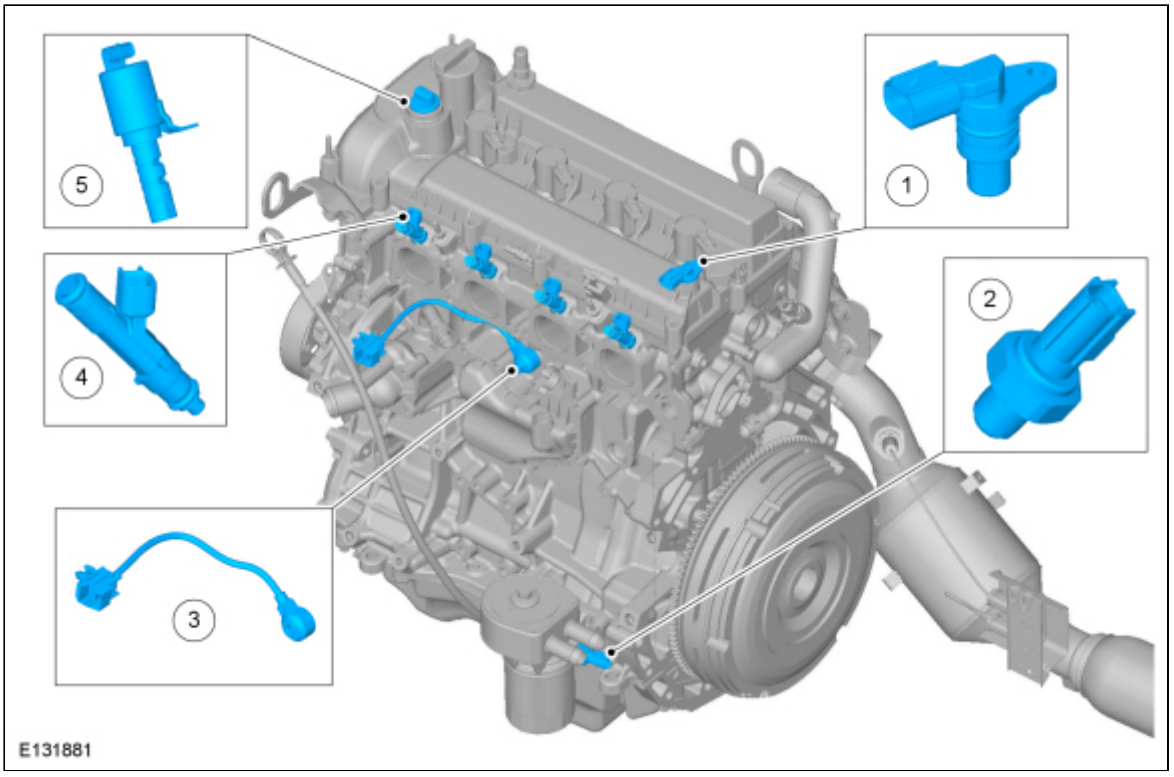
Copyright © 2016 Ford Motor Company

Electronic Engine Controls - Component Location

Electronic Engine Control Location



Item	Part Number	Description
1	—	Ignition coils
2	—	Crankshaft position (CKP) sensor
3	—	Heated oxygen (HO2S) sensor
4	—	Engine coolant temperature (ECT) sensor
5	—	Manifold absolute pressure and temperature (MAPT) sensor
6	—	Electronic throttle body



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor
2	—	Engine oil pressure (EOP) sensor
3	—	Knock (KS) sensor
4	—	Injectors
5	—	Variable camshaft timing (VCT) oil control solenoid

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - Overview

Overview

The EEC system provides optimum control of the engine through the enhanced capability of the powertrain control module (PCM). The EEC system also has an on board diagnostic (OBD) monitoring system with features and functions to meet government regulations on exhaust emissions.

The EEC system has two major divisions: hardware and software. The hardware includes the PCM, sensors, switches, actuators, solenoids, and interconnecting terminals. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM.

The PCM receives information from a variety of sensor and switch inputs. Based on the strategy and calibration stored within the PCM, the PCM generates the appropriate output. The system is designed to minimize emissions and optimize fuel economy and driveability. The software strategy controls the basic operation of the engine, provides the OBD strategy, controls the malfunction indicator lamp (MIL), communicates to the scan tool over the data link connector (DLC), allows for flash electrically erasable programmable read only memory (EEPROM), provides idle air and fuel trim, and controls failure mode effects management (FMEM).

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - System Operation and Component Description

System Operation

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) Manual Description and Operation.

Copyright © 2016 Ford Motor Company

Electronic Engine Controls

DTC Chart: Powertrain Control Module (PCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action
P0462	Fuel Level Sensor A Circuit Low	First, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. If sent here from the PC/ED manual, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P0463	Fuel Level Sensor A Circuit High	First, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. If sent here from the PC/ED manual, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P0504	Brake Switch A / B Correlation	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0562	System Voltage Low	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
P0563	System Voltage High	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
P0572	Brake Switch A Circuit Low	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).

P0573	Brake Switch A Circuit High	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0645	A/C Clutch Relay Control Circuit	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0646	A/C Clutch Relay Control Circuit Low	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0647	A/C Clutch Relay Control Circuit High	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P065B	Generator Control Circuit Range/Performance	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
P065C	Generator Mechanical Performance	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
P06E9	No Engine Rotation Detected During Crank Event	REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
P0812	Reverse Input Circuit	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
P0830	Clutch Pedal Switch A Circuit	REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
P0833	Clutch Pedal Switch B Circuit	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0A3B	Generator Over Temperature	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
P1001	KOEO Not Able to Complete, KOER Aborted	• RETRIEVE and RECORD all Diagnostic Trouble Codes (DTCs). REPAIR any self-test or Continuous Memory Diagnostic Trouble Codes (CMDTCs) first. CLEAR the DTC. RERUN the KOERself-test. • If the DTC returns, REPROGRAM the PCM with the latest software.

		REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). • RERUN the KOER self-test. If the DTC returns, INSTALL a new PCM, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). • After installing the new PCM PROGRAM it with the latest software.
P1397	System Voltage Out Of Self Test Range	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
P1464	A/C Demand Out Of Self Test Range	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P161A	Incorrect Response from Immobilizer Control Module	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
P162F	Starter Motor Disabled - Engine Crank Time Too Long	REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
P1703	Brake Switch Out Of Self-Test Range	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P1820	Transfer Case Clockwise Shift Relay Coil Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1821	Transfer Case Clockwise Shift Relay Coil Open Circuit	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1822	Transfer Case Clockwise Shift Relay Coil Short Circuit to Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1823	Transfer Case Clockwise Shift Relay Coil Short Circuit to Ground	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1828	Transfer Case Clockwise Shift Relay Coil Short Circuit to Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1829	Transfer Case Counter Clockwise Shift Relay Coil Open Circuit	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1830	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1831	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Ground	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P184A	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P184B	Transfer Case Unable To Transition Between 4x4	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems,

	High and 4x4 Low Range	Diagnosis and Testing).
P1870	Mechanical Transfer Case 4x4 Switch Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1871	Mechanical Transfer Case 4x4 Switch Circuit Short To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1874	Transfer Case Hall Effect Sensor Power Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1875	Transfer Case Hall Effect Sensor Power Circuit Short To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P193E	A/C Clutch Request Signal	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P2535	Ignition Switch Run/Start Position Circuit High	REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
U0104	Lost Communication With Cruise Control Module	REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	GO to Pinpoint Test A
U012D	Lost Communication With Generator Control Module	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).
All Other DTCs	—	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. Section 3 Symptom Charts.

Pinpoint Tests

U0121

DTC Fault Trigger Condition-PCM

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	The PCM sets this DTC if data messages received from the ABS module through the GWM are missing.

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

Possible Sources

- Communications network concern
- ABS module
- BCM
- PCM

PINPOINT TEST A : U0121

A1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to A2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Did the ABS module pass the network test?

Yes	GO to A3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A3 PERFORM ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform a ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to A4

A4 CHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the BCM Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to A5

A5 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0562 or DTC P0563 recorded?

Yes	REFER to PCM DTC Chart in this section.

No	GO to A6

A6 RECHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the PCM self-test.

Is DTC U0121 still present?

Yes	GO to A7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0121:00 set in any other module?

Yes	GO to A8
No	GO to A9

A8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect all ABS module connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the ABS module connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect PCM connector.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)

- damaged or bent pins – install new terminals/pins
- pushed-out pins – install new pins as necessary

- Reconnect the PCM connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

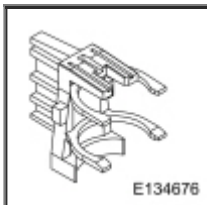
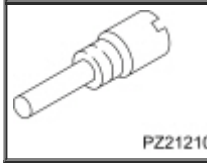
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

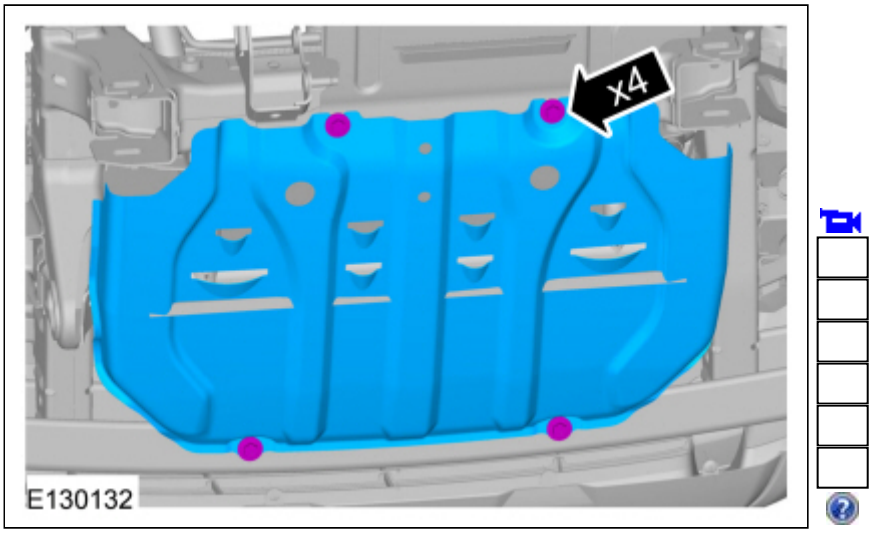
Crankshaft Position (CKP) Sensor

Special Tool(s) / General Equipment

 E134676	303-1417 Tool, Crank Sensor Alignment
 PZ21210	303-507 Timing Peg, Crankshaft TDC

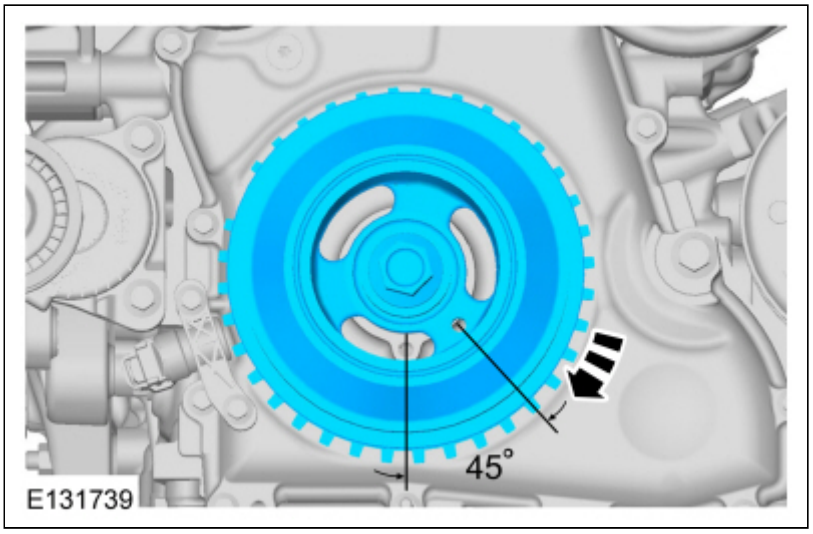
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

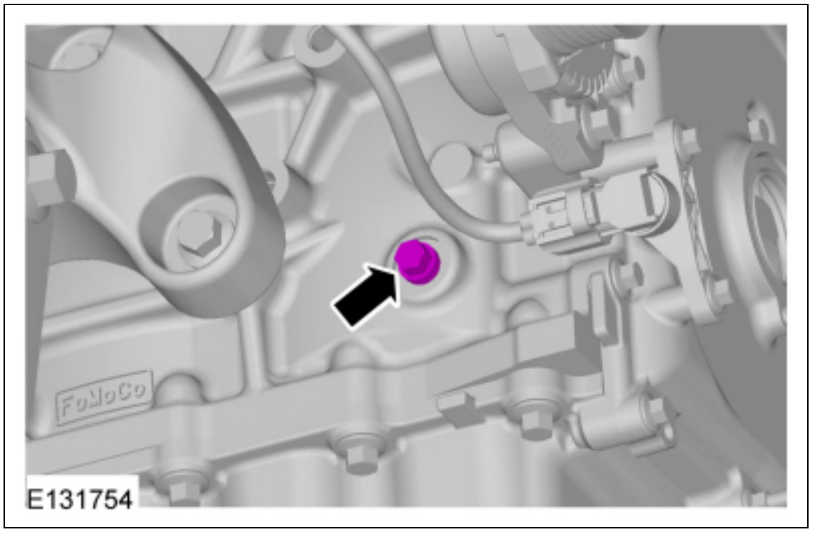
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

4. **WARNING: Only rotate the crankshaft clockwise.**

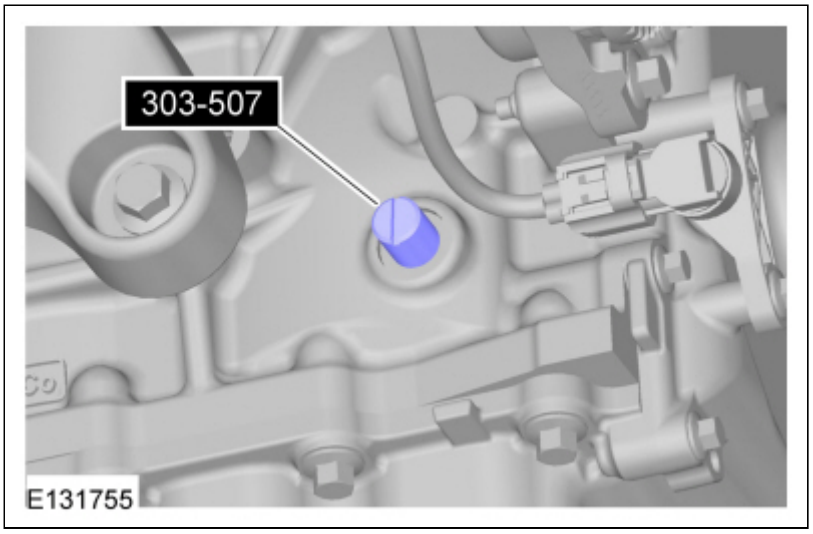
   Turn the crankshaft until no. 1 piston is at about 45° before TDC.



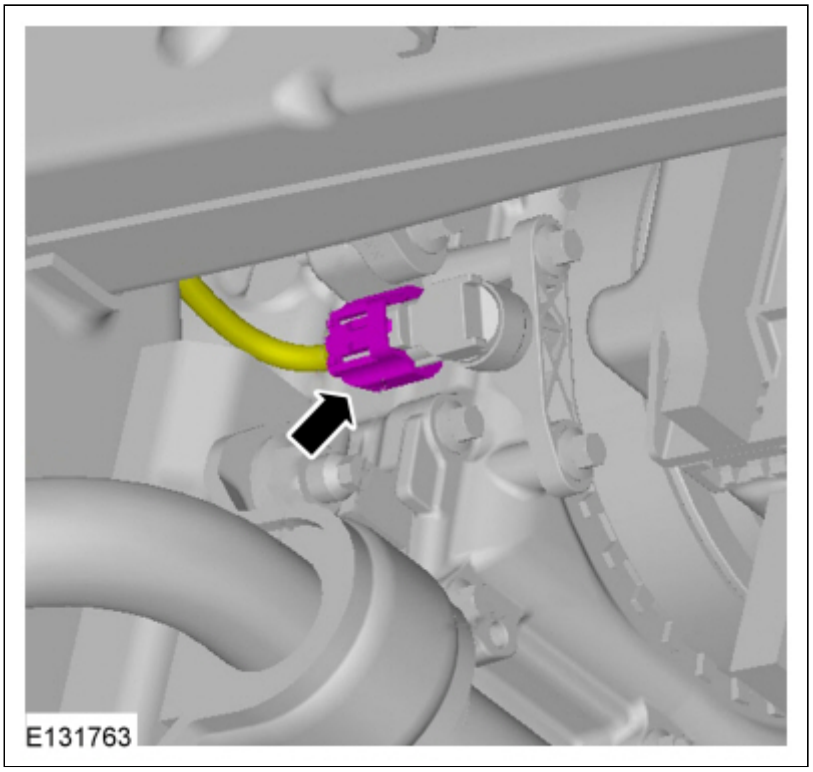
5.



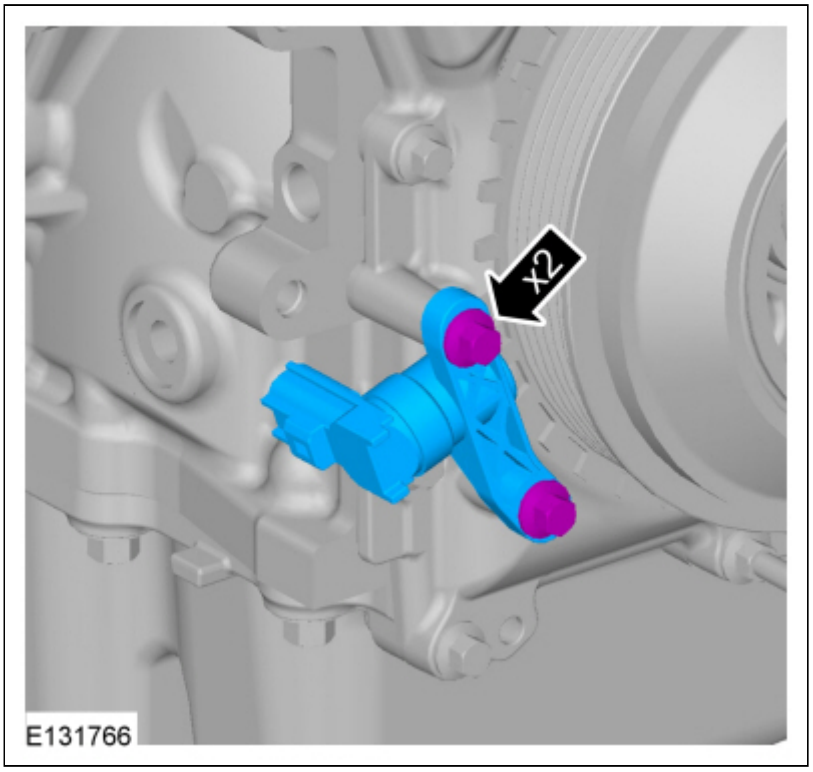
6. Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



7.

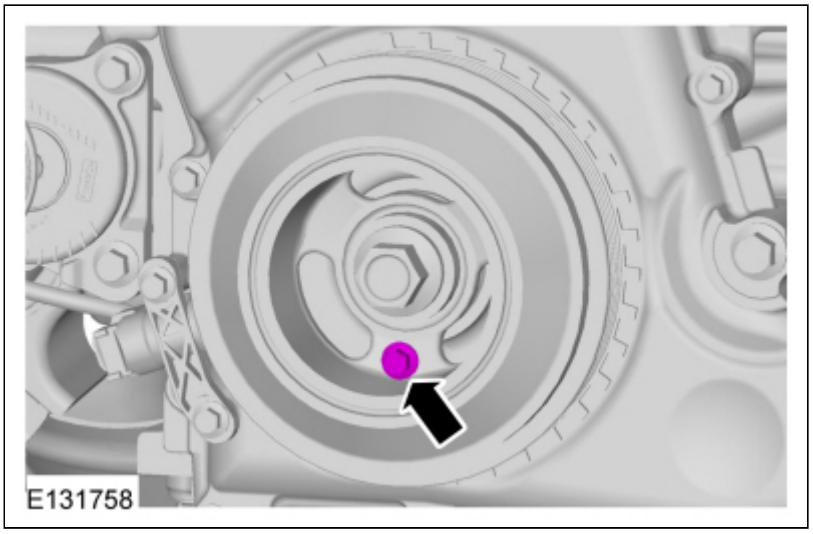


8.

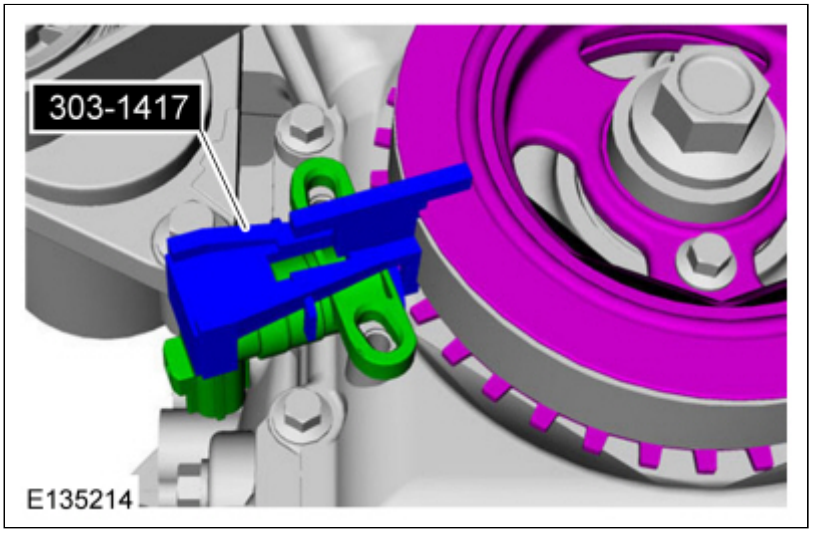


Installation

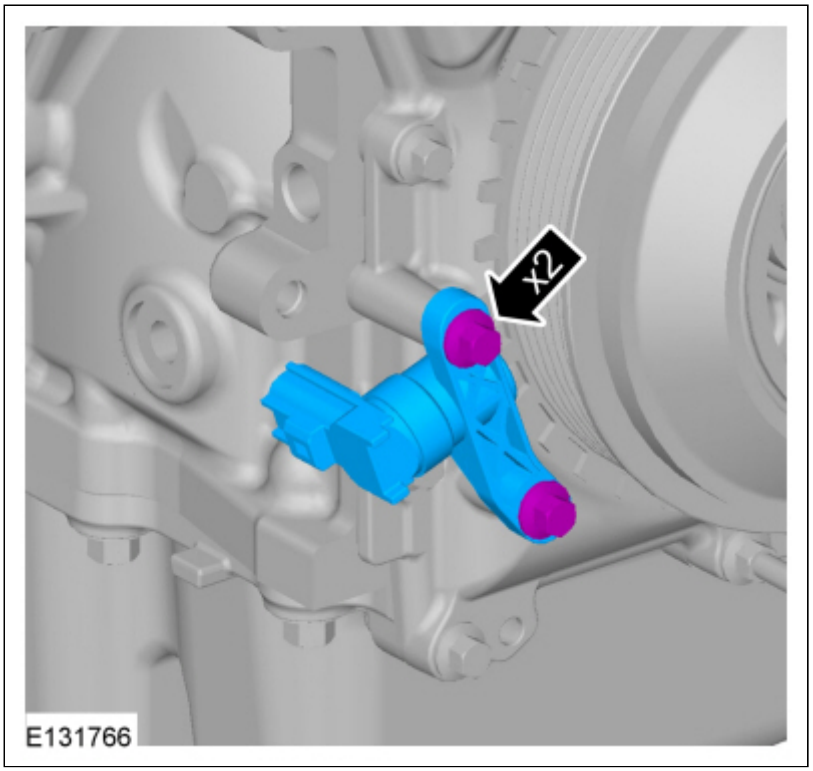
1. Install the bolt M6 x 18 mm.



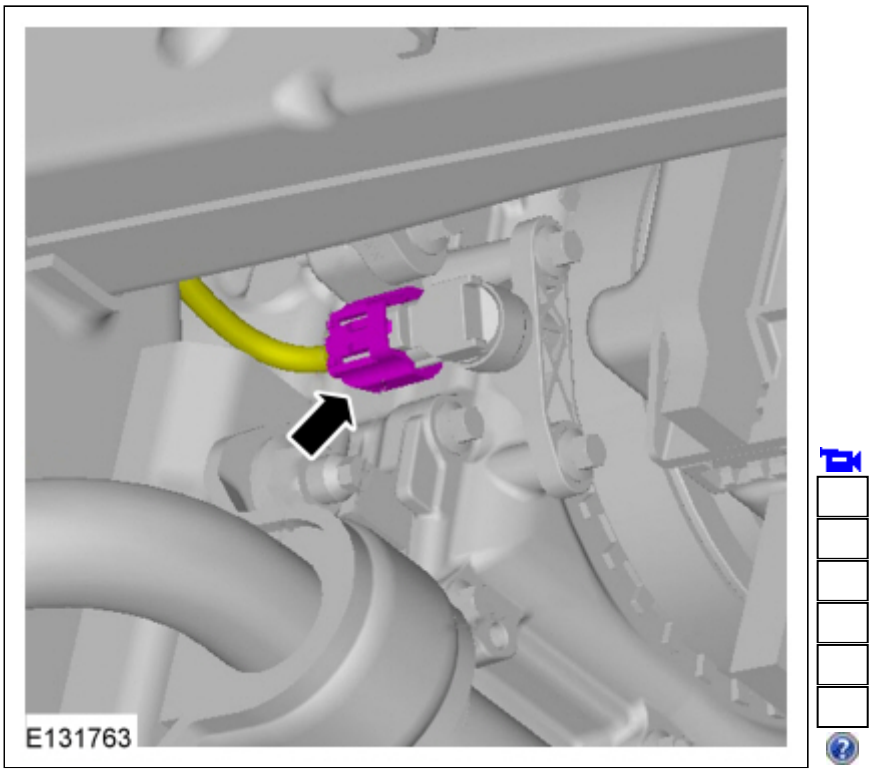
2. Use Special Service Tool: 303-1417 Tool, Crank Sensor Alignment.



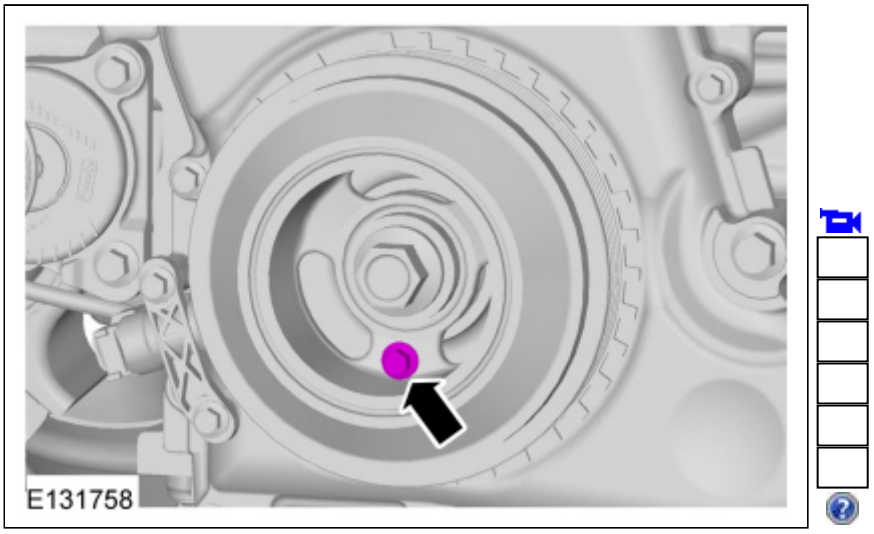
3. *Torque*: 7 Nm



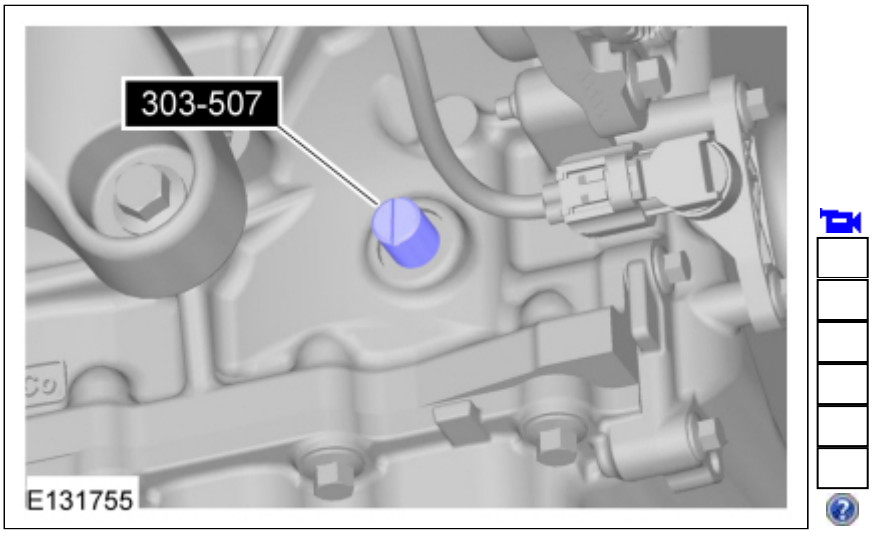
4.



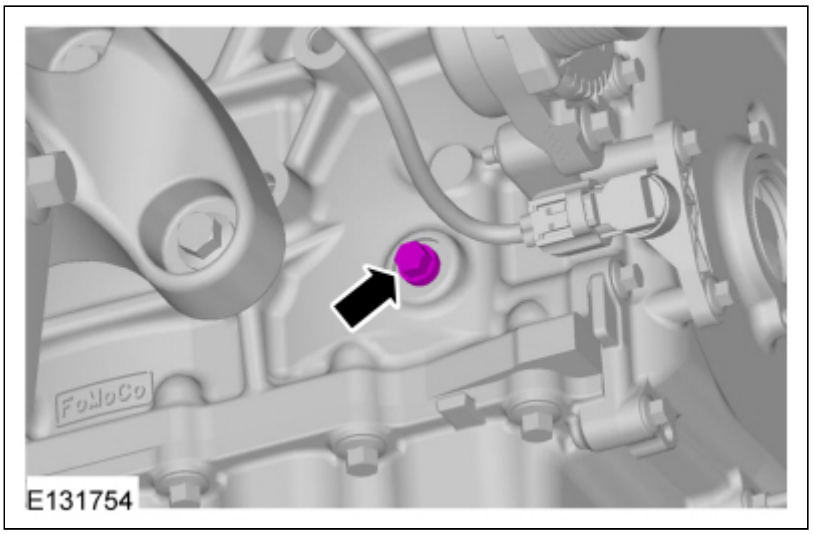
5. Remove the bolt M6 x 18 mm.



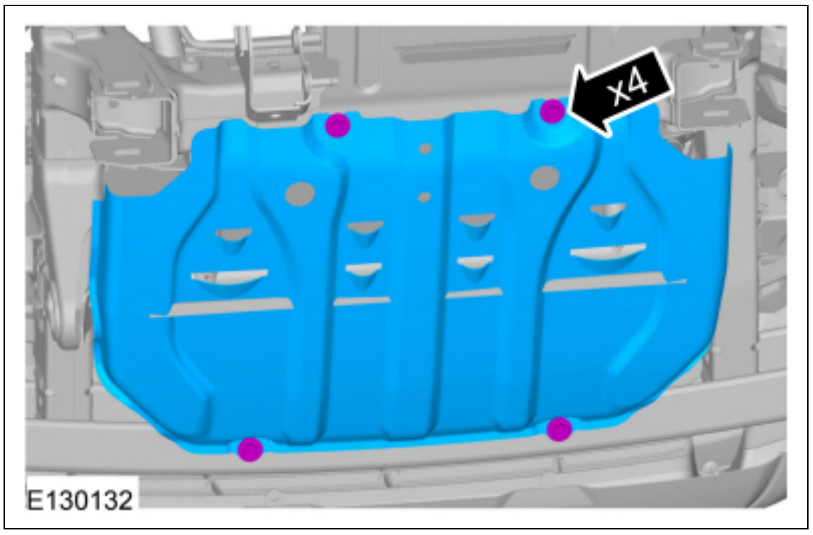
6. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



7. *Torque*: 20 Nm



8. *Torque*: 30 Nm



Copyright © 2016 Ford Motor Company

Powertrain Control Module (PCM)

Base Part Number: 12A650

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

NOTICE: If a new PCM is to be installed, upload the PCM configuration information using the Programmable Modules Installation Routine, prior to commencing the removal of the PCM.

NOTE: *Removal steps in this procedure may contain installation details.*

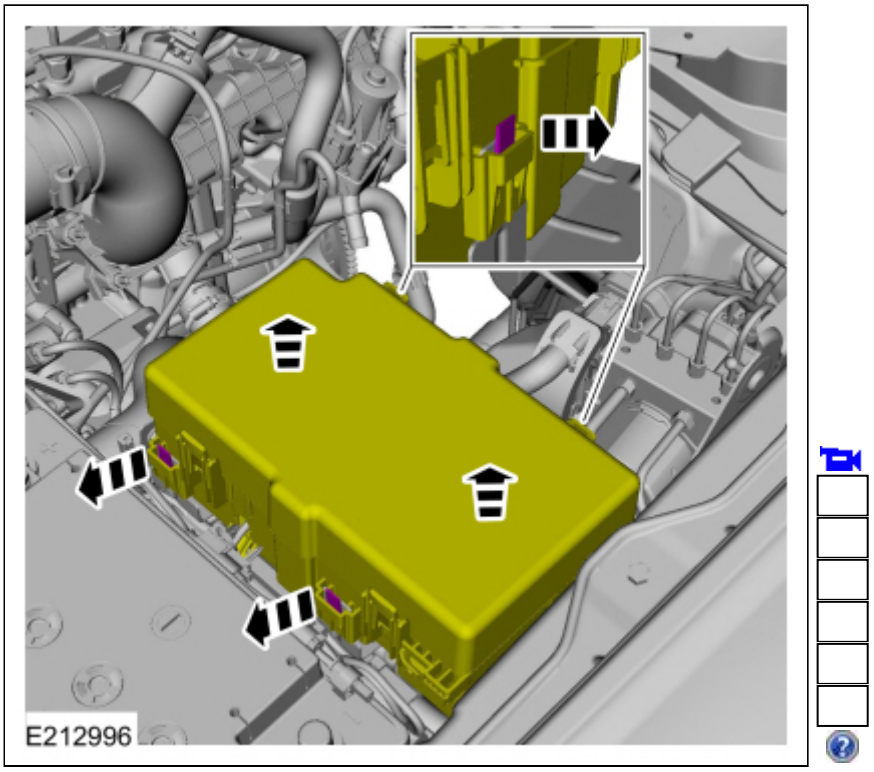
1. **NOTE:** *NOTE: This step is only necessary when installing a new component.*

   Download the PCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

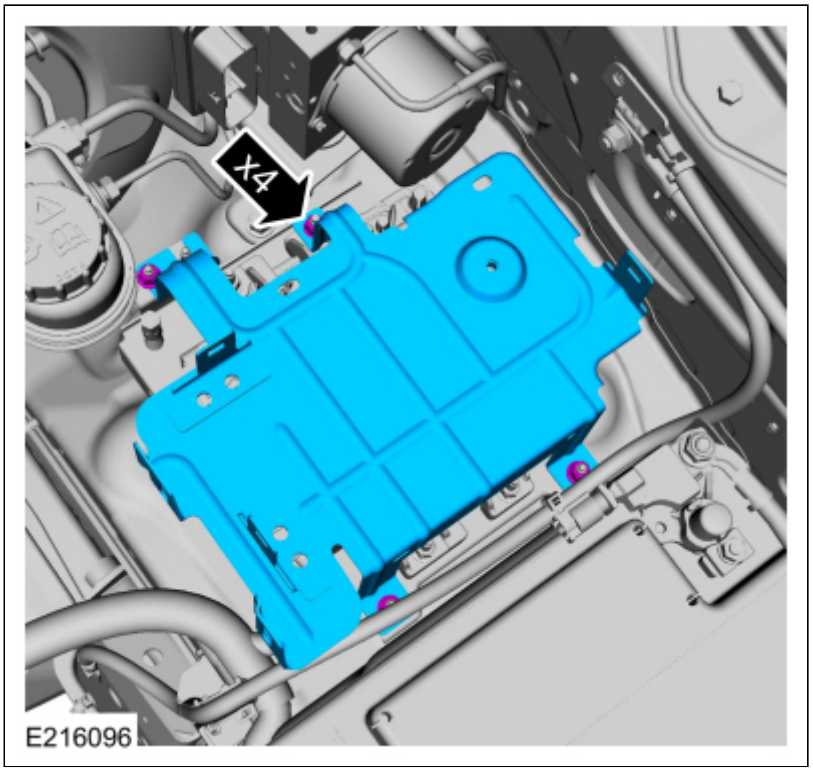
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

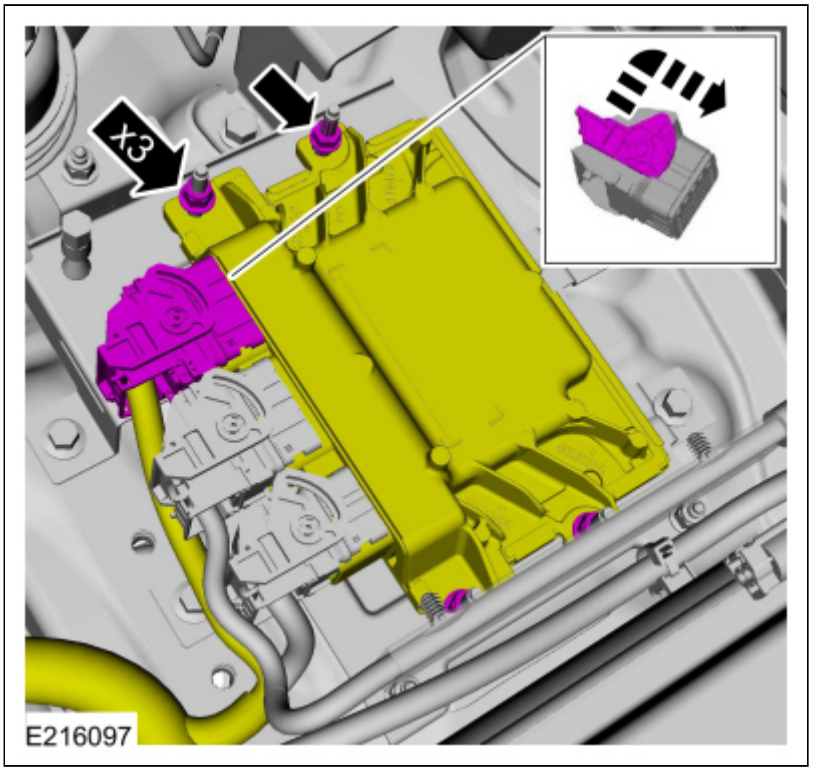
4. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

5. 

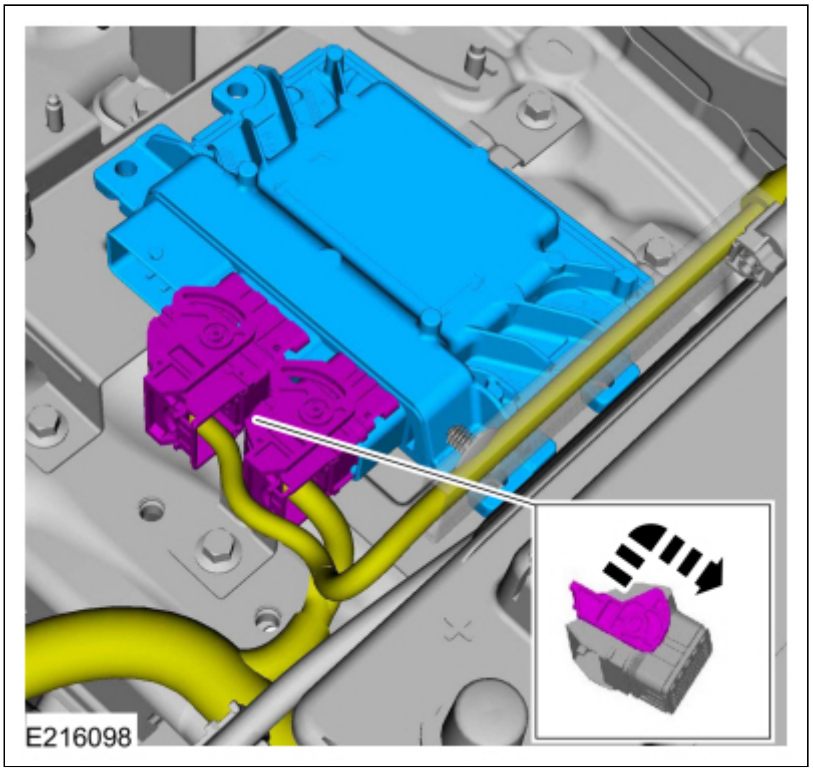
6. *Torque*: 25 Nm



7. *Torque*: 11 Nm



8.



Installation

1. To install, reverse the removal procedure.
2. Carry out the Injector Correction Factors procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment
3. Carry out the Oil Quality History function using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment
4. Carry out the Stored Speed Limit function using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment
5. Carry out the Pump Learn procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment
6. Carry out the Pilot Correction Learn procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment
7. Change the engine oil and the oil filter.
8. Carry out the oil reset procedure.
9. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Camshaft Position (CMP) Sensor

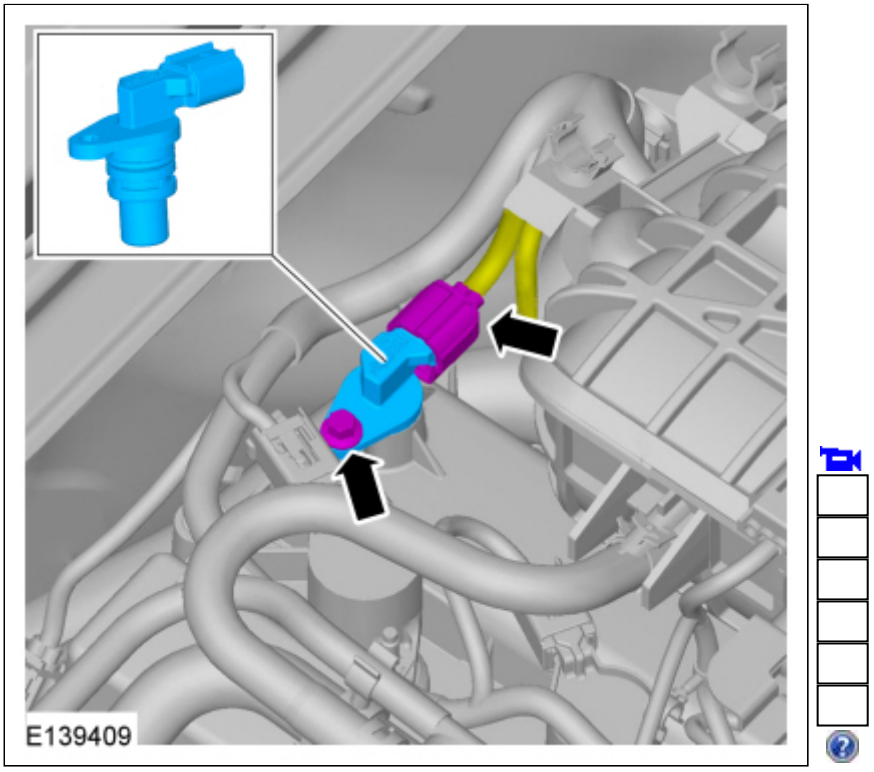
Base Part Number: 12K073

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. **NOTE:** *Lubricate the O-ring seal with clean engine oil.*

   Torque: 7 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Engine Coolant Temperature (ECT) Sensor

Base Part Number: 12A648

Removal

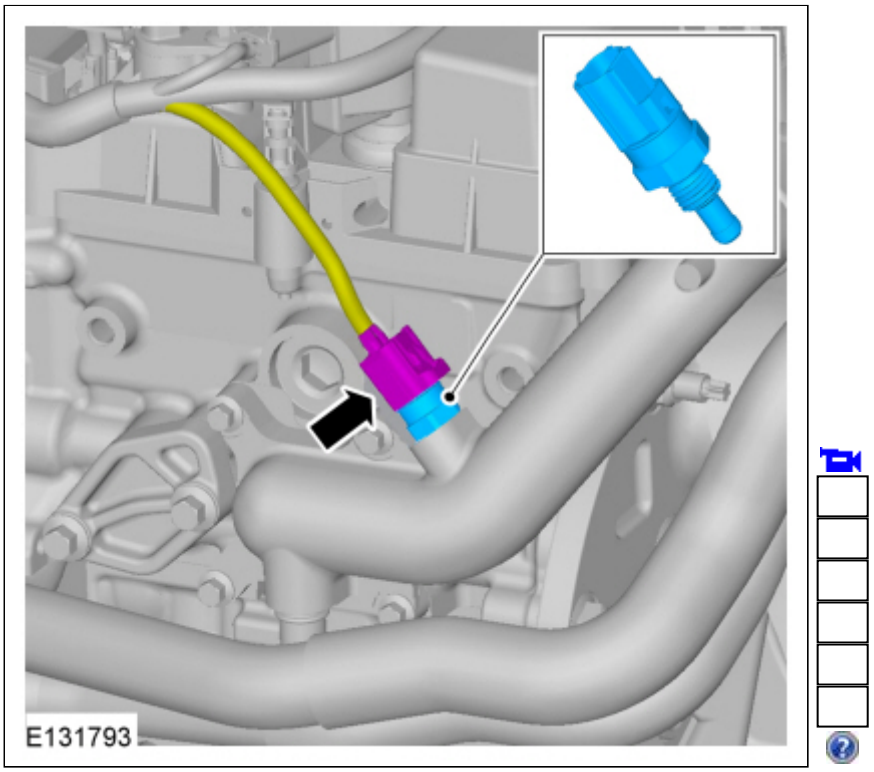
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *The sensor is located at the rear of the cylinder head.*

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. **NOTE:** *Lubricate the O-ring seal with clean engine oil.*

   Torque: 15 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

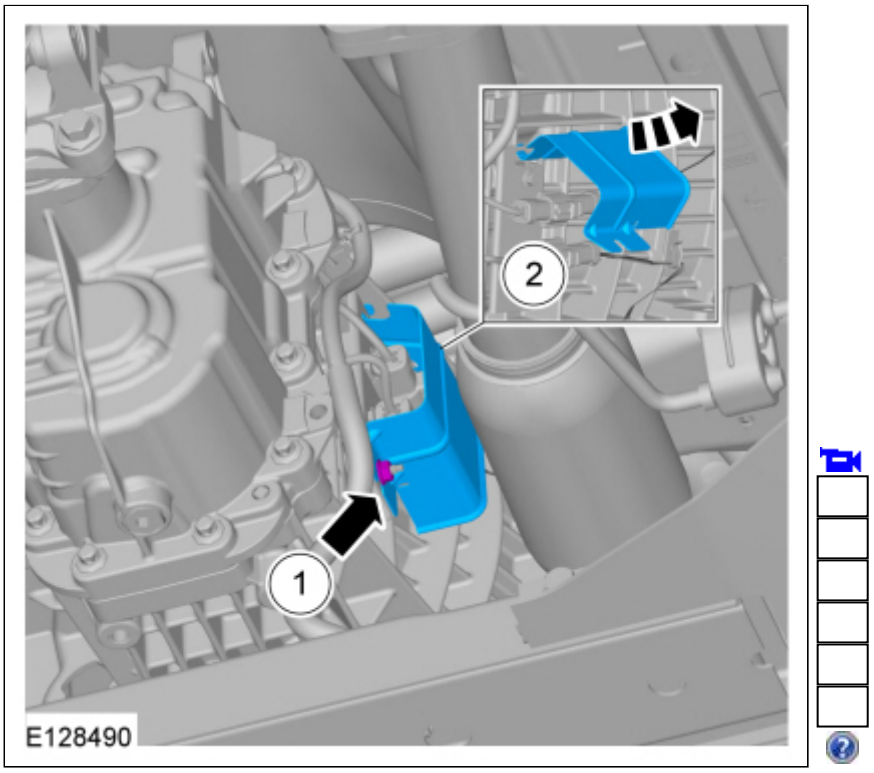
Heated Oxygen Sensor (HO2S)

Base Part Number: 9F472

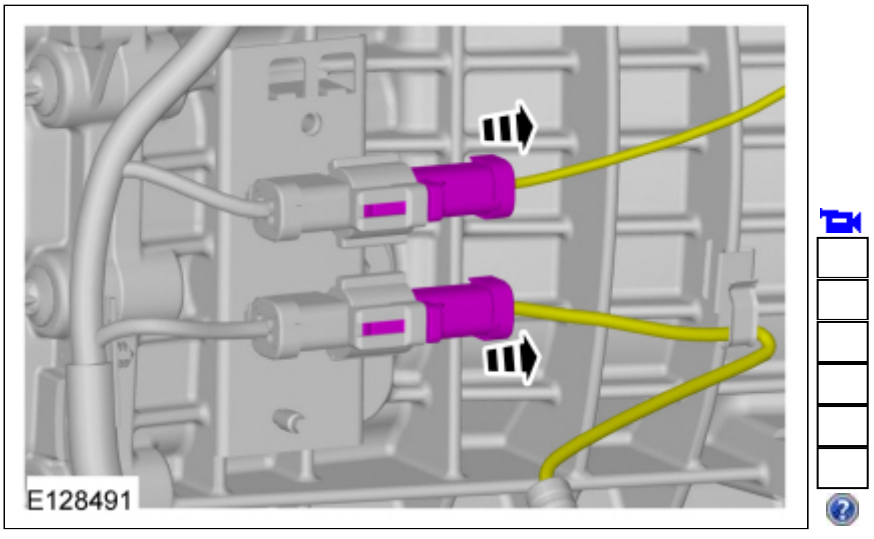
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

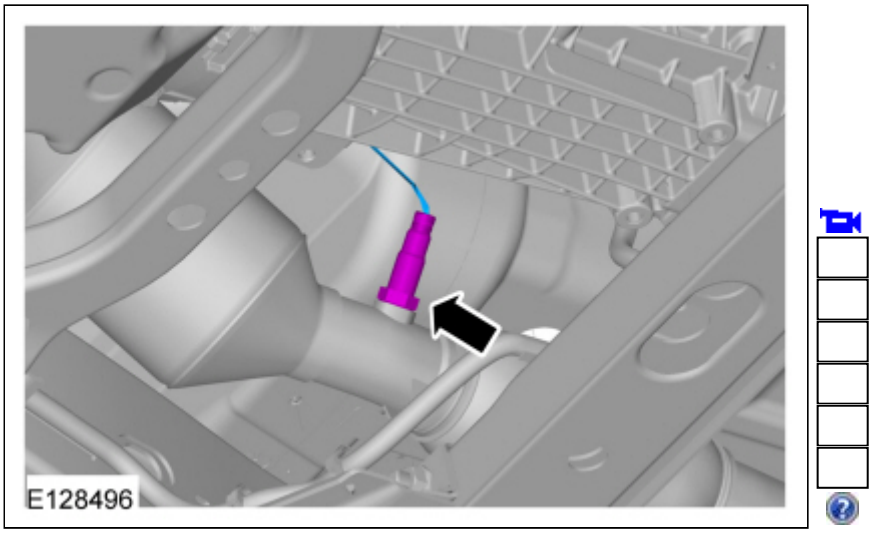
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. *Torque*: 18 Nm



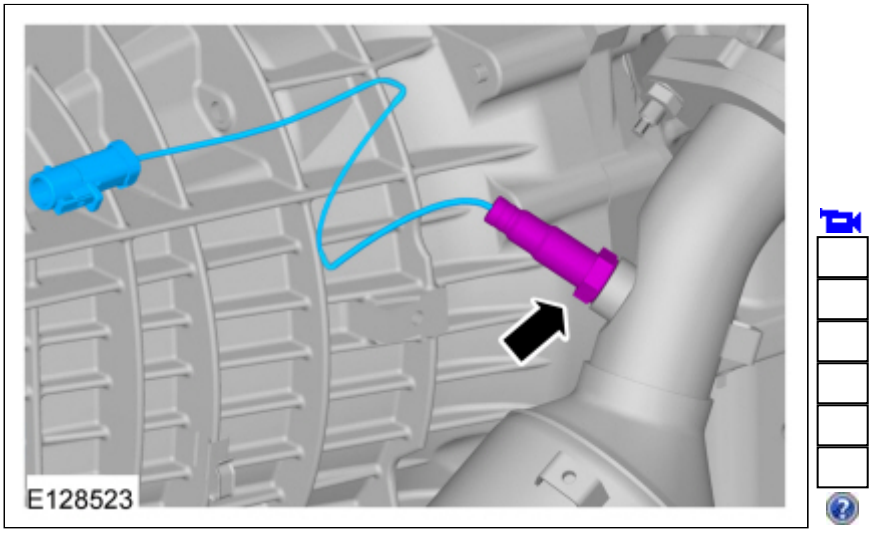
4.



5. *Torque*: 48 Nm



6. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

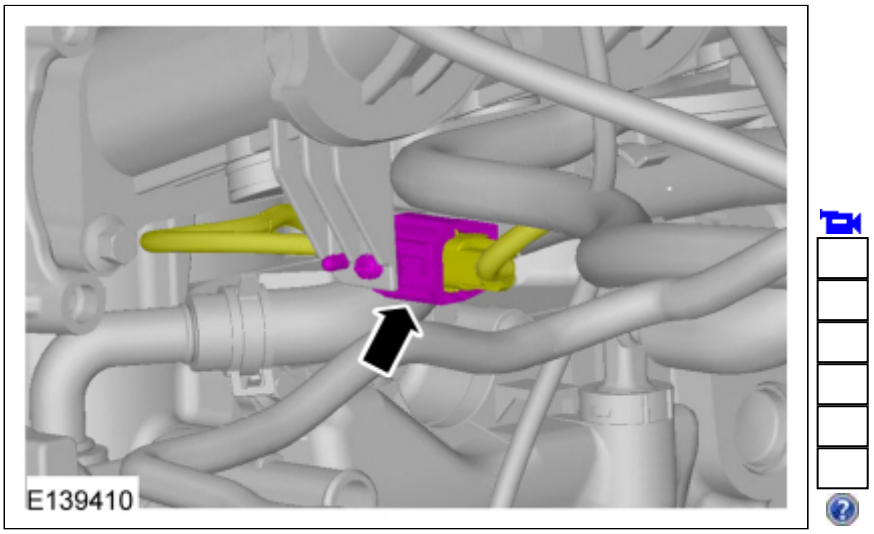
Copyright © 2016 Ford Motor Company

Knock Sensor (KS)

Base Part Number: 12A699

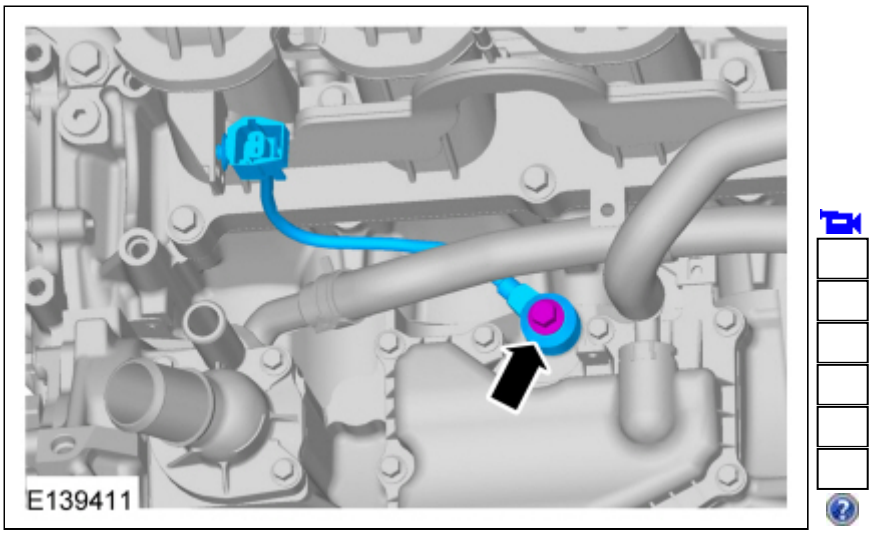
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

4. **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*

   Torque: 20 Nm



Installation

1. To install, reverse the removal procedure.

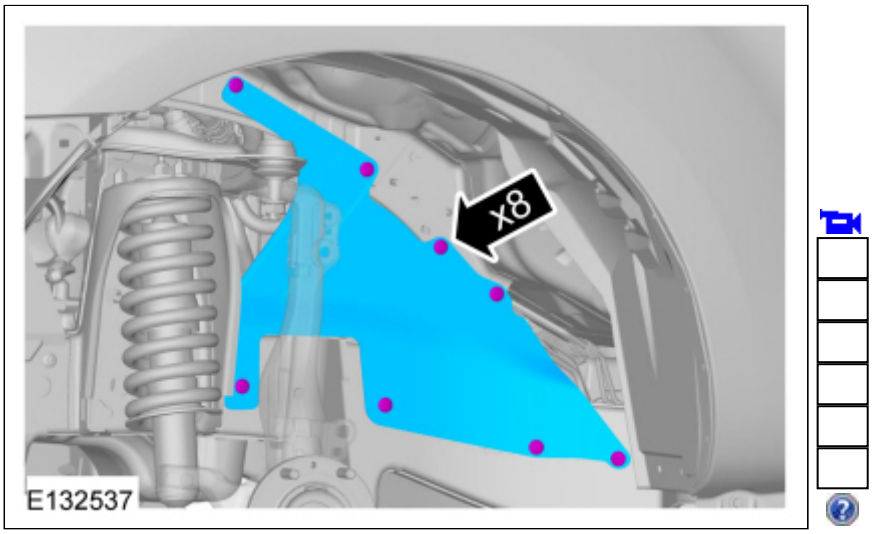
Copyright © 2016 Ford Motor Company

Engine Oil Pressure (EOP) Switch - LHD RWD/RHD RWD

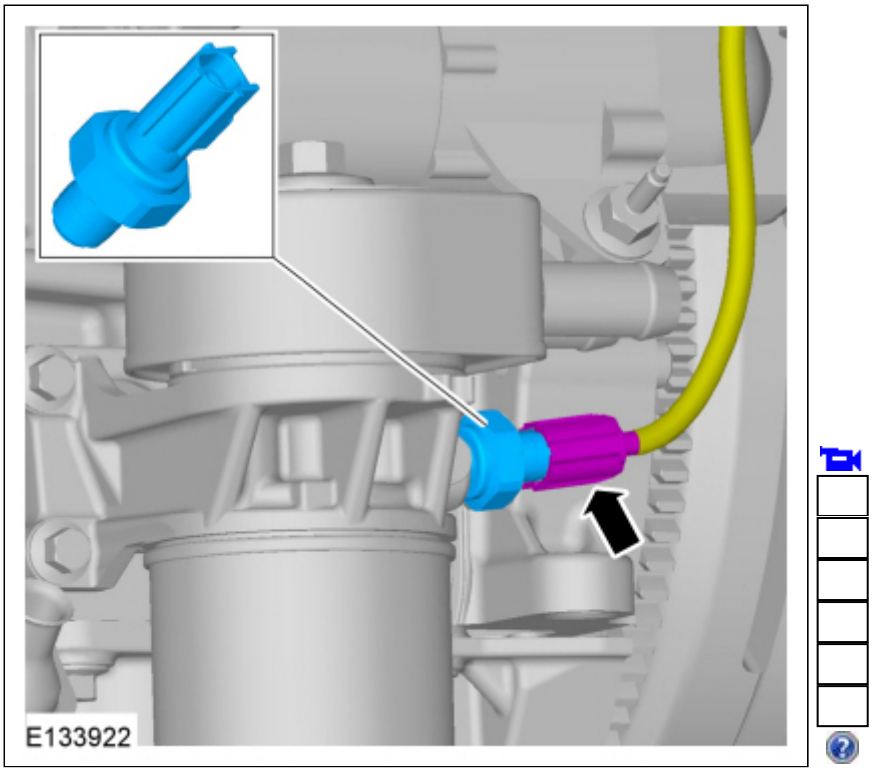
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.



5. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 180°



Installation

1. To install, reverse the removal procedure.

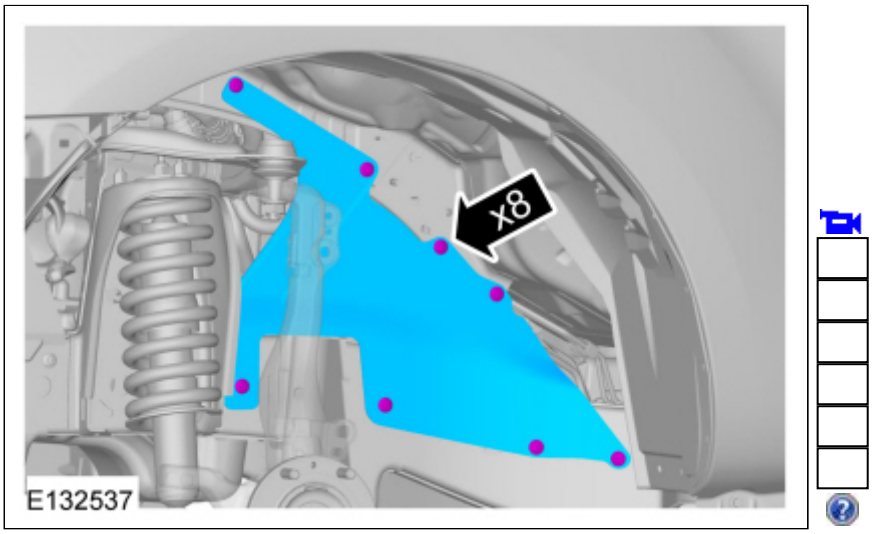
Copyright © 2016 Ford Motor Company

Engine Oil Pressure (EOP) Switch - LHD 4WD/RHD 4WD

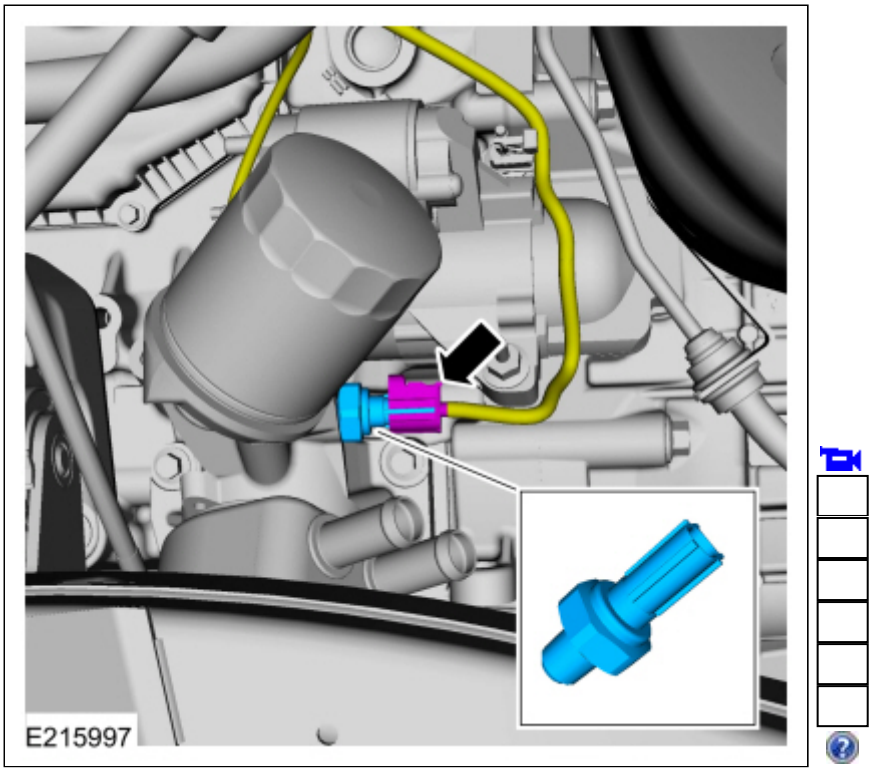
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4.



5. *Torque*:
   Stage 1: 15 Nm
   Stage 2: 180°



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

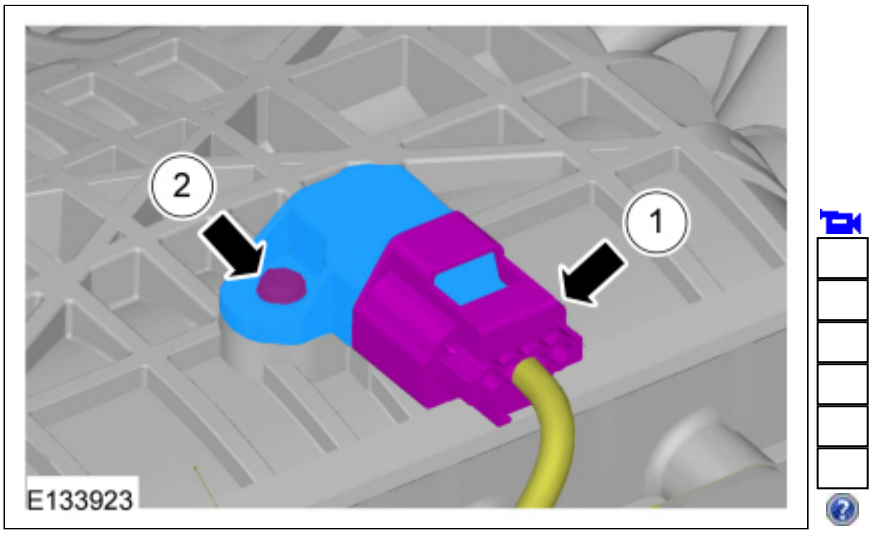
Manifold Absolute Pressure (MAP) Sensor

Base Part Number: 9F479

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. *Torque*: 3 Nm



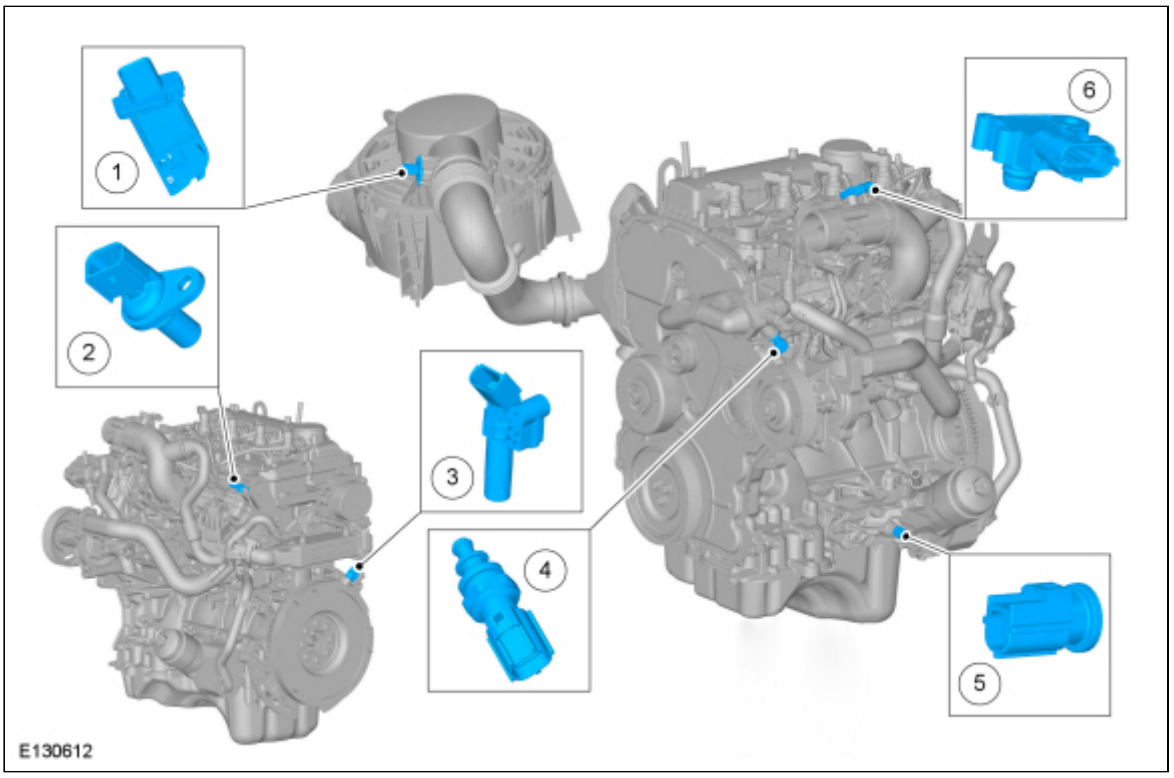
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - Component Location

Vehicles with 2.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Intake air temperature (IAT)
2	—	Camshaft position (CMP) sensor
3	—	Crankshaft position (CKP) sensor
4	—	Engine coolant temprature (ECT) sensor
5	—	Engine oil pressure switch
6	—	Manifold absolute pressure (MAP) sensor

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - Overview

Overview

The EEC system provides optimum control of the engine through the enhanced capability of the powertrain control module (PCM). The EEC system also has an on board diagnostic (OBD) monitoring system with features and functions to meet government regulations on exhaust emissions.

The EEC system has two major divisions: hardware and software. The hardware includes the PCM, sensors, switches, actuators, solenoids, and interconnecting terminals. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM.

The PCM receives information from a variety of sensor and switch inputs. Based on the strategy and calibration stored within the PCM, the PCM generates the appropriate output. The system is designed to minimize emissions and optimize fuel economy and driveability. The software strategy controls the basic operation of the engine, provides the OBD strategy, controls the malfunction indicator lamp (MIL), communicates to the scan tool over the data link connector (DLC), allows for flash electrically erasable programmable read only memory (EEPROM), provides idle air and fuel trim, and controls failure mode effects management (FMEM).

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - System Operation and Component Description

System Operation

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) Manual Description and Operation.

Copyright © 2016 Ford Motor Company

Electronic Engine Controls

DTC Chart: Powertrain Control Module (PCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Powertrain Control Module (PCM) DTC Chart

DTC	Description	Action
P0504	Brake Switch A / B Correlation	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0562	System Voltage Low	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
P0563	System Voltage High	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
P0572	Brake Switch A Circuit Low	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0573	Brake Switch A Circuit High	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).

P0645	A/C Clutch Relay Control Circuit	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0646	A/C Clutch Relay Control Circuit Low	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0647	A/C Clutch Relay Control Circuit High	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0657	Actuator Supply Voltage "A" Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P06E9	Engine Starter Performance	REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
P0701	Transmission Control System Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0702	Transmission Control System Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0705	Transmission Range Sensor "A" Circuit (PRNDL Input)	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0706	Transmission Range Sensor "A" Circuit Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0707	Transmission Range Sensor "A" Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0708	Transmission Range Sensor "A" Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0709	Transmission Range Sensor "A" Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0710	Transmission Fluid Temperature Sensor "A" Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0711	Transmission Fluid	

	Temperature Sensor "A" Circuit Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0715	Turbine/Input Shaft Speed Sensor "A" Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0717	Turbine/Input Shaft Speed Sensor "A" Circuit No Signal	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0718	Turbine/Input Shaft Speed Sensor "A" Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0720	Output Shaft Speed Sensor Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0721	Output Shaft Speed Sensor Circuit Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0722	Output Shaft Speed Sensor Circuit No Signal	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0729	Gear 6 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0731	Gear 1 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0732	Gear 2 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0733	Gear 3 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0734	Gear 4 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0735	Gear 5 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0740	Torque Converter Clutch Solenoid Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0741	Torque Converter Clutch Solenoid Circuit Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0742	Torque Converter Clutch Solenoid Circuit Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0743	Torque Converter Clutch Solenoid Circuit Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

P0744	Torque Converter Clutch Solenoid Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0748	Pressure Control Solenoid "A" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0750	Shift Solenoid "A"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0751	Shift Solenoid "A" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0752	Shift Solenoid "A" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0753	Shift Solenoid "A" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0754	Shift Solenoid "A" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0755	Shift Solenoid "B"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0756	Shift Solenoid "B" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0757	Shift Solenoid "B" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0758	Shift Solenoid "B" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0759	Shift Solenoid "B" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0760	Shift Solenoid "C"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0761	Shift Solenoid "C" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0762	Shift Solenoid "C" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0763	Shift Solenoid "C" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0764	Shift Solenoid "C" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0765	Shift Solenoid "D"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0766	Shift Solenoid "D" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0767	Shift Solenoid "D"	

	Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0768	Shift Solenoid "D" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0769	Shift Solenoid "D" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0770	Shift Solenoid "E"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0771	Shift Solenoid "E" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0772	Shift Solenoid "E" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0773	Shift Solenoid "E" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0774	Shift Solenoid "E" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07A8	Transmission Friction Element "D" Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07A9	Transmission Friction Element "D" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07AA	Transmission Friction Element "E" Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0812	Reverse Input Circuit	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
P0820	Gear Lever X-Y Position Sensor Circuit	GO to Pinpoint Test B
P0825	Gear Lever Push/Pull Switch Circuit (Shift Anticipate)	GO to Pinpoint Test B
P082A	Gear Lever X Position Sensor 1 Circuit Range/Performance	GO to Pinpoint Test B
P082D	Gear Lever Y Position Sensor 1 Circuit Range/Performance	GO to Pinpoint Test B
P082E	Gear Lever Y Position Sensor 1 Circuit Low	GO to Pinpoint Test B
P0850	Park / Neutral Switch Input Circuit	REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
P086E	Neutral Position Sensor "A" Circuit	GO to Pinpoint Test C

	Intermittent/Erratic	
P0882	TCM Power Input Signal Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0883	TCM Power Input Signal High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P08B1	Neutral Position Sensor "B" Circuit Intermittent/Erratic	REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
P0960	Line Pressure Control (LPC) A Control Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0961	Pressure Control Solenoid "A" Control Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0962	Pressure Control Solenoid "A" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0963	Pressure Control Solenoid "A" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0973	Shift Solenoid "A" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0974	Shift Solenoid "A" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0976	Shift Solenoid "B" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0977	Shift Solenoid "B" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0979	Shift Solenoid "C" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0980	Shift Solenoid "C" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0982	Shift Solenoid "D" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0983	Shift Solenoid "D" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0984	Shift Solenoid "E" Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1464	A/C Demand Out Of Self Test Range	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).

P161A	Incorrect Response from Immobilizer Control Module	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
P1632	Smart Alternator Fault Sensor / Circuit	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
P1636	Inductive Signature Chip Communication Error	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P163E	Transmission Control Module Programming Error	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P163F	Transmission ID Block Corrupted, Not Programmed	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1678	Low Oil Pressure Lamp Control Circuit	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P1702	Transmission Range Sensor Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1703	Brake Switch Out Of Self-Test Range	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P1705	Transmission Range Circuit Not Indicating Park/Neutral During Self Test	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1711	Transmission Fluid Temperature Sensor Out Of Self Test Range	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1744	Torque Converter Clutch Solenoid Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1783	Transmission Overtemperature Condition	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1820	Transfer Case Clockwise Shift Relay Coil Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1821	Transfer Case Clockwise Shift Relay Coil Open Circuit	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1822	Transfer Case Clockwise Shift Relay Coil Short Circuit to Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1823	Transfer Case Clockwise Shift Relay Coil Short Circuit to Ground	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1828	Transfer Case	

	Clockwise Shift Relay Coil Short Circuit to Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1829	Transfer Case Counter Clockwise Shift Relay Coil Open Circuit	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1830	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1831	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Ground	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P184A	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P184B	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1870	Mechanical Transfer Case 4x4 Switch Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1871	Mechanical Transfer Case 4x4 Switch Circuit Short To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1874	Transfer Case Hall Effect Sensor Power Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1875	Transfer Case Hall Effect Sensor Power Circuit Short To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1921	Transmission Range Signal	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1933	Fuel Level Signal	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P193E	A/C Clutch Request Signal	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P2700	Transmission Friction Element "A" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2701	Transmission Friction Element "B" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2702	Transmission Friction	

	Element "C" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2703	Transmission Friction Element "D" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2704	Transmission Friction Element "E" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2705	Transmission Friction Element "F" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2758	Torque Converter Clutch Pressure Control Solenoid Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2760	Torque Converter Clutch Pressure Control Solenoid Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
U0104	Lost Communication With Cruise Control Module	REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	GO to Pinpoint Test A
All Other DTCs	—	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. Section 3 Symptom Charts.

Pinpoint Tests

U0121

DTC Fault Trigger Condition-PCM

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	The PCM sets this DTC if data messages received from the ABS module through the GWM are missing.

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

Possible Sources

- Communications network concern
- Communications network concern
- ABS module
- BCM
- PCM

PINPOINT TEST A : U0121

A1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to A2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Did the ABS module pass the network test?

Yes	GO to A3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A3 PERFORM ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform a ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to A4

A4 CHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the BCM Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to A5

A5 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0562 or DTC P0563 recorded?

Yes	REFER to PCM DTC Chart in this section.
No	GO to A6

A6 RECHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES

(DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the PCM self-test.

Is DTC U0121 still present?

Yes	GO to A7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0121:00 set in any other module?

Yes	GO to A8
No	GO to A9

A8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect all ABS MODULE connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the ABS MODULE connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS MODULE. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect PCM connector.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Gear Neutral Sensor Circuit Faults

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

Normal Operation and Fault Conditions

The gear neutral position sensor provides an input to the PCM. The PCM uses this input when controlling the auto-start-stop system. For more information on the auto-start-stop system refer to the owner's literature and
REFER to: Starting System - System Operation and Component Description (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0820	Gear Lever X-Y Position Sensor Circuit	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P0825	Gear Lever Push/Pull Switch Circuit (Shift Anticipate)	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P082A	Gear Lever "X" Position Sensor 1 Circuit Range/Performance	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P082D	Gear Lever Y Position Sensor 1 Circuit Range/Performance	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P082E	Gear Lever Y Position Sensor 1 Circuit Low	Sets in the PCM when the PCM senses lower than expected voltage on the gear neutral position sensor feedback circuit, indicating an open or a short directly to ground.
P086E	Neutral Position Sensor "A" Circuit Intermittent/Erratic	Sets in the PCM when the PCM does not detect current through the gear neutral position sensor and there are no other gear neutral position sensor circuit DTC set.
P08B1	Neutral Position Sensor "B" Circuit Intermittent/Erratic	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.

Possible Sources

- Gear neutral position sensor
- PCM

- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Gear neutral position sensor.
- Gear neutral position sensor connector.

PINPOINT TEST B : GEAR NEUTRAL POSITION SENSOR CIRCUIT FAULTS

B1 CHECK THE GEAR NEUTRAL POSITION SENSOR

- Perform the gear neutral position sensor component test in this section:

Were any conditions found during inspection?

Yes	REPAIR as necessary.
No	GO to B2

B2 CHECK THE GEAR NEUTRAL POSITION SENSOR REFERENCE VOLTAGE CIRCUIT

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-2		Ground

Is the voltage between 4.8 and 5.2 volts?

Yes	GO to B3
No	If the voltage is less than 4.8 volts, REPAIR the circuit for an open or high resistance. If the voltage is greater than 5.2 volts, REPAIR the circuit for a short to voltage.

B3 CHECK THE GEAR NEUTRAL POSITION SENSOR GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-2		C1738-4

Is the voltage between 4.8 and 5.2 volts?

Yes	GO to B4
No	If the voltage is less than 4.8 volts, REPAIR the circuit for an open or high resistance. If the voltage is greater than 5.2 volts, REPAIR the circuit for a short to voltage.

B4 CHECK THE GEAR NEUTRAL POSITION SENSOR FEEDBACK CIRCUITS FOR SHORTS TO VOLTAGE

- Disconnect PCM C1232A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-1		Ground
C1738-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B5

B5 CHECK THE GEAR NEUTRAL POSITION SENSOR FEEDBACK CIRCUITS FOR SHORTS TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-1	Ω	Ground
C1738-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B6
No	REPAIR the circuit.

B6 CHECK THE GEAR NEUTRAL POSITION SENSOR FEEDBACK CIRCUITS FOR OPENS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-1	Ω	C1232A-16
C1738-3	Ω	C1232A-34

Is the resistance less than 3 ohms?

Yes	GO to B7
No	REPAIR the circuit.

B7 CHECK THE GEAR NEUTRAL POSITION SENSOR FOR CORRECT OPERATION

- Install a new gear neutral sensor. Refer to section 308-03A
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the PCM self-test.

Is the DTC still present?

Yes	GO to B8

No	The system has been repaired and is operating correctly at this time.

B8 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect PCM connector.
- Repair:
  - corrosion (install new connector or terminals â€“ clean module pins)
  - damaged or bent pins â€“ install new terminals/pins
  - pushed-out pins â€“ install new pins as necessary
- Connect **all** connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P086E

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

Normal Operation and Fault Conditions

The gear neutral position sensor provides an input to the PCM. The PCM uses this input when controlling the auto-start-stop system. For more information on the auto-start-stop system refer to the owner's literature and
REFER to: Starting System - System Operation and Component Description (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P086E	Neutral Position Sensor "A" Circuit Intermittent/Erratic	Sets in the PCM when the gear neutral position sensor "A" intermittently indicates a different gear than gear neutral position sensor "B".

Possible Sources

- Gear neutral position sensor
- PCM
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Gear neutral position sensor.
- Gear neutral position sensor connector.

PINPOINT TEST C : P086E

C1 CHECK THE GEAR NEUTRAL POSITION SENSOR

- Perform the gear neutral position sensor component test in this section:

Were any conditions found during inspection?

Yes	REPAIR as necessary.
No	GO to C2

C2 CHECK ENGINE HARNESS

- Inspect the engine harness for damage. Refer to the wiring diagram manual for component location and harness routing.
- Inspect engine harness for the following:
  - physical damage
  - corrosion
  - disconnected or loose electrical connectors
  - chaffing
  - pinch points

Are any of these conditions found during inspection?

Yes	REPAIR as necessary.
No	GO to C3

C3 CHECK THE GEAR NEUTRAL POSITION SENSOR

- CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new neutral position sensor. Refer to section 308-03A
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Perform a wiggle test of the engine wiring, gear neutral position sensor, and PCM connections.
- Repeat the PCM self-test.

Did the DTC return?

Yes	INSPECT and REPAIR the wiring harness as necessary. If no concerns are found, CHECK sensor magnet. REPAIR as necessary.
No	The system is operating normally at this time.

Component Test - Gear Neutral Position Sensor

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

1. Inspect the gear neutral position sensor for the following:

- physical damage
- incorrect or loose mounting. Refer to section 308-03A Neutral Position Sensor
- disconnected or loose electrical connector
- corrosion

2. REPAIR as necessary or INSTALL a new neutral position sensor. Refer to section 308-03A Neutral Position Sensor

3. Disconnect the gear neutral position sensor connector C1738

4. Inspect the gear neutral position sensor and gear neutral position sensor connector for the following:

- physical damage
- corrosion (install new connector or terminals- clean module pins)
- damaged or bent pins- install new terminals/pins
- pushed-out pins- install new pins as necessary

5. REPAIR as necessary.

6. Connect and correctly seat the gear neutral position sensor connector C1738

7. Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs) **TR_NTRL_RAW** and **TR_NTRL_RAW2**.

8. While viewing the Parameter Identifications (PIDs), place the shift lever into each position.

9. Record the readings and compare:

Gear Position	TR_NTRL_RAW	TR_NTRL_RAW2
Neutral	47 % to 53 %	37% to 42%
1st	13% to 23 %	12% to 20%
2nd	76% to 86%	59% to 67%
3rd	14% to 24%	13% to 20%
4th	76% to 85%	59% to 67%
5th	14% to 24%	13% to 20%
6th	76% to 86%	59% to 67%
Reverse	14% to 24%	13% to 20%

10. If the readings did not change or were out of specification, continue with inspection.

The gear neutral position sensor reads a magnet attached to the selector mechanism inside the transmission. If this magnet is loose or missing the sensor will not read correctly

11. Inspect the selector mechanism for incorrect or loose mounting or excessive play. Correct installation or replace as necessary.

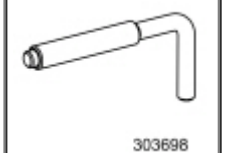
12. If the readings did not change the magnet may be missing or broken. Remove the selector mechanism and inspect the magnet. Repair as necessary.

13. If, after inspecting the selector mechanism, it is suspected the magnet has broken off of the selector shaft, transmission disassembly may be required.

Copyright © 2016 Ford Motor Company

Crankshaft Position (CKP) Sensor Bracket Adjustment - Diesel

Special Tool(s) / General Equipment

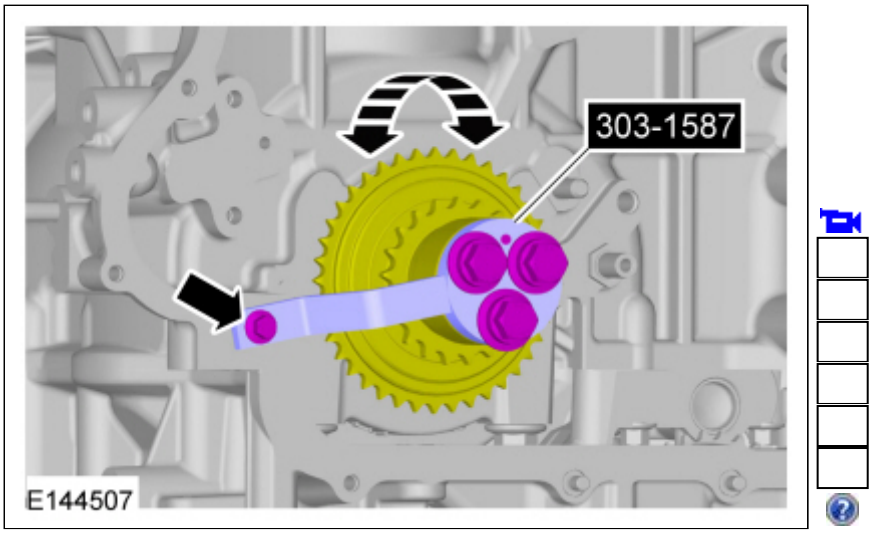
 E131853	303-1562 Timing Tool
 E139146	303-1587 Timing Tool, Crankshaft
 303698	303-698 Timing Tool, Crankshaft

Adjustment

1. Refer to: Timing Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

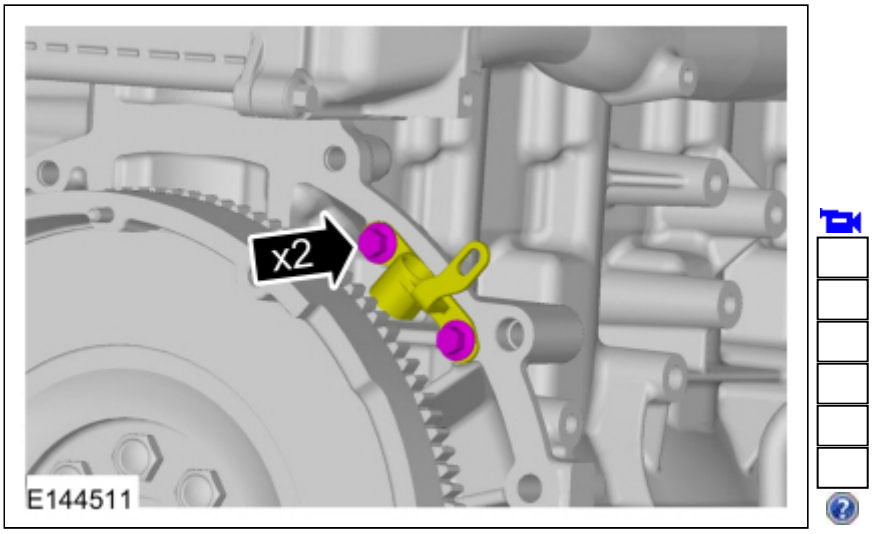
2. Refer to: Crankshaft Position (CKP) Sensor - 2.2L Duratorq-TDCi (Puma) Diesel (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Crankshaft Position (CKP) Sensor - 2.2L Duratorq-TDCi (Puma) Diesel (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

3. Use Special Service Tool: 303-1587 Timing Tool, Crankshaft.



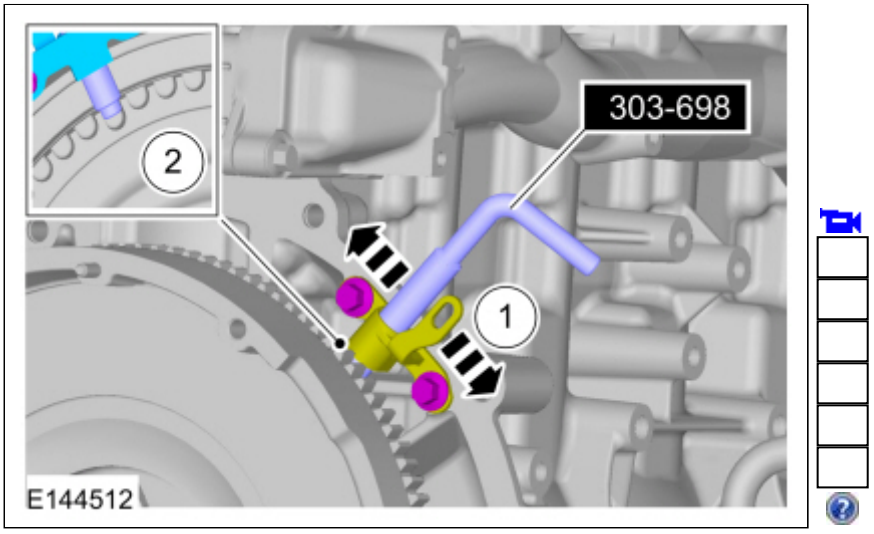
Vehicles with manual transmission

4. Loosen the bolts.

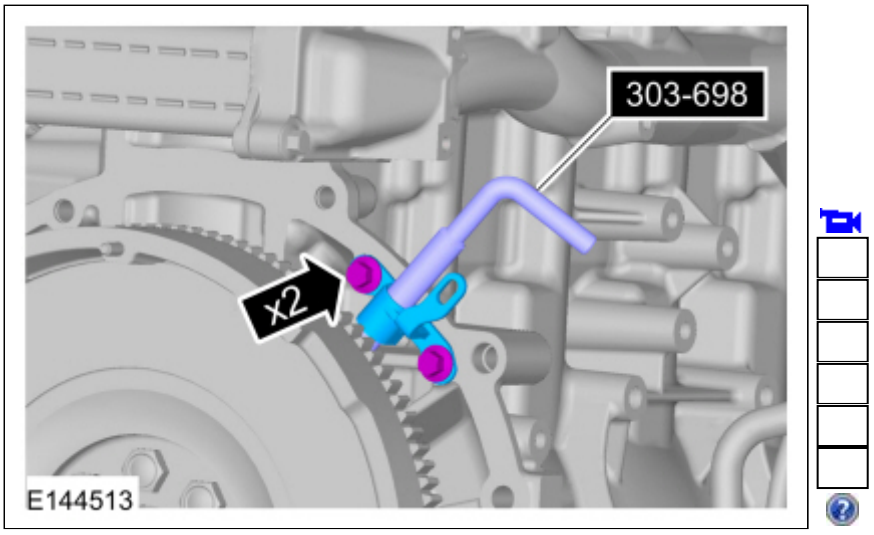


5. **NOTE:** *Make sure that the special tool is located in the flywheel timing slot.*

   Use Special Service Tool: 303-698 Timing Tool, Crankshaft.

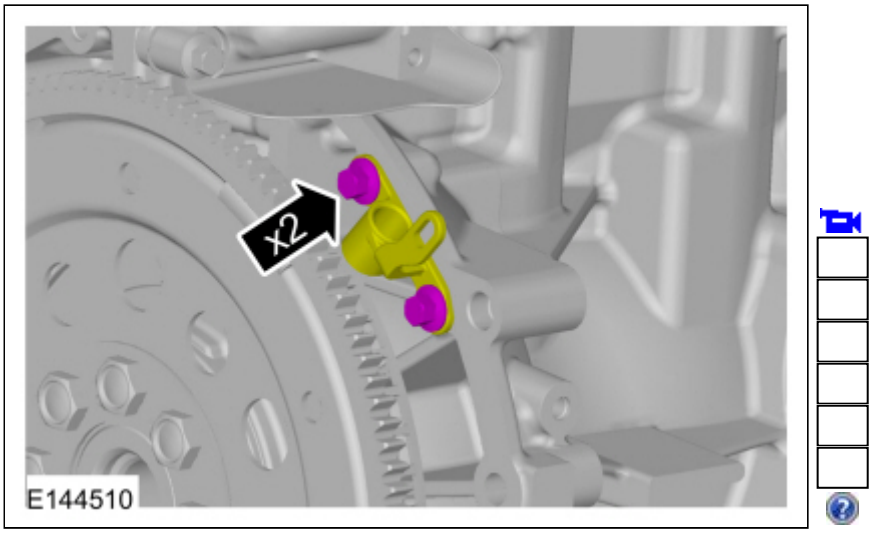


6. Tighten bolts before removing tool.
   Remove Special Service Tool: 303-698 Timing Tool, Crankshaft.
   Torque: 25 Nm



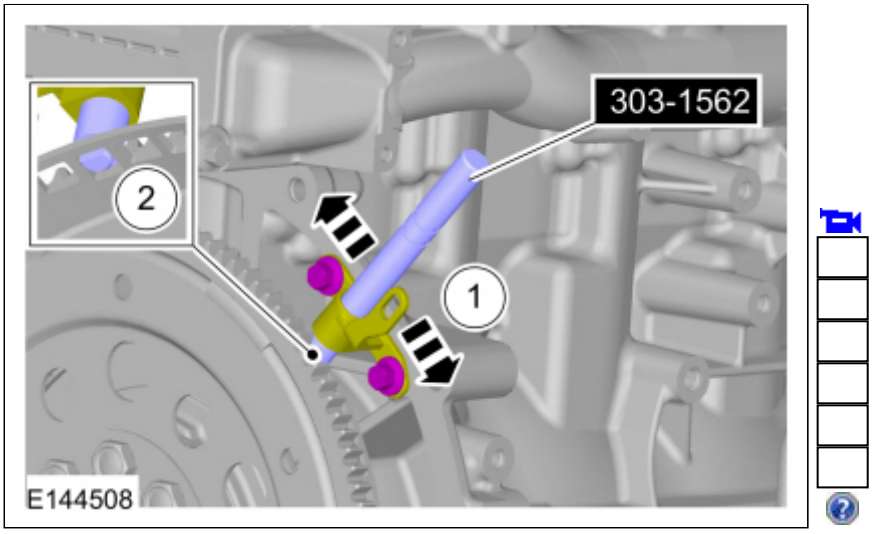
Vehicles with automatic transmission

7. Loosen the bolts.

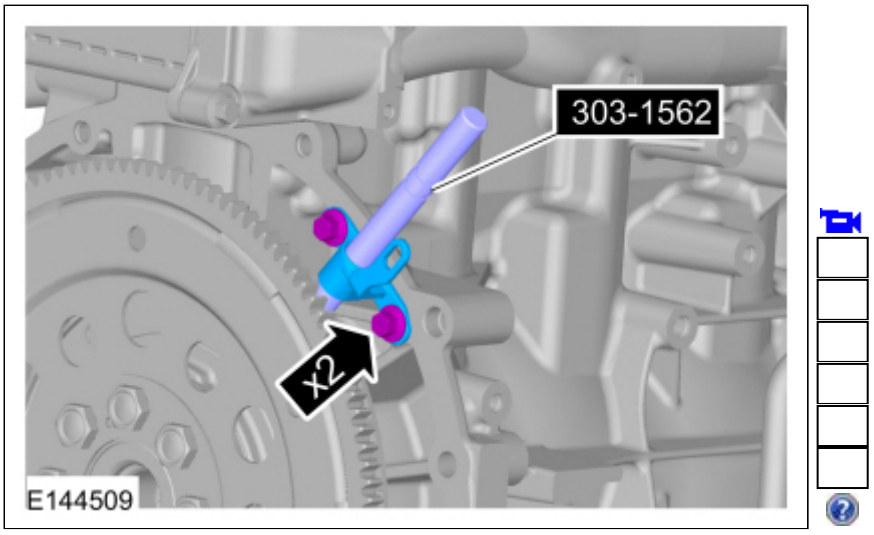


8. **NOTE:** *Make sure that the special tool is located in the flexplate timing slot.*

   Use Special Service Tool: 303-1562 Timing Tool.



9. Tighten bolts before removing tool.
   Remove Special Service Tool: 303-1562 Timing Tool.
   Torque: 25 Nm

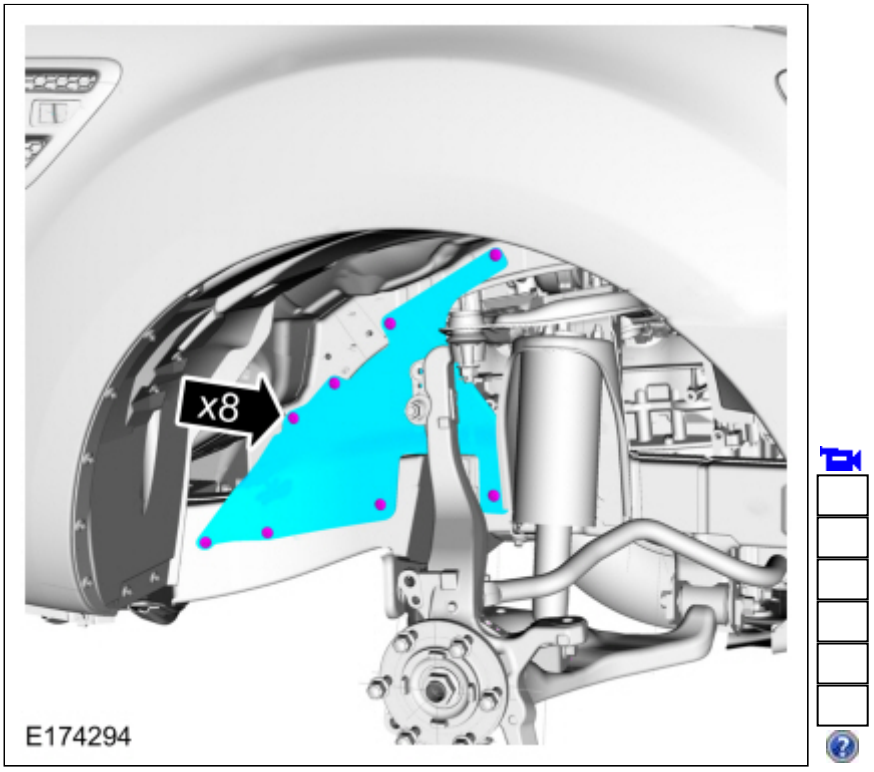


Copyright © 2016 Ford Motor Company

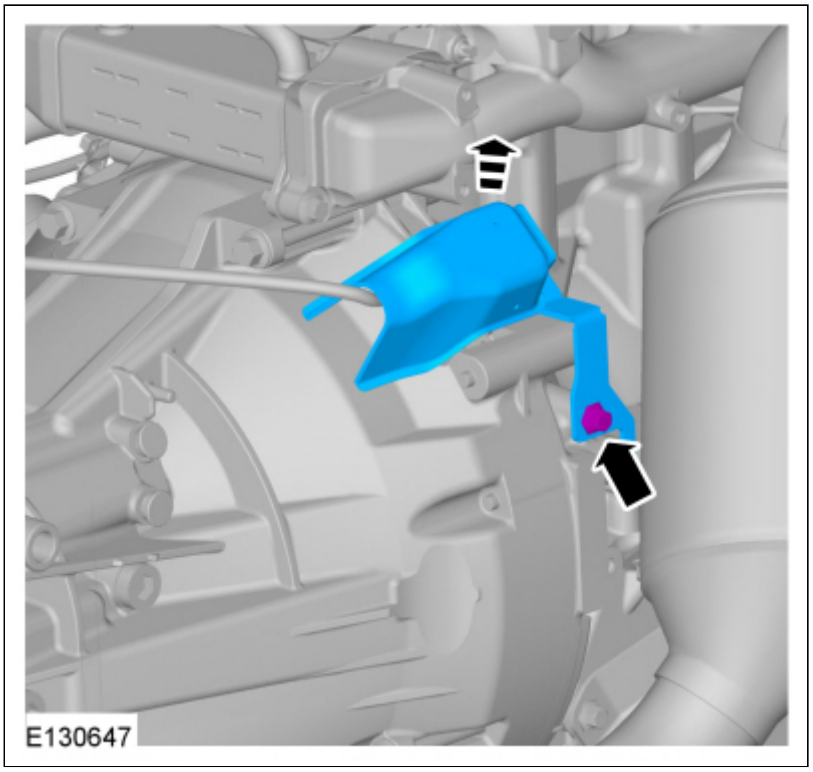
Crankshaft Position (CKP) Sensor - 2.2L Duratorq-TDCi (Puma) Diesel

Removal

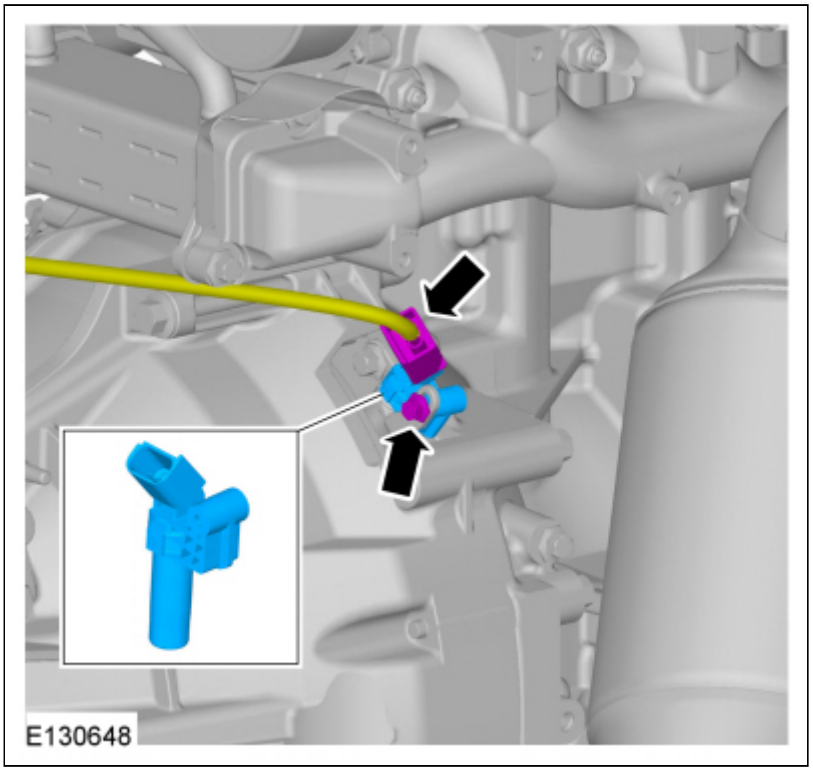
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. 

5.



6. *Torque*: 7 Nm



Installation

1. **NOTICE: Only rotate the crankshaft clockwise.**

   Rotate the crankshaft until a flywheel tooth is visible through the CKP sensor housing.



2. **NOTICE: The tip of the sensor must rest on a flywheel tooth.**

   NOTE: *Make sure that a new component is installed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Powertrain Control Module (PCM)

Base Part Number: 12A650

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

NOTICE: If a new PCM is to be installed, upload the PCM configuration information using the Programmable Modules Installation Routine, prior to commencing the removal of the PCM.

NOTE: *Removal steps in this procedure may contain installation details.*

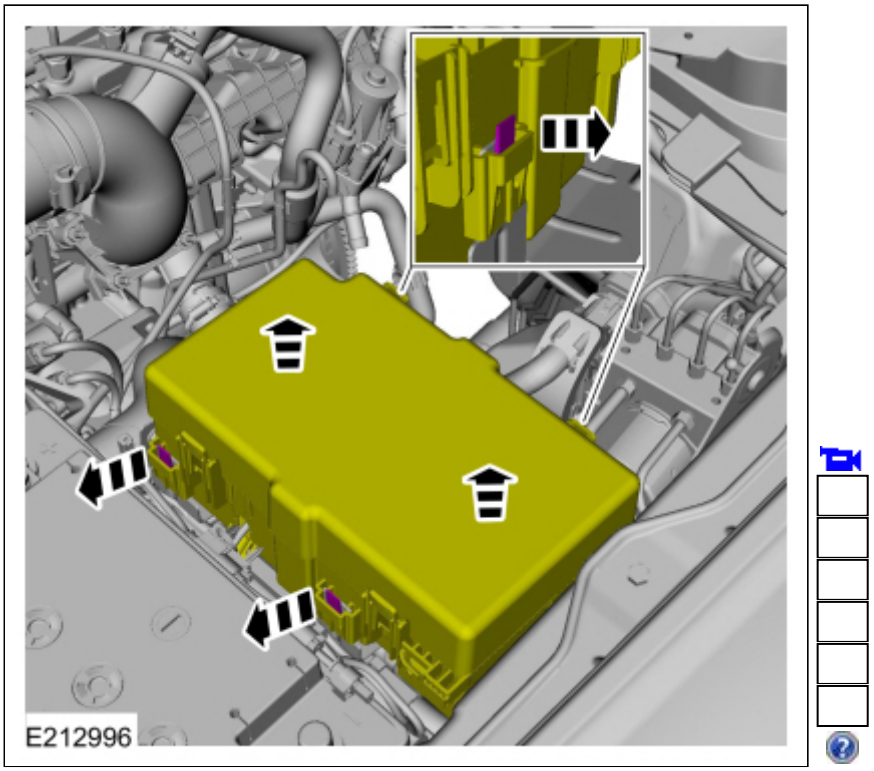
1. **NOTE:** *NOTE: This step is only necessary when installing a new component.*

   Download the PCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

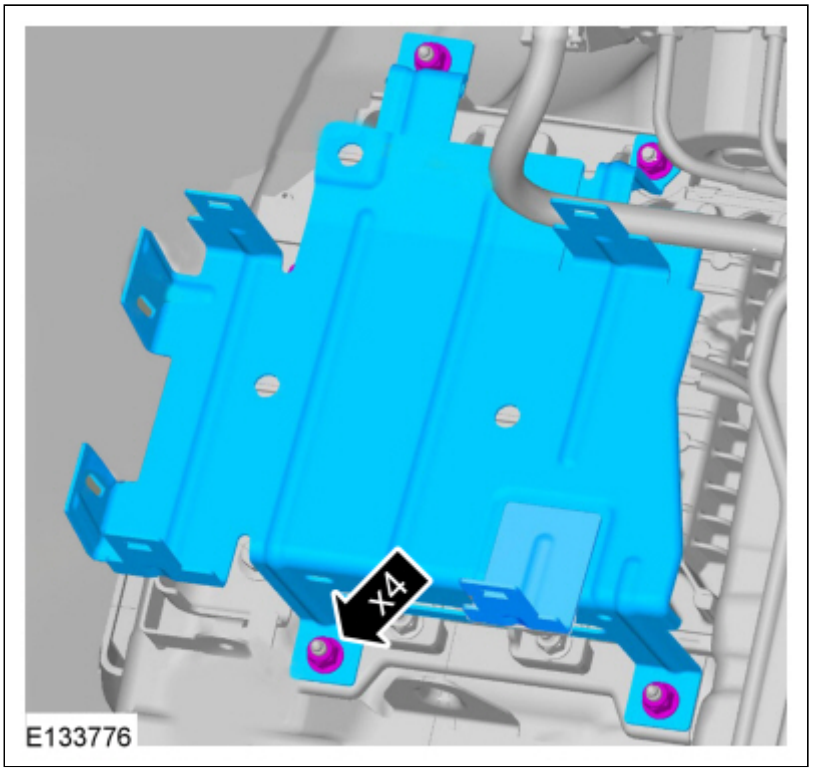
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

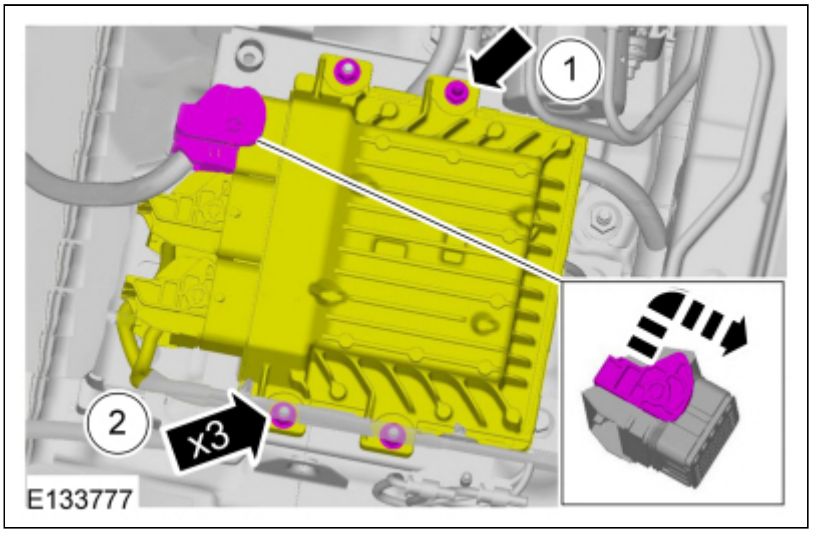
4. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

5. 

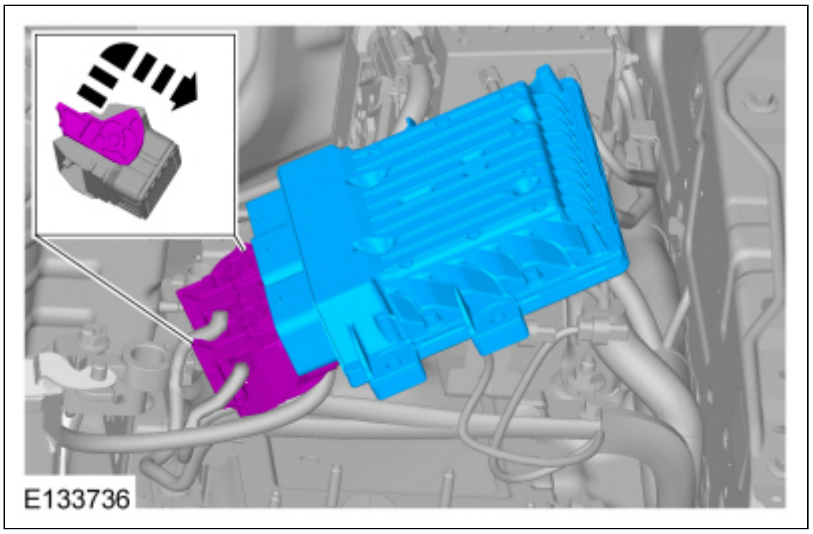
6. *Torque*: 25 Nm



7. *Torque*: 11 Nm



8.



Installation

1. To install, reverse the removal procedure.

2. Carry out the Injector Correction Factors procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

3. Carry out the Oil Quality History function using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

4. Carry out the Stored Speed Limit function using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

5. Carry out the Pump Learn procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

6. Carry out the Pilot Correction Learn procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

7. Change the engine oil and the oil filter.

8. Carry out the oil reset procedure.

9. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

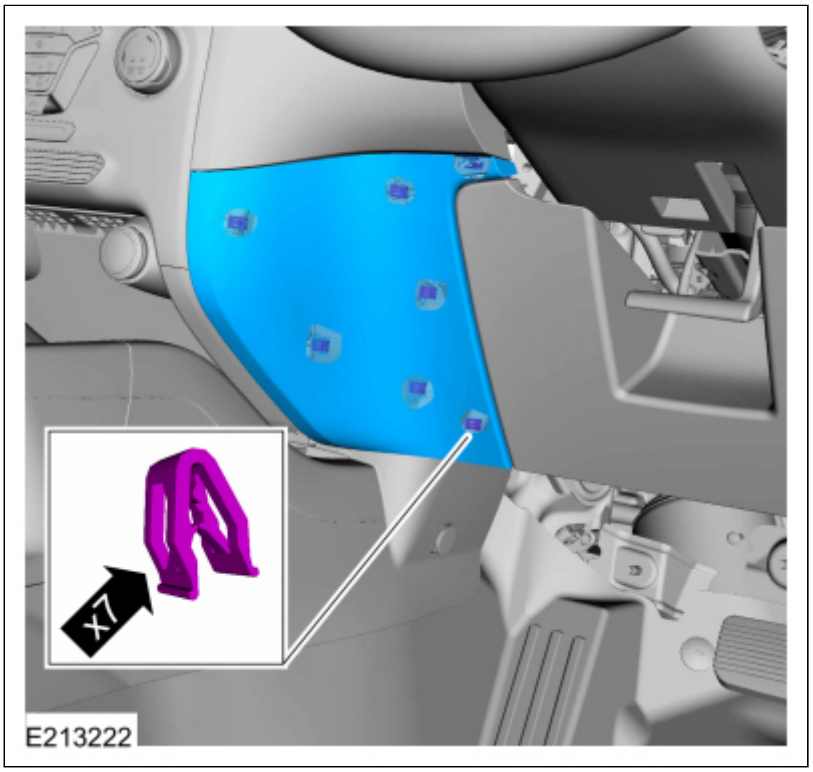
Copyright © 2016 Ford Motor Company

Brake Pedal Position (BPP) Switch

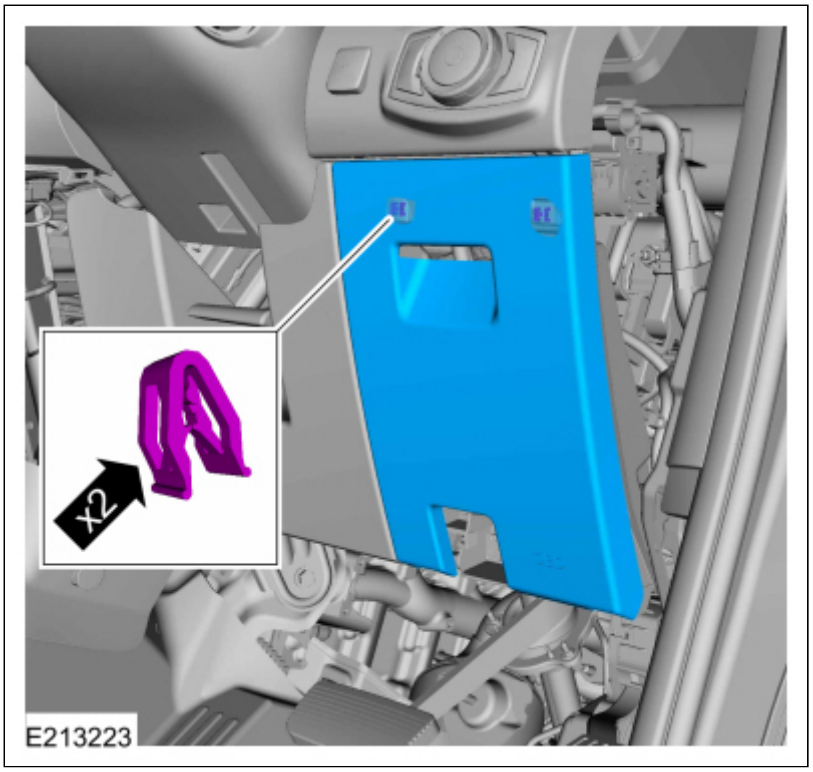
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

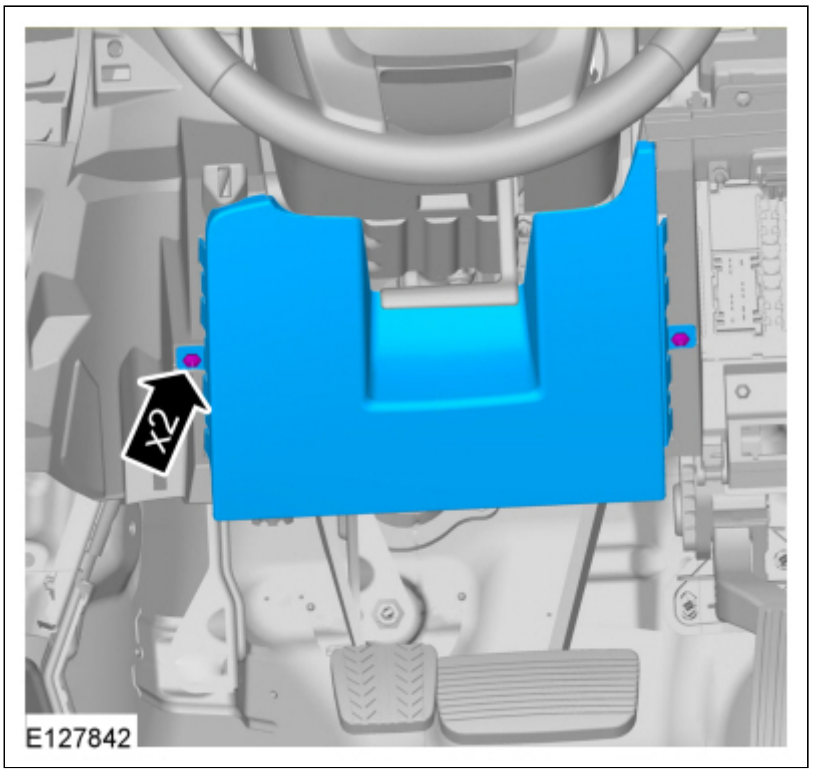
1.



2.



3.

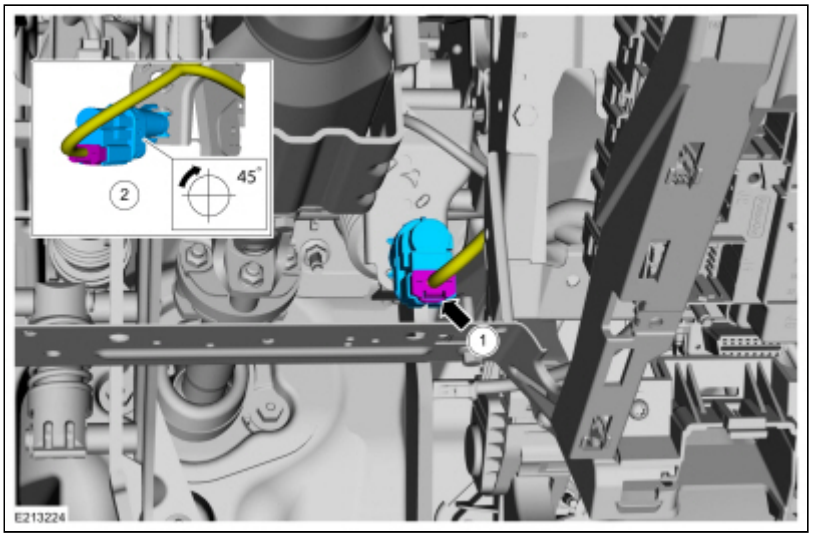


4. **NOTE:** *Only if equipped with driver lower air bag module.*

   Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

5. **NOTE:** *Only if equipped with driver lower air bag module.*

   Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

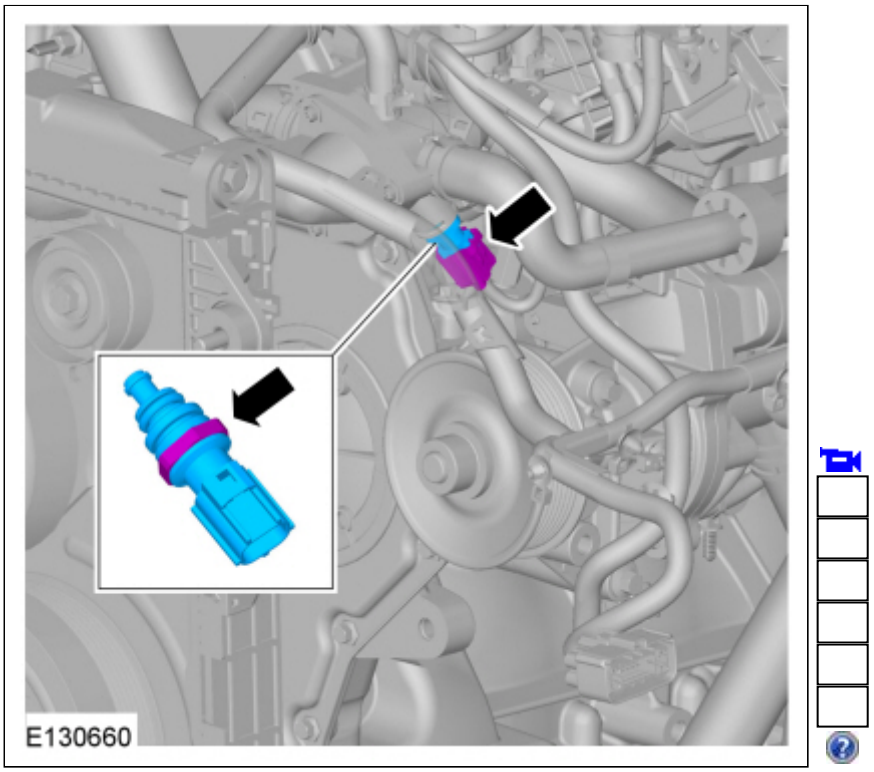
Engine Coolant Temperature (ECT) Sensor

Base Part Number: 12A648

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.



Installation

1. To install, reverse the removal procedure.

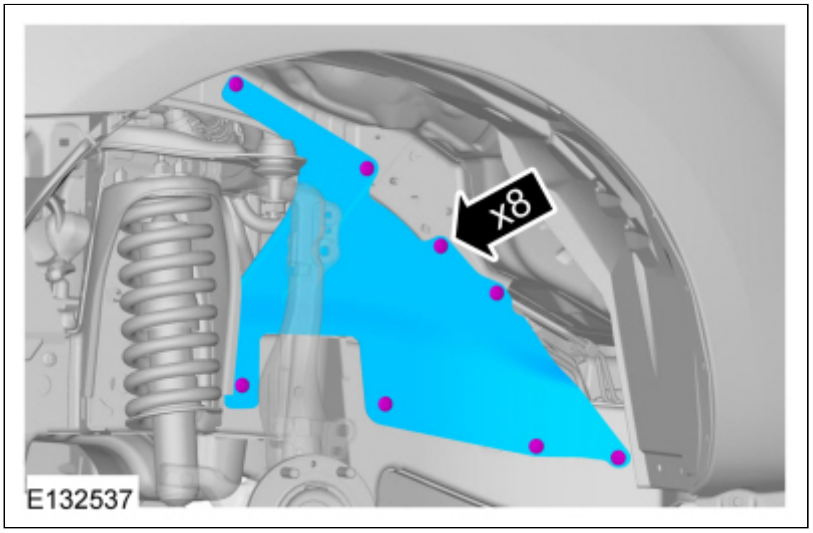
Copyright © 2016 Ford Motor Company

Engine Oil Pressure (EOP) Switch

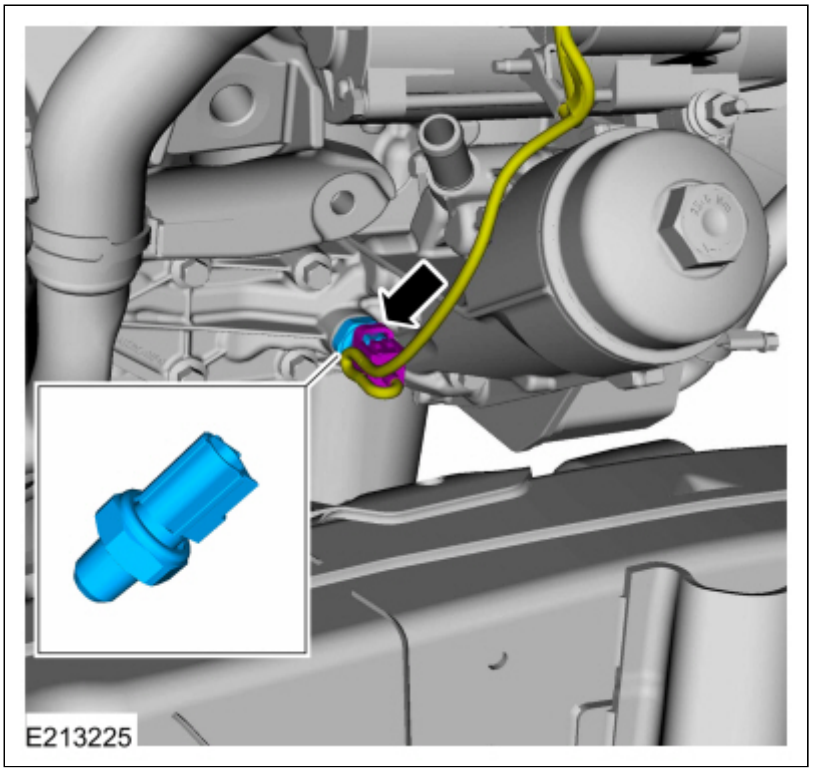
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. Refer to: Lifting (100-02 Jacking and Lifting) .
4.



5. *Torque*: 12 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

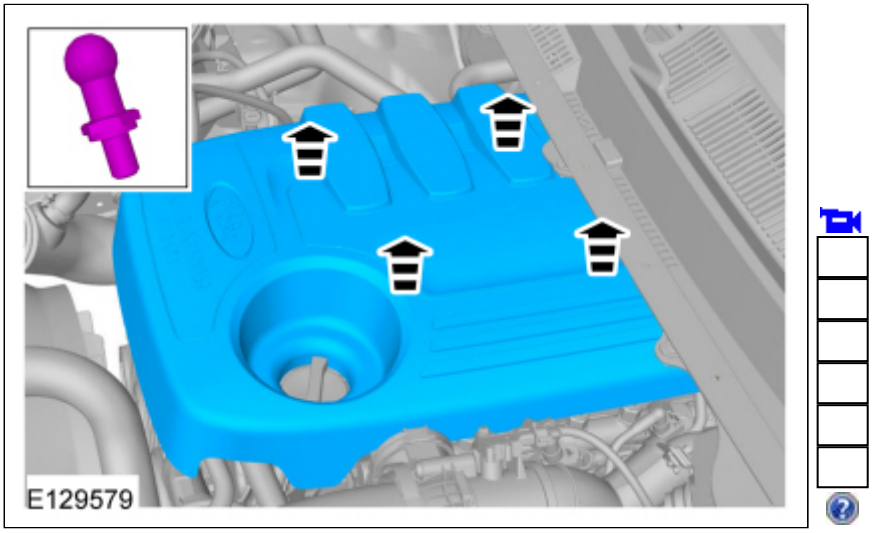
Camshaft Position (CMP) Sensor - 2.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 12K073

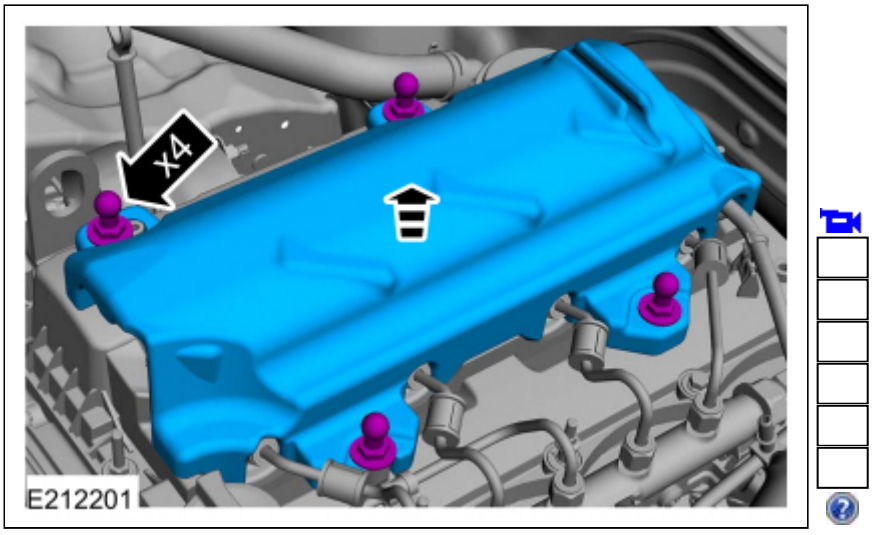
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

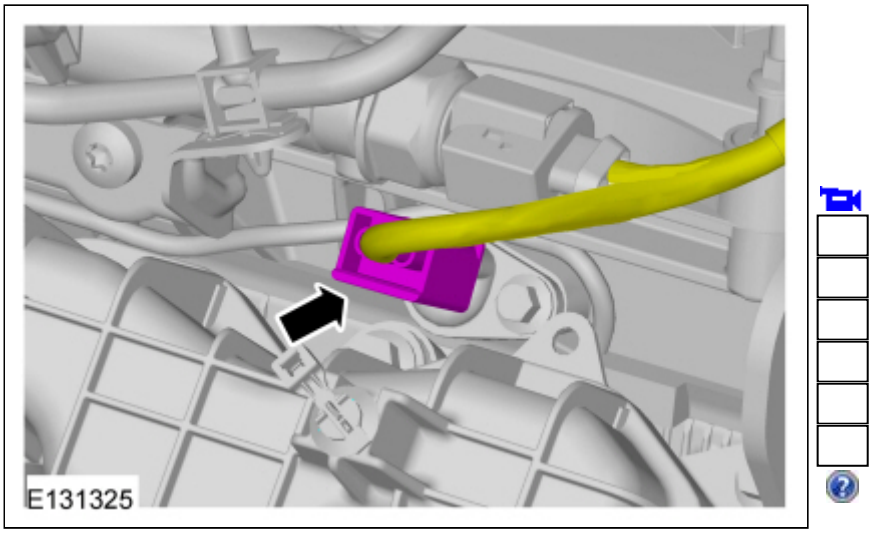
1.



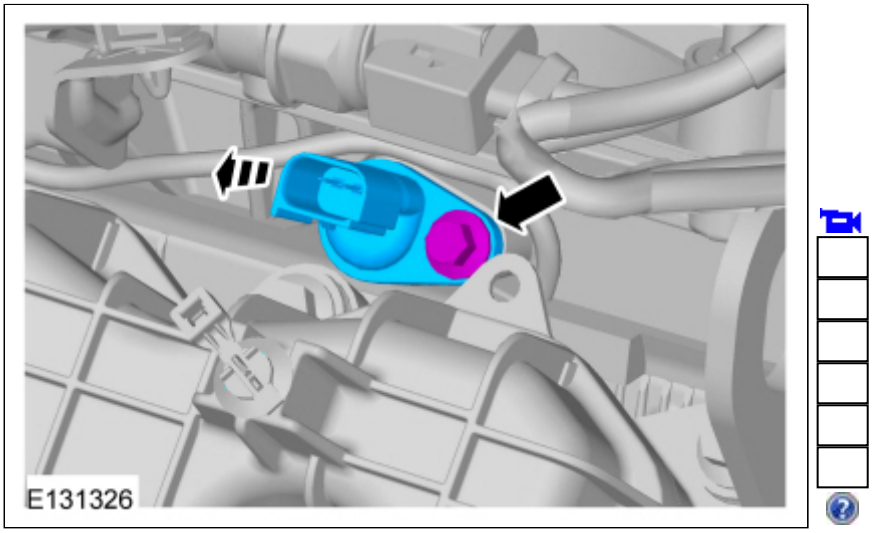
2. *Torque*: 3 Nm



3.



4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Temperature Sensor

Materials

Name	Specification
Brake Cleaner	-

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Make sure that the engine is switched off.**

   WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.

   WARNING: Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

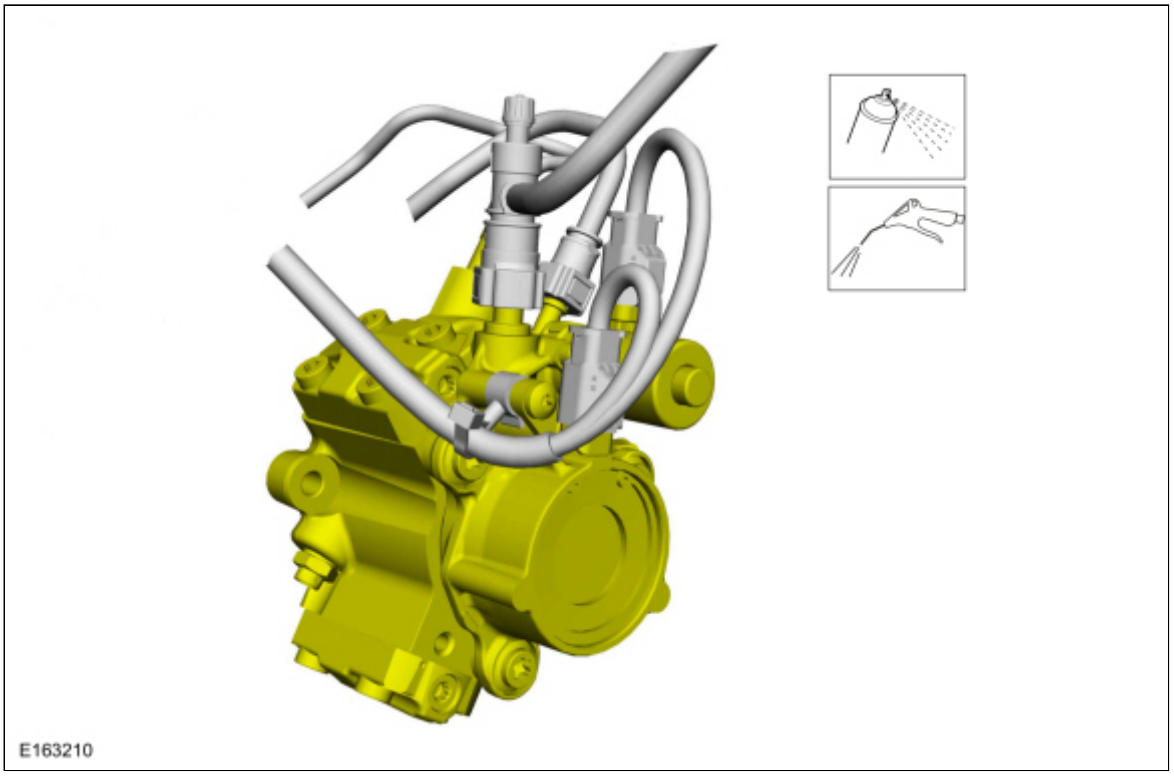
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

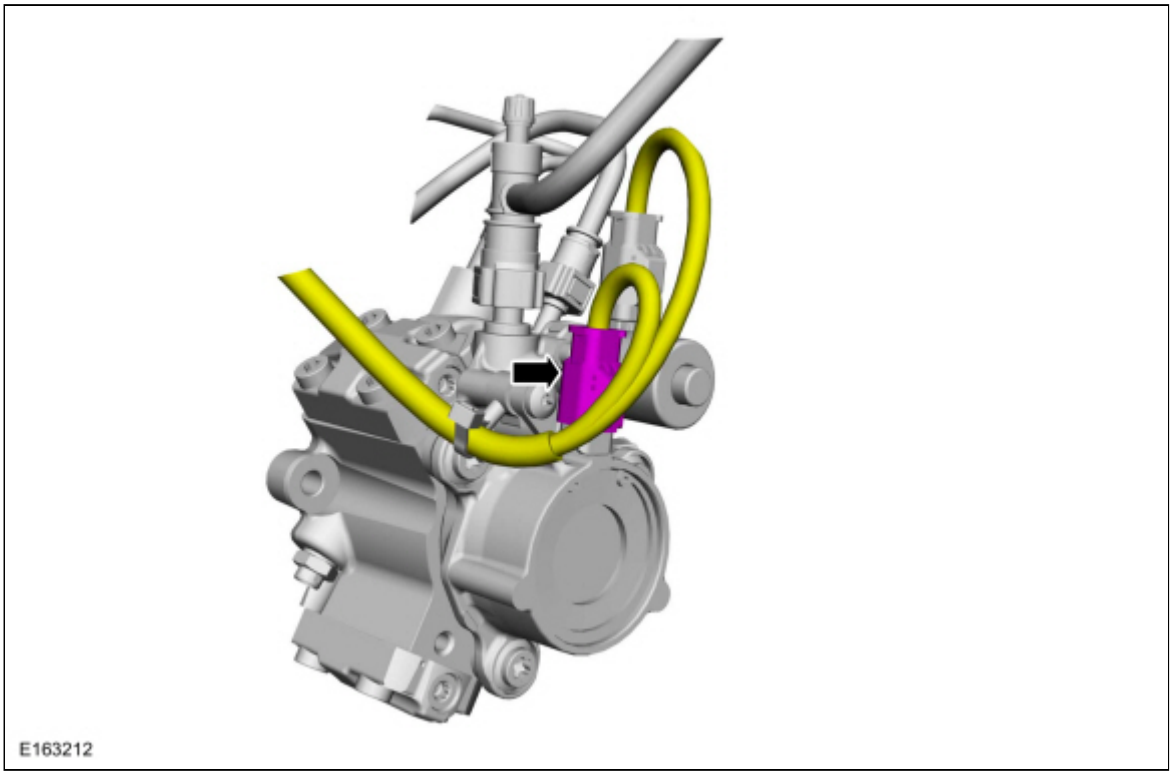
3. 
   

   NOTICE: Extreme cleanliness must be exercised when handling the components.

   Material: Brake Cleaner



4.



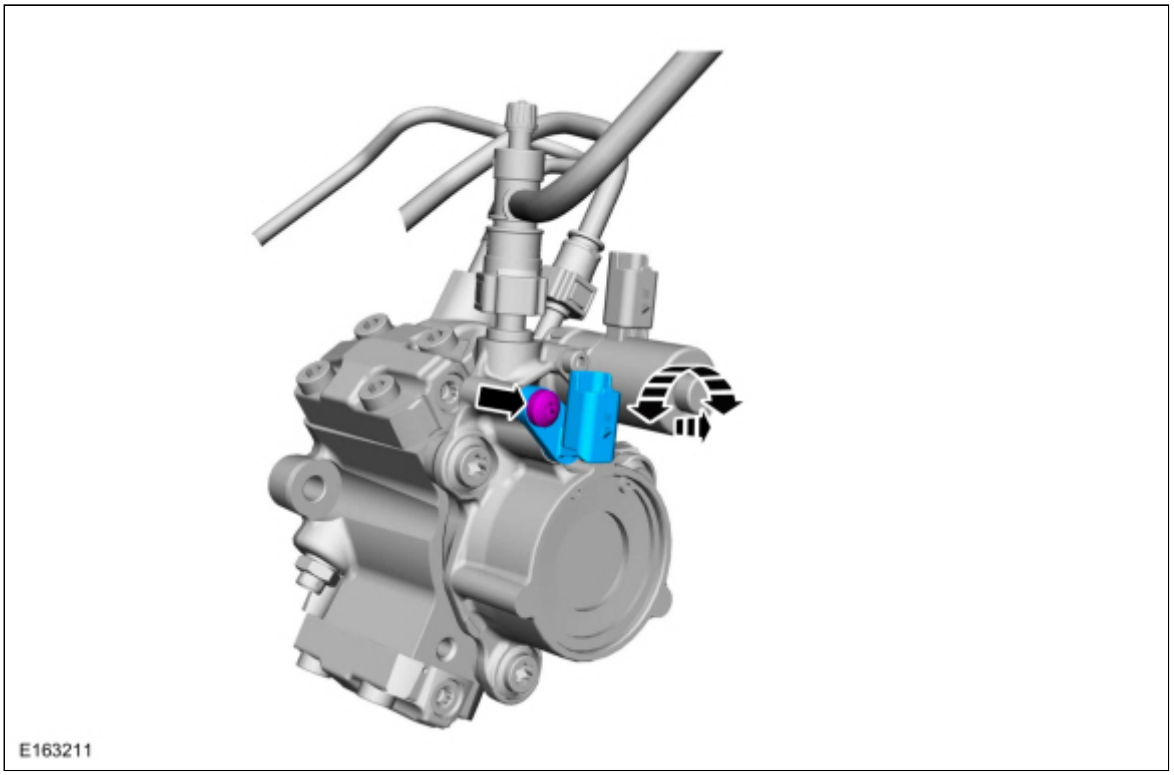
5. **NOTICE: Take extra care when handling the component.**

   NOTICE: Extreme cleanliness must be exercised when handling the component.

   NOTICE: The component must be removed by hand, the use of tools is prohibited.

   NOTE: *Make sure that a new component is installed.*

   Torque: 8 Nm

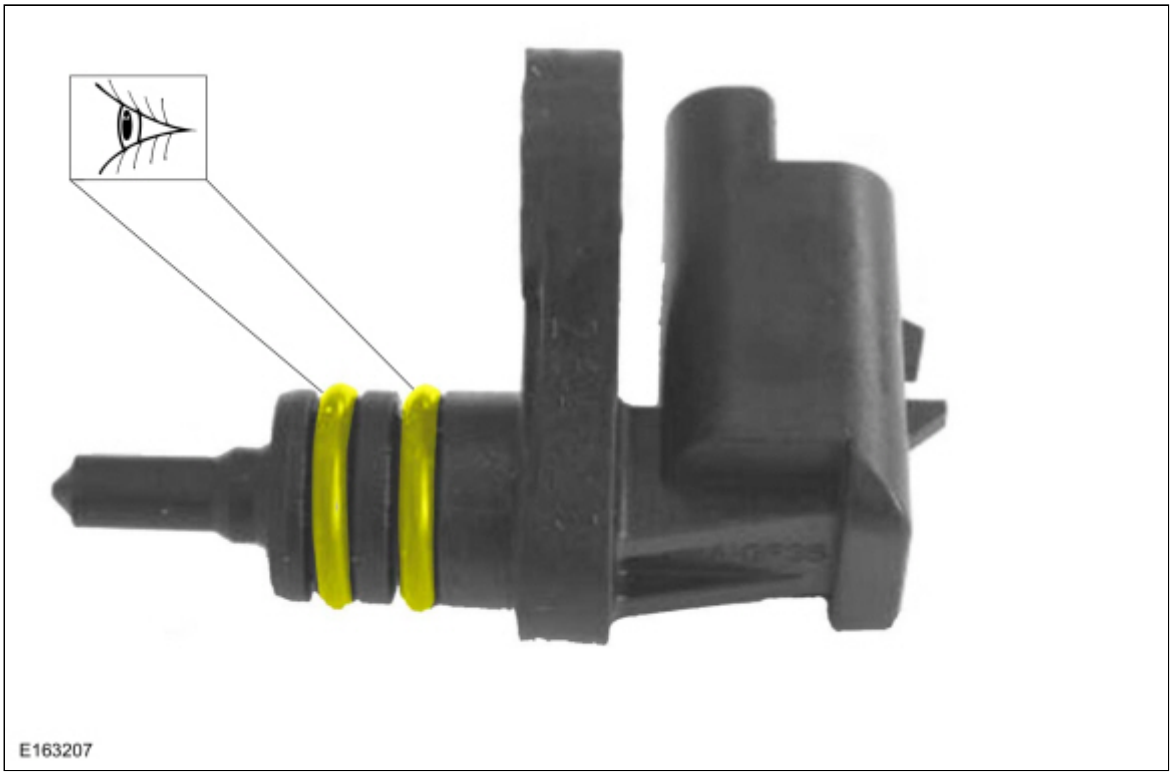


Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Extreme cleanliness must be exercised when handling the component.**

   NOTICE: Take extra care when handling the component.

   NOTE: *Make sure that the seal is correctly located.*



Copyright © 2016 Ford Motor Company

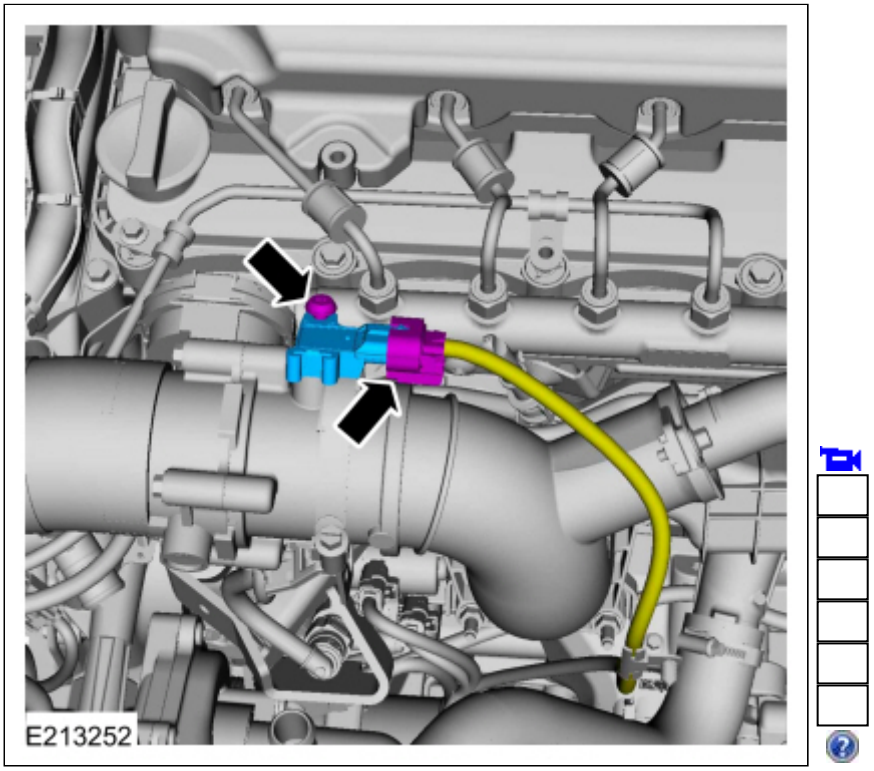
Manifold Absolute Pressure (MAP) Sensor

Base Part Number: 9F479

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*: 5 Nm



Installation

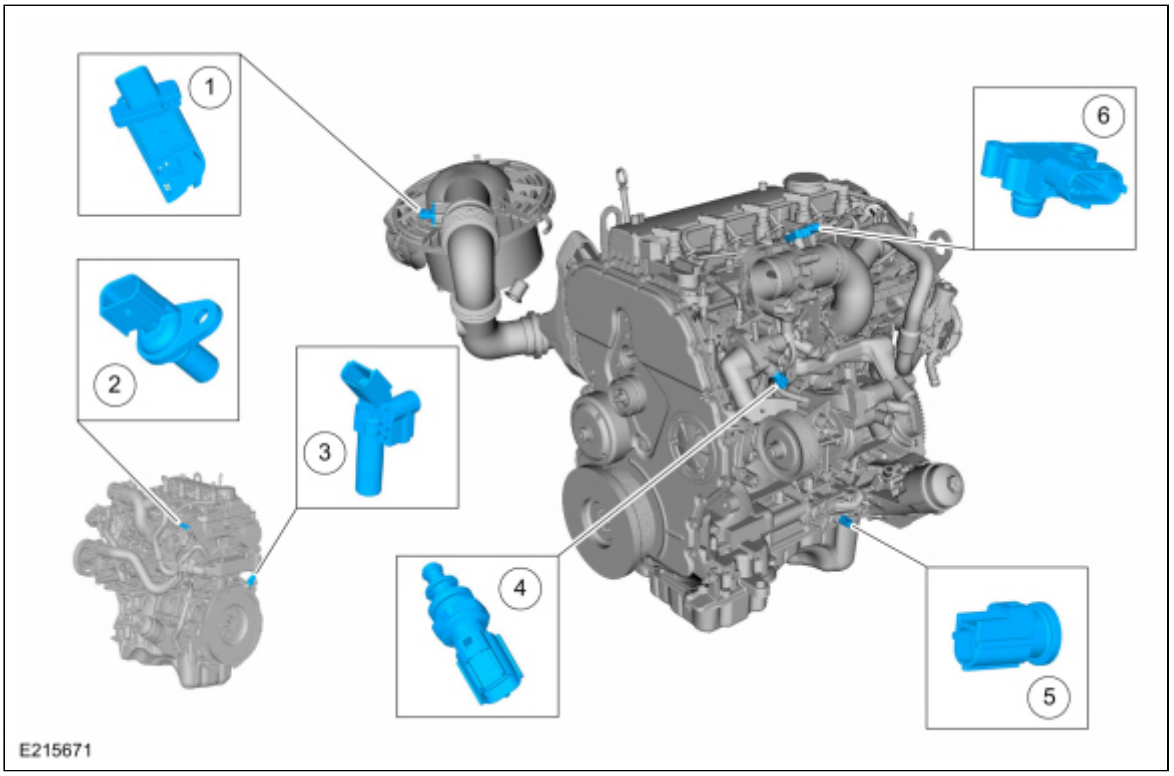
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Information not available at this time.

Electronic Engine Controls - Component Location

Vehicles with 3.2L Duratorq-TDCi (Puma) diesel engine



Item	Part Number	Description
1	—	Intake air temperature (IAT)
2	—	Camshaft position (CMP) sensor
3	—	Crankshaft position (CKP) sensor
4	—	Engine coolant temprature (ECT) sensor
5	—	Engine oil pressure switch
6	—	Manifold absolute pressure (MAP) sensor

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - Overview

Overview

The EEC system provides optimum control of the engine through the enhanced capability of the powertrain control module (PCM). The EEC system also has an on board diagnostic (OBD) monitoring system with features and functions to meet government regulations on exhaust emissions.

The EEC system has two major divisions: hardware and software. The hardware includes the PCM, sensors, switches, actuators, solenoids, and interconnecting terminals. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM.

The PCM receives information from a variety of sensor and switch inputs. Based on the strategy and calibration stored within the PCM, the PCM generates the appropriate output. The system is designed to minimize emissions and optimize fuel economy and driveability. The software strategy controls the basic operation of the engine, provides the OBD strategy, controls the malfunction indicator lamp (MIL), communicates to the scan tool over the data link connector (DLC), allows for flash electrically erasable programmable read only memory (EEPROM), provides idle air and fuel trim, and controls failure mode effects management (FMEM).

Copyright © 2016 Ford Motor Company

Electronic Engine Controls - System Operation and Component Description

System Operation

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) Manual Description and Operation.

Copyright © 2016 Ford Motor Company

Electronic Engine Controls

DTC Chart: Powertrain Control Module (PCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Powertrain Control Module (PCM) DTC Chart

DTC	Description	Action
P0504	Brake Switch A / B Correlation	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0562	System Voltage Low	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
P0563	System Voltage High	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
P0572	Brake Switch A Circuit Low	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P0573	Brake Switch A Circuit High	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
		• With EATC

P0645	A/C Clutch Relay Control Circuit	With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0646	A/C Clutch Relay Control Circuit Low	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0647	A/C Clutch Relay Control Circuit High	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P0657	Actuator Supply Voltage "A" Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P06E9	Engine Starter Performance	REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
P0701	Transmission Control System Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0702	Transmission Control System Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0705	Transmission Range Sensor "A" Circuit (PRNDL Input)	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0706	Transmission Range Sensor "A" Circuit Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0707	Transmission Range Sensor "A" Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0708	Transmission Range Sensor "A" Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0709	Transmission Range Sensor "A" Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0710	Transmission Fluid Temperature Sensor "A" Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0711	Transmission Fluid Temperature Sensor	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-

	"A" Circuit Range/Performance	Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0713	Transmission Fluid Temperature Sensor "A" Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0715	Turbine/Input Shaft Speed Sensor "A" Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0717	Turbine/Input Shaft Speed Sensor "A" Circuit No Signal	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0718	Turbine/Input Shaft Speed Sensor "A" Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0720	Output Shaft Speed Sensor Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0721	Output Shaft Speed Sensor Circuit Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0722	Output Shaft Speed Sensor Circuit No Signal	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0729	Gear 6 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0731	Gear 1 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0732	Gear 2 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0733	Gear 3 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0734	Gear 4 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0735	Gear 5 Incorrect Ratio	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0740	Torque Converter Clutch Solenoid Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0741	Torque Converter Clutch Solenoid Circuit Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0742	Torque Converter Clutch Solenoid Circuit Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0743	Torque Converter Clutch Solenoid Circuit Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

P0744	Torque Converter Clutch Solenoid Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0748	Pressure Control Solenoid "A" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0750	Shift Solenoid "A"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0751	Shift Solenoid "A" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0752	Shift Solenoid "A" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0753	Shift Solenoid "A" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0754	Shift Solenoid "A" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0755	Shift Solenoid "B"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0756	Shift Solenoid "B" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0757	Shift Solenoid "B" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0758	Shift Solenoid "B" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0759	Shift Solenoid "B" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0760	Shift Solenoid "C"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0761	Shift Solenoid "C" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0762	Shift Solenoid "C" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0763	Shift Solenoid "C" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0764	Shift Solenoid "C" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0765	Shift Solenoid "D"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0766	Shift Solenoid "D" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0767	Shift Solenoid "D" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-

		Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0768	Shift Solenoid "D" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0769	Shift Solenoid "D" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0770	Shift Solenoid "E"	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0771	Shift Solenoid "E" Performance/Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0772	Shift Solenoid "E" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0773	Shift Solenoid "E" Electrical	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0774	Shift Solenoid "E" Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07A8	Transmission Friction Element "D" Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07A9	Transmission Friction Element "D" Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07AA	Transmission Friction Element "E" Stuck Off	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0812	Reverse Input Circuit	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
P0820	Gear Lever X-Y Position Sensor Circuit	GO to Pinpoint Test B
P0825	Gear Lever Push/Pull Switch Circuit (Shift Anticipate)	GO to Pinpoint Test B
P082A	Gear Lever X Position Sensor 1 Circuit Range/Performance	GO to Pinpoint Test B
P082D	Gear Lever Y Position Sensor 1 Circuit Range/Performance	GO to Pinpoint Test B
P082E	Gear Lever Y Position Sensor 1 Circuit Low	GO to Pinpoint Test B
P0850	Park / Neutral Switch Input Circuit	REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
P086E	Neutral Position Sensor "A" Circuit Intermittent/Erratic	GO to Pinpoint Test C

P0882	TCM Power Input Signal Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0883	TCM Power Input Signal High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P08B1	Neutral Position Sensor "B" Circuit Intermittent/Erratic	REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
P0960	Line Pressure Control (LPC) A Control Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0961	Pressure Control Solenoid "A" Control Circuit/Open	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0962	Pressure Control Solenoid "A" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0963	Pressure Control Solenoid "A" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0973	Shift Solenoid "A" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0974	Shift Solenoid "A" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0976	Shift Solenoid "B" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0977	Shift Solenoid "B" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0979	Shift Solenoid "C" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0980	Shift Solenoid "C" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0982	Shift Solenoid "D" Control Circuit Low	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0983	Shift Solenoid "D" Control Circuit High	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0984	Shift Solenoid "E" Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1464	A/C Demand Out Of Self Test Range	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).

P161A	Incorrect Response from Immobilizer Control Module	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
P1632	Smart Alternator Fault Sensor / Circuit	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
P1636	Inductive Signature Chip Communication Error	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P163E	Transmission Control Module Programming Error	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P163F	Transmission ID Block Corrupted, Not Programmed	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1678	Low Oil Pressure Lamp Control Circuit	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P1702	Transmission Range Sensor Circuit Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1703	Brake Switch Out Of Self-Test Range	• Without adaptive cruise control, REFER to: Cruise Control (419-03A Cruise Control, Diagnosis and Testing). • With adaptive cruise control, REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
P1705	Transmission Range Circuit Not Indicating Park/Neutral During Self Test	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1711	Transmission Fluid Temperature Sensor Out Of Self Test Range	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1744	Torque Converter Clutch Solenoid Circuit	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1783	Transmission Overtemperature Condition	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1820	Transfer Case Clockwise Shift Relay Coil Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1821	Transfer Case Clockwise Shift Relay Coil Open Circuit	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1822	Transfer Case Clockwise Shift Relay Coil Short Circuit to Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1823	Transfer Case Clockwise Shift Relay Coil Short Circuit to Ground	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1828	Transfer Case Clockwise Shift	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems,

	Relay Coil Short Circuit to Battery	Diagnosis and Testing).
P1829	Transfer Case Counter Clockwise Shift Relay Coil Open Circuit	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1830	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1831	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Ground	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P184A	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P184B	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1870	Mechanical Transfer Case 4x4 Switch Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1871	Mechanical Transfer Case 4x4 Switch Circuit Short To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1874	Transfer Case Hall Effect Sensor Power Circuit Failure	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1875	Transfer Case Hall Effect Sensor Power Circuit Short To Battery	REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
P1921	Transmission Range Signal	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1933	Fuel Level Signal	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P193E	A/C Clutch Request Signal	• With EATC, REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • With EMTC, REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
P2700	Transmission Friction Element "A" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2701	Transmission Friction Element "B" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2702	Transmission Friction	

	Element "C" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2703	Transmission Friction Element "D" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2704	Transmission Friction Element "E" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2705	Transmission Friction Element "F" Apply Time Range/Performance	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2758	Torque Converter Clutch Pressure Control Solenoid Stuck On	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2760	Torque Converter Clutch Pressure Control Solenoid Intermittent	REFER to: Diagnostic Trouble Code Charts (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
U0104	Lost Communication With Cruise Control Module	REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	GO to Pinpoint Test A
All Other DTCs	—	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. Section 3 Symptom Charts.

Pinpoint Tests

U0121

DTC Fault Trigger Condition-PCM

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	The PCM sets this DTC if data messages received from the ABS module through the GWM are missing.

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

Possible Sources

- Communications network concern
- Communications network concern
- ABS module
- BCM
- PCM

PINPOINT TEST A : U0121

A1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to A2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Did the ABS module pass the network test?

Yes	GO to A3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A3 PERFORM ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform a ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to A4

A4 CHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the BCM Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to A5

A5 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0562 or DTC P0563 recorded?

Yes	REFER to PCM DTC Chart in this section.
No	GO to A6

A6 RECHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES

(DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the PCM self-test.

Is DTC U0121 still present?

Yes	GO to A7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0121:00 set in any other module?

Yes	GO to A8
No	GO to A9

A8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect all ABS MODULE connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the ABS MODULE connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS MODULE. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect PCM connector.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Gear Neutral Sensor Circuit Faults

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

Normal Operation and Fault Conditions

The gear neutral position sensor provides an input to the PCM. The PCM uses this input when controlling the auto-start-stop system. For more information on the auto-start-stop system refer to the owner's literature and
REFER to: Starting System - System Operation and Component Description (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0820	Gear Lever X-Y Position Sensor Circuit	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P0825	Gear Lever Push/Pull Switch Circuit (Shift Anticipate)	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P082A	Gear Lever "X" Position Sensor 1 Circuit Range/Performance	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P082D	Gear Lever Y Position Sensor 1 Circuit Range/Performance	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.
P082E	Gear Lever Y Position Sensor 1 Circuit Low	Sets in the PCM when the PCM senses lower than expected voltage on the gear neutral position sensor feedback circuit, indicating an open or a short directly to ground.
P086E	Neutral Position Sensor "A" Circuit Intermittent/Erratic	Sets in the PCM when the PCM does not detect current through the gear neutral position sensor and there are no other gear neutral position sensor circuit DTC set.
P08B1	Neutral Position Sensor "B" Circuit Intermittent/Erratic	Sets in the PCM when the PCM senses higher than expected voltage on the gear neutral position sensor feedback circuit, indicating a short directly to voltage.

Possible Sources

- Gear neutral position sensor
- PCM

- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Gear neutral position sensor.
- Gear neutral position sensor connector.

PINPOINT TEST B : GEAR NEUTRAL POSITION SENSOR CIRCUIT FAULTS

B1 CHECK THE GEAR NEUTRAL POSITION SENSOR

- Perform the gear neutral position sensor component test in this section:

Were any conditions found during inspection?

Yes	REPAIR as necessary.
No	GO to B2

B2 CHECK THE GEAR NEUTRAL POSITION SENSOR REFERENCE VOLTAGE CIRCUIT

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-2		Ground

Is the voltage between 4.8 and 5.2 volts?

Yes	GO to B3
No	If the voltage is less than 4.8 volts, REPAIR the circuit for an open or high resistance. If the voltage is greater than 5.2 volts, REPAIR the circuit for a short to voltage.

B3 CHECK THE GEAR NEUTRAL POSITION SENSOR GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-2		C1738-4

Is the voltage between 4.8 and 5.2 volts?

Yes	GO to B4
No	If the voltage is less than 4.8 volts, REPAIR the circuit for an open or high resistance. If the voltage is greater than 5.2 volts, REPAIR the circuit for a short to voltage.

B4 CHECK THE GEAR NEUTRAL POSITION SENSOR FEEDBACK CIRCUITS FOR SHORTS TO VOLTAGE

- Disconnect PCM C1232A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-1		Ground
C1738-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B5

B5 CHECK THE GEAR NEUTRAL POSITION SENSOR FEEDBACK CIRCUITS FOR SHORTS TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-1	Ω	Ground
C1738-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B6
No	REPAIR the circuit.

B6 CHECK THE GEAR NEUTRAL POSITION SENSOR FEEDBACK CIRCUITS FOR OPENS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1738-1	Ω	C1232A-16
C1738-3	Ω	C1232A-34

Is the resistance less than 3 ohms?

Yes	GO to B7
No	REPAIR the circuit.

B7 CHECK THE GEAR NEUTRAL POSITION SENSOR FOR CORRECT OPERATION

- Install a new gear neutral sensor. Refer to section 308-03A
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the PCM self-test.

Is the DTC still present?

Yes	GO to B8

No	The system has been repaired and is operating correctly at this time.

B8 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect PCM connector.
- Repair:
  - corrosion (install new connector or terminals â€“ clean module pins)
  - damaged or bent pins â€“ install new terminals/pins
  - pushed-out pins â€“ install new pins as necessary
- Connect **all** connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P086E

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

Normal Operation and Fault Conditions

The gear neutral position sensor provides an input to the PCM. The PCM uses this input when controlling the auto-start-stop system. For more information on the auto-start-stop system refer to the owner's literature and
REFER to: Starting System - System Operation and Component Description (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Description and Operation).

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P086E	Neutral Position Sensor "A" Circuit Intermittent/Erratic	Sets in the PCM when the gear neutral position sensor "A" intermittently indicates a different gear than gear neutral position sensor "B".

Possible Sources

- Gear neutral position sensor
- PCM
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Gear neutral position sensor.
- Gear neutral position sensor connector.

PINPOINT TEST C : P086E

C1 CHECK THE GEAR NEUTRAL POSITION SENSOR

- Perform the gear neutral position sensor component test in this section:

Were any conditions found during inspection?

Yes	REPAIR as necessary.
No	GO to C2

C2 CHECK ENGINE HARNESS

- Inspect the engine harness for damage. Refer to the wiring diagram manual for component location and harness routing.
- Inspect engine harness for the following:
  - physical damage
  - corrosion
  - disconnected or loose electrical connectors
  - chaffing
  - pinch points

Are any of these conditions found during inspection?

Yes	REPAIR as necessary.
No	GO to C3

C3 CHECK THE GEAR NEUTRAL POSITION SENSOR

- CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new neutral position sensor. Refer to section 308-03A
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Perform a wiggle test of the engine wiring, gear neutral position sensor, and PCM connections.
- Repeat the PCM self-test.

Did the DTC return?

Yes	INSPECT and REPAIR the wiring harness as necessary. If no concerns are found, CHECK sensor magnet. REPAIR as necessary.
No	The system is operating normally at this time.

Component Test - Gear Neutral Position Sensor

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

1. Inspect the gear neutral position sensor for the following:

- physical damage
- incorrect or loose mounting. Refer to section 308-03A Neutral Position Sensor
- disconnected or loose electrical connector
- corrosion

2. REPAIR as necessary or INSTALL a new neutral position sensor. Refer to section 308-03A Neutral Position Sensor

3. Disconnect the gear neutral position sensor connector C1738

4. Inspect the gear neutral position sensor and gear neutral position sensor connector for the following:

- physical damage
- corrosion (install new connector or terminals- clean module pins)
- damaged or bent pins- install new terminals/pins
- pushed-out pins- install new pins as necessary

5. REPAIR as necessary.

6. Connect and correctly seat the gear neutral position sensor connector C1738

7. Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs) **TR_NTRL_RAW** and **TR_NTRL_RAW2**.

8. While viewing the Parameter Identifications (PIDs), place the shift lever into each position.

9. Record the readings and compare:

Gear Position	TR_NTRL_RAW	TR_NTRL_RAW2
Neutral	47 % to 53 %	37% to 42%
1st	13% to 23 %	12% to 20%
2nd	76% to 86%	59% to 67%
3rd	14% to 24%	13% to 20%
4th	76% to 85%	59% to 67%
5th	14% to 24%	13% to 20%
6th	76% to 86%	59% to 67%
Reverse	14% to 24%	13% to 20%

10. If the readings did not change or were out of specification, continue with inspection.

The gear neutral position sensor reads a magnet attached to the selector mechanism inside the transmission. If this magnet is loose or missing the sensor will not read correctly

11. Inspect the selector mechanism for incorrect or loose mounting or excessive play. Correct installation or replace as necessary.

12. If the readings did not change the magnet may be missing or broken. Remove the selector mechanism and inspect the magnet. Repair as necessary.

13. If, after inspecting the selector mechanism, it is suspected the magnet has broken off of the selector shaft, transmission disassembly may be required.

Copyright © 2016 Ford Motor Company

Crankshaft Position (CKP) Sensor Bracket Adjustment - Diesel

Special Tool(s) / General Equipment

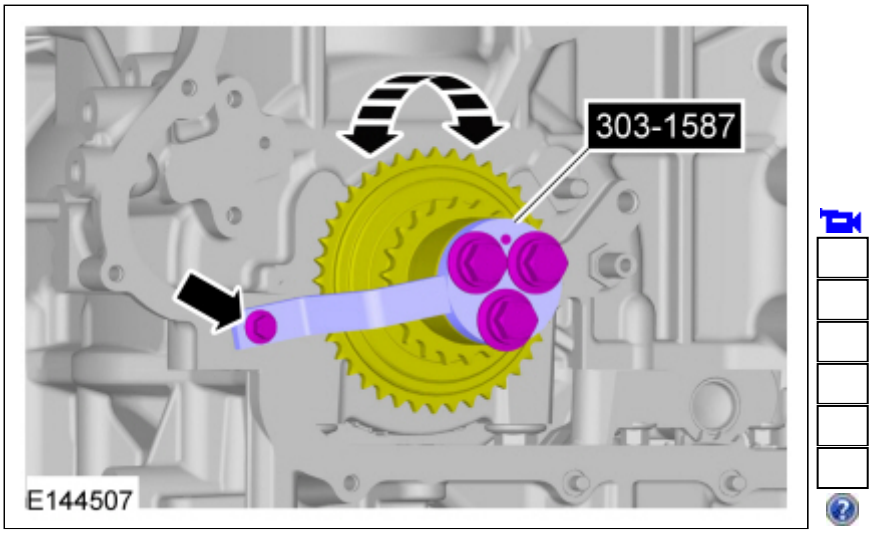
 E131853	303-1562 Timing Tool
 E139146	303-1587 Timing Tool, Crankshaft
 303698	303-698 Timing Tool, Crankshaft

Adjustment

1. Refer to: Timing Cover (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

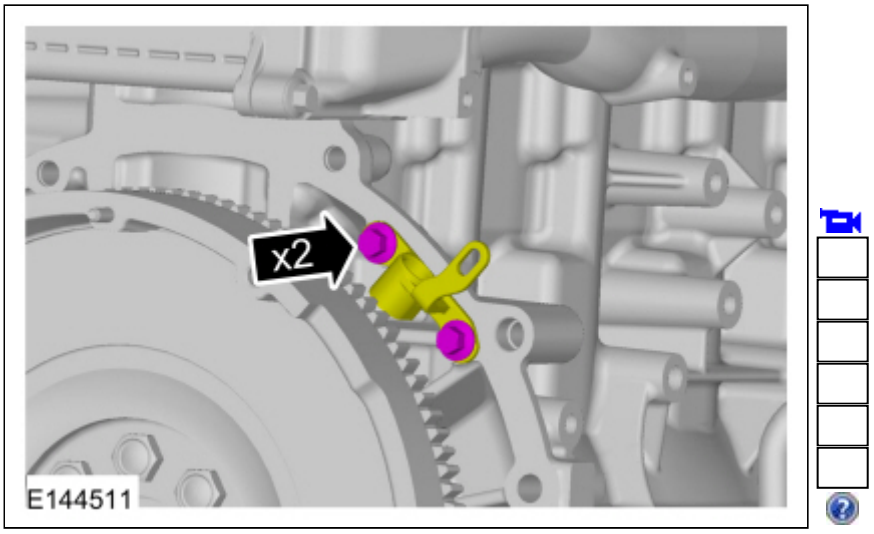
2. Refer to: Crankshaft Position (CKP) Sensor - 2.2L Duratorq-TDCi (Puma) Diesel (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Crankshaft Position (CKP) Sensor - 2.2L Duratorq-TDCi (Puma) Diesel (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

3. Use Special Service Tool: 303-1587 Timing Tool, Crankshaft.



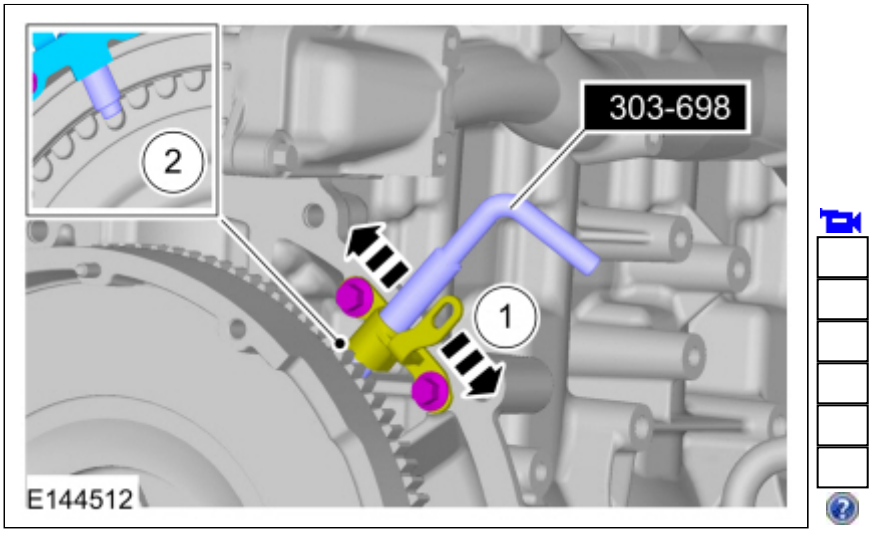
Vehicles with manual transmission

4. Loosen the bolts.

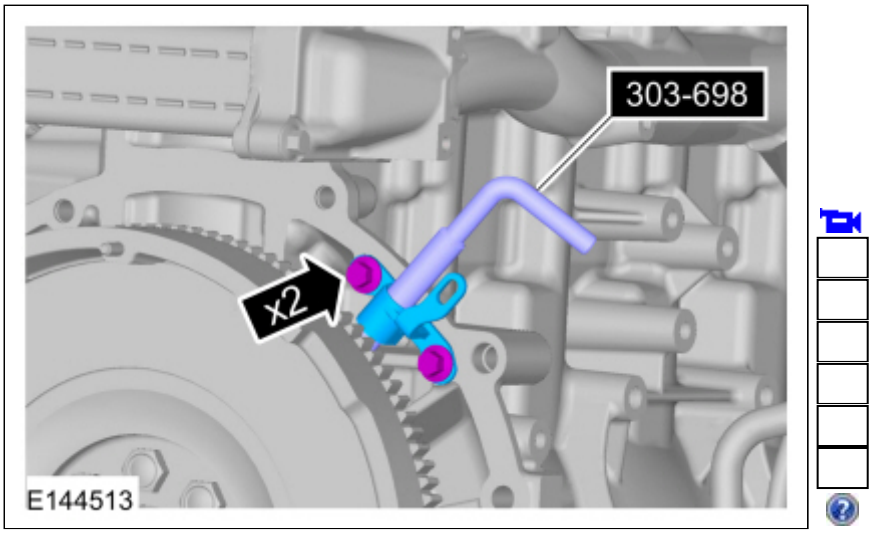


5. **NOTE:** *Make sure that the special tool is located in the flywheel timing slot.*

   Use Special Service Tool: 303-698 Timing Tool, Crankshaft.

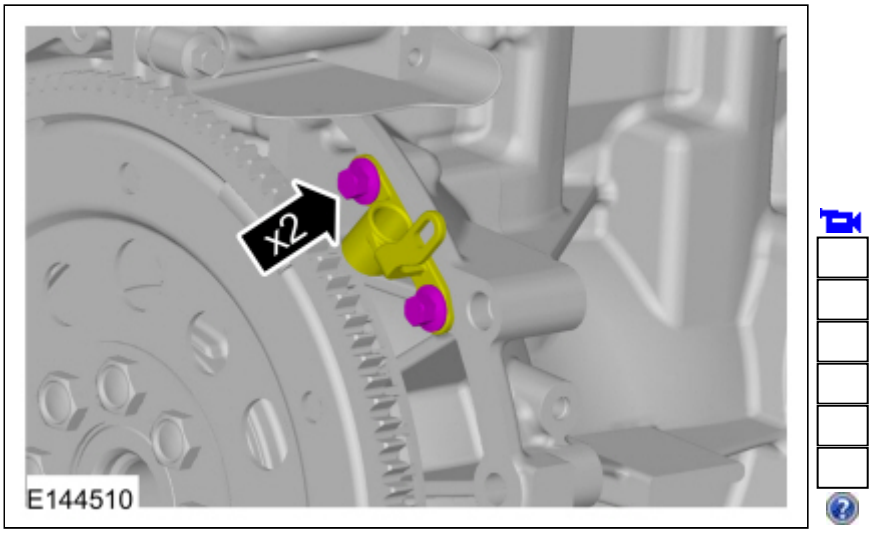


6. Tighten bolts before removing tool.
   Remove Special Service Tool: 303-698 Timing Tool, Crankshaft.
   Torque: 25 Nm



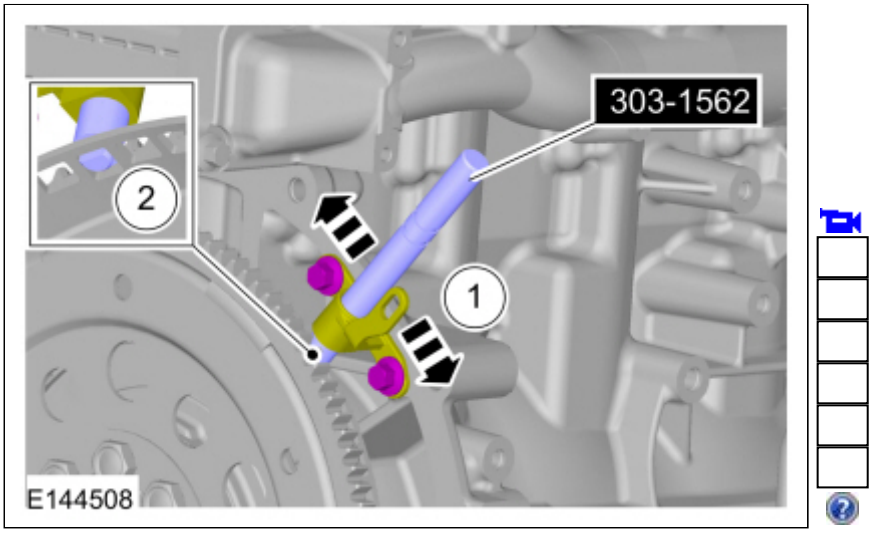
Vehicles with automatic transmission

7. Loosen the bolts.

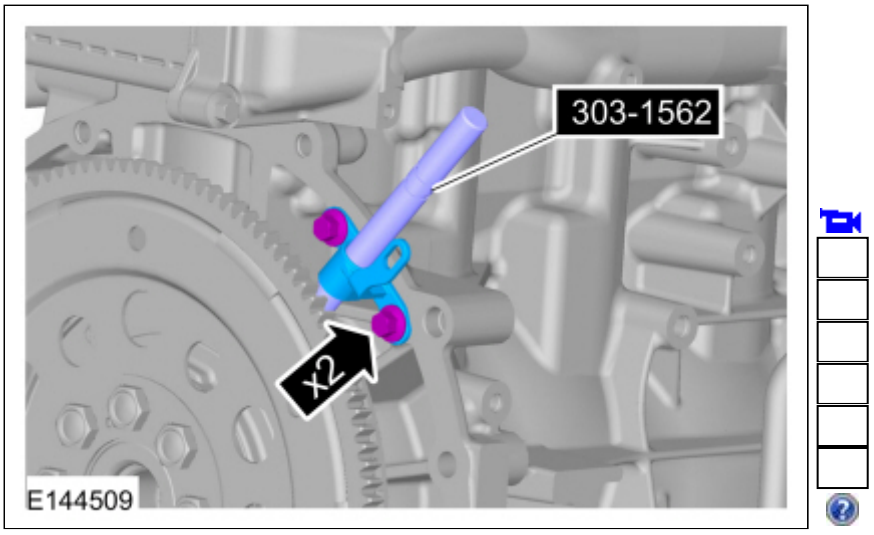


8. **NOTE:** *Make sure that the special tool is located in the flexplate timing slot.*

   Use Special Service Tool: 303-1562 Timing Tool.



9. Tighten bolts before removing tool.
   Remove Special Service Tool: 303-1562 Timing Tool.
   Torque: 25 Nm

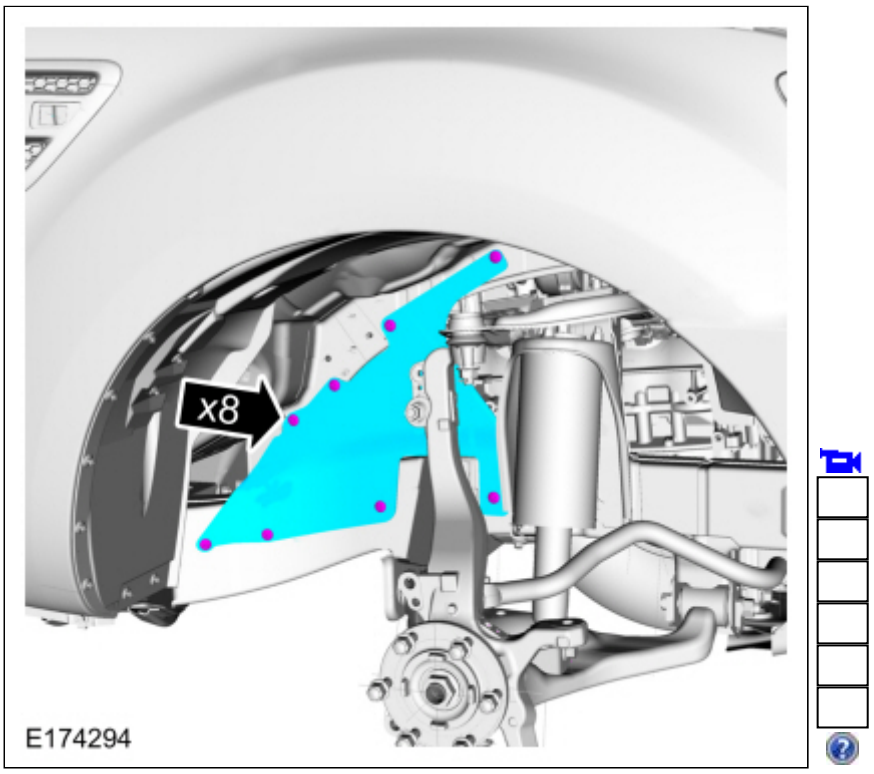


Copyright © 2016 Ford Motor Company

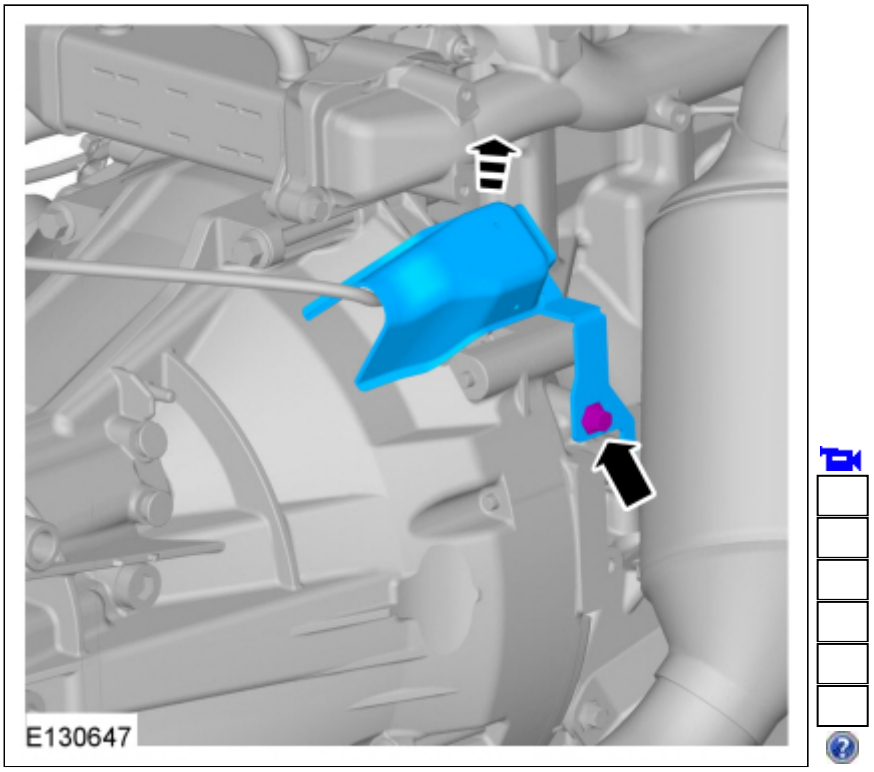
Crankshaft Position (CKP) Sensor - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

Removal

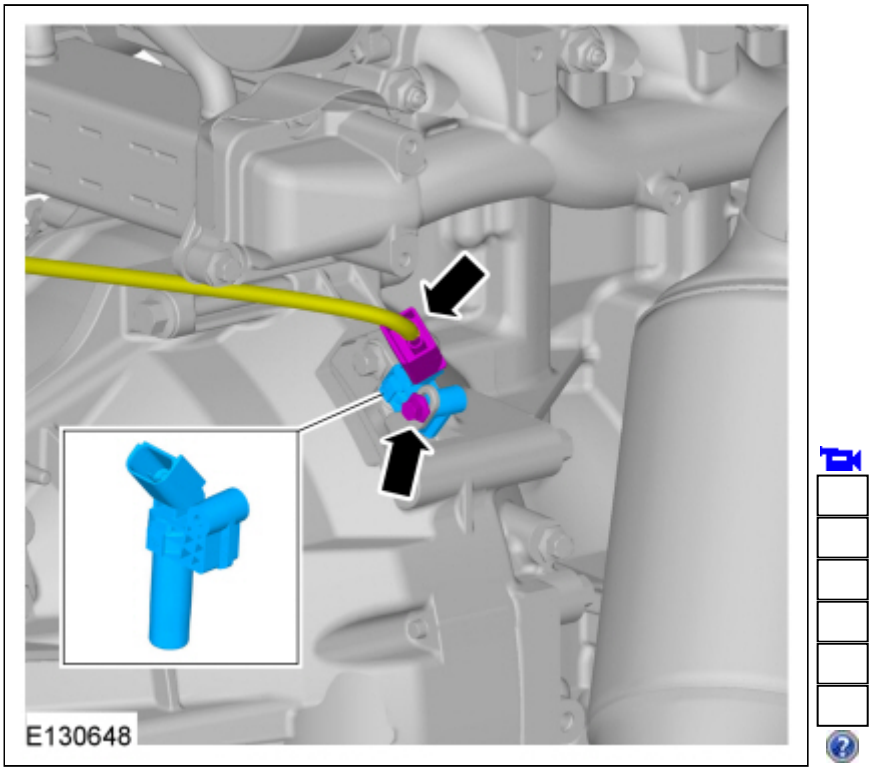
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
3. 

4. *Torque*: 25 Nm



5. *Torque*: 7 Nm



Installation

1. **NOTICE: Only rotate the crankshaft clockwise.**

   Rotate the crankshaft until a flywheel tooth is visible through the CKP sensor housing.



2. **NOTICE: The tip of the sensor must rest on a flywheel tooth.**

   NOTE: *Make sure that a new component is installed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

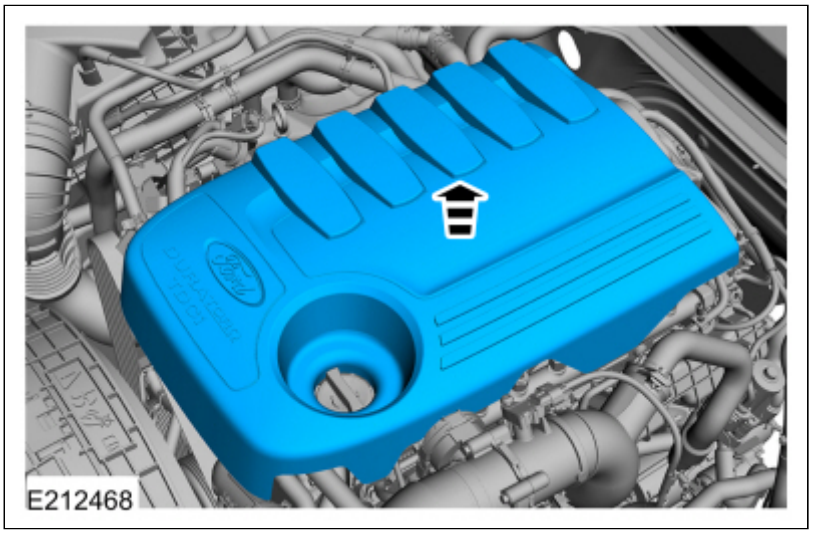
Camshaft Position (CMP) Sensor - 3.2L Duratorq-TDCi (148kW/200PS) - Puma

Base Part Number: 12K073

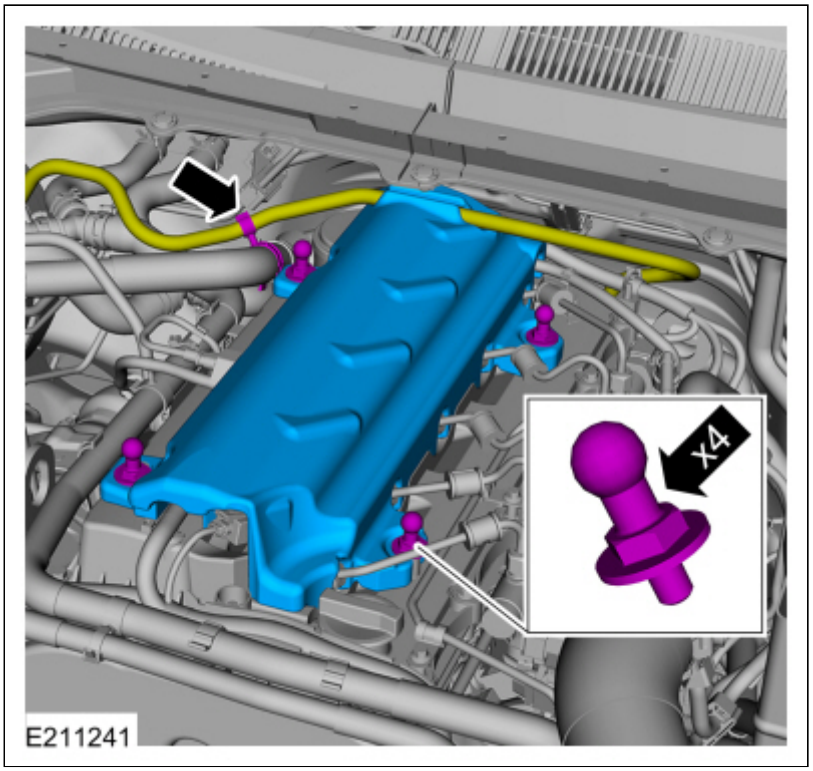
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

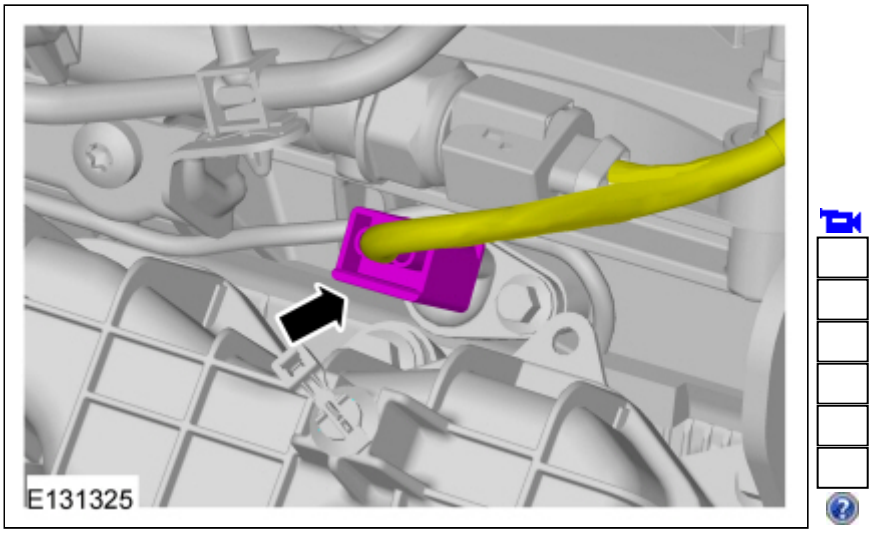
1.



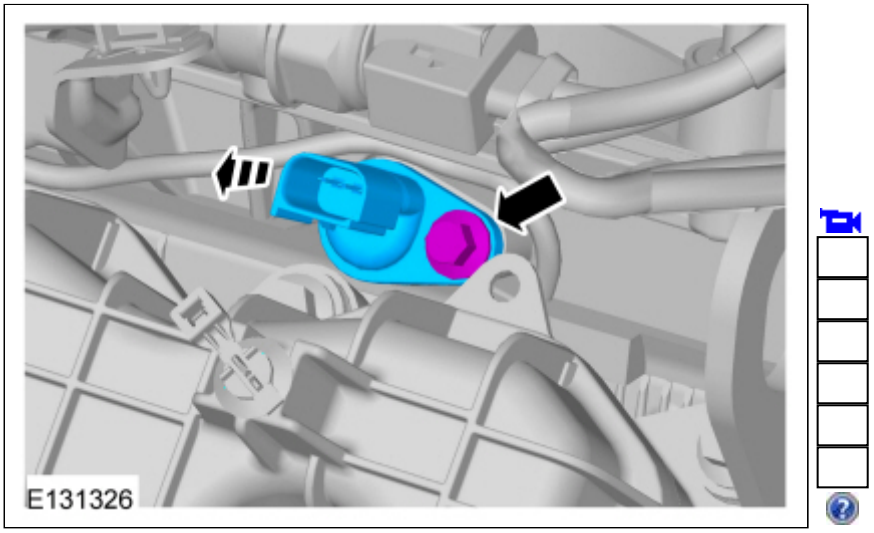
2. *Torque*: 3 Nm



3.



4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Powertrain Control Module (PCM)

Base Part Number: 12A650

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

NOTICE: If a new PCM is to be installed, upload the PCM configuration information using the Programmable Modules Installation Routine, prior to commencing the removal of the PCM.

NOTE: *Removal steps in this procedure may contain installation details.*

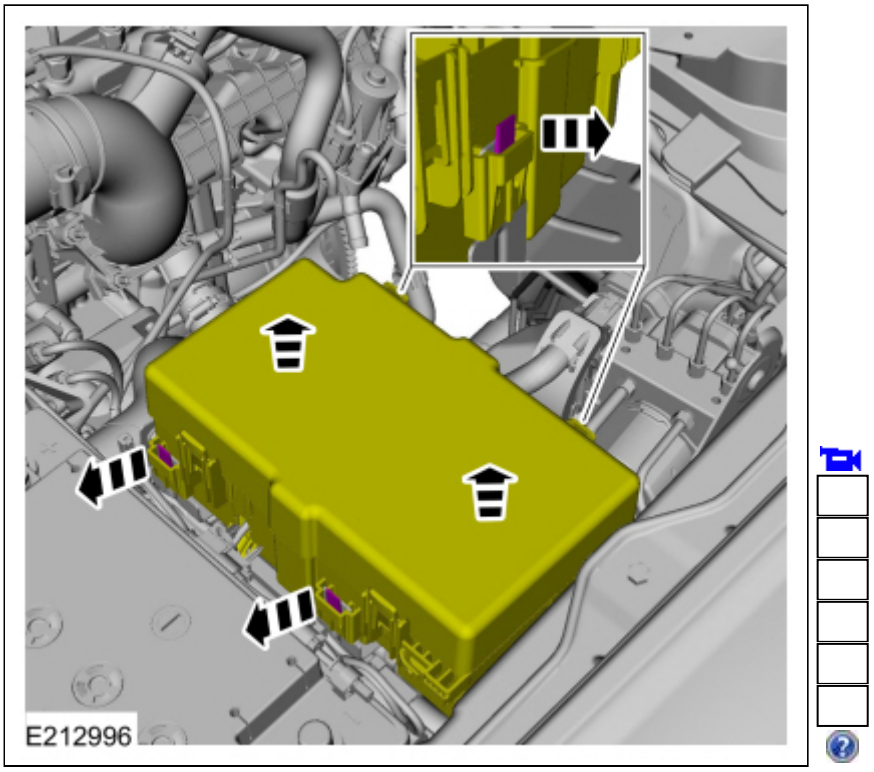
1. **NOTE:** *NOTE: This step is only necessary when installing a new component.*

   Download the PCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

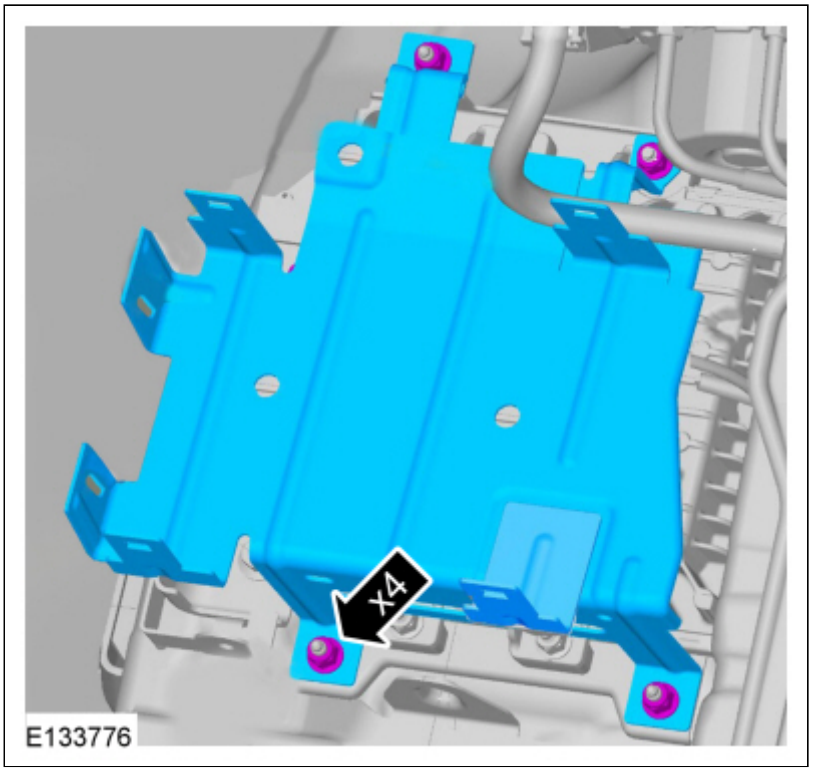
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

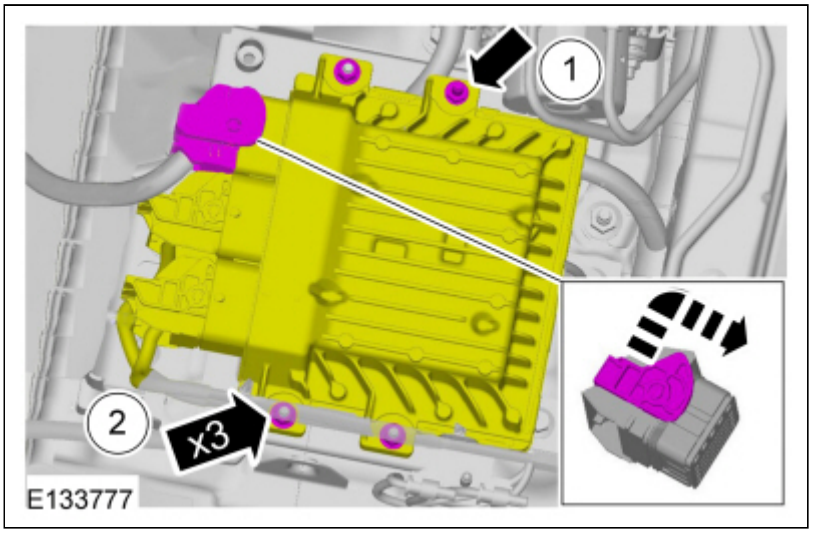
4. Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

5. 

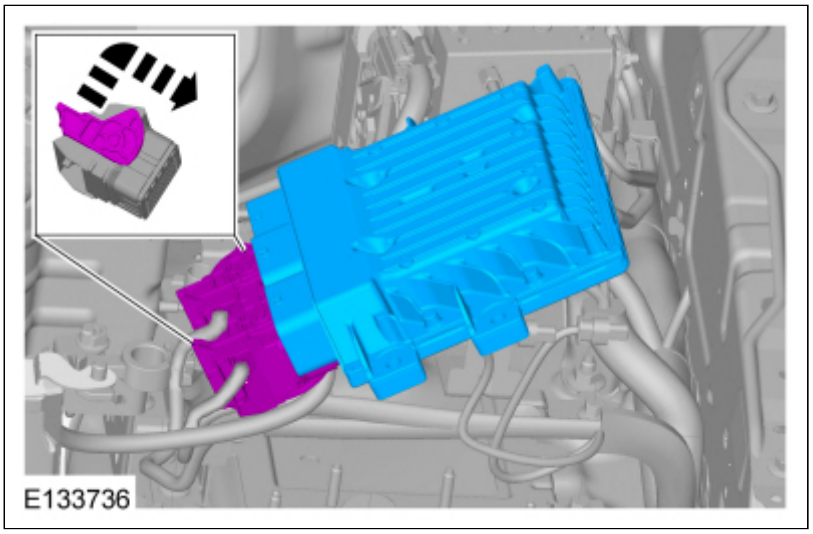
6. *Torque*: 25 Nm



7. *Torque*: 11 Nm



8.



Installation

1. To install, reverse the removal procedure.

2. Carry out the Injector Correction Factors procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

3. Carry out the Oil Quality History function using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

4. Carry out the Stored Speed Limit function using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

5. Carry out the Pump Learn procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

6. Carry out the Pilot Correction Learn procedure using the following menu options: ToolBox/Powertrain/Service Functions.
   Use the General Equipment: Ford Diagnostic Equipment

7. Change the engine oil and the oil filter.

8. Carry out the oil reset procedure.

9. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

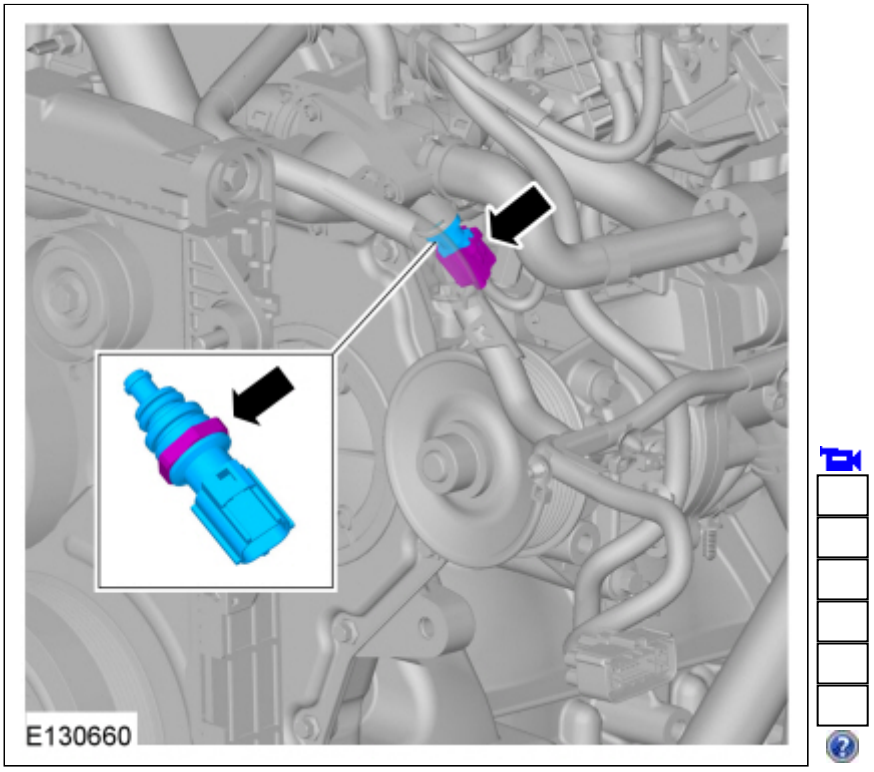
Engine Coolant Temperature (ECT) Sensor

Base Part Number: 12A648

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.



Installation

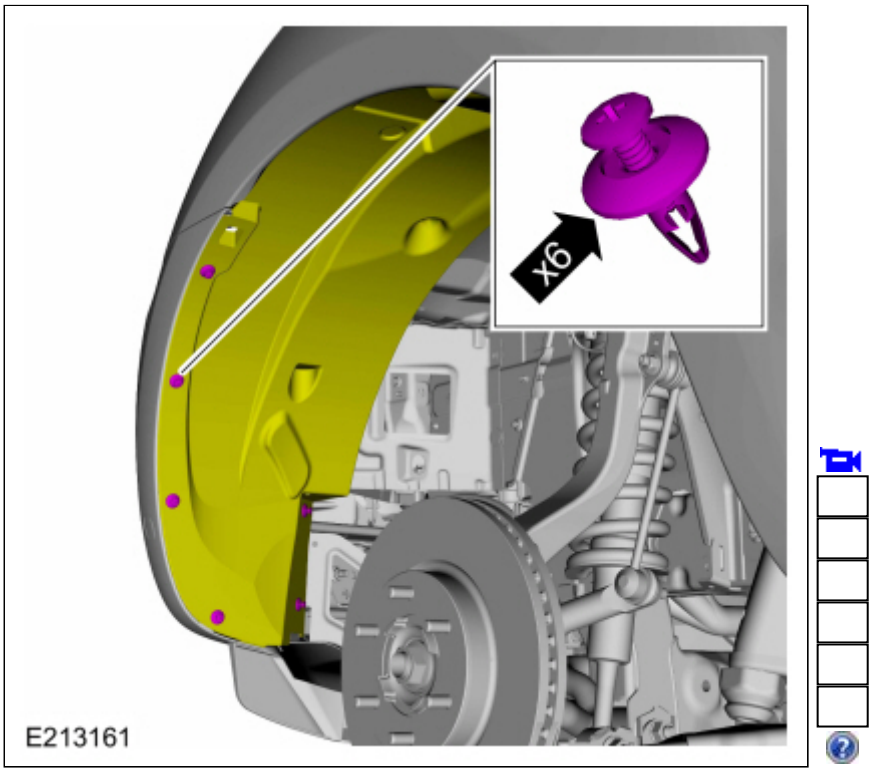
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

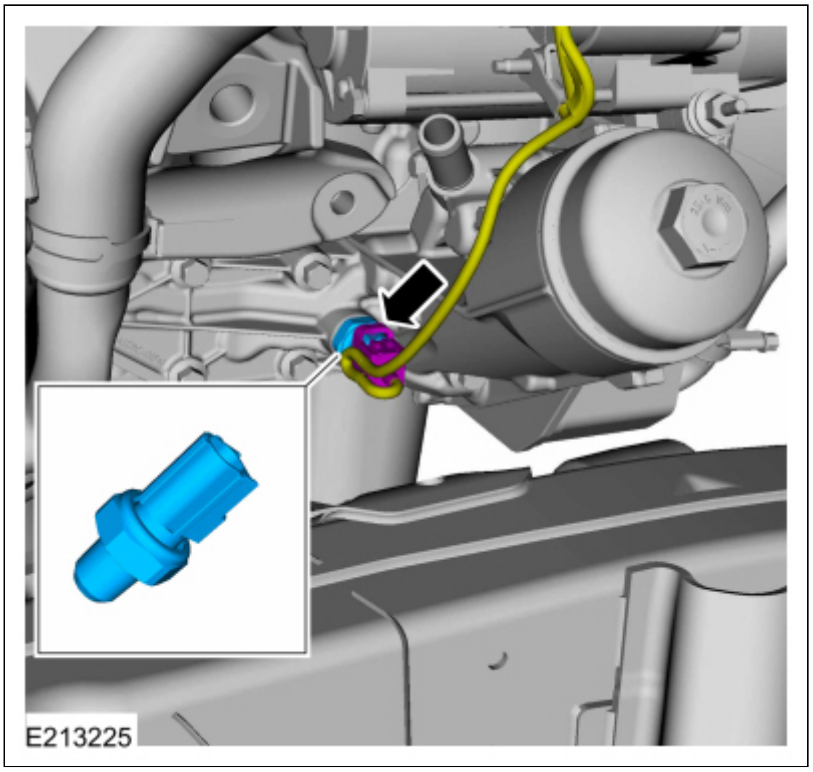
Engine Oil Pressure (EOP) Switch

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

5. *Torque*: 12 Nm



Installation

1. To install, reverse the removal procedure.

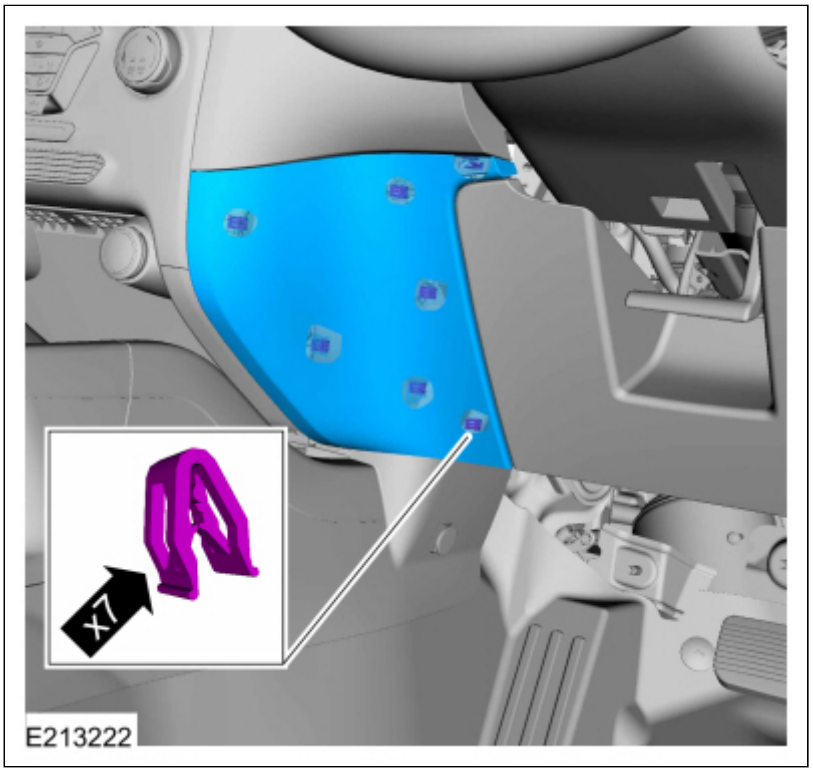
Copyright © 2016 Ford Motor Company

Brake Pedal Position (BPP) Switch

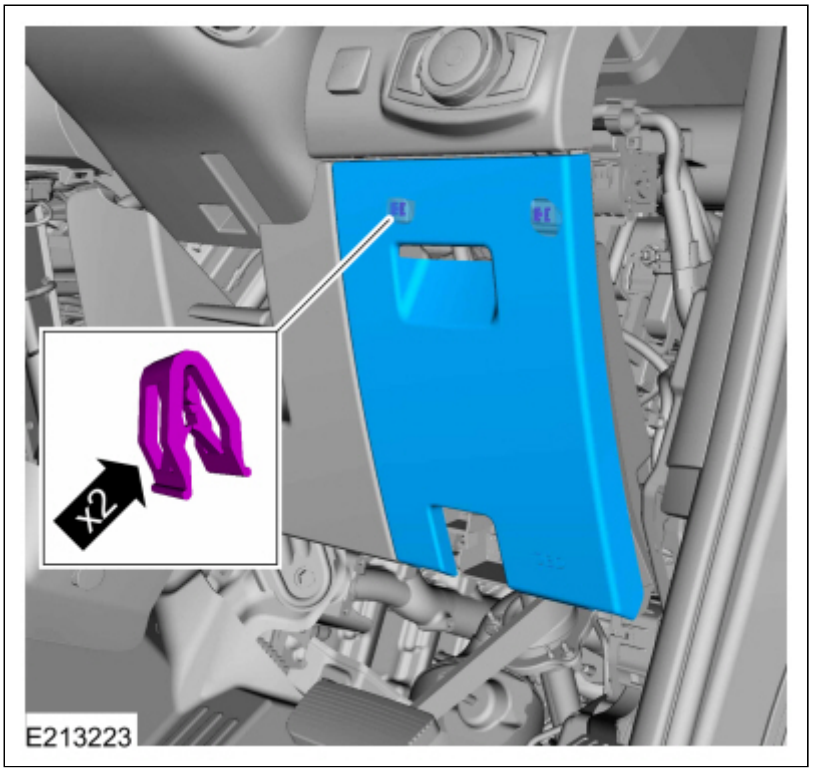
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

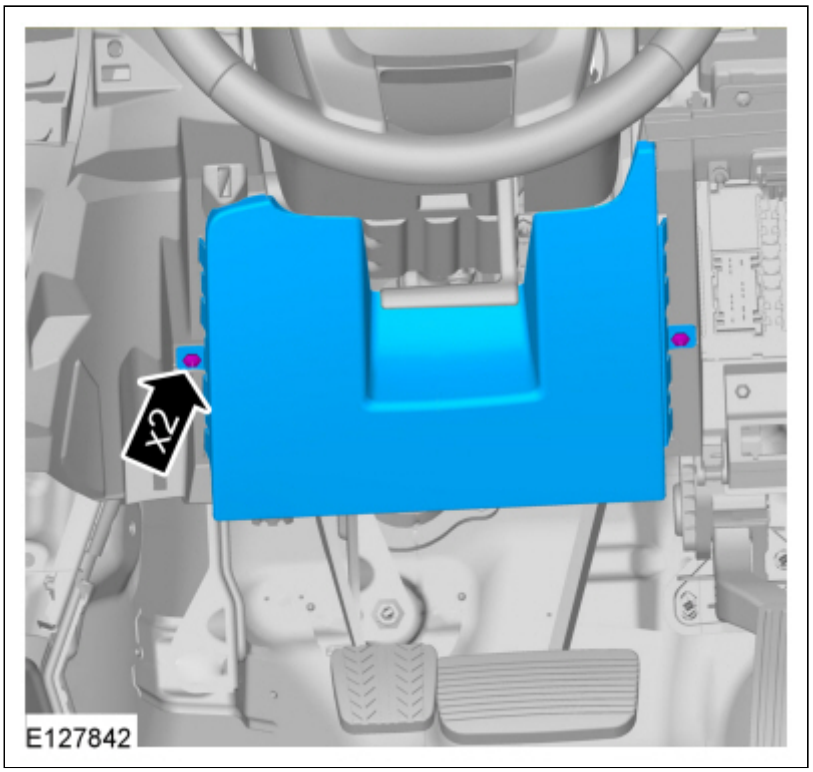
1.



2.



3.

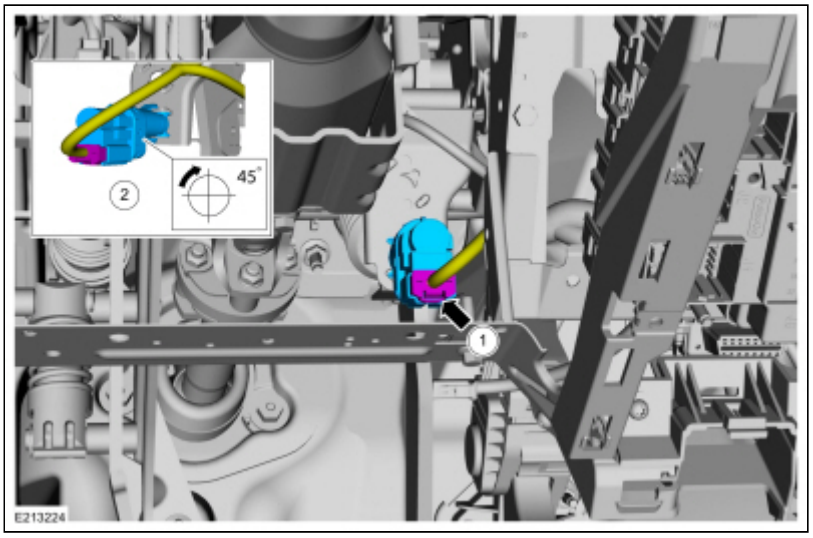


4. **NOTE:** *Only if equipped with driver lower air bag module.*

   Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

5. **NOTE:** *Only if equipped with driver lower air bag module.*

   Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Temperature Sensor

Materials

Name	Specification
Brake Cleaner	-

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Make sure that the engine is switched off.**

   WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.

   WARNING: Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel injection system.

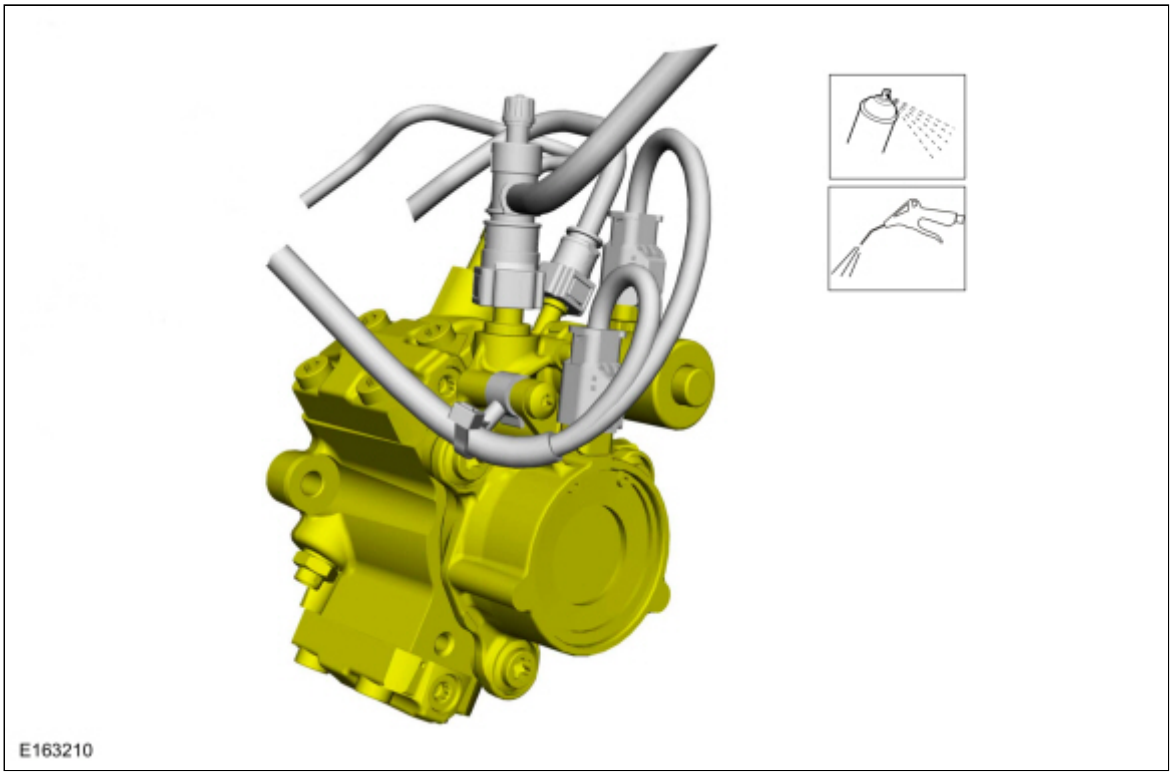
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Intake Manifold - Emission Requirements: EURO Stage V LDT (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Intake Manifold (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

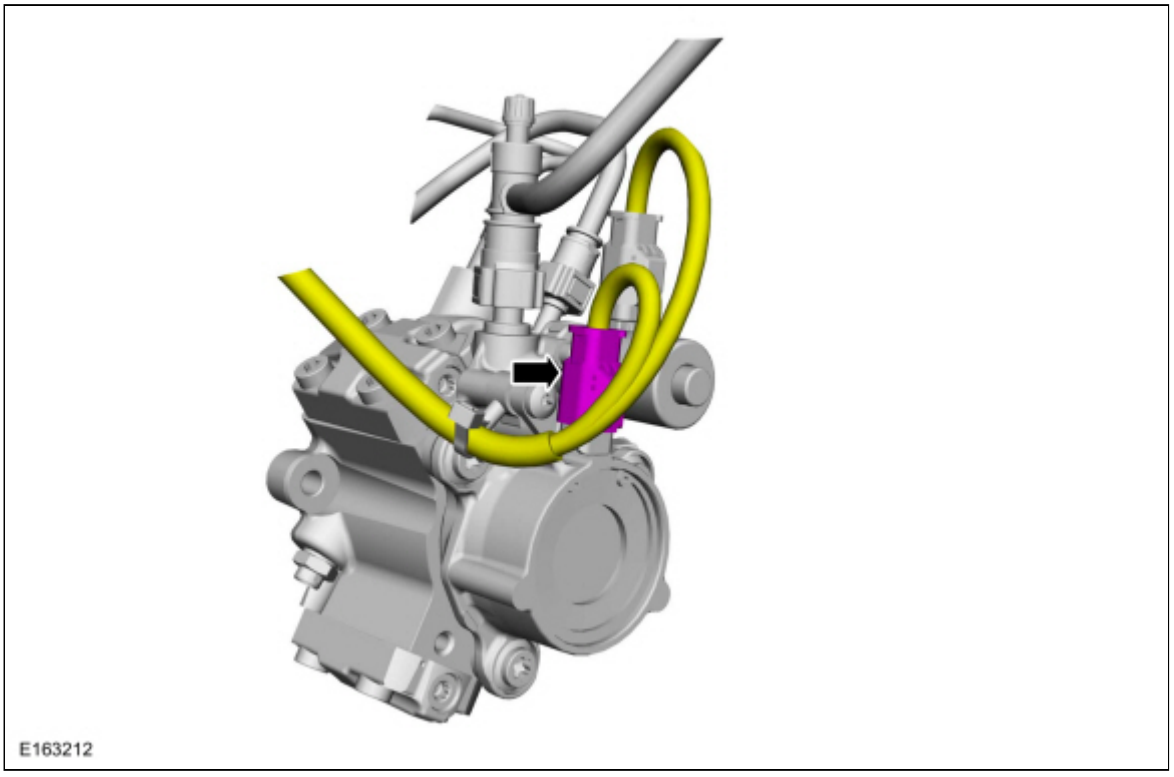
3. 
   

   NOTICE: Extreme cleanliness must be exercised when handling the components.

   Material: Brake Cleaner



4.



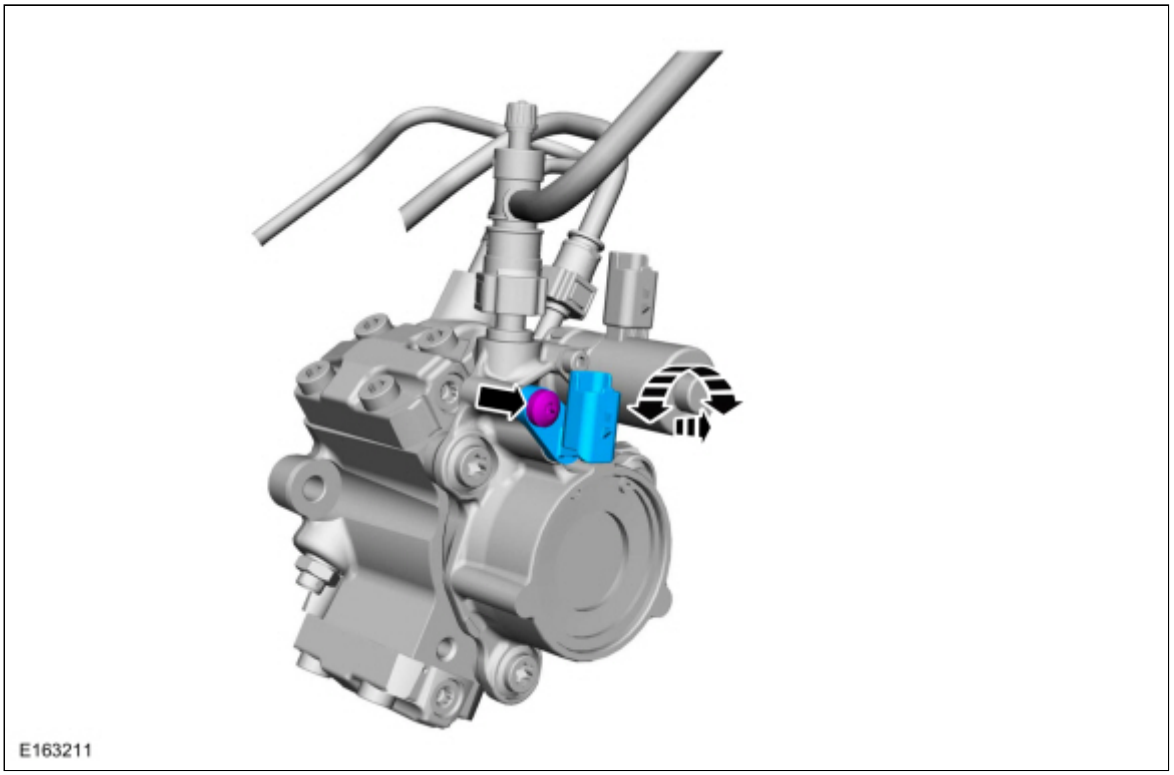
5. **NOTICE: Take extra care when handling the component.**

   NOTICE: Extreme cleanliness must be exercised when handling the component.

   NOTICE: The component must be removed by hand, the use of tools is prohibited.

   NOTE: *Make sure that a new component is installed.*

   Torque: 8 Nm

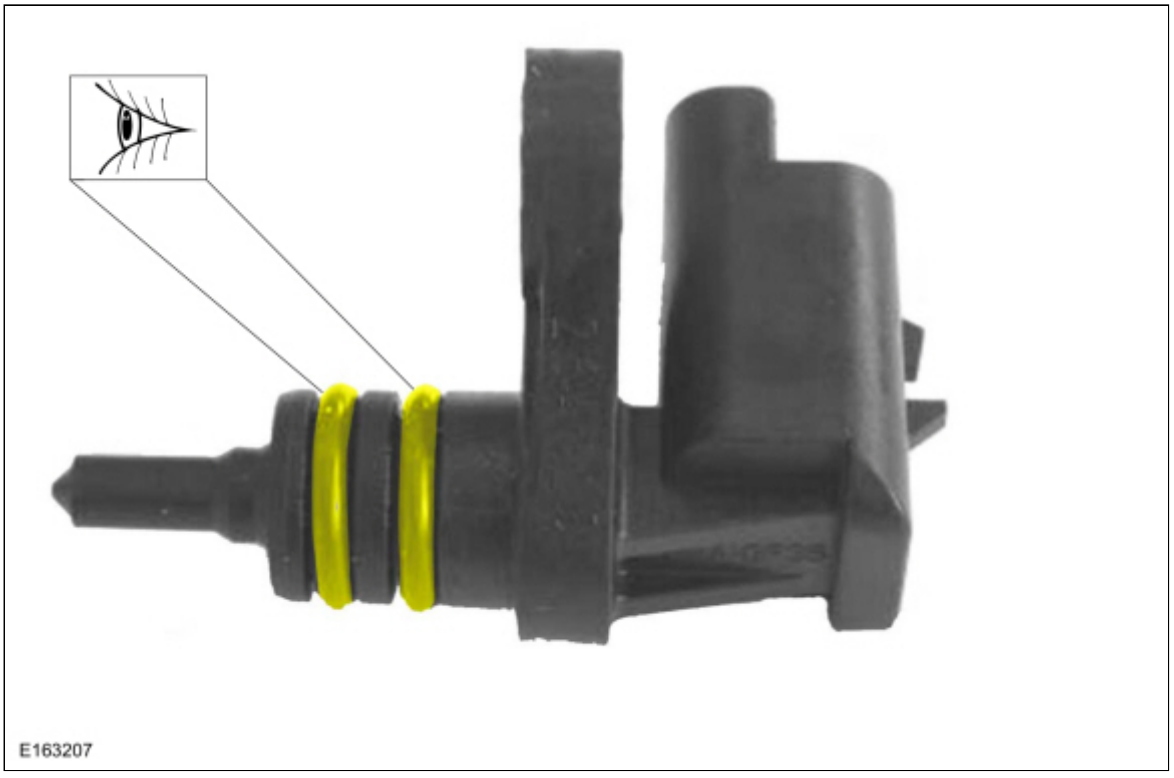


Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Extreme cleanliness must be exercised when handling the component.**

   NOTICE: Take extra care when handling the component.

   NOTE: *Make sure that the seal is correctly located.*



Copyright © 2016 Ford Motor Company

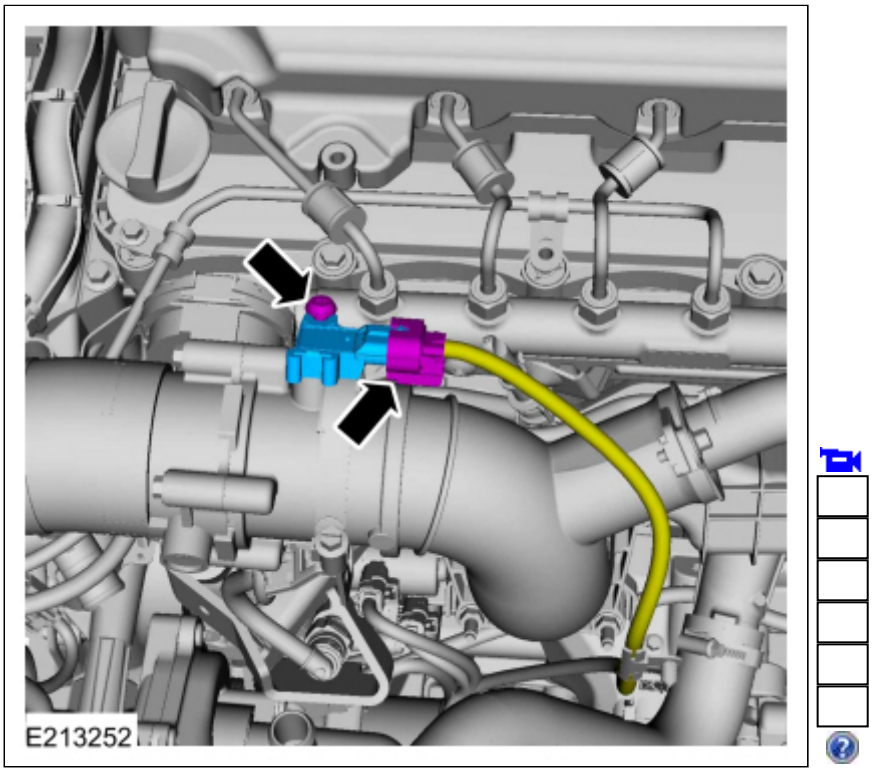
Manifold Absolute Pressure (MAP) Sensor

Base Part Number: 9F479

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*: 5 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Item		Specification
Transmission Type		6R80
Transmission Control		Floor-shift
Transmission Assembly Weight		101 kg
Stall Speed - 2.2L Engine	Minimum	2700 rpm
	Maximum	3200 rpm
Stall Speed - 3.2L Engine	Minimum	2200 rpm
	Maximum	2800 rpm
Transmission Operating Temperature		80 °C - 110 °C
Gear ratio	1 GR	4.17
	2 GR	2.34
	3 GR	1.52
	4 GR	1.14
	5 GR	0.87
	6 GR	0.69
	Reverse	3.40
ATF	Type	WSS-M2C938-A (Motorcraft® MERCON® LV Automatic Transmission Fluid)
	Fluid Change Interval	240,000 km
	Capacity	9 L (Wet)
		10.50 L (Dry)
	Multi-Purpose Grease	• ESA-M1C172-A • WSB-M1C233-A • WSB-M1C227-A
Hydraulic System (Number of drive/driven gear plates)	Forward Clutch (A)	5/6
	Direct Clutch (B)	5/5
	Intermediate Clutch (C)	5/5
	Low/Reverse Clutch (D)	5/5
	O/D Clutch (E)	6/6
Separator Plate Thickness	Forward Clutch (A)	3.0 mm
	Direct Clutch (B)	2.1 mm
	Intermediate Clutch (C)	3.0 mm
	Low/Reverse Clutch (D)	1.75 mm
	O/D Clutch (E)	3.0 mm

Number of Pressure Plates	Forward Clutch (A)	1
	Direct Clutch (B)	1
	Intermediate Clutch (C)	1
	Low/Reverse Clutch (D)	Select
	O/D Clutch (E)	1
Pressure Plate Thickness	Forward Clutch (A)	3.0 mm
	Direct Clutch (B)	3.9 mm
	Intermediate Clutch (C)	3.9 mm
	Low/Reverse Clutch (D)	5.4 mm
		5.7 mm
		6.0 mm
	O/D Clutch (E)	3.1 mm
End Play	Forward Clutch (A)	0.71-1.10 mm
	Direct Clutch (B)	0.50-1.30 mm
	Intermediate Clutch (C)	0.71-1.10 mm
	Low/Reverse Clutch (D)	1.0-1.6 mm
	O/D Clutch (E)	0.50-0.90 mm

Clutch Application Chart

Gear	Forward A (1, 2, 3 & 4)	Direct B (3, 5 & R)	Intermediate C (2 & 6)	Low/Reverse D (1 & R)	O/D (4, 5 & 6)	Low - OWC
P				H		
R		D		H		
N				H		
1st Gear D	D			H (Clutch released when vehicle speed is above 3 mph)		H
2nd Gear D	D		H			O/R
3rd Gear D	D	D				O/R
4th Gear D	D				D	O/R
5th Gear D		D			D	O/R
6th Gear D			H		D	O/R
3rd Gear Manual	D	D				O/R
2nd Gear Manual	D		H			O/R
1st Gear Manual	D			H		H
Planetary Components	Front planetary carrier-to-No. 3	Front carrier-to-No. 2 sun	No. 2 sun gear	Rear planetary carrier	Input shaft-to - rear planetary	Rear planetary

	sun gear	gear			carrier	carrier
D - Drive Clutch						
H - Hold Clutch						
O/R - Overrunning						

Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC Normally Low
		SSA Normally Low (1, 2, 3 & 4)	SSB Normally High (3, 5 & R)	SSC Normally Low (CB 2 & 6)	SSD Normally High (CBL, R/C 4, 5 & 6)	SSE Normally Closed	
P	P	Off	On	Off	Off	Off	Off
R	R	Off	Off	Off	Off	Off	Off
N	N	Off	On	Off	Off (Solenoid state will change if vehicle is moving forward with the selector lever in the N position)	Off	Off
D	1	On	On	Off	Off (Solenoid is On when vehicle is above 3 mph)	Off	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	On	On/Off
	4	On	On	Off	Off	On	On/Off
	5	Off	Off	Off	Off	On	On/Off
	6	Off	On	On	Off	On	On/Off
M (All gears available upon driver request)	-	-	-	-	-	-	-
2	2	On	On	On	On	Off	Off
1	1	On	On	Off	Off	On	Off

Shift Speeds

Throttle Position	Shift	Km/h	MPH
Light Throttle:APP = 20%	1-2	13-21	8-13
	2-3	30-38	19-24
	3-4	51-59	32-37
	4-5	57-65	35-40
	5-6	79-87	49-54
Closed Throttle	6-5	65-75	41-47
	5-4	52-62	33-39
	4-3	38-48	24-30
	3-2	N/A	N/A
	3-1	0-10	0-6
Wide Open Throttle:APP = 100%	1-2	27-33	17-21

	2-3	52-60	33-38
	3-4	88-94	55-59

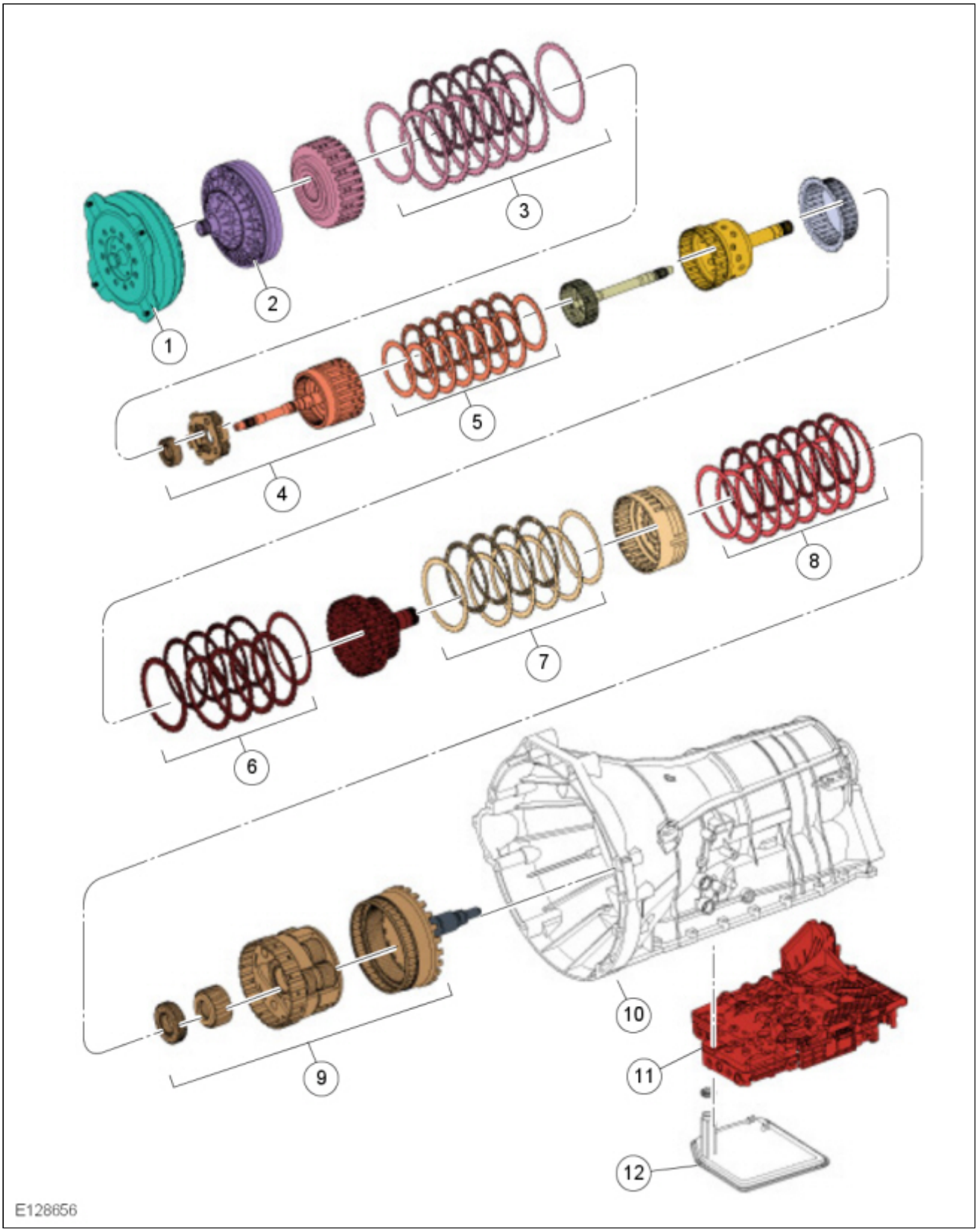
Torque Specifications

Description	Nm
Detent spring bolts	12
EVAP canister bolt	20
Exhaust heat shield bolts	15
Flexplate inspection cover bolts	48
Flexplate-to-torque converter nuts	40
Front pump bolts	15
Fuel line bracket bolt	25
Isolator cap bolt	35
Main control bolts	For additional information, refer to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).
Manual control lever nut	18
Molded Leadframe bolts	For additional information, refer to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).
Output shaft flange nut	80
Park pawl pin bolt	23
Park rod actuating plate	12
Pump plate assembly-to-pump body bolts	15
Selector lever cable bracket bolts	25
Skid plate bolts	40
Solenoid bracket bolts	6
Transmission fluid cooler tube-to-transmission bolt	30
Transmission fluid cooler tube bracket nut	12
Transmission fluid fill plug	35
Transmission fluid pan bolts	11
Transmission insulator and retainer bolts	90
Transmission insulator and retainer nuts	103
Transmission-to-engine bolts	48

Copyright © 2016 Ford Motor Company

Transmission Description - Component Location

Major Components of 6R80 Transmission



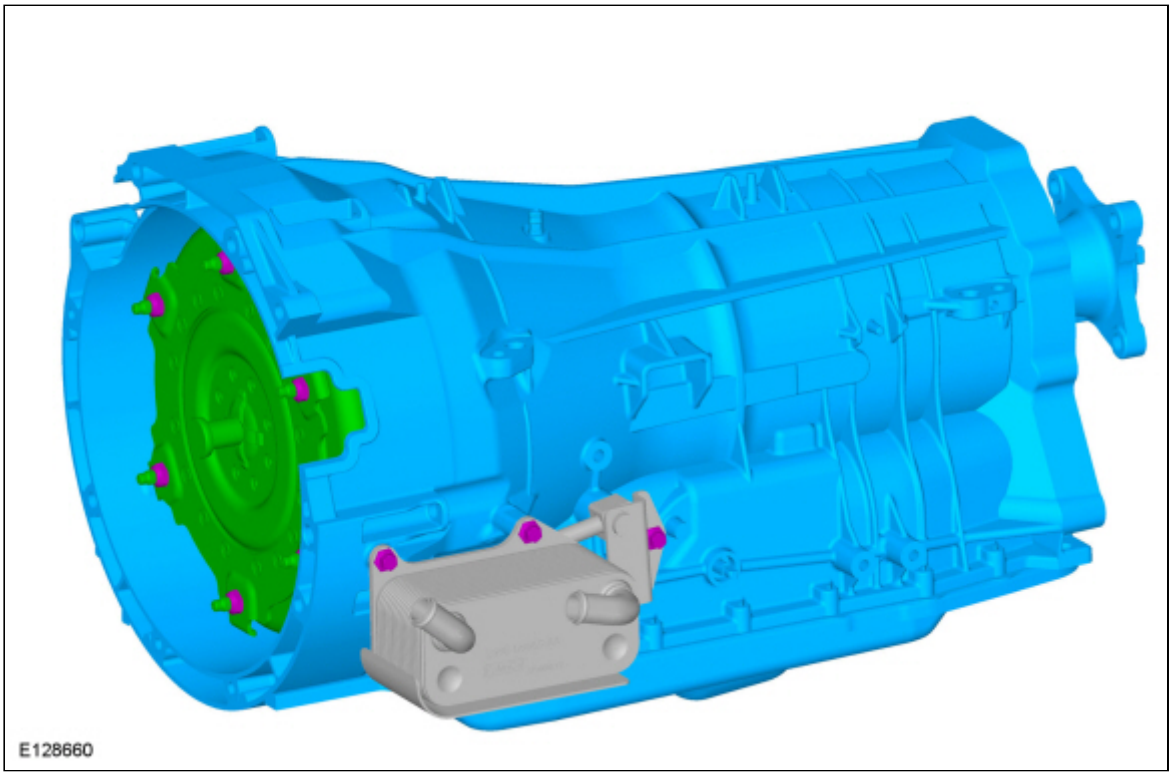
Item	Description
1	Torque converter
2	Front pump assembly

3	Forward clutch (A) (quantity model dependant)
4	Front planetary gearset
5	Overdrive (O/D) clutch (E)
6	Direct clutch (B) (quantity model dependant)
7	Intermediate clutch (C) (quantity model dependant)
8	Low/reverse clutch (D)
9	Rear planetary gearset
10	Transmission case
11	Main control assembly
12	Transmission fluid filter

Copyright © 2016 Ford Motor Company

Transmission Description - Overview

6R80 Transmission



This transmission has an internal thermal bypass valve contained within the case.

This transmission uses planetary gears with hydraulic electronic controls.

This transmission has the following features:

- Six forward speeds
- Torque converter with an integral converter clutch
- Electronic shift and pressure controls
- Single planetary gear set
- Double planetary gear set
- Two fixed multi-disc clutches
- Three multi-plate clutches

All hydraulic functions are directed by electronic solenoids to control the following:

- Engagement feel
- Shift feel
- Shift scheduling
- Modulated Torque Converter Clutch (TCC) applications

This transmission has a mechatronic unit which contains:

- Turbine Shaft Speed (TSS) sensor
- Output Shaft Speed (OSS) sensor
- An internal P, R, N, D selector shaft position sensor
- Transmission Fluid Temperature (TFT) sensor

Engine power reaches the transmission by a torque converter with an integral clutch. The 6 forward gears and one reverse gear are obtained from 2 planetary gearsets.

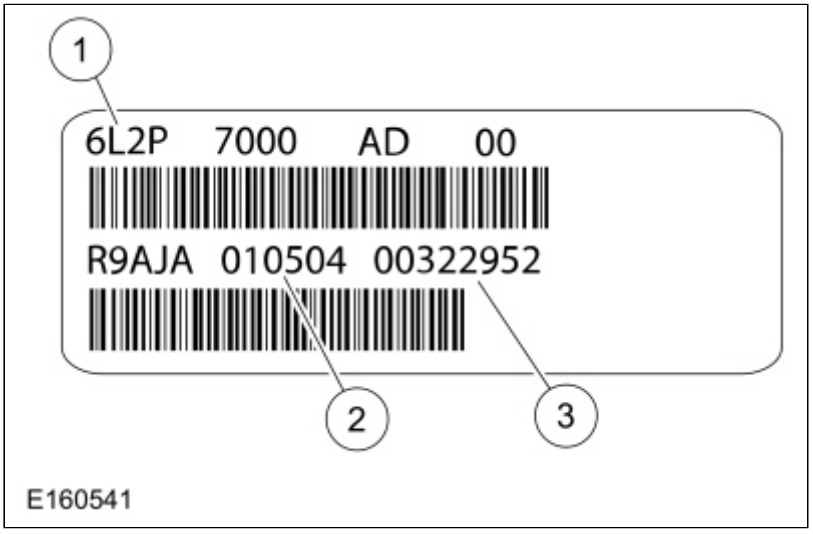
This automatic transmission is a 6-speed electronically controlled transmission comprising the basic elements, main control valve body unit, torque converter, 1 solenoid valve and 6 pressure regulators. Gear selection is achieved by the control of automatic transmission fluid flow to operate various internal clutches. The TCM operates the electrical

components and provides for the control of gear selection shift pressure, which increases refinement and torque converter slip.

In the event of a system fault, the TCM also provides for Failure Mode Effect Management to maintain maximum functional operation of the transmission with a minimum reduction in driver, passenger or vehicle safety. In the event of a total loss of control or electrical power, the basic transmission functions P, R, N and D are retained. Also 3rd or 5th gear is retained by the hydraulic system. The gear retained is dependent upon the gear selected at the time of the failure.

Identification Tags

All vehicles come equipped with a Safety Compliance Certification Label. The location on the label marked TR is reserved for the transmission code. To determine the correct transmission for this vehicle, refer to the Owner's Literature, Transmission Code Designations. All transmissions are equipped with an identification tag located on the transmission case. For transmission part number, serial number and build date, refer to the transmission identification tag located on the transmission case.



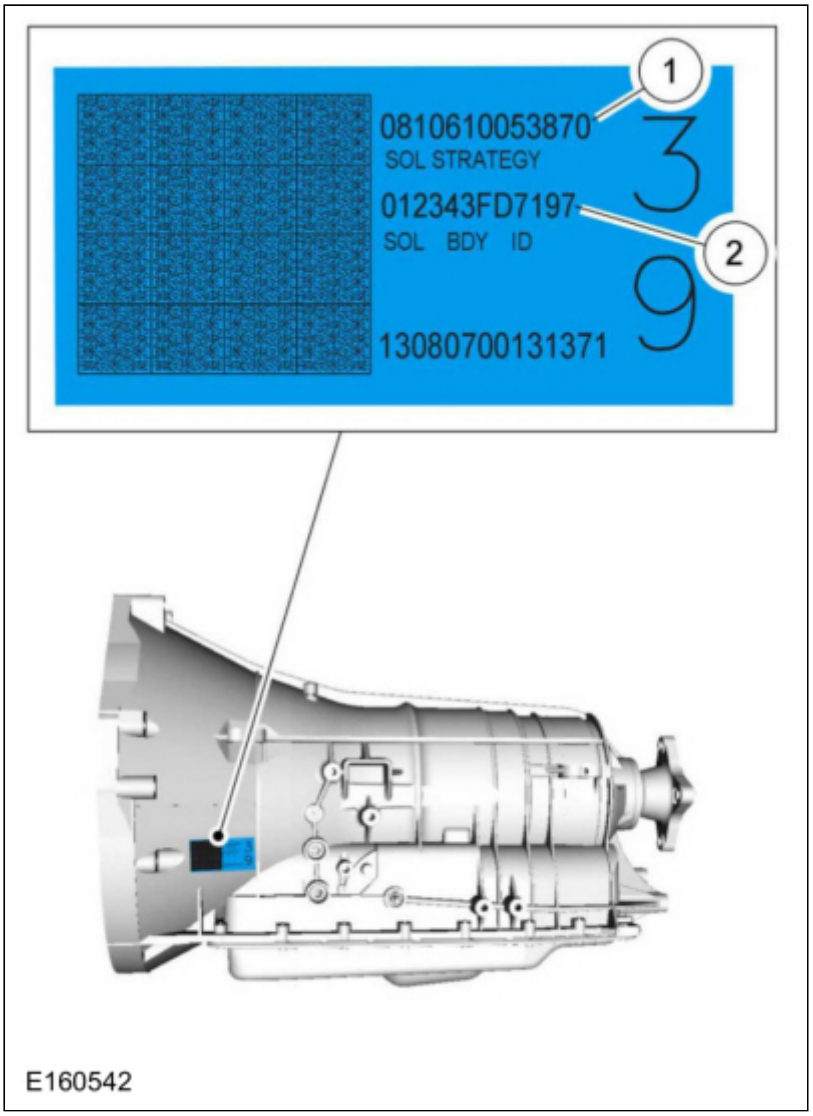
Item	Description
1	Part number
2	Build date
3	Serial number

Solenoid Strategy Identification Tag

NOTE: *Letters are not used in the 13 digit solenoid body strategy. The characters consist of all numbers.*

PCM controlled transmissions have a solenoid strategy identification tag located on the left side of the transmission case. Compare the 13 digit number on the tag with the 13 digit number displayed on the scan tool to determine the correct solenoid strategy for the transmission. If the scan tool matches the service tag then the solenoid strategy is correct. If the solenoid strategy retrieved from the scan tool does not match the solenoid strategy identification tag, the transmission fluid pan must be removed to compare what the scan tool displays to the solenoid strategy number etched on the main control. Refer to Fluid Pan, Gasket and Filter in this section. If the solenoid strategy identification etched on the main control matches what the scan tool displays, then the solenoid strategy is correct. If the solenoid strategy identification etched on the main control does not match the scan tool, then a Solenoid Strategy Data Download is required. Refer to Solenoid Body Strategy for the download procedure in this section.

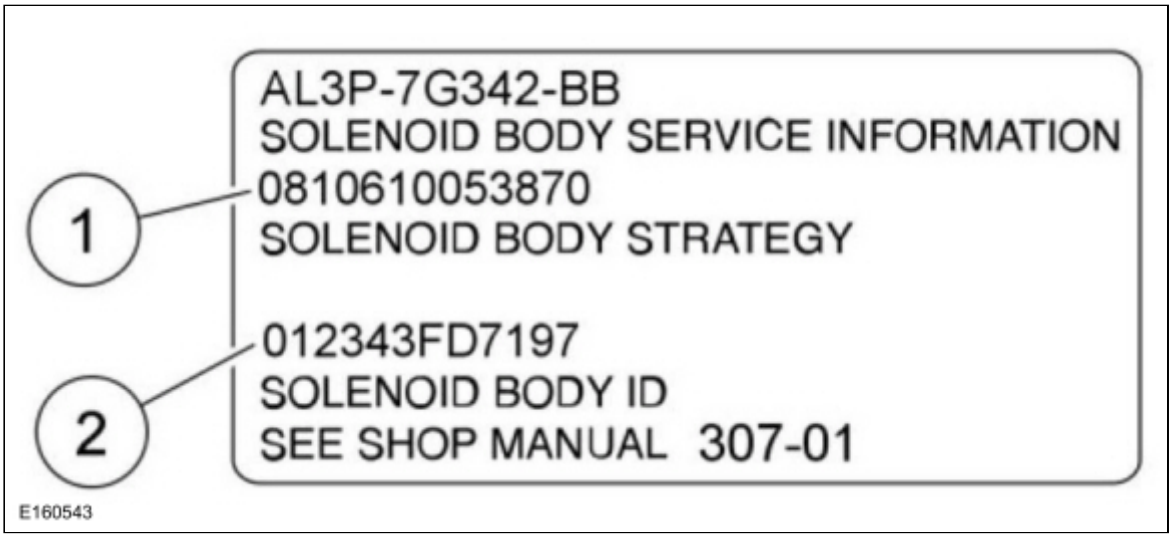
Original Solenoid Body Tag



Item	Description
1	13 Digit Solenoid Strategy
2	12 Digit Solenoid body identification

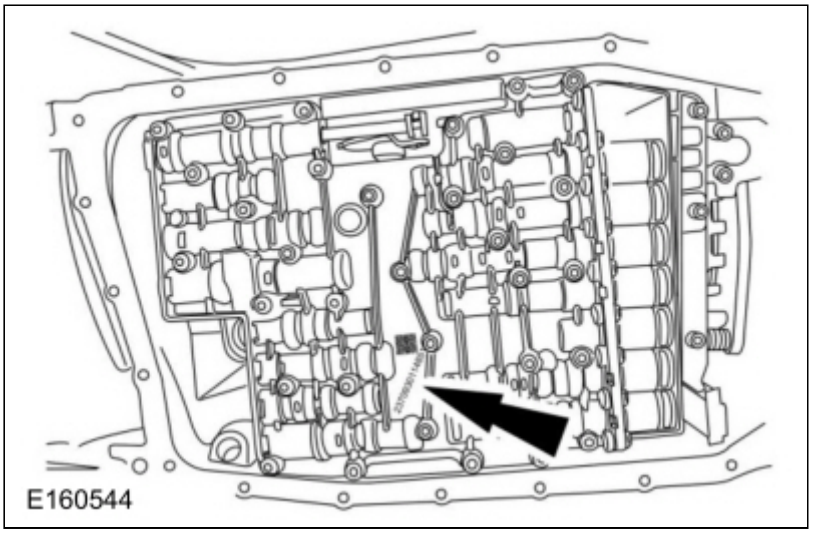
A replacement solenoid body tag is provided when the main control is serviced. The replacement solenoid body tag is placed over the original solenoid body tag.

Replacement Solenoid Body Tag



Item	Description
1	13 Digit Solenoid Strategy

Main Control Solenoid Body Strategy Identification



If the solenoid body strategy etched on the main control does not match what the scan tool displays, the solenoid body strategy must be downloaded into the PCM or harsh shifts will result.

Major Components

This transmission has the following major components:

- Transmission case with integral torque converter housing and extension housing
- Torque converter
- Fluid pump
- Three drive clutches:
  - Forward clutch (A)
  - Direct clutch (B)
  - Overdrive (O/D) clutch (E)
- Three brake clutches:
  - Intermediate clutch (C)
  - Low/reverse clutch (D)
  - One-Way Clutch (OWC)
- Two planetary gearsets:
  - Front single planetary gearset (1 sun gear, 1 carrier, 1 ring gear)
  - Rear Ravigenaux planetary gearset (2 sun gears, 1 carrier with 2 sets of pinion gears and 1 ring gear)
- Main control (mechatronic assembly):
  - Upper valve body
  - Lower valve body
  - Transmission Range (TR) sensor
  - Turbine Shaft Speed (TSS) sensor
  - Output Shaft Speed (OSS) sensor
  - Transmission Fluid Temperature (TFT) sensor
  - Line Pressure Control (LPC) solenoid
  - Torque Converter Clutch (TCC) solenoid
  - Five electronically controlled shift solenoids

In addition to the torque converter, the other shift elements are:

- three rotating multi-plate clutches: forward (A), direct (B) and overdrive (E).
- two fixed multi-disc brakes: intermediate (C) and low/reverse (D).

All gear shifts from 1st to 6th or from 6th to 1st are power-on overlapping shifts. That is, during the shift, one of the clutches must continue to transmit the drive at lower main pressure until the other clutch is able to accept the input torque.

The shift elements, clutches or brakes are engaged hydraulically. The transmission fluid pressure builds up between the cylinder and the piston, pressing the clutches together.

The purpose of these shift elements is to carry out in-load shifts with no interruption to traction.

Multi-plate clutches; forward, direct and overdrive, supply power from the engine to the planetary geartrain. Multi-disc

brakes, intermediate and low/reverse, press against the transmission housing in order to achieve a torque reaction effect.

Multi-Plate Clutch

Clutches; O/D (E), forward (A) and direct (B) are balanced in terms of dynamic pressure. That is, their pistons are exposed to the transmission fluid flow on both sides, in order to prevent pressure buildup in the clutch as speed increases. This equalization process is achieved by a baffle plate and pressure-free transmission fluid supply by a lubricating passage, through which the space between piston and baffle plate is filled with transmission fluid.

The advantages of this dynamic pressure equalization are:

- Reliable clutch engagement and release in all speed ranges.
- Improved shift refinement.

Shift Overlap Control

The electro-hydraulic shift action is obtained by means of various valves in the TCM and main control valve body, actuated by pressure regulators. They engage or disengage the relevant clutches or brakes at the correct moments.

Hydraulic Systems

Fluid Pump

The torque converter is supported in the fluid pump by a needle roller bearing. The fluid pump is driven directly from the engine by the torque converter shell and supplies transmission fluid to the transmission and the hydraulic control unit.

The fluid pump draws in transmission fluid through a transmission fluid filter and delivers it at high pressure to the main pressure valve in the main control valve body unit. The valve adjusts the pressure and returns excess transmission fluid to the transmission fluid pan.

Fluid Filter

All transmission fluid that is picked up from the transmission fluid pan passes through the transmission fluid filter. The transmission fluid filter and its accompanying seal are part of the transmission fluid path from the pan to the transmission fluid pump.

Single Planetary Gearset

The single planetary gear O/D carrier is driven by the input shaft. The single planetary gear set consists of the following components:

- One sun gear
- Four planetary gears meshing with the sun gear
- One planetary carrier
- One ring gear

Ravigenaux Planetary Gearset

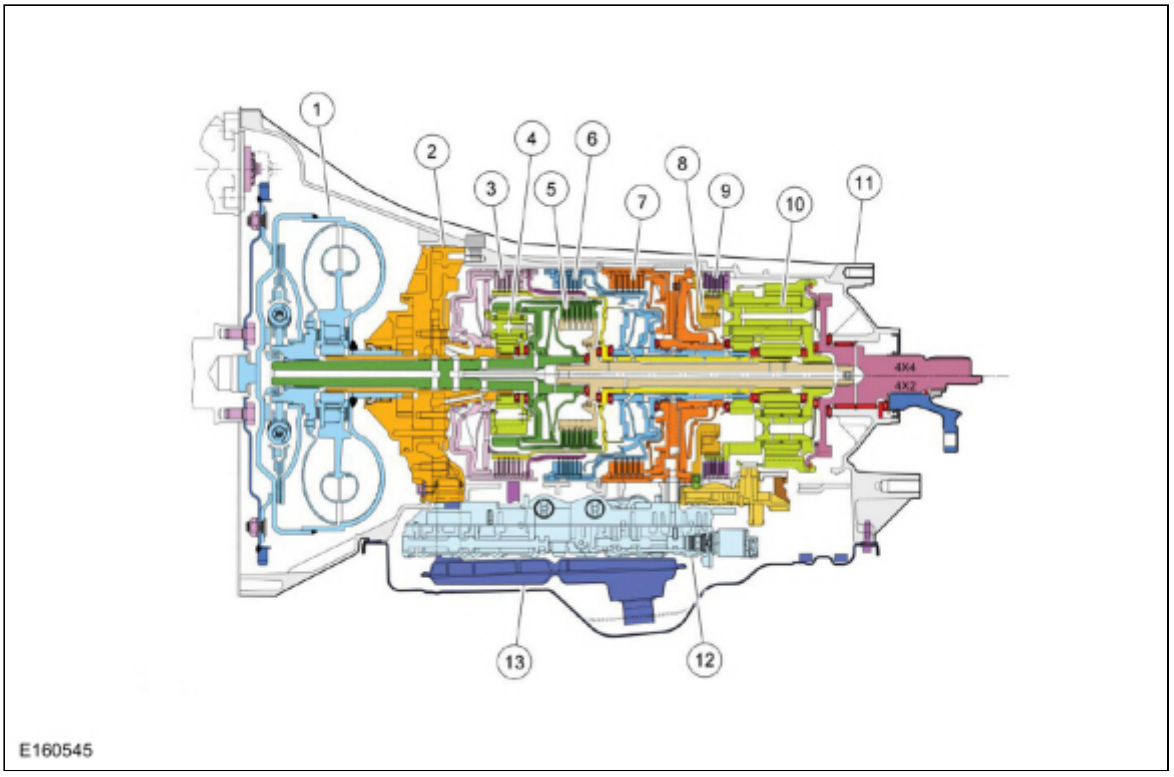
The Ravigenaux planetary gearset is splined to the output shaft and consists of the following components:

- Two sun gears of different sizes
- Three short planetary gear pinions meshing with the sun gears
- Three long planetary gear pinions meshing with the sun gears
- One planetary carrier
- One ring gear

Output Shaft

The output shaft provides torque to the driveshaft and rear axle assembly. It is driven by the ring gear of the planetary gearset.

Major Components Cutaway View



Item	Description
1	Torque converter
2	Front pump assembly
3	Forward clutch (A)
4	Front planetary gearset
5	Overdrive clutch (E)
6	Direct clutch (B)
7	Intermediate clutch (C)
8	One-Way Clutch (OWC)
9	Low/reverse clutch (D)
10	Rear planetary gearset
11	Transmission case
12	Main control assembly
13	Transmission fluid filter

Gear Ratios

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Clutches are used to hold and drive certain combinations of gearsets. This results in 6 forward ratios and one reverse ratio which are transmitted to the rear planetary ring gear (output shaft). The planetary gearsets of this transmission provide the following ratios:

- Reverse:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 2.24:1 (reverse direction)
  - Total ratio of 3.40:1 (reverse direction)
- 1st gear:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 2.74:1
  - Total ratio of 4.17:1
- 2nd gear:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 1.54:1
  - Total ratio of 2.34:1
- 3rd gear:

  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 1:1
  - Total ratio of 1.52:1
- 4th gear:
  - Front planetary gearset provides ratios of 1:1 and 1.52:1 to different rear planetary gearset members
  - Rear planetary gearset ratio of 1.14:1
  - Total ratio of 1.14:1
- 5th gear:
  - Front planetary gearset provides ratios of 1:1 and 1.52:1 to different rear planetary gearset members
  - Rear planetary gearset ratio of 0.87:1
  - Total ratio of 0.87:1
- 6th gear:
  - Front planetary gearset ratio of 1:1
  - Rear planetary gearset ratio of 0.69:1
  - Total ratio of 0.69:1

Range Selection

The transmission has 5 range positions: P, R, N, D, and S.



Park

- In the PARK position:
  - There is no power flow through the transmission.
  - The park pawl locks the output shaft to the case.
  - The engine can be started.
  - The ignition key can be removed.

Reverse

- In the REVERSE position:
  - The vehicle can be operated in a rearward direction, at a reduced gear ratio.
  - Backup lamps are illuminated.

Neutral

- In the NEUTRAL position:
  - There is no power flow through the transmission.
  - The output shaft is not held and is free to turn.
  - The engine can be started.

D Position

The D is the normal position for most forward driving.

- The D position provides:
  - Automatic shifts 1-6 and 6-1.
  - Apply and release of the torque converter clutch.
  - Maximum fuel economy during normal operation.
  - Engine braking in all gears.

Position S — Sport mode with manual shifting™

- This position provides:
  - Manual control of the transmission.
  - Engine braking.

Torque Converter

The torque converter is a 4-element unit containing a 2-plate clutch. The clutch can be controlled and engaged in any gear, 2nd through 6th. Calibration parameters may be set to allow lockup in a higher gear only. The clutch is applied by removing fluid pressure from one side of the plate. The torque converter transmits and multiplies torque. The torque converter includes the following 4 elements:

- Impeller assembly
- Turbine assembly
- Reactor assembly
- Torque Converter Clutch (TCC)

Rotation of the torque converter housing and impeller set the transmission fluid in motion by driving the impeller blades and pump.

The turbine is driven by the transmission fluid from the impeller and transmits power to the input shaft.

The reactor redirects transmission fluid flow returned from the turbine to the impeller so that it rotates in the same direction as the impeller. This action assists in torque multiplication.

The reactor has a One-Way Clutch (OWC) to hold it stationary during torque multiplication and allows it to rotate at higher vehicle speeds.

Torque Converter Clutch (TCC)

The TCC has a cover assembly with a 2-plate clutch and a turbine and damper assembly that connects to the transmission input shaft.

The TCC connects the cover to the turbine when the TCC is applied.

During TCC release, transmission fluid flows through the torque converter in one direction to release the 2-plate clutch.

During TCC apply, transmission fluid flows through the torque converter in the opposite direction to apply the 2-plate clutch.

- The TCC operates in 3 stages:
  - Full release
  - Controlled modulation
  - Full apply

The TCM controls TCC operation using the TCC solenoid. TCC solenoid operation provides the modulation of hydraulic pressure to change the position of the bypass clutch control regulator valve. The valve changes the pressure and direction of transmission fluid flow in the torque converter. TCC may be applied in forward gears, 2nd through 6th.

Shift Patterns

Downshifts

Under certain conditions, the transmission will downshift automatically to a lower gear range (without moving the range selector lever). There are 3 categories of automatic downshifts:

- Coastdown
- Torque demand
- Forced or kickdown shifts

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

Mechanical Components and Functions

Planetary Gearset

This transmission has 2 planetary gearsets (front and rear) to provide operation in reverse and 6 forward speeds.

The front planetary gearset is a single planetary gearset and has the following components:

- Front planetary No. 1 sun gear
- Front planetary carrier
- Front planetary ring gear (part of the input shaft assembly)

The input shaft rotates the front ring gear as a driving member. The front sun gear is connected to the fluid pump and is held stationary. The front ring gear rotates the front planetary carrier assembly with a reduction ratio of 1.52:1

The front planetary carrier assembly is the only output member of the front planetary gearset in reverse, 1st gear, 2nd gear and 3rd gear. The front planetary gearset provides a 1.52:1 gear ratio to the rear planetary gearset.

In 4th gear and 5th gear, both the front ring gear and front planetary carrier assembly are output members of the front planetary gearset. The front planetary gearset provides both a 1:1 and 1.52:1 gear ratio to different members of the rear planetary gearset.

In 6th gear, the front ring gear is the only output member of the front planetary gearset. The front planetary gearset provides a 1:1 gear ratio to the rear planetary gearset.

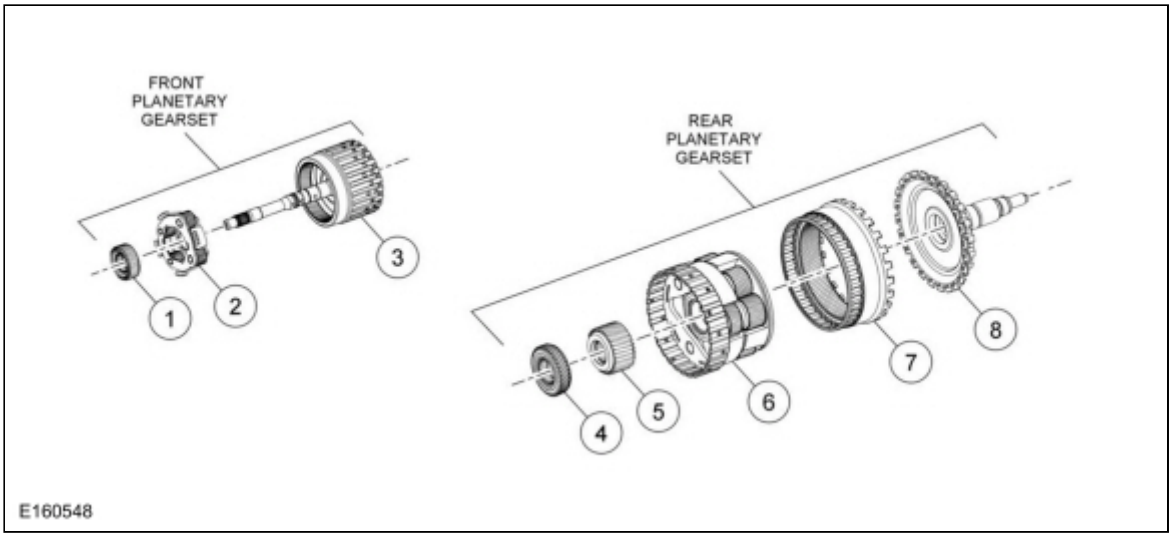
The rear planetary gearset is a ravigenaux planetary gearset and has the following components:

- Rear planetary No. 2 sun gear
- Rear planetary No. 3 sun gear
- Rear planetary carrier assembly (2 sets of pinion gears)
- Rear planetary ring gear assembly

Powerflow through the rear planetary gearset is as follows:

- In reverse, rear sun gear No. 2 is driven, the rear planetary carrier is held and the ring gear is the output (2.24:1 with reverse direction)
- In 1st gear, sun gear No. 3 is driven, the rear planetary carrier is held and the ring gear is the output (2.74:1)
- In 2nd gear, sun gear No. 3 is driven, sun gear No. 2 is held and the ring gear is the output (1.54:1)
- In 3rd gear, sun gear No. 3 and sun gear No. 2 are driven and the ring gear is the output (1:1)
- In 4th gear, sun gear No. 3 and the rear planetary carrier are driven and the ring gear is the output (1.14:1)
- In 5th gear, sun gear No. 2 and the rear planetary carrier are driven and the ring gear is the output (0.87:1)
- In 6th gear, the rear planetary carrier is driven, sun gear No. 2 is held and the ring gear is the output (0.69:1)

Planetary Gearset Exploded View



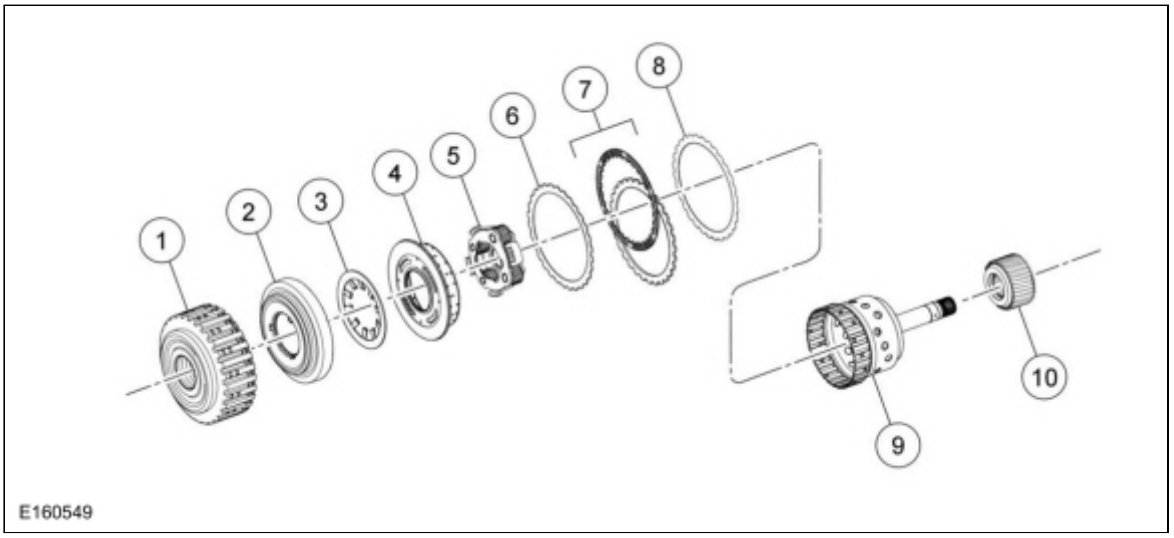
Item	Description
1	Front planetary No. 1 sun gear
2	Front planetary carrier
3	Front planetary ring gear (part of input shaft assembly)
4	Rear planetary No. 2 sun gear
5	Rear planetary No. 3 sun gear
6	Rear planetary carrier
7	Rear planetary ring gear
8	Output shaft

Forward Clutch (A)

The forward clutch (A) connects the front planetary carrier to the rear No. 3 sun gear. This provides a reduction gear ratio of 1.52:1 from the input shaft to rear sun gear No. 3. The forward (A) is applied in 1st, 2nd, 3rd and 4th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the forward (A) clutch piston against the forward (A) clutch pack to apply the clutch. The front planetary carrier and the rear No. 3 sun gear are connected as a result of the clutch being applied.

Forward Clutch (A) Exploded View



Item	Description
1	Forward clutch cylinder
2	Forward clutch piston
3	Forward clutch piston retaining spring
4	Forward clutch balance piston

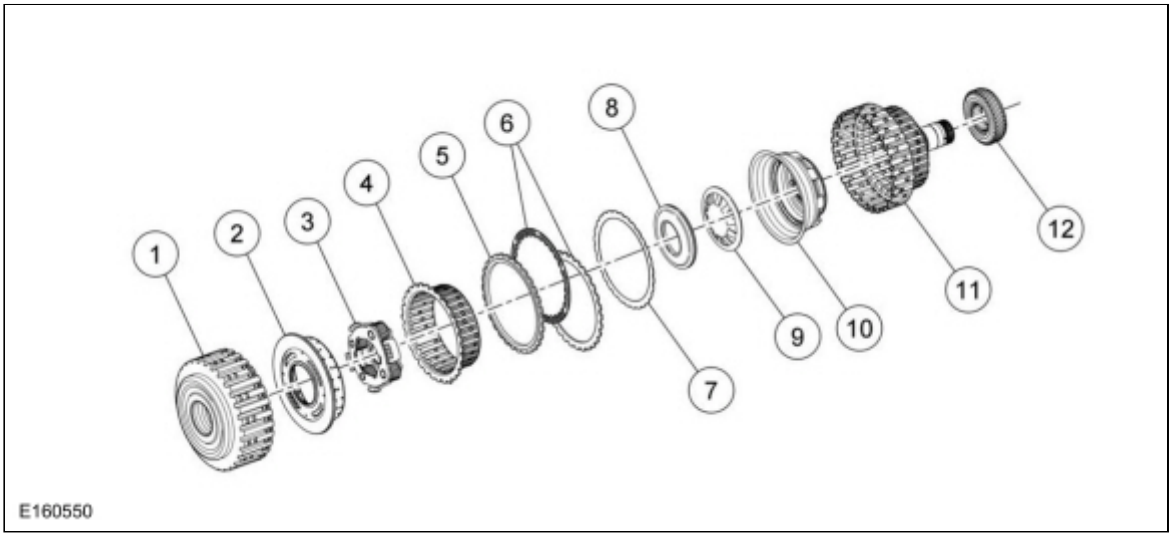
5	Front planetary carrier assembly
6	Forward clutch wave spring
7	Forward clutch friction and steel plates
8	Forward clutch pressure plate
9	Rear planetary No. 3 sun gear hub and shaft assembly
10	Rear planetary No. 3 sun gear

Direct Clutch (B)

The direct clutch (B) connects the front planetary carrier to the rear No. 2 sun gear. This provides a reduction gear ratio of 1.52:1 from the input shaft to rear sun gear No. 2. The direct clutch (B) is applied in reverse, 3rd and 5th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the direct clutch (B) piston against the direct clutch (B) pack to apply theb clutch. The front planetary carrier and the rear No. 2 sun gear are connected as a result of the clutch being applied.

Direct Clutch (B) Exploded View



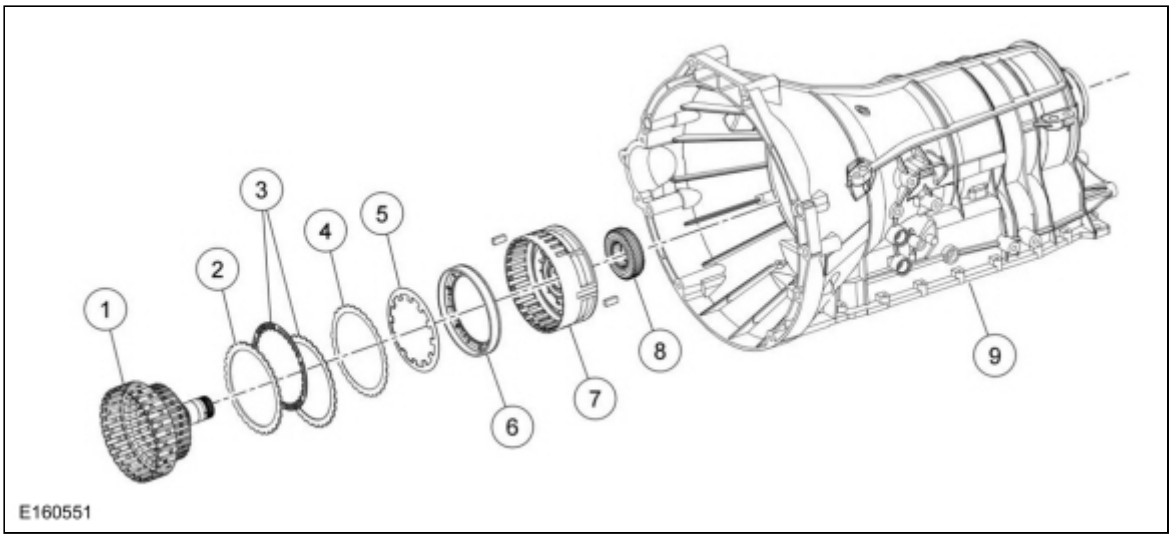
Item	Description
1	Forward clutch cylinder
2	Forward clutch balance piston
3	Front planetary carrier assembly
4	Direct clutch hub
5	Direct clutch pressure plate
6	Direct clutch friction and steel plates
7	Direct clutch wave spring
8	Direct clutch balance piston
9	Direct clutch piston return spring
10	Direct clutch piston
11	Direct clutch cylinder
12	Rear planetary sun gear No. 2

Intermediate Clutch (C)

The intermediate clutch (C) holds the rear planetary No. 2 sun gear stationary to the transmission case. The intermediate clutch (C) is applied in 2nd and 6th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the intermediate clutch (C) piston against the intermediate clutch (C) pack to apply the clutch.

Intermediate Clutch (C) Exploeded View



Item	Description
1	Direct clutch cylinder
2	Intermediate clutch pressure plate
3	Intermediate clutch friction and steel plates
4	Intermediate clutch wave spring
5	Intermediate clutch piston return spring
6	Intermediate clutch piston
7	Center support assembly
8	Rear planetary sun gear No. 2
9	Transmission case

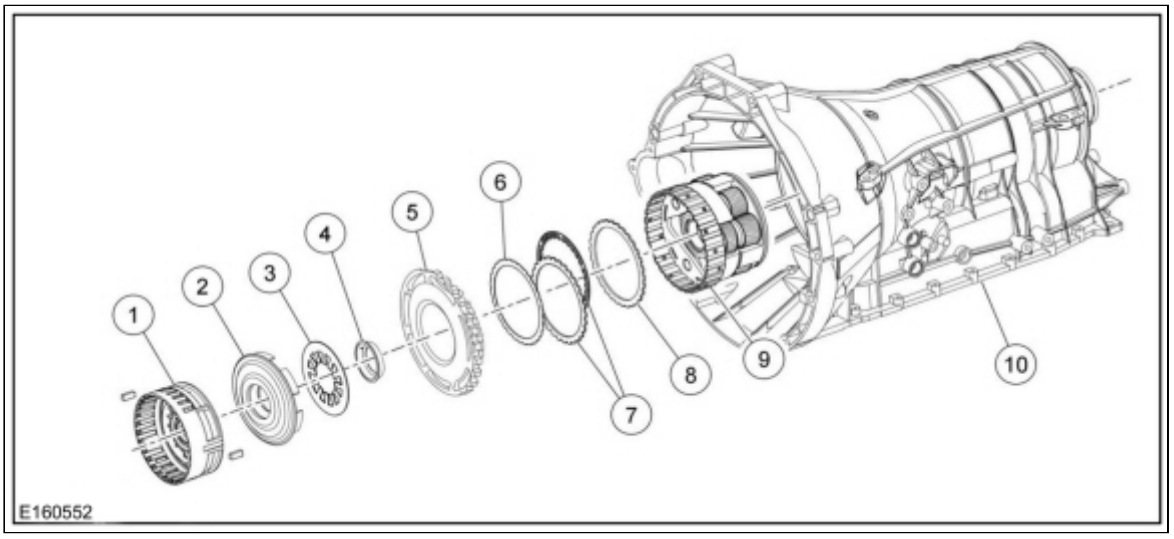
Low/Reverse Clutch (D) and Low/One-Way Clutch (OWC)

The low/reverse clutch (D) holds the rear planetary carrier stationary to the transmission case. The low/ reverse clutch (D) is applied in park, reverse, neutral and 1st gear below 5 kph (3 mph).

Regulated hydraulic pressure from the regulator valve in the valve body pushes the low/reverse clutch (D) piston against the low/reverse clutch (D) pack to apply the clutch.

The low/One-Way Clutch (OWC) is a brake clutch that holds the rear planetary carrier in one direction and allows it to freewheel in the opposite direction eliminating engine braking in 1st gear when the transmission is in drive, above 5 kph (3 mph) only.

Low/Reverse Clutch (D) and Low/One-Way Clutch (OWC) Exploded View



Item	Description

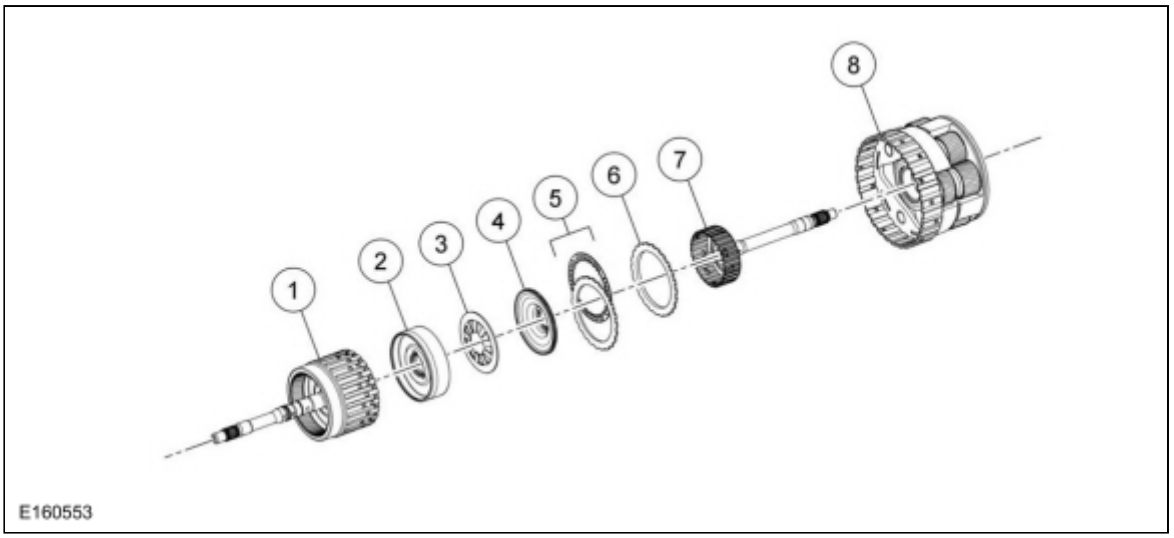
1	Center support assembly
2	Low/reverse clutch (D) piston
3	Low/reverse clutch piston return spring
4	Low/reverse clutch piston retainer
5	Low/reverse clutch assembly
6	Low/reverse clutch disc cushion plate
7	Low/reverse clutch friction and steel plates
8	Low/reverse clutch pressure plate
9	Rear planetary carrier assembly
10	Transmission case assembly

Overdrive (O/D) Clutch (E)

The O/D clutch (E) connects the input shaft with the rear planetary carrier. The O/D clutch (E) is applied in 4th, 5th and 6th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the overdrive clutch (E) piston against the overdrive clutch (E) pack to apply the clutch.

Overdrive Clutch (E) Exploded View



Item	Description
1	Input shaft assembly
2	Overdrive clutch piston
3	Overdrive clutch piston return spring
4	Overdrive clutch balance piston
5	Overdrive clutch friction and steel plates
6	Overdrive clutch pressure plate
7	Intermediate shaft
8	Rear planetary carrier assembly

External Sealing

The pump assembly has a lip-type seal for the torque converter impeller hub. The pump assembly uses a large O-ring to seal the transmission case. The pump bolts also seal the pump to the transmission case.

The manual control lever shaft has a lip seal for its bore in the transmission case.

The transmission fluid pan uses a reusable gasket.

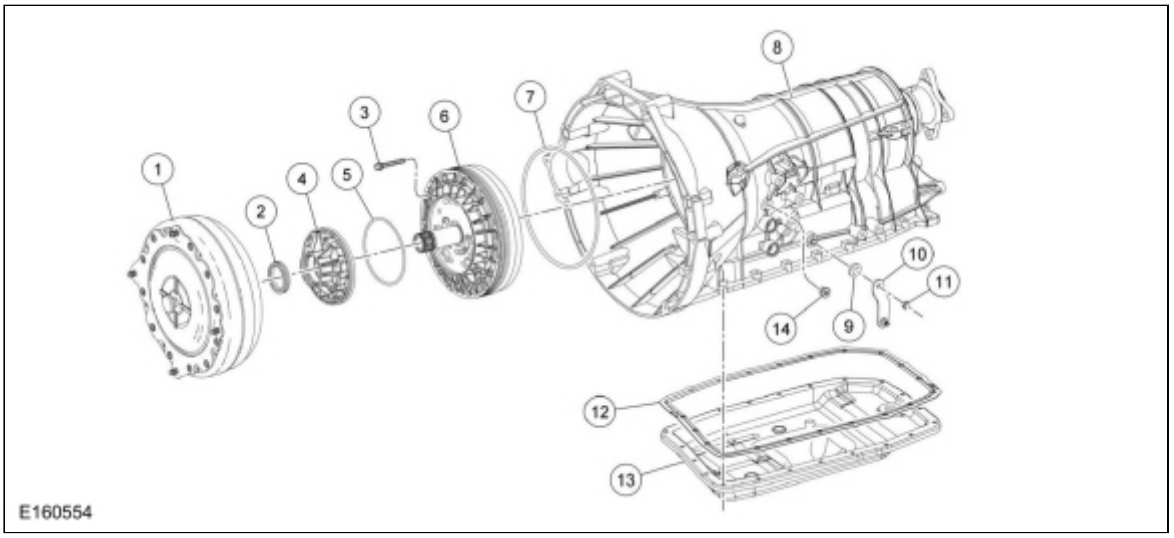
The output shaft flange has a lip-type seal that seals the flange to the transmission case.

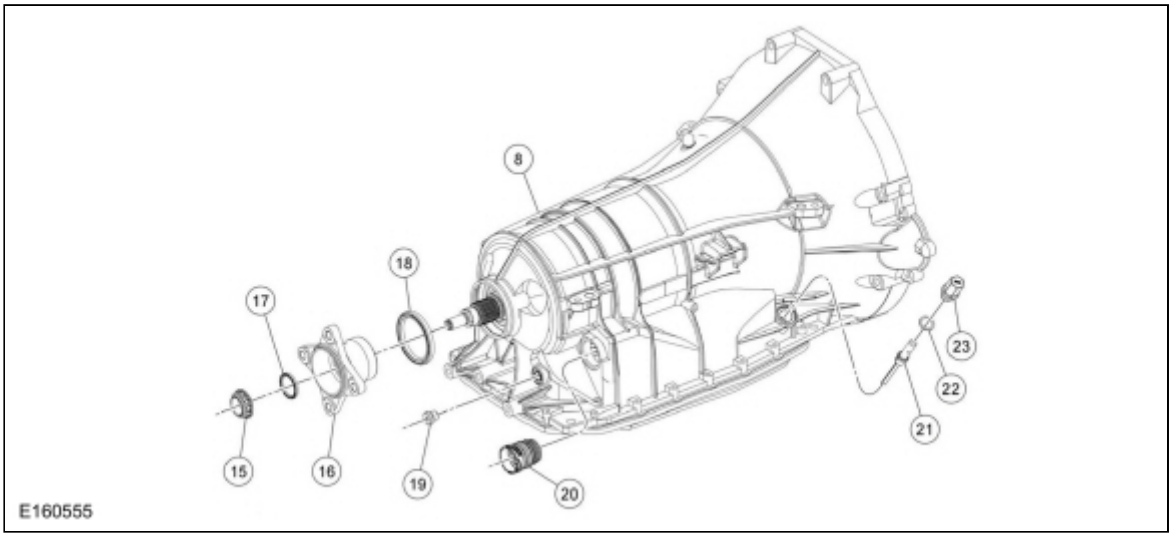
The transmission case plug provides access to the park pawl shaft. The plug has a seal that is serviced as an assembly with the plug.

The main control leadframe connector sleeve has a seal for the transmission case bore. The seal is serviced as an assembly with the bulkhead connector sleeve.

The plug for the fluid level indicator uses an O-ring seal.

External Sealing (Gaskets, O-rings and Seals)





Item	Description
1	Torque converter
2	Front pump oil seal
3	Front pump-to-case bolt (13 required)
4	Front pump assembly
5	Pump assembly inner oil seal
6	Front pump assembly
7	Front pump outer oil seal
8	Transmission case
9	Manual control lever shaft seal
10	Manual control lever (Manual control lever installation position is vehicle/model dependent.)
11	Manual control lever nut
12	Transmission fluid pan gasket

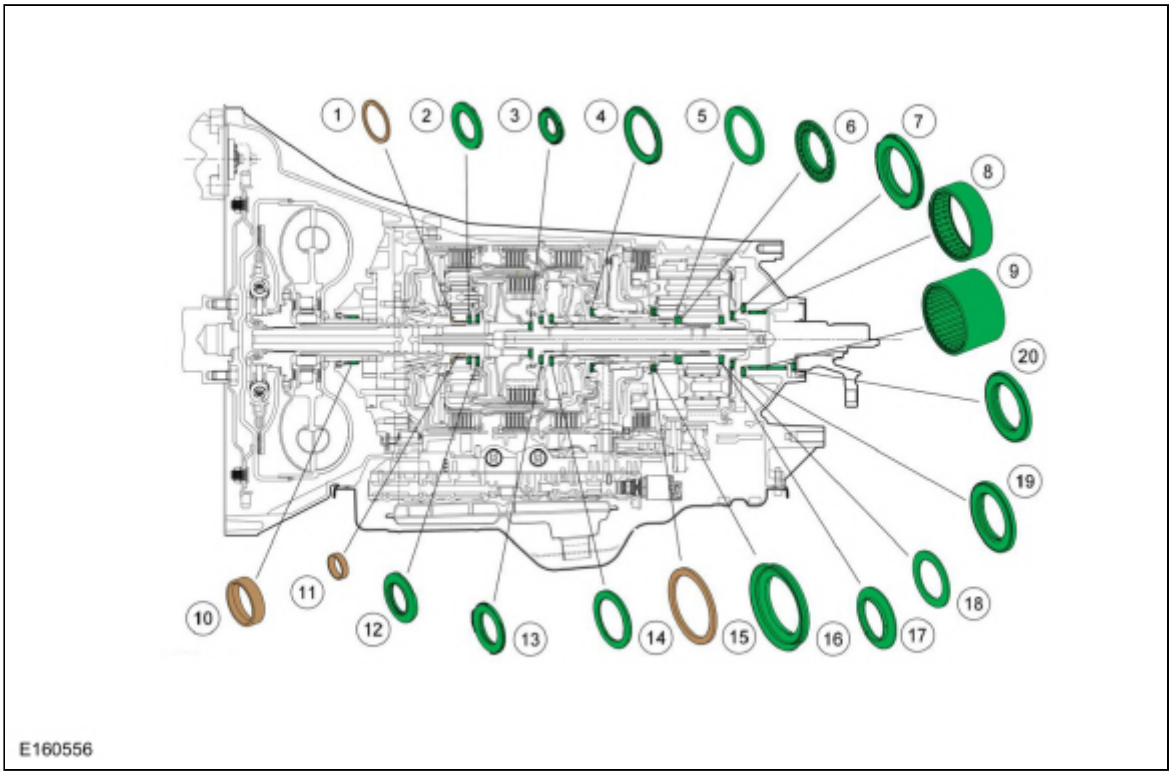
13	Transmission fluid pan
14	Line pressure tap plug
15	Output shaft flange retaining nut
16	Output shaft flange
17	Extension housing flange seal
18	Output shaft flange seal
19	Transmission case plug (park pawl shaft access)
20	Transmission bulkhead connector sleeve
21	Transmission fluid level indicator
22	Transmission fluid level indicator plug seal (part of transmission fluid level indicator)
23	Transmission fluid level indicator plug (part of transmission fluid level indicator)

Bushings, Bearings and Thrust Washer Locations

This transmission supports the rotating components of the transmission with bushings, bearings and thrust washers.

The pump assembly support thrust washer controls the amount of end play for components between the pump assembly and the center support (forward/ Overdrive (O/D) clutch assembly, direct clutch cylinder).

The T8 thrust bearing outer race controls the amount of end play for components between the center support and the rear of the transmission case (rear planetary gearset assembly, output shaft assembly).



Item	Description
1	Front pump selective washer
2	Bearing T1
3	Bearing T3
4	Bearing T6
5	Thrust bearing outer race
6	Roller bearing T8
7	Thrust bearing T10
8	Output shaft bearing assembly (Four-Wheel Drive (4WD) vehicles)

9	Output shaft bearing assembly (Rear Wheel Drive (RWD) vehicles)
10	Front oil pump bushing assembly (part of pump assembly)
11	Input shaft bushing (part of pump assembly)
12	Bearing T2
13	Bearing T4
14	Roller bearing T5
15	Rear planetary carrier selective washer
16	Thrust bearing T7
17	Roller bearing T9
18	Outer race bearing T9
19	Bearing T11
20	Thrust bearing T12 (RWD only)

Lubrication

This transmission provides lubrication for rotating mechanical components through one main hydraulic circuit. The general flow of lubrication moves from the front of the transmission, through the input and intermediate shafts, to the rear of the transmission.

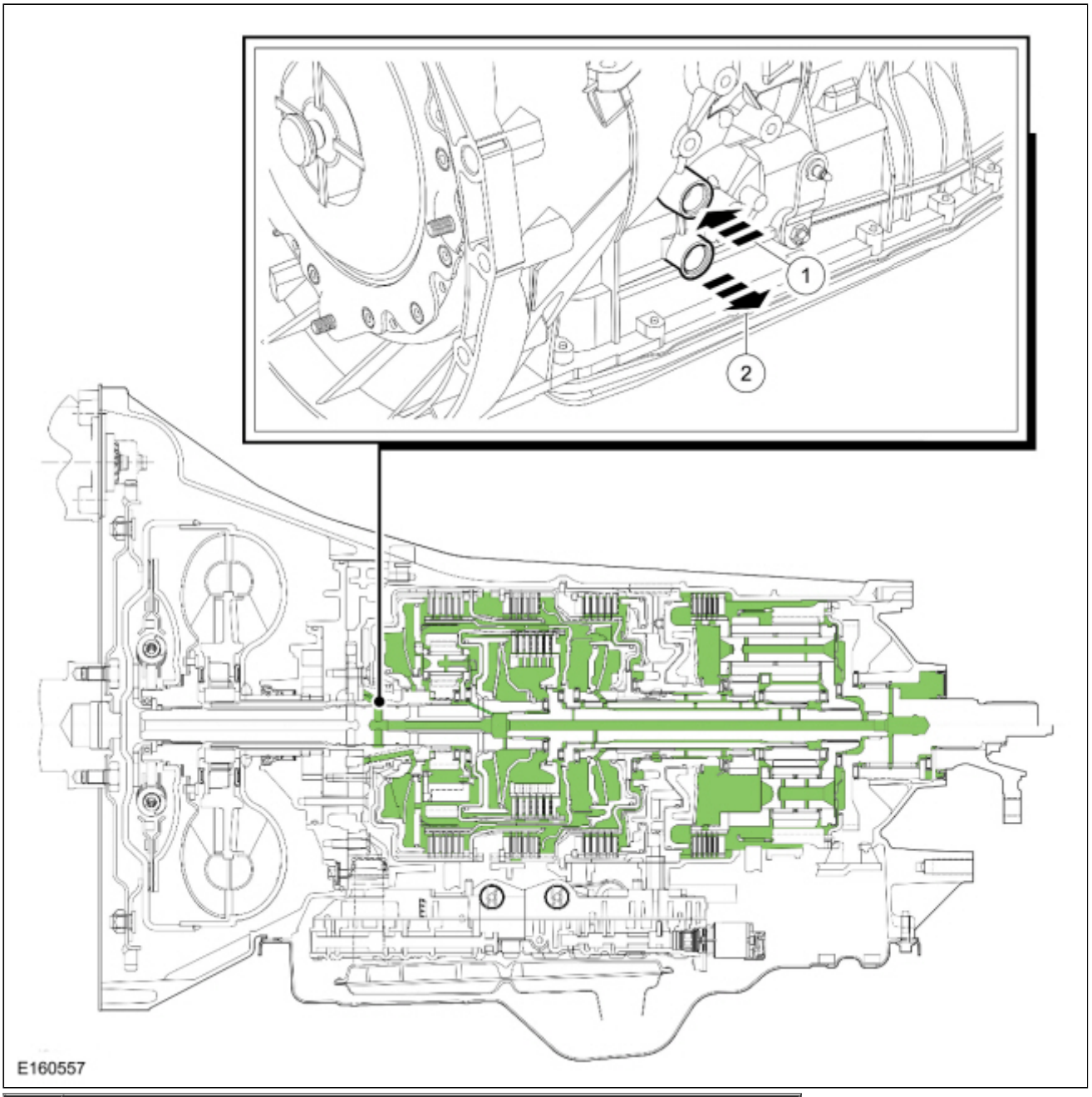
Transmission fluid from the pump assembly and the torque converter exit the transmission case to go to the transmission fluid cooler through the bottom of the transmission fluid cooler tube and returns to the transmission through the top of the transmission fluid cooler tube.

With lower transmission fluid temperatures, the thermal bypass valve in the transmission case bypasses the transmission fluid cooler tubes and redirects the fluid to the lubrication circuit. As transmission fluid temperature increases, the thermal bypass valve directs the fluid to the transmission fluid cooler.

Transmission fluid from the transmission fluid cooler or the thermal bypass valve enters the main lubrication circuit from the top of the transmission fluid cooler tube port.

Transmission fluid in the lubrication circuit flows to each of the balance pistons for the forward (A), direct (B) and overdrive (E) clutches. The balance pistons prevent unwanted clutch application when the clutch cylinder rotates at high speeds and hydraulic controls have released the clutch.

Lubrication Passages



Item	Description
1	Transmission fluid cooler return (inlet from the transmission fluid cooler)
2	Transmission fluid cooler pressure (outlet to the transmission fluid cooler)

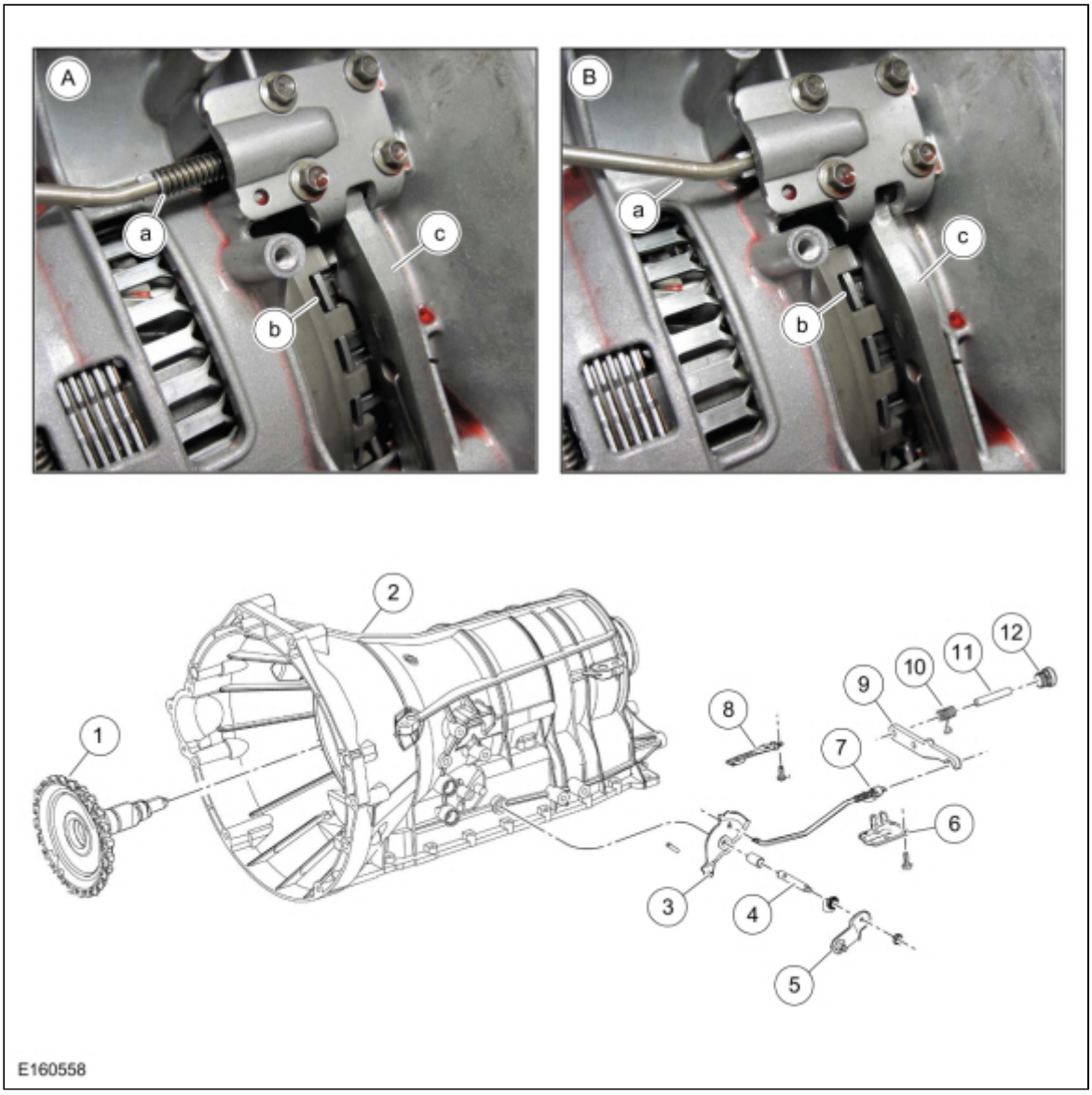
Park

The park gear is part of the output shaft assembly. The park gear has lugs on its OD surface that the park pawl engages with to lock the output shaft.

The park lock prevents the vehicle wheels from rotating by allowing the output shaft to be held stationary by the transmission case through the park pawl. When the park pawl is engaged in the park gear, the output shaft is held stationary.

When the manual control lever is rotated to the PARK position, the park lock works as follows:

- The detent assembly (connected to the manual control shaft) rotates and pushes the park pawl actuator rod into the park pawl. The actuator rod is spring loaded.
- The actuator rod is guided into the park pawl by the park pawl abutment.
- When the park pawl actuator rod is pushed into the park pawl, the park pawl pivots into the park gear and engages with the lugs.
- The park pawl holds the output shaft to the transmission case.



Item	Description
1	Transmission case
2	Output shaft park gear assembly
3	Park pawl
4	Park pawl return spring
5	Park pawl pin
6	Plug — park pawl pin
7	Park pawl actuator rod
8	Manual valve detent spring
9	Manual valve detent lever assembly
10	Manual control lever shaft
11	Manual control lever (Manual control lever installation position is vehicle/model dependent.)
12	Park rod actuating plate

Hydraulic System

Pump Assembly and Transmission Fluid Filter

This transmission has a gear type pump that supplies transmission fluid pressure to the hydraulic system.

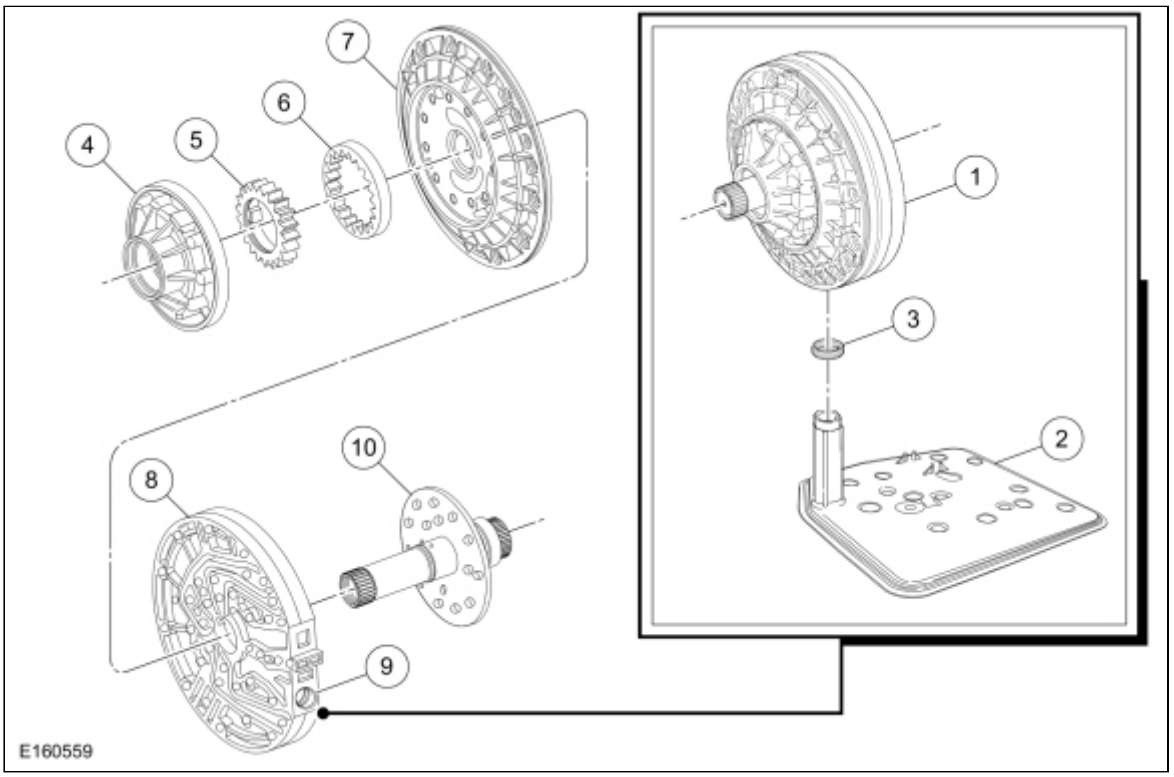
The inner (drive) gear is turned by the torque converter hub.

The transmission fluid pump has the following parts:

- Pump body, with inner (drive) and outer (driven) gears
- Centering plate
- Intermediate plate
- Stator shaft

The transmission fluid pump draws transmission fluid from the sump area, formed by the transmission fluid pan, through the transmission fluid filter, which is installed into the intermediate plate portion of the pump assembly and sealed by a rubber seal. A magnet attached to the transmission fluid pan collects any metallic material in the transmission fluid.

Pump Assembly and Transmission Fluid Filter Components



Item	Description
1	Transmission fluid pump assembly
2	Transmission fluid filter
3	Transmission fluid filter seal
4	Transmission fluid pump body
5	Inner (drive) gear
6	Outer (driven) gear
7	Centering plate
8	Intermediate plate
9	Filter suction port
10	Stator shaft

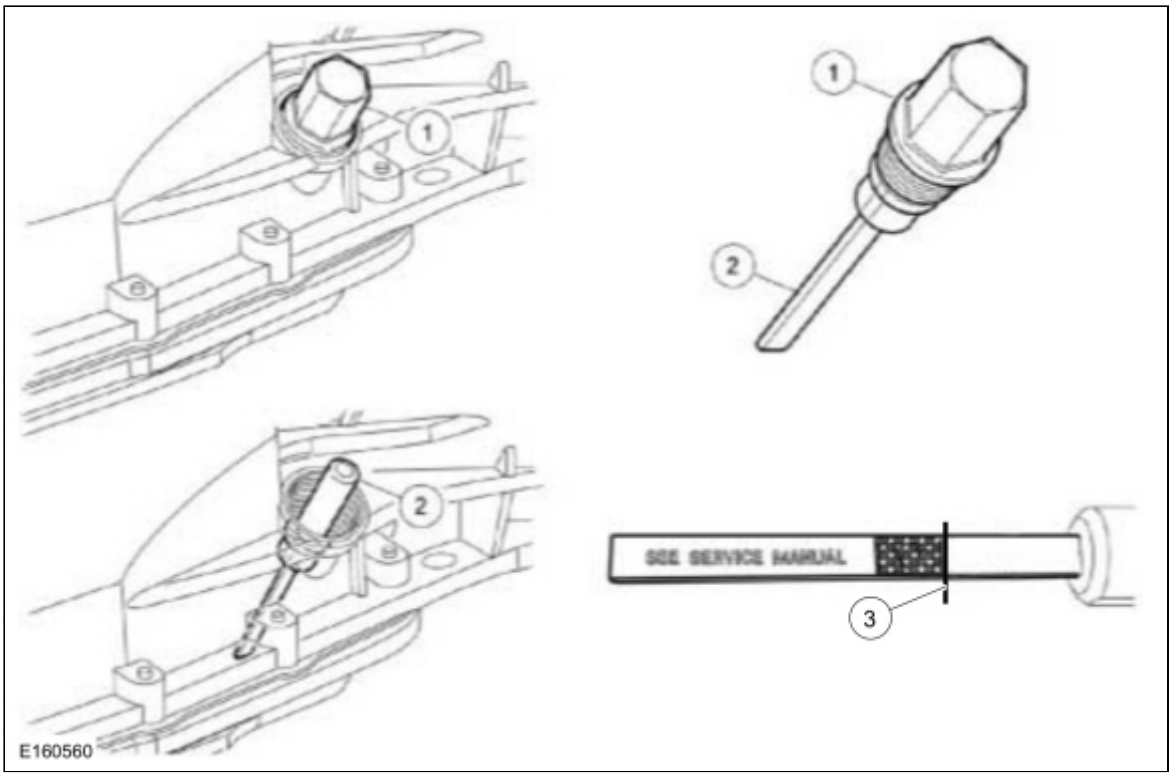
Transmission Fluid Level Indicator

A removable dipstick-type fluid level indicator is located on the right front area of the transmission case. It is held in by an external fluid fill plug. The transmission fluid level indicator is removed with the transmission fluid fill plug. The transmission fluid level indicator is removed from the fill plug to check the transmission fluid level.

The transmission fluid level is correctly checked when the transmission is at normal operating temperature, 80ºC - 85ºC (176ºF - 185ºF), and the vehicle is on a level surface.

The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.

Transmission Fluid Level Indicator



Item	Description
1	Transmission fluid fill plug
2	Transmission fluid level indicator
3	Transmission fluid level indicator FULL line

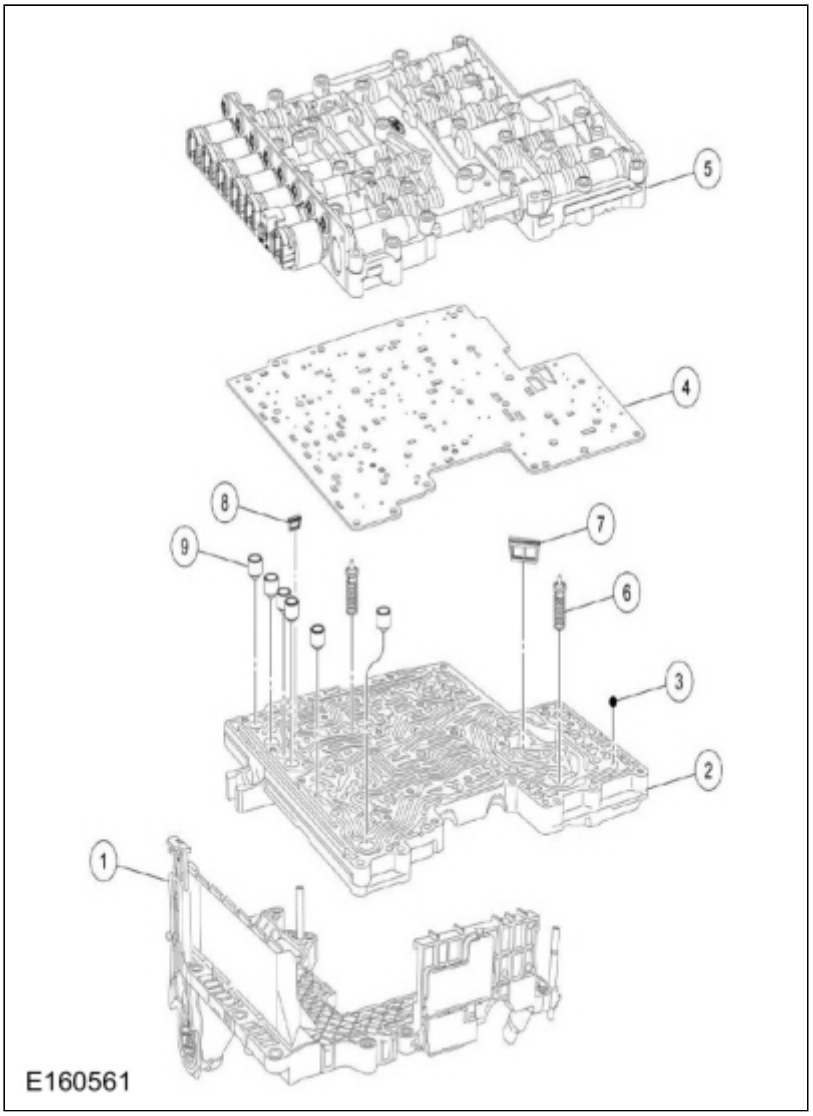
Main Control (Mechatronic) Assembly

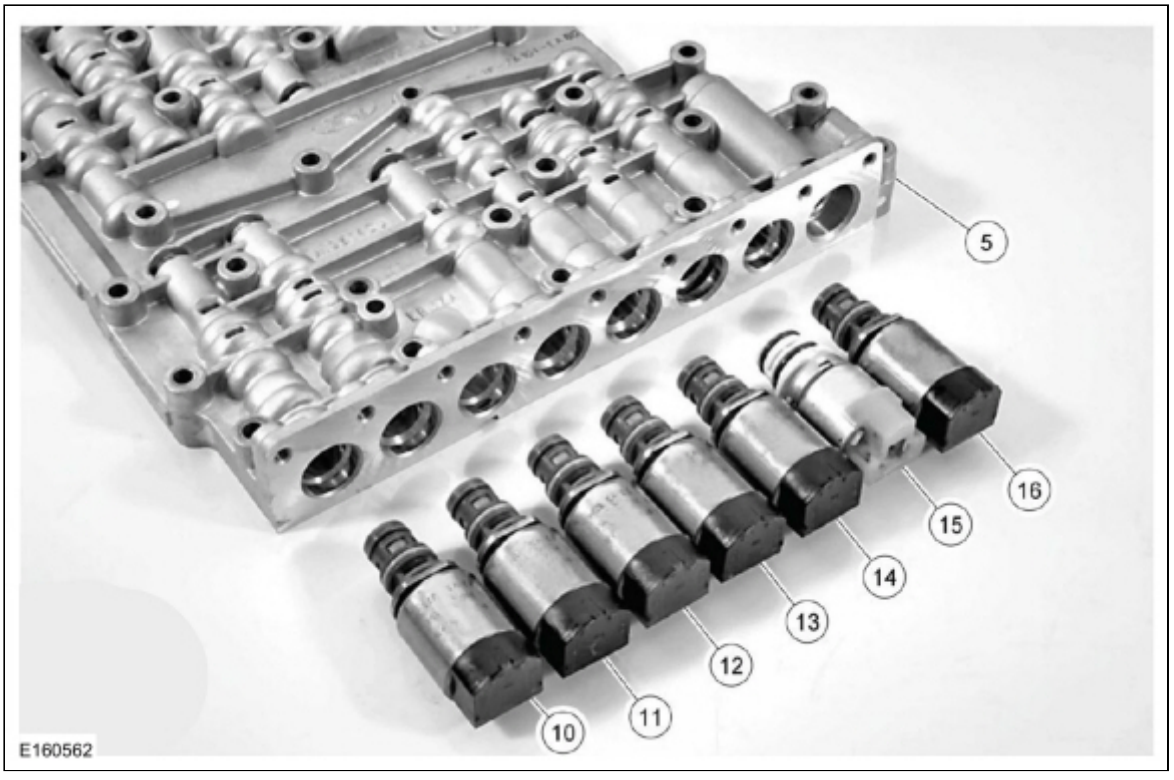
The hydraulic system of this transmission includes the fluid pump, a main control assembly and fluid passages in the transmission case and center support to apply the clutches.

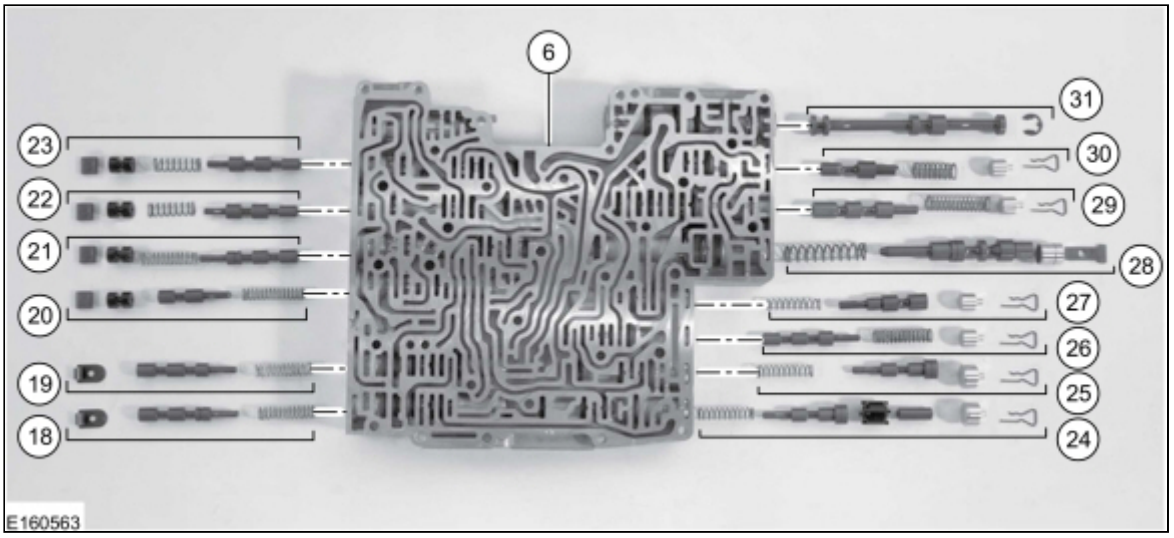
The main control assembly has an upper valve body assembly, a separator plate and a lower valve body assembly. The lower valve body assembly has 7 solenoids to control the valves in the main control.

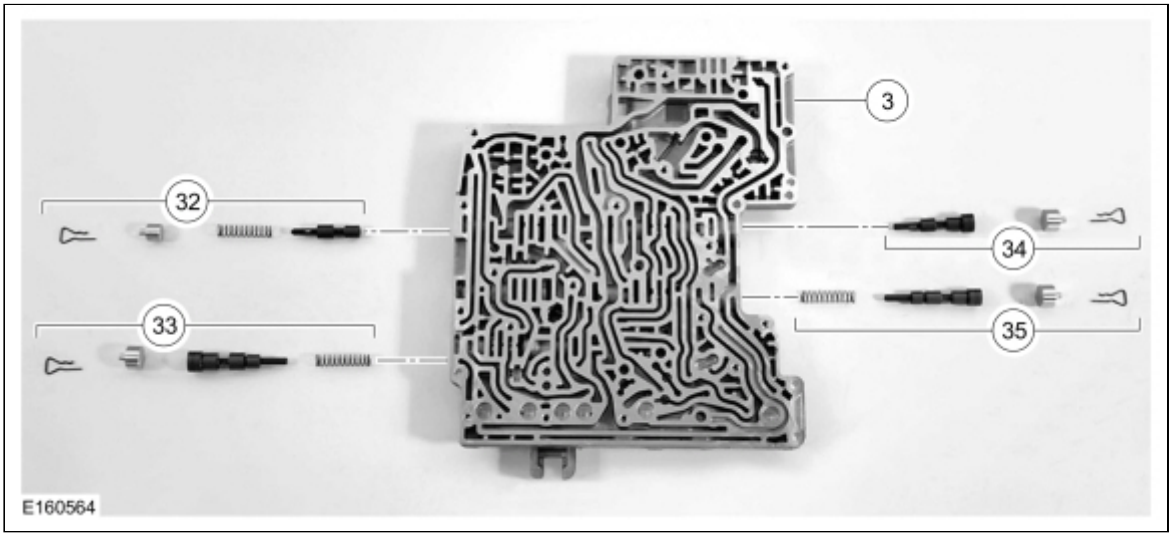
TheTurbine Shaft Speed (TSS), Output Shaft Speed (OSS), Transmission Range (TR) and Transmission Fluid Temperature (TFT) sensors are all part of the main control assembly leadframe.

Mechatronic Assembly


5
4
8
7
9
6
3
2
1
E160561


5
16
15
14
13
12
11
10
E160562



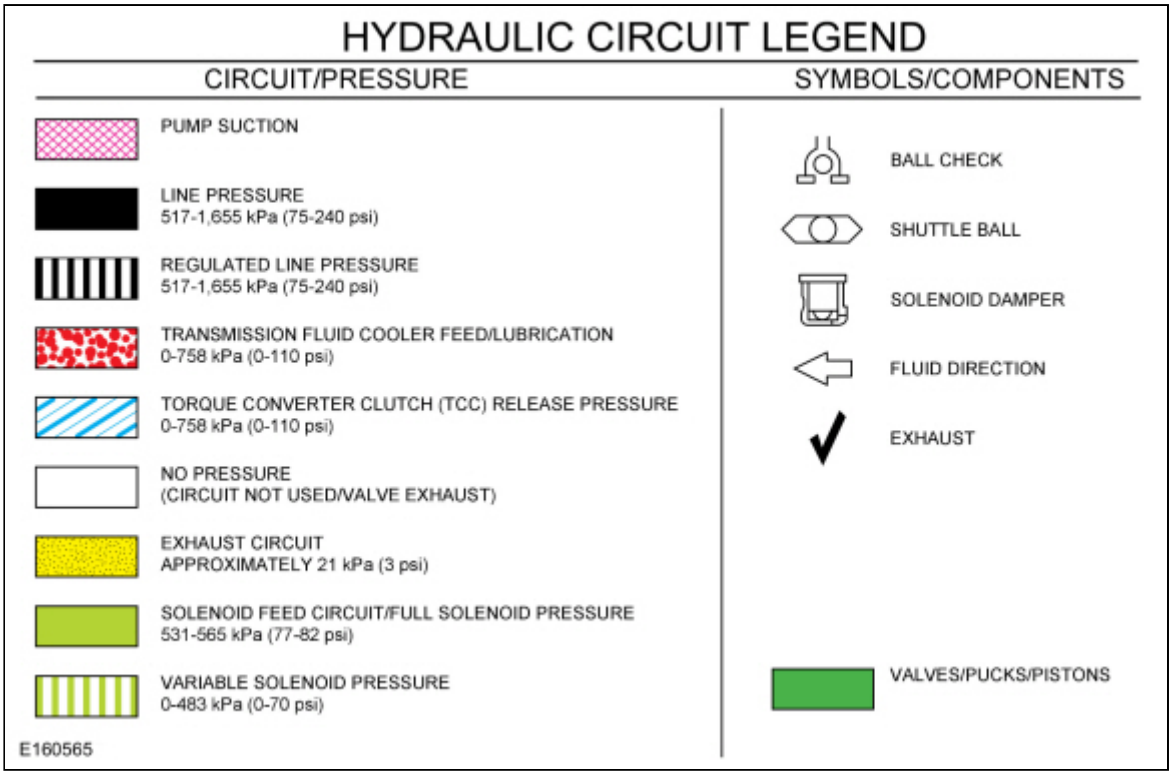


Item	Description
1	Main control / Molded leadframe
2	Transmission control valve body (upper)
3	Transmission control valve check ball (8 required)
4	Transmission control valve body separator plate
5	Transmission control valve body (lower)
6	Transmission control valve assembly
7	Transmission control filter assembly
8	Transmission fluid filter
9	Transmission solenoid damper valve assembly
10	Solenoid A (SSA)
11	Solenoid B (SSB)
12	Solenoid C (SSC)
13	Line Pressure Control (LPC) solenoid
14	Shift Solenoid D (SSD)
15	Shift Solenoid E (SSE)
16	Torque Converter Clutch (TCC) solenoid
17	Forward (A) clutch latch valve assembly
18	Direct (B) clutch latch valve assembly
19	Solenoid regulator valve
20	Low/reverse (D1) clutch latch valve assembly

21	Drive enable valve
22	Solenoid multiplex valve
23	Forward (A) clutch regulator valve assembly
24	Overdrive (E) clutch regulator valve assembly
25	Overdrive (E) clutch latch valve assembly
26	Bypass clutch control regulator valve assembly
27	Main regulator valve assembly
28	Converter release regulator valve assembly
29	Lubrication control valve assembly
30	Manual valve assembly
31	Low/reverse (D2) clutch latch valve assembly
32	Direct (B) clutch regulator valve assembly
33	Low/reverse (D1) clutch regulator valve assembly
34	Intermediate (C) clutch regulator valve

Hydraulic Circuits

Hydraulic Circuit Identification and Function



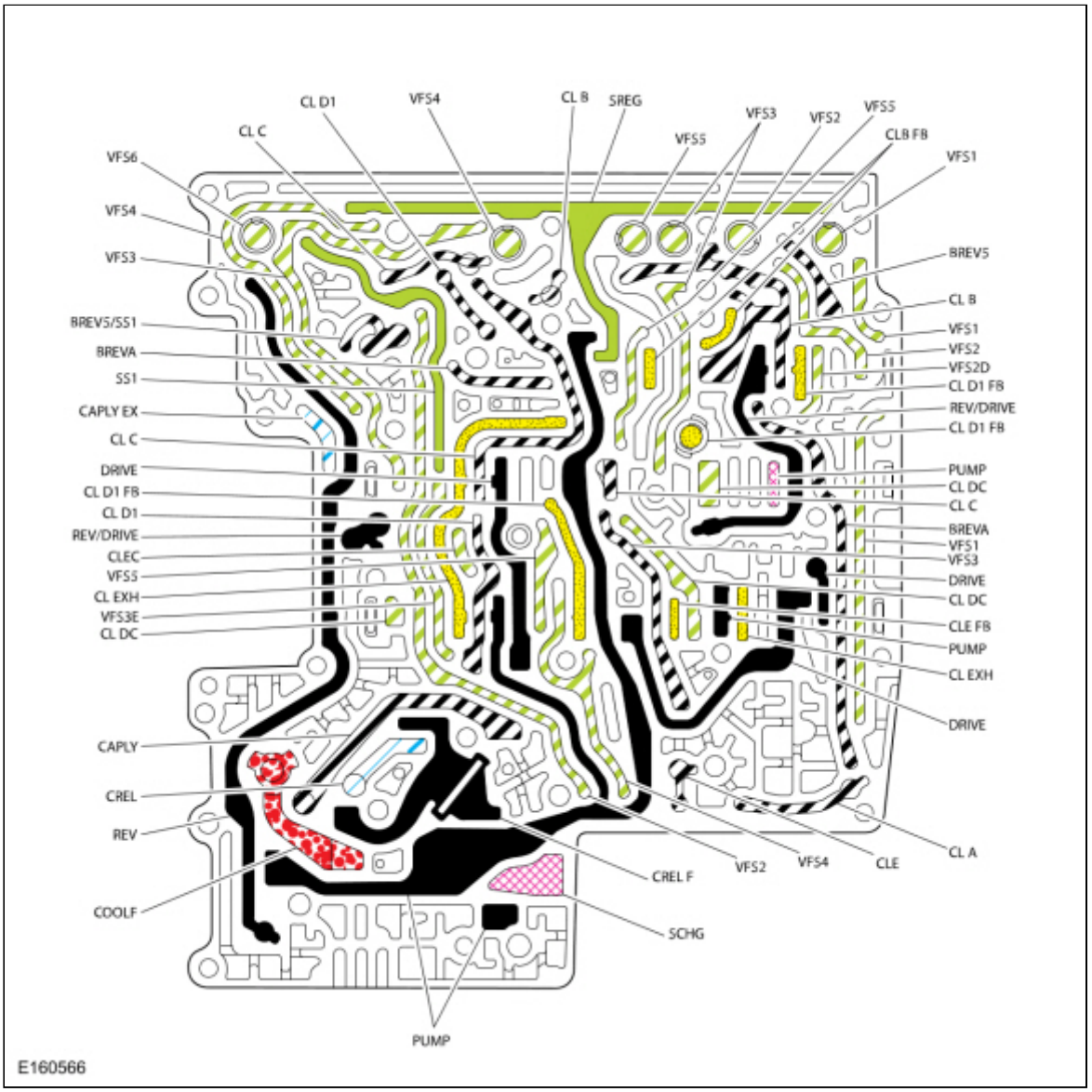
Hydraulic Circuit Identification Chart

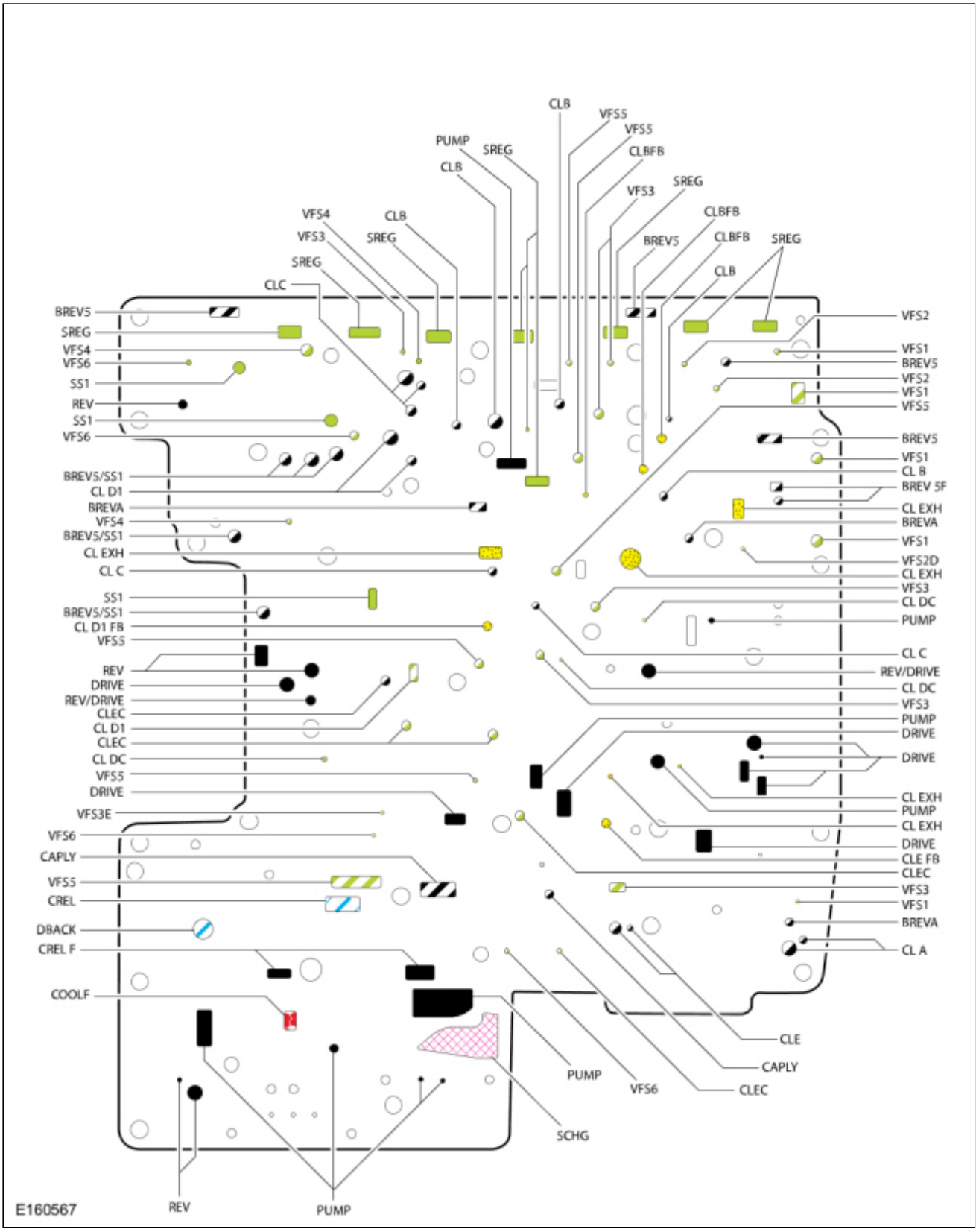
Circuit Name	Description
BREVA	BREV5 pressure from the drive enable valve to the clutch A regulator valve.
BREV5	BREV 5F pressure from the clutch A latch valve to the drive enable valve and the No. 2 shuttle ball.
BREV 5F	Regulated line pressure from the CL B circuit directed to the A clutch latch valve by the B clutch latch valve.
BREV5/SS1	BREV5 or SS1 pressure from the No. 2 shuttle ball to the solenoid multiplex valve.
CAPLY	Apply circuit to the torque converter, also the return circuit during Torque Converter Clutch (TCC) release.

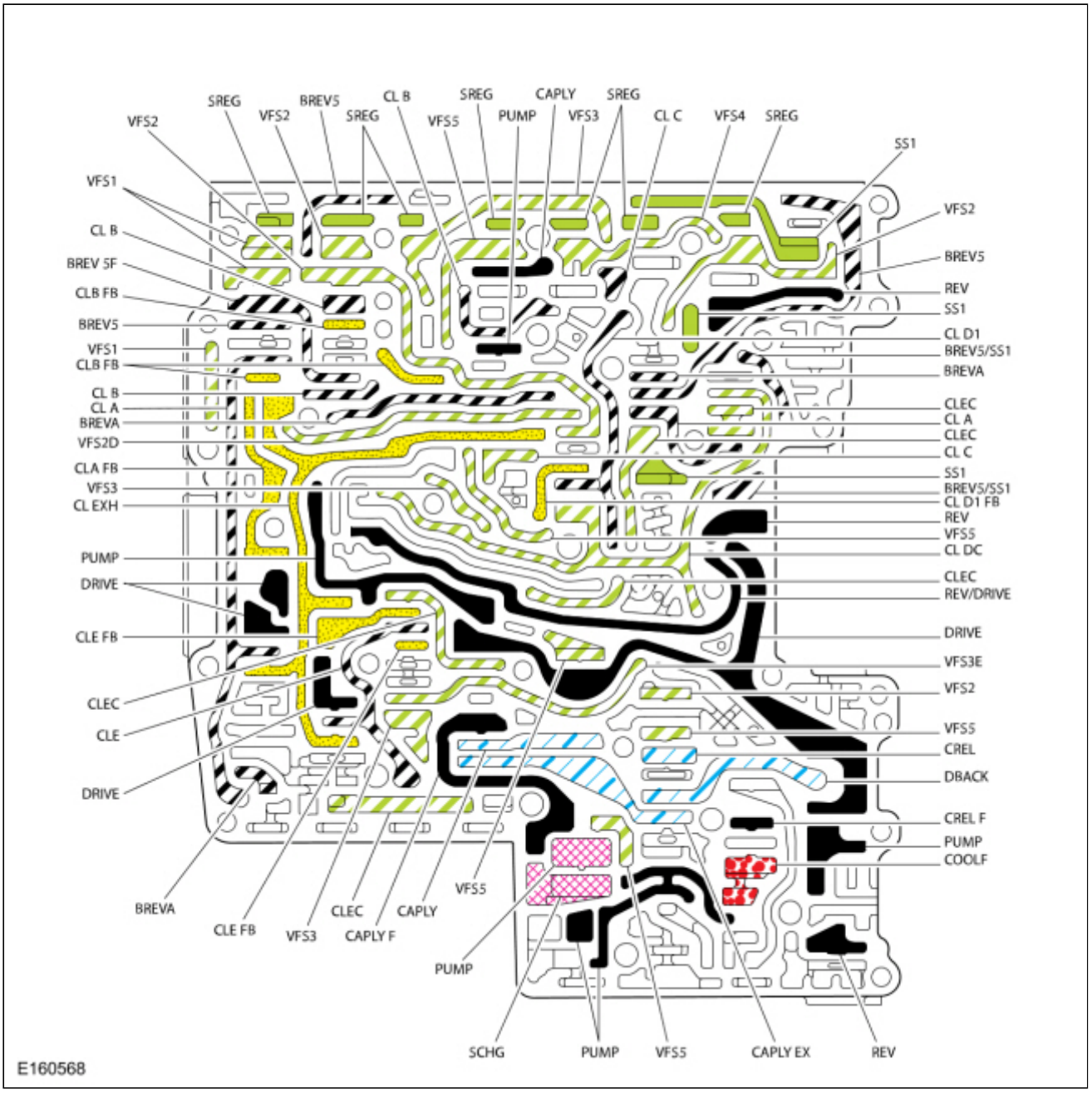
CAPLY EX	TCC release pressure from the bypass clutch control regulator valve to the converter release regulator valve.
CAPLY F	Line pressure from the PUMP circuit directed to the bypass clutch control regulator valve by the main regulator valve.
CL A	Regulated line pressure from the clutch A regulator valve to the clutch A latch valve and the forward (A) clutch to apply the clutch.
CLA FB	Regulated line pressure from the clutch A latch valve that feeds back to the clutch A regulator valve.
CL B	Regulated line pressure from the clutch B regulator valve to the clutch B latch valve and the direct (B) clutch to apply the clutch.
CLB FB	Regulated line pressure from the clutch B latch valve that feeds back to the clutch B regulator valve.
CL C	Regulated line pressure from the clutch C regulator valve to the intermediate (C) clutch to apply the clutch.
CL D1	Regulated line pressure from the clutch D1 regulator valve to the clutch D1 latch valve and the low/reverse (D) clutch to apply the clutch.
CL D1 FB	Regulated line pressure from the clutch D1 latch valve that feeds back to the clutch D1 regulator valve.
CL D2	Regulated line pressure from the clutch D2 regulator valve to the low/reverse (D) clutch to apply the clutch.
CL DC	Regulated solenoid output pressure from Shift Solenoid D (SSD) directed by the solenoid multiplex valve to the D1 and D2 regulator and latch valves to apply the low/reverse (D) clutch.
CLE	Regulated line pressure from the clutch E regulator valve to the clutch E latch valve and the Overdrive (O/D) (E) clutch to apply the clutch.
CLEC	Regulated solenoid output pressure from the CLEC F circuit directed by the drive enable valve to the clutch E regulator and latch valves to apply the clutch.
CLEC F	Regulated solenoid output pressure from the VFS4 circuit directed to the drive enable valve by the solenoid multiplex valve to move the clutch E regulator and latch valves to apply the O/D (E) clutch.
CLE FB	Regulated line pressure from the clutch E latch valve that feeds back to the clutch E regulator valve.
CL EXH	Line pressure regulated to approximately 21 kPa (3 psi) by the D2 latch valve that supplies exhaust pressure to the A, B, C, D1 and E clutch when the clutches are released.
COOLF	Pressure from the lubrication control valve to the oil cooler or the thermal bypass valve that feeds the lubrication circuit.
CREL	Pressure supplied to the torque converter by the converter release regulator valve to release the TCC.
CREL F	Line pressure from the main regulator valve that supplies the converter release regulator valve and the lubrication control valve.
DBACK	CAPLY EX pressure directed to the drain back valve by the converter release regulator valve.
DRIVE	Line pressure directed by the manual valve to the A, C and E clutch regulator valves and the No. 1 shuttle ball.
LUBE	Transmission lubrication circuit supplied by the COOLF circuit after the fluid circulates the transmission fluid cooler or is returned by the cooler bypass valve.
PUMP	Line pressure supplied by the pump to the manual valve, solenoid pressure regulator valve, main regulator valve, clutch D1 regulator valve, clutch D2 regulator valve and clutch D2 latch valve.
REV	Line pressure from the manual valve to the No. 1 shuttle ball and the solenoid multiplex valve.
REV/DRIVE	REV or DRIVE pressure from the No. 1 shuttle ball to the clutch B regulator valve.
SCHG	Line pressure from the main regulator valve to the pump suction port.
SREG	Solenoid output pressure from SSE to the drive enable valve and to shuttle ball No. 2. to direct SSD output pressure to clutch E regulator and latch valves to apply the O/D (E) clutch.
SS1	Solenoid output pressure from SSE to the drive enable valve and to shuttle ball No. 2. to direct SSD output pressure to clutch E regulator and latch valves to apply the O/D (E) clutch.
VFS1	Solenoid output pressure from SSA to the A clutch regulator and latch valve to apply the forward (A) clutch.
VFS2	Solenoid output pressure from SSB to the B clutch regulator and latch valve to apply the direct (B) clutch and is also routed to the D1 latch valve.
VFS2D	SSB output pressure from the VFS2 circuit directed to the clutch B regulator valve by the D1 latch

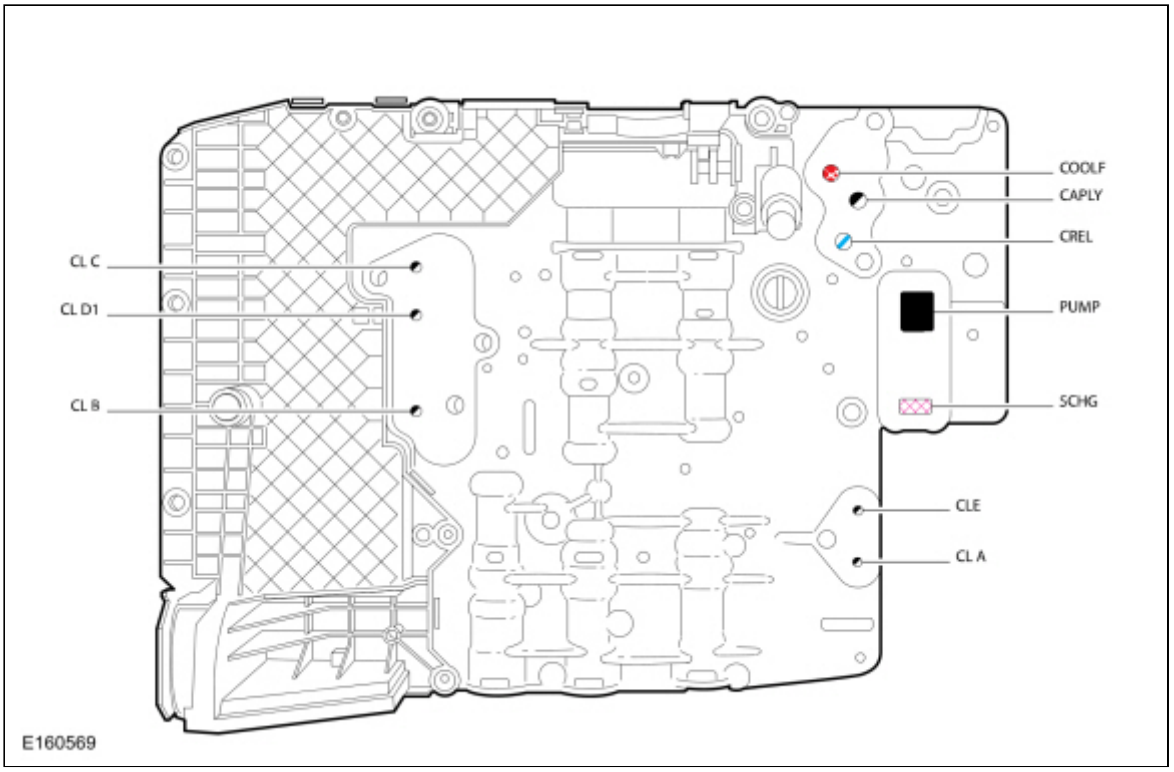
	valve.
VFS3	Solenoid output pressure from SSC to the C clutch regulator valve to apply the intermediate (C) clutch and is also routed to the clutch E latch valve.
VFS3E	SSC output pressure from the VFS3 circuit directed to the clutch C regulator valve by the clutch E latch valve.
VFS4	Solenoid output pressure from SSD to the solenoid multiplex valve to apply either the D or E clutch.
VFS5	Solenoid output pressure from the LPC solenoid to the main regulator valve to control line pressure.
VFS6	Solenoid output pressure from the TCC solenoid to the bypass clutch control regulator valve and the converter release regulator valve to control the TCC.

Main Control Hydraulic Passage Identification




CLB
VFS5
VFS5
PUMP
SREG
CLBFB
CLB
VFS3
SREG
CLBFB
VFS4
CLB
BREVS
CLBFB
SREG
VFS3
SREG
SREG
CLB
CLC
BREVS
SREG
VFS4
VFS6
SS1
REV
SS1
VFS6
BREVS/SS1
CL D1
BREVA
VFS4
BREVS/SS1
CL EXH
CL C
SS1
BREVS/SS1
CL D1 FB
VFS5
REV
DRIVE
REV/DRIVE
CLEC
CL D1
CLEC
CL DC
VFS5
DRIVE
VFS3E
VFS6
CAPLY
VFS5
CREL
DBACK
CREL F
COOLF
REV
PUMP
PUMP
VFS6
CLEC
CAPLY
CLE
SCHG
VFS2
VFS1
BREVS
VFS2
VFS1
VFS5
BREVS
VFS1
CL B
BREV 5F
CL EXH
BREVA
VFS1
VFS2D
CL EXH
VFS3
CL DC
PUMP
CL C
REV/DRIVE
CL DC
VFS3
PUMP
DRIVE
DRIVE
CL EXH
PUMP
CL EXH
DRIVE
CLE FB
CLEC
VFS3
VFS1
BREVA
CL A
E160567


VFS2
SREG
VFS2
BREV5
SREG
CL B
VFS5
SREG
PUMP
CAPLY
VFS3
SREG
CL C
VFS4
SREG
SS1
VFS1
CL B
BREV 5F
CLB FB
BREV5
VFS1
CLB FB
CL B
CL A
BREVA
VFS2D
CLA FB
VFS3
CL EXH
PUMP
DRIVE
CLE FB
CLEC
CLE
DRIVE
VFS2
BREV5
REV
SS1
CL D1
BREV5/SS1
BREVA
CLEC
CL A
CLEC
CL C
SS1
BREV5/SS1
CL D1 FB
REV
VFS5
CL DC
CLEC
REV/DRIVE
DRIVE
VFS3E
VFS2
VFS5
CREL
DBACK
CREL F
PUMP
COOLF
BREVA
CLE FB
VFS3
CLEC
CAPLY F
CAPLY
VFS5
PUMP
SCHG
PUMP
VFS5
CAPLY EX
REV
E160568

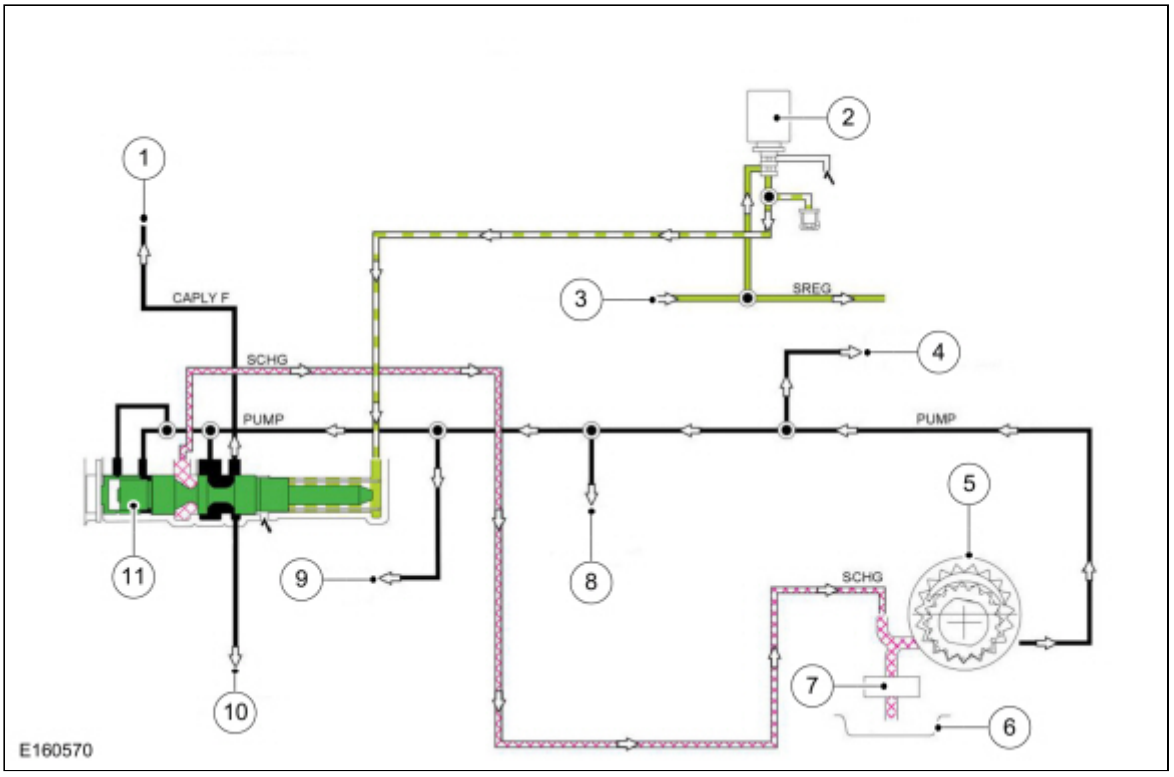


Line Pressure Hydraulic Circuits

The Transmission Control Module (TCM) controls line pressure with the Line Pressure Control (LPC) solenoid. Varying pressure from the LPC solenoid effects shift feel while allowing sufficient pressure for clutch application.

When the engine is running, the pump supplies pressure to the main regulator valve through the PUMP circuit. The position of the main regulator valve controls line pressure (in the PUMP circuit). Pressure from the LPC solenoid through the VFS5 circuit controls the position of the main regulator valve.

The main regulator valve varies pressure in the SCHG circuit. The higher the pressure in the SCHG circuit, the lower the line pressure (PUMP circuit) is. As SCHG pressure decreases, line pressure (PUMP circuit) increases.

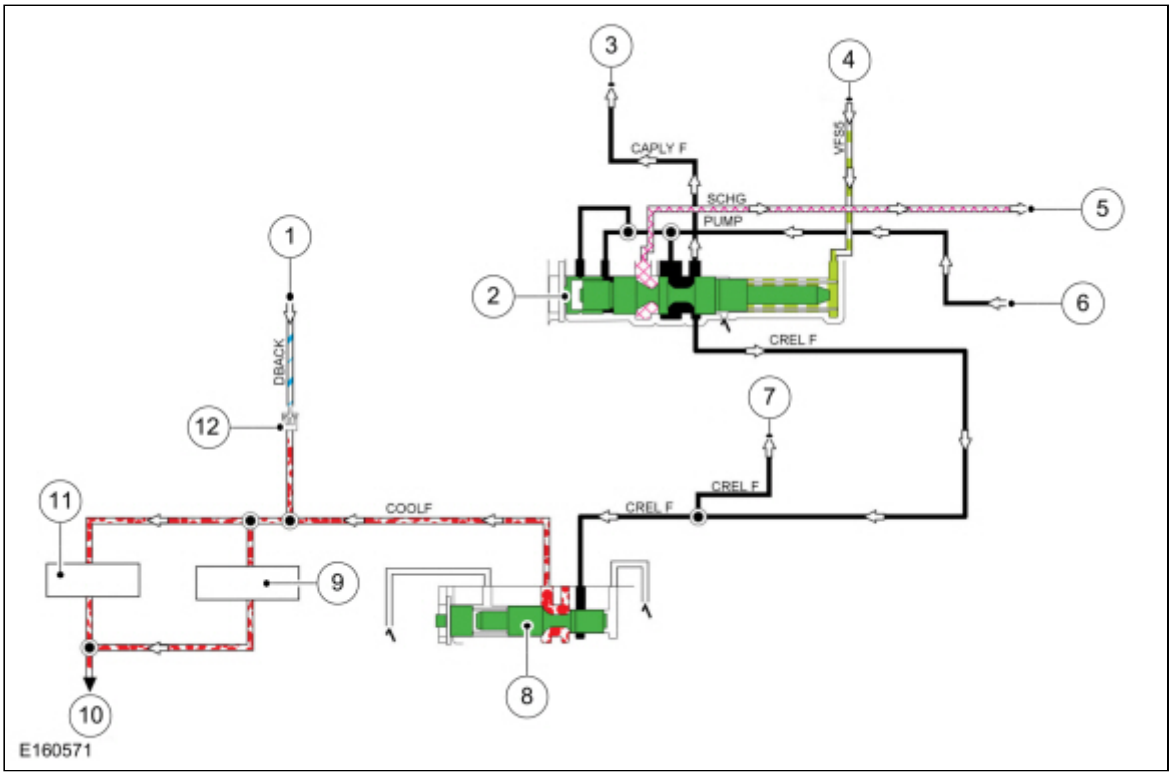


Lubrication Hydraulic Circuits

The main regulator valve supplies pressure to the lubrication control valve through the CREL F circuit. When the Torque Converter Clutch (TCC) is applied, the lubrication control valve supplies the transmission lubrication through the COOLF circuit to the LUBE circuit.

When the TCC is released, return fluid from the torque converter is supplied to the LUBE circuit through the CAPLY, CAPLY EX and DBACK circuits.

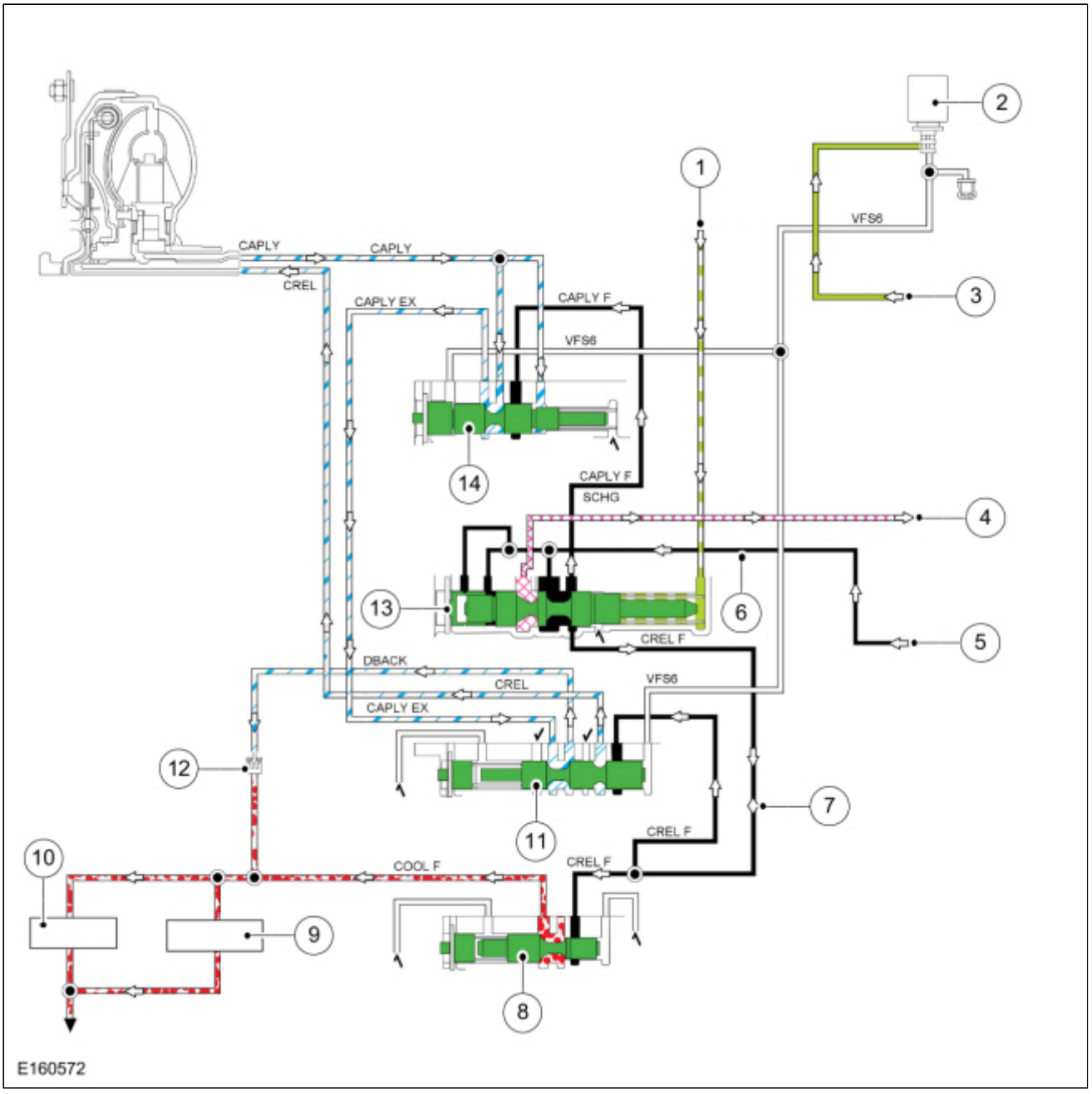
Pressure in the LUBE circuit either circulates through the thermal bypass valve when Transmission Fluid Temperature (TFT) is below operating temperature or through the transmission fluid cooler when the transmission fluid is at or above operating temperature. Return fluid from the thermal bypass valve or the transmission fluid cooler enters the input shaft through the pump assembly and flows through passages in the input shaft, intermediate shaft and output shaft to provide lubrication for the transmission.



Torque Converter Hydraulic Circuits

When the TCC is released, line pressure is supplied to the converter release regulator valve from the lubrication control valve through the CREL F circuit. The converter release regulator valve supplies pressure to the torque converter through the CREL circuit to release the torque converter.

CREL pressure exits the torque converter through the CAPLY circuit and goes to the bypass clutch control regulator valve. The bypass clutch control regulator valve directs the fluid back to the converter release regulator valve through the CAPLY EX circuit. The converter release regulator valve directs the fluid to the DBACK circuit where it supplies lubrication in the LUBE circuit.



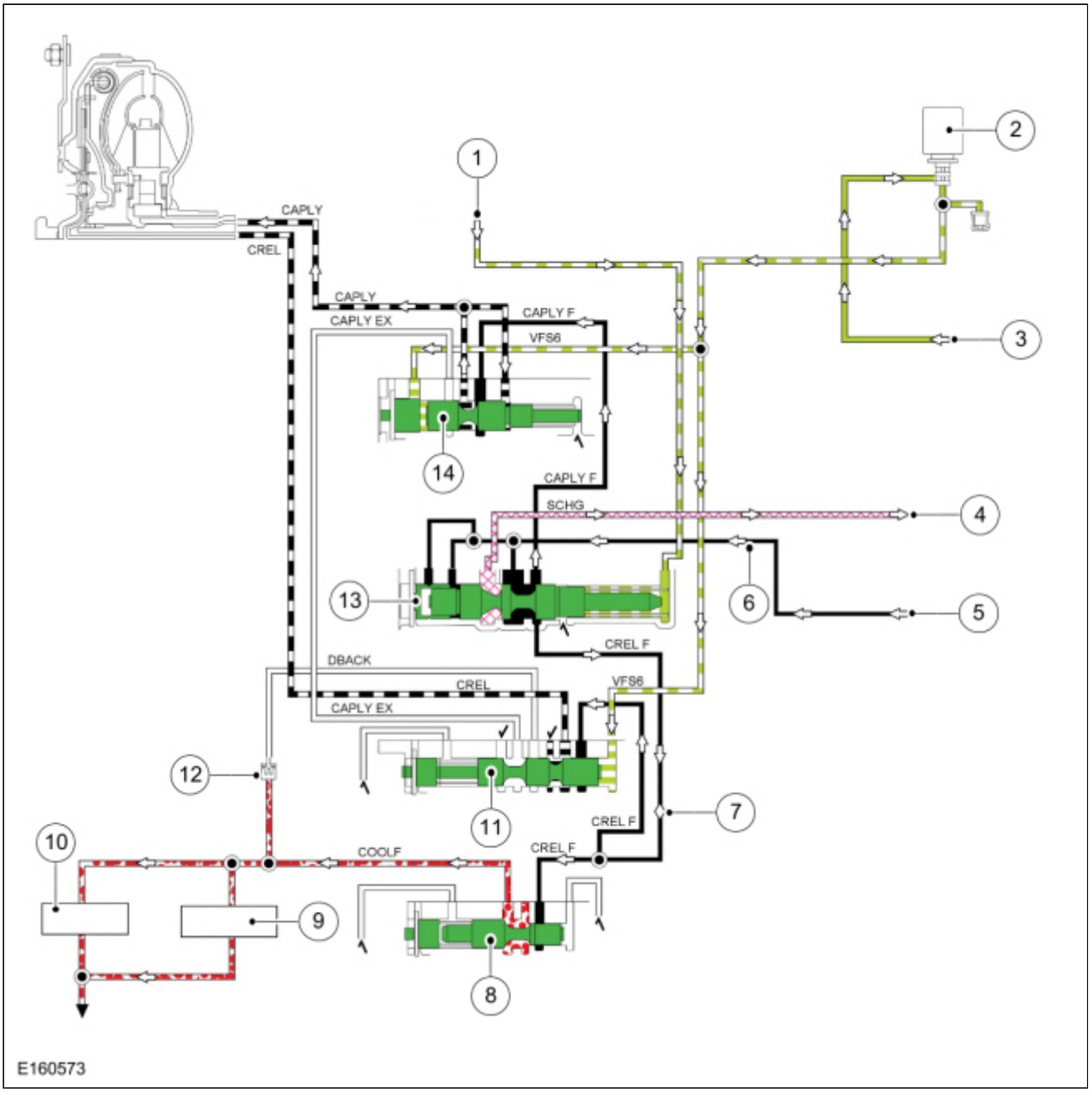
Torque Converter Hydraulic Circuits

When the TCC is applied, the TCC solenoid applies hydraulic pressure to the bypass clutch control regulator valve and the converter release regulator valve through the VFS6 circuit to position the valves to apply the TCC.

Line pressure is supplied to the bypass clutch control regulator valve from the main regulator valve. The bypass clutch control regulator valve directs regulated line pressure to the TCC through the CAPLY circuit to apply the TCC.

CAPLY pressure exits the torque converter through the CREL circuit and goes to the converter release regulator valve.

For torque converter description and function, refer to Torque Converter in this section.



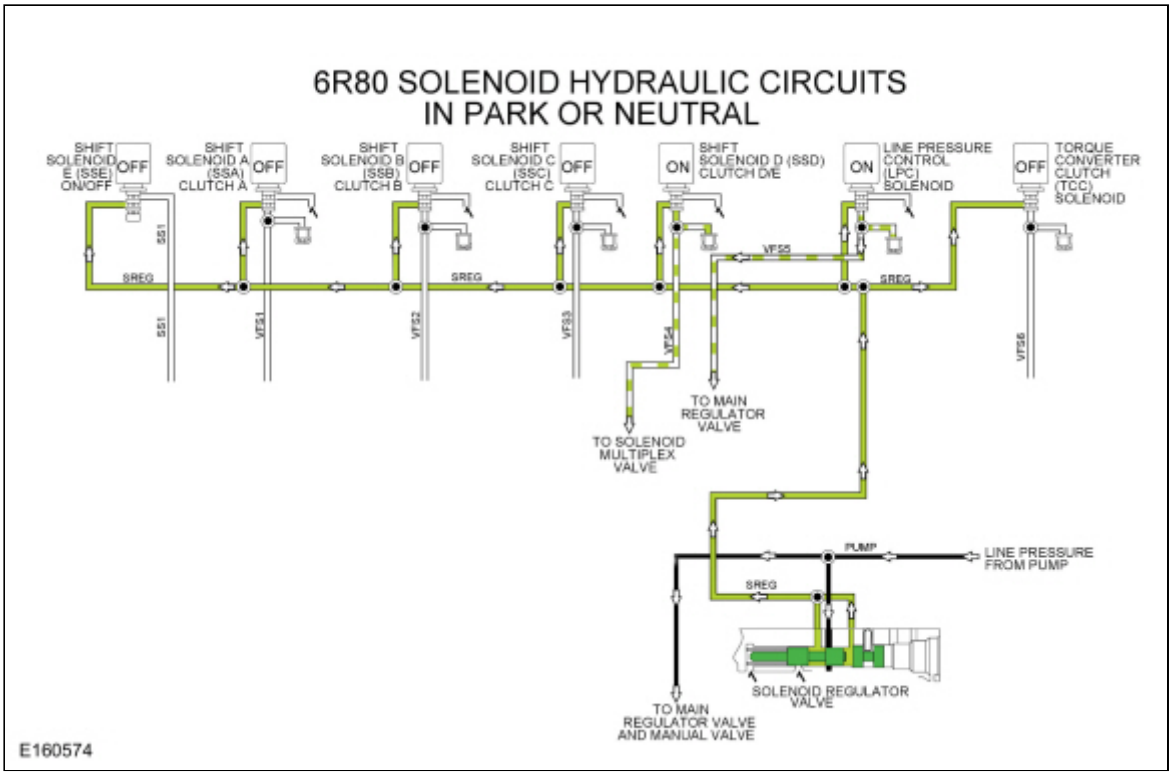
Solenoid Hydraulic Circuits

LINE pressure from the pump is directed to the individual shift, TCC and LPC solenoids by the solenoid regulator valve through the SREG circuit. The solenoids, controlled by the TCM, direct full or regulated SREG pressure to the valves that they control.

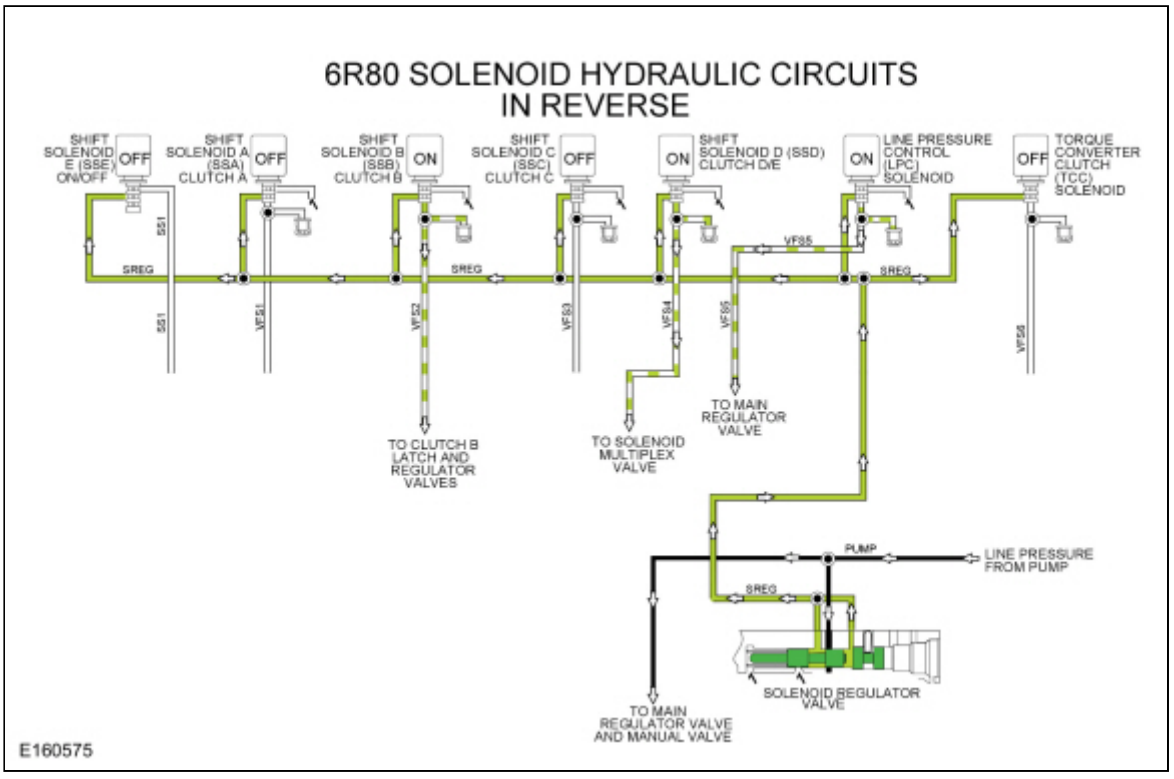
For electrical operation of the solenoids, refer to Transmission Electronic Control System in this section.

The LPC solenoid sends varying pressure to the main regulator valve to control line pressure.

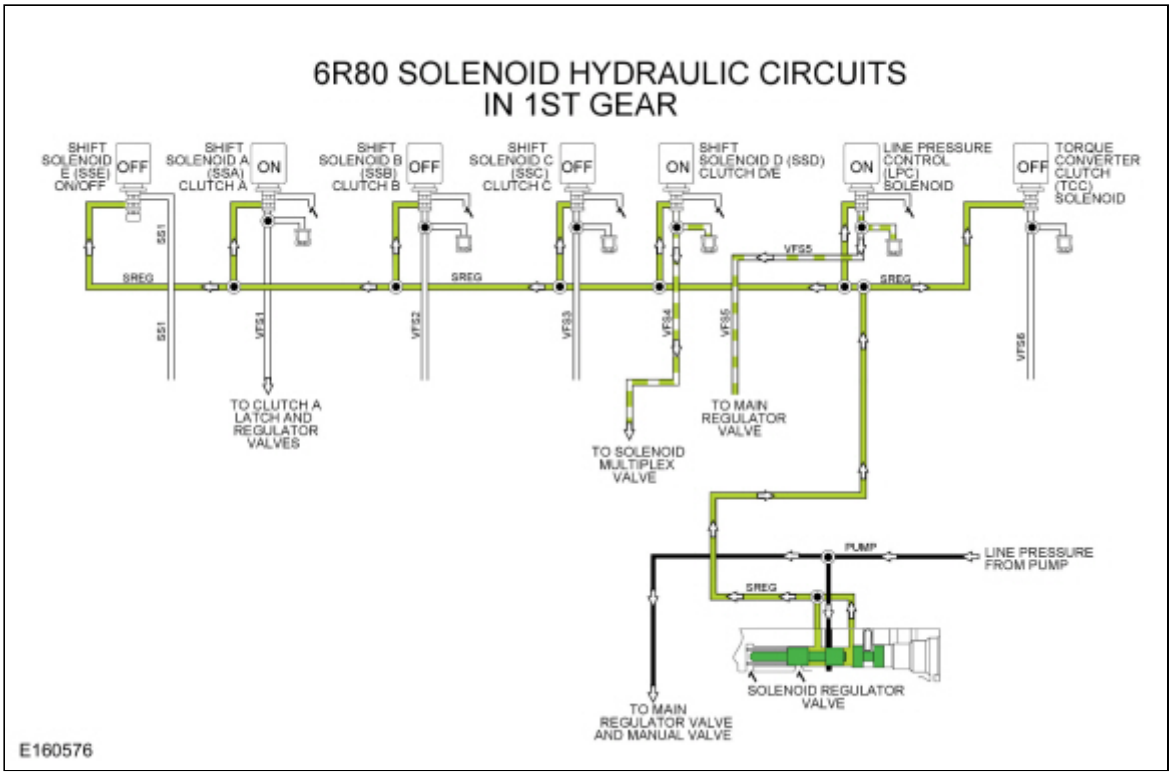
In the PARK and NEUTRAL position, the TCM supplies low amperage to Shift Solenoid D (SSD) to apply highregulated pressure to the solenoid multiplex valve which directs the pressure to the D1 and D2 regulator and latch valves to apply the low/reverse clutch (D).



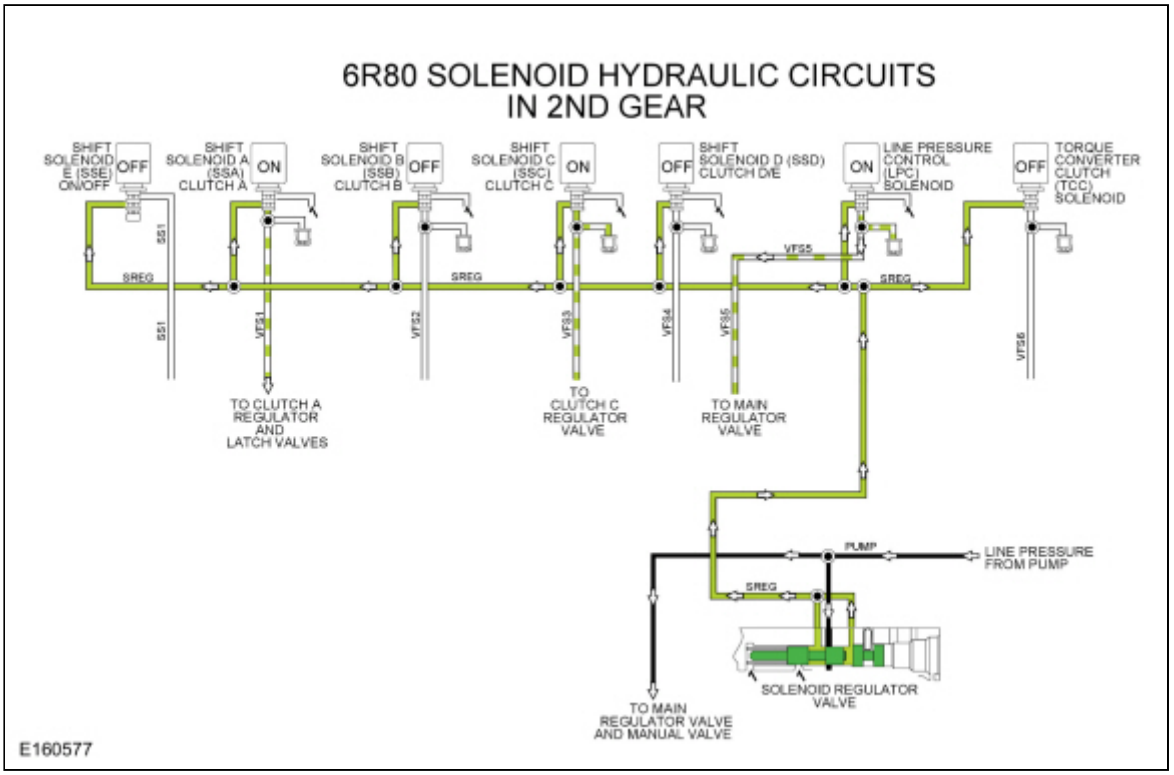
In the REVERSE position, the TCM supplies low amperage to Shift Solenoid B (SSB) to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B). The TCM also supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 and D2 regulator and latch valves to apply the low/reverse clutch (D).



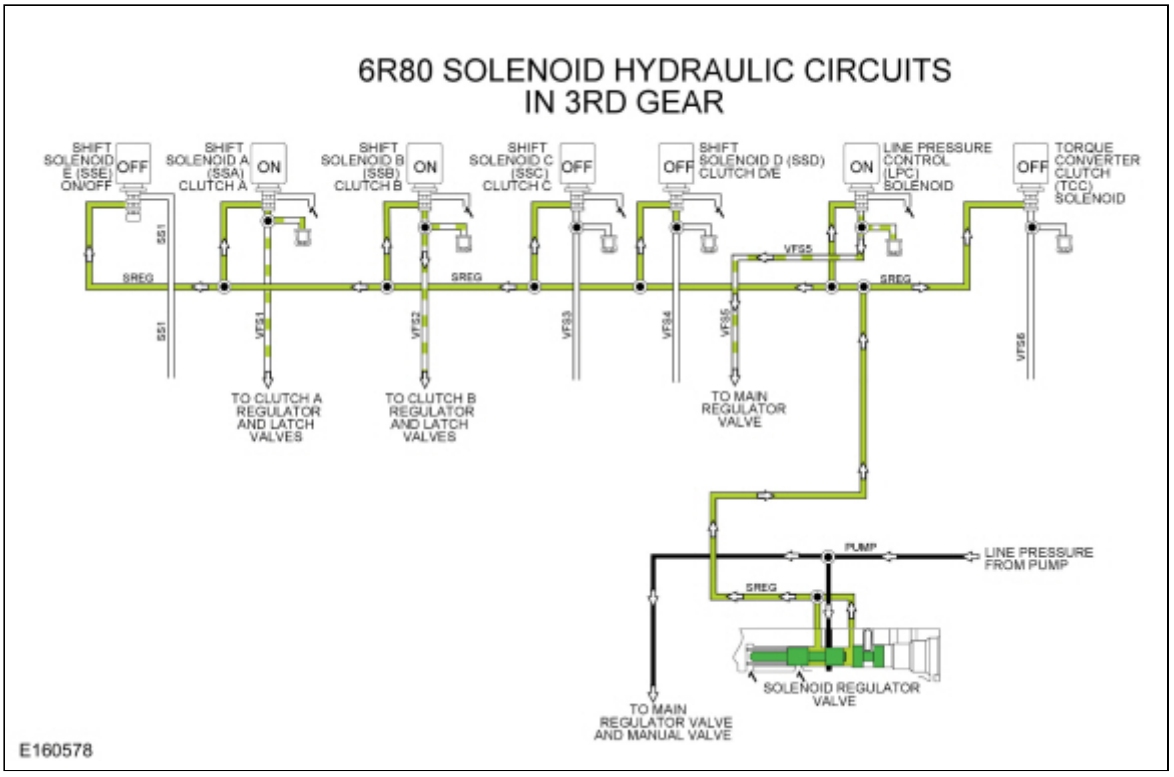
In 1st gear, the TCM supplies high amperage to Shift Solenoid A (SSA) to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies low amperage to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 and D2 regulator and latch valves to apply the low/reverse clutch (D).



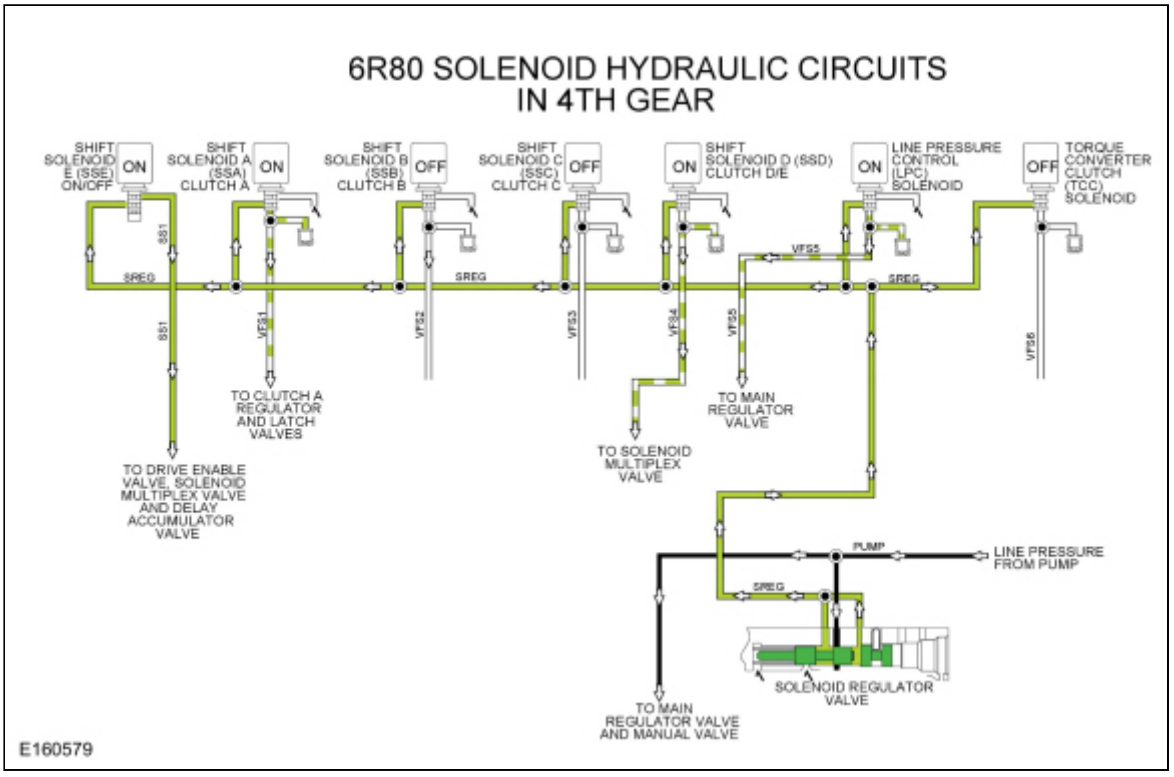
In 2nd gear, the TCM supplies high current to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The PCM also supplies high current to Shift Solenoid C (SSC) to apply high-regulated pressure to the clutch C regulator valve to apply the intermediate clutch (C).



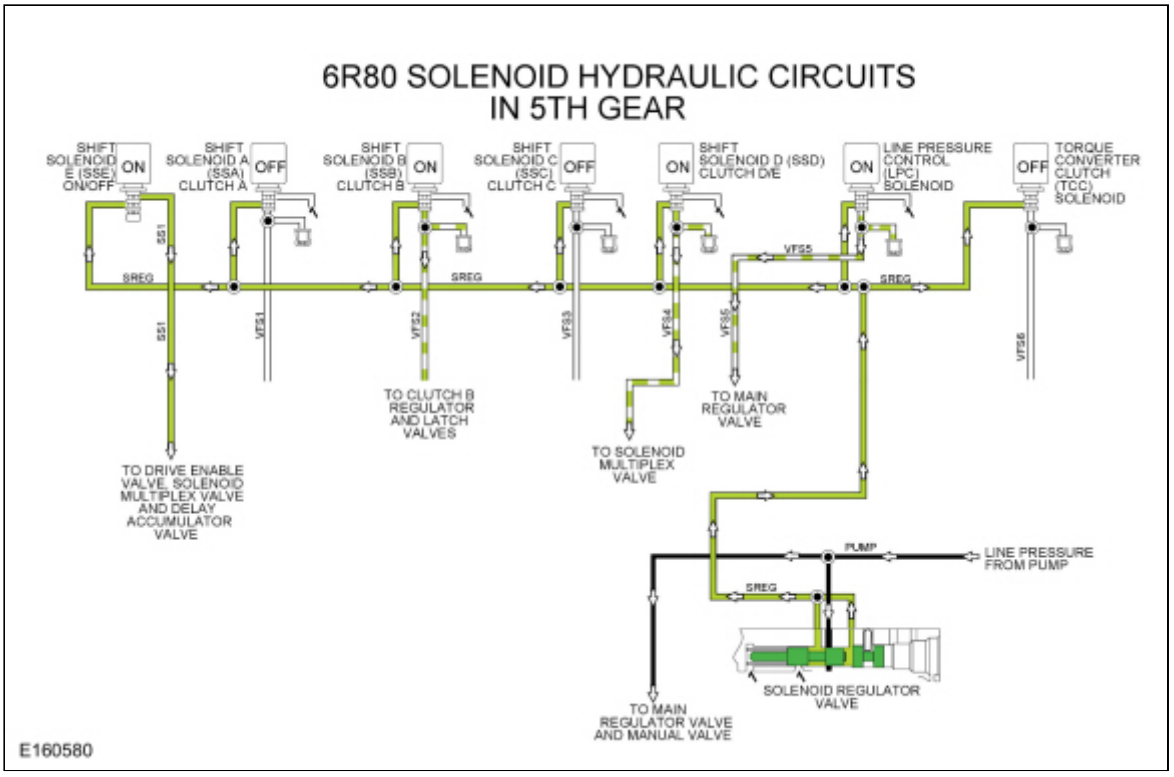
In 3rd gear, the TCM supplies high current to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies low current to Shift Solenoid B (SSB) to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B).



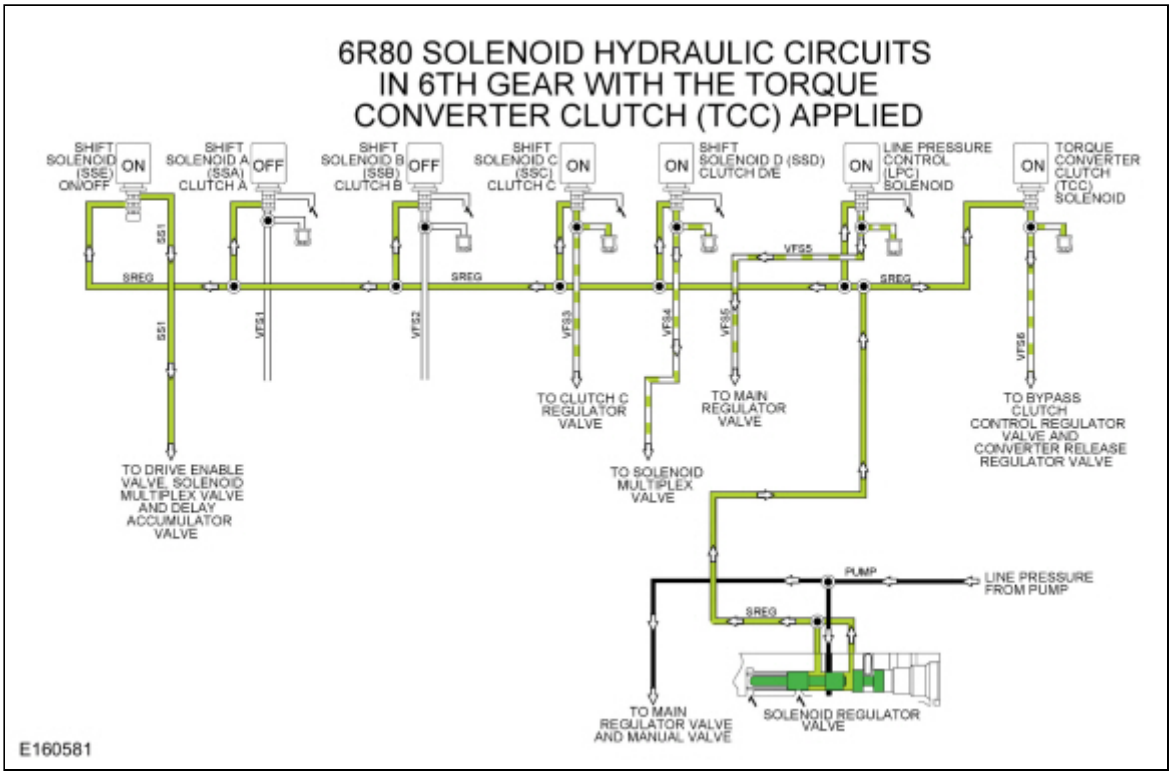
In 4th gear, the TCM supplies high current to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The TCM also supplies low current to SSD to apply highregulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the overdrive clutch (E). The TCM turns on Shift Solenoid E (SSE) to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves.



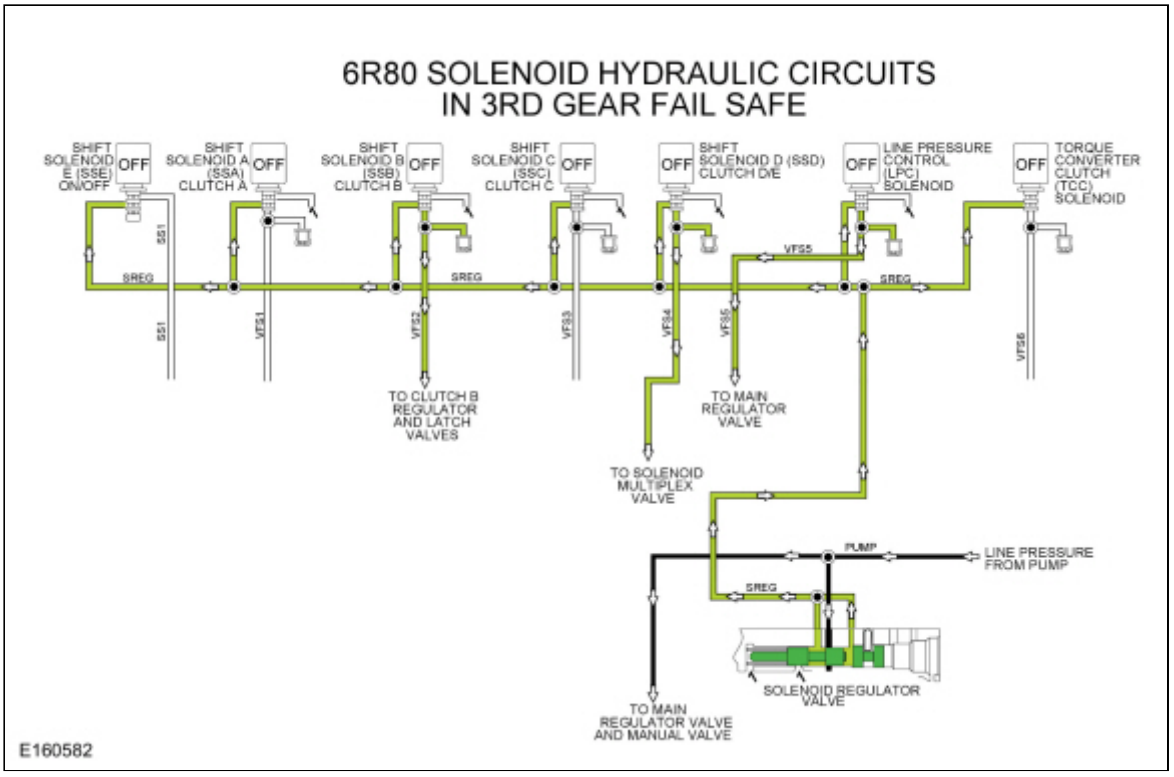
In 5th gear, the TCM supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the overdrive clutch (E). The TCM turns on SSE to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves. The TCM also supplies low current to SSB to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B).



In 6th gear, the TCM supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the overdrive clutch (E). The TCM turns on SSE to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves. The TCM also supplies high current to SSC to apply high-regulated pressure to the clutch C regulator valve to apply the intermediate clutch (C). To apply the TCC, the TCM supplies high current to the TCC solenoid to apply high-regulated pressure to the converter release regulator valve and the bypass clutch control regulator valve to apply the TCC.



In 3rd gear fail safe, all solenoids are off. SSB, in the off position, applies high pressure to the clutch B regulator and latch valves to apply the direct clutch (B). The forward clutch (A) is hydraulically applied in 3rd gear fail safe. The LPC solenoid provides maximum solenoid pressure to the main regulator valve for maximum line pressure. Also, SSD is on which applies high pressure to the solenoid multiplex valve which is directed to the drive enable valve where it is blocked.

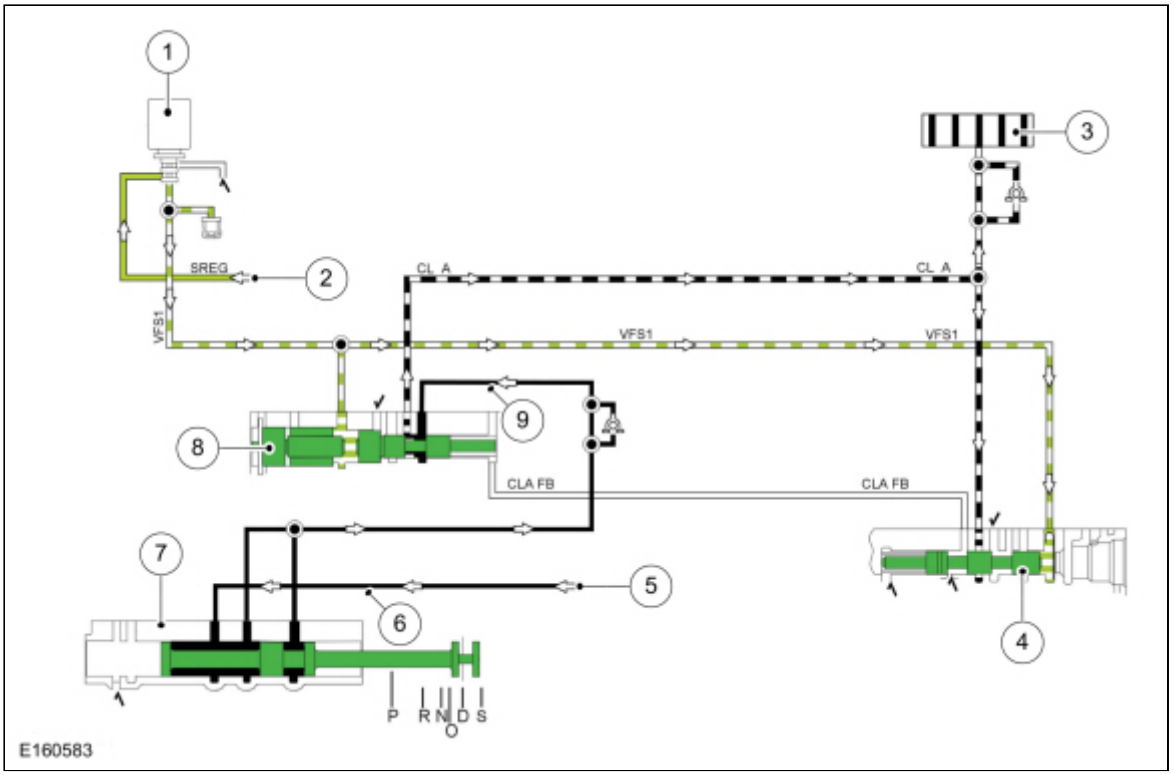


Forward Clutch (A) Hydraulic Circuits

To apply the forward clutch (A), the manual valve must be in the DRIVE, 3, 2 or 1 position to provide line pressure to the clutch A regulator valve through the DRIVE circuit.

For the forward clutch (A) to apply, SSA provides regulated solenoid pressure from the SREG circuit to the clutch A regulator and latch valves through the VFS1 circuit to position the valves to apply the forward clutch (A). As the forward clutch is applied, SSA increases pressure to the clutch A regulator and latch valves.

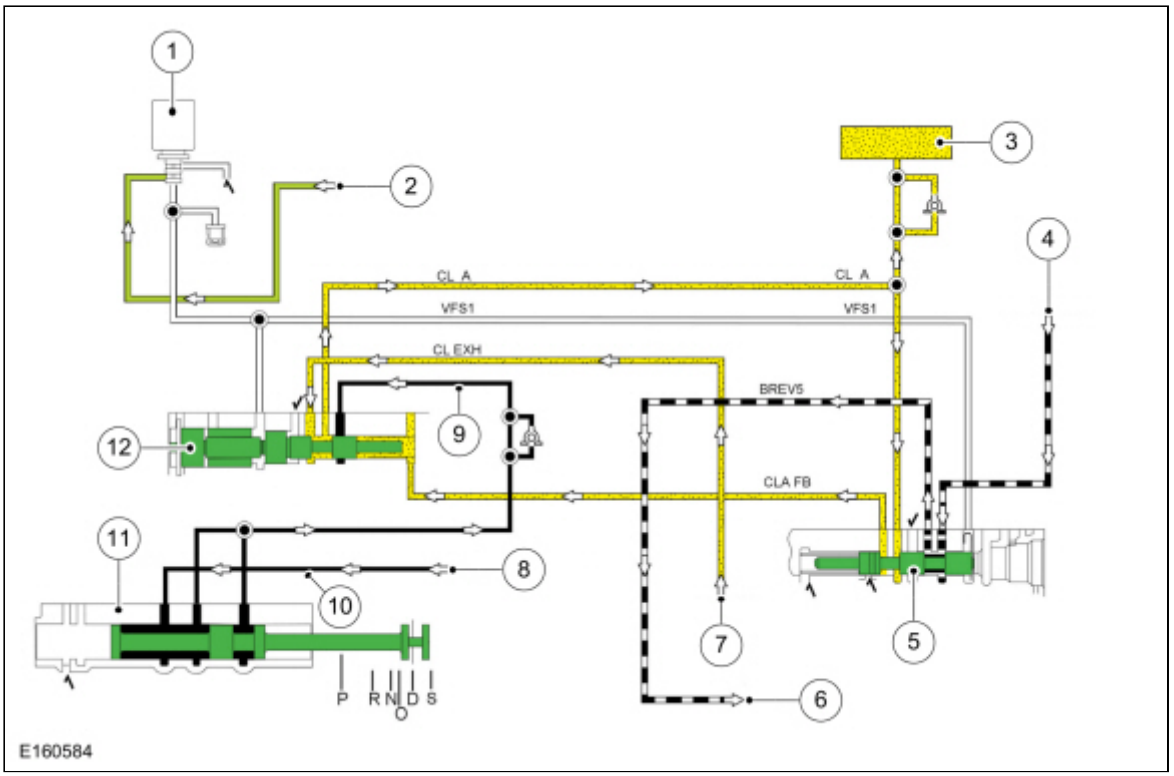
The clutch A regulator valve provides regulated line pressure to the CL A circuit to apply the forward clutch (A).



The forward clutch (A) is released when the manual valve is in the NEUTRAL, REVERSE or PARK position or the when the manual valve is in the DRIVE position with the transmission in 5th or 6th gear.

SSA lowers pressure to the clutch A regulator and latch valve to position the valves to lower the regulated line pressure in the CL A circuit to release the clutch.

When the forward clutch (A) is released, the clutch A regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL A circuit to fill the circuit and the forward clutch (A) with fluid at low pressure, approximately 21 kPa (3 psi).

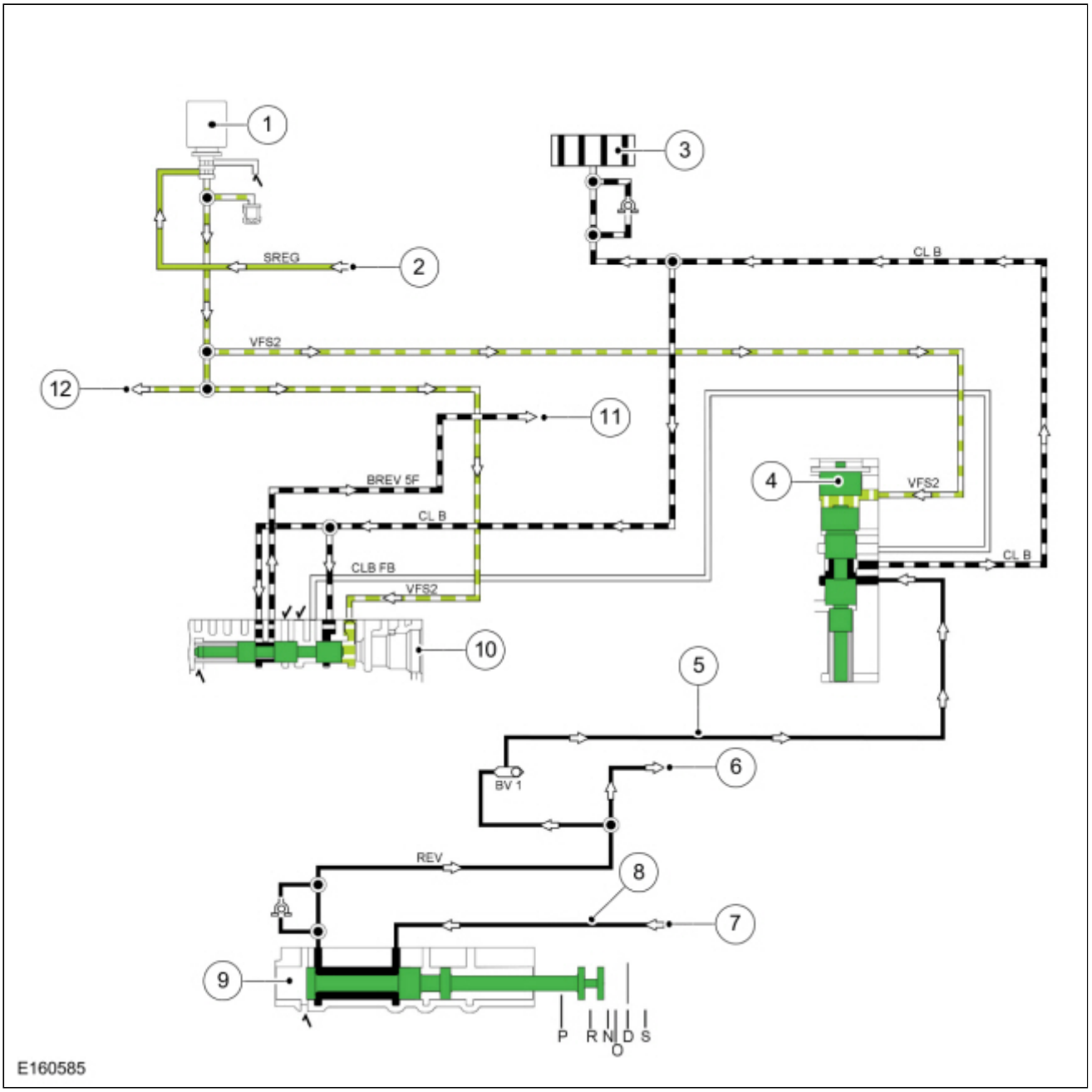


Direct Clutch (B) Hydraulic Circuits

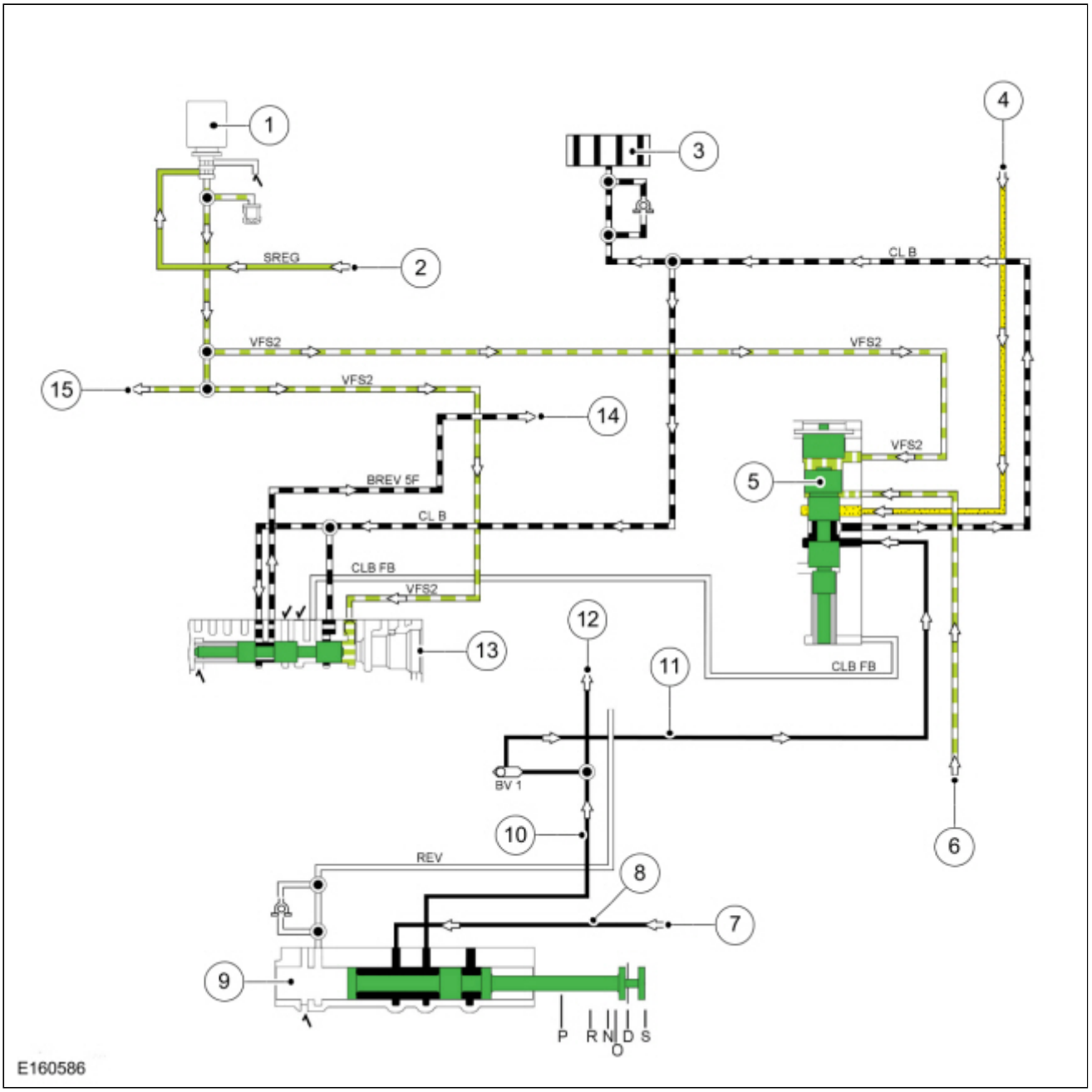
To apply the direct clutch (B), the manual valve can be in the REVERSE, DRIVE, 3, 2 or 1 position to provide line pressure to the clutch B regulator valve through the REV/DRIVE circuit.

For the direct clutch (B) to apply in reverse, SSB provides regulated solenoid pressure from the SREG circuit to the clutch B regulator and latch valves through the VFS2 circuit to position the valves to apply the direct clutch (B). As the direct clutch is applied, SSB increases pressure to the clutch B regulator and latch valves.

The clutch B regulator valve provides regulated line pressure to the CL B circuit to apply the direct clutch (B).

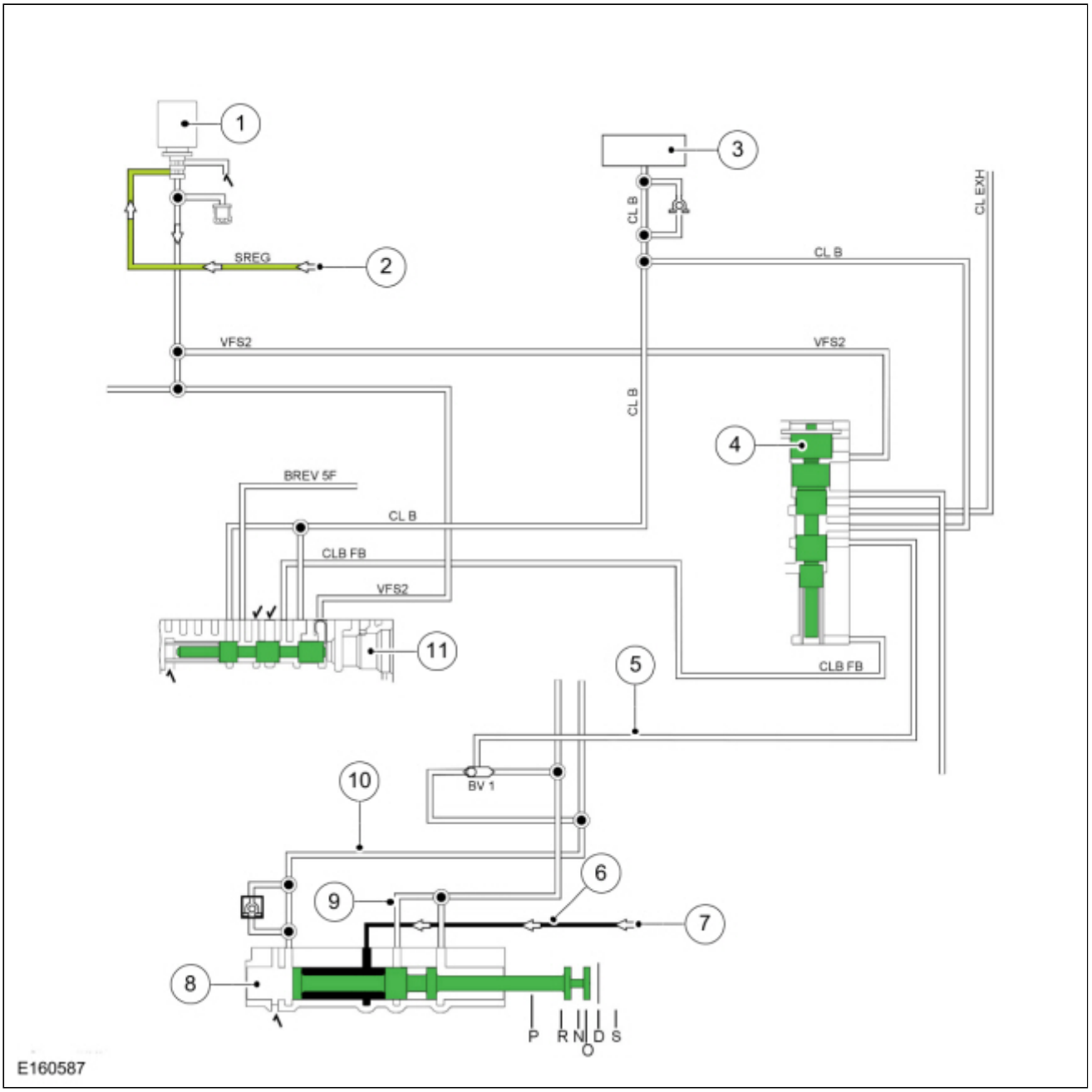


When the direct clutch (B) is applied in 3rd and 5th gear, regulated solenoid pressure from the D1 latch valve is supplied to the clutch B regulator valve through the VFS2D circuit and opposes pressure from the VFS2 circuit for clutch B valve positioning.



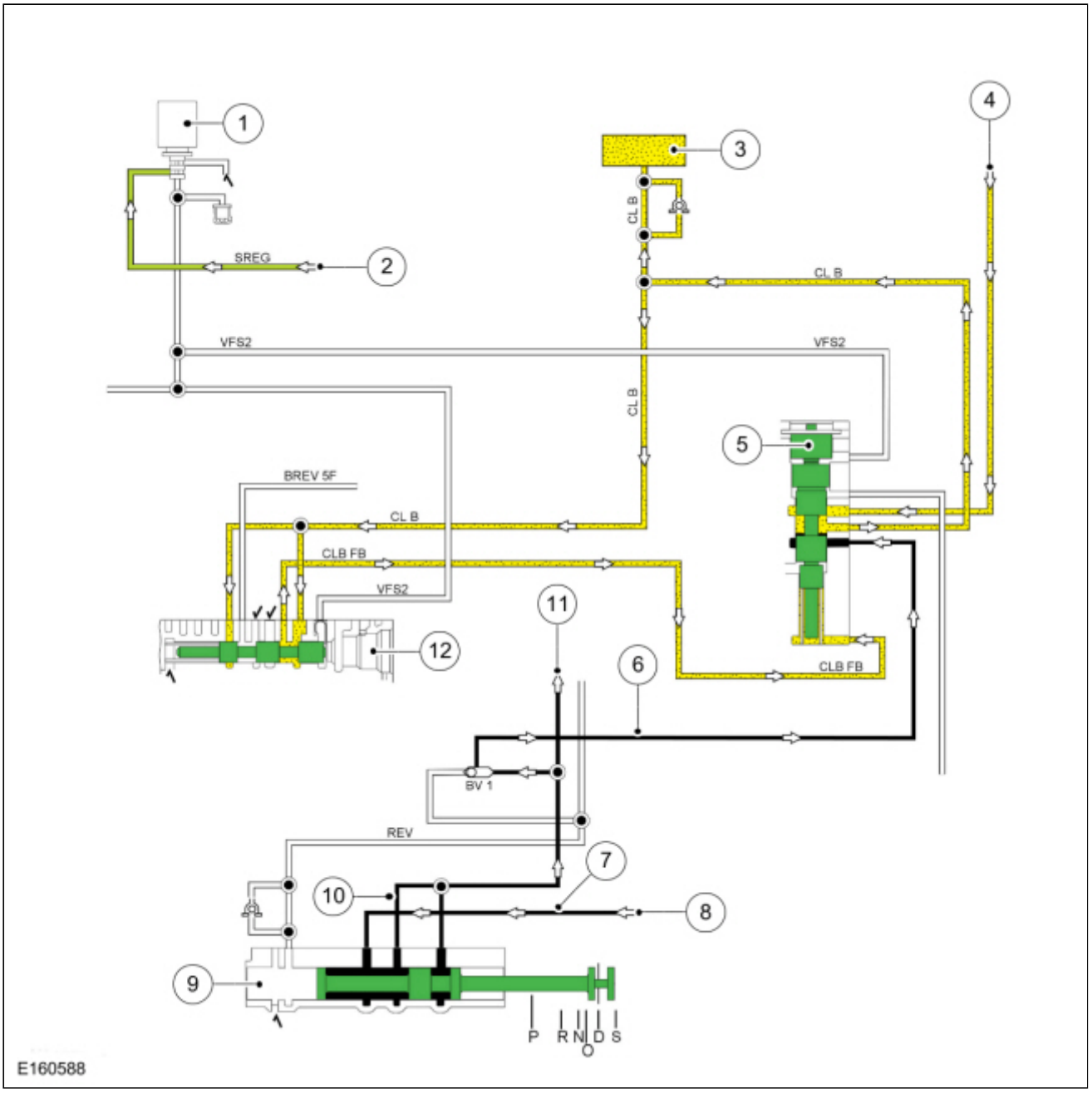
The direct clutch (B) is released when the manual valve is in the PARK or NEUTRAL position or when the manual valve is in the DRIVE position with the transmission in 1st, 2nd, 4th or 6th gear.

In NEUTRAL or PARK, the manual valve does not supply line pressure to the clutch B regulator valve. SSB lowers pressure to the clutch B regulator and latch valve to position the valves to lower the regulated line pressure in the CL B circuit to release the clutch.



In 1st, 2nd, 4th or 6th gear, the manual valve supplies line pressure to the clutch B regulator valve. SSB lowers pressure to the clutch B regulator and latch valve to position the valves to lower the regulated line pressure in the CL B circuit to release the clutch.

When the direct clutch (B) is released in 1st, 2nd, 4th or 6th gear, the clutch (B) regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL B circuit to fill the circuit and the direct clutch (B) with fluid at low pressure, approximately 21 kPa (3 psi).



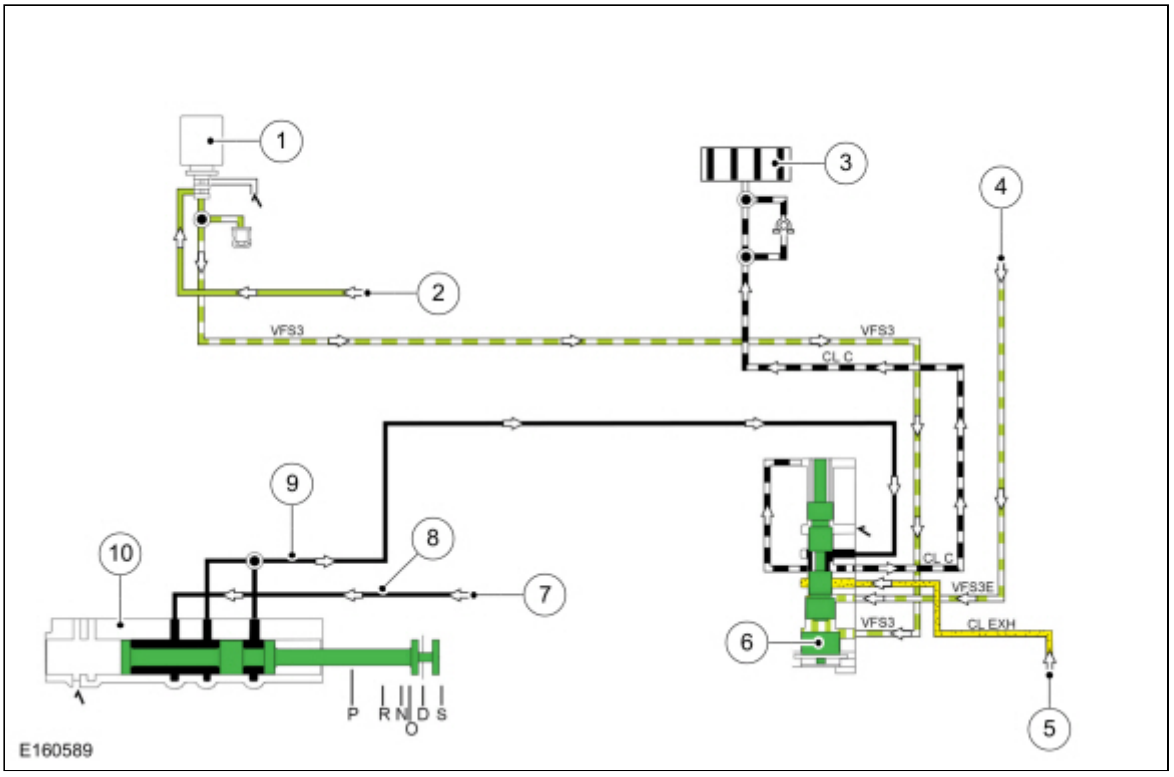
Intermediate Clutch (C) Hydraulic Circuits

To apply the intermediate clutch (C), the manual valve can be in the DRIVE, 3, 2 or 1 position to provide line pressure to the clutch C regulator valve through the DRIVE circuit.

SSC provides regulated solenoid pressure from the SREG circuit to the clutch C regulator valve through the VFS3 circuit to position the valve to apply the intermediate clutch (C). As the intermediate clutch (C) is applied, SSC increases pressure to the clutch C regulator valve.

The clutch C regulator valve provides regulated line pressure to the CL C circuit to apply the intermediate clutch (C).

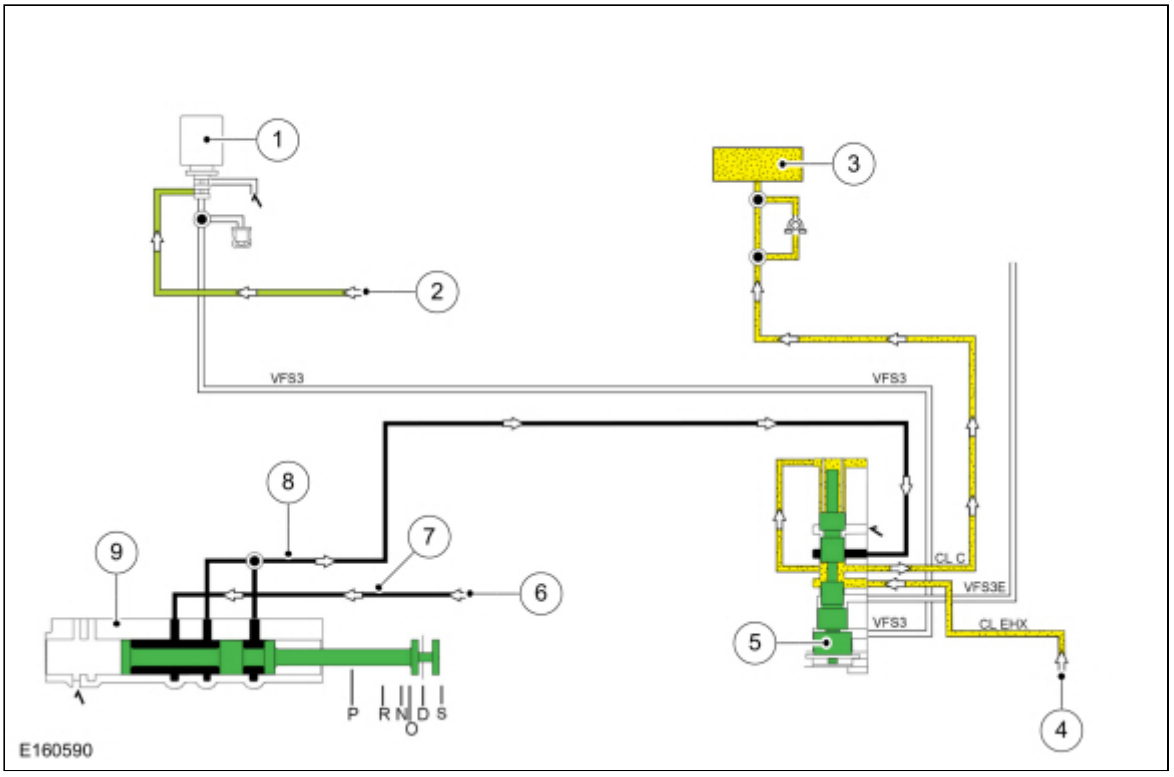
Regulated solenoid pressure from the clutch E latch valve is supplied to the clutch C regulator valve through the VFS3E circuit and opposes VFS3 pressure for clutch C regulator valve positioning in 6th gear only.



To release the intermediate clutch (C) when the manual valve is in the DRIVE, 3, 2 or 1 position SSC lowers pressure to the clutch C regulator valve to position the valve to lower the regulated line pressure in the CL C circuit to release the clutch.

When the intermediate clutch (C) is released, the clutch C regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL C circuit to fill the CL C circuit and the intermediate clutch (C) with fluid at low pressure, approximately 21 kPa (3 psi).

In PARK, REVERSE or NEUTRAL, the manual valve does not supply line pressure to the clutch C regulator valve.



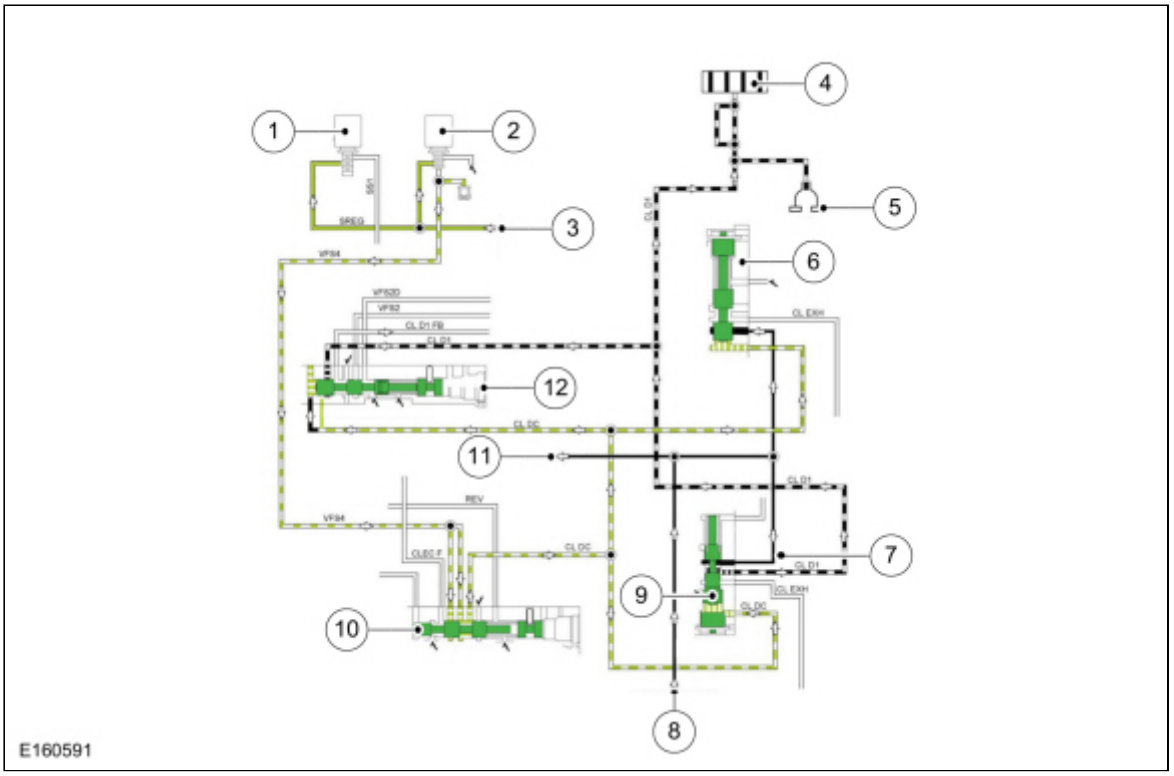
Low/Reverse Clutch (D) Hydraulic Circuits

To apply the low/reverse clutch (D), the manual valve can be in any position. Line pressure is supplied to the D1 and D2 regulator and latch valves by the pump through the PUMP circuit.

SSD provides regulated solenoid pressure from the SREG circuit to the solenoid multiplex valve through the VFS4 circuit where it is directed to the D1 and D2 regulator and latch valves through the CL DC circuit to position the

valves to apply the low/reverse clutch (D). As the low/reverse clutch (D) is applied, SSD increases pressure to the D1 and D2 clutch regulator and latch valves.

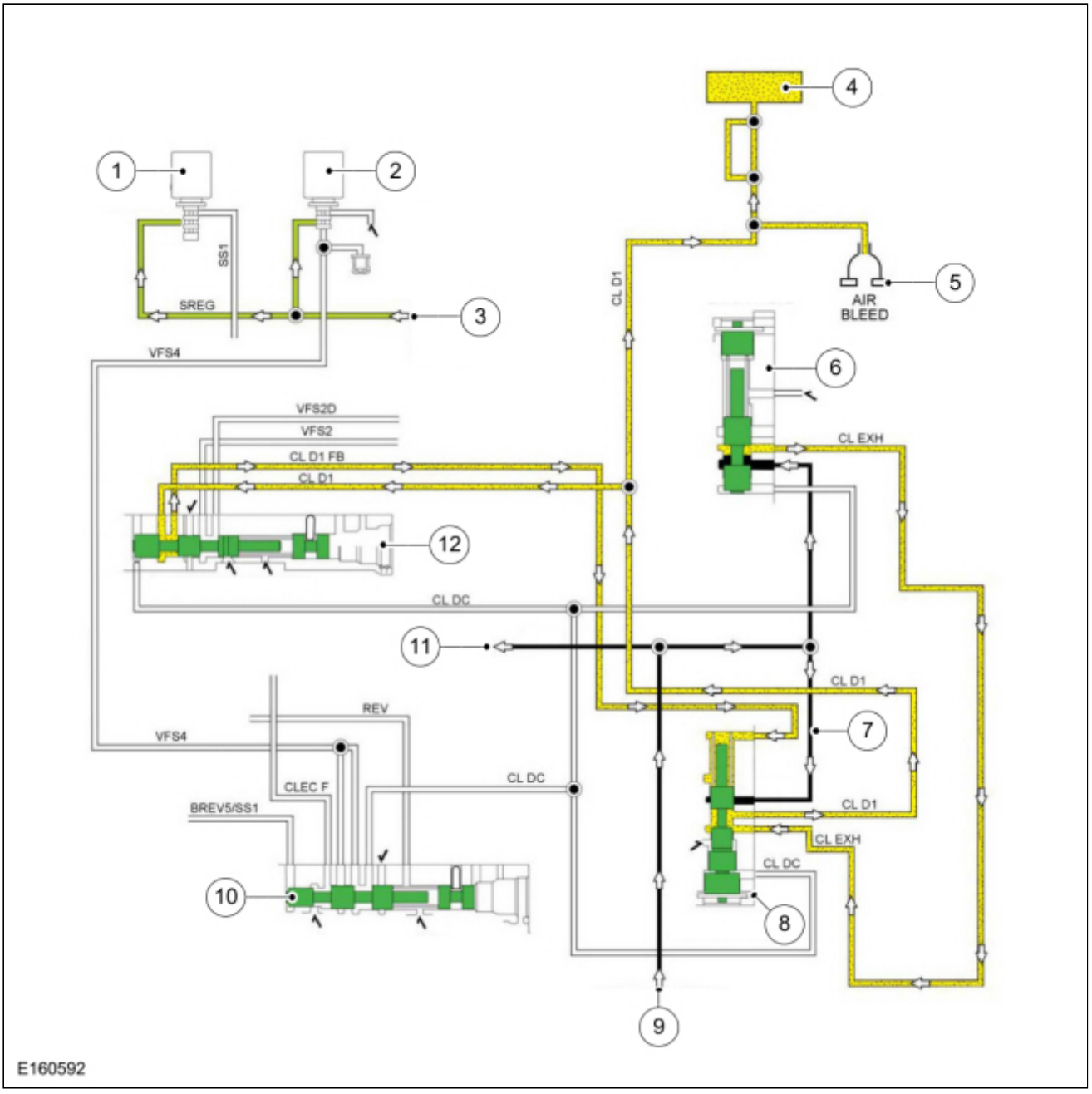
The clutch D1 and D2 regulator valves provide regulated line pressure from the PUMP circuit to the CL D1 and CL D2 circuits to apply the low/reverse clutch (D).



To release the low/reverse clutch (D), the manual valve can be in the DRIVE, 3 or 2 position. SSD lowers pressure to the VFS4 circuit which lowers pressure in the CL DC circuit to position the D clutch regulator and latch valves to lower pressure in the CL D1 circuit and release the low/reverse clutch (D).

When the low/reverse clutch (D) is released, the clutch D2 latch valve directs line pressure regulated to approximately 21 kPa (3 psi) to the CL EXH circuit which fills the volume of the unused clutches and circuits.

When the low/reverse clutch (D) is released, the CL EXH circuit supplies the D1 regulator valve which fills the CL D1 circuit and the low/reverse (D) clutch.

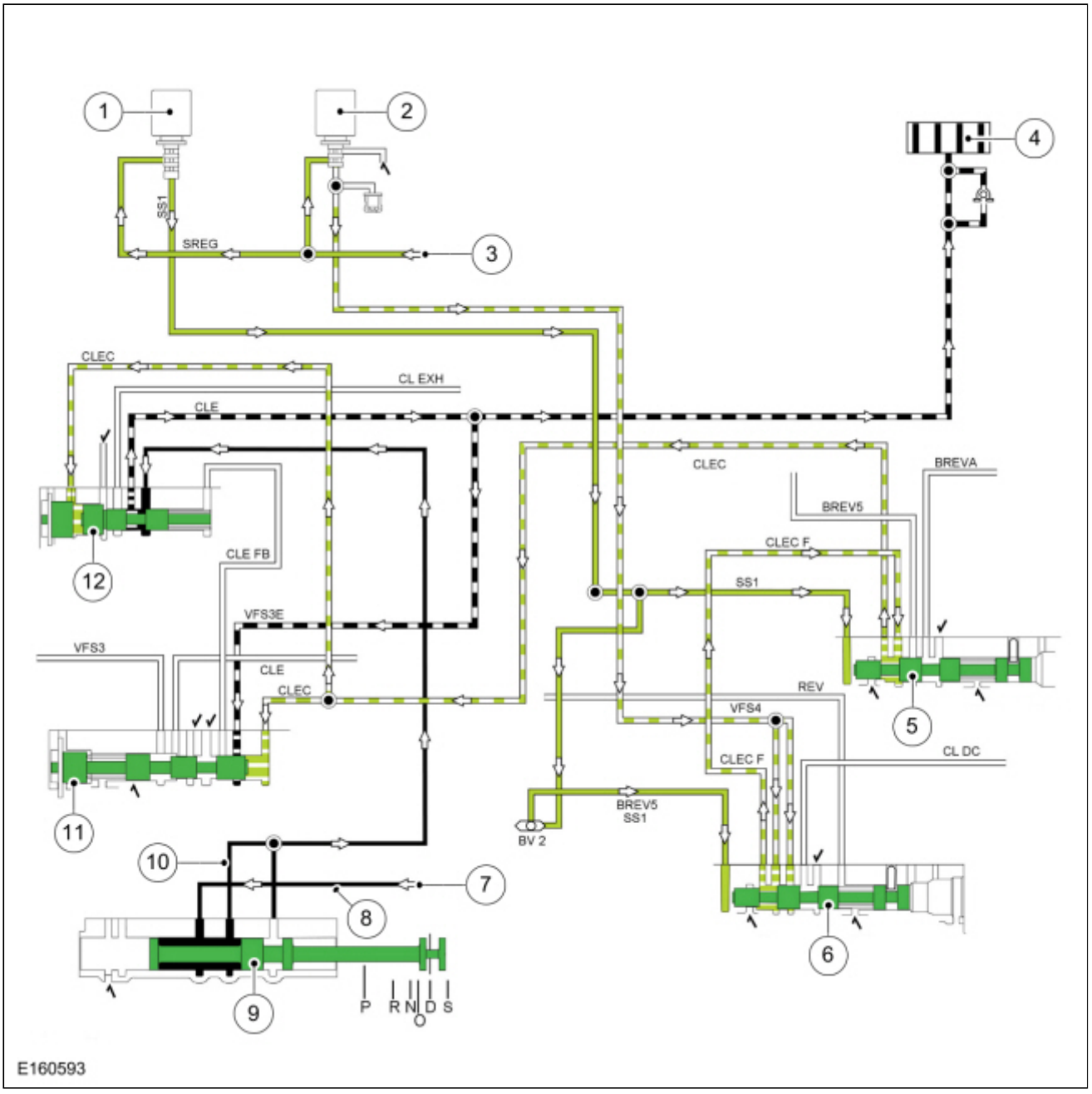


Overdrive Clutch (E) Hydraulic Circuits

To apply the overdrive clutch (E), the manual valve must be in the DRIVE position. Line pressure is supplied to the clutch E regulator valve.

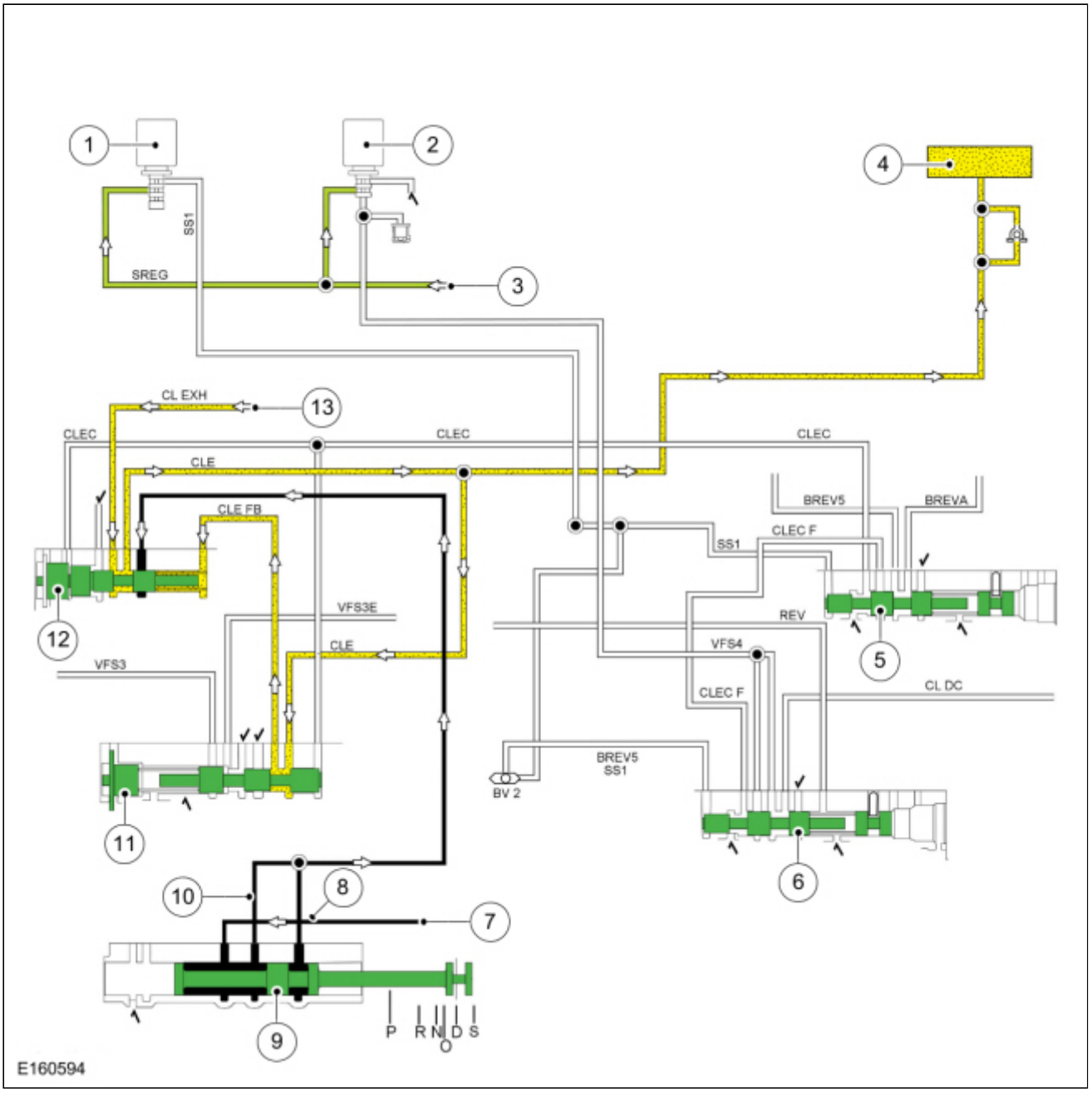
SSD provides regulated solenoid pressure from the SREG circuit to the solenoid multiplex valve through the VFS4 circuit. SSE supplies pressure to the solenoid multiplex valve and the drive enable valve to position the valves to direct pressure from the VFS4 circuit to the CLEC F and CLEC circuits to position the clutch E regulator and latch valves to apply the overdrive clutch (E). As the overdrive clutch (E) is applied, SSD increases pressure to the clutch E regulator and latch valve.

The clutch E regulator valve provides regulated line pressure from the DRIVE circuit to the CLE circuit to apply the overdrive clutch (E).



To release the O/D clutch (E), the manual valve can be in any position. SSD lowers pressure to the VFS4 circuit which lowers pressure in the CLEC and CLEC F circuits and releases the O/D clutch (E). SSE blocks SREG pressure to the solenoid multiplex valve and the drive enable valve to allow SSD to control low/reverse clutch (D) operation.

When the O/D clutch (E) is released, the clutch E regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL E circuit to fill the circuit and the clutch with fluid at low pressure, approximately 21 kPa (3 psi).



Transmission Electronic Control System

Powertrain Control System

The TCM controls the electronic functions of this transmission. The TCM is located under the instrument panel in the cabin. A plastic molded leadframe is bolted to the main control assembly. The leadframe contains the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS), Transmission Fluid Temperature (TFT) and Transmission Range (TR) sensors.

The TCM receives input signals from engine and transmission sensors and uses these inputs to control line pressure, shift time, Torque Converter Clutch (TCC), and shift solenoids. The TCM also provides power and ground for the reverse lamp relay coil and provides a PARK/NEUTRAL start enable signal.

The following is a list of direct engine and driver inputs to the TCM along with module information from the vehicle Controller Area Network (CAN):

- Engine speed
- Engine torque
- Engine Coolant Temperature (ECT)
- Engine Oil Temperature (EOT)
- Throttle Position (TP)
- Accelerator Pedal Position (APP)
- Brake Pedal Position (BPP)
- ABS wheel speed
- Traction Control (ATC) status

The TCM also:

- Monitors inputs and outputs for the presence of faults.
- Stores DTCs related to detected faults.
- Provides outputs on the CAN for transmission range, output shaft speed, turbine shaft speed, transmission fluid temperature, current gear and A/C inhibit.
- Provides On-Board Diagnostic (OBD) information using the CAN to illuminate the Malfunction Indicator Lamp (MIL) or Transmission Control Indicator Lamp (TCIL).
- Provides diagnostic information to a scan tool through the Data Link Connector (DLC).

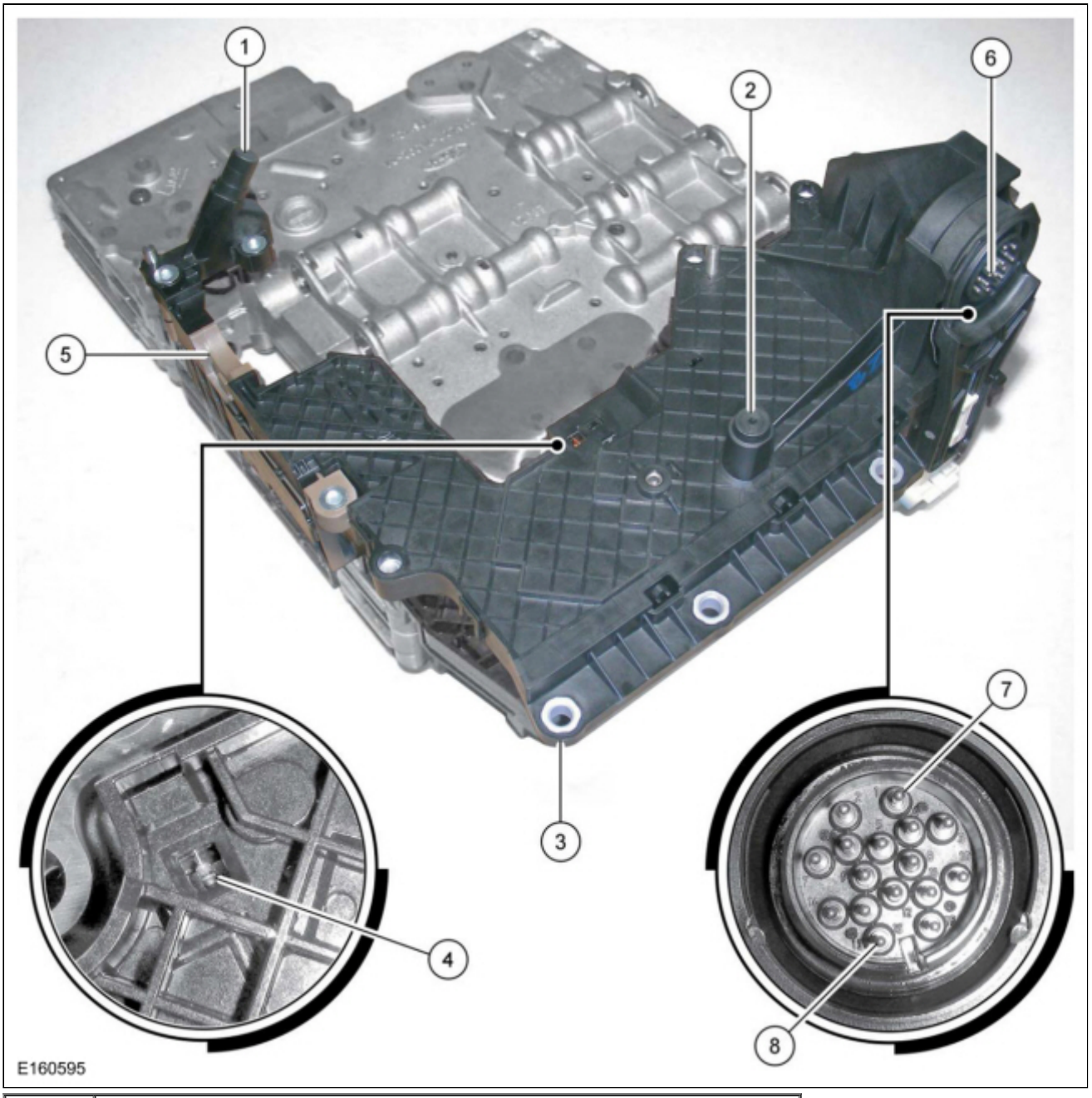
If the TCM detects a system or component fault, it substitutes a default value or signal using Failure Mode and Effect Management strategies.

The TCM also uses Failure Mode and Effect Management strategies to compensate for electrical or mechanical shift solenoid and apply component faults that result in alternate shift patterns.

If the transmission loses complete electronic control, it operates in a fail-safe mode with:

- Maximum line pressure in all transmission ranges
- Functional PARK, REVERSE and NEUTRAL positions
- Operation in 3rd or 5th gear (depending on the failure conditions) when the selector lever is in the DRIVE, 3, 2 or 1 position
- TCC is released in all transmission ranges and gears

Molded Leadframe



Item	Description
1	Turbine Shaft Speed (TSS) sensor
2	Output Shaft Speed (OSS) sensor
3	Molded leadframe
4	Transmission Fluid Temperature (TFT) sensor
5	Transmission Range (TR) sensor
6	Leadframe connector
7	Terminal 1
8	Terminal 16

Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear						TCC NL
		SSA NL(1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L,R/C 4,5,6)	SSE NC	
P	P	OFF	ON	OFF	OFF	OFF	OFF
R	R	OFF	OFF	OFF	OFF	OFF	OFF
N	N	OFF	ON	OFF	OFF a	OFF	OFF
D	1	ON	ON	OFF	OFF b	OFF	OFF
	2	ON	ON	ON	ON	OFF	OFF
	3	ON	OFF	OFF	ON	ON	ON/OFF
	4	ON	ON	OFF	OFF	ON	ON/OFF
	5	OFF	OFF	OFF	OFF	ON	ON/OFF
	6	OFF	ON	ON	OFF	ON	ON/OFF

a Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.

b Solenoid is On when vehicle is above 3 mph.

CB = Clutch brake

NC = Normally closed

NH = Normally high

NL = Normally low

The following are brief descriptions of the sensors and actuators used to control transmission operation.

Line Pressure Control (LPC) Solenoid

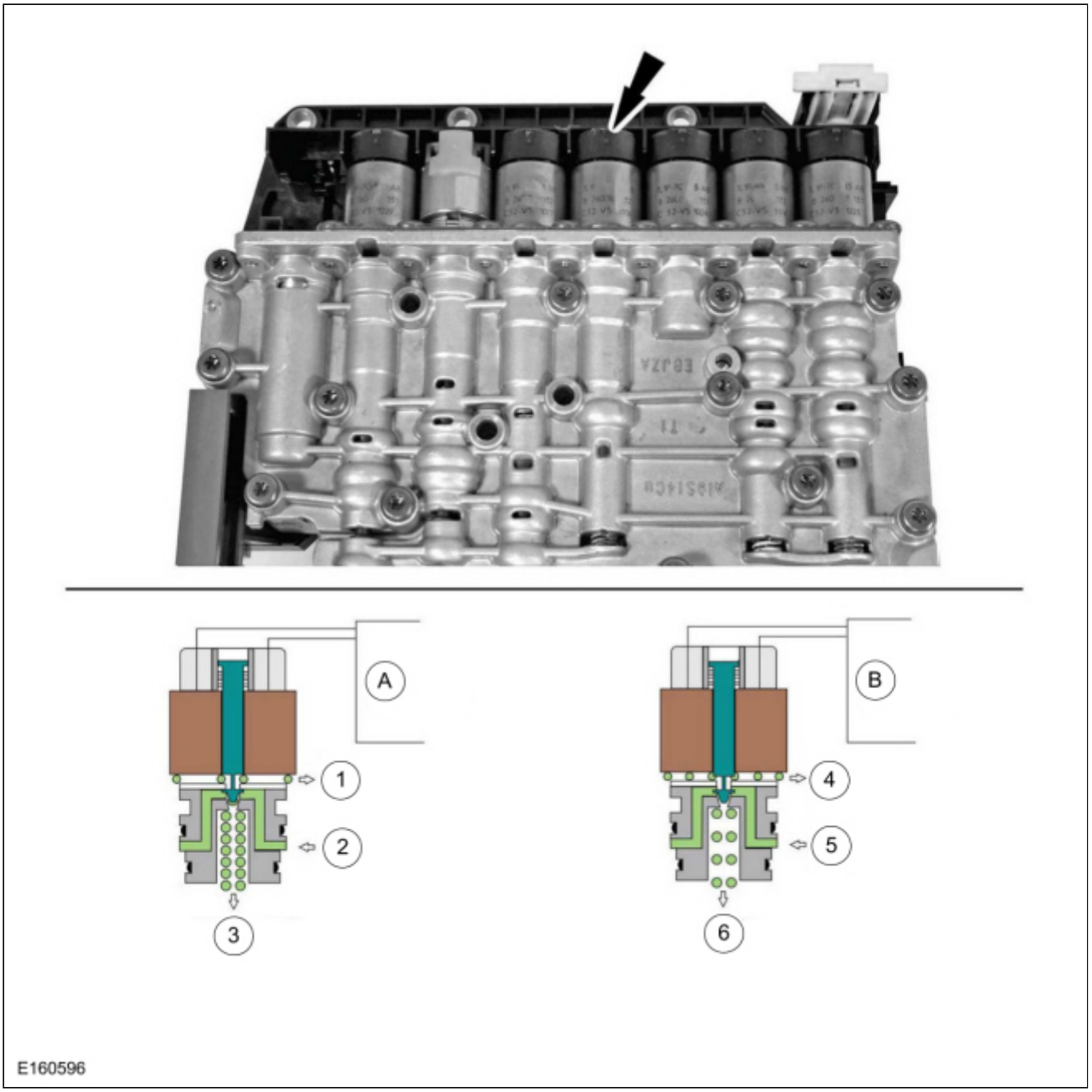
The Line Pressure Control (LPC) solenoid, is a Variable Force Solenoid (VFS) that varies hydraulic pressure by actuating a hydraulic valve.

The TCM applies variable current to the LPC solenoid which varies pressure in the VFS5 hydraulic circuit to the main regulator valve. Refer to Hydraulic Circuits in this section.

The LPC solenoid uses inversely proportional operation. As the current from the TCM decreases, the pressure from the solenoid increases. As the current from the TCM increases, the pressure from the solenoid decreases. The LPC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the LPC solenoid fully opens the hydraulic valve which applies the maximum amount of hydraulic pressure to the main regulator valve through the VFS5 hydraulic circuit and applies maximum line pressure in the PUMP hydraulic circuit. With maximum current to the solenoid, the hydraulic valve fully closes the outlet port for minimum pressure to the VFS5 hydraulic circuit, lowering the line pressure in the PUMP hydraulic circuit.

LPC Inversely Proportional VFS



Torque Converter Clutch (TCC) Solenoid

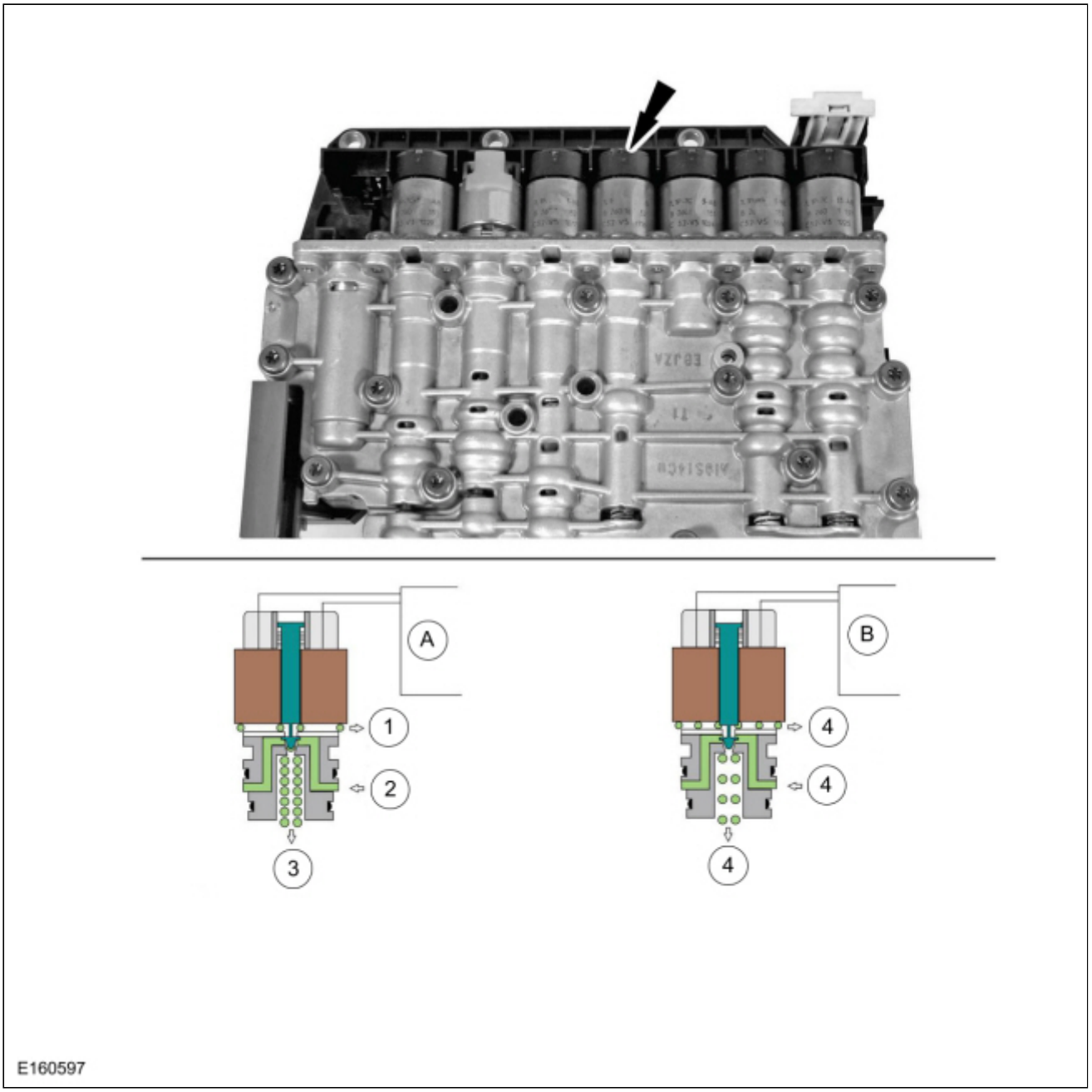
The TCC solenoid is a VFS that varies hydraulic pressure by actuating a hydraulic valve.

The TCM applies variable current to the TCC solenoid which varies pressure in the VFS6 hydraulic circuit to the Converter Release Regulator Valve and the Bypass Clutch Control Regulator Valve. Refer to Hydraulic Circuits in this section.

The TCC solenoid uses proportional operation. As the current from the TCM decreases, the pressure from the solenoid decreases. As the current from the TCM increases, the pressure from the solenoid increases. The TCC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the TCC solenoid fully closes the hydraulic valve which applies the minimum amount of hydraulic pressure to the Converter Release Regulator Valve and the Bypass Clutch Control Regulator Valve through the VFS6 hydraulic circuit and releases the TCC. With maximum current to the solenoid, the hydraulic valve fully opens the outlet port for maximum pressure to the VFS6 hydraulic circuit to apply the TCC.

Torque Converter Clutch (TCC) Proportional (VFS)



Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC) and Shift Solenoid D (SSD)

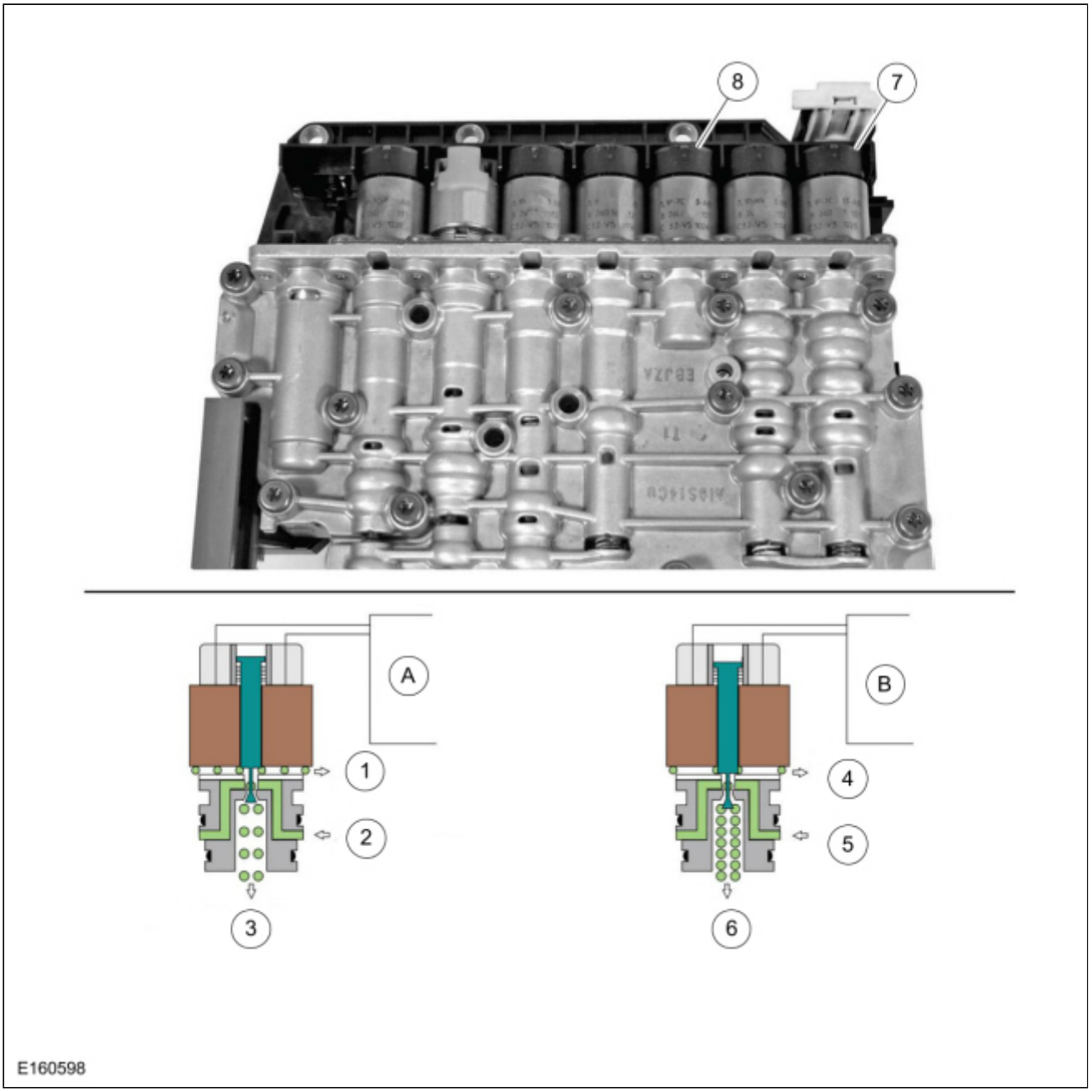
Shift solenoids A through D are VFS that vary hydraulic pressure by actuating a hydraulic valve.

The TCM applies variable current to the shift solenoids which varies pressure in the hydraulic circuit to the regulator and latch valves of the clutch that it controls. Refer to Hydraulic Circuits in this section.

SSA and SSC use proportional operation. As the current from the TCM decreases, the pressure from the solenoid decreases. As the current from the TCM increases, the pressure from the solenoid increases. SSA and SSC are supplied hydraulic pressure from the SREG circuit.

With zero current, SSA and SSC fully close the hydraulic valves which applies zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch. With maximum current to the solenoids, the hydraulic valves fully open for maximum pressure to the regulator and latch valves to apply the clutch.

Shift Solenoid A (SSA) and Shift Solenoid C (SSC) Proportional Solenoids

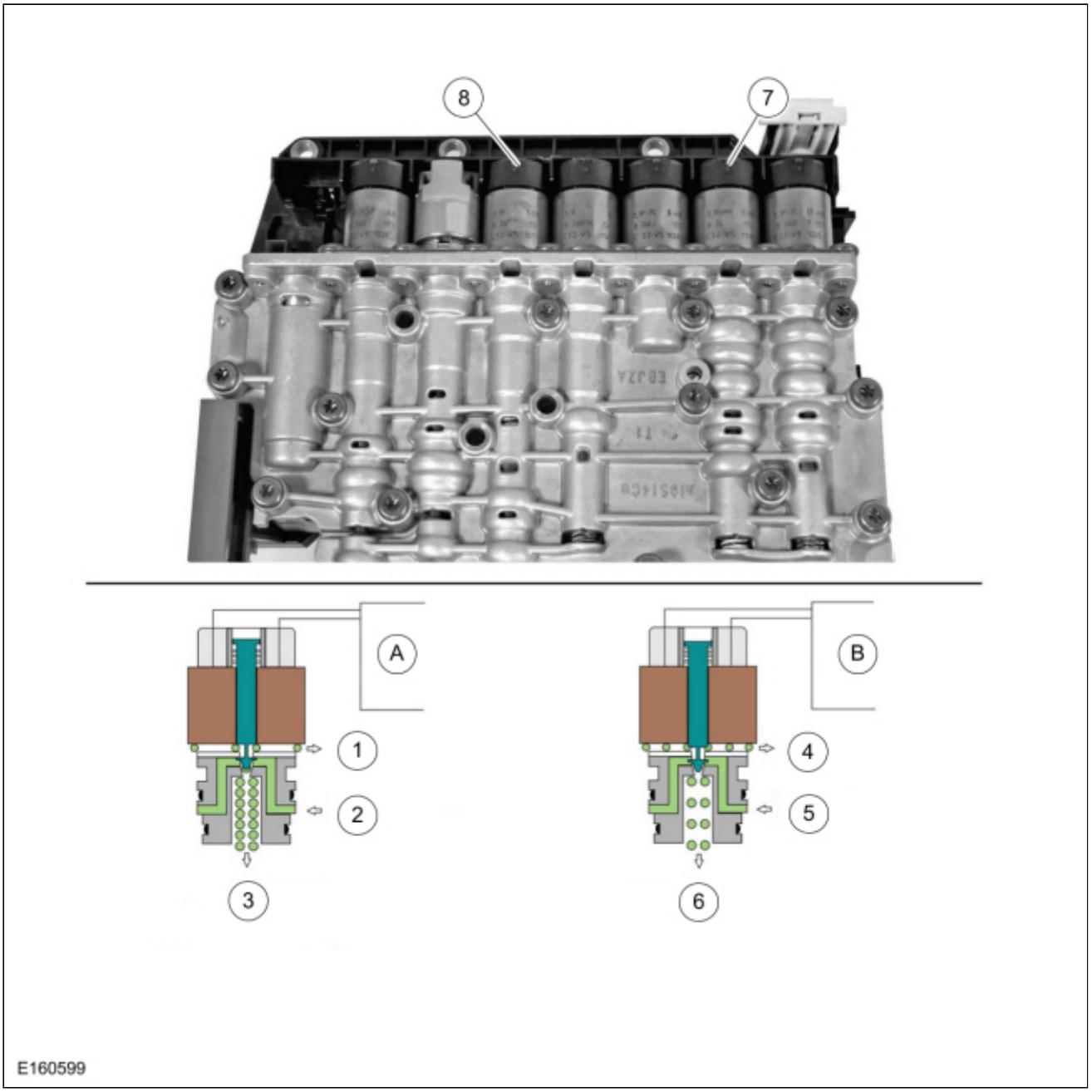


Item	Description
1	Shift Solenoid A (SSA) Variable Force Solenoid (VFS)
2	Shift Solenoid C (SSC) VFS

SSB and SSD use inverse proportional operation. As the current from the TCM decreases, the pressure from the solenoid increases. As the current from the TCM increases, the pressure from the solenoid decreases. SSB and SSD are supplied hydraulic pressure from the SREG circuit.

With zero current, SSB and SSD fully open the hydraulic valves which applies maximum hydraulic pressure to the regulator and latch valves to apply the clutch that it controls. With maximum current to the solenoids, the hydraulic valve fully closes to apply zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch.

Shift Solenoid B (SSB) and Shift Solenoid D (SSD) Inverse Proportional Variable VFS



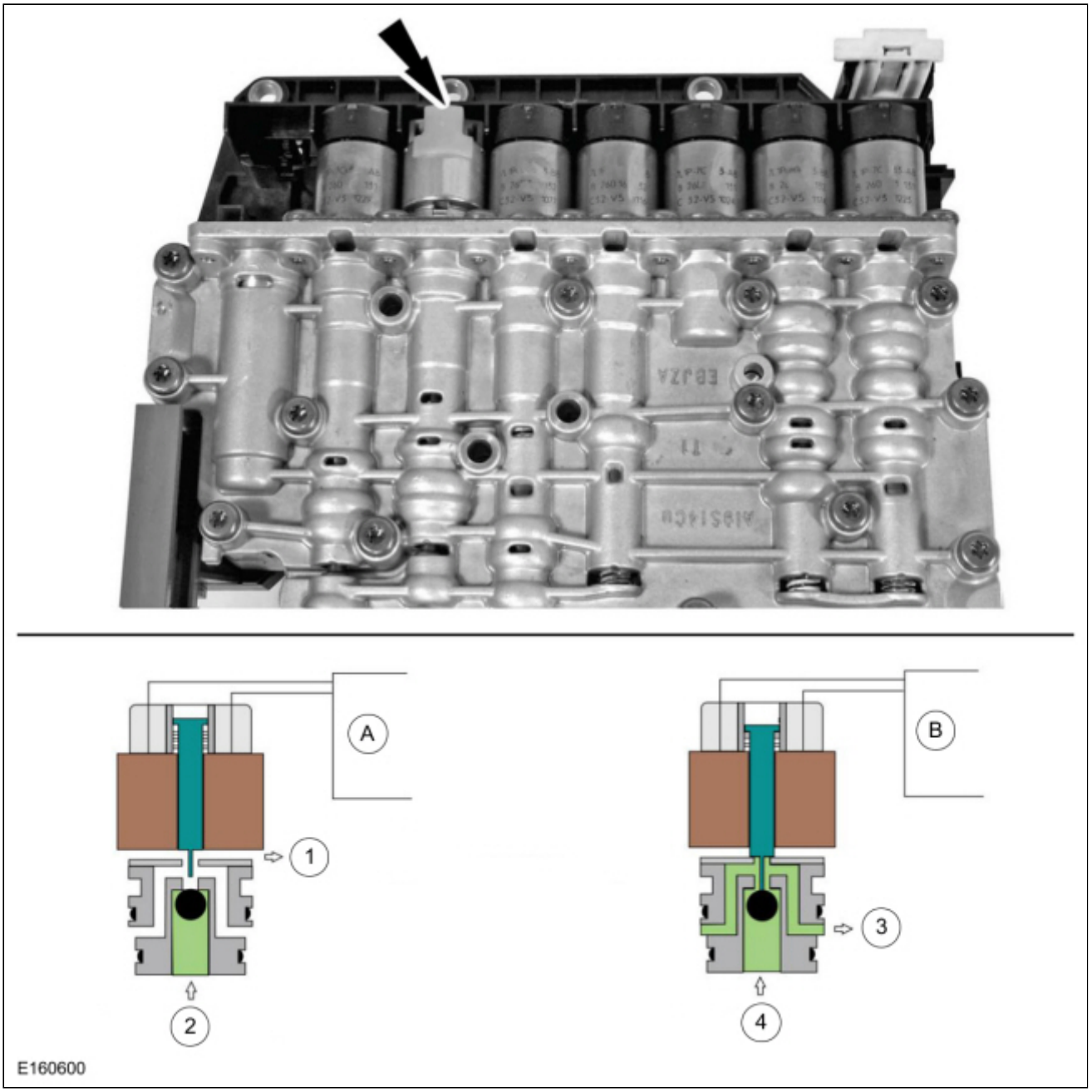
Item	Description
1	Shift Solenoid B (SSB) Variable Force Solenoid (VFS)
2	Shift Solenoid D (SSD) VFS

Shift Solenoid E (SSE)

SSE is an ON/OFF solenoid. When SSE is in the OFF position, SSD controls the regulator and latch valves to apply the low/reverse clutch. When SSE is in the ON position, SSD controls the regulator and latch valves to apply the overdrive (456) clutch. Refer to Hydraulic Circuits in this section.

SSE is supplied hydraulic pressure from the SREG circuit. When SSE is OFF, the solenoid supply is blocked and the outlet port (SS1 circuit) is connected to the exhaust port. When SSE is ON, the exhaust port is blocked and the solenoid supply is connected to the outlet port (SS1 circuit).

Shift Solenoid E (SSE) ON/OFF Solenoid



Turbine Shaft Speed (TSS) Sensor

The TSS sensor is a Hall-effect type sensor that provides a signal to the TCM that changes in frequency as the rotating speed of the forward (1,2,3,4) clutch cylinder varies.

The TCM compares the TSS sensor signal with the engine speed information to determine the amount of slip occurring in the torque converter.

The TCM also compares the TSS sensor signal with the OSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The TCM uses the TSS sensor signal as an input for its strategies for shifts and TCC operation. The TCM also uses the TSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TSS sensor.

Output Shaft Speed (OSS) Sensor

The OSS sensor is a Hall-effect type sensor that provides a signal to the TCM that changes in frequency as the rotating speed of the output shaft ring gear varies.

The TCM also compares the OSS sensor signal with the TSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The TCM uses the OSS sensor signal as an input for its strategies for shifts and TCC operation. The TCM also uses the OSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the OSS sensor.

Transmission Fluid Temperature (TFT) Sensor

The TFT sensor is a temperature dependent resistor that is in contact with transmission fluid in the transmission sump area.

The TCM monitors the voltage across the TFT sensor, which changes as transmission fluid temperature varies.

The TCM uses the TFT sensor signal as an input for its strategy for shifting and TCC operation. The TCM also uses the TFT sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TFT sensor.

Transmission Range (TR) Sensor

The TR sensor has a set of Hall-effect sensors that have a pattern of ON/OFF states which are dependant on the PARK, REVERSE, NEUTRAL, DRIVE, 3,

2 or 1 position of the manual valve.

The TR sensor also provides signals for the starting system and the reverse lights.

The TCM uses the TR sensor signal as an input for its strategy for shifting and TCC operation. The TCM also uses the TR sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TR sensor.

Transmission Operation

Transmission Operation Overview

Torque Converter

This transmission uses a torque converter with the following elements:

- Impeller
- Turbine
- Reactor
- Torque Converter Clutch (TCC)

For component information, refer to Torque Converter Contamination Inspection in this section.

Planetary Gearsets

Operation of this transmission involves the use of 2 planetary gearsets that have the following components:

- Front (single planetary gearset)
  - One sun gear
  - One planetary carrier with 4 gears
  - One ring gear
- Rear (ravigenaux planetary gearset)
  - Two sun gears of different sizes
  - Three short planetary gear pinions meshing with the sun gears
  - Three long planetary gear pinions meshing with the sun gears
  - One planetary carrier
  - One ring gear

Apply Clutches

NOTE: *Friction and steel plate quantity will vary based on engine displacement. Refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.*

This transmission uses the following clutches to operate the 2 planetary gearsets:

- Forward clutch (A)
- Direct clutch (B)
- Intermediate clutch (C)
- Low/reverse clutch (D)
- Overdrive clutch (E)
- Low One-Way Clutch (OWC)

For information about planetary gearsets or the apply clutches, refer to Mechanical Components and Functions in this section.

Hydraulic System

The hydraulic operation of this transmission includes the following components:

- Main control (mechatronic) assembly
- Pump assembly with filter
- Torque converter
- Apply components (clutches)

For component information, refer to Hydraulic System in this section.

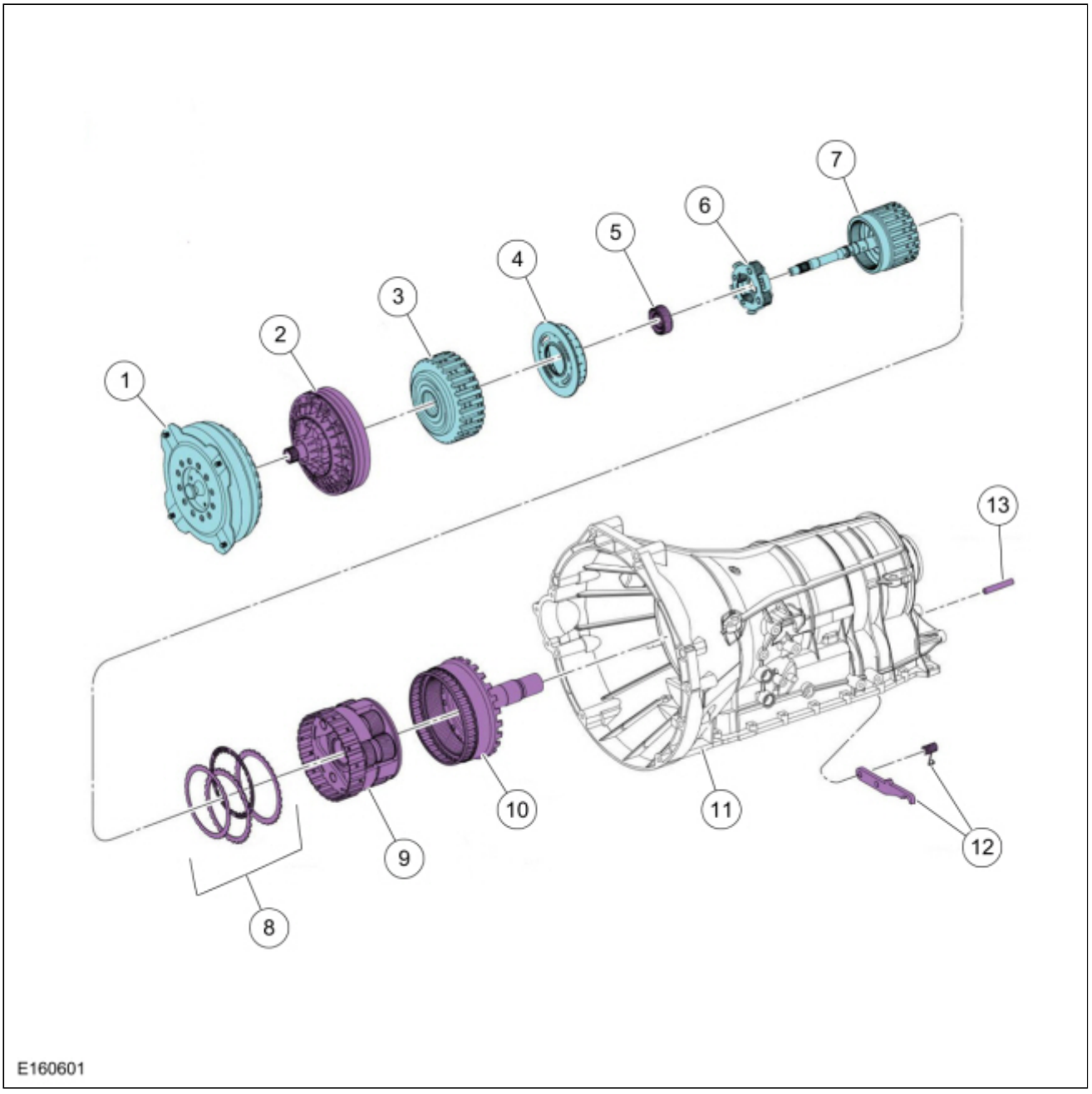
Electronic Operation

The TCM controls the operation of this transmission with the following solenoids:

- Line Pressure Control (LPC) solenoid
- Shift Solenoid A (SSA)
- Shift Solenoid B (SSB)
- Shift Solenoid C (SSC)
- Shift Solenoid D (SSD)
- Shift Solenoid E (SSE)
- TCC solenoid

For solenoid information, refer to Transmission Electronic Control System in this section.

Park Position



Mechanical Operation

Apply components:

- Park pawl engaged holding the park gear (output shaft) stationary
- Low/reverse clutch (D) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- None

Rear planetary gearset driven components:

- None

Rear planetary gearset held components:

- Planetary carrier
- Ring gear (output shaft)

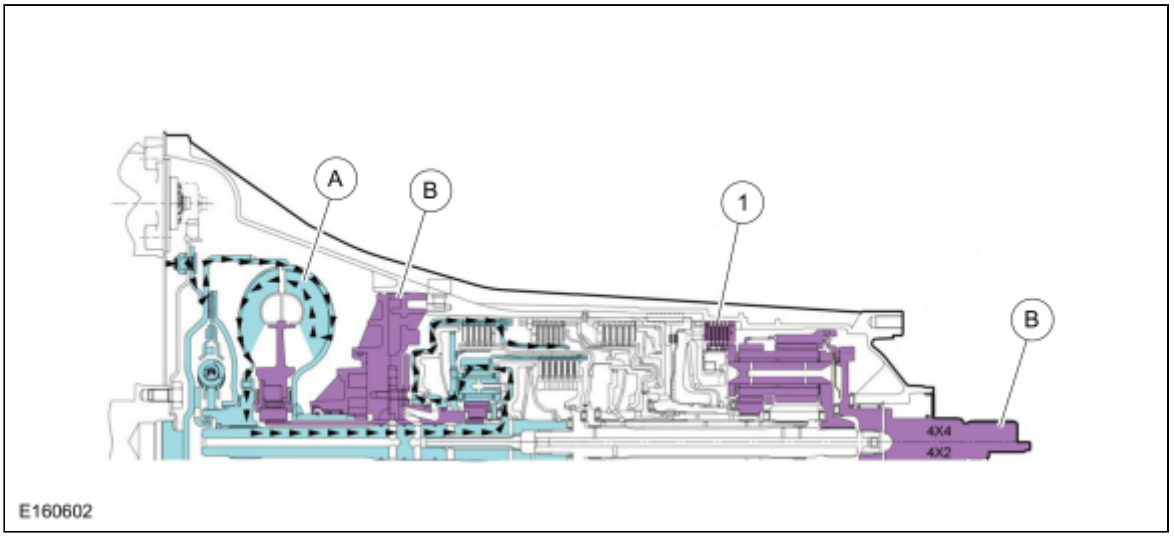
Park Position Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D)	Overdrive (E)	Low-OWC
PARK		D		H		
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- H = Hold Clutch

For component information, refer to Mechanical Components and Functions in this section.

Park Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In reverse, the manual valve directs line pressure to the No. 1 shuttle valve and the solenoid multiplex valve through the REV circuit.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.

- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves throught the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSB supplies pressure to the clutch B regulator and latch valves to position the valves for direct clutch (B) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch.
- Line pressure is supplied by the manual valve to the clutch B latch and regulator valves.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

Park Position Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear						TCC NL
		SSA NL(1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L,R/C 4,5,6)	SSE NC	
P	P	OFF	OFF	OFF	OFF	ON	OFF

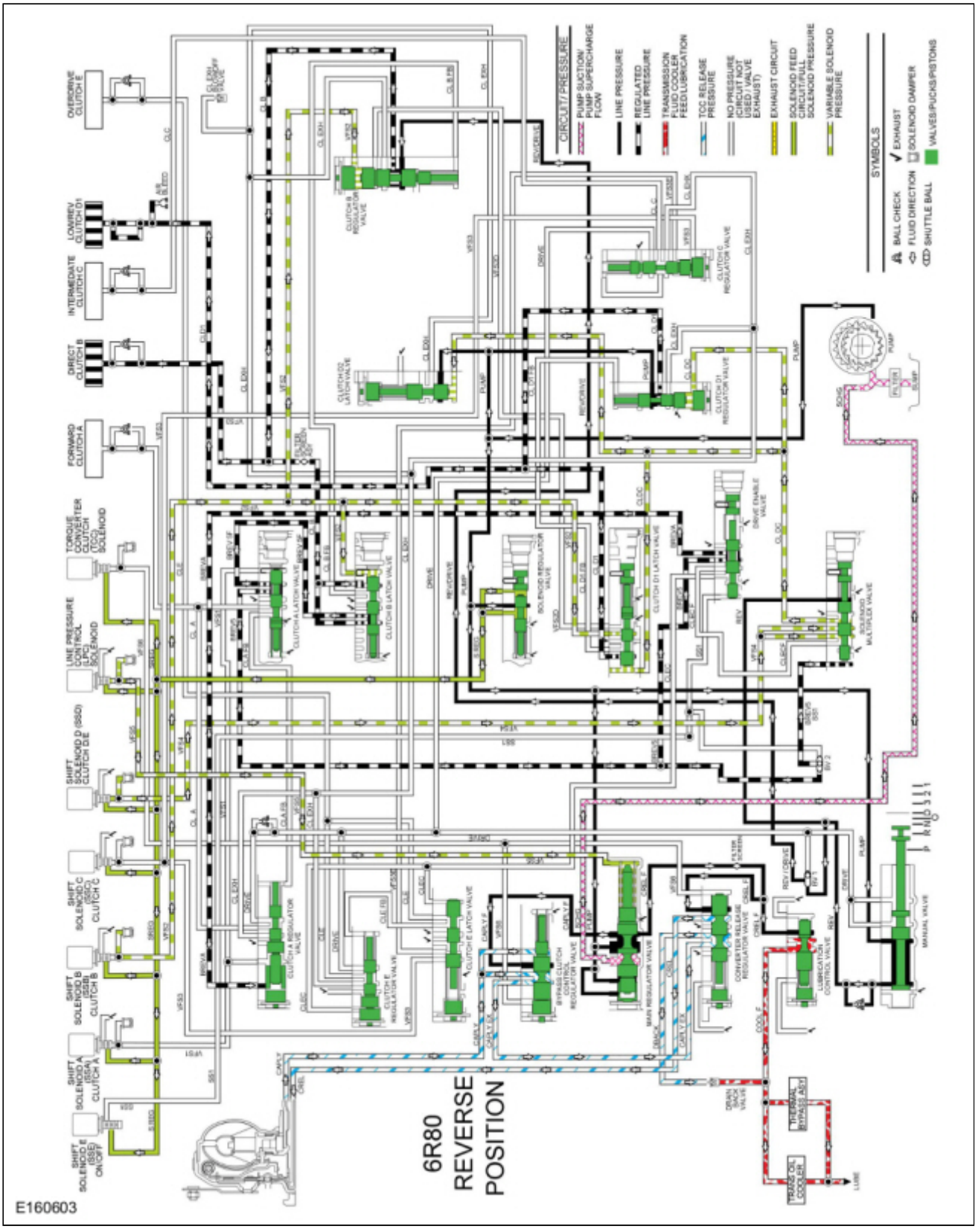
CB = Clutch brake

NC = Normally closed

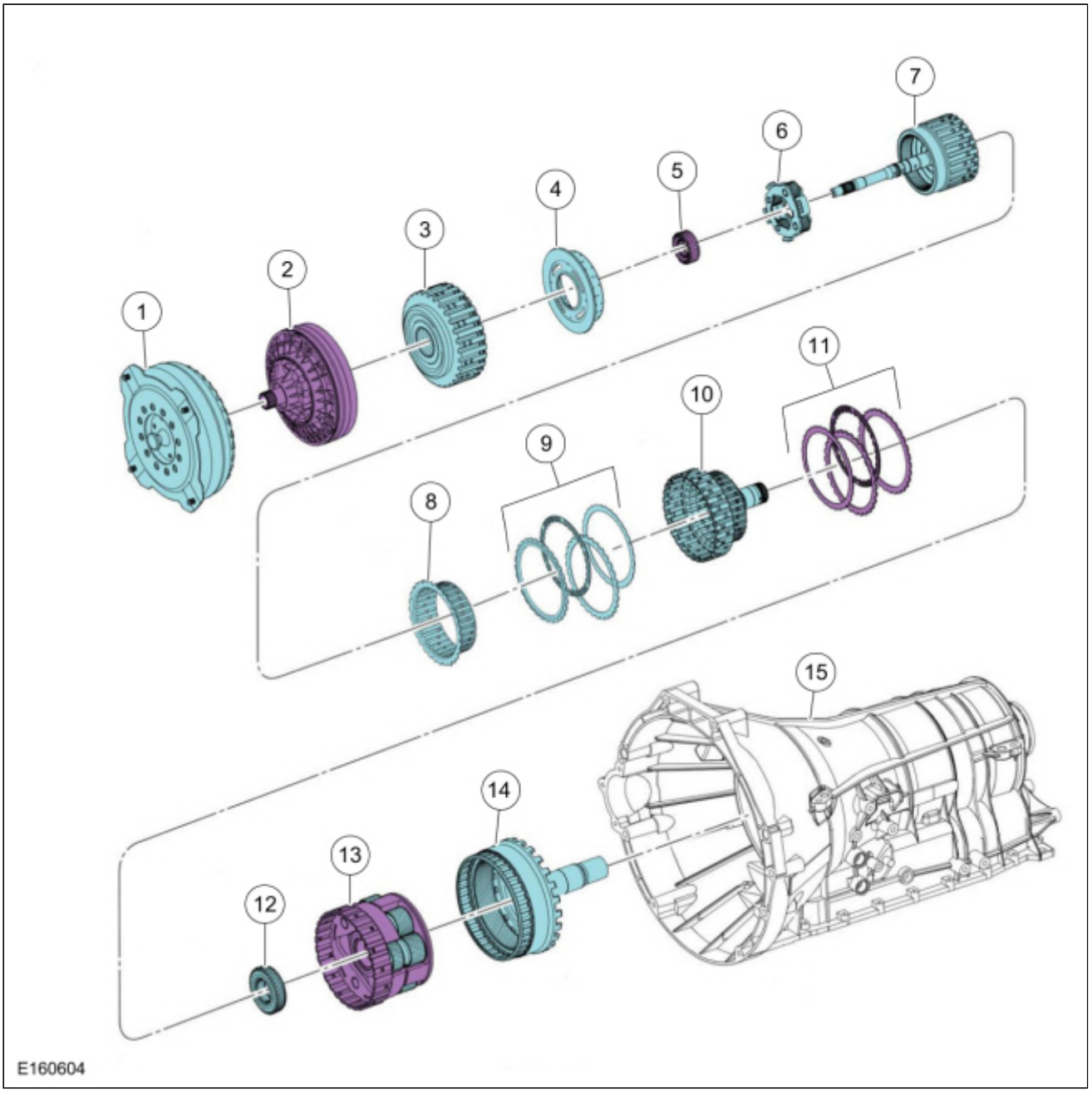
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic system in this section



Reverse Position



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly

Rear planetary gearset driving components:

- Sun gear No. 2

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

- Planetary carrier

Reverse Position Clutch Application Chart

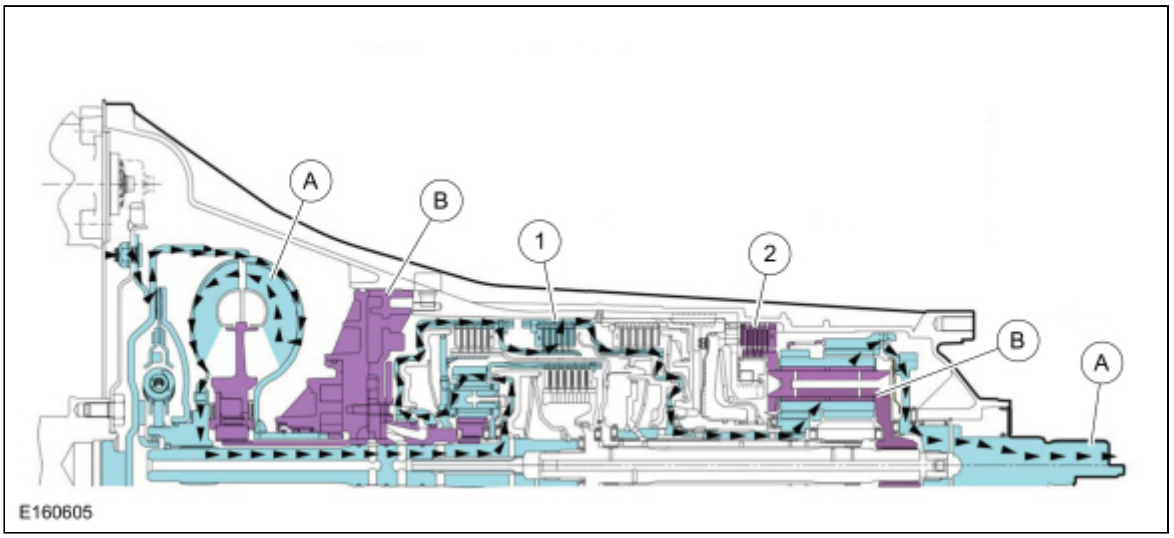
Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Intermediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low- OWC
Reverse		D		H		
Planetary Components	Front planetary carrier-to- No. 3 sun gear	Front carrier-to-No.2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-torear planetary carrier	Rear planetary carrier

D = Drive Clutch

H = Hold Clutch

For component information, refer to Mechanical Components and Functions in this section..

Reverse Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 and D2 latch and regulator valves.
- In reverse, the manual valve directs line pressure to the No. 1 shuttle valve and the solenoid multiplex valve through the REV circuit.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.

- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSB supplies pressure to the clutch B regulator and latch valves to position the valves for direct clutch (B) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 and D2 latch and regulator valves.
- Regulated line pressure from the D1 and D2 regulator valves is supplied to the low/reverse clutch (D) to apply the clutch.
- Line pressure is supplied by the manual valve to the clutch B latch and regulator valves.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

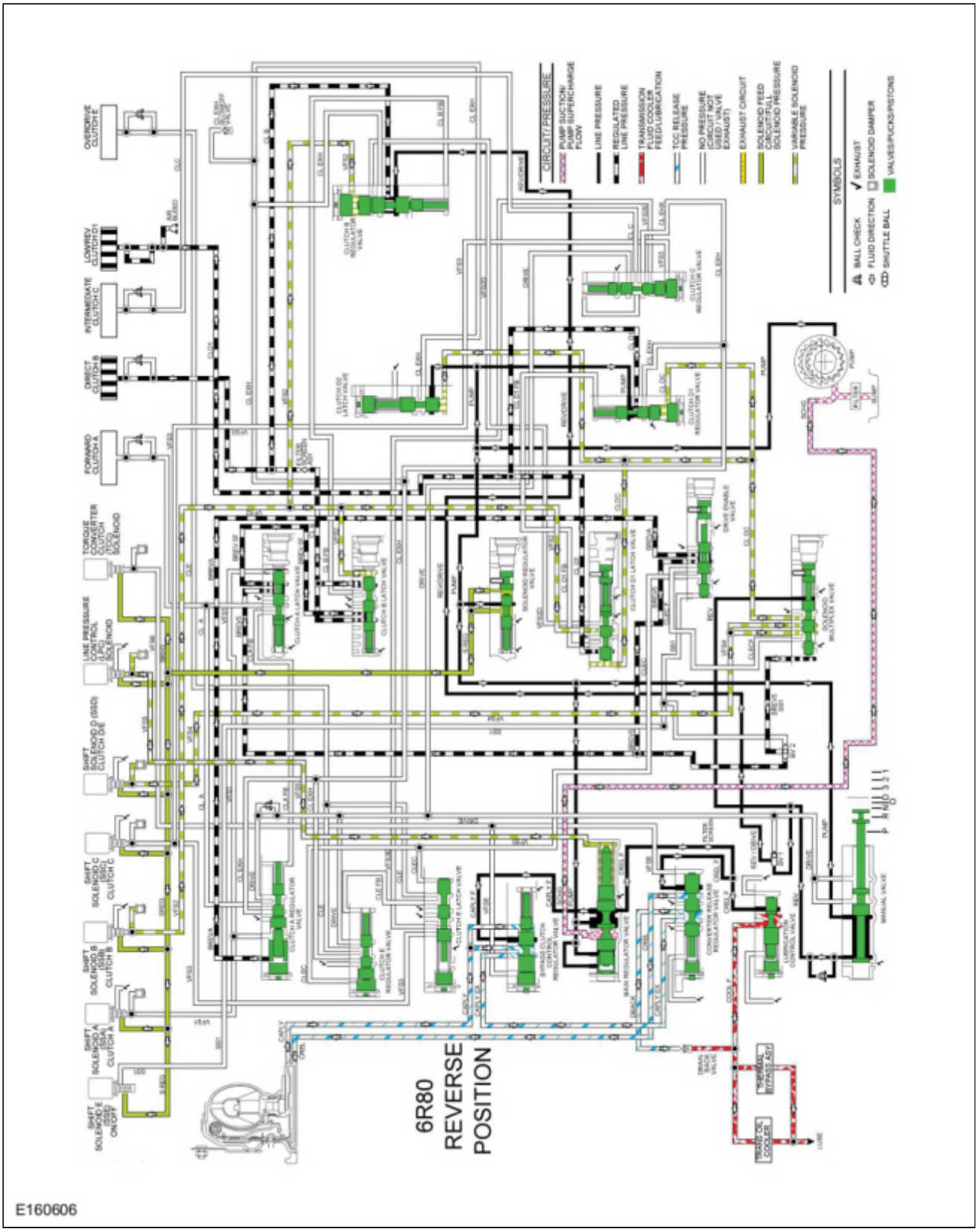
Electrical Operation

Solenoid operation:

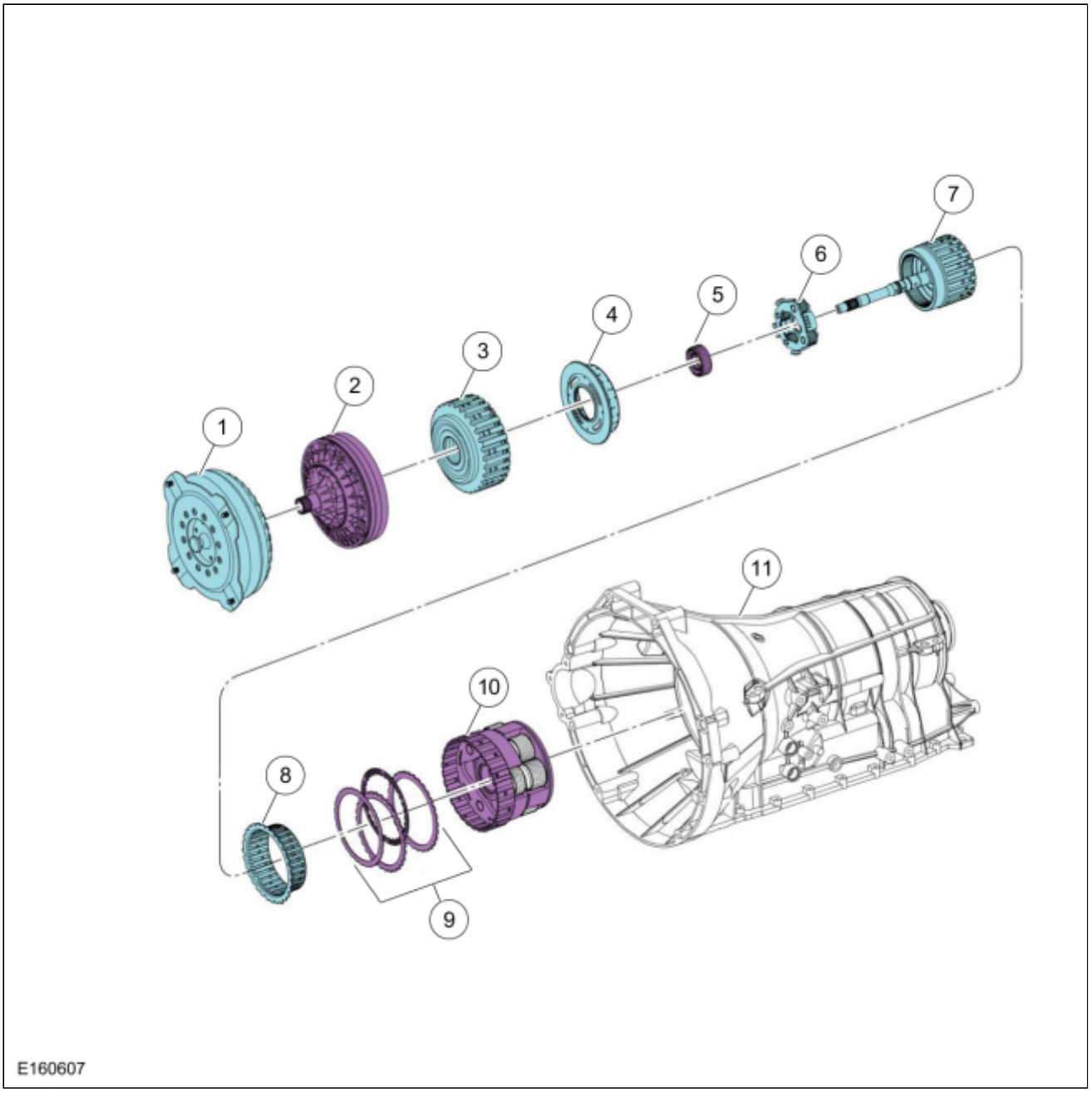
Reverse Position Solenoid Operation Chart

Gear	SSA (VFS) Proportional	SSB (VFS) Inversely Proportional	SSC (VFS) Proportional	SSD (VFS) Inversely Proportional	SSE (ON/ OFF)	LPC (VFS) Inversely Proportional	TCC (VFS) Proportional
Reverse		X		X		X	

For solenoid information, refer to Transmission Electronic Control System in this section.



Neutral Position



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- None

Rear planetary gearset driven components:

- None

Rear planetary gearset held components:

- Planetary carrier

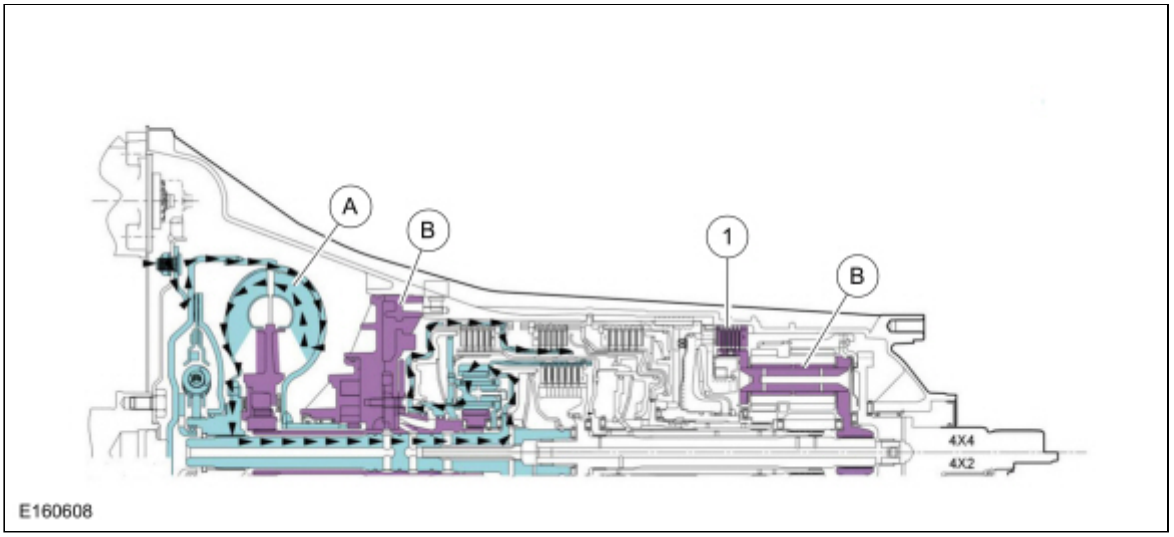
Reverse Position Clutch Application Chart

Gear/Manual Lever Position	Forward (A)	Direct (B)	Intermediate (C)	Low/ Reverse (D) (1,R)	Overdrive E (4,5,6)	Low-OWC
Neutral				H		
Planetary Components	Front planetary carrier-to- No. 3 sun gear	Front carrierto-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-torear planetary carrier	Rear planetary carrier

H = Hold Clutch

For component information, refer to Mechanical Components and Functions in this section.

Neutral Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.

The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.

Line pressure is supplied to the:

- Manual valve.
- Manual valve.
- Converter release regulator valve.
- Bypass clutch control regulator valve.
- Solenoid pressure regulator valve.
- D1 latch and regulator valves.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve

through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 latch and regulator valves through the CL DC circuit to position the valves for low/reverse clutch (D) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

Neutral Position Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear						
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
N	N	OFF	ON	OFF	On (a)	On (a)	OFF

(a) Solenoid state changes if vehicle is moving forward with the selector lever in the NEUTRAL position.

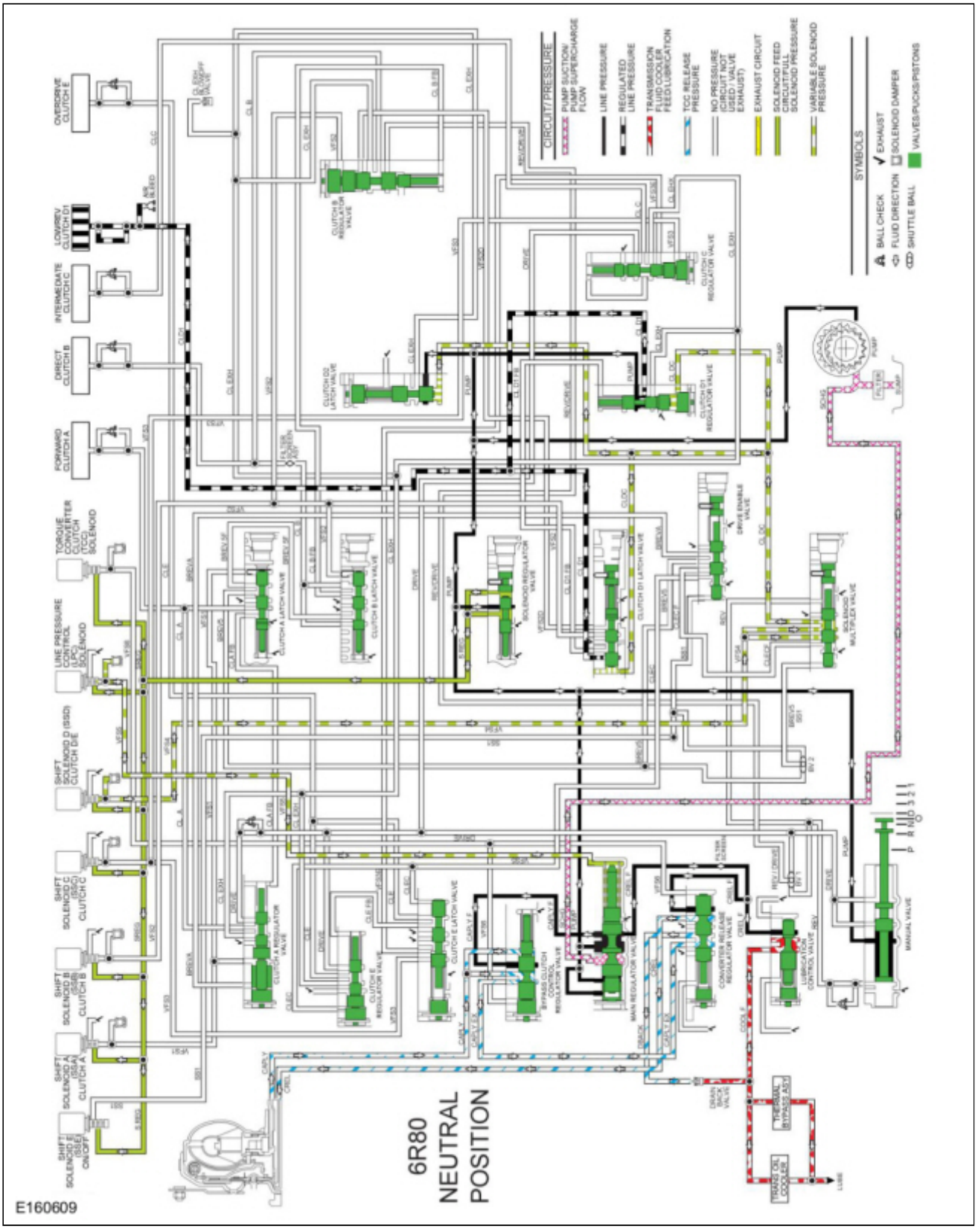
CB = Clutch brake

NC = Normally closed

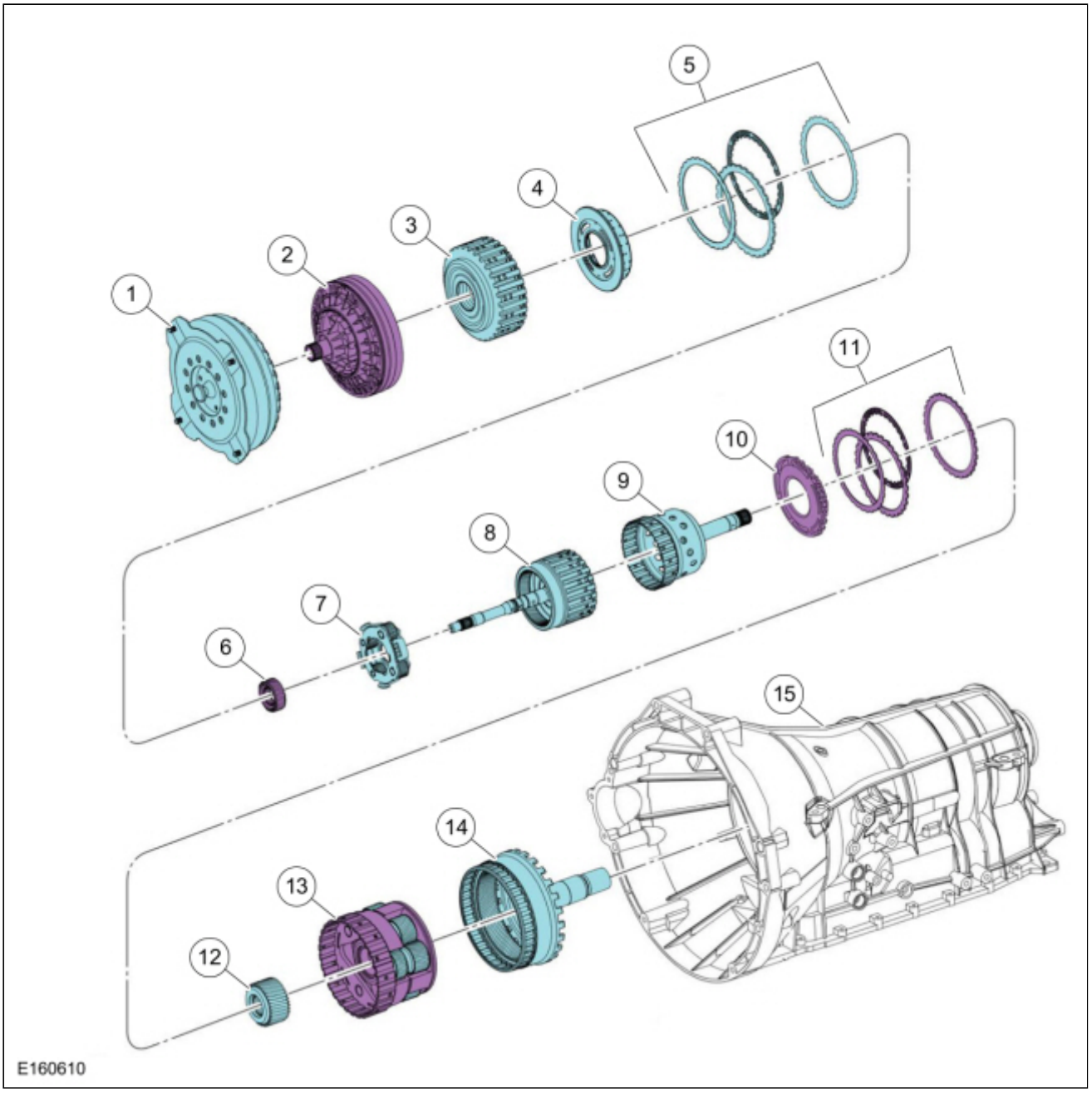
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
NEUTRAL
POSITION
E160609
CIRCUIT/PRESSURE
PUMP SUCTION/ PUMP SUPERCHARGE FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT (ALL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
EXHAUST
FLUID DIRECTION
SOLENOID DAMPER
SHUTTLE BALL
VALVES/PUCKS/PISTONS
OVERDRIVE CLUTCH E
LOW/REV CLUTCH D1
INTERMEDIATE CLUTCH C
DIRECT CLUTCH B
FORWARD CLUTCH A
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
LINE PRESSURE CONTROL (LPC) SOLENOID
SHIFT SOLENOID D (SSD) CLUTCH D/E
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID E (SSE) ON/OFF
CLUTCH B REGULATOR VALVE
CLUTCH D2 LATCH VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH B LATCH VALVE
SOLENOID REGULATOR VALVE
CLUTCH D1 LATCH VALVE
DRIVE ENABLE VALVE
SOLENOID MULTIPLEX VALVE
CLUTCH A REGULATOR VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CONVERTER RELEASE REGULATOR VALVE
LUBRICATION CONTROL VALVE
MANUAL VALVE
P R N D 3 2 1
TRANSAXLE BYPASS VALVE
TRANS OIL COOLER
PUMP
FILTER SCREEN

1st Gear



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied Below 5 kph (3 mph) only
- Low/One-Way Clutch (OWC)
- Forward clutch (A) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components

- Ring gear (output shaft)

Rear planetary gearset held components:

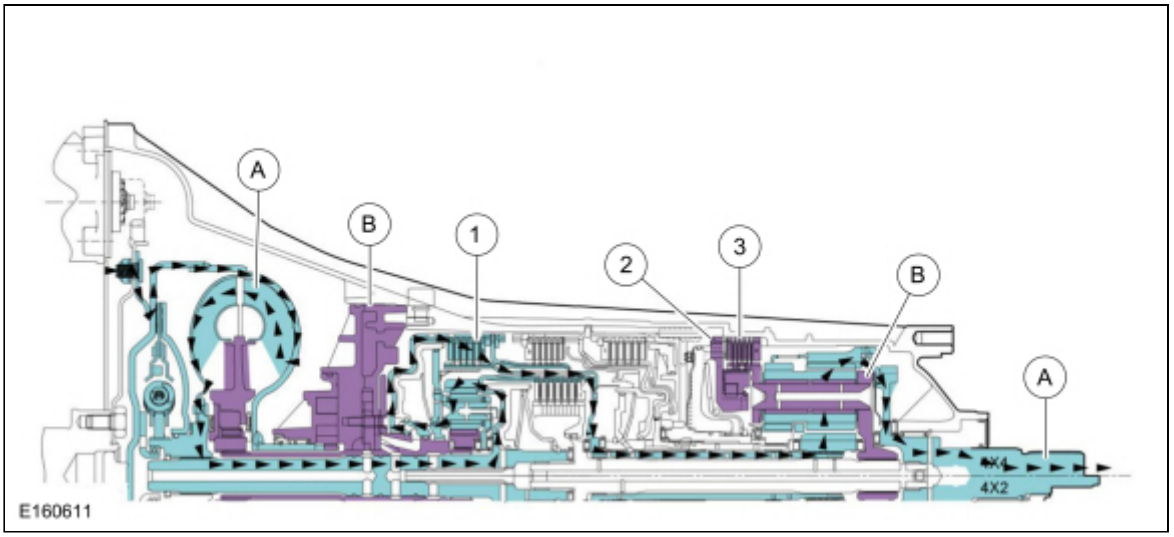
- Planetary carrier

1st Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
1st Gear D	D			H (a)		H
1st Gear Manual	D			H		H
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.

- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC andTCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- Below 5 kph (3 mph), SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit. Above 5 kph (3 mph), amperage to SSD is increased to decrease pressure to the solenoid multiplex valve and clutch D1 regulator valve to release the low/reverse clutch (D).
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 latch and regulator valves through the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Below 5 kph (3 mph), regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch. Above 5 kph (3mph) the D1 regulator valve exhausts to release the low/ reverse clutch and the Low/OWC continues to hold the rear planetary carrier with no engine braking.
- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

1st Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear						TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D	1	ON	ON	OFF	OFF(b)	ON	OFF
1	1	ON	ON	OFF	OFF	ON	OFF

(b) Solenoid is On when vehicle is above 3 mph.

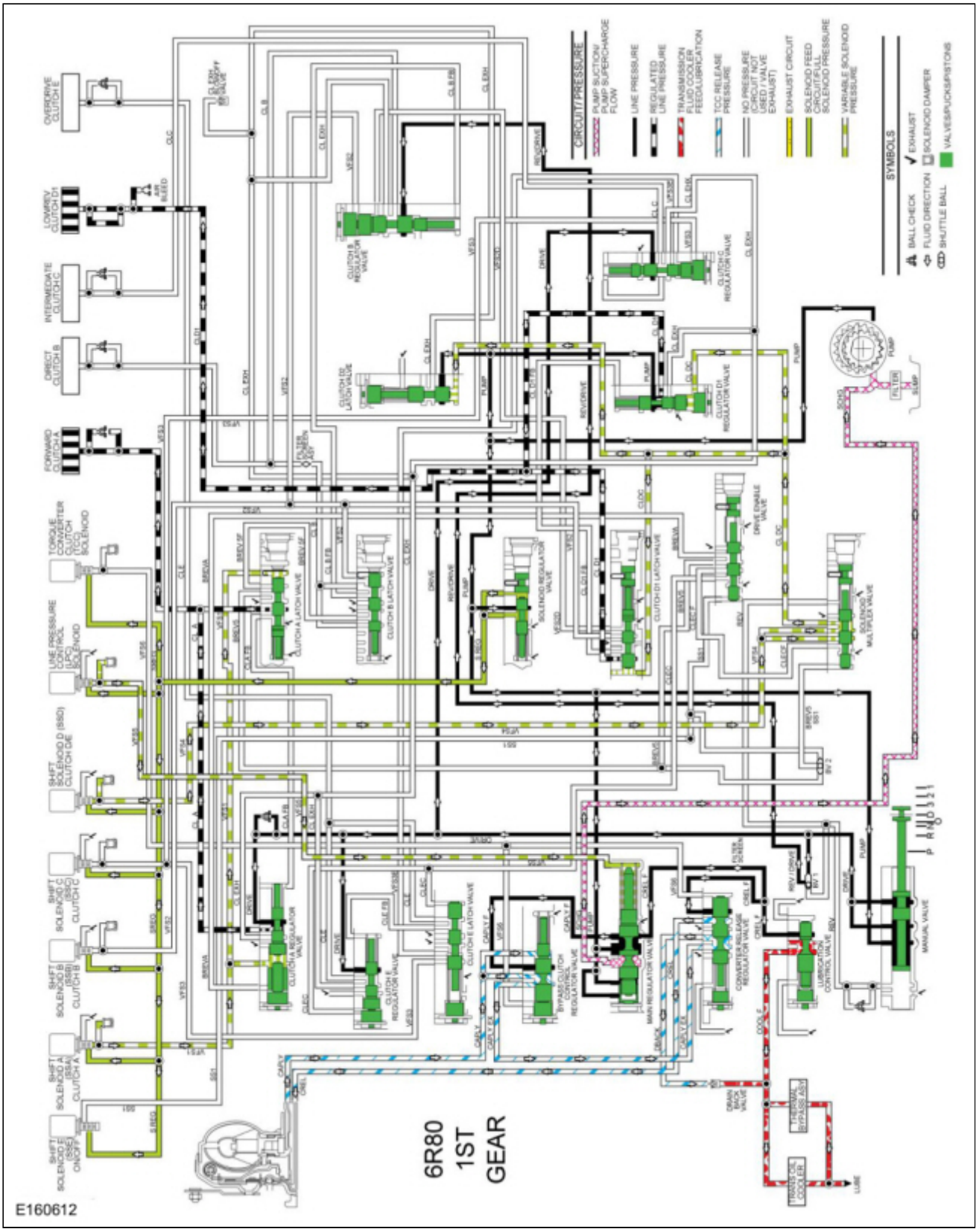
CB = Clutch brake

NC = Normally closed

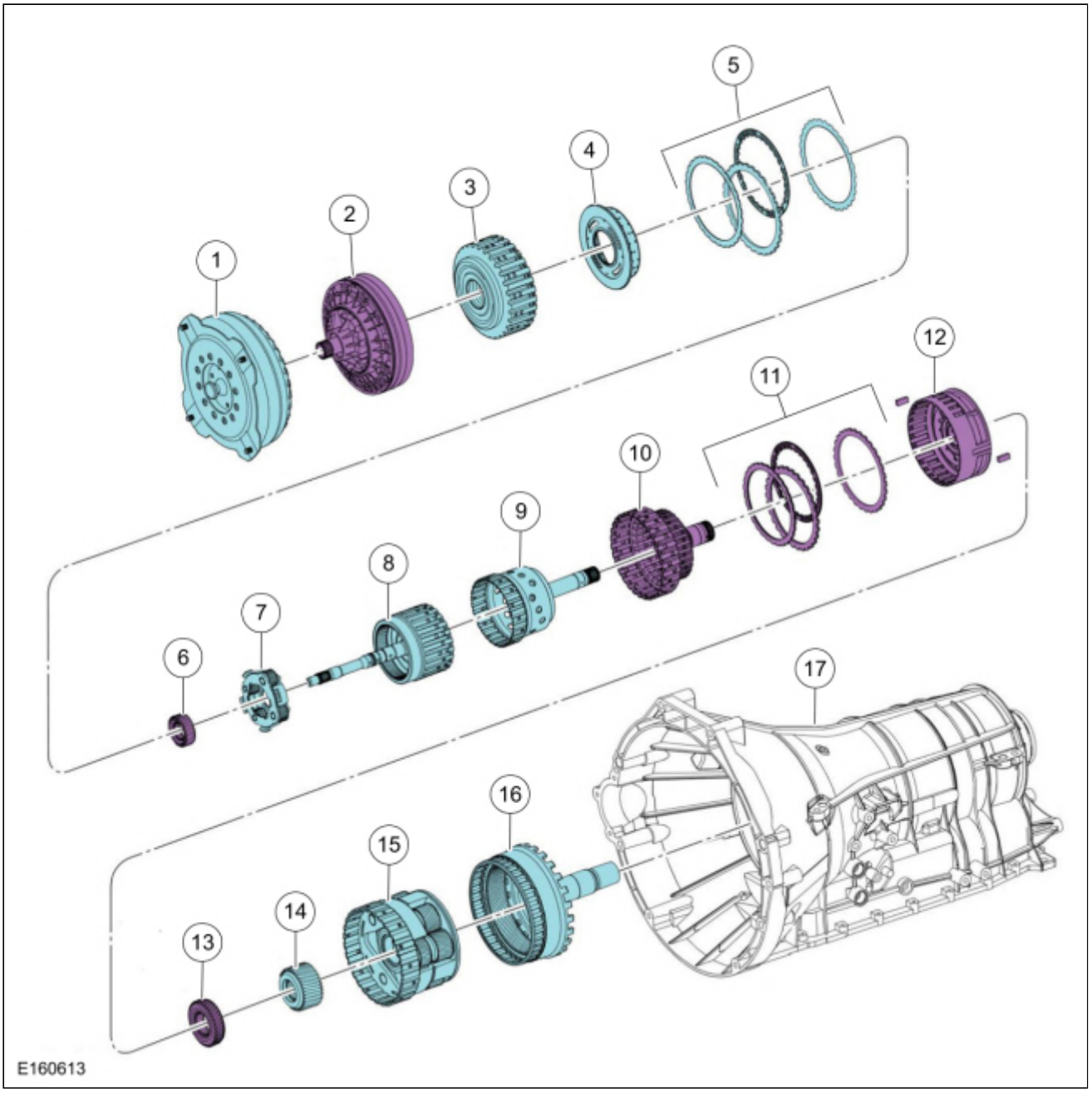
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
1ST
GEAR
E160612
SYMBOLS
CIRCUIT/PRESSURE
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT (FULL SOLENOID PRESSURE
VARIABLE SOLENOID PRESSURE
BALL CHECK
EXHAUST
FLUID DIRECTION
SOLENOID DAMPER
SHUTTLE BALL
VALVES/PUCKS/PISTONS

2nd Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied
- Intermediate clutch (C) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear

Rear planetary gearset driven components:

- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:

- No. 2 sun gear

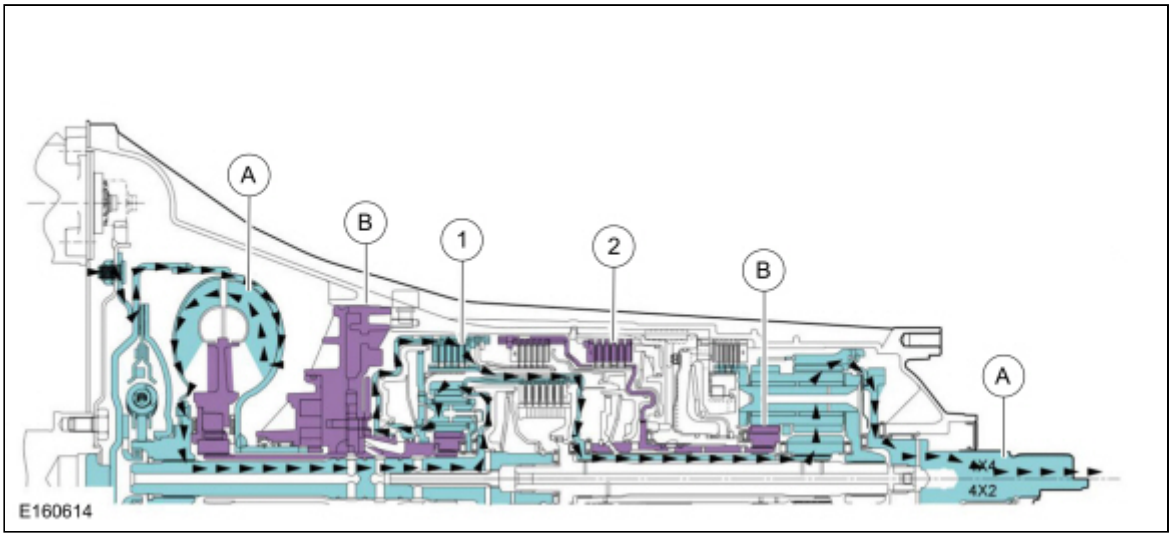
2nd Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Intermediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
2nd Gear D and Manual 2	D		H			O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrierto-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- H = Hold Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section

Power Flow



Hydraulic Operation

Line Pressure Hydraulic Circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSC supplies pressure to the clutch C regulator valve to position the valve for intermediate clutch (C) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch C regulator valve is supplied to the intermediate clutch (C) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

2nd Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D and 2	2	ON	ON	ON	ON	OFF	OFF

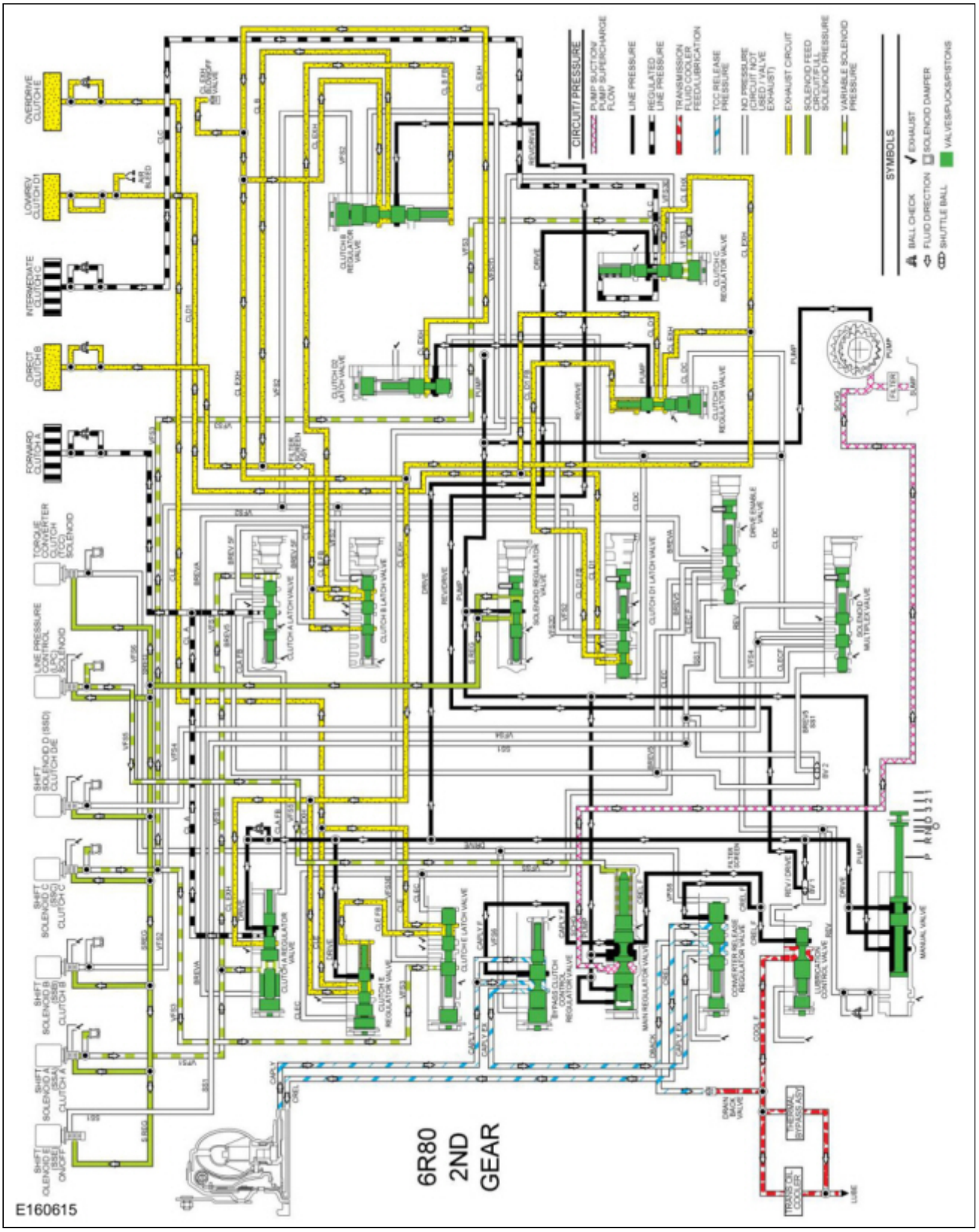
CB = Clutch brake

NC = Normally closed

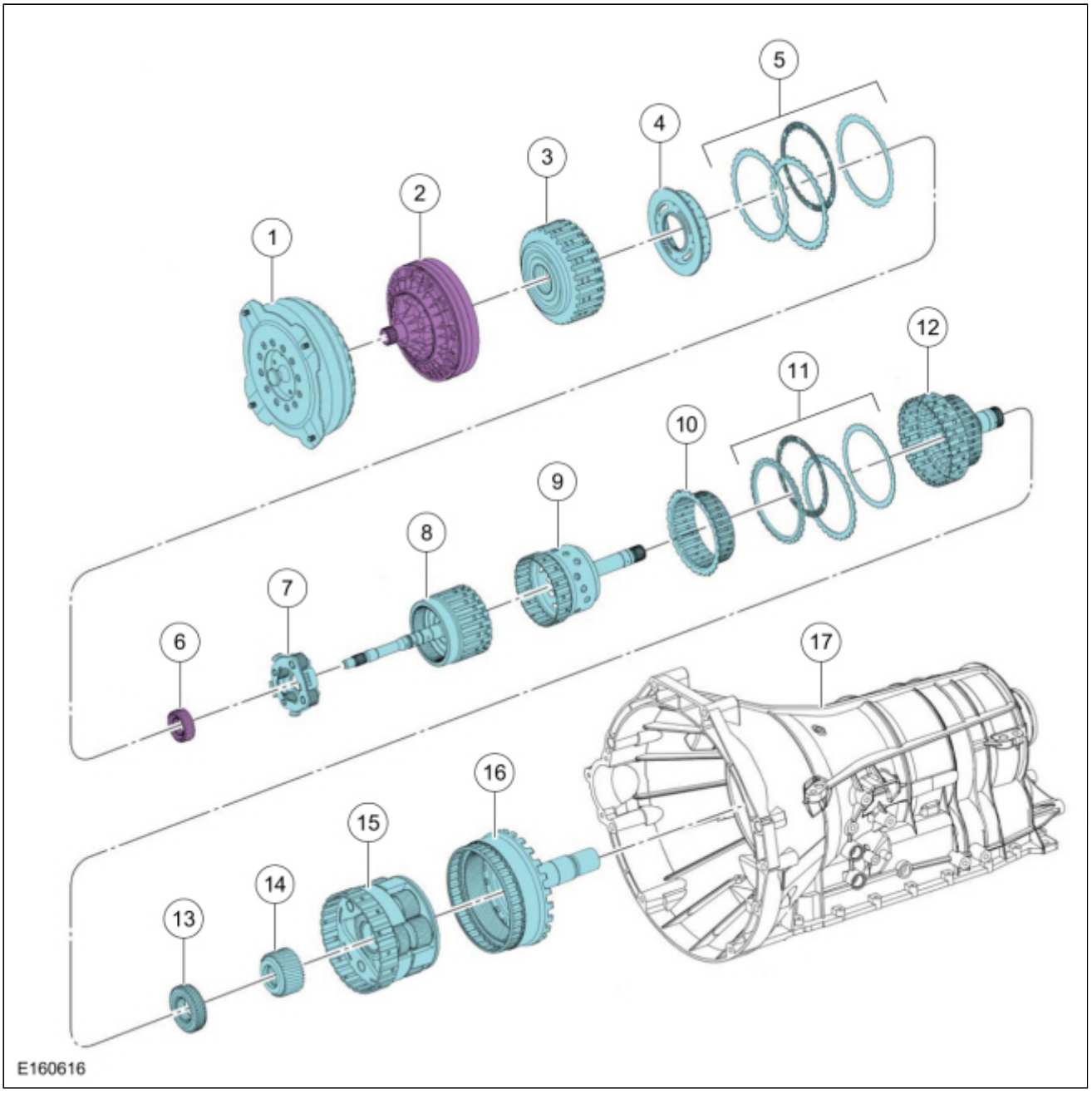
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.



3rd Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear
- No. 2 sun gear

Rear planetary gearset driven components:

- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:

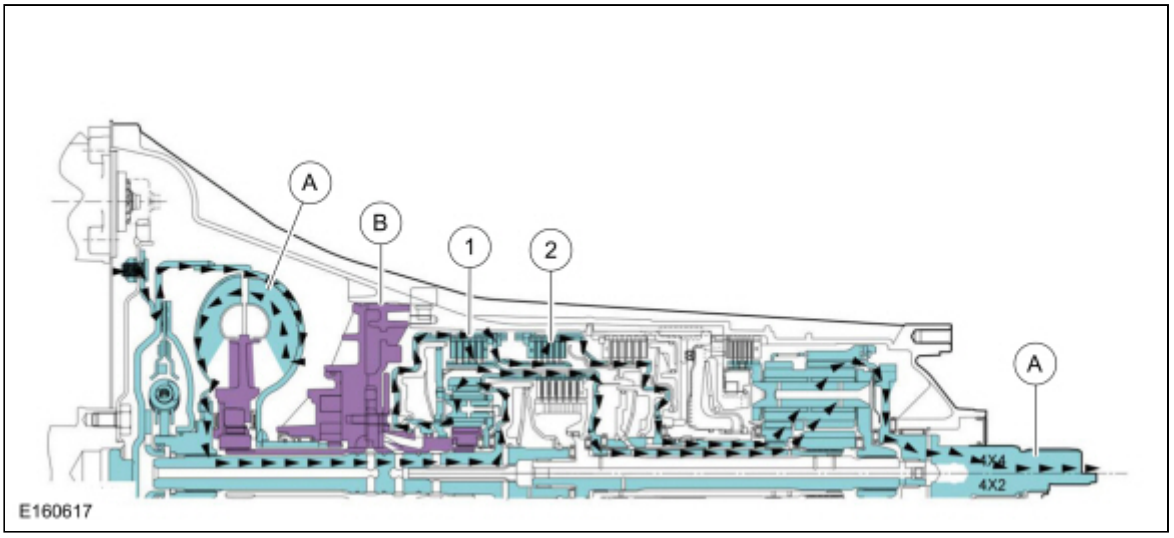
- None

3rd Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Intermediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
3rd Gear D and Manual 3	D	D				O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrierto-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.

- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter

through the CREL circuit to release the TCC.
    - CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSB supplies pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

3rd Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D and 3	3	On	Off	Off	On	Off	Off

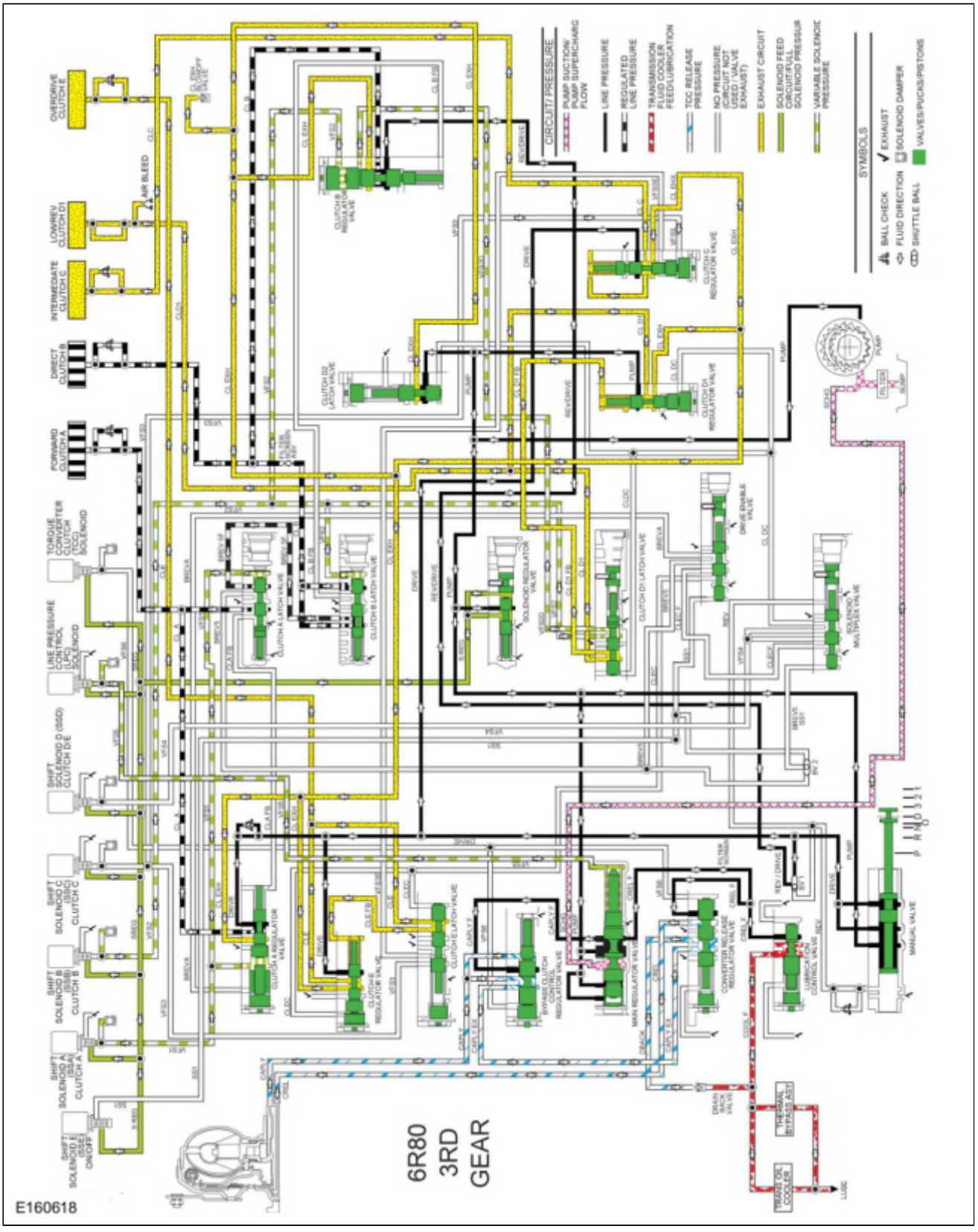
CB = Clutch brake

NC = Normally closed

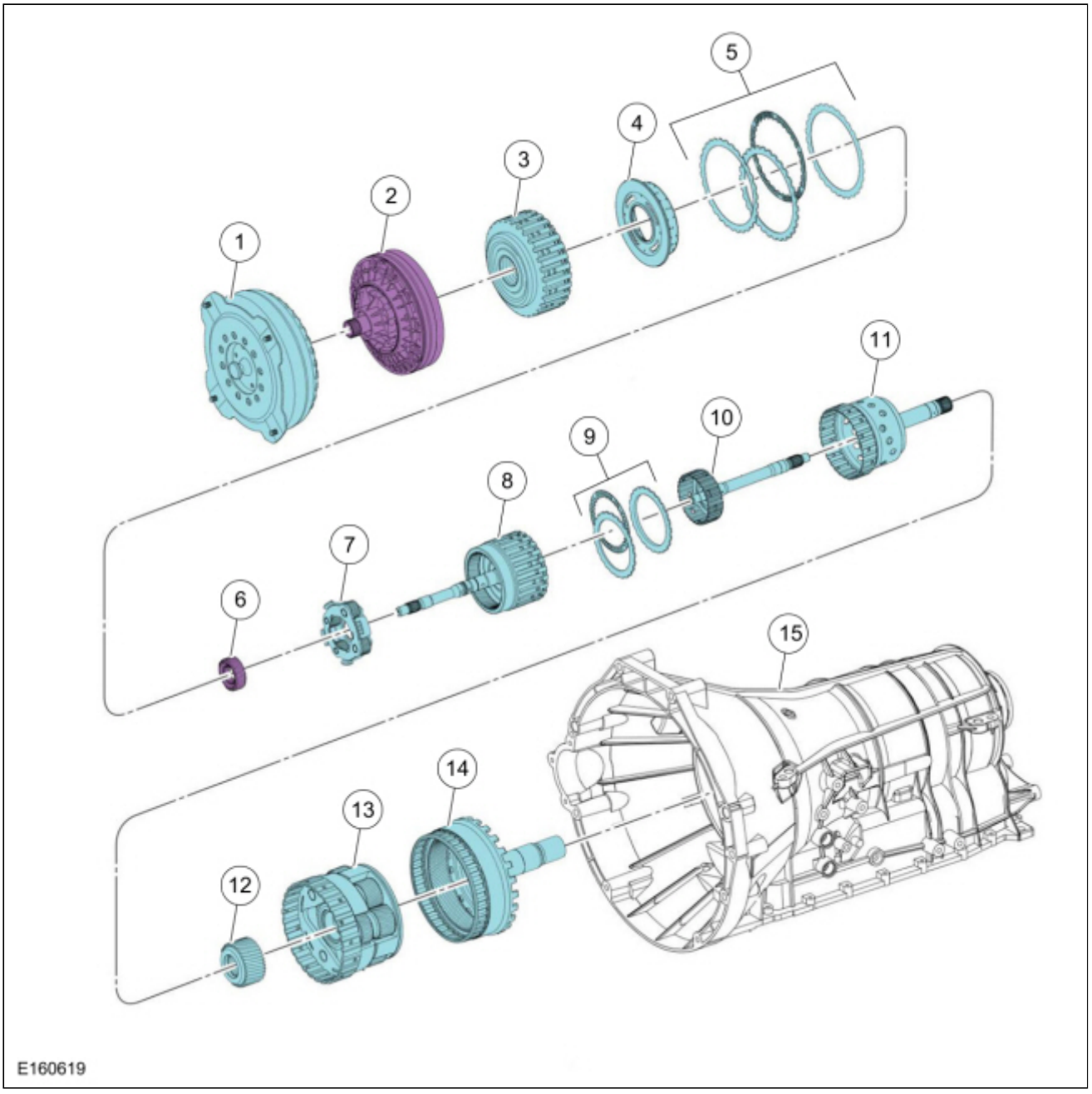
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
3RD
GEAR
E160618
CIRCUIT/PRESSURE
PUMP SUCTION/ PUMP SUPERCHARG FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT USED / VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSUR
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
EXHAUST
FLUID DIRECTION
SOLENOID DAMPER
SHUTTLE BALL
VALVES/PUCKS/PISTONS
OVERDRIVE CLUTCH E
LOW/REV CLUTCH D1
INTERMEDIATE CLUTCH C
DIRECT CLUTCH B
FORWARD CLUTCH A
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
LINE PRESSURE CONTROL (LPC) SOLENOID
SHIFT SOLENOID D (SSD) CLUTCH D/E
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID E (SSE) ON/OFF
AIR BLEED
CLUTCH D2 LATCH VALVE
CLUTCH D1 LATCH VALVE
CLUTCH C REGULATOR VALVE
CLUTCH D2 REGULATOR VALVE
CLUTCH D1 REGULATOR VALVE
CLUTCH A LATCH VALVE
CLUTCH B LATCH VALVE
CLUTCH E LATCH VALVE
CLUTCH A REGULATOR VALVE
CLUTCH B REGULATOR VALVE
CLUTCH E REGULATOR VALVE
SOLENOID REGULATOR VALVE
DRIVE ENABLE VALVE
MAIN REGULATOR VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
CONVERTER FEED REGULATOR VALVE
LUBRICATION CONTROL VALVE
MANUAL VALVE
PUMP
FILTER
DRAIN BACK VALVE
THERMAL BYPASS ASSY
TRANS OIL COOLER
LUBE

4th Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied
- Overdrive clutch (E) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly

Rear planetary gearset driving components:

- No. 3 sun gear
- Planetary carrier

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

- None

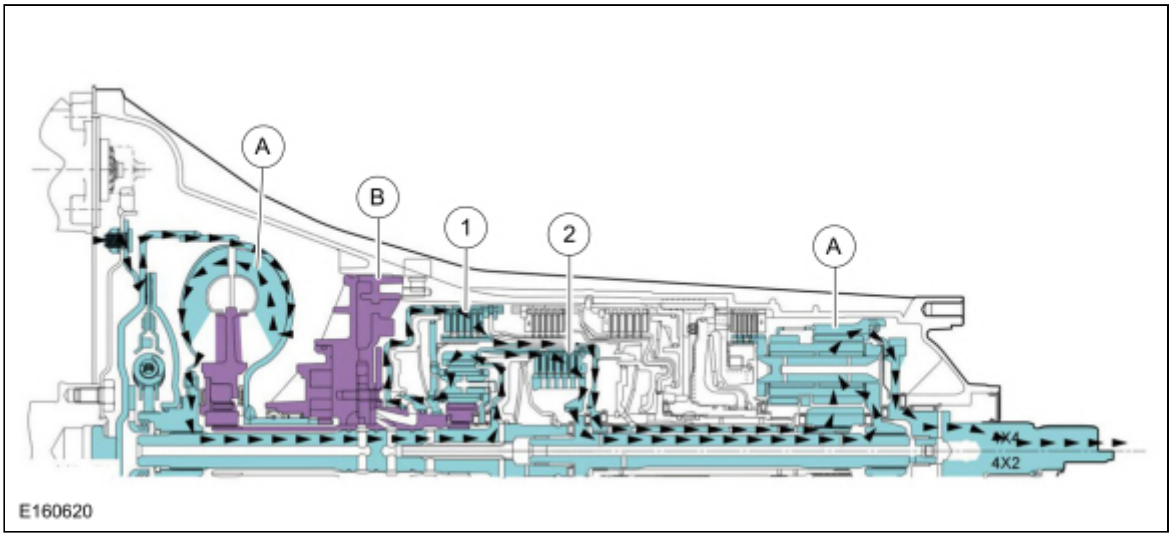
4th Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low- OWC
4th Gear D						
Planetary Components	Front planetary carrier-to- No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.

- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.

- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for overdrive clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the overdrive clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

4th Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear						TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D	4	On	On	Off	Off	Off	On/Off

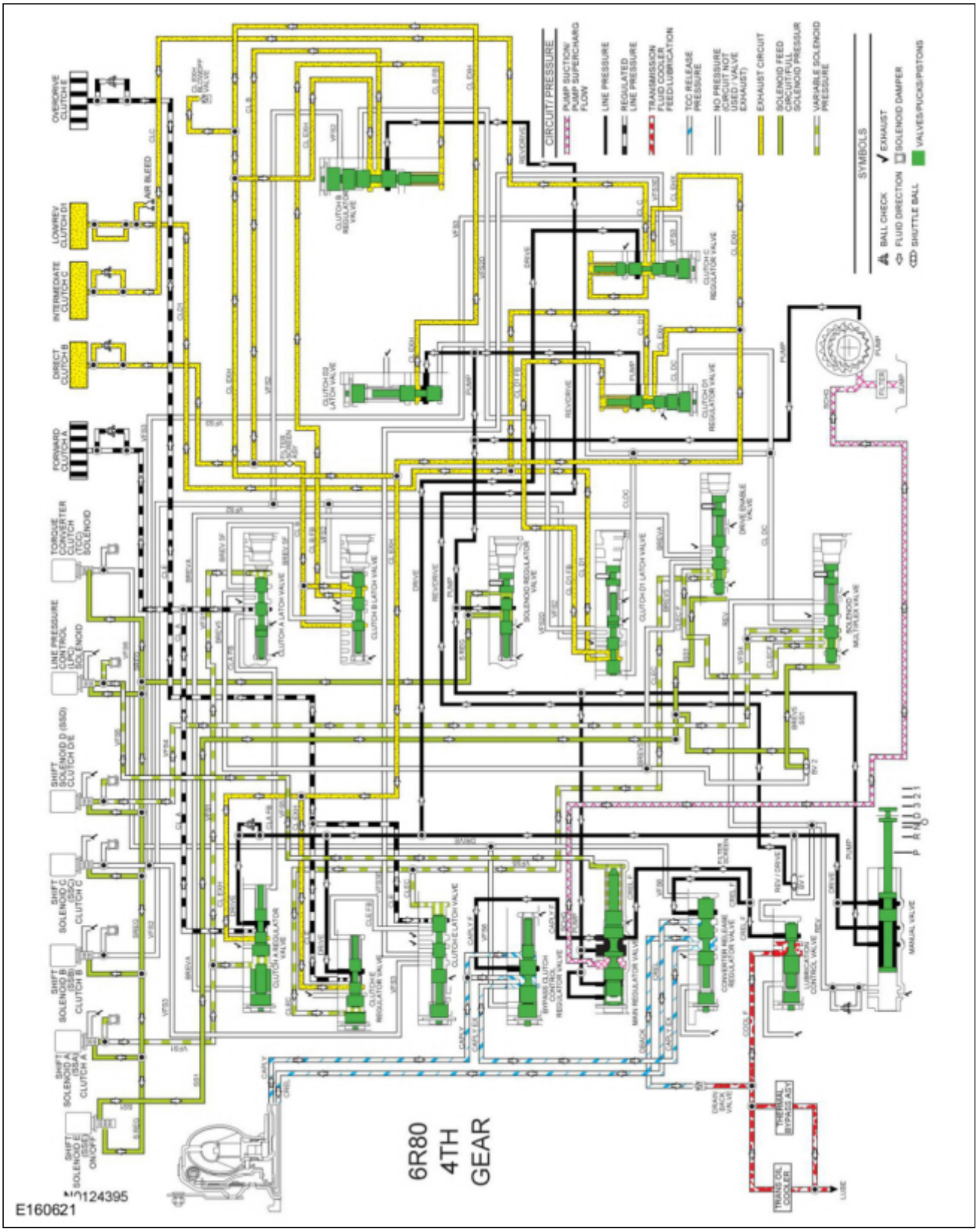
CB = Clutch brake

NC = Normally closed

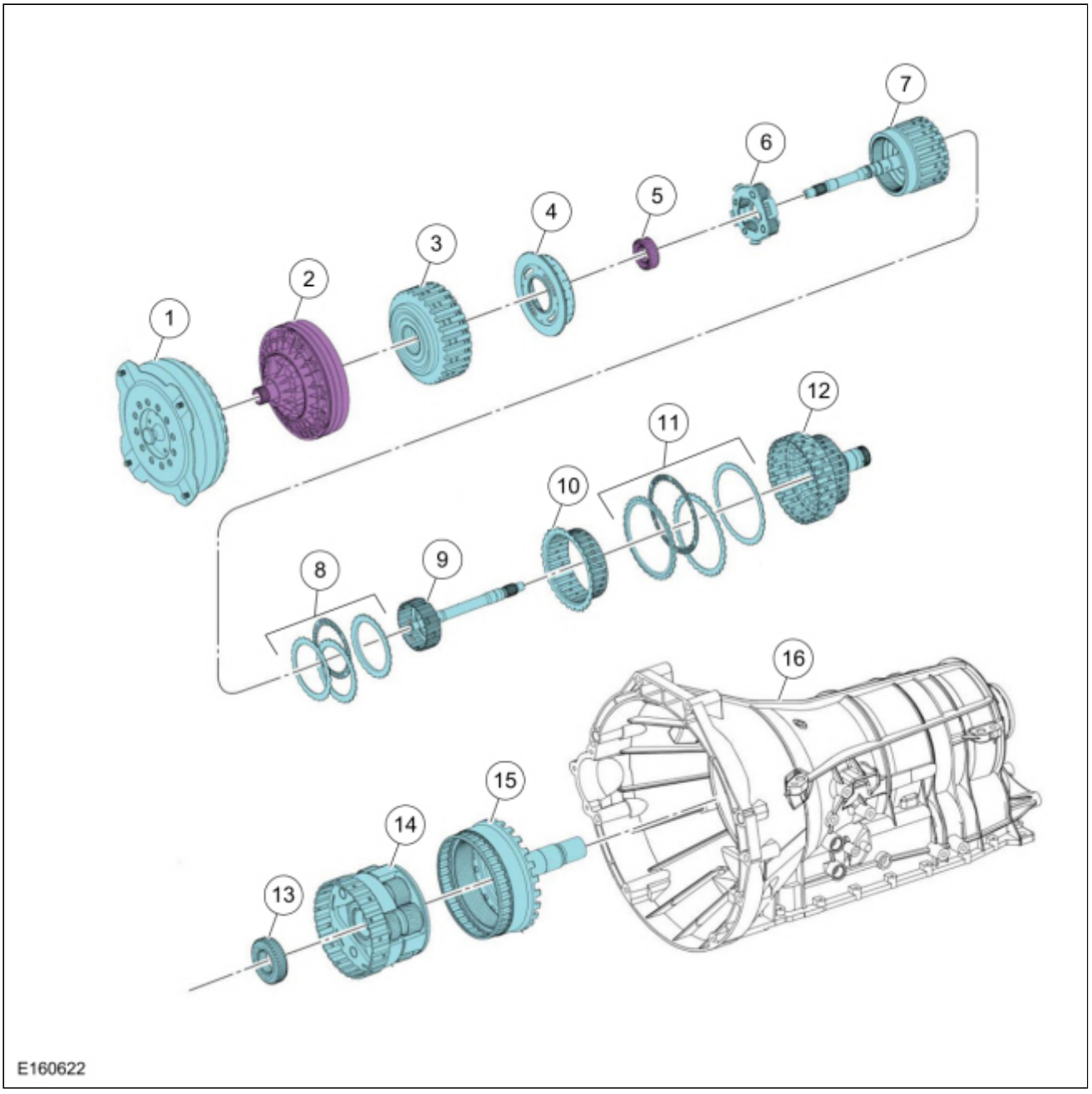
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
4TH
GEAR
E160621
CIRCUIT/PRESSURE
PUMP SUCTION/ PUMP SUPERCHARG FLOW
LINE PRESSURE
REGULATED LINE PRESSURE
TRANSMISSION FLUID COOLER FEED/LUBRICATION
TCC RELEASE PRESSURE
NO PRESSURE (CIRCUIT NOT FED BY VALVE EXHAUST)
EXHAUST CIRCUIT
SOLENOID FEED CIRCUIT/FULL SOLENOID PRESSUR
VARIABLE SOLENOID PRESSURE
SYMBOLS
BALL CHECK
EXHAUST
FLUID DIRECTION
SOLENOID DAMPER
SHUTTLE BALL
VALVES/PUCKS/PISTONS
OVERDRIVE CLUTCH E
LO/REV CLUTCH D1
INTERMEDIATE CLUTCH C
DIRECT CLUTCH B
FORWARD CLUTCH A
TORQUE CONVERTER CLUTCH (TCC) SOLENOID
LINE PRESSURE CONTROL (LPC) SOLENOID
SHIFT SOLENOID D (SSD) CLUTCH D/E
SHIFT SOLENOID C (SSC) CLUTCH C
SHIFT SOLENOID B (SSB) CLUTCH B
SHIFT SOLENOID A (SSA) CLUTCH A
SHIFT SOLENOID E (SSE) ON/OFF
AIR BLEED
CLUTCH B REGULATOR VALVE
CLUTCH C REGULATOR VALVE
CLUTCH LATCH VALVE
CLUTCH D1 LATCH VALVE
CLUTCH A LATCH VALVE
CLUTCH B LATCH VALVE
SOLENOID REGULATOR VALVE
DRIVE ENABLE VALVE
SOLENOID MULTIPLEX VALVE
CLUTCH A REGULATOR VALVE
CLUTCH E REGULATOR VALVE
CLUTCH E LATCH VALVE
BYPASS CLUTCH CONTROL REGULATOR VALVE
MAIN REGULATOR VALVE
CONVERTER FLOW REGULATOR VALVE
LUBRICATION CONTROL VALVE
MANUAL VALVE
PUMP
FILTER
SUMP
FILTER SCREEN
DRAIN BACK VALVE
THERMAL BYPASS ASY
TRANS OIL COOLER
LUBE
P R N D 3 2 1

5th Gear



Mechanical Operation

Apply components:

- Overdrive clutch (E) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 2 sun gear
- Planetary carrier

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

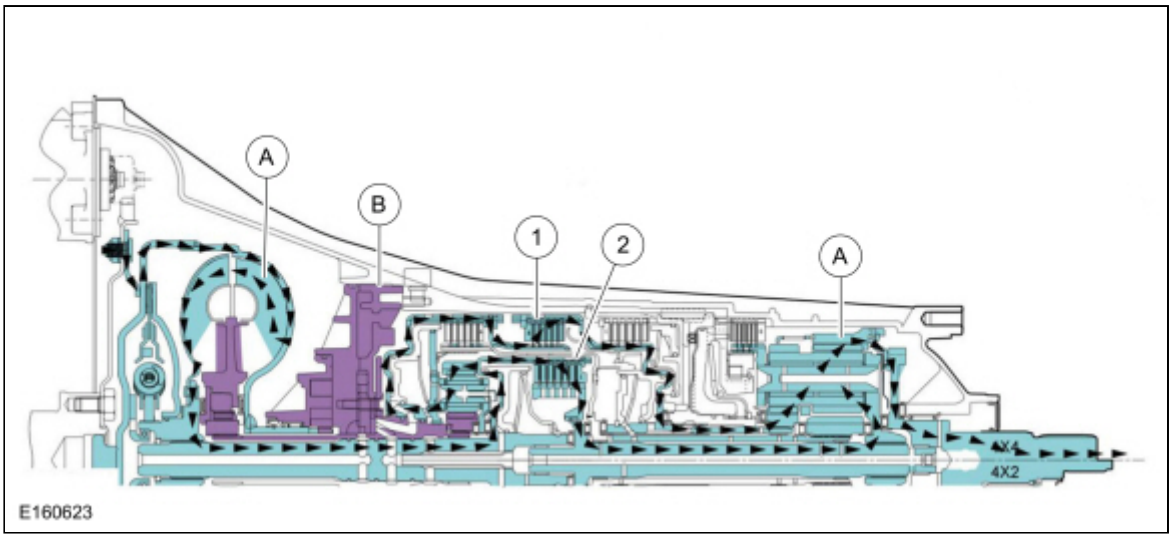
- None

5th Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Intermediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
5th Gear D		D			D	O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrierto-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.

The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.

- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.

- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.

- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.

- The PCA applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. LPC solenoid regulates line pressure by controlling
- The position of the main regulator valve.
- SSB supplies pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for overdrive clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the overdrive clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

5th Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D	5	OFF	Off	Off	OFF	Off	ON/Off

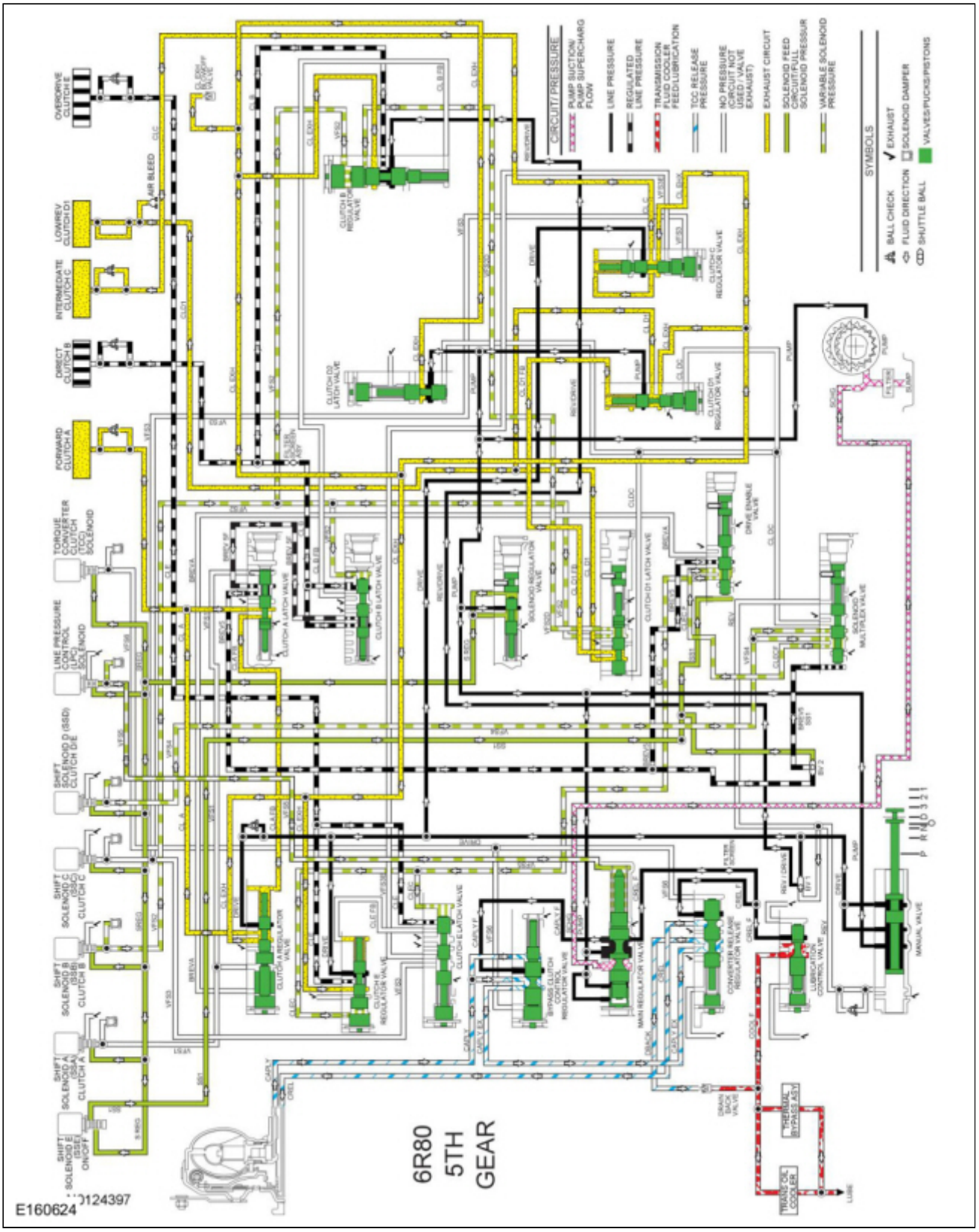
CB = Clutch brake

NC = Normally closed

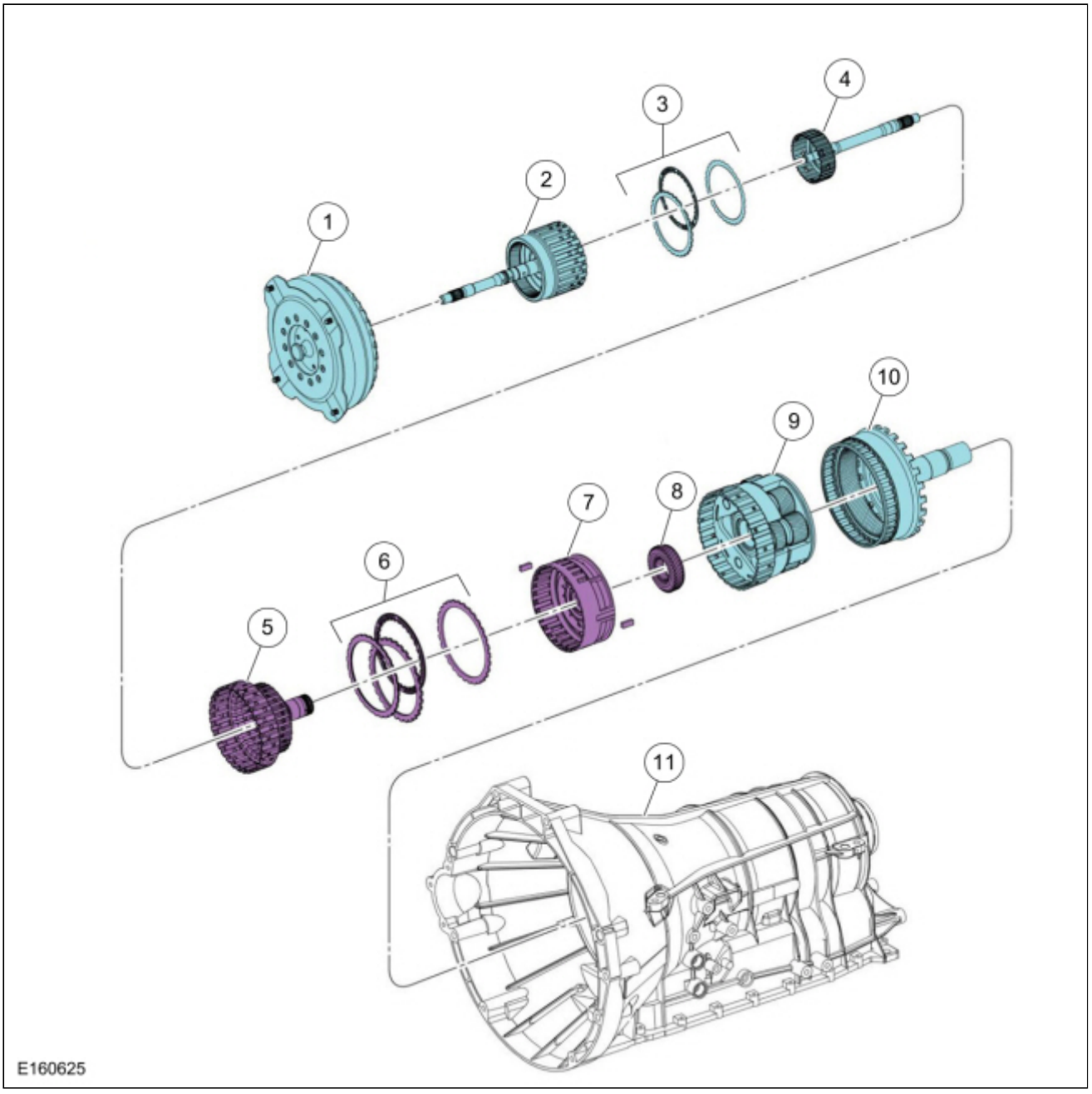
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.



6th Gear Torque Converter Clutch (TCC) Applied



Mechanical Operation

Apply components:

- Overdrive clutch (E) applied
- Intermediate clutch (C) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier(does not contribute to power flow)

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- Planetary carrier

Rear planetary gearset driven components:

- Ring gear (output shaft)

Rear planetary gearset held components:

- No. 2 sun gear

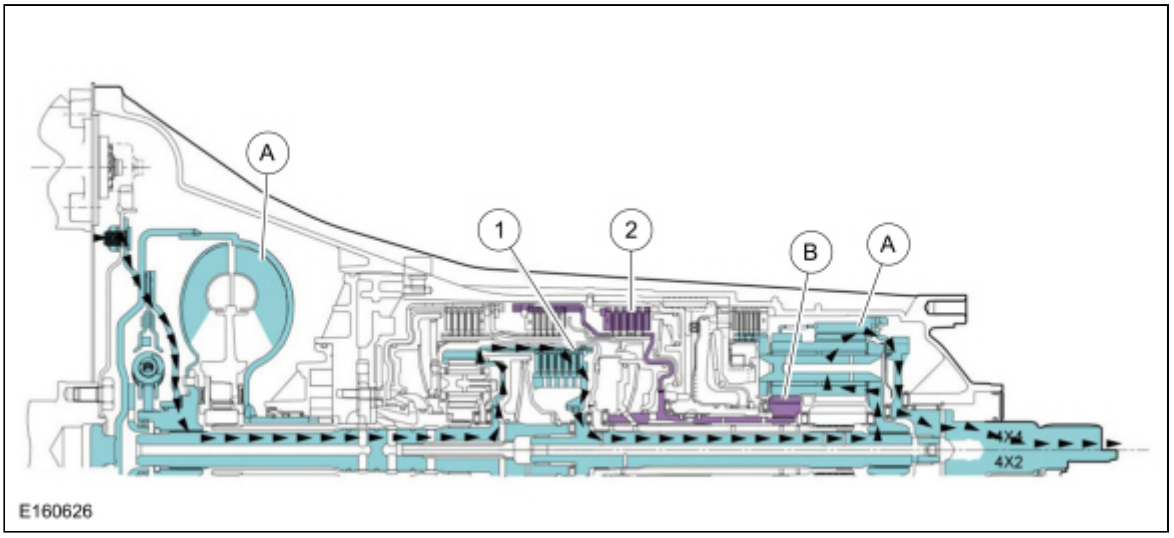
6th Gear Torque Converter Clutch (TCC) Applied Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Intermediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
6th Gear D			H		D	O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrierto-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- H = Hold Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is applied, the bypass clutch control regulator valve applies pressure to the torque converter through the CAPLY circuit to apply the TCC.

- CAPLY pressure exits the torque converter through the CREL circuit to the converter release regulator valve.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit.

For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- The TCC solenoid supplies pressure to the converter release regulator valve and the bypass clutch control regulator valve to move the position of the valves for TCC application.
- SSC supplies pressure to the clutch C regulator valve to position the valve for intermediate clutch (C) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for overdrive clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch C regulator valve is supplied to the intermediate clutch (C) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the overdrive clutch (E) to apply the clutch.
- For hydraulic circuit information, refer to Hydraulic Circuits in this section.

6th Gear Torque Converter Clutch (TCC) Applied Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
6	Off	On	On	Off	Off	Off	On/Off

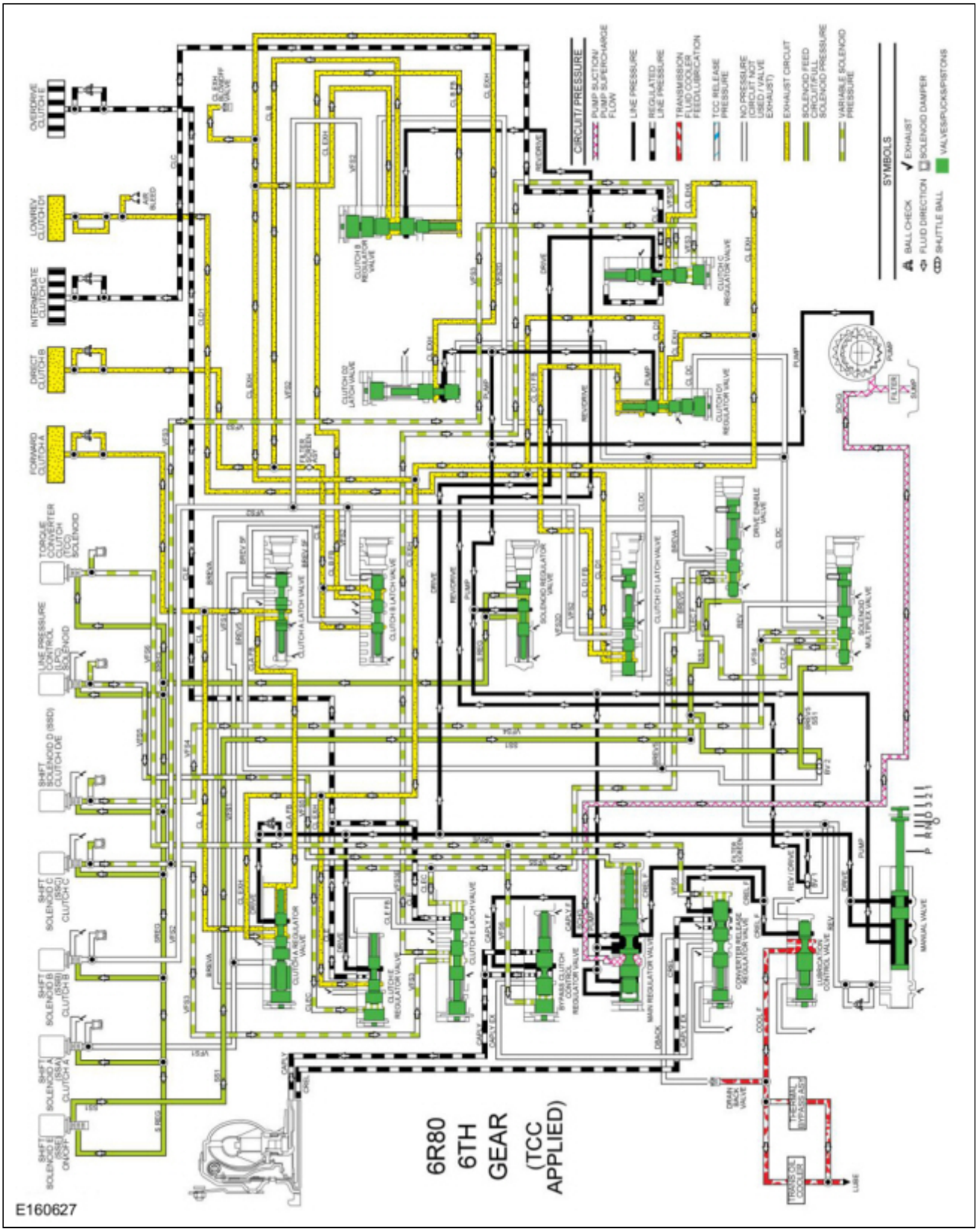
CB = Clutch brake

NC = Normally closed

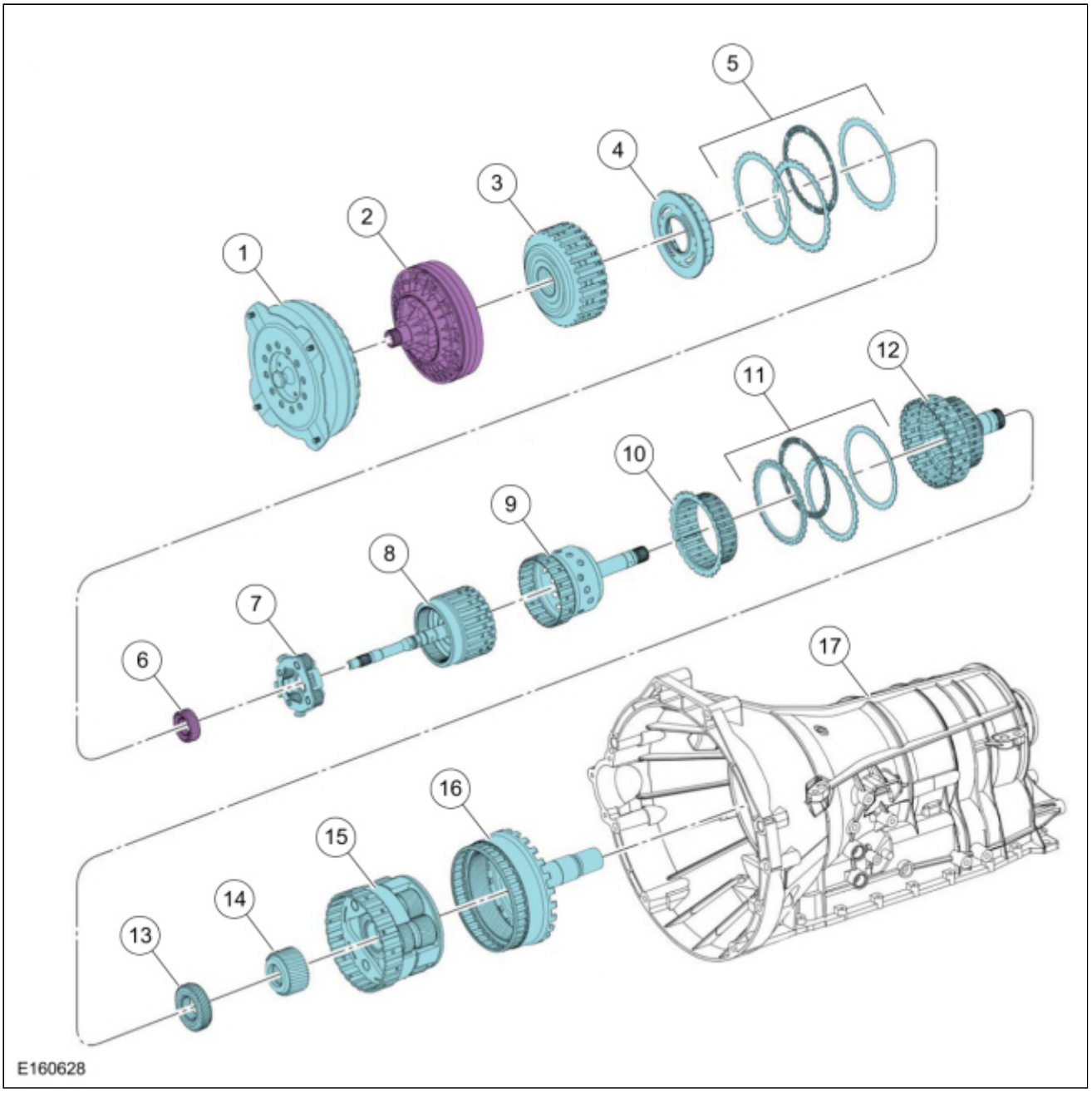
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.



3rd Gear Fail Safe



Mechanical Operation

Apply components:

- Forward clutch (A) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear
- No. 2 sun gear

Rear planetary gearset driven components:

- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:

- None

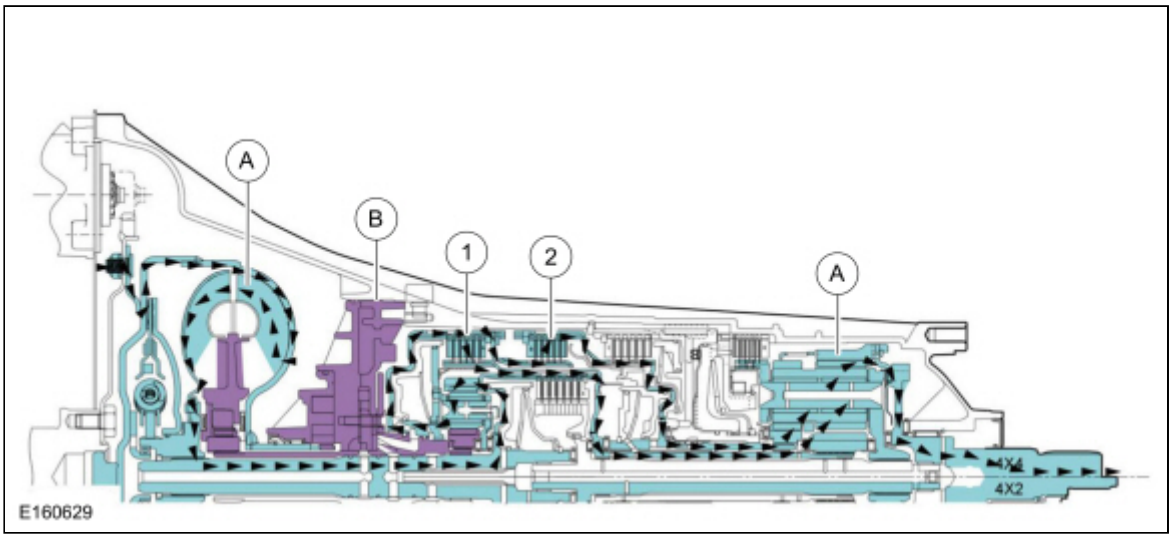
3rd Gear Fail Safe Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Intermediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
3rd Gear D and Manual 3	D	D				O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrierto-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaftto- rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.

- Line pressure is supplied to the:
  - Manual valve.
  - Lubrication control valve.
  - Converter release regulator valve.
  - Bypass clutch control regulator valve.
  - Solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies full solenoid output pressure to the main regulator valve through the VFS5 hydraulic circuit. With full solenoid output pressure, the main regulator valve provides maximum line pressure during fail safe.
- SSB supplies maximum solenoid output pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to, apply the clutch. Regulated line pressure from the clutch B regulator valve is also supplied to the clutch A latch valve from the clutch B latch valve through the BREV 5F circuit.
- The clutch A latch valve directs the regulated line pressure to the drive enable valve through the BREV5 circuit.
- The drive enable valve directs the BREV5 pressure to the BREVA circuit which supplies the clutch A regulator valve to position the valve to apply the forward clutch (A) with 81% of line pressure.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation: In failsafe, voltage is removed from all solenoids and the solenoids default to their normal position. If a solenoid is a normally low (NL)solenoid, the solenoid will not supply pressure to the regulator valve, releasing the clutch that it controls. If a solenoid is a normally high (NH) solenoid, the solenoid will provide high pressure to the regulator valve, applying the clutch that it controls.

3rd Gear Fail Safe Solenoid Operation Chart

Gear	SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/ R 4,5,6	SSE NC	LPC NH	TCC NL
3rd Gear	-	-	-	-	-	-	-

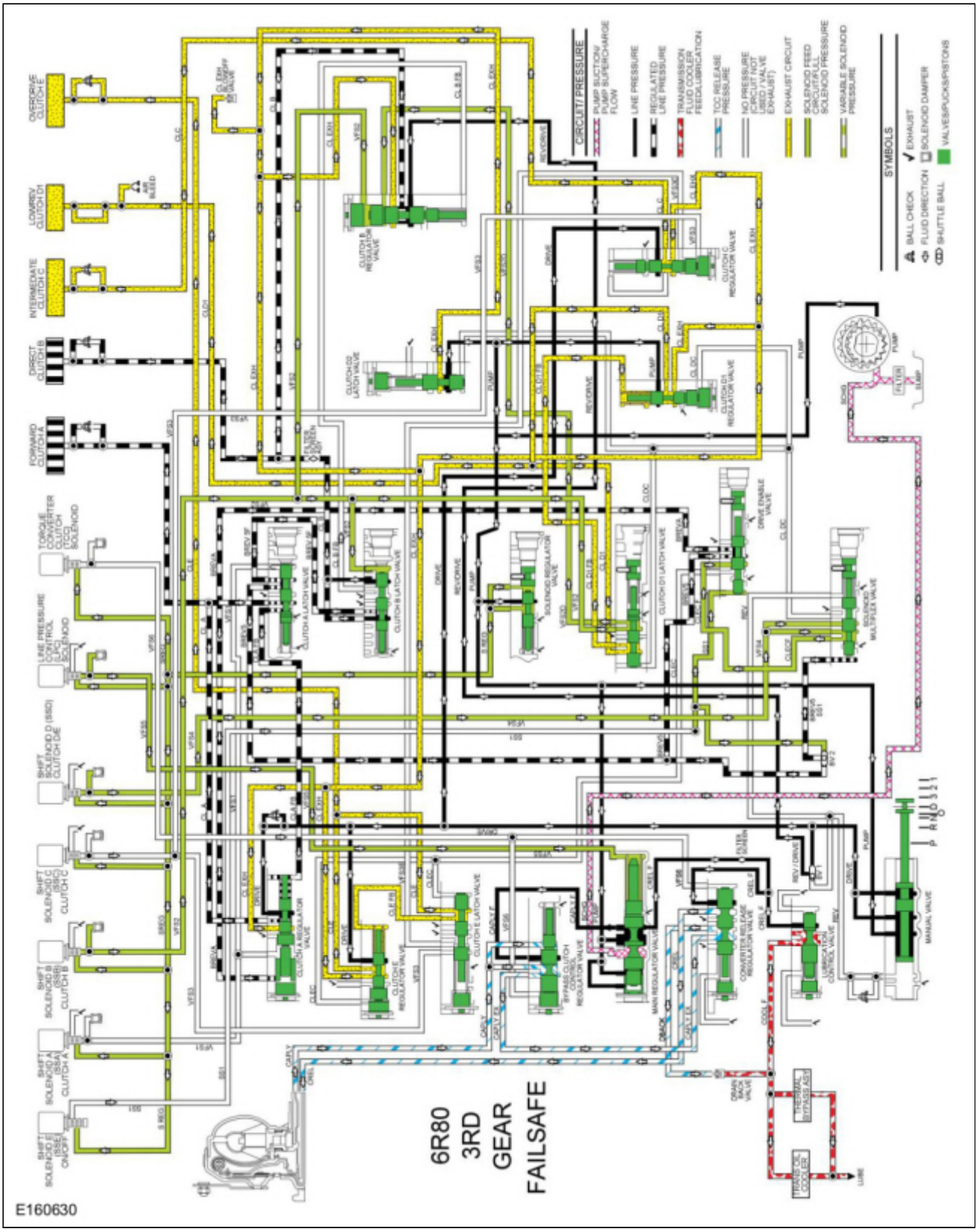
CB = Clutch brake

NC = Normally closed

NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section



Copyright © 2016 Ford Motor Company

Diagnostic Strategy

Diagnostic Strategy

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: *Do not take short cuts or assume that critical checks or adjustments have already been made.*

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- Powertrain Control/Emissions Diagnosis (PC/ED) manual
- On-Line Automotive Service Information System (OASIS)
- TSBs
- Wiring Diagrams manual

These publications provide the information required when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

1. Know and understand the customer concern.
2. Verify the concern by operating the vehicle.
3. Check the transmission fluid level and condition.
4. ICheck for non-factory add-on items.
5. Check selector lever cable for correct adjustment.
6. Check TSBs regarding the concern.

Diagnostics

1. Carry out On-Board Diagnostic (OBD) procedures, Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).
2. Record all DTCs.
3. Repair all non-transmission codes first.
4. Repair all transmission codes second.
5. Clear all continuous codes and attempt to repeat them.
6. Repair all continuous codes.
7. If only pass codes are obtained, refer to Diagnosis By Symptom in this section for additional information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Copyright © 2016 Ford Motor Company

Preliminary Inspection

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool.

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV

Check the following items prior to beginning the diagnostic procedure.

Know and Understand the Concern

To correctly diagnose a concern, first understand the customer concern or condition. Customer contact may be required to understand the conditions, including when the concern occurs. For example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to Verification of Condition.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

Use following procedures when verifying customer concerns for the transmission.

Determine Customer Concern

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperature
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshifting
- Downshifting
- Coasting
- Engagement
- Noise/vibration - check for engine rpm, vehicle speed, shift, gear, range or temperature dependencies.

Check Transmission Fluid Level and Condition

Transmission Fluid Level Check

NOTE: *The vehicle should not be driven if the transmission fluid level is low as internal transmission failure could result.*

NOTE: *The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.*

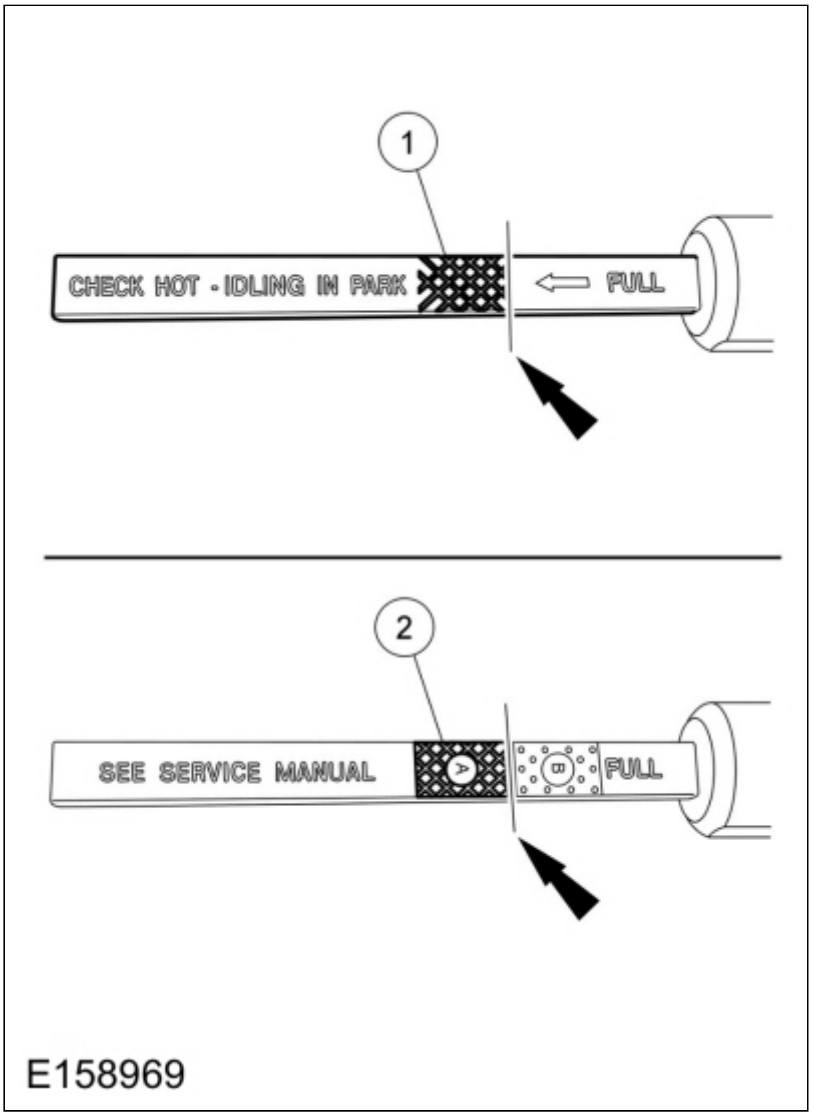
NOTE: *If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot*

weather or while pulling a trailer, the transmission fluid must cool down to obtain an accurate reading.

NOTE: *If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.*

This transmission is equipped with an internal thermal bypass located in the case. This internal thermal bypass valve will shut off transmission fluid flowing to the transmission fluid cooler if the transmission fluid temperature falls below normal operating temperature. Refer to Transmission Fluid Level Check in this section.

The transmission can have 2 types of transmission fluid level, a crosshatched (labeled A) area and a dotted (labelled B) area. Use the dotted (labeled B) area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.



Item	Description
1	Original transmission fluid level indicator
2	Replacement transmission fluid level indicator

High Transmission Fluid Level

NOTE: *Transmission fluid level that is too high can cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid through the vent tube and possible transmission failure.*

If an overfill reading is indicated, remove any excessive transmission fluid. Refer to Transmission Fluid Level Check in this section.

Low Transmission Fluid Level

Low transmission fluid level can result in poor transmission engagement, slipping or failure. This may also indicate a leak in one of the transmission seals or gaskets.

Adding Transmission Fluid

NOTE: *The use of any type of transmission fluid other than specified can result in transmission failure.*

NOTE: *The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.*

NOTE: *The vehicle should not be driven if the transmission fluid level is low as internal failure could result.*

Add transmission fluid using the refill procedure. Refer to Transmission Fluid Drain and Refill in this section.

Transmission Fluid Condition Check

1. Check the transmission fluid level.
2. Remove the transmission fluid fill plug and transmission fluid level indicator allowing the transmission fluid to drip onto a facial tissue and examine the stain.
3. Observe the colour and the odour.
4. If evidence of solid material is found, remove the transmission fluid pan for further inspection.
5. If the stain is a foamy pink colour, this may indicate coolant in the transmission. Inspect the engine cooling system at this time.
6. If transmission fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, disassemble and completely clean the transmission. This includes the torque converter and transmission fluid cooler tubes. Install a new auxiliary transmission fluid cooler.

Water in Transmission Fluid

To correctly repair an automatic transmission that had water or coolant introduced into the system, completely disassemble, clean and replace the following parts:

- All internal and external seals
- All friction material
- Torque converter
- All parts with bonded seals
- All solenoids
- All transmission fluid filters

Prior to installing the transmission, the transmission fluid cooler(s), transmission fluid cooler tubes and hoses need to be flushed and cleaned.

Copyright © 2016 Ford Motor Company

Visual Inspection

A visual inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
- Vehicle modification:

PCM or transmission function is affected if add on devices, wiring splices, abnormal tire size or axle ratio changes are made.

- If leaks are present; refer to Leakage Inspection in this section.
- Correct selector lever adjustments; refer to Section 307-05.

Selector Lever Check

Check for mis-adjustment in the selector lever by matching the detents in the selector lever with those of the manual control lever in the transmission. Refer to Section 307-01B for selector lever cable adjustment.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-01B for selector lever cable adjustment.

Check TSBs and On-Line Automotive Service Information System (OASIS)

Refer to all TSB and On-Line Automotive Service Information System (OASIS) messages that pertain to the transmission concern and follow the procedure as described.

Carry Out On-Board Diagnostic (OBD) Key ON Engine OFF (KOEO), Key ON Engine Running (KOER)

After a road test, with the engine and transmission warm and before disconnecting any connectors, use the scan tool and perform a self-test.

Copyright © 2016 Ford Motor Company

Shift Point Road Test

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool.

NOTE: *Always drive the vehicle in a safe manner according to driving condition and obey all the traffic laws.*

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate vehicle with the selector lever in (D) position.
3. Apply minimum throttle and observe speeds at which upshift occurs and the torque converter engages. Refer to the Shift Speeds chart in this section.
4. With the transmission in (D), move the selector lever into the manual 3 position. The transmission should downshift to 4th gear. Release the accelerator pedal; engine braking should occur.
5. Press the accelerator pedal to floor, Wide Open Throttle (WOT). Transmission should shift from 4th to 3rd, depending on vehicle speed. The Torque Converter should disengage and then reapply.
6. With the transmission in (D) position and speed above 80 km/h (50 mph) and less than half throttle, move the selector lever from (D) position to manual 2 position and release the accelerator pedal. The transmission should downshift into 2nd gear. With the transmission remaining in the manual 2 position, move the selector lever into the manual 1 position and release the accelerator pedal. The transmission should downshift into 1st gear at speeds below approximately 45-56 km/h (28-35 mph).
7. If the transmission fails to upshift/downshift or the torque converter does not apply and release, refer to Diagnosis By Symptom in this section.

Shift Speeds

NOTE: *Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet. Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

Throttle Position	Shift	Km/H
Light Throttle Position (APP1 ~ 20%)	1-2	13-21
	2-3	30-38
	3-4	51-59
	4-5	57-65
	5-6	79-87
Closed Throttle	6-5	72-80
	5-4	52-60
	4-3	38-46
	3-2	12-18
	2-1	6-10
Wide Open Throttle (APP1 ~100%)	1-2	33-41
	2-3	62-70
	3-4	104-112

Road Test — Adaptive Drive Cycle

This test verifies the shift control system is operating correctly.

NOTE: *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

1. Connect the scan tool to the Data Link Connector (DLC).

NOTE: *Disconnecting the battery will not clear the Keep Alive Memory (KAM).*

NOTE: *Do not clear the PCM KAM.*

2. Using the scan tool, clear the adaptive table before conducting an adaptive drive cycle test.

3. Verify that the transmission fluid is at normal operating temperature, between 91°C-102°C (195°F-215°F). If the transmission fluid is not at operating temperature, drive the vehicle until the operating temperature is reached

NOTE: *The transmission fluid must be at operating temperature before proceeding to this step.*

NOTE: *Drive the vehicle on a level road surface performing the adaptive drive cycle.*

4. Drive the vehicle on a level road surface performing the adaptive drive cycle.
    1. Accelerate from a stop with light throttle to 24 km/h (15 mph) then release the accelerator pedal.
    2. Gently brake and bring the vehicle to a stop and hold the brake for 6 seconds.
    3. Repeat substeps 1 and 2 an additional 5 times.
    4. Accelerate from a stop with light throttle so the 1-2, 2-3 and 3-4 shifts occur with engine rpm between 1,700-2,000.
    5. Continue accelerating until the vehicle speed reaches 80 km/h (50 mph) or the 5-6 upshift is reached
    6. Gently brake and bring the vehicle to a stop and hold the brake for 10 seconds.
    7. Repeat substeps 4, 5 and 6 an additional 3 times.

Copyright © 2016 Ford Motor Company

Transmission Drive Cycle Test

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool.

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV

NOTE: *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

NOTE: *The Transmission Drive Cycle Test must be followed exactly. Malfunctions must occur 4 times consecutively for a shift error DTC to set, and 5 times consecutively for continuous Torque Converter Clutch (TCC) DTCs to set.*

NOTE: *Refer to the Solenoid Application Chart for solenoid operation while performing the Transmission Drive Cycle Test.*

After performing the self-test, follow the transmission drive cycle test for checking codes.

1. Record then clear the DTCs.
2. Warm the engine to normal operating temperature.
3. Make sure the transmission fluid level is correct.
4. With the selector lever in D, moderately accelerate from stop to 80 km/h (50 mph) allowing the transmission to shift into 6th gear. Keep vehicle speed and throttle steady for a minimum of 15 seconds.
5. With the transmission in 6th gear and maintaining steady speed and throttle, lightly apply and release the brake to operate the stop lamps. Then, hold vehicle speed and throttle steady for a minimum of 5 seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat steps 4 through 6 at least 5 times.
8. Perform a self-test and record DTCs.
    1. If DTCs are present, refer to the DTC Chart. Repair all non-transmission DTCs first as they can directly affect the operation of the transmission. Repeat the self-test and the road test to verify the correction. Clear the DTCs. Perform the transmission drive cycle test and repeat the self-test after completing the repair
    2. If the tests pass and a concern is present, refer to Diagnosis By Symptom in this section, OASIS messages and TSBs for concerns.

After On-Board Diagnostic (OBD)

NOTE: *The vehicle wiring harness, PCM and nontransmission sensors may affect transmission operations. Repair these concerns first.*

Repair all DTCs after the On-Board Diagnostic (OBD) test procedures are completed.

Begin with non-transmission related DTCs, then repair transmission related DTCs. Use the DTC Chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Diagnosis the vehicle wiring harness and the PCM as well. The Powertrain Control/ Emissions Diagnosis (PC/ED) manual aids in diagnosing non-transmission electronic components.

Copyright © 2016 Ford Motor Company

Diagnostics

General Equipment

Fluke 77-IV Digital Multimeter or equivalent
Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. The most important things to remember is there is a definite procedure to follow. Do not take shortcuts or assume that critical checks or adjustments have already been made. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostic (OBD) with Scan Tool

These self-tests should be used to diagnose the PCM and should be carried out in order.

NOTE: *Make sure the latest software version is loaded on the scan tool.*

1. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: *The Vehicle Communication Module (VCM) LED prove-out confirms power and ground from the DLC to the VCM.*

2. If the scan tool does not communicate with the VCM:

- Check the VCM connection to the vehicle.
- Check the scan tool connection to the VCM.
- No power to the scan tool.

3. If the scan tool does not communicate with the vehicle:

- Verify the ignition is in the RUN position.
- Verify scan tool operation with a known good vehicle.
- The PCM does not respond to the scan tool.

4. Carry out the network test:

- If the scan tool responds with no communication from one or more modules, No High Speed Controller Area Network (CAN) communication, all modules are not responding.
- If the network test passes, retrieve and record the continuous memory DTCs.

5. Clear the continuous DTCs and carry out the PCM self-test.

6. If DTCs retrieved are related to the concern, GO to the DTC Chart.

7. If no DTCs related to the concern are retrieved, Refer to Diagnosis By Symptom in this section.

Copyright © 2016 Ford Motor Company

Torque Converter Diagnosis

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: *If the torque converter is replaced, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.*

Perform all diagnostic procedures prior to torque converter installation. This prevents the unnecessary installation of new or remanufactured torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Torque Converter Operation Test

NOTE: *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

The Torque Converter Operation Test verifies that the Torque Converter Clutch (TCC) control system and the torque converter are operating correctly.

1. Connect a scan tool to the vehicle.
2. Perform a self-test and check for DTCs.
3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds in the (D) position.
4. After normal operating temperature is reached, maintain a constant speed of about 56 km/h (35 mph) in 5th gear for 10 seconds.
5. Release the accelerator pedal and monitor the scan tool TP1 PID voltage to approximately 1.25 volts or 25% throttle.
6. Monitor the TCC_OSC# and RPM# PID. The torque converter should release and engine rpm should increase before the 5-4 shift occurs.

Copyright © 2016 Ford Motor Company

Output State Control (OSC) Mode

On-Board Diagnostic (OBD)

Output state control allows the technician to take control of certain parameters to function the transmission

Output state control allows the technician to shift the transmission when commanding a gear change.

Another example of the output state control features is, the technician can command the torque converter ON or OFF to check operation.

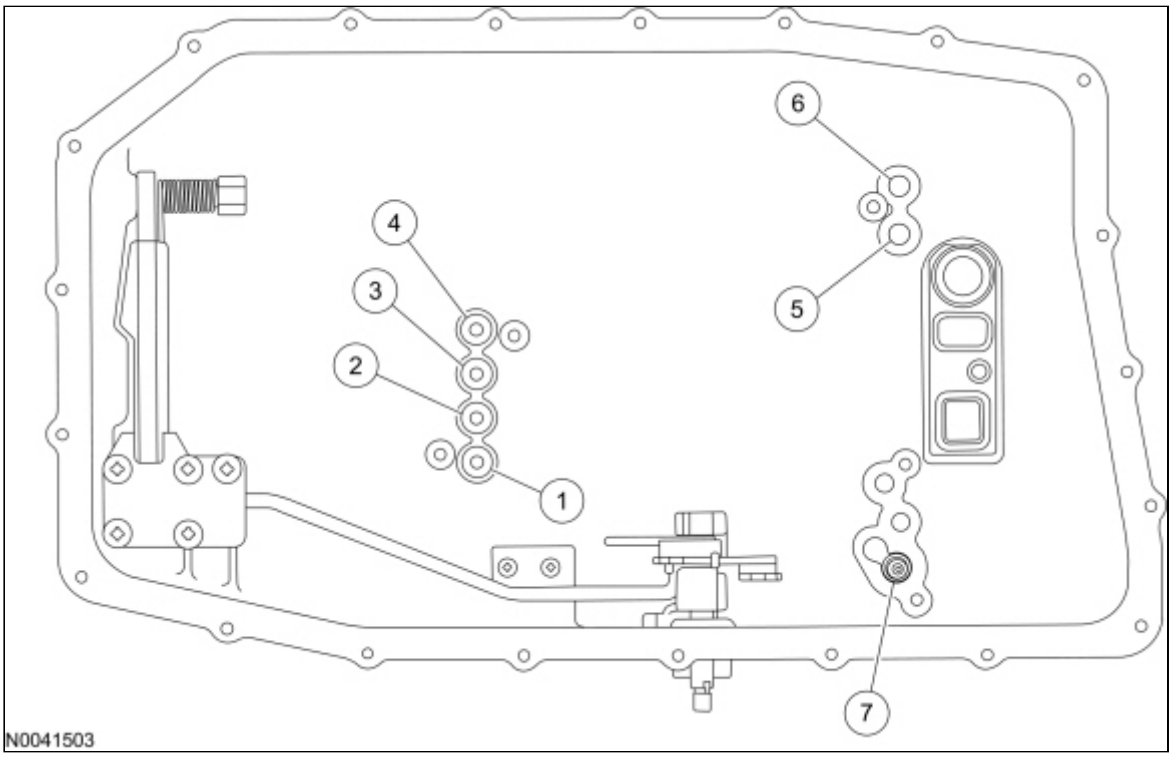
This transmission output state control has one mode of operation; DRIVE. This mode has a unique set of operating requirements that the technician must meet before allowed to operate the torque converter or select gears.

Copyright © 2016 Ford Motor Company

Special Testing Procedures

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transmission.

Air Pressure Test



Item	Description
1	Intermediate clutch (C) port
2	Low/reverse clutch (D1) port
3	Not used
4	Direct clutch (B) port
5	Overdrive clutch (E) port
6	Forward clutch (A) port
7	Cooler bypass valve

A no-drive condition can exist with correct transmission fluid pressure because of inoperative clutches. Refer to the Clutch Application Chart to determine the appropriate elements. A clutch concern can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the concern.

Example: When the selector lever is in a forward gear range, a no-drive condition may be caused by an inoperative clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.
2. Remove the transmission fluid filter, seal assembly and mechatronic unit.
3. Locate the inoperative clutches by applying air pressure into the appropriate clutch port.
4. Apply air pressure to the appropriate clutch port. A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing sound may be heard.

5. If the clutches fail to operate during the air check:

- The piston seals are not seated, damaged or installed incorrectly.
- Plugged feed holes for clutch apply in the case and/or clutch cylinder.
- Damaged piston and/or clutch cylinder.

6. Service as required and recheck.

Copyright © 2016 Ford Motor Company

Solenoid Body

Base Part Number: 7G391

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Solenoid Body Identification Procedure

1. Using the scan tool, select Powertrain, Transmission and Transmission Solenoid Body Identification from the toolbox icon and follow the instructions displayed on the scan tool. The solenoid body identification screen displays solenoid body identification information:

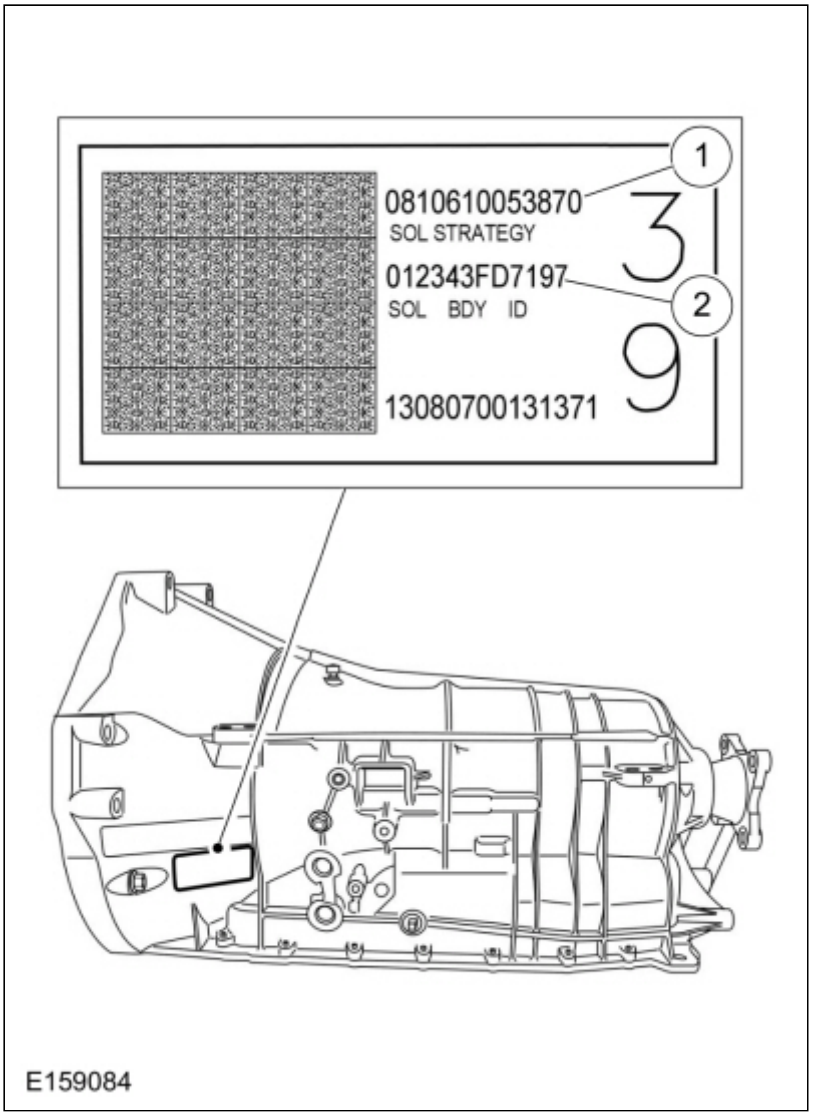
- Solenoid body strategy 13-digits
- Solenoid body identification 12-digits

The next screen displays the current solenoid body identification and strategy data file stored in the PCM. If the solenoid body strategy field is blank, the module contains a partial transmission solenoid body strategy. This is due to a corrupt or missing file at the time the programmable parameters were completed.

NOTE: *The 13-digit solenoid body strategy number consists of only numbers. Letters are not used.*

2. Compare the solenoid body identification and strategy to the solenoid body identification tag located on the left side of the transmission case.

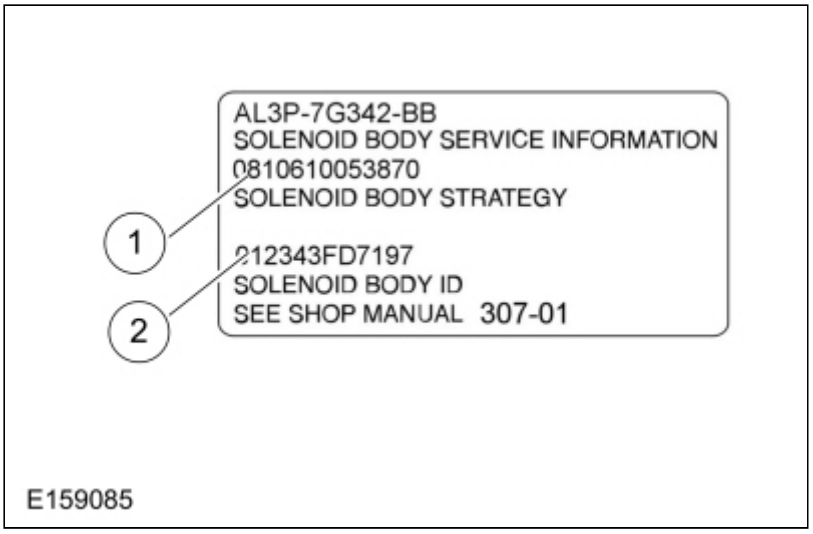
Solenoid Strategy Identification Tag



Item	Description
1	13-digit solenoid body strategy
2	12-digit solenoid body identification

3. If the solenoid body identification and strategy displayed on the scan tool match the solenoid body identification tag or replacement tag, then the solenoid body identification and strategy are correct for this transmission and a solenoid body strategy data download is not required. If the solenoid body identification tag or replacement tag is missing or damaged so it is not readable or does not match the identification or strategy displayed on the scan tool, remove the transmission fluid pan and filter and locate the 13-digit solenoid body strategy etched on the main control casting. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

Replacement Solenoid Strategy Identification Tag



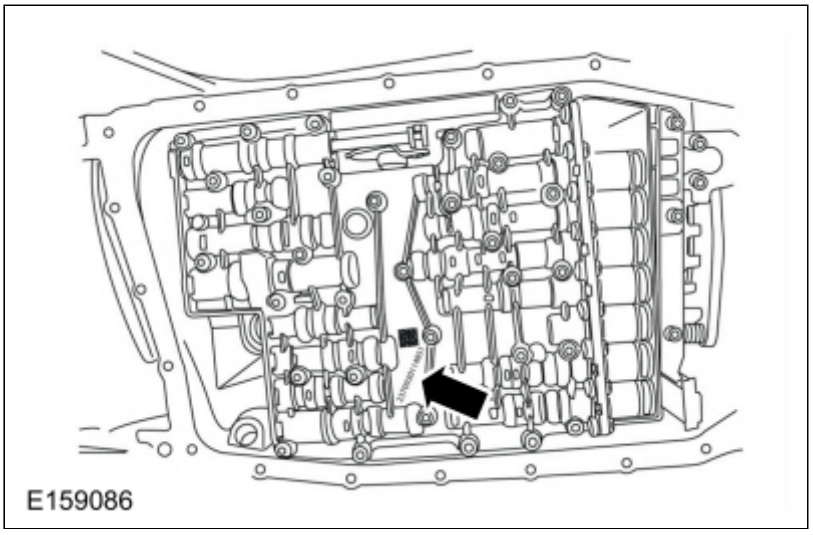
Item	Description
1	13-digit solenoid body strategy
2	12-digit solenoid body identification

NOTE: *The 13-digit solenoid body strategy number displayed on the scan tool must match the solenoid body strategy number etched on the main control. If the numbers do not match, damage to the transmission or driveability concerns can occur.*

NOTE: *If the new main control was not supplied with a replacement solenoid strategy identification tag, DO NOT INSTALL the main control as all required programming information will be missing.*

4. Compare the solenoid body strategy identification etched on the main control to the solenoid strategy identification tag on the transmission case. If the solenoid body strategy identification etched on the main control does not match the solenoid strategy identification tag then a solenoid body strategy data download is required. If the solenoid body strategy etched on the main control does match the solenoid strategy identification tag on the transmission case but does not match the solenoid body identification and strategy displayed on the scan tool, then a solenoid body strategy data download is also required.

Main Control Solenoid Body Strategy



Solenoid Body Strategy Data Download

1. Using the scan tool, select Module Programming and Programmable Parameters under the toolbox icon then select transmission. Follow the instructions displayed on the scan tool. There are fields to enter the 12-digit solenoid body identification and 13-digit solenoid body strategy recorded from the solenoid body.

NOTE: *If the solenoid body information is not correct, transmission damage or driveability concerns can occur.*

2. Enter the solenoid body identification and strategy. The scan tool verifies the numbers entered are valid and displays a message if the information is not valid. The scan tool checks to see if the file is present on the scan tool. If the file is present, the technician may proceed with downloading the file to the PCM. If the file is not present, the scan tool will need to be connected to the Professional Technician Society (PTS) server to download the file onto the scan tool.

3. Verify the file is present on the scan tool. If the file is present, go to Step 8. If the file is not present, continue with this procedure.

4. Connect the scan tool to the PTS server.

5. Follow the instructions on the network to download the strategy file to the scan tool.

6. If the scan tool cannot connect to the PTS server, download the file from www.motorcraft.com. If the scan tool cannot download a strategy from the web site, a partial strategy will automatically be downloaded.

7. Reconnect the scan tool to the vehicle.

8. Follow the instructions displayed on the scan tool.

9. If a new solenoid body was installed, compare the 12-digit identification and the 13-digit strategy fields from the solenoid body to the replacement solenoid body tag provided with the solenoid body service kit and place it over the existing identification tag.

10. The scan tool automatically downloads the strategy file or partial strategy file to the PCM. The scan tool displays a message when it is finished downloading the data that states that the file was downloaded successfully.

NOTE: *The customer may feel erratic shifts and driveability concerns if the adaptive drive cycle has not been performed.*

Road test the vehicle following the Adaptive Drive Cycle. For additional information, refer to Shift Point Road Test in this section.

Copyright © 2016 Ford Motor Company

Leakage Inspection

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	—
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV

The transmission has the following parts to prevent external fluid leakage:

- Gaskets
- Lip-type seals
- O-ring seals
- Seal rings
- Seal grommets
- Seal washers
- Thread sealant

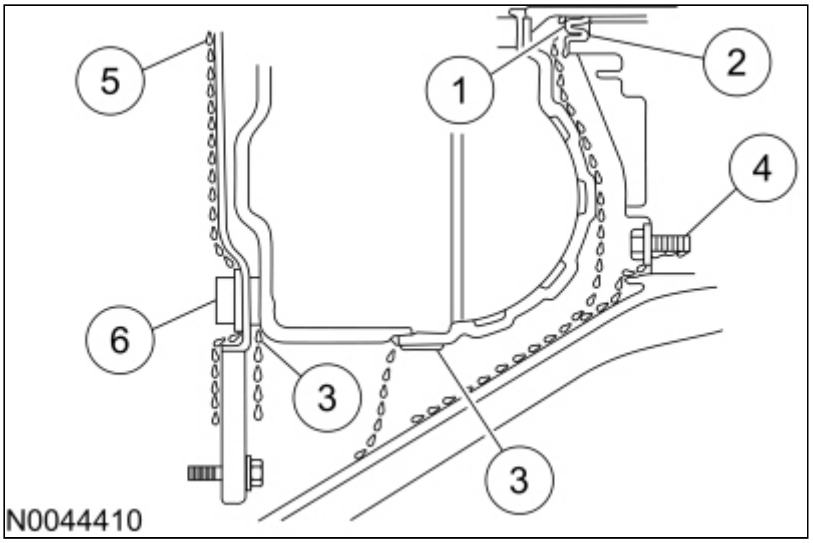
Leakage at the transmission pan-to-case gasket can often be stopped by tightening the bolts to specification. Refer to Torque Specifications in this section.

When transmission fluid is found to be leaking between the case and the cooler tube fitting, tighten the bolt to maximum specification.

If leakage is found at the manual control lever shaft, install a new seal.

Check for transmission fluid leaking from the end of the extension housing. Leakage can result from a damaged seal.Fluid Leakage in Torque Converter Area

Transmission fluid leaks at the front of the transmission, as evidenced by transmission fluid around the torque converter housing part of the case, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of the transmission fluid leak before removing the transmission from the vehicle. The paths which the transmission fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 6 numbers in the illustration correspond with the 6 flow path steps.



Leak Path	Symptom	Possible Source
1, 2 and 4	Leak at front of transmission	Pump lip seal
1, 2 and 4	Leak at front of transmission	Vent
1, 2 and 4	Leak at front of transmission	Converter hub weld
1, 2 and 4	Leak at front of transmission	External pump seal (large)
1, 2 and 4	Leak at front of transmission	Pump-to-case fasteners
1, 2 and 4	Leak at front of transmission	Pump body seal
3	Leak at front of transmission	Torque converter seal weld
5	Leak at front of transmission	Engine oil leak; rear main seal
5	Leak at front of transmission	Engine valve cover
5	Leak at front of transmission	Oil galley
5	Leak at front of transmission	Pump lip seal
5	Leak at front of transmission	Engine oil pressure sensor
6	Leak at front of transmission	Torque converter rivet

Leak Check Test with A Black Light

NOTE: *Use Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 to detect a transmission fluid leak. Add dye to the transmission fluid. Use one 30 ml (1 oz) of dye solution for every 3.8L of transmission fluid. Add additional transmission fluid until it is at the correct level. Such dyes are used to determine whether an engine fluid or transmission fluid leak is present, or if the fluid in the transmission fluid cooler leaks into the engine coolant system. Use an ultraviolet light to detect the fluorescent dye solution.*

1. Remove the transmission fluid level fill plug and note the color of the transmission fluid that drips out.
2. Clean off any transmission fluid from the top and bottom of the torque converter housing, front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable non-flammable solvent and blow-dry with compressed air.
3. Wash the torque converter housing and the front of the flexplate using clean solvent and a squirttype oil can. Blow-dry all washed areas with compressed air.
4. Using the scan tool, start and run the engine until the transmission reaches its normal operating temperature. Shift the transmission through all the gear ranges to make sure that the dye has circulated through the transmission. Using the 110W/12 Volt DC UV Lamp, observe the back of the cylinder block and top of the torque converter housing for evidence of transmission fluid leakage. Observe the front of the flexplate, back of the cylinder block (in as far as possible) and inside the torque converter housing and front of the case. Run the engine until transmission fluid leakage is evident and the probable source of leakage can be determined. Repair as required.

Description	Possible Source
Leaks at the transmission fluid pan-to-case	Transmission fluid pan bolts not tightened to specificationTransmission fluid pan gasket damagedCase transmission fluid pan rail damaged
Transmission fluid cooler tubes or O-rings leaking	Transmission fluid cooler tube(s), transmission fluid cooler tube O-rings damagedTransmission fluid cooler tube hold-down plate damaged
Leaks at the transmission fluid cooler	Transmission fluid cooler damagedTransmission fluid cooler tube O-rings damaged
Leaks at the manual control lever	Manual control lever seal missing or damaged
Mechatronic harness connector	O-ring on connector missing or damaged

Copyright © 2016 Ford Motor Company

Diagnosis By Symptom

Principles of Operation

The Diagnosis by Symptom[1] gives the technician diagnostic information and direction, and suggests possible components using a symptom as a starting point. All routines start out with any potential electrical components that can cause or contribute to the symptom described. The routines then list all possible hydraulic or mechanical components that can cause or contribute the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Diagnosis by Symptom, select the condition that best describes the condition.
2. Refer to the routine indicated in the Diagnosis by Symptom Index.
3. Always begin diagnosis of a symptom with:
    1. preliminary inspections.
    2. verifications of condition.
    3. checking the fluid levels.
    4. carrying out other test procedures as directed.[3]
4.

NOTE: *Not all concerns and conditions with electrical components will set a DTC. Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.*

NOTE: *When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The PCM must relearn these parameters. During this learning process, the vehicle may exhibit slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.*

NOTE: *Begin Diagnosis by Symptoms with the Routines, if indicated. Follow the reference or action required statements. Always perform the self-tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, proceed to the Hydraulic/Mechanical Routine listed.*

5. The list contains only possible hydraulic or mechanical components that may cause or contribute to the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure that repairs are complete.

Engagement Concerns: No Forward in D

Symptom	Possible Sources	Action
• No Forward in D	• Incorrect transmission fluid level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Selector lever linkage - damaged or incorrectly adjusted	• INSPECT and REPAIR as required. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.VERIFY transmission selector lever cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures). ADJUST transmission selector lever cable as necessary.
	• PCM, external vehicle harness, main control molded leadframe or Shift Solenoid A (SSA)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01

		Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Main control - defective manual valve	• INSPECT the manual valve linkage.
	• Main control - defective clutch (A) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Main control - front pump adapter seal - cracked, leaking or damaged.	• INSTALL a new front pump adapter seal.
	• Forward clutch plate (A) friction and steel plate - failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to: Forward Clutch Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).
	• Direct clutch plate (B) friction and steel plate - failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to: Direct Clutch Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).
	• Low One-Way Clutch assembly - failure	• INSPECT the One-Way Clutch assembly for damage. The One-Way Clutch must rotate counterclockwise and lock clockwise. REFER to: Transmission (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly).
	• Pump gear - failure	• Install a new pump assembly. REFER to: Pump Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).

Engagement Concerns: No Reverse

Symptom	Possible Sources	Action
• No Reverse	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to: Direct Clutch Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).
	• Pump gear — failure	• Install a new pump assembly. REFER to: Pump Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).

Engagement Concerns: Harsh Reverse

Symptom	Possible Sources	Action
• Harsh Reverse	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Engine driveline looseness in the driveshaft, U-joints or the engine mounts	• REPAIR as required.
	• PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to: Direct Clutch Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).

Engagement Concerns: Harsh Forward

Symptom	Possible Sources	Action
• Harsh Forward	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Engine driveline looseness in the driveshaft, U-joints or the engine mounts	• REPAIR as required.
	• PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (A) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (A) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80,

		Removal and Installation).
	• Defective clutch (A) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Engagement Concerns: Delayed/Soft Reverse

Symptom	Possible Sources	Action
• Delayed/Soft Reverse	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to: Direct Clutch Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).

Engagement Concerns: Delayed/Soft Forward

Symptom	Possible Sources	Action
• Delayed/Soft Forward	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM, external vehicle harness, main control leadframe or Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6- Speed Automatic Transmission - 6R80) .

	• Defective clutch (A) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.
	• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to: Forward Clutch Assembly (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly of Subassemblies).

Engagement Concerns: No Forward and No Reverse

Symptom	Possible Sources	Action
• No Forward and No Reverse	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Damaged, out of aadjustment	• INSPECT for damage, repair as required.
	• Not seated, damaged or plugged	• INSPECT for crack or damage. INSTALL new as required.
	• Pump adapter Seal	• INSPECT for crack or damage. INSTALL new as required.
	• Manual Valve	• INSPECT for damage. Replace as required.
	• Mounting bolt torque	• INSPECT for loose main control to transmission bolts. Tighten to specification.
	• Solenoid Pressure Regulator Valve	• NSPECT for valve stuck in spring compressed position or broken spring. CLEAN or REPLACE main control as required. Main Control
	• Gear	• INSPECT for damage. REPLACE as required.
	• Sun gear hub/splines	• INSPECT for damage. REPLACE as required.
	• Turbine shaft	• INSPECT for damage. REPAIR as required.
	• Front planetary gear set	• INSPECT for damage. REPAIR as required.
	• Forward clutch drum	• INSPECT for damage. REPAIR as required.
	• Output shaft/ring gear	• INSPECT for damage. REPAIR as required.

Engagement Concerns: Harsh Forward and Harsh Reverse

Symptom	Possible Sources	Action
• Harsh Forward and Harsh Reverse	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM electrical inputs/outputs, external vehicle wiring	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine

	harnesses, main control molded leadframe, Transmission Range (TR) sensor, Shift Solenoid A (SSA) or Line Pressure Control (LPC)	Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. If engine control DTCs return, Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Multiple shift missing (more than one gear)	• If some shifts are missing, DETERMINE which shifts do not occur. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . MONITOR appropriate PIDs as listed in Diagnostic Parameters Identification (PID) Chart. REFER to Routine 210.
	• Gears 4-6 default to 5th gear and gears 1-3 default to 3rd gear	• RETRIEVE DTCs.

Engagement Concerns: Delayed Forward and Delayed Reverse

Symptom	Possible Sources	Action
• Delayed Forward and Delayed Reverse	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM, external vehicle wiring harnesses or molded leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section.
	• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.

Shift Concerns: Some/All Shifts Missing

Symptom	Possible Sources	Action
• Some/All Shifts Missing	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Selector lever cable	• INSPECT and REPAIR as required. VERIFY selector lever cable adjustment. REFER to Section 307-05. ADJUST selector lever cable as necessary.
	• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe, Transmission Range (TR) sensor, Shift Solenoid A (SSA) or Line	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Pressure Control (LPC)	
• Multiple shift missing (more than one gear)	• If some shifts are missing, DETERMINE which shifts do not occur. REFER to clutch and solenoid application charts in this section. MONITOR appropriate PIDs as listed in Diagnostic Parameters Identification (PID) Chart.
• Leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (A) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Defective clutch (A) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Defective clutch (B) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Defective clutch (C) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Defective clutch (E) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Defective clutch (E) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
• Forward clutch (A) friction and steel plate — failure or Low One- Way Clutch (OWC) assembly — failure	• For 1st, 2nd, 3rd or 4th gear concerns, INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section. For the One-Way Clutch (OWC), INSPECT for damage. One-Way Clutch (OWC) must rotate counterclockwise and lock clockwise. REFER to Transmission in this section.
• Direct clutch (B) friction and steel plate — failure	• For 3rd or 5th gear concerns, INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• For 2nd or 6th gear concerns, INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
• Overdrive clutch (E)	• For 4th, 5th or 6th gear concerns, INSPECT the

	assembly — failure	overdrive clutch for damage. REPLACE the overdrive clutch. REFER to Overdrive Clutch Assembly in this section.

Shift Concerns: Timing — Early/Late

Symptom	Possible Sources	Action
• Early/Late	• PCM electrical inputs/outputs, external vehicle wiring harnesses or main control molded leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section.
	• Engine driveability concerns	•
	• Bolts not tightened to specification	• TIGHTEN to specification.
	• Main control unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• REFER to Main Control in this section.
	• Application pressures are incorrect	• Incorrect application pressures may be due to non-transmission components, main control assembly or internal transmission damage. REPAIR all non-transmission components then continue with this routine.
	• Tire size change, axle ratio change	• VERIFY the vehicle has the original equipment. REFER to the certification label. Changes in tire size and axle ratio will affect shift timing.

Shift Concerns: Timing — Erratic/Hunting

Symptom	Possible Sources	Action
• Erratic/Hunting	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM electrical inputs/outputs, external vehicle wiring harnesses or main control leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	• Torque converter	• REFER to torque converter operation concern: Cycling/Chatter.

Feel Concerns: Soft/Slipping (Some or All)

Symptom	Possible Sources	Action
• Soft/Slipping (Some or All)	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged,	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic

	damaged	Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe or Transmission Fluid Temperature (TFT) sensor.	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test B.
	• Main control molded leadframe	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.
	• Bolts not tightened to specification	• TIGHTEN to specification.
	• Main control contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stick or bore damaged	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to Main Control in this section.

Feel Concerns: Harsh (Some or All)

Symptom	Possible Sources	Action
• Harsh (Some or All)	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe or solenoid body information does not match PCM information	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If solenoid body and PCM information does not match, REPROGRAM the PCM with the latest calibration. PERFORM the Solenoid Body Strategy Data Download. REFER to Solenoid Body Strategy in this section. PERFORM Road Test — Adaptive Drive Cycle, REFER to Shift Point Road Test in this section. ROAD TEST and CHECK for DTCs.
	• Bolts not tightened to specification	• TIGHTEN bolts to specification.
	• Main control contaminated, solenoid(s) damaged, solenoids stuck or bore damaged	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Feel Concerns: No 1st Gear, Engages in a Higher Gear

Symptom	Possible Sources	Action
• No 1st Gear, Engages in a Higher Gear	• PCM, external vehicle wiring harnesses or main control molded leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs.
	• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.
	• Transmission failure	• DETERMINE which gear the transmission is in. REFER to the Clutch and Solenoid Application Charts in this section.

Feel Concerns: No Manual 1st Gear

Symptom	Possible Sources	Action
• No Manual 1st Gear	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• PCM, external vehicle harness, main control molded leadframe or Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
	• Low/reverse clutch (D) friction and steel plate — failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
	• Low One-Way Clutch (OWC) assembly — failure	• If no 1st gear above 3 mph, INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.
	• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No Manual 2nd Gear

Symptom	Possible	Action

	Sources	
• No Manual 2nd Gear	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• PCM, external vehicle harness, main control molded leadframe or Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
	• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
	• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No Manual 3rd Gear

Symptom	Possible Sources	Action
• No Manual 3rd Gear	• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• PCM, external vehicle wiring harnesses, main control molded leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control

		assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No 1-2 Shift

Symptom	Possible Sources	Action
• No 1-2 Shift	• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid C (SSC) or Shift Solenoid D (SSD).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Defective clutch (B) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (C) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
	• Low/reverse clutch (D) friction and steel plate — failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
	• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.

Feel Concerns: No 2-3 Shift

Symptom	Possible Sources	Action
• No 2-3 Shift	• Selector lever cable system —	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment.

	damaged, misaligned	REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Defective clutch (B) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (C) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 3-4 Shift

Symptom	Possible Sources	Action
• No 3-4 Shift	• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB), Shift Solenoid D (SSD) or Shift Solenoid E (SSE).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Defective clutch (B) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80,

		Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (E) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective solenoid multiplex valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Overdrive clutch (E) friction and steel plate — failure	• INSPECT the overdrive clutch assembly for damage. REPAIR as required. REFER to Overdrive Clutch Assembly in this section.

Feel Concerns: No 4-3 Shift

Symptom	Possible Sources	Action
• No 4-3 Shift	• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid D (SSD).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Defective clutch (E) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (E) latch valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective solenoid multiplex valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Solenoid multiplex	• INSPECT for damage. If damaged, INSTALL a new main control

	valve	assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Drive enable valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Overdrive clutch (E) friction and steel plate — failure	• INSPECT the overdrive clutch assembly for damage. REPAIR as required. REFER to Overdrive Clutch Assembly in this section.

Feel Concerns: No 3-2 Shift

Symptom	Possible Sources	Action
• No 3-2 Shift	• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Defective clutch (B) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (C) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Symptom	Possible Sources	Action
	• PCM, external vehicle wiring harnesses, main control molded leadframe or Shift Solenoid C (SSC).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .

		. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Defective clutch (C) regulator valve	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (C) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Low/reverse clutch (D) friction and steel plate — failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
	• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.

Torque Converter Operation Concerns: No Apply

Symptom	Possible Sources	Action
• No Apply	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM, external vehicle wiring harnesses, main control molded leadframe or Torque Converter Clutch (TCC) solenoid.	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
	• Main control assembly contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new main control assembly. REFER to Main Control in this section.
	• Defective torque	• INSPECT main control assembly for stuck valves or

	converter apply regulator valve	contamination. REFER to Main Control in this section.
	• Defective torque converter release regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
	• Main control assembly bolts — not tightened to specification	• TIGHTEN to specification.
	• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Operation Concerns: Cycling/Chatter

Symptom	Possible Sources	Action
• Cycling/Chatter	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM, vehicle wiring harnesses, main control molded leadframe, Torque Converter Clutch (TCC) solenoid or Transmission Fluid Temperature (TFT) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the TCC solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A to diagnosis the Torque Converter Clutch (TCC) or GO to Pinpoint Test B to diagnosis the Transmission Fluid Temperature (TFT) sensor.
	• Main control assembly contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new main control assembly. REFER to Main Control in this section.
	• Defective torque converter apply regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
	• Main control assembly bolts — not tightened to specification	• TIGHTEN to specification.

	• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Operation Concerns: Always Applied/Stalls Vehicle

Symptom	Possible Sources	Action
• Always Applied/Stalls Vehicle	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid filter and seal assembly - plugged, damaged	• INSTALL a new filter assembly. REFER to: Transmission Fluid Filter (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• PCM, vehicle wiring harnesses, main control molded leadframe, Torque Converter Clutch (TCC) solenoid or Transmission Fluid Temperature (TFT) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the TCC solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A to diagnosis the Torque Converter Clutch (TCC) or GO to Pinpoint Test B to diagnosis the Transmission Fluid Temperature (TFT) sensor.
	• Main control assembly contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new main control assembly. REFER to Main Control in this section.
	• Main control assembly bolts — not tightened to specification	• TIGHTEN to specification.
	• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Other Concerns: External Leaks

Symptom	Possible Sources	Action
• External Leaks	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
	• Transmission case vent — damaged,	• REPAIR as necessary.

	case porosity	
	• Leakage at gaskets, seals, electrical connector	• REFER to Leakage Inspection, Fluid Leakage in Torque Converter Area and Leak Check Test with A Black Light in this section. REMOVE all traces of lubricant on exposed surface of the transmission. REPAIR as necessary.
	• Cooler tube fittings	• LOCATE leak source. REPAIR as required. REFER to Section 307-02.
	• Cooler tube O-rings, cooler tubes	• LOCATE leak source. REPAIR as required. REFER to Section 307-02.
	• Torque converter studs	• INSTALL a new torque converter. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
	• Torque converter hub seal	• INSTALL a new torque converter hub seal.
	• Torque converter weld	• INSTALL a new torque converter. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
	• Case — leaking	• INSTALL a new transmission case. REFER to Transmission in this section.
	• Transmission vehicle harness connector	• INSTALL a new transmission vehicle harness connector O-ring.
	• Transmission fluid fill plug	• INSTALL a new transmission fluid fill plug.
	• Output shaft seal	• INSTALL a new seal. REFER to Output Shaft Seal in this section.
	• Manual control lever seal	• INSTALL a new seal.
	• Transmission fluid pan gasket	• INSTALL a new gasket.
	• Fluid pump O-ring	• INSTALL a new O-ring. REFER to Pump Assembly in this section.
	• Fluid pump seal ring	• INSTALL a new seal ring. REFER to Pump Assembly in this section.

NOTE: *NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.*

Other Concerns: Noise/Vibration in Forward or Reverse

Symptom	Possible Sources	Action
• Noise/Vibration in Forward or Reverse	• Incorrect level (low) pump cavitation	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
	• Cooler tubes grounding out	• ADJUST or REPOSITION cooler tubes.
	• Check the torque converter components/balance weight	• LOCATE source of disturbance. REPAIR as required. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.

	• Engine drive accessories	• REFER to: Specifications (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications), Specifications (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Specifications), Specifications (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Specifications).

Other Concerns: Engine Will Not Crank

Symptom	Possible Sources	Action
• Engine Will Not Crank	• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• PCM, vehicle wiring harnesses, engine starting and charging system, main control molded leadframe or Transmission Range (TR) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Flexplate — damaged	• REPAIR as necessary.
	• Starter system concerns	• INSPECT and REPAIR as necessary. REFER to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
	• TR sensor assembly — damaged	• INSPECT and REPAIR as necessary.
	• Internal parts seized	• REPAIR as necessary.

Other Concerns: No Park (P) Range

Symptom	Possible Sources	Action
• No Park (P) Range	• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged, park pawl pin loose or damaged, park rod actuating plate loose, damaged or missing	• INSPECT for damage. REPAIR as necessary.
	• Transmission case	• INSPECT for damage. If damaged, REPAIR as necessary.
	• Park gear, park pawl, park pawl return spring, part or guide, park actuating rod, park pawl shaft, manual lever	• INSPECT for damage. If damaged, REPAIR as necessary.
	• External linkages/brackets — damaged	• INSPECT for damage. REPAIR as necessary.
	• PCM, vehicle wiring harnesses, main control molded leadframe or Transmission Range (TR) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A,

		REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Manual lever detent spring	• INSPECT for damage. REPAIR as necessary.
	• TR sensor assembly	• INSTALL a new main control assembly. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Other Concerns: Transmission Overheating

Symptom	Possible Sources	Action
• Transmission Overheating	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Fluid condition	• CHECK transmission fluid condition. REFER to Preliminary Inspection in this section.
	• PCM, vehicle wiring harnesses, main control molded leadframe, Torque Converter Clutch (TCC) solenoid or Transmission Fluid Temperature (TFT) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A for TCC solenoid diagnosis and GO to Pinpoint Test B for TFT sensor diagnosis.
	• Torque converter	• INSTALL a new torque converter. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
	• Transmission case	• INSPECT for damage. If damaged, REPAIR as necessary.
	• Restriction in transmission cooling system	• CHECK transmission cooling system efficiency. REFER to Section 307-02 for automatic transmission cooling system diagnostic procedures.
	• Excessive trailer tow load	• REFER to the Owner's Literature for specifications on trailer towing.
	• Vehicle heat shield — missing or damaged	• INSPECT for damage. REPAIR as necessary.
	• Vehicle airflow is restricted	• INSPECT for damage. REPAIR as necessary.
	• Thermal bypass valve — missing or damaged	• INSPECT for damage. REPAIR as necessary. REFER to Main Control in this section.

Other Concerns: Fluid Venting/Foaming

Symptom	Possible Sources	Action
• Fluid Venting/Foaming	• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Transmission case	• INSPECT for damage. If damaged, REPAIR as necessary.

Feel Concerns: Shift Concerns: No 4-5 Shift

Symptom	Possible Sources	Action
• Shift Concerns: No 4-5 Shift	• PCM, vehicle wiring harnesses, main control molded leadframe, Shift Solenoid A (SSA) solenoid or Shift Solenoid B (SSB) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (A) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (A) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.

Feel Concerns: No 5-4 Shift (Automatic)

Symptom	Possible Sources	Action
• No 5-4 Shift (Automatic)	• PCM, vehicle wiring harnesses, main control molded leadframe or Shift Solenoid B (SSB)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.

		REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (A) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.

Feel Concerns: No 5-6 Shift (Automatic)

Symptom	Possible Sources	Action
• No 5-6 Shift (Automatic)	• PCM, vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (C) regulator	• INSPECT the main control assembly for stuck valves or contamination.

	valve	REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 6-5 Shift (Automatic)

Symptom	Possible Sources	Action
• No 6-5 Shift (Automatic)	• PCM, vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) . . INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to: Solenoid (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Molded leadframe — contamination	• REMOVE the main control assembly, REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination, REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
	• Defective clutch (B) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (B) latch valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Defective clutch (C) regulator valve	• INSPECT the main control assembly for stuck valves or contamination. REFER to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
	• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
	• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Copyright © 2016 Ford Motor Company

Transmission Fluid Cooler

Base Part Number: 7A095

For transmission fluid cooler tube installation, refer to Section 307-01B of the 2011.0 Territory Workshop Manual.

Copyright © 2016 Ford Motor Company

Diagnostic Trouble Code Charts

General Equipment

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Using a scan tool to retrieve Diagnostic Trouble Codes (DTCs), begin with and repair all non-transmission related DTCs. Start with the U- DTCs (communication link codes) then repair transmission related DTCs.

The Powertrain Control Module (PCM) will command a default gear to protect the engine and transmission when certain faults occur. Default or (limp-home mode) depends on the actual gear the vehicle was in when the fault occurred.

- For gears 1-3, the default will be 3rd gear.
- For gears 4-6, the default will be 5th gear.

The default gear is held until the vehicle is placed in reverse, park or the vehicle is restarted. After these action(s) the vehicle will default to 3rd gear.

DTC Chart

DTC	Component	Description	Condition	Symptom	Action
B2572	Brake Shift Interlock Actuator (BSIA)	BSIA open or shorted circuit	The BSIA system a malfunction.	• BSIA inoperative.	Refer to REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).
P0604	PCM	PCM Random Access Memory (RAM) Error	PCM RAM has been corrupted	--------	Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0605	PCM	PCM Read Only Memory (ROM) Error	PCM ROM has been corrupted	--------	Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0657	PCM	Actuator supply voltage A circuit open	The Transmission Solenoid Power Control (TSPC) relay failed open.	• Malfunction Indicator Lamp (MIL) ON • Maximum line pressure • Default to 5th gear	Power is routed through the transmission solenoid power control (TSPC) relay (inside the PCM) to all solenoids. If the power circuit to the transmission solenoids or the TSPC relay fails open, then all solenoids are failed electrically off. CHECK for open, short to ground or the transmission connector disconnected. The TSPC relay also disables power to the transmission solenoids when certain transmission DTCs are set. REPAIR as required. CLEAR the DTC. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.

P06B8	PCM	PCM Non-Volatile Random Access Memory (NVRAM) Error	Ability of the PCM to correctly store permanent DTCs is present.	--------	Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0701	PCM	Transmission control system range performance	The PCM detected an intermittent clutch ON fault	• Vehicle decelerates during upshift or hangs in gear • DTCs P2700 (A) clutch • P2701 (B) clutch, • P2702 (C) clutch, • P2703 (D) clutch and/or • P2704 (E) clutch may set	CLEAR the DTCs. TEST the system for normal operation. If the DTCs return, REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0702	Battery	Battery voltage out of range	The PCM detected a voltage level above or below the accepted voltage range	• Wrench light illuminated • Maximum line pressure • DTCs P0882 and/or P0883 may set	REPAIR the more specific DTC first. CLEAR the DTCs. TEST the system for normal operation.
P0705	Transmission Range (TR) sensor	TR sensor failure	The PCM detected a TR sensor signal duty cycle is within range but does not match the calibrated bit pattern.	• MIL ON • Engine will not crank • Default to 3rd or 5th gear if DTC sets after engine running • Maximum line pressure DTC • P1702 may set	REPAIR the more specific DTC first. CLEAR the DTCs. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P0706	TR sensor	TR sensor A circuit range performance	The PCM detected a TR sensor signal duty cycle is out of range	• MIL ON • Engine will not crank • Default to 3rd or 5th gear if DTC sets after engine running • Maximum line pressure • DTC P1705 may set	The TR sensor outputs a duty cycle indicating manual lever position. This DTC sets when the duty cycle is greater or less than commanded by 50Hz. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P0707	TR sensor	TR sensor A circuit low	The PCM detected a TR sensor signal duty cycle is out of range.	• MIL ON • Engine will not crank • Default to 5th gear if DTC sets	The TR sensor outputs a duty cycle indicating manual lever position. This DTC sets when the duty cycle is 8% less than commanded. REFER to: Pinpoint Tests - OSC

				after engine is running • Maximum line pressure • DTC P1702 may set	Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P0708	TR sensor	TR sensor A circuit high	The PCM detected a TR sensor signal duty cycle is out of range	• MIL ON • Engine will not crank • Default to 5th gear if DTC sets after engine running • Maximum line pressure • DTC P1702 may set	The TR sensor outputs a duty cycle indicating manual lever position. This DTC sets when the duty cycle is 92% greater than commanded. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P0709	TR sensor	TR sensor A circuit intermittent	The PCM detected a TR sensor signal duty cycle is not out of range but is invalid	• Wrench light illuminated • Engine may not crank • Default to 5th gear if DTC sets after engine running • Maximum line pressure • DTC P1702 may set	The TR sensor outputs a duty cycle indicating manual lever position. This DTC sets when the duty cycle is within range but is in the dead band between the design position, an in-range but invalid duty cycle. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P0710	Transmission Fluid Temperature (TFT) sensor	TFT sensor A circuit	The PCM detected a voltage drop across the TFT sensor exceeds scale.	• Wrench light illuminated • DTC P0712 and/or P0713 may set	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test B.
P0711	TFT sensor	TFT sensor A circuit range / performance	The PCM detected no TFT sensor change during operation. The TFT sensor is stuck below 21°C (70°F) or above 107°C (225°F) or the temperature did not change by 8°F during a drive cycle.	• MIL ON • Default to 1st or 3rd gear	CLEAR the DTC. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test B.
P0712	TFT sensor	TFT sensor A circuit low	The PCM detected a temperature greater than 171°C (340°F) for at least 2.5 seconds (grounded circuit).	• MIL ON • Default to 1st gear • DTC P0710 may set	REPAIR the more specific DTC first. CLEAR the DTCs. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test B.
P0713	TFT sensor	TFT sensor A	The PCM	• MIL ON	CLEAR the DTC. If the DTC

		circuit high	detected a temperature less than -45°C (-50°F) for at least 2.5 seconds (open circuit).	• Default to 1st gear • DTC P0710 may set	returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test B
P0715	Turbine Shaft Speed (TSS) sensor	TSS sensor A circuit	The PCM indicated no rpm input from the TSS sensor when the Output Shaft Speed (OSS) sensor indicated rpm greater than 0	• MIL ON • Default to 5th gear • Maximum line pressure • DTC P0717 may set	REPAIR the more specific DTC first. CLEAR the DTCs. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test D
P0717	TSS sensor	TSS sensor A circuit no signal	The PCM has not detected a TSS sensor signal during operation	• Wrench light illuminated • Default to 5th gear • Maximum line pressure • DTC P0715 may set	This DTC sets when DTC P0715 is set. REFER to DTC P0715
P0718	TSS sensor	TSS sensor A circuit intermittent	The PCM has detected an intermittent (noise) in the TSS sensor signal during operation	• Wrench light illuminated • Poor shift quality	CLEAR the DTC. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test D.
P0720	OSS sensor	OSS sensor circuit	The PCM indicated no rpm input from the OSS sensor when the TSS sensor indicated rpm greater than 0	• MIL ON • Default to 5th gear • Maximum line pressure • DTC P0722 may set	REPAIR the more specific DTC first. CLEAR the DTCs. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test E.
P0721	OSS sensor	OSS sensor circuit intermittent	The PCM has detected and unrealistic rpm change in the OSS sensor	• Wrench light illuminated • Poor shift quality	CLEAR the DTC. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test E
P0722	OSS sensor	OSS sensor no signal	The PCM indicated no rpm input from the OSS sensor when the TSS sensor indicated rpm greater than 0	• Wrench light illuminated • Default to 5th gear • Maximum line pressure • DTC P0720 may set	This DTC sets when DTC P0720 is set. REFER to DTC P0720.
P0729	Transmission	Gear 6 incorrect ratio	The PCM did not detect a 6th gear ratio when commanded.	• Wrench light illuminated • No 6th gear • Flair or	Intermediate clutch (C) or overdrive clutch (E) failed to apply. REFER to: Specifications (307-01 Automatic Transmission - 6-Speed

				• neutral condition • Hangs in gear	Automatic Transmission - 6R80, Specifications). GO to the Clutch Application Chart. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0731	Transmission	Gear 1 incorrect ratio	The PCM did not detect a 1st gear ratio when commanded.	• Wrench light illuminated • No 1st gear • Flair or neutral condition • Hangs in gear	Forward clutch (A) or low / reverse clutch (D) slip of clutch (D) failed to apply or OWC failed to hold. REFER to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications). GO to the Clutch Application Chart. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0732	Transmission	Gear 2 incorrect ratio	The PCM did not detect a 2nd gear ratio when commanded.	• Wrench light illuminated • No 2nd gear • Flair or neutral condition • Hangs in gear	Forward clutch (A) or intermediate clutch (C) slip or clutch (C) failed to apply. REFER to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications). GO to the Clutch Application Chart. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0733	Transmission	Gear 3 incorrect ratio	The PCM did not detect a 3rd gear ratio when commanded	• Wrench light illuminated • No 3rd gear • Flair or neutral condition • Hangs in gear	Forward clutch (A) or direct clutch (B) slip or clutch (B) failed to apply. REFER to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications). GO to the Clutch Application Chart. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0734	Transmission	Gear 4 incorrect ratio	The PCM did not detect a 4th gear ratio when commanded	• Wrench light illuminated • No 4th gear • Flair or neutral condition • Hangs in gear	Forward clutch (A) or overdrive clutch (E) slip or clutch (A) or (E) failed to apply. REFER to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications). GO to the Clutch Application

					Chart. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0735	Transmission	Gear 5 incorrect ratio	The PCM did not detect a 5th gear ratio when commanded.	• Wrench light illuminated • No 5th gear • Flair or neutral condition • Hangs in gear	Direct clutch (B) or overdrive clutch (E) slip or clutch (B) or (E) failed to apply. REFER to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications). GO to the Clutch Application Chart. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0740	Torque Converter Clutch (TCC) solenoid	TCC solenoid circuit/open	The PCM detected that the TCC solenoid control circuit failed open	• MIL ON • TCC is disabled • DTC P0743 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0741	TCC solenoid	TCC solenoid circuit performance / stuck OFF	The TCC failed to apply after 3 consecutive commands from the PCM.	• MIL ON • TCC is disabled • TCC regulator apply valve stuck in the release position • TCC control valve stuck in the release position • DTC P0751 may set	DTC P0741 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). GO to Torque Converter Operation Concerns, No Apply
P0742	TCC solenoid	TCC solenoid circuit stuck ON	The PCM detected the TCC solenoid control circuit is shorted to ground	• MIL ON • TCC is disabled • poor launch performance • Default to 3rd or 5th gear • DTC P0743 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0743	TCC solenoid	TCC solenoid circuit electrical	The PCM detected that the TCC solenoid circuit is open, shorted to ground or an intermittent	• Wrench light illuminated • TCC is disabled • Poor launch performance • Default to 5th gear • DTCs	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.

				P0740, P0742 and / or P0744 may set	
P0744	TCC solenoid	TCC solenoid circuit intermittent	The PCM detected that the TCC solenoid control circuit is shorted to power	• MIL ON • TCC is disabled • DTC P0743 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0748	Line Pressure Control (LPC)	LPC electrical	The PCM sets this DTC along with one or more specific electrical DTCs	• Wrench light illuminated • Maximum line pressure • May default to 5th gear • DTCs P0960, P0962 and/or P0963 may set	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0750	Shift Solenoid A (SSA)	SSA	The PCM detected that the SSA circuit failed open or shorted to power	• MIL ON • 5th and 6th gear only • DTC P0753 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0751	SSA	SSA performance/ stuck OFF	The PCM commanded SSA ON but detected a ratio error. Forward clutch (A) failed OFF	• MIL ON • 5th and 6th gear only • Harsh reverse engagement • Neutral or flair condition • Clutch A regulator valve stuck in default position • Clutch A latch valve stuck in default position • DTC P2700 may set	DTC P0751 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0752	SSA	SSA stuck ON	The PCM commanded SSA OFF but detected a ratio error. Forward clutch (A) stuck ON.	• MIL ON • Disable 5th and 6th gear • Erratic shifts • Stuck in 4th gear • Clutch A regulator valve stuck in spring compressed position • DTC P2700 may set	DTC P0752 is a non-electrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

P0753	SSA	SSA electrical	The PCM sets this DTC along with one or more specific electrical DTCs	• Wrench light illuminated • 5th and 6th gear only • DTCs P0750, P0973 and/or P0974 may set	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0754	SSA	SSA intermittent	The PCM sets this DTC when an intermittent condition (open, short to power or ground) occurs 3 times for less than 5 seconds with each occurrence	• Unexpected upshifts, downshifts, flairs or neutral conditions	CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0755	Shift Solenoid B (SSB)	SSB	The PCM detected that the SSB circuit failed open or shorted to power	• MIL ON • Default to 3rd or 5th gear • Harsh 1-3 shift • DTC P0756 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0756	SSB	SSB performance/ stuck OFF	The PCM commanded SSB ON but detected a ratio error. Direct clutch (B) failed OFF	• MIL ON • Default to 3rd or 5th gear • Neutral or flair condition • Transmission hangs in 2nd gear on acceleration • Clutch B regulator valve stuck in default position • Clutch B latch valve stuck in default position • DTC P0757 may set	DTC P0756 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0757	SSB	SSB stuck ON	The PCM commanded SSB OFF but detected a ratio error. Direct clutch (B) stuck ON	• MIL ON • Default to 3rd or 5th gear • Harsh 1-3 shift • Erratic shifts • Clutch B regulator valve stuck in spring compressed position • DTC P0758	DTC P0757 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

				may set	
P0758	SSB	SSB electrical	The PCM sets this DTC along with one or more specific electrical DTCs	• Wrench light illuminated • Default to 3rd or 5th gear • Maximum line pressure • DTCs P0755, P0976 and/or P0977 may set	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0759	SSB	SSB intermittent	The PCM sets this DTC when an intermittent condition (open, short to power or ground) occurs 3 times for less than 5 seconds with each occurrence	• Unexpected upshifts, downshifts, flairs or neutral conditions	CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0760	Shift Solenoid C (SSC)	SSC	The PCM detected the SSC circuit has failed open	• MIL ON • Disable 2nd and 6th gear • Erratic or harsh 1-3 shift • DTC P0763 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0761	SSC	SSC performance/ stuck OFF	The PCM commanded SSC ON but detected a ratio error. Intermediate clutch (C) failed OFF	• MIL ON • Disable 2nd and 6th gear • Neutral or flair condition • Clutch C regulator valve stuck in default position • DTC P2702 may set	DTC P0761 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0762	SSC	SSC stuck ON	The PCM commanded SSC OFF but detected a ratio error. Intermediate clutch (C) stuck ON.	• MIL ON • 2nd and 6th upshift only • Harsh reverse engagement • Erratic shift or stuck in 6th • Clutch C regulator valve stuck in spring compressed position • DTC P2702 may set	DTC P0762 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0763	SSC	SSC electrical	The PCM sets	• Wrench light	REPAIR the more specific DTC

			this DTC along with one or more specific electrical DTCs.	• illuminated • Disable 2nd and 6th gear • DTCs P0760, P0979 and/or P0980 may set	first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0764	SSC	SSC intermittent	The PCM sets this DTC when an intermittent condition (open, short to power or ground) occurs 3 times for less than 5 seconds with each occurrence.	Unexpected upshifts, downshifts, flairs or neutral conditions	CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0765	Shift Solenoid D (SSD)	SSD	The PCM detected that SSD circuit has failed open	• MIL ON • Disable 1st, 2nd and 3rd gears • Poor launch performance • DTC P0768 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0766	SSD	SSD performance/ stuck OFF	The PCM commanded SSD ON but detected a ratio error. The low/reverse clutch (D) and overdrive clutch (E) have both failed OFF	• MIL ON • 3rd gear only • Delayed or no reverse engagement • Neutral or flair condition • DTCs P2703 and/or P2704 may set	REPAIR the more specific DTC first. DTC P0766 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0767	SSD	SSD stuck ON	The PCM commanded SSD OFF but detected a ratio error. Overdrive clutch (E) failed to release	• MIL ON • 4th, 5th and 6th gear only • Early upshifts • Stuck in 4th • DTC P2704 may set	DTC P0767 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0768	SSD	SSD electrical	The PCM sets this DTC along with one or more specific electrical DTCs	• Wrench light illuminated • Default to 3rd gear • DTCs P0765, P0982 and/or P0983 may set	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A
P0769	SSD	SSD intermittent	The PCM sets this DTC when an intermittent condition (open, short to power or ground) occurs 3 times	• The PCM sets this DTC when an intermittent condition (open, short	CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80,

			for less than 5 seconds with each occurrence	to power or ground) occurs 3 times for less than 5 seconds with each occurrence	Diagnosis and Testing). Pinpoint Test A.
P0770	Shift Solenoid E (SSE)	SSE	The PCM detected that the SSE circuit failed open, shorted to ground or shorted to power	• MIL ON • No TCC • If 1st, 2nd and 3rd gears are achieved than circuit is open or shorted to power (no pressure) • If 5th gear launch than circuit is shorted to ground (pressure) • DTC P0773 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0771	SSE	SSE performance/ stuck OFF	The PCM commanded SSE ON but detected a ratio error (mechanical failure).	• MIL ON • 1st, 2nd and 3rd gear only • Solenoid multiplex valve stuck in default position • DTC P0984 may set	DTC P0771 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0772	SSE	SSE stuck ON	The PCM commanded SSE OFF but detected a ratio error (mechanical failure)	• MIL ON • No 1st gear • 4th gear launch • Solenoid multiplex valve stuck in spring compressed position • DTC P0984 may set	DTC P0772 is a nonelectrical DTC. CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0773	SSE	SSE electrical	The PCM sets this DTC along with one other specific electrical DTC. SSE circuit may be open, short to power or ground.	• Wrench light illuminated • If 1st, 2nd and 3rd gears are achieved than circuit is open or shorted to power (no pressure) • If 5th gear launch than circuit is	REFER to DTC P0770.

				shorted to ground (pressure) • DTC P0770 may set	
P0774	SSE	SSE intermittent	The PCM sets this DTC when an intermittent condition (open, short to power or ground) occurs but does not set DTC P0770.	• Wrench light illuminated • Transmission hangs in 1st gear or may be stuck in 3rd gear	CLEAR the DTCs. TEST the system for normal operation. If the DTC returns, REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P07A8	Transmission	Transmission friction element D performance stuck OFF	The low/reverse clutch failed OFF.	• Wrench light illuminated • Delay or no reverse engagement • Disable 1st gear • Erratic shifts	DTC P07A8 is a nonelectrical DTC. CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07A9	Transmission	Transmission friction element D stuck ON	The low/reverse One-Way Clutch (OWC) is failed ON.	• Wrench light illuminated • No TCC • 1st gear only • High engine rpm	DTC P07A9 is a nonelectrical DTC. CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P07AA	Transmission	Transmission friction element E performance stuck off	The PCM detected a ratio error. Overdrive clutch (E) failed OFF.	• Wrench light illuminated • 1st, 2nd and 3rd gears only • Neutral or flair condition • High engine rpm • Erratic shifts	DTC P07AA is a nonelectrical DTC. CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P0815	SelectShift™ switch	Upshift switch circuit	The upshift and downshift switches are open in PARK, REVERSE and NEUTRAL. The PCM sets this DTC when it detects an upshift switch is closed (short to ground).	--------	CLEAR the DTC. If DTC P0815 returns, REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).
P0816	SelectShift™ switch	Downshift switch circuit	The upshift and downshift switches are open in PARK, REVERSE and NEUTRAL. The PCM sets this DTC when it detects a downshift	--------	CLEAR the DTC. If DTC P0815 returns, REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).

			switch is closed (short to ground).		
P0882	Battery	PCM power input signal low	The battery voltage is out of range low. At low volts the solenoid drivers may no longer be able to achieve desired current so the transmission solenoid power control relay will be turned OFF.	• MIL ON • Default to 3rd or 5th gear depending vehicle speed and gear • Battery voltage below 9 volts • Maximum line pressure	INSPECT the PCM power and ground circuits for opens or short to ground. INSPECT the PCM connector for damaged or pushed-out terminals, corrosion or loose wires. CLEAR the DTC. If DTC P0882 returns, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
P0883	Battery	PCM power input signal high	The battery voltage is out of range high. Greater than 21 volts.	• MIL ON • Default to 3rd or 5th gear depending vehicle speed and gear • Battery voltage above 21 volts • Maximum line pressure • May set DTC P0702	INSPECT the PCM power and ground circuits for opens or short to ground. INSPECT the PCM connector for damaged or pushed-out terminals, corrosion or loose wires. CLEAR the DTC. If DTC P0882 returns, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
P0884	Battery	PCM power input signal intermittent	The battery voltage is out intermittently out of range.	• MIL ON • Default to 3rd or 5th gear depending vehicle speed and gear • Battery voltage above 21 volts or below 9 volts intermittently • Maximum line pressure	INSPECT the PCM power and ground circuits for opens or short to ground. INSPECT the PCM connector for damaged or pushed-out terminals, corrosion or loose wires. CLEAR the DTC. If DTC P0882 returns, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
P0960	Line Pressure Control (LPC)	LPC control circuit/open	The PCM detected 0 volts on the LPC circuit.	• MIL ON • Maximum line pressure • May default to 5th gear • DTC P0748 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0961	LPC	LPC control circuit range / performance	The PCM detected that the LPC control circuit is shorted to ground but not long enough to set DTC	• Intermittent condition • Minimum line pressure	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.

			P0962.		
P0962	LPC	LPC control circuit low	The PCM detected 0 volts on the LPC circuit. Short to ground detected.	• MIL ON • Default to 5th gear • Maximum line pressure • DTC P0748 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0963	LPC	LPC control circuit high	The PCM detected voltage on the LPC circuit. Short to power detected.	• MIL ON • Maximum line pressure • DTC P0748 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0973	SSA	SSA control circuit low	The PCM detected 0 volts on the SSA circuit. Short to ground detected.	• MIL ON • Default to 5th gear • Default to 3rd only, when the selector lever is shifted into Reverse then back into Drive • Maximum line pressure • DTC P0753 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0974	SSA	SSA control circuit high	The PCM detected voltage on the SSA circuit. Short to power or open circuit detected.	• MIL ON • 5th and 6th gear only • DTC P0753 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0976	SSB	SSB control circuit low	The PCM detected 0 volts on the SSB circuit. Short to ground detected.	• MIL ON • Default to 5th gear • Default to 3rd only, when the selector lever is shifted into REVERSE then back into DRIVE • Maximum line pressure • DTC P0753 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0977	SSB	SSB control circuit high	The PCM detected voltage on the SSB circuit. Short to power or open circuit.	• MIL ON • Default to 3rd and 5th gear • Harsh 1st to 3rd shift • Maximum line pressure • DTC P0758 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.

P0979	SSC	SSC control circuit low	The PCM detected 0 volts on the SSC circuit. Short to ground detected.	• MIL ON • Default to 5th gear • Maximum line pressure • DTC P0763 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0980	SSC	SSC control circuit high	The PCM detected voltage on the SSC circuit. Short to power detected	• MIL ON • 2nd and 6th gears disabled • Harsh 1st to 3rd shift • Maximum line pressure • DTC P0763 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0982	SSD	SSD control circuit low	The PCM detected 0 volts on the SSD circuit. Short to ground detected.	• MIL ON • Default to 5th gear • Default to 3rd only, when the selector lever is shifted into REVERSE then back into DRIVE • Maximum line pressure • DTC P0768 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0983	SSD	SSD control circuit high	The PCM detected voltage on the SSD circuit. Short to power detected	• MIL ON • Disable 1st, 2nd and 3rd gear • Poor launch performance • Maximum line pressure • DTC P0768 may set	REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.
P0984	SSE	SSE control circuit range / performance	The PCM commanded SSE ON or OFF but detected a ratio error (mechanical failure).	• Wrench light illuminated • DTC P0771 and/or P0772 will set	DTC P0984 is a nonelectrical DTC. CLEAR the DTCs. REPAIR the more specific DTC first. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1001	PCM	Key ON Engine Running (KOER) not able to complete, KOER aborted	The KOER self test was unable to complete and aborted.	--------	Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1397	PCM	System voltage out of self-test range	The PCM detected that system voltage is out of self	--------	CLEAR the DTC. RERUN the KOEO and KOER self test. If the DTC returns.

			test range of 11 to 18 volts, during the Key ON Engine OFF (KOEO) or KOER		
P1501	PCM	Vehicle Speed Sensor (VSS) out of self-test range	The PCM detected a VSS signal during the self-test.	• Self-test aborted	CLEAR the DTC. With the selector lever in the Park position, RERUN the self test. If the DTC returns, Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1502	PCM	VSS intermittent	Intermittent VSS fault keeps disabling engine monitors.	• Can not complete engine monitors	Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1635	PCM	Tire/Axle out of acceptable range	The tire, axle or the combination of tire and axle are out of the certified range. Calibration was not updated.	• MIL ON • PCM will use a default tire and axle calibration	Refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1636	PCM	Inductive signature chip communication error	The PCM lost communication with an internal chip that controls the solenoid states and fault reporting.	• MIL ON • Default to 3rd or 5th gear • Maximum line pressure • Poor launch performance	REPLACE the PCM. After installing the new PCM, PROGRAM it with the latest calibration and PERFORM the Solenoid Body Strategy Data Download. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). ROAD TEST the vehicle and PERFORM the Adaptive Drive Cycle. REFER to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P163E	PCM	PCM programming error	The PCM has detected an invalid checksum.	• MIL ON • Default to 1st or 3rd gear • Maximum line pressure	REPROGRAM the original PCM with the latest calibration. CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REPLACE the PCM. After installing the new PCM, PROGRAM it with the latest calibration and PERFORM the Solenoid Body Strategy Data Download. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). ROAD TEST the vehicle and PERFORM the Adaptive Drive Cycle. REFER to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P163F	PCM	Transmission ID block corrupted, not programmed	The PCM has detected an invalid transmission	• MIL ON • Default to 1st or 3rd gear	REPROGRAM the original PCM with the latest calibration. CLEAR the DTC. TEST the system for normal operation. If the DTC

			identification.	• Maximum line pressure	returns, REPLACE the PCM. After installing the new PCM, PROGRAM it with the latest calibration and PERFORM the Solenoid Body Strategy Data Download. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). ROAD TEST the vehicle and PERFORM the Adaptive Drive Cycle. REFER to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1700	Transmission	Transmission intermittent failure (failed to neutral)	Main control body issue where the multiplex valve reverse pressure bleeds off to slow and causes the multiplex valve to get stuck in the wrong state.	• Wrench light illuminated • Neutral condition when 1st gear commanded	DTC P1700 is a nonelectrical DTC. CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1702	TR sensor	TR sensor circuit intermittent	The PCM detected a TR sensor signal duty cycle is not out of range but is invalid.	• Wrench light illuminated • DTC P0705, P0706, P0707, P0708 and/or P0709 may set	REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C
P1705	TR sensor	TR sensor circuit did not indicate PARK/NEUTRAL during the self test.	The TR sensor circuit did not indicate PARK / NEUTRAL during KOEO or KOER self test.	--------	CLEAR the DTC. RERUN the KOEO and KOER self test. If DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P1711	TFT sensor	TFT sensor out of self-test range	The PCM did not receive a TFT sensor input during the KOEO or KOER self test that was within -1.11°C to 104°C (30°F to 220°F) during the self test	--------	CLEAR the DTC. RERUN the KOEO and KOER self test. If DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test B.
P1744	TCC	TCC solenoid circuit	The PCM detected that the TCC solenoid is stuck ON or stuck OFF.	• Wrench light illuminated • DTC P0741 and/or P2758 may set	DTC P1744 is a nonelectrical DTC. REPAIR the more specific DTC first. CLEAR the DTCs. TEST the system for normal operation. If the DTCs return, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

P1780	Transmission Control Switch (TCS)	TCS (Tow/Haul) circuit out of self test range	The PCM did not receive a TCS input during the KOER self-test	• Disable Tow / Haul function	CLEAR the DTC. RERUN KOER self-test. If DTC returns, REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).
P1783	Transmission	Transmission overtemperature condition	The PCM detected a transmission temperature greater than 135°C (275°F) for more than 5 seconds.	• Wrench light illuminated • TCC commanded on early	CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P1921	TR sensor	TR signal	The PCM detected a TR sensor signal duty cycle out of range	• Engine will not crank • DTCs P1705, P0706, P0707, P0708 and/or P0709 may set	REPAIR the more specific DTC first. REFER to: Pinpoint Tests - OSC Equipped Vehicle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test C.
P2700	Transmission	Transmission friction element A apply time range/ performance	The PCM commanded SSA ON or OFF but detected a ratio error (mechanical failure)	• Wrench light illuminated • DTC P0751 and/or P0752 will set	DTC P2700 is a nonelectrical DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2701	Transmission	Transmission friction element B apply time range / performance	The PCM commanded SSB ON or OFF but detected a ratio error (mechanical failure)	• Wrench light illuminated • DTC P0756 and/or P0757 will set	DTC P2701 is a nonelectrical DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2702	Transmission	Transmission friction element C apply time range / performance	The PCM commanded SSC ON or OFF but detected a ratio error (mechanical failure).	• Wrench light illuminated • DTC P0761 and/or P0762 will set	DTC P2702 is a nonelectrical DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2703	Transmission	Transmission friction element D apply time range / performance	The PCM commanded SSD ON or OFF but detected a ratio error (mechanical failure).	• Wrench light illuminated • DTC P0766 and/or P2704 will set	DTC P2703 is a nonelectrical DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2704	Transmission	Transmission friction element E apply time range / performance	The PCM commanded SSE ON or OFF but detected a ratio error (mechanical failure).	• Wrench light illuminated • DTC P0766 and/or P0767 will set	DTC P2704 is a nonelectrical DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2705	Transmission	Transmission	The One-Way	• Wrench light	DTC P2704 is a nonelectrical

		friction element F apply time range / performance	Clutch (OWC) failed OFF (OWC failure).	illuminated • Neutral condition when 1st gear is commanded • Poor launch performance • Harsh engagements	DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2758	TCC	TCC pressure control solenoid stuck ON	The PCM commanded the TCC solenoid OFF but the TCC did not release (mechanical error).	• Wrench light illuminated • Engine stalls or is lugging • DTC P1744 may set	DTC P2758 is a nonelectrical DTC. REPAIR the more specific DTC first. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
P2760	TCC	TCC pressure control solenoid intermittent	The TCC solenoid control circuit shorted to ground 3 times without setting DTC P0742.	• TCC disabled • Poor launch performance • Default to 5th gear	CLEAR the DTC. TEST the system for normal operation. If the DTC returns, REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). Pinpoint Test A.

Copyright © 2016 Ford Motor Company

Parameter Identification (PID) Chart

The following is a list of output state control parameters and their corresponding PIDs:

Diagnostic PID Chart

PID Name	PID Description	Units
4X4L	4x4 Low	On/Off
AXLE	Axle Ratio	Ratio
APP 1	Accelerator Pedal Position	Percentage
BOO	Brake Switch Input Status	On/Off
CLRDIST	Distance since DTC cleared	Distance driven since PCM DTCs were cleared
DTC	Continuous Codes	Number
ENGLOAD	Engine Load	Percentage
GEAR_CMD	Gear Commanded by Module	Mode
GEAR_OSC#	Gear Commanded by Output State Control	Mode
GEAR_RAT	Gear Ratio Commanded	Ratio
HRSH_SHFT#	Firm Shift	On/Off
IN_GEAR	In Gear-Transmission is Applying a Load to Engine	In Gear
ISS_F	Input Shaft Speed Sensor Fault	No Fault/Yes Fault
ISS_SRC	Input Shaft Speed Sensor	rpm
LINEDSD#	Line Pressure Control Desired	Pressure
MIL_DIS	The distance travelled since the MIL was activated	The distance travelled since the MIL was activated
OSS_F	Output Shaft Speed Reliable	No Fault/Yes Fault
OSS_SRC	Unfiltered Output Shaft Speed	rpm
RLC_F	Reverse Control Lamp Status	No Fault/Yes Fault
RPM#	Engine Revolutions Per Minute	rpm
SHFT_DROP	Shift rpm Drop in Input Shaft Speed Below Expected	rpm
SHFT_FLRE	Shift rpm Rise in Input Shaft Speed Above Expected	rpm
SHFT_ID	Shift Identification of Shift PIDs Lag, Time, Flair and Drop	rpm
SHFT_LAG	Shift Time Elapsed From 1% to 9% Complete	Time
SHFT_TIME	Shift Time From Commanded to 10% Complete	Time
SHFT_TYP	Shift Type	Type
SSA_AMP#	Shift Solenoid Pressure Control A (SSPCA)	Current
SSB_AMP#	Shift Solenoid Pressure Control B (SSPCB)	Current
SSC_AMP#	Shift Solenoid Pressure Control C (SSPCC)	Current
SSD_AMP#	Shift Solenoid Pressure Control D (SSPCD)	Current
SSE_AMP#	Shift Solenoid Pressure Control E (SSPCE)	Current
SSPCA	SSPCA	Pressure

SSPCA_F	SSPCA Status	No Fault/Yes Fault
SSPCB	SSPCB	Pressure
SSPCB_F	SSPCB Status	No Fault/Yes Fault
SSPCC	SSPCC	Pressure
SSPCC_F	SSPCC Status	No Fault/Yes Fault
SSPCD	SSPCD	Pressure
SSPCD_F	SSPCD Status	No Fault/Yes Fault
SSPCE_F	SSPCE Status	No Fault/Yes Fault
TCCC	Torque Converter Clutch (TCC) Solenoid	Pressure
TCC AMP#	Converter Pressure Control	Current
TCC_F	TCC Fault	No Fault/Yes Fault
TCC_OSC#	Output State Control of Torque Converter	Locked/Unlocked
TCC_RAT	Transmission Slip Ratio	Ratio
TCIL	Transmission Control Indicator Lamp (TCIL)	On/Off
TCS_DEPRES	Transmission Control Switch (TCS) Pressed	Yes/No
TCS_STATE	TCS Requested State	On/Off
TC_SLIPACT	Torque Converter Slip Actual	rpm
TC_SLIPDSD	Torque Converter Slip Desired	rpm
TFT	Transmission Fluid Temperature (TFT)	Temperature
TFTV	TFT Volts	Volts
TFT_F	TFT Status	No Fault/Yes Fault
TIRESIZE	Tire Size	Rev Per Mile
TP	Throttle Position (TP) Sensor	Percentage
TR	Transmission Range (TR)	Mode
TRANS_VOLT_A	Transmission Supply Voltage Control State	On/Off
TRAN_RAT	Transmission Gear ratio	Ratio
TRO_N_F	Neutral Output Status	On/Off
TRO_P_F	Park Output Status	On/Off
TR_CRANK	TR Input Allowing Input Start	Yes/No
TR_DC	TR Duty Cycle	Percentage
TR_F	TR Status	No Fault/Yes Fault
TR_FREQ	TR Frequency	Frequency
TSS	Turbine Shaft Speed	rpm
TSS_F	Turbine Shaft Speed (TSS) Reliable	No Fault/Yes Fault
VPWR	Module Supply Voltage	Volts
VSOUT_F	Vehicle Speed Output Status	No Fault/Yes Fault
VSS	Vehicle Speed Sensor (VSS)	Speed

Copyright © 2016 Ford Motor Company

Pinpoint Tests - OSC Equipped Vehicle

General Equipment

Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool)

When the electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install new components as required.

Power is routed through the Transmission Solenoid Power Control (TSPC) relay, located inside the Transmission Control Module (TCM), to all transmission solenoids. If the power circuit to the transmission solenoids or the TSPC relay fails to open, then all solenoids are failed electrically OFF. CHECK for open, short to ground or the transmission connector disconnected. The TSPC relay will disable power to the transmission solenoids when certain transmission DTCs are set.

Shift Solenoid Pre-Diagnosis

Selector Lever Position	TCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL TCC NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L,R/C 4,5,6)	SSE NC	
P	P	Off	On	Off	Off	Off	Off
R	R	Off	Off	Off	Off	Off	Off
N	N	Off	On	Off	Offa	Off	Off
D	1	On	On	Off	Offb	Off	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	On	On/Off
	4	On	On	Off	Off	On	On/Off
	5	Off	Off	Off	Off	On	On/Off
	6	Off	On	On	Off	On	On/Off
M c	--	--	--	--	--	--	--
2	2	On	On	On	On	Off	Off
1	1	On	On	Off	Off	On	Off

a Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.

b Solenoid is On when vehicle is above 3 mph.

c All gears available upon driver request.

CB = Clutch brake.

NC = Normally closed.

NH = Normally high

NL = Normally low

Pinpoint Tests

Refer to Wiring Diagrams section for schematic and connector information.

NOTE: *Refer to all TSBs and On-Line Automotive Service Information System (OASIS) messages that pertain to the transmission concern and follow the procedure as described.*

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS

NOTE: *Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control management section of the workshop manual.*

NOTE: *Read and record all DTCs.*

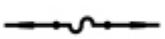
NOTE: *Without a voltage signal return to the TCM, the Transmission Solenoid Power Control (TSPC) relay is commanded OFF. By using a fused jumper between a transmission solenoid control circuit and the signal return circuit, the TSPC relay circuit will supply power to the transmission solenoids when the ignition is cycled from OFF to ON. Do not use a solenoid control circuit that may be at fault, refer to Diagnostic Trouble Code (DTC) Charts in this section for a fault listing.*

PINPOINT TEST A :

A1 CHECK THE SOLENOID POWER CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect Transmission C1575.
- Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals.
- **NOTE:** *Do not use a solenoid control circuit that may be at fault. Failure to jump pin 5 to a known good solenoid control circuit can cause incorrect diagnostic results. For additional information, refer to Diagnostic Trouble Code (DTC) Charts in this section for a fault listing.*

  Connect a fused jumper between one of the following:

Positive Lead	Measurement / Action	Negative Lead
C1575-9		C1575-5
C1575-14		C1575-5
C1575-13		C1575-5
C1575-10		C1575-5
C1575-8		C1575-5
C1575-16		C1575-5
C1575-3		C1575-5

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-7		Ground

Is the voltage greater than 10 volts?

Yes	Remove fused jumper GO to A4
No	Remove fused jumper GO to A2

A2 CHECK THE SOLENOID POWER CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect TCM C2391.
- Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2391-2	Ω	C1575-7

Is the resistance less than 5 ohms?

Yes	GO to A3
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. If DTC P0657 returns, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

A3 CHECK THE SOLENOID POWER CIRCUIT FOR VOLTAGE

- Connect TCM C2391.
- Disconnect Transmission C1575.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-7	V	Ground

Is voltage greater than 3 volts?

Yes	GO to A5
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation. If DTC P0657 returns, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

A4 CHECK SOLENOID CONTROL CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TCM C2391.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2391-42	Ω	C1575-9
C2391-7	Ω	C1575-14
C2391-6	Ω	C1575-13
C2391-43	Ω	C1575-10
C2391-11	Ω	C1575-8
C2391-4	Ω	C1575-16
C2391-3	Ω	C1575-3

Is the resistance less than 5 ohms on each circuit?

Yes	GO to A5
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

A5 CHECK SOLENOID CONTROL CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-7	Ω	Ground
C1575-9	Ω	Ground
C1575-14	Ω	Ground
C1575-13	Ω	Ground
C1575-10	Ω	Ground
C1575-8	Ω	Ground
C1575-16	Ω	Ground
C1575-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A6
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

A6 CHECK SOLENOID CONTROL CIRCUITS FOR A SHORT TO POWER

- Connect TCM C2391.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-9	V	Ground
C1575-14	V	Ground
C1575-13	V	Ground

C1575-10		Ground
C1575-8		Ground
C1575-16		Ground
C1575-3		Ground

Is voltage greater than 3 volts?

Yes	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
No	GO to A7

A7 CHECK COMPONENT RESISTANCE

- Measure resistance of the solenoid between the transmission molded leadframe C14, component side using the following chart:

C14 @ trans.	Solenoid	C14 @ trans.	Ohms
C1575-7	PC1	C1575-9	4.8 to 5.6
C1575-7	PC2	C1575-14	4.8 to 5.6
C1575-7	PC3	C1575-13	4.8 to 5.6
C1575-7	PC4	C1575-10	4.8 to 5.6
C1575-7	SSI	C1575-8	17.5 to 18.6
C1575-7	PC5	C1575-16	4.8 to 5.6
C1575-7	PC6	C1575-3	4.8 to 5.6

Is the resistance within specifications?

Yes	REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.
No	GO to A8

A8 CHECK COMPONENT RESISTANCE

- Remove the molded leadframe from the main control. Inspect for metallic contamination and clean the solenoid and molded leadframe terminals.
- Measure and record the resistance of the suspected solenoid. Compare the recorded value with the chart below:

Solenoid	Ohms
PC1	4.8 to 5.6
PC2	4.8 to 5.6
PC3	4.8 to 5.6
PC4	4.8 to 5.6

SSI	17.5 to 18.6
PC5	4.8 to 5.6
PC6	4.8 to 5.6

Is the solenoid resistance within specification?

Yes	INSTALL a new molded leadframe. CLEAR the DTCs. TEST the system for normal operation.
No	REPLACE the suspected solenoid which failed the resistance check. REFER to: Solenoid (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) . CLEAR the transmission adaptive tables and perform the adaptive drive cycle. REFER to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

PINPOINT TEST B: TFT SENSOR

NOTE: *Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/ Emissions Diagnosis (PC/ED) manual.*

NOTE: *Read and record all DTCs.*

PINPOINT TEST B :

B1 CHECK TFT INPUT SIGNAL

- Ignition OFF.
- Disconnect Transmission C1575.
- Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals.
- Enter the following diagnostic mode on the scan tool: Self-Test — TCM.
- Ignition ON.

Does the TFT PID display -40°C (-40°F) and the TFTV PID display 4.96 to 5.10 volts?

Yes	GO to B2
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

B2 CHECK TFT SIGNAL INPUT CIRCUIT FOR VOLTAGE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-6		Ground

Is the voltage between 4.8 and 5.1 volts?

Yes	GO to B3
No	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

B3 CHECK TFT SIGNAL RETURN CIRCUIT

- Ignition OFF.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C1575-5		C1575-6

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self-Test — TCM.

Does the TFT PID display 190°-195°C and the TFTV PID display 0 volts?

Yes	GO to B4
No	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation

B4 CHECK TFT SENSOR RESISTANCE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-5	Ω	C1575-6

- Compare the resistance value to the transmission fluid temperature (TFT) value side using the following chart.
  - TRANSMISSION FLUID TEMPERATURE (TFT)

°C	°F	Resistance
-40 to -20	40 to -4	967K-284K
-19 to -1	-3 to 31	284K-100K
0-20	32-68	100K-37K
21-40	69-104	37K-16K
41-70	105-158	16K-5K
71-90	159-194	5K-2.7K
91-110	195-230	2.7K-1.5K

111-130	231-266	1.5K-0.8K
131-150	267-302	0.8K-0.54K

Does the temperature to resistance specifications match?

Yes	REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	INSPECT and CLEAN the TFT sensor on the molded leadframe for metallic contamination. INSTALL a new molded leadframe if no debris was found. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST C: TR SENSOR

NOTE: *Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/ Emissions Diagnosis (PC/ED) manual.*

NOTE: *Read and record all DTCs.*

PINPOINT TEST C :

C1 VERIFY DTCS

- Ignition OFF.
- Select PARK.
- With the scan tool, carry out the Key ON Engine OFF (KOEO) then the Key ON Engine Running (KOER) test. DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and P1921 cannot be set by an incorrectly adjusted selector lever cable.

Are Transmission Range (TR) sensor DTCs present?

Yes	GO to C3
No	GO to C2

C2 VERIFY SELECTOR LEVER CABLE/LINKAGE ADJUSTMENT

- Verify the selector lever cable is correctly adjusted.

Is the selector lever cable correctly adjusted?

Yes	GO to C3
No	ADJUST the selector lever cable. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

C3 CHECK TR SENSOR ELECTRICAL OPERATION

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self-Test — TCM.
- Move the selector lever into each range and stop.
- Observe the following PIDs: TR_DC and TR_FREQ while wiggling the harness or driving the vehicle.

- Compare the TR_DC PID to the selector lever position duty cycle, using the following chart.

Selector Lever Position	Range (% Duty Cycle)
P	8.0 — 25.8
R	30.50 — 39.31
N	40.54 — 52.49
D	54.35 — 71.15

Is the TR_FREQ between 100 to 150 Hz?

Is the TR_DC within range?

Does the TR_DC and TR_FREQ remain steady when the harness is wiggled or the vehicle driven?

Yes	The problem is not in the TR sensor system. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to C4

C4 CHECK TR SENSOR VPWR CIRCUIT FOR POWER

- Ignition OFF.
- Disconnect Transmission C1575.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-12		Ground

Is the voltage less than 9.5 volts?

Yes	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). CLEAR the DTCs. TEST the system for normal operation.
No	GO to C5

C5 CHECK TR SENSOR SIGNAL CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-4		Ground

Is the voltage greater than 4.8 volts?

Yes	GO to C6
No	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). CLEAR the DTCs. TEST the system for normal operation.

C6 CHECK TR SENSOR GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-4		C1575-11

Is the voltage greater than 4.8 volts?

Yes	GO to C7
No	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). CLEAR the DTCs. TEST the system for normal operation.

C7 CHECK TR SENSOR POWER CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect TCM C1822.
- Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C8
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

C8 CHECK TR SENSOR CIRCUITS FOR A SHORT TO POWER

- Connect TCM C1822.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-4		Ground
C1575-11		Ground

Is voltage greater than 9.8 volts?

Yes	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.
No	GO to C9

C9 CHECK TR SENSOR TO MANUAL VALVE

- Drain the transmission fluid and remove the transmission fluid pan.
- Check the connection between the TR sensor and the manual control valve.
- Inspect the molded leadframe for metallic contamination.

Is the TR sensor connected to the manual control valve shaft?

Yes	REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.
No	CONNECT the TR sensor to the manual control valve. CLEAN any debris from the molded leadframe. RUN the Key ON Engine OFF (KOEO) self-test. If DTCs return, REPLACE the molded leadframe.

PINPOINT TEST D: TSS SENSOR

NOTE: *Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/ Emissions Diagnosis (PC/ED) manual.*

NOTE: *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*

NOTE: *Read and record all DTCs.*

NOTE: *If DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and/or P1921 are set, diagnose those DTCs first.*

PINPOINT TEST D :

D1 DRIVE CYCLE TEST

- Connect the scan tool.
- Enter the following diagnostic mode on the scan tool: Self-Test — TCM.
- Monitor the TSS PID while road testing the vehicle.

Does the TSS sensor rpm increase and decrease with engine rpm and vehicle speed?

Yes	

	REFER to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to D2

D2 CHECK TSS SENSOR SIGNAL CIRCUIT FOR POWER

- Ignition OFF.
- Disconnect Transmission C1575.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-1		Ground

Is the voltage less than 4.8 volts?

Yes	GO to D3
No	GO to D6

D3 CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect TCM C2391.
- Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2391-50	Ω	C1575-1

Is the resistance less than 5 ohms?

Yes	GO to D4
No	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

D4 CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to D5
No	INSPECT and REPAIR the circuit. If a short to ground is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

D5 CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO POWER

- Connect TCM C2391.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-1		Ground

Is voltage greater than 5.1 volts?

Yes	INSPECT and REPAIR the circuit. If a short to power is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.
No	GO to D6

D6 CHECK THE TSS SENSOR GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-1		C1575-5

Is voltage less than 4.8 volts?

Yes	REPAIR the transmission vehicle harness signal return circuit for an open. If an open is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.
No	REPLACE the molded leadframe. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST E: OSS SENSOR

NOTE: *Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.*

NOTE: *If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/ Emissions Diagnosis (PC/ED) manual.*

Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: *Read and record all DTCs.*

NOTE: *If DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and/or P1921 are set, diagnose those DTCs first.*

PINPOINT TEST E :

E1 DRIVE CYCLE TEST

- Connect the scan tool.
- Enter the following diagnostic mode on the scan tool: Self-Test — TCM.
- Monitor the OSS_SRC PID while road testing the vehicle. Drive the vehicle so the transmission upshifts and downshifts through all the gears.

Does the OSS sensor rpm increase and decrease with engine rpm and vehicle speed?

Yes	REFER to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to E2

E2 CHECK OSS SENSOR SIGNAL CIRCUIT FOR POWER

- Ignition OFF.
- Disconnect Transmission C1575.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-15		Ground

Is the voltage less than 4.8 volts?

Yes	GO to E3
No	GO to E6

E3 CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect TCM C2391.
- Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2391-51	Ω	C1575-15

Is the resistance less than 5 ohms?

Yes	GO to E4
No	INSPECT and REPAIR the circuit. If an open circuit is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

E4 CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-15	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to E5
No	INSPECT and REPAIR the circuit. If a short to ground is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.

E5 CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO POWER

- Connect TCM C2391.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-15	V	Ground

Is voltage greater than 5.1 volts?

Yes	INSPECT and REPAIR the circuit. If a short to power is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

	TEST the system for normal operation.
No	GO to E6

E6 CHECK THE OSS SENSOR GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1575-15		C1575-5

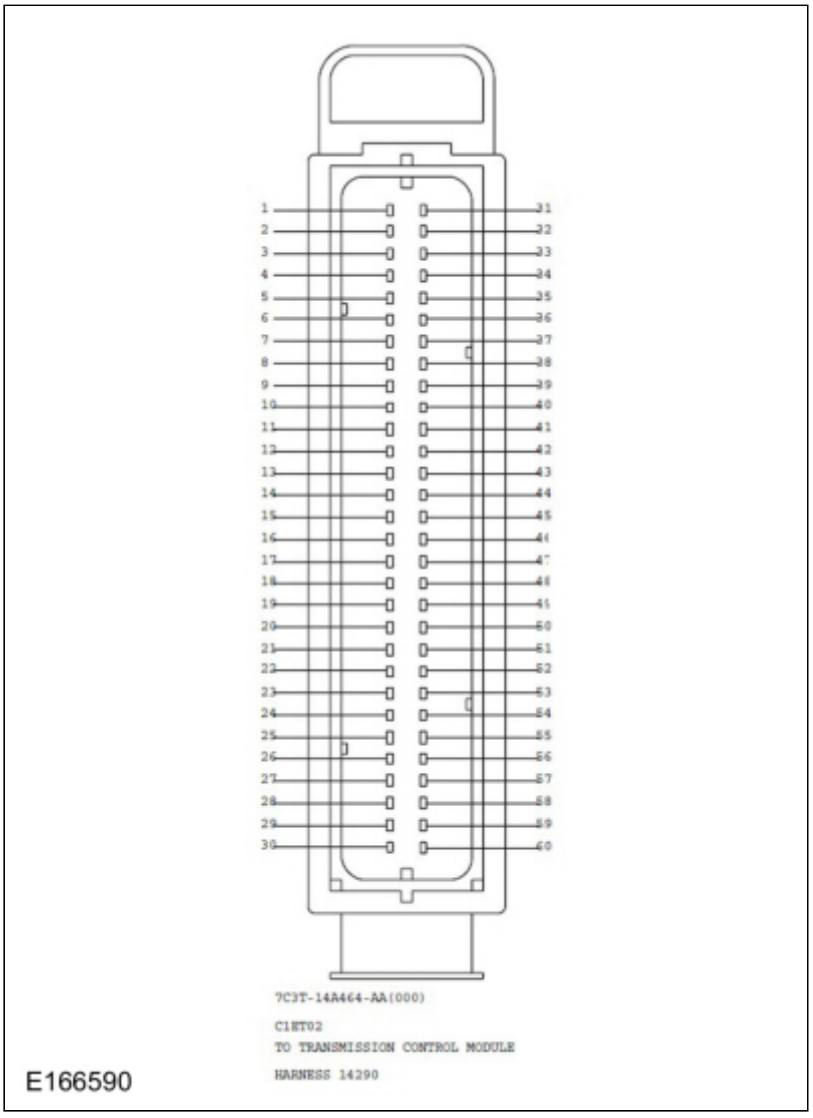
Is voltage less than 4.8 volts?

Yes	REPAIR the circuit. If an open is not found, REPLACE the TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Solenoid Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). TEST the system for normal operation.
No	REPLACE the molded leadframe. CLEAR the DTCs. TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Transmission Connector Layouts

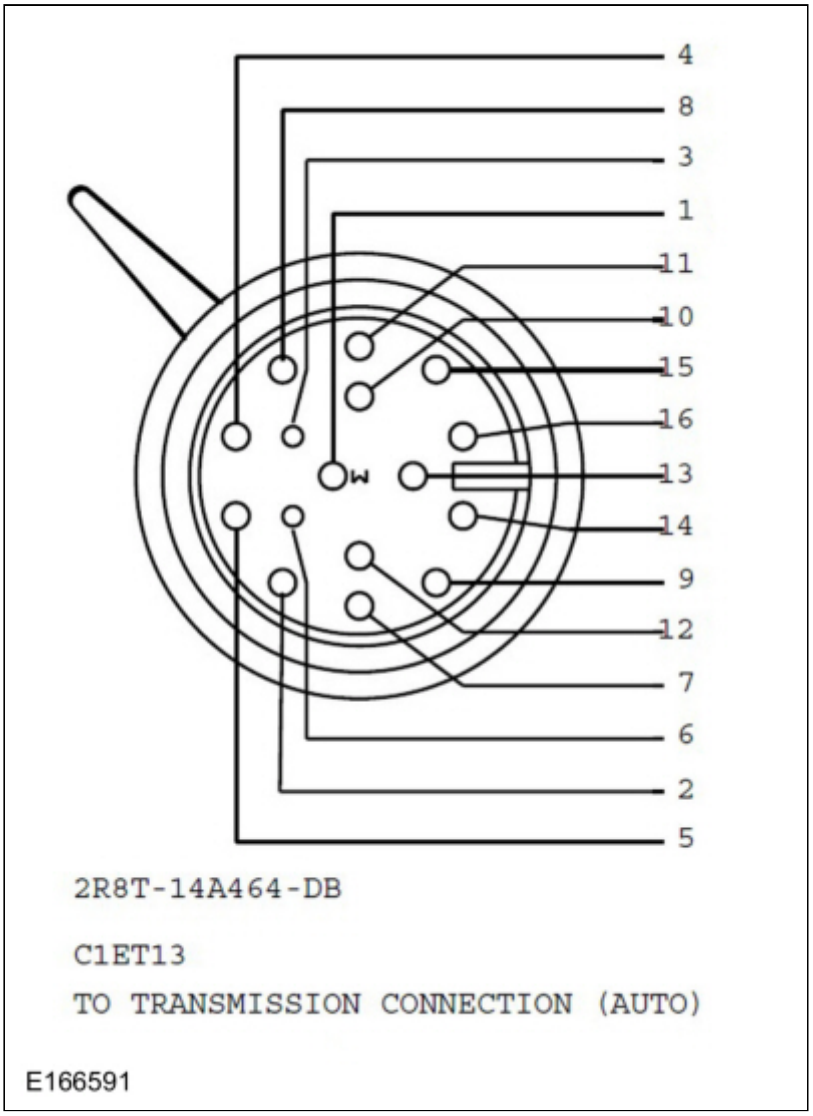
TCM Vehicle Harness C1822



Pin #	Circuit	Description
1	SBB35	VBAT1
2	CET25	TSPC (Transmission Solenoids Power Control)
3	CET10	TCC (Torque Converter Pressure Control)
4	CET09	LPC (Line Pressure Control VFS)
6	CET07	SSC (Variable Force Solenoid SSC)
7	CET06	SSB (Variable Force Solenoid SSB)
9	GD238	GND
11	CET45	SSE (ON/OFF Shift Solenoid)
16	CE903	
20	VET74	TSS / OSS VPWR (High Side VPWR to TSS,TRP,OSS Sensors)
31	SBB35	VBATT
33	CBB21	ISP-R

39	GD238	GND
40	CET44	SST-M (Manual Shift Switch)
41	GD238	GND
42	CET05	SSA (Variable Force Solenoid SSA)
43	CET08	SSD (Variable Force Solenoid SSD)
45	CET22	TRP (Transmission Range Sensor)
46	RE406	SIG RTN (Transmission Fluid Temperature Sensor Signal Return)
47	VDB04	HS CAN +
48	VDB05	HS CAN -
49	RET24	TR GND (Low Side TR GND to TSS, TRP, OSS Sensors)
50	VET33	TSS (Transmission Input Shaft Sensor)
51	VET26	OSS (Transmission Output Shaft Sensor)
54	VET27	TFT (Transmission Fluid Temperature)
58	CET18	SST-U (Manual Up Shift Switch)
59	CET19	SST-D (Manual Down Shift Switch)

Transmission Vehicle Harness C1575

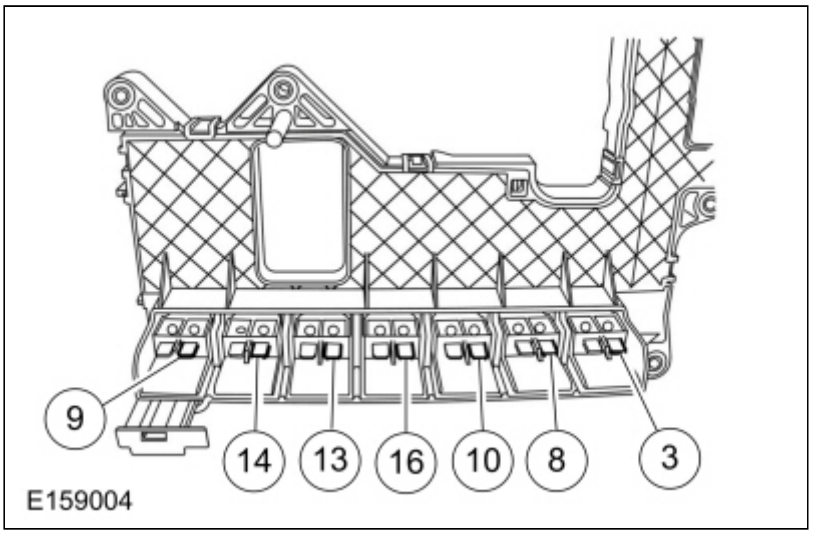


Pin #	Circuit	Description
1	VET33	TSS (Transmission Input Shaft Sensor)

1	VET33	TSS (Transmission Input Shaft Sensor)
2	-	-
3	CET10	TCC (Torque Converter Pressure Control VFS)
4	CET40	TRP (Transmission Range Sensor)
5	RE454	SIG RTN (Signal Return)
6	VET27	TFT (Transmission Fluid Temperature Sensor)
7	CET25	TSPC (Transmission Solenoids Power Control)
8	CET45	SSE ((ON/OFF Shift Solenoid)
9	CET05	SSA (Variable Force Solenoid SSA)
10	CET08	SSD (Variable Force Solenoid SSD)
11	RET24	TR GND (Low Side TR GND to TSS, TRP, OSS Sensors)
12	VET47	TSS / OSS VPWR (High Side VPWR to TSS, TRP, OSS Sensors)
13	CET07	SSC (Variable Force Solenoid SSC)
14	CET06	SSB (Variable Force Solenoid SSB)
15	VET26	OSS (Transmission Output Shaft Sensor)
16	CET09	LPC (Line Pressure Control VFS)

Molded Leadframe

NOTE: *Terminal 7 of the transmission leadframe connector is the common power feed to the solenoids listed in the following chart.*

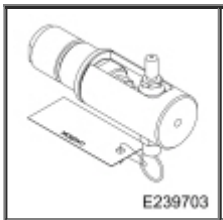


Item	Description
3	TCC (Torque Converter Pressure Control VFS)
8	SSE (ON/OFF Shift Solenoid)
10	SSD (Variable Force Solenoid SSD)
16	LPC (Line Pressure Control VFS)
13	SSC (Variable Force Solenoid SSC)
14	SSB (Variable Force Solenoid SSB)
9	SSA (Variable Force Solenoid SSA)

Copyright © 2016 Ford Motor Company

Torque Converter Contamination Inspection

Special Tool(s) / General Equipment

 E239703	307-691 Tester, Torque Convertor Leak
 E233333	307-732 Tool Kit, Torque Converter Flusher

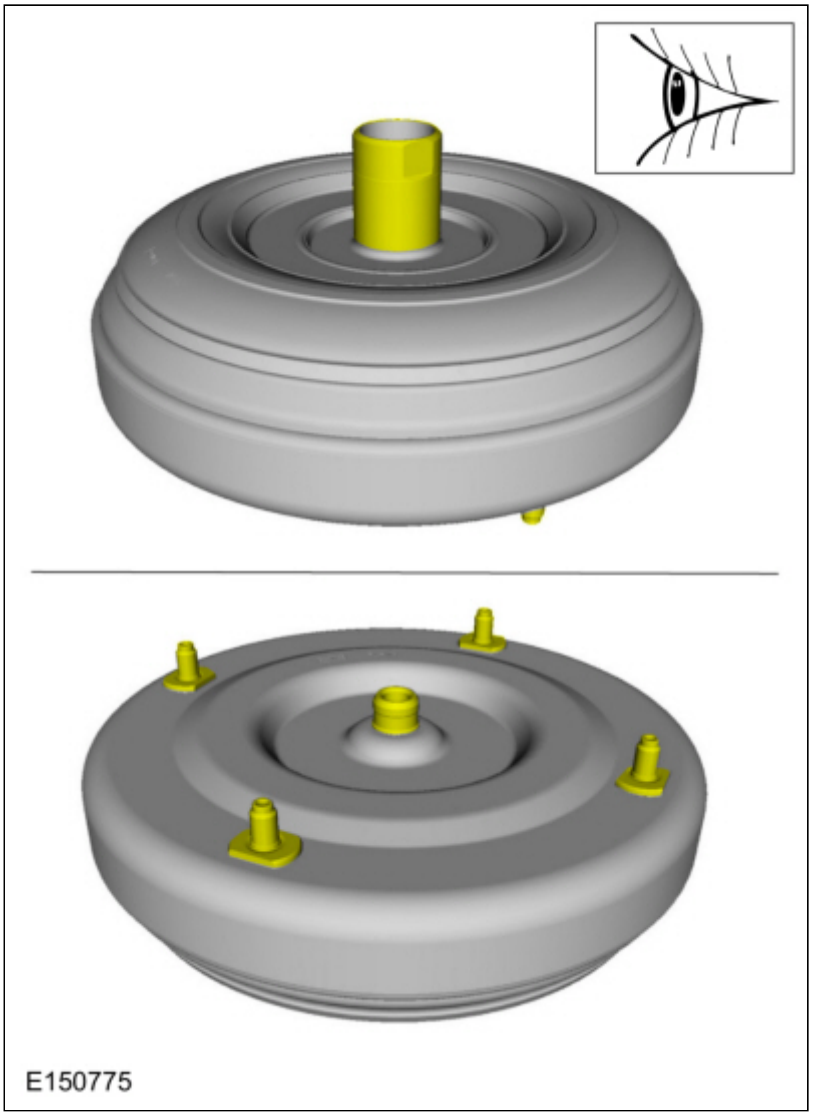
Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

Flushing

All vehicles

1. A new or remanufactured torque converter must be installed if one or more of the following statements are true:
   - The sealing surface has a groove worn from the seal.
   - A torque converter malfunction has been determined based on complete diagnostic procedures.
   - The torque converter stud or studs, threaded pads, impeller hub or bushing are damaged.
   - The torque converter exhibits external discoloration (due to overheating).
   - There is evidence of water or antifreeze contamination.



Flush The Torque Converter With The Transmission Cooling System Heated Flusher

2. **NOTE:** *Use transmission fluid specified for this transmission. Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products could cause internal transmission components to fail, which will affect the operation of the transmission.*

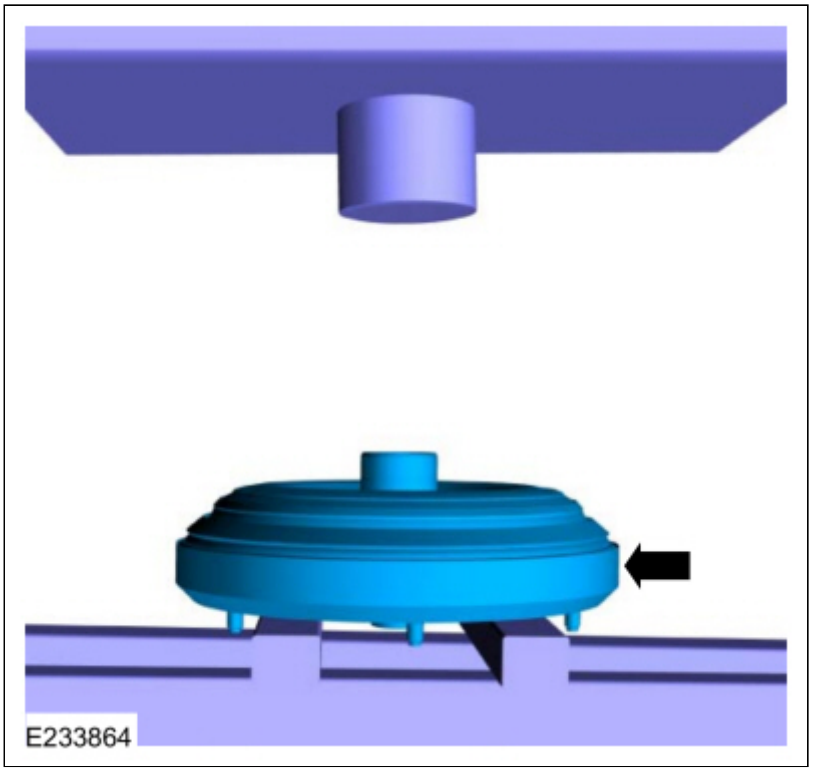
   The torque converter must be flushed every time the transmission is overhauled. It is mandatory that proper equipment and procedures be followed when flushing the torque converter. The flushing equipment used MUST:
   - Maintain the transmission fluid at 140°F or above
   - Pulsate the transmission fluid during cleaning
   - Have a GPM flow meter
   - Have a filter with a rating of 100 micron or less
   - Have air purge capability before and after flushing

3. If equipment meeting the specifications above is not available, the torque converter must be flushed by hand. Go to Flush The Torque Converter By Hand steps later in this procedure.

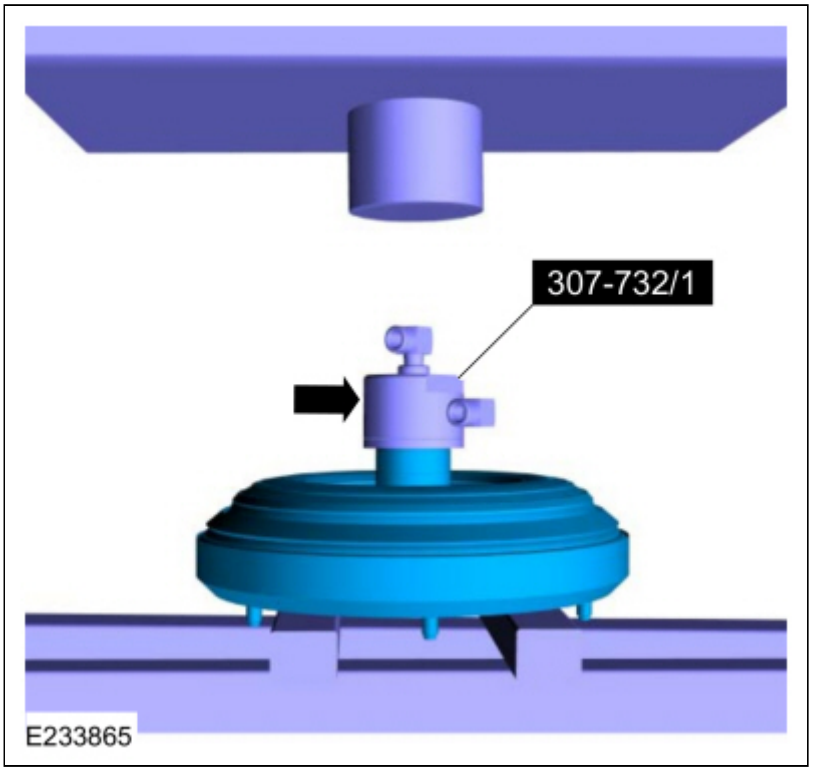
4. Check and top off the transmission fluid level of the transmission cooling system heated flusher with transmission fluid.

5. Turn on the heater and allow the transmission fluid in the transmission cooling system heated flusher 15-30 minutes to heat up to 60°C (140°F) before using.

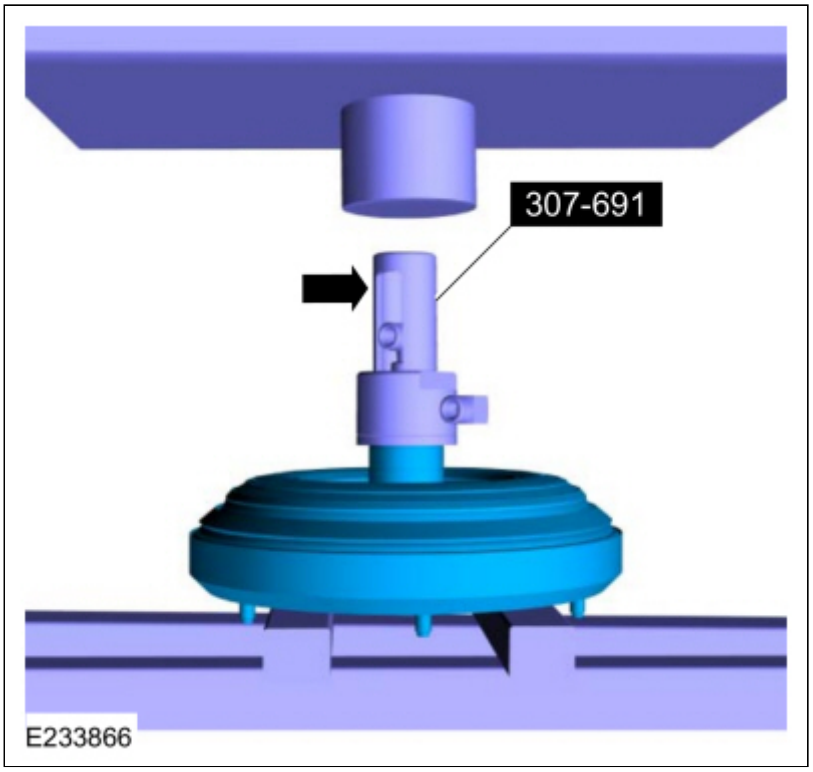
6. Place the torque converter in an arbor press. Support the torque converter on the mounting pads.



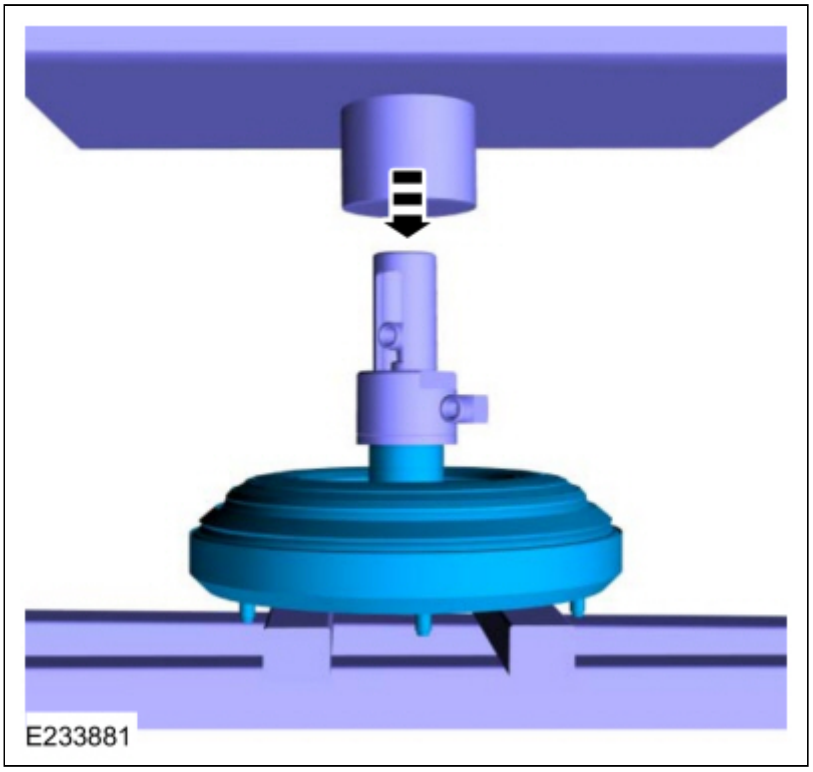
7. Using the special tools, assemble the correct turbine shaft simulator to the torque converter flush main hub and place it on the torque converter hub.
   Use Special Service Tool: 307-732 Tool Kit, Torque Converter Flusher.



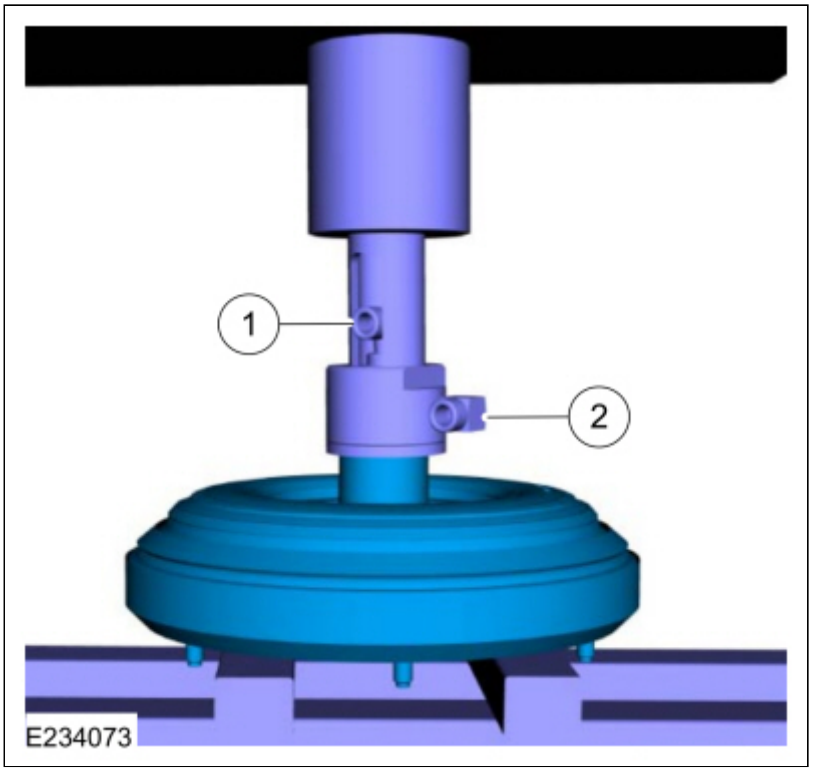
8. Using the special tool, install the slotted cap.
   Use Special Service Tool: 307-691 Tester, Torque Convertor Leak.



9. Apply enough force from the press to seal the torque converter flush main hub to the torque converter hub.



10. Connect the flush machine to the main hub.
    1. Red hose on top.
    2. Blue hose on bottom.



11. Follow the equipment instructions to purge transmission fluid from the torque converter prior to starting the flushing procedure.

12. **WARNING: The torque converter, adaptor 307-732, and the hoses will be hot.**

    NOTE: *Maintain visual contact with torque converter during the entire flush procedure. Immediately stop the flush machine if a leak develops. Repeat set up steps to reseal the tool to the converter hub and continue flushing.*

    Forward flush the converter for 15 minutes.

13. Monitor GPM flow meter periodically during the flush procedure. Flow rate above 2.0 gallons per minute is required to break up and dislodge any contamination trapped behind the TCC plate. Service flush machine filter(s) if flow rate drops below 2 GPM.

14. Follow the equipment instructions to purge the torque converter.

15. **WARNING: The torque converter, adaptor 307-732, and the hoses will be hot.**

    Allow torque converter and equipment to cool for 30 minutes before handling.

16. Disconnect the hoses and remove the special tools.

Flush The Torque Converter By Hand

NOTICE: Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur. Use only clean transmission fluid designated for the transmission and torque converter being serviced.

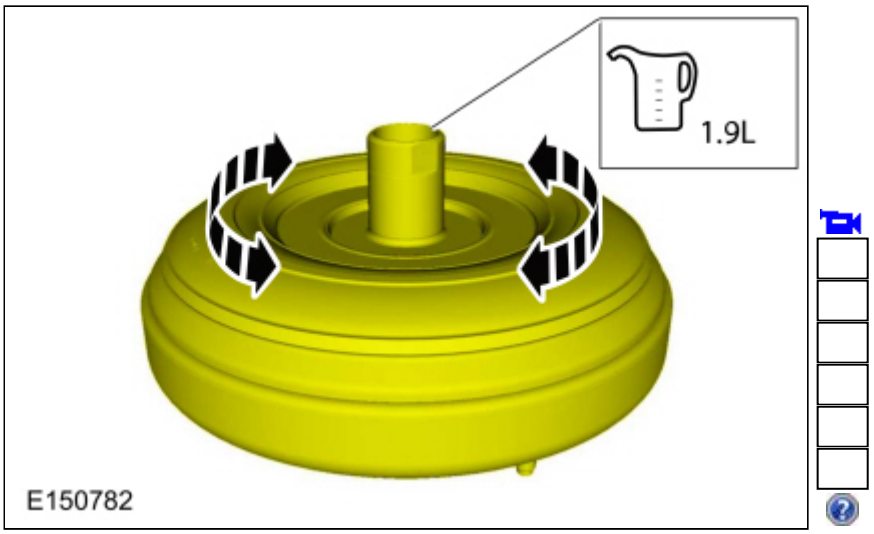
NOTE: *Only flush the torque converter by hand when the transmission cooling system heated flusher is not available.*

17. Pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter.

18. Examine the transmission fluid for contaminants. The transmission fluid must be free of metallic contaminants. If metallic contaminants are present, do not continue with hand flushing. The torque converter must be flushed with the transmission cooling system heated flusher.

19. Drain the remaining transmission fluid from the torque converter.

20. Using only the recommended transmission fluid, add 1.9L (2 qt) of clean transmission fluid into the converter and agitate by hand.
    Material: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)

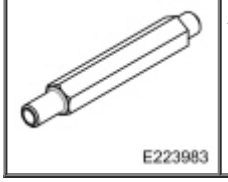


21. Thoroughly drain the transmission fluid.

Copyright © 2016 Ford Motor Company

Transmission Fluid Drain and Refill - Emission Requirements: EURO Stage V LDT

Special Tool(s) / General Equipment

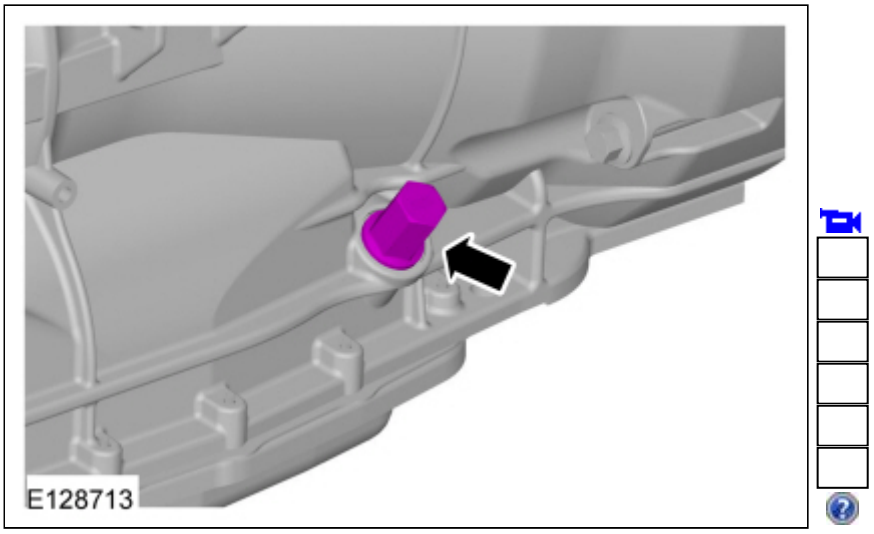
 E223981	307-730 Filling Tool, Transmission Fluid
 E223983	307-730-01 Adapter, Fluid Filling

Draining

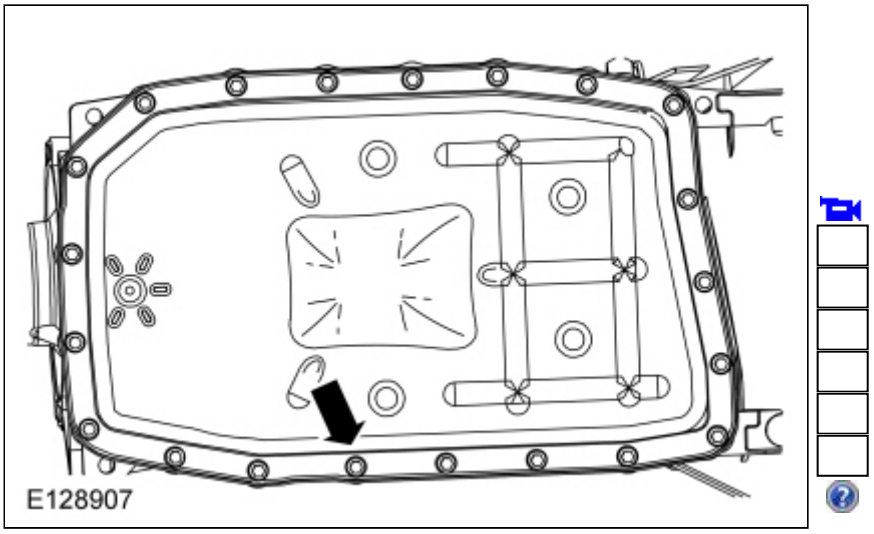
1. With the vehicle in NEUTRAL, position it on a hoist.
   Refer to: Lifting - Vehicles Built Up To: 16-08-2015 (100-02 Jacking and Lifting) .

2. **NOTE:** *Be prepared to collect escaping fluid.*

   Remove the transmission fluid fill plug fluid level indicator assembly located on the front portion of the transmission case. Removal of the transmission fluid fill plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the transmission fluid pan to be easily removed when the bolts are removed.

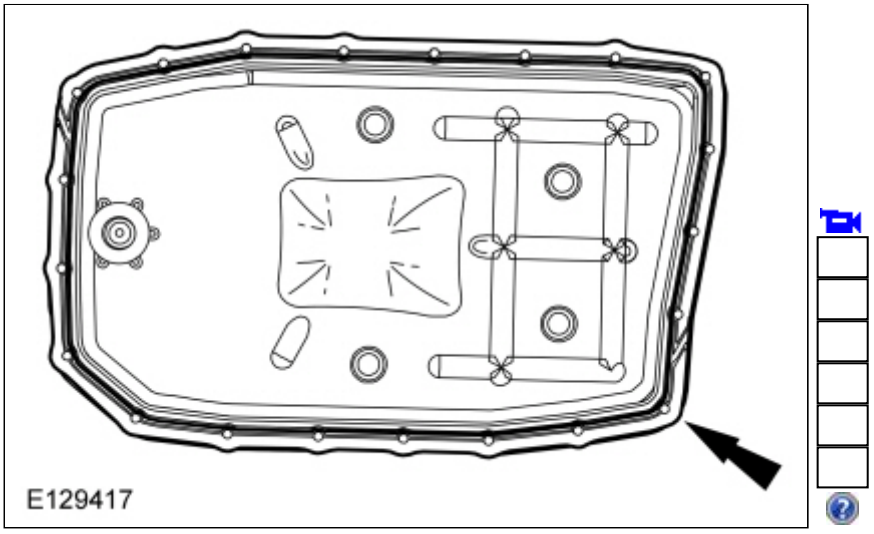


3. Remove the transmission fluid pan and allow the transmission fluid to drain.

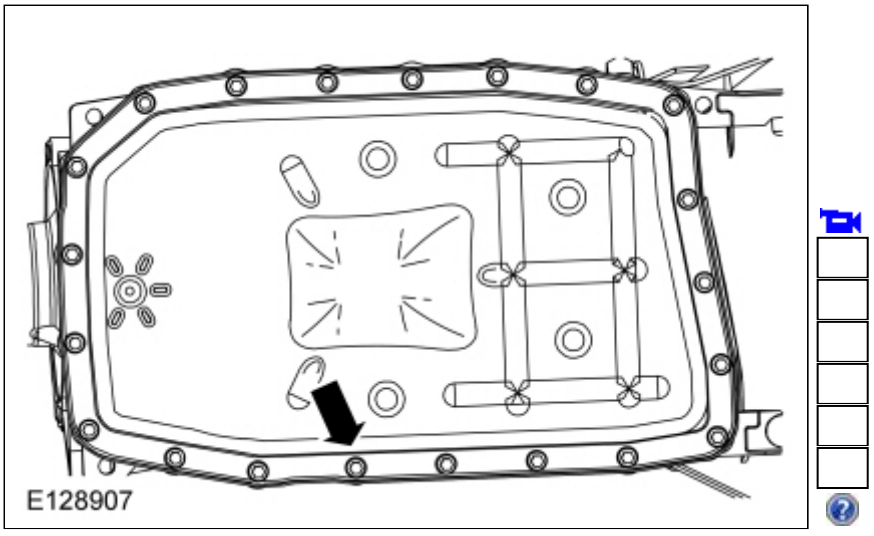


4. **NOTE:** *The gasket is to be reused unless damaged.*

   Install a new transmission fluid pan gasket, if required.



5. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   Torque: 12 Nm

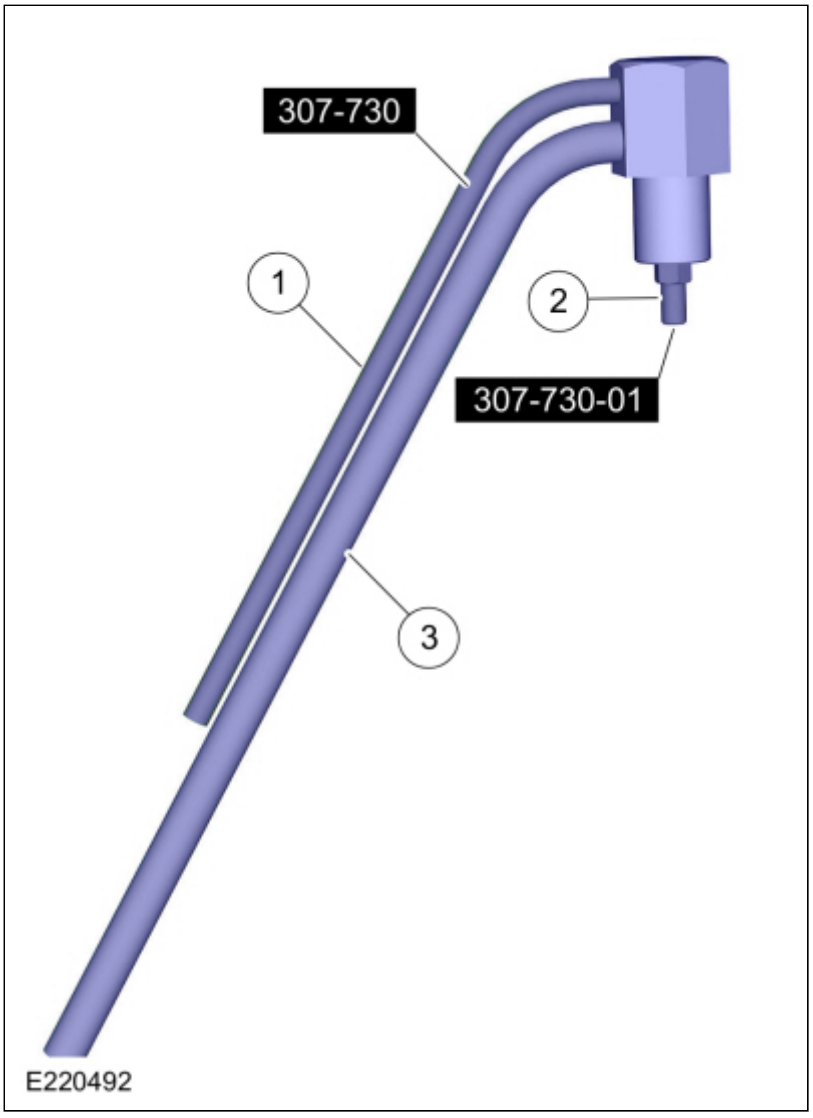


Filling

1. **NOTICE: Only use the specified special tool.**

Component	Description
1	Return pipe
2	Return pipe inside transmission (set depth)
3	Fill pipe

Use Special Service Tool: 307-730 Filling Tool, Transmission Fluid. , 307-730-01 Adapter, Fluid Filling.



NOTICE: The transmission fluid fill port is located near the exhaust pipe. The exhaust will be extremely hot during this procedure. Make sure you wear the appropriate Personal Protection Equipment (PPE) for hand and arm protection.

NOTE: *Use an appropriate tool to refill the fluid.*

2. To add fluid or fill the transmission the transmission filling tool must be inserted into the fluid fill port.The transmission filling tool has a fill and return pipe.
    - **Fill pipe** - Used to pump transmission fluid into the transmission
    - **Return pipe** - Used to return the excess fluid from the transmission. The return line is under vacuum.

3. **NOTE:** *Airlock must be released from the filling tube and vacuum must be removed from the return pipe prior to removing the transmission filling tool.*

    - If filling and draining separately, transmission fluid should be added until the transmission is in an overfill state. Air lock on fill line should be released and the fill tube disconnected. Fluid should then be vacuumed out until no more fluid is drawn. At this point the correct fill level had been achieved.
    - The correct fill level is achieved when the fluid in the transmission reaches the return pipe (set depth) draining out while the fluid temperature is at the correct operating temperature.

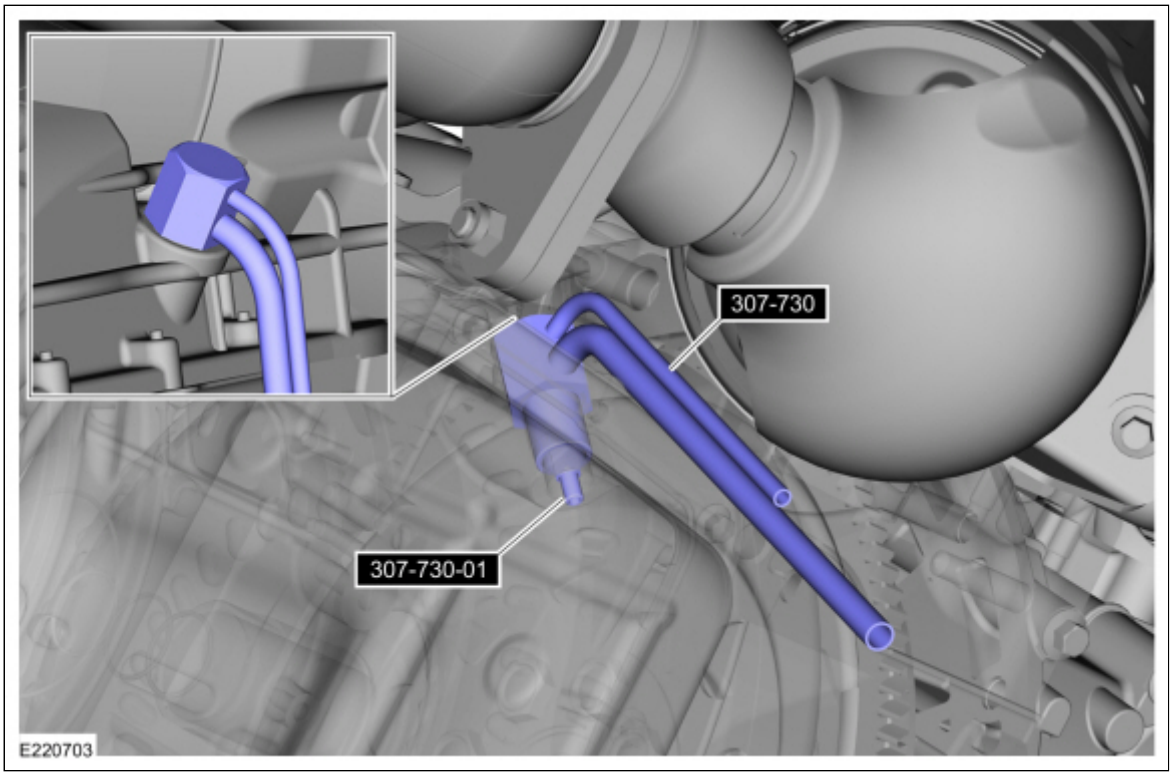
4. With the engine running monitor the transmission temperature (between 96.7°C and 102°C) while filling the transmission as the temperature may drop due to the cold fluid entering the transmission. If transmission

temperature drops below the specified requirement during fill, the transmission should be stalled until the temperature climbs within the required range.

5. **NOTICE: Only use the specified special tool.**

   NOTE: *Take extra care not to spill fluid onto the exhaust system.*

   When the fluid is seen returning to the container via the return line, the fluid is at the correct fluid level and the filling tool can be removed.
   Use Special Service Tool: 307-730 Filling Tool, Transmission Fluid. , 307-730-01 Adapter, Fluid Filling.



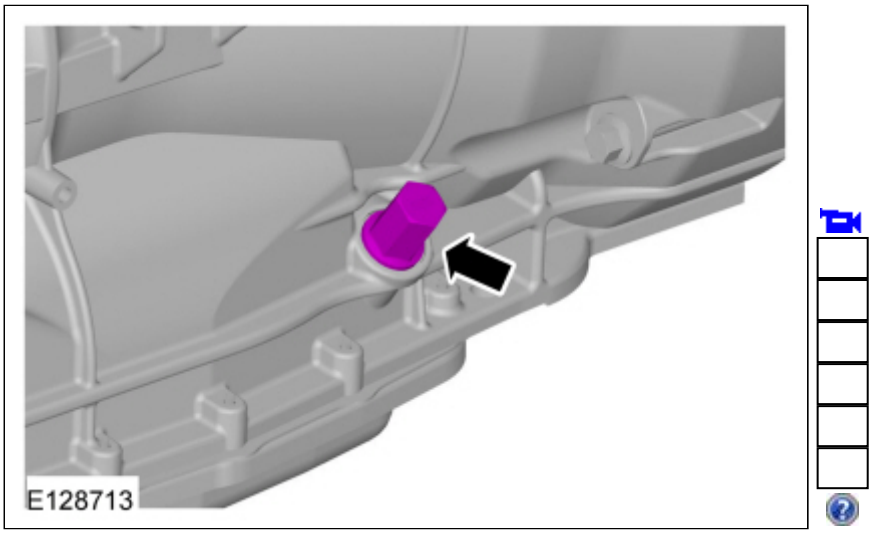
6. **NOTE:** *Use the transmission filling tool to add or remove transmission fluid.*

   Using the fluid level indicator check the level of the fluid (fluid temperature between 96.7°C and 102°C).
   Refer to: Transmission Fluid Level Check - Emission Requirements: EURO Stage V LDT (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) .

7. Refit the dipstick plug to the transmission when the correct level is reached.

8. **NOTICE: Make sure you wear the appropriate Personal Protection Equipment (PPE) for hand and arm protection..**

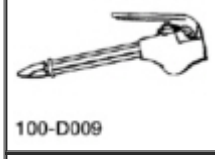
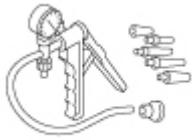
   After the correct level is reached refit the dipstick to the plug and refit plug to the transmission.
   Torque: 35 Nm



Copyright © 2016 Ford Motor Company

Transmission Fluid Drain and Refill

Special Tool(s) / General Equipment

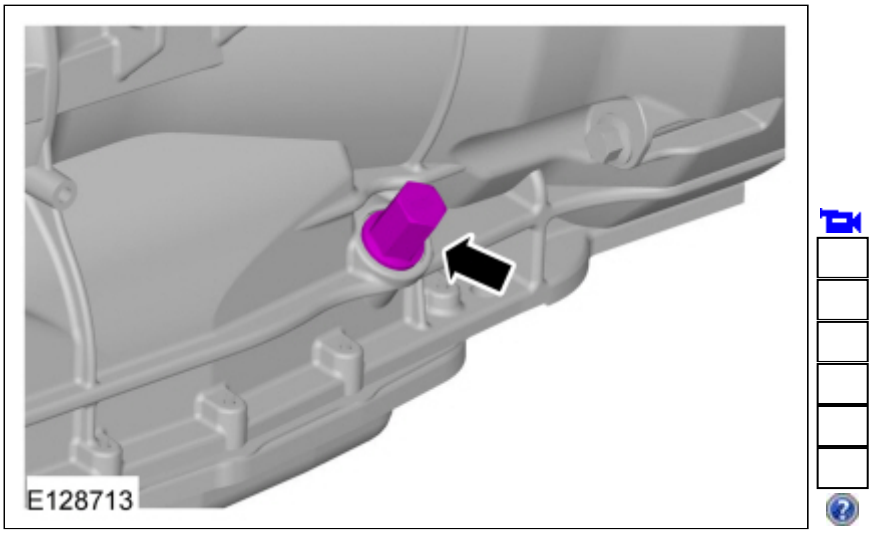
 100-D009	100-D009 (D93L-7000-A) Rubber Tip Air Nozzle
	307-570 Tube, Transmission Fill
	307-D465 Transporter Fluid Evacuator/Injector
 23036A	416-D001 Hand Vacuum Pump/Pressure Pump
Ford Diagnostic Equipment	

Draining

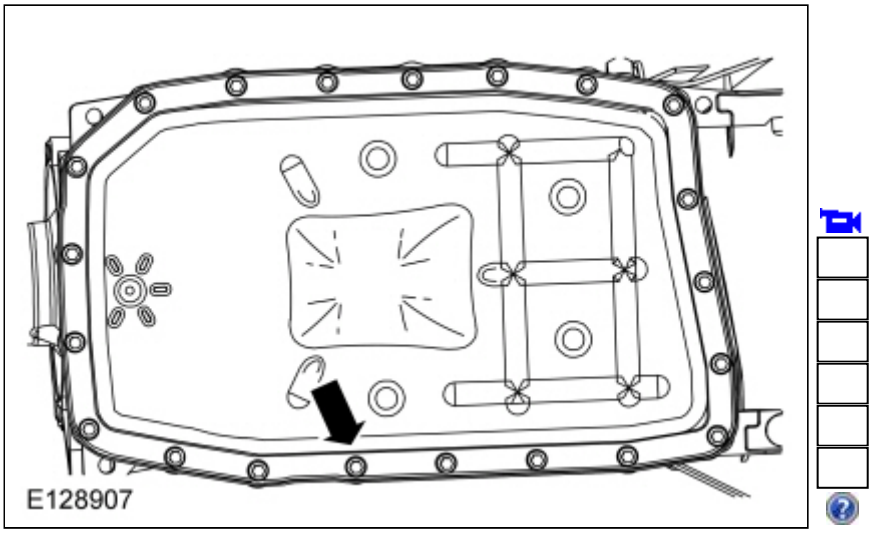
1. With the vehicle in NEUTRAL, position it on a hoist.
   Refer to: Jacking and Lifting (100-02 Jacking and Lifting) .

2. **NOTE:** *Some transmission fluid leakage may occur when removing the transmission fluid fill plug.*

   Remove the transmission fluid fill plug fluid level indicator assembly located on the front portion of the transmission case. Removal of the transmission fluid fill plug will relieve any vacuum that might have built up in the transmission. This will aid in allowing the transmission fluid pan to be easily removed when the bolts are removed.

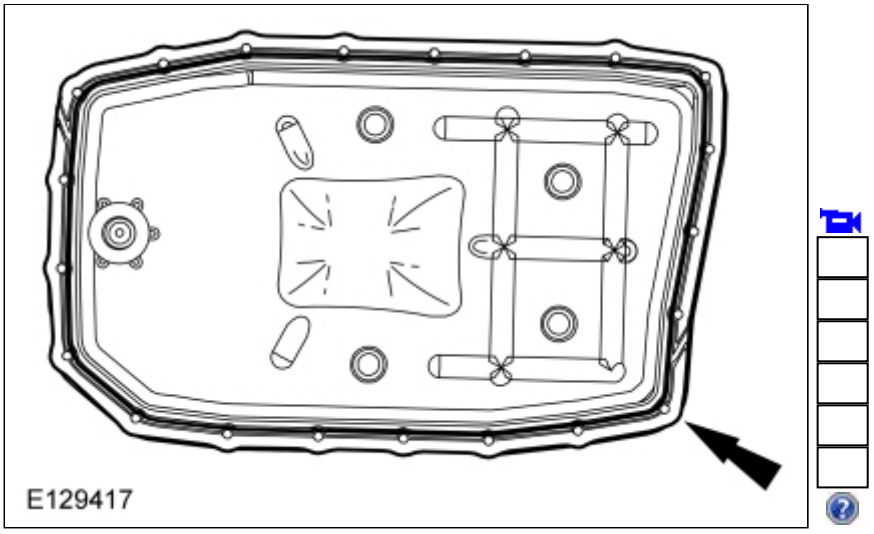


3. Remove the transmission fluid pan and allow the transmission fluid to drain.

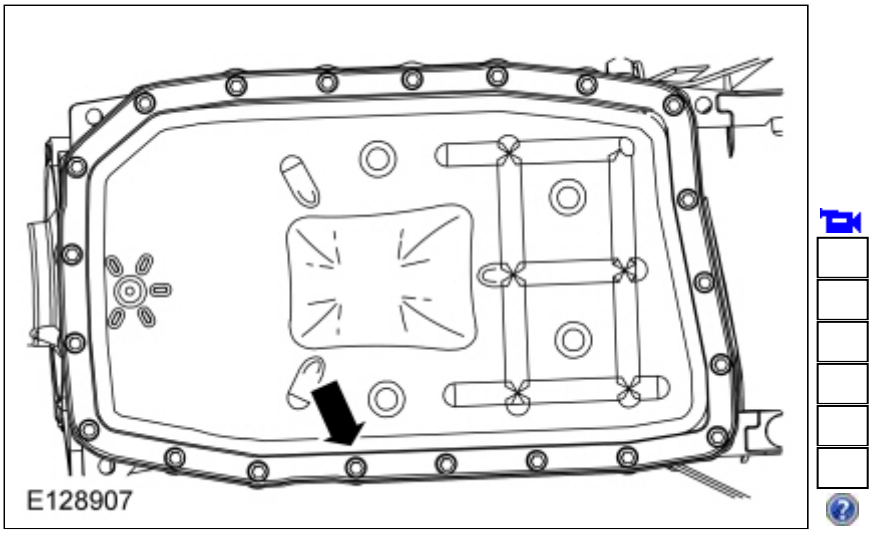


4. **NOTE:** *The transmission fluid pan gasket can be reused if not damaged.*

   Install a new transmission fluid pan gasket, if required.



5. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   Torque: 12 Nm



Filling

WARNING: The transmission fluid fill plug is located near the exhaust pipe. The exhaust will be extremely hot during this procedure.

NOTICE: This procedure contains the air purge steps required to purge air from the transmission fluid cooling

system. This procedure is NOT intended for use with the Transmission Fluid Level Check.

NOTICE: The vehicle should not be driven if the transmission fluid level is low as internal failure could result.

NOTICE: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

NOTE: *If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.*

NOTE: *Here is an overview of the Transmission Fluid Drain and Refill procedure.*

- *Adding 3.3L (3.5 qt) of transmission fluid to the transmission is an initial fill enabling the engine to be started.*
- *The cold level range shown in the procedure allows the vehicle to be driven.*
- *The vehicle should be driven to allow the Transmission Fluid Temperature (TFT) to reach 97–102°C in order to purge the air from the transmission fluid cooling system.*
- *Fill the transmission fluid to the fill range on the transmission fluid level indicator at the normal operating range 97–102°C.*

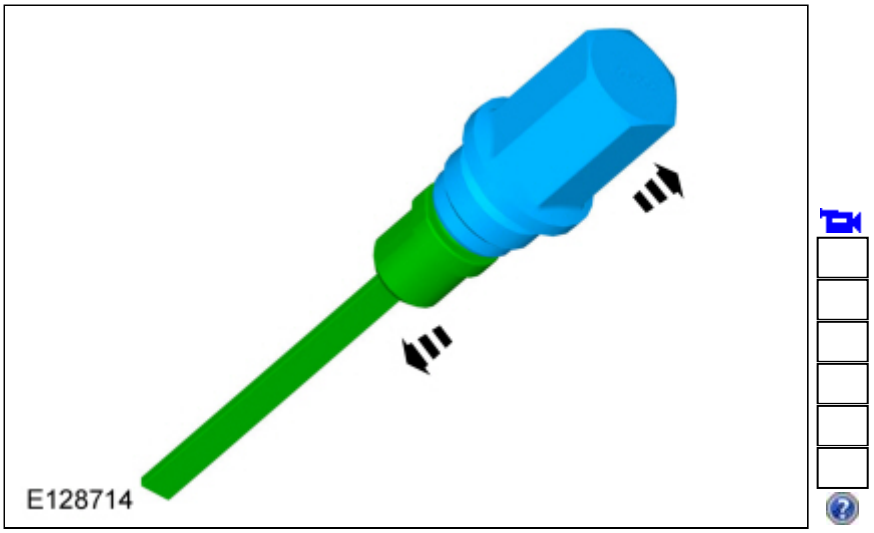
NOTE: *The transmission will need 3.3L (3.5 qt) of transmission fluid added to the transmission as an initial fill if:*

- *If the transmission has been overhauled.*
- *A new mechatronic assembly has been installed.*
- *The transmission fluid pan or transmission fluid filter have been removed.*

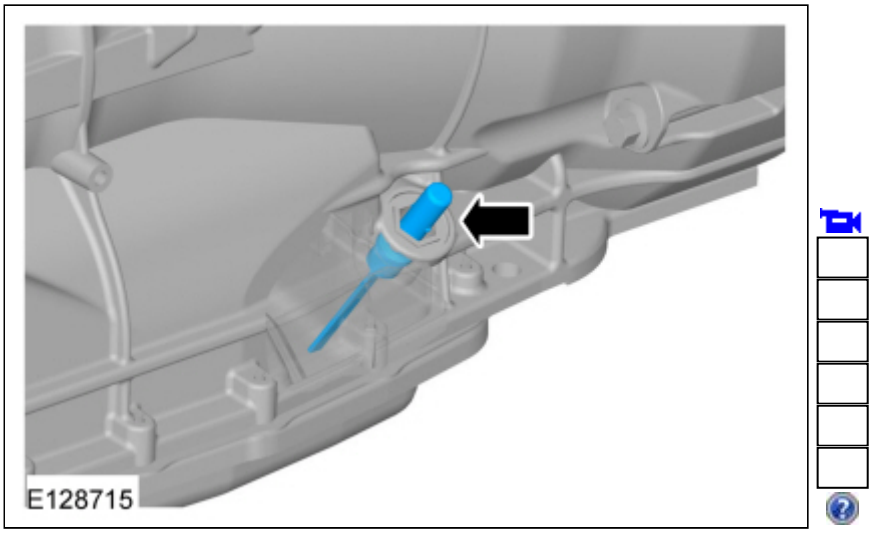
1. Using the Transmission Fluid Fill Tube, add 3.3L (3.5 qt) of transmission fluid to the transmission through the transmission fluid fill hole. For additional information, refer to Adding Additional Transmission Fluid in this procedure.
   Refer to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) .

2. Check the transmission fluid level cold.
   - The vehicle is safe to drive if the transmission fluid is in the cold level range 32°C-43°C (90°F-110°F).
   - Using the ford diagnostic equipment and with the engine running, place the selector lever in each gear position and hold approximately 5 seconds. Place the selector lever in PARK, with the engine at idle (600-750 rpm).
     Use the General Equipment: Ford Diagnostic Equipment

3. Separate the transmission fluid level indicator from the transmission fluid fill plug.

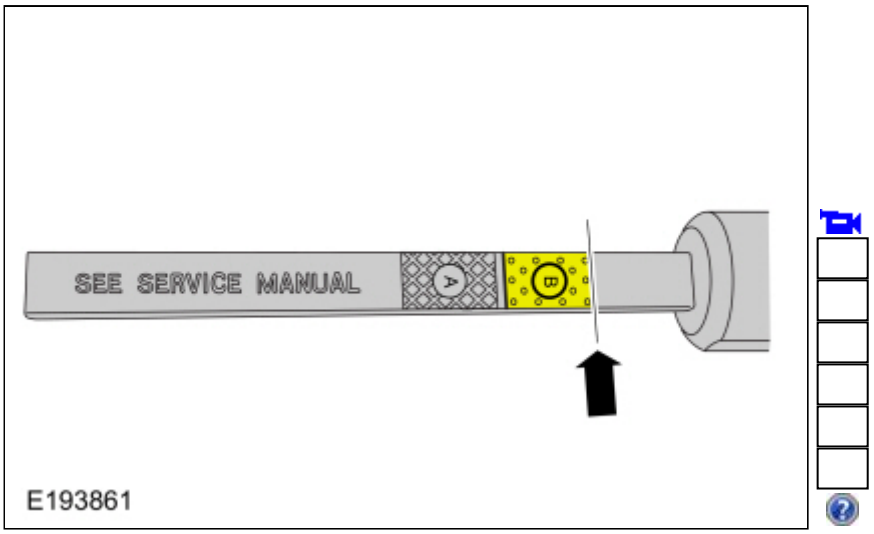


4. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator (with the A and B markings toward drivers left) only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.

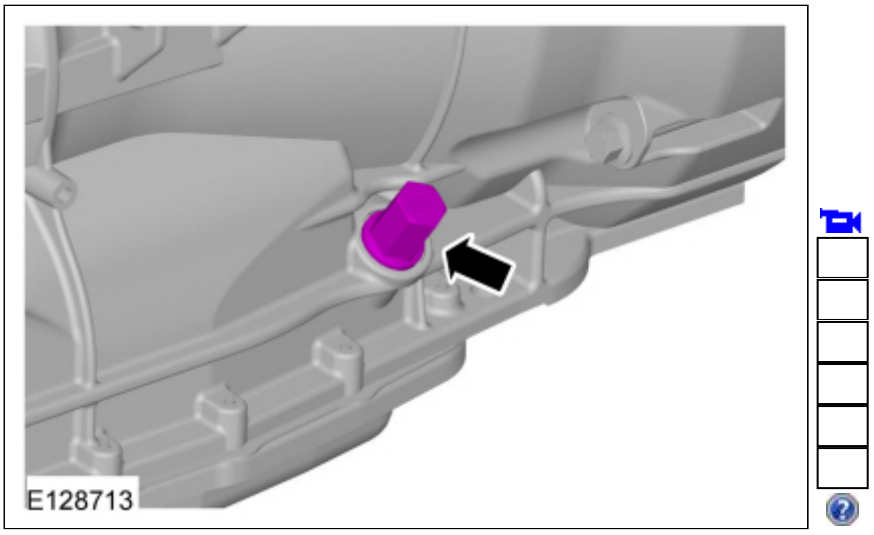


5. **NOTE:** *The transmission has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted area to check the transmission fluid level.*

   Using the ford diagnostic equipment, verify that the TFT is between 97°C - 102°C. Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (B) marked area on the transmission fluid level indicator.l
   Use the General Equipment: Ford Diagnostic Equipment



6. Install the transmission fluid fill plug.
   Torque: 35 Nm

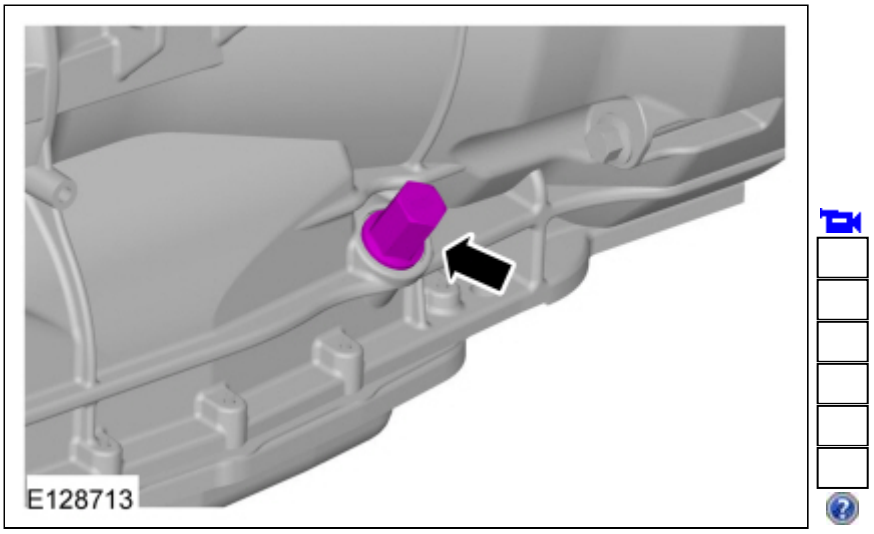


7. While driving the vehicle, use the Ford diagnostic equipment to verify that the TFT has reached a temperature of 97°C . This will circulate the transmission fluid through the torque converter and the transmission fluid

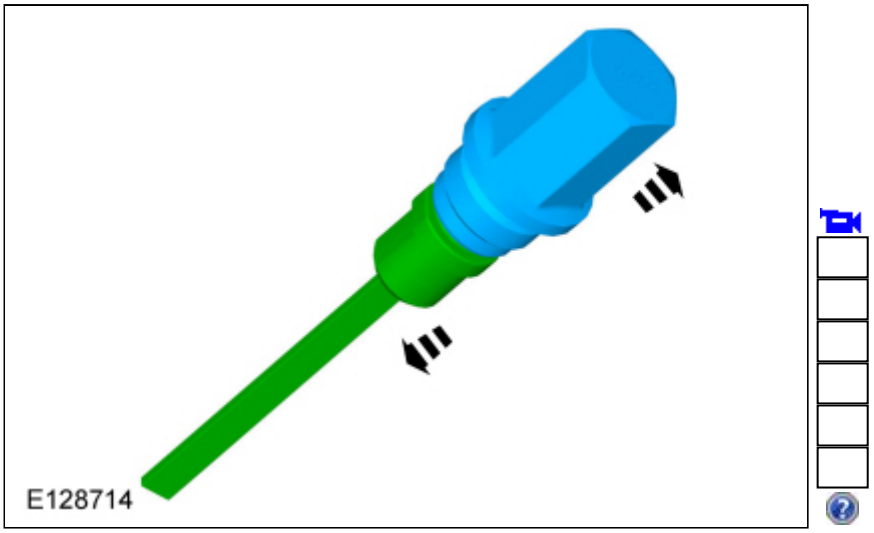
cooling system, eliminating any trapped air in the transmission fluid cooling system.

- With the engine idling (600-750 rpm) in PARK, verify that theTFTis between 97°C - 102°C.

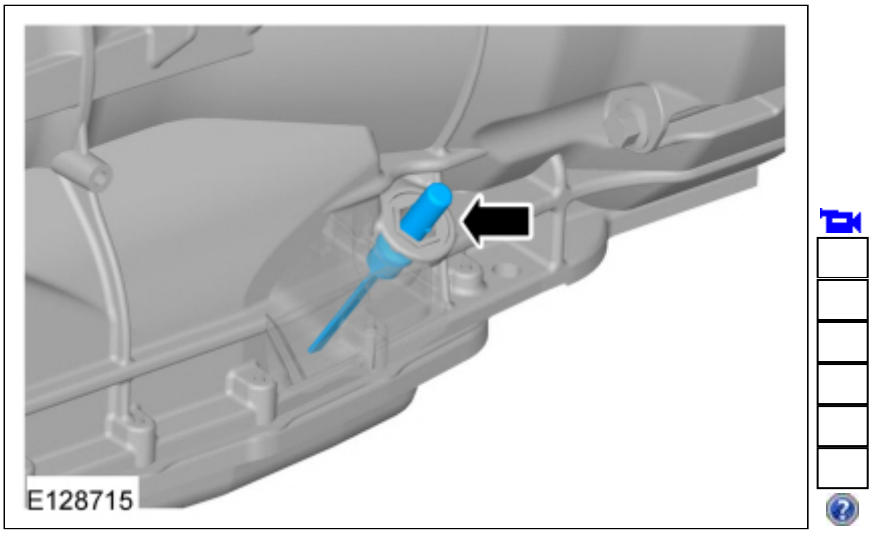
8. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the front portion of the transmission case.



9. Separate the transmission fluid level indicator from the transmission fluid fill plug.



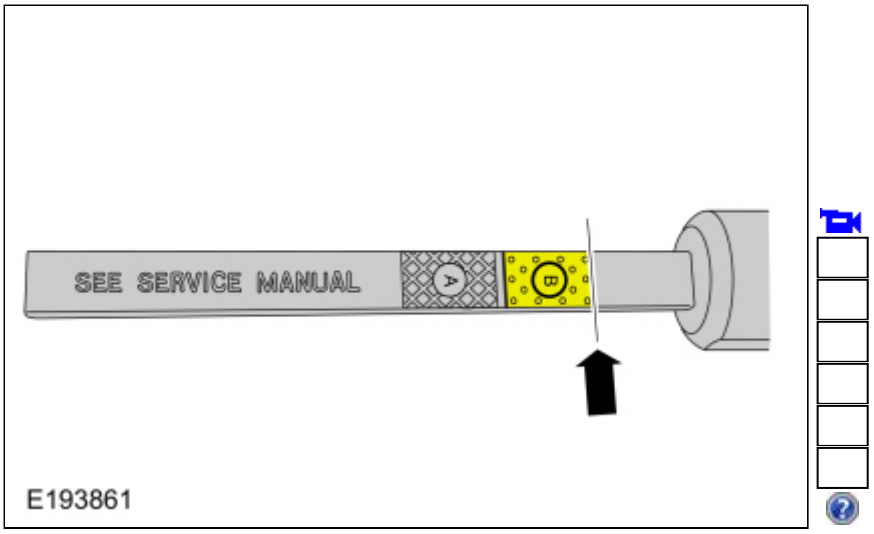
10. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator (with the A and B markings toward drivers left) only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



11. **NOTE:** *The transmission has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled*

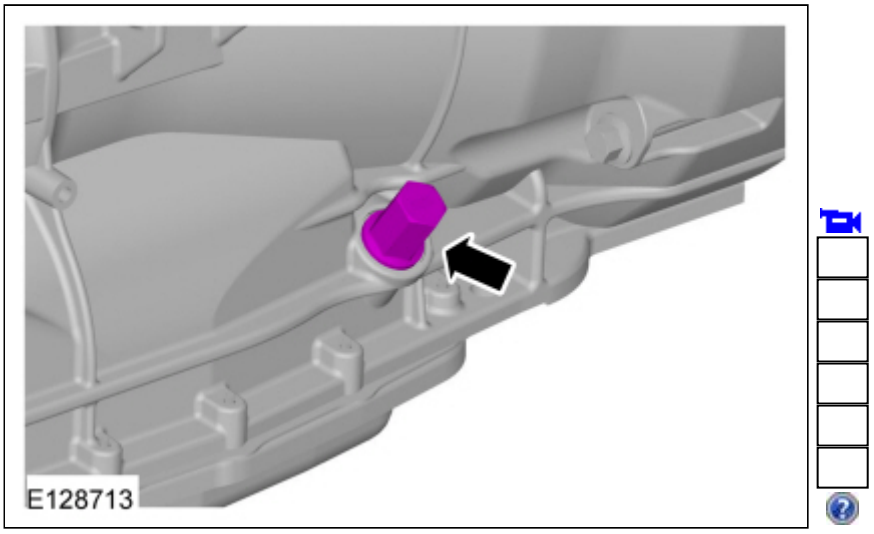
B) area. Use the dotted area to check the transmission fluid level.

Using the Ford diagnostic equipment, verify that the TFT is between 97°C - 102°C. Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (B) marked area on the transmission fluid level indicator.



12. **NOTE:** *If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid in this procedure.*

    Install the transmission fluid fill plug.
    Torque: 35 Nm

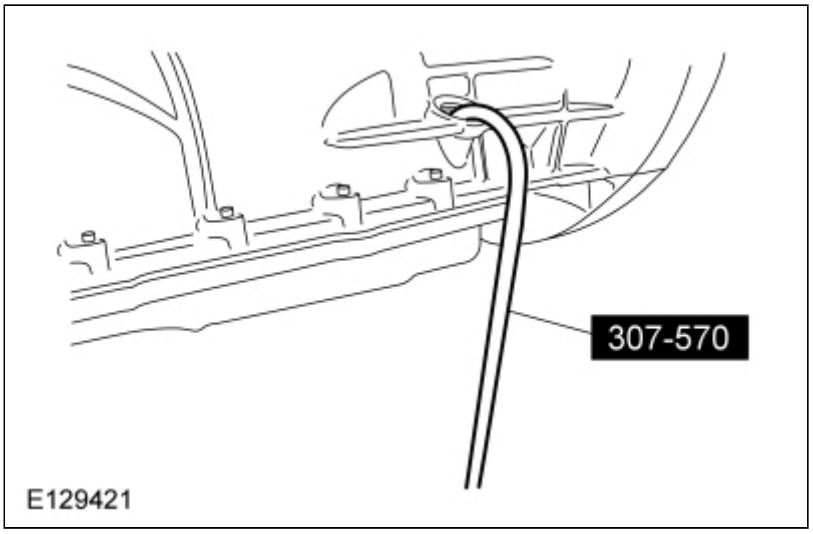


Filling

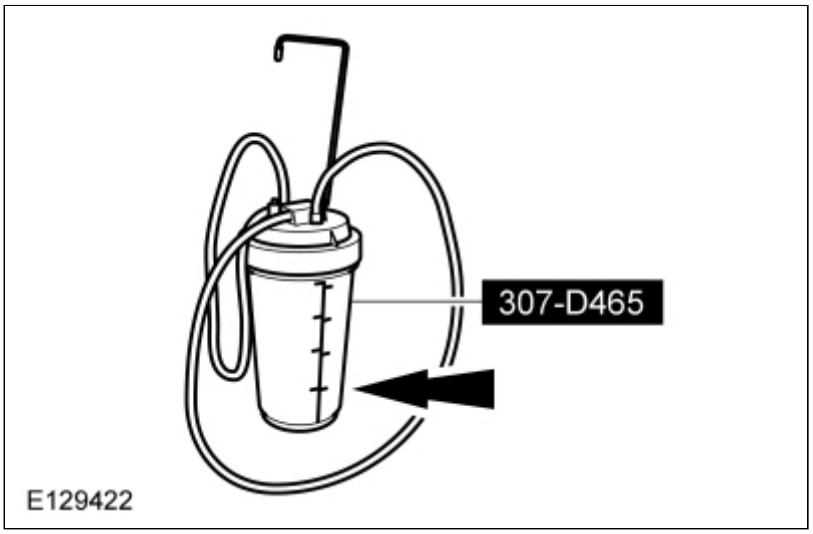
NOTE: ***Adding additional transmission fluid***

1. **NOTE:** *To get an accurate transmission fluid level reading the engine should be idling in PARK.*

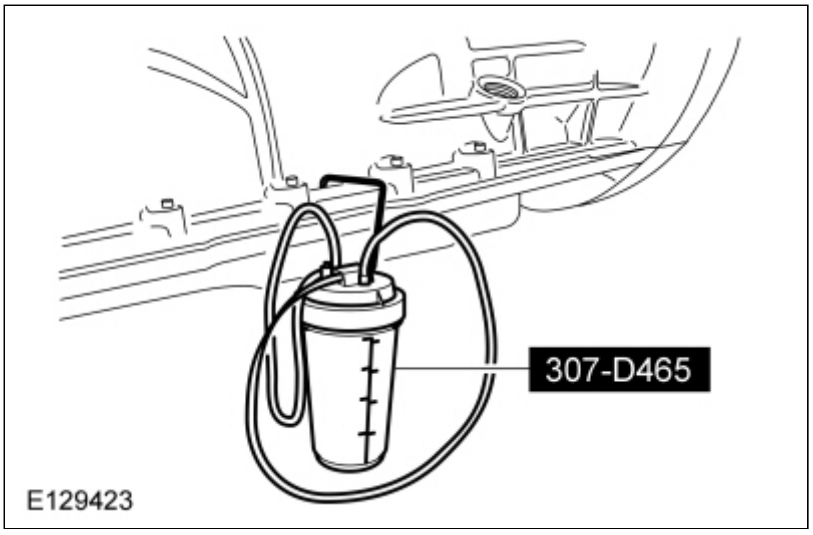
   Install the Transmission Fluid Fill Tube into the transmission fluid fill hole.
   Use Special Service Tool: 307-570 Tube, Transmission Fill.



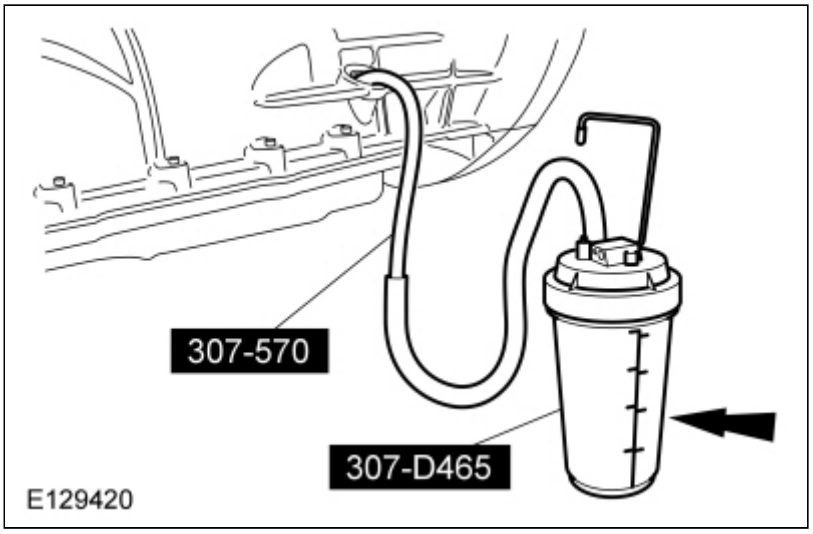
2. Fill the Transporter Fluid Evacuator/Injector with approximately 0.47L of transmission fluid.
   Use Special Service Tool: 307-D465 Transporter Fluid Evacuator/Injector.



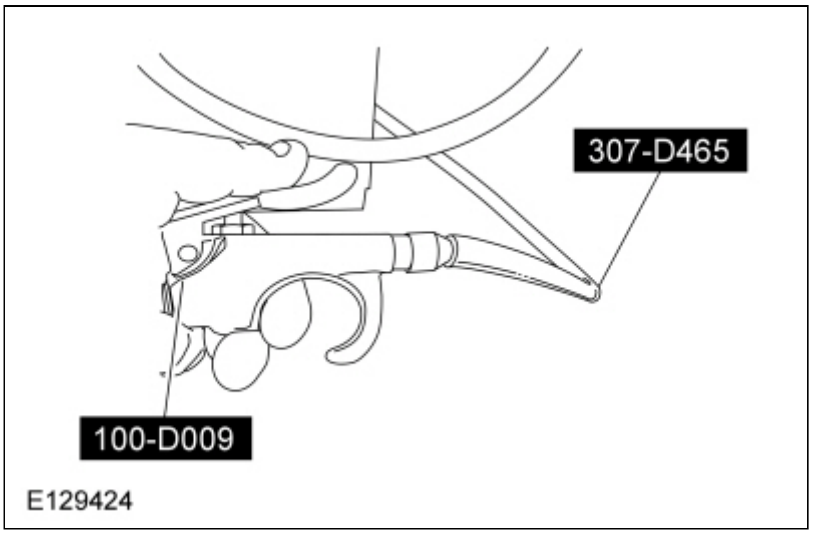
3. Hang the Transporter Fluid Evacuator/Injector under the vehicle, upright and close to the transmission.
   Use Special Service Tool: 307-D465 Transporter Fluid Evacuator/Injector.



4. Connect the Transporter Fluid Evacuator/Injector and Transmission Fluid Fill Tube.
   - Connect the open end of the fluid hose from the Transporter Fluid Evacuator/Injector onto the Transmission Fluid Fill Tube from the transmission case.
     Use Special Service Tool: 307-570 Tube, Transmission Fill. , 307-D465 Transporter Fluid Evacuator/Injector.

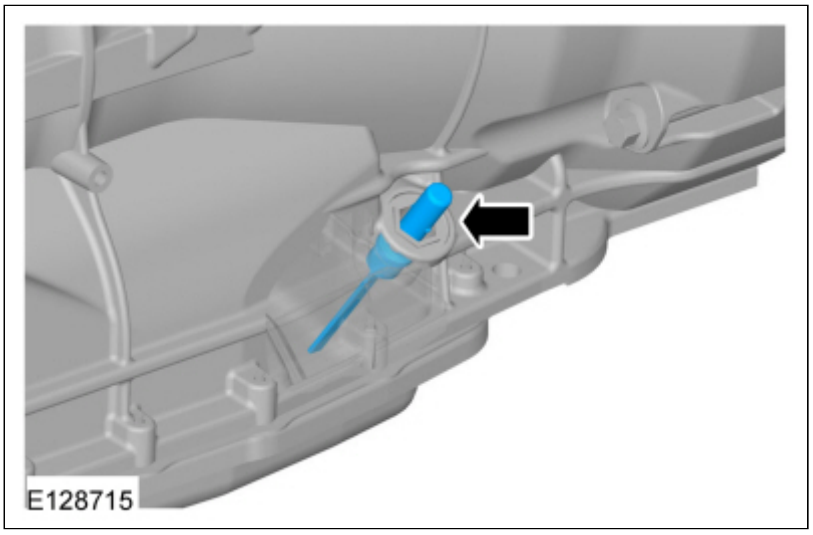


5. Use a Rubber Tip Air Nozzle to apply a maximum of 206.85 kPa to the open end of the vacuum/pressure hose from the Transporter Fluid Evacuator/Injector. Transmission fluid will immediately start flowing out of the Transporter Fluid Evacuator/Injector into the transmission.
   Use Special Service Tool: 100-D009 (D93L-7000-A) Rubber Tip Air Nozzle. , 307-D465 Transporter Fluid Evacuator/Injector.



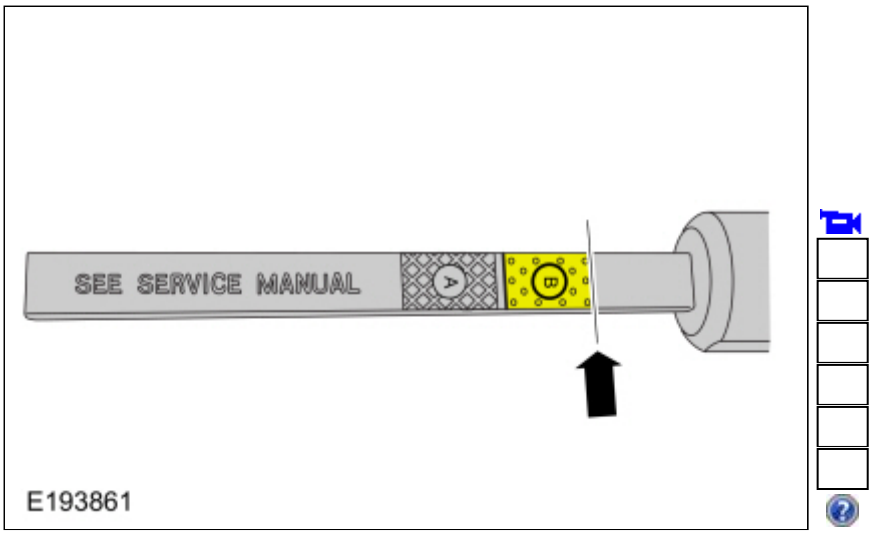
6. **NOTE:** *Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (labeled B) mark.*

   Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole (with the A and B markings toward drivers left) to check the transmission fluid level. Repeat this until a consistent reading is established.



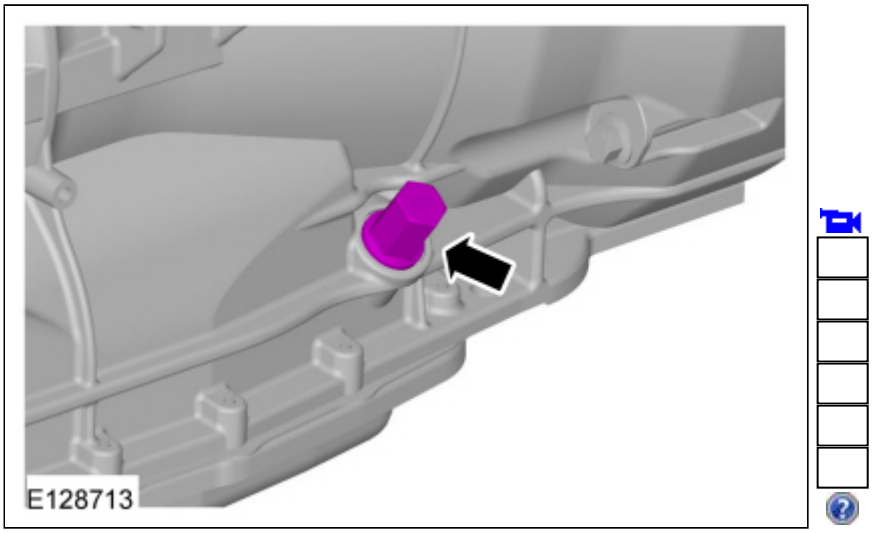
7. **NOTE:** *The transmission has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted area to check the transmission fluid level.*

   Using the Ford diagnostic equipment, verify that the TFT is between 97ºC-102ºC. Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (B) marked area on the transmission fluid level indicator.
   Use the General Equipment: Ford Diagnostic Equipment



8. **NOTE:** *If the transmission fluid is over full, follow the steps for Removing Transmission Fluid in this procedure.*

   Install the transmission fluid fill plug.
   Torque: 35 Nm

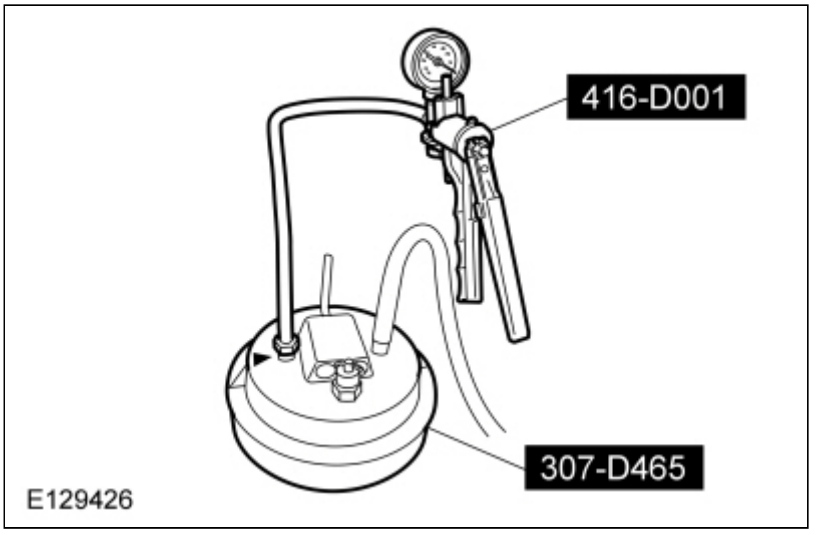


Draining

NOTE: ***Removing transmission fluid***

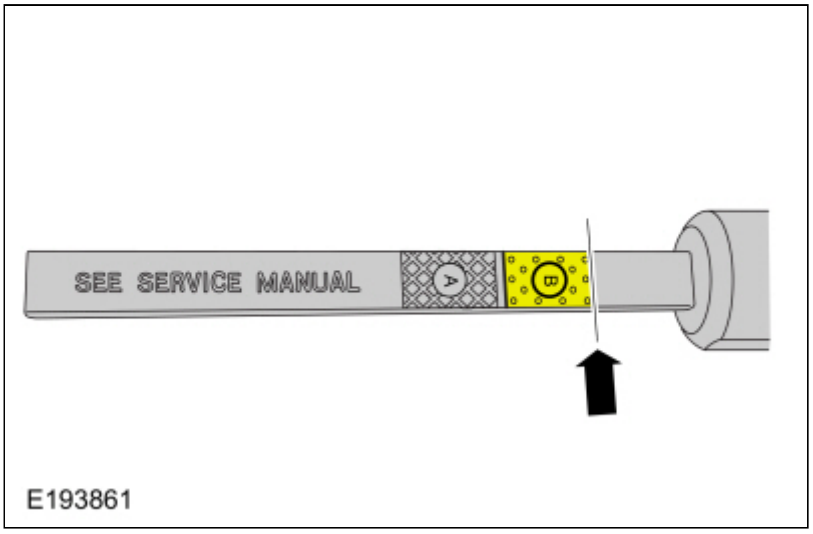
1. **NOTE:** *To get an accurate transmission fluid level reading the engine should be idling in PARK.*

   If the transmission is overfilled, transmission fluid must be removed to the correct level. Use the Transporter Fluid Evacuator/Injector and the Vacuum Pump Kit to extract any excessive transmission fluid.
   Use Special Service Tool: 307-D465 Transporter Fluid Evacuator/Injector. , 416-D001 Hand Vacuum Pump/Pressure Pump.

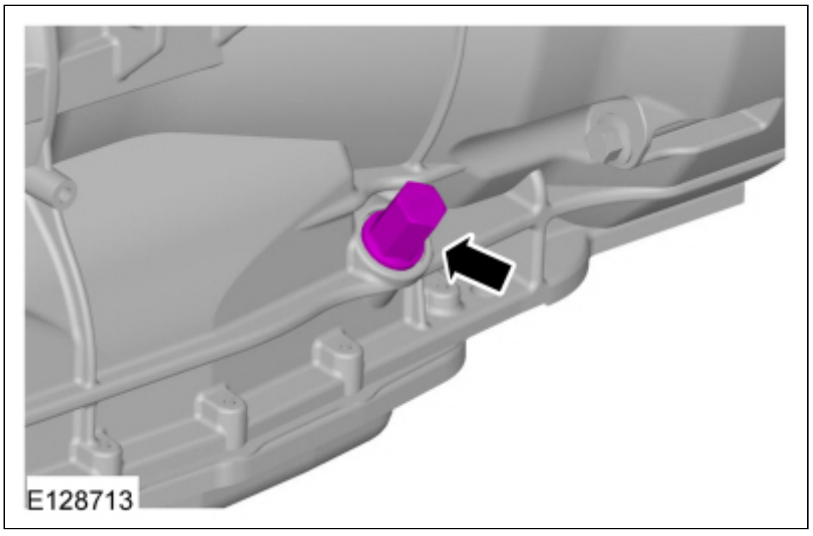


2. **NOTE:** *The transmission has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted area to check the transmission fluid level.*

   Using the Ford diagnostic equipment, verify that the TFT is between 97ºC-102ºC. Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (B) marked area on the transmission fluid level indicator with the A and B markings toward drivers left when inserted into the oil fill hole.
   Use the General Equipment: Ford Diagnostic Equipment



3. Install the transmission fluid fill plug.
   Torque: 35 Nm



Copyright © 2016 Ford Motor Company

Transmission Fluid Level Check - Emission Requirements: EURO Stage V LDT

Special Tool(s) / General Equipment

	307-731 Holder, Dip Stick 6R80 Transmission
Ford Diagnostic Equipment	

Check

NOTICE: The transmission fluid fill port is located near the exhaust pipe. The exhaust will be extremely hot during this procedure. Make sure you wear the appropriate Personal Protection Equipment (PPE) for hand and arm protection.

NOTICE: Do not drive the vehicle if the fluid levels are low.

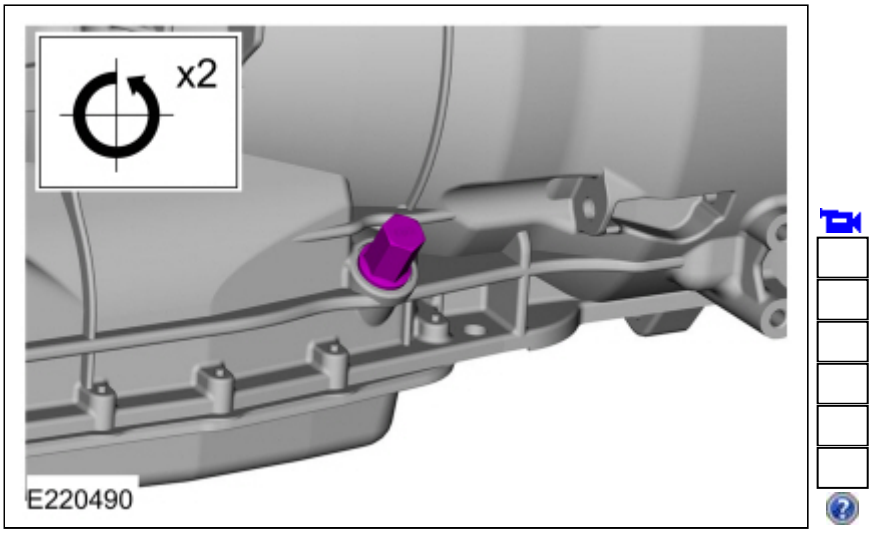
NOTE: *Check the transmission fluid level if the transmission slips, shifts slowly or shows any sign of leaking.*

NOTE: *Make sure that the transmission fluid is cool before attempting to obtain an accurate reading.*

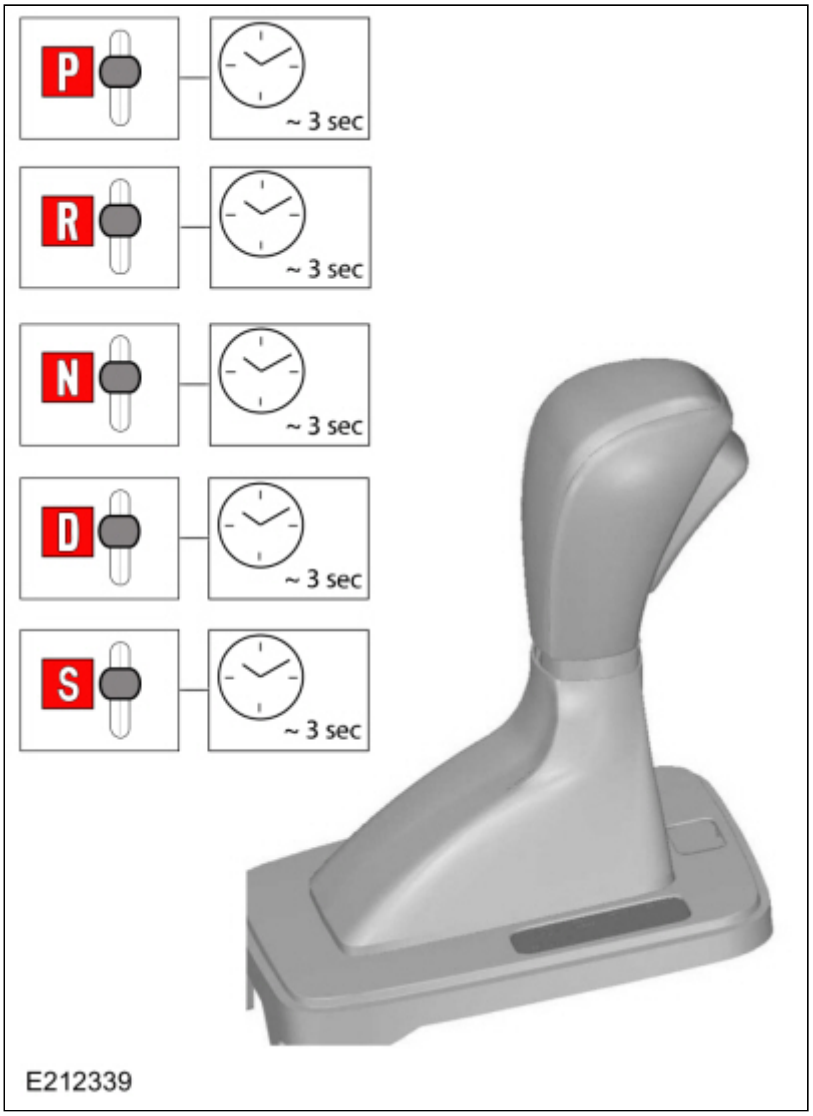
NOTE: *Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted mark.*

NOTE: *If a new transmission fluid cooler or transmission fluid cooler tubes have been installed, purge the air from the fluid cooling system by driving the vehicle.*

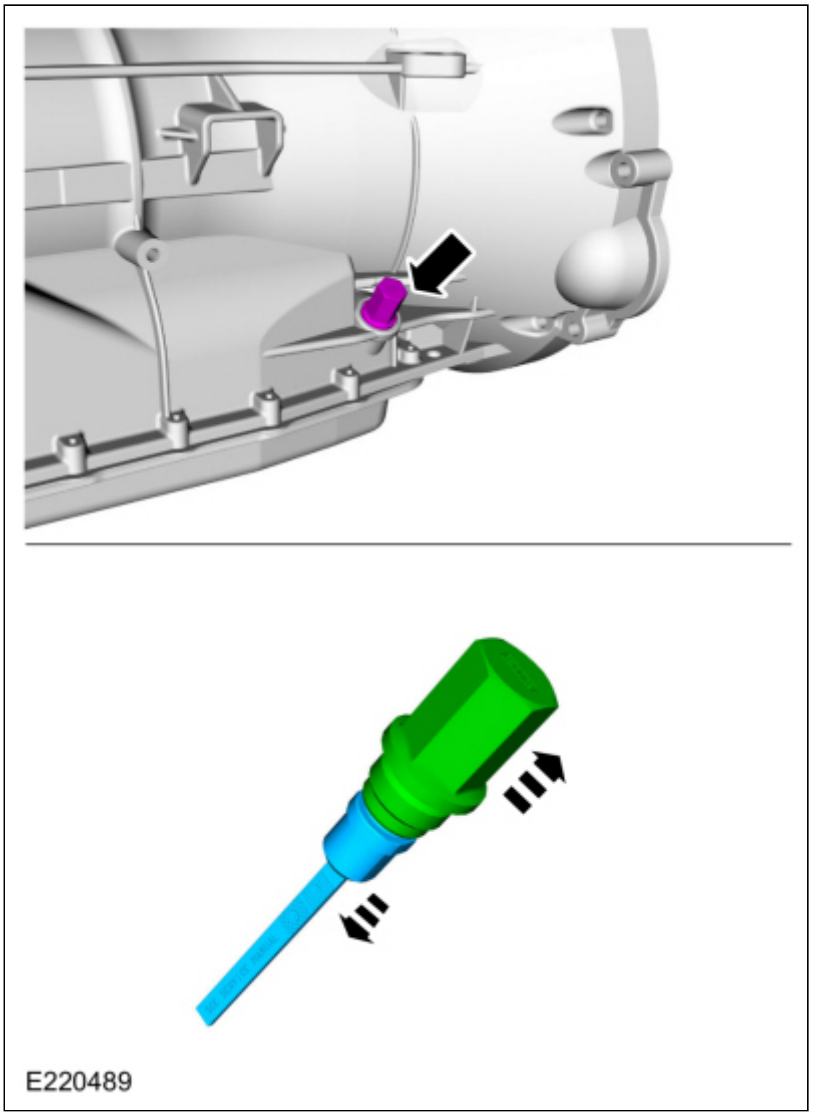
1. Connect the diagnostic scan tool and position the vehicle on a hoist.
2. Loosen the transmission fluid fill plug prior to starting the vehicle to ensure easier removal.



3. With the engine running, place the transmission selector lever in each gear position holding approximately 3 seconds in each position.



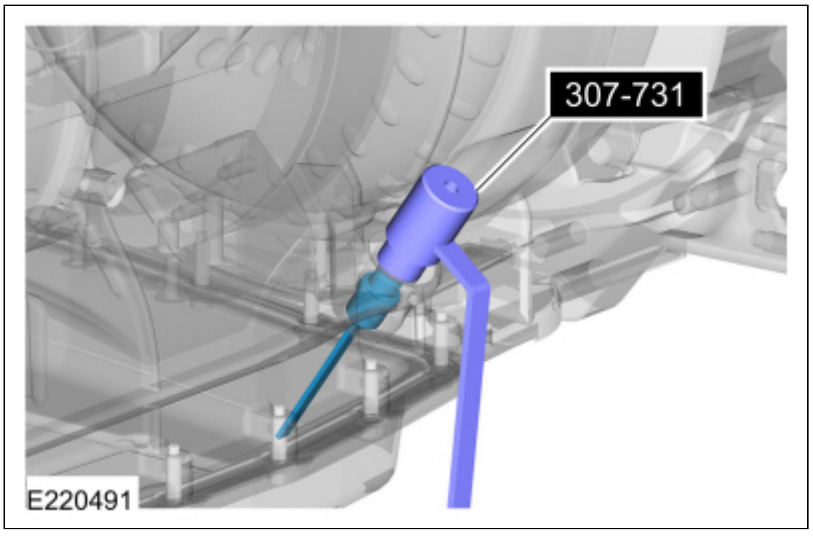
4. Place the transmission selector lever in park
5. Ensure the transmission fluid temperature is between 96.7°C and 102°C.
   Use the General Equipment: Ford Diagnostic Equipment
6. Remove the transmission fluid fill plug and remove the transmission fluid level indicator from the plug.



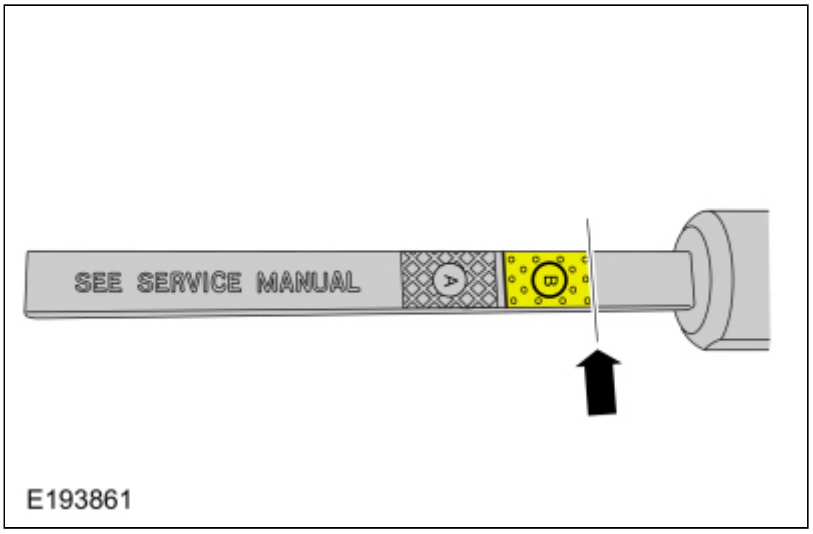
7. **NOTICE: Only use the specified special tool.**

   NOTE: *The marking side of the dipstick should be facing upwards against the angle of installation, and the flat sides of the disptick aligned with the flat markings on tool 307-731.*

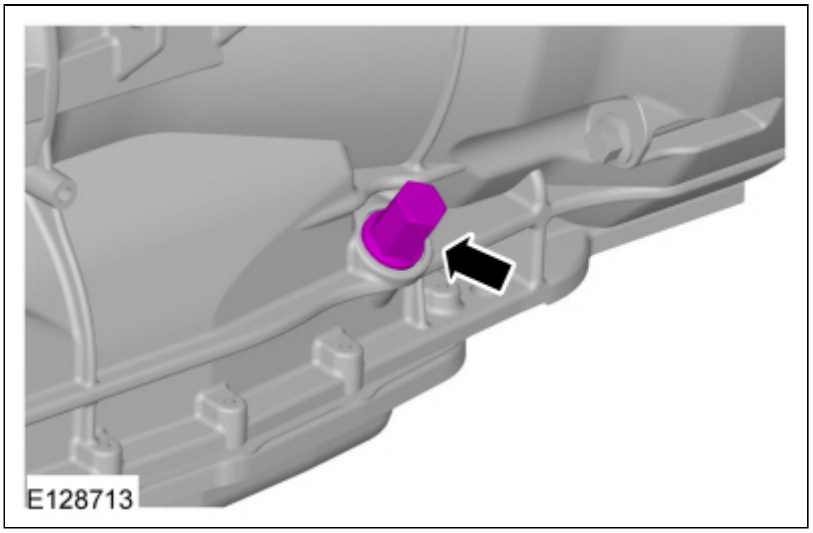
   Check the transmission fluid level by inserting the fluid level indicator into the transmission using the special tool (fluid level indicator holder).
   Use Special Service Tool: 307-731 Holder, Dip Stick 6R80 Transmission.



8. **NOTE:** *Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted mark.*



9. If the transmission fluid is not at the correct level, follow the steps for adding or removing transmission fluid. Refer to: Transmission Fluid Drain and Refill - Emission Requirements: EURO Stage V LDT (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
10. *Torque*: 35 Nm



Copyright © 2016 Ford Motor Company

Transmission Fluid Level Check

Inspection

WARNING: Do not drive the vehicle if the fluid levels are low.

NOTICE: Take extra care when removing the transmission fluid fill plug situated near the exhaust pipe. Failure to follow this instruction may result in personal injury. .

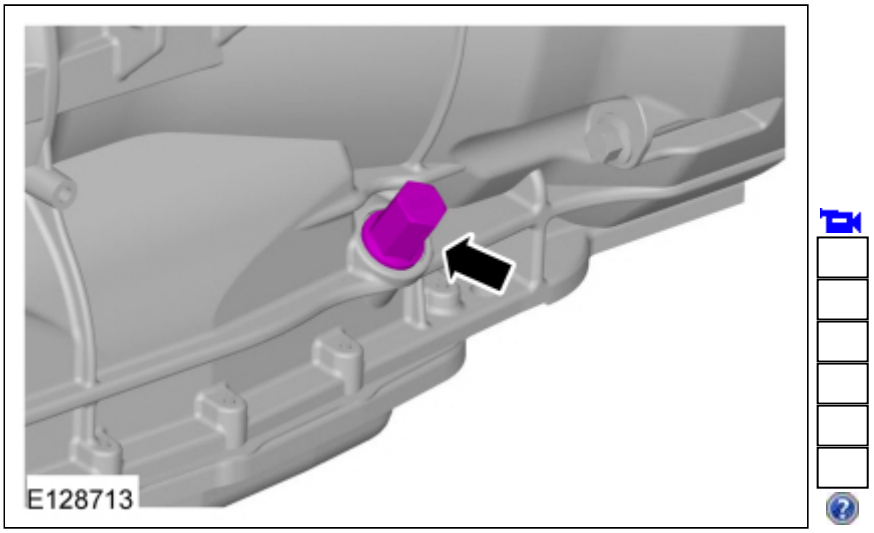
NOTE: *Make sure that the transmission fluid is cool before attempting to obtain an accurate reading.*

NOTE: *Check the transmission fluid level if the transmission slips, shifts slowly or shows any sign of leaking.*

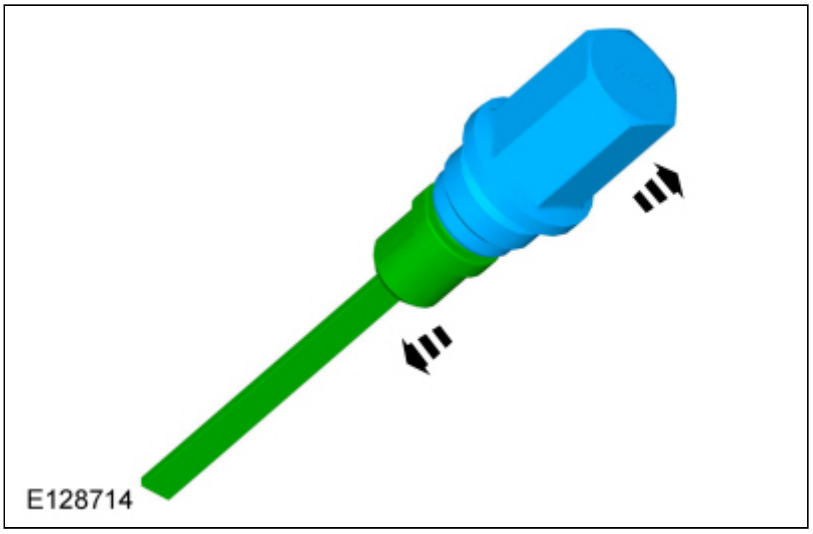
NOTE: *Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted mark.*

NOTE: *If a new transmission fluid cooler or transmission fluid cooler tubes have been installed, purge the air from the fluid cooling system by driving the vehicle..*

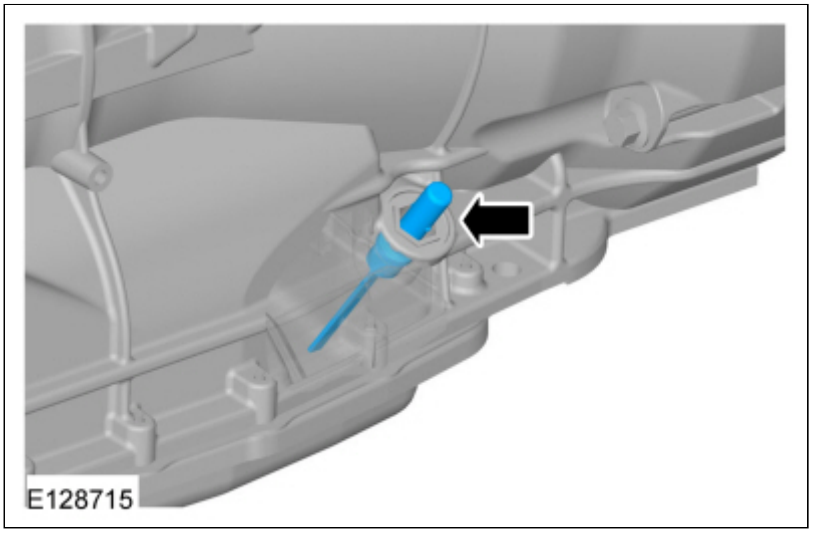
1. With the engine running, place the transmission selector lever in each gear position and hold approximately 5 seconds. Place the transmission selector lever in PARK.
2. With the engine idling in PARK, position it on a hoist.
   Refer to: Jacking and Lifting (100-02 Jacking and Lifting) .
3. Remove the transmission fluid fill plug transmission fluid level indicator assembly, located on the right side of the transmission case.



4. Separate the transmission fluid level indicator from the transmission fluid fill plug.

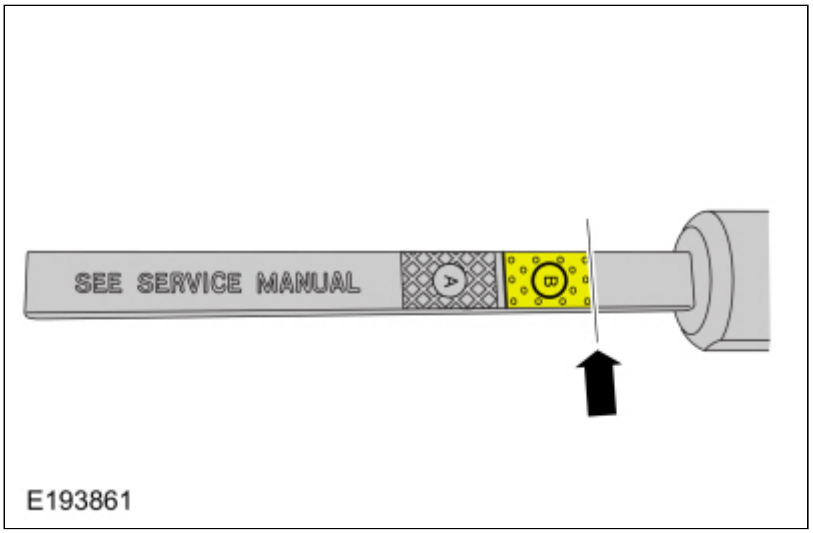


5. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator (with the A and B markings toward drivers left) only back into the transmission fluid fill plug hole to check the transmission fluid level.



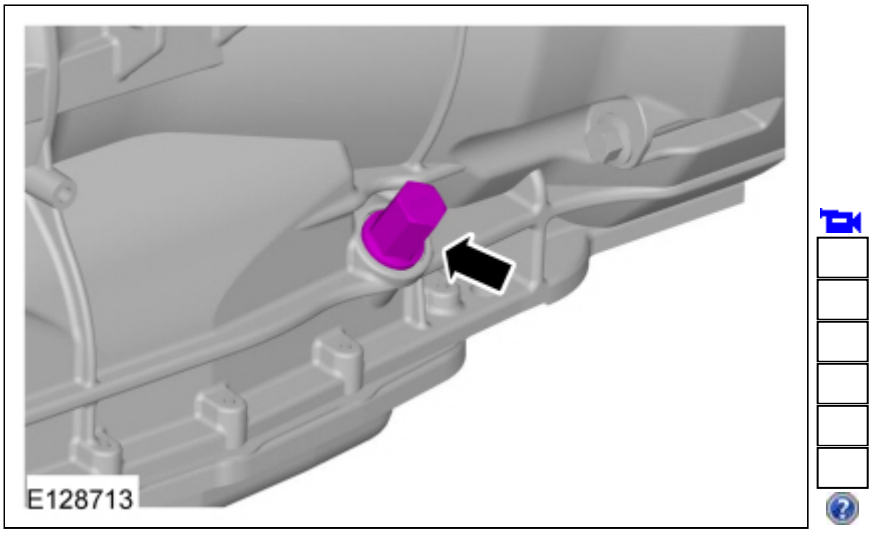
6. **NOTE:** *Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted mark..*

   Using the ford diagnostic equipment, verify that the Transmission Fluid Temperature (TFT) is between 97ºC-102ºC. Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (labeled B) mark.



7. If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid.

Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
Torque: 35 Nm

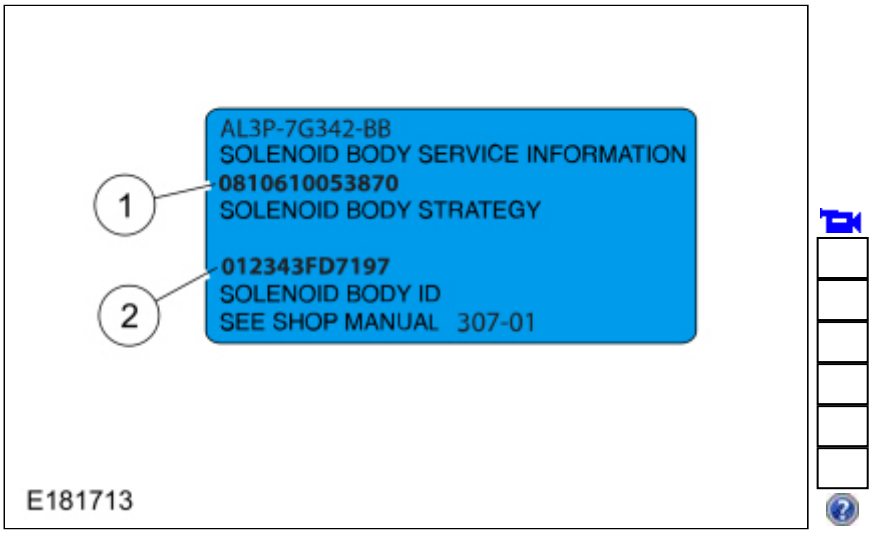


Copyright © 2016 Ford Motor Company

Transmission Strategy Download

Programming

1. If a new main control was installed, record the 12-digit solenoid body identification and 13-digit solenoid body strategy from the replacement solenoid body tag provided with the main control service kit. Place the replacement tag over the existing identification tag.
   - 13 - digit solenoid body strategy
   - 12 - digit solenoid body identification



2. Using the scan tool, select module Programming and Programmable Parameters under the toolbox icon and select transmission. Follow the instructions displayed on the scan tool. There are fields to enter the solenoid body 12-digit identification and 13-digit strategy recorded from the solenoid body.
3. **NOTICE: If the solenoid body information is not correct, transmission damage or driveability concerns can occur.**

   Enter the solenoid body 13-digit strategy. The scan tool verifies the numbers entered are valid and display a message if the information is not valid. The scan tool will check to verify the file is present on the scan tool. If the file is present, the technician may proceed with downloading the file to the module. If the file is not present, the scan tool will need to be connected to the Professional Technician Society (PTS) server to download the file onto the scan tool.
4. Verify the file is present on the scan tool. If the file is present, go to Step 8. If the file is not present, continue with this procedure.
5. Connect the scan tool to the Professional Technician Society (PTS) server.
6. Follow the instructions on the network to download the strategy file to the scan tool.
7. If the scan tool cannot connect to the Professional Technician Society (PTS) server, download the file from Professional Technician Society (PTS) using the OASIS tab and select the transmission strategy. If the scan tool cannot download a strategy from the web site, a partial strategy will automatically be downloaded.
8. Reconnect the scan tool to the vehicle.
9. Follow the instructions displayed on the scan tool.
10. The scan tool automatically downloads the strategy file or partial strategy file to the module. The scan tool displays a message when it is finished downloading the data that states that the file was downloaded successfully.
11. **NOTICE: If a drive cycle is not completed, erratic shifts and driveability concerns may occur.**

    Road test the vehicle following the Adaptive Learning Drive Cycle.
    Refer to: Adaptive Learning Drive Cycle (307-01 Automatic Transmission) .

Copyright © 2016 Ford Motor Company

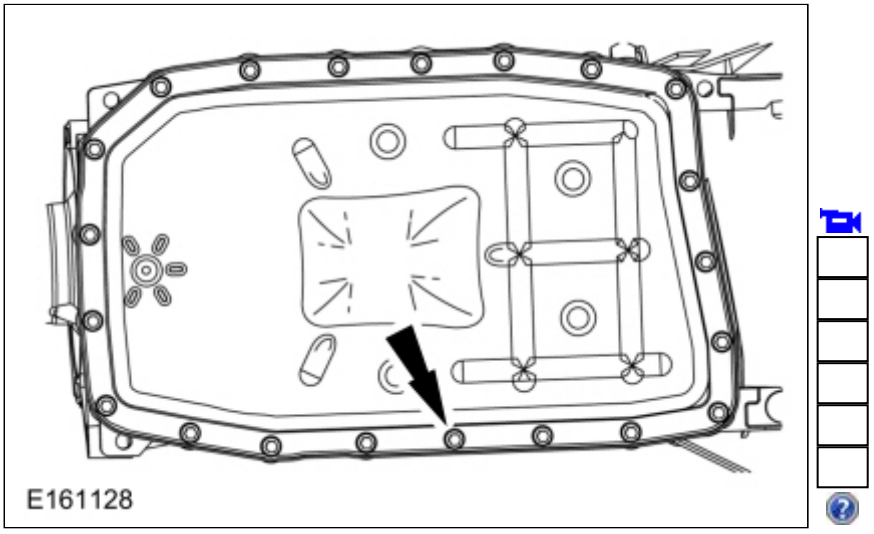
Transmission Fluid Pan

Removal

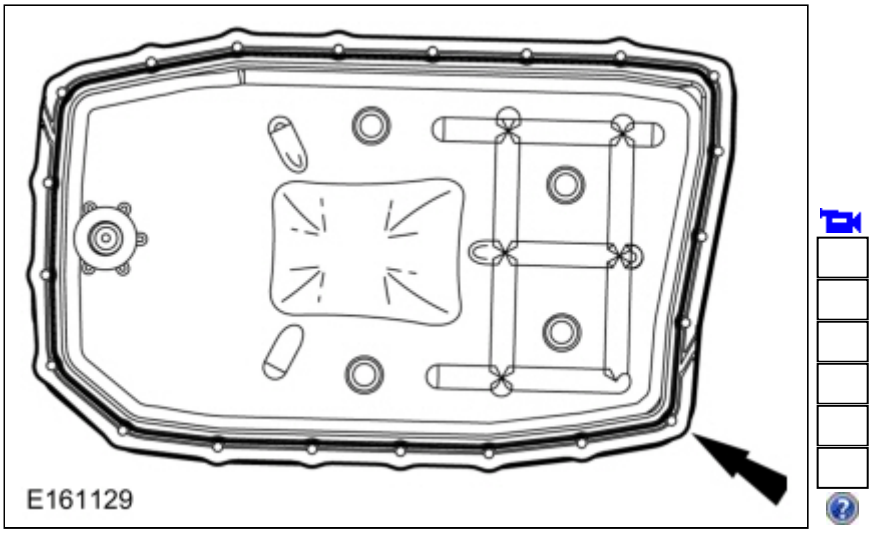
NOTE: *The use of any transmission fluid other than specified can result in the transmission failing to operate in a normal manner or transmission failure.*

1. With the vehicle in NEUTRAL, position it on a hoist.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

2. Remove the transmission fluid pan and allow the transmission fluid to drain.

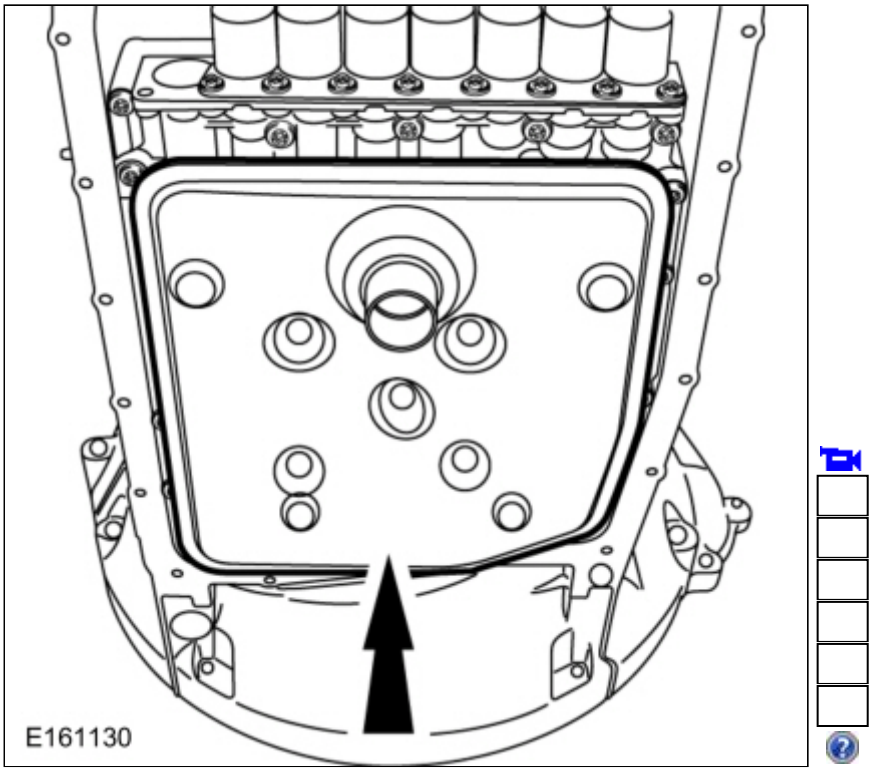


3. Remove the transmission fluid pan gasket.

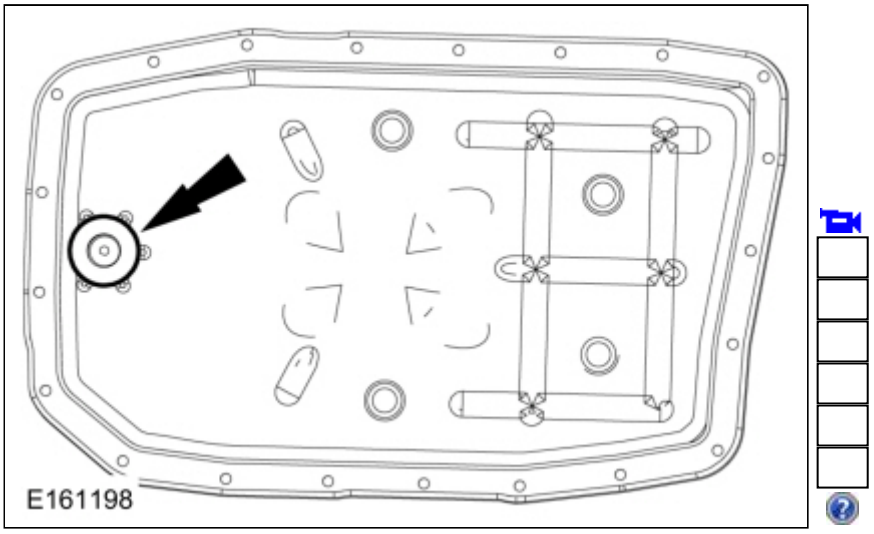


4. **NOTE:** *The transmission fluid filter may be reused if no excessive contamination is indicated.*

   Remove and discard the transmission fluid filter.



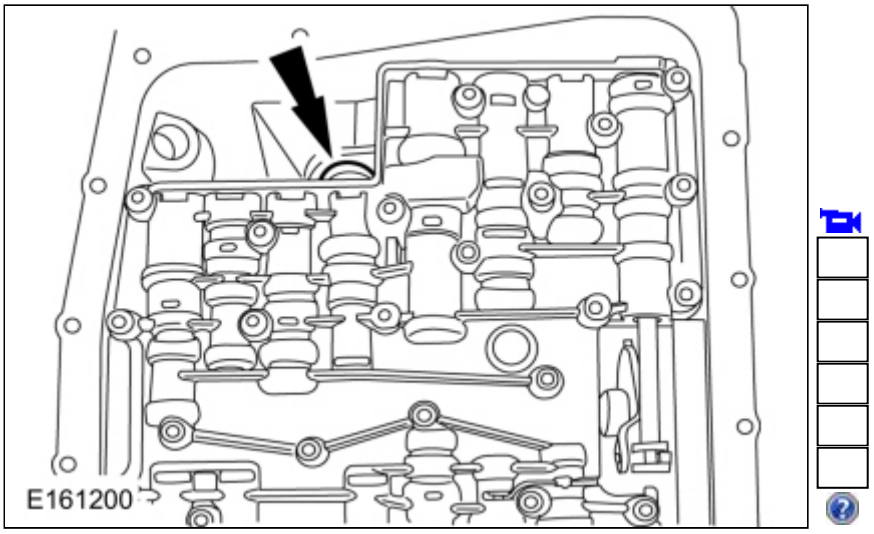
5. Clean and inspect the transmission fluid pan and magnet.



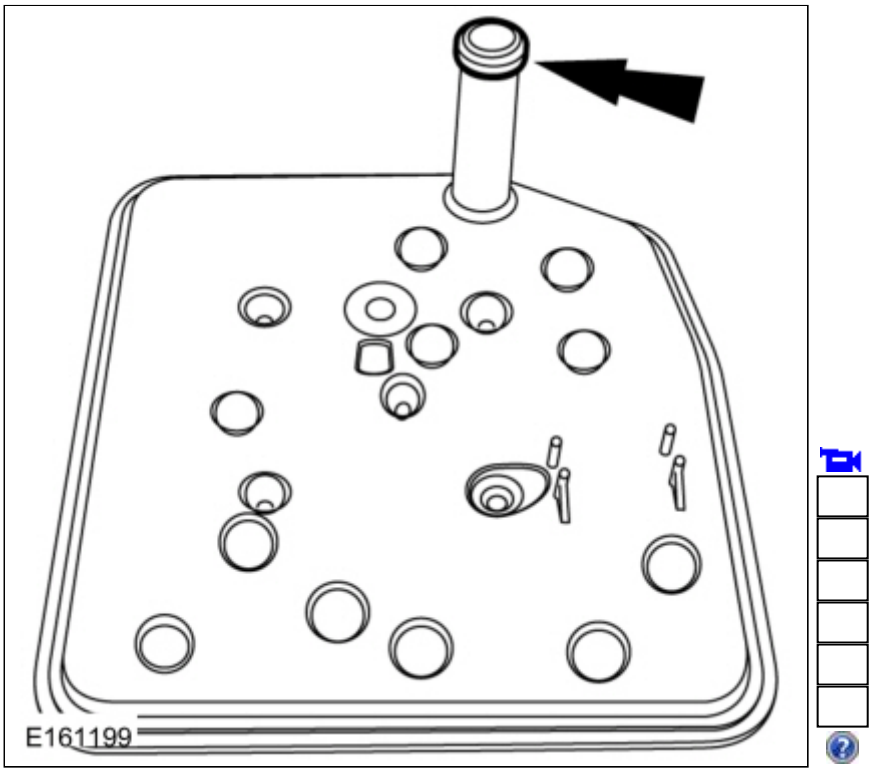
Installation

NOTE: *If the transmission is being repaired for a contamination-related failure, install a new transmission fluid filter and seal assembly. The transmission fluid filter may be reused if no excessive contamination is indicated.*

1. Inspect the transmission case for the transmission fluid filter seal. If the seal is in the case, carefully remove the seal without scratching the case.

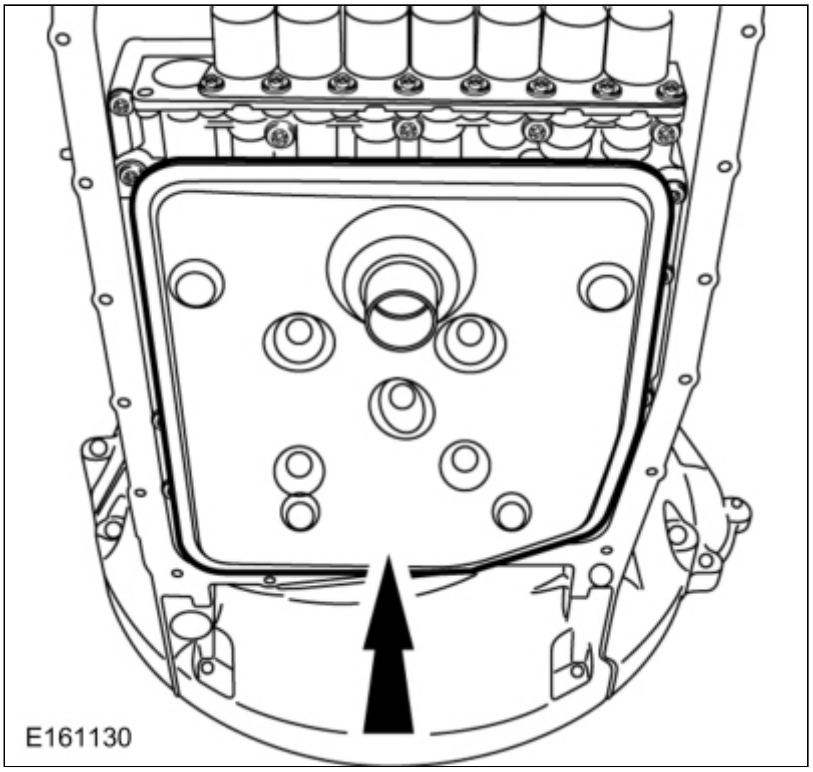


2. Make sure that the seal is on the transmission fluid filter and lubricate the seal with automatic transmission fluid.

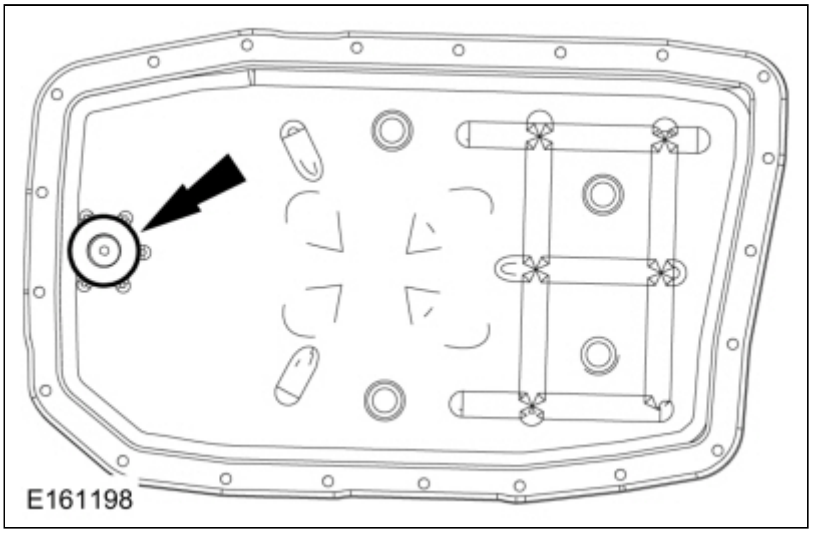


3. **NOTE:** *The transmission fluid filter may be reused if no excessive contamination is indicated.*

   If required, install a new transmission fluid filter.

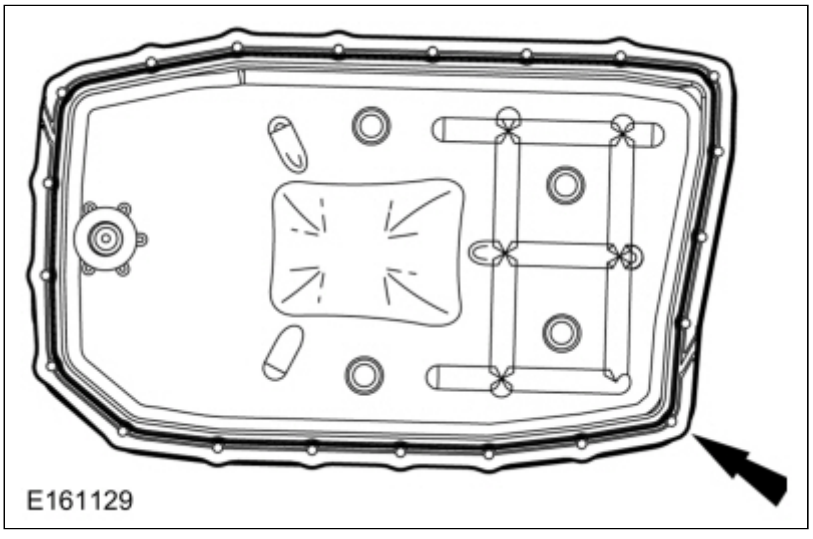


4. Position the magnet in the transmission fluid pan.

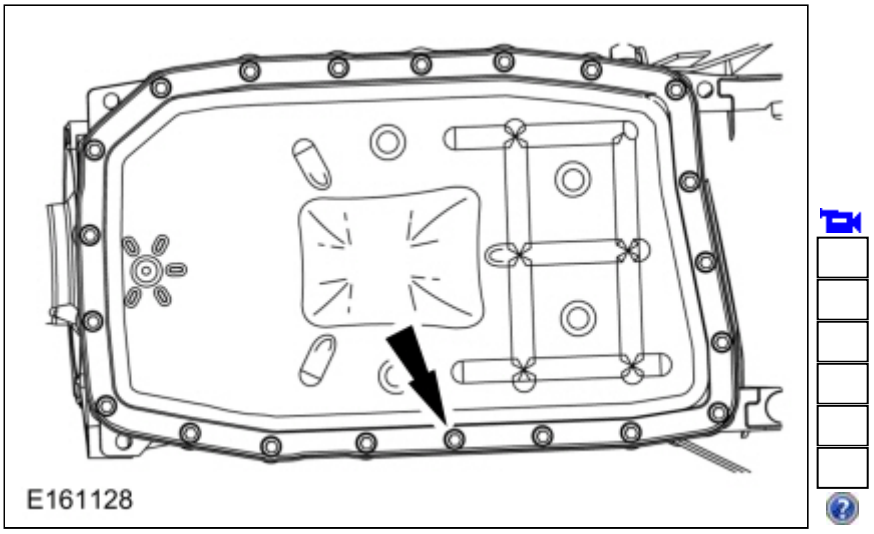


5. **NOTE:** *The transmission fluid pan gasket can be reused if not damaged.*

   Install a new transmission fluid pan gasket if required.



6. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   Torque: 12 Nm



7. Using the Adding Additional Transmission Fluid procedure, fill and check the transmission fluid.
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .

Copyright © 2016 Ford Motor Company

Transmission Fluid Filter

Removal and Installation

1. Refer to: Transmission Fluid Pan (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Copyright © 2016 Ford Motor Company

Main Control Valve Body

Base Part Number: 7A100

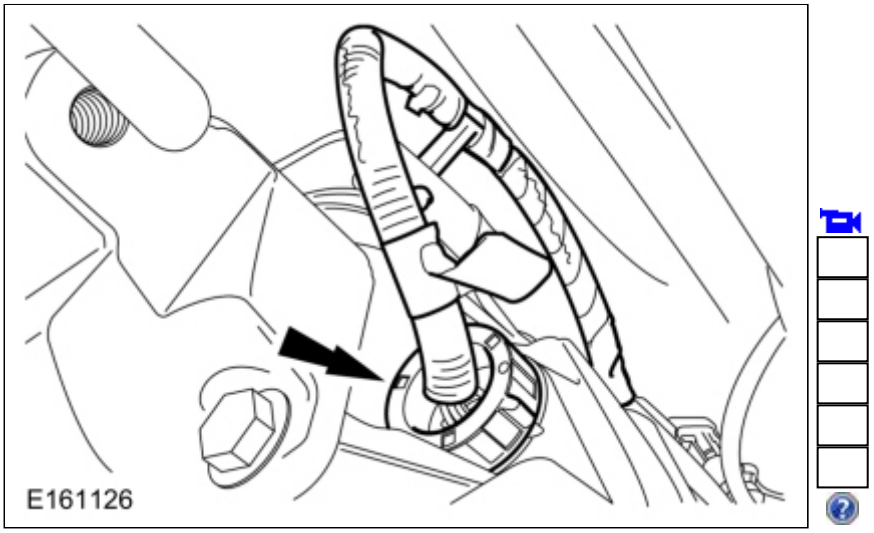
Removal

NOTE: *The Solenoid Body Strategy Data Download procedure must be performed if a new main control assembly is installed.*

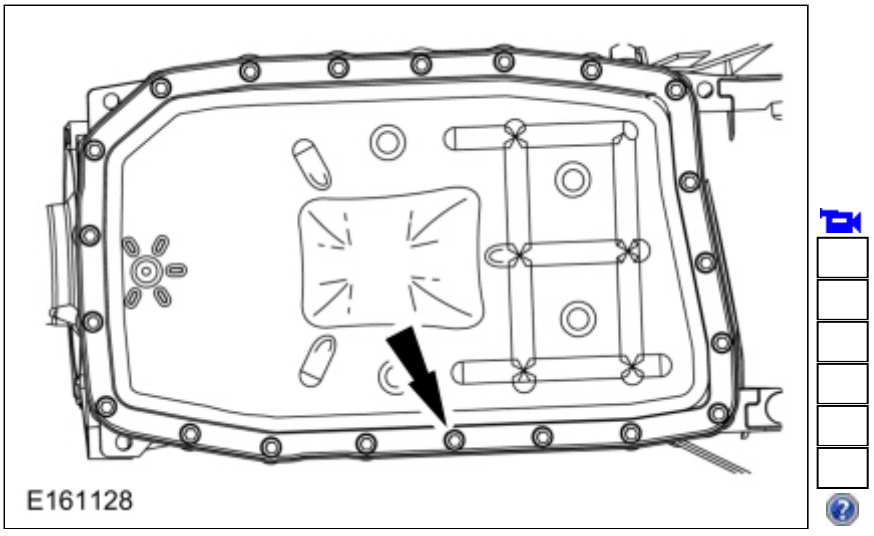
1. With the vehicle in NEUTRAL, position it on a hoist
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

2. **NOTE:** *Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.*

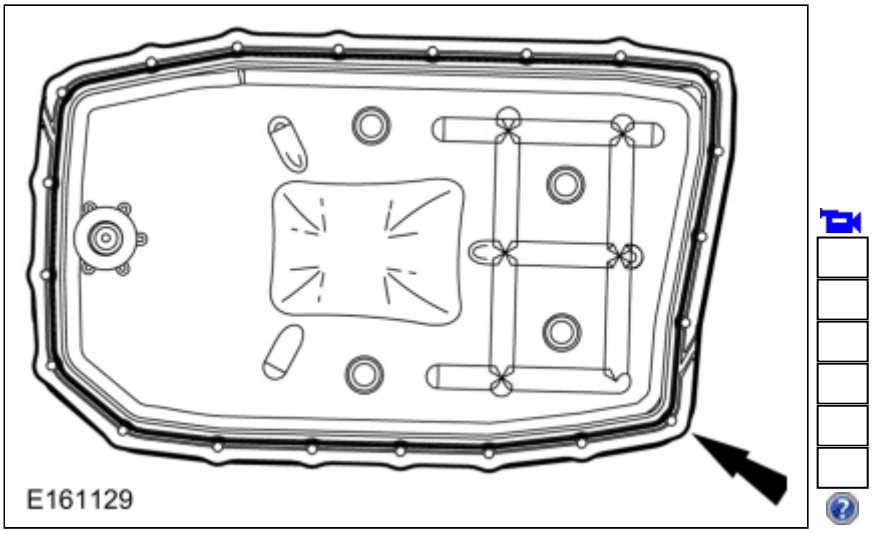
   Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.



3. Remove the transmission fluid pan and allow the transmission fluid to drain.

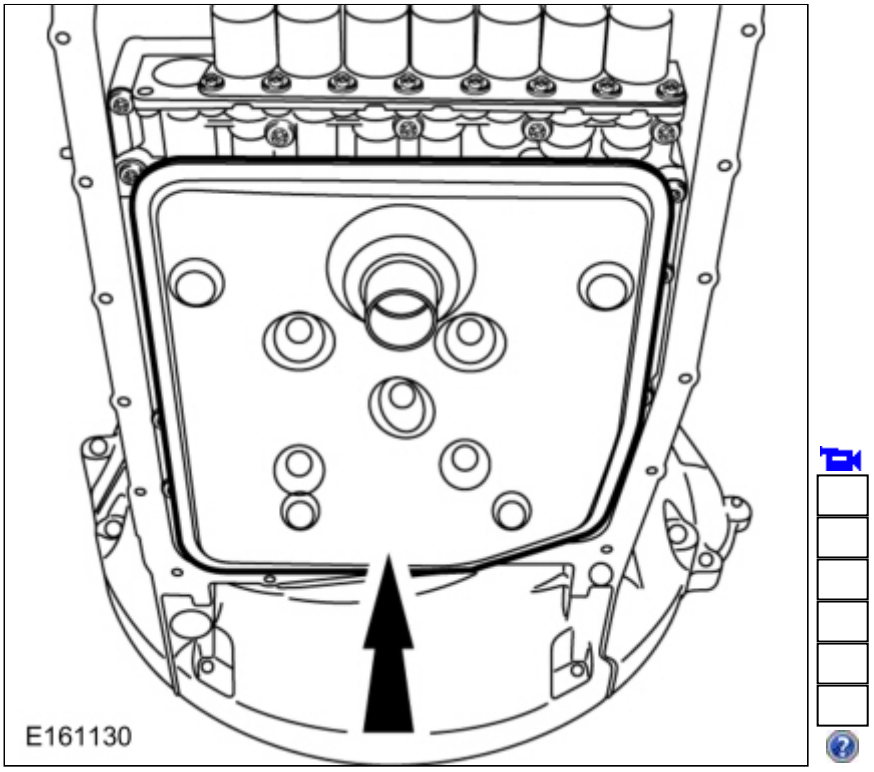


4. Remove the transmission fluid pan gasket.

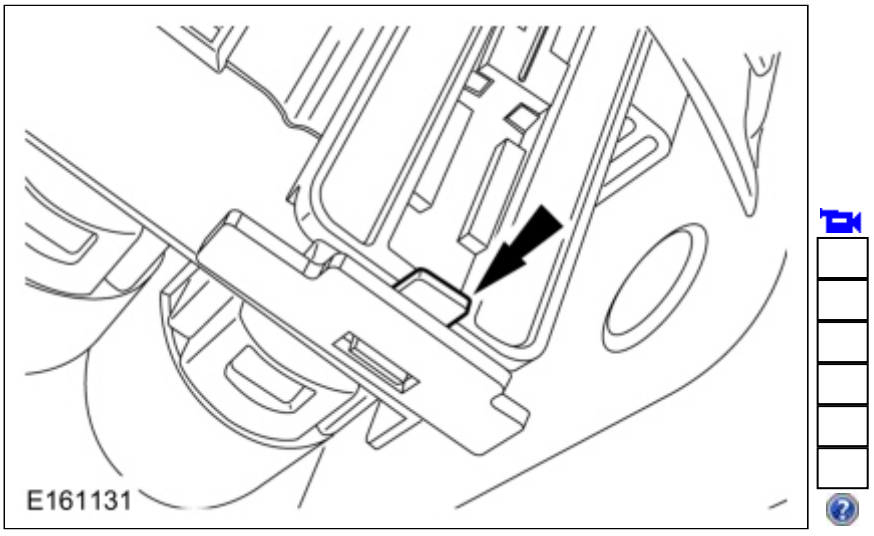


5. **NOTE:** *The transmission fluid filter may be reused if no excessive contamination is indicated.*

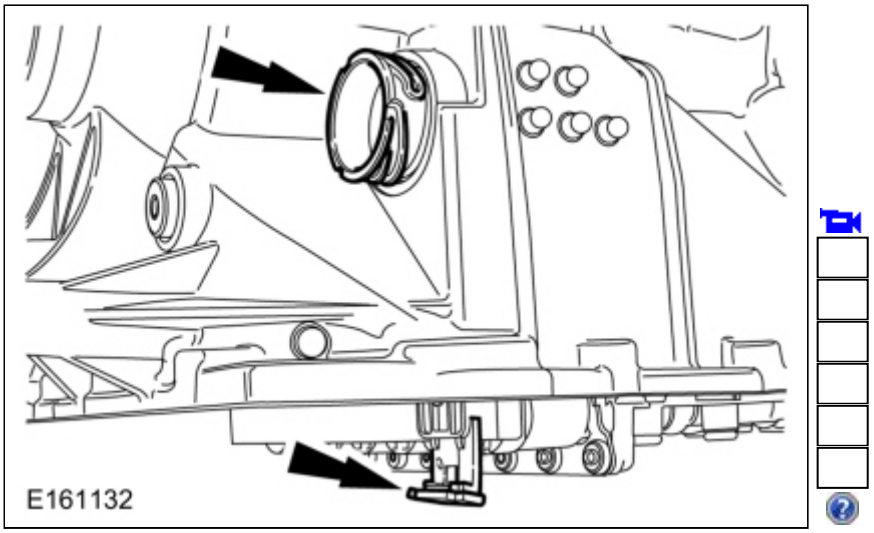
   Remove and discard the transmission fluid filter.



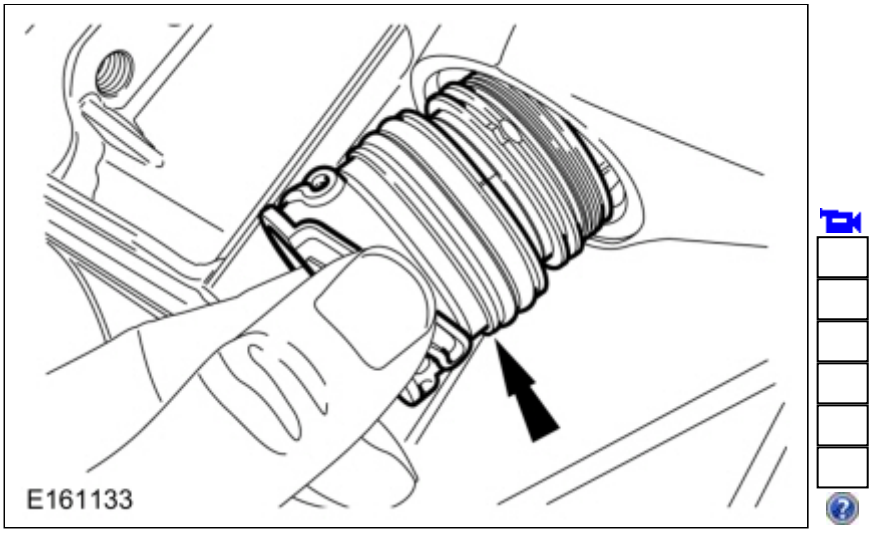
6. Pull the release tab and pull down on the main control electrical connector retainer.



7. With the release tab down, pull the outer shell of the main control electrical connector out of the main control assembly.

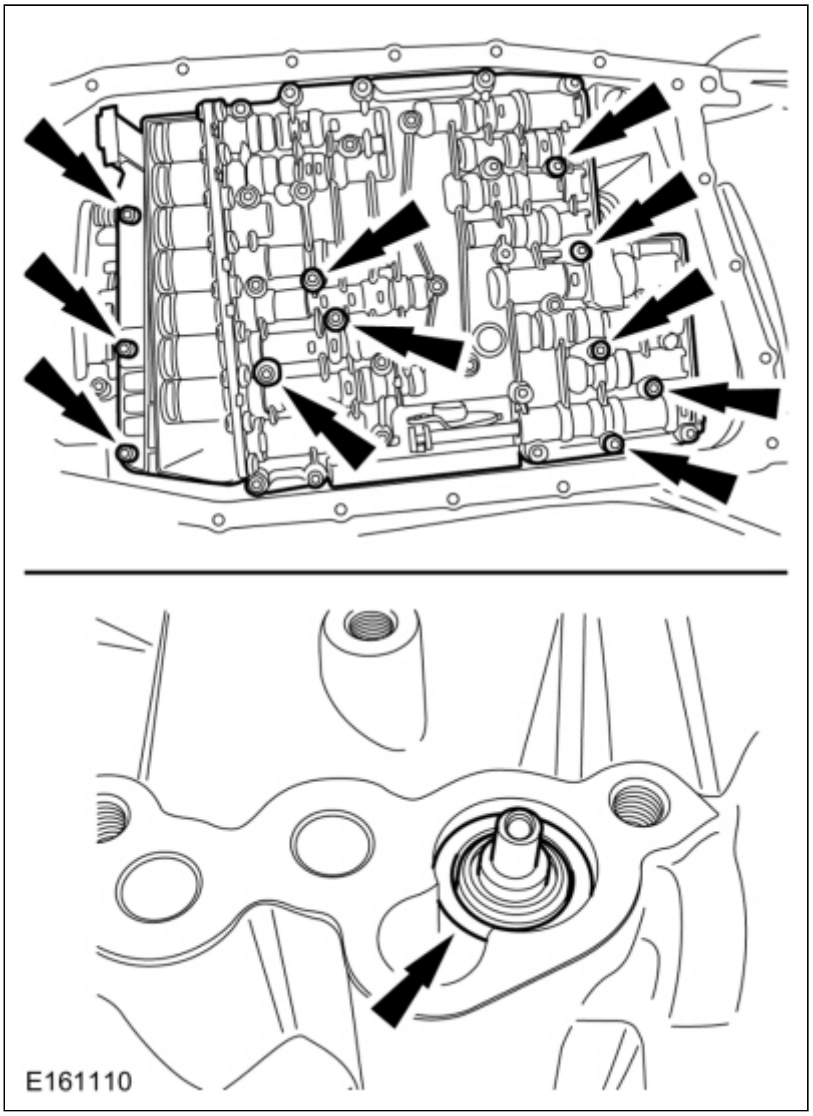


8. Pull the main control electrical connector out of the transmission case



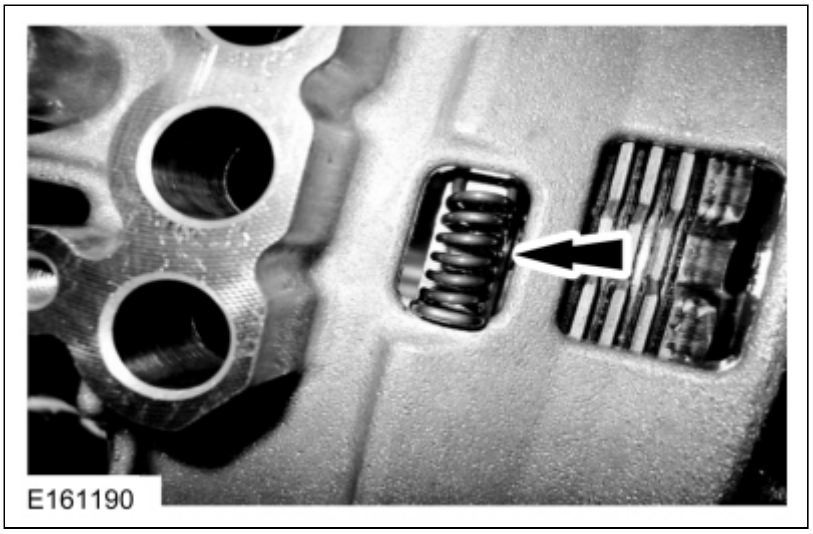
9. **NOTE:** *During removal of the main control assembly, the thermal bypass valve may fall out of the transmission case. Damage to the valve may occur if the valve falls out.*

   Remove the 11 bolts from the main control assembly and remove the main control assembly and the bypass valve.



Installation

1. Inspect the bias spring to make sure it is positioned correctly in the transmission case.

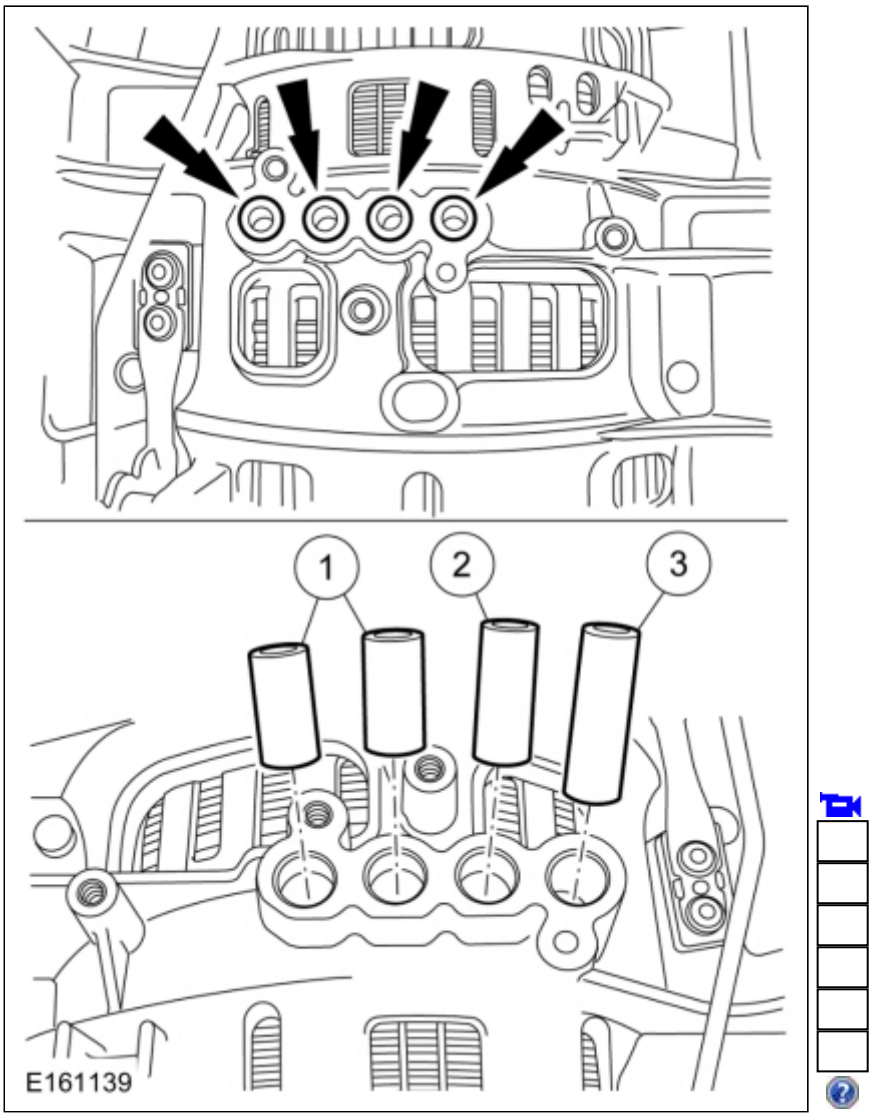


2. **NOTE:** *Before installing the main control assembly into the transmission case, verify the presence and orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the main control assembly during removal and should be installed into the transmission case at this time.*

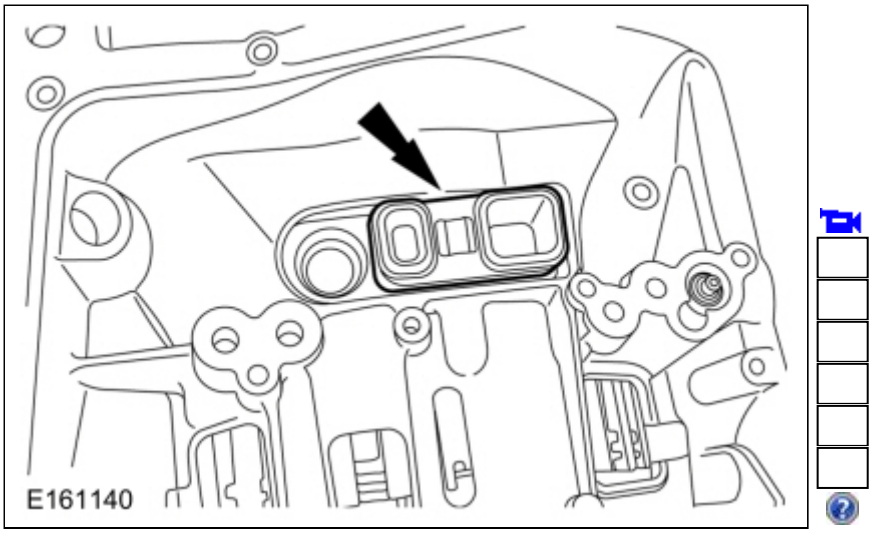
   NOTE: *Verify the 4 rubber feed tubes for the center support are in place.*

   1. Black feed tubes
   2. Green feed tubes

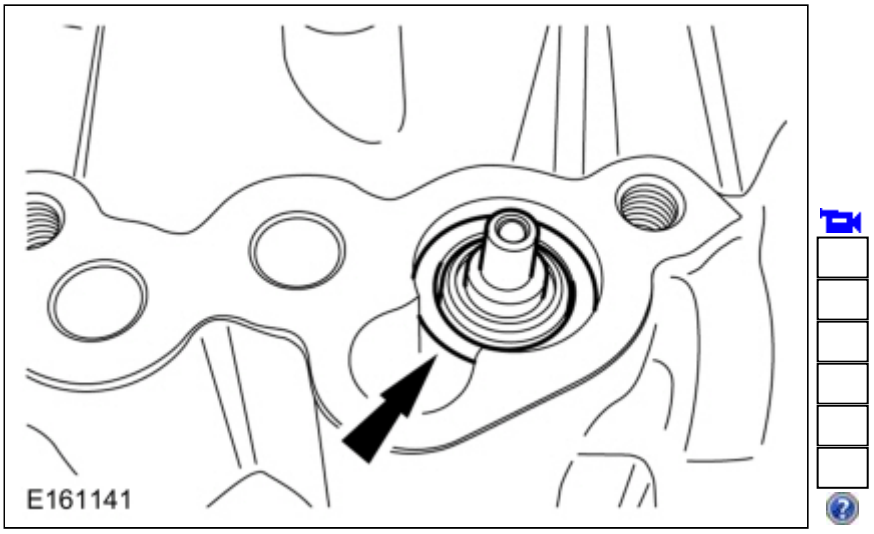
3. Blue feed tubes



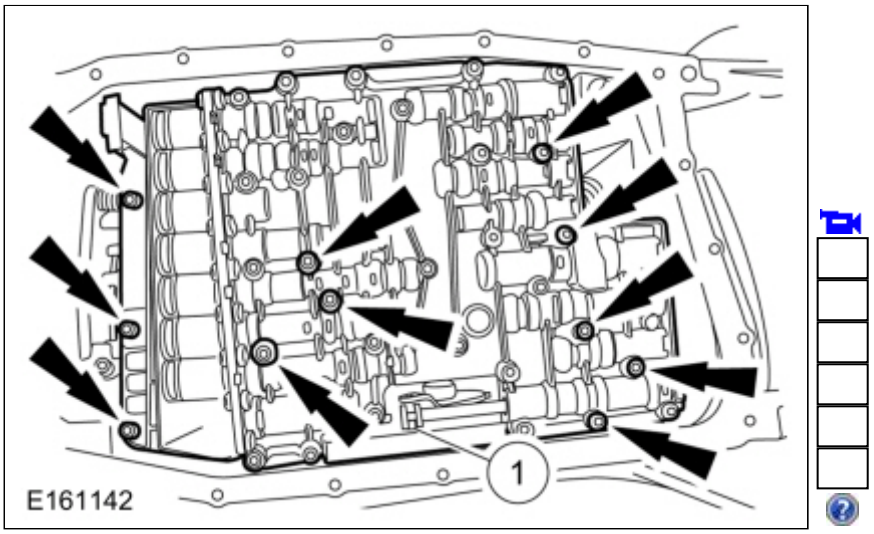
3. Verify the rubber adapter is in place.



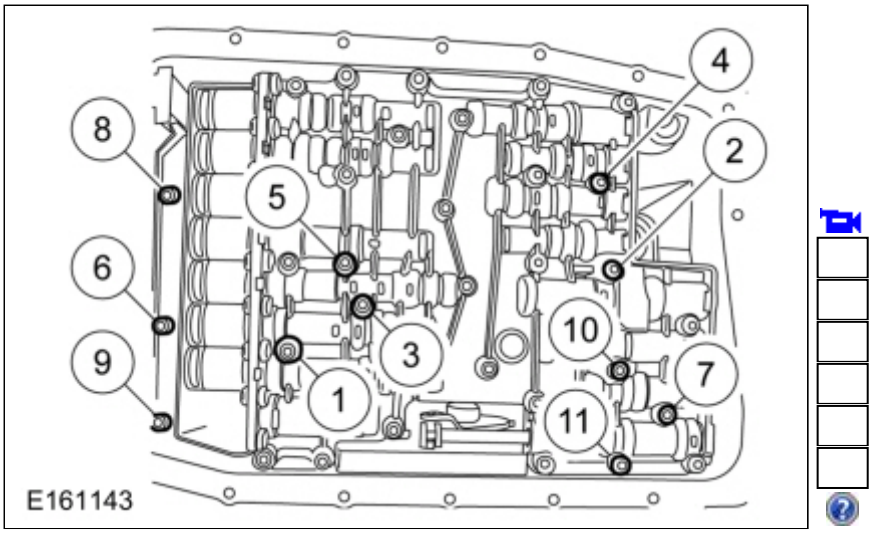
4. Coat the thermal bypass valve with petroleum jelly to hold it in place and install the thermal bypass valve into the transmission case.



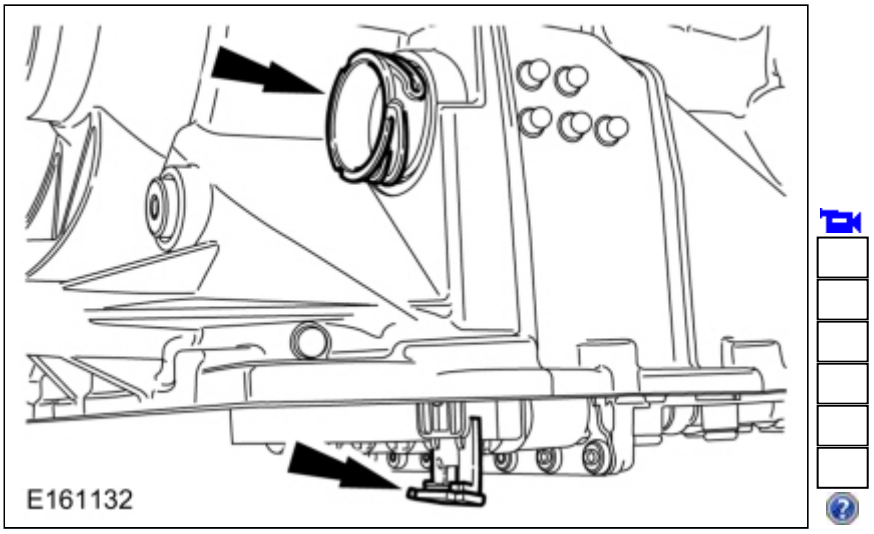
5. Position the main control assembly in place and loosely install the 11 bolts. Align the manual valve and control lever linkage.



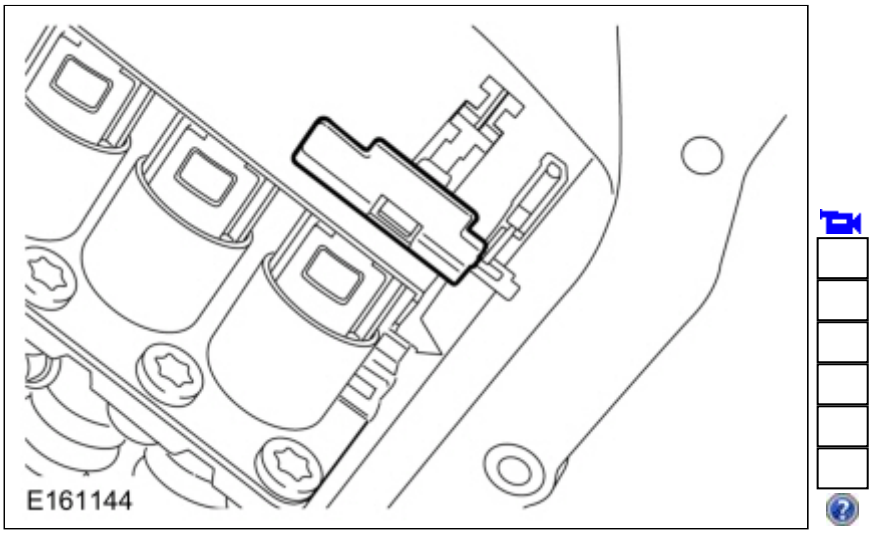
6. Tighten the main control bolts in the sequence shown.
   Torque: 8 Nm



7. With the release tab down and unlocked, push the outer shell of the main control electrical connector into the transmission. Make sure that the main control electrical connector is fully seated into the main control assembly.

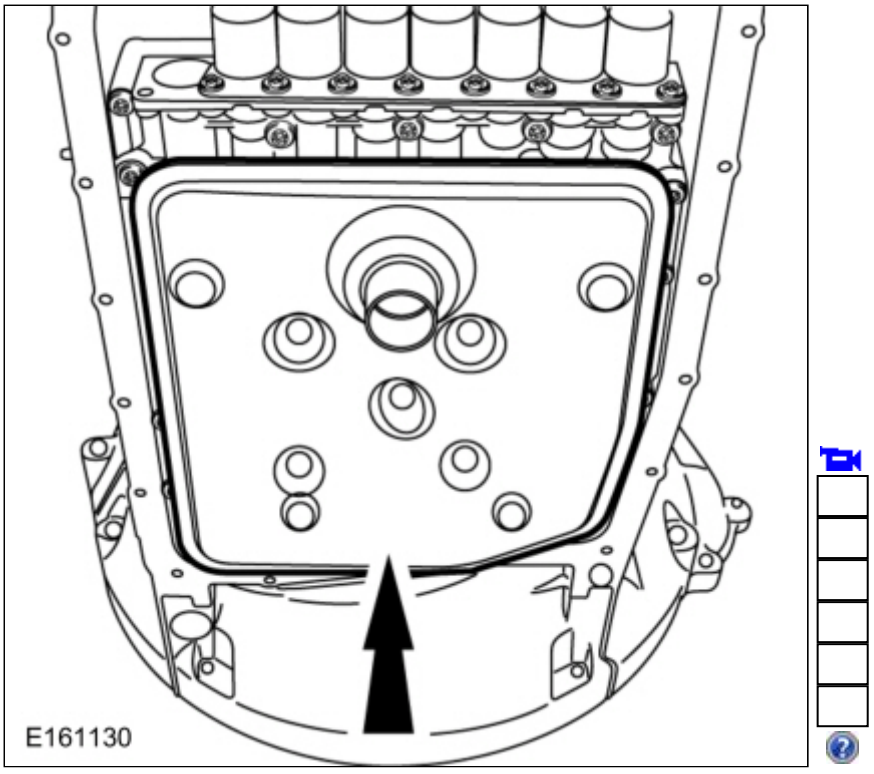


8. Press up on the tab and lock the outer shell of the main control electrical connector in place. Make sure that the locking tab is securely locked.



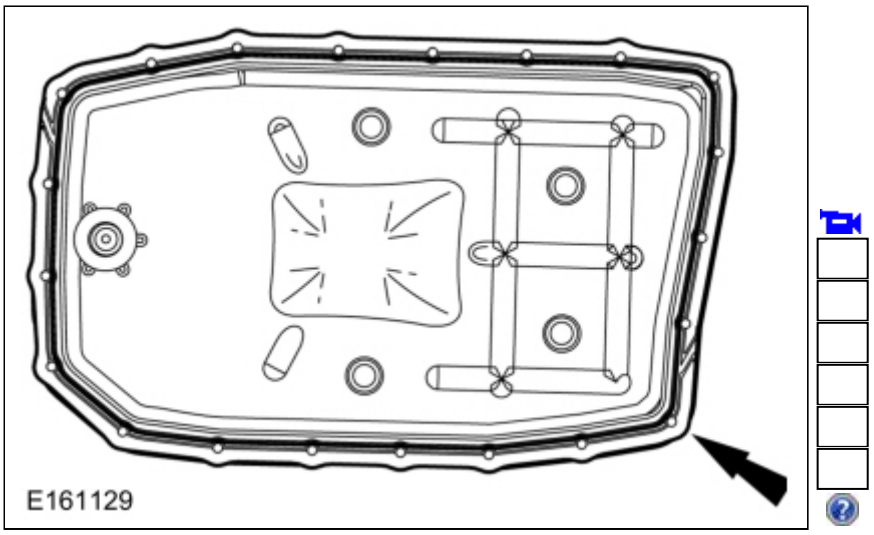
9. **NOTE:** *The transmission fluid filter may be reused if no excessive contamination is indicated.*

   If required, install a new transmission fluid filter.

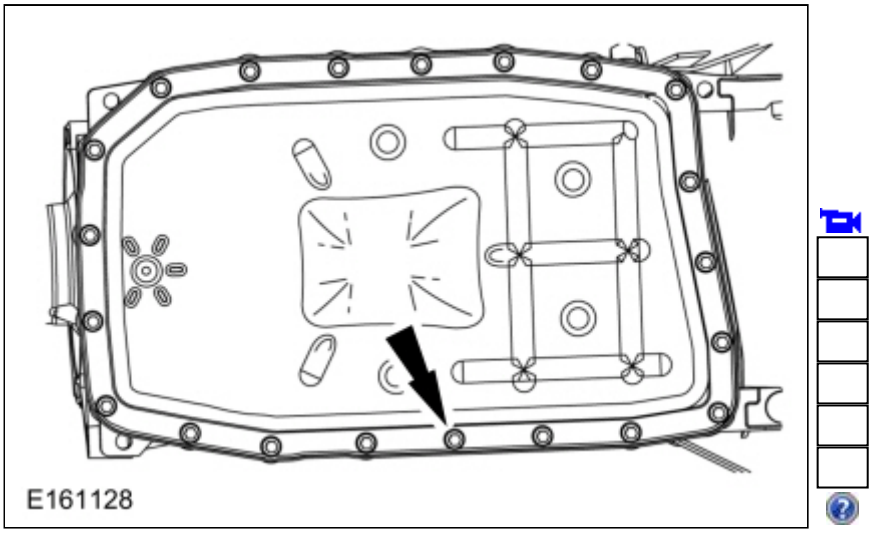


10. **NOTE:** *The transmission fluid pan gasket can be reused if not damaged.*

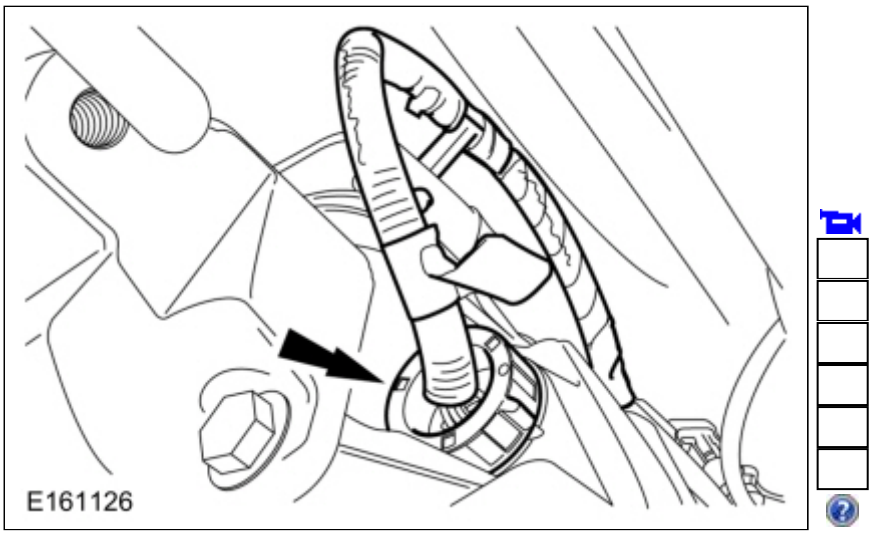
    Install a new transmission fluid pan gasket, if required.



11. Install the transmission fluid pan and tighten the transmission fluid pan bolts in a crisscross pattern.
    Torque: 12 Nm



12. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.



13. Make sure the transmission fluid is at the correct level.
    Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - Vehicles With: 6-Speed

Automatic Transmission - 6R80) .

14. **NOTE:** *If an individual solenoid was replaced clear the adaptive strategy.*

    Perform a Road Test — Adaptive Drive Cycle after the adaptive strategy is cleared.
    Refer to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

15. **NOTE:** *If the main control assembly was replaced, perform the Solenoid Body Strategy Data Download.*

    Perform a Road Test — Adaptive Drive Cycle after the Solenoid Body Strategy Data Download.
    Refer to: Shift Point Road Test (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Transmission Control Module (TCM)

Special Tool(s) / General Equipment

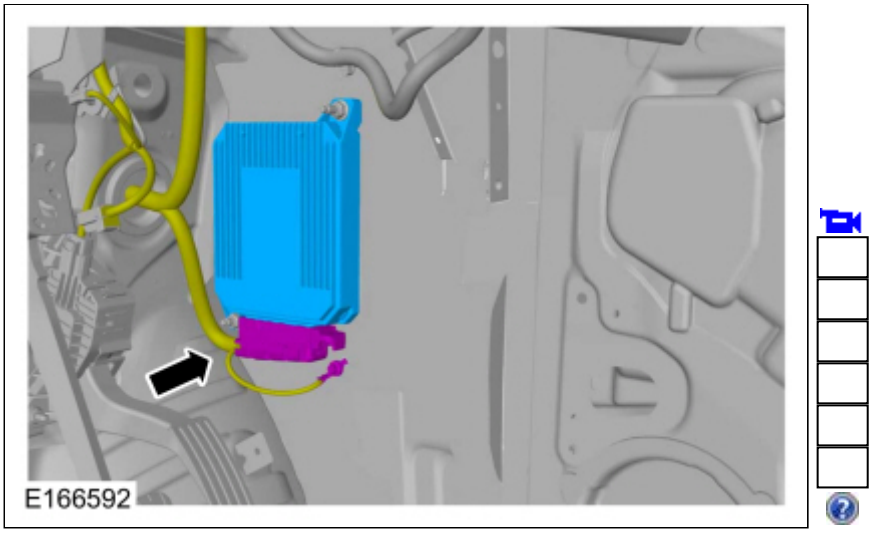
Ford Diagnostic Equipment

Removal

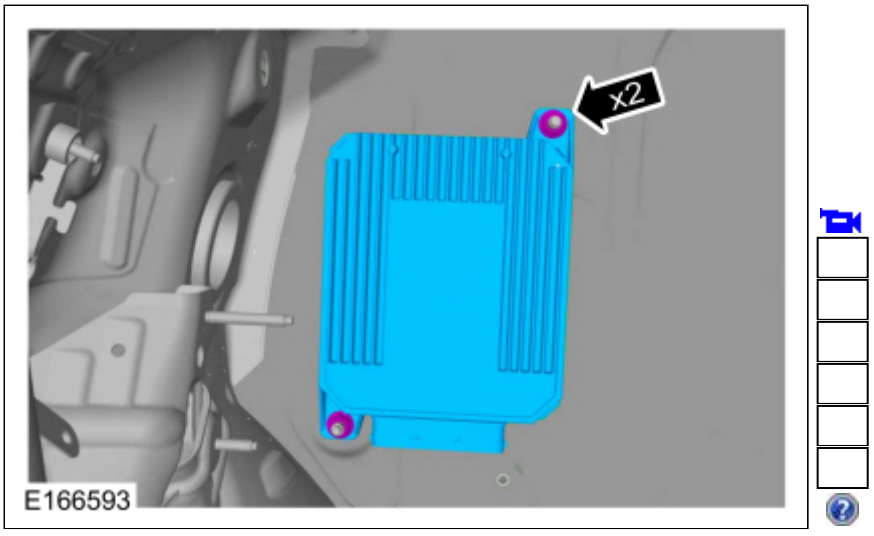
1. **NOTE:** *This step is only necessary when installing a new component.*

   Download the TCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

2. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. 

4. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.

2. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the TCM configuration information into the TCM, using the Programmable Modules Installation routine.

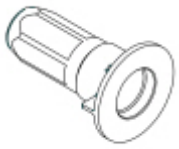
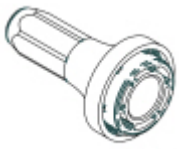
Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Output Shaft Seal

Base Part Number: 7B215

Special Tool(s) / General Equipment

 E129694	100-001 (T50T-100-A) Slide Hammer
 E142023	307-637 Installer, Rear Seal, 4x4
 E142024	307-638 Installer, Rear Seal, 4x2
 308-375	308-375 Remover, Input Shaft Seal

Removal

All vehicles

1. With the vehicle in NEUTRAL position it on a hoist.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

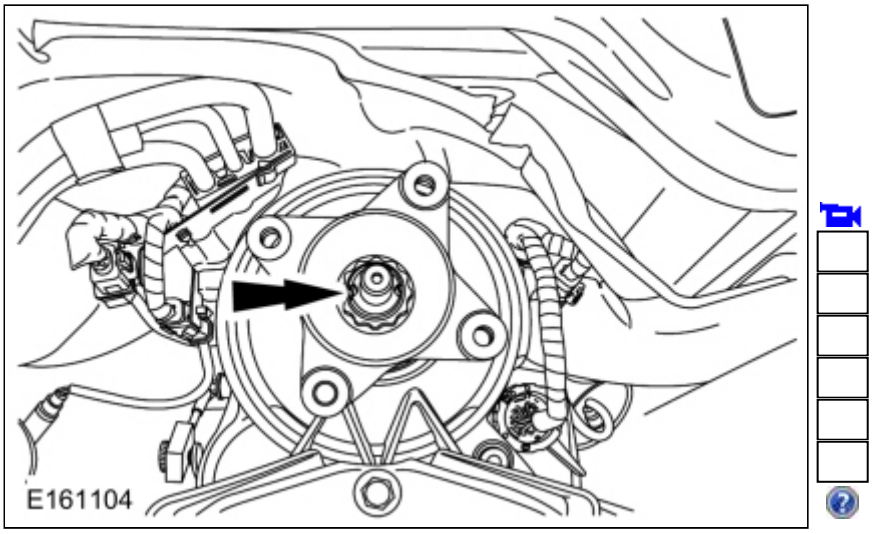
2. Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .

Vehicles with rear wheel drive (RWD)

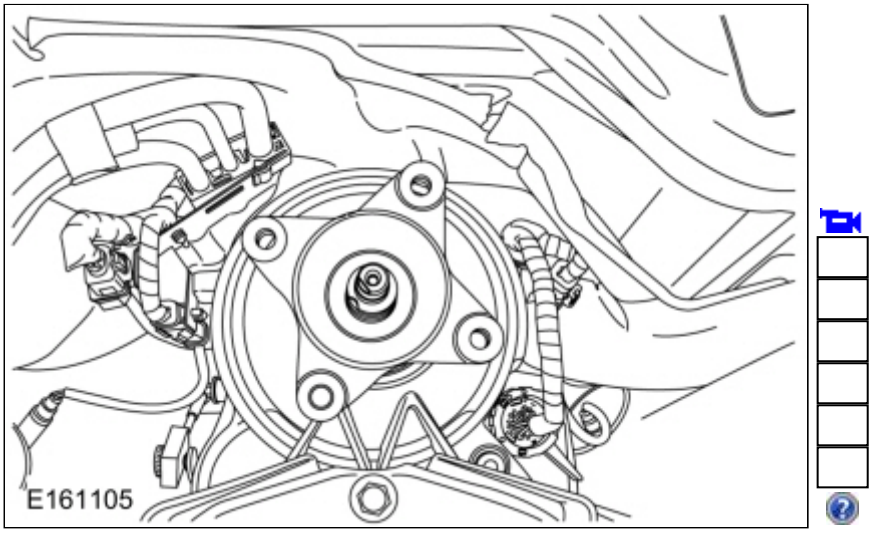
3. **NOTE:** *The Output shaft flange nut has been staked to prevent it from coming loose. Prior to removing the nut, remove the stake to prevent damage to the output shaft*

   Remove the rear drive shaft.
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

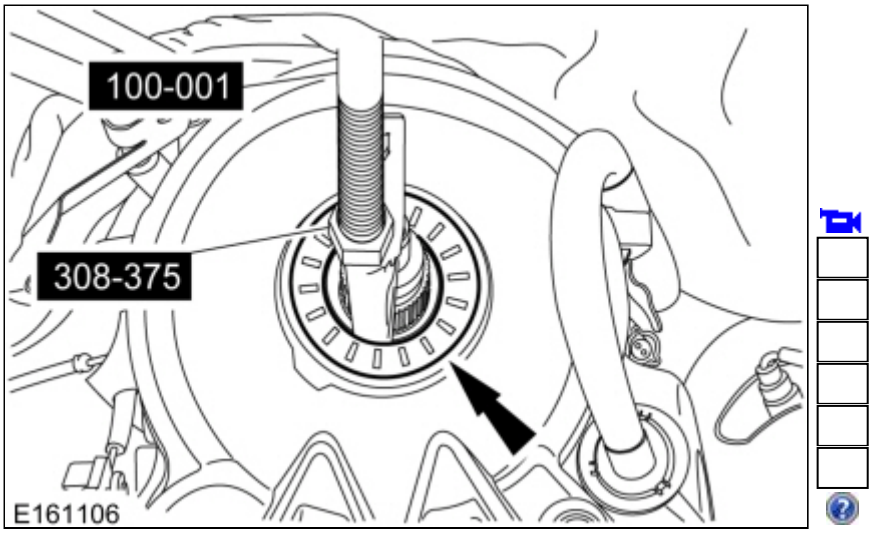
4. Remove and discard the output shaft flange nut.



5. Remove the extension housing flange seal and the output shaft flange



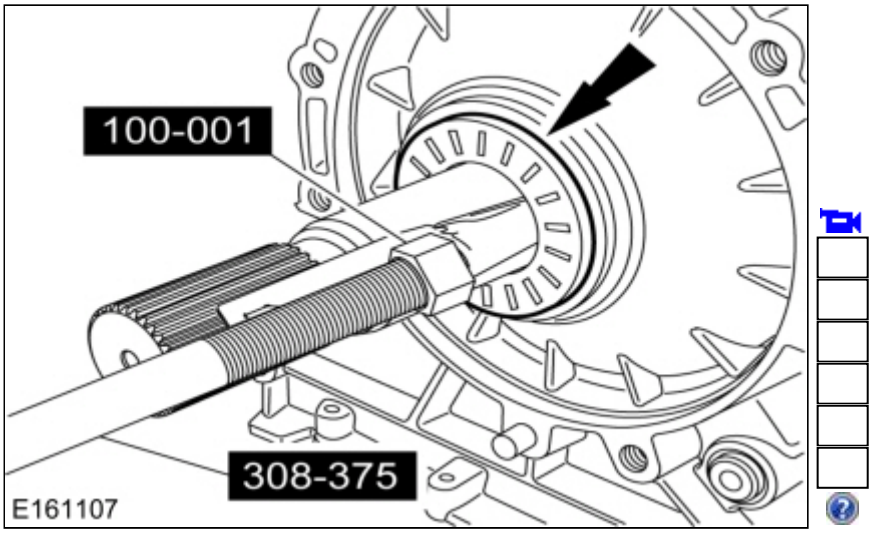
6. Using the input shaft oil seal remover and slide Hammer, remove the output shaft seal
   Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 308-375 Remover, Input Shaft Seal.



4x4

7. Remove the transfer case
   Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Removal).

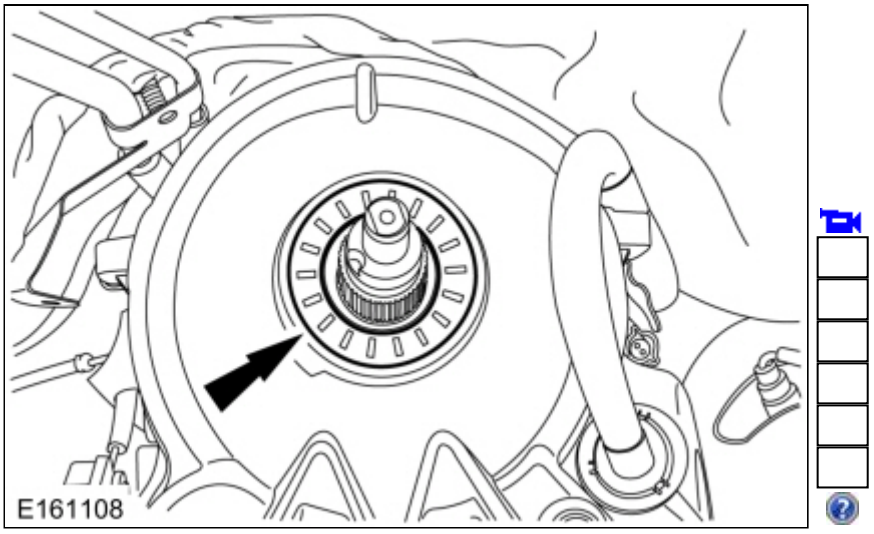
8. Using the input shaft oil seal remover and slide Hammer, remove the output shaft seal
   Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 308-375 Remover, Input Shaft Seal.



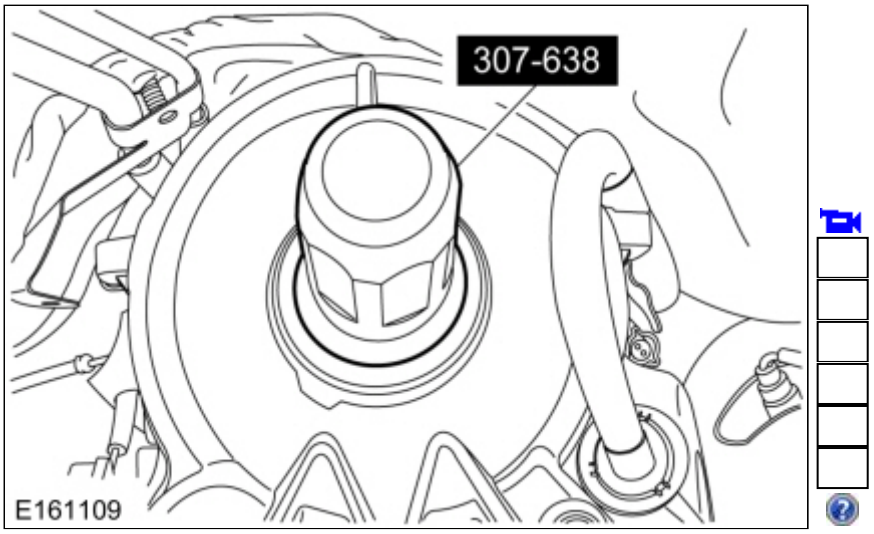
Installation

Vehicles with rear wheel drive (RWD)

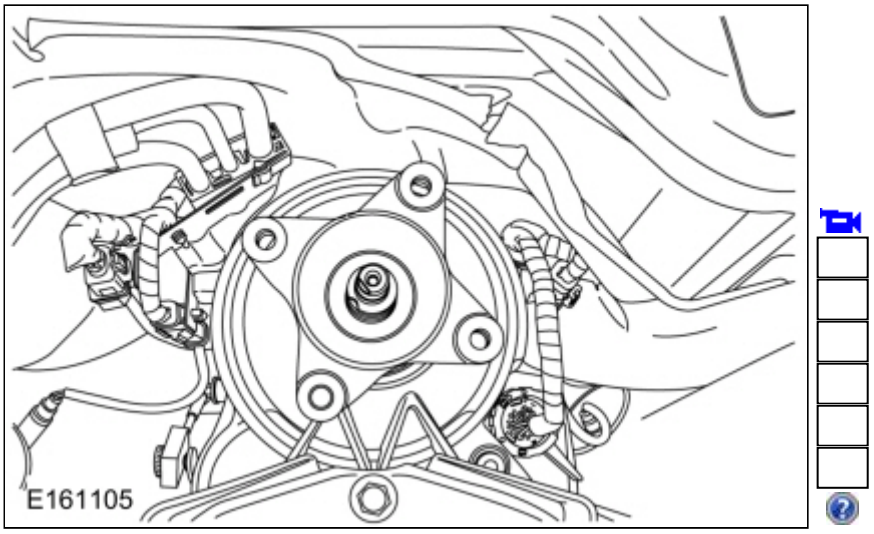
1. Position a new output shaft seal



2. Using the Rear seal 4×2 Installer, Install the output shift seal.
   Use Special Service Tool: 307-638 Installer, Rear Seal, 4x2.

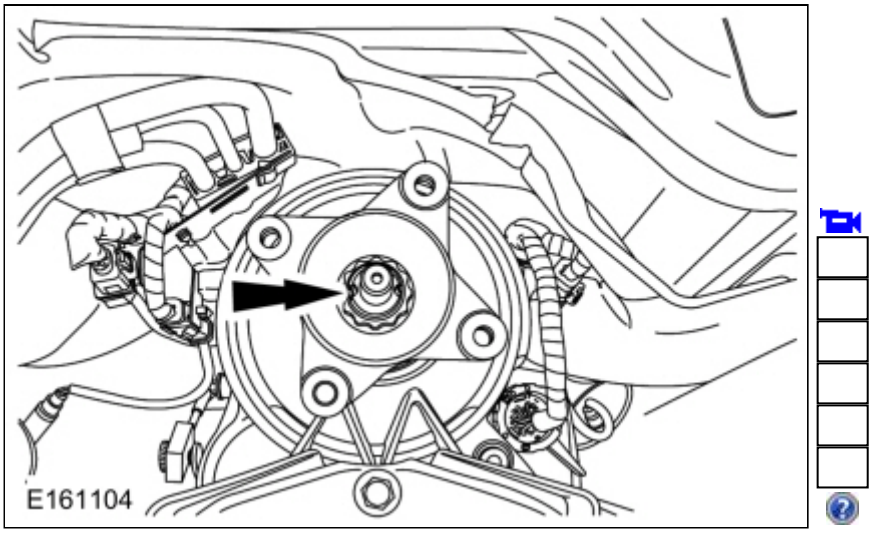


3. Install the output shaft flange



4. **NOTE:** *After installing the new output shaft flange nut, it must be staked at the slots to prevent it from coming loose.*

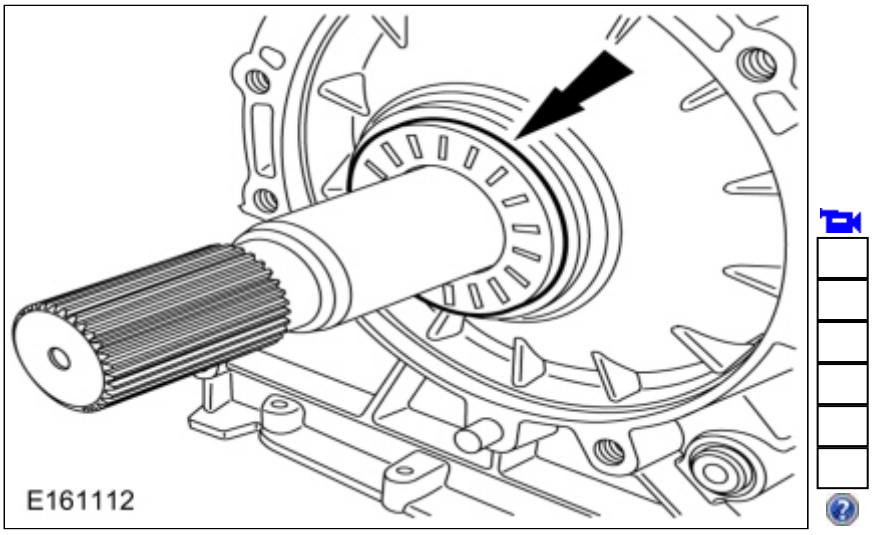
   Install the extension housing flange seal and a new output shaft flange nut.
   Torque: 80 Nm



5. Install the rear drive shaft
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

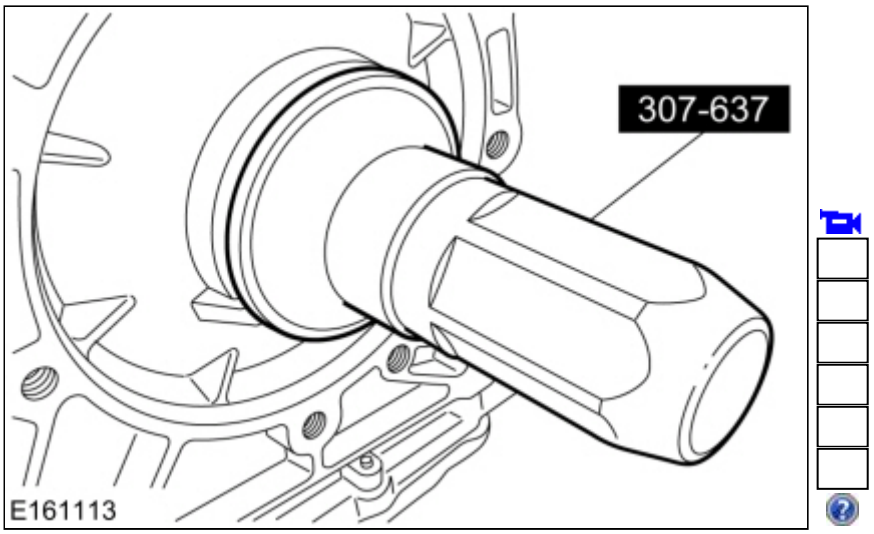
4x4

6. Position the output shaft seal



7. Using the Rear seal 4×4 Installer, Install a output shaft seal

Use Special Service Tool: 307-637 Installer, Rear Seal, 4x4.



8. Install the transfer case
   Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Installation).

All vehicles

9. Fill and check the transmission fluid.
   Refer to: Transmission Fluid Level Check (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .

Copyright © 2016 Ford Motor Company

Shift Solenoids (SS)

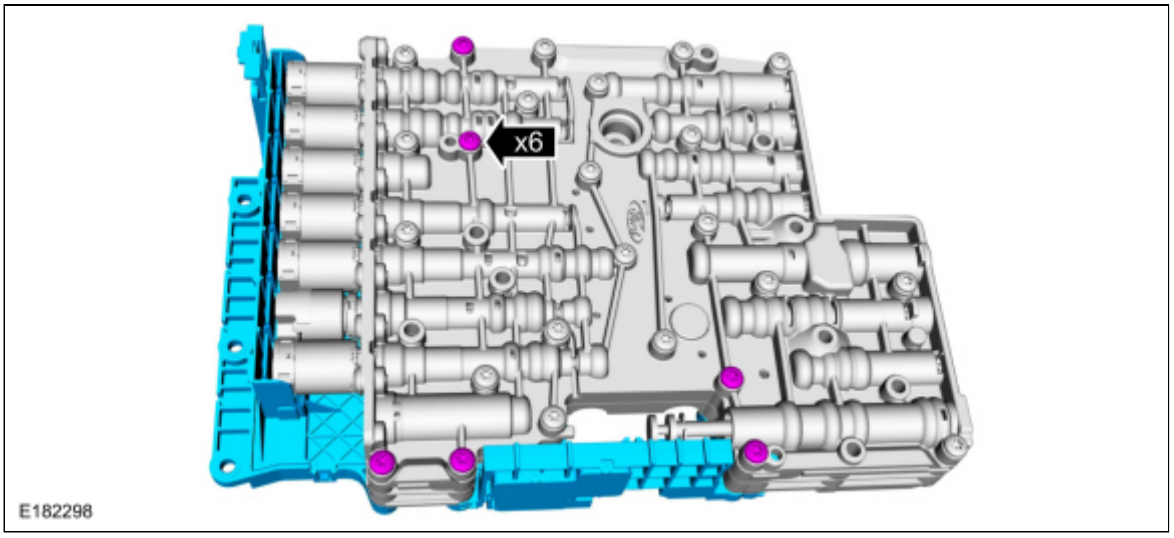
Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

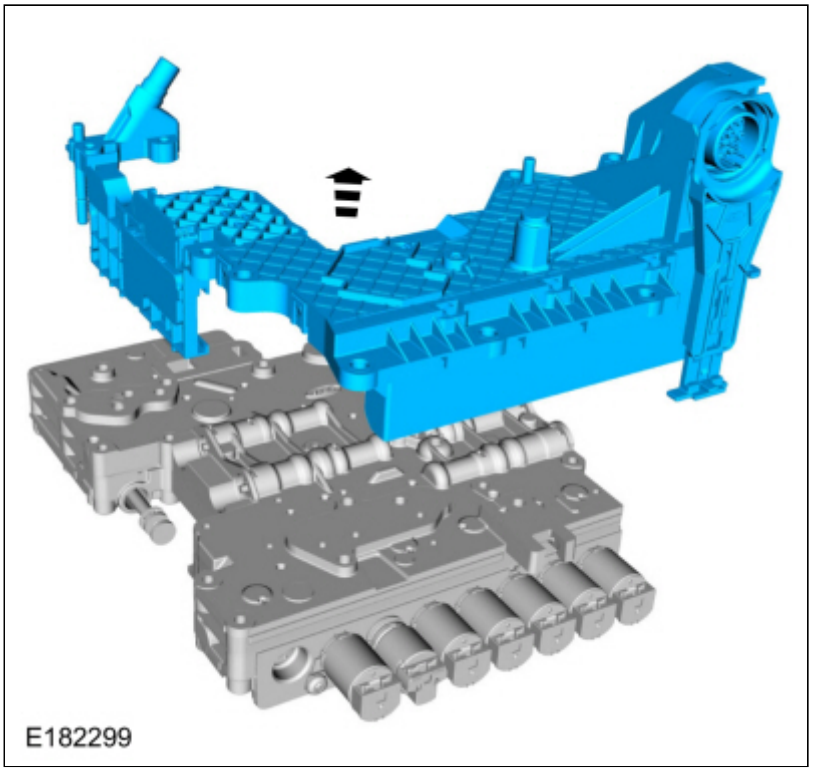
Removal

1. Remove the main control valve body.
   Refer to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R100) .
   Refer to: Main Control Valve Body - 2.7L EcoBoost (238kW/324PS) (307-01 Automatic Transmission) .

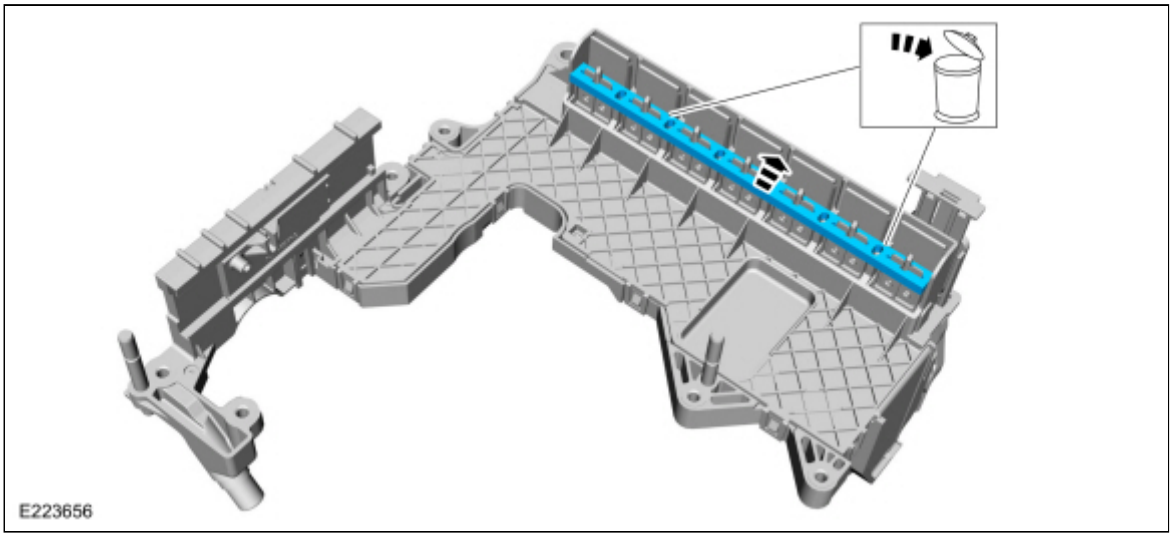
2. Remove the long bolts from the molded leadframe.



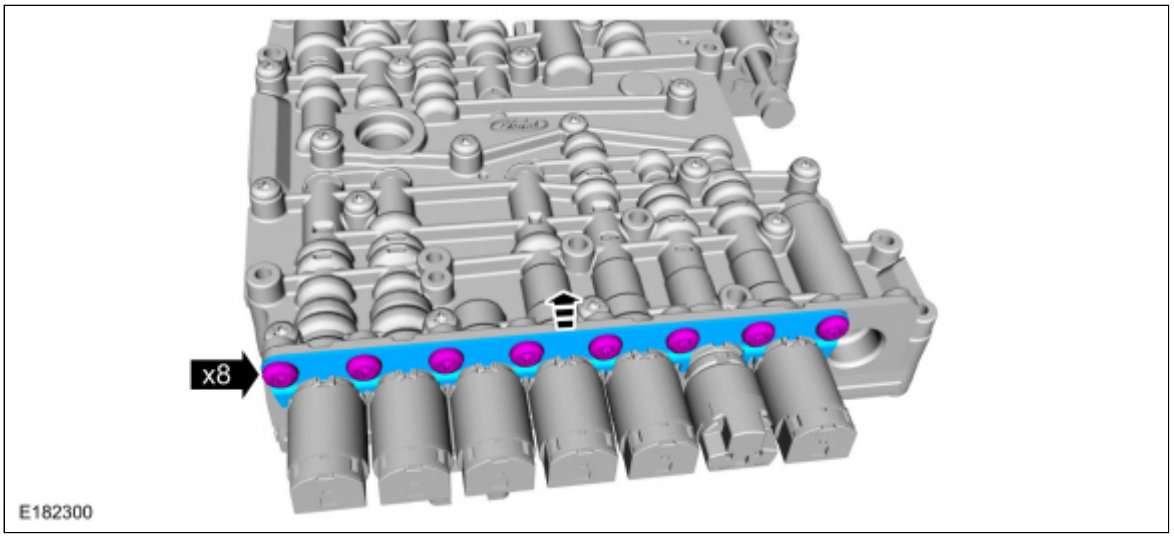
3. Carefully separate the molded leadframe from the main control valve body assembly.



4. If equipped, remove and discard the foam strip seal.



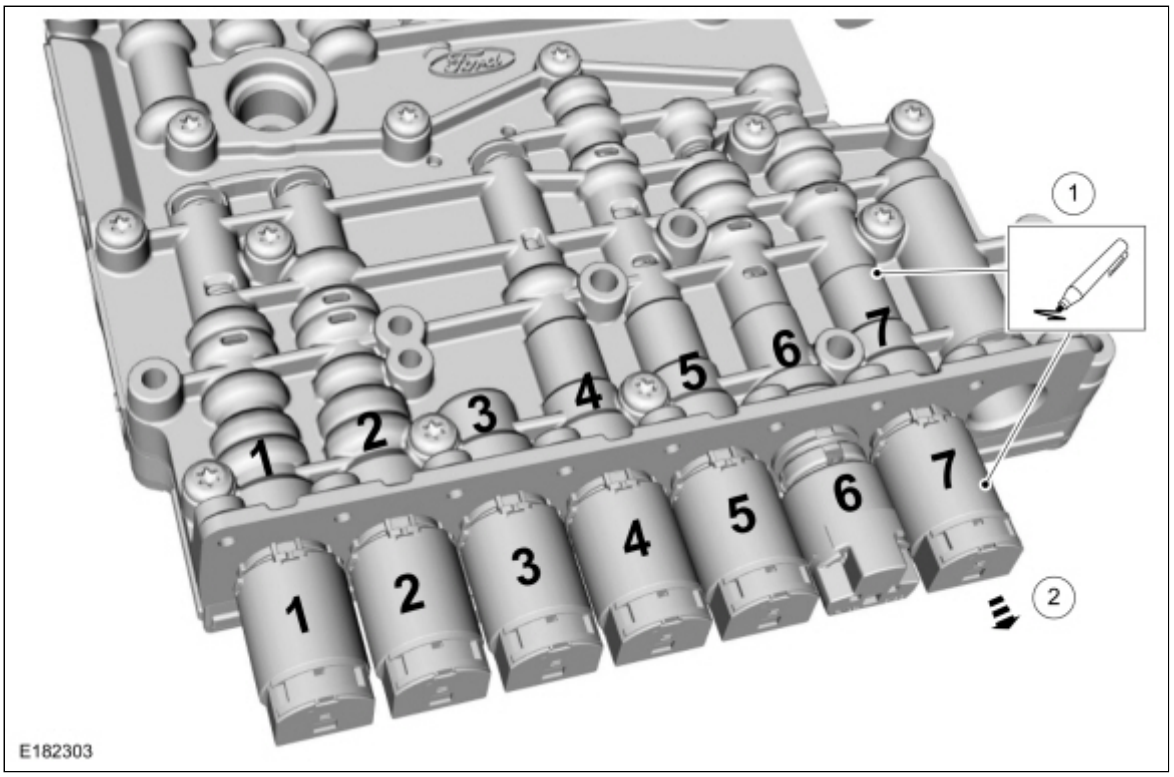
5. Remove the solenoid bracket bolts and the solenoid bracket.



6. **NOTICE: A Variable Force Solenoid (VFS) is calibrated from the factory and are not all the same. To**

replace a Variable Force Solenoid (VFS), match the replacement solenoid nozzle color and the band number with the original solenoid or harsh/erratic shifts, harsh/soft engagement or damage to the transmission can occur.

1. If replacing more then one solenoid, number the solenoids and number the main control valve body solenoid ports to correspond to the solenoid.
2. Pull the solenoid(s) out of the main control valve body.

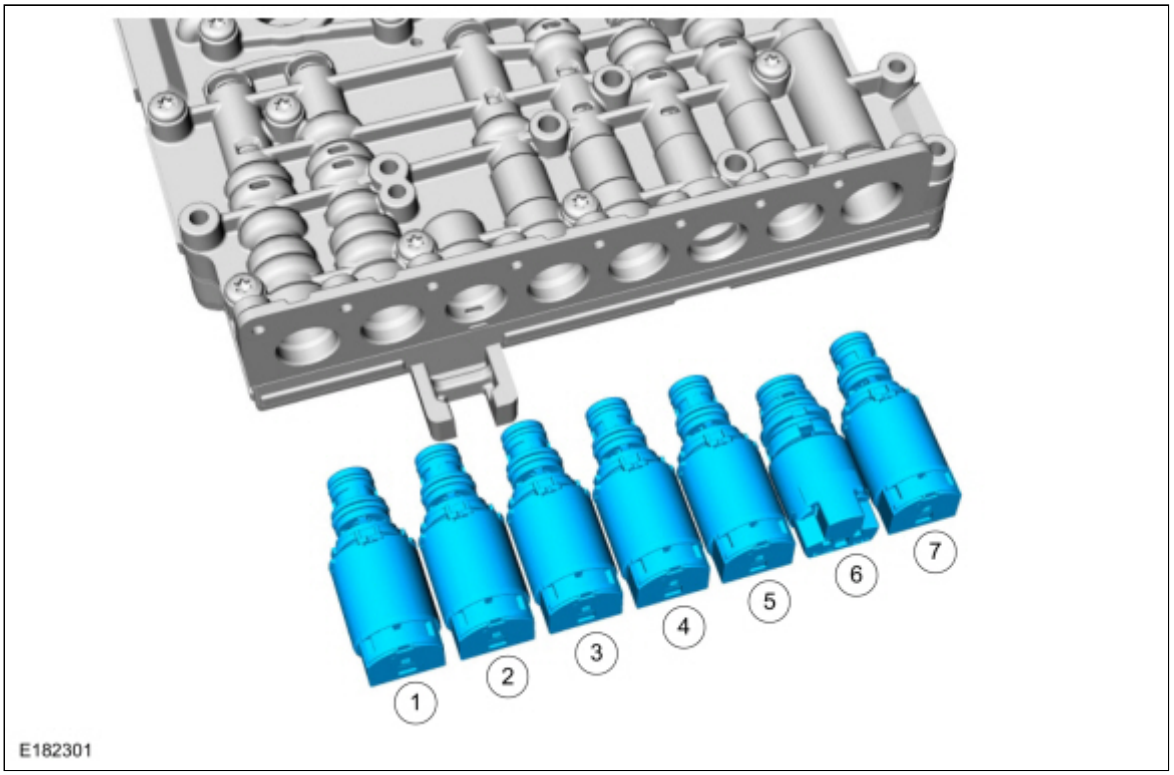


Installation

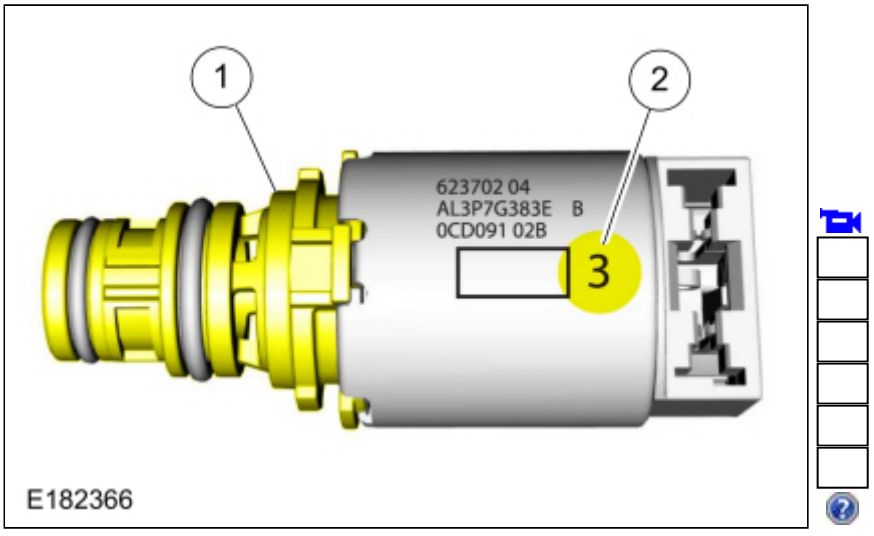
NOTICE: A Variable Force Solenoid (VFS) is calibrated from the factory and are not all the same. To replace a Variable Force Solenoid (VFS), match the replacement solenoid nozzle color and the band number with the original solenoid or harsh/erratic shifts, harsh/soft engagement or damage to the transmission can occur.

NOTE: *Identify what type of solenoid is being replaced. The solenoid can be a normally high Variable Force Solenoid (VFS) with a black nozzle, normally low Variable Force Solenoid (VFS) with a brown nozzle or an ON/OFF solenoid.*

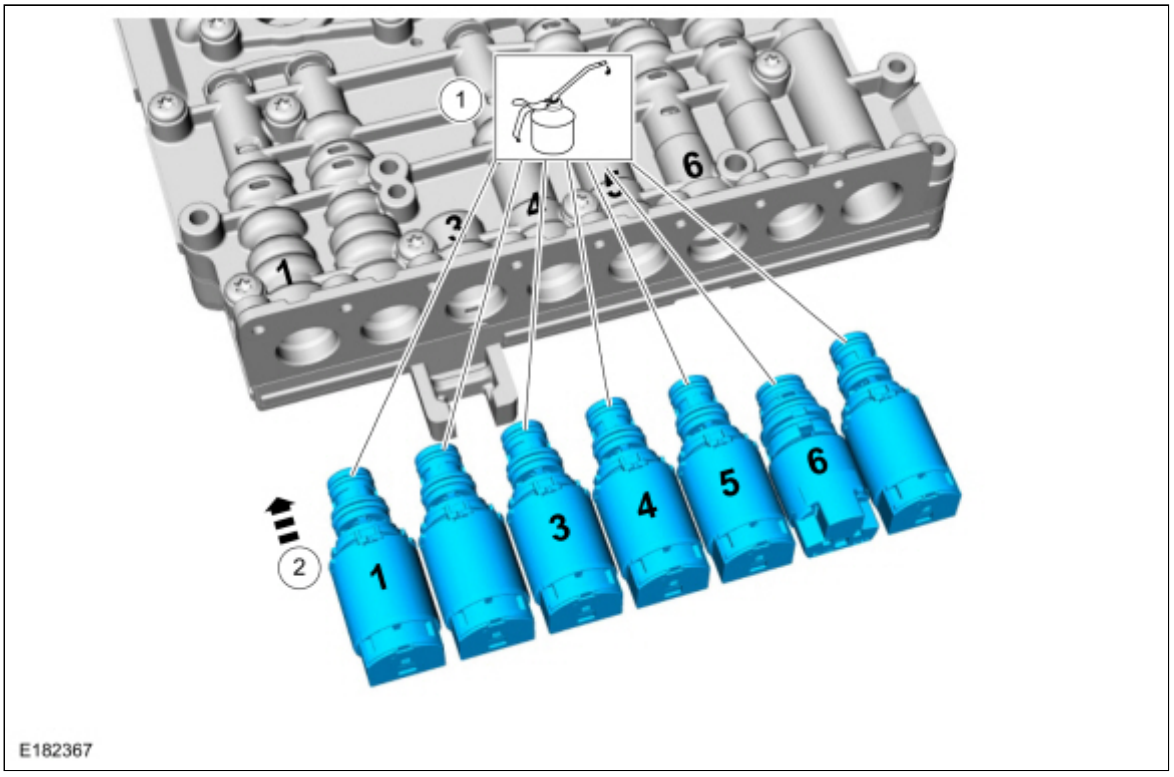
1. 7G383, SSA, Forward (1,2,3,4) clutch, normally low solenoid (brown nozzle).
2. 7G383, SSB, Direct (3,5,R) clutch, normally high solenoid (black nozzle).
3. 7G383, SSC, Intermediate (2,6) clutch, normally low solenoid (brown nozzle).
4. 7G383, LPC solenoid, normally high solenoid (black nozzle).
5. 7G383, SSD, low/reverse/overdrive clutch, normally high solenoid (black nozzle).
6. 7G484, SSE, normally off ON/OFF solenoid.
7. 7G383, TCC solenoid, normally low solenoid (brown nozzle).



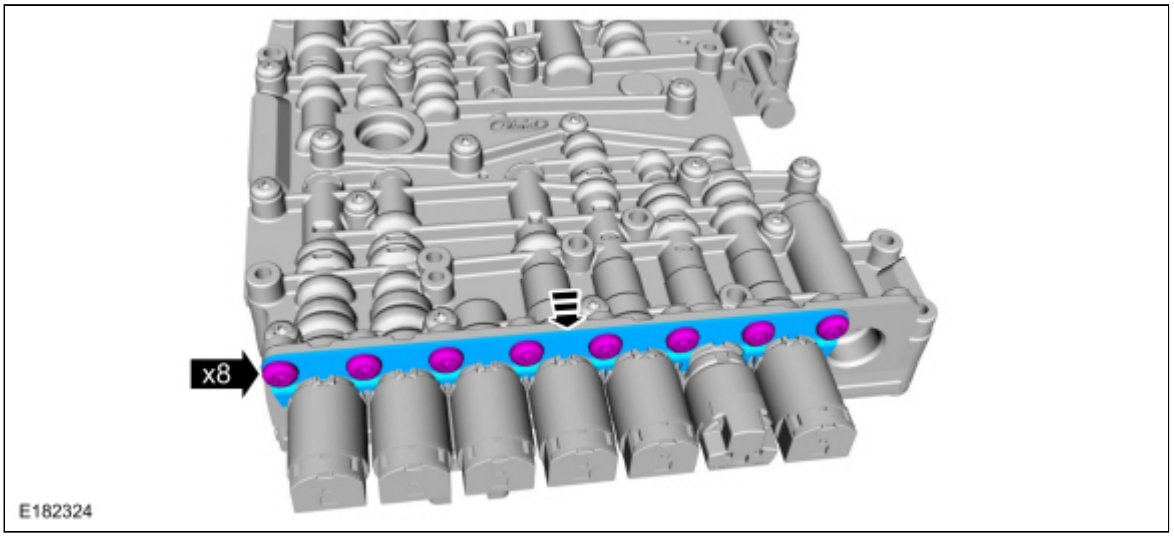
1. If replacing a Variable Force Solenoid (VFS), record the solenoid nozzle color to get the correct part number for the solenoid.
2. If replacing a Variable Force Solenoid (VFS), record the band number to get the correct part number for the solenoid.



3. Lubricate the solenoid O-rings and position the solenoid(s) in the main control valve body in the correct port(s) as marked during removal.
   Material: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)

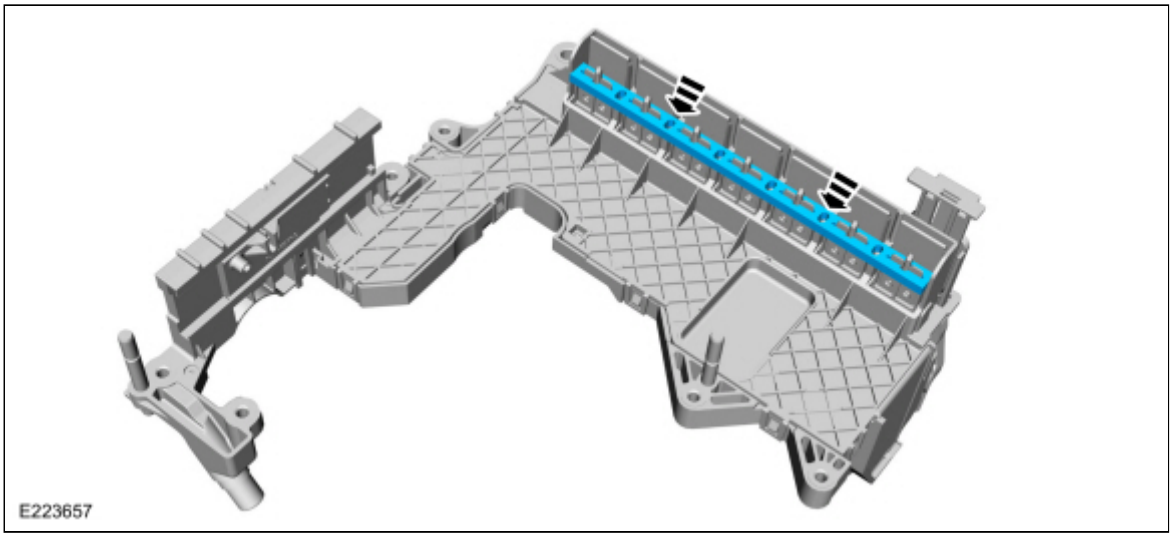


4. Position the solenoid bracket in place and install the bolts.
   Torque: 6 Nm



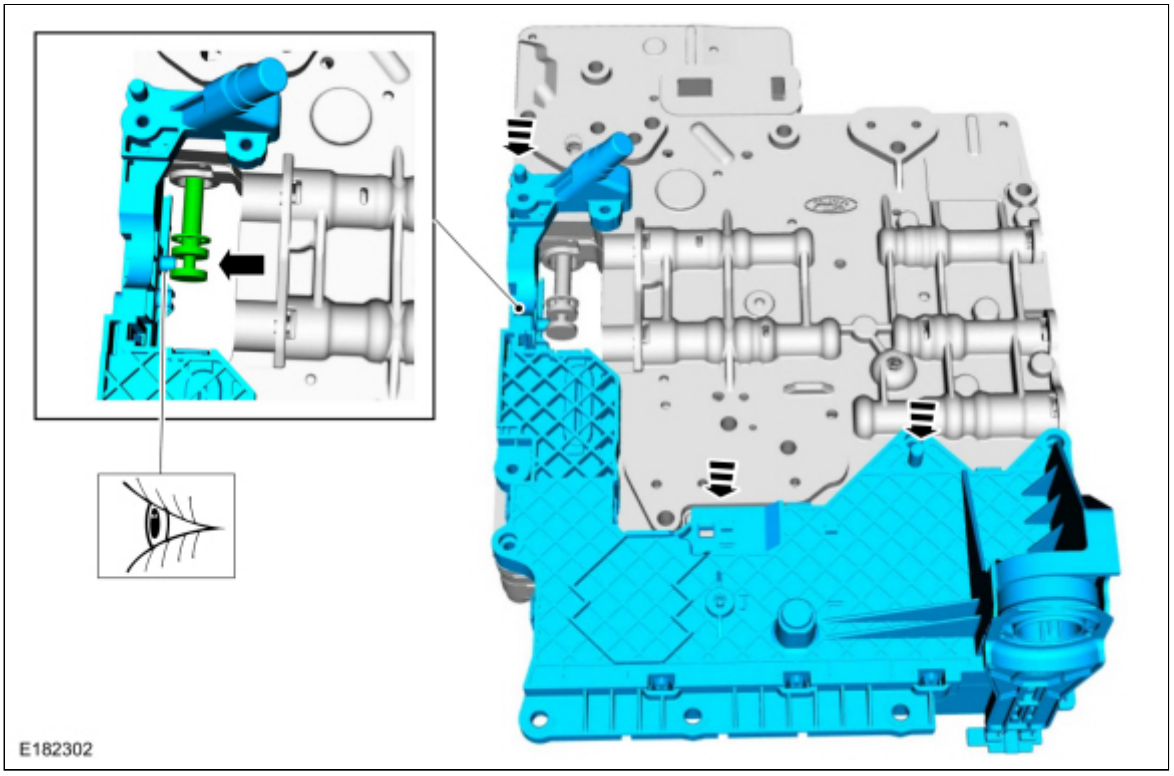
5. **NOTE:** *Some vehicles may not have been built with a foam strip seal. A new foam strip seal should be installed on all molded leadframes.*

   Install a new foam strip seal on the molded leadframe.

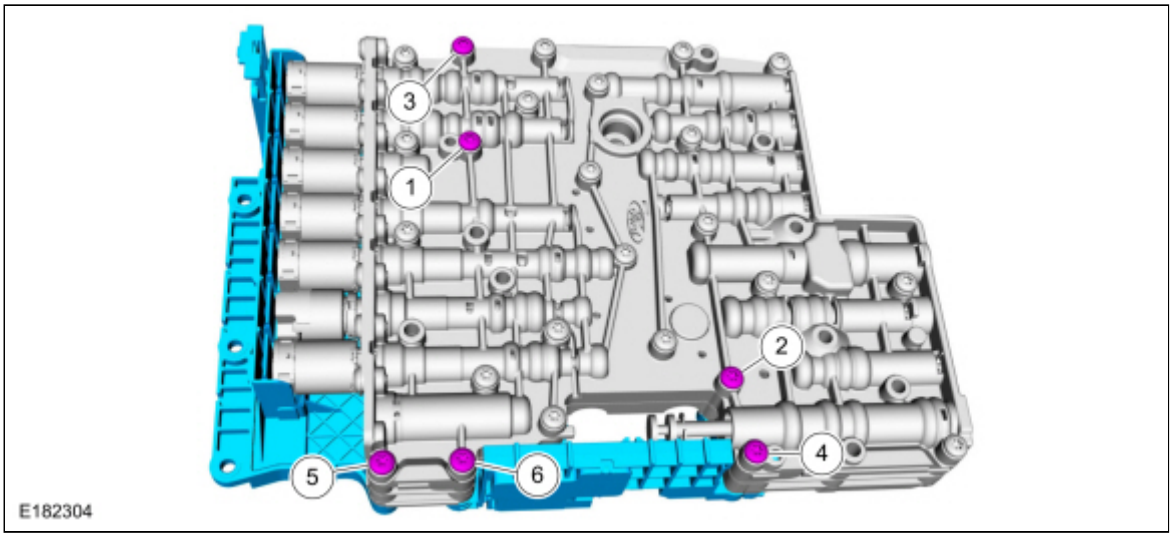


6. **NOTE:** *The TR sensor pin must be aligned with the manual control valve during installation.*

   Position the molded leadframe on the main control valve body and align the TR sensor pin with the manual control valve.



7. Install the long bolts into the molded leadframe. Tighten the bolts in the sequence shown.
   Torque: 6 Nm

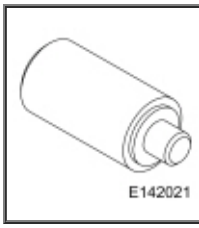


8. Install the main control valve body.
   Refer to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R100) .
   Refer to: Main Control Valve Body - 2.7L EcoBoost (238kW/324PS) (307-01 Automatic Transmission) .

Copyright © 2016 Ford Motor Company

Selector Shaft Seal

Special Tool(s) / General Equipment

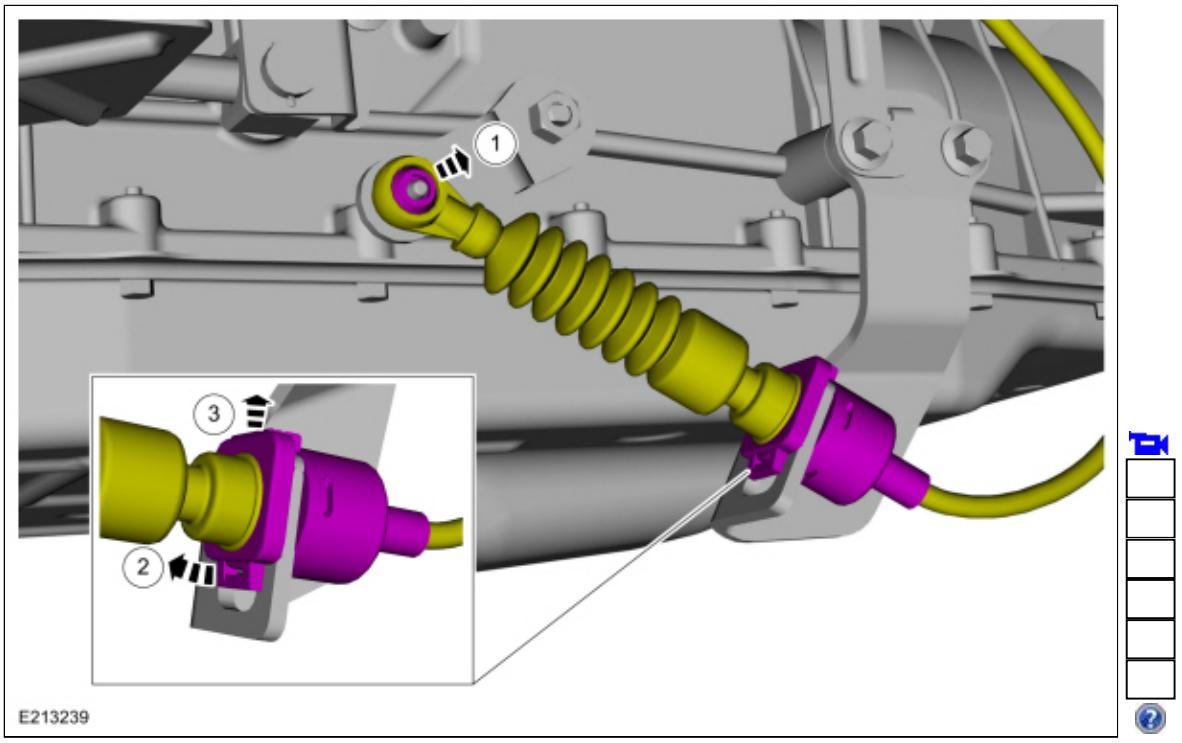
 E142021	307-559 Installer, Shifter Fluid Seal

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

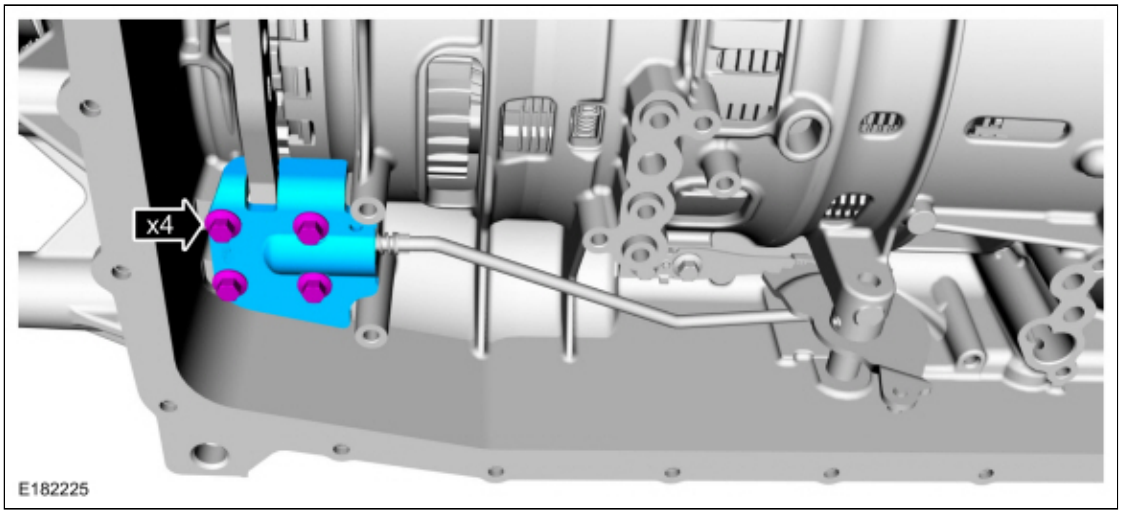
2. **NOTICE: Take extra care not to damage the components.**

   Disconnect the transmission selector lever cable end from the selector lever.

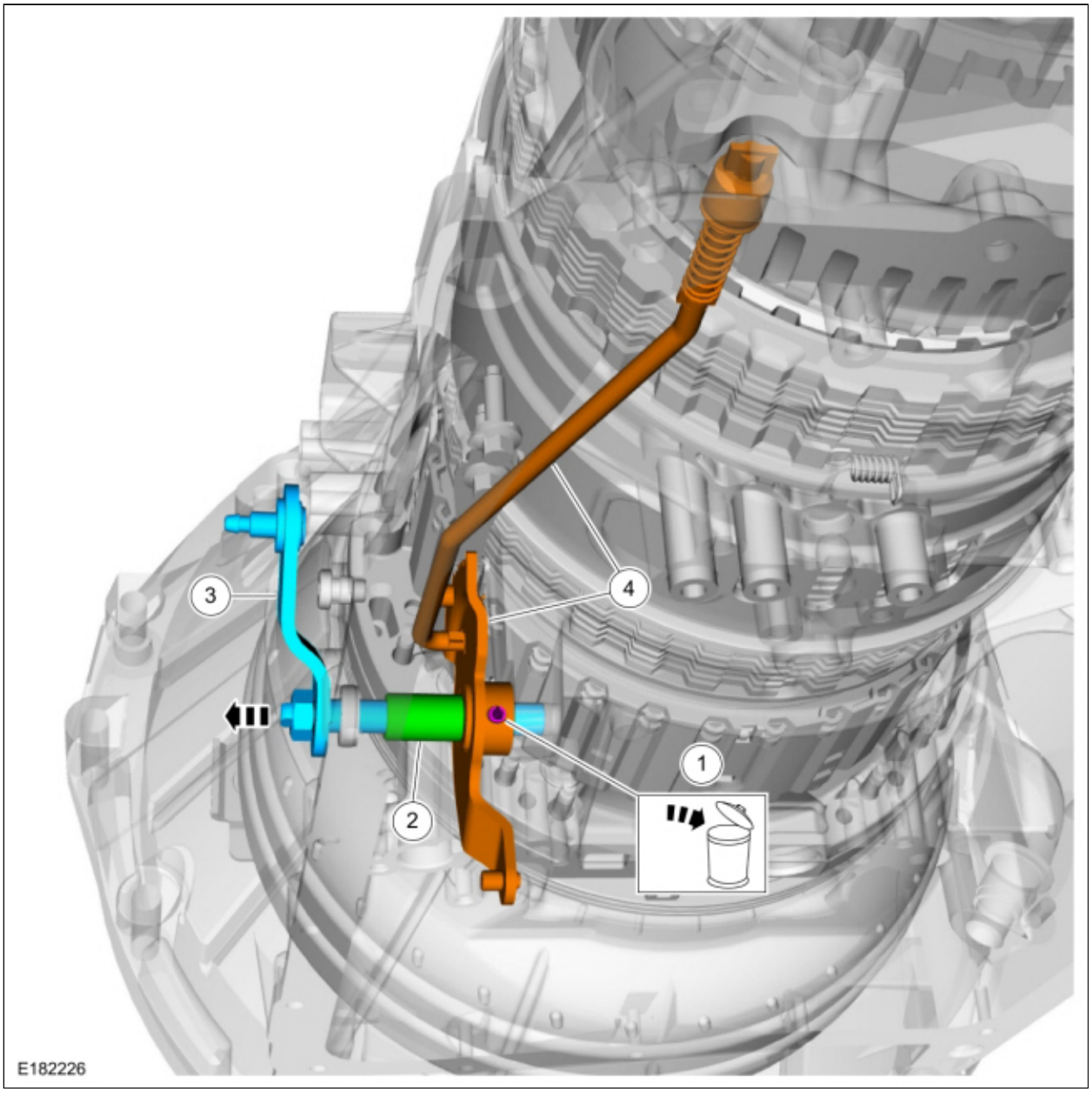


3. Refer to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

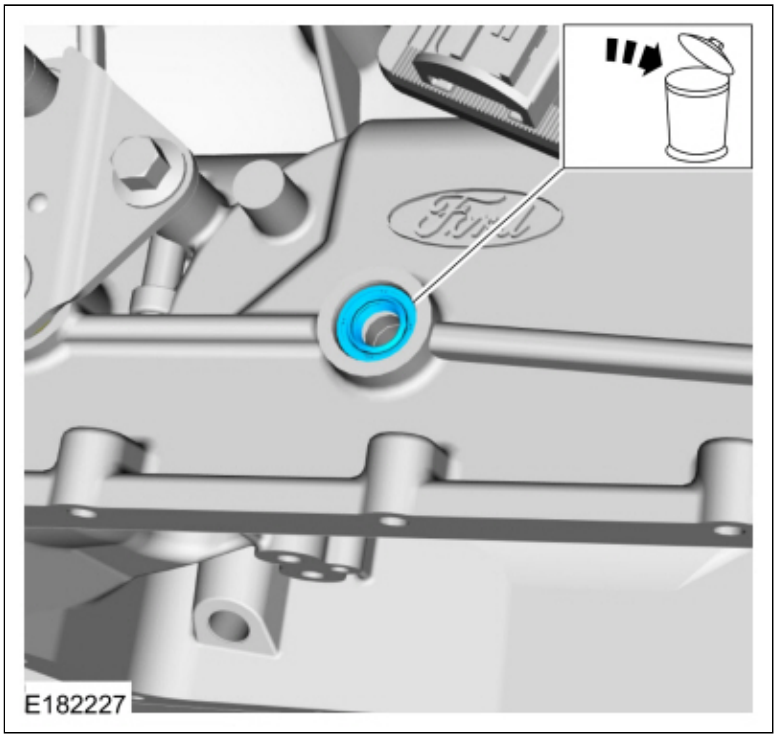
4.



1. Remove and discard the roll pin.
2. Hold the selector lever spacer to keep it from falling.
3. Slide the selector lever shaft out of the case.
4. Remove the manual valve detent lever and park pawl actuator rod as an assembly.

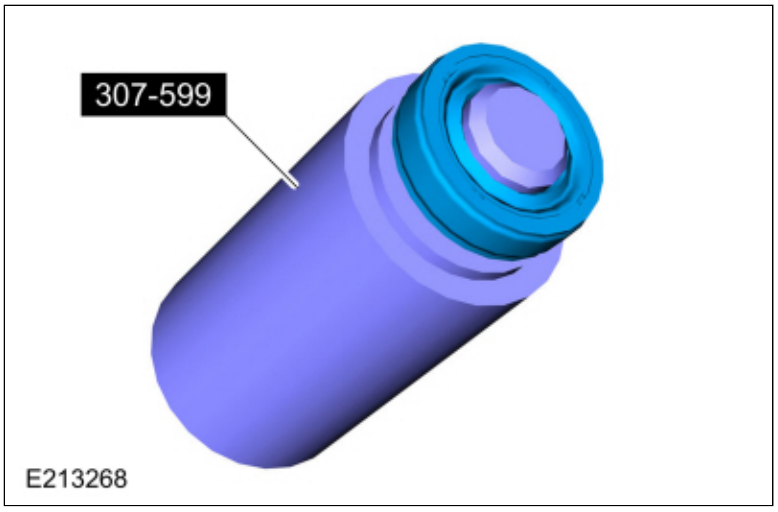


6.

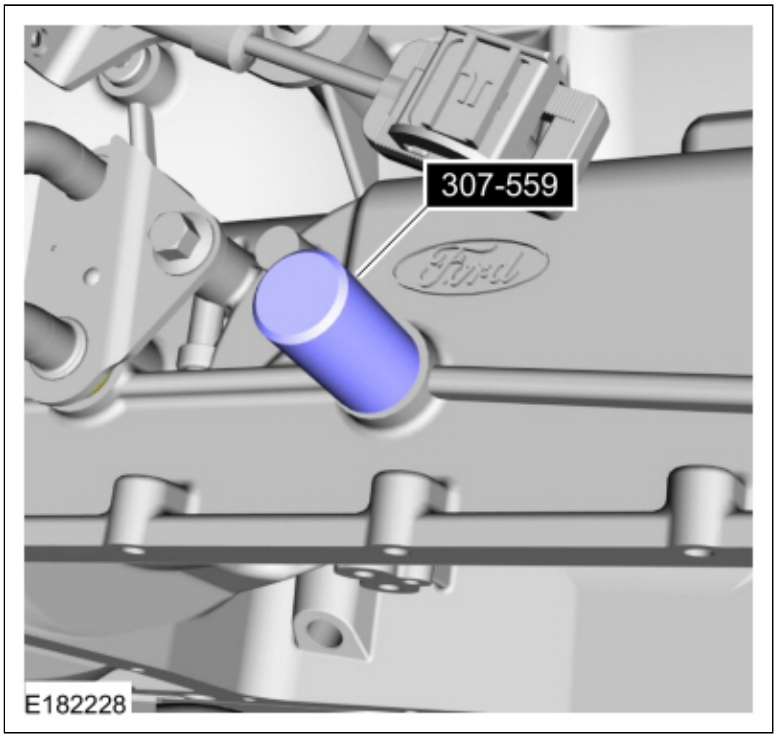


Installation

1. Install a new selector shaft seal on the special tool.
   Use Special Service Tool: 307-559 Installer, Shifter Fluid Seal.

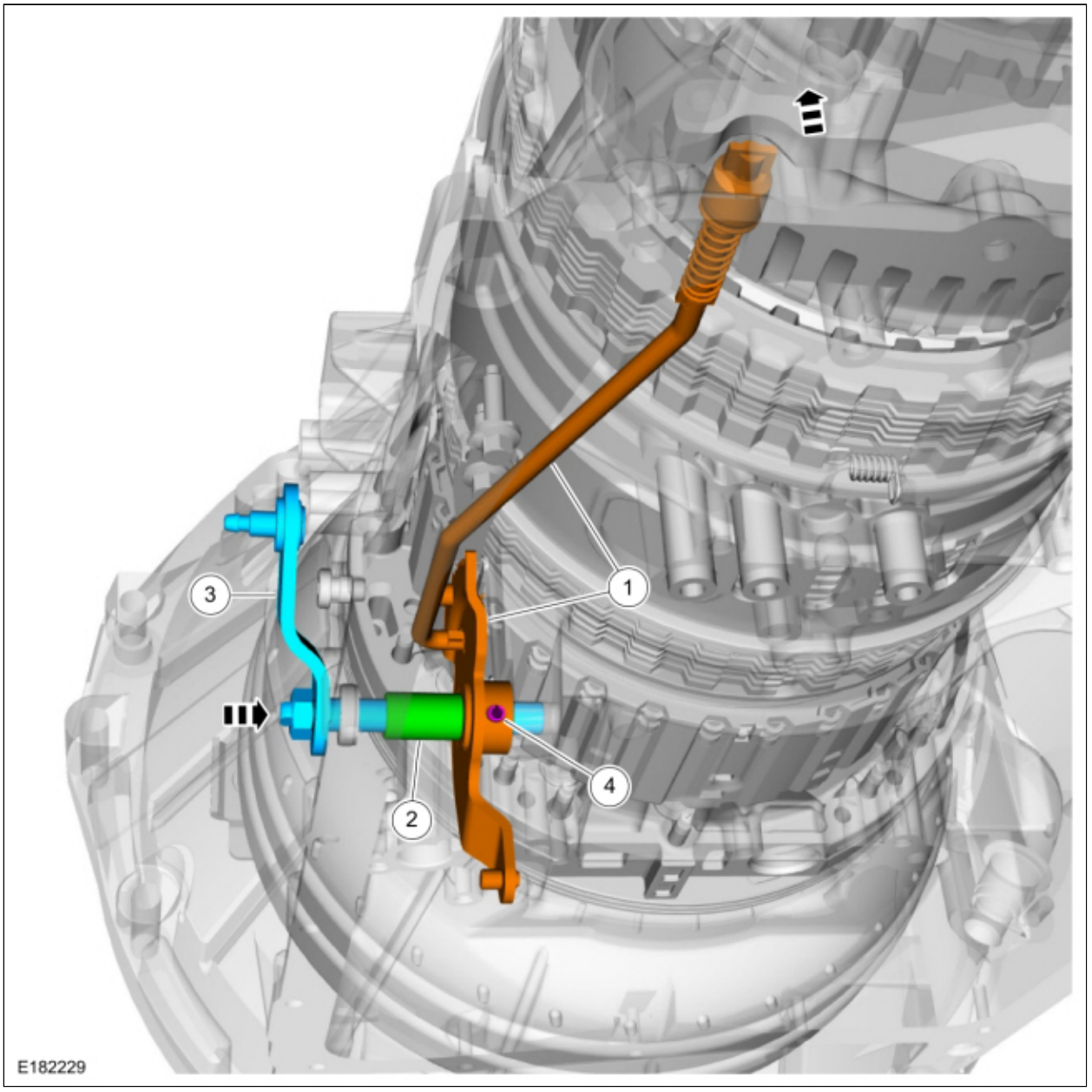


2. Using the special tool, install the selector shaft seal.
   Use Special Service Tool: 307-559 Installer, Shifter Fluid Seal.

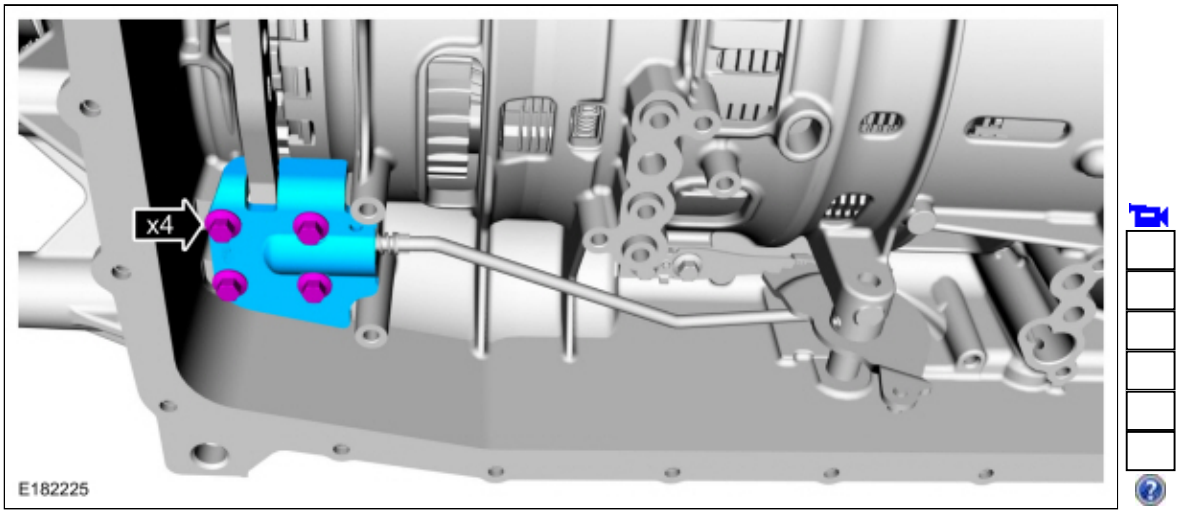


1. **NOTE:**

   Install the manual valve detent lever and park pawl actuator rod as an assembly.
2. Position the selector lever spacer in place.
3. Slide the selector lever shaft into the case and line up the roll pin hole.
4. Install the new roll pin.

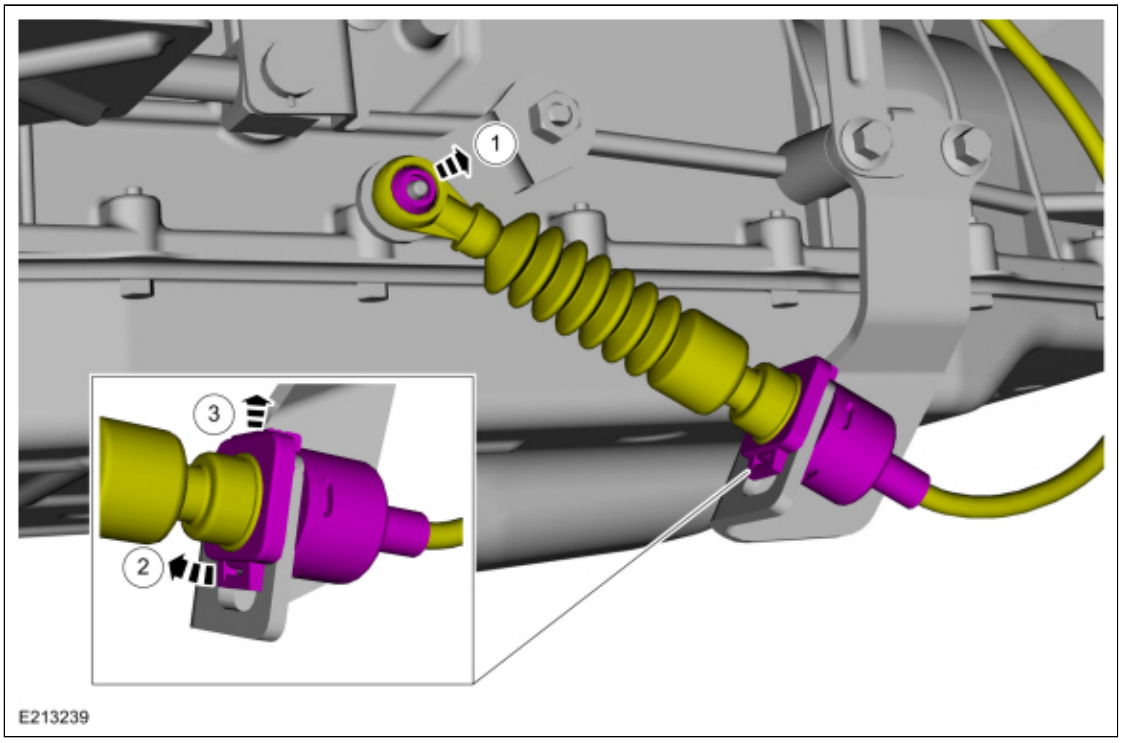


4. *Torque*: 12 Nm



5. Refer to: Main Control Valve Body (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

6. **NOTICE: Take extra care not to damage the components.**

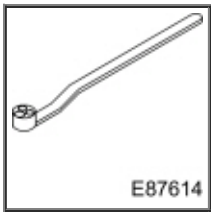


Copyright © 2016 Ford Motor Company

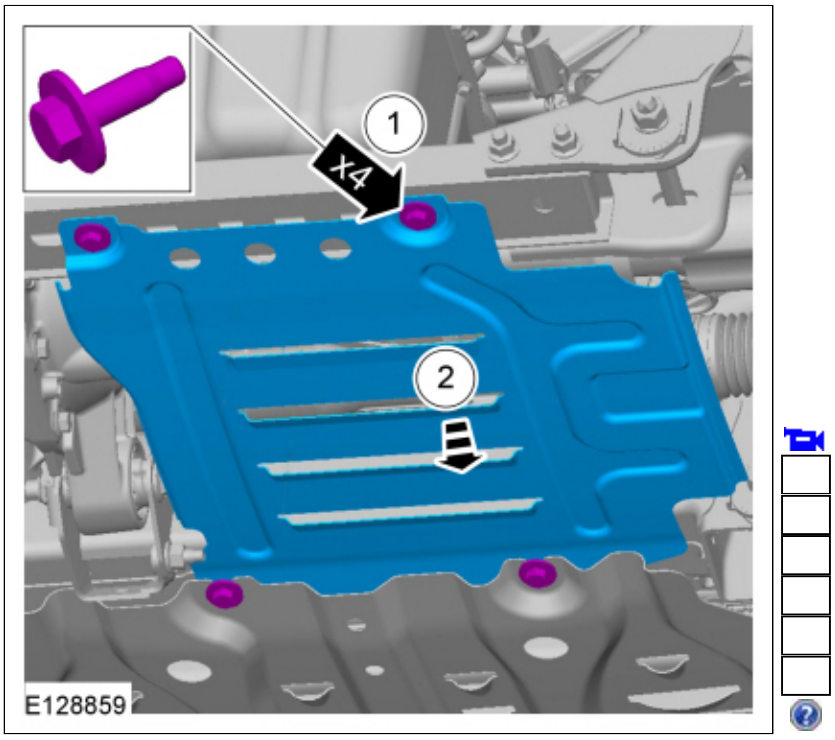
Transmission - LHD RWD/RHD RWD

Base Part Number: 7000

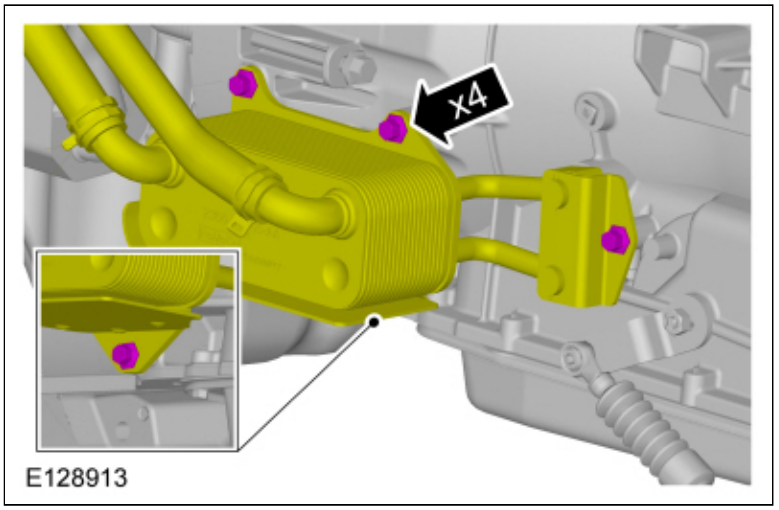
Special Tool(s) / General Equipment

 E87614	303-1310 Holding Wrench, Crankshaft
 307-346	307-346 (T97T-7902-A) Retainer, Torque Converter
Transmission Jack	

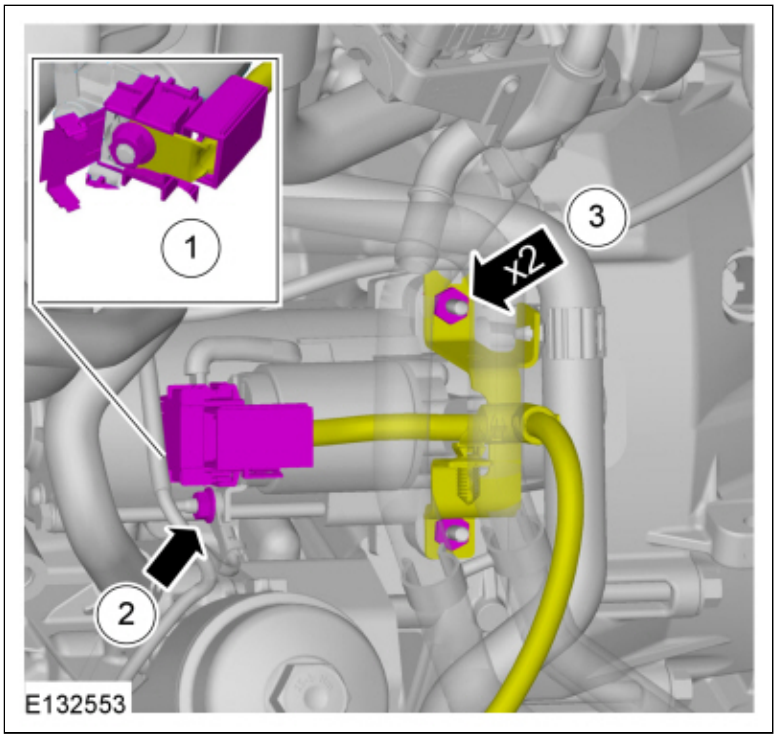
Removal

1. Remove the battery negative terminal.
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Remove the rear driveshaft.
   Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
4. Drain the transmission fluid.
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
5. 

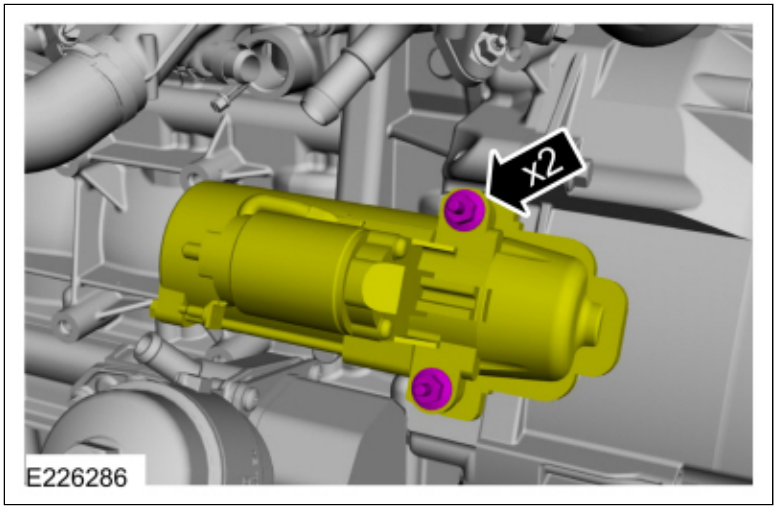
6. **NOTE:** *Be prepared to collect escaping fluid.*



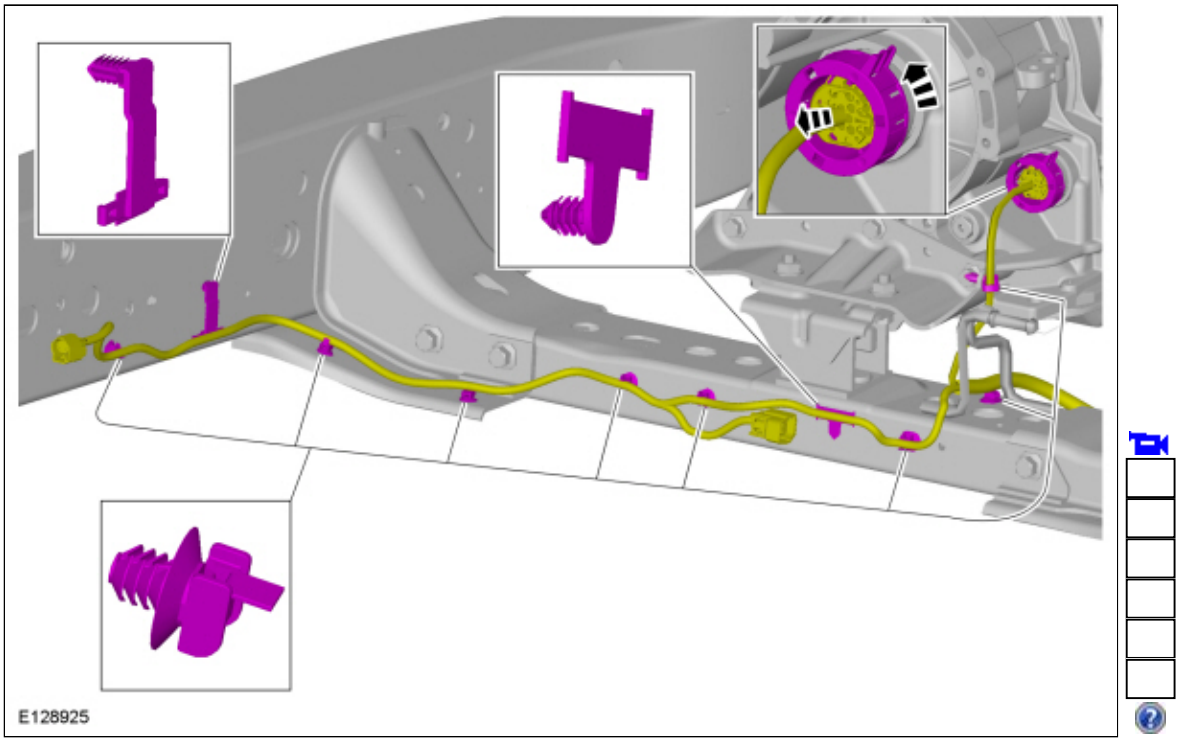
7.



8.

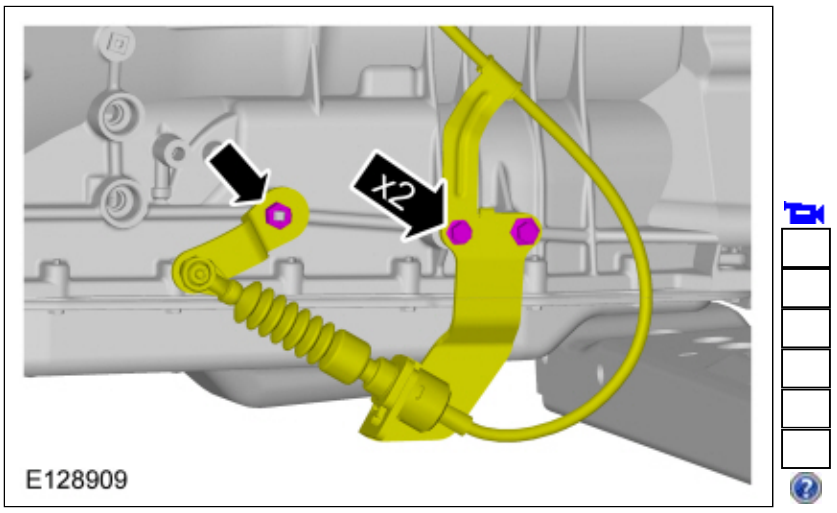


9.

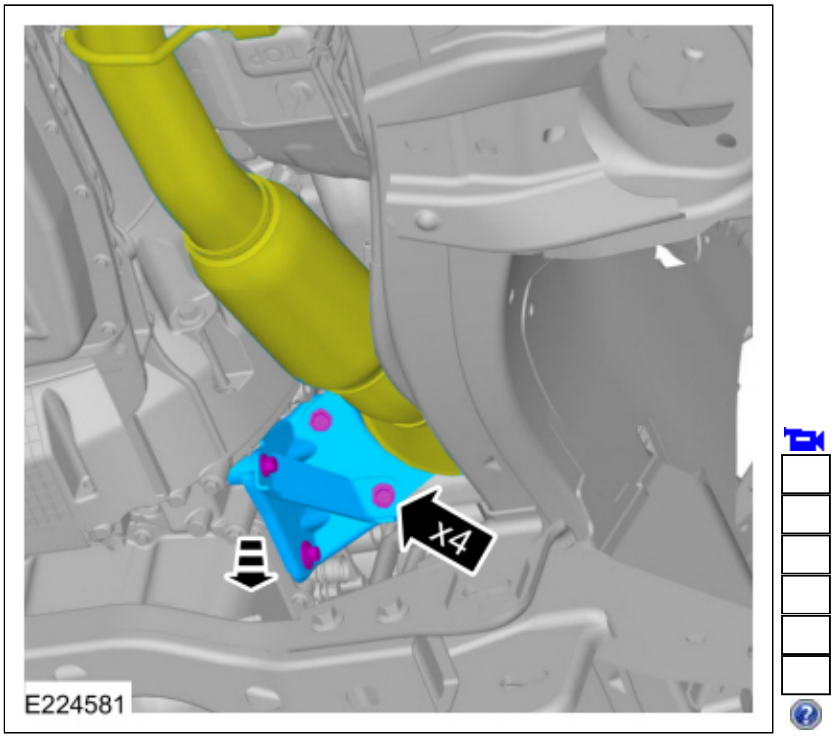


10. **NOTICE: Take extra care when handling selector lever cable.**

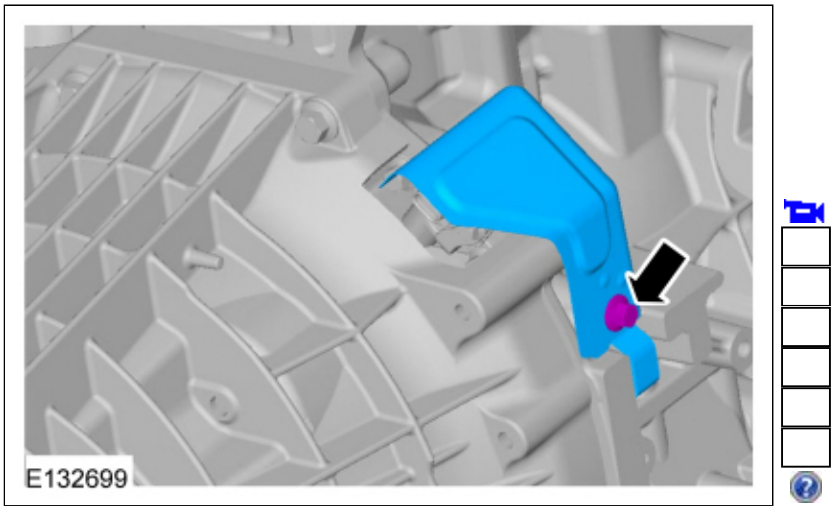
    NOTE: *Note the position of the component before removal.*



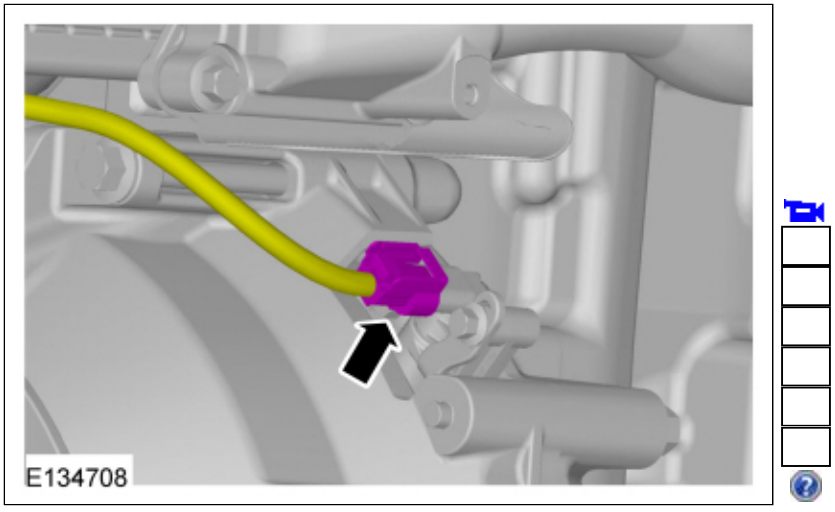
11.



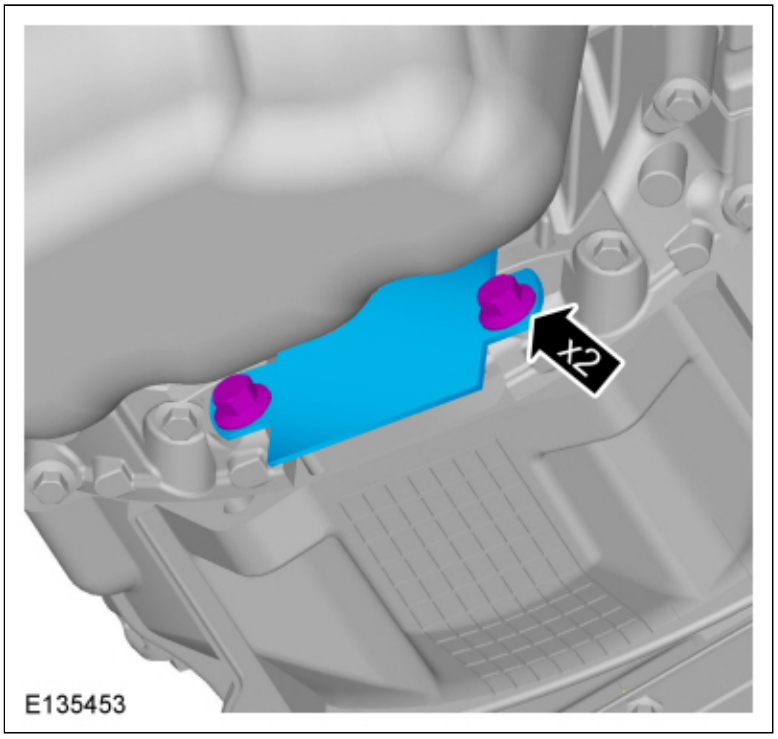
12.



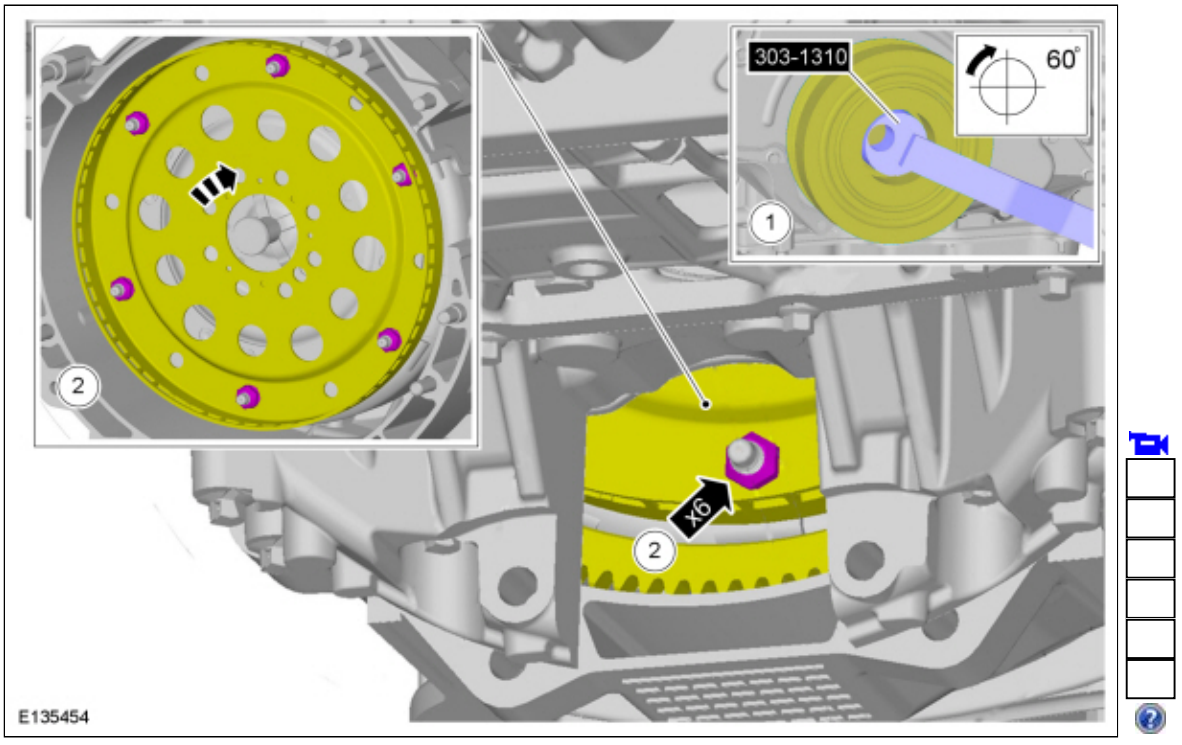
13.



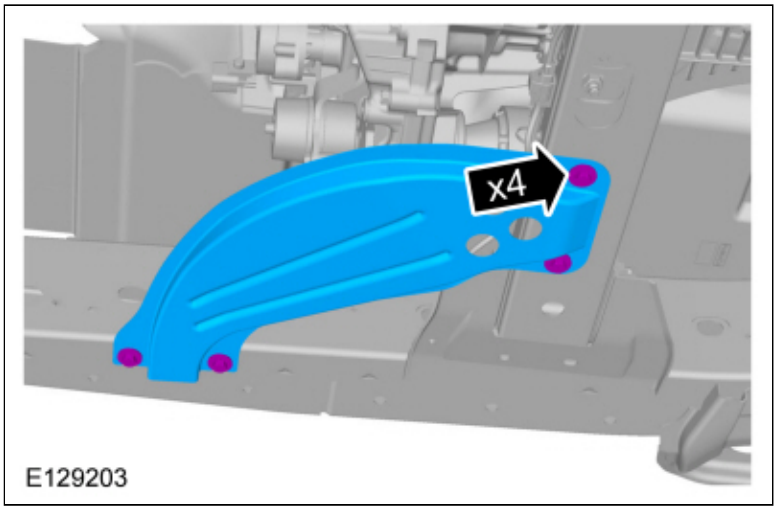
14.



15. Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.

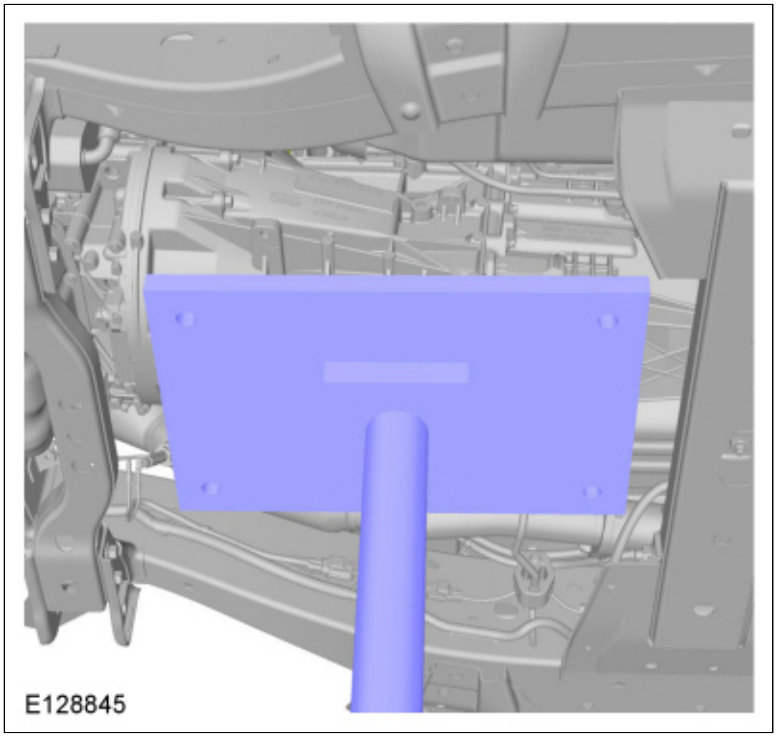


16. If equipped.

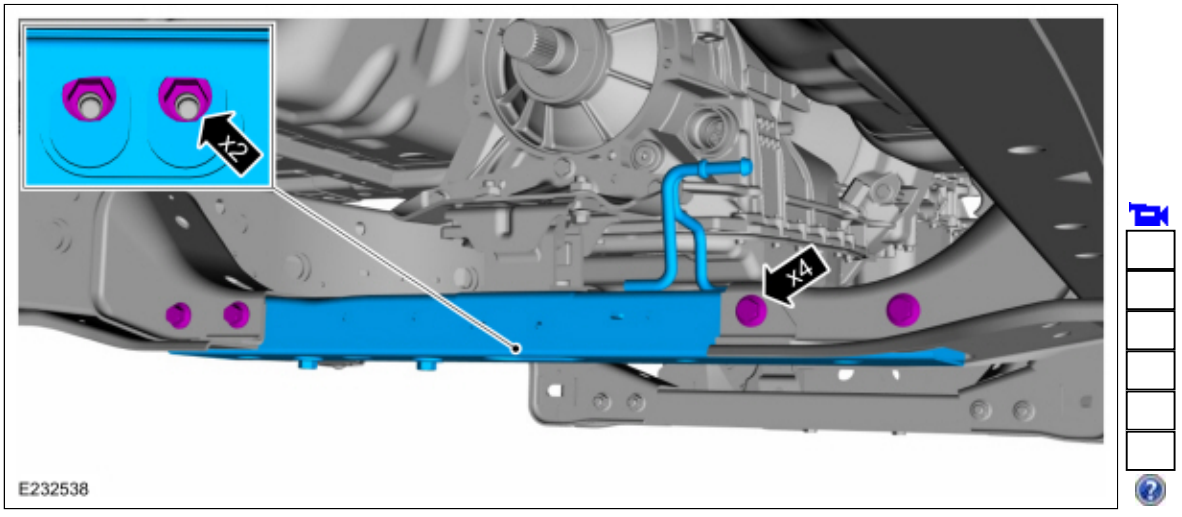


17. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

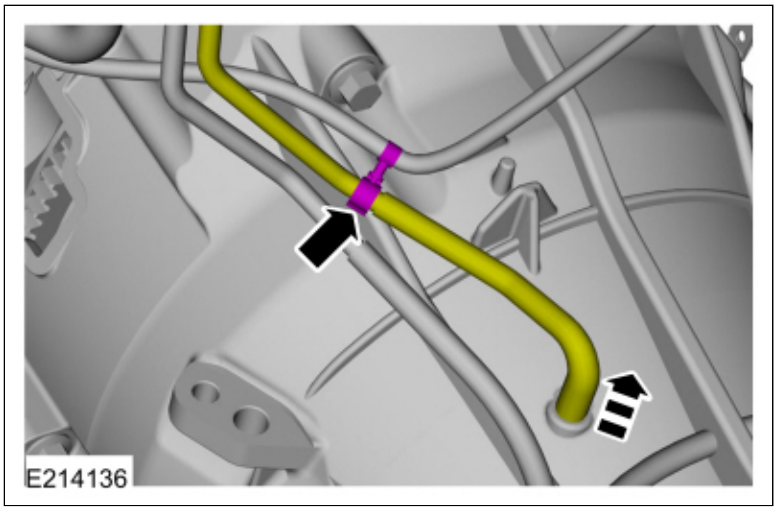
    Use the General Equipment: Transmission Jack



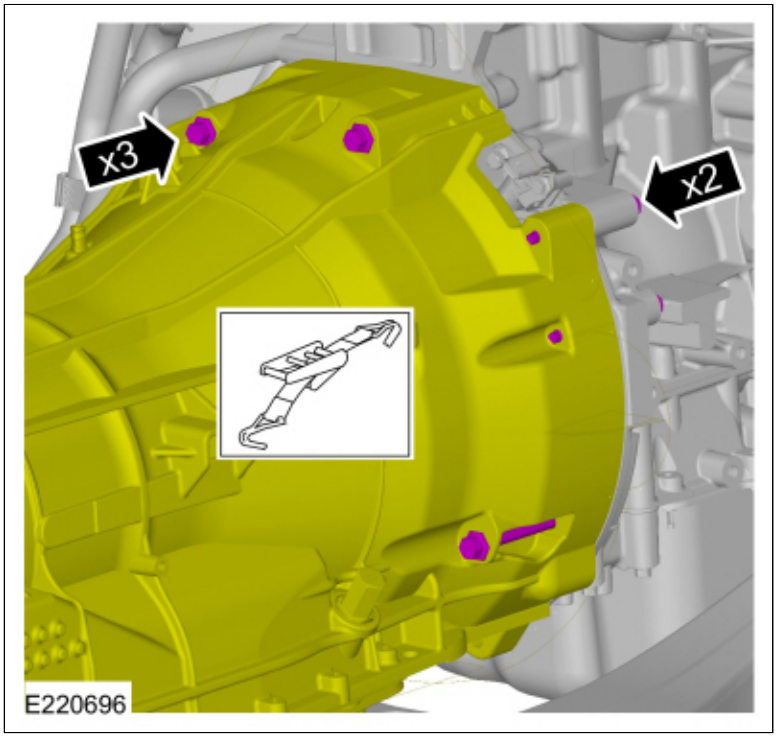
18.



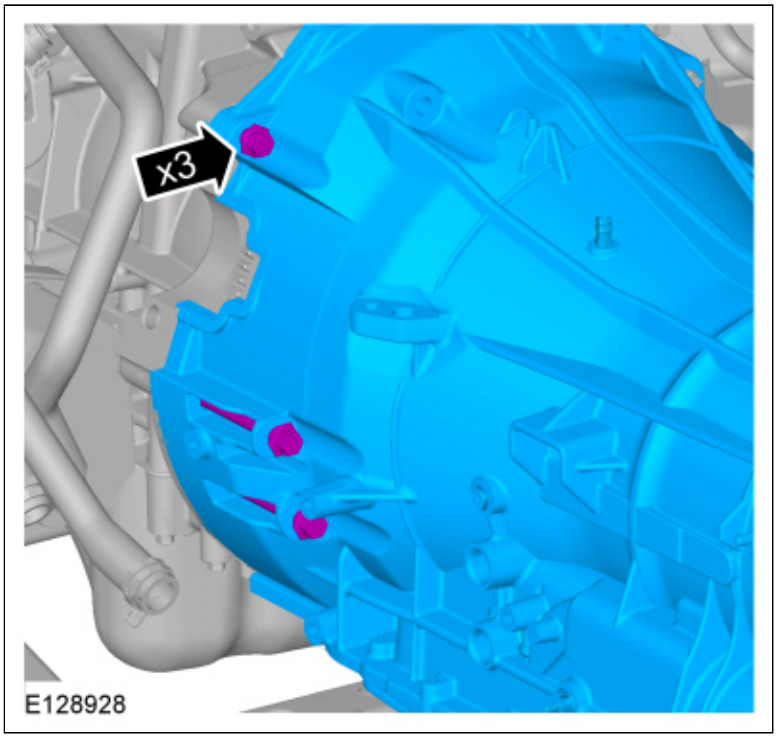
19.



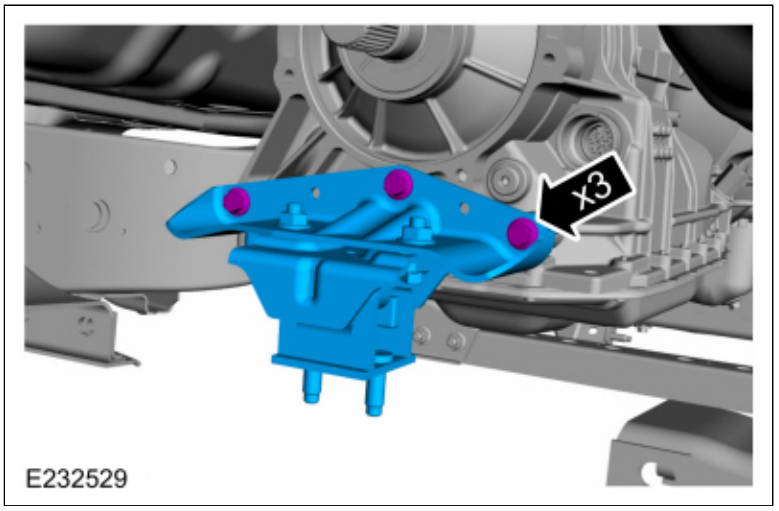
20.



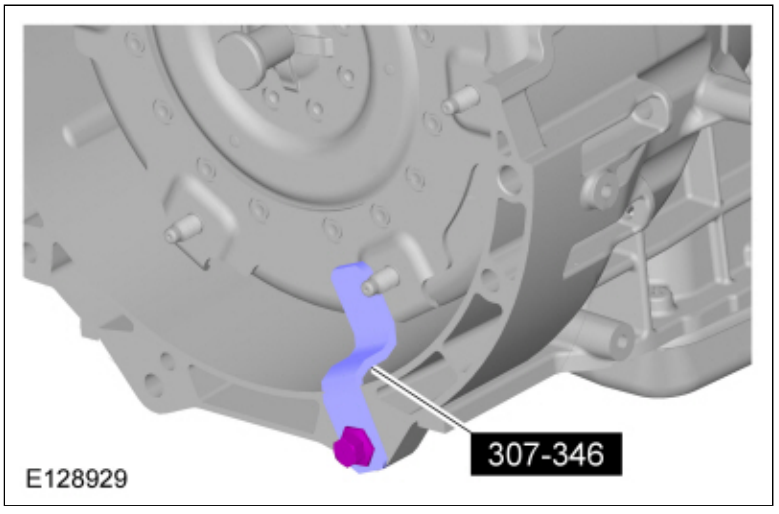
21.



22.

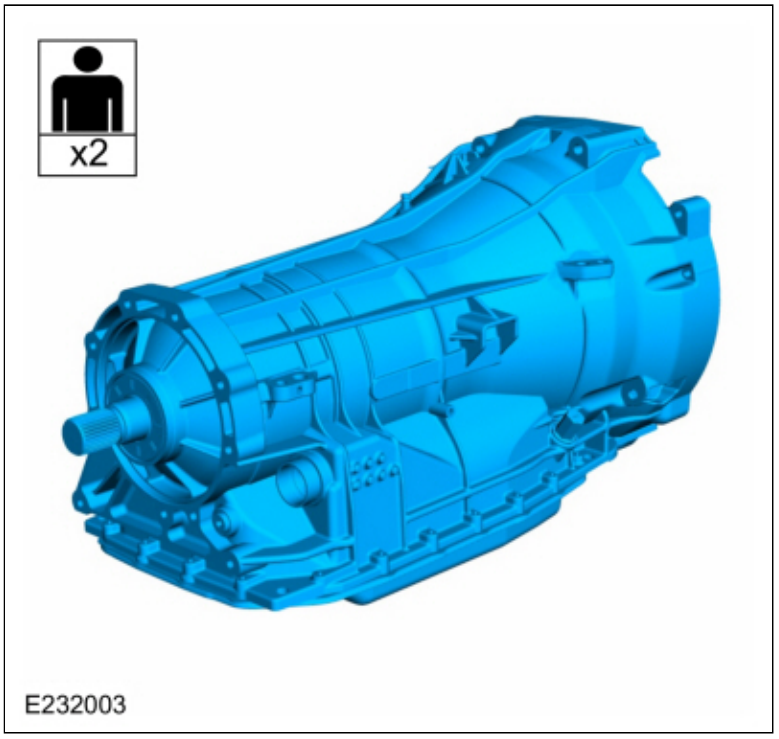


23. Slide the transmission back far enough to install the Torque Converter Retainer. Use Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



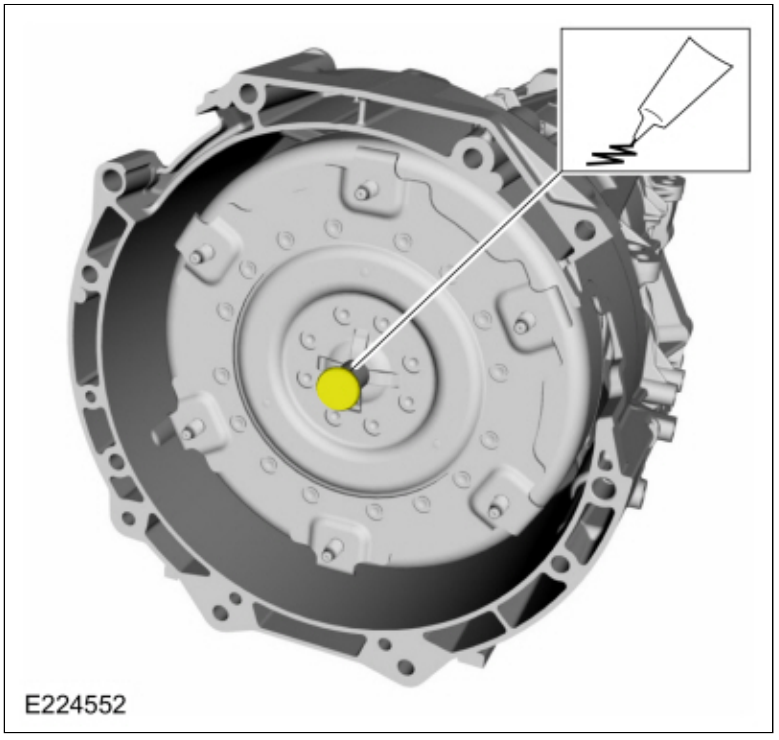
24. **NOTE:** *This step requires the aid of another technician.*

    Remove the transmission assembly from the vehicle.

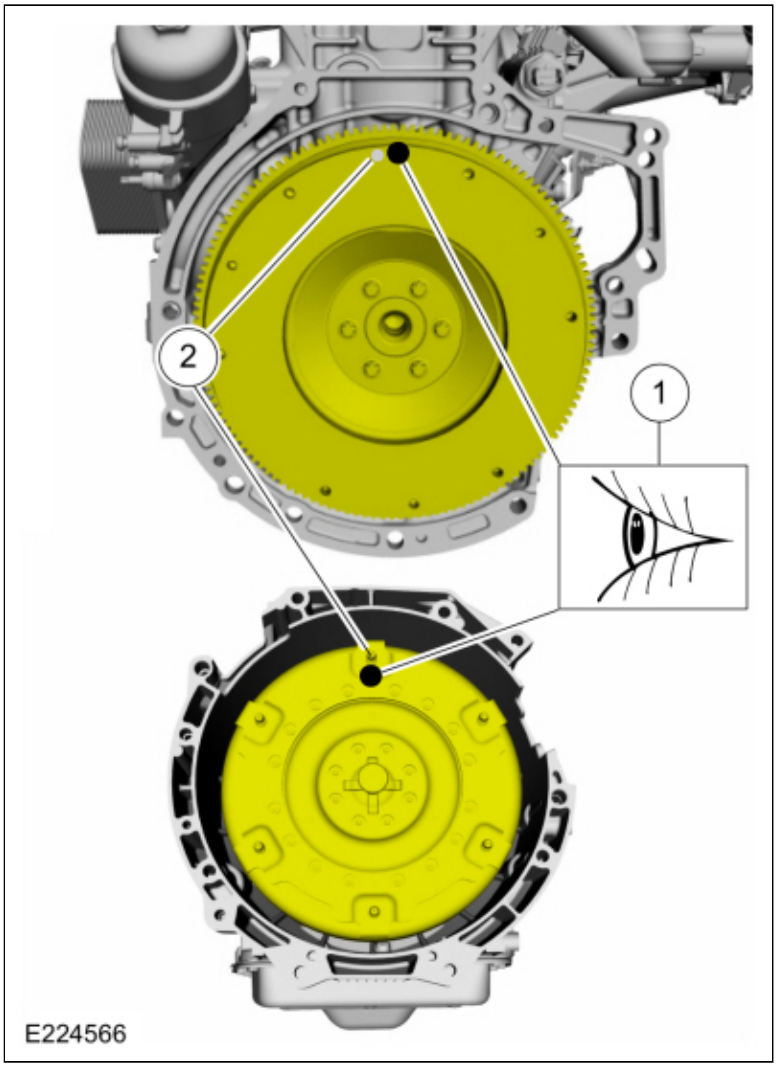


Installation

1. Lubricate the torque converter pilot hub with multipurpose grease.



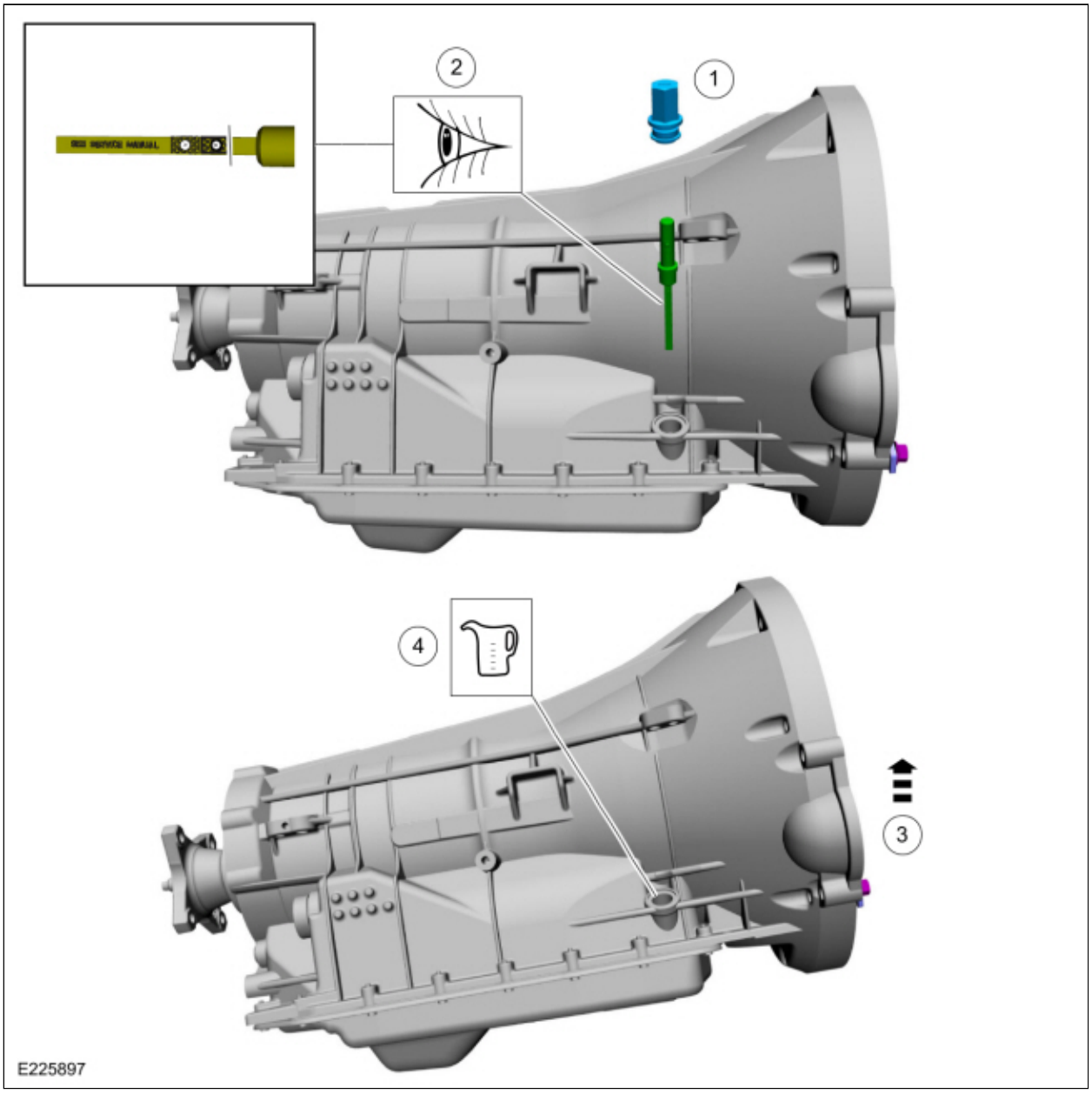
1. Inspect the torque converter stud and flexplate for paint marks.
2. Align the torque converter stud and flexplate hole near the paint marks to the 12 o'clock position.



3. **NOTICE: If a new transmission is installed, the fluid level must be checked after installation.**

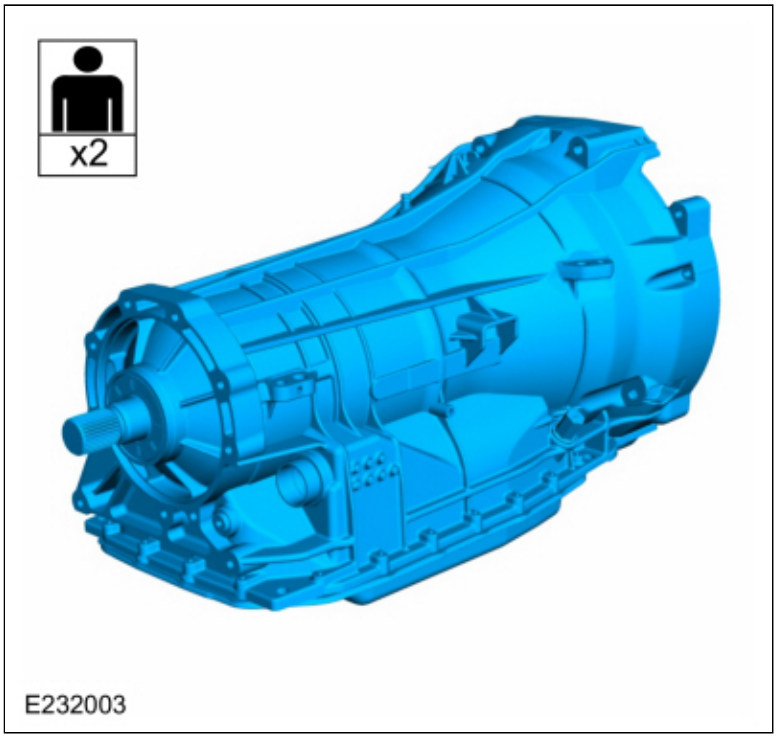
   NOTE: *If transmission was disassembled, add transmission fluid to the transmission.*

   1. Remove the transmission fluid fill plug transmission fluid level indicator assembly.
      Torque: 26 Nm
   2. Verify transmission is filled with transmission fluid.
   3. Slightly tilt the transmission rearward.
   4. Refer to: Transmission Fluid Drain and Refill (307-01A) .

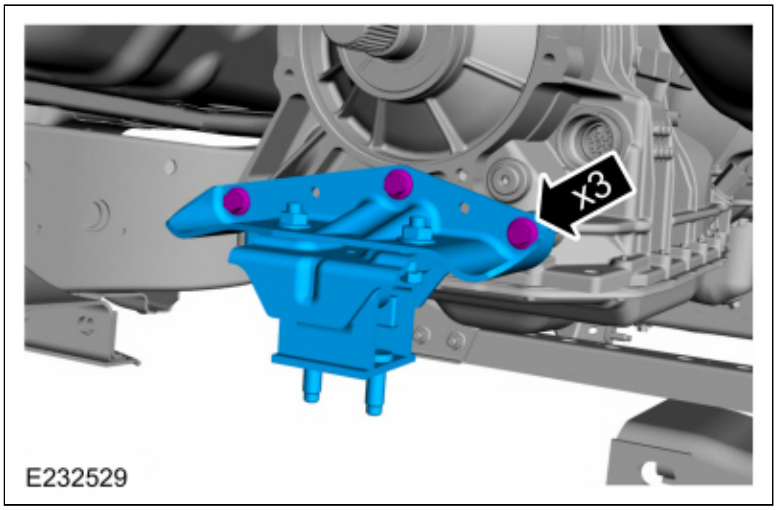


4. **NOTE:** *This step requires the aid of another technician.*

    1. Position the transmission assembly on jack.
       Use the General Equipment: Transmission Jack
    2. Secure the transmission to the transmission jack with a safety strap.



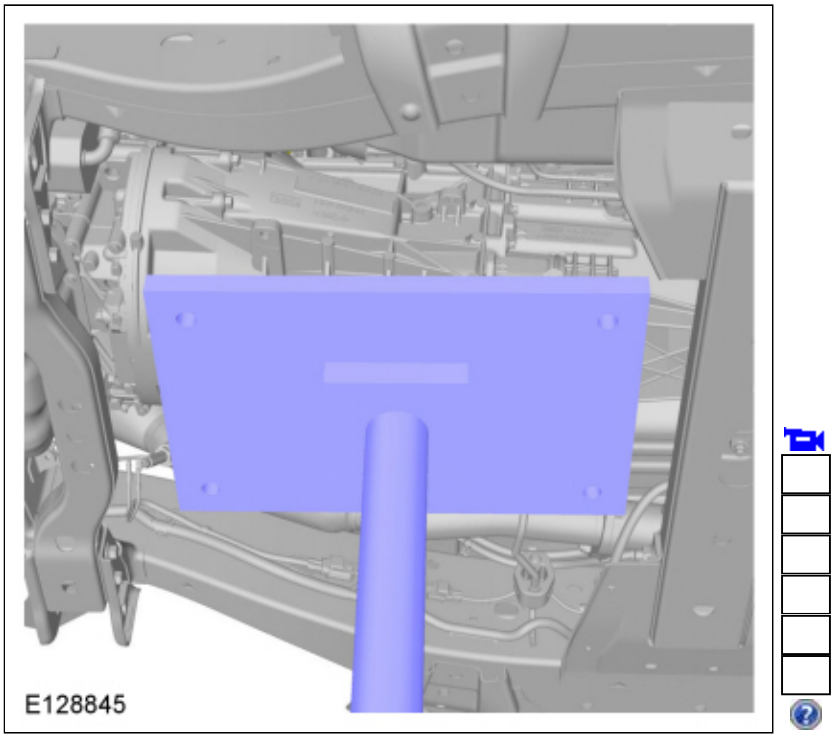
5. *Torque*: 48 Nm



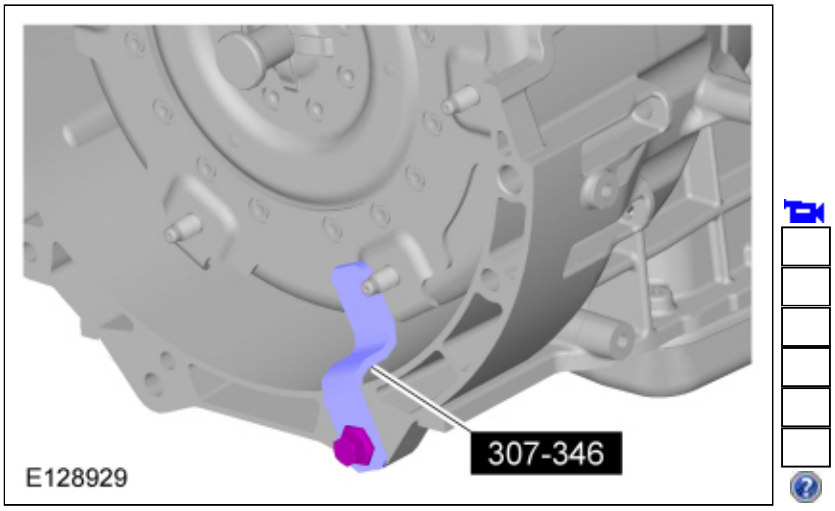
6. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

   NOTE: *Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.*

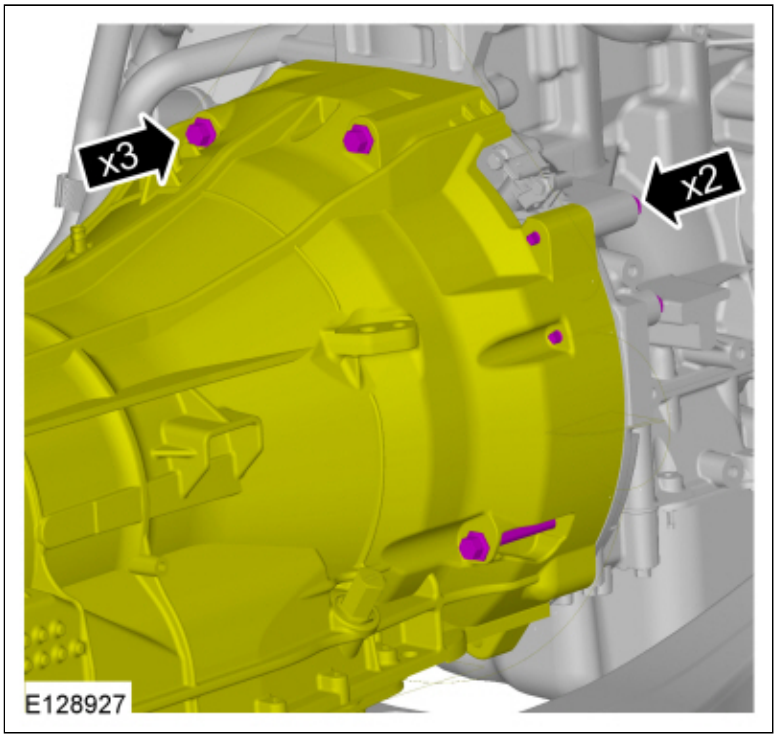
   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.
   Use the General Equipment: Transmission Jack



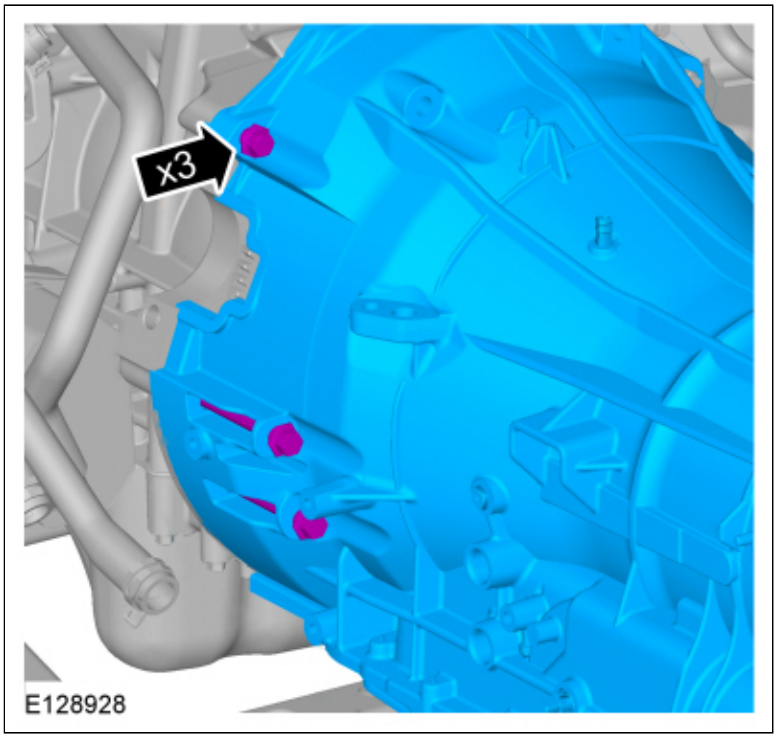
7. Remove Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



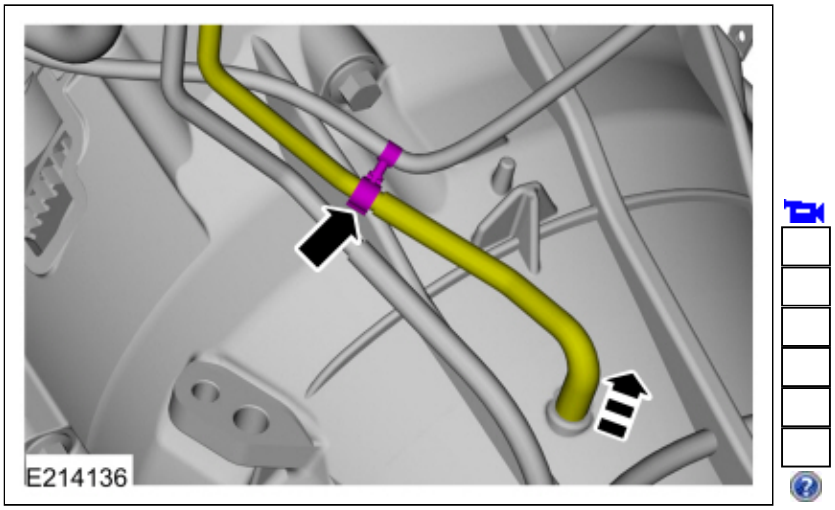
8. *Torque*: 48 Nm



9. *Torque*: 48 Nm

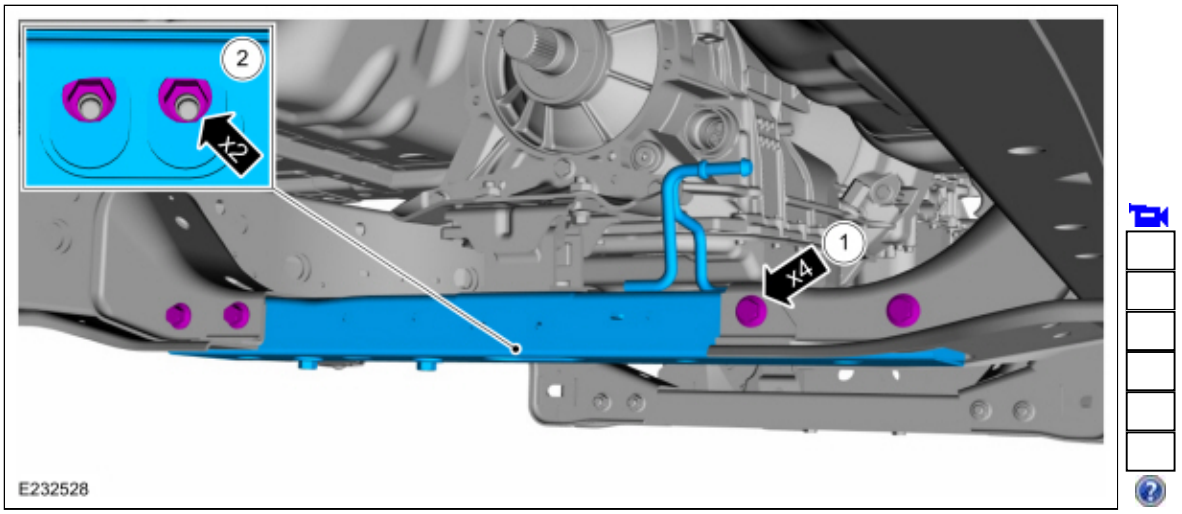


10.

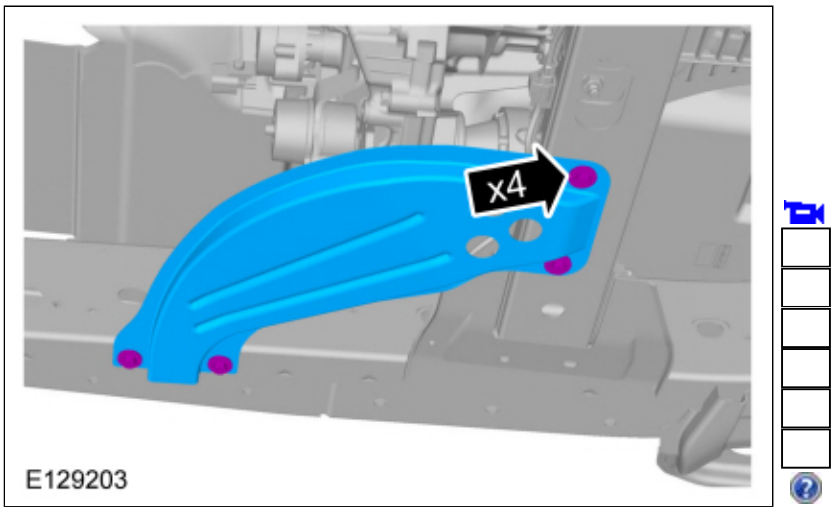


11. **NOTE:** *Install all the bolts and nuts finger tight before final tightening.*

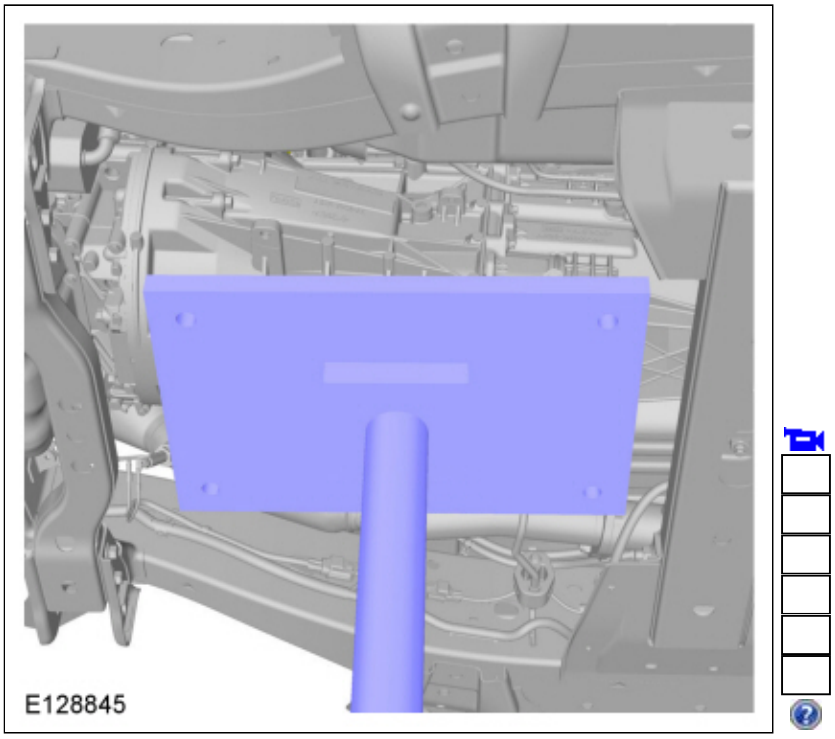
    Torque:
    1: 90 Nm
    2: 90 Nm



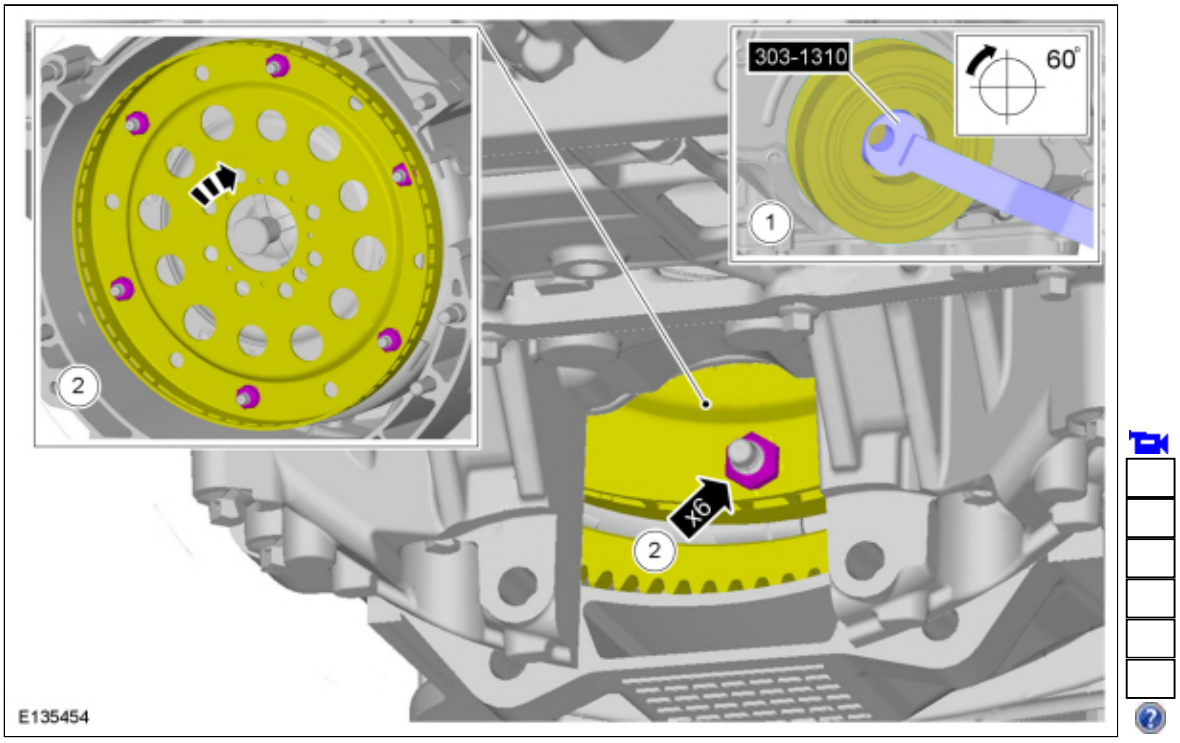
12. If equipped.
    Torque: 48 Nm



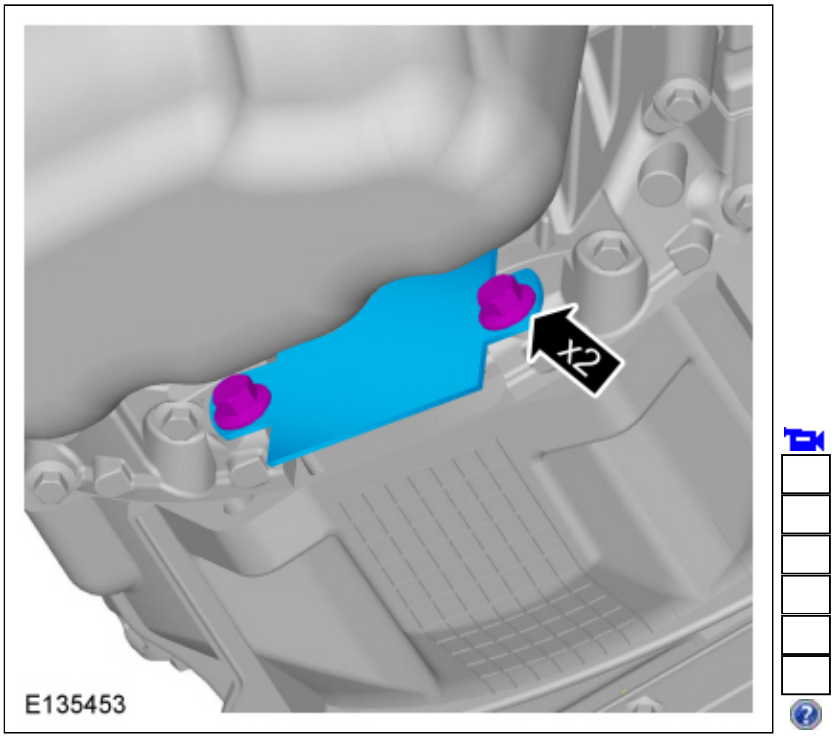
13. Remove the transmission jack.



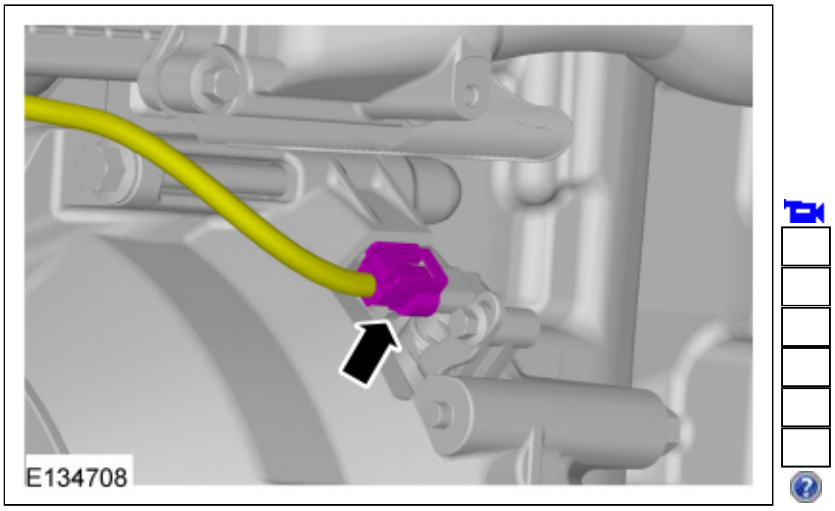
14. Remove Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
    Torque: 48 Nm



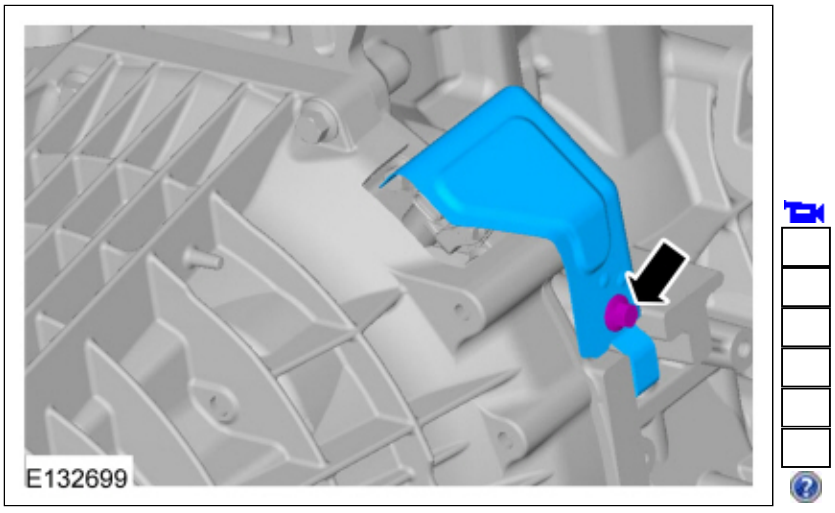
15. *Torque*: 48 Nm



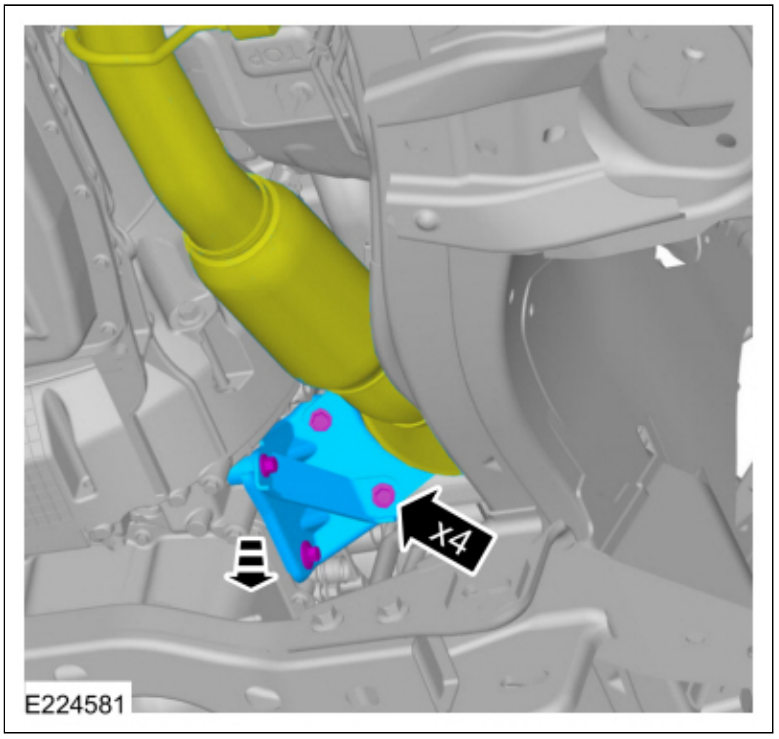
16.



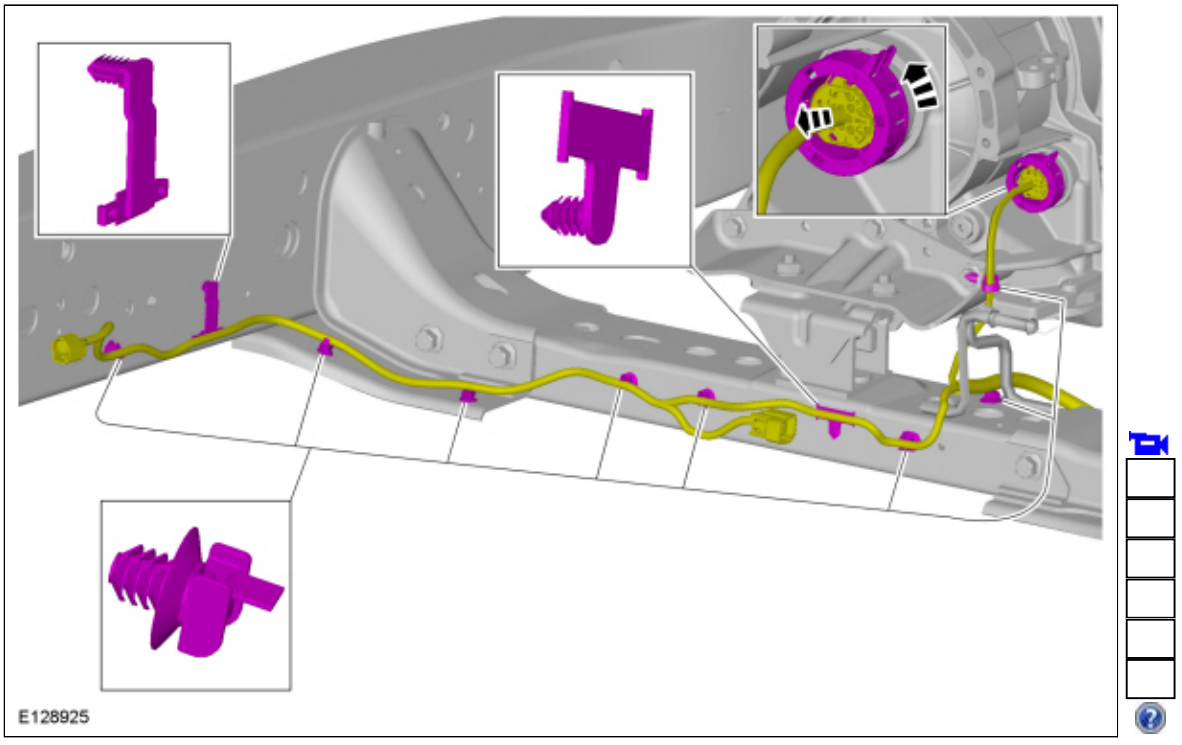
17. *Torque*: 25 Nm



18. *Torque*: 25 Nm



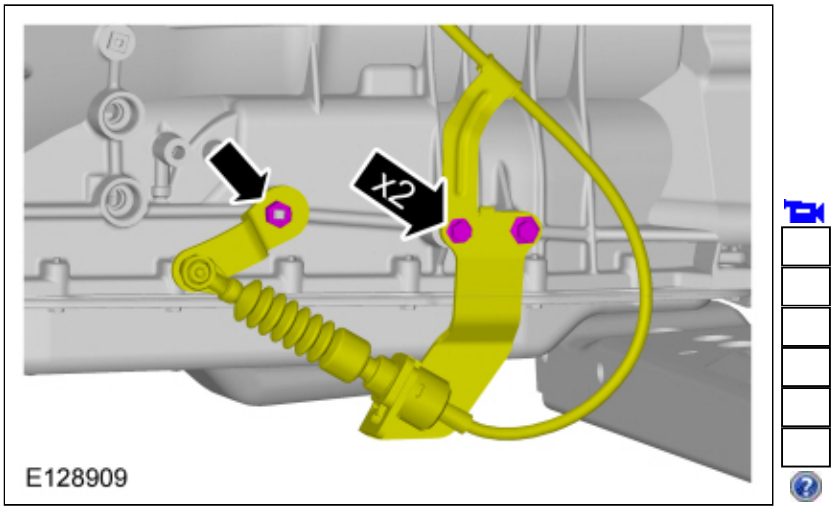
19.



20. **NOTICE: Take extra care when handling selector lever cable.**

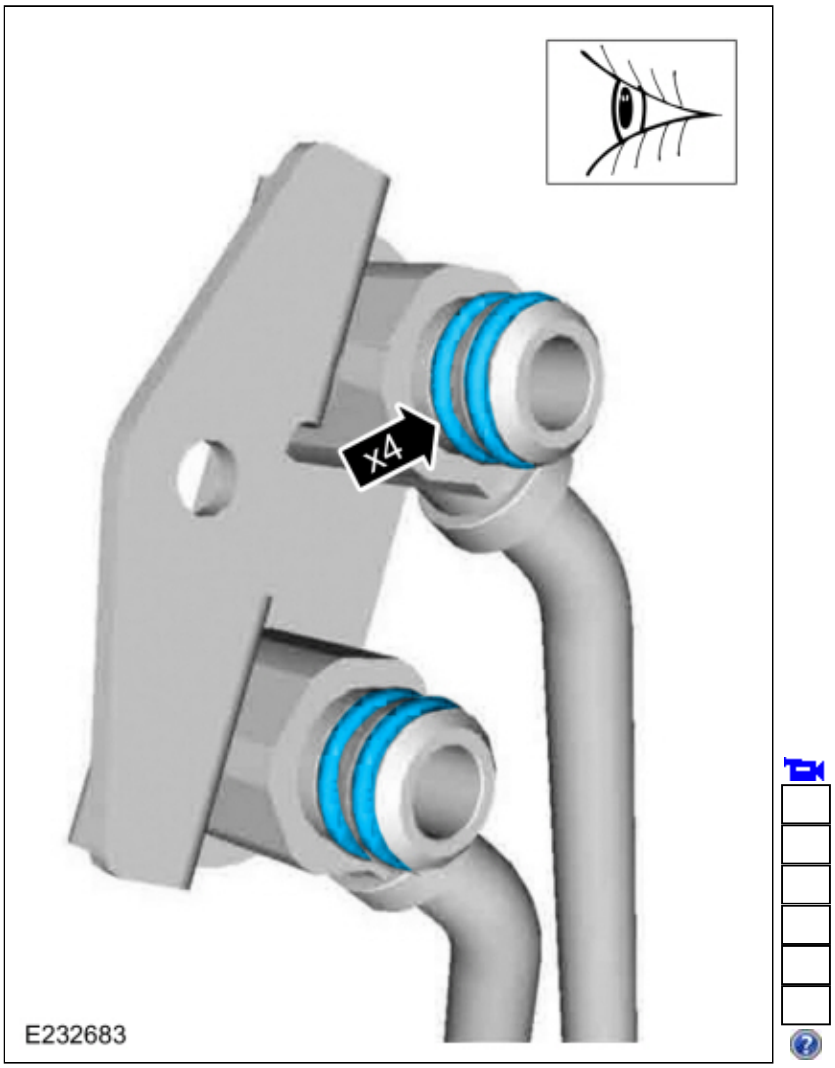
NOTE: *Make sure that the component is installed to the position noted before removal.*

Torque: 25 Nm

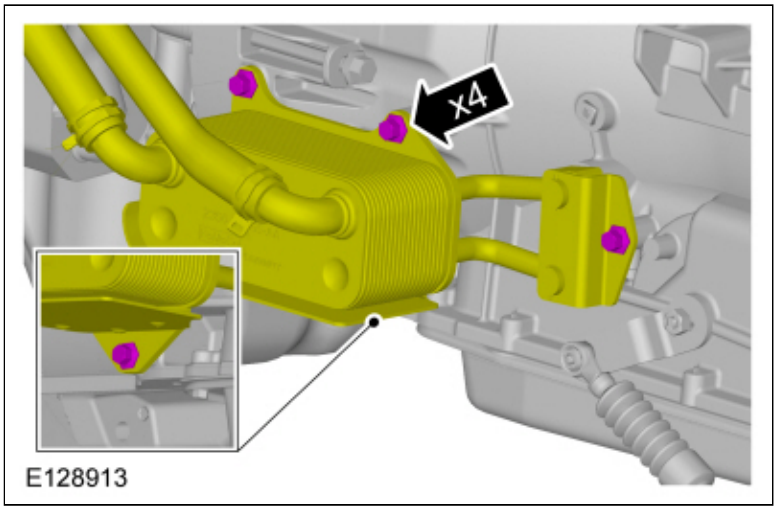


21. **NOTE:** *Make sure that a new component is installed if the O-ring is damaged.*

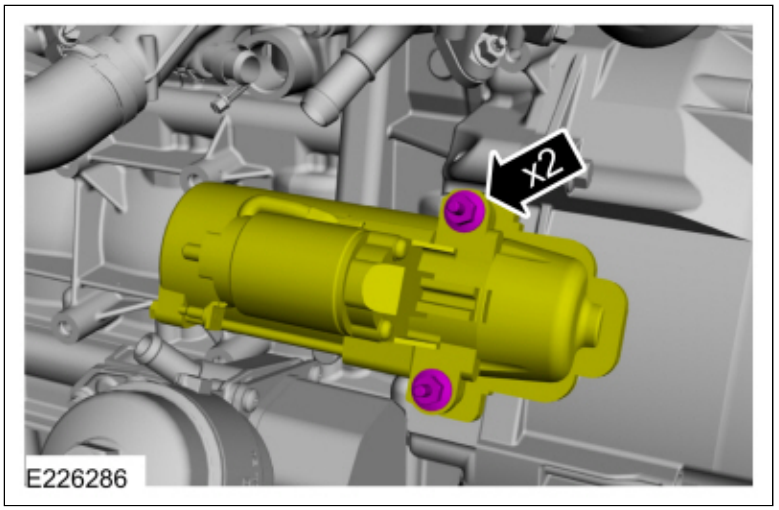
    NOTE: *Inspect the case to make sure that the old transmission fluid cooler tube O-rings are not stuck in the case.*



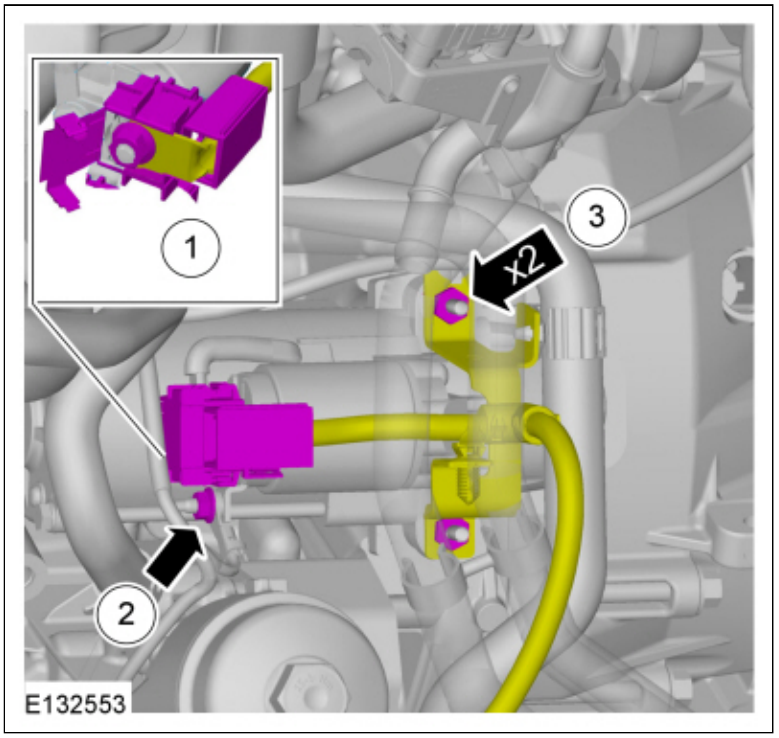
22. *Torque*: 20 Nm



23. *Torque*: 35 Nm

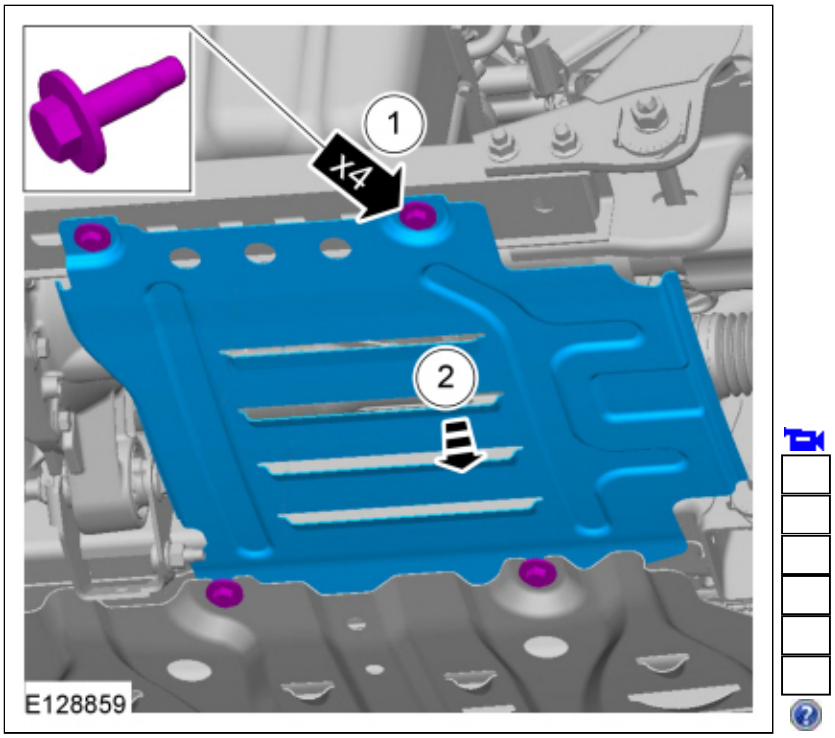


24. *Torque*:
    1: 10 Nm
    2: 10 Nm
    3: 10 Nm



25. Install the rear driveshaft.
    Refer to: Driveshaft (205-01) .

26. *Torque*: 30 Nm



27. Connect the battery ground cable.
    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .

28. Verify that the selector lever cable is correctly adjusted.
    Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

29. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.

30. If a new transmission or a new main control was installed, the solenoid body strategy must be updated.
    Refer to: Transmission Strategy Download (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).

31. If the transmission was overhauled, the adaptive drive cycle must be updated.
    Refer to: Adaptive Learning Drive Cycle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) .

32. Program the TCM with the latest calibration.

33. While driving the vehicle, use the scan tool to verify that the TFT has reached a temperature of 96.7ºC-102ºC (206ºF-215ºF). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.

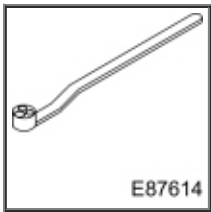
34. Check the transmission fluid level.
    Refer to: Transmission Fluid Level Check (307-01A) .

Copyright © 2016 Ford Motor Company

Transmission - LHD 4WD/RHD 4WD

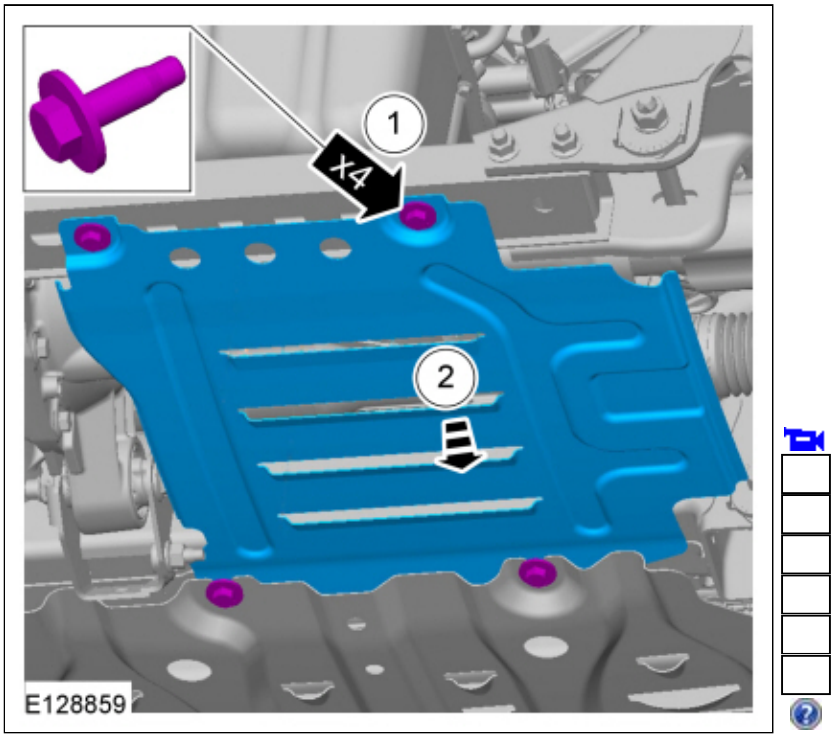
Base Part Number: 7000

Special Tool(s) / General Equipment

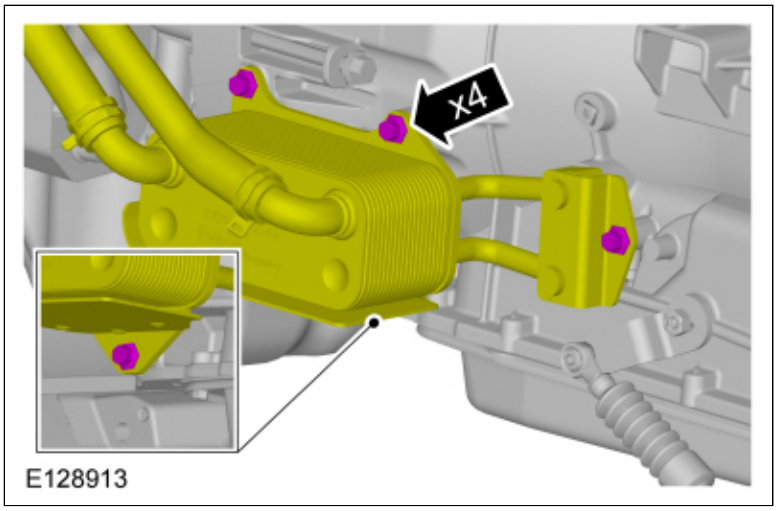
 E87614	303-1310 Holding Wrench, Crankshaft
 307-346	307-346 (T97T-7902-A) Retainer, Torque Converter
Transmission Jack	

Removal

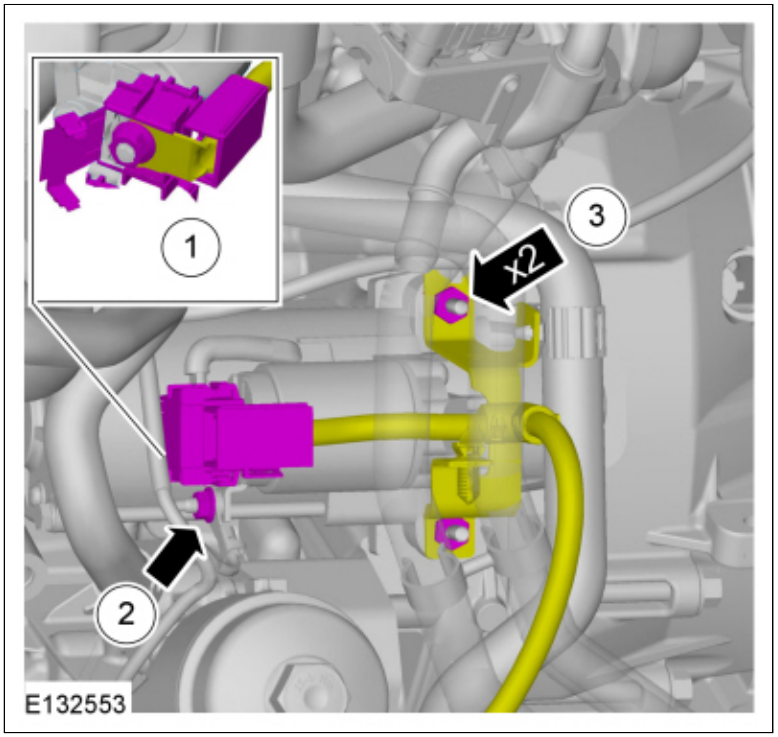
1. Remove the battery negative terminal.
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Remove the front driveshaft.
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
4. Remove the rear driveshaft.
   Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
5. Drain the transmission fluid.
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
6.



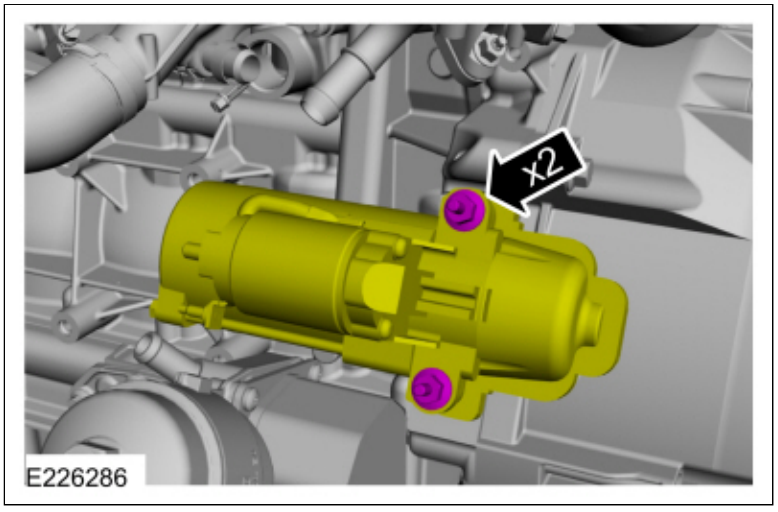
7. **NOTE:** *Be prepared to collect escaping fluid.*



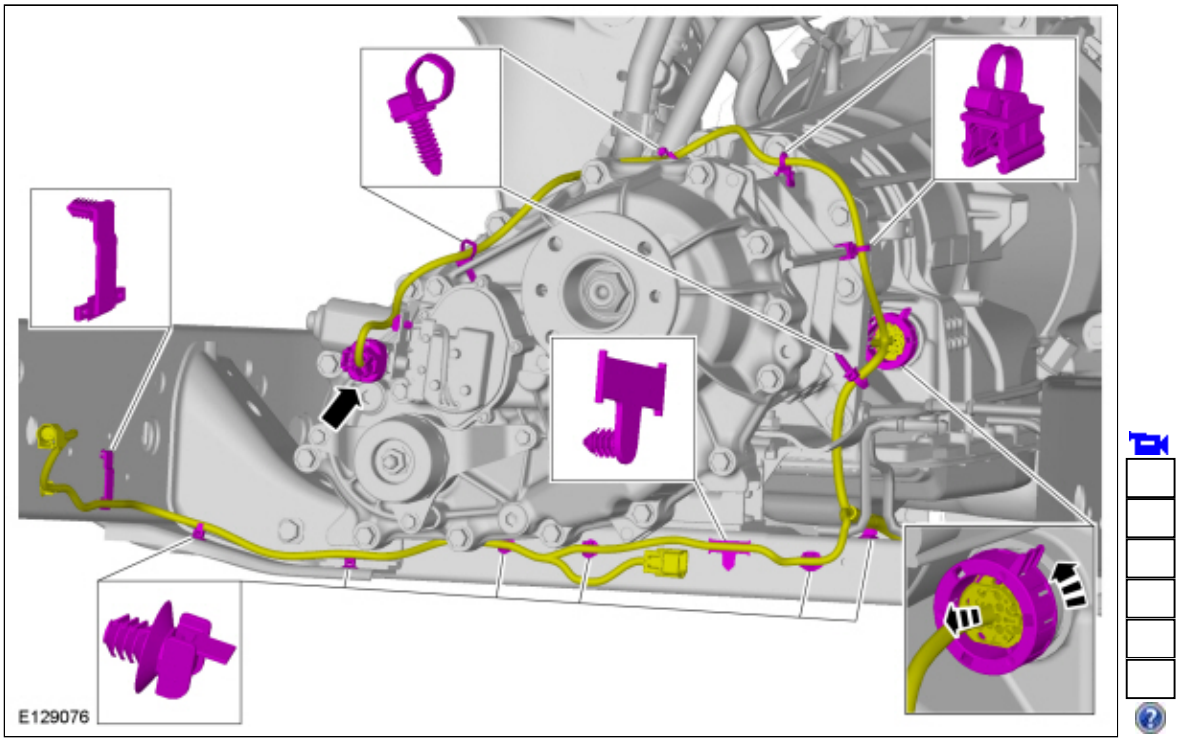
8.



9.

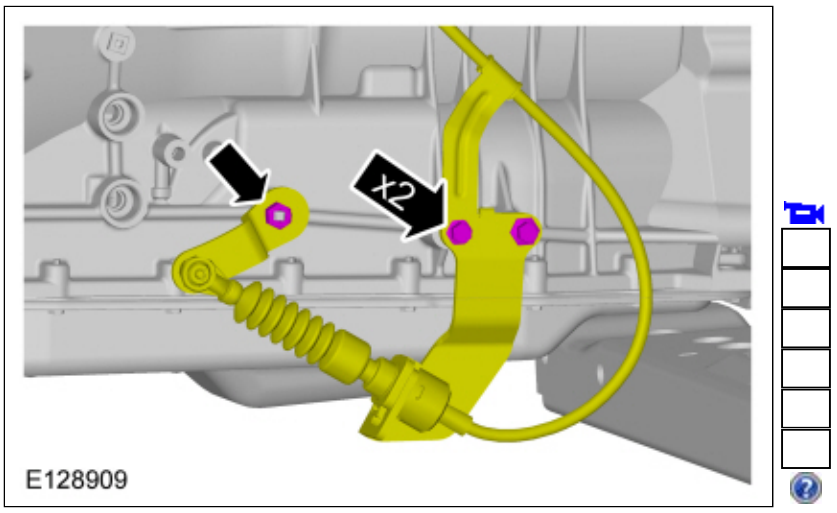


10.

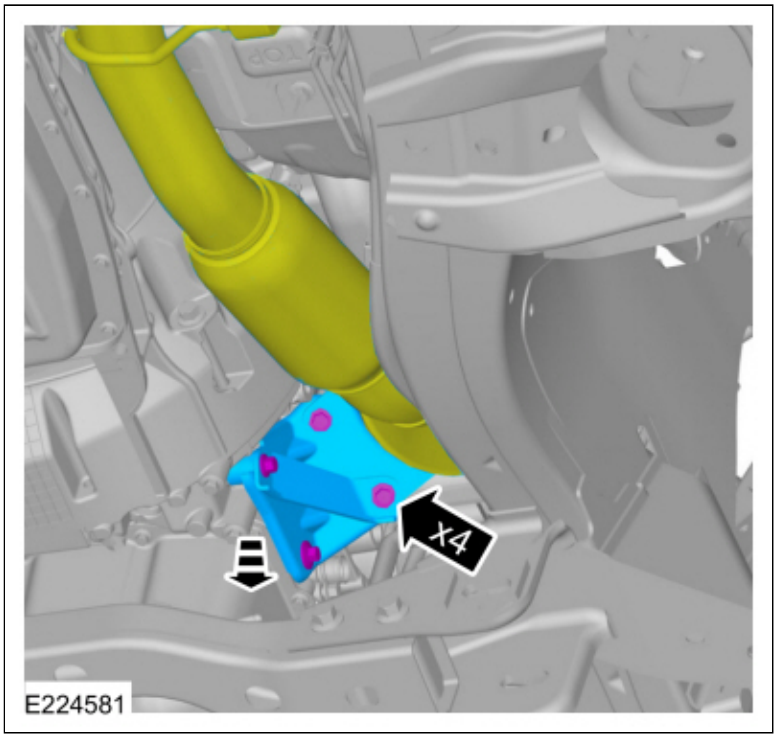


11. **NOTICE: Take extra care when handling selector lever cable.**

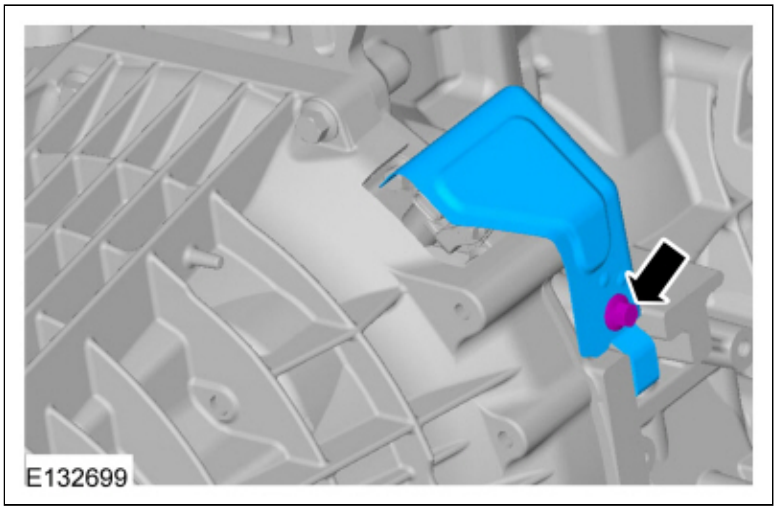
    NOTE: *Note the position of the component before removal.*



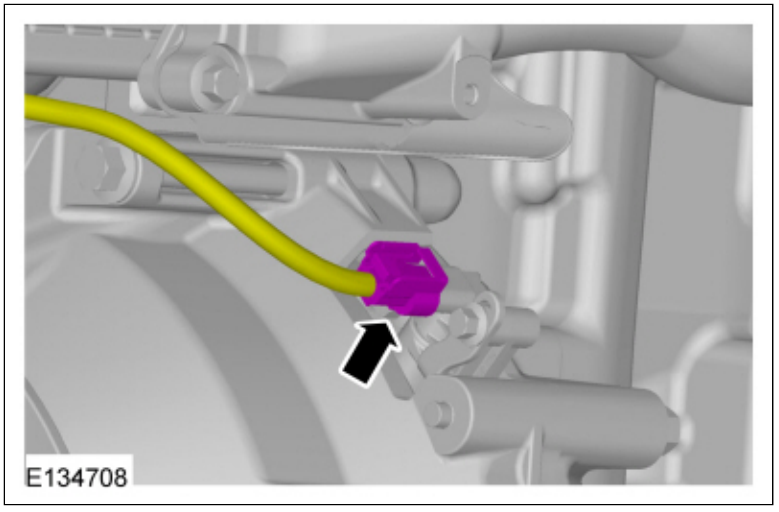
12.



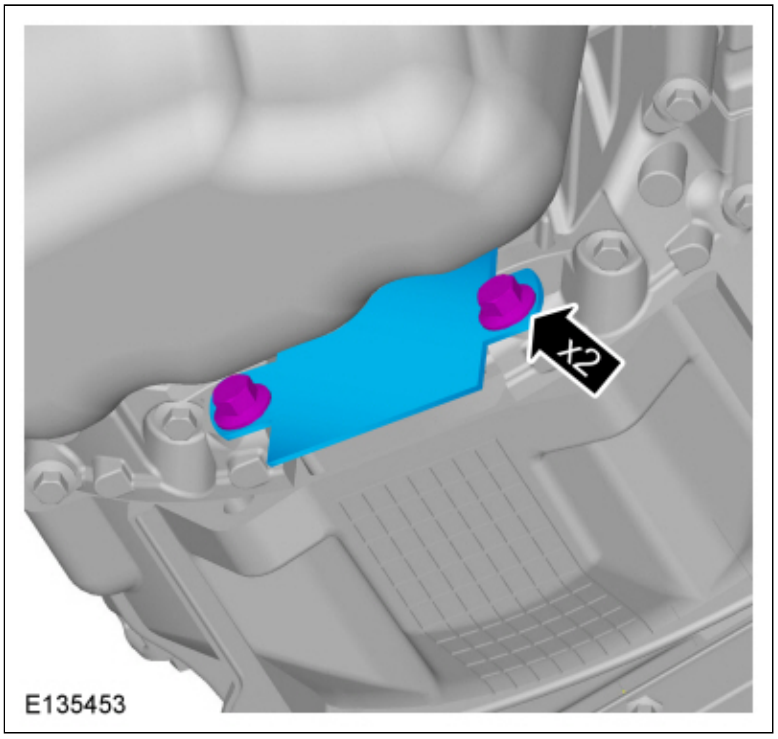
13.



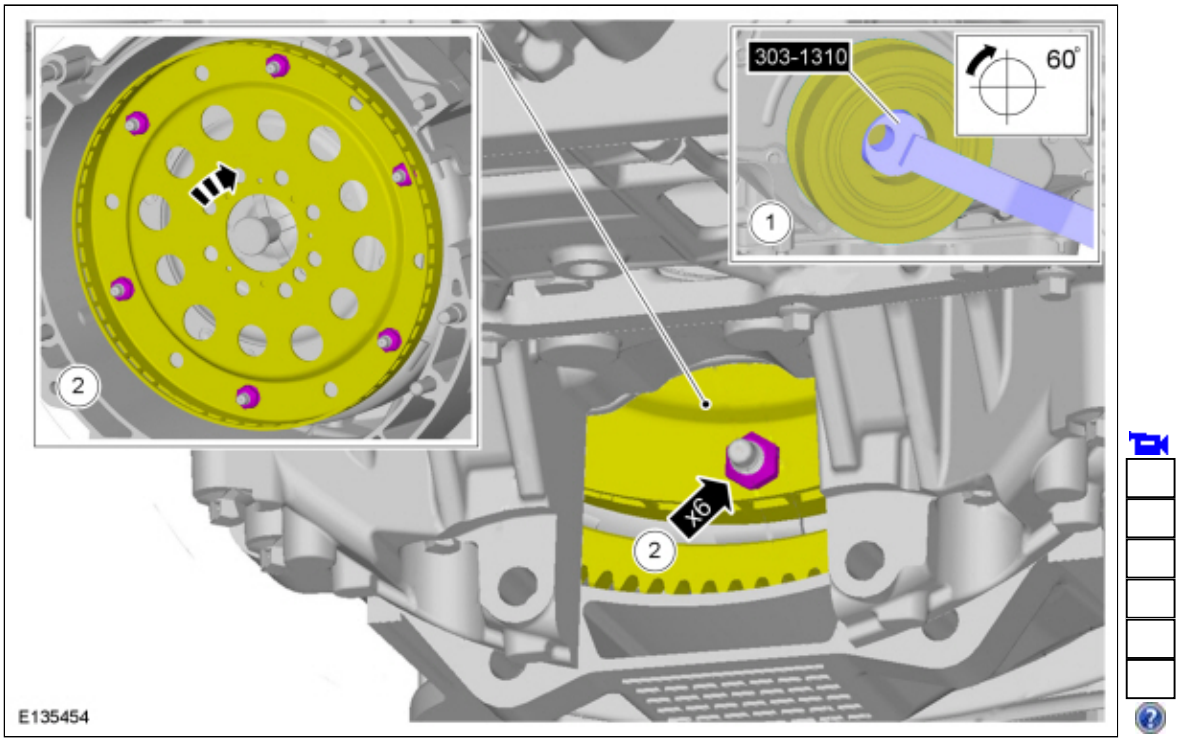
14.



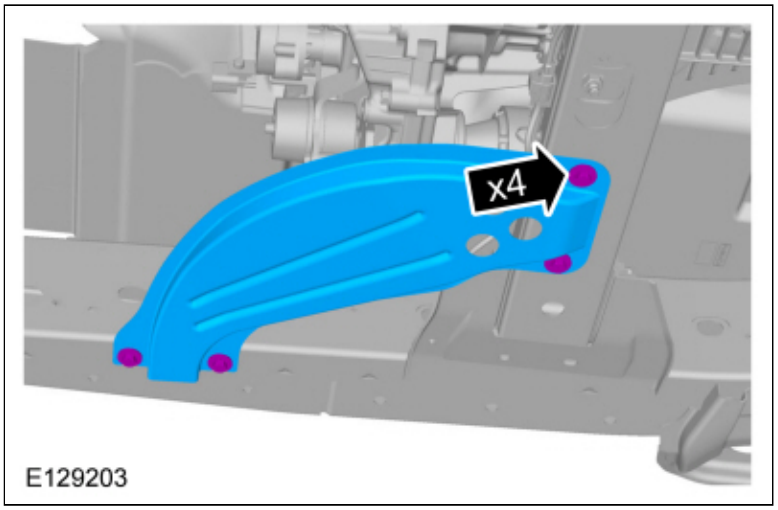
15.



16. Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.

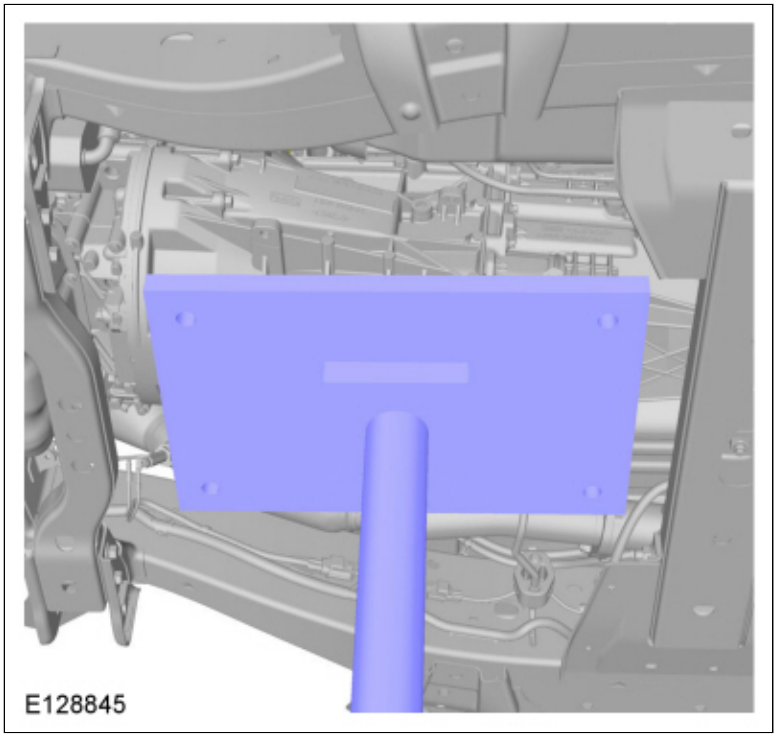


17. If equipped.

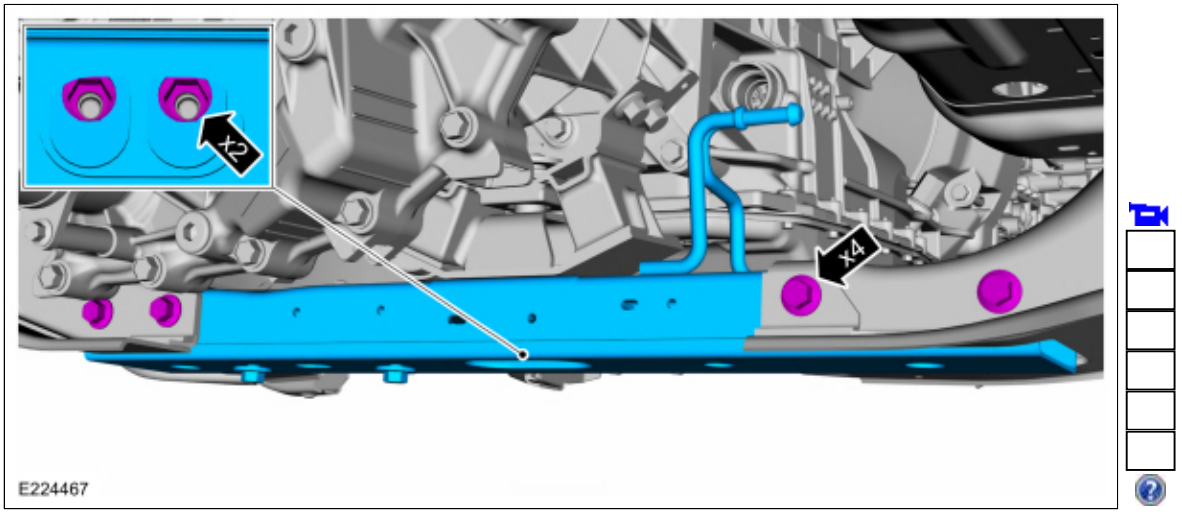


18. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

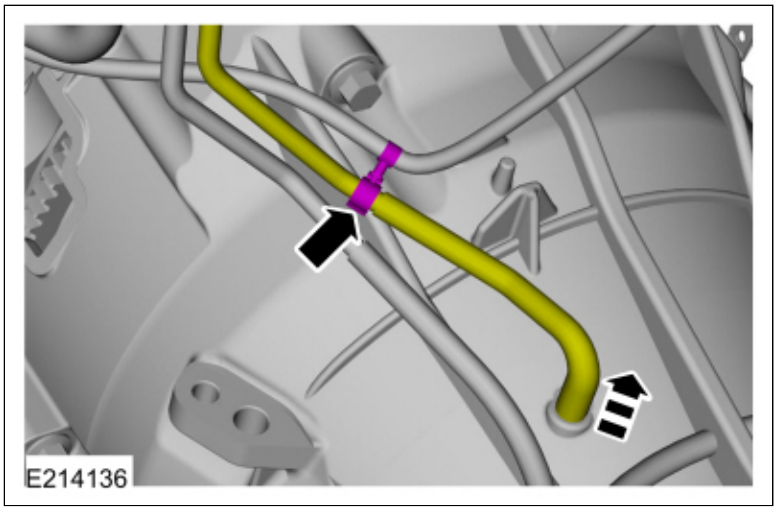
    Use the General Equipment: Transmission Jack



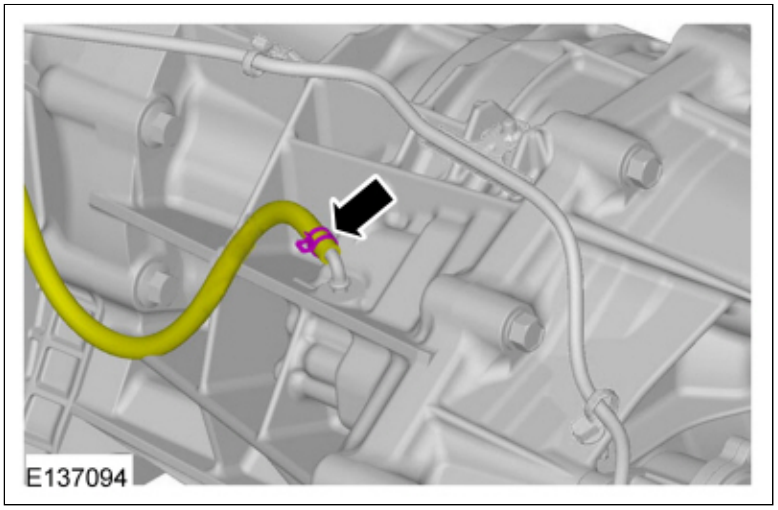
19.



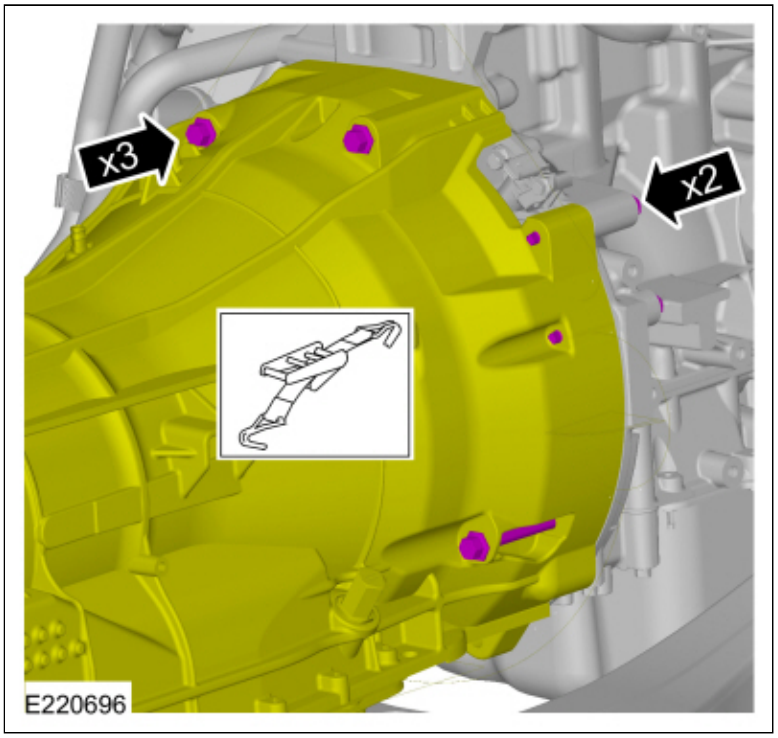
20.



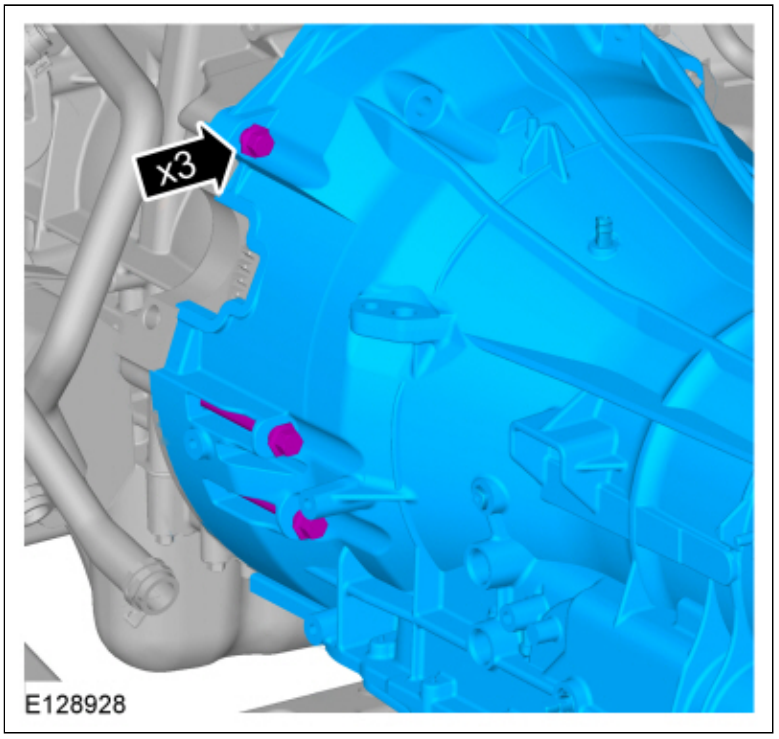
21.



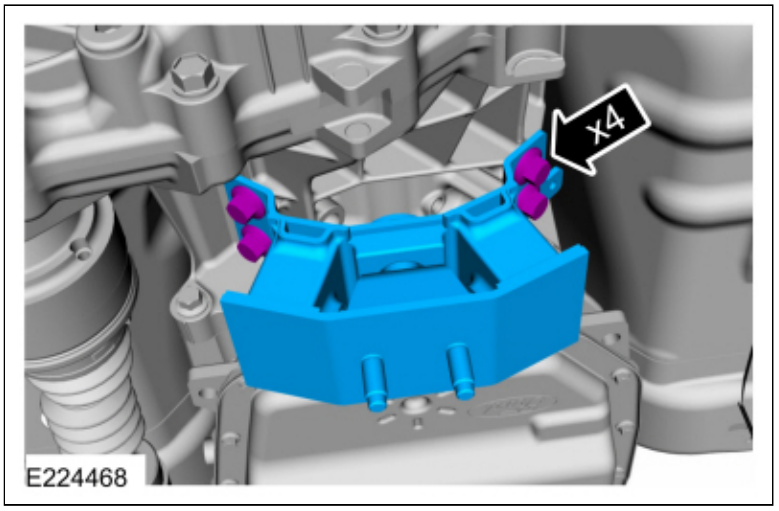
22.



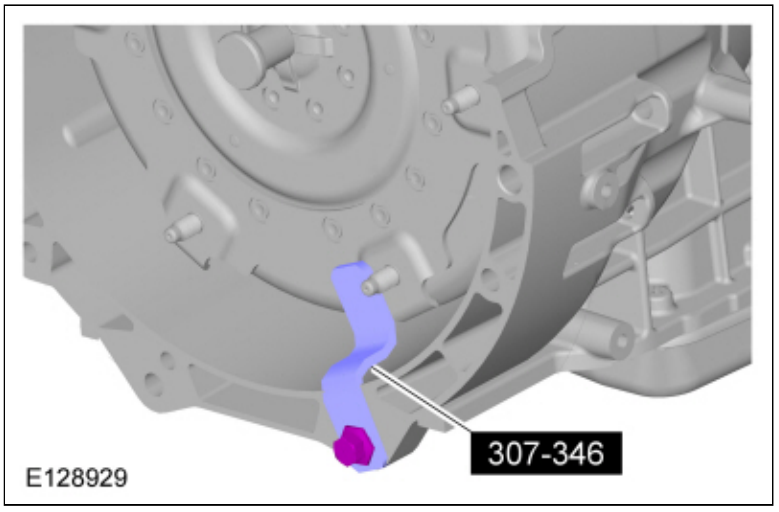
23.



24.

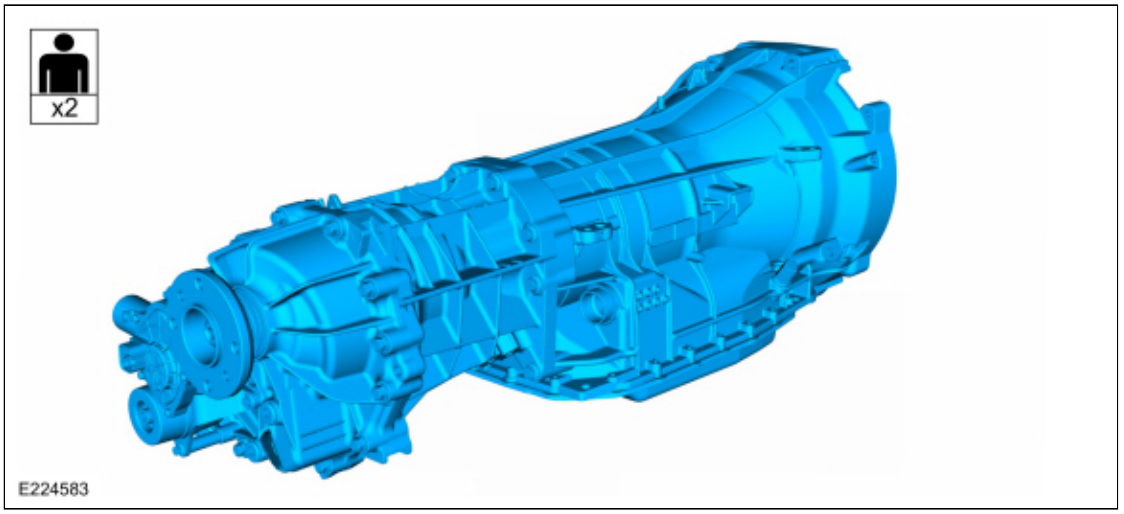


25. Slide the transmission back far enough to install the Torque Converter Retainer.
Use Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



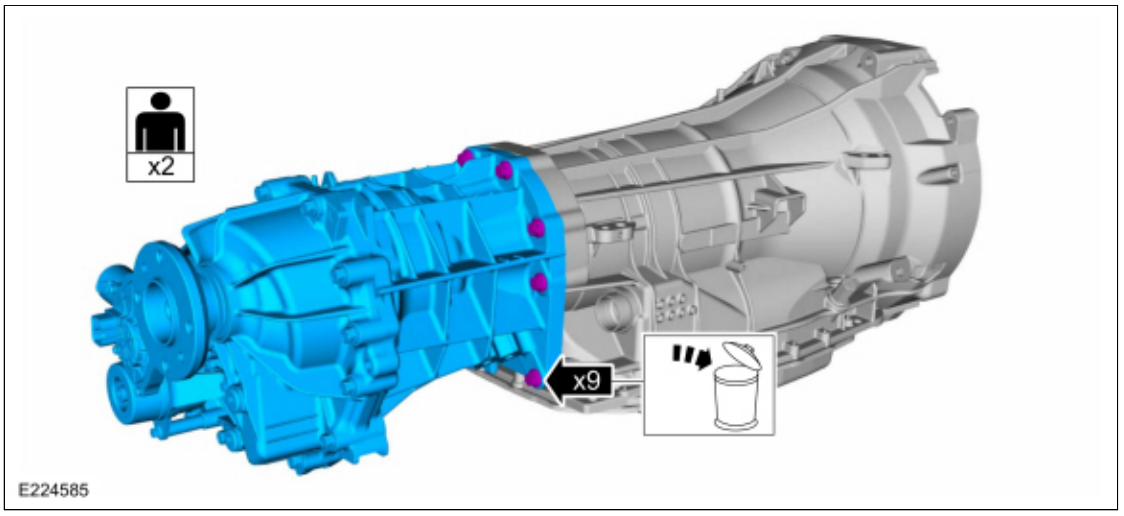
26. **NOTE:** *This step requires the aid of another technician.*

Remove the transmission and transfer case assembly from the vehicle.



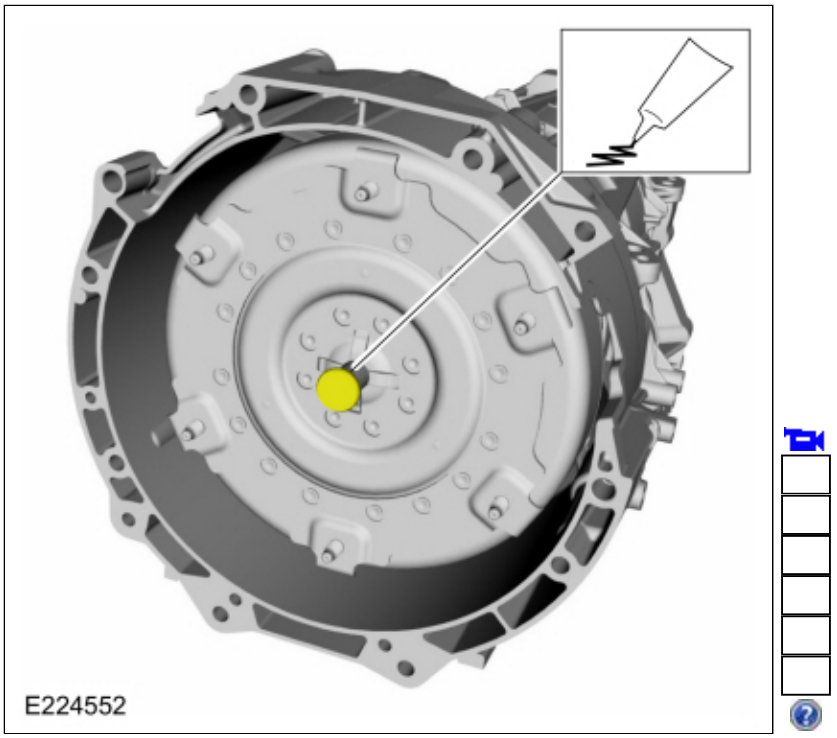
27. **NOTE:** *This step requires the aid of another technician.*

    Separate the transfer case assembly from the transmission and remove the transmission jack.

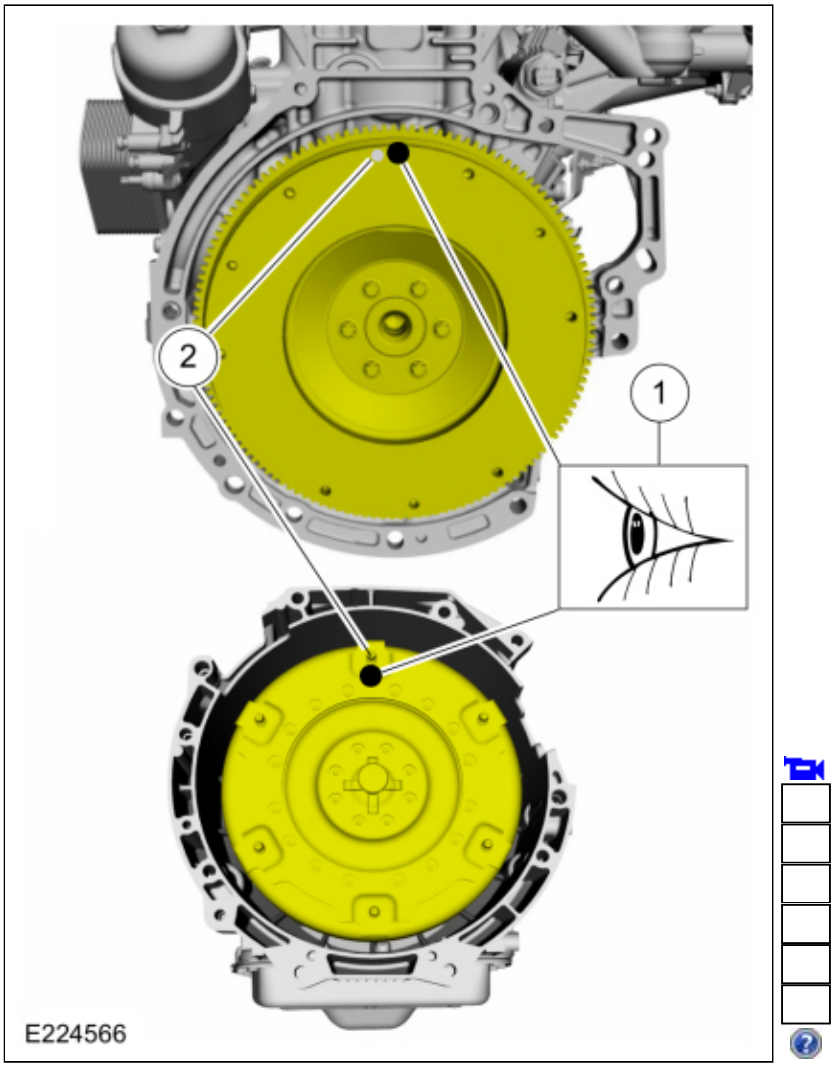


Installation

1. Lubricate the torque converter pilot hub with multipurpose grease.



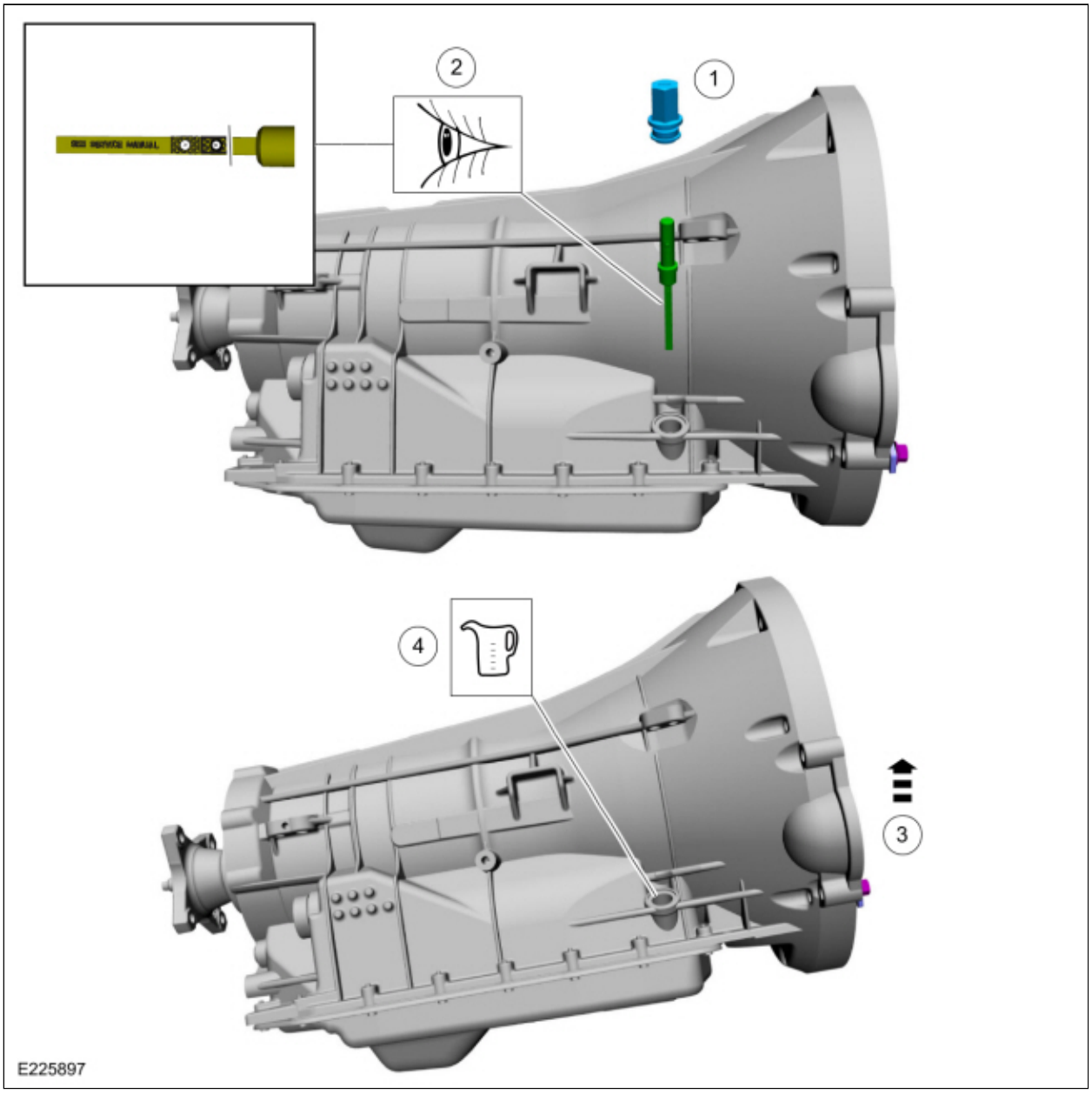
1. Inspect the torque converter stud and flexplate for paint marks.
2. Align the torque converter stud and flexplate hole near the paint marks to the 12 o'clock position.



3. **NOTICE: If a new transmission is installed, the fluid level must be checked after installation.**

   NOTE: *If transmission was disassembled, add transmission fluid to the transmission.*

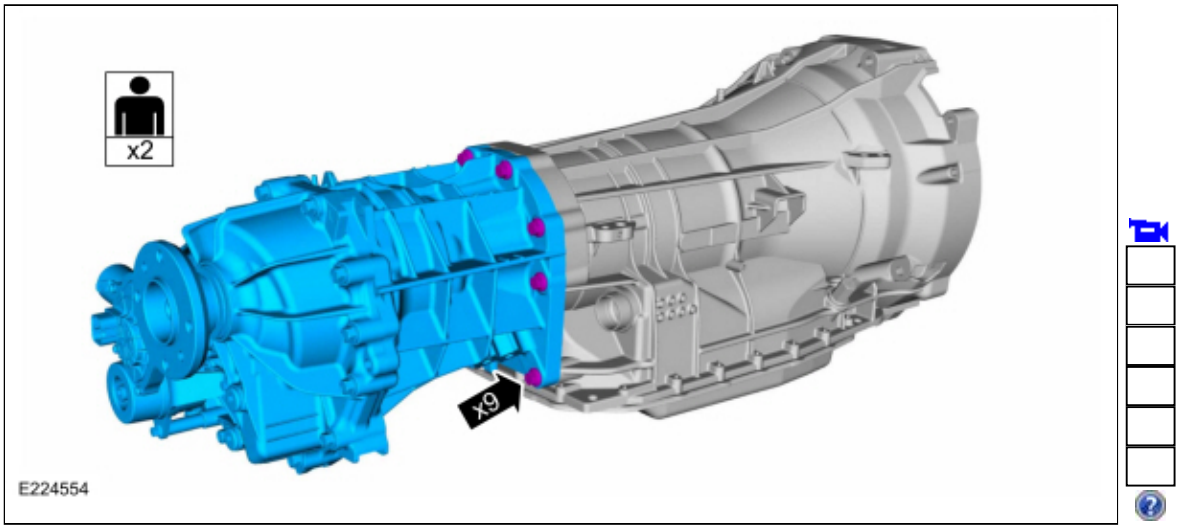
   1. Remove the transmission fluid fill plug transmission fluid level indicator assembly.
      Torque: 26 Nm
   2. Verify transmission is filled with transmission fluid.
   3. Slightly tilt the transmission rearward.
   4. Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).



4. **NOTE:** *This step requires the aid of another technician.*

   NOTE: *Make sure that new bolts are installed.*

   Torque: 48 Nm

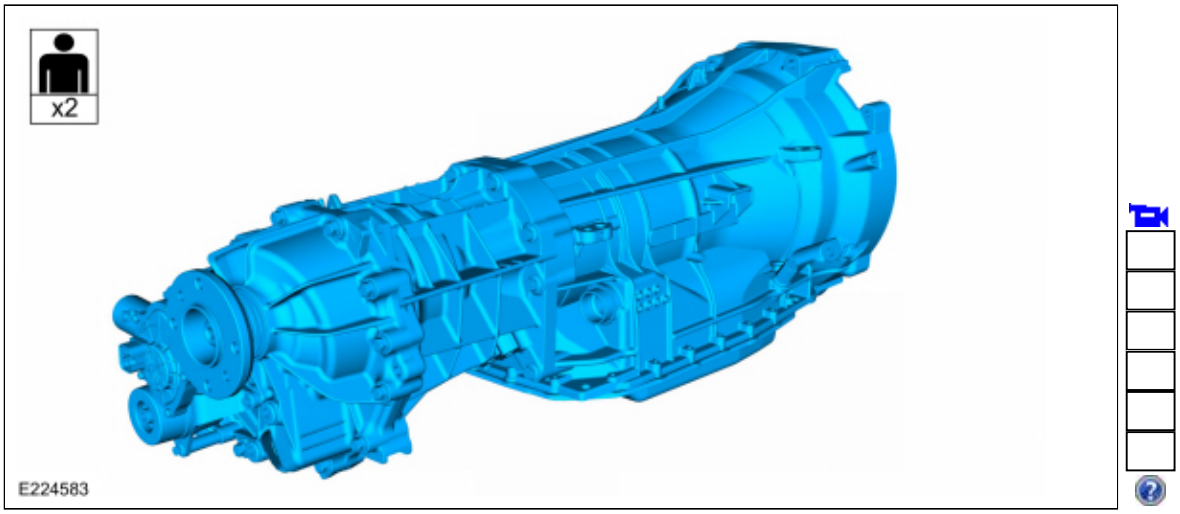


5. **NOTE:** *This step requires the aid of another technician.*

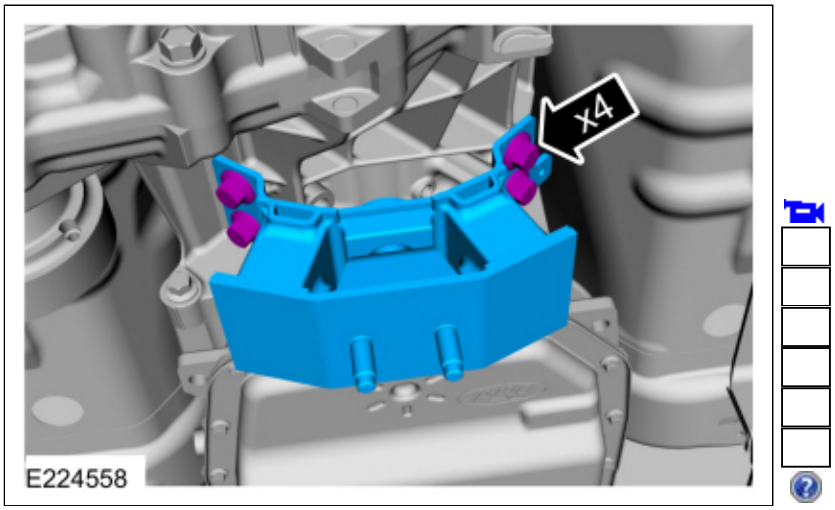
   1. Position the transmission assembly on jack.

Use the General Equipment: Transmission Jack

2. Secure the transmission to the transmission jack with a safety strap.



6. *Torque*: 90 Nm

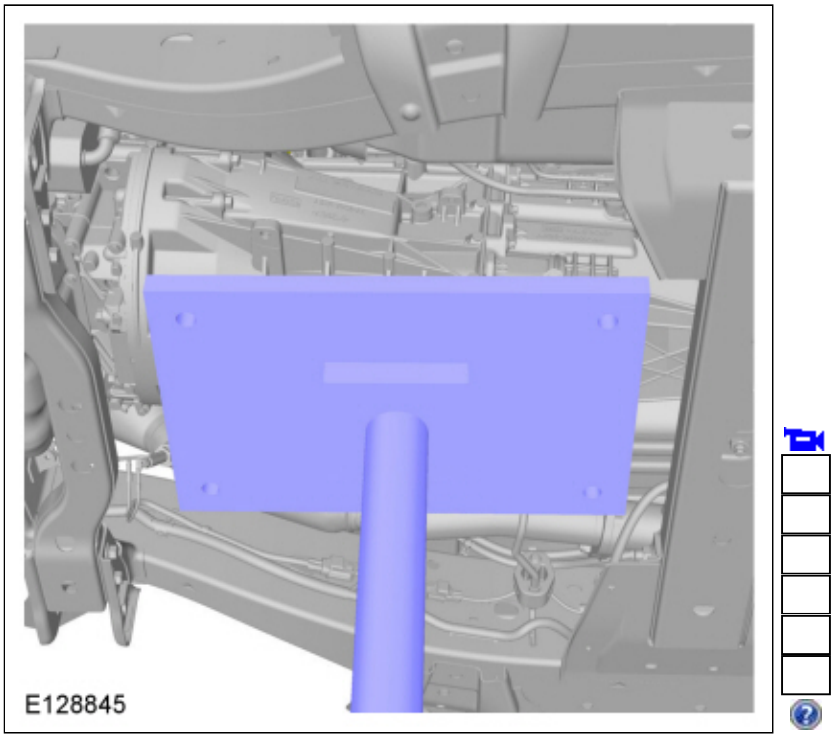


7. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

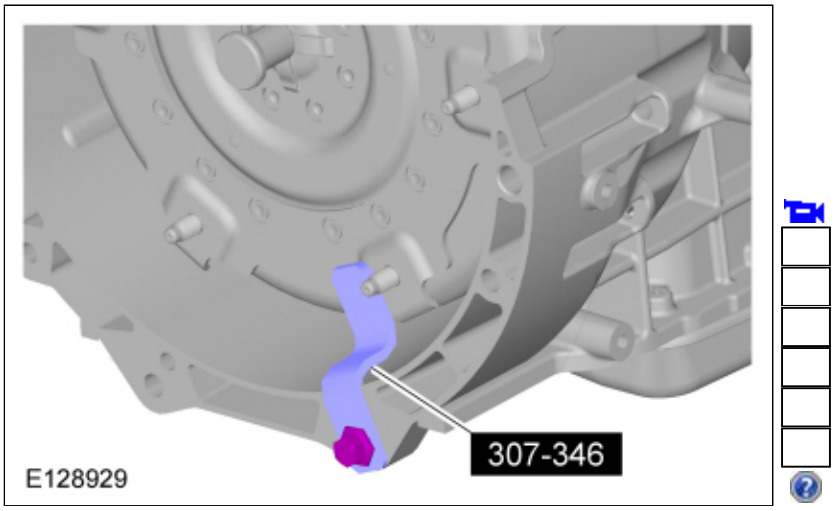
   NOTICE: The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.

   NOTE: *Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.*

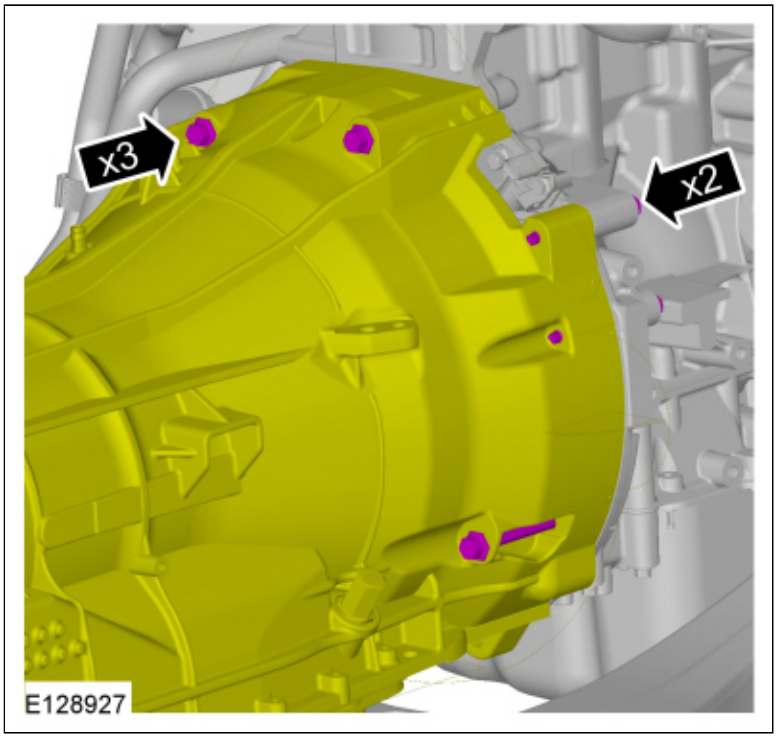
   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.



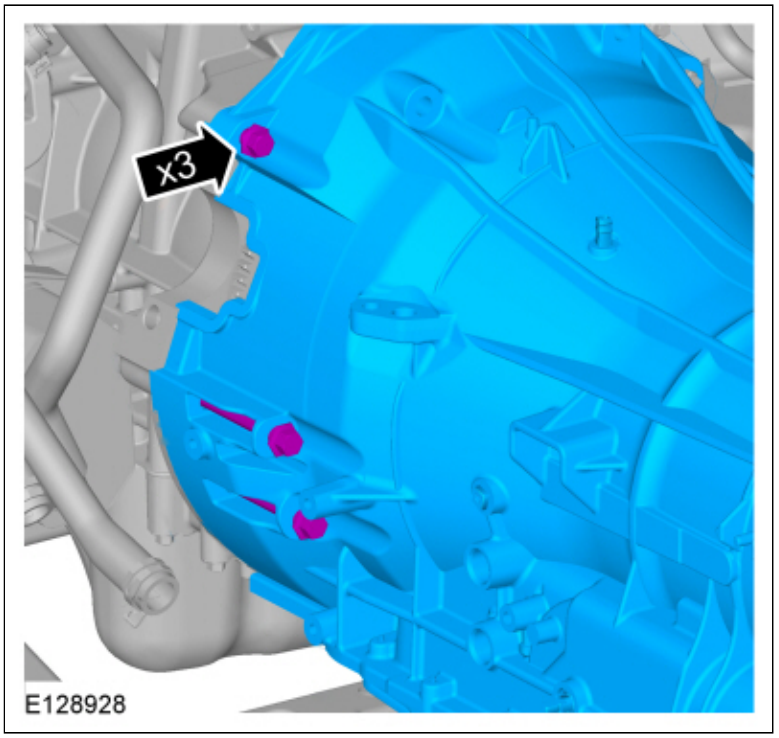
8. Remove Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



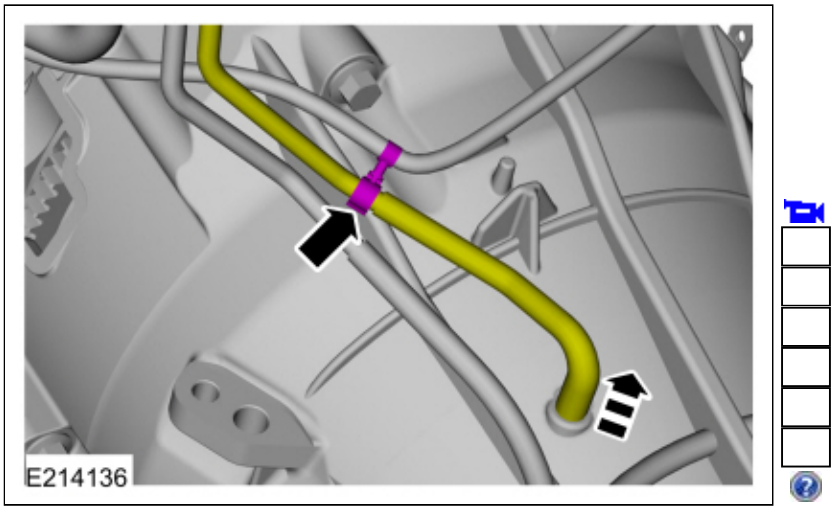
9. *Torque*: 48 Nm



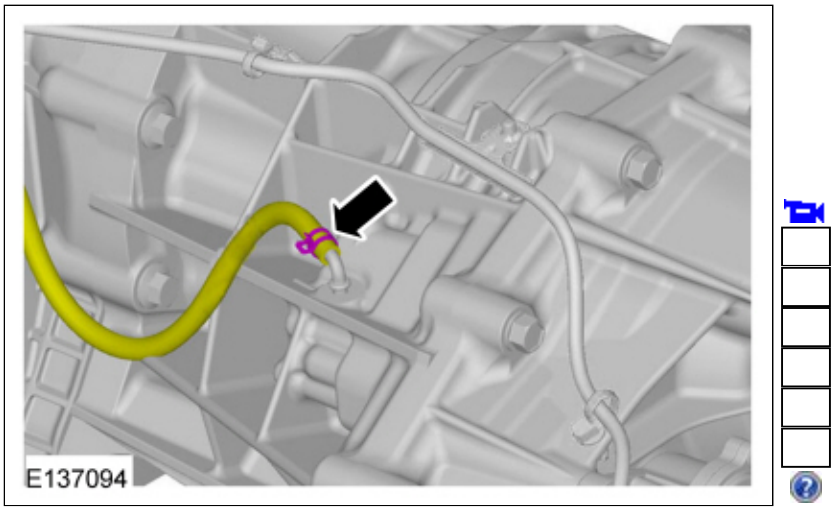
10. *Torque*: 48 Nm



11.

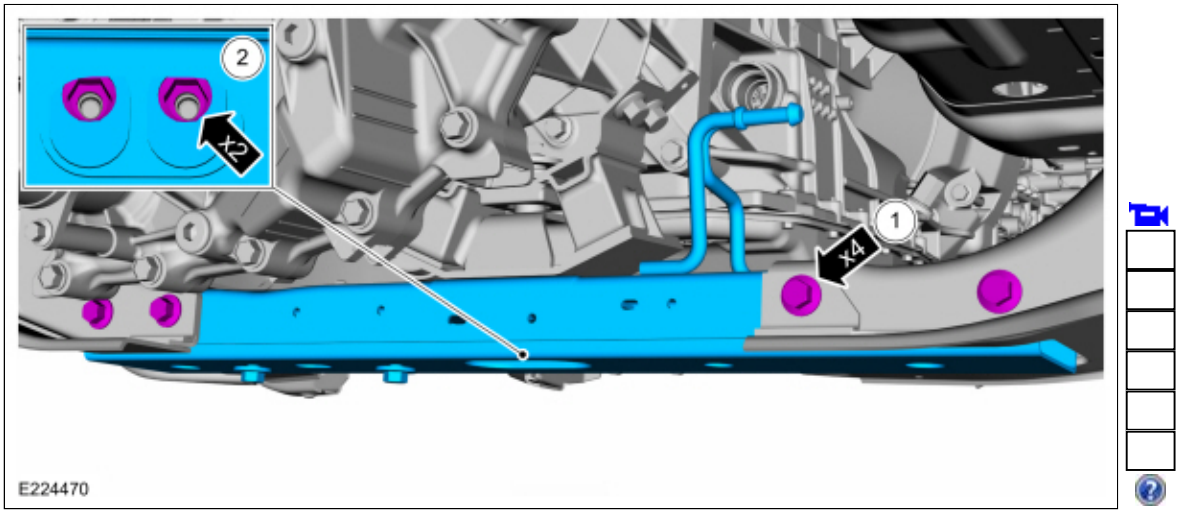


12.

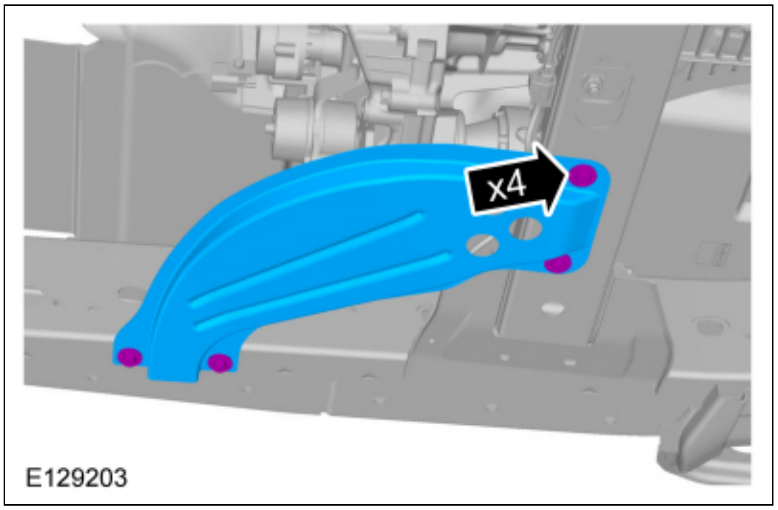


13. **NOTE:** *Install all the bolts and nuts finger tight before final tightening.*

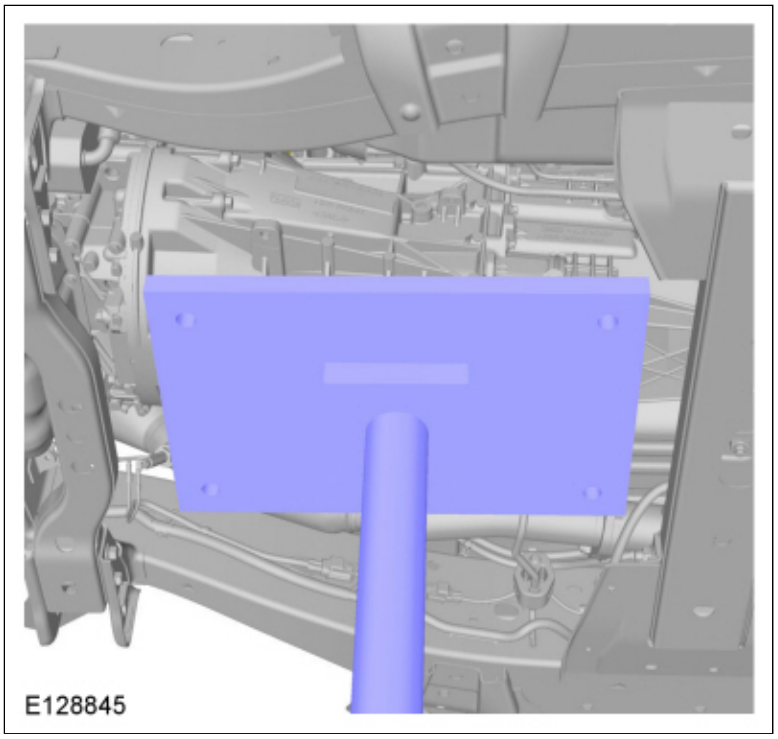
Torque:
1: 90 Nm
2: 90 Nm



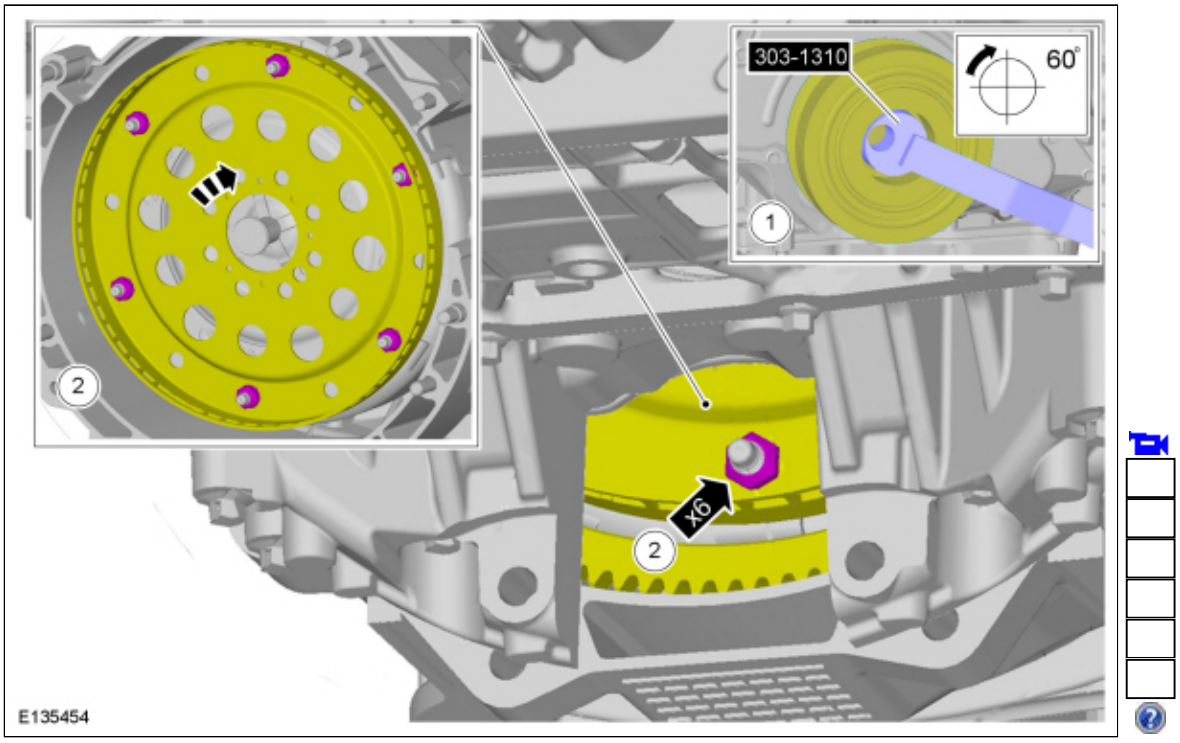
14. If equipped.
Torque: 48 Nm



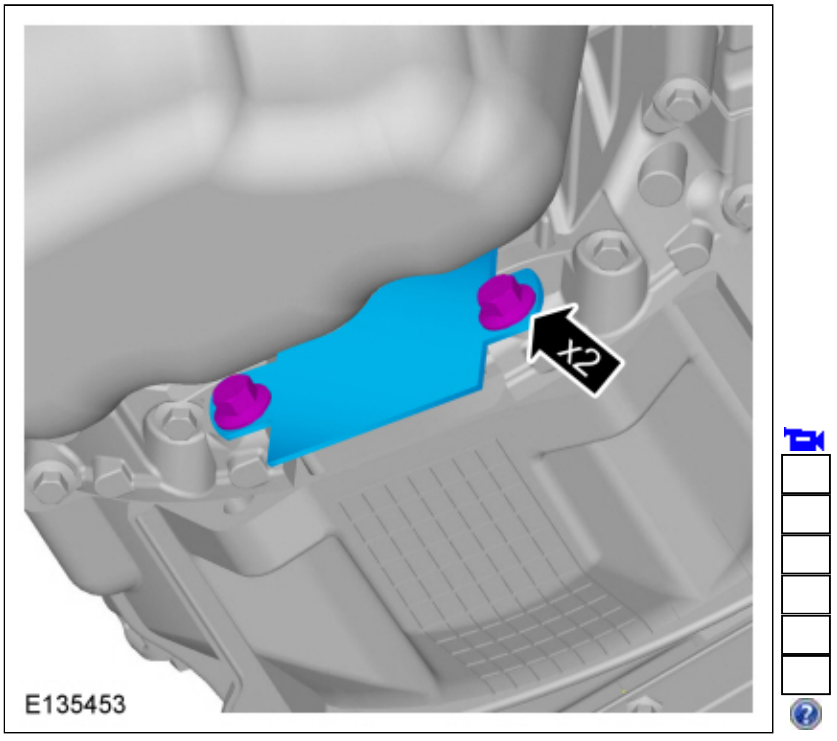
15. Remove the transmission jack.



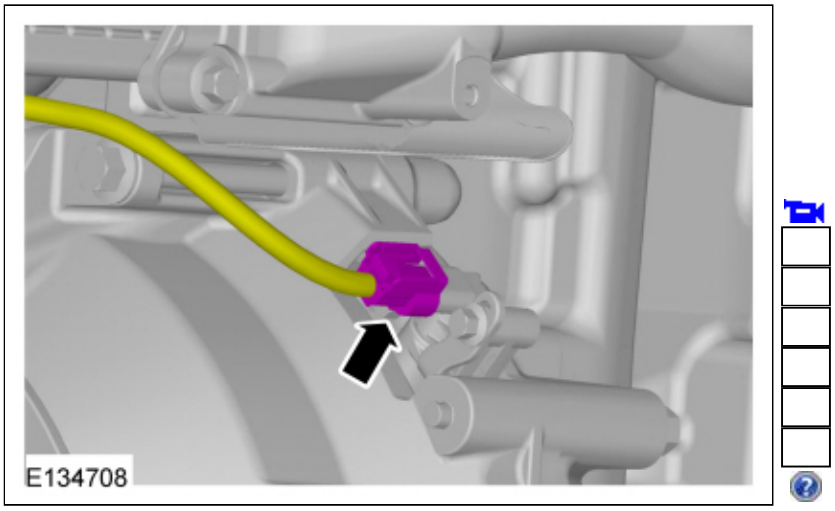
16. Remove Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
Torque: 48 Nm



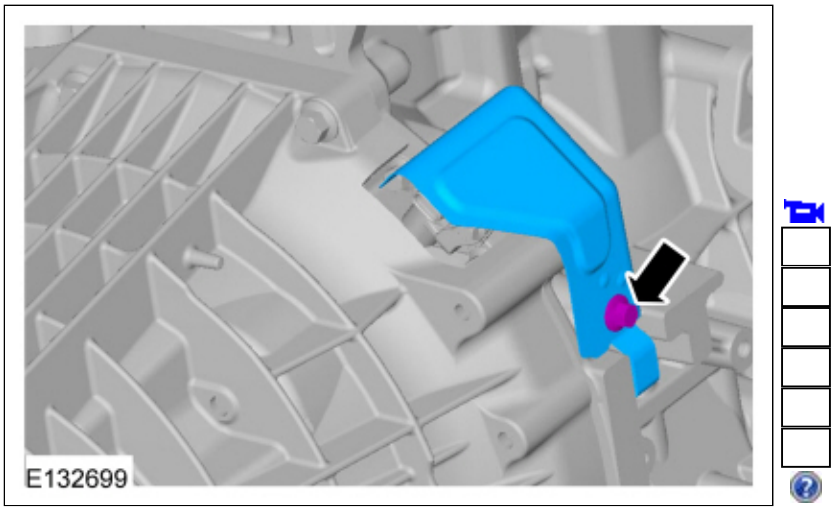
17. *Torque*: 48 Nm



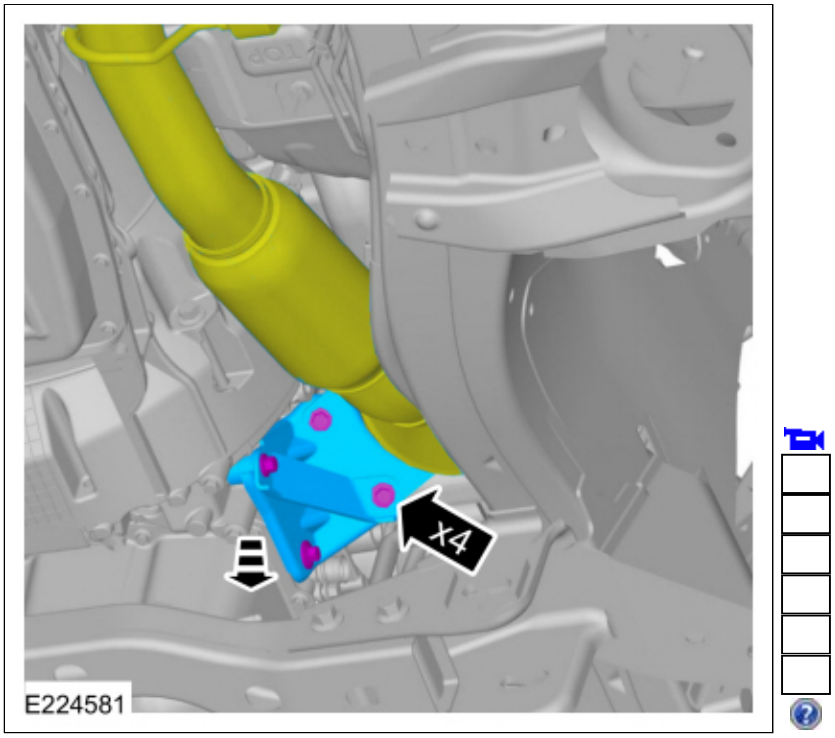
18.



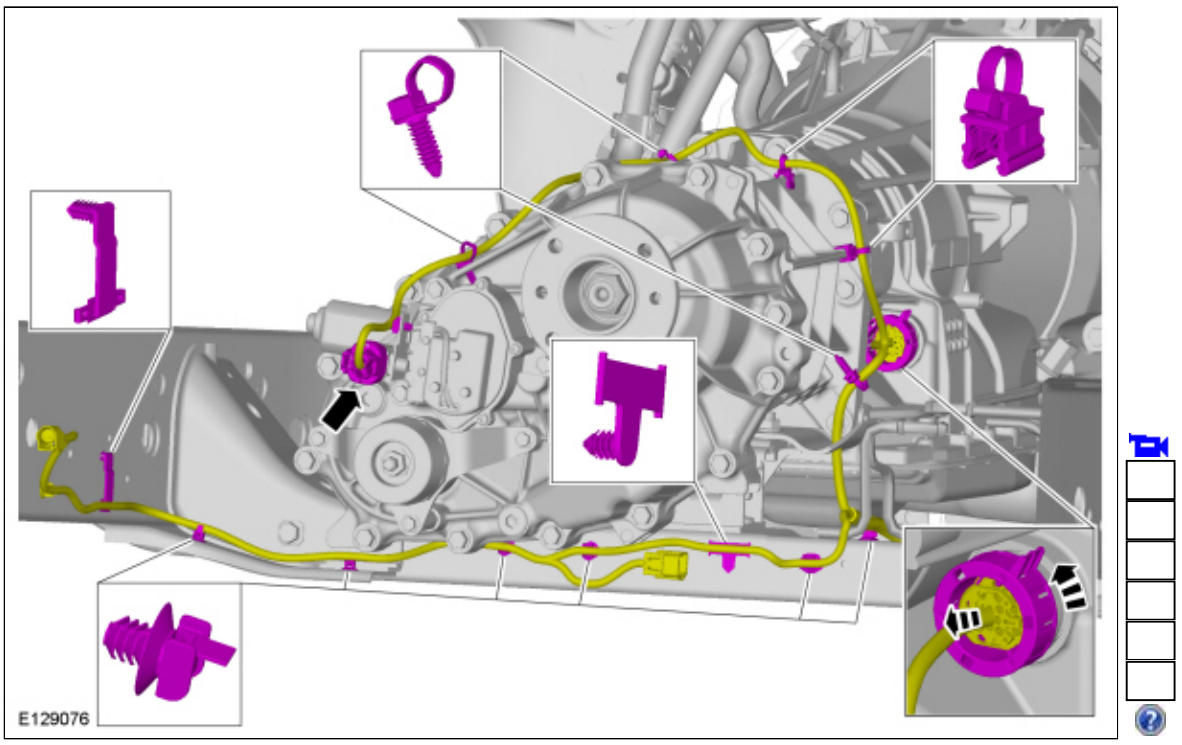
19. *Torque*: 25 Nm



20. *Torque*: 25 Nm



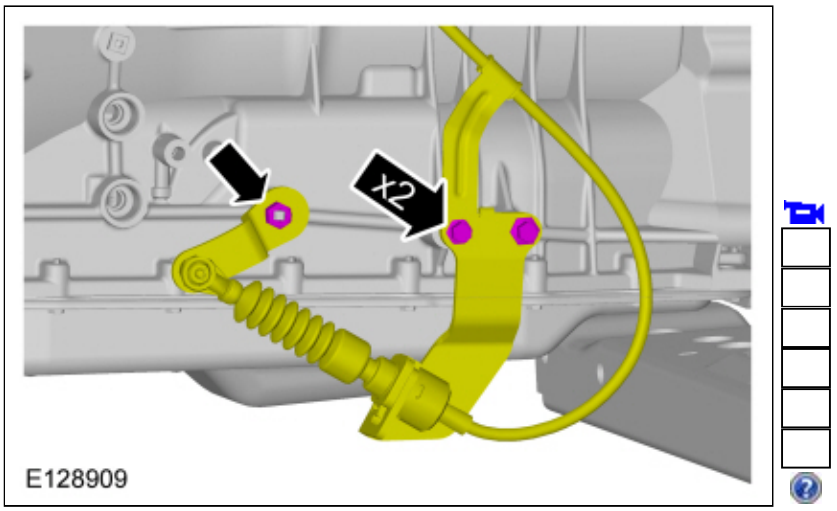
21.



22. **NOTICE: Take extra care when handling selector lever cable.**

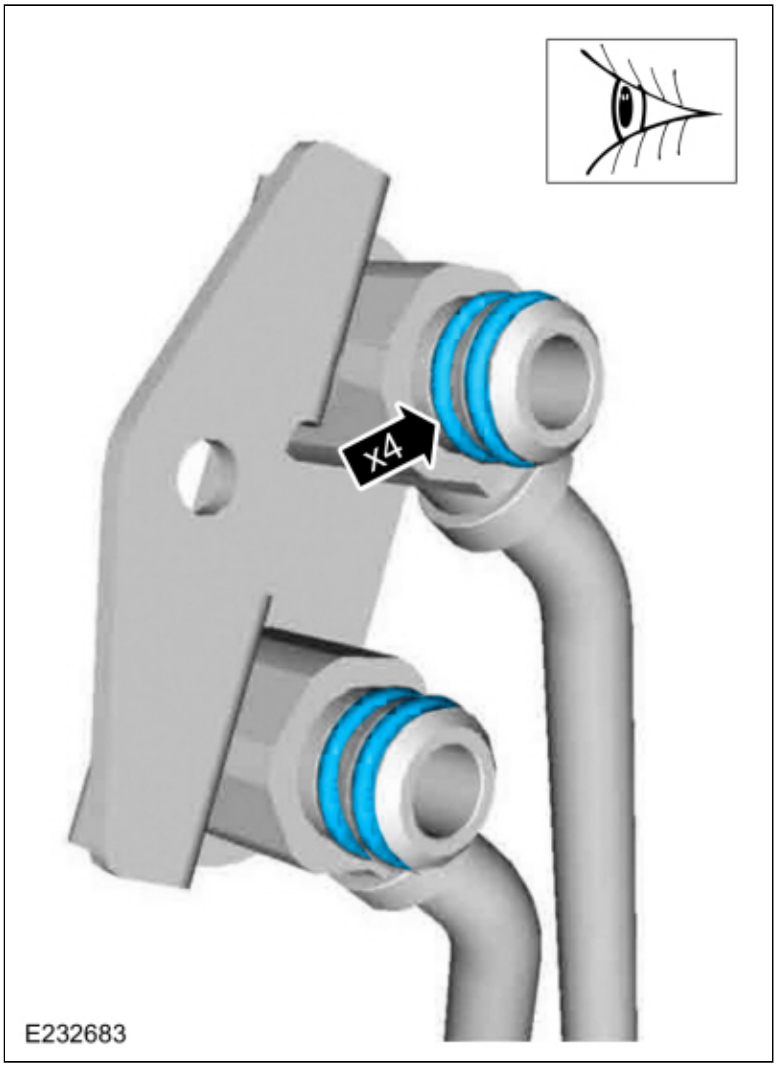
    NOTE: *Make sure that the component is installed to the position noted before removal.*

    Torque: 25 Nm

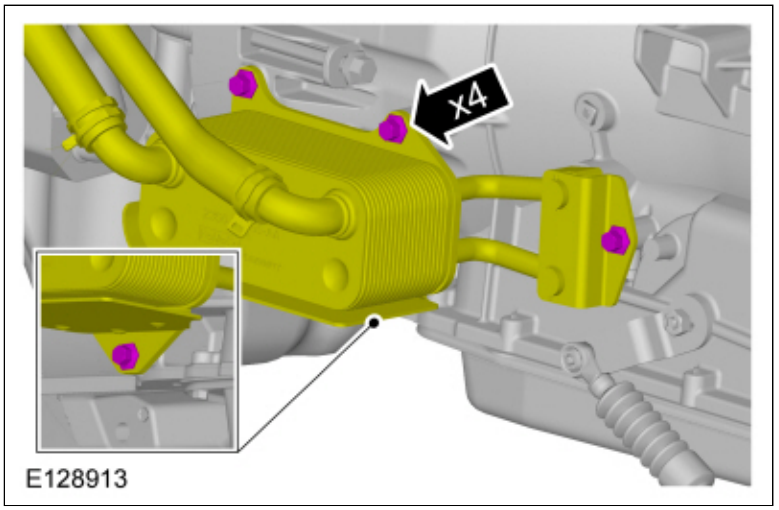


23. **NOTE:** *Make sure that a new component is installed if the O-ring is damaged.*

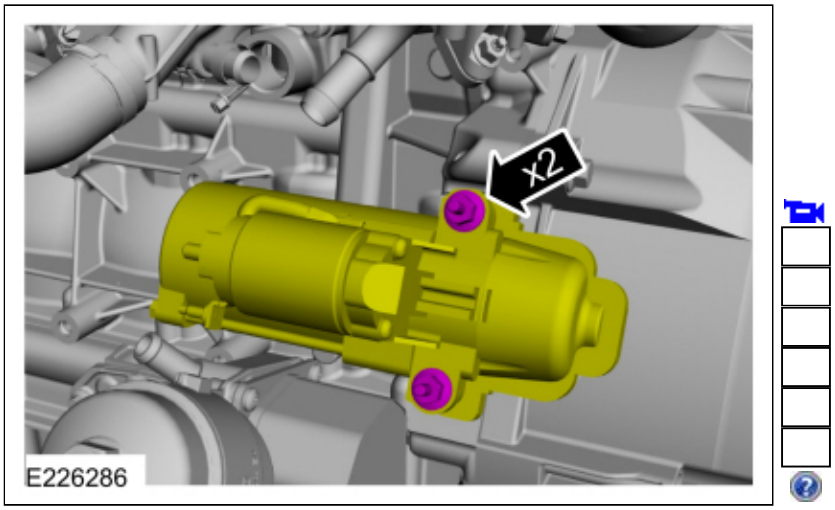
    NOTE: *Inspect the case to make sure that the old transmission fluid cooler tube O-rings are not stuck in the case.*



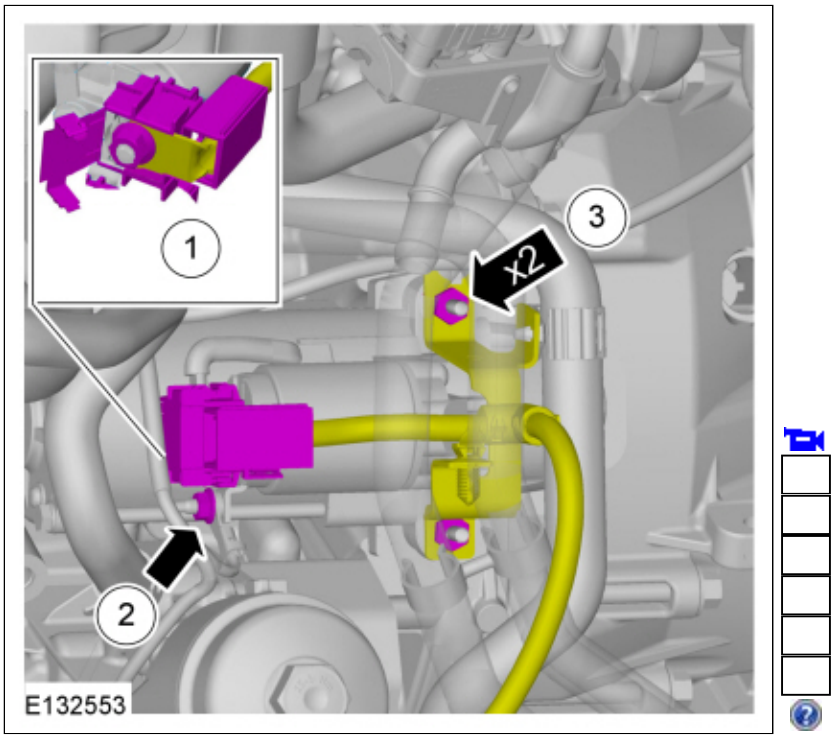
24. *Torque*: 20 Nm



25. *Torque*: 35 Nm



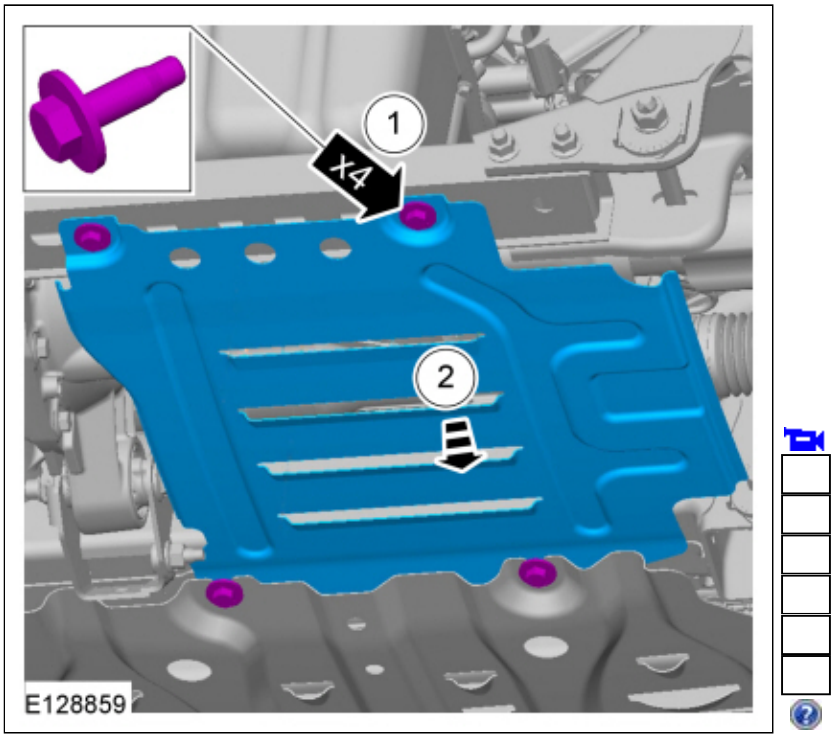
26. *Torque*:
    1: 10 Nm
    2: 10 Nm
    3: 10 Nm



27. Install the rear driveshaft.
    Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).

28. Install the front driveshaft.
    Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

29. *Torque*: 30 Nm



30. Connect the battery ground cable.
    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

31. Verify that the selector lever cable is correctly adjusted.
    Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

32. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.

33. If a new transmission or a new main control was installed, the solenoid body strategy must be updated.
    Refer to: Transmission Strategy Download (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).

34. If the transmission was overhauled, the adaptive drive cycle must be updated.
    Refer to: Adaptive Learning Drive Cycle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80)
    .

35. Program the TCM with the latest calibration.

36. While driving the vehicle, use the scan tool to verify that the TFT has reached a temperature of 96.7ºC-102ºC (206ºF-215ºF). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.

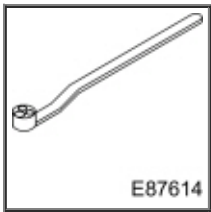
37. Check the transmission fluid level.
    Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).

Copyright © 2016 Ford Motor Company

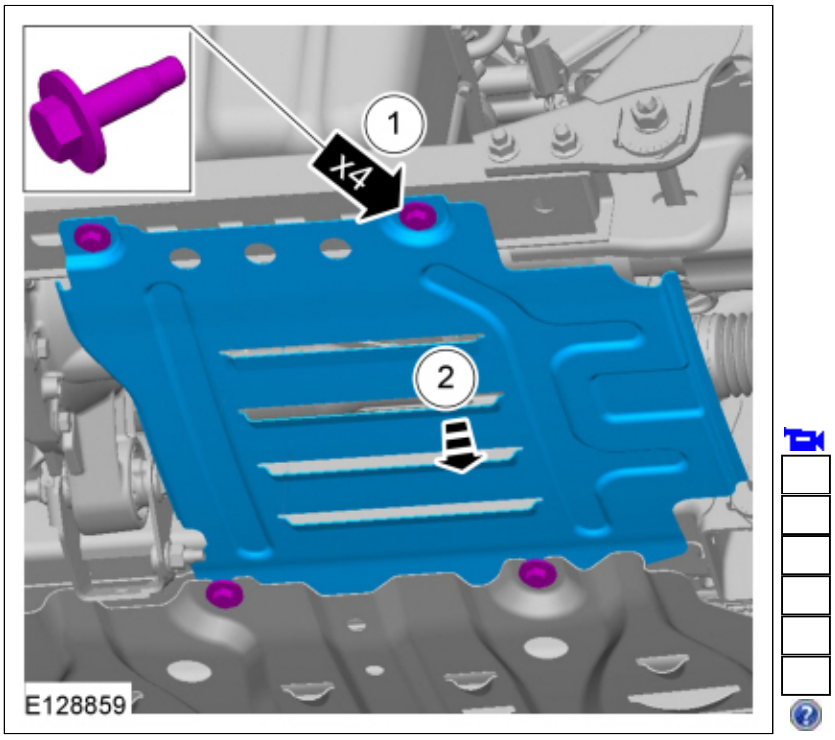
Transmission - Emission Requirements: EURO Stage V LDT/EURO Stage VI, LHD RWD/RHD RWD

Base Part Number: 7000

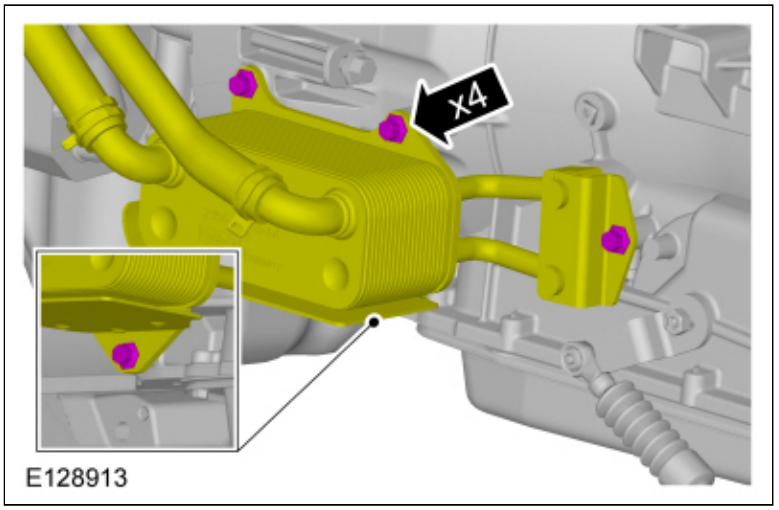
Special Tool(s) / General Equipment

	303-1310 Holding Wrench, Crankshaft
	307-346 (T97T-7902-A) Retainer, Torque Converter
Transmission Jack	

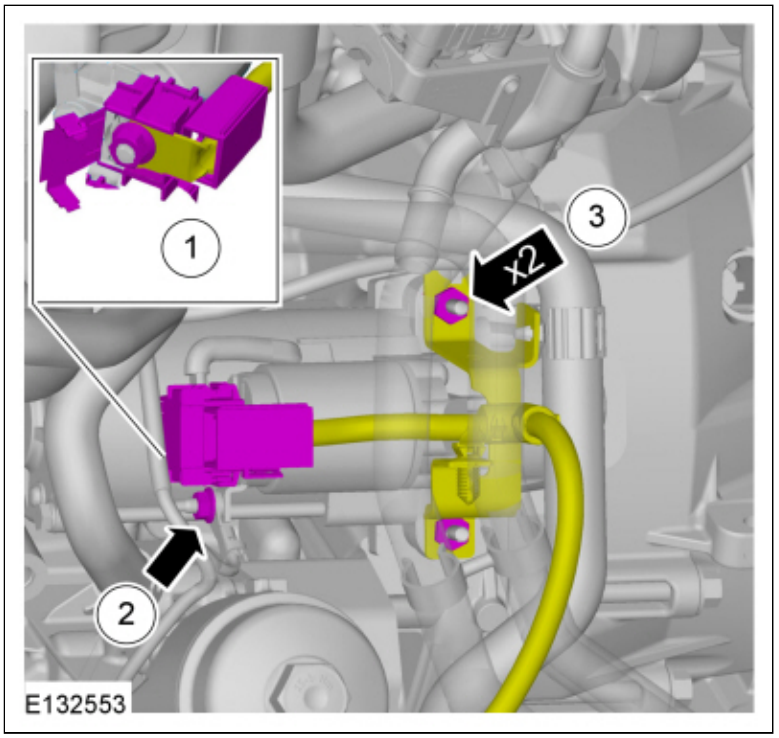
Removal

1. Remove the battery negative terminal.
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Remove the rear driveshaft.
   Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
4. Drain the transmission fluid.
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
5. 

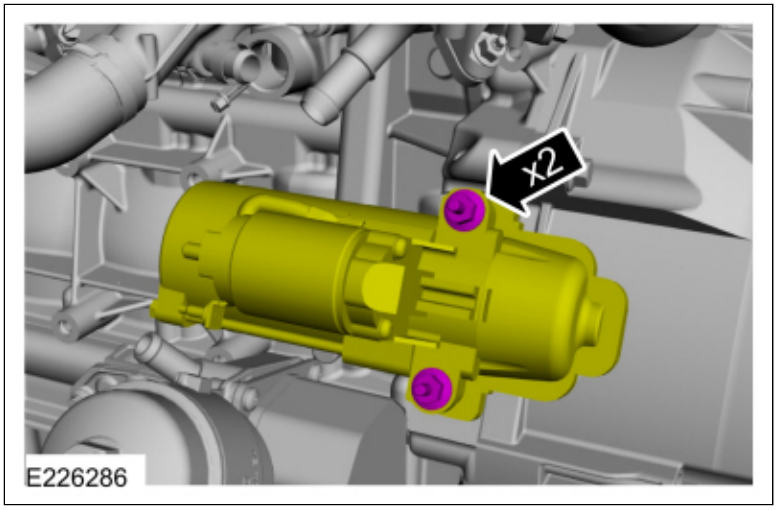
6. **NOTE:** *Be prepared to collect escaping fluid.*



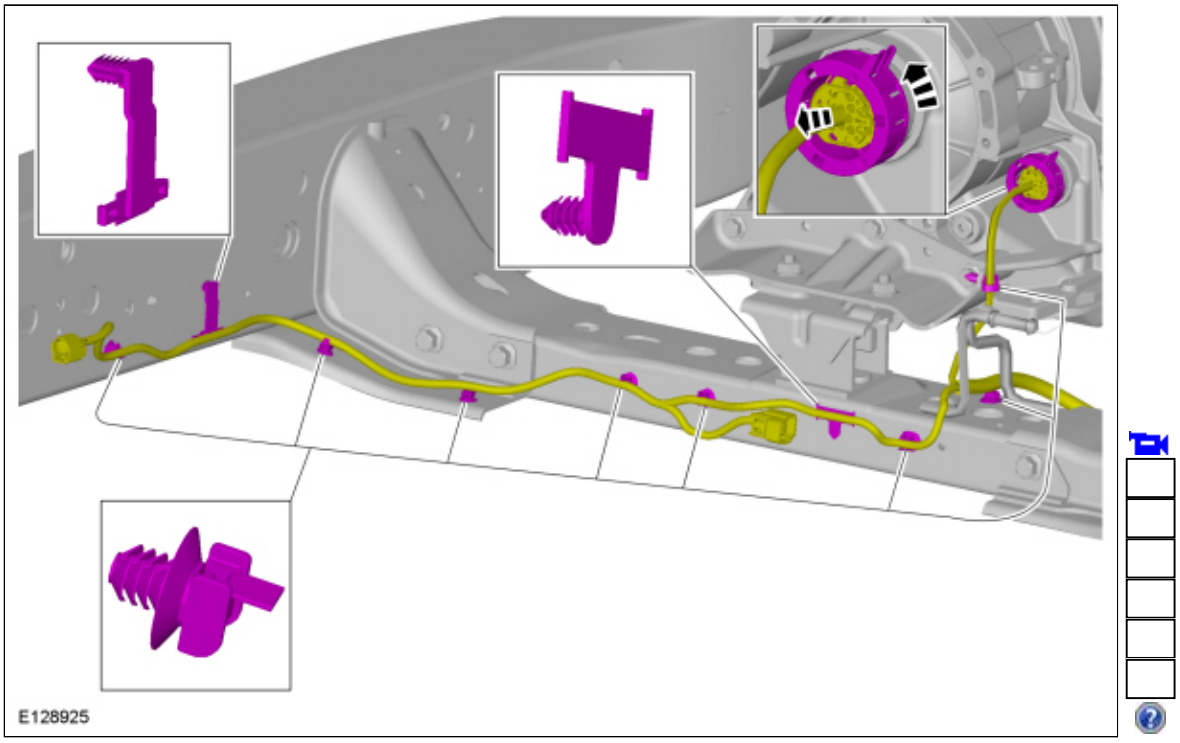
7.



8.

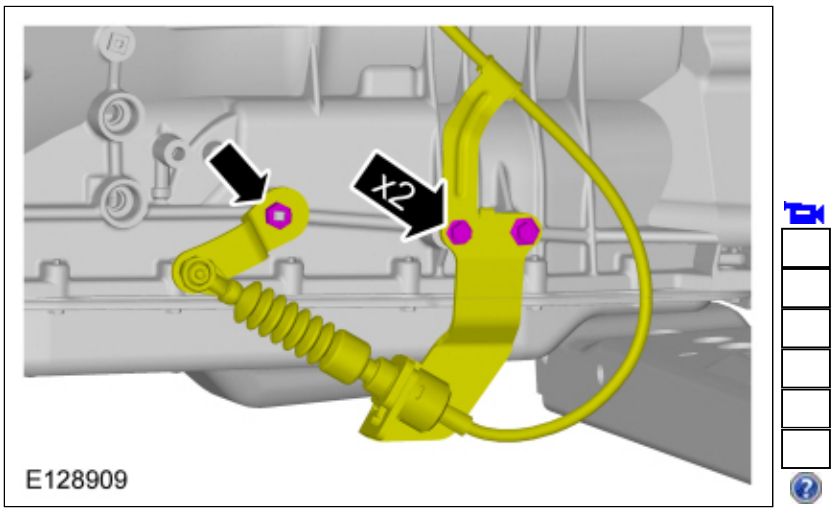


9.



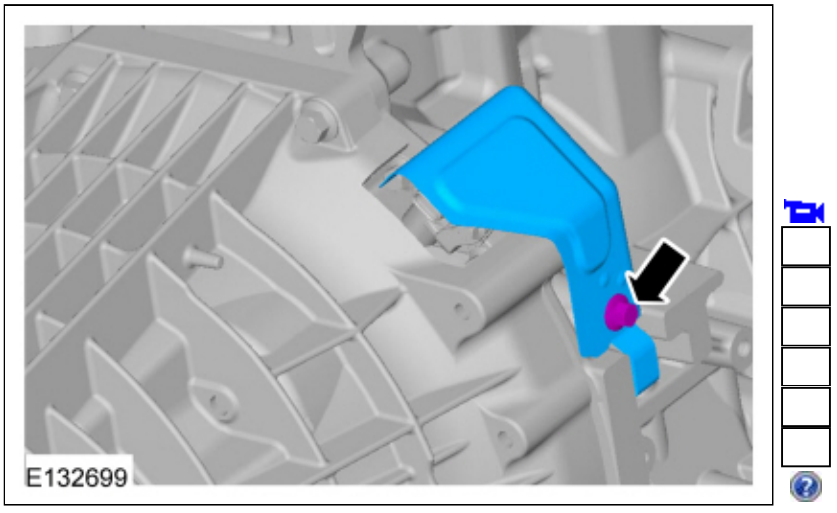
10. **NOTICE: Take extra care when handling selector lever cable.**

    NOTE: *Note the position of the component before removal.*

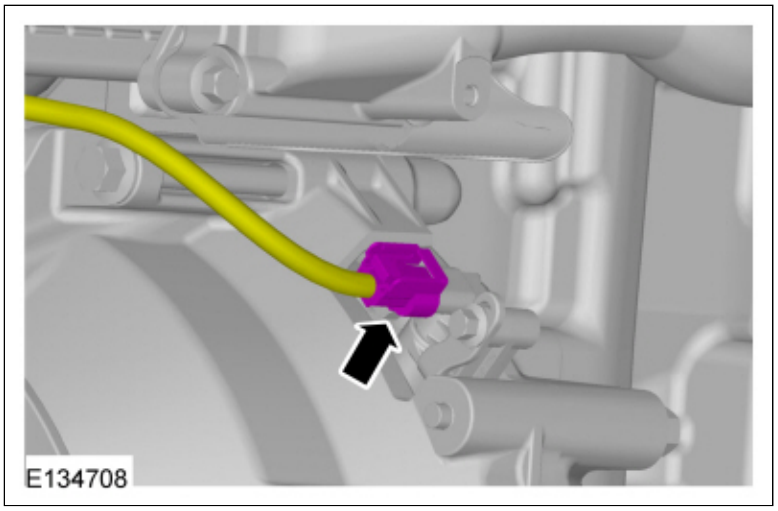


11. Refer to: Diesel Particulate Filter (DPF) - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

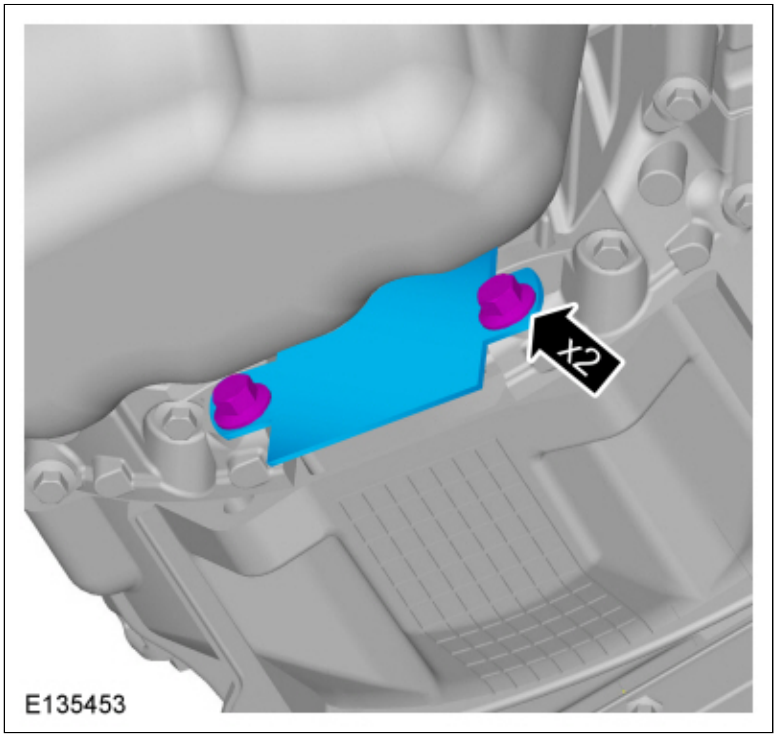
12.



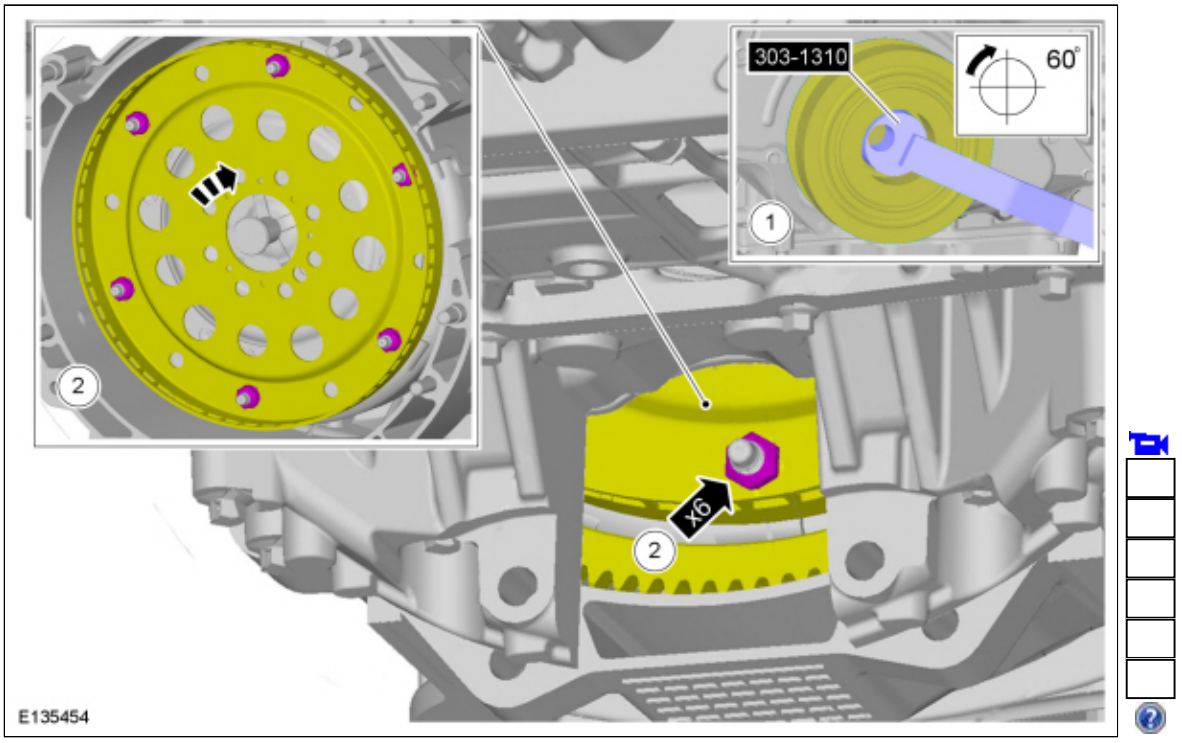
13.



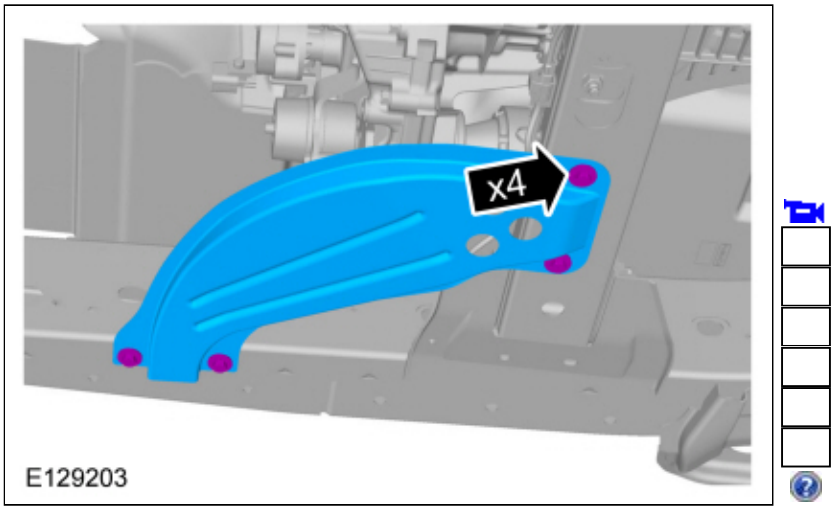
14.



15. Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.

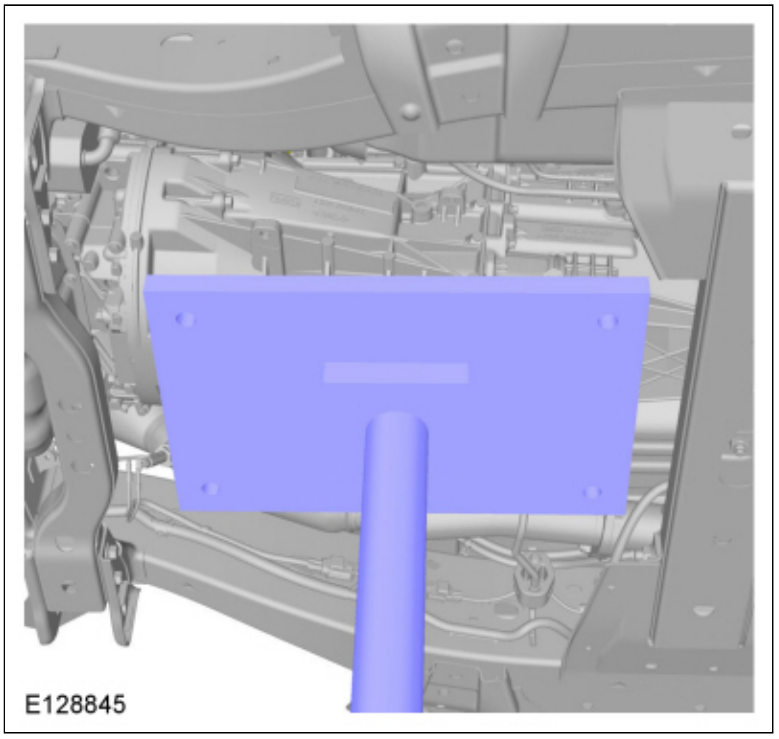


16. If equipped.

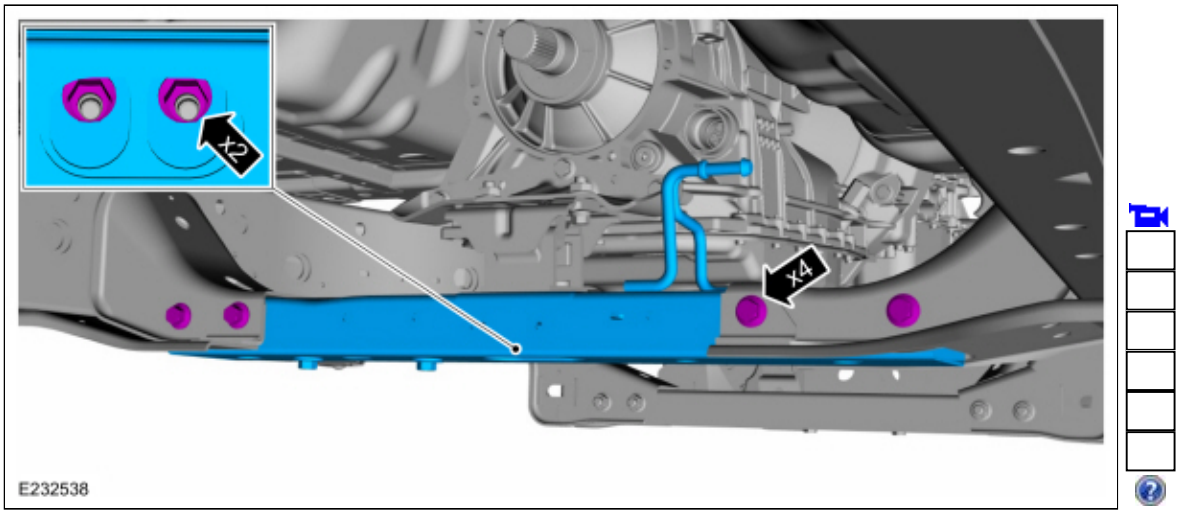


17. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

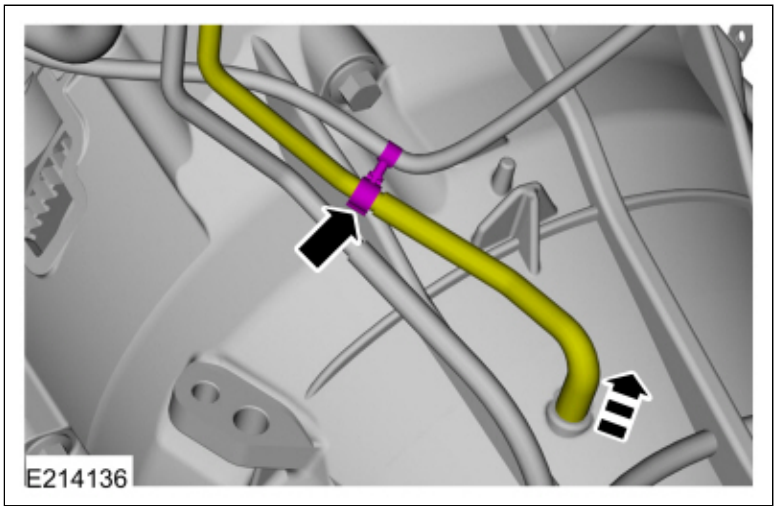
    Use the General Equipment: Transmission Jack



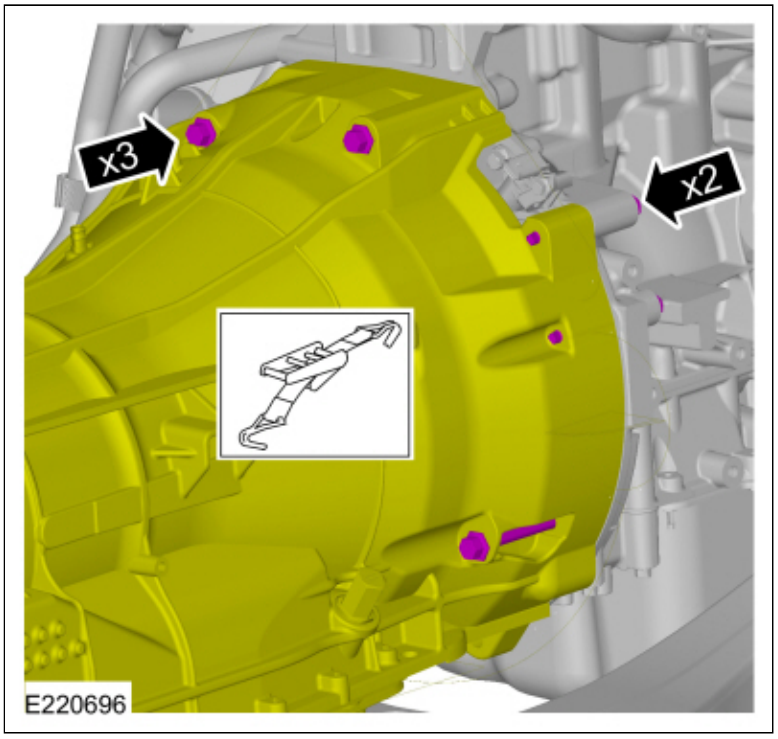
18.



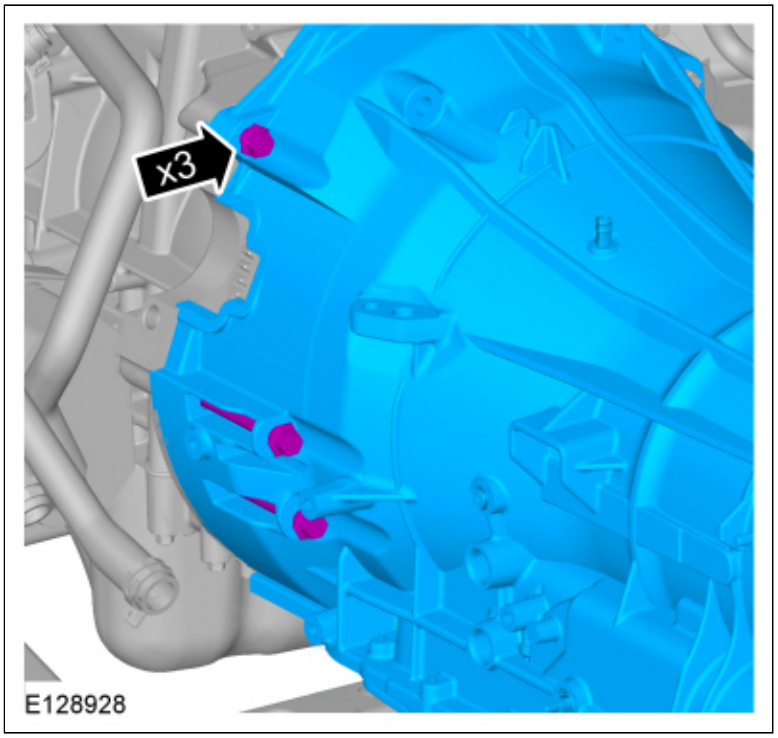
19.



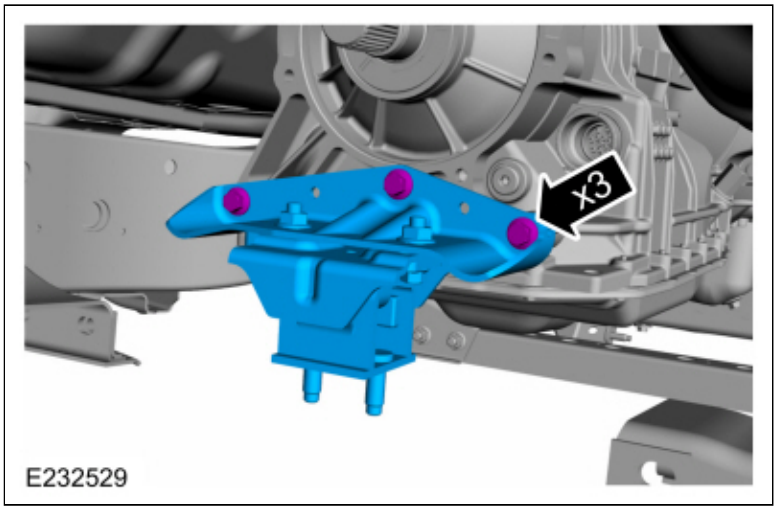
20.



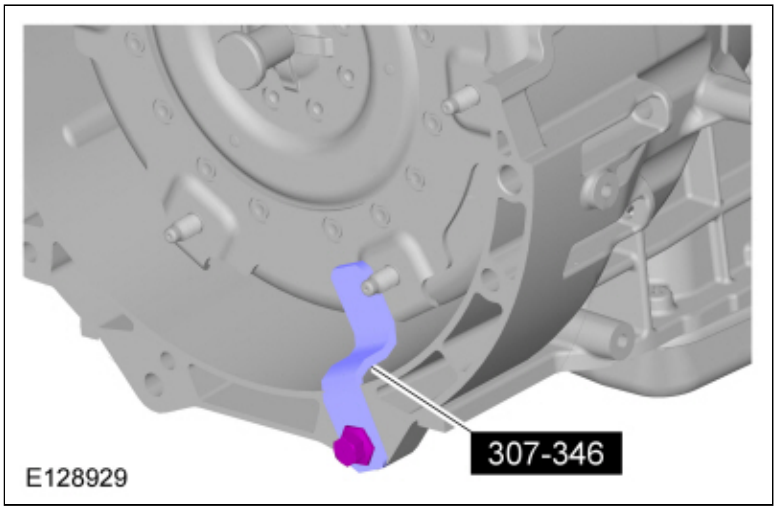
21.



22.

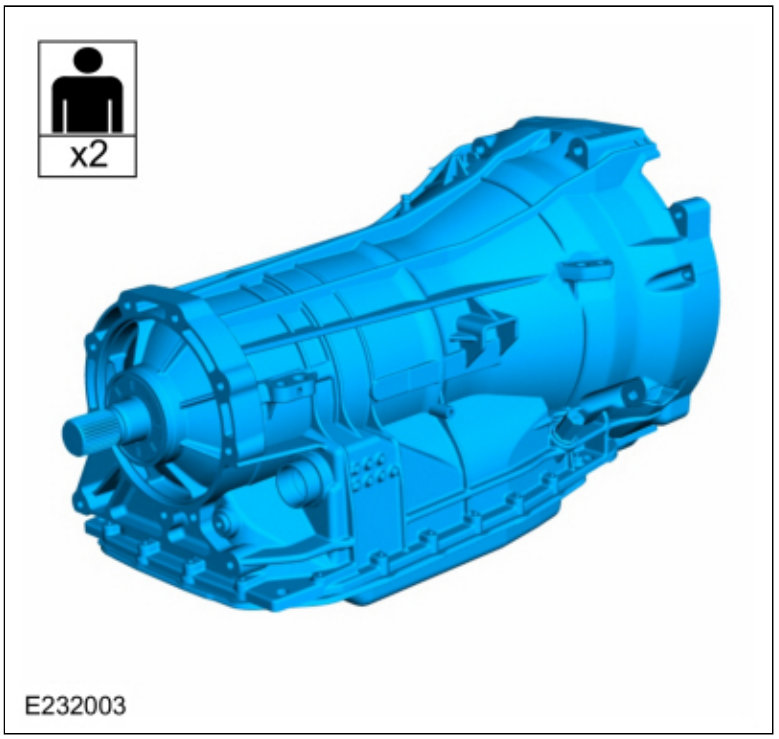


23. Slide the transmission back far enough to install the Torque Converter Retainer. Use Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



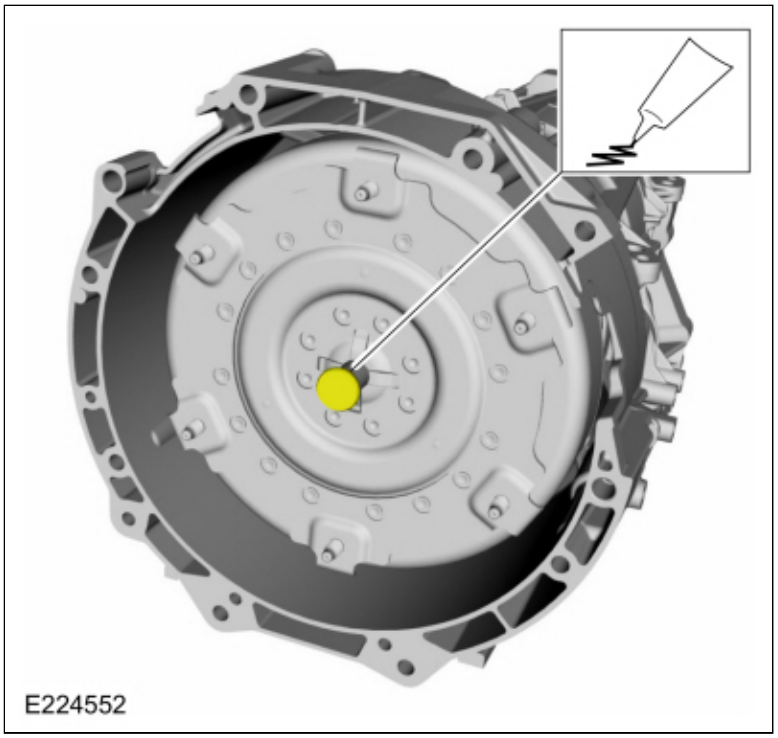
24. **NOTE:** *This step requires the aid of another technician.*

    Remove the transmission assembly from the vehicle.

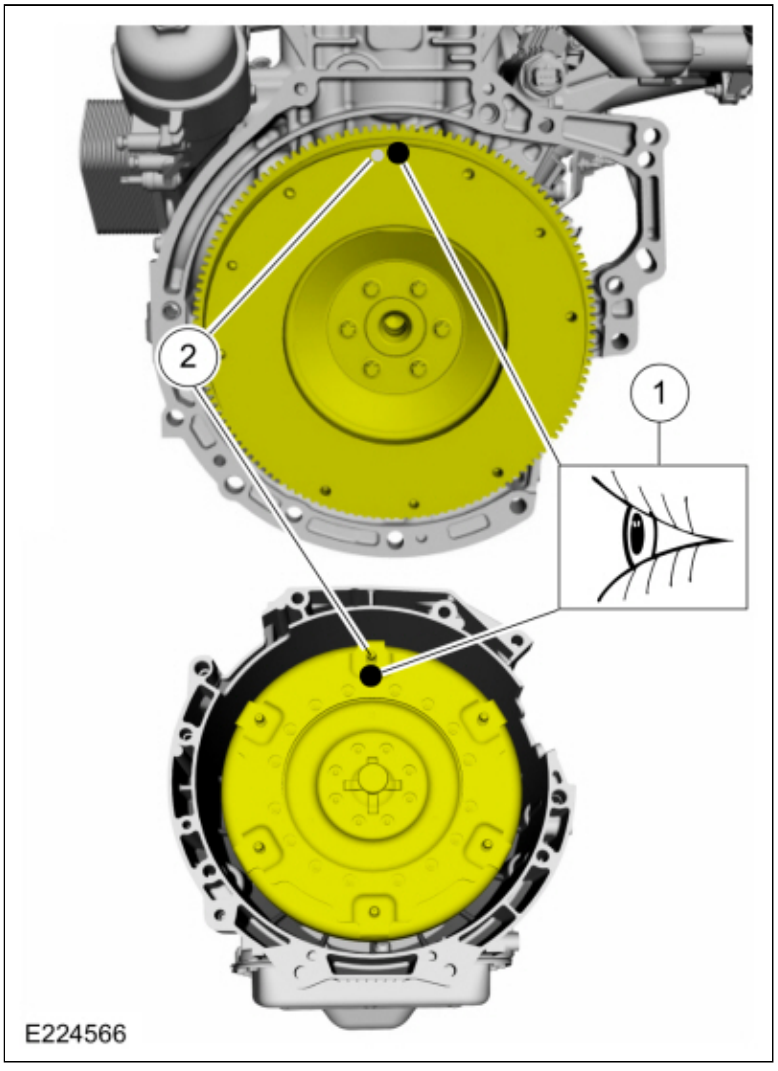


Installation

1. Lubricate the torque converter pilot hub with multipurpose grease.



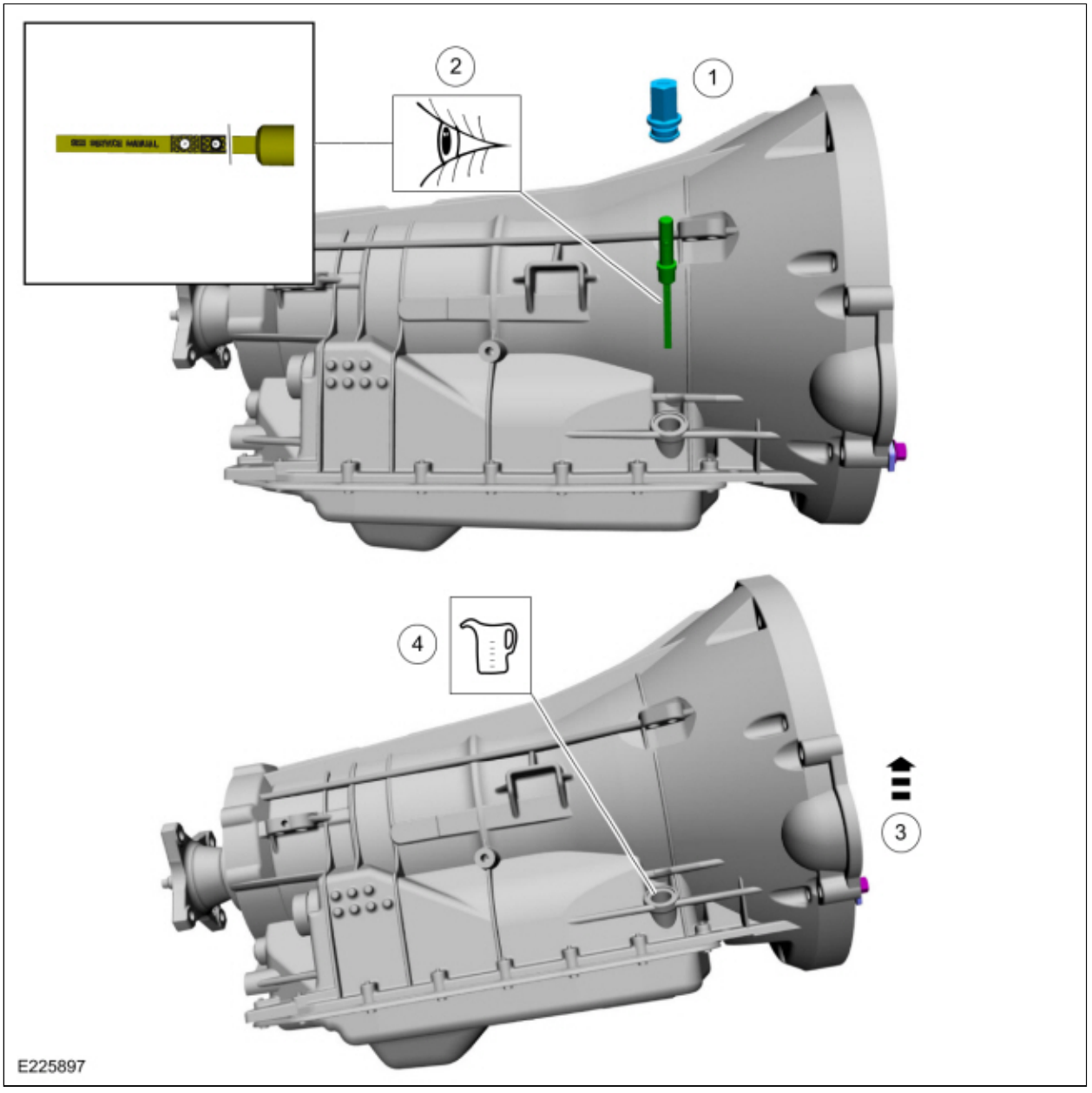
1. Inspect the torque converter stud and flexplate for paint marks.
2. Align the torque converter stud and flexplate hole near the paint marks to the 12 o'clock position.



3. **NOTICE: If a new transmission is installed, the fluid level must be checked after installation.**

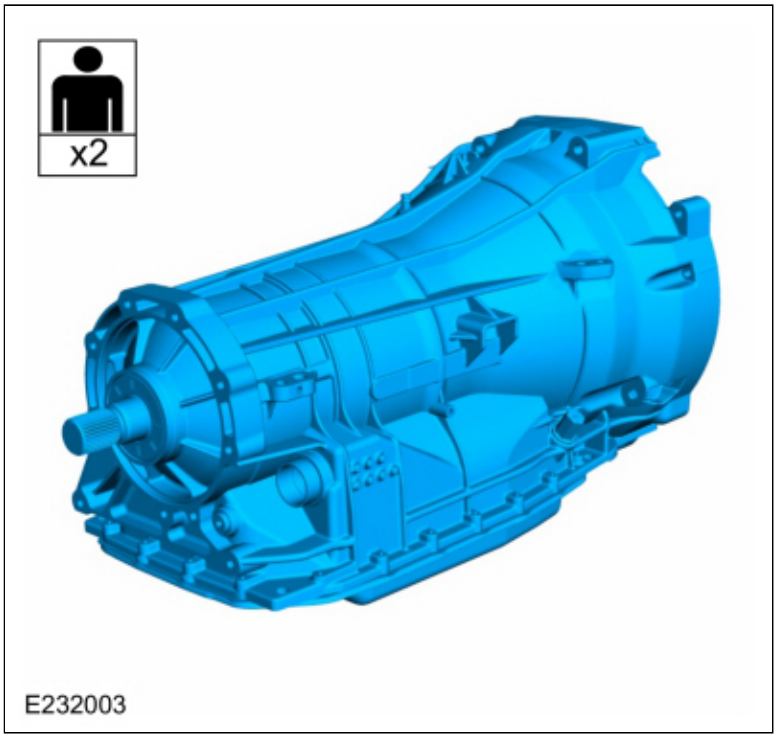
NOTE: *If transmission was disassembled, add transmission fluid to the transmission.*

1. Remove the transmission fluid fill plug transmission fluid level indicator assembly.
   Torque: 26 Nm
2. Verify transmission is filled with transmission fluid.
3. Slightly tilt the transmission rearward.
4. Refer to: Transmission Fluid Drain and Refill (307-01A) .

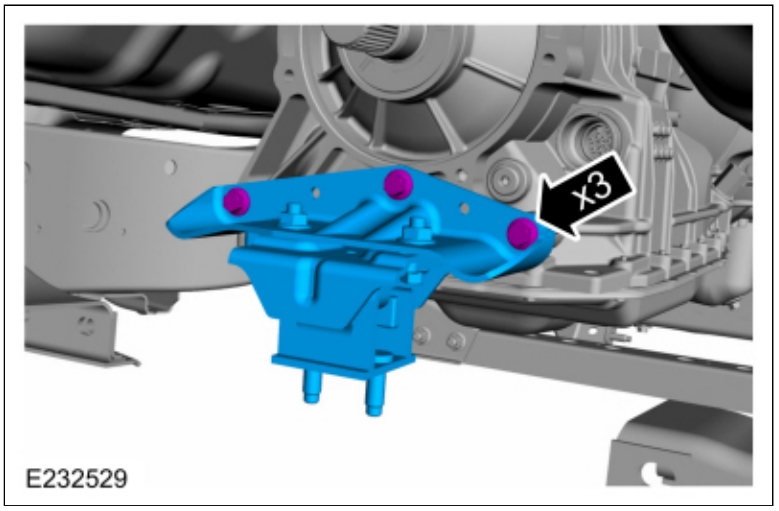


4. **NOTE:** *This step requires the aid of another technician.*

   1. Position the transmission assembly on jack.
      Use the General Equipment: Transmission Jack
   2. Secure the transmission to the transmission jack with a safety strap.



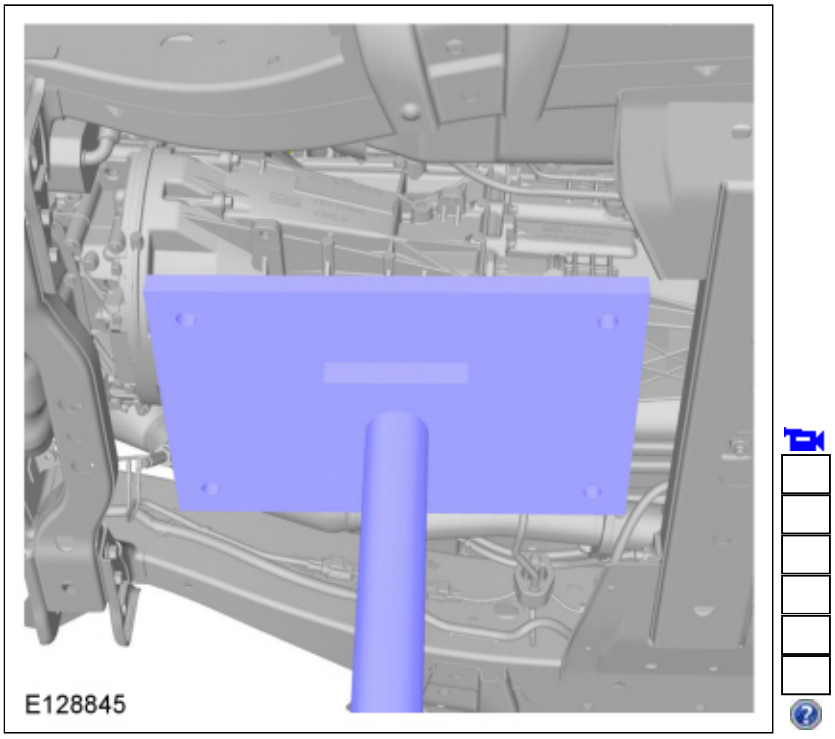
5. *Torque*: 48 Nm



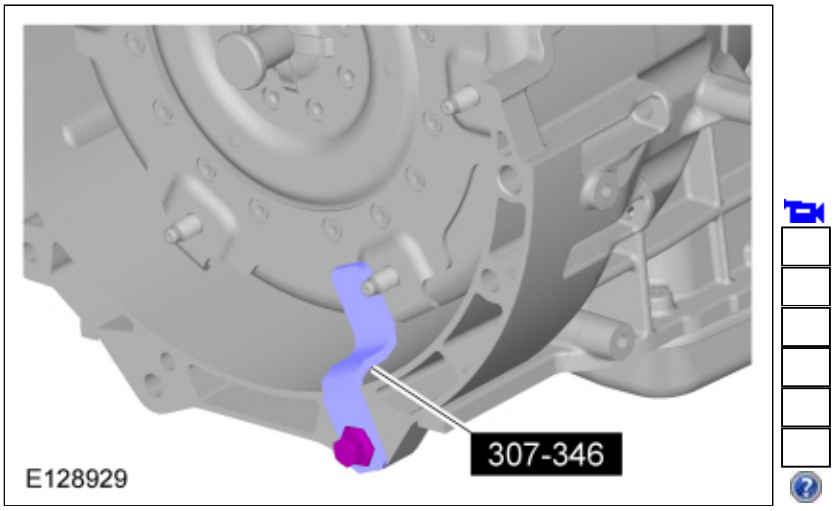
6. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

   NOTE: *Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.*

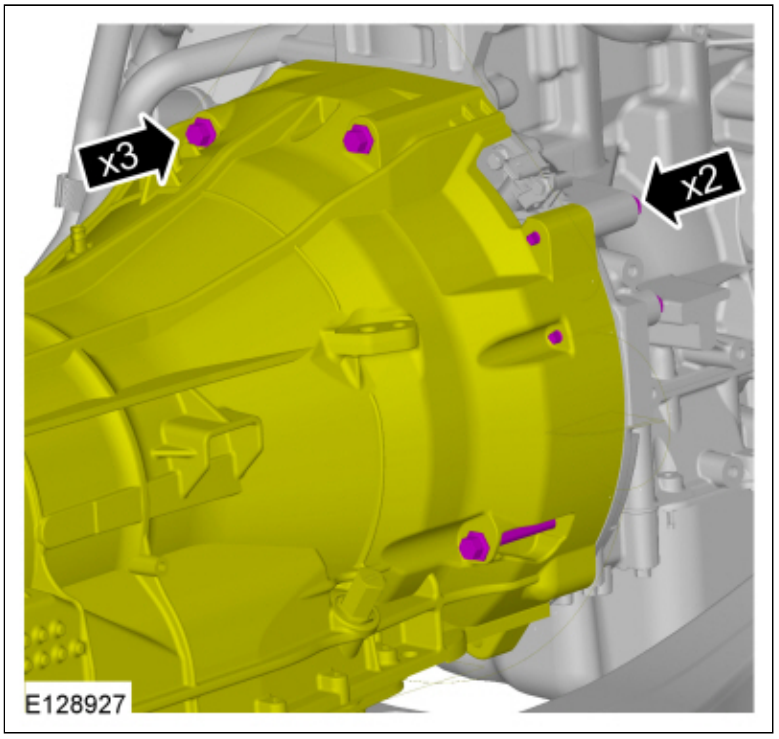
   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.



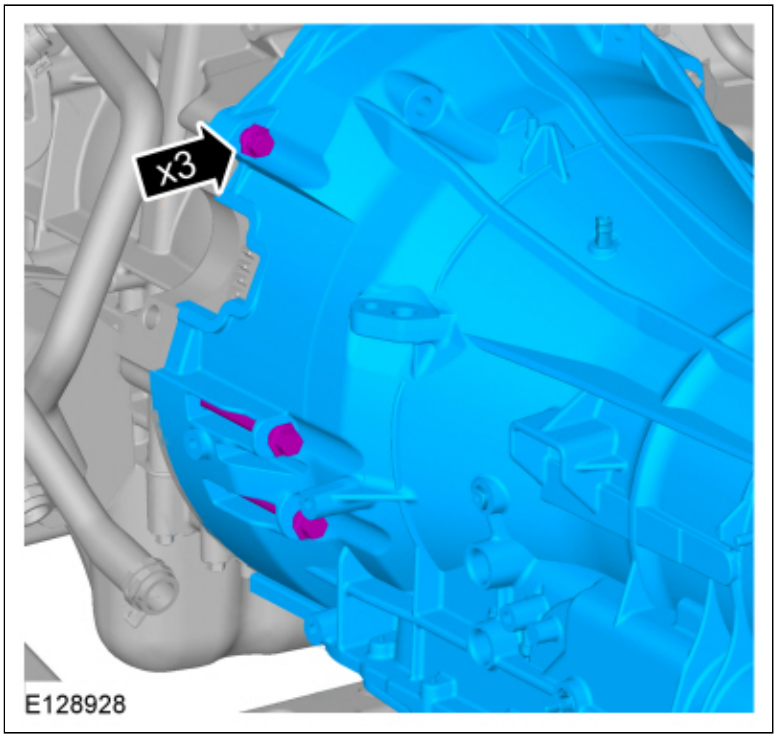
7. Remove Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



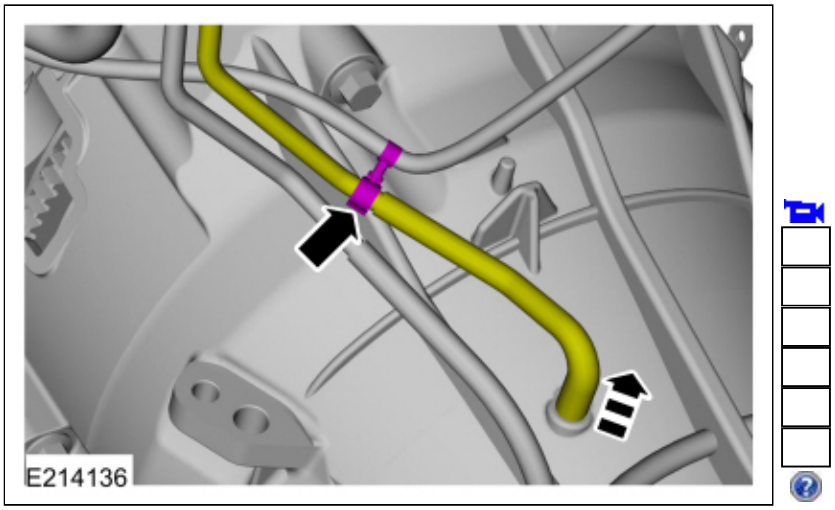
8. *Torque*: 48 Nm



9. *Torque*: 48 Nm

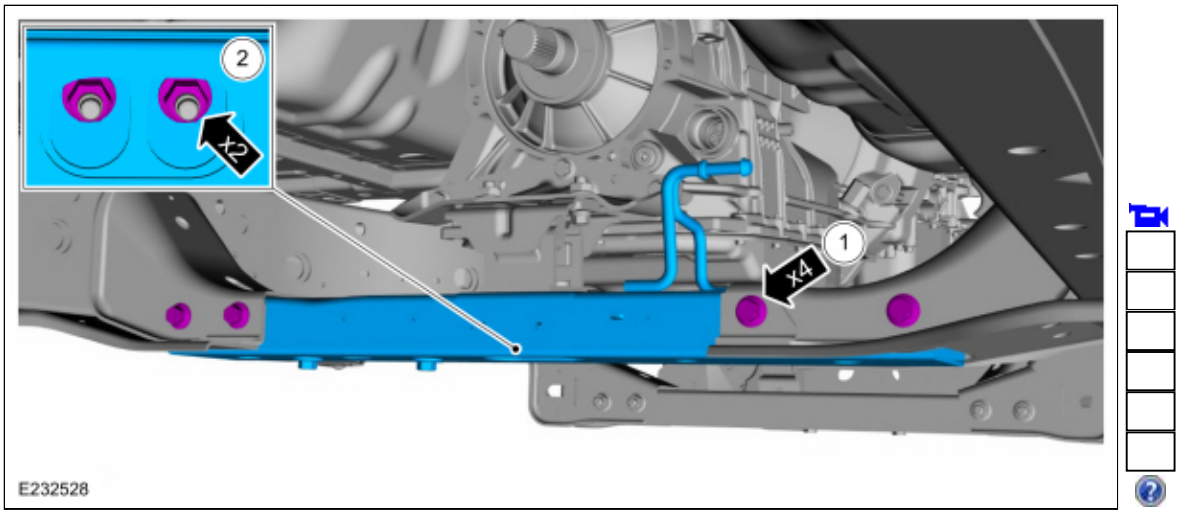


10.

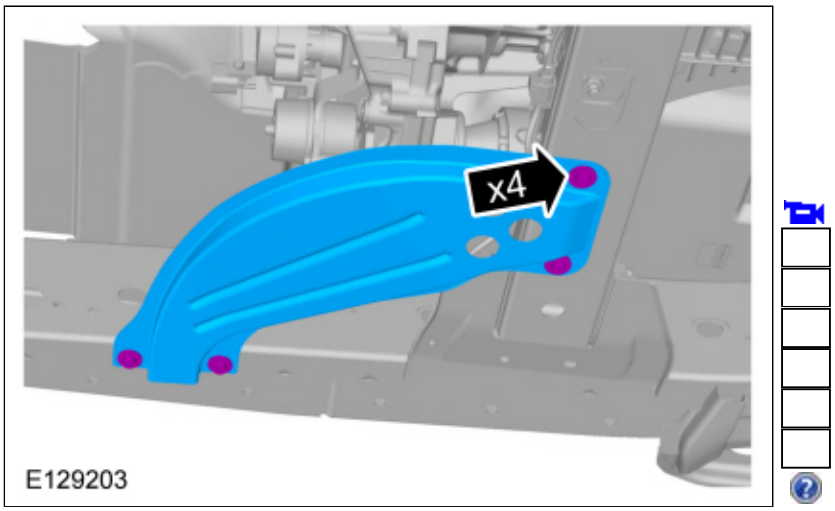


11. **NOTE:** *Install all the bolts and nuts finger tight before final tightening.*

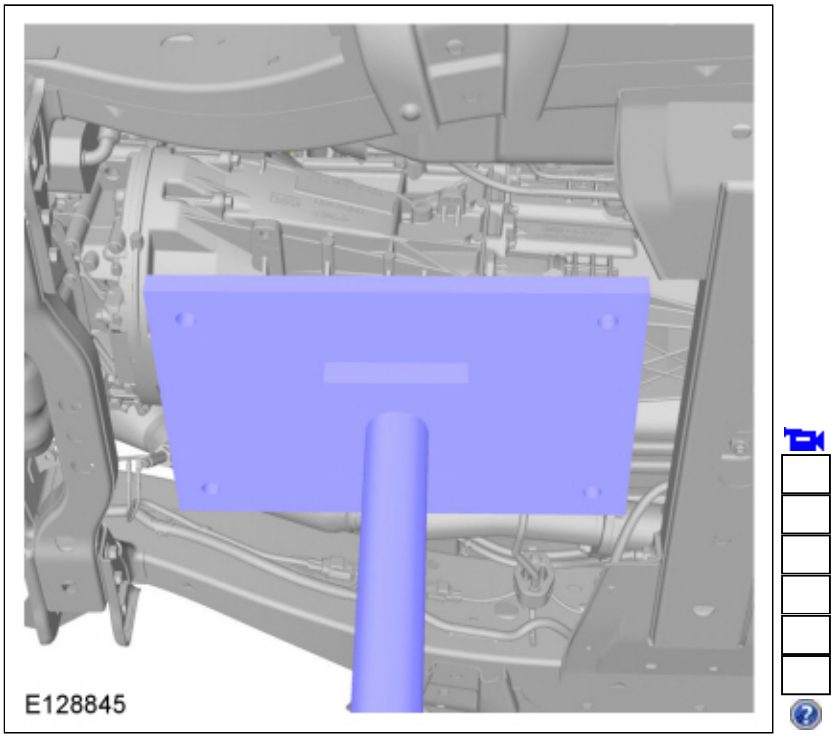
    Torque:
    1: 90 Nm
    2: 90 Nm



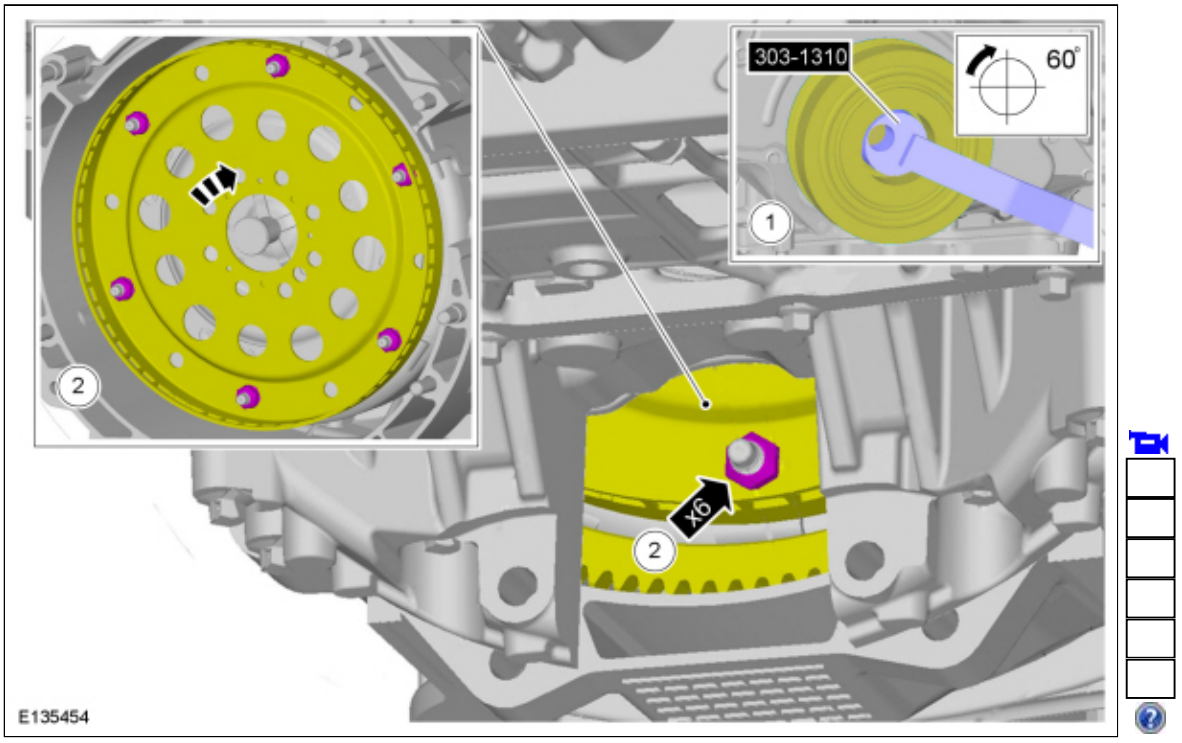
12. If equipped.
    Torque: 48 Nm



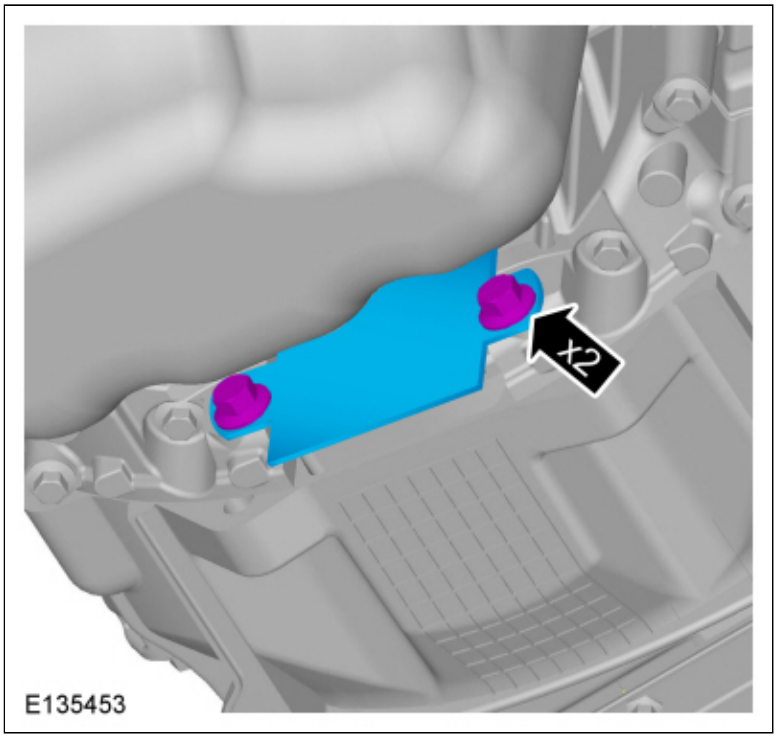
13. Remove the transmission jack.



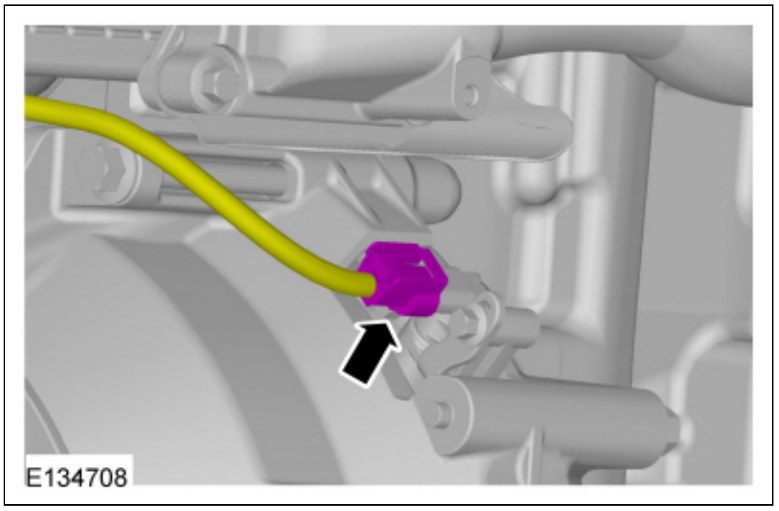
14. Remove Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
    Torque: 48 Nm



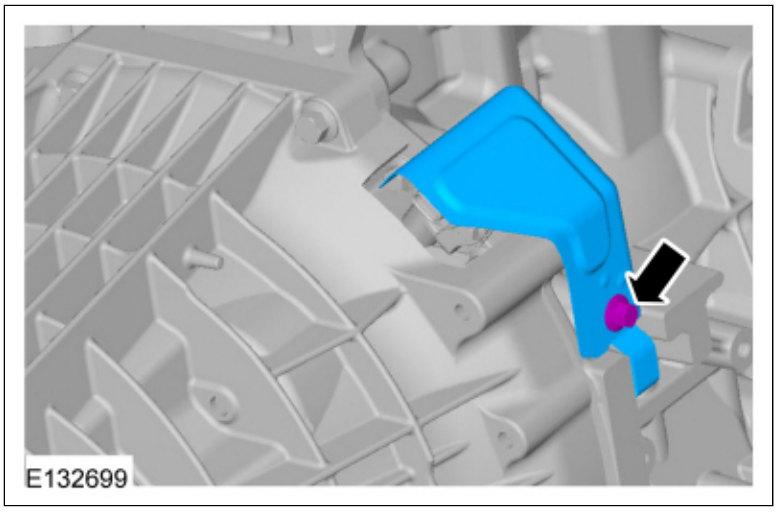
15. *Torque*: 48 Nm



16.

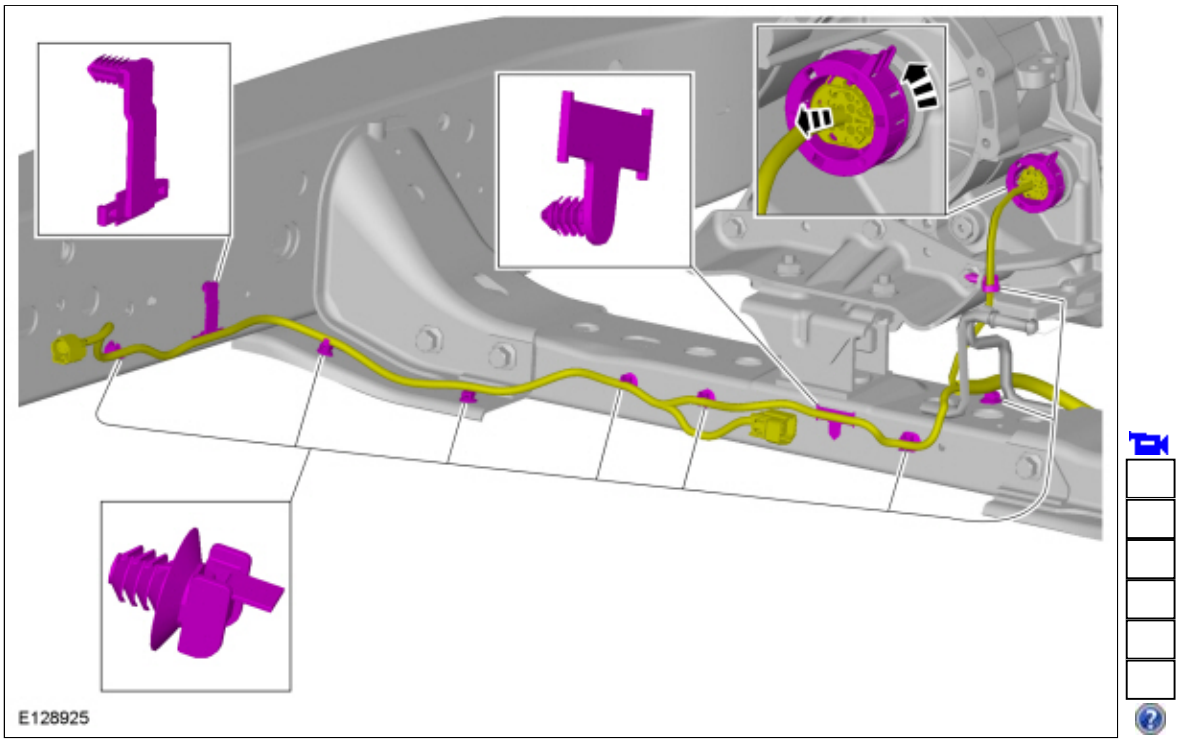


17. *Torque*: 25 Nm



18. Refer to: Diesel Particulate Filter (DPF) - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

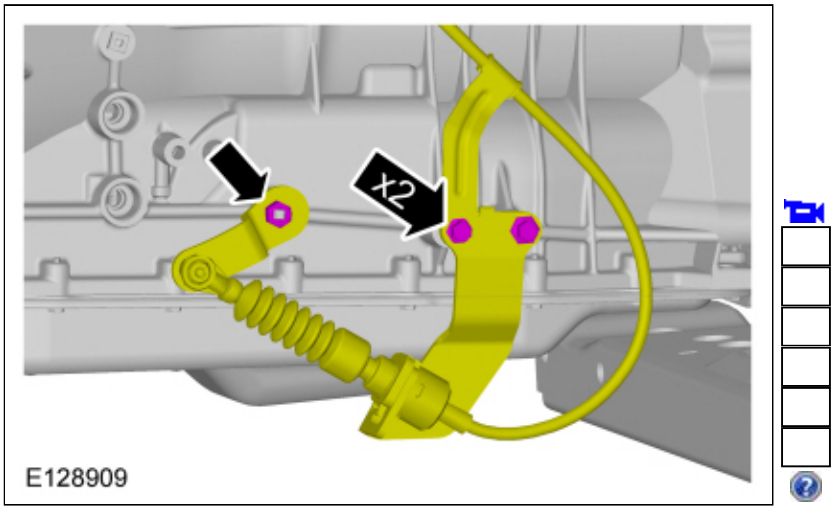
19.



20. **NOTICE: Take extra care when handling selector lever cable.**

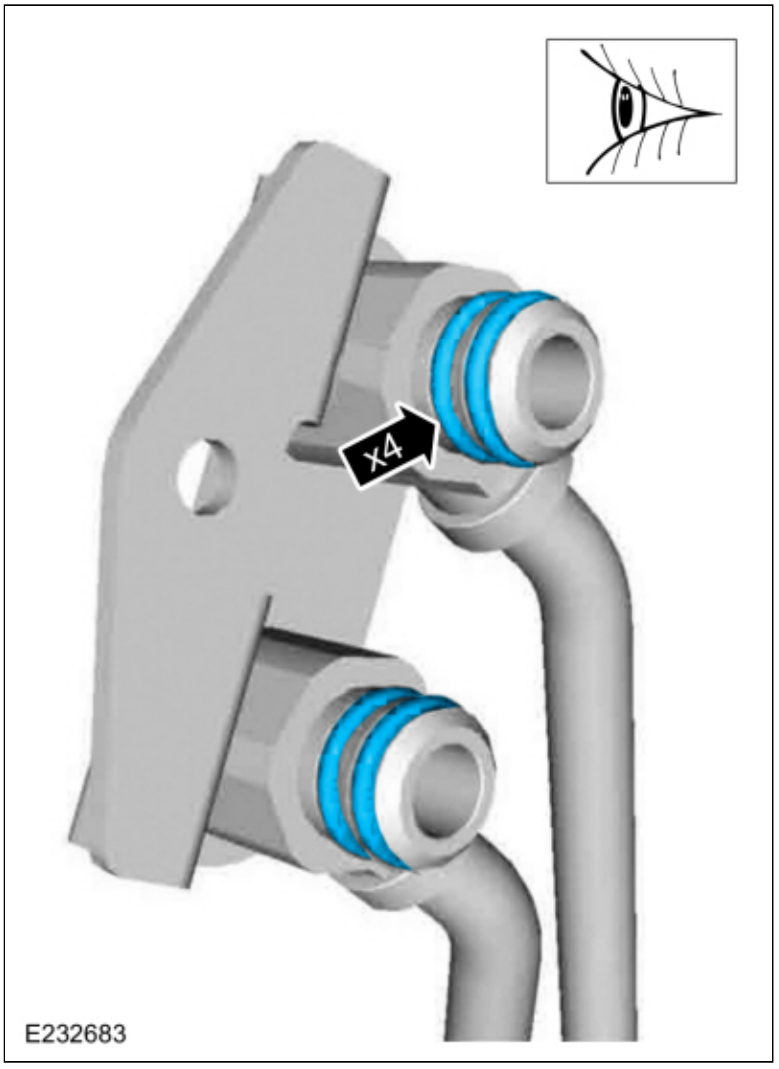
    NOTE: *Make sure that the component is installed to the position noted before removal.*

    Torque: 25 Nm

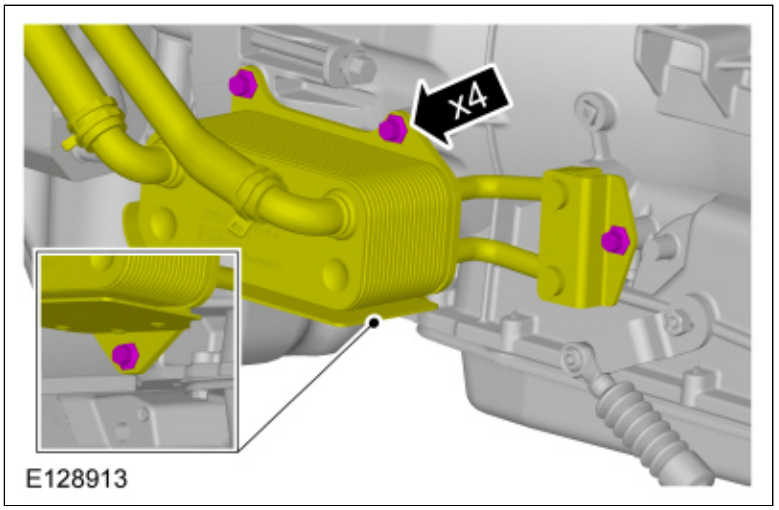


21. **NOTE:** *Make sure that a new component is installed if the O-ring is damaged.*

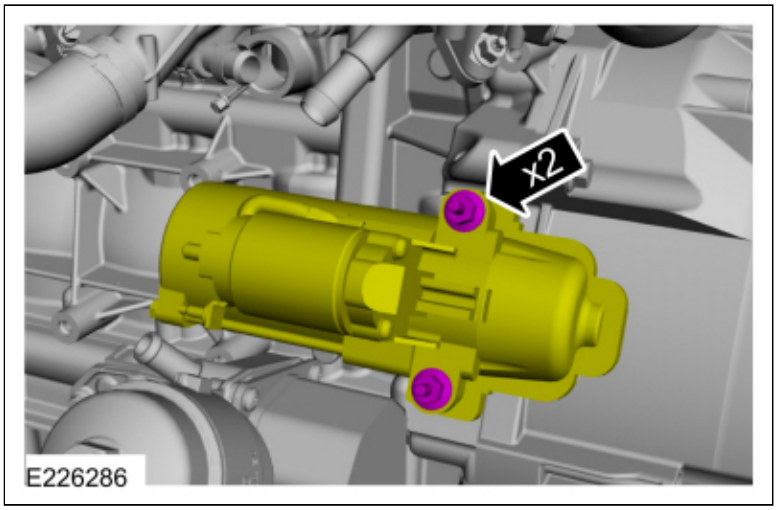
    NOTE: *Inspect the case to make sure that the old transmission fluid cooler tube O-rings are not stuck in the case.*



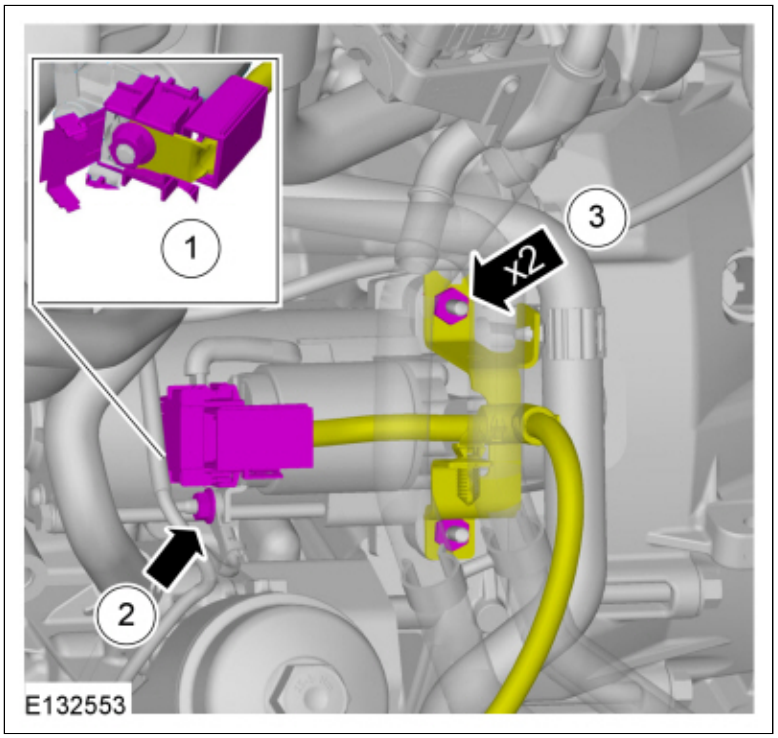
22. *Torque*: 20 Nm



23. *Torque*: 35 Nm

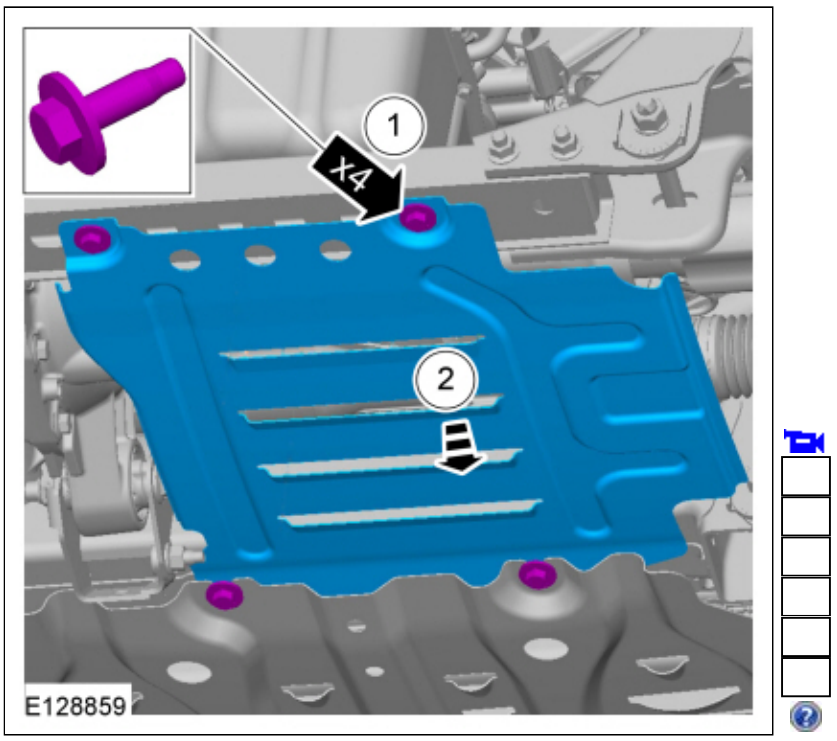


24. *Torque*:
    1: 10 Nm
    2: 10 Nm
    3: 10 Nm



25. Install the rear driveshaft.
    Refer to: Driveshaft (205-01) .

26. *Torque*: 30 Nm



27. Connect the battery ground cable.
    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .

28. Verify that the selector lever cable is correctly adjusted.
    Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

29. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.

30. If a new transmission or a new main control was installed, the solenoid body strategy must be updated.
    Refer to: Transmission Strategy Download (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).

31. If the transmission was overhauled, the adaptive drive cycle must be updated.
    Refer to: Adaptive Learning Drive Cycle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) .

32. Program the TCM with the latest calibration.

33. While driving the vehicle, use the scan tool to verify that the TFT has reached a temperature of 96.7ºC-102ºC (206ºF-215ºF). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.

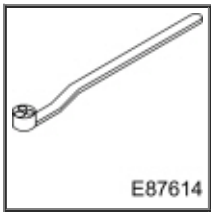
34. Check the transmission fluid level.
    Refer to: Transmission Fluid Level Check (307-01A) .

Copyright © 2016 Ford Motor Company

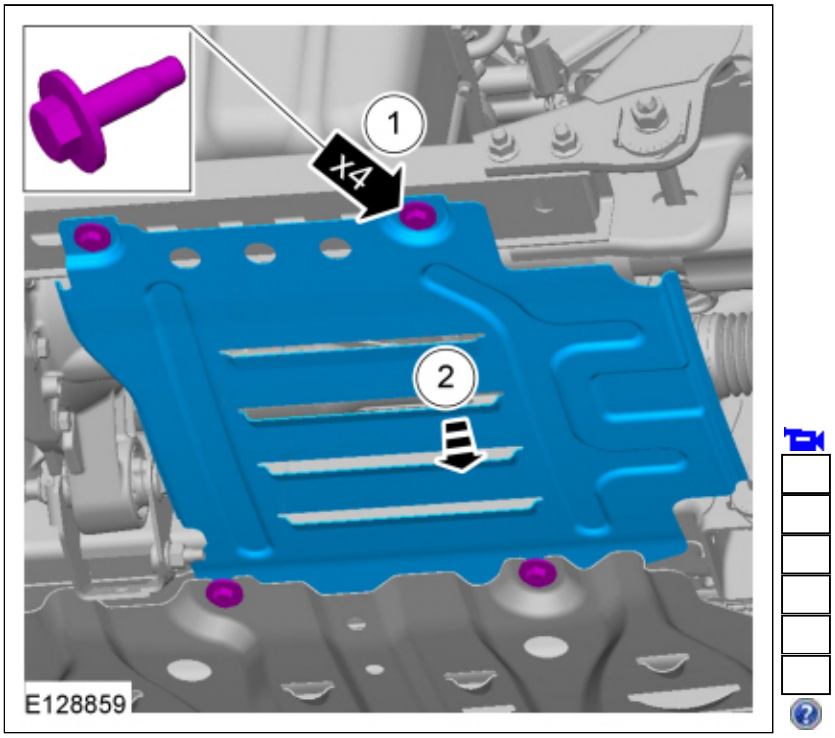
Transmission - Emission Requirements: EURO Stage V LDT/EURO Stage VI, LHD 4WD/RHD 4WD

Base Part Number: 7000

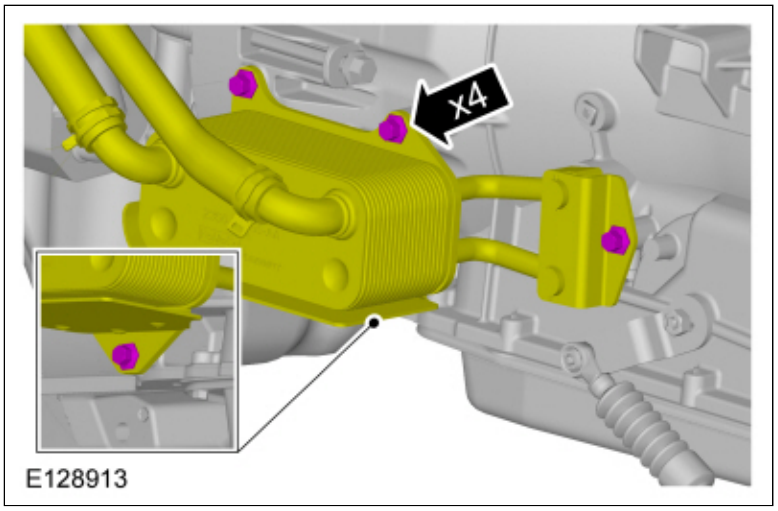
Special Tool(s) / General Equipment

 E87614	303-1310 Holding Wrench, Crankshaft
 307-346	307-346 (T97T-7902-A) Retainer, Torque Converter
Transmission Jack	

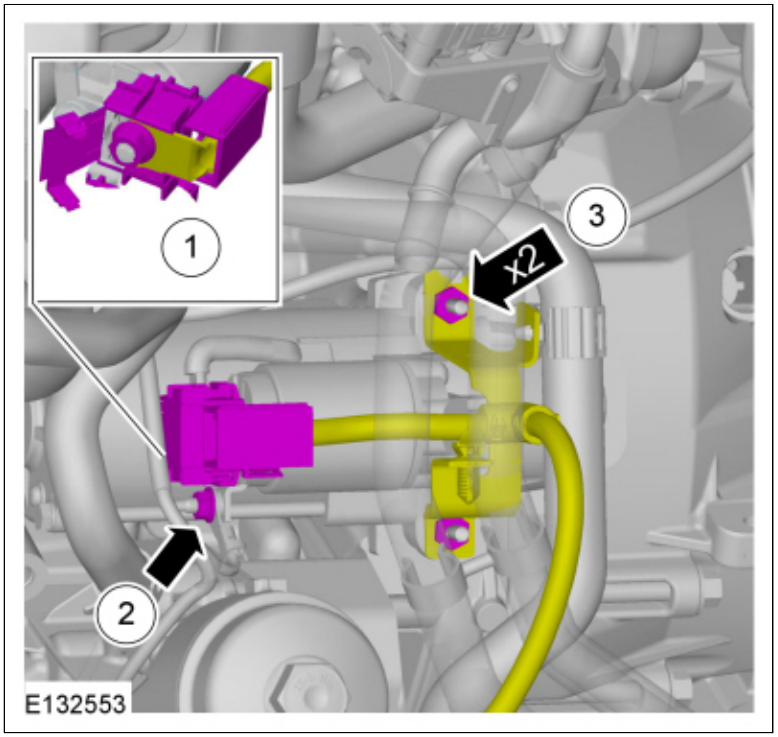
Removal

1. Remove the battery negative terminal.
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Remove the front driveshaft.
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
4. Remove the rear driveshaft.
   Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
5. Drain the transmission fluid.
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
6. 

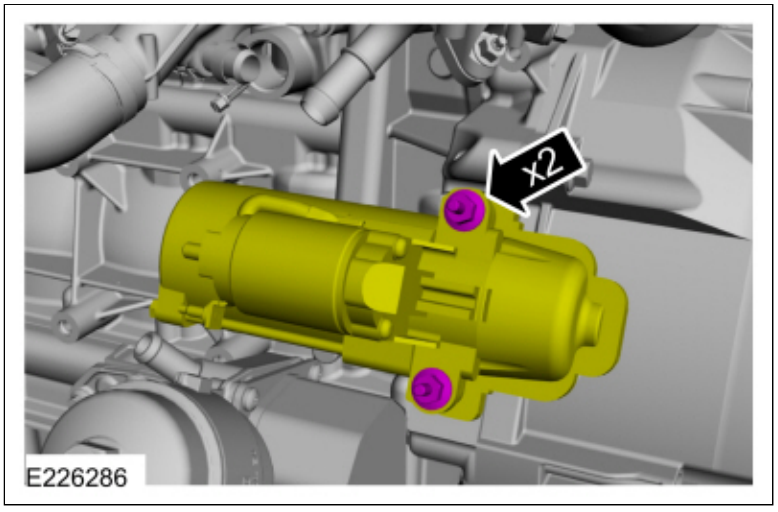
7. **NOTE:** *Be prepared to collect escaping fluid.*



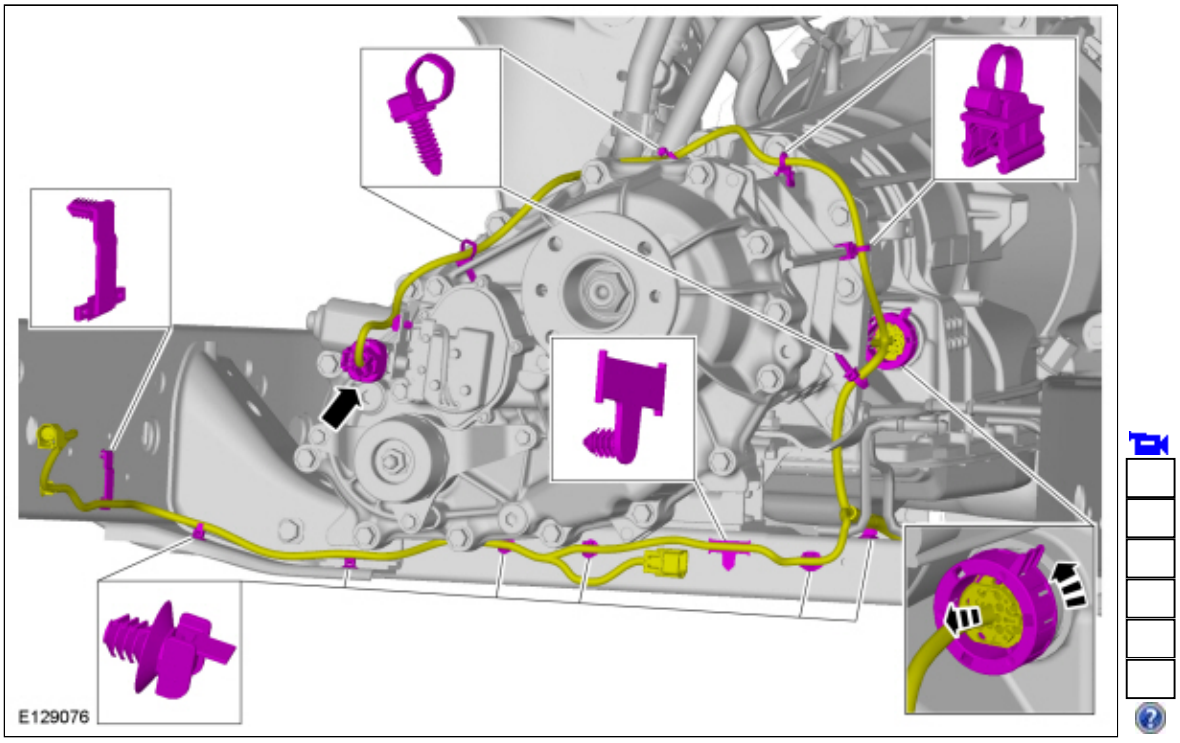
8.



9.

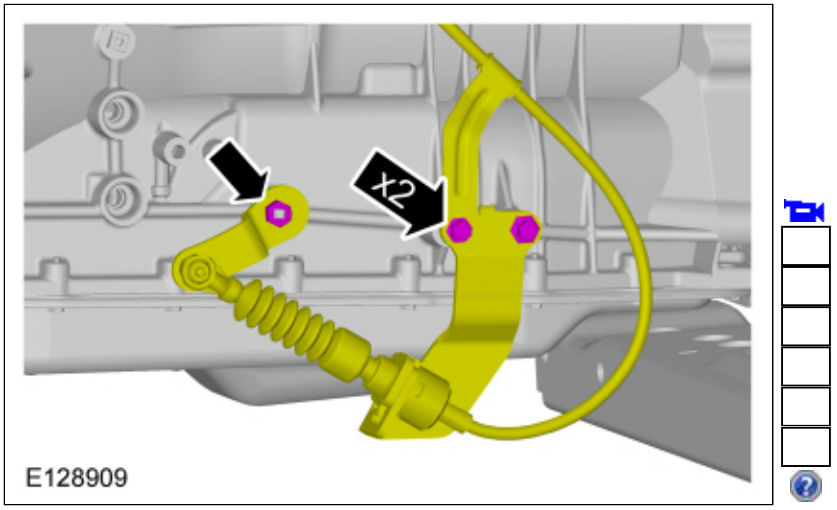


10.



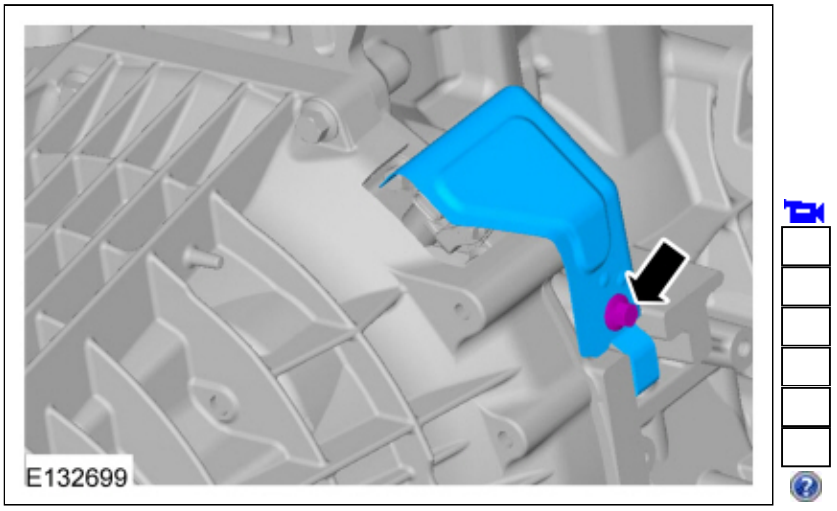
11. **NOTICE: Take extra care when handling selector lever cable.**

    NOTE: *Note the position of the component before removal.*

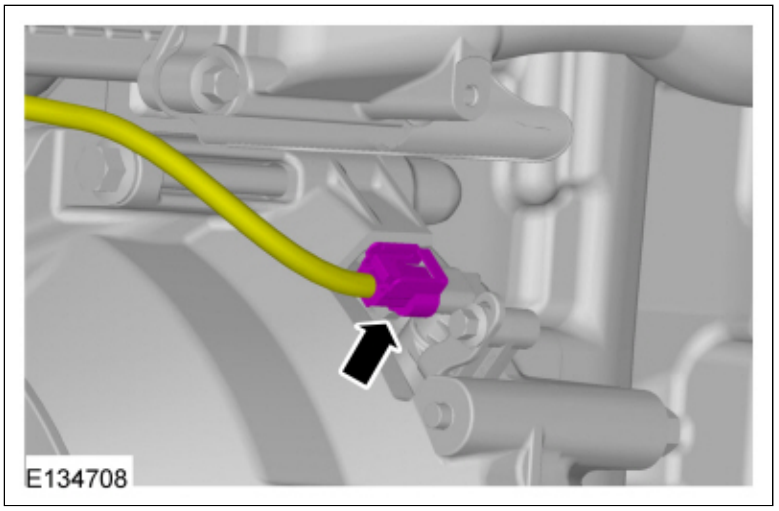


12. Refer to: Diesel Particulate Filter (DPF) - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

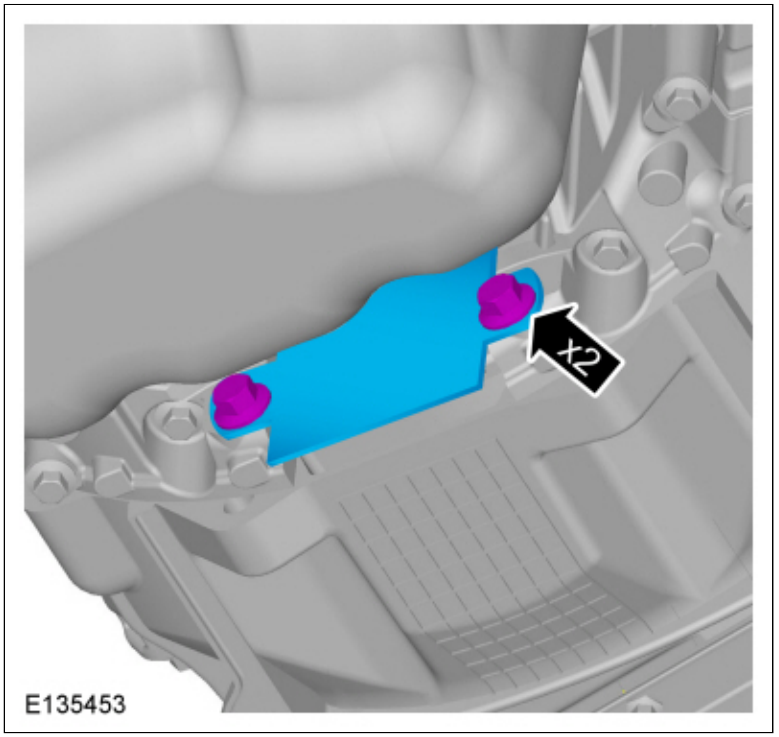
13.



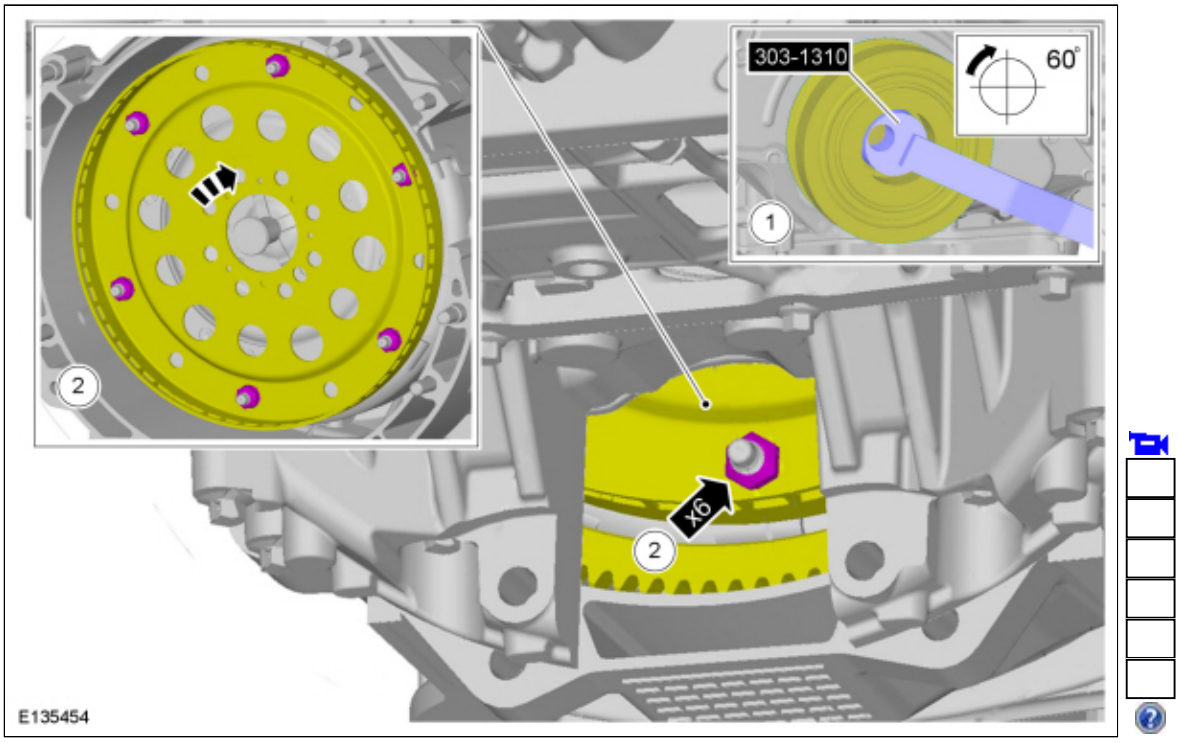
14.



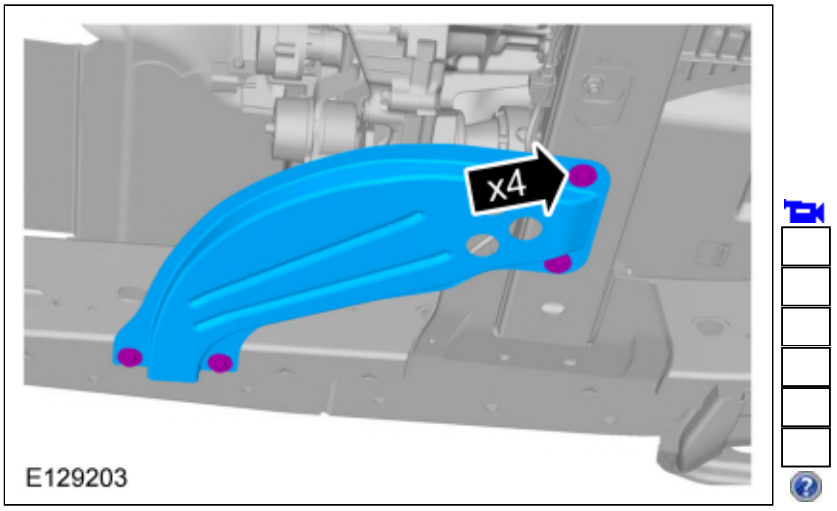
15.



16. Use Special Service Tool: 303-1310 Holding Wrench, Crankshaft.

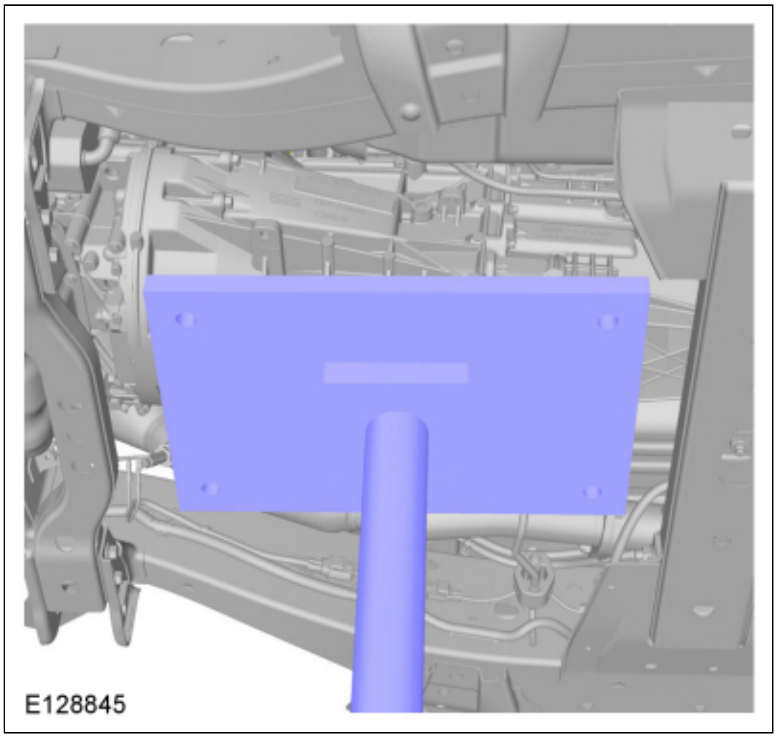


17. If equipped.

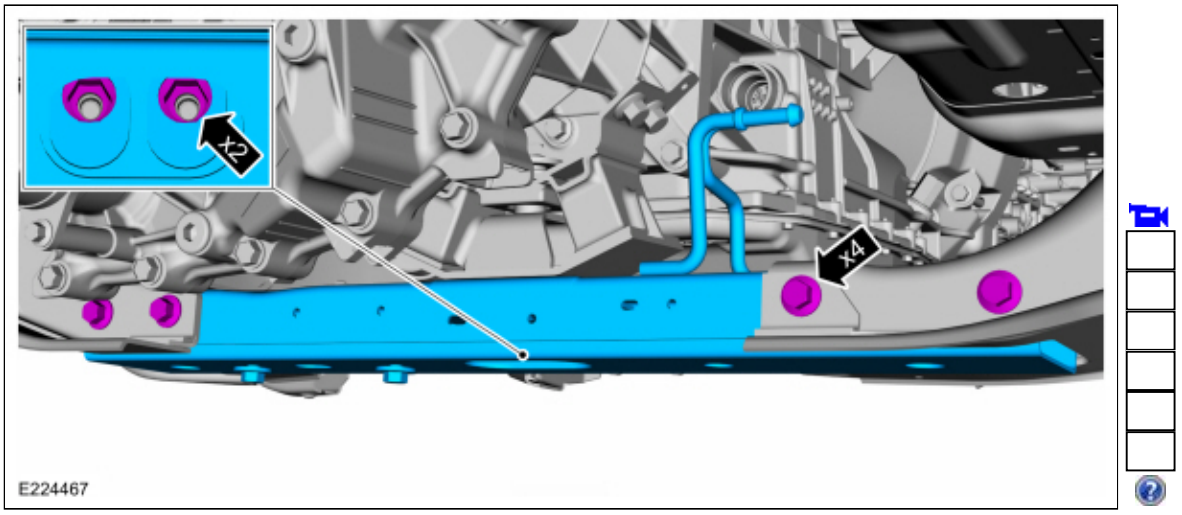


18. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

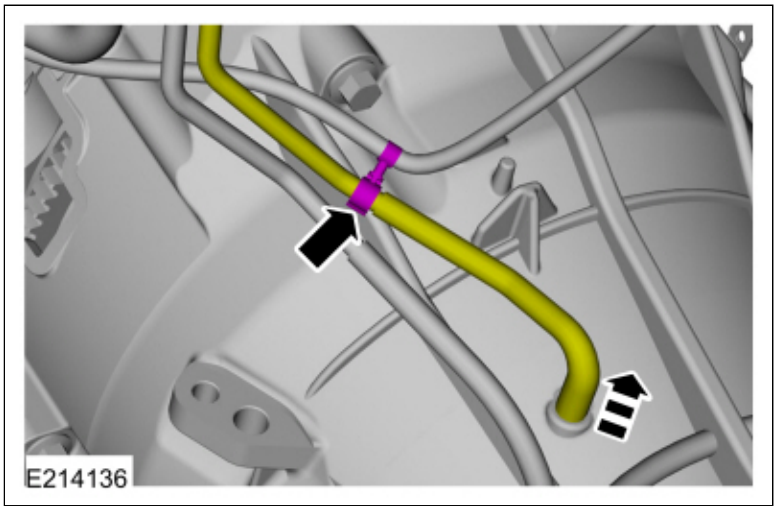
    Use the General Equipment: Transmission Jack



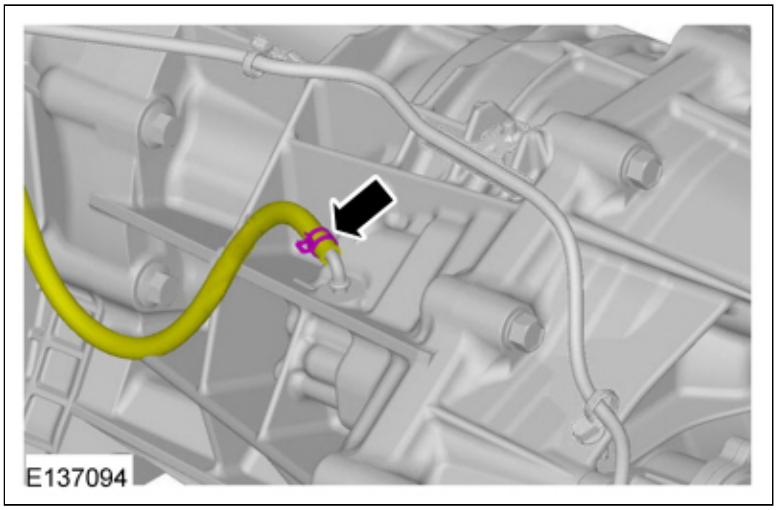
19.



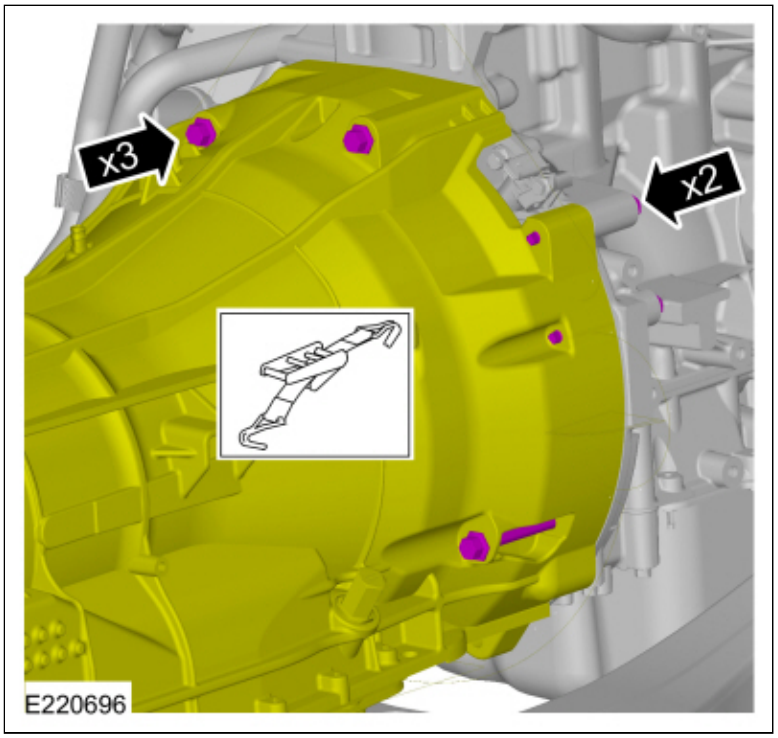
20.



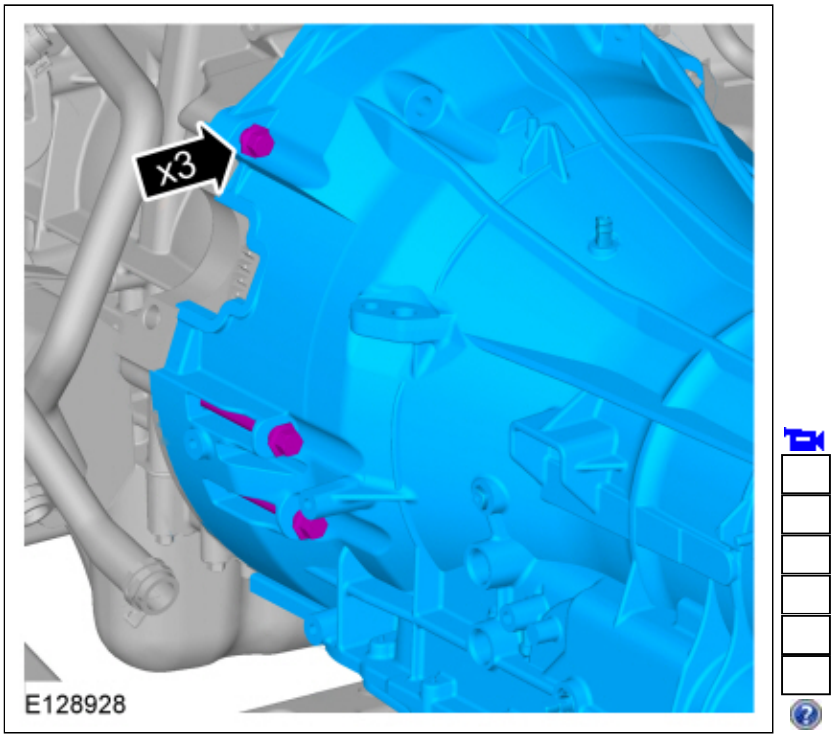
21.



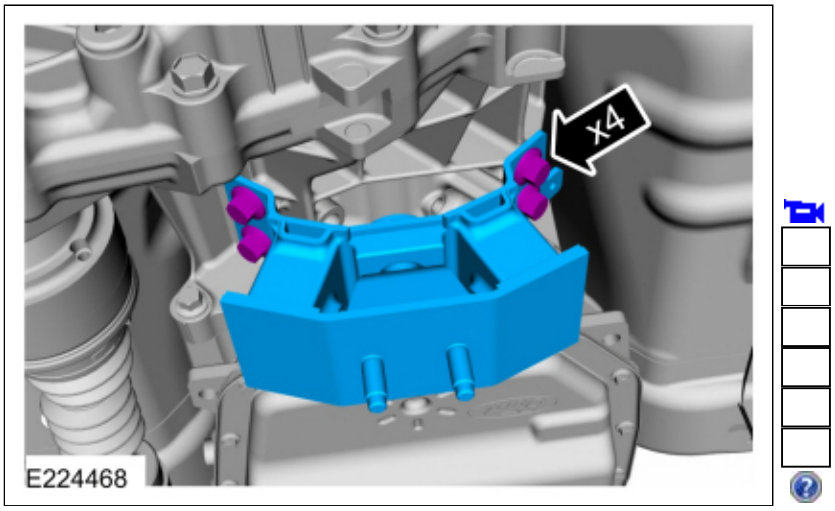
22.



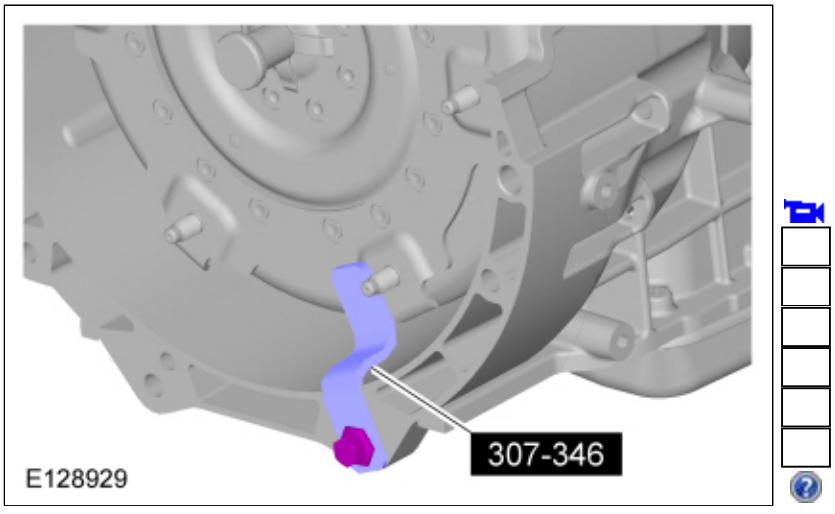
23.



24.

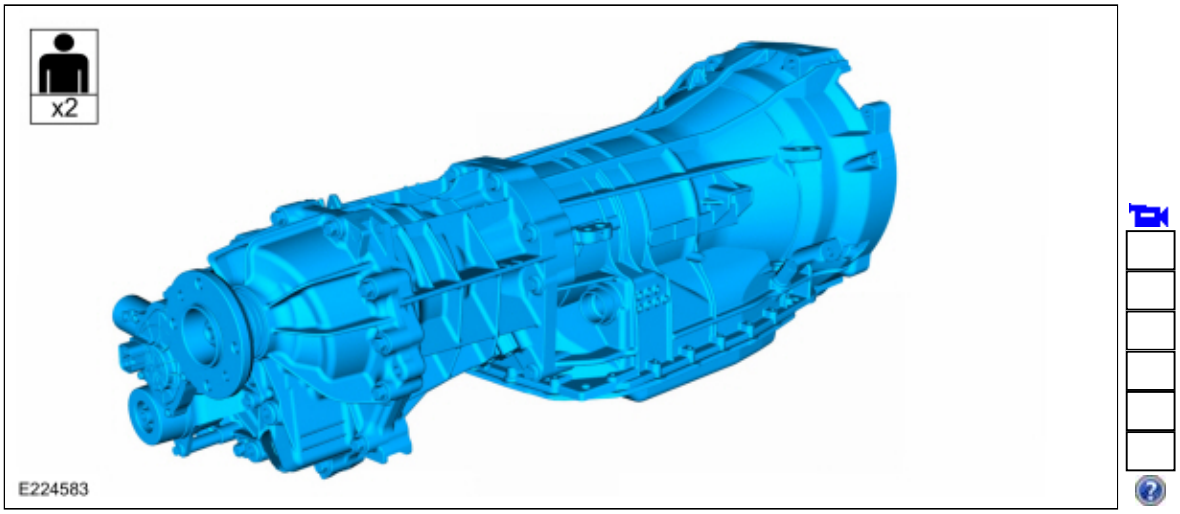


25. Slide the transmission back far enough to install the Torque Converter Retainer.
Use Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



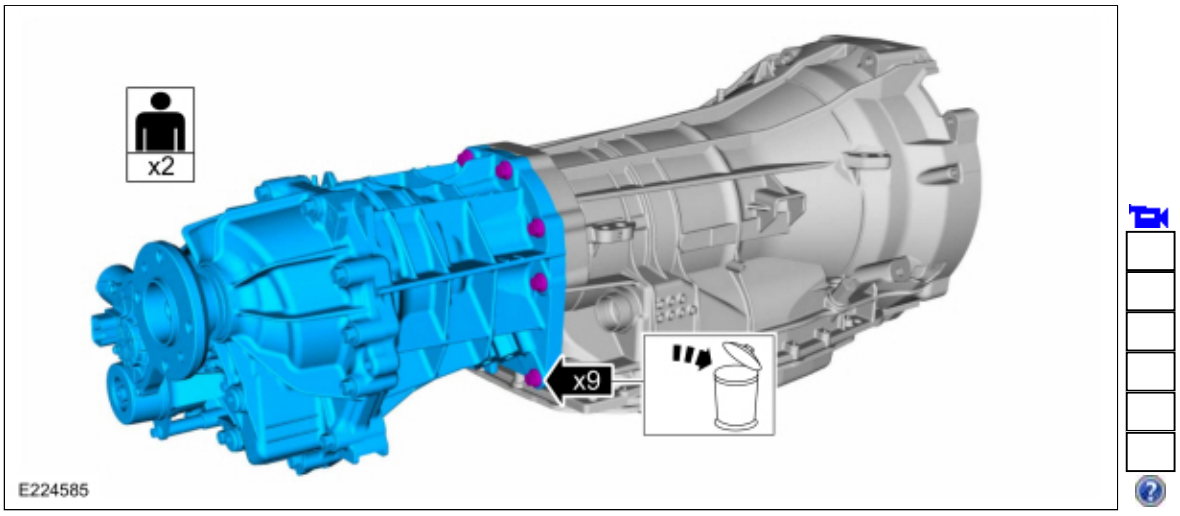
26. **NOTE:** *This step requires the aid of another technician.*

Remove the transmission and transfer case assembly from the vehicle.



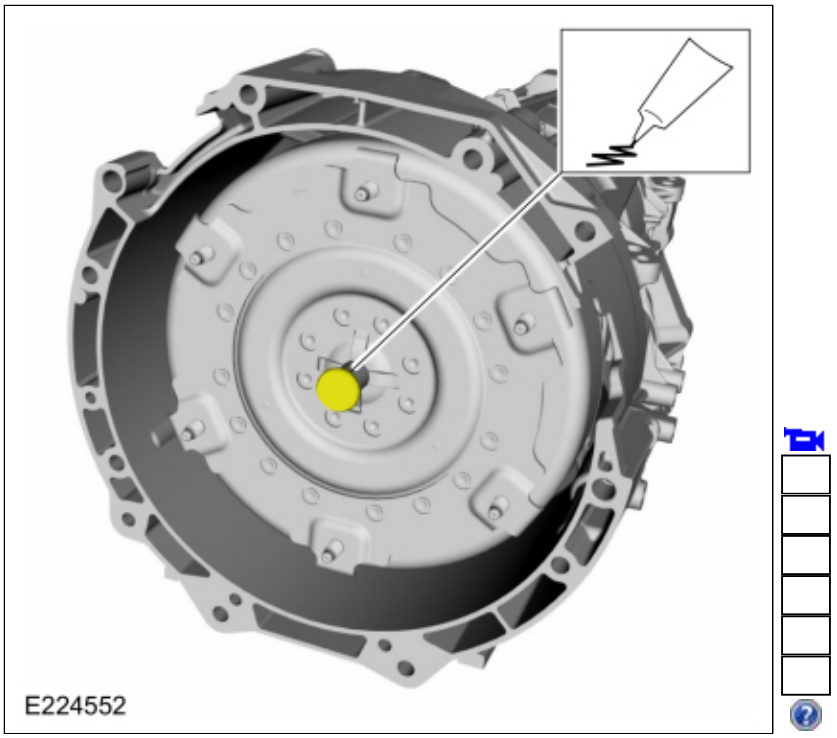
27. **NOTE:** *This step requires the aid of another technician.*

    Separate the transfer case assembly from the transmission and remove the transmission jack.

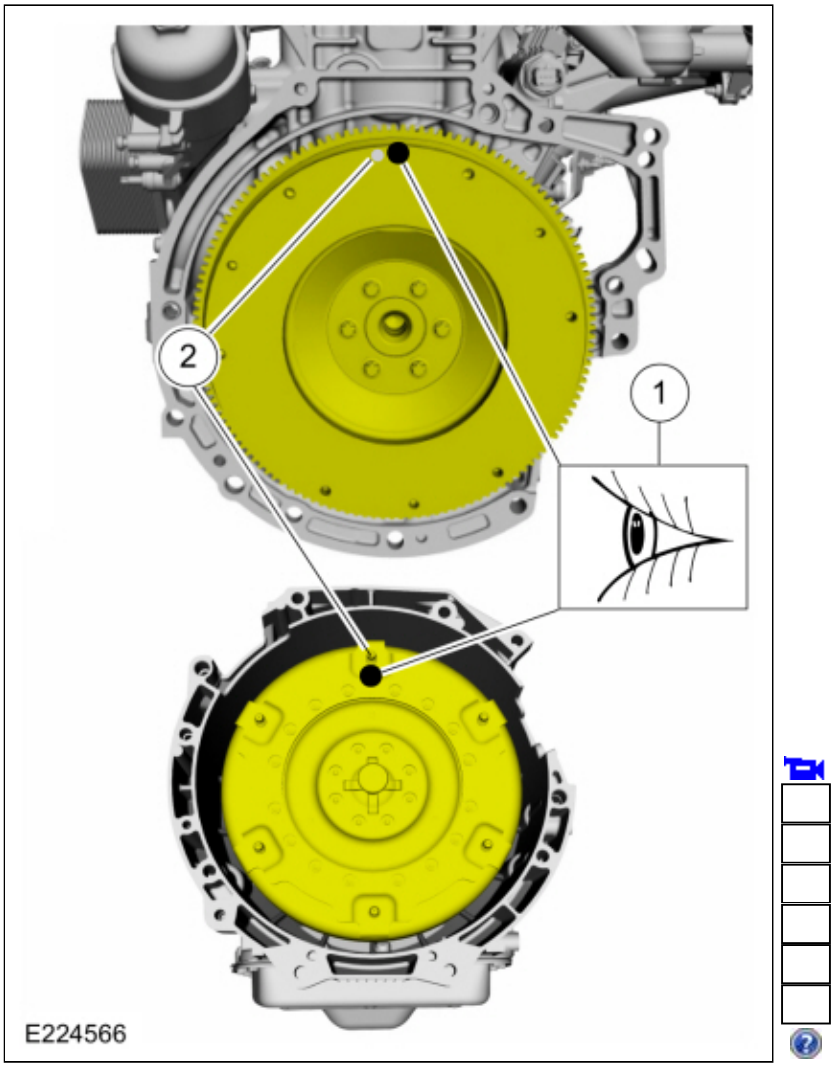


Installation

1. Lubricate the torque converter pilot hub with multipurpose grease.



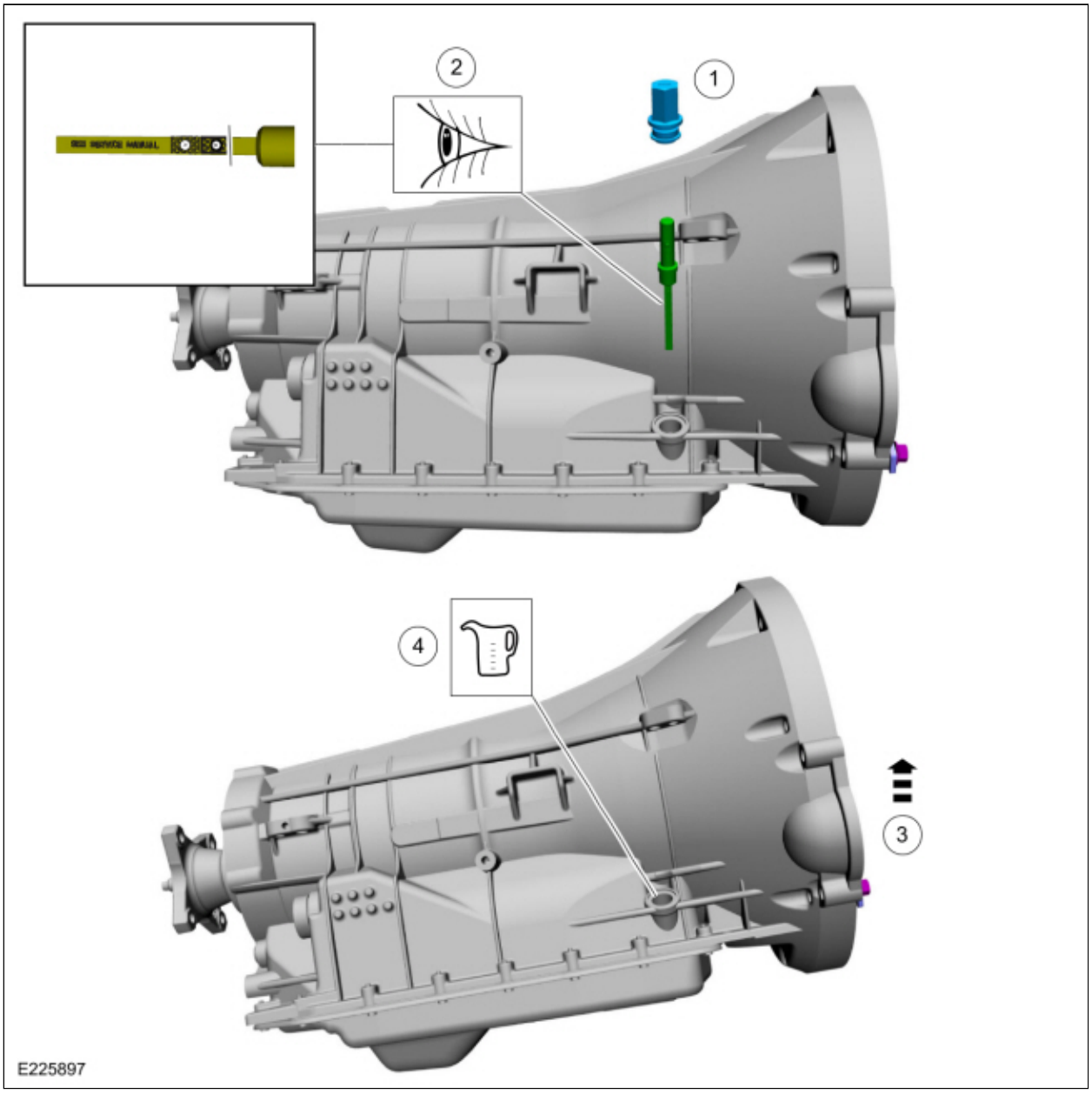
1. Inspect the torque converter stud and flexplate for paint marks.
2. Align the torque converter stud and flexplate hole near the paint marks to the 12 o'clock position.



3. **NOTICE: If a new transmission is installed, the fluid level must be checked after installation.**

   NOTE: *If transmission was disassembled, add transmission fluid to the transmission.*

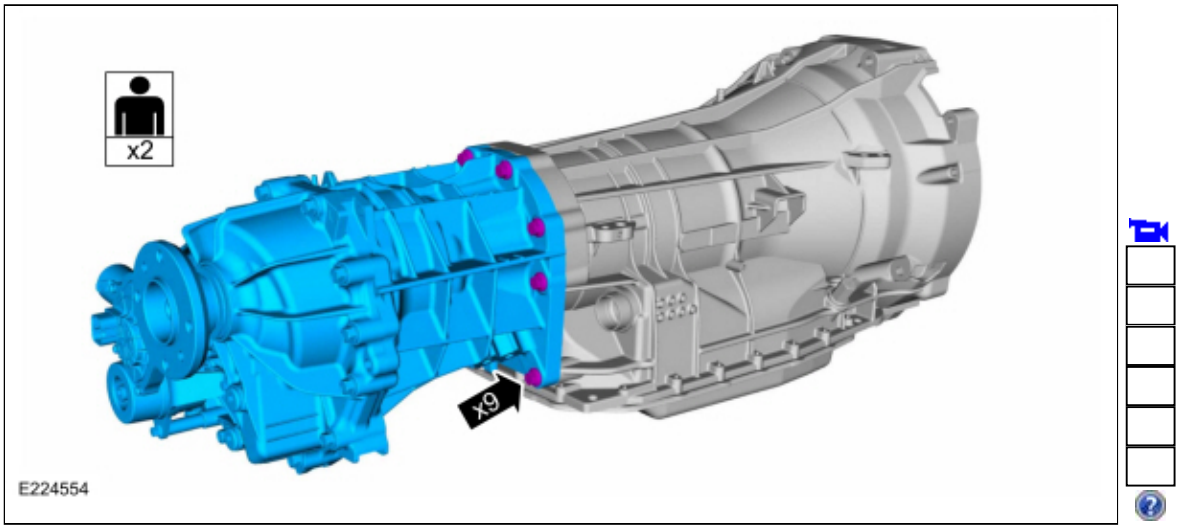
   1. Remove the transmission fluid fill plug transmission fluid level indicator assembly.
      Torque: 26 Nm
   2. Verify transmission is filled with transmission fluid.
   3. Slightly tilt the transmission rearward.
   4. Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).



4. **NOTE:** *This step requires the aid of another technician.*

   NOTE: *Make sure that new bolts are installed.*

   Torque: 48 Nm

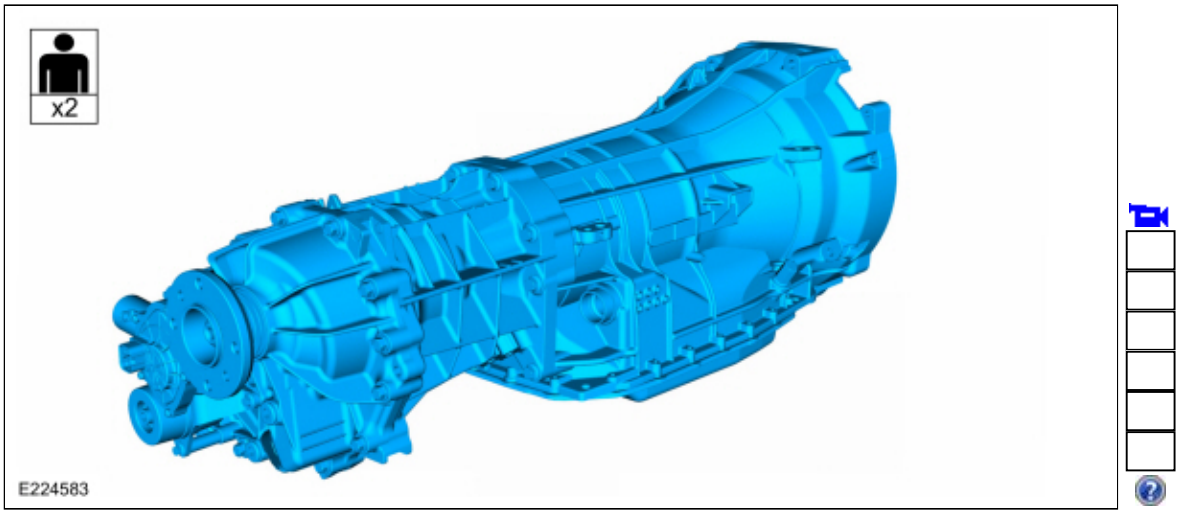


5. **NOTE:** *This step requires the aid of another technician.*

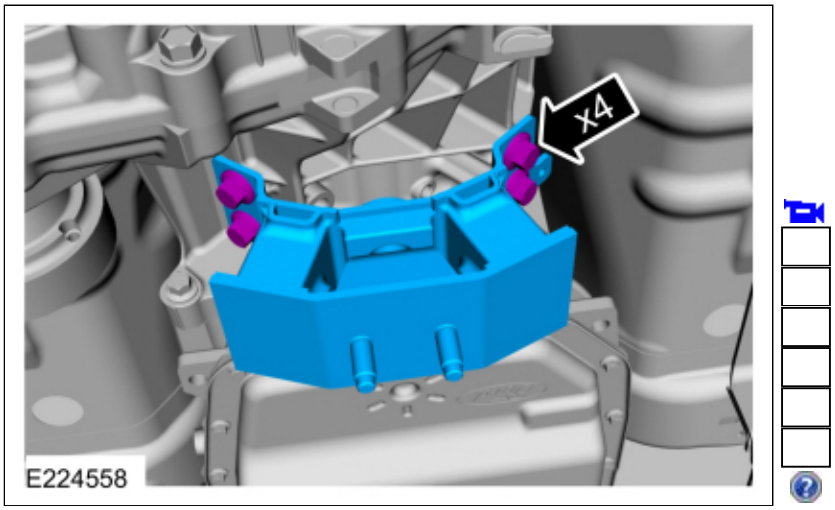
   1. Position the transmission assembly on jack.

Use the General Equipment: Transmission Jack

2. Secure the transmission to the transmission jack with a safety strap.



6. *Torque*: 90 Nm

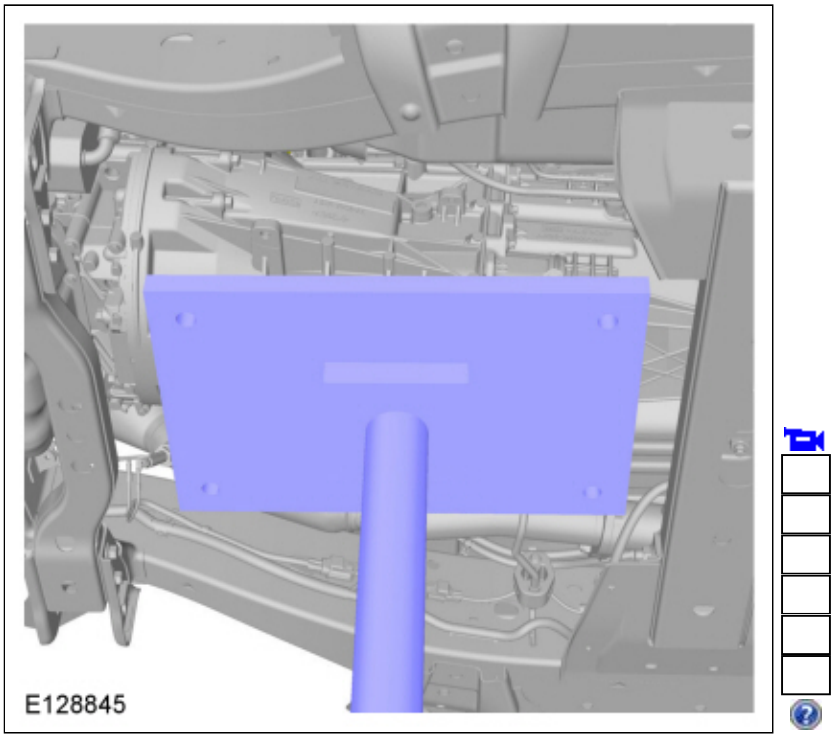


7. **WARNING: Always secure engines, transmissions, or other heavy components to the support fixture with straps and wooden support blocks. Improperly secured assemblies could fall off the fixture, resulting in serious personal injury.**

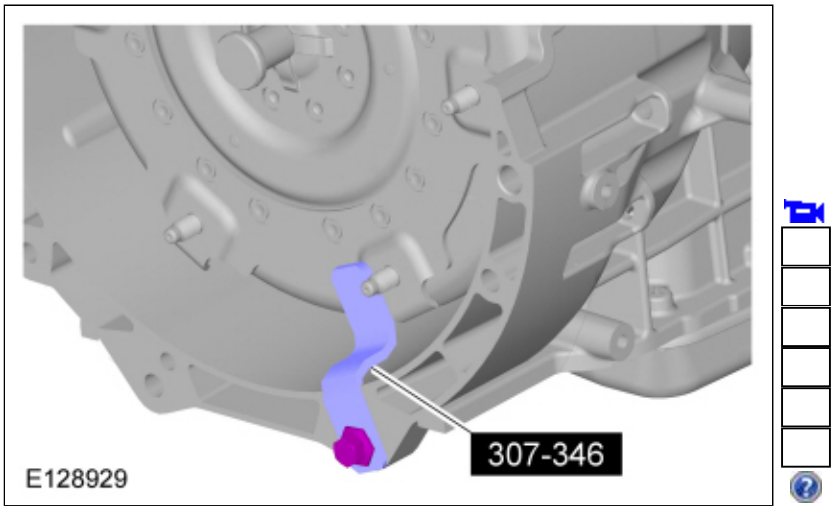
   NOTICE: The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine crankshaft.

   NOTE: *Make sure that the transmission jack makes contact on the outer ribs of the fluid pan.*

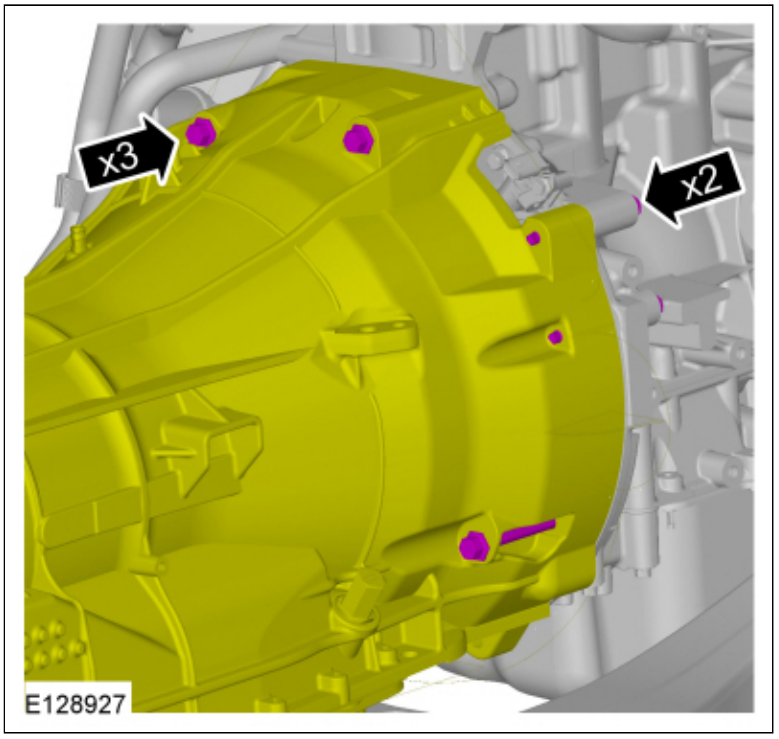
   Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle.



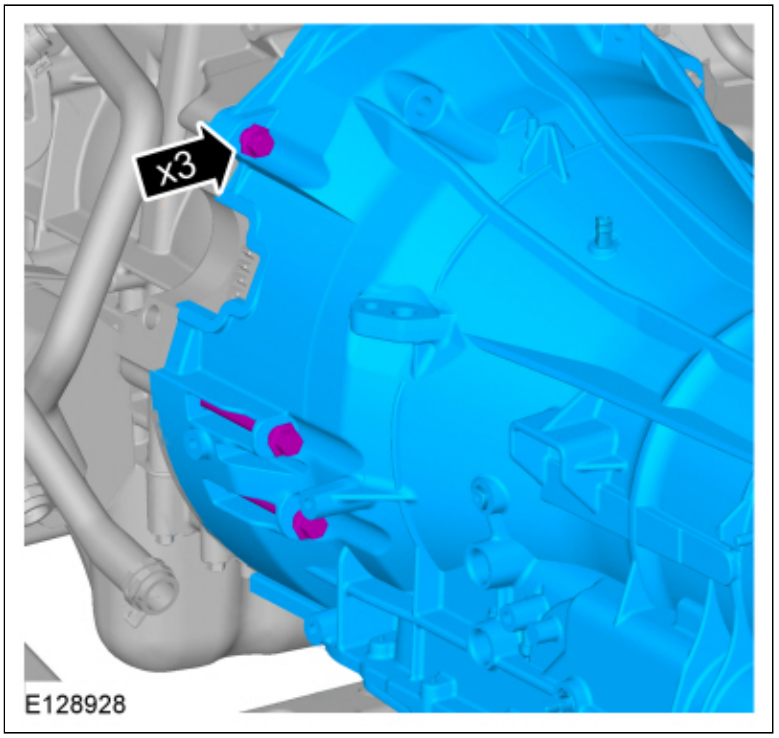
8. Remove Special Service Tool: 307-346 (T97T-7902-A) Retainer, Torque Converter.



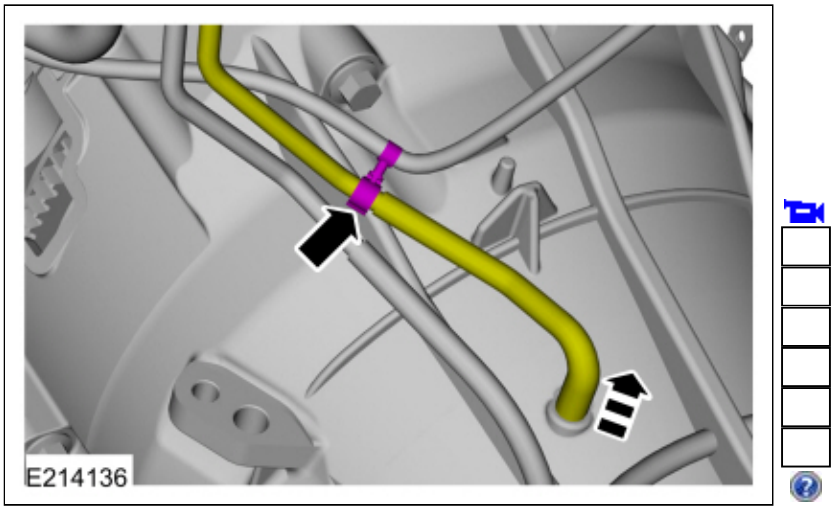
9. *Torque*: 48 Nm



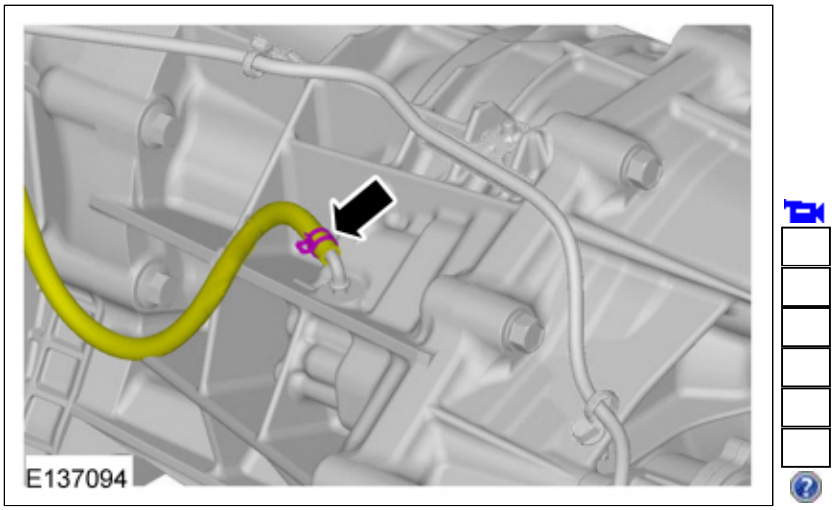
10. *Torque*: 48 Nm



11.

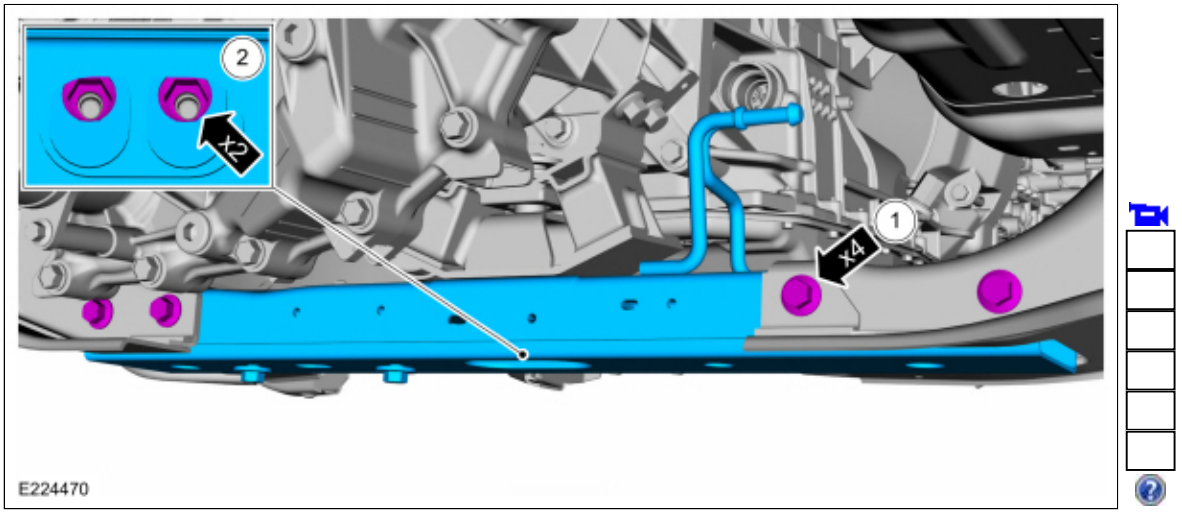


12.

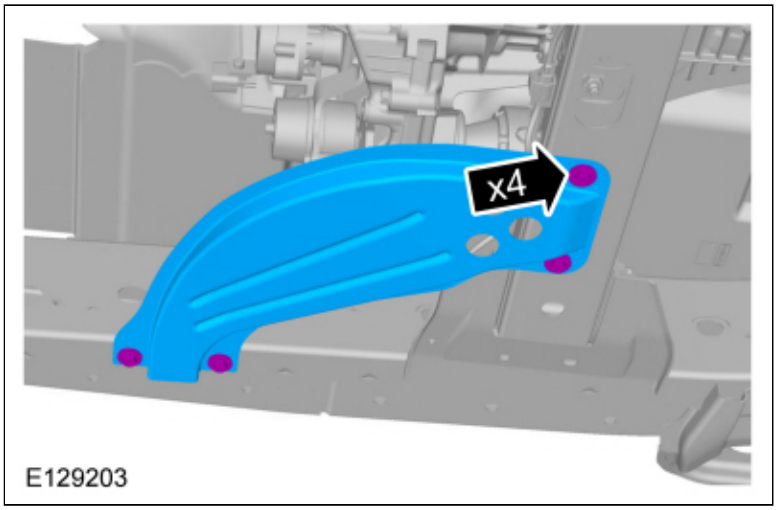


13. **NOTE:** *Install all the bolts and nuts finger tight before final tightening.*

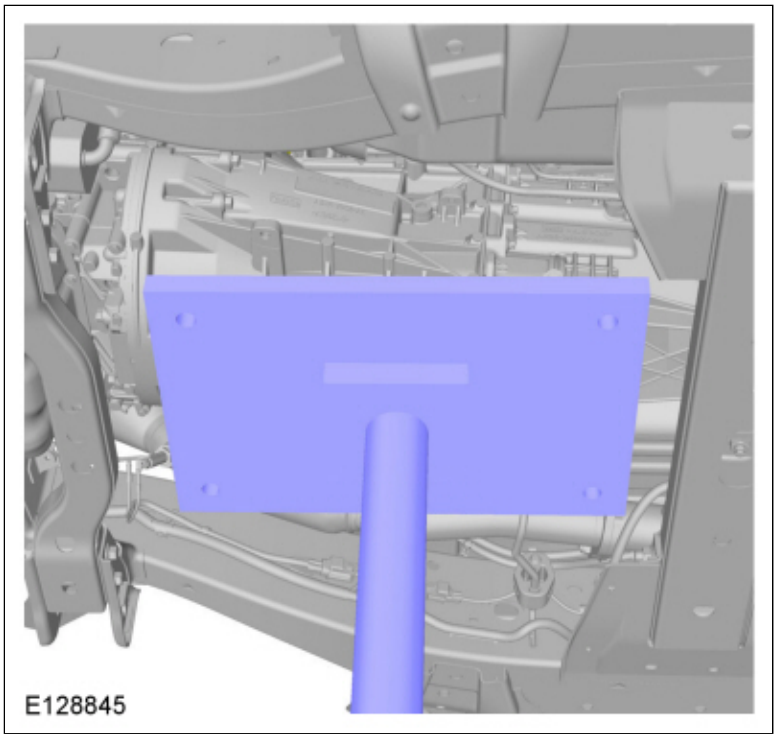
Torque:
1: 90 Nm
2: 90 Nm



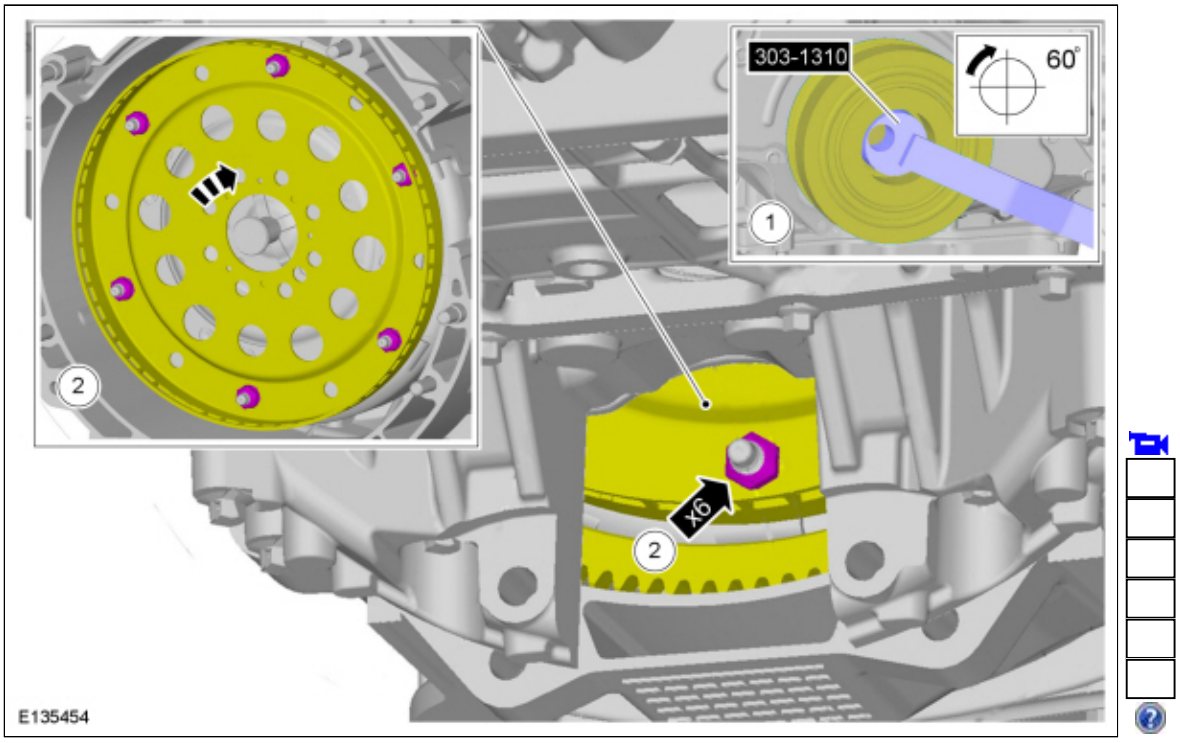
14. If equipped.
Torque: 48 Nm



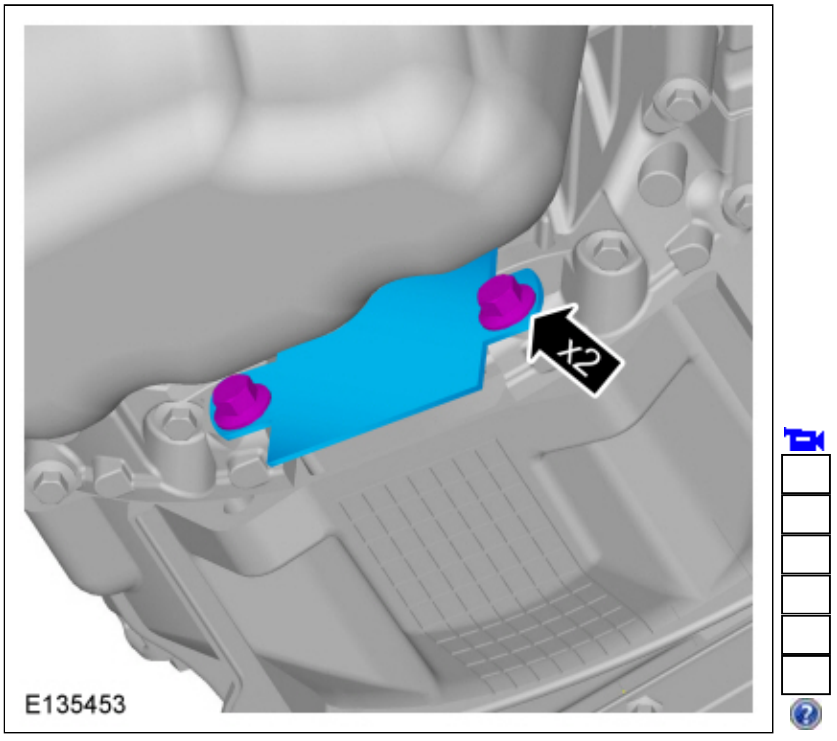
15. Remove the transmission jack.



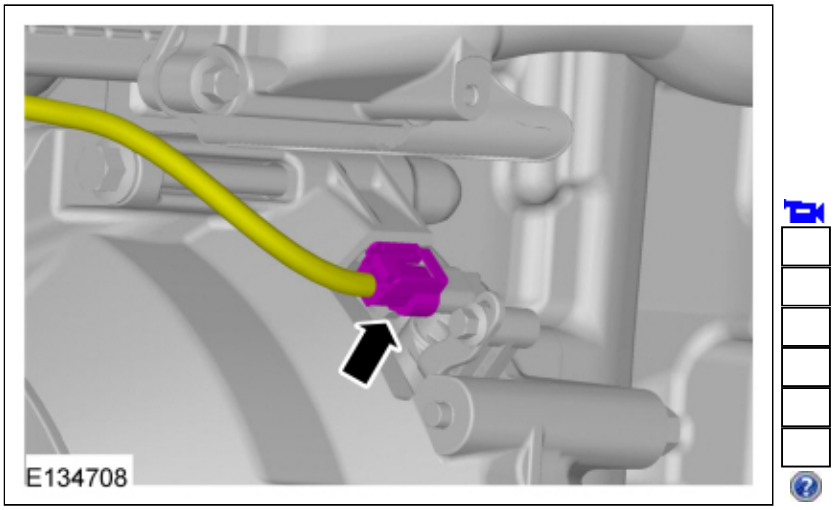
16. Remove Special Service Tool: 303-1310 Holding Wrench, Crankshaft.
Torque: 48 Nm



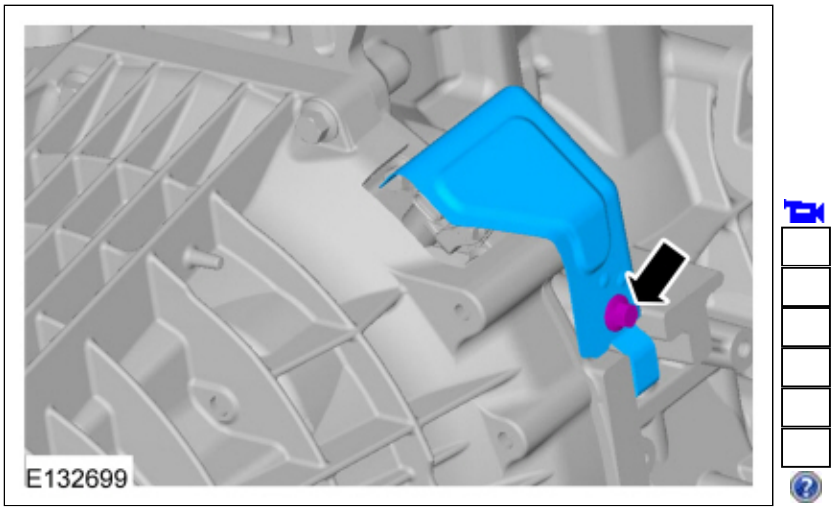
17. *Torque*: 48 Nm



18.

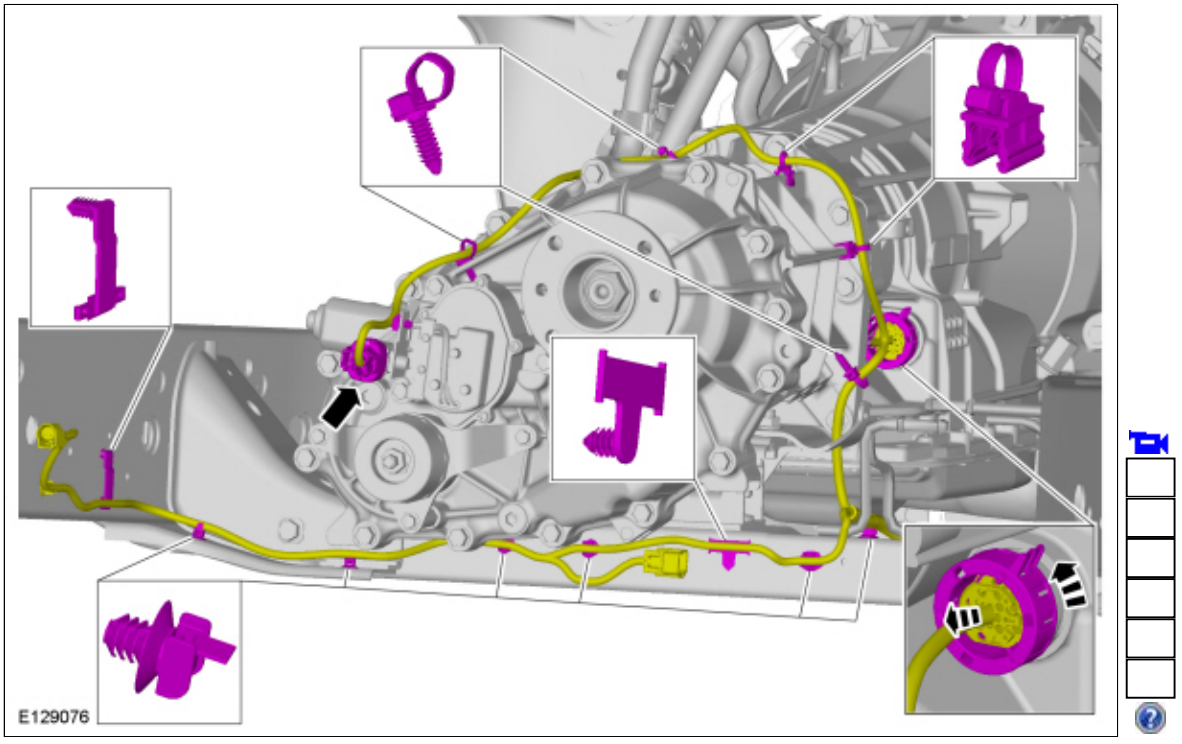


19. *Torque*: 25 Nm



20. Refer to: Diesel Particulate Filter (DPF) - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

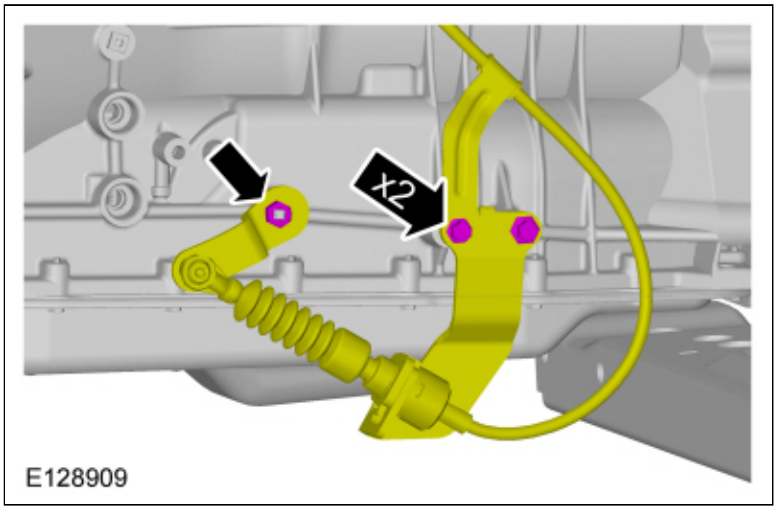
21.



22. **NOTICE: Take extra care when handling selector lever cable.**

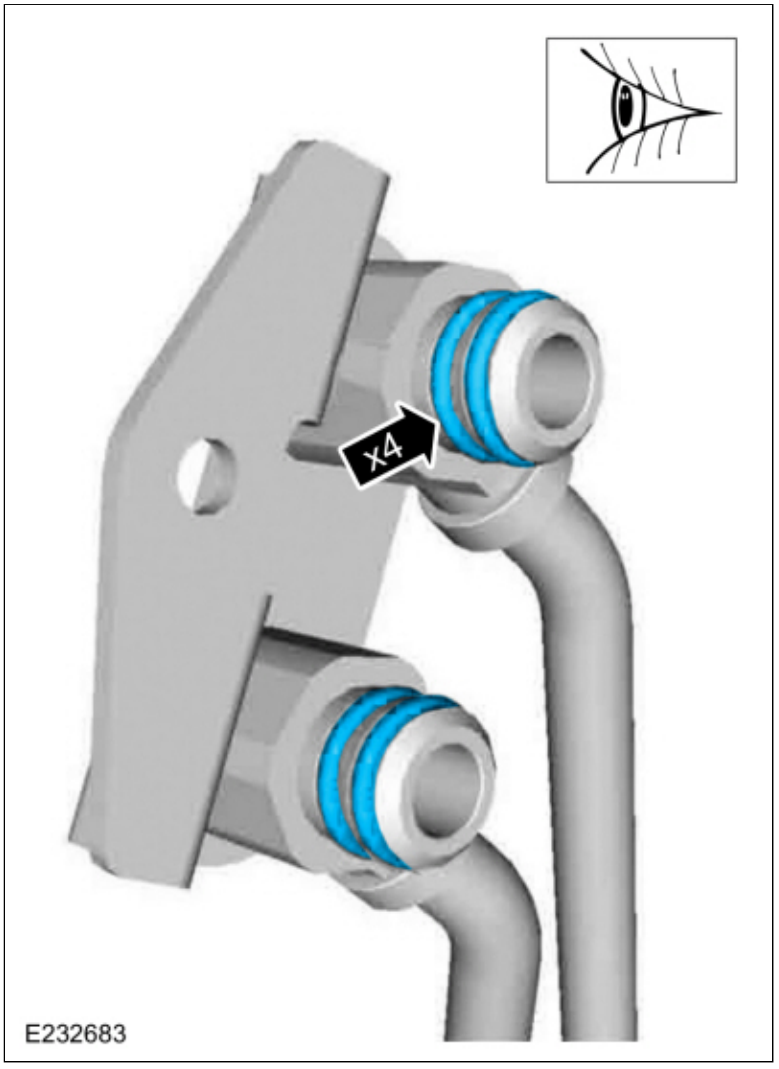
NOTE: *Make sure that the component is installed to the position noted before removal.*

Torque: 25 Nm

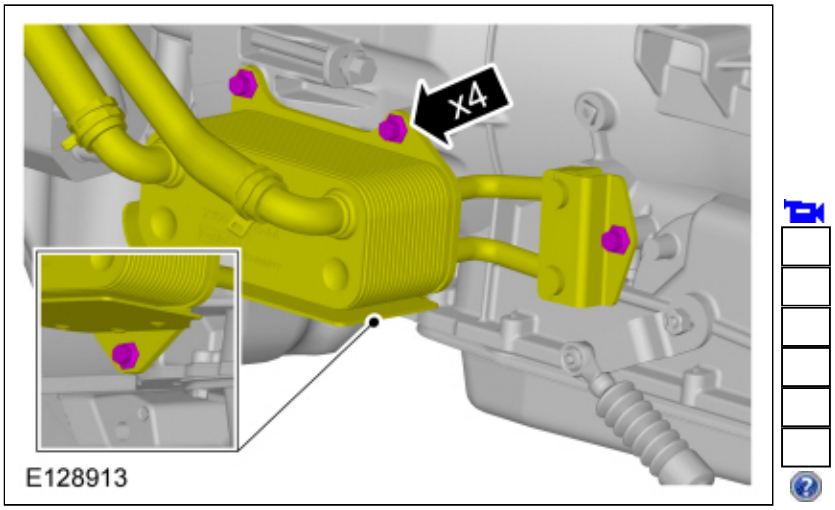


23. **NOTE:** *Make sure that a new component is installed if the O-ring is damaged.*

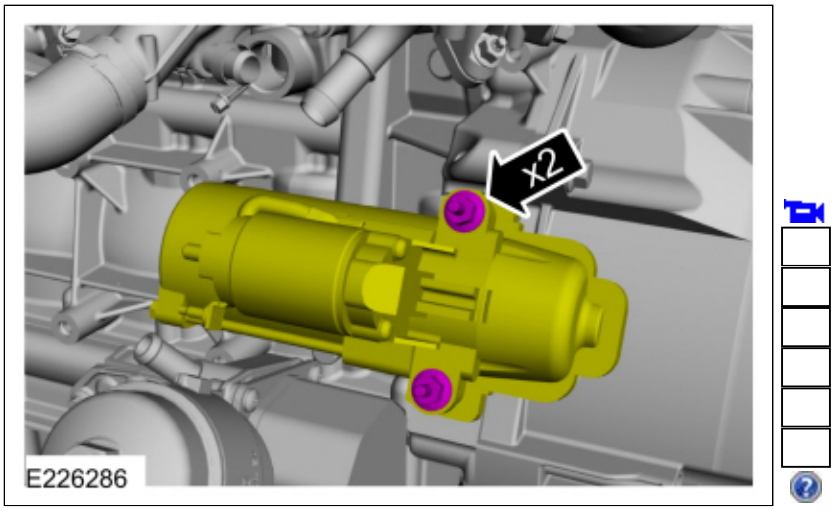
    NOTE: *Inspect the case to make sure that the old transmission fluid cooler tube O-rings are not stuck in the case.*



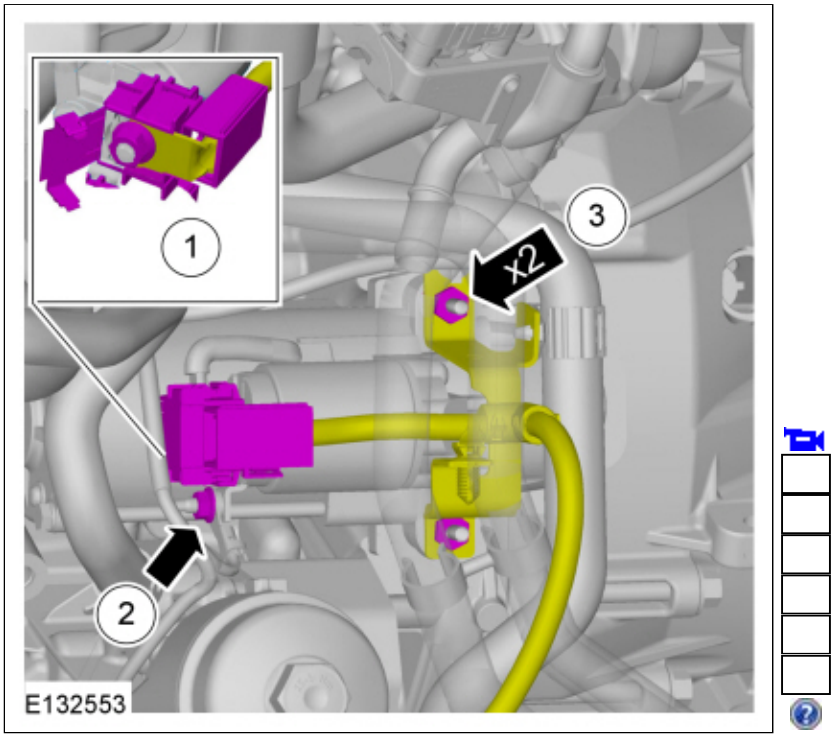
24. *Torque*: 20 Nm



25. *Torque*: 35 Nm



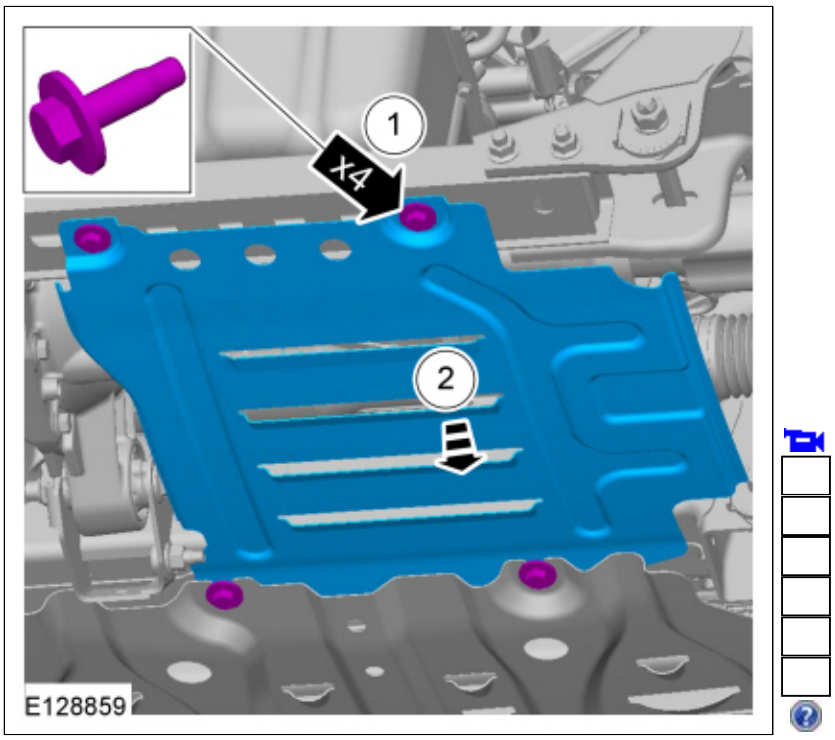
26. *Torque*:
    1: 10 Nm
    2: 10 Nm
    3: 10 Nm



27. Install the rear driveshaft.
    Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).

28. Install the front driveshaft.
    Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

29. *Torque*: 30 Nm



30. Connect the battery ground cable.
    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

31. Verify that the selector lever cable is correctly adjusted.
    Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

32. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.

33. If a new transmission or a new main control was installed, the solenoid body strategy must be updated.
    Refer to: Transmission Strategy Download (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).

34. If the transmission was overhauled, the adaptive drive cycle must be updated.
    Refer to: Adaptive Learning Drive Cycle (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80)
    .

35. Program the TCM with the latest calibration.

36. While driving the vehicle, use the scan tool to verify that the TFT has reached a temperature of 96.7ºC-102ºC (206ºF-215ºF). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.

37. Check the transmission fluid level.
    Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).

Copyright © 2016 Ford Motor Company

Transmission - 4x2

Base Part Number: 7000

1. To remove the transmission assembly.
   Refer to: Transmission - Emission Requirements: EURO Stage V LDT/EURO Stage VI, LHD RWD/RHD RWD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
   Refer to: Transmission - LHD RWD/RHD RWD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Copyright © 2016 Ford Motor Company

Transmission - 4x4

Base Part Number: 7000

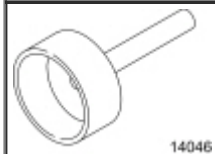
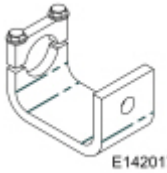
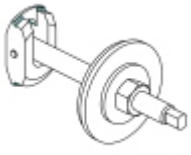
1. To remove the transmission assembly.
   Refer to: Transmission - Emission Requirements: EURO Stage V LDT/EURO Stage VI, LHD 4WD/RHD 4WD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
   Refer to: Transmission - LHD 4WD/RHD 4WD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Copyright © 2016 Ford Motor Company

Transmission

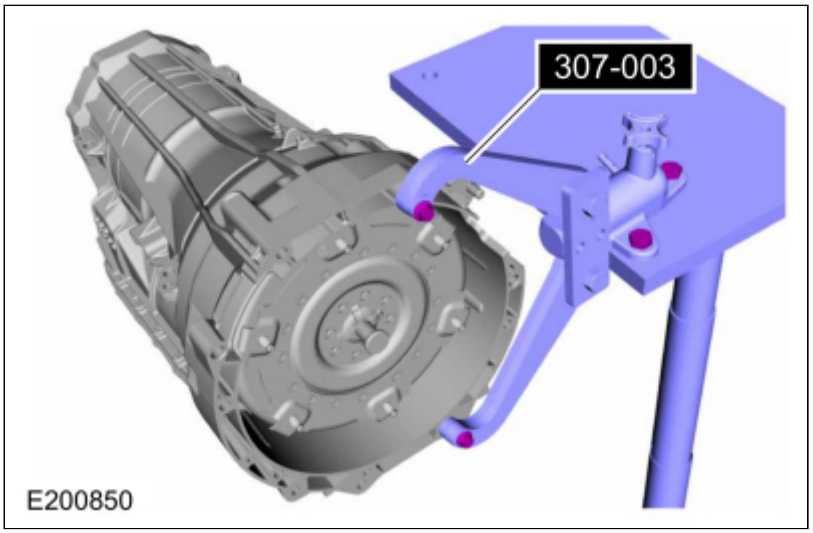
Base Part Number: 7000

Special Tool(s) / General Equipment

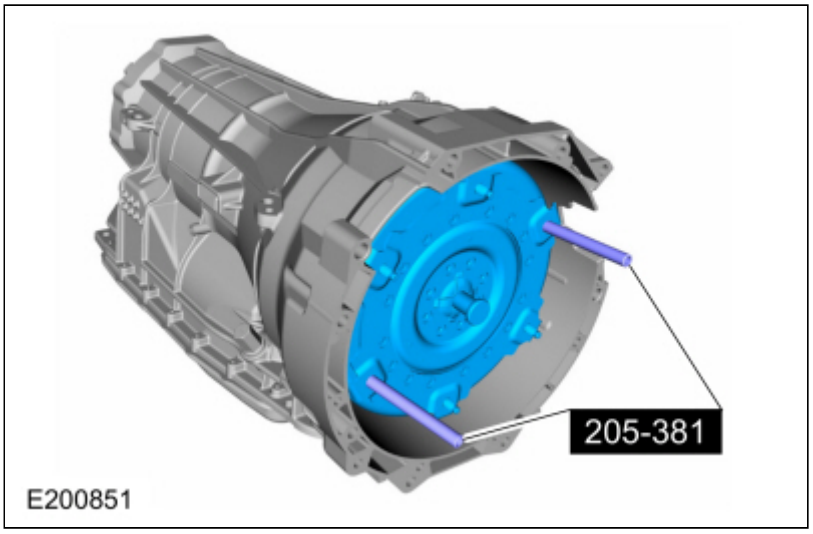
 E129694	100-001 (T50T-100-A) Slide Hammer
 14046	205-256 Installer, Front Wheel Hub Seal
 307-003	307-003 (T57L-500-B) Holding Fixture, Transmission
 E142010	307-091 Handle, Torque Converter
 E142013	307-343 Retaining Ring Pliers
 E142017	307-553 Remover, Transmission Fluid Pump
 E142022	307-562 Remover, Needle Bearing
 E173280	307-717 Remover, Kostal Sleeve
	308-375 Remover, Input Shaft Seal

	
Punch	

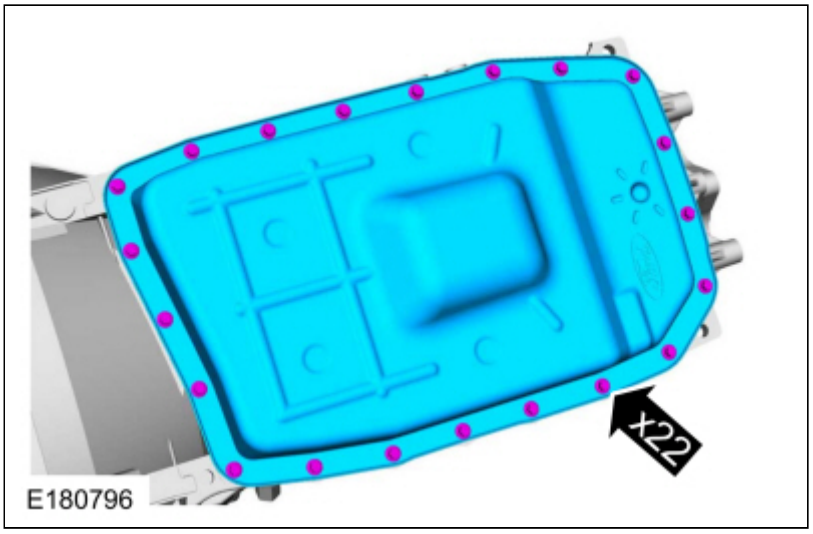
1. Install Transmission Holding Fixture on the torque converter housing and install the transmission on a bench.
   Use Special Service Tool: 307-003 (T57L-500-B) Holding Fixture, Transmission.



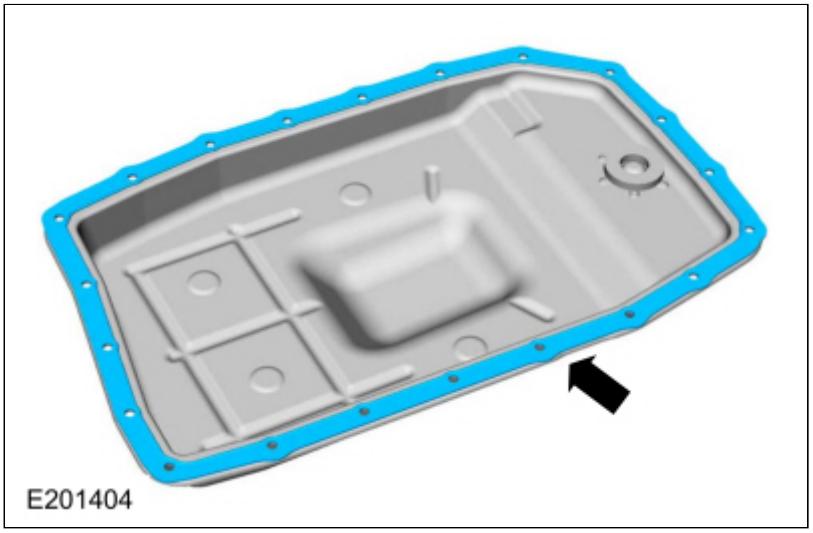
2. Using the Torque Converter Handle, remove the torque converter.
   Use Special Service Tool: 307-091 Handle, Torque Converter.



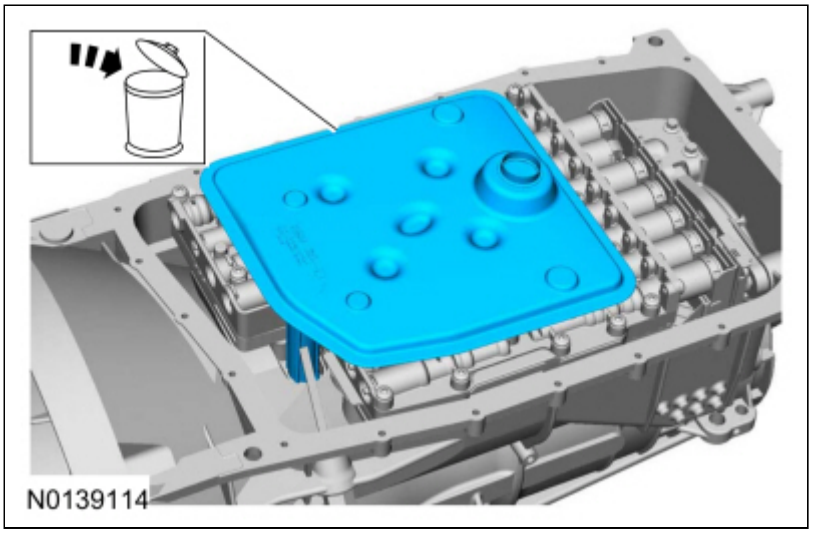
3. Remove the transmission fluid pan bolts and the pan.



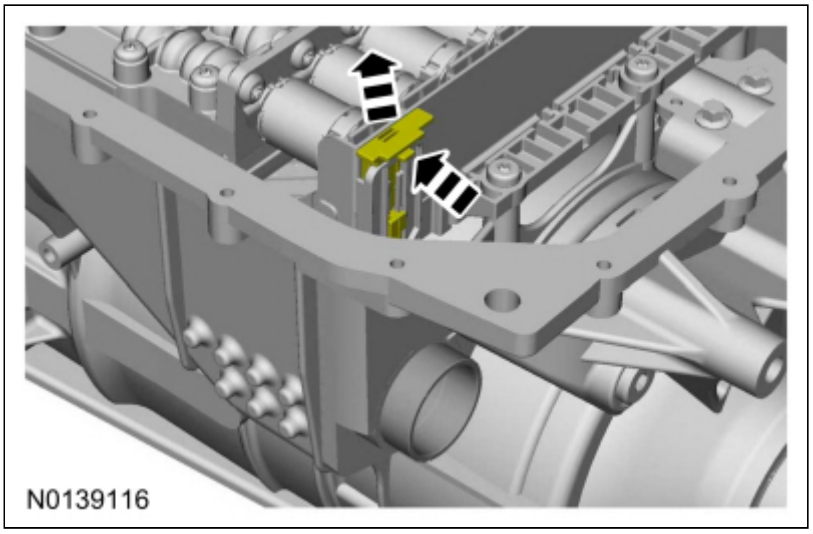
4. Remove the transmission fluid pan gasket.



5. Remove and discard the transmission fluid filter.

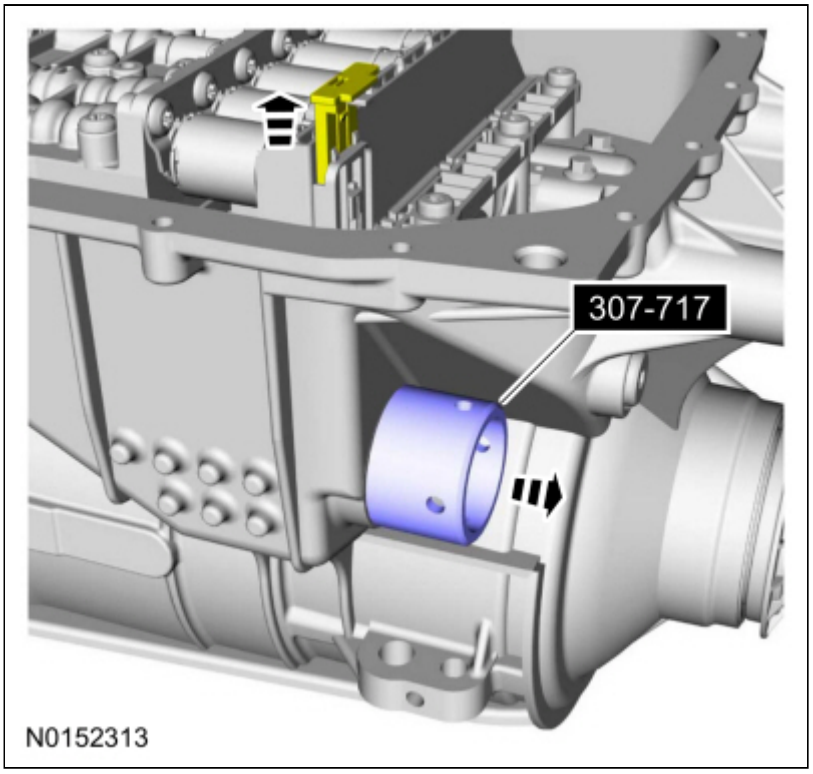


6. Press the release tab and lift up on the bulkhead connector retainer to release the bulkhead connector shell.

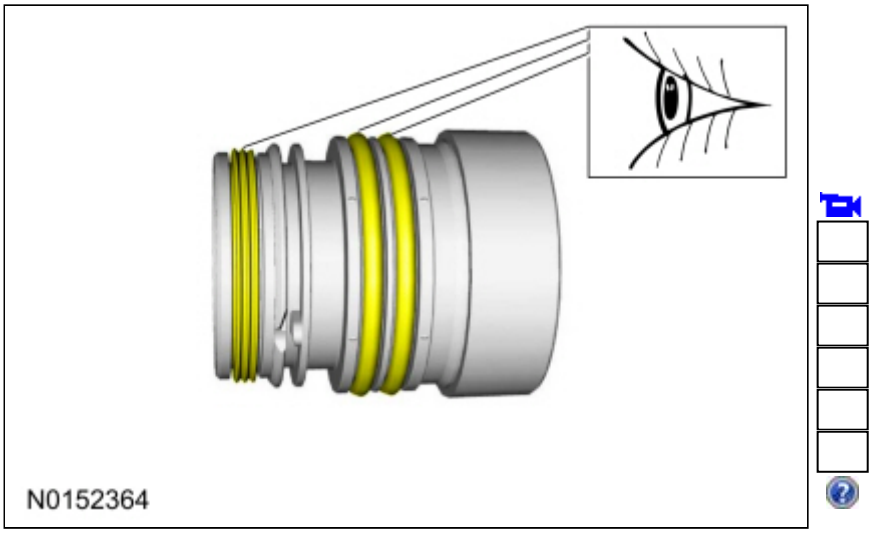


7. **NOTICE: Do not touch the electrical connector pins or the exposed solenoid tabs on the Transmission Control Module (TCM). Electrostatic discharge may occur and cause damage to the mechatronic unit.**

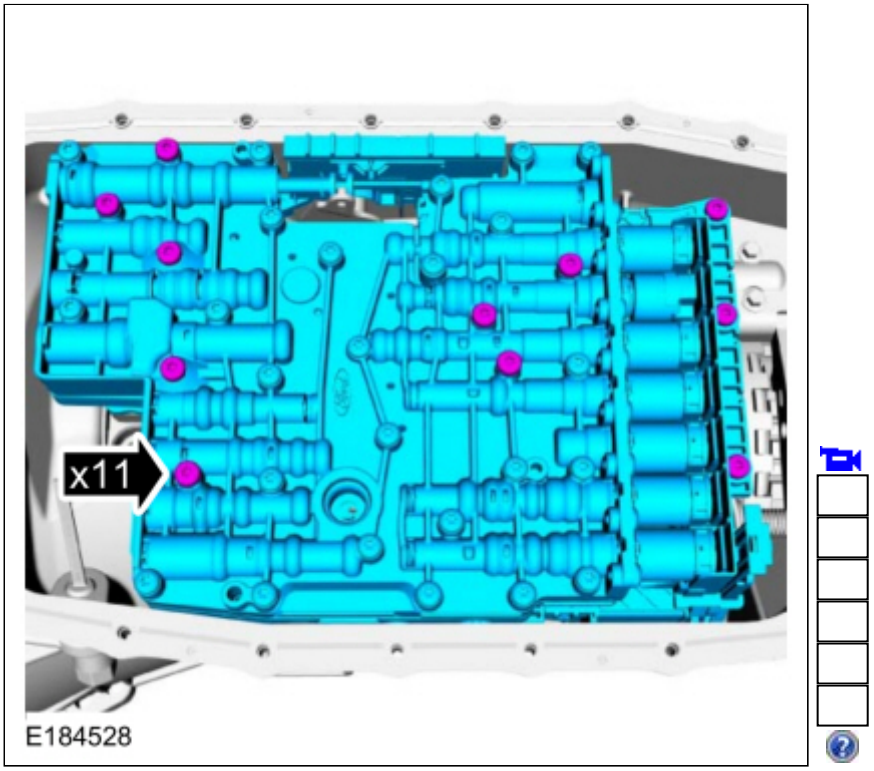
   With the transmission bulkhead connector sleeve retainer released, use the special tool to pull the outer shell of the bulkhead connector sleeve out of the transmission.
   Use Special Service Tool: 307-717 Remover, Kostal Sleeve.



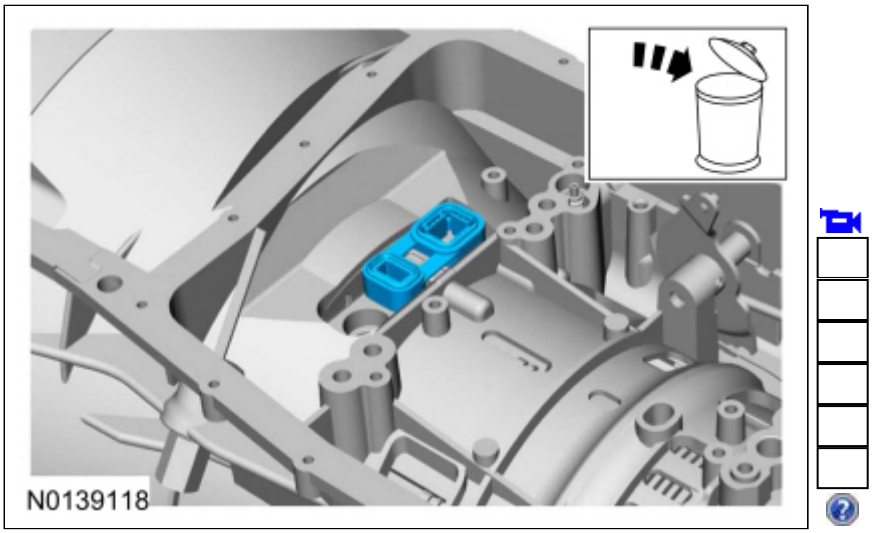
8. Inspect the bulkhead connector sleeve seals. If necessary, replace the seals.



9. Remove the bolts from the main control assembly and remove the main control assembly.



10. Remove the rubber adapter and the fluid filter seal. Inspect for crack or damages.

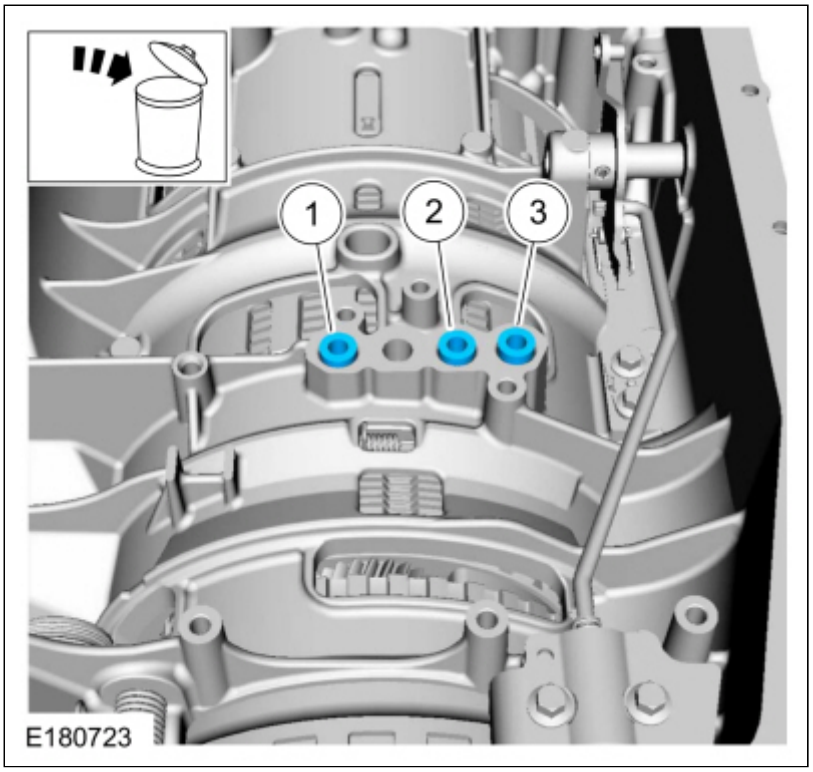


11. **NOTE:** *The green (7G087) center support feed tube seal may be replaced with an orange (7G087) center*

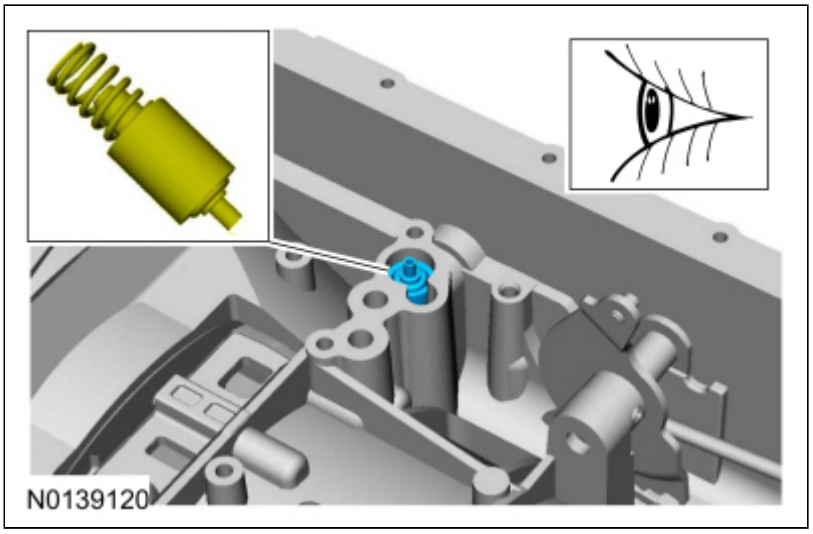
support feed tube seal.

1. Center support feed tube seal (7G199 Black)
2. Center support feed tube seal (7G087 Green or Orange)
3. Center support feed tube seal (7G084 Blue)

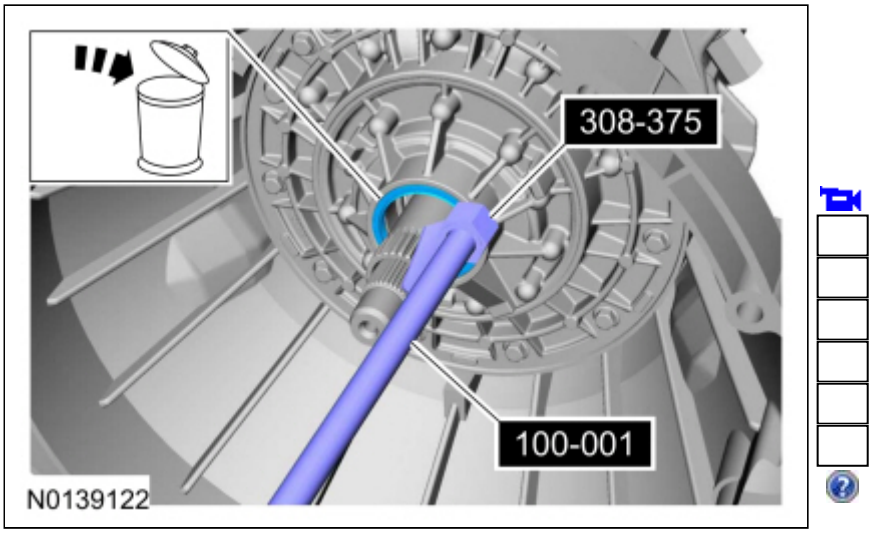
- Remove and discard the feed tubes.



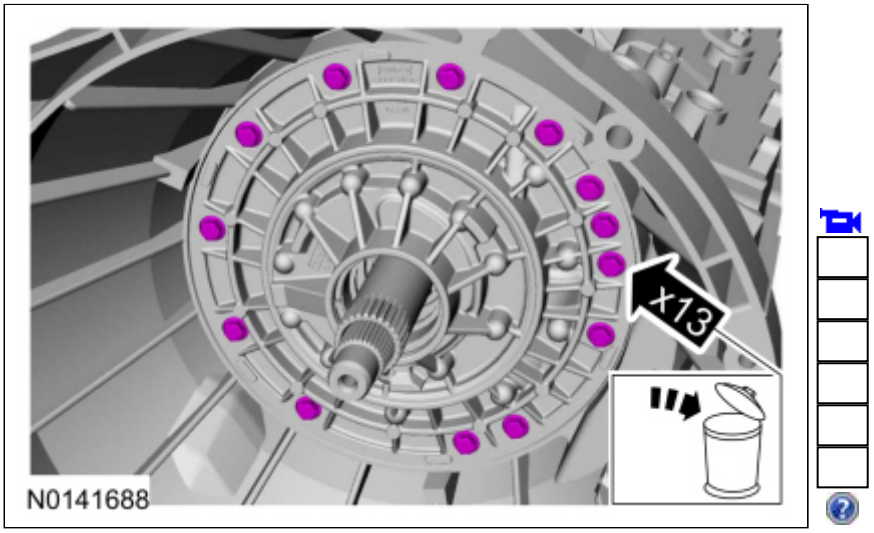
12. Remove the thermal bypass valve from the case. Inspect the thermal bypass valve for damage and discard the valve if damaged.



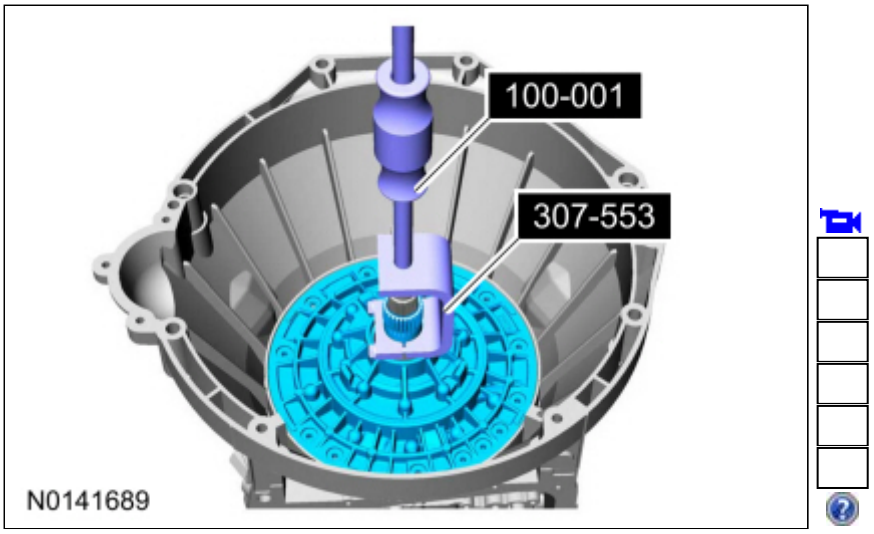
13. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove and discard the front pump seal.
    Use Special Service Tool: 308-375 Remover, Input Shaft Seal. , 100-001 (T50T-100-A) Slide Hammer.



14. Remove and discard the 13 front pump bolts.

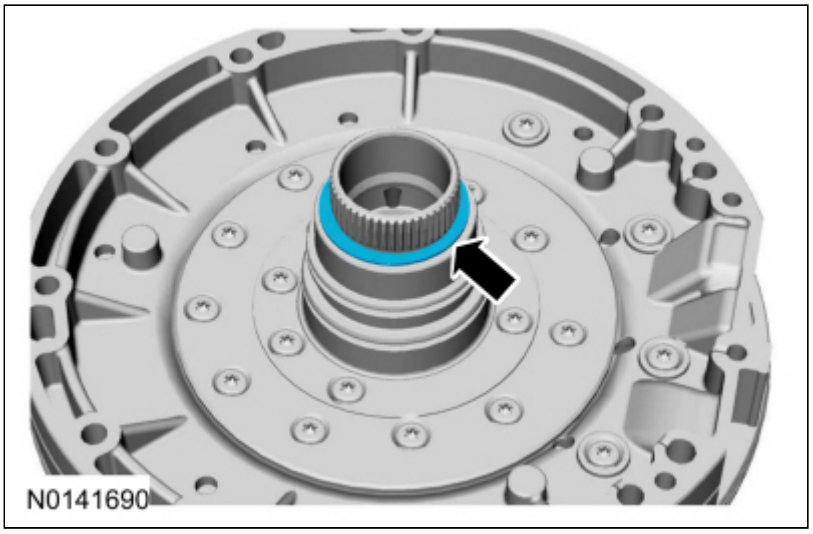


15. Using the Transmission Fluid Pump Remover and Slide Hammer, remove the front pump support.
    Use Special Service Tool: 307-553 Remover, Transmission Fluid Pump. , 100-001 (T50T-100-A) Slide Hammer.

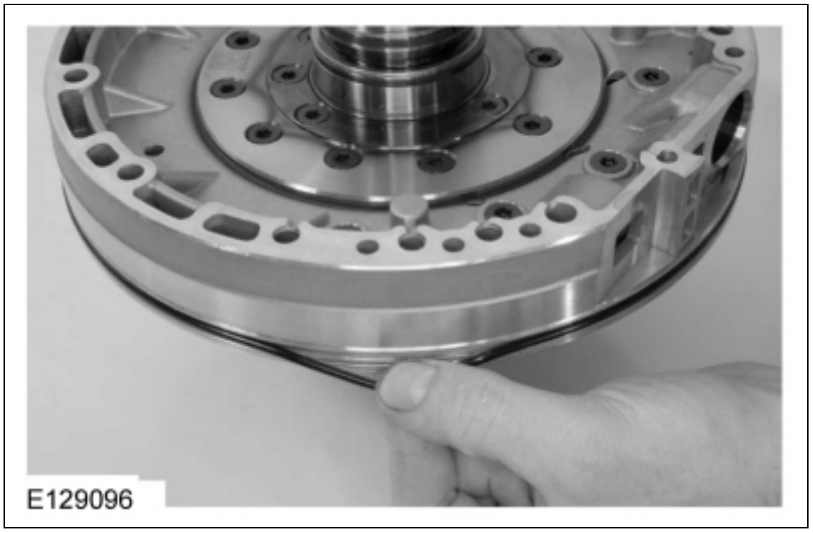


16. **NOTE:** *The selective shim may come out while removing the front pump.*

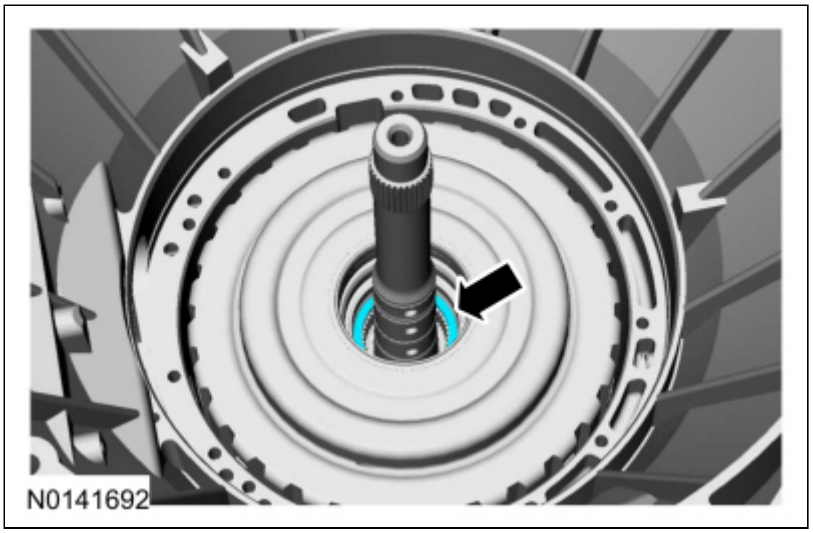
    Inspect the back of the front pump to check if the selective shim is on the pump. If the selective shim is on the pump, remove it from the pump.



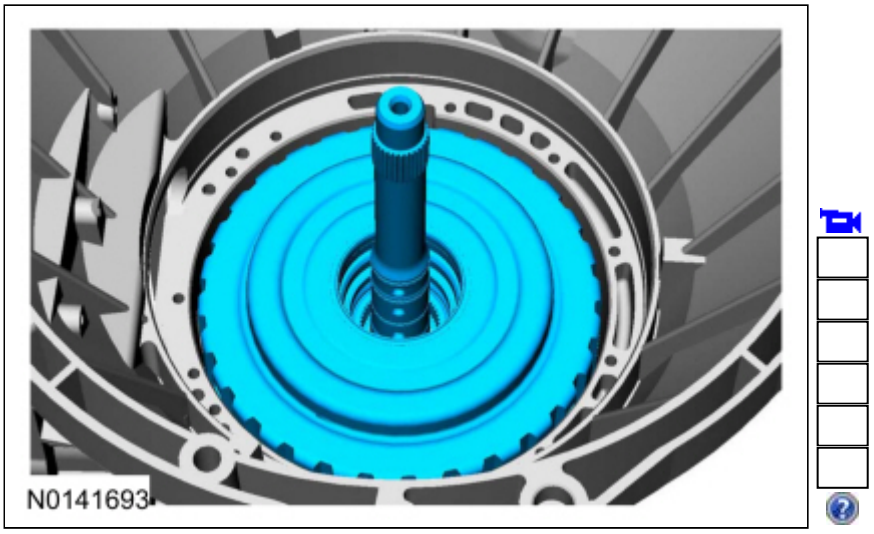
17. Remove and discard the front pump O-ring seal.



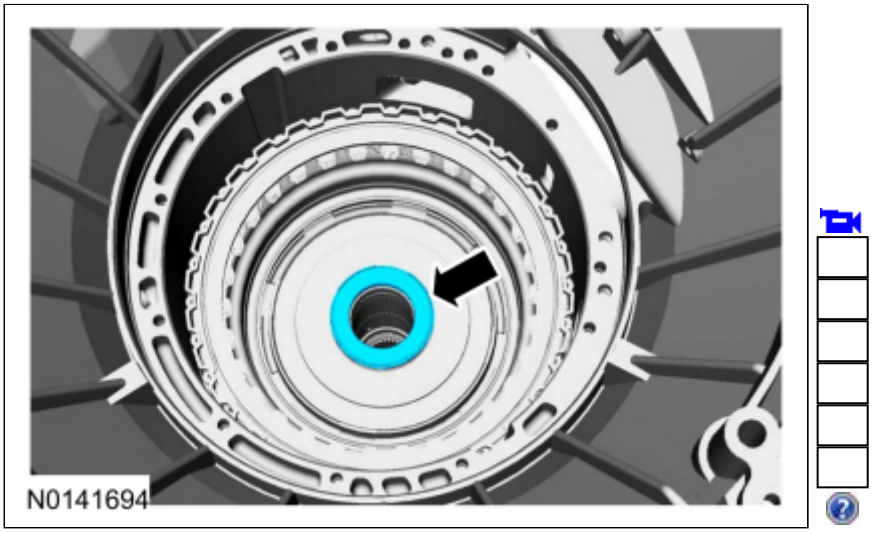
18. If the selective shim is not on the pump, using a magnet, remove it from the forward (A)/overdrive (E) clutch assembly.



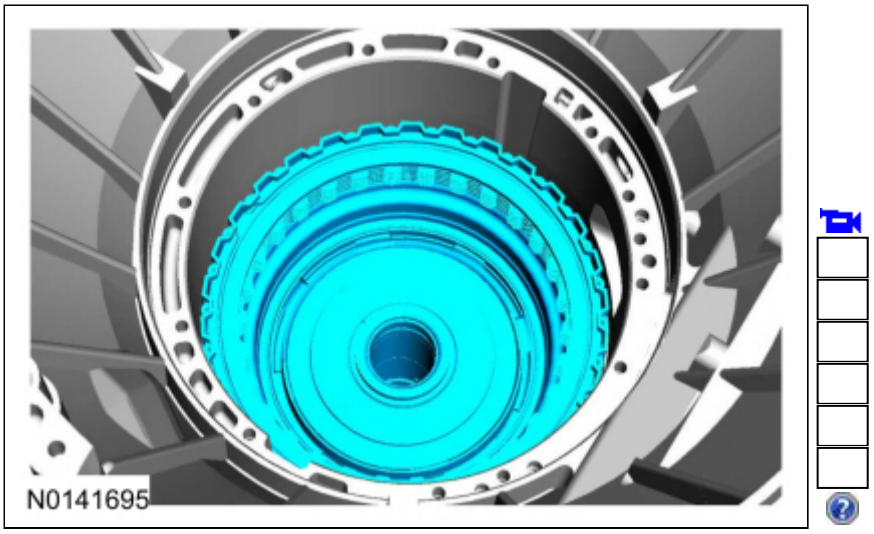
19. Remove the forward (clutch A)/overdrive (clutch E) clutch assembly.



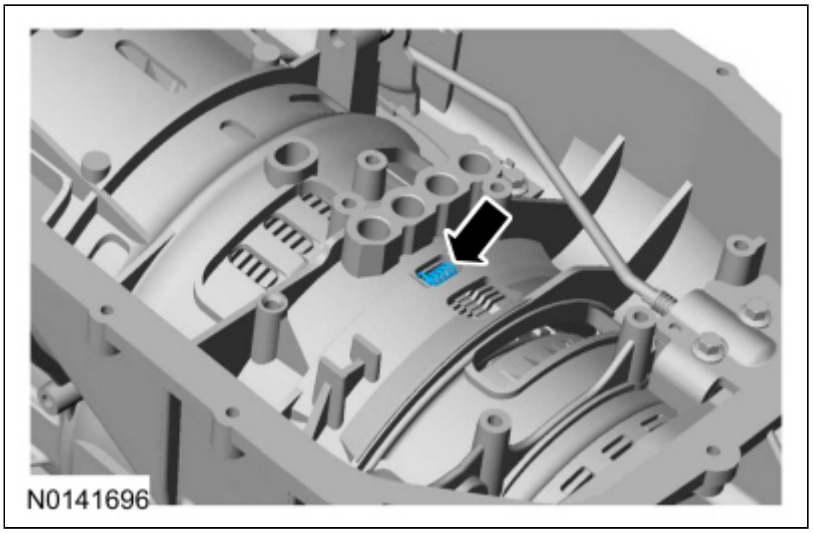
20. Remove the caged T5 roller bearing from the direct (B) clutch assembly.



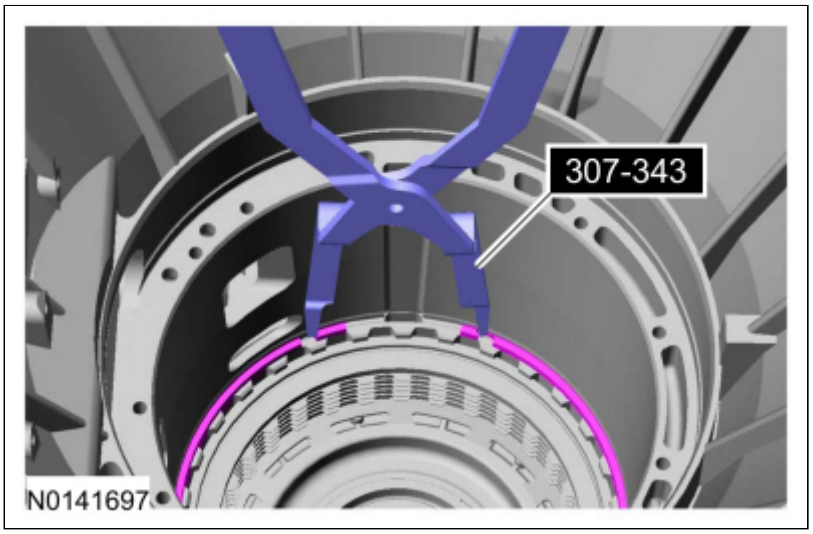
21. Remove the direct (B) clutch assembly.



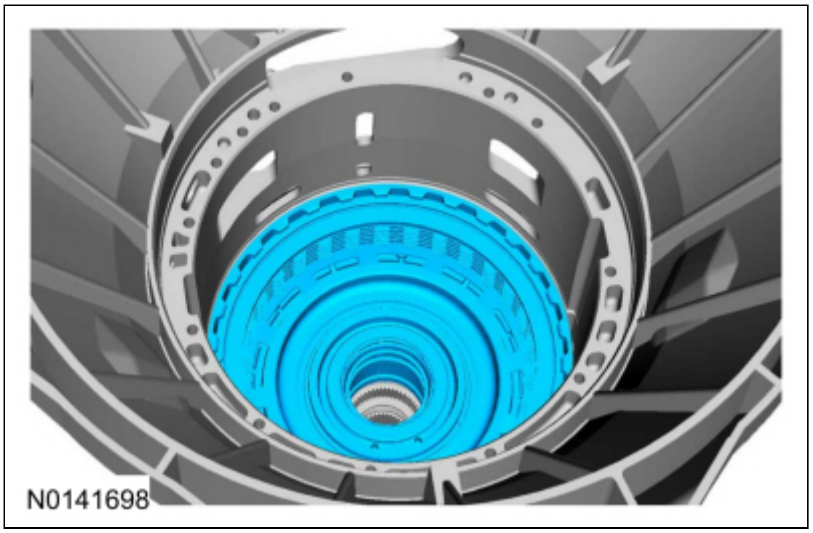
22. Remove the bias spring.



23. Using the Retaining Ring Pliers, remove the center support snap ring.
    Use Special Service Tool: 307-343 Retaining Ring Pliers.



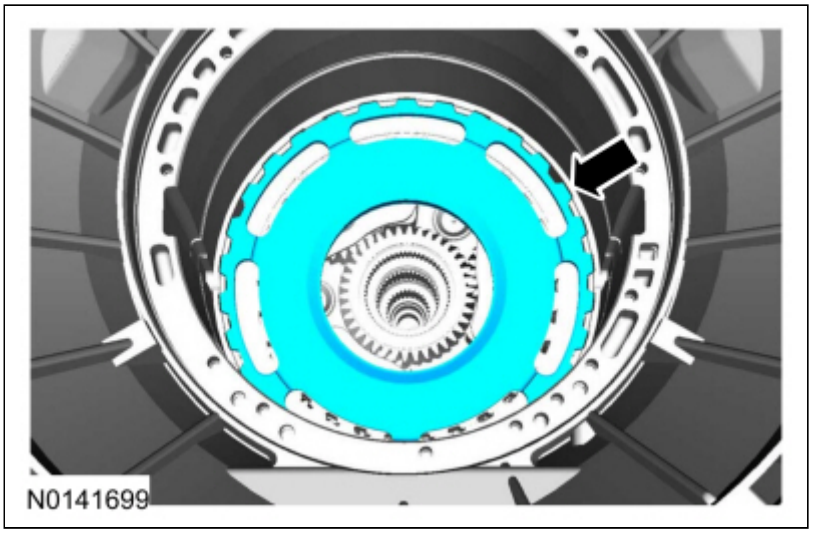
24. Remove the center support and T6 bearing.



25. **NOTE:** *If the thrust bearing stuck to the back of the center support during removal, remove the thrust bearing from the center support.*

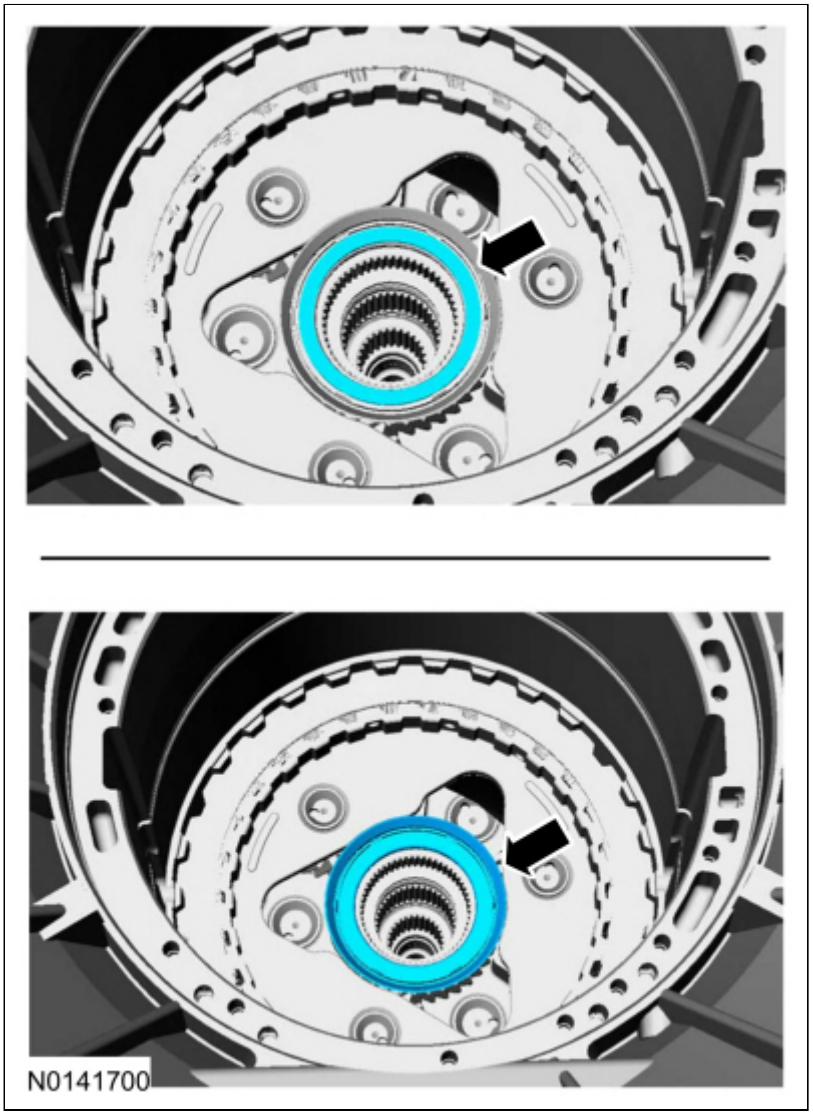
    When Removing the selective shim, note the position for assembly.

    Remove the selective shim from the center support.



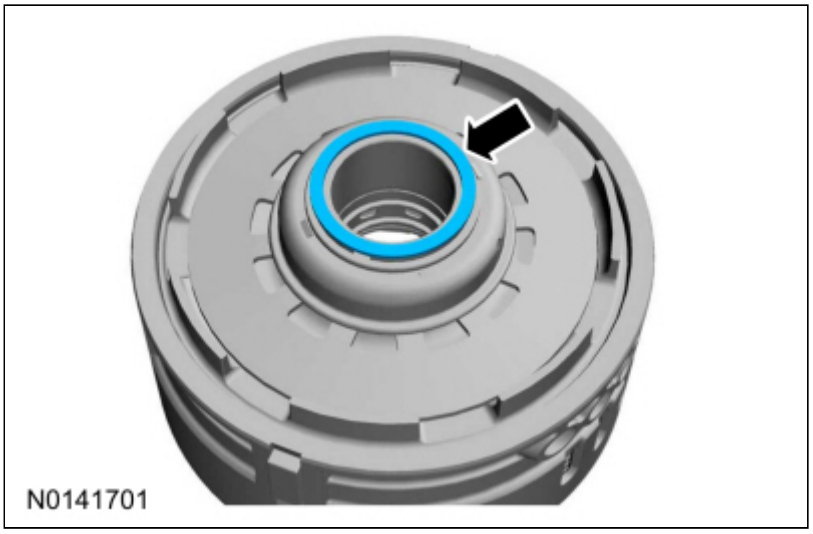
26. **NOTE:** *The selective shim might stick to the T7 thrust bearing during removal of the center support.*

    Remove the selective shim and the T7 thrust bearing.



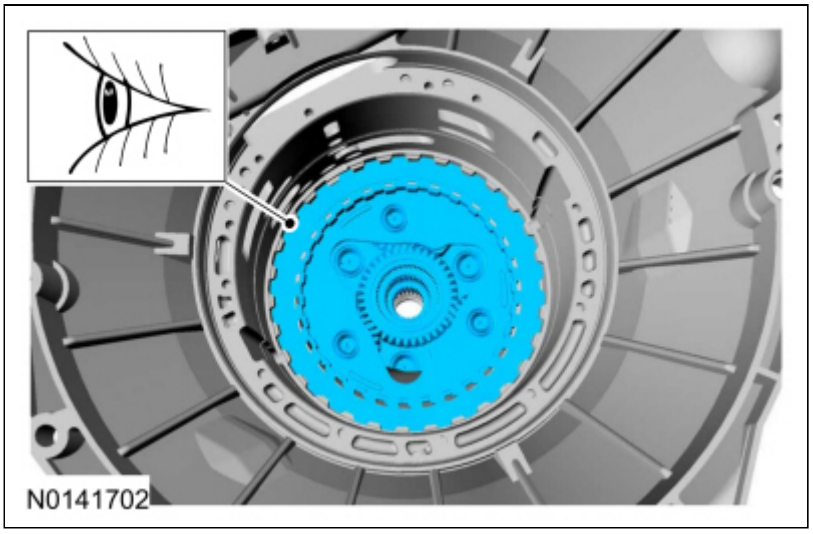
27. **NOTE:** *The selective shim might stick to the back of the center support assembly during removal.*

    Remove the selective shim from the center support assembly.

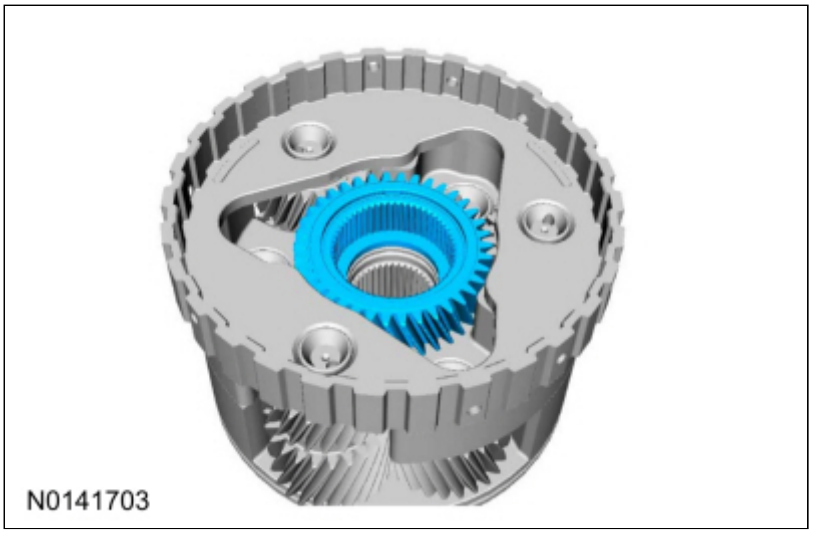


28. **NOTE:** *Some of the clutch plates may stay in the case when removing the planetary carrier and the low/reverse clutch pack. Remove any clutch plates from the transmission that were not removed with the carrier and keep the clutch plates together.*

    Remove the planetary carrier and the low/reverse clutch pack as an assembly.



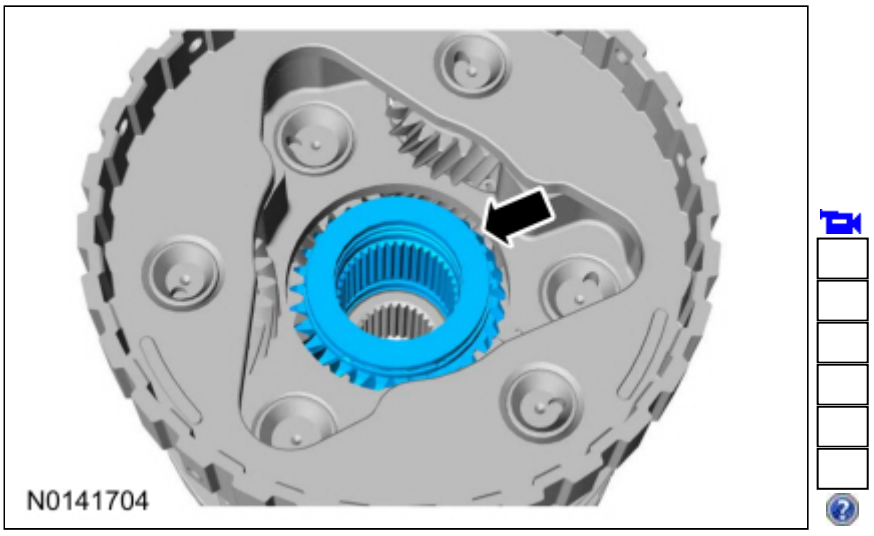
29. Remove the No. 2 sun gear and race.



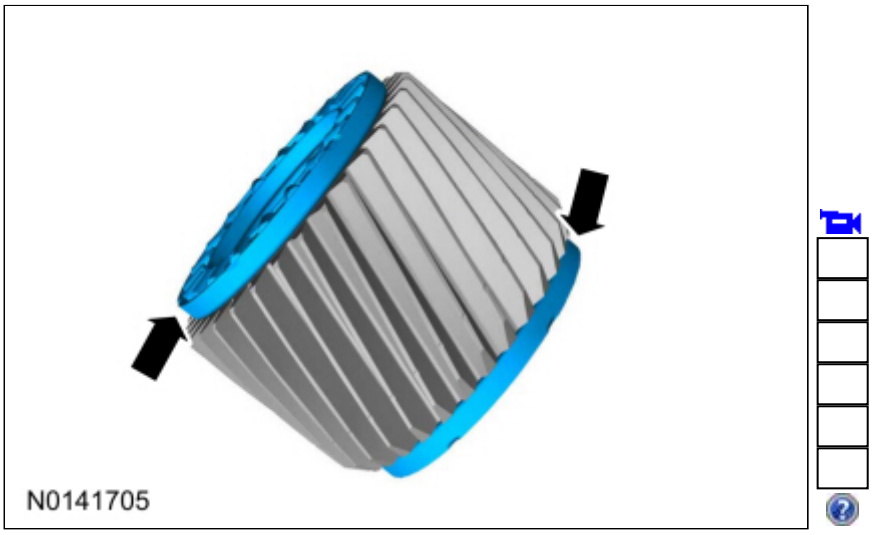
30. **NOTE:** *Remove the bearings with the sun gear.*

    NOTE: *When removing the sun gear, note that the tapered edge is facing up toward the torque converter housing.*

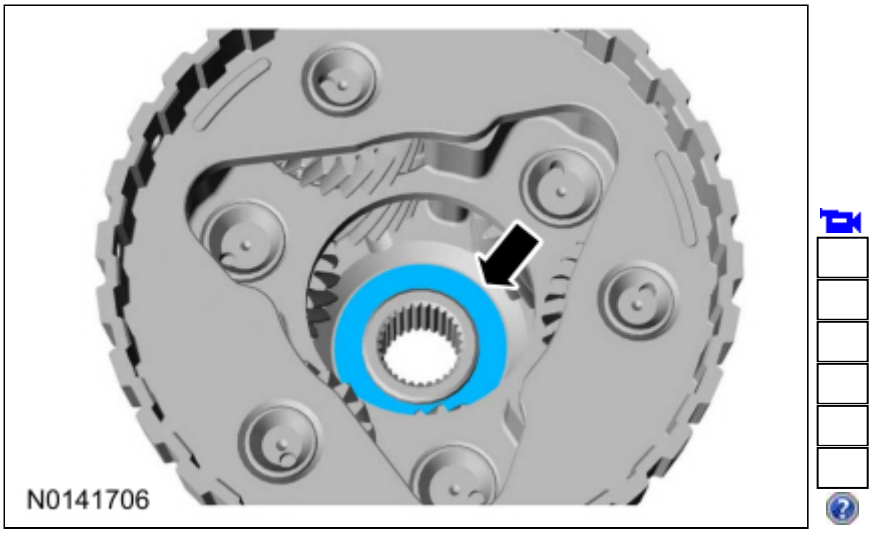
    Remove the No. 3 sun gear from the planetary assembly.



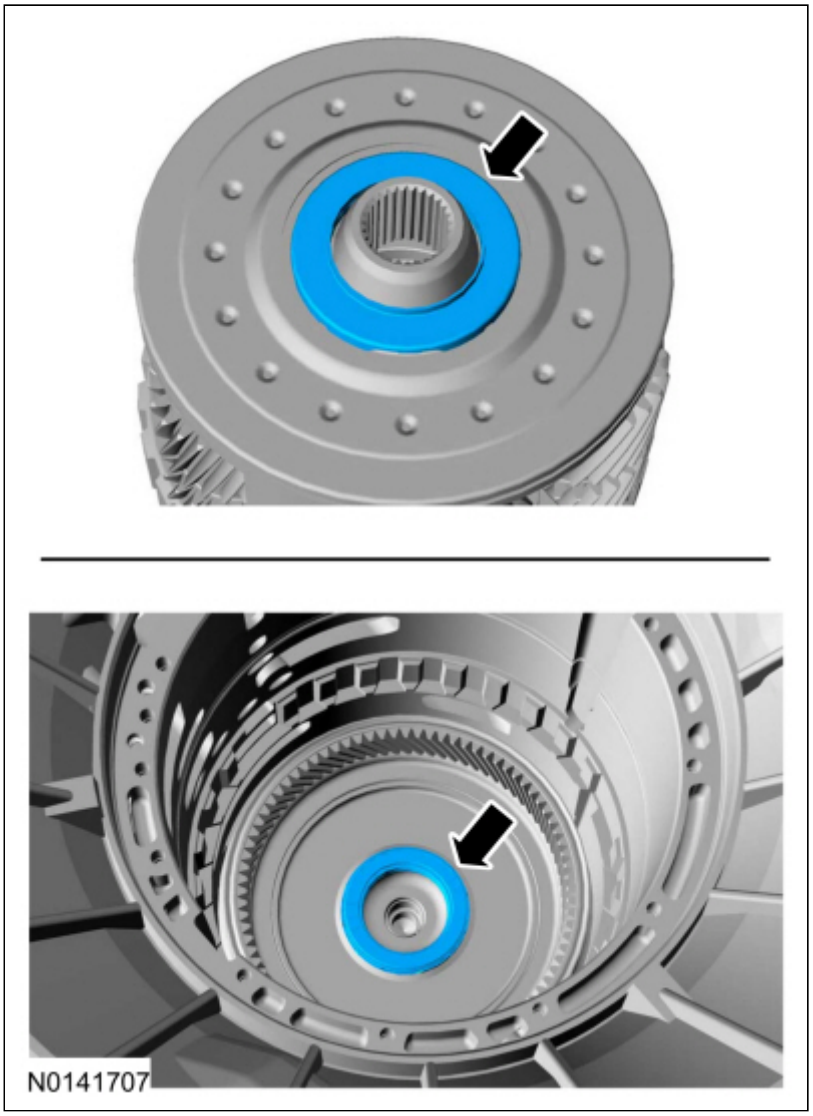
31. Remove the top T8 and the bottom T9 roller bearings from the sun gear.



32. Remove the T9 roller bearing race in the bottom of the carrier.

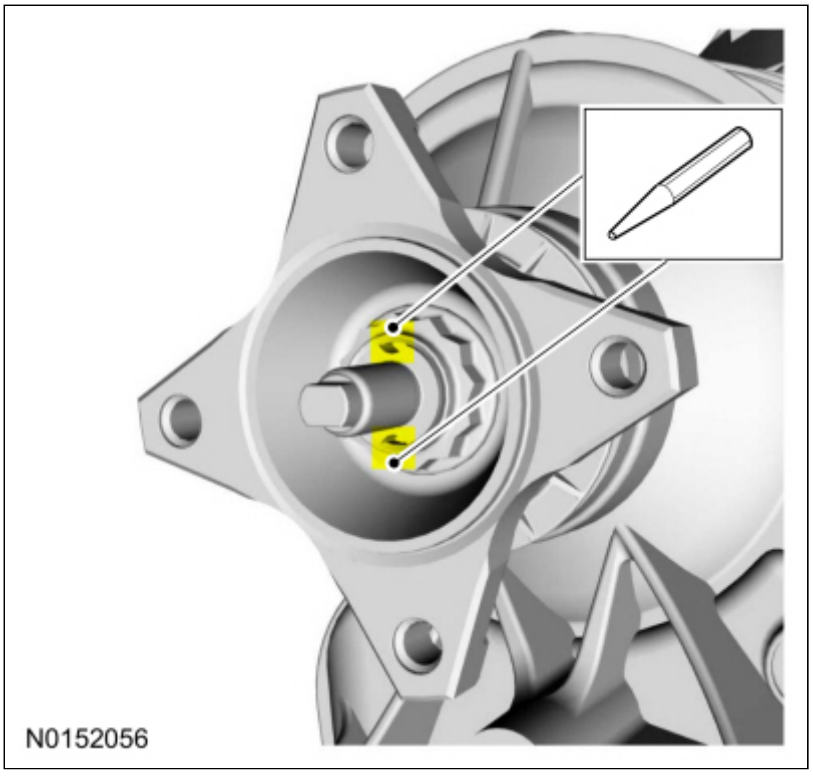


33. Remove the T10 thrust bearing from either the rear planetary carrier or the output shaft assembly.

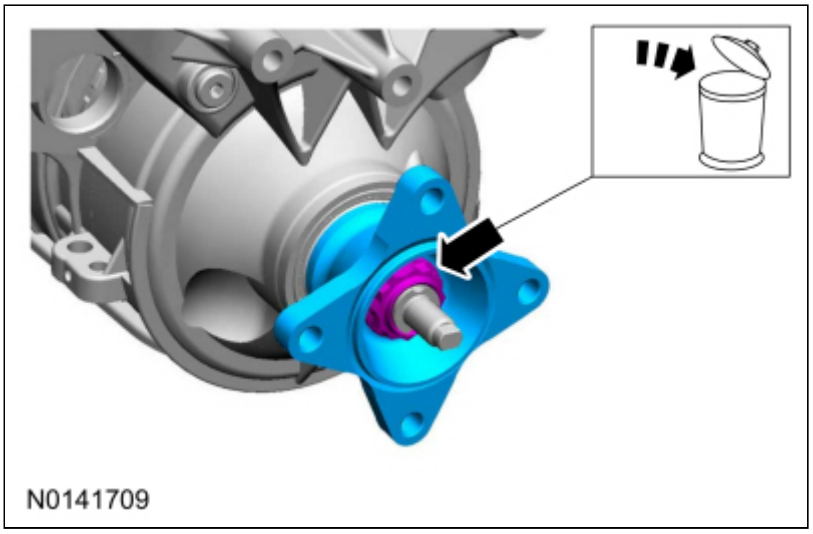


34. **NOTICE: The output shaft flange retaining nut has been staked to prevent it from coming loose. Prior to removing the nut, remove the stake to prevent damage to the output shaft.**

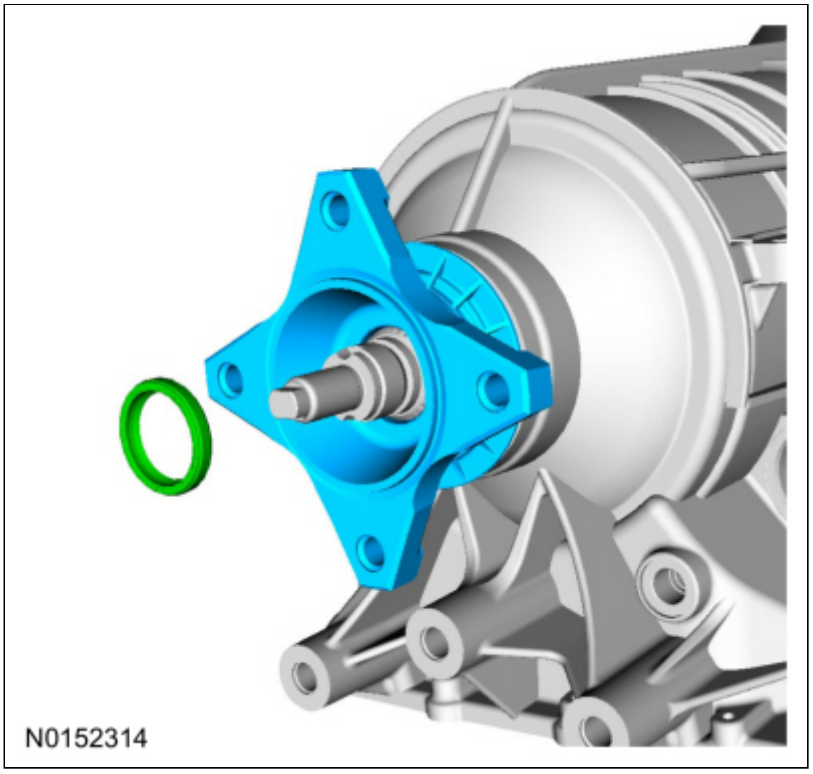
    Remove the stakes from the output shaft flange retaining nut.
    Use the General Equipment: Punch



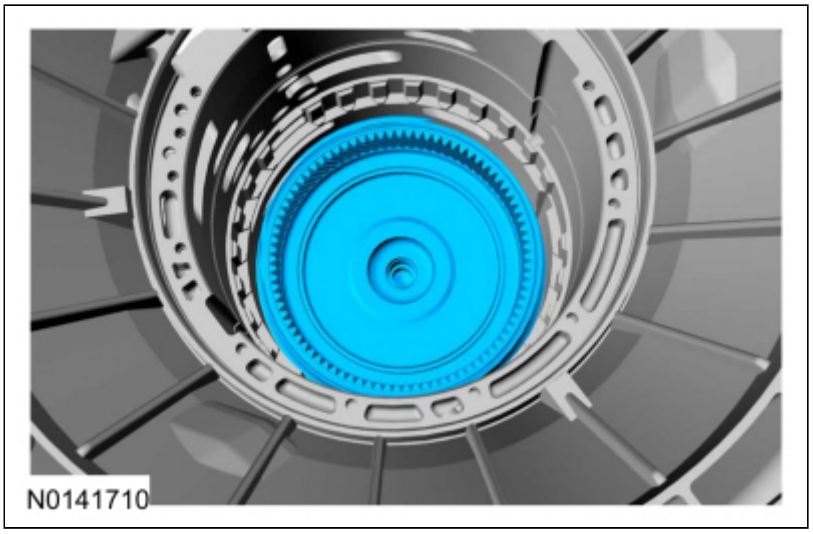
35. Place the manual control lever in the PARK position and remove and discard the output shaft flange retaining nut.



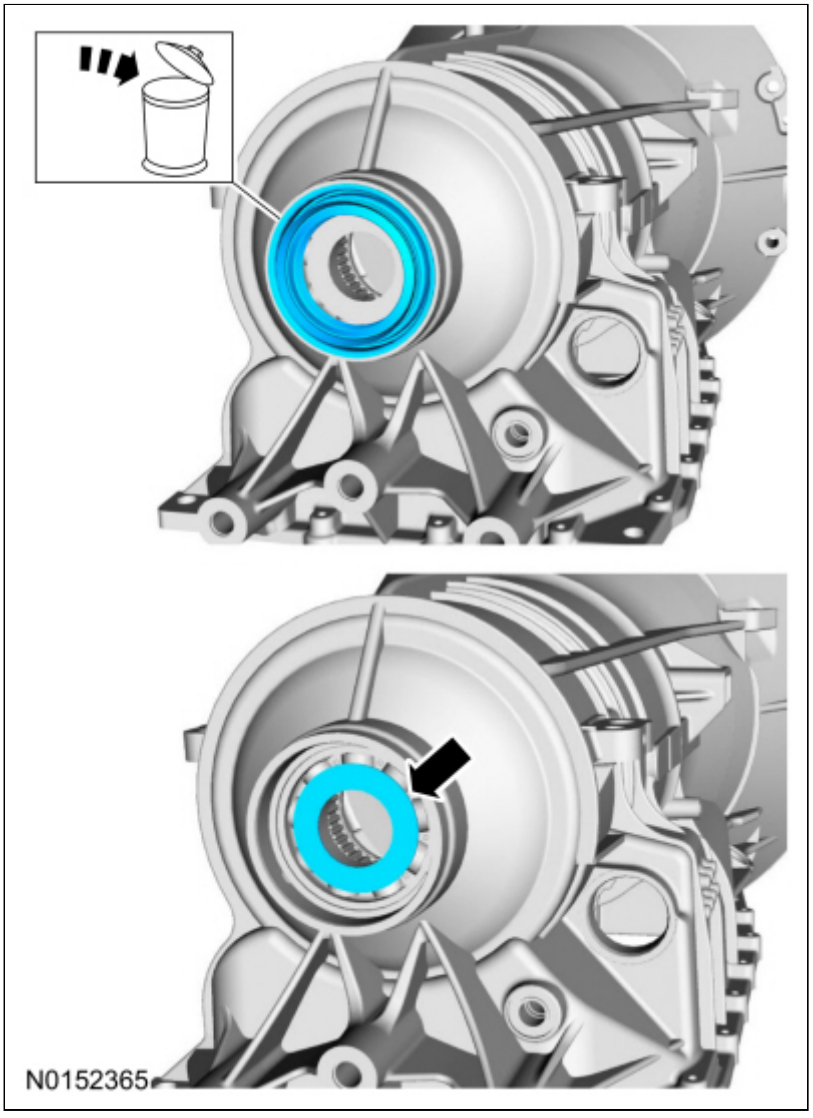
36. Remove the output shaft flange seal and flange.



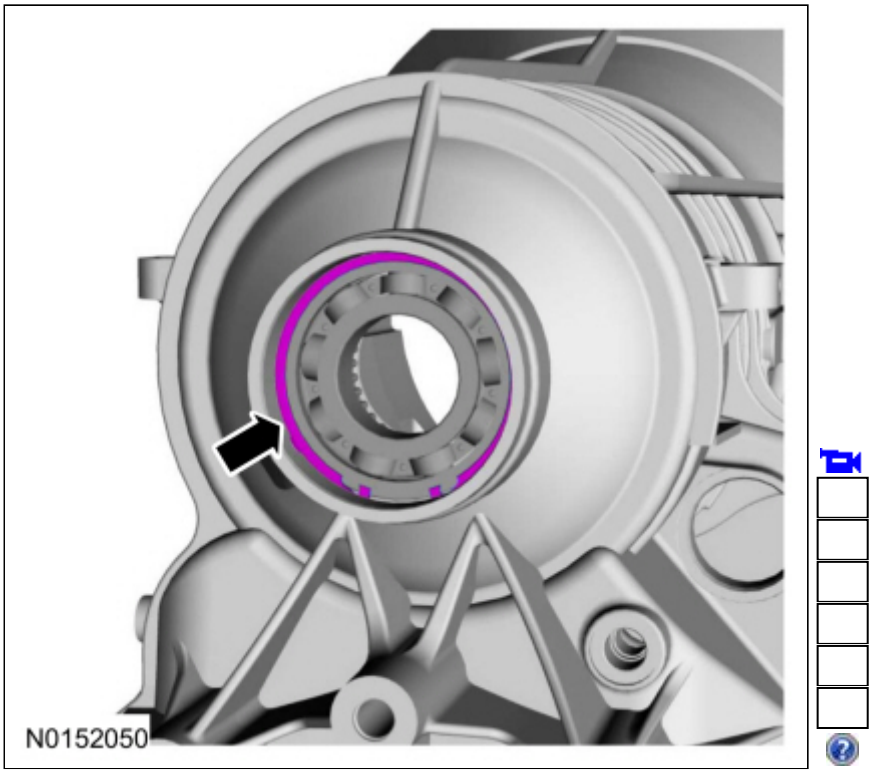
37. Remove the planet carrier hub, output shaft assembly and T11 bearing.



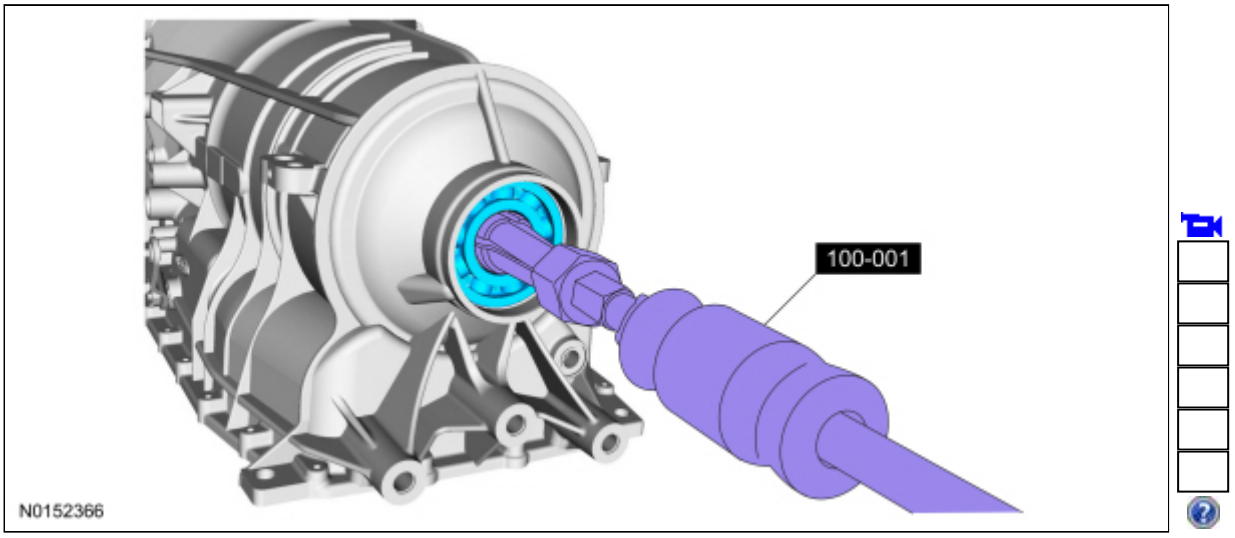
38. Remove and discard the output shaft seal and remove the slip plane washer.



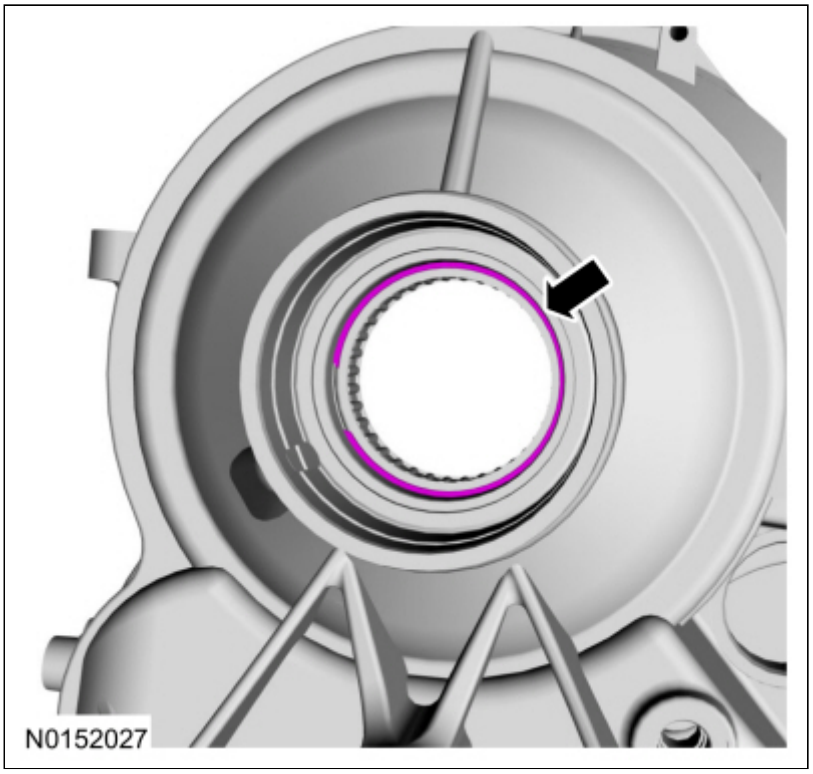
39. Remove the T12 thrust bearing.



40. Using the Slide Hammer, Actuator Pin 303-D012, Collet, 1 1/4 Inch to 1 1/2 Inch 303-D022, remove the output shaft ball bearing.

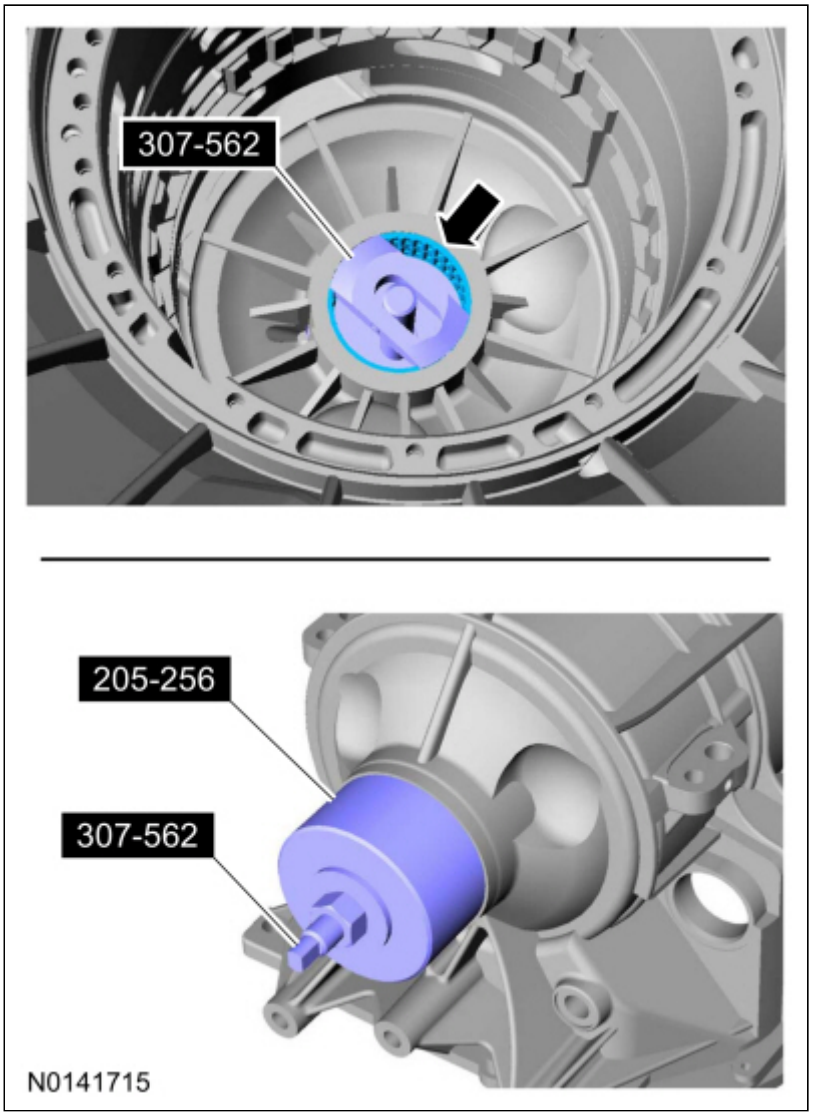


41. If equipped.
    - Remove the snap ring.



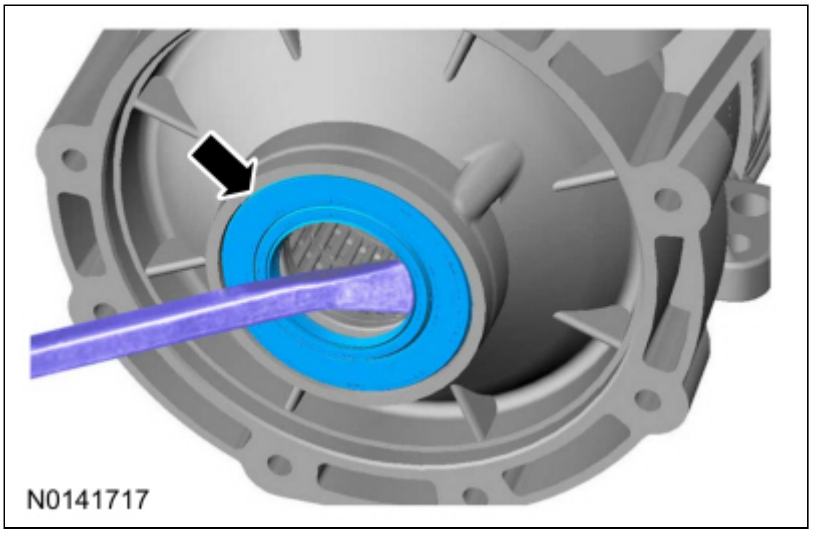
42. **NOTICE: Use care when installing the Needle Bearing Remover. Look inside the transmission case to make sure that the Needle Bearing Remover contacts the bearing only and not the lip of the case, or damage to the case will occur.**

    Install the special tools on the bearing and remove the bearing.
    Use Special Service Tool: 205-256 Installer, Front Wheel Hub Seal. , 307-562 Remover, Needle Bearing.

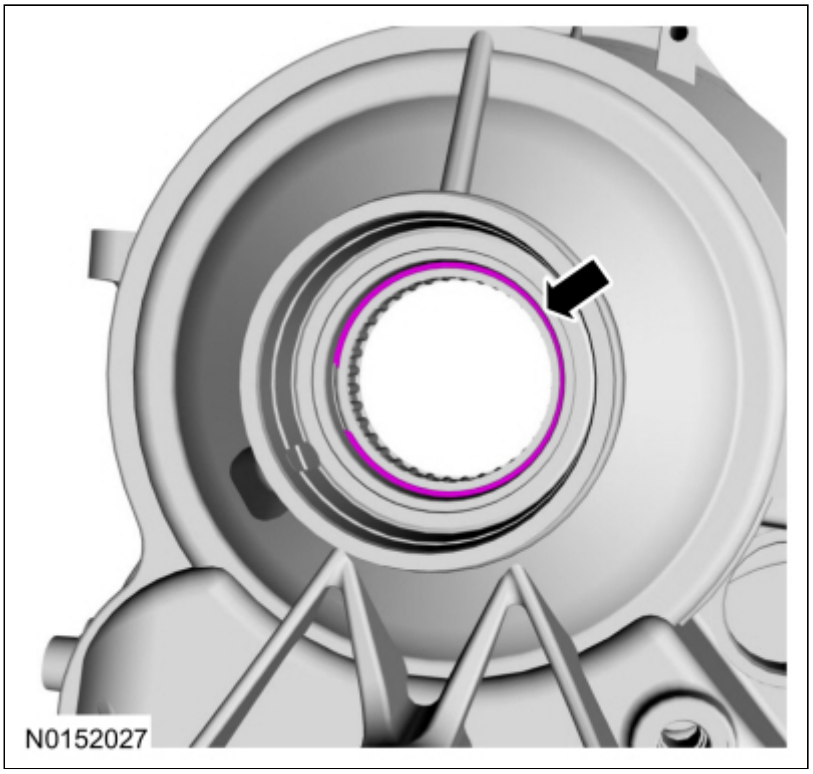


4x4

43. Remove and discard the output shaft seal.

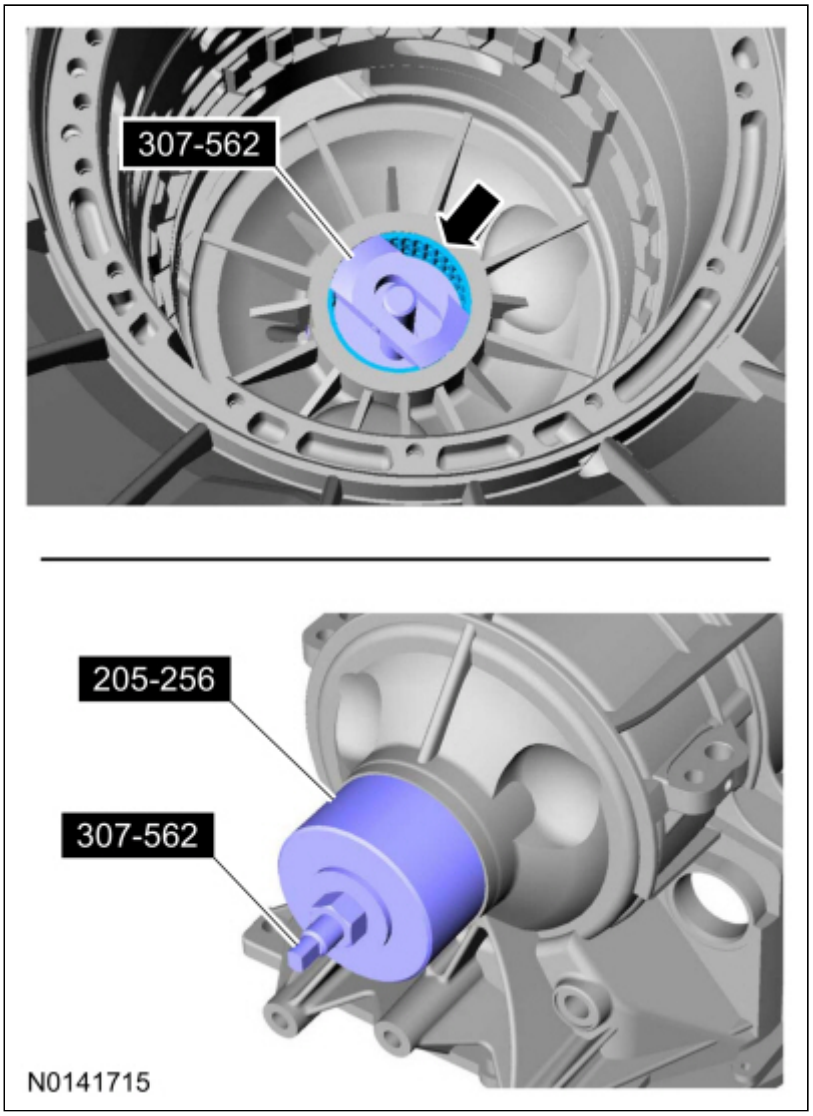


44. Remove the snap ring.



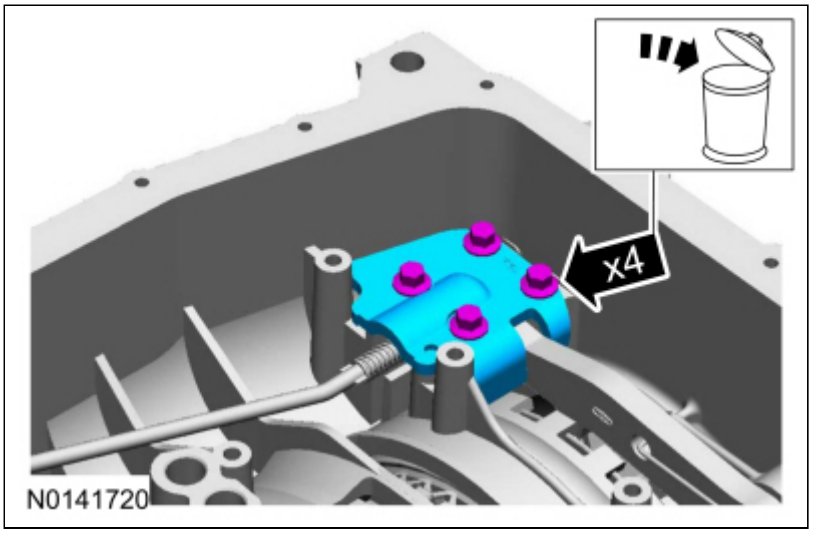
45. **NOTICE: Use care when installing the Needle Bearing Remover. Look inside the transmission case to make sure that the Needle Bearing Remover contacts the bearing only and not the lip of the case, or damage to the case will occur.**

    Using the Needle Bearing Remover and the Front Wheel Hub Oil Seal Installer, remove the bearing assembly. Use Special Service Tool: 307-562 Remover, Needle Bearing. , 205-256 Installer, Front Wheel Hub Seal.

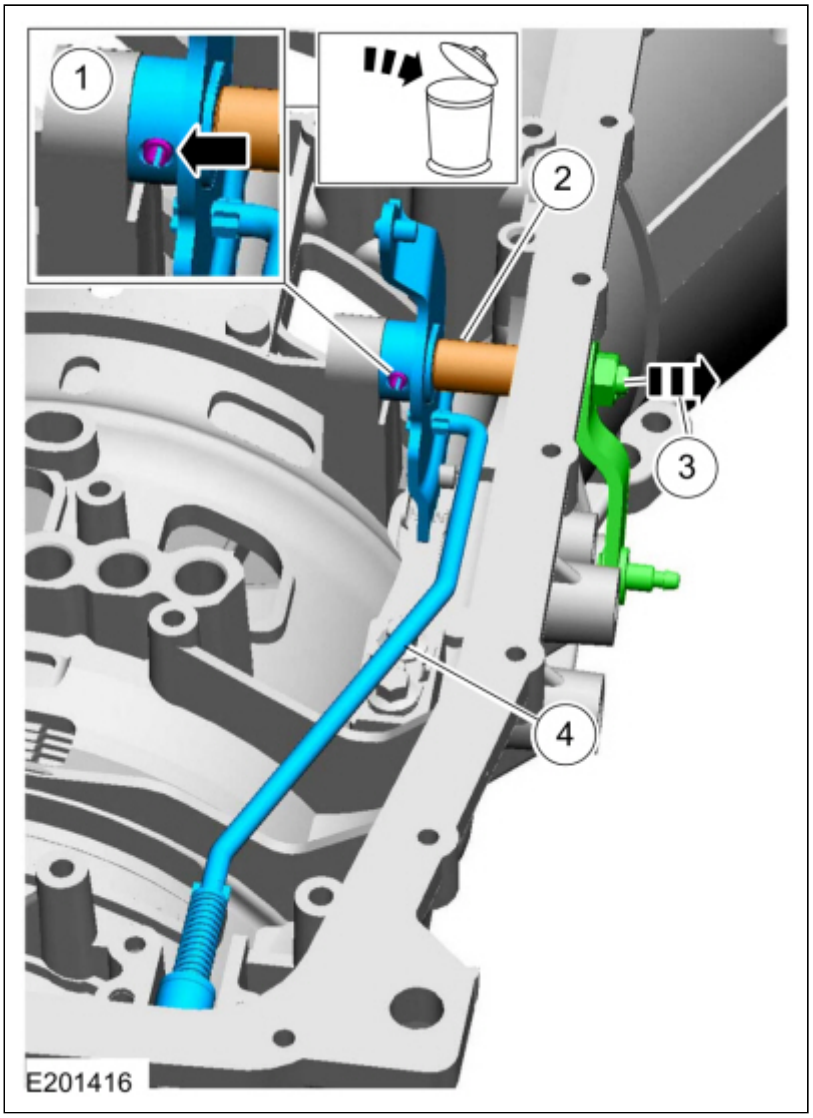


All vehicles

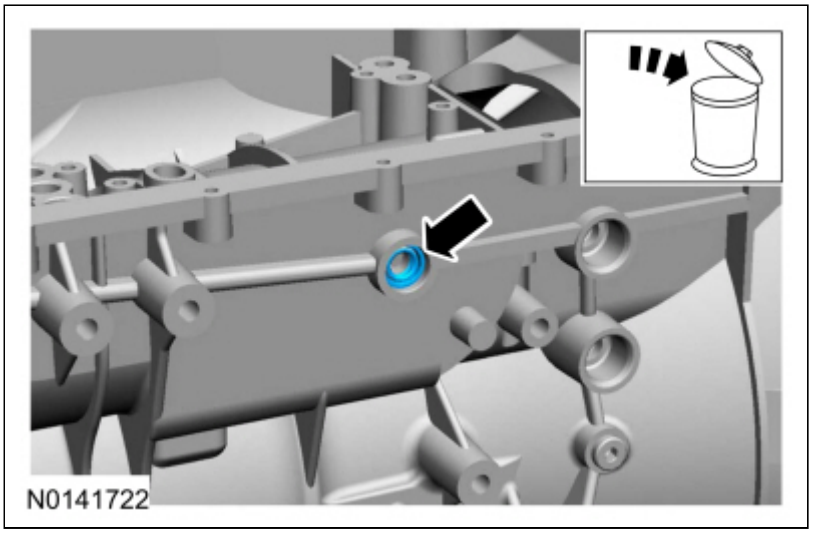
46. Remove and discard the 4 park rod actuating plate bolts and the park rod actuating plate.



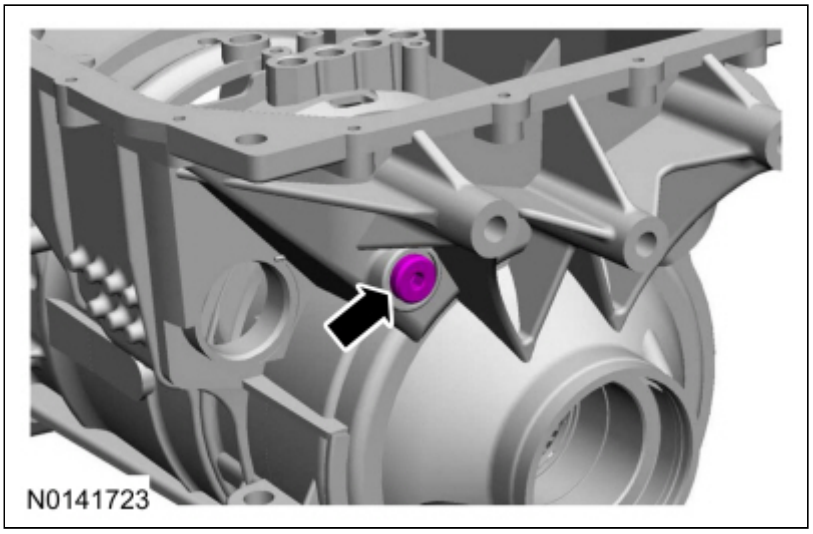
1. Remove and discard the roll pin.
2. Hold the manual control lever spacer to keep it from falling into the case.
3. Slide the manual control lever shaft out of the case.
4. Remove the manual valve detent lever and park pawl actuator rod as an assembly.



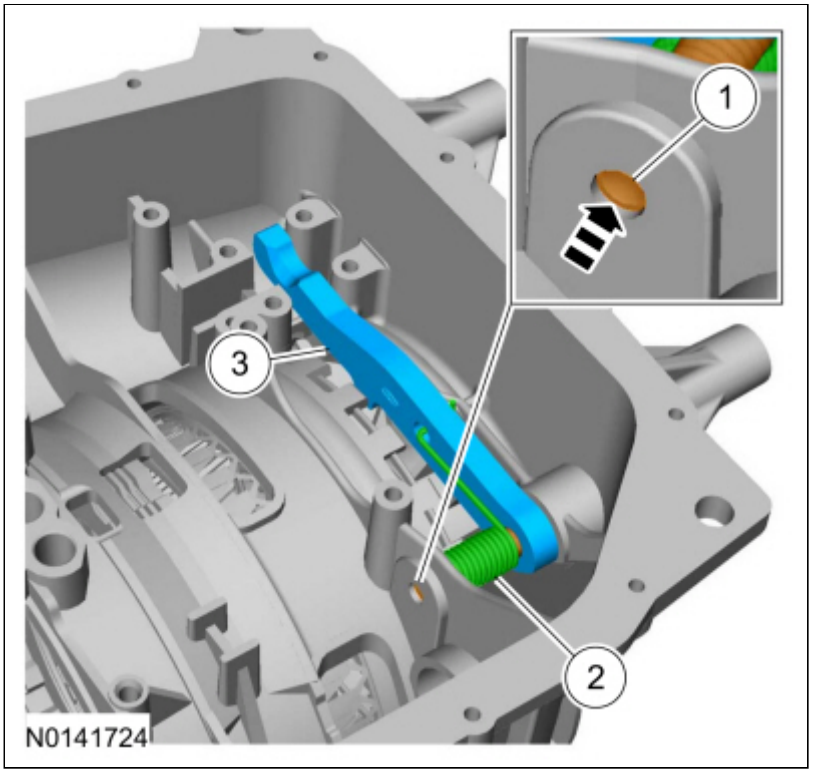
48. Using a suitable tool, remove and discard the manual control lever shaft seal.



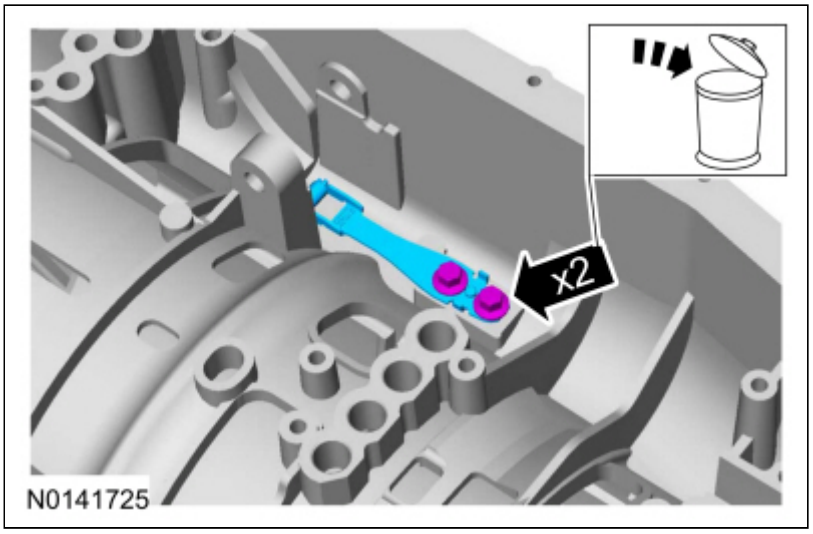
49. Remove the bolt from the back of the case to gain access to the park pawl pin.



1. Push the park pawl pin out toward the back side of the case and remove the pin.
2. Remove the park pawl return spring.
3. Remove the park pawl.



51. Remove and discard the 2 bolts and remove the park detent spring.



Copyright © 2016 Ford Motor Company

Forward/Overdrive Clutch Assembly

Special Tool(s) / General Equipment

	307-555 End Play Gauge, Clutch

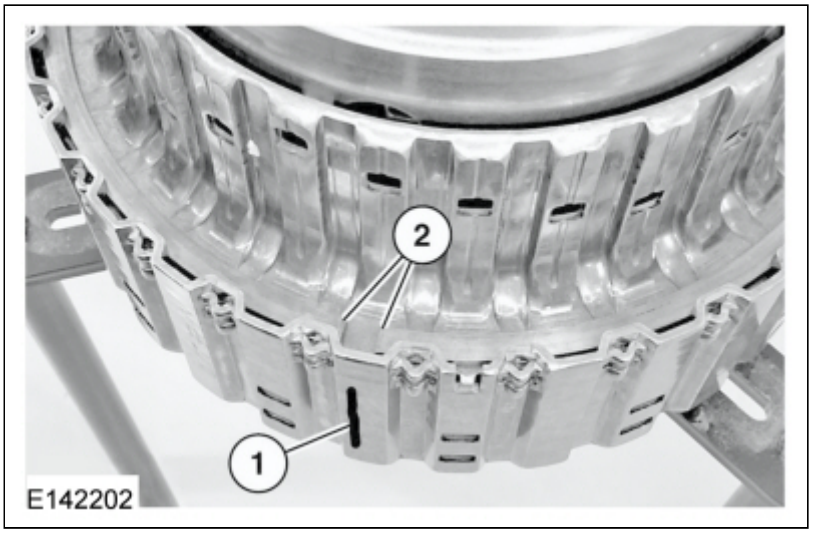
DISASSEMBLY

1. Position the forward/overdrive clutch assembly in the Clutch End Play Gauge.
   Use Special Service Tool: 307-555 End Play Gauge, Clutch.



2. **NOTE:** *Index-mark the direct clutch outer shell snap ring gap location to the side of the forward clutch hub using a suitable paint marker.*

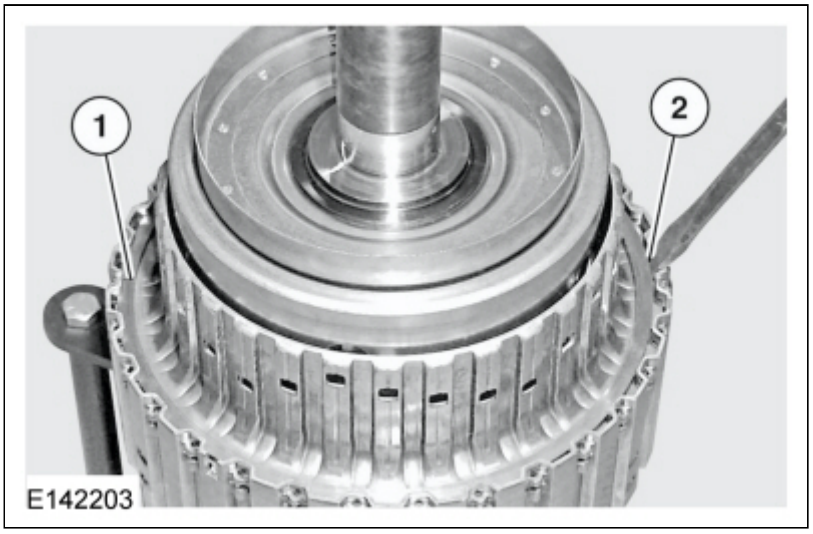
   - Index mark
   - Snap ring gap



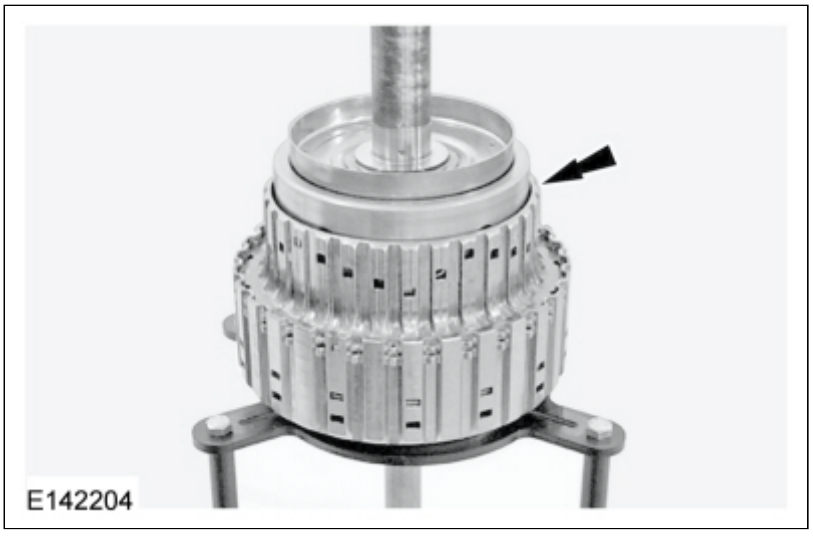
3. **NOTICE: Compress the snap ring out of the groove 180° from the snap ring gap or damage to the forward clutch hub can occur.**

   NOTE: *Using a suitable tool, remove and discard the direct clutch outer shell retaining ring by compressing the snap ring 180° from the snap ring gap.*

   - Snap ring gap
   - 180° from the snap ring gap



4. Remove and discard the direct clutch hub.

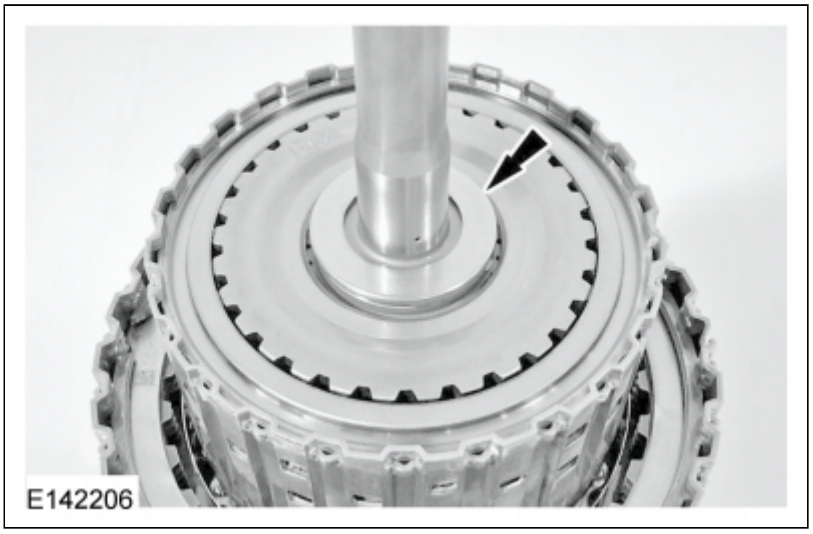


5. Remove the forward clutch and sun shaft assembly.

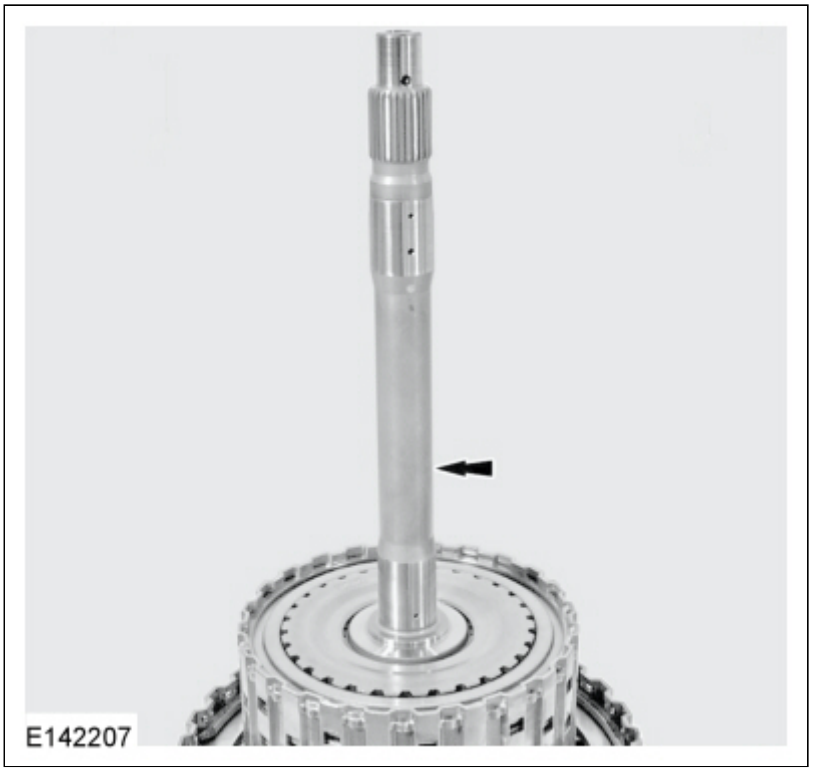


6. **NOTE:** *The bearing may stick in the forward clutch drum.*

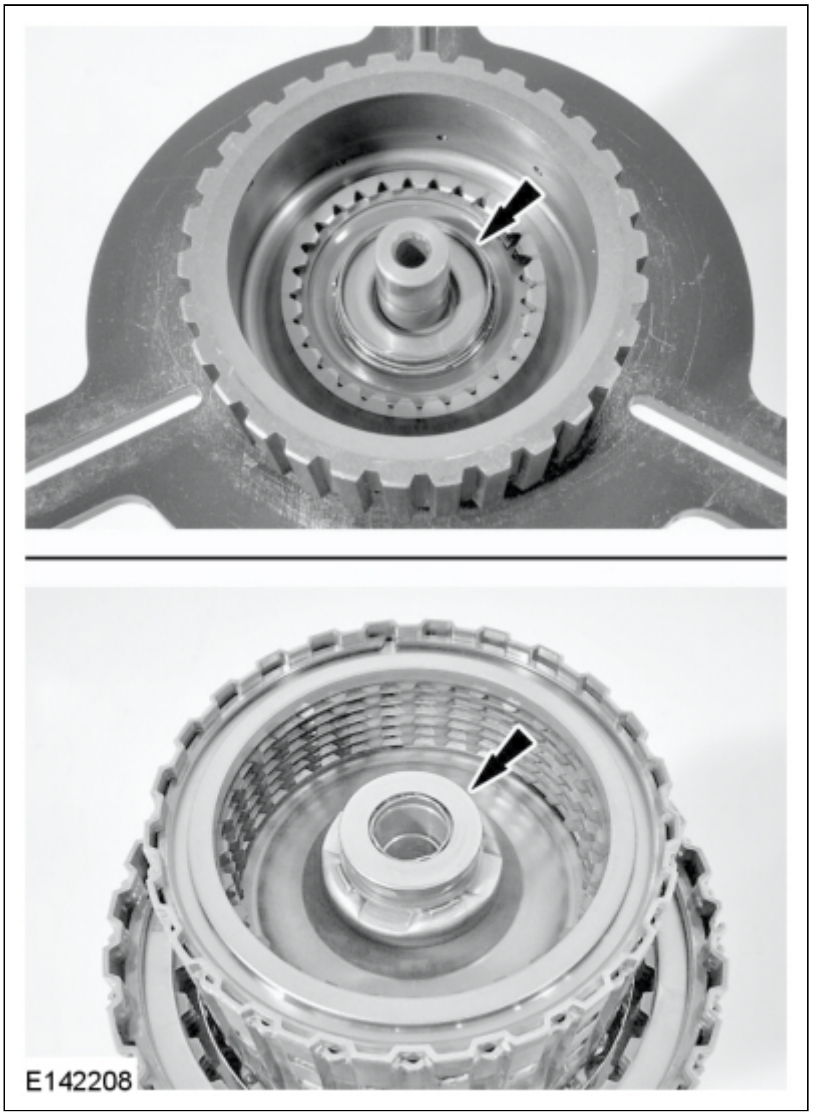
   Remove the intermediate shaft bearing.



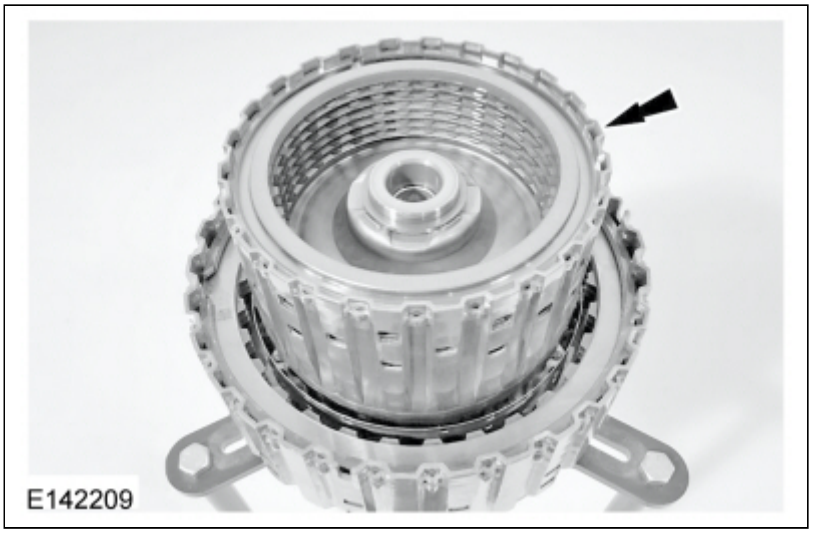
7. Remove the intermediate shaft assembly.



8. If the T3 thrust bearing stuck to the intermediate shaft assembly, remove it from the intermediate shaft assembly. If the T3 thrust bearing is on

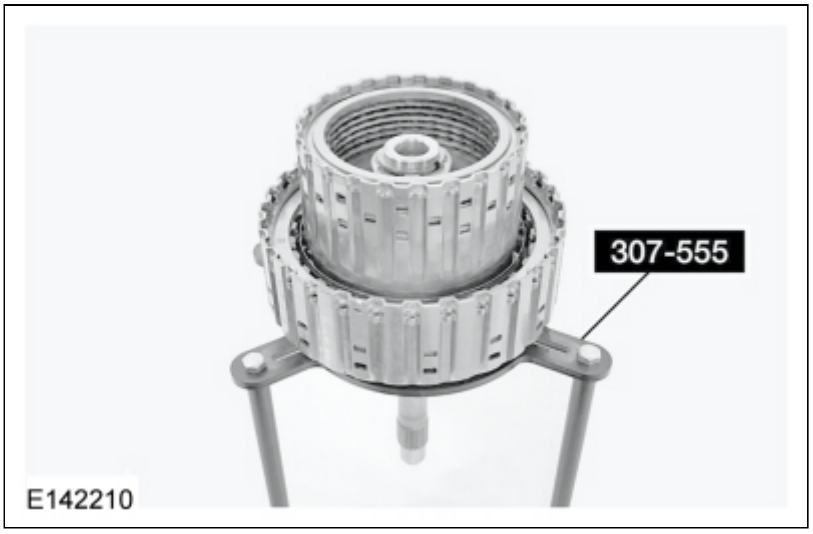


9. Remove the overdrive clutch pack from the forward clutch pack.

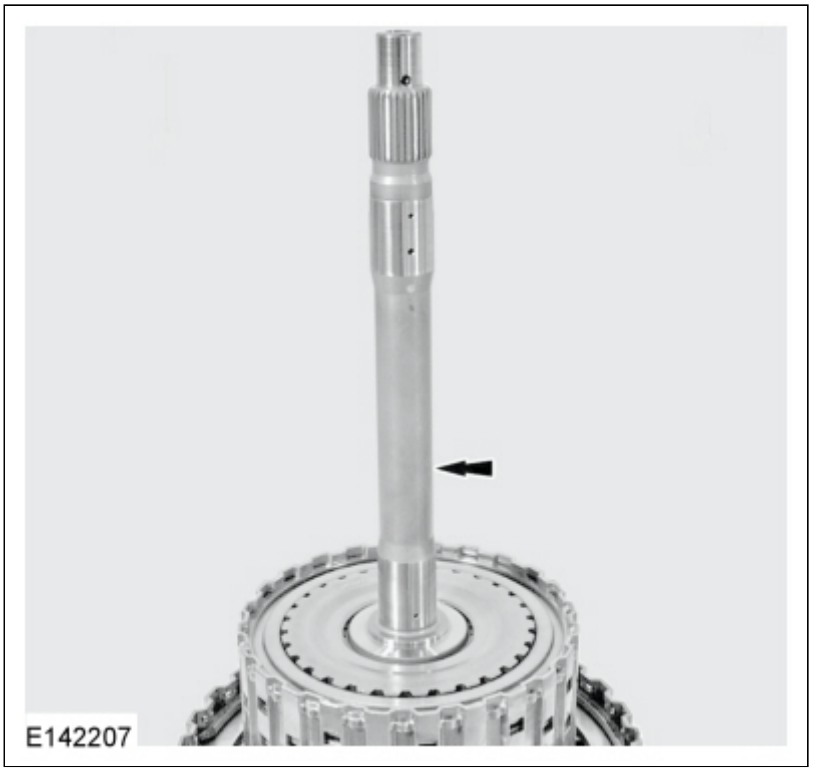


ASSEMBLY

1. Position the forward clutch assembly in the Clutch End Play Gauge and install the overdrive clutch pack onto the forward clutch and planetary gear set.
   Use Special Service Tool: 307-555 End Play Gauge, Clutch.

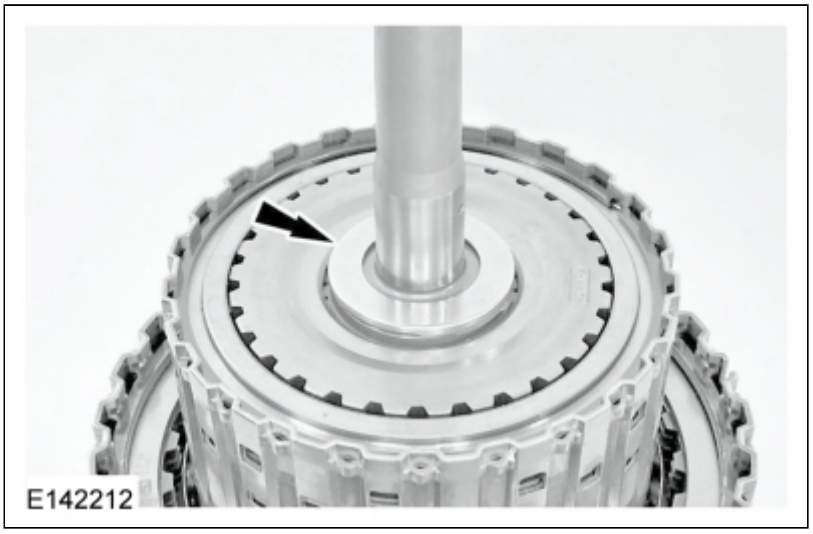


2. Install the intermediate shaft assembly.



3. **NOTE:** *Inspect and install new thrust bearings as required.*

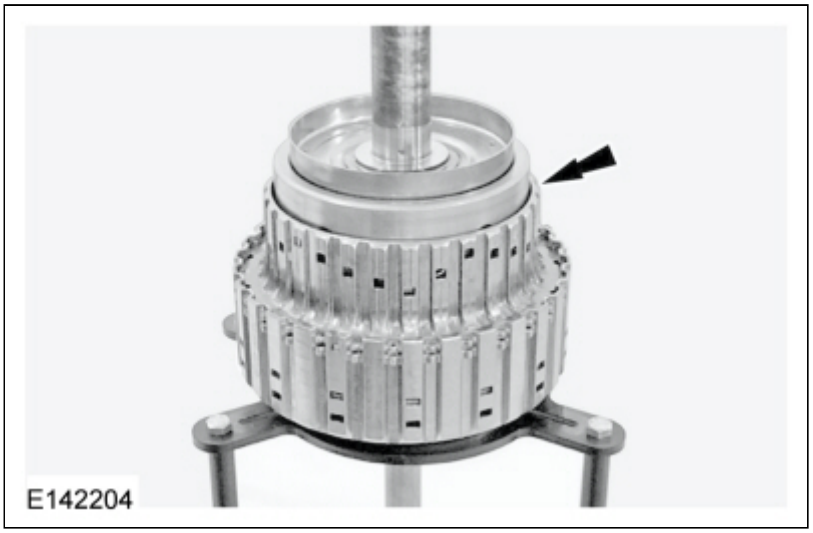
   Install the T4 intermediate shaft bearing.



4. Install the forward clutch hub and sun shaft assembly.



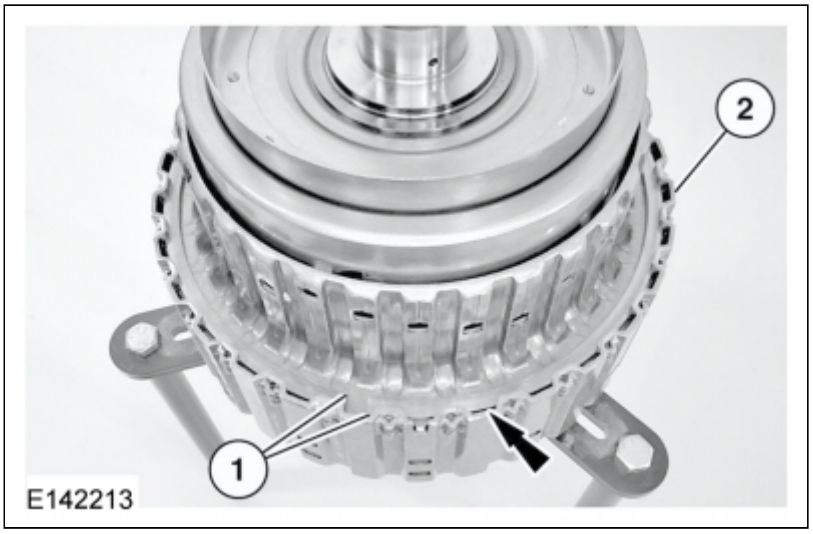
5. Install a new the direct clutch hub.



WARNING: Do not install the snap ring on the forward clutch hub with the snap ring gap in the same position as the original snap ring or damage to the transmission can occur.

6. **NOTE:** *Install a new direct clutch outer shell retaining ring with the snap ring gap positioned approximately 120° from the index mark made on the forward clutch hub during disassembly.*

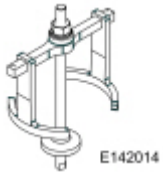
    - New snap ring gap
    - Index mark from original snap ring gap



Copyright © 2016 Ford Motor Company

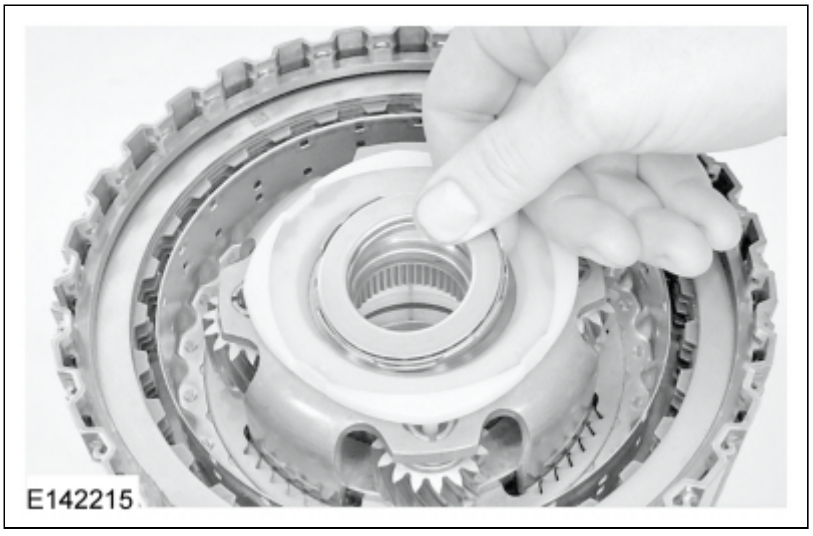
Forward Clutch Assembly

Special Tool(s) / General Equipment

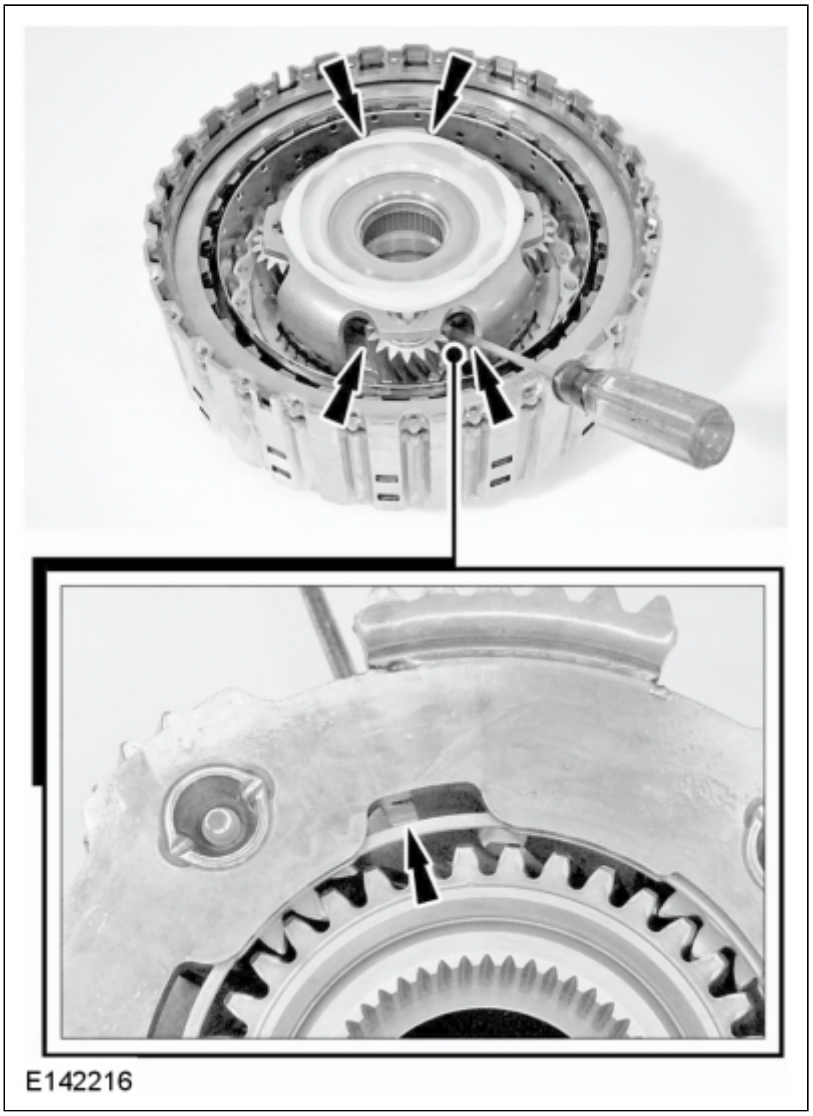
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 E142014	307-525 Compressor, Clutch Spring
 E142019	307-555 End Play Gauge, Clutch
Flat Headed Screw Driver	

DISASSEMBLY

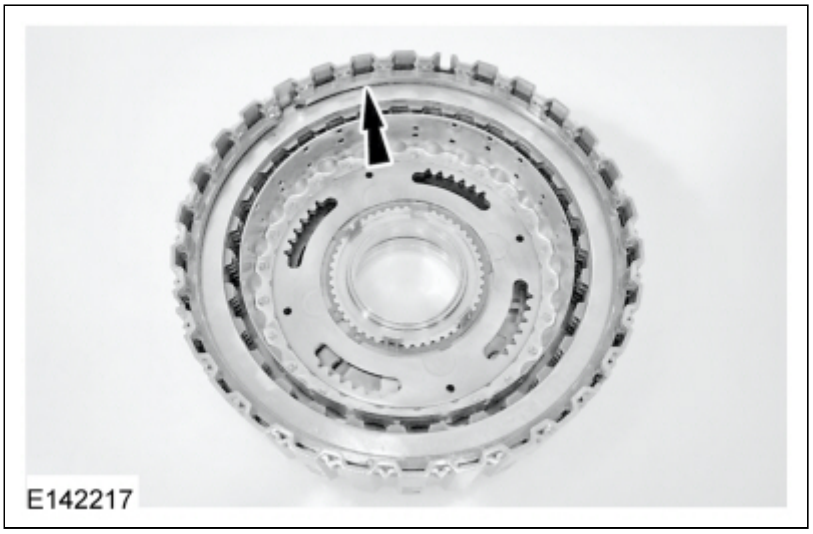
1. If the T2 thrust bearing is on the forward clutch assembly, remove it from the forward clutch assembly.



2. Remove the front planetary carrier and sun gear from the forward clutch assembly. With a small screwdriver or a suitable pick inserted into the front planetary assembly, push on the retaining ring in 4 places while lifting up on the front planetary assembly.
   Use the General Equipment: Flat Headed Screw Driver



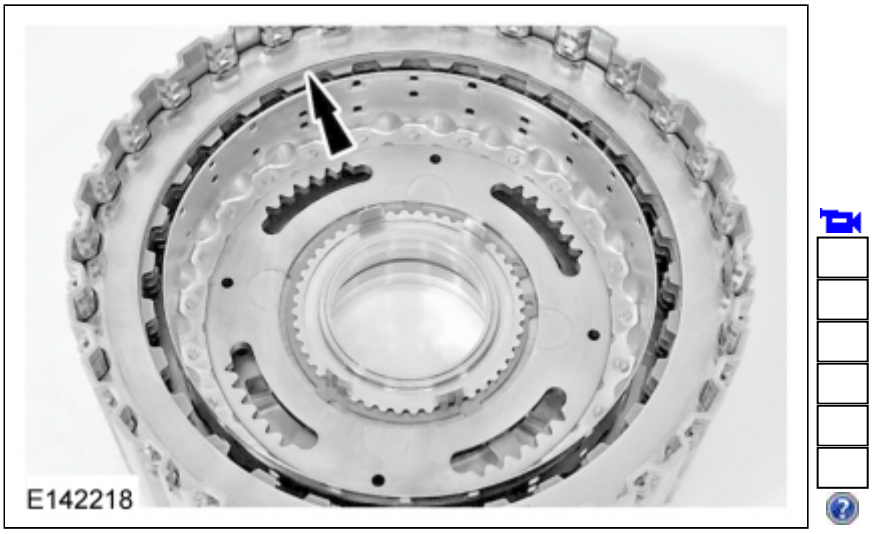
3. Remove the forward clutch pack snap ring.



NOTE: *Inspect the forward clutch drum and the friction and steel plates for damage. Install new components as necessary.*

4. **NOTE:** *Remove and inspect the forward clutch steel and friction plates.*

   - If the plates are damaged, install a new forward clutch assembly.
   - If no damage is indicated, the forward clutch may be reassembled.

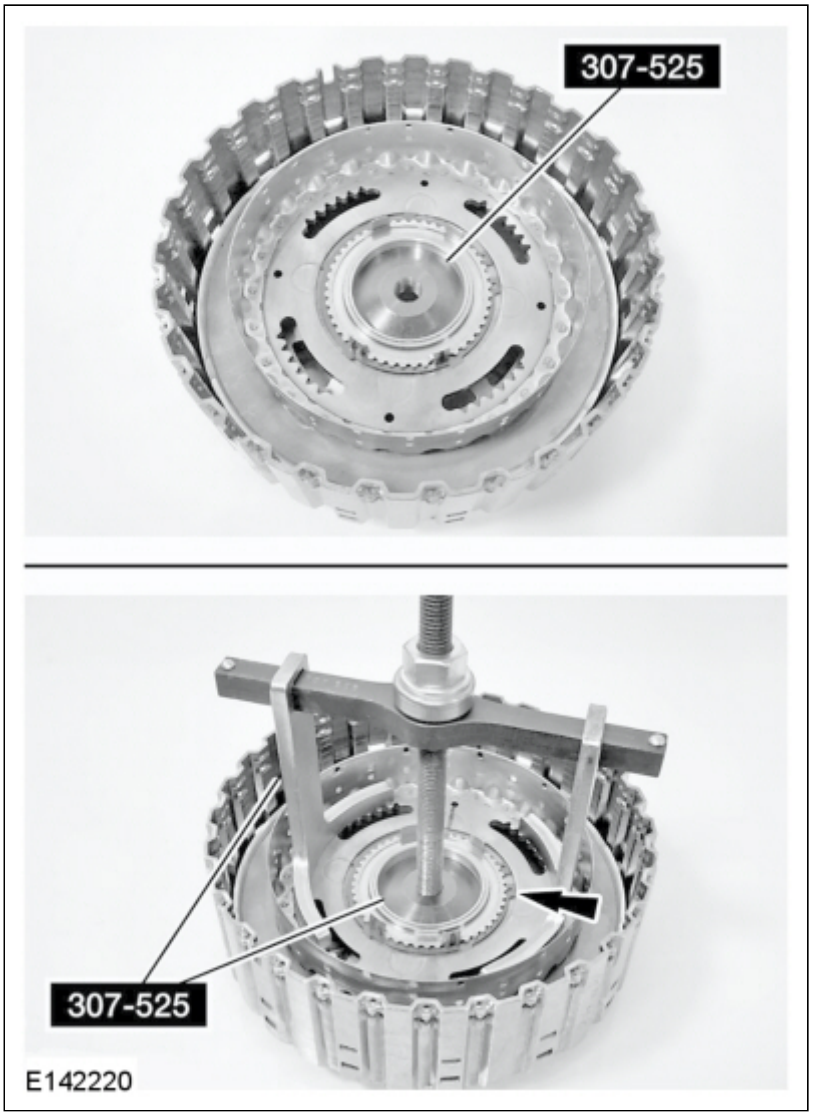


5. For correct alignment during assembly, make an identifying mark on the balance dam and the center part of the housing.

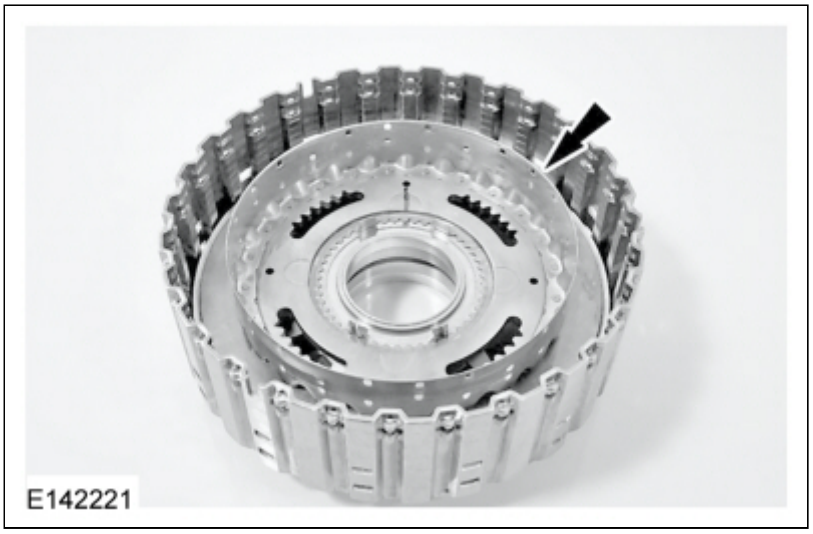


NOTE: *The bottom of the Clutch Spring Compressor will need to be installed from the back side of the forward clutch assembly.*

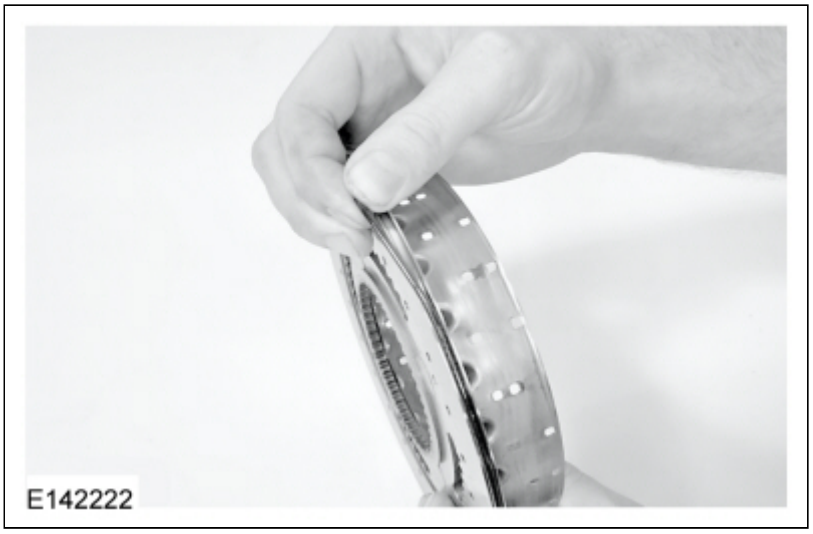
6. Using the Clutch Spring Compressor, slightly collapse the balance dam to gain access to the retaining ring and remove the retaining ring.
   Use Special Service Tool: 307-525 Compressor, Clutch Spring.



7. Remove the balance dam.



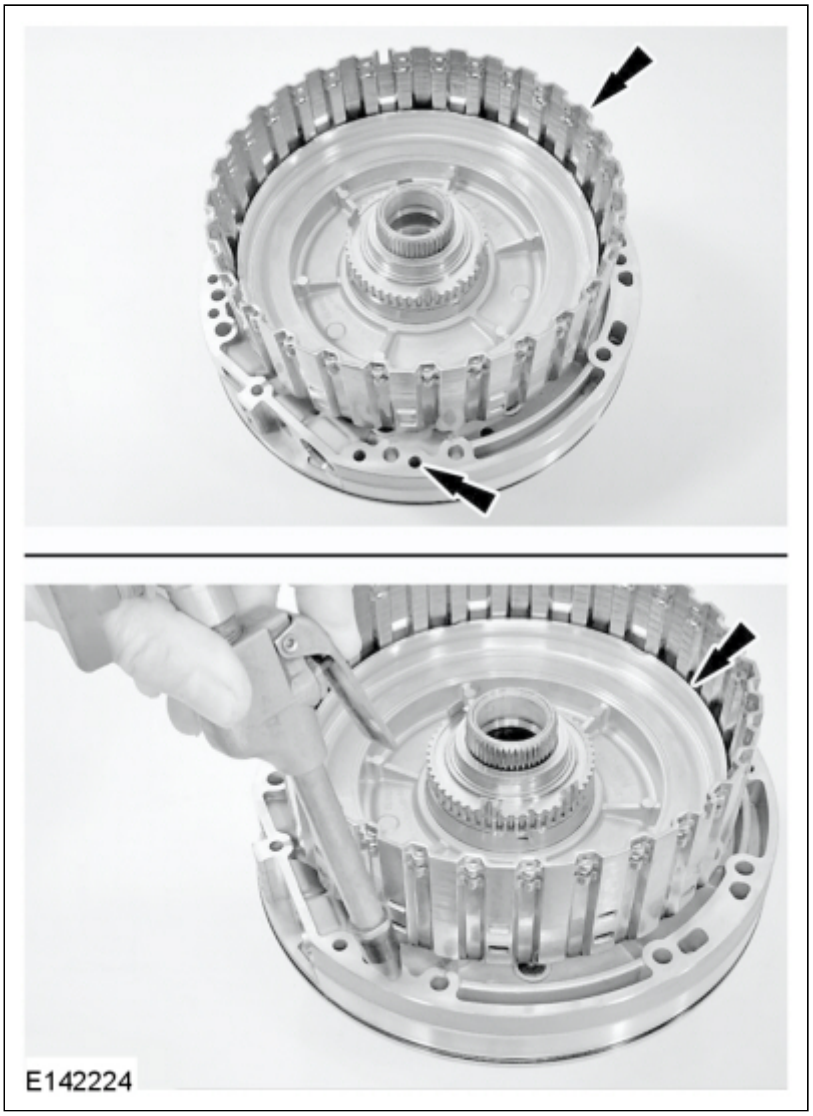
8. Remove and discard the O-ring seal from the balance dam.



9. Remove the forward clutch return spring.



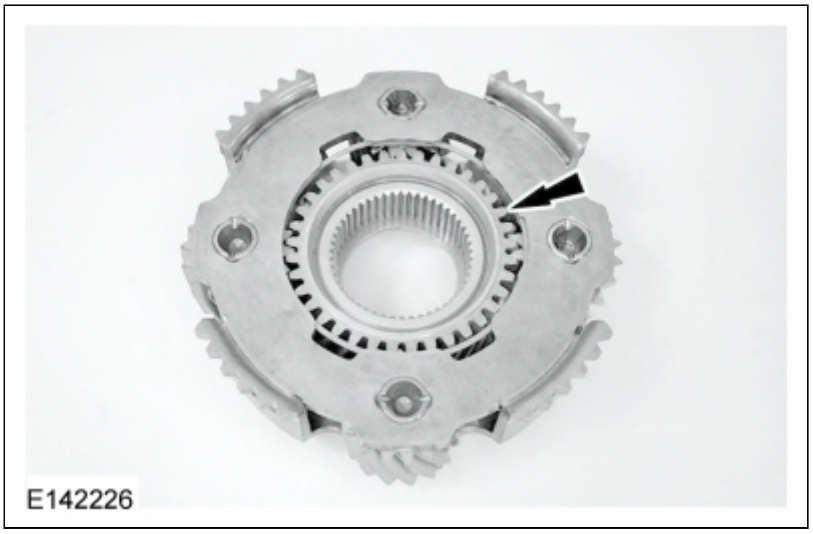
10. Install the forward clutch on the front pump to remove the forward clutch piston. Apply a small amount of shop air to remove the piston.



11. Remove and discard the inner and outer piston O-ring seals.

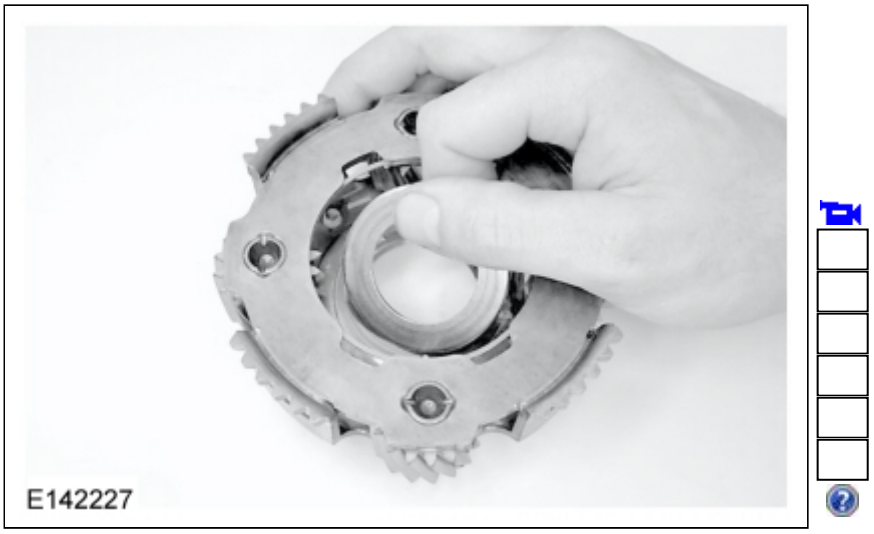


12. Remove the sun gear from the planet assembly.

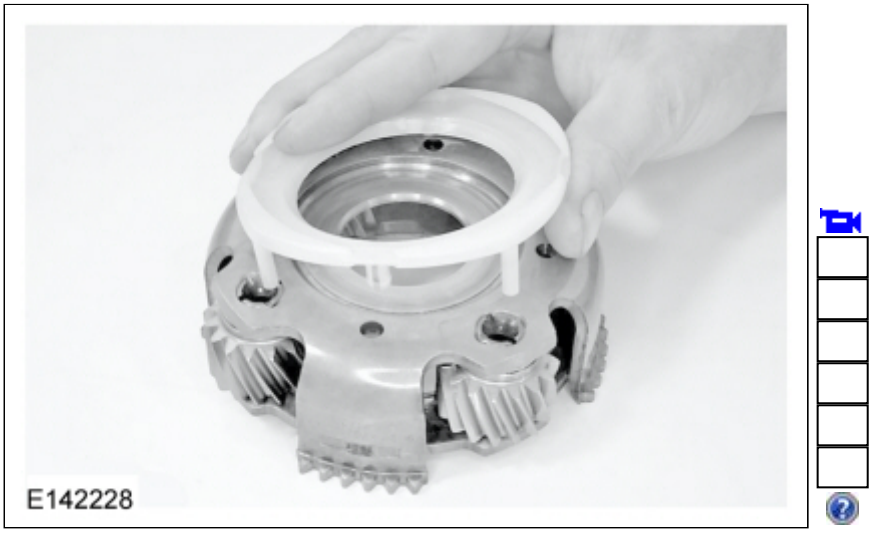


NOTE: *The T1 thrust bearing may have stuck to the sun gear when it was removed.*

13. Remove the T1 bearing from the planetary carrier.



14. Remove the transmission fluid collector plate from the front planetary carrier.

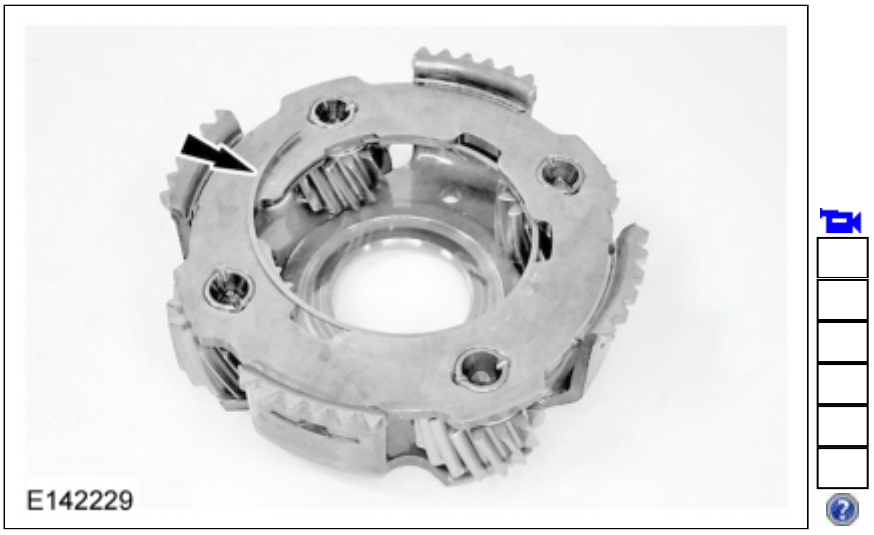


15. Clean and inspect the components of the forward clutch assembly for damage and install new components as necessary.

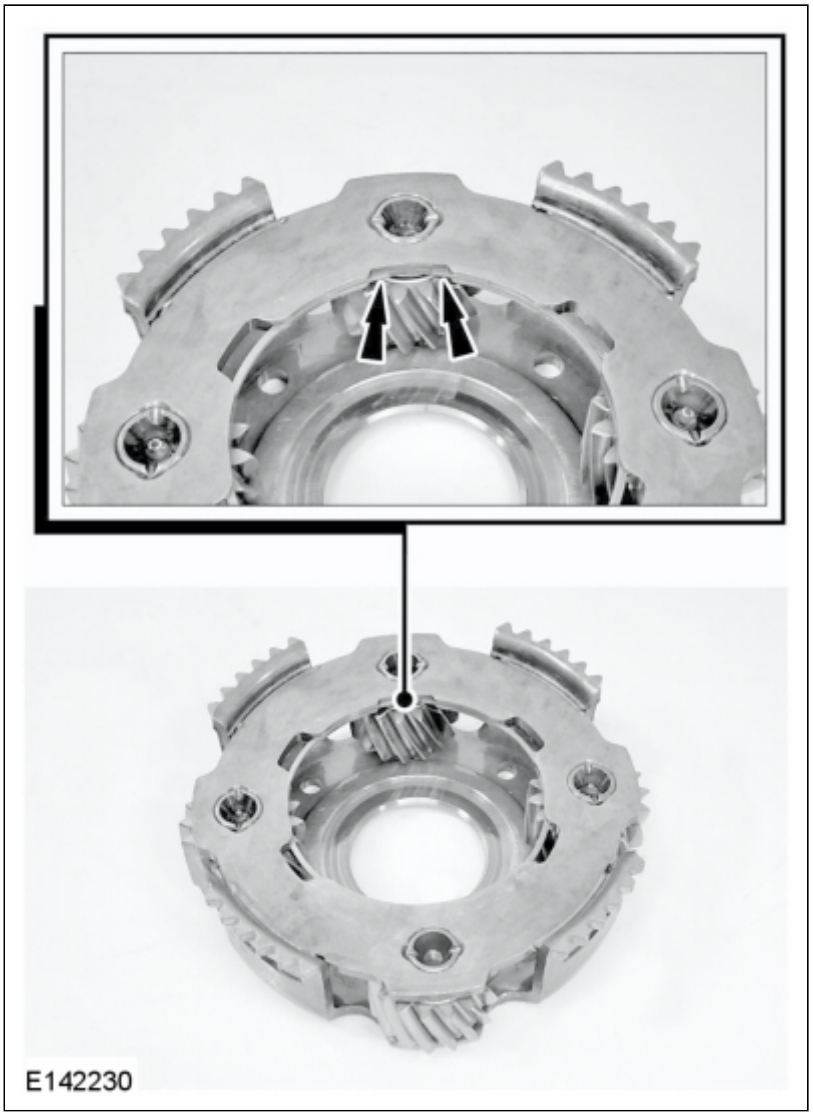
ASSEMBLY

NOTE: *If a new planetary assembly is being installed, the new planetary assembly may not come with the snap ring installed.*

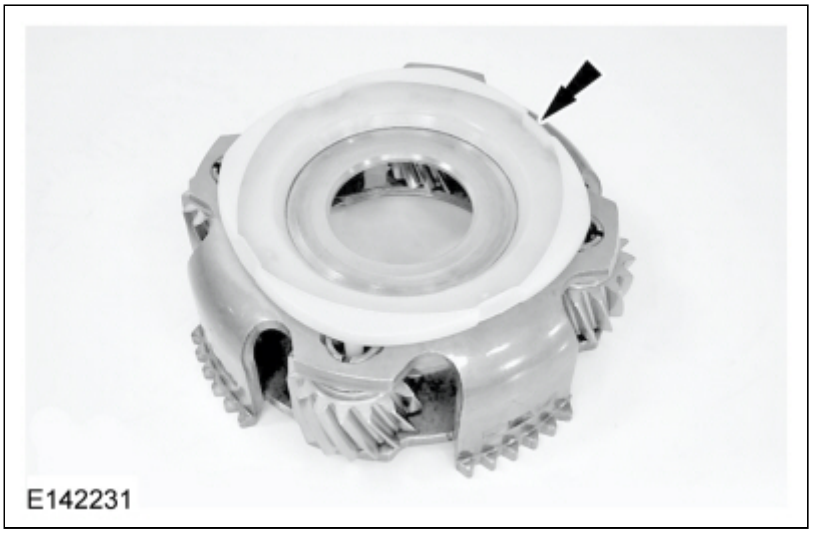
1. Install the planetary assembly snap ring, if necessary.



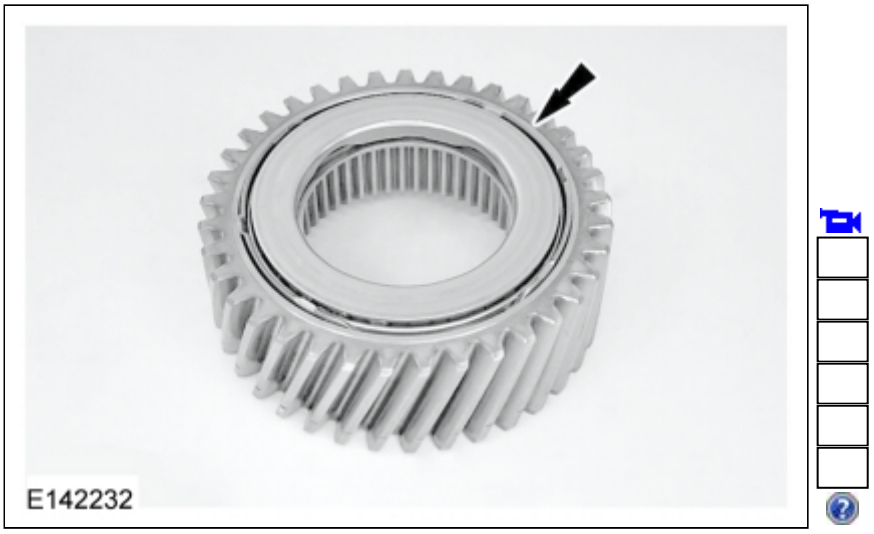
2. Make sure the planetary snap ring is oriented as shown.



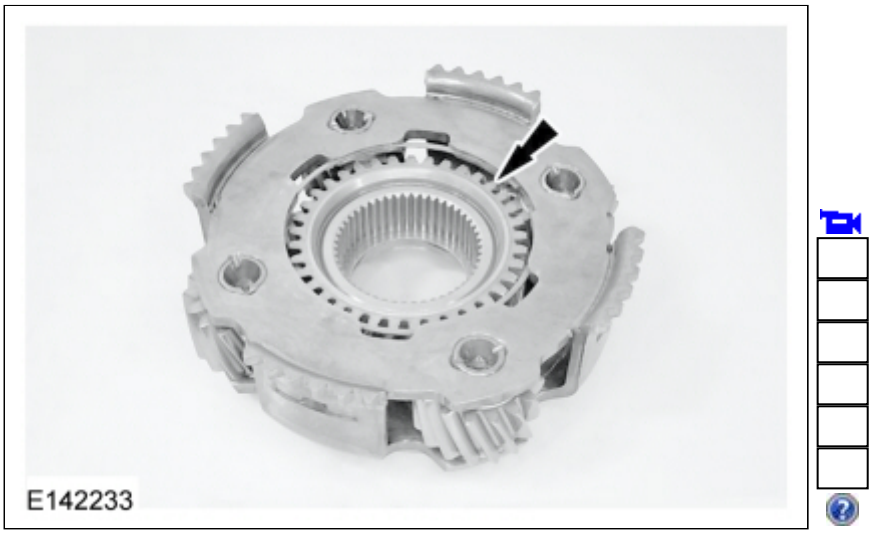
3. Install the transmission fluid collector plate on the front planetary carrier.



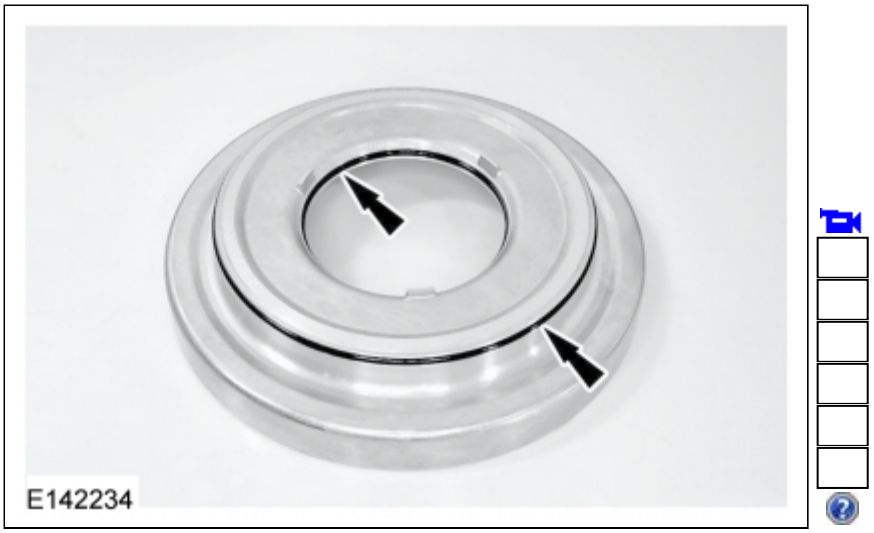
4. Install the T1 bearing onto the sun gear.



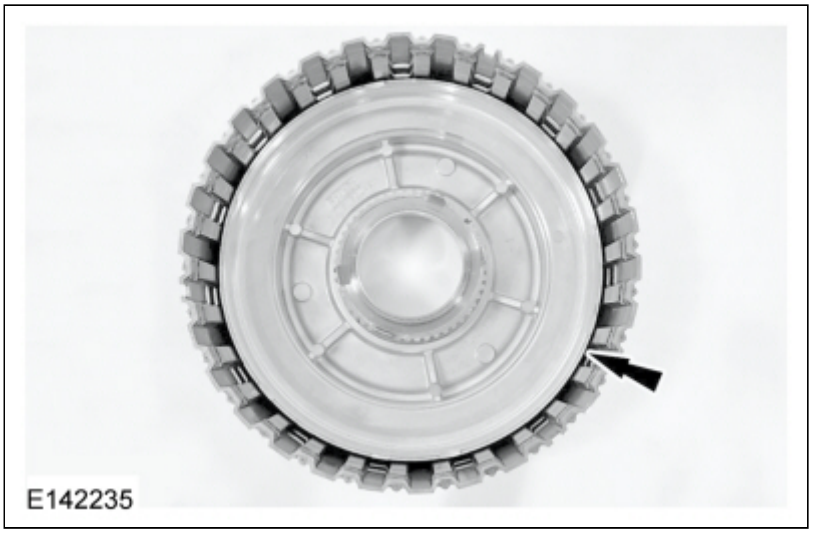
5. Install the sun gear into the planet assembly with the T1 bearing facing down and the recessed part of the gear up.



6. Install new O-ring seals onto the forward clutch piston.



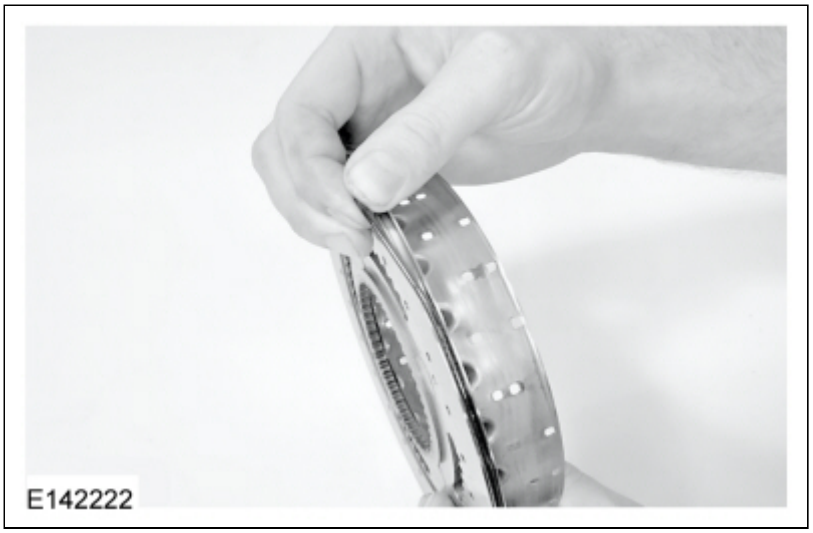
7. Lightly coat the O-ring seals with clean transmission fluid and install the forward clutch piston into the forward clutch drum.



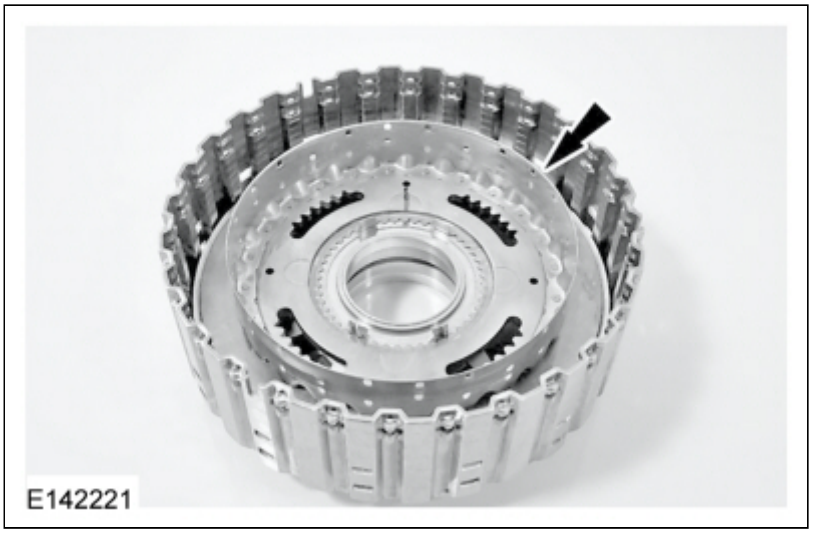
8. Install the forward clutch return spring.



9. Install a new O-ring seal onto the forward clutch balance dam. Lightly coat the O-ring seal with clean transmission fluid.

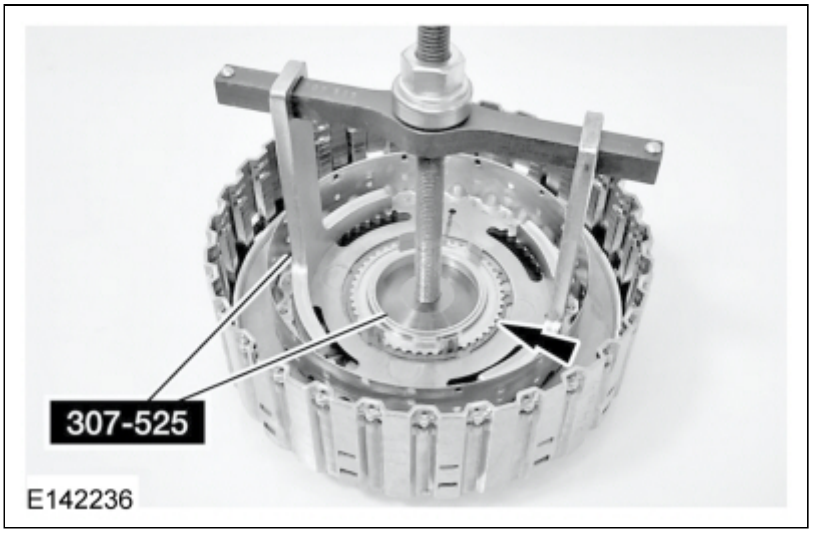


10. Align the marks made during disassembly and install the balance dam into the forward clutch drum.



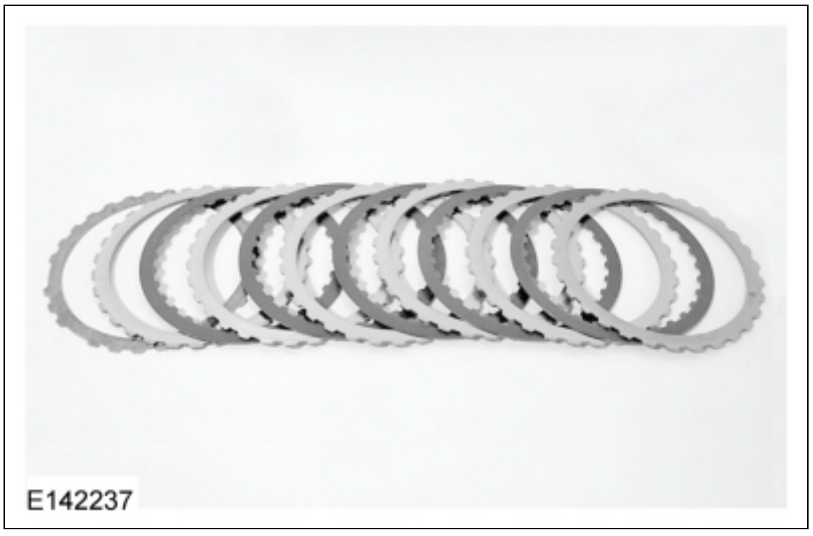
NOTE: *Prior to releasing the Clutch Spring Compressor, make sure that the snap ring is fully seated.*

11. Using the Clutch Spring Compressor, slightly collapse the balance dam to install the retaining ring. Install the retaining ring.
    Use Special Service Tool: 307-525 Compressor, Clutch Spring.

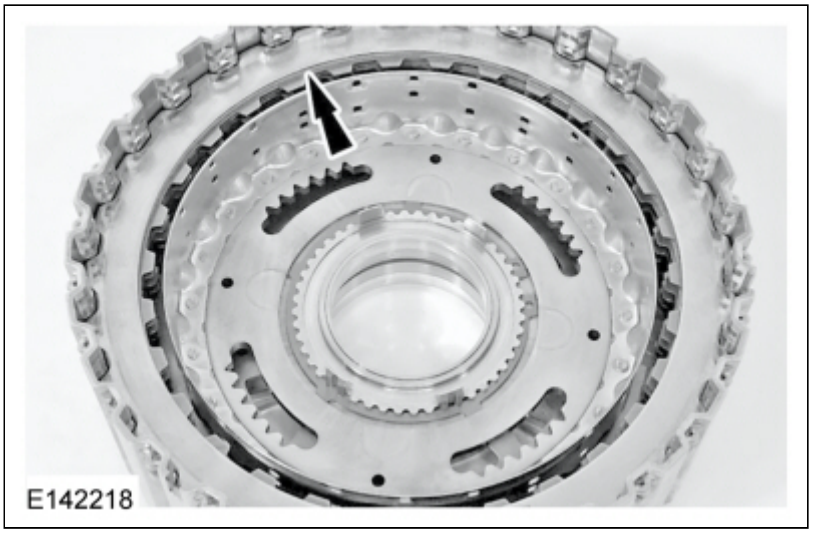


NOTE: *Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity chart in the Specifications portion of this section.*

12. Soak the new forward clutch plates in clean transmission fluid.



13. Install the new forward clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates and install the pressure plate.

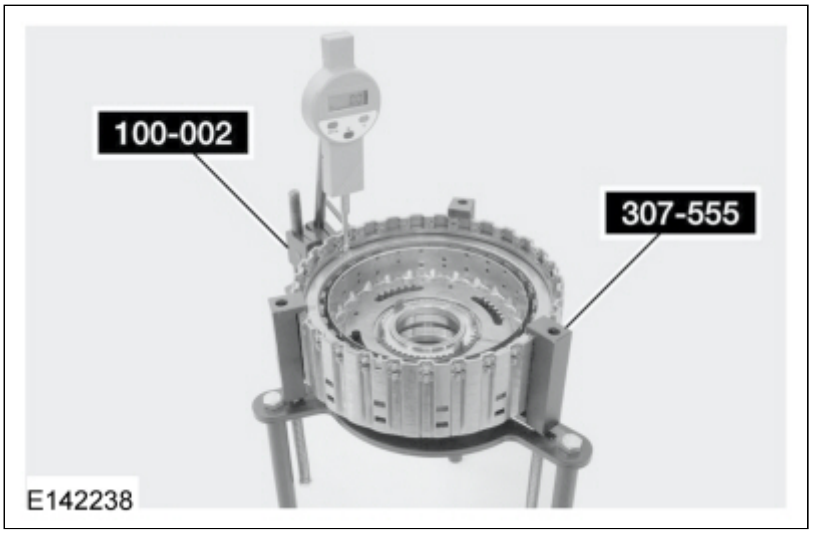


14. Install the forward clutch plate snap ring.

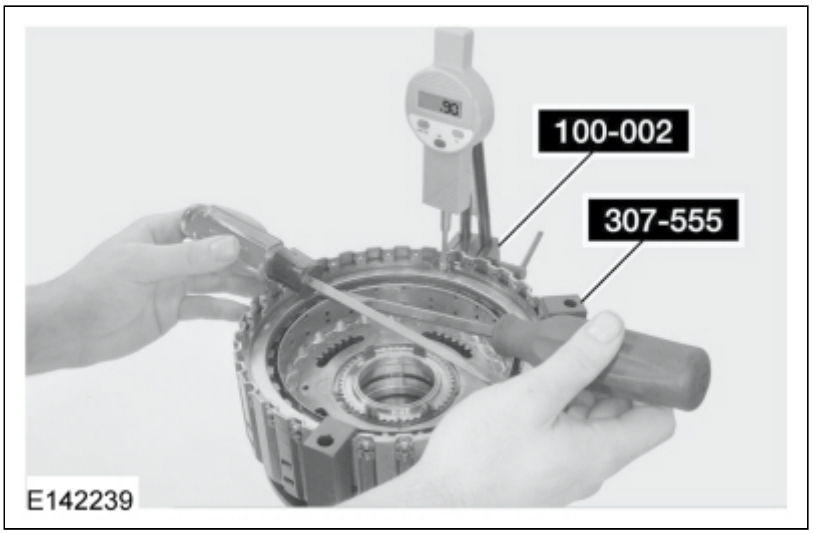


NOTE: *All forward clutch plates, friction and steel are of a wave-type design.*

15. Install the forward clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.
Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



16. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.
Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.

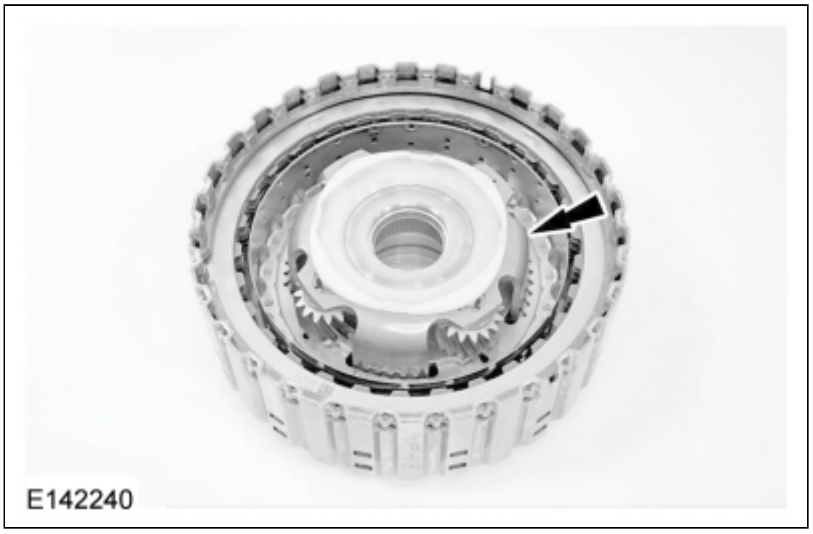


17. Rotate the forward clutch assembly 180° from the opening of the snap ring, take a second reading and record this reading as reading B.

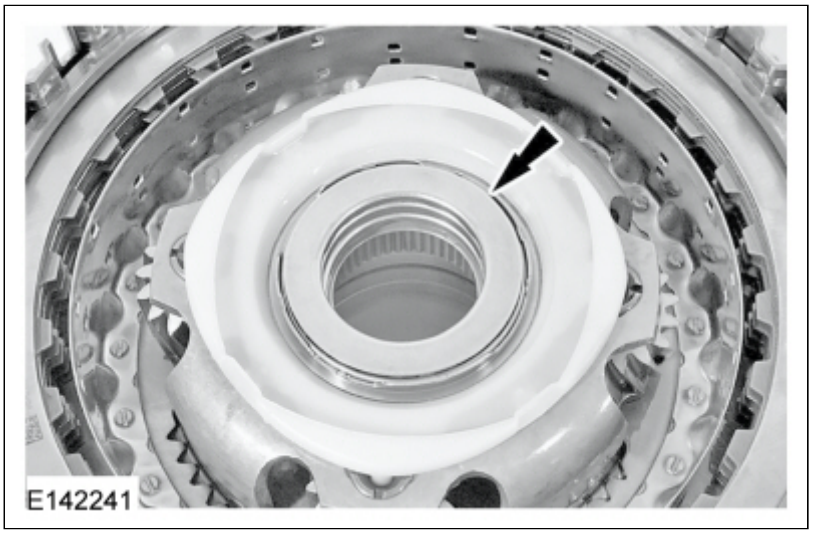
18. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

NOTE: *If the final measurement is not within specification, install a new snap ring until the correct specification is achieved. 0.71-1.10 mm*

19. Install the sun gear and planetary gearset into the forward clutch drum. Make sure it snaps and locks in place.



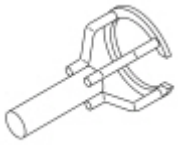
20. Install the T2 thrust bearing.



Copyright © 2016 Ford Motor Company

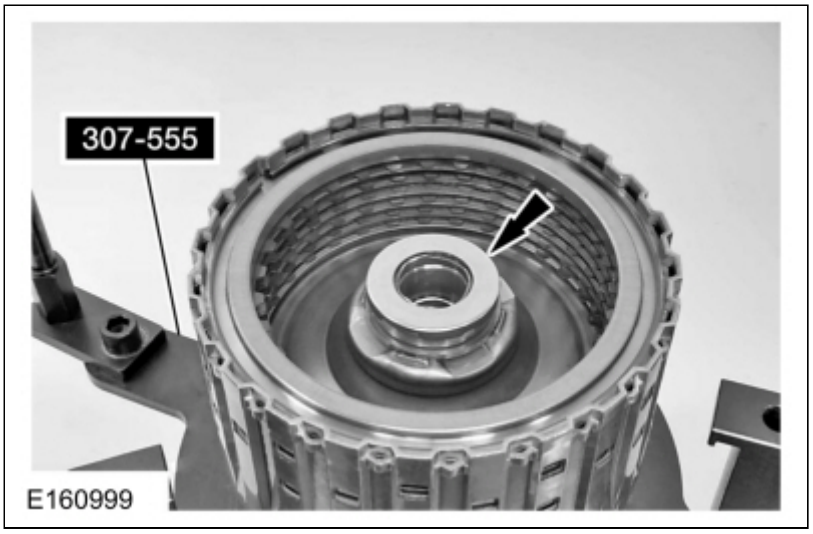
Overdrive Clutch Assembly

Special Tool(s) / General Equipment

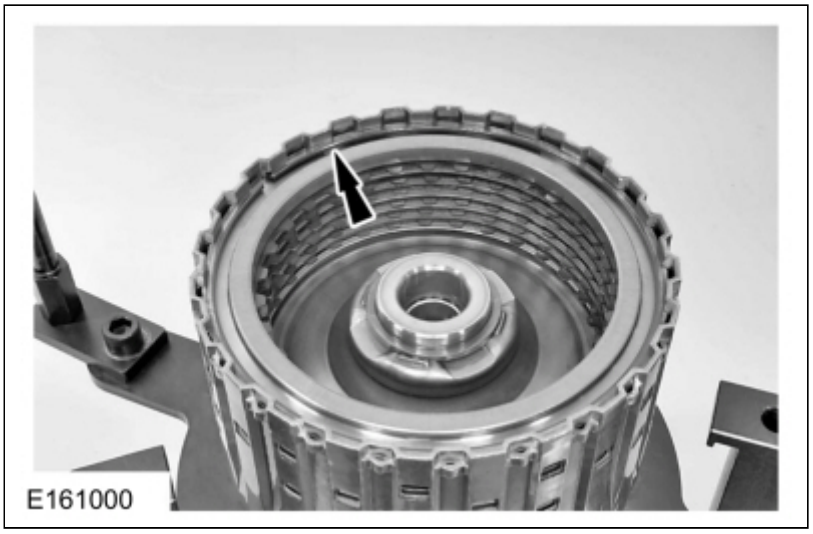
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 17040	307-209 Compressor, Spring Washer
 E142019	307-555 End Play Gauge, Clutch

DISASSEMBLY

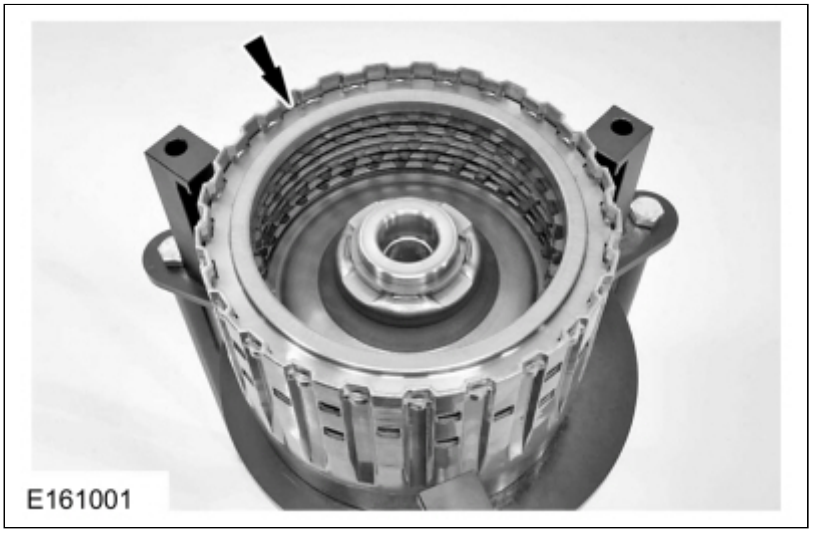
1. Position the Overdrive (O/D) clutch assembly in the Clutch End Play Gauge and remove the T3 thrust bearing. Use Special Service Tool: 307-555 End Play Gauge, Clutch.



2. Remove the O/D clutch pack snap ring.



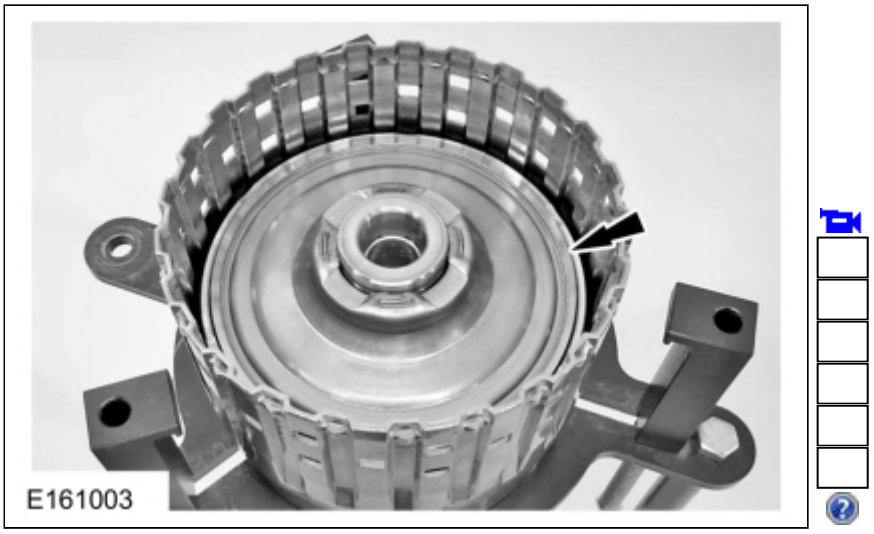
3. Remove the O/D clutch pack.



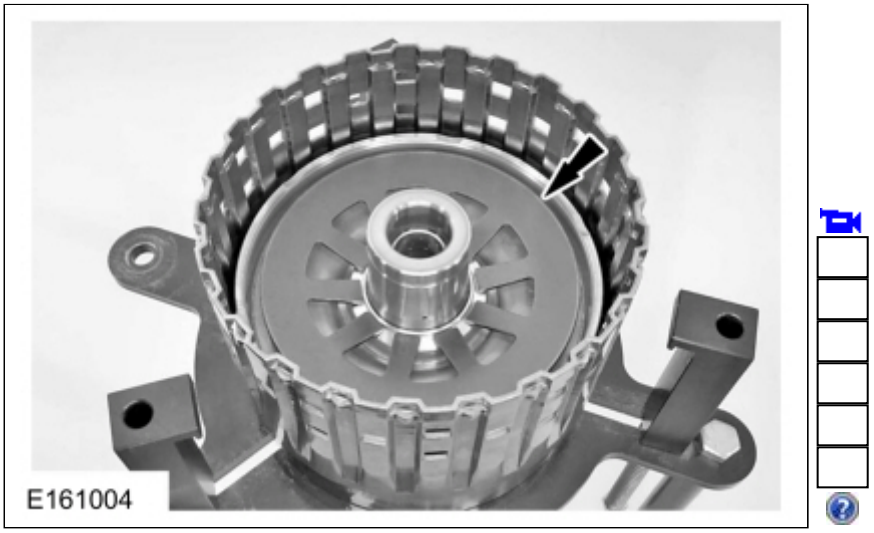
4. Using the Spring Washer Compressor and a press, remove and discard the O/D clutch balance piston retaining ring.
   Use Special Service Tool: 307-209 Compressor, Spring Washer.



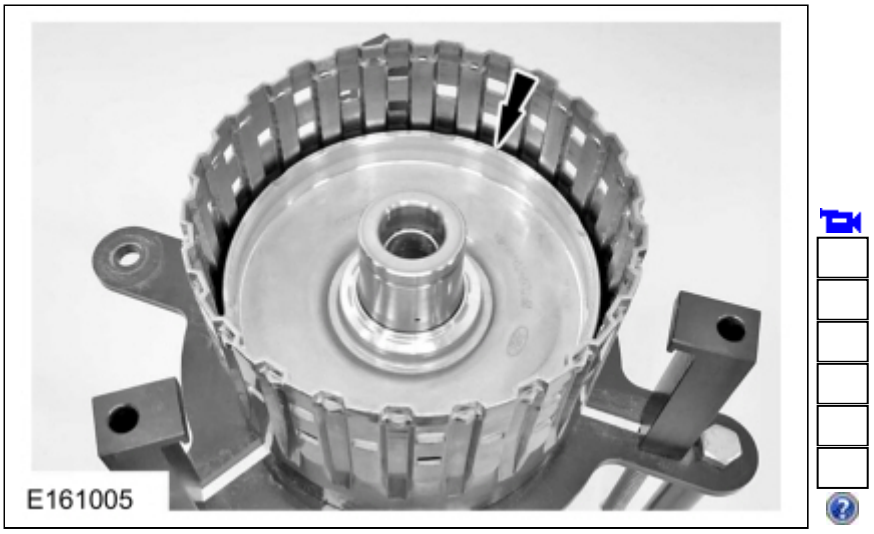
5. Remove the O/D clutch balance piston.



6. Remove the O/D clutch return spring.



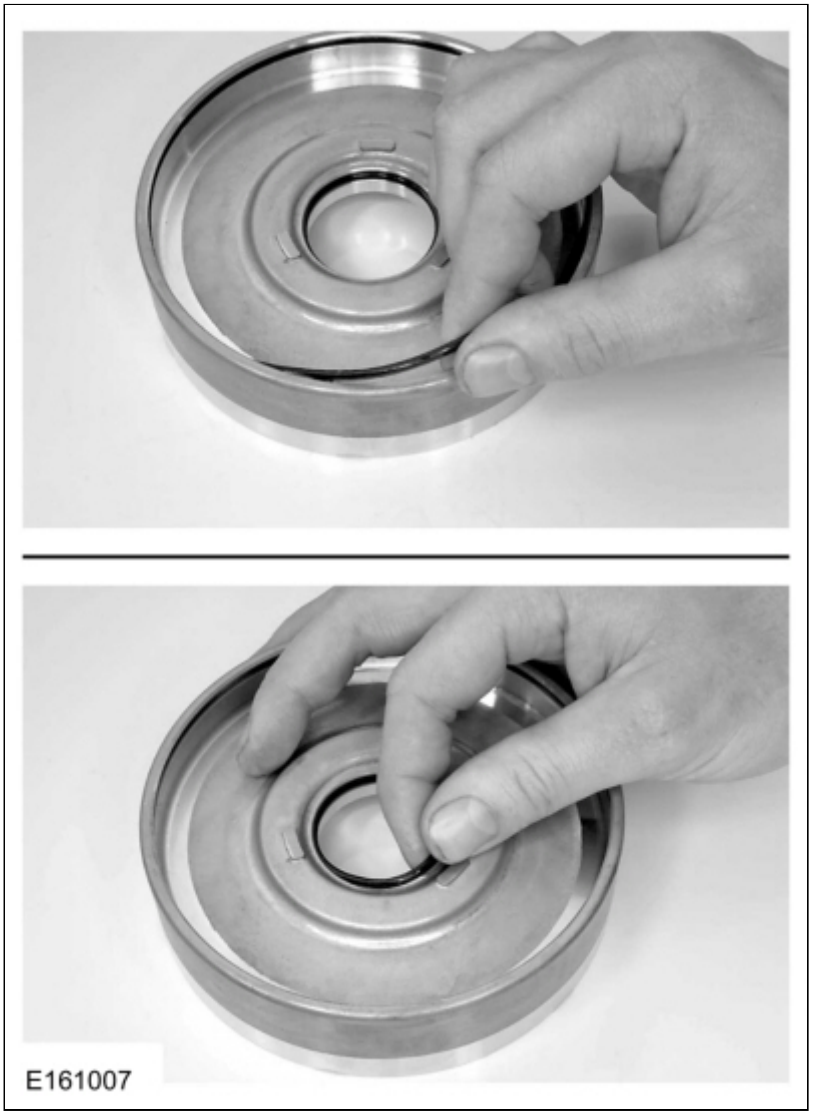
7. Remove the O/D clutch apply piston.



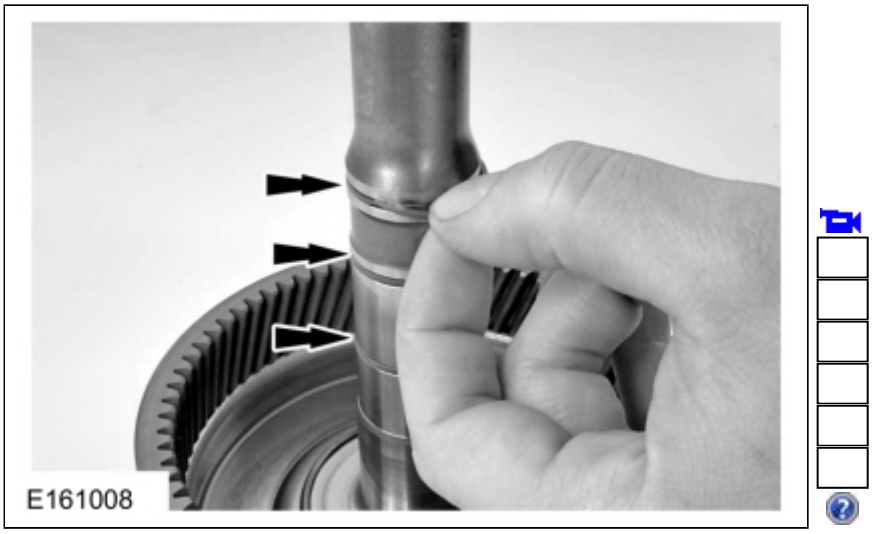
8. Remove and discard the outer O-ring seal on the O/D clutch balance piston.



9. Remove and discard both the inner (one large and one small) O-ring seals on the O/D clutch apply piston.

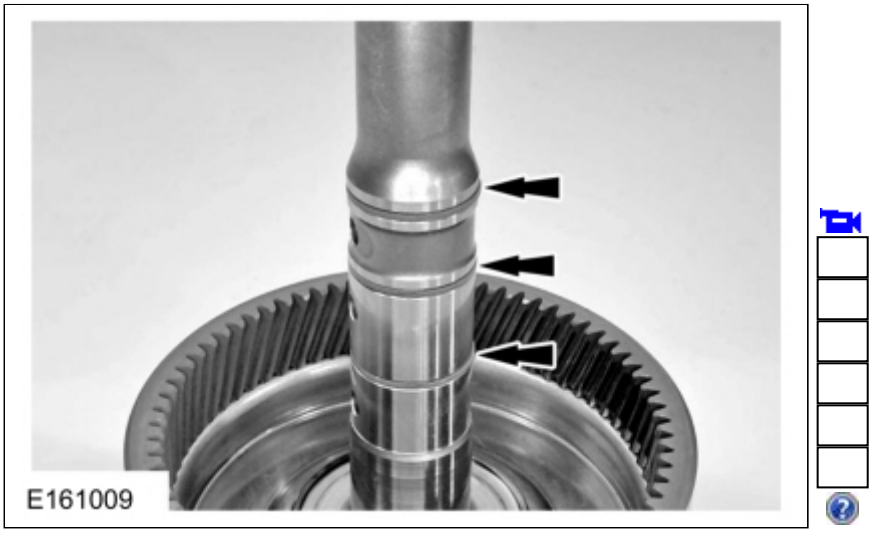


10. Remove and discard the 3 scarf cut seals.



ASSEMBLY

1. Install the 3 new scarf cut seals and the roller bearing.



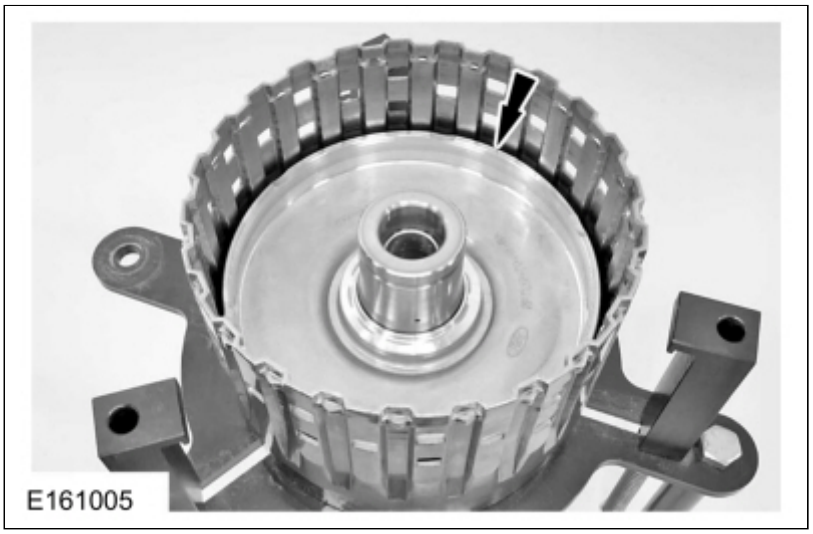
2. Install a new outer O-ring seal on the O/D clutch balance piston.



3. Install 2 new inner O-ring seals on the O/D clutch apply piston.

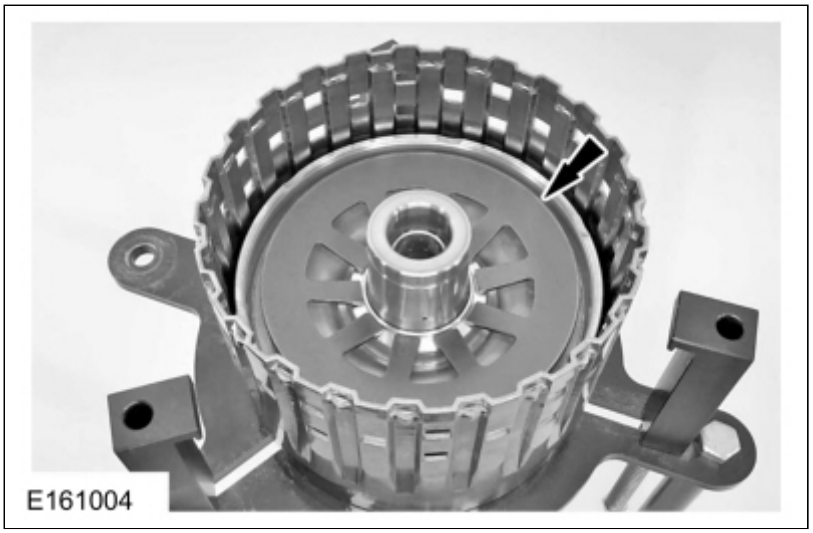


4. Lubricate all the O-ring seals with clean transmission fluid. Install the O/D clutch apply piston into the drum with the O-ring seals and the 3 pads facing down toward the drum.



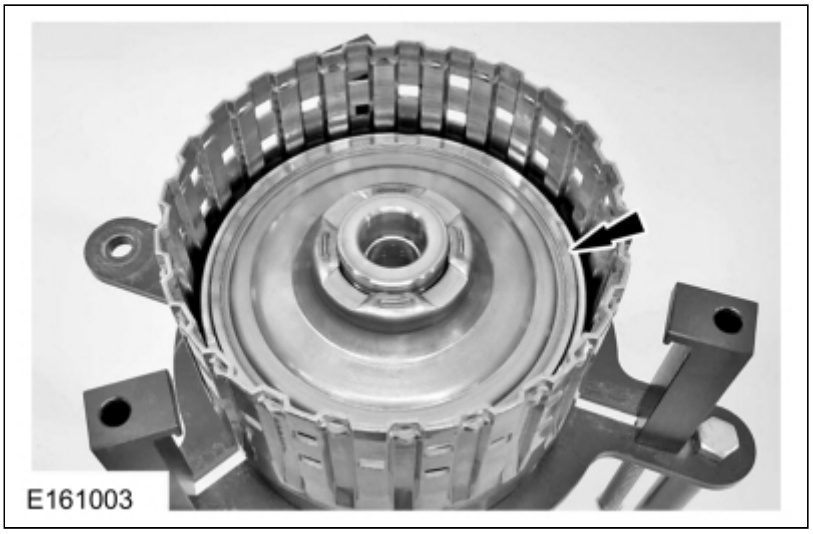
5. **NOTE:** *The fingers on the return spring are facing down toward the piston.*

   Install the O/D clutch return spring.

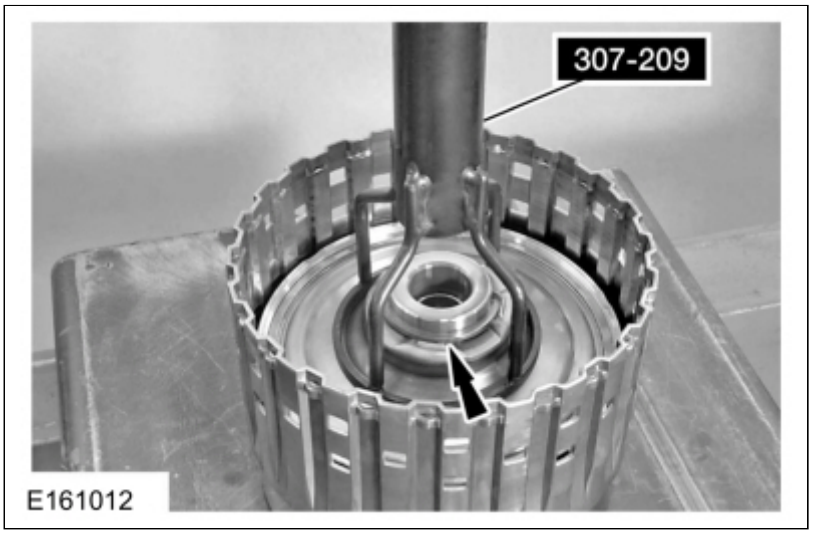


6. **NOTE:** *The cone shape of the balance piston must face up when installed correctly.*

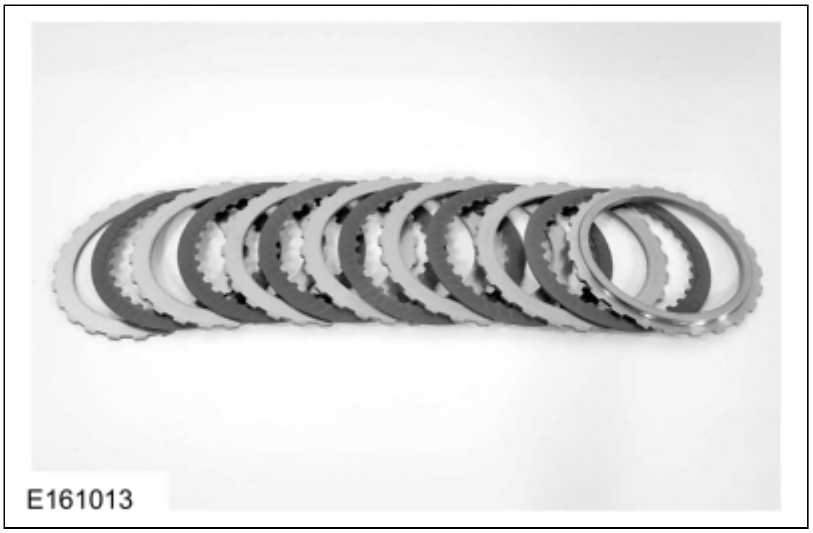
   Lubricate all the O-ring seals with clean transmission fluid. Install the O/D clutch balance piston.



7. Using the Spring Washer Compressor, install a new O/D clutch balance piston retaining ring.
   Use Special Service Tool: 307-209 Compressor, Spring Washer.

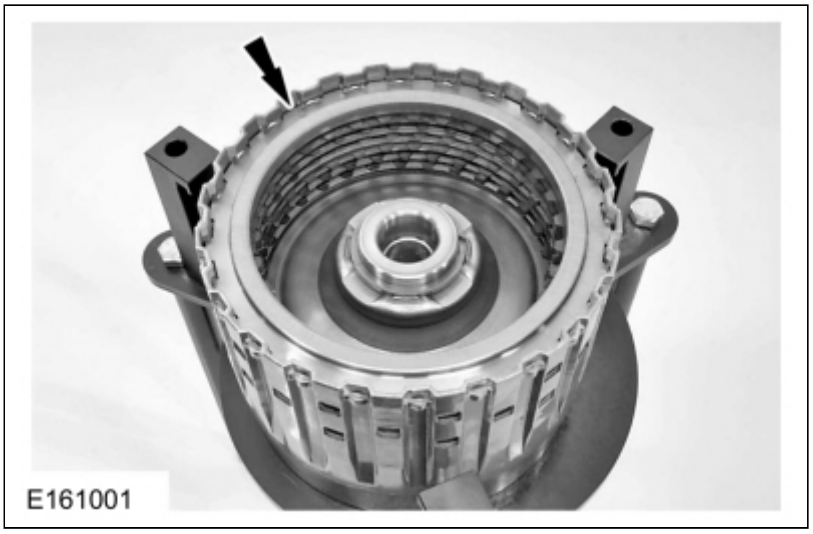


8. Soak the new O/D clutch plates in clean transmission fluid.

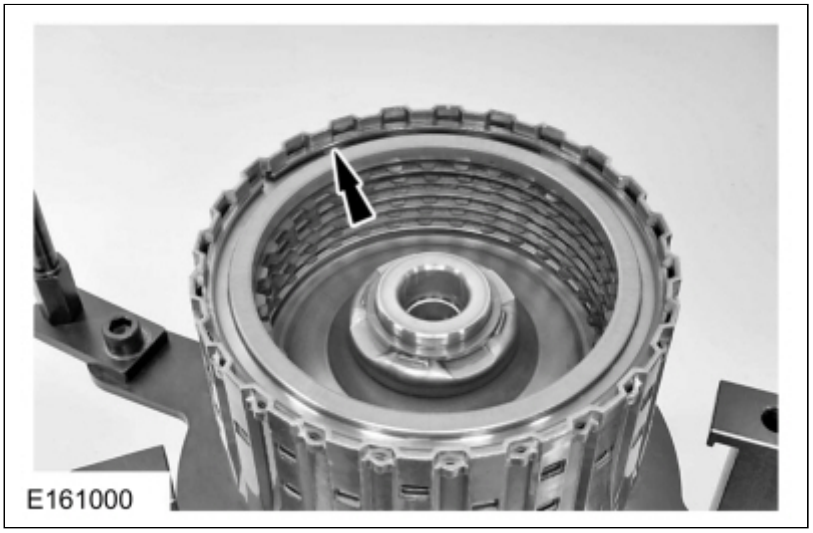


9. **NOTE:** *Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity chart in the Specifications portion of this section*

   Install the new O/D clutch plates, starting with a steel plate and alternating between friction and steel plates, and ending with the pressure plate on the top.



10. Install the O/D clutch pack snap ring.



11. **NOTE:** *All O/D clutch plates, friction and steel are of a wave-type design.*

    Install the O/D clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.
    Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



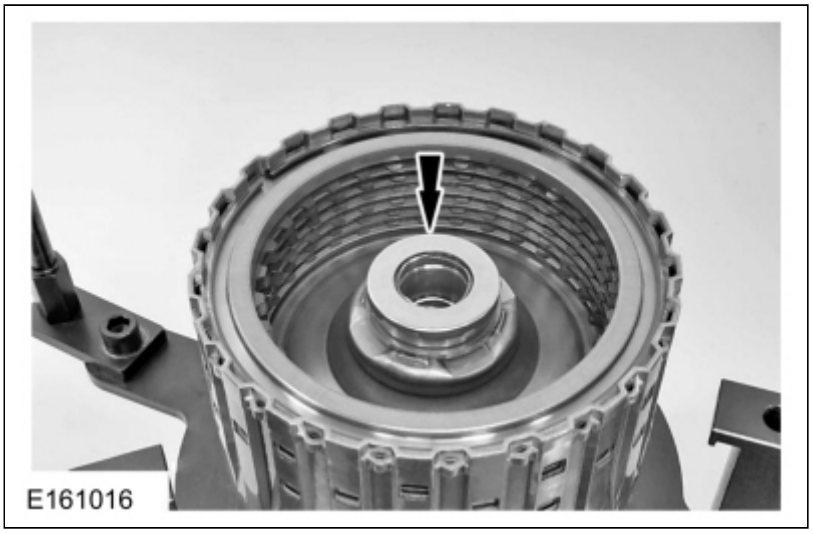
12. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



13. Rotate the O/D clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.
14. **NOTE:** *If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.*

    If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.
15. **NOTE:** *Inspect and install new thrust bearings as required.*

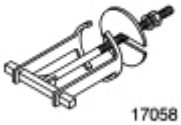
    Install the T3 thrust bearing.



Copyright © 2016 Ford Motor Company

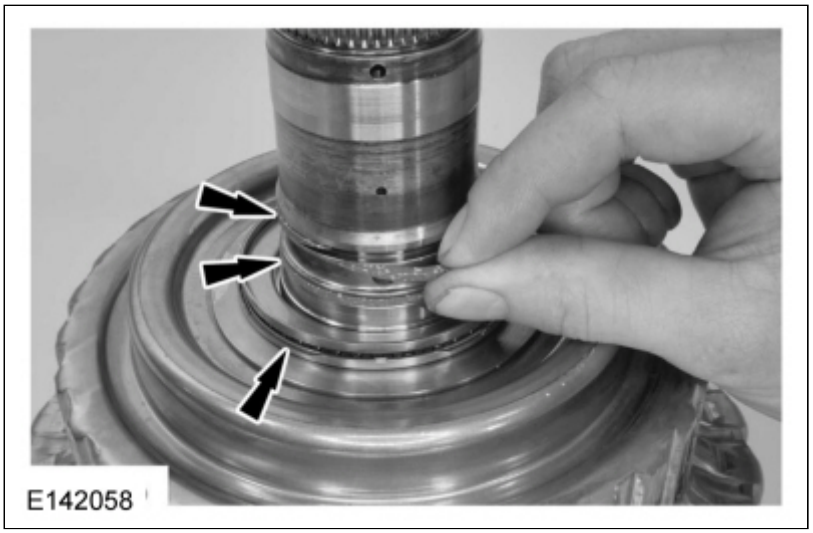
Direct Clutch Assembly

Special Tool(s) / General Equipment

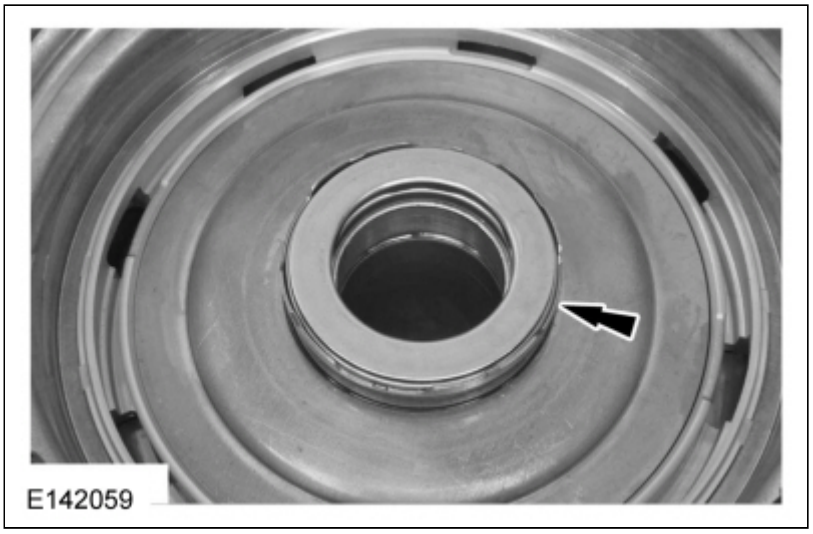
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 17058	307-015 Compressor, Clutch Spring
 E142016	307-552 Compressor, Clutch Spring
 E142019	307-555 End Play Gauge, Clutch

DISASSEMBLY

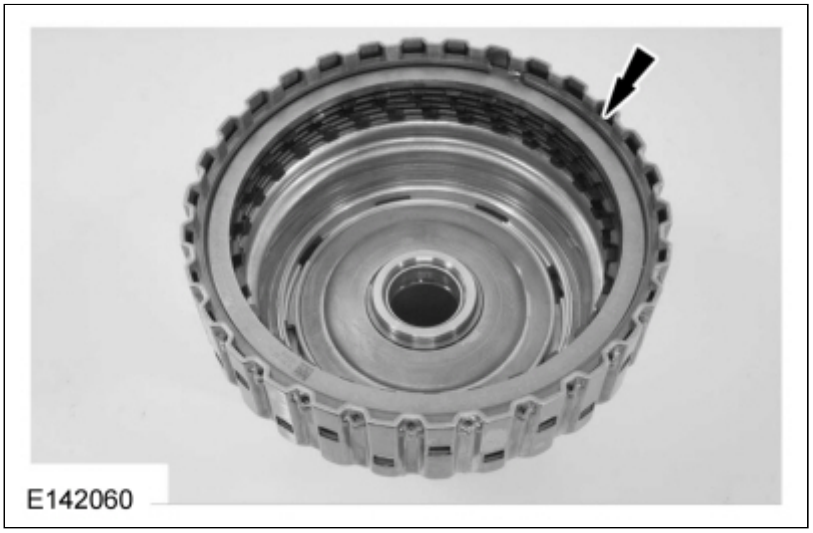
1. Remove and discard the 2 scarf cut seals and the roller bearing.



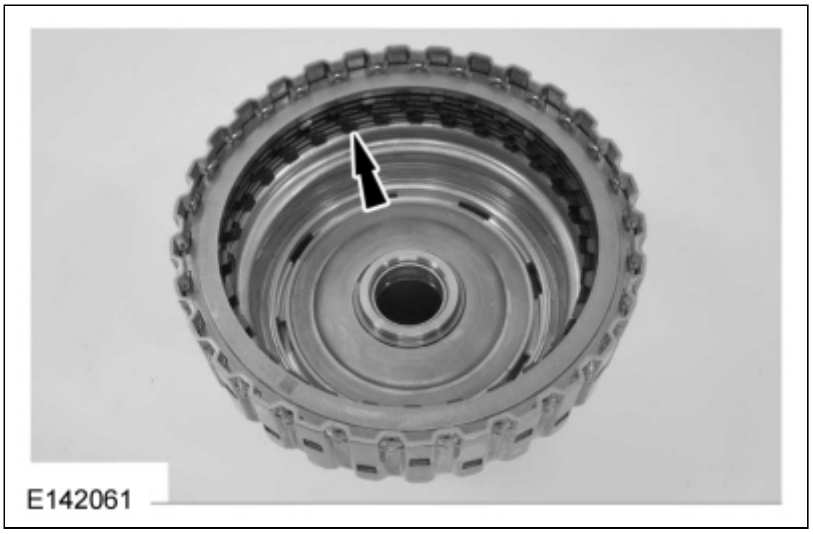
2. Remove the T5 thrust bearing.



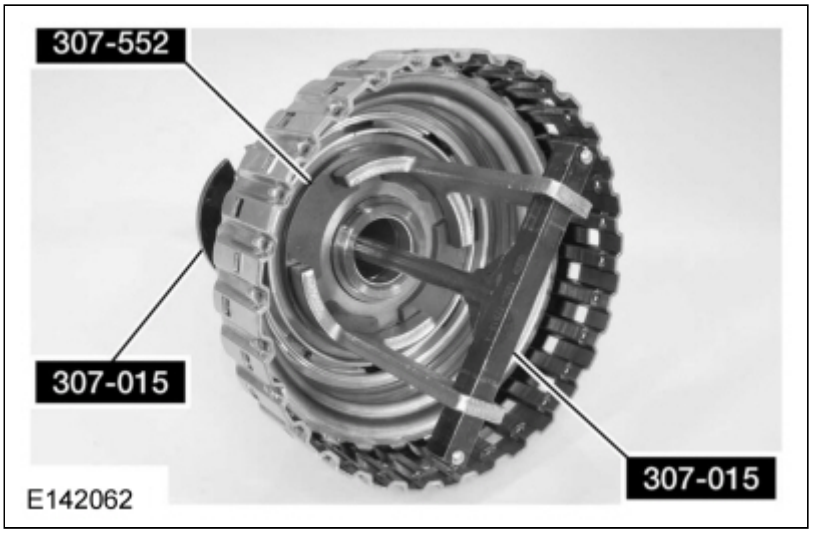
3. Remove the direct clutch snap ring.



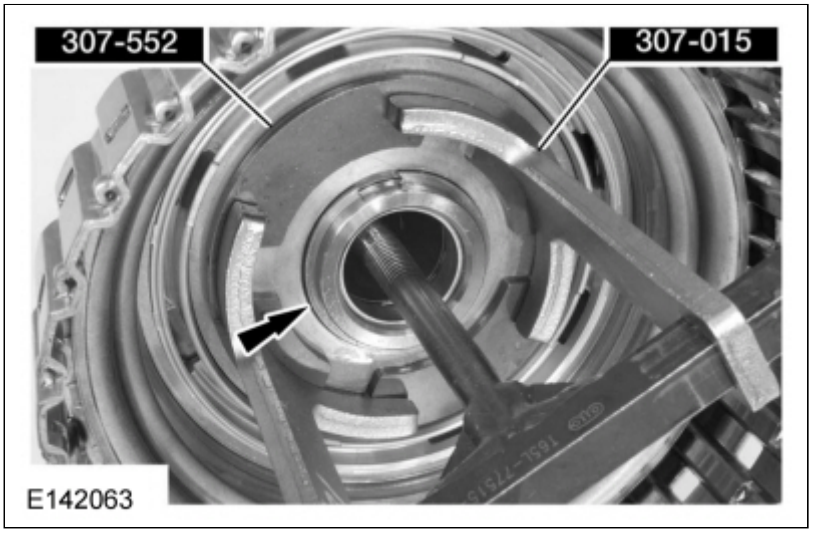
4. Remove the direct clutch steel and friction plates.



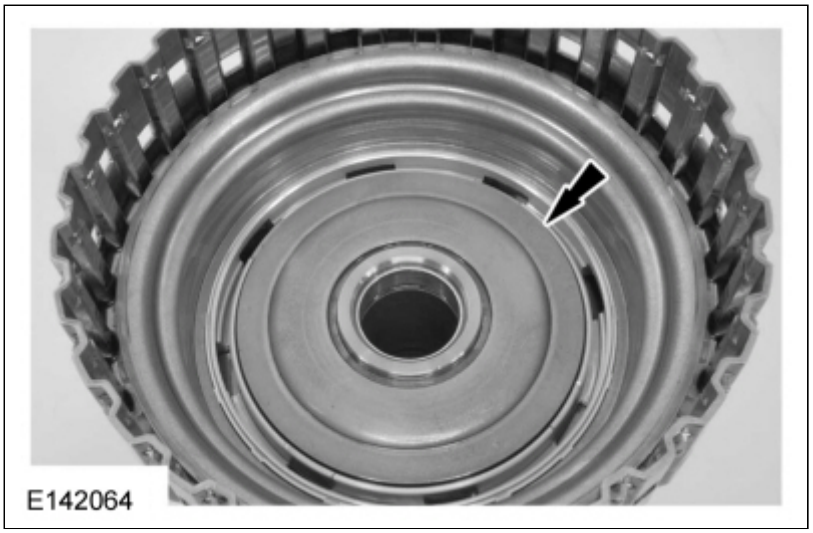
5. Install the Clutch Spring Compressors onto the direct clutch assembly.
   Use Special Service Tool: 307-552 Compressor, Clutch Spring. , 307-015 Compressor, Clutch Spring.



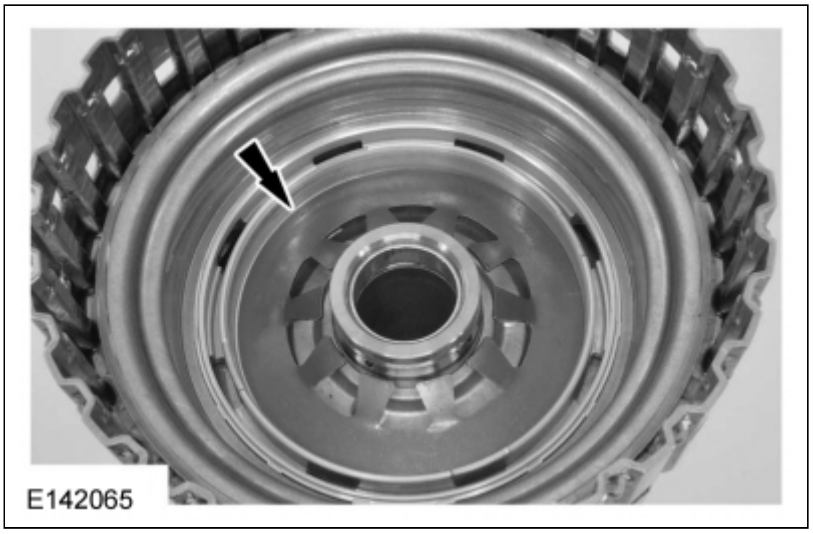
6. Using the Clutch Spring Compressors, compress the direct clutch return spring and remove the direct clutch return spring retainer.
   Use Special Service Tool: 307-552 Compressor, Clutch Spring. , 307-015 Compressor, Clutch Spring.



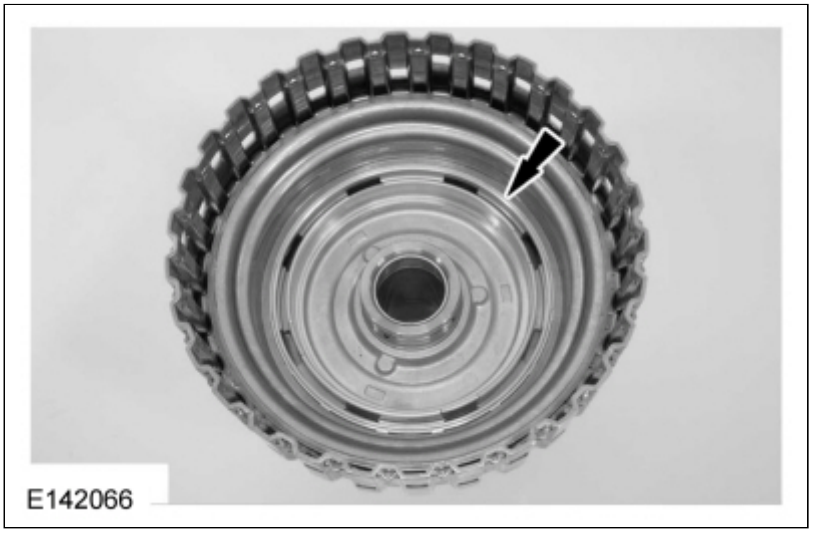
7. Remove the balance piston.



8. Remove the balance piston.



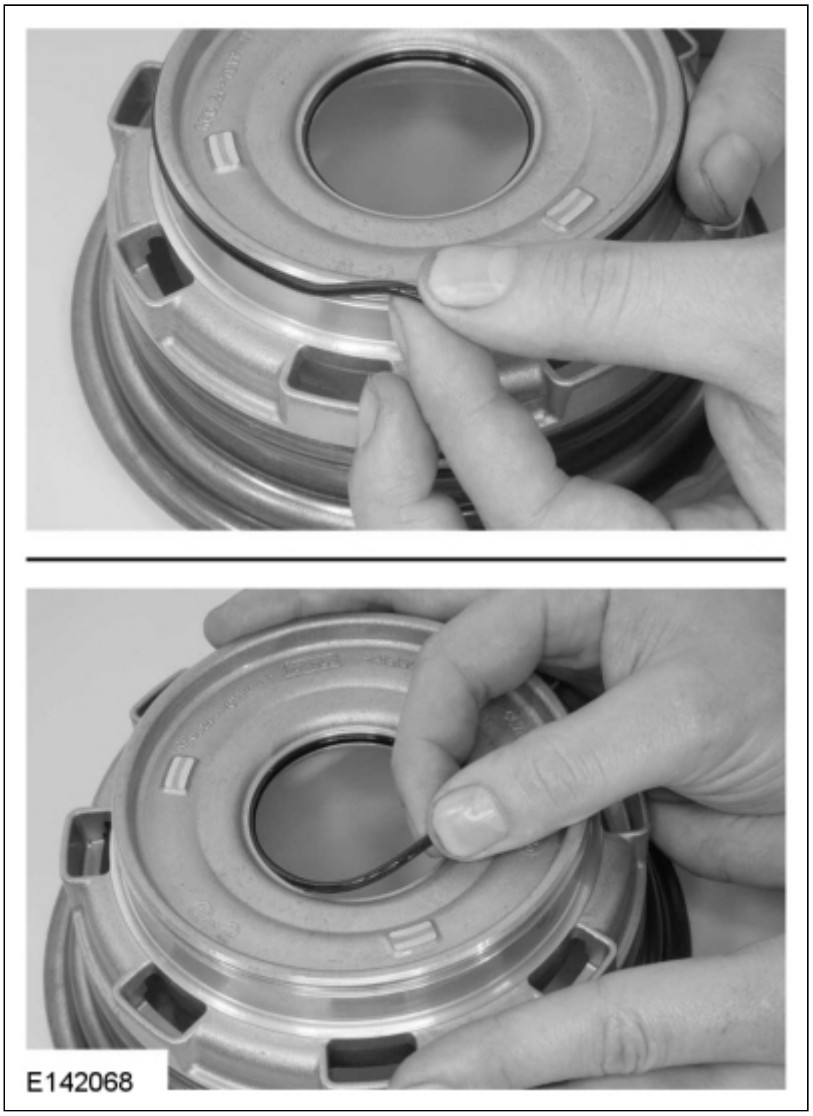
9. Remove the direct clutch piston.



10. Remove and discard the outer O-ring seal from the balance piston.



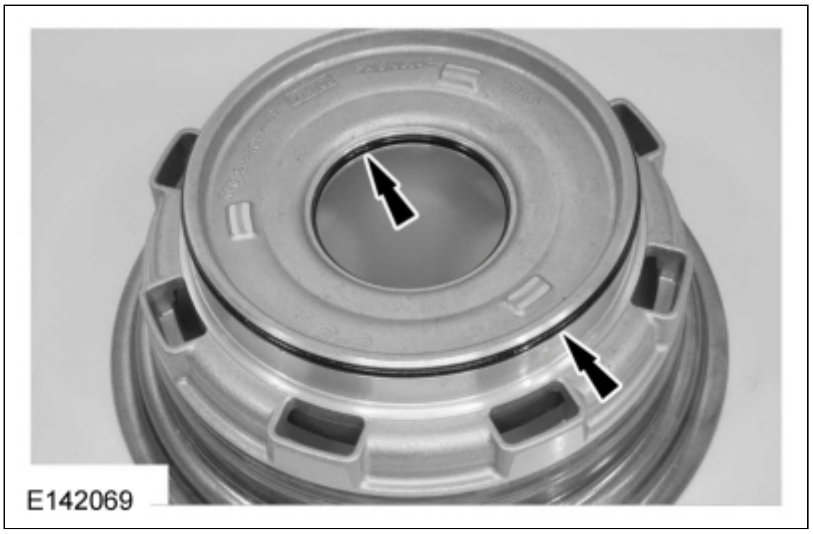
11. Remove and discard the outer and inner O-ring seals from the apply piston.



12. Inspect the components of the direct clutch for damage. If damage is indicated, install new components as necessary.

ASSEMBLY

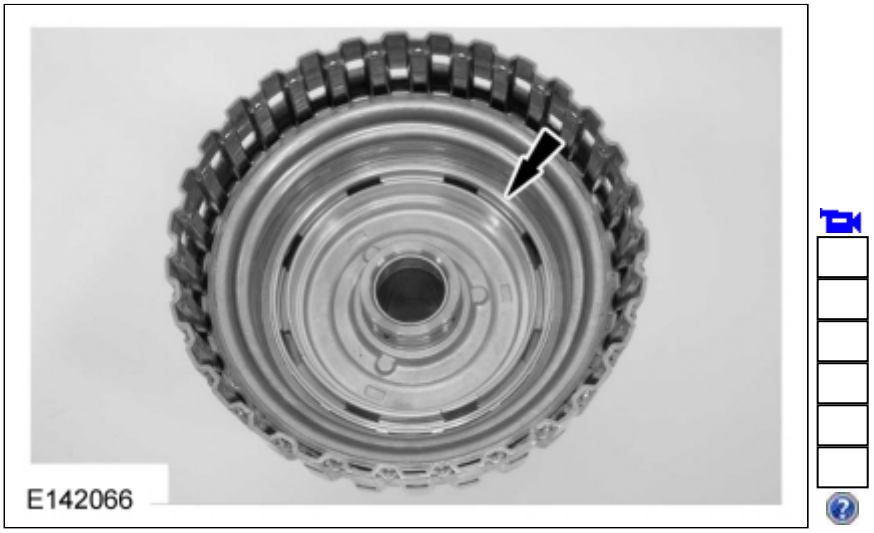
1. Install a new inner and outer O-ring seal on the apply piston.



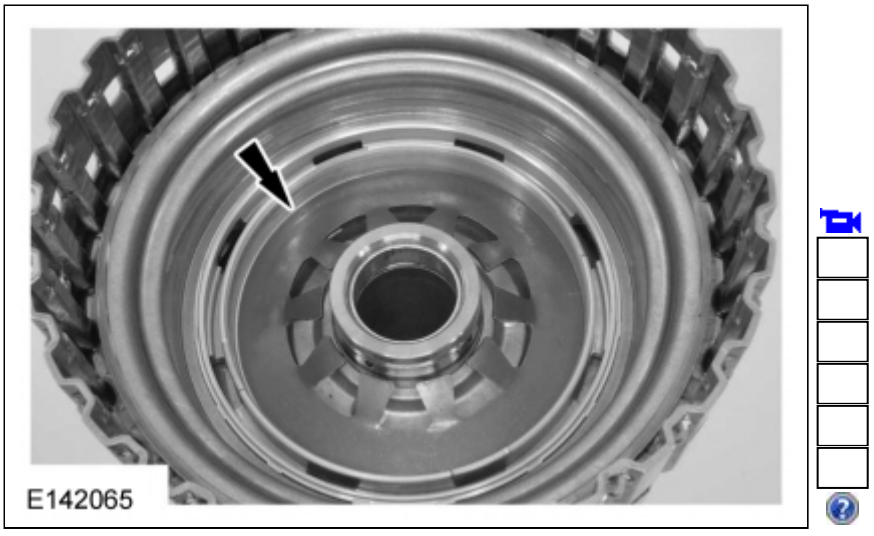
2. Install a new outer O-ring seal on the balance piston.



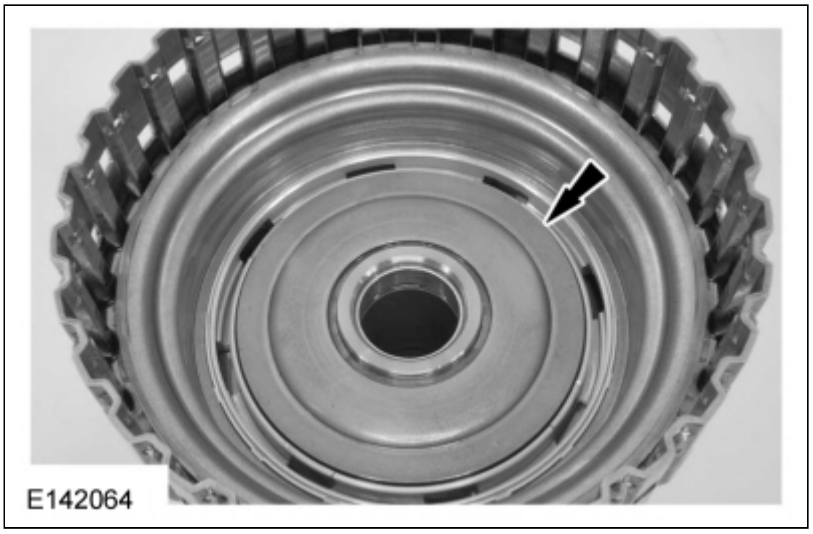
3. Lightly coat the O-ring seals in clean transmission fluid and install the direct clutch piston.



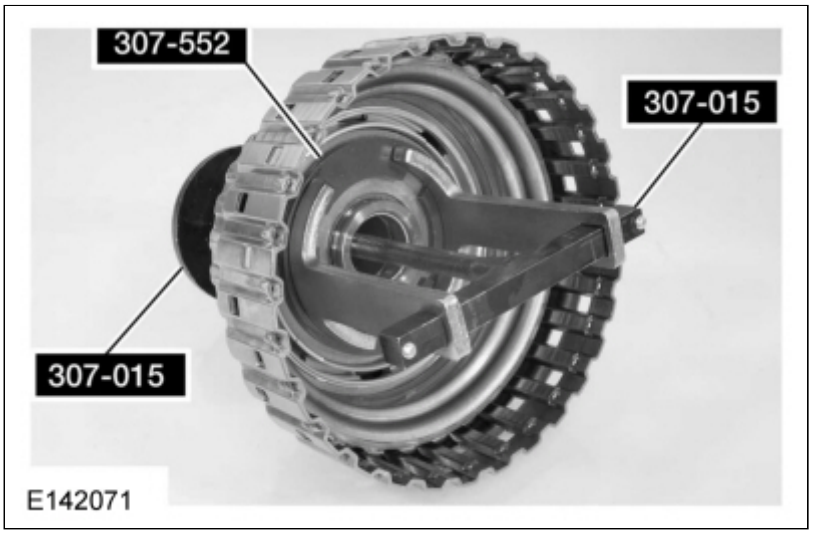
4. Install the direct clutch return spring.



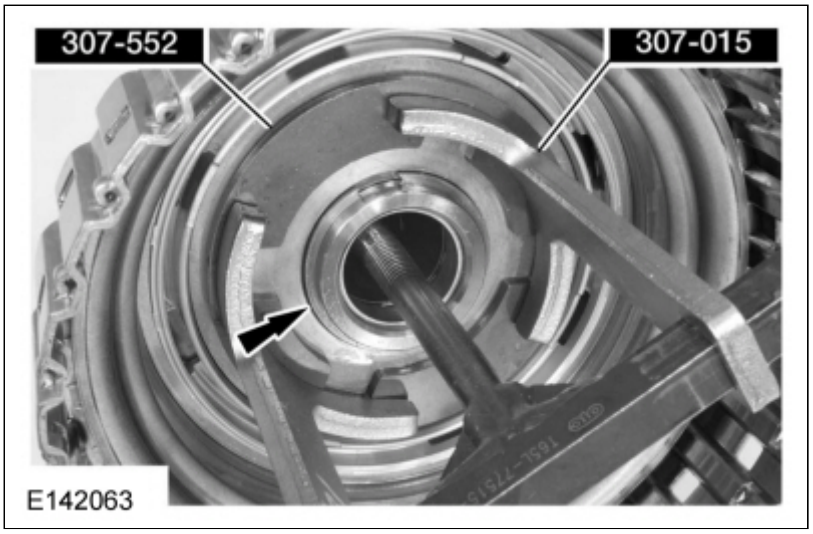
5. Install the balance piston.



6. Install the Clutch Spring Compressors onto the direct clutch assembly.
   Use Special Service Tool: 307-552 Compressor, Clutch Spring. , 307-015 Compressor, Clutch Spring.

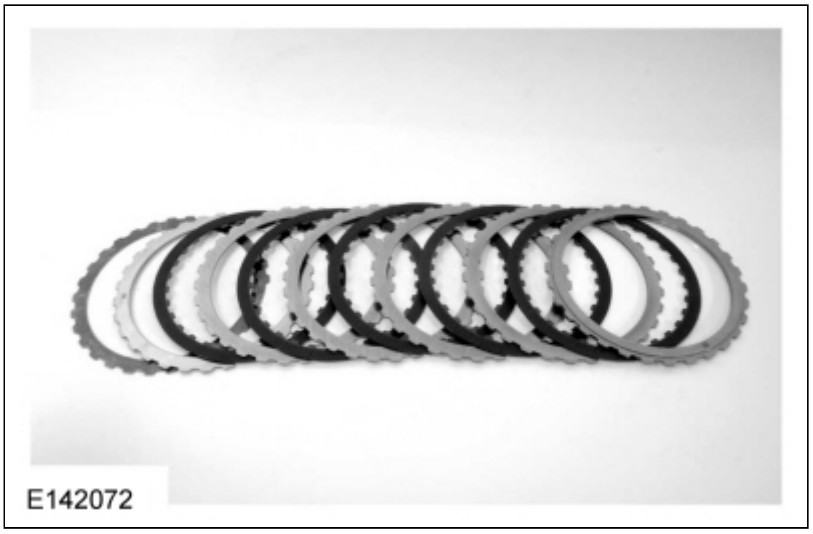


7. Using the Clutch Spring Compressors, compress the direct clutch return spring and install the direct clutch return spring retainer.
   Use Special Service Tool: 307-552 Compressor, Clutch Spring. , 307-015 Compressor, Clutch Spring.

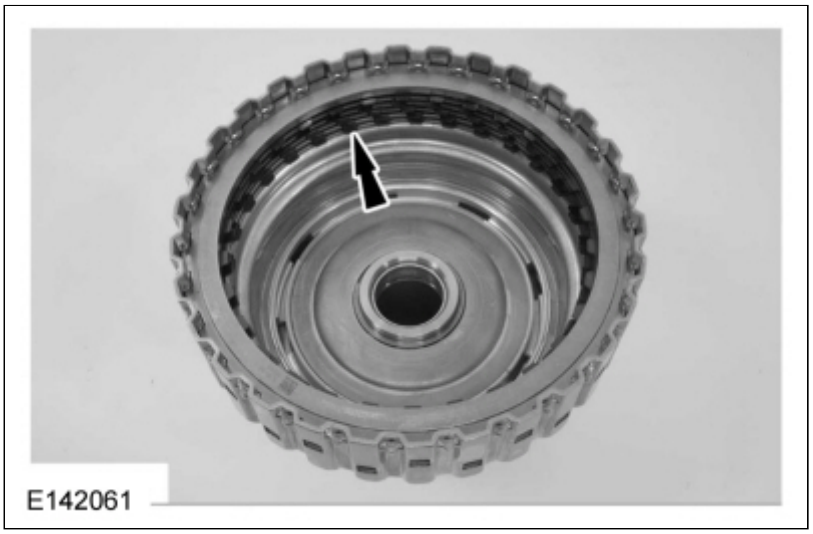


NOTE: *Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.*

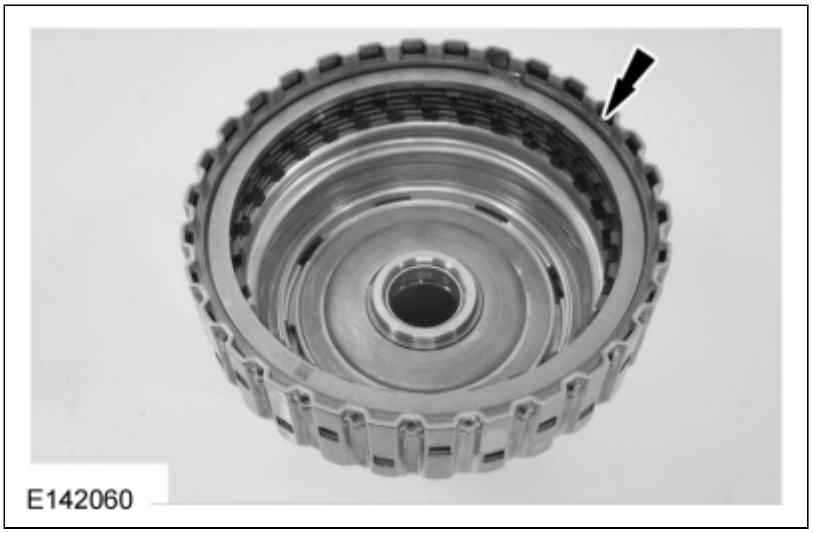
8. Soak the new direct clutch in clean transmission fluid.



9. Install the new direct clutch plates, starting with the wave spring then a steel plate and alternating between steel and friction plates, and ending with the pressure plate on the top.

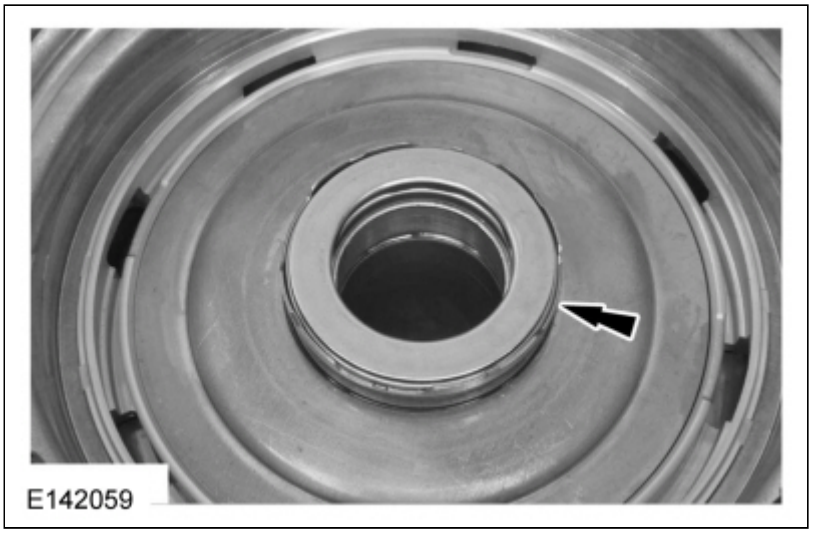


10. Install the direct clutch snap ring.



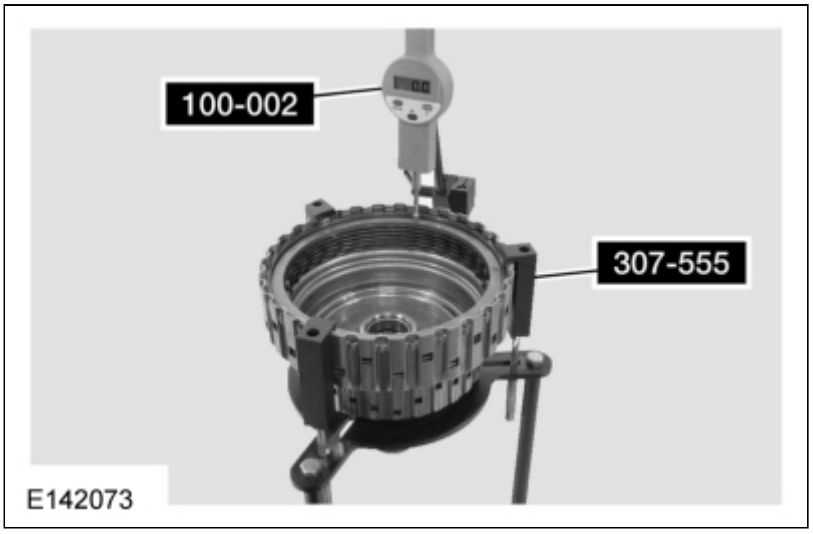
NOTE: *Inspect and install a new thrust bearing as required.*

11. Install the T5 thrust bearing.

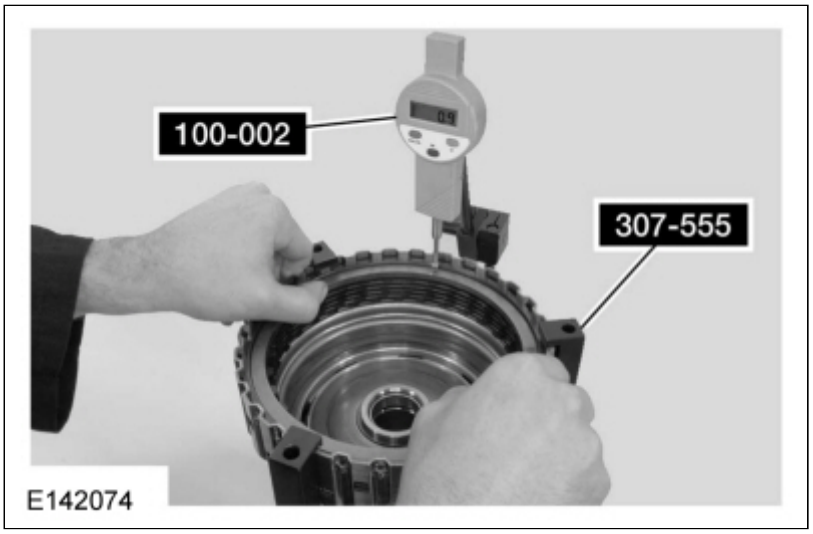


NOTE: *All direct clutch plates, friction and steel are of a wave-type design.*

12. Install the direct clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.
    Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



13. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.
    Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



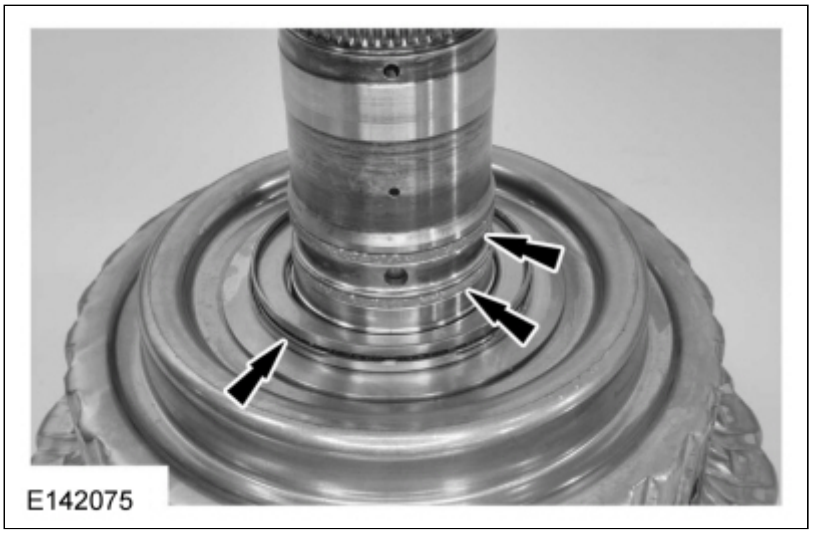
14. Rotate the direct clutch assembly 180° from the opening of the snap ring, take a second reading and record

this reading as reading B.

NOTE: *If the final measurement is not within specification, install a new snap ring until the correct specification is achieved. 0.5-1.3 mm*

15. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

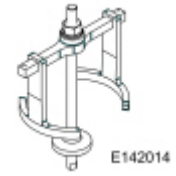
16. Install 2 new scarf cut seals and the roller bearing.



Copyright © 2016 Ford Motor Company

Intermediate Clutch Assembly

Special Tool(s) / General Equipment

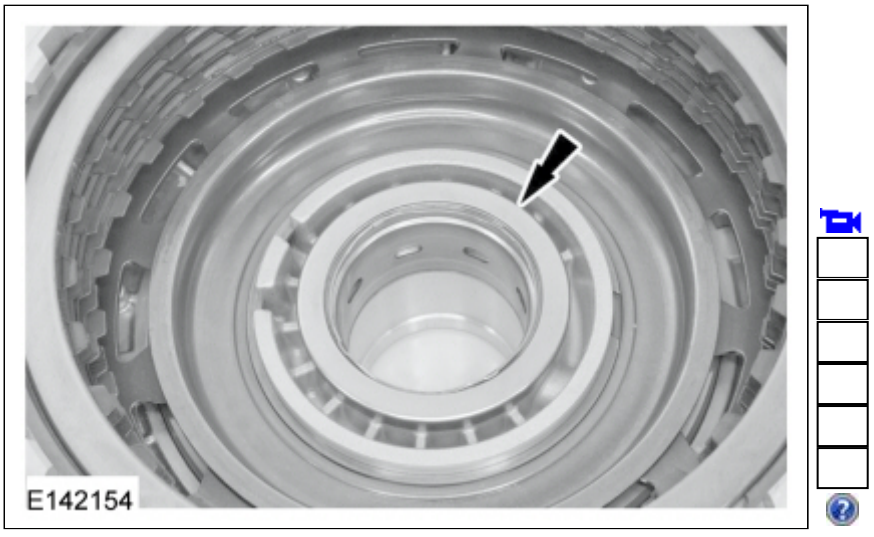
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 E142014	307-525 Compressor, Clutch Spring
 E142019	307-555 End Play Gauge, Clutch

DISASSEMBLY

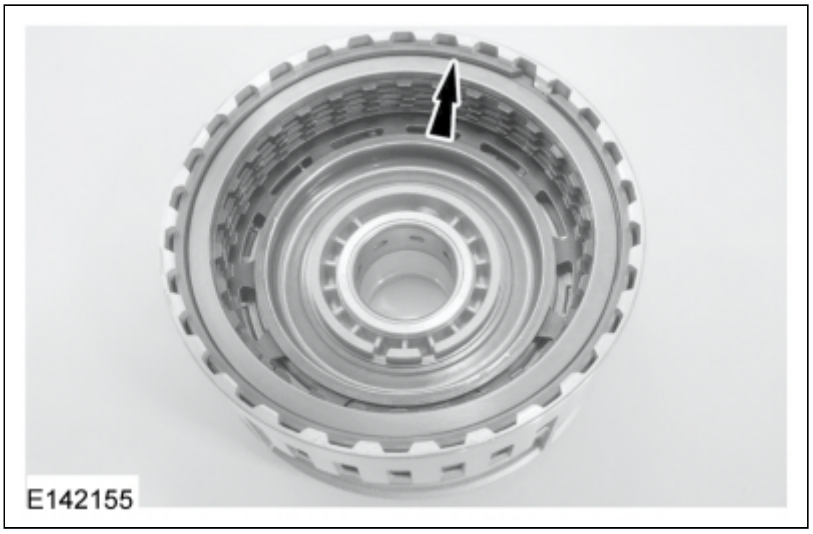
NOTE: *The intermediate clutch plate quantity is model dependent on engine size. Check the clutch plate quantity charts in specifications for the correct clutch plate quantity. Failure to install the correct clutch plate quantity will result in transmission failure.*

NOTE: *The intermediate clutch piston is model dependent on engine size due to the different quantity of intermediate clutch plates. If installing a new intermediate clutch piston, check to make sure the height of the new piston is the same as the original piston. Failure to install the correct piston*

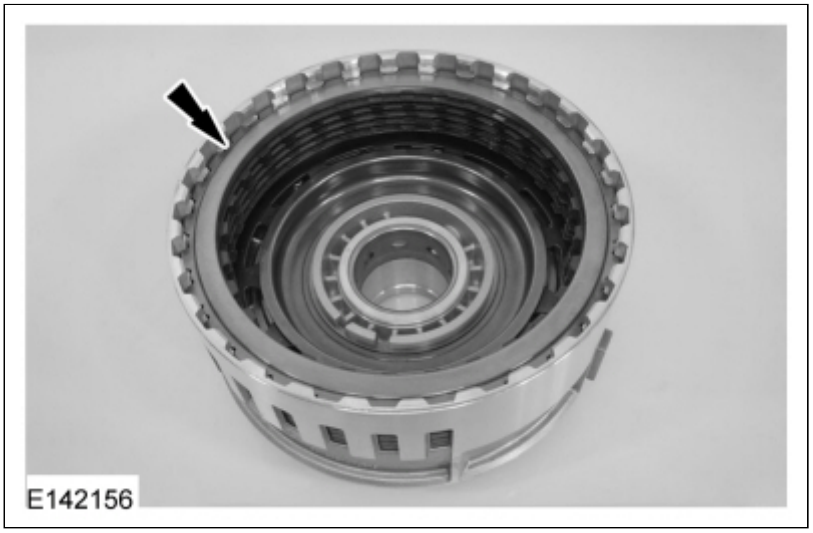
1. Remove the T6 thrust bearing.



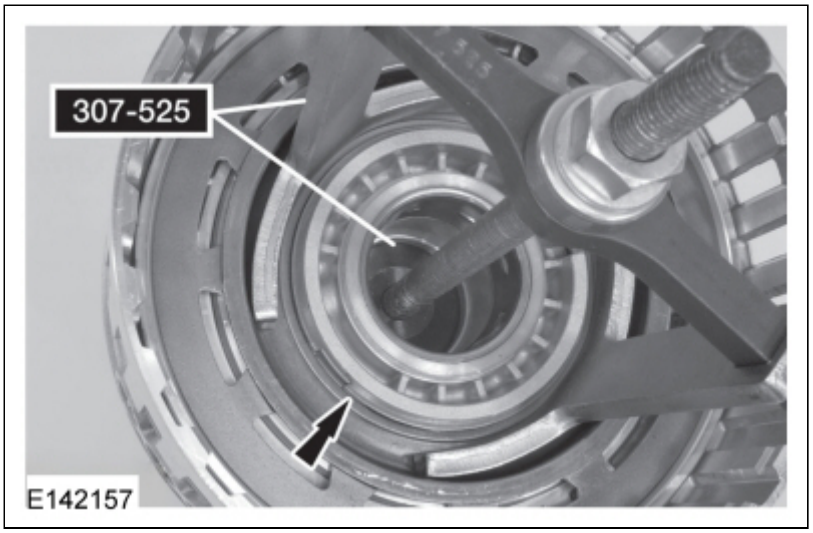
2. Remove the intermediate clutch plate snap ring.



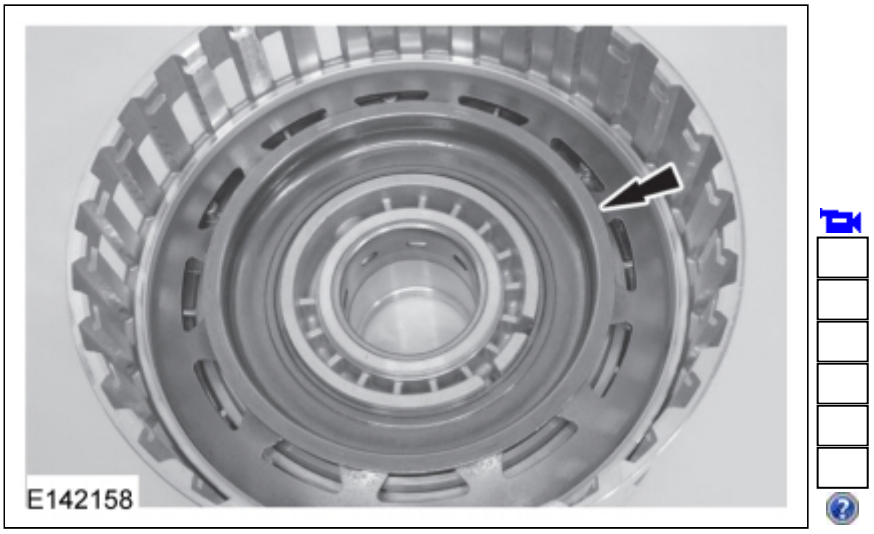
3. Remove the intermediate clutch plates.



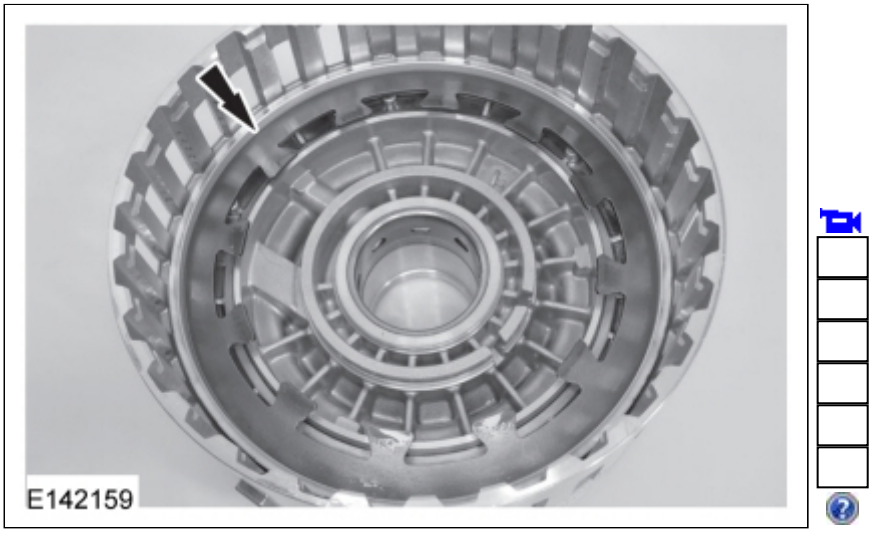
4. Using the Clutch Spring Compressor, remove and discard the intermediate clutch return spring retainer.
   Use Special Service Tool: 307-525 Compressor, Clutch Spring.



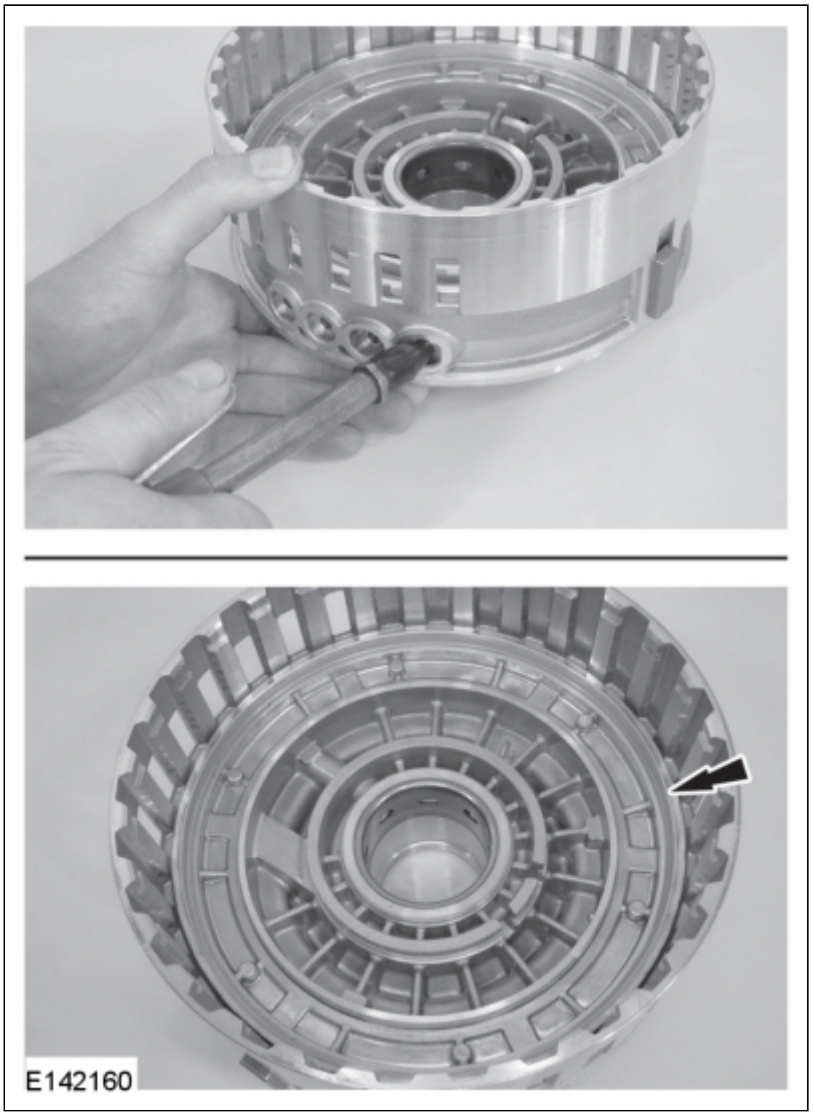
5. Remove the intermediate clutch return spring top plate.



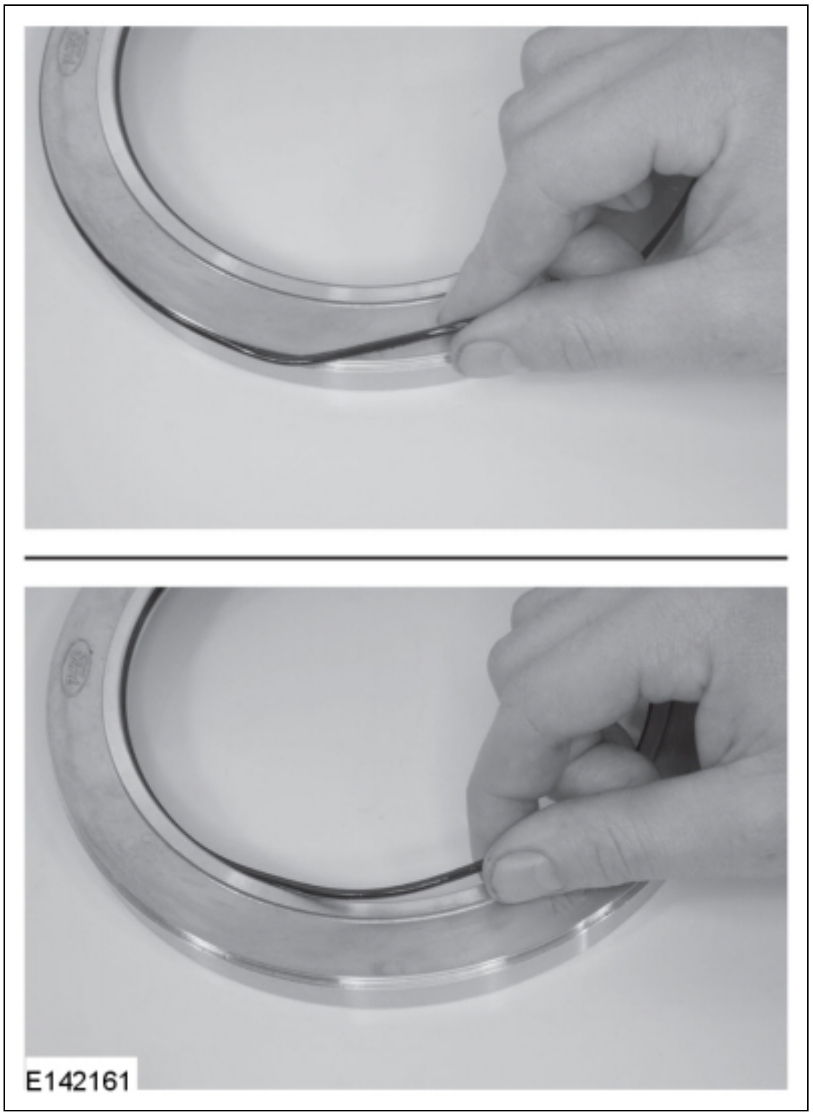
6. Remove the intermediate clutch return spring.



7. Applying a slight amount of air to the port, remove the intermediate clutch piston.

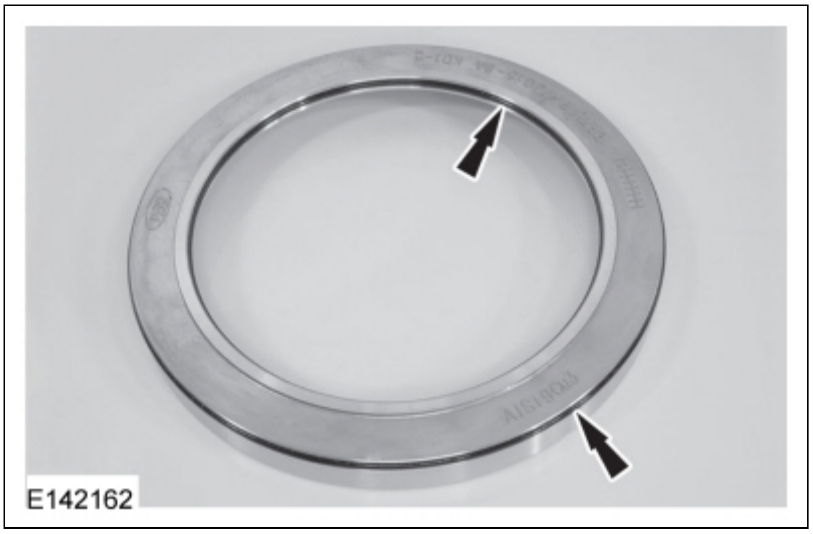


8. Remove and discard the inner and outer intermediate clutch piston O-ring seals.

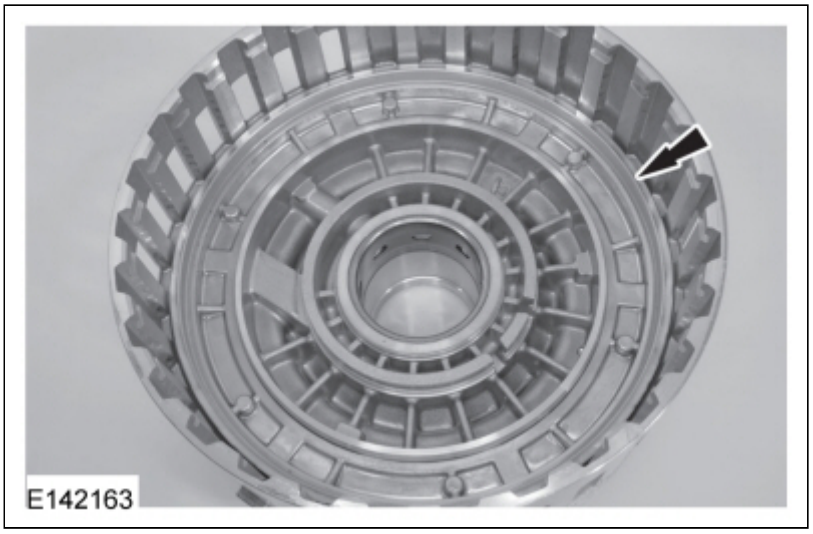


ASSEMBLY

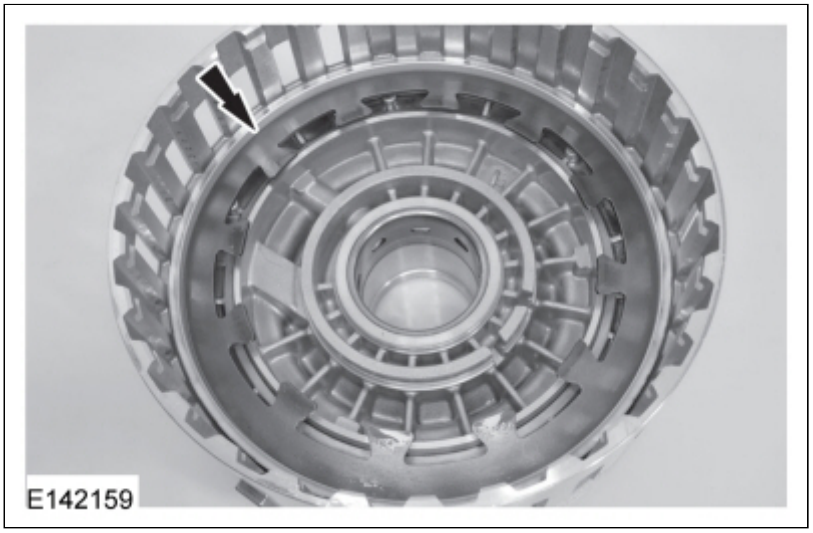
1. Install new inner and outer intermediate clutch piston O-ring seals.



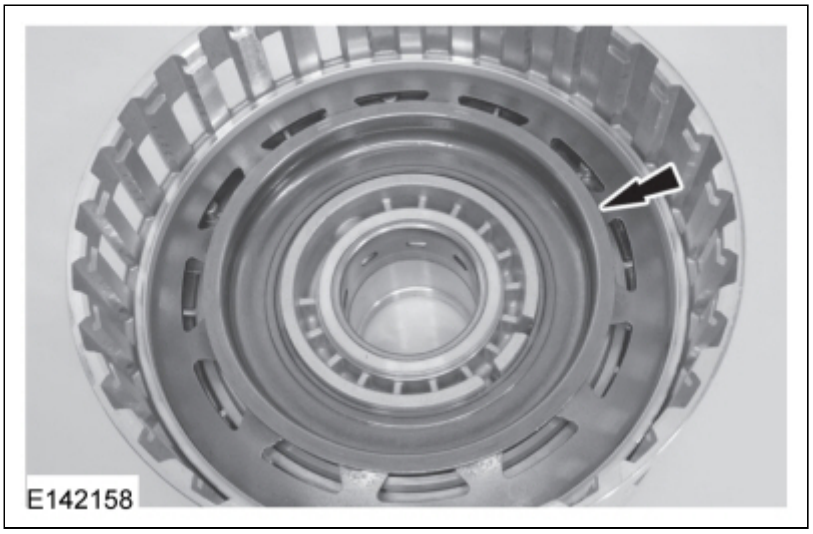
2. Lightly coat the O-ring seals in clean automatic transmission fluid and install the intermediate clutch piston.



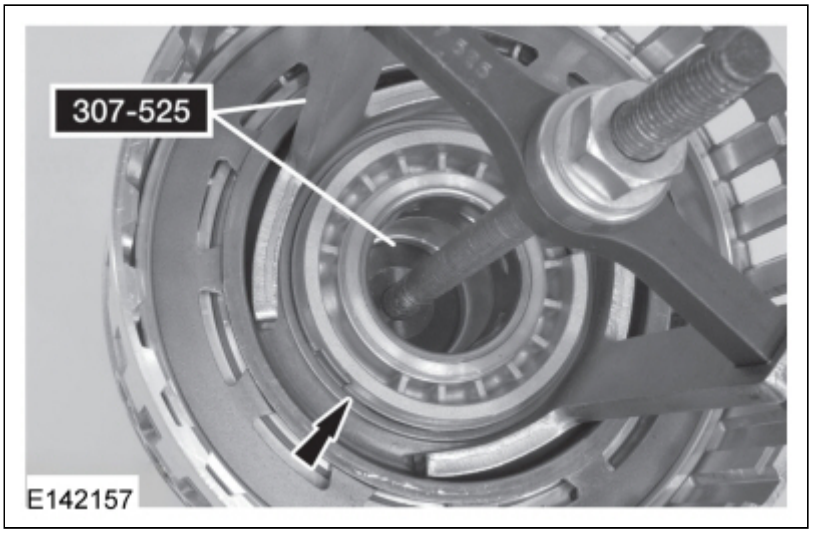
3. Install the intermediate clutch return spring.



4. Install the intermediate clutch return spring top plate.

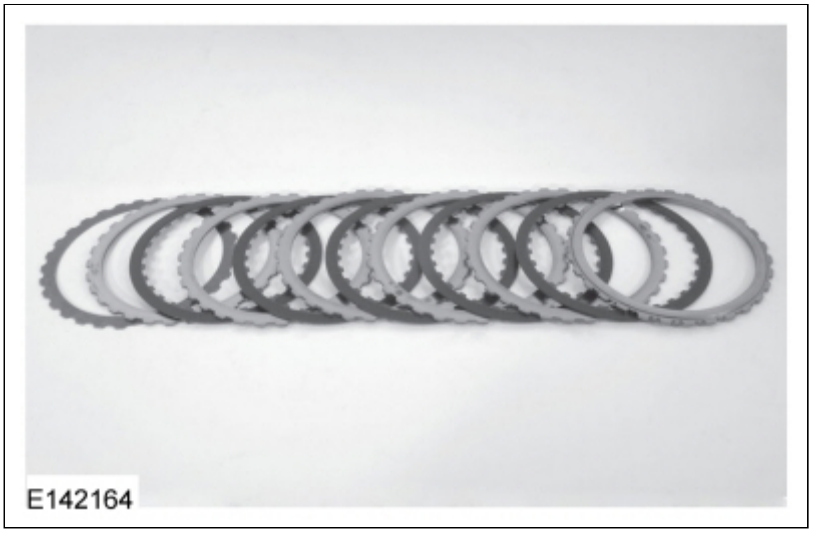


5. Using the Clutch Spring Compressor, install a new intermediate clutch return spring retainer.
   Use Special Service Tool: 307-525 Compressor, Clutch Spring.

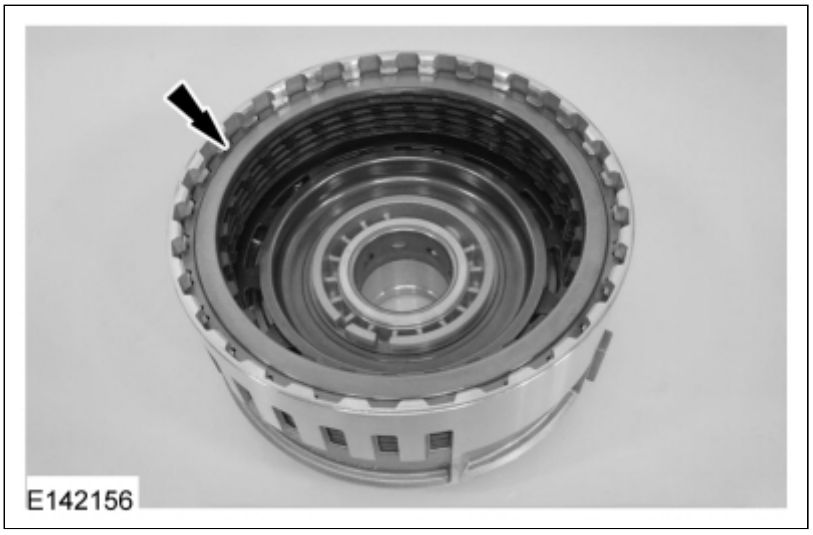


NOTE: *Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.*

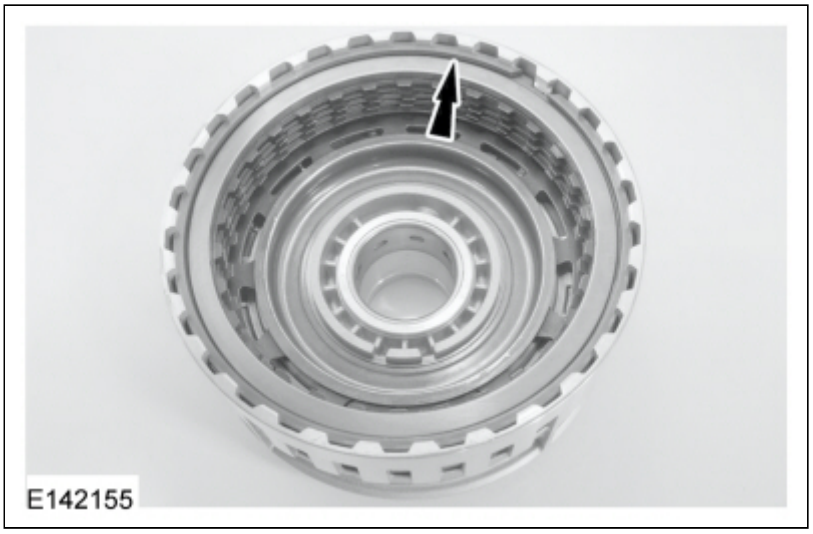
6. Soak the new intermediate clutch plates in clean automatic transmission fluid.



7. Install the new intermediate clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending with the pressure plate.

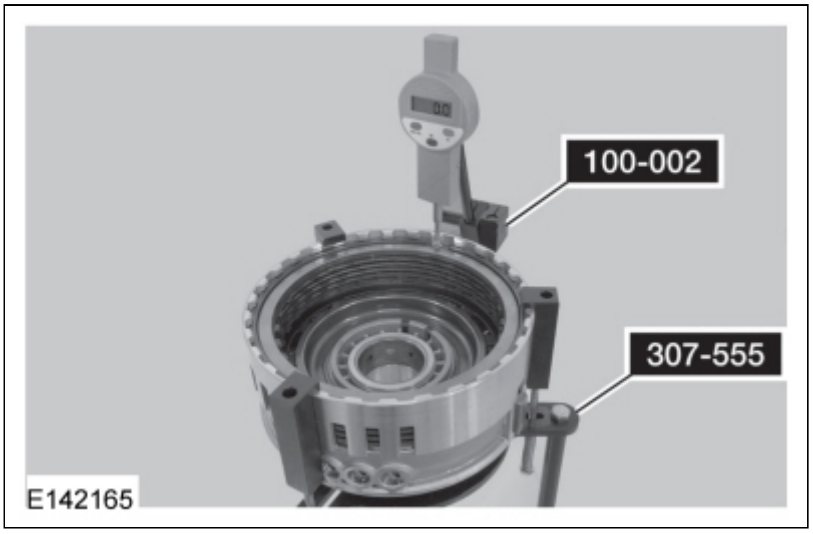


8. Install the intermediate clutch plate snap ring.



NOTE: *All intermediate clutch plates, friction and steel are of a wave-type design.*

9. Install the intermediate clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.
   Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



10. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.
    Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.

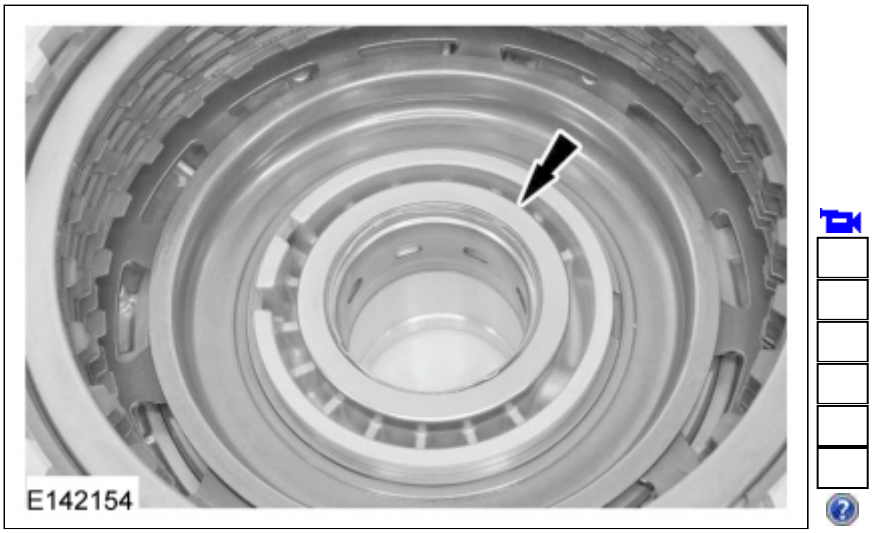


11. Rotate the intermediate clutch assembly 180° from the opening of the snap ring, take a second reading and record this reading as reading B.

NOTE: *If the final measurement is not within specification, install a new snap ring until the correct specification is achieved. 0.7-1.1 mm*

12. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

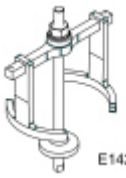
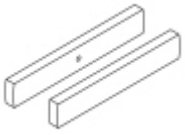
13. Install the T6 thrust bearing.



Copyright © 2016 Ford Motor Company

Low/Reverse Clutch Assembly

Special Tool(s) / General Equipment

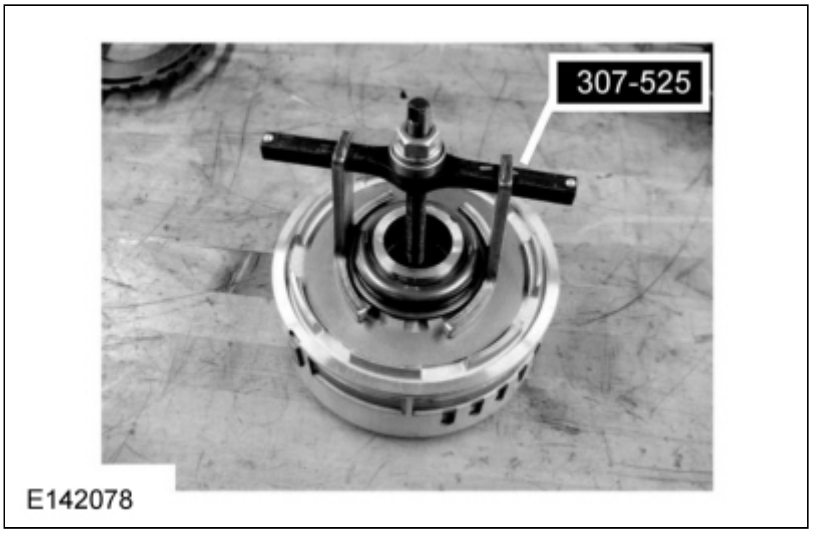
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 E142009	303-D075 Depth Micrometer
 E142014	307-525 Compressor, Clutch Spring
 E142018	307-554 Gauge, D-Clutch Measurement
 E142019	307-555 End Play Gauge, Clutch

DISASSEMBLY

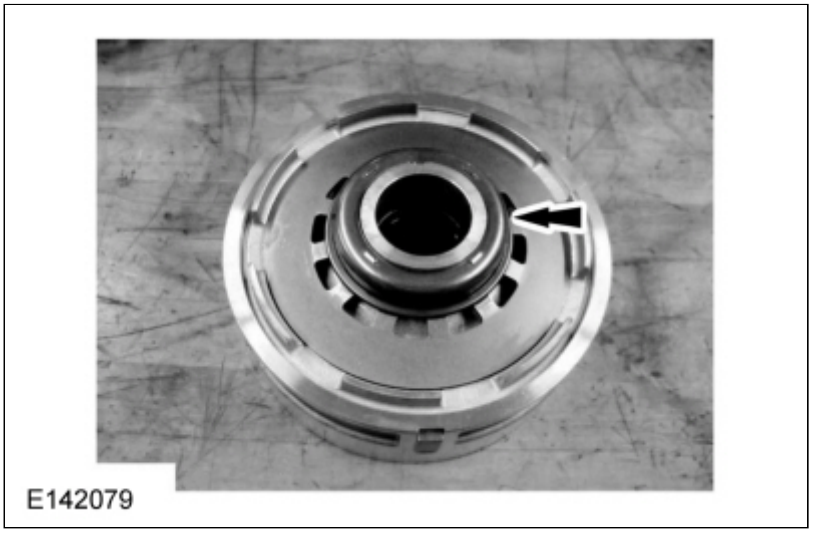
NOTICE: The low/reverse clutch plate quantity is model dependent on engine size. Check the clutch plate quantity charts in specifications for the correct clutch plate quantity. Failure to install the correct clutch plate quantity will result in transmission failure.

NOTE: *The low/reverse clutch plates are installed in the case during the transmission assembly procedure.*

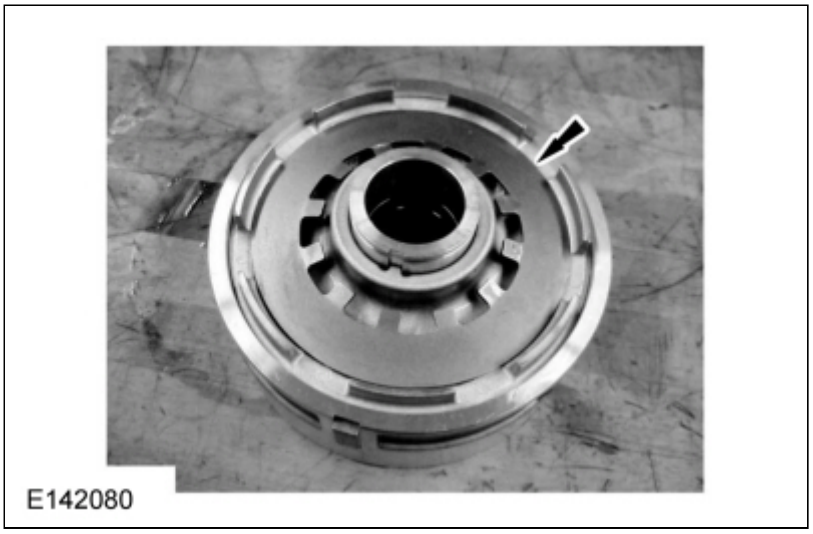
1. Using the Clutch Spring Compressor, remove and discard the low/reverse clutch return spring retainer.
   Use Special Service Tool: 307-525 Compressor, Clutch Spring.



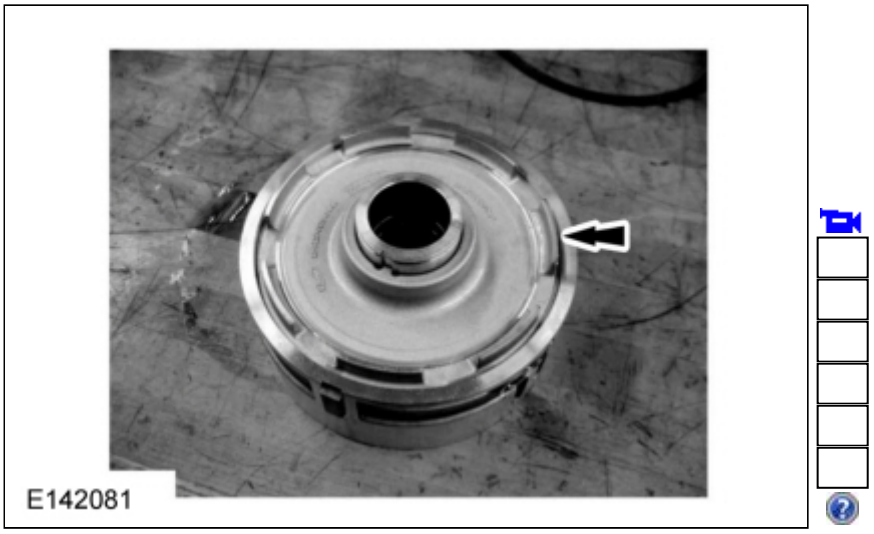
2. Remove and discard the low/reverse clutch return spring retainer.



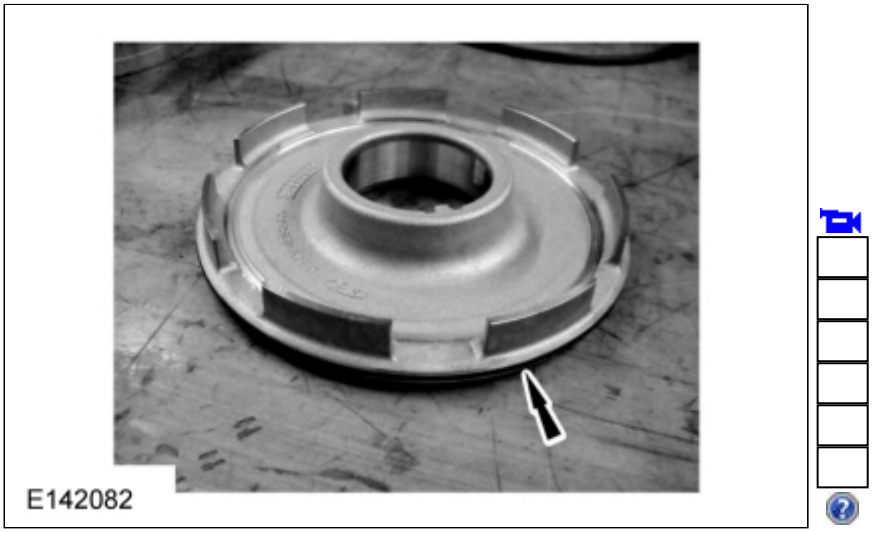
3. Remove the low/reverse clutch return spring.



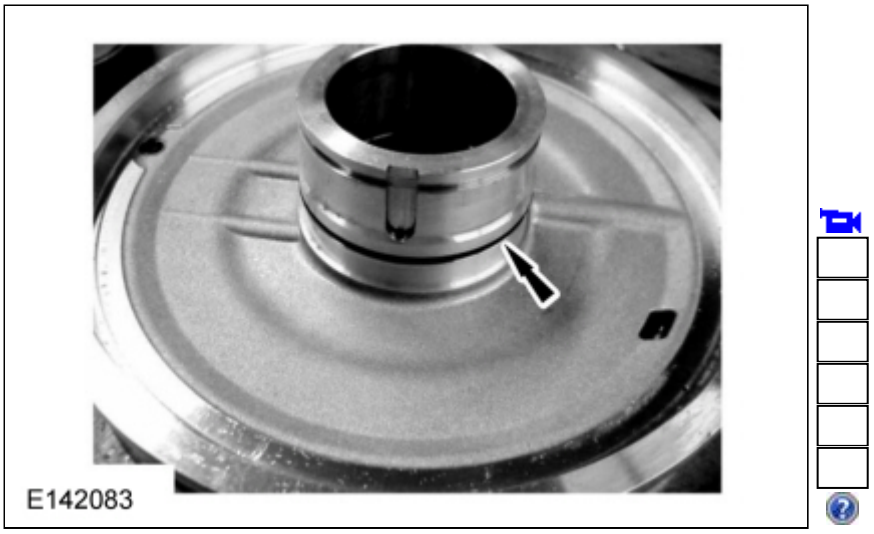
4. Apply a slight amount of air to the port, remove the low/reverse clutch piston from the low/reverse clutch drum.



5. Remove and discard the low/reverse outer piston O-ring seal.

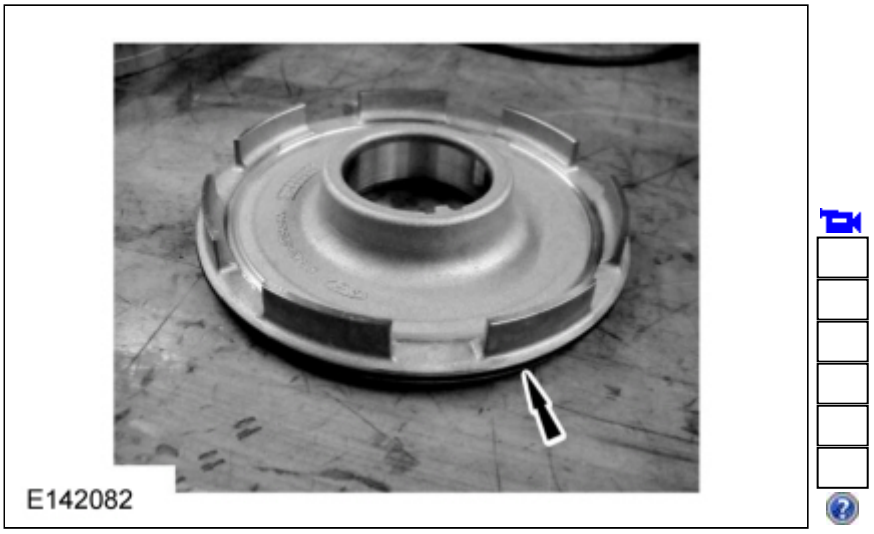


6. Remove and discard the low/reverse drum O-ring seal.

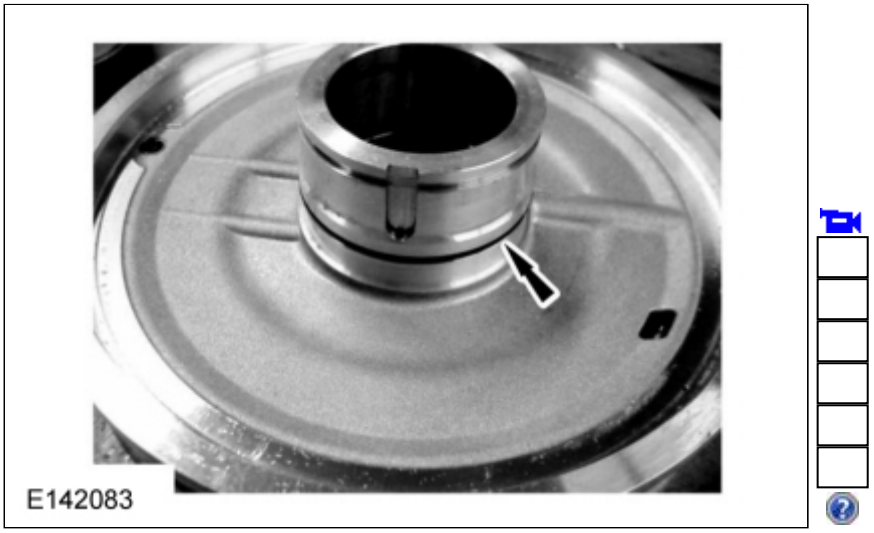


ASSEMBLY

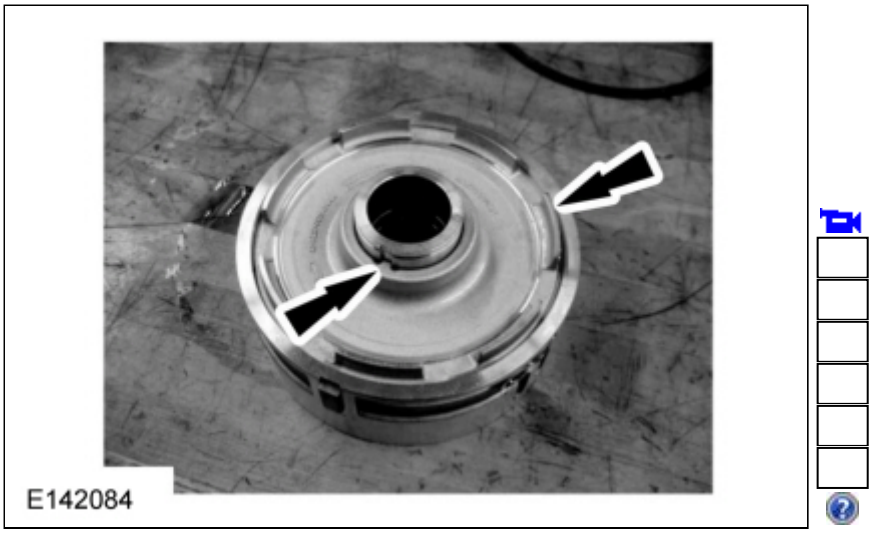
1. Install new low/reverse outer piston O-ring seal.



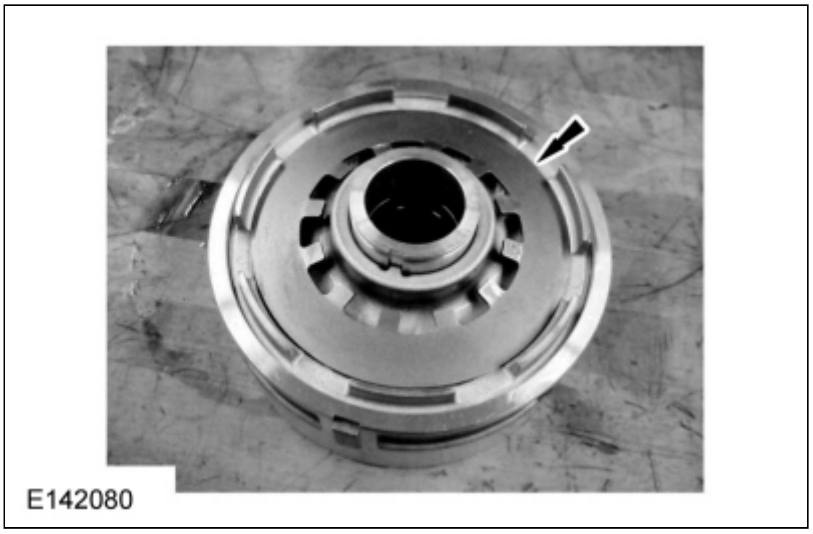
2. Install new low/reverse drum O-ring seal.



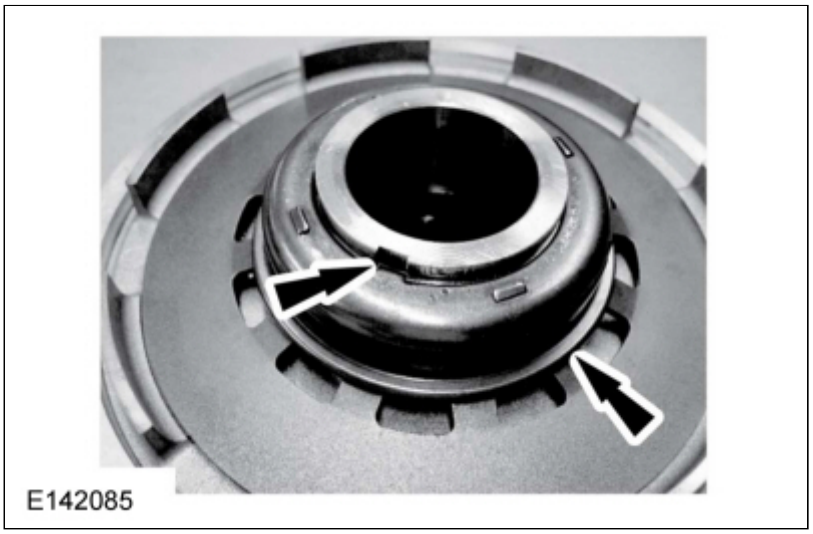
3. Lubricate the O-ring seal with clean transmission fluid. Align the alignment tab on the piston with the groove in the center support and install the low/ reverse piston.



4. Install the low/reverse clutch return spring.



5. Install a new low/reverse clutch return spring retainer. Align the alignment tab on the retainer with the groove in the center support and install the low/ reverse piston return spring retainer.

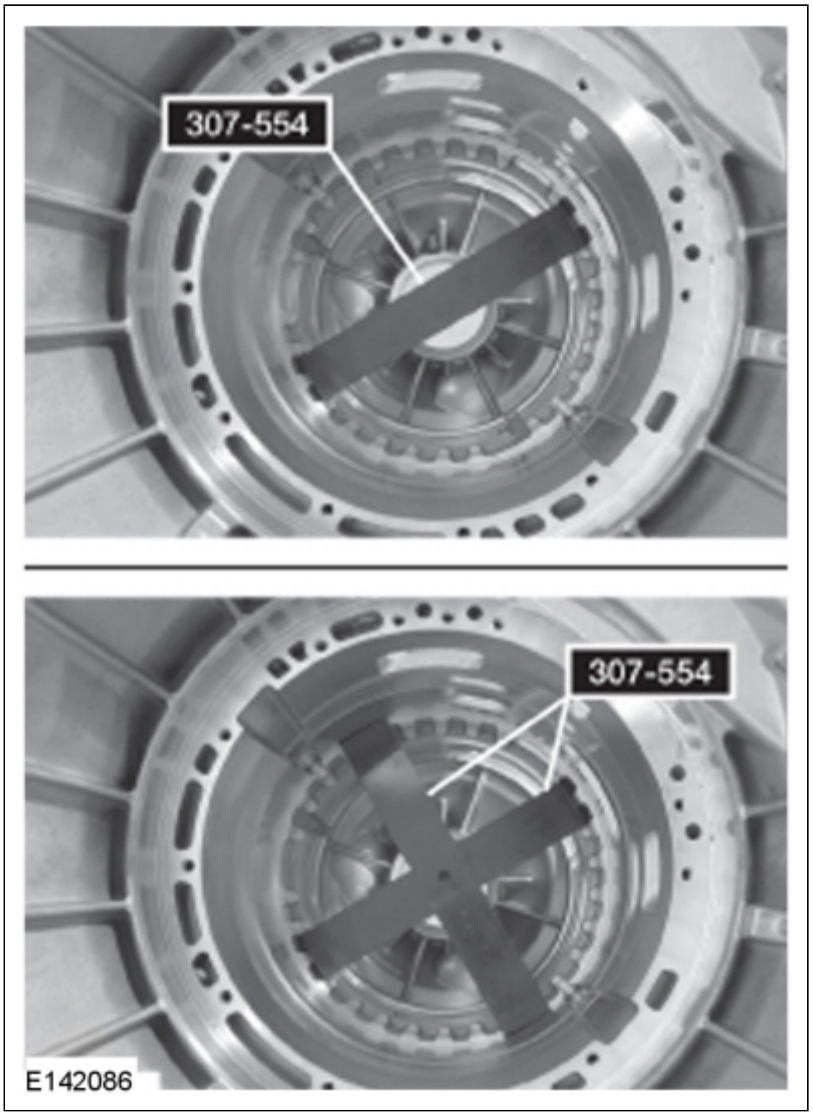


6. Using the Clutch Spring Compressor, compress the low/reverse clutch return spring and install the retaining ring.
   Use Special Service Tool: 307-525 Compressor, Clutch Spring.

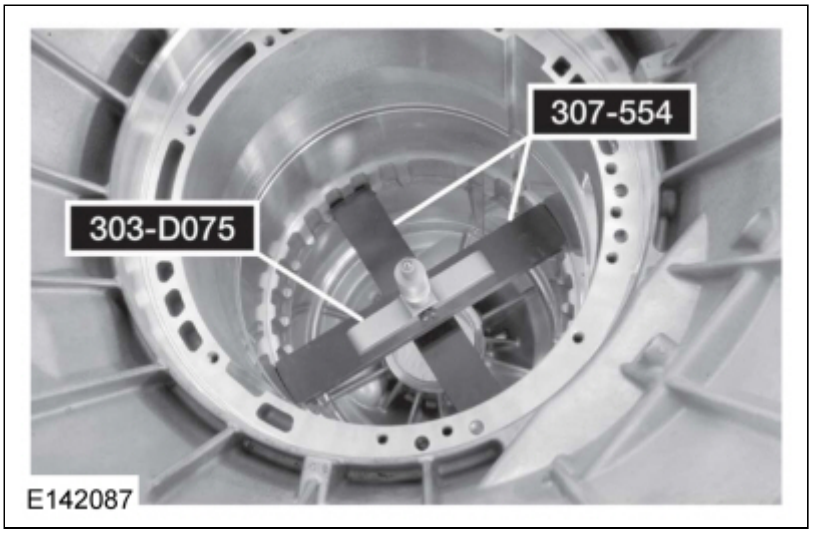


NOTE: *All low/reverse clutch plates, friction and steel are of a wave-type design.*

7. Install the D-Clutch Measurement Gauge into the case.
   Use Special Service Tool: 307-554 Gauge, D-Clutch Measurement.



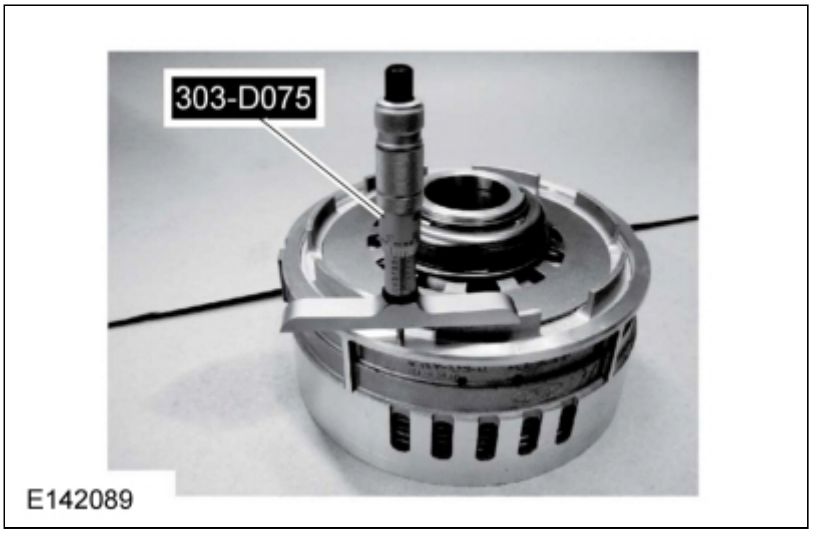
8. With the D-Clutch Measurement Gauge positioned in the case, use the Depth Micrometer to measure the case stop depth.
   Use Special Service Tool: 307-554 Gauge, D-Clutch Measurement. , 303-D075 Depth Micrometer.



9. Measure the clutch pack height. With the D-Clutch Measurement Gauge and install the Dial Indicator Gauge with Holding Fixture.
   Use Special Service Tool: 307-555 End Play Gauge, Clutch. , 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



10. Using the Depth Micrometer, measure the piston to center support shoulder height.
    Use Special Service Tool: 303-D075 Depth Micrometer.



11. Calculate the end clearance. **End clearance specification 1.0-1.6 mm (0.039- 0.062 in)**

12. Compare the end clearance to the specification. If the end clearance is out of specification, select the next thinner or thicker plate as required and repeat Steps 10, 11 and 12.

Copyright © 2016 Ford Motor Company

Main Control Valve Body

Base Part Number: 7A100

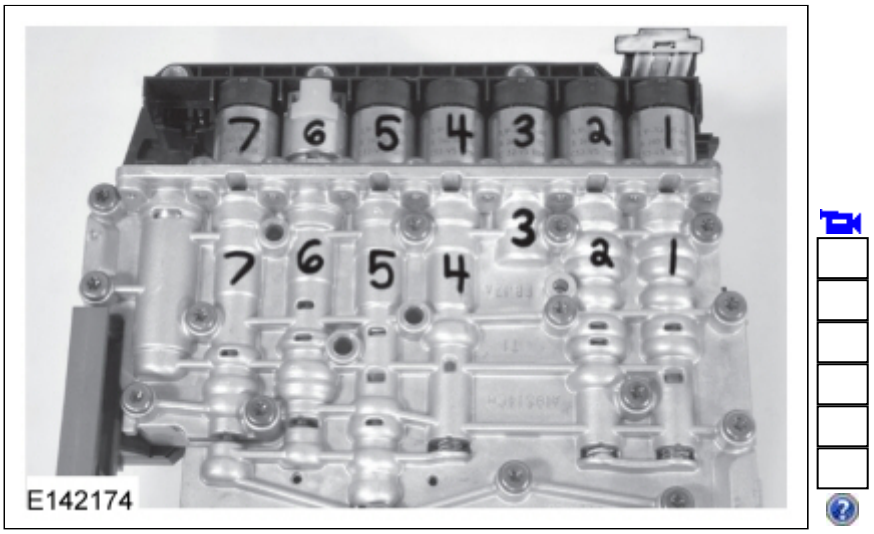
DISASSEMBLY

NOTE: *Make an identifying mark on each solenoid and the corresponding bore for correct assembly.*

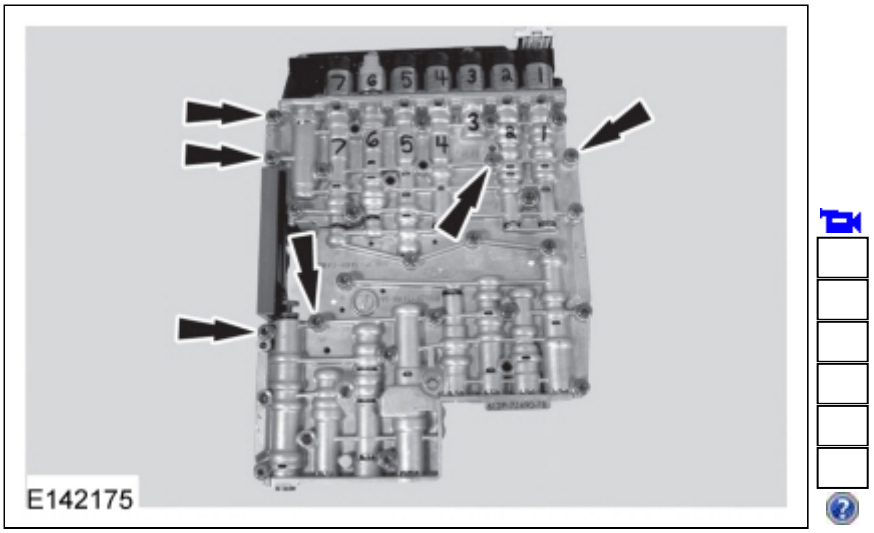
NOTE: *Solenoids may visually appear the same but their designs/functions are different. Use care not to assemble the main control assembly incorrectly. Incorrect solenoid installation results in poor transmission shift quality.*

NOTE: *Note the location of the 8 check balls, 6 solenoid dampers, 2 internal valves and springs and 2 filter screens for reassembly.*

1. Make an identifying mark on each solenoid and the corresponding bore for correct assembly.

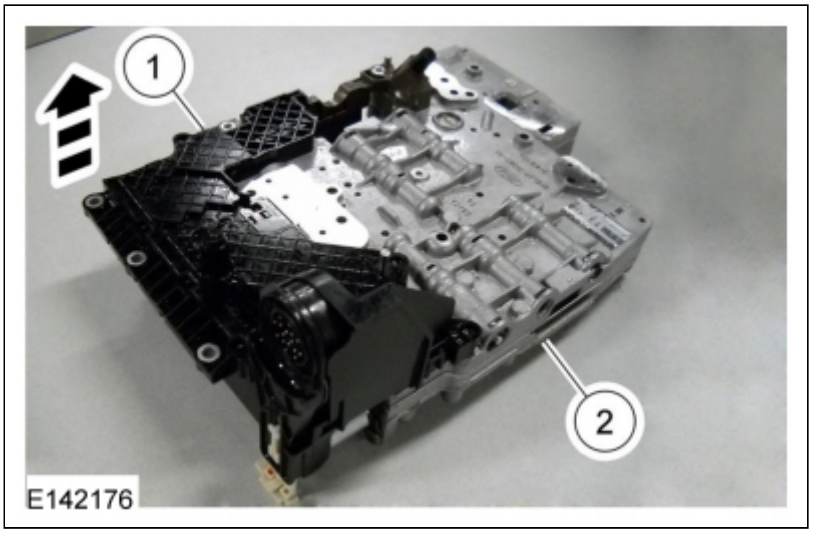


2. Remove the 6 long molded leadframe to valve body bolts from the molded leadframe.



3. **NOTE:** *Carefully separate the molded leadframe from the main control assembly.*

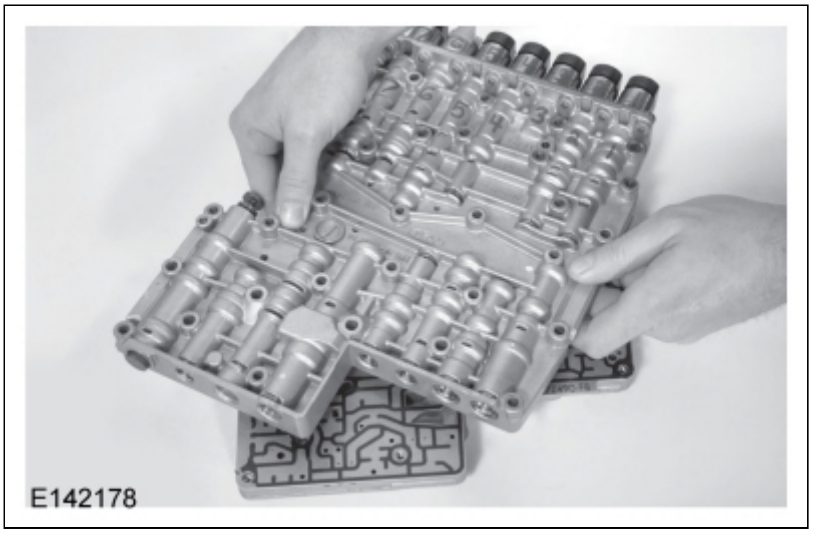
    1. Molded leadframe
    2. Main control assembly



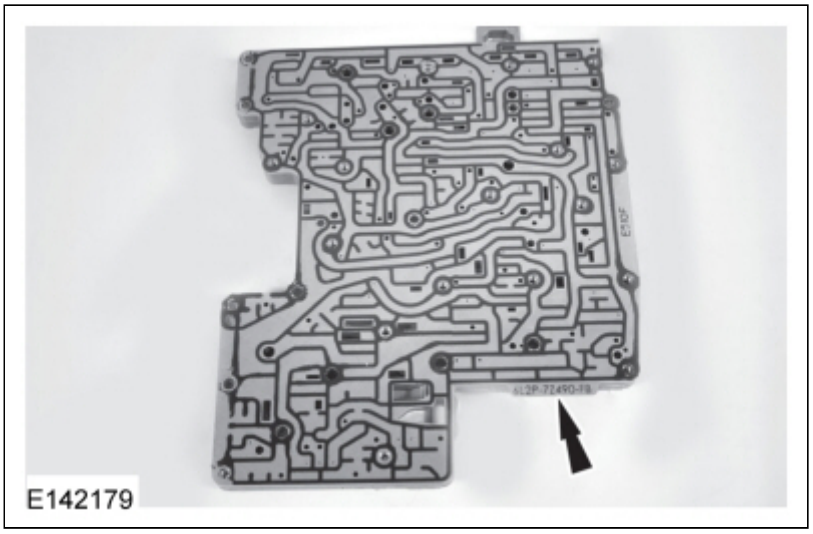
4. Remove 19 short molded leadframe to valve body bolts from the main control assembly.



5. Separate the lower half of the main control assembly from the upper half of the main control assembly.

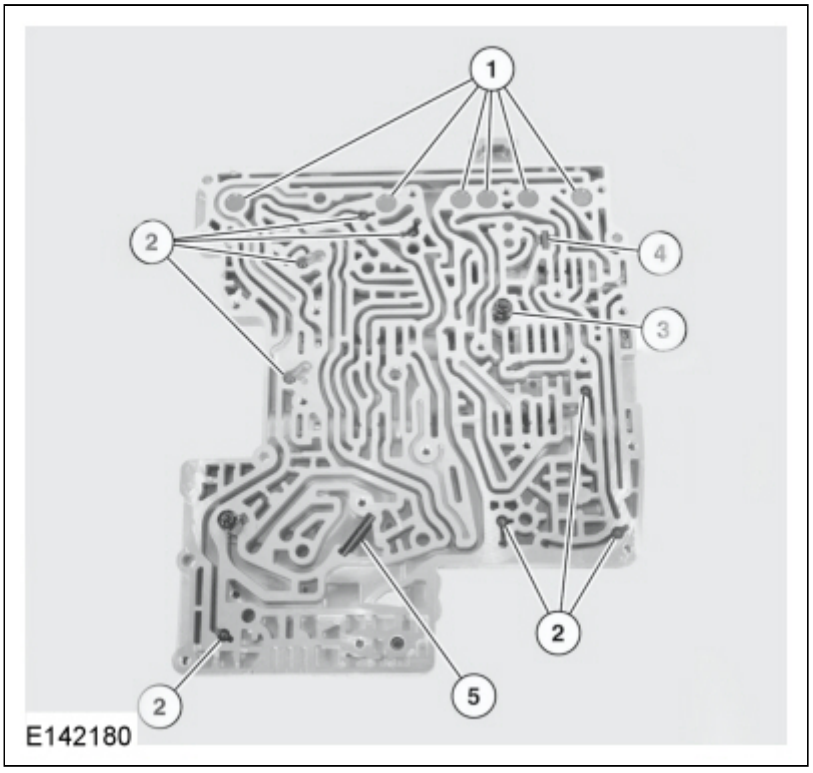


6. Remove and discard the main control valve body separator plate.

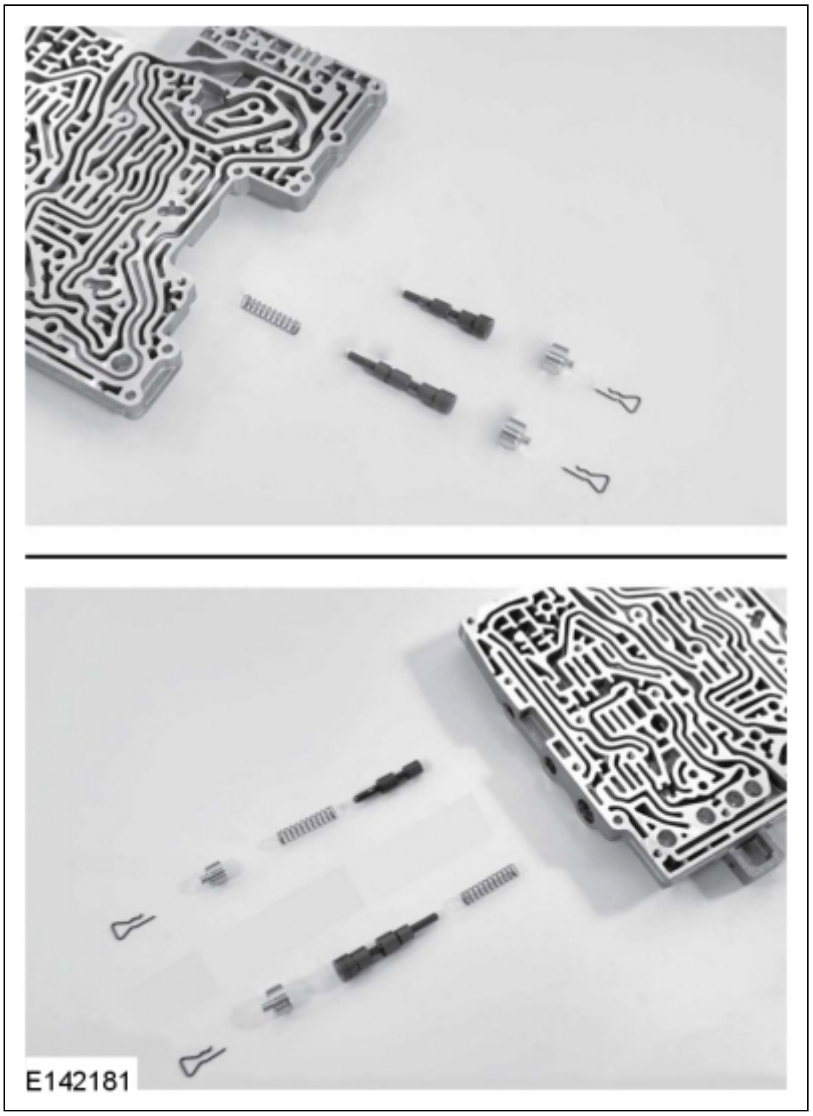


7. **NOTE:** *Remove the solenoid dampers, check balls, converter drain back valve and filter screens from the main control assembly. Note the location for assembly.*

    1. Solenoid dampers
    2. Check balls
    3. Converter drain back valve
    4. Small filter screen
    5. Large filter screen



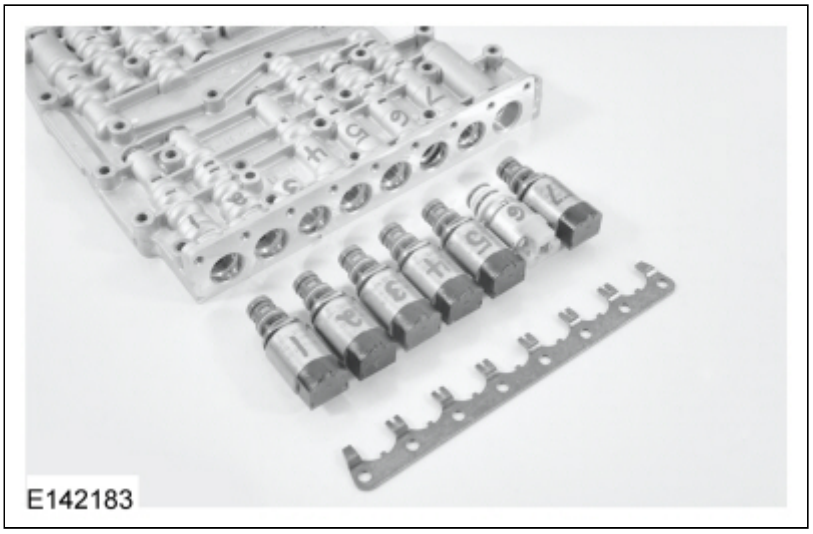
8. Remove the retaining clips, caps, valves and valve springs from each bore of the main control assembly. Note the location and order for assembly.



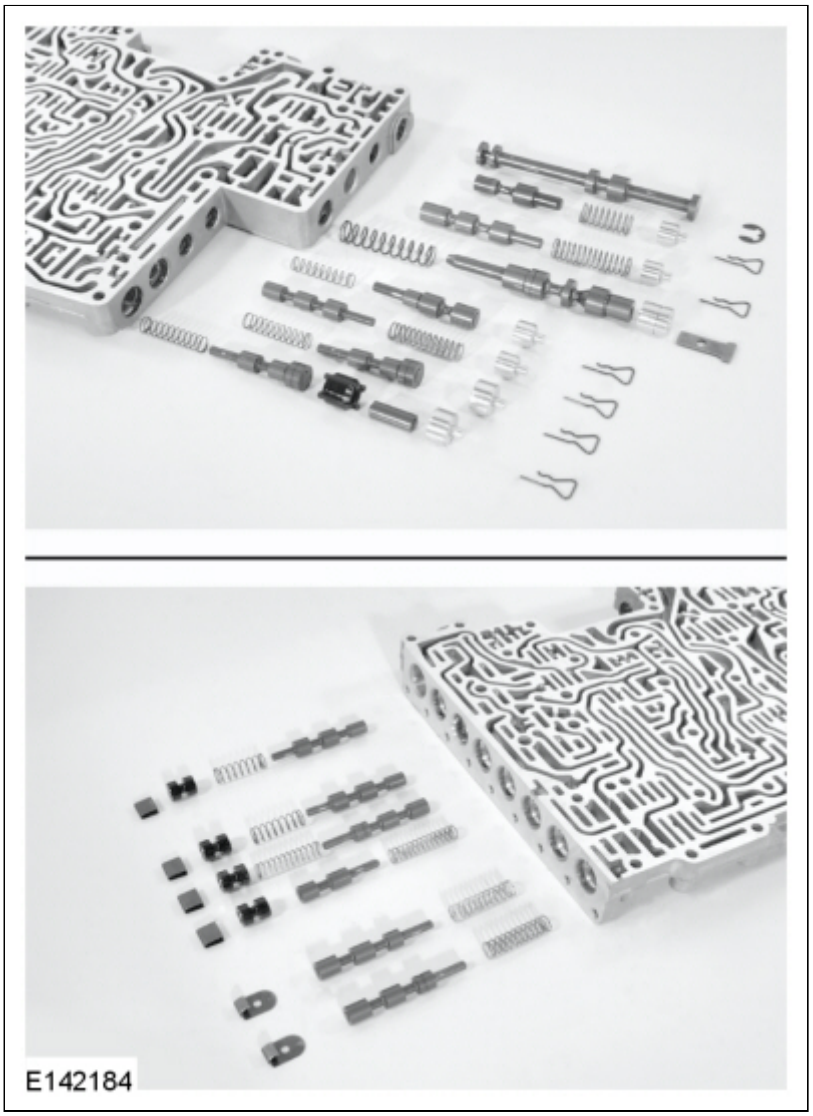
9. Using clean mineral spirits, clean the upper half of the main control assembly.
10. Remove the 8 solenoid hold down bracket bolts and the solenoid hold down bracket.



11. Remove the solenoids.



12. Remove the retaining clips, caps, valves and valve springs from each bore of the main control assembly. Note the location and order for assembly.

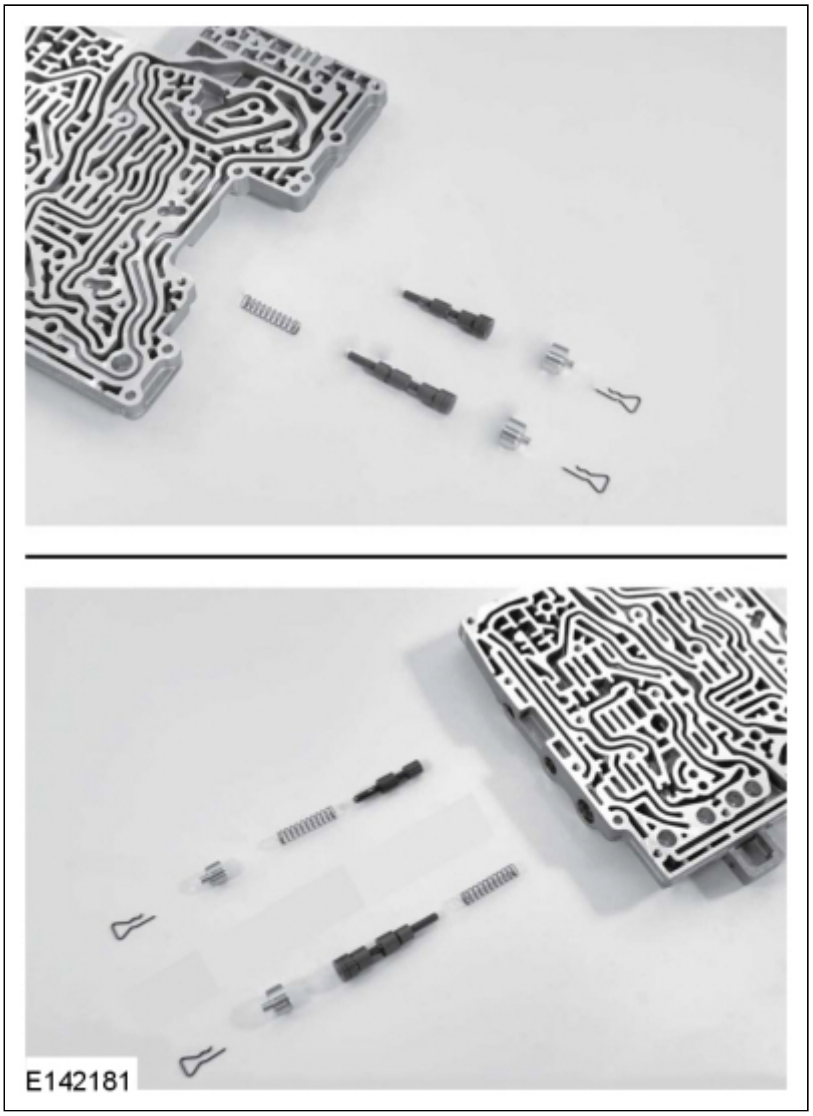


13. Using clean mineral spirits, clean the lower half of the main control assembly.

ASSEMBLY

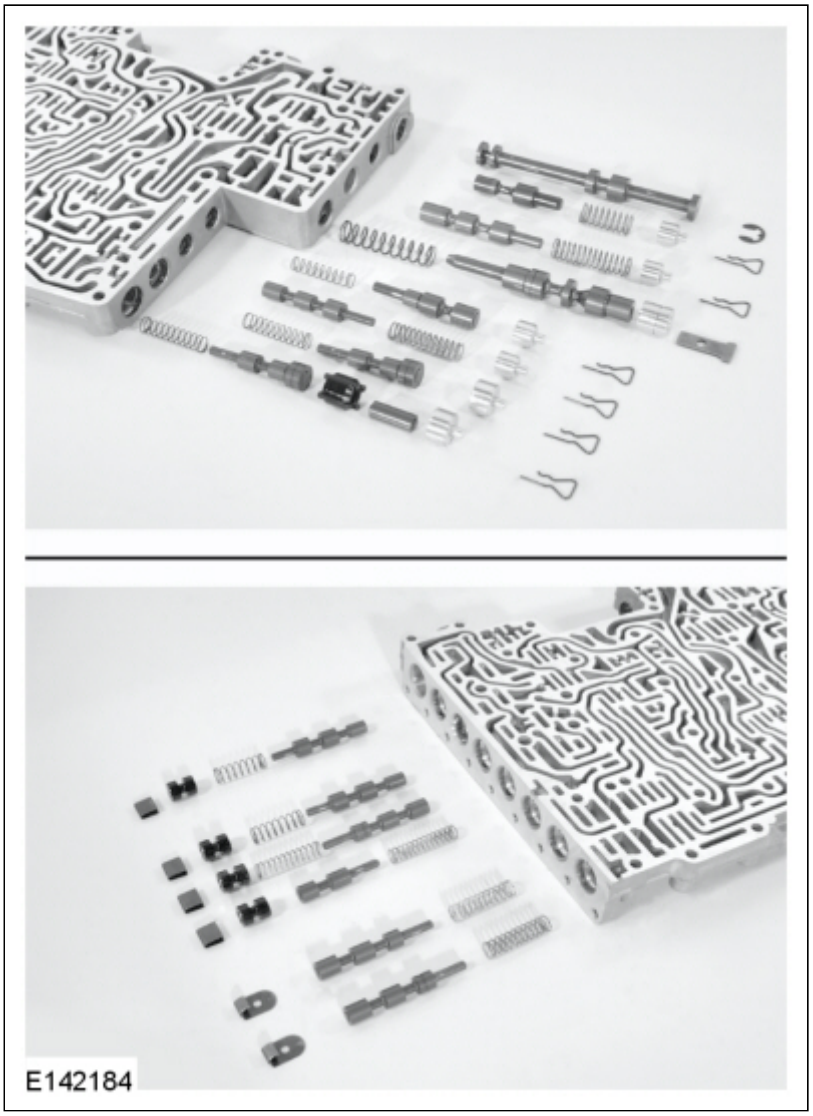
NOTE: *Many components and surfaces in the main control valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly prevents unnecessary damage to machined surfaces.*

1. Install the retaining clips, caps, valves and valve spring into each bore.



NOTE: *Many components and surfaces in the main control valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly prevents unnecessary damage to machined surfaces.*

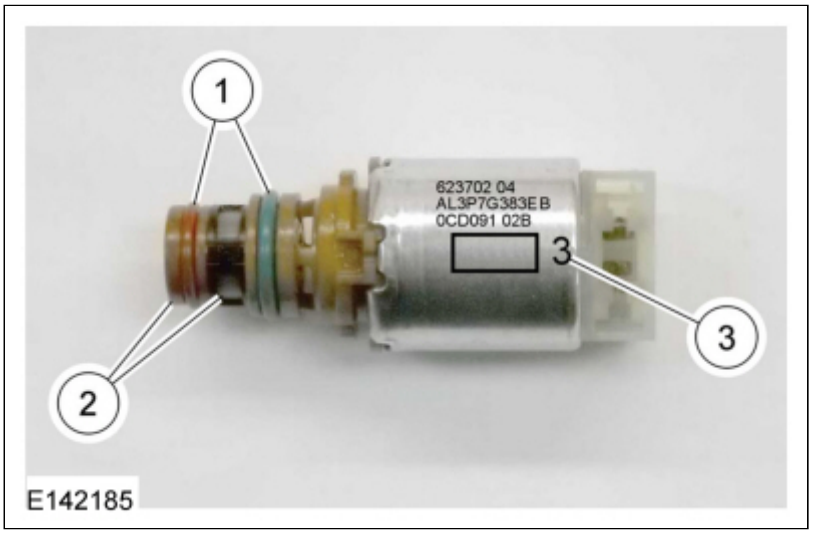
2. Install the retaining clips, caps, valves and valve spring into each bore.



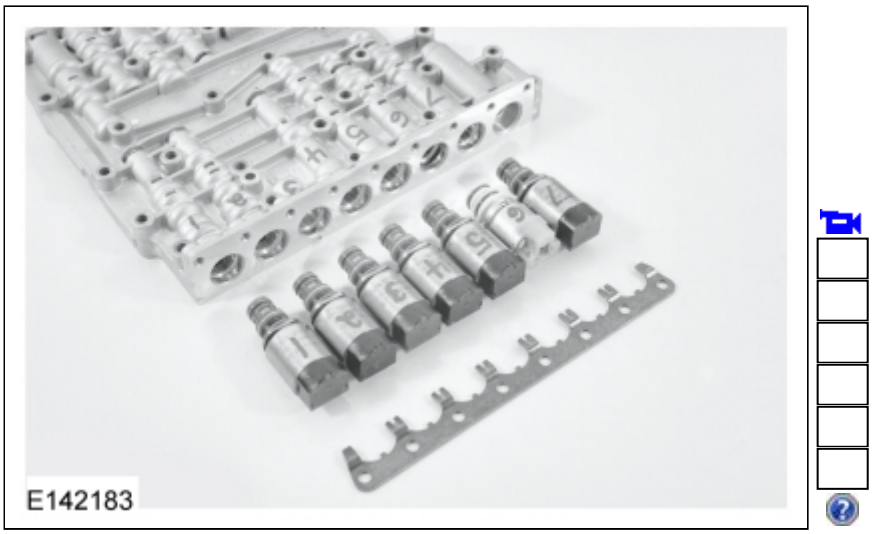
NOTICE: A Variable Force Solenoid is calibrated from the factory and are not all the same. If replacing a Variable Force Solenoid, match the replacement solenoid type (normally high/normally low) and the band number with the original solenoid or harsh shifts or damage to the transmission can occur.

3. **NOTE:** *Inspect the solenoid screens for contamination and install new solenoids if needed. Lubricate the solenoid O-rings with clean transmission fluid. If replacing a solenoid, use the solenoid exploded view at the beginning of this procedure to identify what type of solenoid is being replaced. The solenoid can be a normally high Variable Force Solenoid, normally low Variable Force Solenoid or an ON/OFF solenoid. If replacing a Variable Force Solenoid, record the band number to get the correct part number for the solenoid.*

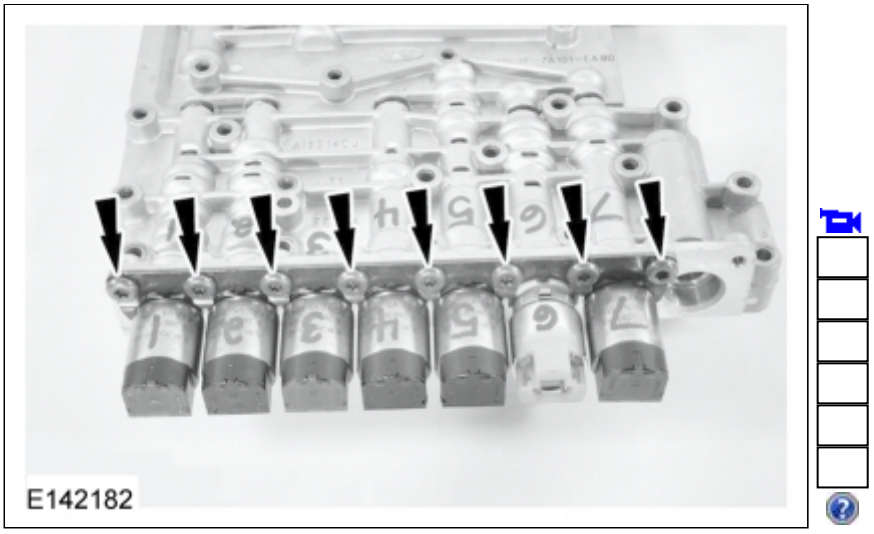
    1. O-rings
    2. Screens
    3. Solenoid band number



4. Install the solenoids into their correct bores as indicated during disassembly.



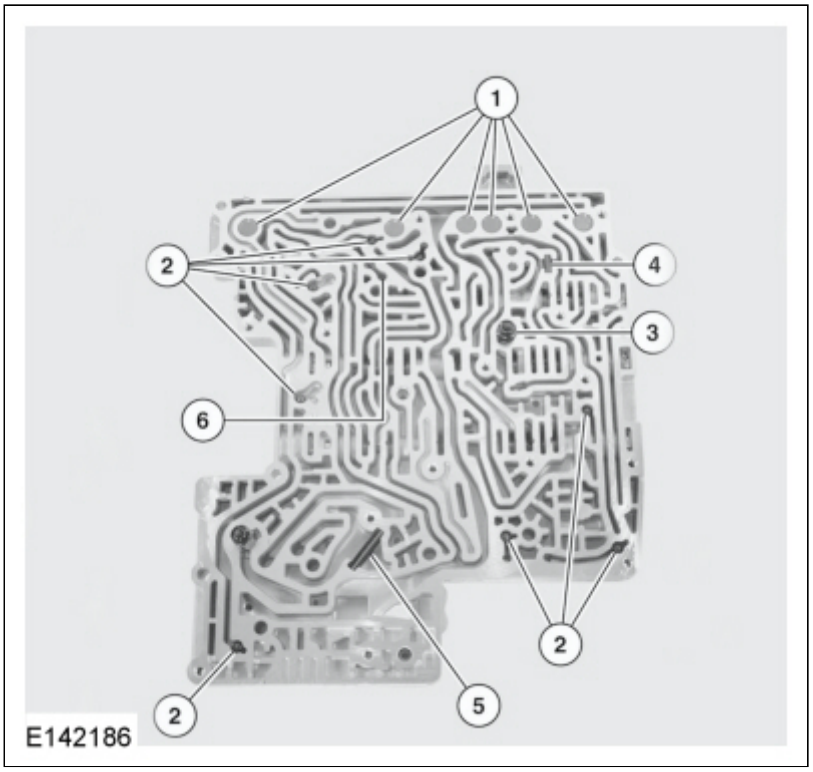
5. Install the shift control solenoid hold down bracket and the 8 hold down bracket bolts.
   Torque: 6 Nm



NOTICE: Toward the back of the upper valve body there is a hydraulic passage that is shaped as though it receives a check ball. This passage does not require a check ball. Be sure not to mistake this hydraulic passage for a passage that does require a check ball or damage to the transmission can occur.

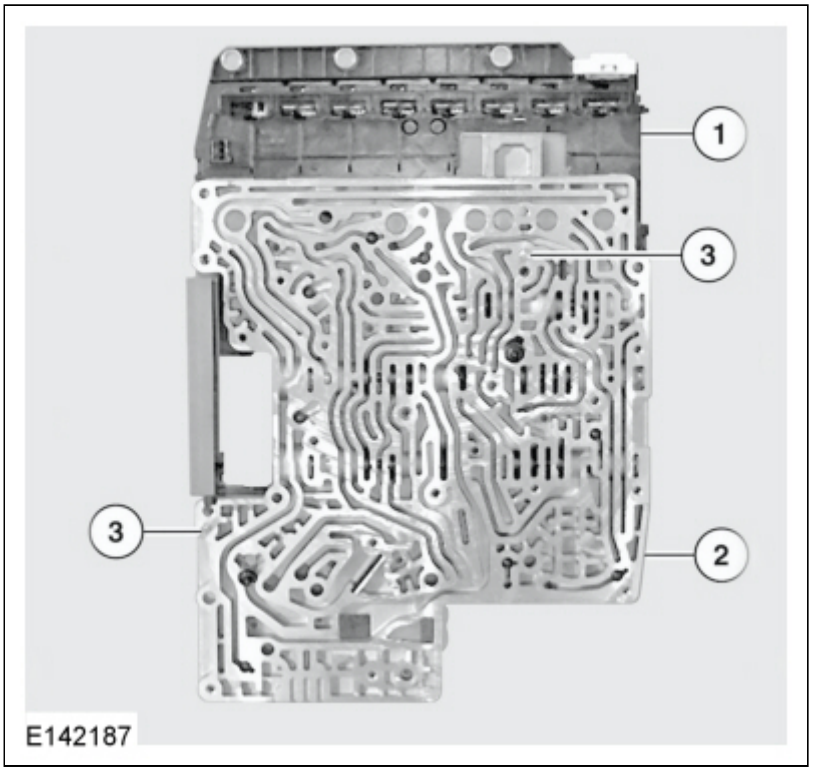
6. **NOTE:** *Install the solenoid dampers, check balls, converter drain back valve and filter screens.*

    1. Solenoid dampers
    2. Check balls
    3. Converter drain back valve
    4. Small filter screen
    5. Large filter screen
    6. Empty hydraulic passage (no check ball)



7. **NOTE:** *Align the guide pins on the molded leadframe with the holes in the main control upper valve body and install the valve body onto the molded leadframe.*

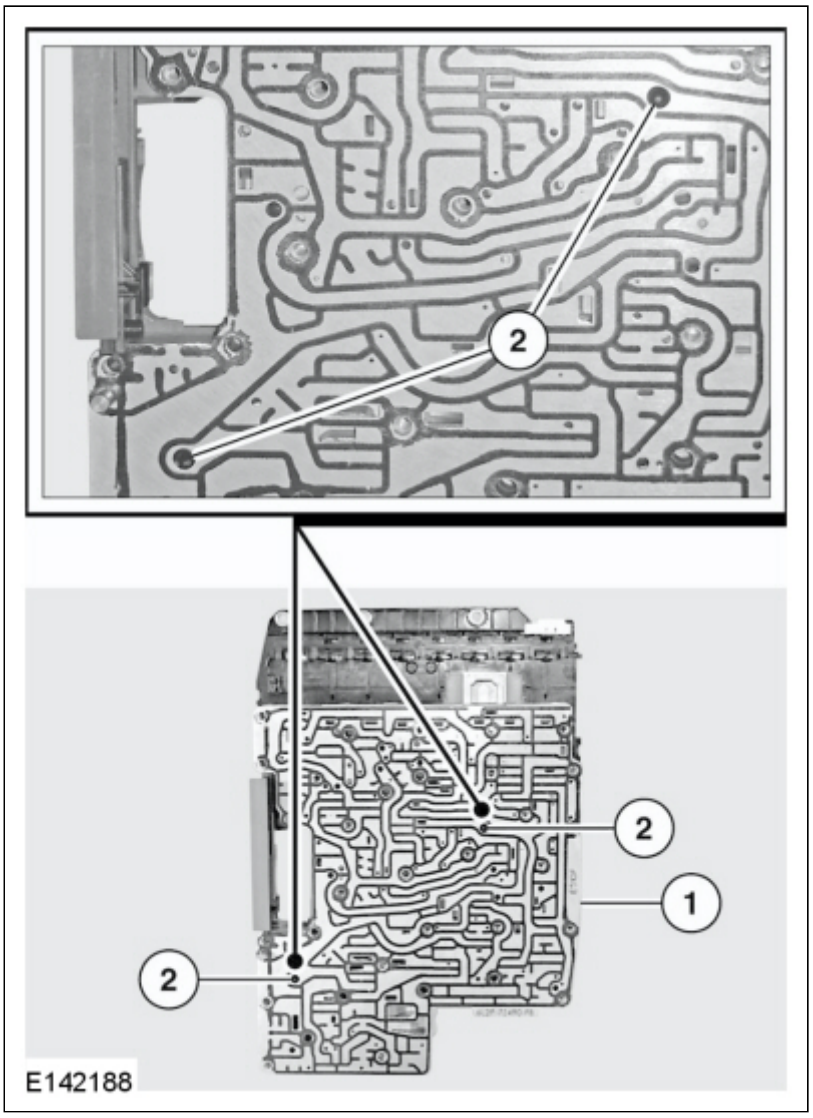
    1. Molded leadframe
    2. Main control upper valve body
    3. Guide pins



NOTICE: If the drain back valves are not installed correctly in the separator plate, damage to the transmission can occur.

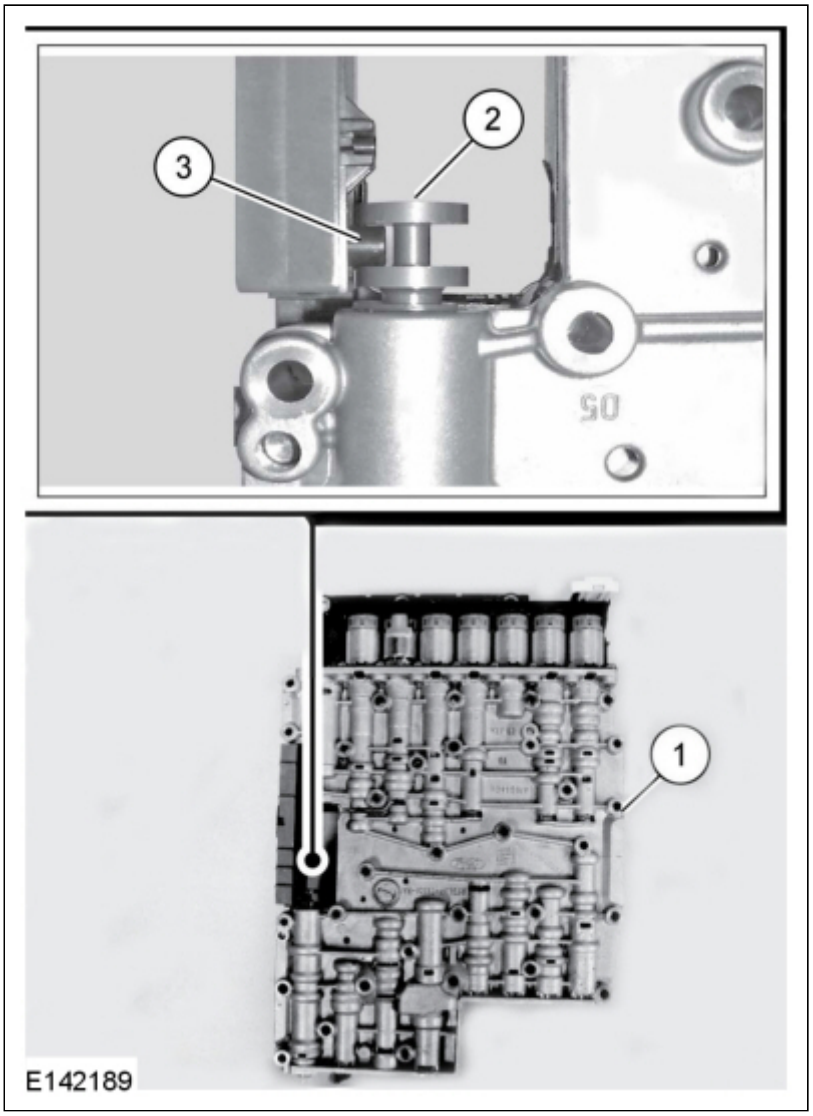
8. **NOTE:** *Position the new main control separator plate on the main control upper valve body. Check the 2 drain back valves to be sure they are correctly positioned in the separator plate when the separator plate is pressed flush against the main control upper valve body.*

    1. Main control separator plate
    2. Drain back valves

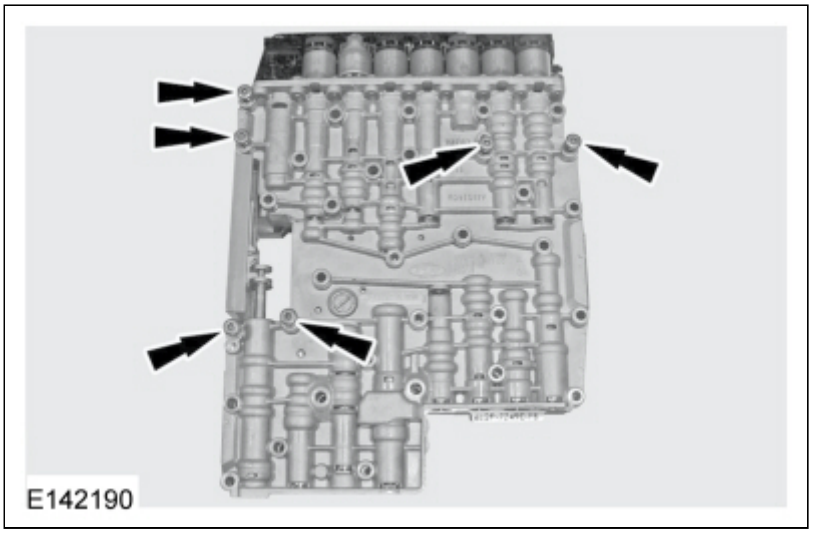


9. **NOTE:** *Position the main control lower valve body on the 2 molded leadframe alignment studs, align the manual valve with the Transmission Range (TR) sensor on the molded leadframe and install the main control lower valve body.*

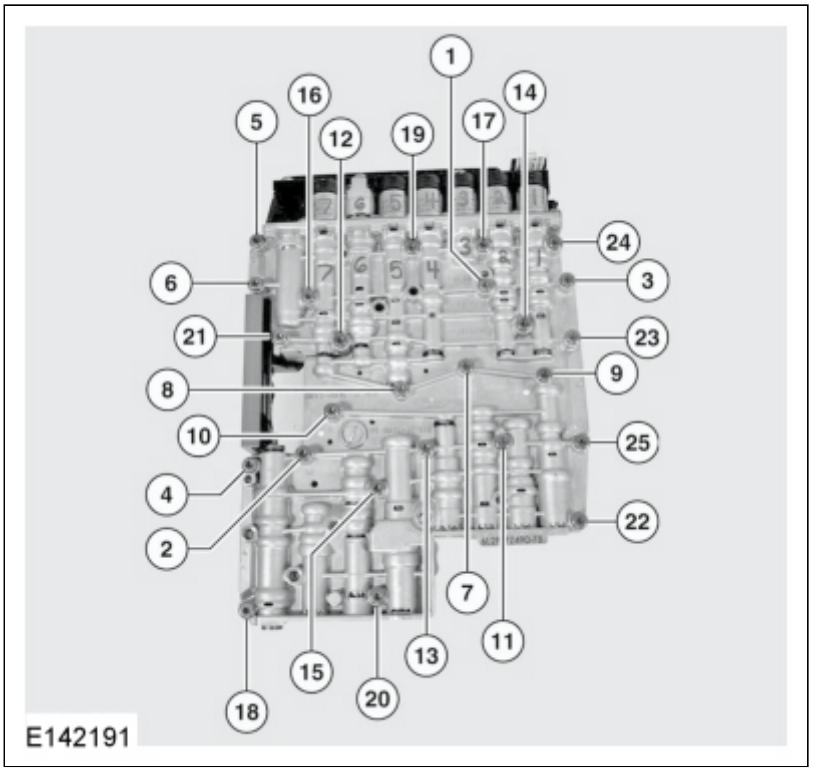
    1. Main control lower valve body
    2. Manual valve
    3. TR sensor



10. Install the 6 long molded leadframe-to-valve body bolts hand-tight.



11. Install the 19 short main control assembly lower-to-upper valve body bolts. Tighten the bolts in the sequence shown.
    Torque:
    :
    Stage 1: 6 Nm
    Stage 2: 7 Nm



Copyright © 2016 Ford Motor Company

Pump Assembly

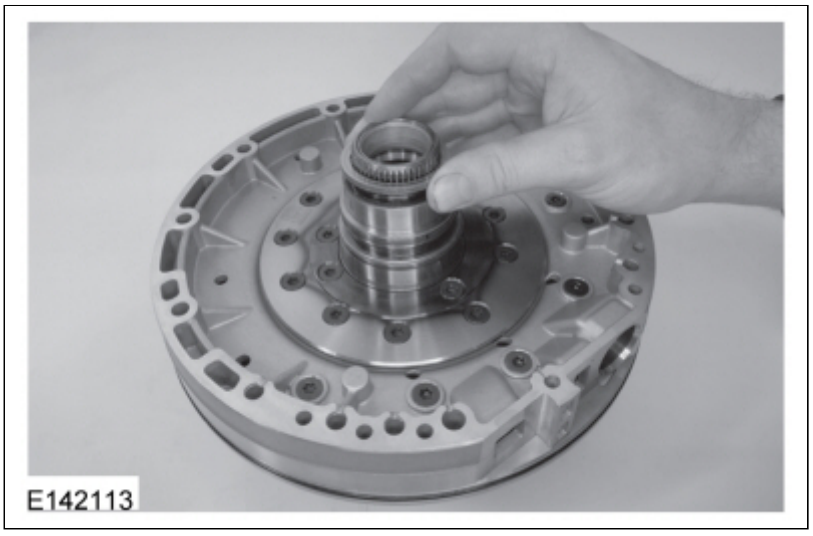
Base Part Number: 7A103

Special Tool(s) / General Equipment

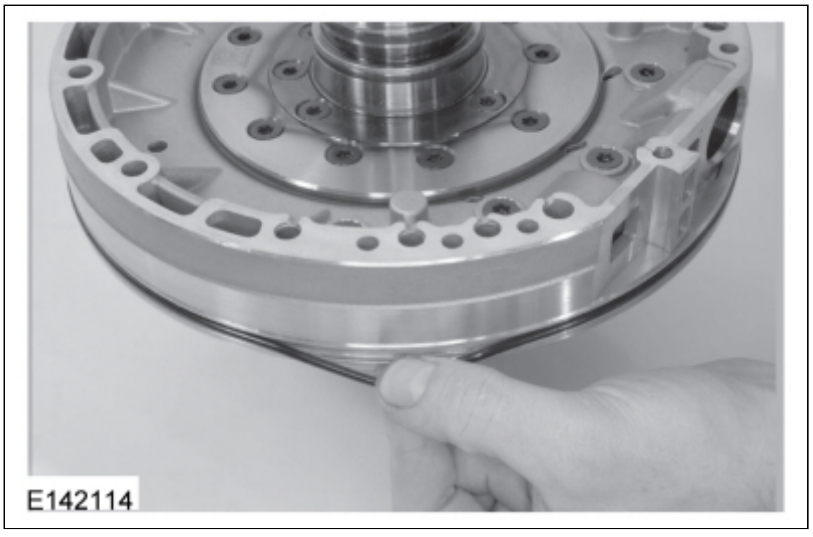
 E142020	307-556 Installer, Fluid Pump Seal

DISASSEMBLY

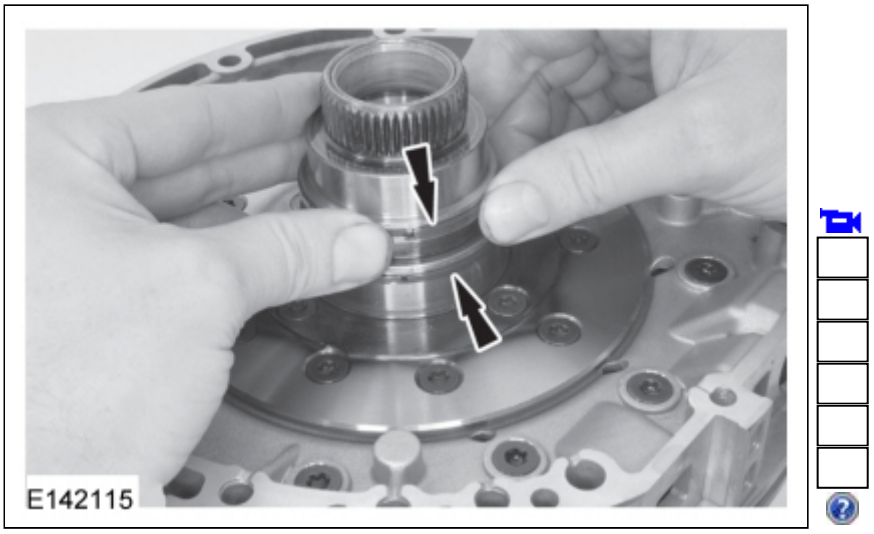
1. Remove the front pump washer.



2. If the O-ring seal was not removed during disassembly, remove and discard the front pump O-ring seal from the pump assembly.

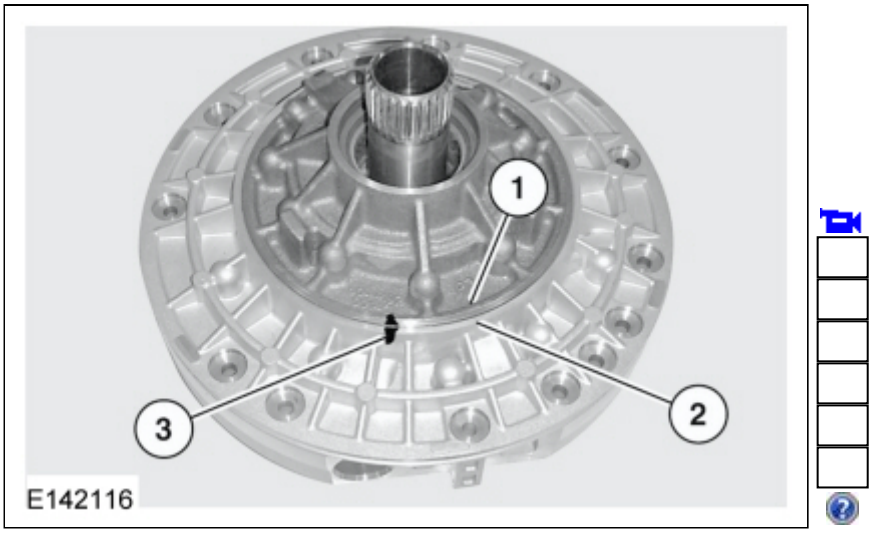


3. Remove and discard the front pump seal rings from the stator support.

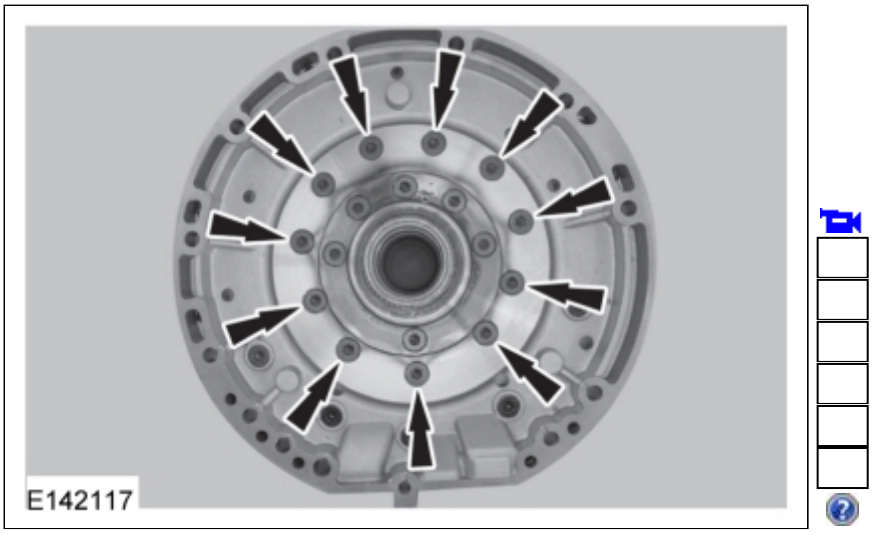


4. **NOTE:** *Index-mark the pump body to the pump plate assembly.*

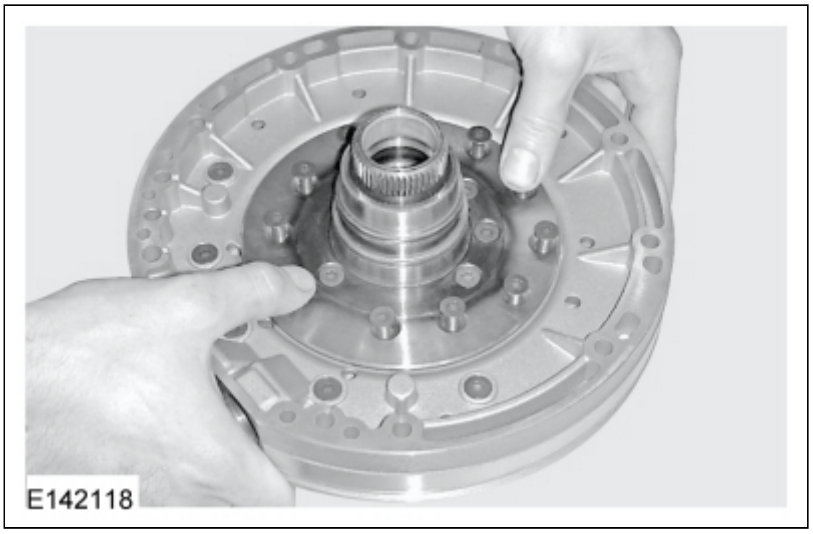
    1. Pump body
    2. Pump plate assembly
    3. Index mark



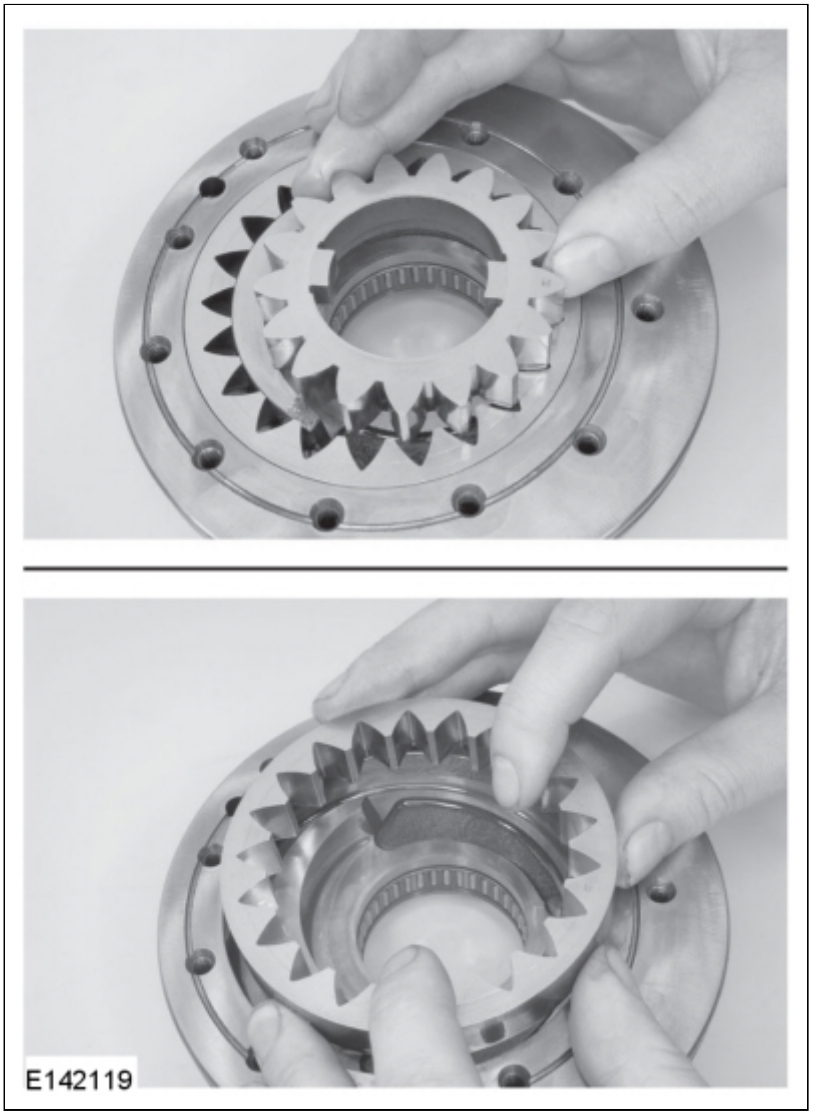
5. Remove the 11 pump plate assembly-to-pump body bolts.



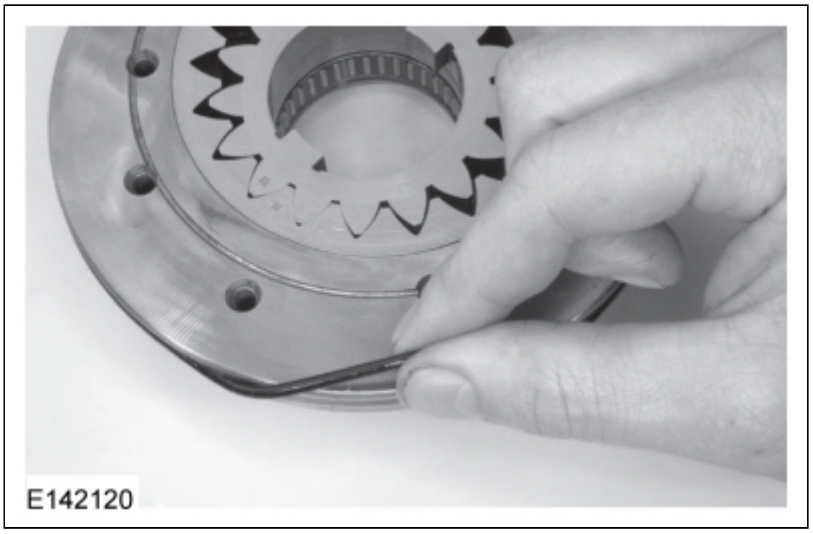
6. Push down on the loose pump plate assembly-to-pump body bolts to remove the pump body from the pump plate assembly and remove the 11 bolts.



7. Remove the fluid pump gears.

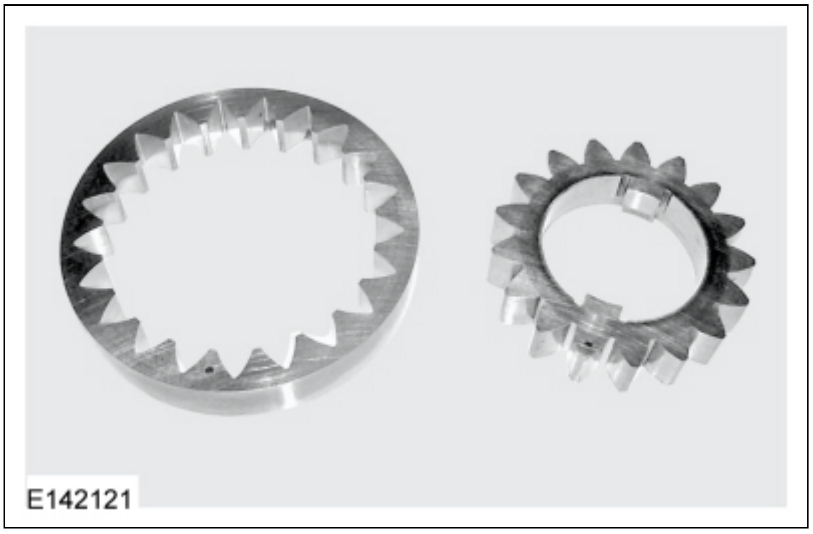


8. Remove and discard the pump body outer seal.



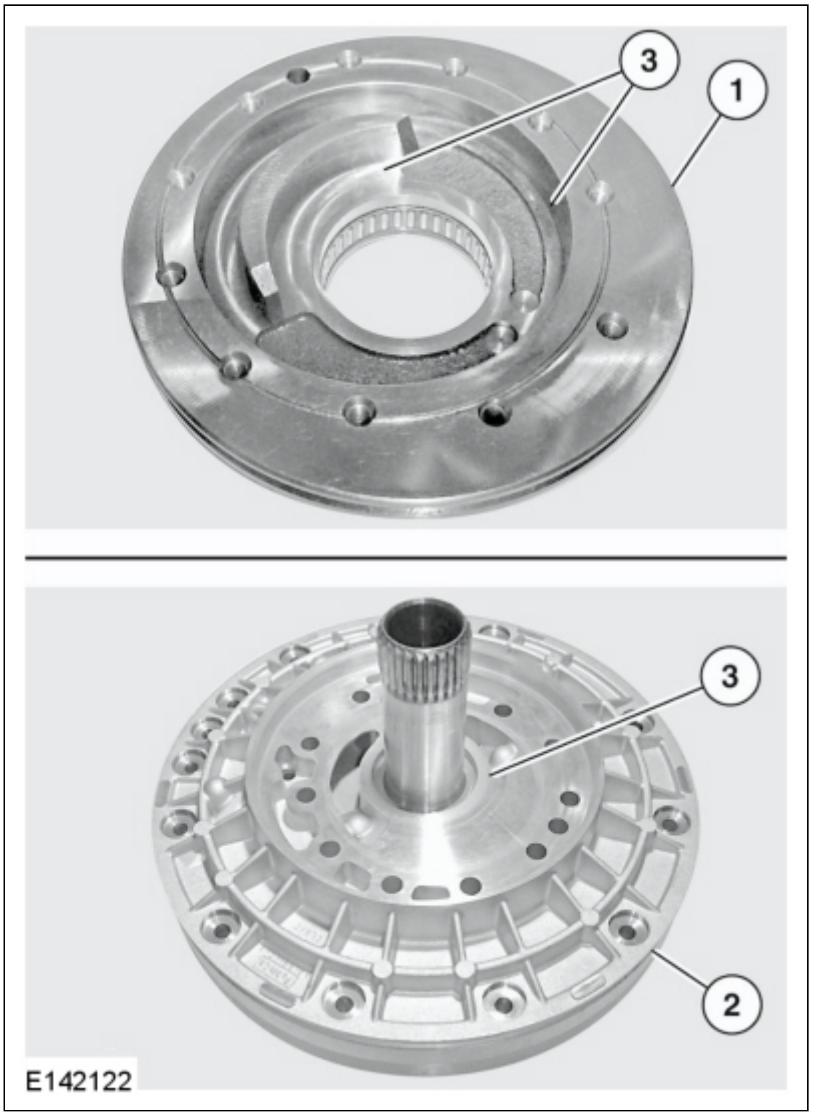
9. **NOTE:** *Inspect the inner and the outer pump gears for damage.*

    1. Clean all pump components in solvent.
    2. Dry the parts with compressed air.
    3. Inspect the pump gears, faces, gear teeth and mating surfaces for damage or scoring.
    4. Install a new pump as necessary.



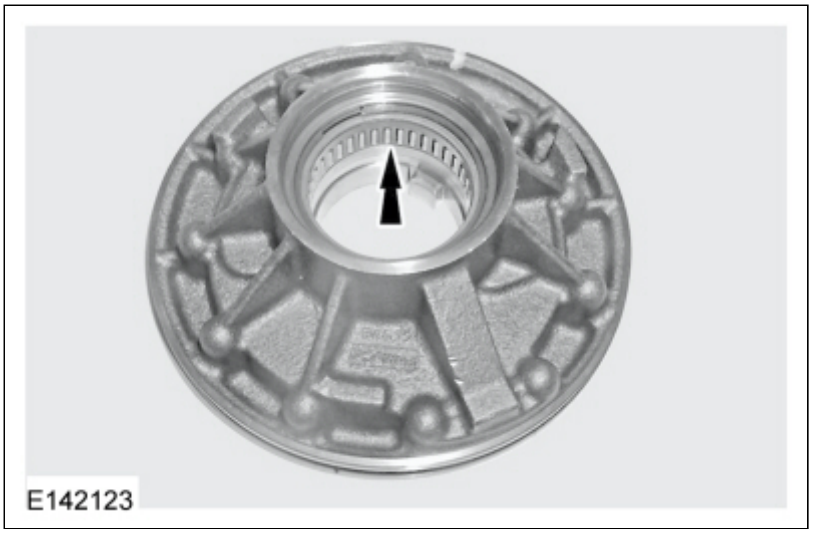
10. **NOTE:** *Inspect the pump body and pump plate thrust surfaces for damage or scoring.*

    1. Pump body
    2. Pump plate assembly
    3. Pump gear thrust surfaces



NOTE: *Bearing shown, bushing similar.*

11. Inspect the torque converter hub bearing or bushing. If equipped with a bearing, make sure that the bearing rotates smoothly and is not damaged. If equipped with a bushing, check the bushing for damage or scoring.



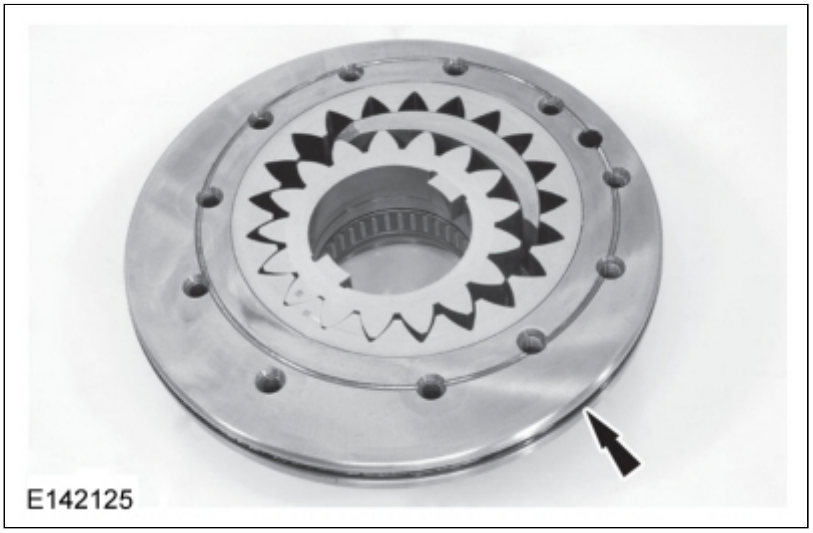
ASSEMBLY

NOTE: *Prior to installation, lightly lubricate the pump gears with clean automatic transmission fluid.*

1. Install the pump gears with the dot facing the pump plate assembly.

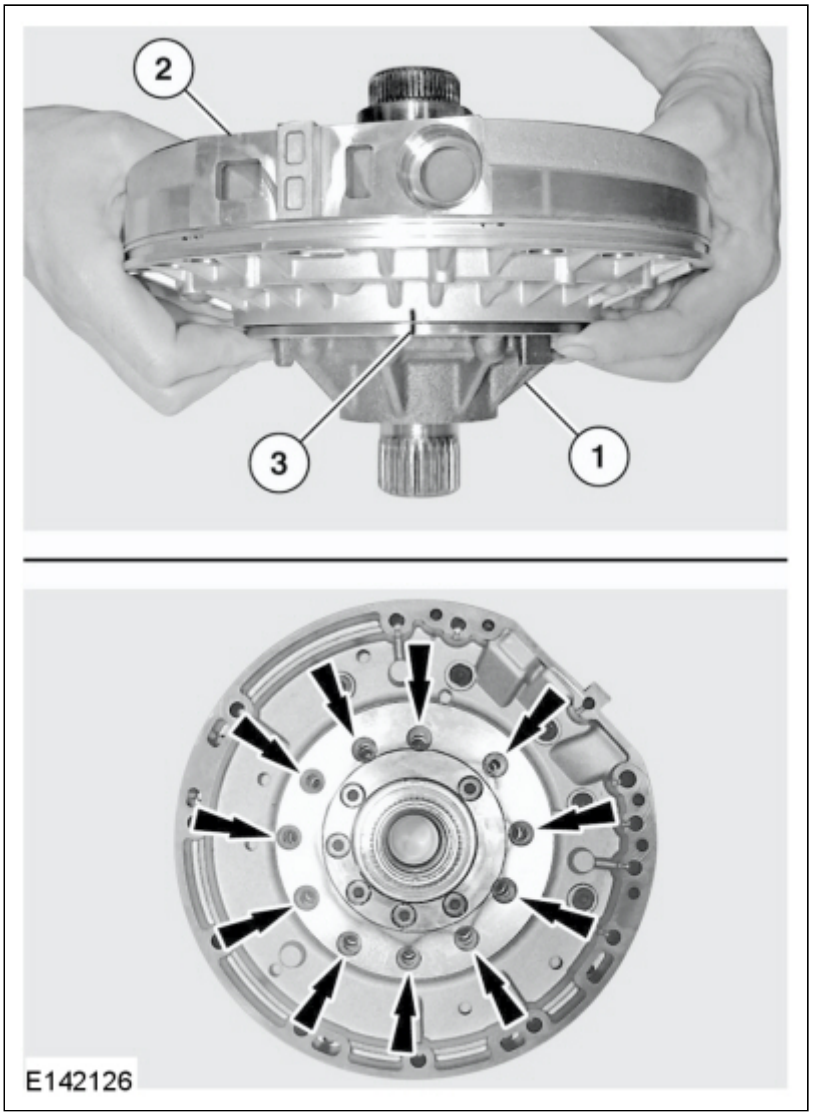


2. Install a new pump body outer seal.

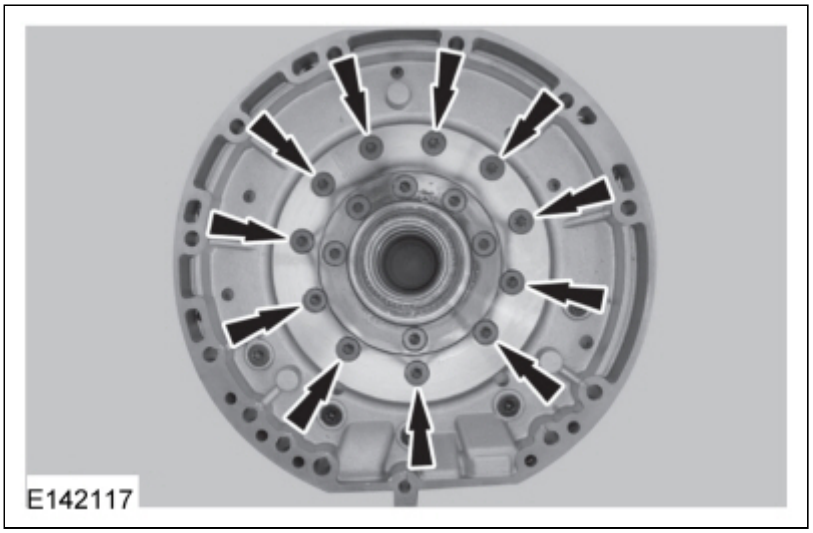


3. **NOTE:** *Align the marks made during disassembly to correctly assemble the pump. Press the pump body into the pump plate assembly. Visually inspect the pump body-to-pump plate assembly bolt holes to be sure that the pump body and pump plate are correctly aligned.*

    1. Pump body
    2. Pump plate assembly
    3. Pump gear thrust surfaces

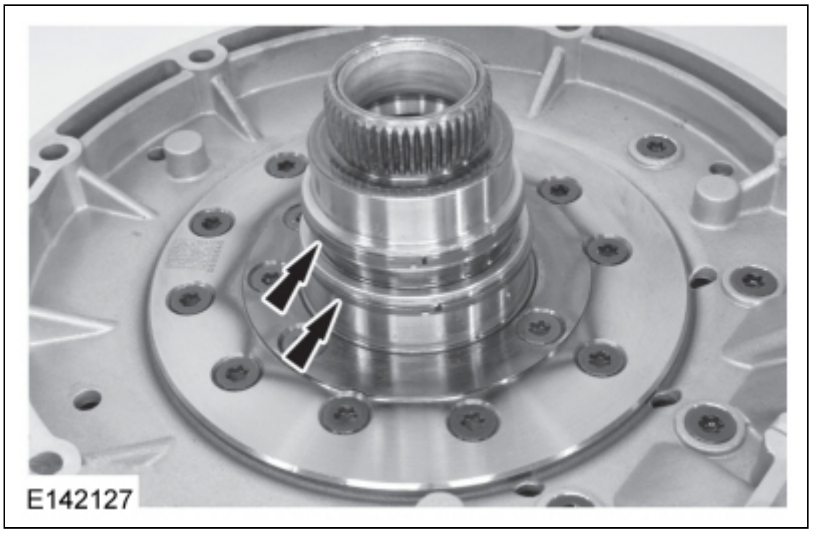


4. Install the pump plate assembly-to-front pump body bolts.
   Torque: 15 Nm

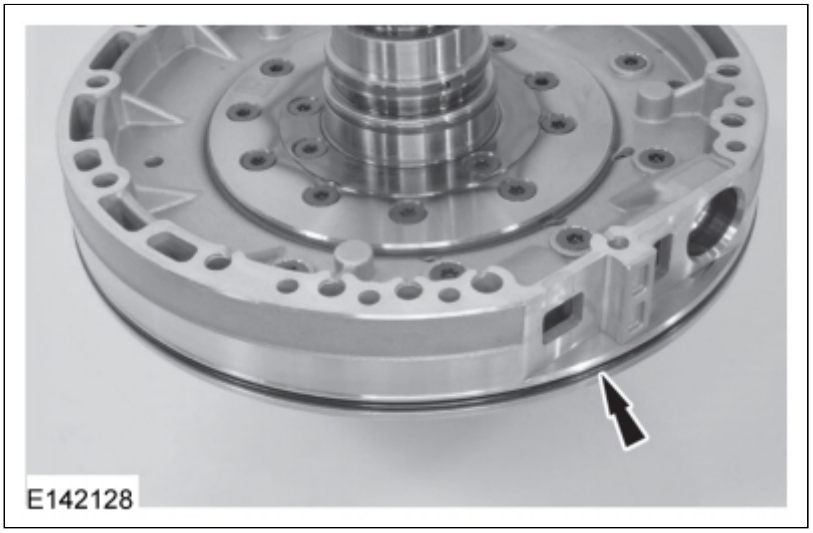


NOTICE: Make sure that the seal ends of each seal ring are hooked together or fluid leakage can occur.

5. Install the 2 front pump seal rings onto the stator support. Make sure the seals are fully seated in the stator support seal grooves and the seal ends are oriented 180° apart.



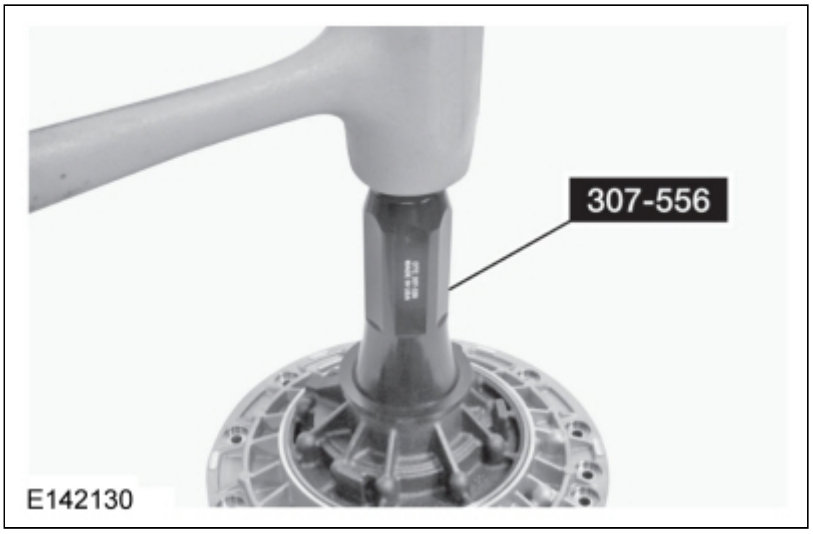
6. Install the pump outer diameter front pump O-ring seal.



7. Install a new front pump seal on the Fluid Pump Seal Installer.
   Use Special Service Tool: 307-556 Installer, Fluid Pump Seal.

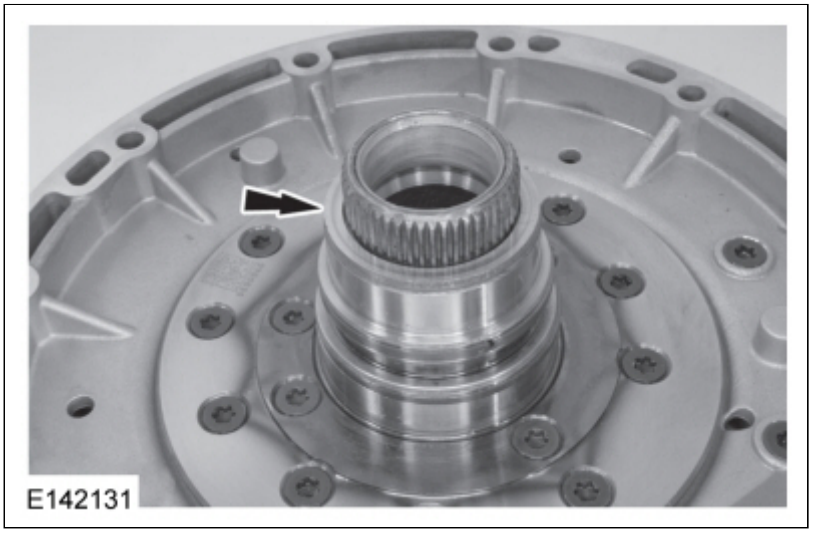


8. Using the Fluid Pump Seal Installer, install the front pump seal.
   Use Special Service Tool: 307-556 Installer, Fluid Pump Seal.



NOTE: *Lightly lubricate the thrust washer with petroleum jelly to hold it in place during assembly.*

9. Install the pump thrust washer.

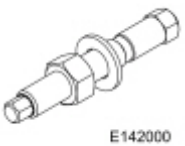
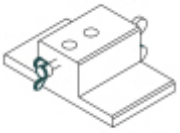
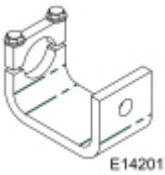


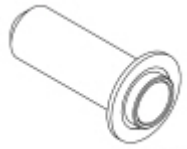
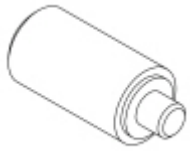
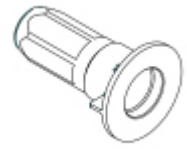
Copyright © 2016 Ford Motor Company

Transmission

Base Part Number: 7000

Special Tool(s) / General Equipment

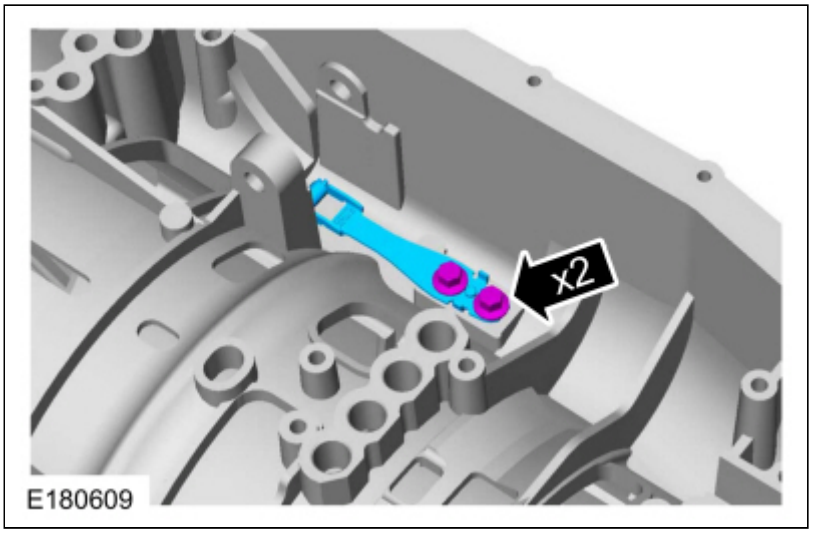
 E139373	100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge
 E142000	204-029 Drawbar
 E216593	205-199 (T83T-3132-A1) Installer, Spindle/Axle Shaft
 E142003	205-276 Installer, Front Wheel Hub Seal
 E142010	307-091 Handle, Torque Converter
 E142013	307-343 Retaining Ring Pliers
 E142015	307-534 End Play Gauge, Transmission
 E142017	307-553 Remover, Transmission Fluid Pump

 E142020	307-556 Installer, Fluid Pump Seal
 E142021	307-559 Installer, Shifter Fluid Seal
 E142023	307-637 Installer, Rear Seal, 4x4
 E181071	307-713 Installer, Roller Bearing
 E181072	307-714 Installer, Needle Bearing
 E181073	307-715 Installer, Output Seal (4X2)
Flat Headed Screw Driver	
Punch	

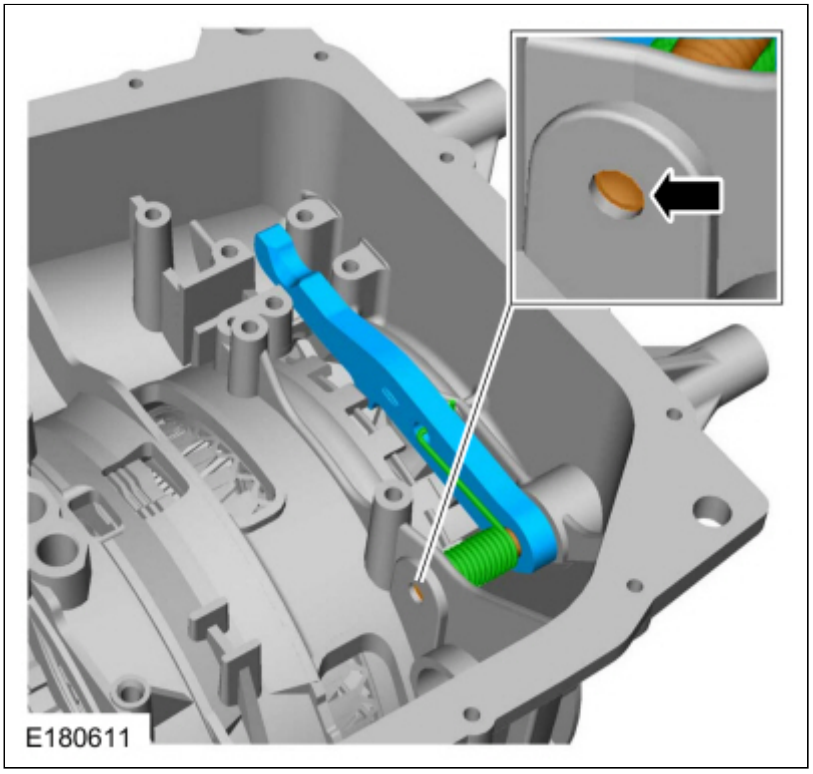
Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

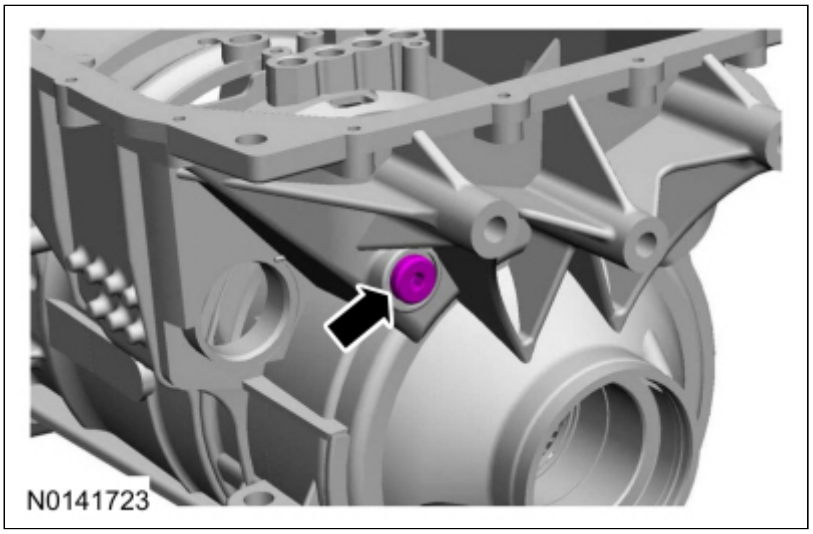
1. *Torque*: 12 Nm



2.

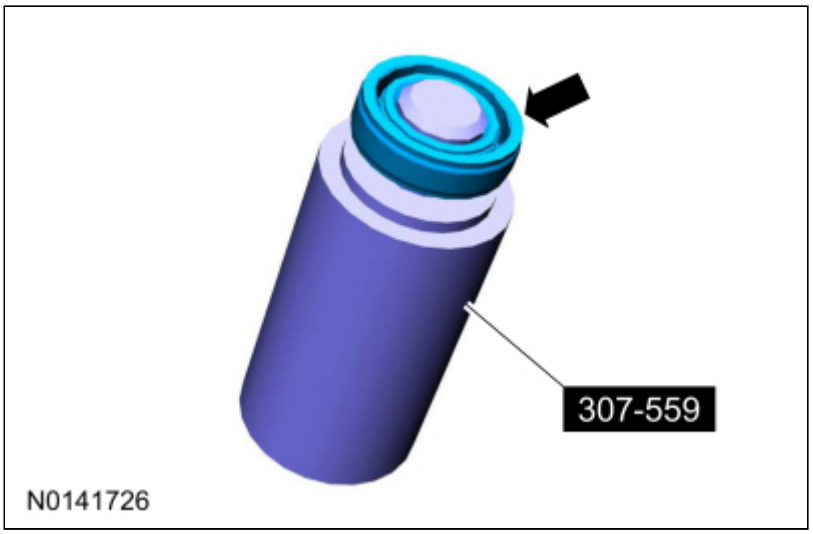


3. *Torque*: 23 Nm

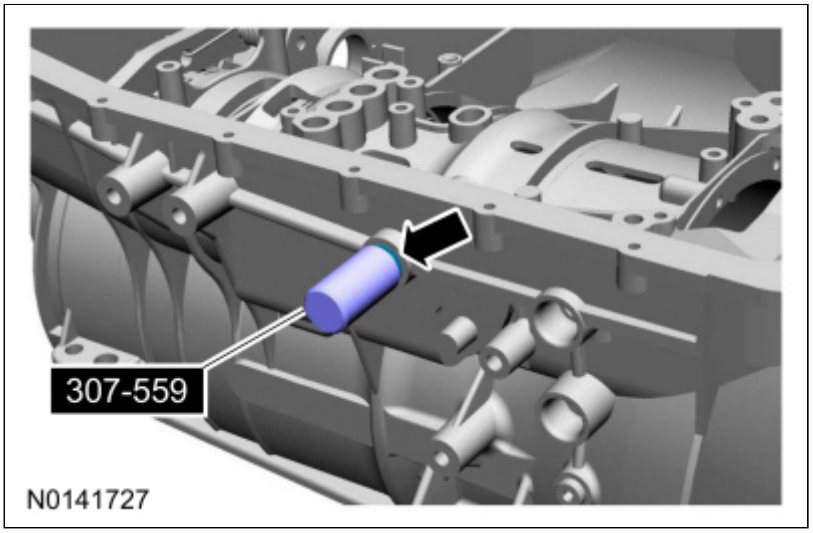


4. Install a new manual control lever shaft seal on the Shifter Fluid Seal Installer.

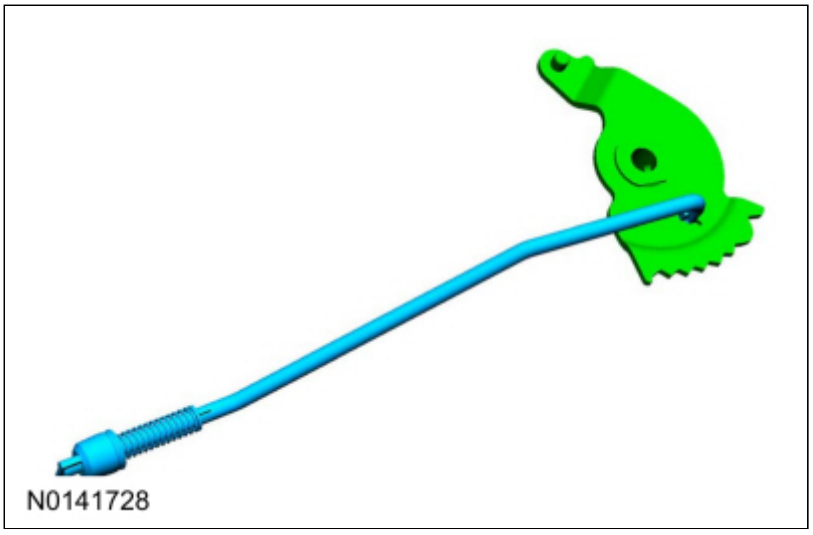
Use Special Service Tool: 307-559 Installer, Shifter Fluid Seal.



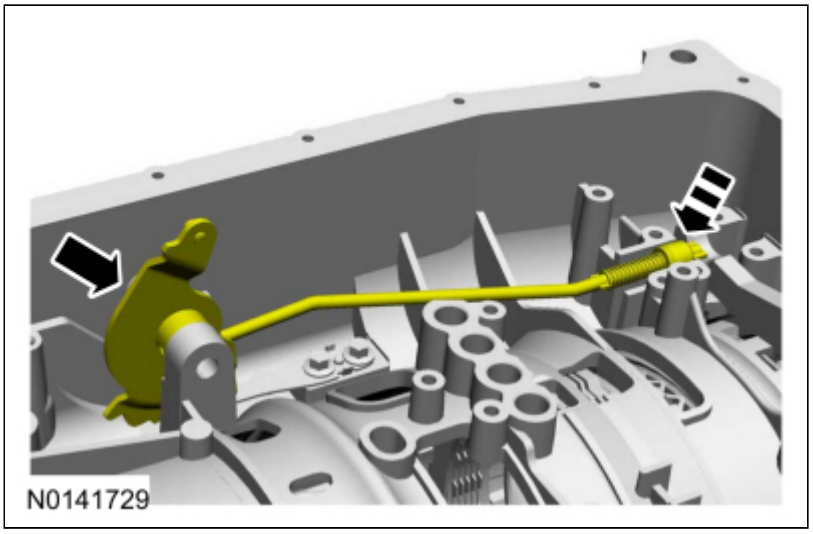
5. Use Special Service Tool: 307-559 Installer, Shifter Fluid Seal.



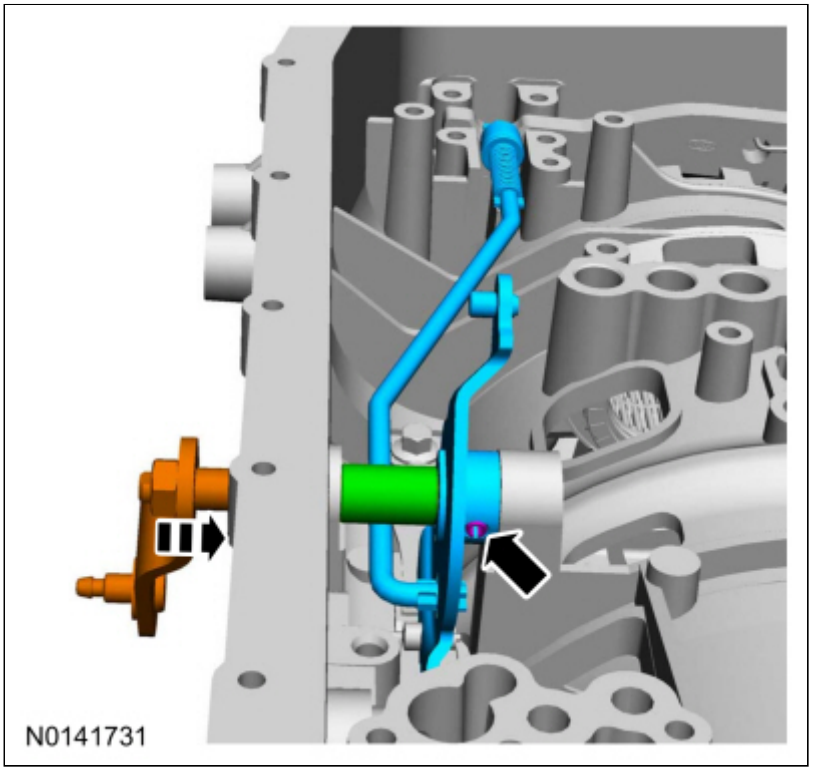
6. Assemble the manual control lever detent plate assembly and park pawl actuator rod.



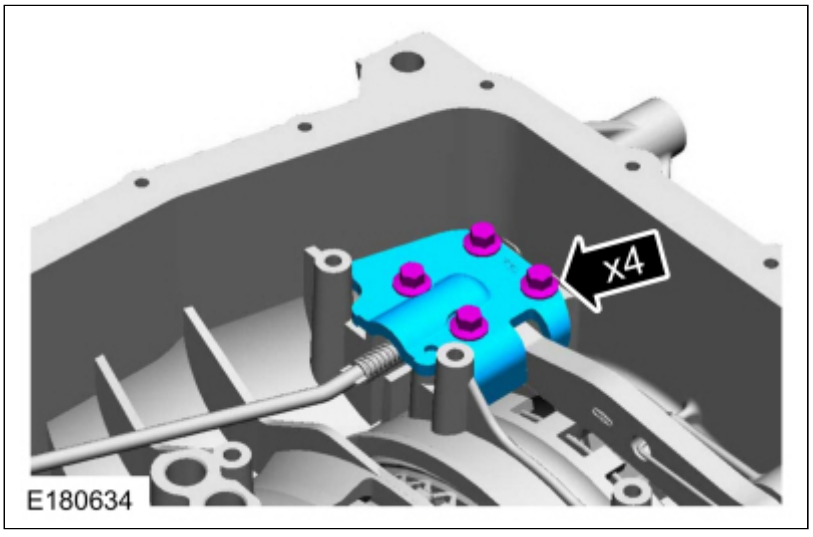
7.



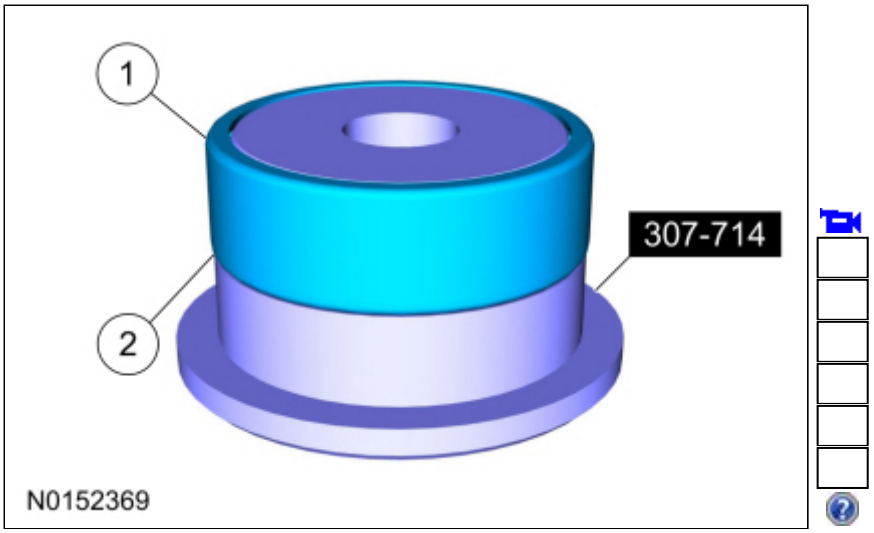
8. Position the manual control lever spacer in place and slide the manual control lever shaft into the case and the manual lever detent plate. Align the roll pin hole in the manual control lever detent plate with the roll pin hole in the manual control lever shaft and install a new roll pin.



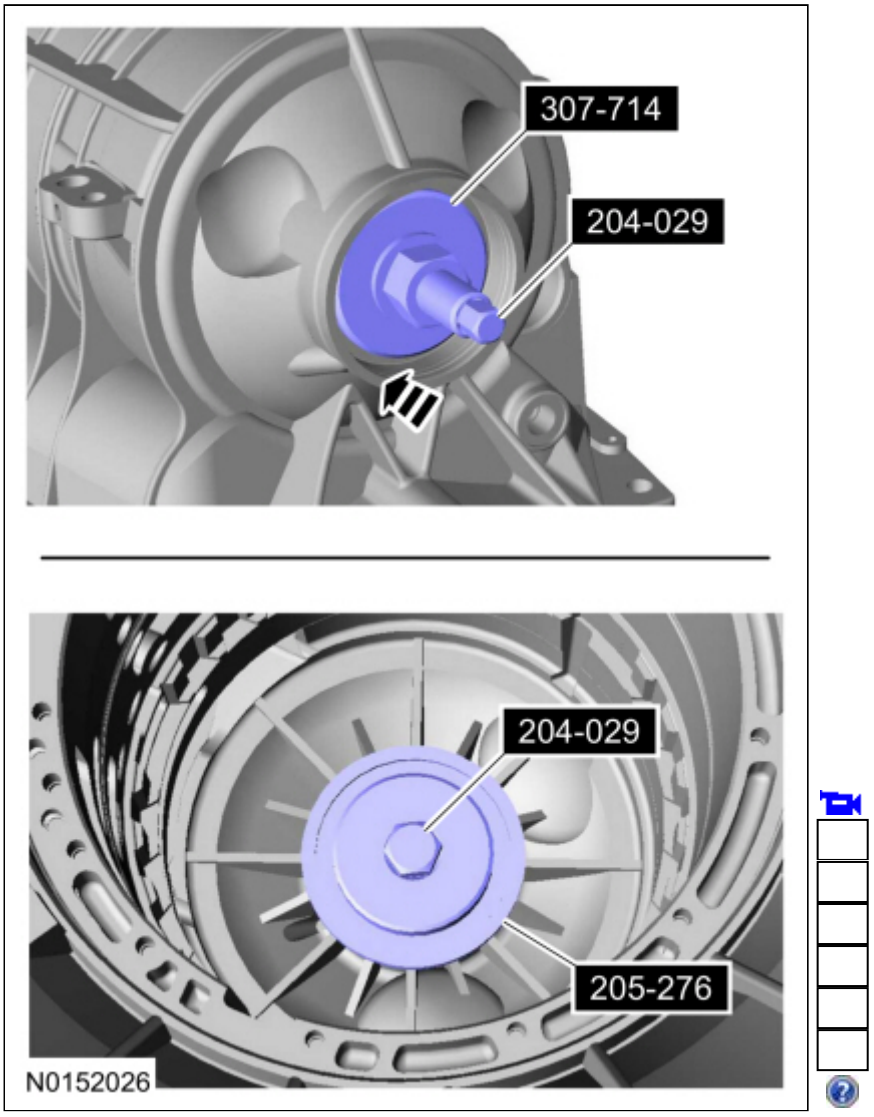
9. *Torque*: 12 Nm



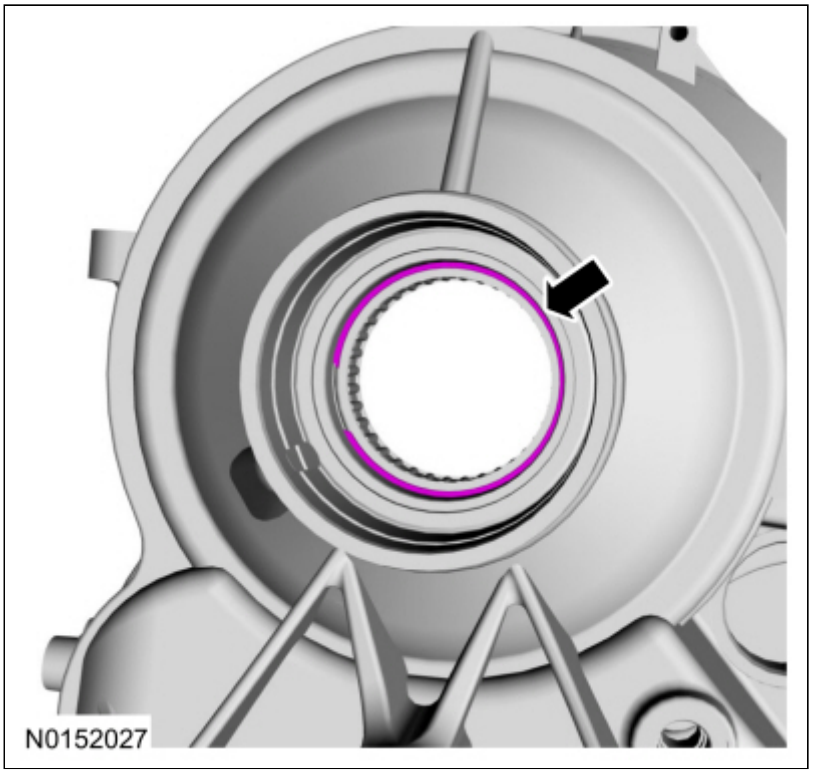
1. Install the needle bearing on the special tool so that the rounded end faces up.
2. Flat bearing surface (snap ring side) facing down.
   Use Special Service Tool: 307-714 Installer, Needle Bearing.



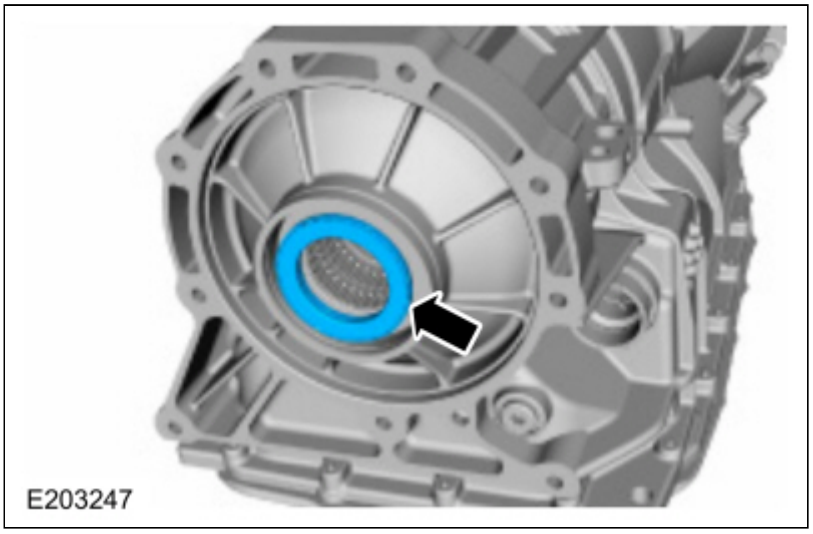
11. Assemble the special tools and install the bearing in the transmission case.
    Use Special Service Tool: 204-029 Drawbar. , 205-276 Installer, Front Wheel Hub Seal. , 307-714 Installer, Needle Bearing.



12.

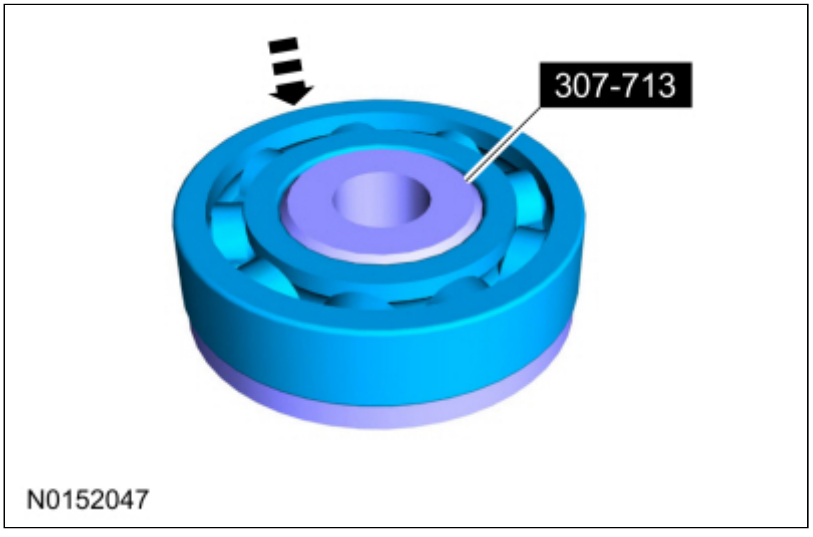


13.

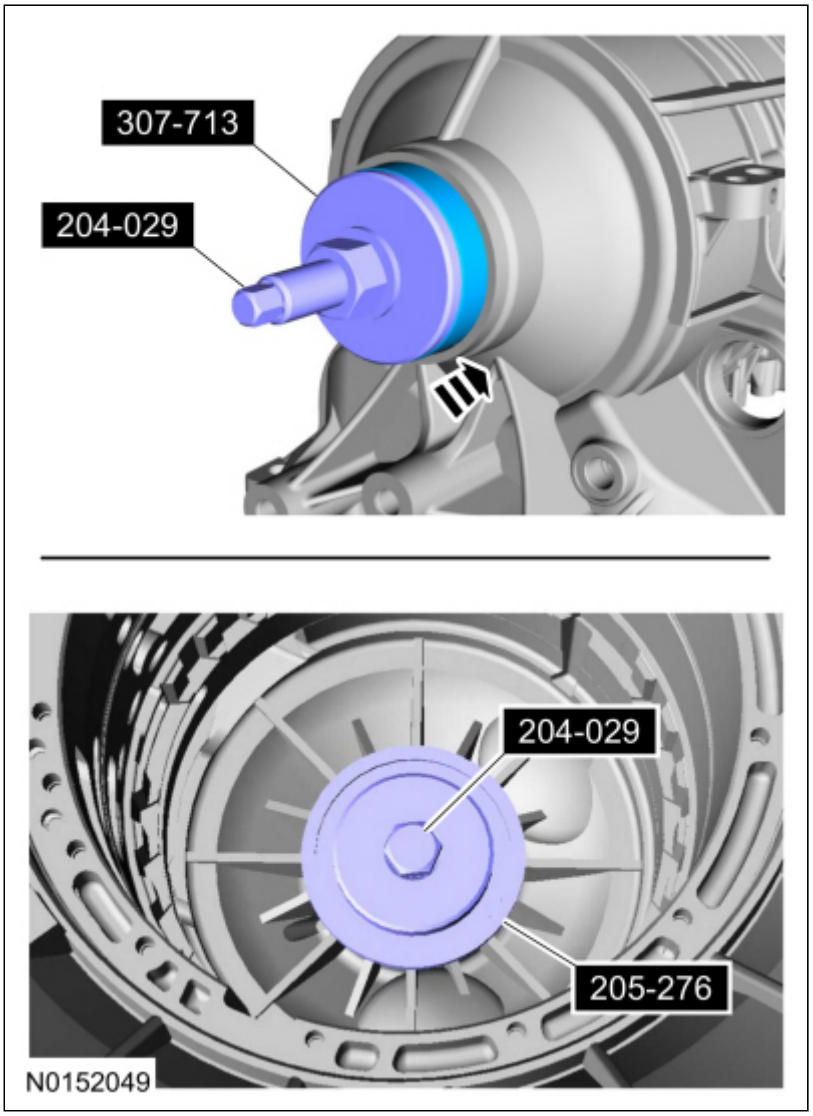


4x2

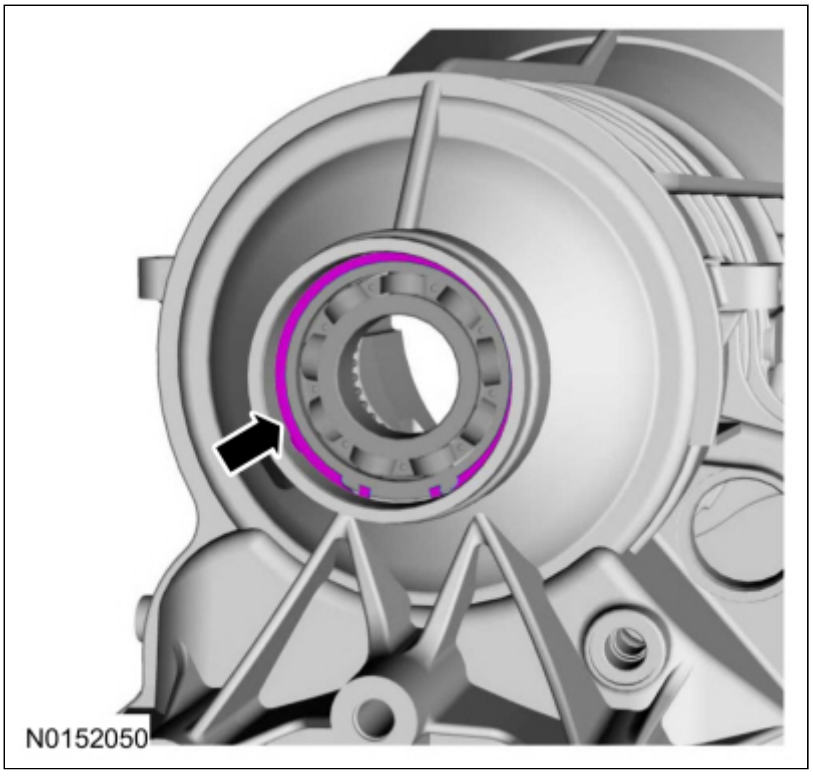
14. Install the bearing on the special tool.
    Use Special Service Tool: 307-713 Installer, Roller Bearing.



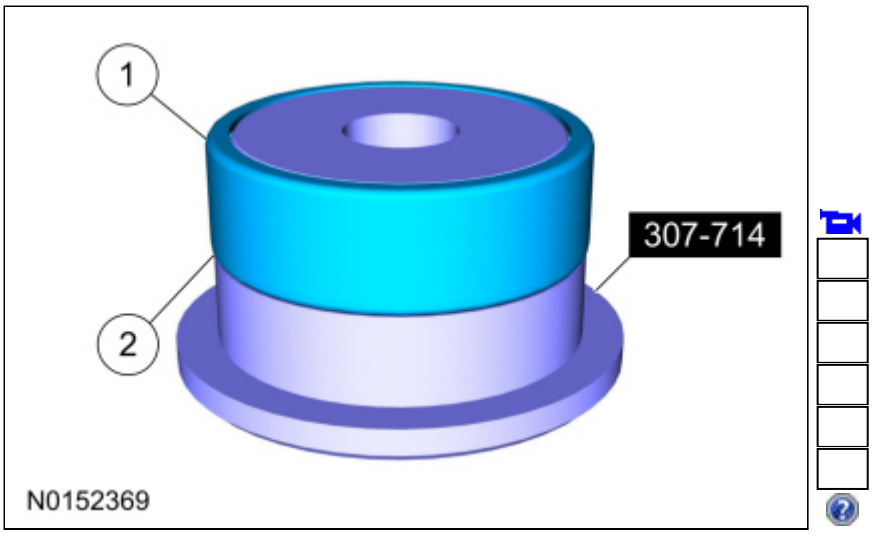
15. Use Special Service Tool: 204-029 Drawbar. , 205-276 Installer, Front Wheel Hub Seal. , 307-713 Installer, Roller Bearing.



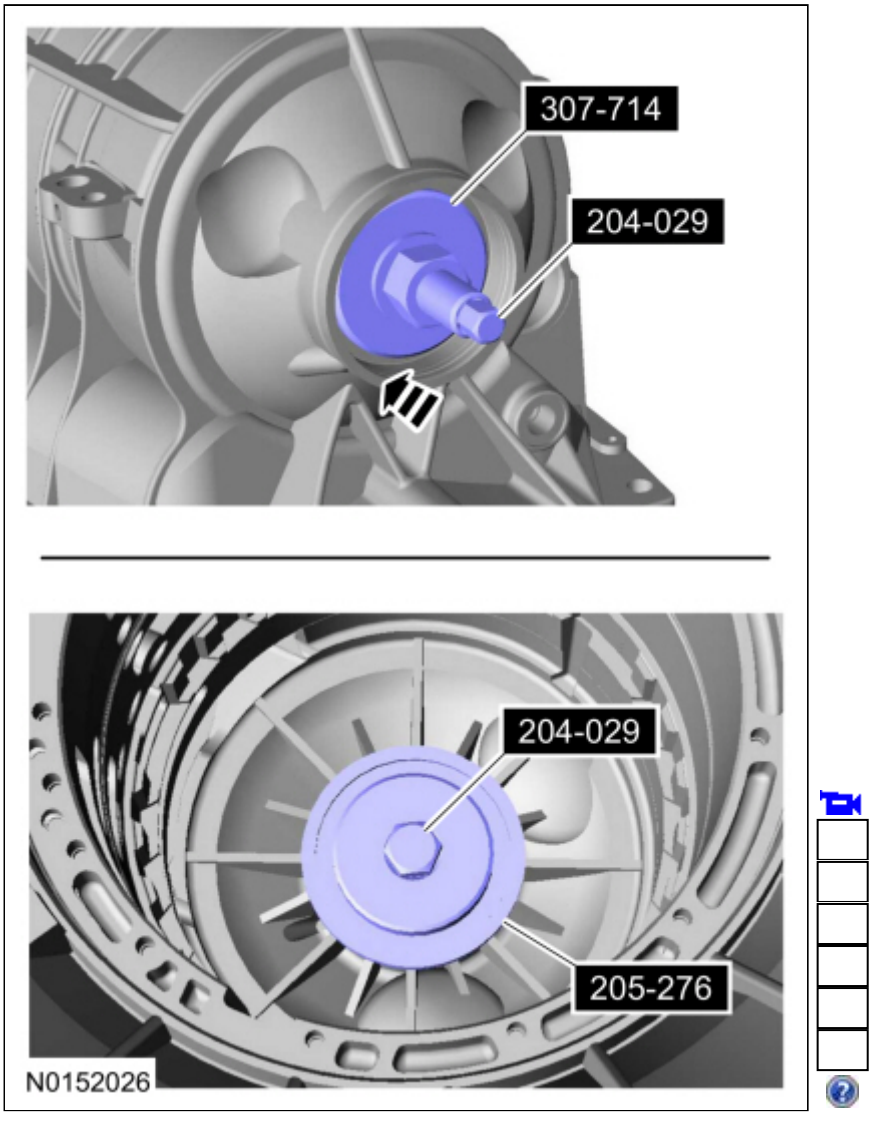
16. Position the thrust bearing spacer in place.



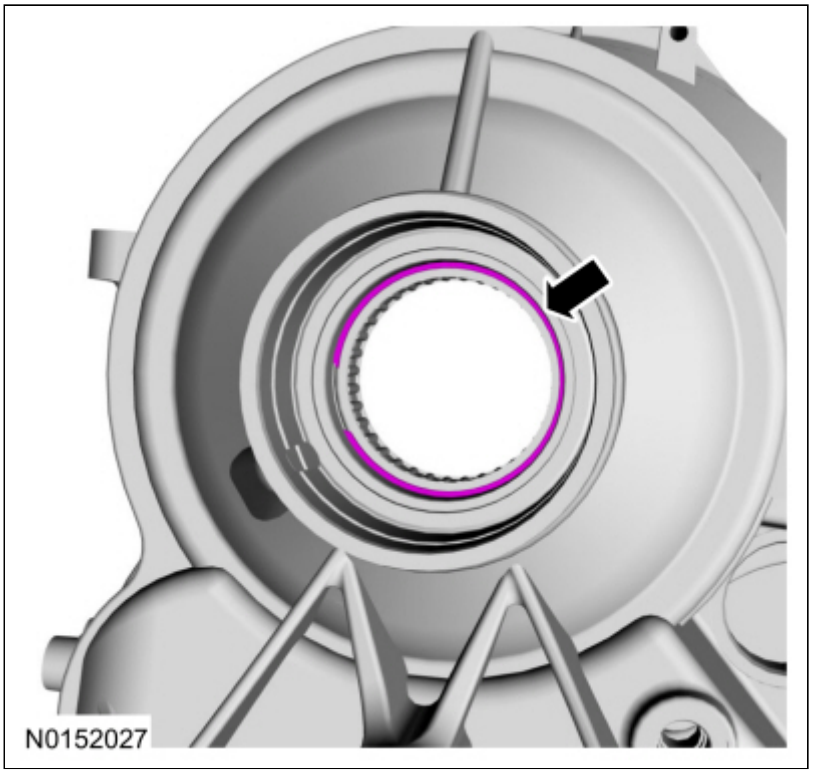
17. If equipped.
    - Install the needle bearing on the special tool so that the rounded end faces up.
    - Flat bearing surface (snap ring side) facing down.
      Use Special Service Tool: 307-714 Installer, Needle Bearing.



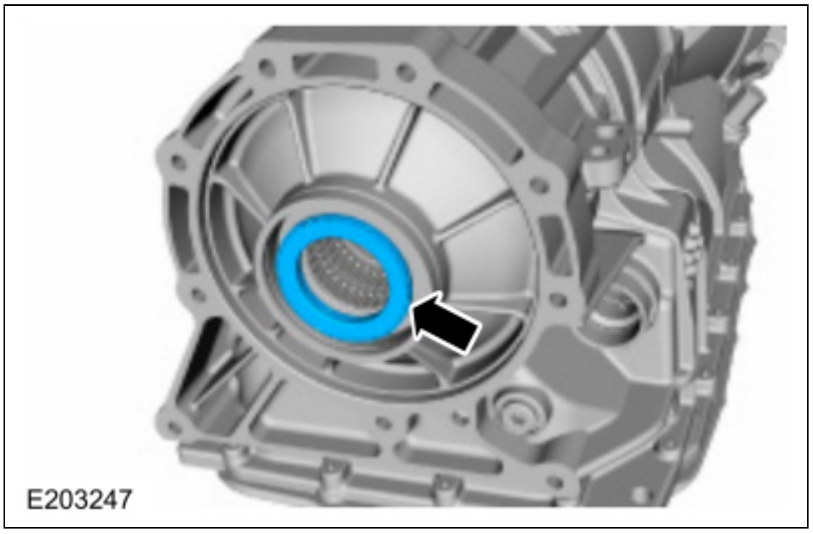
18. Assemble the special tools and install the bearing in the transmission case.
    Use Special Service Tool: 204-029 Drawbar. , 205-276 Installer, Front Wheel Hub Seal. , 307-714 Installer, Needle Bearing.



19.

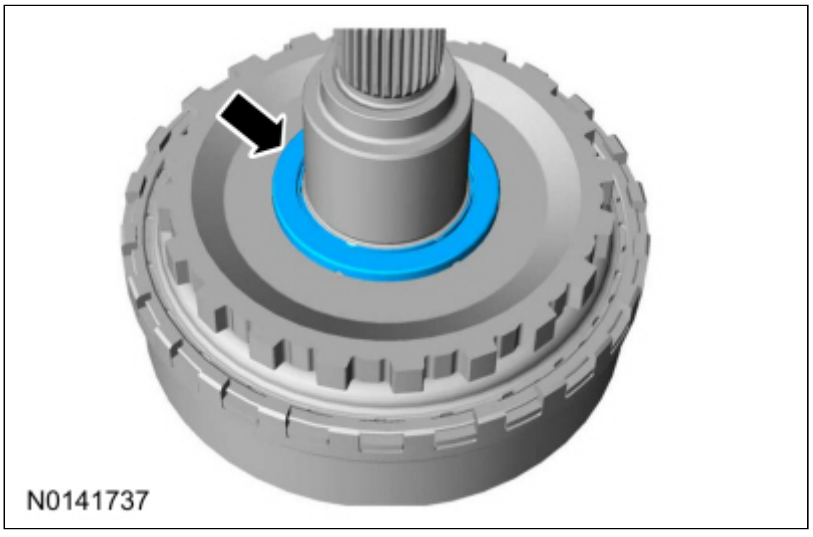


20.

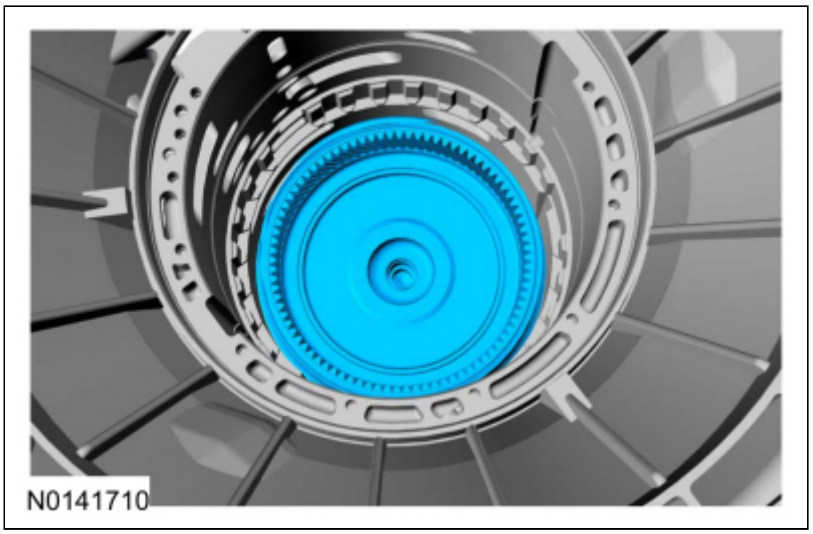


All vehicles

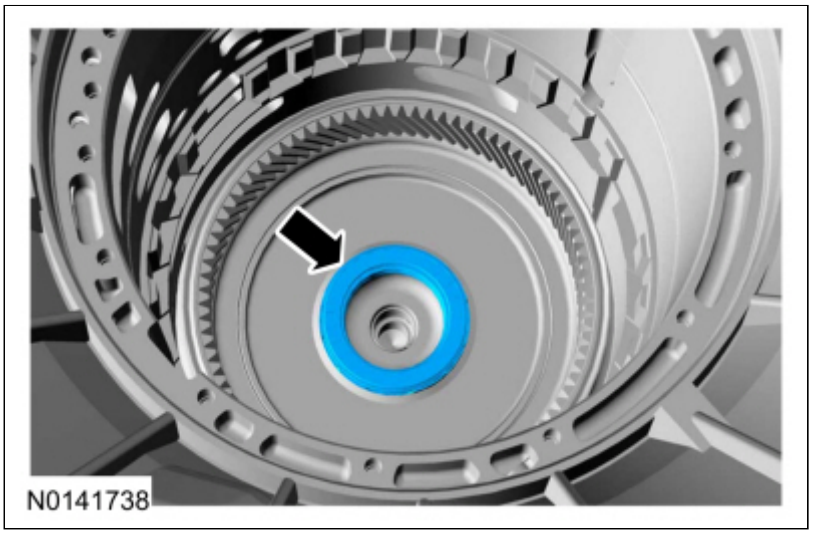
21.



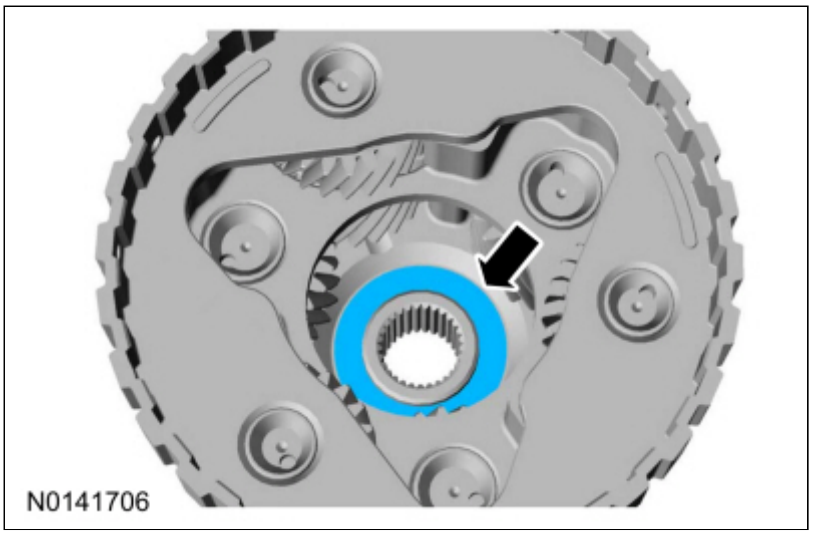
22. Install the rear planetary ring gear and output shaft assembly.



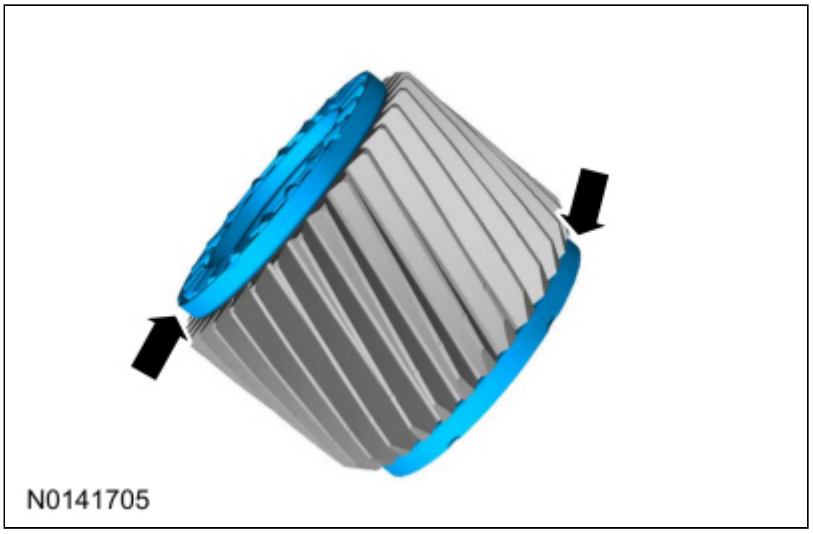
23.



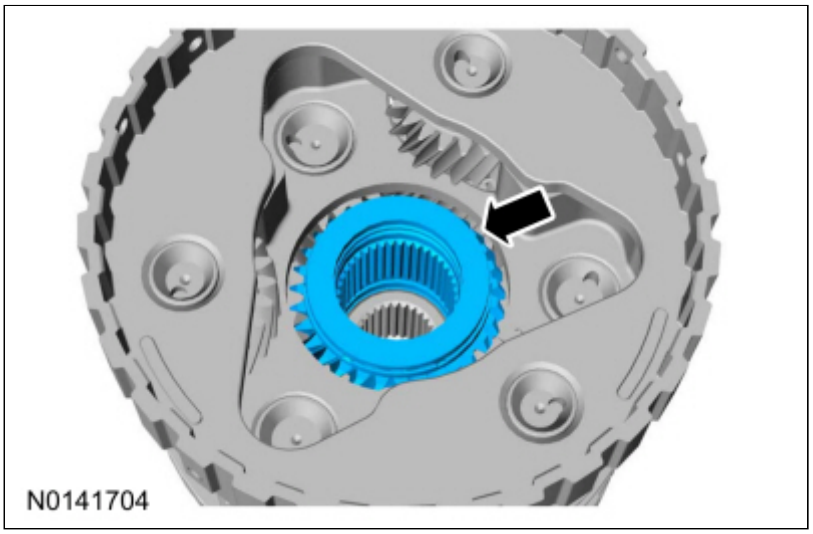
24.



25.



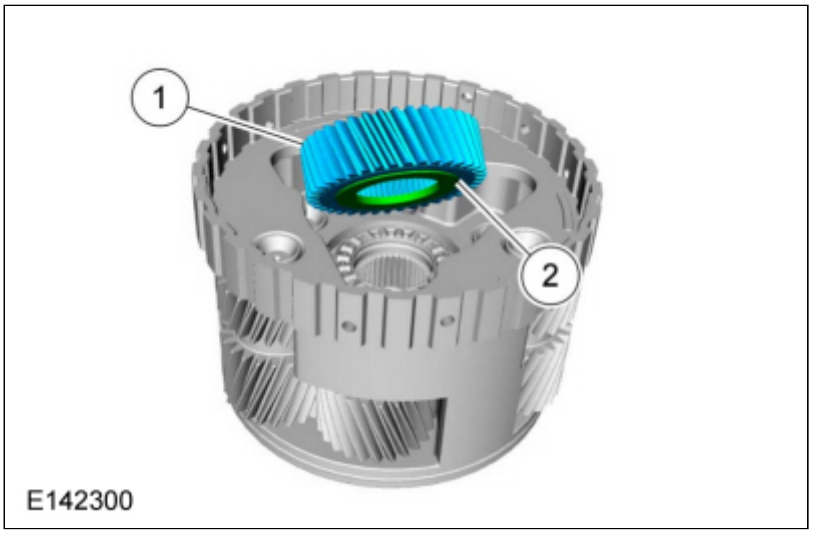
26. **NOTE:** *When installing the sun gear, make sure that the taper edge is facing up toward the torque converter housing.*



27. **NOTE:** *Make sure that the bearing race is installed in the sun gear.*

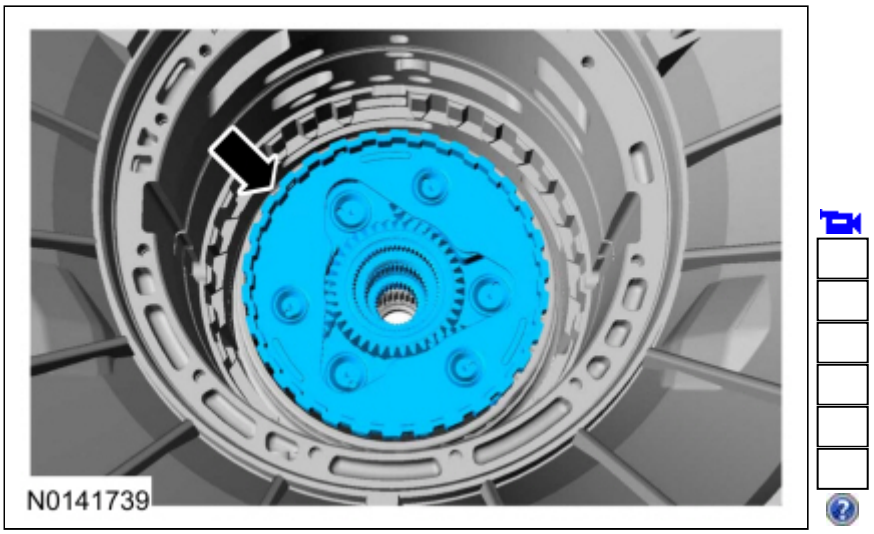
    NOTE: *Install the low/reverse sun gear and bearing race into the planetary carrier with the race side facing down.*

    Install the following items:
    1. Low/reverse sun gear
    2. Bearing race



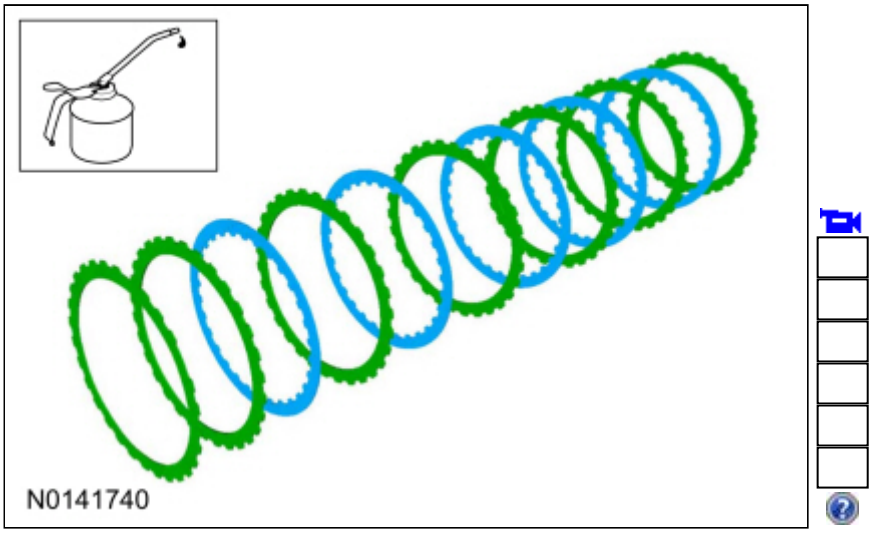
28. **NOTE:** *Place the manual control lever in PARK when installing the rear planetary gearset to hold the rear ring gear stationary.*

Install the planet carrier.

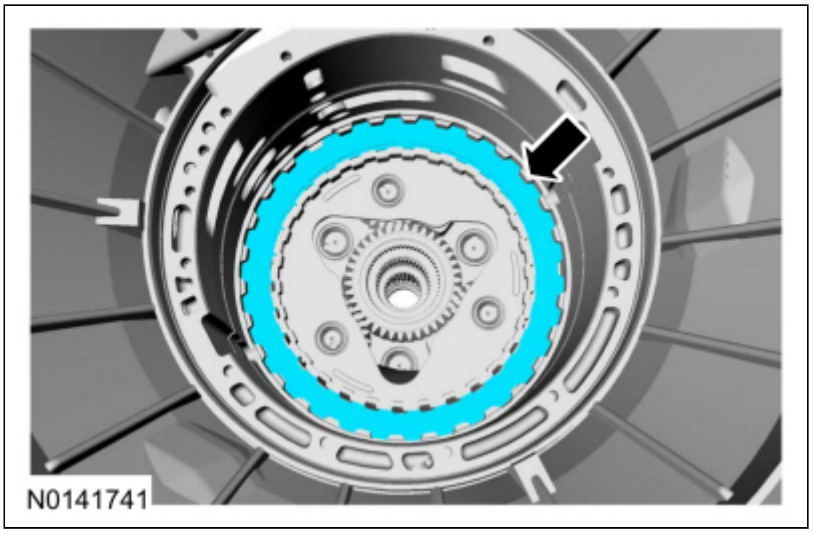


29. **NOTE:** *Friction and steel plate quantity are model dependent and vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.*

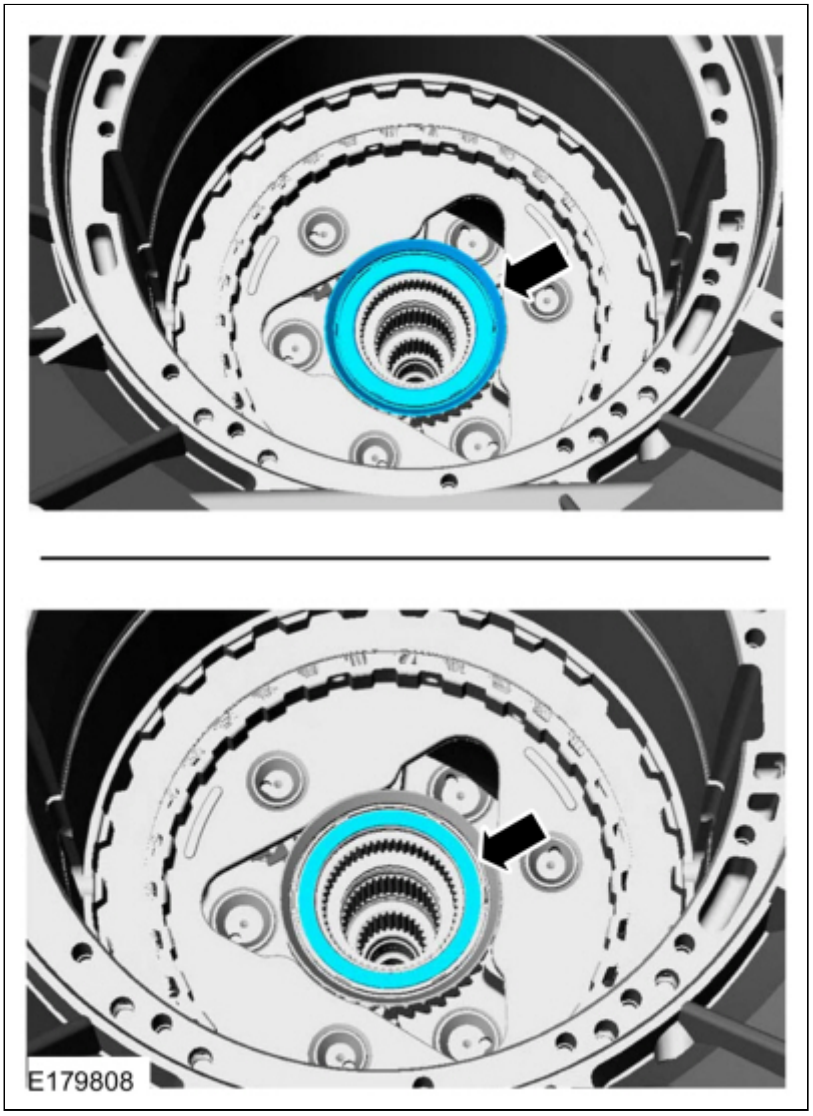
    Soak the new low/reverse clutch plates in clean automatic transmission fluid.
    Refer to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications).
    Material: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)



30. Install the low/reverse clutch plates, starting with the pressure plate and alternating between the friction and steel plates and ending with the wave spring plate on the top.
    Refer to: Specifications (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Specifications).

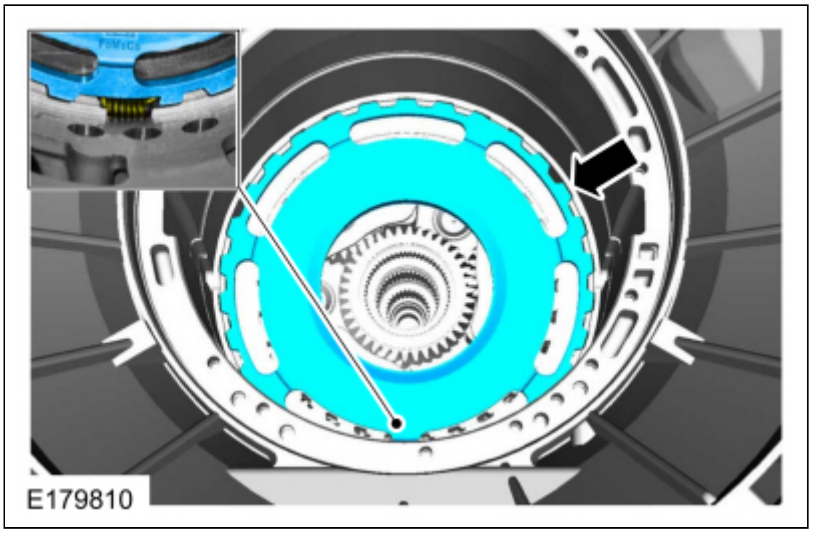


31. **NOTE:** *Inspect the T7 thrust bearing and selective shim for damage or scoring.*

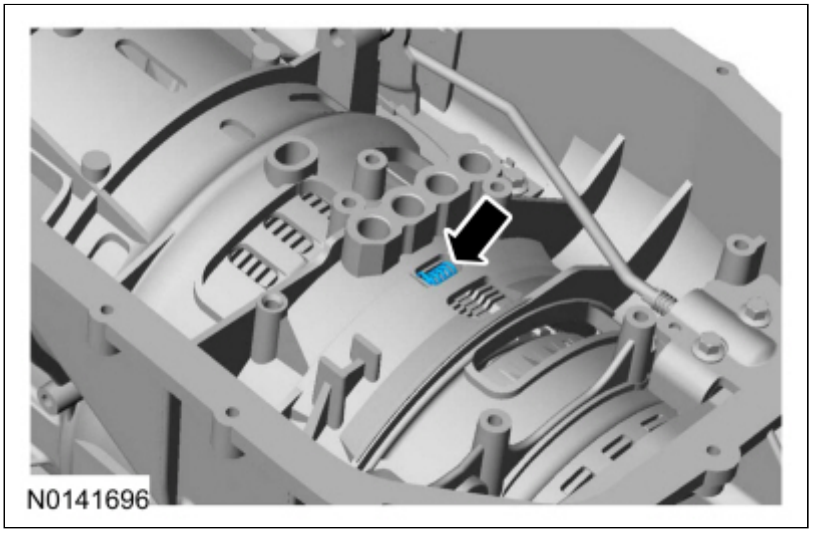


32. **NOTE:** *Align the One-Way Clutch in the transmission case so the bias spring fits into the transmission case.*

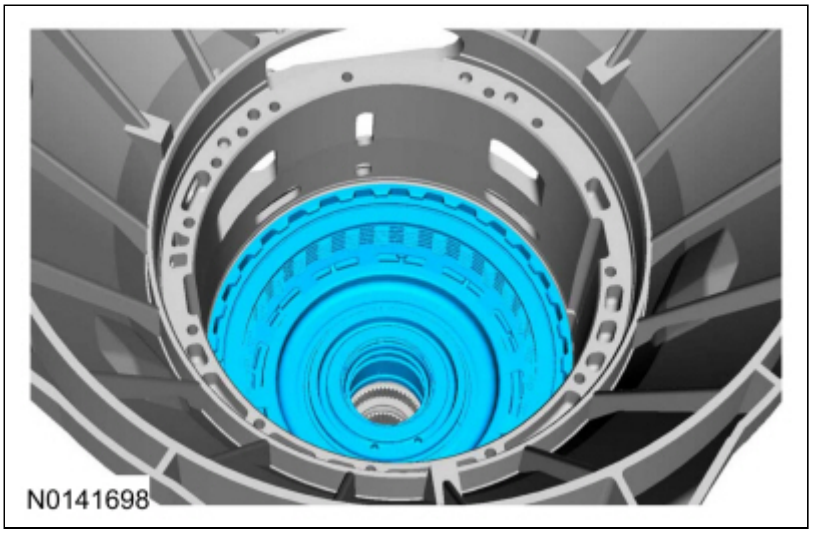
    Install the One-Way Clutch as shown so the bias spring can be installed as shown.



33.



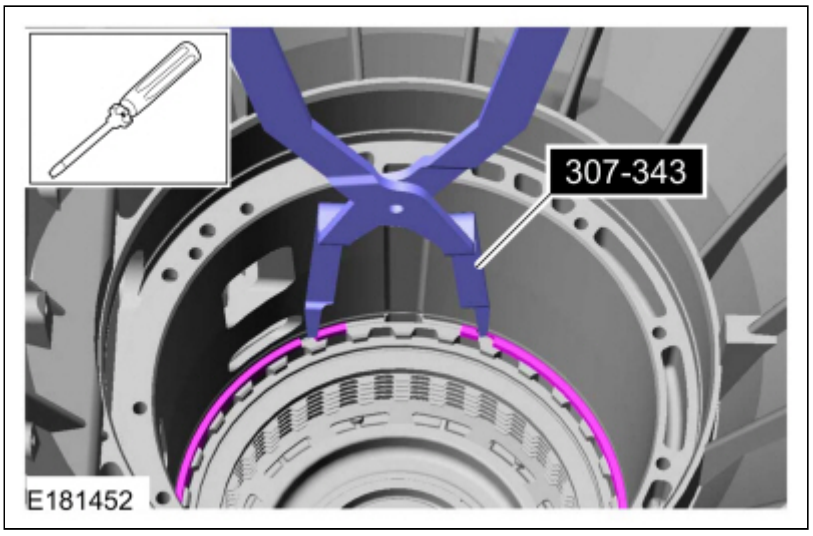
34. **NOTE:** *Make sure that when installing the center support the feed holes on the center support are lined up with the feed holes in the case.*



35. **NOTE:** *Install the snap ring with the beveled surface facing up and the snap ring gap in the 3 o'clock or the 9 o'clock position.*

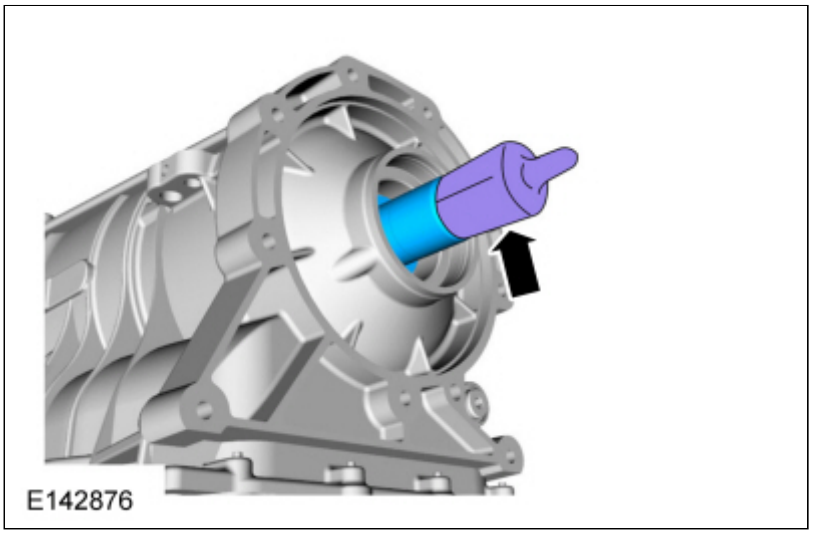
NOTE: *Rotate the component to a horizontal position.*

Using the Retaining Ring Pliers, install the center support snap ring. Using a suitable tool, be sure the snap ring is fully seated.
Use Special Service Tool: 307-343 Retaining Ring Pliers.
Use the General Equipment: Flat Headed Screw Driver

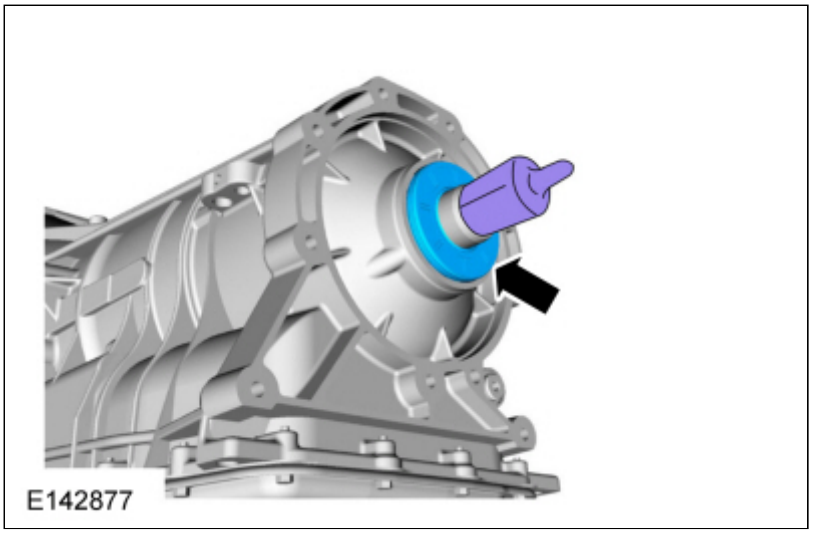


4x4

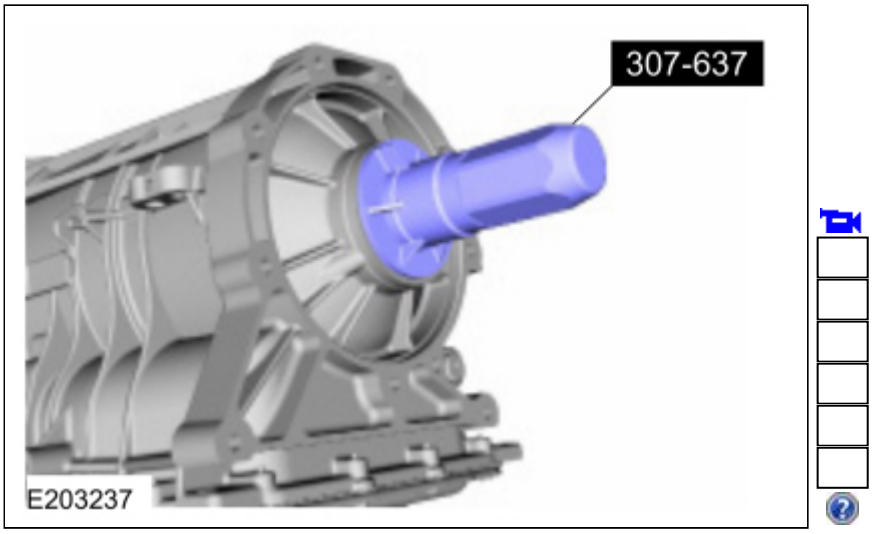
36. Install the seal protector provided with the new output shaft seal on the output shaft.



37. Slide the output shaft seal over the output shaft seal protector onto the output shaft. Remove the output shaft seal protector.

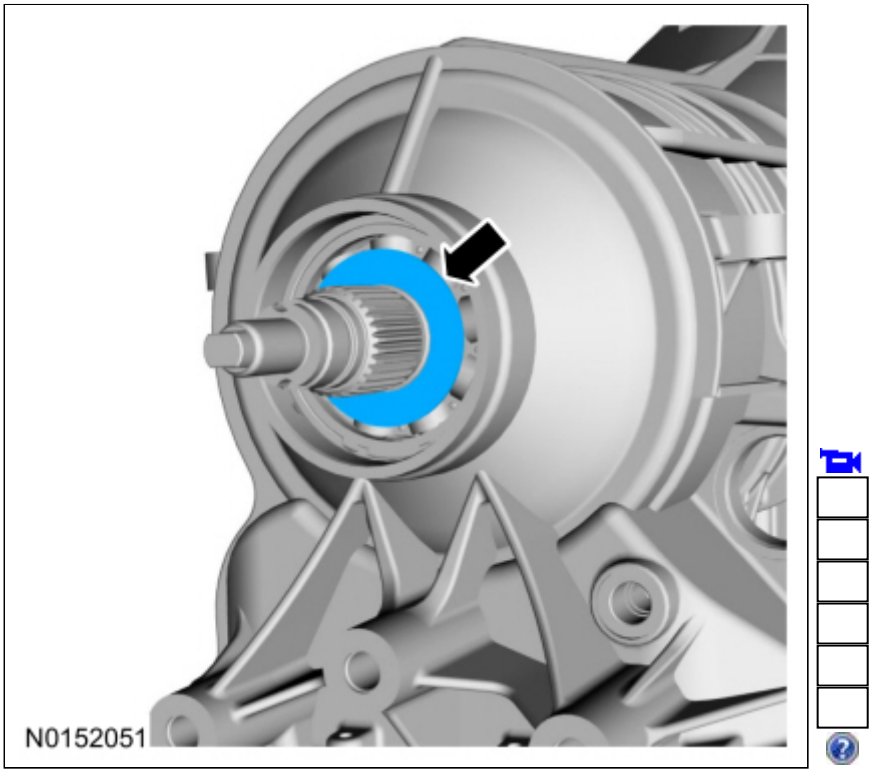


38. Use Special Service Tool: 307-637 Installer, Rear Seal, 4x4.

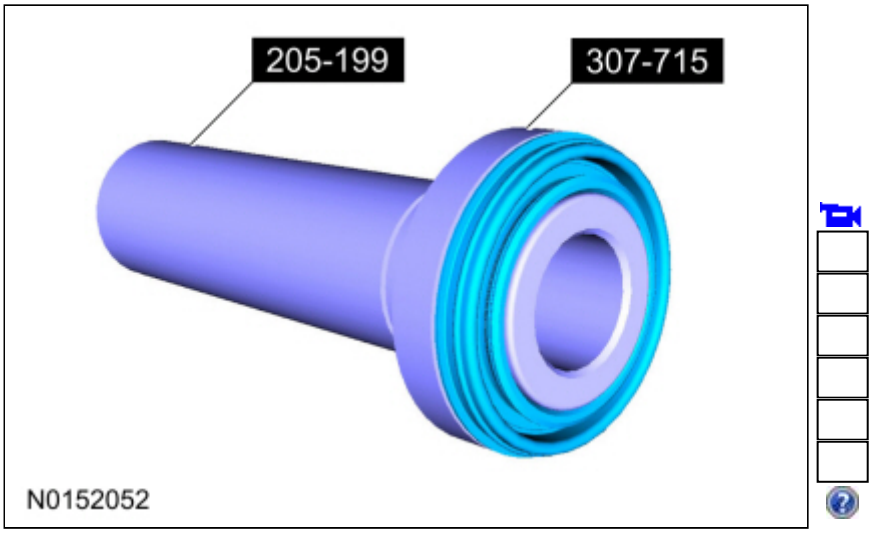


4x2

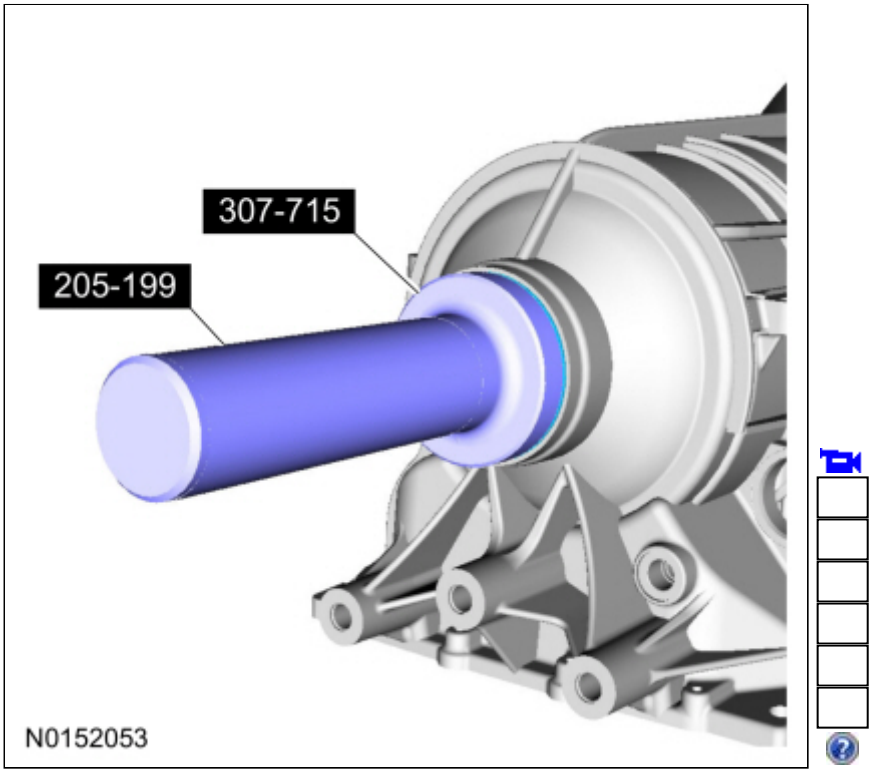
39. Rotate the transmission to the vertical position and install the slip plane washer.



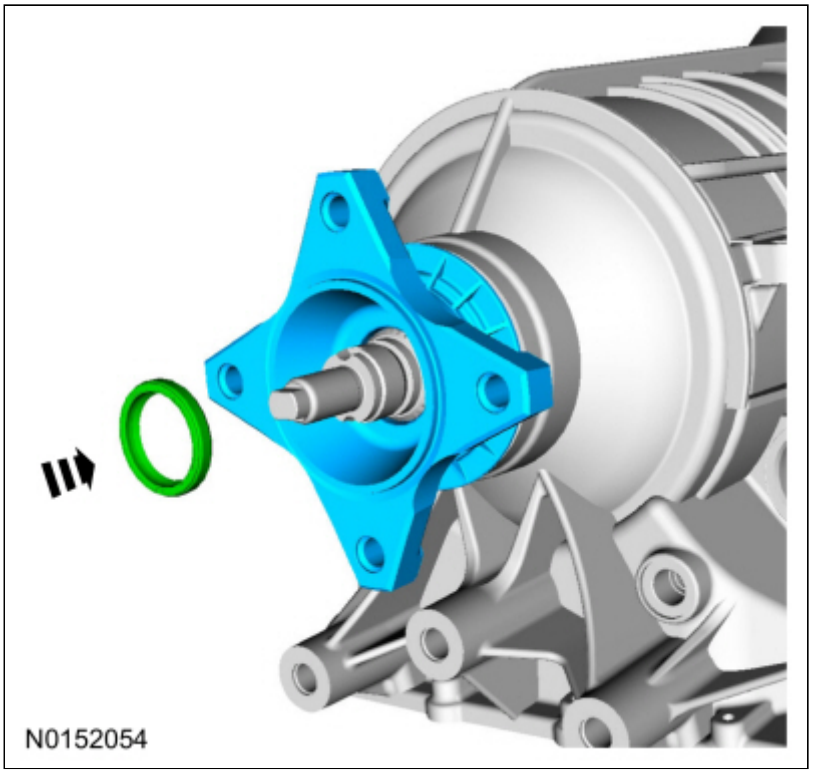
40. Position a new output shaft seal on the special tool.
    Use Special Service Tool: 205-199 (T83T-3132-A1) Installer, Spindle/Axle Shaft. , 307-715 Installer, Output Seal (4X2).



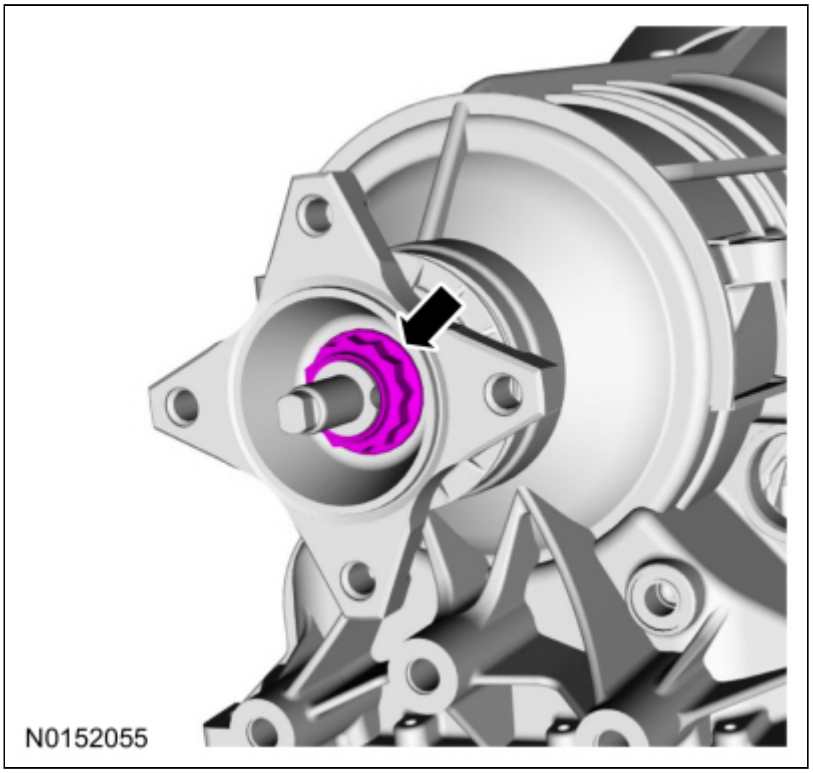
41. Using the special tools, install the output shaft seal.
    Use Special Service Tool: 205-199 (T83T-3132-A1) Installer, Spindle/Axle Shaft. , 307-715 Installer, Output Seal (4X2).



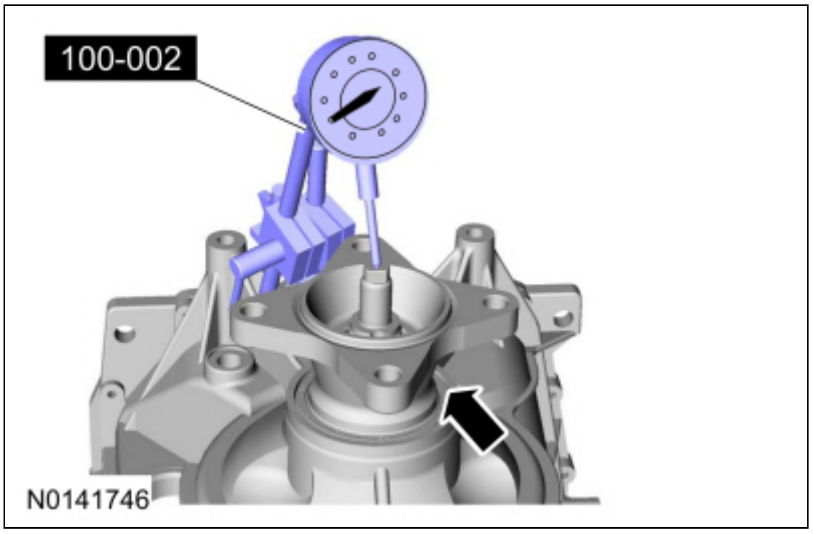
42.



43. **NOTE:** *Only tighten the nut finger tight at this stage.*



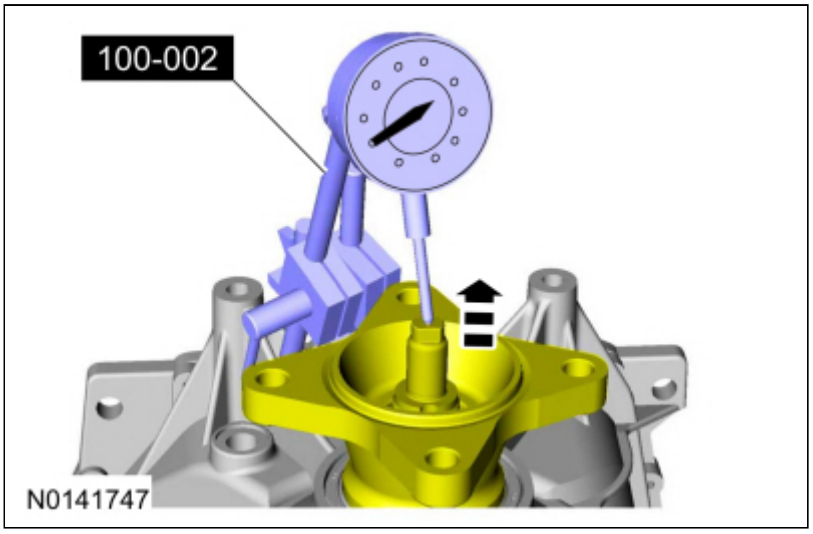
44. Install the Dial Indicator Gauge with Holding Fixture on the transmission case and position the plunger on the output shaft flange.
    Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



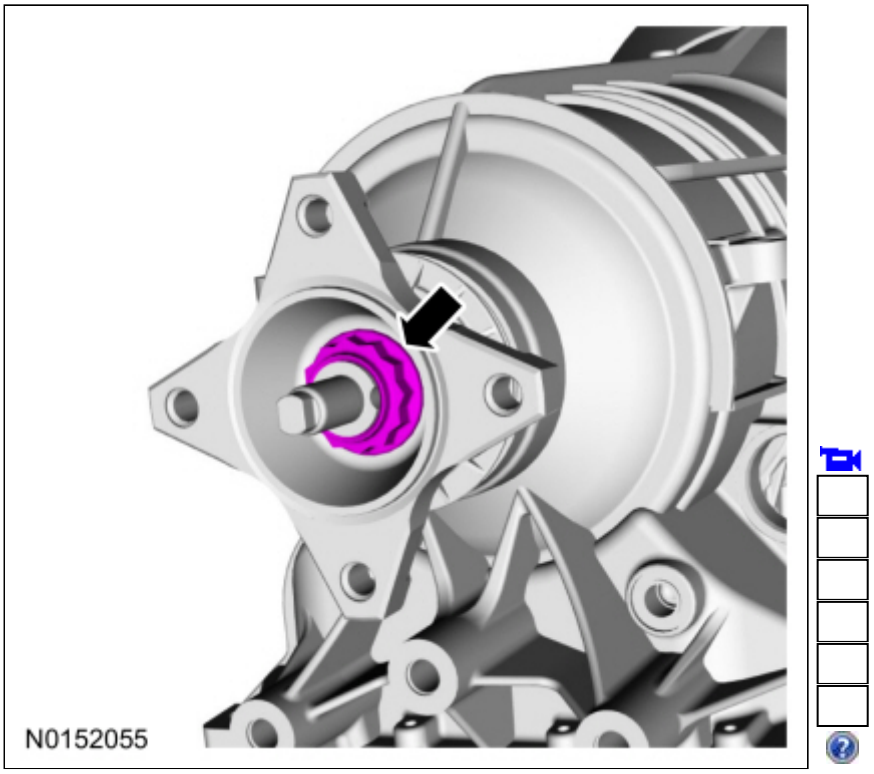
45. **NOTE:** *Only tighten the nut finger tight at this stage.*

    NOTE: *If the reading is not within the specification, install a different (either thinner or thicker) select fit thrust gear shim.*

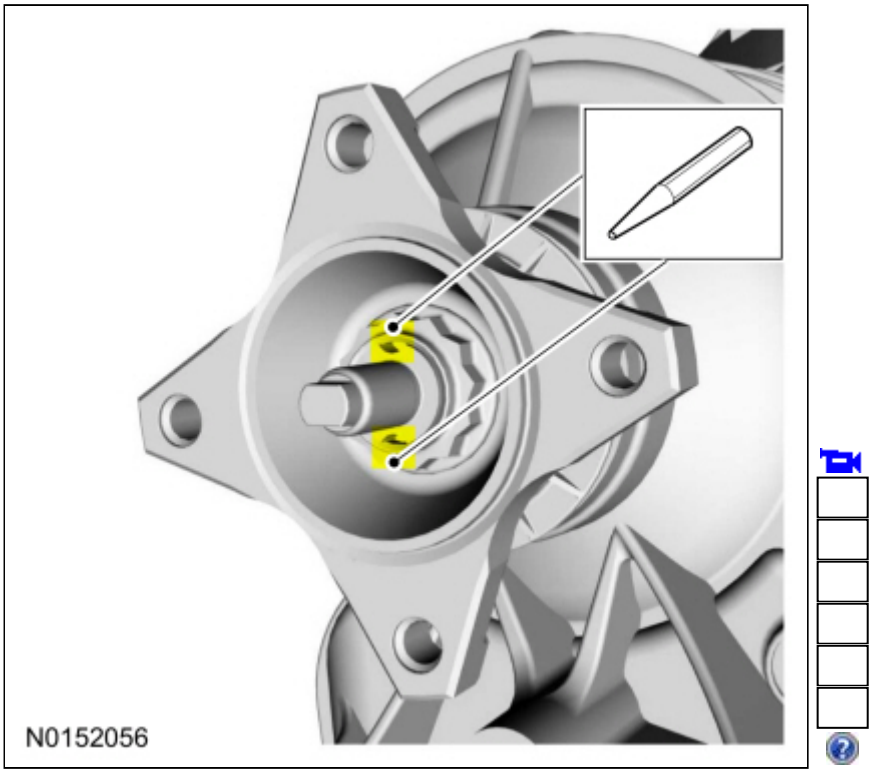
    Using the Dial Indicator Gauge with Holding Fixture, lift up on the output shaft flange and record the reading. .
    The reading should be within 0.6-0.9 mm.
    Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



46. *Torque*: 80 Nm

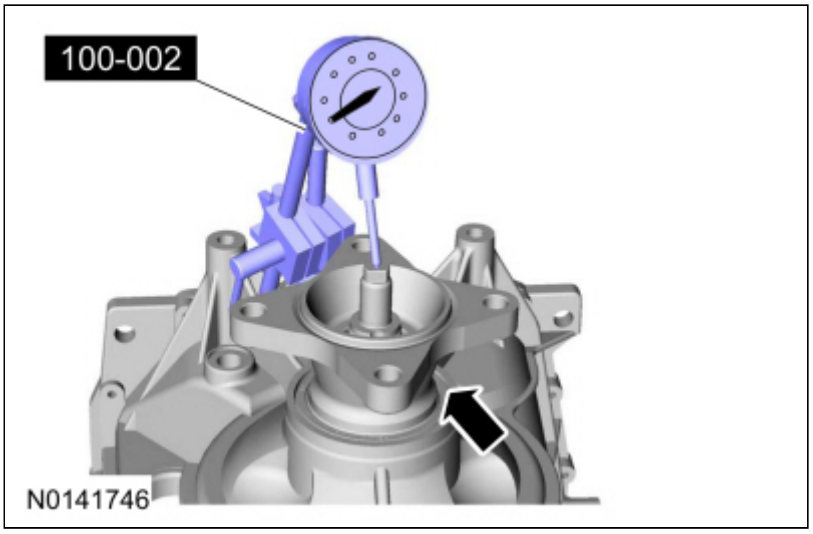


47. After installing the new output shaft flange retaining nut, stake the slots to prevent it from coming loose.
    Use the General Equipment: Punch



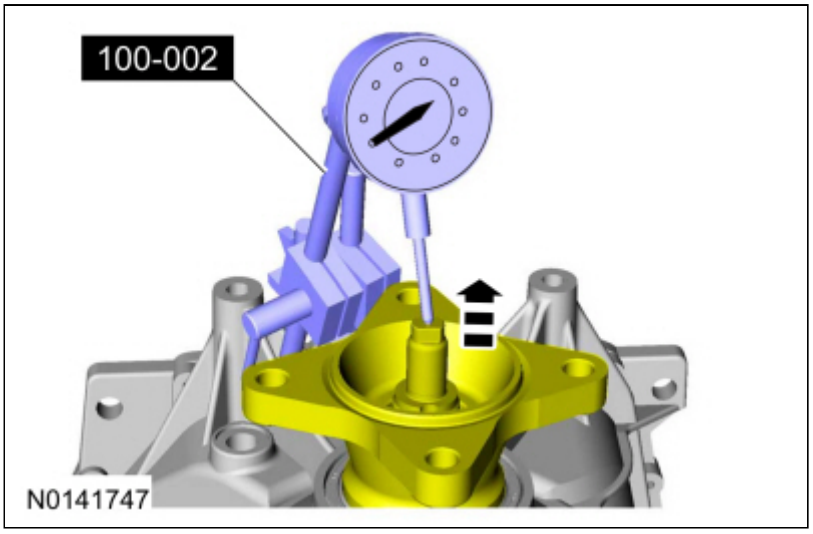
4x4

48. Install the Dial Indicator Gauge with Holding Fixture on the transmission case and position the plunger on the output shaft.
    Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.



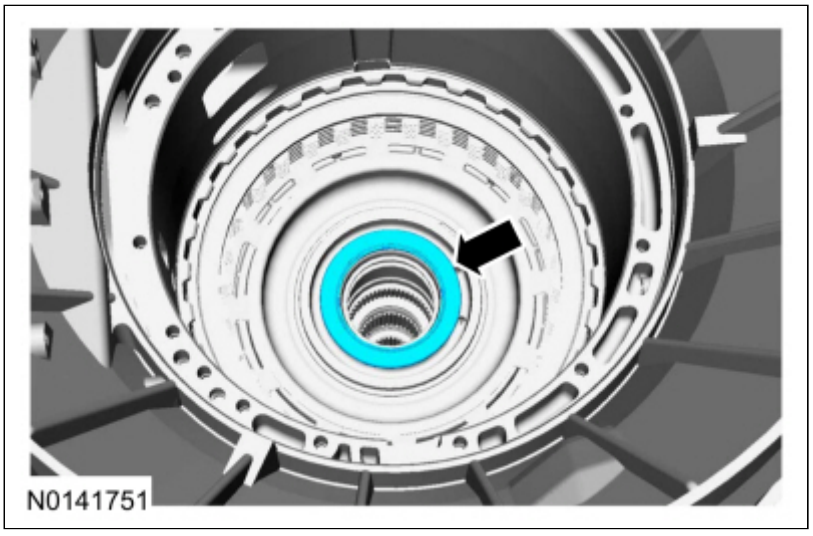
49. **NOTE:** *Loosely install the flange nut or an inaccurate reading may be recorded.*

    Lift up on the output shaft flange and record the reading. The reading should be within 0.6-0.9 mm (0.024-0.035 in). If the reading is not within specification, install a different (either thinner or thicker) rear planetary gearset selective shim.
    Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge.

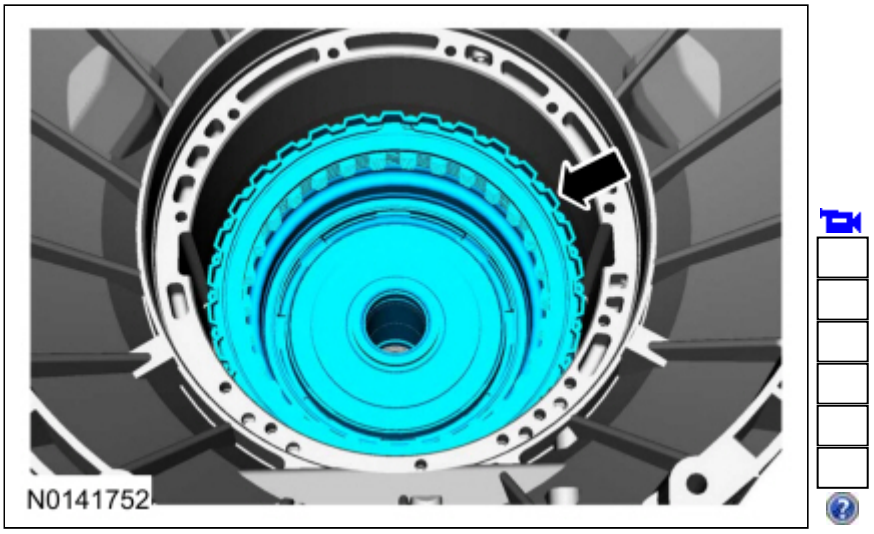


All vehicles

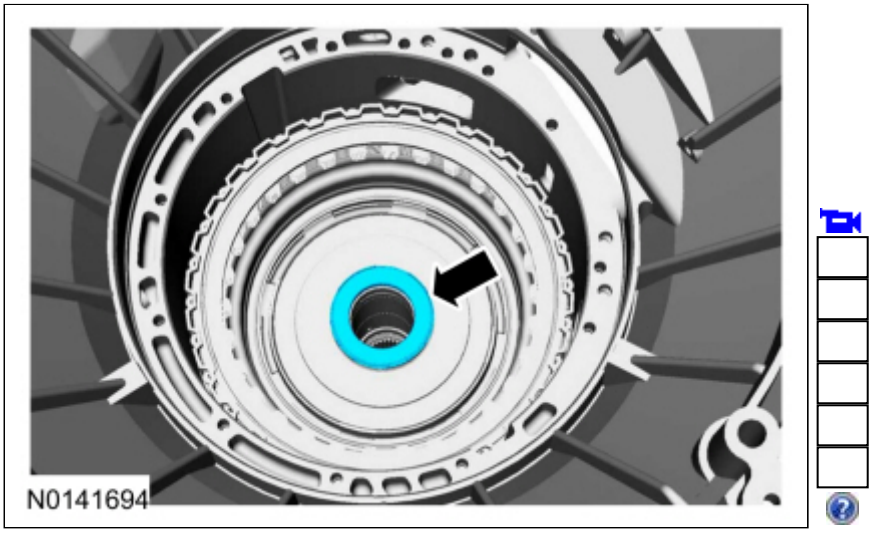
50. Rotate the transmission in the vertical position with the torque converter housing facing up and install the T6 bearing.



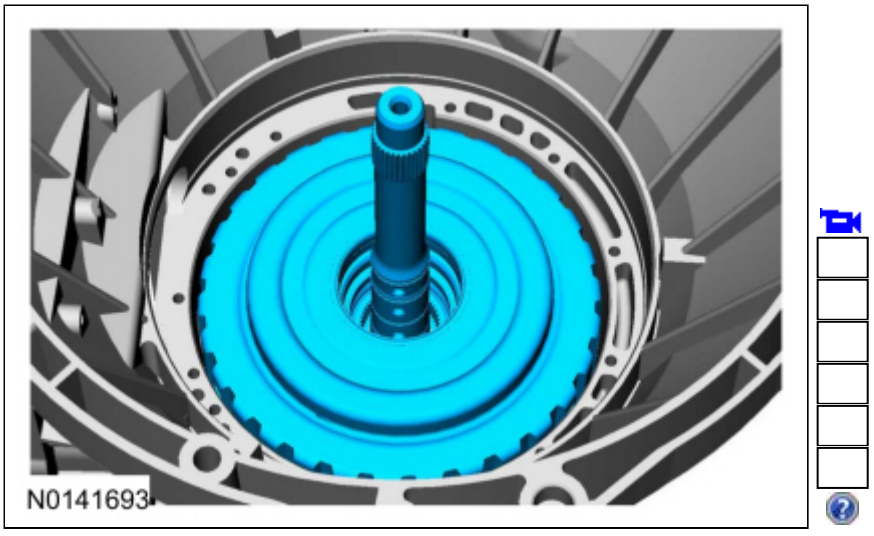
51. Install the direct (B) clutch assembly.



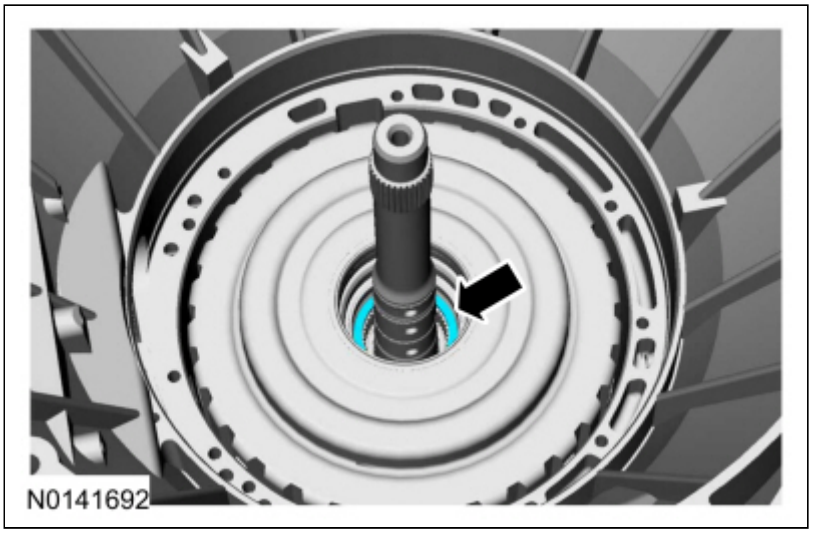
52. Install the T5 roller bearing on the direct (B) clutch assembly.



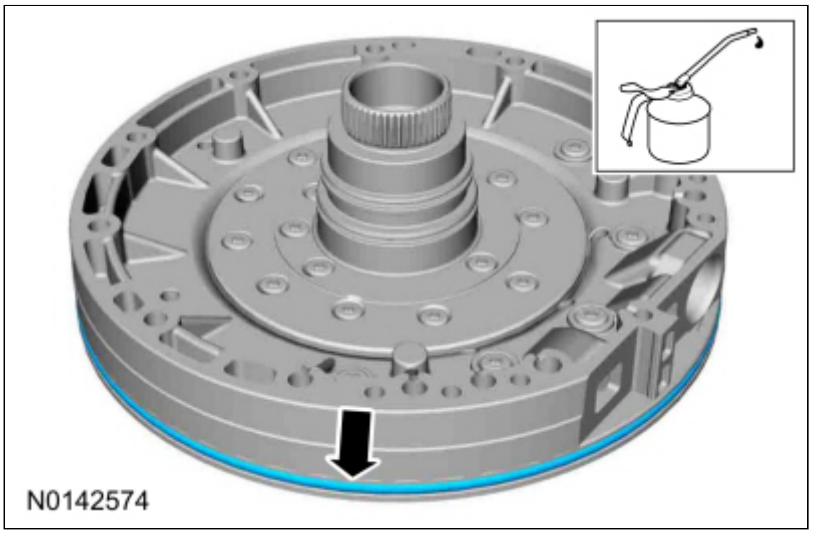
53. Install the forward (A)/overdrive (E) clutch assembly.



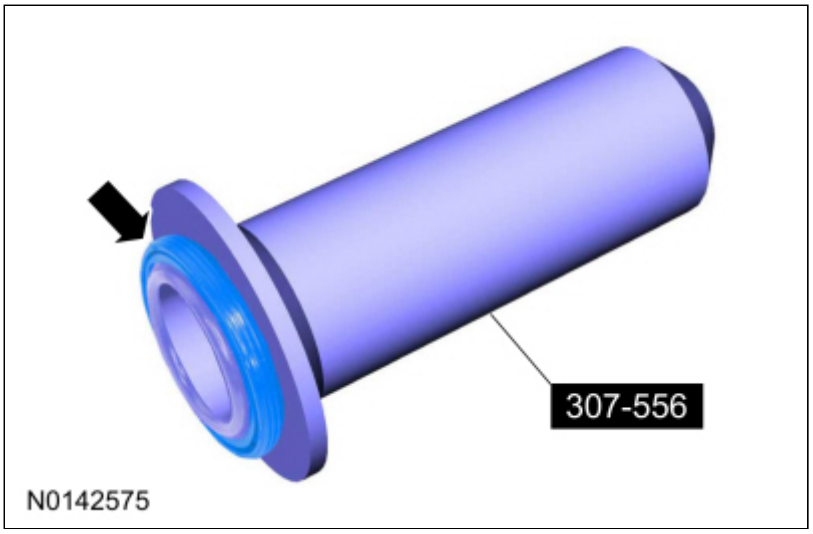
54. Install the selective shim.



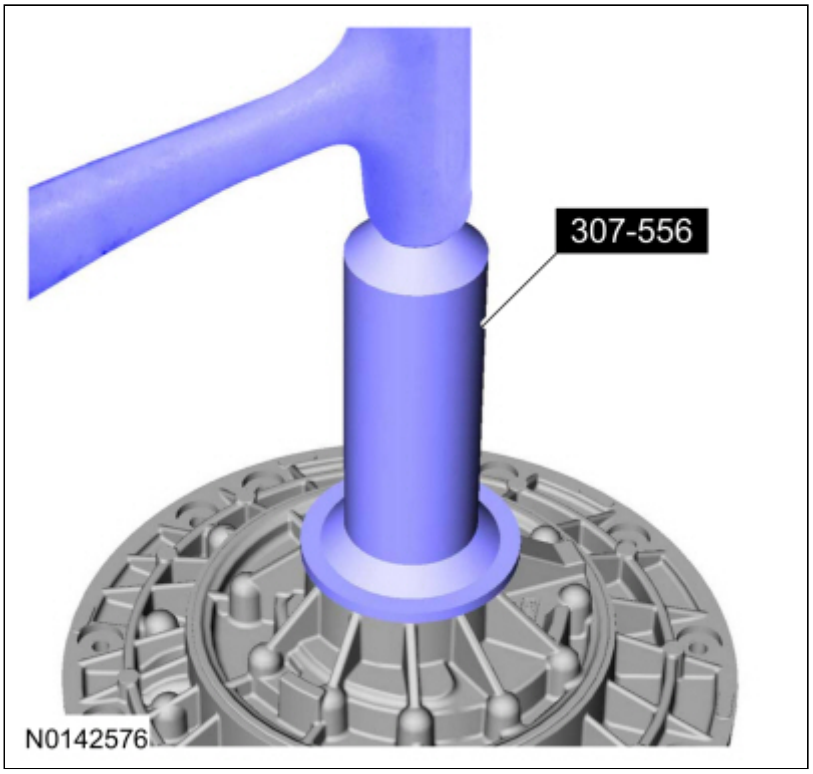
55. If the front pump was not disassembled and assembled, install a new front pump O-ring seal and lubricate it with petroleum jelly.



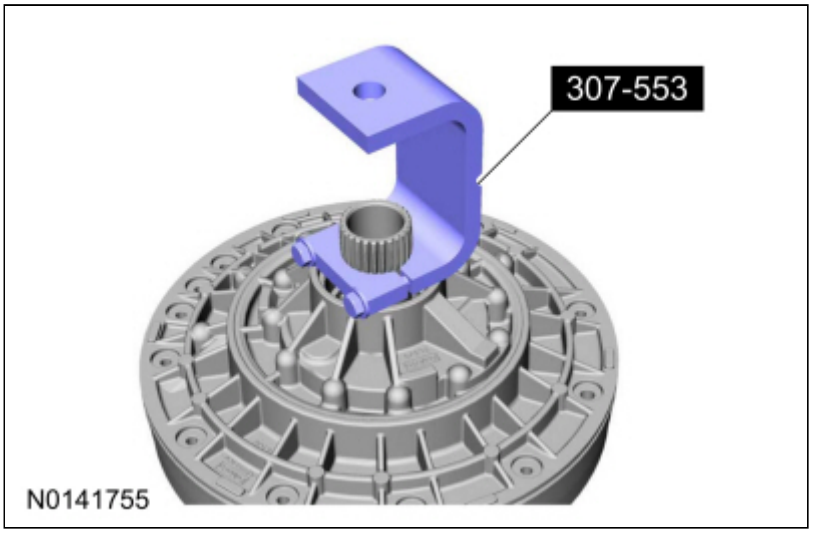
56. Install a new front pump seal on the Fluid Pump Seal Installer.
Use Special Service Tool: 307-556 Installer, Fluid Pump Seal.



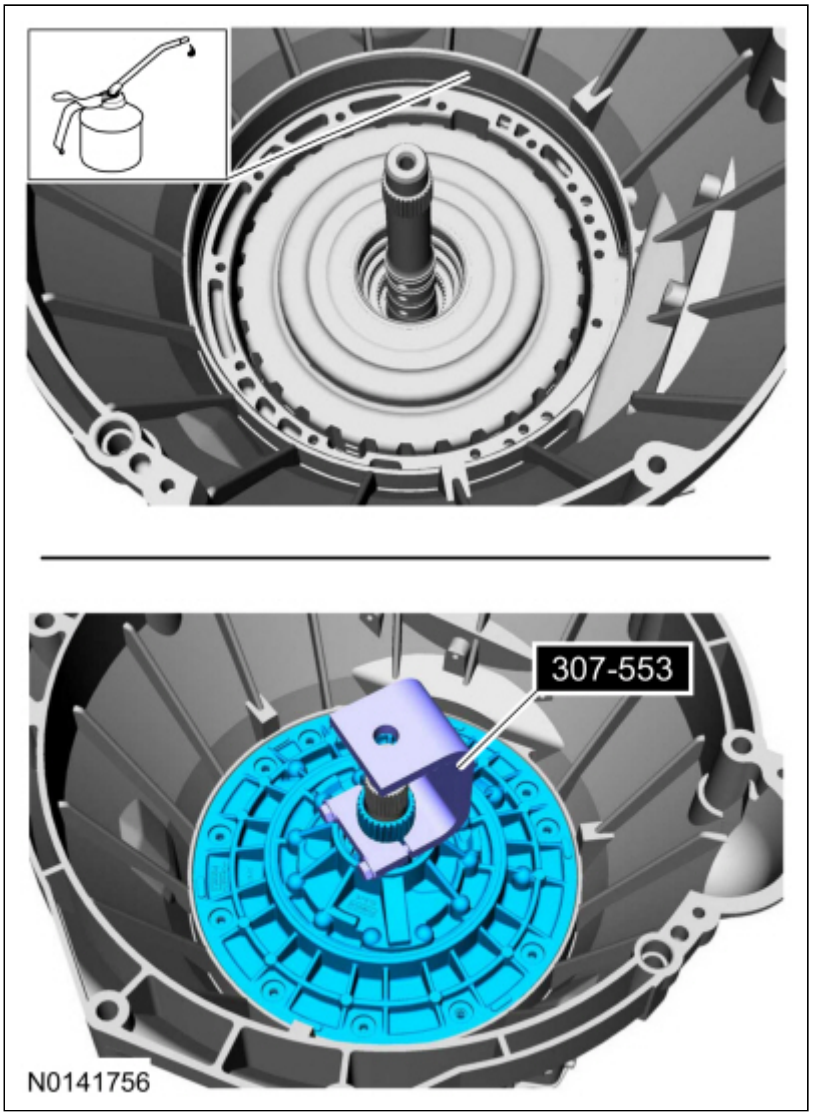
57. Using the Fluid Pump Seal Installer, install the front pump seal.
Use Special Service Tool: 307-556 Installer, Fluid Pump Seal.



58. Install the Transmission Fluid Pump Remover on the front pump.
    Use Special Service Tool: 307-553 Remover, Transmission Fluid Pump.

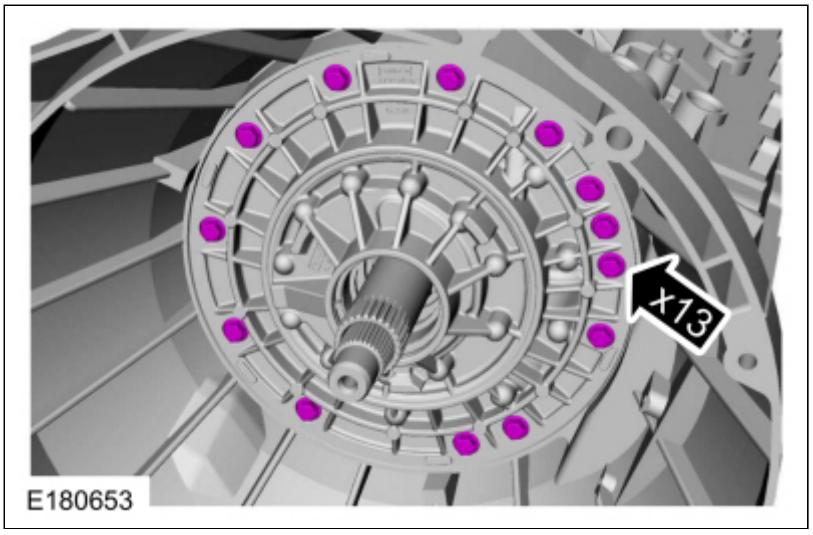


59. Lubricate the transmission case pump bore with petroleum jelly. Using the Transmission Fluid Pump Remover, position the pump assembly in the case and rotate the pump to insert the pump splines into the front planetary sun gear. Rotate the pump to align the pump-to-case bolts and push the pump into the case.
    Use Special Service Tool: 307-553 Remover, Transmission Fluid Pump.

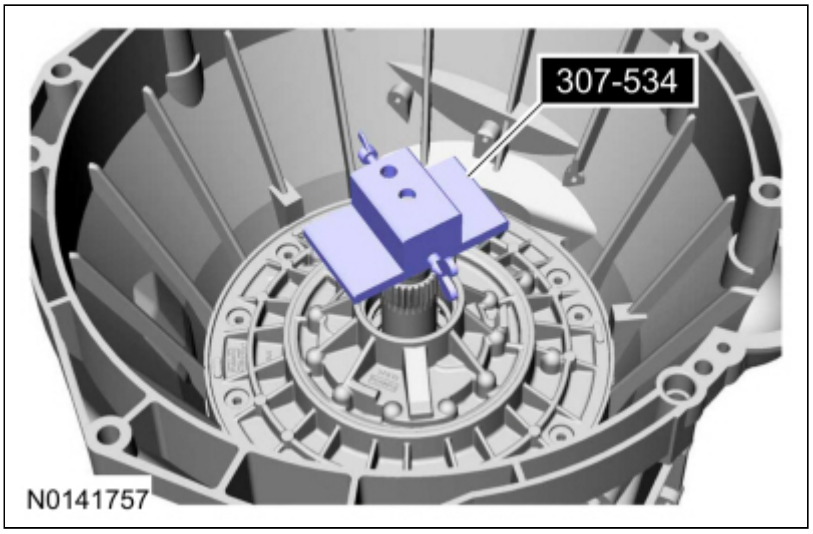


60. **NOTICE: Failure to replace the fasteners will result in transmission fluid leakage.**

    Install new front pump-to-case bolts and washers. Tighten in a crisscross pattern.
    Torque: 10 Nm

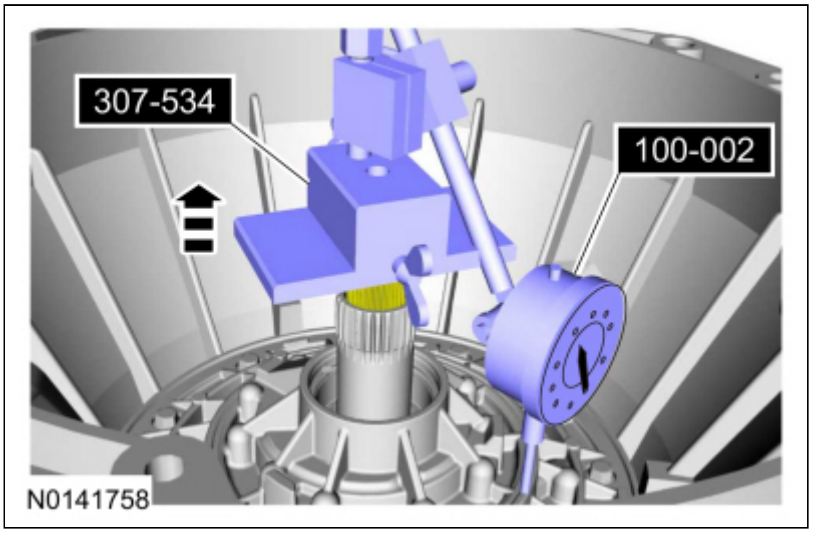


61. Install the special tool on the input shaft.
    Use Special Service Tool: 307-534 End Play Gauge, Transmission.



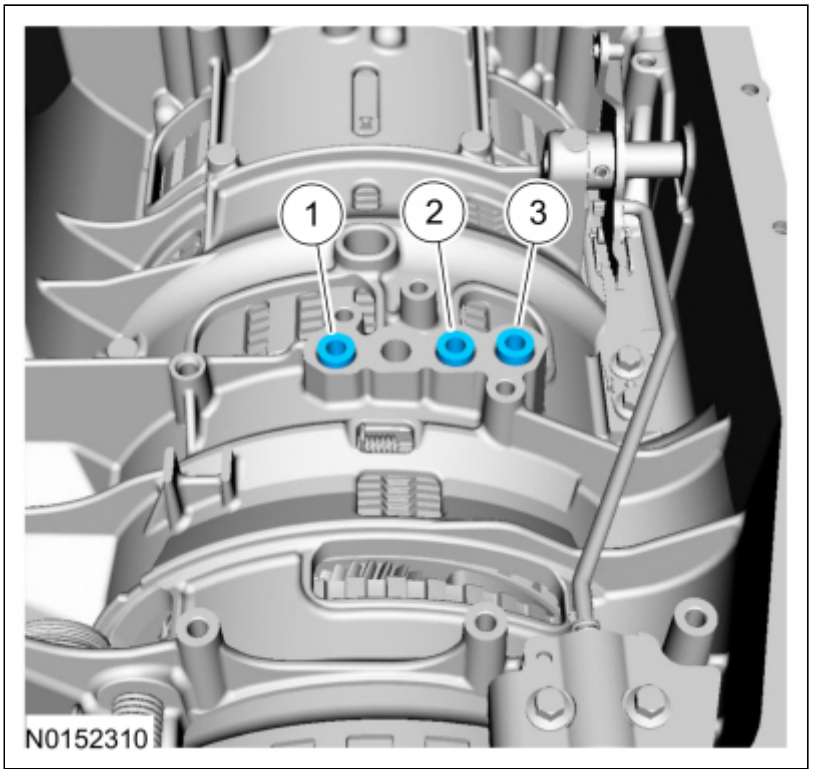
62. **NOTE:** *Install the Dial Indicator Gauge with Holding Fixture on the Transmission End Play Gauge.*

- Push down on the Transmission End Play Gauge and zero the Dial Indicator Gauge.
- Lift up on the Transmission End Play Gauge and record the measurement on the Dial Indicator Gauge. The measurement should be between 0.2-0.4 mm (0.008-0.015 in). If the measurement is not within specification, install a new selective front pump shim.
- Measure the original shim, install a thinner or a thicker shim to achieve the correct measurement. Use Special Service Tool: 100-002 (TOOL-4201-C) Holding Fixture with Dial Indicator Gauge. , 307-534 End Play Gauge, Transmission.



63. **NOTE:** *The green (7G087) center support feed tube seal may be replaced with an orange (7G087) center support feed tube seal.*

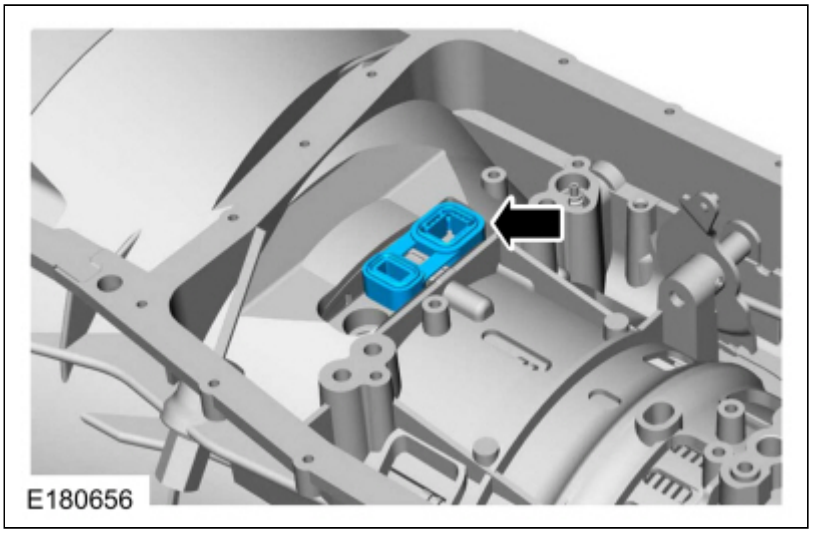
1. Install a new center support feed tube seal (7G199 Black).
2. Install a new center support feed tube seal (7G087 Green or Orange).
3. Install a new center support feed tube seal (7G084 Blue).



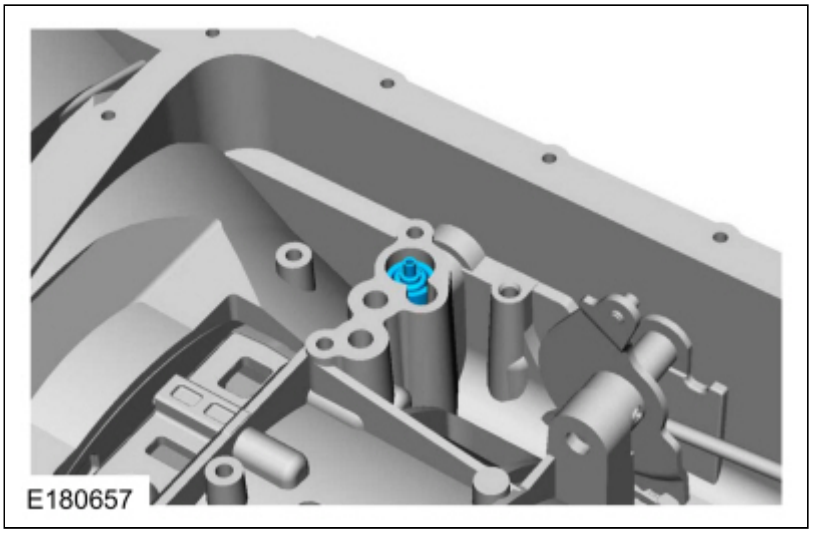
64. **NOTE:** *Make sure the transmission fluid filter seal has been removed. If it has not, use a suitable pick and remove the seal.*

    NOTE: *Add 0.118L (4 oz) of clean transmission fluid to prime the pump.*

    Install the front pump adapter seal and prime the fluid pump.

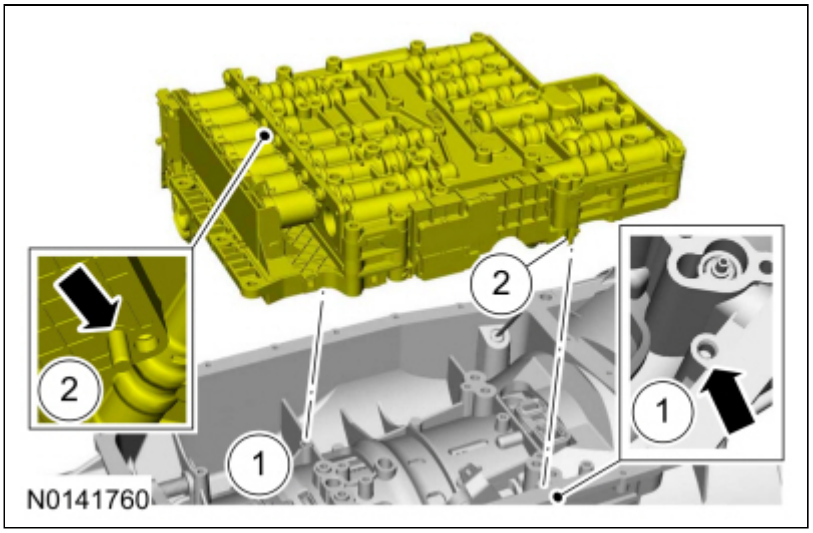


65. Install the thermal bypass valve into the case.



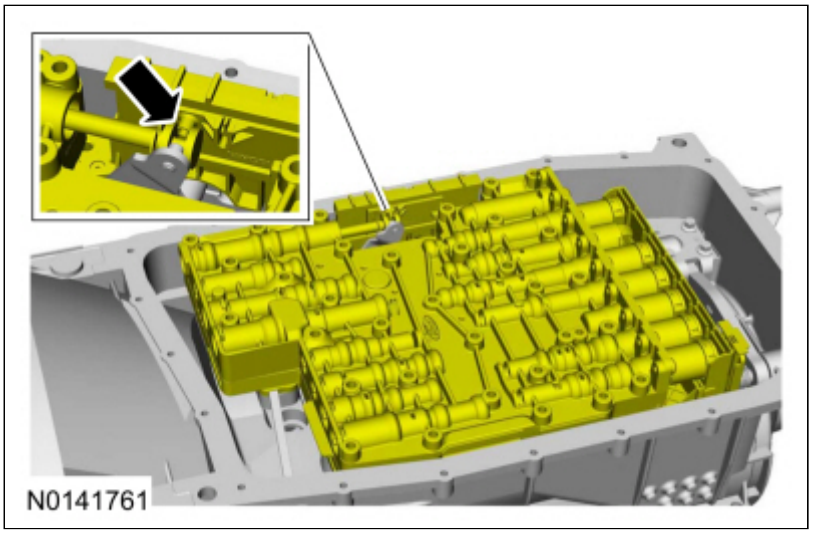
66. **NOTE:** *Align the guide pins in the alignment holes in the transmission case and position the mechatronic assembly in place.*

    1. Alignment holes
    2. Guide pins

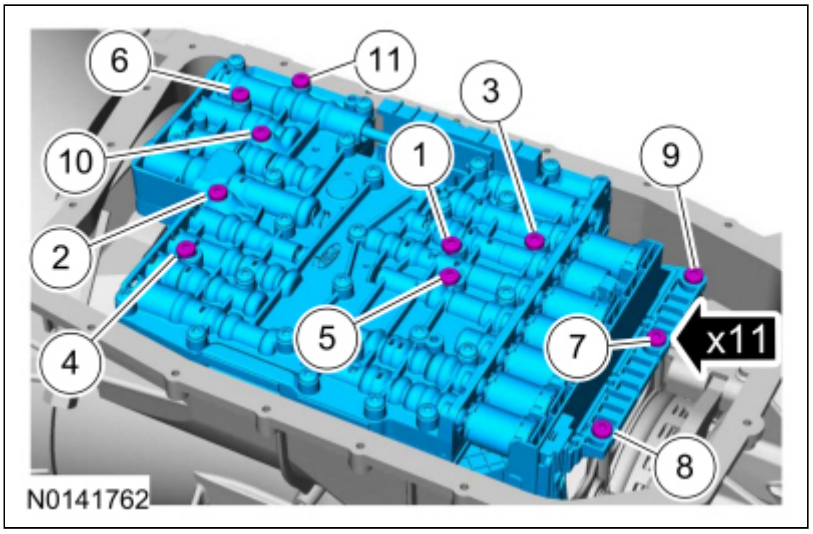


67. **NOTE:** *Tightening the bolts will pull the mechatronic assembly toward the case.*

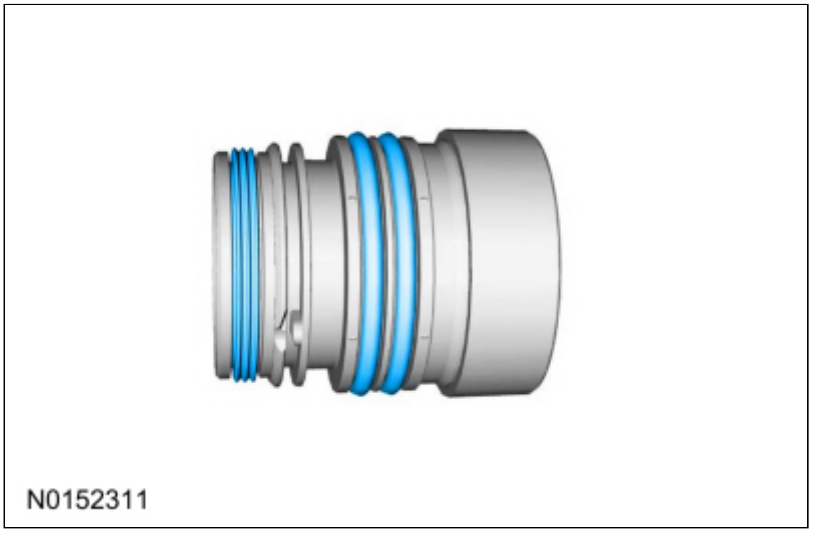
    Slightly lift the mechatronic assembly and align the manual valve in the manual valve linkage and position the mechatronic assembly in place.



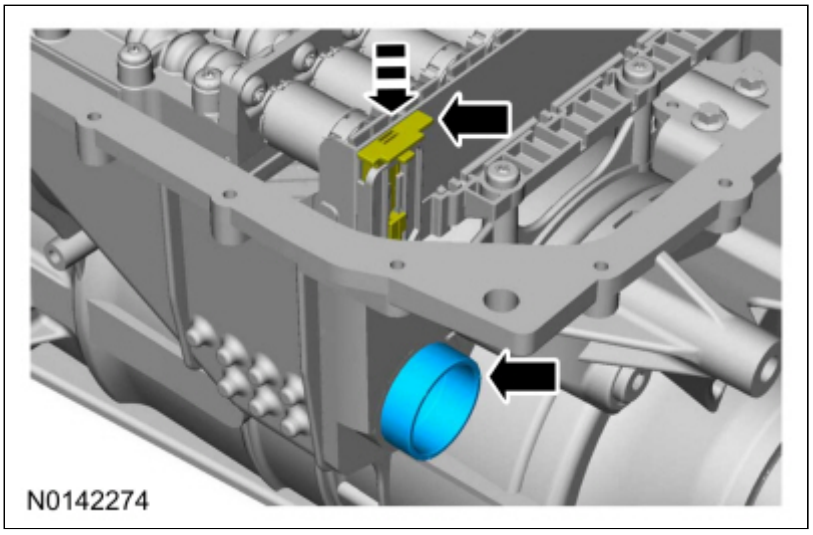
68. Install the mechatronic assembly bolts and tighten in the sequence shown.
    Torque: 8 Nm



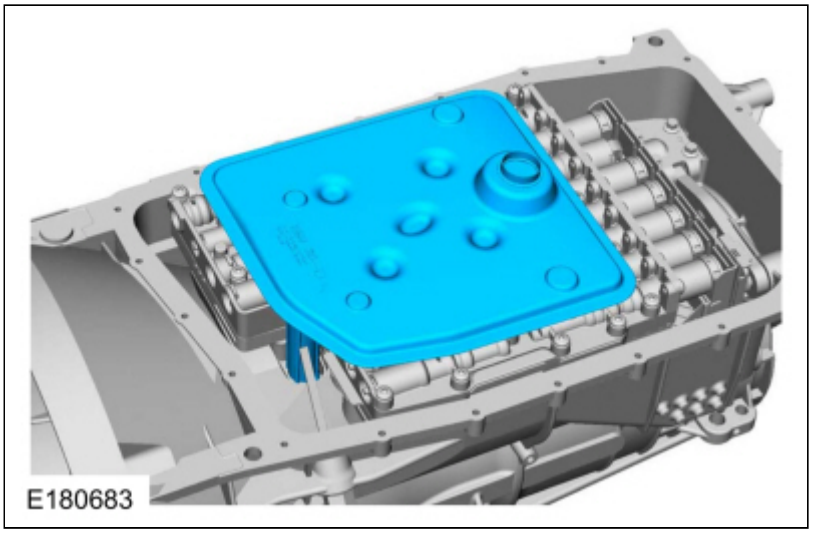
69. If removed, install the bulkhead connector sleeve seals.



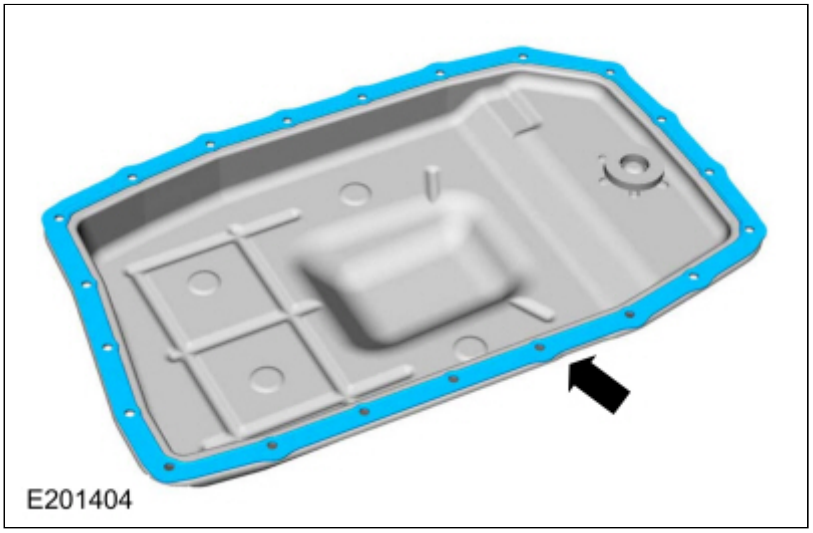
70. With the release tab up and unlocked, push the outer shell of the bulkhead electrical connector into the transmission. Make sure the bulkhead connector is fully seated into the molded leadframe. Press down on the tab and lock the outer shell of the bulkhead electrical connector in place. Make sure the locking tab is securely locked.
Torque: 8 Nm



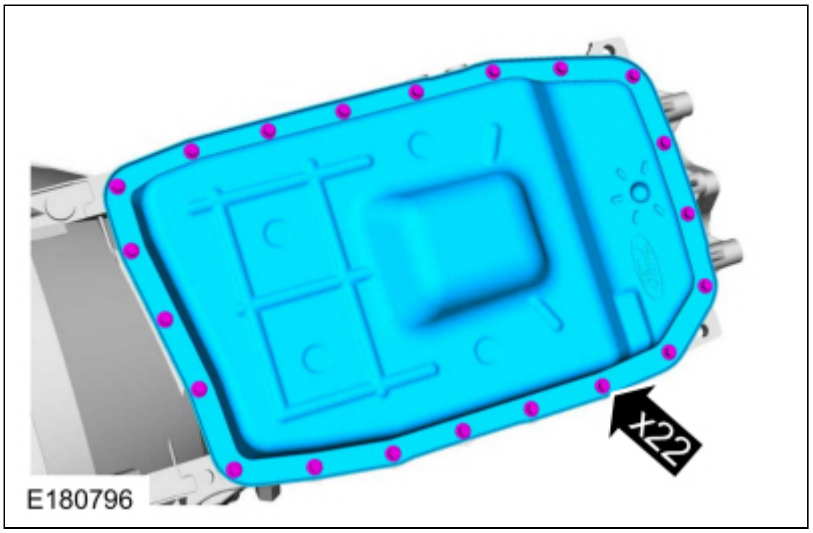
71. Install a new transmission fluid filter.



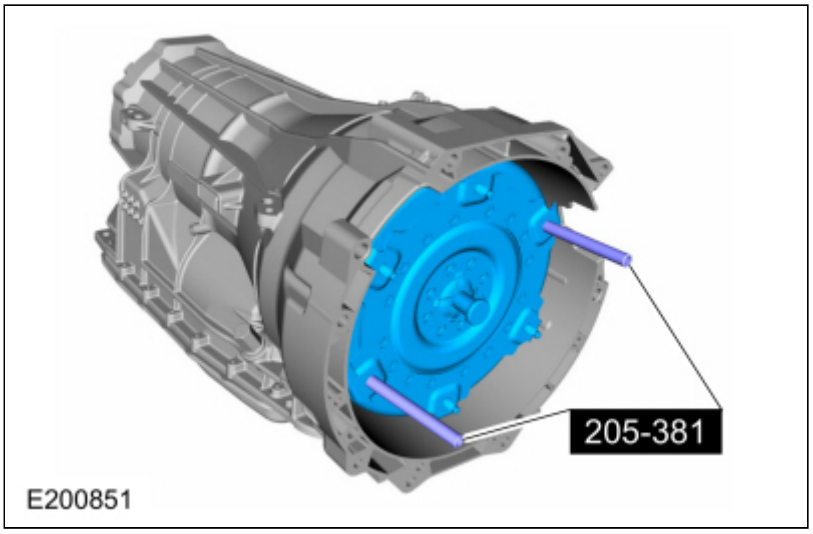
72. **NOTE:** *The fluid pan gasket can be reused if not damaged.*



73. Install the transmission fluid pan and transmission fluid pan bolts. Tighten in a crisscross pattern.
    Torque: 12 Nm



74. Use Special Service Tool: 307-091 Handle, Torque Converter.



Copyright © 2016 Ford Motor Company

Transmission - 4x2

Base Part Number: 7000

1. To install the transmission assembly.
   Refer to: Transmission - Emission Requirements: EURO Stage V LDT/EURO Stage VI, LHD RWD/RHD RWD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
   Refer to: Transmission - LHD RWD/RHD RWD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Copyright © 2016 Ford Motor Company

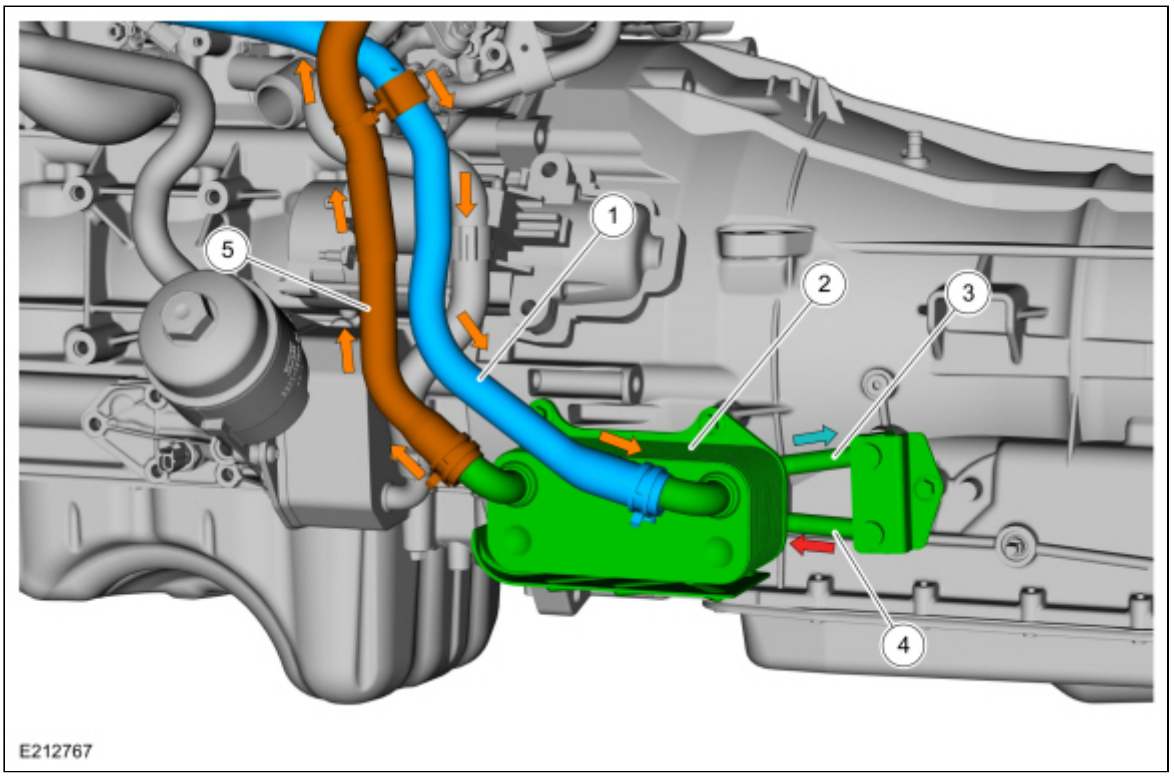
Transmission - 4x4

Base Part Number: 7000

1. To install the transmission assembly.
   Refer to: Transmission - Emission Requirements: EURO Stage V LDT/EURO Stage VI, LHD 4WD/RHD 4WD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
   Refer to: Transmission - LHD 4WD/RHD 4WD (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

Copyright © 2016 Ford Motor Company

Transmission Cooling - Component Location

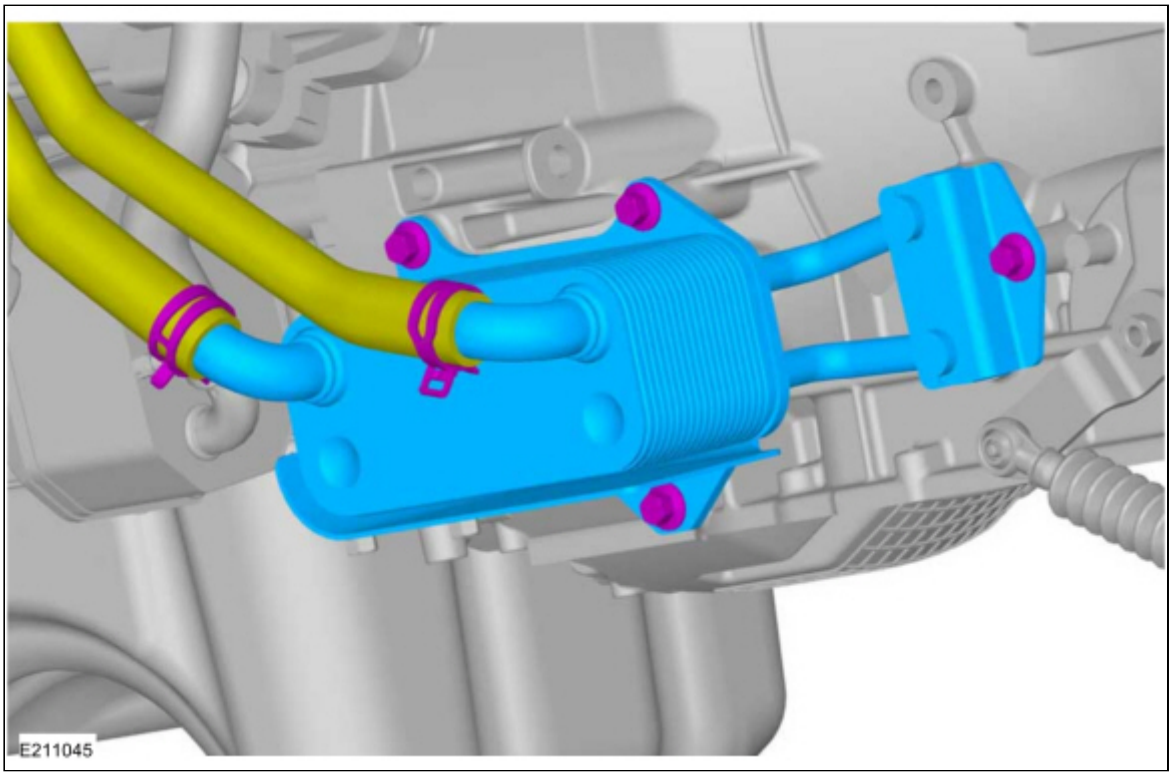


Item	Description
1	Transmission fluid cooler inlet tube
2	Transmission fluid cooler
3	Transmission fluid inlet tube
4	Transmission fluid outlet tube
5	Transmission fluid cooler outlet tube

Copyright © 2016 Ford Motor Company

Transmission Cooling - Overview

6R80 Automatic Transmission Cooling



Vehicles with an automatic transmission are equipped with an external transmission fluid cooler. The transmission fluid cooler is an oil to water fluid cooler which is mounted to the side of the transmission. The transmission fluid travels from the transmission into cooler and back in the transmission. The transmission fluid cooler transfers heat from the transmission fluid to coolant passing through the cooler from the engine cooling system via two coolant hoses. This is the same setup with all the engine types.

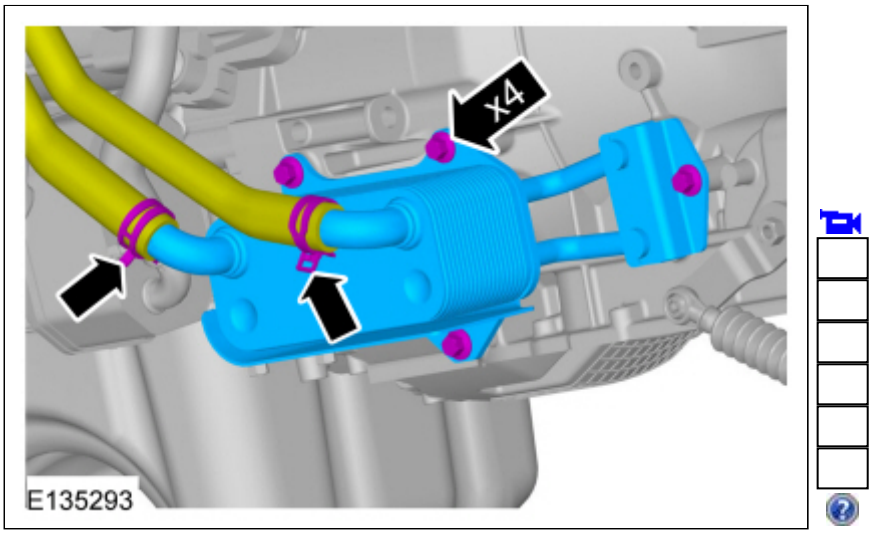
Copyright © 2016 Ford Motor Company

Transmission Fluid Cooler

Base Part Number: 7A095

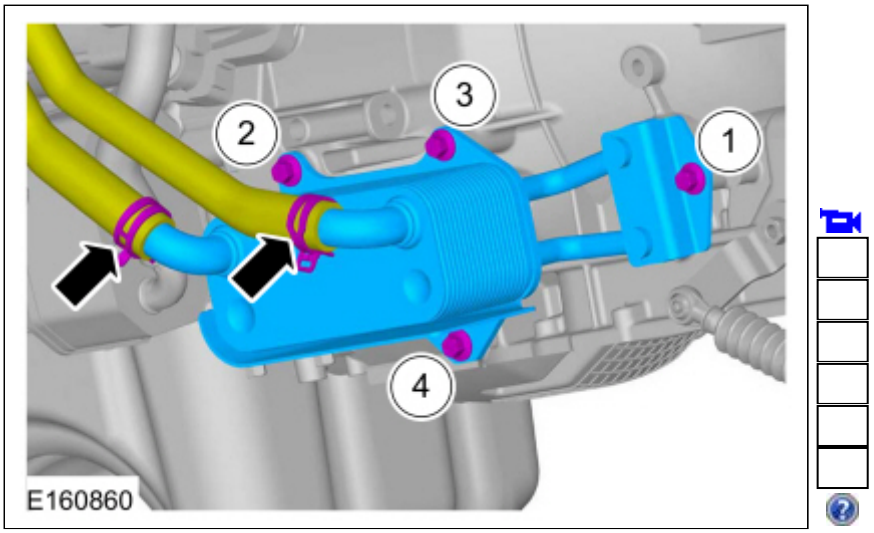
Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTICE: Make sure that all openings are sealed.**

   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .
3. 

Installation

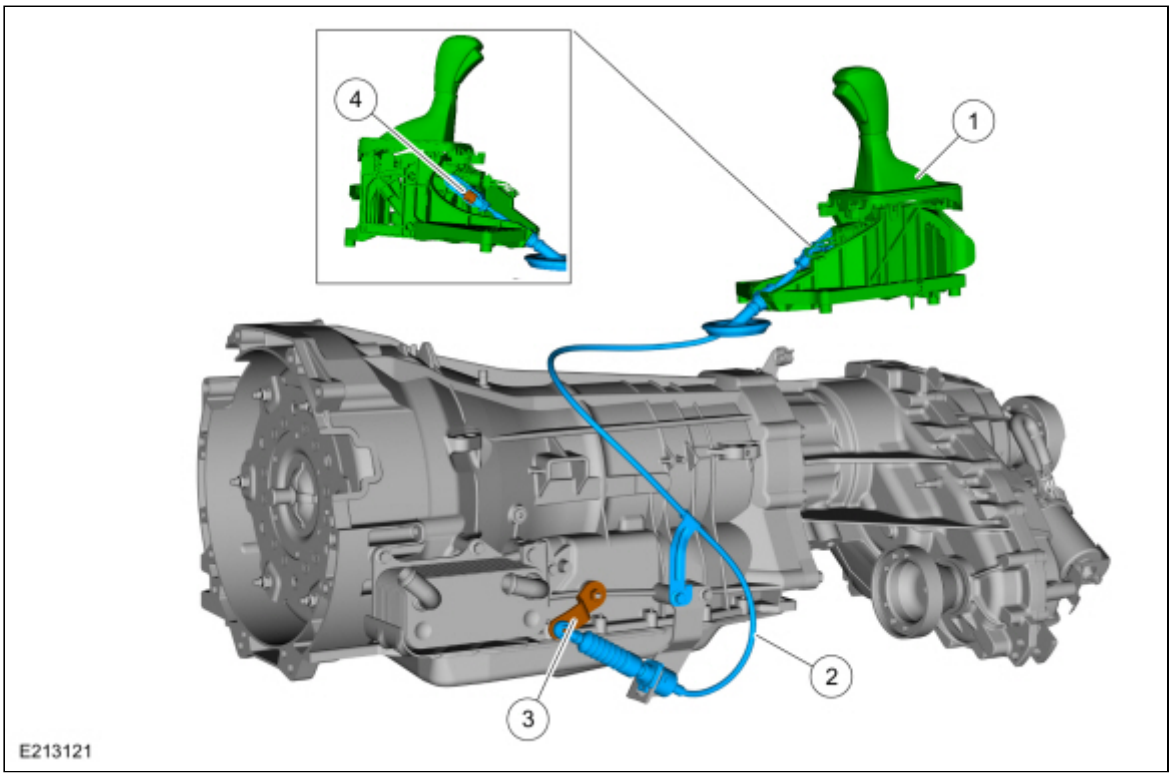
1. *Torque*: 20 Nm



2. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).
   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission - Vehicles With: 6-Speed Automatic Transmission - 6R80) .

Copyright © 2016 Ford Motor Company

External Controls - Component Location



Item	Part Number	Description
1	—	Shifter assembly
2	—	Selector lever cable
3	—	Lever assembly - Transmission main control
4	—	Selector lever cable adjuster lock

Copyright © 2016 Ford Motor Company

External Controls - Overview

Automatic Transmission External Controls



Vehicles with automatic transmissions are equipped with a floor shift selector lever.

The transmission selector lever linkage consists of:

- Selector lever cable that connects the transmission manual control lever to the selector lever assembly
- Brake shift interlock actuator that is integral to the selector lever assembly

The selector lever assembly:

- Locks the transmission selector lever in the P (Park) position when the ignition switch is in the LOCK position
- Requires the transmission selector lever to be in the P position to turn the ignition switch to the LOCK position

Copyright © 2016 Ford Motor Company

External Controls - System Operation and Component Description

System Operation

The transmission has 7 range positions P, R, N, D, side movement to S, then '+' or '-' SelectShift™ to select desired gear 1 to 6.

Park

In the PARK position:

- there is no powerflow through the transmission.
- the parking pawl locks the output shaft
- the engine may be started.
- the ignition key may be removed.

Reverse

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.
- engine braking will occur.

Neutral

In the NEUTRAL position:

- there is no powerflow through the transmission.
- the output shaft is not held and is free to turn.
- the engine may be started.

Drive

DRIVE is the normal position for most forward driving.

DRIVE position provides:

- automatic shifts - 1st through 6th gears.
- maximum fuel economy during normal operation.

Sports

The SPORTS position provides:

- automatic shifts - 1st through 6th gears.
- maximum performance during Sports operation.
- optimised engine braking is provided.

SelectShift™ Mode

In the SelectShift™ mode:

- the driver can manually shift the transmission to gears 1 through 6 by pushing the selector lever to the '+' and '-' positions.
- downshifts will happen automatically when road speed is too low.

Brake Shift Interlock Operation

The brake shift interlock actuator inhibits the selector lever movement from the PARK position by mechanically blocking the detent pawl of the selector lever mechanism. When the brake pedal is pressed (BPP switch closed) with the ignition key in the RUN position and the transmission in PARK, the brake shift interlock actuator is energized by the BCM, allowing the selector lever to be moved out of the PARK position.

The brake shift interlock system consists of:

- a brake shift interlock actuator that is integral to the selector lever assembly.

- an ignition switch.
- a BPP switch.
- a BCM.

Selector Lever Cable

The selector lever cable consists of:

- a cable that connect the transmission manual control lever to the selector lever assembly.
- a cable grommet that is fastened to the floor pan.
- an adjuster locking tab at the transmission manual control lever.

Selector Lever

The selector lever consists of:

- a selector lever knob (floor shift only).
- a brake shift interlock actuator that is integral to the selector lever assembly.

Copyright © 2016 Ford Motor Company

External Controls

Principles of Operation

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Mechanical	Electrical
Transmission selector lever cable	Brake Shift Interlock Actuator (BSIA)
Manual control lever	Wiring harness
Selector lever	Terminals
Selector lever knob	Connectors
	SelectShift™ switch

DTC Chart - BCM

DTC	Description	Action
B1319:11	Brake Shift Interlock (BSI) Output Circuit Short To Ground	GO to Pinpoint Test A
B1319:15	Brake Shift Interlock (BSI) Output Circuit Short To Battery or Open	GO to Pinpoint Test A

DTC Chart - PCM (2.5L)

DTC	Description	Action
P0815	Upshift Switch Circuit	GO to Pinpoint Test B
P0816	Downshift Switch Circuit	GO to Pinpoint Test B

DTC Chart - TCM (2.2L, 3.2L)

DTC	Description	Action
P0815	Upshift Switch Circuit	GO to Pinpoint Test B
P0816	Downshift Switch Circuit	GO to Pinpoint Test B
P0826	Up and Down Switch Circuit	GO to Pinpoint Test B

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

In most circumstances the PCM sets a DTC to help guide diagnostics. Refer to the DTC charts before using the Symptom Chart. The Symptom column lists the vehicle condition. The Possible Sources column lists a detailed vehicle condition. The Action column lists the action to be performed to determine the cause of the condition. Each action lists the components that can cause the symptom and the individual components in that system. The components are listed in order of disassembly. Use the list of components and the required action to focus on disassembly inspections for the root cause of the concern.

Symptom	Possible Sources	Action
• Brake shift interlock system does not release/lock correctly	• Circuitry open, shorted to ground or shorted to power	• GO to Pinpoint Test A
	• Brake Shift Interlock Actuator (BSIA) solenoid	• INSTALL a new selector lever assembly. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
• SelectShift™	• Selector lever not fully engaging in S position • Selector lever damaged	• GO to Pinpoint Test B
• Selector lever linkage is out of correct gear relationship	• Selector lever linkage out of adjustment	• REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• Loose selector lever cable bracket	• CHECK the selector lever cable bracket. TIGHTEN as necessary.
	• Loose or out of alignment selector lever bezel	• CHECK the selector lever bezel alignment. ALIGN or INSTALL a new selector lever bezel if necessary. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
• Selector lever binding	• Selector lever bezel damaged	• CHECK the selector lever bezel for damage. If necessary, INSTALL a new selector lever bezel. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
	• Selector lever damaged	• CHECK the selector lever for damage. If necessary, INSTALL a new selector lever assembly. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
	• Selector lever cable damaged	• CHECK the selector lever cable for damage. If necessary, INSTALL a new selector lever cable. REFER to: Selector Lever Cable (307-05 Automatic Transmission External Controls, Removal and Installation).
	• Internal transmission components damaged	• CHECK the manual control lever and internal transmission components for damage. REFER to: Transmission (307-01 Automatic Transmission - 6-Speed

		Automatic Transmission - 6R80, Assembly).
• Brake shift interlock override does not release the selector lever	• Brake shift interlock override damaged	• INSPECT the selector lever for damage. If necessary, INSTALL a new selector lever. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
• Vibration — a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed	• Selector lever cable incorrectly routed, grounded out or loose	• CHECK the selector lever cable. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation). REPAIR as necessary.
• The ignition key cannot be returned to the OFF position or the ignition key can be turned to the OFF position when the selector lever is not in P	• Wiring, terminals or connectors • Ignition lock cylinder • Key removal inhibit solenoid (part of the ignition switch) • Park detect switch (part of the selector lever) • Selector lever cable • Mechanical damage to the selector lever, selector lever cable or selector lever knob	• REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
• The PRNDS indicator does not illuminate P	• Wiring, terminals or connectors • PCM concern or TCM • IPC • Park detect switch (part of the selector lever assembly)	• REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

Pinpoint Tests

DTCs B1319:11, B1319:15

Refer to Wiring Diagrams Cell 37 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM provides power to the Brake Shift Interlock Actuator (BSIA). When the BCM receives a brake pedal applied input, voltage is applied to the brake shift interlock actuator. When the actuator is energized, the plunger is pulled inward allowing the selector lever to move from the park position.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1319:11	Brake Shift Interlock Output Circuit Short To Ground	Short to ground in the Brake Shift Interlock Actuator (BSIA) circuitry.
B1319:15	Brake Shift Interlock Output Circuit Short To Battery or Open	Short to power or open in the Brake Shift Interlock Actuator (BSIA) circuitry.

Possible Sources

- Connectors damaged or pushed-out terminals, corrosion, loose wires and missing or damaged seals
- Brake Shift Interlock Actuator (BSIA)
- BCM

PINPOINT TEST A : DTCS B1319:11, B1319:15

A1 RETRIEVE AND RECORD ALL DTCS

- Using the diagnostic scan tool, retrieve all DTCs.

Is DTC B1319:11 or B1319:15 present?

Yes	CLEAR the DTC. Using the diagnostic scan tool, perform the BCM self-test. If the DTC returns, GO to A2
No	The concern may not be in the brake shift interlock (BSI) system. REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).

A2 CHECK THE BRAKE SHIFT INTERLOCK ACTUATOR POWER CIRCUIT FOR AN OPEN

- Disconnect Floor Shifter C3245.
- Disconnect BCM C2280G.
- Inspect for damaged or pushed-out terminals.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-3	Ω	C2280G-12

Is the resistance less than 3 ohms?

Yes	GO to A3
No	REPAIR the circuit.

A3 CHECK THE BRAKE SHIFT INTERLOCK ACTUATOR GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-9	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A4
No	REPAIR the circuit.

A4 CHECK THE BRAKE SHIFT INTERLOCK ACTUATOR POWER CIRCUIT FOR VOLTAGE

- Ignition ON.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A5

A5 CHECK THE BRAKE SHIFT INTERLOCK ACTUATOR POWER CIRCUIT FOR SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new selector lever. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
No	REPAIR the circuit.

DTCs P0815, P0816, P0826

Refer to Wiring Diagrams Cell 30 for schematic and connector information.

Normal Operation and Fault Conditions

When the selector lever is placed in the manual shift position, the upshift/downshift feature is activated. Install a new selector lever assembly if a new switch is required.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0815	Upshift Switch Circuit	The PCM detects a voltage high signal when an upshift is requested.
P0816	Downshift Switch Circuit	The PCM detects a voltage high signal when a downshift is requested.
P0826 (3.2L diesel only)	Up and Down Switch Circuit	The TCM detects a mismatch between the requested up or downshift and the actual lever state.

Possible Sources

- Circuitry open/shorted
- Selector lever assembly
- PCM (2.5L)
- TCM (2.2.L, 3.2L)

PINPOINT TEST B : DTCS P0815, P0816, P0826

B1 RETRIEVE AND RECORD ALL DTC (DIAGNOSTIC TROUBLE CODE) S

- Using the diagnostic scan tool, retrieve all DTCs.

Are DTCs P0815, P0816, or P0826 present?

Yes	CLEAR the DTC. Using the diagnostic scan tool, perform the KOER self-test. If DTC P0815 returns, GO to B2 If DTC P0816 returns, GO to B6
No	The system is operating correctly at this time. The concern may have been caused by a loose connector. ADDRESS the root cause of any connector or terminal issues.

B2 CHECK THE UPSHIFT SIGNAL CIRCUIT FOR VOLTAGE

- Disconnect Floor Shifter C3245.
- Inspect for damaged or pushed-out terminals.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-7	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to B5
No	GO to B3

B3 CHECK THE UPSHIFT SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Inspect for damaged or pushed-out terminals.
- Disconnect TCM C1822 for 2.2L, 3.2L Diesel.
- For 2.2L, 3.2L Diesel measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-7	Ω	C1822-58

- Disconnect PCM C175B for 2.5L engine.
- For 2.5L engine measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-7	Ω	C175B-23

Is the resistance less than 3 ohms?

Yes	GO to B4
No	REPAIR the circuit.

B4 CHECK THE UPSHIFT SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-7	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B5
No	REPAIR the circuit.

B5 CHECK THE SIGNAL RETURN CIRCUIT FOR AN OPEN

- Disconnect TCM C1822 for 2.2L, 3.2L diesel.
- Disconnect PCM C175B for 2.5L engine.
- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-2	Ω	C1822-40

Is the resistance less than 3 Ohms?

Yes	REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
No	REPAIR the circuit. If an open circuit is not found, INSTALL a new PCM if equipped with a 2.5L engine REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). , or a new TCM if equipped with the 2.2L or 3.2L diesel. REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the PCM or TCM with the latest calibration level. PERFORM the Transmission Strategy Download procedure.

B6 CHECK THE DOWNSHIFT SIGNAL CIRCUIT FOR VOLTAGE

- Disconnect Shifter C3245.
- Inspect for damaged or pushed-out terminals.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C3245-8		Ground

Is the voltage greater than 11 volts?

Yes	GO to B9
No	GO to B7

B7 CHECK THE DOWNSHIFT SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect TCM C1822 for 2.2L or 3.2L Diesel.
- Inspect for damaged or pushed-out terminals.
- For 2.2L or 3.2L Diesel measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-8	Ω	C1822-59

- Disconnect PCM C175B for 2.5L engine.
- For the 2.5L engine measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-8	Ω	C175B-24

Is the resistance less than 3 ohms?

Yes	GO to B8
No	REPAIR the circuit.

B8 CHECK THE DOWNSHIFT SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-8	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B9
No	REPAIR the circuit.

B9 CHECK THE SIGNAL RETURN CIRCUIT FOR AN OPEN

- Connect TCM C1822 for 2.2L or 3.2L diesel.
- Connect PCM C175B for 2.5L engine.
- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3245-2	Ω	C1822-40

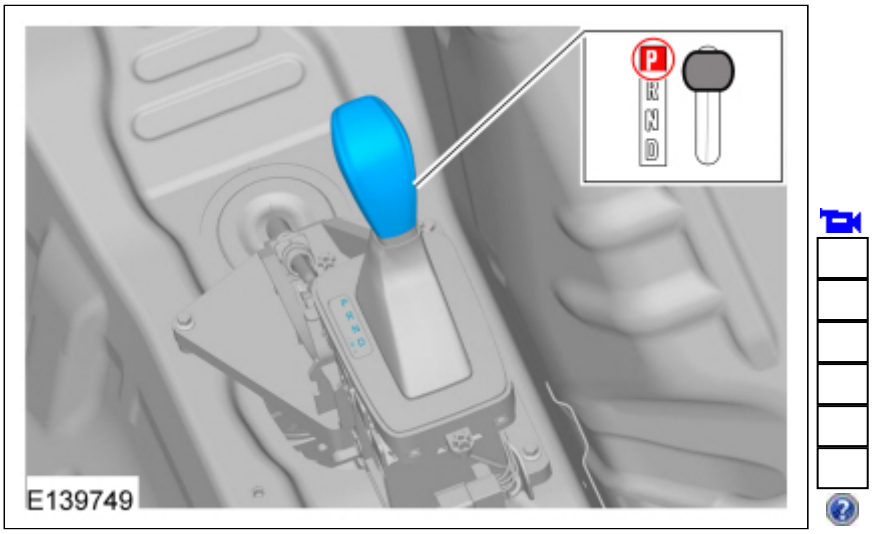
Is the resistance less than 3 ohms?

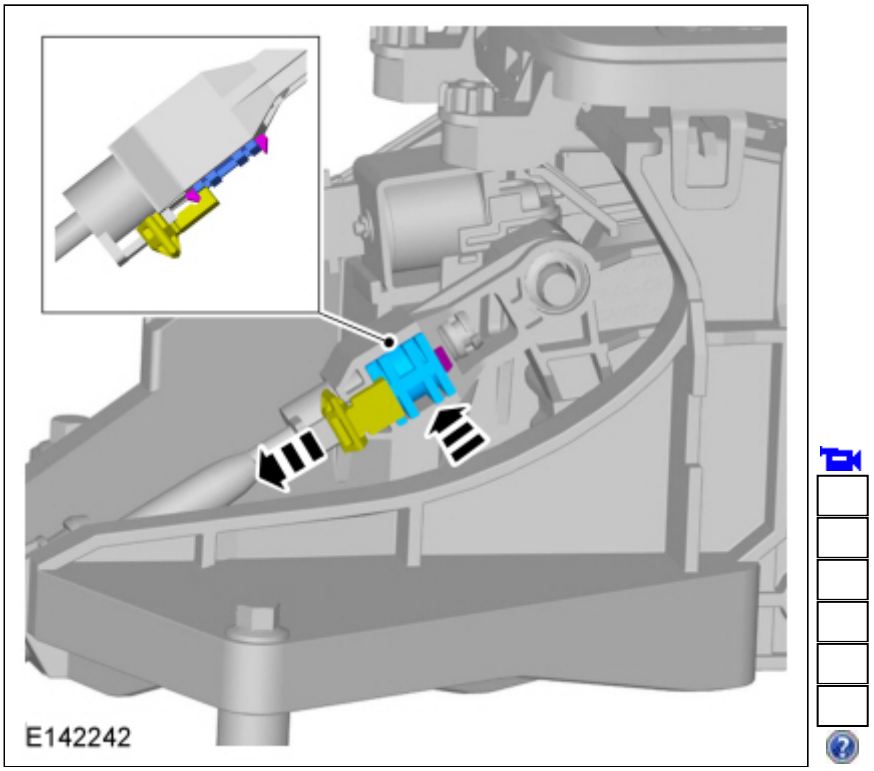
Yes	REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).
No	REPAIR the circuit. If an open circuit is not found, INSTALL a new PCM if equipped with a 2.5L or a new TCM if equipped with the 2.2L or 3.2L. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation). PROGRAM the PCM or TCM with the latest calibration level. PERFORM the Transmission Strategy Download procedure.

Copyright © 2016 Ford Motor Company

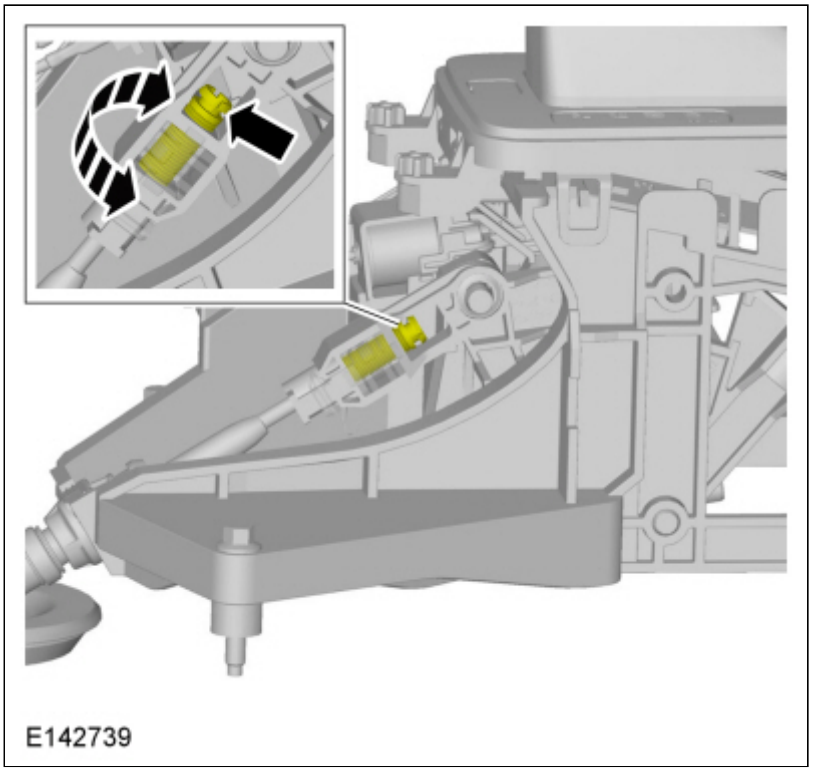
Selector Lever Cable Adjustment

Adjustment

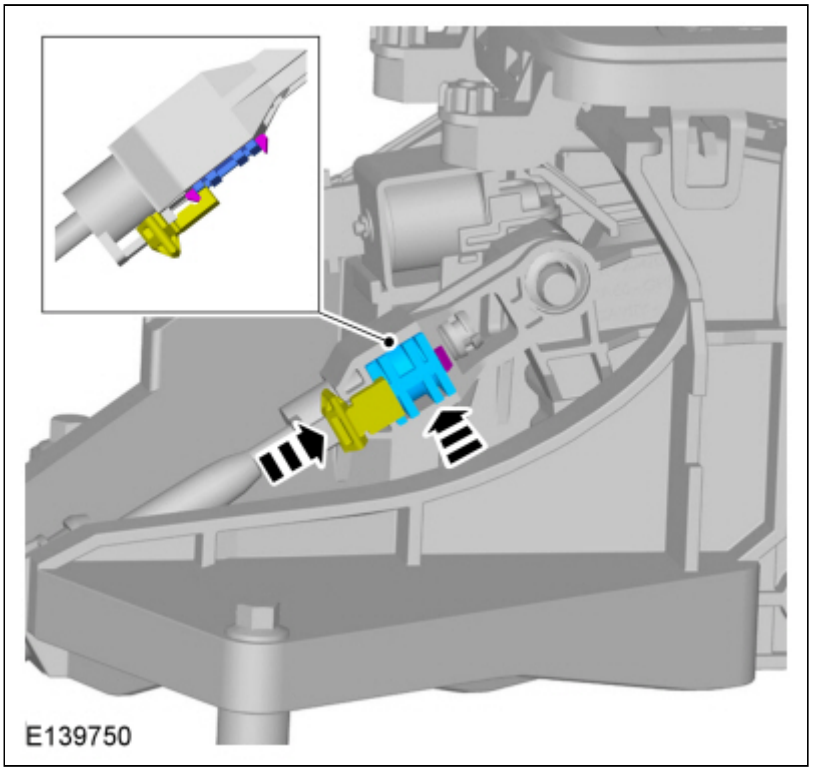
1. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3. 

4.



5. **NOTE:** *NOTE: Ensure that the selector lever cable adjustment mechanism is locked.*



6. Start the engine and move the selector lever through all the gear positions. Wait until each gear engages when moving through the gear positions.
7. Check that the selector lever position indicator corresponds to the position of the selector lever, repeat the adjustment procedure if necessary.
8. Move the selector lever into the "P" (PARK) position and switch off the engine.

Copyright © 2016 Ford Motor Company

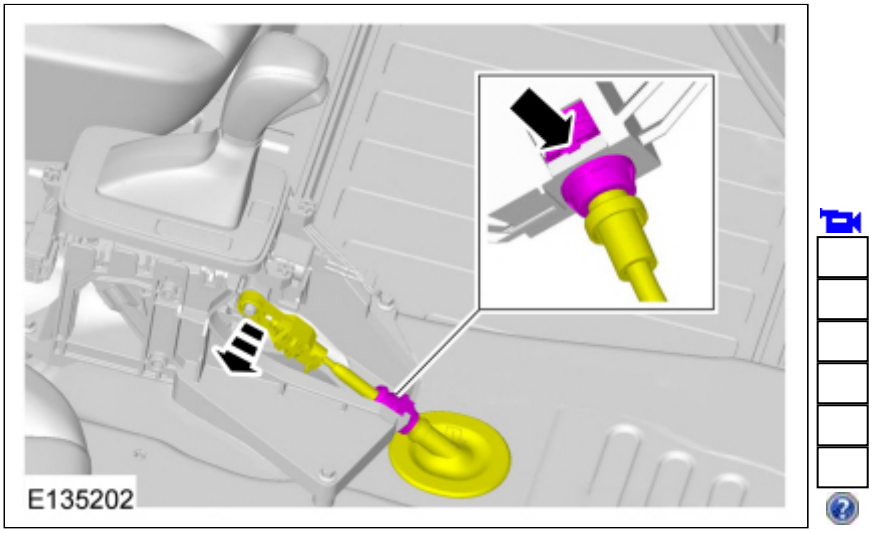
Selector Lever Assembly

Base Part Number: 7K004

Removal

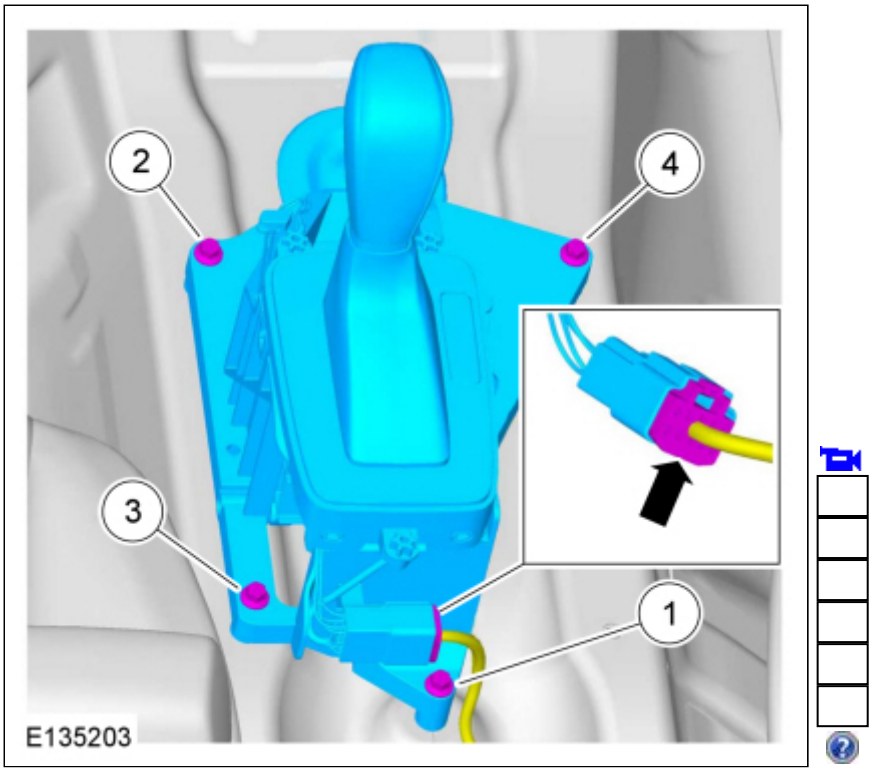
NOTICE: Gearshift cables must not be kinked or bent.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3. **NOTE:** *Make sure that the component is correctly located..*

   Torque: 11 Nm



Installation

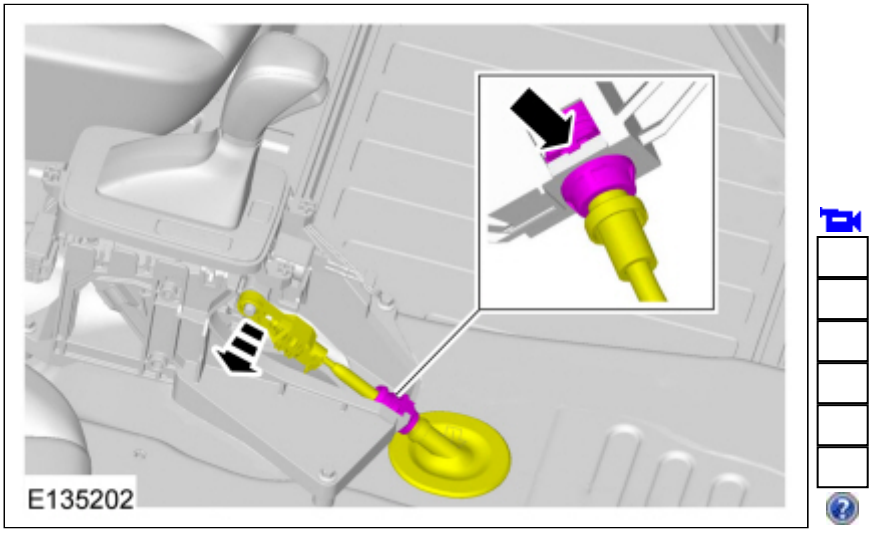
1. To Install, reverse the removal procedure.
2. Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

Copyright © 2016 Ford Motor Company

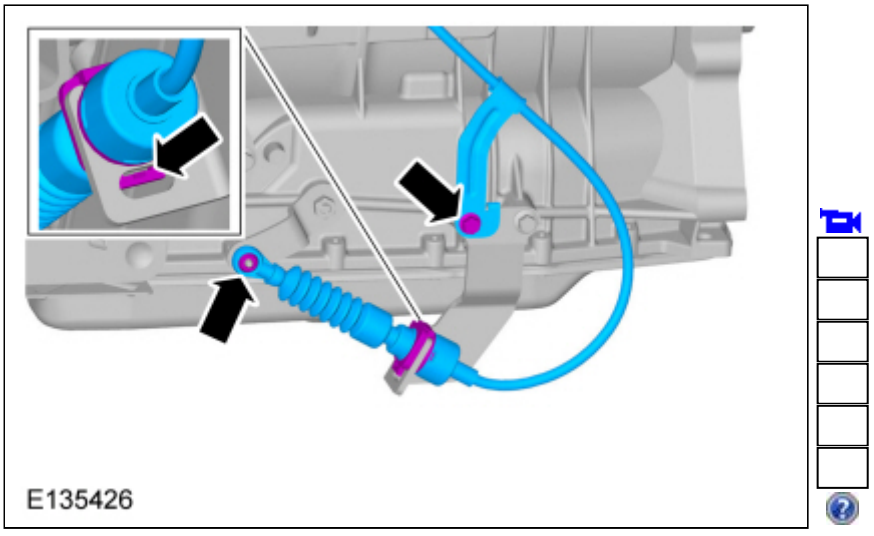
Selector Lever Cable

Base Part Number: 7E395

Removal

1. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).

Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Grease - pilot bearing	WSD-M1C238-A
Grease - input shaft guide sleeve	ESD-M1C220-A

Copyright © 2016 Ford Motor Company

Clutch

General Equipment

Ultraviolet fluid leak detection equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Oil leaks. • Visibly damaged or worn components. • Loose or missing nuts or bolts.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Symptom Chart

Symptom	Possible Sources	Action
• Clutch slippage	• Clutch master cylinder • Clutch slave cylinder • Clutch pressure plate • Clutch disc. • Engine or transmission housing oil or fluid leak(s)	• GO to Pinpoint Test A
• Clutch chatter or shudder	• Engine and transmission mounts • Clutch pressure plate • Clutch disc • Flywheel	• REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing). • GO to Pinpoint Test B
• Clutch drag	• Insufficient brake fluid • Air in the clutch hydraulic system • Clutch pedal free travel • Clutch pressure plate	• FILL the brake master cylinder reservoir to the MAX mark. INSPECT the brake and clutch hydraulic systems for leaks. REPAIR as necessary. • BLEED the clutch system. REFER to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures). • GO to Pinpoint Test C

	• Clutch disc • Crankshaft end play	
• Clutch pedal pulsation	• Clutch pressure plate • Clutch disc	• INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
	• Crankshaft end play	• CHECK the crankshaft end play.
• Hard shifting	• Clutch drag	• GO to Pinpoint Test C
	• Gearshift cable adjustment	• CHECK the gearshift cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures).
	• External controls	• REFER to: External Controls (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).
	• Gear wheels	• REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).
	• Selector mechanism	• REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).
	• Synchronizer(s)	• REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).
• Excessive noise	• Clutch pedal • Clutch release bearing	• GO to Pinpoint Test D
• Fluid leakage	• Clutch master cylinder • Clutch slave cylinder • Clutch hydraulic lines	• INSPECT the brake and clutch hydraulic systems for leaks. REPAIR as necessary.

Pinpoint Tests

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 TEST CLUTCH SLIPPAGE

- Lock the wheels and apply the parking brake.
- Start the engine and engage fourth gear.
- Run the engine at approximately 2000 rpm.
- Release the clutch pedal slowly.

Does the engine stall when the clutch pedal is fully released?

Yes	Clutch OK.
No	GO to A2

A2 CHECK THE CLUTCH PEDAL OPERATION

- Depress clutch pedal and allow it to return.

Does the pedal return to the initial position?

Yes	GO to A3

No	GO to A4

A3 CHECK THE CLUTCH DISC AND PRESSURE PLATE

- Remove the clutch disc and pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Is the clutch disc or pressure plate contaminated with oil or hydraulic fluid?

Yes	CHECK the engine and transmission for leaks. INSTALL new components as necessary. INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	GO to A4

A4 CHECK THE CLUTCH HYDRAULIC SYSTEM

- Release the clutch slave cylinder bleed nipple.

Does the pedal return to the initial position?

Yes	INSTALL a new clutch slave cylinder. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	INSTALL a new clutch master cylinder. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER

B1 TEST FOR CLUTCH SHUDDER

- Start the engine.
- Engage the clutch and select fourth gear.
- Run the engine at approximately 2000 rpm.
- Release the clutch pedal slowly.

Does the clutch take up the drive smoothly?

Yes	Clutch is OK.
No	GO to B2

B2 CHECK THE CLUTCH DISC AND PRESSURE PLATE FOR OIL OR HYDRAULIC FLUID CONTAMINATION

- Remove the clutch disc and pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Is the clutch disc and pressure plate contaminated with oil or hydraulic fluid?

Yes	CHECK the engine and transmission for leaks. INSTALL new components as necessary. INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission

	- MT75, Removal and Installation). TEST the system for normal operation.
No	GO to B3

B3 CHECK THE CLUTCH DISC AND PRESSURE PLATE

- Visually check the clutch disc and pressure plate.

Is the clutch disc and pressure plate worn or damaged?

Yes	INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	INSPECT the flywheel clutch surface. TEST the system for normal operation.

PINPOINT TEST C : CLUTCH DRAG

C1 CHECK THE OPERATION OF THE CLUTCH PEDAL

- Bleed the clutch system.
  REFER to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).

Does the clutch properly disengage after bleeding?

Yes	Clutch system is OK.
No	GO to C2

C2 CHECK THE CLUTCH DISC AND PRESSURE PLATE FOR OIL OR HYDRAULIC FLUID CONTAMINATION

- Remove the clutch disc and pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Is the clutch disc and pressure plate contaminated with oil or hydraulic fluid?

Yes	CHECK the engine and transmission for leaks. INSTALL new components as necessary. INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	GO to C3

C3 CHECK THE CLUTCH DISC AND PRESSURE PLATE

- Visually check the clutch disc and pressure plate.

Is the clutch disc and pressure plate worn or damaged?

Yes	INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	GO to C4

C4 CHECK THE INPUT SHAFT SPLINES

- Check that the clutch disc slides freely on the input shaft splines.

Does the clutch disc stick on the input shaft?

Yes	CHECK the clutch disc and input shaft splines for damage. INSTALL new components as necessary. TEST the system for normal operation.
No	MEASURE the crankshaft end play.

PINPOINT TEST D : EXCESSIVE NOISE

D1 STATIC CHECK

- Depress and release the clutch pedal.

Is the noise apparent when the clutch is operated?

Yes	LUBRICATE the clutch and brake pedal shaft. TEST the system for normal operation.
No	GO to D2

D2 DYNAMIC CHECK

- Start the engine.
- Depress the clutch pedal.

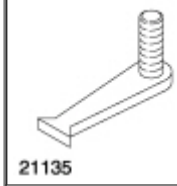
Is the noise apparent when the clutch pedal is depressed?

Yes	REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
No	INSTALL a new clutch slave cylinder and release bearing assembly. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Clutch Disc and Pressure Plate

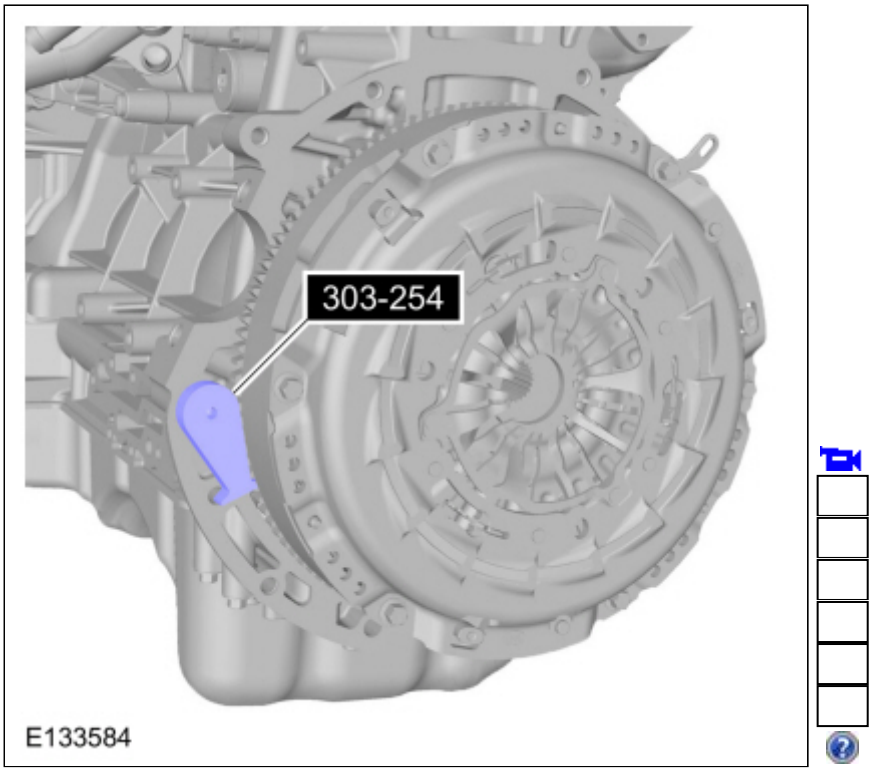
Special Tool(s) / General Equipment

 21135	303-254 Locking Tool, Flywheel
 16067	308-204 Aligner, Clutch Disc

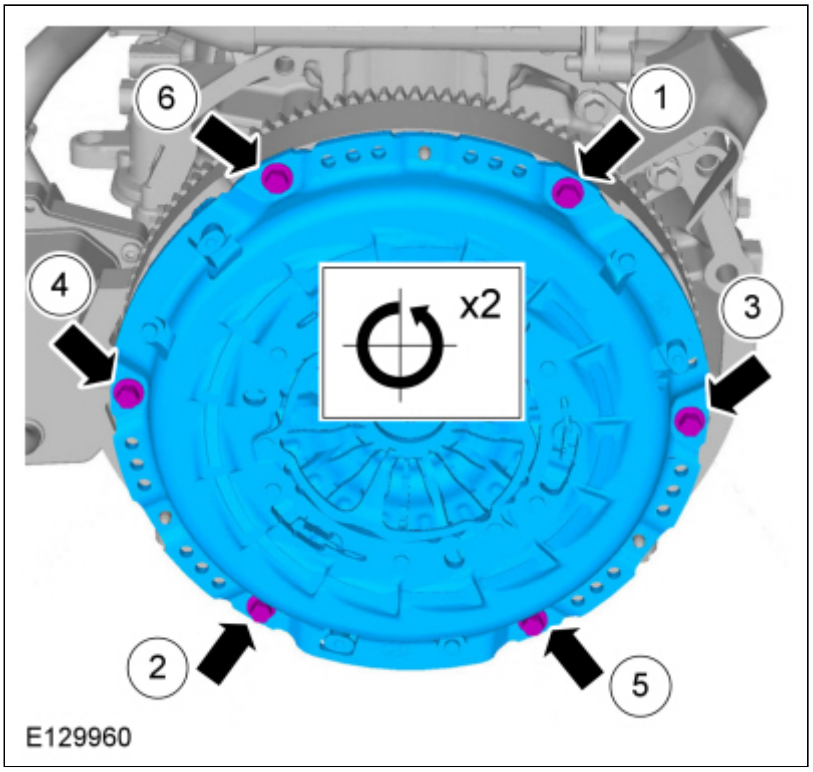
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
   Refer to: Transmission - 4x4 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
4. Use Special Service Tool: 303-254 Locking Tool, Flywheel.

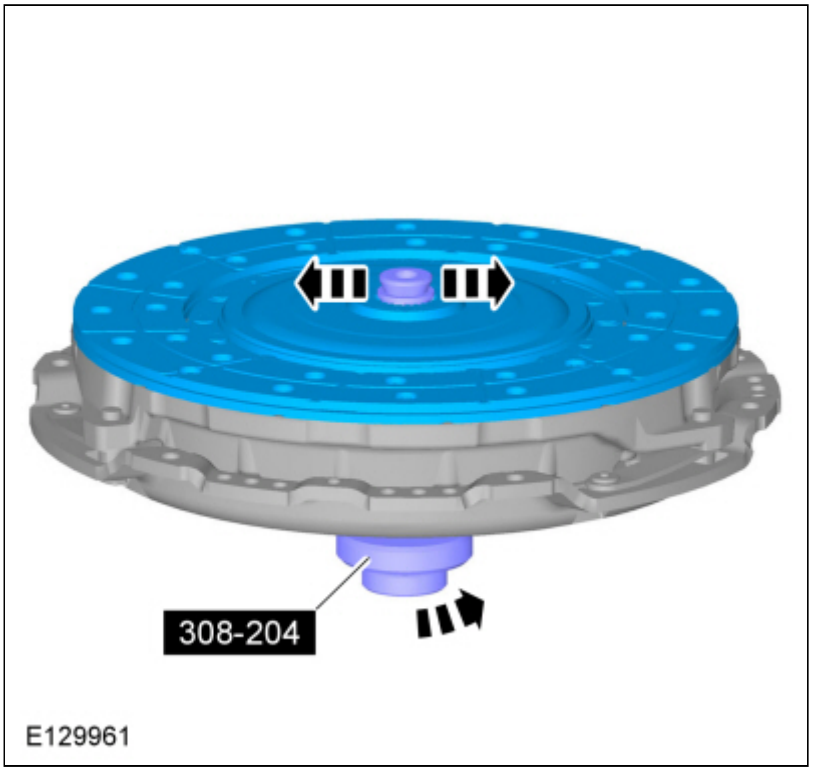


5. **NOTICE: Loosen the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.**



Installation

1. Using the special tool, centralize the clutch disc on the pressure plate.
   Use Special Service Tool: 308-204 Aligner, Clutch Disc.



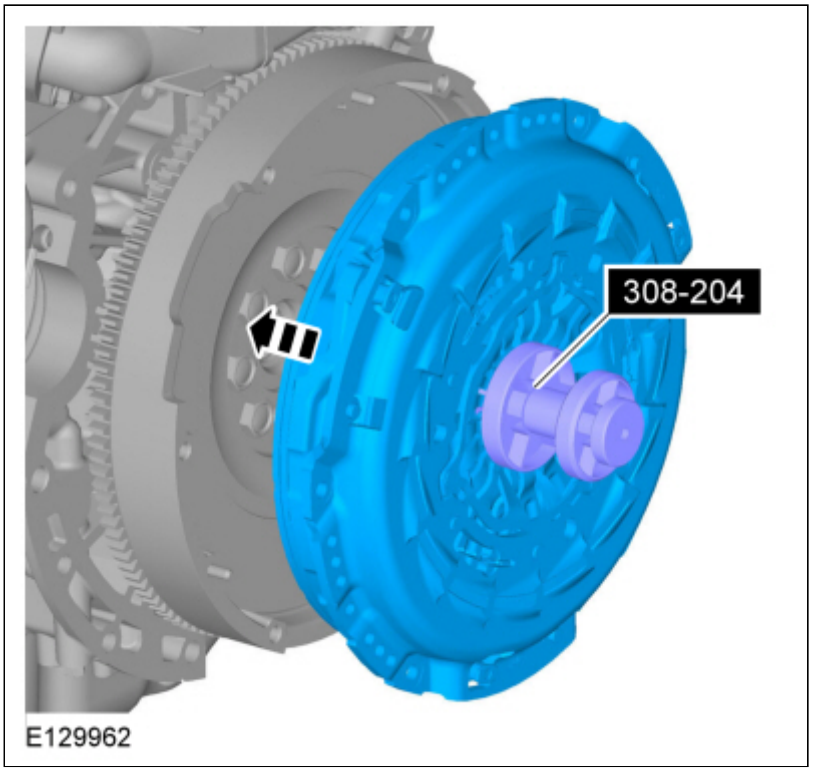
2. **NOTE:** *Check the pilot bearing for damage. If damaged, install a new pilot bearing.*

   NOTE: *Do not apply grease to a newly installed pilot bearing.*

   Refer to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

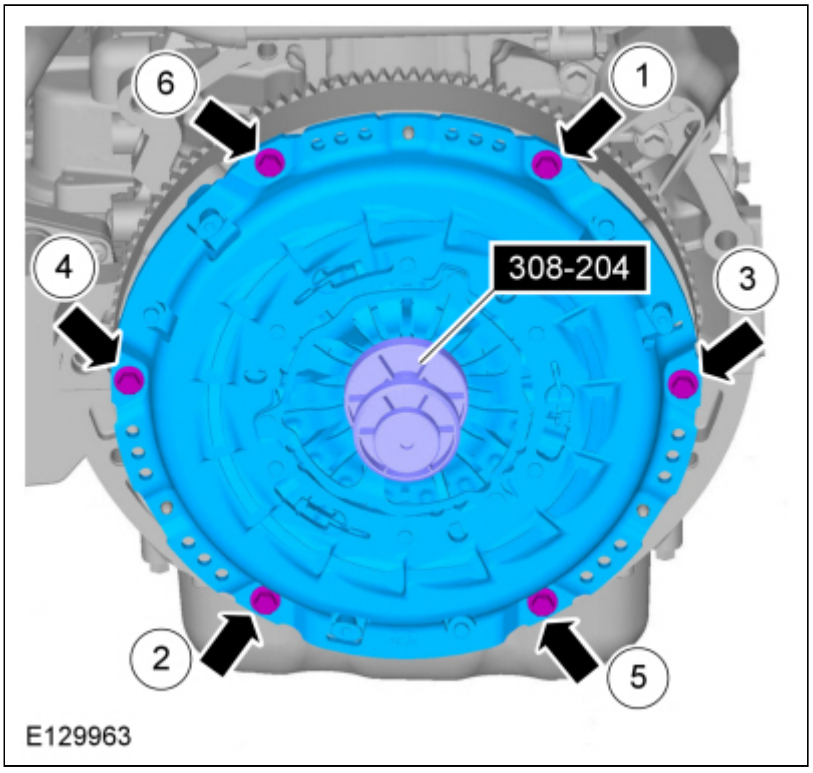
3. **NOTE:** *Hand tighten the bolts at this stage.*

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.

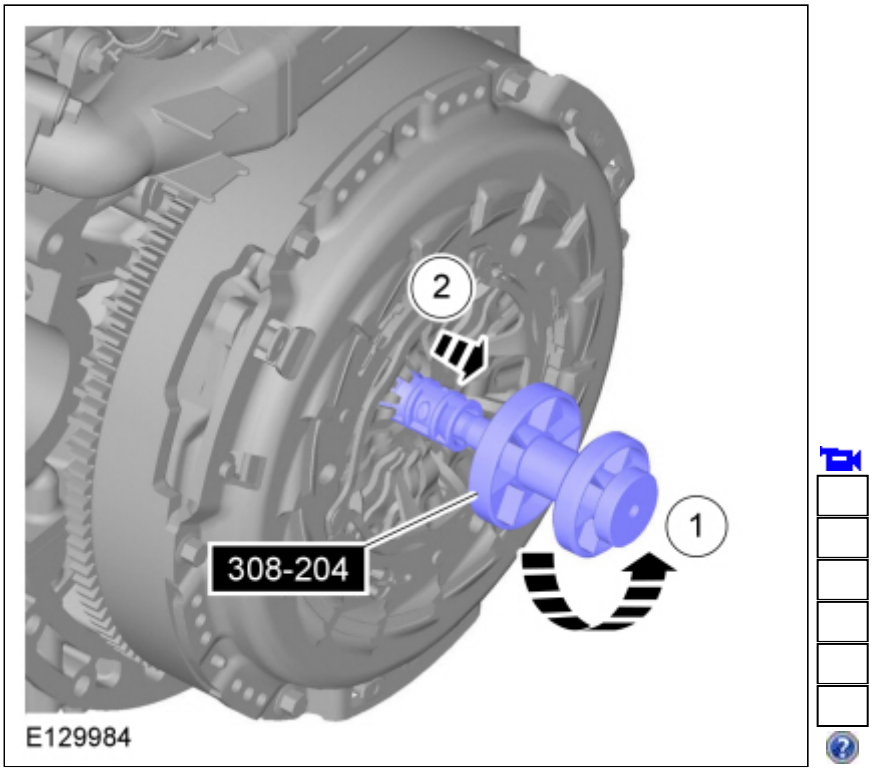


4. **NOTICE: Tighten the clutch pressure plate retaining bolts in the sequence shown to the specified torque.**

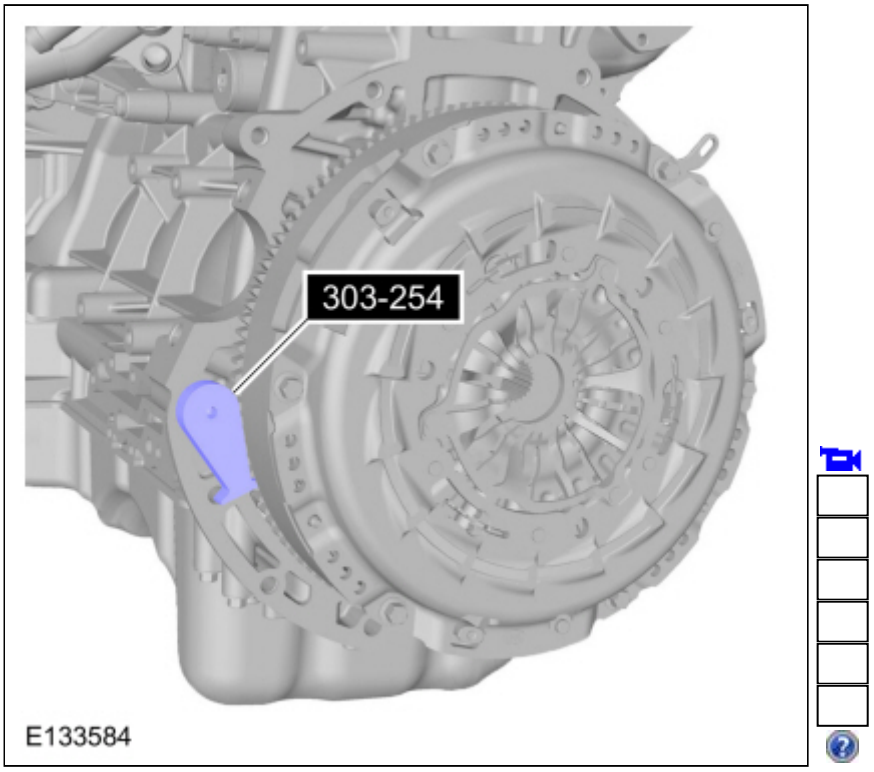
   Use Special Service Tool: 308-204 Aligner, Clutch Disc.
   Torque: 30 Nm



5. Remove Special Service Tool: 308-204 Aligner, Clutch Disc.



6. Remove Special Service Tool: 303-254 Locking Tool, Flywheel.

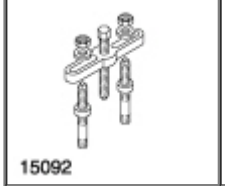
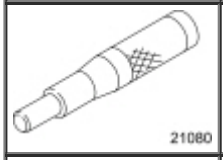
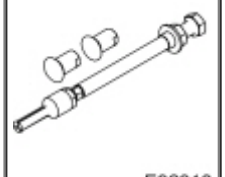


7. Refer to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Installation).
   Refer to: Transmission - 4x4 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Installation).

Copyright © 2016 Ford Motor Company

Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4

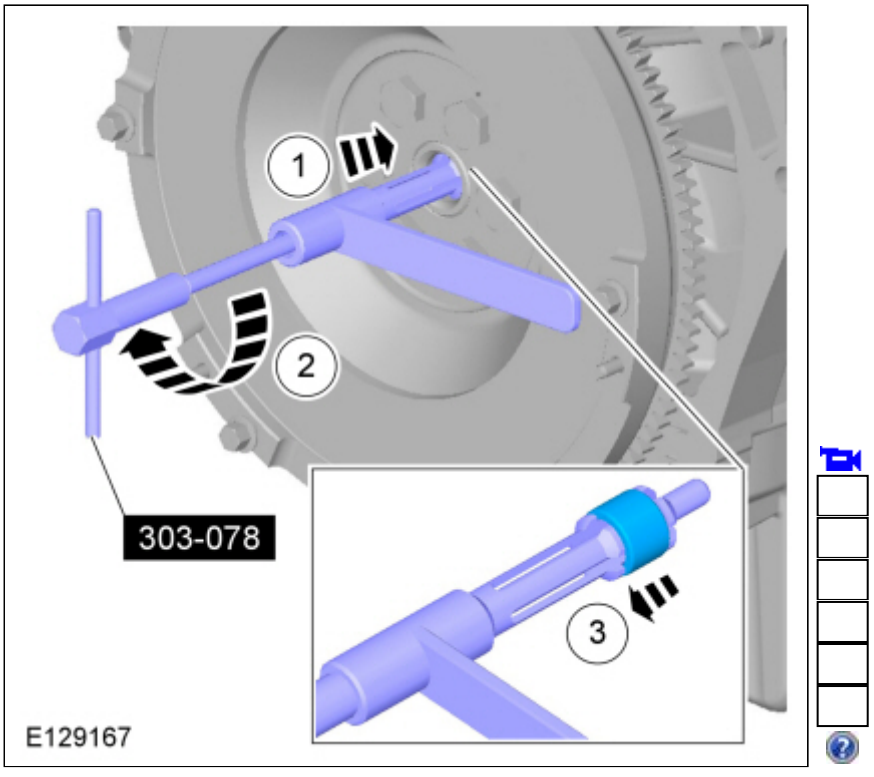
Special Tool(s) / General Equipment

 15092	205-311 Remover, Bearing/Gear
 21080	303-132 Installer/Aligner, Pilot Bearing/Clutch Plate
 E92318	303-1365 Remover, Crankshaft Pilot Bearing

Removal

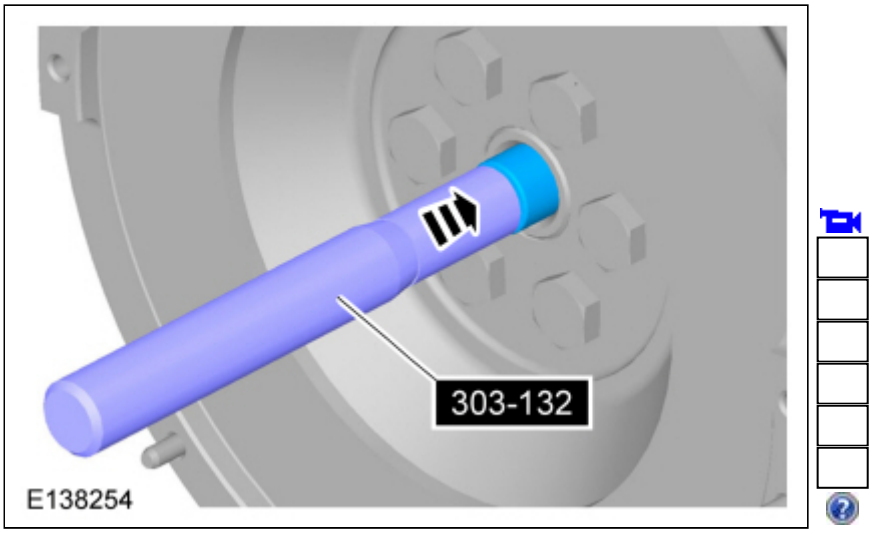
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
2. Use Special Service Tool: 205-311 Remover, Bearing/Gear. , 303-1365 Remover, Crankshaft Pilot Bearing.



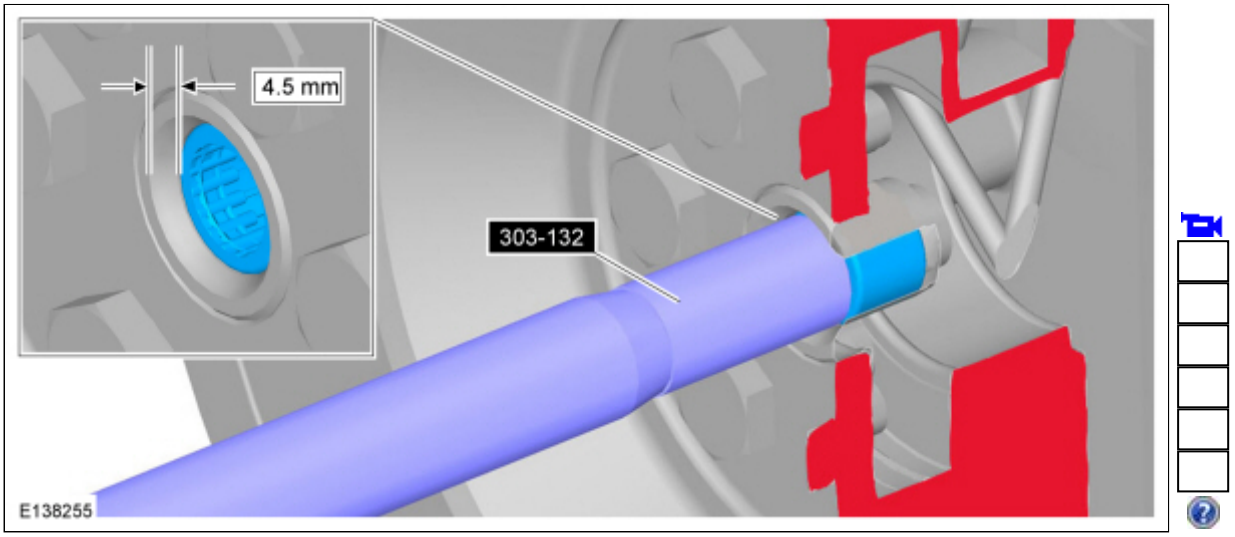
Installation

1. Use Special Service Tool: 303-132 Installer/Aligner, Pilot Bearing/Clutch Plate.



2. **NOTICE: Make sure that the pilot bearing is correctly installed.**

   Use Special Service Tool: 303-132 Installer/Aligner, Pilot Bearing/Clutch Plate.

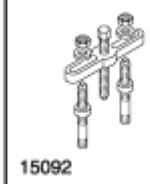
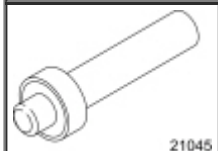


3. Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Copyright © 2016 Ford Motor Company

Pilot Bearing - Diesel

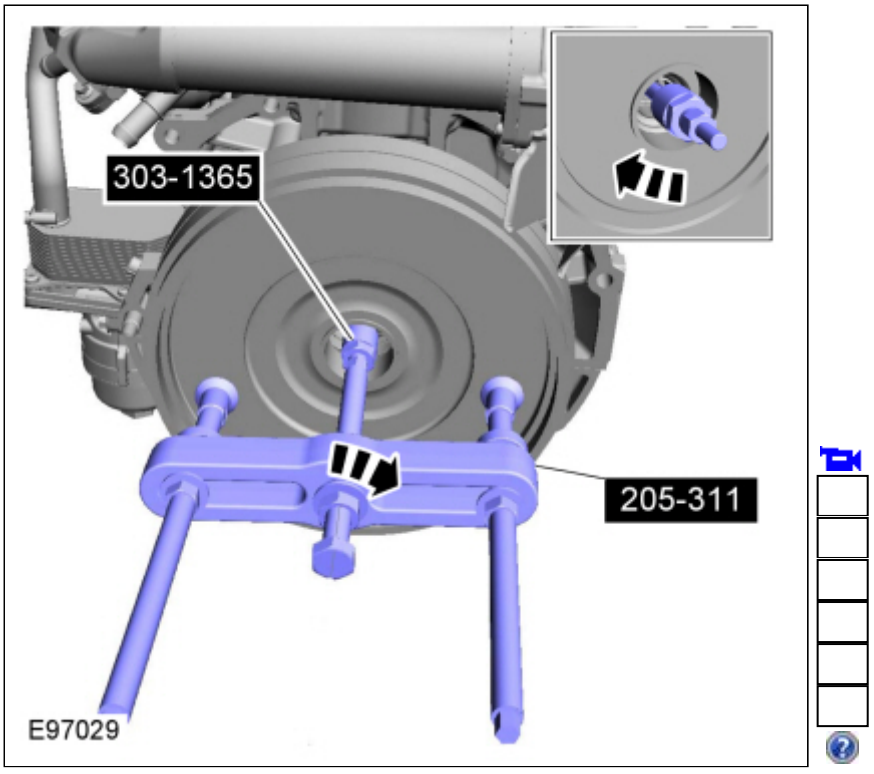
Special Tool(s) / General Equipment

 15092	205-311 Remover, Bearing/Gear
 21045	303-090 Installer, Crankshaft Pilot Bearing
 E92318	303-1365 Remover, Crankshaft Pilot Bearing

Removal

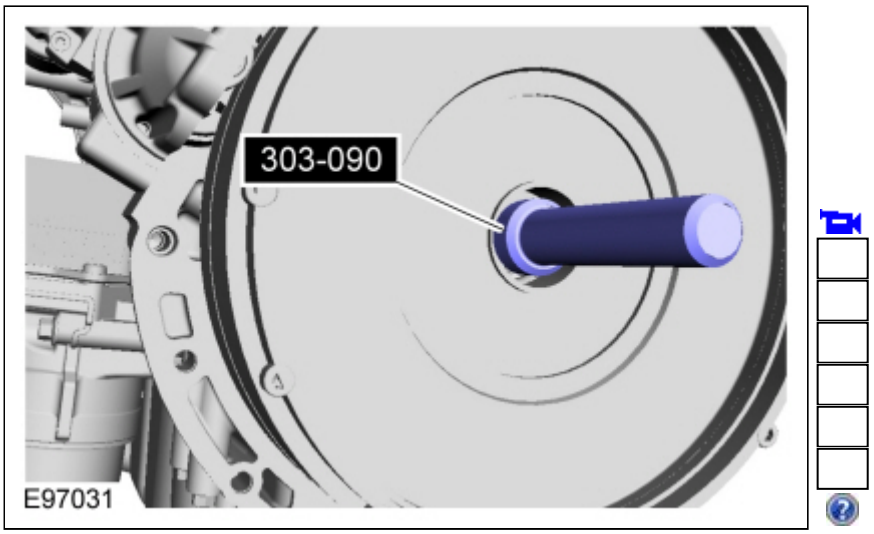
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
   Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
2. Use Special Service Tool: 205-311 Remover, Bearing/Gear. , 303-1365 Remover, Crankshaft Pilot Bearing.



Installation

1. Use Special Service Tool: 303-090 Installer, Crankshaft Pilot Bearing.



2. Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
   Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Grease - pilot bearing	WSD-M1C238-A
Grease - input shaft guide sleeve	ESD-M1C220-A

Copyright © 2016 Ford Motor Company

Clutch

General Equipment

Ultraviolet fluid leak detection equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Oil leaks. • Visibly damaged or worn components. • Loose or missing nuts or bolts.

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Symptom Chart

Symptom	Possible Sources	Action
• Clutch slippage	• Clutch master cylinder • Clutch slave cylinder • Clutch pressure plate • Clutch disc. • Engine or transaxle housing oil or fluid leak(s)	• GO to Pinpoint Test A
• Clutch chatter or shudder	• Engine and transaxle mounts	• REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).
	• Clutch pressure plate • Clutch disc • Flywheel	• GO to Pinpoint Test B
• Clutch drag	• Insufficient brake fluid	• FILL the brake master cylinder reservoir to the MAX mark. INSPECT the brake and clutch hydraulic systems for leaks. REPAIR as necessary.
	• Air in the clutch hydraulic system	• BLEED the clutch system. REFER to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).
	• Clutch pedal free travel • Clutch pressure plate • Clutch disc	• GO to Pinpoint Test C

	• Crankshaft end play	
• Clutch pedal pulsation	• Clutch pressure plate • Clutch disc • Crankshaft end play	• INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). • CHECK the crankshaft end play.
• Hard shifting	• Clutch drag • Gearshift cable adjustment • External controls • Gear wheels • Selector mechanism • Synchronizer(s)	• GO to Pinpoint Test C • CHECK the gearshift cable adjustment. REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission External Controls, General Procedures). • REFER to: External Controls (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Diagnosis and Testing). • REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing). • REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing). • REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).
• Excessive noise	• Clutch pedal • Clutch release bearing	• GO to Pinpoint Test D
• Fluid leakage	• Clutch master cylinder • Clutch slave cylinder • Clutch hydraulic lines	• INSPECT the brake and clutch hydraulic systems for leaks. REPAIR as necessary.

Pinpoint Tests

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 TEST CLUTCH SLIPPAGE

- Lock the wheels and apply the parking brake.
- Start the engine and engage fourth gear.
- Run the engine at approximately 2000 rpm.
- Release the clutch pedal slowly.

Does the engine stall when the clutch pedal is fully released?

Yes	Clutch OK.
No	GO to A2

A2 CHECK THE CLUTCH PEDAL OPERATION

- Depress clutch pedal and allow it to return.

Does the pedal return to the initial position?

Yes	GO to A3
No	GO to A4

A3 CHECK THE CLUTCH DISC AND PRESSURE PLATE

- Remove the clutch disc and pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Is the clutch disc or pressure plate contaminated with oil or hydraulic fluid?

Yes	CHECK the engine and transaxle for leaks. INSTALL new components as necessary. INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	GO to A4

A4 CHECK THE CLUTCH HYDRAULIC SYSTEM

- Release the clutch slave cylinder bleed nipple.

Does the pedal return to the initial position?

Yes	INSTALL a new clutch slave cylinder. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	INSTALL a new clutch master cylinder. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER

B1 TEST FOR CLUTCH SHUDDER

- Start the engine.
- Engage the clutch and select fourth gear.
- Run the engine at approximately 2000 rpm.
- Release the clutch pedal slowly.

Does the clutch take up the drive smoothly?

Yes	Clutch is OK.
No	GO to B2

B2 CHECK THE CLUTCH DISC AND PRESSURE PLATE FOR OIL OR HYDRAULIC FLUID CONTAMINATION

- Remove the clutch disc and pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Is the clutch disc and pressure plate contaminated with oil or hydraulic fluid?

Yes	CHECK the engine and transaxle for leaks. INSTALL new components as necessary. INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.

No	GO to B3

B3 CHECK THE CLUTCH DISC AND PRESSURE PLATE

- Visually check the clutch disc and pressure plate.

Is the clutch disc and pressure plate worn or damaged?

Yes	INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	INSPECT the flywheel clutch surface. TEST the system for normal operation.

PINPOINT TEST C : CLUTCH DRAG

C1 CHECK THE OPERATION OF THE CLUTCH PEDAL

- Bleed the clutch system.
  REFER to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).

Does the clutch properly disengage after bleeding?

Yes	Clutch system is OK.
No	GO to C2

C2 CHECK THE CLUTCH DISC AND PRESSURE PLATE FOR OIL OR HYDRAULIC FLUID CONTAMINATION

- Remove the clutch disc and pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Is the clutch disc and pressure plate contaminated with oil or hydraulic fluid?

Yes	CHECK the engine and transaxle for leaks. INSTALL new components as necessary. INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	GO to C3

C3 CHECK THE CLUTCH DISC AND PRESSURE PLATE

- Visually check the clutch disc and pressure plate.

Is the clutch disc and pressure plate worn or damaged?

Yes	INSTALL a new clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	GO to C4

C4 CHECK THE INPUT SHAFT SPLINES

- Check that the clutch disc slides freely on the input shaft splines.

Does the clutch disc stick on the input shaft?

Yes	CHECK the clutch disc and input shaft splines for damage. INSTALL new components as necessary. TEST the system for normal operation.
No	MEASURE the crankshaft end play.

PINPOINT TEST D : EXCESSIVE NOISE

D1 STATIC CHECK

- Depress and release the clutch pedal.

Is the noise apparent when the clutch is operated?

Yes	LUBRICATE the clutch and brake pedal shaft. TEST the system for normal operation.
No	GO to D2

D2 DYNAMIC CHECK

- Start the engine.
- Depress the clutch pedal.

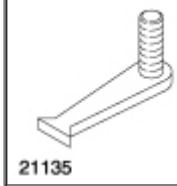
Is the noise apparent when the clutch pedal is depressed?

Yes	REFER to: Engine (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).
No	INSTALL a new clutch slave cylinder and release bearing assembly. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Clutch Disc and Pressure Plate

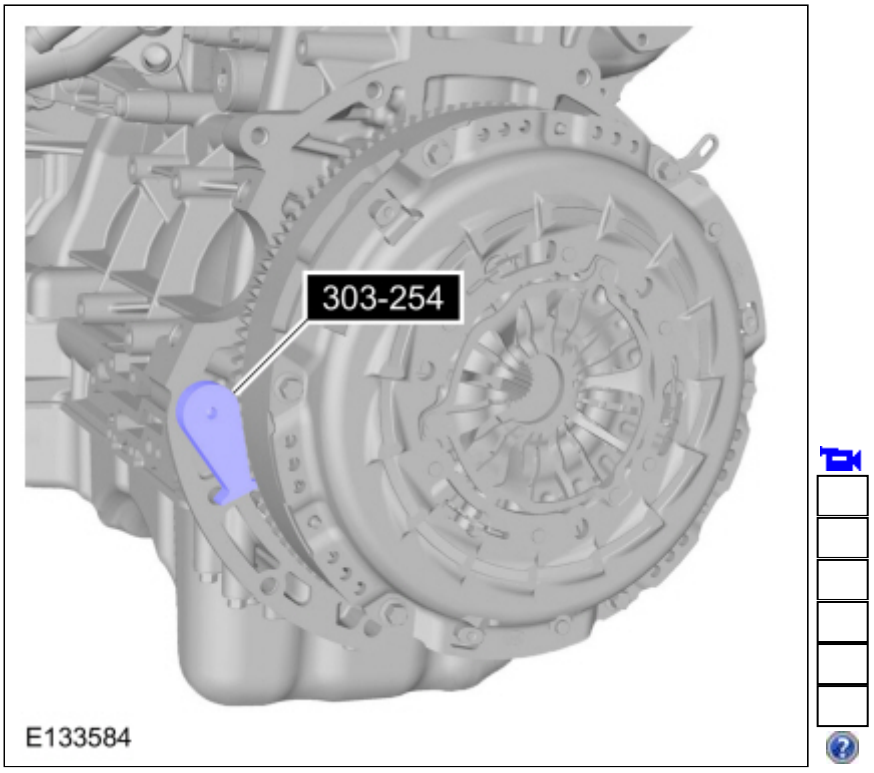
Special Tool(s) / General Equipment

 21135	303-254 Locking Tool, Flywheel
 16067	308-204 Aligner, Clutch Disc

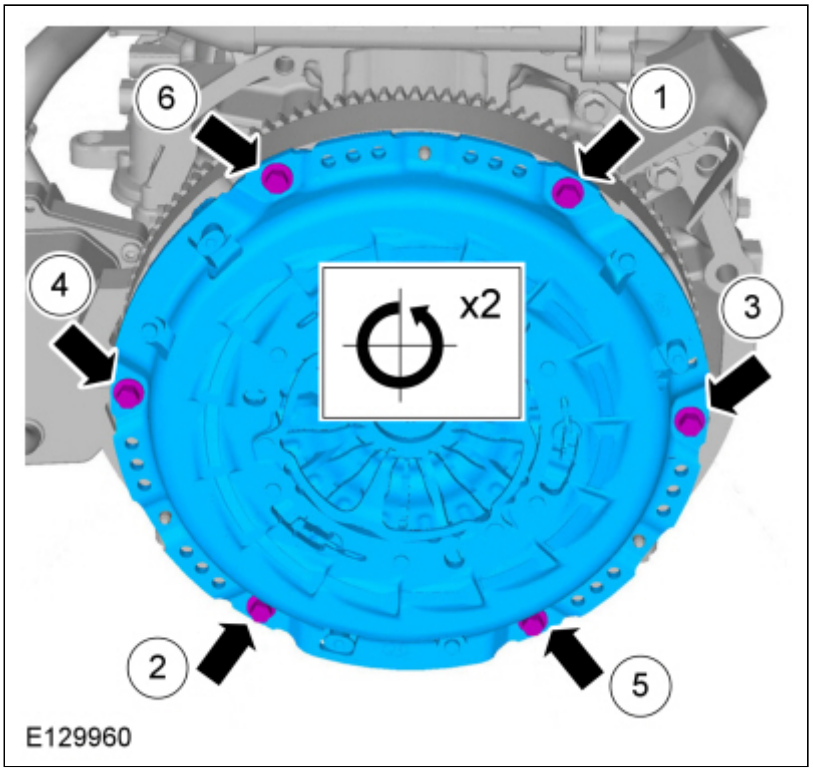
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Removal).
   Refer to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x4 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Removal).
4. Use Special Service Tool: 303-254 Locking Tool, Flywheel.

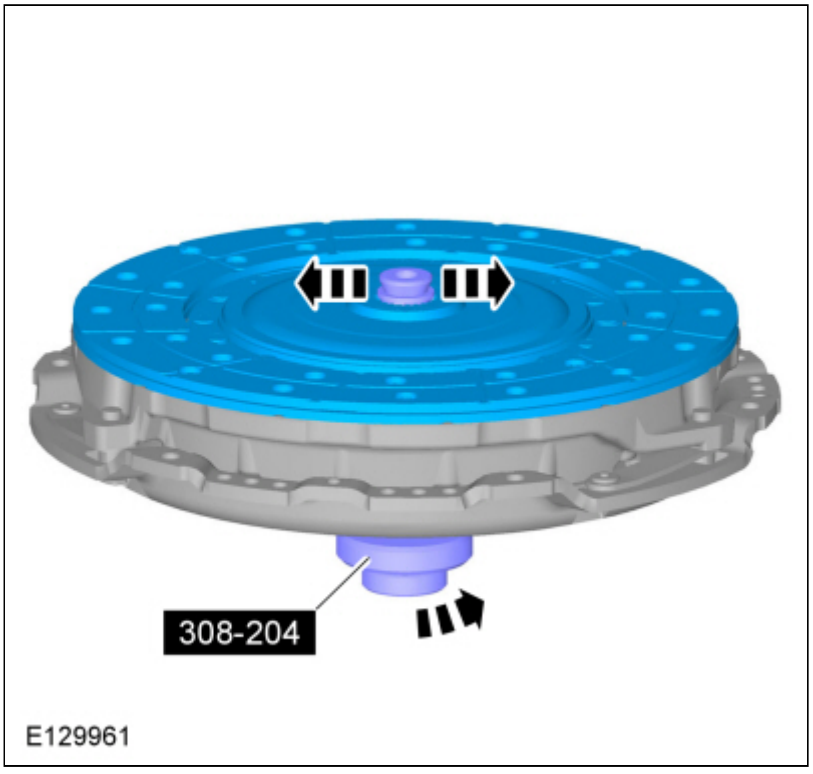


5. **NOTICE: Loosen the clutch pressure plate retaining bolts by two turns at a time in the sequence shown.**



Installation

1. Using the special tool, centralize the clutch disc on the pressure plate.
   Use Special Service Tool: 308-204 Aligner, Clutch Disc.



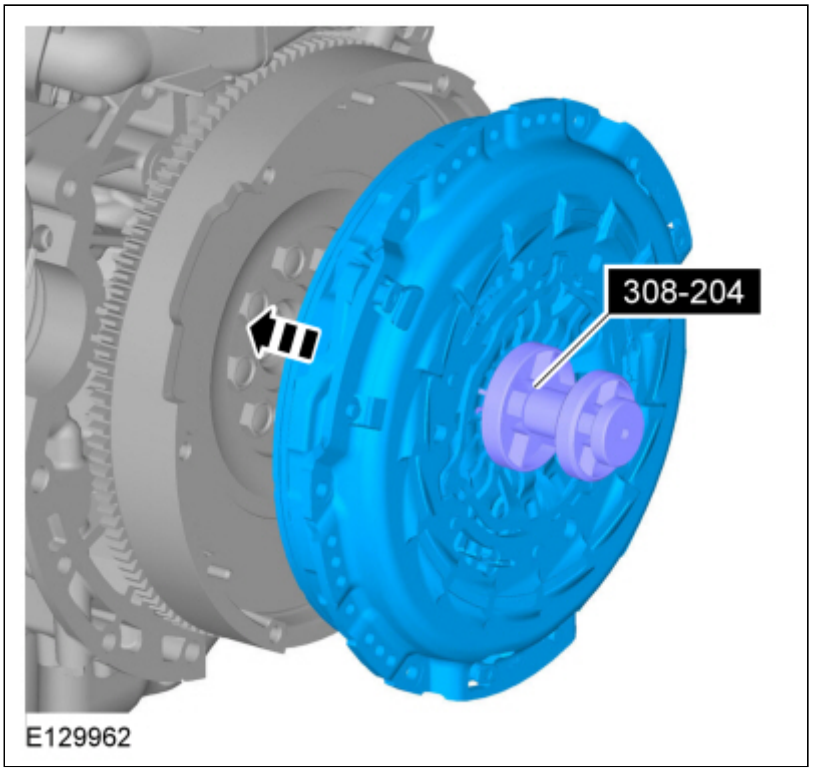
2. **NOTE:** *Check the pilot bearing for damage. If damaged, install a new pilot bearing.*

   NOTE: *Do not apply grease to a newly installed pilot bearing.*

   Refer to: Pilot Bearing - Diesel (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

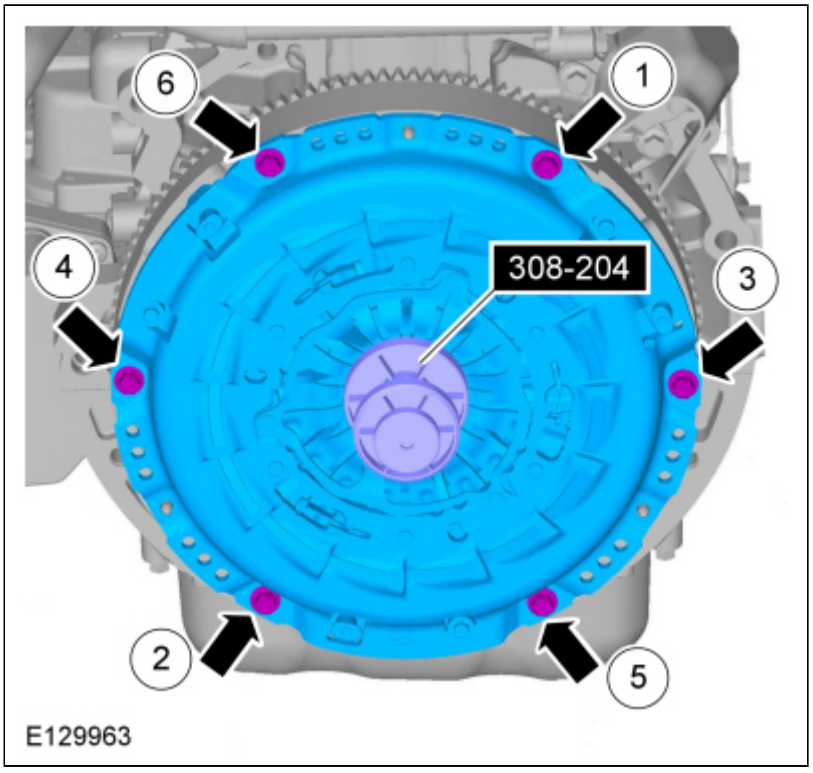
3. **NOTE:** *Hand tighten the bolts at this stage.*

   Use Special Service Tool: 308-204 Aligner, Clutch Disc.

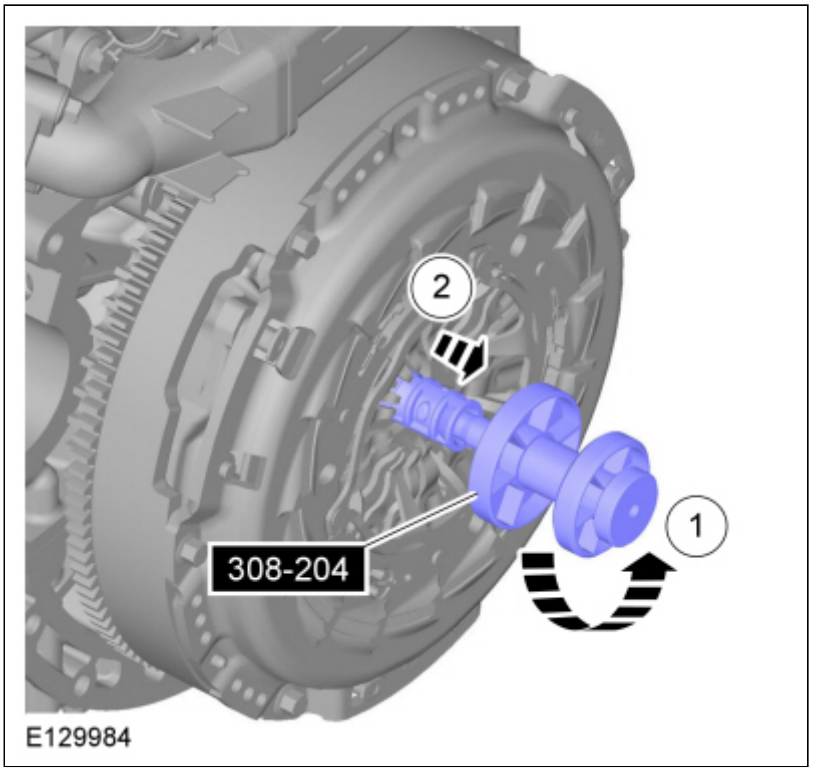


4. **NOTICE: Tighten the clutch pressure plate retaining bolts in the sequence shown to the specified torque.**

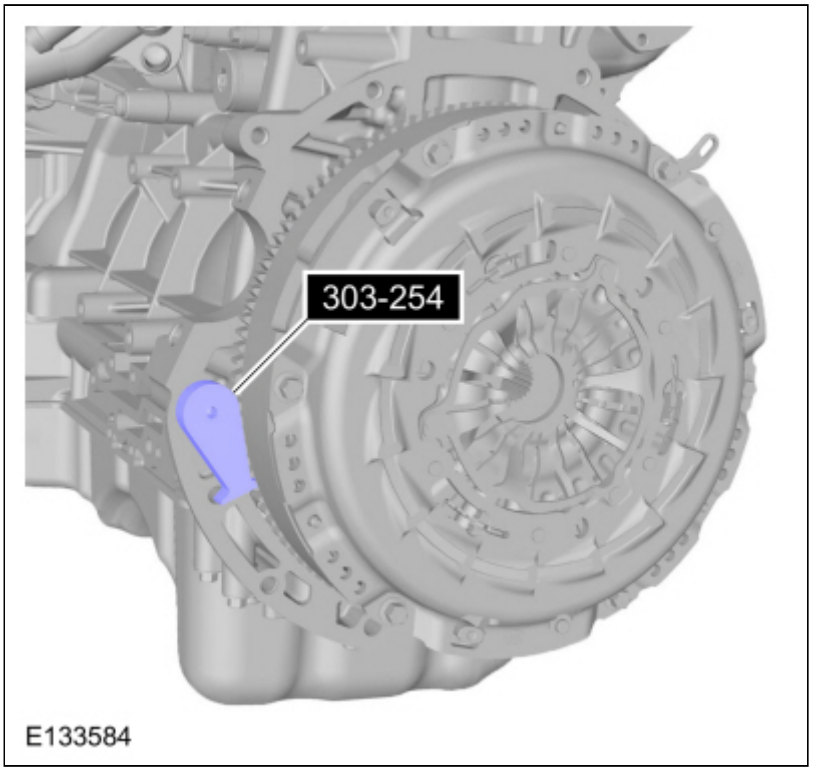
   Use Special Service Tool: 308-204 Aligner, Clutch Disc.
   Torque: 30 Nm



5. Remove Special Service Tool: 308-204 Aligner, Clutch Disc.



6. Remove Special Service Tool: 303-254 Locking Tool, Flywheel.

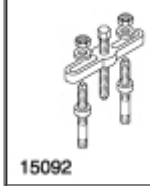
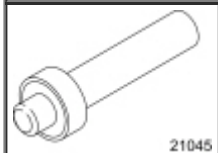


7. Refer to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Installation).
   Refer to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x4 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Installation).

Copyright © 2016 Ford Motor Company

Pilot Bearing - Diesel

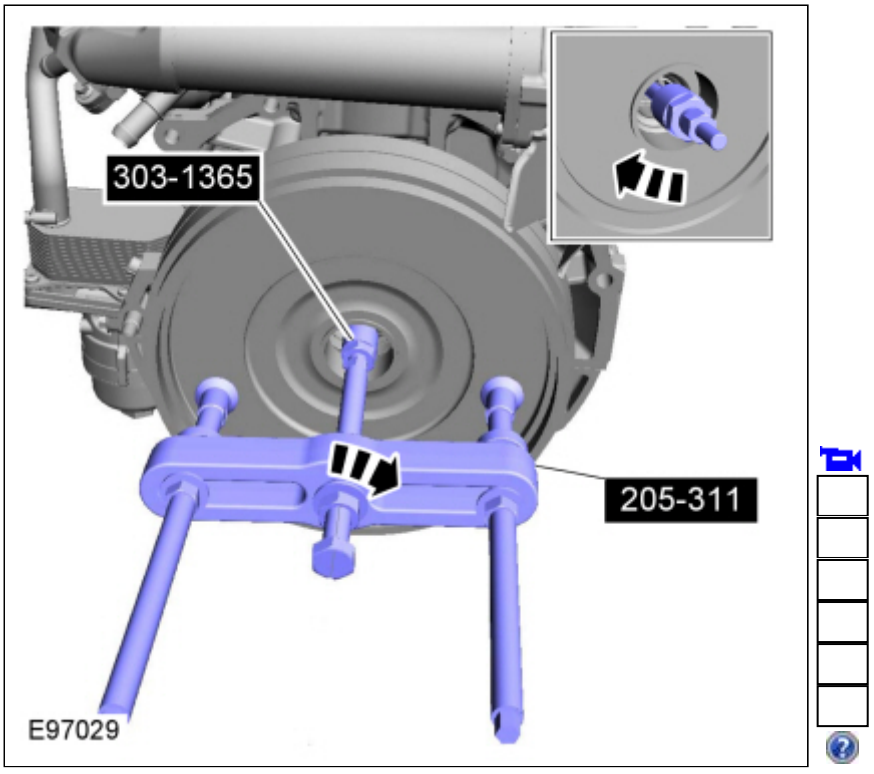
Special Tool(s) / General Equipment

 15092	205-311 Remover, Bearing/Gear
 21045	303-090 Installer, Crankshaft Pilot Bearing
 E92318	303-1365 Remover, Crankshaft Pilot Bearing

Removal

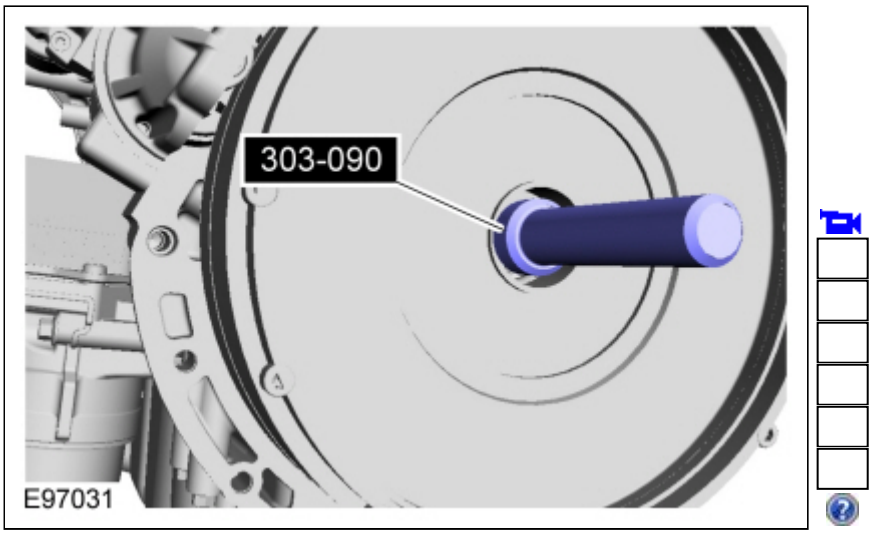
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
   Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
2. Use Special Service Tool: 205-311 Remover, Bearing/Gear. , 303-1365 Remover, Crankshaft Pilot Bearing.



Installation

1. Use Special Service Tool: 303-090 Installer, Crankshaft Pilot Bearing.



2. Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
   Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

Copyright © 2016 Ford Motor Company

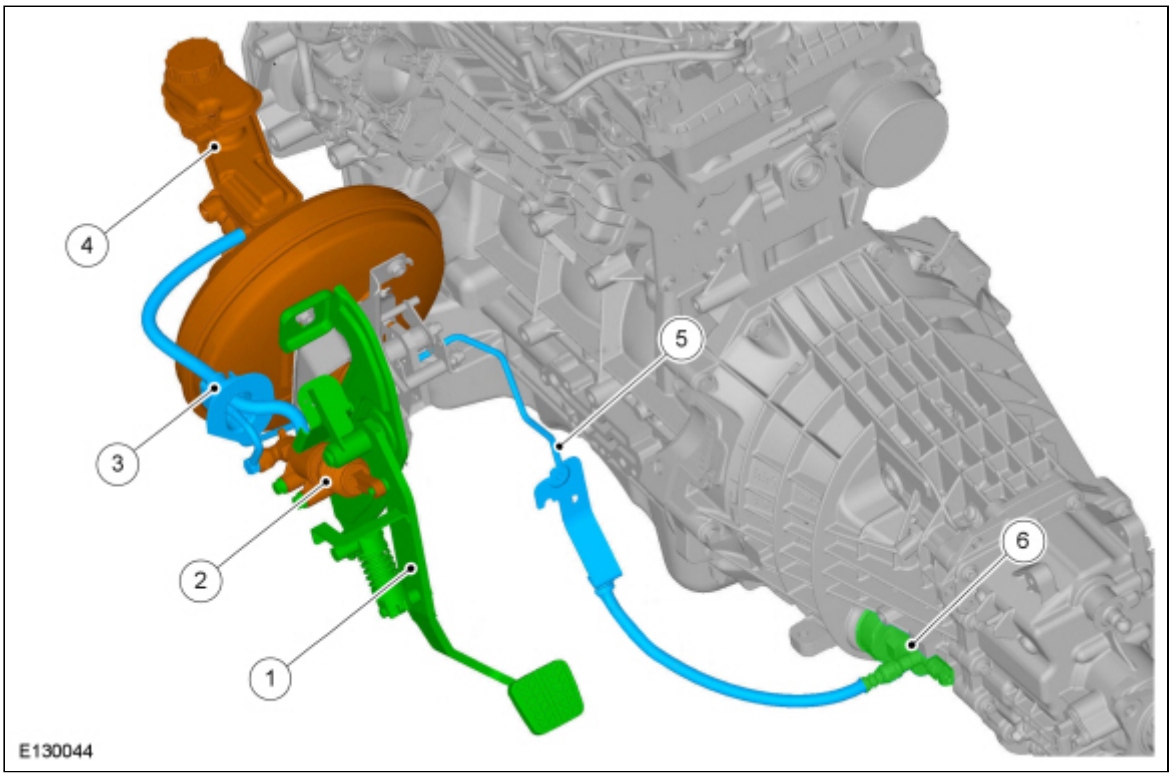
Specifications

General Specifications

	Specifications
Super Dot 4 brake fluid	ESD-M6C57-A / WSSM6C57- A2

Copyright © 2016 Ford Motor Company

Clutch Controls - Component Location



Item	Part Number	Description
1	—	Clutch pedal
2	—	Clutch master cylinder
3	—	Master cylinder fluid tube
4	—	Hydraulic fluid reservior
5	—	Slave cylinder fluid tube
6	—	Clutch slave cylinder

Copyright © 2016 Ford Motor Company

Clutch Controls

Symptom Chart(s)

Symptom Chart: Clutch Controls

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

Condition	Possible Sources	Actions
Clutch slippage	• Clutch pedal reserve • Worn or damaged pressure plate • Clutch disc facing • Hardened or oiled clutch disc facing surface • Flywheel	GO to Pinpoint Test A
Clutch chatter, rattle or shudder	• Loose or damaged engine or transmission mounts • Oil on clutch disc facing • Worn pressure plate • Clutch disc facing • Loose or damaged flywheel • Worn clutch disc	GO to Pinpoint Test B
Clutch drag	• Insufficient clutch hydraulic fluid • Air in hydraulic system • Clutch pedal reserve • Diaphragm springs • Clutch disc • Clutch disc splines • Oil on clutch disc facing	GO to Pinpoint Test C
Clutch pedal pulsation	• Clutch and brake pedal pivot shaft not correctly lubricated • Flywheel • Worn pressure plate springs	GO to Pinpoint Test B
Clutch related vibrations	• Engine component grounding against frame • Accessory drive belt • Flywheel bolts loose • Flywheel • Imbalanced clutch pressure plate	GO to Pinpoint Test B
Hard shifting	• Insufficient clutch hydraulic fluid • Clutch pedal reserve • Transmission concern	GO to Pinpoint Test C
Clutch system	• Clutch master cylinder	INSPECT the clutch master cylinder, the clutch slave cylinder

leakage	• Clutch slave cylinder • Clutch hydraulic tubes	and all hydraulic system tubes for leakage. REPAIR as necessary.

Pinpoint Test(s)

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 TEST CLUTCH SLIPPAGE

- Apply the parking brake.
- Start engine and engage 4th gear.
- Run the engine at approximately 2,000 rpm.
- Slowly release clutch pedal.

Does the engine stall when the clutch pedal is fully released?

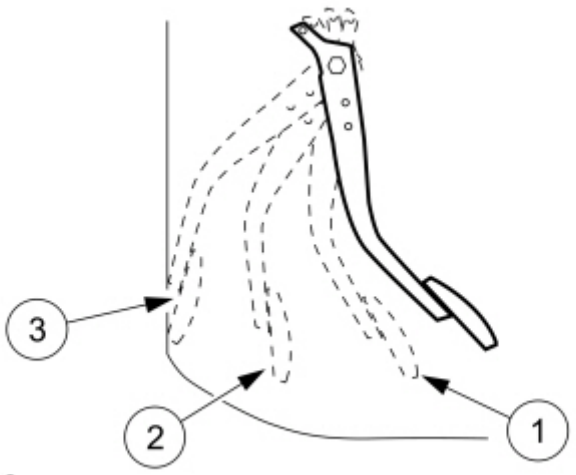
Yes	Clutch is OK.
No	GO to A2

A2 MEASURE THE CLUTCH RESERVE

NOTE: *If equipped, remove the floor mat to allow the clutch pedal to travel to the downstop.*

- Install a cable tie to the clutch pedal, than attach a tape measure to the cable tie.
- Pull the tape measure up to the steering wheel. Position it through the steering wheel opening. Put a piece of masking tape on the steering wheel and index mark the masking tape.
- Press the clutch pedal fully and start the vehicle.
- Shift the transmission into REVERSE gear, then move the gearshift lever forward to the position in between REVERSE gear and NEUTRAL. Slowly release the clutch pedal (if the vehicle creeps rearward, move the gearshift lever forward a little more). The transmission will work as if in NEUTRAL, but the reverse gear synchronizer will be bypassed.
- With the clutch pedal released, gently pull the gearshift lever toward the REVERSE gear position. Gear clash can now be heard.
- Slowly press the clutch pedal. Using the mark on the tape as a reference, note the measurement when the gear clash stops or the gearshift lever slides into REVERSE gear. Press the clutch pedal to the downstop. The difference between the measurement taken when the gear clash stopped and the measurement taken at the downstop is the clutch reserve.

Item	Pedal Position
1	Gear clash begins
2	Gear clash ends
3	Clutch pedal downstop



Is the clutch reserve greater than or equal to 25 mm (0.984 in)?

Yes	Clutch pedal reserve is OK. VERIFY customer concern.
No	INSTALL a clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

PINPOINT TEST B : CLUTCH EXCESSIVE NOISE OR VIBRATION

B1 CHECK THE ENGINE OR TRANSMISSION MOUNTS

- Inspect all the engine and transmission mounts for looseness or damage.

Are any of the engine or transmission mounts loose or damaged?

Yes	TIGHTEN or INSTALL new engine or transmission mounts. TEST the system for normal operation.
No	GO to B2

B2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolts loose?

Yes	TIGHTEN or INSTALL new bolts. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to B3

B3 INSPECT THE PRESSURE PLATE

- Remove the clutch pressure plate.
- Inspect the clutch pressure plate for wear or damage.

Are any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). . TEST the system for normal operation.

No	GO to B4

B4 CHECK THE CLUTCH DISC

- NOTE: If the internal damper of the clutch disc is damaged or contaminated with grease or oil, it will sound similar to a "transmission rattle".
- Check the clutch disc for wear or damage.

Is the clutch disc OK?

Yes	GO to B5
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). . TEST the system for normal operation.

B5 INSPECT THE FLYWHEEL

- Inspect the flywheel for wear or damage.

Is the flywheel OK?

Yes	GO to B6
No	REPAIR or INSTALL a new flywheel as necessary. REFER to: Engine Accessories (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal). REFER to: Engine Accessories (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Installation). REFER to: Engine Accessories (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal). REFER to: Engine Accessories (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation). TEST the system for normal operation.

B6 INSPECT THE INPUT SHAFT

- Inspect the input shaft for signs of wear, damage or corrosion.

Are any signs of wear damage, or corrosion present on the input shaft?

Yes	If wear or damage is found, INSTALL a new input shaft. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Assembly). If corrosion is found on the splines of the input shaft, apply a small amount of grease to the splines of the input shaft.
No	VERIFY the customer concern. Refer to Symptom Chart: Transmission REFER to: Manual Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).

PINPOINT TEST C : HARD TO SHIFT

C1 CHECK CLUTCH FLUID LEVEL

- Check clutch fluid level.

Is the clutch fluid level between the MAX and MIN marks on the brake fluid reservoir?

Yes	GO to C2
No	FILL reservoir to specification, CHECK the brake and clutch systems for leaks. TEST clutch system for normal operation.

C2 BLEED THE CLUTCH SYSTEM

- Bleed the clutch system.
  REFER to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).

Does the clutch pedal show improved disengaging characteristics after bleeding the clutch system?

Yes	Clutch OK.
No	GO to C3

C3 CHECK THE CLUTCH PEDAL FREE PLAY

- Measure the clutch pedal free play.
- Press the clutch pedal until resistance is felt, then release it.

Is the pedal travel approximately 10 mm?

Yes	GO to C4
No	Check that the clutch pedal moves freely, remove the clutch pedal if necessary.

C4 CHECK THE BELLEVILLE SPRING WASHER OF THE CLUTCH PRESSURE PLATE

- Remove transmission.
  REFER to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
  REFER to: Transmission - 4x4 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).

Does the clutch pressure plate or the Belleville spring washer of the clutch pressure plate show signs of wear or damage?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). TEST the system for normal operation.
No	VERIFY the customer concern.

Component Test(s)

Clutch Hydraulic System

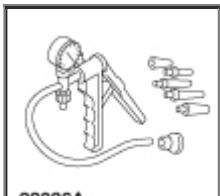
1. Verify the clutch hydraulic fluid reservoir is filled to the correct level.
2. If the fluid level is low, add fluid as necessary. Check the clutch hydraulic system for leaks and repair as necessary.
3. If the fluid is at the correct level, proceed to clutch check.
4. Apply and release the clutch pedal slowly to check for pedal binding. Make sure the clutch pedal can be fully applied and is not restricted by the floor mat. Verify the pedal return spring is present and functions correctly.
5. Measure the clutch reserve. GO to Pinpoint Test A

6. Set the park brake. The clutch pedal is in the up position and the engine idling, gently move the gearshift lever forward toward reverse gear until gear clash can be heard. Apply the clutch pedal slowly.
7. If the gears cease to clash (full disengage at to from the floor), hold the clutch pedal at the point of disengagement and increase engine speed to 4,000 rpm. The clutch should remain disengaged, clutch OK.
8. With the engine idling and the clutch pedal applied, move the gearshift lever into 4th gear. Increase the engine speed to 2,000 rpm and slowly release the clutch pedal.
9. If the engine does not stall, clutch is slipping. Repair as necessary.
   REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
10. If the engine stalls, clutch is OK.

Copyright © 2016 Ford Motor Company

Clutch System Bleeding

Special Tool(s) / General Equipment

 23036A	416-D001 Hand Vacuum Pump/Pressure Pump

Activation

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

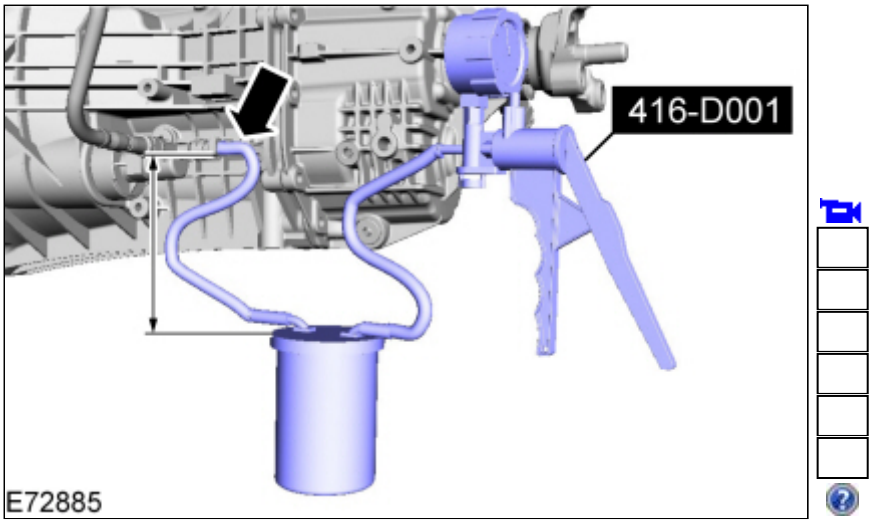
NOTICE: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

NOTE: *If proprietary brake bleeding equipment is available, this can be used to bleed the clutch system, following the method below. The maximum pressure must not exceed 1.5 bar.*

NOTE: *The clutch control system is self-venting. The components are arranged in such a way that small amounts of air trapped in the system are removed automatically during clutch operation.*

1. Fill the brake fluid reservoir.
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Fill the reservoir of the special tool with approximately 100 ml of new brake fluid WSS-M6C65-A2 Super Dot4-14M.
4. **NOTE:** *Make sure that the special tool reservoir is positioned lower than the bleed nipple.*

   Install Special Service Tool: 416-D001 Hand Vacuum Pump/Pressure Pump.



5. Open the bleed nipple.
6. Using the special tool, bleed the clutch system.
7. Close the bleed nipple.
8. Remove Special Service Tool: 416-D001 Hand Vacuum Pump/Pressure Pump.

9. Lower the vehicle. In order to remove any small amounts of trapped air remaining in the system, operate the clutch pedal several times (maximum five times), using the full clutch pedal travel.
10. Check the fluid level in the brake fluid reservoir and top up to the MAX mark with brake fluid WSS-M6C65-A2 Super Dot4-14M, if necessay.
11. Start the engine, depress the clutch pedal, wait for two seconds, then carefully engage reverse gear. If there are any abnormal noises, or reverse gear is difficult to engage, repeat the clutch system bleeding procedure.

Copyright © 2016 Ford Motor Company

Clutch Master Cylinder

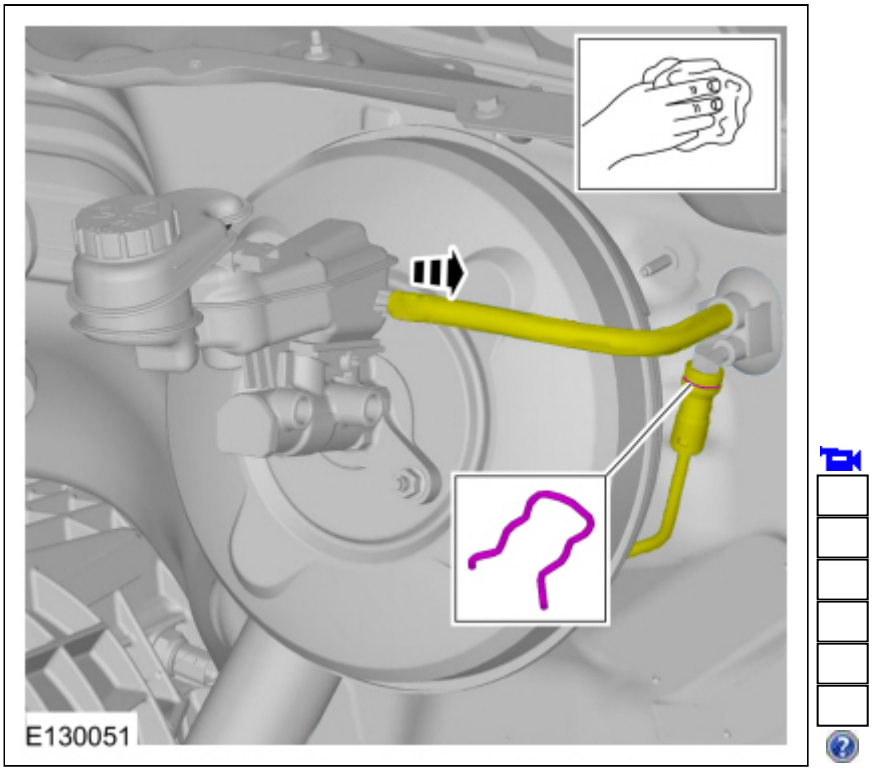
Removal

NOTICE: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

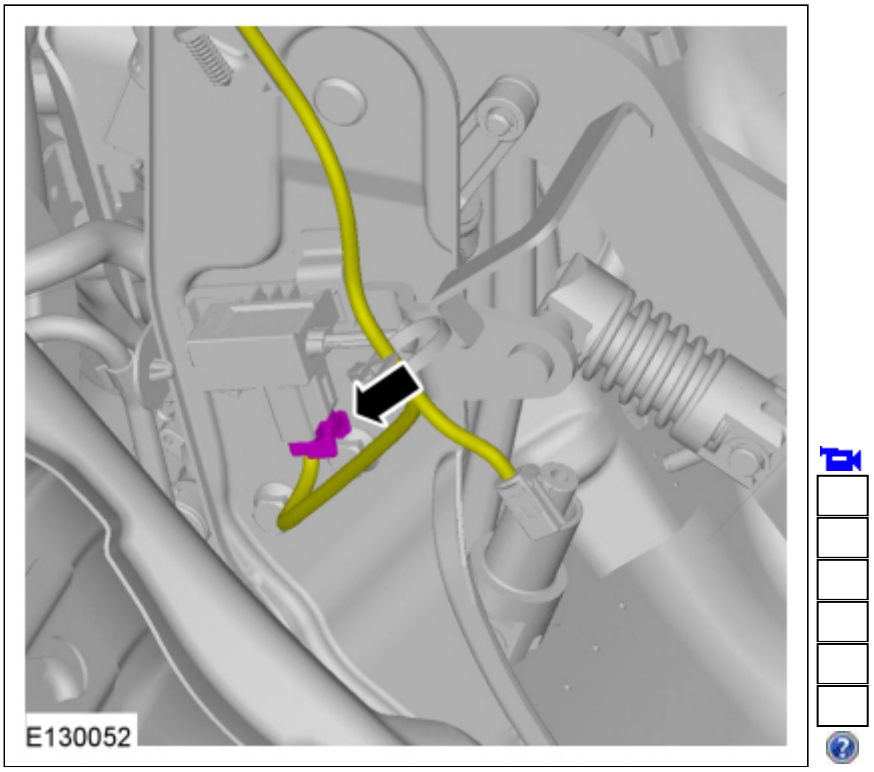
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. Refer to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
4. **WARNING: Be prepared to collect escaping fluids.**

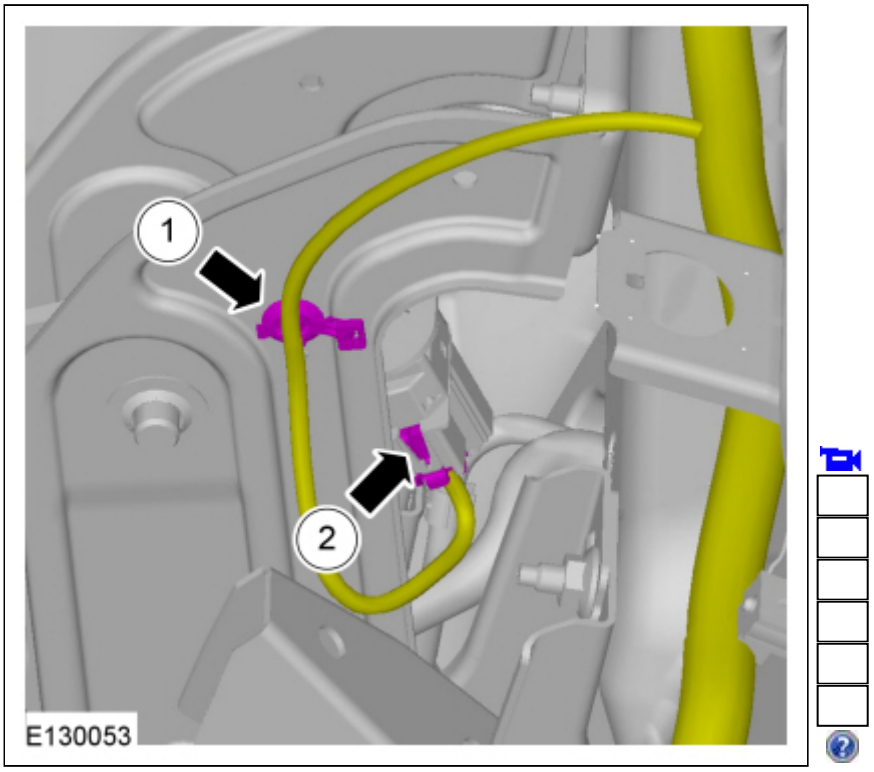
   NOTE: *Cap the clutch master cylinder supply hose to prevent fluid loss or dirt ingress.*



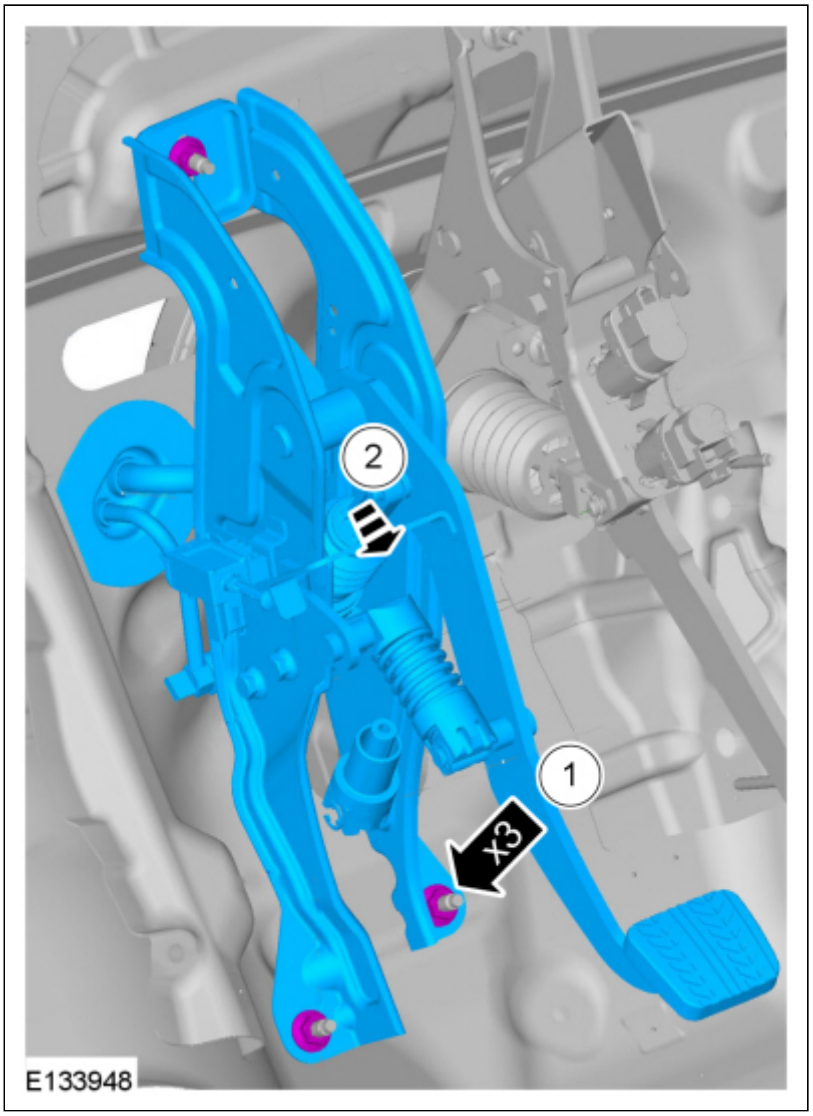
5.



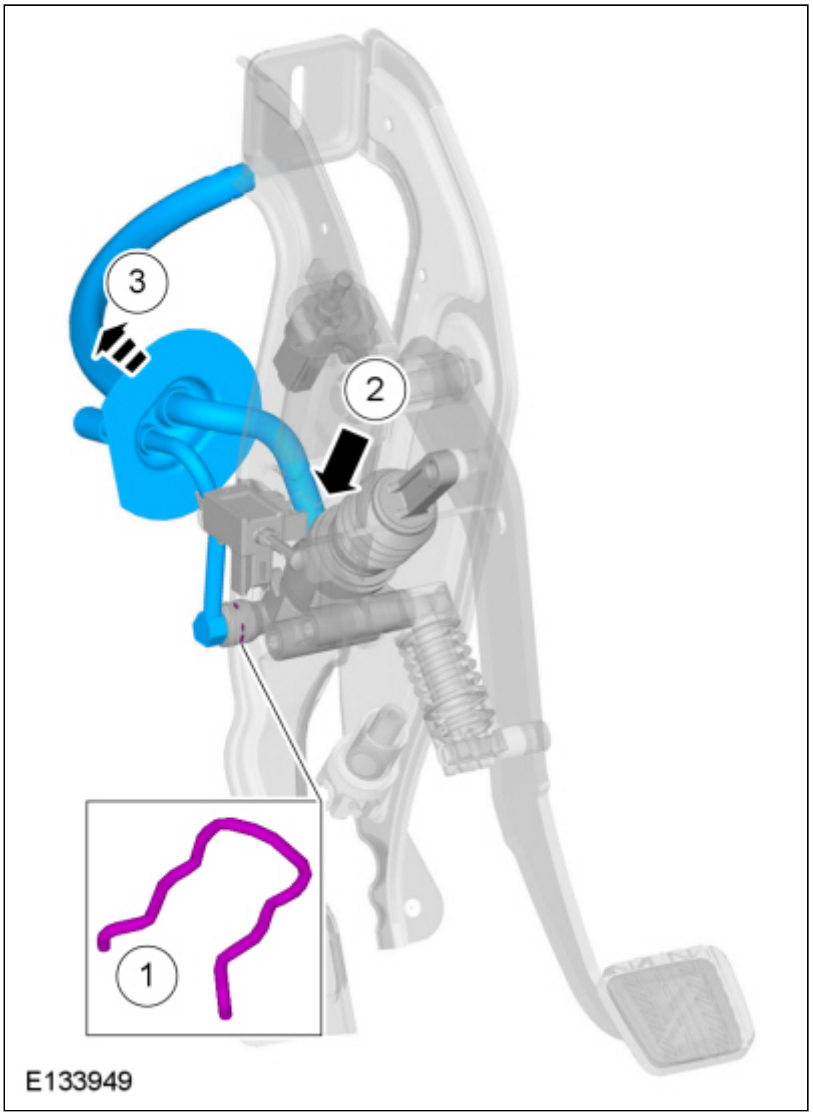
6.



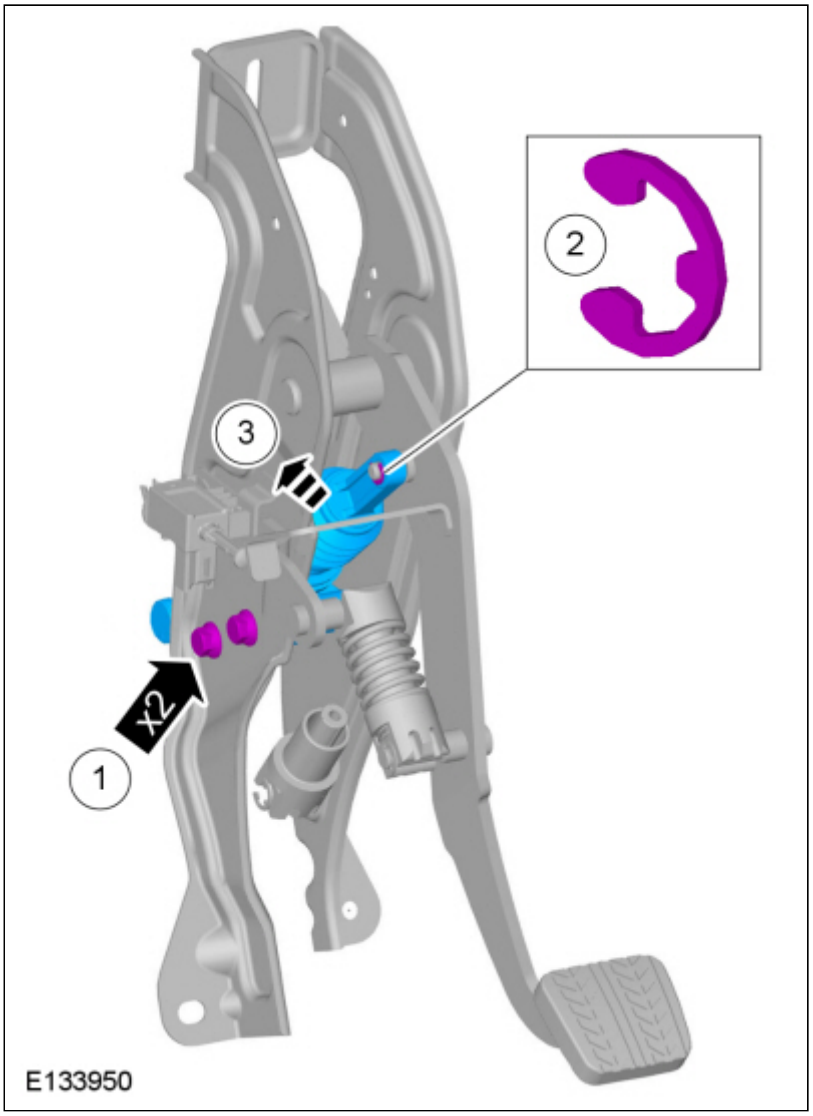
7. *Torque*: 15 Nm



8.



9. *Torque*: 23 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).
   Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

Clutch Slave Cylinder

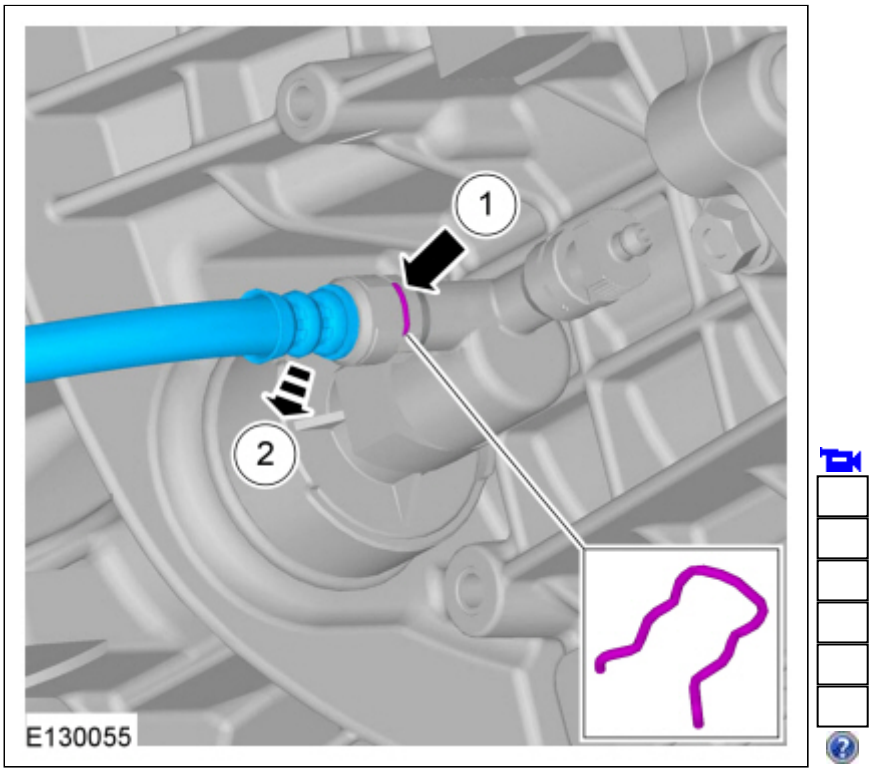
Removal

NOTICE: If the fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

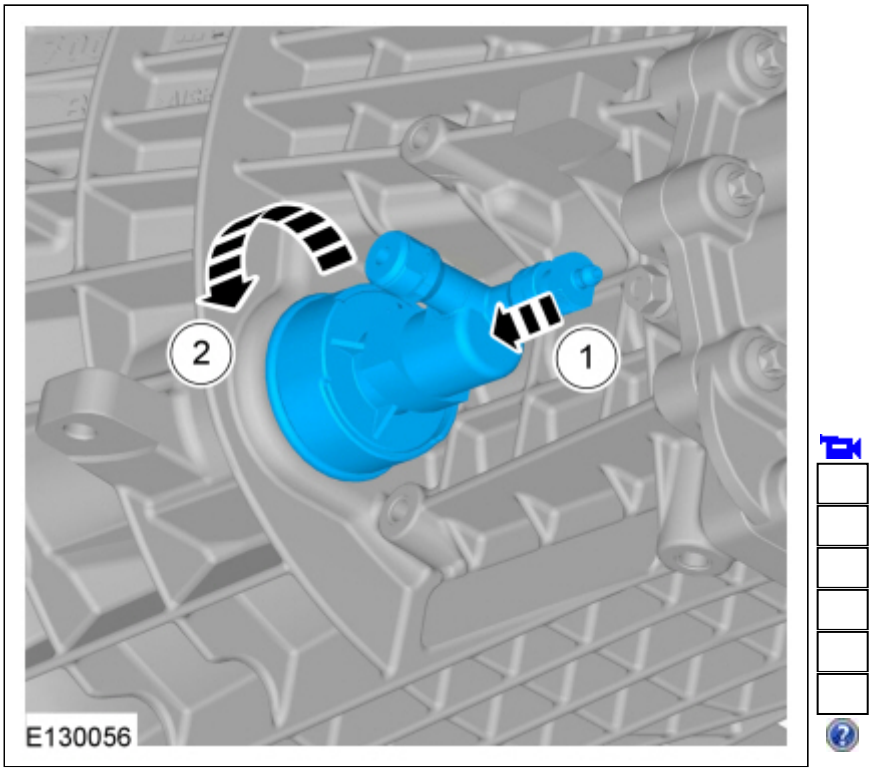
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).

2.

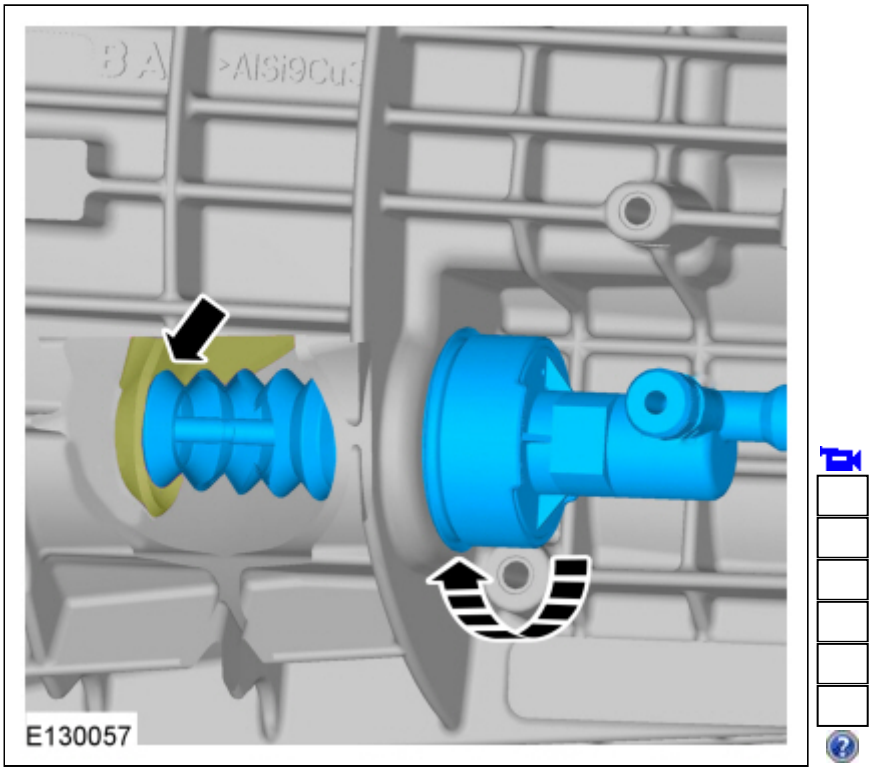


3.



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Make sure that the clutch slave cylinder actuating rod is correctly engaged with the clutch release lever.**



3. Refer to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).

Copyright © 2016 Ford Motor Company

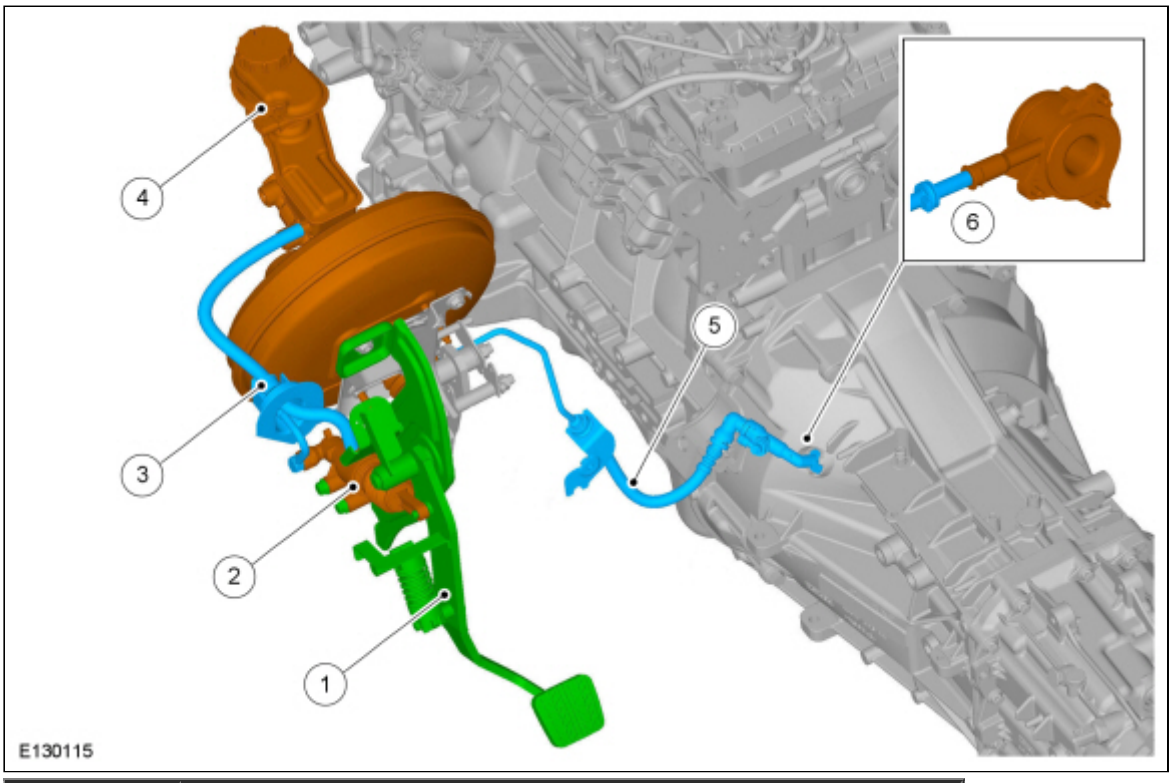
Specifications

General Specifications

	Specifications
Super Dot 4 brake fluid	ESD-M6C57-A / WSSM6C57- A2

Copyright © 2016 Ford Motor Company

Clutch Controls - Component Location



Item	Description
1	Clutch pedal
2	Clutch master cylinder
3	Master cylinder fluid tube
4	Hydraulic fluid reservior
5	Slave cylinder fluid tube
6	Clutch slave cylinder

Copyright © 2016 Ford Motor Company

Clutch Controls

Symptom Chart(s)

Symptom Chart: Clutch Controls

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

Condition	Possible Sources	Actions
Clutch slippage	• Clutch pedal reserve • Worn or damaged pressure plate • Clutch disc facing • Hardened or oiled clutch disc facing surface • Flywheel	GO to Pinpoint Test A
Clutch chatter, rattle or shudder	• Loose or damaged engine or transmission mounts • Oil on clutch disc facing • Worn pressure plate • Clutch disc facing • Loose or damaged flywheel • Worn clutch disc	GO to Pinpoint Test B
Clutch drag	• Insufficient clutch hydraulic fluid • Air in hydraulic system • Clutch pedal reserve • Diaphragm springs • Clutch disc • Clutch disc splines • Oil on clutch disc facing	GO to Pinpoint Test C
Clutch pedal pulsation	• Clutch and brake pedal pivot shaft not correctly lubricated • Flywheel • Worn pressure plate springs	GO to Pinpoint Test B
Clutch related vibrations	• Engine component grounding against frame • Accessory drive belt • Flywheel bolts loose • Flywheel • Imbalanced clutch pressure plate	GO to Pinpoint Test B
Hard shifting	• Insufficient clutch hydraulic fluid • Clutch pedal reserve • Transmission concern	GO to Pinpoint Test C
Clutch system	• Clutch master cylinder	INSPECT the clutch master cylinder, the clutch slave cylinder

leakage	• Clutch slave cylinder • Clutch hydraulic tubes	and all hydraulic system tubes for leakage. REPAIR as necessary.

Pinpoint Test(s)

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 TEST CLUTCH SLIPPAGE

- Apply the parking brake.
- Start engine and engage 4th gear.
- Run the engine at approximately 2,000 rpm.
- Slowly release clutch pedal.

Does the engine stall when the clutch pedal is fully released?

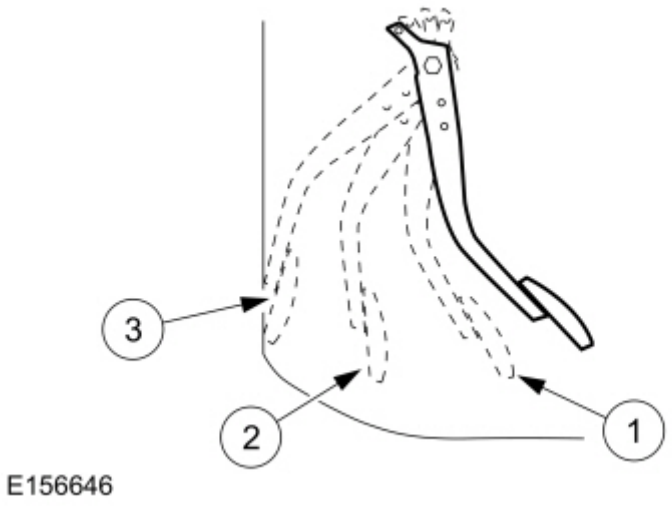
Yes	Clutch is OK.
No	GO to A2

A2 MEASURE THE CLUTCH RESERVE

NOTE: *If equipped, remove the floor mat to allow the clutch pedal to travel to the downstop.*

- Install a cable tie to the clutch pedal, than attach a tape measure to the cable tie.
- Pull the tape measure up to the steering wheel. Position it through the steering wheel opening. Put a piece of masking tape on the steering wheel and index mark the masking tape.
- Press the clutch pedal fully and start the vehicle.
- Shift the transmission into REVERSE gear, then move the gearshift lever forward to the position in between REVERSE gear and NEUTRAL. Slowly release the clutch pedal (if the vehicle creeps rearward, move the gearshift lever forward a little more). The transmission will work as if in NEUTRAL, but the reverse gear synchronizer will be bypassed.
- With the clutch pedal released, gently pull the gearshift lever toward the REVERSE gear position. Gear clash can now be heard.
- Slowly press the clutch pedal. Using the mark on the tape as a reference, note the measurement when the gear clash stops or the gearshift lever slides into REVERSE gear. Press the clutch pedal to the downstop. The difference between the measurement taken when the gear clash stopped and the measurement taken at the downstop is the clutch reserve.

Item	Pedal Position
1	Gear clash begins
2	Gear clash ends
3	Clutch pedal downstop



Is the clutch reserve greater than or equal to 25 mm (0.984 in)?

Yes	Clutch pedal reserve is OK. VERIFY customer concern.
No	INSTALL a clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

PINPOINT TEST B : CLUTCH EXCESSIVE NOISE OR VIBRATION

B1 CHECK THE ENGINE OR TRANSMISSION MOUNTS

- Inspect all the engine and transmission mounts for looseness or damage.

Are any of the engine or transmission mounts loose or damaged?

Yes	TIGHTEN or INSTALL new engine or transmission mounts. TEST the system for normal operation.
No	GO to B2

B2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolts loose?

Yes	TIGHTEN or INSTALL new bolts. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to B3

B3 INSPECT THE PRESSURE PLATE

- Remove the clutch pressure plate.
- Inspect the clutch pressure plate for wear or damage.

Are any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). TEST the system for normal operation.

No	GO to B4

B4 CHECK THE CLUTCH DISC

- NOTE: If the internal damper of the clutch disc is damaged or contaminated with grease or oil, it will sound similar to a "transmission rattle".
- Check the clutch disc for wear or damage.

Is the clutch disc OK?

Yes	GO to B5
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). TEST the system for normal operation.

B5 INSPECT THE FLYWHEEL

- Inspect the flywheel for wear or damage.

Is the flywheel OK?

Yes	GO to B6
No	REPAIR or INSTALL a new flywheel as necessary. REFER to: Engine Accessories (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal). REFER to: Engine Accessories (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation). REFER to: Engine Accessories (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal). REFER to: Engine Accessories (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Installation). TEST the system for normal operation.

B6 INSPECT THE INPUT SHAFT

- Inspect the input shaft for signs of wear, damage or corrosion.

Are any signs of wear damage, or corrosion present on the input shaft?

Yes	If wear or damage is found, INSTALL a new input shaft. REFER to: Transmission - 2WD (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Disassembly). REFER to: Transmission - 4WD (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Disassembly). REFER to: Transmission - 2WD (308-03B) . REFER to: Transmission - 4WD (308-03B) . If corrosion is found on the splines of the input shaft, apply a small amount of grease to the splines of the input shaft.
No	VERIFY the customer concern. REFER to: Manual Transmission (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Diagnosis and Testing).

PINPOINT TEST C : HARD TO SHIFT

C1 CHECK CLUTCH FLUID LEVEL

- Check clutch fluid level.

Is the clutch fluid level between the MAX and MIN marks on the brake fluid reservoir?

Yes	GO to C2
No	FILL reservoir to specification, CHECK the brake and clutch systems for leaks. TEST clutch system for normal operation.

C2 BLEED THE CLUTCH SYSTEM

- Bleed the clutch system.
  REFER to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Does the clutch pedal show improved disengaging characteristics after bleeding the clutch system?

Yes	Clutch OK.
No	GO to C3

C3 CHECK THE CLUTCH PEDAL FREE PLAY

- Measure the clutch pedal free play.
- Press the clutch pedal until resistance is felt, then release it.

Is the pedal travel approximately 10 mm?

Yes	GO to C4
No	Check that the clutch pedal moves freely, remove the clutch pedal if necessary.

C4 CHECK THE BELLEVILLE SPRING WASHER OF THE CLUTCH PRESSURE PLATE

- Remove transmission.
  REFER to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Removal).
  REFER to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x4 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Removal).

Does the clutch pressure plate or the Belleville spring washer of the clutch pressure plate show signs of wear or damage?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). TEST the system for normal operation.
No	VERIFY the customer concern.

Component Test(s)

Clutch Hydraulic System

1. Verify the clutch hydraulic fluid reservoir is filled to the correct level.
2. If the fluid level is low, add fluid as necessary. Check the clutch hydraulic system for leaks and repair as necessary.
3. If the fluid is at the correct level, proceed to clutch check.

4. Apply and release the clutch pedal slowly to check for pedal binding. Make sure the clutch pedal can be fully applied and is not restricted by the floor mat. Verify the pedal return spring is present and functions correctly.
5. Measure the clutch reserve. GO to Pinpoint Test A
6. Set the park brake. The clutch pedal is in the up position and the engine idling, gently move the gearshift lever forward toward reverse gear until gear clash can be heard. Apply the clutch pedal slowly.
7. If the gears cease to clash (full disengage at to from the floor), hold the clutch pedal at the point of disengagement and increase engine speed to 4,000 rpm. The clutch should remain disengaged, clutch OK.
8. With the engine idling and the clutch pedal applied, move the gearshift lever into 4th gear. Increase the engine speed to 2,000 rpm and slowly release the clutch pedal.
9. If the engine does not stall, clutch is slipping. Repair as necessary.
   REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
10. If the engine stalls, clutch is OK.

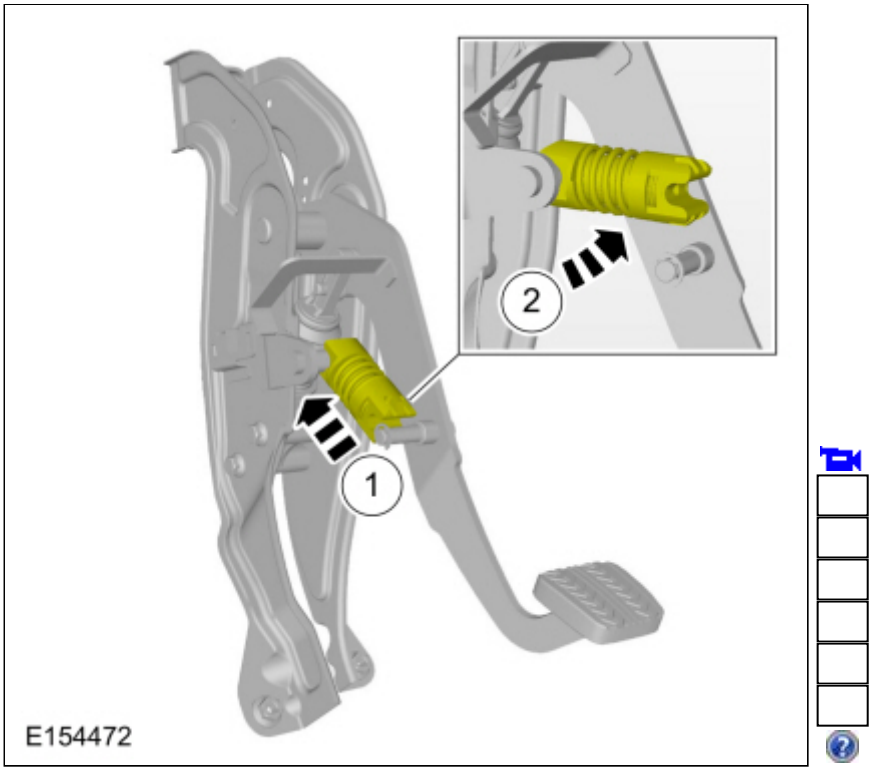
Copyright © 2016 Ford Motor Company

Clutch System Bleeding

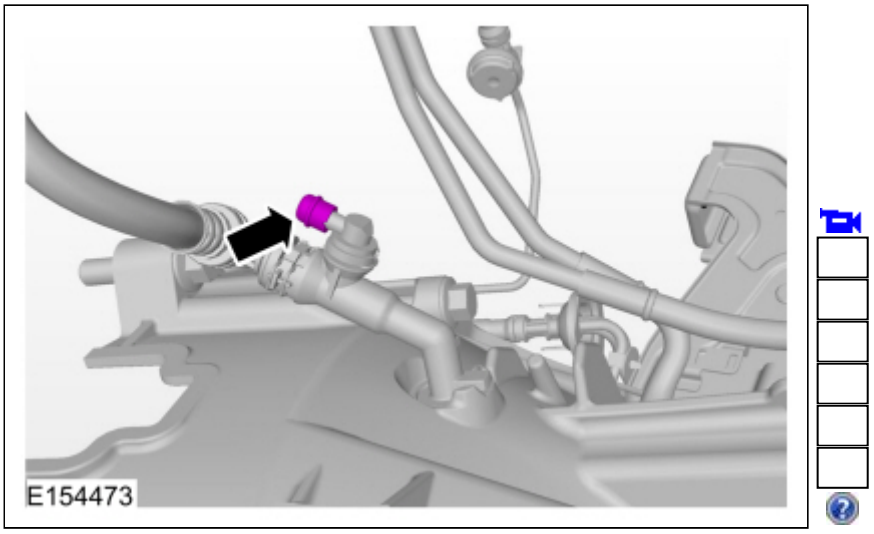
Activation

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

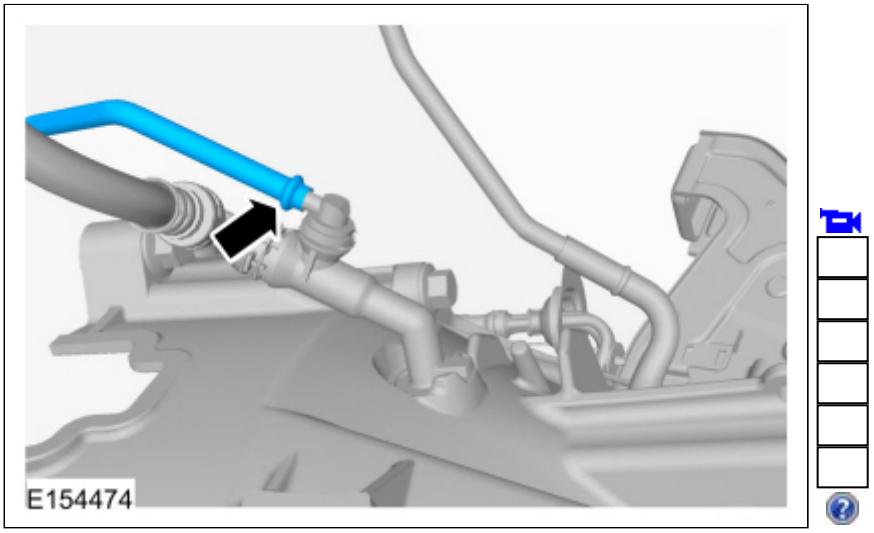
NOTICE: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

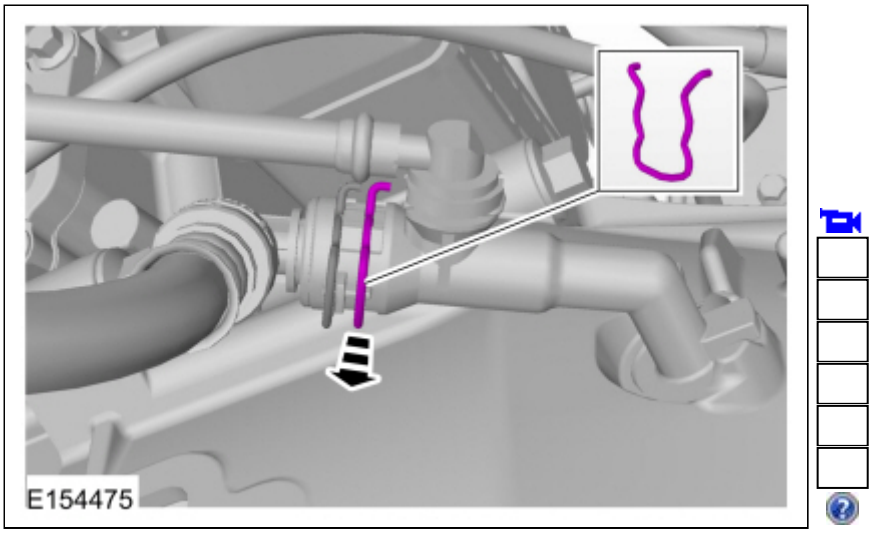
4.



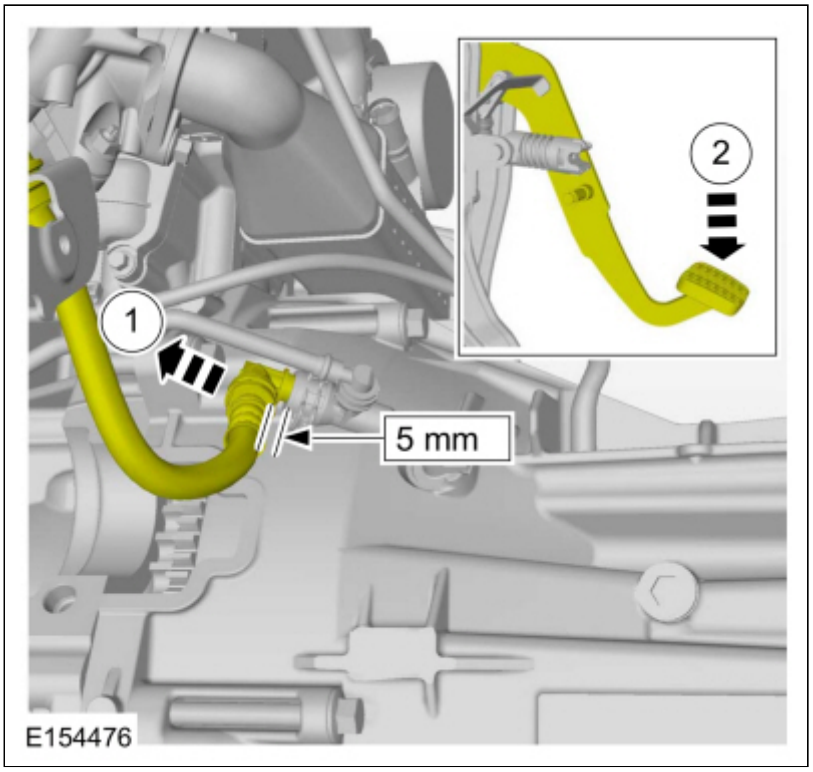
5.



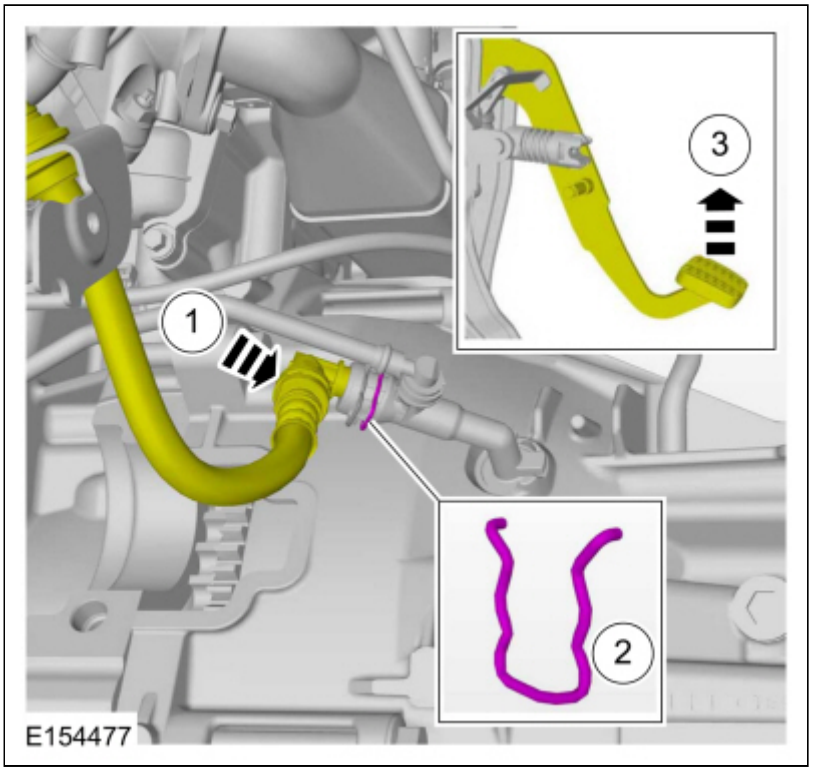
6. Pull the pin out until it clicks into the out position.



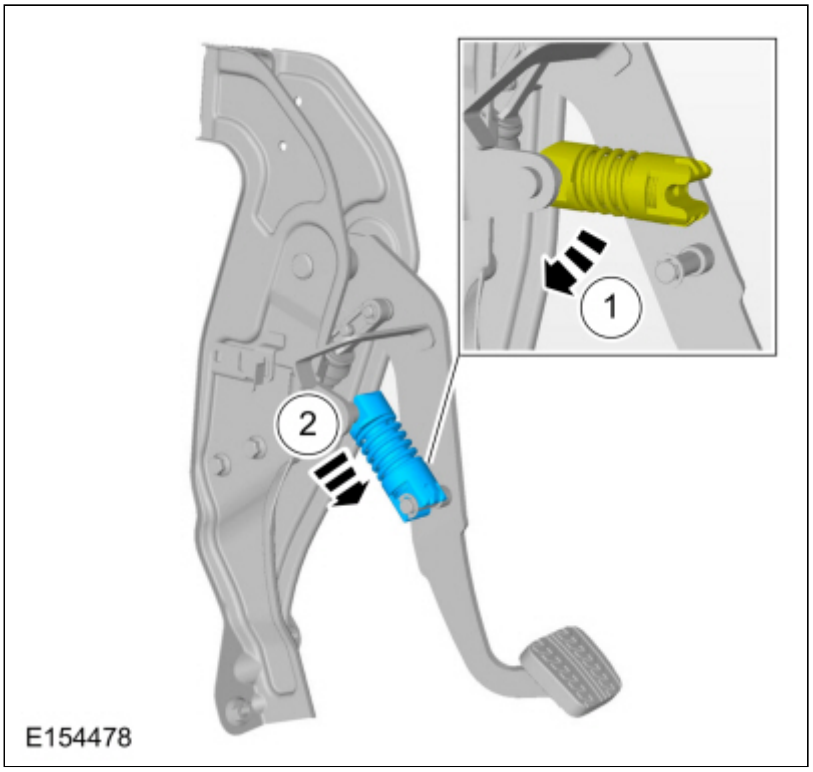
1. Pull this clutch line connector partially out of the adapter and will it then allow fluid to exit the bleed port.
2. Fully depress the clutch pedal.



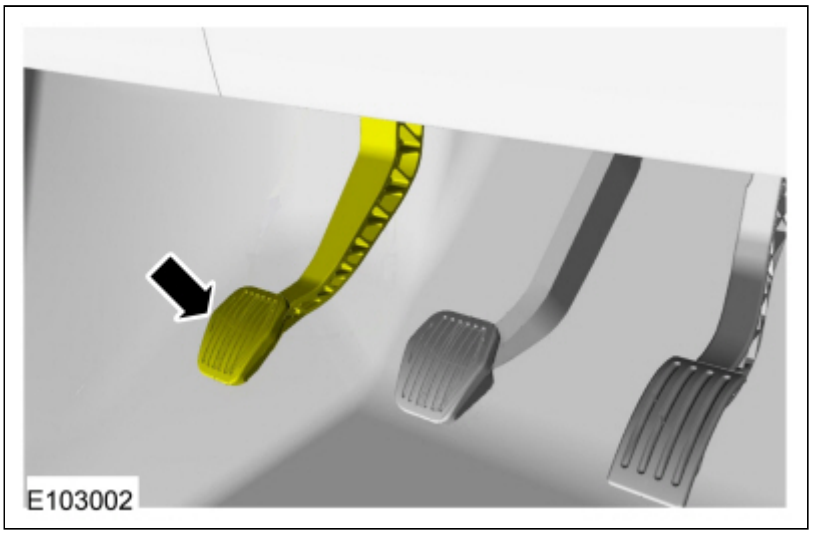
1. Push the clutch line connector back into the adapter.
2. Push the pin in until it clicks into the lock position.
3. Pull the clutch pedal fully up until it reaches it’s end-stop, then hold for 2 seconds to allow fluid to enter from the reservoir.



9. In order to remove any small amounts of trapped air remaining in the system, repeat steps 6 to 10, 15 times.
10.



11. Cycle the pedal from it's undepressed condition to depressed condition (fast upwards). Hold for 2 seconds each time in the fully undepressed condition.



12. Repeat this procedure for a minimum 20 times, until the pedal force builds up to a consistent level.

Copyright © 2016 Ford Motor Company

Clutch Master Cylinder

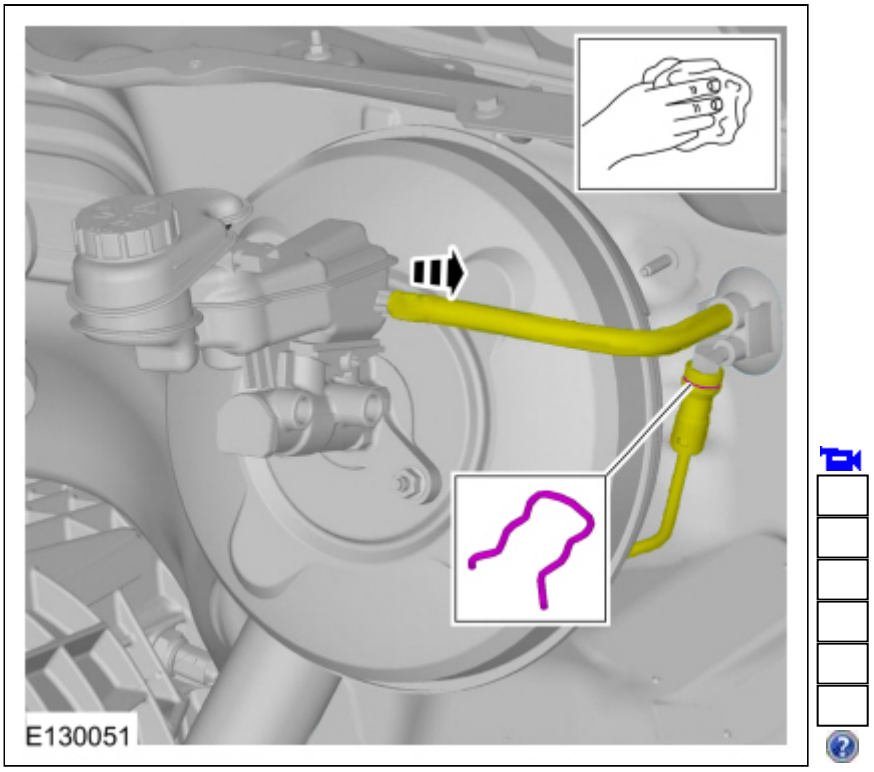
Removal

NOTICE: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

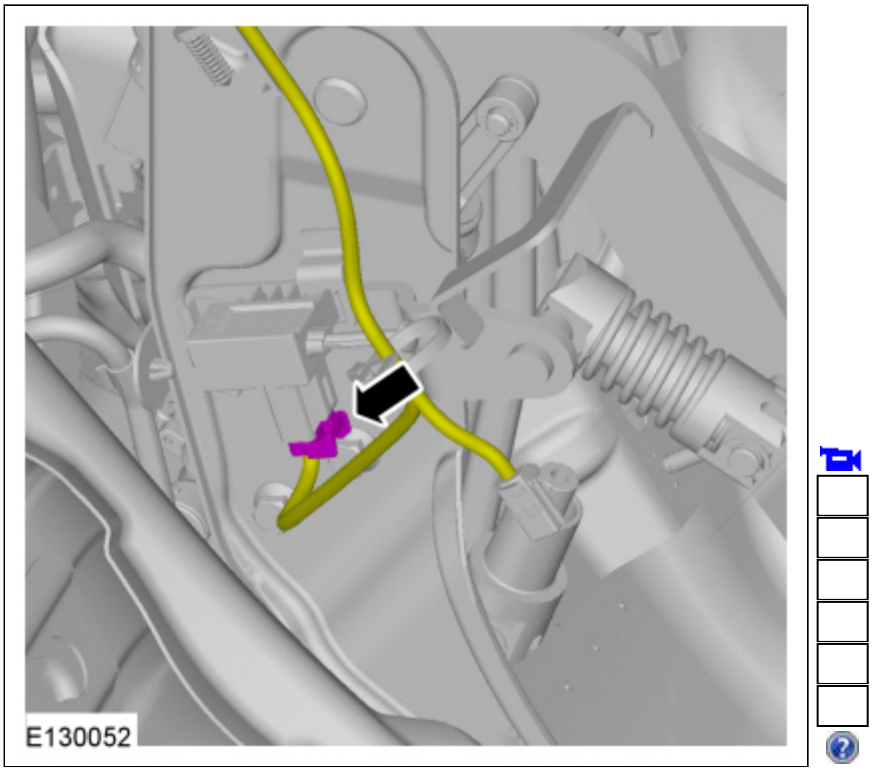
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
3. Refer to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
4. **WARNING: Be prepared to collect escaping fluids.**

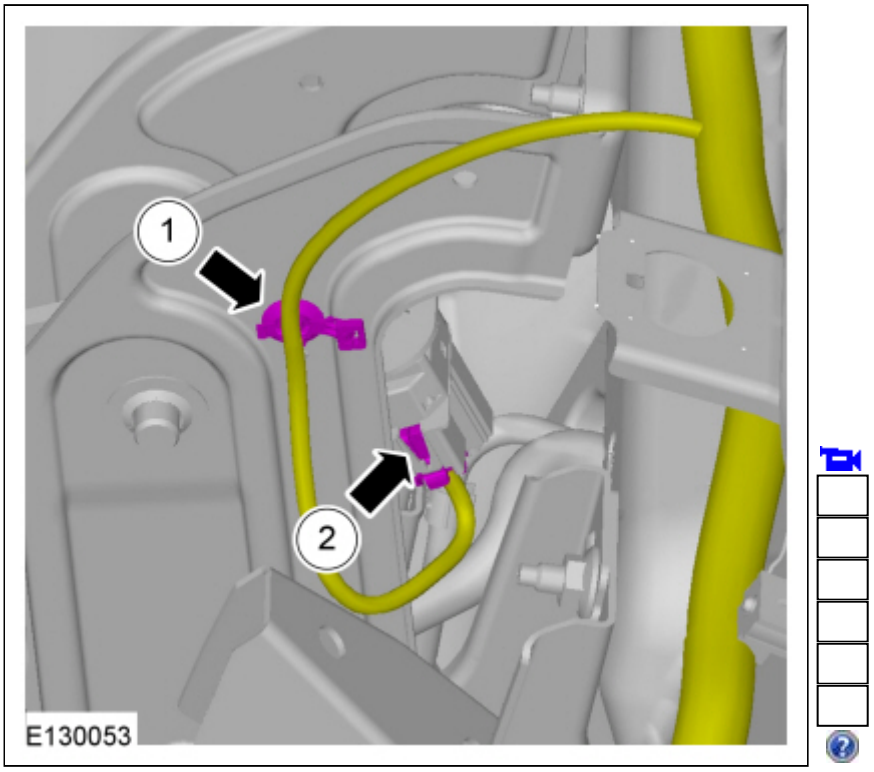
   NOTE: *Cap the clutch master cylinder supply hose to prevent fluid loss or dirt ingress.*



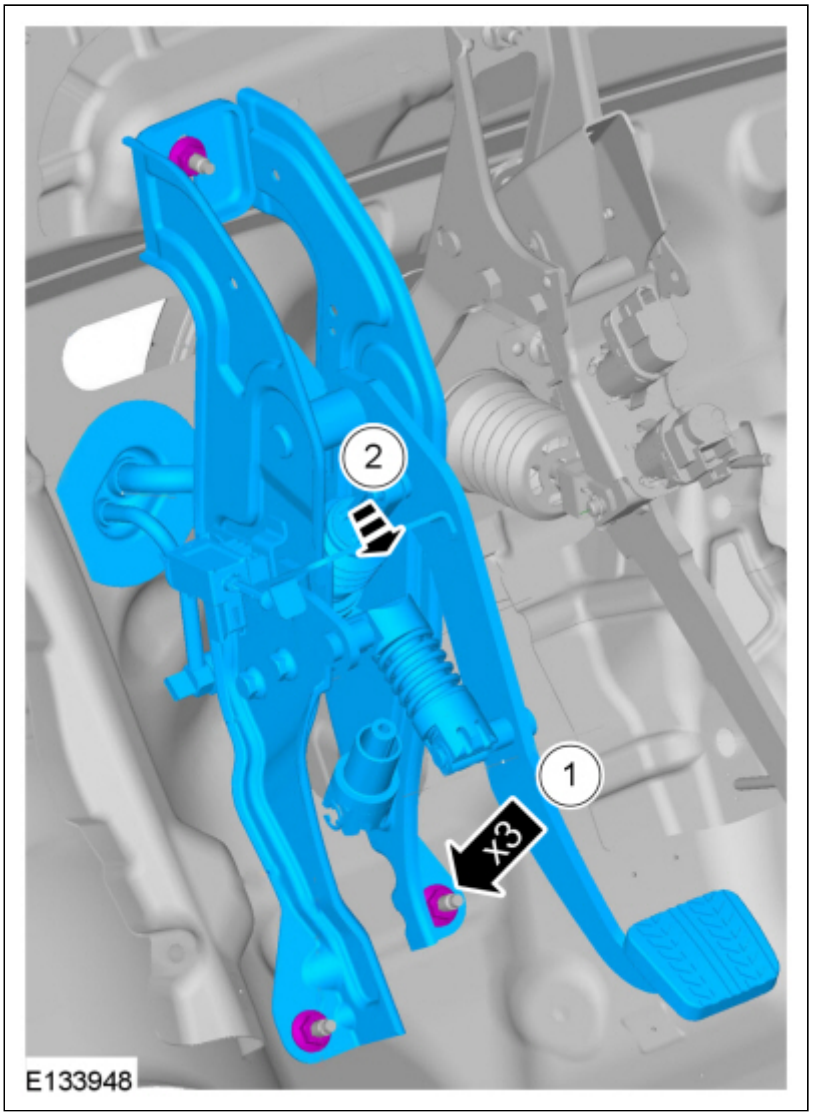
5.



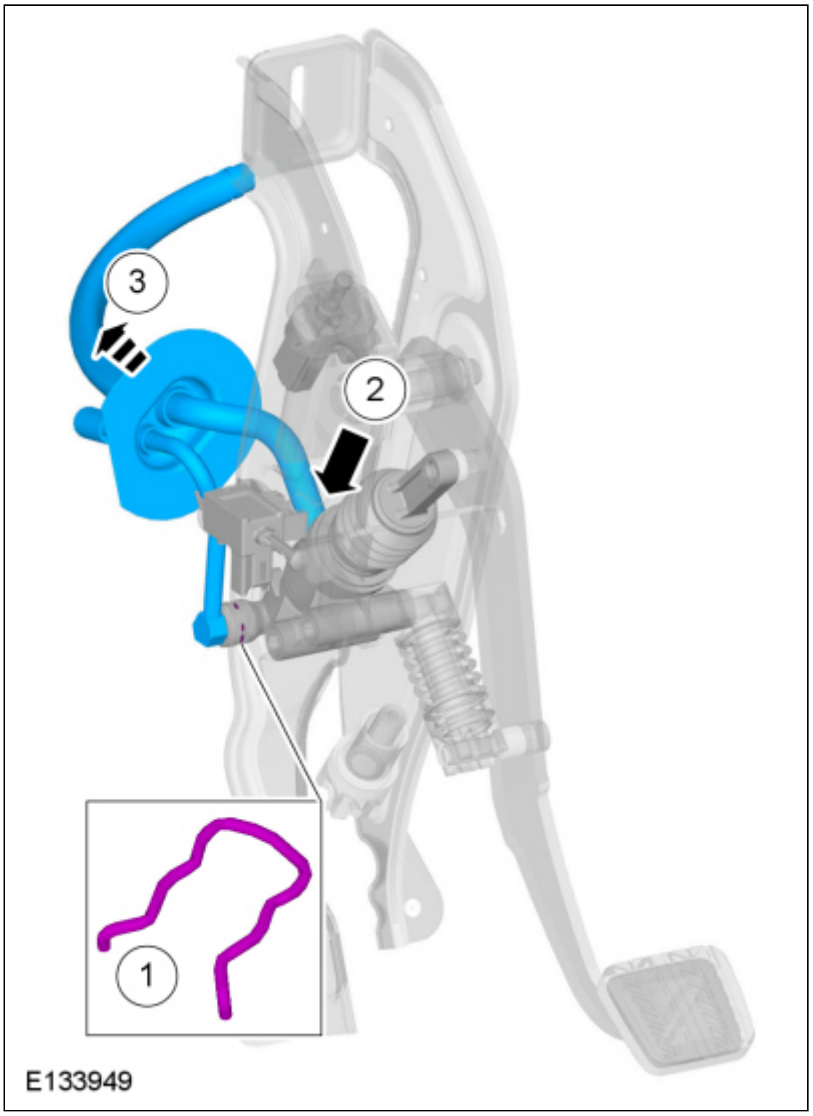
6.



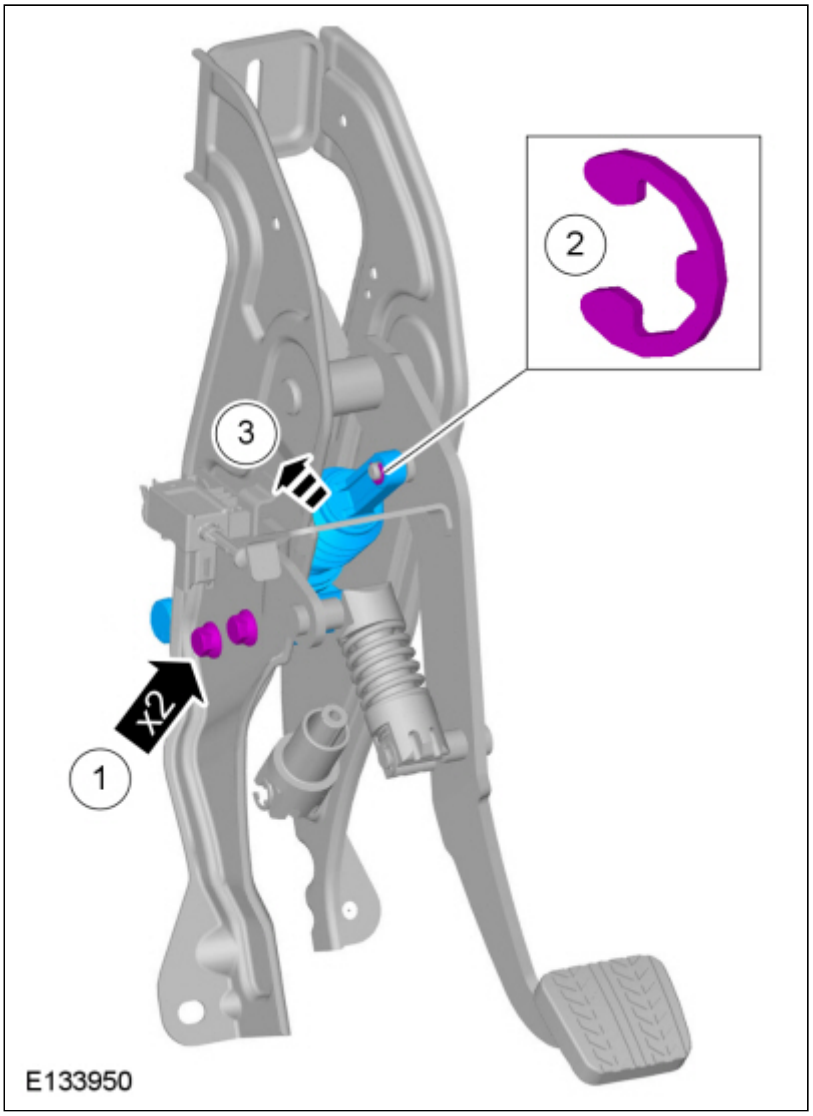
7. *Torque*: 15 Nm



8.



9. *Torque*: 23 Nm



Installation

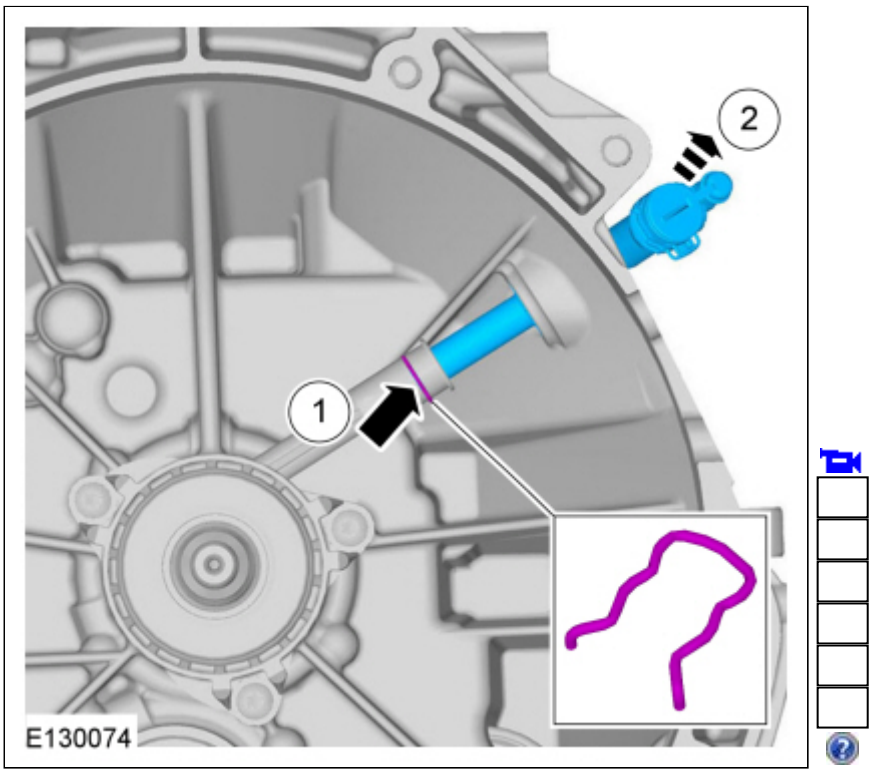
1. To install, reverse the removal procedure.
2. Refer to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).
   Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

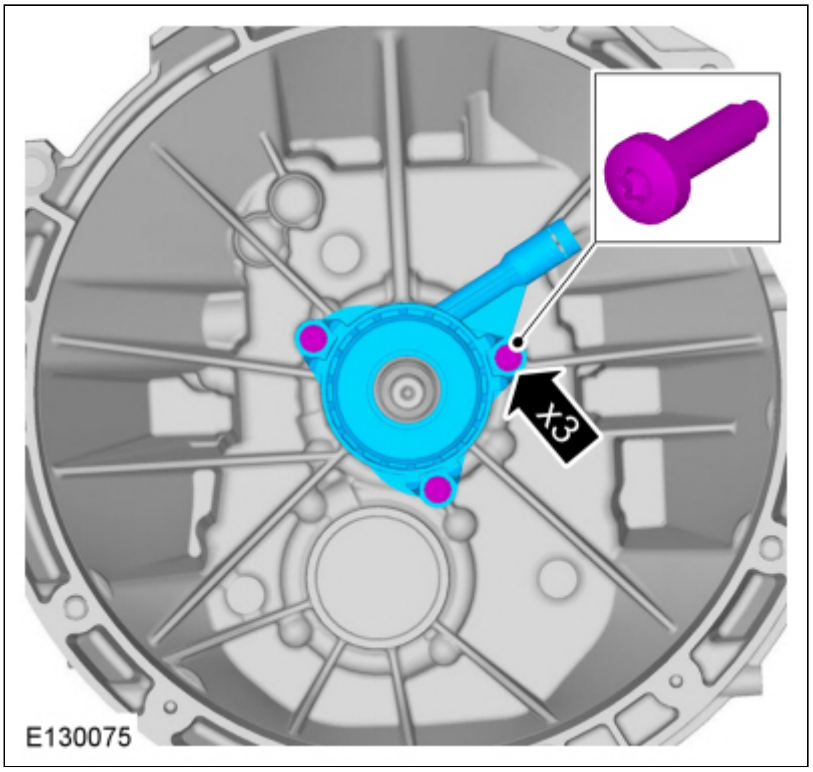
Clutch Slave Cylinder

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Removal).
   Refer to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x4 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Removal).
3. 

4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Manual transmission fluid	WSD-M2C200-C
Sealant	WSK-M2G348-A8 / WSS-M2G348-A10
Grease	ESD-M1C220-A
Thread-locking compound	SDM-4G9107-A

Capacities

	Litres
MT75 transmission	1.7

Torque Specifications

Description	Nm	lb-ft	lb-in
Selector gate retaining bolts	10	-	89
Transmission retaining bolts	50	37	-
Reversing lamp switch	20	15	-
Transmission output shaft flange retaining nut	200	148	-
Oil drain plug	50	37	-
Oil fill plug	35	26	-

Transmission Ratios

2.5L Petrol and 2.2L Diesel Low Power	Gearbox Ratio(s)
1st gear	4.200
2nd gear	2.238
3rd gear	1.366
4th gear	1.00
5th gear	0.763
6th gear	N/A
Reverse gear	3.840

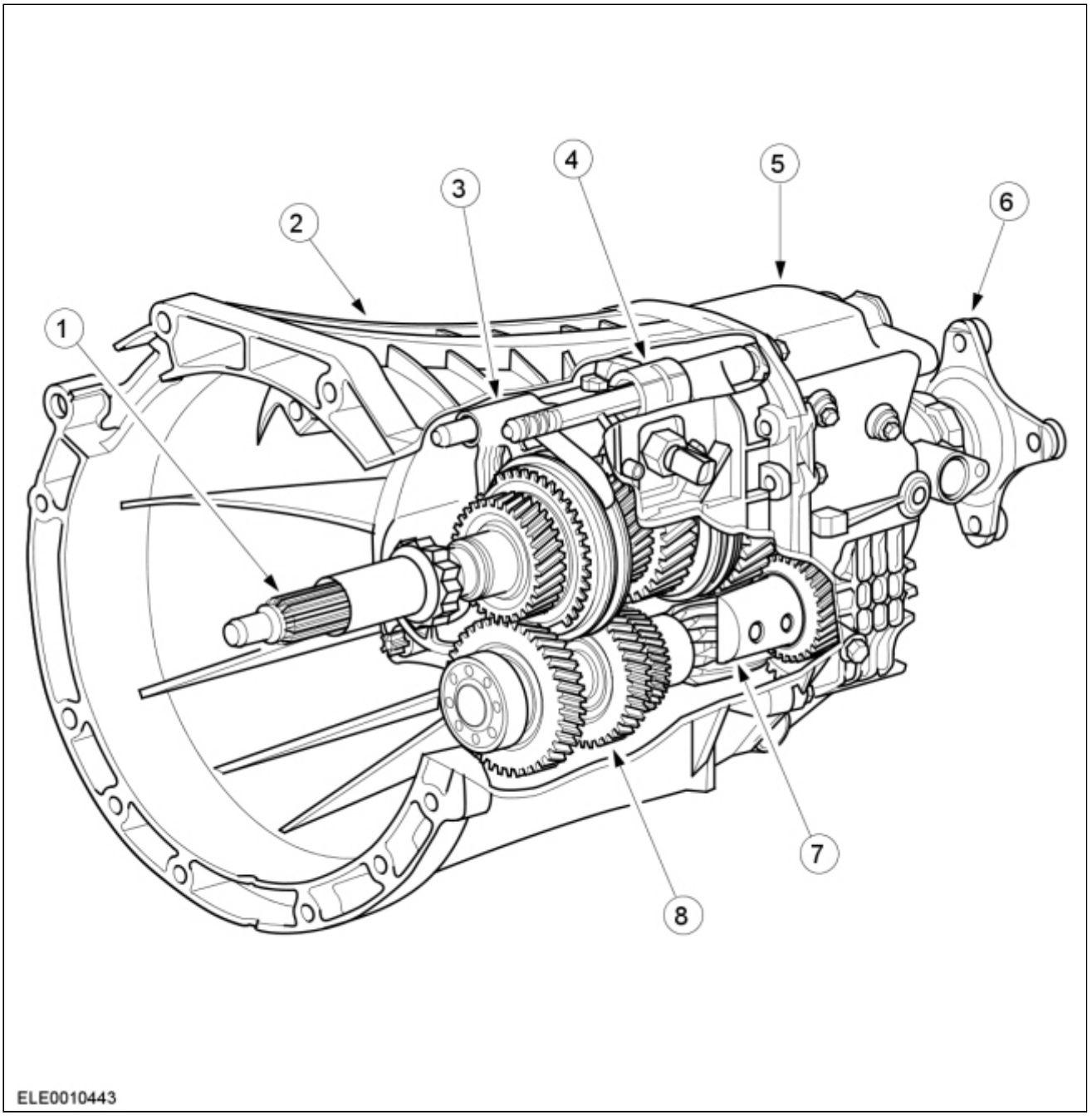
* The overall ratio for reverse gear is calculated by multiplying the internal gearbox ratio for reverse gear, 1st gear and

the final drive ratio of the 5th/6th and reverse gear output shaft.

Copyright © 2016 Ford Motor Company

Manual Transmission - Overview

Transmission Overview



Item	Part Number	Description
1	—	Mainshaft — Input shaft/Output shaft
2	—	Transmission front case
3	—	Shifter fork third/fourth gear
4	—	Selector shaft
5	—	Transmission rear case
6	—	Output drive flange
7	—	Reverse gear idler
8	—	Counter shaft

The MT - 75 manual transmission is a ” three - shaft transmission".

MT - 75 means:

- M: Manual.
- T: Transmission
- 75: Distance between main shaft and counter shaft in mm.

The aluminum transmission housing consists of two closed sections. The reinforcing ribs on the transmission housing have been revised to reduce noise and vibration.

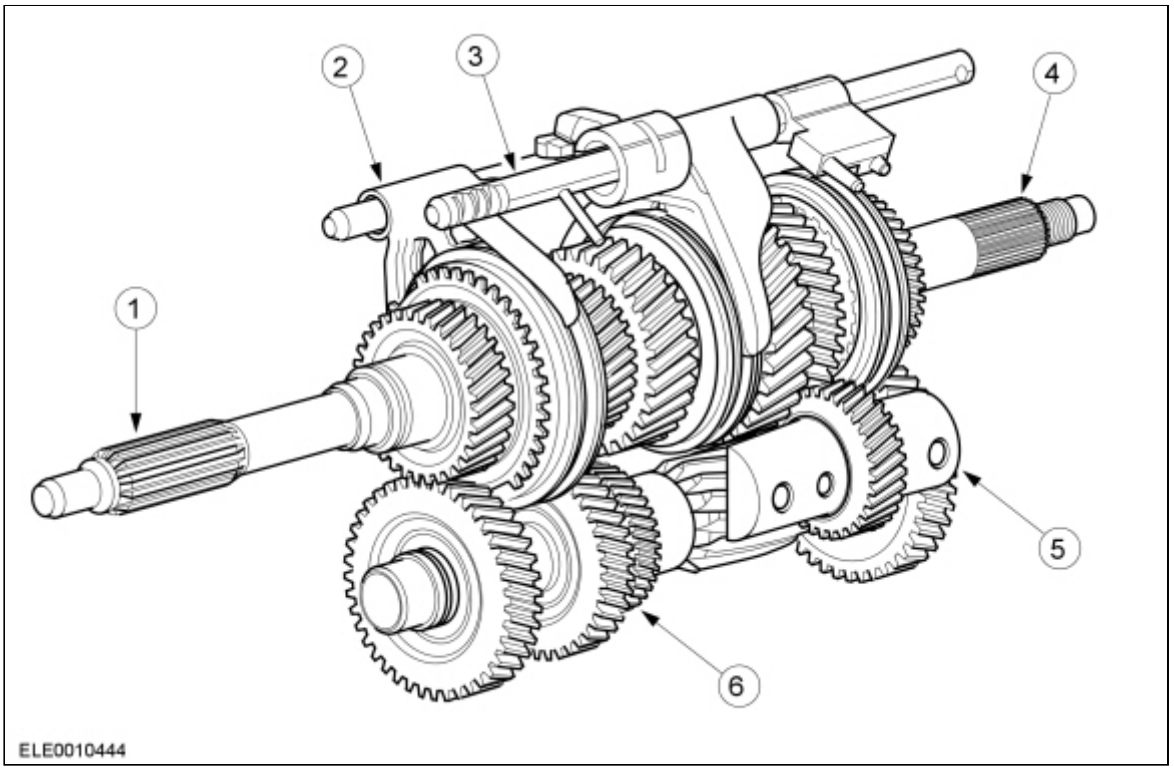
With the ” three - shaft transmission", all the gears are in permanent mesh. In each gear the required transmission ratio is achieved by means of a pair of gears.

When the reverse gear is selected, the direction of the output shaft is changed by an idler gear.

The input and output shafts turn on taper roller bearings.

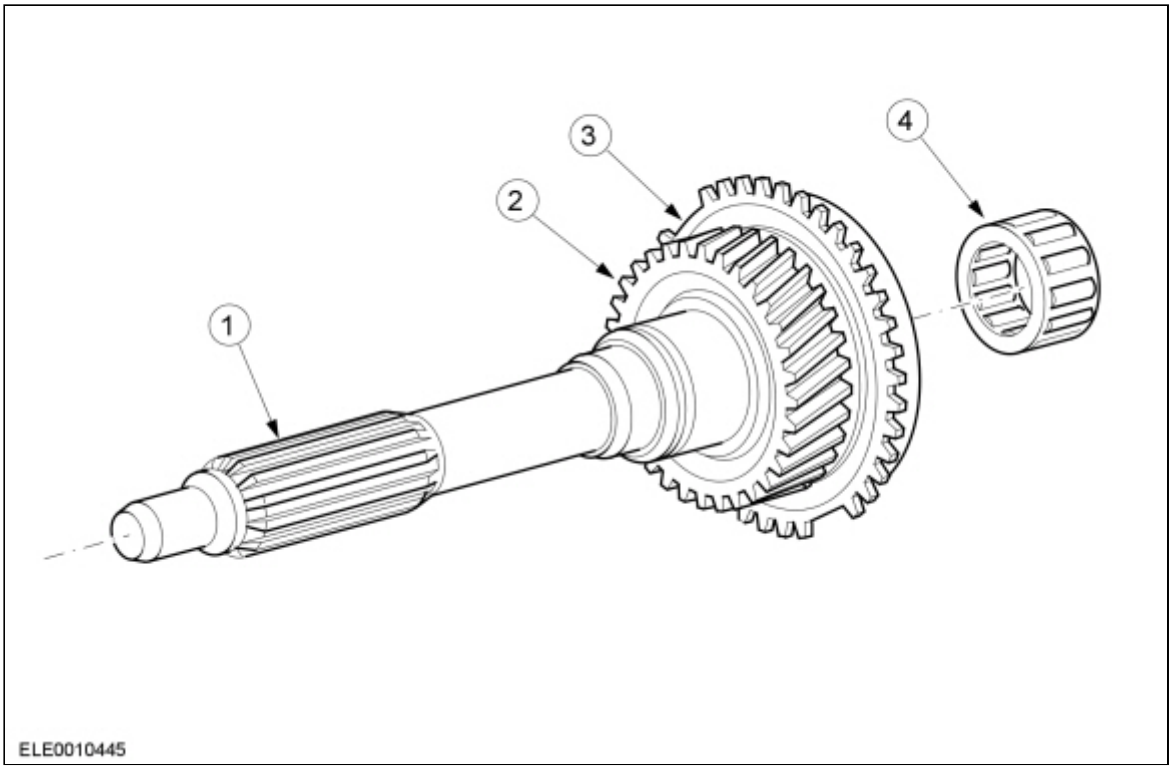
All the gears, including reverse, are bevel - cut, synchronized and turn on needle roller bearings.

Mainshaft and Counter Shaft



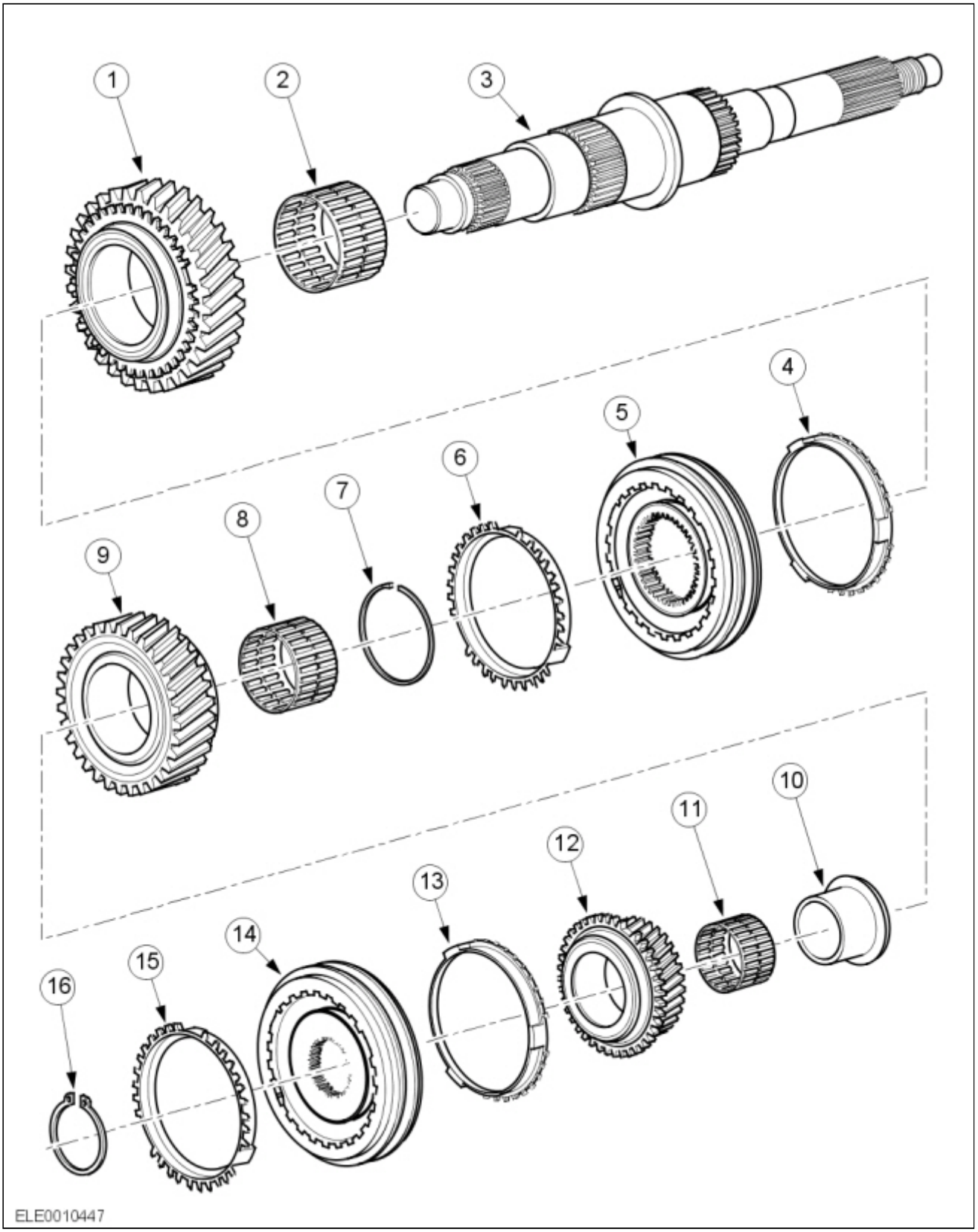
Item	Part Number	Description
1	—	Input shaft
2	—	Selector fork third/fourth gear
3	—	Selector fork fifth/reverse gear
4	—	Output shaft
5	—	Reverse gear idler
6	—	Counter shaft

Input shaft



Item	Part Number	Description
1	—	Input shaft
2	—	Driving gear for counter shaft
3	—	Fourth gear synchronizer teeth
4	—	Output shaft locating bearing

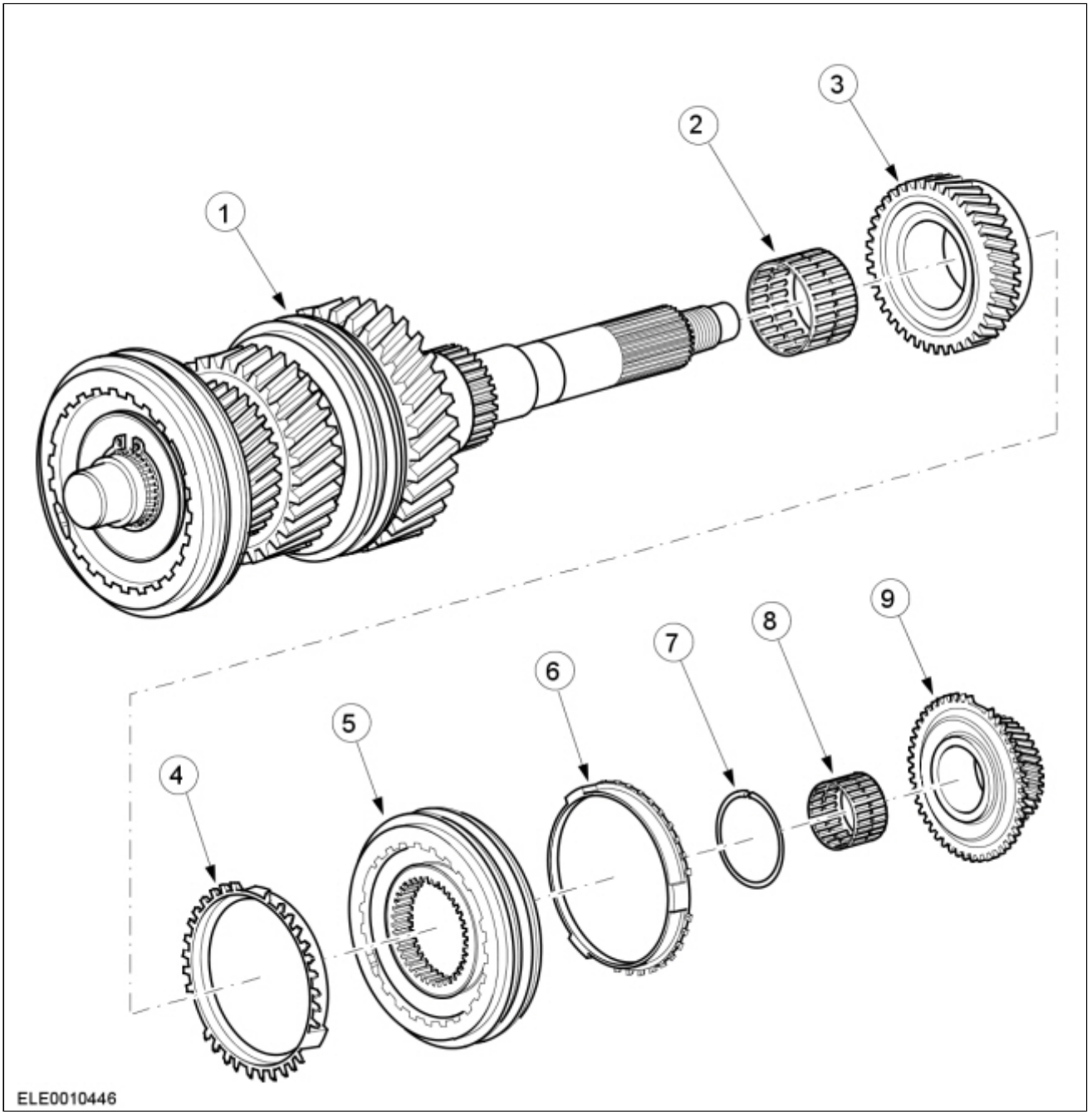
Mainshaft (left - hand side shown)



Item	Part Number	Description
1	—	Output shaft
2	—	Needle roller bearing
3	—	Gear wheel first gear
4	—	Synchronizer ring first gear
5	—	Synchronizer clutch first/second gear
6	—	Synchronizer ring second gear
7	—	Snap ring
8	—	Needle roller bearing

9	—	Gear wheel second gear
10	—	Inner race third gear needle roller bearing
11	—	Neeedle roller bearing
12	—	Gear wheel third gear
13	—	Synchronizer ring third gear
14	—	Synchronizer clutch third/fourth gear
15	—	Synchronizer ring fourth gear
16	—	Snap ring

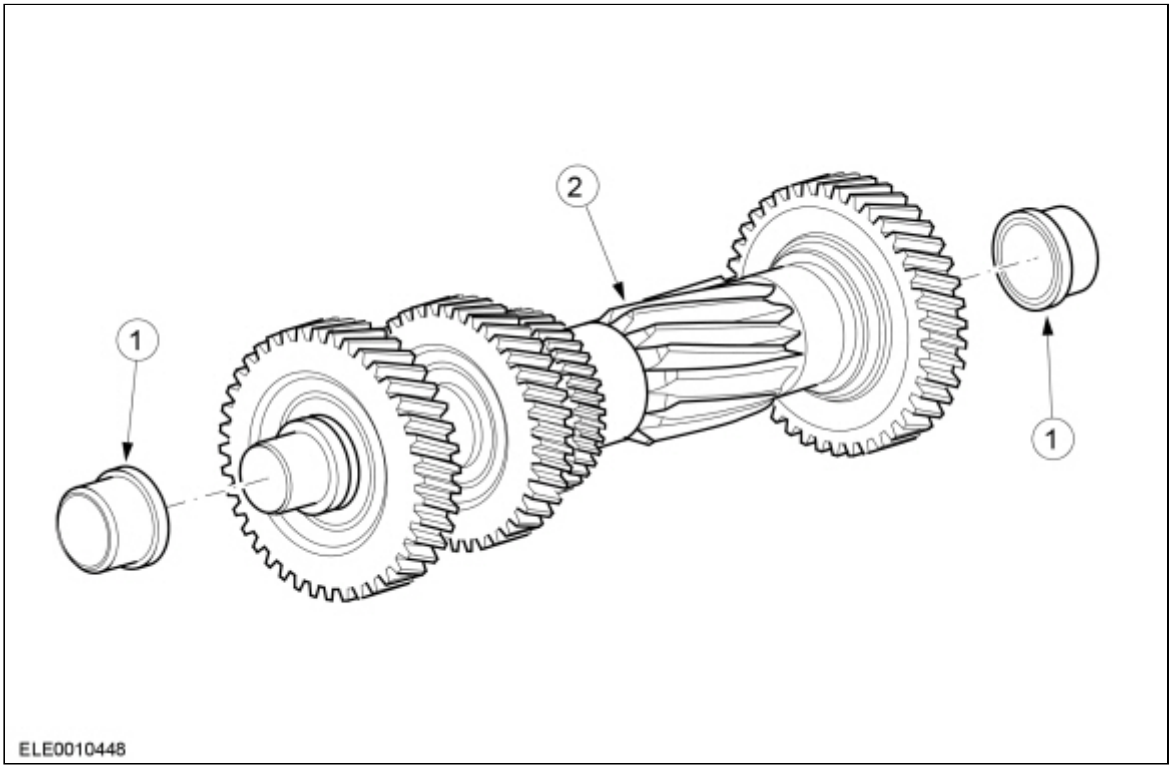
Mainshaft (right - hand side shown)



Item	Part Number	Description
1	—	Output shaft
2	—	Needle roller bearing

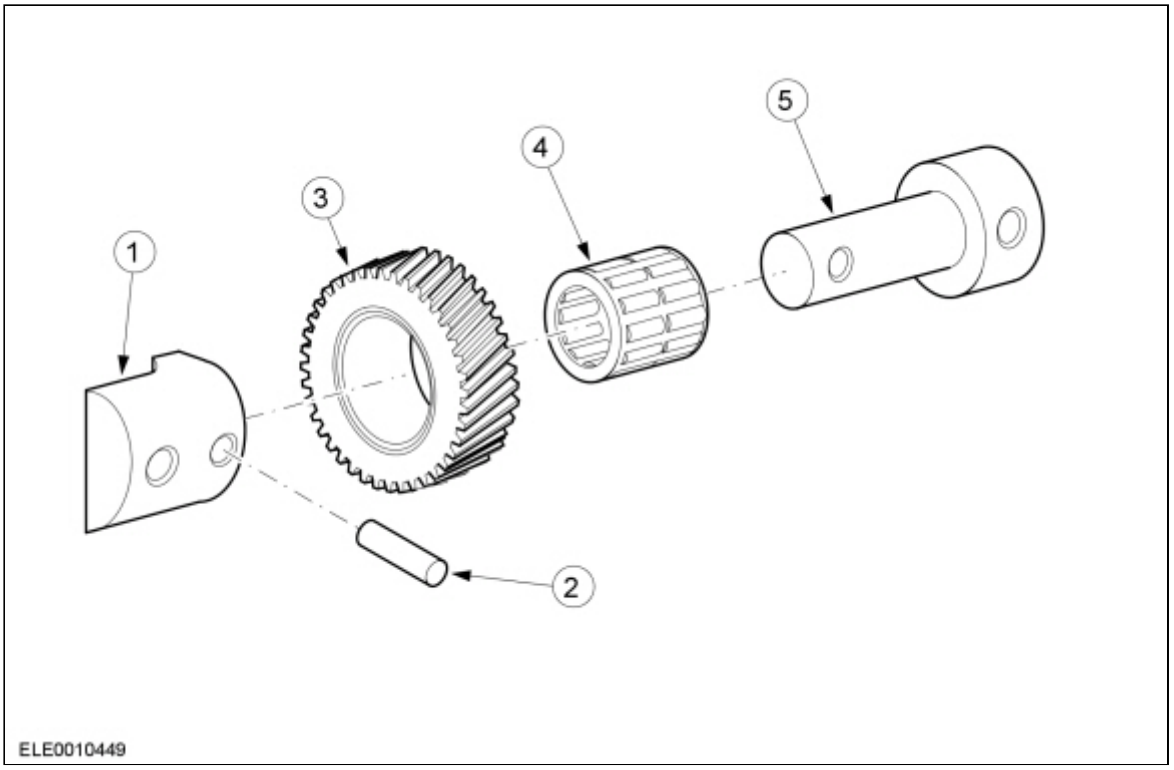
3	—	Reverse gear wheel
4	—	Synchronizer ring reverse gear
5	—	Synchronizer clutch fifth/reverse gear
6	—	Synchronizer ring fifth gear
7	—	Snap ring
8	—	Needle roller bearing
9	—	Gear wheel fifth gear
10	—	Taper roller bearing

Countershaft



Item	Part Number	Description
1	—	Inner race
2	—	Countershaft

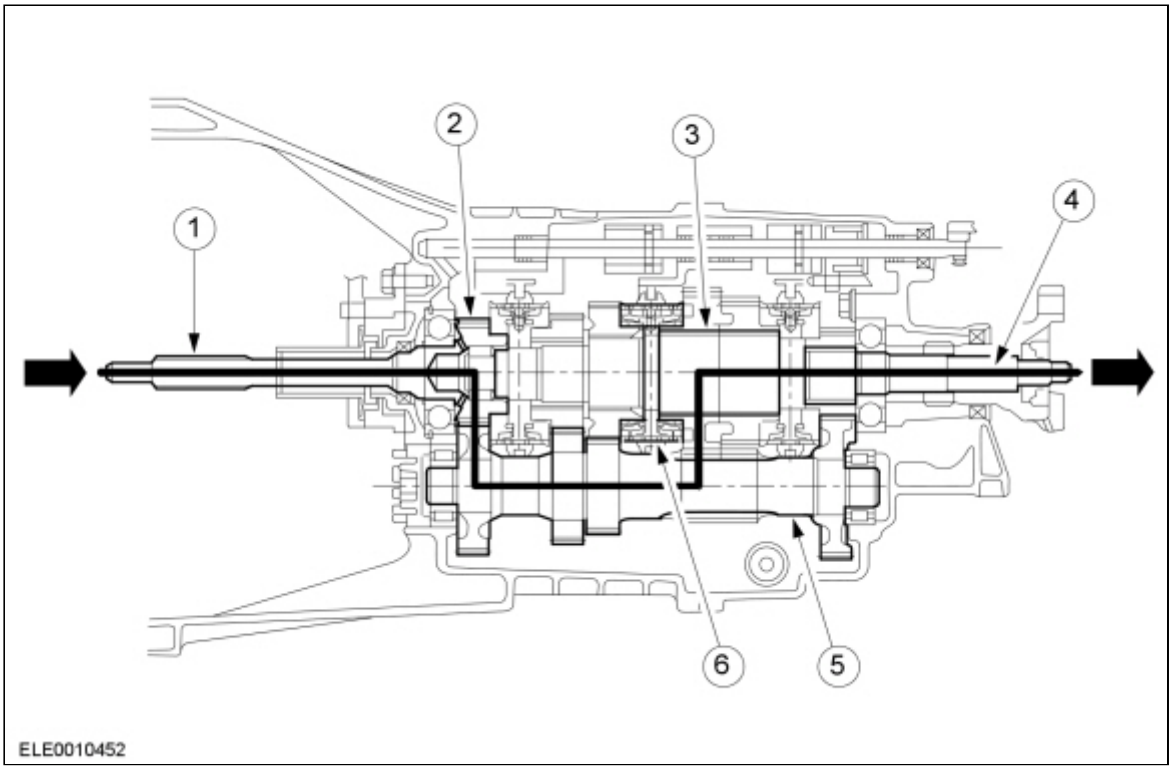
Reverse gear idler



Item	Part Number	Description
1	—	Reverse gear idler shaft mounting
2	—	Roll pin
3	—	Reverse gear idler
4	—	Needle roller bearing
5	—	Reverse gear idler shaft

Power Flow

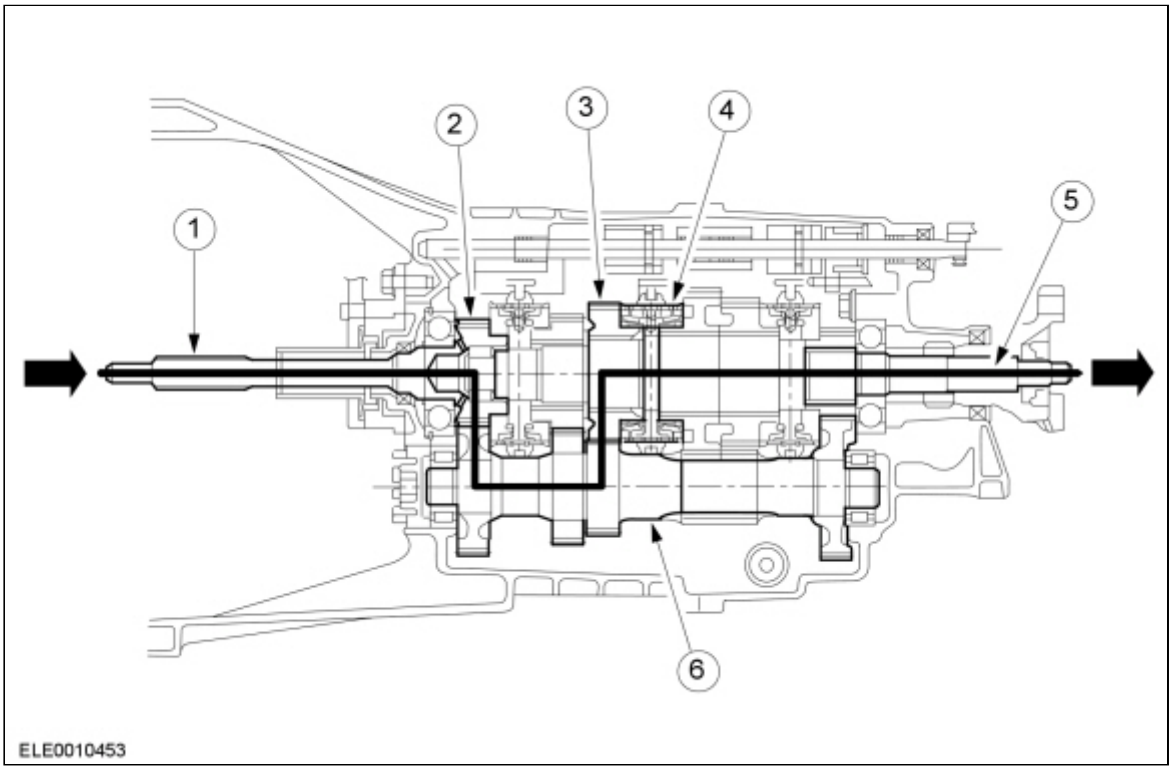
First gear



Item	Part Number	Description

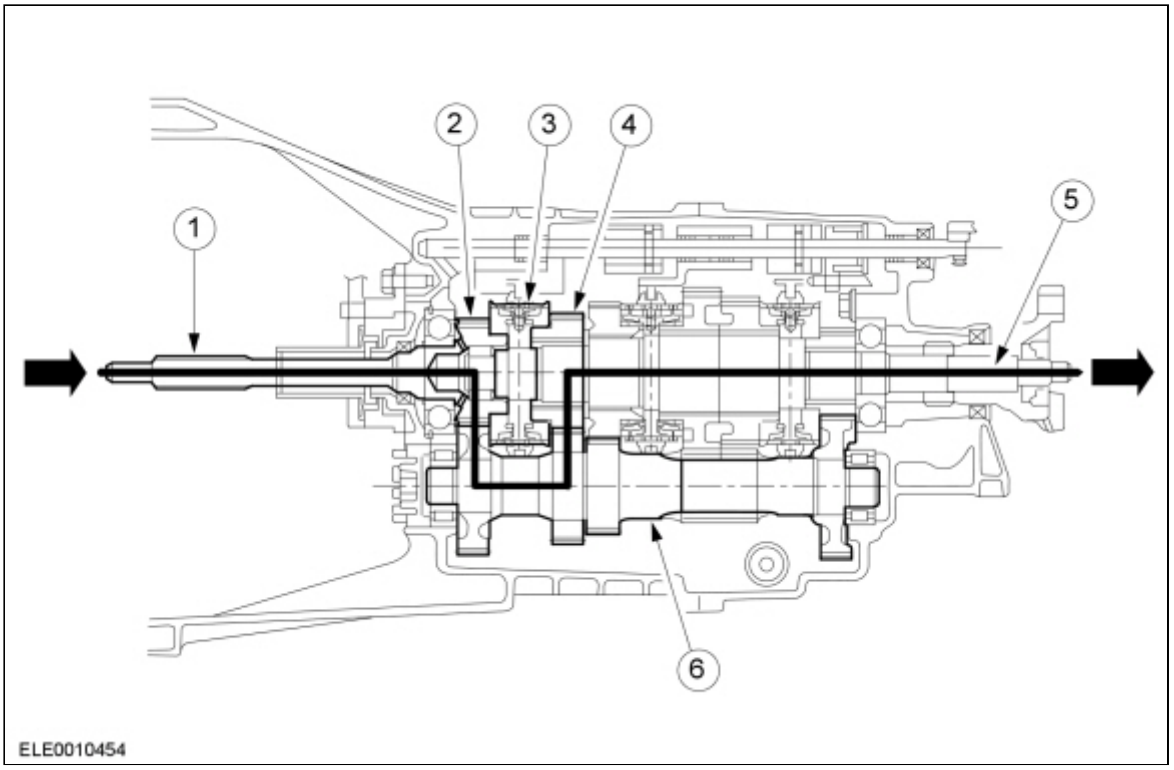
1	—	Input shaft
2	—	Driving gear for countershaft
3	—	Gear wheel fist gear
4	—	Output shaft
5	—	Counter shaft
6	—	Synchonizer clutch first/second gear

Second gear



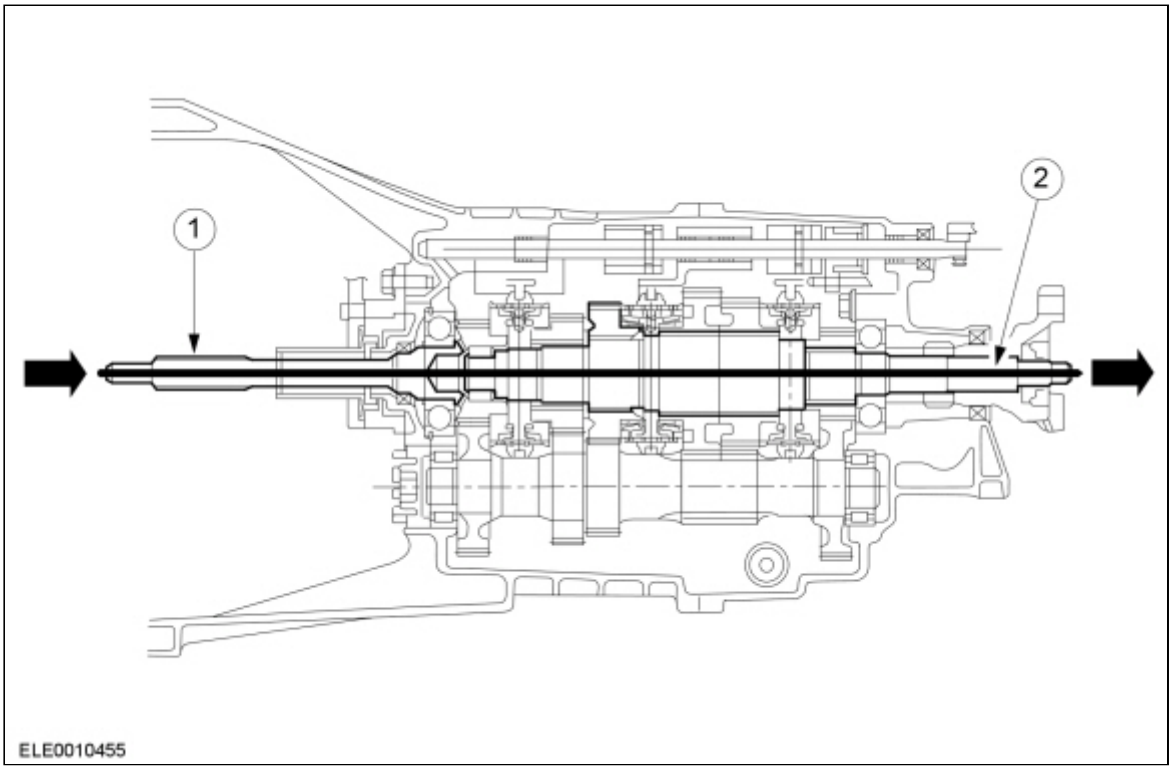
Item	Part Number	Description
1	—	Input shaft
2	—	Driving gear for countershaft
3	—	Gear wheel second gear
4	—	Synchonizer clutch first/second gear
5	—	Output shaft
6	—	Counter shaft

Third gear



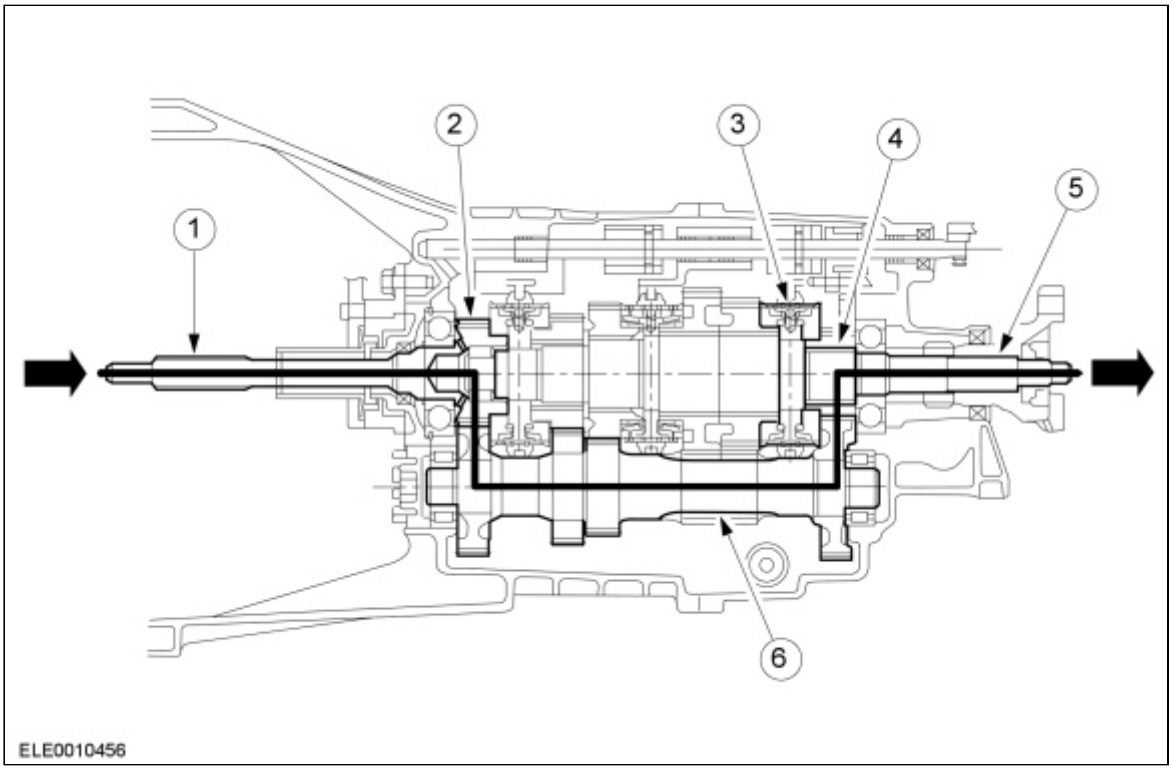
Item	Part Number	Description
1	—	Input shaft
2	—	Driving gear for countershaft
3	—	Synchronizer clutch first/second gear
4	—	Gear wheel second gear
5	—	Output shaft
6	—	Counter shaft

Fourth gear



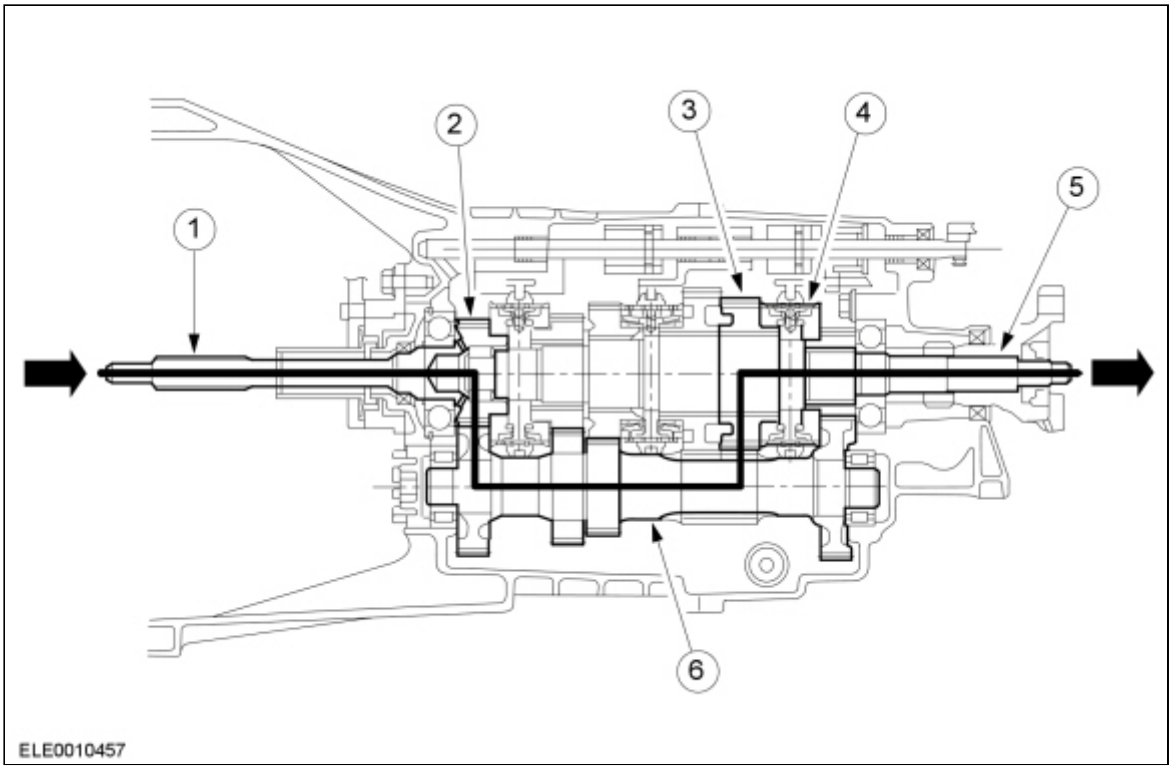
Item	Part Number	Description
1	—	Input shaft
2	—	Output shaft

Fifth gear



Item	Part Number	Description
1	—	Input shaft
2	—	Driving gear for countershaft
3	—	Synchronizer clutch fifth/reverse gear
4	—	Gerar wheel fifth gear
5	—	Output shaft
6	—	Counter shaft

Reverse gear



Item	Part Number	Description
1	—	Input shaft
2	—	Driving gear for countershaft
3	—	Gear wheel reverse gear
4	—	Synchronizer clutch fifth/reverse gear
5	—	Output shaft
6	—	Input shaft

Copyright © 2016 Ford Motor Company

Manual Transmission

General Equipment

Ford diagnostic equipment

Inspection and Verification

NOTICE: If transmission noise is reported, first check the transmission fluid level. The vehicle should not be driven if the transmission fluid level is low. A low transmission fluid level will damage the transmission.

NOTE: *Before attempting to repair any concerns, road test the vehicle to determine which system the concern is in.*

NOTE: *If an observed or reported concern is found, correct the causes before proceeding.*

Gear driven units produce a certain level of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Many conditions, such as road and weather can amplify normal vehicle noise.

The following overview is a guide to diagnose a transmission or clutch concern:

- Verify and document the customer concern.
  - During the customer interview, if a leak was noticed or if a leak is the concern, check the transmission fluid level. the vehicle should not be driven if the transmission fluid level is low.
- Check fluid level and condition.
- Evaluate the clutch hydraulic system.
- Evaluate the clutch.
- Inspect gearshift mechanism.
- Evaluate the transmission.
- Find the cause of the problem and correct it.

Verify Customer Concern

1. Verify and document the customer concern.
    1. When was it first noticed?
    2. Did it appear suddenly or gradually?
    3. Did anything unusual occur that would coincide with it or precede it?
    4. Identify when the condition occurs:
        - Hot or cold vehicle operating conditions.
        - Type of terrain.
        - City/highway driving.
        - Driving at a particular speed.
            - Coasting.
            - hard acceleration.
        - Shifting.
            - Upshifts.
            - downshifts.
            - in a particular gear.
            - in all gears.
        - Hot or cold ambient
    5. Has the transmission/clutch been repaired before or components installed?
        - Check the vehicle service record. Note any repairs.

Check Fluid Level and Condition

NOTICE: The vehicle should not be driven if the transmission fluid level is low or damage may occur.

NOTICE: Excessive temperatures may break down the transmission lubricant. If there is reason to believe the transmission has been subjected to temperatures exceeding 135°C (275°F) for an extended period (greater than 20 minutes), change the lubricant immediately.

An incorrect transmission fluid level may affect the transmission operation and can result in transmission damage. For transmission draining and filling.
REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).

A low transmission fluid level can result in poor transmission shifting, engagement or damage. It also indicated a leak in the transmission seals or gaskets.

1. Check the transmission fluid condition.
    - Observe the color and the odor of the fluid. Allow the transmission fluid to drip onto a white cloth and examine the stain. Check the transmission fluid for contamination or metal particles.
        - Transmission fluid should appear amber to dark amber in color for the MT75.

Evaluate Clutch Hydraulic System

1. Verify the clutch hydraulic fluid reservoir is filled to the correct level.
    - If the clutch hydraulic fluid is correct, proceed to clutch check.
    - If the clutch hydraulic fluid is low, add fluid as necessary. Check the clutch hydraulic system for leaks and repair as necessary.

Evaluate the Clutch

1. Apply and release the clutch pedal slowly to check pedal binding. Make sure the clutch pedal can be fully applied and is not restricted by the floor mat.

2. Measure the clutch reserve. GO to Pinpoint Test C

3. With the engine idling and the park brake applied, move the gearshift lever into 4th gear. Increase engine speed to 2,000 rpm and slowly release the clutch pedal.
    - If the engine stalls, the clutch is OK.
    - If the engine does not stall, the clutch is slipping. Repair as necessary.

4. Compare the clutch evaluation results with the following chart. The following list of conditions are typical clutch concerns.

Symptom Chart – Clutch Operation

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Symptom	Possible Sources	Action
• Clutch slippage	• Clutch pedal reserve • Diaphragm springs • Clutch pressure plate • Clutch disc facing • Hardened or oiled clutch disc facing surface • Flywheel	• GO to Pinpoint Test A
• Clutch chatter or shudder	• Engine mounts • Oil on clutch disc facing • Diaphragm springs • Clutch pressure plate • Clutch disc facing • Flywheel • Clutch disc	• GO to Pinpoint Test B
• Clutch pedal feels spongy or has excessive travel. Clutch will not disengage	• Insufficient clutch fluid • Air in hydraulic system • Clutch pedal reserve • Diaphragm springs • Clutch disc • Clutch disc splines • Oil on clutch facing	• GO to Pinpoint Test C
• Clutch drag, also hard to shift	• Insufficient clutch fluid • Air in hydraulic system • Clutch pedal reserve • Diaphragm springs • Clutch disc • Transmission concern	• GO to Pinpoint Test D
• Clutch pedal pulsation	• Clutch and brake pedal pivot shaft not correctly lubricated	• GO to Pinpoint

	not correctly lubricated • Flywheel • Worn springs in pressure plate	Pinpoint Test E
• Clutch-related vibrations	• Engine component grounding against frame • Accessory drive belt • Flywheel bolts • Flywheel • Imbalanced clutch pressure plate	• GO to Pinpoint Test F
• Excessive noise	• Clutch pedal reserve • Clutch slave cylinder • Pilot bearing • Excessive crankshaft end play	• GO to Pinpoint Test G
• Clutch system leakage	• Clutch master cylinder • Clutch slave cylinder • Clutch hydraulic tubes	• GO to Pinpoint Test C

Inspect Gearshift Mechanism

1. Inspect the gearshift mechanism for:
   - signs of damage.
   - missing or loose fasteners.
   - binding.

2. Repair as necessary.

Evaluate Transmission

1. Road test the vehicle. Use the following methods to diagnose the concern.
   - Start the engine.
   - Evaluate the noise in NEUTRAL while vehicle is parked.
     - Check whether the noise is present with the clutch fully disengaged (clutch pedal applied). Check to see if the pedal pulsates abnormally (clutch diaphragm finger runout).
     - Check whether the noise is present with the gearshift in the NEUTRAL position and the clutch fully engaged (clutch pedal released). Apply the park brake and move the gearshift towards the 1st gear position. Apply very slight pressure and note if the gear noise level is reduced (gear rollover noise).
     - With the clutch fully engaged (clutch pedal released) check whether the noise is present as the engine speed is raised. If the noise reduces, note the engine speed at which this occurs.
   - Listen for any change in noise while applying and releasing the clutch pedal.
   - Listen for any change in noise while changing the engine rpm.
   - Drive the vehicle and shift through all the gears including REVERSE. Listen for any changes in noise.
   - Drive the vehicle in the gear in which the noise is most noticeable. Apply the clutch pedal and leave the gear engaged. Listen for any change in noise.
   - Drive the vehicle in the gear in which the noise is most noticeable. Apply the clutch pedal and shift the transmission into NEUTRAL. Release the clutch pedal and allow the vehicle to coast.
   - Compare the noise to another vehicle. Make sure the transmissions are the same.

2. Compare the road test results with the following symptom charts. The following list of conditions are typical transmission concerns:
   - GO to Symptom Chart — Transmission Operation or GO to Symptom Chart — NVH.

Symptom Chart — Transmission Operation

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Symptom	Possible Sources	Action
• Transmission difficult to shift	• Lubricant • Internal shift mechanism • Sliding gears, synchronizers • Housings, shaft	• ADD or DRAIN and FILL with specified lubricant. REFER to: Transmission Draining and

	• Loose pressure plate to flywheel bolts	Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures). • CHECK the internal shift mechanism for smooth operation. REPAIR or INSTALL a new mechanism as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK for free movement of gears and synchronizers. REPAIR or INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK for binding condition between the input shaft and the engine crankshaft pilot bearing or bushing. REPAIR or INSTALL new components as necessary. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual

		Transmission - MT82, Removal and Installation). • CHECK for loose bolts at the pressure plate. INSTALL new components as necessary. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
• Transmission will not shift — gearshift lever moves	• Gearshift lever damaged • Damaged or worn selector arm. Loose shift rail bushings	• INSTALL a new gearshift lever. REFER to: Gearshift Lever (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation). REFER to: Gearshift Lever (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation). • CHECK the internal shift components. INSTALL new component as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• **NOTE:** *While verifying the condition, determine whether the noise is gear rollover noise, release bearing rub or some other transmission-related noise. Gear rollover noise, inherent in manual transmissions, is caused by the constant mesh of gears turning at the engine idle speed while the clutch is engaged and the transmission is in NEUTRAL. Release bearing rub is sometimes mistaken for mainshaft bearing noise. Gear rollover noise will disappear when the clutch is disengaged or when the transmission is engaged in gear. Release bearing rub will disappear when the clutch is engaged. In the event that a bearing is damaged, the noise is more pronounced while*	• Lubricant • Components grounding out on the transmission • Components housing bolts • Bearings or gears	• ADD or DRAIN and FILL with specified lubricant. REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual

bearing is damaged, the noise is more pronounced while engaged in gear under load or coast than in NEUTRAL. • Noisy in forward gears		5-Speed Manual Transmission - MT75, General Procedures). • CHECK for screws and bolts of body or other components grounding out. CORRECT as necessary. • CHECK the torque on the transmission-to-flywheel housing bolts and the flywheel housing-to-engine block bolts. TIGHTEN the bolts to specification. REFER to: Specifications (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Specifications). • INSPECT the bearings. INSPECT the gears and gear teeth for wear or damage. INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Gears clash when shifting from one forward gear to another	• Pilot bearing • Gear teeth and/or synchronizer • Damaged shift forks or worn shift fork inserts	• CHECK for a binding condition between the input shaft and the engine crankshaft pilot bearing. INSTALL new components as necessary. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal

		and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • REPAIR or INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • INSPECT for wear or damage. INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission jumps out of gear	• Transmission-to-engine mounting bolts • Crankshaft pilot bearing • Internal damage • Gear teeth	• TIGHTEN the bolts to specification. • INSTALL a new pilot bearing. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • INSPECT the synchronizer sleeves for free movement on their hubs. INSPECT the synchronizer blocking rings for widened

		index slots, rounded clutch teeth and smooth internal surface. REPAIR or INSTALL a new component as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • If worn or damaged, INSTALL new gears. REFER to: Countershaft (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly and Assembly of Subassemblies).
• Transmission will not shift into one gear — all others OK	• Manual shift linkage • Backup switch ball • Internal components	• REPAIR or INSTALL new components as necessary. • If REVERSE is the problem, CHECK reverse lamp switch for ball frozen in extended position. • INSPECT the shift rail and fork system, synchronizer system and the gear clutch teeth for restricted travel. REPAIR or INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission is locked in one gear and cannot be shifted out of that gear	• Internal components • Fork on rail or shift rail	• INSPECT the problem gears, shift rails, forks and the

	shift rail	and the synchronizer for wear or damage. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK the shift rail interlock system. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission leaks	• Lubricant • Other component leaking • False report • Fill and drain plugs	• CHECK the level and type. • IDENTIFY leaking fluid as engine, power steering or transmission fluid. REPAIR as necessary. • REMOVE all traces of lube on the exposed transmission surfaces. CHECK the vent for free breathing. OPERATE the transmission and INSPECT for new leakage. REPAIR as necessary. • CHECK fill and drain plugs and bore threads. REPAIR as necessary. TIGHTEN plugs to specified torque value. REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General

		Procedures).
• Bearing failure	• Other part failure • Raceways or rollers • Lubricant • Vibration break-up of retainer and brinelling of races • Bearing(s) • Shafts or bore • Overloading of vehicle • Incorrect preload • Input shaft oil dam • Oil baffle in the input bearing shim pack	• REMOVE, DISASSEMBLE and CLEAN the transmission. Inspect for damaged parts and install new components as necessary. (Note: RESET the bearing preload if any new tapered bearings are installed.) REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • DETERMINE the cause of vibration and CORRECT. Otherwise, PROCEED as above. • INSTALL new components as necessary and VERIFY the oil dam installation is correct. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). CHECK for correct installation of the snap ring on the mainshaft next to the oil dam. • INSTALL a new oil baffle, making sure it is not damaged during assembly. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75,

		Disassembly).

Symptom Chart — NVH

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. Refer to Diagnostic Methods in Section 100-00 for information about these practices.

Symptom	Possible Sources	Action
NOTE: *NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.*		
• Excessive noise	• Clutch disc damper damaged • Transmission input shaft pilot bearing worn or damaged • Crankshaft end play excessive • Release bearing worn or damaged	• REMOVE the clutch disc and pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). INSPECT the clutch disc for damage. INSPECT the transmission input shaft pilot bearing for wear and damage. REFER to Pilot Bearing Check. • CHECK the crankshaft end play. REFER to: Crankshaft End Play (303-00 Engine System - General Information, General Procedures). • CHECK the clutch release hub and bearing, and guide tube for wear and damage. REPAIR all components as necessary.
• Clutch rattling noise — occurs with clutch engaged, noise changes/disappears with clutch pedal pressed	• Flywheel bolts loose • Clutch housing bolts or clutch pressure plate bolts loose	• TIGHTEN the bolts to specifications. CHECK the bolts for damage. REFER to: Specifications (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Specifications). • TIGHTEN the bolts to specifications. CHECK the bolts for damage. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
• Clutch squeaking noise — noise is heard when the clutch is operated. Vehicle moves slowly or creeps when the clutch is disengaged. Can also be difficult to shift into 1st and REVERSE gears	• Pilot bearing seized or damaged	• INSTALL a new pilot bearing. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Clutch squeaking noise — occurs with clutch pedal pressed/released	• Worn clutch pedal shaft or bushings	• INSPECT the clutch pedal for wear or damage. REPAIR as necessary. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
• Clutch whirring/rattle noise — occurs when clutch pedal is pressed	• Worn, damaged or misaligned clutch release bearing	• INSTALL a new clutch release bearing. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
• Clutch grating/grinding noise — occurs when clutch pedal is	• Clutch pressure plate fingers bent	• INSPECT the clutch pressure plate release fingers. INSTALL a new

occurs when clutch pedal is pressed	plate fingers bent or worn • Contact surface of clutch release bearing worn or damaged	release fingers. INSTALL a new pressure plate as necessary. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). • INSTALL a new clutch release bearing. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
• Clutch chatter — a small amount of noise when clutch pedal is released at initial take-off	• Clutch engagement	• Acceptable operating condition.
• Clutch chatter/grabs — in some cases a shudder is felt. Occurs with clutch pedal pressed/released	• Damaged or worn powertrain/driveline mounts • Binding or dragging plunger of the clutch master cylinder or slave cylinder • Grease or oil on the clutch disc facing • Clutch disc surface glazed or damaged • Damaged or worn clutch pressure plate • Flywheel surface damaged or glazed	• INSPECT the powertrain/drivetrain mounts. INSTALL new mounts as necessary. REFER to: Engine - 5-Speed Manual Transmission - MT75 (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal). REFER to: Engine - 5-Speed Manual Transmission - MT75 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal). • CHECK the master and slave cylinder operation. INSPECT the components for damage or wear. INSTALL a new master or slave cylinder as necessary. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation). • CHECK the input shaft seal and rear main oil seal. REPAIR as necessary. INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). • INSPECT the clutch disc surface for a glazed, hardened or damage condition. CARRY OUT a disc check. INSTALL a new clutch disc as necessary. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). • INSPECT the clutch pressure plate for wear or damage. INSTALL a new clutch pressure plate as necessary. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). • INSPECT the flywheel for damage or wear. CARRY OUT a flywheel runout check. INSTALL a new flywheel as necessary.
• Clutch chatter noise — noise when	• Pilot bearing worn,	• INSPECT the clutch pressure plate

clutch pedal is released at initial take-off. Clutch is hard to engage and disengage	damaged or not correctly aligned in bore	release fingers for uneven wear, clutch components burnt or a seized pilot bearing. INSTALL a new pilot bearing as necessary. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Transmission rattling/clattering noise — occurs in NEUTRAL or in gear, at idle	• Incorrect fluid level or fluid quality	• COMPARE with other like vehicles. CHECK that the transmission is filled to the correct level and with the specified fluid. For the fluid type, REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).
• Transmission rattling/clattering noise — noise at idle in NEUTRAL	• Worn or rough reverse idler gear • Excessive backlash in gears • Worn countershaft gears	• CHECK the reverse idler gear. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK the gear backlash. ADJUST as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission whine — a mild whine at extreme speeds or high rpm	• Rotating gears/geartrain	• Acceptable noise.
• Transmission whine — a high pitched whine, also described as a squeal	• Transmission gears are worn (high mileage vehicle) • Mismatched gear sets • Damaged or worn transmission bearing	• Result of normal gear wear. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • INSPECT the gear sets for an uneven wear pattern on the face of the gear teeth. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission growling/humming — noise occurs in the forward gears. The noise is more prominent when the gear is loaded. The problem gear can be located as the noise occurs in a specific gear position	• Gear is cracked, chipped or rough	• INSPECT the transmission gears for damage or wear. INSTALL new gears as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission hissing — noise in NEUTRAL or in forward gears. As bearings wear or break up, the noise changes to a thumping noise	• Damaged or worn bearings	• INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission knocking/thudding —	• Bearings with	• INSPECT the transmission bearings.

noise at low speeds in forward gears	damaged balls or rollers or with pitted and spalled races	INSTALL new bearings as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission rumble/growl — noise at higher speeds in forward gears, more pronounced in a coast/deceleration condition	• Incorrect driveline angle • Driveshaft out of balance or damaged	• CHECK the driveline angle. REPAIR as necessary. REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing). • CHECK the driveshaft for damage, missing balance weights or undercoating. REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
• Transmission rumble/growl — noise at all speeds in forward gears, more pronounced in a heavy acceleration condition	• Damaged or worn transmission bearing or gears (high mileage vehicles)	• CHECK transmission fluid for excessive metal particles. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).

Pinpoint Tests

PINPOINT TEST A: CLUTCH SLIPPAGE

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Clutch pedal
- Clutch hydraulic system
- Clutch disc
- Clutch pressure plate

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 INSPECT THE CLUTCH PEDAL

- Ignition OFF.
- Block the wheels and apply the park brake.
- Apply and slowly release the clutch pedal.

Does the clutch pedal release without binding?

Yes	GO to A2
No	INSPECT the clutch pedal.

A2 CHECK THE HYDRAULIC SYSTEM

- Ignition OFF.
- Apply and release the clutch pedal.

Is there residual hydraulic pressure at bleed screw?

Yes	INSTALL a new clutch master cylinder. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to A3

A3 CARRY OUT A STALL TEST

- Start the engine.
- Block the wheels and apply the park brake.
- Place the transmission in 4th gear.
- Increase the speed to 2,000 rpm and slowly release the clutch pedal.

Does the engine stall within 5 seconds?

Yes	The clutch is not slipping. VERIFY the customer concern.
No	INSPECT the clutch components for damage.

PINPOINT TEST B: CLUTCH CHATTER OR SHUDDER

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

This pinpoint test is intended to diagnose the following:

- Engine or transmission mounts
- Clutch disc
- Clutch pressure plate
- Flywheel
- Pilot bearing
- Input shaft

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER

B1 CHECK THE ENGINE AND TRANSMISSION MOUNTS

- Inspect all the engine and transmission mounts for loose fasteners or damage.

Are any of the engine or transmission mounts loose or damage?

Yes	TIGHTEN or INSTALL new engine mounts or transmission mounts as necessary.
No	GO to B2

B2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolt loose?

Yes	TIGHTEN or INSTALL new bolts as necessary. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to B3

B3 INSPECT THE PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
- Inspect the clutch pressure plate.

Are any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to B4

B4 CHECK THE CLUTCH

- Inspect the clutch disc for wear or damage.

Is the clutch disc OK?

Yes	GO to B5
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

B5 INSPECT THE FLYWHEEL

- Inspect the flywheel for damage and runout.

Is the fly wheel OK?

Yes	GO to B6
No	TIGHTEN or INSTALL a new flywheel. REFER to: Engine Accessories (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal). REFER to: Engine Accessories (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Installation). REFER to: Engine Accessories (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal). REFER to: Engine Accessories (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation).

B6 INSPECT THE PILOT BEARING

- Inspect the pilot bearing for wear or damage.

Are there signs of wear or damage?

Yes	INSTALL a new pilot bearing. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to B7

B7 INSPECT THE INPUT SHIFT

- Inspect the input shaft for signs of wear or damage.

Are any signs of wear or damage present on the input shaft?

Yes	INSTALL a new input shaft. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
No	VERIFY the customer concerns. GO to Symptom Chart.

PINPOINT TEST C: CLUTCH PEDAL FEELS SPONGY OR HAS EXCESSIVE TRAVEL/CLUTCH WILL NOT DISENGAGE/CLUTCH SYSTEM LEAKAGE

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

This pinpoint test is intended to diagnose the following:

- Internal operation
- Clutch pedal reserve
- Clutch slave cylinder travel
- Clutch disc
- Clutch pressure plate
- Clutch pedal free play

PINPOINT TEST C : CLUTCH PEDAL FEELS SPONGY OR HAS EXCESSIVE TRAVEL/CLUTCH WILL NOT DISENGAGE/CLUTCH SYSTEM LEAKAGE

C1 CHECK THE FLUID LEVEL

NOTE: *Do not check the hydraulic system after a road test. Allow the vehicle to cool down before carrying out the clutch hydraulic system check.*

- Remove the brake and clutch reservoir cap.
- Check the fluid level of the brake and clutch reservoir.

Is the fluid level at or above the step mark?

Yes	INSTALL the reservoir cap. GO to C2
No	ADD brake fluid to the specified level. GO to C2

C2 INSPECT THE HYDRAULIC SYSTEM FOR LEAKAGE

- Check the reservoir and reservoir tubes for leakage.
- Check the master cylinder and hydraulic tube for leakage.
- Check the clutch slave cylinder and the hydraulic tube connection for leakage.

Are there any signs of leakage?

Yes	INSTALL new components as necessary.
No	GO to C3

C3 CHECK INTERNAL OPERATION

- Remove the reservoir cap.
- Have an assistant slowly apply and release the clutch pedal.
- On the down stroke, the fluid level should not increase by more than 1.0 mm (0.039 in).

Does the fluid level increase more than 1 mm (0.039 in)?

Yes	INSTALL a new clutch master cylinder assembly. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to C4

C4 CHECK THE CLUTCH PEDAL RESERVE

NOTE: *The clutch reserve is the distance between the clutch pedal when fully applied and the position when the vehicle starts to move forward.*

- Park the vehicle on a level surface.
- Verify the clutch hydraulic system is properly bled.
  REFER to: Clutch System Bleeding (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, General Procedures).
- Check for obstructions behind clutch pedal.
- Attach a cable tie to the lower clutch pedal.
- Attach a tape measure to the cable tie.
- Apply the clutch fully and start the vehicle.
- Shift the transmission into 1st gear.
- Use the seam on the steering wheel as a reference point.
- While observing the tape measure, slowly engage the clutch, noting when the vehicle starts to move forward or a noticeable engine rpm decrease occurs (noted on tachometer).

Is the clutch pedal reserve greater than or equal to 25 mm (0.984 in)?

Yes	The clutch hydraulic system is OK.
No	GO to C5

C5 CHECK THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
- Inspect the clutch pressure plate for wear or runout.

REFER to: Clutch (308-01A Clutch - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).

Are there any signs of excessive wear or runout to the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to C6

C6 INSPECT THE CLUTCH DISC

- Carry out the clutch disc inspection procedure.
  REFER to: Clutch (308-01A Clutch - 5-Speed Manual Transmission - MT75, Diagnosis and Testing).

Is the clutch disc OK?

Yes	GO to C7
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

C7 CHECK CLUTCH PEDAL FREE PLAY

NOTE: *The clutch pedal free play is the distance between the clutch pedal when fully released and the position when slight resistance is felt on downward motion.*

- Ignition OFF.
- Attach a tape measure to the cable tie.
- While observing the tape measure, slowly push downward on the clutch pedal until a slight resistance is felt.

Is the clutch pedal free play less than 13 mm (0.511 in) ?

Yes	The clutch hydraulic system is OK.
No	BLEED the clutch hydraulic system. REFER to Clutch System Bleeding.

PINPOINT TEST D: CLUTCH DRAG, ALSO HARD TO SHIFT

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Internal operation
- Clutch pedal reserve
- Clutch slave cylinder travel
- Clutch disc
- Clutch pressure plate

- Clutch pedal free play

PINPOINT TEST D : CLUTCH DRAG, ALSO HARD TO SHIFT

D1 CHECK FLUID LEVEL

- Ignition OFF.
- Remove the reservoir cap.
- Inspect the fluid level in the brake and clutch reservoir.

Is the fluid level at or above the step mark?

Yes	INSTALL the reservoir cap. GO to D2
No	ADD brake fluid. GO to D2

D2 INSPECT THE CLUTCH HYDRAULIC SYSTEM FOR LEAKAGE

- Inspect the clutch master cylinder and the hydraulic tubes for leakage.
- Inspect the reservoir and reservoir tube for leakage.
- Inspect the clutch slave cylinder and the hydraulic tube connection for leakage.

Are there any signs of leakage?

Yes	INSTALL new component as necessary.
No	GO to D3

D3 CHECK INTERNAL OPERATION

- Remove the reservoir cap.
- Have an assistant slowly apply and release the clutch pedal.
- On the down stroke, the fluid level should not increase by more than 1 mm (0.039 in).

Does the fluid level increase more than 1 mm (0.039 in)?

Yes	INSTALL a new clutch master cylinder assembly. REFER to: Clutch Master Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to D4

D4 CHECK THE CLUTCH PEDAL RESERVE

NOTE: *The clutch reserve is the distance between the clutch pedal when fully applied and the position when the vehicle starts to move forward.*

- Park the vehicle on a level surface.
- Check for obstructions behind the clutch pedal. Check the carpet for correct installation
- Attach a cable tie to the lower clutch pedal.
- Attach a tape measure to the cable tie.
- Apply the clutch fully and start the vehicle.
- Shift the transmission into 1st gear.
- Use the seam on the steering wheel as a reference point.
- While observing the tape measure, slowly engage the clutch, noting when the vehicle starts to move forward or a noticeable engine rpm decrease occurs (noted on tachometer).

Is the clutch pedal reserve greater than or equal to 25 mm (0.984 in)?

Yes	The clutch hydraulic system is OK.
No	GO to D5

D5 CHECK THE PEDAL FREE PLAY

NOTE: *The clutch pedal free play is the distance between the clutch pedal when fully released and the position when slight resistance is felt on downward motion.*

- Ignition OFF.
- Attach a tape measure to the cable tie.
- While observing the tape measure, slowly push downward on the clutch pedal until a slight resistance is felt.

Is the clutch pedal free play less than 13 mm (0.511 in)?

Yes	The clutch hydraulic system is OK.
No	GO to D6

D6 CHECK THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
- Inspect the clutch pressure plate for wear or runout. REFER to Clutch Pressure Plate Check.

Are there any signs of excessive wear or runout to the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to D7

D7 INSPECT THE CLUTCH DISC

- Carry out the clutch disc inspection procedure.

Is the clutch disc OK.

Yes	GO to D8
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

D8 INSPECT THE TRANSMISSION

- Remove the transmission.
  REFER to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
  REFER to: Transmission - 4x4 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
- Disassemble the transmission.
  REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
- Carry out the following:
  - Inspect all the shift rails for excessive scuffing or wear.
  - Check the interlock pins on the shift rail.
  - Make sure the interlock bolts are tightened to specifications.
  - Inspect the shift pads for wear or cracking.
  - Inspect the shift forks for wear or damage.
  - Check the synchronizer rings of the affected gear for wear or damage.
  - Check the synchronizer hubs of the affected gear for wear or damage.
  - Inspect the clutching teeth of the affected gear.

Are there any internal components worn or damaged?

Yes	INSTALL new components or REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Assembly).
No	ASSEMBLE and INSTALL the transmission. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Assembly).

PINPOINT TEST E: CLUTCH PEDAL PULSATION

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Conditions

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Clutch disc
- Clutch pressure plate
- Flywheel

PINPOINT TEST E : CLUTCH PEDAL PULSATION

E1 CHECK THE CLUTCH PEDAL PULSATION

- Start the engine.
- With the transmission in NEUTRAL, slowly apply the clutch pedal.

Does the clutch pedal pulsate while being applied?

Yes	GO to E2
No	VERIFY the customer concern. GO to Symptom Chart.

E2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolts loose?

Yes	TIGHTEN or INSTALL new bolts. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to E3

E3 INSPECT THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

- Inspect the clutch pressure plate for damage.

Are there any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to E4

E4 INSPECT THE CLUTCH DISC

- Carry out clutch disc inspection procedure. REFER to Clutch Disc Check.

Is the clutch disc OK?

Yes	GO to E5
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

E5 INSPECT THE FLYWHEEL

- Inspect the flywheel for damage and runout. REFER to Flywheel Runout Check.

Is flywheel OK?

Yes	VERIFY the customer concern. GO to Symptom Chart.
No	TIGHTEN or INSTALL a new flywheel.

PINPOINT TEST F - CLUTCH-RELATED VIBRATIONS

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Conditions

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Engine components
- Accessory drive belts
- Release bearing
- Flywheel

PINPOINT TEST F : CLUTCH-RELATED VIBRATIONS

F1 CHECK FOR ENGINE COMPONENT GROUNDING

- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Check the engine and transmission mounts for grounding.

- Check for exhaust manifolds or other engine component grounding on the body or frame.

Is there evidence of grounding on the body or frame?

Yes	REPAIR the components as necessary.
No	GO to F2

F2 CHECK FOR ACCESSORY DRIVE VIBRATIONS

- Remove the accessory drive belt.
  REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
  REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
- Start the engine.

Does the vibration stop when the accessory drive belt is removed from the engine?

Yes	INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	STOP the engine and INSTALL the drive belt. GO to F3

F3 CHECK FOR CLUTCH RELEASE BEARING NOISE

NOTE: *With the transmission in NEUTRAL, transmission rollover noise can be heard. Make sure to distinguish between rollover noise and clutch release bearing noise.*

- Start the engine.
- Apply and hold the clutch pedal.

Is a whirring, grating or grinding noise present only when pedal is pushed?

Yes	INSTALL a new clutch release bearing. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to F4

F4 INSPECT THE FLYWHEEL

- Ignition OFF.
- Remove the transmission.
  REFER to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
  REFER to: Transmission - 4x4 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
- Carry out a flywheel check. REFER to Flywheel Runout Check.

Is the flywheel OK?

Yes	VERIFY the customer concern. GO to Symptom Chart.
No	TIGHTEN or INSTALL a new flywheel.

PINPOINT TEST G: EXCESSIVE NOISE

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Conditions

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

This pinpoint test is intended to diagnose the following:

- Transmission
- Clutch slave cylinder
- Pilot bearing

PINPOINT TEST G : EXCESSIVE NOISE

G1 TRANSMISSION NEUTRAL GEAR ROLLOVER TEST

- Start the engine.
- With the engine at idle, the transmission in NEUTRAL and the clutch engaged (pedal up). If noise is excessive, apply the clutch pedal to stop the transmission input shaft from rotating.

Does the noise stop when the clutch pedal is applied?

Yes	INSPECT the clutch components for damage.
No	GO to G2

G2 CHECK THE CLUTCH SYSTEM

- Ignition OFF.
- Using slow, medium, then fast stroke, and release the clutch pedal.

Is there a squeak?

Yes	GO to G3
No	The clutch system is OK. VERIFY the customer concern.

G3 CHECK THE CPP SWITCH

- Remove the CPP switch. Using slow, medium, then fast stroke, apply and release the clutch pedal.

Is there a squeak?

Yes	REINSTALL the CPP switch. GO to G4
No	INSTALL a new CPP switch.

G4 CHECK THE CLUTCH SLAVE CYLINDER

- Remove the transmission.
  REFER to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
  REFER to: Transmission - 4x4 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Removal).
- Inspect the clutch slave cylinder for wear or loss of lubrication.

Are there any signs of wear or loss of lubrication?

Yes	INSTALL a new clutch slave cylinder. REFER to: Clutch Slave Cylinder (308-02A Clutch Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	GO to G5

G5 CHECK THE PILOT BEARING

- Inspect the pilot bearing for wear or damage.

Is the pilot bearing OK?

Yes	GO to G6
No	INSTALL a new pilot bearing. REFER to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation). REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

G6 CHECK THE DAMPER SPRINGS

- Inspect the damper springs for fatigue or breakage.

Are there any signs of fatigue or breakage?

Yes	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
No	INSPECT the crankshaft end play.

Copyright © 2016 Ford Motor Company

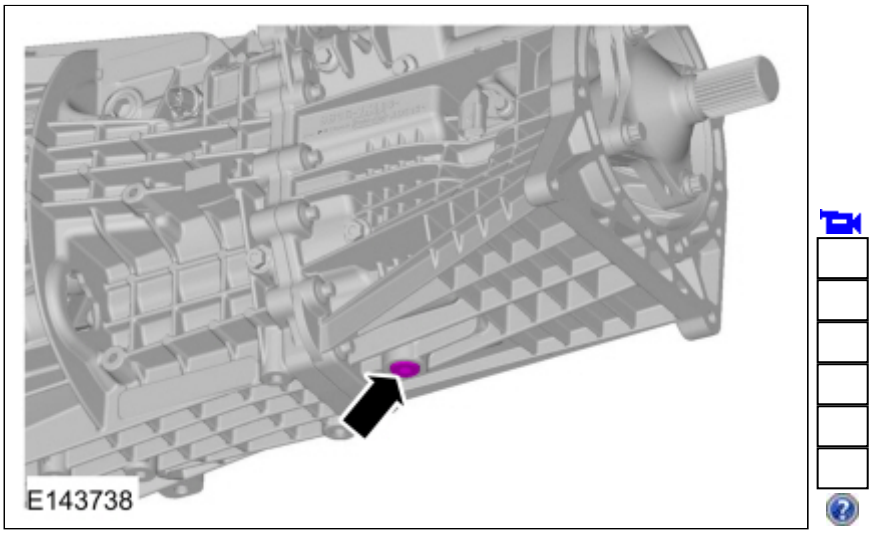
Transmission Draining and Filling

Materials

Name	Specification
Gear/Transmission Fluid - SAE 75W	WSS-M2C200-D2

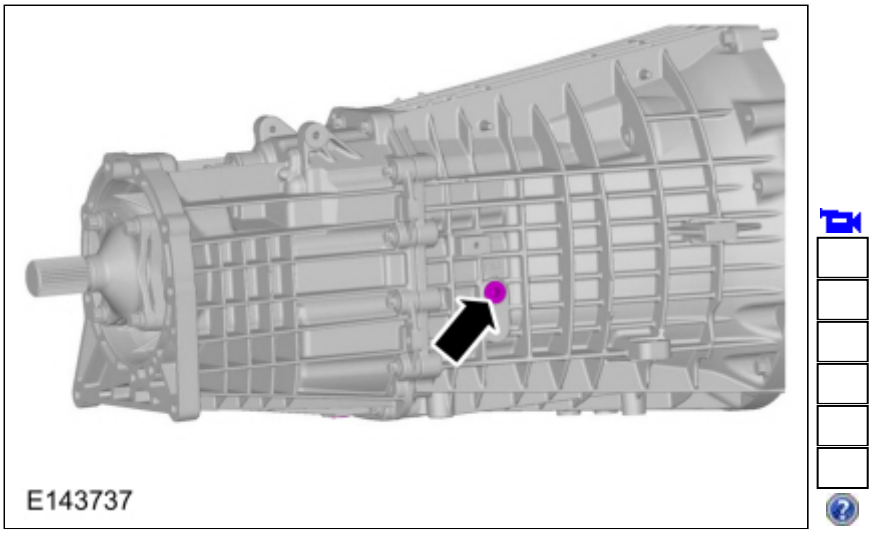
Draining

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. *Torque*: 50 Nm



Filling

1. *Material*: Gear/Transmission Fluid - SAE 75W (WSS-M2C200-D2)
   Torque: 35 Nm



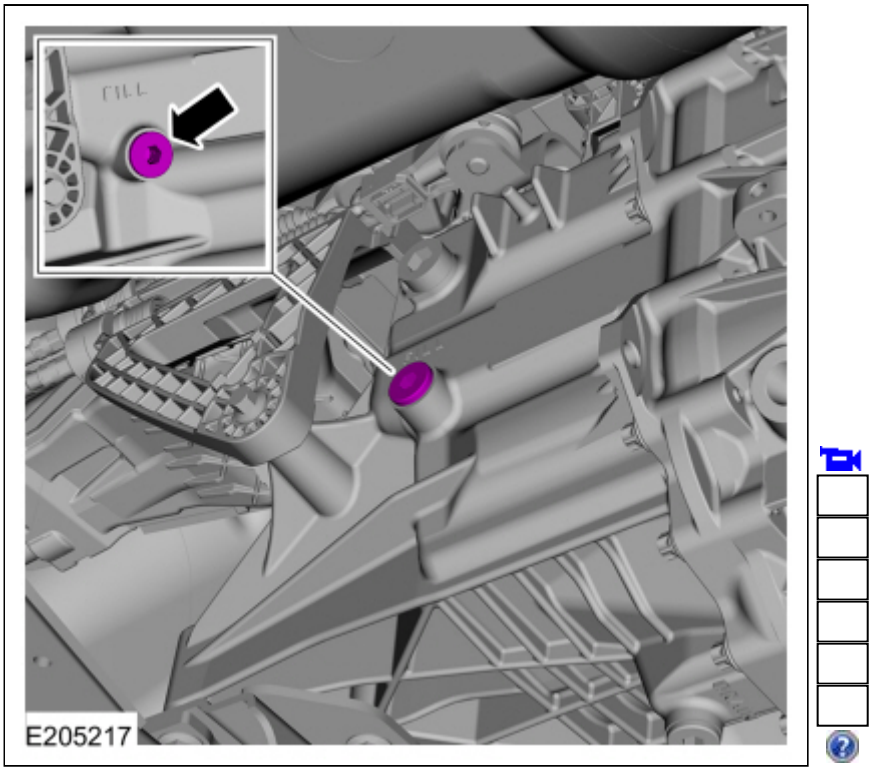
Copyright © 2016 Ford Motor Company

Transmission Fluid Level Check

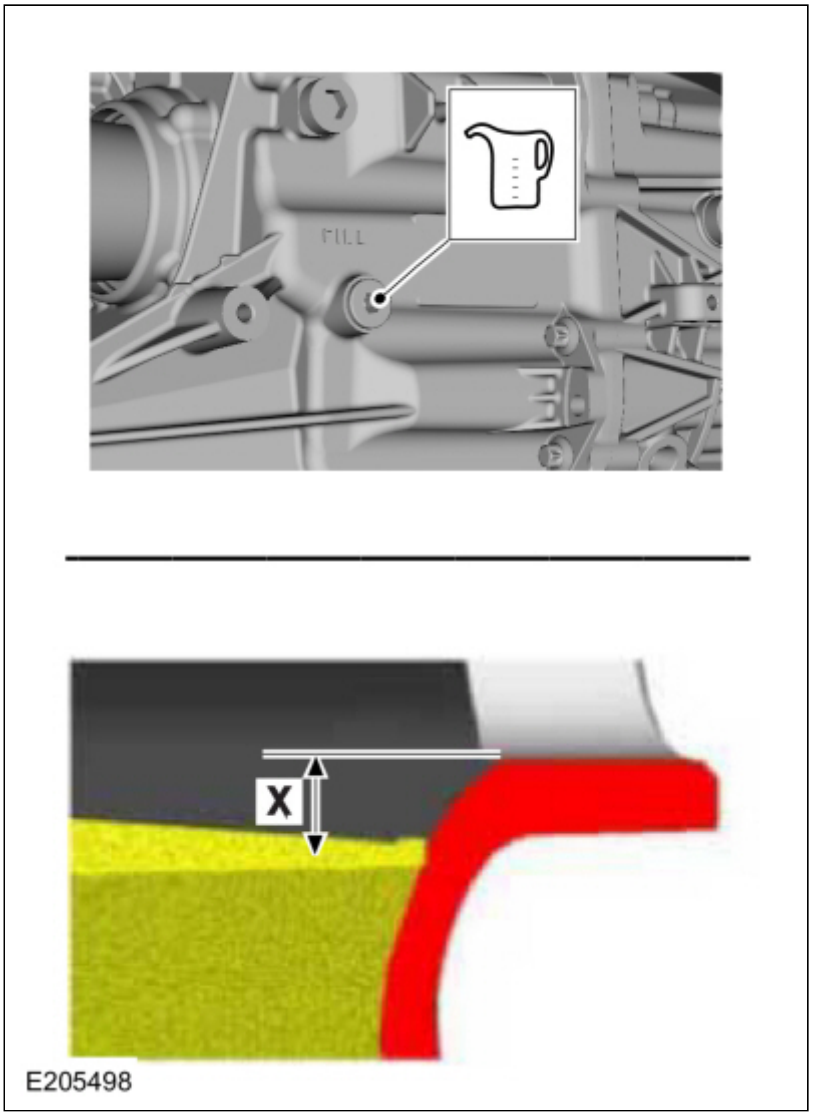
Materials

Name	Specification
Gear/Transmission Fluid - SAE 75W	WSS-M2C200-D2

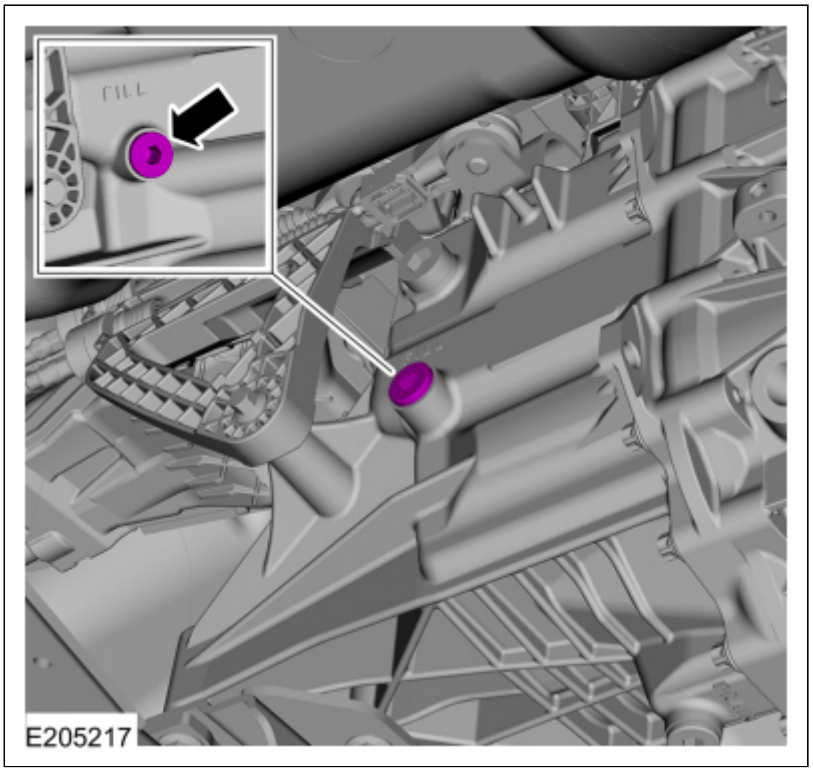
1. Check the component for leaks.
2. Transmission Fluid Level Check should only be carried out if an oil leak was identified.
   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
3. **NOTE:** *Make sure that the vehicle is standing on a level surface.*

   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

5. **X:**0 - 5 mm
   Material: Gear/Transmission Fluid - SAE 75W (WSS-M2C200-D2)



6. *Torque*: 35 Nm



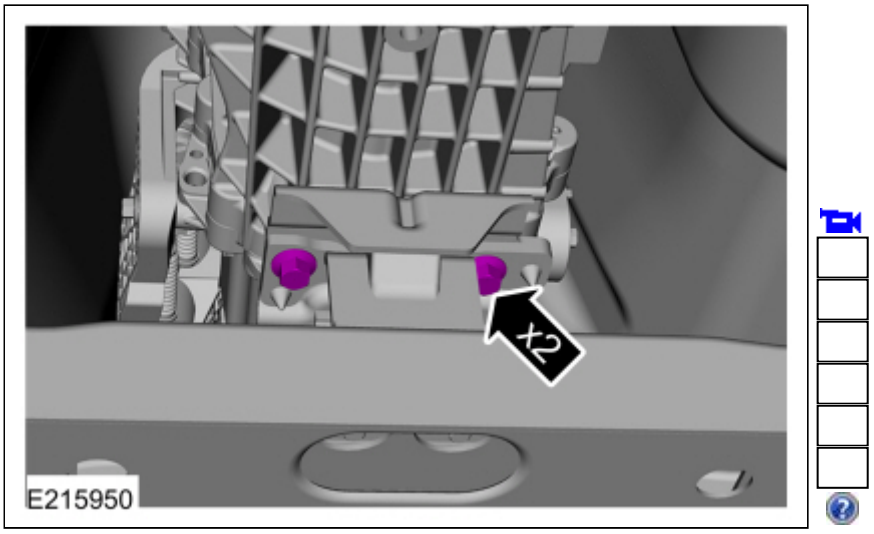
Copyright © 2016 Ford Motor Company

Transmission - 4x2

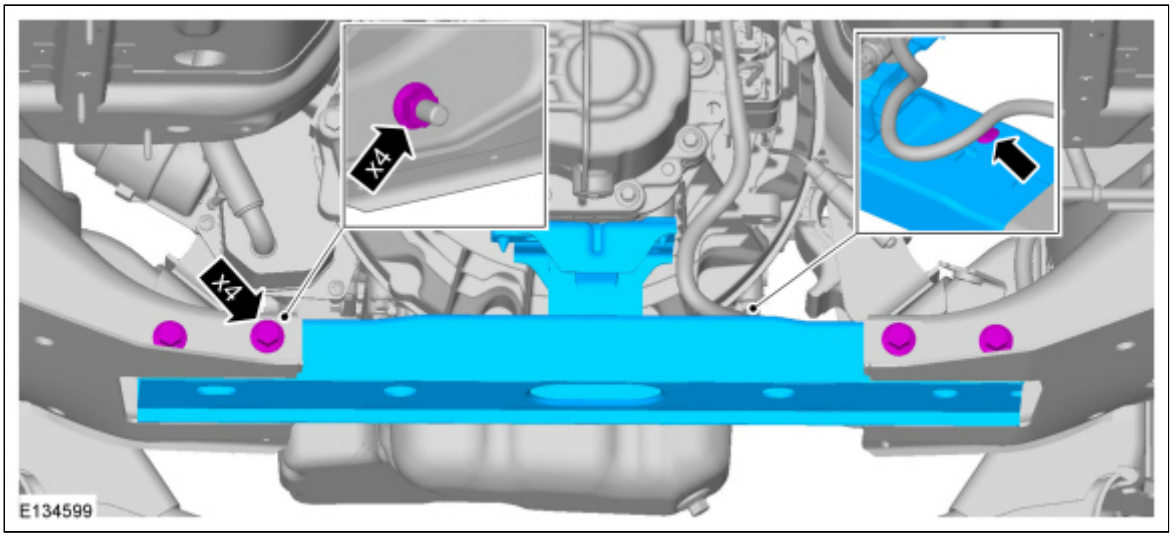
Base Part Number: 7000

Special Tool(s) / General Equipment

Transmission Jack
Cable Ties
Adhesive Tape

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
3. Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
   Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
4. Refer to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
5. Refer to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).
6. 

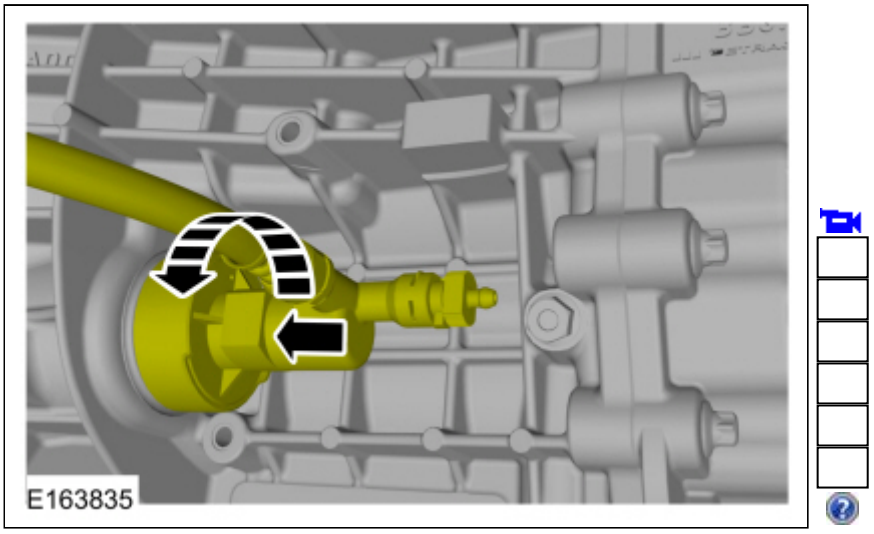
7. Use the General Equipment: Transmission Jack



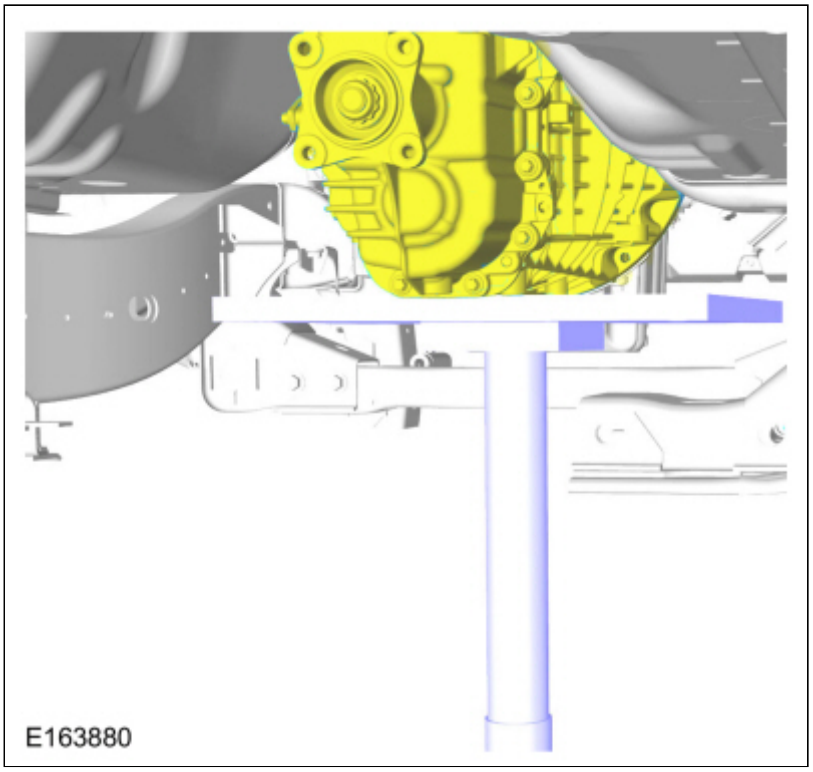
8. **NOTICE: Do not operate the clutch pedal while the clutch slave cylinder is detached from the transmission. Failure to follow this instruction may result in damage to the clutch slave cylinder.**

   NOTE: *Upon removal of the clutch slave cylinder, secure the clutch cylinder push rod to the clutch slave cylinder with adhesive tape.*

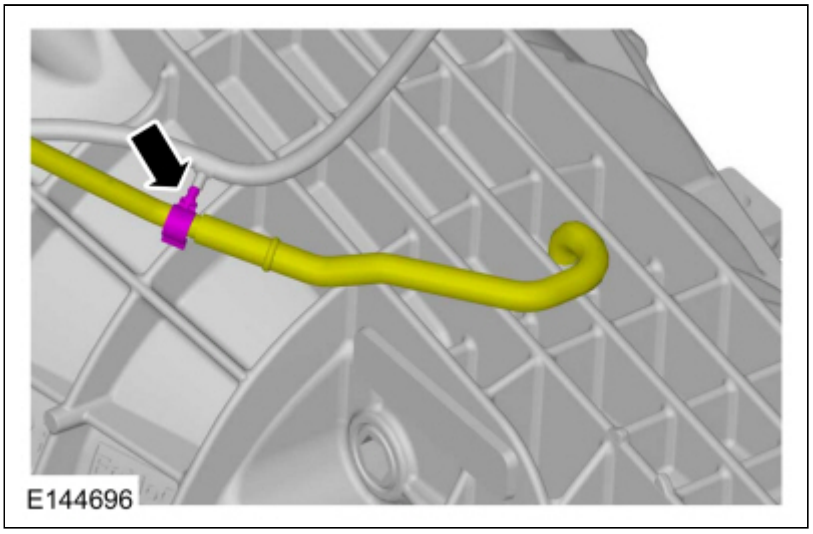
   .
   Use the General Equipment: Adhesive Tape



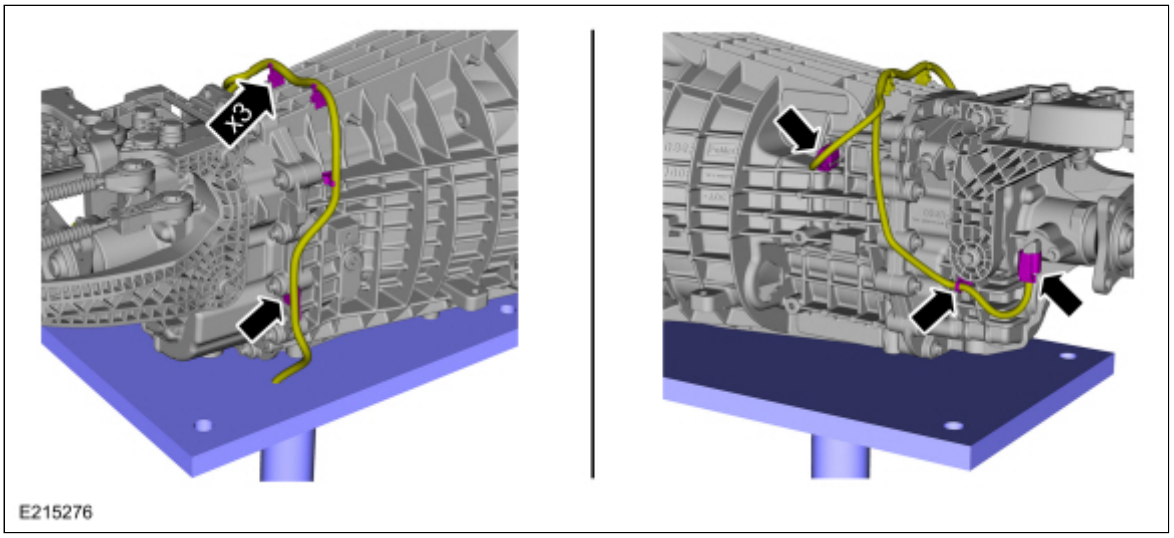
9. Lower the transmission.
   Use the General Equipment: Transmission Jack



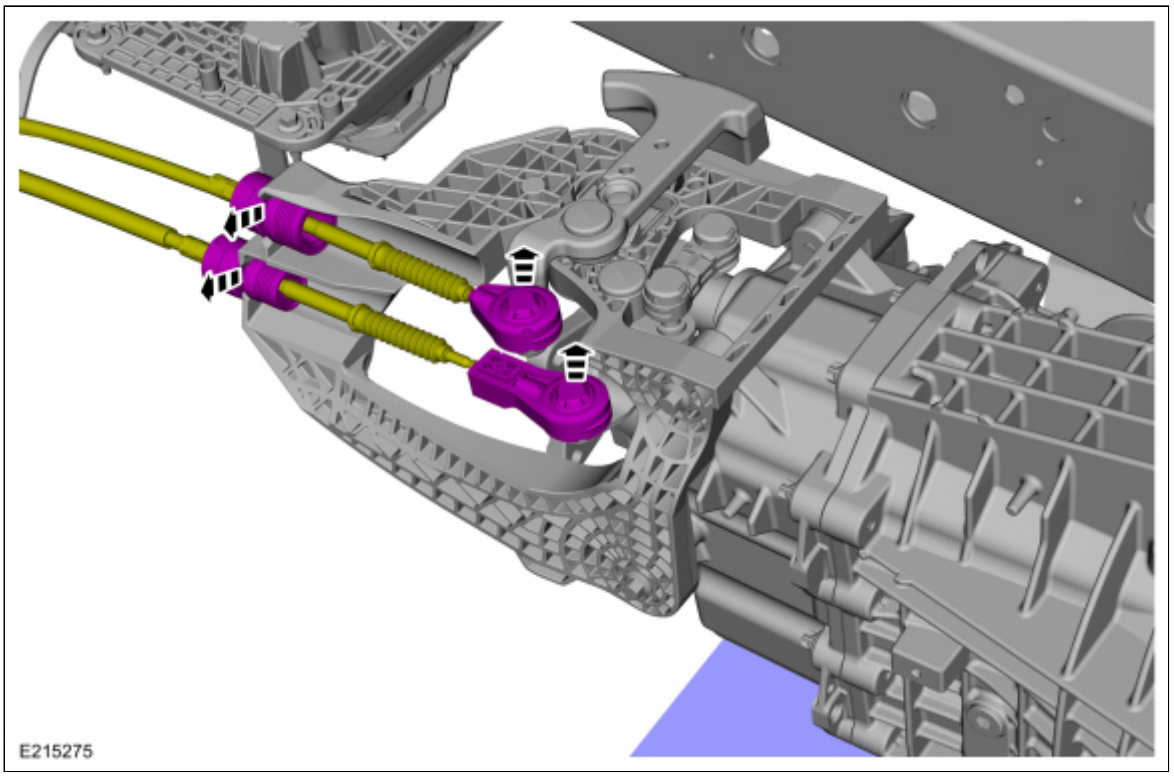
10.



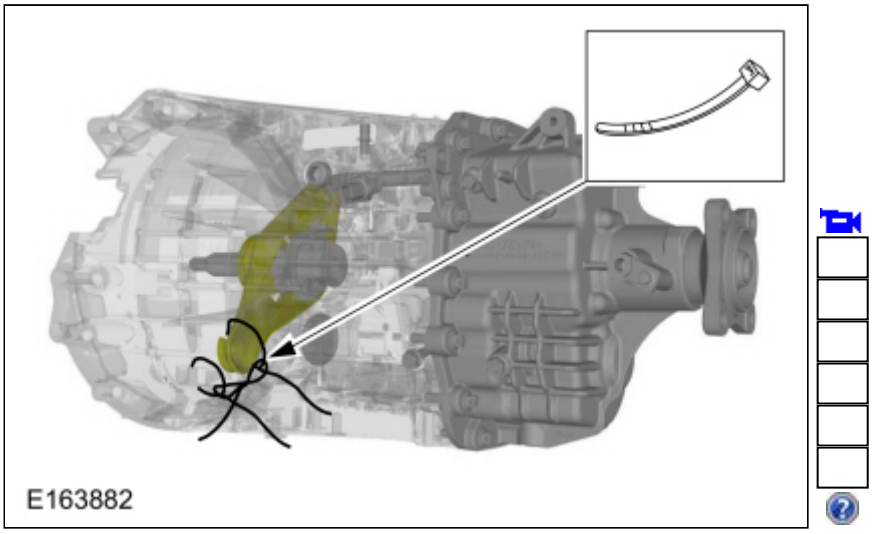
11. Use the General Equipment: Transmission Jack



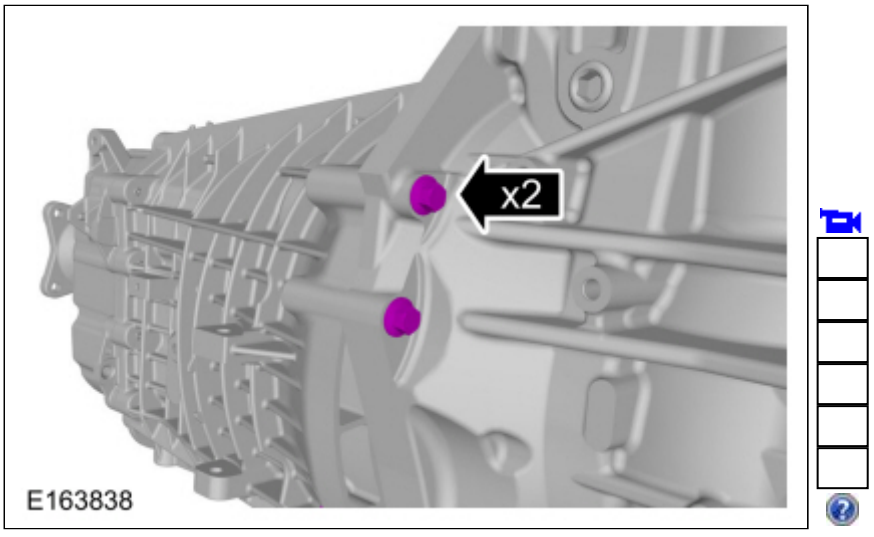
12.



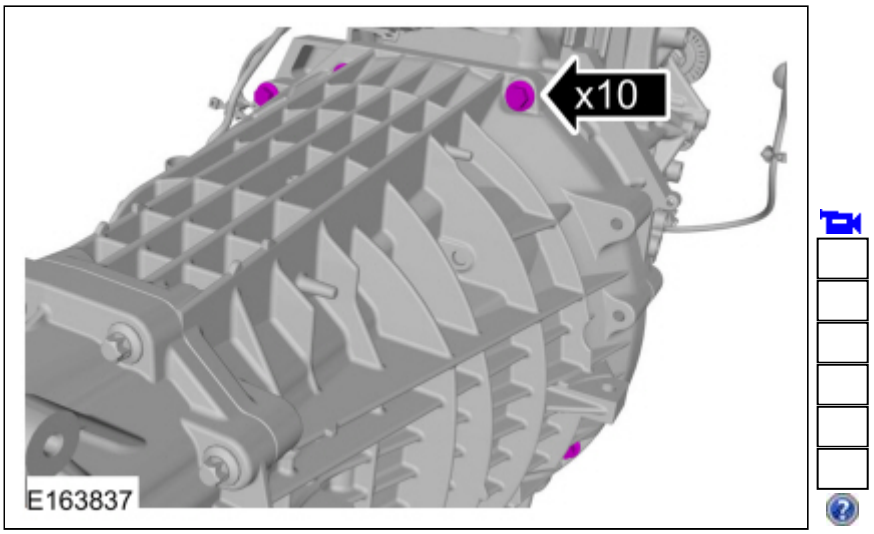
13. Secure the clutch fork with cable ties.
    Use the General Equipment: Cable Ties



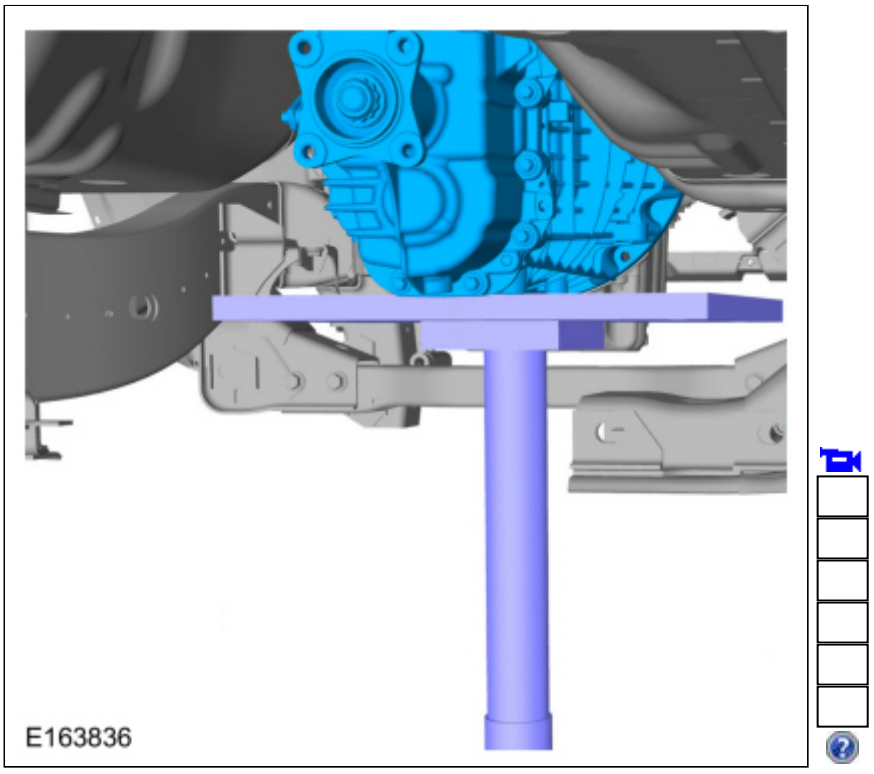
14.



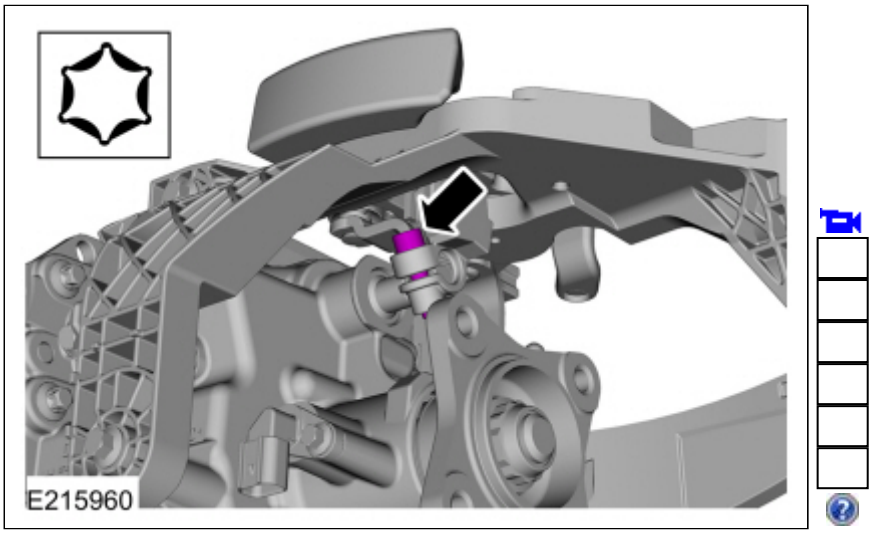
15.



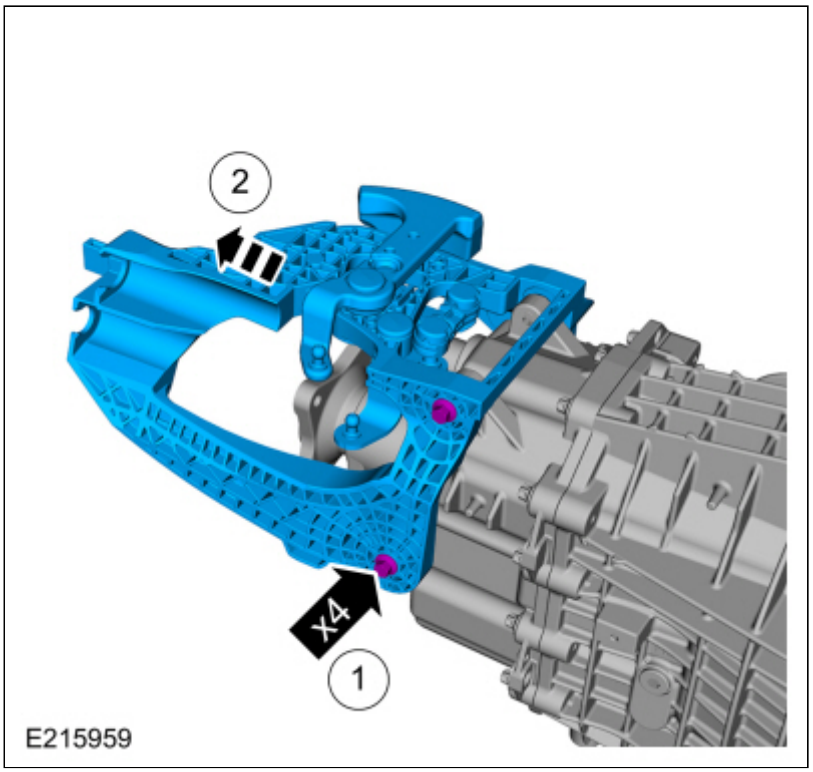
16. Use the General Equipment: Transmission Jack



17.



18.



Copyright © 2016 Ford Motor Company

Transmission - 4x4

Base Part Number: 7000

Special Tool(s) / General Equipment

Transmission Jack
Cable Ties
Adhesive Tape

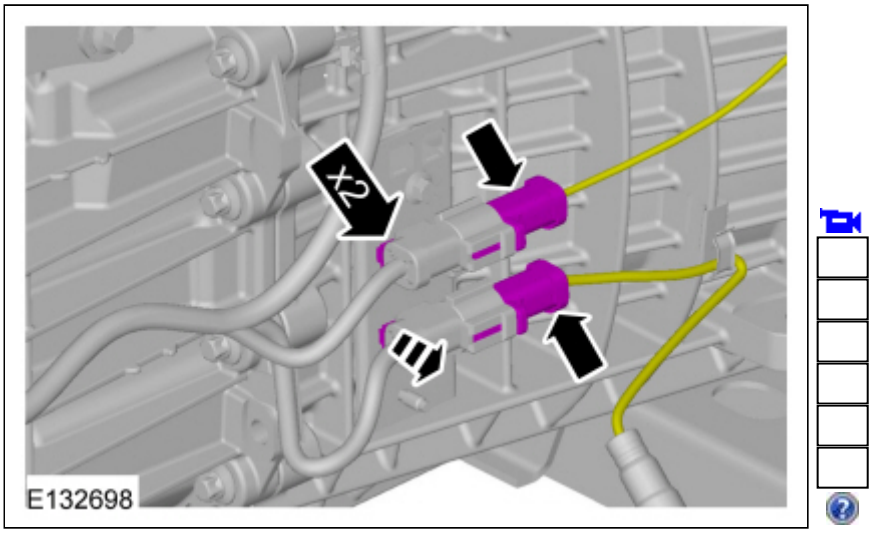
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

3. Drain the transmission oil.
   Refer to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).

4. Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
   Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

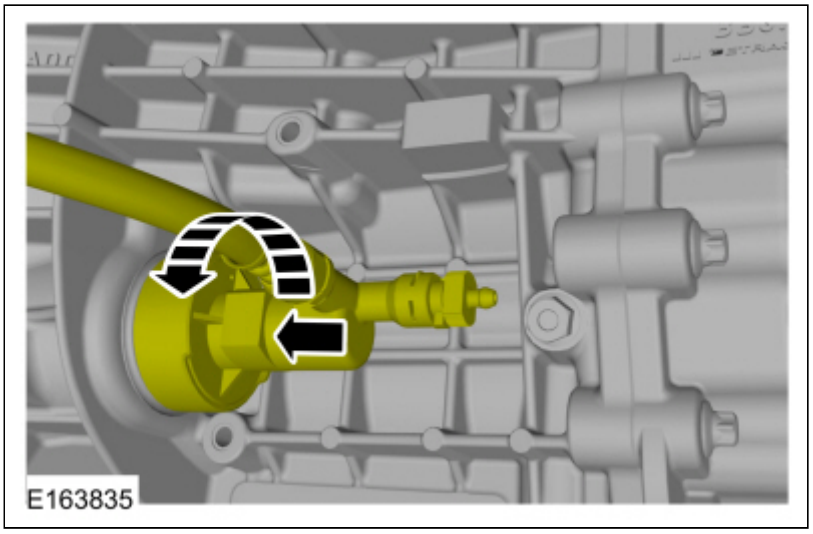
5.



6. **NOTICE: Do not operate the clutch pedal while the clutch slave cylinder is detached from the transmission. Failure to follow this instruction may result in damage to the clutch slave cylinder.**

   NOTE: *Upon removal of the clutch slave cylinder, secure the clutch cylinder push rod to the clutch slave cylinder with adhesive tape.*

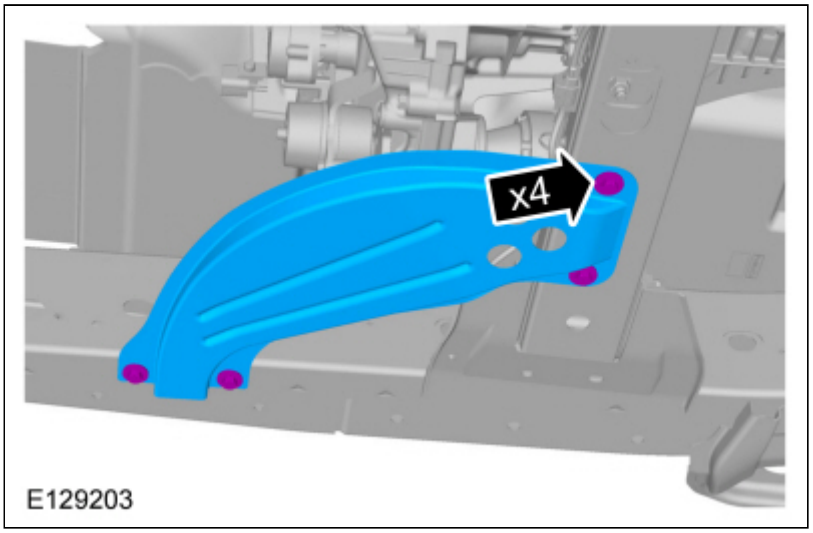
   Use the General Equipment: Adhesive Tape



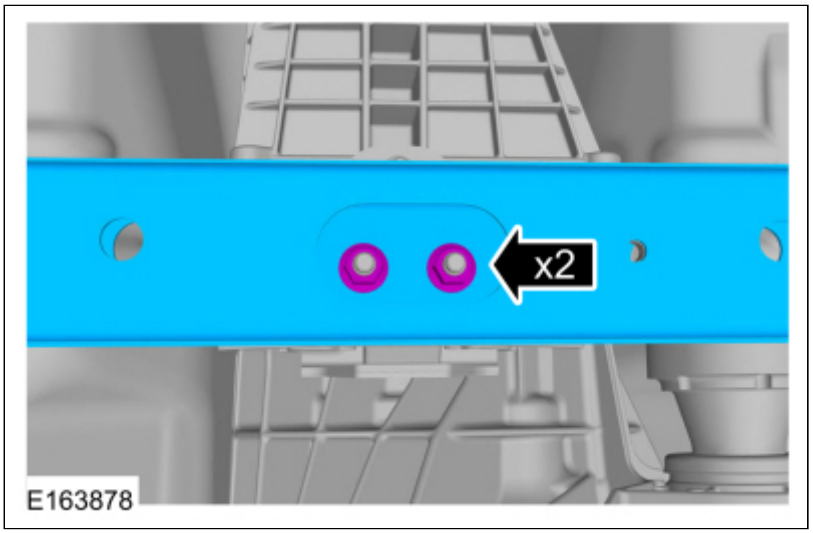
7. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

8. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

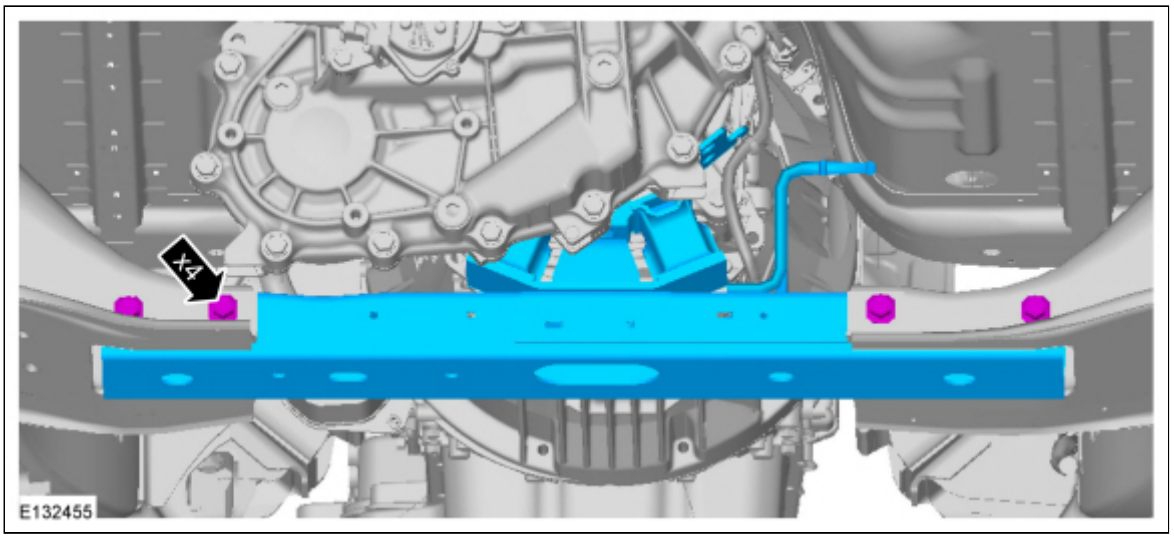
9.



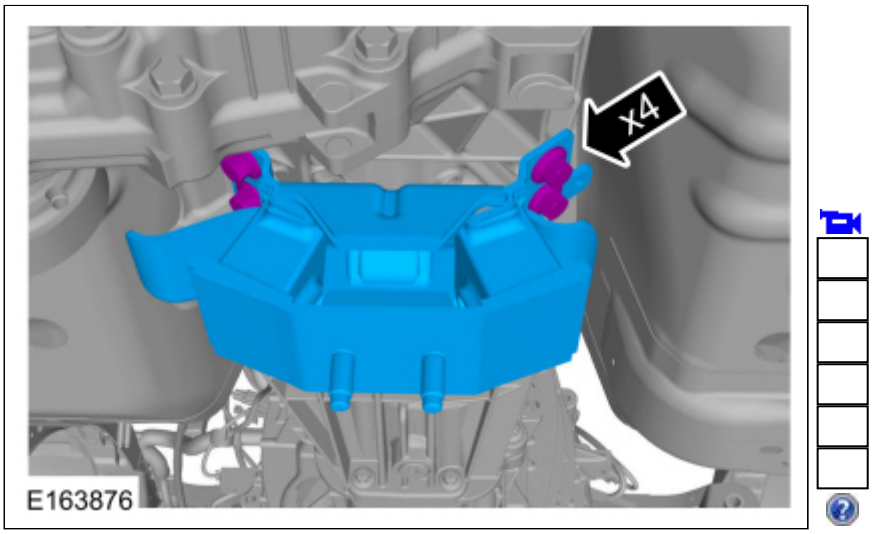
10.



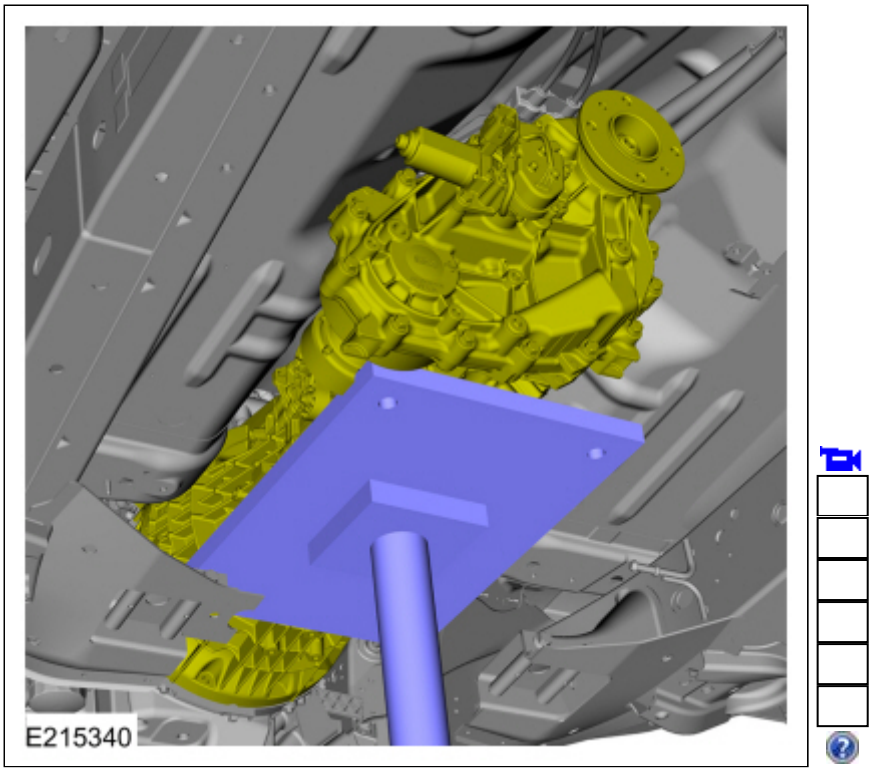
11. Use the General Equipment: Transmission Jack



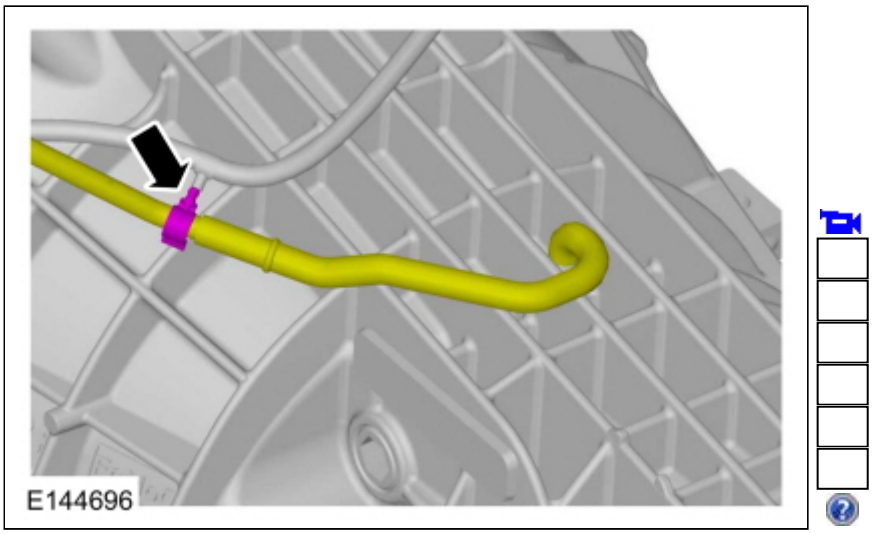
12. Use the General Equipment: Transmission Jack



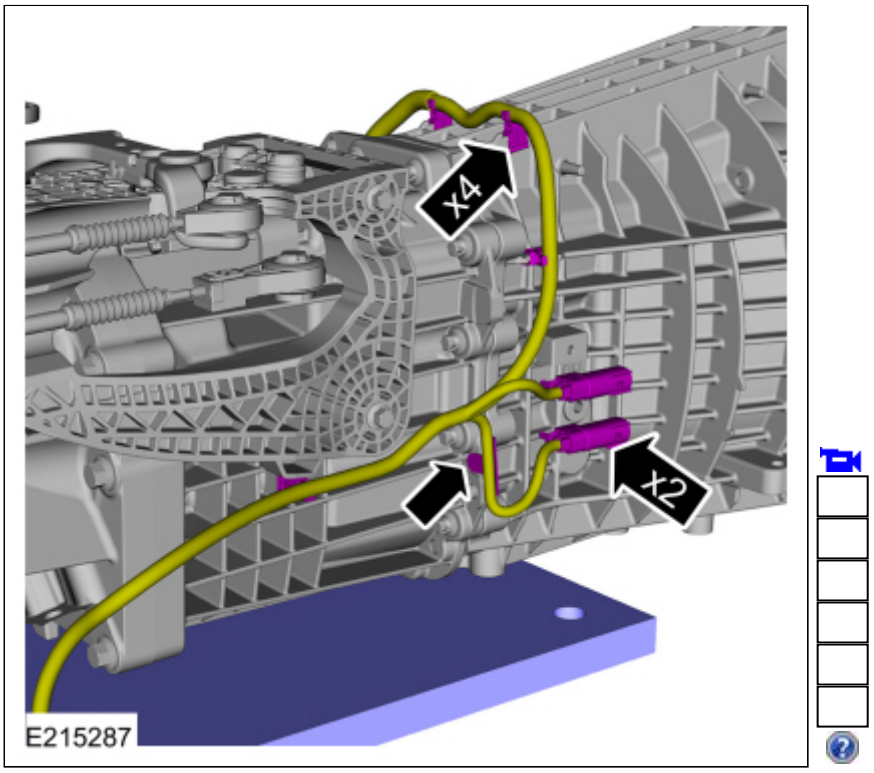
13.



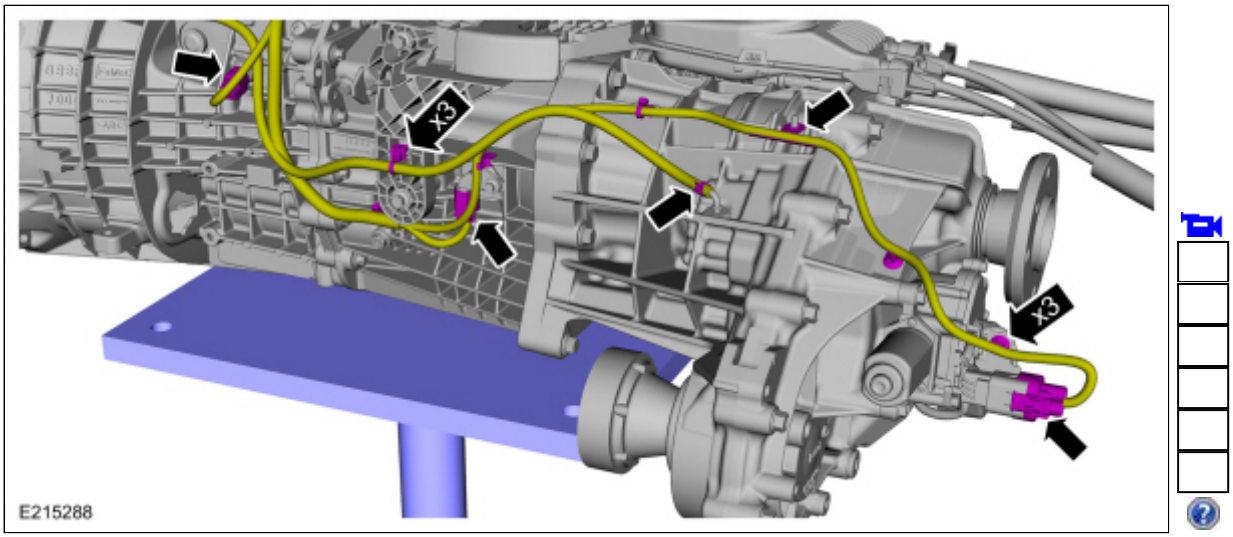
14.



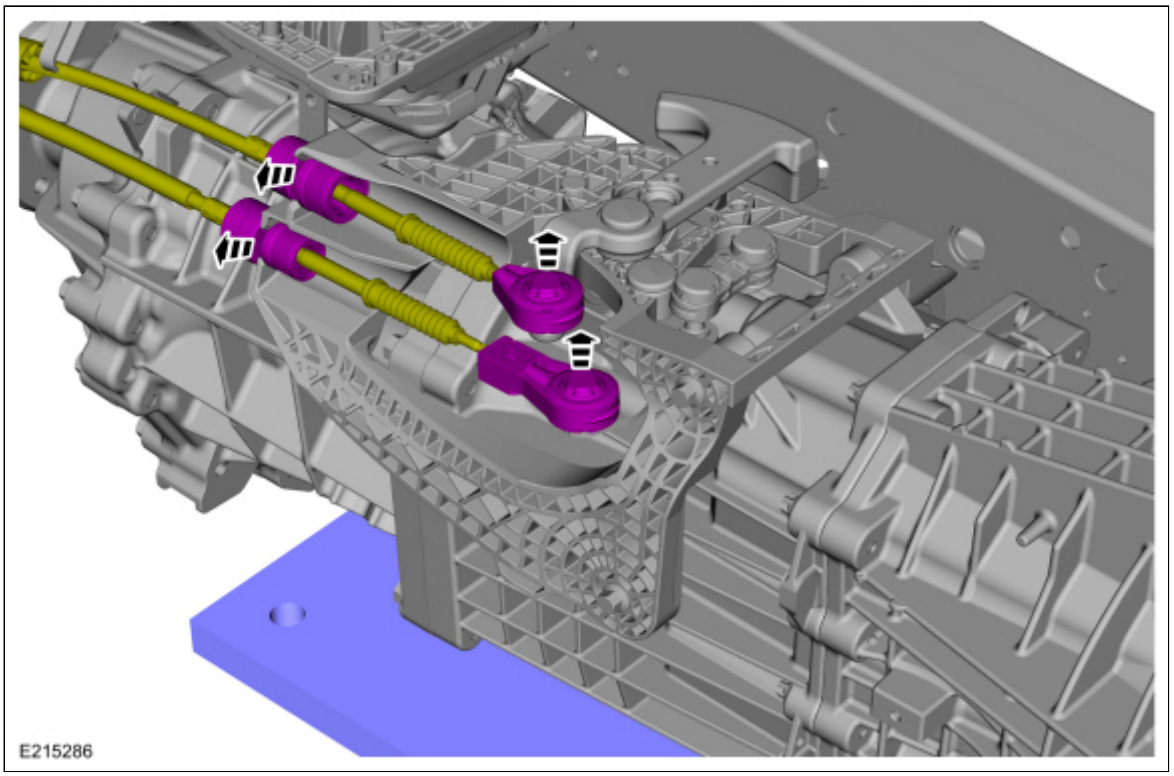
15. Use the General Equipment: Transmission Jack



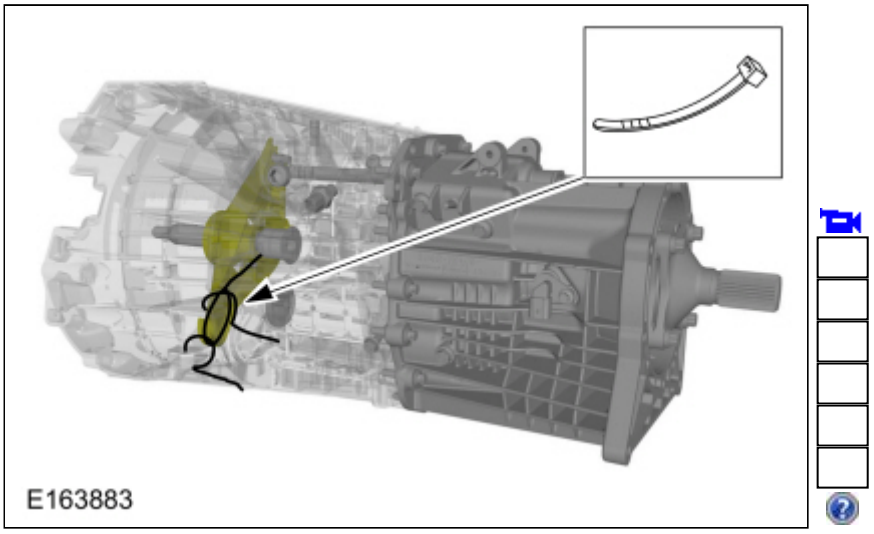
16. Use the General Equipment: Transmission Jack



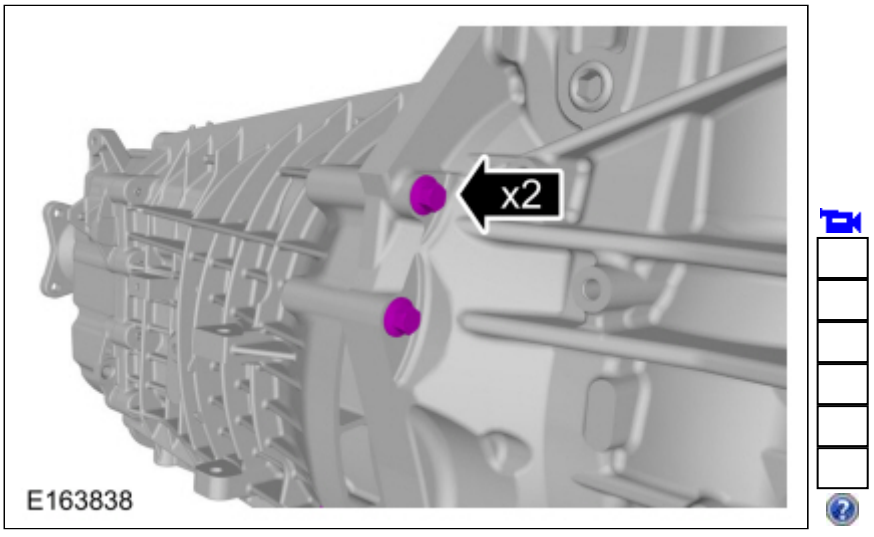
17.



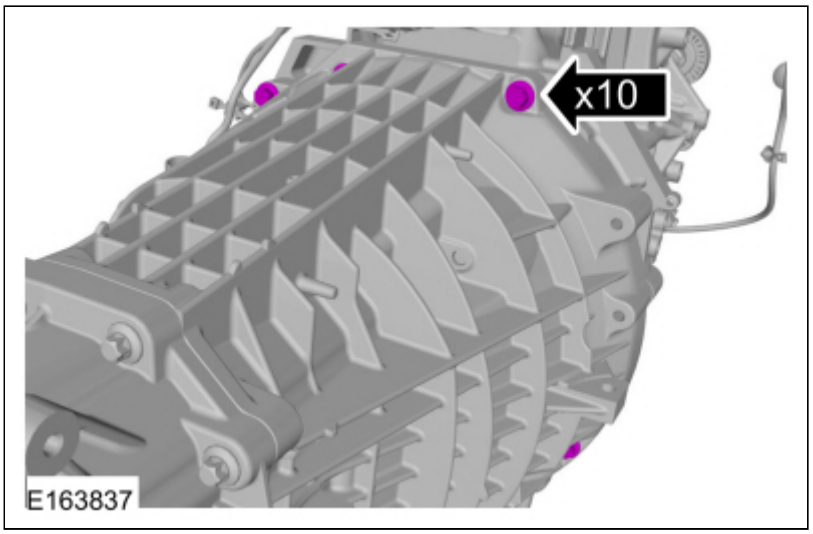
18. Secure the clutch fork with cable ties.
    Use the General Equipment: Cable Ties



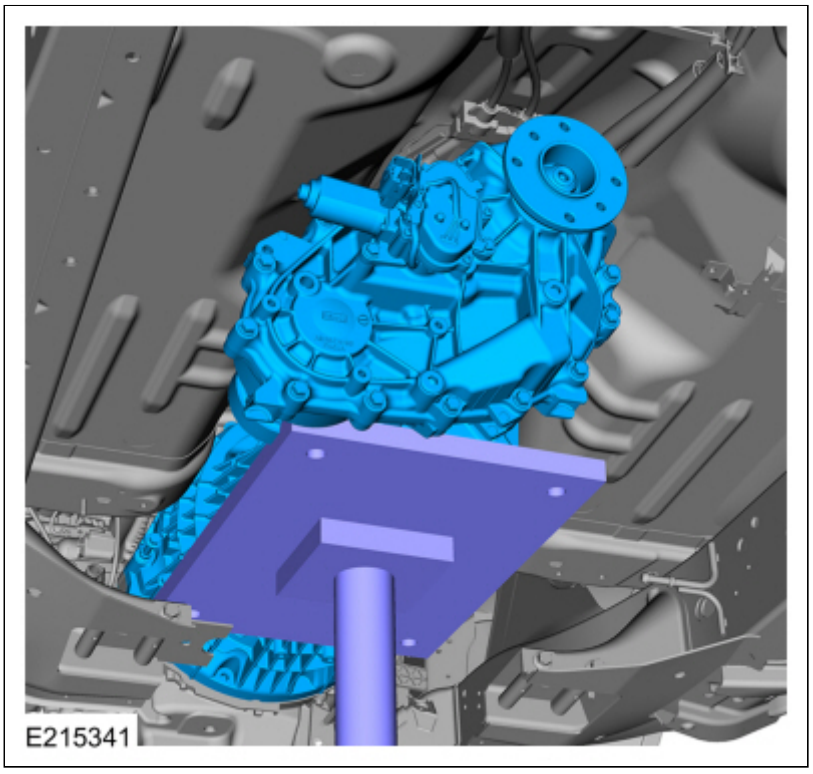
19.



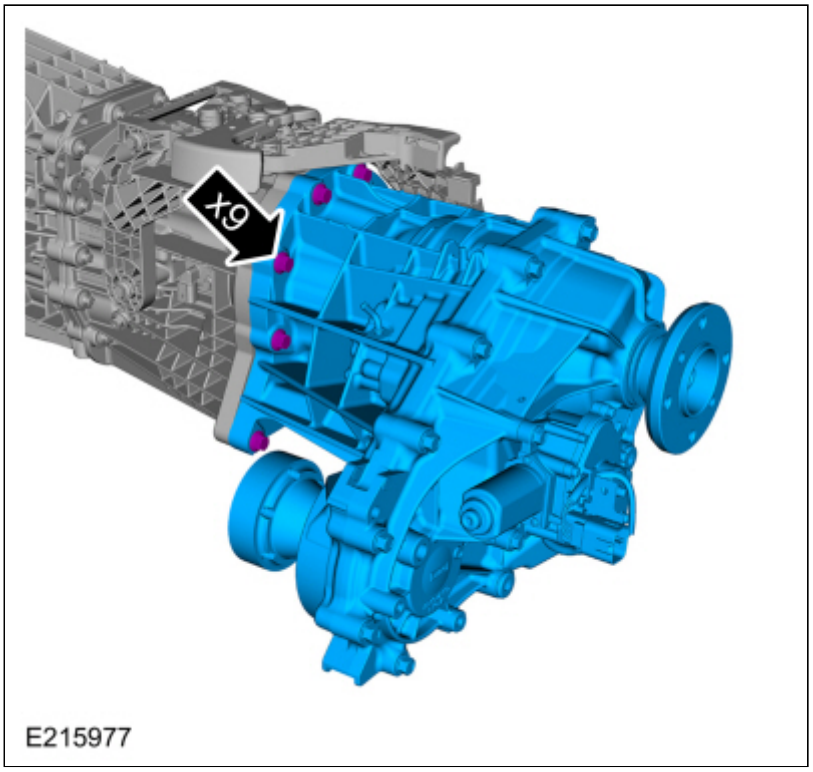
20.



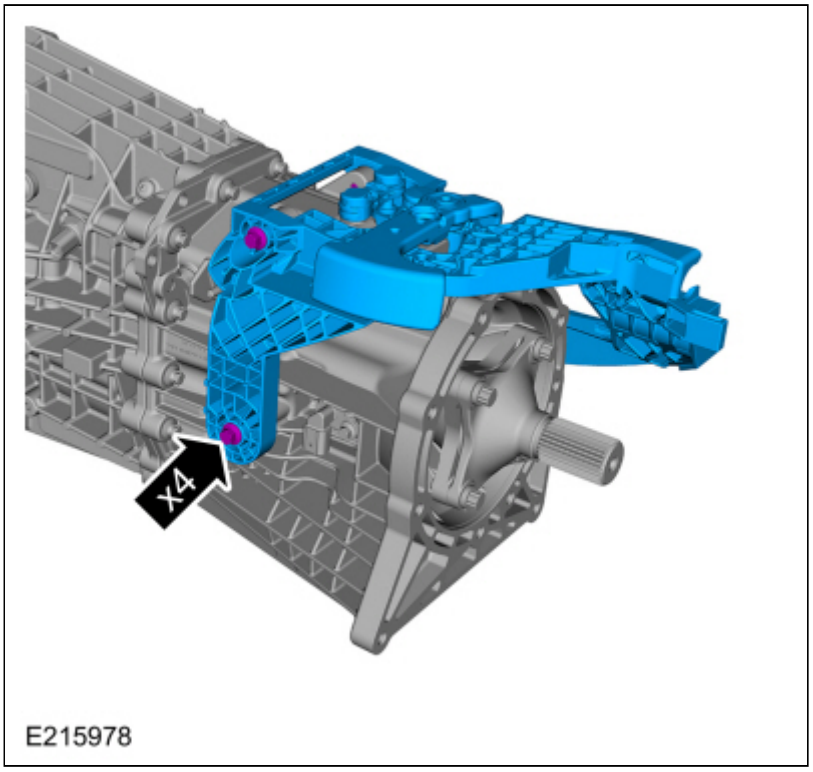
21. Use the General Equipment: Transmission Jack



22.



23.

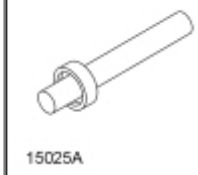
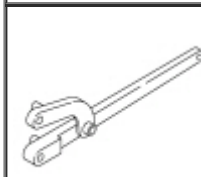
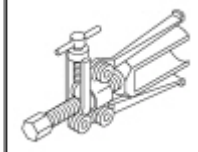
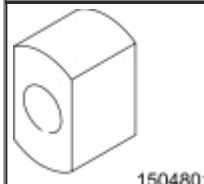
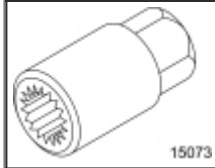
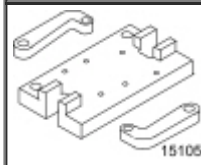


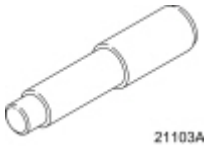
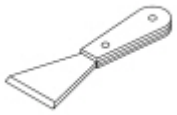
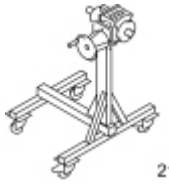
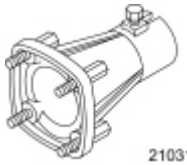
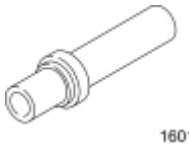
Copyright © 2016 Ford Motor Company

Transmission

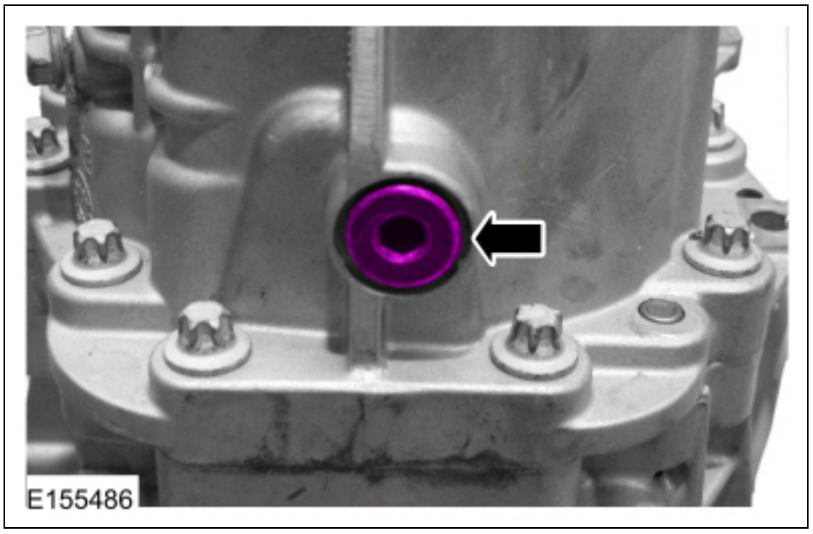
Base Part Number: 7000

Special Tool(s) / General Equipment

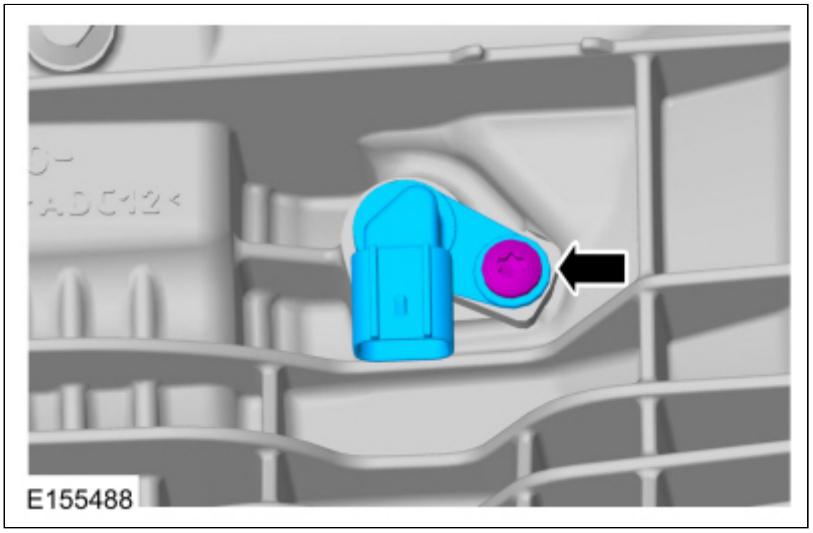
 E129694	100-001 (T50T-100-A) Slide Hammer
 15025A	205-062 Installer, Differential Bearing
 15026A01	205-071-01 Adapter for 205-071 (Thrust Pad)
 15030A	205-072 Universal Flange Holding Wrench
 15048	205-078 Remover, Drive Pinion Seal
 1504801	205-078-01 Adapter for 205-078 (Thrust Pad)
 15073	205-175 Socket, Drive Pinion Nut
 15105A	205-329 Mounting Bracket, Engine/Differential
	205-D072 (D97L-4221-A) 2 Jaw Puller

 E155534	
 2110201	303-172-01 Adapter for 303-172
 21103A	303-173 Aligner, Clutch Plate
 21143	303-293 Remover, Crankshaft Seal
 21179	303-428 Separator, Oil Pan
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 16014	308-044 Installer, Transmission Extension Housing Bushing/Seal
 E142027	308-125 Remover, Transfer Case Bearing
Hydraulic Press	
Two Leg Puller	

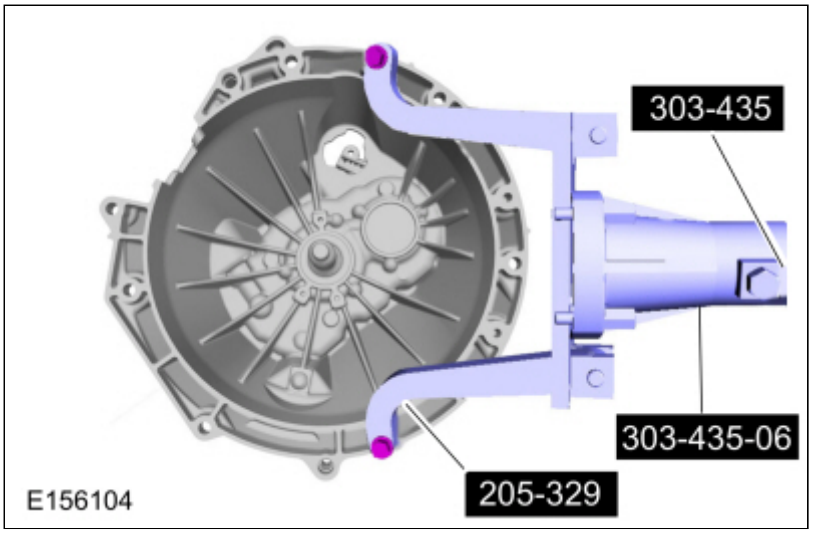
1.



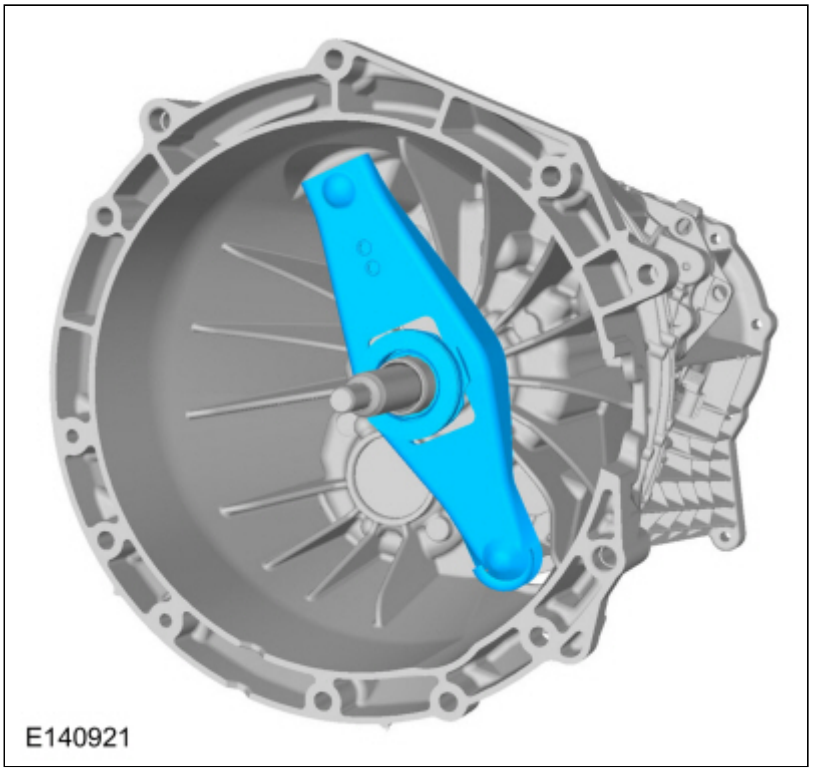
2.



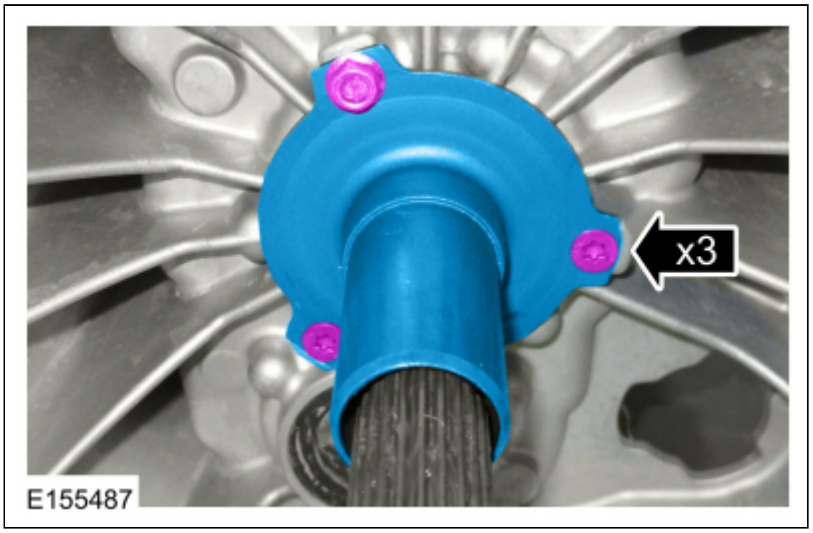
- Use Special Service Tool: 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435. , 205-329 Mounting Bracket, Engine/Differential.



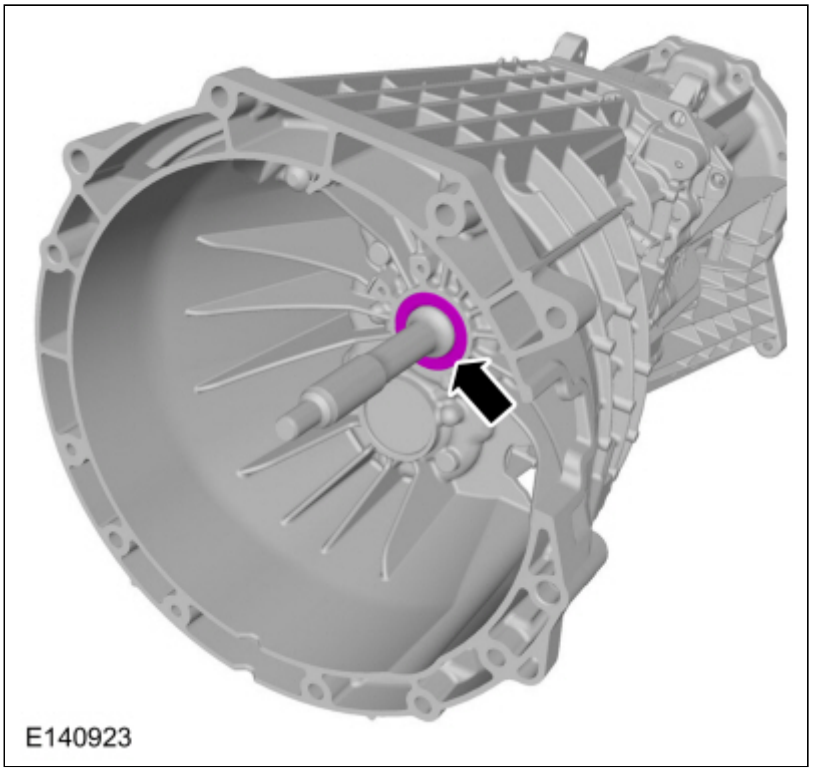
4.



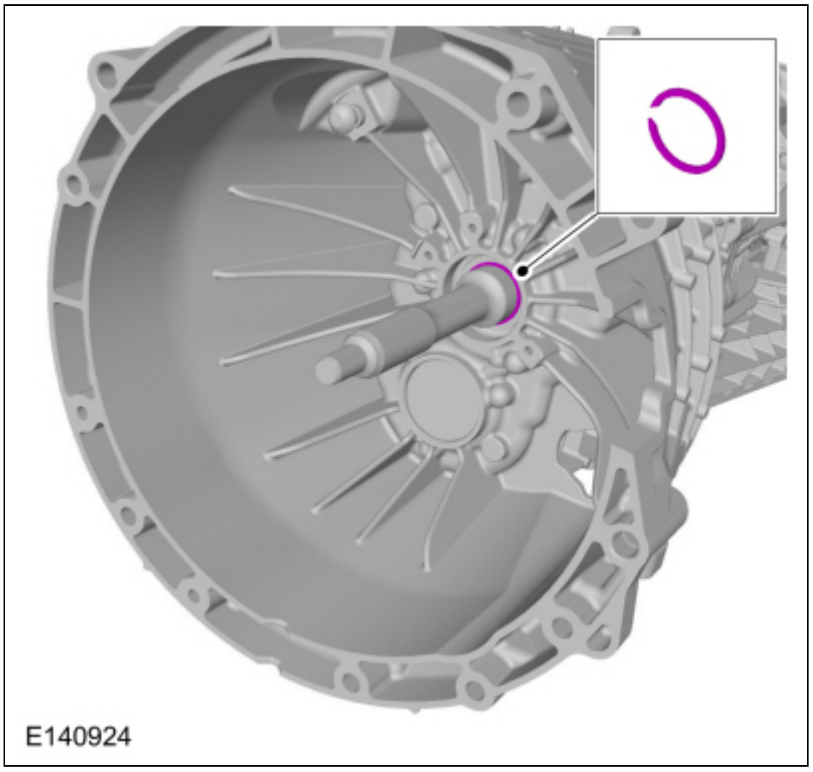
5.



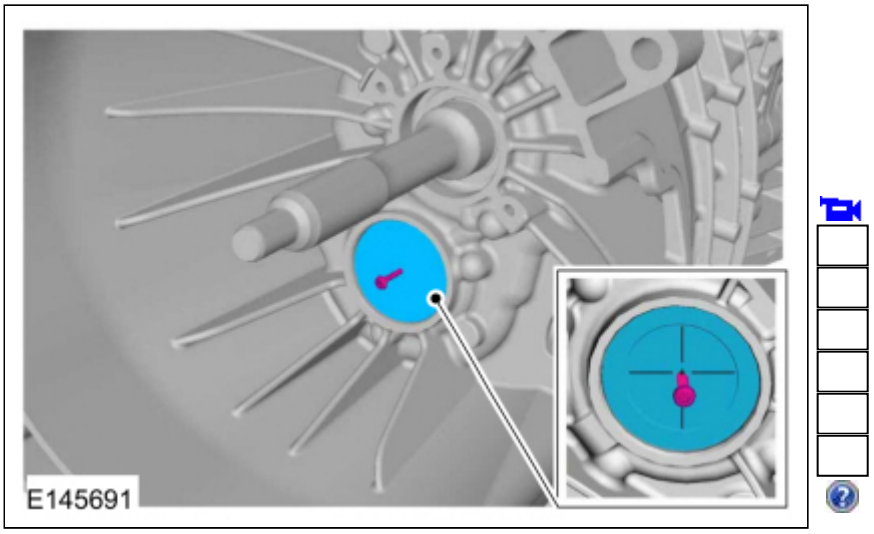
6.



7.

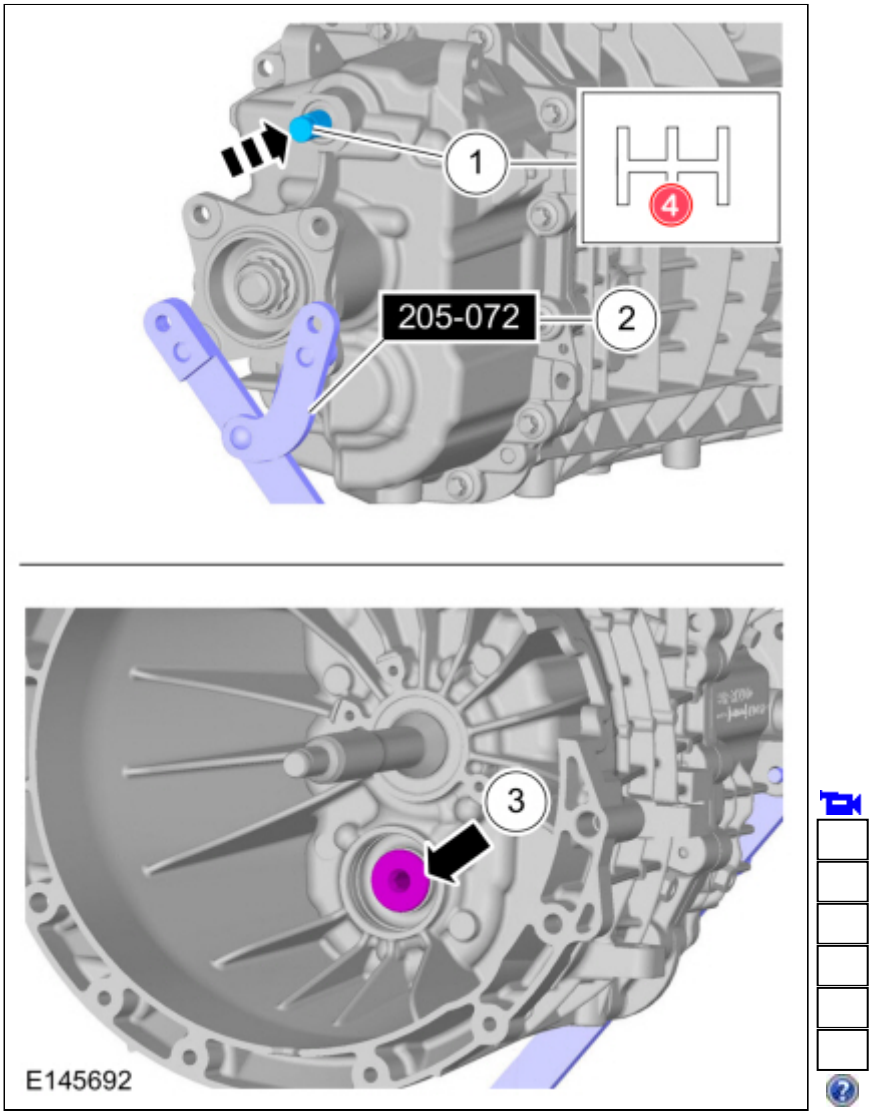


8.

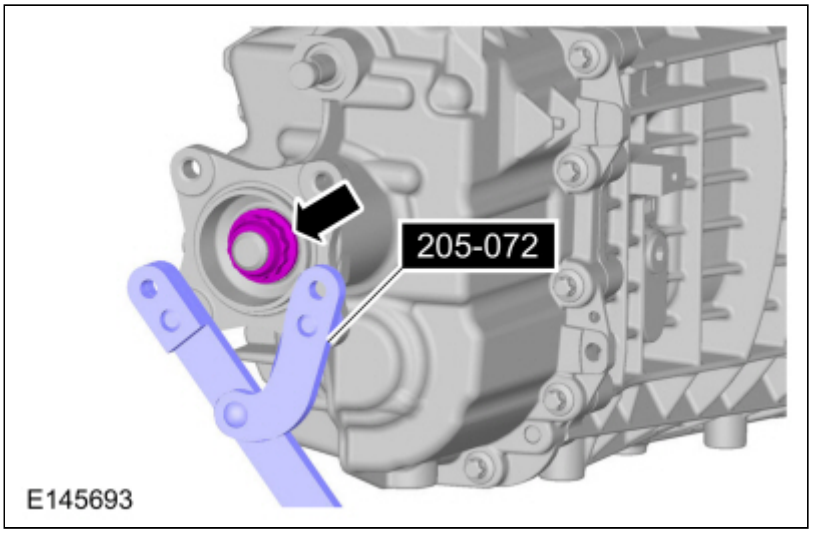


4x2

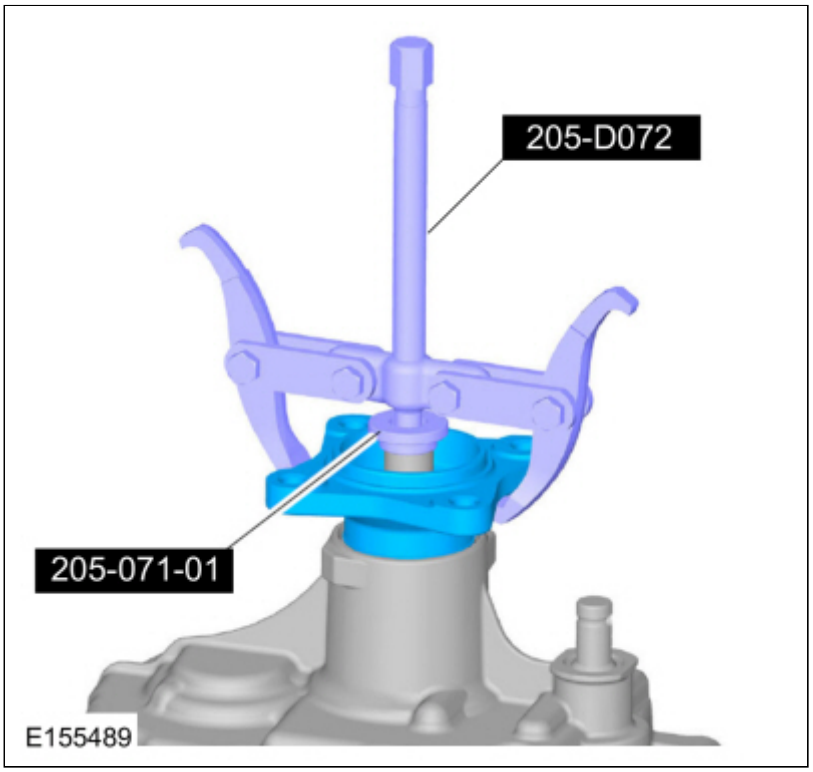
9. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



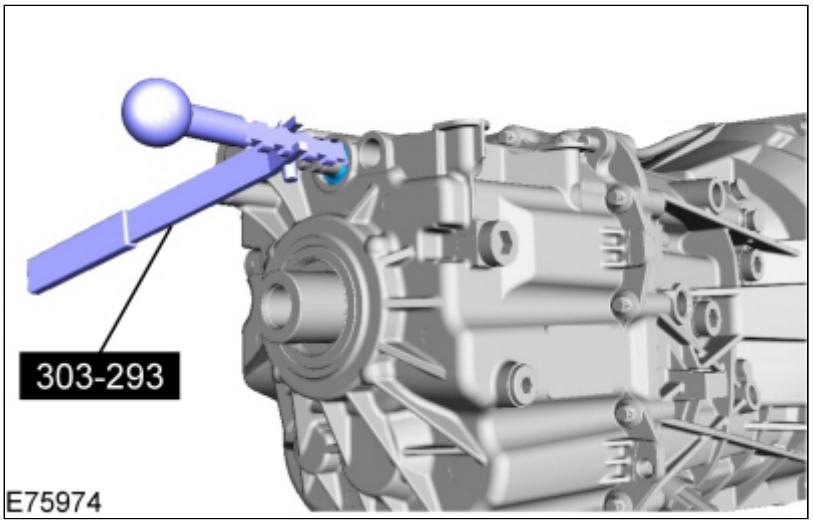
10. Discard the nut.
    Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



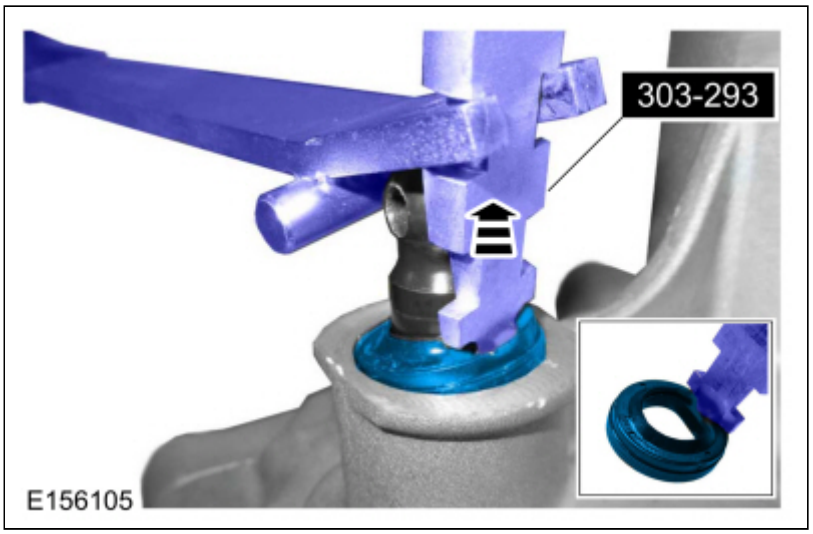
11. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad). , 205-D072 (D97L-4221-A) 2 Jaw Puller.



12. Use Special Service Tool: 303-293 Remover, Crankshaft Seal.



13. Use Special Service Tool: 303-293 Remover, Crankshaft Seal.



14. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal.

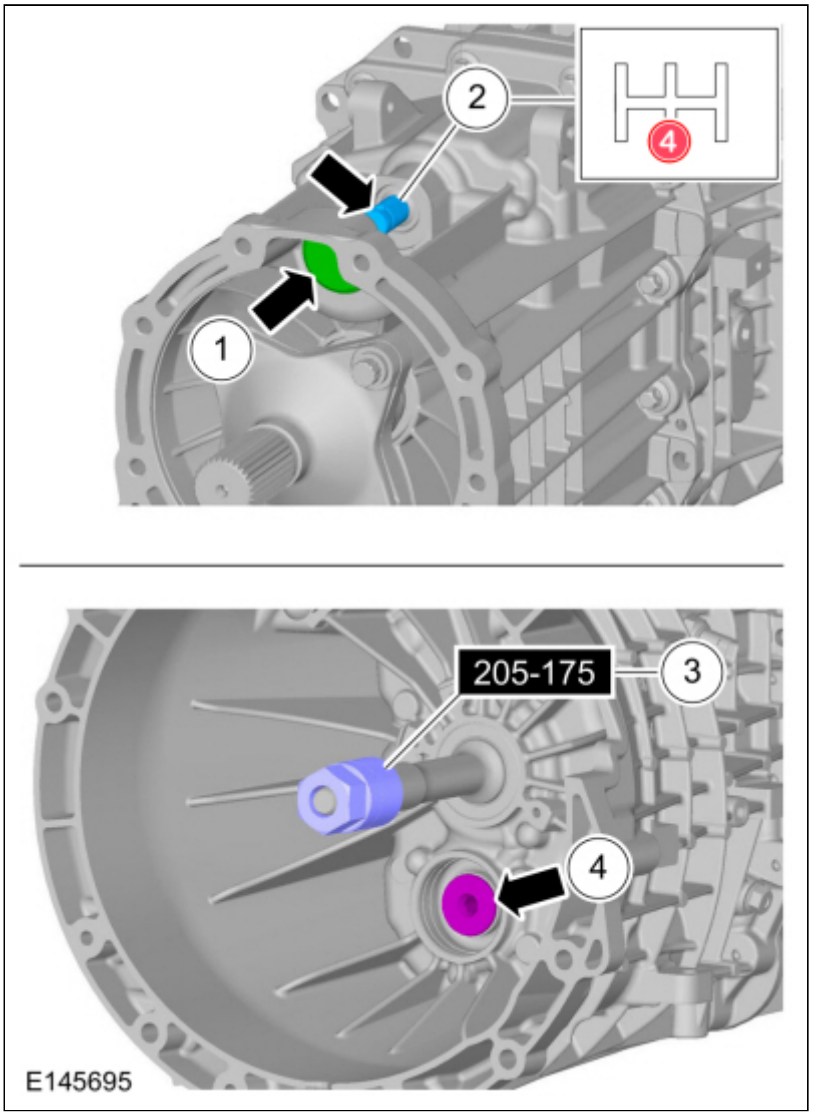


15.

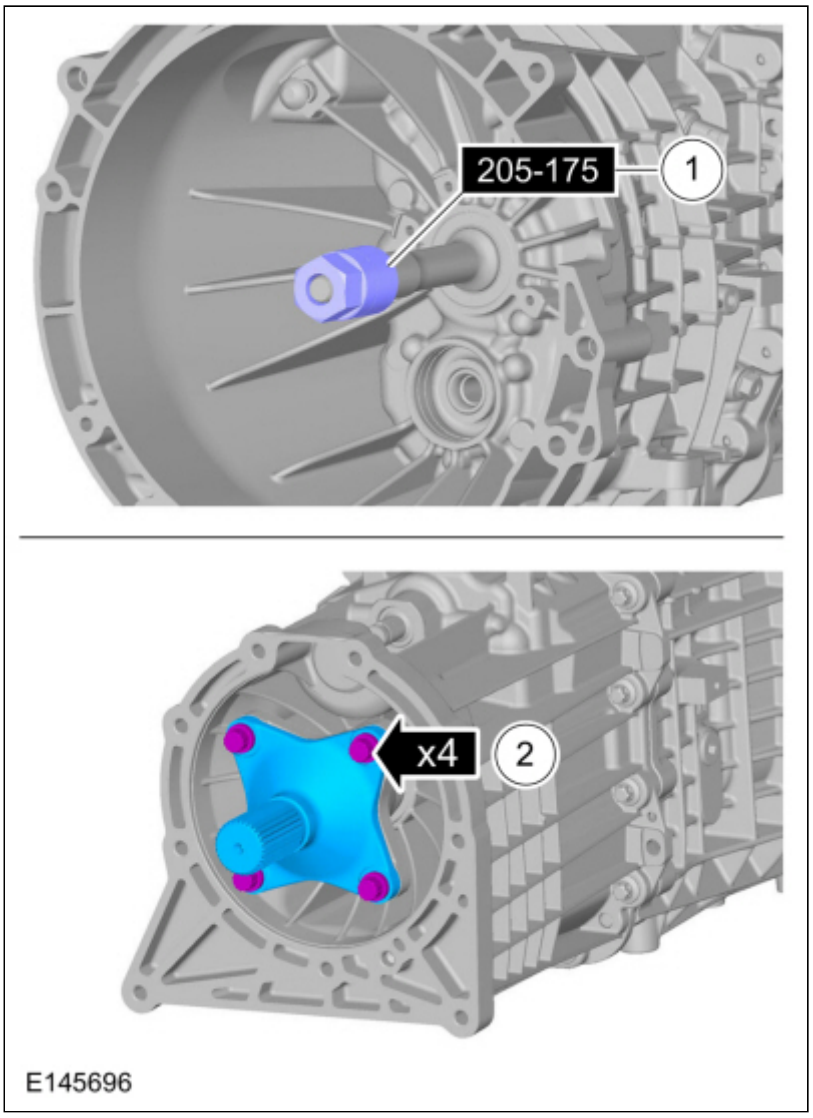


4x4

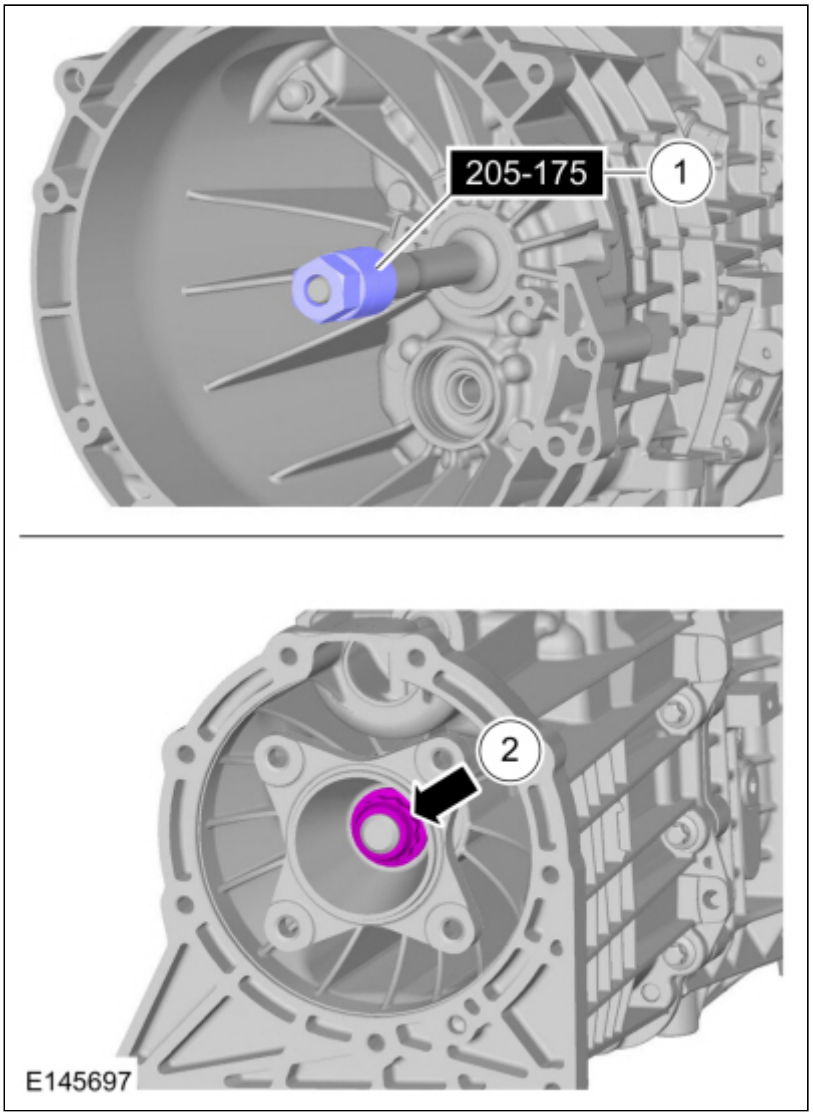
16. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.



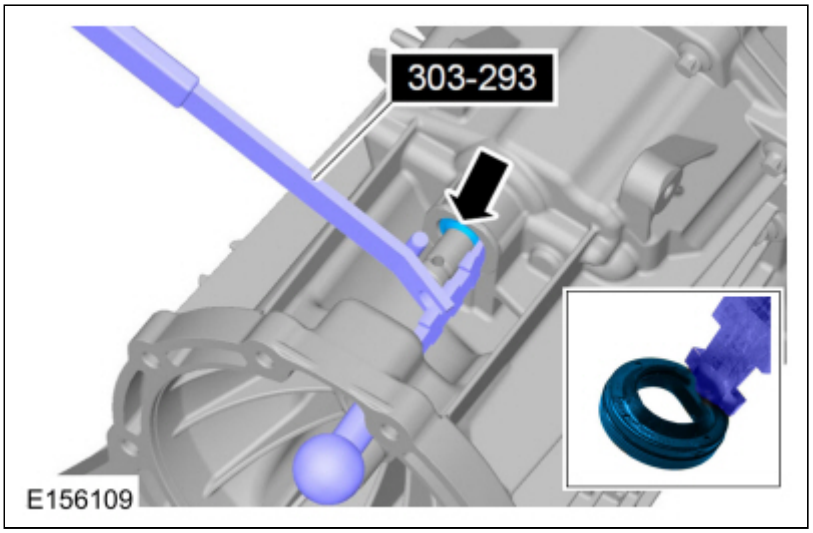
17. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.



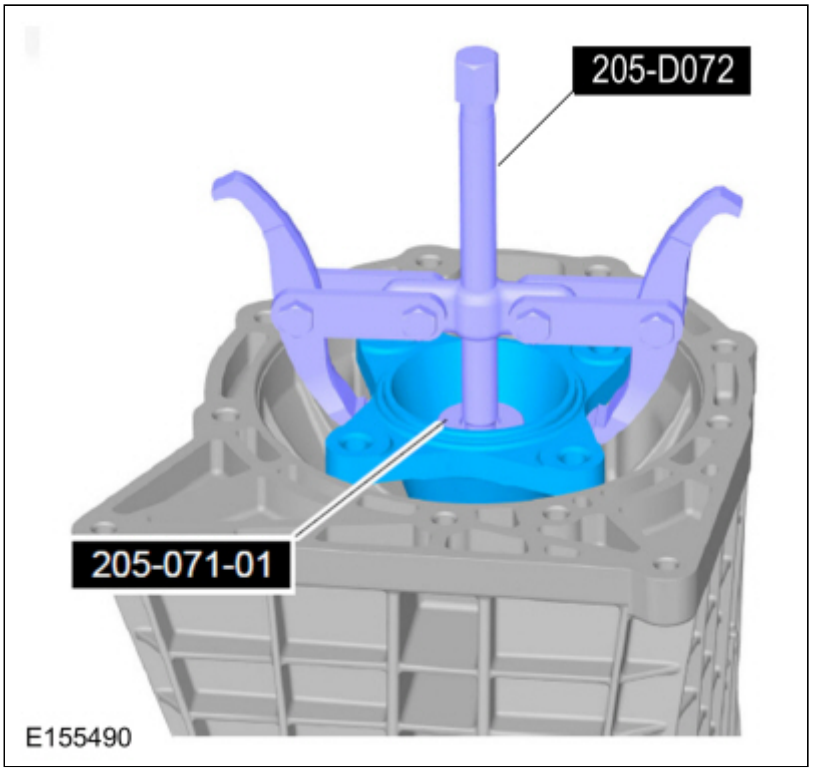
18. Discard the nut.
    Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.



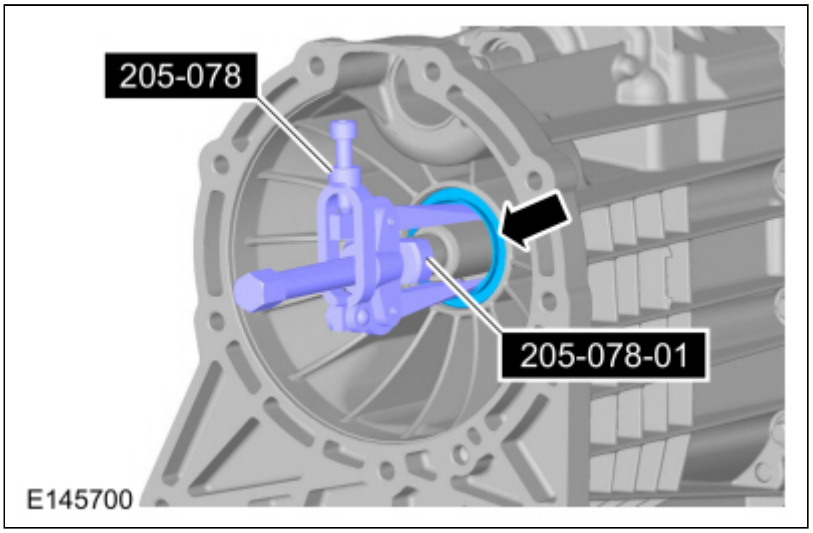
19. Use Special Service Tool: 303-293 Remover, Crankshaft Seal.



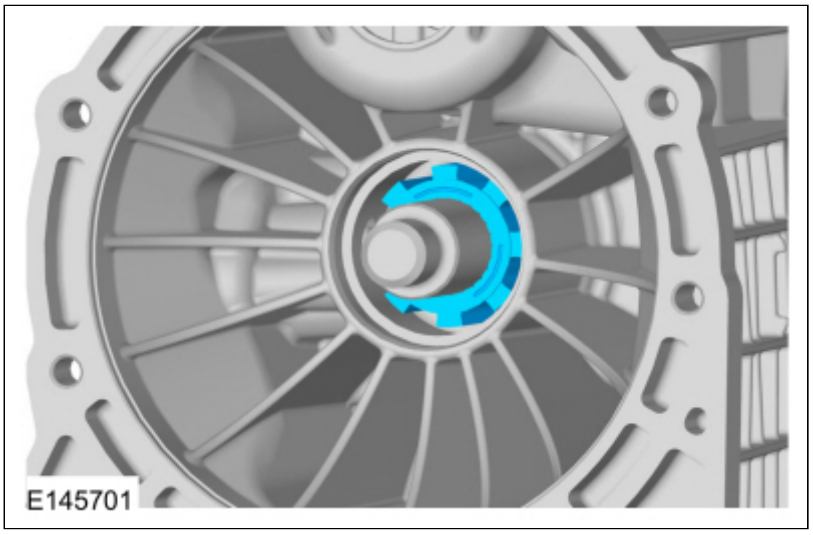
20. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad). , 205-D072 (D97L-4221-A) 2 Jaw Puller.



21. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal. , 205-078-01 Adapter for 205-078 (Thrust Pad).

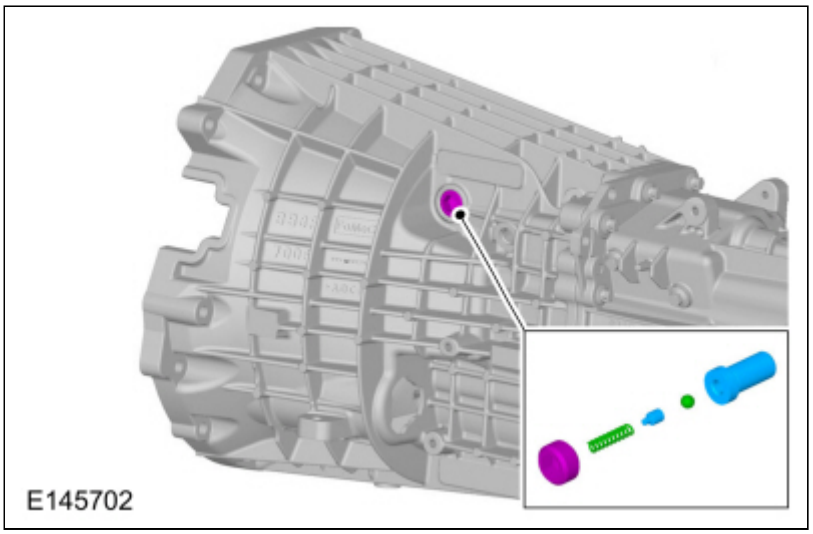


22.

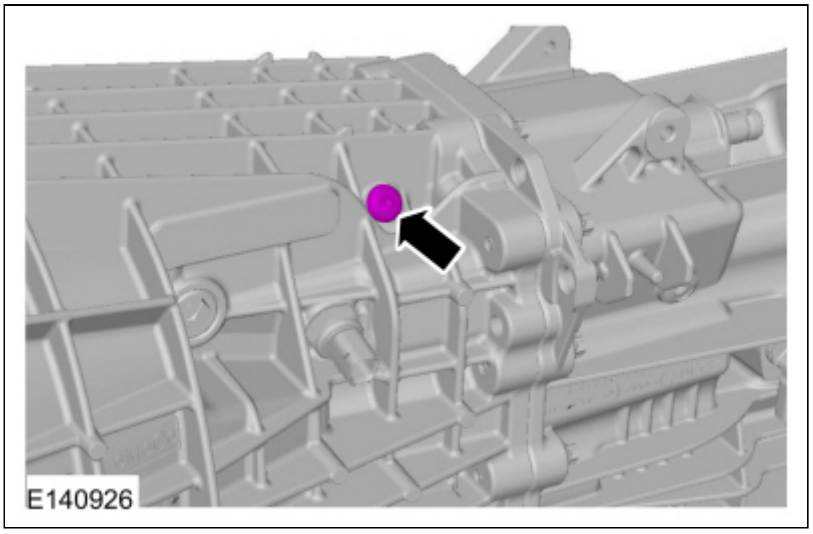


All vehicles

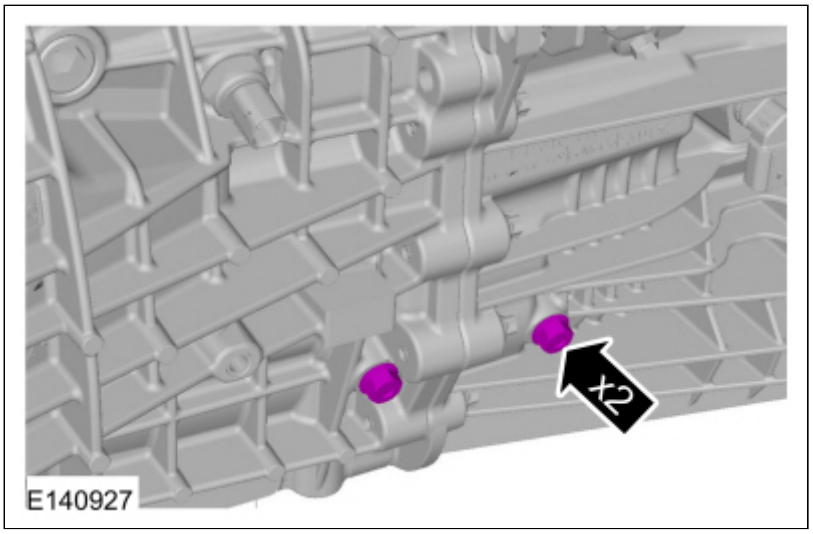
23. **NOTICE: Make sure that the selector interlock mechanism is fully removed including the sleve. Failure to follow this instruction may result in damage to the selctor shaft and transmission casing.**



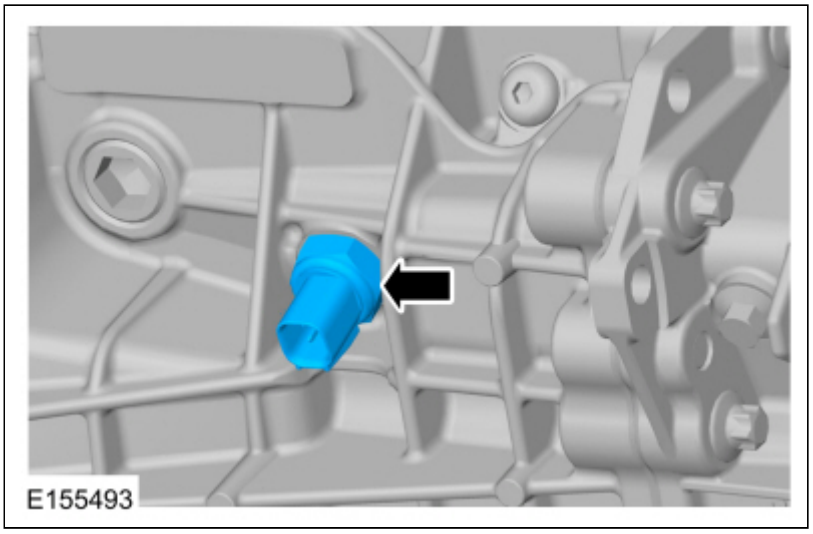
24.



25.



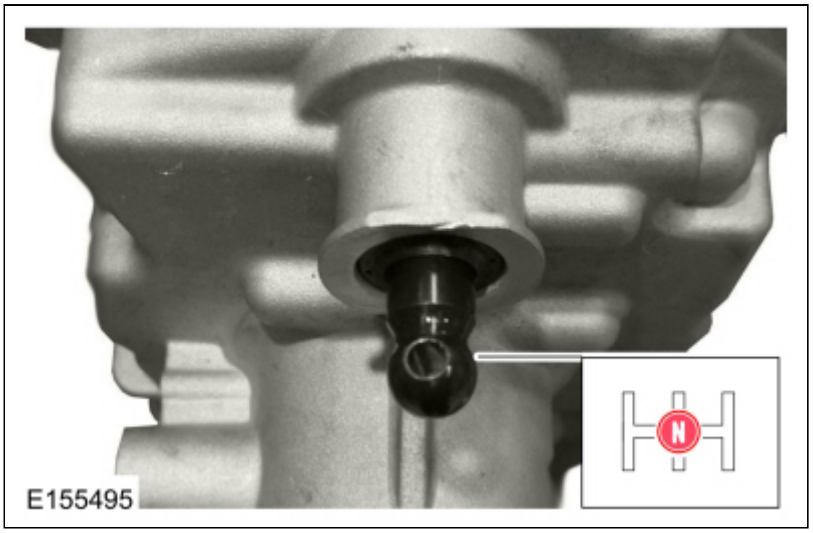
26.



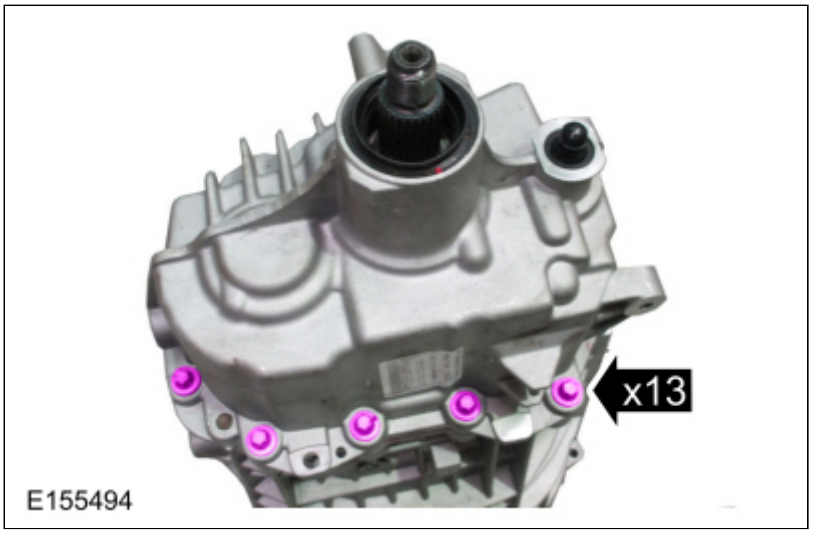
4x2

27. **NOTICE: Move the main selector shaft to the NEUTRAL position. Failure to follow this instruction may result in damage to the shift finger.**

    Use Special Service Tool: 303-428 Separator, Oil Pan.



28.

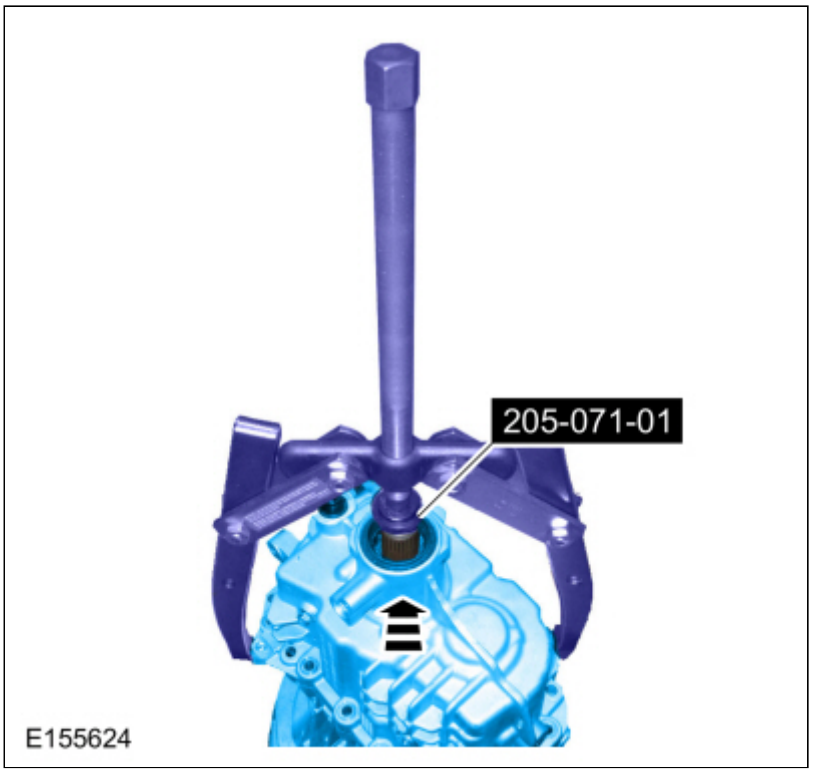


29. **NOTICE: Do not remove the housing locating dowels.**

    NOTICE: Only apply leverage to the reinforcement ribs.

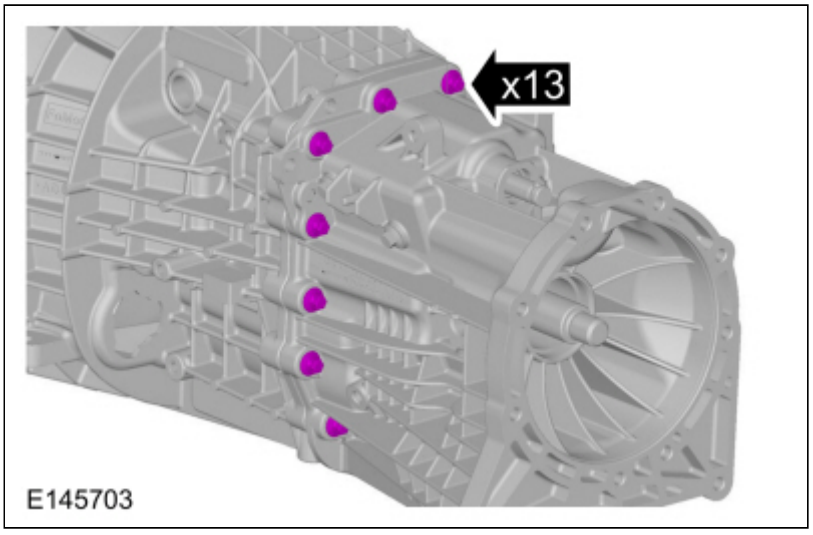
    Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).

Use the General Equipment: Two Leg Puller



4x4

30.



31. **NOTICE: Move the main selector shaft to the NEUTRAL position. Failure to follow this instruction may result in damage to the shift finger.**

    NOTICE: Do not remove the housing locating dowels.

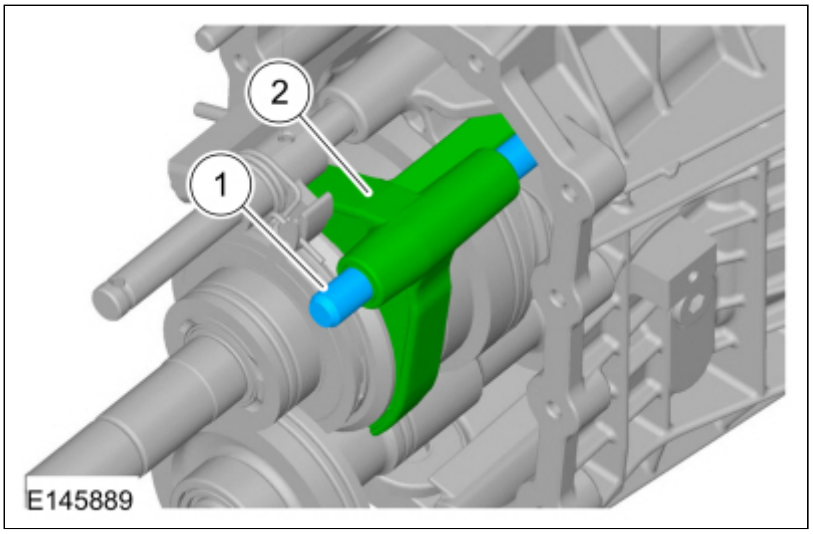
    NOTICE: Only apply leverage to the reinforcement ribs.

    Use Special Service Tool: 303-172-01 Adapter for 303-172.
    Use the General Equipment: Two Leg Puller

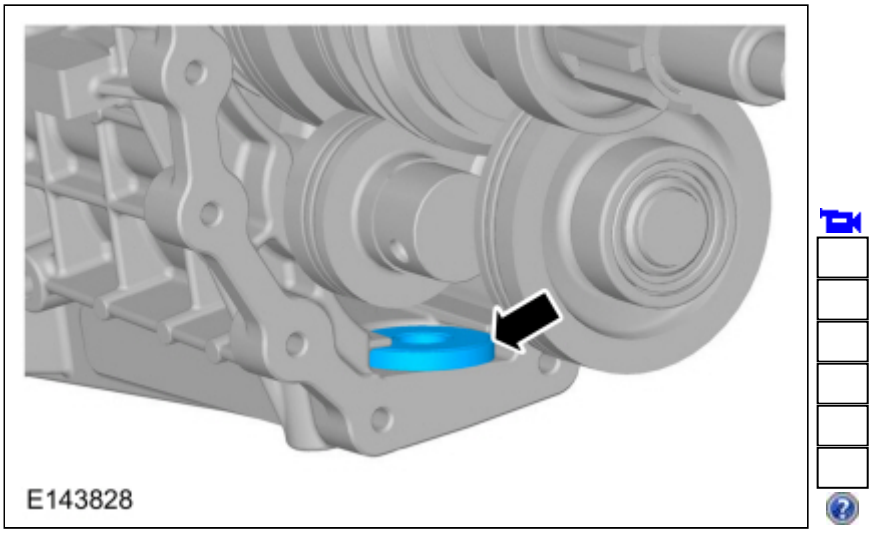


All vehicles

- Remove the third and fourth gear selector fork.
- Remove the auxiliary selector shaft.
- Remove the selector fork.



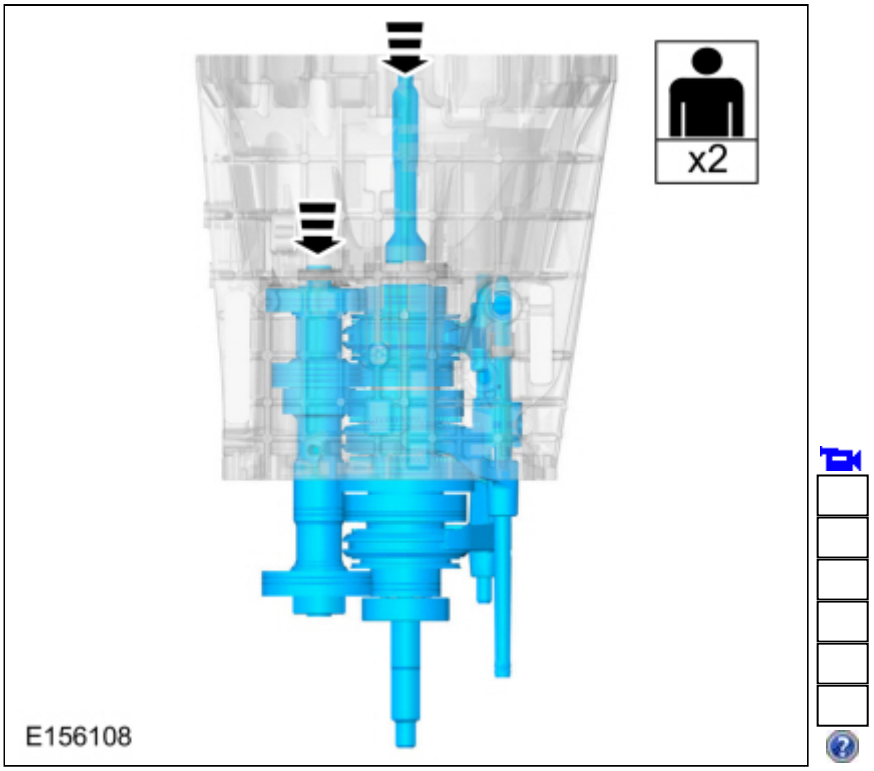
33.



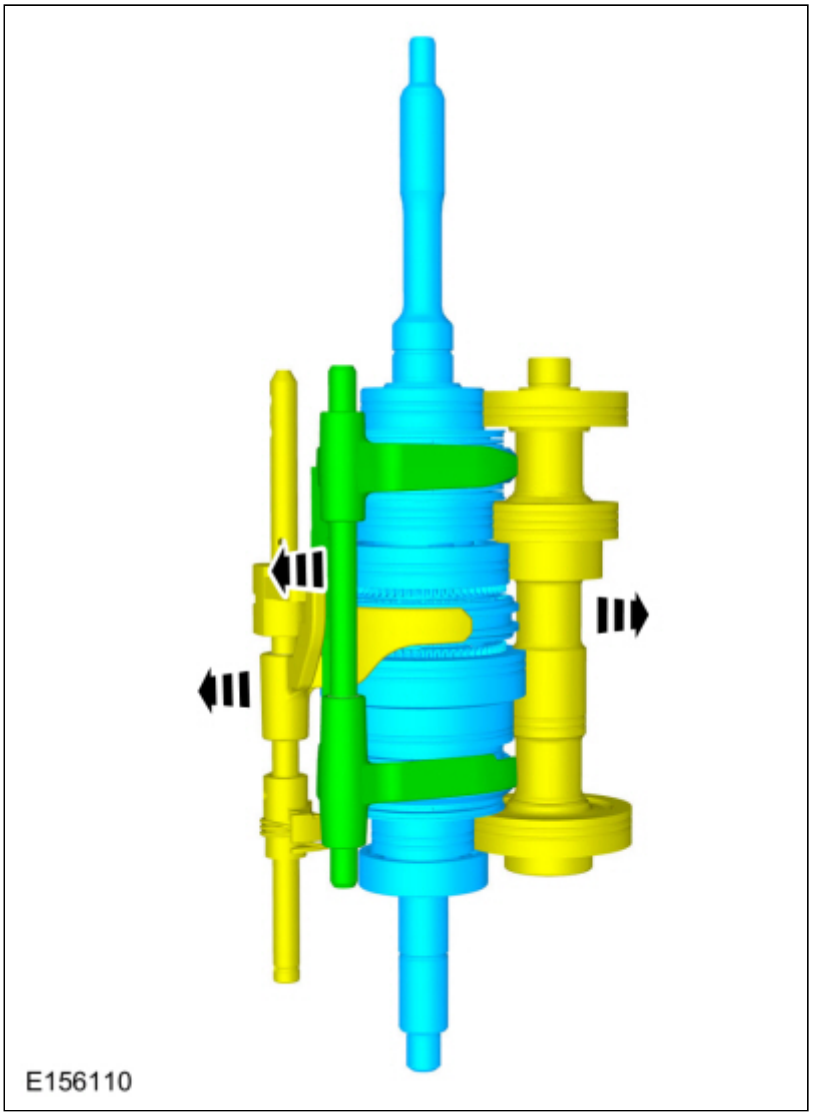
34. **NOTICE: Make sure that the main selector shaft is in NEUTRAL position. Failure to follow this instruction may result in damage to the shift finger.**

    NOTICE: Make sure that no component falls off during removal.

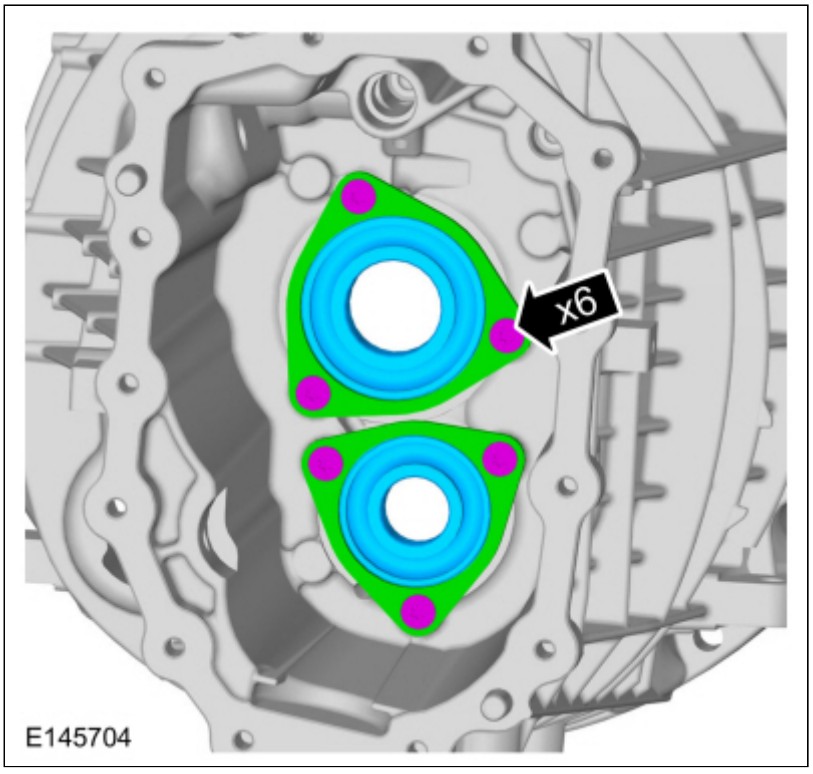
    Use the General Equipment: Hydraulic Press



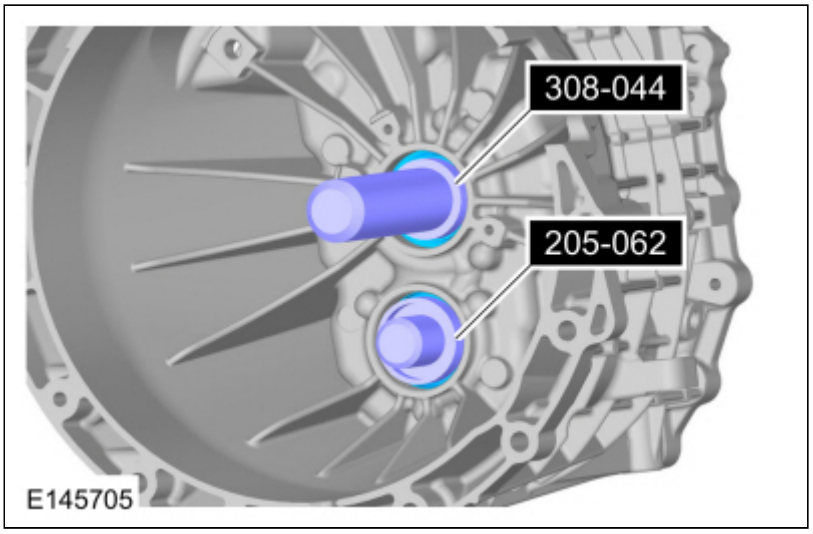
35. Remove the mainshaft and countershaft assembly, the main selector shaft and the selector fork.



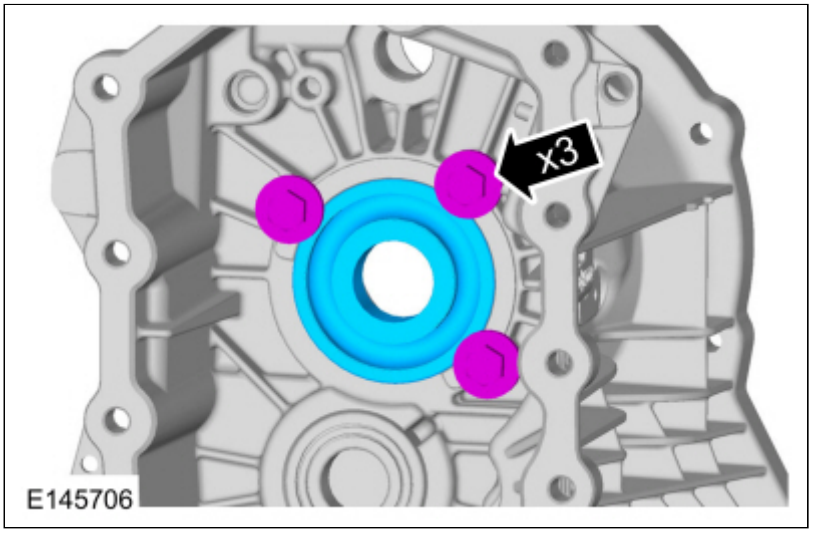
36.



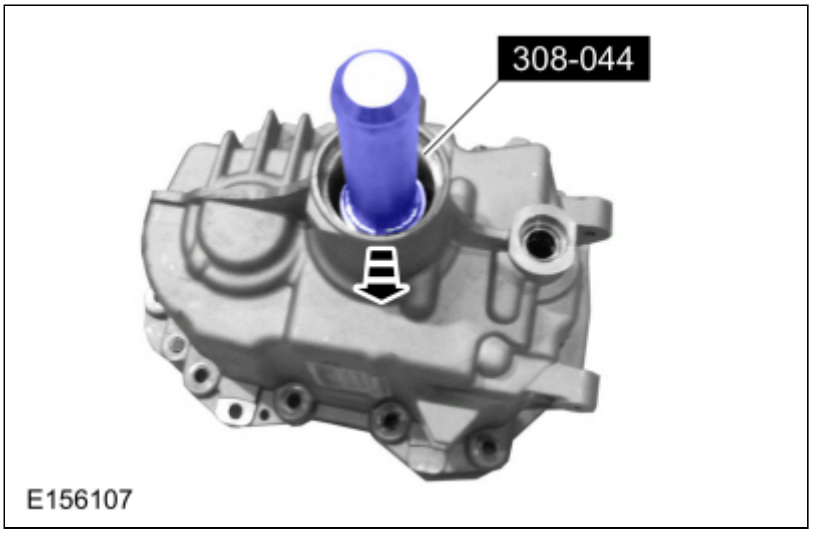
37. Use Special Service Tool: 308-044 Installer, Transmission Extension Housing Bushing/Seal. , 205-062 Installer, Differential Bearing.



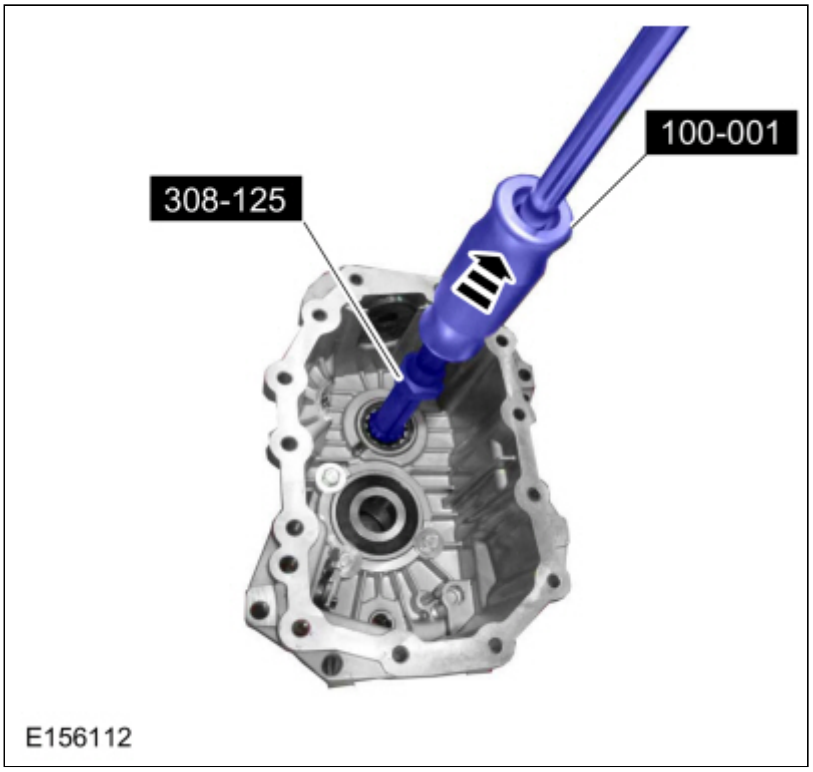
38.



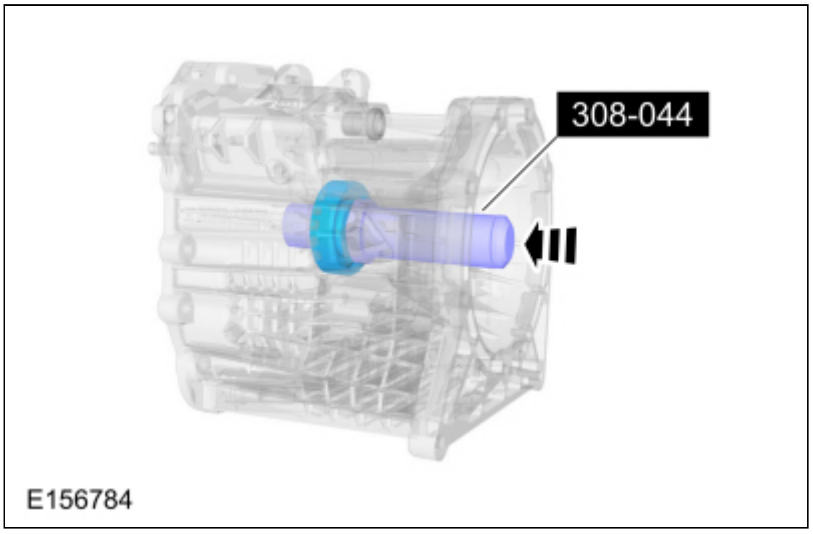
39. Use Special Service Tool: 308-044 Installer, Transmission Extension Housing Bushing/Seal.



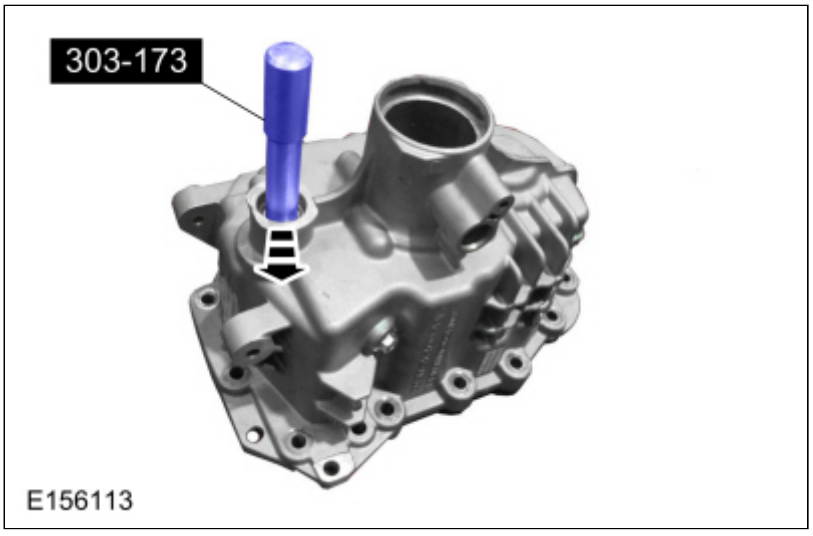
40. Use Special Service Tool: 308-125 Remover, Transfer Case Bearing. , 100-001 (T50T-100-A) Slide Hammer.



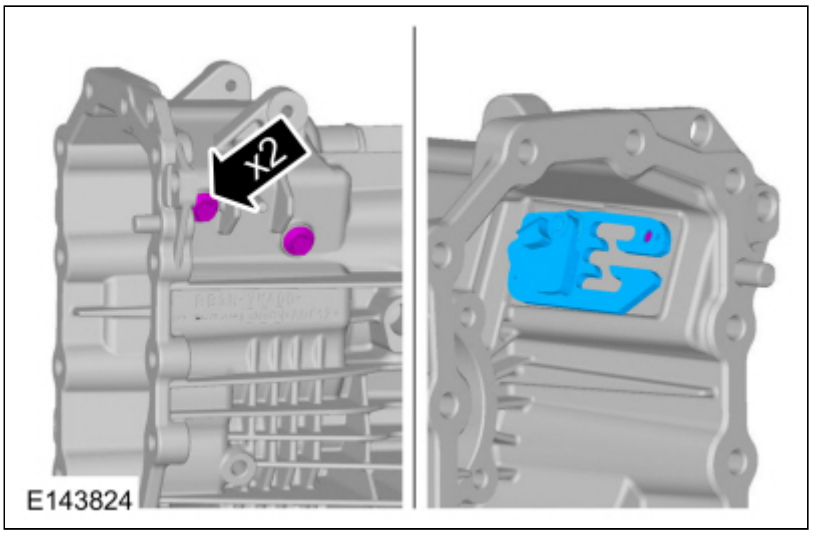
41. Use Special Service Tool: 308-044 Installer, Transmission Extension Housing Bushing/Seal.



42. Use Special Service Tool: 303-173 Aligner, Clutch Plate.



43. **NOTE:** *Only remove the selector gate if it is damaged.*



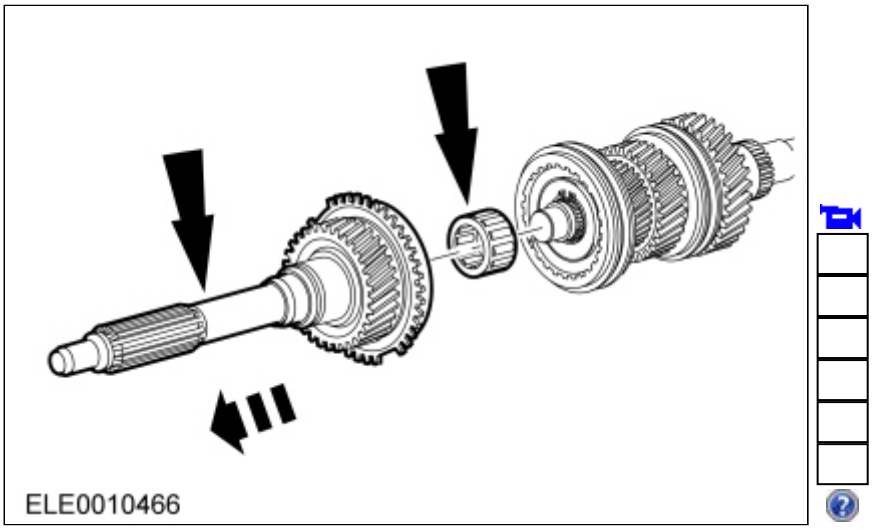
Copyright © 2016 Ford Motor Company

Input Shaft

Disassembly

1. **NOTICE: Handle the synchronizer ring and synchronizer cone with care.**

   Remove the input shaft with the fourth gear synchronizer ring from the output shaft.
   - Remove the output shaft locating bearing.



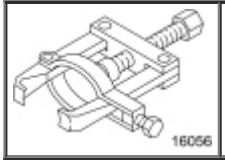
Assembly

1. Carefully clean and check all parts and assemble the parts in reverse order.

Copyright © 2016 Ford Motor Company

Output Shaft

Special Tool(s)

	Remover, Mainshaft Needle Bearing Sleeve 308 - 191 (16 - 056)

General Equipment

Hot air gun

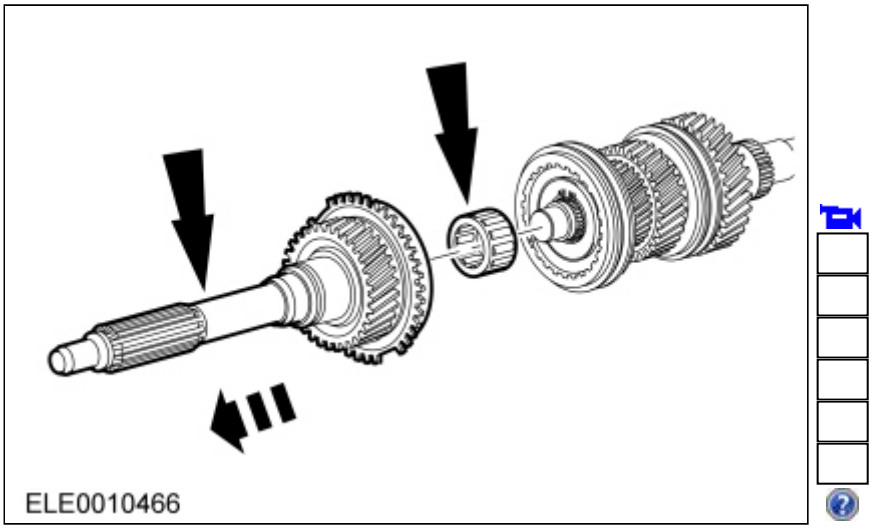
Material

Item	Specification
Manual transmission fluid	WSD - M2C200 - C

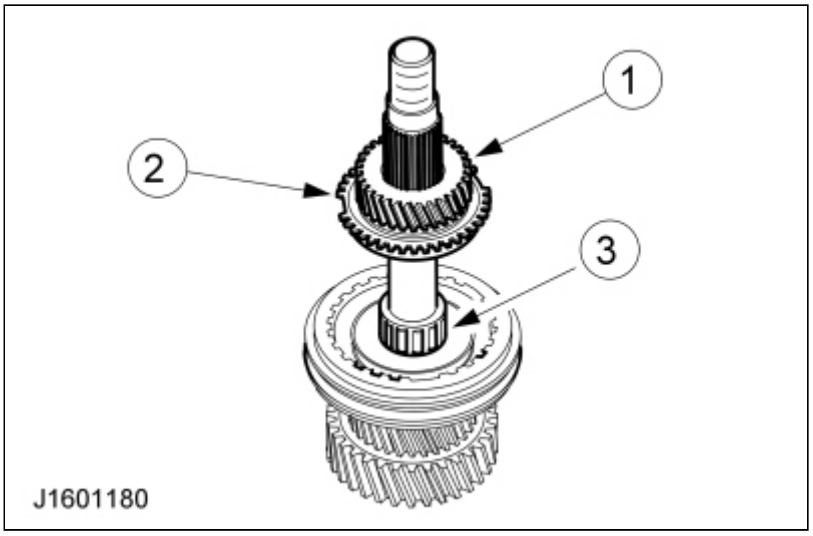
Disassembly

1. **NOTICE: Mark the position of the synchronizer rings in relation to the synchronizer units to aid installation.**

   Remove the input shaft and fourth gear synchronizer ring from the output shaft.
   - Remove the output shaft locating bearing.



2. Remove the fifth gear wheel and synchronizer ring from the output shaft.
   1. Remove the gear wheel.
   2. Remove the gear synchronizer ring.
   3. Remove the needle roller bearing.

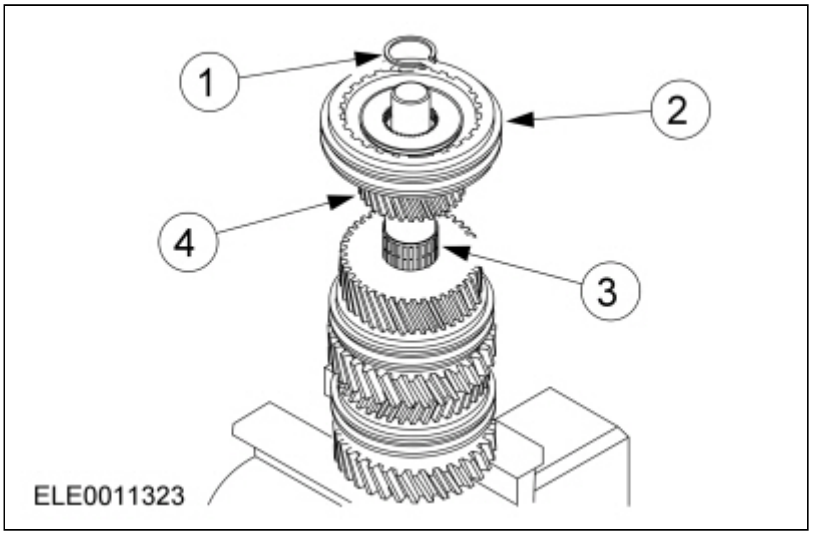


3. **WARNING: Do not allow the synchronizers to fall apart. Failure to follow these instructions may result in personal injury.**

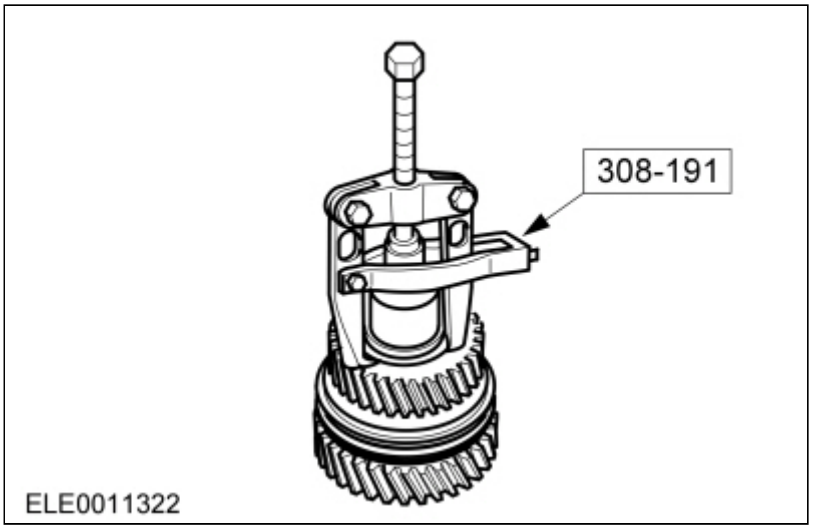
   NOTICE: Use soft jaws for all operations in a vise.

   NOTE: *Clamp the output shaft in a vise with the output end.*

   Remove the third/fourth gear synchronizer unit together with the third gear wheel.
   1. Remove the circlip.
   2. Third/fourth gear synchronizer.
   3. Needle roller bearing.
   4. Third gear wheel.

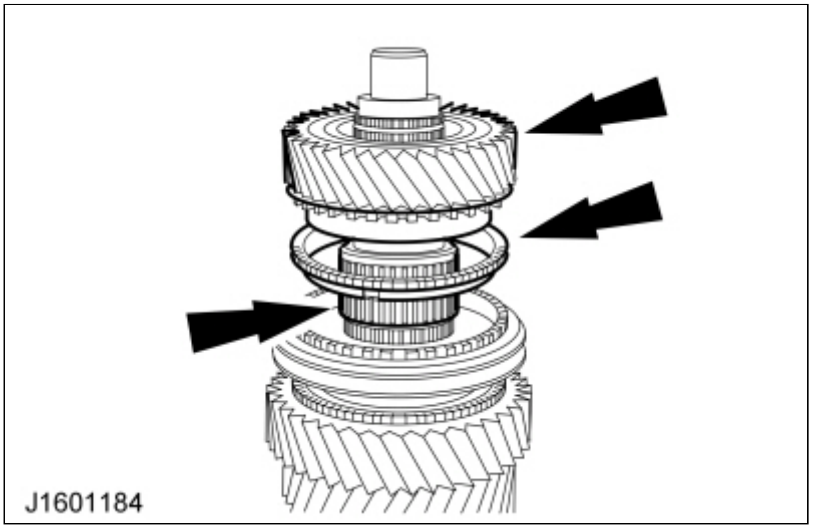


4. Using the special tool, remove the third gear bearing ring.
   - Locate the special tool in the recesses off the bearing ring.



5. **NOTE:** *Mark the position of the second gear wheel in relation to the synchronizer ring to aid installation.*

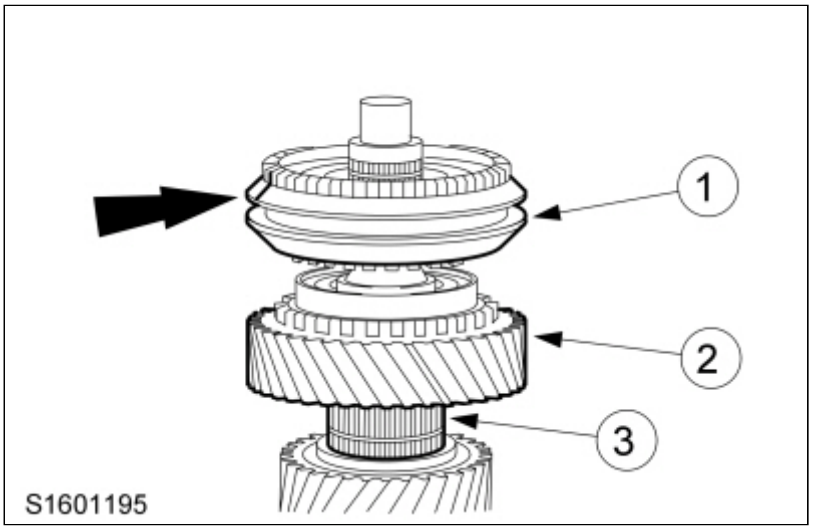
   Remove the second gear wheel, the needle roller bearing and synchronizer ring.



6. **NOTE:** *Mark the position of the shift ring in relation to the first gear wheel to aid installation.. Components are paired.*

   NOTE: *Remove the circlip.*

   Remove the first/second gear synchronizer and the first gear wheel.
   1. First/second gear synchronizer.
   2. First gear wheel.
   3. Needle roller bearing.

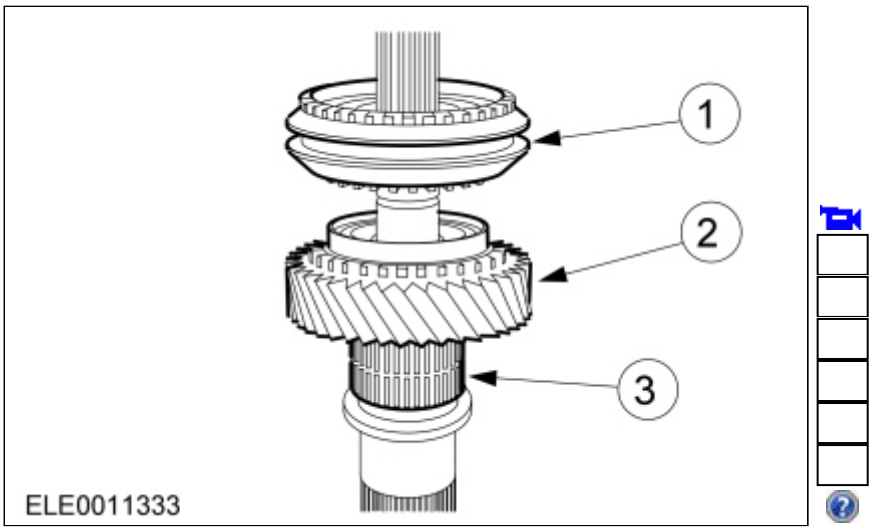


7. **NOTE:** *Mark the position of the shift ring in relation to the reverse gear wheel to aid installation. Components are paired.*

   NOTE: *Clamp the output shaft the other way round in the vise.*

   NOTE: *Remove the circlip.*

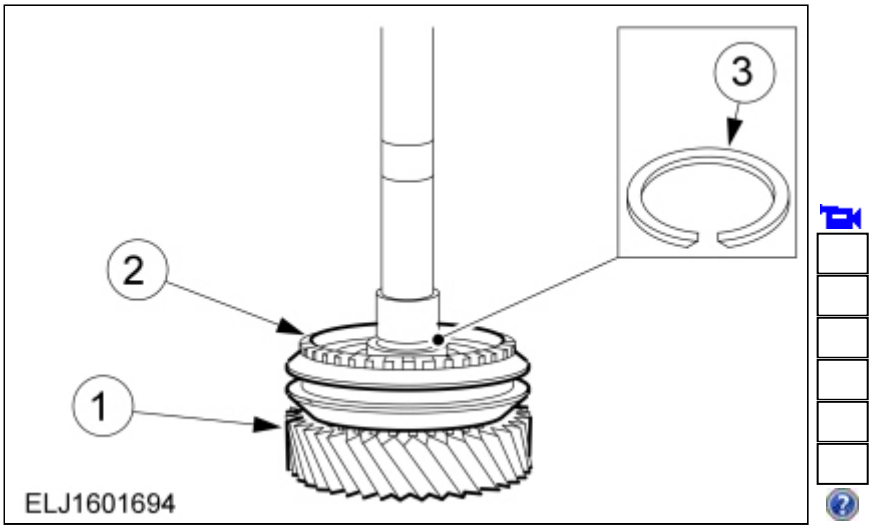
   Remove the fifth/reverse gear synchronizer, the reverse gear wheel and needle roller bearing.
   1. Fifth/reverse gear synchronizer.
   2. Reverse gear wheel.
   3. Needle roller bearing.



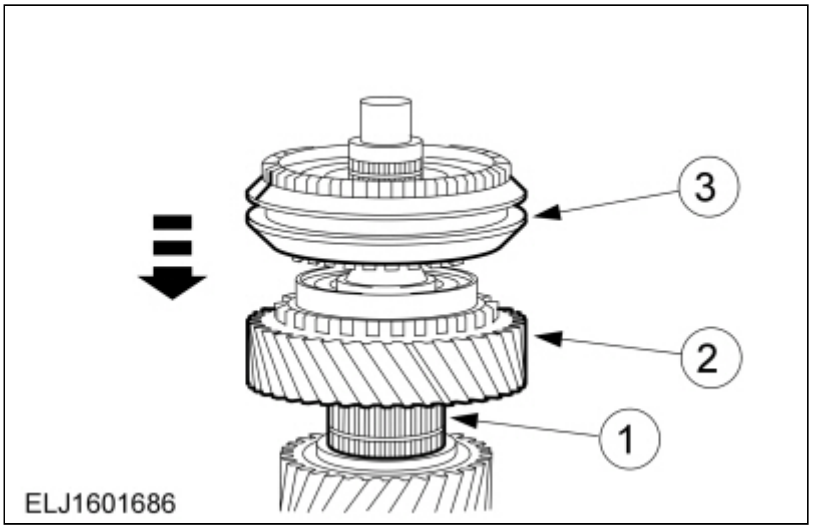
Assembly

1. Carefully clean and check all sliding parts and lubricate the synchronizer rings with Manual transmission fluid (WSD-M2C200-C) before assembly.

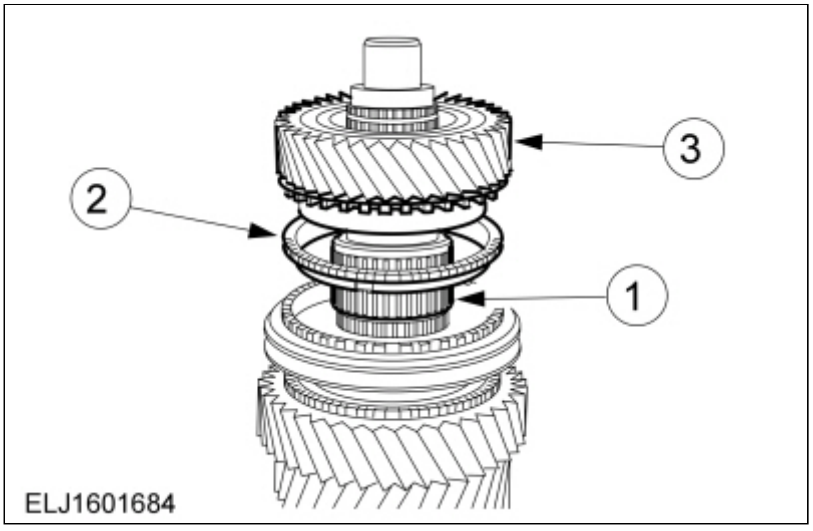
2. Install the needle roller bearing, reverse gear wheel and synchronizer unit.
   1. Install the reverse gear wheel.
   2. Install the synchronizer.
   3. Install the snap ring.



3. Install the first/second gear synchronizer unit.
   1. Install the needle roller bearing.
   2. Install the gear wheel.
   3. Install the synchronizer unit.
   - Install the circlip.



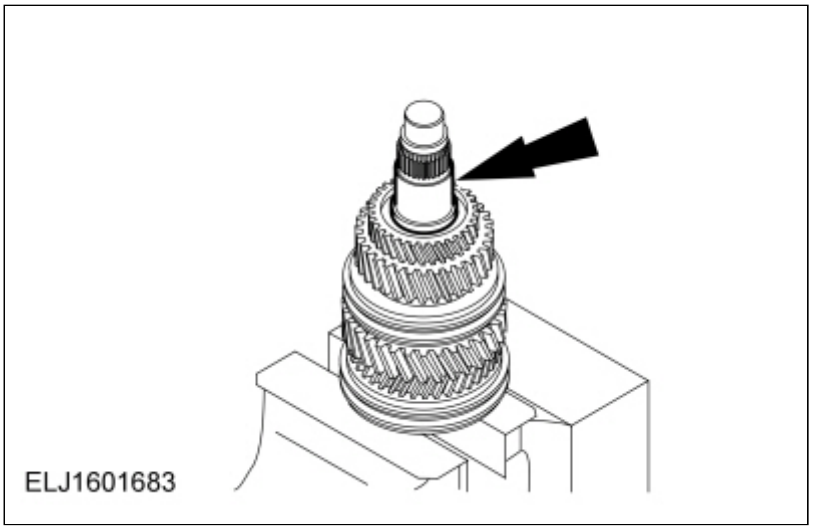
4. Install the synchronizer ring, needle roller bearing and second gear wheel.
    1. Install the needle roller bearing.
    2. Install the synchronizer ring.
    3. Install the gear wheel.



5. **NOTE:** *Slide the inner bearing ring onto the output shaft as far as the shoulder.*

   NOTE: *Install a new inner bearing ring and needle bearing.*

   Using a hot air gun heat the inner bearing ring to approximately 100 ° C and install it.

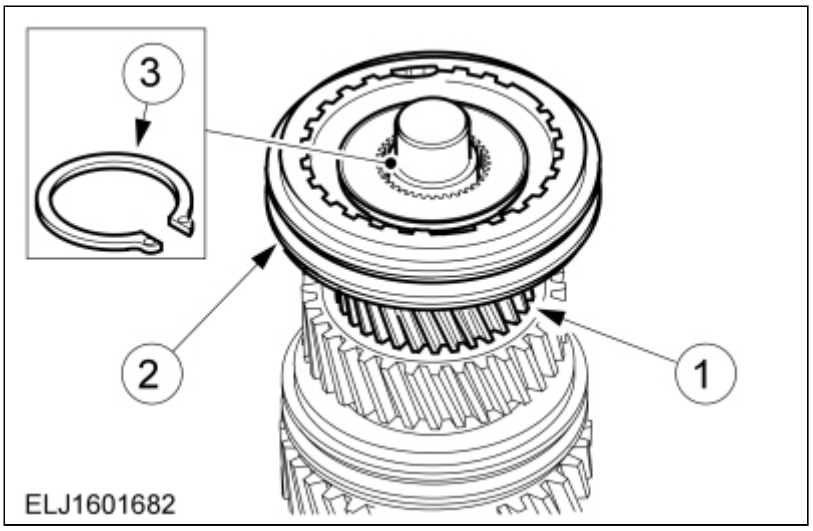


6. **NOTE:** *Install the synchronizer with the small collar upwards.*

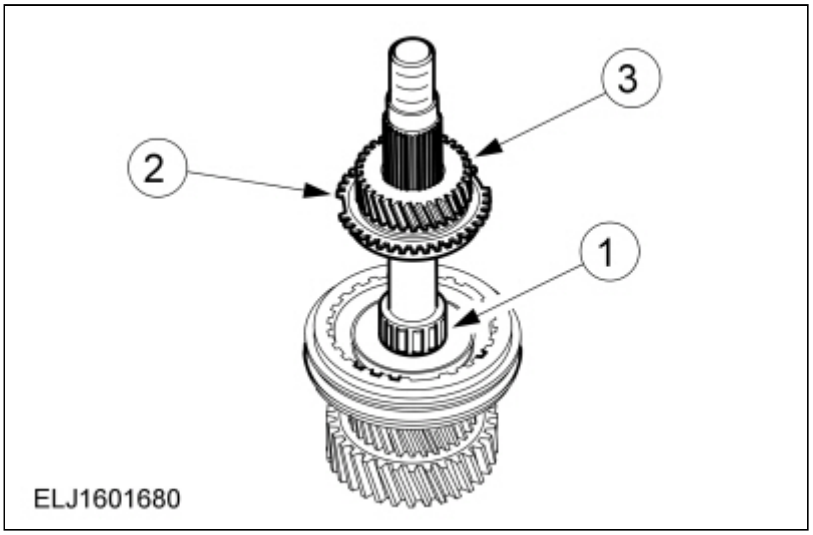
   NOTE: *Install the needle roller bearing.*

Install the third/fourth gear synchronizer.

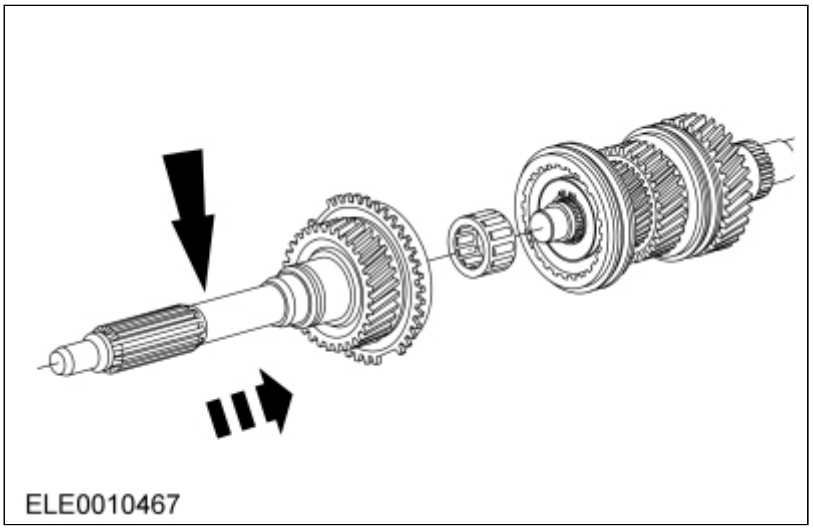
1. Install the gear wheel.
2. Install the synchronizer.
3. Install the circlip.



7. Install the fifth gear wheel.
    1. Install the needle roller bearing.
    2. Install the synchronizer ring.
    3. Install the gear wheel.



8. Install the output shaft locating bearing, synchronizer ring and the input shaft.



Copyright © 2016 Ford Motor Company

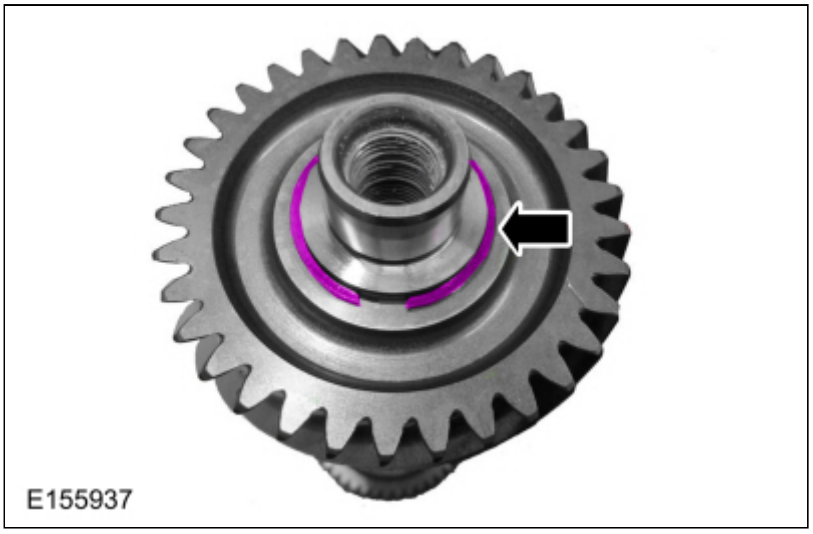
Countershaft

Special Tool(s) / General Equipment

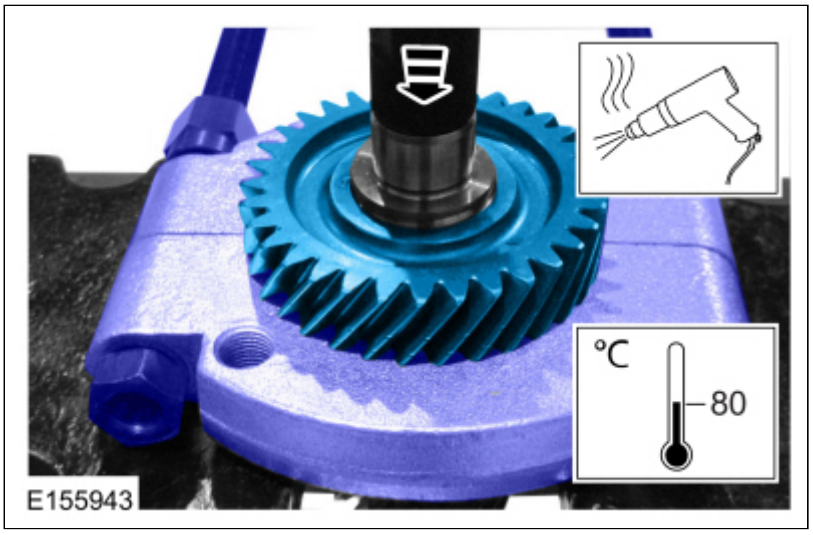
 E170256	308-885 Remover, counter shaft bearing race
Hydraulic Press	
Hot Air Gun	
Bearing Separator	

DISASSEMBLY

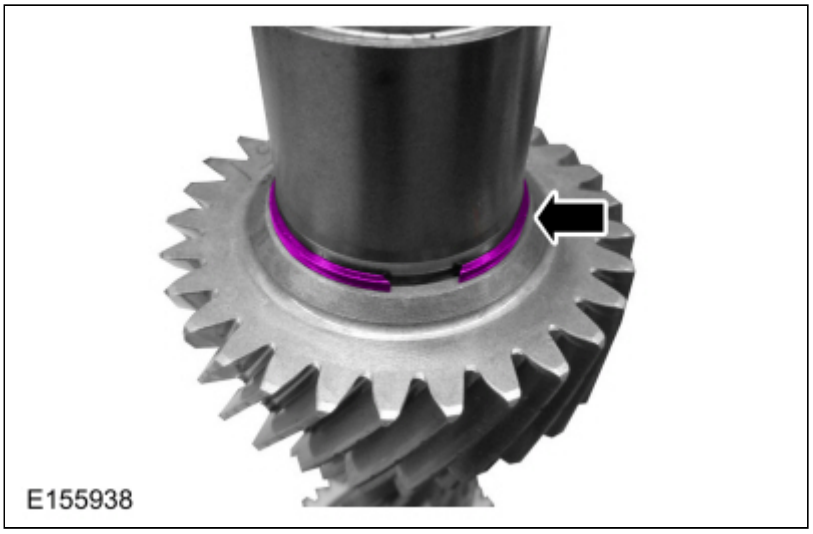
1.



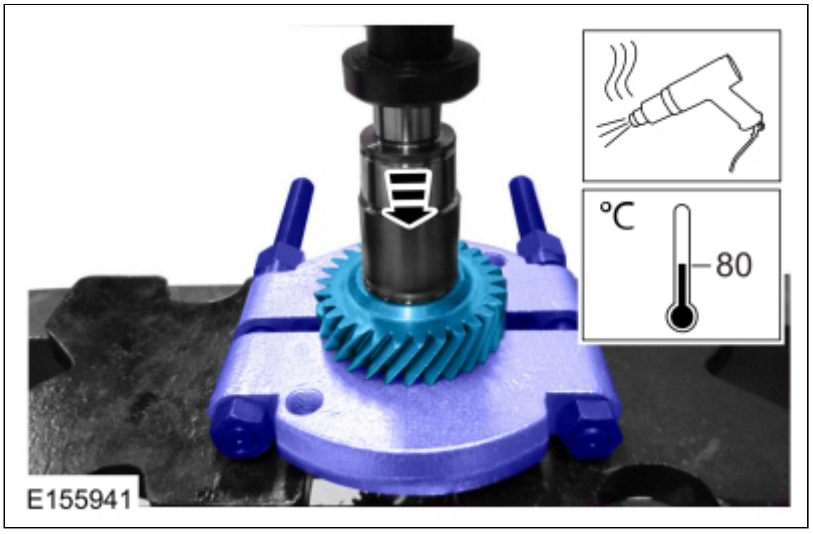
2. Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator
   Use the General Equipment: Hot Air Gun



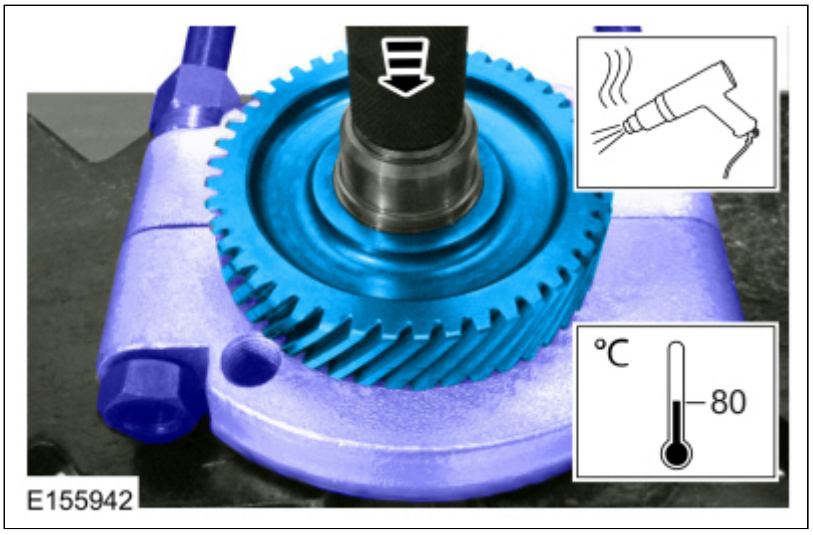
3.



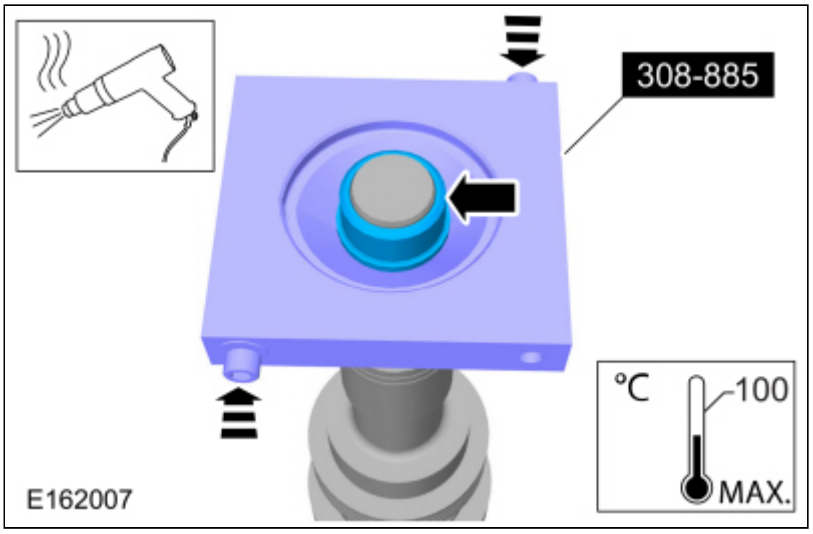
4. Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator
   Use the General Equipment: Hot Air Gun



5. Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator
   Use the General Equipment: Hot Air Gun

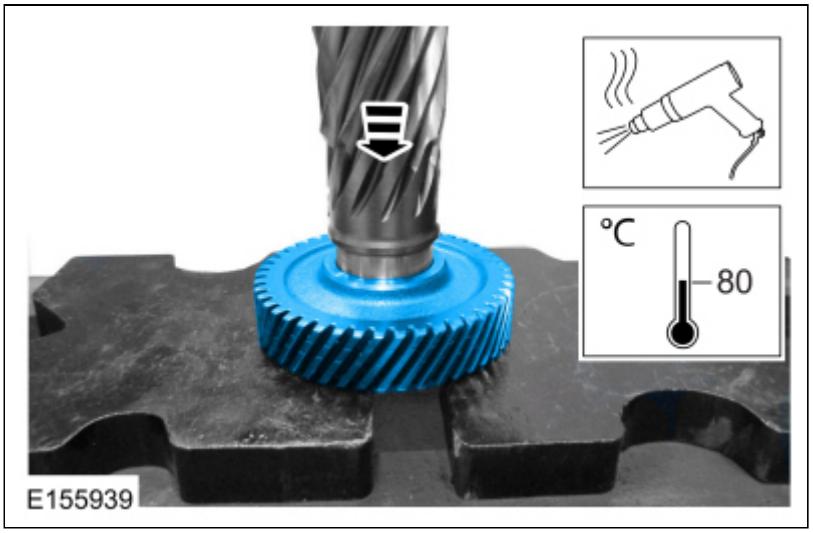


6. Use Special Service Tool: 308-885 Remover, counter shaft bearing race.
   Use the General Equipment: Hot Air Gun
   Use the General Equipment: Hydraulic Press



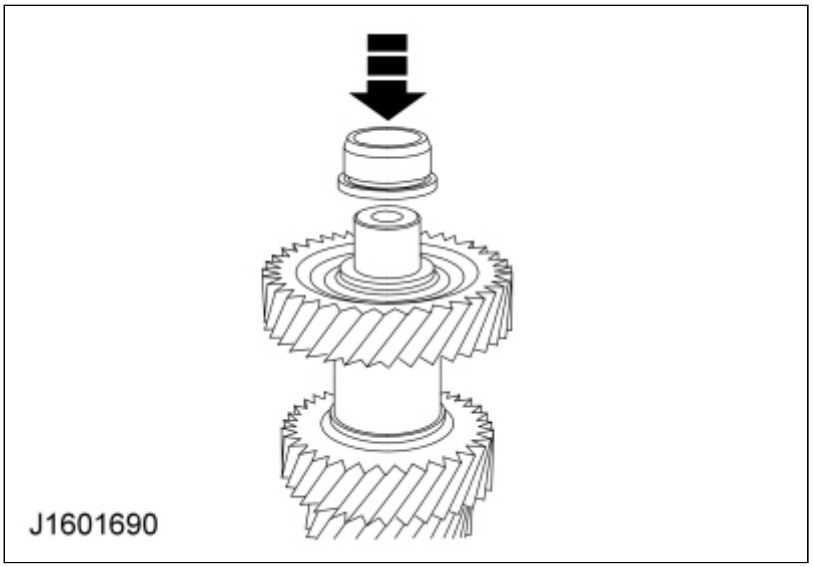
ASSEMBLY

1. Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator
   Use the General Equipment: Hot Air Gun



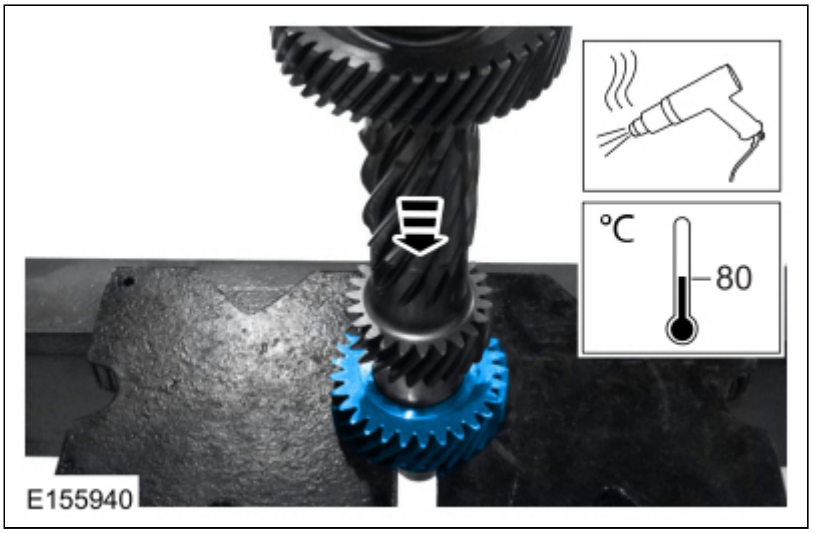
2. **NOTE:** *Heat the bearing race to approximately 100°C and install the race to the countershaft.*

   Use the General Equipment: Hot Air Gun
   Use the General Equipment: Hydraulic Press

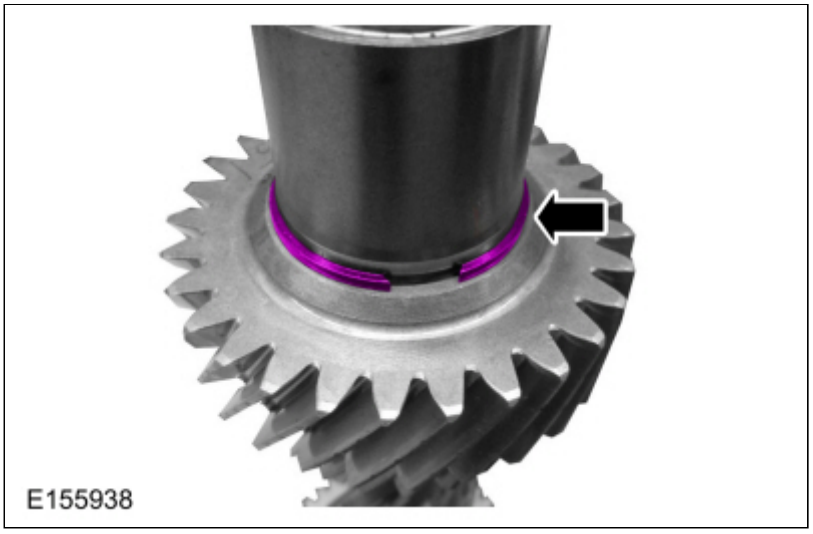


3. Use the General Equipment: Hydraulic Press

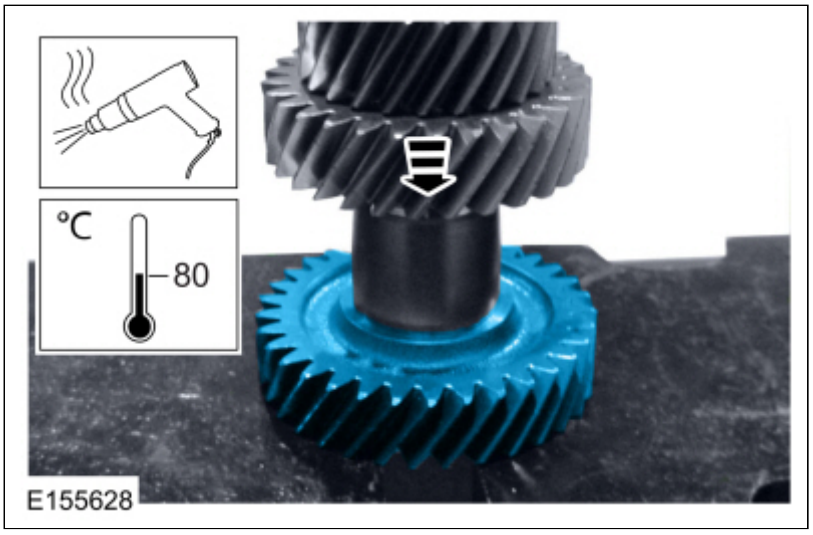
Use the General Equipment: Bearing Separator
Use the General Equipment: Hot Air Gun



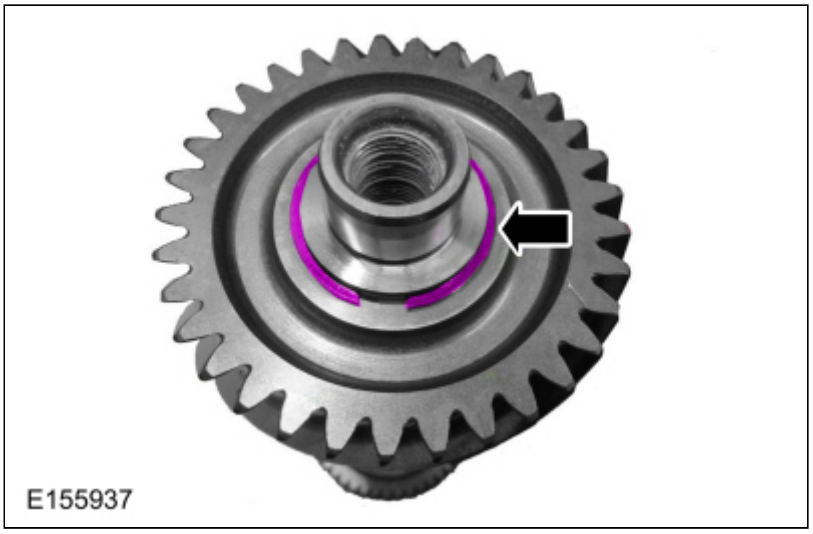
4.



5. Use the General Equipment: Hydraulic Press
Use the General Equipment: Bearing Separator
Use the General Equipment: Hot Air Gun



6.

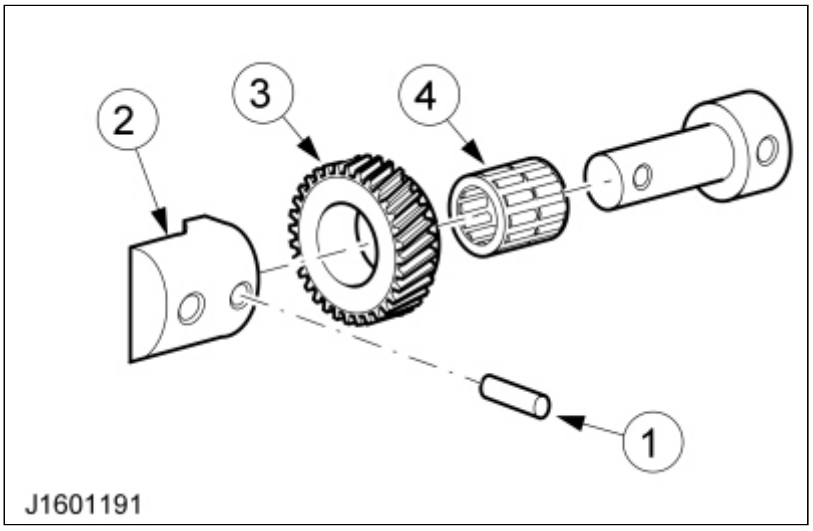


Copyright © 2016 Ford Motor Company

Reverse Idler Gear

Disassembly

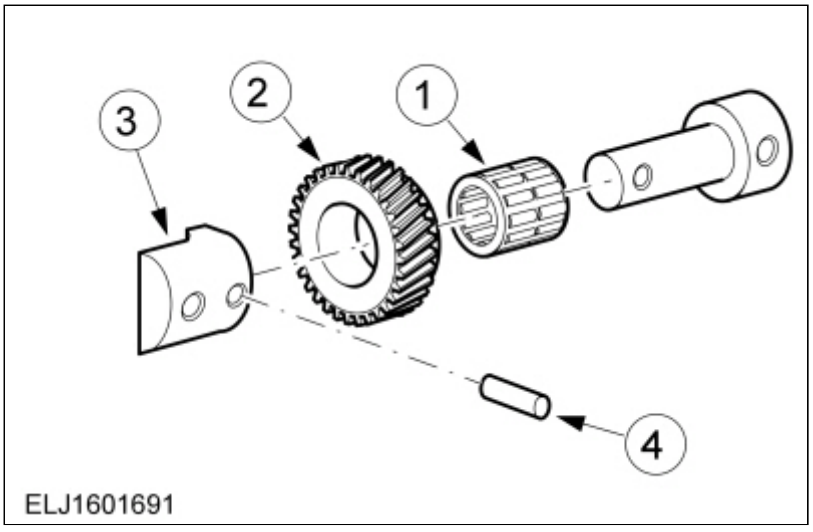
1. Disassemble the reverse gear idler shaft.
    1. Drive out the roll pin.
    2. Remove the bearing housing.
    3. Remove the reverse idler gear.
    4. Remove the needle roller bearing.



Assembly

1. **NOTE:** *Do not install the bearing housing twisted. The threaded holes must line up with one another.*

   Assemble the reverse gear idler shaft.
    1. Install the needle roller bearing.
    2. Install the reverse idler gear.
    3. Install the bearing housing.
    4. Drive in the roll pin.



Copyright © 2016 Ford Motor Company

Synchronizers

Material

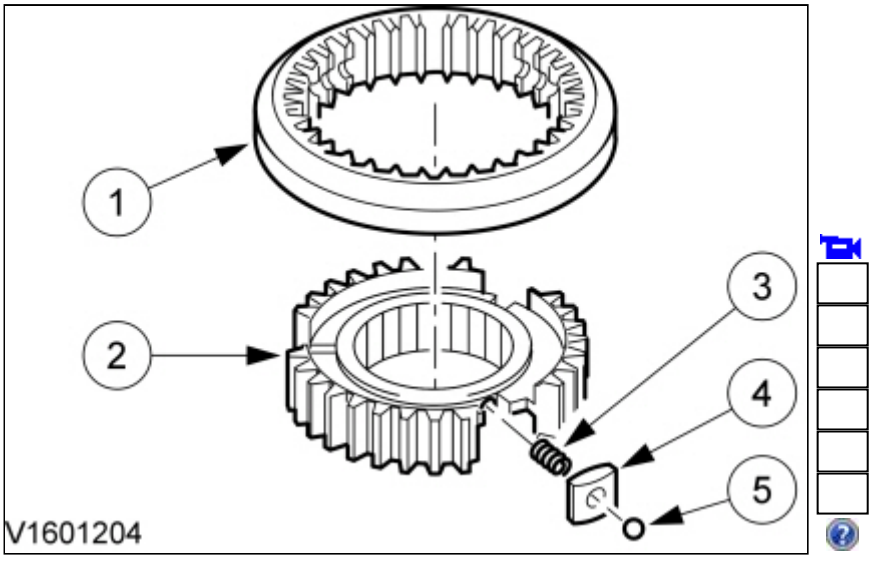
Item	Specification
Manual transmission fluid	WSD-M2C200-C

Disassembly

1. **NOTICE: Take care when pulling the selector ring off the synchronizer hub. The detent balls are spring-loaded.**

   NOTICE: Mark the synchronizers to the synchronizer hubs in relation to the selector rings.

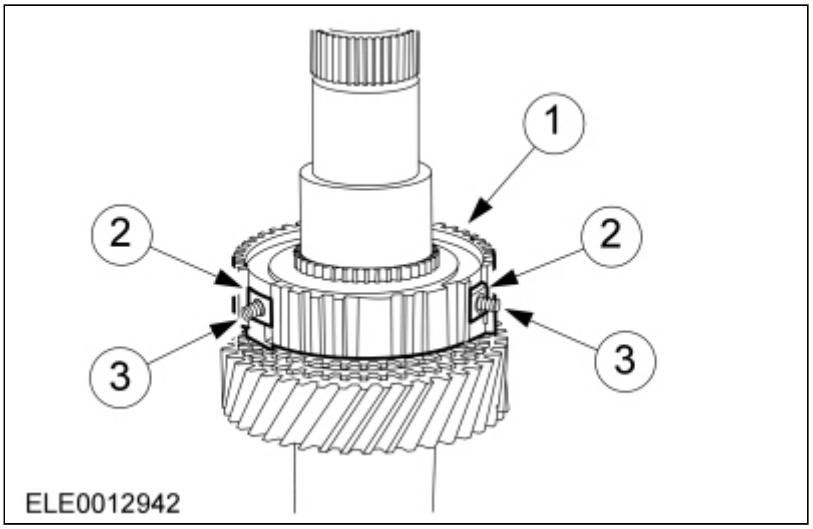
   Disassemble the synchronizer.
   1. Selector ring.
   2. Synchronizer hub.
   3. Compression spring.
   4. Blocker bar.
   5. Detent ball.



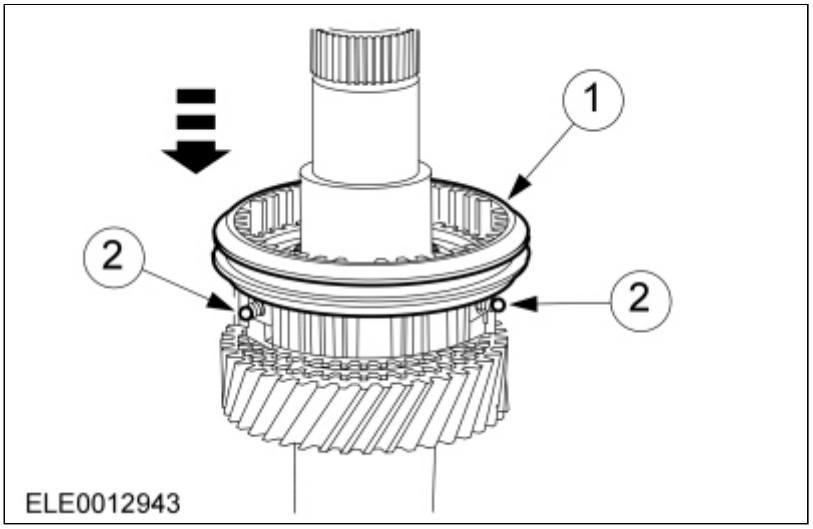
Assembly

1. **NOTE:** *Carefully clean and check all sliding parts and lubricate them with Manuel transmission fluid before assembly.*

   Assemble the inner synchronizer.
   1. Synchronizer inner ring.
   2. Blocker bars.
   3. Compression springs.



2. Assemble the outer synchronizer.
    1. Synchronizer outer ring.
    2. Detent balls.

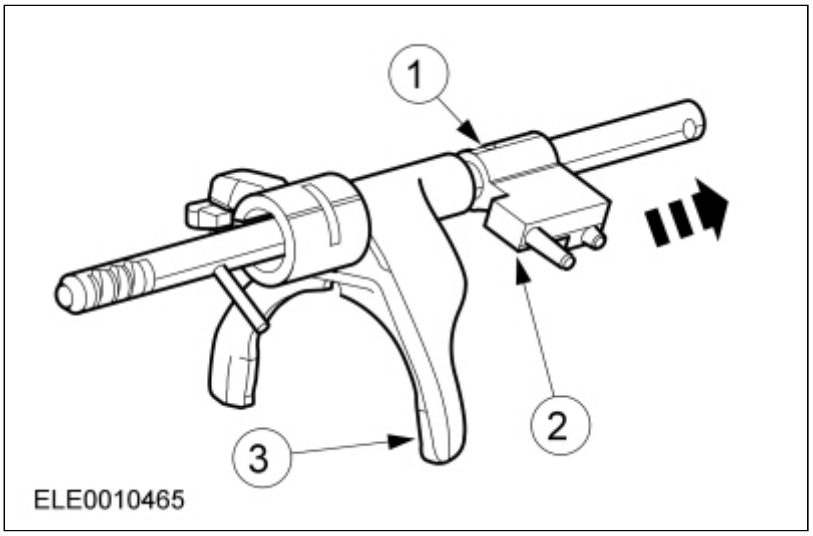


Copyright © 2016 Ford Motor Company

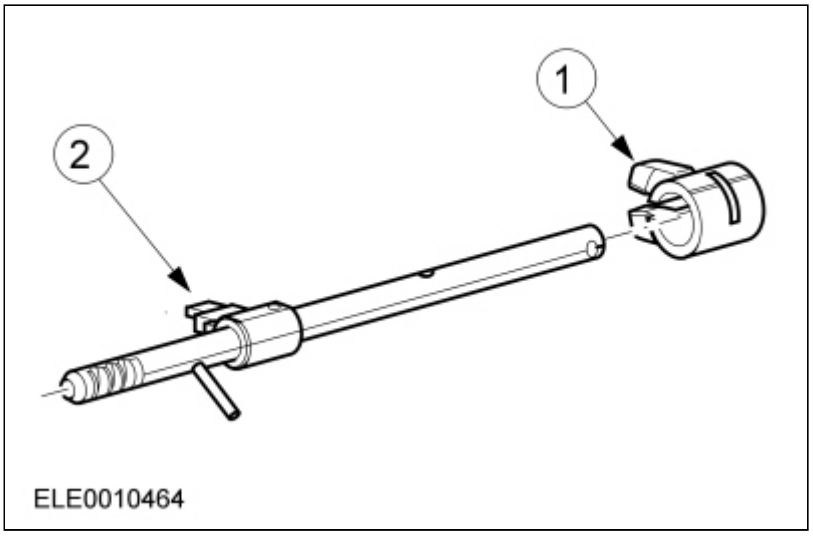
Gearshift Control Shaft

Disassembly

1. Disassemble the gearshift control shaft.
    1. Remove the roll pin.
    2. Remove the shift finger.
    3. Remove the selector fork.



2. Disassemble the gearshift control shaft (continued)
    1. Remove the locking sleeve.
    2. Remove the roll pin and the selector finger.



Assembly

1. **NOTE:** *Make sure that the roll pins do not protrude.*

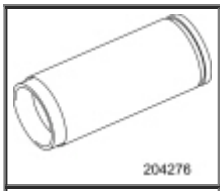
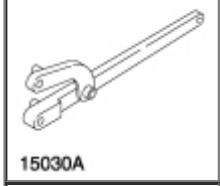
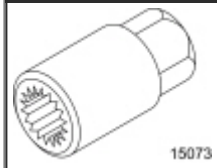
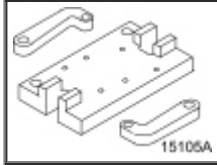
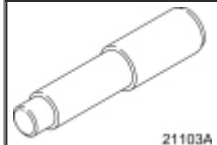
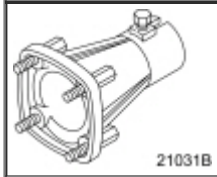
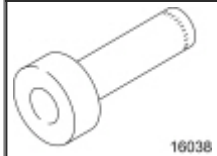
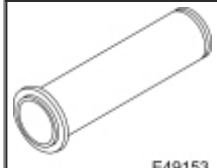
    To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

Transmission

Base Part Number: 7000

Special Tool(s) / General Equipment

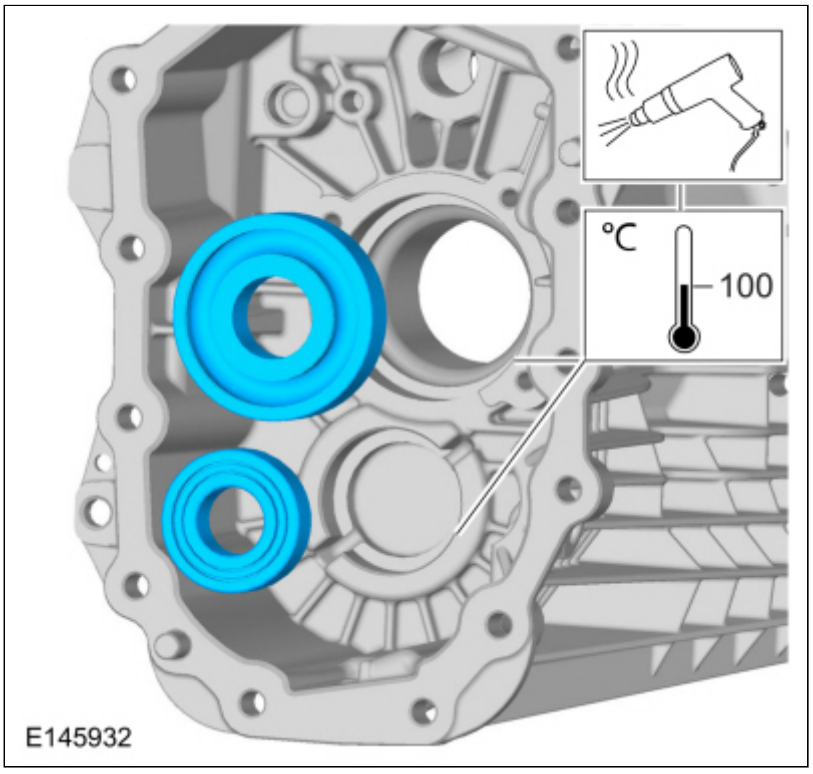
 204276	204-276 Installer, Wheel Spindle Wear Sleeve
 15030A	205-072 Universal Flange Holding Wrench
 15073	205-175 Socket, Drive Pinion Nut
 15105A	205-329 Mounting Bracket, Engine/Differential
 21103A	303-173 Aligner, Clutch Plate
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 16038	308-095 Installer, Input Shaft Bearing
 E49153	308-605 Installer, Input Shaft Seal
Cable Ties	
Hot Air Gun	

Materials

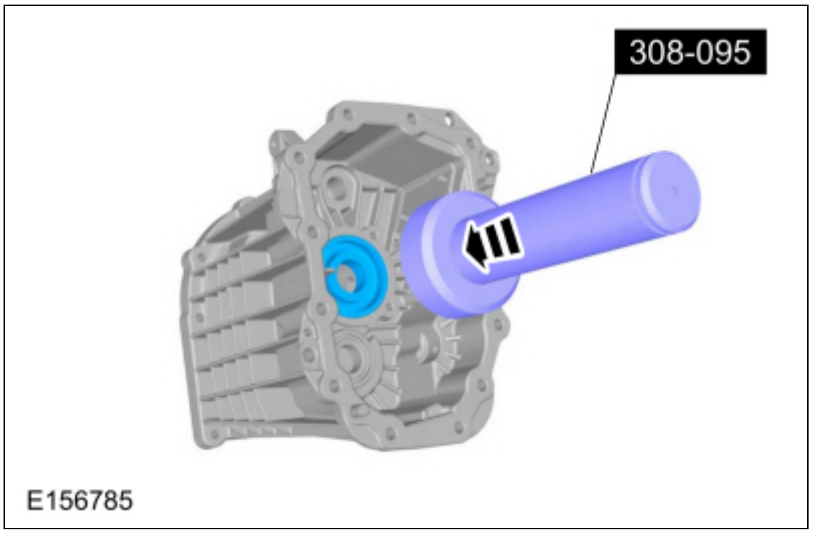
Name	Specification
Grease - High Temperature	ESD-M1C220-A
Gear/Transmission Fluid - SAE 75W-90	WSD-M2C200-C
Sealant	WSK-M2G348-A5
Thread Locking Adhesive	WSK-M2G349-A7

1. **NOTE:** *Lubricate all moving parts with manual transmission fluid during assembly.*

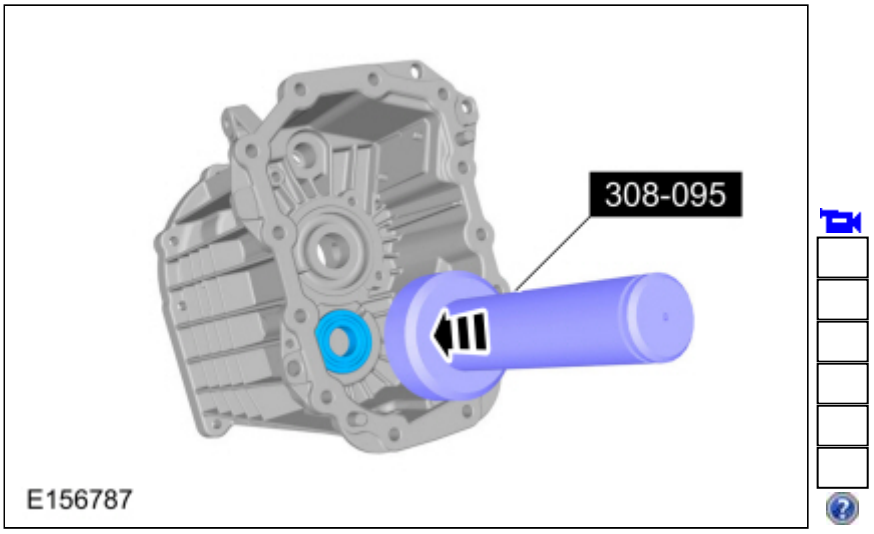
   NOTE: *Clean and check all parts for wear and damage. Install new parts as necessary.*



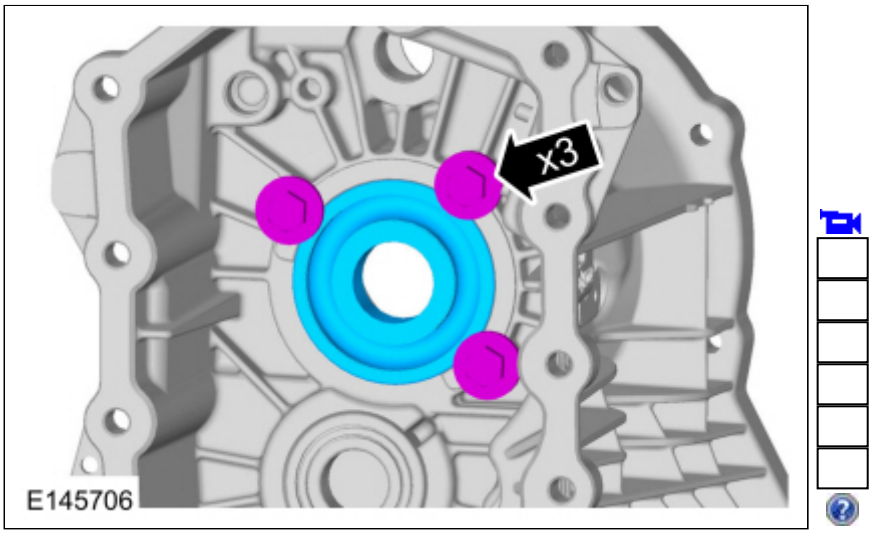
2. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing.



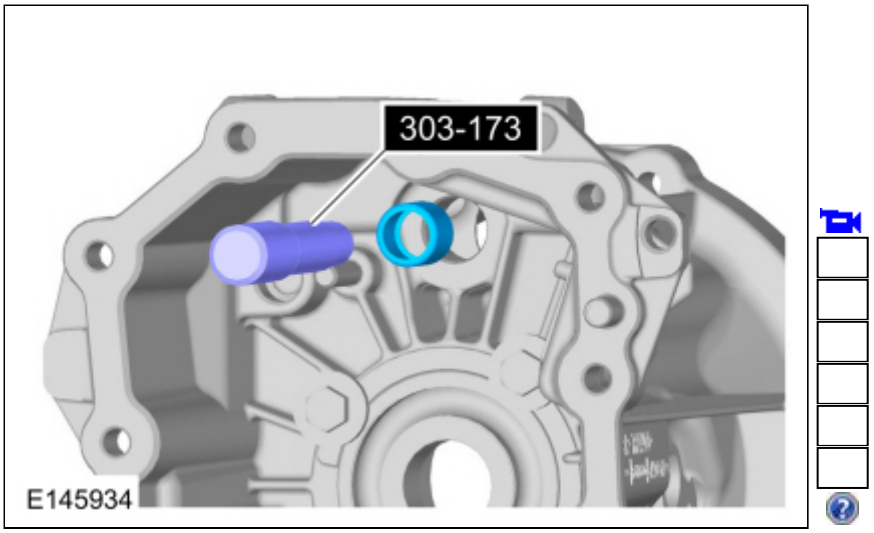
3. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing.



4. *Material*: Thread Locking Adhesive (WSK-M2G349-A7)
   Torque: 24 Nm

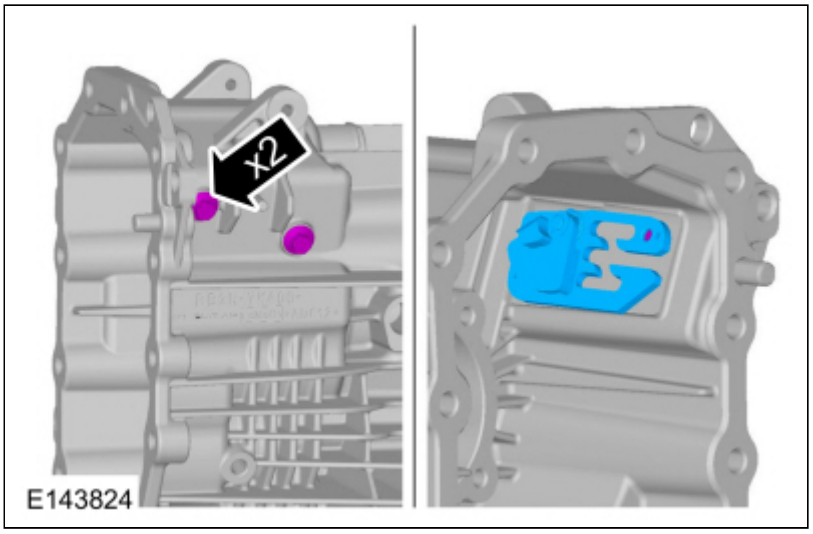


5. Use Special Service Tool: 303-173 Aligner, Clutch Plate.

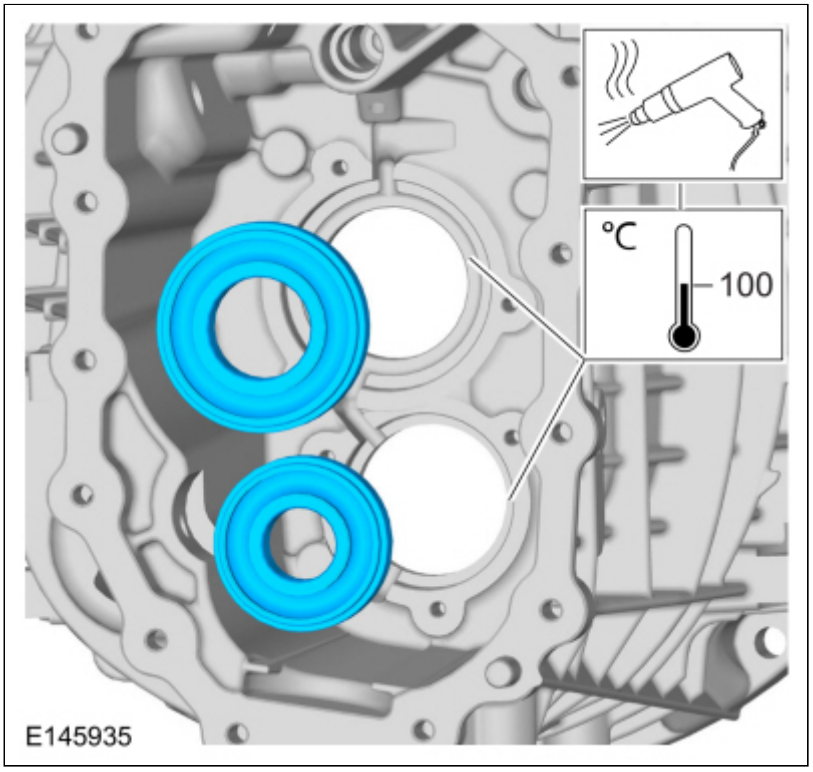


6. **NOTE:** *Install new selector gate retaining bolts.*

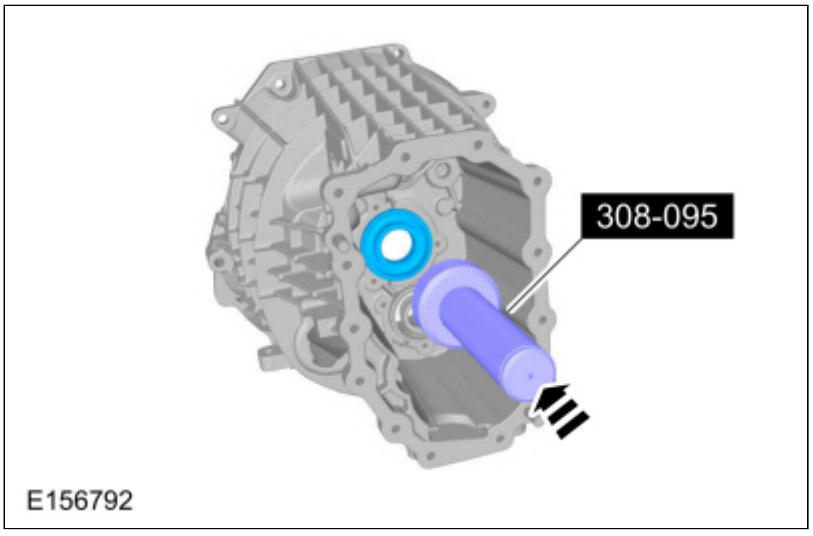
   Torque: 10 Nm



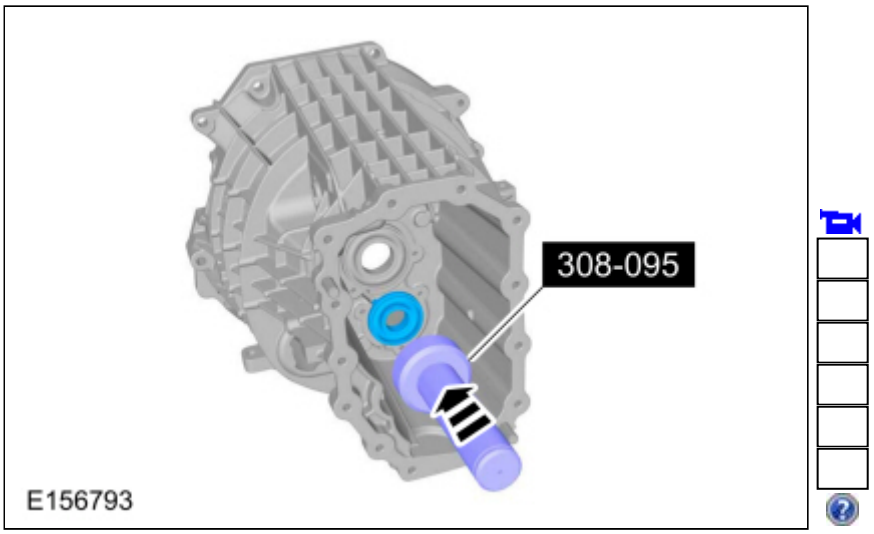
7.



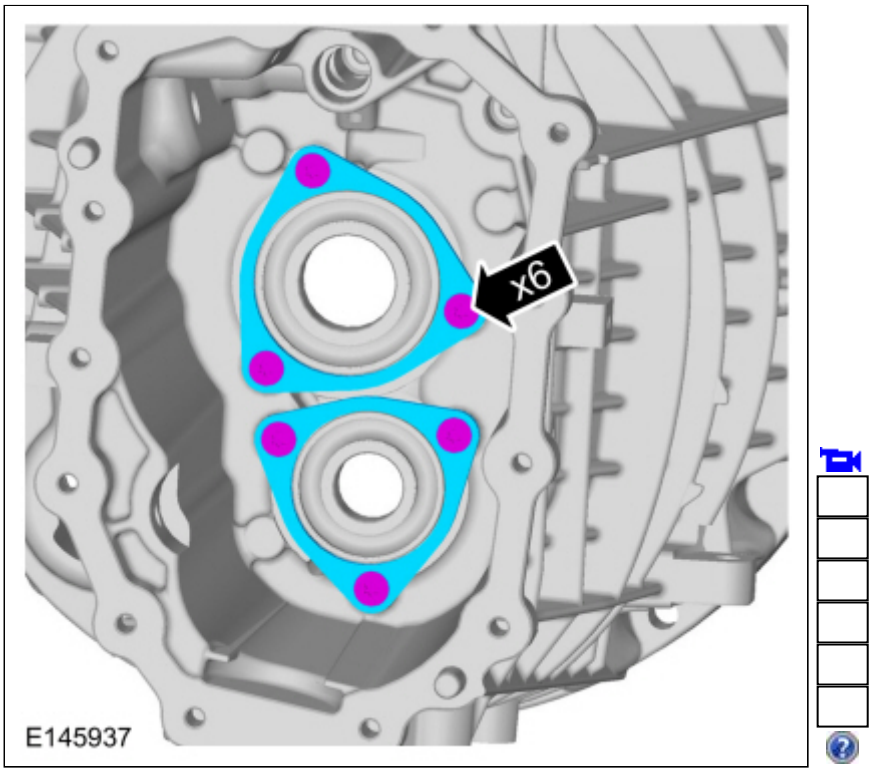
8. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing.



9. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing.



10. *Torque*: 17 Nm

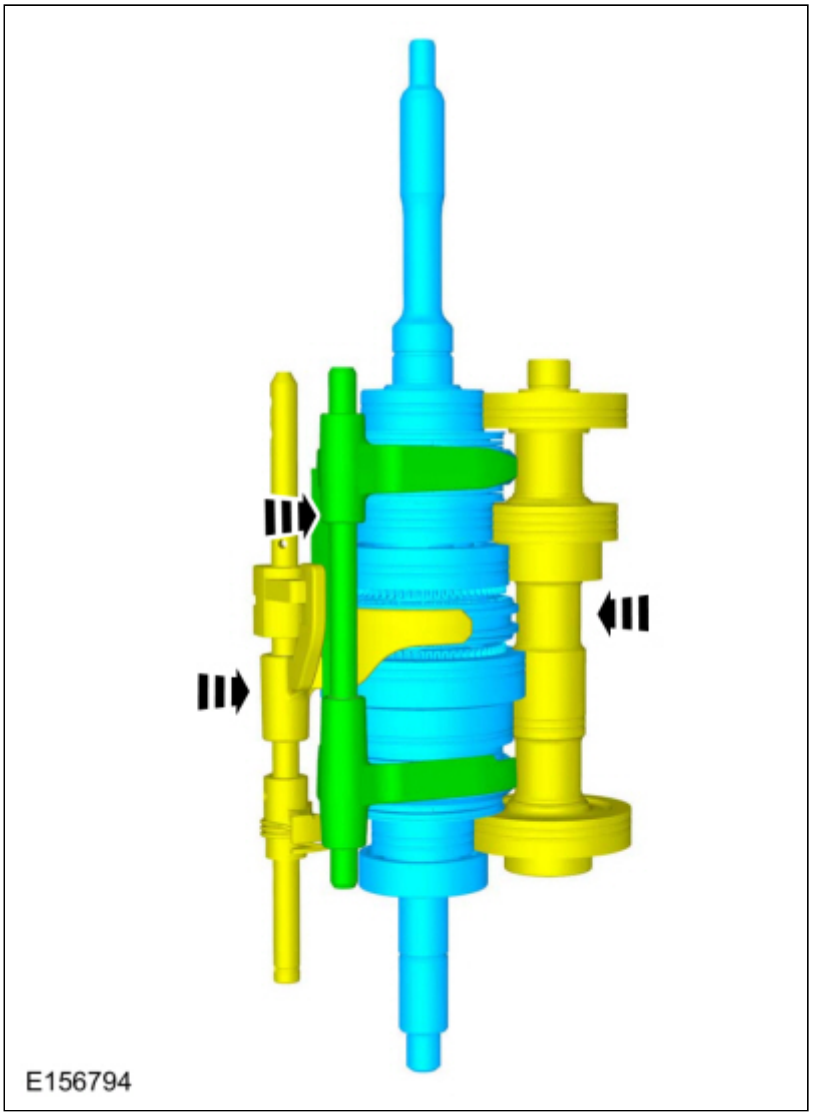


1. **NOTE:** *The first and second gear selector fork must engage in the middle of the first and second gear synchronizer unit.*

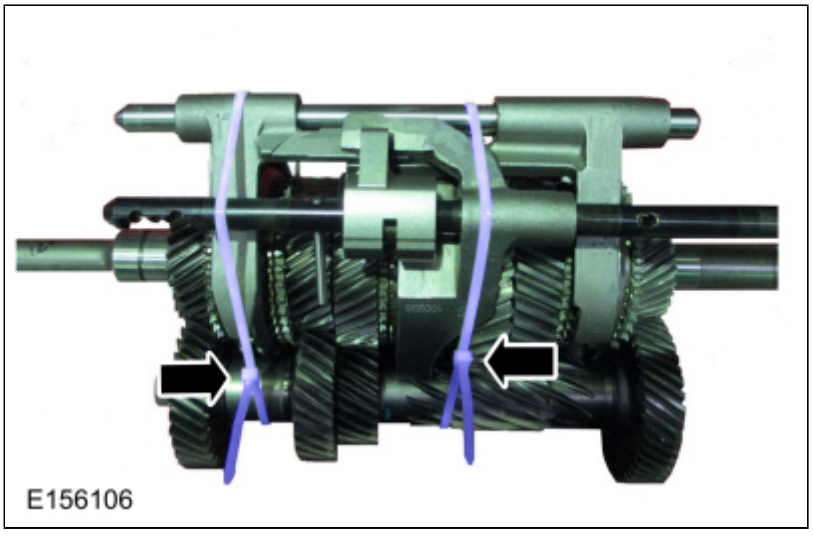
   Assemble the main selector shaft to the countershaft and output shaft assembly.

2. **NOTE:** *Make sure that the outrigger of the selector fork is facing upwards.*

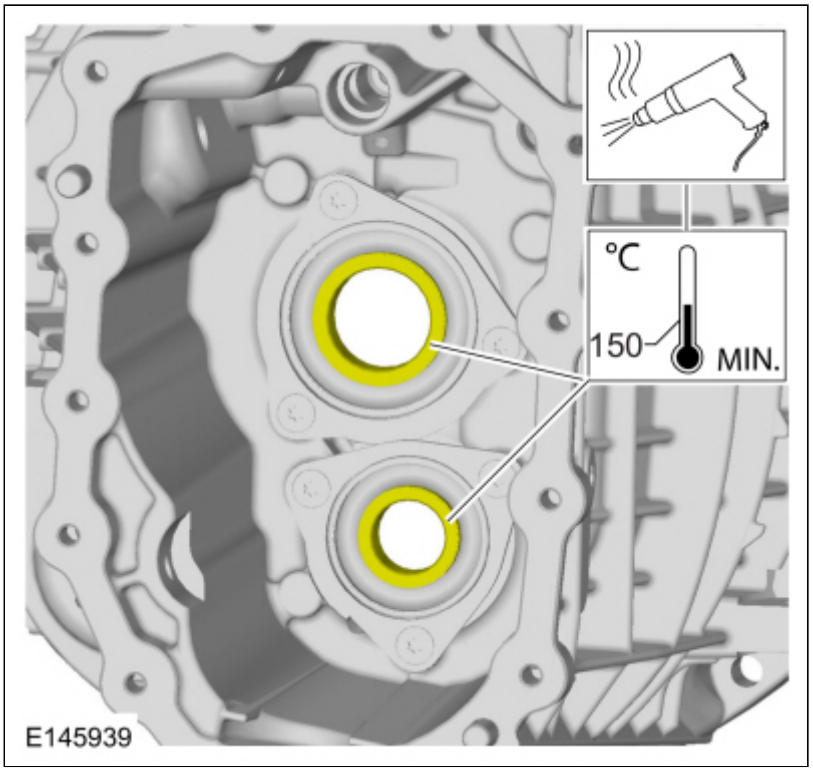
   Attach the thrid and fouth gear selector fork to the synchronizer unit.



12. Install the General Equipment: Cable Ties

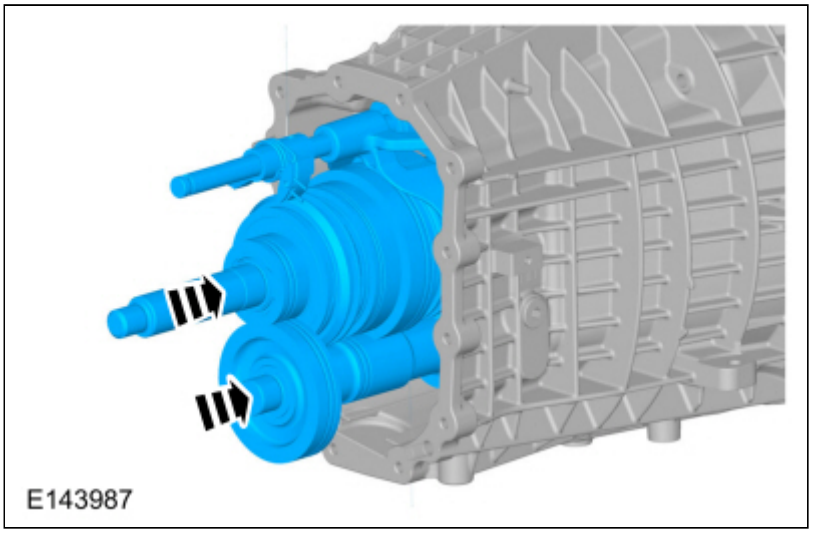


13.

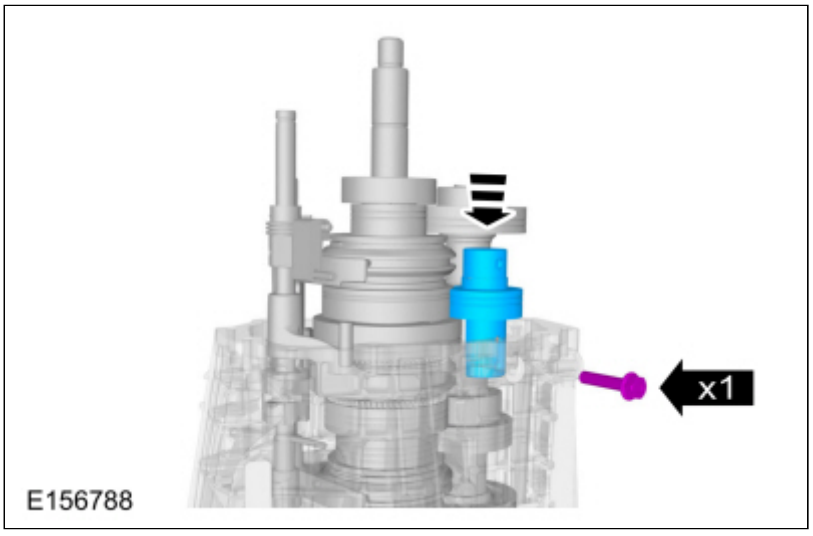


14. **NOTE:** *During installation, guide the selector shaft into the case bearing.*

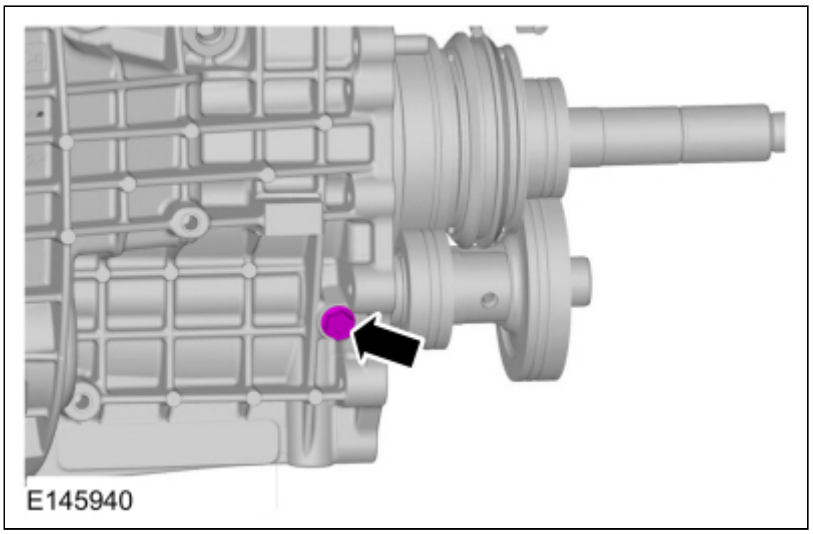
    NOTE: *Secure the input shaft to prevent it from falling down*



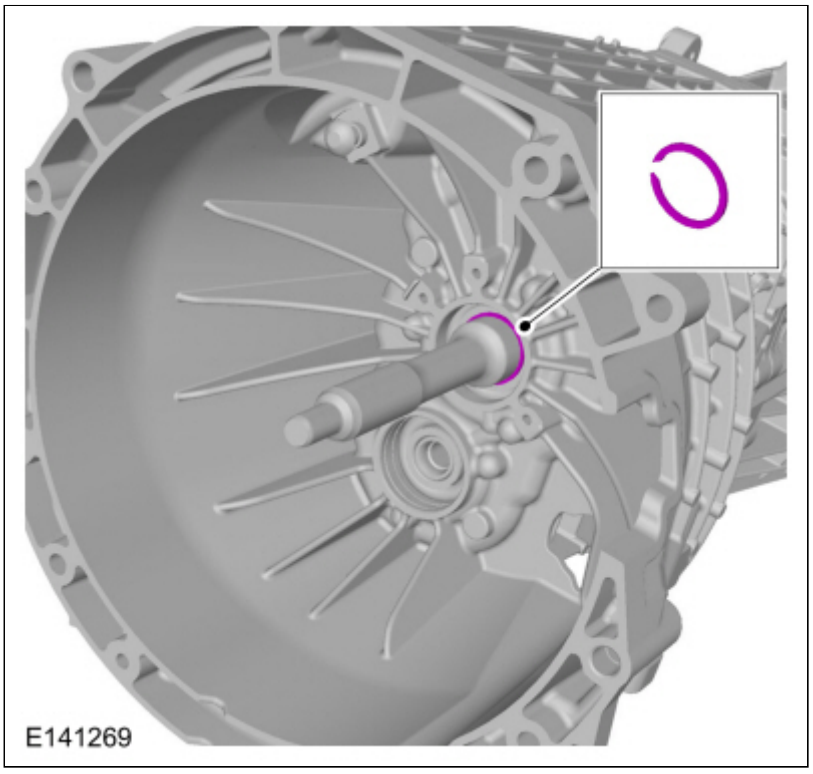
15. **NOTE:** *Make sure that the flat end of the reverse gear idler shaft is facing upwards.*



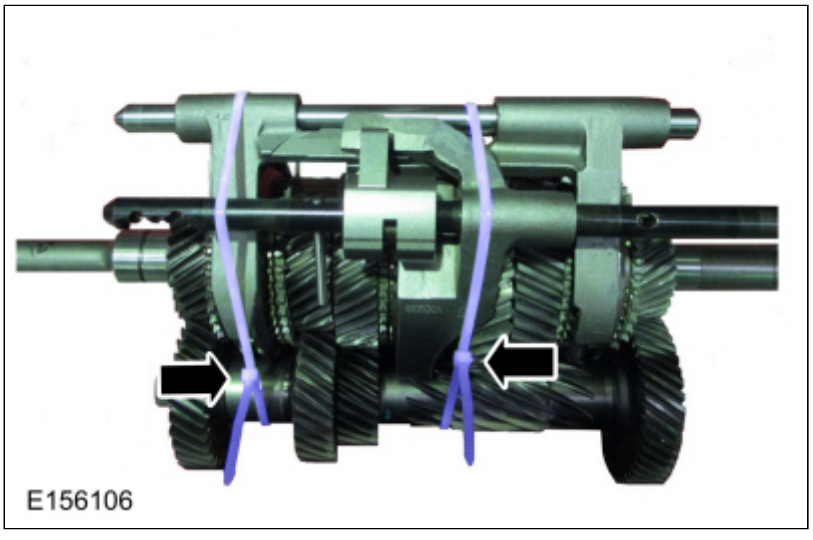
16. **NOTE:** *Only tighten the bolt finger tight at this stage.*



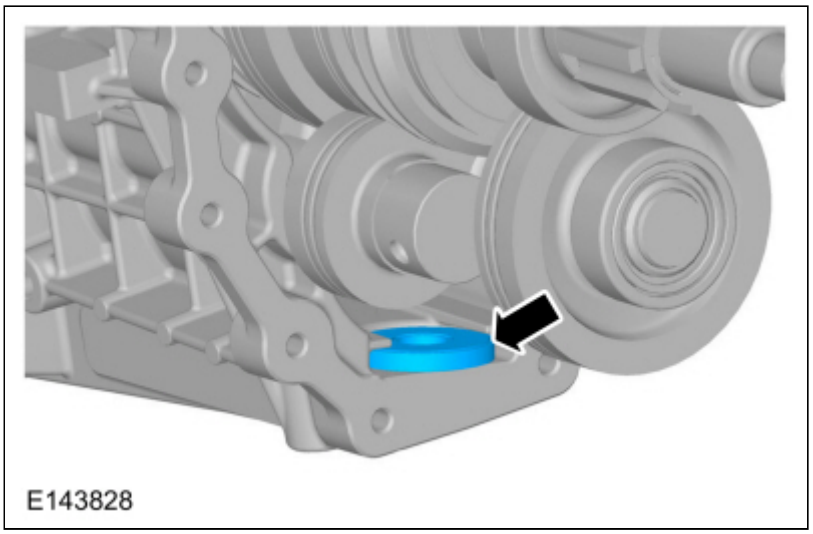
17. **NOTE:** *Make sure that a new component is installed.*



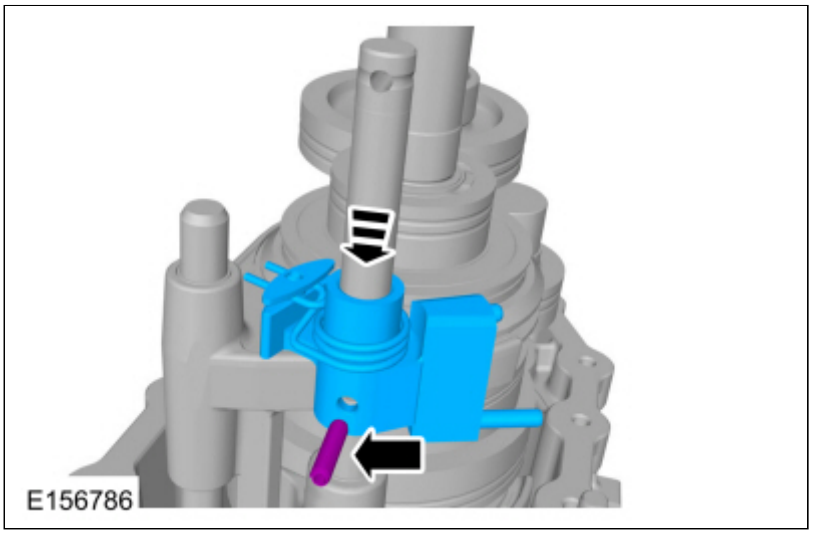
18. Remove the General Equipment: Cable Ties



19.

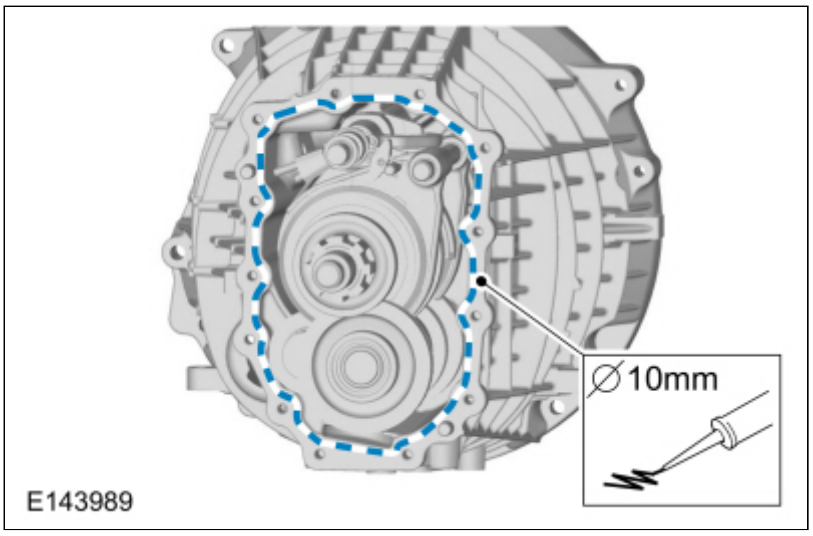


20.



21. **NOTICE: Install the transmission rear housing within 15 minutes of applying the sealant.**

Material: Sealant (WSK-M2G348-A5)

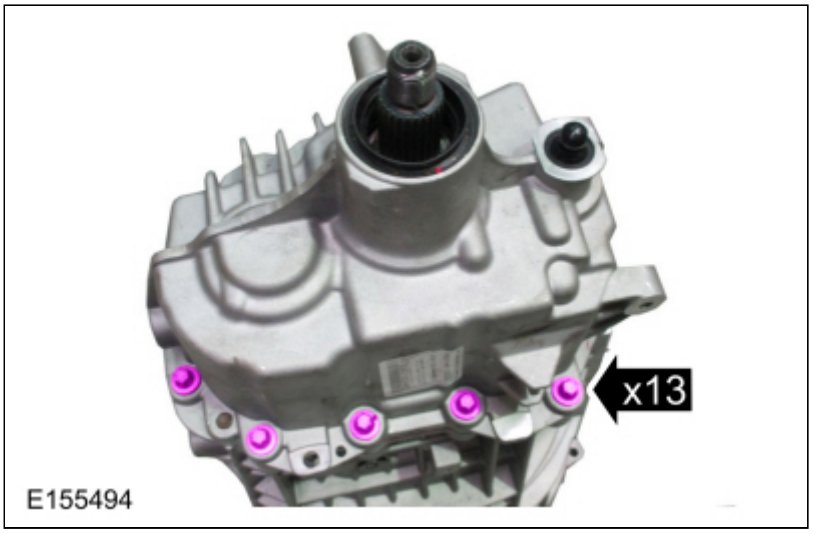


4x2

22. **NOTICE: Install the transmission rear housing carefully. Failure to follow this instruction may result in damage to the fifth gear synchronizer ring.**

NOTE: *When installing a new transmission rear housing, install the locating studs with a 15 mm protrusion.*

Install the transmission housing retaining bolts.
Torque: 24 Nm



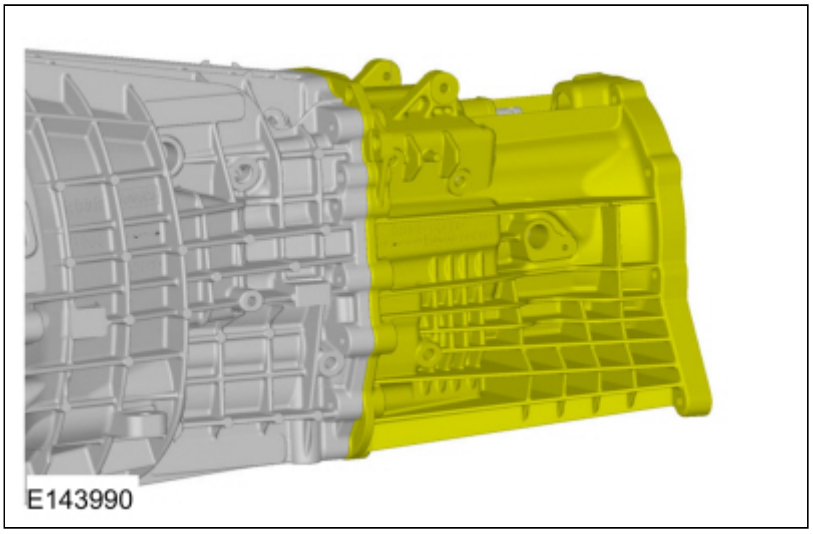
4x4

23. **NOTICE: Install the transmission rear housing carefully. Failure to follow this instruction may result in damage to the fifth gear synchronizer ring.**

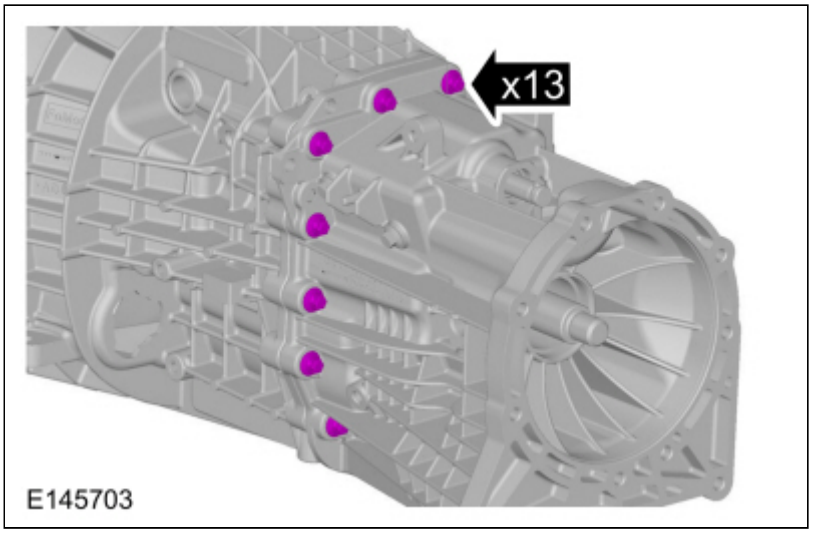
    NOTE: *When installing a new transmission rear housing, install the locating studs with a 15 mm protrusion.*

    NOTE: *Make sure that the pin of the select arm slides correctly into the gate.*

    Assemble the transmission rear housing to the transmission front housing.



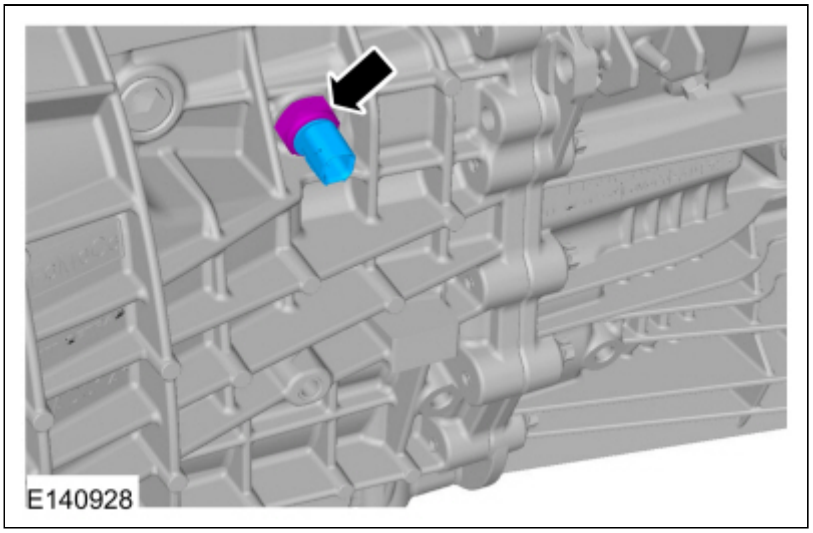
24. Install the transmission housing retaining bolts.
    Torque: 24 Nm



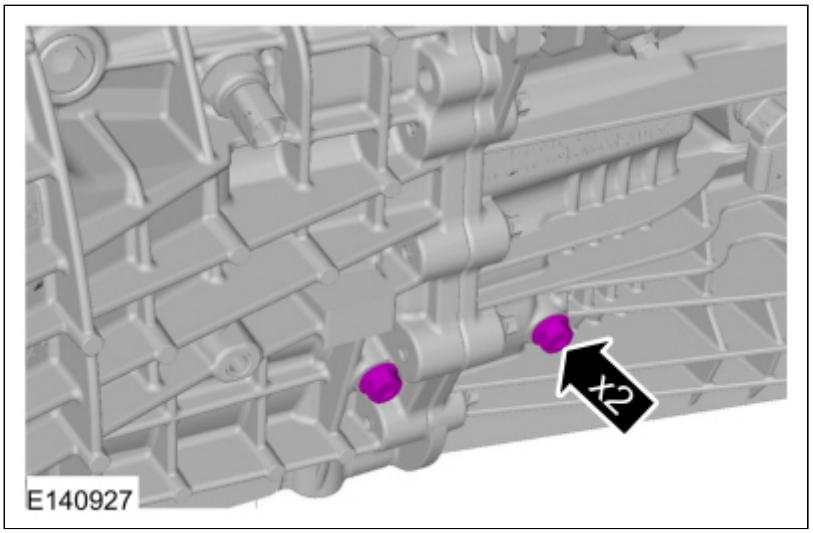
All vehicles

25. **NOTICE: Check the reversing lamp switch gasket. If the gasket is loose or damaged, discard the reversing lamp switch.**

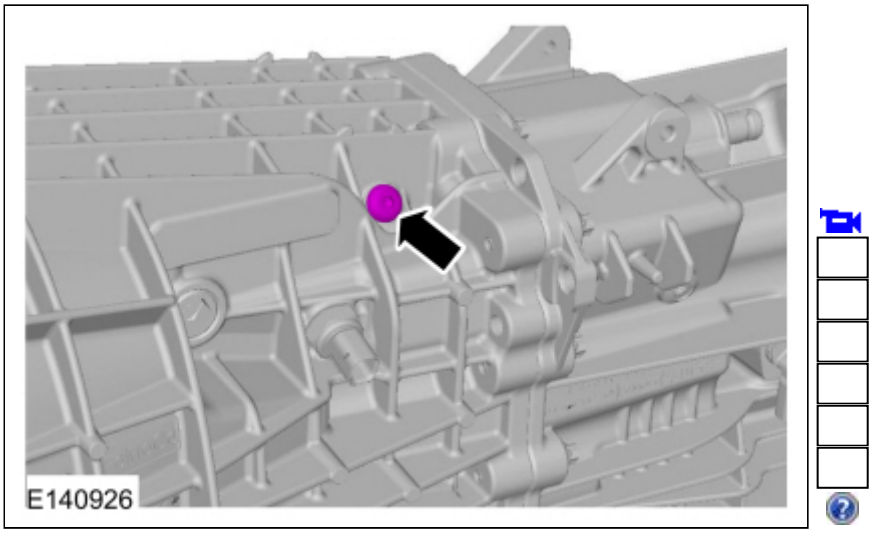
    Torque: 20 Nm



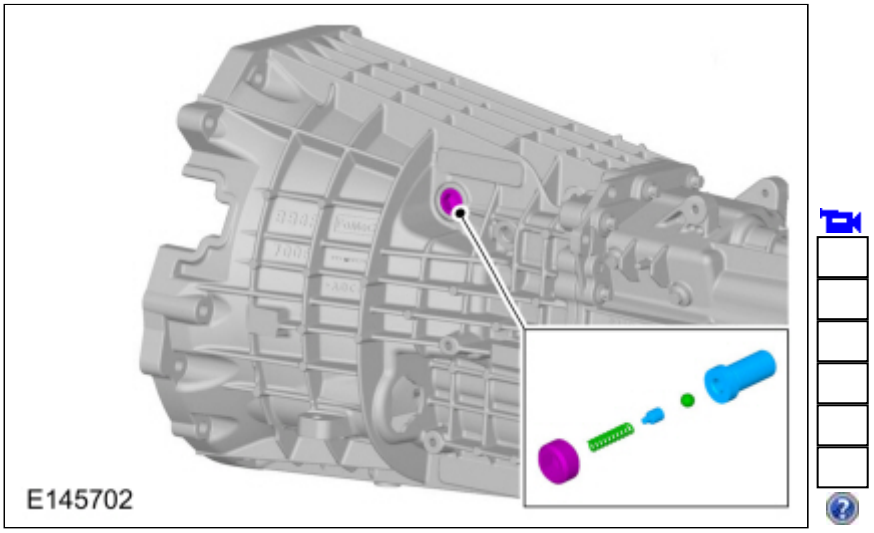
26. *Torque*: 32 Nm



27. *Torque*: 14 Nm

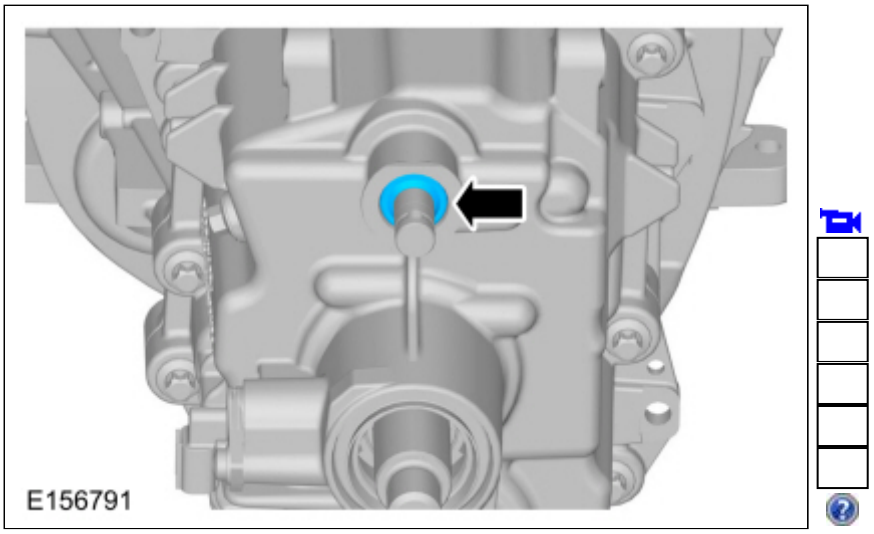


28. *Torque*: 24 Nm

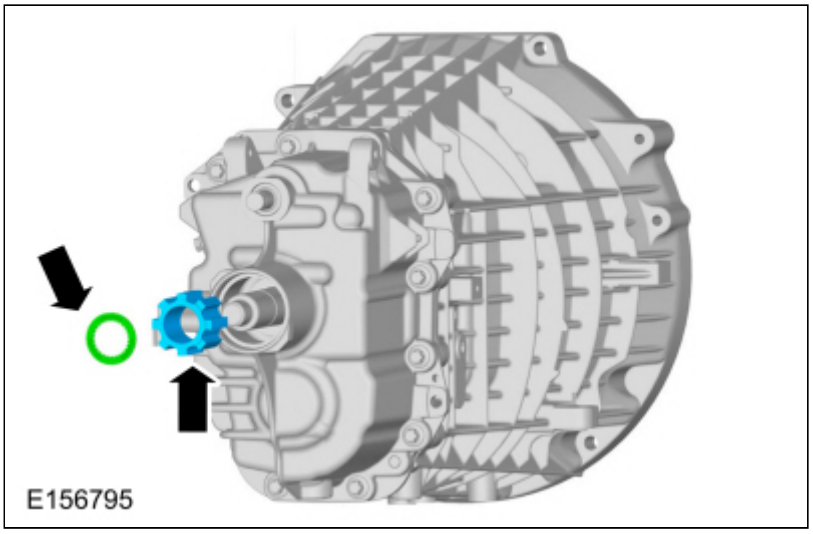


4x2

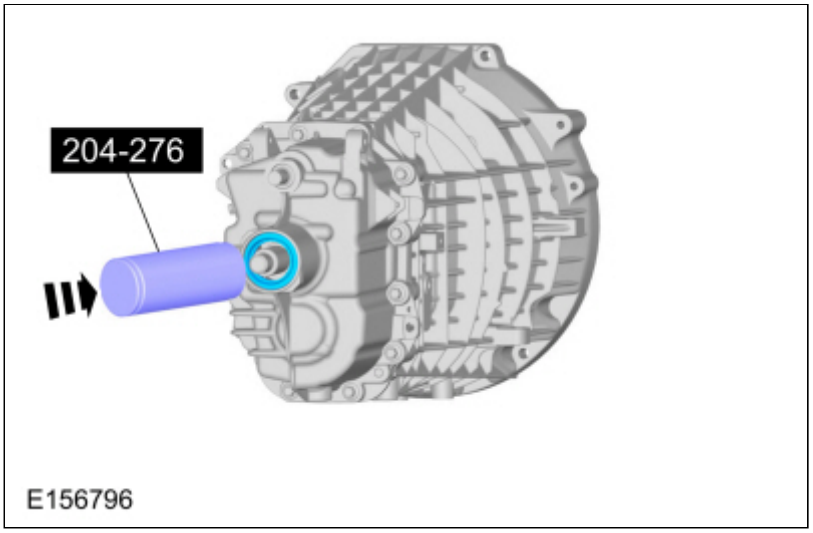
- Coat the lip of the main selector shaft oil seal.
  Material: Grease - High Temperature (ESD-M1C220-A)
- Using a 17 mm socket, install the main selector shaft oil seal.



30. **NOTE:** *Make sure that the inside splines of the sensor ring are facing the output shaft flange.*

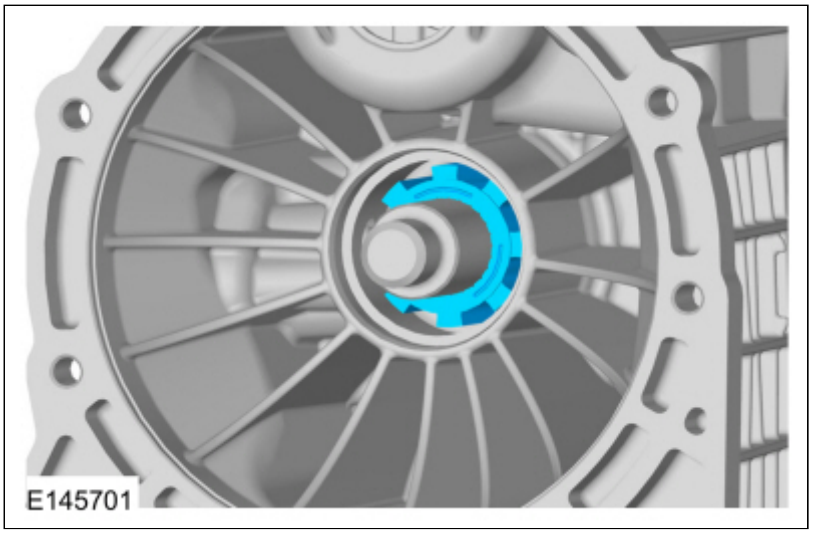


- Coat the lip of the output shaft oil seal.
  Material: Grease - High Temperature (ESD-M1C220-A)
- Use Special Service Tool: 204-276 Installer, Wheel Spindle Wear Sleeve.

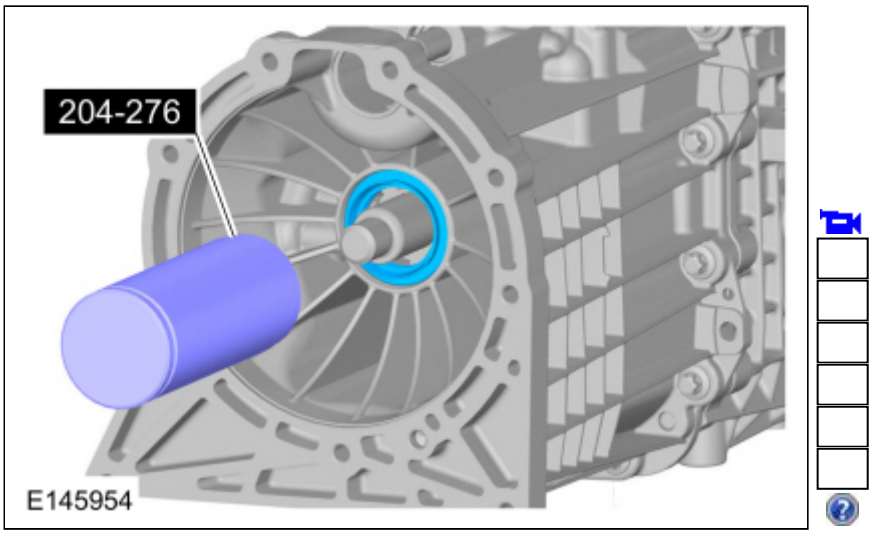


4x4

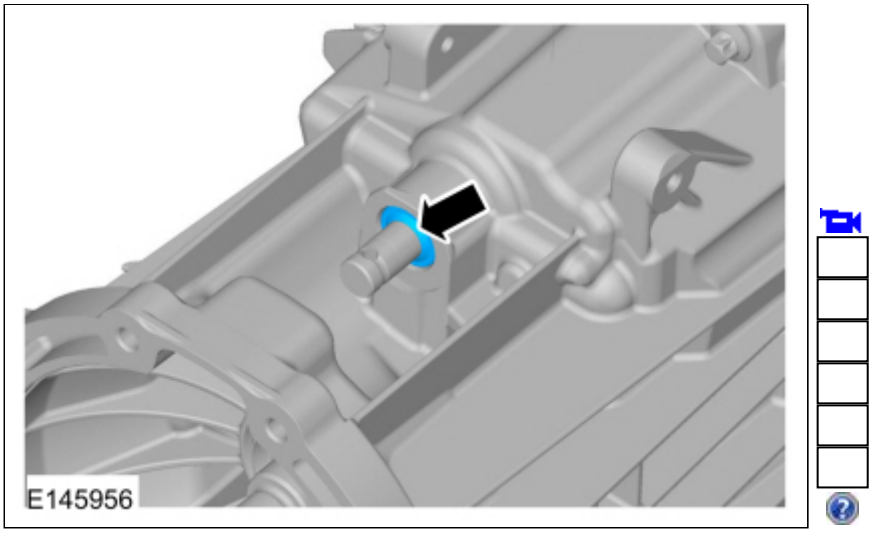
32. **NOTE:** *Make sure that the inside splines of the sensor ring are facing the output shaft flange.*



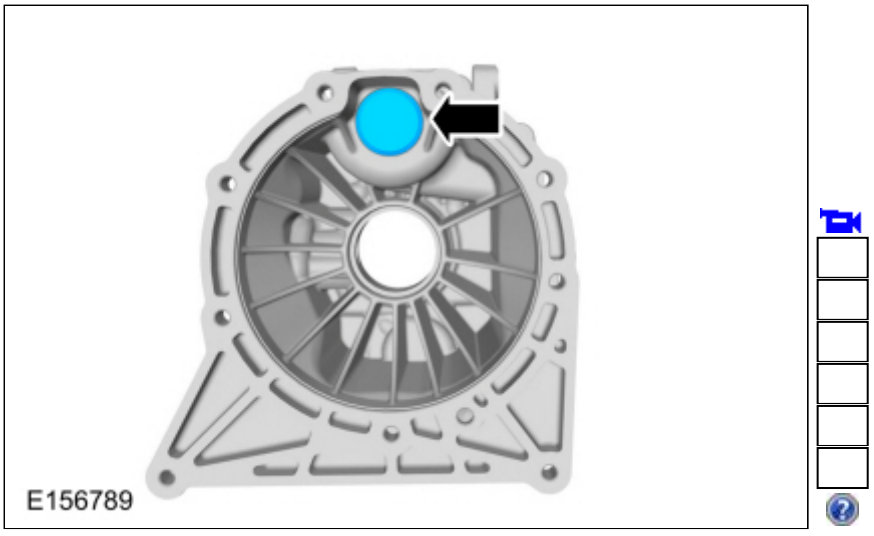
- Coat the lip of the output shaft oil seal.
  Material: Grease - High Temperature (ESD-M1C220-A)
- Use Special Service Tool: 204-276 Installer, Wheel Spindle Wear Sleeve.



- Coat the lip of the main selector shaft oil seal.
  Material: Grease - High Temperature (ESD-M1C220-A)
- Using a 17 mm socket, install the main selector shaft oil seeal.

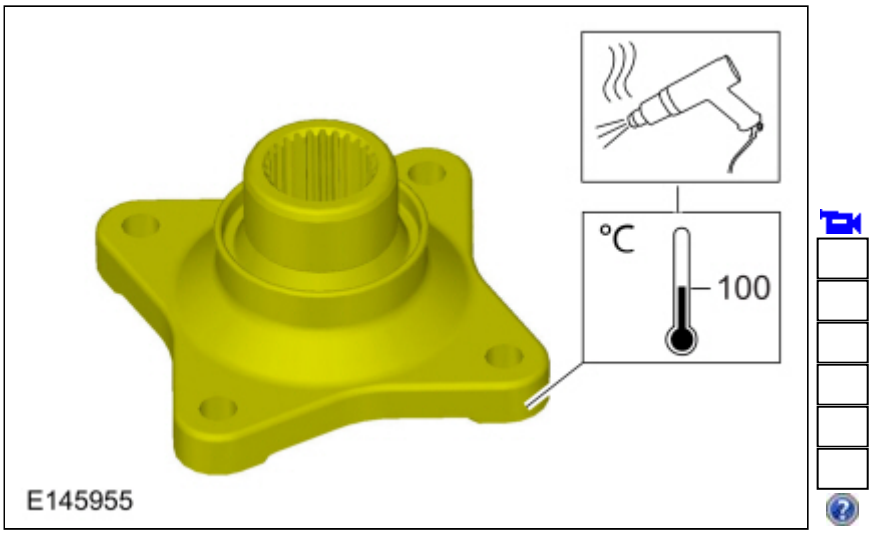


35.



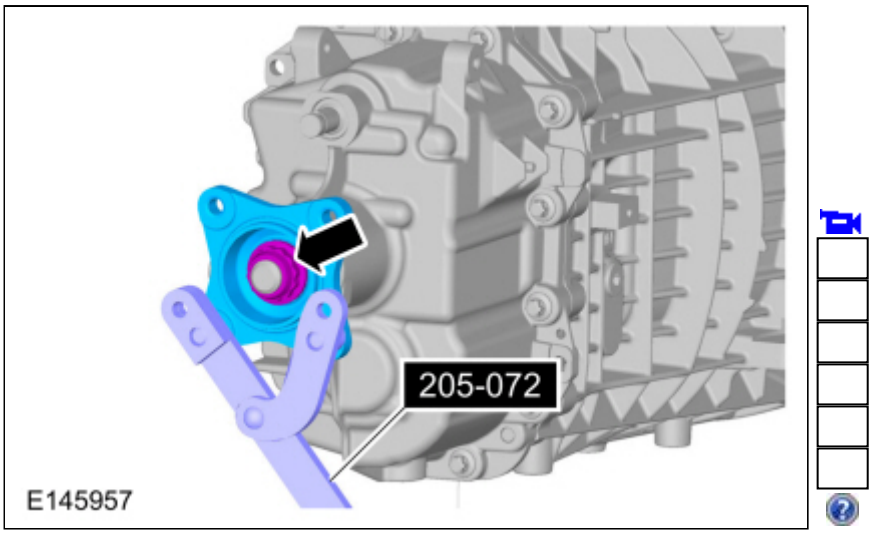
All vehicles

36. Use the General Equipment: Hot Air Gun

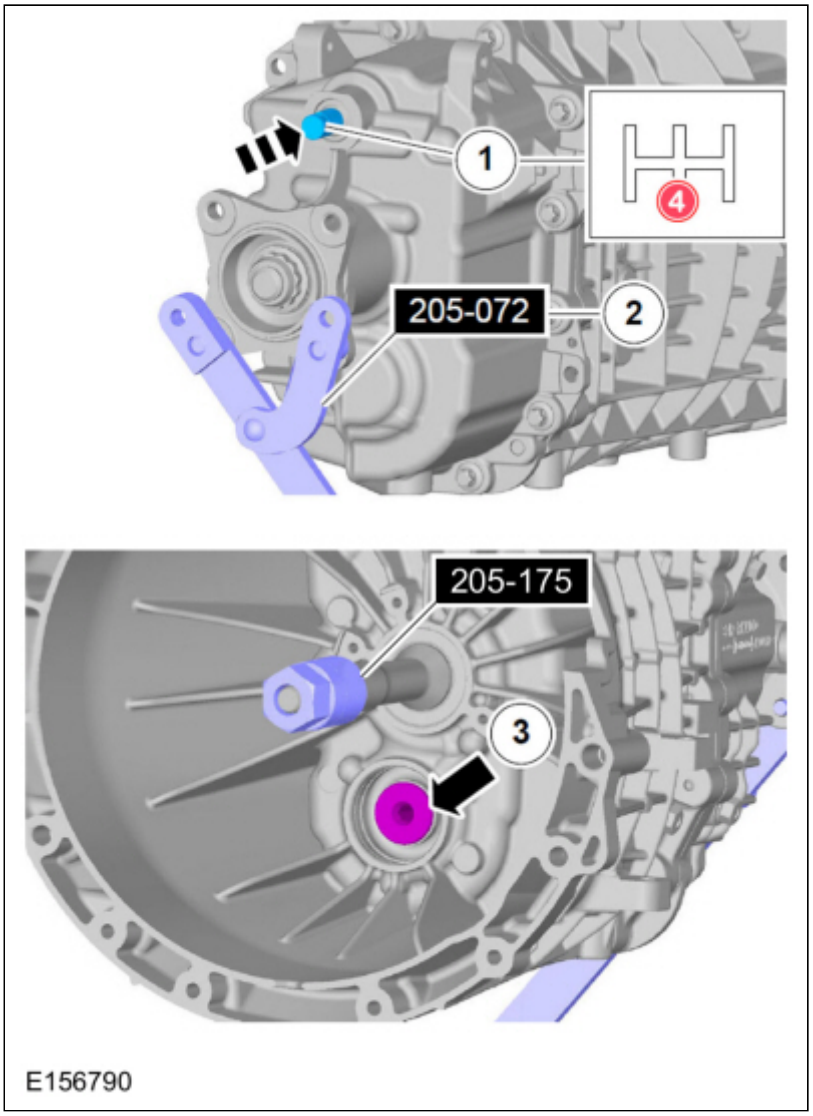


4x2

- Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
- *Material*: Thread Locking Adhesive (WSK-M2G349-A7)
- *Torque*: 200 Nm

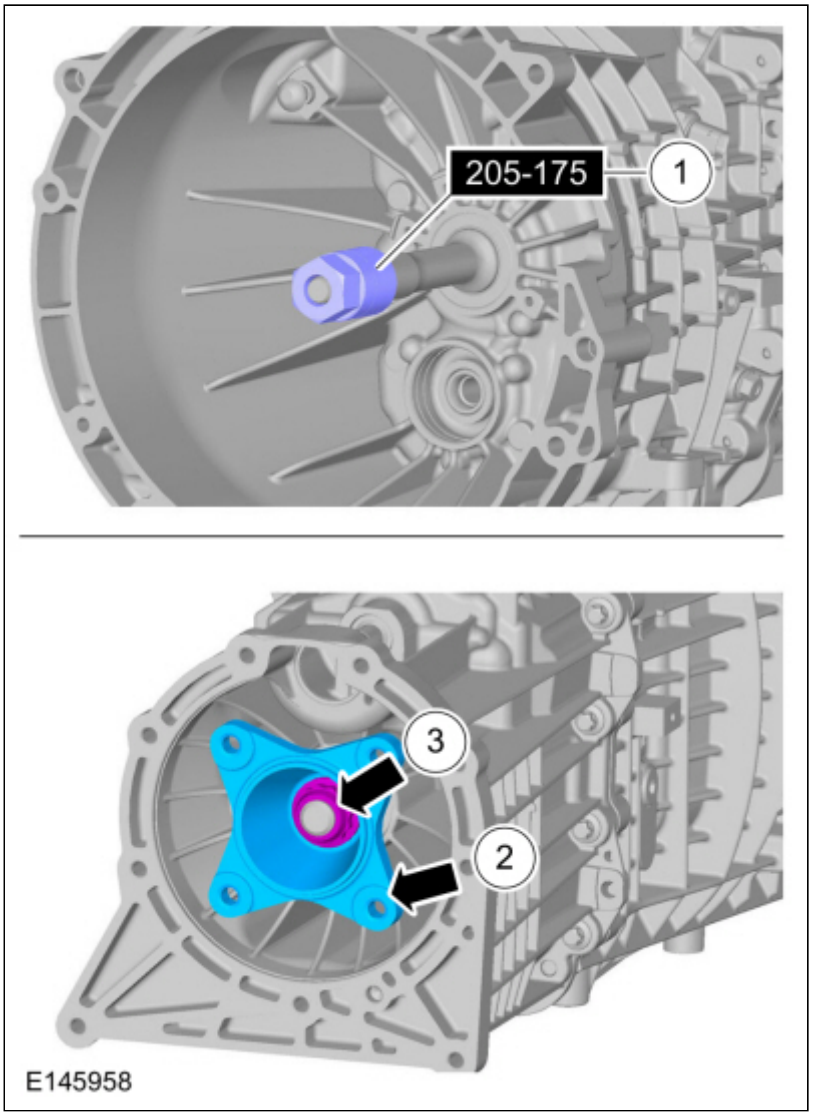


38. Use Special Service Tool: 205-072 Universal Flange Holding Wrench. , 205-175 Socket, Drive Pinion Nut.
    Torque: 85 Nm

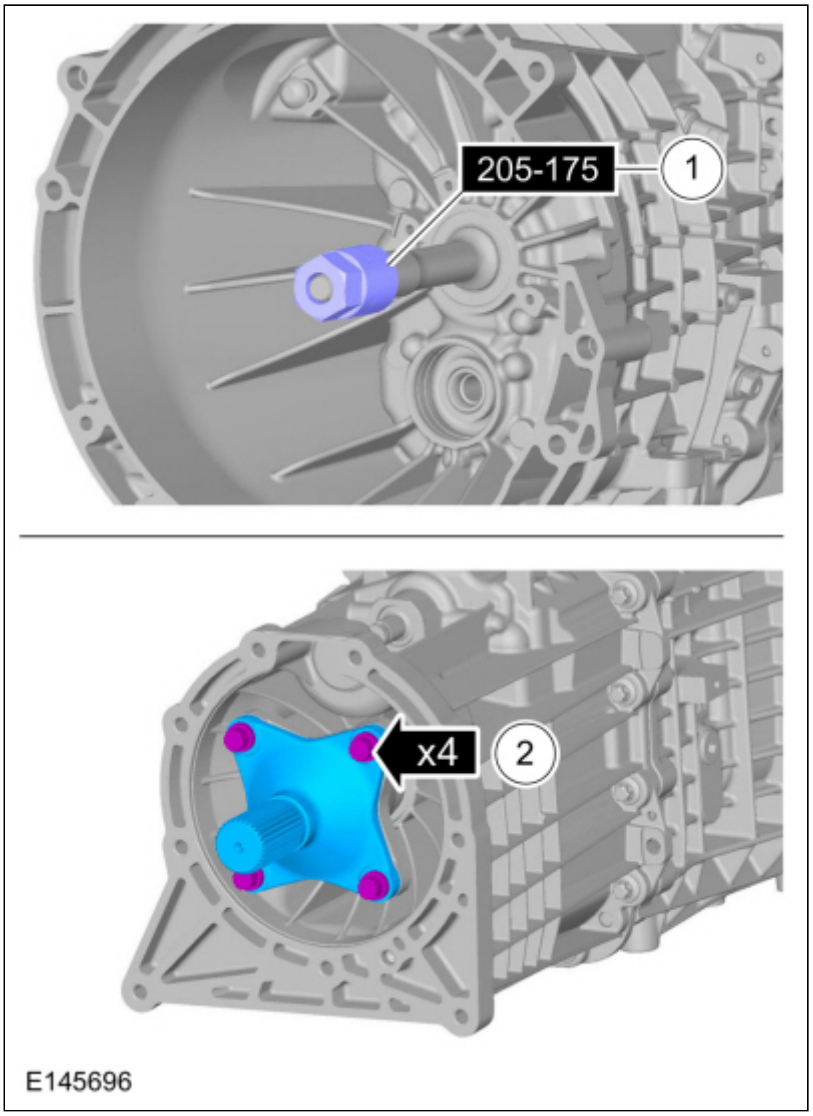


4x4

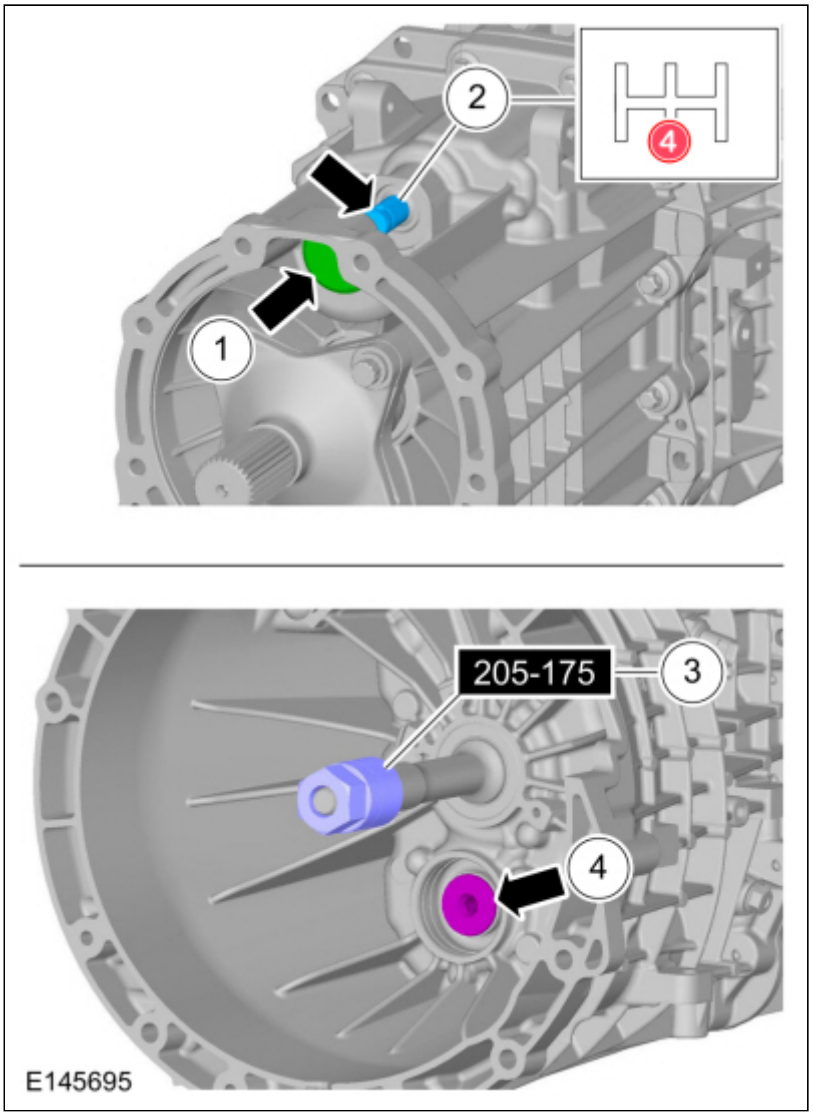
39. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.
    Torque: 200 Nm



40. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.
    Torque: 130 Nm

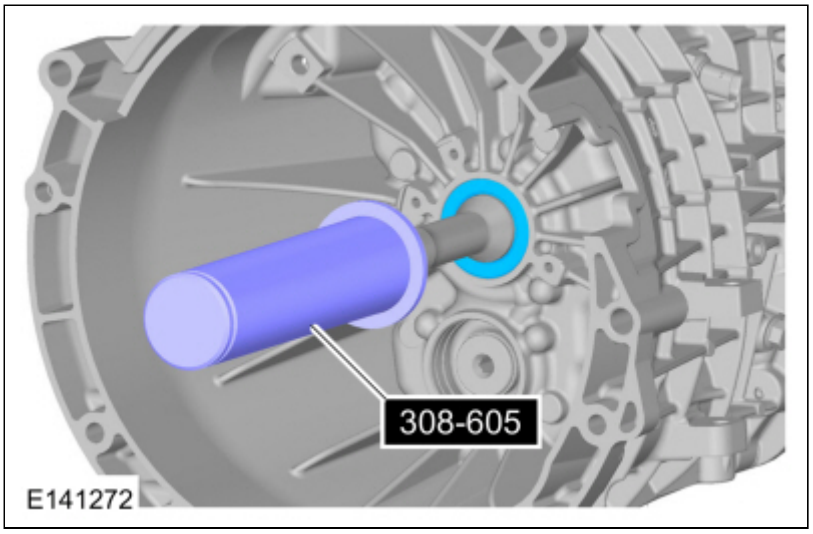


41. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.
    Torque: 85 Nm

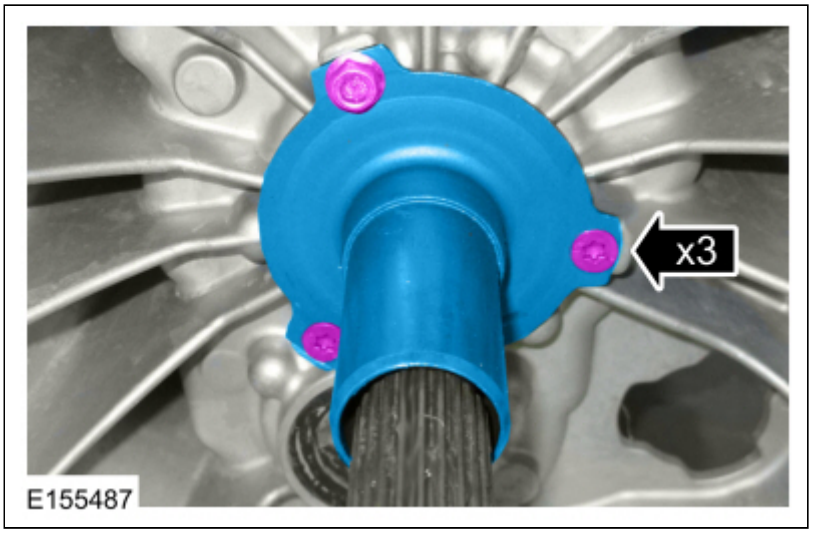


All vehicles

42. Use Special Service Tool: 308-605 Installer, Input Shaft Seal.



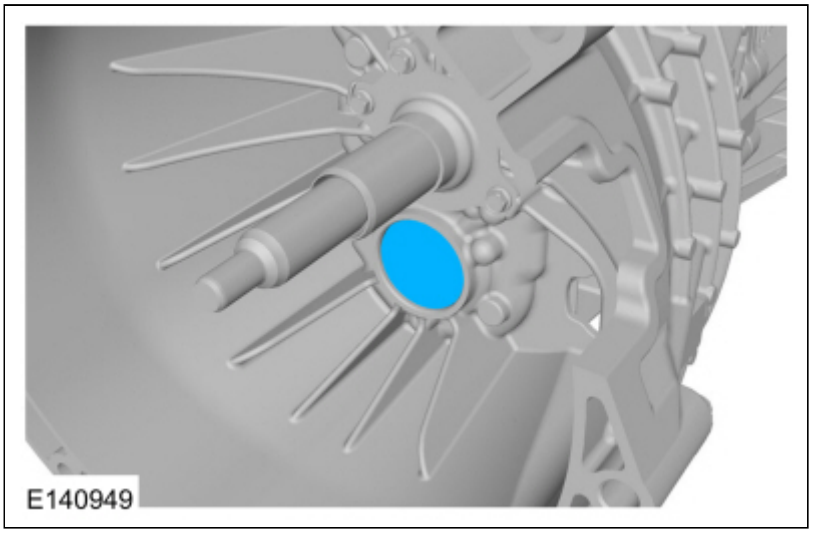
43. *Torque*: 10 Nm



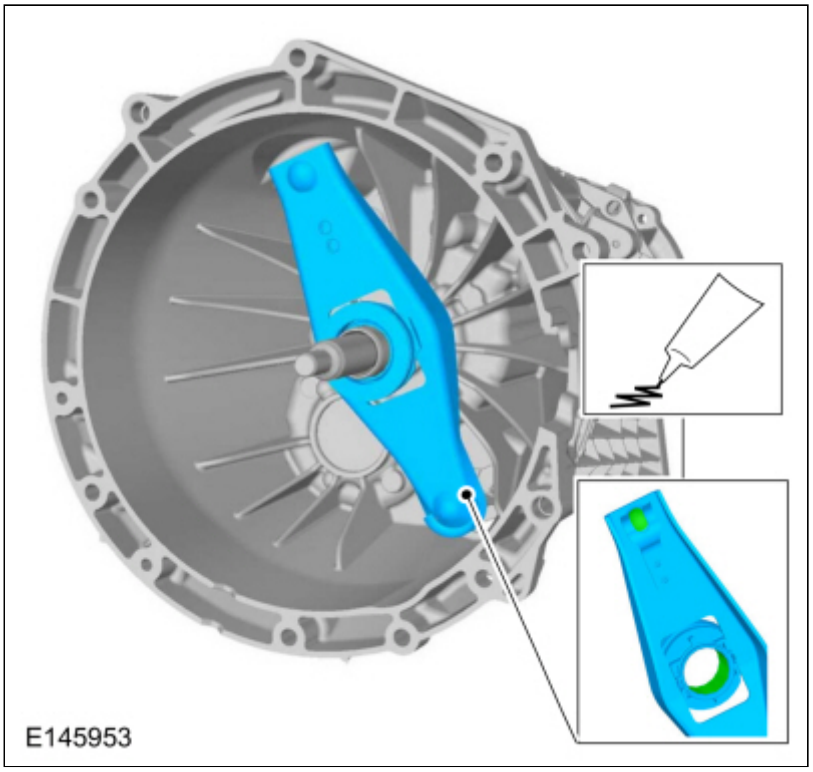
- **NOTE:** *Install the blanking plug to a depth of 2.1 ± 0.5 mm.*

  Install a new countershaft bearing seal (blanking plug).
- **NOTE:** *Coat the input shaft splines with thin film of grease.*

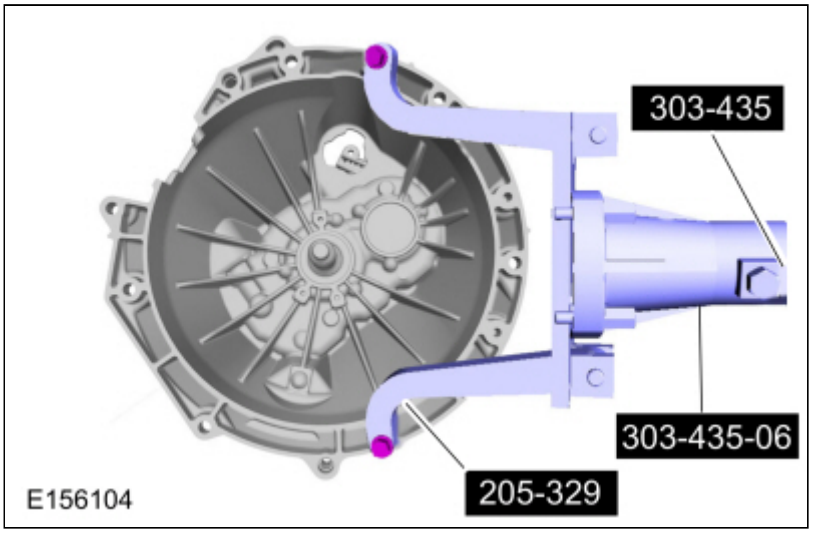
  Material: Grease - High Temperature (ESD-M1C220-A)



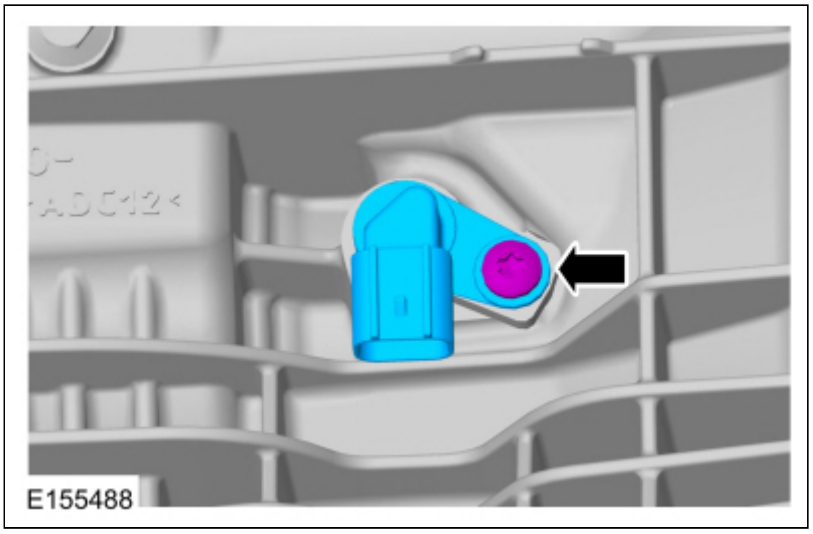
- Material: WSD-M1C227-A (Grease).
- Install the clutch release bearing and the clutch release lever.



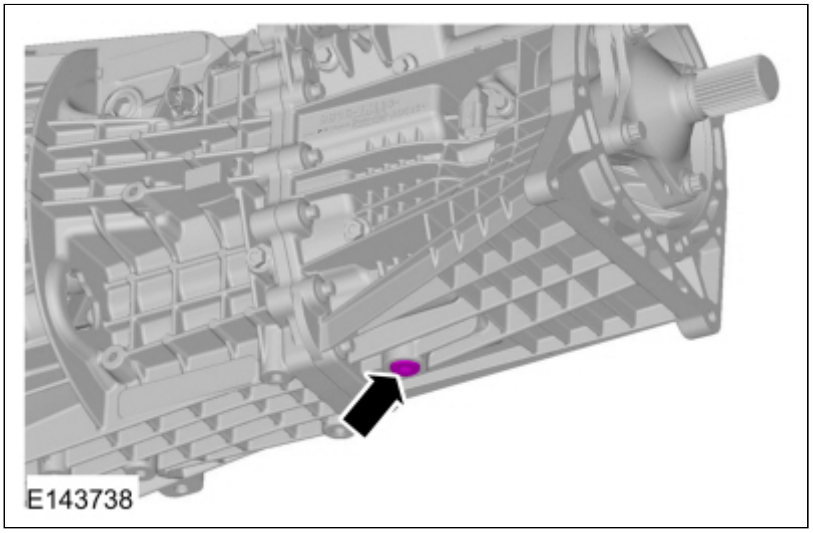
46. Remove Special Service Tool: 205-329 Mounting Bracket, Engine/Differential. , 303-435-06 Mounting Bracket for 303-435. , 303-435 Mounting Stand.



47. Coat the VSS O-ring seal.
    Material: Grease - High Temperature (ESD-M1C220-A)
    Torque: 8 Nm



48. *Torque*: 35 Nm



49. Fill the transmission with manual transmission fluid.
    Refer to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).
    Material: Gear/Transmission Fluid - SAE 75W-90 (WSD-M2C200-C)

Copyright © 2016 Ford Motor Company

Transmission - 4x2

Base Part Number: 7000

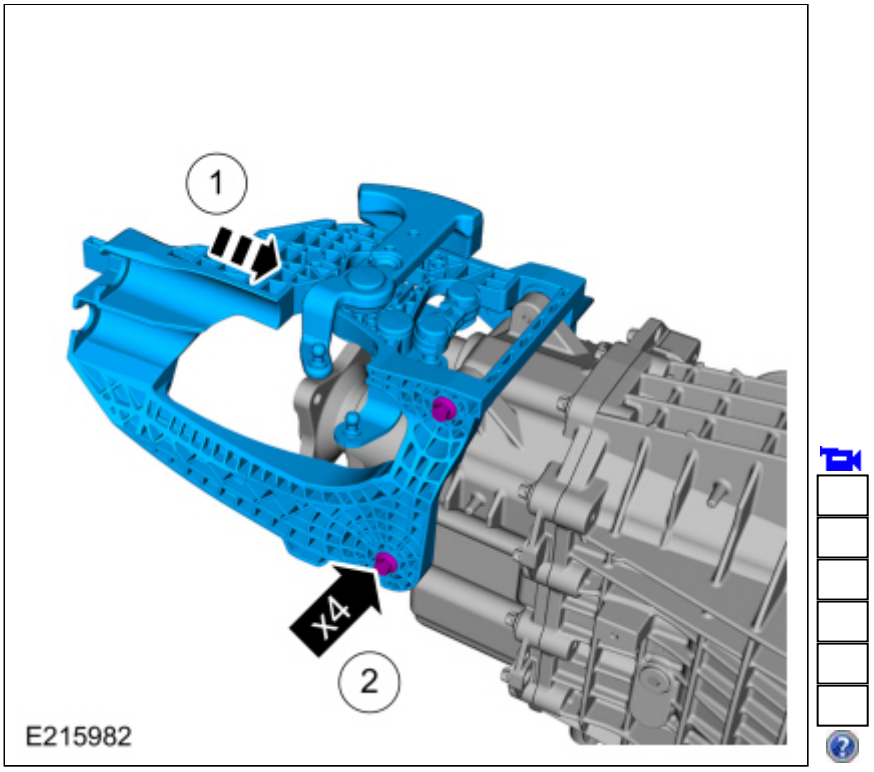
Special Tool(s) / General Equipment

Transmission Jack

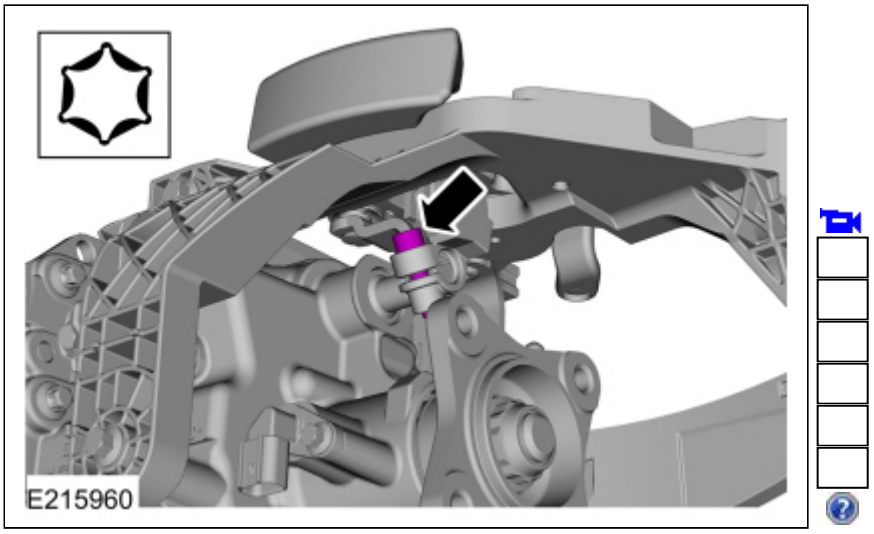
1. Check the pilot bearing for damage. If damaged, install a new pilot bearing.
   Refer to: Pilot Bearing - Diesel (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
   Refer to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

2. **NOTE:** *Do not apply grease to a newly installed pilot bearing.*

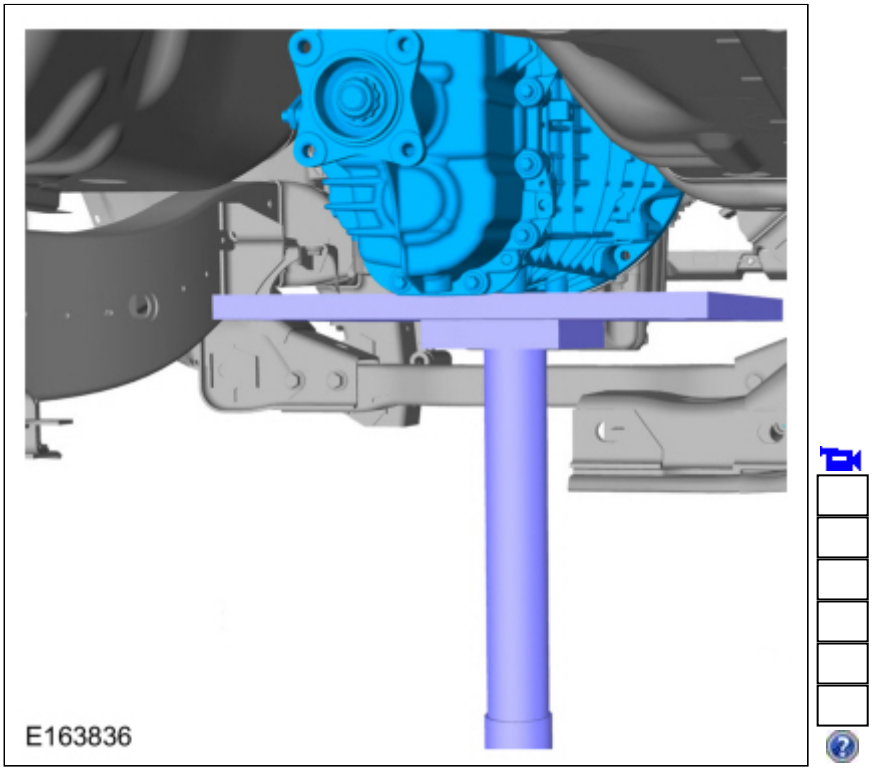
3. *Torque*: 20 Nm



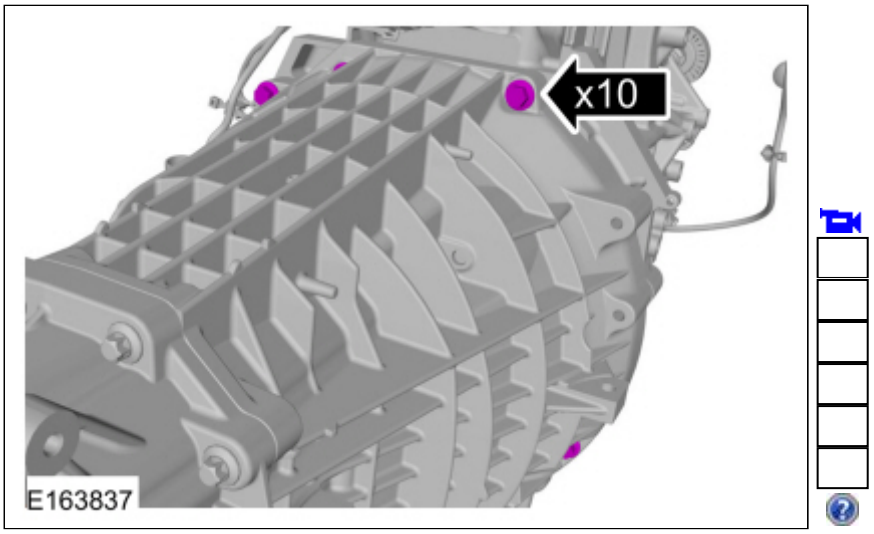
4. *Torque*: 20 Nm



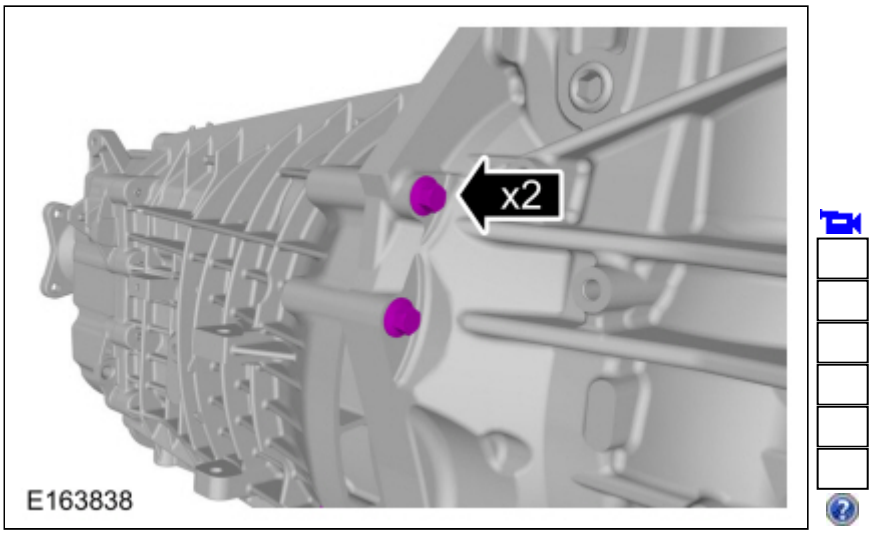
5. Use the General Equipment: Transmission Jack



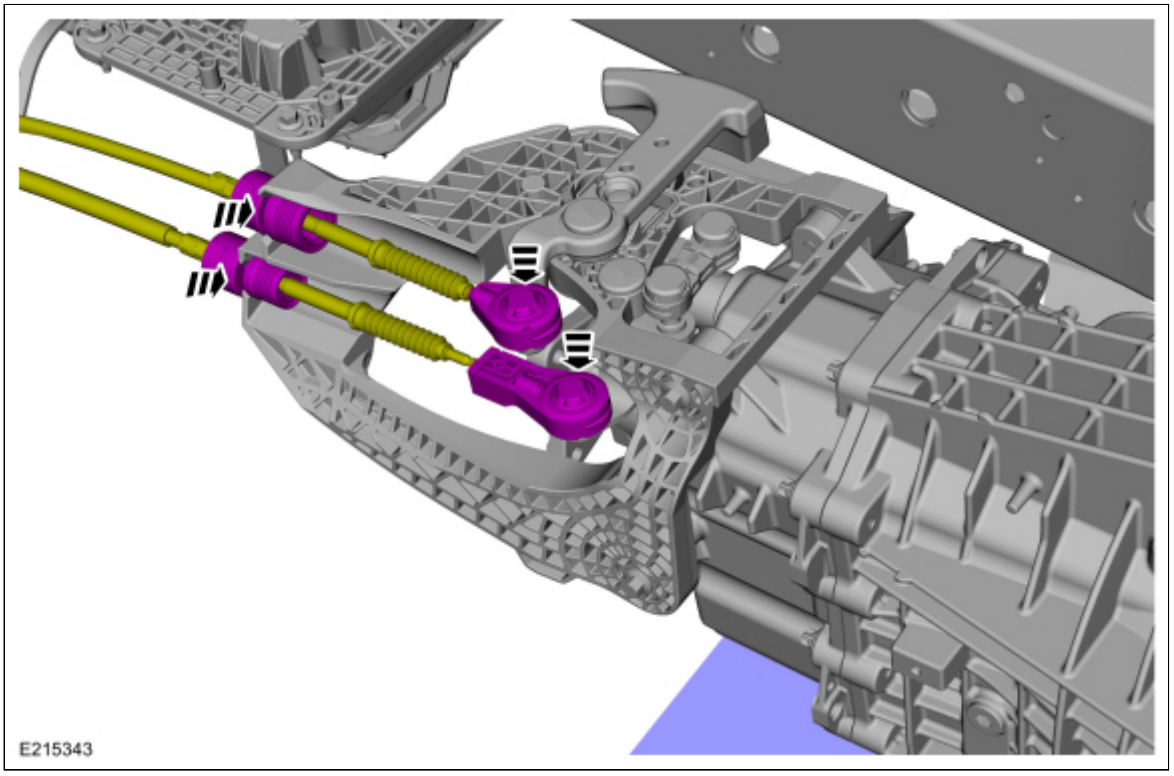
6.



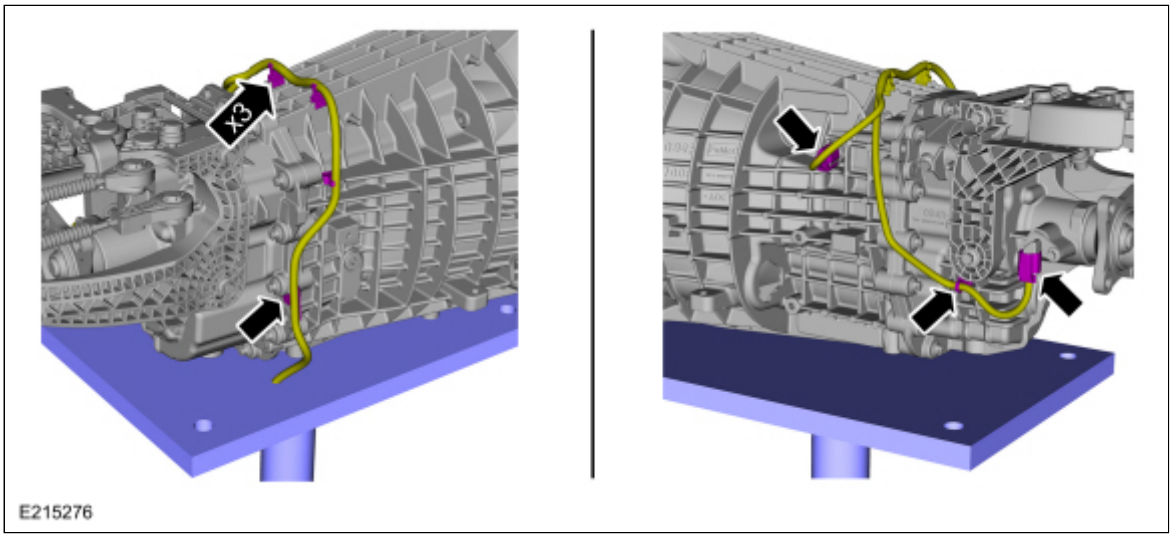
7.



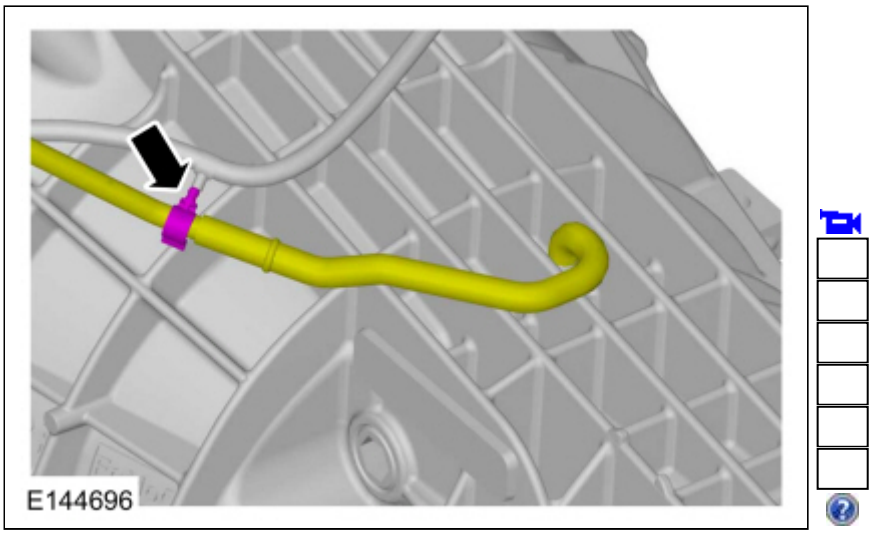
8. Refer to: Gearshift Cable Adjustment (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, General Procedures).



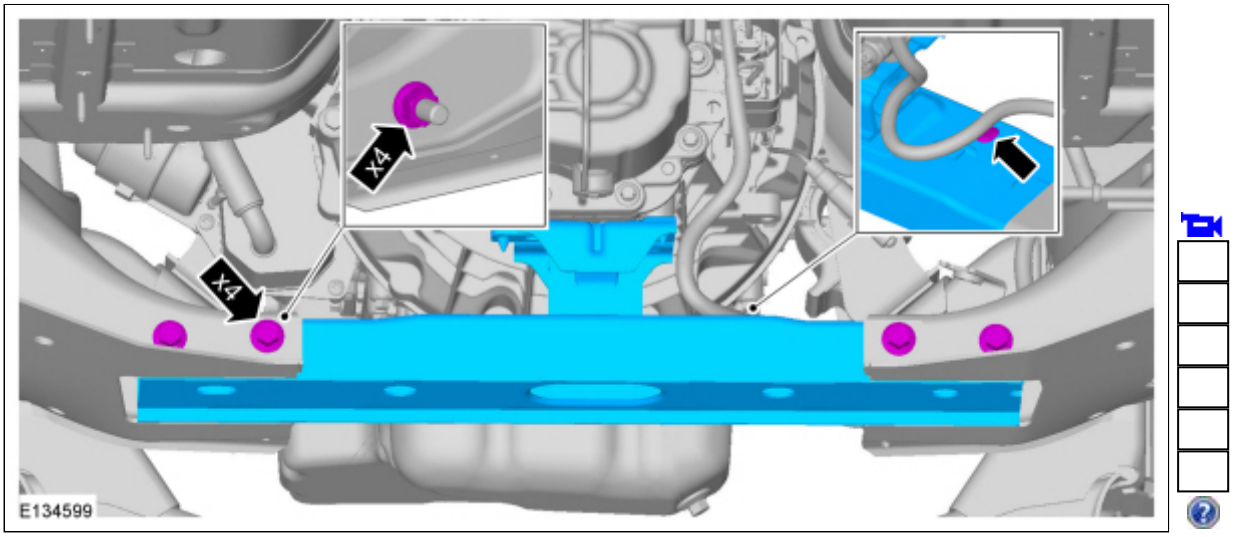
9. Use the General Equipment: Transmission Jack



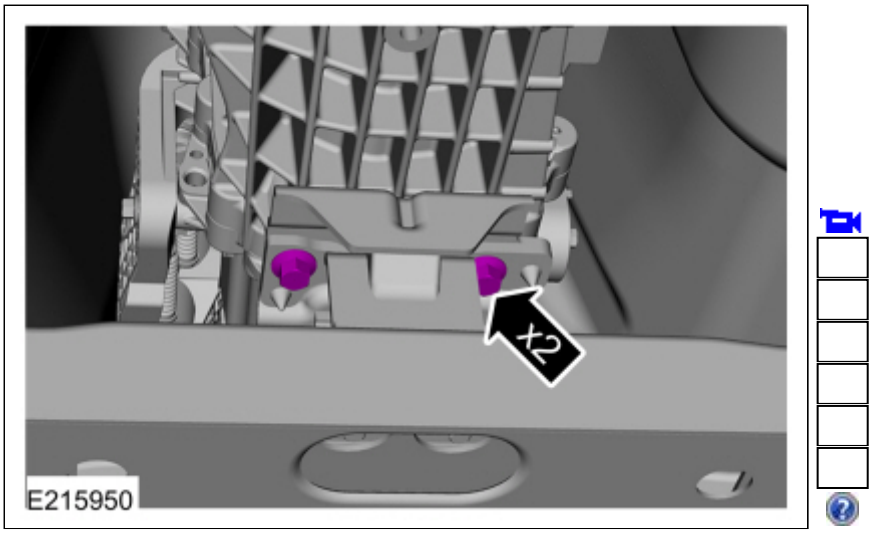
10.



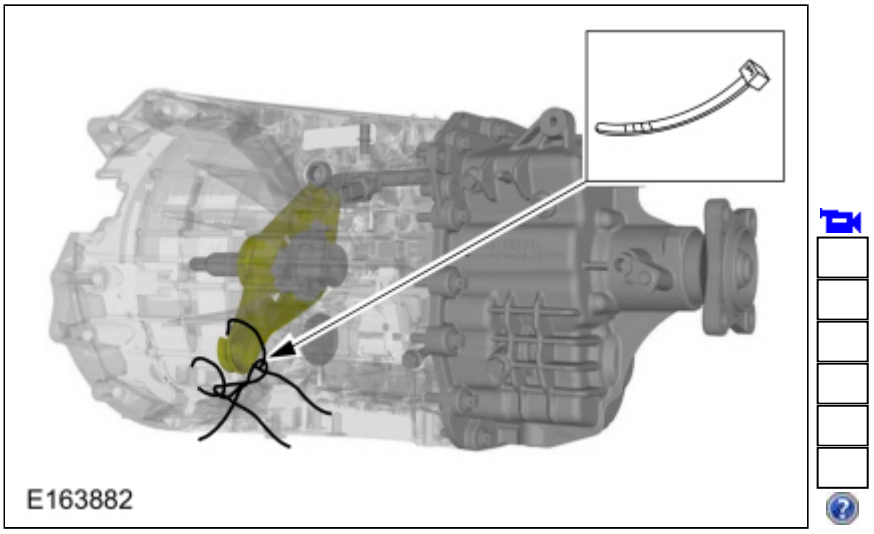
11. *Torque*: 90 Nm



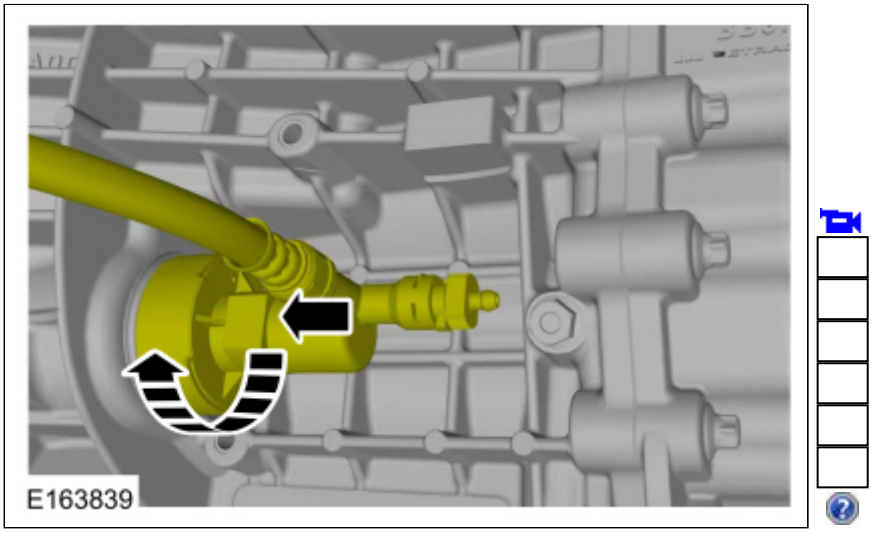
12. *Torque*: 55 Nm



13. Remove the cable ties.



14. **NOTE:** *Remove the insulation tape from the clutch slave cylinder.*



15. Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
    Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

16. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

17. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    Refer to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

18. Fill the transmission with oil.
    Refer to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).

19. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

20. Connect the battery.
    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

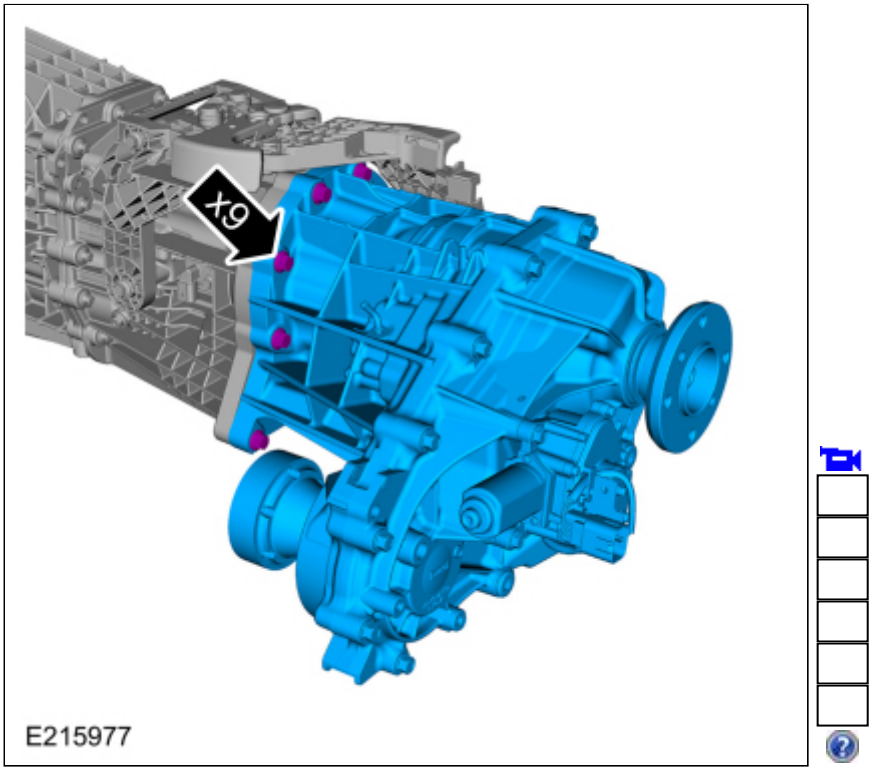
Transmission - 4x4

Base Part Number: 7000

Special Tool(s) / General Equipment

Feeler Gauge
Transmission Jack
Cable Ties
Adhesive Tape

1. *Torque*: 47 Nm

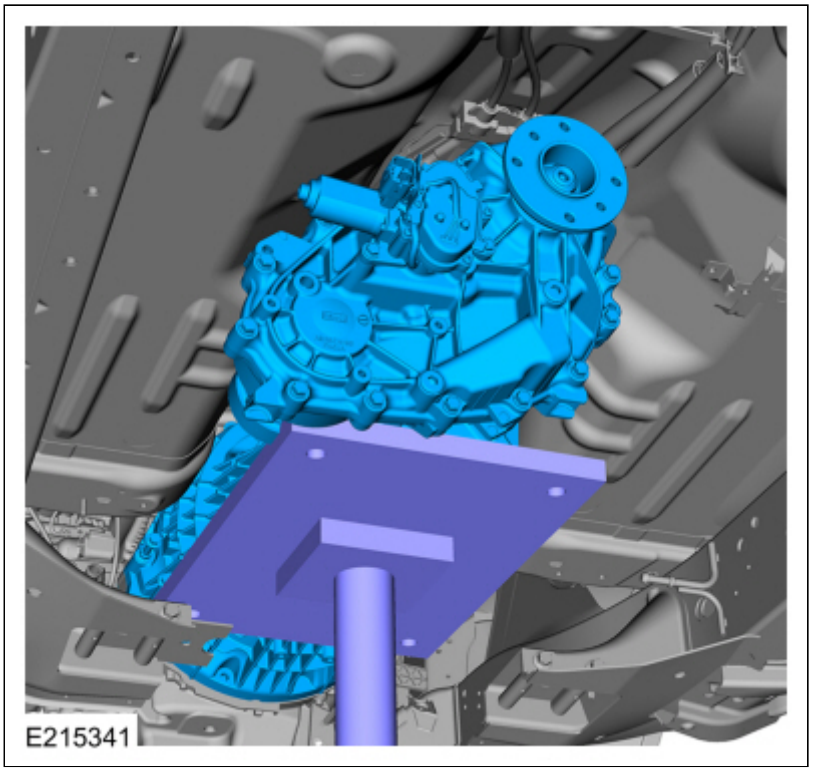


2. **NOTE:** *Check the pilot bearing for damage. If damaged, install a new pilot bearing.*

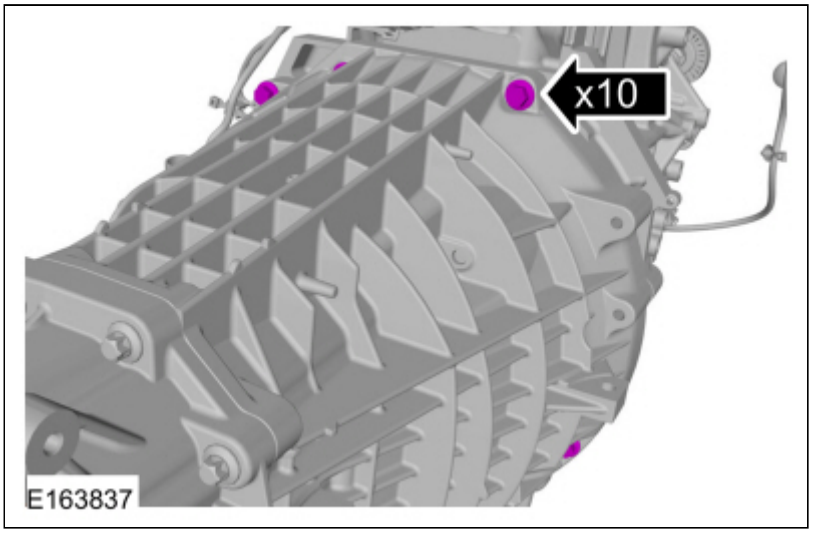
   NOTE: *Do not apply grease to a newly installed pilot bearing.*

   Refer to: Pilot Bearing - 2.5L Duratec-HE (122kW/165PS) - MI4 (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).
   Refer to: Pilot Bearing - Diesel (308-01A Clutch - 5-Speed Manual Transmission - MT75, Removal and Installation).

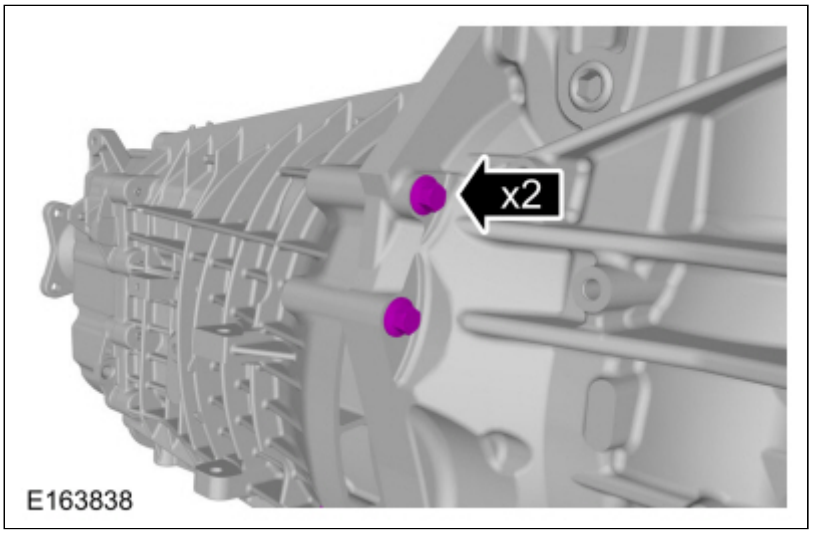
3. Use the General Equipment: Transmission Jack



4.

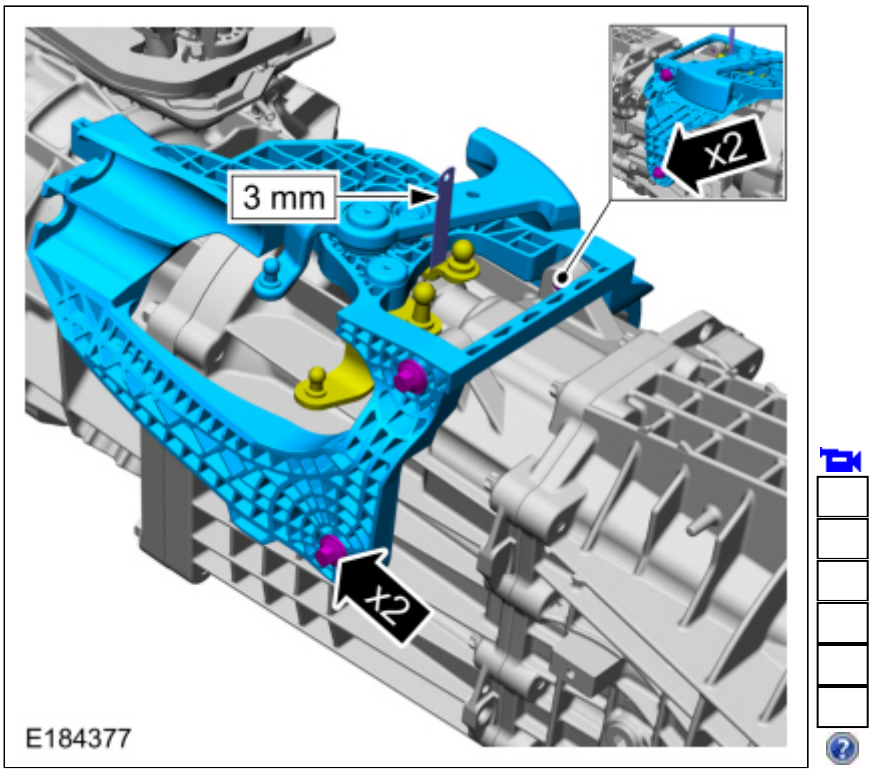


5.

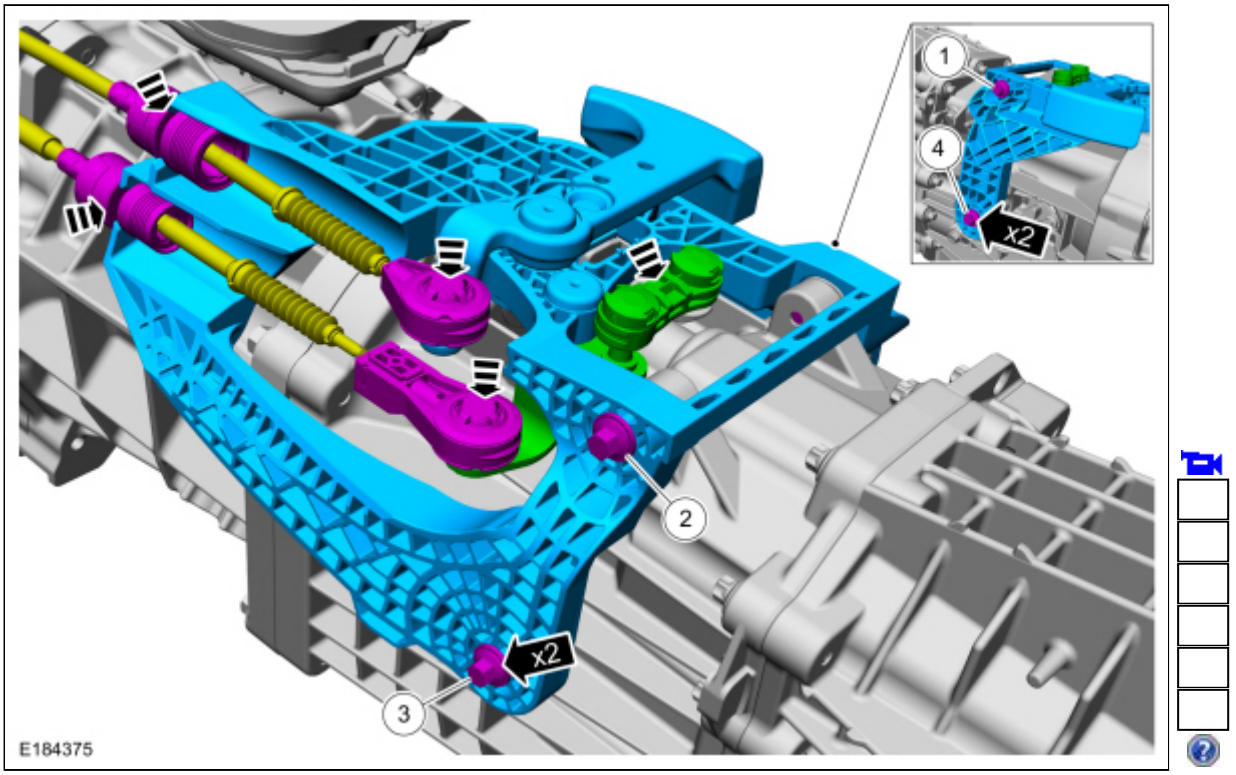


6. **NOTE:** *Only tighten the bolts finger tight at this stage.*

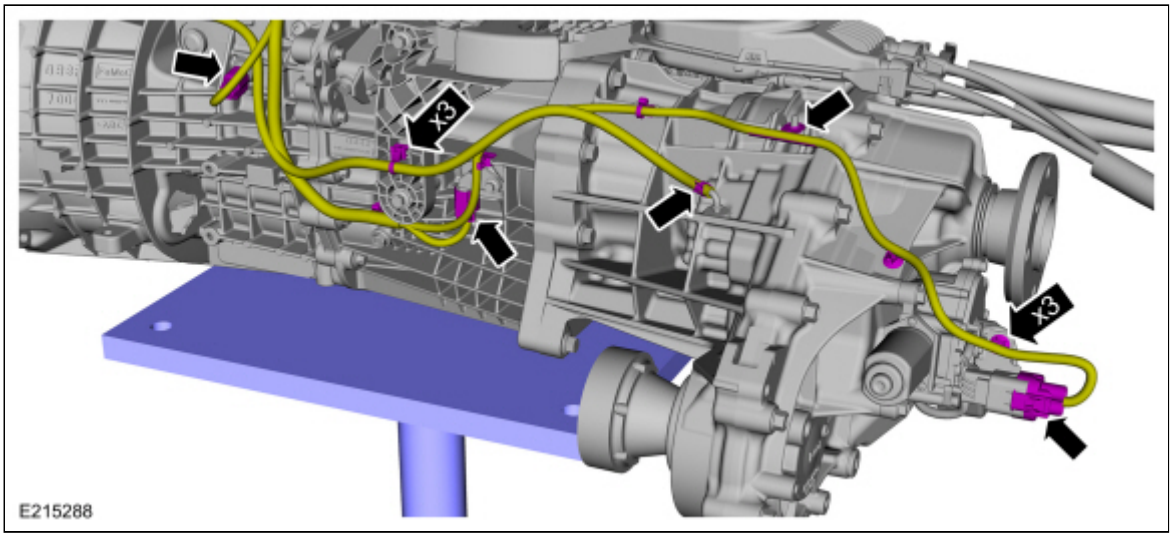
Use the General Equipment: Feeler Gauge



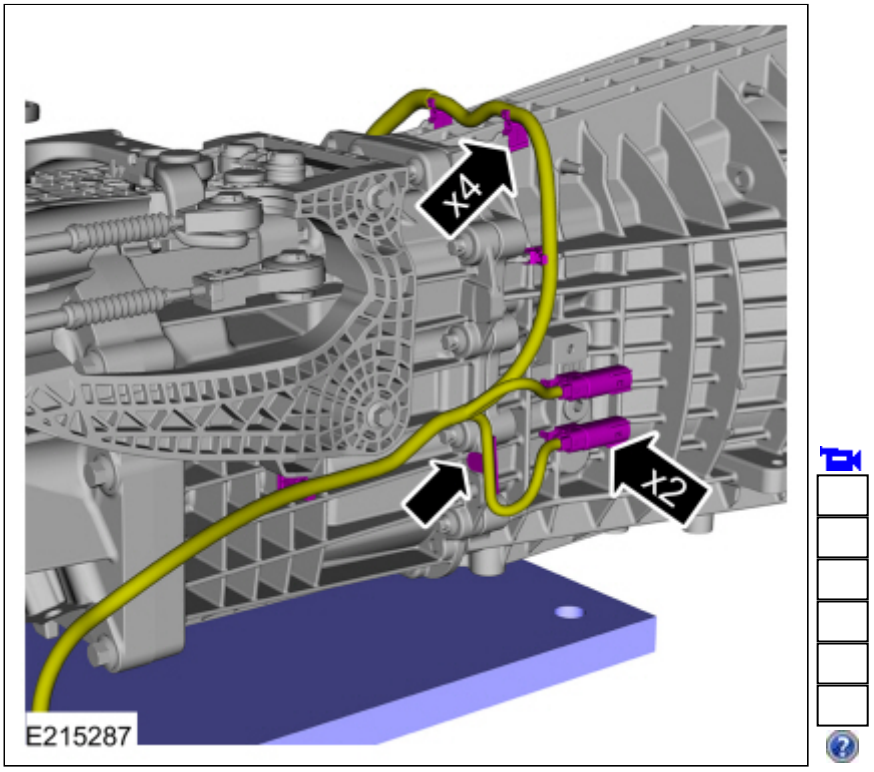
7. *Torque*: 20 Nm



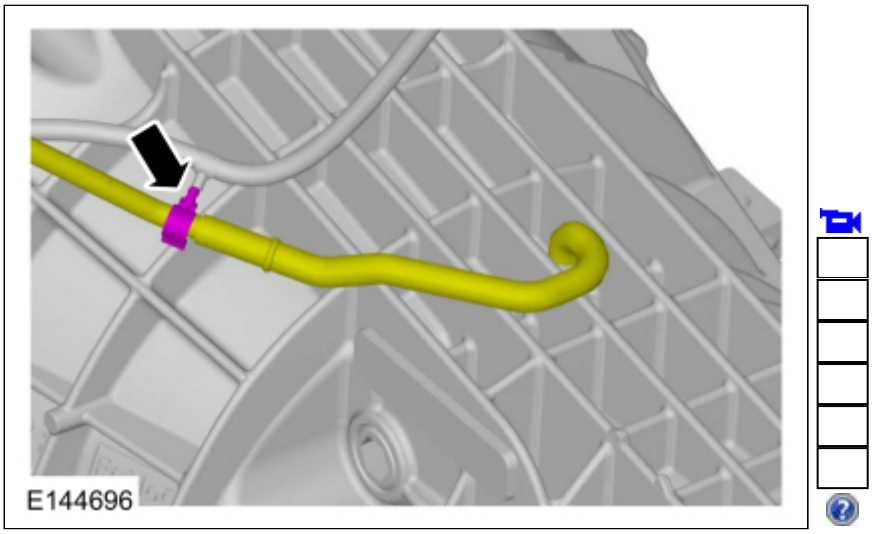
8. Use the General Equipment: Transmission Jack



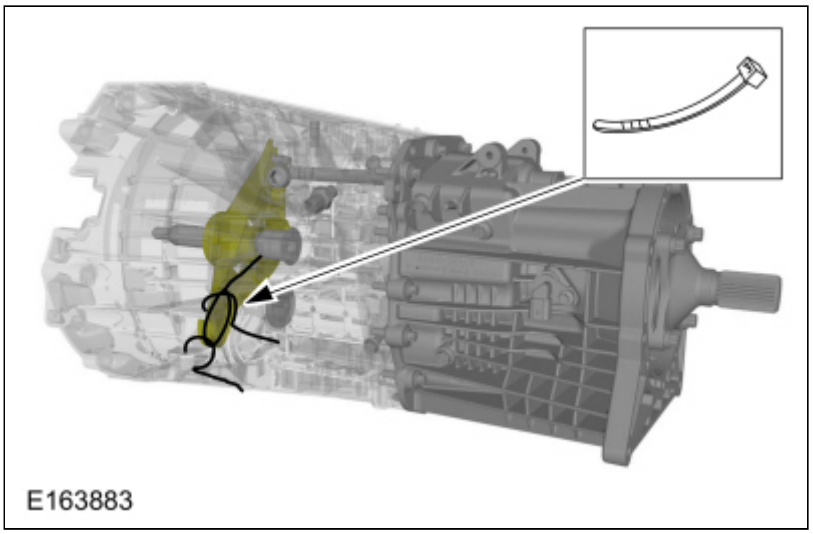
9. Use the General Equipment: Transmission Jack



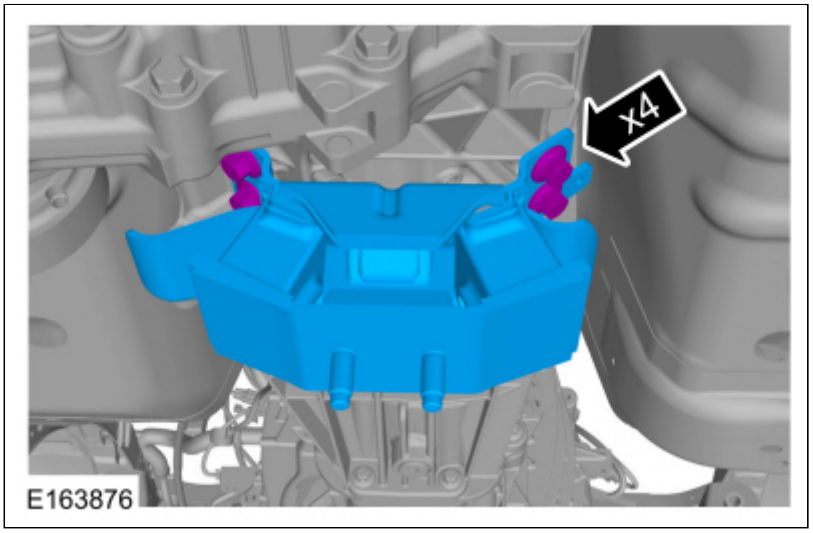
10.



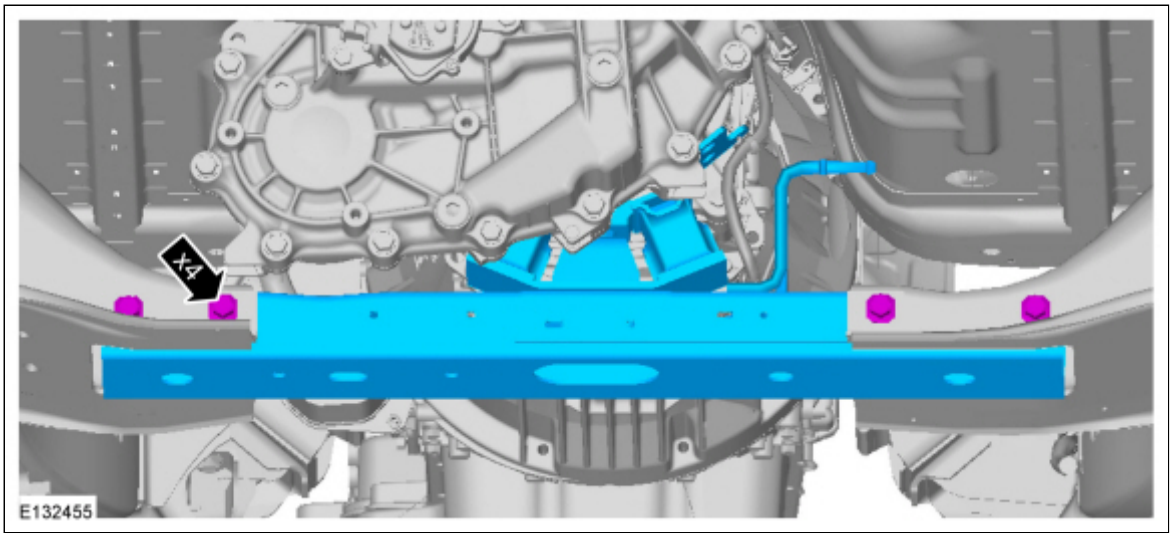
11. Remove the General Equipment: Cable Ties



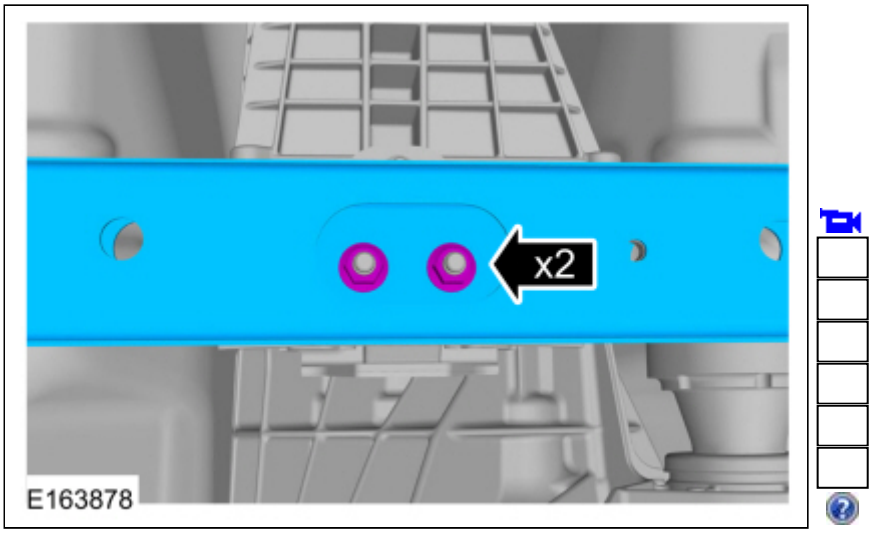
12. Use the General Equipment: Transmission Jack
    Torque: 90 Nm



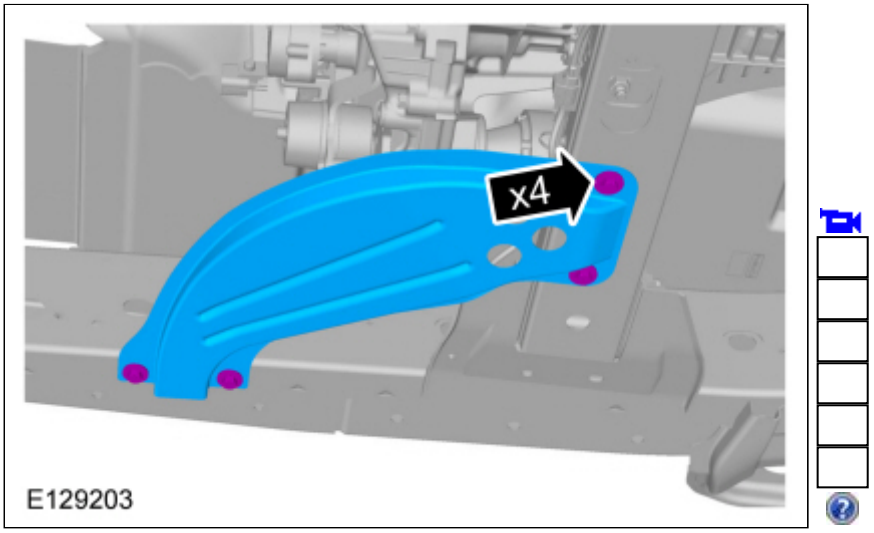
13. *Torque*: 90 Nm



14. *Torque*: 60 Nm

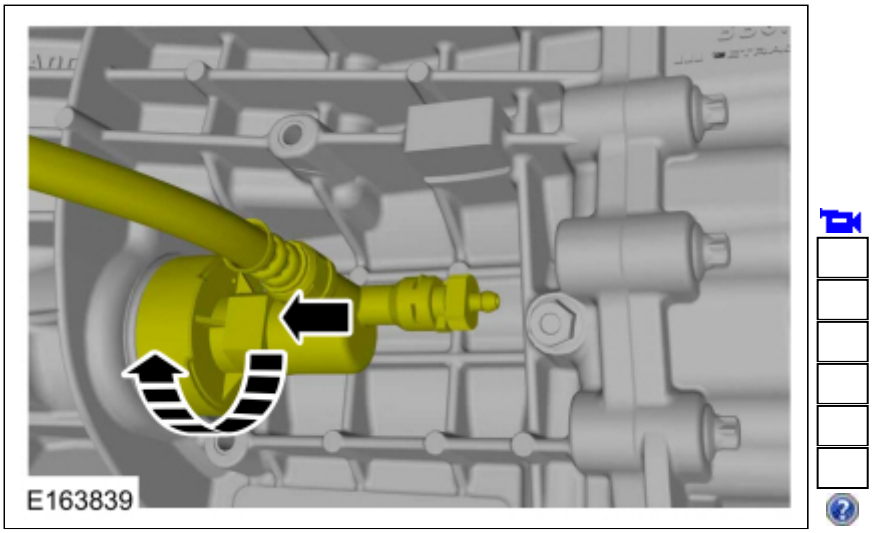


15. *Torque*: 15 Nm



16. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
    Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

17. Remove the General Equipment: Adhesive Tape



18. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
    Refer to: Starter Motor (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

19. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi

(110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
Refer to: Catalytic Converter (309-00A Exhaust System - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

20. Refer to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).
21. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
22. Refer to: Gearshift Cable Adjustment (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, General Procedures).
23. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Manual transmission fluid	WSS-M2C200-D2
Thread locking compound	WSK-M2G349-A7
Sealant	WSK-M2G348-A7
Grease	ESD-M1C220-A

Capacities

	Litres
MT82 transmission - Service fill	2.6
MT82 transmission - Add-on for initial fill or if transmission has been disassembled and assembled in the workshop	0.1

Torque Specifications

Description	Nm	lb-ft	lb-in
Transmission retaining bolts	50	37	-
Reversing lamp switch	20	15	-
Transmission output shaft flange retaining nut	180	133	-
Oil drain plug	50	37	-
Oil fill plug	35	26	-

Transmission Ratios

2.2/3.2L Diesel Mid/High Power	Gearbox Ratio(s)
1st gear	5.701
2nd gear	2.850
3rd gear	1.645
4th gear	1.183
5th gear	1.000
6th gear	0.814
Reverse gear	5.170

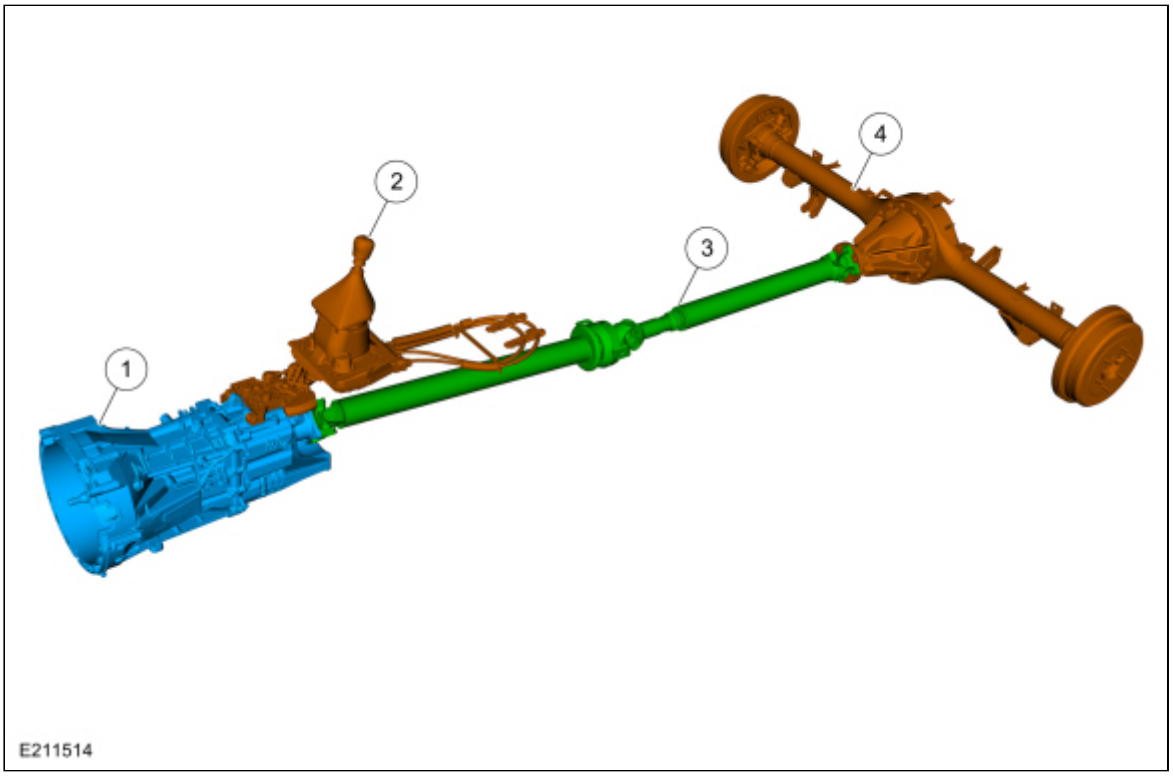
*The overall ratio for reverse gear is calculated by multiplying the internal gearbox ratio for reverse gear, 1st gear and the final drive ratio of the 5th/6th and reverse gear output shaft.

Copyright © 2016 Ford Motor Company

Manual Transmission - Overview

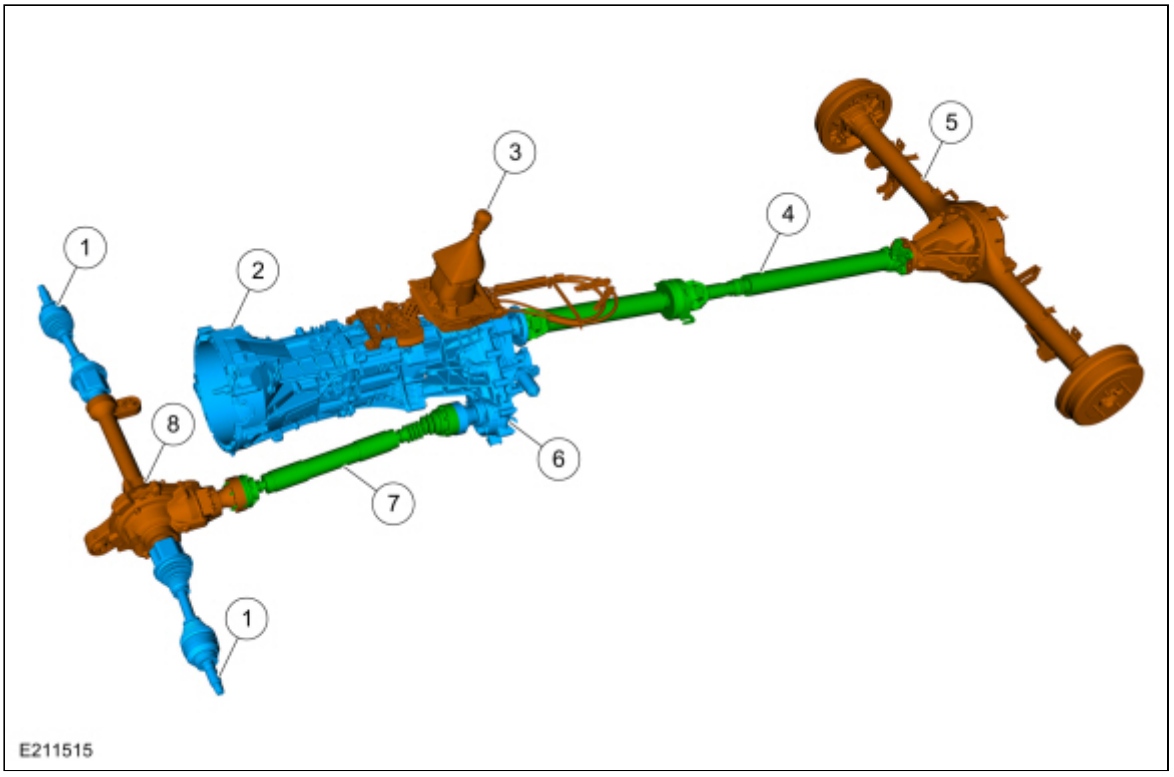
Component Location

4x2



Item	Description
1	MT82 transmission - 4X2
2	Gearshift lever
3	Rear driveshaft
4	Rear drive axle

4x4

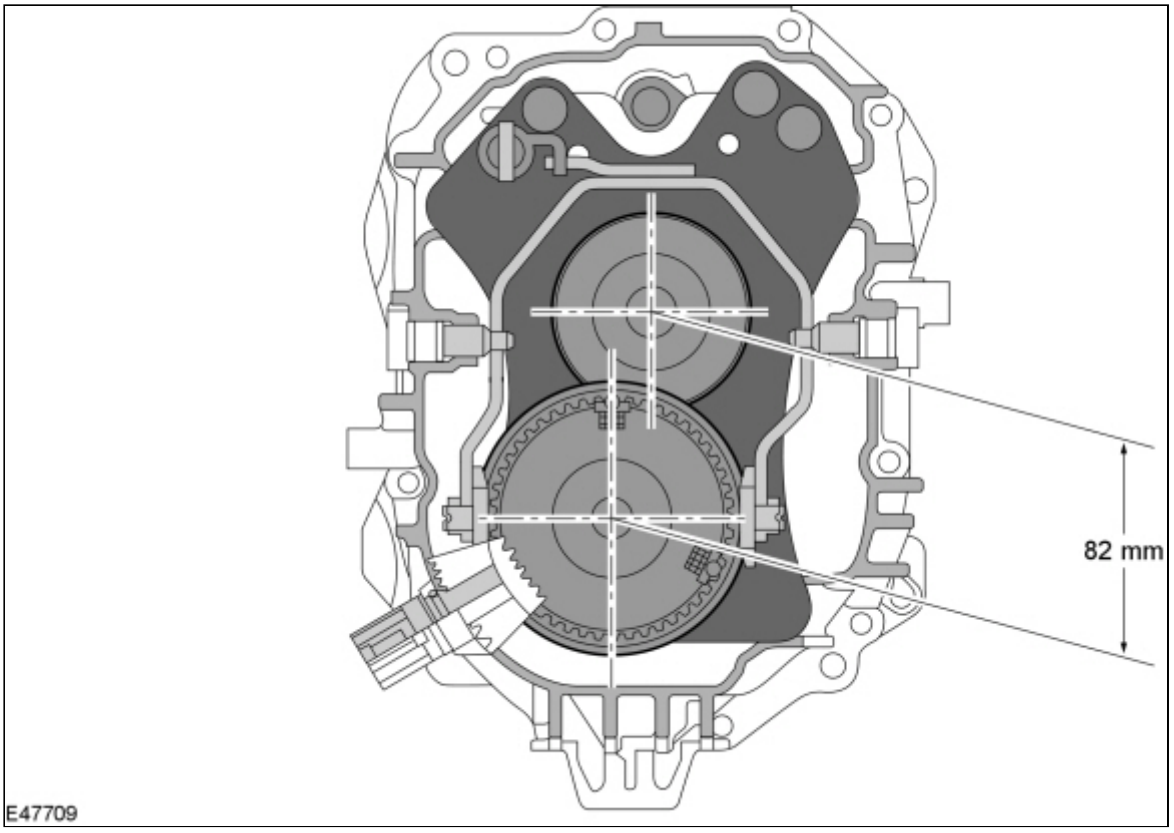


Item	Description
1	Front drive halfshafts
2	MT82 transmission - 4X4
3	Gearshift lever
4	Rear driveshaft
5	Rear drive axle
6	Transfer case
7	Front driveshaft
8	Front drive axle

Overview

The name of the 6-speed manual transaxle MT82 is derived from the distance between the two shafts in the transaxle:

- M stands for Manual
- T stands for Transaxle
- 82 is the distance between the two shafts in mm



Transaxles are designed for a torque of max. 480 Nm.

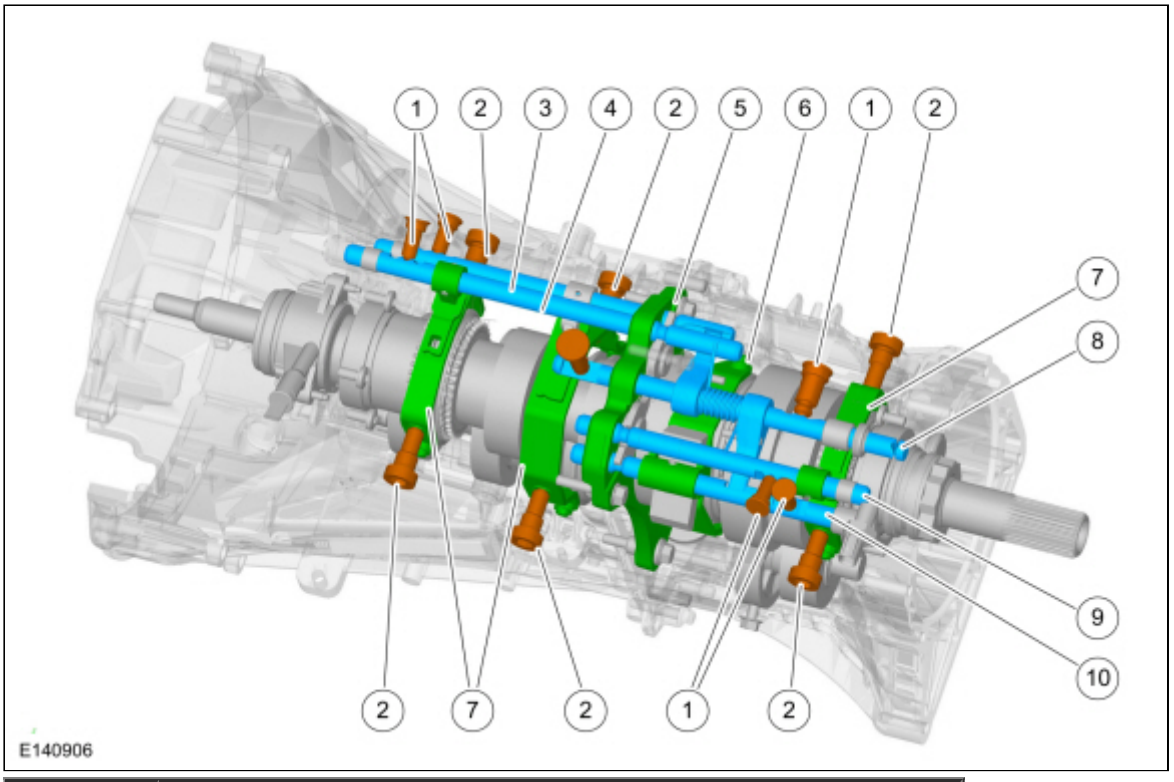
In order to ensure secure mounting of the selector rods, these are passed through a centre bearing mounting plate. The centre bearing mounting plate is in turn bolted to the housing.

All gear selector forks and shift forks are made of forged steel.

The sliding elements of the selector forks are made of a plastic material that exhibits high resistance to wear.

The main selector shaft is mounted in the centre bearing mounting plate.

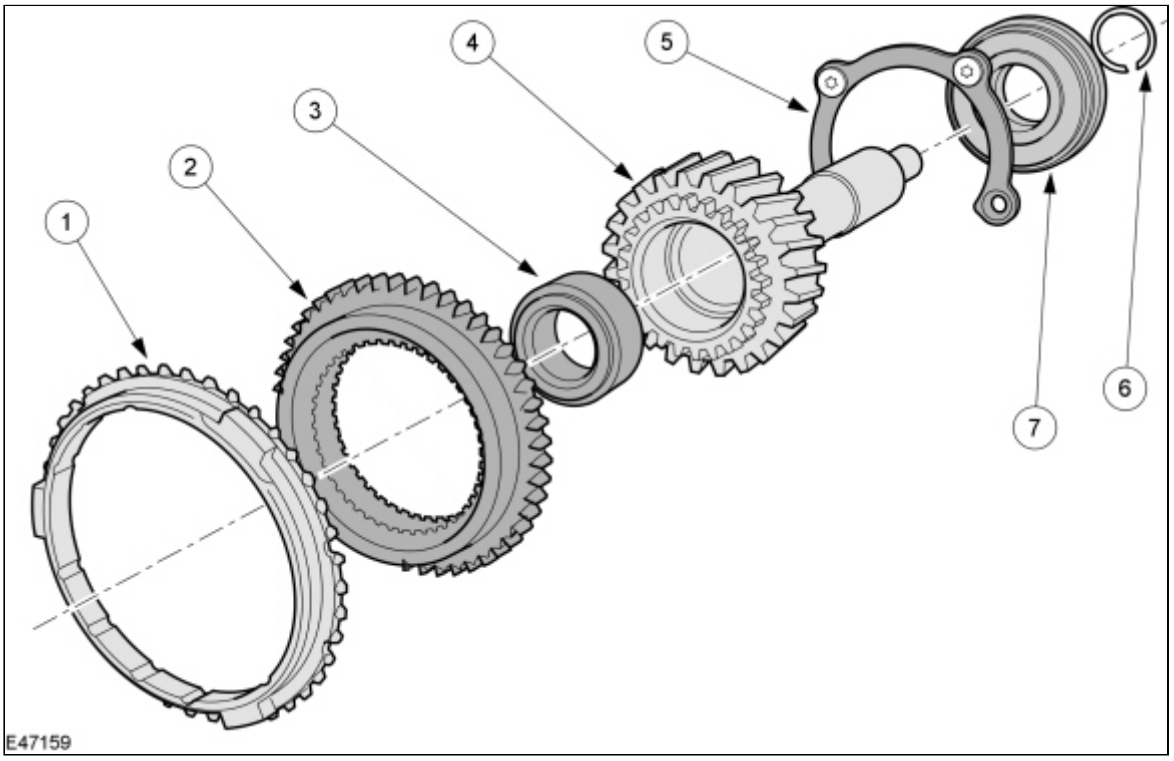
Internal gearshift mechanism



Item	Description
1	Selector rod detent

2	Shift fork bolt
3	3rd/4th gear selector rod
4	5th/6th gear selector rod
5	Centre bearing mounting plate
6	1st/2nd gear selector fork
7	Shift fork
8	Main shift rod
9	Reverse gear selector rod
10	1st/2nd gear selector rod

Input shaft



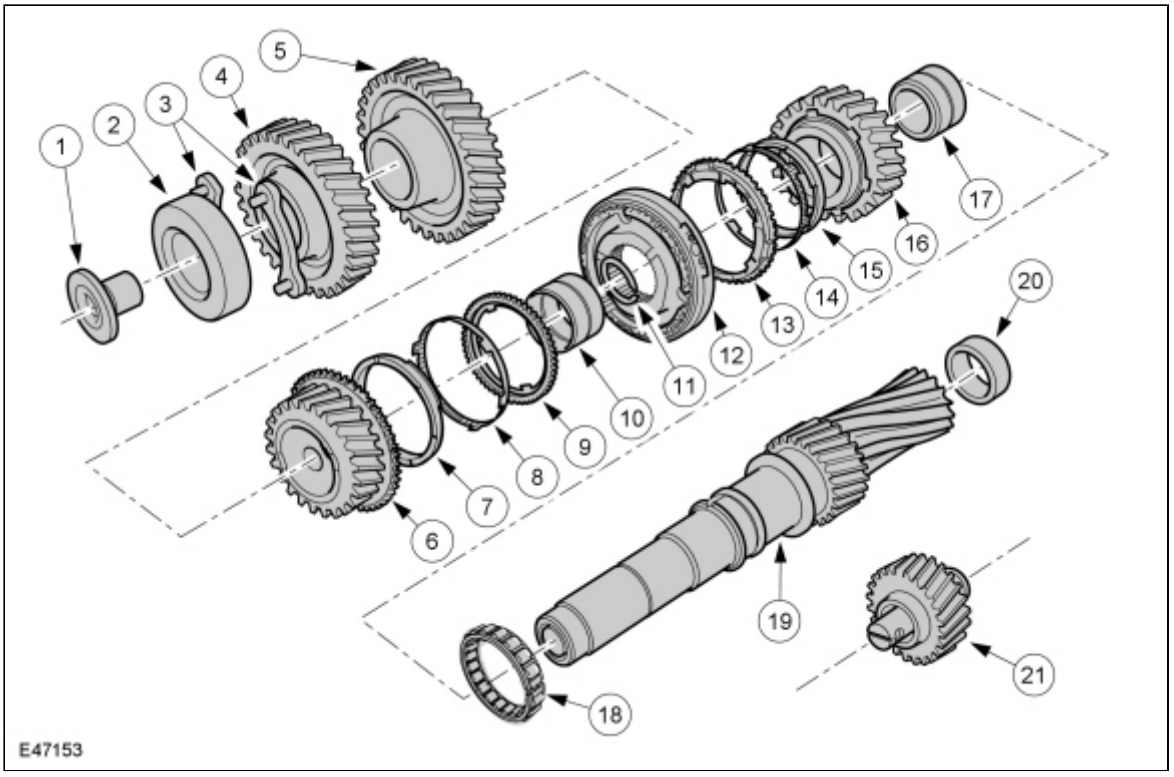
Item	Description
1	Synchronizer ring (5th gear)
2	5th gear Synchronizer teeth
3	Output shaft pilot bearing
4	Input shaft
5	Bearing retaining plate
6	Ball bearing circlip
7	Input shaft ball bearing

The output shaft is rotationally mounted in the input shaft on the pilot bearing.

In order to absorb the axial forces, the input shaft ball bearing is additionally secured.

All the components of the input shaft can be detached and replaced separately.

Layshaft



Item	Description
1	Fixing bolt
2	Countershaft ball bearing
3	Bearing retaining plate
4	Countershaft input pinion
5	6th gear
6	3rd gear
7	Inner synchronizer ring
8	3rd gear synchronizer cone
9	3rd gear outer synchronizer ring
10	Needle bearing
11	Retaining ring
12	3rd/4th gear synchronizer clutch
13	4th gear outer synchronizer ring
14	4th gear synchronizer cone
15	Inner synchronizer ring
16	4th gear
17	Needle bearing
18	Countershaft centre bearing
19	Layshaft
20	Countershaft roller bearing
21	Reverse gear idler

The countershaft transfers the torque from the input shaft to the output shaft. Gear wheels, gears and the 3rd/4th gear synchronizer clutch are located on the shaft. The gears of the 1st, 2nd and reverse gears are an integral part of the shaft.

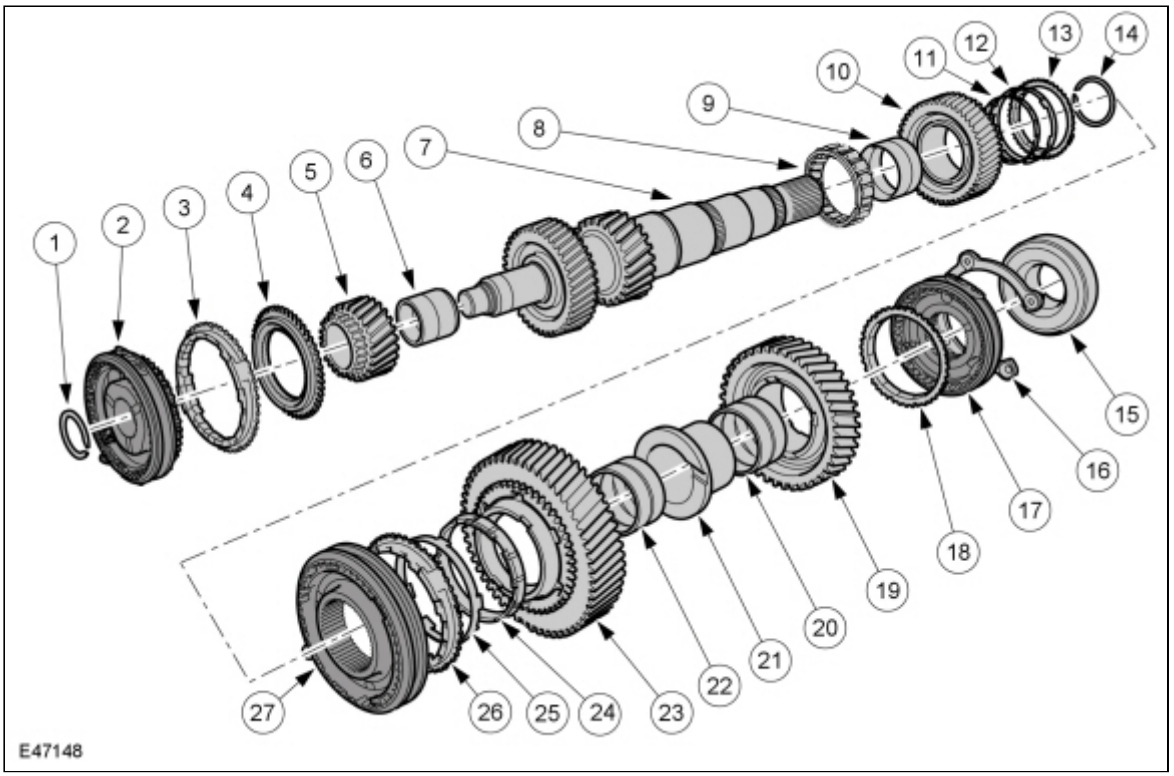
The Countershaft can be completely dismantled, i.e. faulty gear wheels or gears can be replaced singly. Because of improved tolerances, it is no longer necessary to replace the gears in pairs.

The countershaft is a solid shaft. In order to prevent the shaft from moving axially, it is additionally secured with a

retaining bolt and a bearing retaining plate.

The retaining bolts are installed with thread locking compound.

Output shaft



Item	Description
1	Retaining ring
2	5th/6th gear synchronizer clutch
3	6th gear synchronizer ring
4	6th gear synchronizer teeth
5	6th gear wheel
6	Needle bearing
7	Output shaft
8	Output shaft centre bearing
9	Needle bearing
10	2nd gear
11	2nd gear synchronizer cone
12	Inner synchronizer ring
13	2nd gear outer synchronizer ring
14	Retaining ring
15	Output shaft ball bearing
16	Bearing retaining plate
17	Reverse gear synchronizer clutch
18	Reverse gear synchronizer ring
19	Reverse gear
20	Needle bearing
21	Needle bearing inner ring
22	Needle bearing
23	1st gear
24	1st gear synchronizer cone

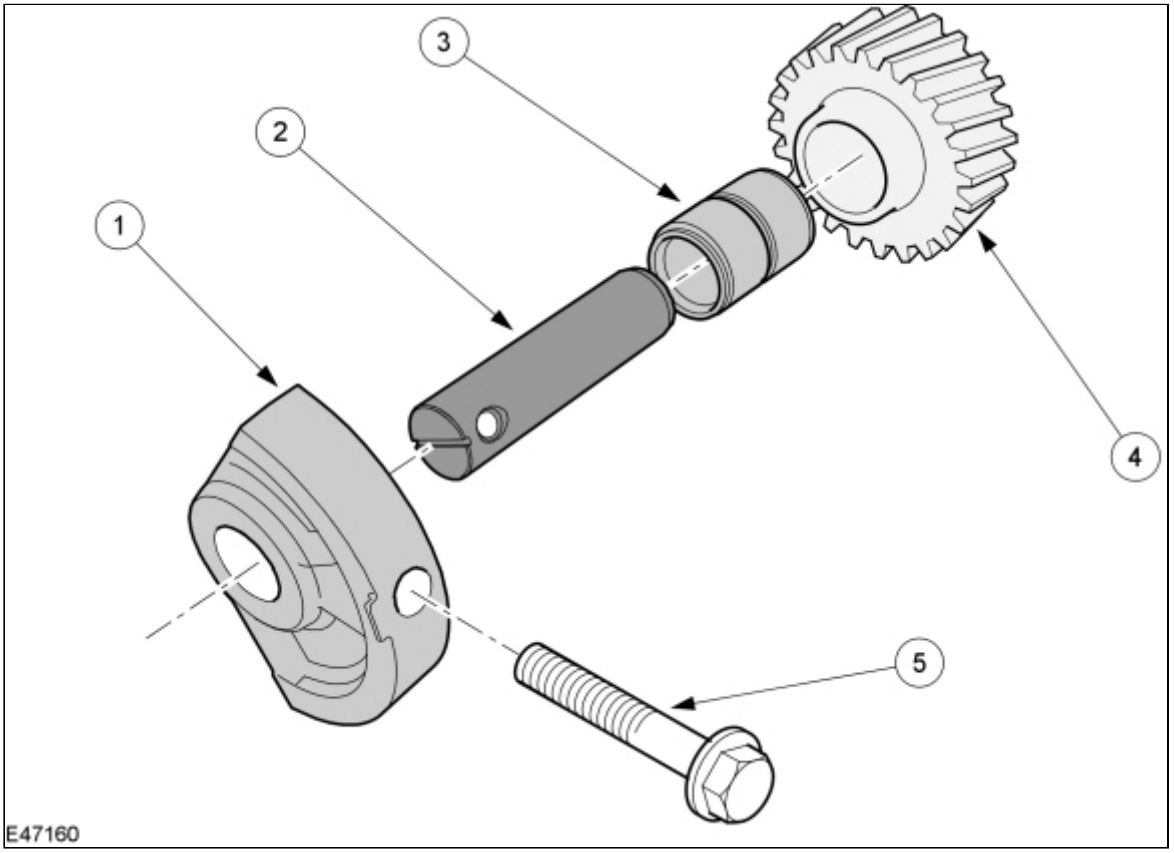
25	1st gear inner synchronizer ring
26	1st gear outer synchronizer ring
27	1st/2nd gear synchronizer clutch

The output shaft transfers the torque through the driveshaft output flange to the driveshaft and then to the rear axle. The 1st/2nd/6th and reverse gear wheels are located on the output shaft. The gears of the 3rd and 4th gear are an integral part of the output shaft.

Synchronizer teeth have place on the 6th gear wheel. This makes it possible to transfer the torque in 6th gear.

Output shaft can be completely dismantled. Damaged gear wheels and gears can be replaced individually.

Reverse gear idler



Item	Description
1	Mounting
2	Reverse gear idler shaft
3	Needle bearing
4	Reverse gear idler
5	Reverse gear mounting retaining bolt

The reverse idler gear turns on a needle bearing, which runs on the reverse gear idler shaft. The shaft is retained by the mounting and a locating bore in the transaxle housing.

The reverse gear mounting retaining bolt is secured with thread locking compound. For this reason, the reverse gear mounting retaining bolt may only be used once.

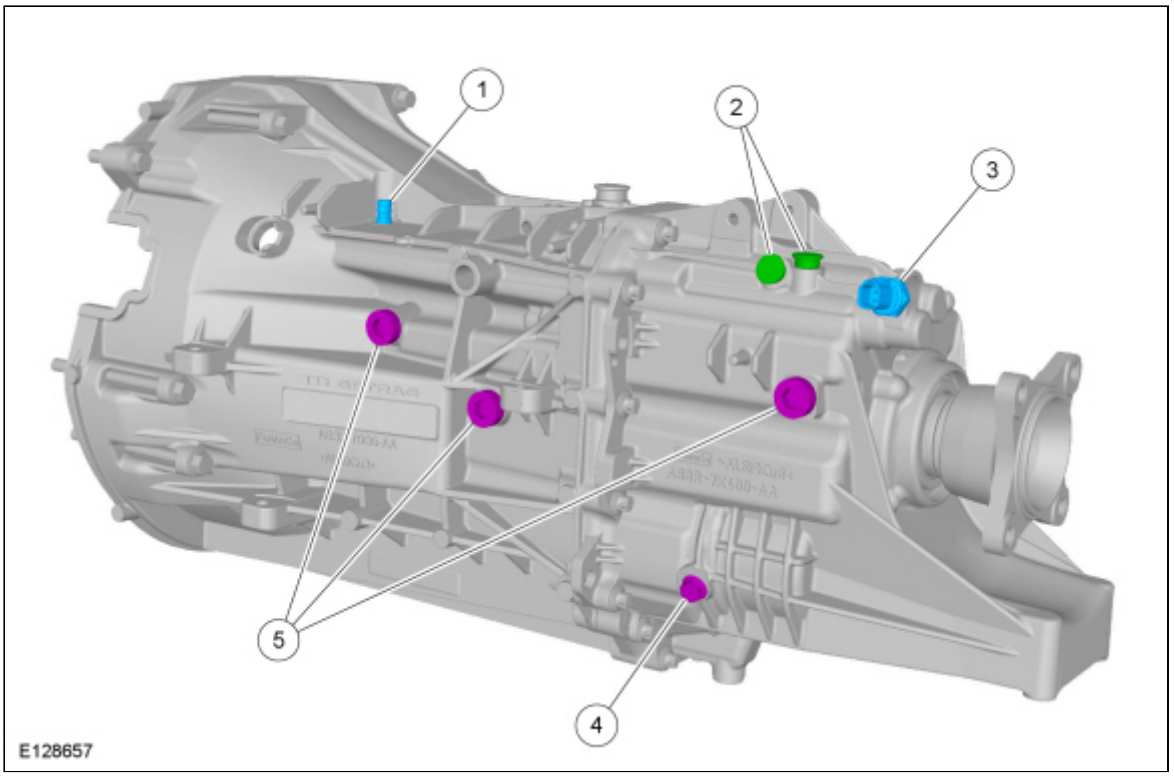
In order to absorb the radial forces, the reverse gear runs on an additional mounting.

If the reverse idler gear becomes damaged, it can be changed as an individual unit.

NOTE: *On transaxles used in combination with the 3.2L Duratorq TDCi engine, the first gear has been reinforced by means of a special shot blasting method.*

4x2

Side view - left-hand side

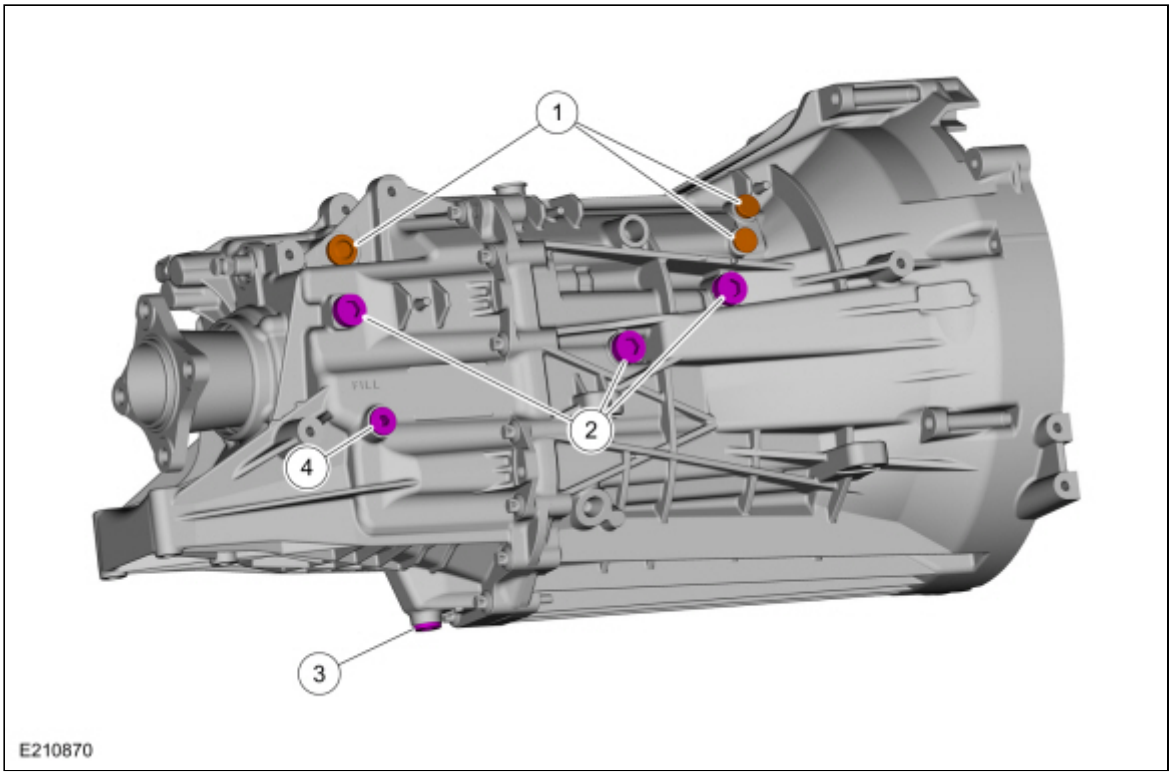


Item	Description
1	Transaxle breather
2	Selector rod detents
3	Reverse switch
4	Reverse gear mounting retaining bolt
5	Shift fork bolts

The reverse idler gear shaft is attached to the housing using the reverse gear mounting retaining bolt (4). This should not be mixed up with any other bolt on the transaxle.

NOTE: *The reverse gear mounting retaining bolt should only be removed to dismantle the transaxle.*

Side view - right-hand side



Item	Description
1	Shift fork bolts
2	Selector rod detents
3	Vehicle speed sensor
4	Oil drain plug
5	Oil filler plug / oil level check

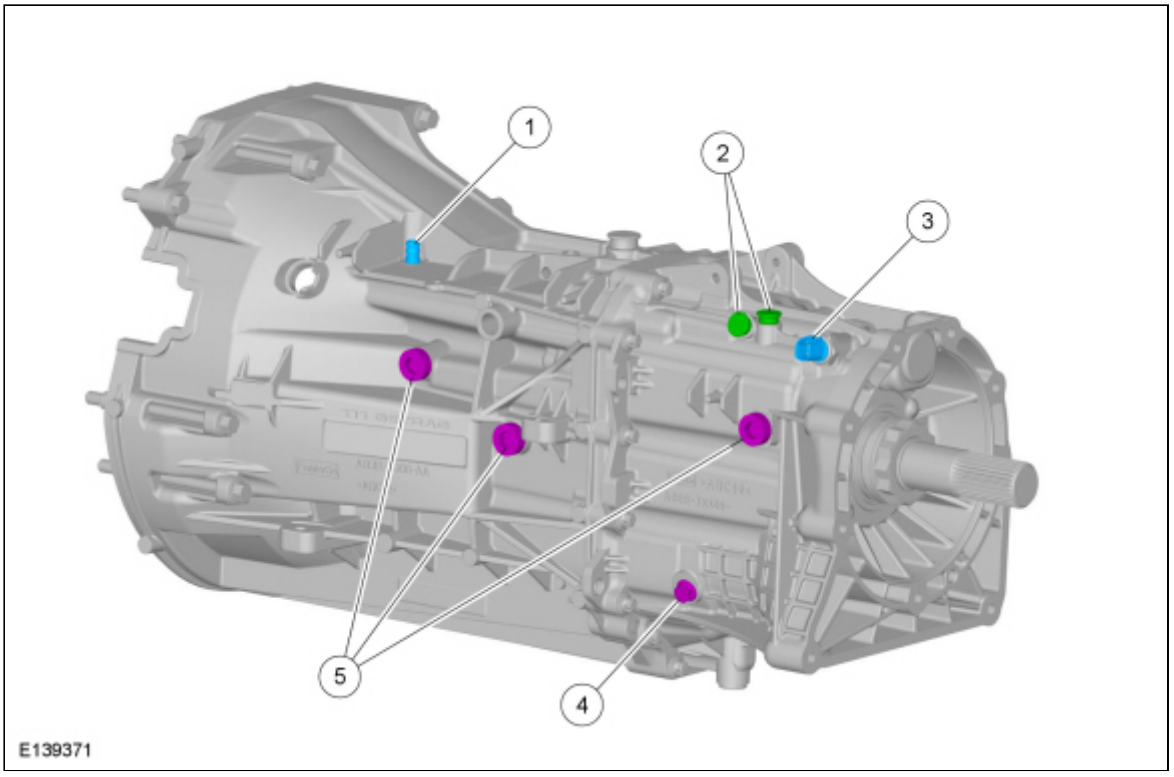
The transmission oil in the MT82 6-speed transaxle does not need to be changed in service. Only before repair work on the transaxle should the transmission oil be drained by removing the oil drain plug (4).

NOTE: *The shift fork bolts (1) must only be removed during repair.*

The oil filler plug (5) also allows the oil level to be checked.

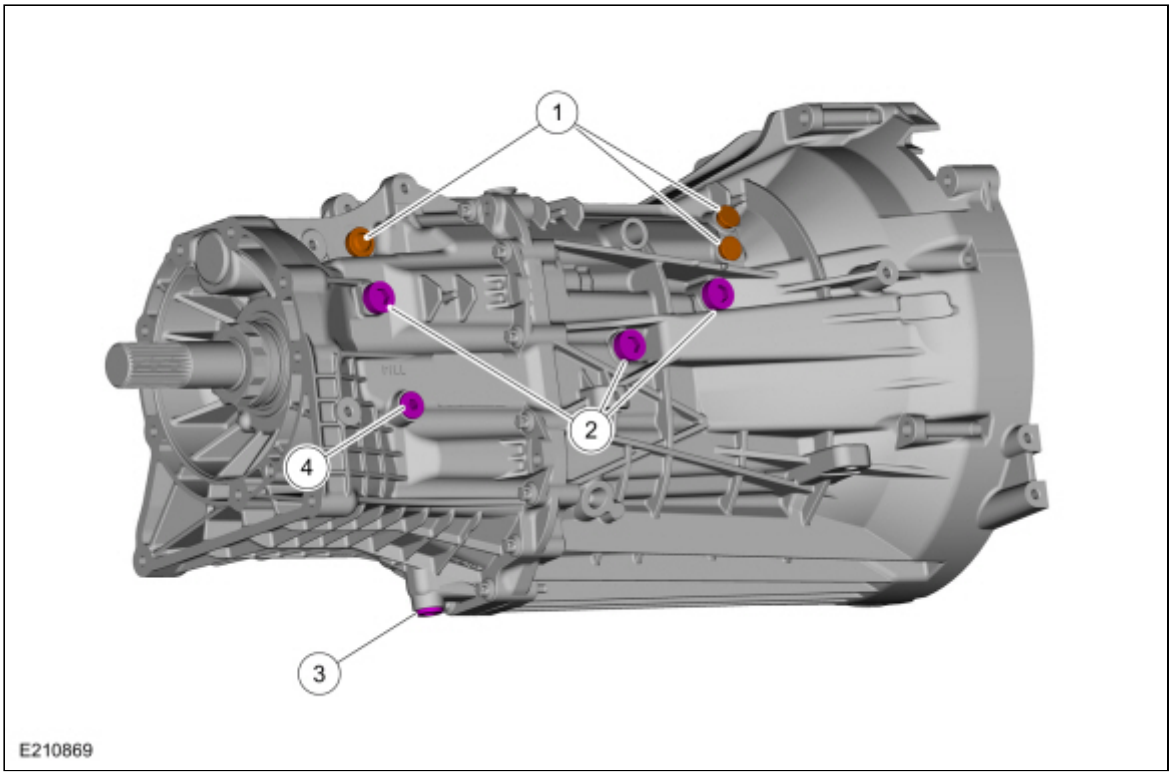
4x4

Side view - left-hand side



Item	Description
1	Transaxle breather
2	Selector rod detents
3	Reverse switch
4	Reverse gear mounting retaining bolt
5	Shift fork bolts

Side view - right-hand side

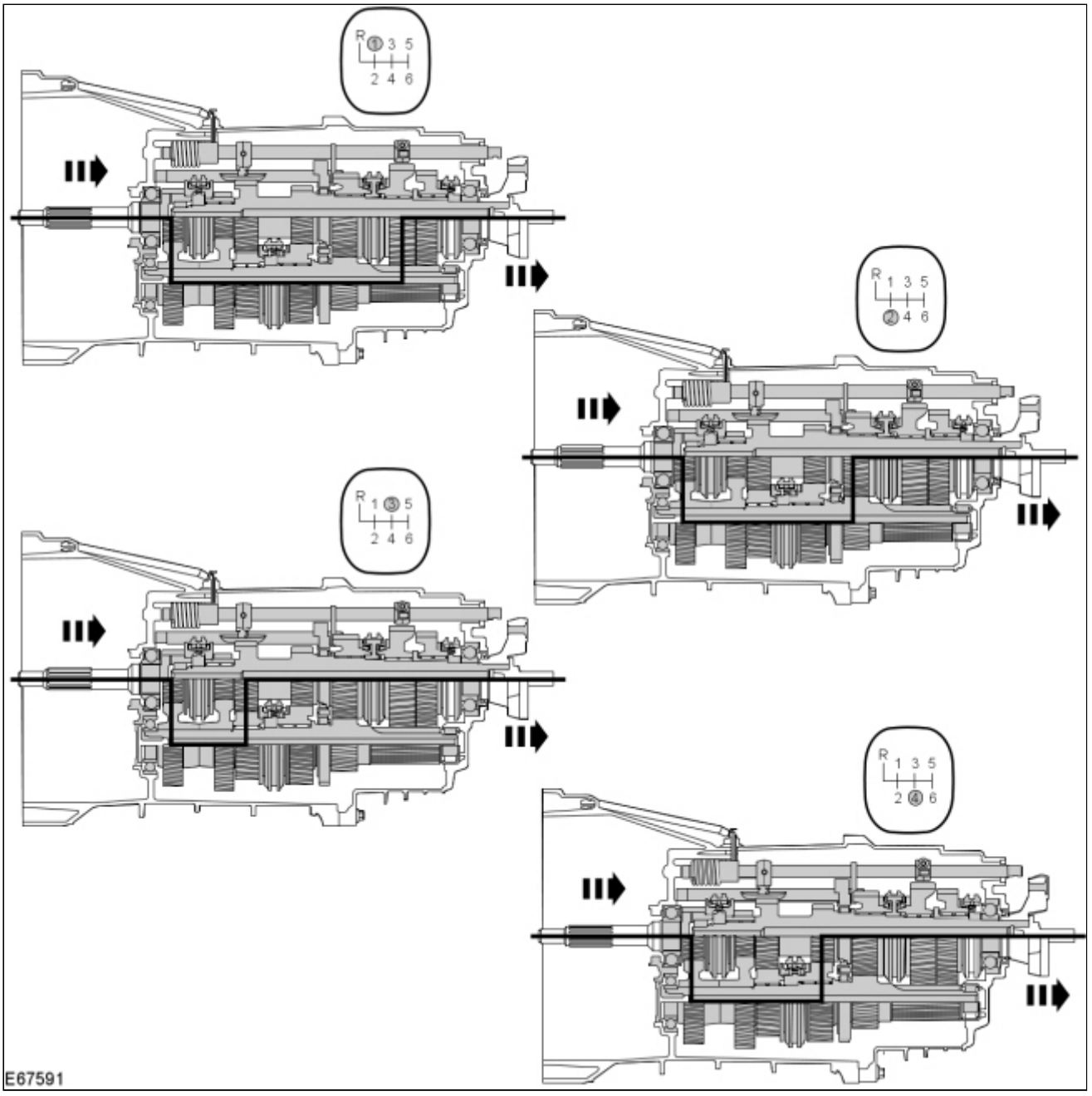


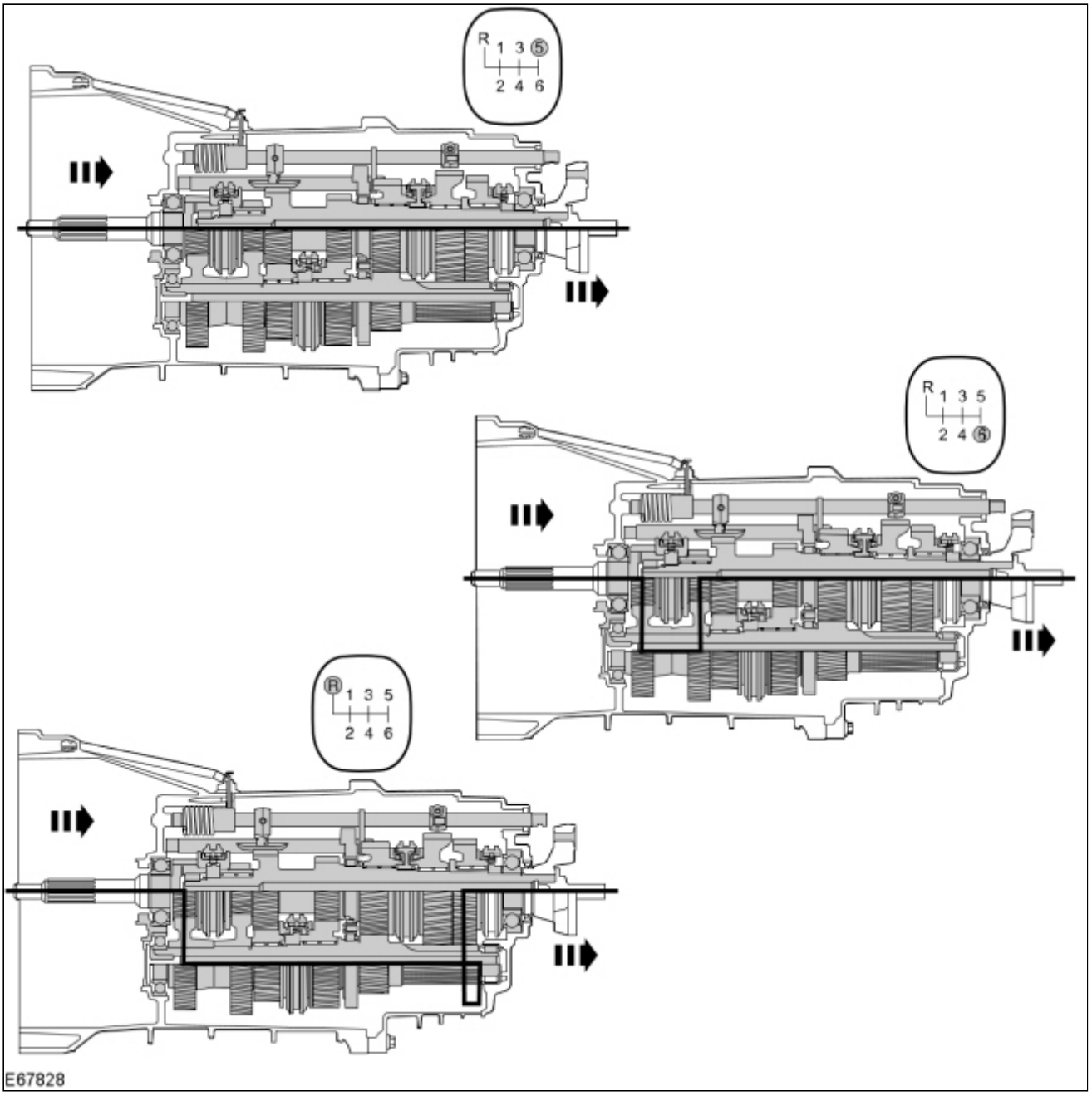
Item	Description
1	Shift fork bolts
2	Selector rod detents

3	Vehicle speed sensor
4	Oil drain plug
5	Oil filler plug / oil level check

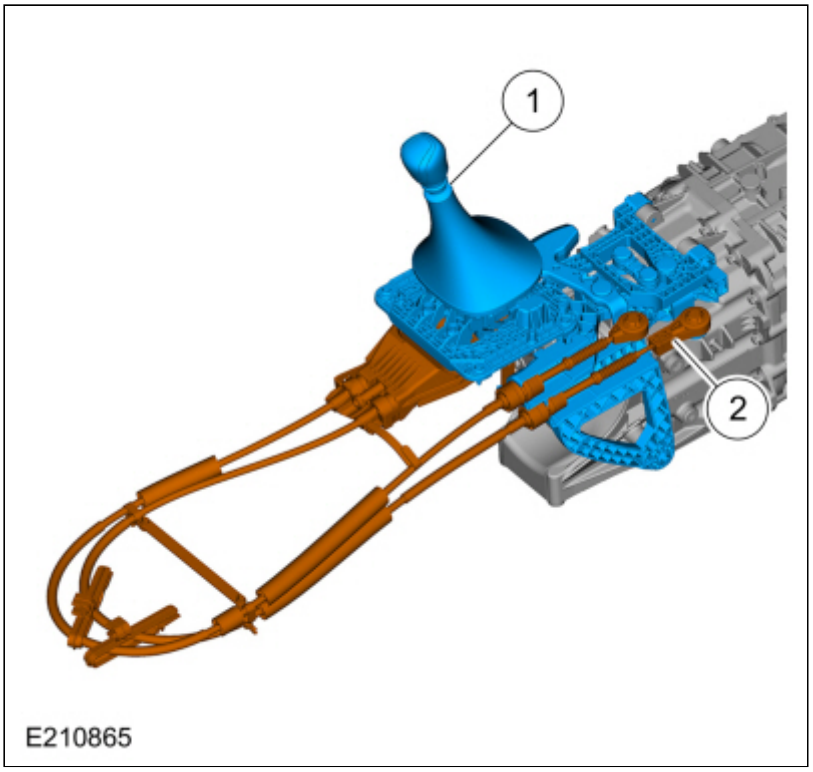
Torque path

Schematic diagram of the torque path in all gears





External gearshift mechanism



Item	Description
1	Selector lever
2	Gear shift cable

Copyright © 2016 Ford Motor Company

Manual Transmission

General Equipment

Ford diagnostic equipment

Inspection and Verification

NOTICE: If transmission noise is reported, first check the transmission fluid level. The vehicle should not be driven if the transmission fluid level is low. A low transmission fluid level will damage the transmission.

NOTE: *Before attempting to repair any concerns, road test the vehicle to determine which system the concern is in.*

NOTE: *If an observed or reported concern is found, correct the causes before proceeding.*

Gear driven units produce a certain level of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Many conditions, such as road and weather can amplify normal vehicle noise.

The following overview is a guide to diagnose a transmission or clutch concern:

- Verify and document the customer concern.
  - During the customer interview, if a leak was noticed or if a leak is the concern, check the transmission fluid level. the vehicle should not be driven if the transmission fluid level is low.
- Check fluid level and condition.
- Evaluate the clutch hydraulic system.
- Evaluate the clutch.
- Inspect gearshift mechanism.
- Evaluate the transmission.
- Find the cause of the problem and correct it.

Verify Customer Concern

1. verify and document the customer concern.
    1. When was it first noticed?
    2. Did it appear suddenly or gradually?
    3. Did anything unusual occur that would coincide with it or precede it?
    4. Identify when the condition occurs:
        - Hot or cold vehicle operating conditions.
        - Type of terrain.
        - City/highway driving.
        - Driving at a particular speed.
            - Coasting.
            - hard acceleration.
        - Shifting.
            - Upshifts.
            - downshifts.
            - in a particular gear.
            - in all gears.
        - Hot or cold ambient
    5. Has the transmission/clutch been repaired before or components installed?
        - Check the vehicle service record. Note any repairs.

Check Fluid Level and Condition

NOTICE: The vehicle should not be driven if the transmission fluid level is low or damage may occur.

NOTICE: Excessive temperatures may break down the transmission lubricant. If there is reason to believe the transmission has been subjected to temperatures exceeding 135°C (275°F) for an extended period (greater than 20 minutes), change the lubricant immediately.

An incorrect transmission fluid level may affect the transmission operation and can result in transmission damage. For transmission draining and filling.
REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).

A low transmission fluid level can result in poor transmission shifting, engagement or damage. It also indicated a leak in the transmission seals or gaskets.

1. Check the transmission fluid condition.
    - Observe the color and the odor of the fluid. Allow the transmission fluid to drip onto a white cloth and examine the stain. Check the transmission fluid for contamination or metal particles.
        - Transmission fluid should appear amber to dark amber in color for the MT82.

Evaluate Clutch Hydraulic System

1. Verify the clutch hydraulic fluid reservoir is filled to the correct level.
    - If the clutch hydraulic fluid is correct, proceed to clutch check.
    - If the clutch hydraulic fluid is low, add fluid as necessary. Check the clutch hydraulic system for leaks and repair as necessary.

Evaluate the Clutch

1. Apply and release the clutch pedal slowly to check pedal binding. Make sure the clutch pedal can be fully applied and is not restricted by the floor mat.

2. Measure the clutch reserve. GO to Pinpoint Test C.

3. With the engine idling and the park brake applied, move the gearshift lever into 4th gear. Increase engine speed to 2,000 rpm and slowly release the clutch pedal.
    - If the engine stalls, the clutch is OK.
    - If the engine does not stall, the clutch is slipping. Repair as necessary.

4. Compare the clutch evaluation results with the following chart. The following list of conditions are typical clutch concerns.

Symptom Chart – Clutch Operation

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Symptom	Possible Sources	Action
• Clutch slippage	• Clutch pedal reserve • Diaphragm springs • Clutch pressure plate • Clutch disc facing • Hardened or oiled clutch disc facing surface • Flywheel	• GO to Pinpoint Test A
• Clutch chatter or shudder	• Engine mounts • Oil on clutch disc facing • Diaphragm springs • Clutch pressure plate • Clutch disc facing • Flywheel • Clutch disc	• GO to Pinpoint Test B
• Clutch pedal feels spongy or has excessive travel. Clutch will not disengage	• Insufficient clutch fluid • Air in hydraulic system • Clutch pedal reserve • Diaphragm springs • Clutch disc • Clutch disc splines • Oil on clutch facing	• GO to Pinpoint Test C
• Clutch drag, also hard to shift	• Insufficient clutch fluid • Air in hydraulic system • Clutch pedal reserve • Diaphragm springs • Clutch disc • Transmission concern	• GO to Pinpoint Test D
• Clutch pedal pulsation	• Clutch and brake pedal pivot shaft not correctly lubricated	• GO to Pinpoint

	not correctly lubricated • Flywheel • Worn springs in pressure plate	Pinpoint Test E
• Clutch-related vibrations	• Engine component grounding against frame • Accessory drive belt • Flywheel bolts • Flywheel • Imbalanced clutch pressure plate	• GO to Pinpoint Test F
• Excessive noise	• Clutch pedal reserve • Clutch slave cylinder • Pilot bearing • Excessive crankshaft end play	• GO to Pinpoint Test G
• Clutch system leakage	• Clutch master cylinder • Clutch slave cylinder • Clutch hydraulic tubes	• GO to Pinpoint Test C

Inspect Gearshift Mechanism

1. Inspect the gearshift mechanism for:
   - signs of damage.
   - missing or loose fasteners.
   - binding.

2. Repair as necessary.

Evaluate Transmission

1. Road test the vehicle. Use the following methods to diagnose the concern.
   - Start the engine.
   - Evaluate the noise in NEUTRAL while vehicle is parked.
     - Check whether the noise is present with the clutch fully disengaged (clutch pedal applied). Check to see if the pedal pulsates abnormally (clutch diaphragm finger runout).
     - Check whether the noise is present with the gearshift in the NEUTRAL position and the clutch fully engaged (clutch pedal released). Apply the park brake and move the gearshift towards the 1st gear position. Apply very slight pressure and note if the gear noise level is reduced (gear rollover noise).
     - With the clutch fully engaged (clutch pedal released) check whether the noise is present as the engine speed is raised. If the noise reduces, note the engine speed at which this occurs.
   - Listen for any change in noise while applying and releasing the clutch pedal.
   - Listen for any change in noise while changing the engine rpm.
   - Drive the vehicle and shift through all the gears including REVERSE. Listen for any changes in noise.
   - Drive the vehicle in the gear in which the noise is most noticeable. Apply the clutch pedal and leave the gear engaged. Listen for any change in noise.
   - Drive the vehicle in the gear in which the noise is most noticeable. Apply the clutch pedal and shift the transmission into NEUTRAL. Release the clutch pedal and allow the vehicle to coast.
   - Compare the noise to another vehicle. Make sure the transmissions are the same.

2. Compare the road test results with the following symptom charts. The following list of conditions are typical transmission concerns:
   - GO to Symptom Chart — Transmission Operation or GO to Symptom Chart — NVH.

Symptom Chart — Transmission Operation

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Symptom	Possible Sources	Action
• Transmission difficult to shift	• Lubricant • Internal shift mechanism • Sliding gears, synchronizers • Housings, shaft	• ADD or DRAIN and FILL with specified lubricant. REFER to: Transmission Draining and

		• Loose pressure plate to flywheel bolts	Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures). • CHECK the internal shift mechanism for smooth operation. REPAIR or INSTALL a new mechanism as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK for free movement of gears and synchronizers. REPAIR or INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK for binding condition between the input shaft and the engine crankshaft pilot bearing or bushing. REPAIR or INSTALL new components as necessary. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • CHECK for loose bolts at the pressure plate. INSTALL new components as necessary.

		REFER to: Specifications (308-01B Clutch - 6-Speed Manual Transmission - MT82, Specifications).
• Transmission will not shift — gearshift lever moves	• Gearshift lever damaged • Damaged or worn selector arm. Loose shift rail bushings	• INSTALL a new gearshift lever. REFER to: Gearshift Lever (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation). REFER to: Gearshift Lever (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation). • CHECK the internal shift components. INSTALL new component as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• **NOTE:** *While verifying the condition, determine whether the noise is gear rollover noise, release bearing rub or some other transmission-related noise. Gear rollover noise, inherent in manual transmissions, is caused by the constant mesh of gears turning at the engine idle speed while the clutch is engaged and the transmission is in NEUTRAL. Release bearing rub is sometimes mistaken for mainshaft bearing noise. Gear rollover noise will disappear when the clutch is disengaged or when the transmission is engaged in gear. Release bearing rub will disappear when the clutch is engaged. In the event that a bearing is damaged, the noise is more pronounced while engaged in gear under load or coast than in NEUTRAL.* • Noisy in forward gears	• Lubricant • Components grounding out on the transmission • Components housing bolts • Bearings or gears	• ADD or DRAIN and FILL with specified lubricant. REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures). • CHECK for screws and bolts of body or other components grounding out. CORRECT as

		necessary. • CHECK the torque on the transmission-to-flywheel housing bolts and the flywheel housing-to-engine block bolts. TIGHTEN the bolts to specification. REFER to: Specifications (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Specifications). • INSPECT the bearings. INSPECT the gears and gear teeth for wear or damage. INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Gears clash when shifting from one forward gear to another	• Pilot bearing • Gear teeth and/or synchronizer • Damaged shift forks or worn shift fork inserts	• CHECK for a binding condition between the input shaft and the engine crankshaft pilot bearing. INSTALL new components as necessary. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). . • REPAIR or INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual

		Transmission - MT75, Disassembly). • INSPECT for wear or damage. INSTALL new components as necessary. REFER to: Specifications (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Specifications).
• Transmission jumps out of gear	• Transmission-to-engine mounting bolts • Crankshaft pilot bearing • Internal damage • Gear teeth	• TIGHTEN the bolts to specification. • INSTALL a new pilot bearing. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • INSPECT the synchronizer sleeves for free movement on their hubs. INSPECT the synchronizer blocking rings for widened index slots, rounded clutch teeth and smooth internal surface. REPAIR or INSTALL a new component as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • If worn or damaged, INSTALL new gears. REFER to: Countershaft (308-03B Manual Transmission - 6-Speed Manual Transmission -

		MT82, Disassembly and Assembly of Subassemblies).
• Transmission will not shift into one gear — all others OK	• Manual shift linkage • Backup switch ball • Internal components	• REPAIR or INSTALL new components as necessary. • If REVERSE is the problem, CHECK reverse lamp switch for ball frozen in extended position. • INSPECT the shift rail and fork system, synchronizer system and the gear clutch teeth for restricted travel. REPAIR or INSTALL new components as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission is locked in one gear and cannot be shifted out of that gear	• Internal components • Fork on rail or shift rail	• INSPECT the problem gears, shift rails, forks and the synchronizer for wear or damage. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK the shift rail interlock system. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly)

		Disassembly).
• Transmission leaks	• Lubricant • Other component leaking • False report • Fill and drain plugs	• CHECK the level and type. REFER to: Transmission Fluid Level Check (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures). • IDENTIFY leaking fluid as engine, power steering or transmission fluid. REPAIR as necessary. • REMOVE all traces of lube on the exposed transmission surfaces. CHECK the vent for free breathing. OPERATE the transmission and INSPECT for new leakage. REPAIR as necessary. • CHECK fill and drain plugs and bore threads. REPAIR as necessary. TIGHTEN plugs to specified torque value. REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).
• Bearing failure	• Other part failure • Raceways or rollers • Lubricant • Vibration break-up of retainer and brinelling of races • Bearing(s) • Shafts or bore • Overloading of vehicle • Incorrect	• REMOVE, DISASSEMBLE and CLEAN the transmission. Inspect for damaged parts and install new components as necessary. (Note: RESET the bearing preload if any new tapered bearings are installed.) REFER to: Transmission

	preload • Input shaft oil dam • Oil baffle in the input bearing shim pack	Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • DETERMINE the cause of vibration and CORRECT. Otherwise, PROCEED as above. • INSTALL new components as necessary and VERIFY the oil dam installation is correct. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). CHECK for correct installation of the snap ring on the mainshaft next to the oil dam. • INSTALL a new oil baffle, making sure it is not damaged during assembly. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).

Symptom Chart — NVH

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. Refer to Diagnostic Methods in Section 100-00 for information about these practices.

Symptom	Possible Sources	Action
NOTE: *NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.*		
• Excessive noise	• Clutch disc damper damaged • Transmission input	• REMOVE the clutch disc and pressure plate. REFER to: Clutch Disc and Pressure

	shaft pilot bearing worn or damaged • Crankshaft end play excessive • Release bearing worn or damaged	Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). INSPECT the clutch disc for damage. INSPECT the transmission input shaft pilot bearing for wear and damage. REFER to Pilot Bearing Check. • CHECK the crankshaft end play. REFER to: Crankshaft End Play (303-00 Engine System - General Information, General Procedures). • CHECK the clutch release hub and bearing, and guide tube for wear and damage. REPAIR all components as necessary.
• Clutch rattling noise — occurs with clutch engaged, noise changes/disappears with clutch pedal pressed	• Flywheel bolts loose • Clutch housing bolts or clutch pressure plate bolts loose	• TIGHTEN the bolts to specifications. CHECK the bolts for damage. REFER to: Specifications (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Specifications). • TIGHTEN the bolts to specifications. CHECK the bolts for damage. REFER to: Specifications (308-01B Clutch - 6-Speed Manual Transmission - MT82, Specifications).
• Clutch squeaking noise — noise is heard when the clutch is operated. Vehicle moves slowly or creeps when the clutch is disengaged. Can also be difficult to shift into 1st and REVERSE gears	• Pilot bearing seized or damaged	• INSTALL a new pilot bearing. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Clutch squeaking noise — occurs with clutch pedal pressed/released	• Worn clutch pedal shaft or bushings	• INSPECT the clutch pedal for wear or damage. REPAIR as necessary. REFER to: Clutch Master Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Clutch whirring/rattle noise — occurs when clutch pedal is pressed	• Worn, damaged or misaligned clutch release bearing	• INSTALL a new clutch release bearing. REFER to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Clutch grating/grinding noise — occurs when clutch pedal is pressed	• Clutch pressure plate fingers bent or worn • Contact surface of clutch release bearing worn or damaged	• INSPECT the clutch pressure plate release fingers. INSTALL a new pressure plate as necessary. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • INSTALL a new clutch release bearing. REFER to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Clutch chatter — a small amount of noise when clutch pedal is released at initial take-off	• Clutch engagement	• Acceptable operating condition.
• Clutch chatter/grabs — in some cases a shudder is felt. Occurs with clutch pedal pressed/released	• Damaged or worn powertrain/driveline mounts • Binding or dragging plunger of the clutch master cylinder or slave cylinder Grease or oil on	• INSPECT the powertrain/drivetrain mounts. INSTALL new mounts as necessary. REFER to: Engine - 6-Speed Manual Transmission - MT82 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L

	• Grease or oil on the clutch disc facing • Clutch disc surface glazed or damaged • Damaged or worn clutch pressure plate • Flywheel surface damaged or glazed	TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation). • CHECK the master and slave cylinder operation. INSPECT the components for damage or wear. INSTALL a new master or slave cylinder as necessary. REFER to: Clutch Master Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation). REFER to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation). • CHECK the input shaft seal and rear main oil seal. REPAIR as necessary. INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • INSPECT the clutch disc surface for a glazed, hardened or damage condition. CARRY OUT a disc check. INSTALL a new clutch disc as necessary. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • INSPECT the clutch pressure plate for wear or damage. INSTALL a new clutch pressure plate as necessary. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation). • INSPECT the flywheel for damage or wear. CARRY OUT a flywheel runout check. INSTALL a new flywheel as necessary.
• Clutch chatter noise — noise when clutch pedal is released at initial take-off. Clutch is hard to engage and disengage	• Pilot bearing worn, damaged or not correctly aligned in bore	• INSPECT the clutch pressure plate release fingers for uneven wear, clutch components burnt or a seized pilot bearing. INSTALL a new pilot bearing as necessary. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
• Transmission rattling/clattering noise — occurs in NEUTRAL or in gear, at idle	• Incorrect fluid level or fluid quality	• COMPARE with other like vehicles. CHECK that the transmission is filled to the correct level and with the specified fluid. For the fluid type, REFER to: Transmission Draining and Filling (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, General Procedures).
• Transmission rattling/clattering noise — noise at idle in NEUTRAL	• Worn or rough reverse idler gear • Excessive backlash in gears • Worn countershaft gears	• CHECK the reverse idler gear. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • CHECK the gear backlash. ADJUST as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly)

		• REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission whine — a mild whine at extreme speeds or high rpm	• Rotating gears/geartrain	• Acceptable noise.
• Transmission whine — a high pitched whine, also described as a squeal	• Transmission gears are worn (high mileage vehicle) • Mismatched gear sets • Damaged or worn transmission bearing	• Result of normal gear wear. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • INSPECT the gear sets for an uneven wear pattern on the face of the gear teeth. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). • INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission growling/humming — noise occurs in the forward gears. The noise is more prominent when the gear is loaded. The problem gear can be located as the noise occurs in a specific gear position	• Gear is cracked, chipped or rough	• INSPECT the transmission gears for damage or wear. INSTALL new gears as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission hissing — noise in NEUTRAL or in forward gears. As bearings wear or break up, the noise changes to a thumping noise	• Damaged or worn bearings	• INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission knocking/thudding — noise at low speeds in forward gears	• Bearings with damaged balls or rollers or with pitted and spalled races	• INSPECT the transmission bearings. INSTALL new bearings as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
• Transmission rumble/growl — noise at higher speeds in forward gears, more pronounced in a coast/deceleration condition	• Incorrect driveline angle • Driveshaft out of balance or damaged	• CHECK the driveline angle. REPAIR as necessary. REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing). • CHECK the driveshaft for damage, missing balance weights or undercoating. REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
• Transmission rumble/growl — noise at all speeds in forward gears, more pronounced in a heavy acceleration condition	• Damaged or worn transmission bearing or gears (high mileage vehicles)	• CHECK transmission fluid for excessive metal particles. REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).

Pinpoint Tests

PINPOINT TEST A: CLUTCH SLIPPAGE

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).

for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Clutch pedal
- Clutch hydraulic system
- Clutch disc
- Clutch pressure plate

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 INSPECT THE CLUTCH PEDAL

- Ignition OFF.
- Block the wheels and apply the park brake.
- Apply and slowly release the clutch pedal.

Does the clutch pedal release without binding?

Yes	GO to A2
No	INSPECT the clutch pedal. REFER to: Clutch Controls (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Diagnosis and Testing).

A2 CHECK THE HYDRAULIC SYSTEM

- Ignition OFF.
- Apply and release the clutch pedal.

Is there residual hydraulic pressure at bleed screw?

Yes	INSTALL a new clutch master cylinder. REFER to: Clutch Master Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to A3

A3 CARRY OUT A STALL TEST

- Start the engine.
- Block the wheels and apply the park brake.
- Place the transmission in 4th gear.
- Increase the speed to 2,000 rpm and slowly release the clutch pedal.

Does the engine stall within 5 seconds?

Yes	The clutch is not slipping. VERIFY the customer concern.
No	INSPECT the clutch components for damage.

PINPOINT TEST B: CLUTCH CHATTER OR SHUDDER

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

This pinpoint test is intended to diagnose the following:

- Engine or transmission mounts
- Clutch disc
- Clutch pressure plate
- Flywheel
- Pilot bearing
- Input shaft

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER

B1 CHECK THE ENGINE AND TRANSMISSION MOUNTS

- Inspect all the engine and transmission mounts for loose fasteners or damage.

Are any of the engine or transmission mounts loose or damage?

Yes	TIGHTEN or INSTALL new engine mounts or transmission mounts as necessary.
No	GO to B2

B2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolt loose?

Yes	TIGHTEN or INSTALL new bolts as necessary. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to B3

B3 INSPECT THE PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
- Inspect the clutch pressure plate. REFER to Clutch Pressure Plate Check.

Are any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to B4

B4 CHECK THE CLUTCH

- Carry out the clutch disc inspection procedure. REFER to Clutch Disc Check.

Is the clutch disc OK?

Yes	GO to B5
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

B5 INSPECT THE FLYWHEEL

- Inspect the flywheel for damage and runout. REFER to Flywheel Run out Check.

Is the fly wheel OK?

Yes	GO to B6
No	TIGHTEN or INSTALL a new flywheel. REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Assembly). REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Assembly).

B6 INSPECT THE PILOT BEARING

- Inspect the pilot bearing for wear or damage. REFER to Pilot Bearing Check.

Are there signs of wear or damage?

Yes	INSTALL a new pilot bearing. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to B7

B7 INSPECT THE INPUT SHIFT

- Inspect the input shaft for signs of wear or damage.

Are any signs of wear or damage present on the input shaft?

Yes	INSTALL a new input shaft. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
No	VERIFY the customer concerns. GO to Symptom Chart.

PINPOINT TEST C: CLUTCH PEDAL FEELS SPONGY OR HAS EXCESSIVE TRAVEL/CLUTCH WILL NOT DISENGAGE/CLUTCH SYSTEM LEAKAGE

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

This pinpoint test is intended to diagnose the following:

- Internal operation
- Clutch pedal reserve
- Clutch slave cylinder travel
- Clutch disc
- Clutch pressure plate
- Clutch pedal free play

PINPOINT TEST C : CLUTCH PEDAL FEELS SPONGY OR HAS EXCESSIVE TRAVEL/CLUTCH WILL NOT DISENGAGE/CLUTCH SYSTEM LEAKAGE

C1 CHECK THE FLUID LEVEL

NOTE: *Do not check the hydraulic system after a road test. Allow the vehicle to cool down before carrying out the clutch hydraulic system check.*

- Remove the brake and clutch reservoir cap.
- Check the fluid level of the brake and clutch reservoir.

Is the fluid level at or above the step mark?

Yes	INSTALL the reservoir cap. GO to C2
No	ADD brake fluid to the specified level. GO to C2

C2 INSPECT THE HYDRAULIC SYSTEM FOR LEAKAGE

- Check the reservoir and reservoir tubes for leakage.
- Check the master cylinder and hydraulic tube for leakage.
- Check the clutch slave cylinder and the hydraulic tube connection for leakage.

Are there any signs of leakage?

Yes	INSTALL new components as necessary.
No	GO to C3

C3 CHECK INTERNAL OPERATION

- Remove the reservoir cap.
- Have an assistant slowly apply and release the clutch pedal.
- On the down stroke, the fluid level should not increase by more than 1.0 mm (0.039 in).

Does the fluid level increase more than 1 mm (0.039 in)?

Yes	INSTALL a new clutch master cylinder assembly. REFER to: Clutch Master Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to C4

C4 CHECK THE CLUTCH PEDAL RESERVE

C4 CHECK THE CLUTCH PEDAL RESERVE

NOTE: *The clutch reserve is the distance between the clutch pedal when fully applied and the position when the vehicle starts to move forward.*

- Park the vehicle on a level surface.
- Verify the clutch hydraulic system is properly bled.
  REFER to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).
- Check for obstructions behind clutch pedal.
- Attach a cable tie to the lower clutch pedal.
- Attach a tape measure to the cable tie.
- Apply the clutch fully and start the vehicle.
- Shift the transmission into 1st gear.
- Use the seam on the steering wheel as a reference point.
- While observing the tape measure, slowly engage the clutch, noting when the vehicle starts to move forward or a noticeable engine rpm decrease occurs (noted on tachometer).

Is the clutch pedal reserve greater than or equal to 25 mm (0.984 in)?

Yes	The clutch hydraulic system is OK.
No	GO to C5

C5 CHECK THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
- Inspect the clutch pressure plate for wear or runout.
  REFER to: Clutch (308-01B Clutch - 6-Speed Manual Transmission - MT82, Diagnosis and Testing).

Are there any signs of excessive wear or runout to the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to C6

C6 INSPECT THE CLUTCH DISC

- Carry out the clutch disc inspection procedure.
  REFER to: Clutch (308-01B Clutch - 6-Speed Manual Transmission - MT82, Diagnosis and Testing).

Is the clutch disc OK?

Yes	GO to C7
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

C7 CHECK CLUTCH PEDAL FREE PLAY

NOTE: *The clutch pedal free play is the distance between the clutch pedal when fully released and the position when slight resistance is felt on downward motion.*

- Ignition OFF.
- Attach a tape measure to the cable tie.
- While observing the tape measure, slowly push downward on the clutch pedal until a slight resistance is felt.

Is the clutch pedal free play less than 13 mm (0.511 in) ?

Yes	The clutch hydraulic system is OK

No	BLEED the clutch hydraulic system. REFER to Clutch System Bleeding.

PINPOINT TEST D: CLUTCH DRAG, ALSO HARD TO SHIFT

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Condition

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Internal operation
- Clutch pedal reserve
- Clutch slave cylinder travel
- Clutch disc
- Clutch pressure plate
- Clutch pedal free play

PINPOINT TEST D : CLUTCH DRAG, ALSO HARD TO SHIFT

D1 CHECK FLUID LEVEL

- Ignition OFF.
- Remove the reservoir cap.
- Inspect the fluid level in the brake and clutch reservoir.

Is the fluid level at or above the step mark?

Yes	INSTALL the reservoir cap. GO to D2
No	ADD brake fluid. GO to D2

D2 INSPECT THE CLUTCH HYDRAULIC SYSTEM FOR LEAKAGE

- Inspect the clutch master cylinder and the hydraulic tubes for leakage.
- Inspect the reservoir and reservoir tube for leakage.
- Inspect the clutch slave cylinder and the hydraulic tube connection for leakage.

Are there any signs of leakage?

Yes	INSTALL new component as necessary.
No	GO to D3

D3 CHECK INTERNAL OPERATION

- Remove the reservoir cap.
- Have an assistant slowly apply and release the clutch pedal.
- On the down stroke, the fluid level should not increase by more than 1 mm (0.039 in).

Does the fluid level increase more than 1 mm (0.039 in)?

Yes	INSTALL a new clutch master cylinder assembly. REFER to: Clutch Master Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to D4

D4 CHECK THE CLUTCH PEDAL RESERVE

NOTE: *The clutch reserve is the distance between the clutch pedal when fully applied and the position when the vehicle starts to move forward.*

- Park the vehicle on a level surface.
- Check for obstructions behind the clutch pedal. Check the carpet for correct installation
- Attach a cable tie to the lower clutch pedal.
- Attach a tape measure to the cable tie.
- Apply the clutch fully and start the vehicle.
- Shift the transmission into 1st gear.
- Use the seam on the steering wheel as a reference point.
- While observing the tape measure, slowly engage the clutch, noting when the vehicle starts to move forward or a noticeable engine rpm decrease occurs (noted on tachometer).

Is the clutch pedal reserve greater than or equal to 25 mm (0.984 in)?

Yes	The clutch hydraulic system is OK.
No	GO to D5

D5 CHECK THE PEDAL FREE PLAY

NOTE: *The clutch pedal free play is the distance between the clutch pedal when fully released and the position when slight resistance is felt on downward motion.*

- Ignition OFF.
- Attach a tape measure to the cable tie.
- While observing the tape measure, slowly push downward on the clutch pedal until a slight resistance is felt.

Is the clutch pedal free play less than 13 mm (0.511 in)?

Yes	The clutch hydraulic system is OK.
No	GO to D6

D6 CHECK THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
- Inspect the clutch pressure plate for wear or runout. REFER to Clutch Pressure Plate Check.

Are there any signs of excessive wear or runout to the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to D7

D7 INSPECT THE CLUTCH DISC

- Carry out the clutch disc inspection procedure.

Is the clutch disc OK.

Yes	GO to D8
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

D8 INSPECT THE TRANSMISSION

- Remove the transmission.
  REFER to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Installation).
  REFER to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Installation).
- Disassemble the transmission.
  REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
- Carry out the following:
  - Inspect all the shift rails for excessive scuffing or wear.
  - Check the interlock pins on the shift rail.
  - Make sure the interlock bolts are tightened to specifications.
  - Inspect the shift pads for wear or cracking.
  - Inspect the shift forks for wear or damage.
  - Check the synchronizer rings of the affected gear for wear or damage.
  - Check the synchronizer hubs of the affected gear for wear or damage.
  - Inspect the clutching teeth of the affected gear.

Are there any internal components worn or damaged?

Yes	INSTALL new components or REPAIR as necessary. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly).
No	ASSEMBLE and INSTALL the transmission. REFER to: Transmission (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Disassembly). REFER to: Transmission - 4x2 (308-03A Manual Transmission - 5-Speed Manual Transmission - MT75, Installation). REFER to: Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2 (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, Installation).

PINPOINT TEST E: CLUTCH PEDAL PULSATION

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Normal Operation and Fault Conditions

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Clutch disc
- Clutch pressure plate

- Flywheel

PINPOINT TEST E : CLUTCH PEDAL PULSATION

E1 CHECK THE CLUTCH PEDAL PULSATION

- Start the engine.
- With the transmission in NEUTRAL, slowly apply the clutch pedal.

Does the clutch pedal pulsate while being applied?

Yes	GO to E2
No	VERIFY the customer concern. GO to Symptom Chart.

E2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolts loose?

Yes	TIGHTEN or INSTALL new bolts. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to E3

E3 INSPECT THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate.
  REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
- Inspect the clutch pressure plate for damage.

Are there any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to E4

E4 INSPECT THE CLUTCH DISC

- Carry out clutch disc inspection procedure. REFER to Clutch Disc Check.

Is the clutch disc OK?

Yes	GO to E5
No	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

E5 INSPECT THE FLYWHEEL

- Inspect the flywheel for damage and runout. REFER to Flywheel Runout Check.

Is flywheel OK?

Yes	VERIFY the customer concern. GO to Symptom Chart.

No	TIGHTEN or INSTALL a new flywheel.

PINPOINT TEST F - CLUTCH-RELATED VIBRATIONS

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation). for information about these practices.

Normal Operation and Fault Conditions

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Engine components
- Accessory drive belts
- Release bearing
- Flywheel

PINPOINT TEST F : CLUTCH-RELATED VIBRATIONS

F1 CHECK FOR ENGINE COMPONENT GROUNDING

- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Check the engine and transmission mounts for grounding.
- Check for exhaust manifolds or other engine component grounding on the body or frame.

Is there evidence of grounding on the body or frame?

Yes	REPAIR the components as necessary.
No	GO to F2

F2 CHECK FOR ACCESSORY DRIVE VIBRATIONS

- Remove the accessory drive belt.
  REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
- Start the engine.

Does the vibration stop when the accessory drive belt is removed from the engine?

Yes	INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	STOP the engine and INSTALL the drive belt. GO to F3

F3 CHECK FOR CLUTCH RELEASE BEARING NOISE

NOTE: *With the transmission in NEUTRAL, transmission rollover noise can be heard. Make sure to distinguish between rollover noise and clutch release bearing noise.*

- Start the engine.
- Apply and hold the clutch pedal.

Is a whirring, grating or grinding noise present only when pedal is pushed?

Yes	INSTALL a new clutch release bearing. REFER to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to F4

F4 INSPECT THE FLYWHEEL

- Ignition OFF.
- Remove the transmission.
  REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Assembly).
  REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Assembly).
- Carry out a flywheel check. REFER to Flywheel Runout Check.

Is the flywheel OK?

Yes	VERIFY the customer concern. GO to Symptom Chart.
No	TIGHTEN or INSTALL a new flywheel.

PINPOINT TEST G: EXCESSIVE NOISE

Diagnostic Overview

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
for information about these practices.

Normal Operation and Fault Conditions

The clutch is designed to transfer the power from the engine to the transmission, which may be stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

This pinpoint test is intended to diagnose the following:

- Transmission
- Clutch slave cylinder
- Pilot bearing

PINPOINT TEST G : EXCESSIVE NOISE

G1 TRANSMISSION NEUTRAL GEAR ROLLOVER TEST

- Start the engine.
- With the engine at idle, the transmission in NEUTRAL and the clutch engaged (pedal up). If noise is excessive, apply the clutch pedal to stop the transmission input shaft from rotating.

Does the noise stop when the clutch pedal is applied?

Yes	INSPECT the clutch components for damage. REFER to Clutch Disc Check.
No	GO to G2

G2 CHECK THE CLUTCH SYSTEM

- Ignition OFF.
- Using slow, medium, then fast stroke, and release the clutch pedal.

Is there a squeak?

Yes	GO to G3
No	The clutch system is OK. VERIFY the customer concern.

G3 CHECK THE CPP SWITCH

- Remove the CPP switch. Using slow, medium, then fast stroke, apply and release the clutch pedal.

Is there a squeak?

Yes	REINSTALL the CPP switch. GO to G4
No	INSTALL a new CPP switch.

G4 CHECK THE CLUTCH SLAVE CYLINDER

- Remove the transmission.
  REFER to: Engine (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Assembly).
  REFER to: Engine (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Assembly).
- Inspect the clutch slave cylinder for wear or loss of lubrication.

Are there any signs of wear or loss of lubrication?

Yes	INSTALL a new clutch slave cylinder. REFER to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	GO to G5

G5 CHECK THE PILOT BEARING

- Inspect the pilot bearing for wear or damage.

Is the pilot bearing OK?

Yes	GO to G6
No	INSTALL a new pilot bearing. REFER to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

G6 CHECK THE DAMPER SPRINGS

- Inspect the damper springs for fatigue or breakage.
  REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

Are there any signs of fatigue or breakage?

Yes	INSTALL a new clutch disc. REFER to: Clutch Disc and Pressure Plate (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).
No	INSPECT the crankshaft end play.

Copyright © 2016 Ford Motor Company

Transmission Draining and Filling

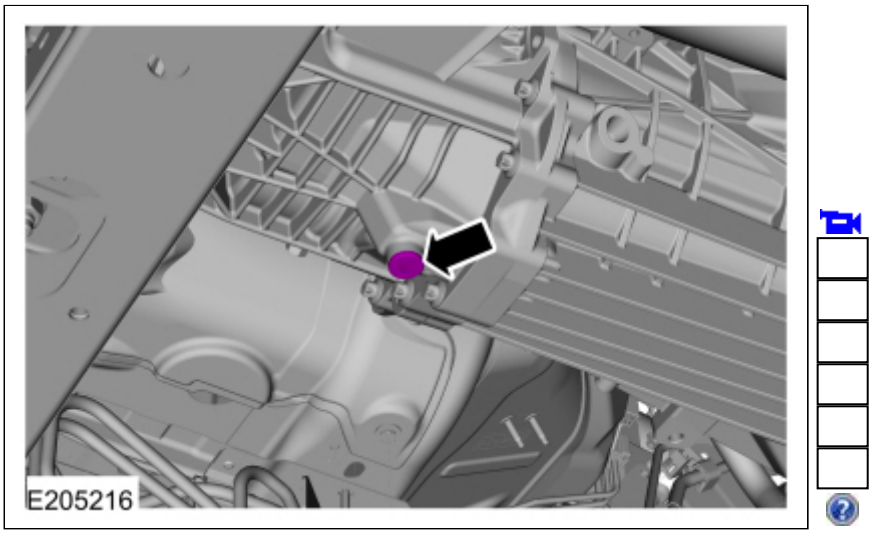
Materials

Name	Specification
Gear/Transmission Fluid - SAE 75W	WSS-M2C200-D2

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

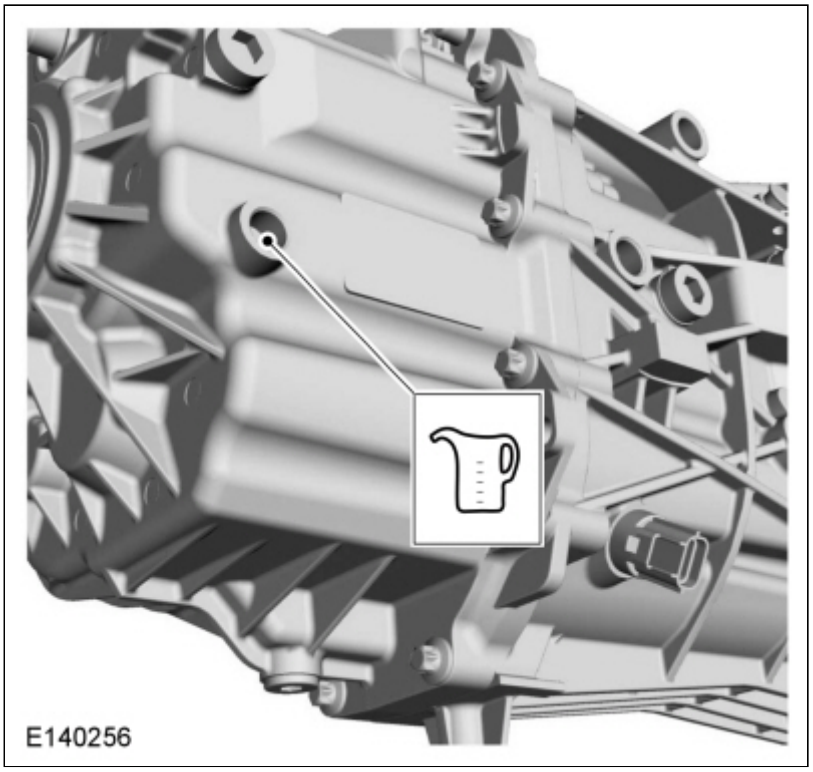
2. **WARNING: Be prepared to collect escaping fluid.**

   Torque: 50 Nm

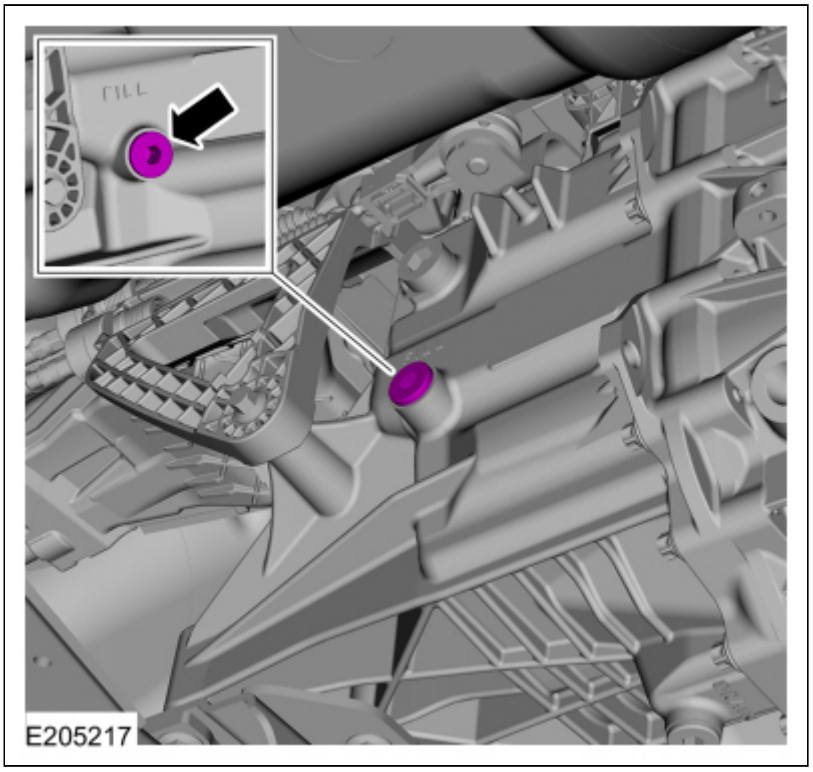


3. **NOTE:** *Add additional 0.1L Transmission Fluid to the initial fill amount, if transmission has been disassembled and assembled in your workshop.*

   Fill with 2.6L Transmission fluid.
   Material: Gear/Transmission Fluid - SAE 75W (WSS-M2C200-D2)



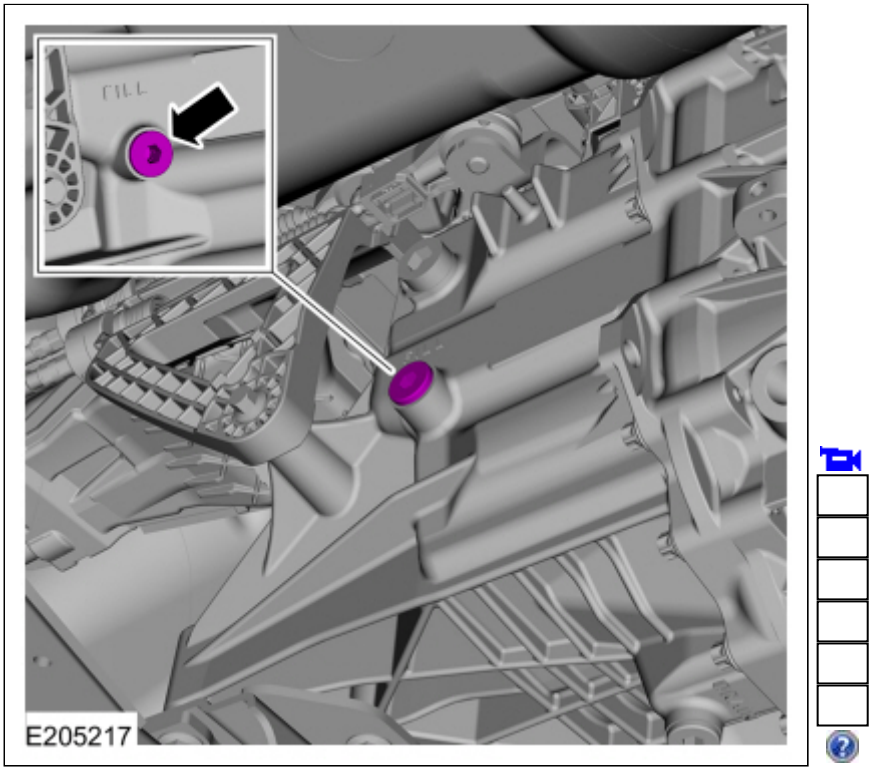
4. *Torque*: 35 Nm



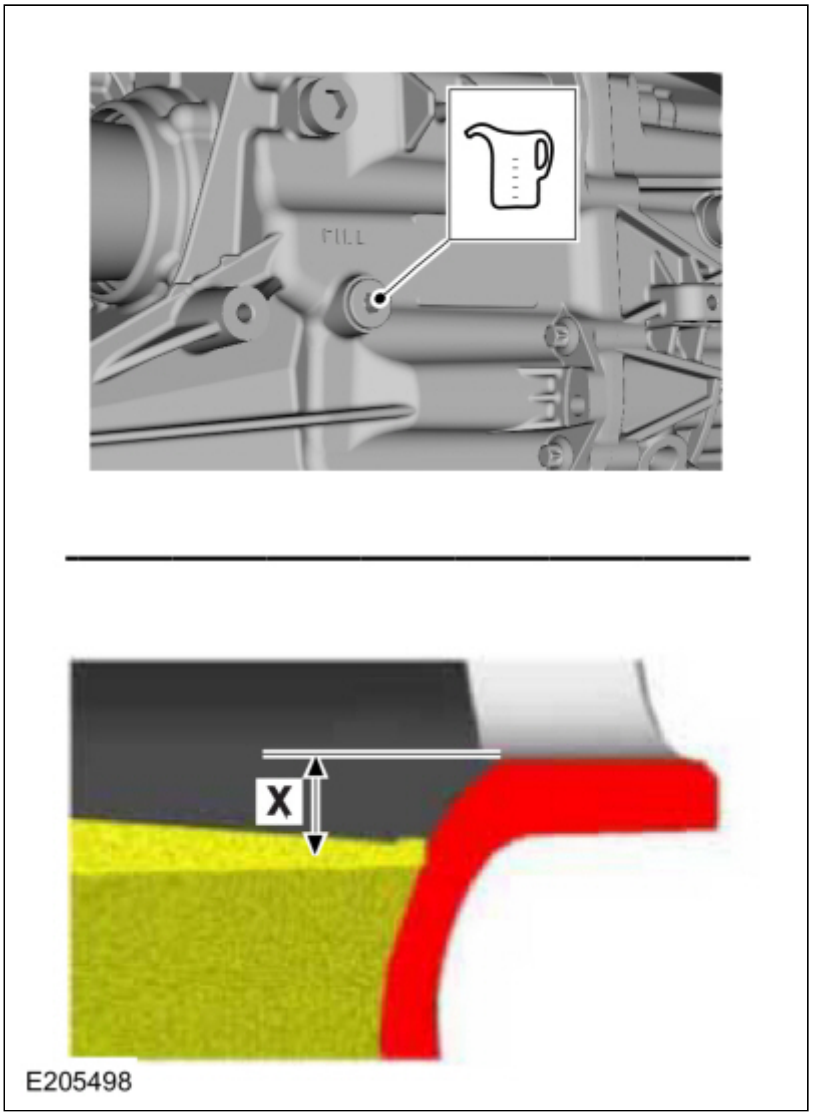
Copyright © 2016 Ford Motor Company

Transmission Fluid Level Check

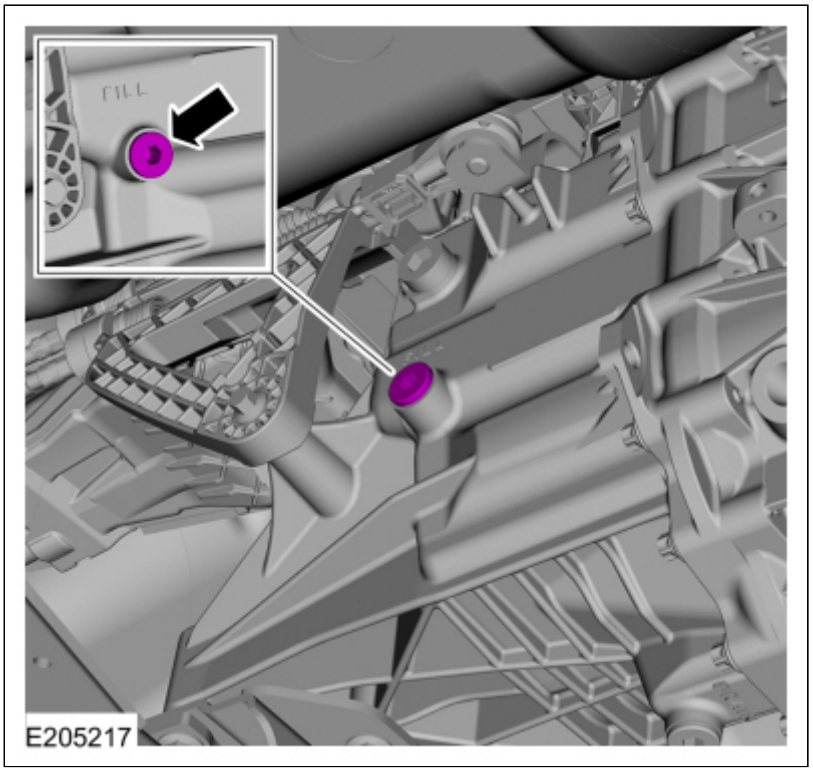
1. Check the component for leaks.
2. Transmission Fluid Level Check should only be carried out if an oil leak was identified.
   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
3. **NOTE:** *Make sure that the vehicle is standing on a level surface.*

   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

- 2WD **X:** 11-13mm
- 4WD **X:** 7.5-8.5mm



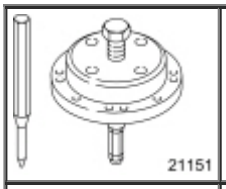
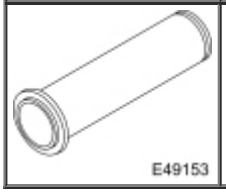
6. *Torque*: 35 Nm



Copyright © 2016 Ford Motor Company

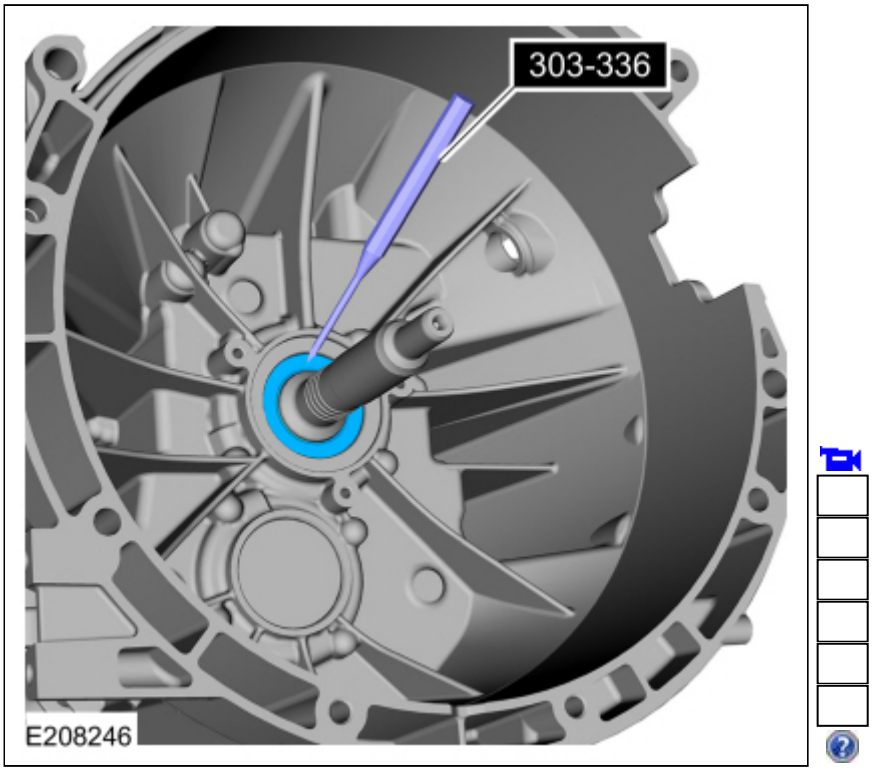
Input Shaft Seal

Special Tool(s) / General Equipment

 21151	303-336 Remover, Crankshaft Rear Seal
 E49153	308-605 Installer, Input Shaft Seal

Removal

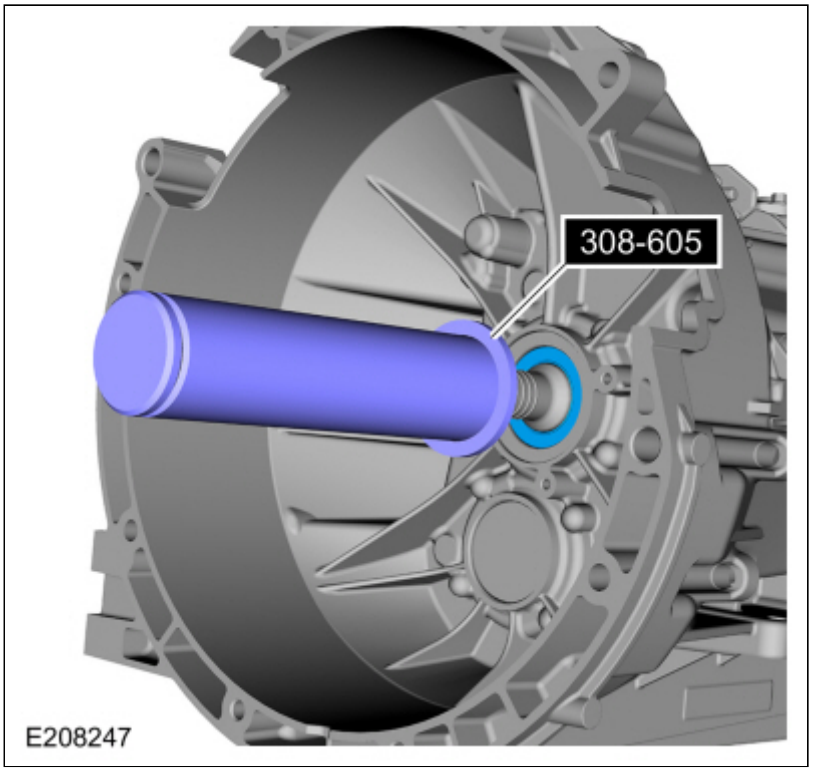
1. Refer to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
2. Use Special Service Tool: 303-336 Remover, Crankshaft Rear Seal.



- Screw a self-tapping screw into the input shaft seal.
- Pull out the screw and the input shaft seal with pliers.
- Discard the input shaft seal.

Installation

1. Use Special Service Tool: 308-605 Installer, Input Shaft Seal.



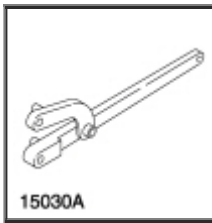
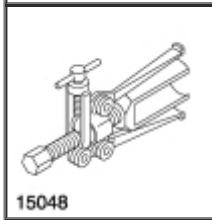
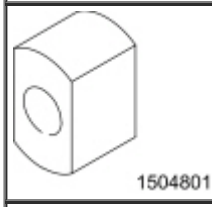
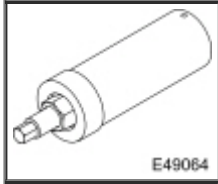
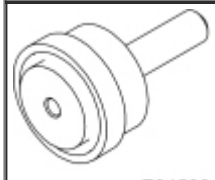
2. Refer to: Clutch Slave Cylinder (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
3. Refer to: Transmission Draining and Filling (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

Output Shaft Seal - LHD RWD/RHD RWD

Base Part Number: 7B215

Special Tool(s) / General Equipment

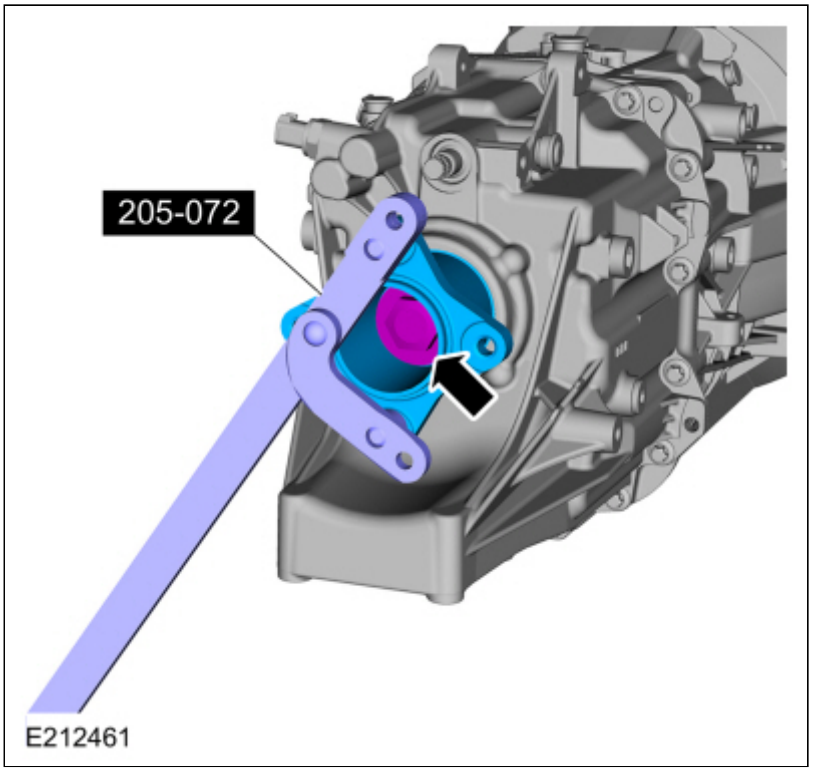
 15030A	205-072 Universal Flange Holding Wrench
 15048	205-078 Remover, Drive Pinion Seal
 1504801	205-078-01 Adapter for 205-078 (Thrust Pad)
 E49064	308-604 Installer, Output Drive Flange Seal
 E84508	308-690 Installer, Output Drive Flange Seal

Materials

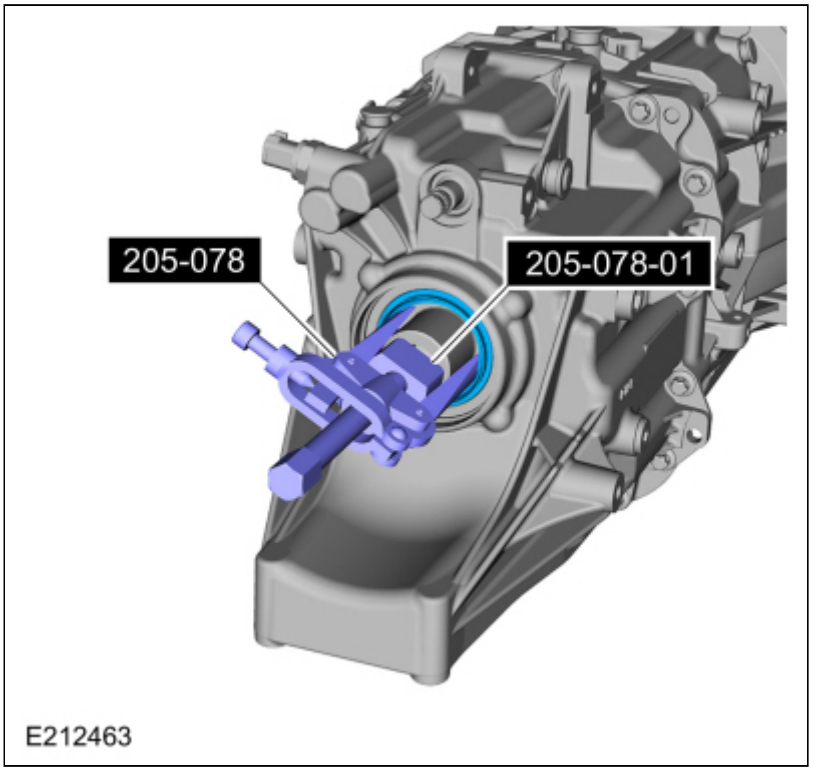
Name	Specification
Thread Locking Adhesive	WSK-M2G351-A6

Removal

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
3. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.

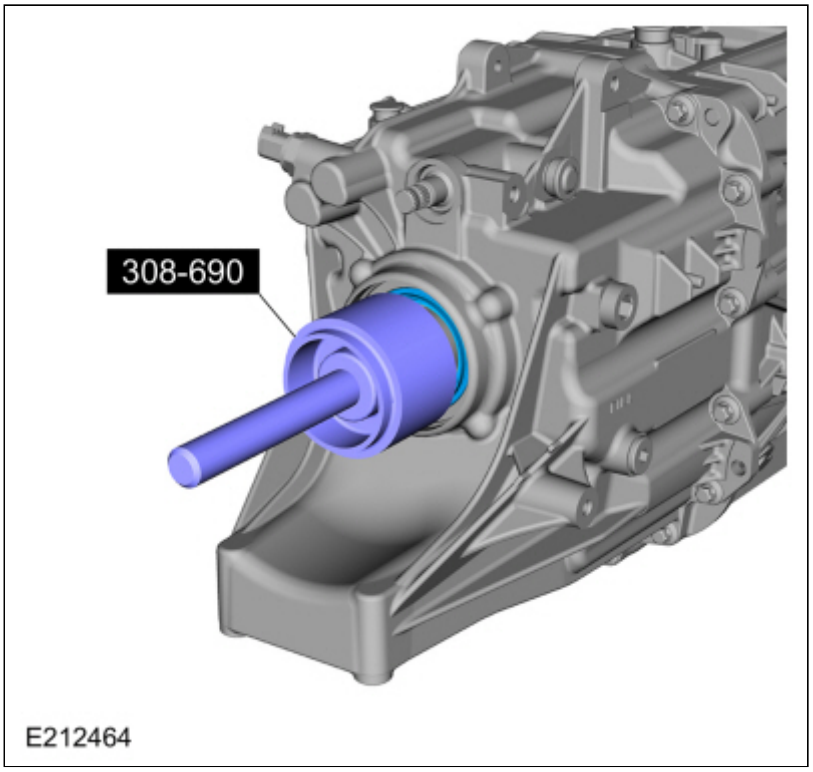


4. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal. , 205-078-01 Adapter for 205-078 (Thrust Pad).

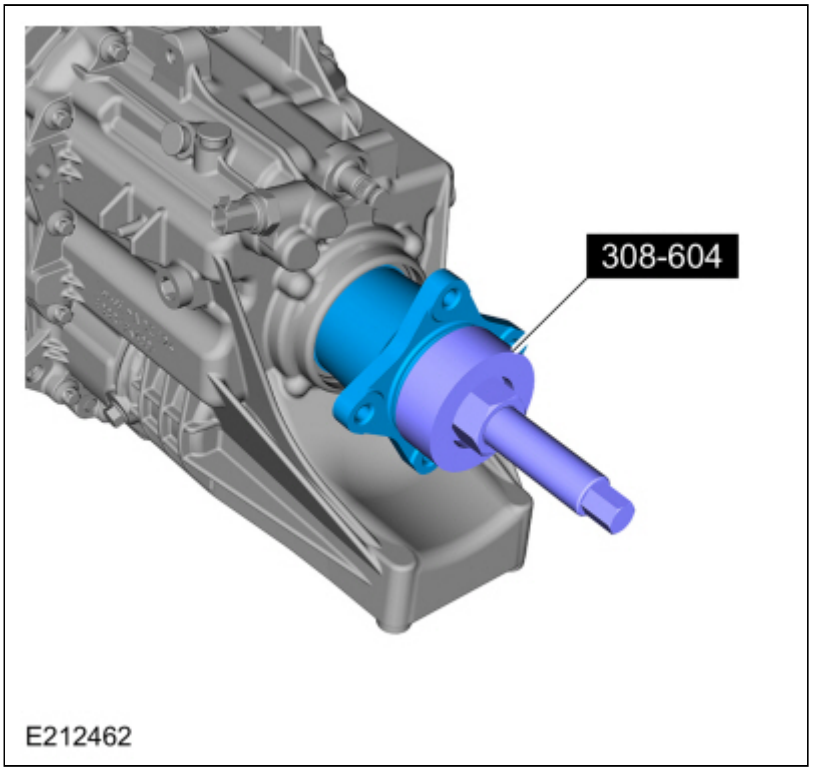


Installation

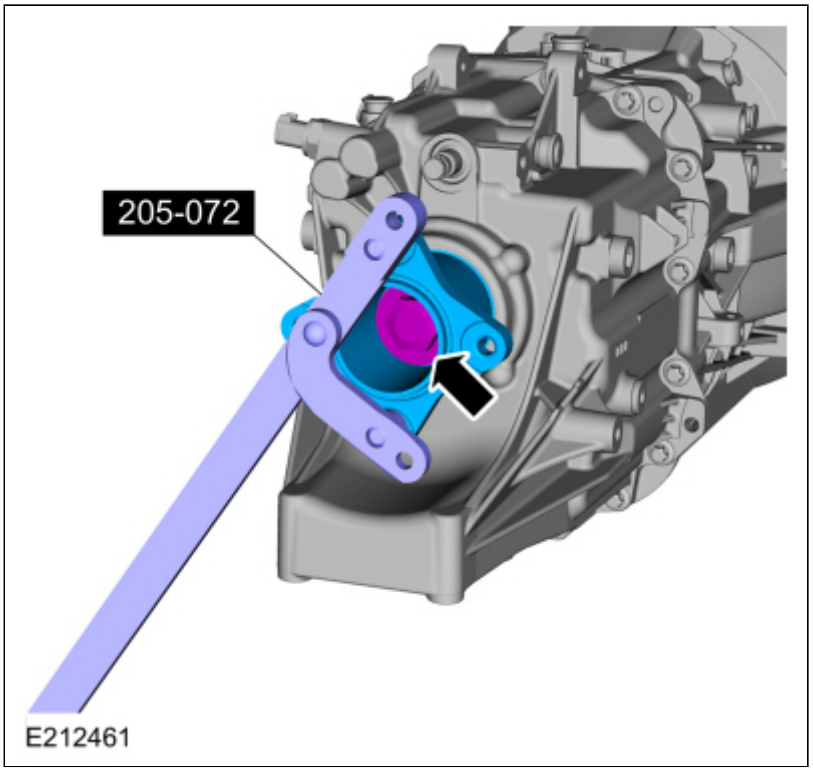
1. Use Special Service Tool: 308-690 Installer, Output Drive Flange Seal.



2. Use Special Service Tool: 308-604 Installer, Output Drive Flange Seal.



3. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
   Material: Thread Locking Adhesive (WSK-M2G351-A6)
   Torque:
   Stage 1: 200 Nm
   Stage 2: Loosen: 1 turn(s)
   Stage 3: 180 Nm



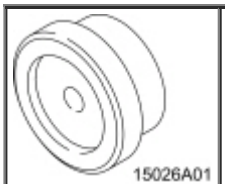
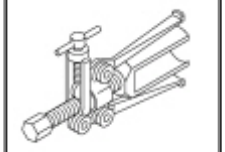
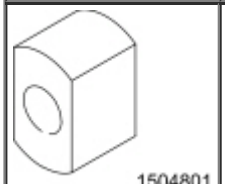
4. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

Copyright © 2016 Ford Motor Company

Output Shaft Seal - LHD 4WD/RHD 4WD

Base Part Number: 7B215

Special Tool(s) / General Equipment

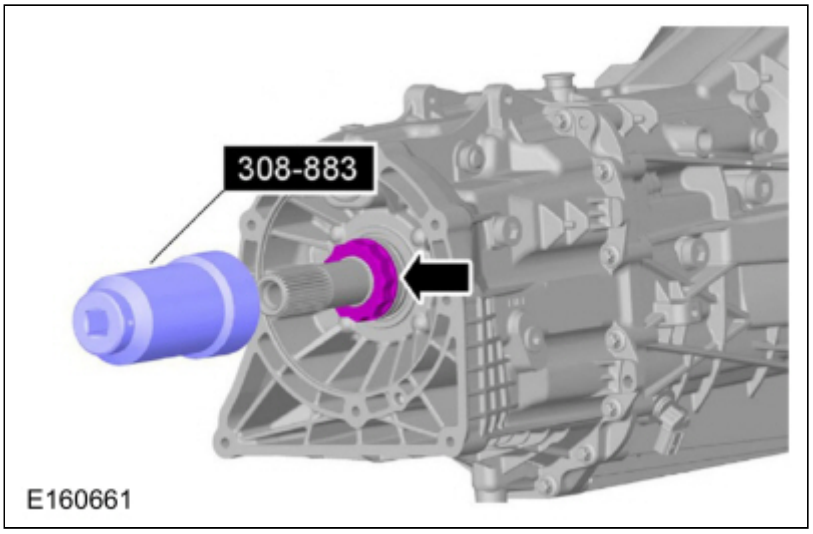
 15026A01	205-071-01 Adapter for 205-071 (Thrust Pad)
 15048	205-078 Remover, Drive Pinion Seal
 1504801	205-078-01 Adapter for 205-078 (Thrust Pad)
 E163726	308-883 Wrench, Output Shaft Nut
 E163727	308-884 Installer, Output Shaft Seal
Hot Air Gun	
Puller	

Materials

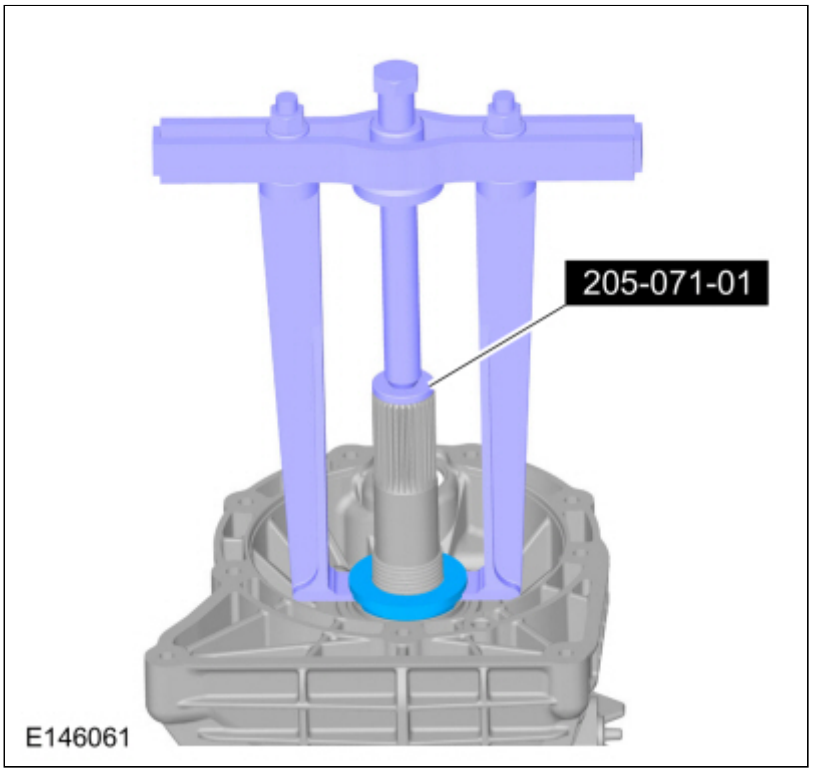
Name	Specification
Thread Locking Adhesive	WSK-M2G349-A7

Removal

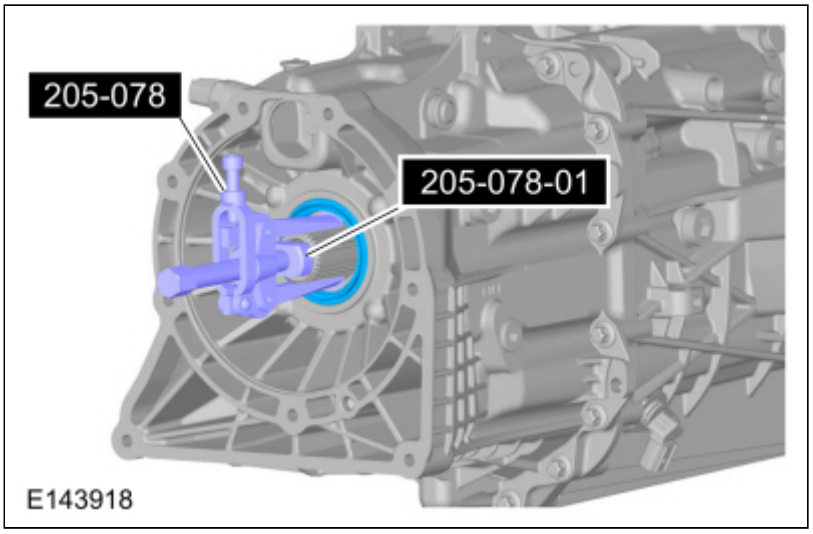
1. Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Removal).
2. Use Special Service Tool: 308-883 Wrench, Output Shaft Nut.



3. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).
   Use the General Equipment: Puller



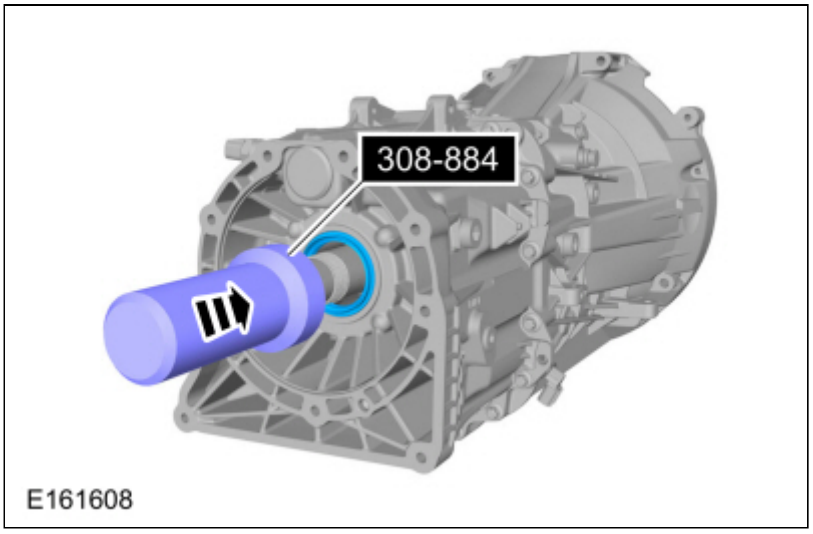
4. Discard the output shaft oil seal.
   Use Special Service Tool: 205-078 Remover, Drive Pinion Seal. , 205-078-01 Adapter for 205-078 (Thrust Pad).



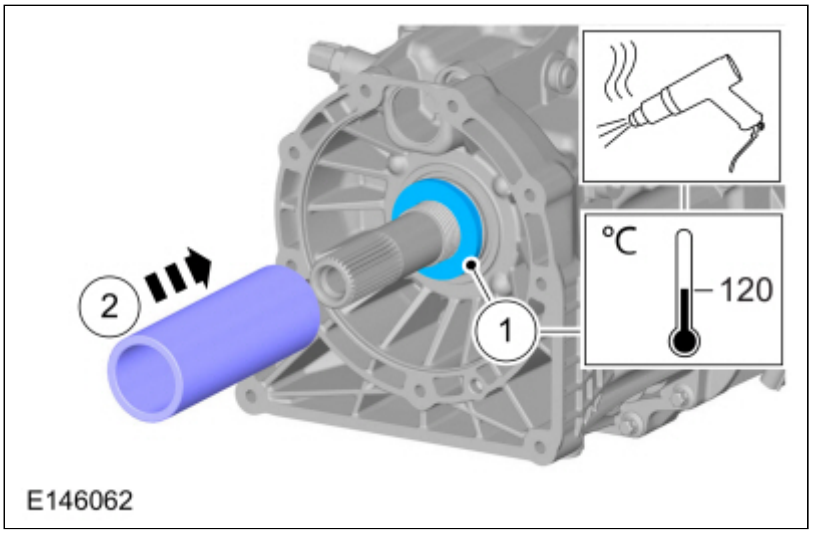
Installation

1. **NOTICE: Install a new output shaft oil seal.**

   Use Special Service Tool: 308-884 Installer, Output Shaft Seal.

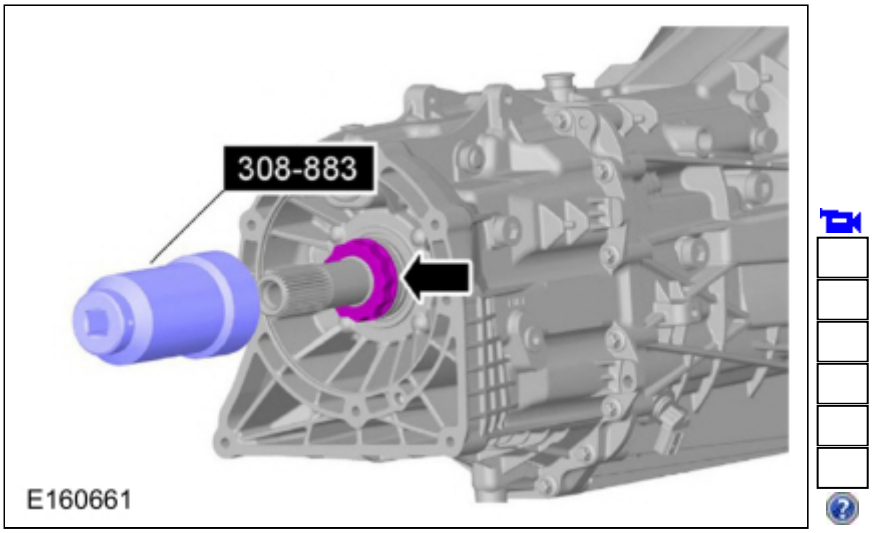


1. Use the General Equipment: Hot Air Gun
2. Use a suitable pipe to install the seal.



1. Use Special Service Tool: 308-883 Wrench, Output Shaft Nut.
2. Tighten the bolt.
   Material: Thread Locking Adhesive (WSK-M2G349-A7)

Torque: 210 Nm
3. Loosen the bolt.
4. *Torque*: 180 Nm



4. Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Installation).

Copyright © 2016 Ford Motor Company

Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2

Base Part Number: 7000

Special Tool(s) / General Equipment

Transmission Jack
Retaining Strap

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

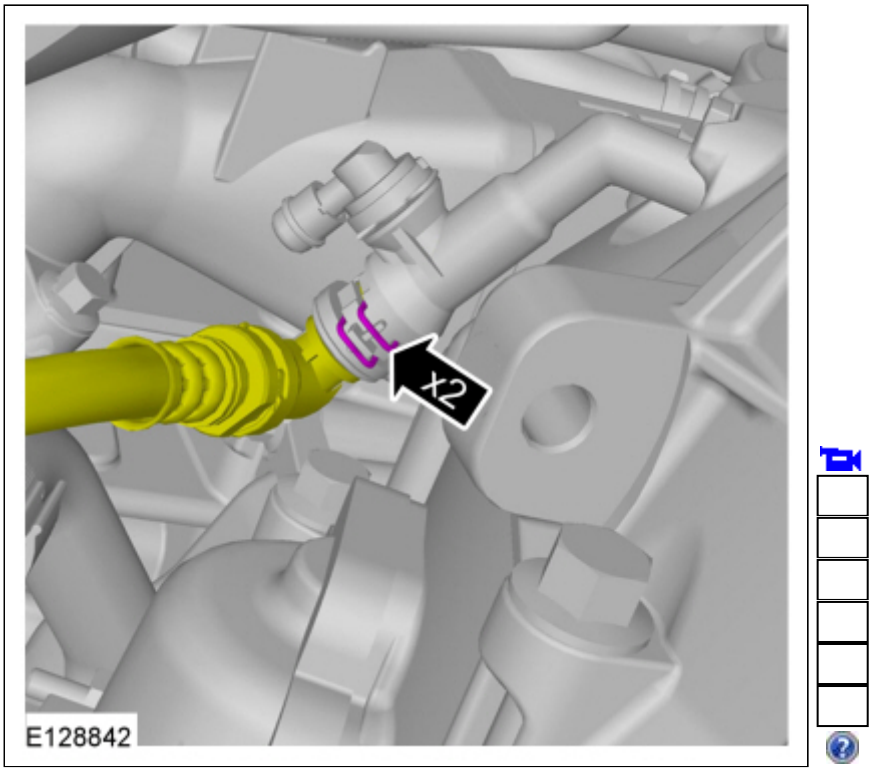
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

3. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

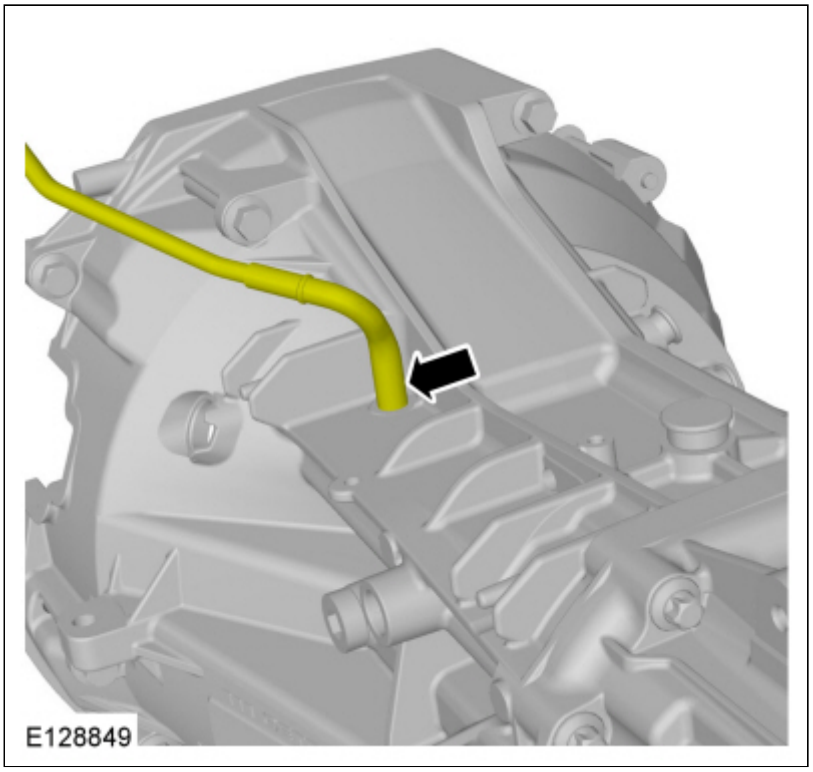
4. Refer to: Transmission Draining and Filling (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, General Procedures).

5. **NOTICE: Cap the clutch slave cylinder supply line to prevent fluid loss or dirt ingress.**

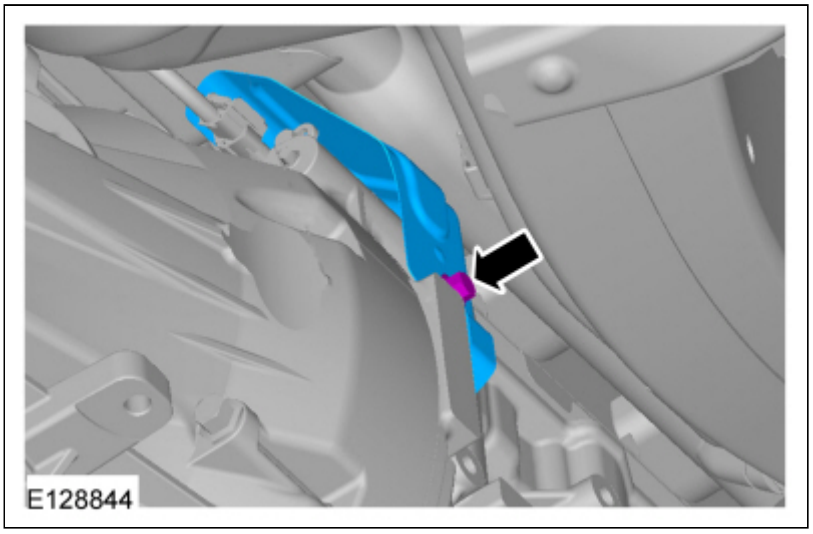
   NOTE: *If the clutch fluid comes into contact with the painted area, rinse off the affected areas with cold water without delay.*



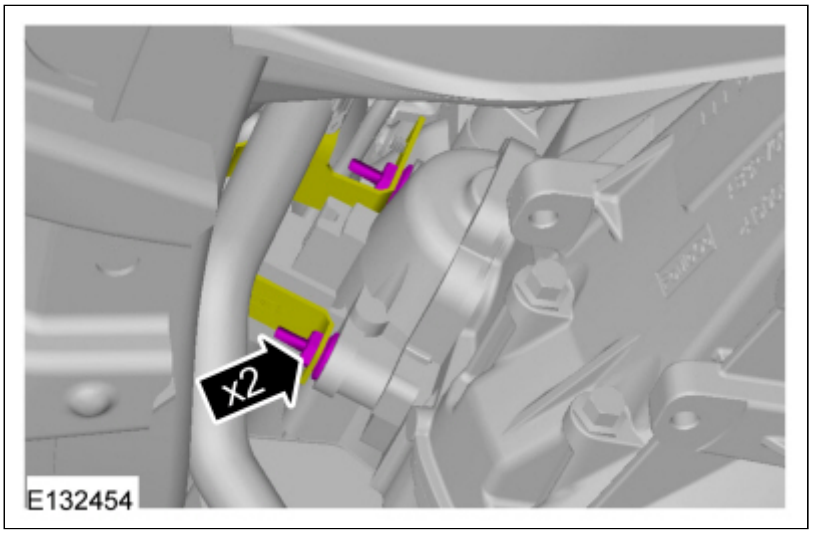
6.



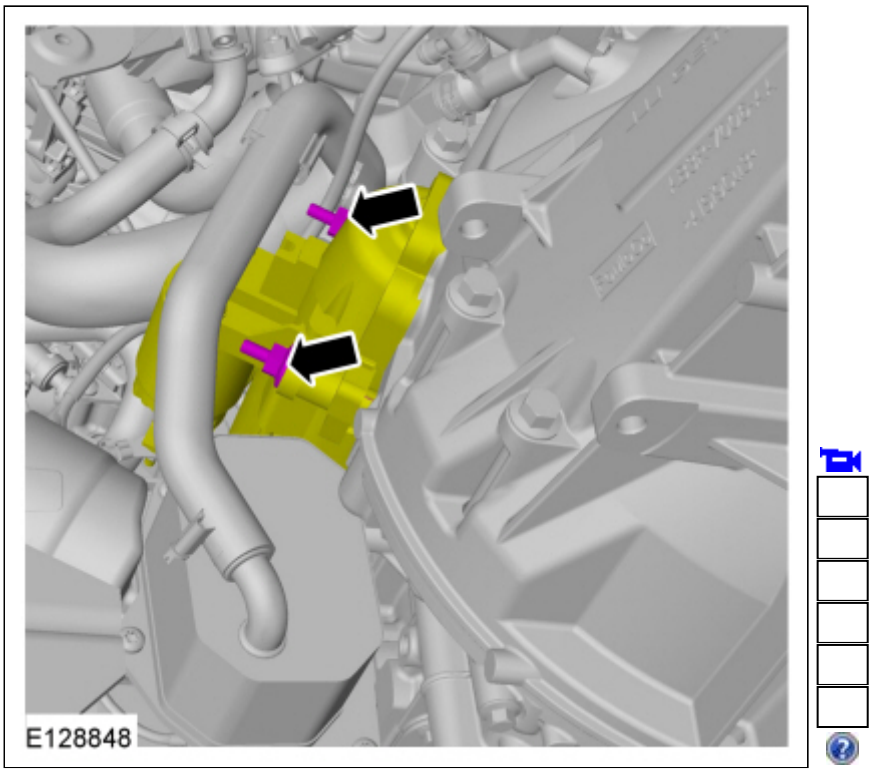
7.



8.

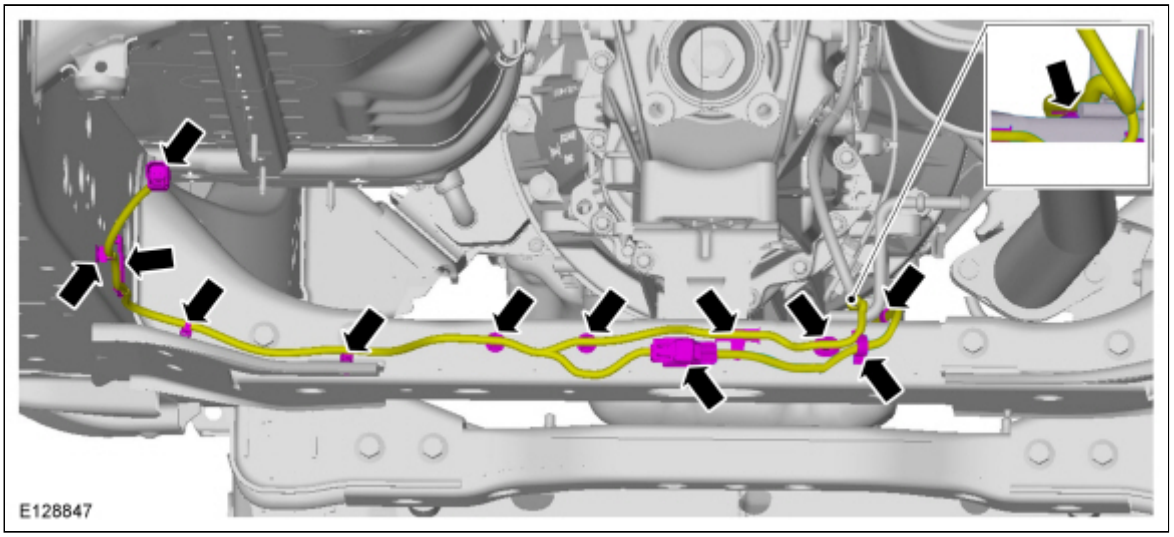


9.

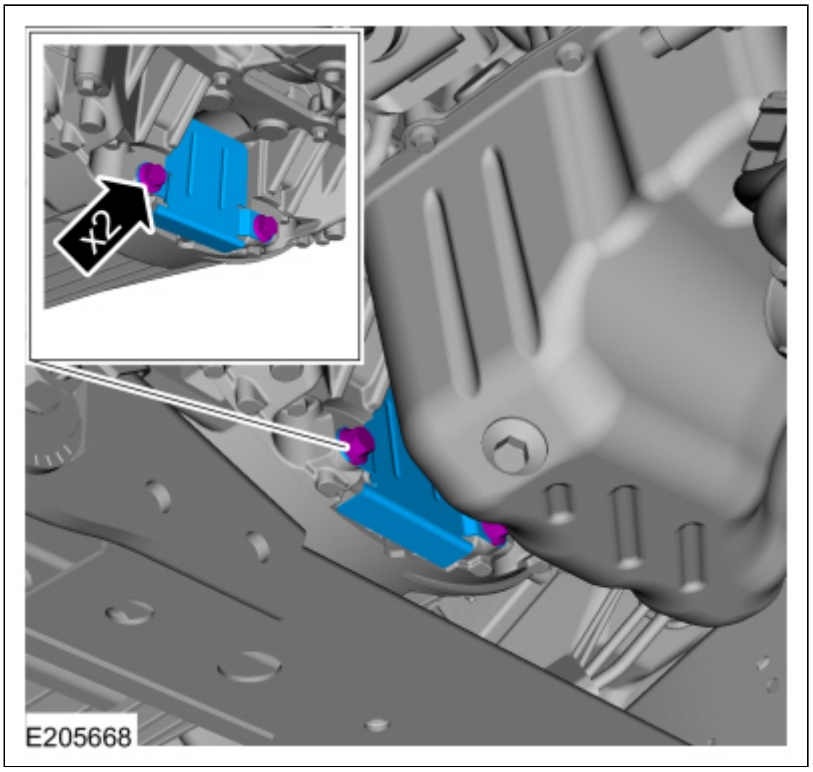


10. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

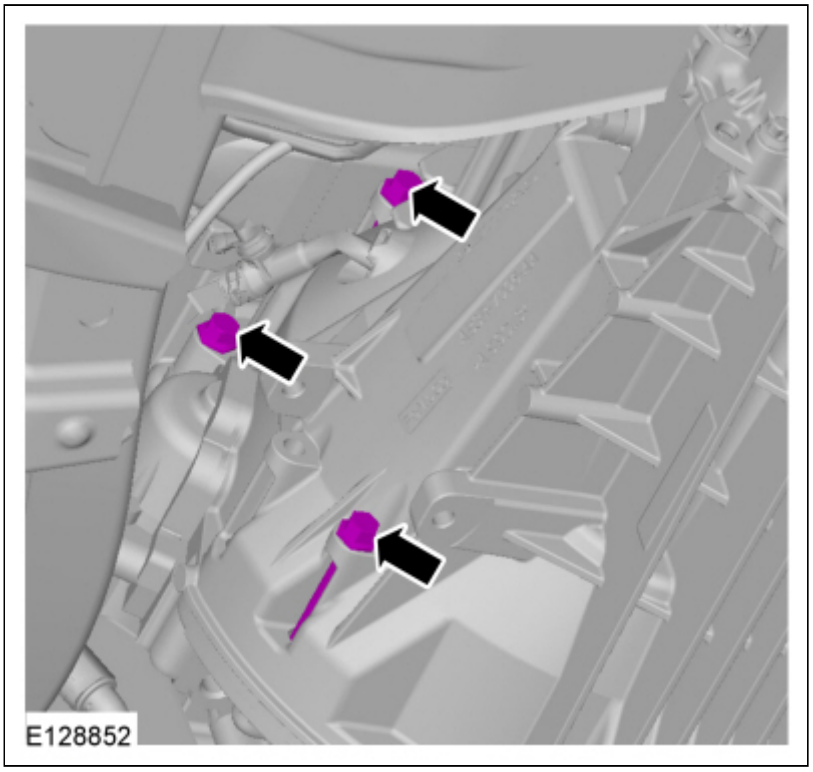
11.



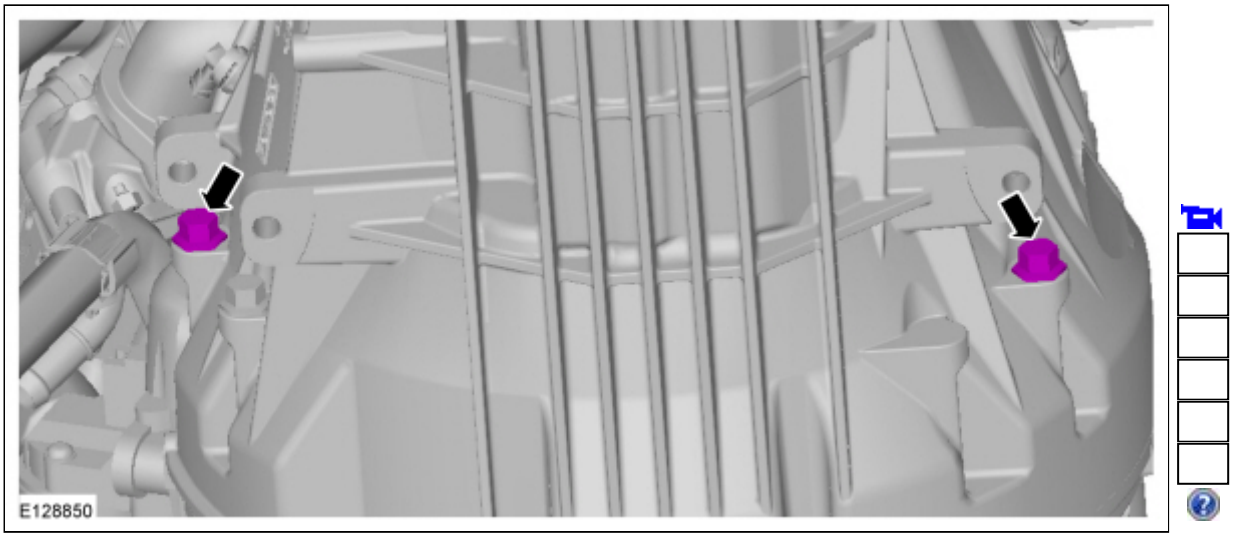
12.



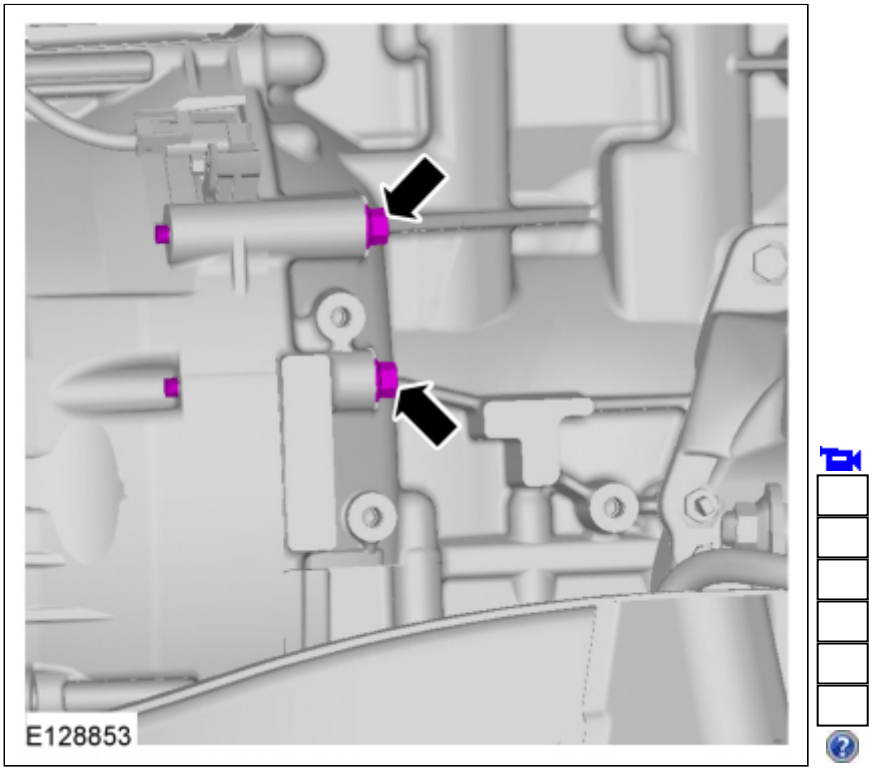
13.



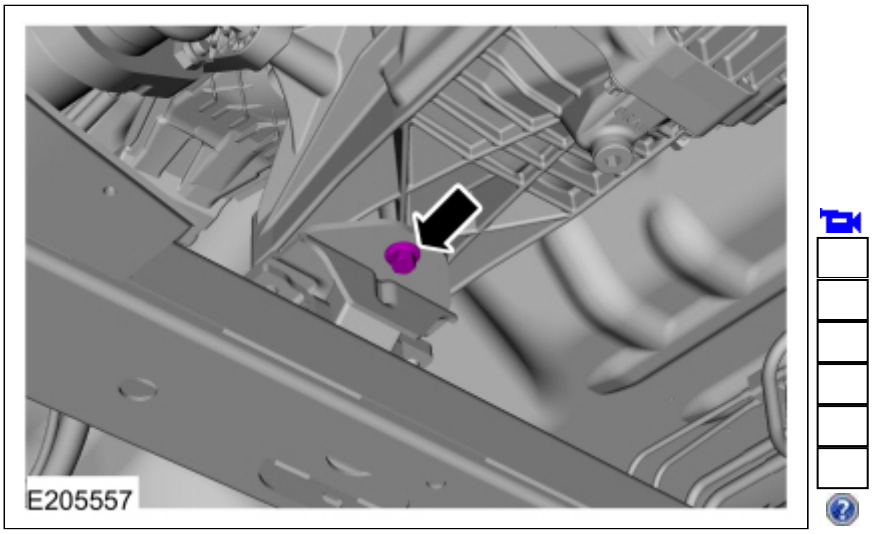
14.



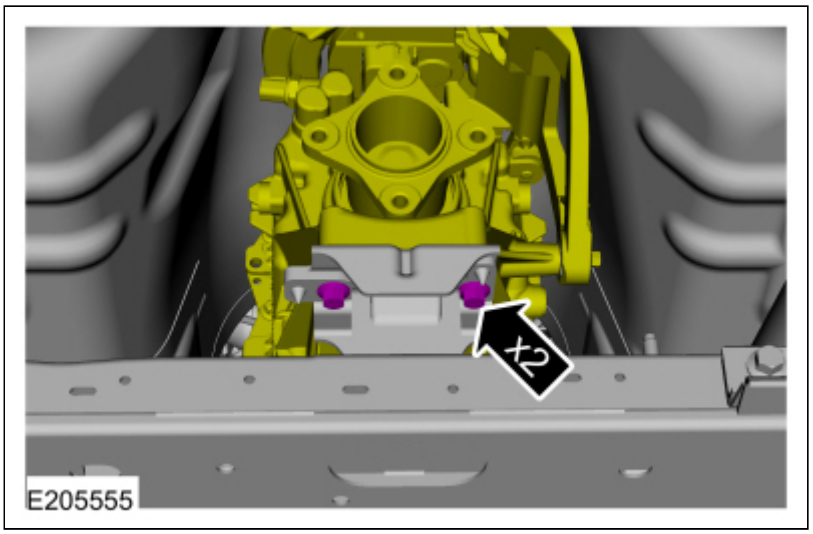
15.



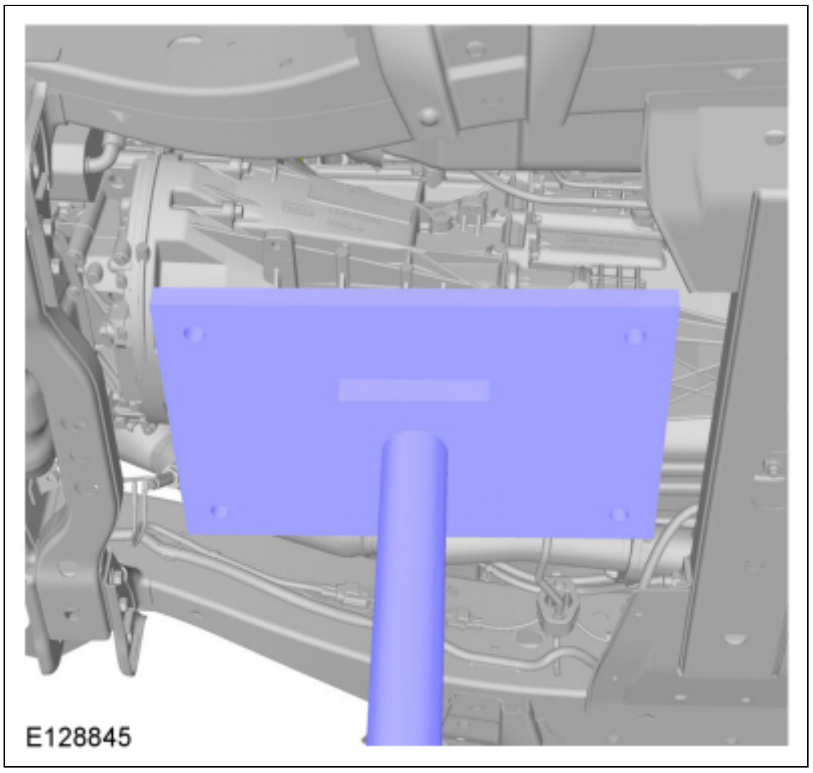
16.



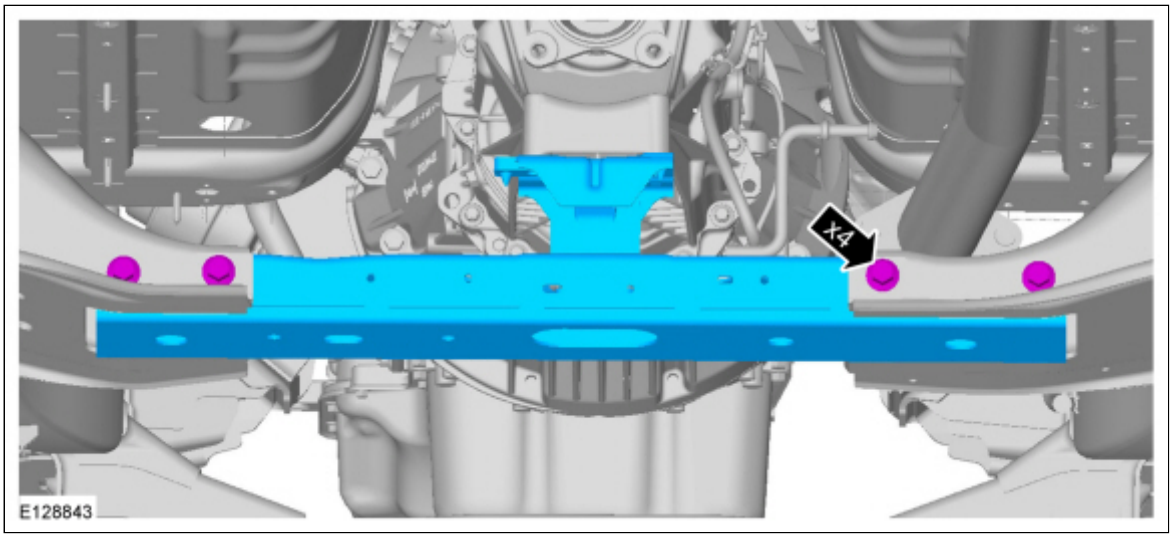
17.



18. Use the General Equipment: Transmission Jack

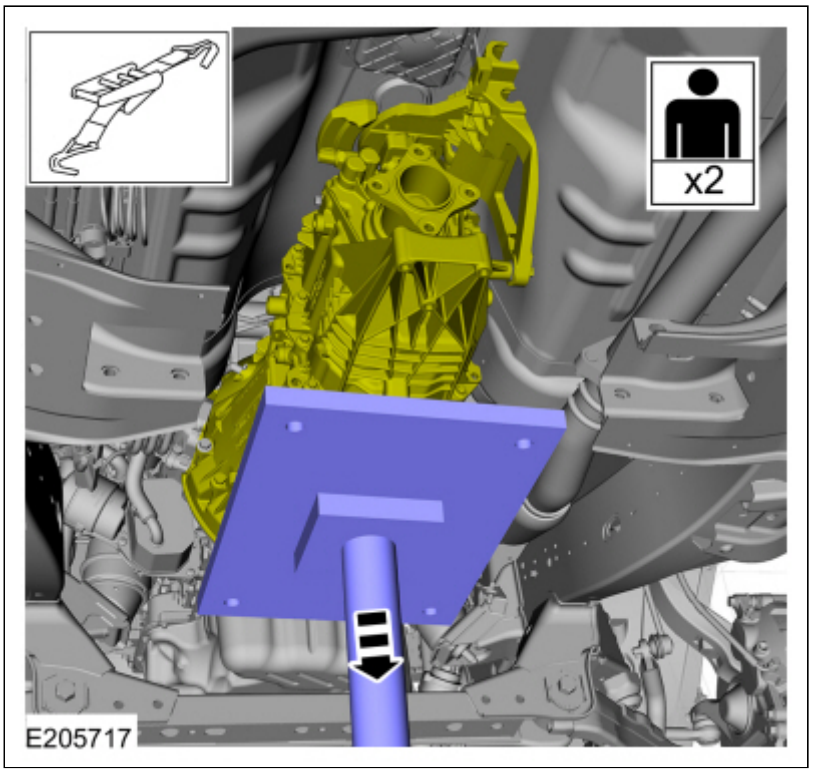


19.

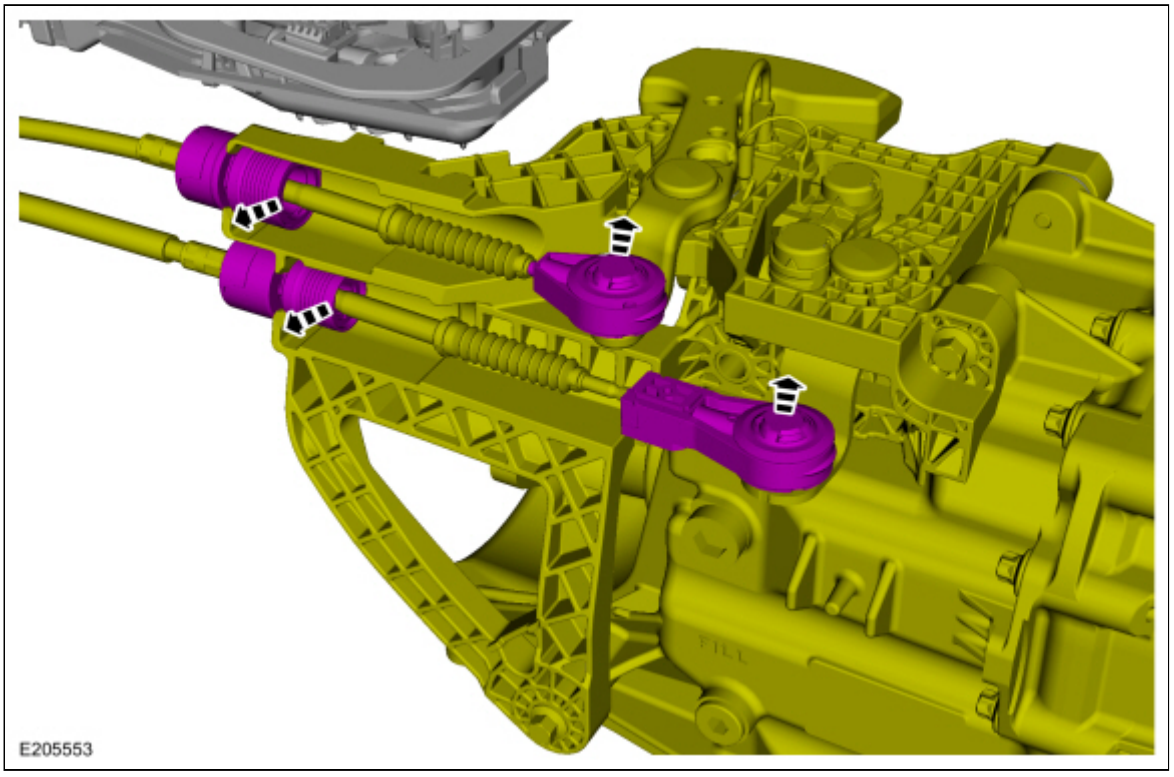


20. Use the General Equipment: Transmission Jack

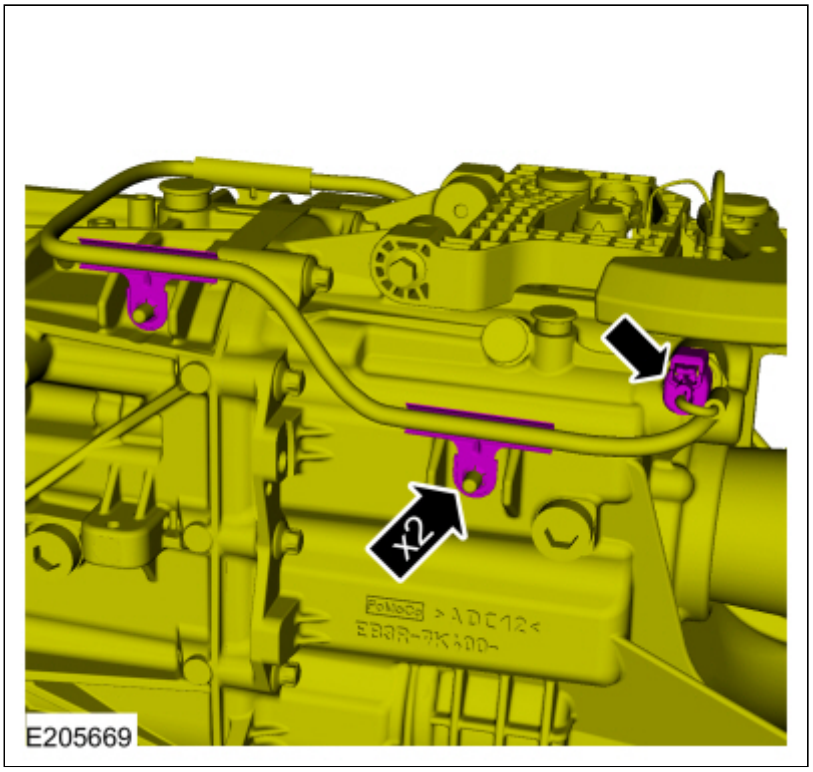
Use the General Equipment: Retaining Strap



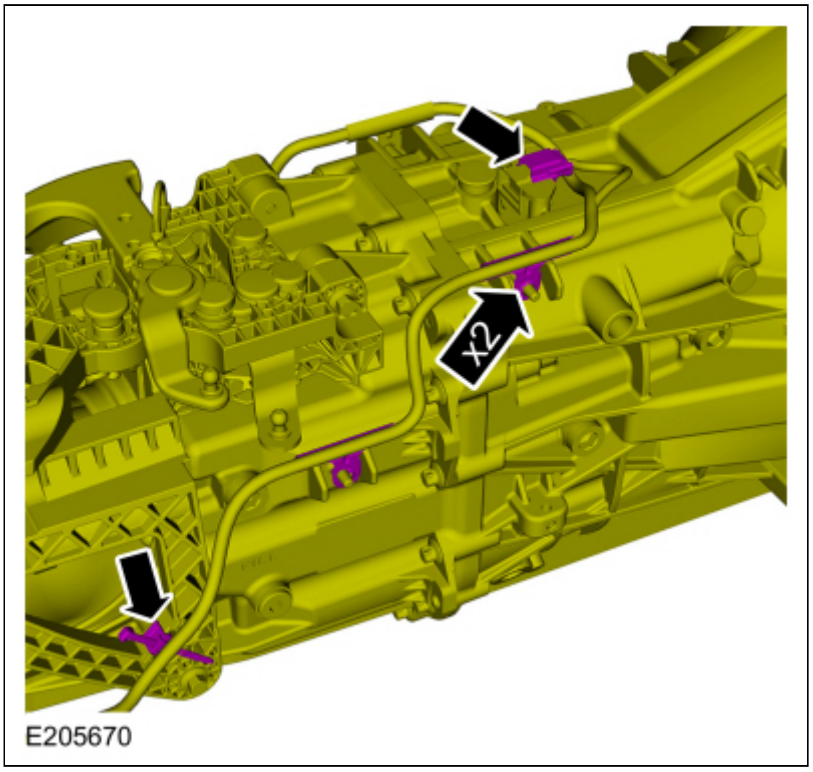
21.



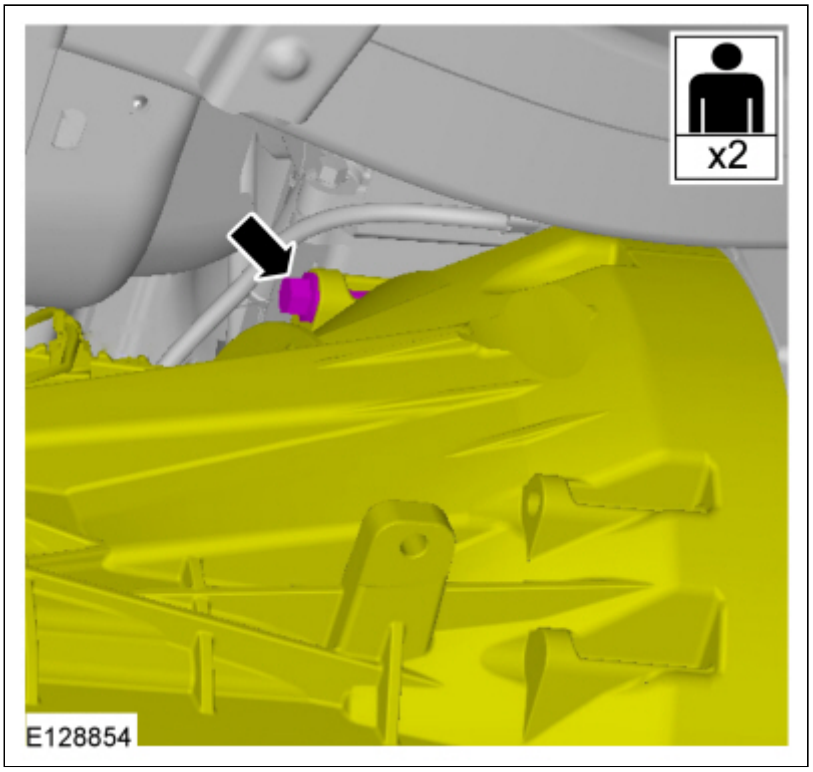
22.



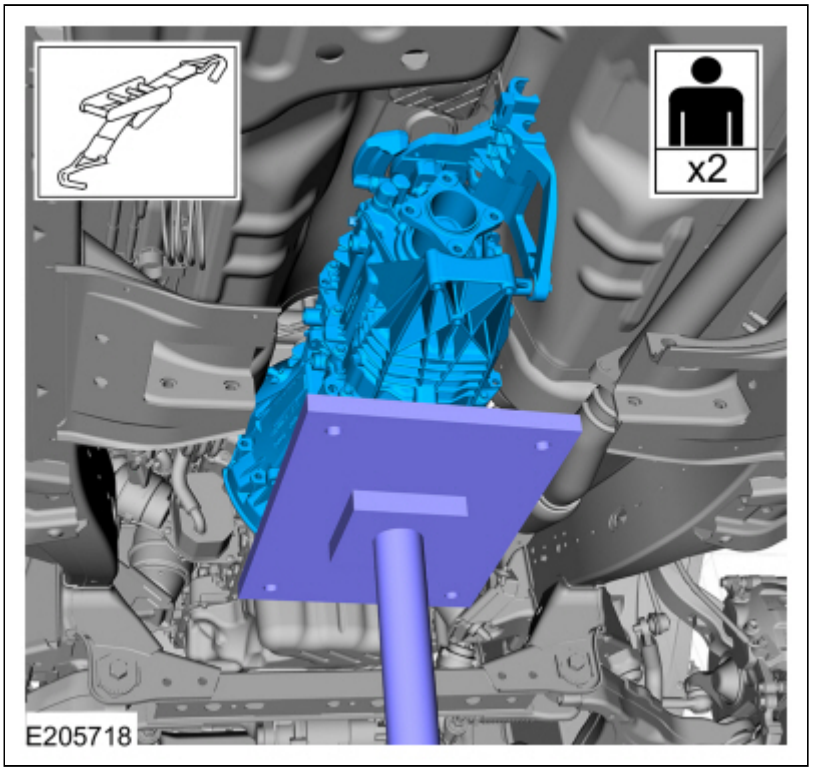
23.



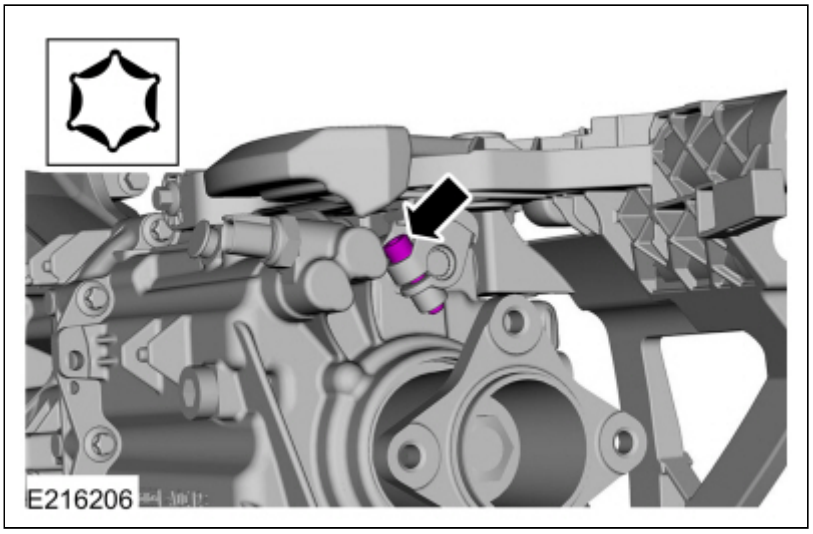
24. **NOTICE: Do not tilt the transmission during removal. This may cause damage to the pilot bearing.**



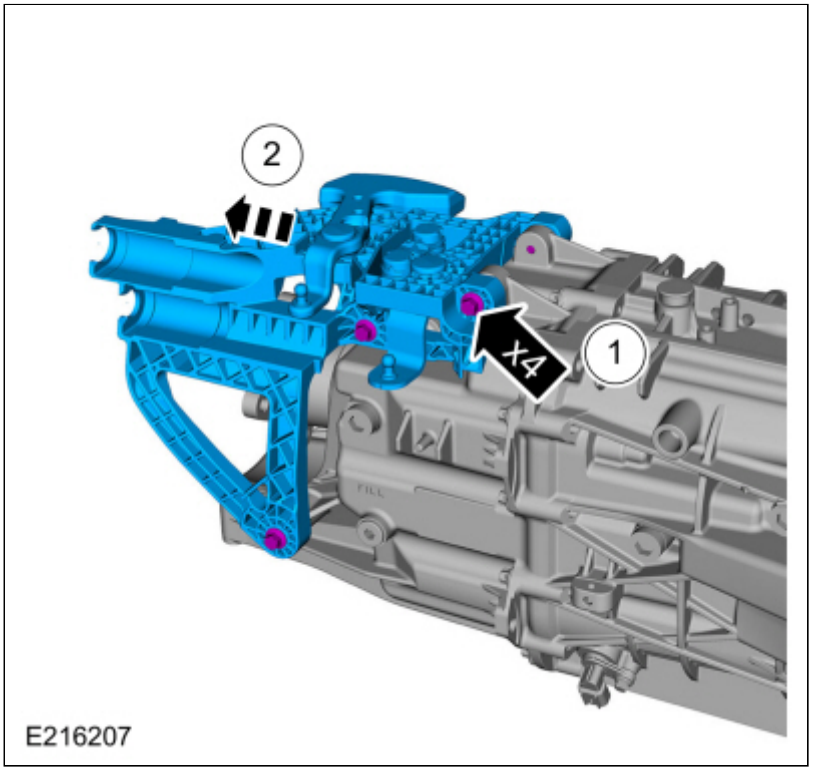
25. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap



26.



27.



Copyright © 2016 Ford Motor Company

Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x4

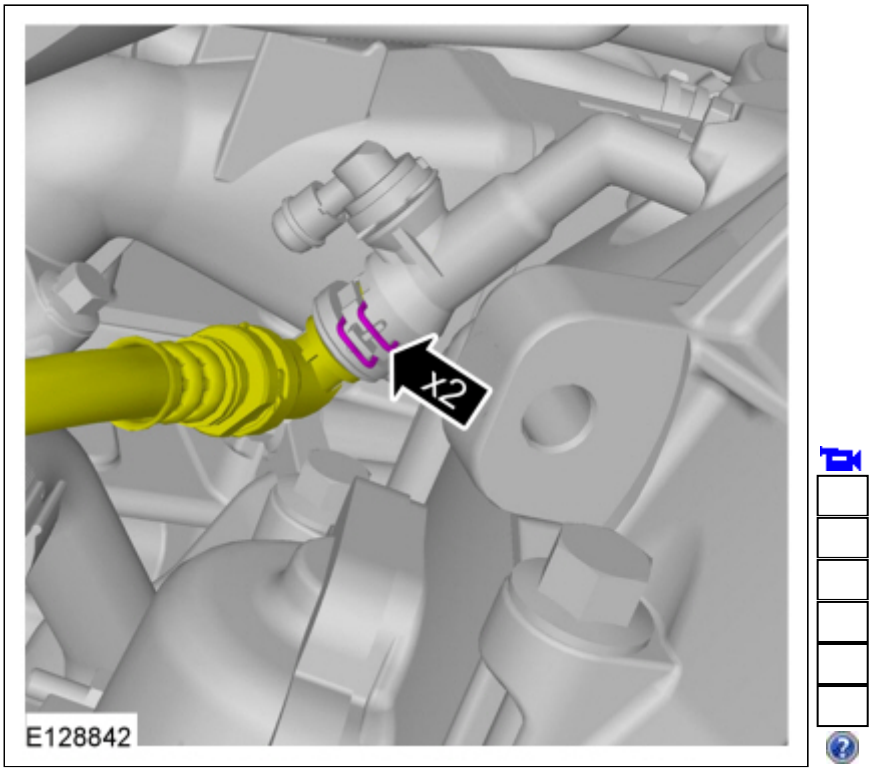
Base Part Number: 7000

Special Tool(s) / General Equipment

Transmission Jack
Retaining Strap

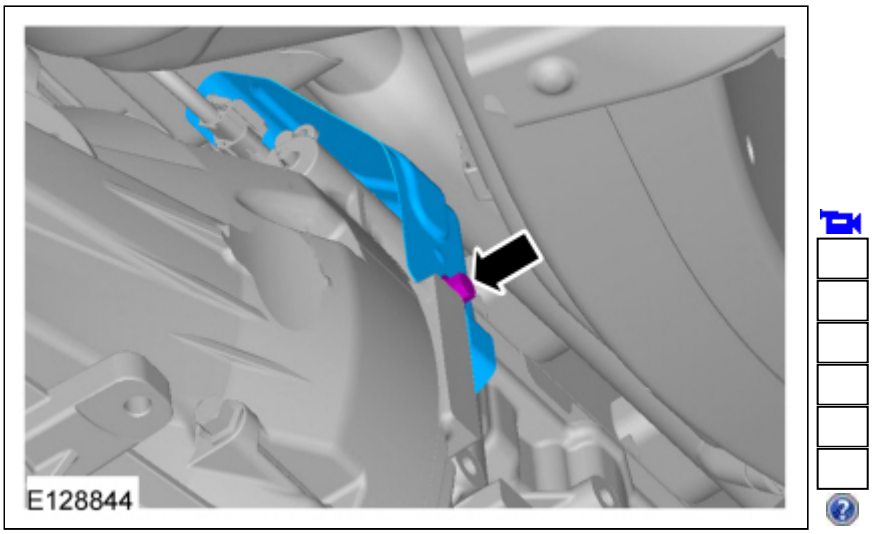
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Transmission Draining and Filling (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, General Procedures).
4. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
5. **NOTICE: Cap the clutch slave cylinder supply line to prevent fluid loss or dirt ingress.**

   NOTE: *If the clutch fluid comes into contact with the painted area, rinse off the affected areas with cold water without delay.*

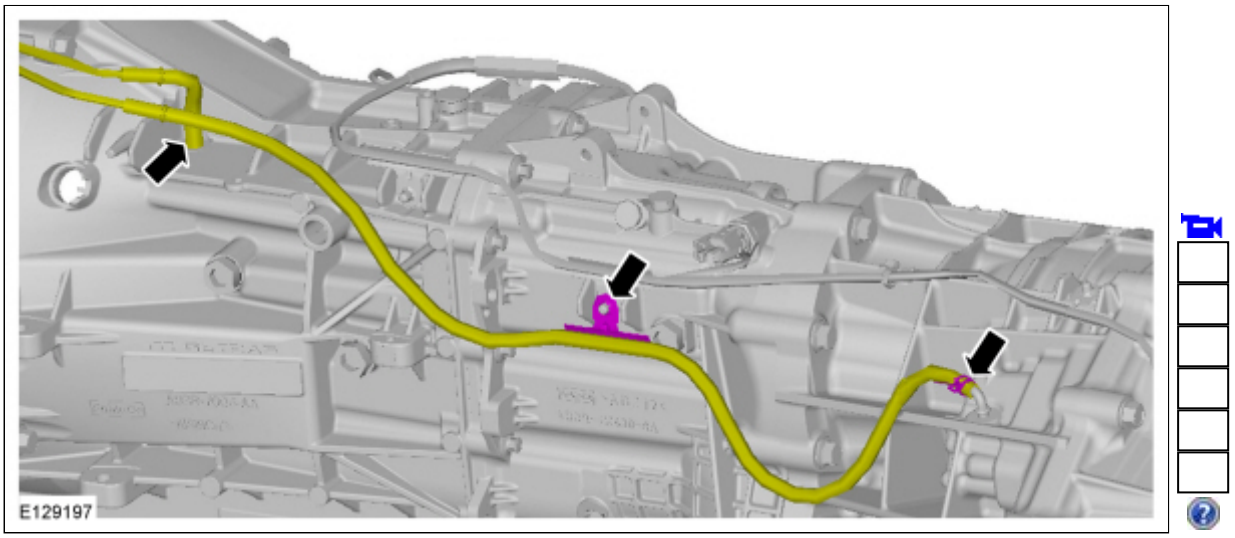


6. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
   Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).

7.

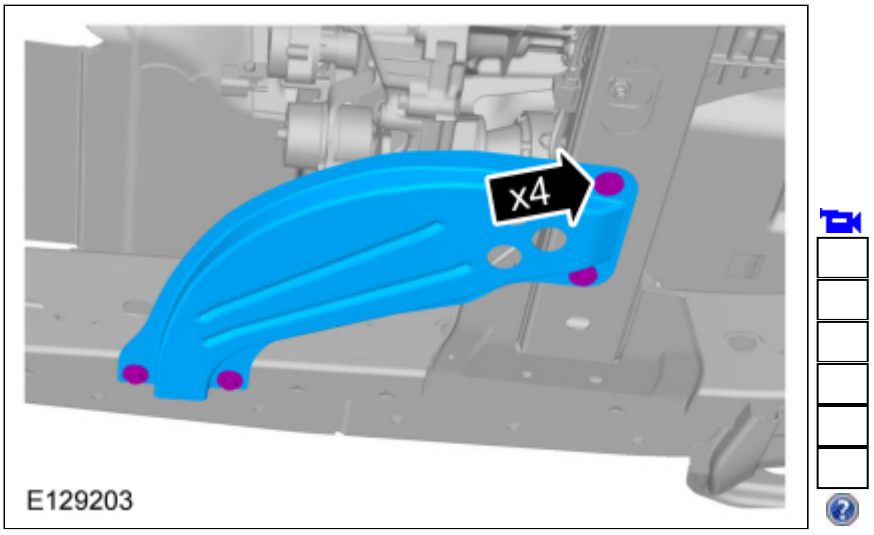


8.

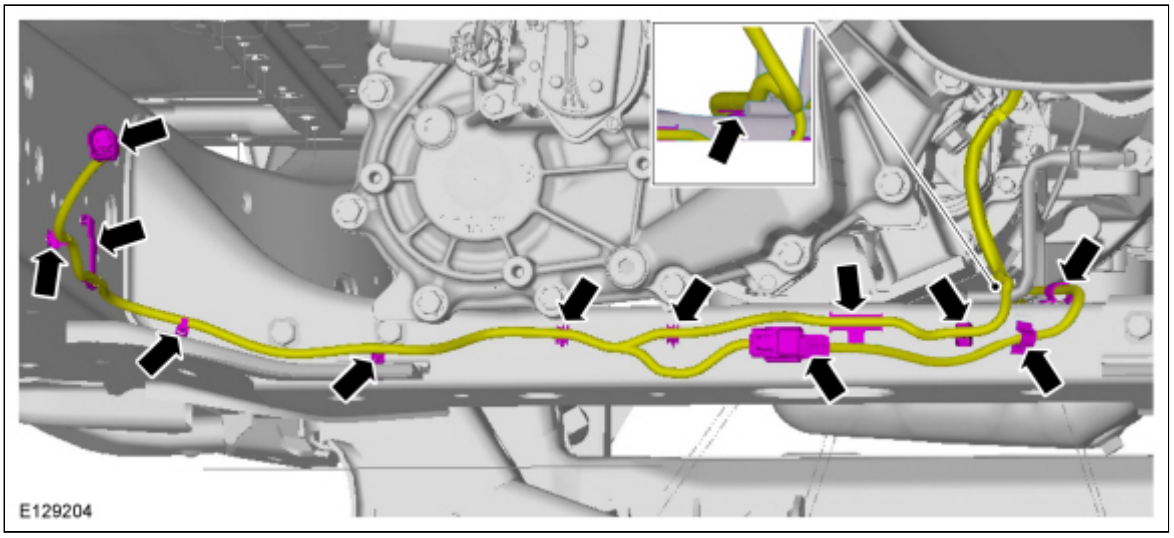


9. Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
   Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).

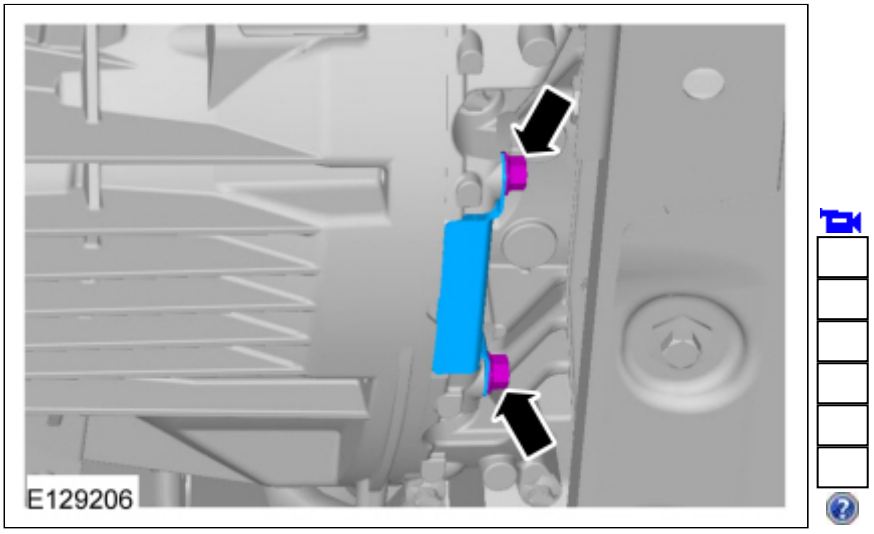
10.



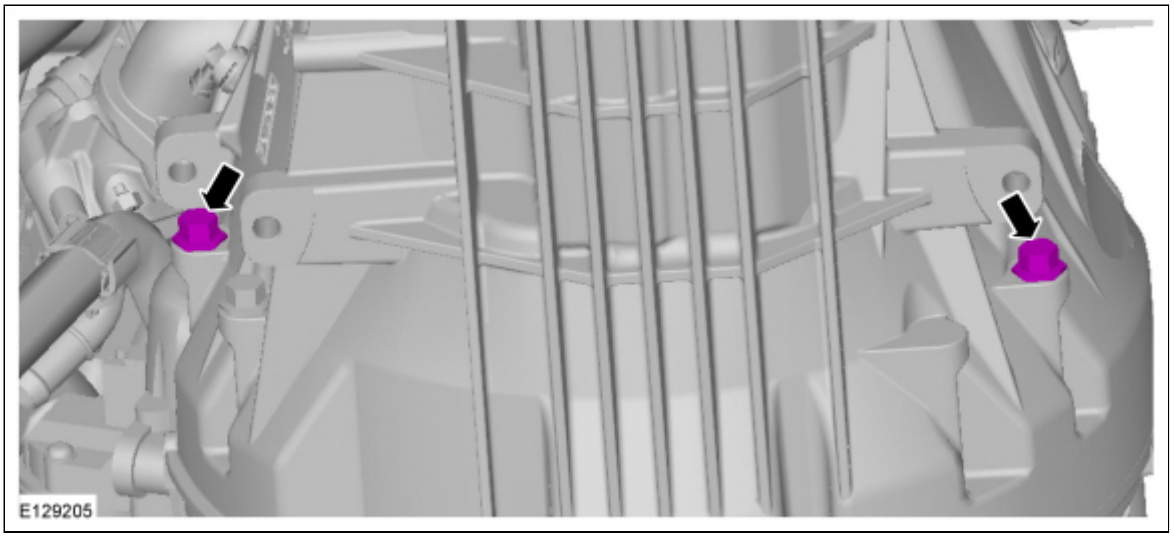
11.



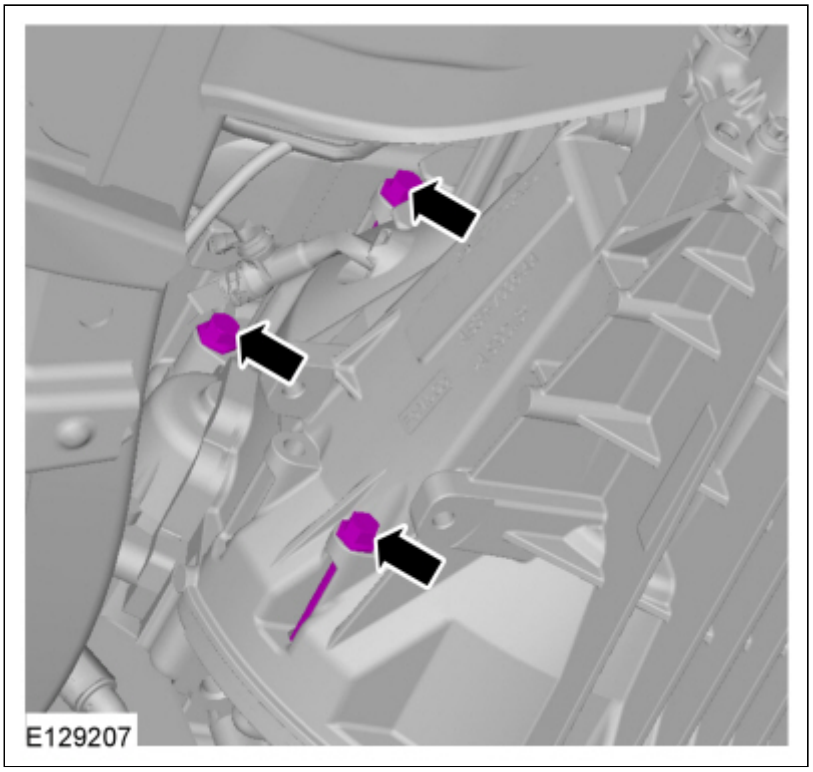
12.



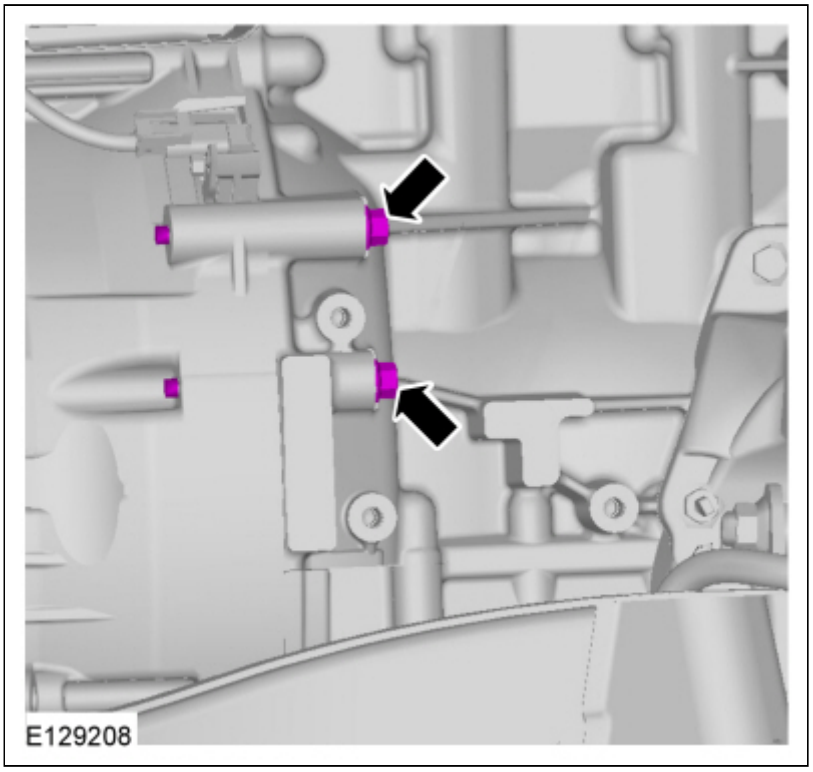
13.



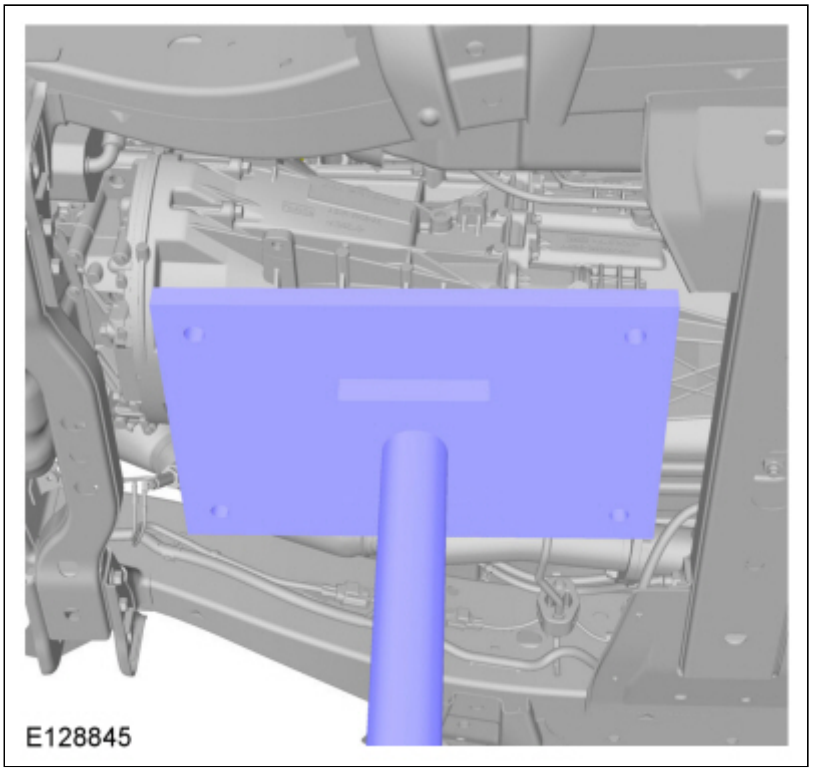
14.



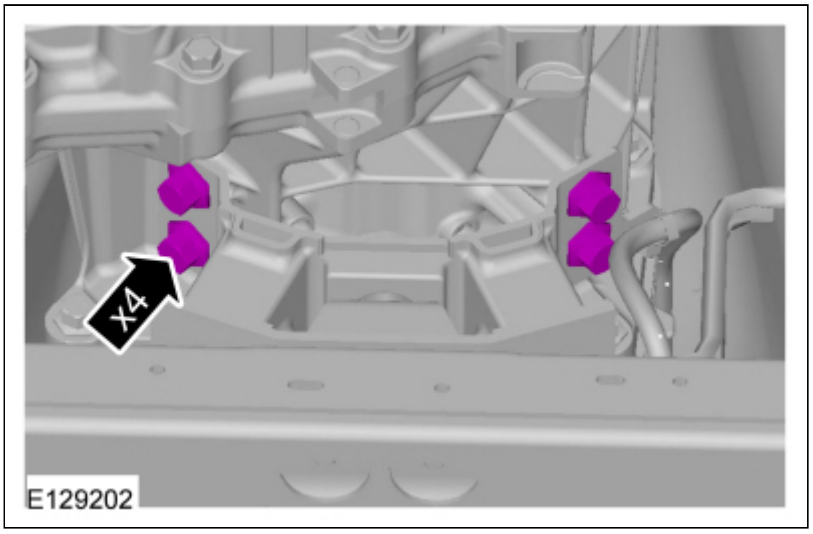
15.



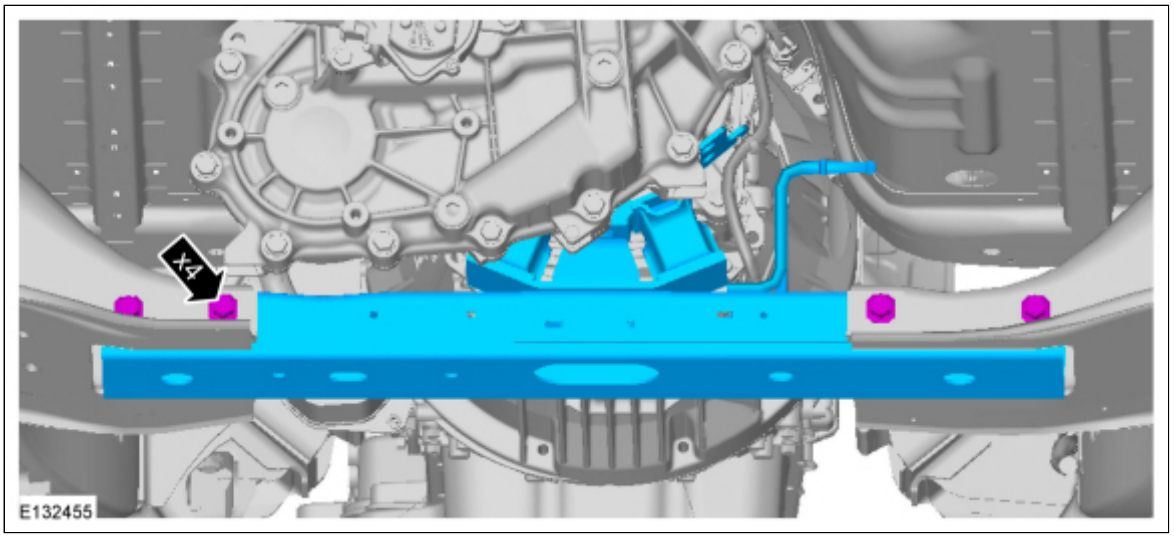
16. Use the General Equipment: Transmission Jack



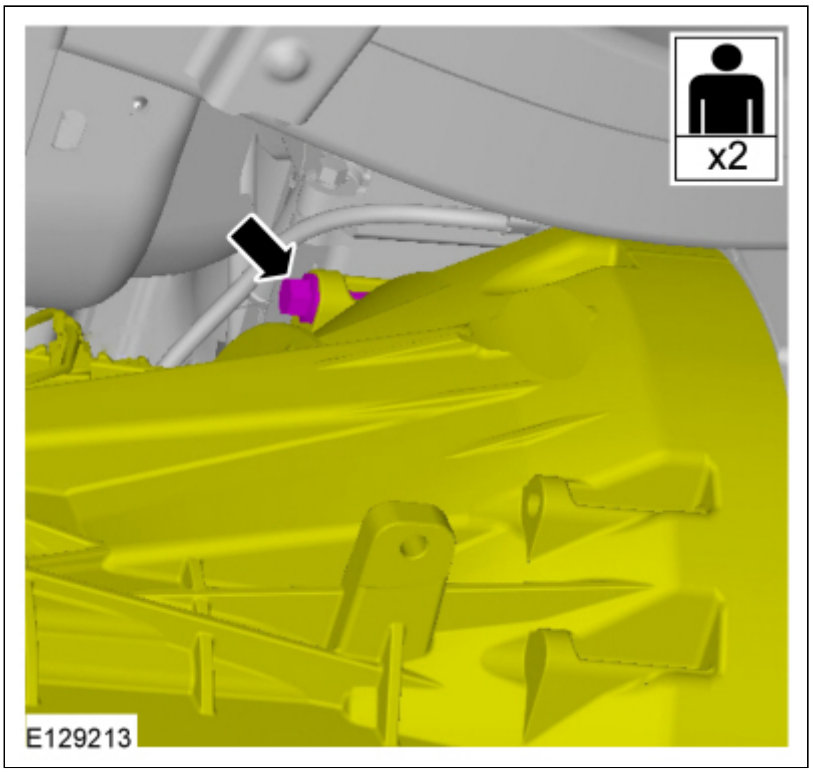
17.



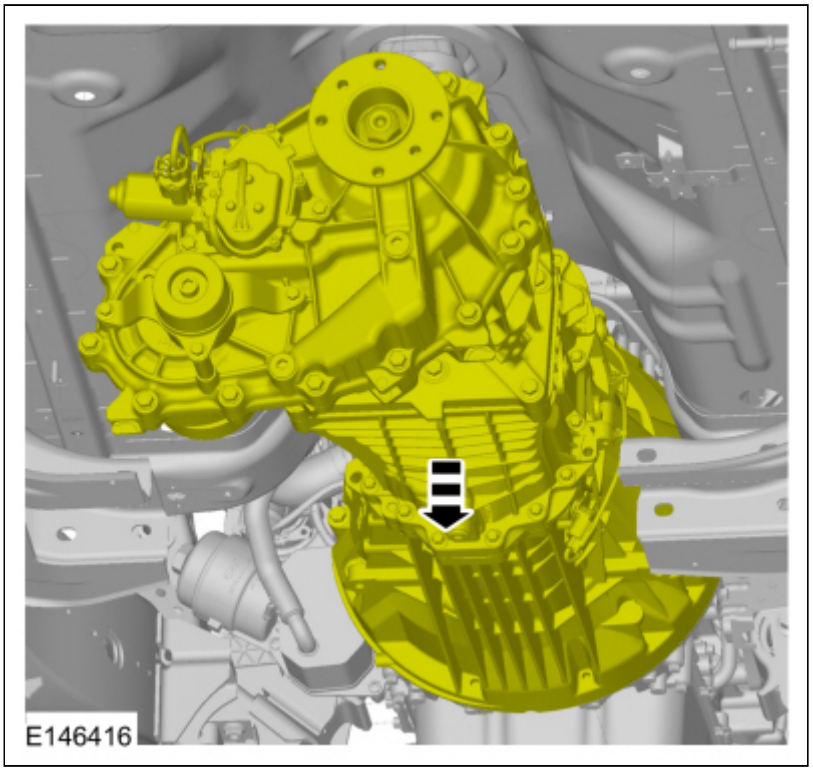
18.



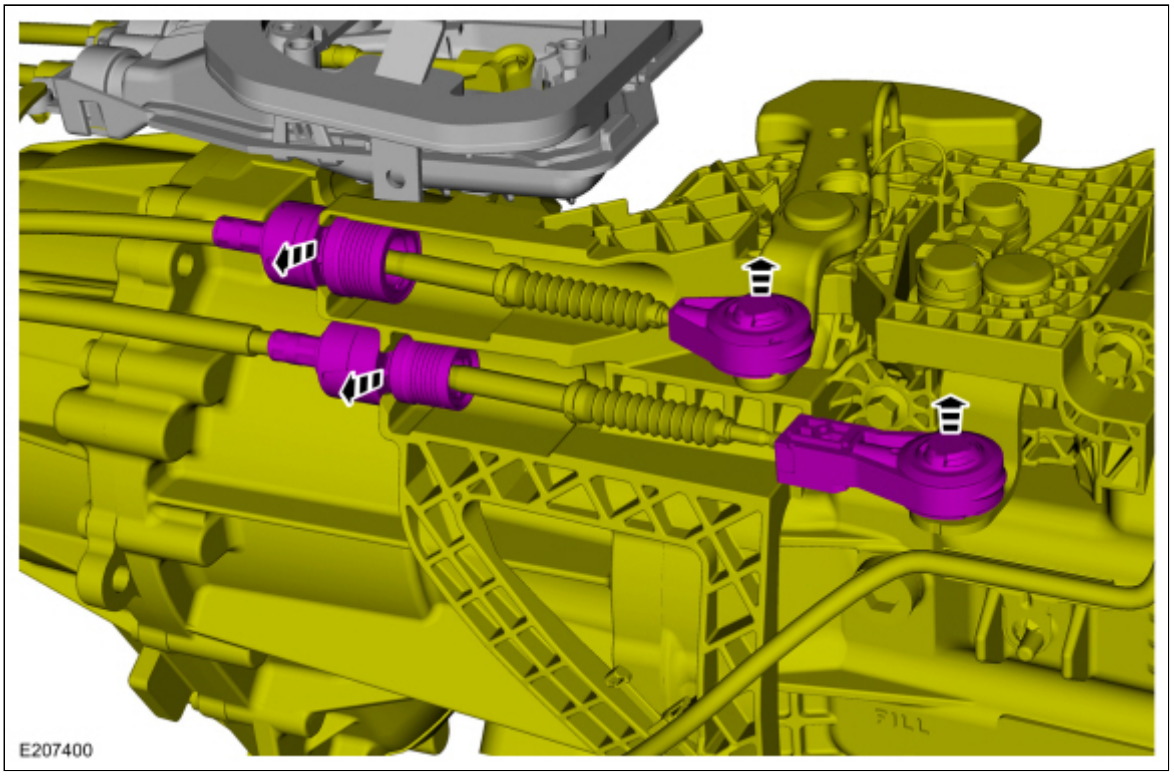
19. **NOTICE: Do not tilt the transmission during removal. This may cause damage to the pilot bearing.**



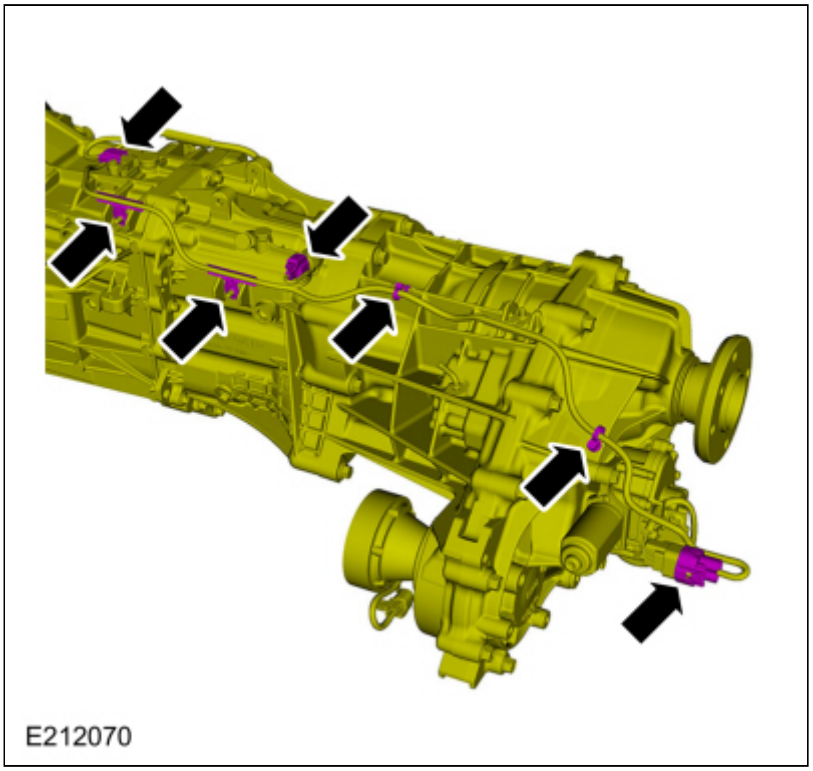
20. Use the General Equipment: Transmission Jack



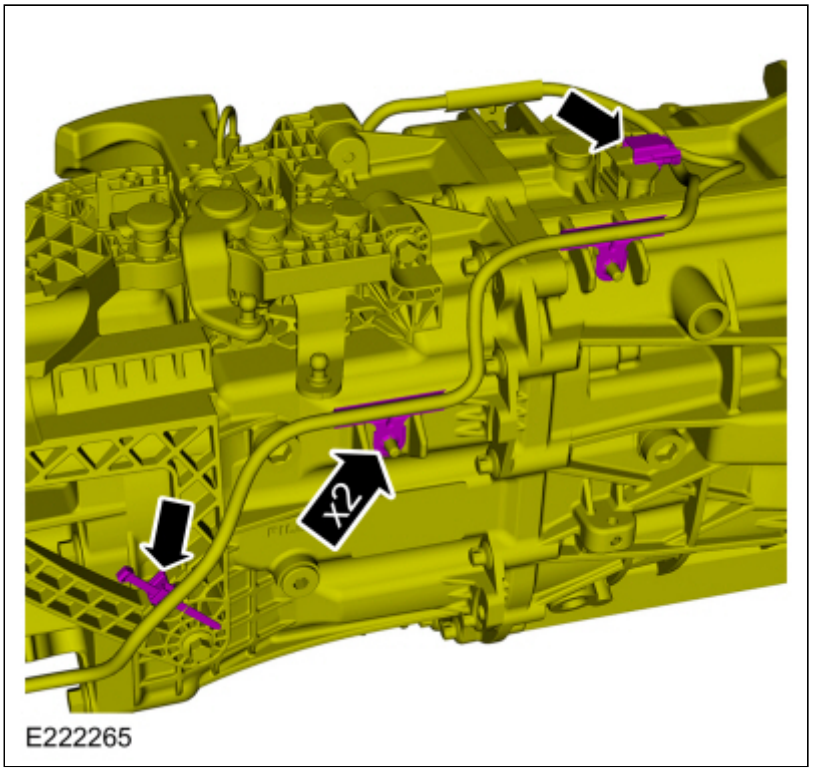
21.



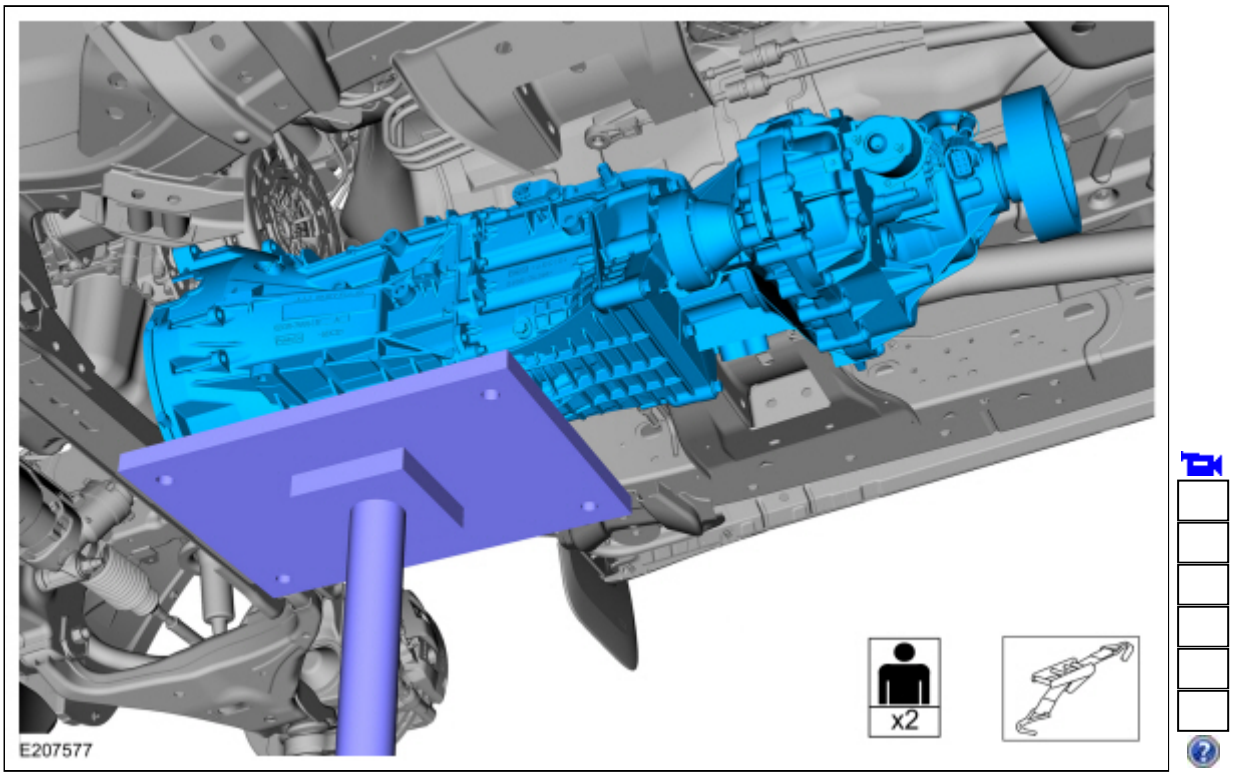
22.



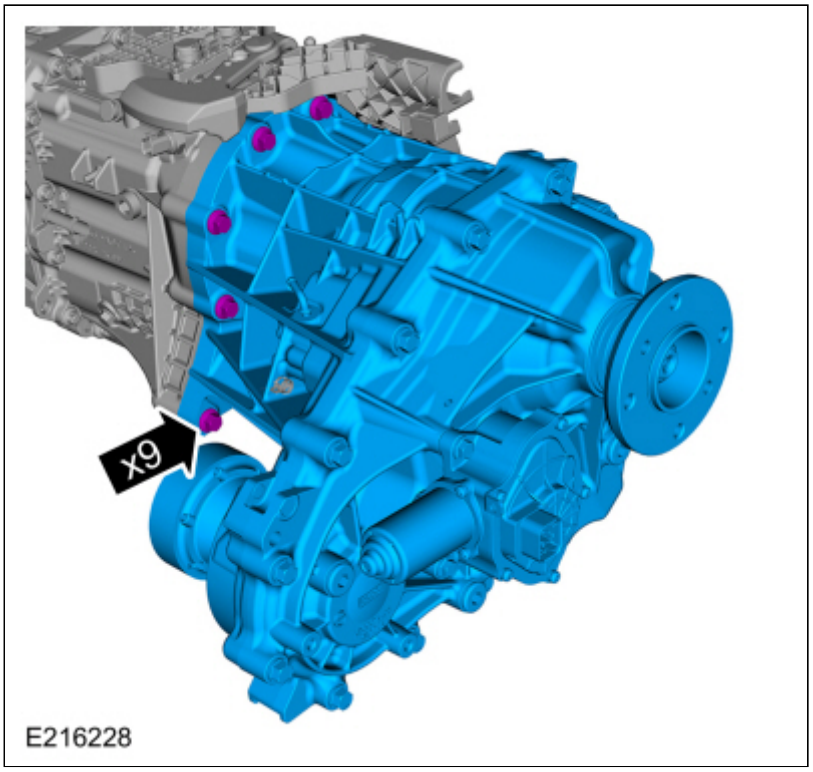
23.



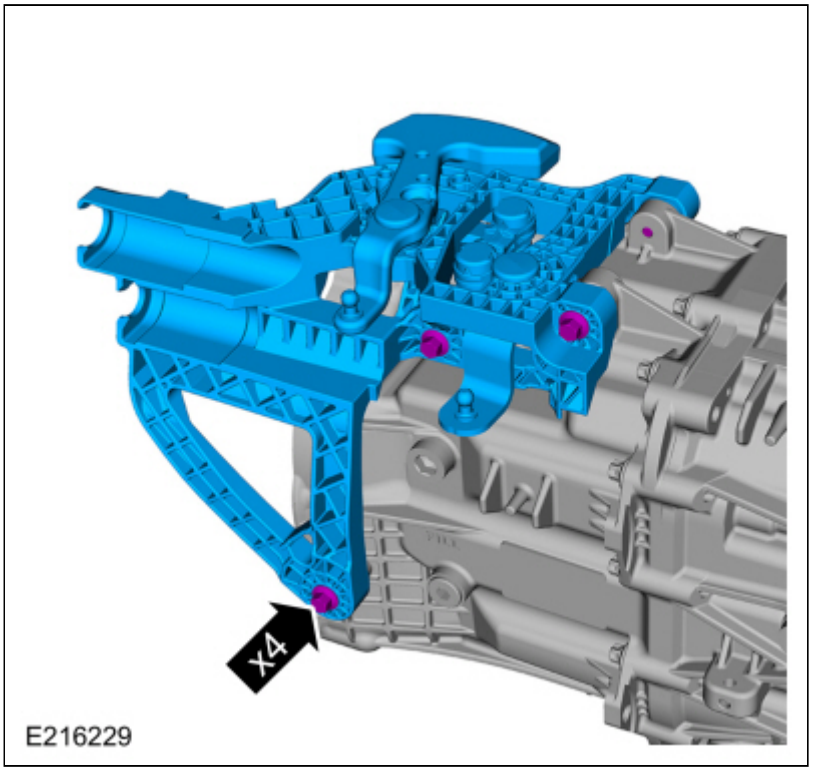
24. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap



25.



26.

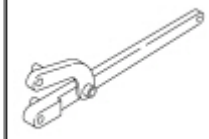
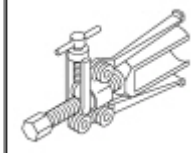
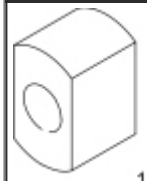
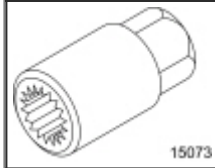
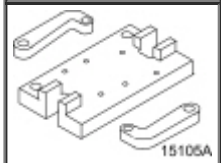


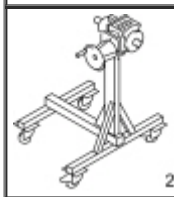
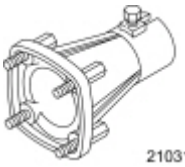
Copyright © 2016 Ford Motor Company

Transmission - 2WD

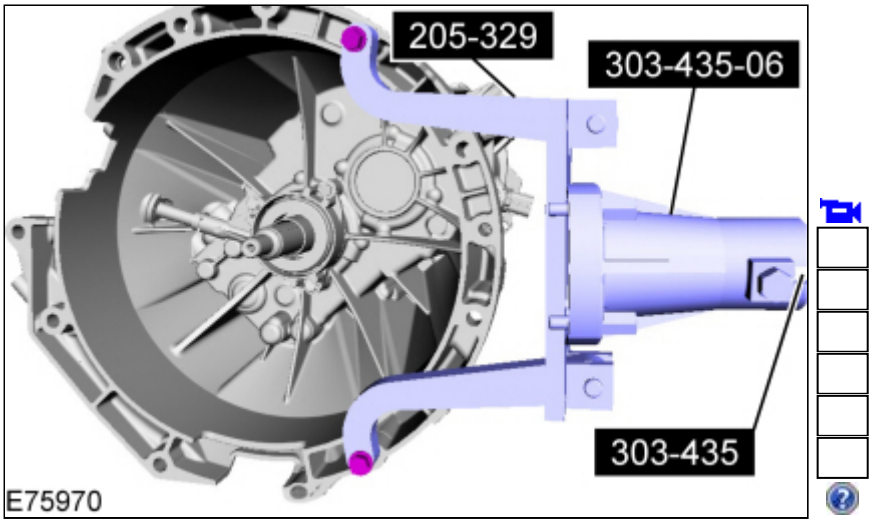
Base Part Number: 7000

Special Tool(s) / General Equipment

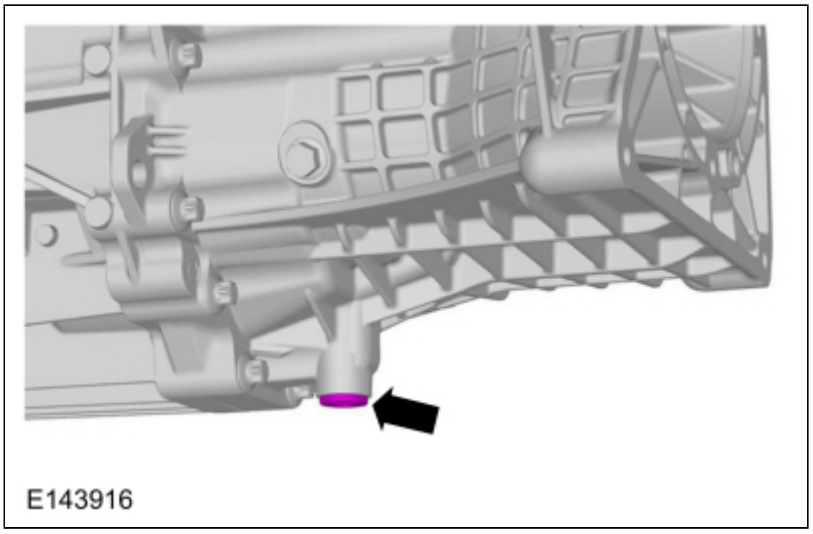
 E129694	100-001 (T50T-100-A) Slide Hammer
 15026A01	205-071-01 Adapter for 205-071 (Thrust Pad)
 15030A	205-072 Universal Flange Holding Wrench
 15048	205-078 Remover, Drive Pinion Seal
 1504801	205-078-01 Adapter for 205-078 (Thrust Pad)
 E133913	205-153 (T80T-4000-W) Handle
 15073	205-175 Socket, Drive Pinion Nut
 15105A	205-329 Mounting Bracket, Engine/Differential
	205-D072 (D97L-4221-A) 2 Jaw Puller

 E155534	
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E182026	308-130 (T87T-7025-DH) Installer, Shift Rail Needle Bearing
 E216591	308-812 Remover, Detent
Hydraulic Press	
Two Leg Puller	

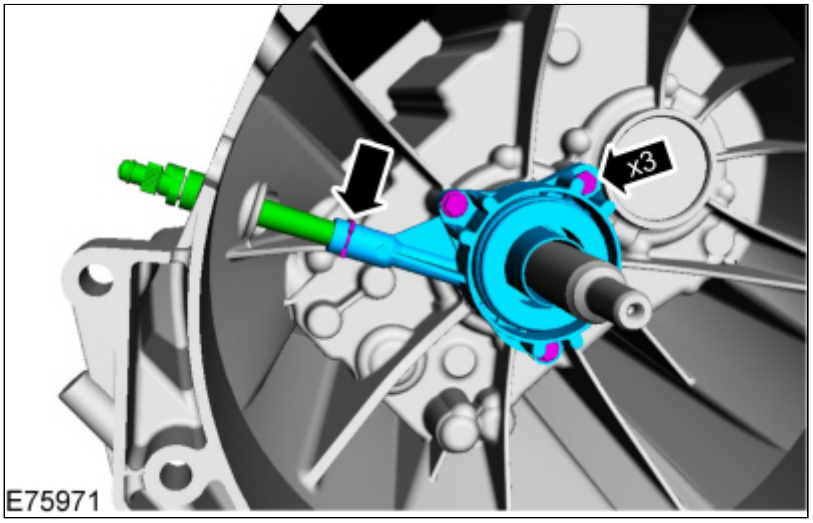
1. Use Special Service Tool: 205-329 Mounting Bracket, Engine/Differential. , 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435.



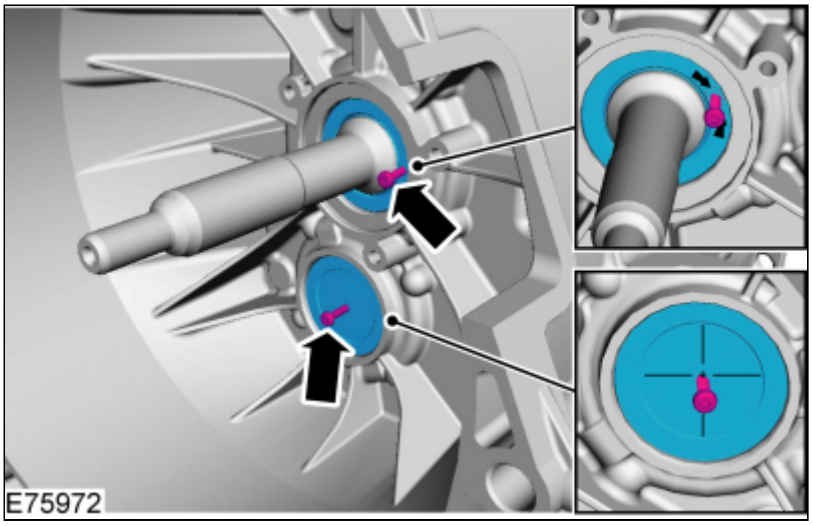
2. **WARNING: Be prepared to collect escaping fluid.**



3.

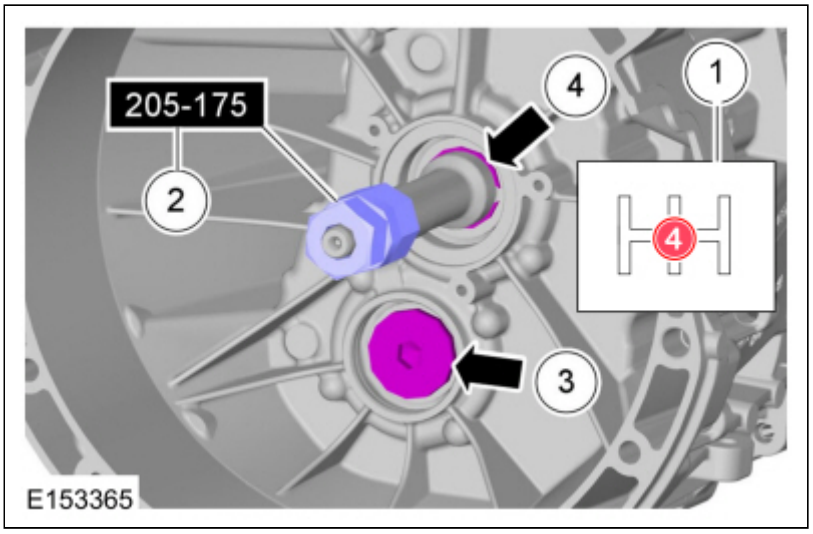


4.

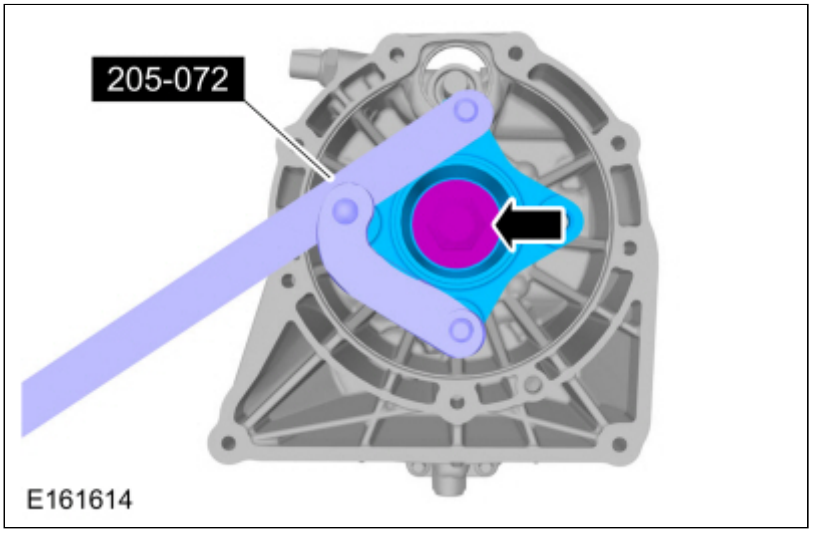


5. **NOTE:** *Make sure that 4th gear is selected.*

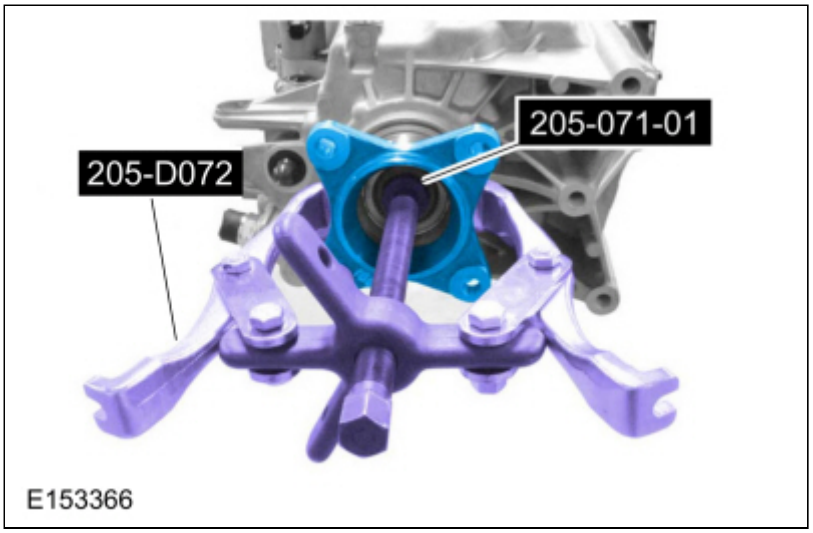
   Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.



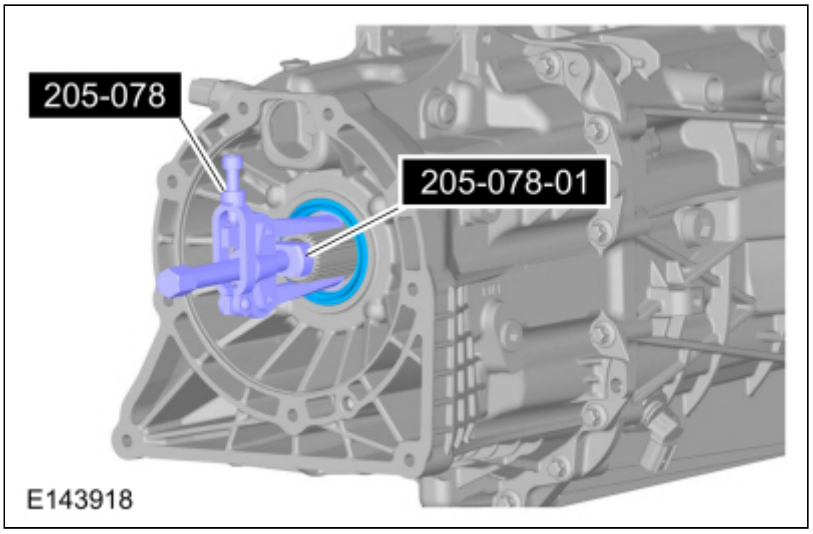
6. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



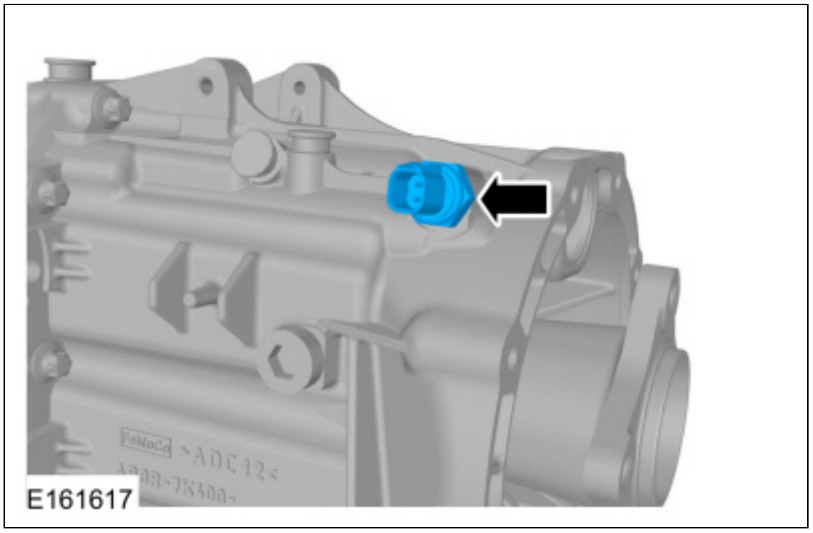
7. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad). , 205-D072 (D97L-4221-A) 2 Jaw Puller.



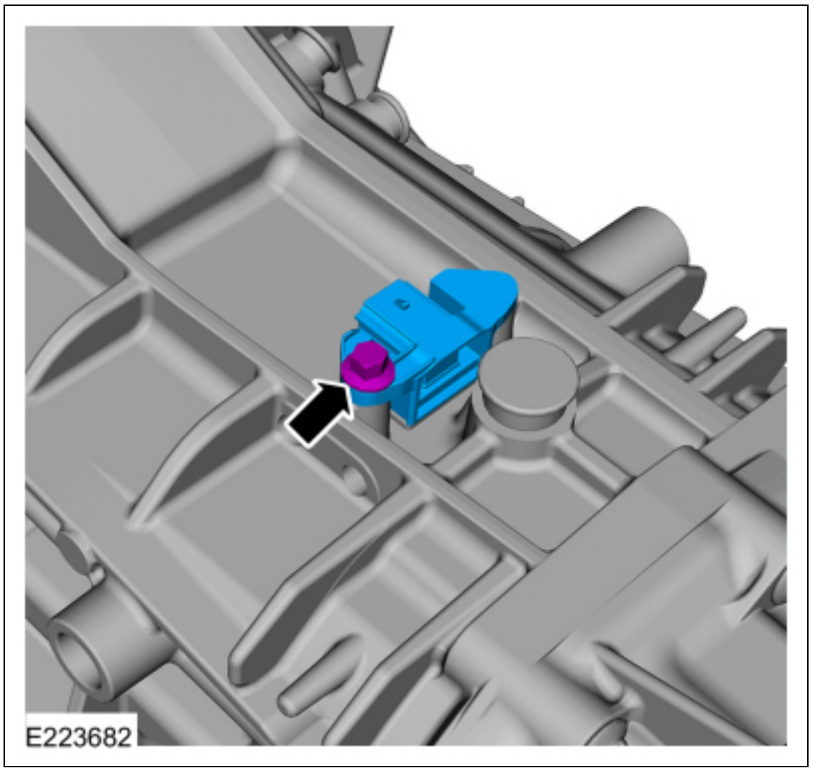
8. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal. , 205-078-01 Adapter for 205-078 (Thrust Pad).



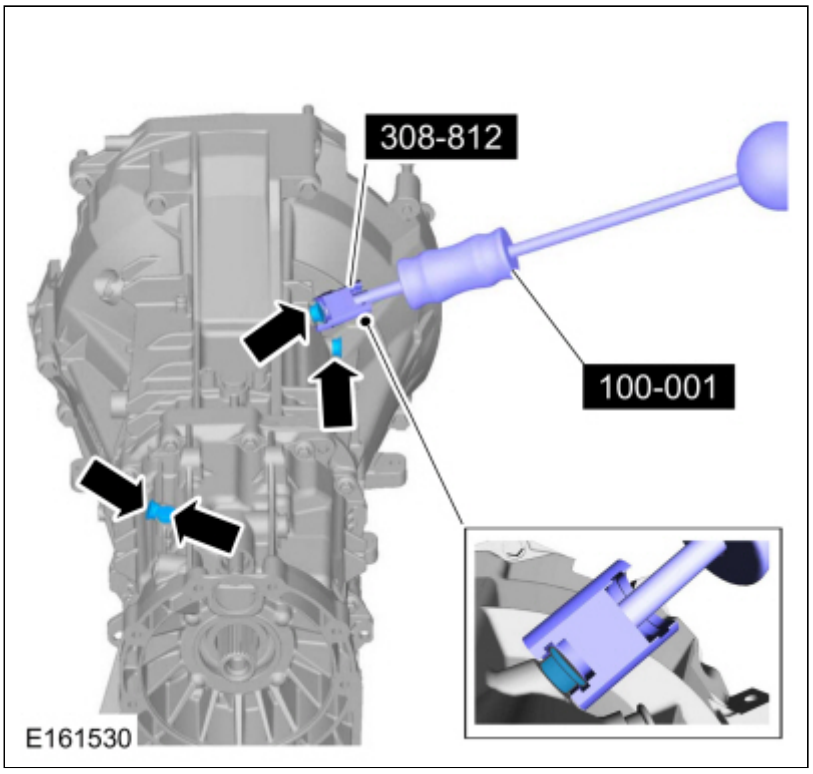
9.



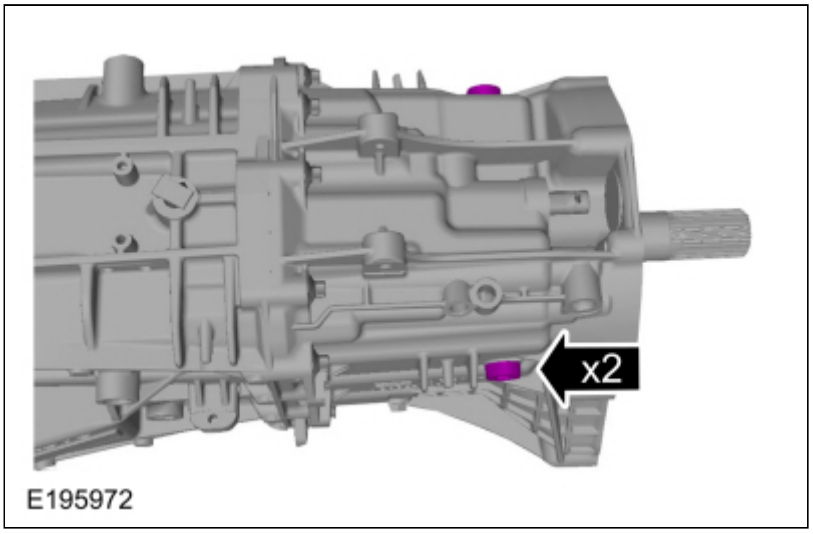
10.



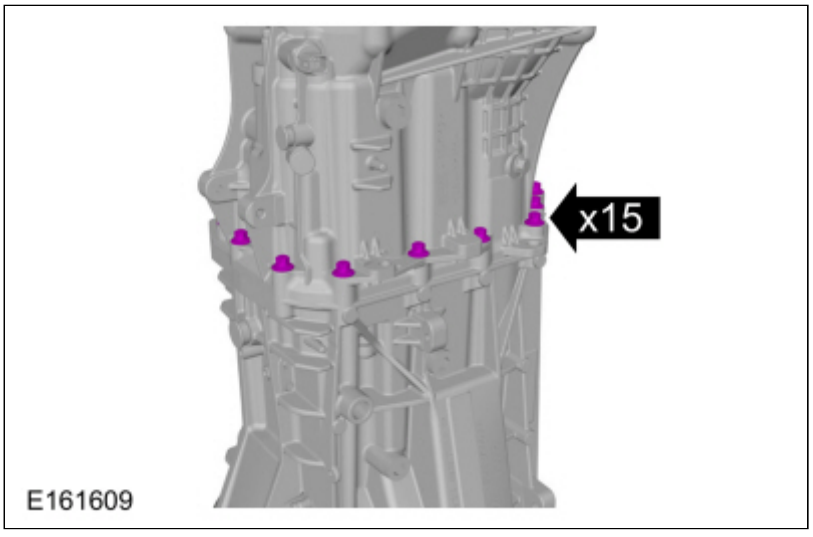
11. Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 308-812 Remover, Detent.



12.

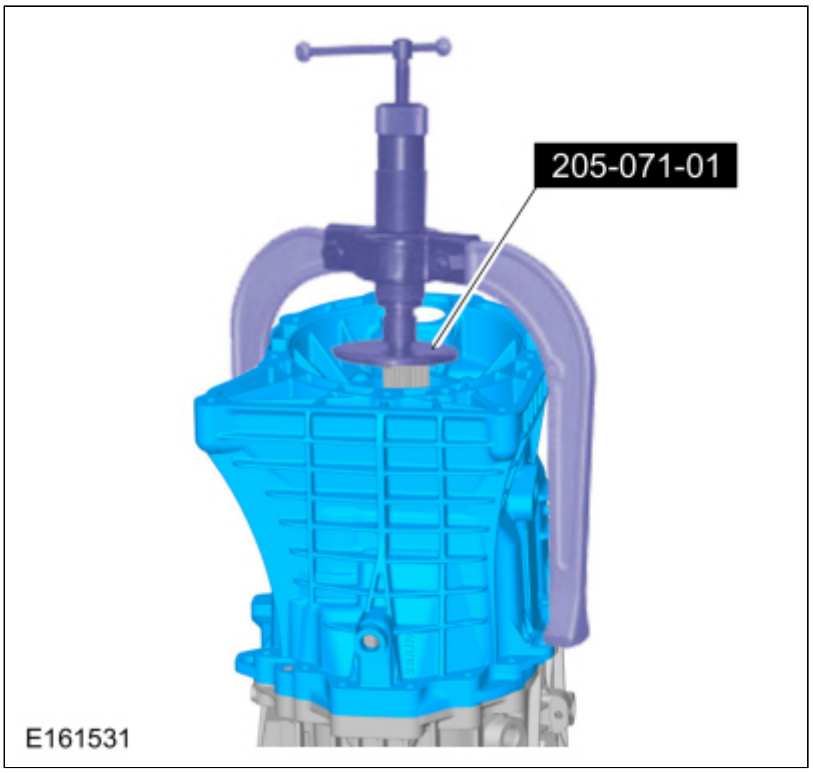


13.

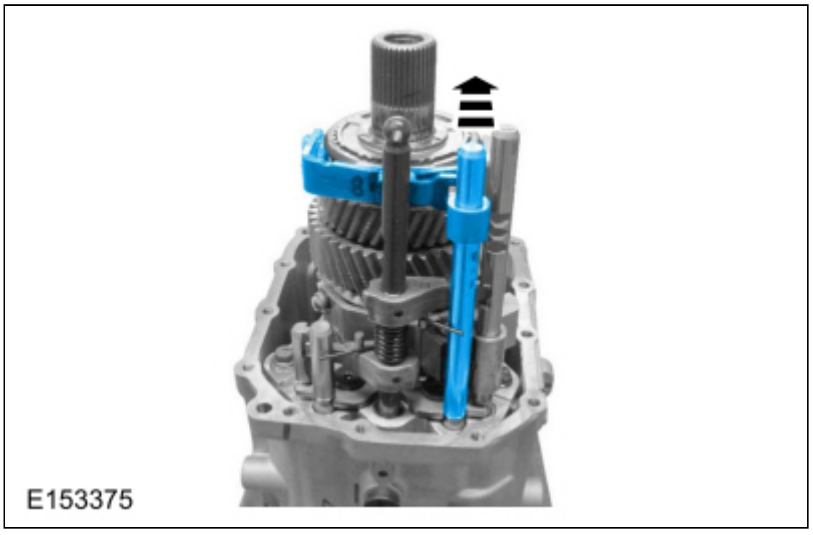


14. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).

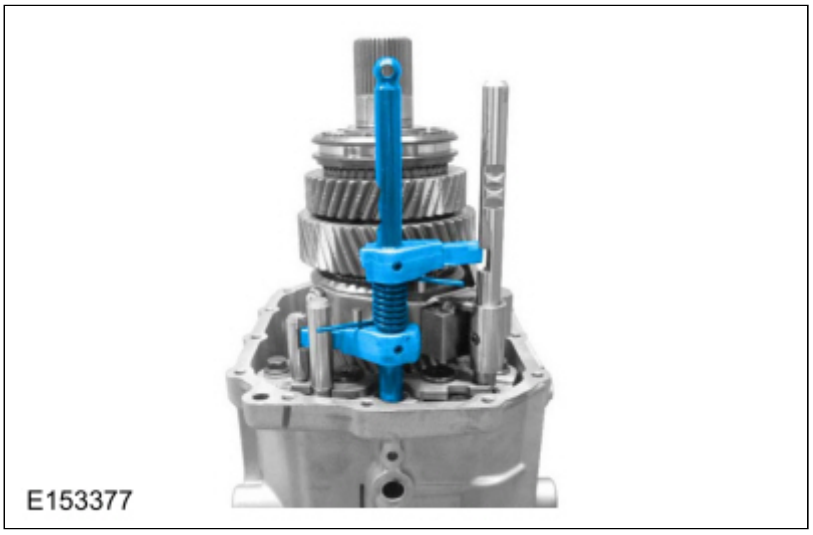
Use the General Equipment: Two Leg Puller



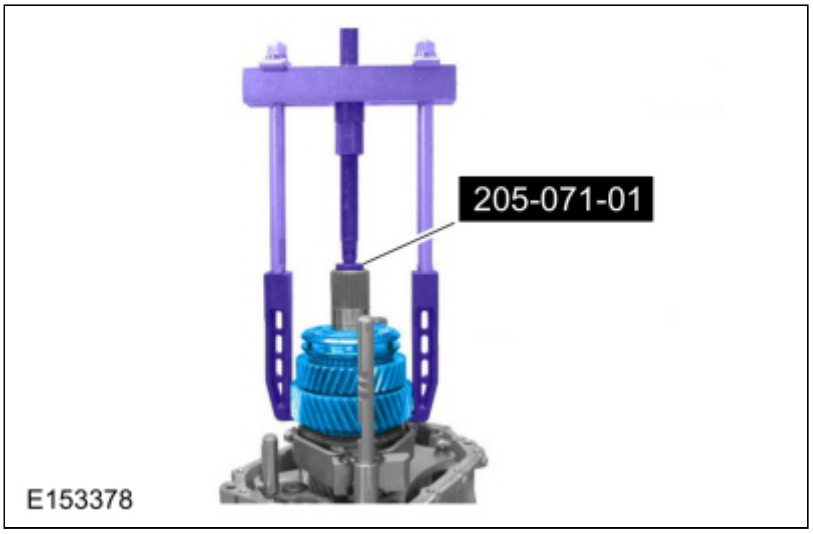
15.



16.



17. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).
Use the General Equipment: Two Leg Puller

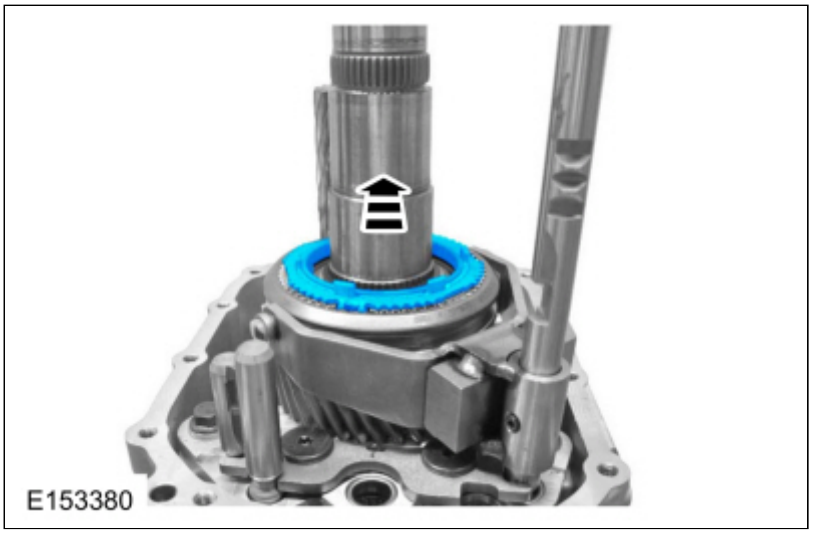


18.



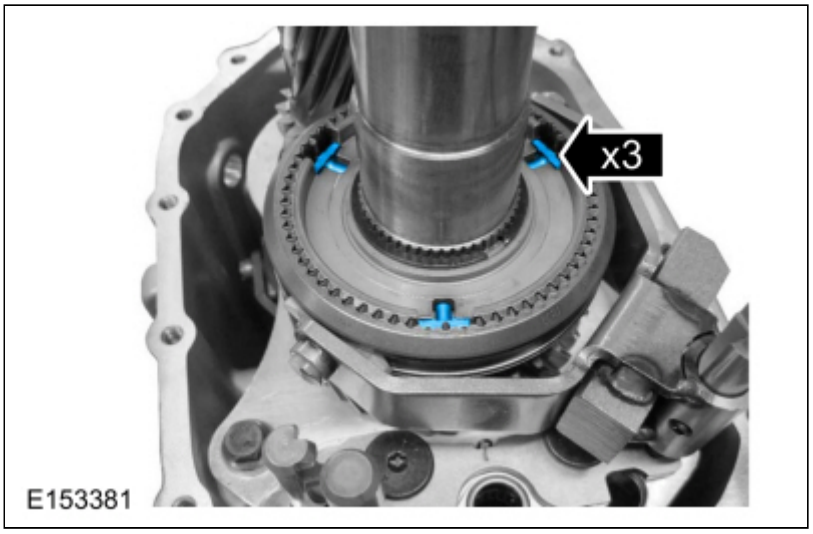
NOTE: *Note the position of each synchronizer ring component before removal.*

19.



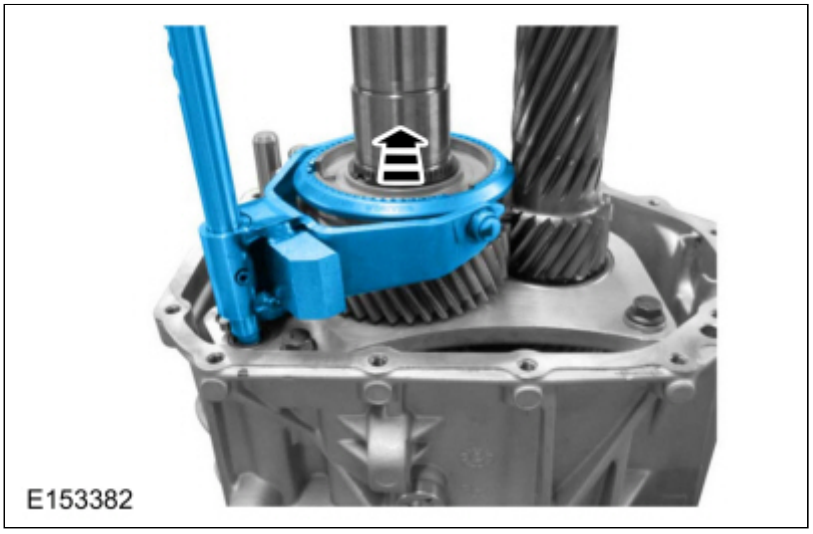
NOTE: *Slide the synchronizer sleeve up while removing the pressure pieces.*

20.

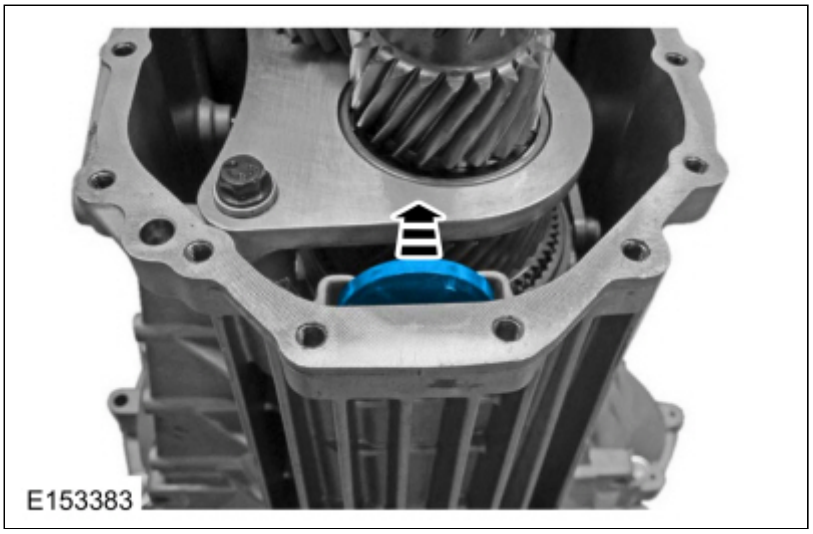


NOTE: *Index-mark the synchronizer sleeve to the synchronizer hub before removal.*

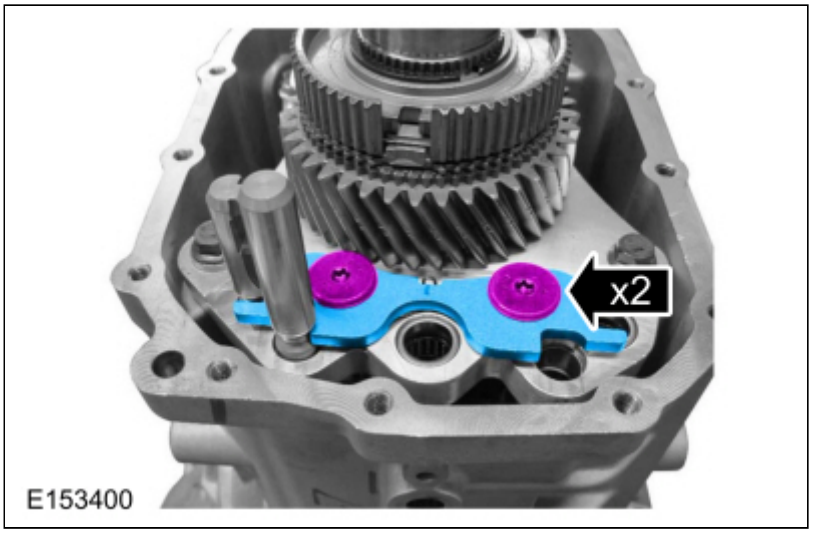
21.



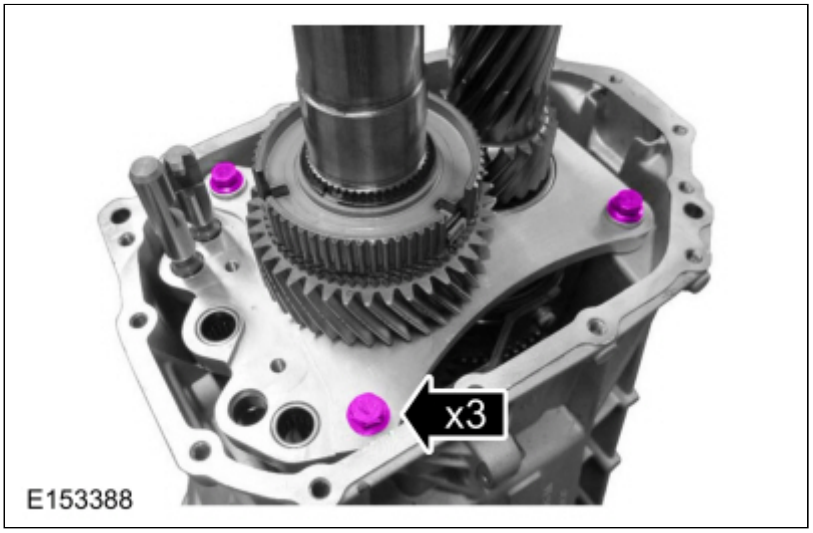
22.



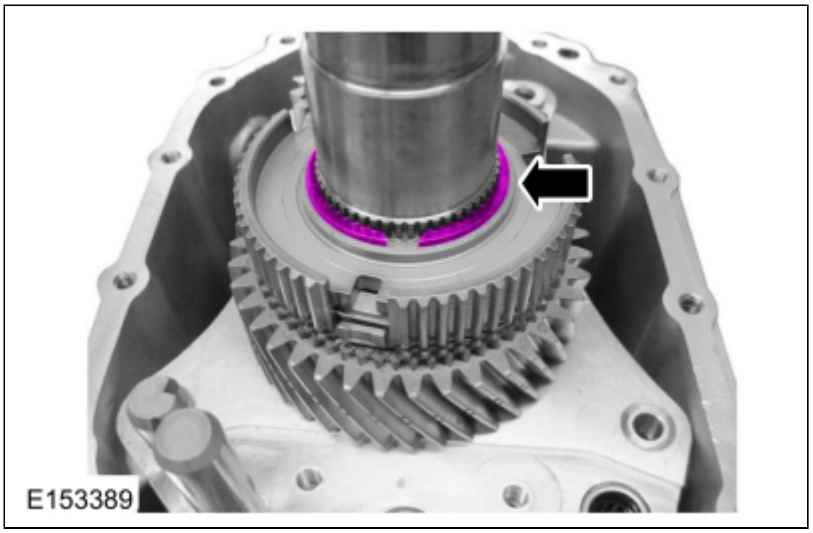
23.



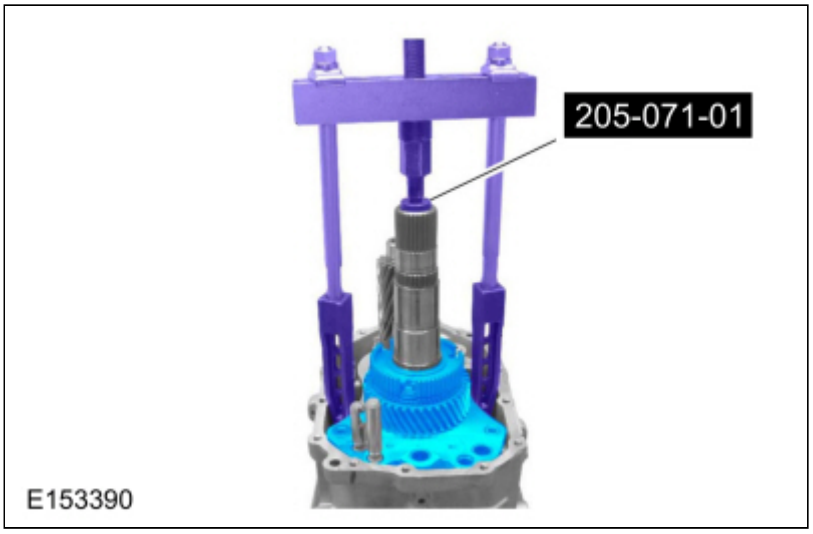
24.



25. **NOTICE: The center support must be pulled up evenly or damage to the center support or transmission case can occur.**

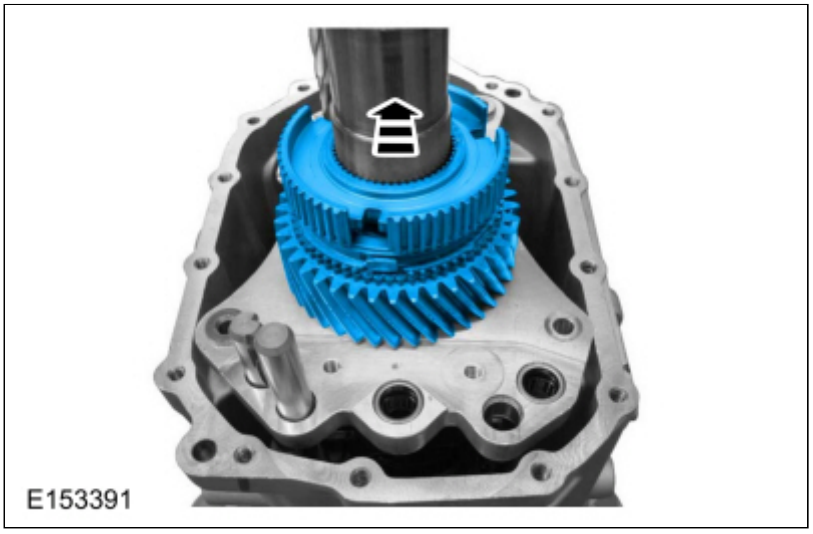


26. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).
Use the General Equipment: Two Leg Puller

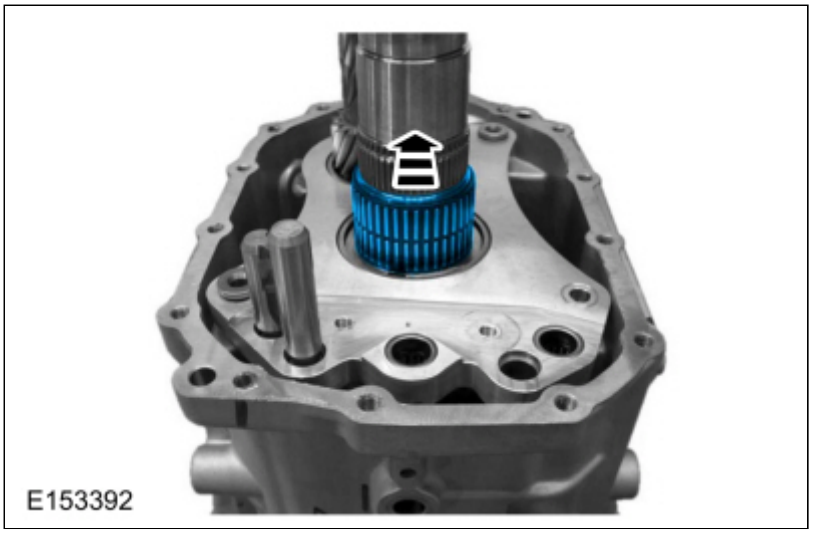


NOTE: *Note the position of each synchronizer ring component before removal.*

27.



28.

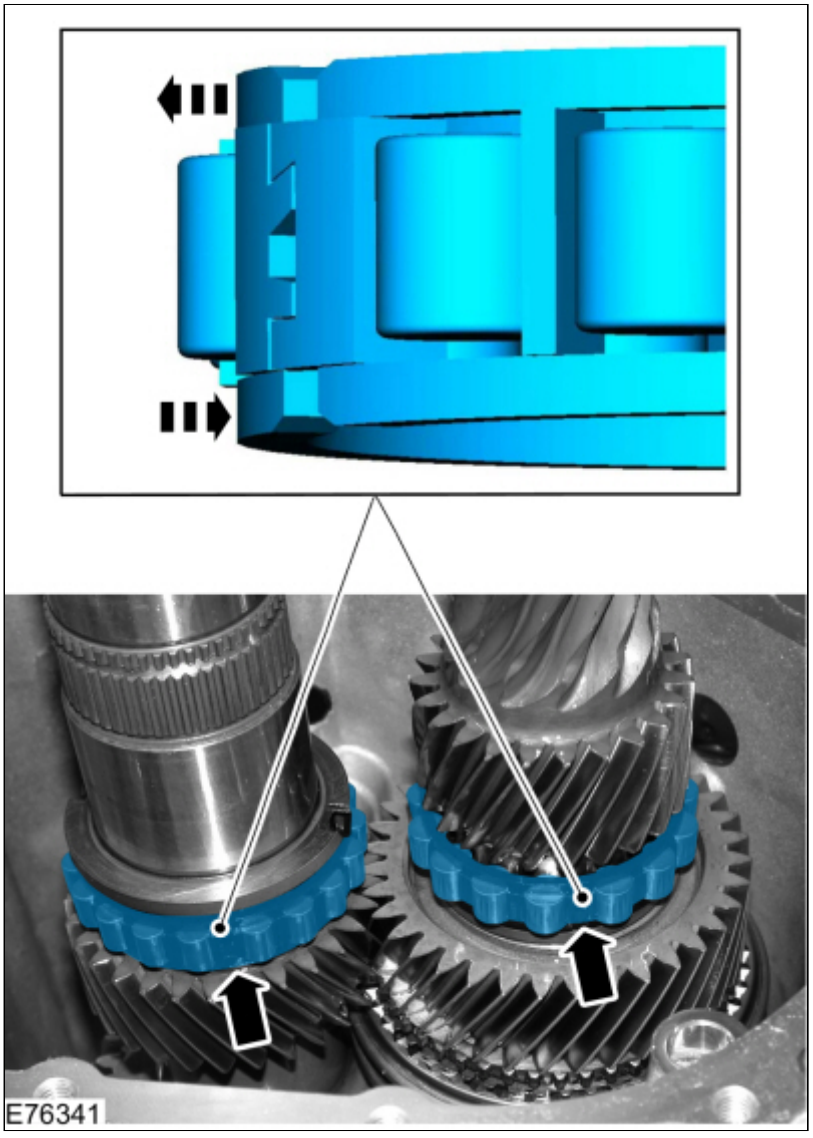


29.

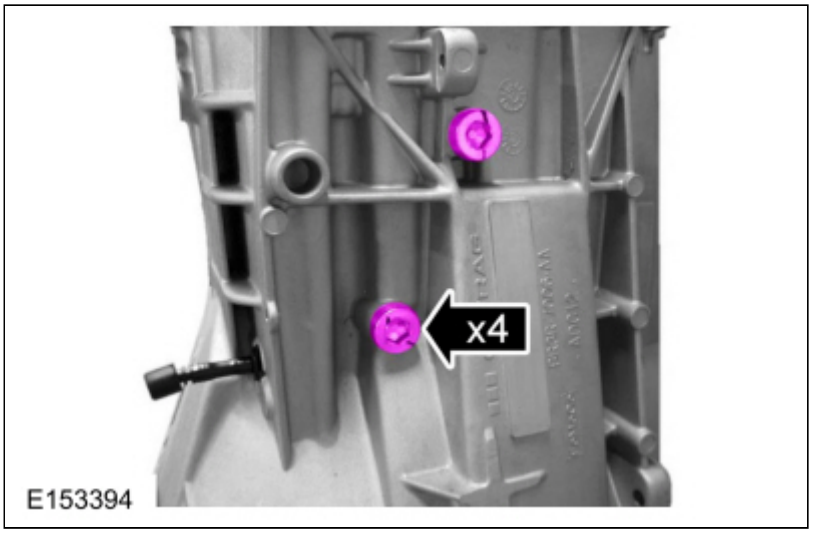


30. **NOTICE: When removing the bearings, do not over expand the bearing cages or damage to the bearing cages can occur.**

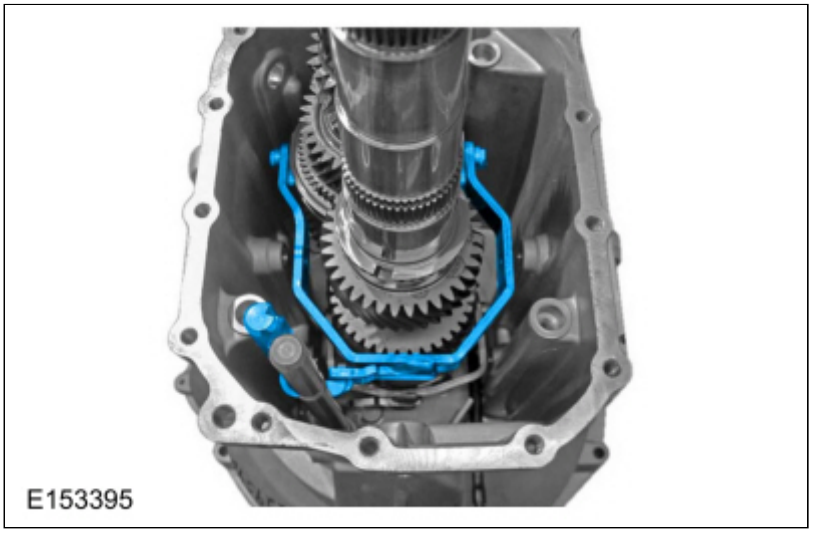
    Unlock the bearing cage Tabs and lightly expand the bearing cages.



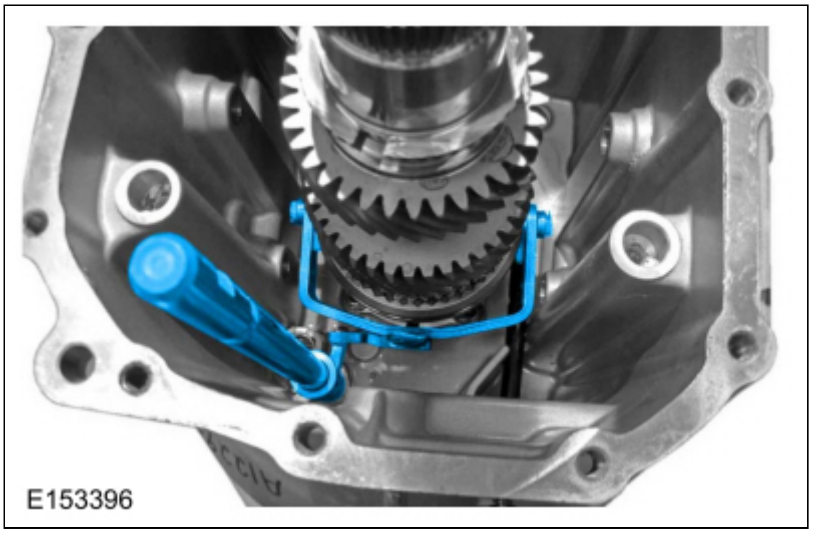
31.



32.



33.



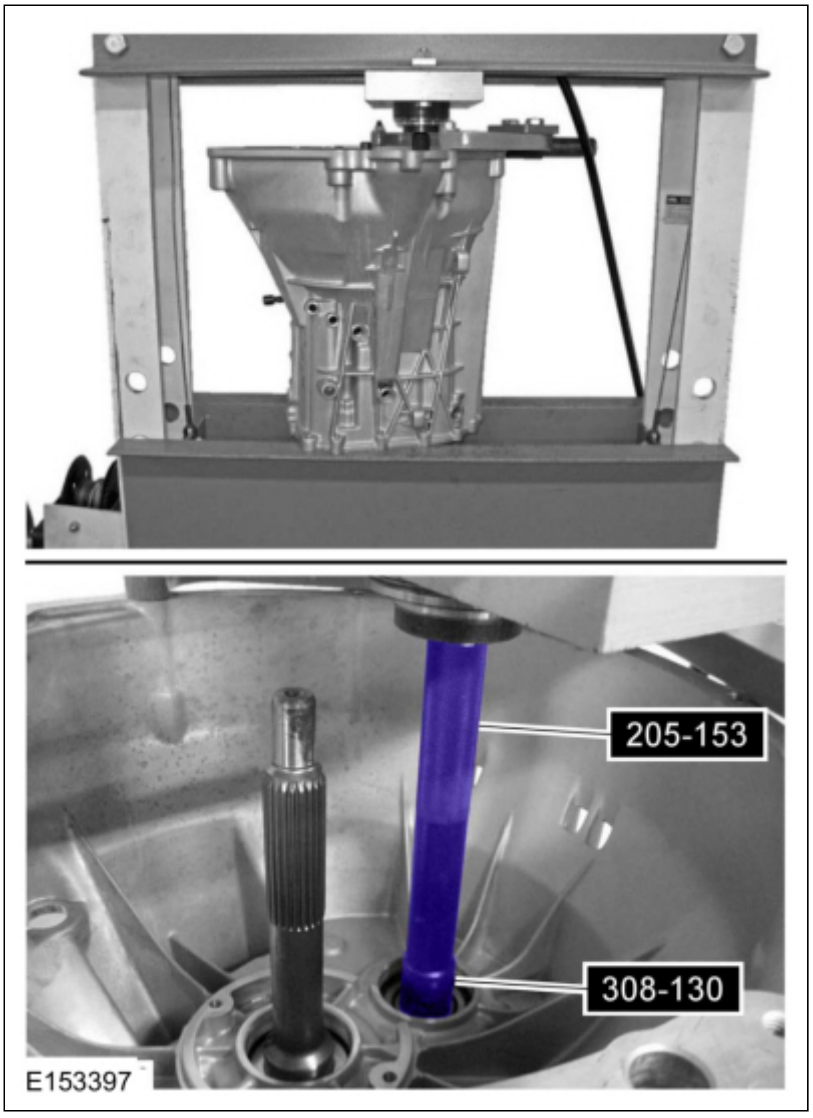
34. **WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow instructions may result in personal injury.**

NOTE: *Use an assistant when pressing out the countershaft and output shaft, do not allow the shafts to bind during removal.*

NOTE: *The countershaft bolt must be removed prior to pressing out the countershaft or damage to the transmission case will occur.*

NOTE: *With an assistant, support the transmission case on flat surfaces of a hydraulic press. Press the countershaft out of the bearing and remove the countershaft and output shaft.*

Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 308-130 (T87T-7025-DH) Installer, Shift Rail Needle Bearing.



35.

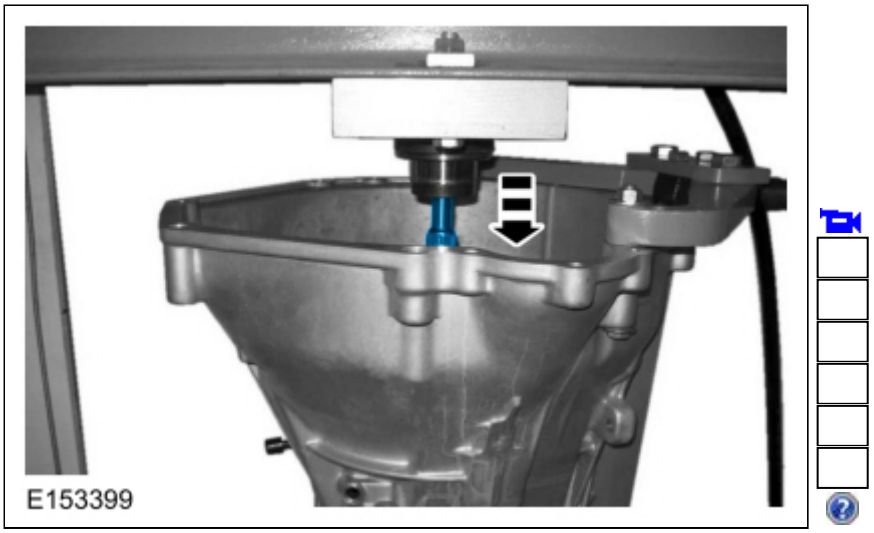


36. **WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow instructions may result in personal injury.**

NOTE: *Use an assistant when pressing out the input shaft, do not allow the input shaft to drop during removal.*

NOTE: *With an assistant, support the transmission case on flat surfaces of a hydraulic press.Using the hydraulic press, remove the input shaft.*

Use the General Equipment: Hydraulic Press

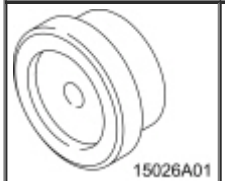
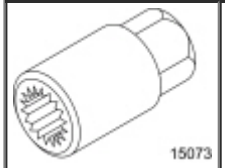
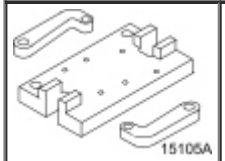
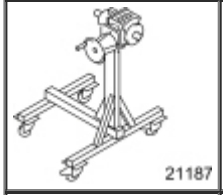
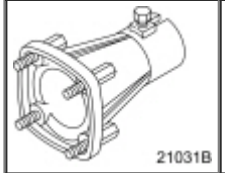


Copyright © 2016 Ford Motor Company

Transmission - 4WD

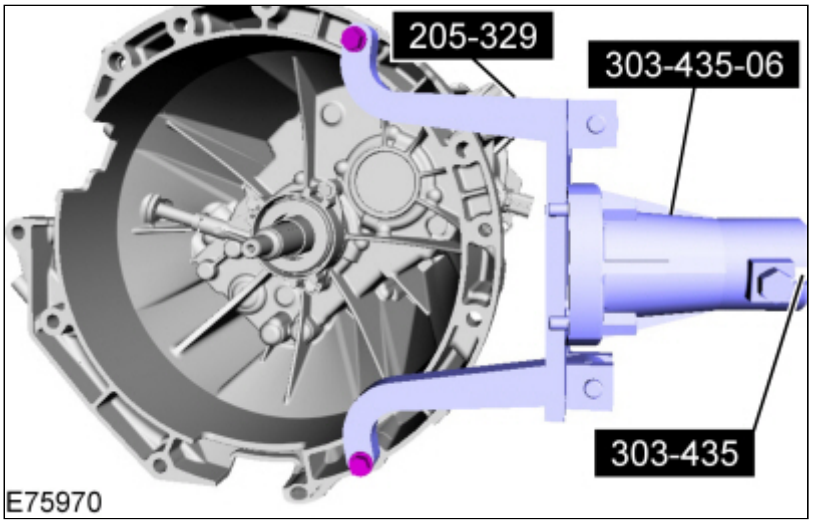
Base Part Number: 7000

Special Tool(s) / General Equipment

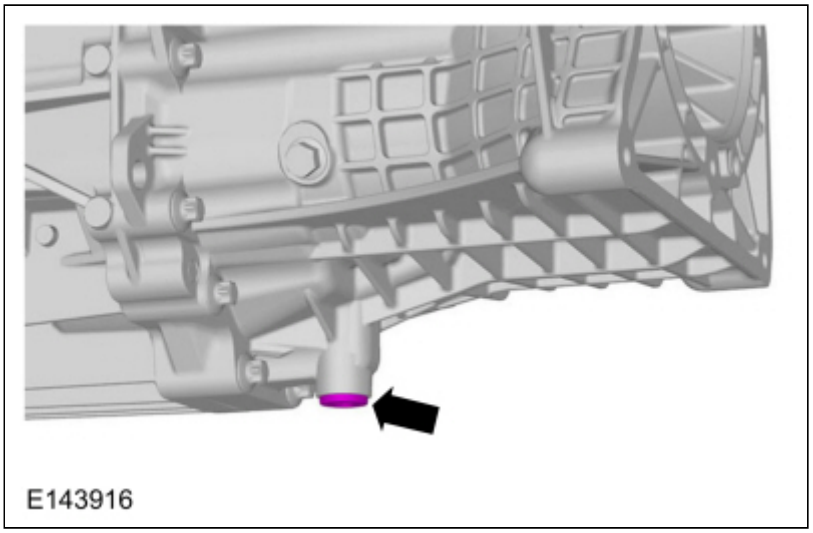
 E129694	100-001 (T50T-100-A) Slide Hammer
 15026A01	205-071-01 Adapter for 205-071 (Thrust Pad)
 E133913	205-153 (T80T-4000-W) Handle
 15073	205-175 Socket, Drive Pinion Nut
 15105A	205-329 Mounting Bracket, Engine/Differential
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E182026	308-130 (T87T-7025-DH) Installer, Shift Rail Needle Bearing
 E216591	308-812 Remover, Detent

 E163726	308-883 Wrench, Output Shaft Nut
Hydraulic Press	
Two Leg Puller	

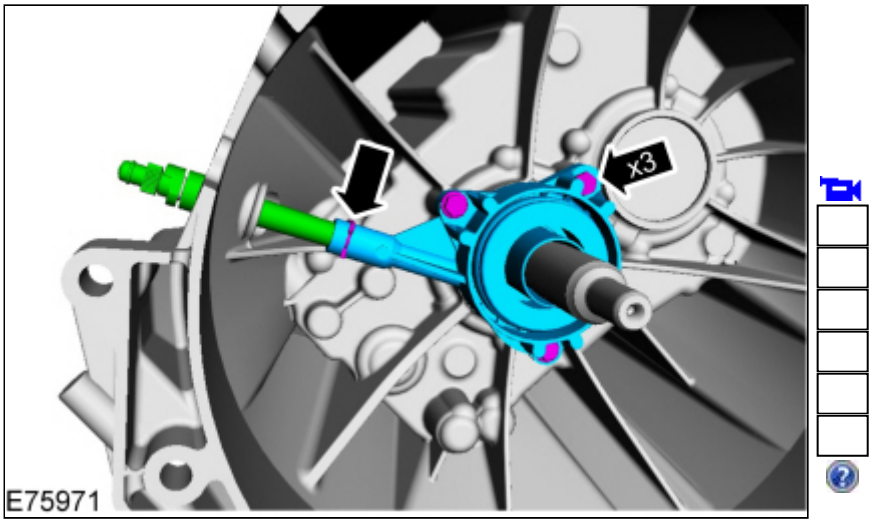
1. Use Special Service Tool: 205-329 Mounting Bracket, Engine/Differential. , 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435.



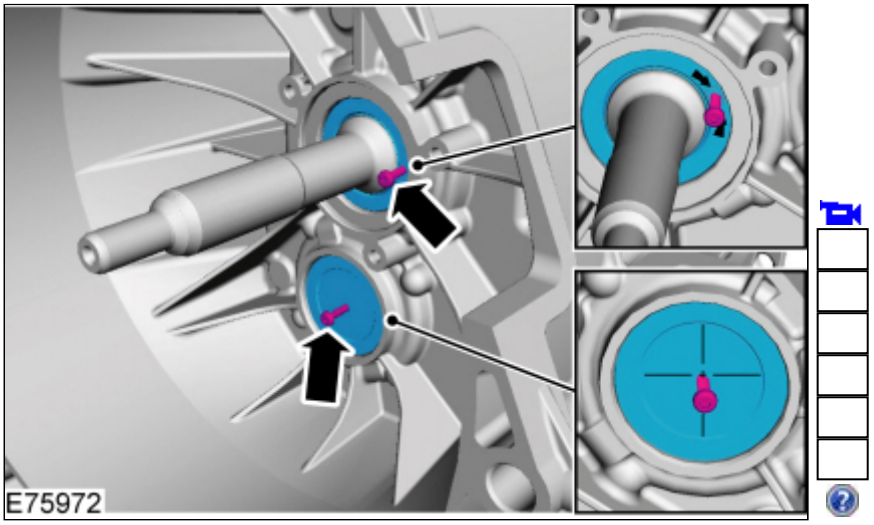
2. **WARNING: Be prepared to collect escaping fluid.**



3.

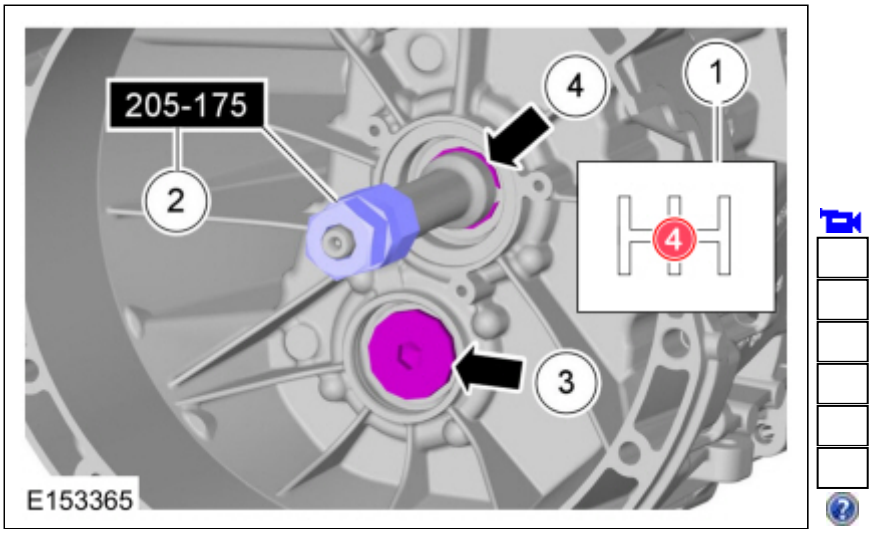


4.

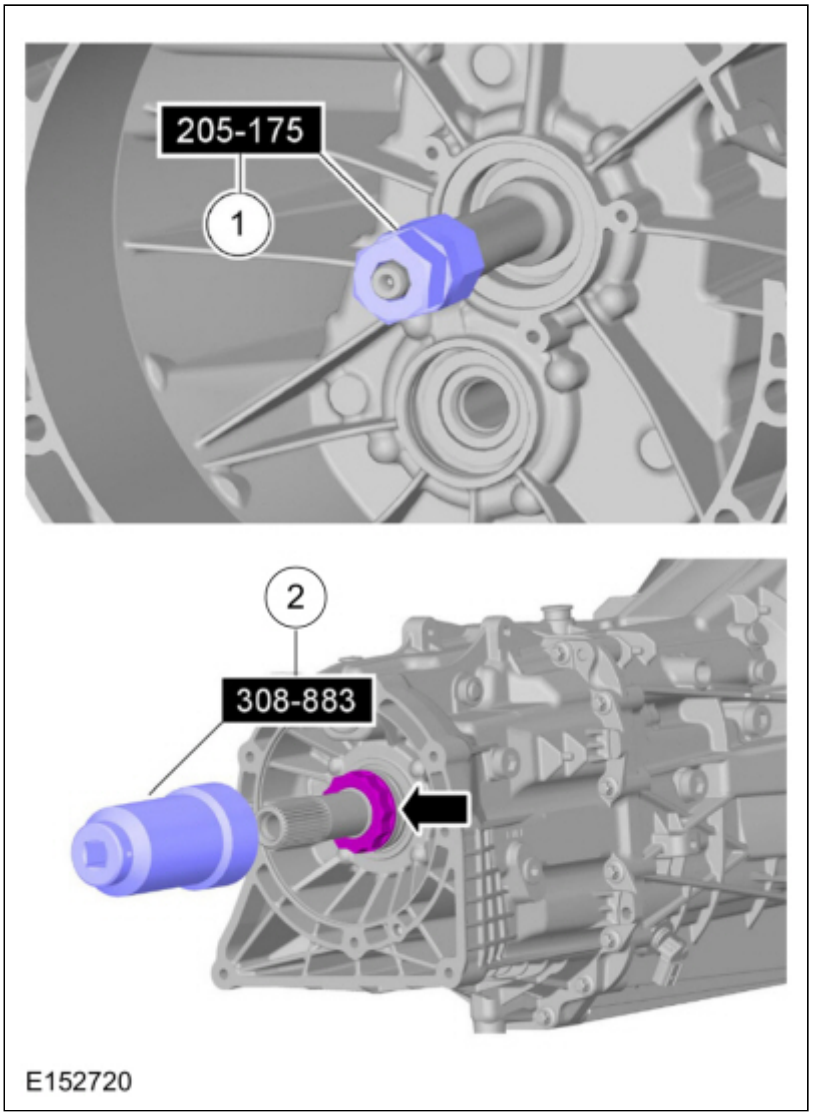


5. **NOTE:** *Make sure that 4th gear is selected.*

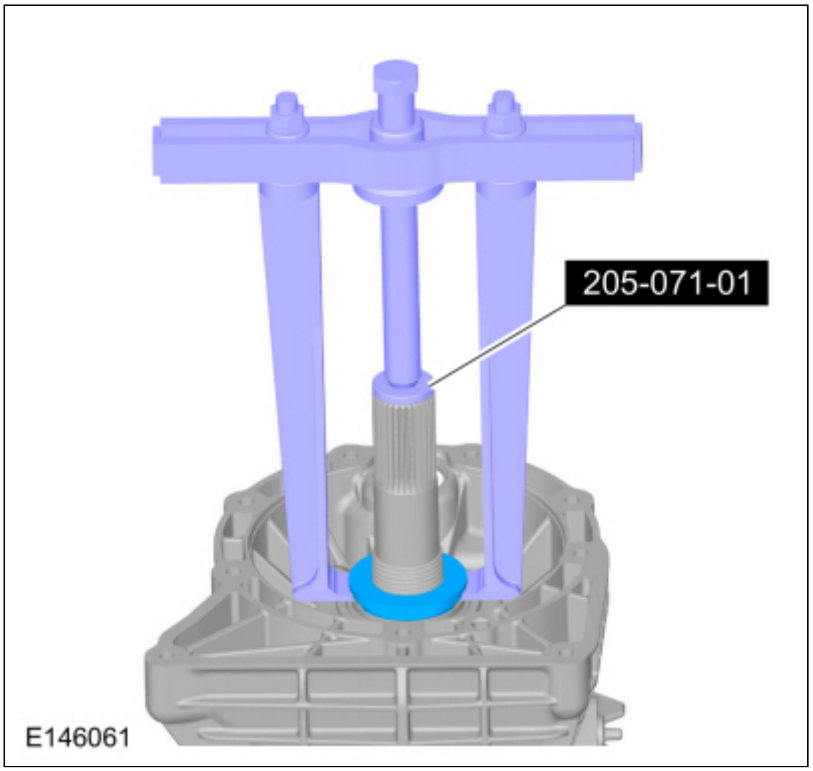
   Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.



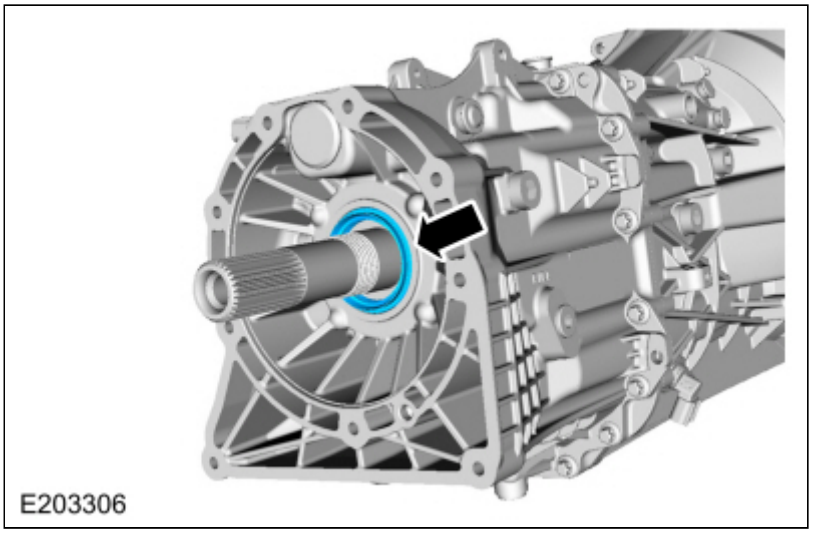
6. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut. , 308-883 Wrench, Output Shaft Nut.



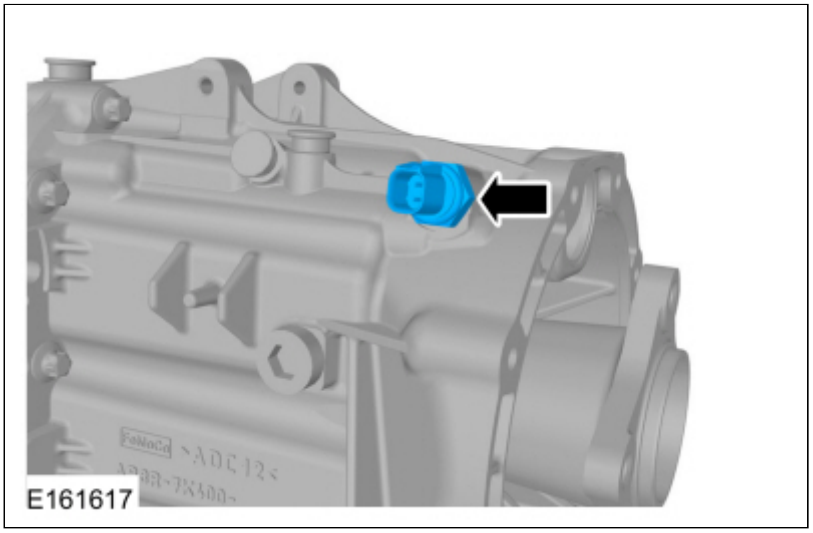
7. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).
   Use the General Equipment: Two Leg Puller



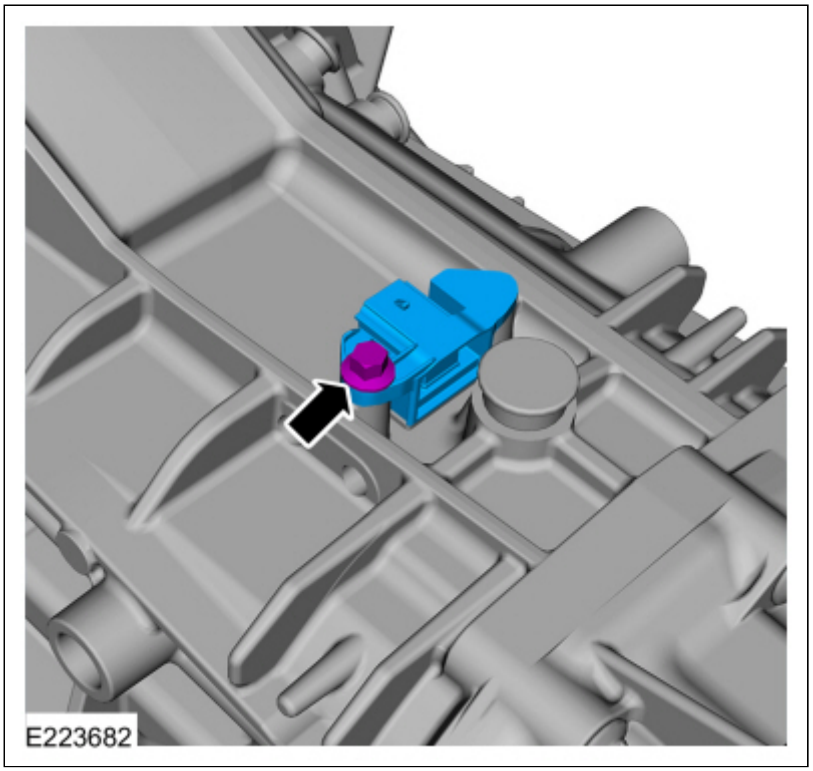
8. Use the General Equipment: Seal Remover



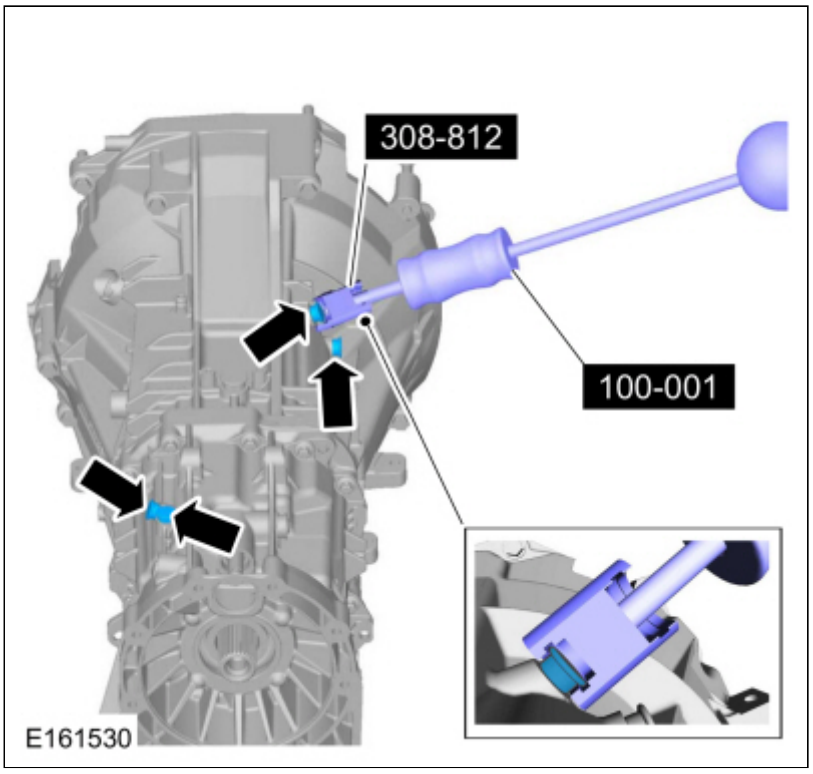
9.



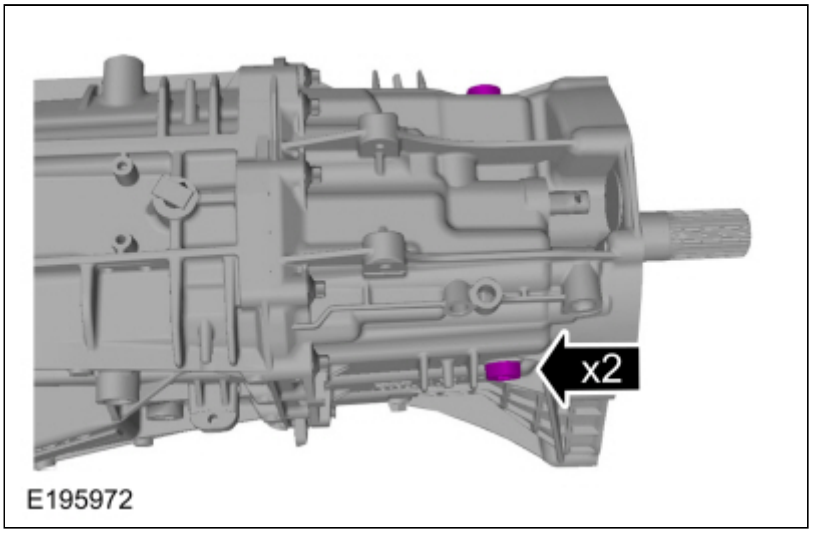
10.



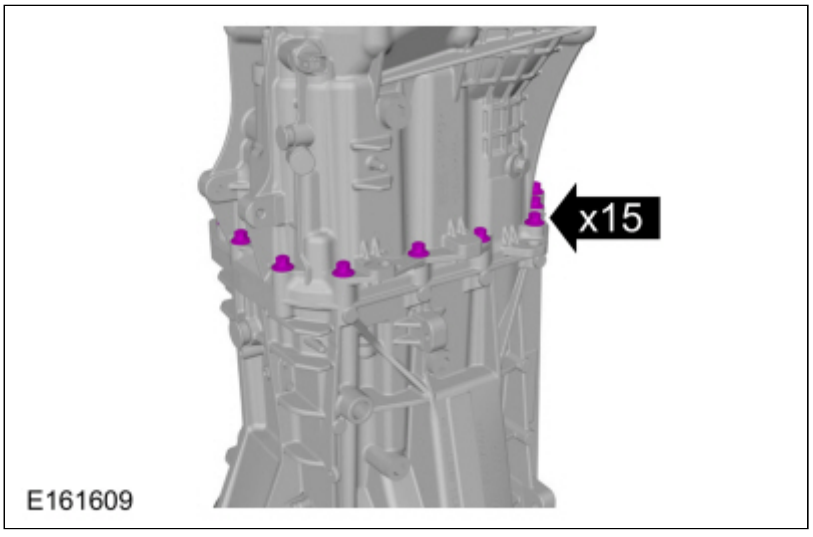
11. Use Special Service Tool: 100-001 (T50T-100-A) Slide Hammer. , 308-812 Remover, Detent.



12.

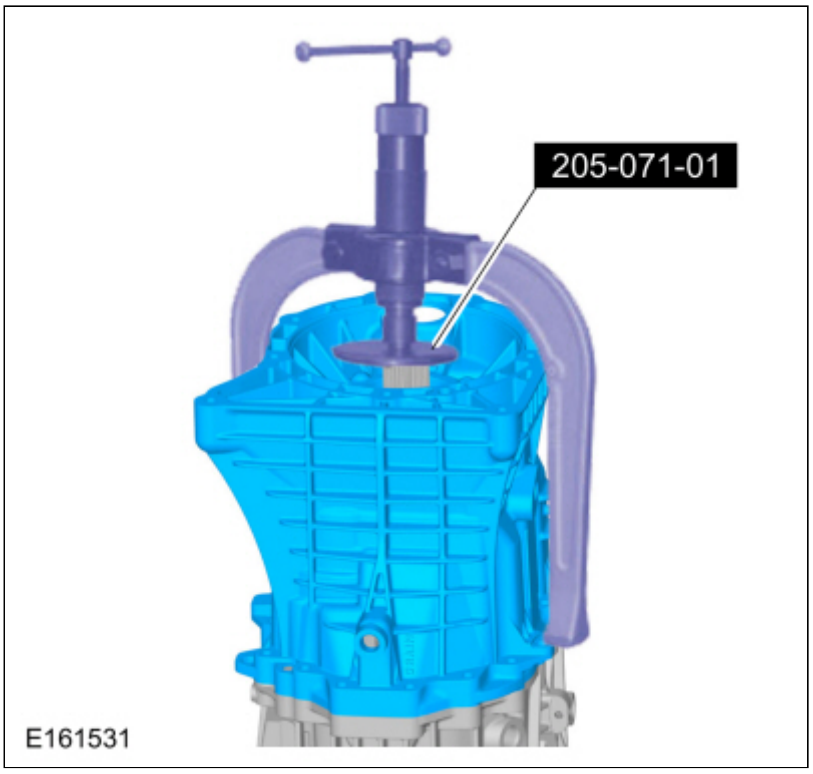


13.

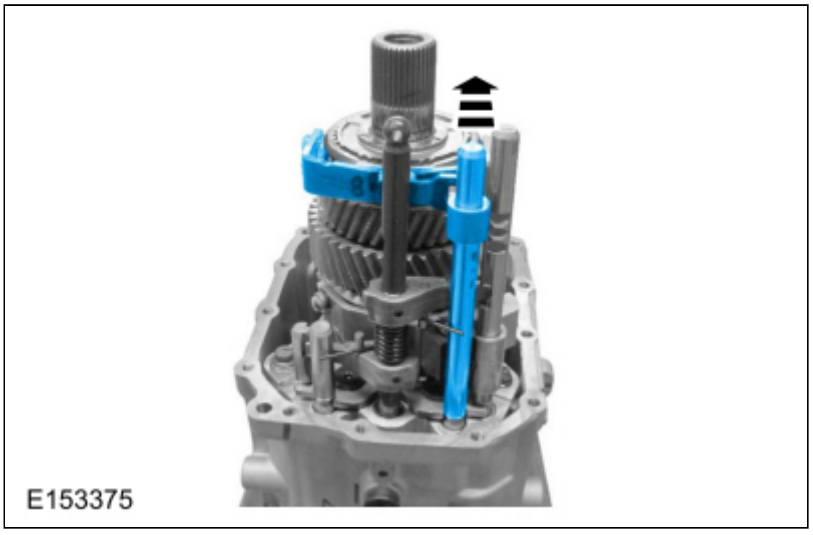


14. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).

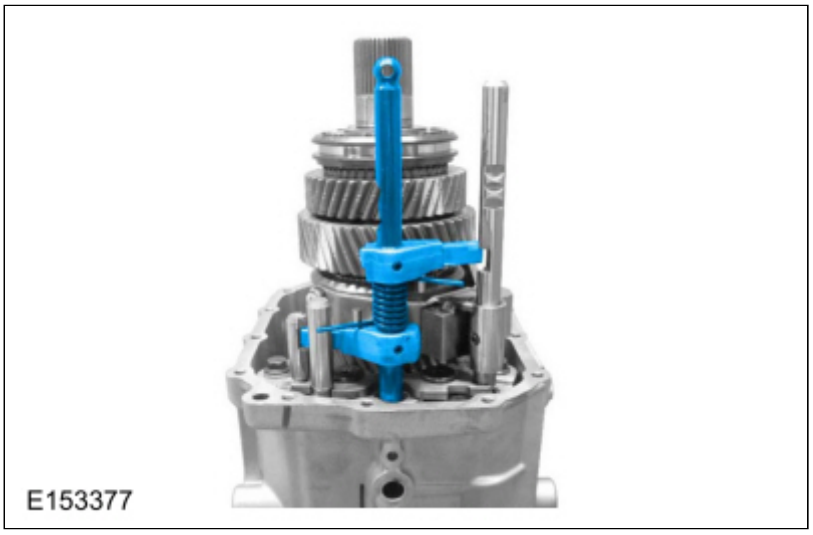
Use the General Equipment: Two Leg Puller



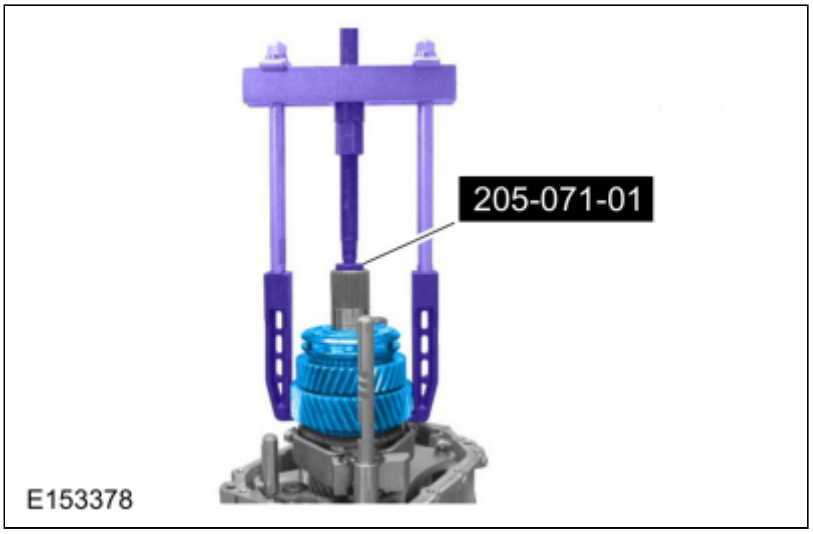
15.



16.



17. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).
Use the General Equipment: Two Leg Puller

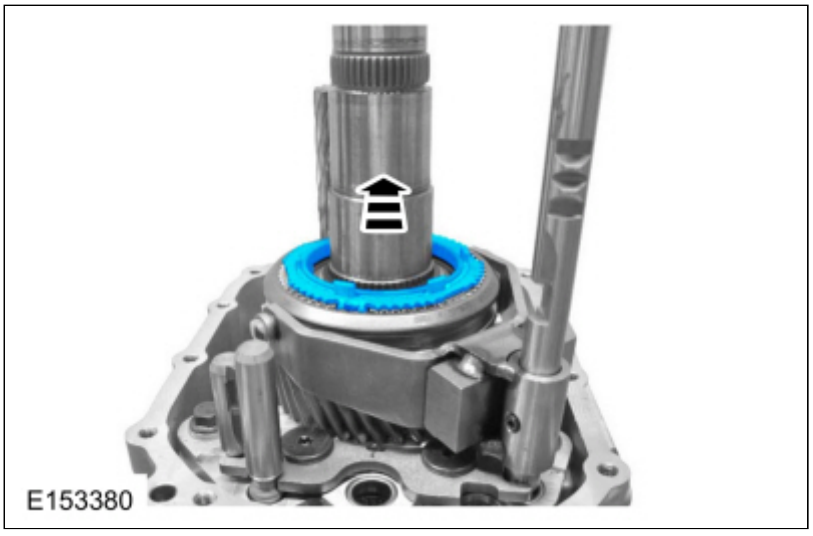


18.



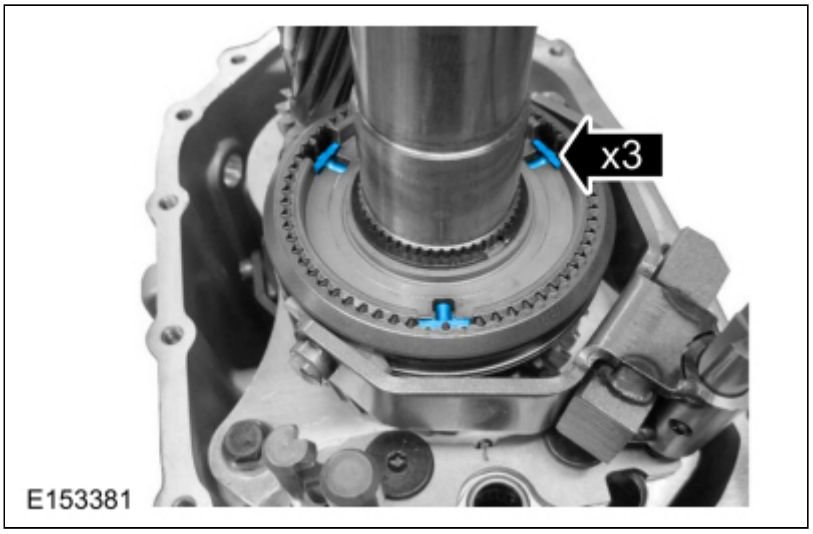
NOTE: *Note the position of each synchronizer ring component before removal.*

19.



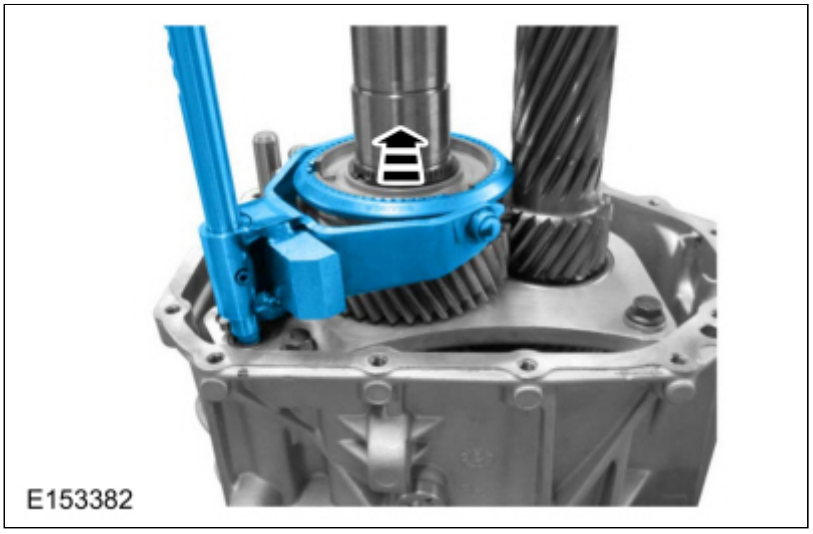
NOTE: *Slide the synchronizer sleeve up while removing the pressure pieces.*

20.

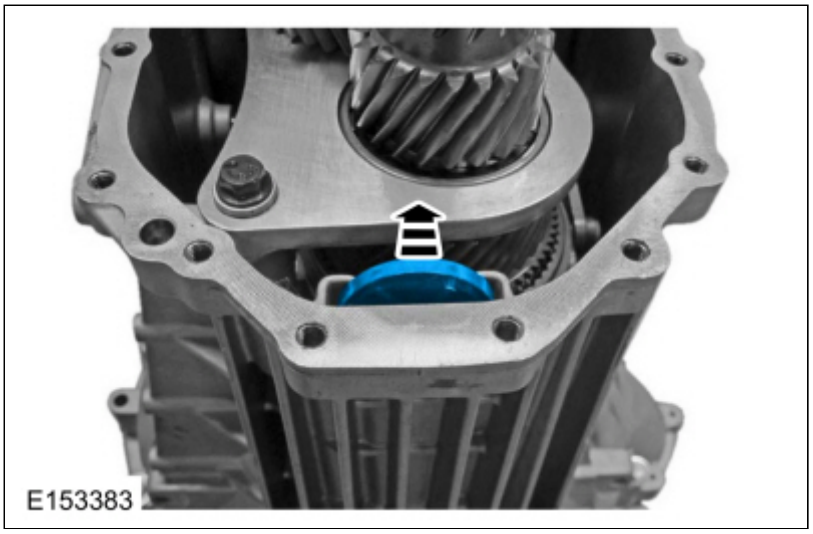


NOTE: *Index-mark the synchronizer sleeve to the synchronizer hub before removal.*

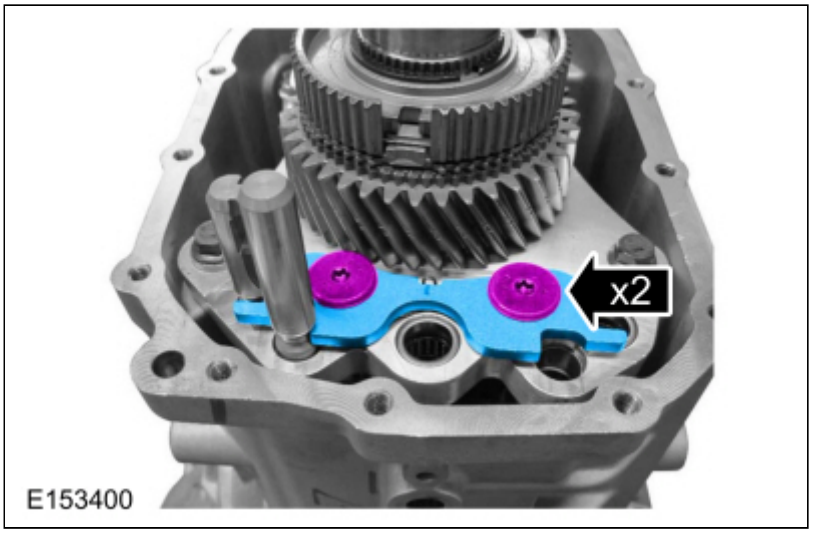
21.



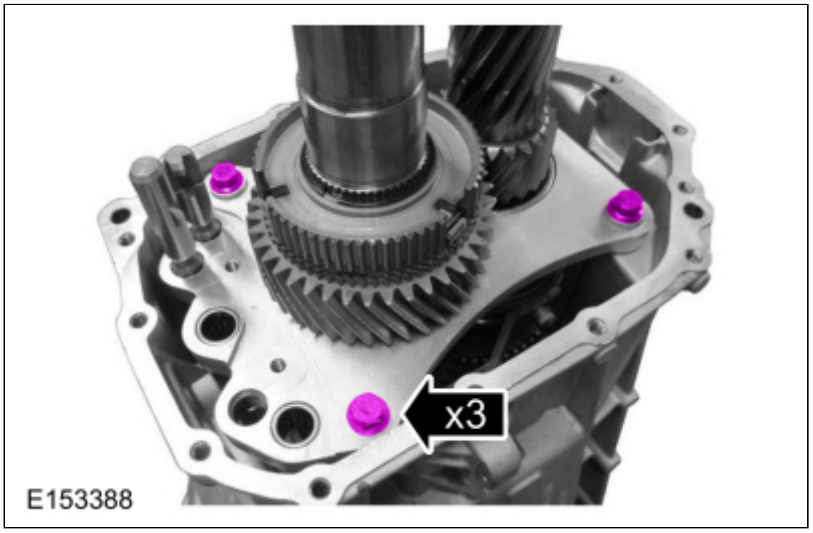
22.



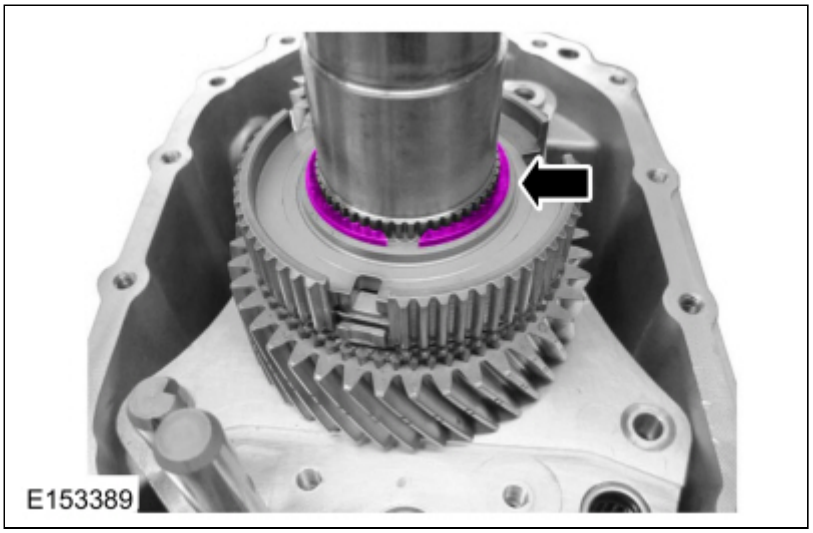
23.



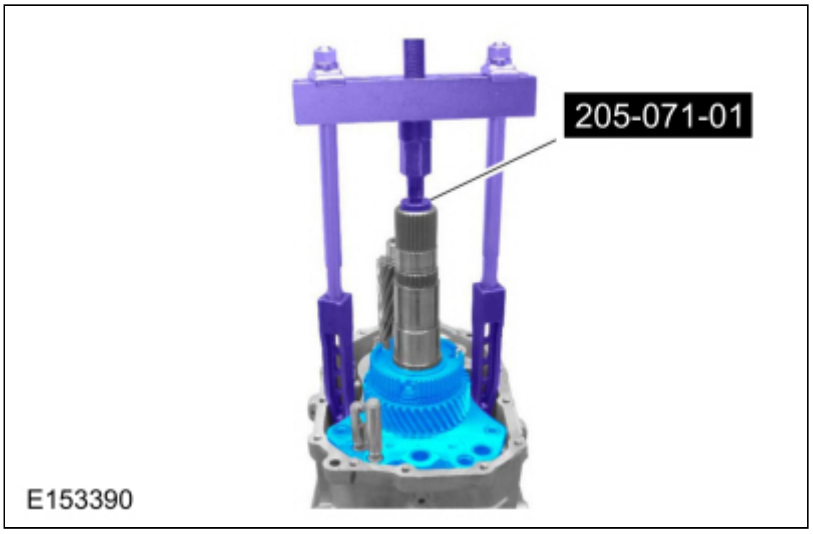
24.



25. **NOTICE: The center support must be pulled up evenly or damage to the center support or transmission case can occur.**

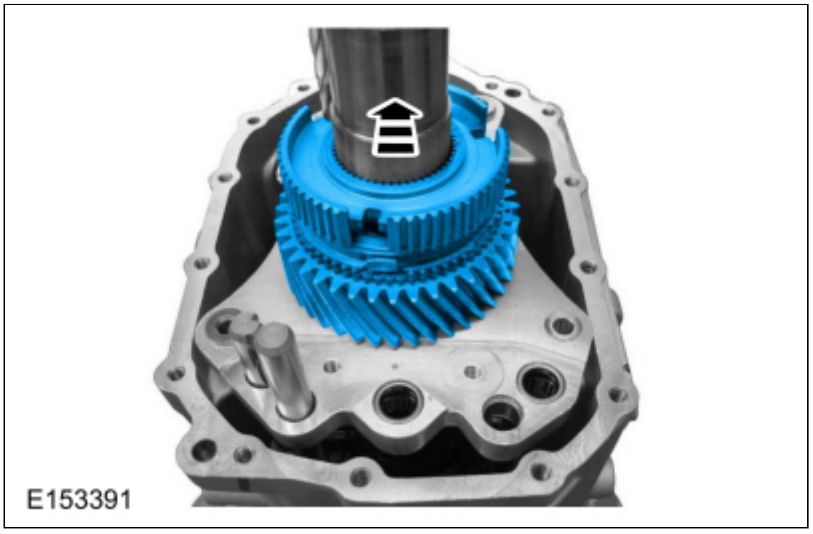


26. Use Special Service Tool: 205-071-01 Adapter for 205-071 (Thrust Pad).
Use the General Equipment: Two Leg Puller

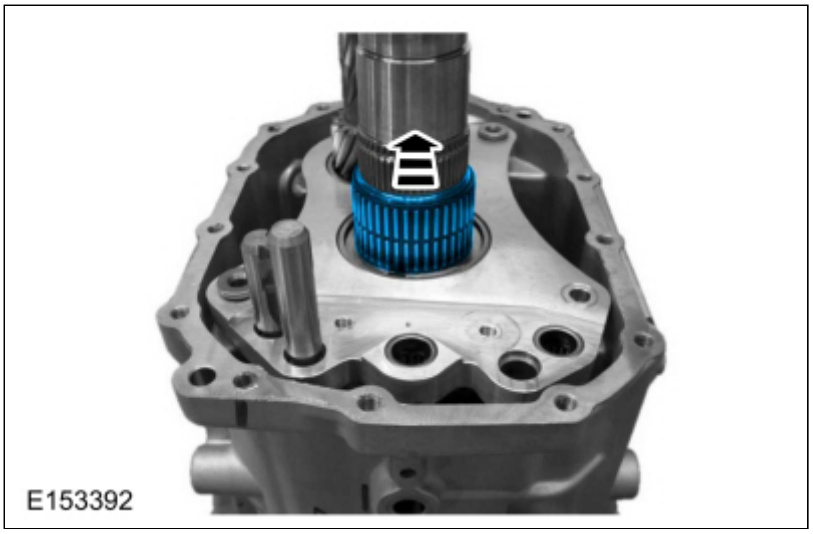


NOTE: *Note the position of each synchronizer ring component before removal.*

27.



28.

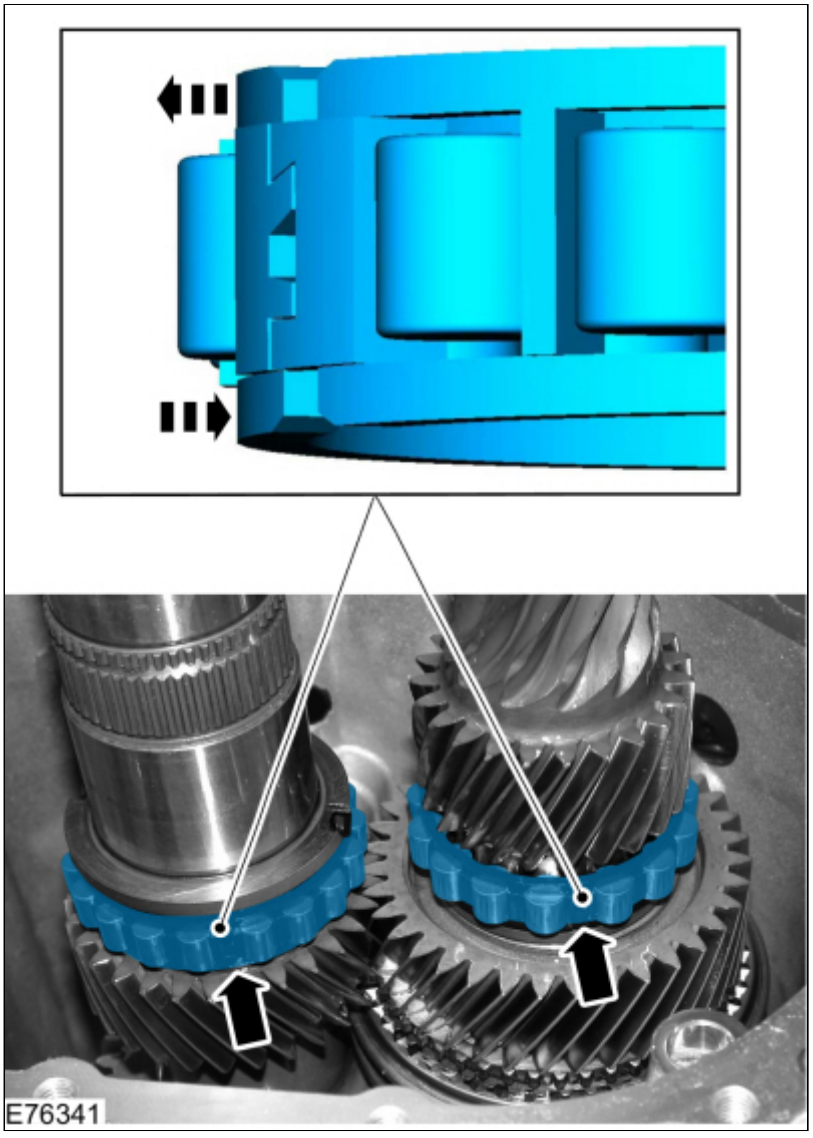


29.

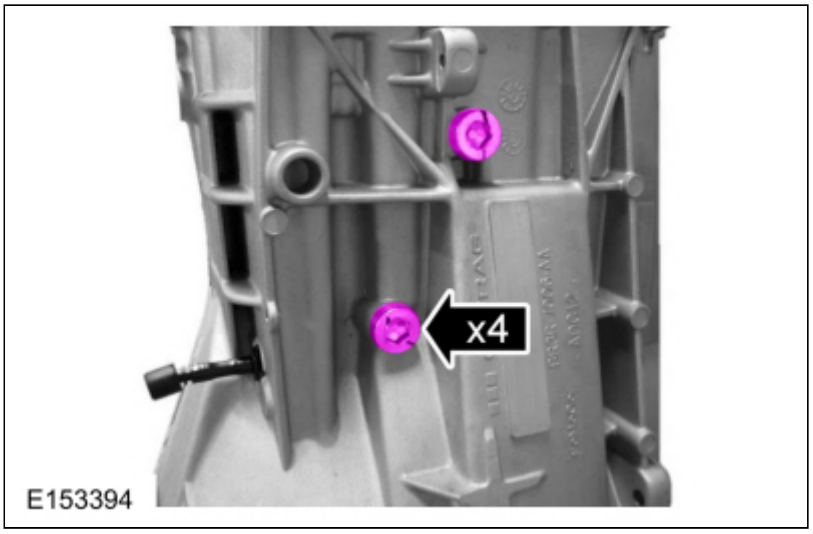


30. **NOTICE: When removing the bearings, do not over expand the bearing cages or damage to the bearing cages can occur.**

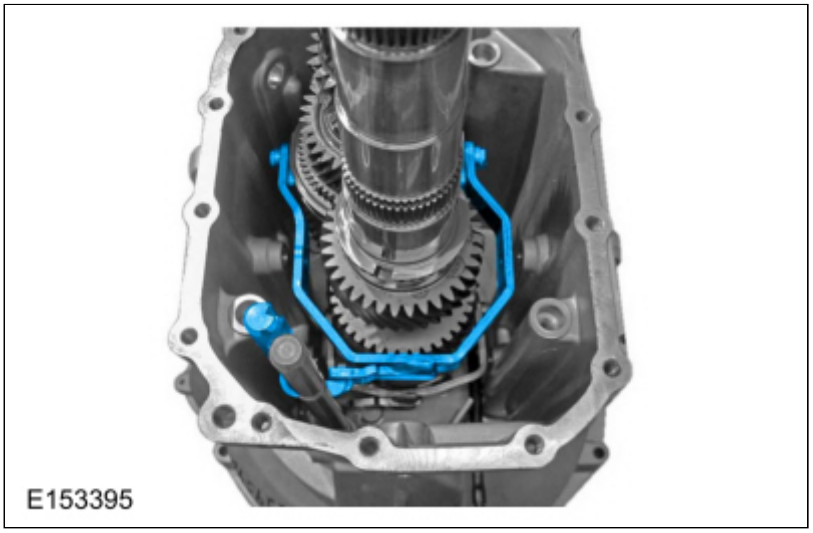
    Unlock the bearing cage Tabs and lightly expand the bearing cages.



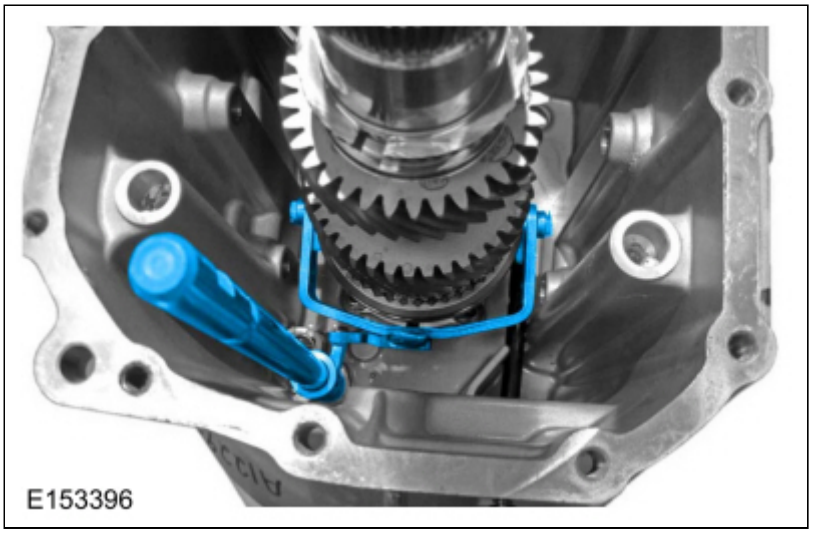
31.



32.



33.



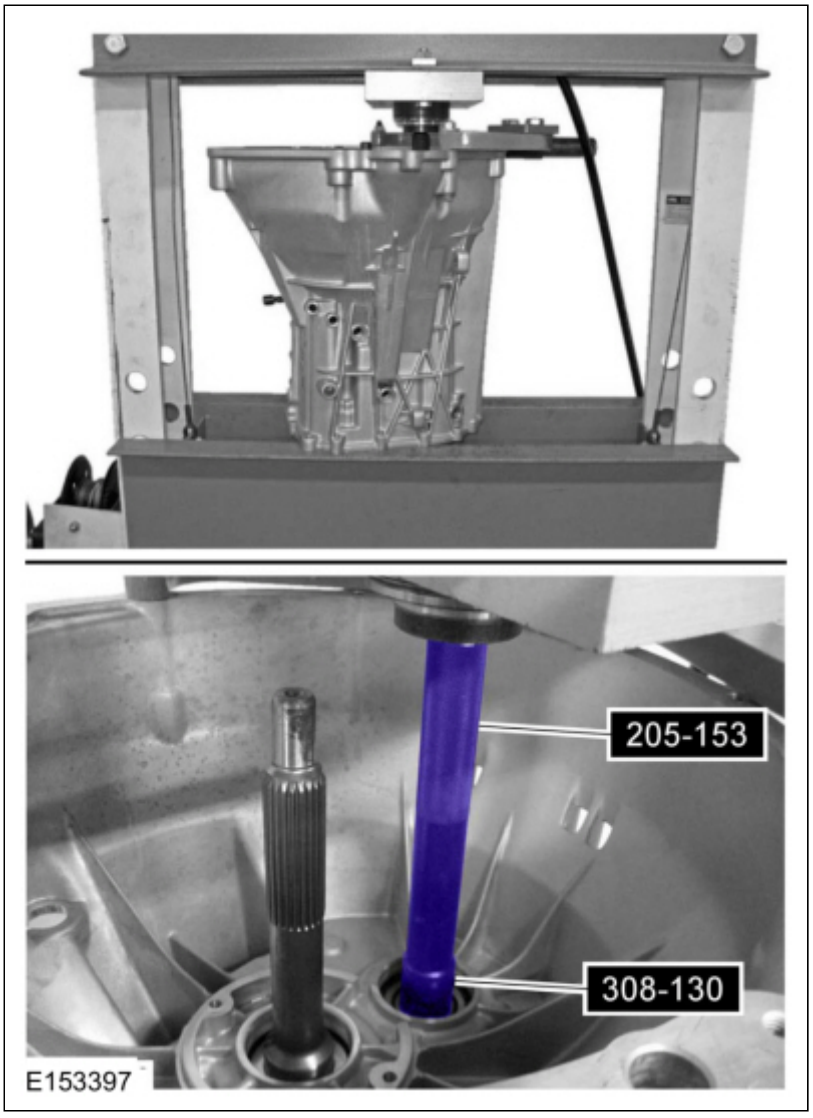
34. **WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow instructions may result in personal injury.**

NOTE: *Use an assistant when pressing out the countershaft and output shaft, do not allow the shafts to bind during removal.*

NOTE: *The countershaft bolt must be removed prior to pressing out the countershaft or damage to the transmission case will occur.*

NOTE: *With an assistant, support the transmission case on flat surfaces of a hydraulic press. Press the countershaft out of the bearing and remove the countershaft and output shaft.*

Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 308-130 (T87T-7025-DH) Installer, Shift Rail Needle Bearing.



35.

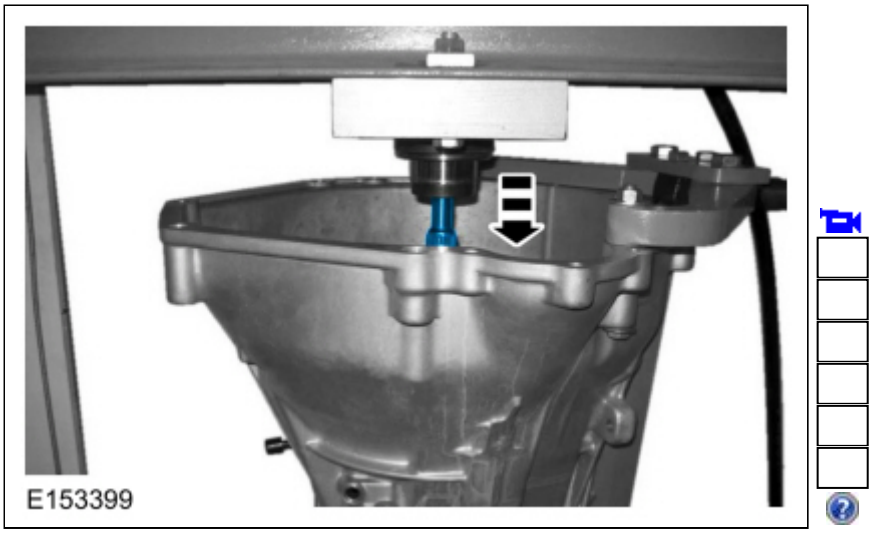


36. **WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow instructions may result in personal injury.**

NOTE: *Use an assistant when pressing out the input shaft, do not allow the input shaft to drop during removal.*

NOTE: *With an assistant, support the transmission case on flat surfaces of a hydraulic press.Using the hydraulic press, remove the input shaft.*

Use the General Equipment: Hydraulic Press

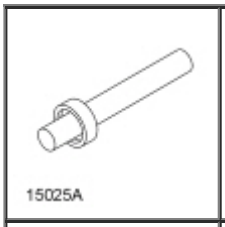
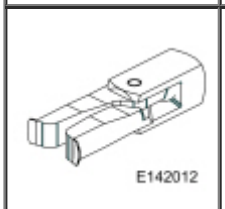
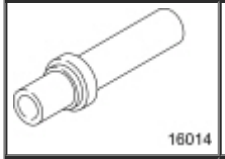
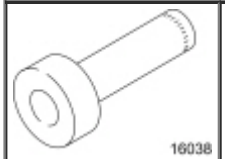


Copyright © 2016 Ford Motor Company

Transmission Case

Base Part Number: 7005

Special Tool(s) / General Equipment

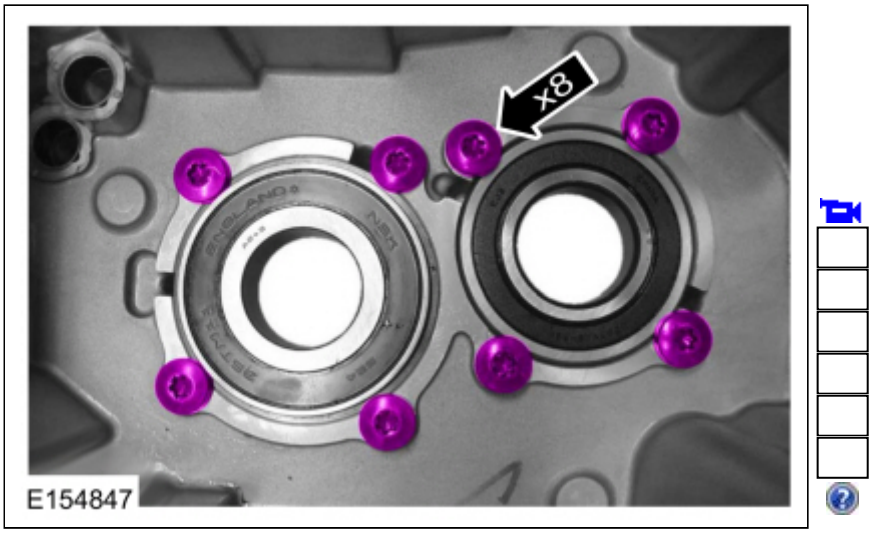
 15025A	205-062 Installer, Differential Bearing
 E92318	303-1365 Remover, Crankshaft Pilot Bearing
 E142012	307-318 Remover, Stator Bearing
 16014	308-044 Installer, Transmission Extension Housing Bushing/Seal
 16038	308-095 Installer, Input Shaft Bearing
Hot Air Gun	
Two Leg Puller	

Materials

Name	Specification
Thread Locking Adhesive	WSK-M2G349-A7

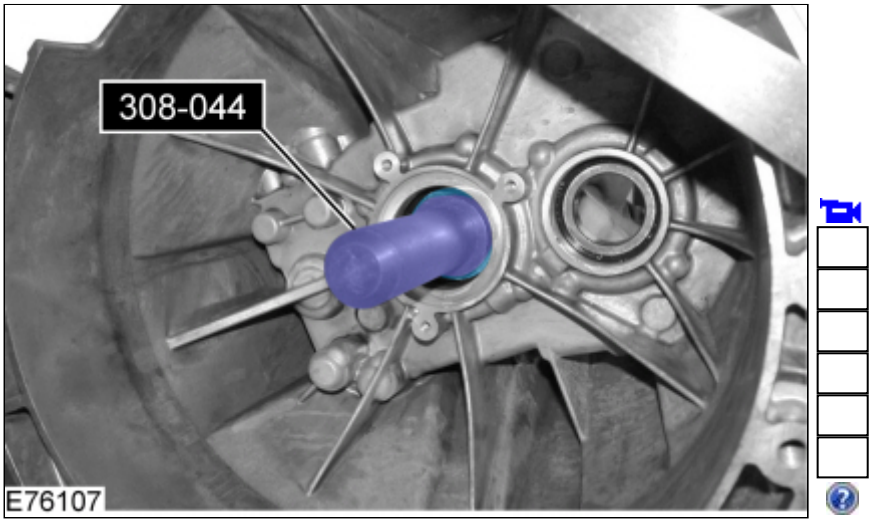
DISASSEMBLY

1.



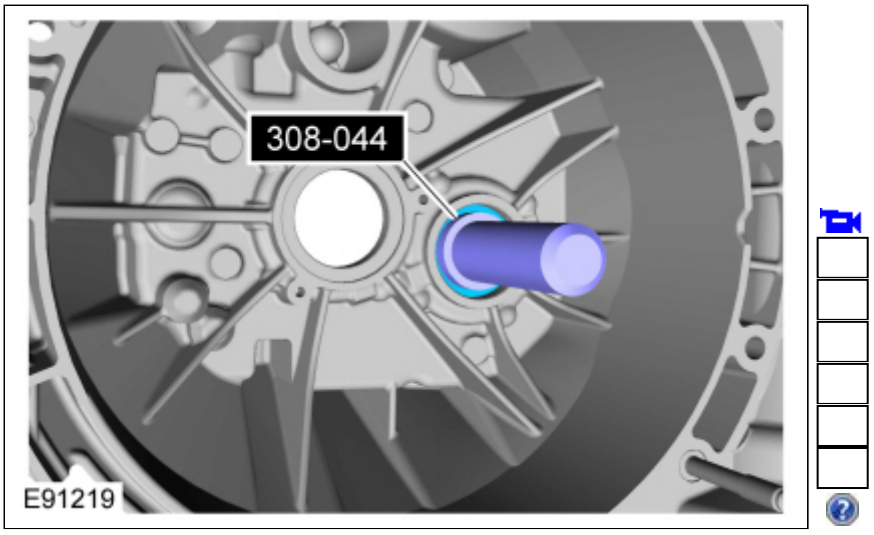
2. **NOTE:** *Inspect the input shaft bearing for wear or damage. Install a new bearing as necessary.*

   Use Special Service Tool: 308-044 Installer, Transmission Extension Housing Bushing/Seal.

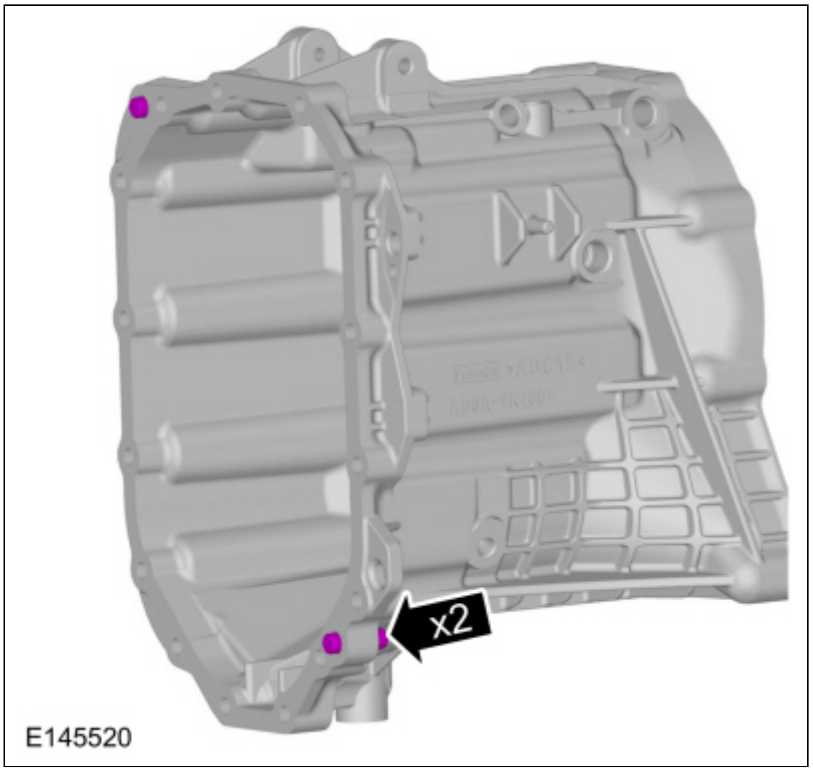


3. **NOTE:** *Inspect the countershaft bearing for wear or damage. Install a new bearing as necessary.*

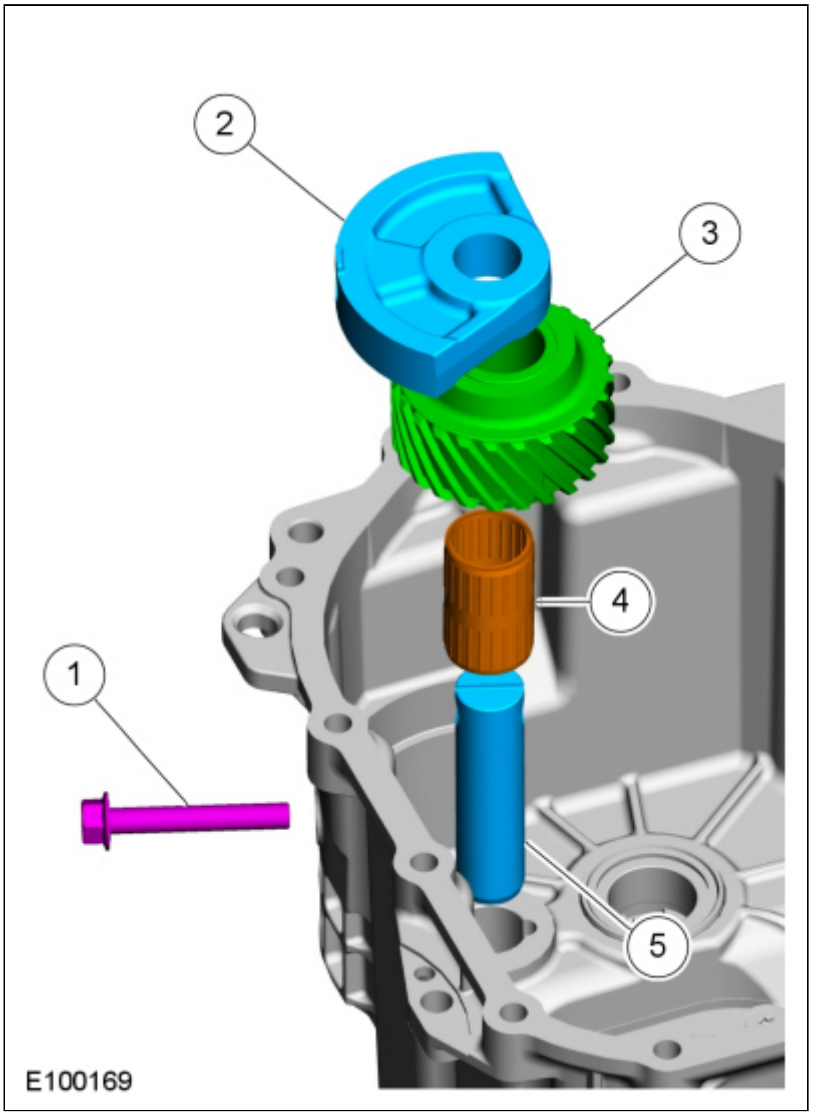
   Use Special Service Tool: 308-044 Installer, Transmission Extension Housing Bushing/Seal.



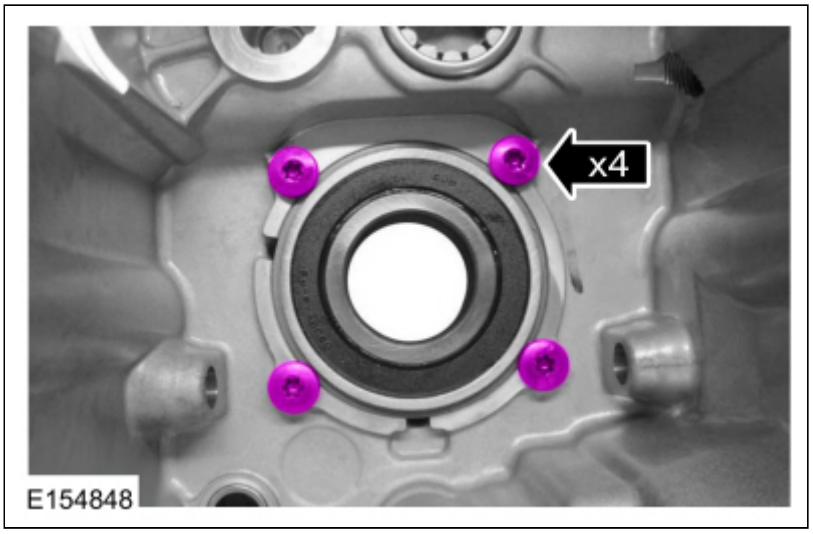
4. **NOTE:** *Using a brass drift, tap the dowel pins flush with the transmission case.*



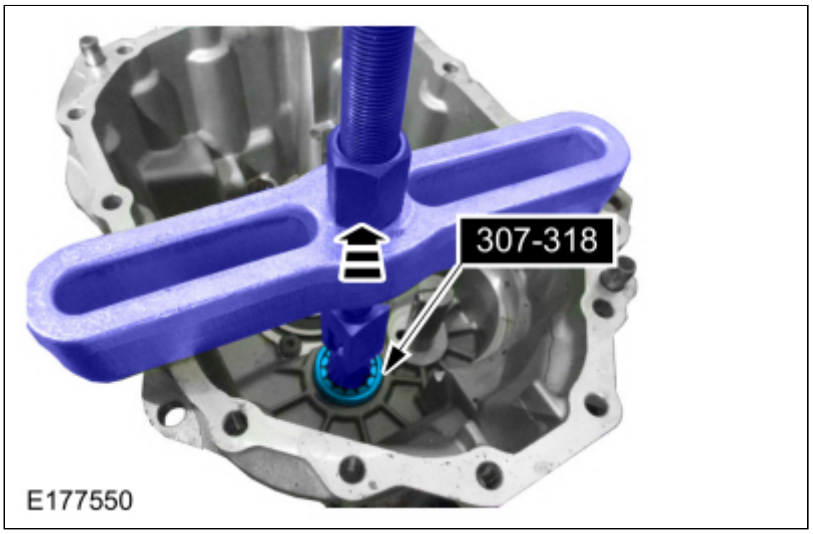
5.



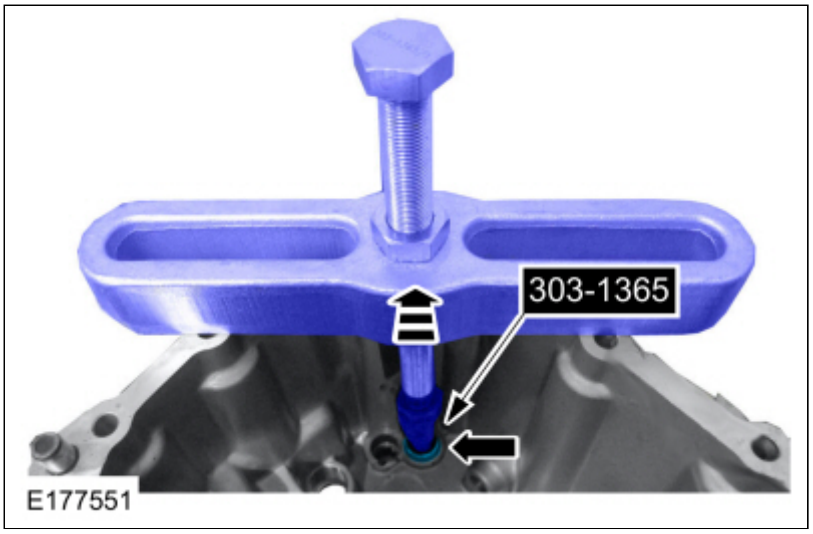
6.



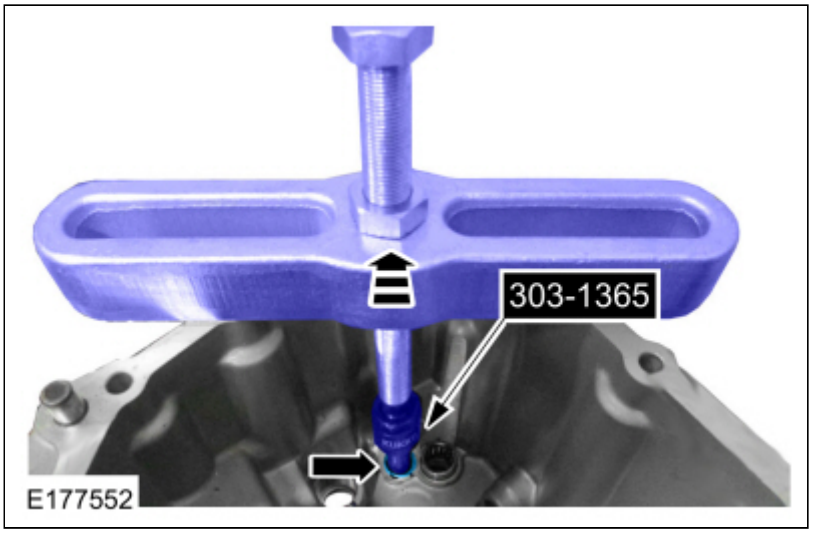
7. Use Special Service Tool: 307-318 Remover, Stator Bearing.
   Use the General Equipment: Two Leg Puller



8. Use Special Service Tool: 303-1365 Remover, Crankshaft Pilot Bearing.
   Use the General Equipment: Two Leg Puller



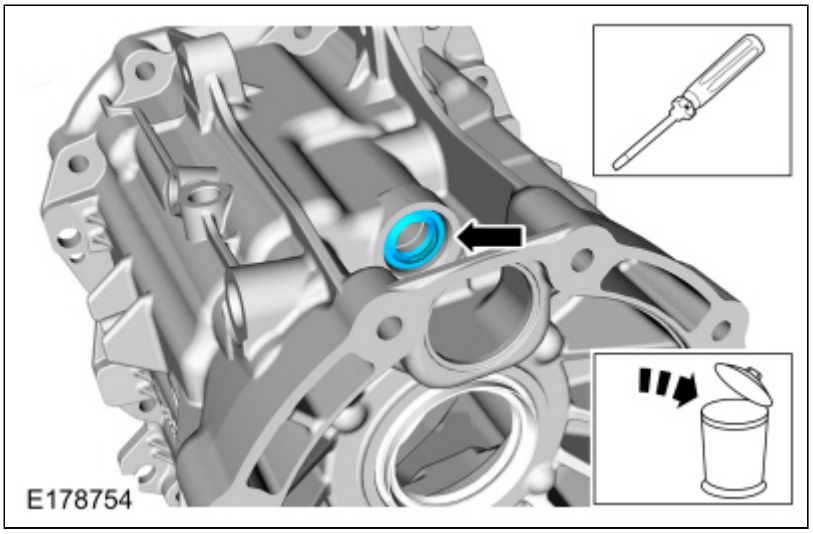
9. Use Special Service Tool: 303-1365 Remover, Crankshaft Pilot Bearing.
   Use the General Equipment: Two Leg Puller



10.

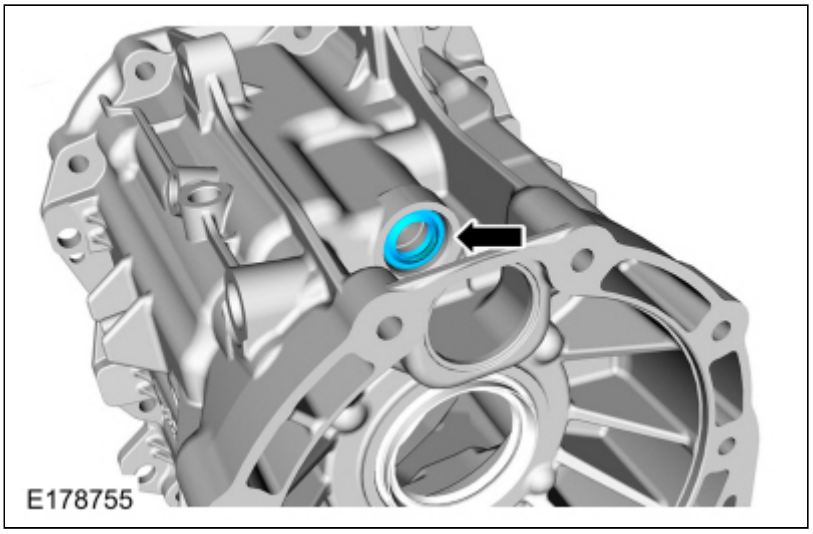


11.

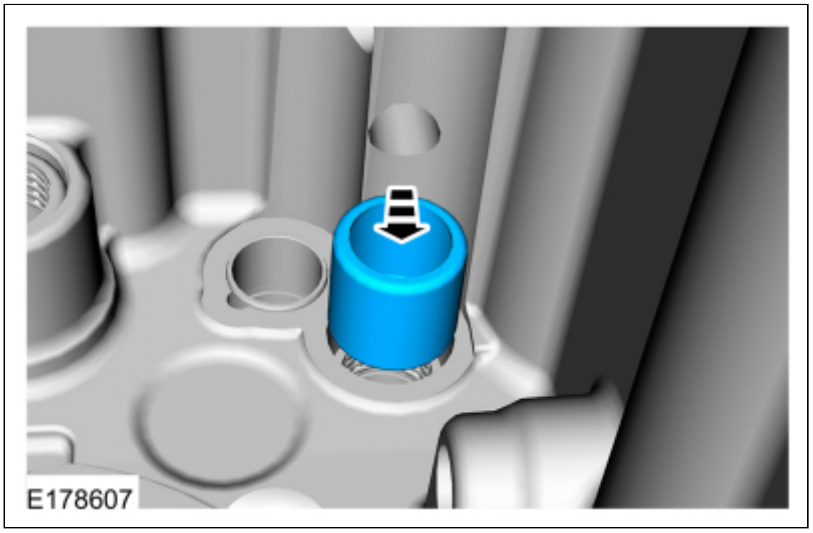


ASSEMBLY

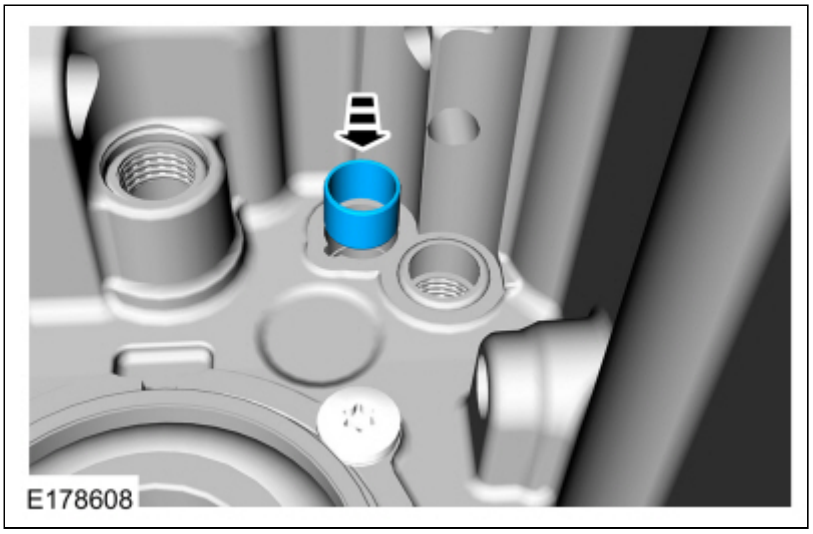
1. Make sure that a new component is installed.



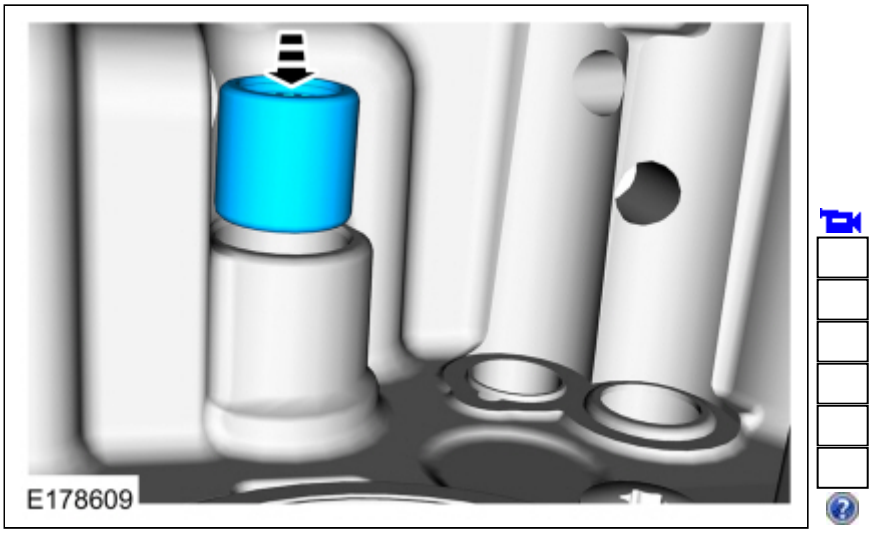
2. Make sure that a new component is installed.



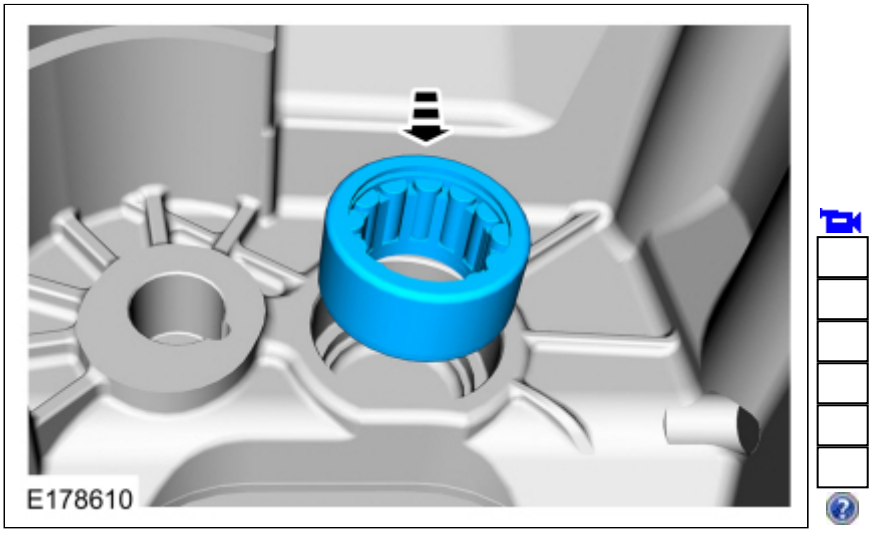
3. Make sure that a new component is installed.



4. Make sure that a new component is installed.

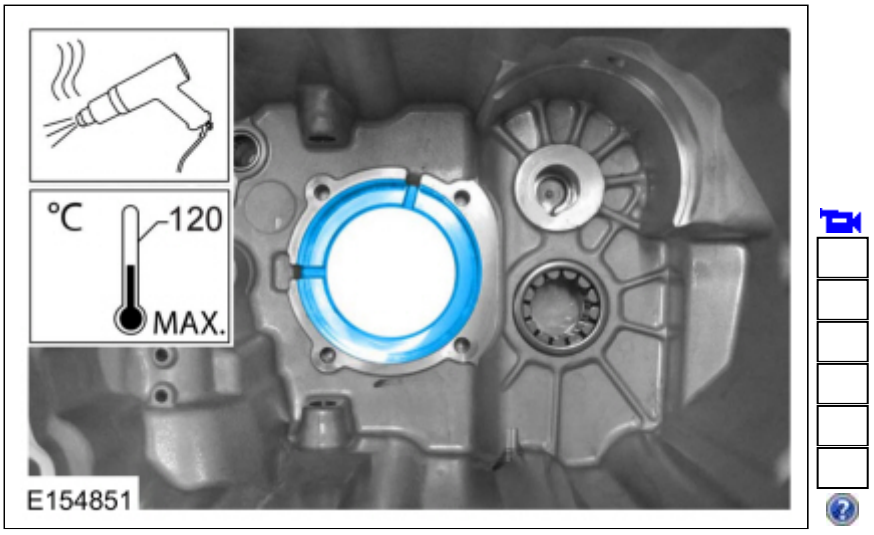


5. Make sure that a new component is installed.



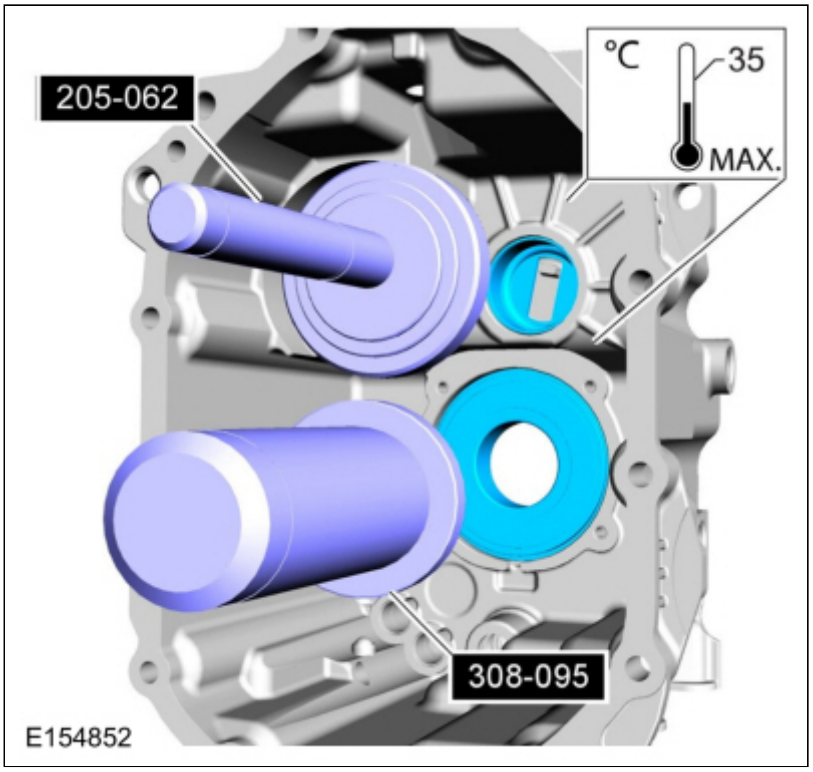
6. **NOTICE: Do not heat the transmission case higher than 120°C maximum or damage to the transmission case can occur.**

   Use the General Equipment: Hot Air Gun

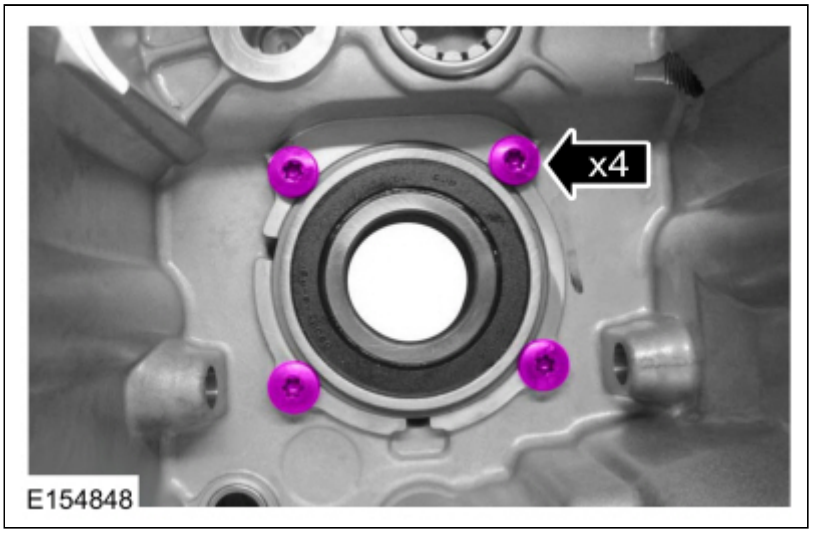


7. **NOTICE: Install the output shaft bearing with the grooved side of the outer output shaft bearing race facing the inside of the transmission case or damage to the transmission case can occur.**

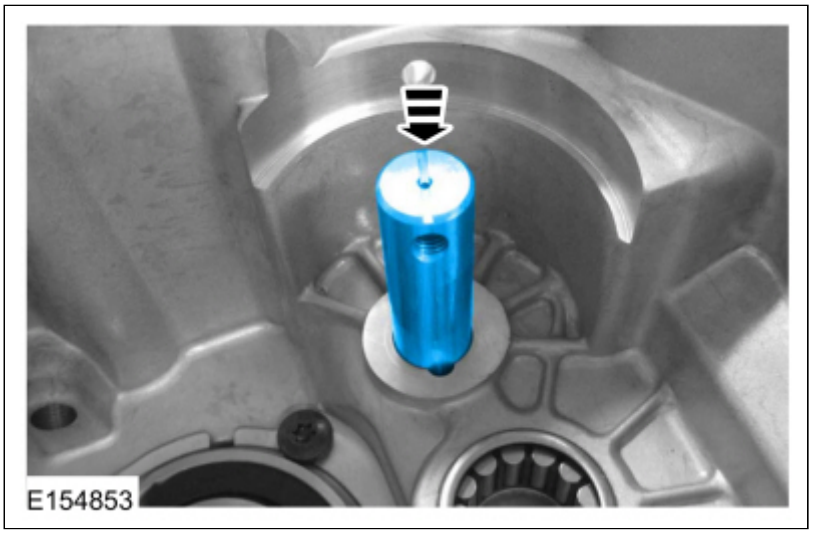
   Use Special Service Tool: 205-062 Installer, Differential Bearing. , 308-095 Installer, Input Shaft Bearing.



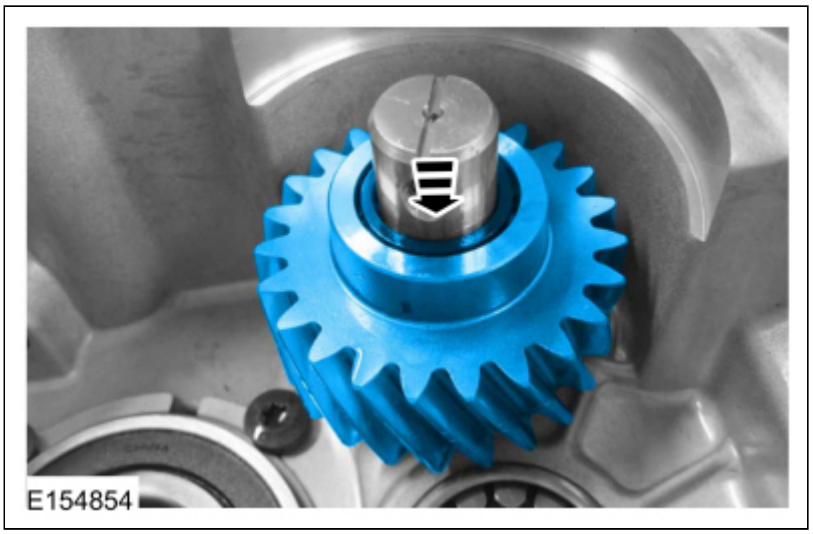
8. *Torque*: 36 Nm



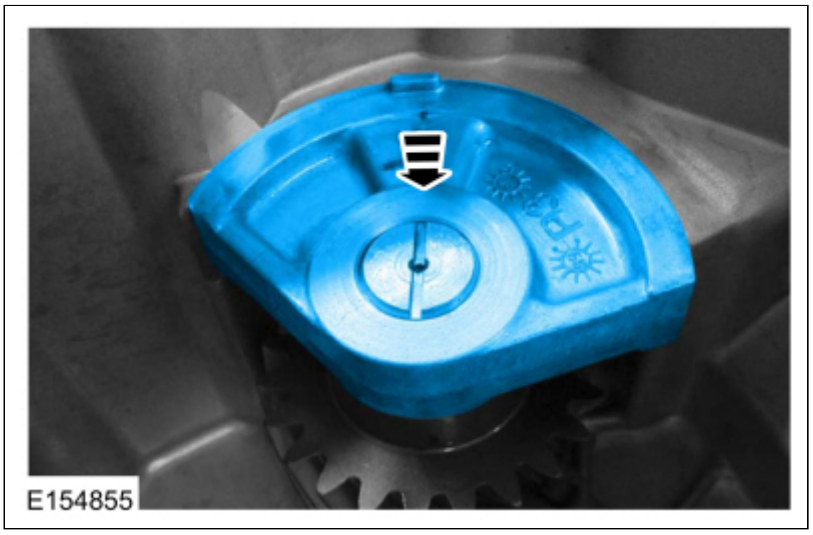
9.



10.

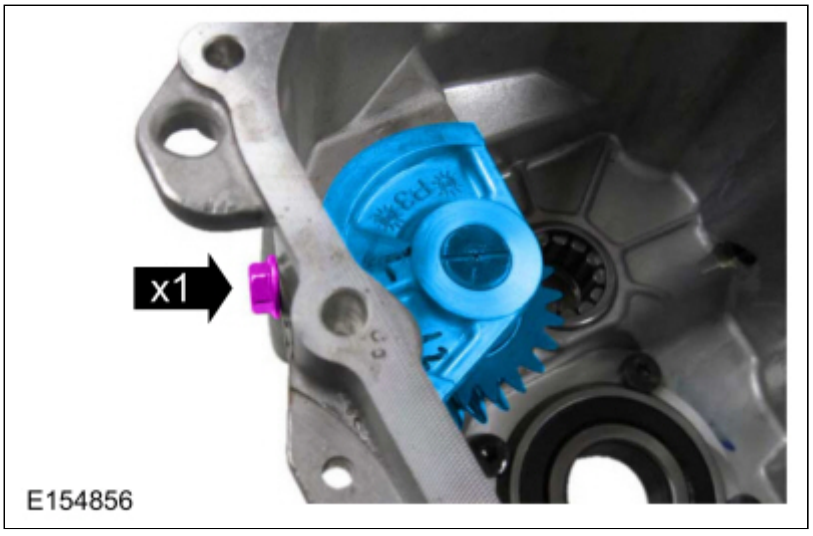


11.



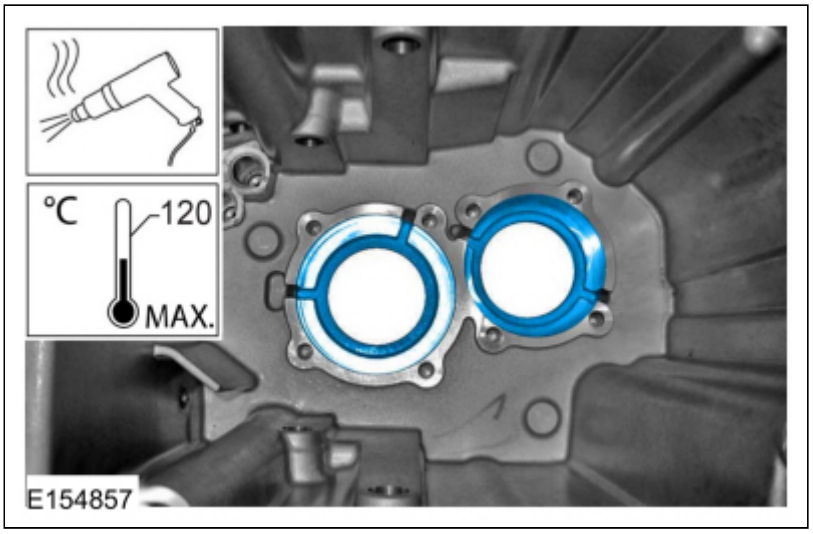
12. **NOTE:** *Apply threadlock to the reverse idler gear bolt.*

    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 27 Nm

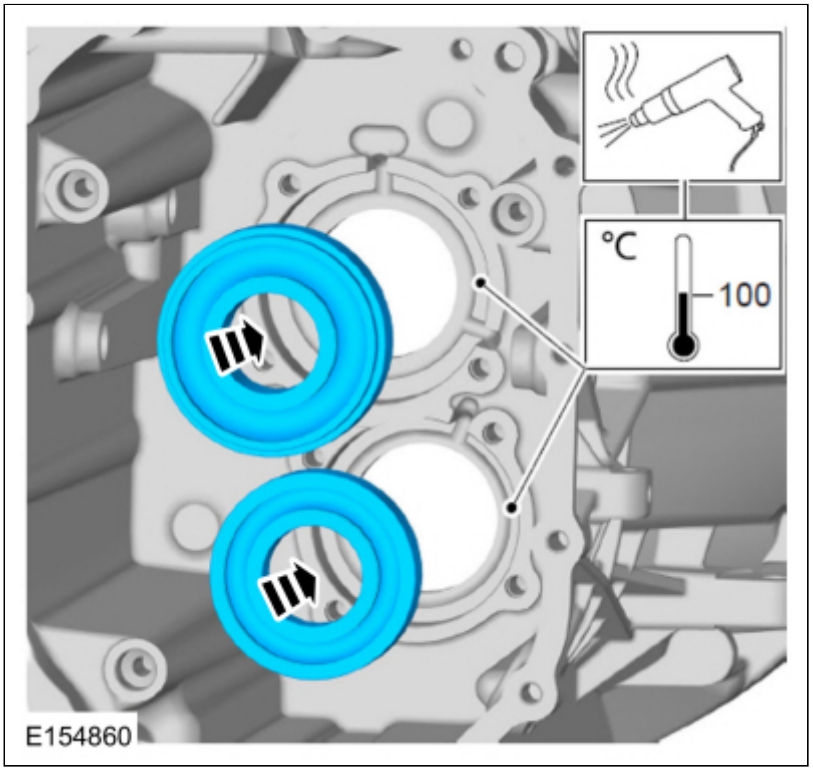


13. **NOTICE: Do not heat the transmission case higher than 120°C maximum or damage to the transmission case can occur.**

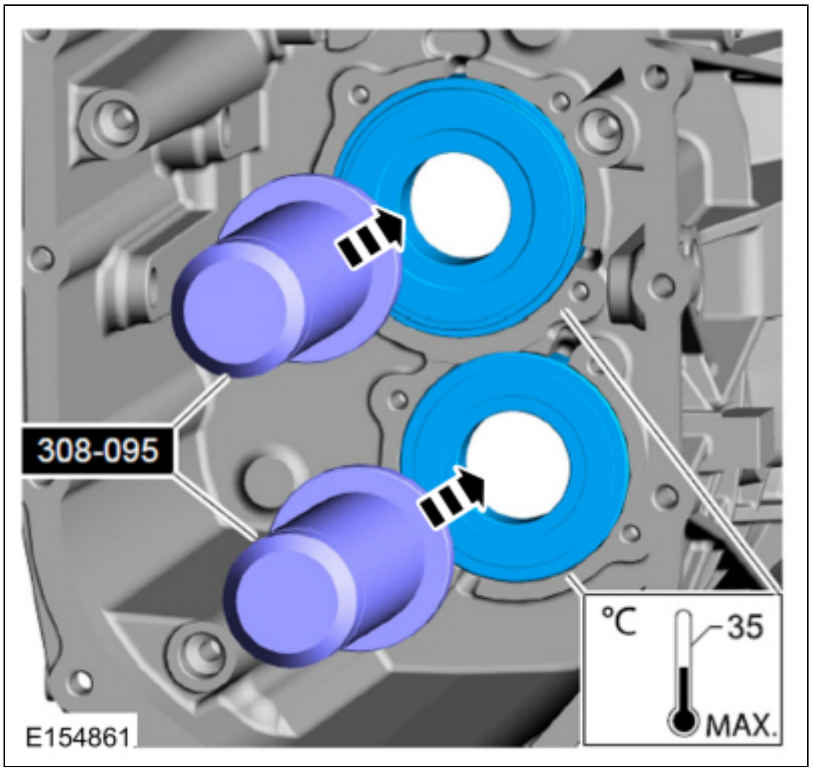
    Use the General Equipment: Hot Air Gun



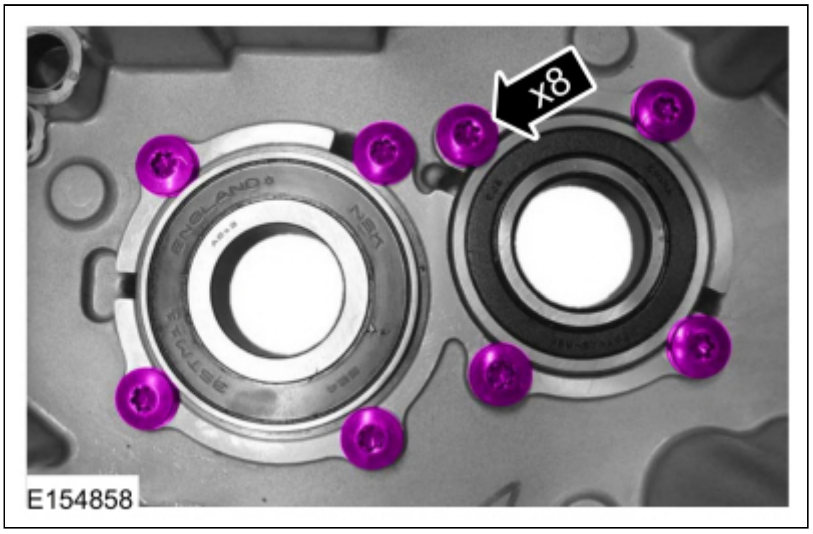
14. Use the General Equipment: Hot Air Gun



15. Use Special Service Tool: 308-095 Installer, Input Shaft Bearing.



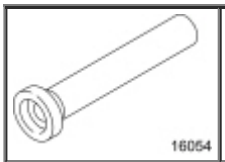
16. *Torque*: 36 Nm



Copyright © 2016 Ford Motor Company

Countershaft

Special Tool(s) / General Equipment

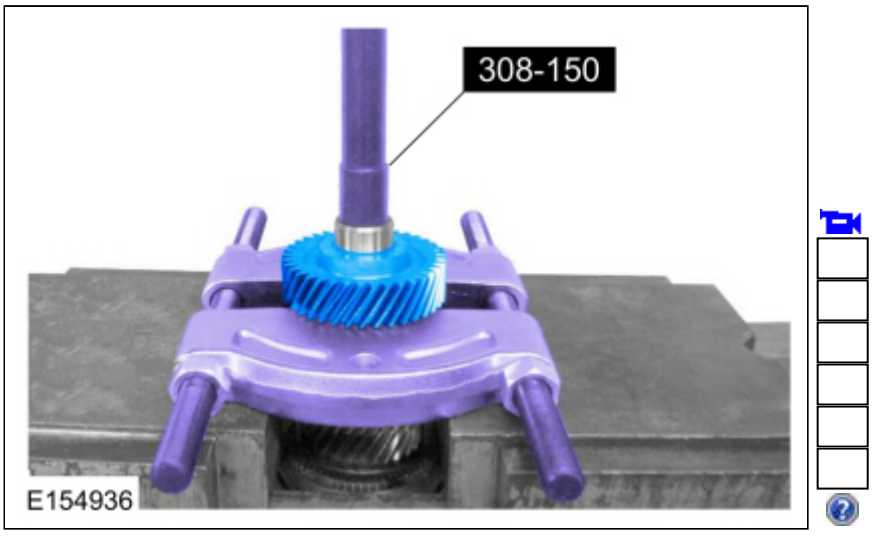
	308-150 Installer, Mainshaft Double Lip Seal
Hydraulic Press	
Bearing Separator	

DISASSEMBLY

1. **NOTICE: Support the countershaft while using the hydraulic press to prevent damage to the shaft or gears.**

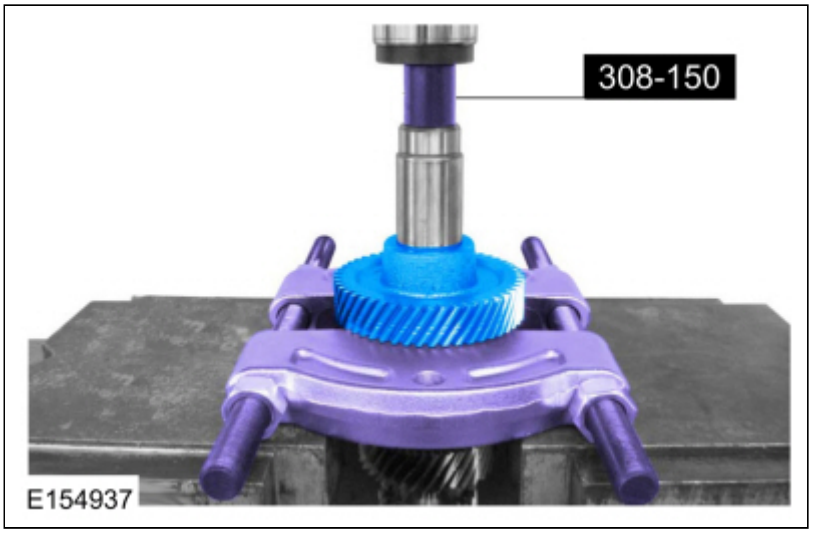
   NOTICE: Hand-tighten the Bearing Puller to prevent gear damage.

   Use Special Service Tool: 308-150 Installer, Mainshaft Double Lip Seal.
   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



2. **NOTE:** *Inspect component for wear or damage, Install a new component as necessary.*

   Use Special Service Tool: 308-150 Installer, Mainshaft Double Lip Seal.
   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



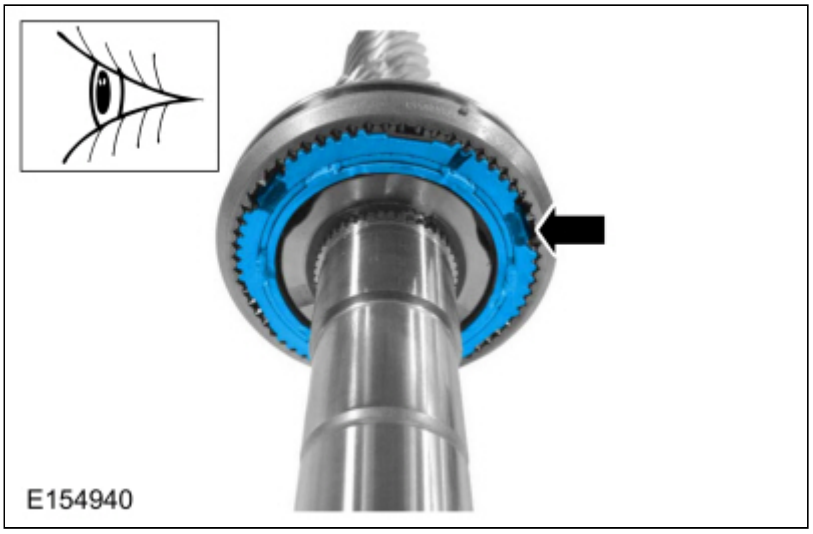
3. **NOTE:** *Inspect component for wear or damage, Install a new component as necessary.*



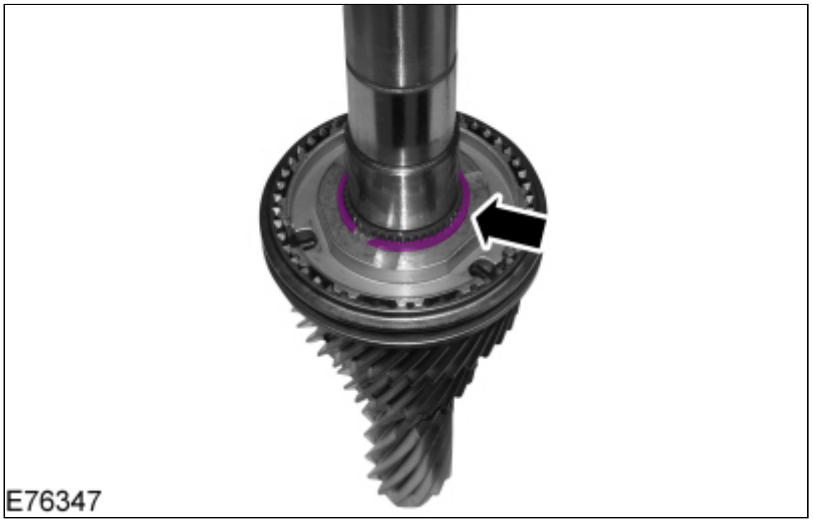
4. **NOTE:** *Inspect component for wear or damage, Install a new component as necessary.*



5. **NOTE:** *Inspect component for wear or damage, Install a new component as necessary.*



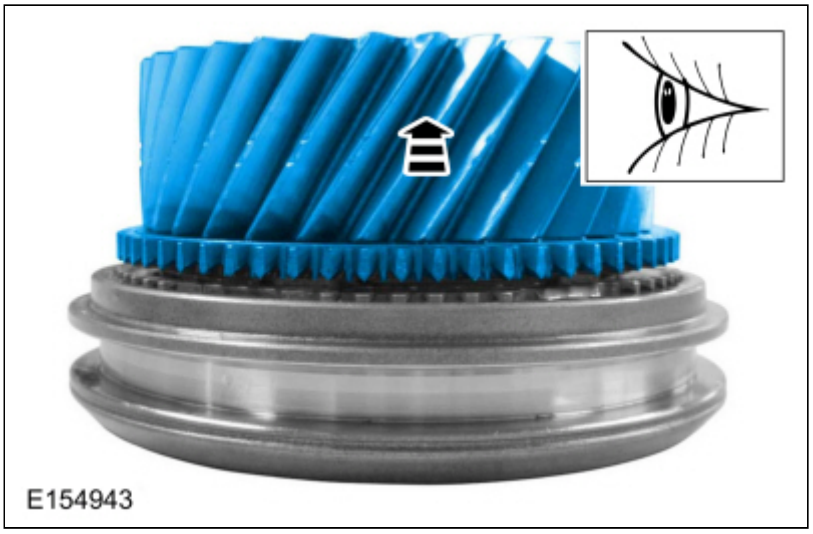
6.



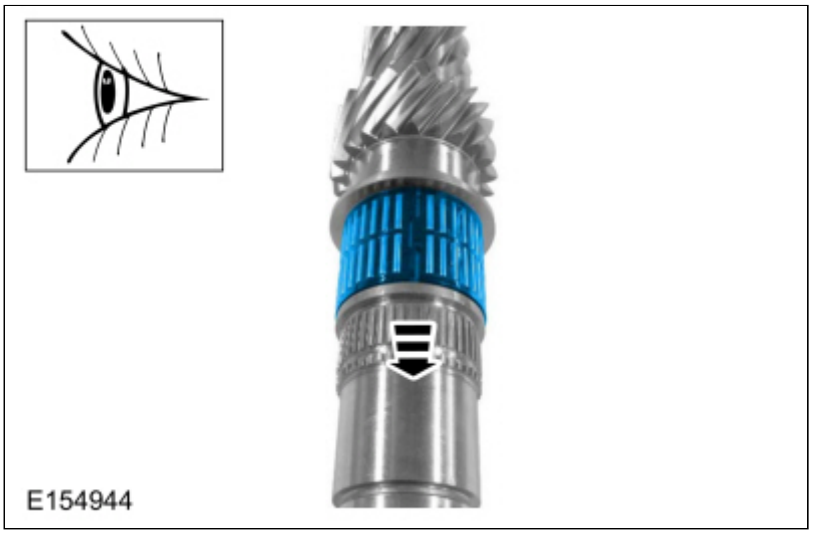
7. Use Special Service Tool: 308-150 Installer, Mainshaft Double Lip Seal.
   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



8. **NOTE:** *Inspect components for wear or damage, Install a new component as necessary.*



9. **NOTICE: When removing the bearing, do not over expand the bearing cage or damage to the bearing cage can occur.**



ASSEMBLY

1. **NOTICE: When installing the bearing, do not over expand the bearing cage or damage to the bearing cage can occur.**



2. **NOTICE: The groove on the 3rd/4th gear synchronizer assembly must be facing away from 4th gear or damage to the synchronizer assembly can occur.**

   NOTICE: The 6 synchronizer ring tabs must engage into the 6 gear slots and the 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage to the synchronizer assembly and synchronizer ring assembly can occur.

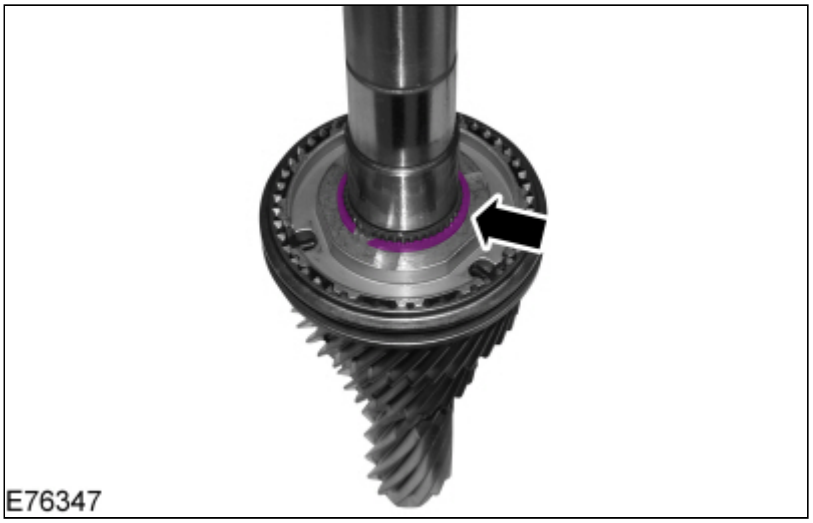
NOTE: *The 4th gear synchronizer ring assembly outer ring has one identification notch.*



3. Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



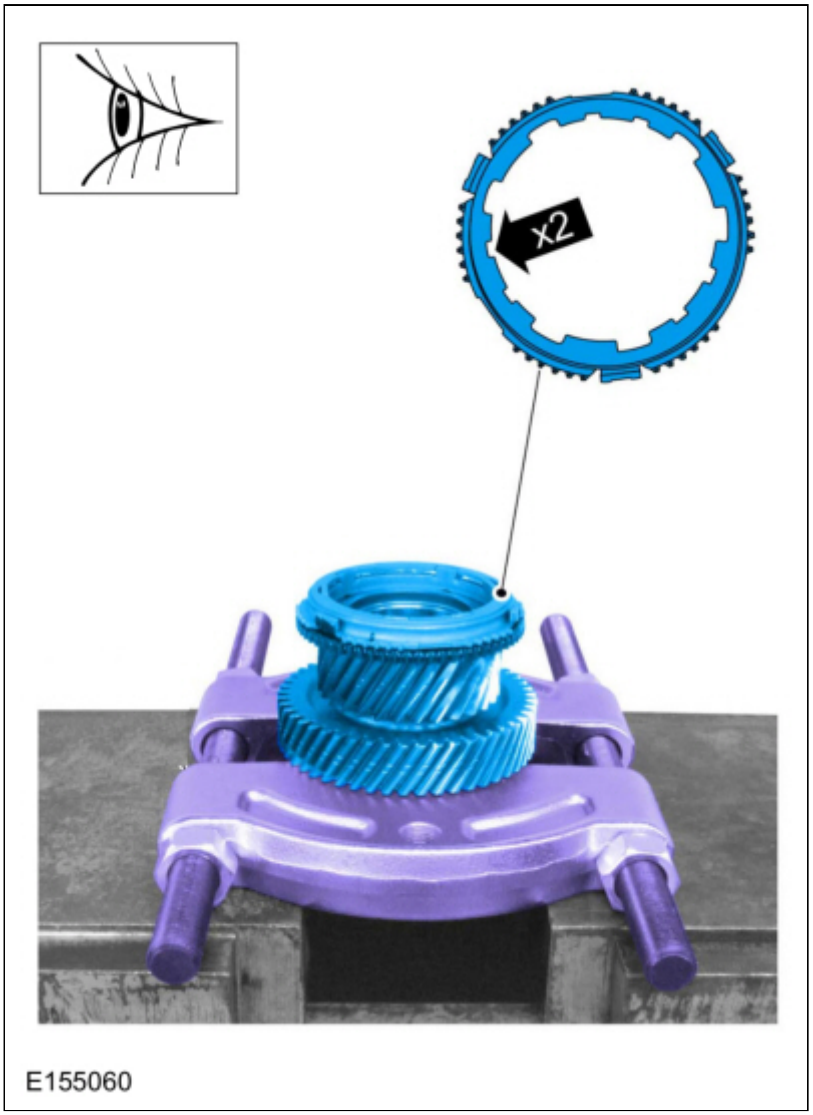
4.



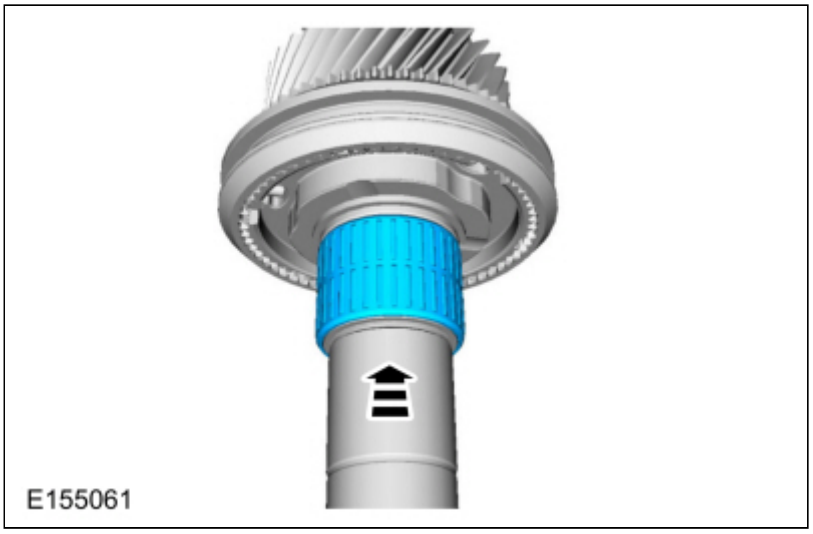
5. **NOTICE: The 6 synchronizer ring tabs must engage into the 6 gear slots or damage to the synchronizer assembly and synchronizer ring assembly can occur.**

   NOTICE: The 3rd gear synchronizer ring assembly outer ring has 2 identification notches.

   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



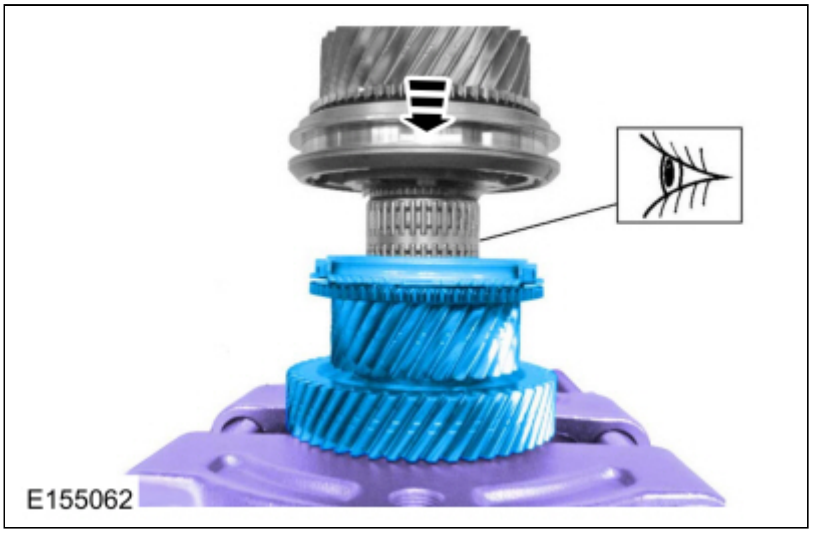
6. **NOTE:** *Lubricate the needle bearing with petroleum jelly to hold it in place during assembly.*



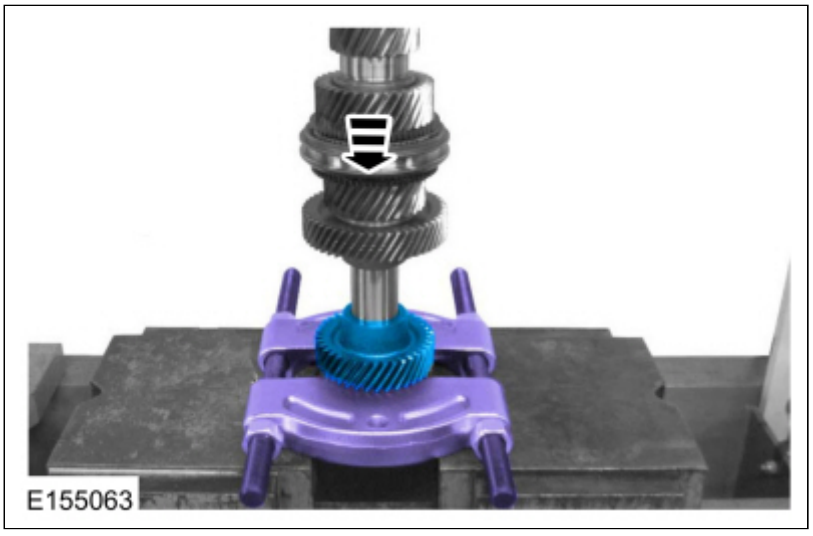
7. **NOTICE: The 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage to the synchronizer assembly and synchronizer ring assembly can occur.**

   NOTICE: Do not allow the 3rd gear needle bearing to slide down the countershaft while pressing the components or damage to the needle bearing can occur.

   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



8. Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



Copyright © 2016 Ford Motor Company

Output Shaft

Special Tool(s) / General Equipment

Hydraulic Press
Bearing Separator

Materials

Name	Specification
Gear/Transmission Fluid - SAE 75W	WSS-M2C200-D2

DISASSEMBLY

1. **NOTICE: Hand-tighten the Bearing Puller to prevent gear damage.**

   NOTICE: Support the output shaft while using the press to prevent damage to the shaft or gears.



2. **NOTE:** *Inspect components for wear or damage, Install new components as necessary.*

   Inspect components for wear or damage, Install new components as necessary.
   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator



3. **NOTE:** *Inspect components for wear or damage, Install new components as necessary.*



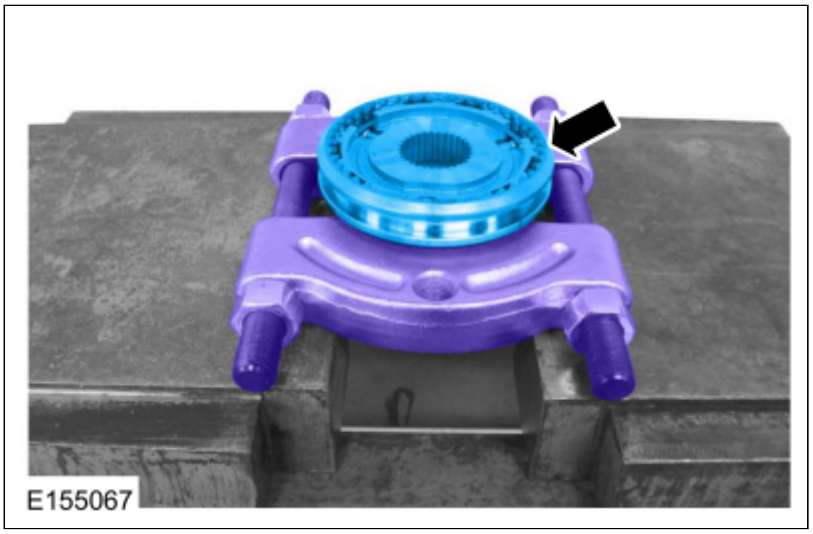
4. **NOTE:** *Inspect components for wear or damage, Install new components as necessary.*



ASSEMBLY

1. **NOTE:** *Lubricate all components with the recommended transmission fluid before reassembling.*

   Use the General Equipment: Hydraulic Press
   Use the General Equipment: Bearing Separator
   Material: Gear/Transmission Fluid - SAE 75W (WSS-M2C200-D2)

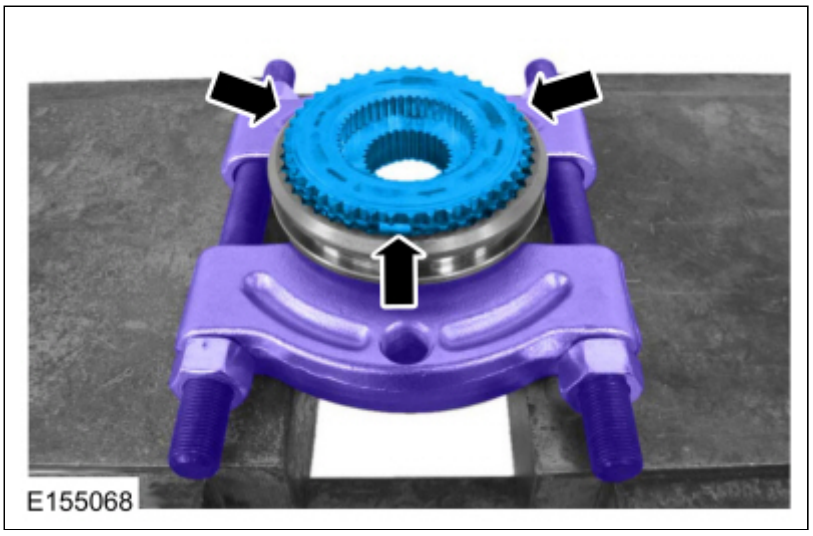


2. **NOTICE: The 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage**

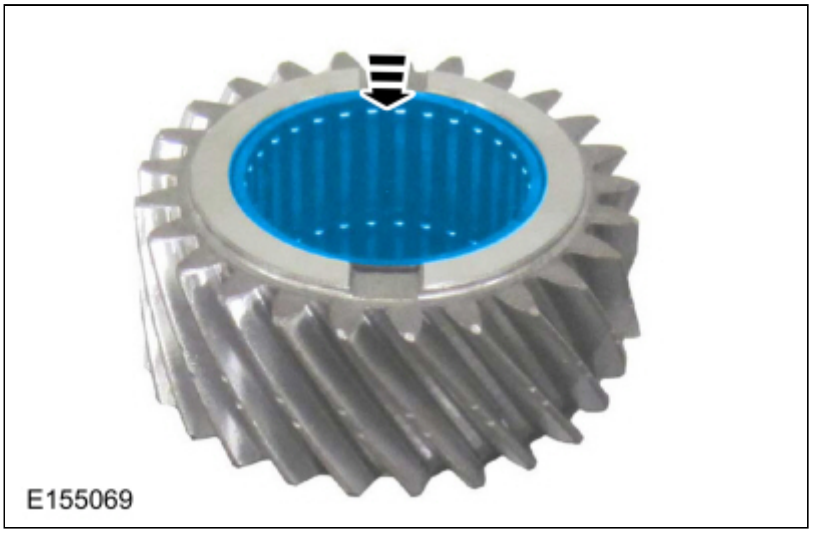
to the synchronizer assembly and synchronizer ring can occur.

NOTE: *Lubricate all components with the recommended transmission fluid before reassembling.*

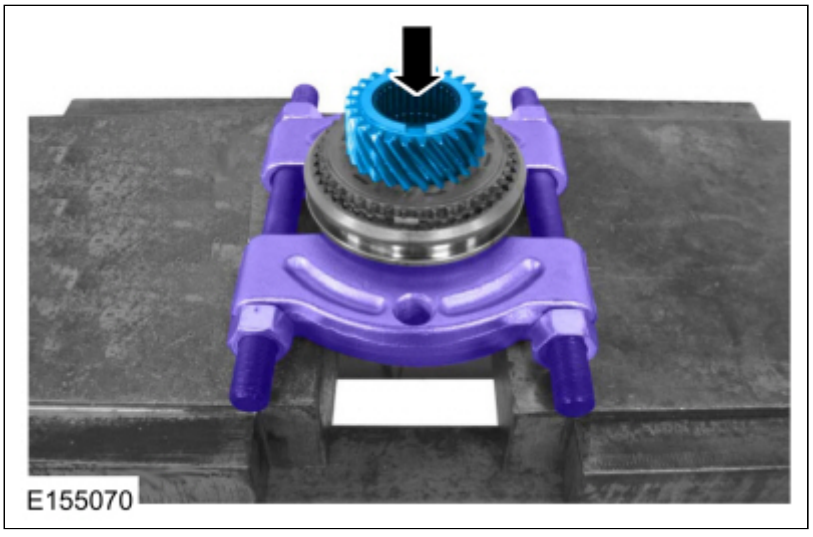
Use the General Equipment: Hydraulic Press
Use the General Equipment: Bearing Separator



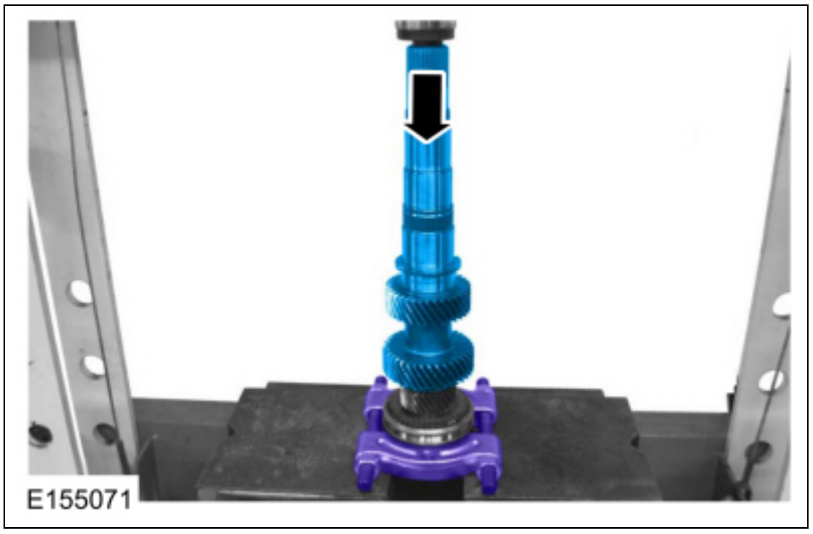
3.



4.



5.



6.



Copyright © 2016 Ford Motor Company

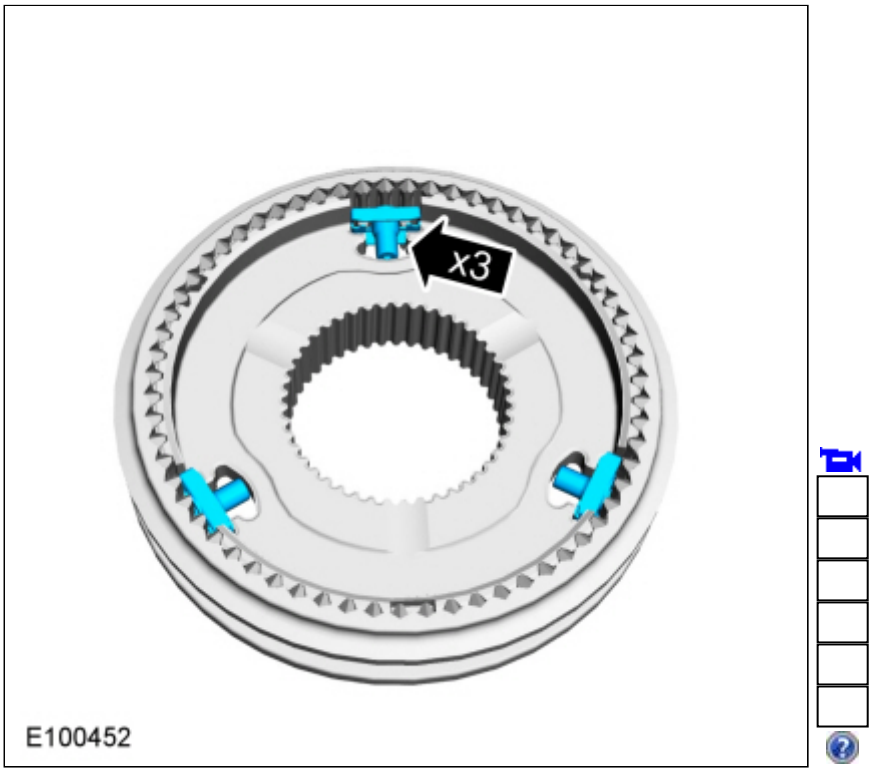
Synchronizers

Materials

Name	Specification
Grease - High Temperature	ESD-M1C220-A

DISASSEMBLY

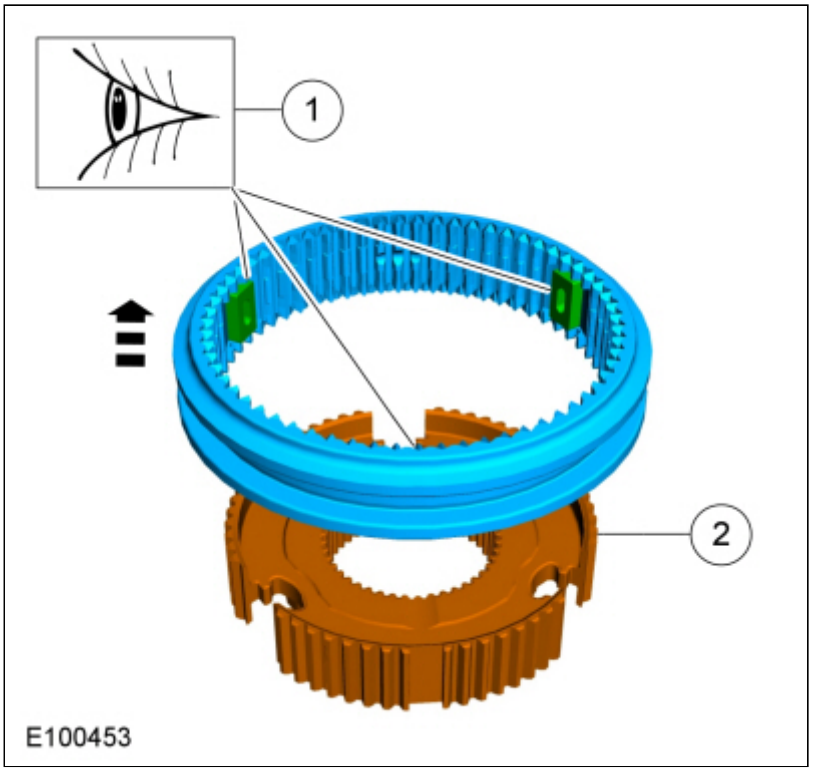
1.



2. **NOTE:** *Note the position of each component before removal.*

   NOTE: *Make sure that no component falls off during removal.*

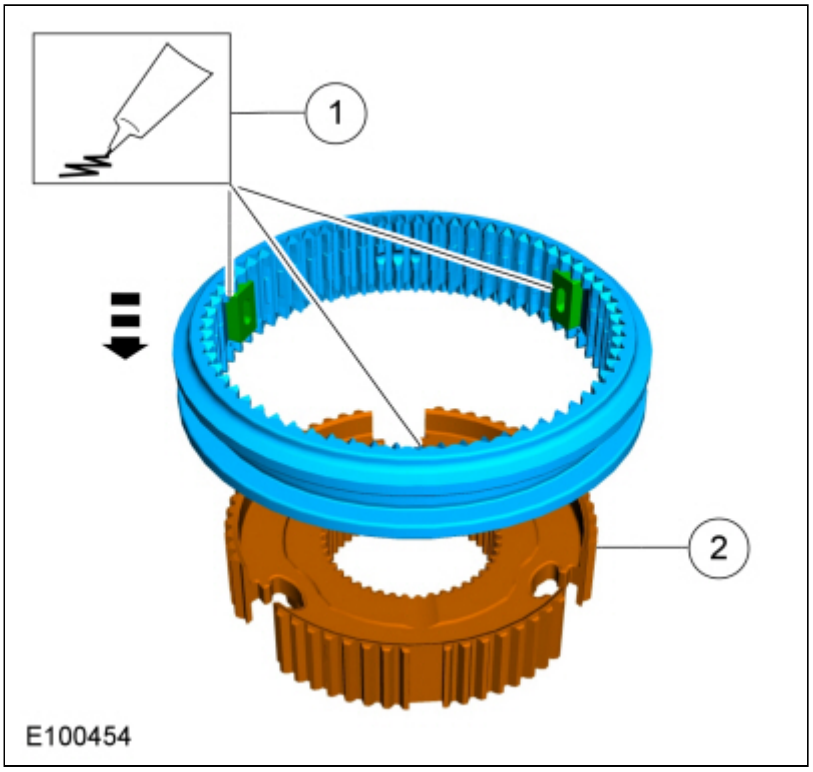
   1. 3rd/4th gear only



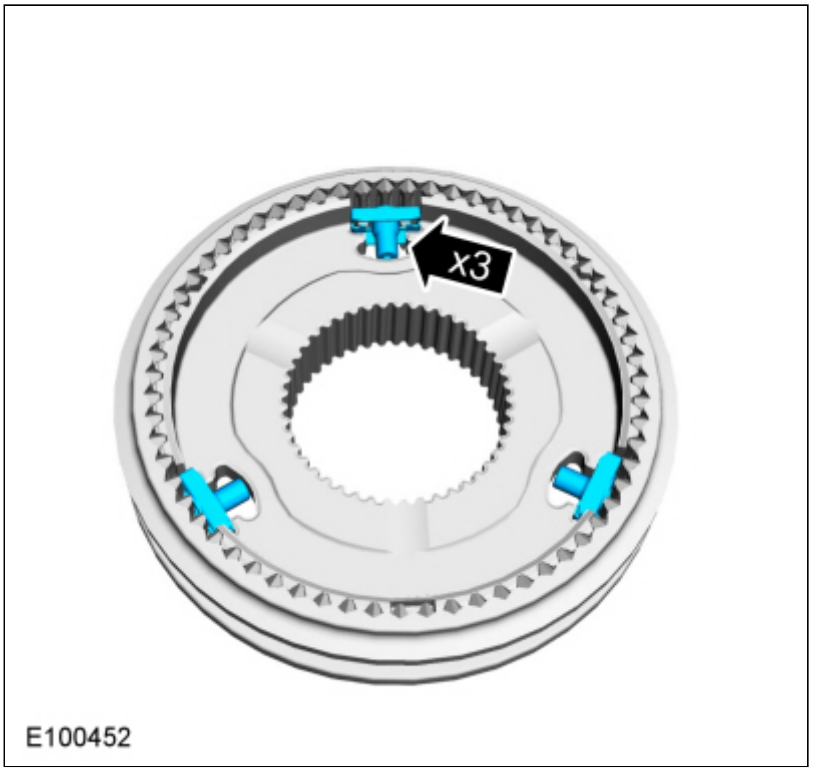
ASSEMBLY

1. **NOTE:** *Make sure that these components are installed to the noted removal position.*

    1. 3rd/4th gear only
    Material: Grease - High Temperature (ESD-M1C220-A)



2.

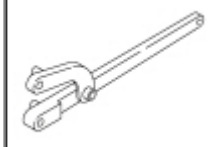
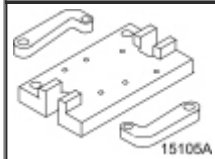
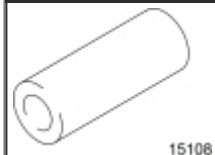
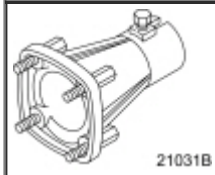
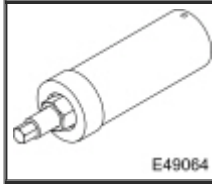
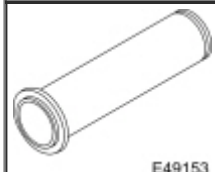


Copyright © 2016 Ford Motor Company

Transmission - 2WD

Base Part Number: 7000

Special Tool(s) / General Equipment

 15030A	205-072 Universal Flange Holding Wrench
 15105A	205-329 Mounting Bracket, Engine/Differential
 15108	205-332 Protector, Axle Shaft
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E49064	308-604 Installer, Output Drive Flange Seal
 E49153	308-605 Installer, Input Shaft Seal
 E84508	308-690 Installer, Output Drive Flange Seal
Cable Ties	
Hot Air Gun	
Copper Hammer	

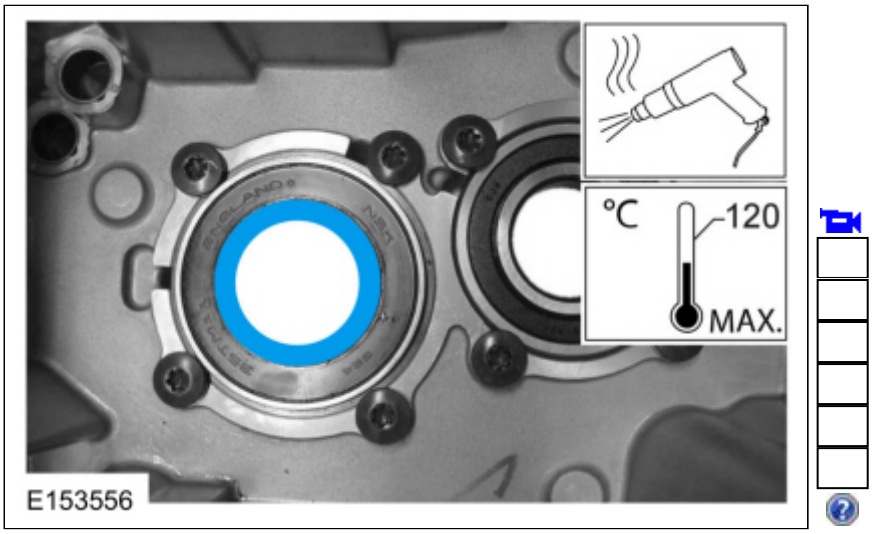
Materials

Name	Specification

Thread Locking Sealant	-
Thread Locking Adhesive	WSK-M2G349-A7
Sealant	WSK-M2G348-A7

1. **NOTICE: Do not heat the input shaft bearing higher than 120°C (248°F) maximum or damage to the input shaft bearing can occur.**

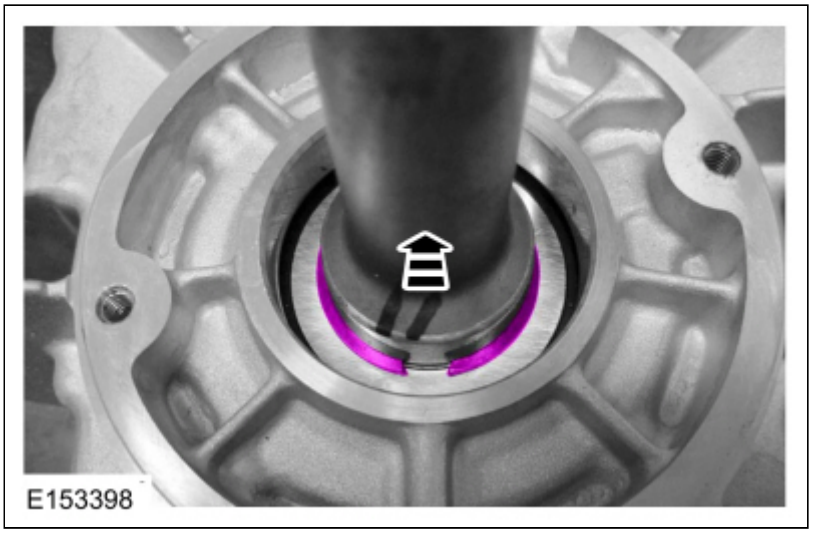
   Use the General Equipment: Hot Air Gun



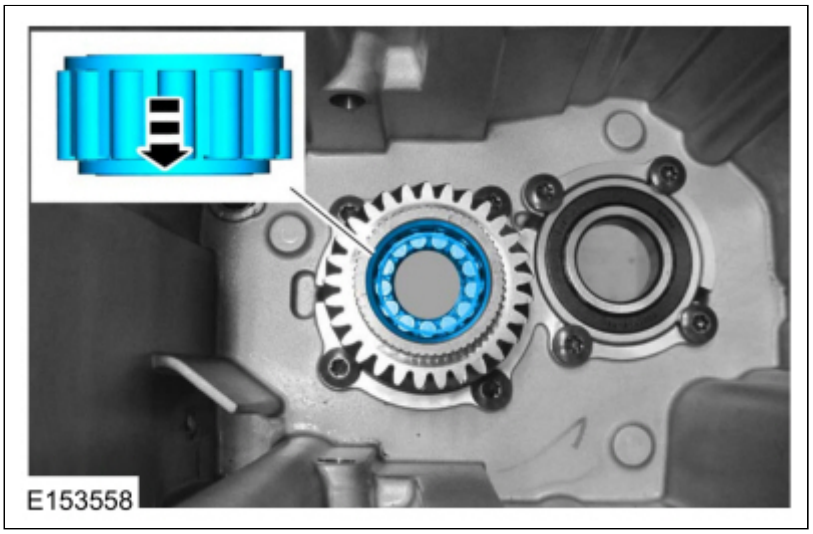
2. **NOTE:** *Install the oil feed hole facing the countershaft bearing.*



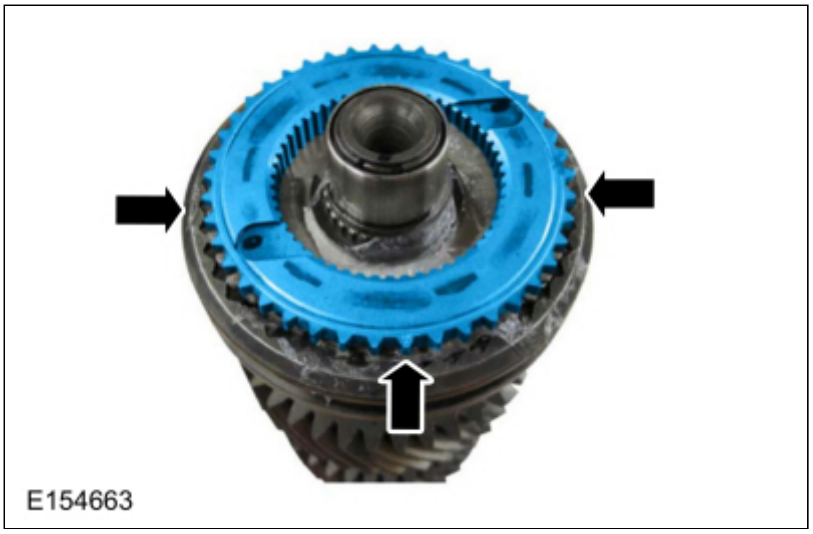
3.



4. **NOTE:** *Make sure the small diameter side of the output shaft bearing cage is facing the input shaft or damage to the output shaft bearing can occur.*



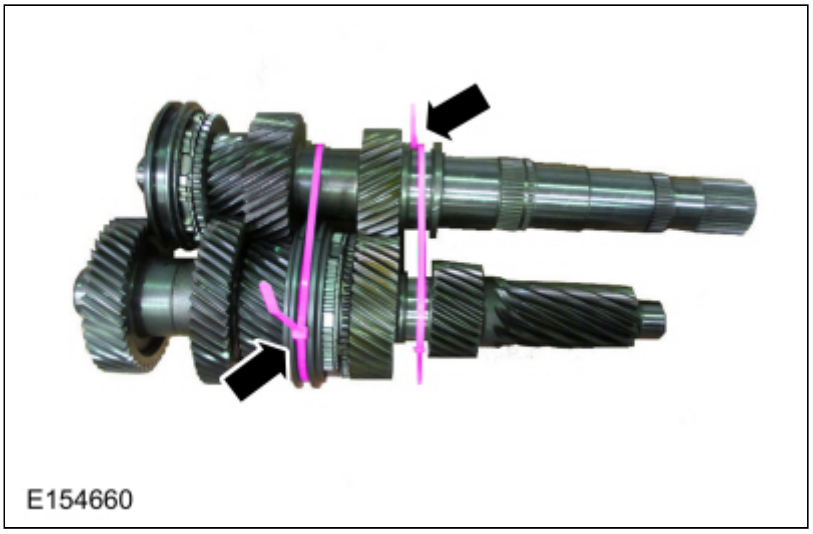
5. **NOTE:** *Apply petroleum jelly to hold 5th gear synchronizer ring and the 5th gear synchronizer cone in place during assembly.*



6. **NOTE:** *Assemble the shafts with the oil feed hole on the 5th gear cone facing the countershaft.*

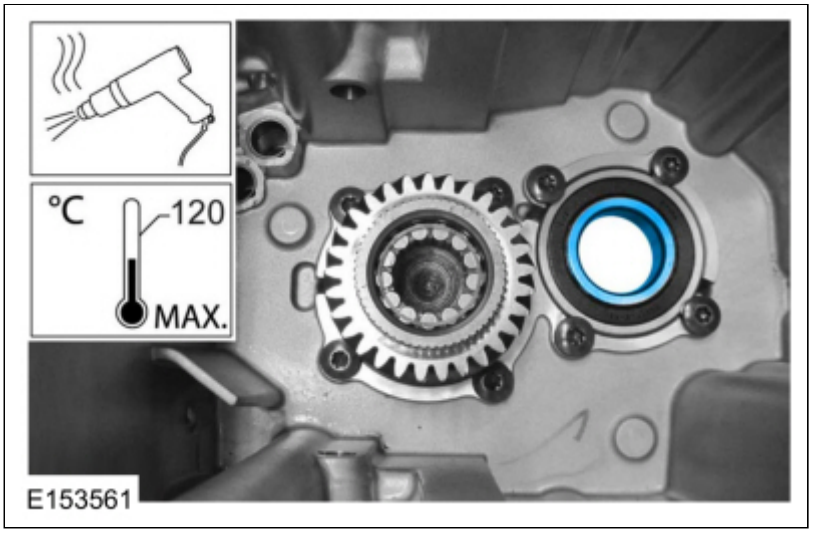
   NOTE: *Sercure the shaft pack with cable ties.*

   Install the General Equipment: Cable Ties

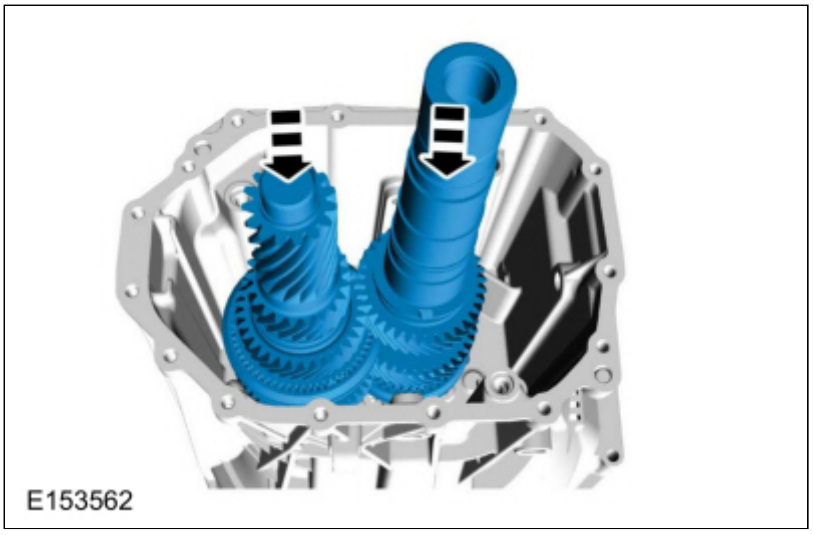


7. **NOTICE: Do not heat the countershaft bearing higher than 120°C (248°F) maximum or damage to the countershaft bearing can occur.**

   Use the General Equipment: Hot Air Gun

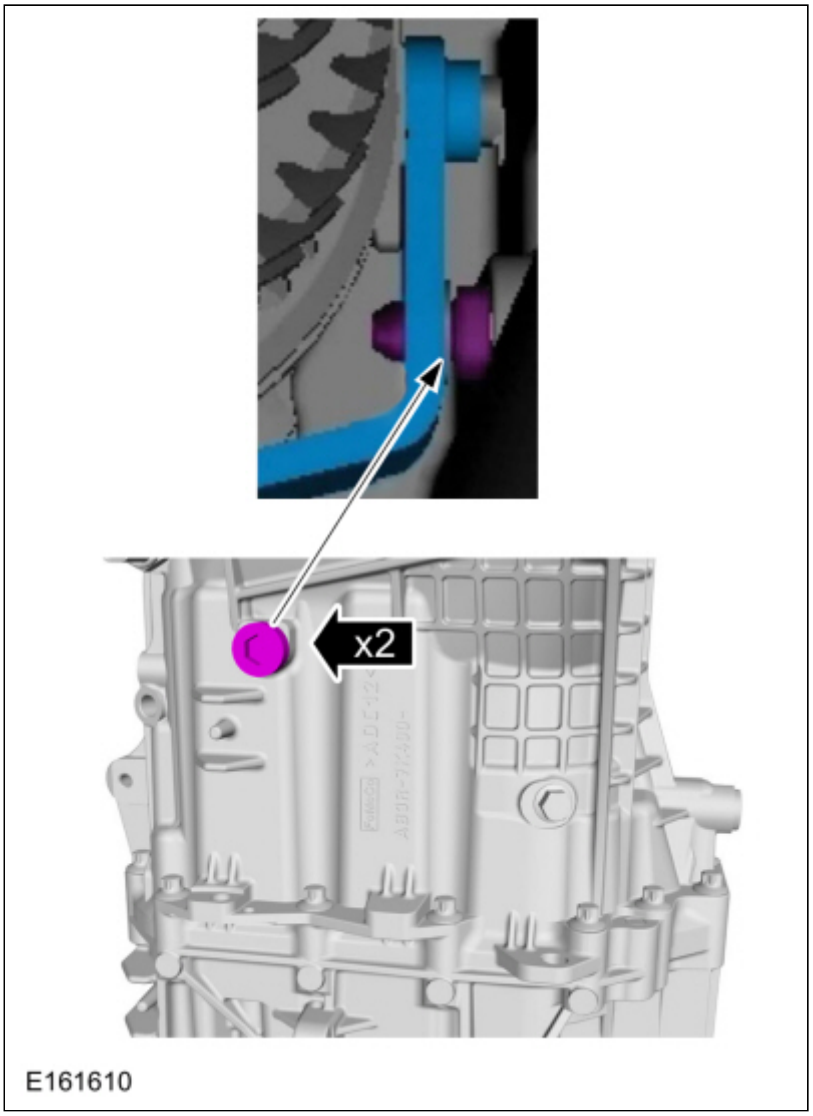


8. **NOTE:** *With the oil feed holes aligned, install the output shaft and countershaft assemblies.*



9. **NOTICE: Make sure the shift fork pivot bolts engauge into the shift fork or damage to the shift fork can occur.**

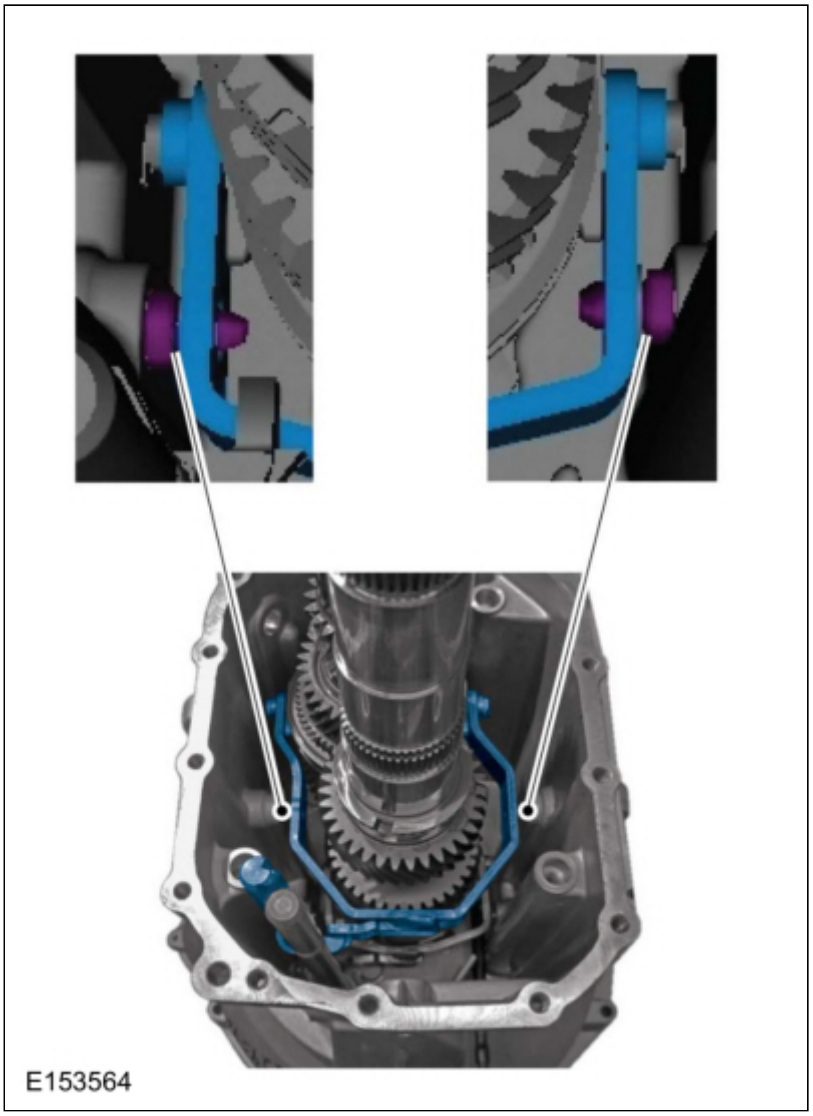
   Material: Thread Locking Sealant



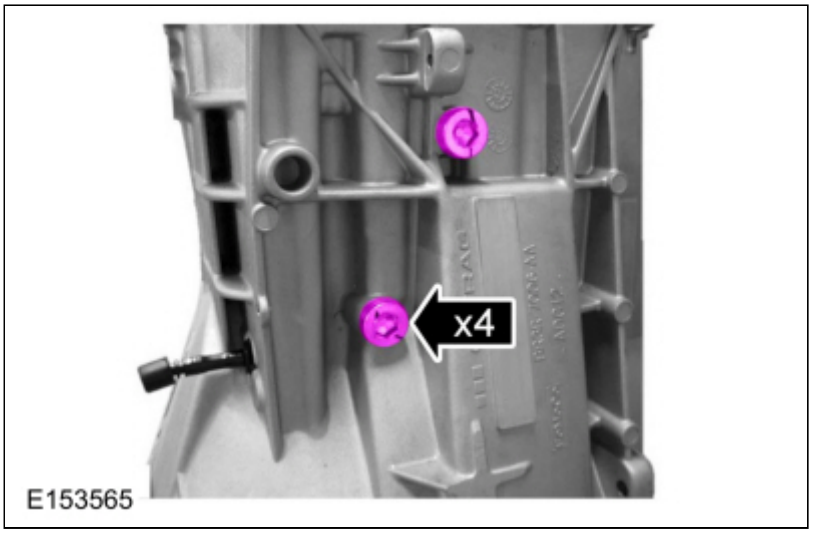
10. **NOTICE: Make sure the shift fork pivot bolts engauge into the shift fork or damage to the shift fork can occur.**

    NOTE: *Apply Threadlock and Sealer to the shift fork pivot bolts.*

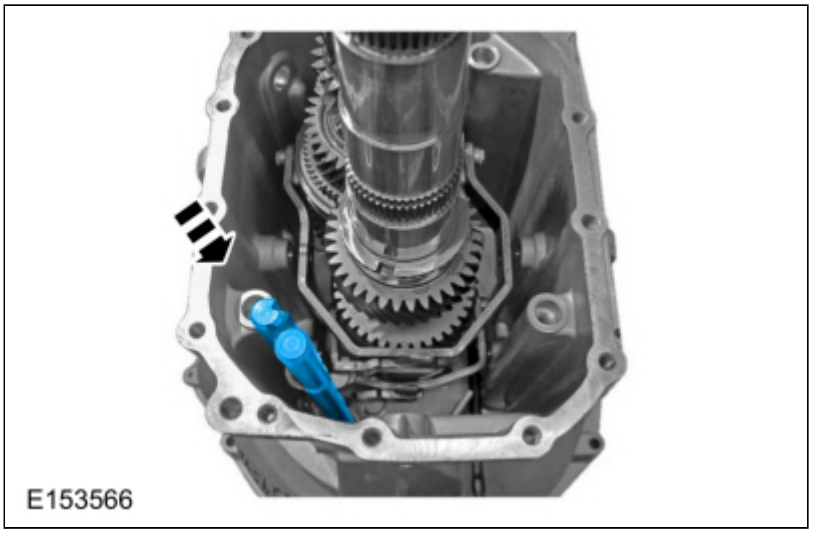
    Material: Thread Locking Adhesive (WSK-M2G349-A7)



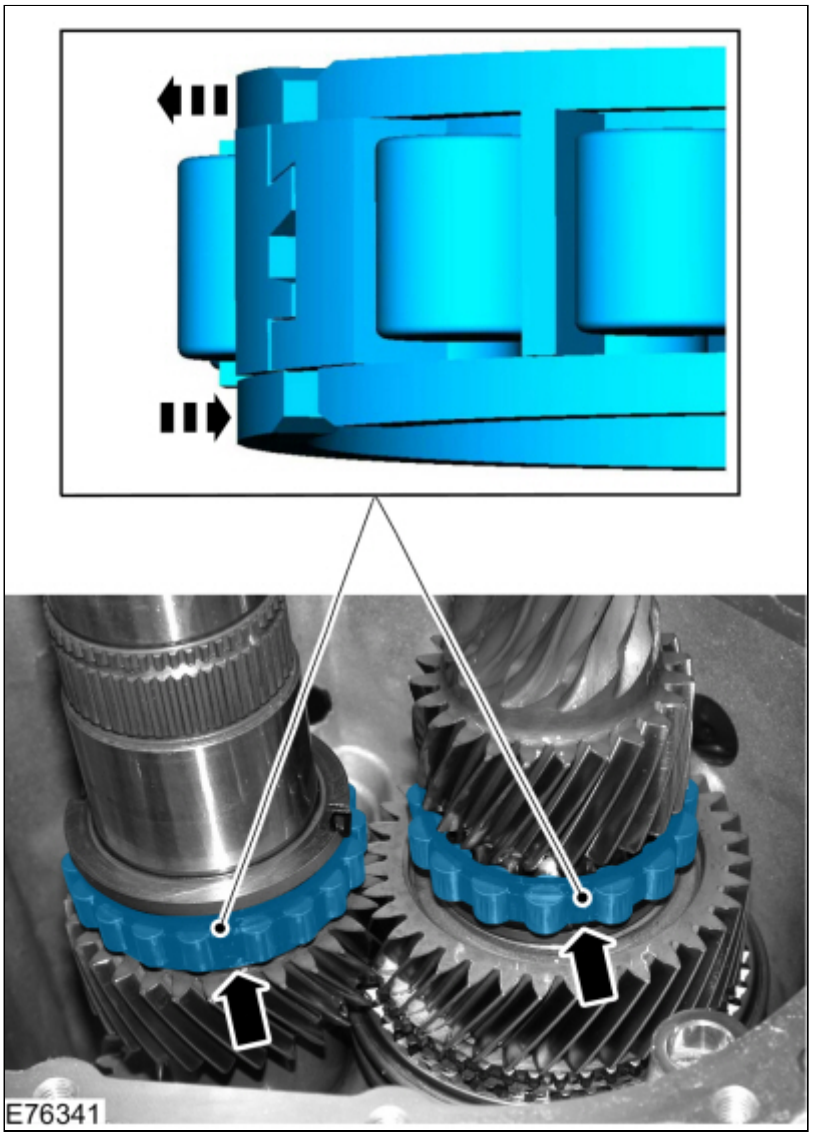
11. *Torque*: 37 Nm



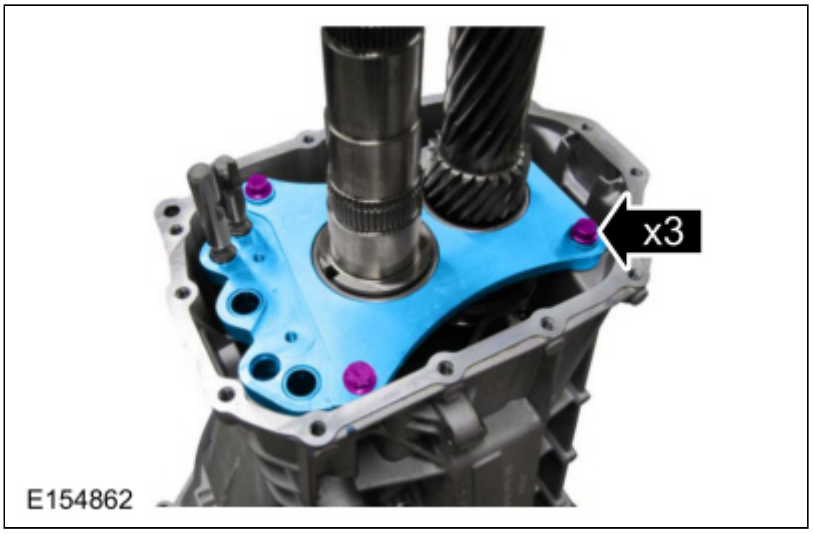
12. Push down the 3rd/4th shift rail and the 5th/6th shift rail to lock the transmission into 2 gears.



13. **NOTICE: When installing the bearings, do not over expand the bearing cages or damage to the bearing cages can occur.**

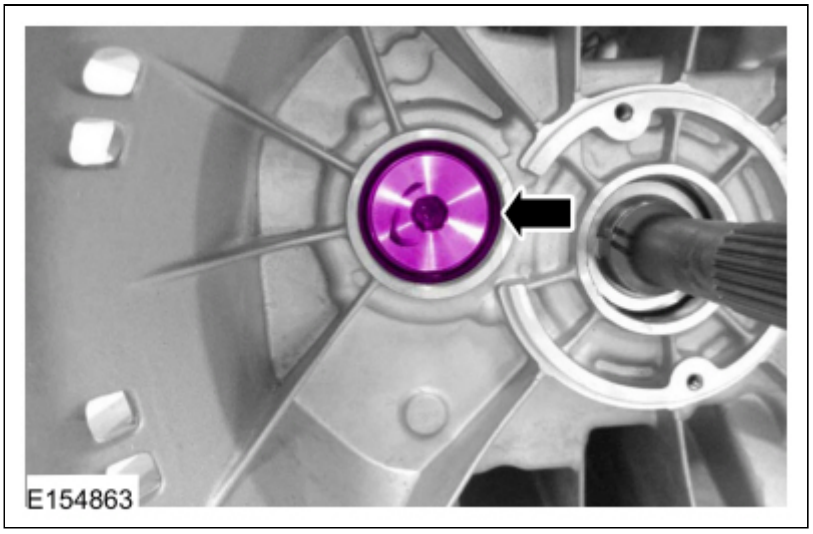


14. **NOTE:** *Only tighten the bolts finger tight at this stage.*



15. **NOTE:** *Install the counter shaft bolt with the transmission in the vertical position with the input shaft facing down.*

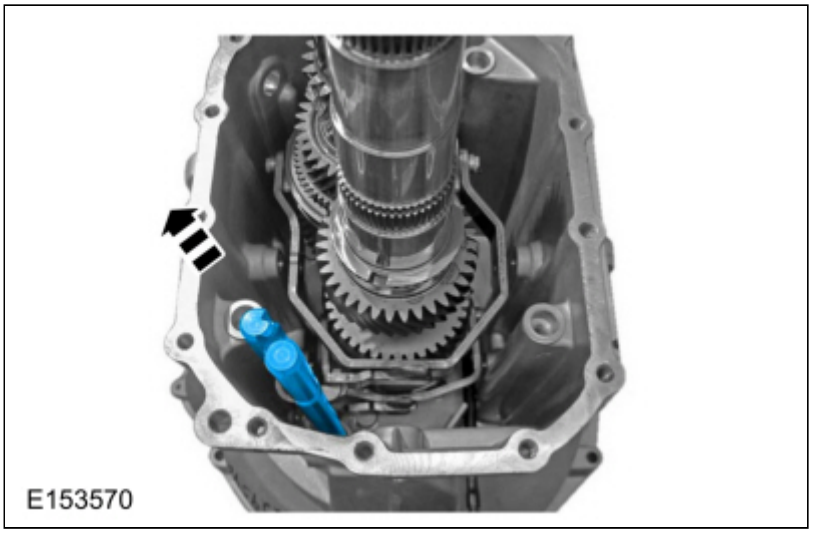
    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 95 Nm



16. **NOTE:** *Remove the center support and 3 center support bolts.*



17. **NOTE:** *Pull up on the 3rd/4th shift rail and the 5th/6th shift rail to unlock the transmission from 2 gears.*

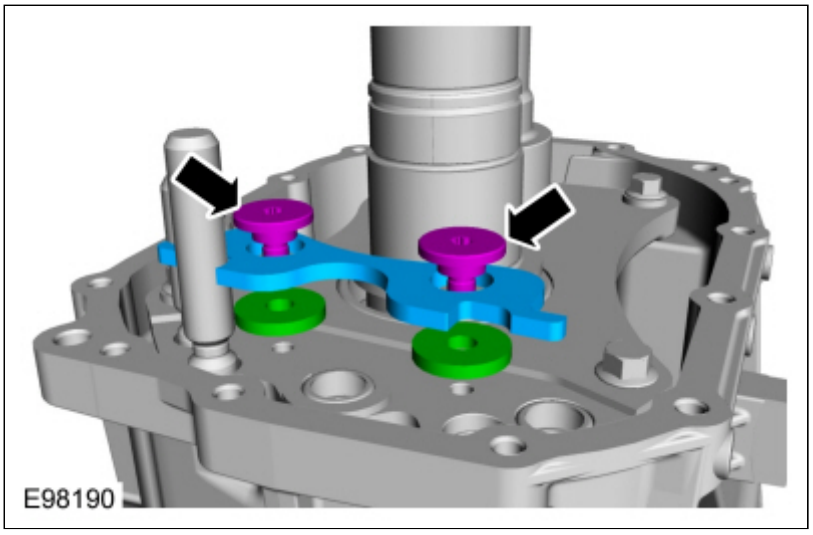


18. **NOTICE: The center support must be tightened evenly or damage to the center support or transmission case can occur.**

    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 35 Nm

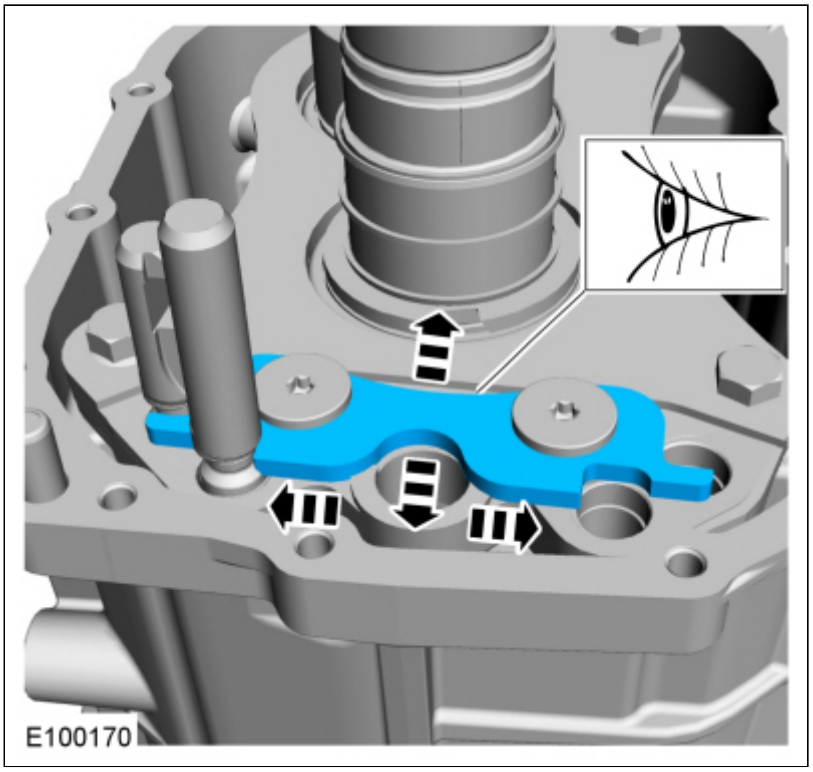


19. *Torque*: 24 Nm

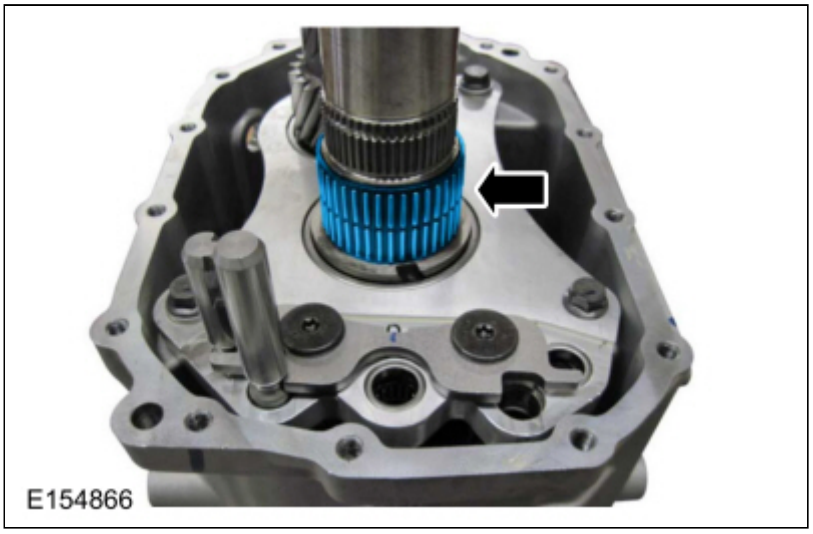


20. **NOTE:** *Make sure the interlock plate moves freely.*

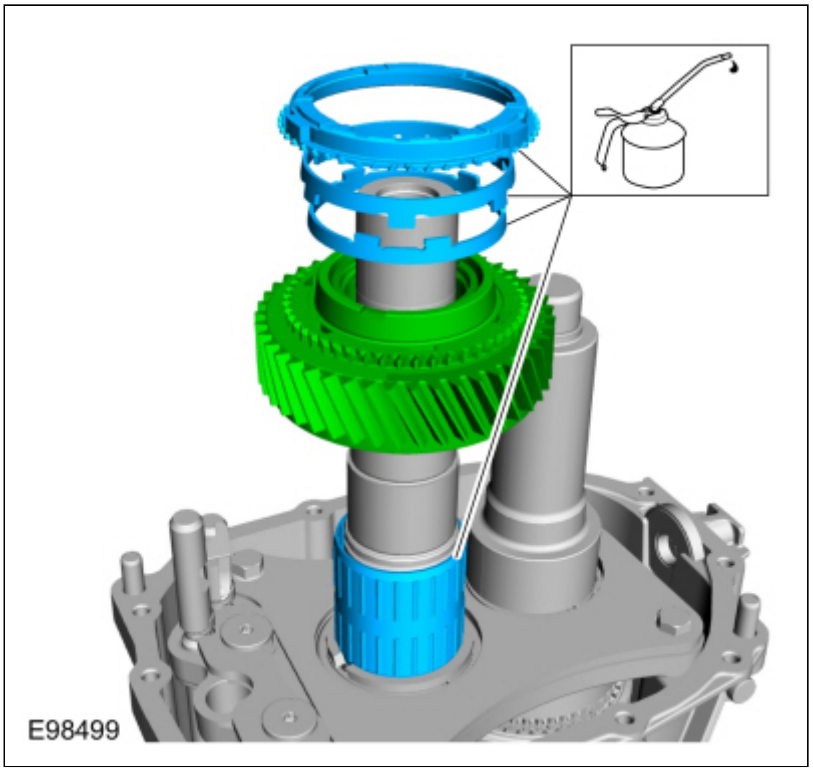
    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 24 Nm



21.



22.



23. **NOTICE: The 6 synchronizer ring tabs must engauge into the 6 gear slots or damage to the synchronizer ring assembly can occur.**

    NOTE: *The 2nd gear synchronizer ring assembly outer ring has one identification notch.*

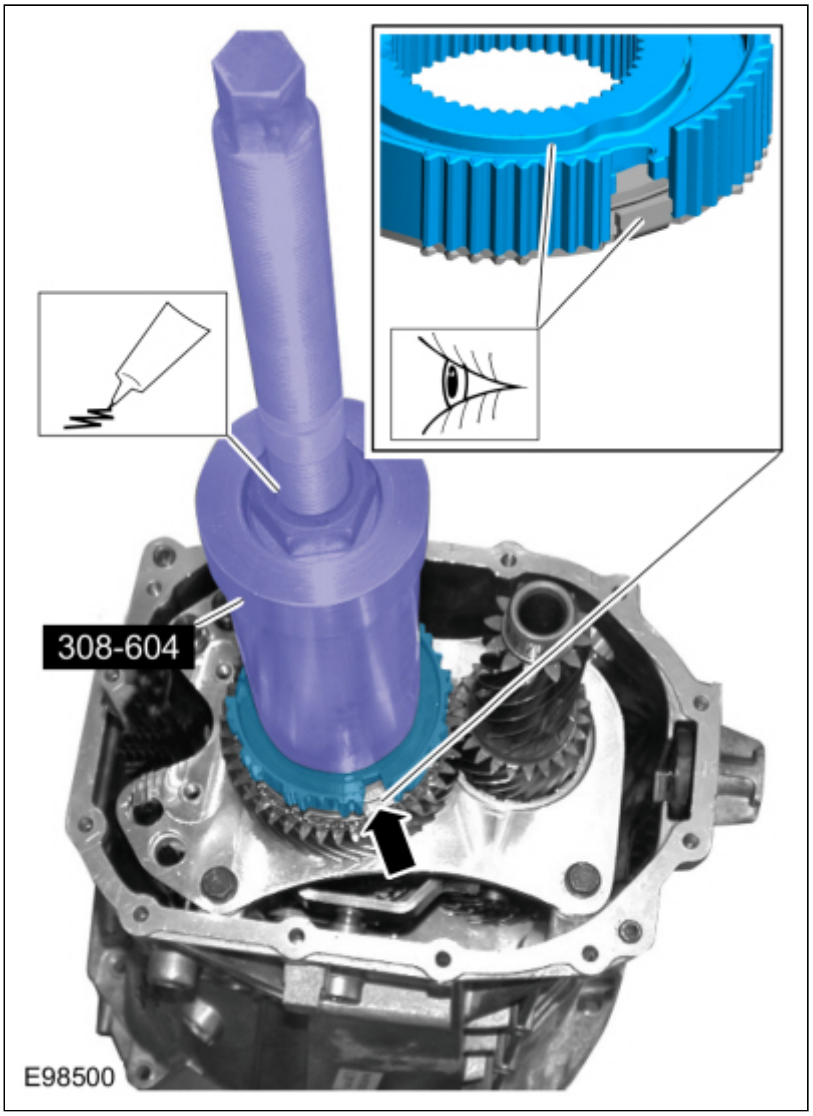
    Torque: 37 Nm



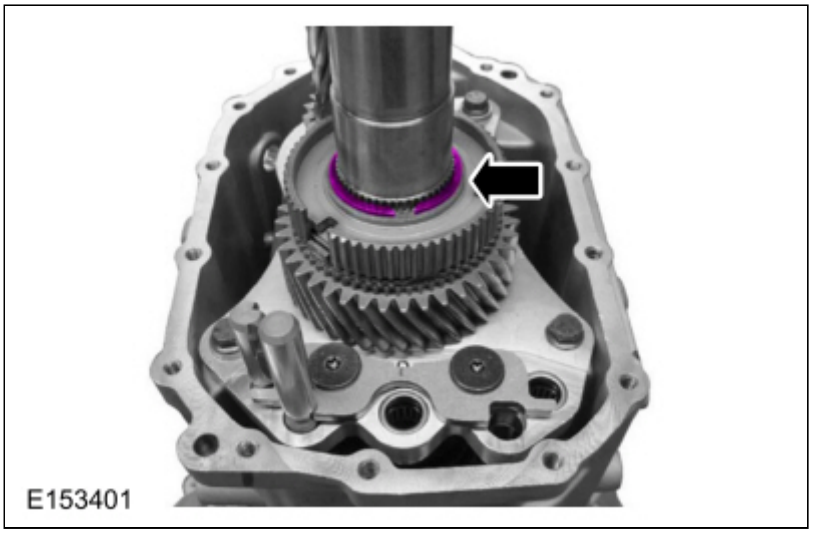
24. **NOTICE: The 3 synchronizer ring tabs must engauge into the 3 synchronizer hub slots or damage to the synchronizer hub and the synchronizer ring assembly can occur.**

    NOTICE: The long shoulder of the 1st/2nd synchronizer hub must be facing 2nd gear or damage to the synchronizer hub can occur.

    Use Special Service Tool: 308-604 Installer, Output Drive Flange Seal.

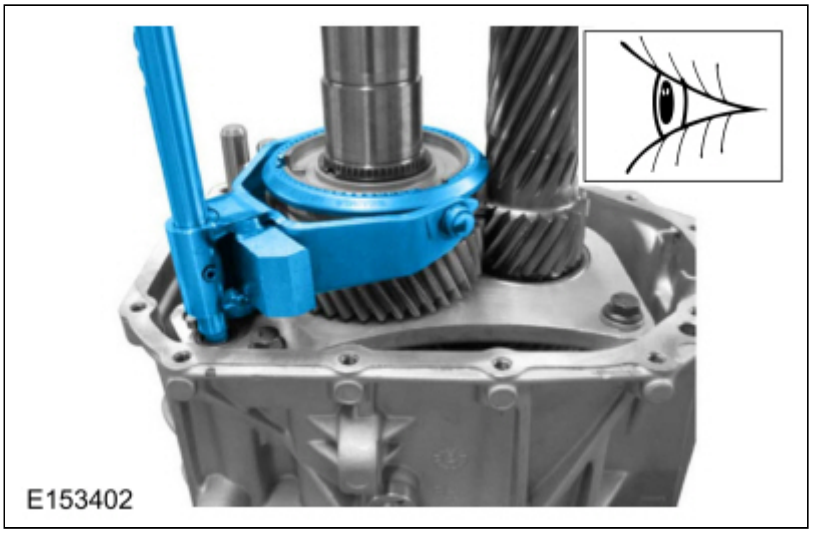


25.

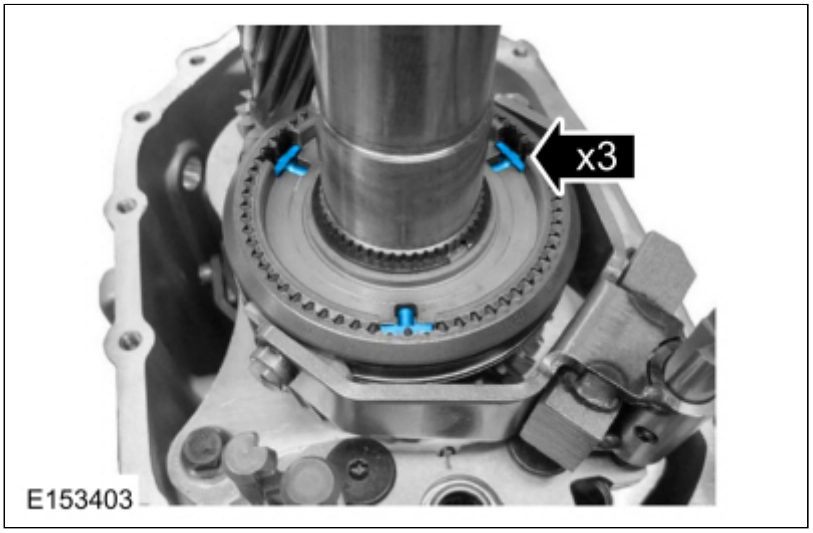


26. **NOTE:** *Align the index marks made during removal on the synchronizer sleeve and the synchronizer hub.*

NOTE: *With the groove on the 1st/2nd synchronizer sleeve facing 2nd gear, install the 1st/2nd shift fork, the 1st/2nd shift rail and the 1st/2nd synchronizer sleeve.*

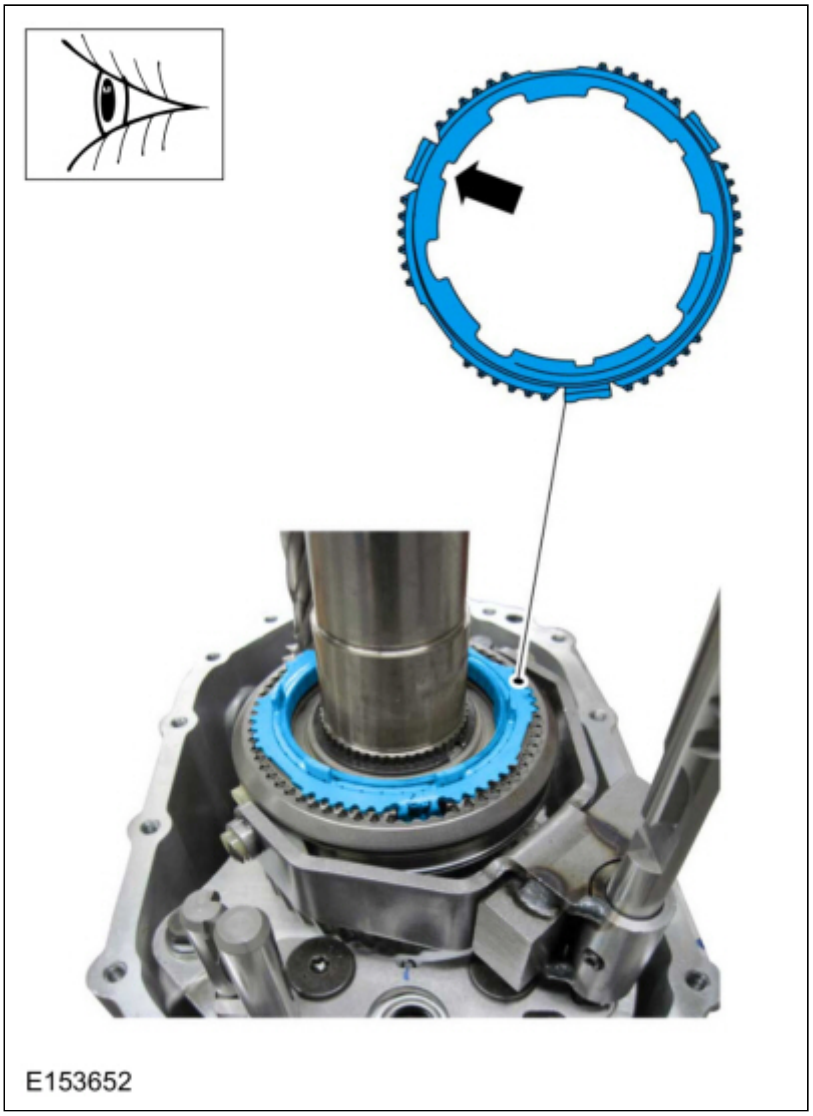


27. **NOTE:** *Slide the synchronizer sleeve up and install the 3 pressure pieces.*

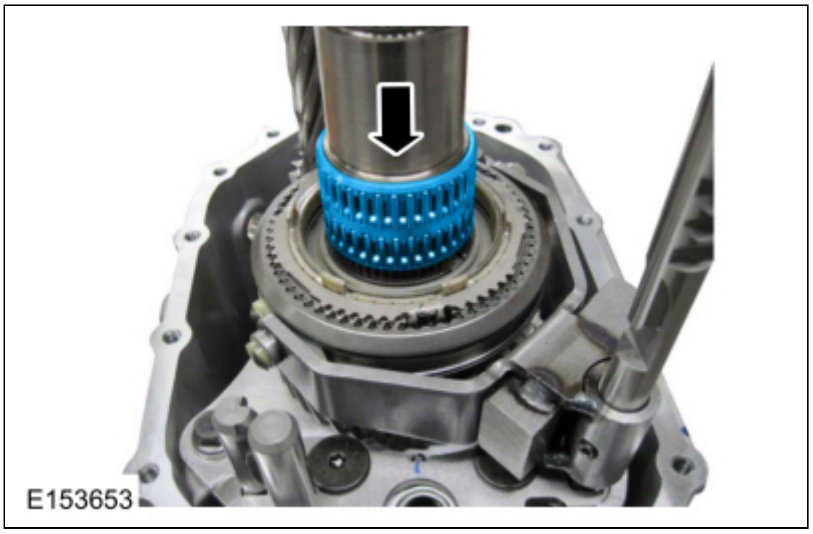


28. **NOTICE: The 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage to the synchronizer assembly and the synchronizer ring assembly can occur.**

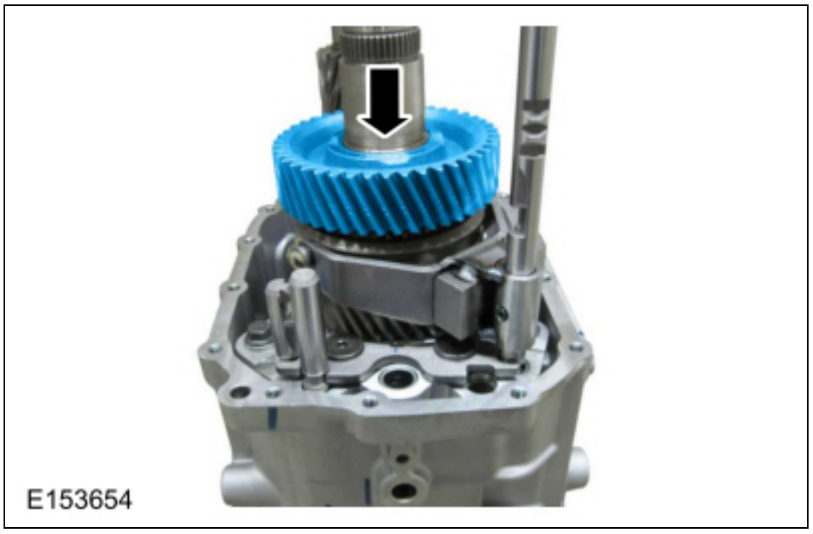
    NOTE: *The 1st gear synchronizer ring assembly outer ring has one identification notch.*



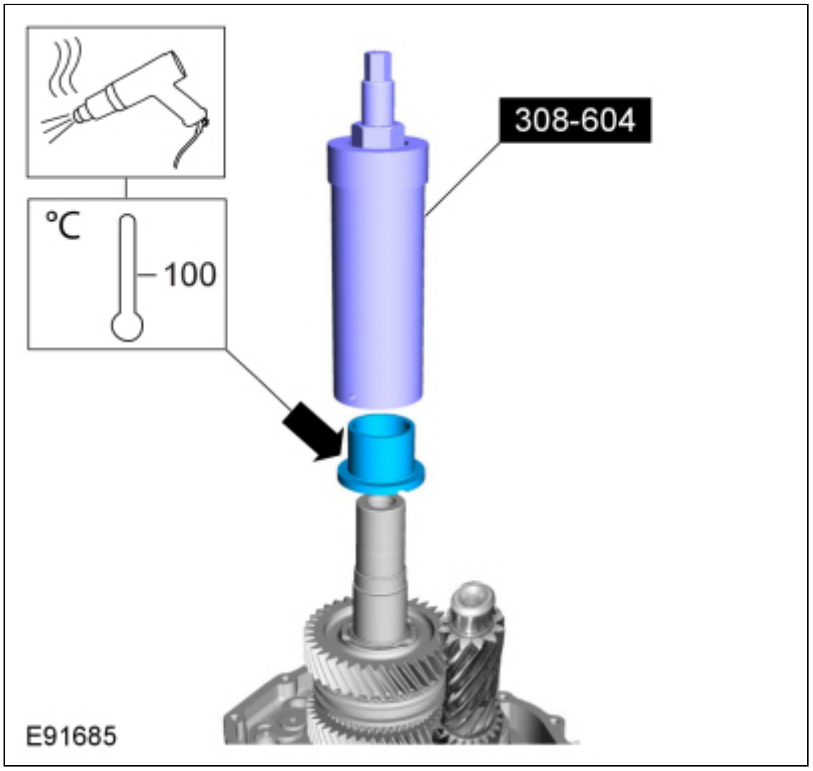
29.



30. **NOTICE: The 6 synchronizer ring tabs must engauge into the 6 gear slots or damage to the synchronizer assembly and synchronizer ring assembly can occur.**



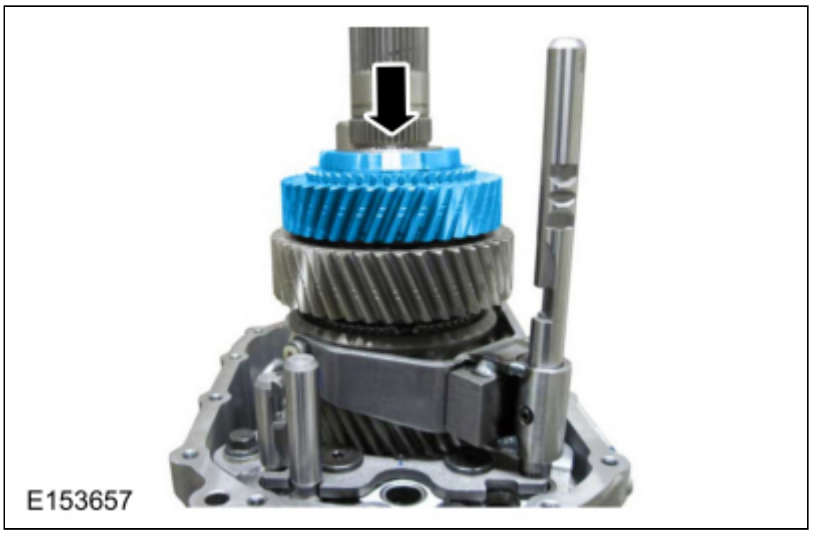
31. Use Special Service Tool: 308-604 Installer, Output Drive Flange Seal.



32.

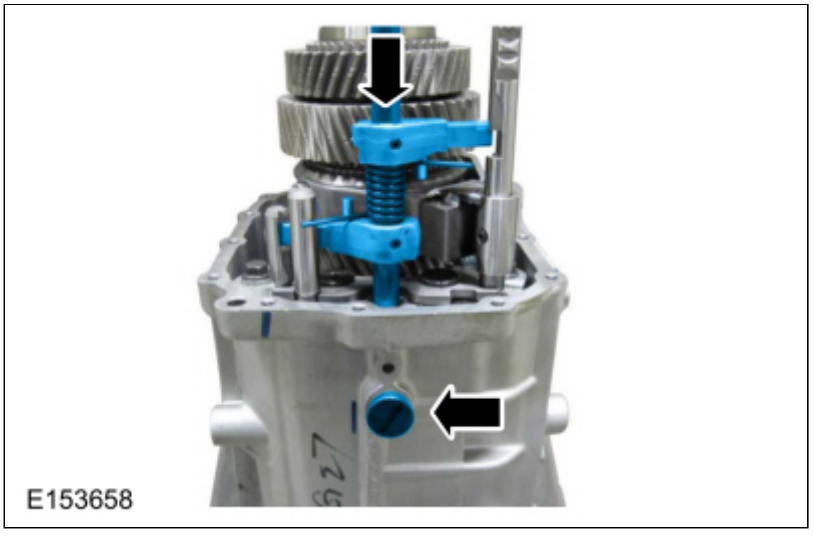


33.

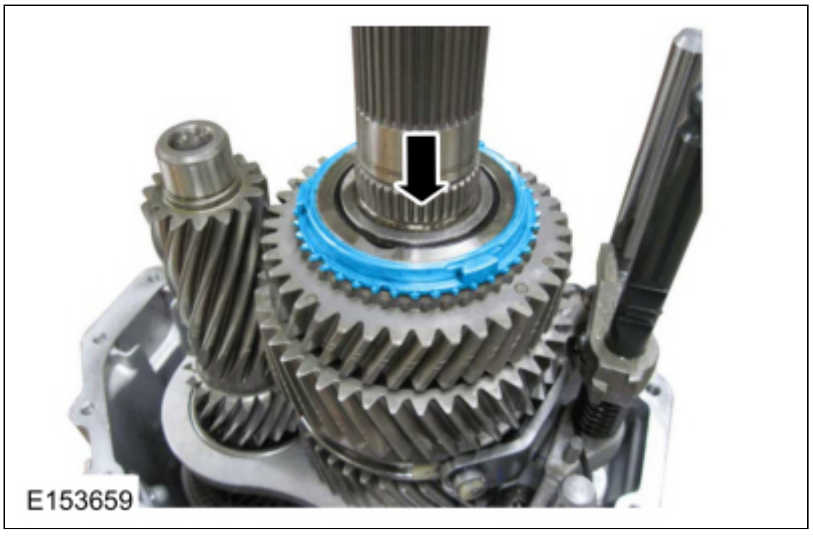


34. **NOTICE: The shift shaft must be installed in the neutral position prior to installing the shift shaft stop pin or damage to the shift shaft stop pin can occur.**

    Use the General Equipment: Copper Hammer

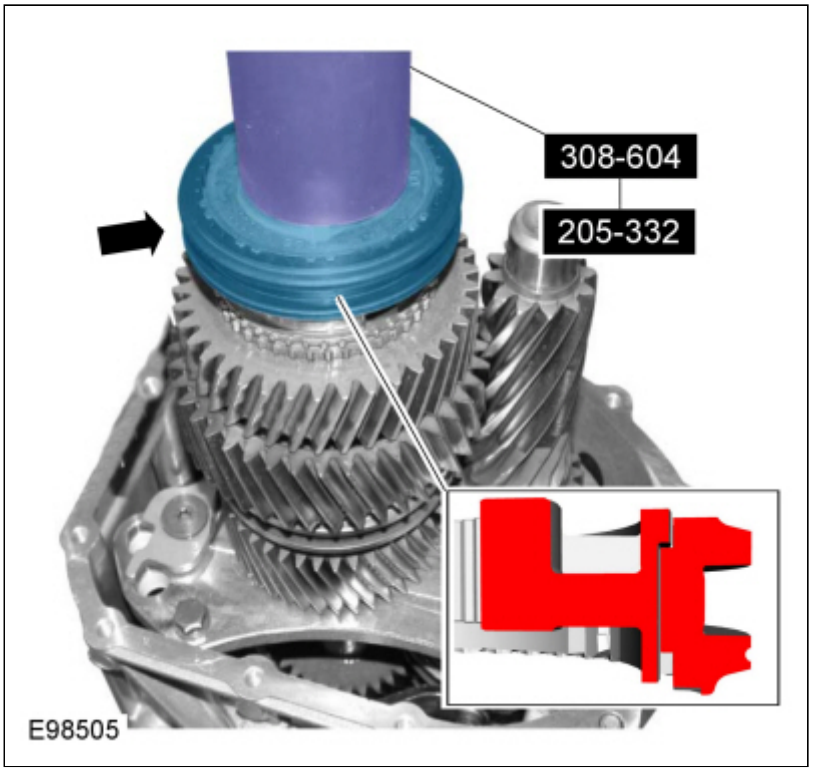


35.

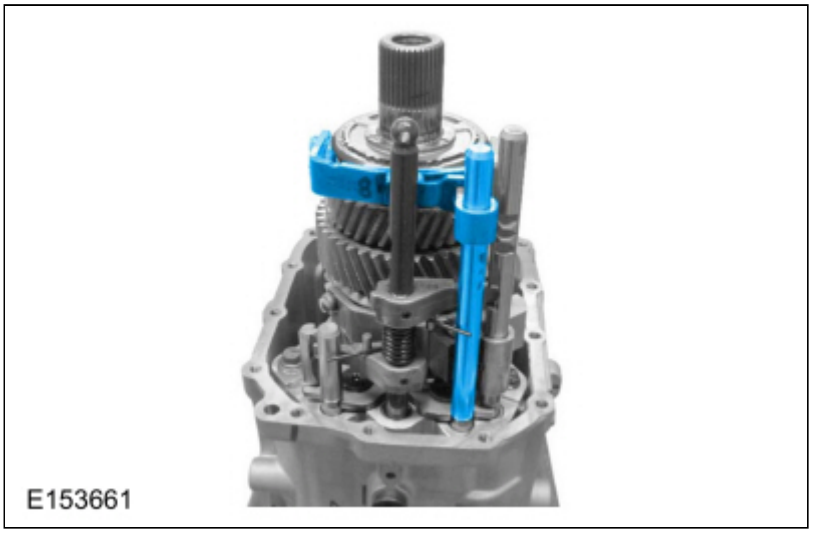


36. **NOTICE: The 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage to the synchronizer assembly and the synchronizer ring can occur.**

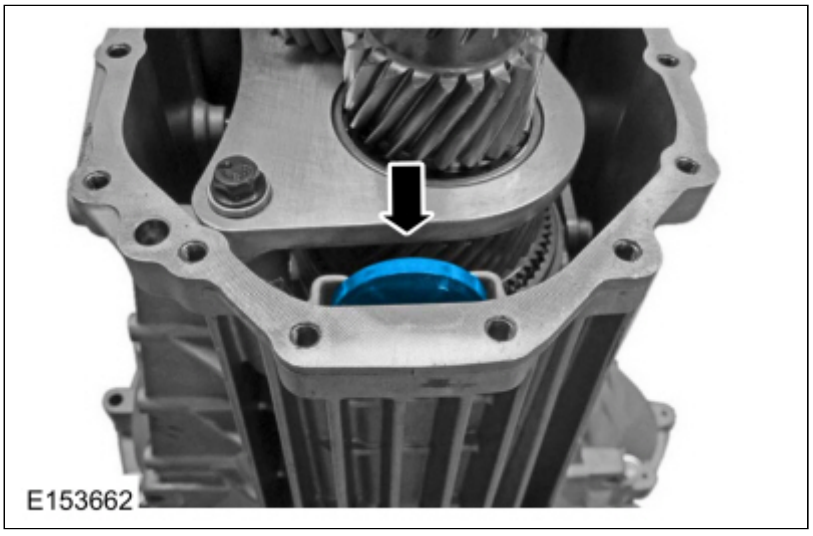
    Use Special Service Tool: 205-332 Protector, Axle Shaft. , 308-604 Installer, Output Drive Flange Seal.



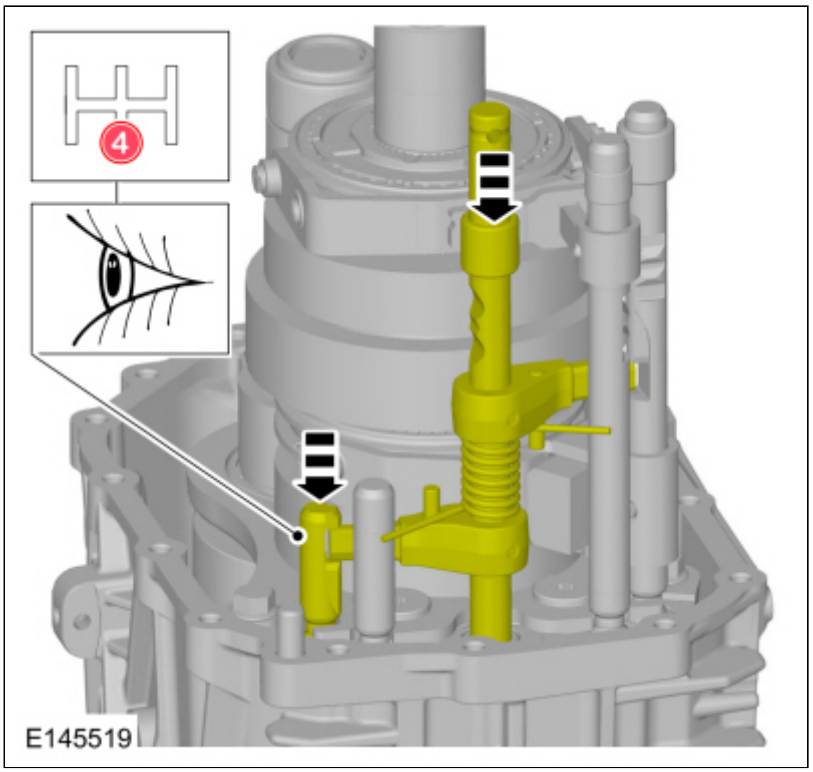
37. **NOTE:** *To install the reverse shift fork and the reverse shift rail assembly, the transmission must be in neutral and the groves on the shift rails must be aligned with the interlock plate.*



38.



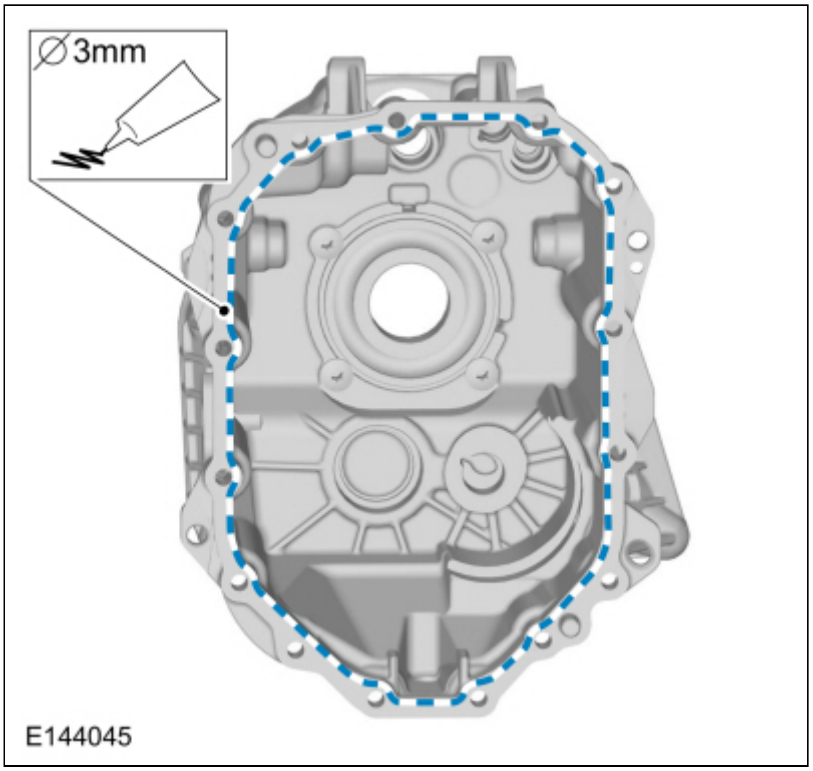
39. Engage fourth gear.



40. **NOTICE: Make sure the surface is cleaned with acetone and is free of foreign material.**

    NOTICE: Make sure that the sealant is applied continuously. Start and end should be on top of case.

    Material: Sealant (WSK-M2G348-A7)



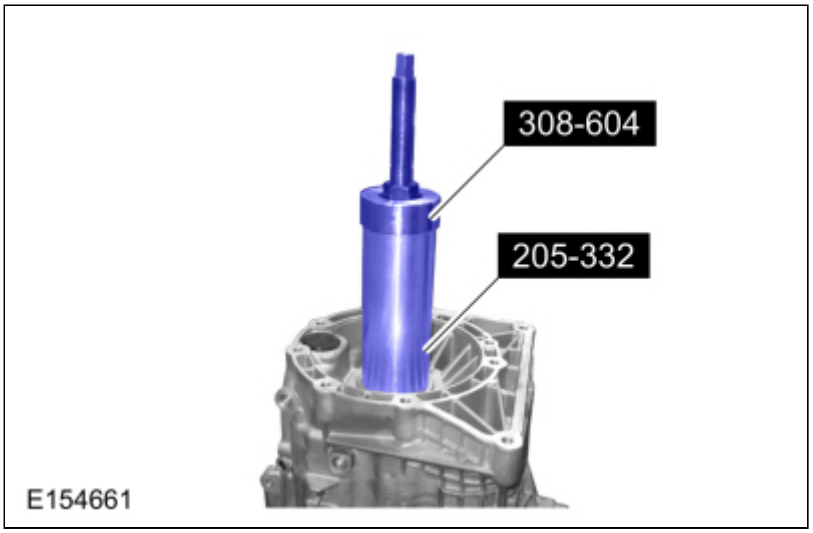
41. **NOTE:** *Do not wait longer than 10 minutes to install the rear transmission case assembly due to the rapid cure time of the sealant.*

    NOTE: *Clean the sealing surfaces of the front transmission case and the sealing surfaces of the rear transmission case. Thinly coat the sealing surface of the front transmission case assembly and the sealing surface of the rear transmission case assembly with Gasket Maker.*

42. **NOTICE: The rear transmission case assembly must be installed evenly with the transmission shifted**

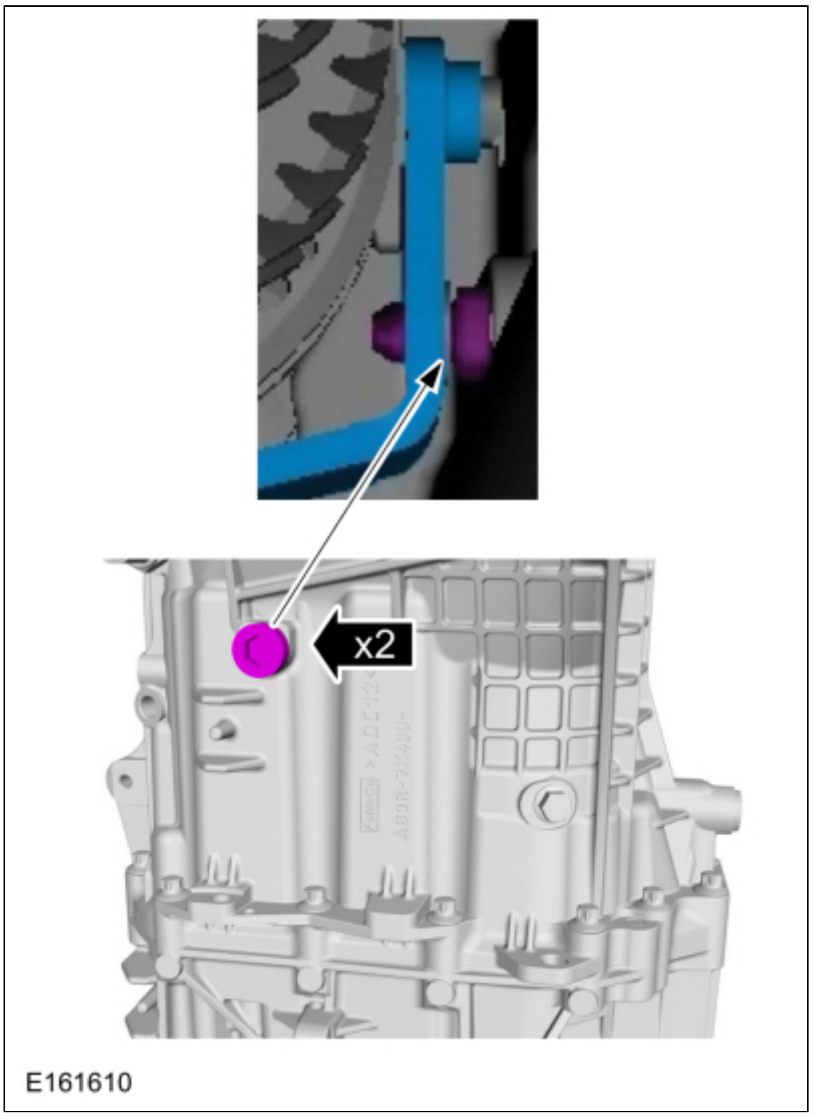
into 4th gear, do not allow the shift rails to bind during installation or damage to the transmission case assembly can occur.

Use Special Service Tool: 308-604 Installer, Output Drive Flange Seal. , 205-332 Protector, Axle Shaft.



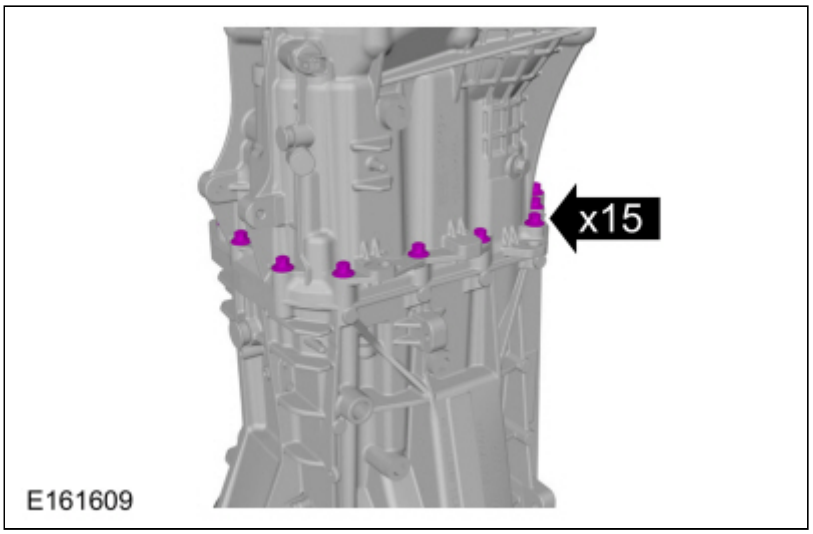
43. **NOTICE: Make sure the shift fork pivot bolts engage into the shift fork or damage to the shift fork can occur.**

    Material: Thread Locking Sealant
    Torque: 37 Nm

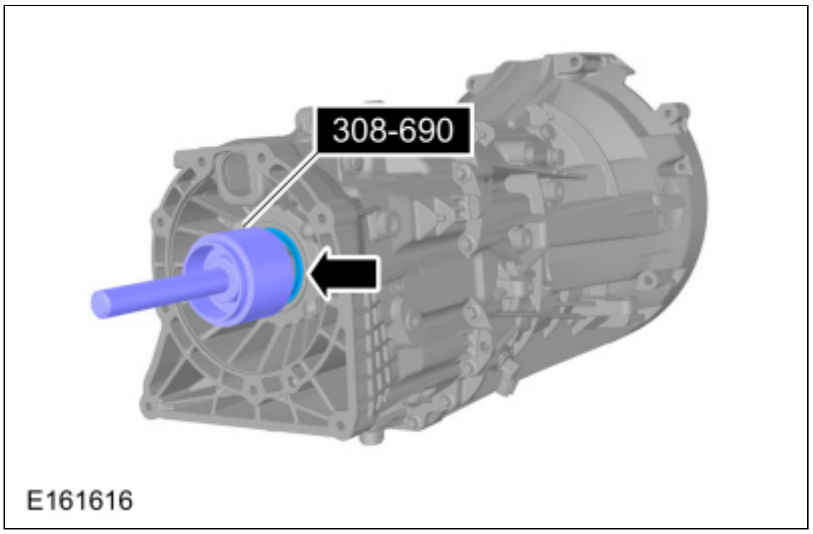


44. Loosely install the 15 transmission case bolts. Using a suitable brass drift, tap the 2 dowel pins flush with the transmission case.

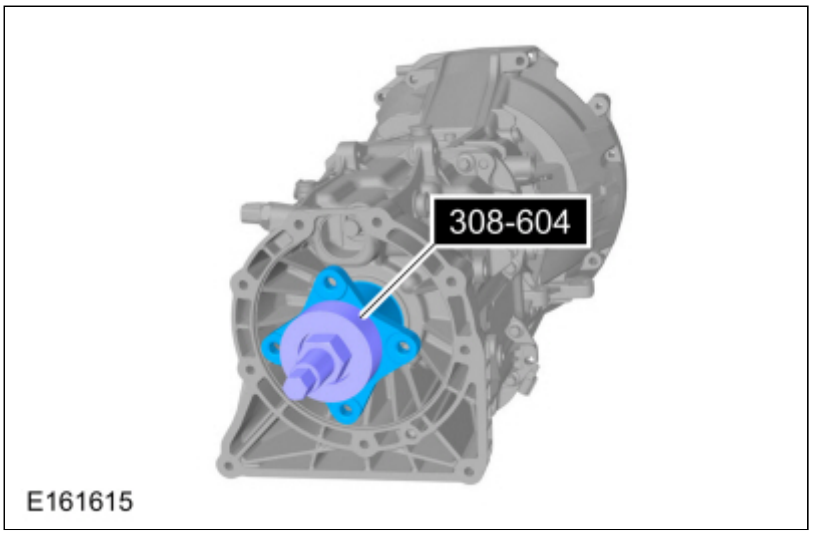
Torque: 24 Nm



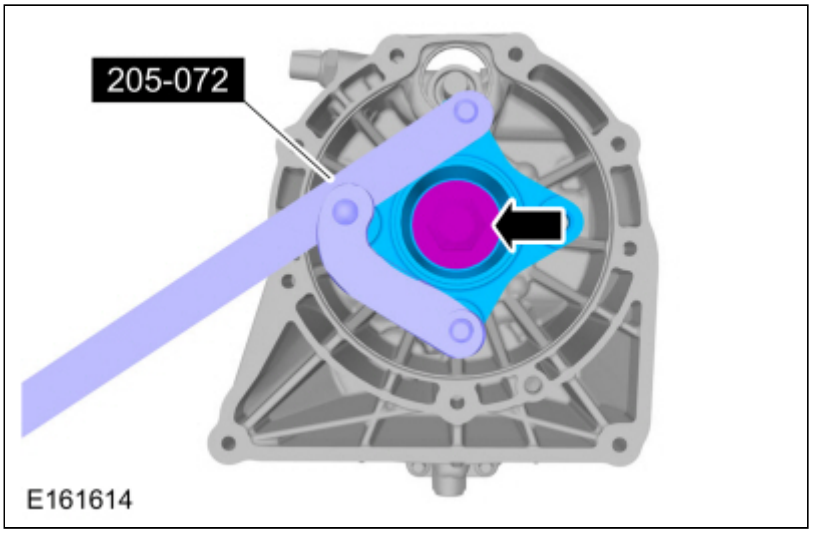
45. Use Special Service Tool: 308-690 Installer, Output Drive Flange Seal.



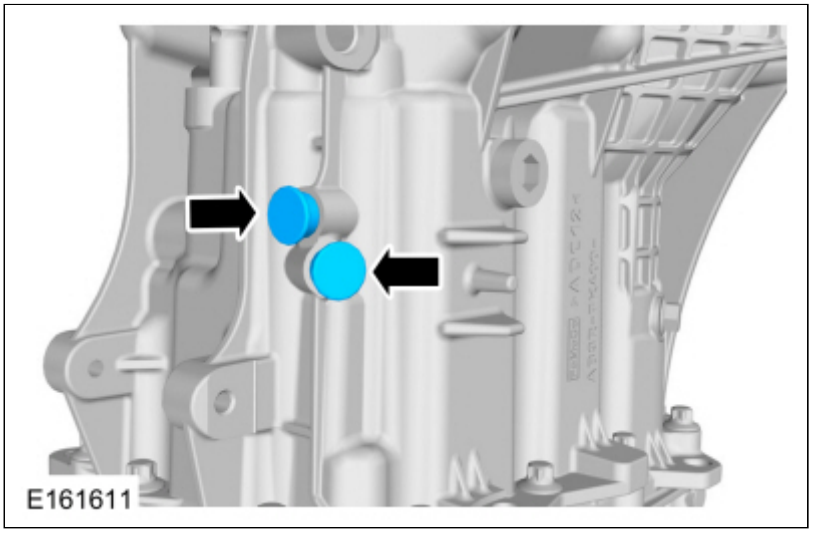
46. Use Special Service Tool: 308-604 Installer, Output Drive Flange Seal.



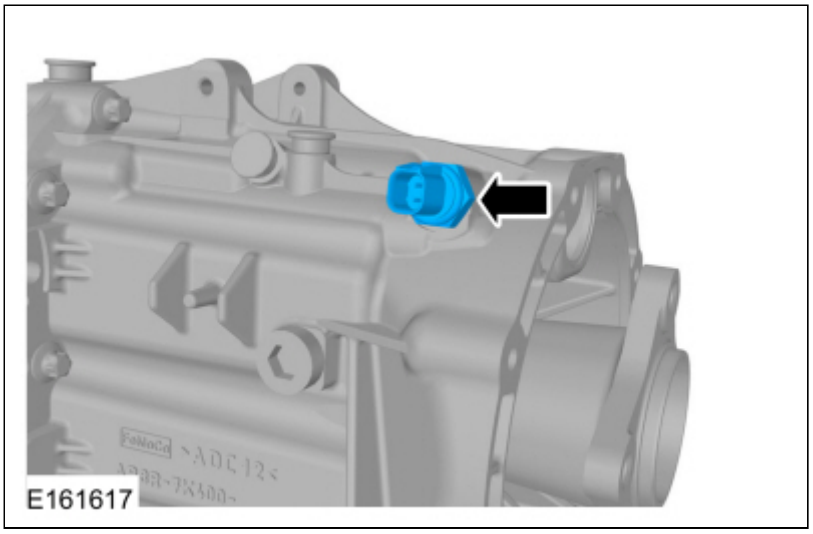
47. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Material: Thread Locking Adhesive (WSK-M2G349-A7)
Torque:
Stage 1: 200 Nm
Stage 2: Loosen: °
Stage 3: 180 Nm



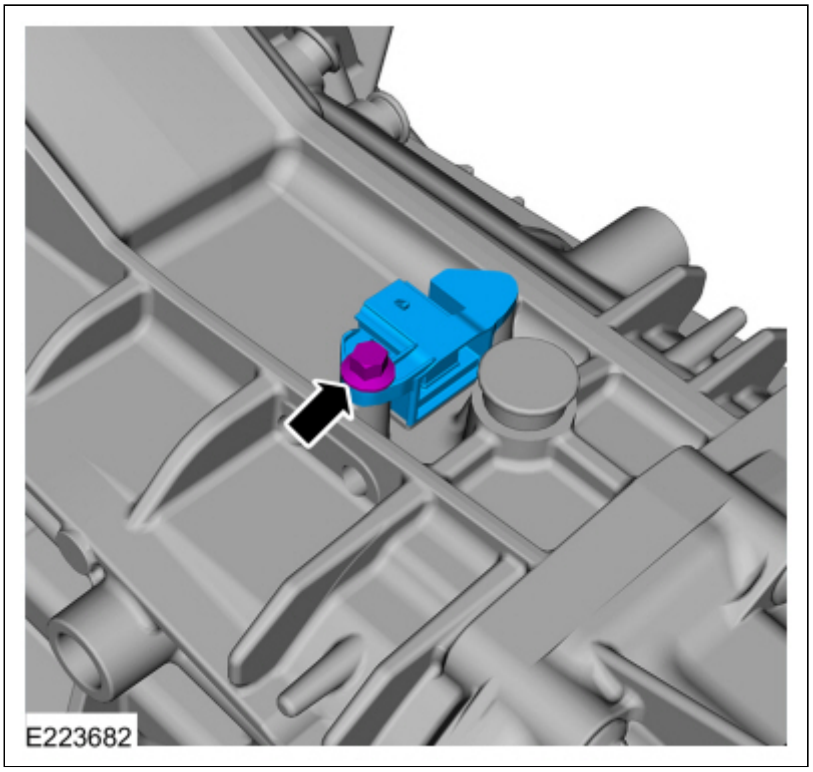
48.



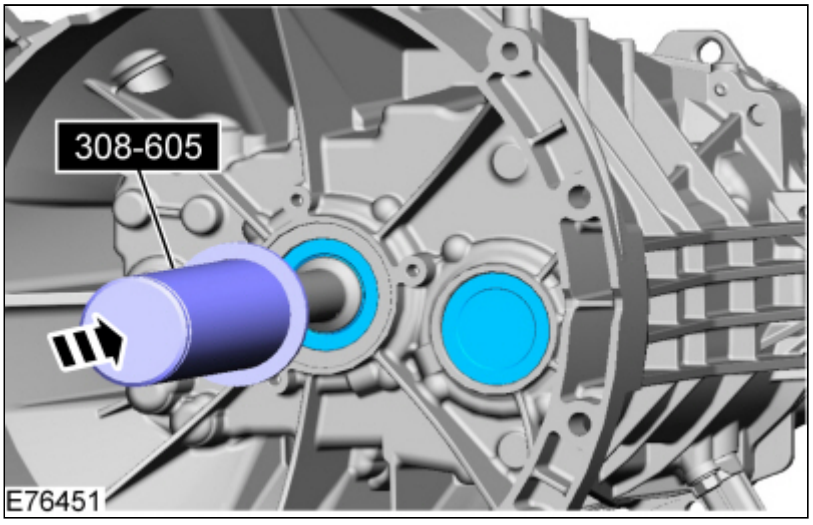
49. *Torque*: 20 Nm



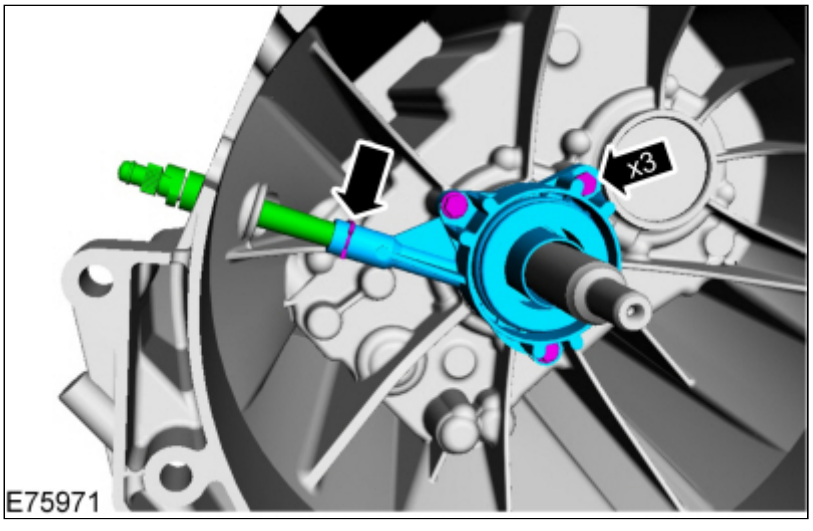
50. *Torque*: 10 Nm



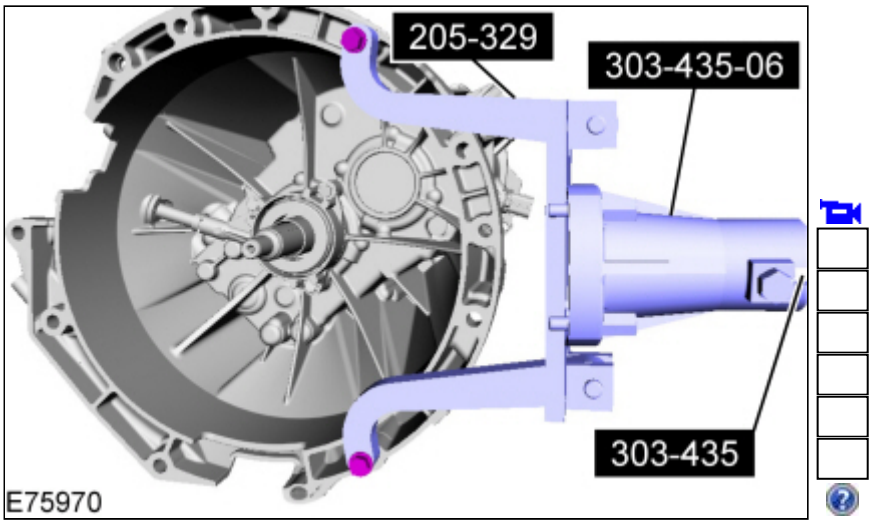
51. Use Special Service Tool: 308-605 Installer, Input Shaft Seal.



52. *Torque*: 11 Nm



53. Remove Special Service Tool: 205-329 Mounting Bracket, Engine/Differential. , 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435.

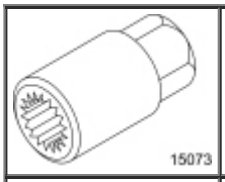
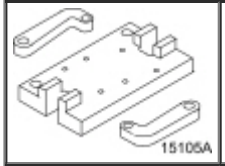
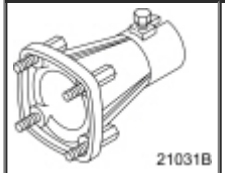
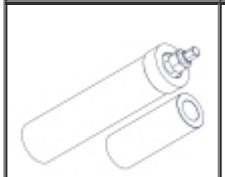
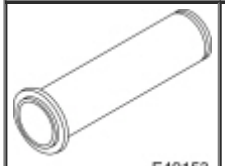


Copyright © 2016 Ford Motor Company

Transmission - 4WD

Base Part Number: 7000

Special Tool(s) / General Equipment

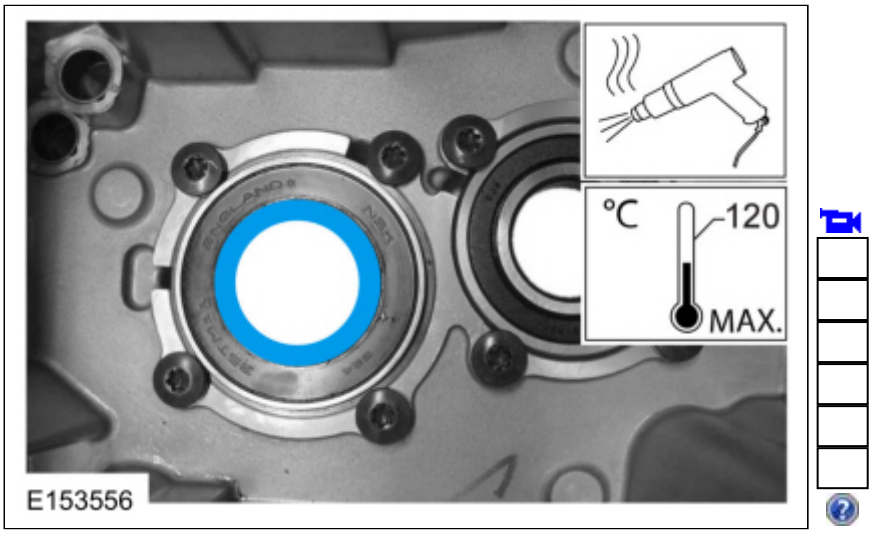
 15073	205-175 Socket, Drive Pinion Nut
 15105A	205-329 Mounting Bracket, Engine/Differential
 21187	303-435 Mounting Stand
 21031B	303-435-06 Mounting Bracket for 303-435
 E227704	307-728 Installer, Output Shaft Seal and Bearing
 E49153	308-605 Installer, Input Shaft Seal
 E163726	308-883 Wrench, Output Shaft Nut
 E163727	308-884 Installer, Output Shaft Seal
Cable Ties	
Hot Air Gun	
Copper Hammer	

Materials

Name	Specification
Thread Locking Sealant	-
Thread Locking Adhesive	WSK-M2G349-A7
Sealant	WSK-M2G348-A7

1. **NOTICE: Do not heat the input shaft bearing higher than 120°C (248°F) maximum or damage to the input shaft bearing can occur.**

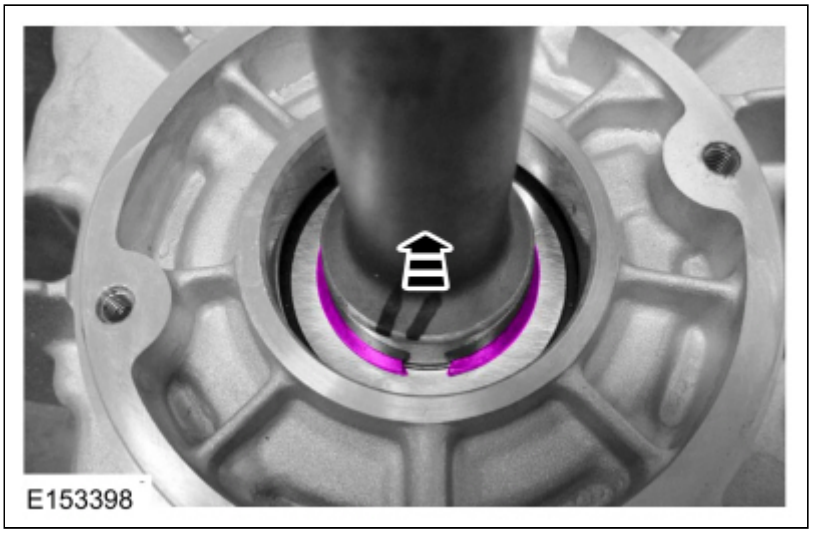
   Use the General Equipment: Hot Air Gun



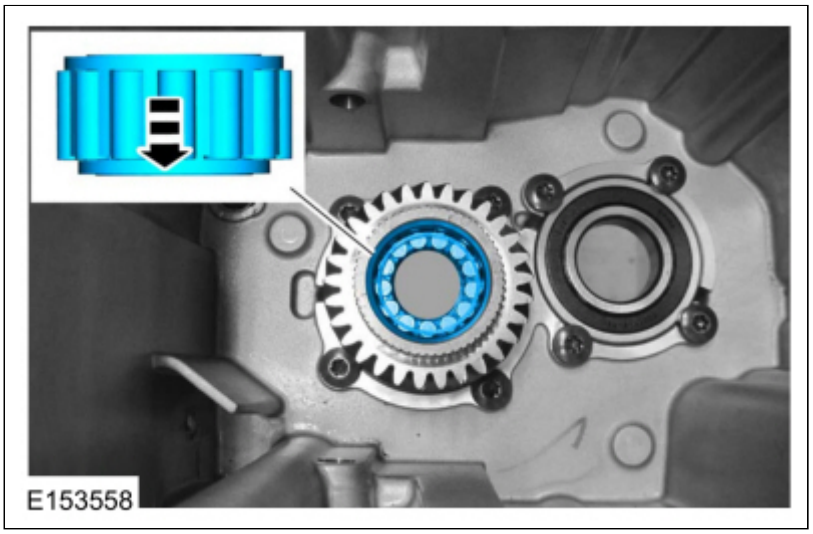
2. **NOTE:** *Install the oil feed hole facing the countershaft bearing.*



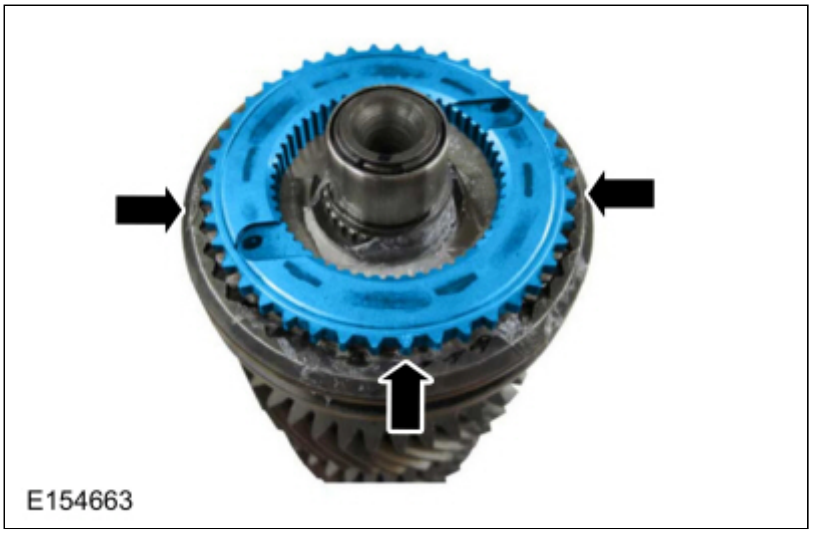
3.



4. **NOTE:** *Make sure the small diameter side of the output shaft bearing cage is facing the input shaft or damage to the output shaft bearing can occur.*



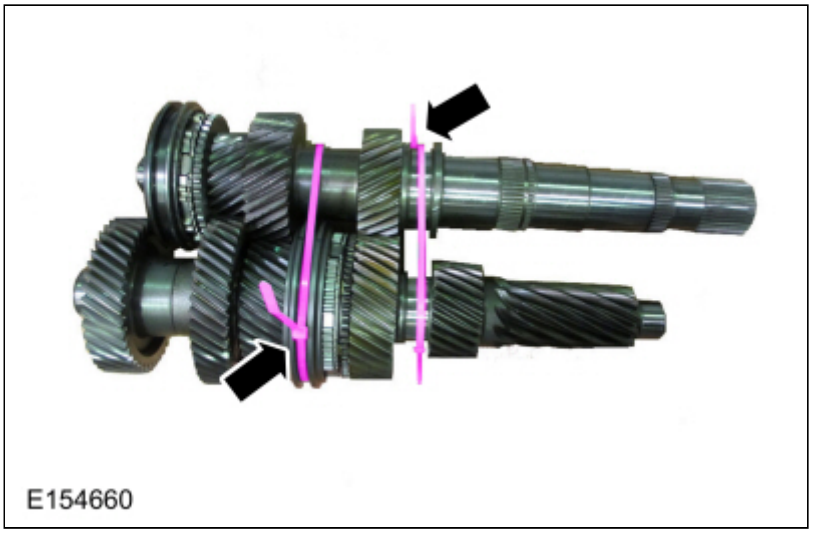
5. **NOTE:** *Apply petroleum jelly to hold 5th gear synchronizer ring and the 5th gear synchronizer cone in place during assembly.*



6. **NOTE:** *Assemble the shafts with the oil feed hole on the 5th gear cone facing the countershaft.*

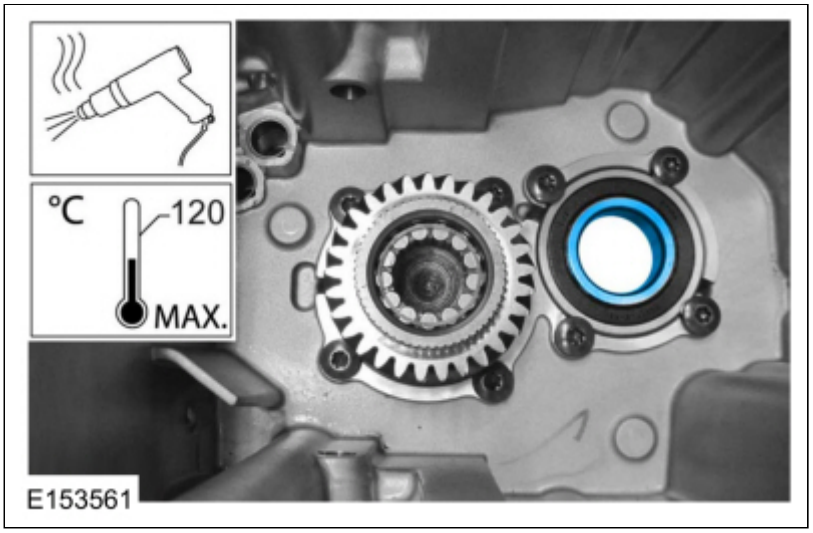
   NOTE: *Sercure the shaft pack with cable ties.*

   Install the General Equipment: Cable Ties

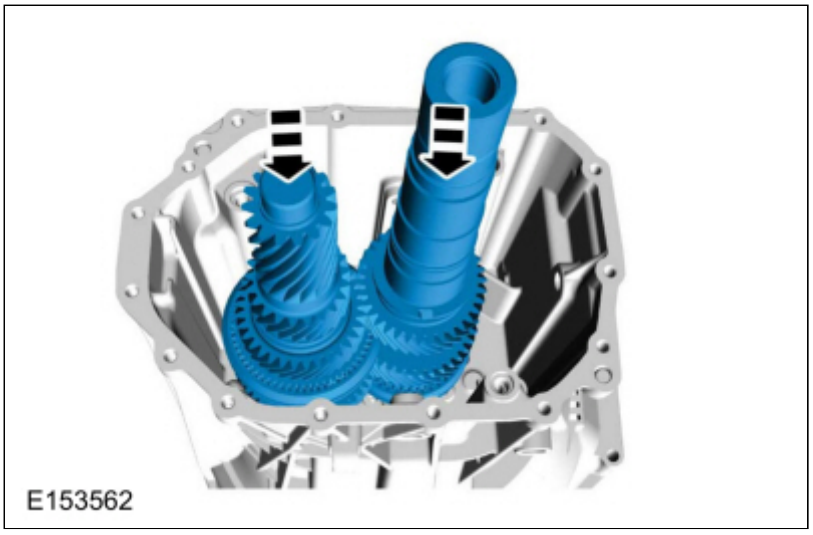


7. **NOTICE: Do not heat the countershaft bearing higher than 120°C (248°F) maximum or damage to the countershaft bearing can occur.**

   Use the General Equipment: Hot Air Gun

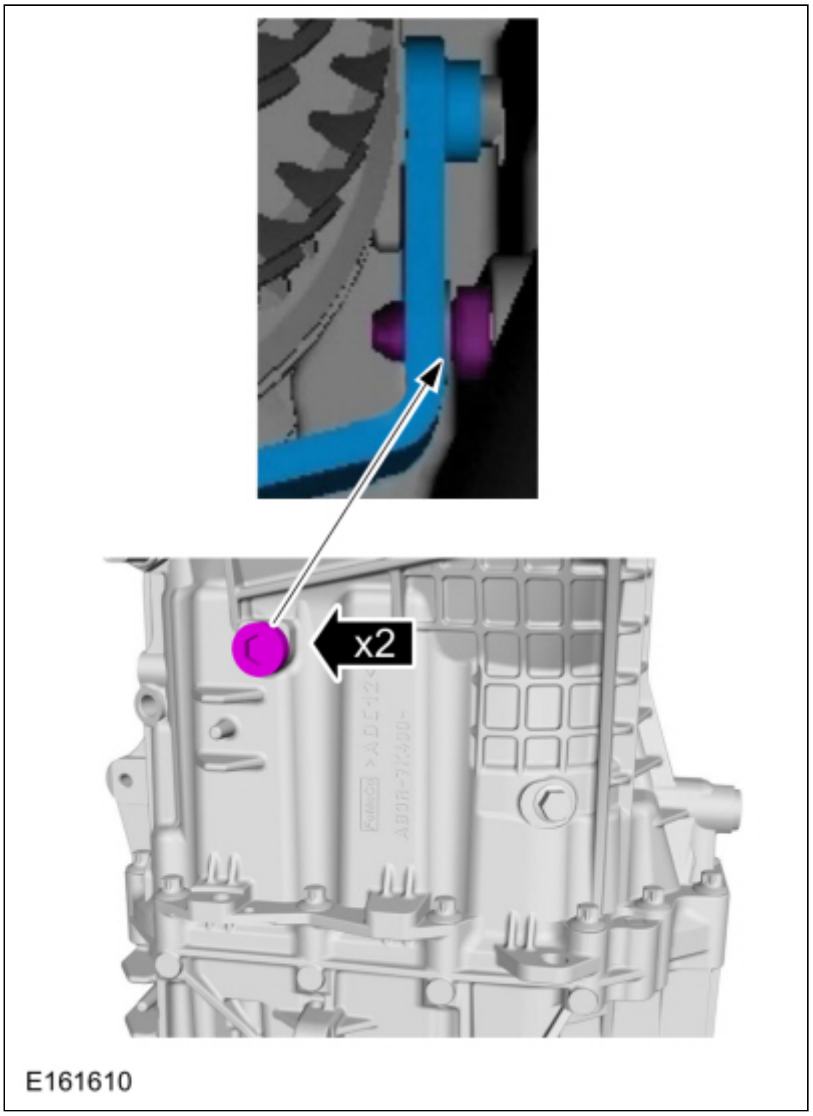


8. **NOTE:** *With the oil feed holes aligned, install the output shaft and countershaft assemblies.*



9. **NOTICE: Make sure the shift fork pivot bolts engauge into the shift fork or damage to the shift fork can occur.**

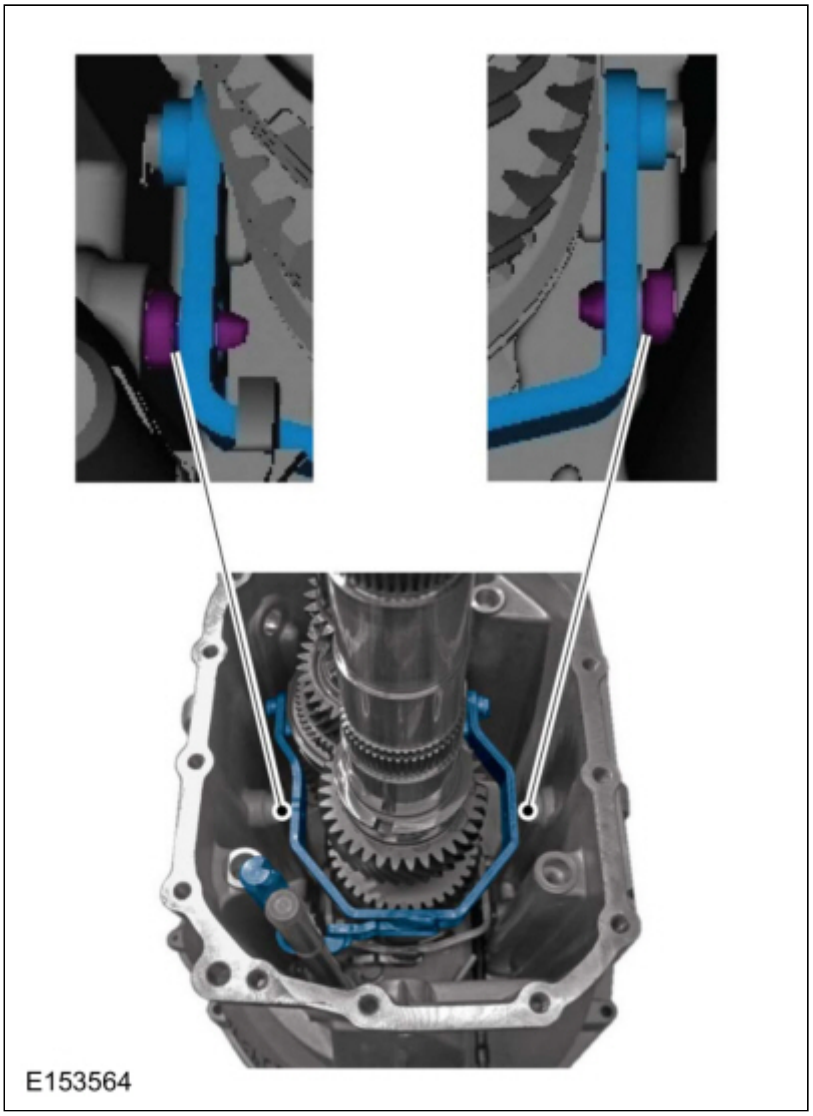
   Material: Thread Locking Sealant



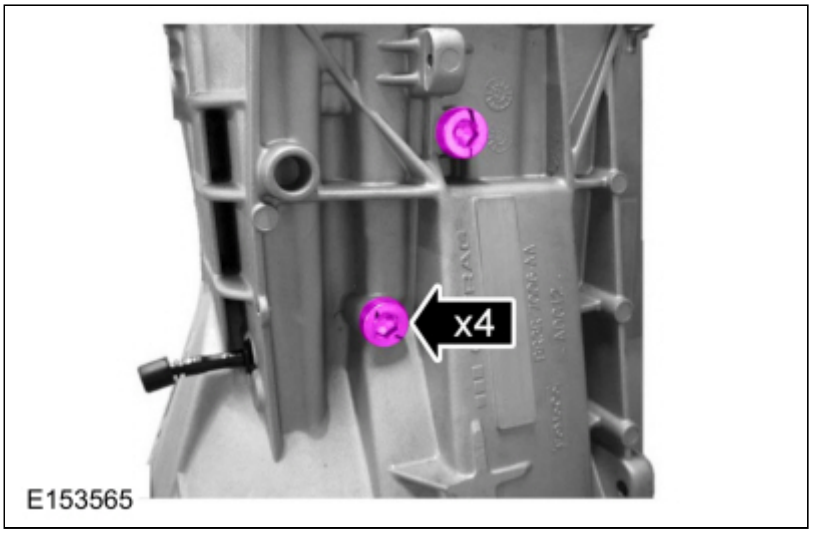
10. **NOTICE: Make sure the shift fork pivot bolts engauge into the shift fork or damage to the shift fork can occur.**

    NOTE: *Apply Threadlock and Sealer to the shift fork pivot bolts.*

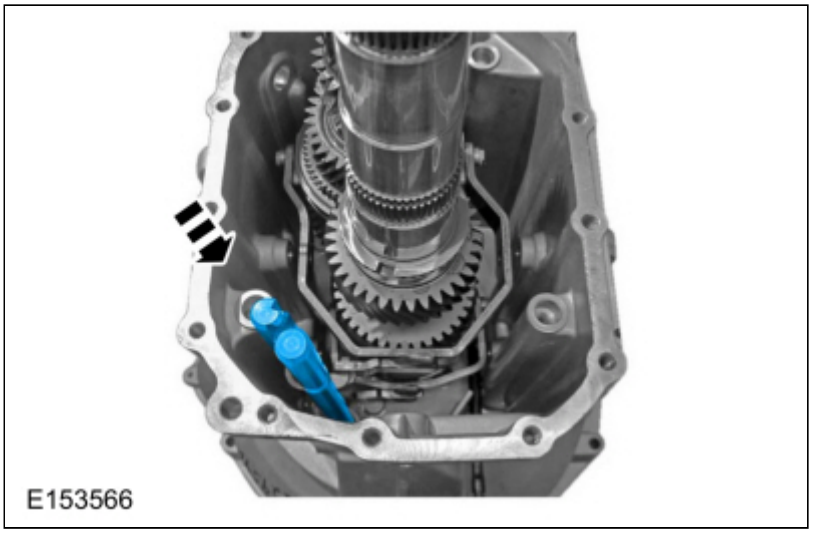
    Material: Thread Locking Adhesive (WSK-M2G349-A7)



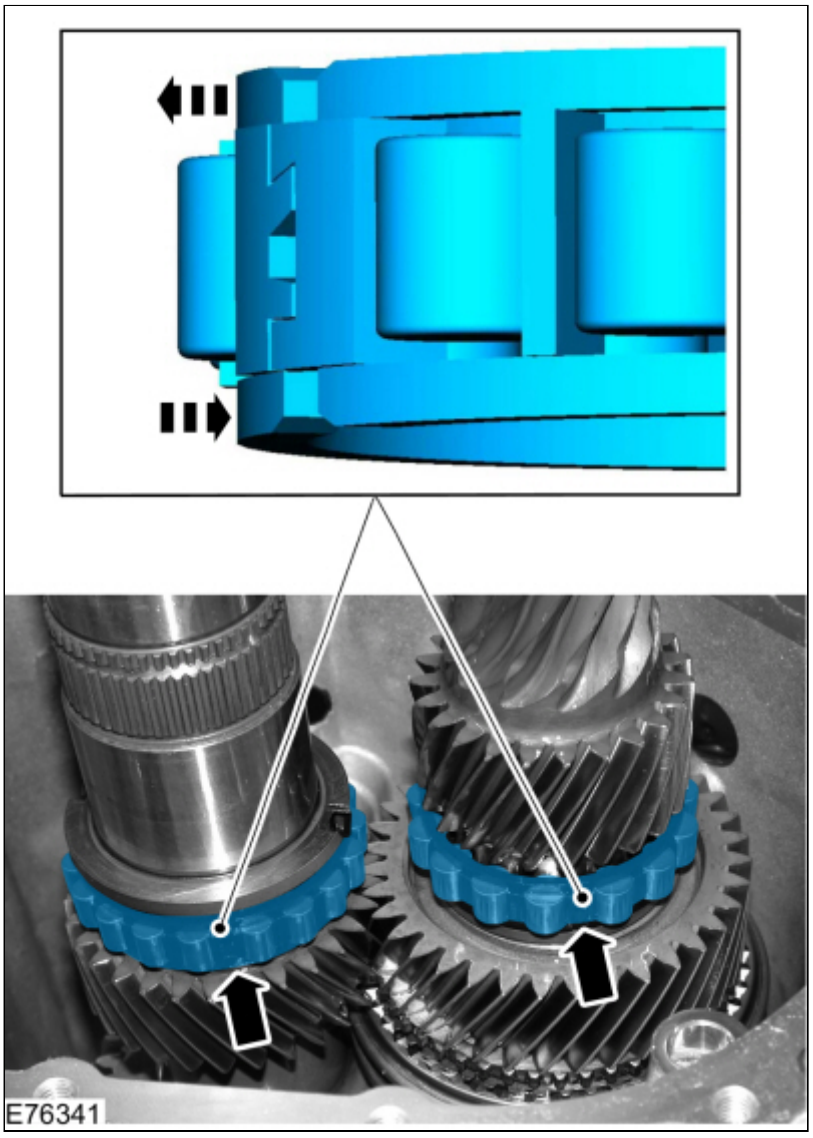
11. *Torque*: 37 Nm



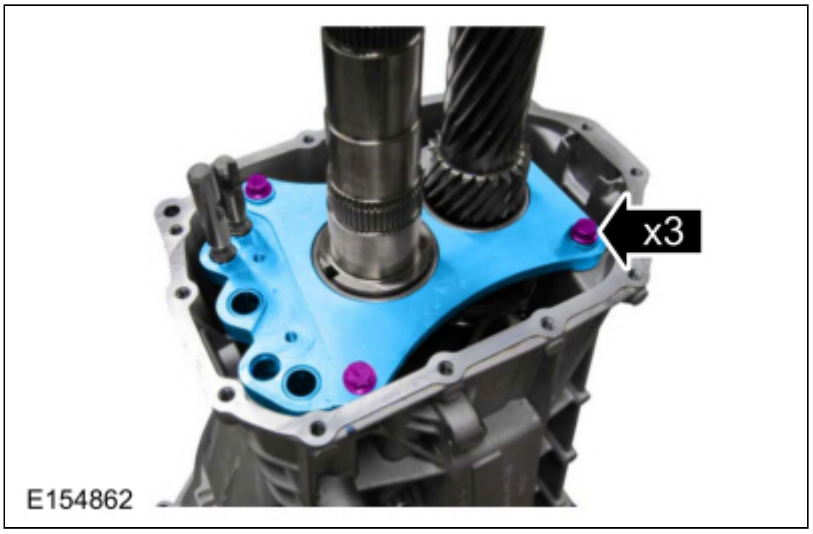
12. Push down the 3rd/4th shift rail and the 5th/6th shift rail to lock the transmission into 2 gears.



13. **NOTICE: When installing the bearings, do not over expand the bearing cages or damage to the bearing cages can occur.**

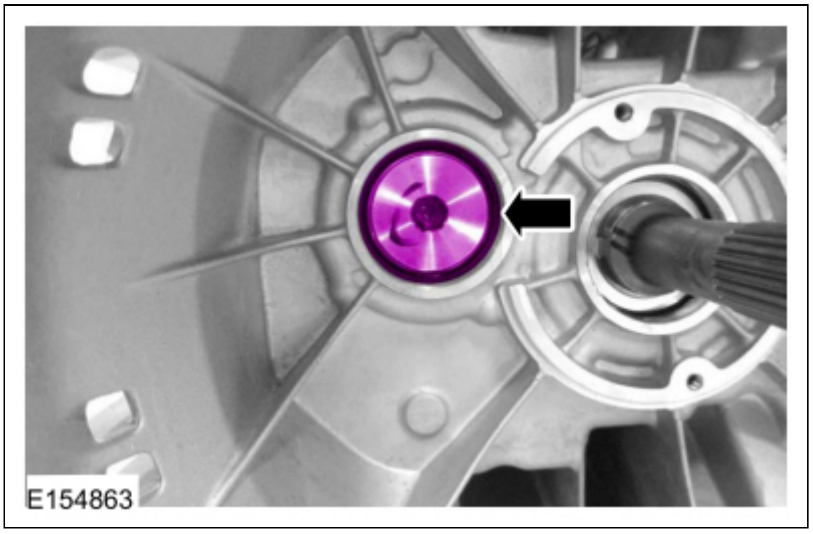


14. **NOTE:** *Only tighten the bolts finger tight at this stage.*



15. **NOTE:** *Install the counter shaft bolt with the transmission in the vertical position with the input shaft facing down.*

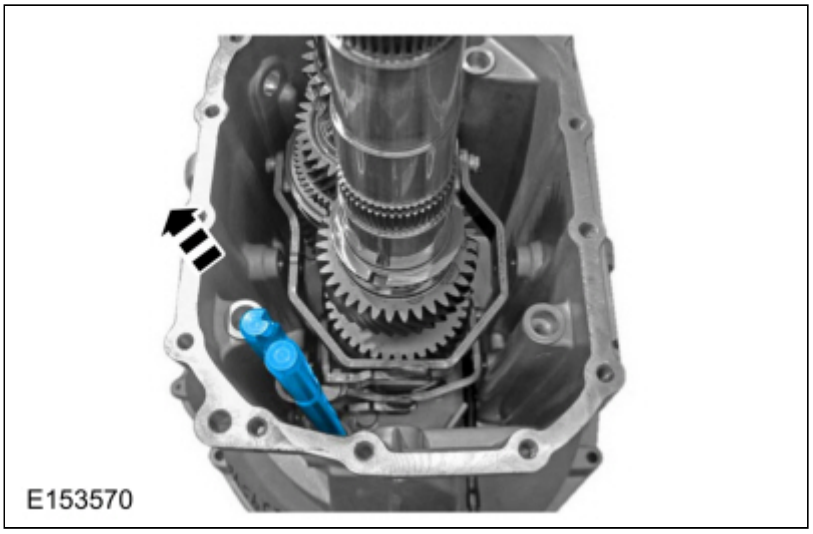
    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 95 Nm



16. **NOTE:** *Remove the center support and 3 center support bolts.*



17. **NOTE:** *Pull up on the 3rd/4th shift rail and the 5th/6th shift rail to unlock the transmission from 2 gears.*

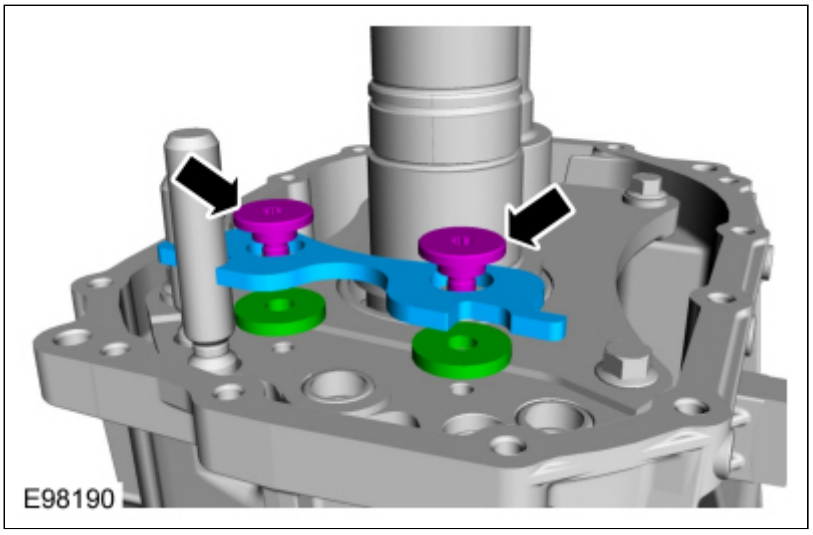


18. **NOTICE: The center support must be tightened evenly or damage to the center support or transmission case can occur.**

    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 35 Nm

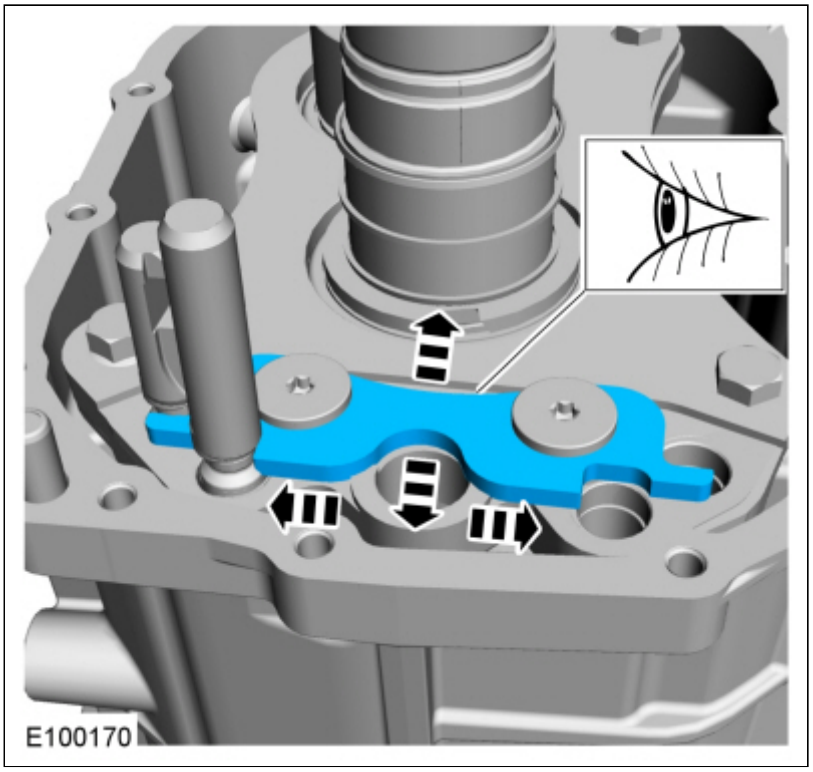


19. *Torque*: 24 Nm

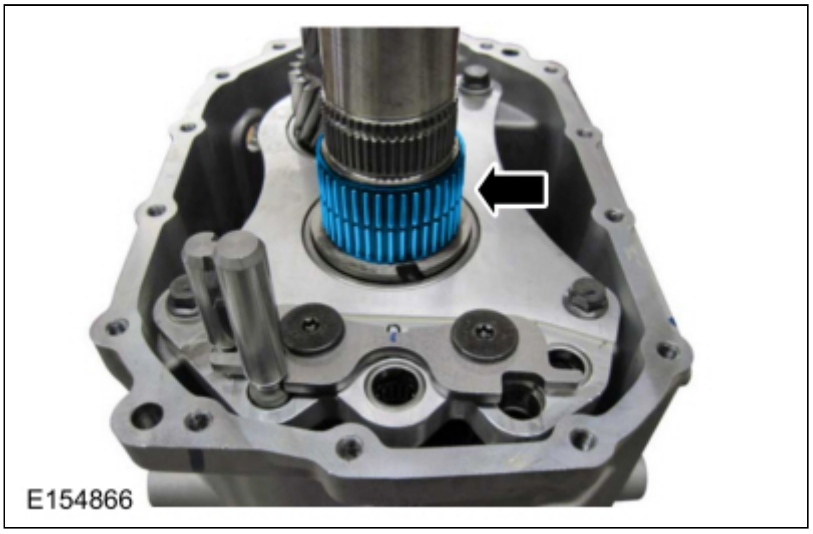


20. **NOTE:** *Make sure the interlock plate moves freely.*

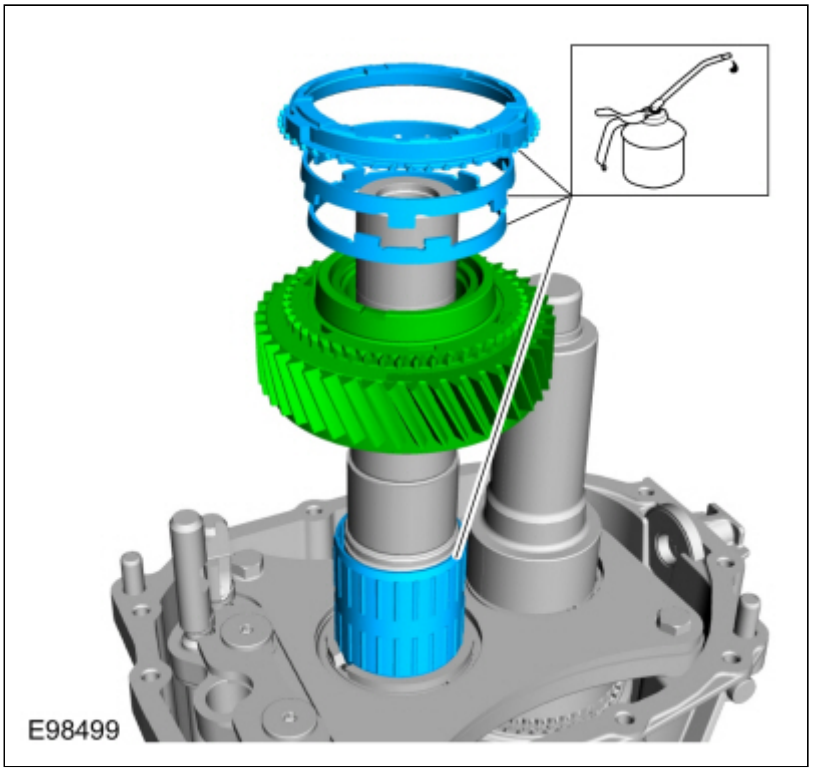
    Material: Thread Locking Adhesive (WSK-M2G349-A7)
    Torque: 24 Nm



21.



22.



23. **NOTICE: The 6 synchronizer ring tabs must engauge into the 6 gear slots or damage to the synchronizer ring assembly can occur.**

    NOTE: *The 2nd gear synchronizer ring assembly outer ring has one identification notch.*

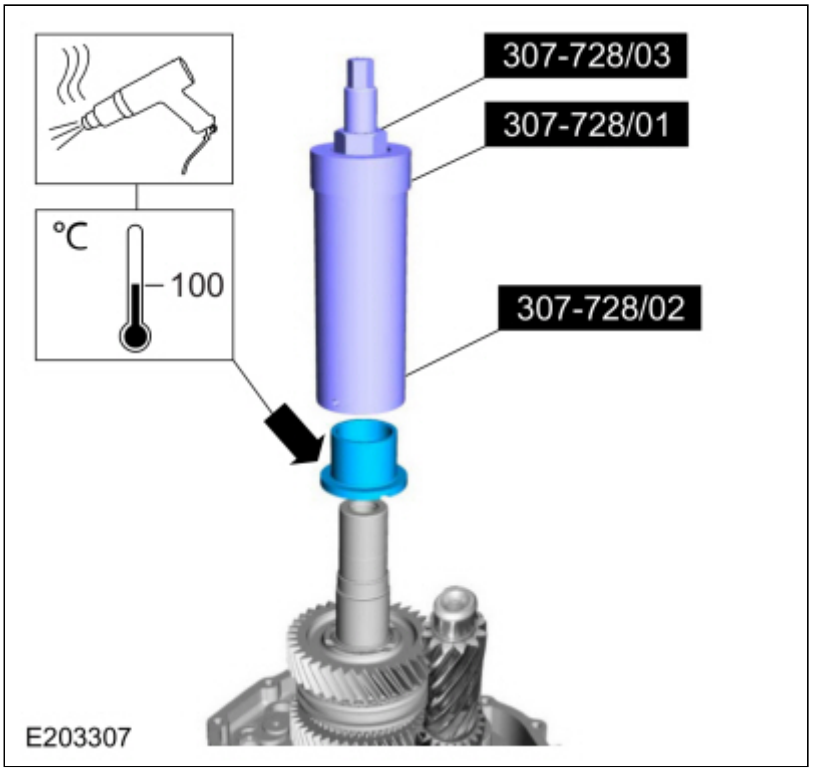
    Torque: 37 Nm



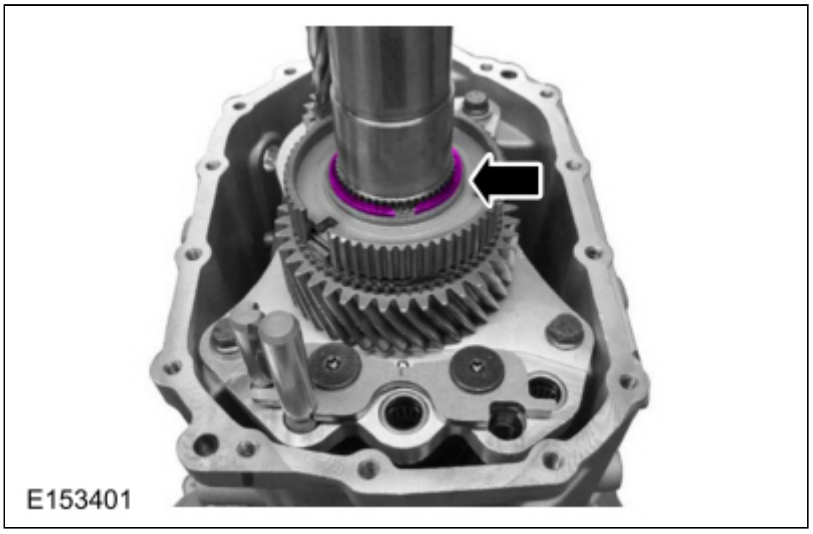
24. **NOTICE: The 3 synchronizer ring tabs must engauge into the 3 synchronizer hub slots or damage to the synchronizer hub and the synchronizer ring assembly can occur.**

    NOTICE: The long shoulder of the 1st/2nd synchronizer hub must be facing 2nd gear or damage to the synchronizer hub can occur.

    Use Special Service Tool: 307-728 Installer, Output Shaft Seal and Bearing.

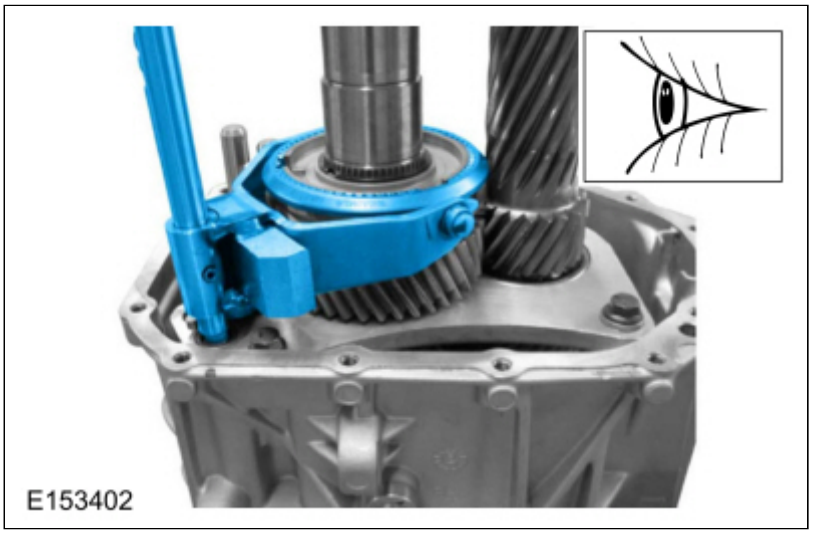


25.

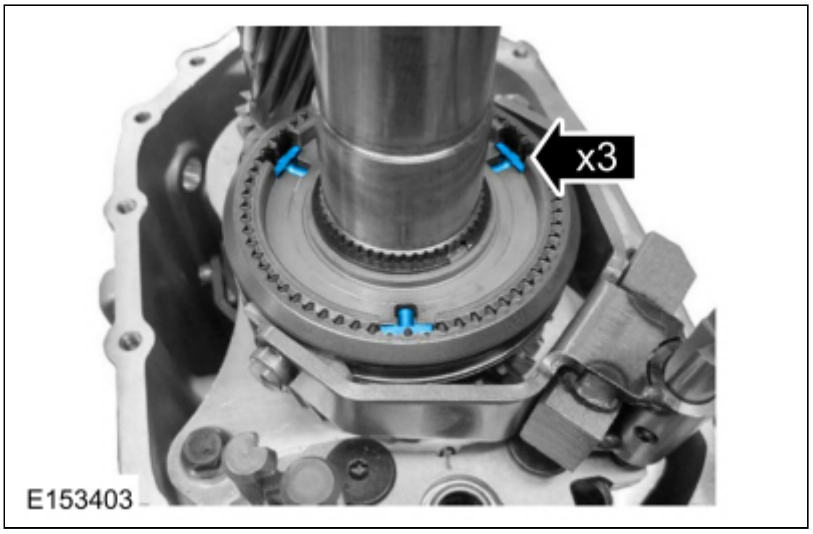


26. **NOTE:** *Align the index marks made during removal on the synchronizer sleeve and the synchronizer hub.*

NOTE: *With the groove on the 1st/2nd synchronizer sleeve facing 2nd gear, install the 1st/2nd shift fork, the 1st/2nd shift rail and the 1st/2nd synchronizer sleeve.*

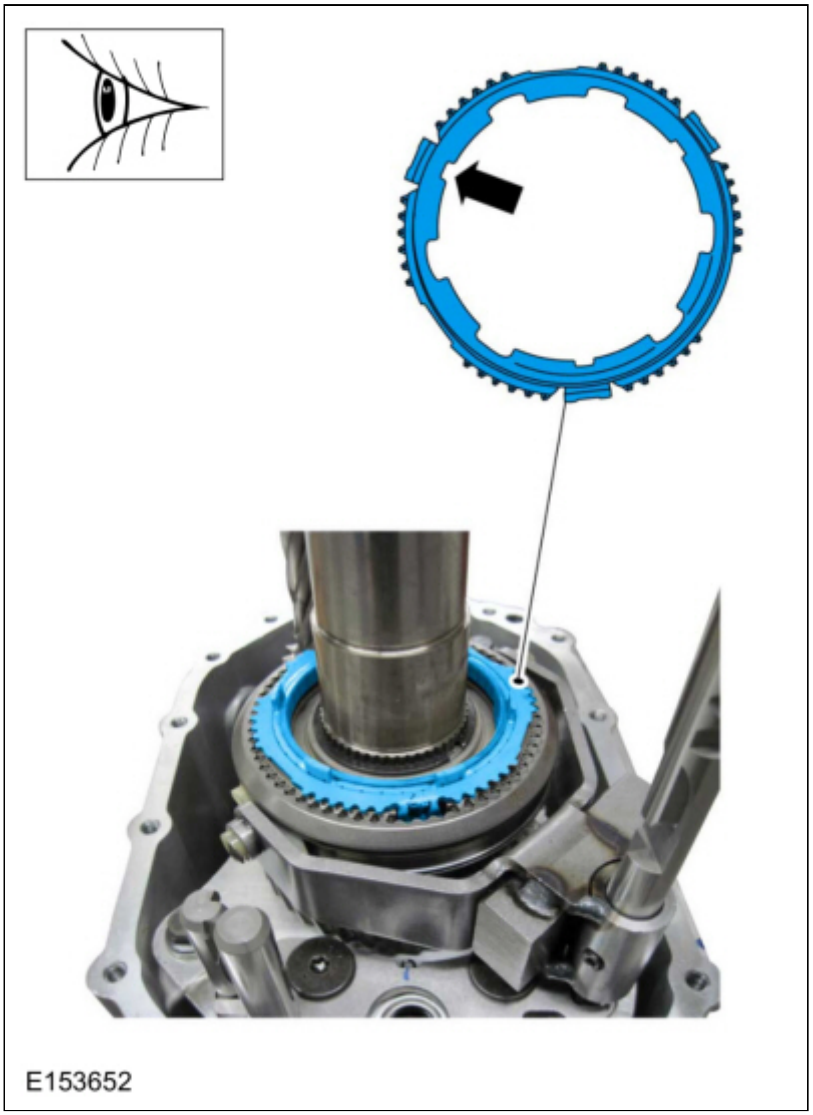


27. **NOTE:** *Slide the synchronizer sleeve up and install the 3 pressure pieces.*

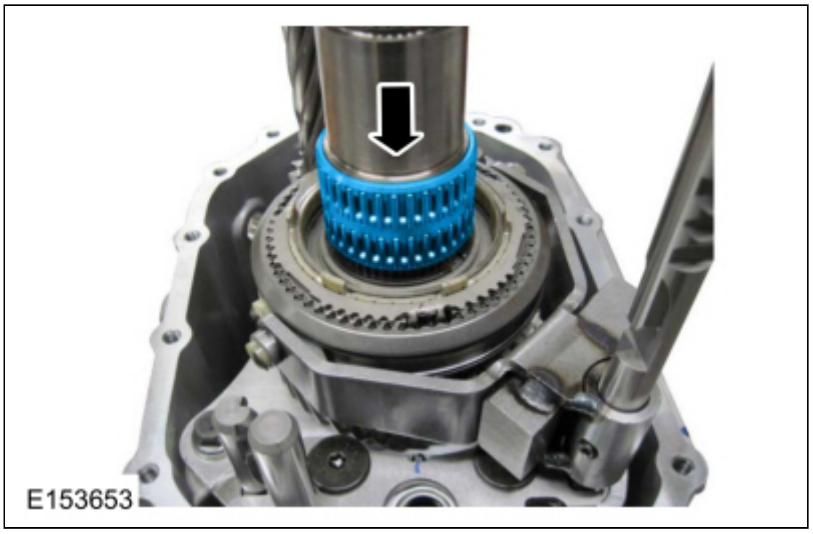


28. **NOTICE: The 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage to the synchronizer assembly and the synchronizer ring assembly can occur.**

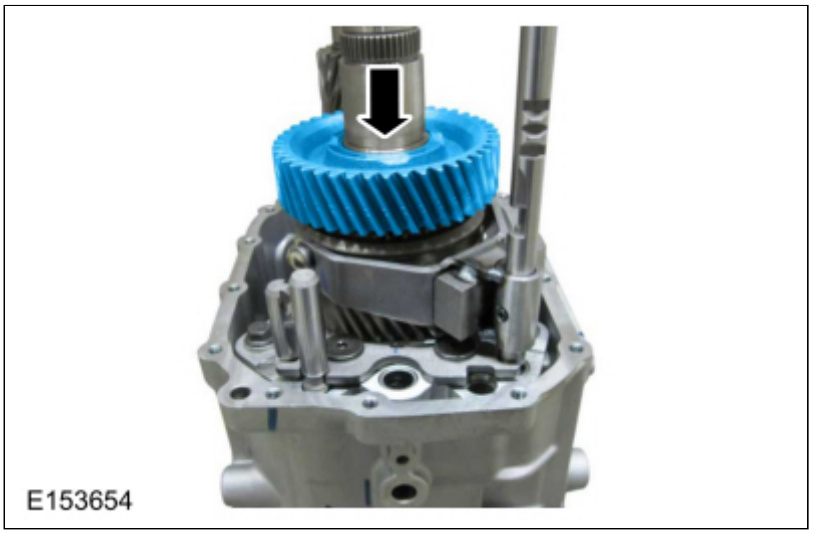
    NOTE: *The 1st gear synchronizer ring assembly outer ring has one identification notch.*



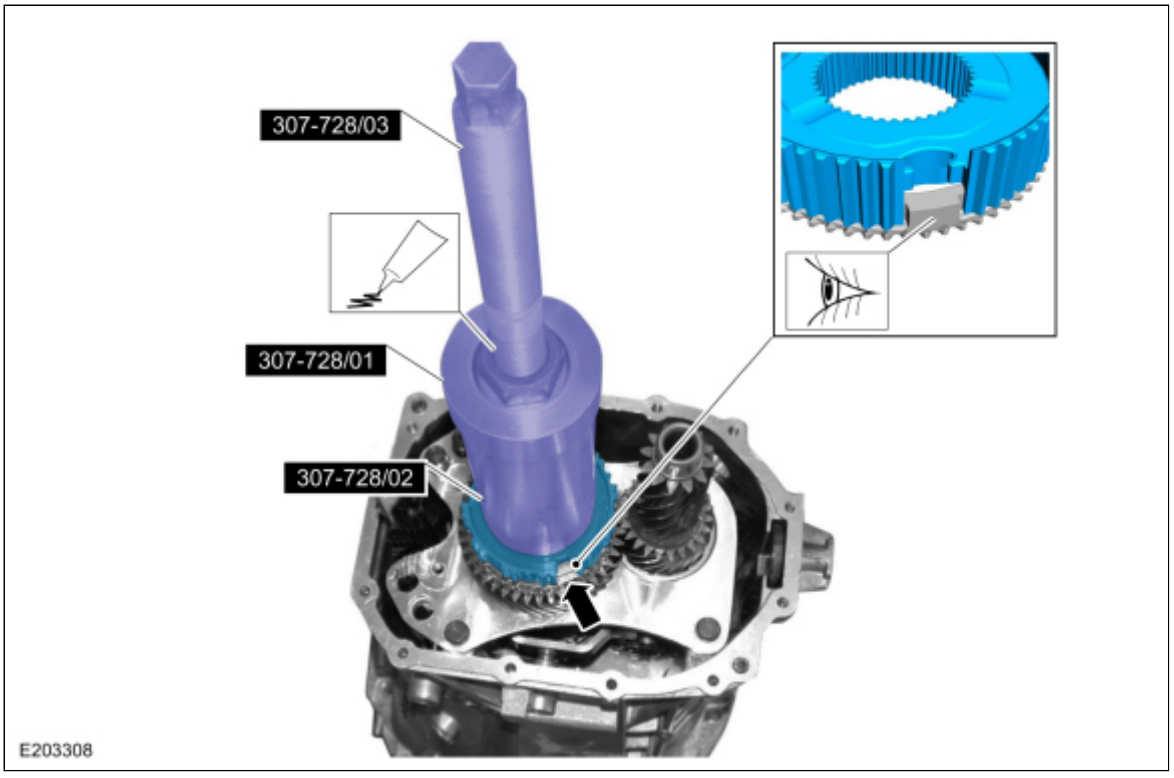
29.



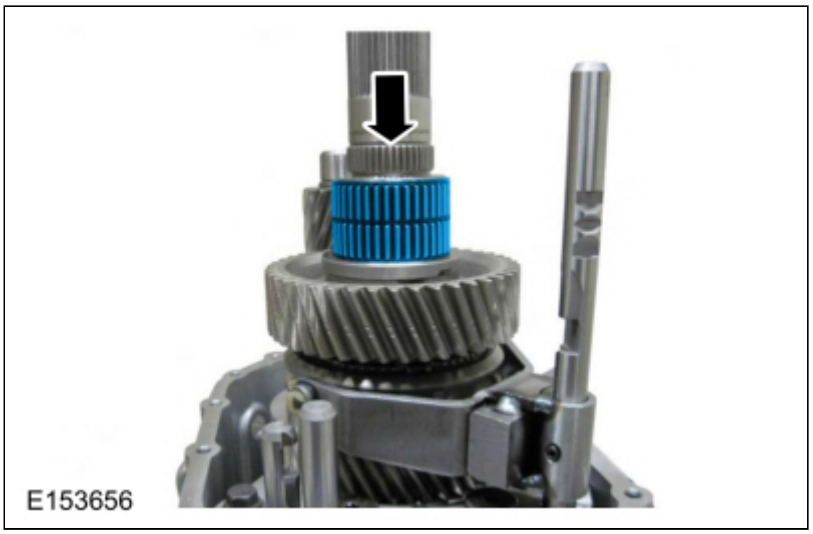
30. **NOTICE: The 6 synchronizer ring tabs must engauge into the 6 gear slots or damage to the synchronizer assembly and synchronizer ring assembly can occur.**



31. Use Special Service Tool: 307-728 Installer, Output Shaft Seal and Bearing.



32.

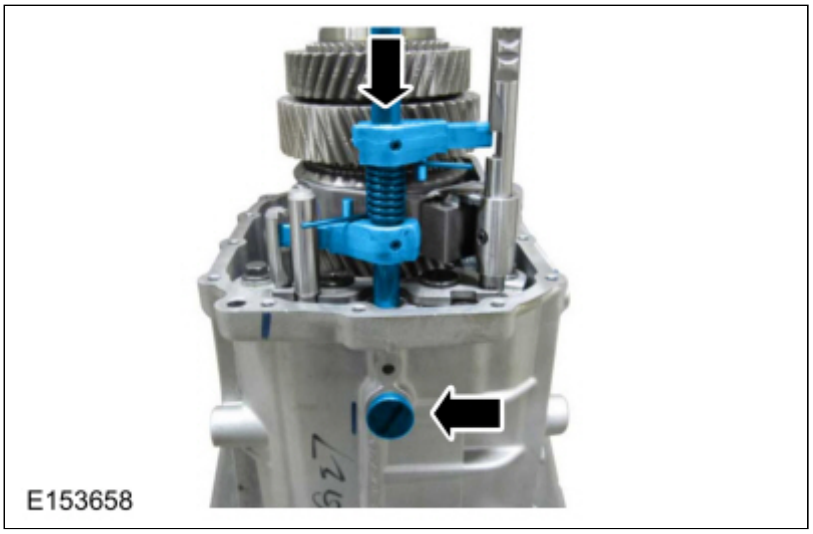


33.

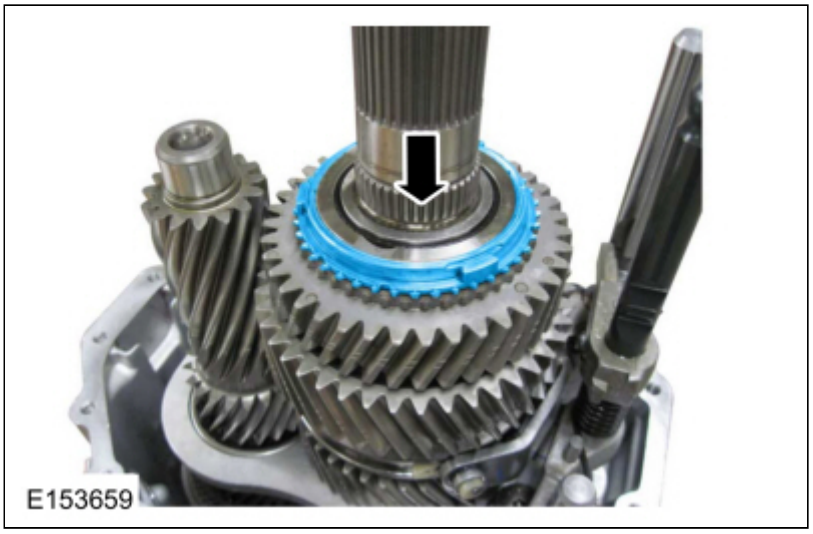


34. **NOTICE: The shift shaft must be installed in the neutral position prior to installing the shift shaft stop pin or damage to the shift shaft stop pin can occur.**

Use the General Equipment: Copper Hammer

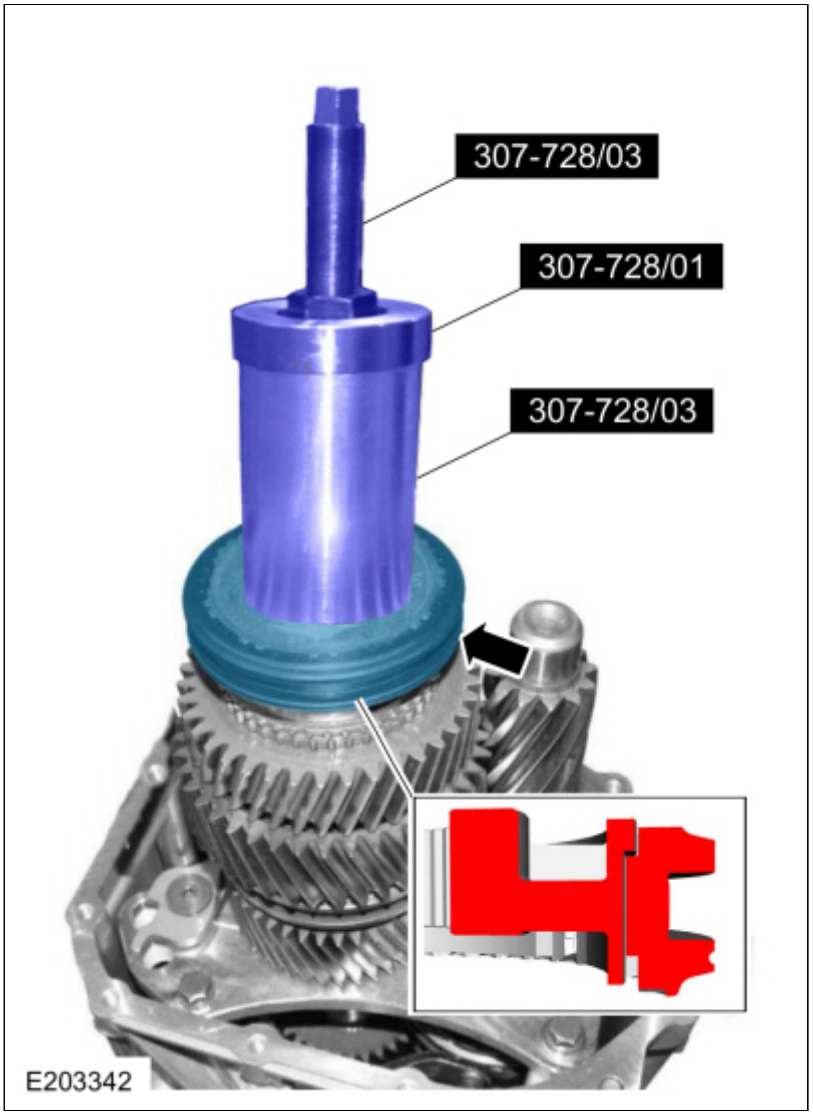


35.

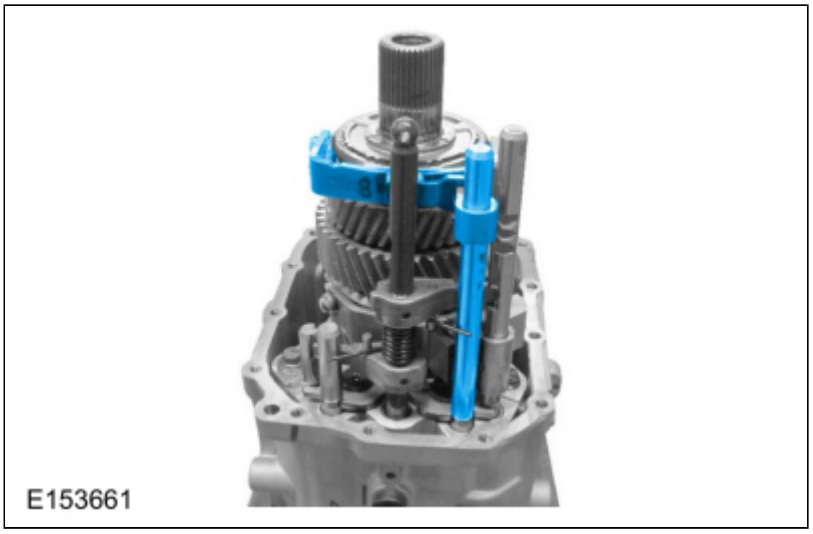


36. **NOTICE: The 3 synchronizer ring tabs must engage into the 3 synchronizer assembly slots or damage to the synchronizer assembly and the synchronizer ring can occur.**

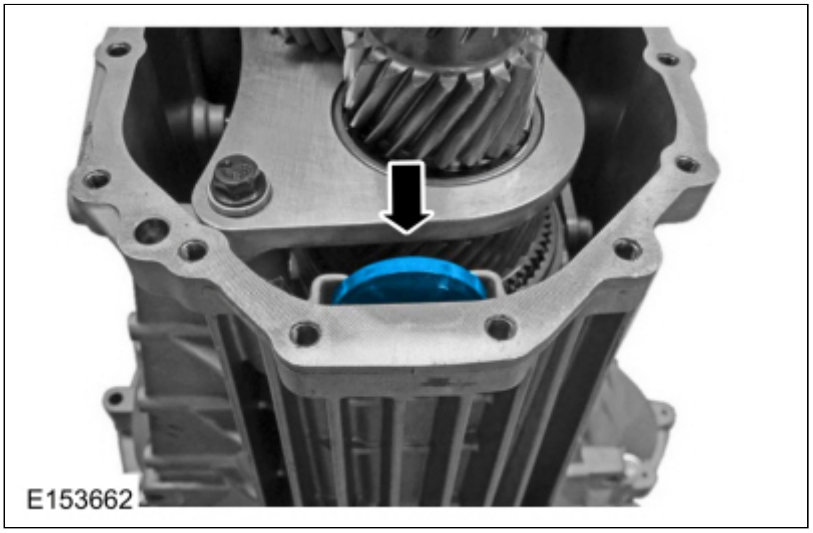
    Use Special Service Tool: 307-728 Installer, Output Shaft Seal and Bearing.



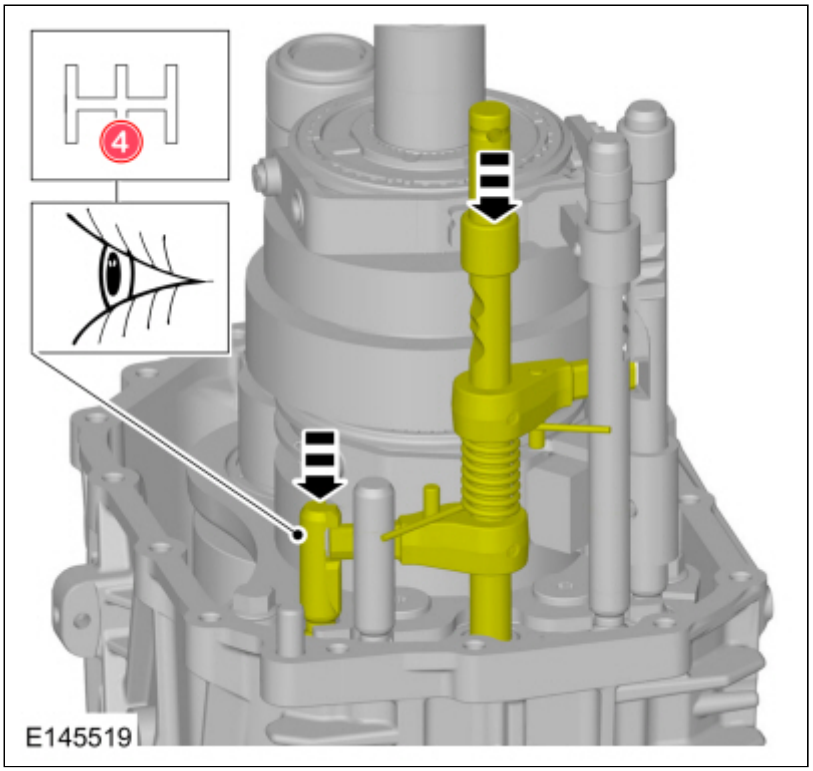
37. **NOTE:** *To install the reverse shift fork and the reverse shift rail assembly, the transmission must be in neutral and the groves on the shift rails must be aligned with the interlock plate.*



38.



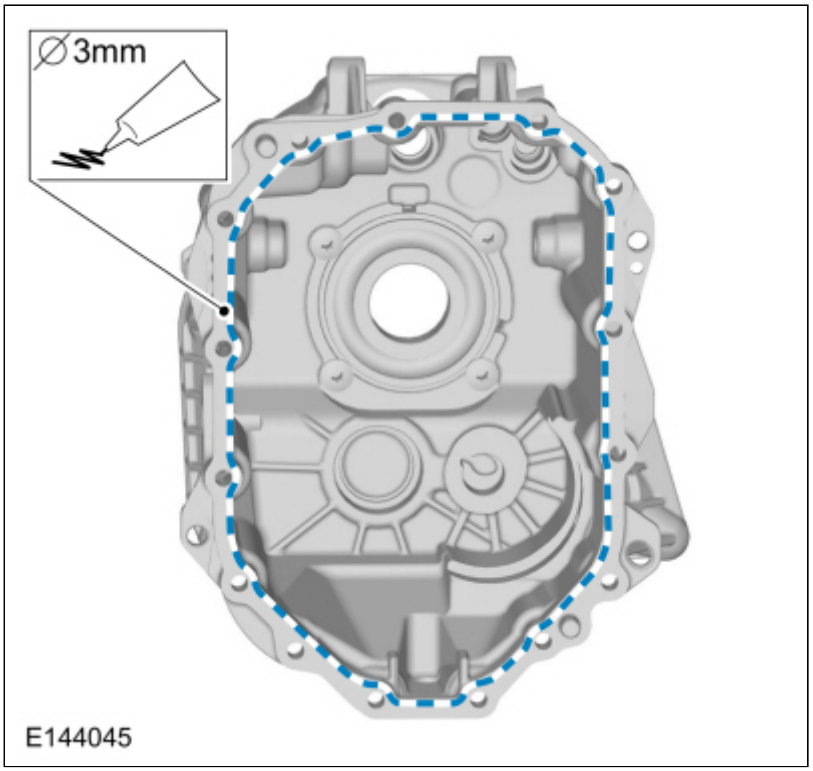
39. Engage fourth gear.



40. **NOTICE: Make sure the surface is cleaned with acetone and is free of foreign material.**

NOTICE: Make sure that the sealant is applied continuously. Start and end should be on top of case.

Material: Sealant (WSK-M2G348-A7)

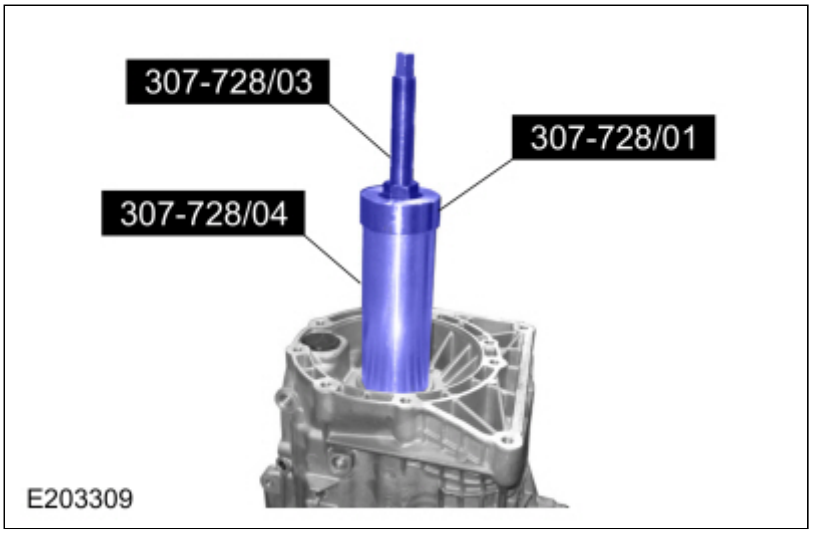


41. **NOTE:** *Do not wait longer than 10 minutes to install the rear transmission case assembly due to the rapid cure time of the sealant.*

    NOTE: *Clean the sealing surfaces of the front transmission case and the sealing surfaces of the rear transmission case. Thinly coat the sealing surface of the front transmission case assembly and the sealing surface of the rear transmission case assembly with Gasket Maker.*

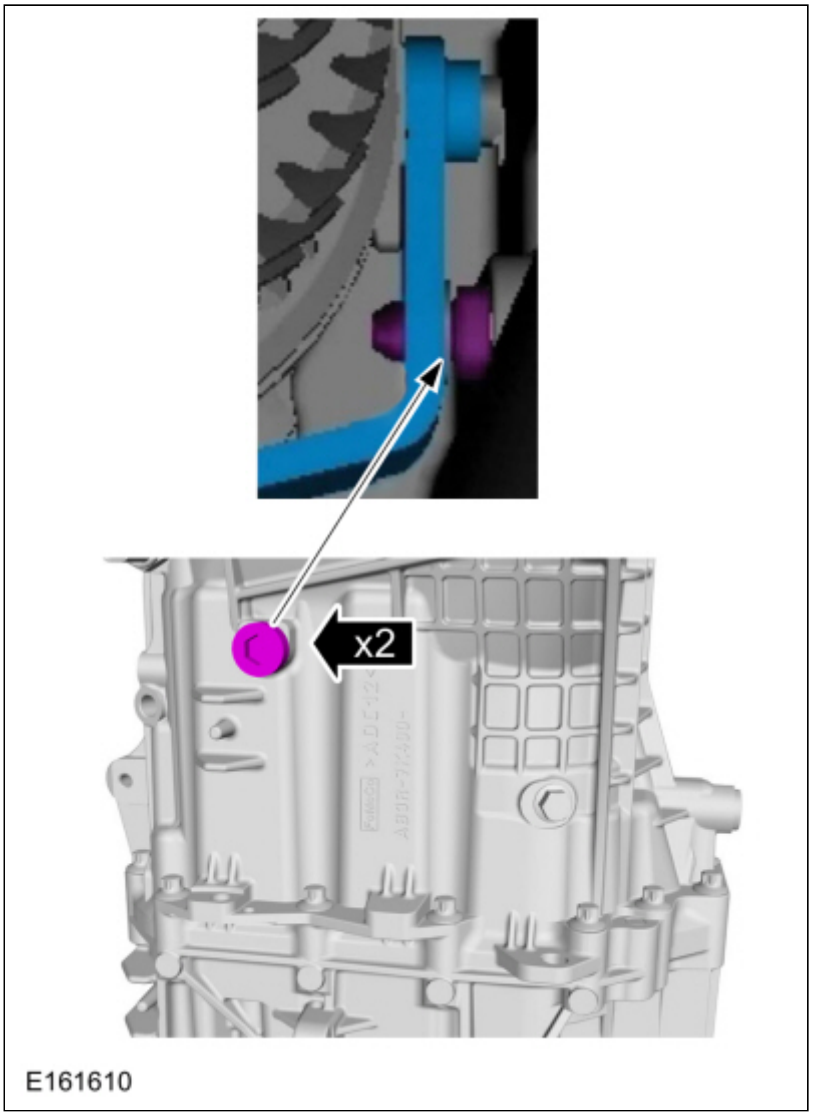
42. **NOTICE: The rear transmission case assembly must be installed evenly with the transmission shifted into 4th gear, do not allow the shift rails to bind during installation or damage to the transmission case assembly can occur.**

    Use Special Service Tool: 307-728 Installer, Output Shaft Seal and Bearing.

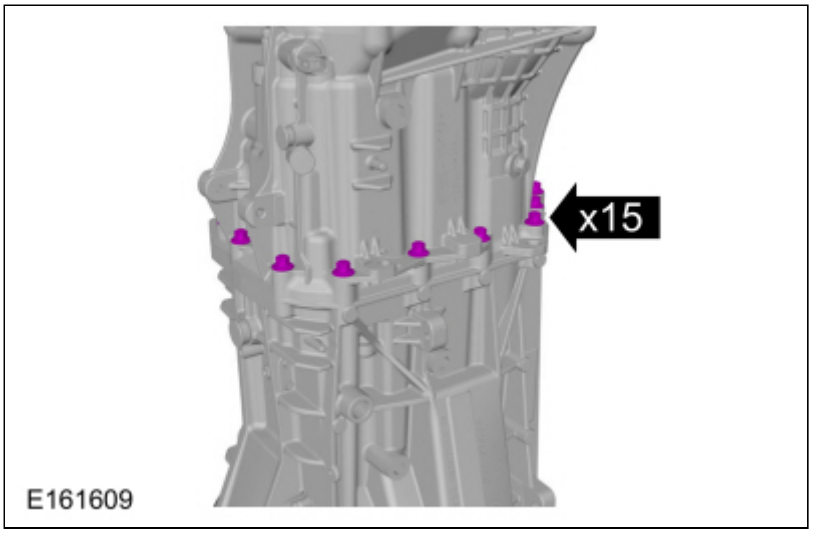


43. **NOTICE: Make sure the shift fork pivot bolts engage into the shift fork or damage to the shift fork can occur.**

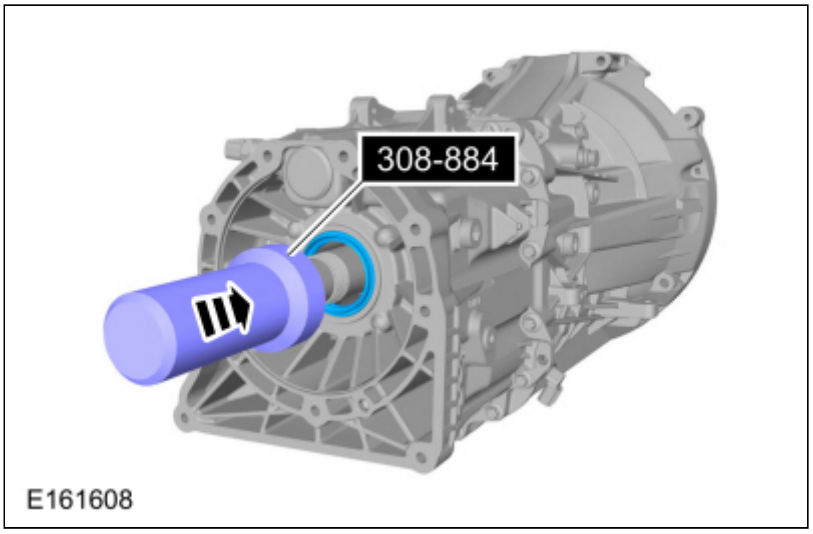
    Material: Thread Locking Sealant
    Torque: 37 Nm



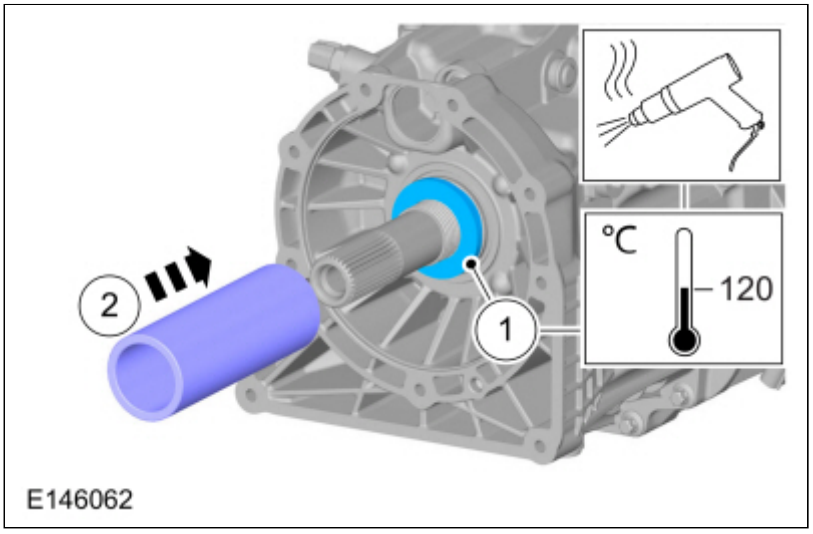
44. Loosely install the 15 transmission case bolts. Using a suitable brass drift, tap the 2 dowel pins flush with the transmission case.
Torque: 24 Nm



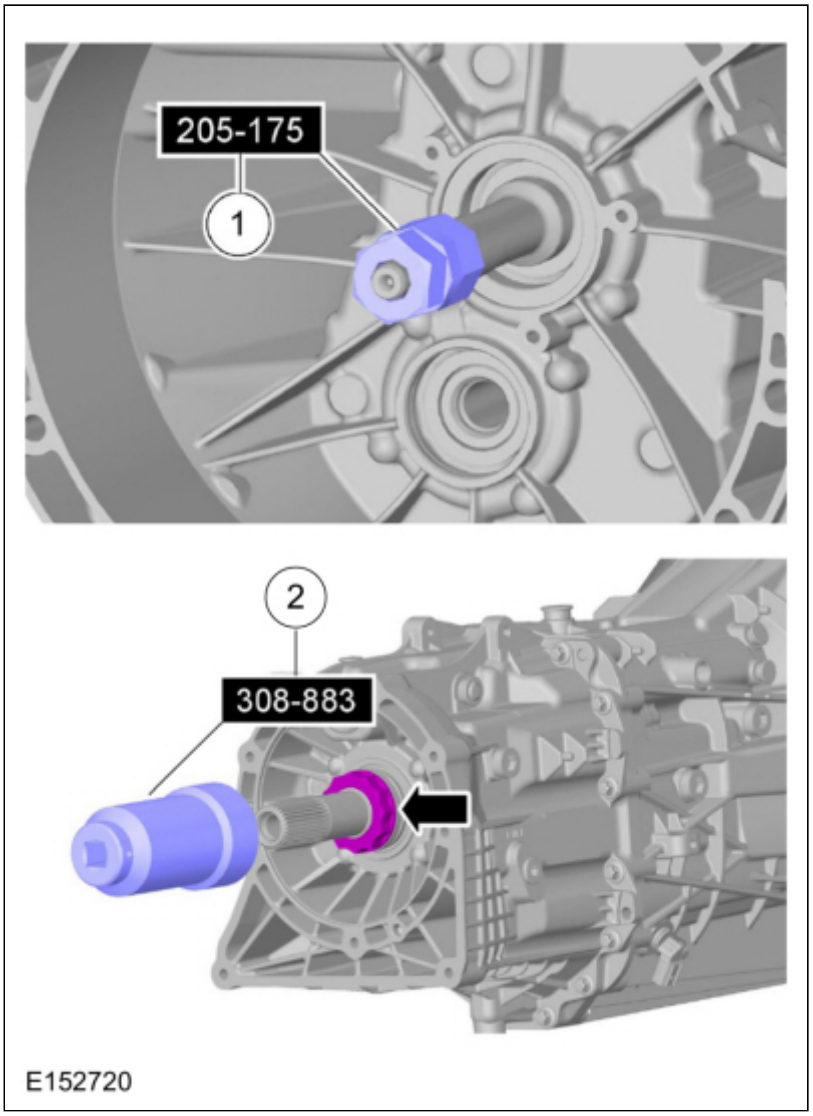
45. Use Special Service Tool: 308-884 Installer, Output Shaft Seal.



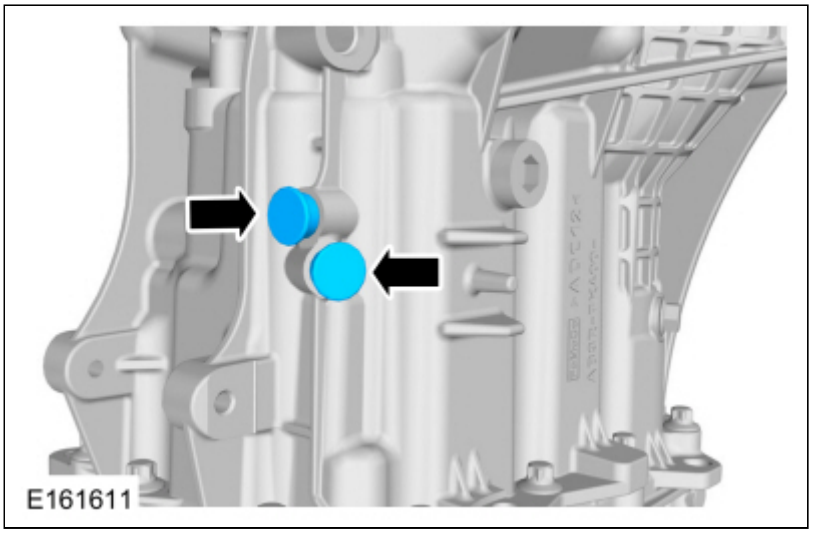
1. Use the General Equipment: Hot Air Gun
2. Use a suitable pipe to install the seal.



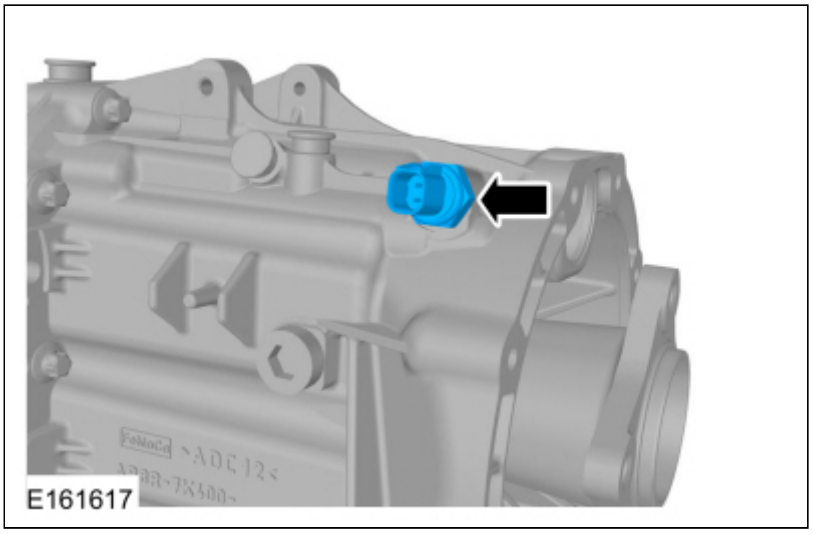
1. Use Special Service Tool: 205-175 Socket, Drive Pinion Nut.
2. Tighten the bolt.
   Use Special Service Tool: 308-883 Wrench, Output Shaft Nut.
   Material: Thread Locking Adhesive (WSK-M2G349-A7)
   Torque: 210 Nm
3. Undo the bolt.
4. Tighten the bolt.
   Torque: 180 Nm



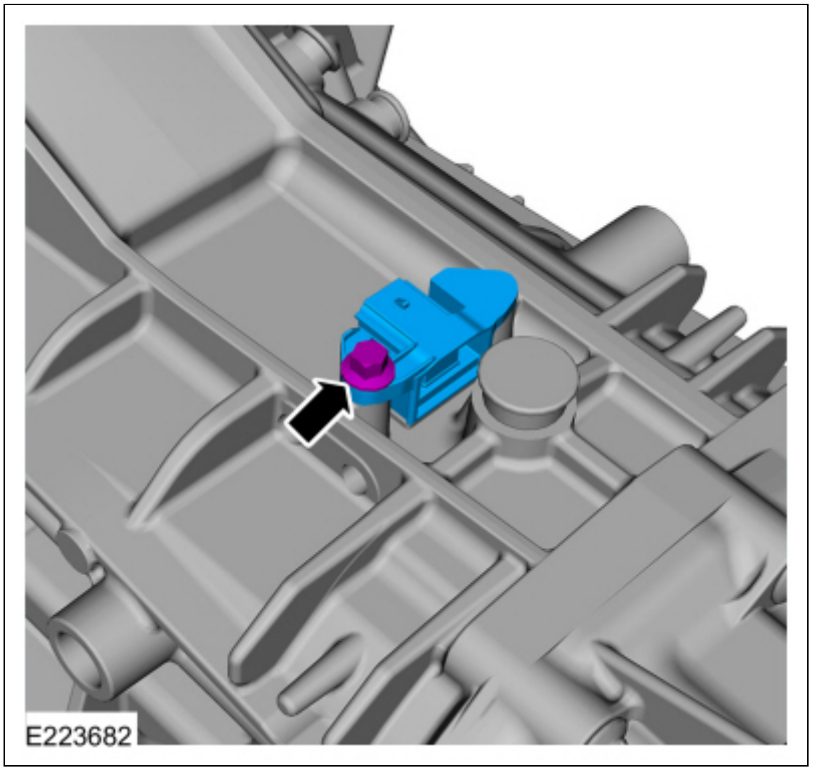
48.



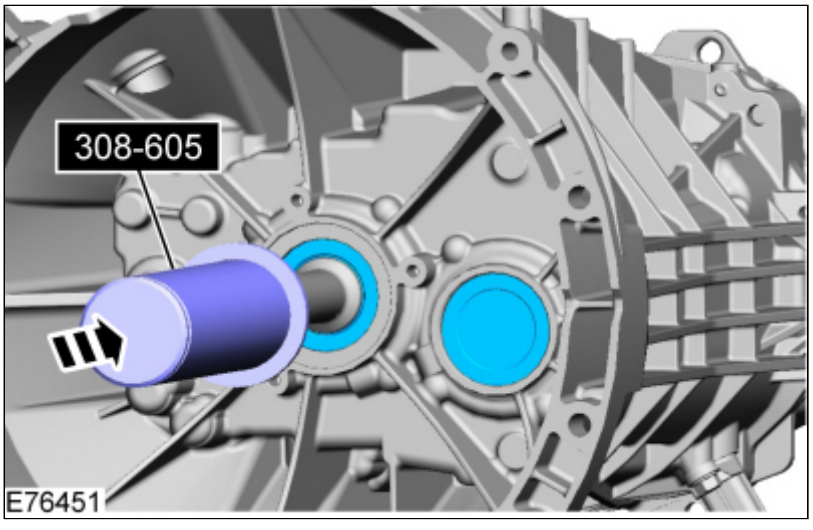
49. *Torque*: 20 Nm



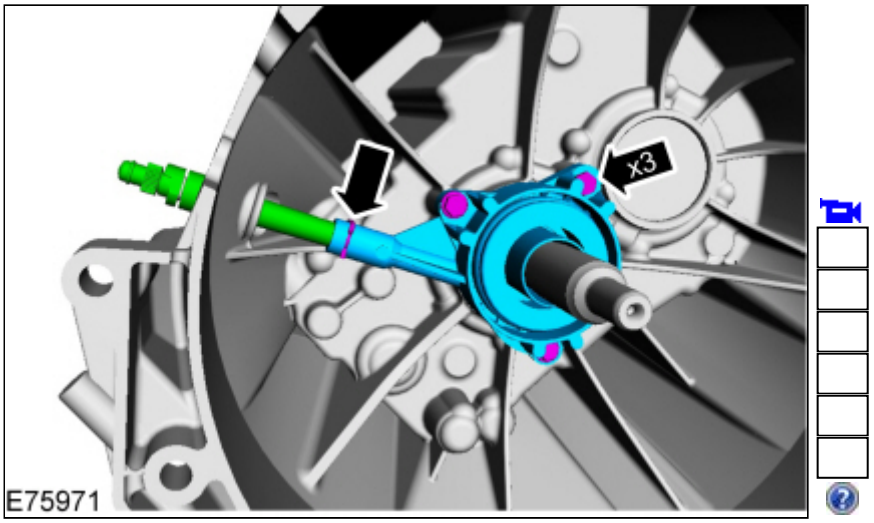
50. *Torque*: 10 Nm



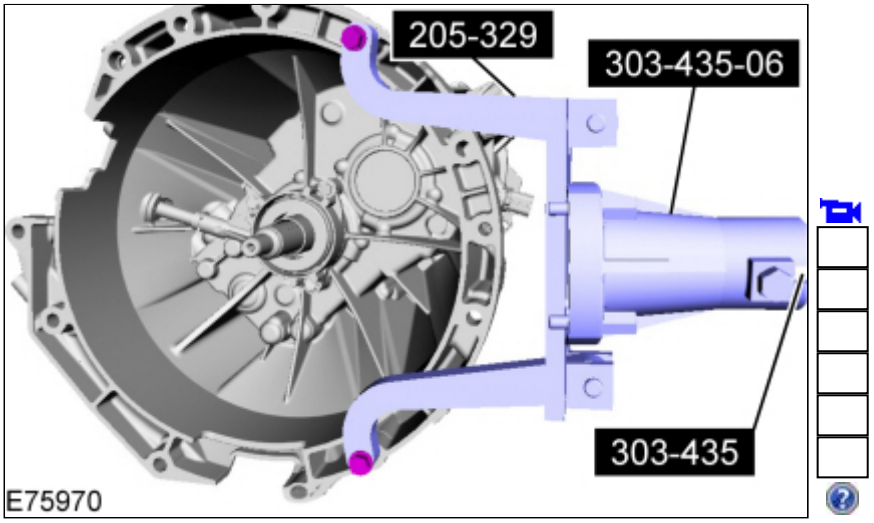
51. Use Special Service Tool: 308-605 Installer, Input Shaft Seal.



52. *Torque*: 11 Nm



53. Remove Special Service Tool: 205-329 Mounting Bracket, Engine/Differential. , 303-435 Mounting Stand. , 303-435-06 Mounting Bracket for 303-435.



Copyright © 2016 Ford Motor Company

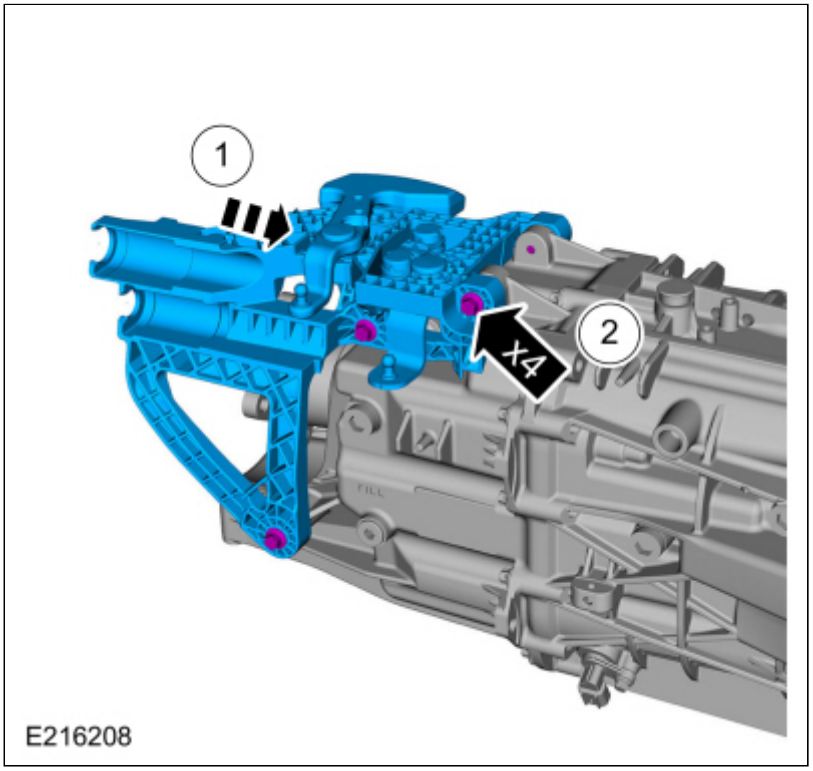
Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x2

Base Part Number: 7000

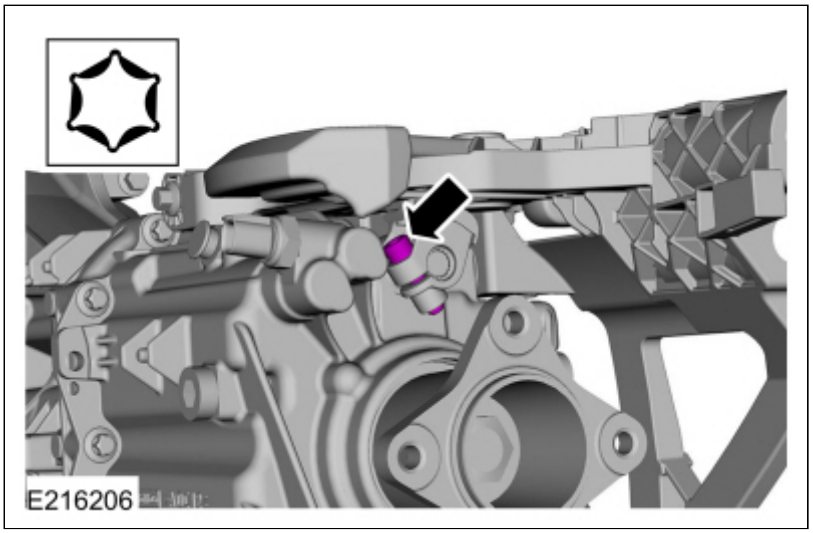
Special Tool(s) / General Equipment

Transmission Jack
Retaining Strap

1. *Torque*: 20 Nm



2. *Torque*: 20 Nm

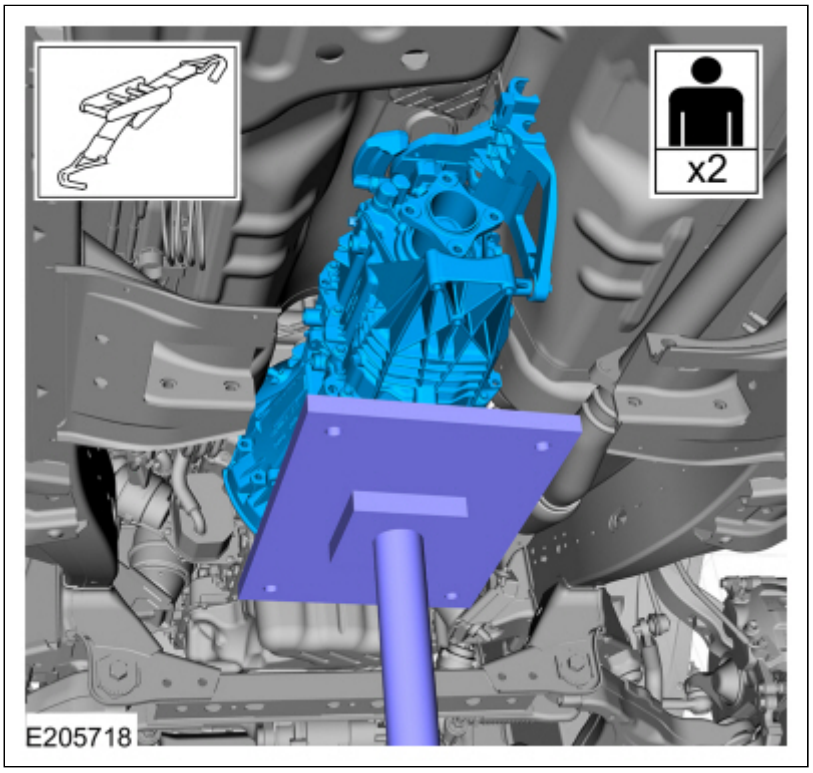


3. Check the pilot bearing for damage. If damaged, install a new pilot bearing.
   Refer to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

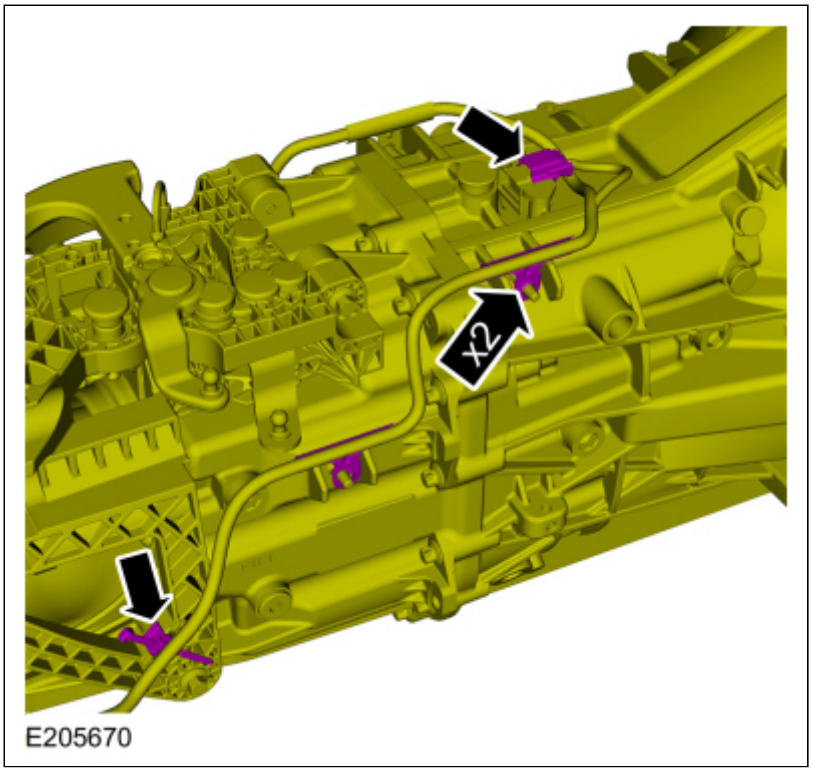
4. **NOTE:** *Do not apply grease to a newly installed pilot bearing.*

5. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

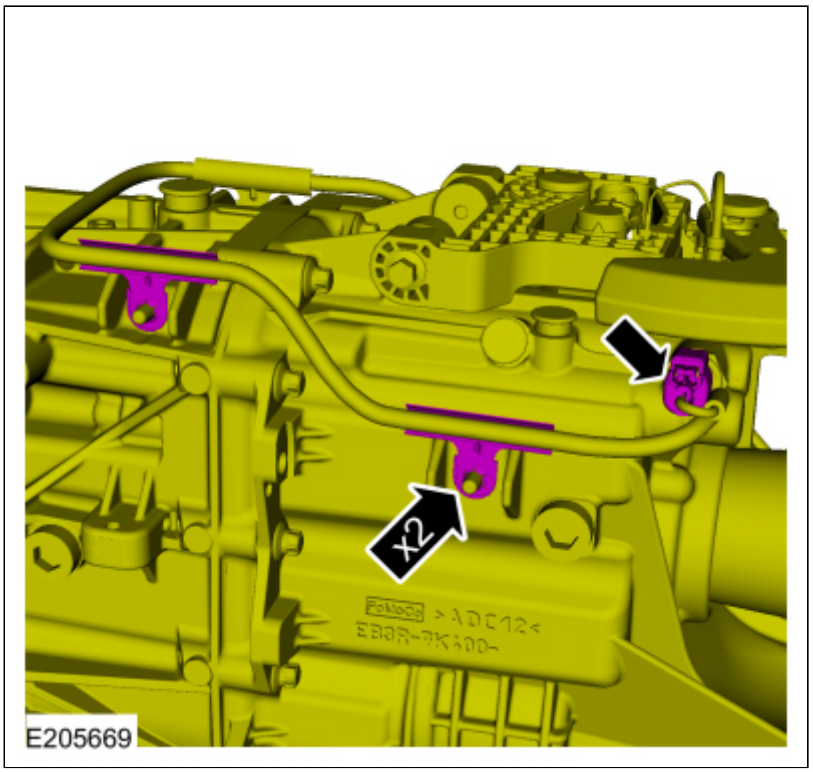
6. Use the General Equipment: Transmission Jack
   Use the General Equipment: Retaining Strap



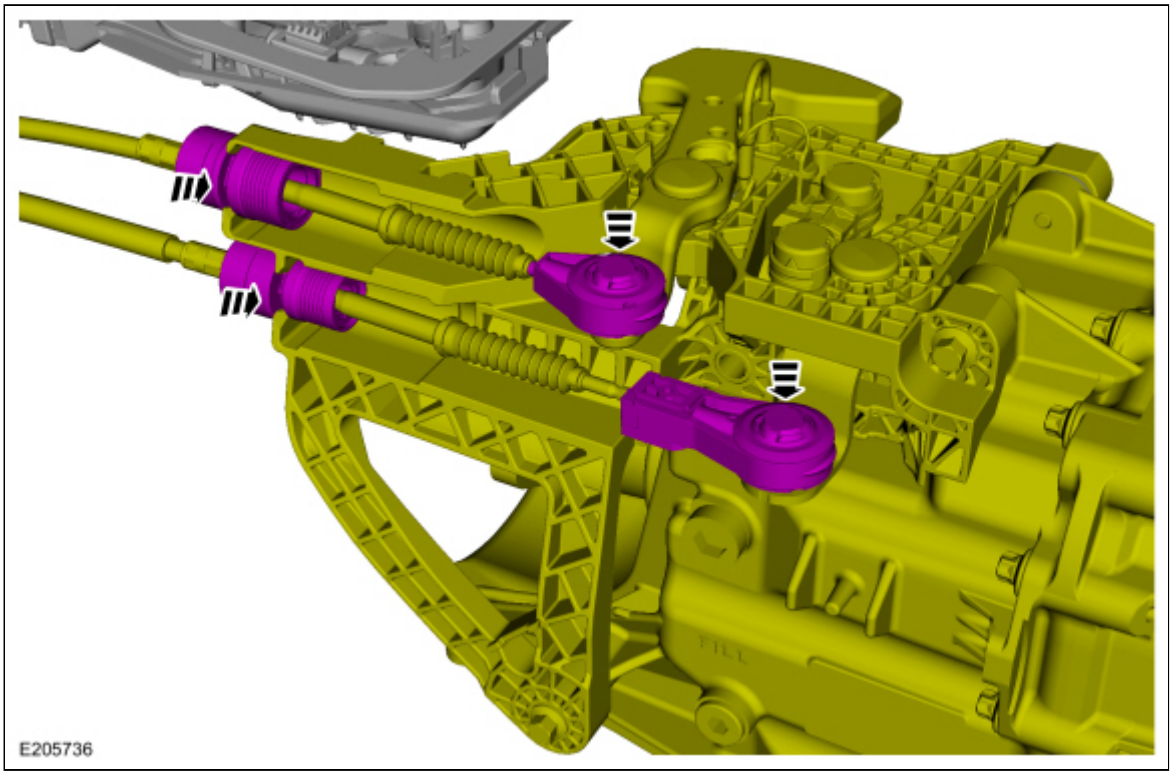
7.



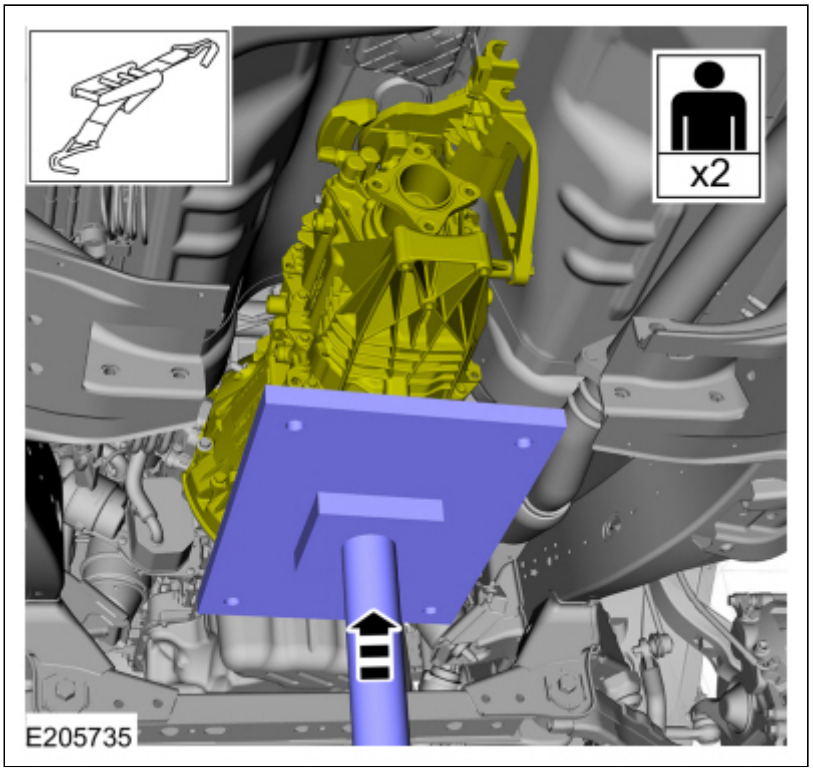
8.



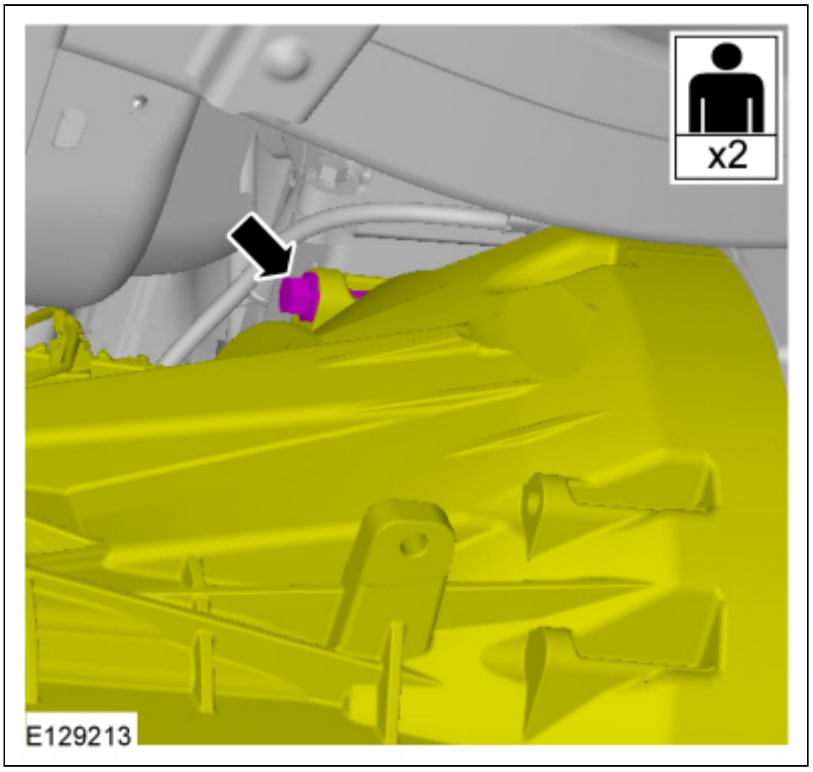
9.



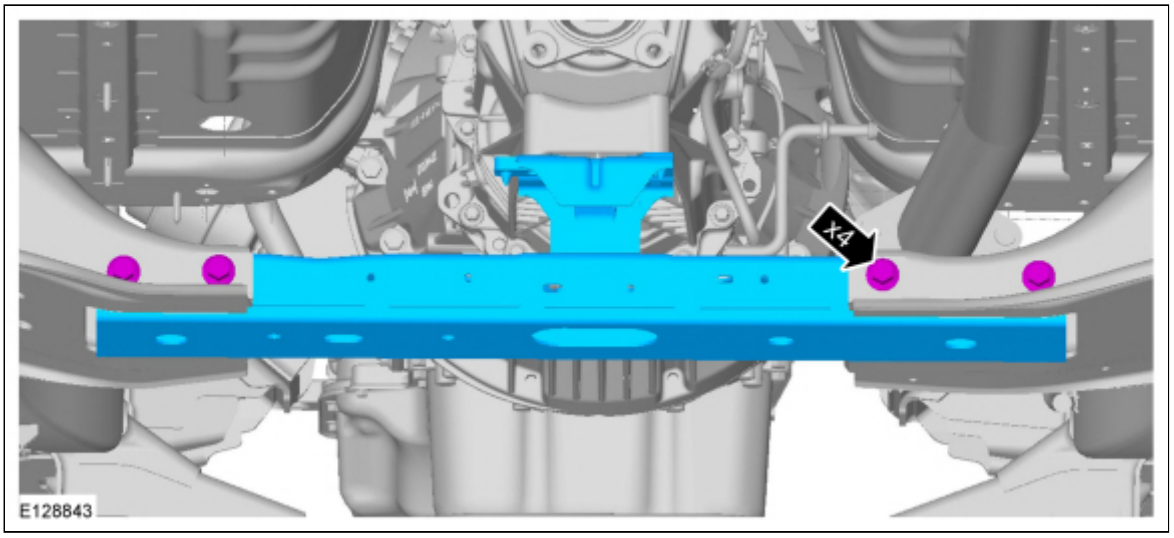
10. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap



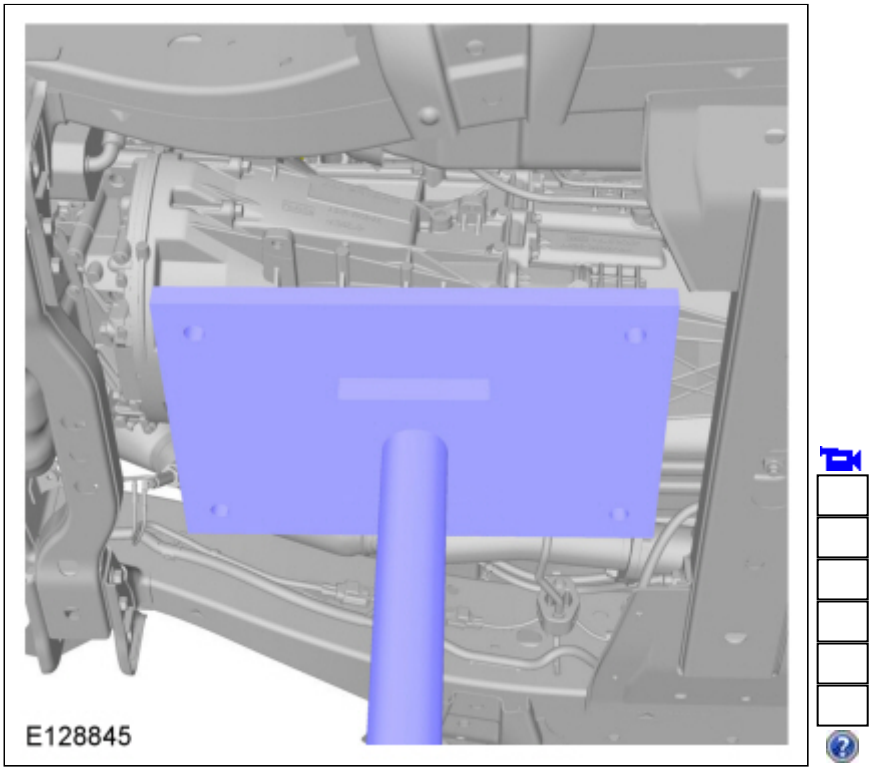
11. *Torque*: 50 Nm



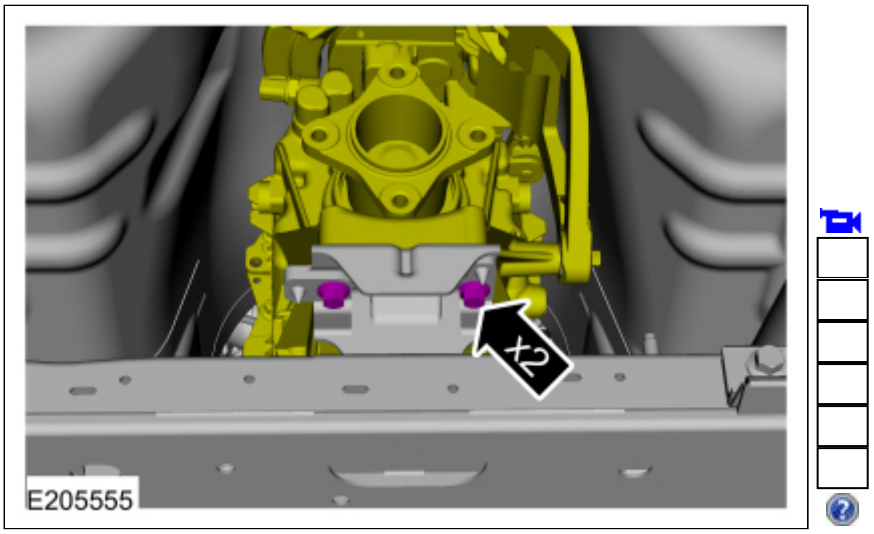
12. *Torque*: 90 Nm



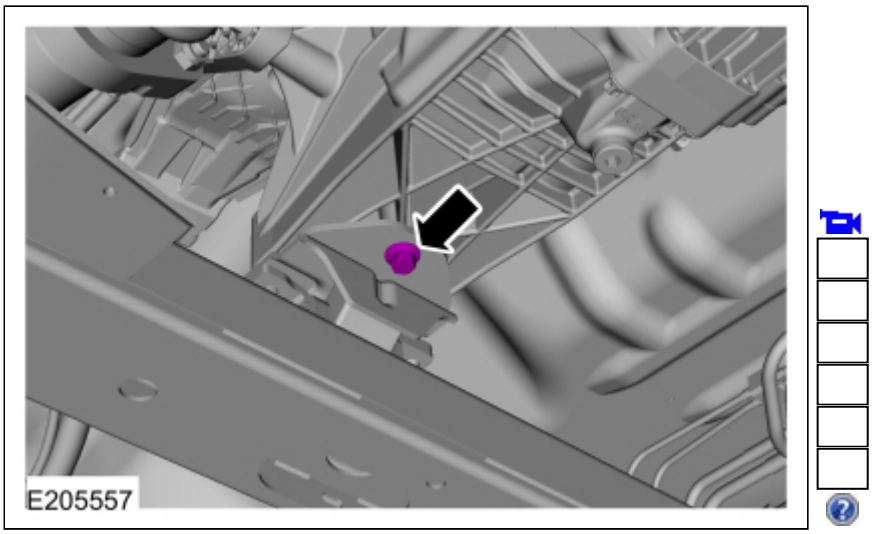
13. Use the General Equipment: Transmission Jack



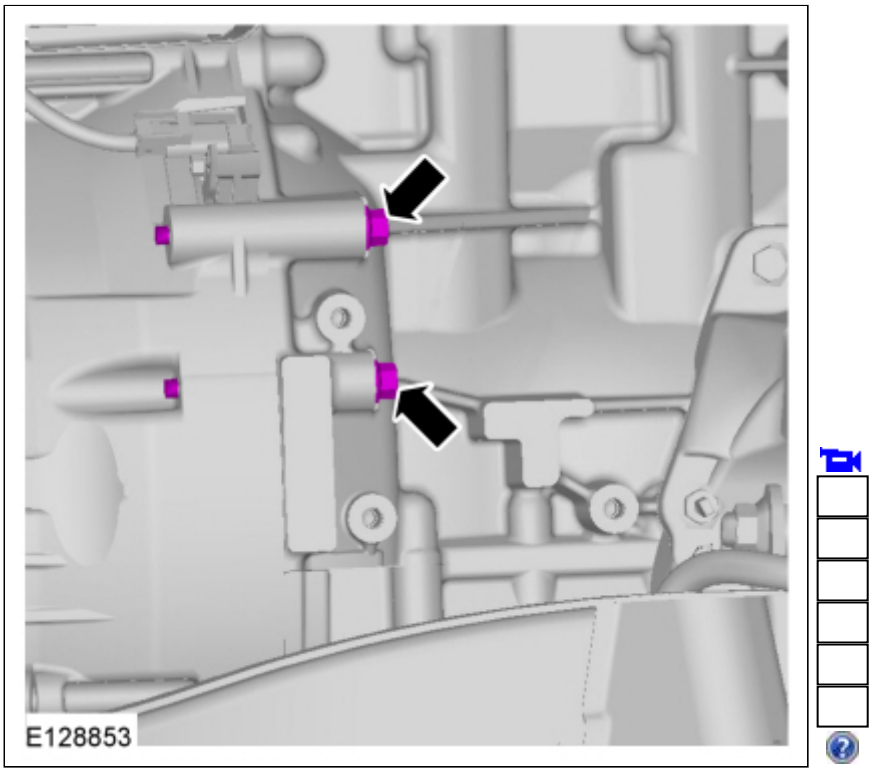
14. *Torque*: 55 Nm



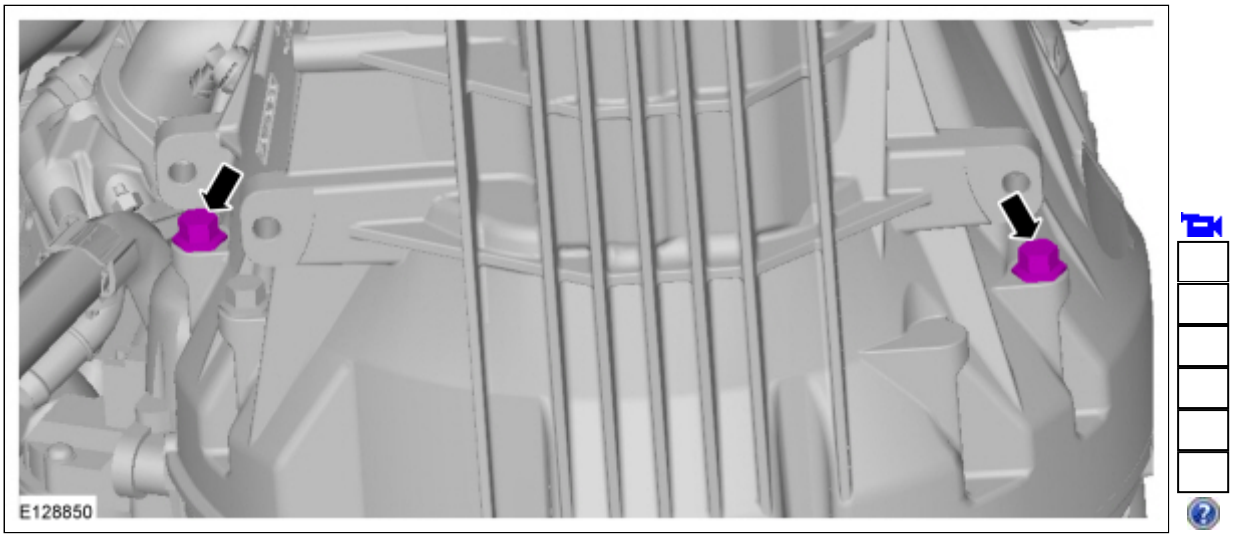
15. *Torque*: 55 Nm



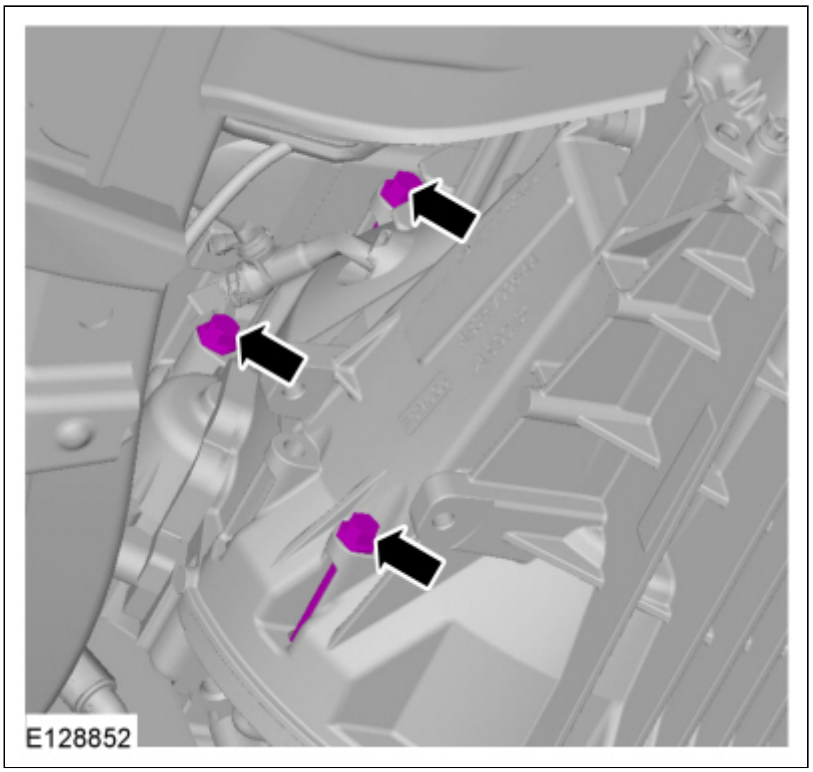
16. *Torque*: 50 Nm



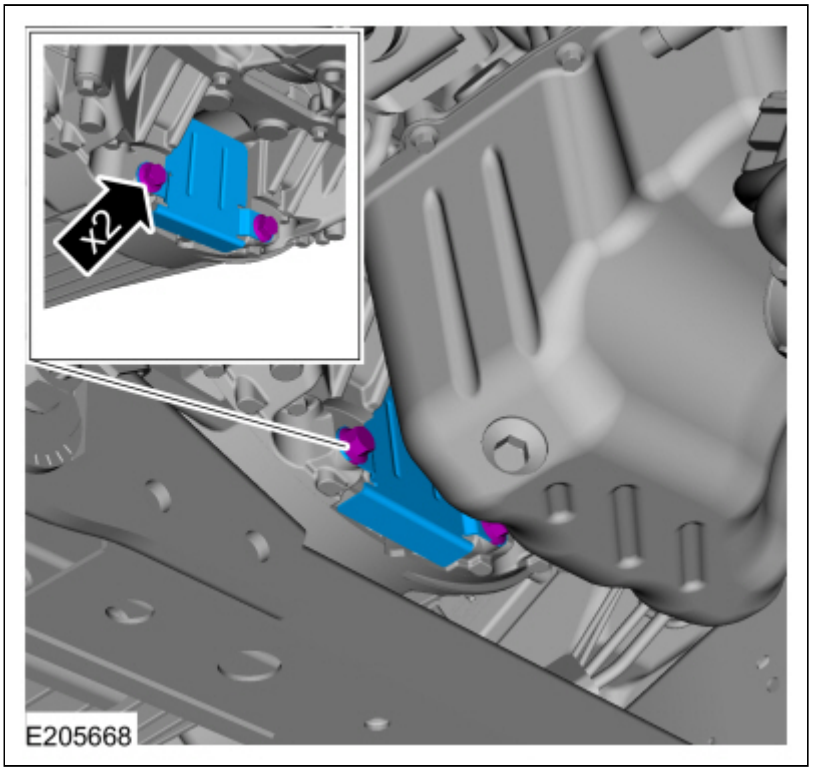
17. *Torque*: 50 Nm



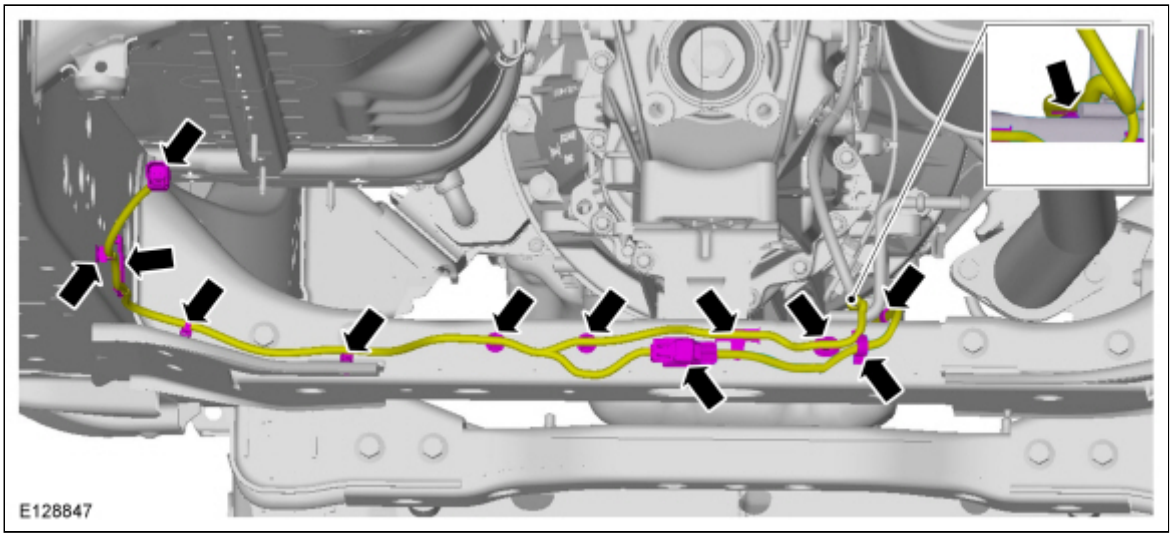
18. *Torque*: 50 Nm



19. *Torque*: 50 Nm

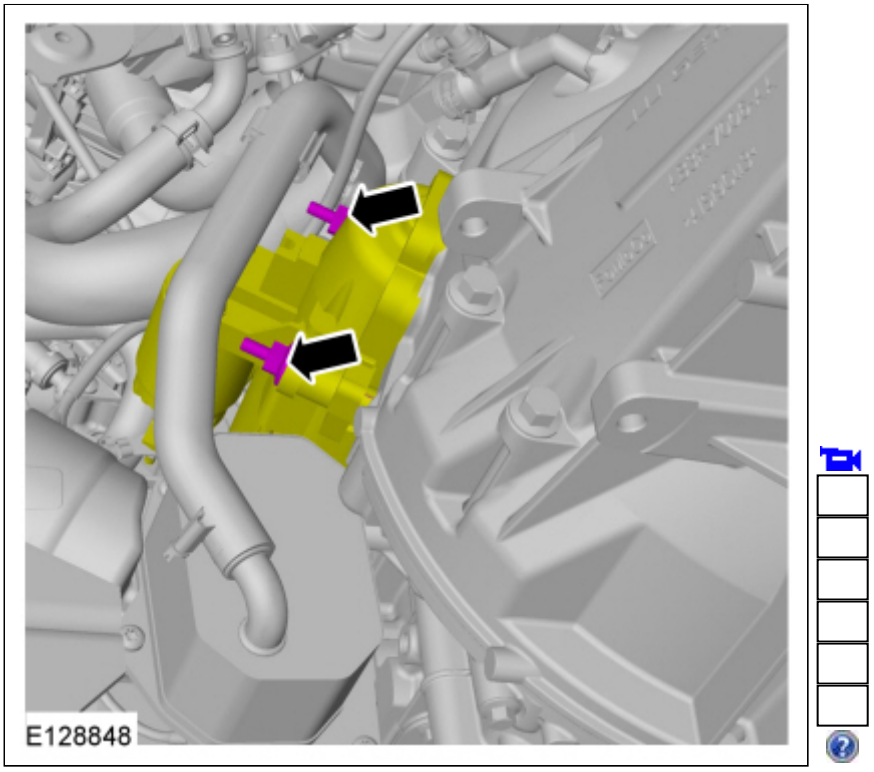


20.

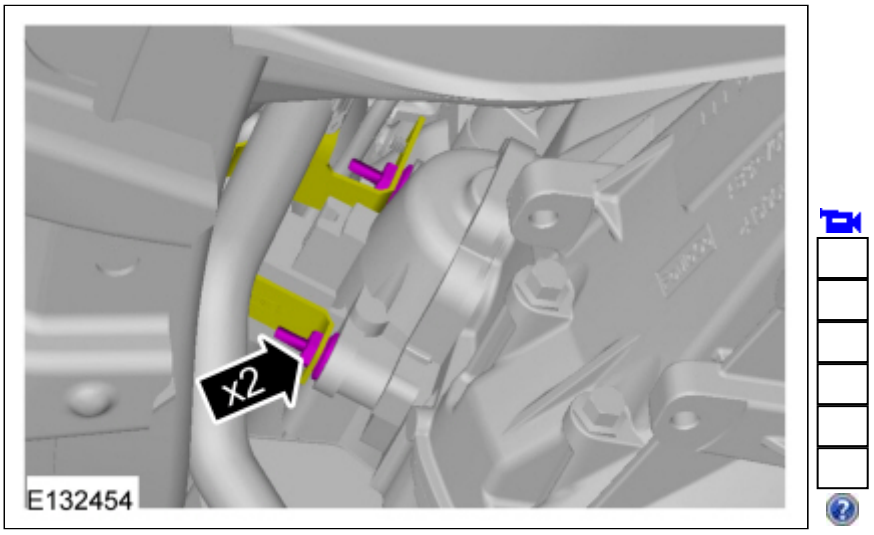


21. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

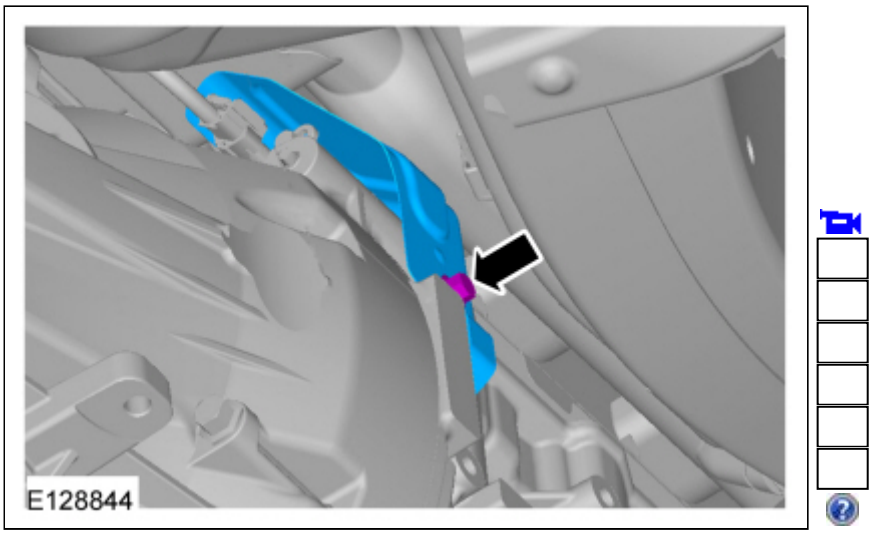
22. *Torque*: 35 Nm



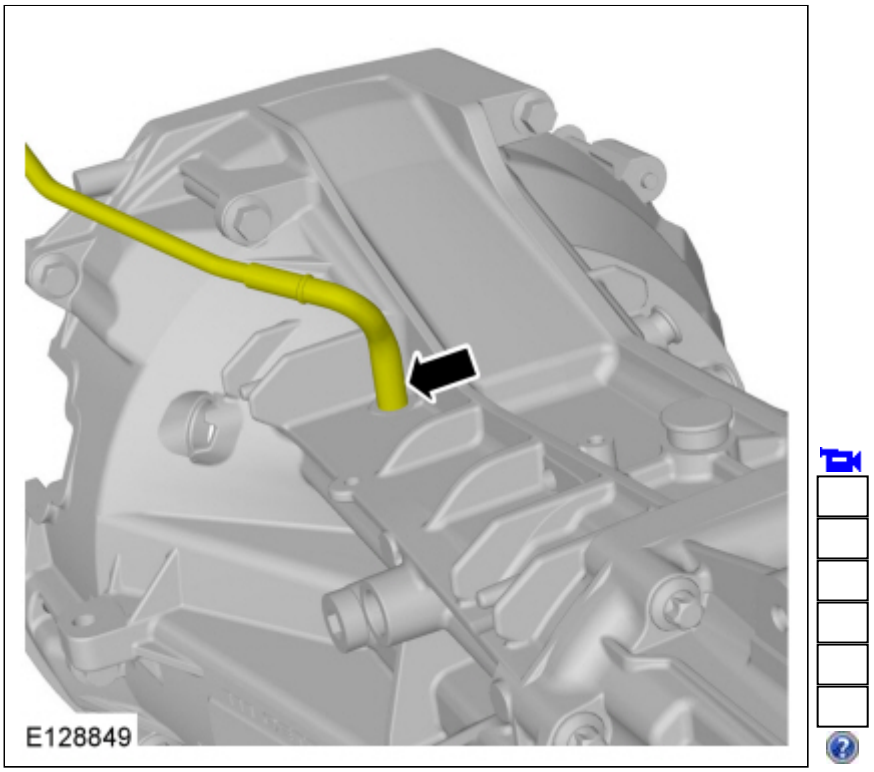
23. *Torque*: 35 Nm



24. *Torque*: 25 Nm

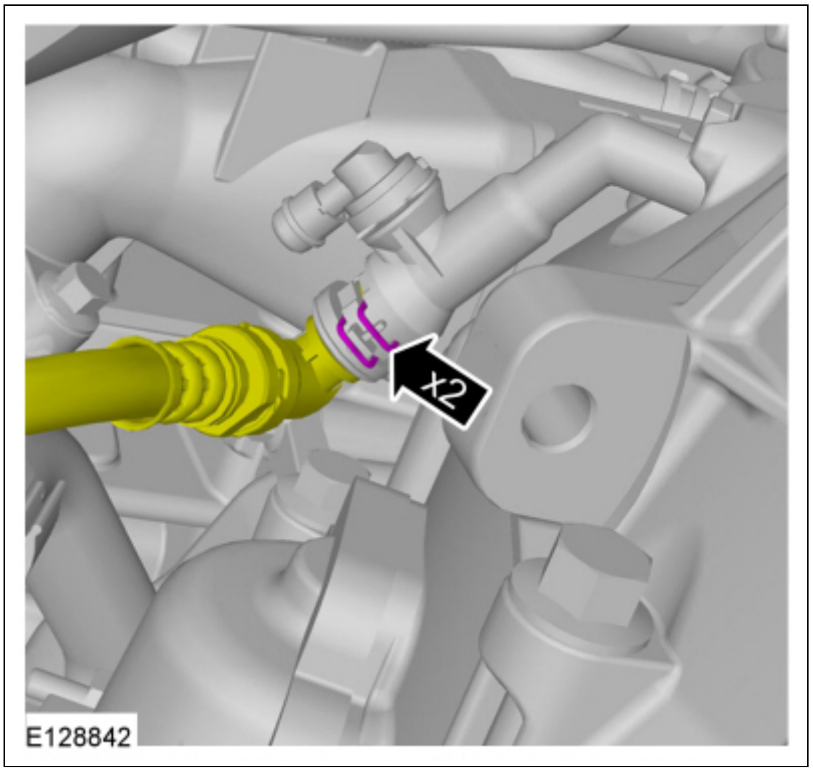


25.



26. **NOTICE: Cap the clutch slave cylinder supply line to prevent fluid loss or dirt ingress.**

NOTE: *If the clutch fluid comes into contact with the painted area, rinse off the affected areas with cold water without delay.*



27. Refer to: Transmission Draining and Filling (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, General Procedures).
28. Refer to: Gearshift Cable Adjustment (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, General Procedures).
29. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
30. Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

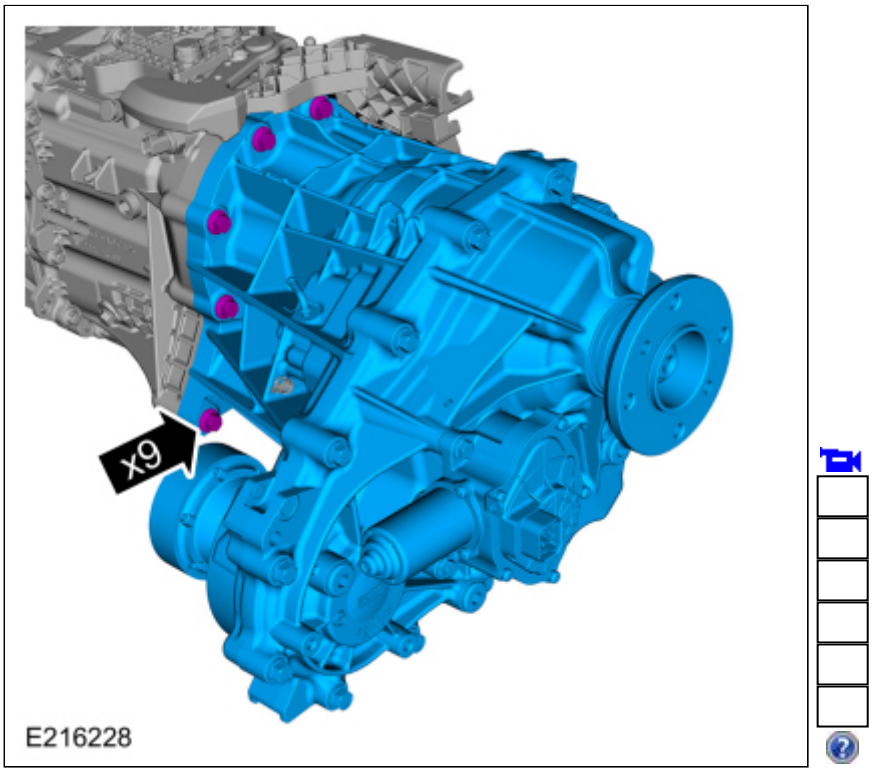
Transmission - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, 2.2L Duratorq-TDCi (Puma) Diesel, 4x4

Base Part Number: 7000

Special Tool(s) / General Equipment

Feeler Gauge
Transmission Jack
Retaining Strap

1. *Torque*: 47 Nm

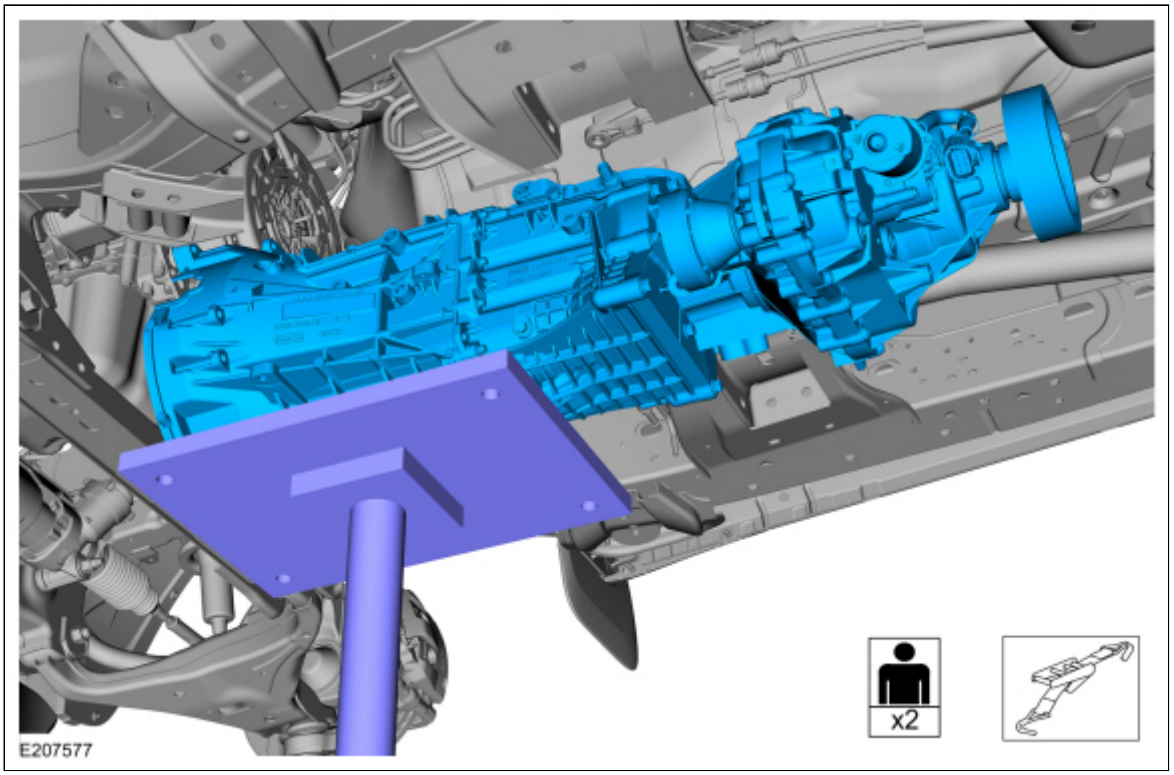


2. Check the pilot bearing for damage. If damaged, install a new pilot bearing.
   Refer to: Pilot Bearing - Diesel (308-01B Clutch - 6-Speed Manual Transmission - MT82, Removal and Installation).

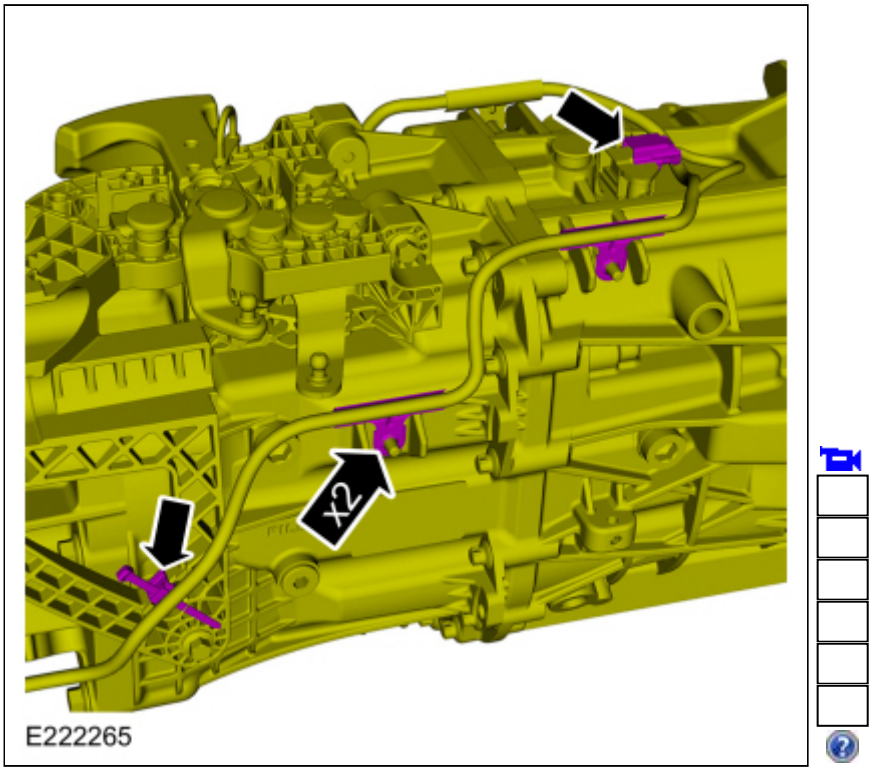
3. **NOTE:** *Do not apply grease to a newly installed pilot bearing.*

4. Refer to: Catalytic Converter (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00C Exhaust System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

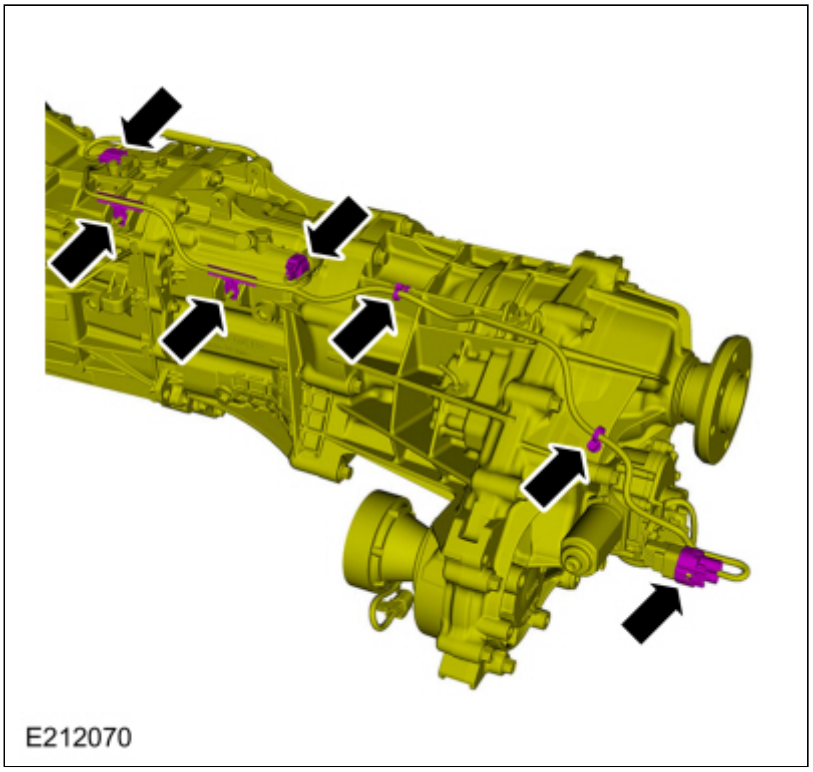
5. Use the General Equipment: Transmission Jack
   Use the General Equipment: Retaining Strap



6.

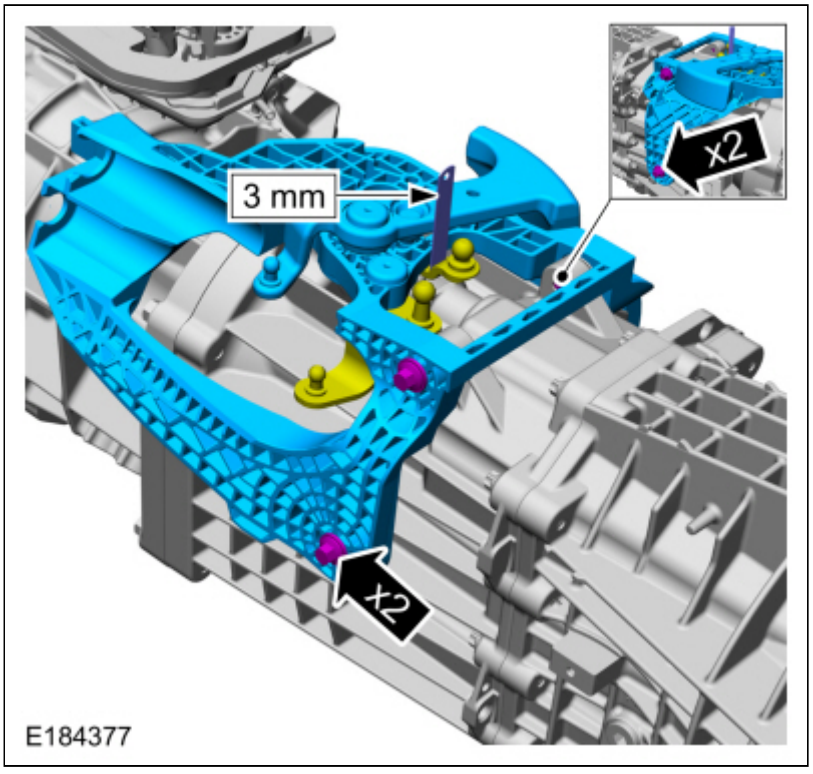


7.

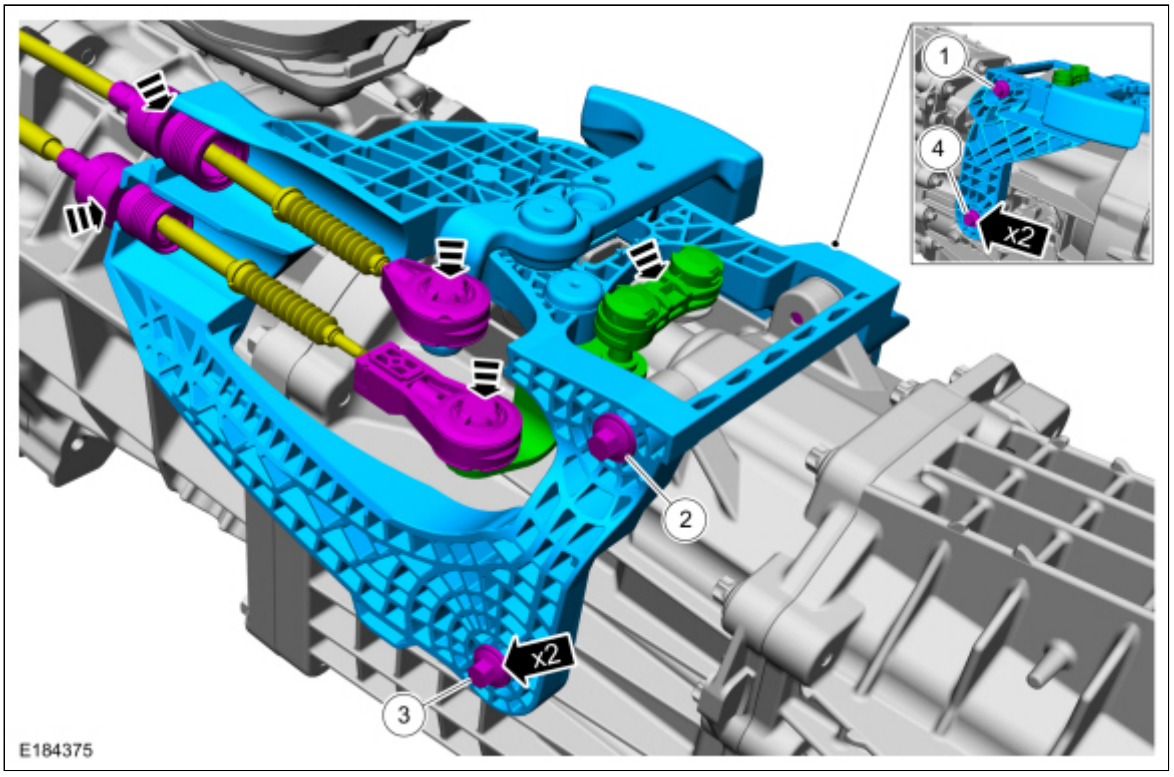


8. **NOTE:** *Only tighten the bolts finger tight at this stage.*

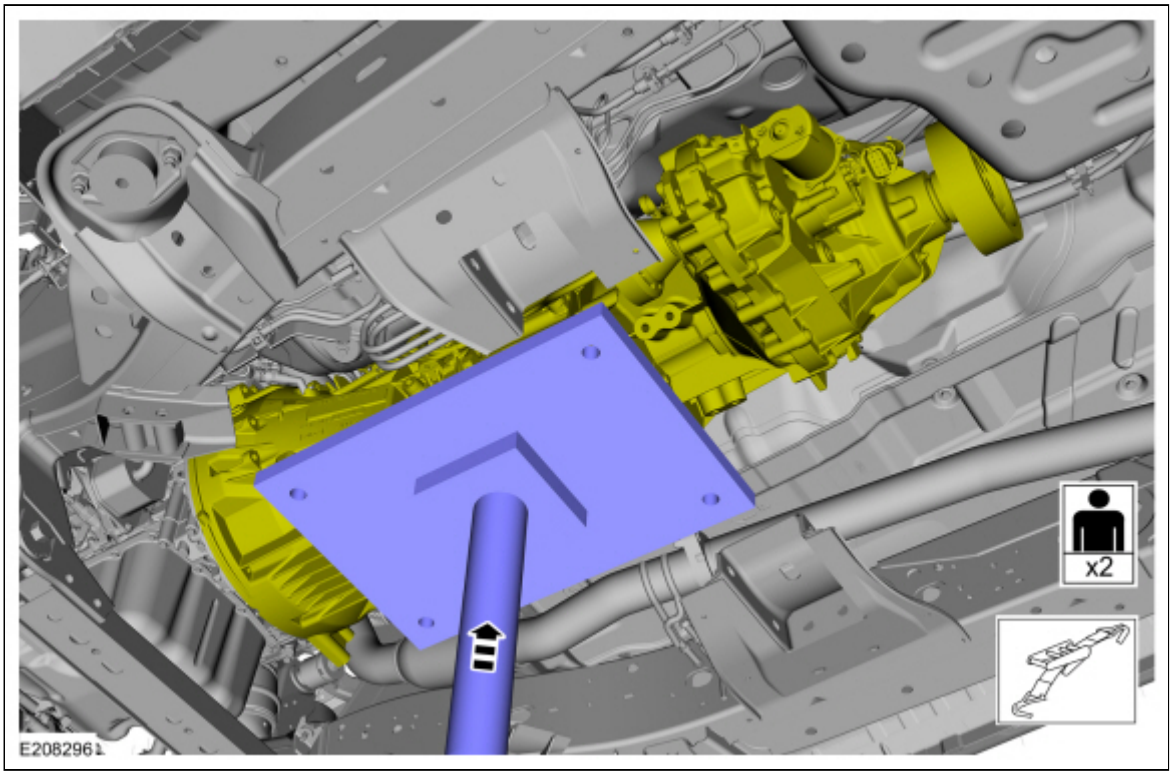
   Use the General Equipment: Feeler Gauge



9. *Torque*: 20 Nm

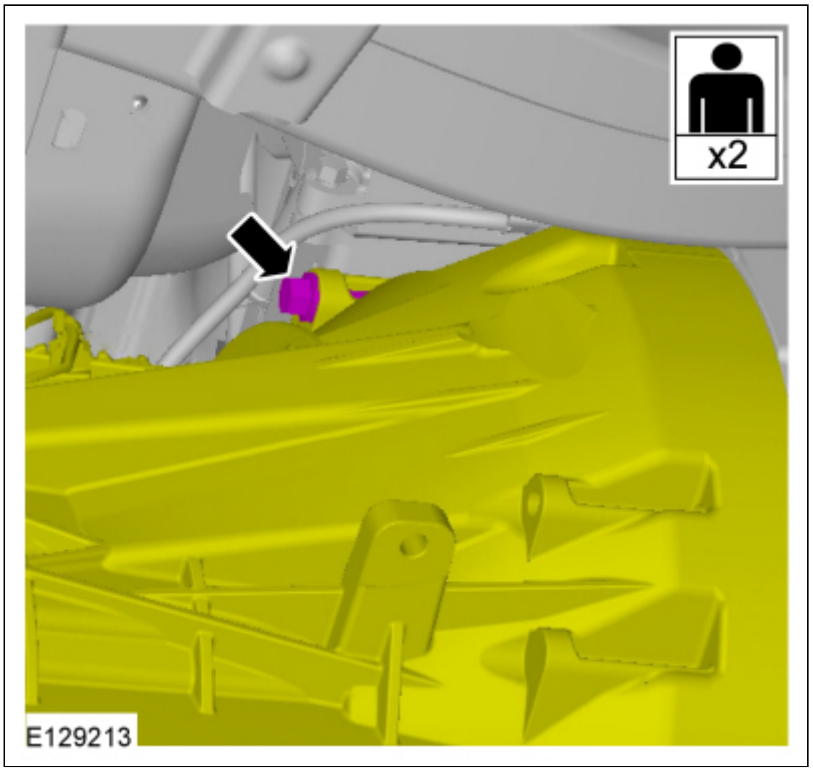


10.

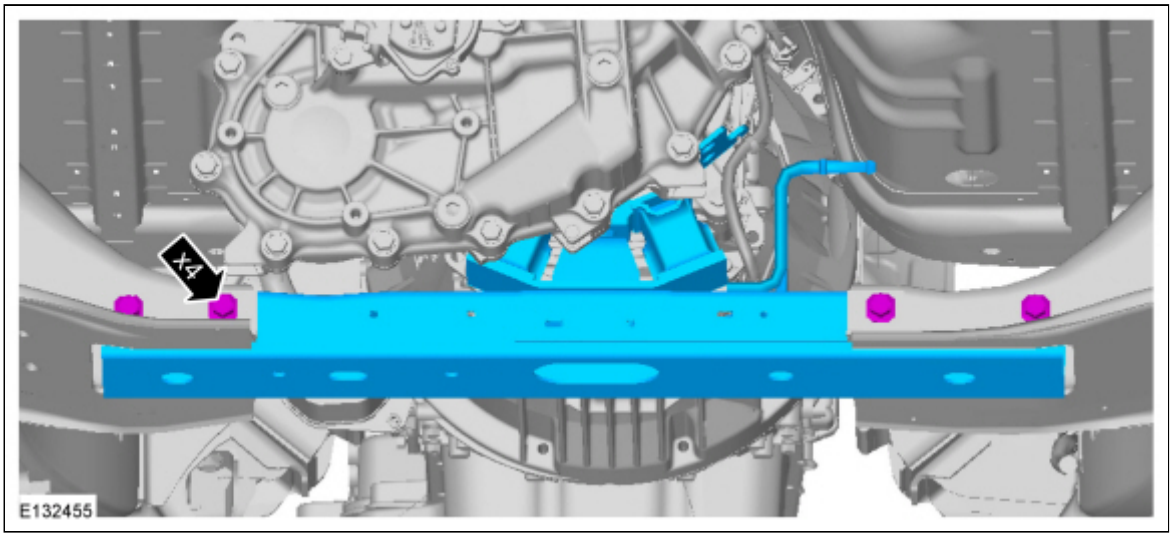


11. **NOTICE: Do not tilt the transmission during removal. This may cause damage to the pilot bearing.**

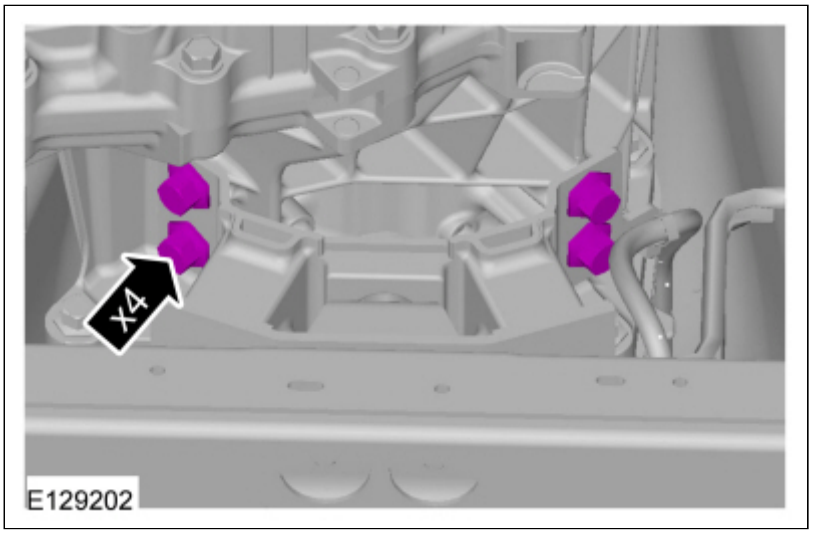
Torque: 50 Nm



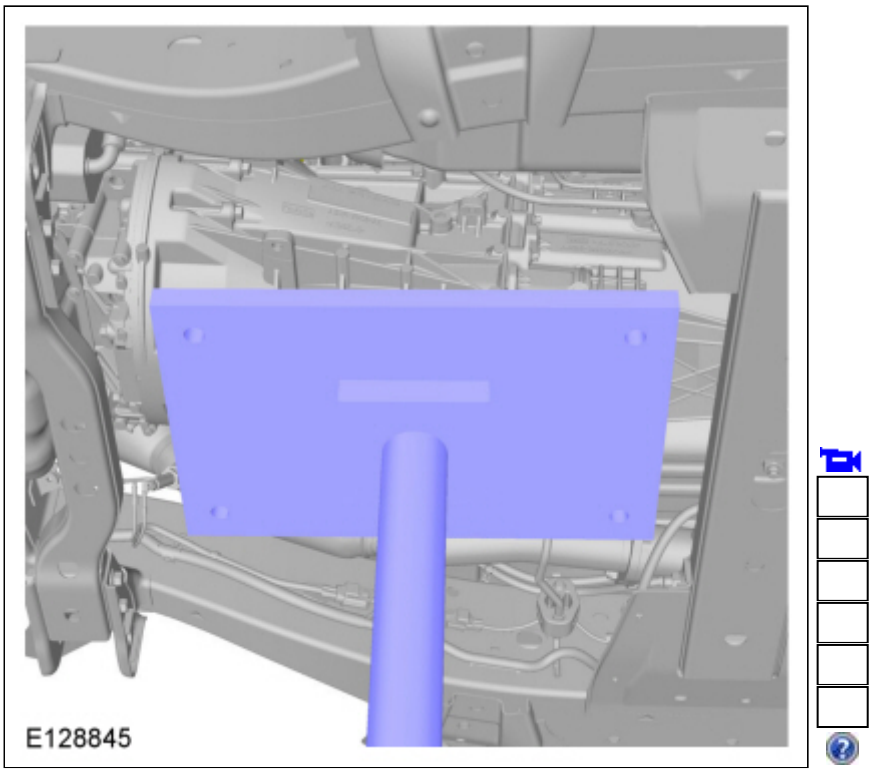
12. *Torque*: 90 Nm



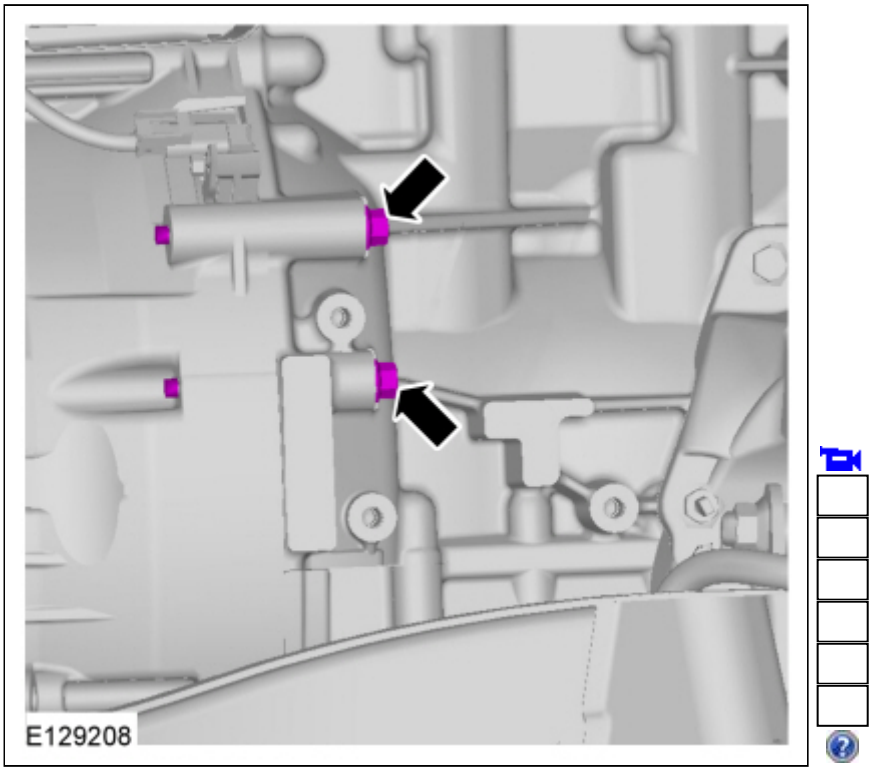
13. *Torque*: 90 Nm



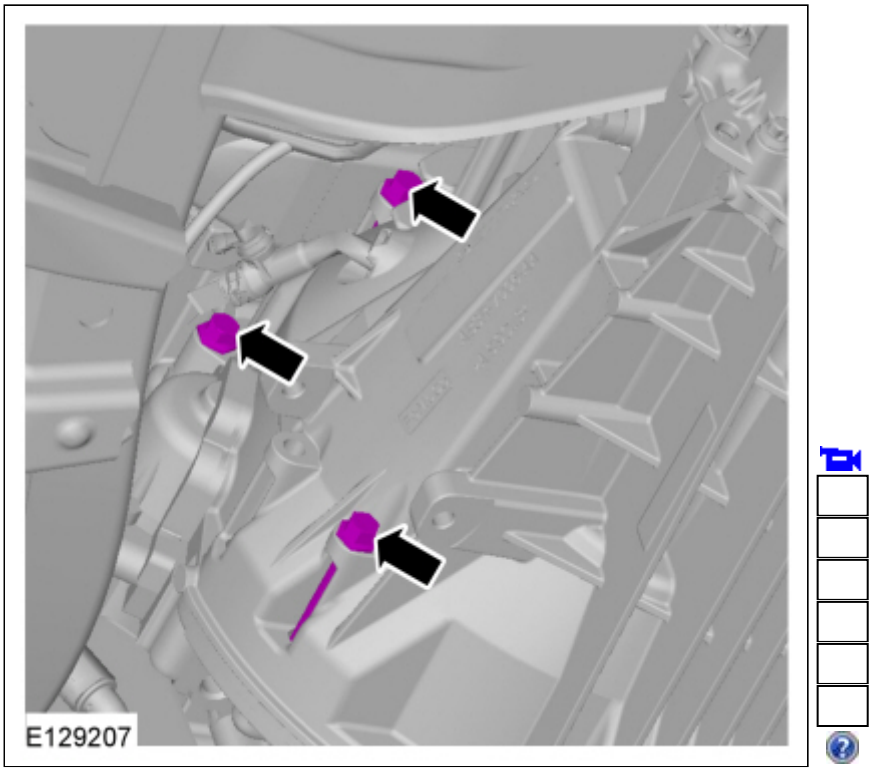
14. Use the General Equipment: Transmission Jack



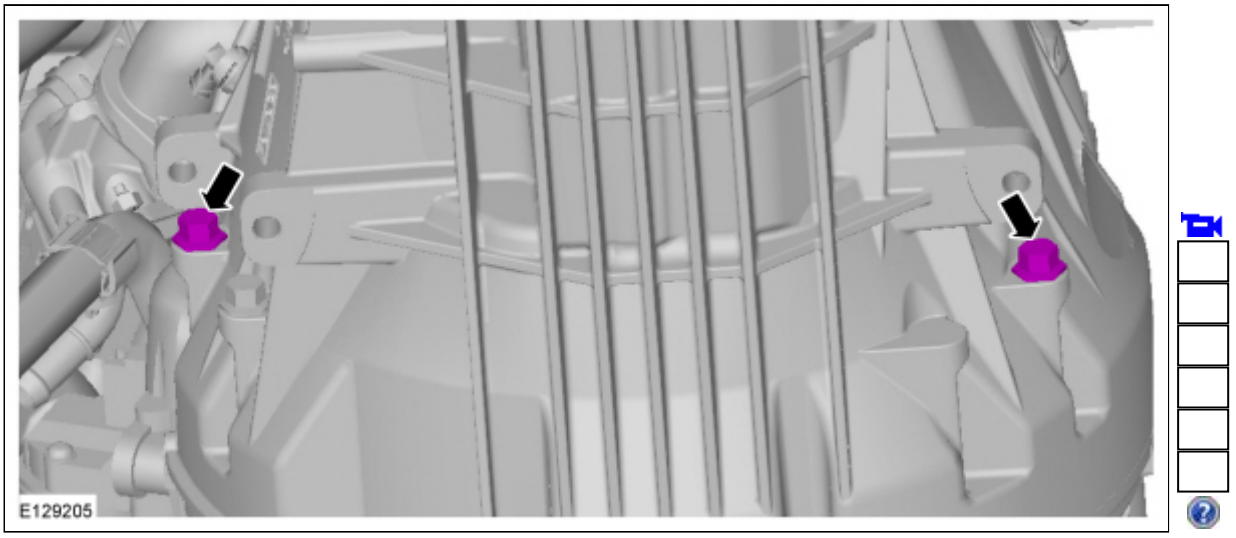
15. *Torque*: 50 Nm



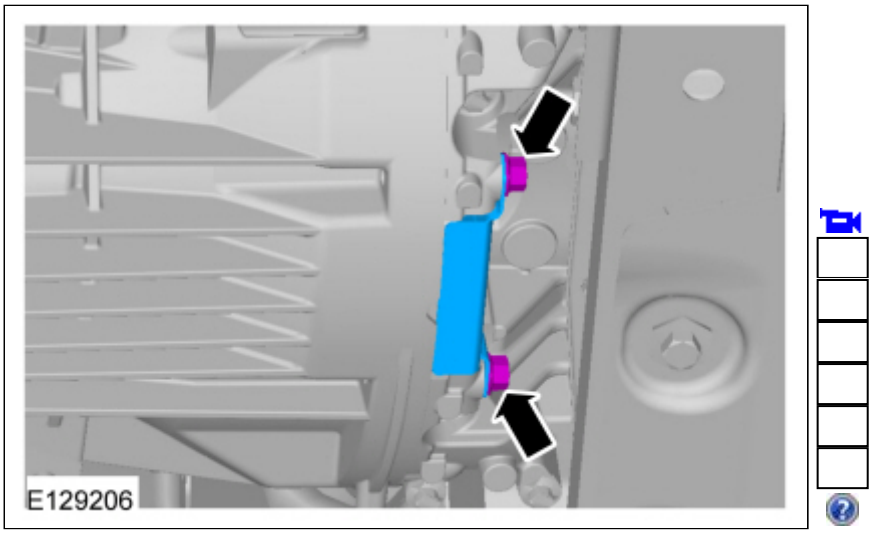
16. *Torque*: 50 Nm



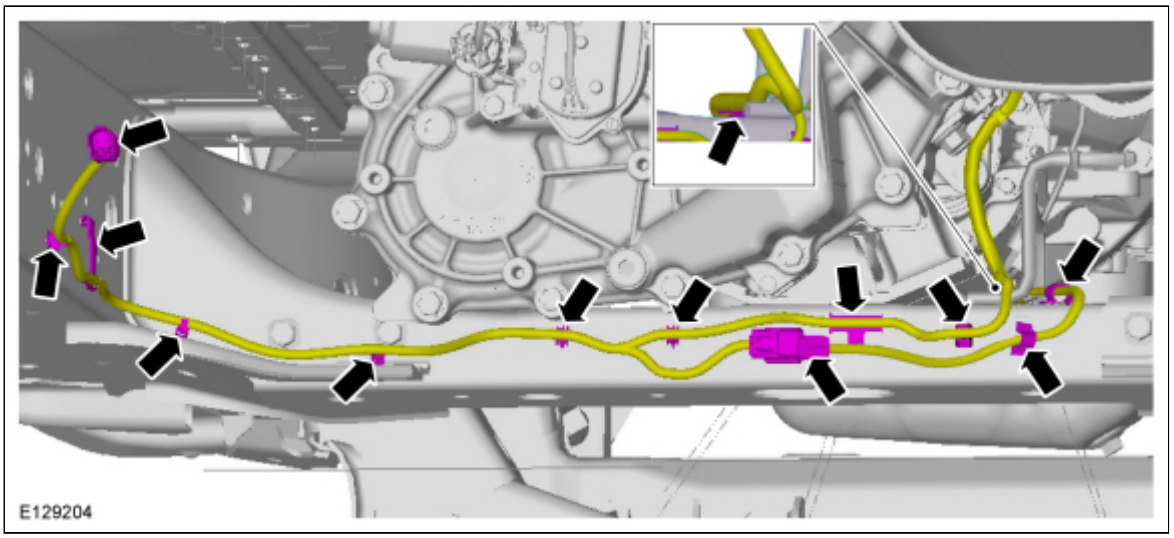
17. *Torque*: 50 Nm



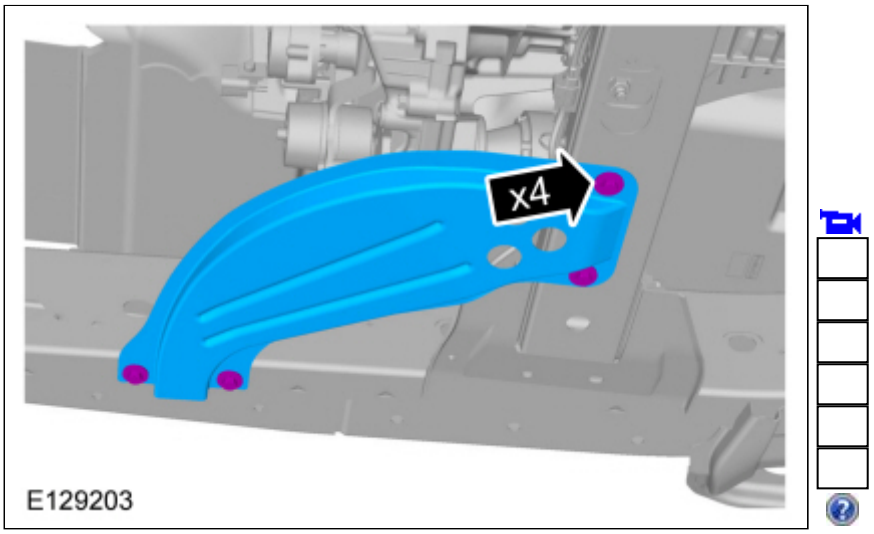
18. *Torque*: 50 Nm



19.

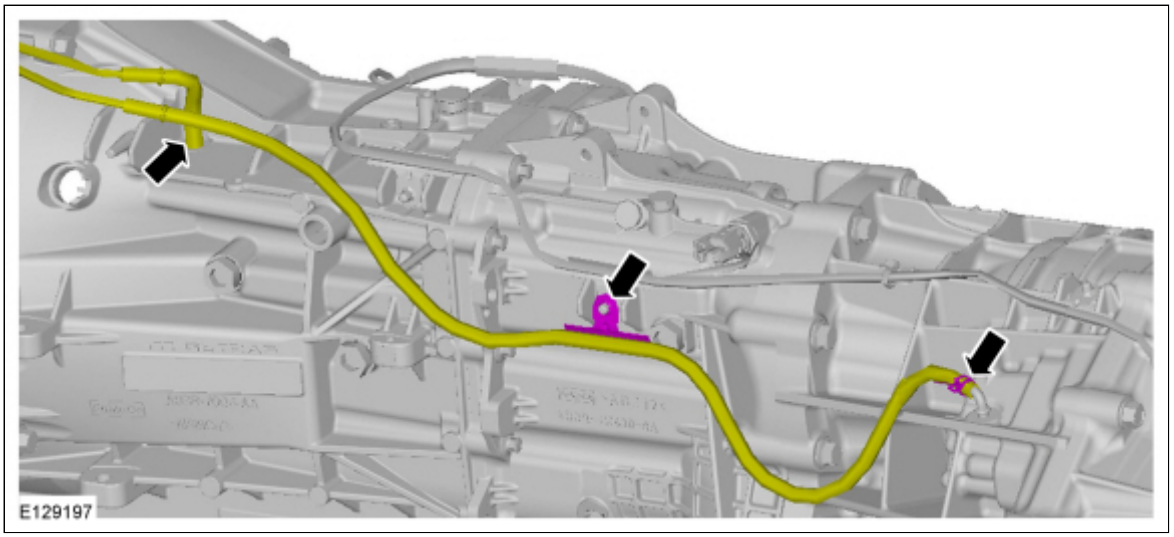


20. *Torque*: 50 Nm

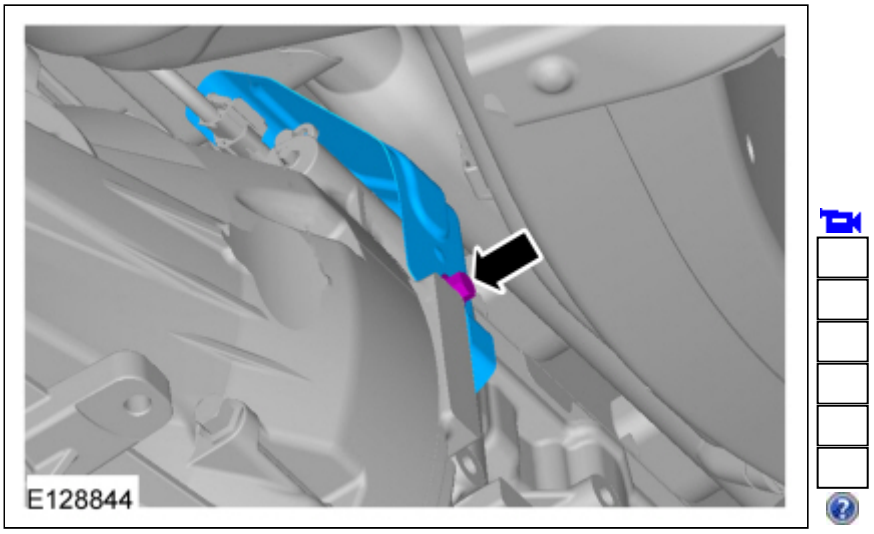


21. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
    Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).

22.

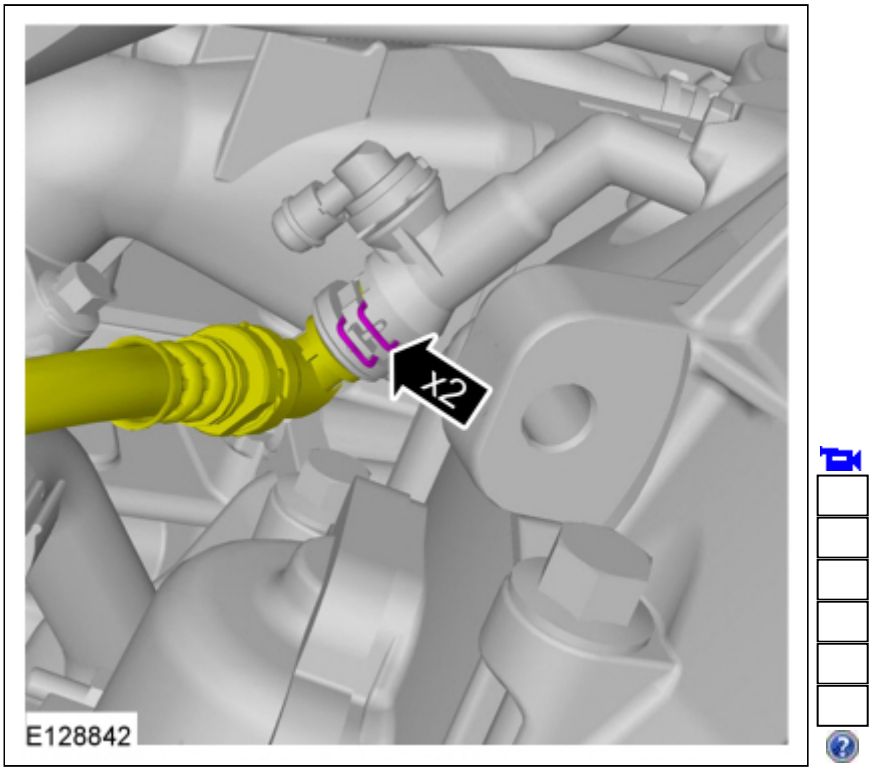


23. *Torque*: 25 Nm



24. Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
    Refer to: Starter Motor (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Removal and Installation).
25. **NOTICE: Cap the clutch slave cylinder supply line to prevent fluid loss or dirt ingress.**

    NOTE: *If the clutch fluid comes into contact with the painted area, rinse off the affected areas with cold water without delay.*

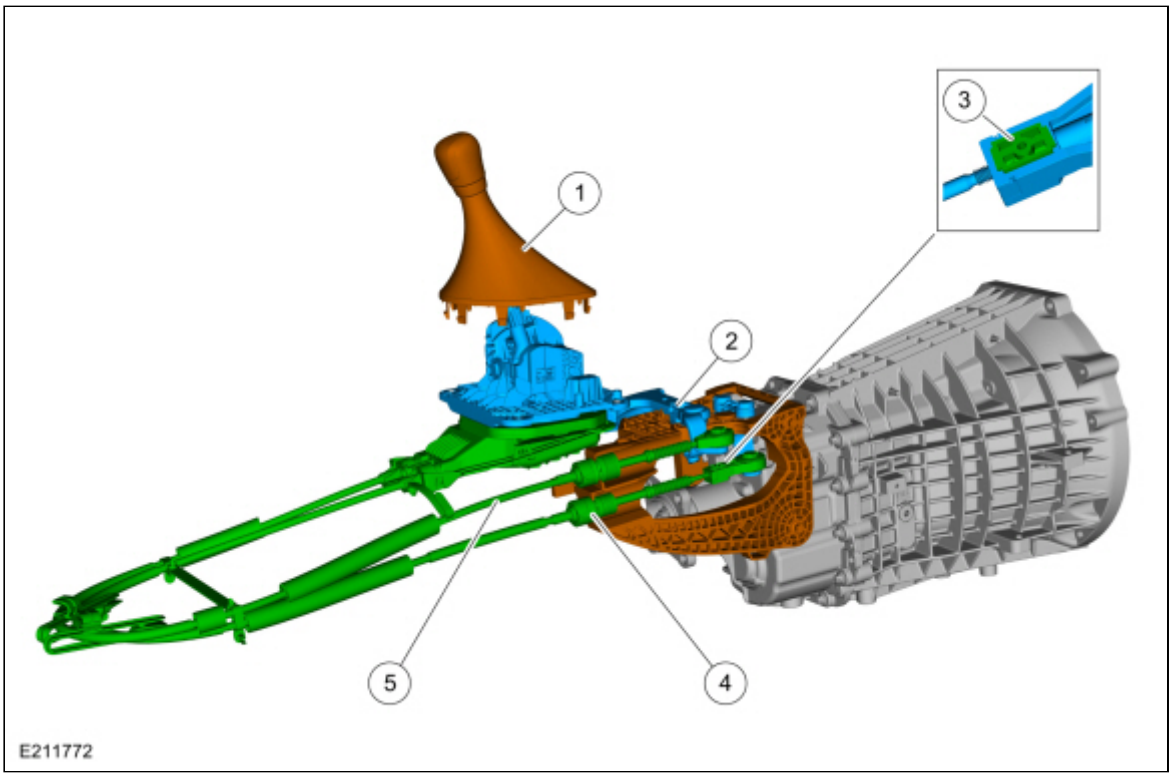


26. Refer to: Transmission Draining and Filling (308-03B Manual Transmission - 6-Speed Manual Transmission - MT82, General Procedures).
27. Refer to: Clutch System Bleeding (308-02B Clutch Controls - 6-Speed Manual Transmission - MT82, General Procedures).
28. Refer to: Gearshift Cable Adjustment (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, General Procedures).
29. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

External Controls - Component Location

External Controls - Gear selector unit and gearshift cables



Item	Part Number	Description
1	—	Selector lever assembly
2	—	Shift arm with damping weight
3	—	Selector cable adjusting mechanism
4	—	Selector cable
5	—	Gearshift cable

Copyright © 2016 Ford Motor Company

External Controls - Overview

MT75 Manual Transmission External Controls

The length of the selector cable can be adjusted.

A spring in the gearshift lever pulls the selector cable into the neutral position between 3rd and 4th gear.

In order to ensure precision shifting as well as to prevent increased wear, the gearshift cables must be precisely adjusted. The instructions in the current workshop literature must be observed for this.

Incorrect adjustment of the gearshift cables or incorrect operation by the driver during driving can cause shifting problems and excessive wear of the shift forks as well as of the synchronizers.

Copyright © 2016 Ford Motor Company

External Controls

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.
3. Make sure that the gearshift cables are correctly routed and not under any tension from other components.
4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
5. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• External controls do not operate freely.	• Gearshift cables incorrectly adjusted. • Gearshift lever damaged. • Selector mechanism damaged. • Gearshift cables damaged.	• ADJUST the gearshift cables. • GO to Pinpoint Test A

Pinpoint Tests

PINPOINT TEST A : STIFF GEARSHIFT

A1 CHECK THE GEARSHIFT LEVER

- Detach the gearshift cables from the gearshift lever.

Is the gearshift lever difficult to operate?

Yes	Install a new gearshift lever.
No	GO to A2

A2 CHECK THE GEARSHIFT CABLES

- Attach the gearshift cables to the gearshift lever.
- Detach the gearshift cables from the transaxle.

Is the gearshift lever difficult to operate?

Yes	Install new gearshift cables.
No	Check the selector mechanism.

Copyright © 2016 Ford Motor Company

Gearshift Cable Adjustment

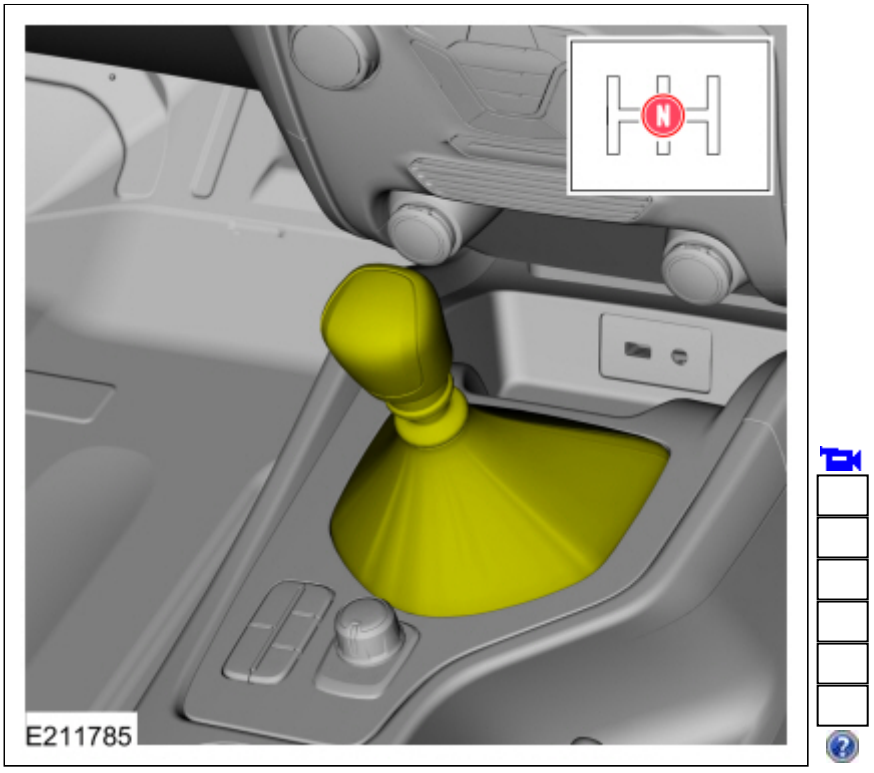
Special Tool(s) / General Equipment

6 mm Drill Bit

Adjustment

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

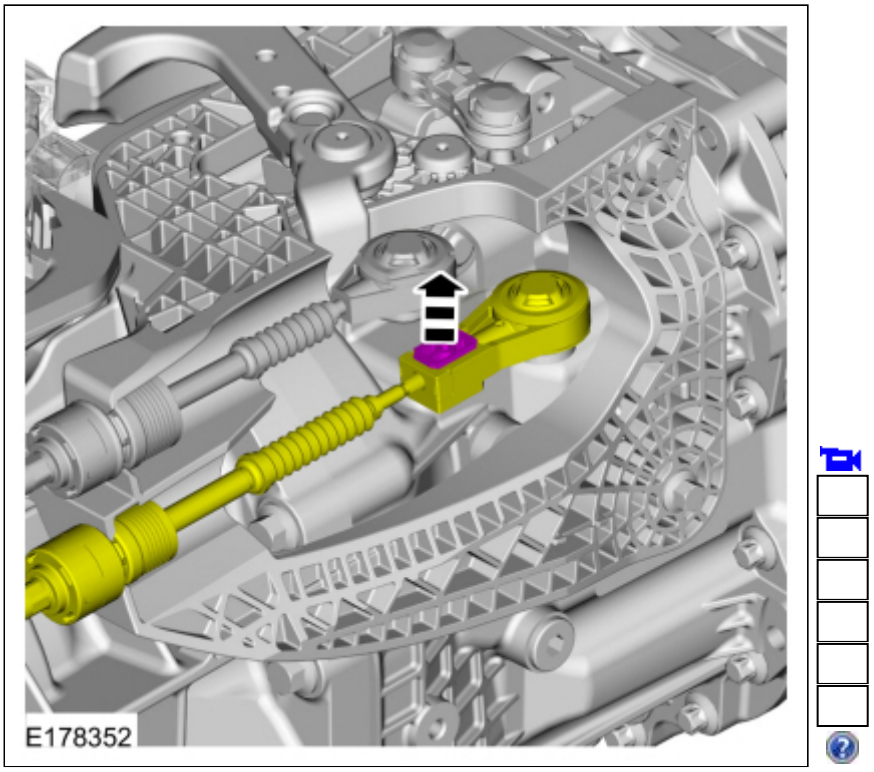
   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. 

3. Refer to: Gearshift Lever Boot (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).

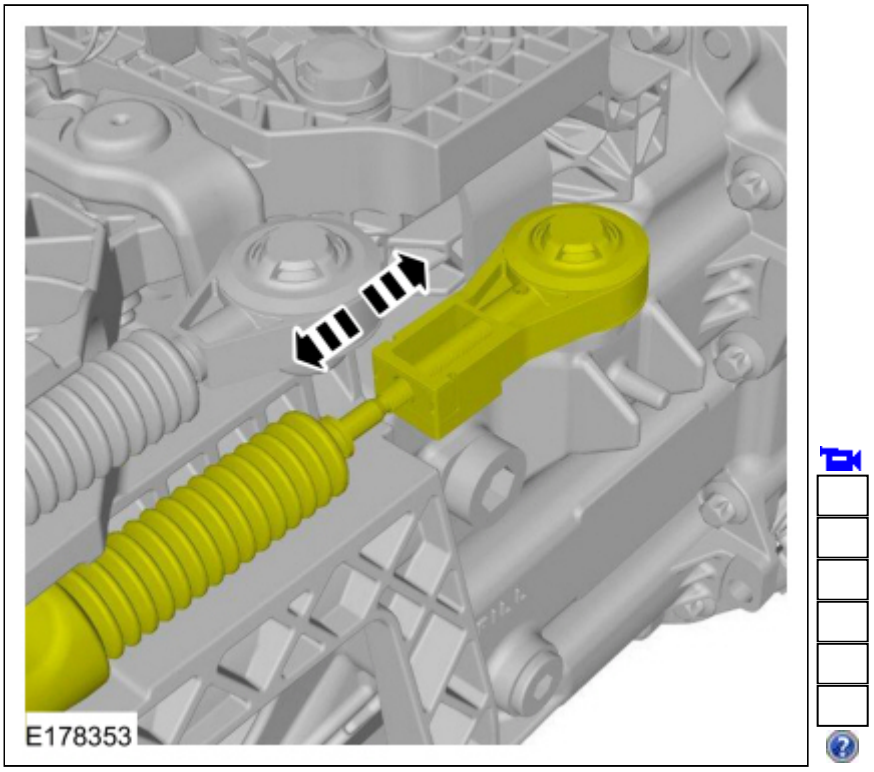
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

5.



NOTE: *Move the select lever side to side and verify free motion.*

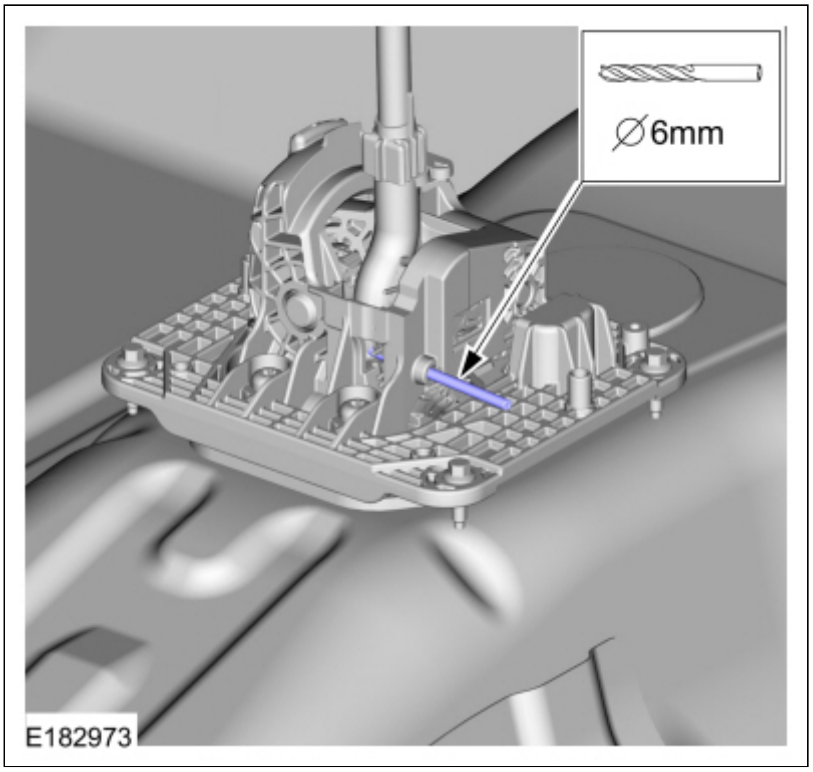
6.



7. Lower the Vehicle.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

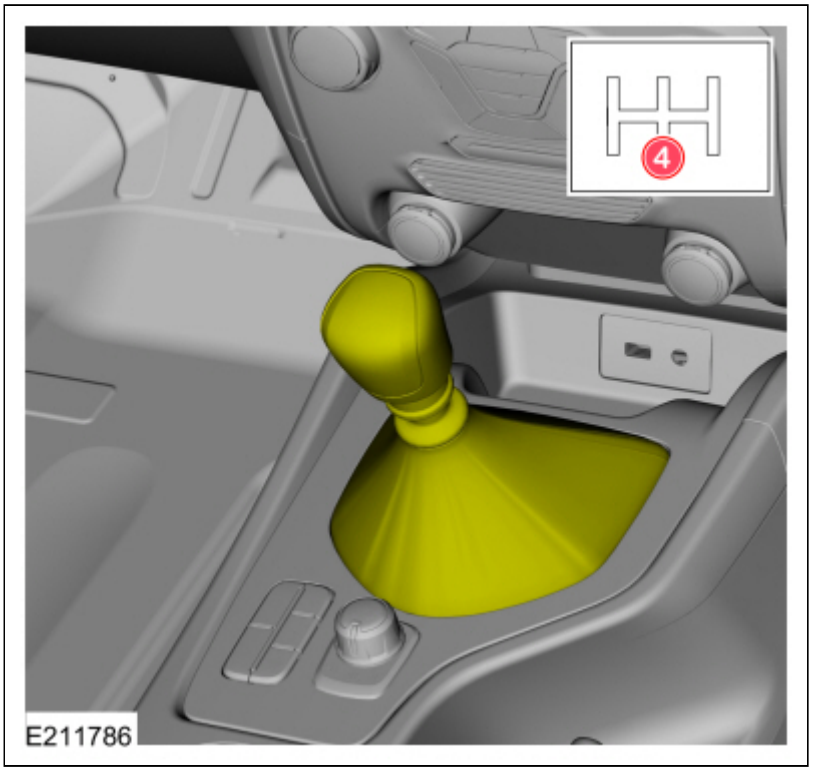
NOTE: *Install the 6mm drill bit to lock the gearshift lever in to 3-N-4 plane.*

8. Use the General Equipment: 6 mm Drill Bit



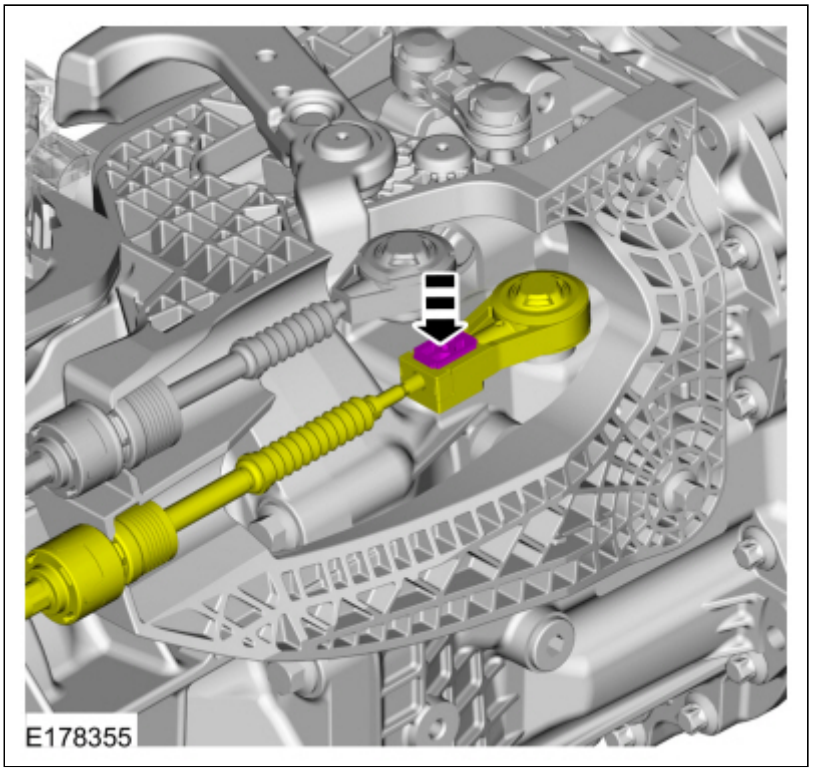
NOTE: *By placing the gearshift lever into the 4th gear position, it locks the small lever into the N position.*

9.



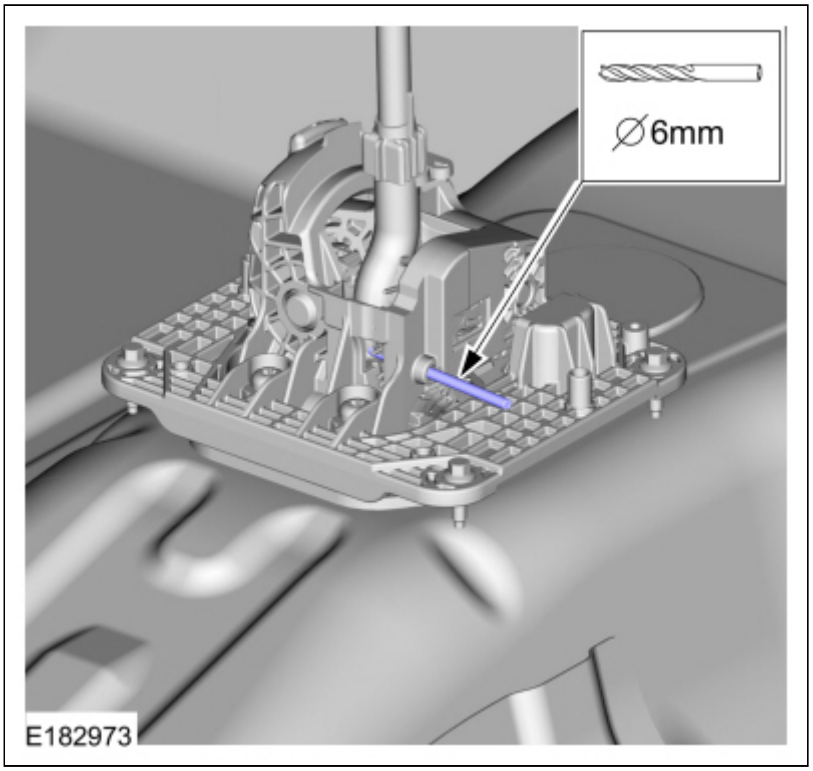
10. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

11.



12. Lower the Vehicle.
    Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

13. Remove the 6mm drill bit.



14. Refer to: Gearshift Lever Boot (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).

Copyright © 2016 Ford Motor Company

Gearshift Cables

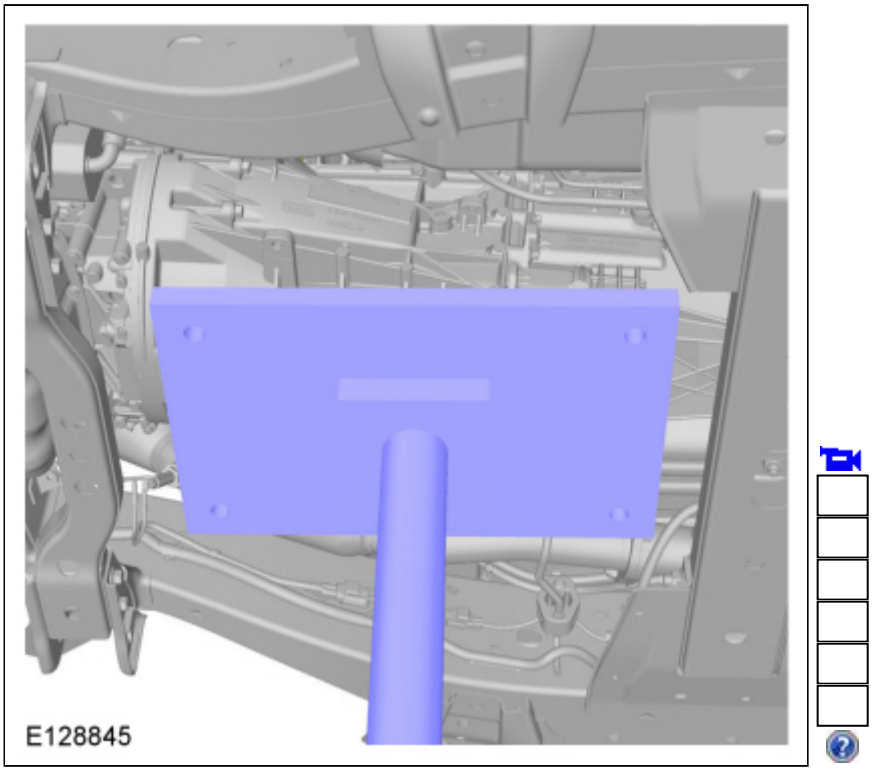
Special Tool(s) / General Equipment

Transmission Jack

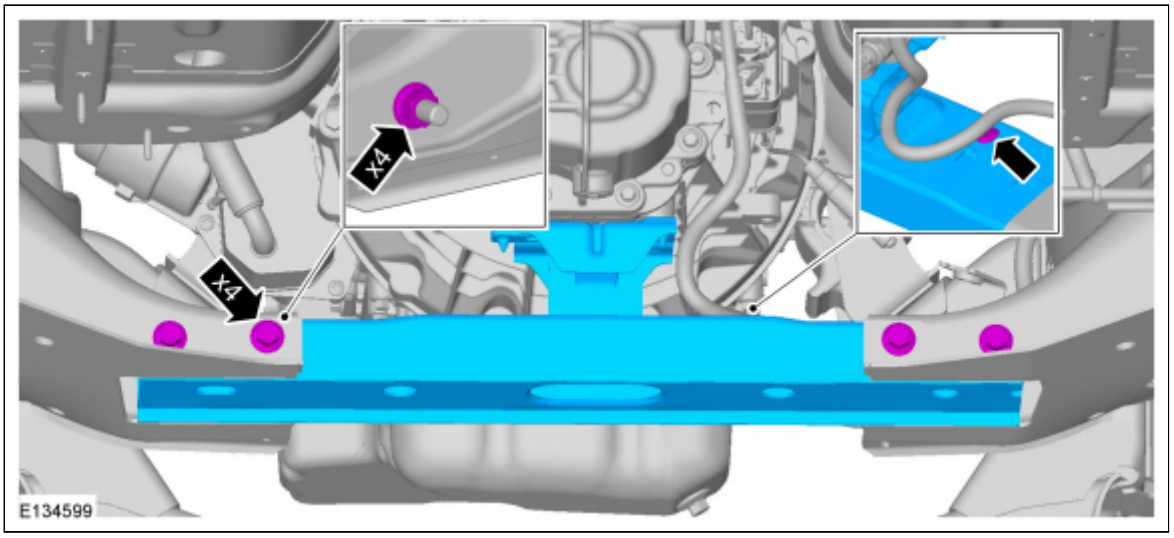
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

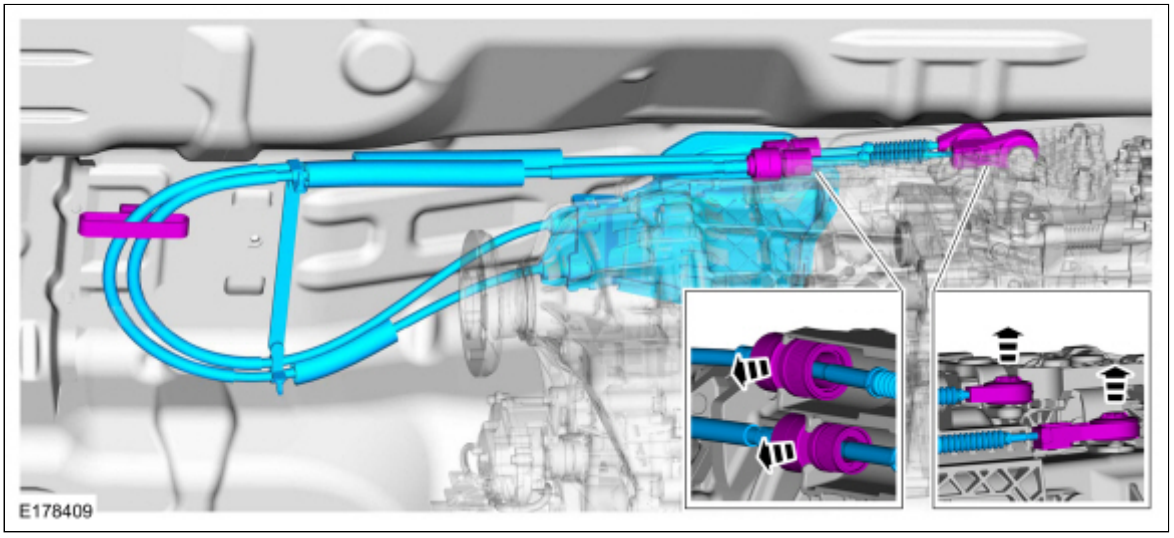
1. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. Refer to: Gearshift Lever (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Install the General Equipment: Transmission Jack



5.

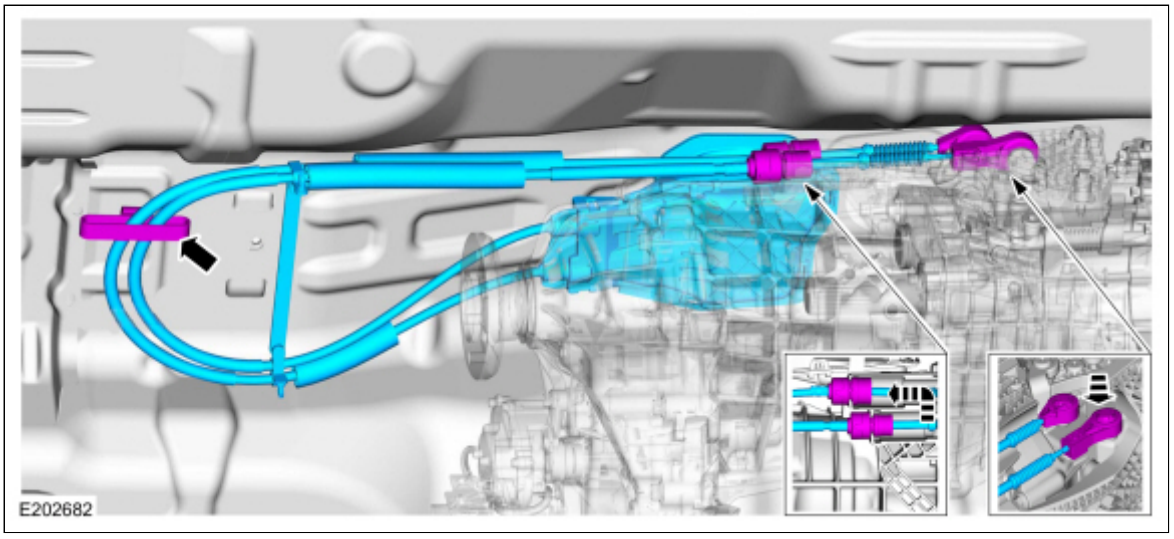


6.

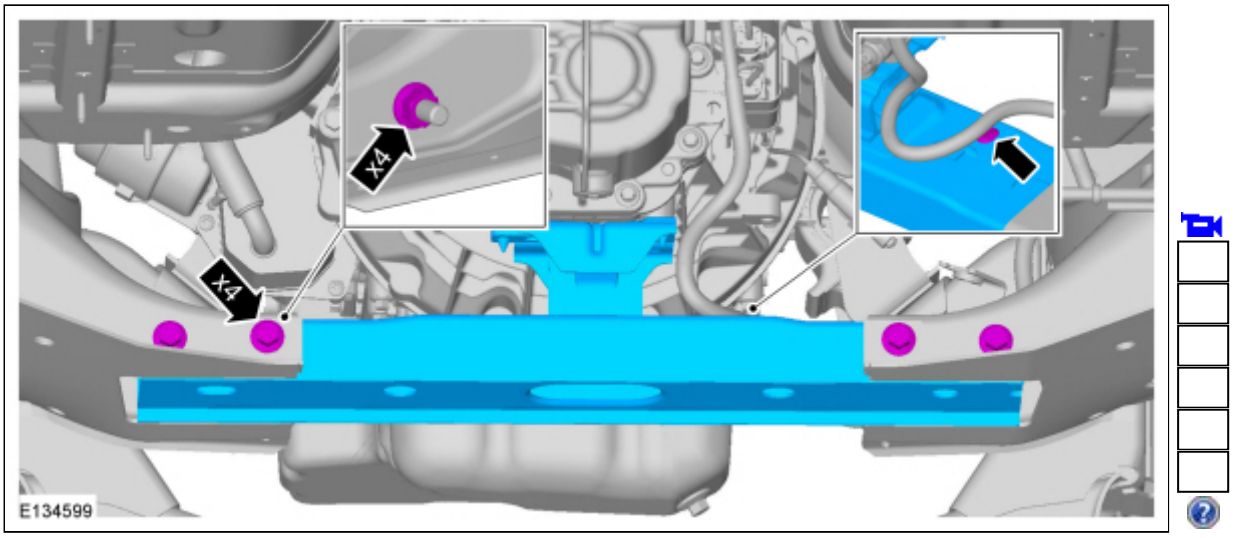


Installation

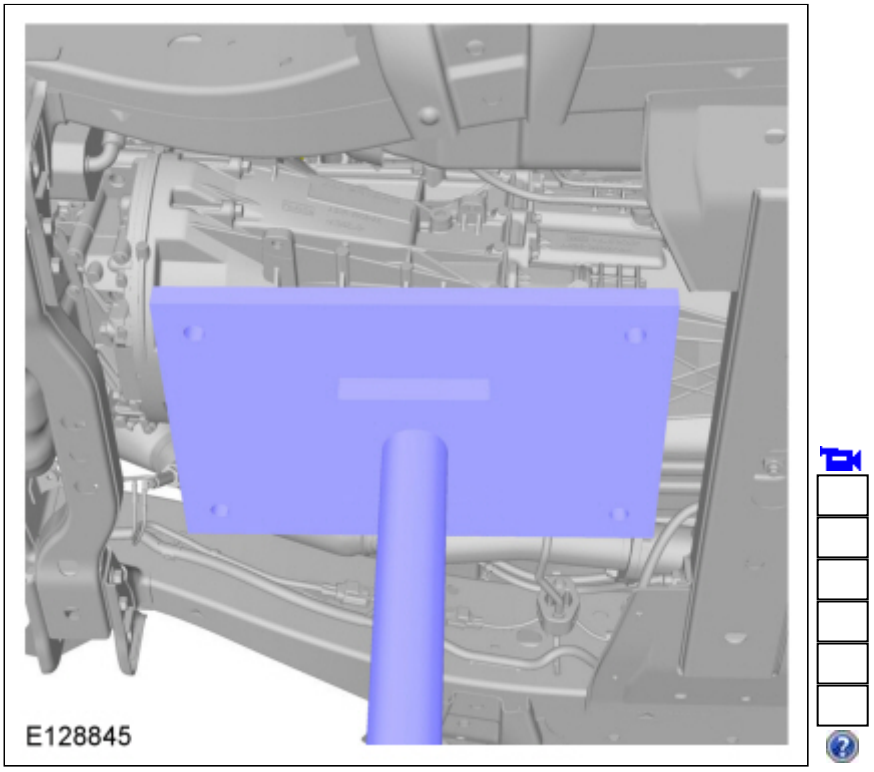
1.



2. *Torque*: 90 Nm



3. Remove the General Equipment: Transmission Jack



4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

5. Refer to: Gearshift Lever (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).

6. Refer to: Gearshift Cable Adjustment (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, General Procedures).

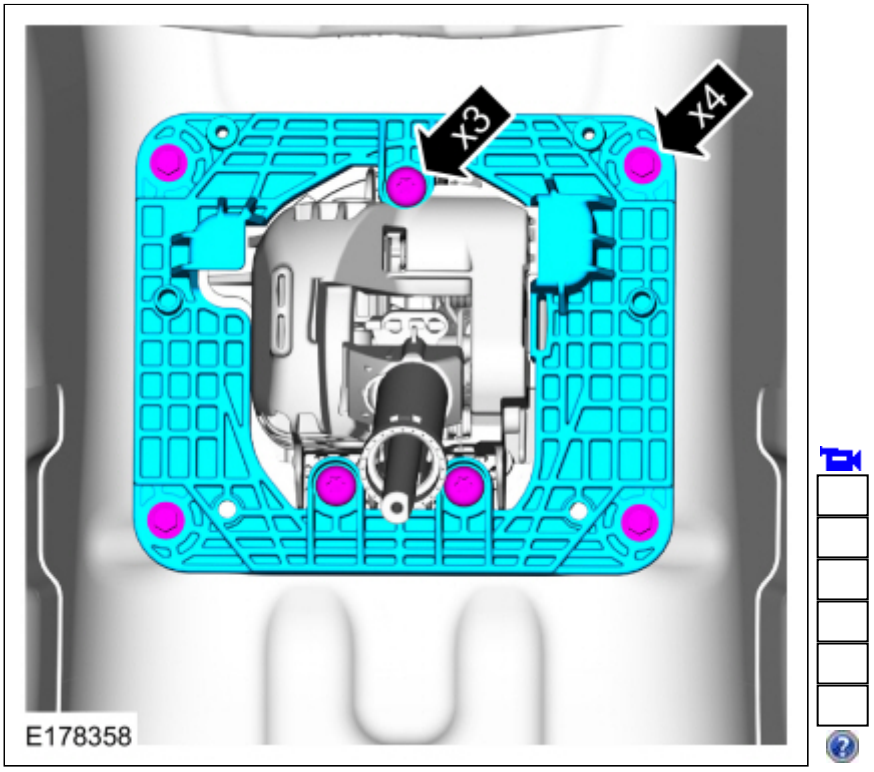
7. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).

Copyright © 2016 Ford Motor Company

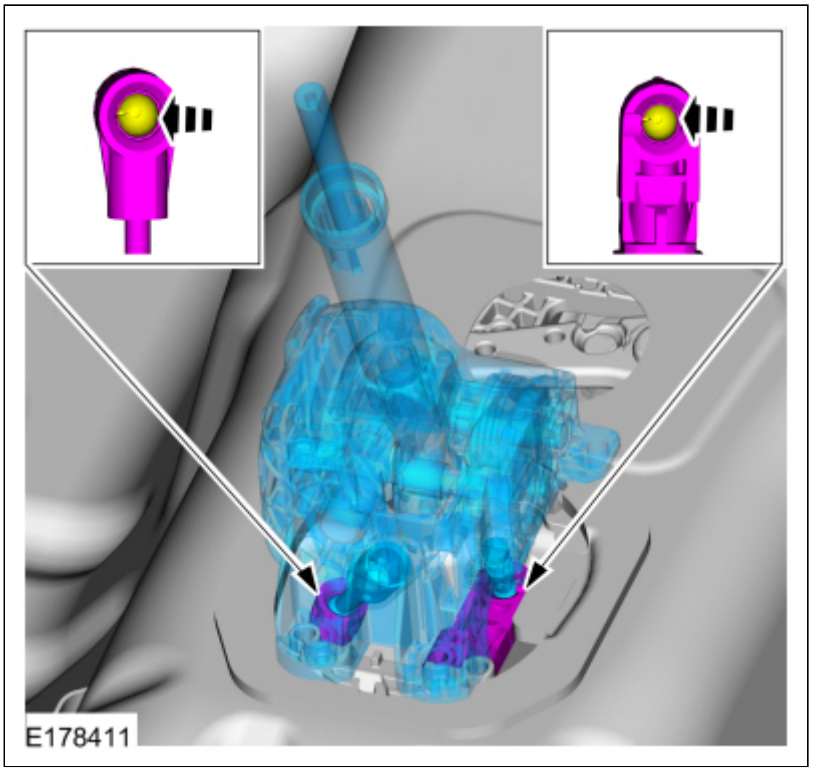
Gearshift Lever

Removal

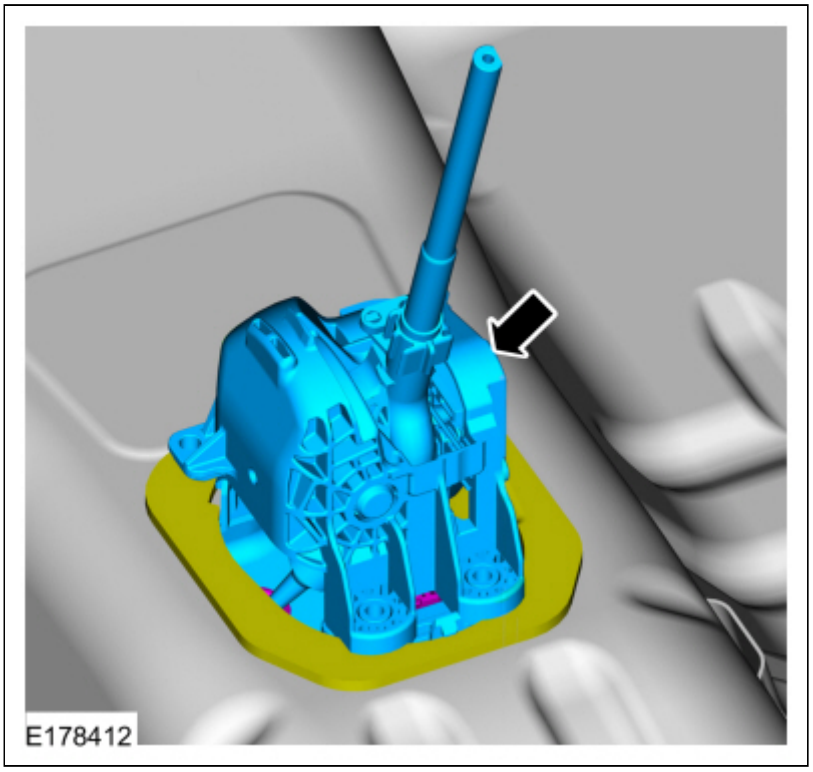
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. Refer to: Gearshift Lever Boot (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
3. 

4.

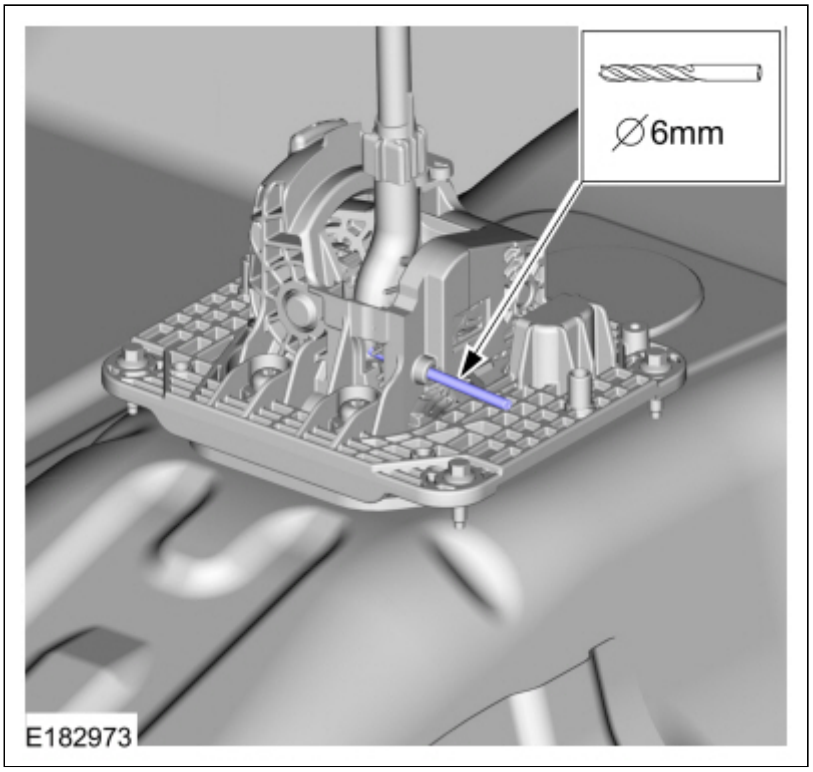


5.

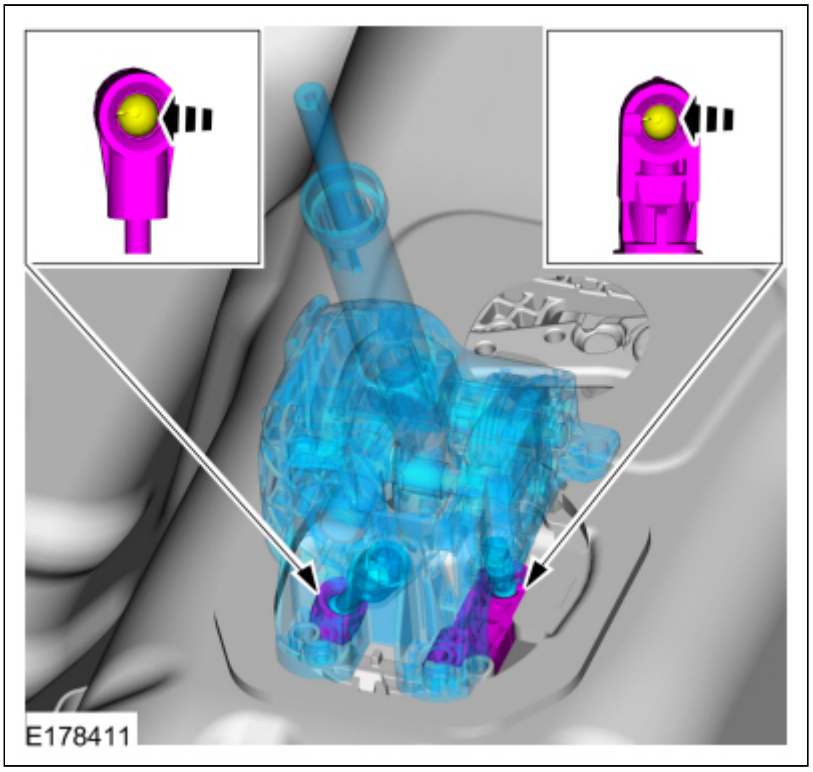


Installation

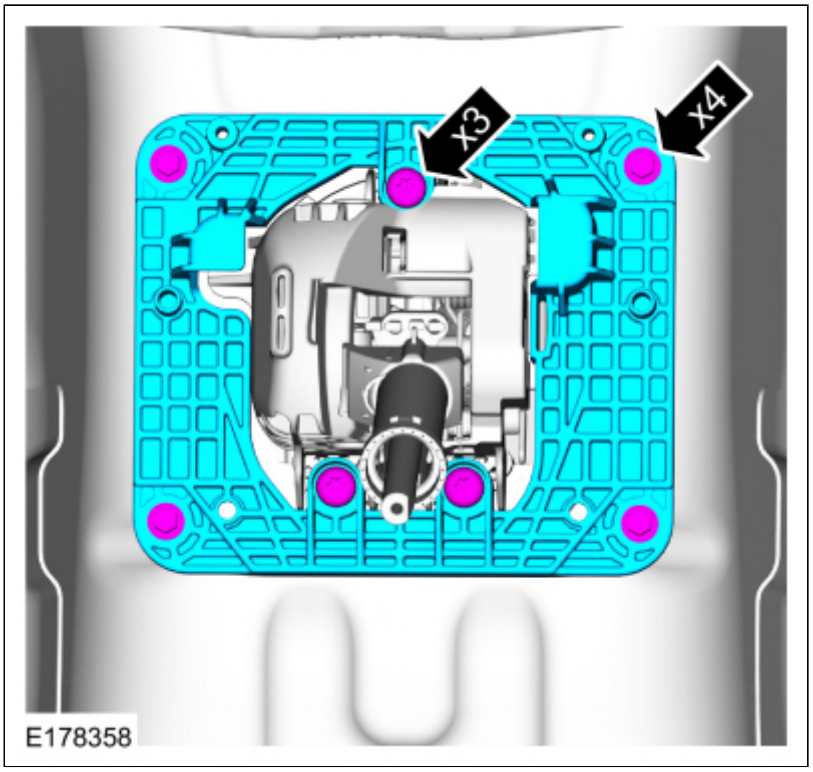
1. To install, reverse the removal procedure.
2.



3.

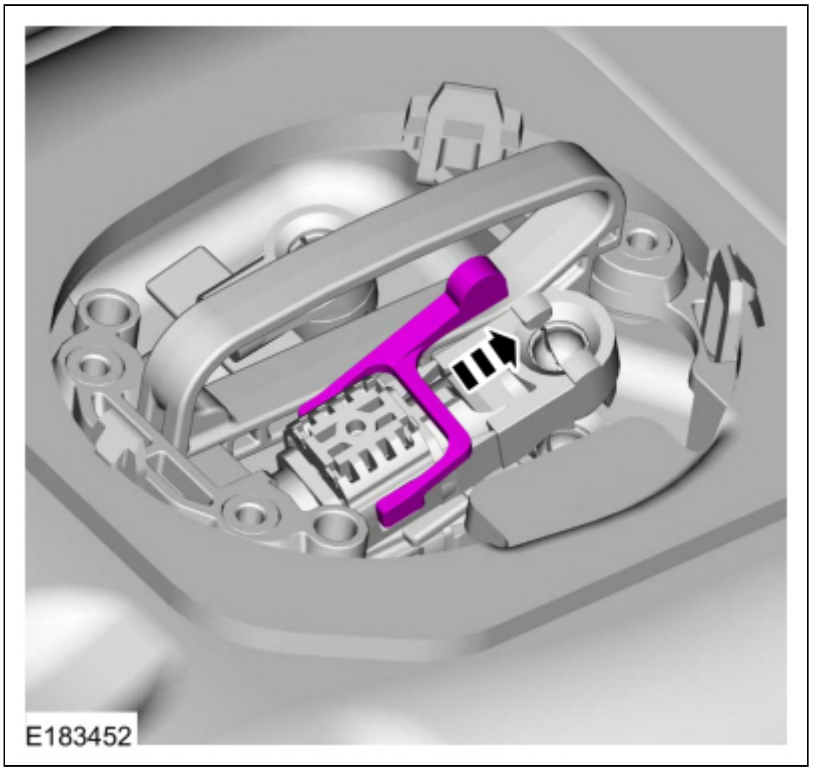


4. *Torque*: 10 Nm

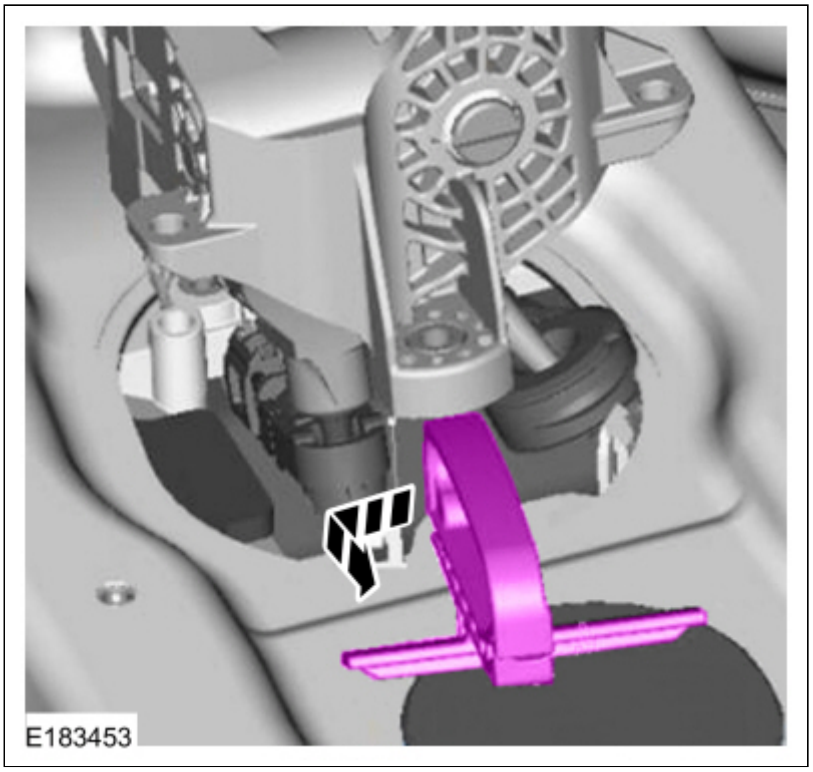


5. **NOTICE: Do not press the adjuster clip downwards.**

   NOTE: *When installing a new component.*

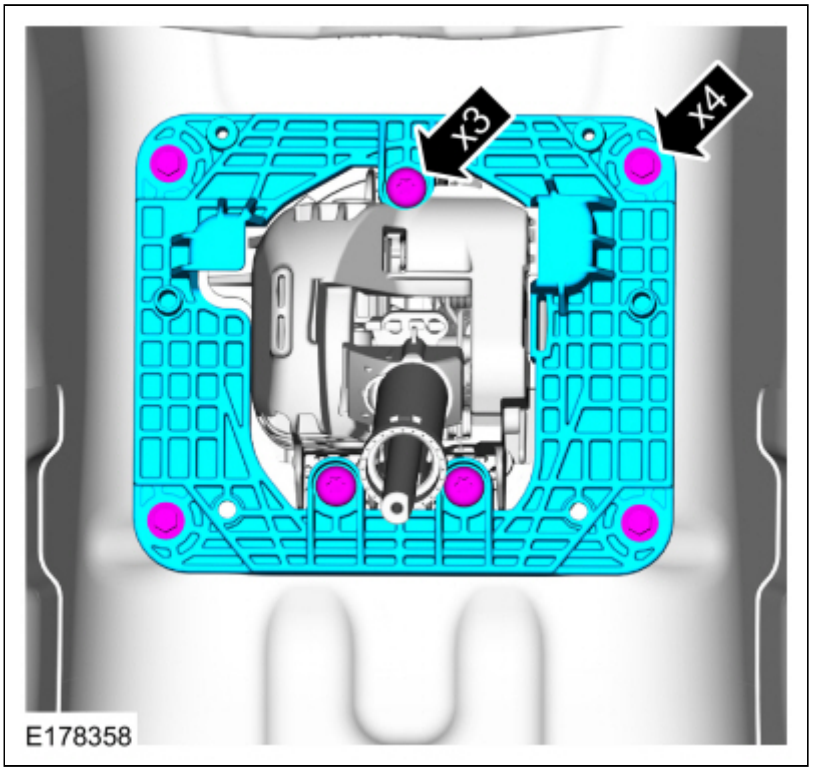


6. **NOTE:** *When installing a new component.*

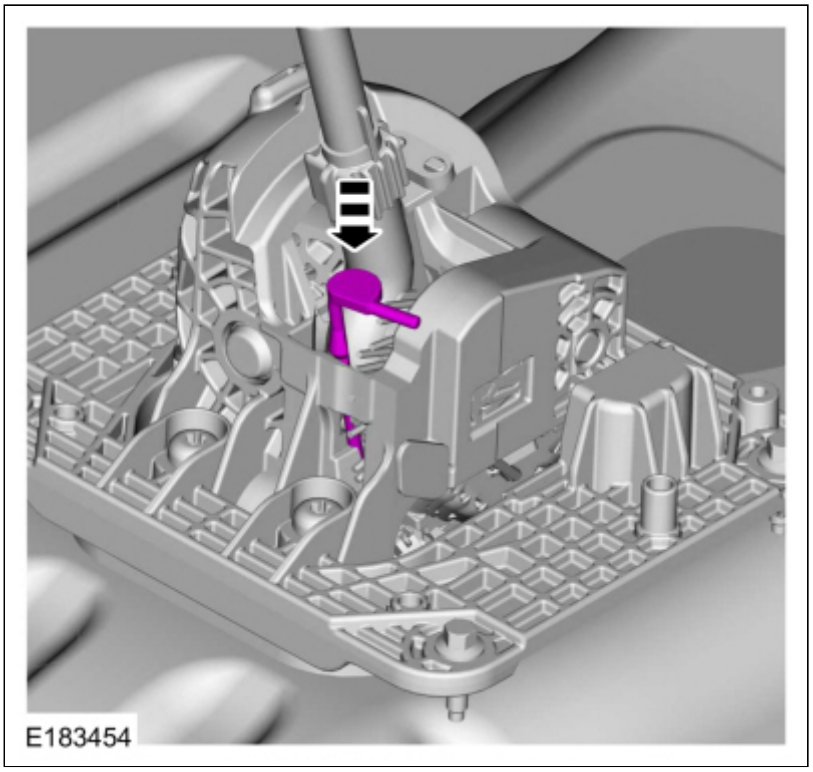


7. **NOTE:** *When installing a new component.*

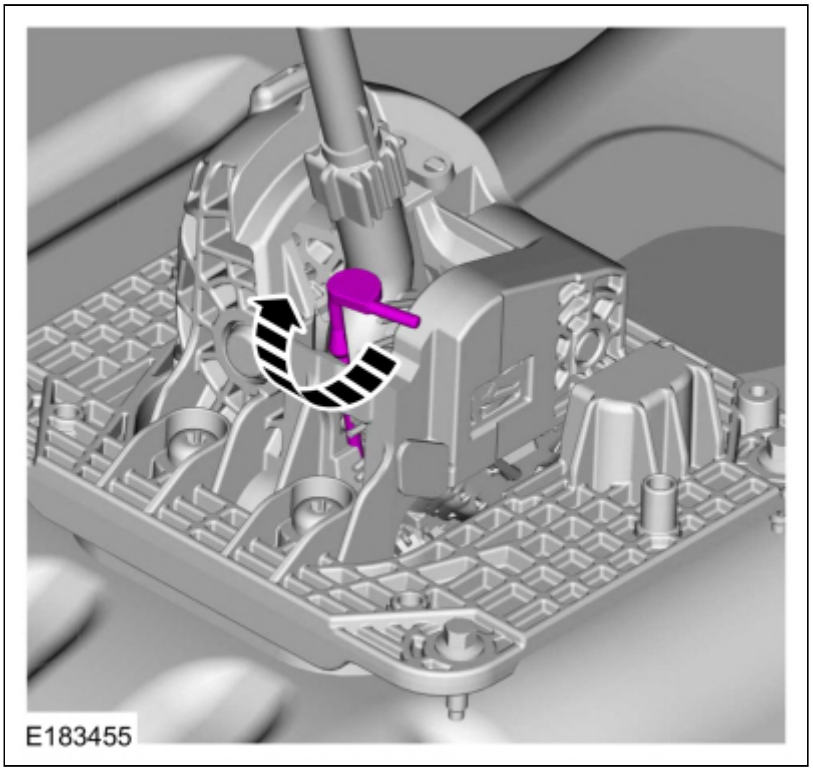
   Torque: 10 Nm



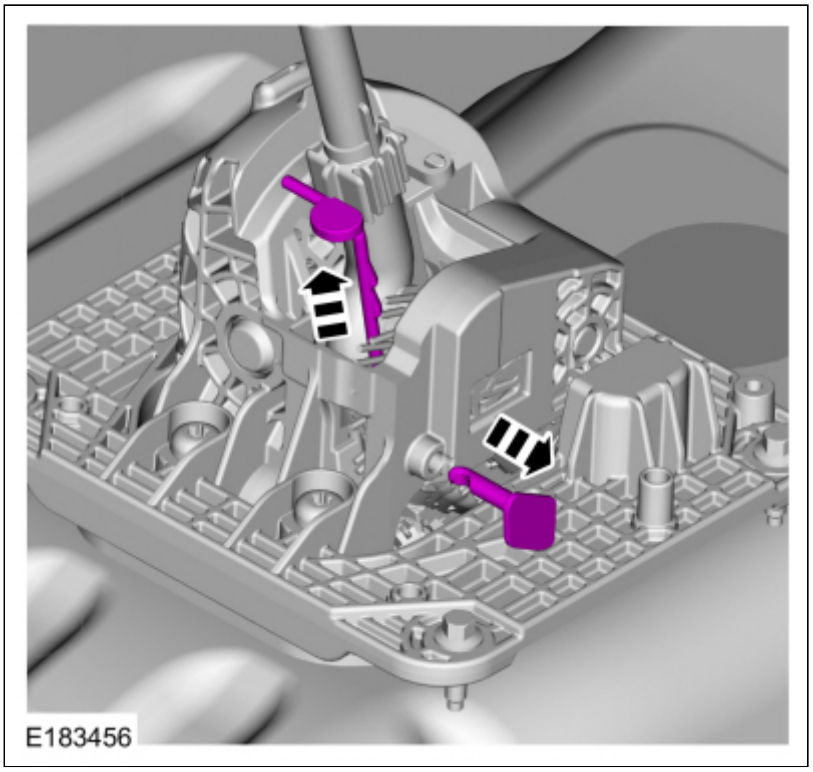
8. **NOTE:** *When installing a new component.*



9. **NOTE:** *When installing a new component.*



10. **NOTE:** *When installing a new component.*



11. Refer to: Gearshift Cable Adjustment (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, General Procedures).
12. Refer to: Gearshift Lever Boot (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
13. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
    Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Copyright © 2016 Ford Motor Company

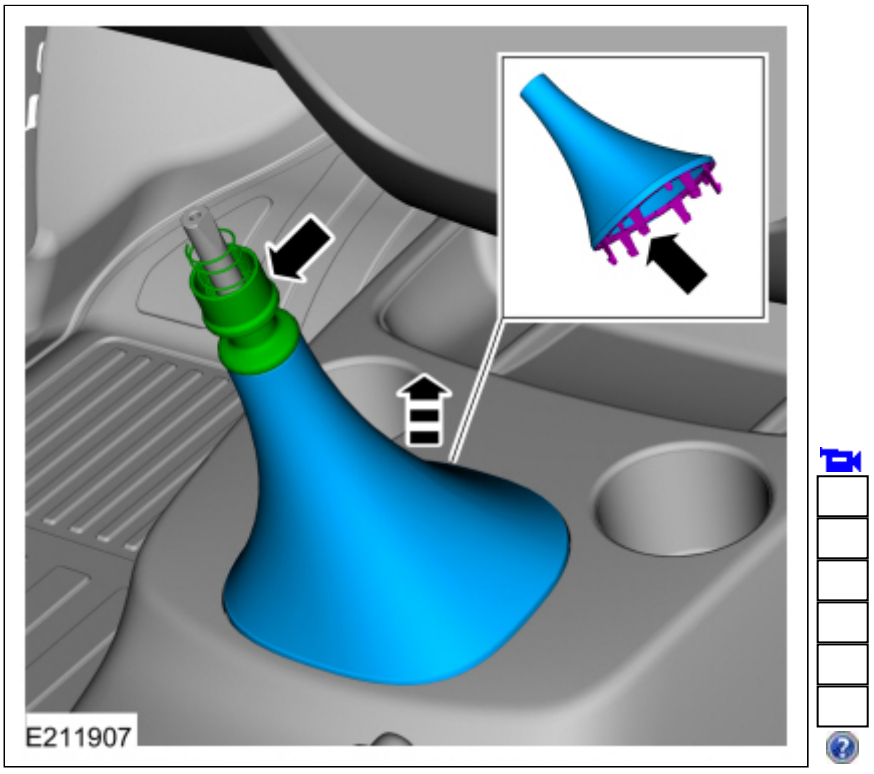
Gearshift Lever Boot

Removal

1. Refer to: Gearshift Lever Knob (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).

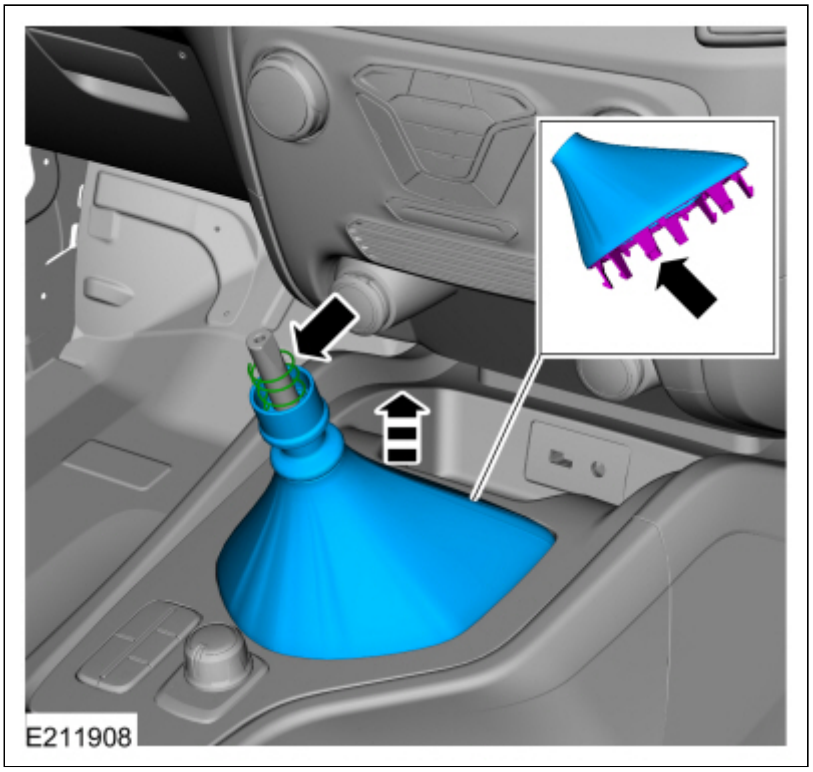
Single Cab

2.



Double Cab

3.



Installation

1. To install, reverse the removal procedure.

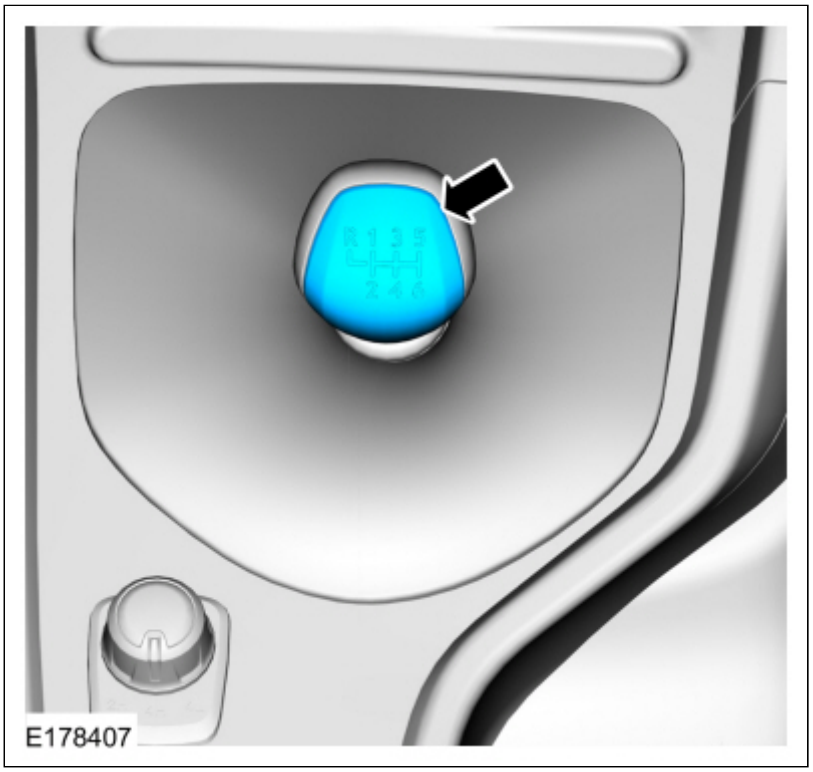
Copyright © 2016 Ford Motor Company

Gearshift Lever Knob

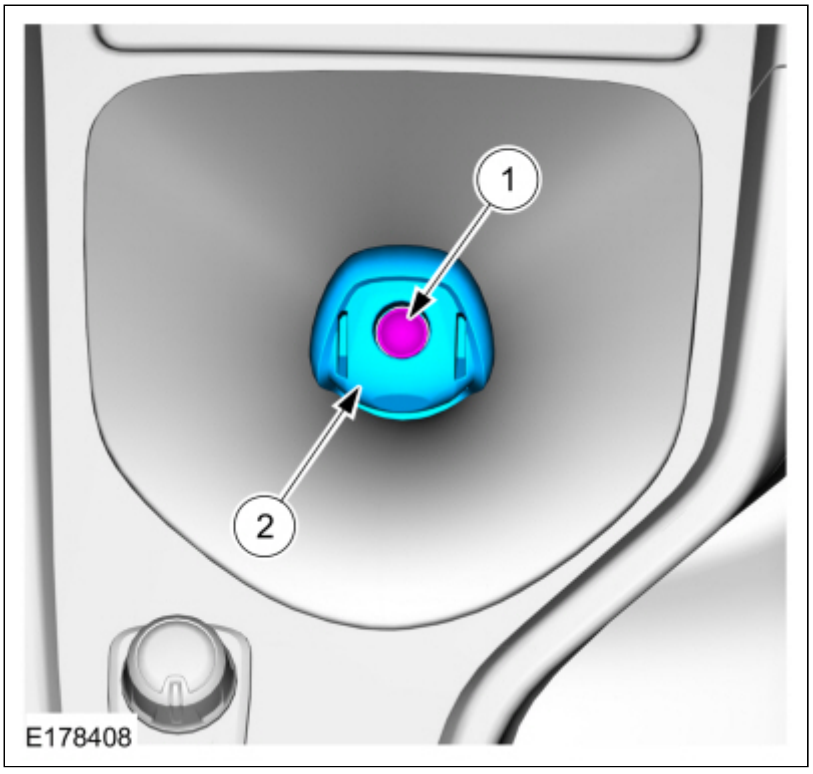
Base Part Number: 7K327

Removal

1.



2. *Torque*: 6 Nm



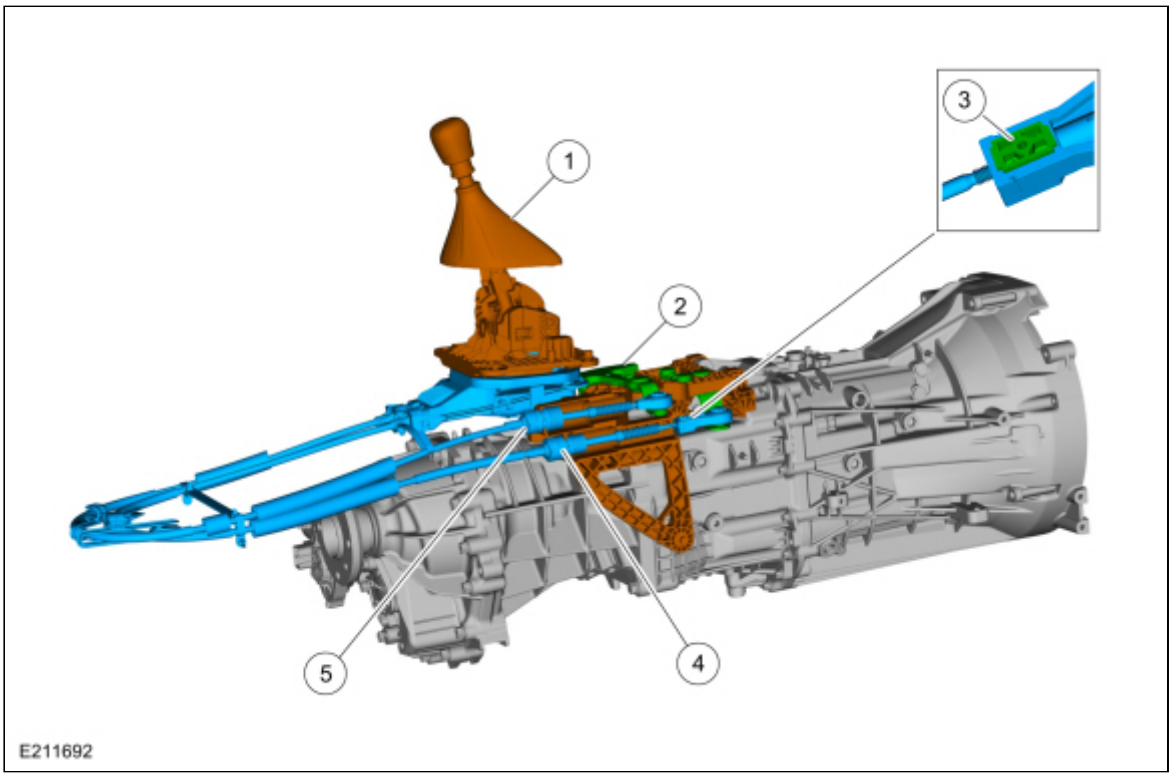
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

External Controls - Component Location

External Controls - Gear selector unit and gearshift cables



Item	Part Number	Description
1	—	Selector lever assembly
2	—	Shift arm with damping weight
3	—	Selector cable adjusting mechanism
4	—	Selector cable
5	—	Gearshift cable

Copyright © 2016 Ford Motor Company

External Controls - Overview

MT82 Manual Transmission External Controls

The length of the selector cable can be adjusted.

A spring in the gearshift lever pulls the selector cable into the neutral position between 3rd and 4th gear.

In order to ensure precision shifting as well as to prevent increased wear, the gearshift cables must be precisely adjusted. The instructions in the current workshop literature must be observed for this.

Incorrect adjustment of the gearshift cables or incorrect operation by the driver during driving can cause shifting problems and excessive wear of the shift forks as well as of the synchronizers.

Copyright © 2016 Ford Motor Company

External Controls

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.
3. Make sure that the gearshift cables are correctly routed and not under any tension from other components.
4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
5. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• External controls do not operate freely.	• Gearshift cables incorrectly adjusted. • Gearshift lever damaged. • Selector mechanism damaged. • Gearshift cables damaged.	• ADJUST the gearshift cables. • GO to Pinpoint Test A

Pinpoint Tests

PINPOINT TEST A : STIFF GEARSHIFT

A1 CHECK THE GEARSHIFT LEVER

- Detach the gearshift cables from the gearshift lever.

Is the gearshift lever difficult to operate?

Yes	Install a new gearshift lever.
No	GO to A2

A2 CHECK THE GEARSHIFT CABLES

- Attach the gearshift cables to the gearshift lever.
- Detach the gearshift cables from the transaxle.

Is the gearshift lever difficult to operate?

Yes	Install new gearshift cables.
No	Check the selector mechanism.

Copyright © 2016 Ford Motor Company

Gearshift Cable Adjustment

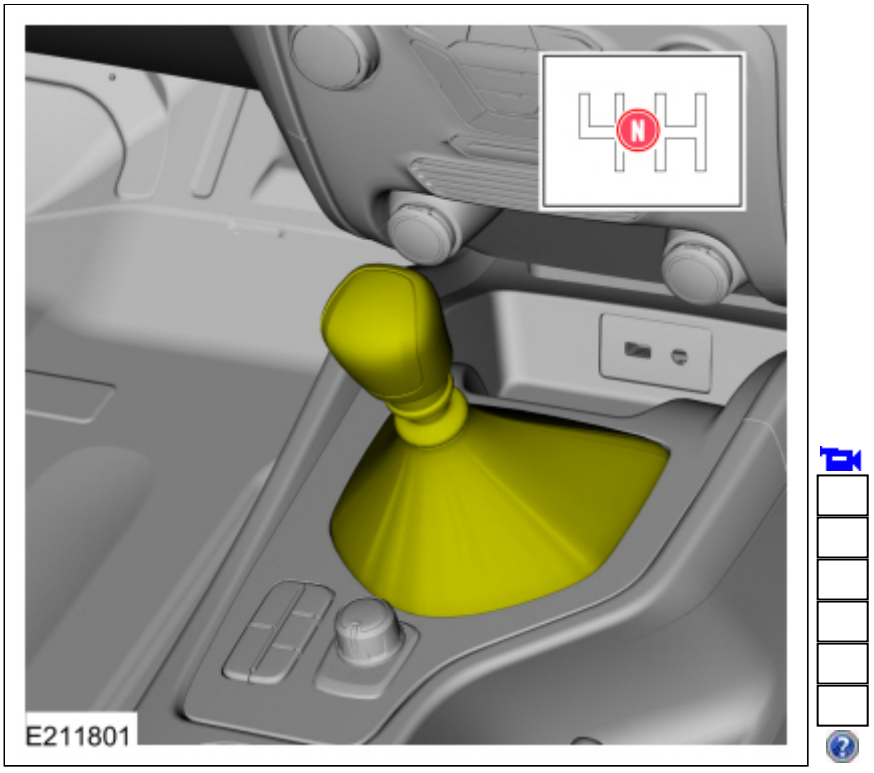
Special Tool(s) / General Equipment

6 mm Drill Bit

Adjustment

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

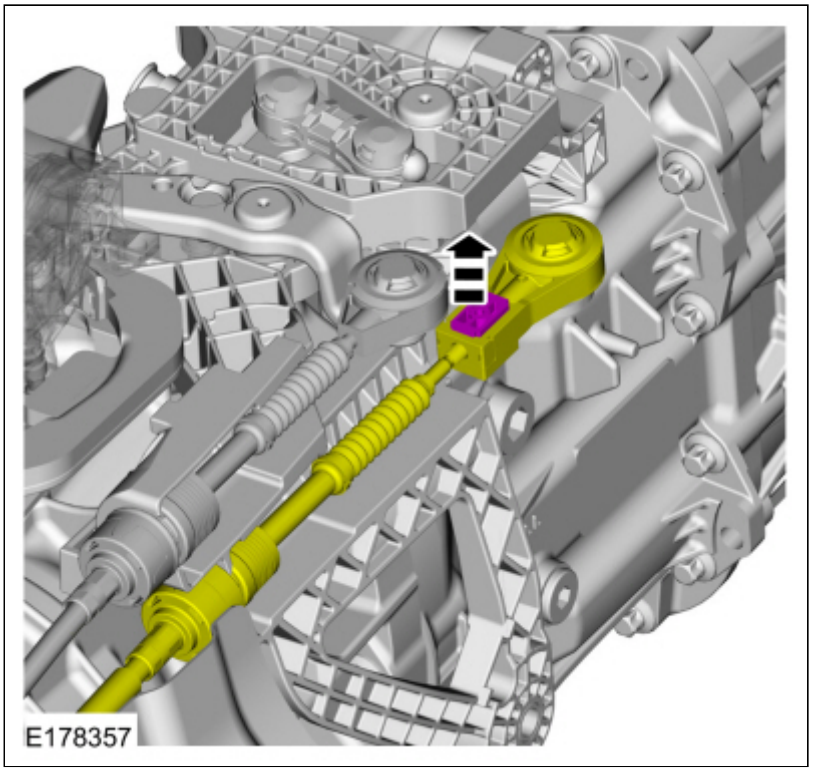
   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. 

3. Refer to: Gearshift Lever Boot (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).

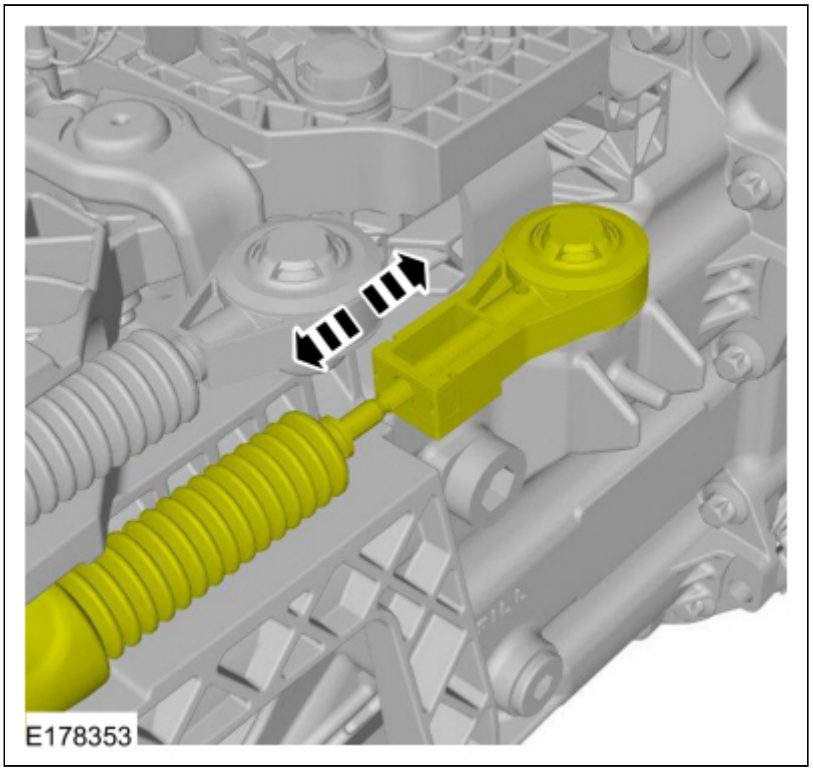
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

5.



NOTE: *Move the select lever side to side to verify free motion.*

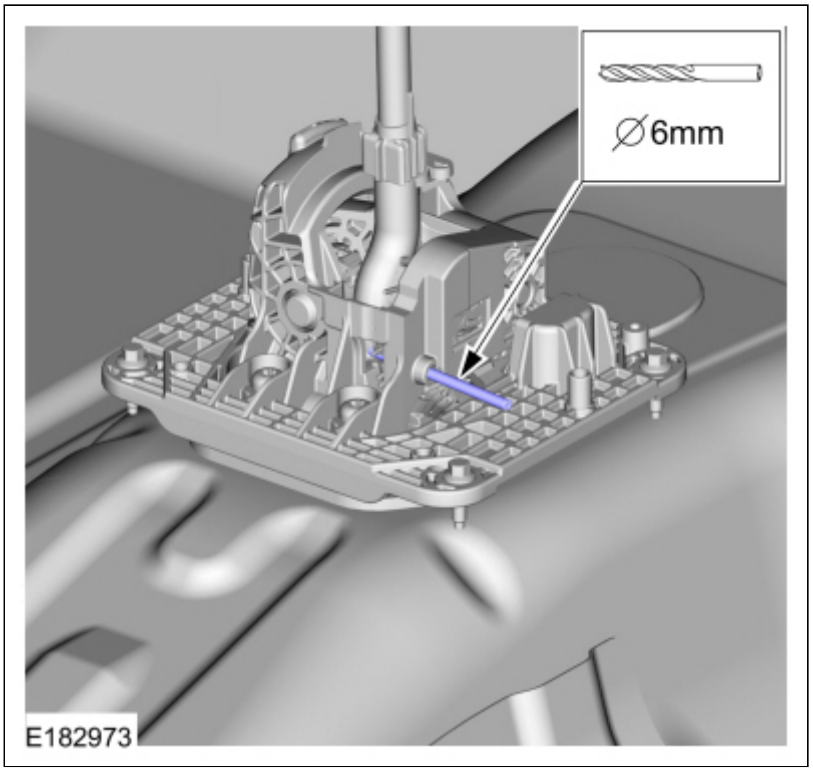
6.



7. Lower the Vehicle.
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

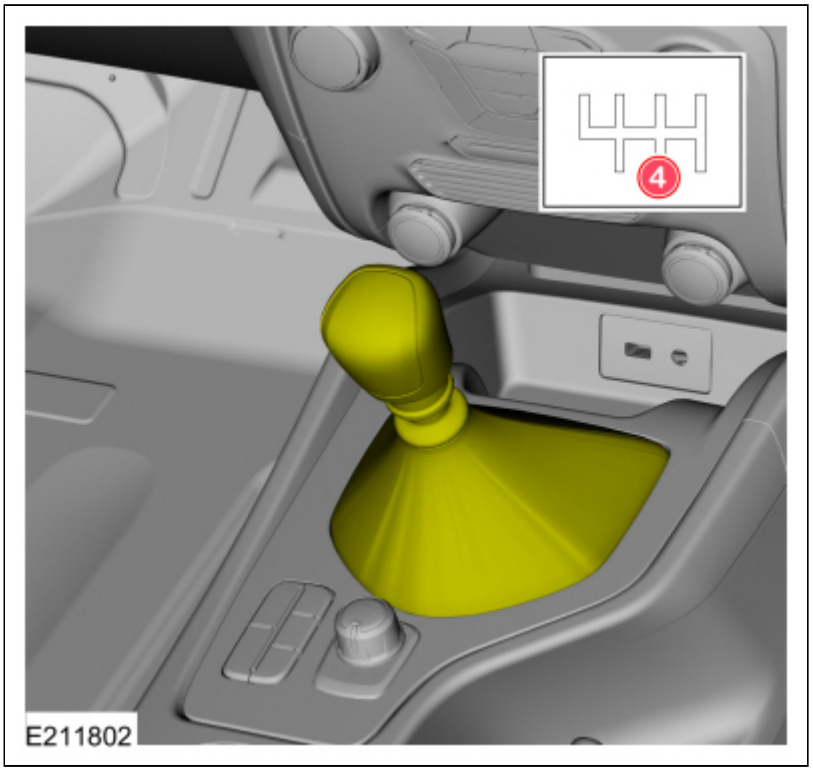
NOTE: *Install the 6mm drill bit to lock the gearshift lever in 3-N-4 plane.*

8. Use the General Equipment: 6 mm Drill Bit



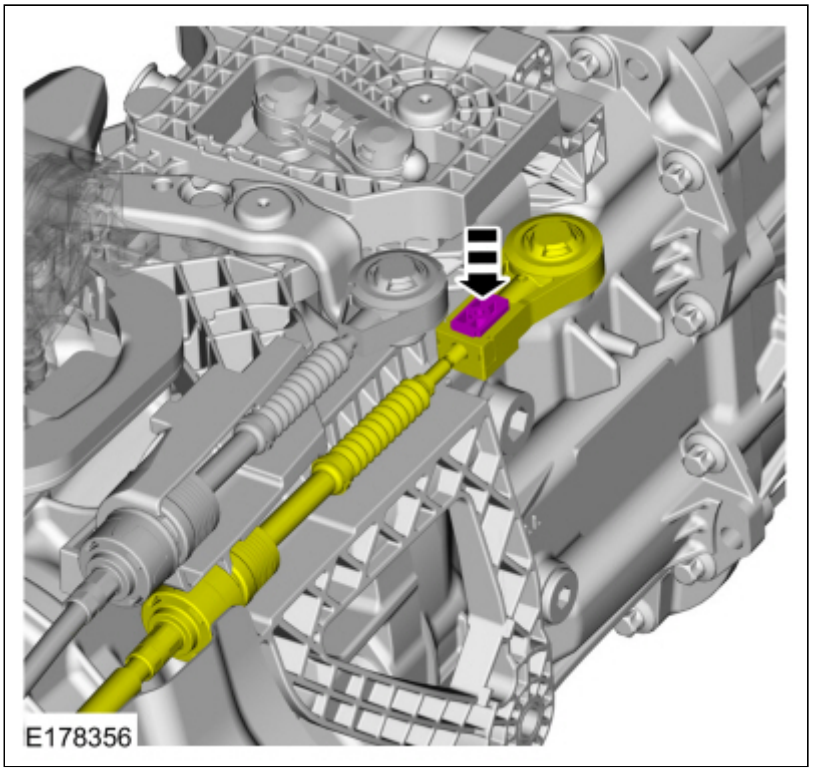
NOTE: *By placing the gearshift lever into the 4th gear position, it locks the small lever into the N position.*

9.



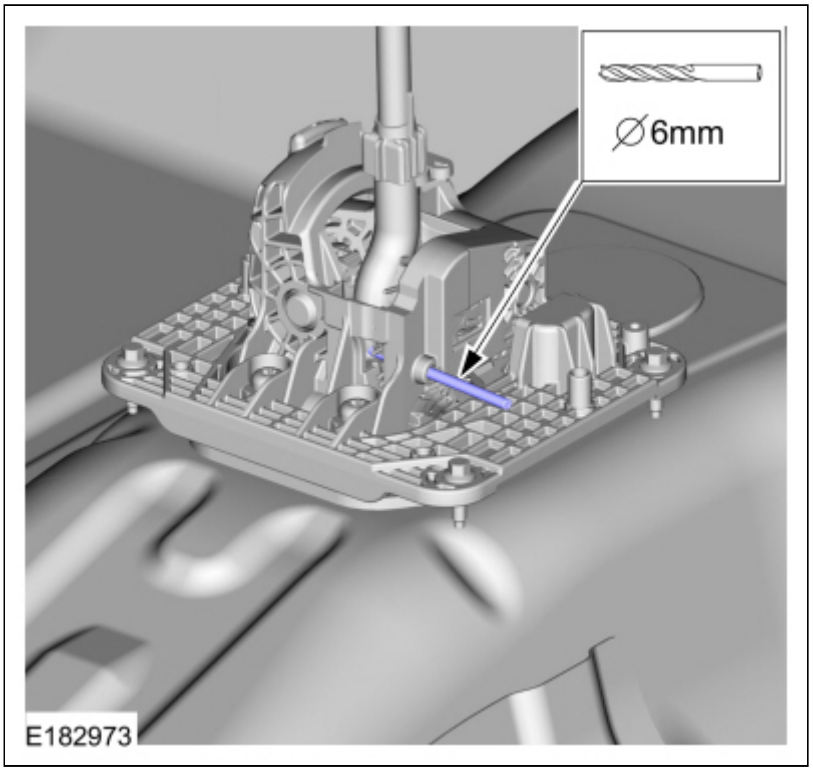
10. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

11.



12. Lower the Vehicle.
    Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

13. Remove the 6mm drill bit.



14. Refer to: Gearshift Lever Boot (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).

Copyright © 2016 Ford Motor Company

Gearshift Cables

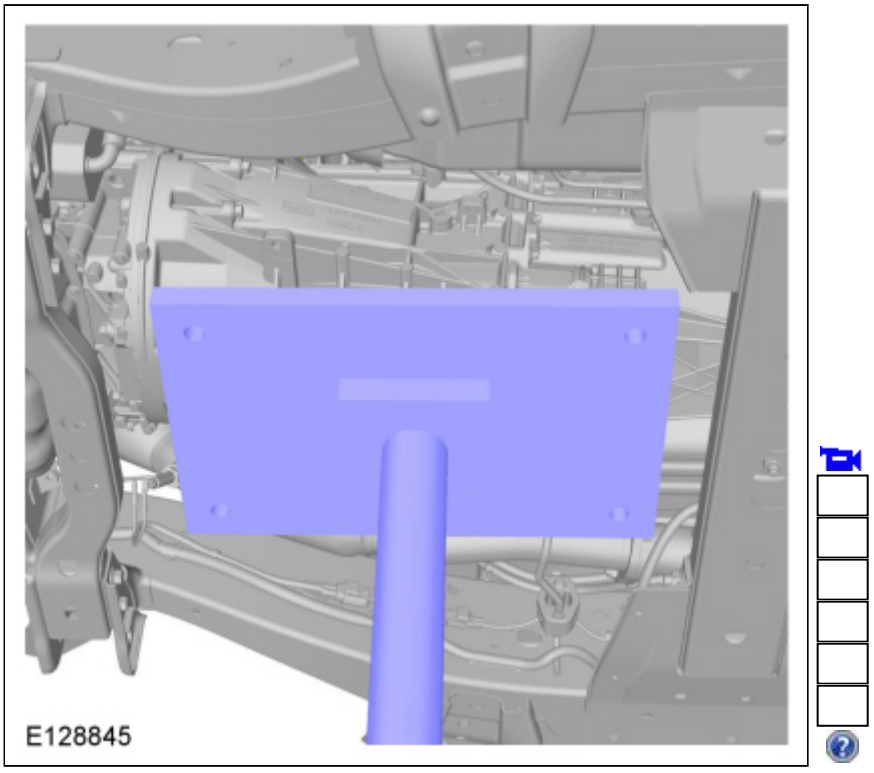
Special Tool(s) / General Equipment

Transmission Jack

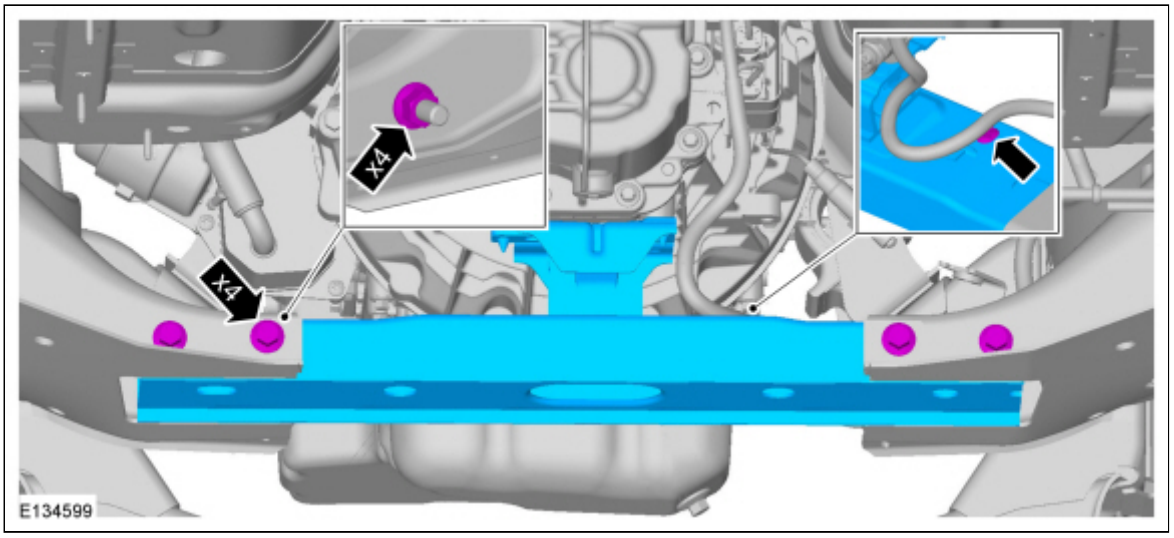
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

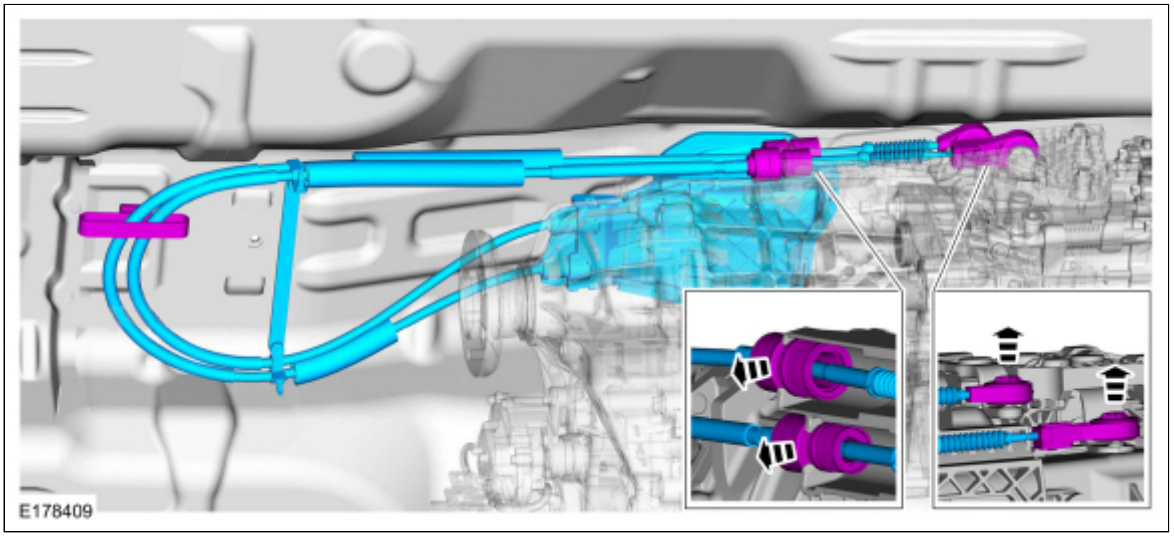
1. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. Refer to: Gearshift Lever (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Install the General Equipment: Transmission Jack



5.

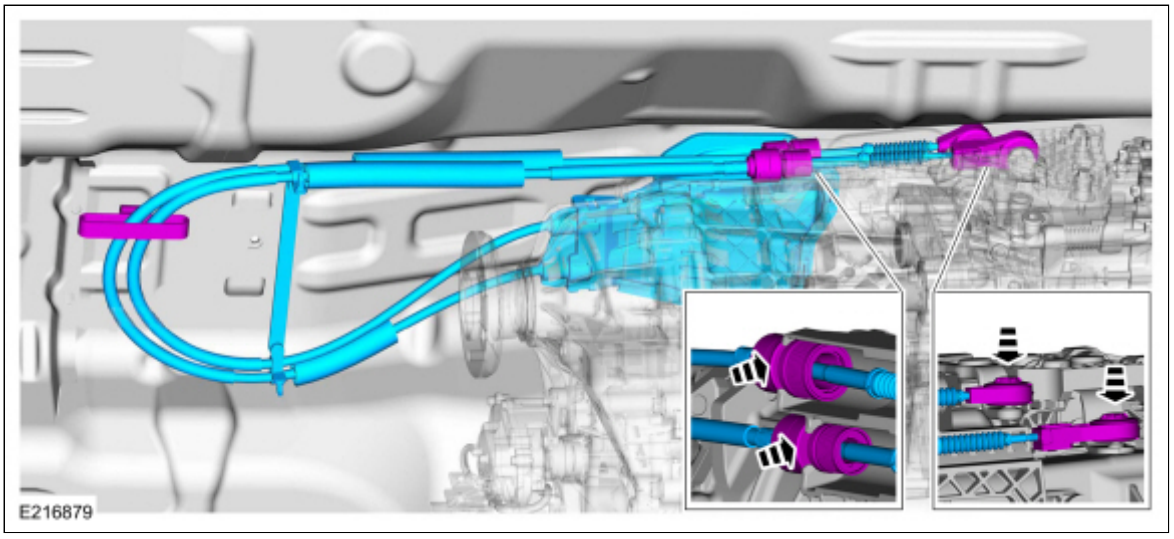


6.

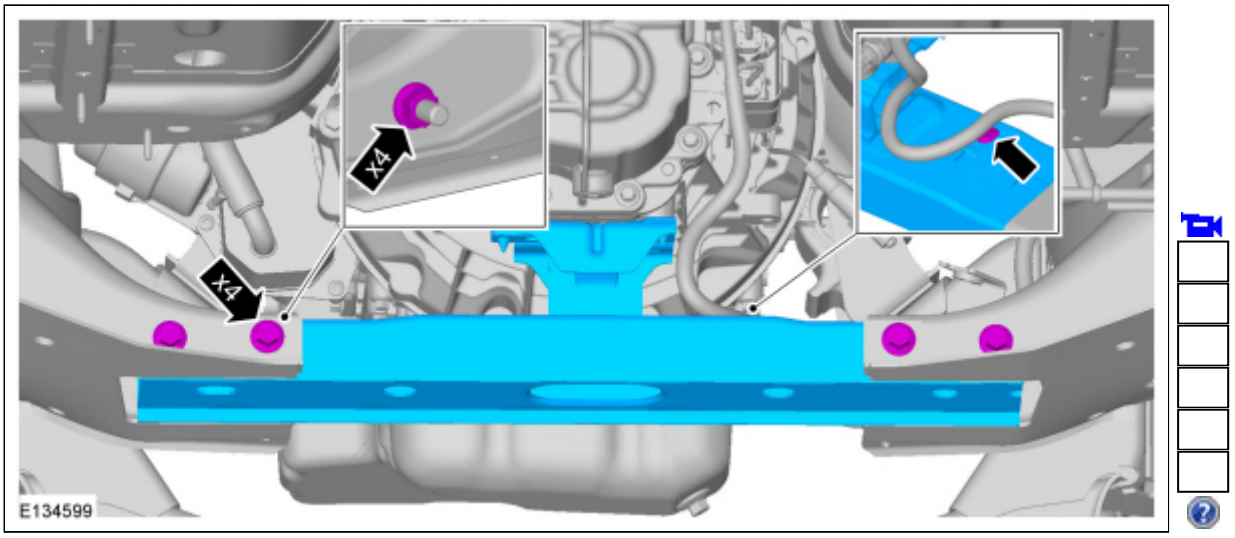


Installation

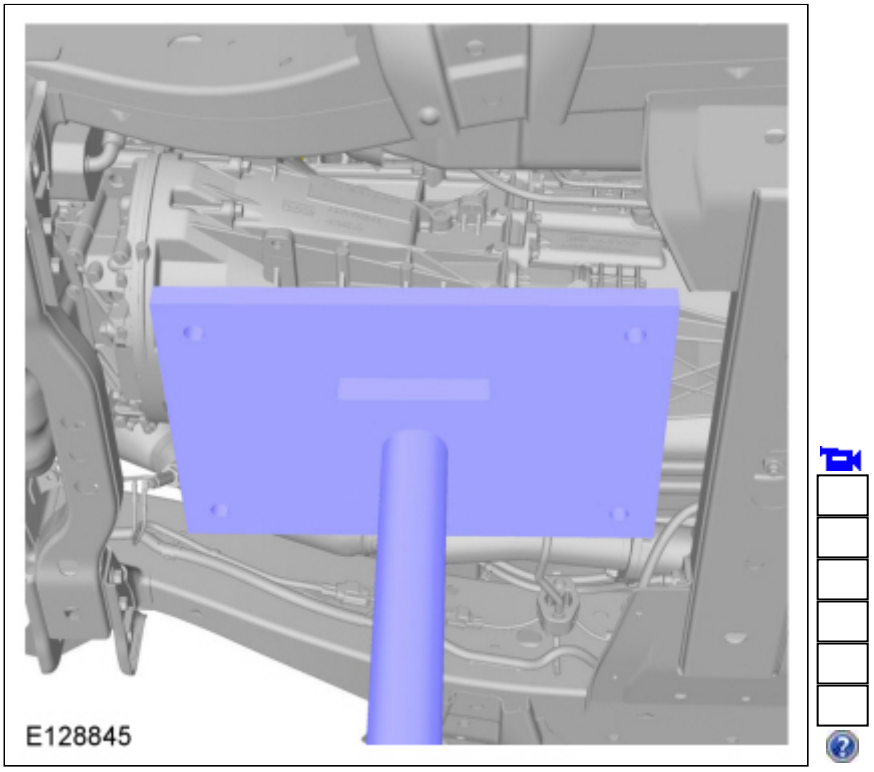
1.



2. *Torque*: 90 Nm



3. Remove the General Equipment: Transmission Jack



4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

5. Refer to: Gearshift Lever (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, Removal and Installation).

6. Refer to: Gearshift Cable Adjustment (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, General Procedures).

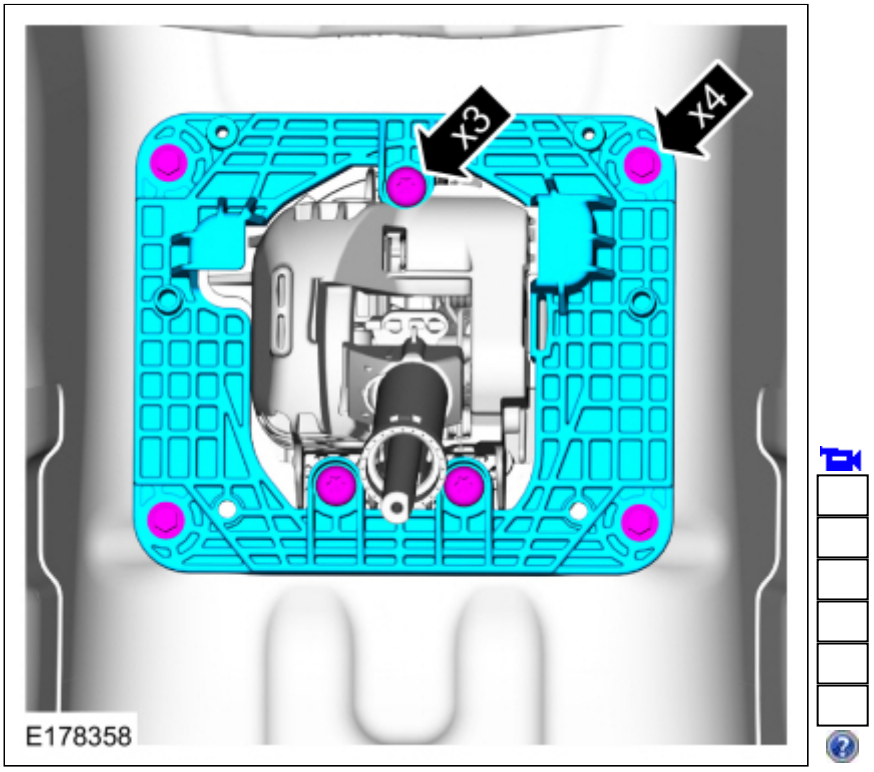
7. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).

Copyright © 2016 Ford Motor Company

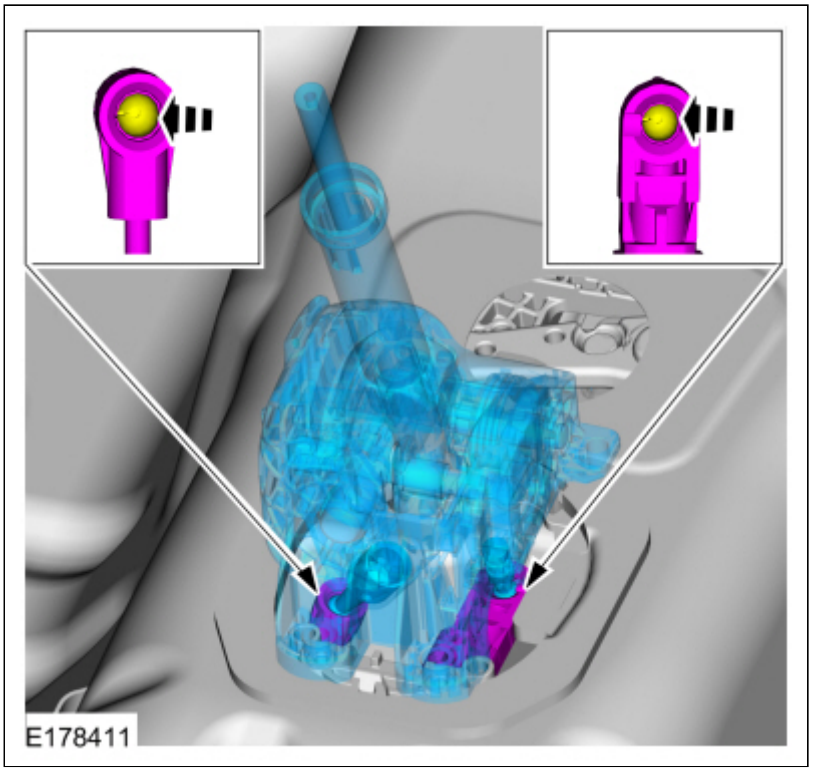
Gearshift Lever

Removal

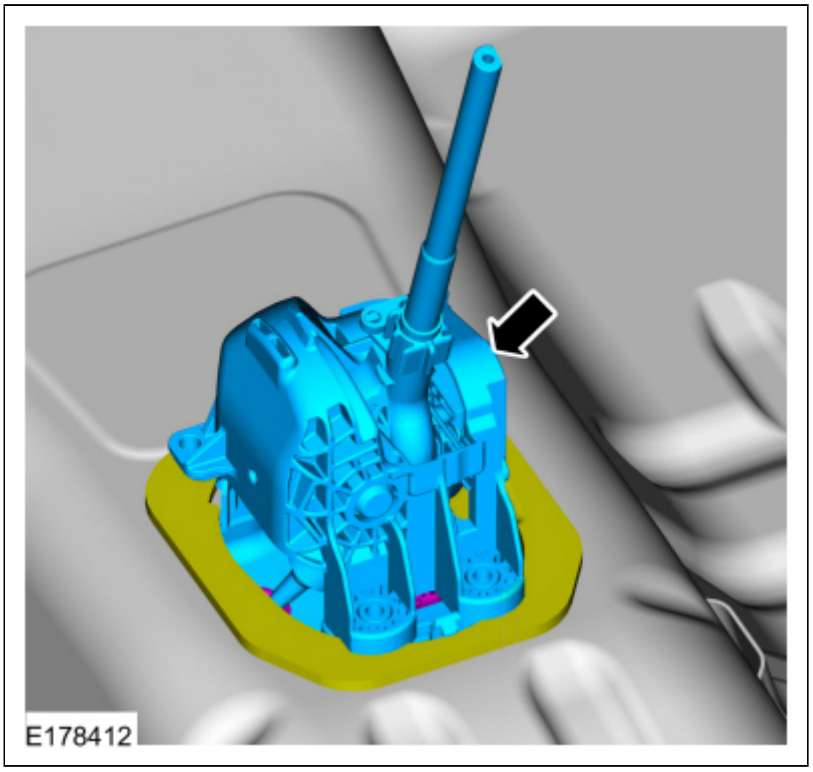
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
2. Refer to: Gearshift Lever Boot (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
3. 

4.

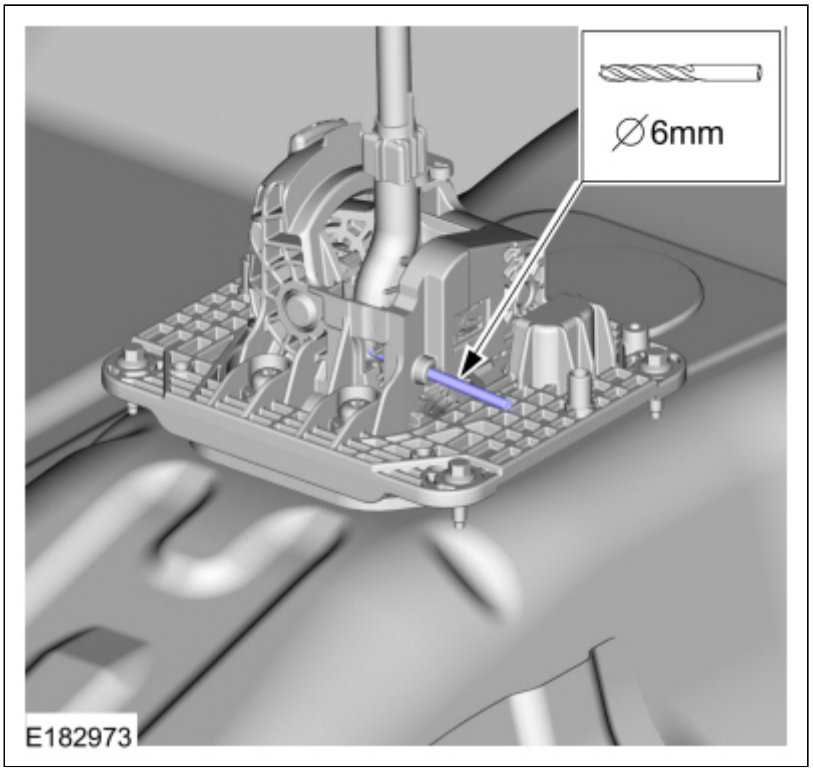


5.

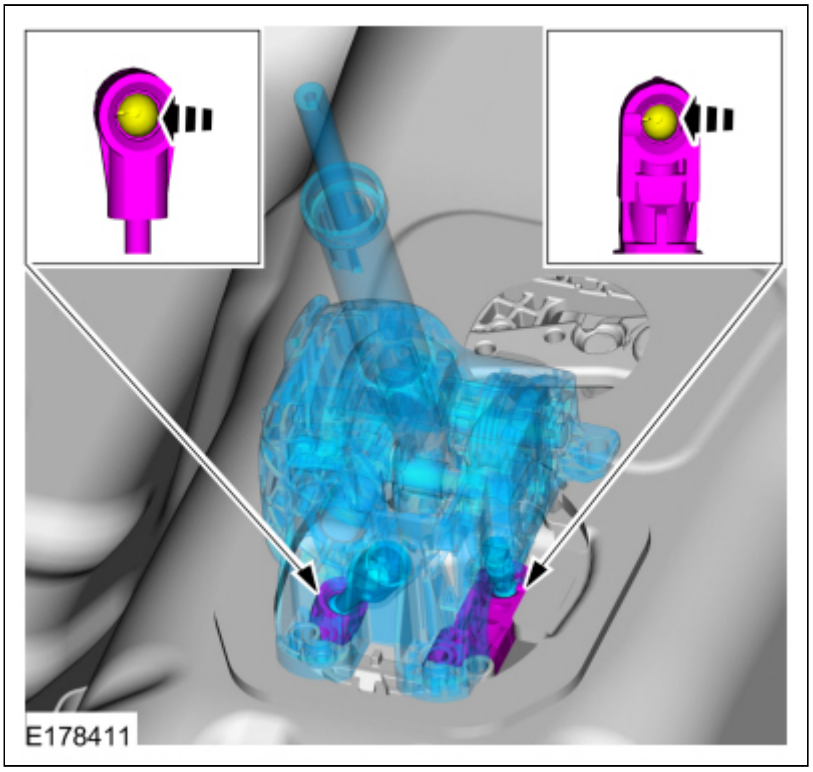


Installation

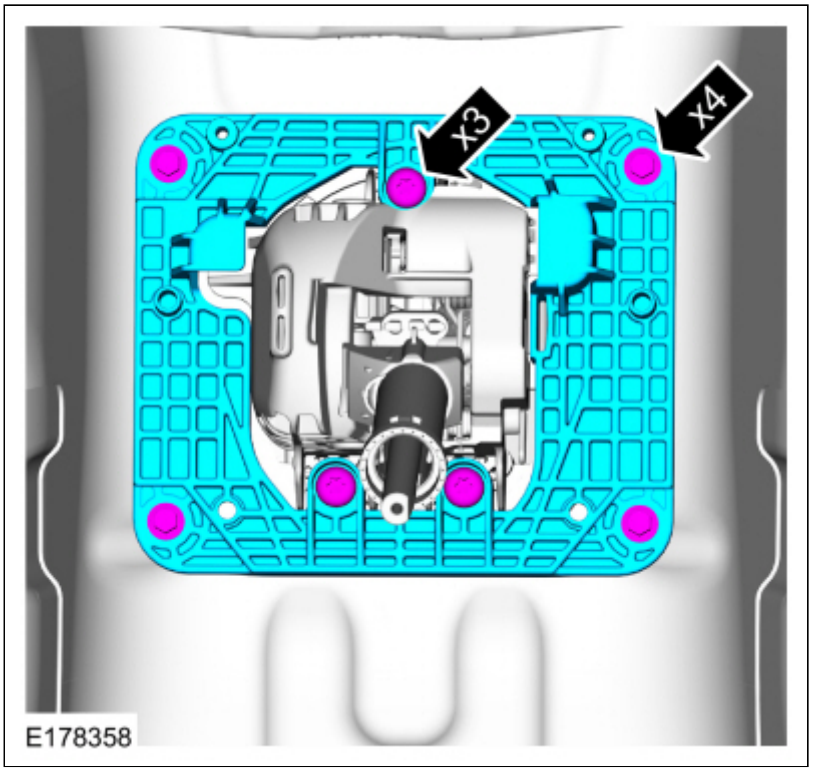
1. To install, reverse the removal procedure.
2.



3.

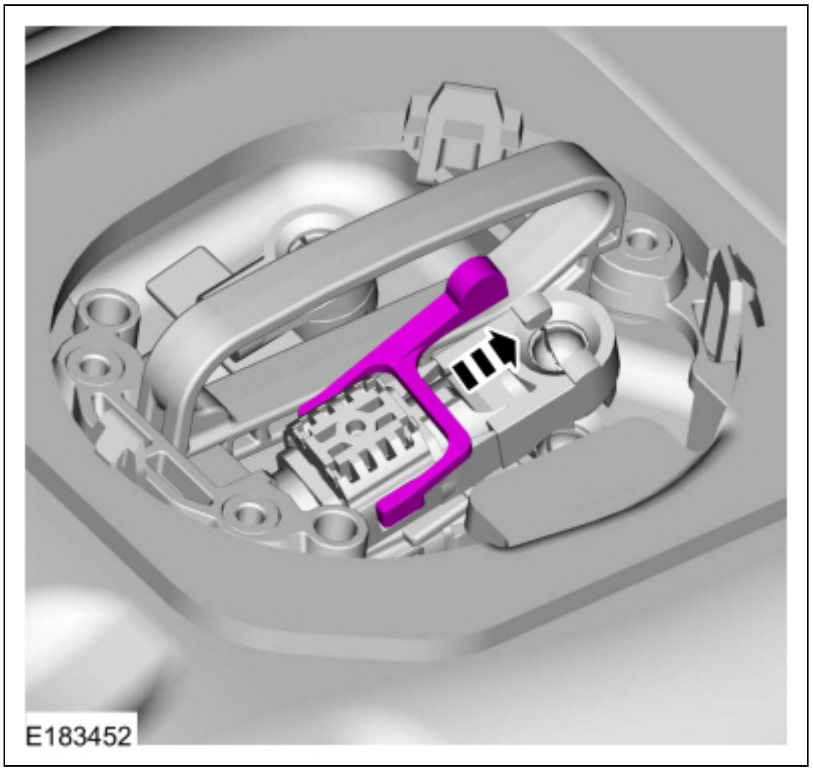


4. *Torque*: 10 Nm

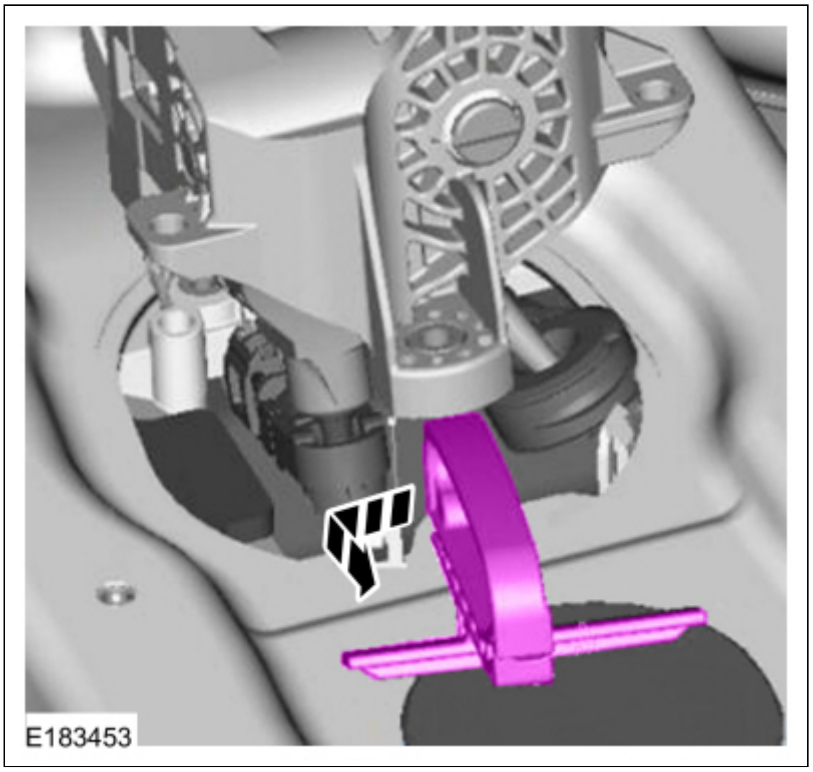


5. **NOTICE: Do not press the adjuster clip downwards.**

   NOTE: *When installing a new component.*

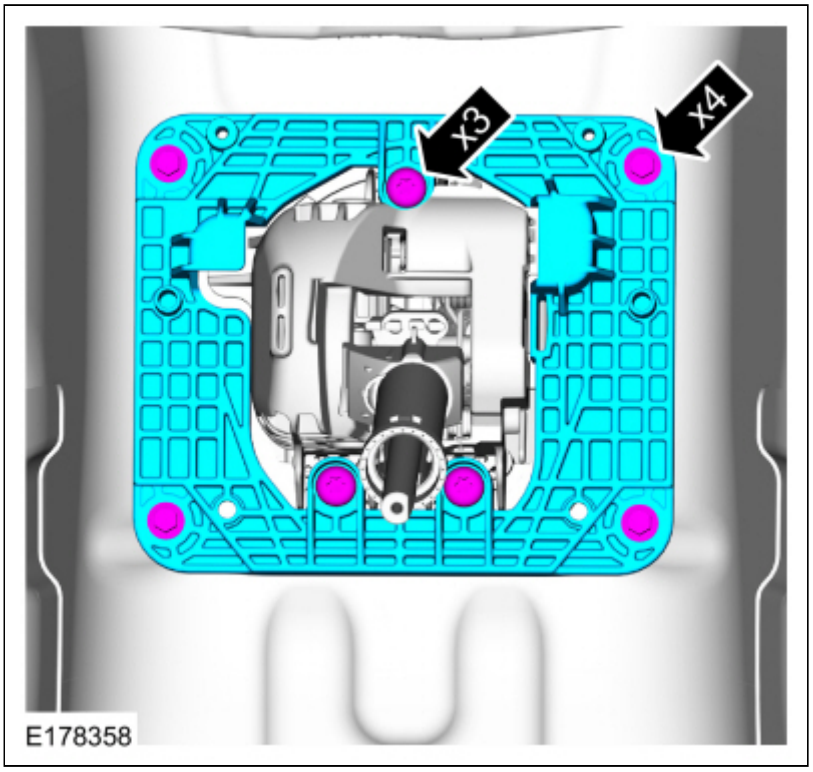


6. **NOTE:** *When installing a new component.*

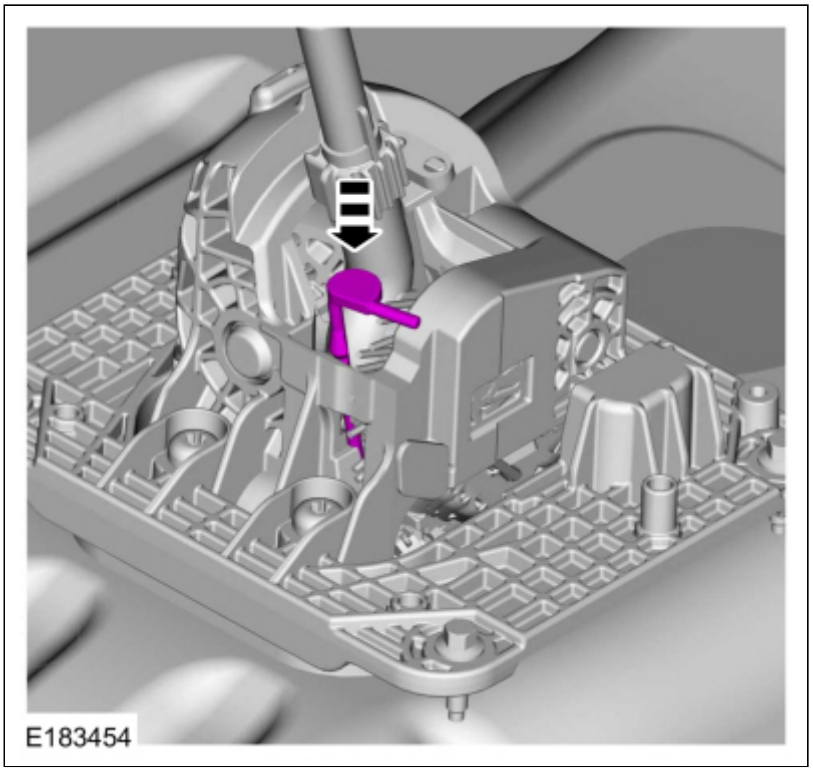


7. **NOTE:** *When installing a new component.*

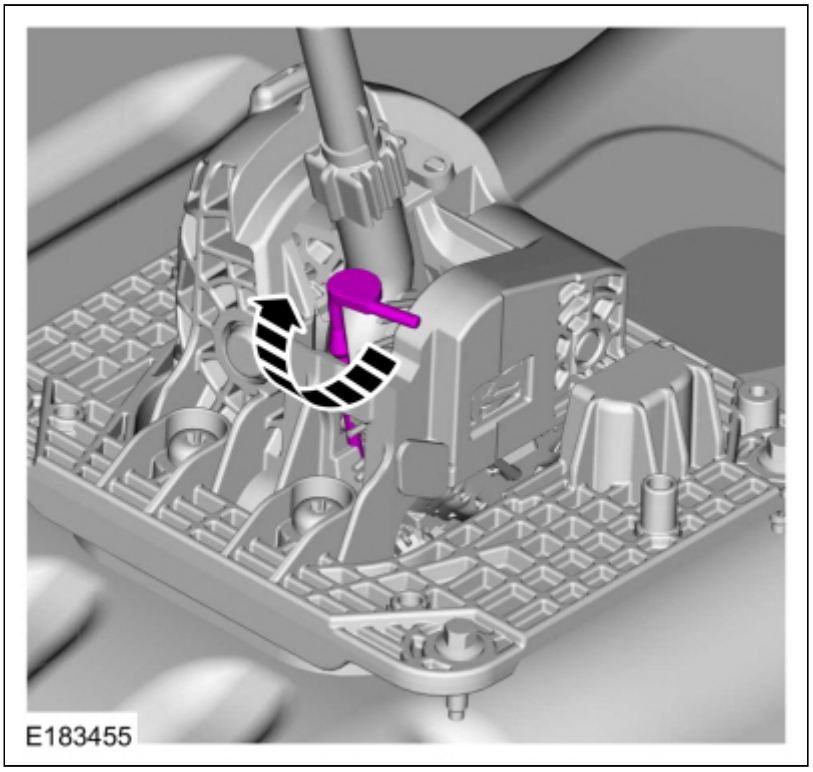
   Torque: 10 Nm



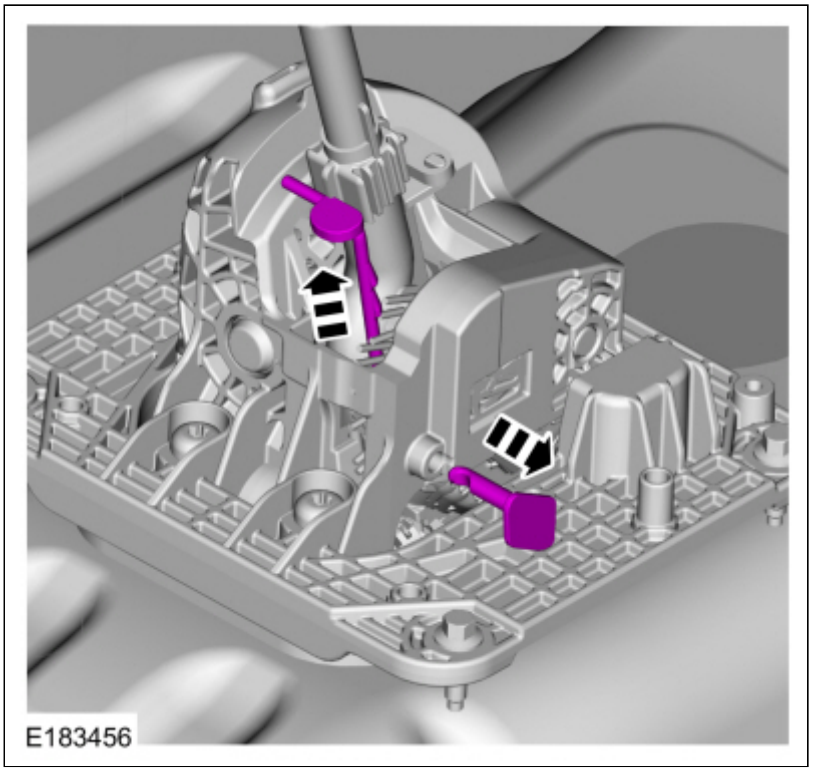
8. **NOTE:** *When installing a new component.*



9. **NOTE:** *When installing a new component.*



10. **NOTE:** *When installing a new component.*



11. Refer to: Gearshift Cable Adjustment (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, General Procedures).
12. Refer to: Gearshift Lever Boot (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).
13. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
    Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Copyright © 2016 Ford Motor Company

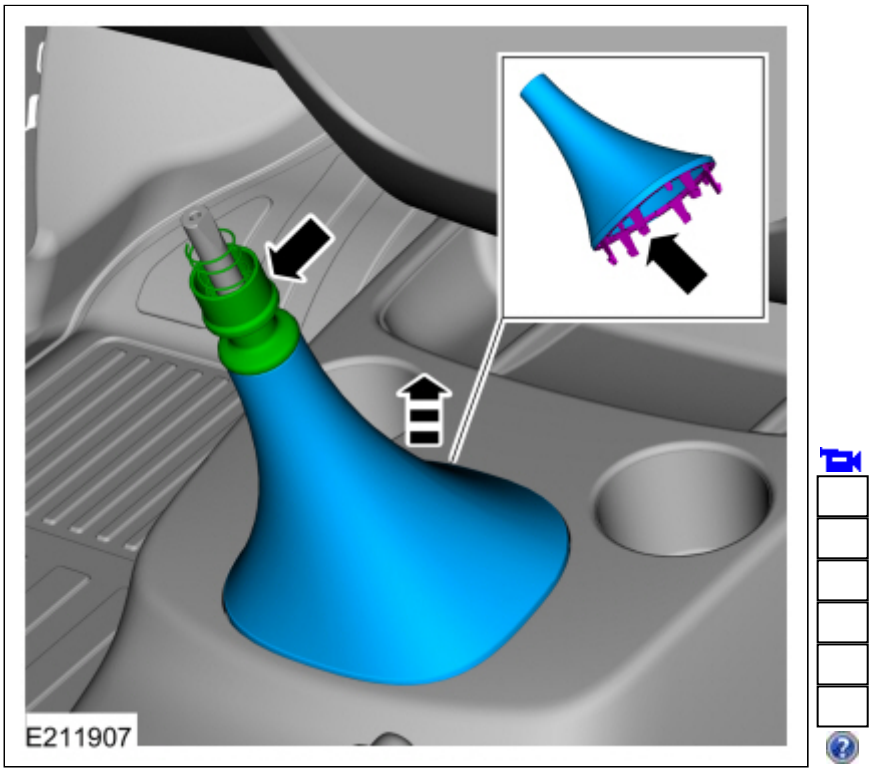
Gearshift Lever Boot

Removal

1. Refer to: Gearshift Lever Knob (308-06A Manual Transmission External Controls - 5-Speed Manual Transmission - MT75, Removal and Installation).

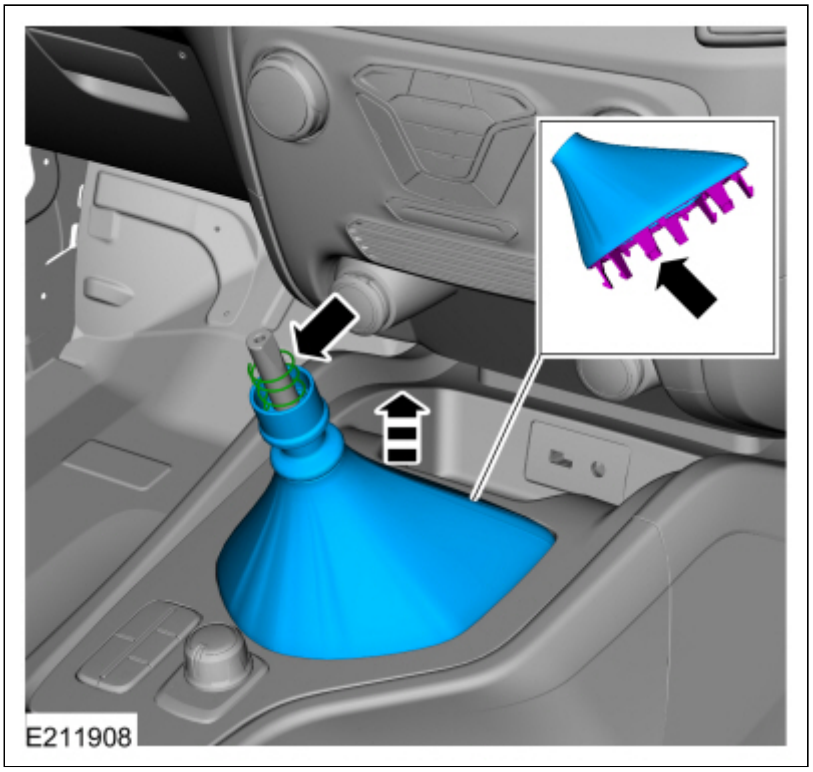
Single Cab

2.



Double Cab

3.



Installation

1. To install, reverse the removal procedure.

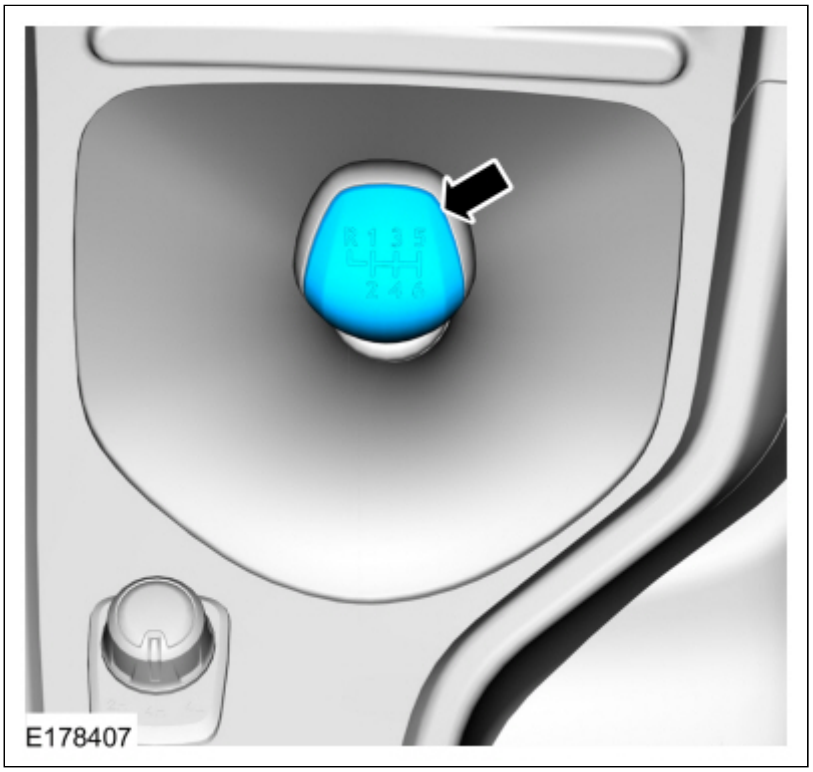
Copyright © 2016 Ford Motor Company

Gearshift Lever Knob

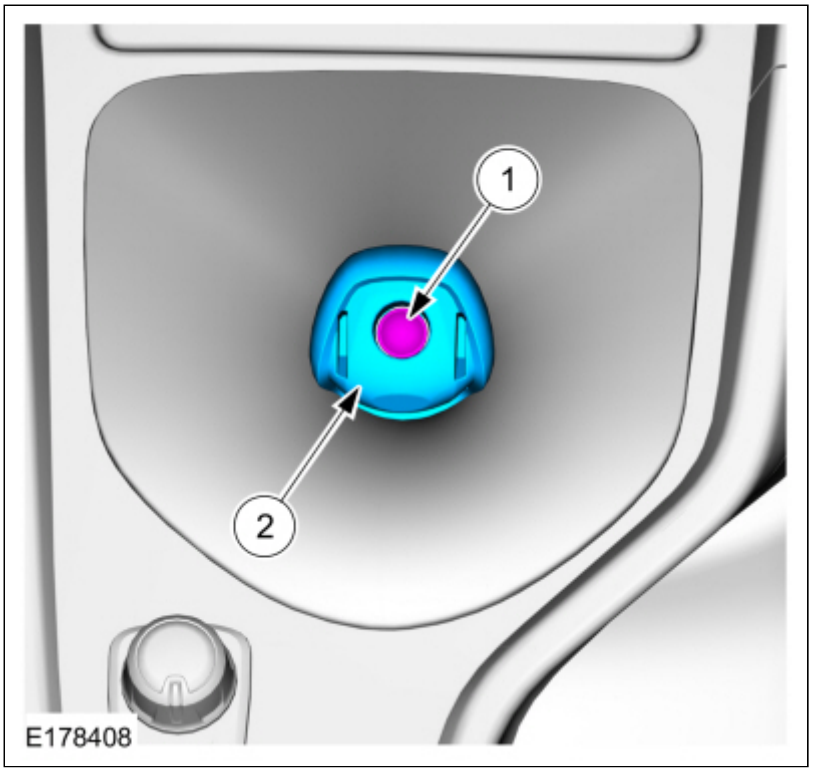
Base Part Number: 7K327

Removal

1.



2. *Torque*: 6 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Gearshift Cable Mounting Bracket

Special Tool(s) / General Equipment

Feeler Gauge

Removal

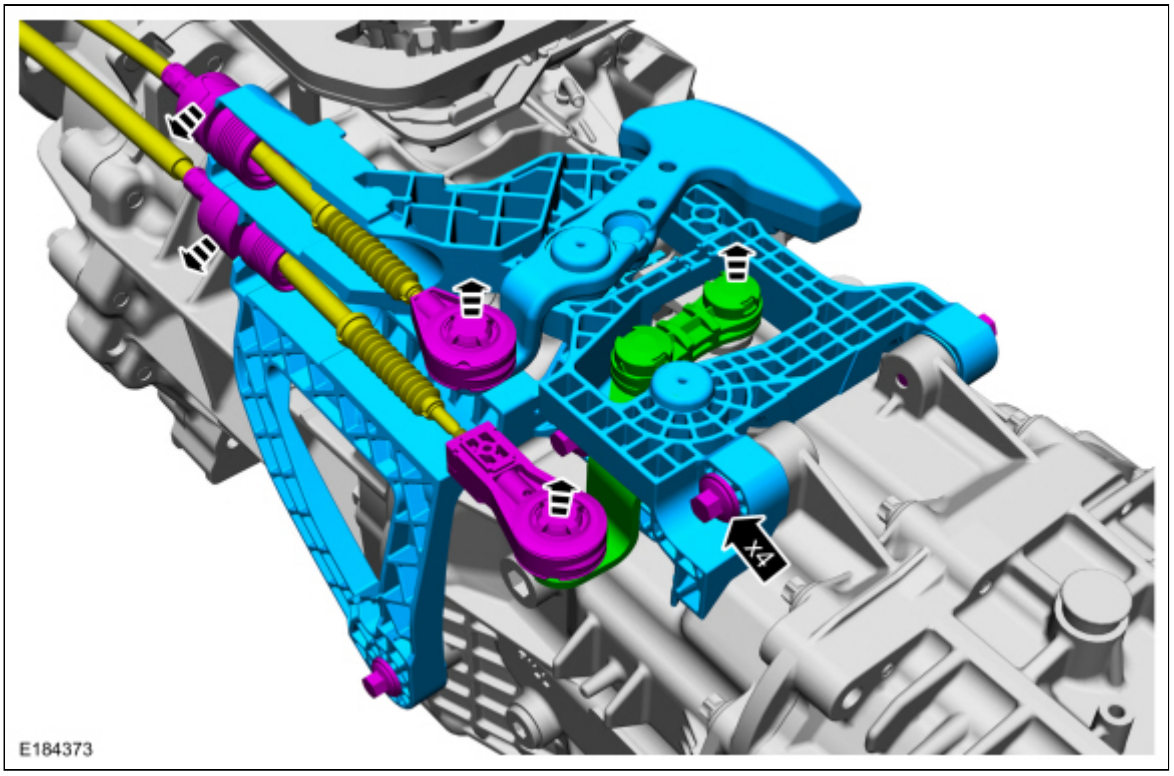
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *All wheel drive vehicles.*

   Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Removal).

NOTE: *All vehicles.*

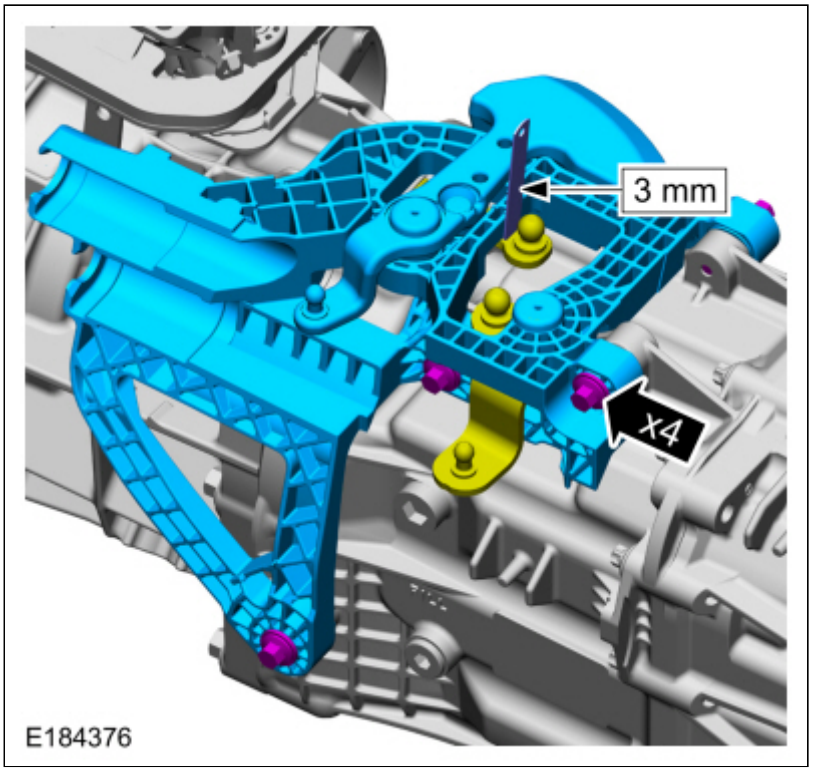
2.



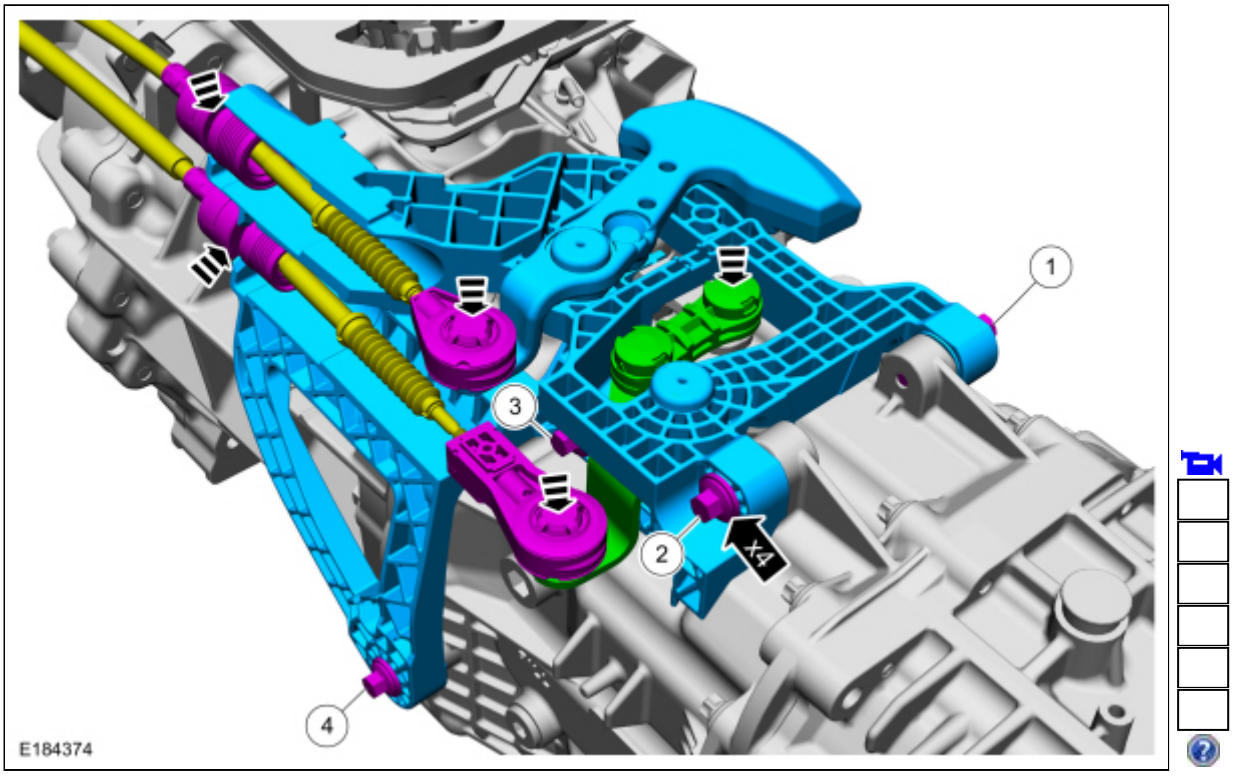
Installation

1. **NOTE:** *Only tighten the bolts finger tight at this stage.*

   Use the General Equipment: Feeler Gauge



2. *Torque*:
   1: 20 Nm
   2: 20 Nm
   3: 20 Nm
   4: 20 Nm



NOTE: *All wheel drive vehicles.*

3. Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Installation).

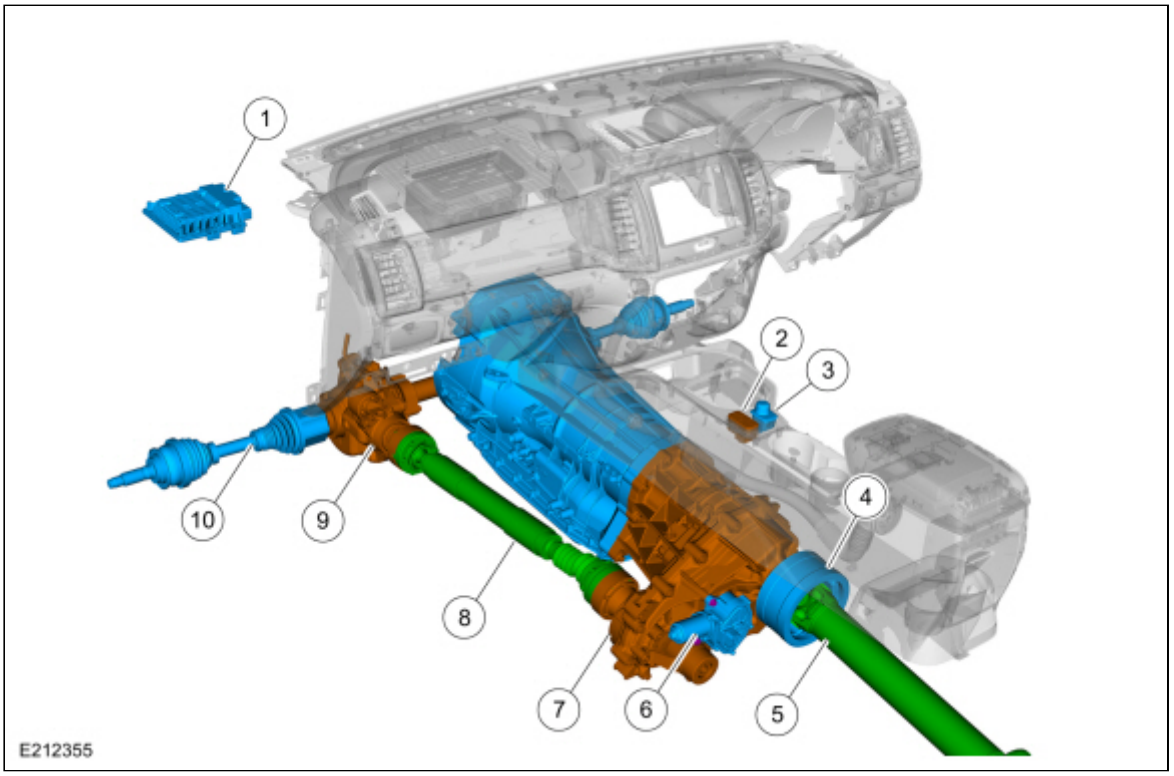
NOTE: *All vehicles.*

4. Refer to: Gearshift Cable Adjustment (308-06B Manual Transmission External Controls - 6-Speed Manual Transmission - MT82, General Procedures).

Copyright © 2016 Ford Motor Company

Four-Wheel Drive Systems

4-WHEEL DRIVE LOCATION INDEX



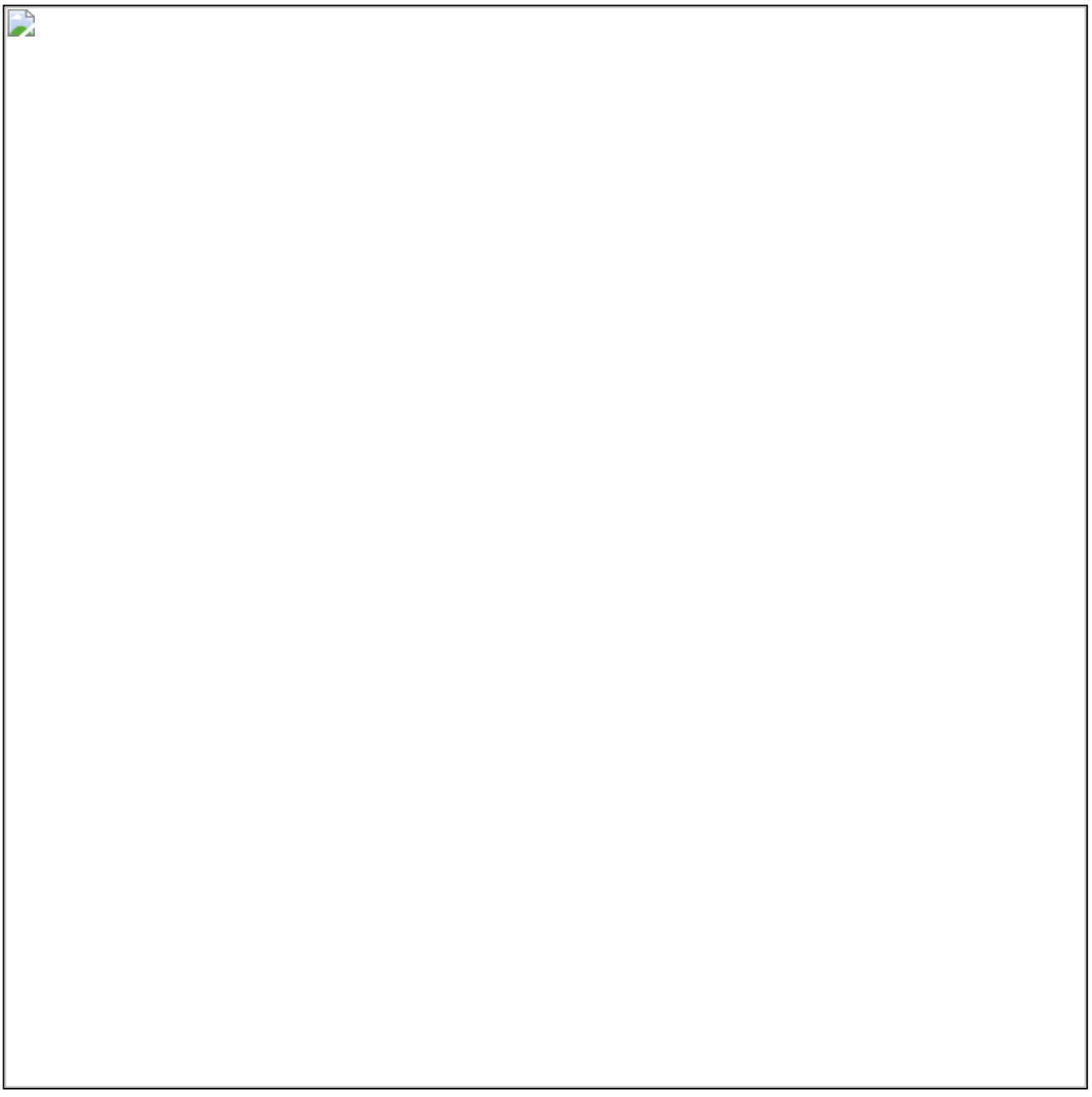
Item	Part Number	Description
1	—	Powertrain control module (PCM)
2	—	Floor console switch assembly
3	—	4WD switch
4	—	Vibration damper
5	—	Rear drive shaft
6	—	4WD actuator
7	—	Transfercase
8	—	Front drive shaft
9	—	Front drive axle
10	—	Front drive half shaft

Copyright © 2016 Ford Motor Company

Four-Wheel Drive Systems - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

PCM Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Wheel speed data	ABS	The PCM uses wheel speed information for the four-wheel drive system to determine percentage of torque to be transferred to the front wheels.

4WD Control And Fault Indicators

The 4WD system consists of a transfer case, driveshafts, front and rear axles, mode select switch (MSS), and PCM. Using inputs from various module/systems, the PCM controls the transfer case. 4WD system faults are be indicated by an icon indicator in the IPC as well as the Check 4WD message in the message center.

Electronic Locking Differential (ELD) System

The ELD system consists of the following components:

- ELD field coil, located at the rear differential
- Rear differential
- ELD switch

For more information on the ELD system,
Refer to: Electronic Locking Differential (ELD) (205-02) .

Component Description

Mode Select Switch

The MSS allows the driver to select the mode best suited to the terrain and driving conditions. The MSS is located on the center console. The driver can select the following modes with the MSS:

- 2WD High (2H)
- 4WD High (4H)
- 4WD Low (4L)

Transfer Case

The transfer case is a gearbox that attaches to the transmission. The transfer case directs power to the front driveshaft and the front drive axle. For more information on the transfer case,
Refer to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Description and Operation).
Refer to: Transfer Case (308-07C Transfer Case - 6-Speed Automatic Transmission - 6R80, Description and Operation).

Copyright © 2016 Ford Motor Company

Four-Wheel Drive Systems

Principles of Operation

The Four-Wheel Drive (4WD) system is an electronic shift system that allows the operator to choose between 2 different 4WD modes as well as 2-Wheel Drive (2WD).

Using the Four Wheel Drive Switch on the shift console, the operator can switch between 2WD-High (2H) and 4WD-High (4H) mode at speeds up to 110 km/h (68 mph), but only with the accelerator pedal released. During the shift the indicator lamp will flash. To engage or disengage 4WD-Low (4L) mode , the vehicle speed must be less than 5 km/h (3 mph) and the transmission must be in neutral (or the clutch pedal pressed in manual transmission vehicles).

When shifting to 4L the Engine Traction Control and Trailer Stability Control are deactivated. Hill Descent Control, Hill Start Assist and Brake Traction Control remain active. When shifting to 2H, all the stability control (ESP) functions are reactivated.

2WD-High Range (2H)

Use for all normal road driving and also for off-road driving across dry, level terrain.

4WD-High Range (4H)

Use for off-road driving. The 4WD indicator lamp will come on when the four wheel drive switch is in the 4H position.

4WD-Low Range (4L)

Use for more extreme off-road conditions, such as steep ascents and descents. Also use when low speed manoeuvring is necessary, such as reversing a trailer or negotiating a boulder-strewn river bed. The 4L and 4WD indicator lamps will come on when the four wheel drive switch is in the 4L position. During the shift the indicator lamp will flash.

When the four wheel drive switch is turned, the Powertrain Control Module (PCM) activates the appropriate relay to supply power to the transfer case shift motor.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the 2 shift forks in the transfer case to change between the 2H and 4H modes and between the 4H and 4L modes. For information on transfer case mechanical operation, refer to Section 308-07B for automatic transmission or Section 308-07C for manual transmission. The PCM directly controls the electric shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The transfer case hall effect sensor, an integral part of the shift motor assembly, informs the PCM of the transfer case position.

Shifts from 2H mode to 4H mode can be made at any speed. The following are the inputs and outputs needed by the PCM to execute a change between these modes.

Feature inputs:

- Ambient air temperature from the PCM
- Four wheel drive switch
- Wheel speed signal from ABS module
- APP from PCM

Feature outputs:

- Transfer case electric shift motor outputs
- PWM signal to transfer case clutch
- Instrument panel cluster (IPC) indicators

When shifting into or out of 4L mode, the PCM requires the vehicle speed to be less than 5 km/h (3 mph) and the transmission in NEUTRAL. The following are the inputs and outputs needed by the PCM to execute a change into or out of 4L mode.

Feature inputs:

- Four wheel drive switch
- Wheel speed signal from ABS module
- TR position from PCM

Feature outputs:

- Transfer case electric shift motor outputs
- PWM signal to transfer case clutch
- IPC

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Driveshaft and U-joints • Fluid leaks • Matching tire sizes • Transfer case	• Fuse(s) • Four wheel drive switch • Transfer case shift motor • Loose or corroded connections • Wiring harness

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).
5. If the scan tool does not communicate with the VCM:

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- to diagnose no power to the scan tool,
  REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

6. If the scan tool does not communicate with the vehicle:

- verify the ignition is in the ON position.
- verify the scan tool operation with a known good vehicle.
- to diagnose no response from the PCM,
  REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules,
  REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
- If the network test passes, retrieve and record CMDTCs.

8. Carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to the PCM DTC Chart in this section. For all other DTCs, refer to appropriate section diagnostics.
10. If no DTCs related to the concern are retrieved, refer to the Symptom Chart in this section.

DTC Chart: PCM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

PCM DTC Chart

DTC	Description	Action
P1820-00	Transfer Case Clockwise Shift Relay Coil	GO to Pinpoint Test G

	Circuit Failure	
P1821-00	Transfer Case Clockwise Shift Relay Coil Open Circuit	GO to Pinpoint Test G
P1822-00	Transfer Case Clockwise Shift Relay Coil Short Circuit To Battery	GO to Pinpoint Test G
P1823-00	Transfer Case Clockwise Shift Relay Coil Short Circuit To Ground	GO to Pinpoint Test G
P1828-00	Transfer Case Counter Clockwise Shift Relay Coil Circuit Failure	GO to Pinpoint Test G
P1829-00	Transfer Case Counter Clockwise Shift Relay Coil Open Circuit	GO to Pinpoint Test G
P1830-00	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Battery	GO to Pinpoint Test G
P1831-00	Transfer Case Counter Clockwise Shift Relay Coil Short Circuit To Ground	GO to Pinpoint Test G
P184A-00	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode	GO to Pinpoint Test B
P184B-00	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range	GO to Pinpoint Test C
P1870-00	Mechanical Transfer Case 4x4 Switch Circuit Failure	GO to Pinpoint Test B
P1871-00	Mechanical Transfer Case 4x4 Switch Circuit Short To Battery	GO to Pinpoint Test B
P1874-00	Transfer Case Hall Effect Sensor Power Circuit Failure	GO to Pinpoint Test B
P1875-00	Transfer Case Hall Effect Sensor Power Circuit Short To Battery	GO to Pinpoint Test B
All other Diagnostic Trouble Codes (DTCs)	-	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom	Possible Sources	Action
• No communication with the PCM	• Scan tool • DLC • PCM • Wiring, terminals or connectors.	• REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
• The 4WD indicators do not operate correctly/do not operate	• 4WD system fault • IPC • PCM • Wiring, terminals or connectors.	• GO to Pinpoint Test A
• The vehicle does not shift between 2H and 4H modes correctly	• MSS • Transfer case • Transfer case synchronization clutch • PCM • Front axle assembly • Relay • Wiring, terminals or	• GO to Pinpoint Test B

	terminals or connectors	
• The vehicle does not shift between 4H and 4L modes correctly	• MSS • TR • Transmission drag torque • ABS wheel speed inputs • HS-CAN • Relay	• GO to Pinpoint Test C
• The 4WD does not engage at speed correctly	• Transfer case • Transfer case synchronization clutch • PCM • Front axle assembly • Relay • Wiring, terminals or connectors	• GO to Pinpoint Test G
• The front axle does not engage/disengage correctly	• MSS • Transfer case • Front axle assembly • Fuse • Wiring, terminals or connectors	• GO to Pinpoint Test D
• The transfer case jumps out of gear	• MSS • Transfer case	• GO to Pinpoint Test E
• Rear wheels binding when turning corners with the MSS in 2WD or OFF	• ELD field coil • Differential • Wiring, terminals or connectors	• REFER to: Electronic Locking Differential (ELD) (205-02 Rear Drive Axle/Differential) . and perform Pinpoint Test D.
• Unable to duplicate customer concern	• 4WD system and/or related components	• CARRY OUT the ESOF Functional Test. GO to Pinpoint Test I

Pinpoint Tests

PINPOINT TEST A : THE 4WD INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

A1 CHECK THE 4WD INDICATOR PROVE-OUT

- Ignition OFF.
- Ignition ON.

Do the 4WD indicators prove out correctly?

Yes	GO to A2
No	CHECK the IPC for faults. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

A2 CHECK FOR IPC DTCS

- Enter the following diagnostic mode on the scan tool: Self-Test — IPC.

Are any DTCs present?

Yes	For all IPC DTCs, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to A3

A3 CHECK FOR PCM DTCS

- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section for diagnosis.
No	GO to A4

A4 CHECK THE 4WD SYSTEM INDICATION IN 2H

- Switch the four wheel drive switch to 2H while monitoring the IC.

Does 4WD indicator or 4WD Low indicator display on the IC?

Yes	GO to A7
No	GO to A5

A5 CHECK THE 4WD SYSTEM INDICATION IN 4H

- Switch the four wheel drive switch to 4H while monitoring the IC.

Does the 4WD indicator display on the IC?

Yes	GO to A6
No	GO to A7

A6 CHECK THE 4WD SYSTEM INDICATION IN 4L

- **NOTE:** *When shifting in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).*

  With the vehicle at a stop and transmission in NEUTRAL, switch the four wheel drive switch to 4L while monitoring the IC.

Does the 4WD Low indicator display on the IC?

Yes	The 4WD indicators are operating correctly. CARRY OUT the ESOF Functional Test. GO to Pinpoint Test I
No	GO to A7

A7 CHECK THE MSS USING THE PCM 4WD SWITCH STATUS (4X4_SW) PID

- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Monitor the 4X4_SW PID while switching to each four wheel drive switch position.

Does the 4X4_SW PID match the four wheel drive switch position?

Yes	CHECK the IPC for faults. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

No	CARRY OUT the ESOF Functional Test. GO to Pinpoint Test I

PINPOINT TEST B : THE VEHICLE DOES NOT SHIFT BETWEEN 2H AND 4H CORRECTLY AND/OR GRINDING NOISE HEARD DURING 4WD ENGAGEMENT AT HIGH SPEEDS

B1 CHECK FOR PCM DTCS

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	For DTC P184A:00 and P184B:00, GO to B16 For P1870:00 and P1871:00, GO to B3 Fort DTC P1874:00 and P1875:00, GO to B28 For all other DTCs, REFER to the DTC Chart in this section.
No	GO to B2

B2 CHECK THE FOUR WHEEL DRIVE SWITCH POSITION MONITORING THE PCM 4WD SWITCH STATUS (4X4_SW) PID

- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Monitor the 4X4_SW PID while switching to each four wheel drive switch position.

Does the 4X4_SW PID match the four wheel drive switch position?

Yes	GO to B9
No	GO to B3

B3 CHECK THE FOUR WHEEL DRIVE SWITCH RESISTANCE VALUES

- Ignition OFF.
- Disconnect Four Wheel Drive Switch C284.
- Measure the resistance between C284 pins 2 and 3, component side, while rotating the four wheel drive switch through all positions. Refer to the following chart.

MSS Position	Resistance
2H	606 - 632 ohms
4H	265 - 275 ohms
4L	127 - 133 ohms

Are the resistance values within specification?

Yes	GO to B4
No	INSTALL a new four wheel drive switch. CLEAR the DTCs. TEST the system for normal operation.

B4 CHECK THE FOUR WHEEL DRIVE SWITCH CONTROL CIRCUIT FOR SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect PCM C175B (Petrol).
- Disconnect PCM C1232A (Diesel).
- Disconnect PCM C1232B (Diesel).

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C284-2	V	Ground
C284-3	V	Ground

Is any voltage present?

Yes	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.
No	GO to B5

B5 CHECK THE FOUR WHEEL DRIVE SWITCH CONTROL AND RETURN CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C284-2	Ω	Ground
C284-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B6
No	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B6 CHECK THE FOUR WHEEL DRIVE SWITCH CONTROL AND RETURN CIRCUITS FOR AN OPEN

- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C284-2	Ω	C175B-46
C284-3	Ω	C175B-34

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C284-2	Ω	C1232B-46
C284-3	Ω	C1232A-43

Are the resistances less than 3 ohms?

Yes	GO to B7
No	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

No	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B7 CHECK THE FOUR WHEEL DRIVE SWITCH CONTROL AND RETURN CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C284-2	Ω	C284-3

Is the resistance greater than 10,000 ohms?

Yes	GO to B8
No	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B8 CHECK THE ABS FRONT AND REAR WHEEL SPEED PIDS

- Connect PCM C175B (Petrol).
- Connect PCM C1232A (Diesel).
- Connect PCM C1232B (Diesel).
- Connect Four Wheel Drive Switch C284.
- Ignition ON.
- Set the four wheel drive switch to 2H.
- Enter the following diagnostic mode on the scan tool: DataLogger — ABS.
- With the vehicle stopped and while driving, monitor the wheel speed PIDs:
  - Left Front Wheel Speed Sensor (WSPD_LF)
  - Left Rear Wheel Speed Sensor (WSPD_LR)
  - Right Front Wheel Speed Sensor (WSPD_RF)
  - Right Rear Wheel Speed Sensor (WSPD_RR)

Do the Wheel Speed PIDs match with the vehicle stopped and at all speeds?

Yes	GO to B9
No	For further diagnosis of the ABS system, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing). After the repair is complete, CLEAR the DTCs. TEST the system for normal operation.

B9 CHECK THE PCM 4WD MODE (4WD_MODES) PID WITH THE MSS IN 4H

- Start the engine.
- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Switch the four wheel drive switch to 4H while monitoring the IC and the 4WD_SWITCH PID.

Does the 4WD indicator display on the IC and the 4WD_SWITCH PID indicate 4WD High?

Yes	GO to B12
No	GO to B10

B10 CHECK FOR 4H WIND-UP

- Drive the vehicle on a dry, hard surface in turns.

Is wind-up present in turns?

Yes	For petrol equipped vehicles, GO to B13 For diesel equipped vehicles, GO to B14
No	GO to B11

B11 CHECK FOR TRANSFER CASE ENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft.
- Observe the front driveshaft.

Does the front driveshaft rotate?

Yes	CHECK that all driveline fasteners are present and tightened to specification. For further diagnosis of the front axle, REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
No	GO to B16

B12 CHECK FOR FRONT HALFSHAFT ENGAGEMENT

- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft and U-joint.

Did both front halfshafts rotate?

Yes	CHECK that all driveline fasteners are present and tightened to specification. For further diagnosis of the front axle, REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
No	GO to Pinpoint Test D

B13 CHECK THE TRANSFER CASE SHIFT TO 2H

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Set the four wheel drive switch to 2H.
- Monitor the 4WD_MODE PID.

Does the 4WD_MODE PID indicate 2WD?

Yes	GO to B15
No	GO to B16

B14 CHECK THE TRANSFER CASE SHIFT TO 2H

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Switch the four wheel drive switch to 2H while monitoring the IC and the 4WD_SWITCH PID.

Does 4WD indicator or 4WD Low indicator display on the IC and does the 4WD_SWITCH PID indicate 2WD?

Yes	GO to B15

No	GO to B16

B15 CHECK FOR TRANSFER CASE DISENGAGEMENT

- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	GO to B16
No	The system is functioning correctly. CARRY OUT the ESOF Functional Test. GO to Pinpoint Test I

B16 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the four wheel drive switch from 2H to 4H.
- Observe the transfer case shift motor while switching the four wheel drive switch from 4H to 2H.

Does the transfer case shift motor rotate when the switch is commanded to both positions?

Yes	GO to B35
No	GO to B17

B17 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

- Disconnect Transfer Case C350 (Automatic Transmission).
- Disconnect Transfer Case C3820 (Manual Transmission).
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350, Pin 4, Component Side	Ω	Ground
C350, Pin 5, Component Side	Ω	Ground

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820, Pin 4, Component Side	Ω	Ground
C3820, Pin 5, Component Side	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to B18
No	INSTALL a new transfer case shift motor. CLEAR the DTCs. REPEAT the self-test, if the concern is still present, GO to B35

B18 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER

- Connect PCM C175B (Petrol).
- Connect PCM C1232A (Diesel).
- Connect PCM C1232B (Diesel).
- Ignition ON.

- On an automatic transmission equipped vehicle, switch the four wheel drive switch between 2H and 4H while measuring:

Positive Lead	Measurement / Action	Negative Lead
C350-4		C350-5

- On a manual transmission equipped vehicle, switch the four wheel drive switch between 2H and 4H while measuring:

Positive Lead	Measurement / Action	Negative Lead
C3820-4		C350-5

Are the voltages 9 volts or greater on the circuits only when switching the four wheel drive switch between 2H and 4H?

Yes	GO to B34
No	GO to B19

B19 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect 4WD Relay R17.
- Ignition ON.
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-4		Ground
C350-5		Ground

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-4		Ground
C3820-5		Ground

Is any voltage present?

Yes	VERIFY that circuit fuse (10A) is OK. REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.
No	GO to B20

B20 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-4	Ω	Ground
C350-5	Ω	Ground

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-4	Ω	Ground
C3820-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to B21
No	VERIFY that circuit fuse (25A) is OK. REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B21 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

- Disconnect 4WD Motor 1 Relay R16.
- Disconnect 4WD Motor 2 Relay R15.
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-4	Ω	4WD Motor 2 Relay R15, Pin 3, Component Side
C350-5	Ω	4WD Motor 1 Relay R16, Pin 3, Component Side

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-4	Ω	4WD Motor 2 Relay R15, Pin 3, Component Side
C3820-5	Ω	4WD Motor 1 Relay R16, Pin 3, Component Side

Are the resistances less than 3 ohms?

Yes	GO to B22
No	REPAIR the affected circuit. CLEAR the DTCs. TEST the system for normal operation.

B22 CHECK THE 4WD RELAY VOLTAGE CIRCUIT

- Connect 4WD Relay R17.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
4WD Motor 2 Relay R15, Pin 5, Component Side		Ground

4WD Motor 2 Relay R15, Pin 5, Component Side	V	Ground
4WD Motor 1 Relay R16, Pin 5, Component Side	V	Ground

Is the voltage greater than 11 volts at both relays?

Yes	GO to B23
No	GO to B25

B23 CHECK 4WD RELAY GROUND CIRCUIT AN OPEN AND A SHORT TO VOLTAGE

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
4WD Motor 2 Relay R15, Pin 4, Component Side	Ω	Ground
4WD Motor 1 Relay R16, Pin 4, Component Side	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to B24
No	VERIFY that circuit fuse (10A) is OK. REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B24 CHECK THE 4WD MOTOR 1 RELAY

- Carry out the Relay component test. Refer to Wiring Diagrams Cell 149 for component testing.

Did the 4WD Motor 1 Relay pass the component test?

Yes	INSTALL a new 4WD Motor 2 Relay. TEST the system for normal operation.
No	INSTALL a new 4WD Motor 1 Relay. TEST the system for normal operation.

B25 CHECK THE 4WD RELAY VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect 4WD Relay R17.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
4WD Motor 2 Relay R15, Pin 5, Component Side	Ω	Ground
4WD Motor 1 Relay R16, Pin 5, Component Side	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to B26
No	VERIFY that circuit fuse F12 (10A) is OK. REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B26 CHECK THE 4WD RELAY VOLTAGE CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
4WD Motor 2 Relay R15, Pin 5, Component Side	Ω	4WD Relay R17, Pin 5, Component Side
4WD Motor 1 Relay R16, Pin 5, Component Side	Ω	4WD Relay R17, Pin 5, Component Side

Is the resistance less than 3 ohms?

Yes	GO to B27
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

B27 CHECK THE 4WD RELAY GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
4WD Relay R17, Pin 2, Component Side	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new 4WD Motor 2 Relay. TEST the system for normal operation.
No	REPAIR the circuit. CLEAR the DTCs. TEST the system for normal operation.

B28 CHECK TRANSFER CASE HALL EFFECT SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Transfer Case C350 (Automatic Transmission).
- Disconnect Transfer Case C3820 (Manual Transmission).
- Disconnect PCM C175B (Petrol).
- Disconnect PCM C1232A (Diesel).
- Disconnect PCM C1232B (Diesel).
- Ignition ON.
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-1		Ground
C350-2		Ground
C350-3		Ground

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead

C3820-1	V	Ground
C3820-2	V	Ground
C3820-3	V	Ground

Is any voltage present?

Yes	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.
No	GO to B29

B29 CHECK TRANSFER CASE HALL EFFECT SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-1	Ω	Ground
C350-2	Ω	Ground
C350-3	Ω	Ground

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-1	Ω	Ground
C3820-2	Ω	Ground
C3820-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to B30
No	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B30 CHECK THE TRANSFER CASE HALL EFFECT SENSOR CIRCUITS FOR AN OPEN

- On a petrol / automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-1	Ω	C175B-15
C350-2	Ω	C175B-27
C350-3	Ω	C175B-39

- On a diesel / automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-1	Ω	C1232A-51

C350-1	Ω	C1232A-51
C350-2	Ω	C1232B-7
C350-3	Ω	C1232A-35

- On a petrol / manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-1	Ω	C175B-15
C3820-2	Ω	C175B-27
C3820-3	Ω	C175B-39

- On a diesel / manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-1	Ω	C1232A-51
C3820-2	Ω	C1232B-7
C3820-3	Ω	C1232A-35

Are the resistances less than 3 ohms?

Yes	GO to B17
No	REPAIR the affected circuit(s). CLEAR the DTCs. TEST the system for normal operation.

B31 CHECK THE VREF VOLTAGE TO TRANSFER CASE HALL EFFECT SENSOR

- Ignition OFF.
- Connect PCM C175B (Petrol).
- Connect PCM C1232A (Diesel).
- Connect PCM C1232B (Diesel).
- Ignition ON.
- On an automatic transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C350-1	V	C350-3

- On a manual transmission equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C3820-1	V	C3820-3

Is the voltage between 4.5 V - 5.5 V?

Yes	For petrol equipped vehicles, GO to B32 For diesel equipped vehicles, GO to B33
No	GO to B34

B32 CHECK THE TRANSFER CASE HALL EFFECT SENSOR SIGNAL CIRCUIT

- Enter the following diagnostic mode on the scan tool:
- Monitor the 4X4_MODE PID.
- Ignition OFF.
- On an automatic transmission equipped vehicle, connect:

Positive Lead	Measurement / Action	Negative Lead
C350-1		C350-2

- On a manual transmission equipped vehicle, connect:

Positive Lead	Measurement / Action	Negative Lead
C3820-1		C3820-2

- Ignition ON.
- Monitor the 4X4_MODE PID.

Does the 4X4_MODE PID change with the jumper installed?

Yes	INSTALL a new transfer case shift motor. CLEAR the DTCs. TEST the system for normal operation.
No	GO to B34

B33 CHECK THE TRANSFER CASE HALL EFFECT SENSOR SIGNAL CIRCUIT

- Ignition OFF.
- Connect Transfer Case C350 (Automatic Transmission).
- Connect Transfer Case C3820 (Manual Transmission).
- On an automatic transmission equipped vehicle, measure the signal circuit voltage by carefully backprobing the connector pin:

Positive Lead	Measurement / Action	Negative Lead
C350-2		Ground

- On a manual transmission equipped vehicle, measure the signal circuit voltage by carefully backprobing the connector pin:

Positive Lead	Measurement / Action	Negative Lead
C3820-2		Ground

- Ignition ON.
- Switch the four wheel drive switch between 2H and 4H while observing the DVOM.

Does the signal circuit voltage change when the four wheel drive switch is switched between 2H and 4H?

Yes	GO to B34
No	INSTALL a new transfer case shift motor. CLEAR the DTCs. TEST the system for normal operation.

B34 CHECK FOR CORRECT PCM OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Connect all PCM connectors. Make sure they are seated correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). TEST the system for normal operation.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

B35 SHIFT THE TRANSFER CASE TO 4H MANUALLY

- Remove the transfer case shift motor from the transfer case.
- Using a wrench, rotate the shift cam to the 4H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4H and the front driveshaft rotates?

Yes	GO to B36
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Disassembly and Assembly). REFER to: Transfer Case (308-07C Transfer Case - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly).

B36 CHECK THE TORQUE REQUIRED TO SHIFT THE TRANSFER CASE

- Rotate the shift cam by hand through 4L, 4H and 2H positions.
- Measure the torque required to perform the shift.

Is the torque required to shift 45 Nm (33 lb-ft) or less?

Yes	GO to B37
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Disassembly and Assembly). REFER to: Transfer Case (308-07C Transfer Case - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly).

B37 SHIFT THE TRANSFER CASE TO 2H MANUALLY

- Rotate the shift cam to the 2H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 2H and the front driveshaft does not rotate?

Yes	GO to B38

No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Disassembly and Assembly). REFER to: Transfer Case (308-07C Transfer Case - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly).

B38 SHIFT THE TRANSFER CASE TO 4L MANUALLY

- Rotate the shift cam by hand to the 4L position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4L and the front driveshaft rotates?

Yes	INSTALL a new transfer case shift motor. CLEAR the DTCs. TEST the system for normal operation.
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Disassembly and Assembly). REFER to: Transfer Case (308-07C Transfer Case - 6-Speed Automatic Transmission - 6R80, Disassembly and Assembly).

PINPOINT TEST C : THE VEHICLE DOES NOT SHIFT BETWEEN 4H AND 4L MODES CORRECTLY

C1 CHECK THE 2H TO 4H SHIFT

- Ignition ON.
- Drive the vehicle and shift four wheel drive switch from 2H to 4H.

Does the vehicle shift between 2H and 4H correctly?

Yes	GO to C2
No	GO to Pinpoint Test B

C2 CHECK THE 4H TO 4L SHIFT

- **NOTE:** *When shifting in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).*

  Drive the vehicle and shift four wheel drive switch from 4H to 4L.

Does the transfer case shift from 4H to 4L correctly and the complaint is related to a clunk noise during the shift?

Yes	Transmission neutral drag is excessive. REFER to: Diagnostic Strategy (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to C3

C3 CHECK THE PCM GEAR (GEAR_OSC) PID

- Monitor the GEAR_OSC PID while shifting the transmission through gear ranges.

Does the GEAR_OSC PID show the correct gear position when shifted?

Yes	GO to C4
No	REFER to: Diagnostic Strategy (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). for further diagnosis of the TR sensor.

C4 CHECK THE PCM ABS MODULE WHEEL SPEED PIDS

- Enter the following diagnostic mode on the scan tool: DataLogger — ABS Module.
- Monitor the wheel speed PIDs:
  - Left Front Wheel Speed Sensor (WSPD_LF)
  - Left Rear Wheel Speed Sensor (WSPD_LR)
  - Right Front Wheel Speed Sensor (WSPD_RF)
  - Right Rear Wheel Speed Sensor (WSPD_RR)

Do the wheel speed PIDs indicate 0 km/h (0 mph)?

Yes	All PIDs are accurate. GO to Pinpoint Test B
No	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing). for further diagnosis of the ABS system.

PINPOINT TEST D : THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY

D1 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- Ignition ON.
- With the vehicle warm and the four wheel drive switch in 2H mode, drive the vehicle at sustained WOT for 5 seconds.

Is there a grinding noise from the axle system during WOT?

Yes	REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
No	GO to D2

D2 CHECK PCM OPERATION

- Ignition ON.
- Monitor the 4X4 indicator on the IPC while moving the four wheel drive switch between 2H and 4H modes.

Does the 4X4 indicator illuminate when the MSS is in the 4H position and turn off when the four wheel drive switch is in the 2H position?

Yes	GO to Pinpoint Test C
No	GO to Pinpoint Test B

PINPOINT TEST E : THE TRANSFER CASE JUMPS OUT OF GEAR

E1 VERIFY THE CONCERN

- Drive the vehicle and attempt to duplicate the concern.

Is the concern an uncommanded range shift (in or out of low range)?

Yes	GO to E5
No	For petrol equipped vehicles, GO to E2 For diesel equipped vehicles, GO to E3

E2 CHECK THE MSS POSITION MONITORING THE PCM 4WD SWITCH STATUS (4X4_SW) PID AND 4WD MODE STATUS (4X4_MODE) PID

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Drive the vehicle.
- Dynamically monitor the 4X4_SW and 4X4_MODE PIDs while driving the vehicle in each shift position.

Do the 4X4_SW and 4X4_MODE PIDs always agree with the switch position?

Yes	GO to E4
No	GO to Pinpoint Test B

E3 CHECK THE MSS POSITION MONITORING THE PCM 4WD SWITCH STATUS (4X4_SW) PID

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Drive the vehicle.
- Dynamically monitor the 4X4_SW PID while driving the vehicle in each shift position.

Do the 4X4_SW PID always agree with the switch position?

Yes	GO to E4
No	GO to Pinpoint Test B

E4 CHECK FOR PCM DTCS

- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section.
No	CARRY OUT the ESOF Functional Test. GO to Pinpoint Test I

E5 CHECK THE 4WD INDICATORS

- Stop the vehicle.
- Transmission in NEUTRAL.
- Depress the brake pedal.
- Observe the 4WD indication on the IC while cycling through each four wheel drive switch position.

Do the 4WD indicator and 4WD Low indicator match the four wheel drive switch?

Yes	GO to E6
No	GO to Pinpoint Test A

E6 CHECK FOR PCM DTCS

- Transmission in PARK.
- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section.
No	CHECK the transfer case fluid level.

	REFER to: Transfer Case Fluid Level Check (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, General Procedures). . If the fluid level is OK, CHECK for internal transfer case faults.

PINPOINT TEST F : THE FRONT AXLE MAKES NOISE IN 2H MODE ONLY AND GENERALLY UNDER HEAVY THROTTLE

F1 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle warm and the four wheel drive switch in 2H mode, drive the vehicle at sustained WOT for 5 seconds.

Is there a grinding noise from the axle system during WOT?

Yes	REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
No	IDENTIFY the customer concern and GO to the Symptom Chart in this section.

PINPOINT TEST G : THE 4WD DOES NOT ENGAGE AT SPEED CORRECTLY

G1 CHECK FOR PCM DTCS

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	For DTC P1820:00, P1821:00, P1822:00, or P1823:00, GO to G7 For DTC P1828:00, P1829:00, P1830:00, or P1831:00, GO to G11 For all other DTCs, REFER to the PCM DTC Chart for diagnosis.
No	GO to G2

G2 CHECK 4H ENGAGEMENT AT REST

- Switch the four wheel drive switch from 2H to 4H.
- Confirm 4H engagement by driving the vehicle and check for wind-up in turns.

Does 4H engage at rest correctly?

Yes	GO to G3
No	GO to Pinpoint Test B

G3 CHECK 2H TO 4H SHIFT AT SPEED

- Switch the four wheel drive switch to 2H.
- Drive the vehicle and carry out a 2H to 4H shift while driving approximately at 16 km/h (10 mph).
- Stop the vehicle, shift to 2H, drive the vehicle and carry out a 2H to 4H shift while driving at approximately 64 km/h (40 mph).

Does 4H engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?

Yes	GO to Pinpoint Test D
No	GO to G4

G4 CHECK THE ABS FRONT AND REAR WHEEL SPEED SENSOR PIDS

- Enter the following diagnostic mode on the scan tool: DataLogger — ABS.
- While driving in a straight line, monitor the wheel speed PIDs:
  - Left Front Wheel Speed Sensor (WSPD_LF)
  - Left Rear Wheel Speed Sensor (WSPD_LR)
  - Right Front Wheel Speed Sensor (WSPD_RF)
  - Right Rear Wheel Speed Sensor (WSPD_RR)

Do the Wheel Speed PIDs match?

Yes	GO to G5
No	For further diagnosis of the ABS system, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).

G5 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH IN 2H

- Ignition OFF.
- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Remove the transfer case shift motor from the transfer case, leaving the electrical connector connected.
- Using a wrench, shift the transfer case shift cam to 2H.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Disassembly and Assembly). .
No	GO to G6

G6 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH IN 4H

- Using a wrench, shift the transfer case shift cam to 4H.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	The system is functioning correctly. CARRY OUT the ESOF Functional Test. GO to Pinpoint Test I
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Disassembly and Assembly). .

G7 CHECK THE 4WD MOTOR 1 RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect PCM C175B (Petrol).
- Disconnect PCM C1232A (Diesel).
- Disconnect 4WD Motor 1 Relay.
- Ignition ON.
- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-37		Ground

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-52		Ground

Is any voltage present?

Yes	REPAIR circuit. CLEAR the DTCs. TEST the system for normal operation.
No	GO to G8

G8 CHECK THE 4WD MOTOR 1 RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect 4WD Motor 1 Relay.
- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-37	Ω	Ground

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-52	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	VERIFY that circuit fuse is OK. REPAIR circuit. CLEAR the DTCs. TEST the system for normal operation.
No	GO to G9

G9 CHECK THE 4WD MOTOR 1 RELAY CONTROL CIRCUIT FOR AN OPEN

- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C175B-37	Ω	4WD Motor 1 Relay R16, Pin 2, Component Side

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-52	Ω	4WD Motor 1 Relay R16, Pin 2, Component Side

Is the resistance less than 3 ohms?

Yes	GO to G10
No	REPAIR circuit. CLEAR the DTCs. TEST the system for normal operation.

G10 CHECK THE 4WD MOTOR 1 RELAY

- Ignition OFF.
- Carry out the Relay component test. Refer to Wiring Diagrams Cell 149 for component testing.

Did the 4WD Motor 1 Relay pass the component test?

Yes	GO to G15
No	INSTALL a new 4WD Motor 1 Relay. TEST the system for normal operation.

G11 CHECK THE 4WD MOTOR 2 RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect PCM C175C (Petrol).
- Disconnect PCM C1232A (Diesel).
- Disconnect 4WD Motor 2 Relay.
- Ignition ON.
- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C175C-20		Ground

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-41		Ground

Is any voltage present?

Yes	REPAIR circuit. CLEAR the DTCs. TEST the system for normal operation.
No	GO to G12

G12 CHECK THE 4WD MOTOR 2 RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect 4WD Motor 2 Relay.
- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C175C-20	Ω	Ground

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-41	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	VERIFY that circuit fuse (10A) is OK. REPAIR circuit. CLEAR the DTCs. TEST the system for normal operation.
No	GO to G13

G13 CHECK THE 4WD MOTOR 2 RELAY CONTROL CIRCUIT FOR AN OPEN

- On a petrol equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C175C-20	Ω	4WD Motor 2 Relay R15, Pin 2, Component Side

- On a diesel equipped vehicle, measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-41	Ω	4WD Motor 2 Relay R15, Pin 2, Component Side

Is the resistance less than 3 ohms?

Yes	GO to G14
No	REPAIR circuit. CLEAR the DTCs. TEST the system for normal operation.

G14 CHECK THE 4WD MOTOR 2 RELAY

- Ignition OFF.
- Carry out the Relay component test. Refer to Wiring Diagrams Cell 149 for component testing.

Did the 4WD Motor 2 Relay pass the component test?

Yes	GO to G15
No	INSTALL a new 4WD Motor 2 Relay. TEST the system for normal operation.

G15 CHECK FOR CORRECT PCM OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Connect all PCM connectors. Make sure they are seated correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new PCM.

	REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). TEST the system for normal operation.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

PINPOINT TEST H : VEHICLE PULSATES OR SHUDDERS IN A STRAIGHT LINE (STRAIGHTLINE DRIVELINE WIND-UP)

NOTE: *4X4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.*

H1 VERIFY THE CONCERN

- Drive the vehicle and shift from 2H to 4H. There should be minimal wind-up in 4H mode during straight line maneuvers (wind-up in turns is normal; 4X4 high/low is not intended for driving on hard/dry surfaces).

Is excessive wind-up present?

Yes	GO to H2
No	RETURN the vehicle to the customer. ADVISE about correct system operation and normal vehicle behavior.

H2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

- Check the wheel and tire sizes.

Do the 4 wheel and tire sizes match?

Yes	GO to H3
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H3 CHECK TIRE WEAR

- Check each of the 4 tires for wear.

Are the 4 tires worn evenly?

Yes	GO to H4
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H4 CHECK TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to VC label.

Are the tire inflation pressures correct?

Yes	GO to H5
No	ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match.

Do the front and rear axle ratios match?

Yes	RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior.
No	CHECK the vehicle VC label. INSTALL the correct axle(s).

PINPOINT TEST I : ESOF FUNCTIONAL TEST

NOTE: *4X4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.*

I1 CHECK FOR IPC DTCS

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self-Test — IPC.

Are any DTCs present?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). .
No	GO to I2

I2 CHECK 2H OPERATION

- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- Switch the four wheel drive switch to 2H.
- Monitor the 4X4_SW PID.

Does the PID display the vehicle in 2H?

Yes	GO to I4
No	GO to I3

I3 CHECK FOR PCM DTCS

- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section.
No	GO to I4

I4 CHECK FOR WIND-UP IN 2H

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test B
No	GO to I5

I5 CHECK 4H OPERATION

- Switch the four wheel drive switch to 4H while monitoring the IPC.

Does the 4WD indicator display on the IPC?

Yes	GO to I8
No	GO to I6

I6 CHECK FOR PCM DTCS

- Select PARK.
- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section.
No	GO to I7

I7 CHECK FOR WIND-UP IN 4H

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	REFER to: Electronic Locking Differential (ELD) (205-02 Rear Drive Axle/Differential) . and perform Pinpoint Test D.
No	REFER to: Electronic Locking Differential (ELD) (205-02 Rear Drive Axle/Differential) . and perform Pinpoint Test C.

I8 CHECK FOR STRAIGHT LINE 4H WIND-UP

- Drive the vehicle on a dry, hard surface.

Is straightline wind-up present?

Yes	GO to Pinpoint Test B
No	GO to I9

I9 CHECK 4H WIND-UP IN TURNS

- Drive the vehicle in 4H while turning.

Is wind-up present in turns?

Yes	GO to I10
No	GO to Pinpoint Test B

I10 CHECK 4L OPERATION

- **NOTE:** *When shifting in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).*

  With the vehicle at a stop and transmission in NEUTRAL, switch the four wheel drive switch to 4L while monitoring the IPC.

Does the 4WD Low indicator display on the IPC?

Yes	GO to I13
No	GO to I11

I11 CHECK FOR PCM DTCS

- Select PARK.
- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section.
No	GO to I12

I12 CHECK FOR WIND-UP IN 4L

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test A
No	GO to Pinpoint Test C

I13 CHECK FOR 4L WIND-UP IN TURNS

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present and 4L functioning?

Yes	GO to I14
No	CHECK for PCM DTCs. REFER to the PCM DTC Chart in this section. If no DTCs are present, GO to Pinpoint Test C

I14 CHECK 4L TO 2H SHIFT

- Enter the following diagnostic mode on the scan tool: DataLogger — PCM.
- With the vehicle at a stop and transmission in NEUTRAL, switch the four wheel drive switch from 4L to 2H.
- Monitor the 4X4_SW PID.

Does the PID display the vehicle in 2H?

Yes	GO to I15
No	GO to I16

I15 CHECK FOR WIND-UP IN 2H

- Switch the four wheel drive switch to 2H.
- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test A
No	GO to I18

I16 CHECK FOR PCM DTCS

- Select PARK.
- Enter the following diagnostic mode on the scan tool: Self-Test — PCM.

Are any DTCs present?

Yes	REFER to the PCM DTC Chart in this section.
No	GO to I17

I17 CHECK FOR WIND-UP IN 2H

- Switch the four wheel drive switch to 2H.
- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test C
No	GO to Pinpoint Test A

I18 CHECK FOR TRANSFER CASE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	REFER to: Driveline System (205-00 Driveline System - General Information, Diagnosis and Testing).
No	GO to I19

I19 CHECK 2H TO 4H SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)

- Switch the four wheel drive switch to 2H.
- Drive the vehicle on the road and shift from 2H to 4H while driving above 32 km/h (20 mph).

Does the transfer case shift to 4H satisfactorily?

Yes	The 4WD system is functioning correctly.
No	GO to Pinpoint Test G

Copyright © 2016 Ford Motor Company

Specifications

Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
MT82 Transfer case fluid	*Material*: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)

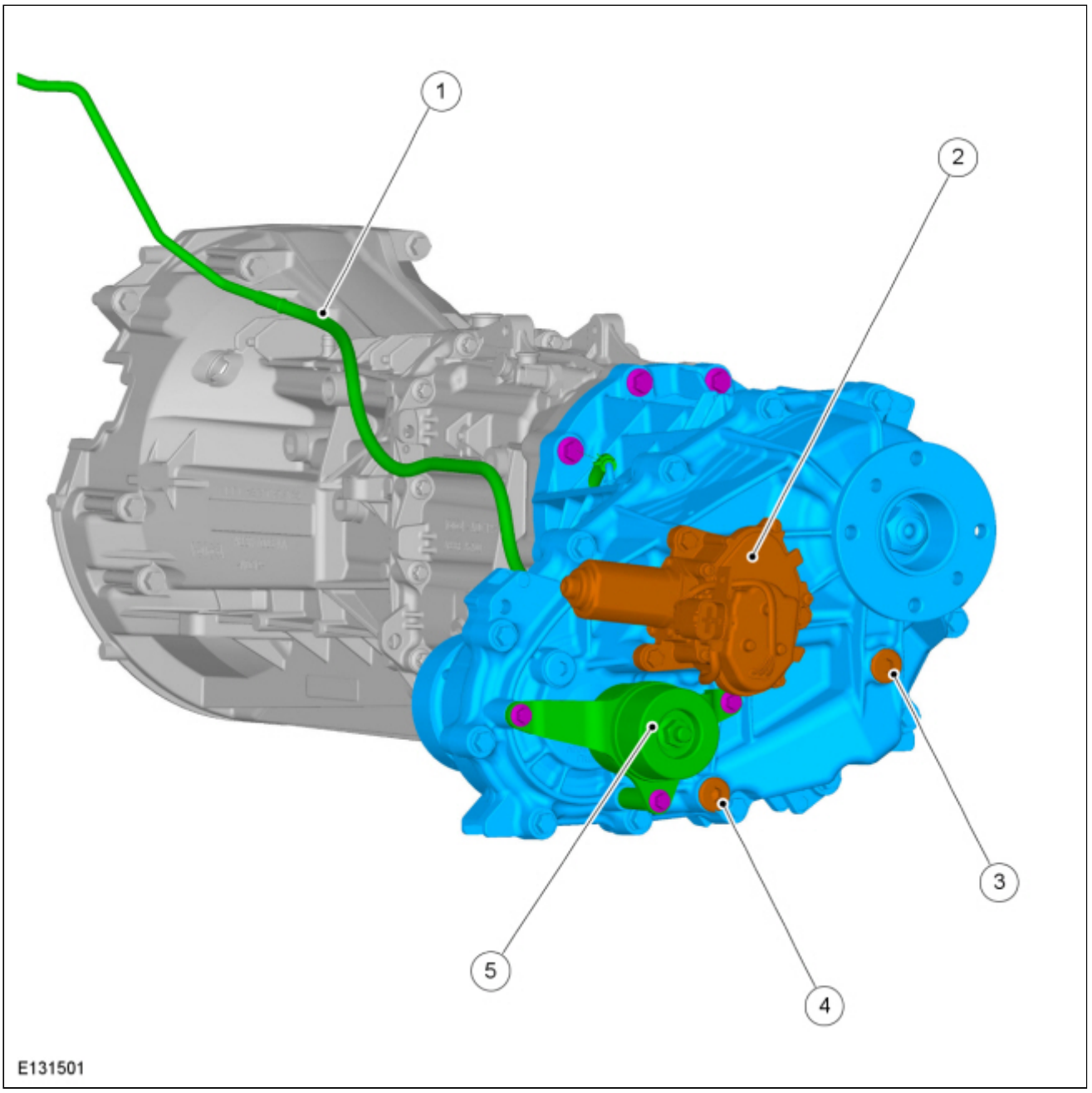
Capacities

	Liters
MT82 Transfer case - Service fill	1.2

Copyright © 2016 Ford Motor Company

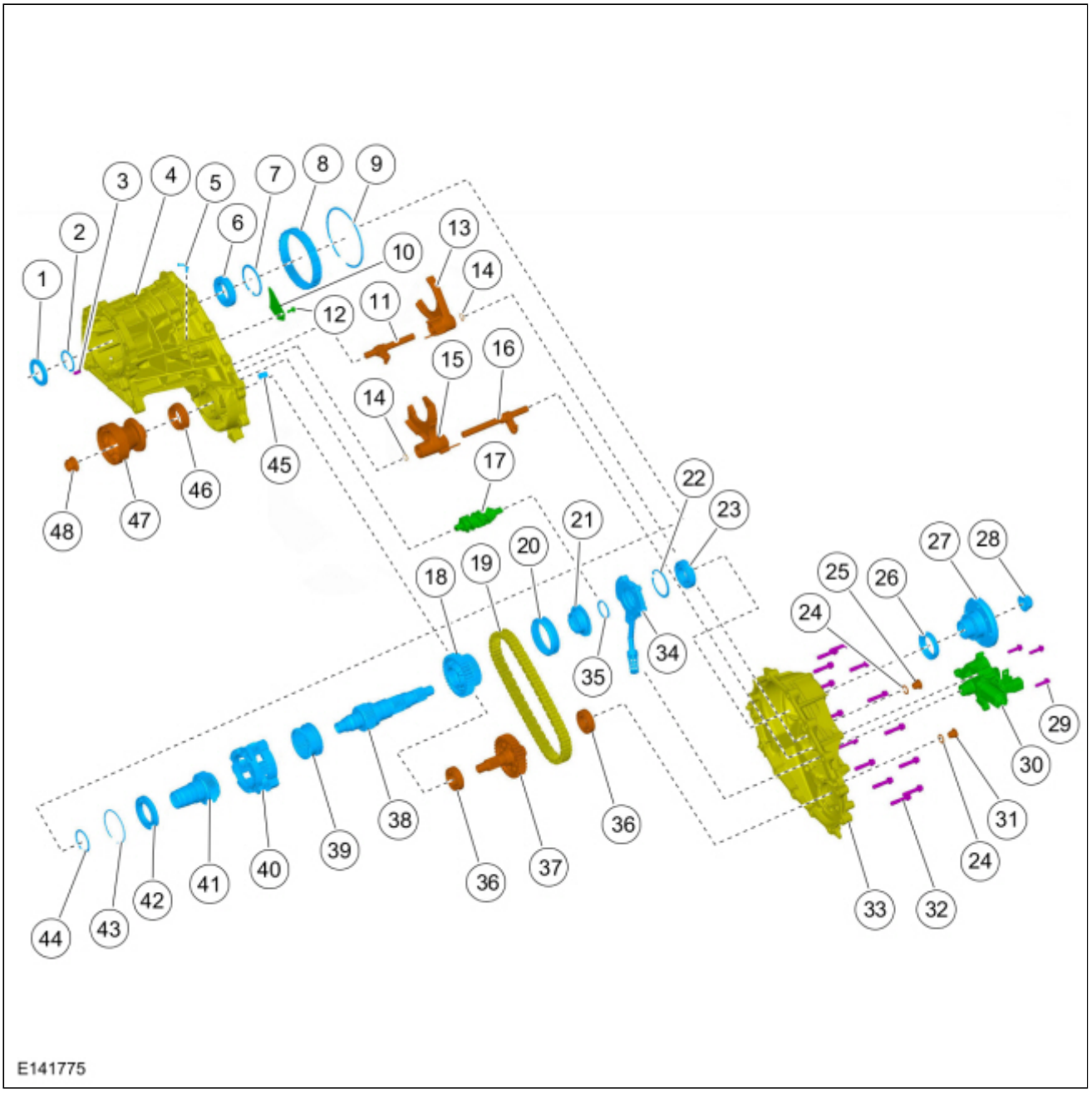
Transfer Case

Base Part Number: 7251



Item	Part Number	Description
1	—	Breather tube
2	—	Motor
3	—	Oil filler plug
4	—	Drain plug
5	—	Damper

Exploded view



Item	Part Number	Description
1	—	Input oil seal
2	—	Snap ring
3	—	Fork shift pin
4	—	Front transfer case cover
5	—	Breather
6	—	Input ball bearing
7	—	Snap ring
8	—	Internal gear
9	—	Snap ring
10	—	Baffle plate
11	—	Shift rod (2-4)
12	—	Hexagonal bolt head
13	—	Shift fork (2-4)
14	—	Snap ring
15	—	Shift fork (low, high)

16	—	Shift rod (low, high)
17	—	Control shift rod
18	—	Sprocket
19	—	Transfer chain
20	—	Coupling sleeve (2-4)
21	—	Clutch gear
22	—	Snap ring
23	—	Rear ball bearing
24	—	Washer
25	—	Filler plug
26	—	Output oil seal
27	—	Companion flange assembly
28	—	Self lock nut
29	—	Hexagonal bolt flange
30	—	Transfer case shift motor
31	—	Drain plug
32	—	Hexagonal bolt head
33	—	Rear transfer case
34	—	Oil pump assembly
35	—	Clip
36	—	Front drive shaft ball bearing
37	—	Front drive shaft
38	—	Main shaft
39	—	Coupling sleeve (low, high)
40	—	Planet carrier assembly
41	—	Main transfer gear
42	—	Carrier ball bearing
43	—	Snap ring
44	—	Snap ring
45	—	Dowel pin
46	—	Front drive oil seal
47	—	Companion flange assembly
48	—	Self lock nut

OPERATING PRINCIPLE

The transfer case delivers engine torque to the rear wheels and when requested to the front wheels. The transfer case is mounted on the rear of the transmission assembly and also has the ability to drive an additional gear reduction.

The transfer case has three different operating modes;

- Two Wheel Drive
- Four Wheel Drive - High Range
- Four Wheel Drive - Low Range

A toggle switch mounted in the vehicle cabin is used to select between the three different operating modes. The transfer case is electronically shifted via a shift motor mounted on the rear of the transfer case housing. The transfer case is filled with lubricating oil which is circulated using a mechanical oil pump. The oil pump is fitted with a strainer to filter any debris.

In four wheel drive mode there is no speed differential between the front and rear axles. This can cause driveline

windup when cornering on sealed surfaces.

Two Wheel Drive Operation

When the transfer case is in two wheel drive mode the engine torque is transferred from the input shaft through the planetary gearset. The planetary gearset is driven as one unit providing the torque to the rear output shaft, through the rear differential to the rear wheels.

Four Wheel Drive Operation

To engage four wheel drive the shift motor rotates the shift hub attached to the motor assembly which moves the shift fork to engage to drive either the high or low operating mode depending on the electronic request sent from the cabin switch.

Four Wheel Drive High Range

When the transfer case is in Four Wheel Drive High Range mode, the engine torque is transferred from the input shaft through the planetary gearset. The planetary gearset is driven as one unit providing the torque to the rear output shaft, through the rear differential to the rear wheels. To drive the front wheels one of the selector forks engages a selector ring to lock the silent chain gear wheel to the rear output shaft which drives engine torque to the front output shaft via the silent chain. Engine torque is the delivered to both the front and rear wheel without any gear reduction.

Four Wheel Drive Low Range

When the transfer case is in Four Wheel Drive Low Range mode, the operation is the same as described in high range mode except the planetary gearset is independently driven to provide a gear reduction to both the front and rear drive axles.

Tachograph

For markets where a tachograph is required, a 'tachograph ready' transfer case is fitted to the vehicle. This allows the fitment of a tachograph sensor to the transfer case housing. The machined hole in the housing is filled with the blanking plug, which can be removed for the fitment of the sensor.

The tachograph ready transfer case has the following additional features:

- Internal pulse gear.
- Machined shoulder on front output shaft for pulse gear.
- Machined hole and thread on rear case.

Copyright © 2016 Ford Motor Company

Transfer Case

Base Part Number: 7251

REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

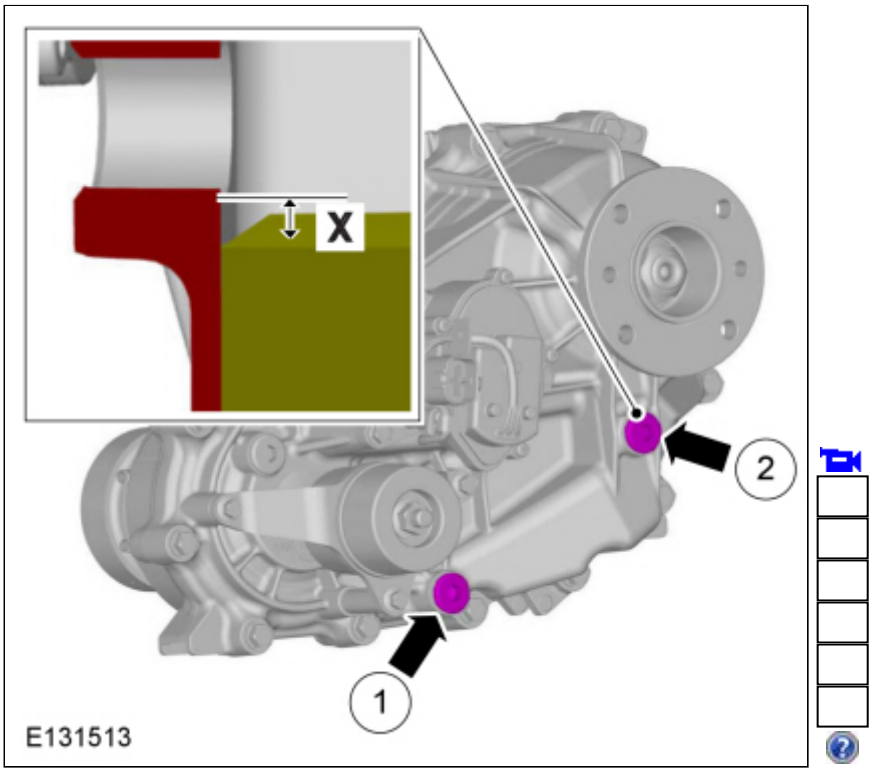
Copyright © 2016 Ford Motor Company

Transfer Case Draining and Filling

1. For additional information, refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

2. **NOTICE: Do not use an impact wrench when removing the filler plug or drain plug. It may damage the transfer case.**

   Remove the drain plug and the seal.
   - Drain the oil into a suitable container.
   - Tighten the drain plug with a new seal.
   - Tightening torque 19-30 Nm.



3. **NOTICE: Only use the specified lubricant.**

   NOTE: *The transfer case should be in in-vehicle position.*

   NOTE: *Make sure that fluid level is to the MAX mark.*

   Remove the filler plug and seal and add the specified amount and type of oil through the filler plug hole until the level reaches the bottom of the filler plug hole **X:** 0 mm.
   For additional information, refer to: Specifications (308-07B Transfer Case - 5-Speed Manual Transmission - MT75/6-Speed Manual Transmission - MT82, Specifications).

   - Wait for three minutes and check if **X:** 0 mm.
   - Top up the oil if necessary.
   - Tighten the filler plug with a new seal.
   - Tightening torque 19-30 Nm.

Copyright © 2016 Ford Motor Company

Transfer Case Fluid Level Check

Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

Check

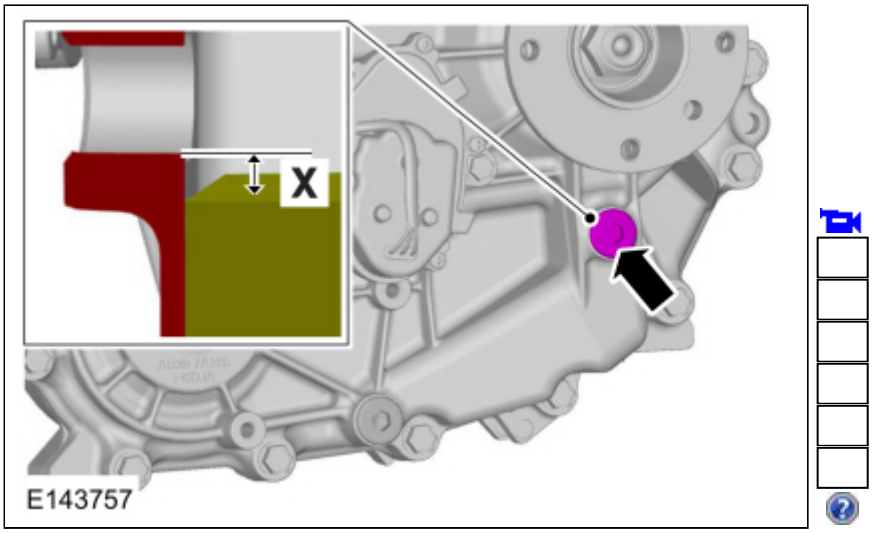
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Make sure that the vehicle is standing on a level surface.*

   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Check the component for leaks.
4. Transfer case Fluid Level Check should only be carried out if an oil leak was identified.
5. **NOTICE: Only use the specified lubricant.**

   NOTE: *The transfer case should be in in-vehicle position.*

   NOTE: *Make sure that fluid level is to the MAX mark.*

   Remove the filler plug and seal and add the specified amount and type of oil through the filler plug hole until the level reaches the bottom of the filler plug hole **X:** 0 mm.
   Material: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)



Copyright © 2016 Ford Motor Company

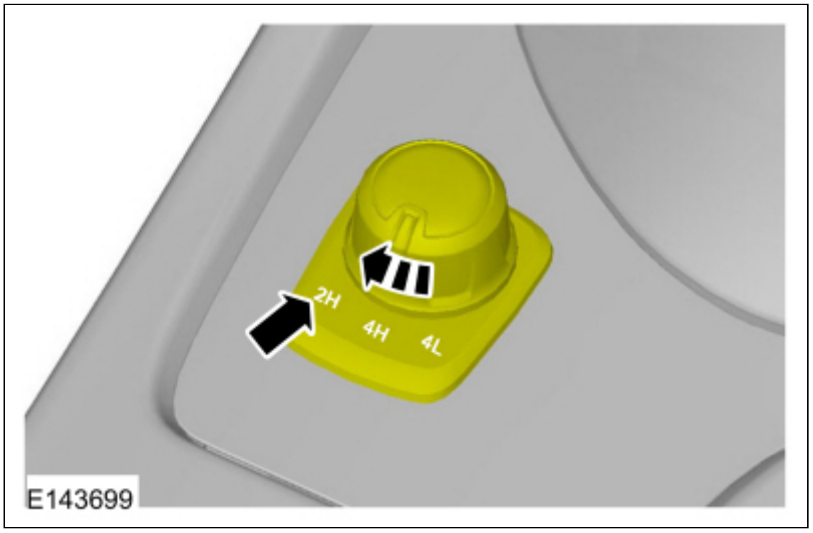
Transfer Case

Base Part Number: 7251

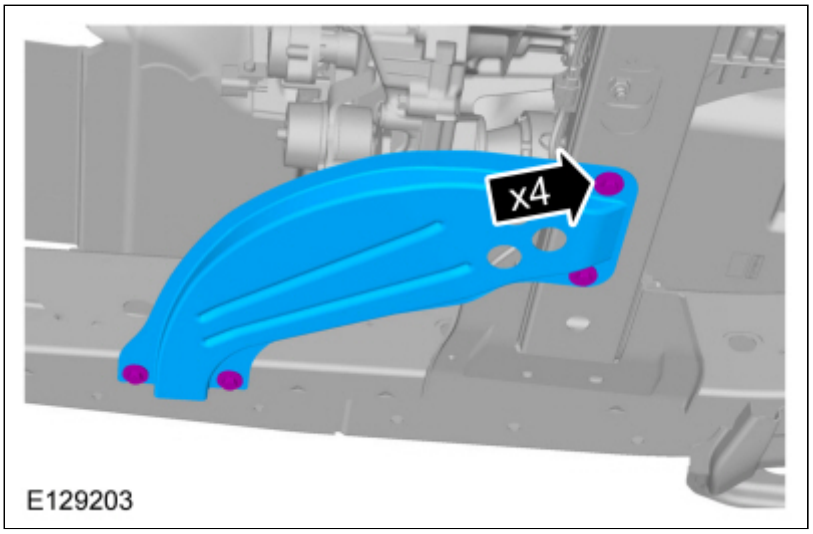
Special Tool(s) / General Equipment

Transmission Jack

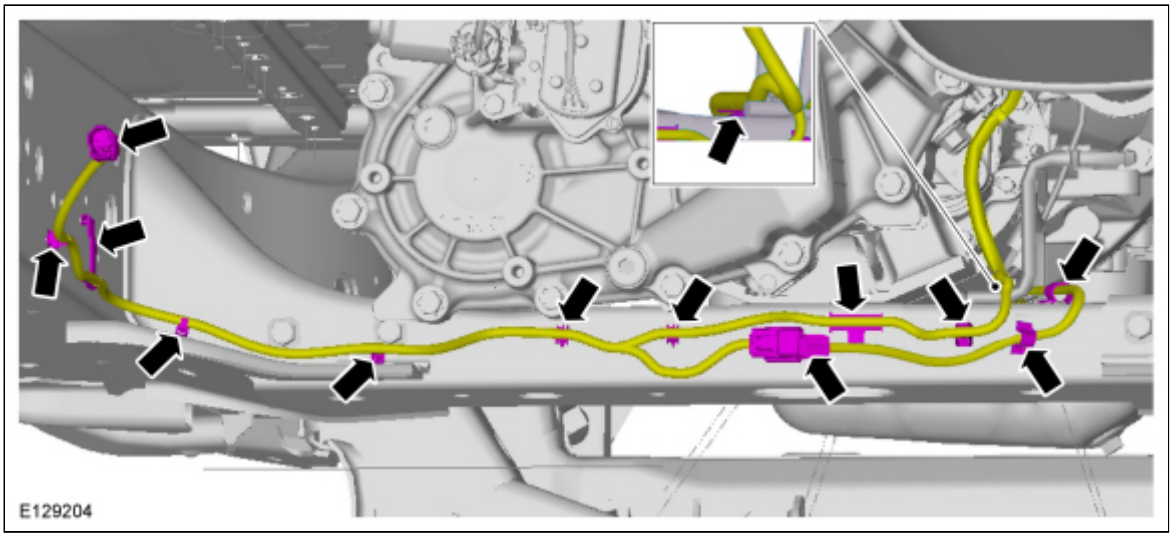
1.



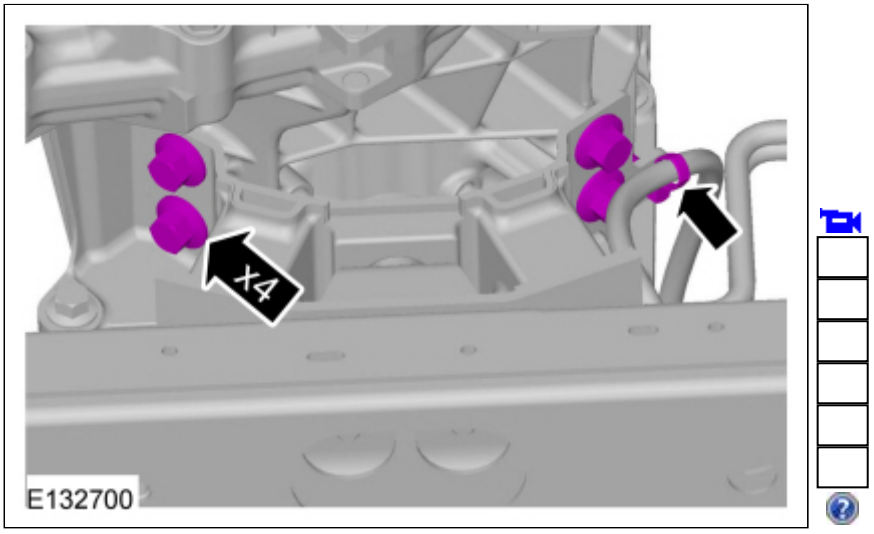
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
5.



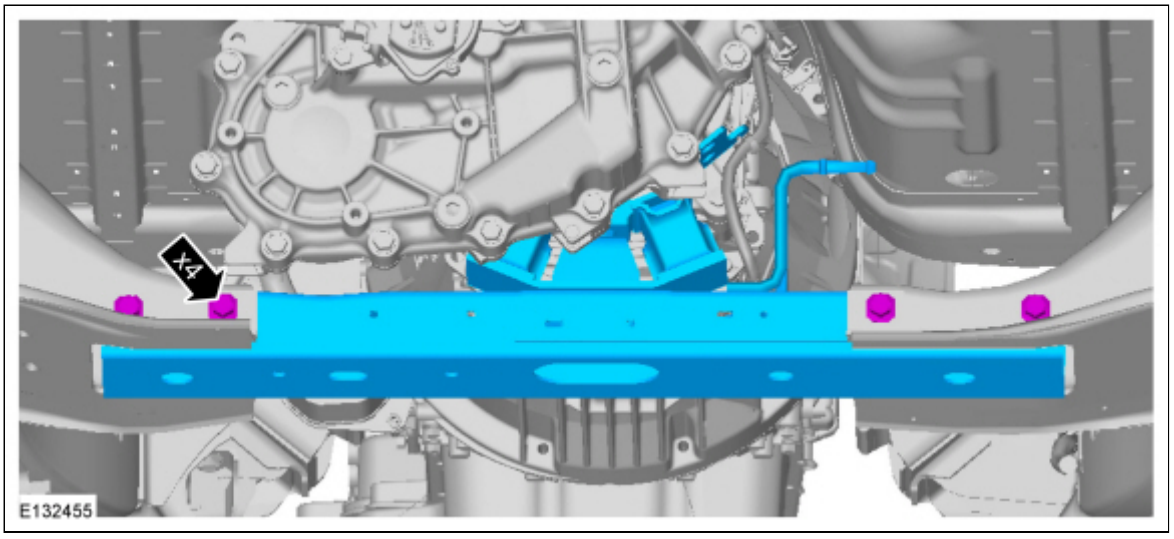
6.



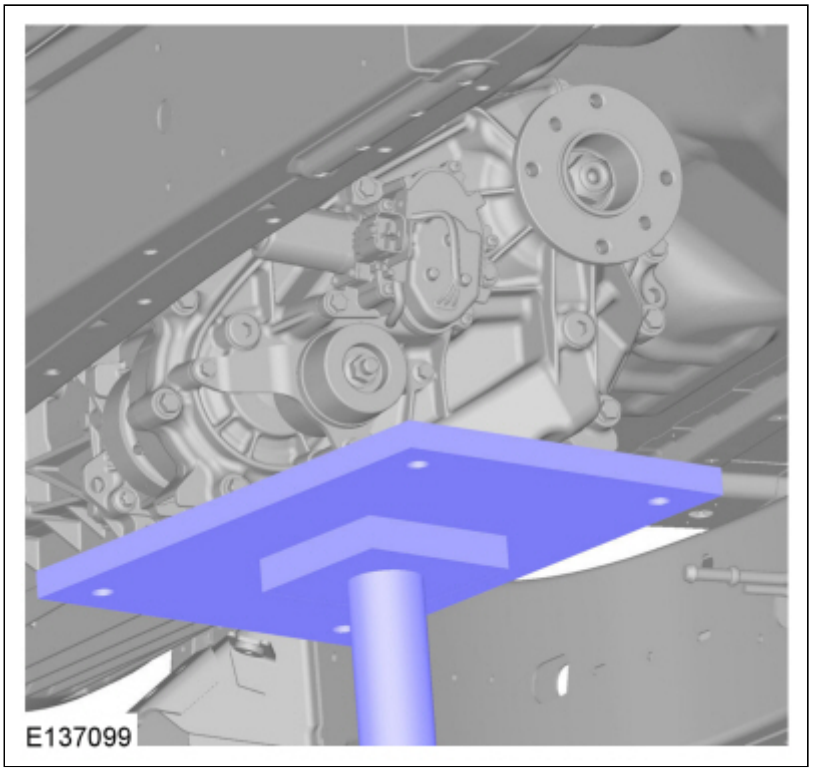
7.



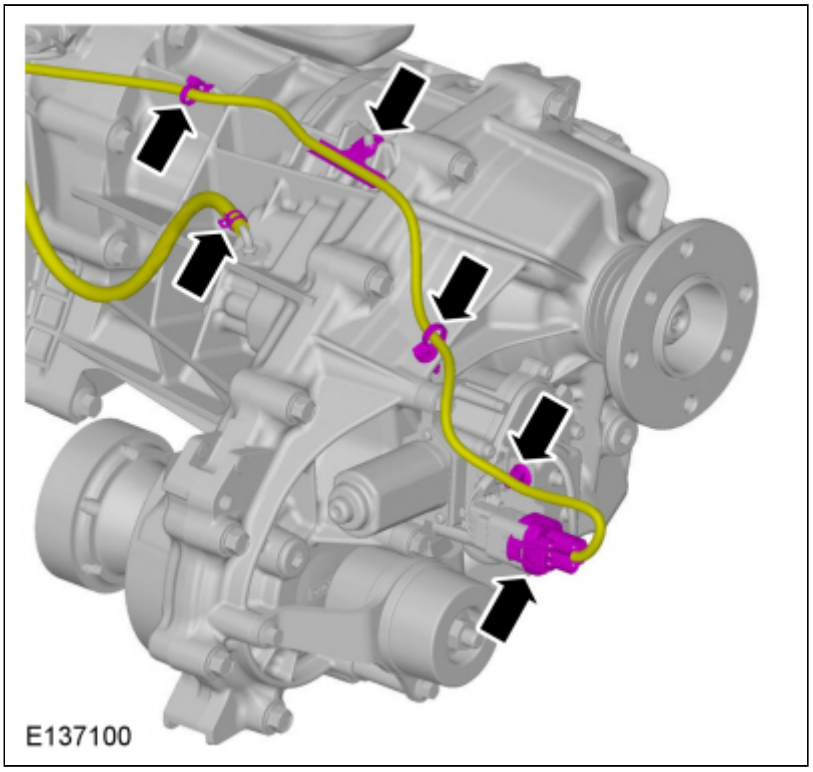
8.



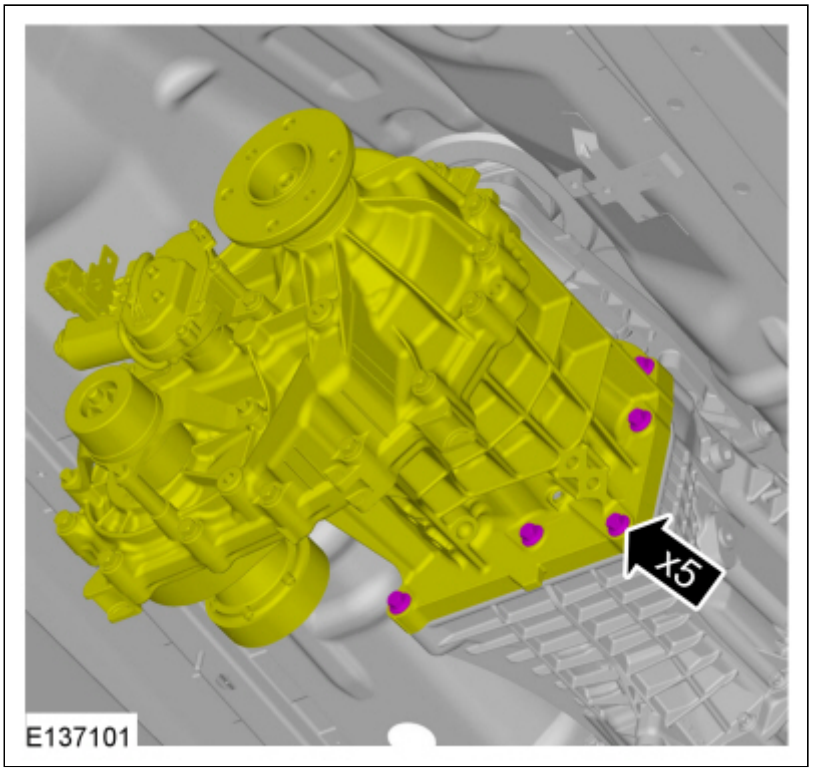
9. Use the General Equipment: Transmission Jack



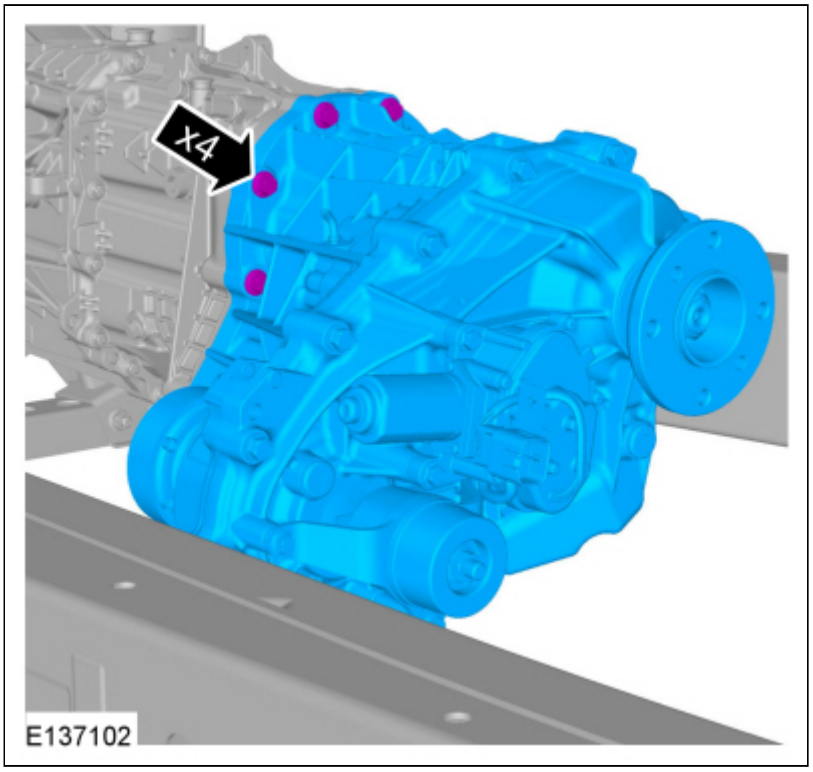
10.



11.



12.

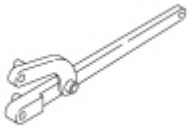
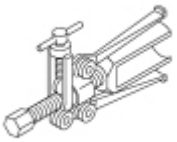
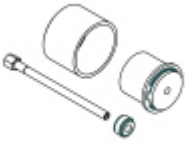


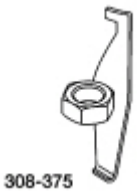
Copyright © 2016 Ford Motor Company

Transfer Case

Base Part Number: 7251

Special Tool(s) / General Equipment

 E129694	100-001 (T50T-100-A) Slide Hammer
 E144131	205-007 Replacer, Pinion Seal
 15030A	205-072 Universal Flange Holding Wrench
 15048	205-078 Remover, Drive Pinion Seal
 15091	205-310 Remover, Bearing/Gear
 E144132	205-509 Remover/Installer, Bushing
 E144133	307-612 Installer, Seal
	308-375 Remover, Input Shaft Seal

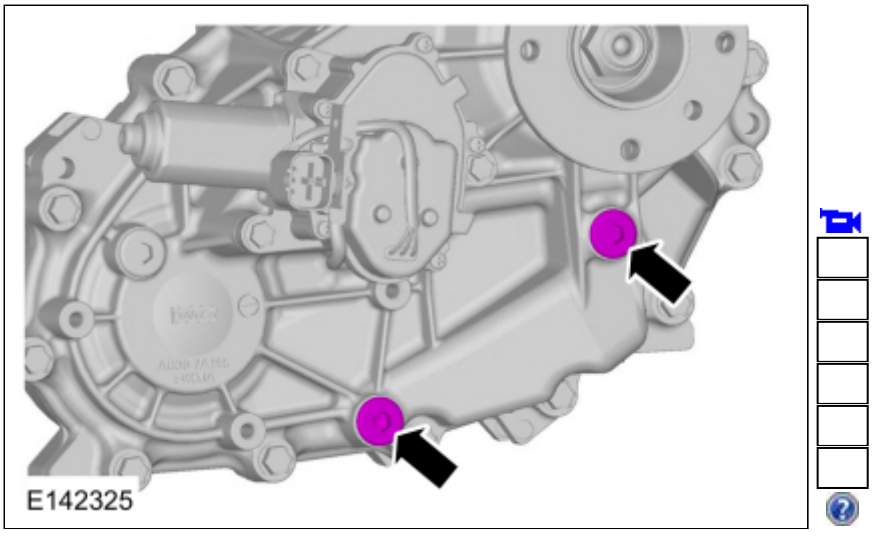
	
	308-612 Installer, Input Shaft Seal
	308-614 Installer, Output Shaft Seal
Hydraulic Press	
Puller	
Punch	
Bearing Separator	

Materials

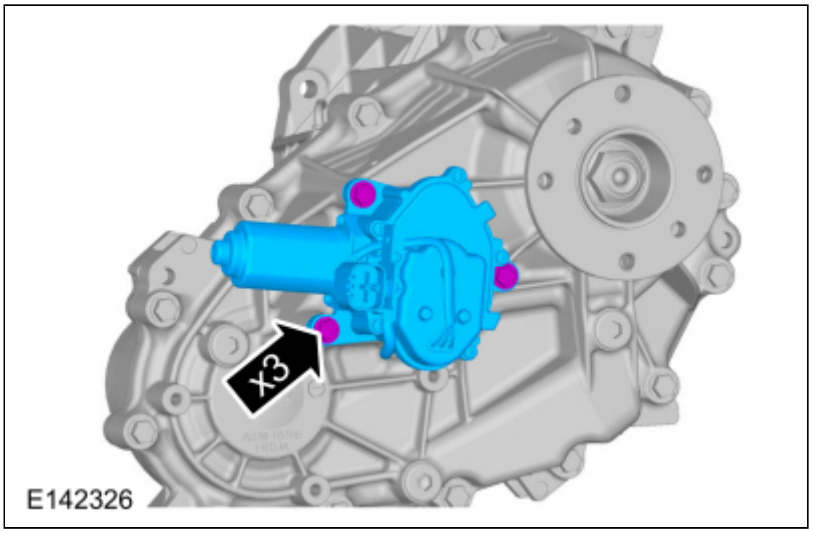
Name	Specification
Silicone Sealant	WSE-M4G323-A4
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

DISASSEMBLY

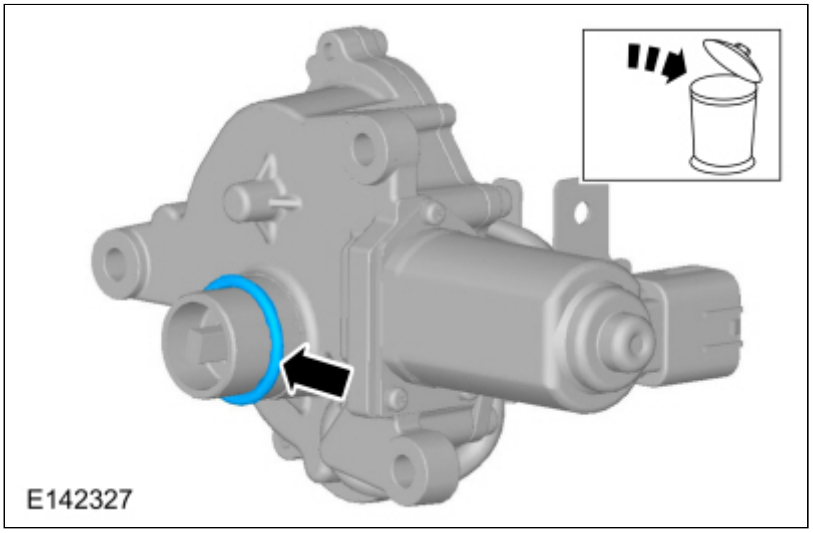
1. **NOTE:** *Be prepared to collect escaping fluids.*



2.

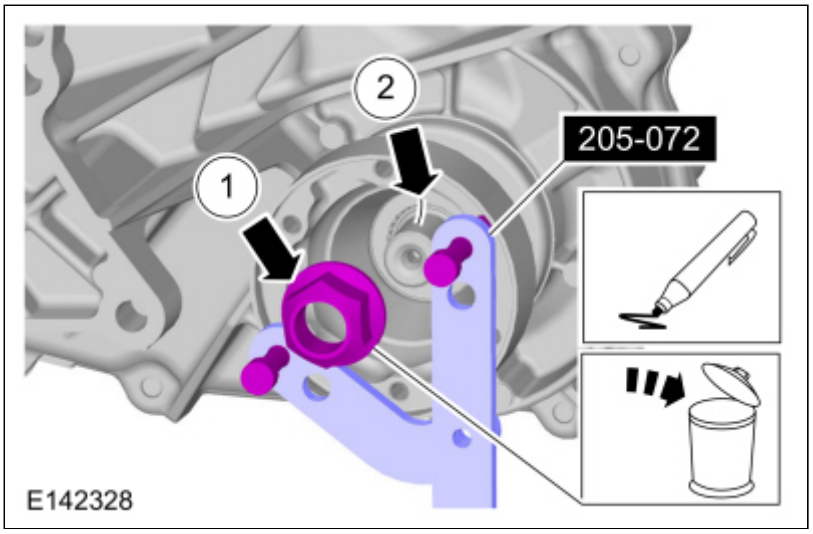


3. **NOTE:** *This step is not necessary when installing a new component.*

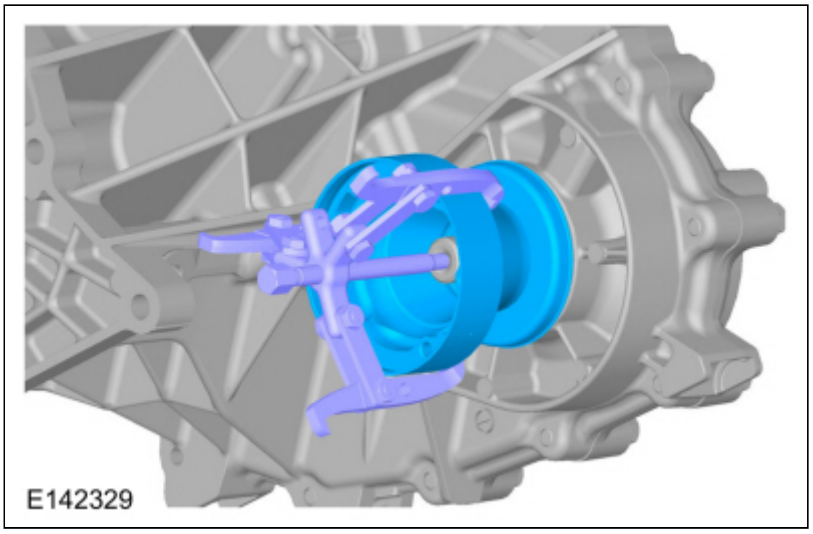


4. **NOTE:** *Note the position of the component before removal.*

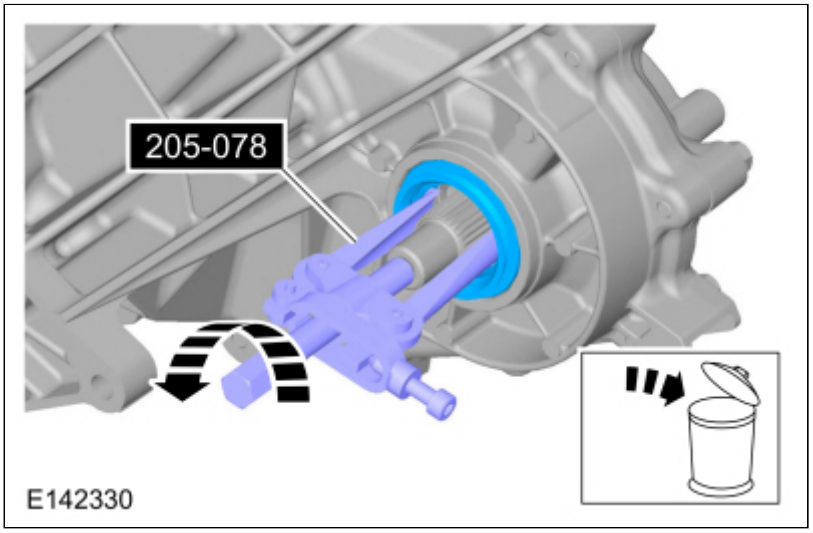
   Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



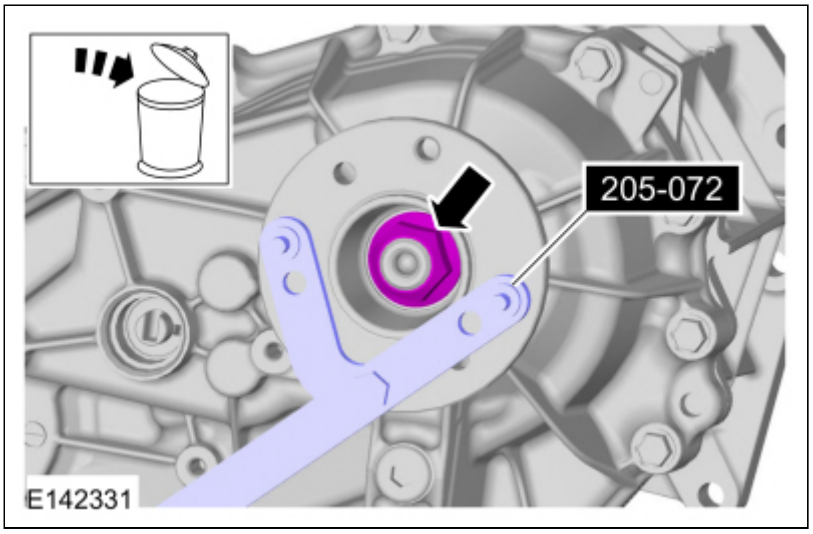
5. Use the General Equipment: Puller



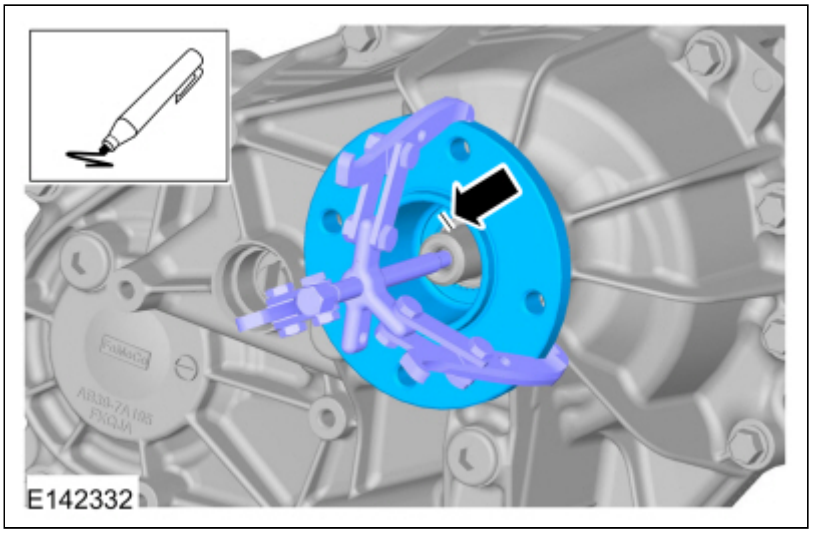
6. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal.



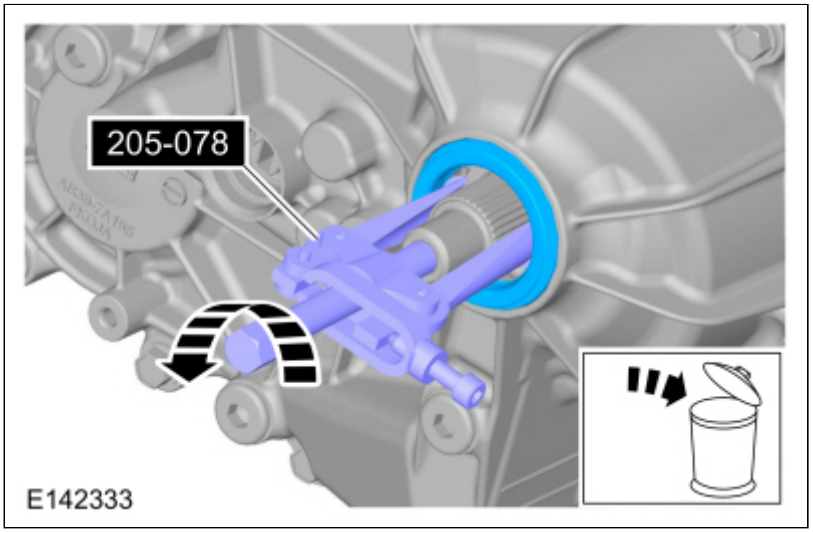
7. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



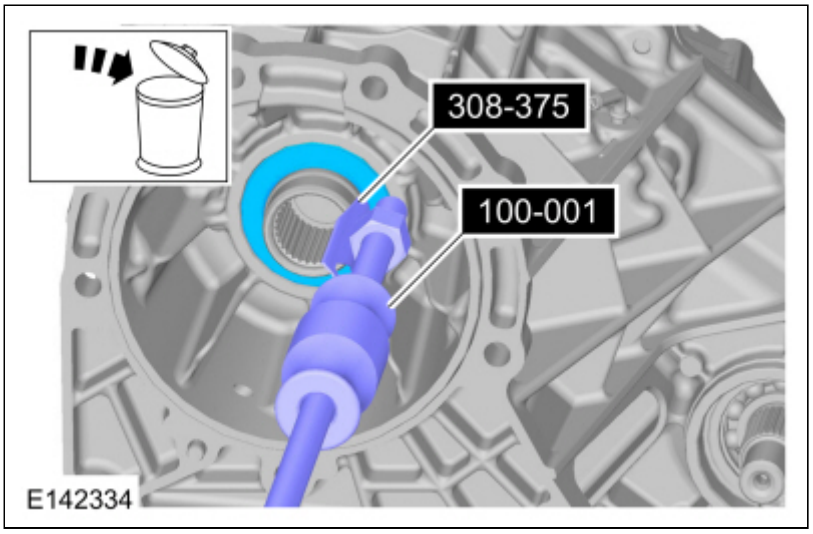
8. Use the General Equipment: Puller



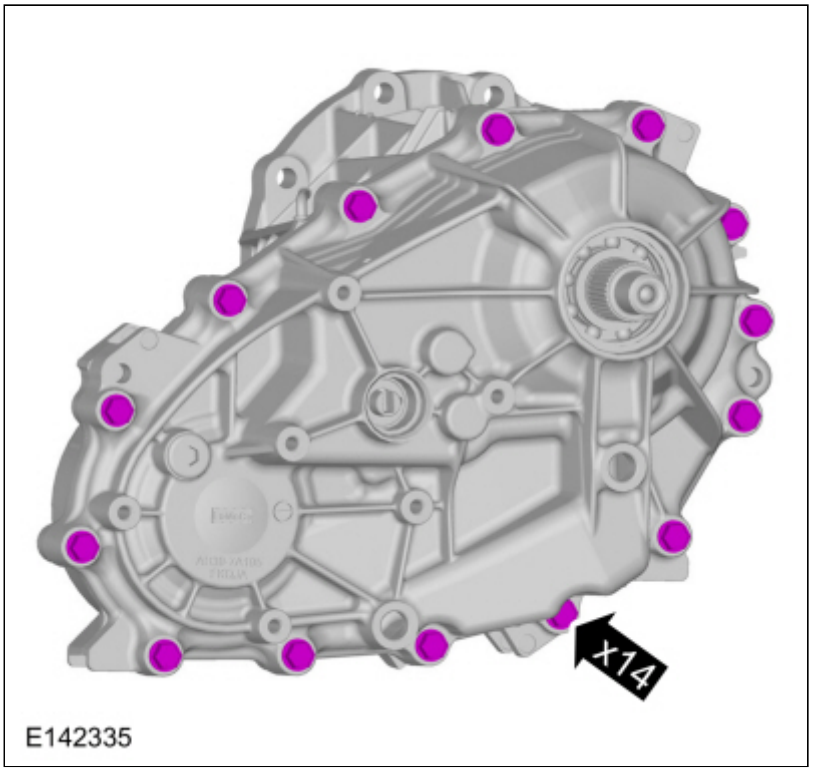
9. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal.



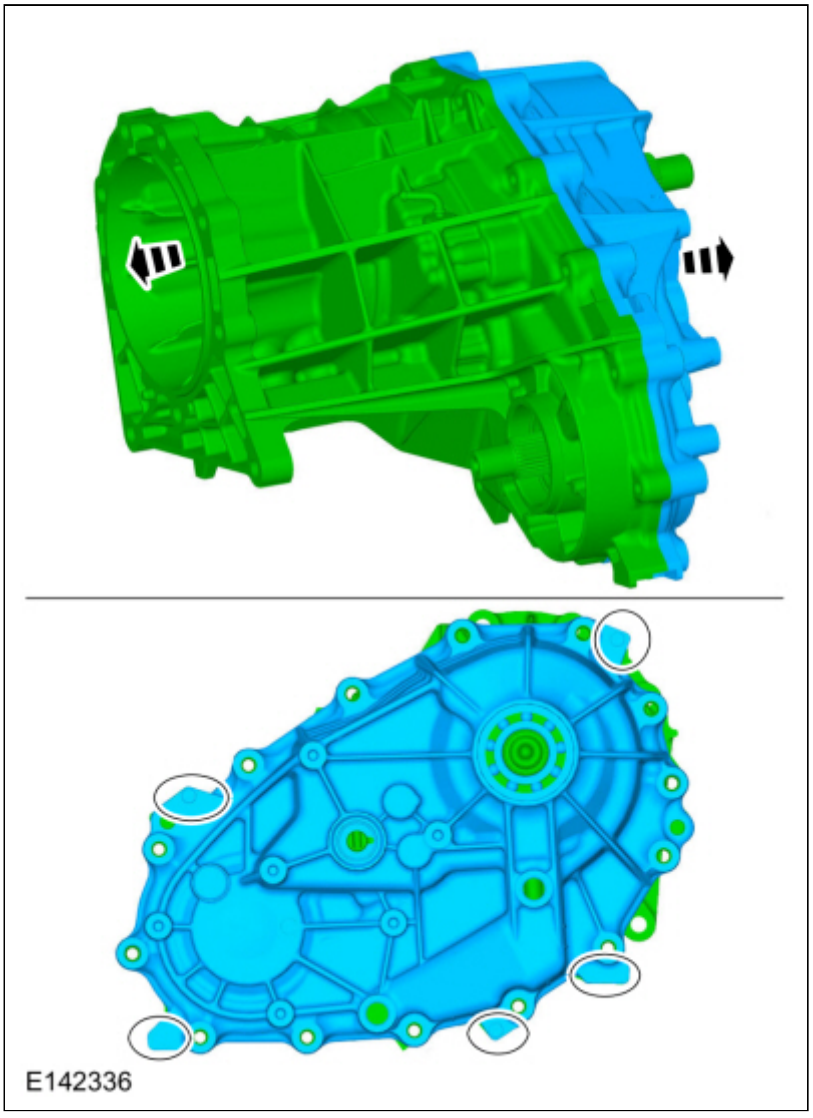
10. Use Special Service Tool: 308-375 Remover, Input Shaft Seal. , 100-001 (T50T-100-A) Slide Hammer.



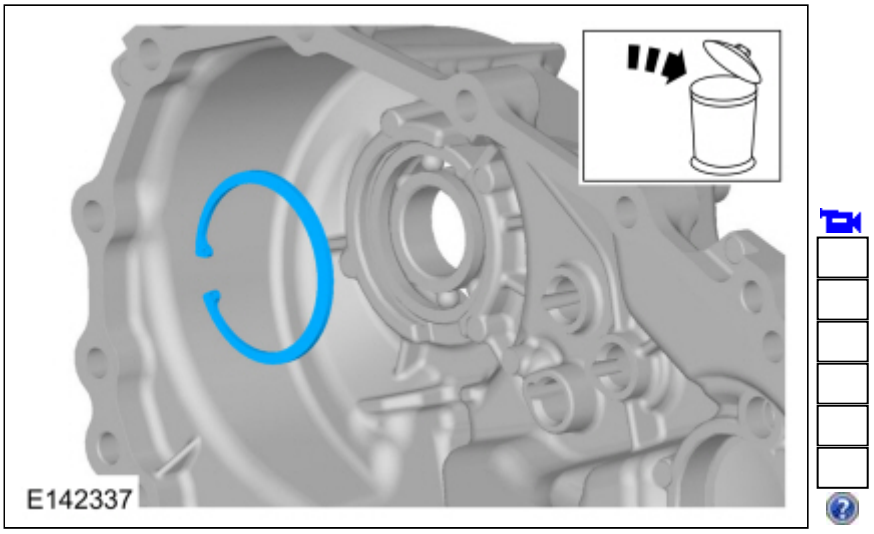
11.



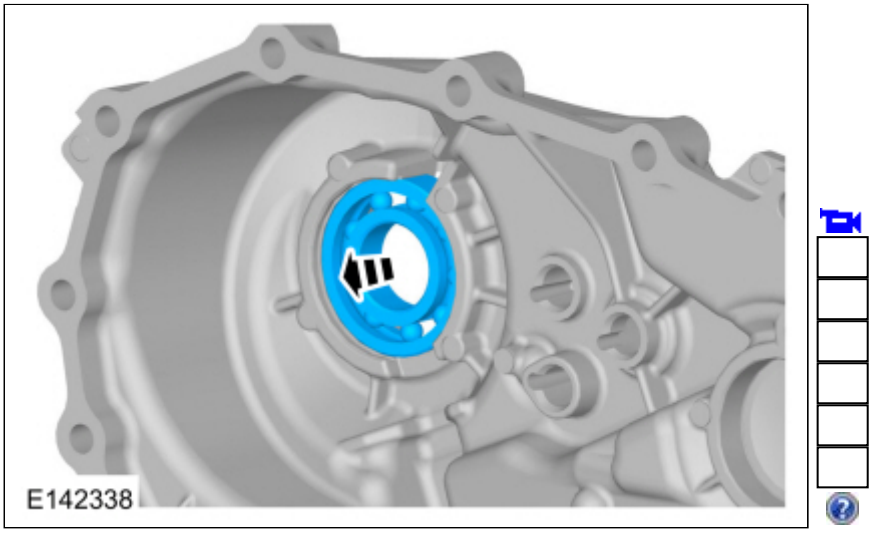
12. Using a suitable separator tool on the locations shown, separate the front and rear casing.



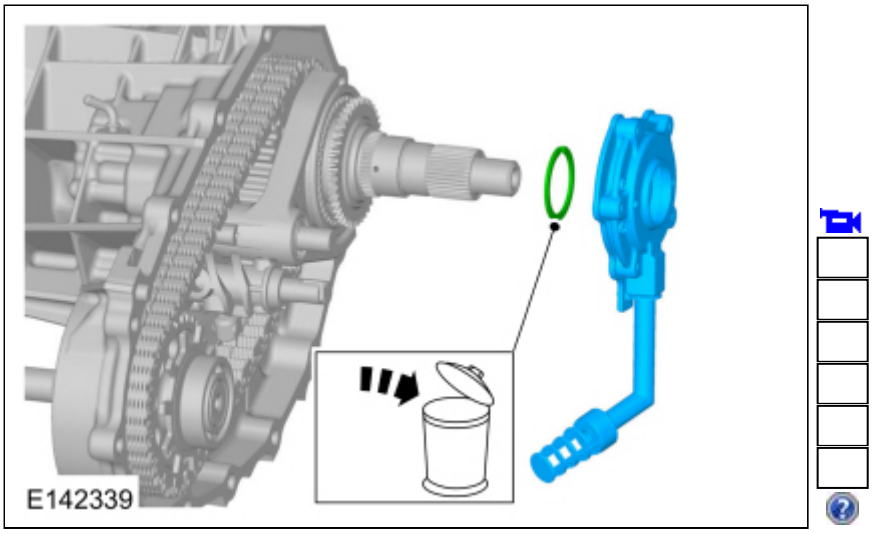
13.



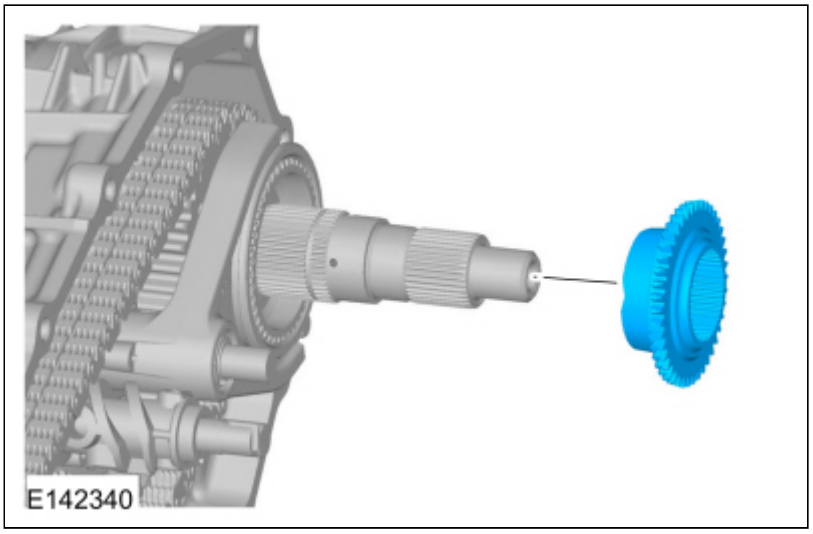
14. Use the General Equipment: Punch



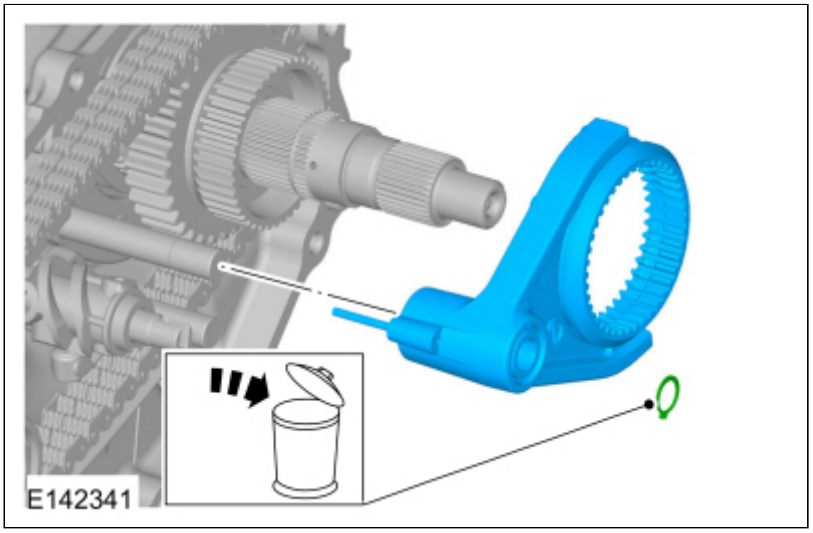
15.



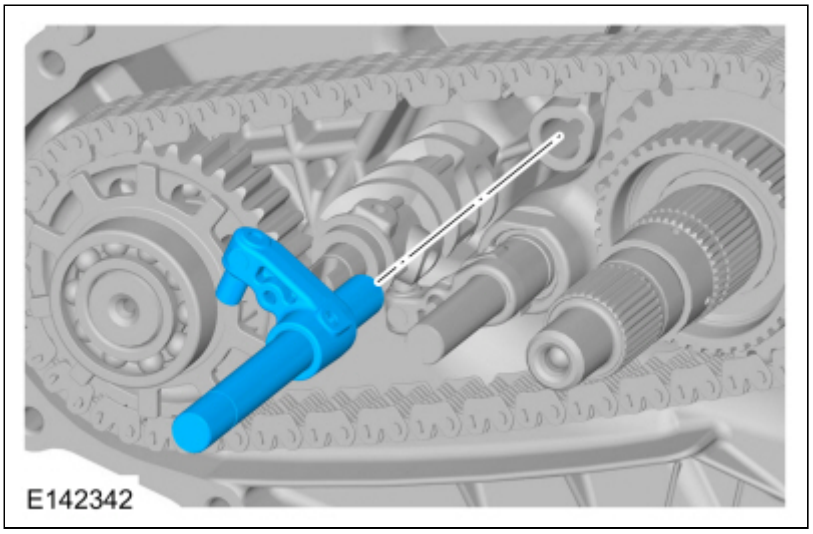
16.



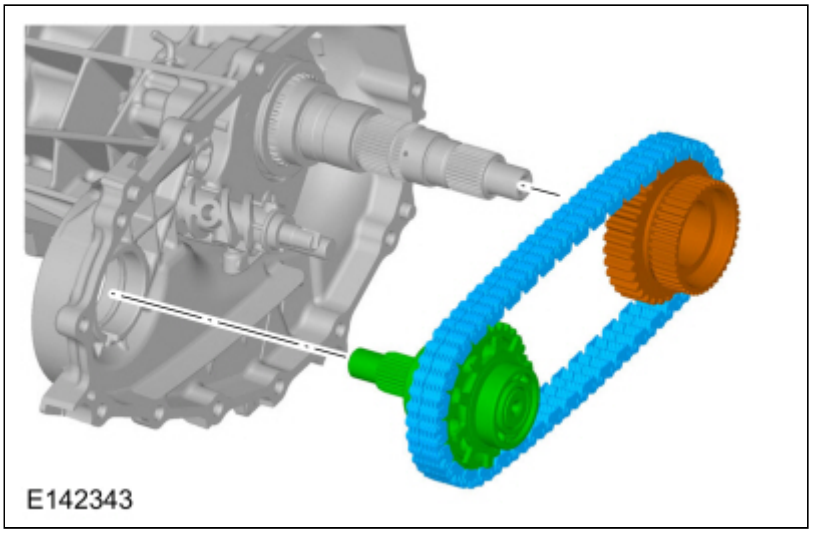
17.



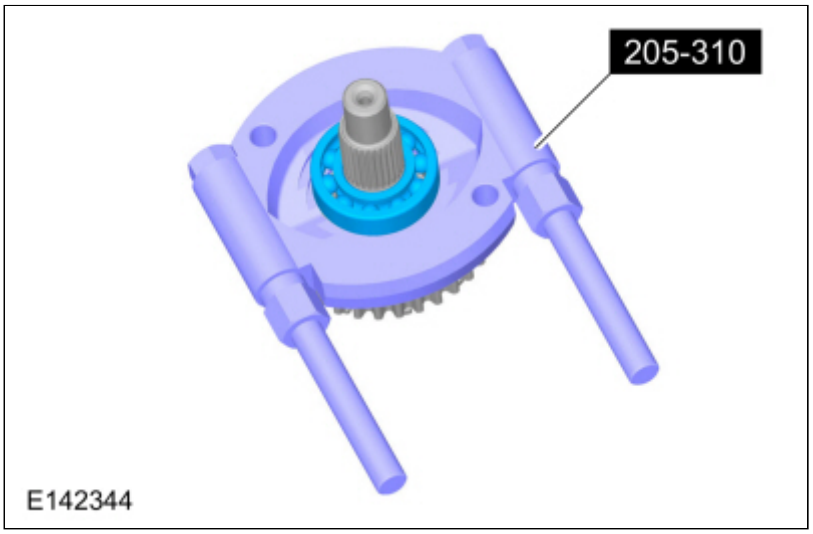
18. **NOTE:** *Remove the dissengage pin from the control shift rod groove.*



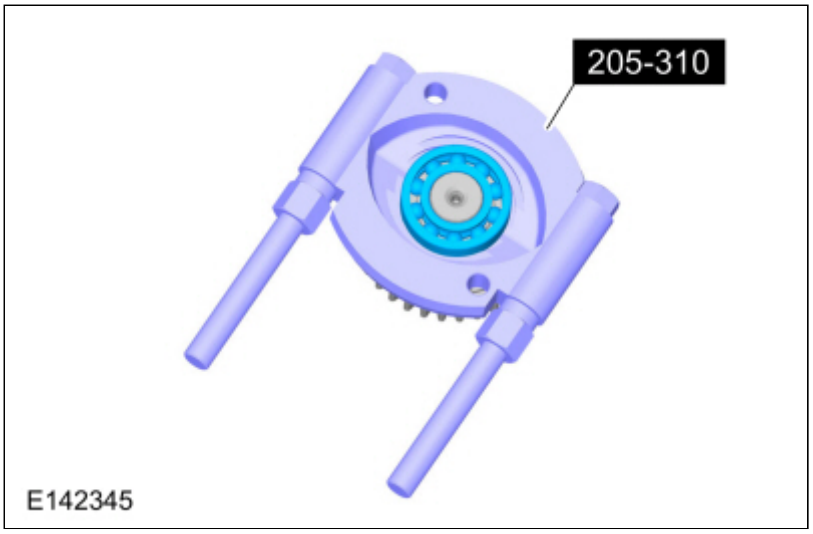
19.



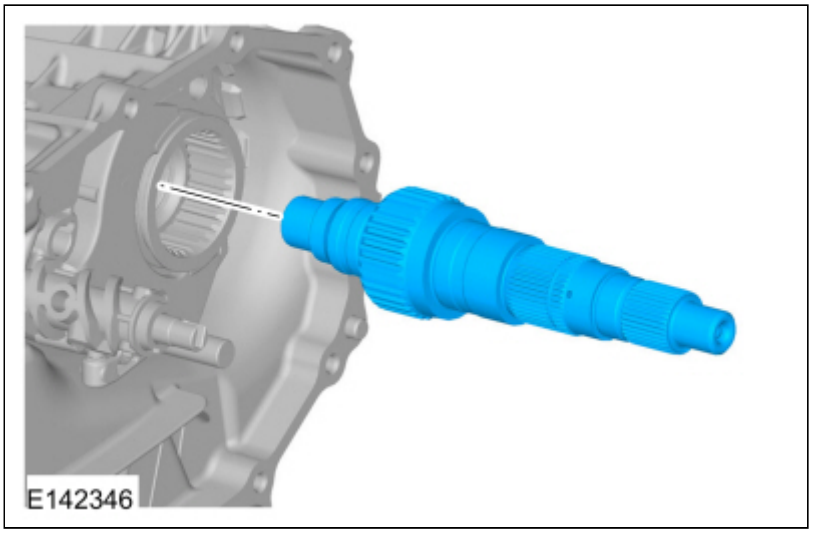
20. Use Special Service Tool: 205-310 Remover, Bearing/Gear.
    Use the General Equipment: Hydraulic Press



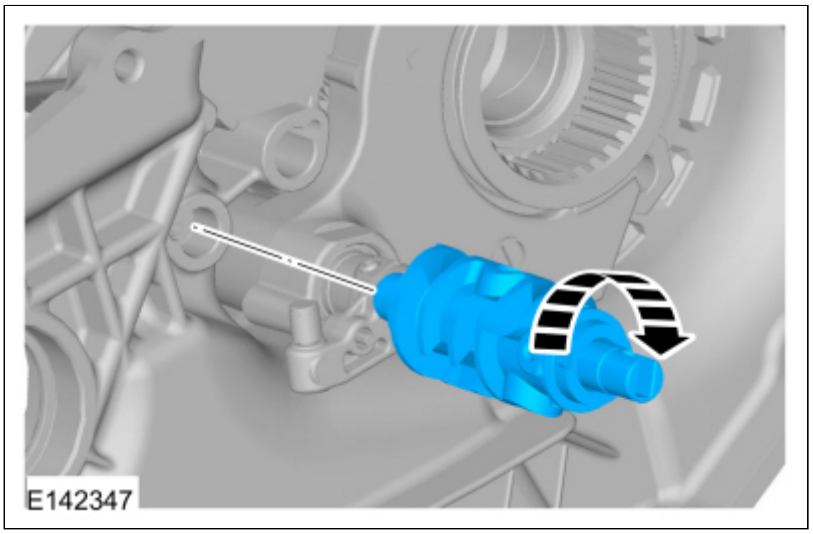
21. Use Special Service Tool: 205-310 Remover, Bearing/Gear.
    Use the General Equipment: Hydraulic Press



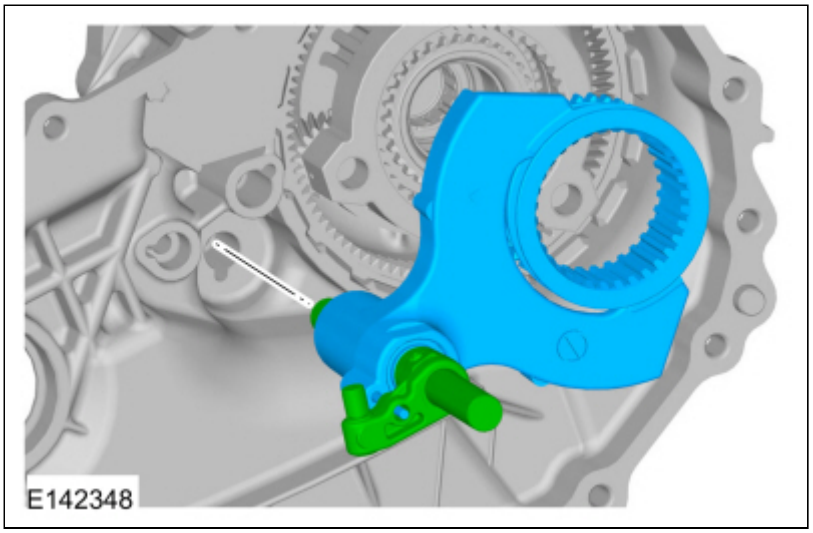
22.



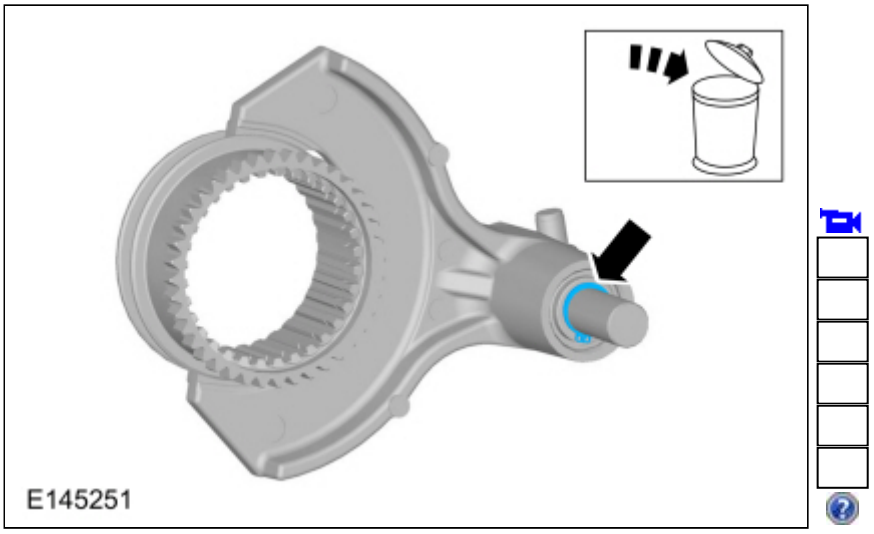
23. **NOTE:** *Rotate the control shift rod until the H-L shift rod assembly pin is aligned with the longitudinal groove of the control shift rod.*



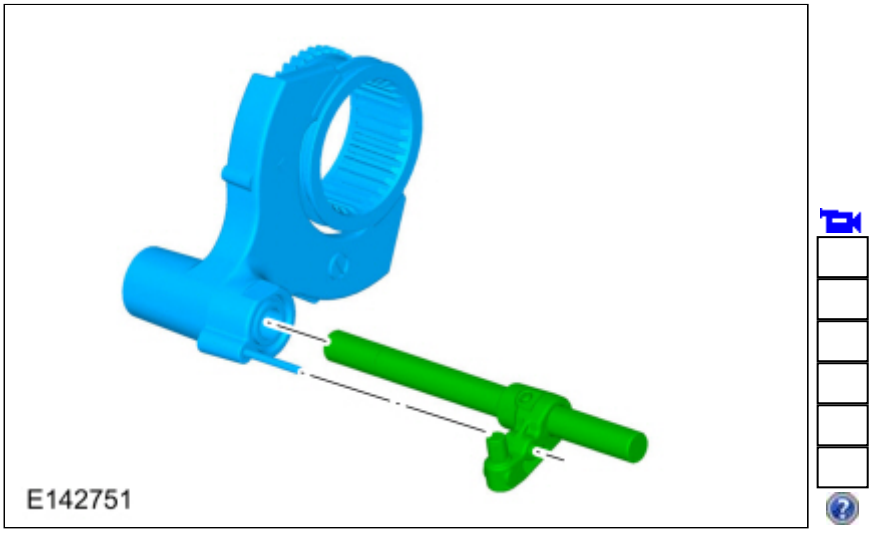
24.



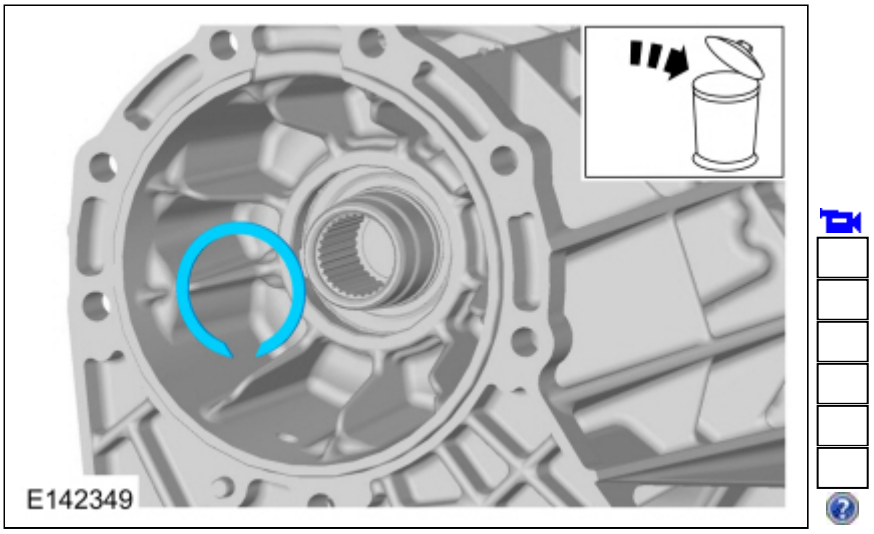
25.



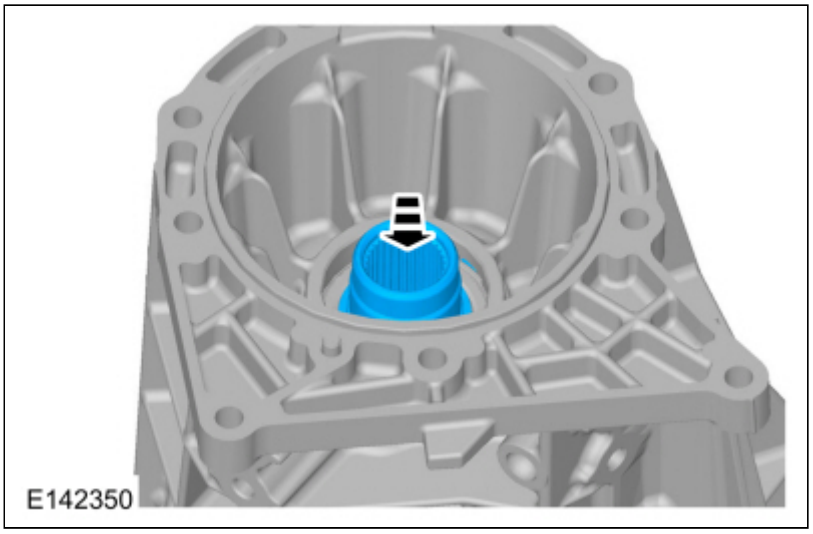
26.



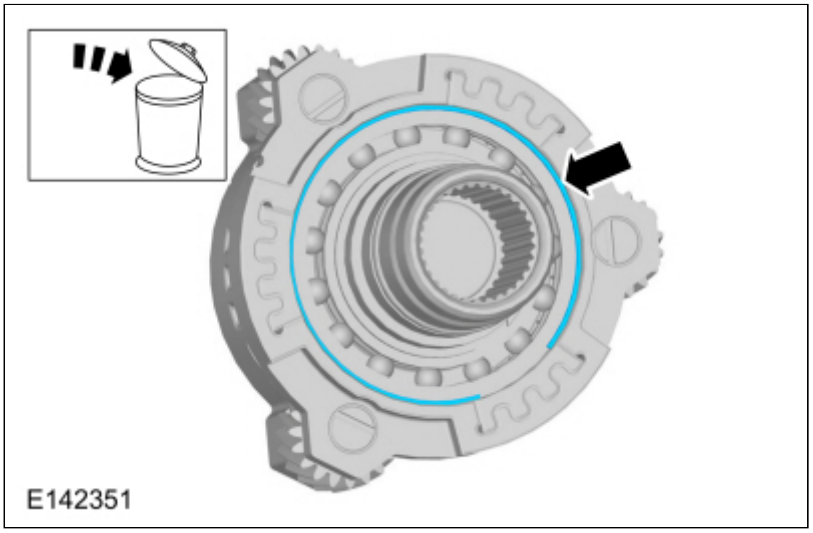
27. **NOTE:** *Make sure that the component is not damaged.*



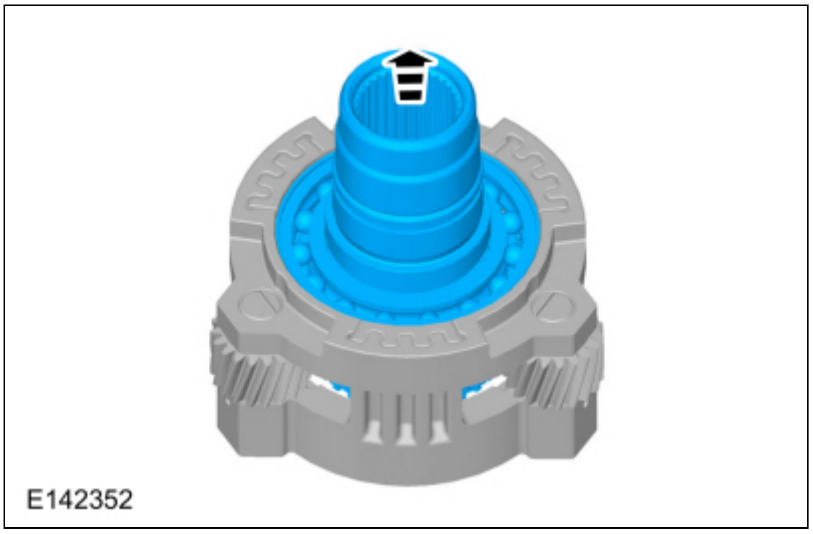
28. Use the General Equipment: Hydraulic Press



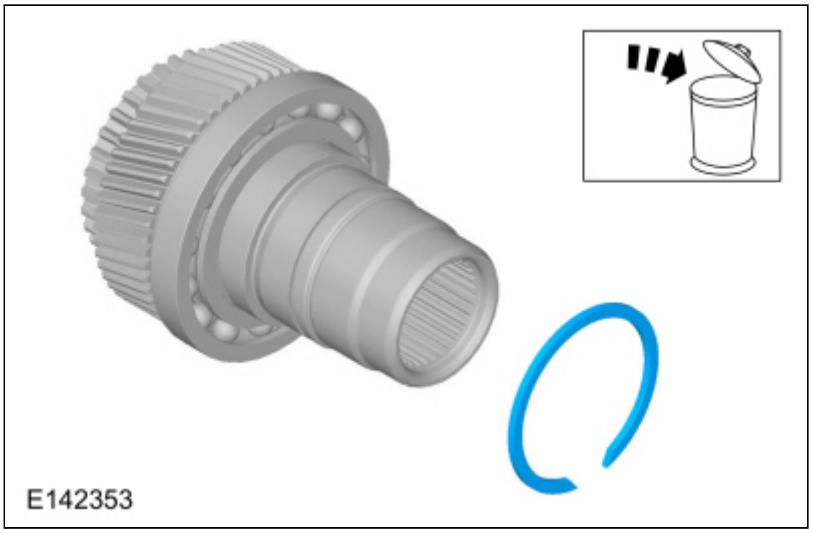
29.



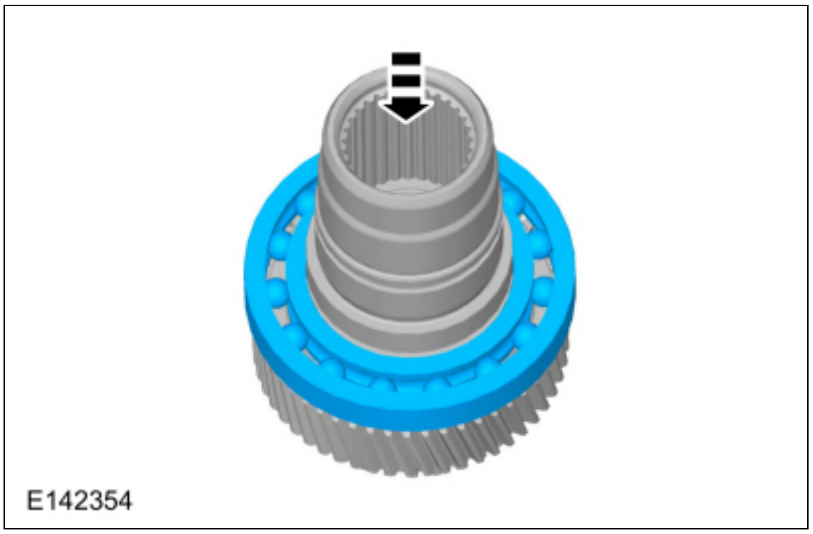
30.



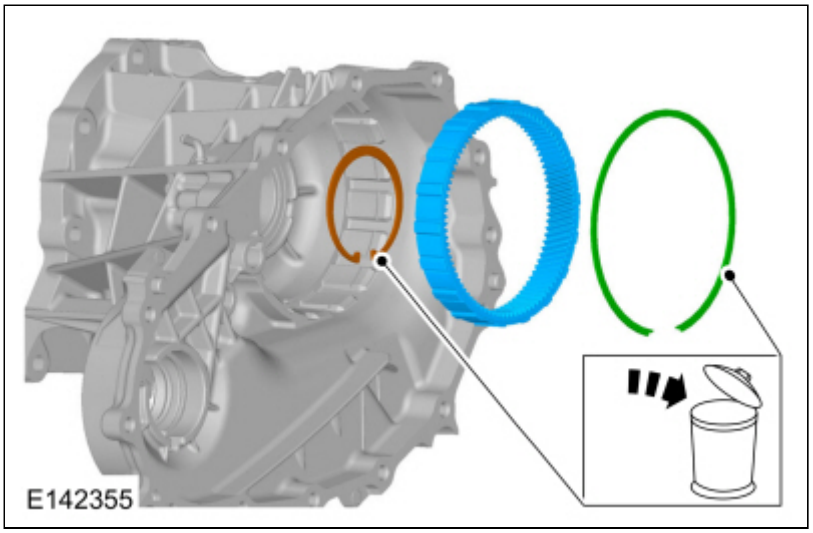
31.



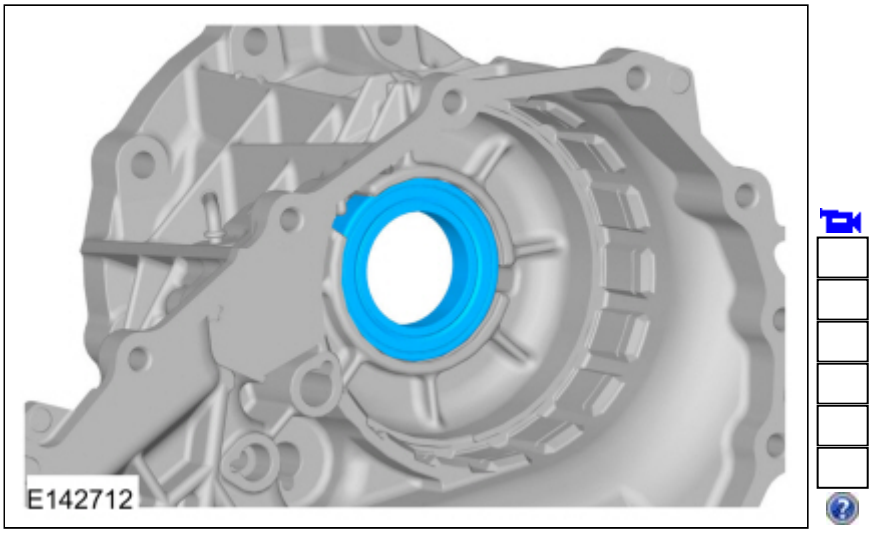
32. Use the General Equipment: Bearing Separator
    Use the General Equipment: Hydraulic Press



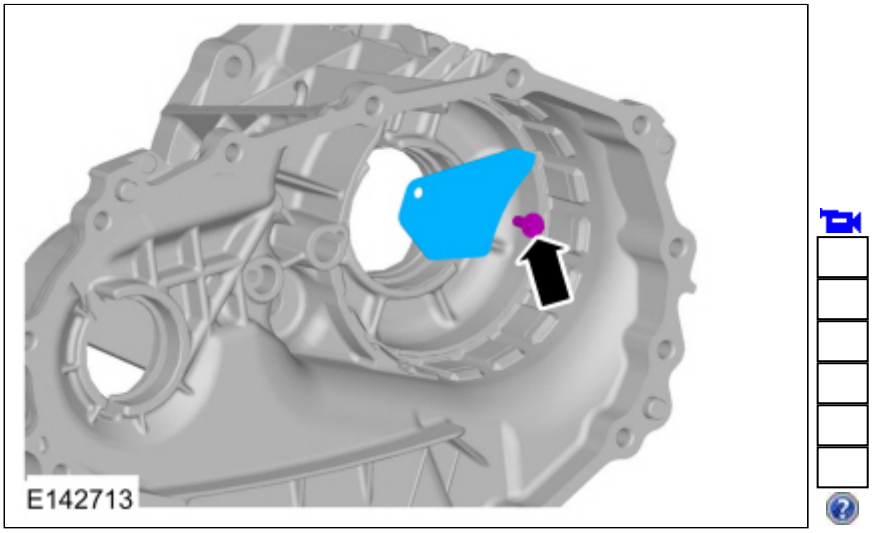
33.



34.

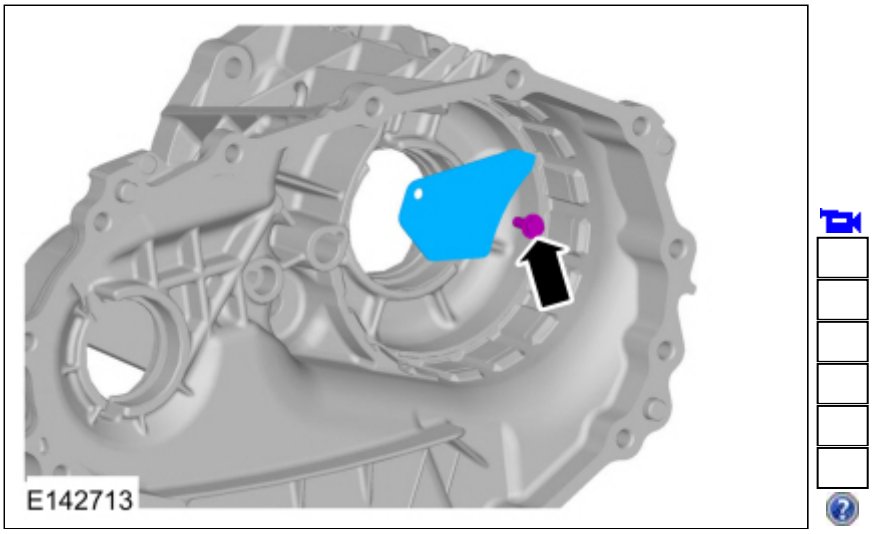


35.

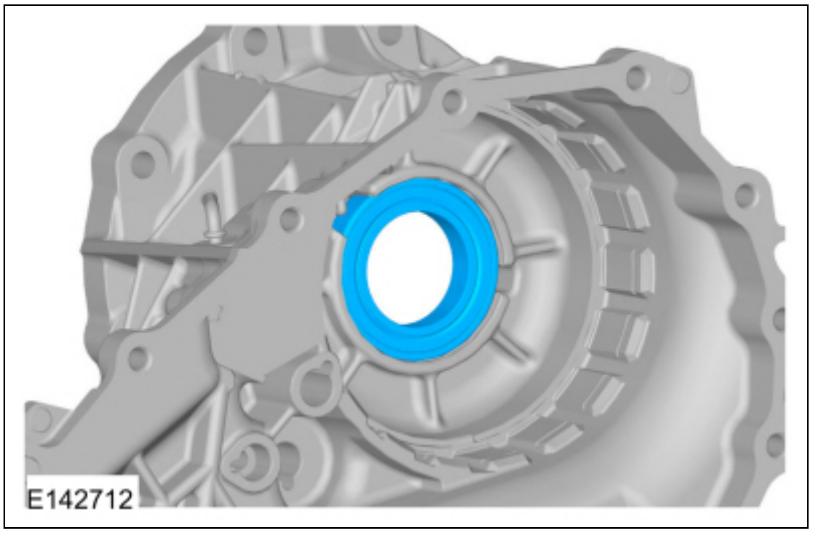


ASSEMBLY

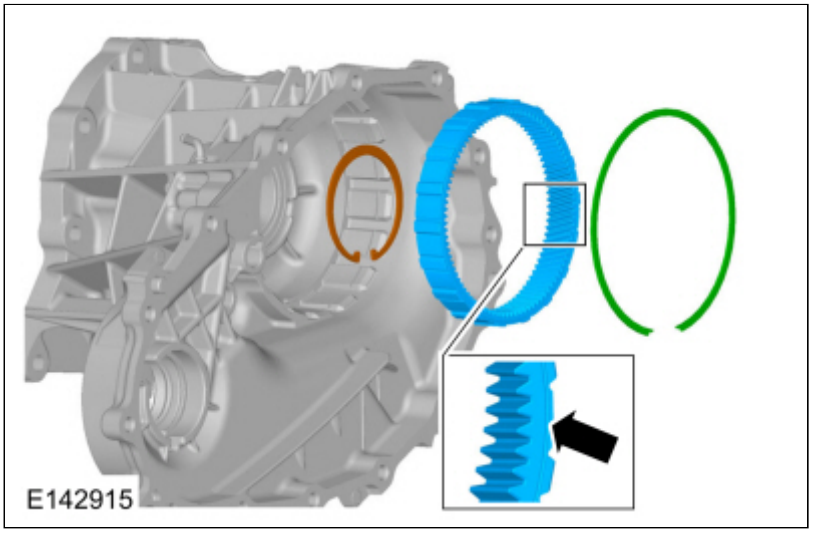
1. *Torque*: 4.5 Nm



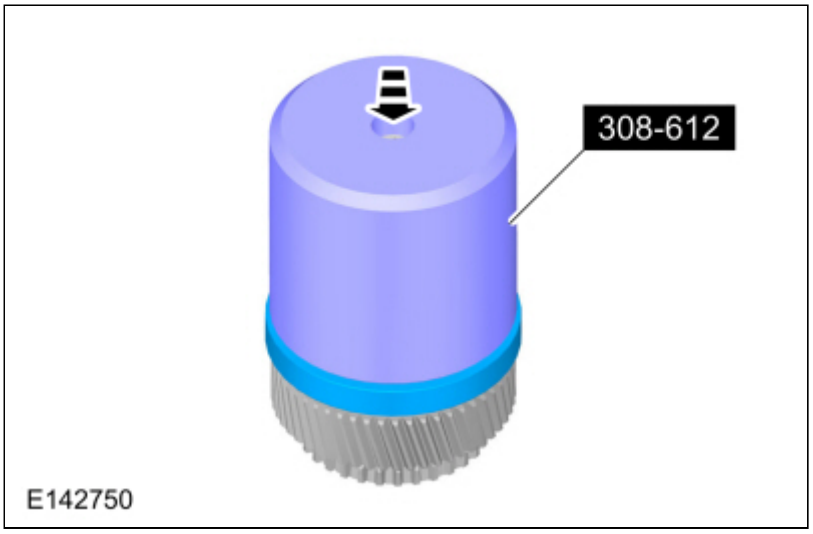
2.



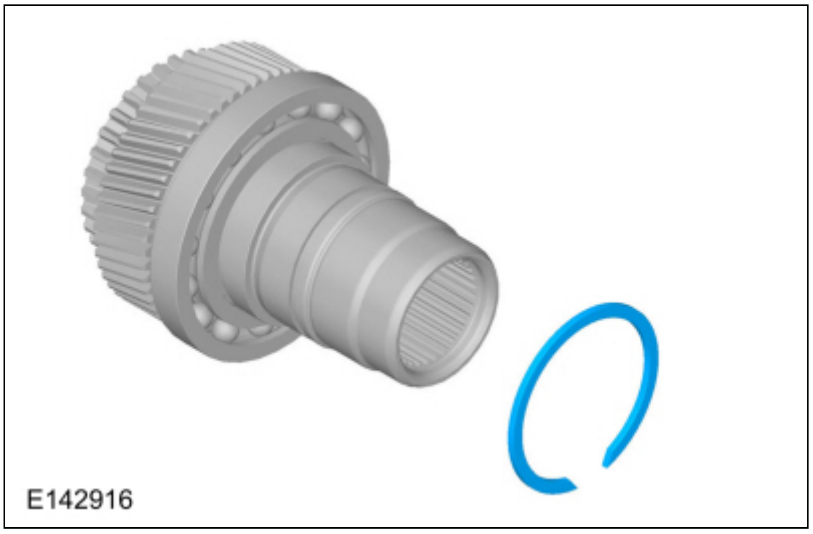
3.



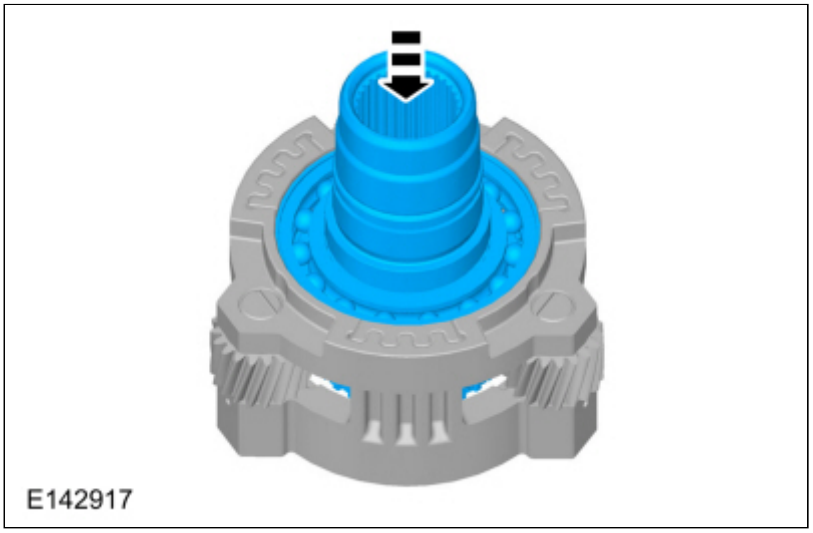
4. Use Special Service Tool: 308-612 Installer, Input Shaft Seal.



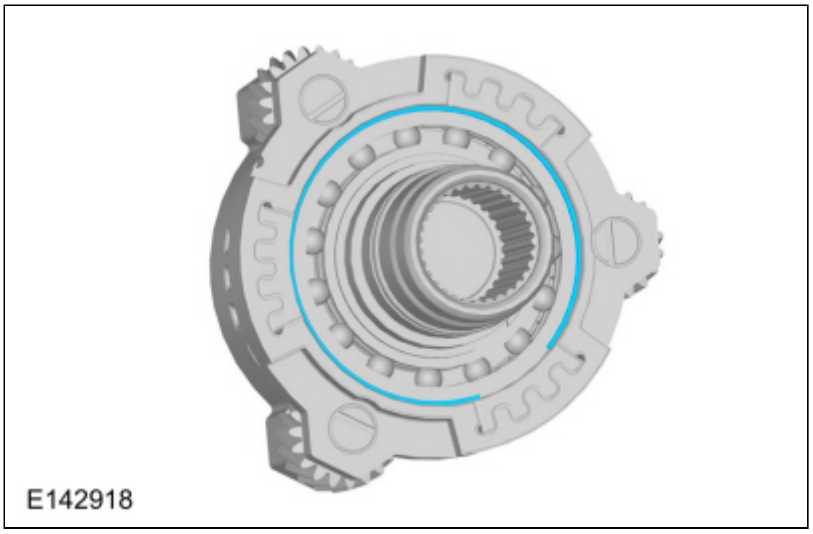
5. **NOTE:** *Make sure that the component is not damaged.*



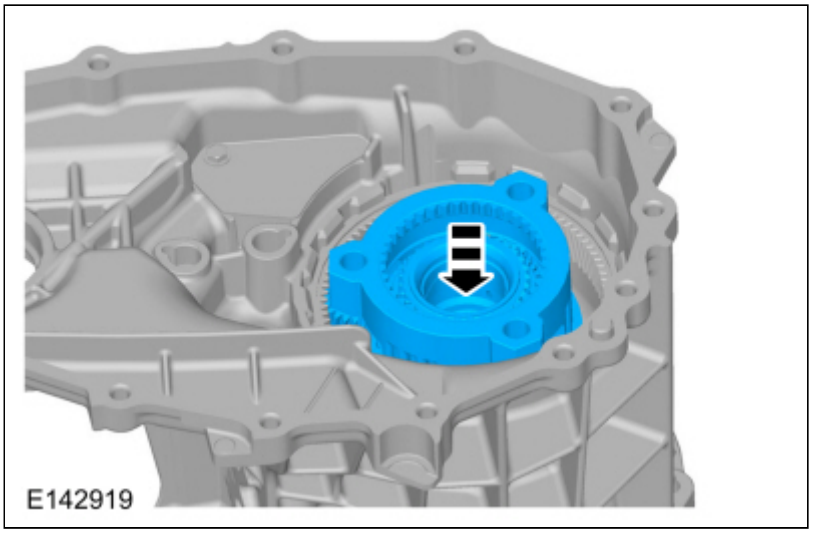
6.



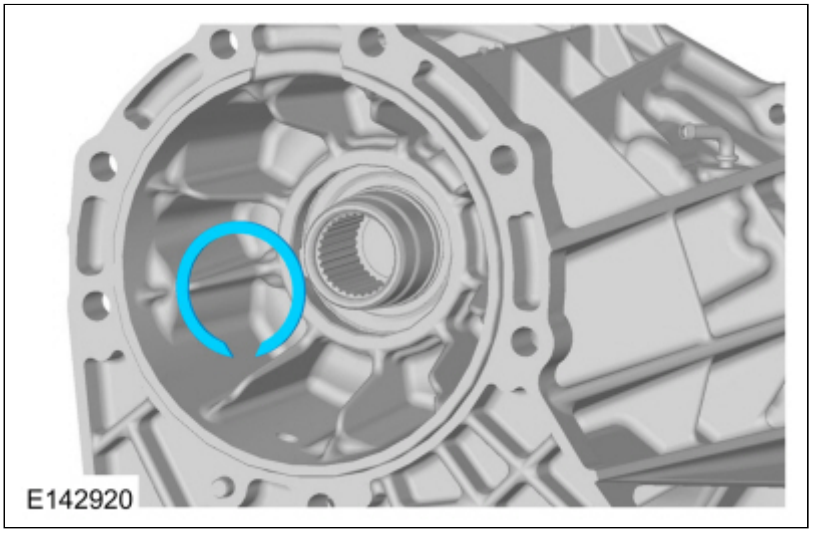
7.



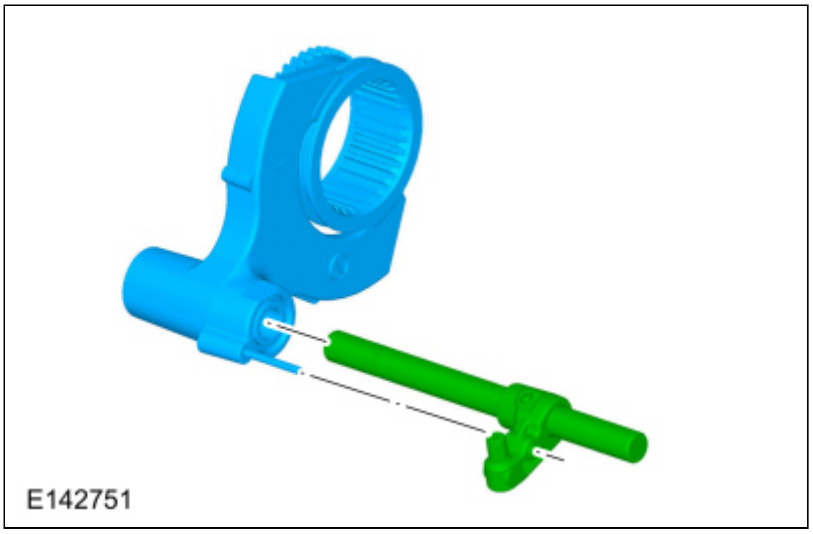
8. Use the General Equipment: Hydraulic Press



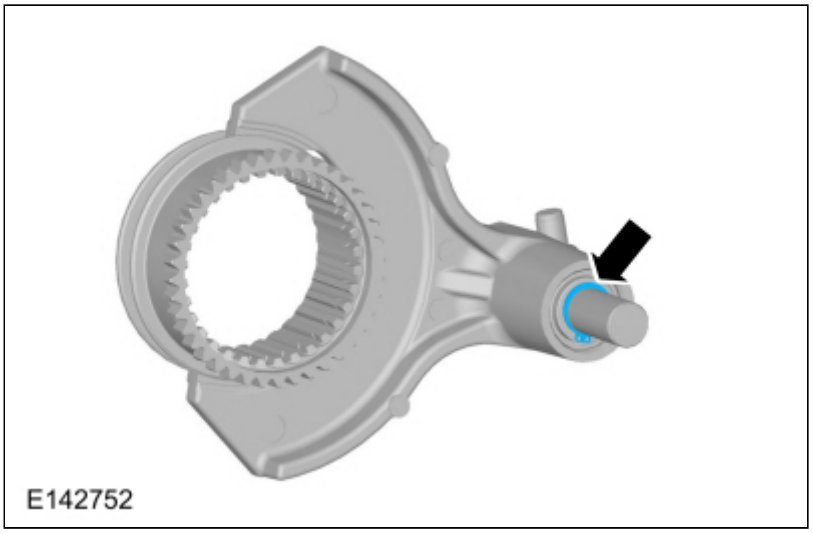
9. **NOTE:** *Make sure that the component is not damaged.*



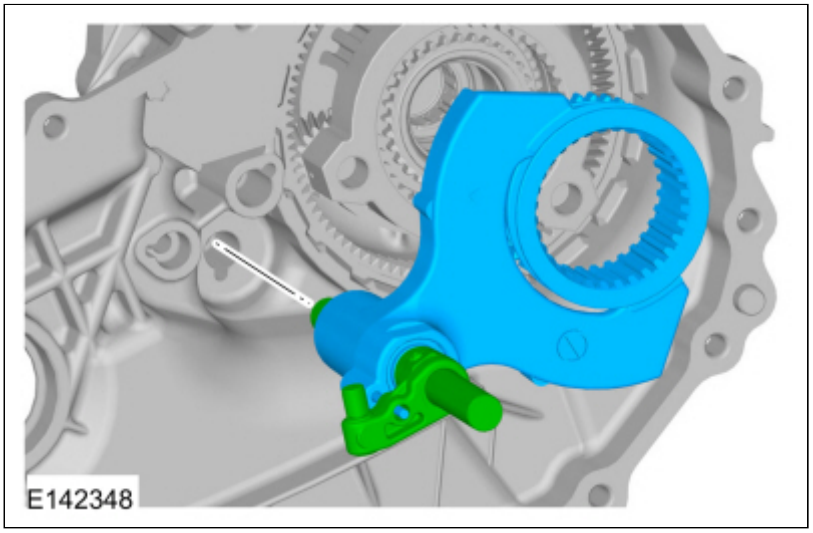
10.



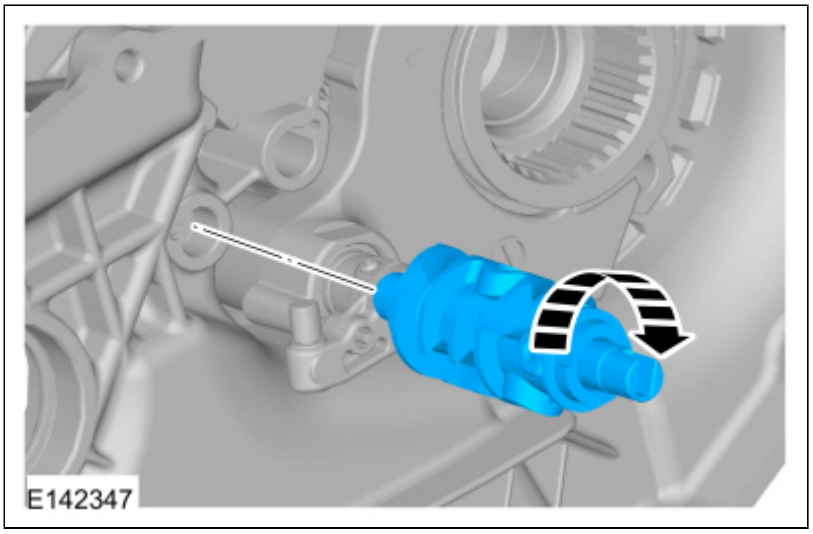
11. **NOTE:** *Use a new snap ring.*



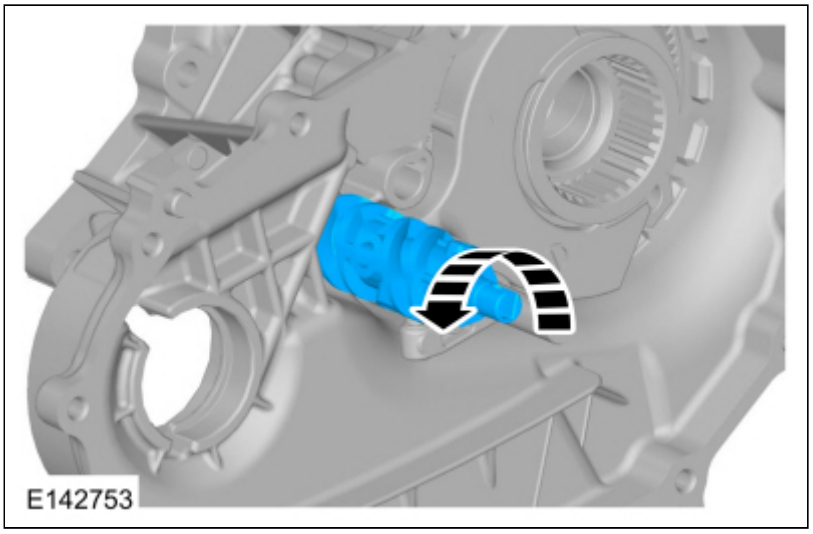
12.



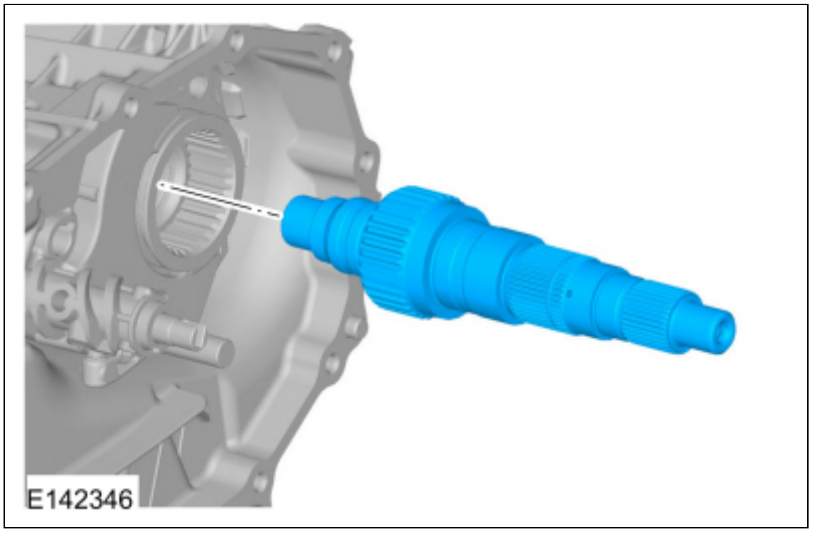
13. **NOTE:** *Set the H-L shift rod assembly pin into the longitudinal groove of the control shift rod.*



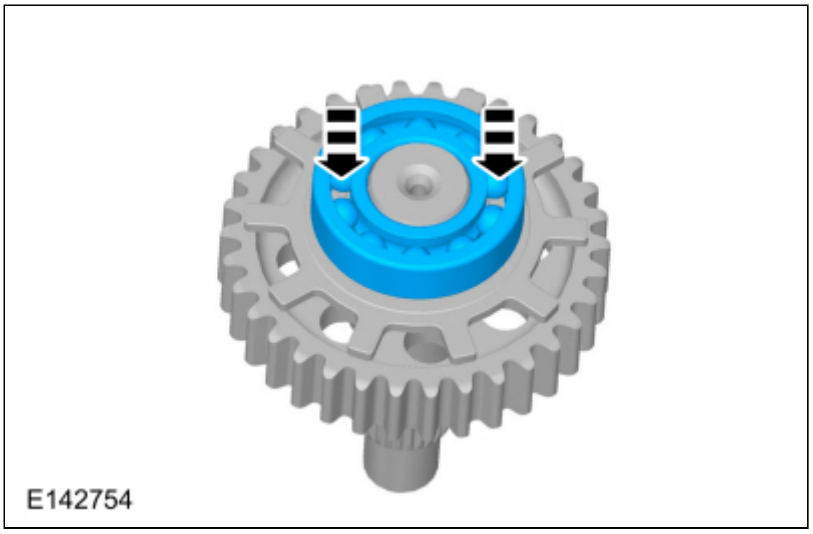
14.



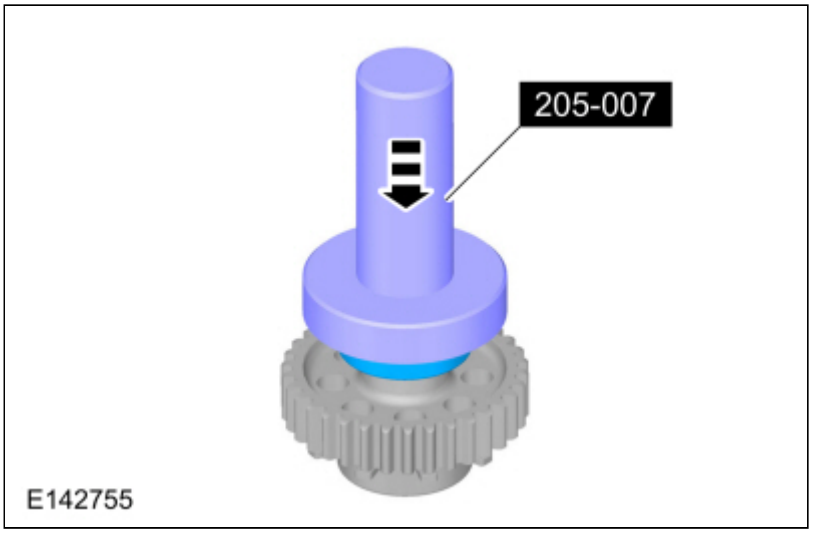
15.



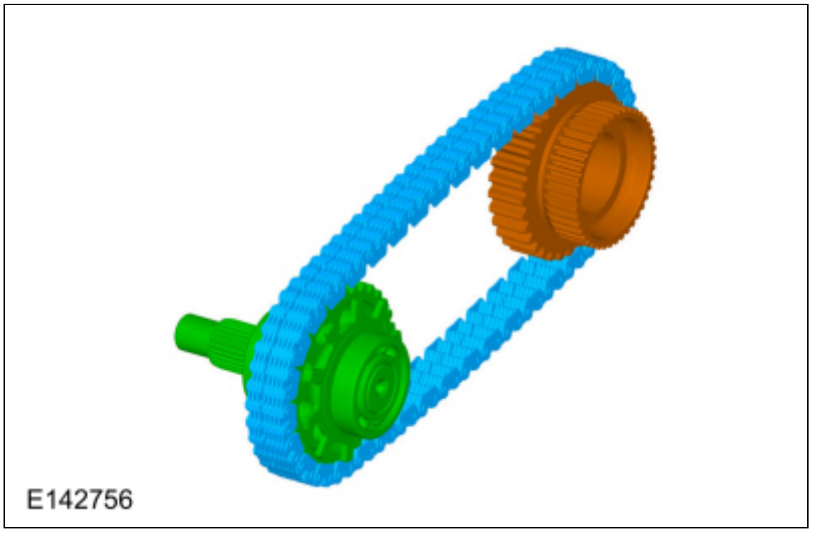
16. Use the General Equipment: Hydraulic Press



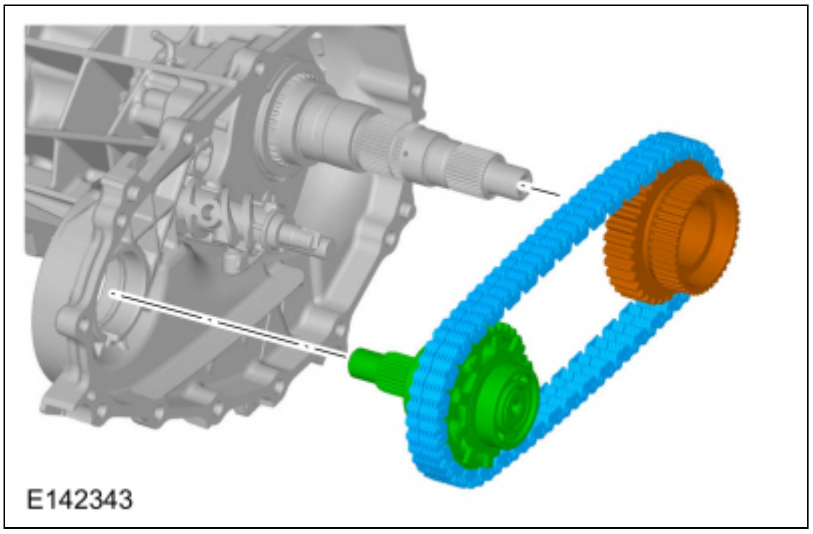
17. Use Special Service Tool: 205-007 Replacer, Pinion Seal.
    Use the General Equipment: Hydraulic Press



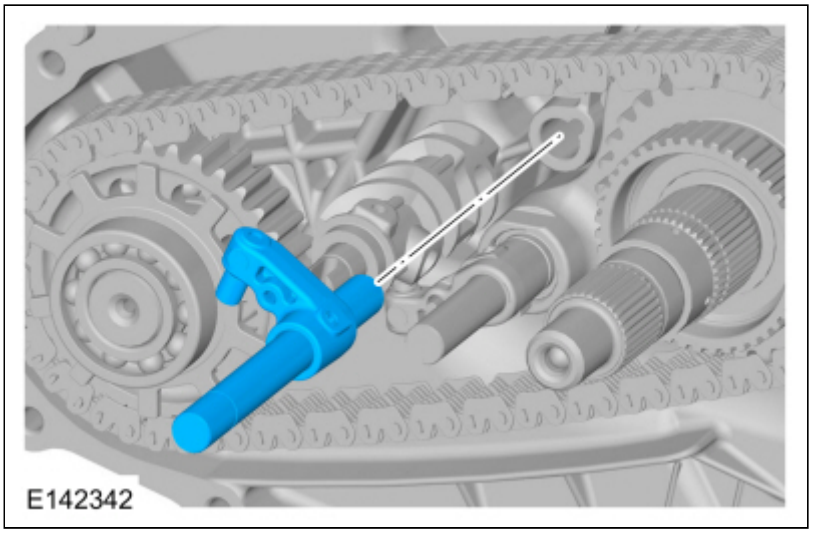
18.



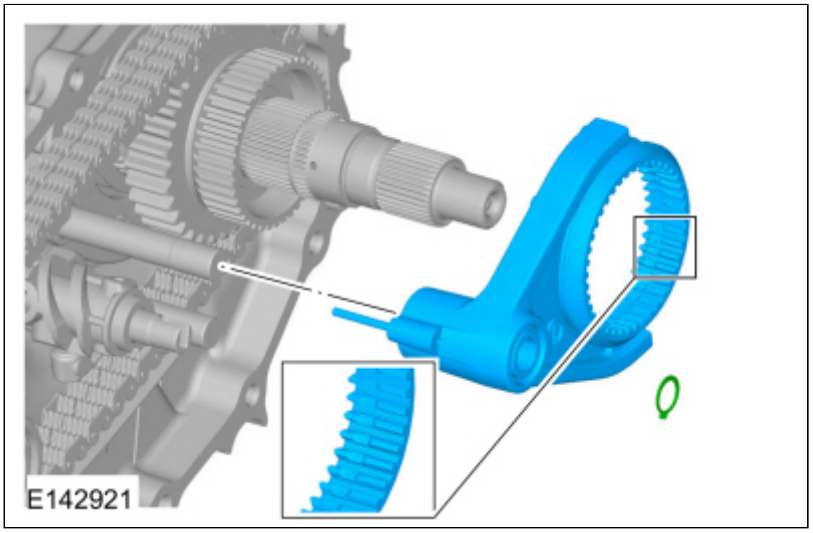
19.



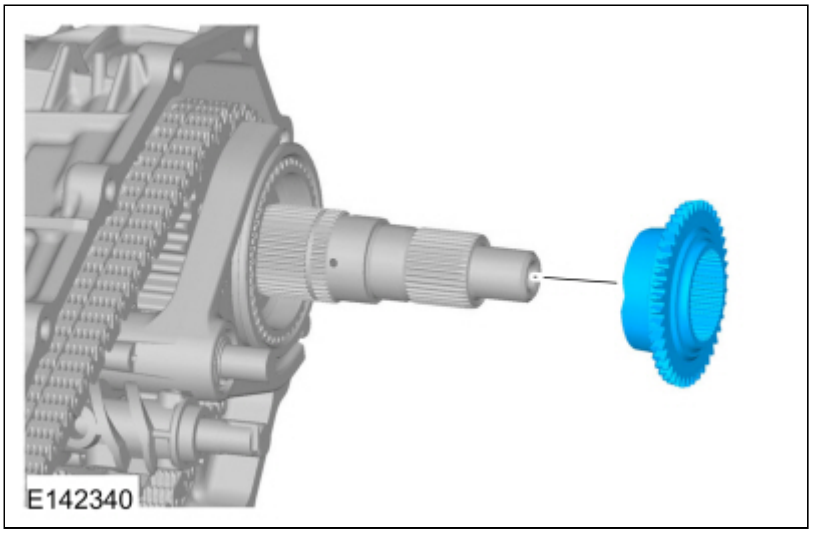
20. **NOTE:** *Set the 2-4 shift rod assembly pin into the groove of the control shift rod.*



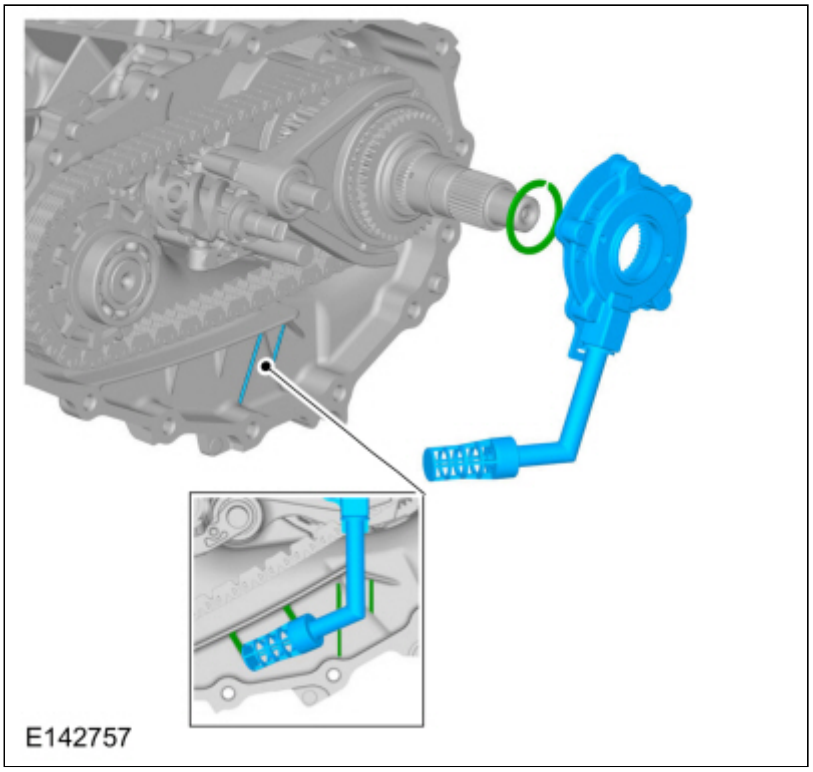
21.



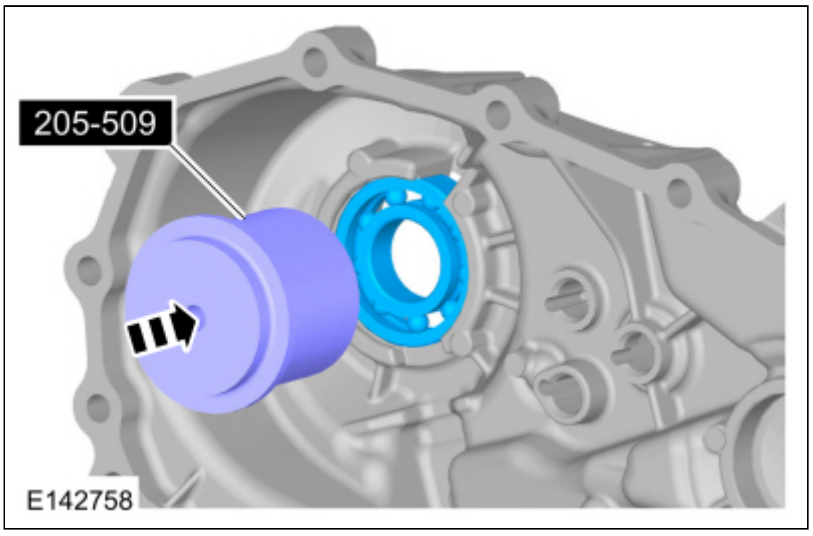
22.



23. **NOTICE: Make sure the oil pump is installed in the range of the rib as shown.**

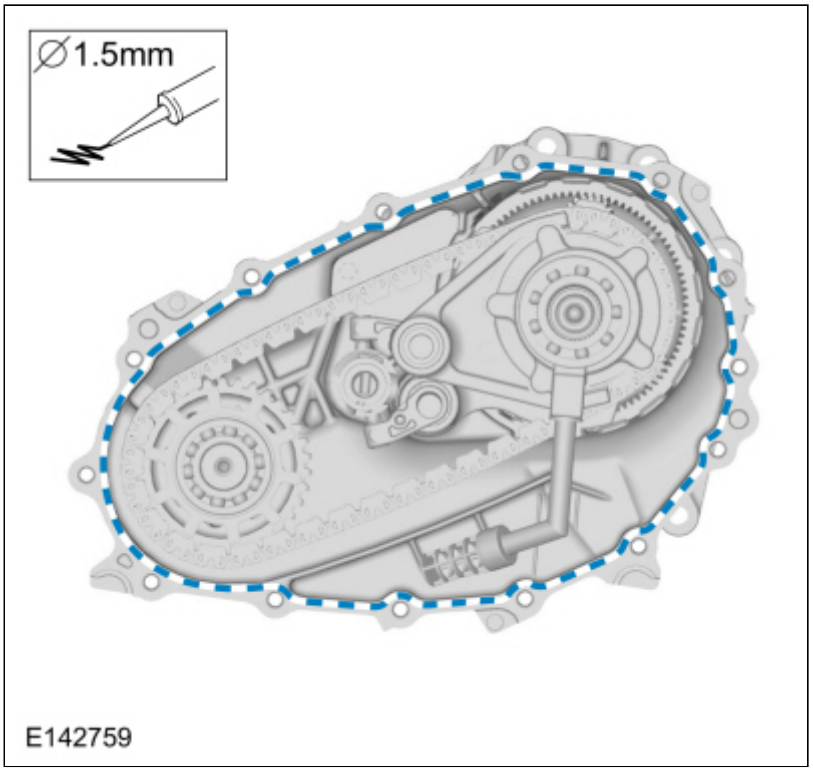


24. Use Special Service Tool: 205-509 Remover/Installer, Bushing.
    Use the General Equipment: Hydraulic Press

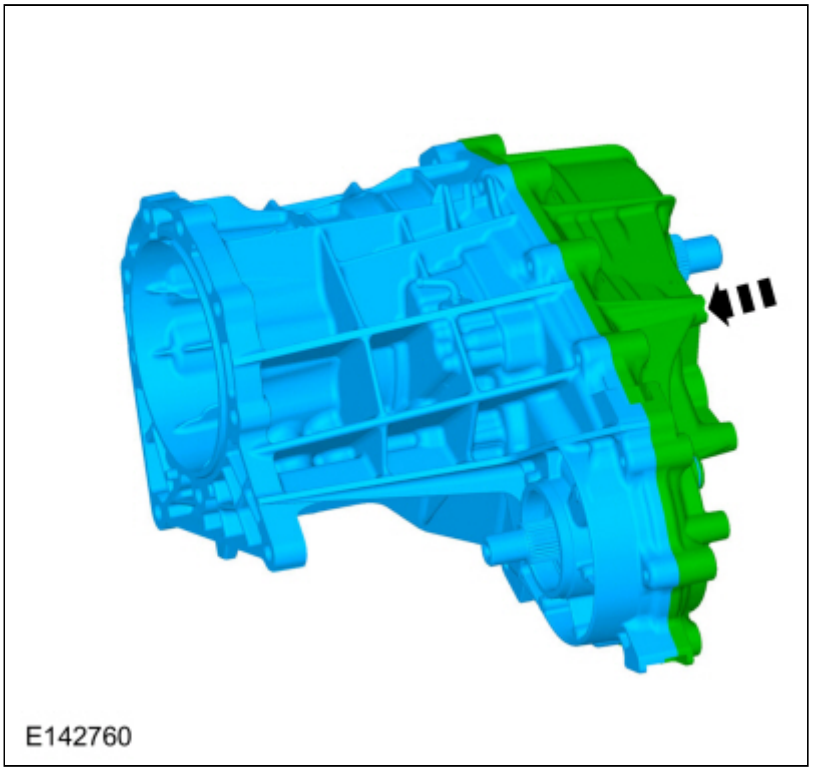


25. **NOTICE: Make sure that no excess sealant residue is evident.**

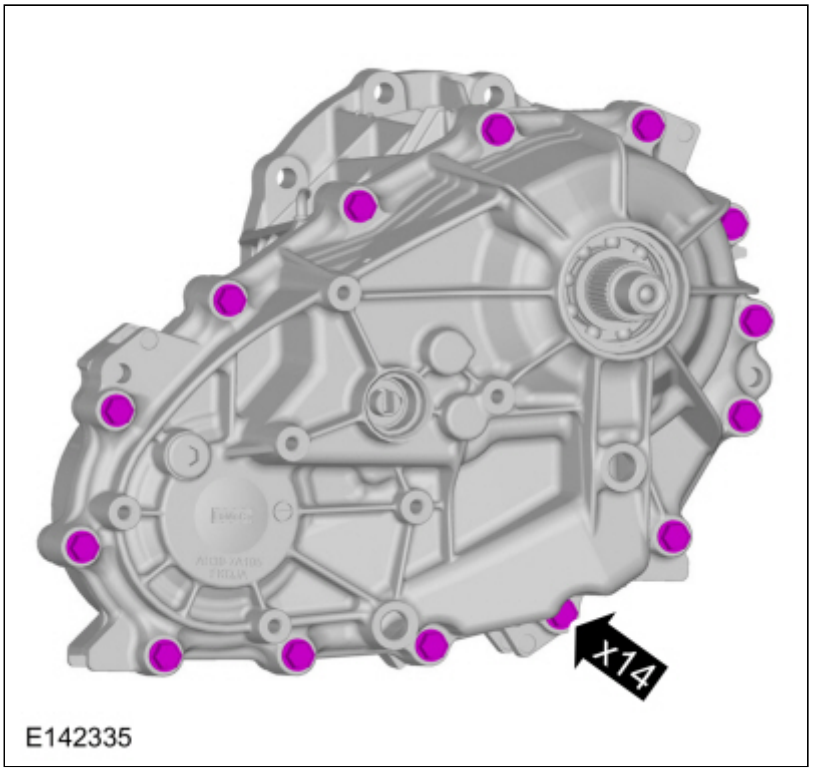
    Material: Silicone Sealant (WSE-M4G323-A4)



26.

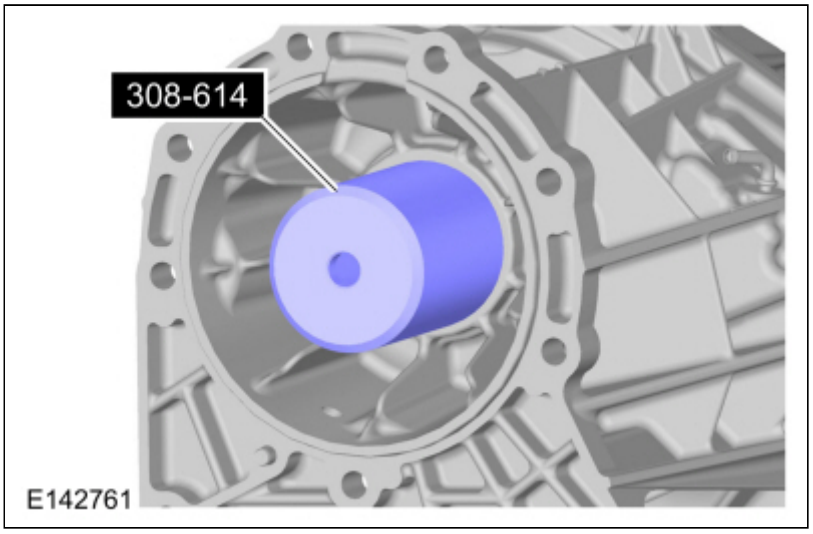


27. *Torque*: 45 Nm



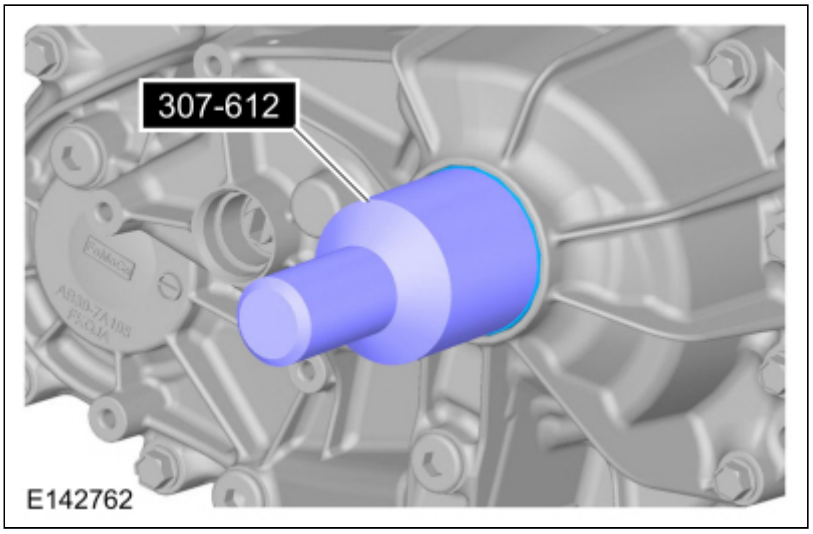
28. **NOTE:** *Apply petroleum jelly to the outer circumference of the oil seal.*

    Use Special Service Tool: 308-614 Installer, Output Shaft Seal.

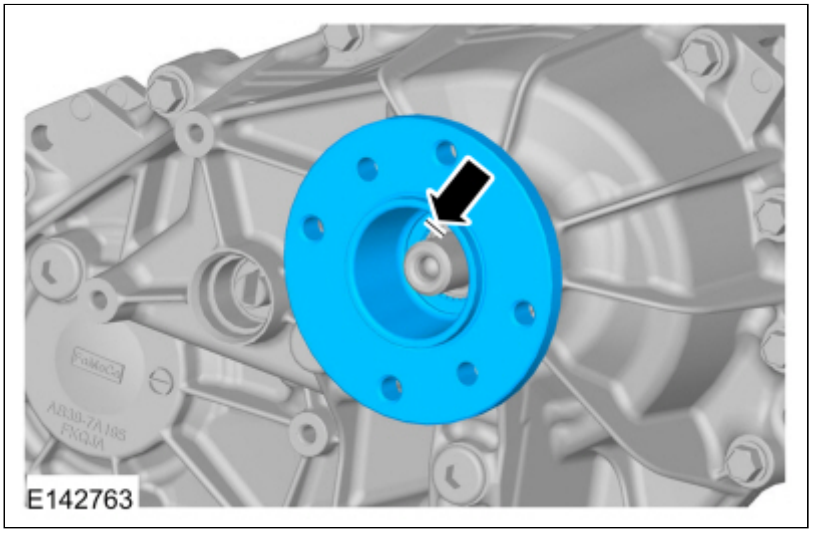


29. **NOTE:** *Apply petroleum jelly to the outer circumference of the oil seal.*

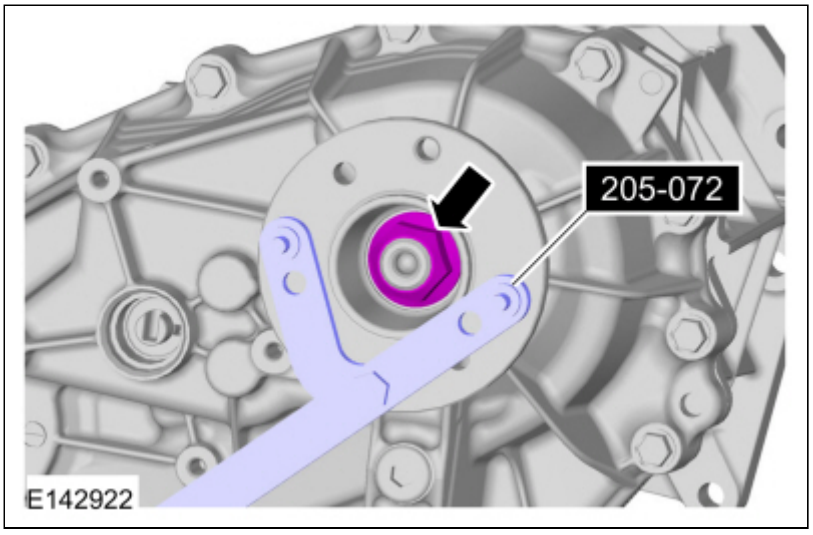
    Use Special Service Tool: 307-612 Installer, Seal.



30.

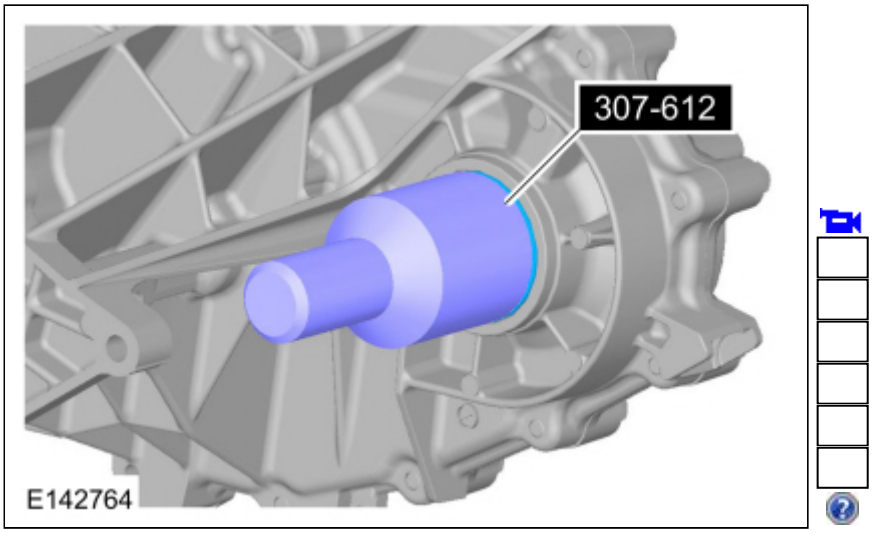


31. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Torque: 373 Nm

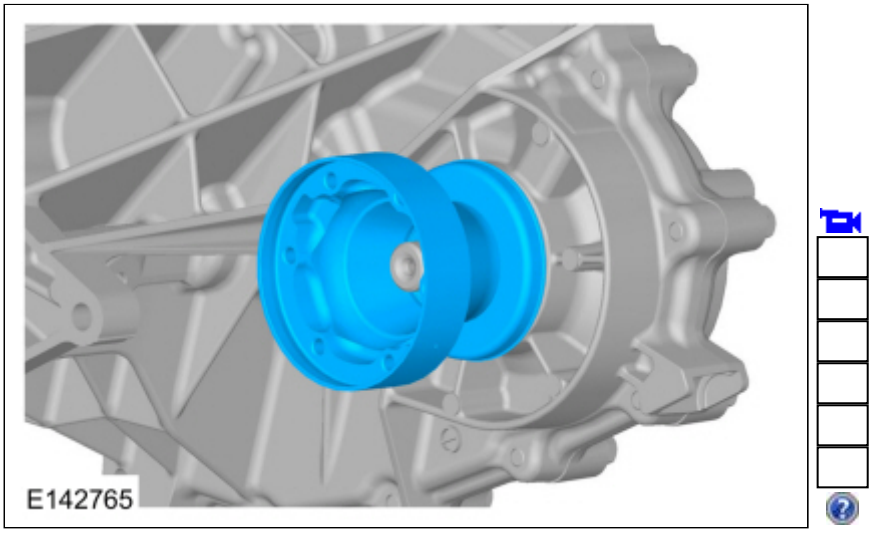


32. **NOTE:** *Apply petroleum jelly to the outer circumference of the oil seal.*

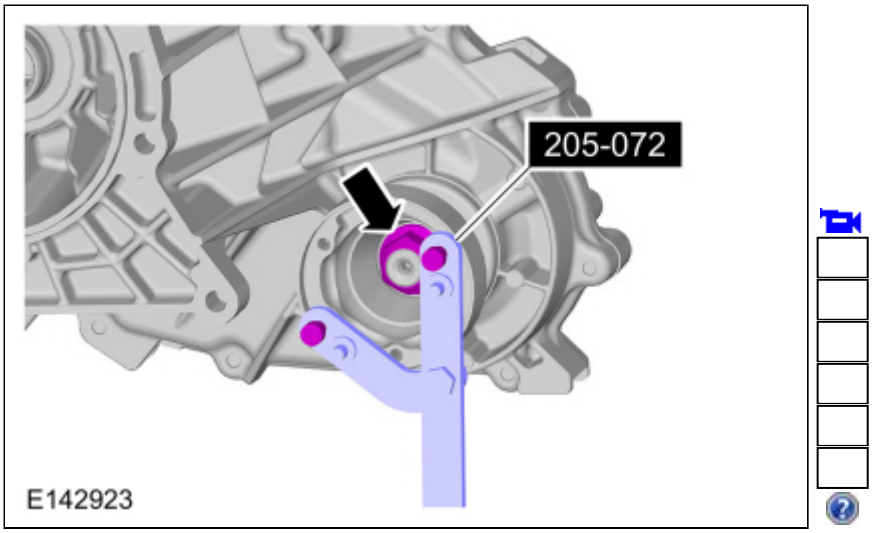
Use Special Service Tool: 307-612 Installer, Seal.



33.

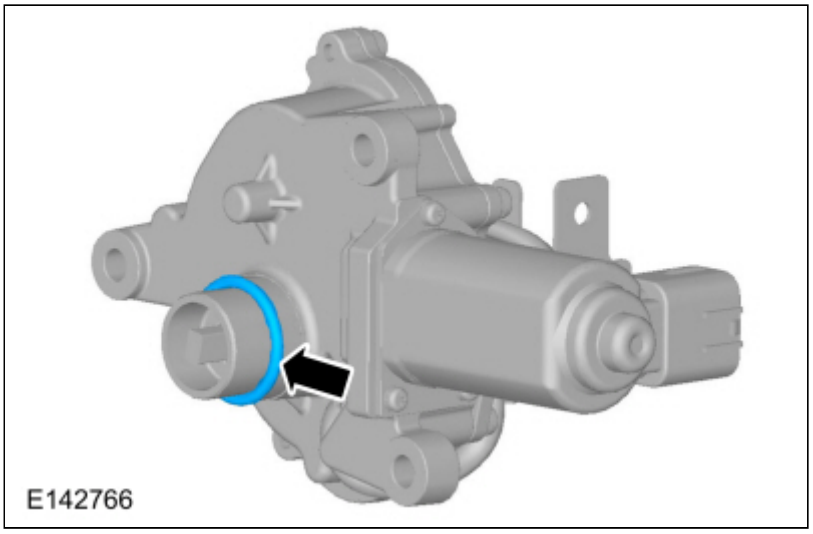


34. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Torque: 275 Nm

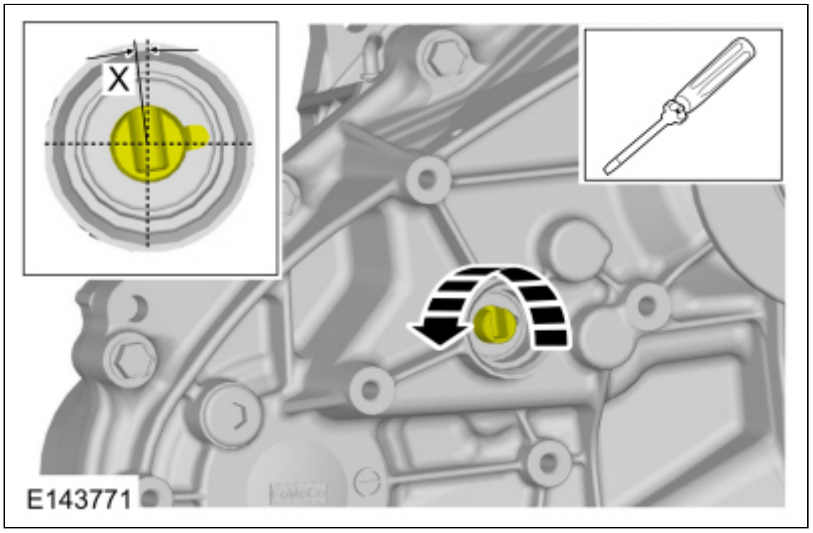


35. **NOTE:** *This step is not necessary when installing a new shift motor.*

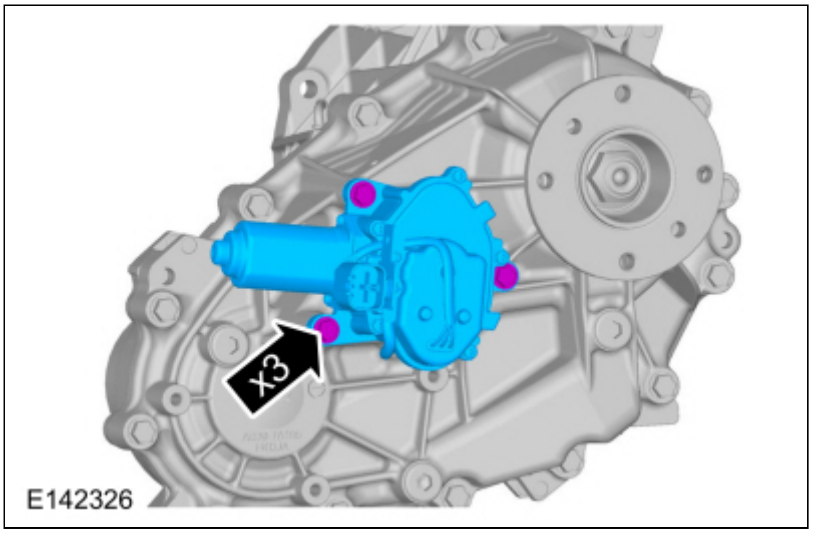
NOTE: *lubricate the "O" ring before installing*



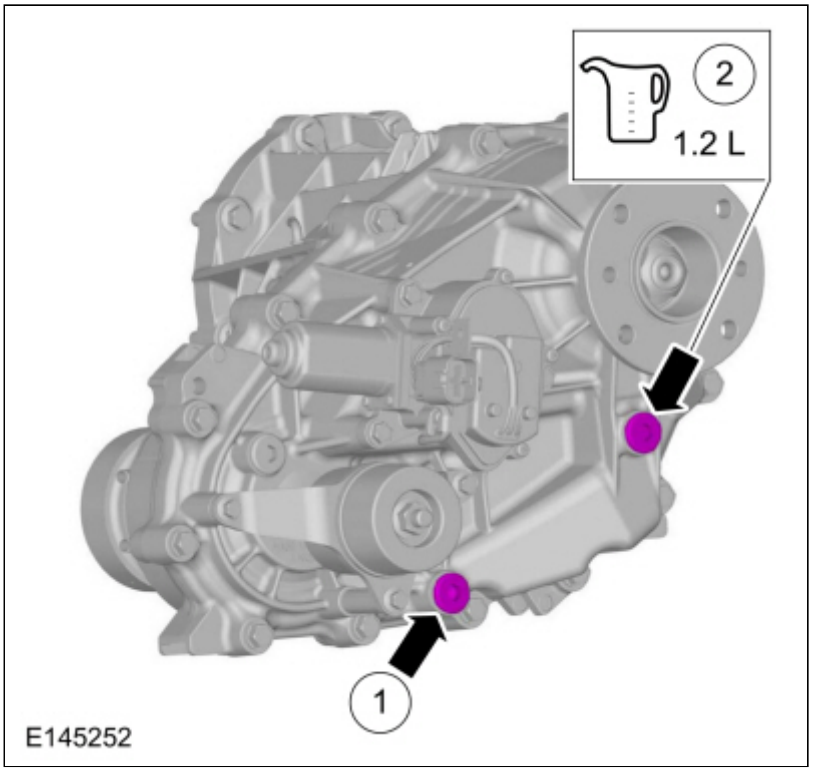
36. **X:** 5.4°



37. *Torque*: 22 Nm



1. *Torque*: 35 Nm
2. *Material*: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)
   Torque: 35 Nm



Copyright © 2016 Ford Motor Company

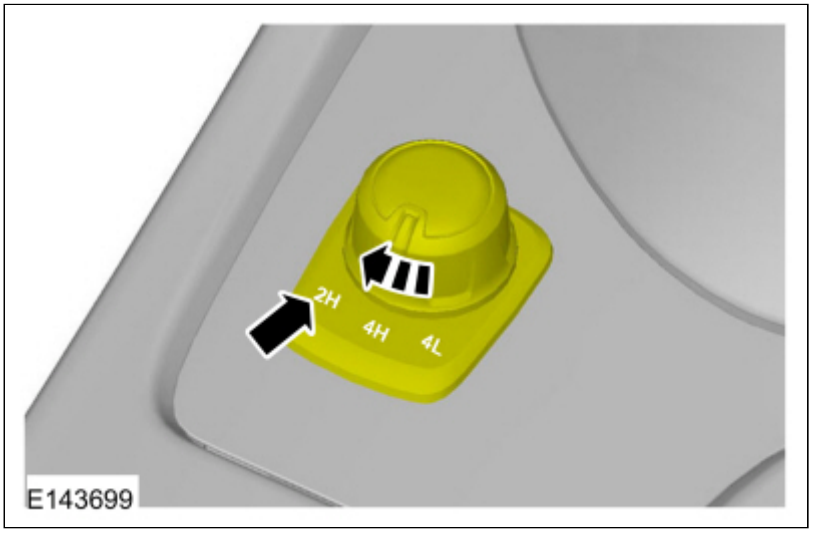
Transfer Case

Base Part Number: 7251

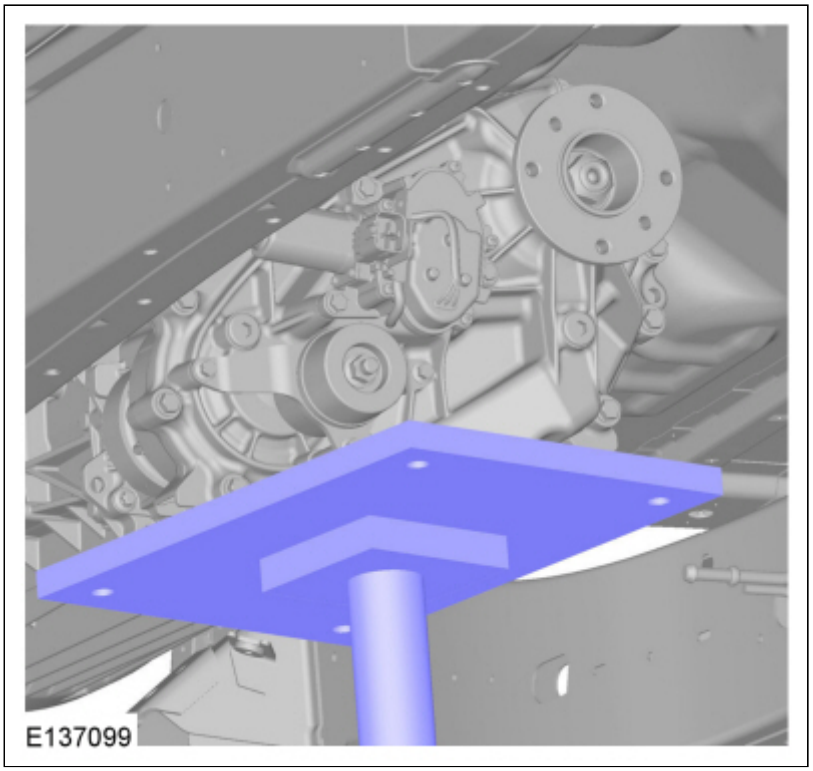
Special Tool(s) / General Equipment

Transmission Jack

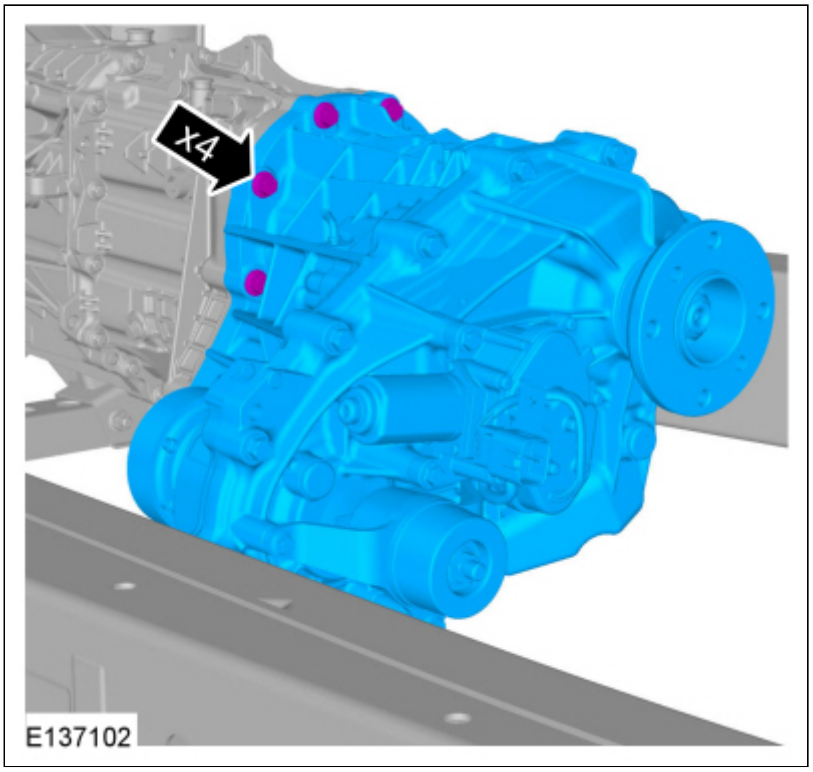
1.



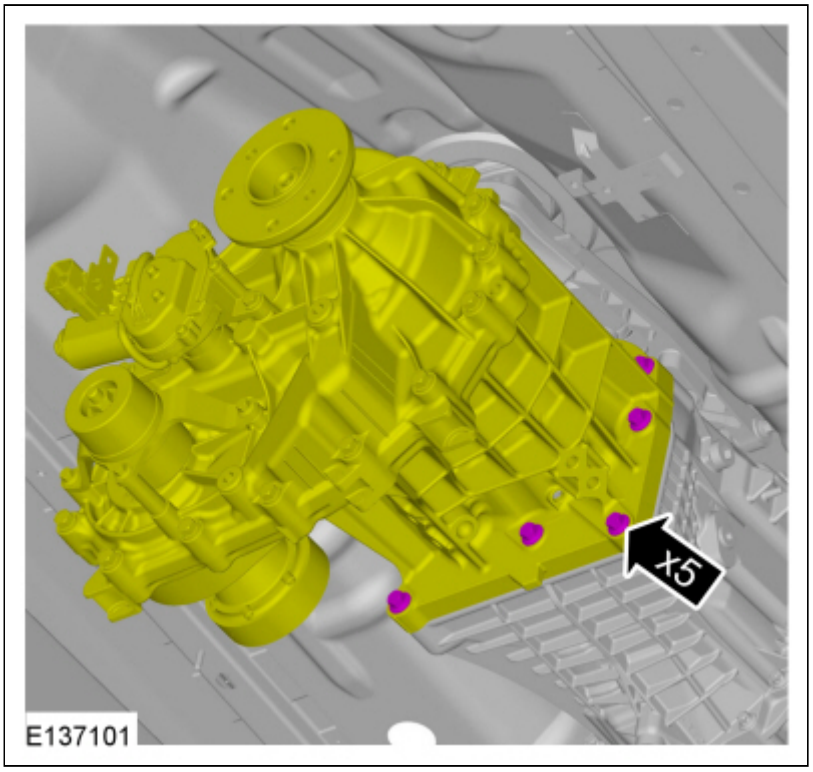
2. Use the General Equipment: Transmission Jack



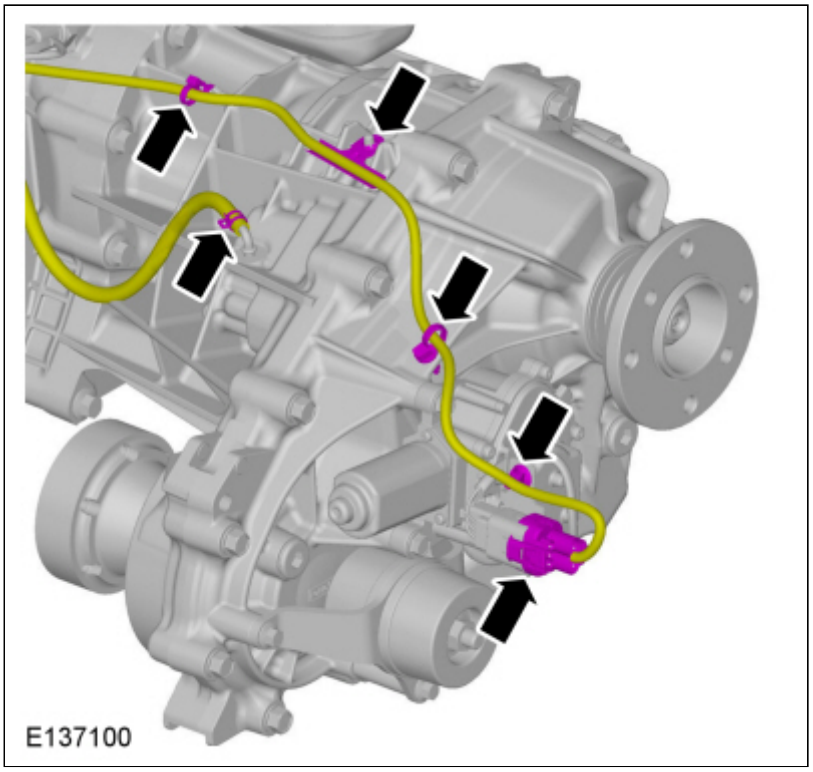
3. *Torque*: 48 Nm



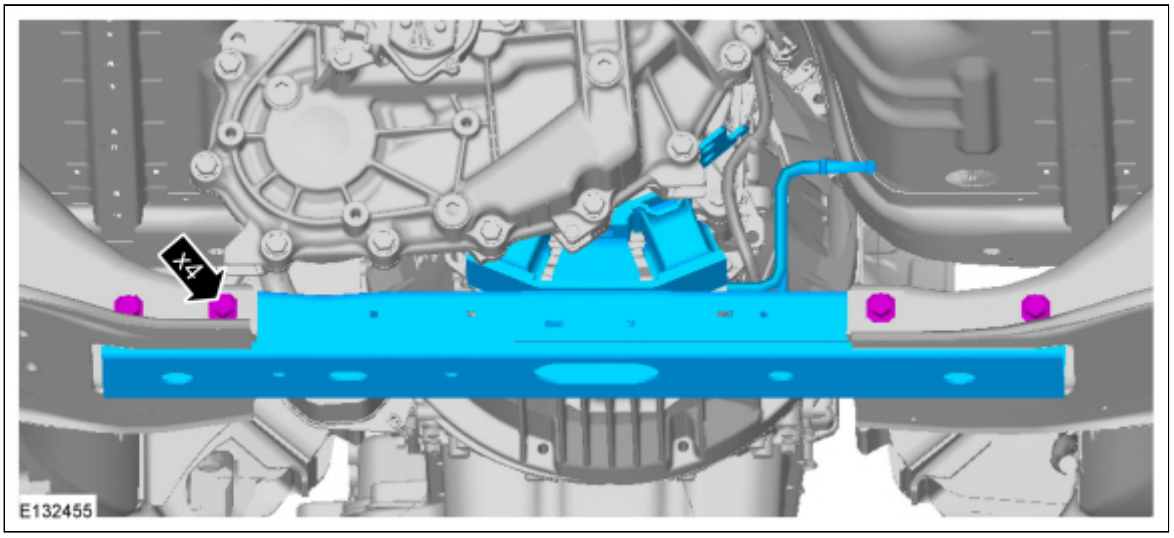
4. *Torque*: 48 Nm



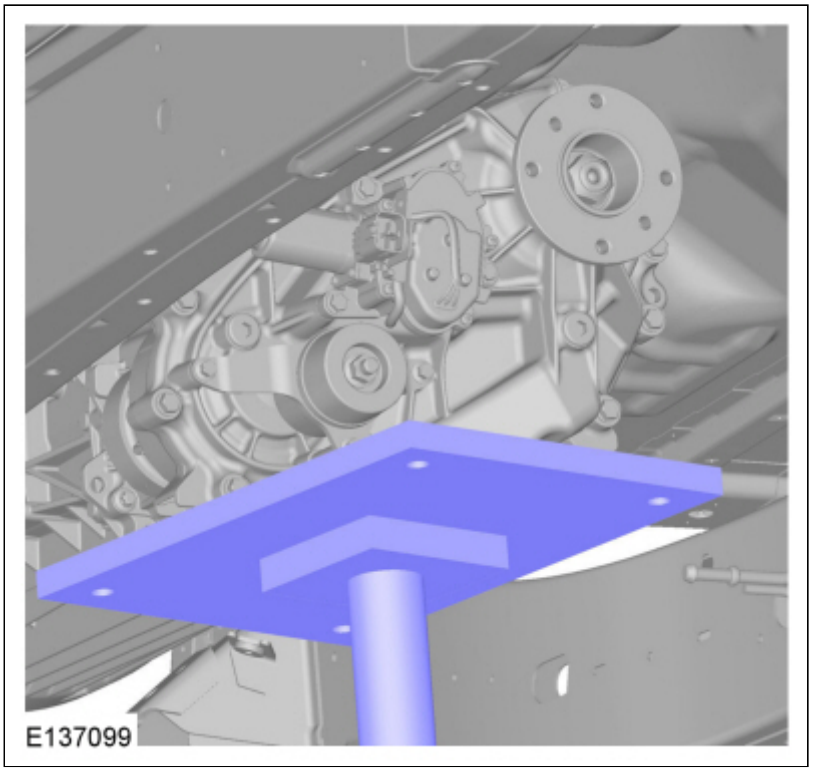
5.



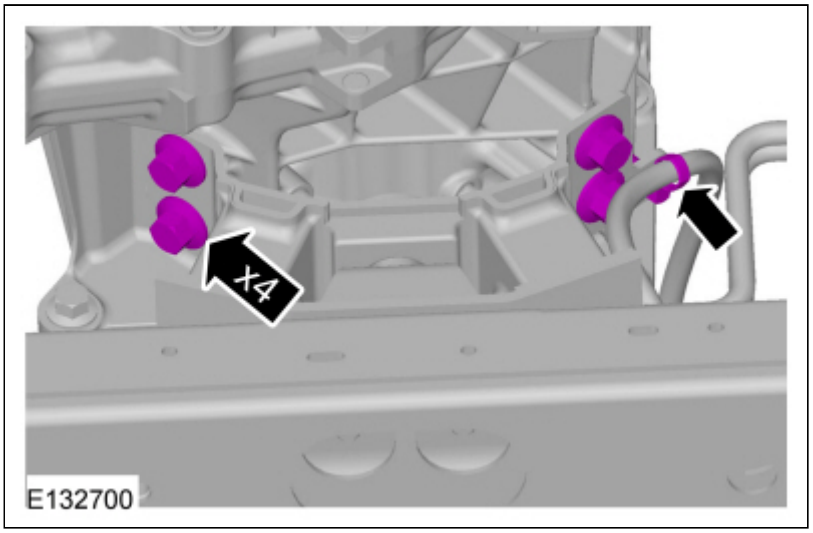
6. *Torque*: 90 Nm



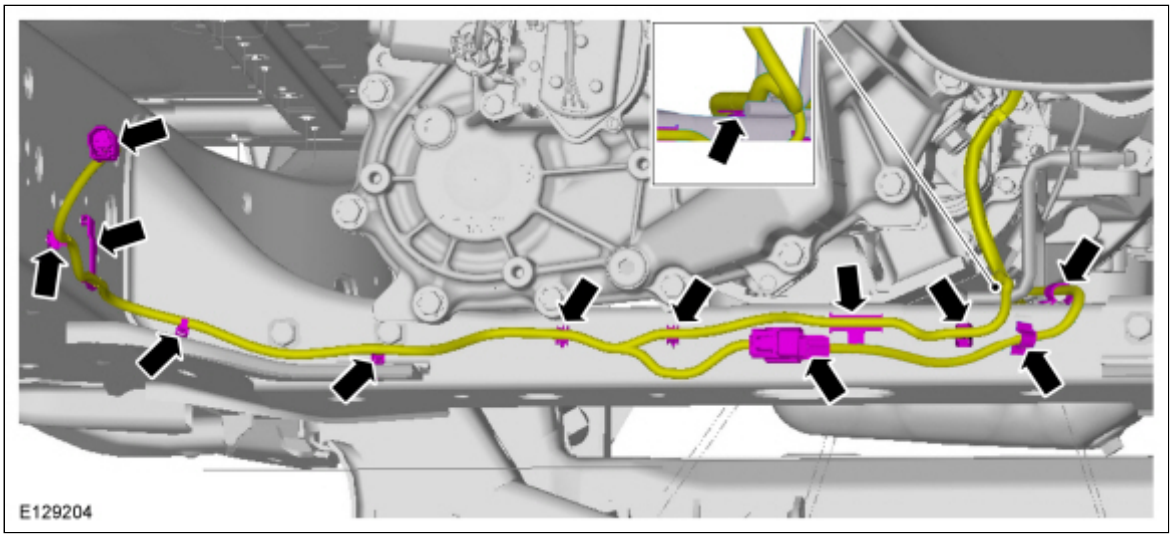
7. Lower the transmission jack.
   Use the General Equipment: Transmission Jack



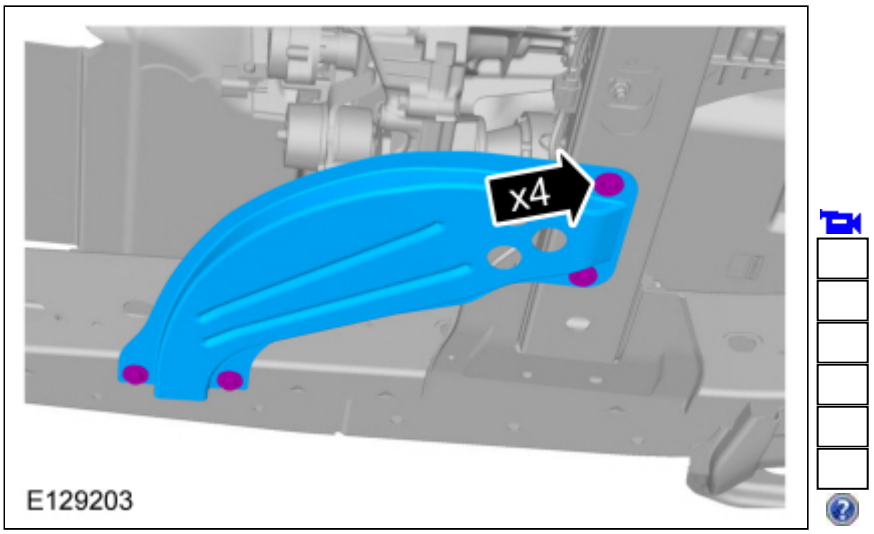
8. *Torque*: 90 Nm



9.



10. *Torque*: 48 Nm



11. Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
    Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
12. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
13. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Specifications

Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
MT82 Transfer case fluid	*Material*: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)

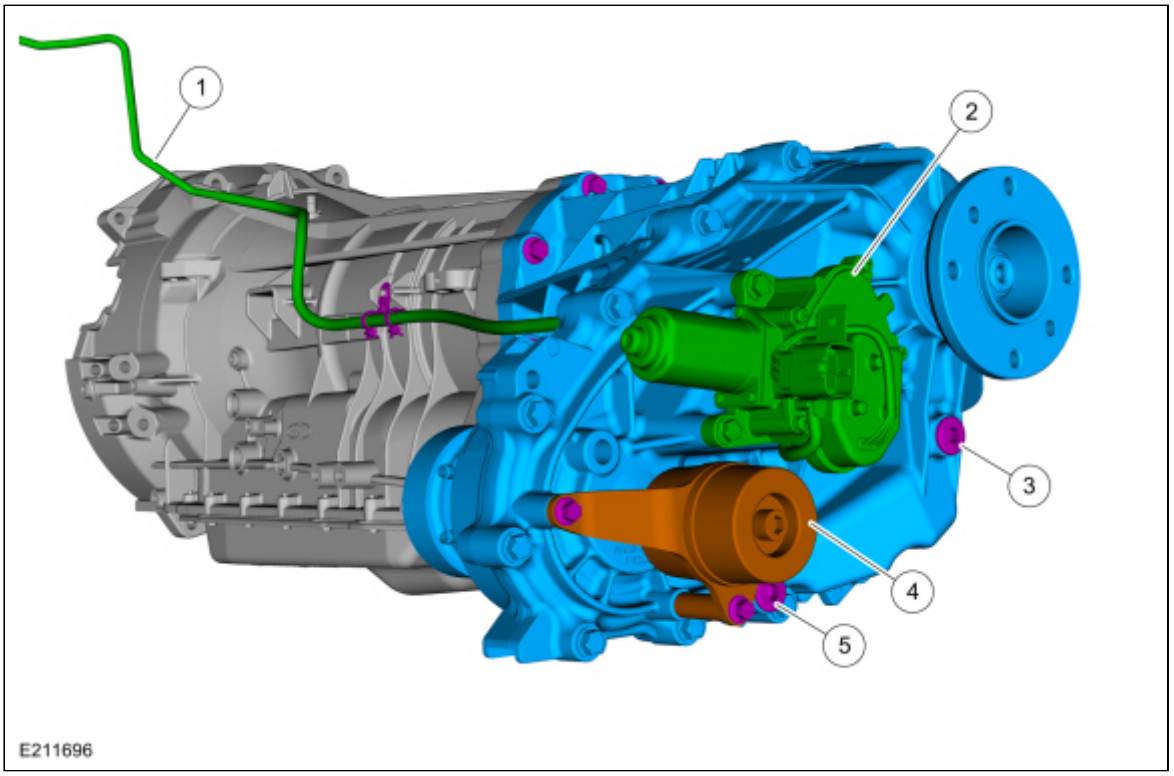
Capacities

	Liters
MT82 Transfer case - Service fill	1.2

Copyright © 2016 Ford Motor Company

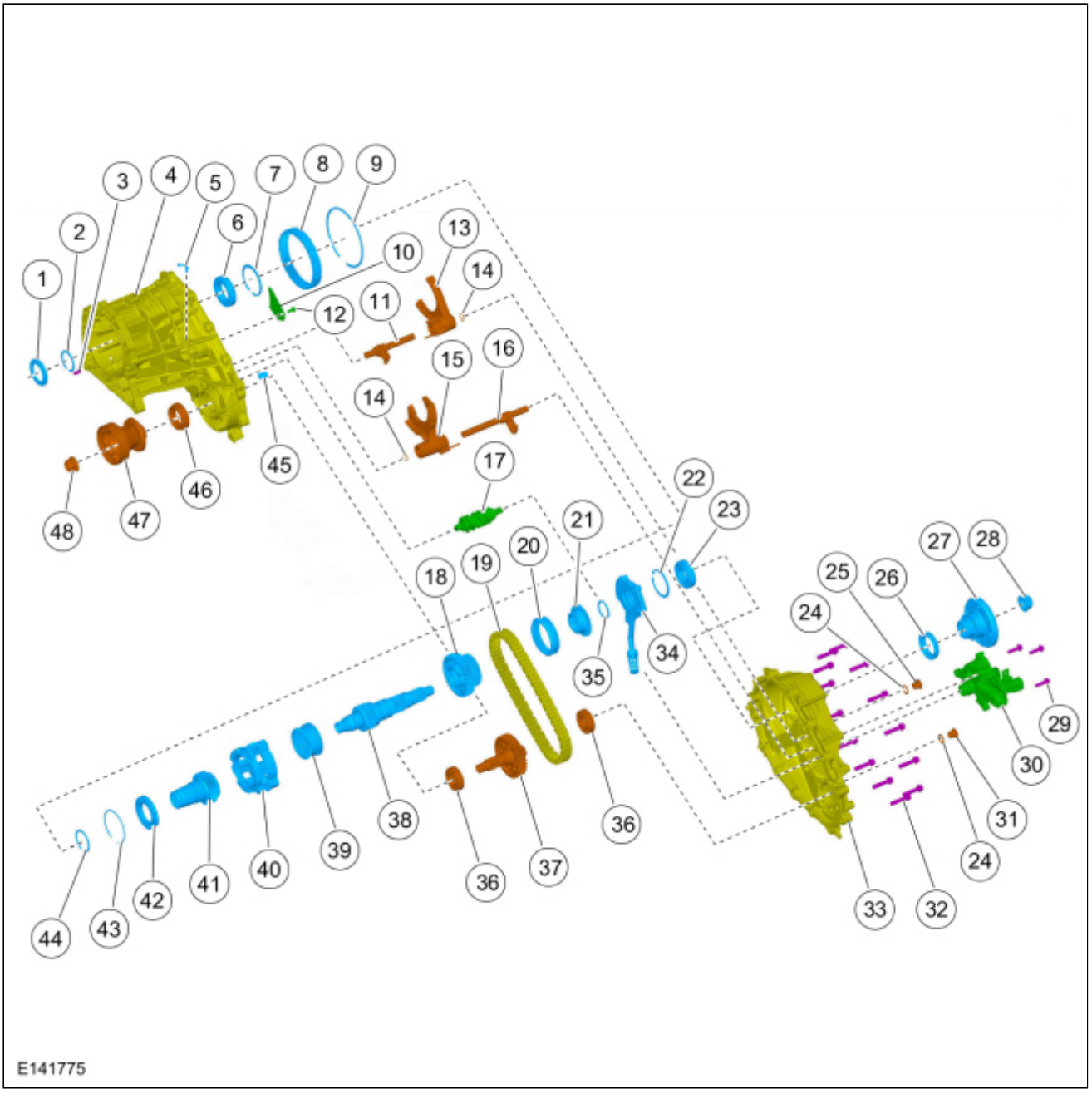
Transfer Case

Base Part Number: 7251



Item	Part Number	Description
1	—	Breather tube
2	—	Motor
3	—	Oil filler plug
4	—	Damper
5	—	Drain plug

Exploded view



Item	Part Number	Description
1	—	Input oil seal
2	—	Snap ring
3	—	Fork shift pin
4	—	Front transfer case cover
5	—	Breather
6	—	Input ball bearing
7	—	Snap ring
8	—	Internal gear
9	—	Snap ring
10	—	Baffle plate
11	—	Shift rod (2-4)
12	—	Hexagonal bolt head
13	—	Shift fork (2-4)
14	—	Snap ring
15	—	Shift fork (low, high)

16	—	Shift rod (low, high)
17	—	Control shift rod
18	—	Sprocket
19	—	Transfer chain
20	—	Coupling sleeve (2-4)
21	—	Clutch gear
22	—	Snap ring
23	—	Rear ball bearing
24	—	Washer
25	—	Filler plug
26	—	Output oil seal
27	—	Companion flange assembly
28	—	Self lock nut
29	—	Hexagonal bolt flange
30	—	Transfer case shift motor
31	—	Drain plug
32	—	Hexagonal bolt head
33	—	Rear transfer case
34	—	Oil pump assembly
35	—	Clip
36	—	Front drive shaft ball bearing
37	—	Front drive shaft
38	—	Main shaft
39	—	Coupling sleeve (low, high)
40	—	Planet carrier assembly
41	—	Main transfer gear
42	—	Carrier ball bearing
43	—	Snap ring
44	—	Snap ring
45	—	Dowel pin
46	—	Front drive oil seal
47	—	Companion flange assembly
48	—	Self lock nut

OPERATING PRINCIPLE

The transfer case delivers engine torque to the rear wheels and when requested to the front wheels. The transfer case is mounted on the rear of the transmission assembly and also has the ability to drive an additional gear reduction.

The transfer case has three different operating modes;

- Two Wheel Drive
- Four Wheel Drive - High Range
- Four Wheel Drive - Low Range

A toggle switch mounted in the vehicle cabin is used to select between the three different operating modes. The transfer case is electronically shifted via a shift motor mounted on the rear of the transfer case housing. The transfer case is filled with lubricating oil which is circulated using a mechanical oil pump. The oil pump is fitted with a strainer to filter any debris.

In four wheel drive mode there is no speed differential between the front and rear axles. This can cause driveline

windup when cornering on sealed surfaces.

Two Wheel Drive Operation

When the transfer case is in two wheel drive mode the engine torque is transferred from the input shaft through the planetary gearset. The planetary gearset is driven as one unit providing the torque to the rear output shaft, through the rear differential to the rear wheels.

Four Wheel Drive Operation

To engage four wheel drive the shift motor rotates the shift hub attached to the motor assembly which moves the shift fork to engage to drive either the high or low operating mode depending on the electronic request sent from the cabin switch.

Four Wheel Drive High Range

When the transfer case is in Four Wheel Drive High Range mode, the engine torque is transferred from the input shaft through the planetary gearset. The planetary gearset is driven as one unit providing the torque to the rear output shaft, through the rear differential to the rear wheels. To drive the front wheels one of the selector forks engages a selector ring to lock the silent chain gear wheel to the rear output shaft which drives engine torque to the front output shaft via the silent chain. Engine torque is the delivered to both the front and rear wheel without any gear reduction.

Four Wheel Drive Low Range

When the transfer case is in Four Wheel Drive Low Range mode, the operation is the same as described in high range mode except the planetary gearset is independently driven to provide a gear reduction to both the front and rear drive axles.

Tachograph

For markets where a tachograph is required, a 'tachograph ready' transfer case is fitted to the vehicle. This allows the fitment of a tachograph sensor to the transfer case housing. The machined hole in the housing is filled with the blanking plug, which can be removed for the fitment of the sensor.

The tachograph ready transfer case has the following additional features:

- Internal pulse gear.
- Machined shoulder on front output shaft for pulse gear.
- Machined hole and thread on rear case.

Copyright © 2016 Ford Motor Company

Transfer Case

Base Part Number: 7251

REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

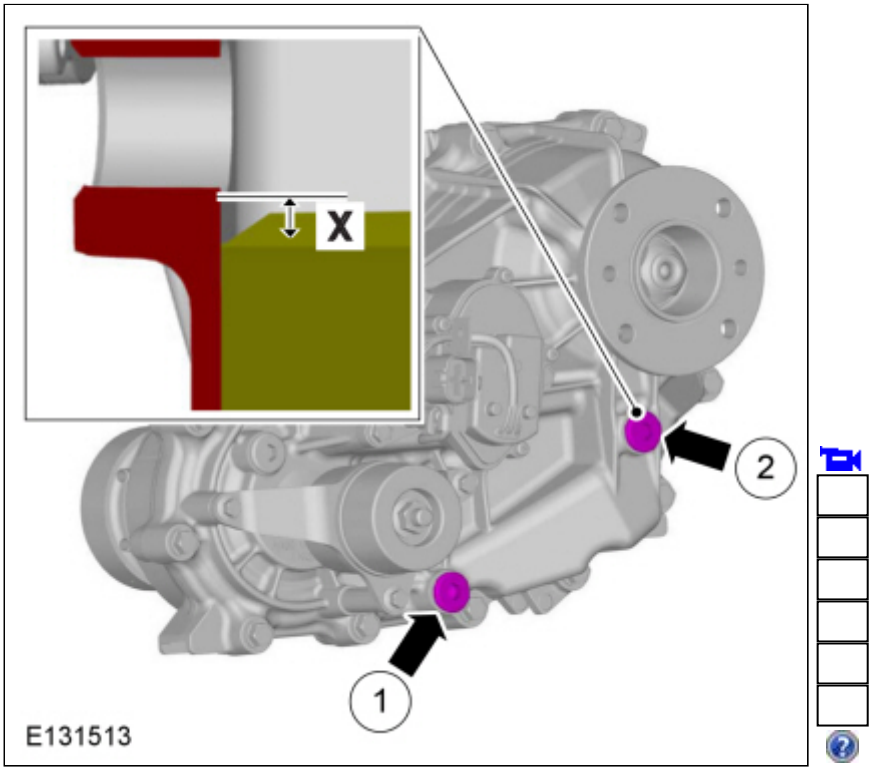
Copyright © 2016 Ford Motor Company

Transfer Case Draining and Filling

1. For additional information, refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

   NOTICE: Do not use an impact wrench when removing the filler plug or drain plug. It may damage the transfer case.

   Remove the drain plug and the seal.
   - Drain the oil into a suitable container.
   - Tighten the drain plug with a new seal.
   - Tightening torque 19-30 Nm.



2. **NOTICE: Only use the specified lubricant.**

   Remove the filler plug and seal and add the specified amount and type of oil through the filler plug hole until the level reaches the bottom of the filler plug hole.
   - Transfer oil type: Motorcraft MERCON® LV WSS-M2C938-A XT-10 QLVC. Capacity (approximate quantity): 1.2 L {1.3 US qt, 1.1 Imp qt}.
   - Tighten the filler plug with a new seal.
   - Tightening torque 19-30 Nm.

Copyright © 2016 Ford Motor Company

Transfer Case Fluid Level Check

Materials

Name	Specification
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

Check

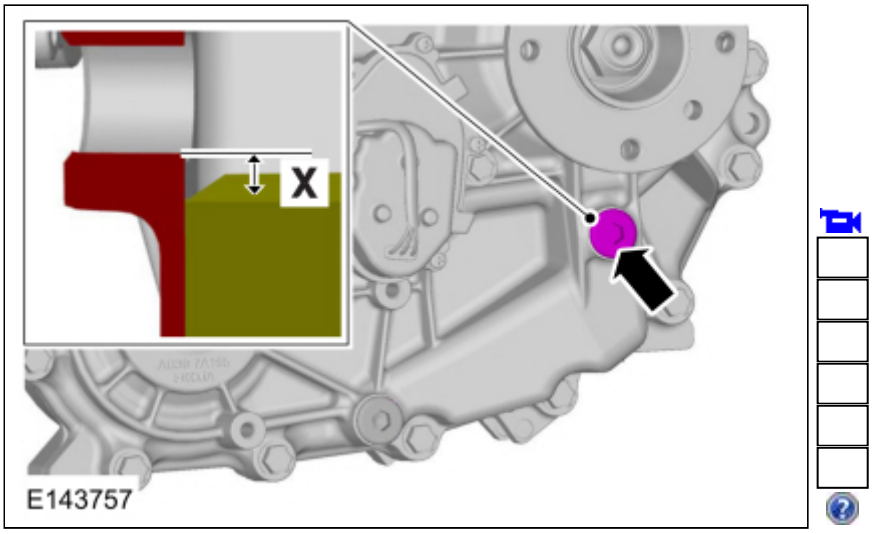
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Make sure that the vehicle is standing on a level surface.*

   Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Check the component for leaks.
4. Transfer case Fluid Level Check should only be carried out if an oil leak was identified.
5. **NOTICE: Only use the specified lubricant.**

   NOTE: *The transfer case should be in in-vehicle position.*

   NOTE: *Make sure that fluid level is to the MAX mark.*

   Remove the filler plug and seal and add the specified amount and type of oil through the filler plug hole until the level reaches the bottom of the filler plug hole **X:** 0 mm.
   Material: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)



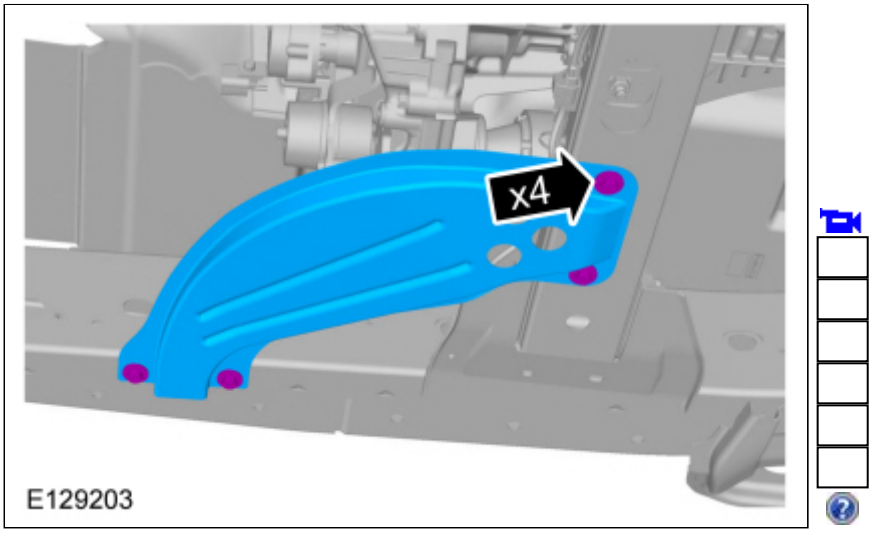
Copyright © 2016 Ford Motor Company

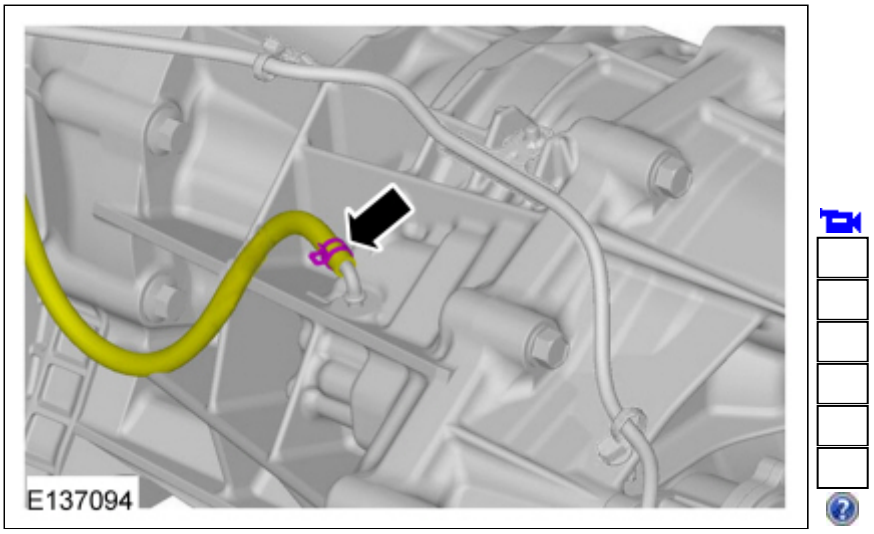
Transfer Case

Base Part Number: 7251

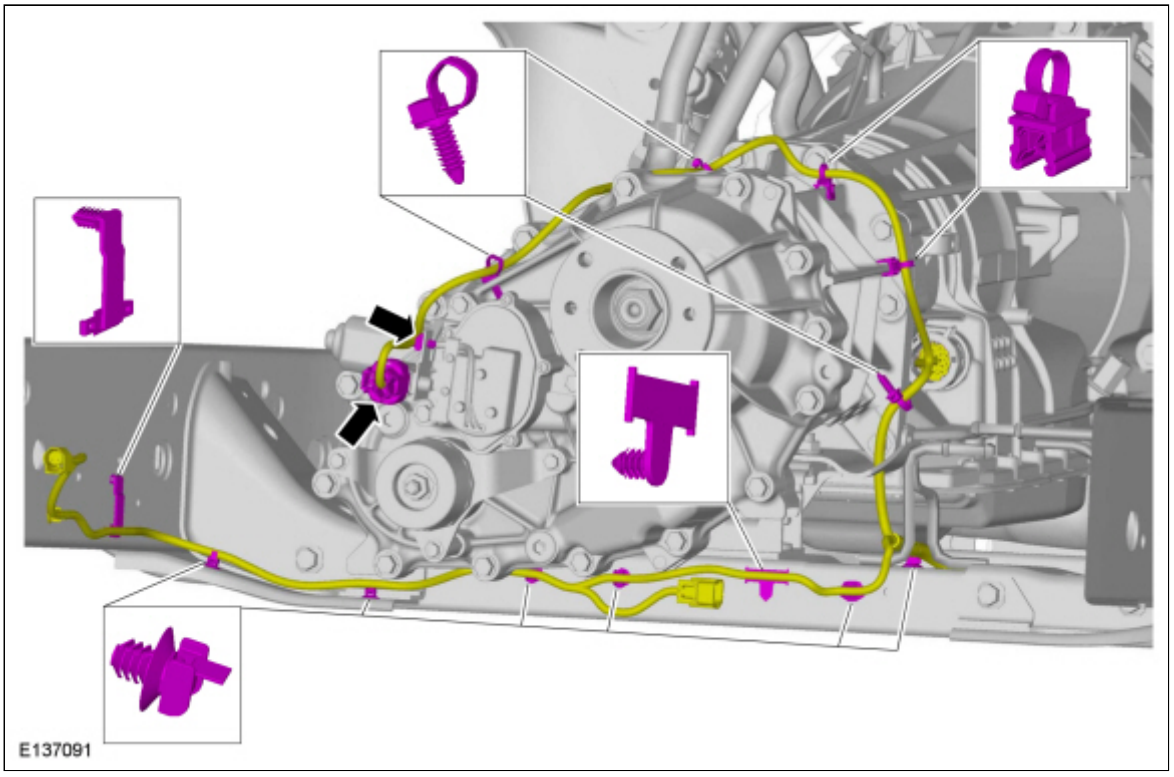
Special Tool(s) / General Equipment

Transmission Jack

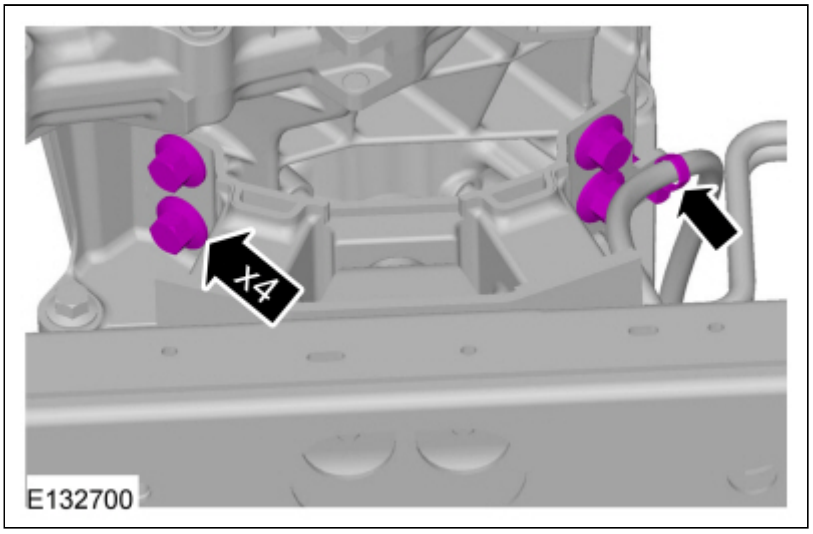
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
   Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
4. 

5. 

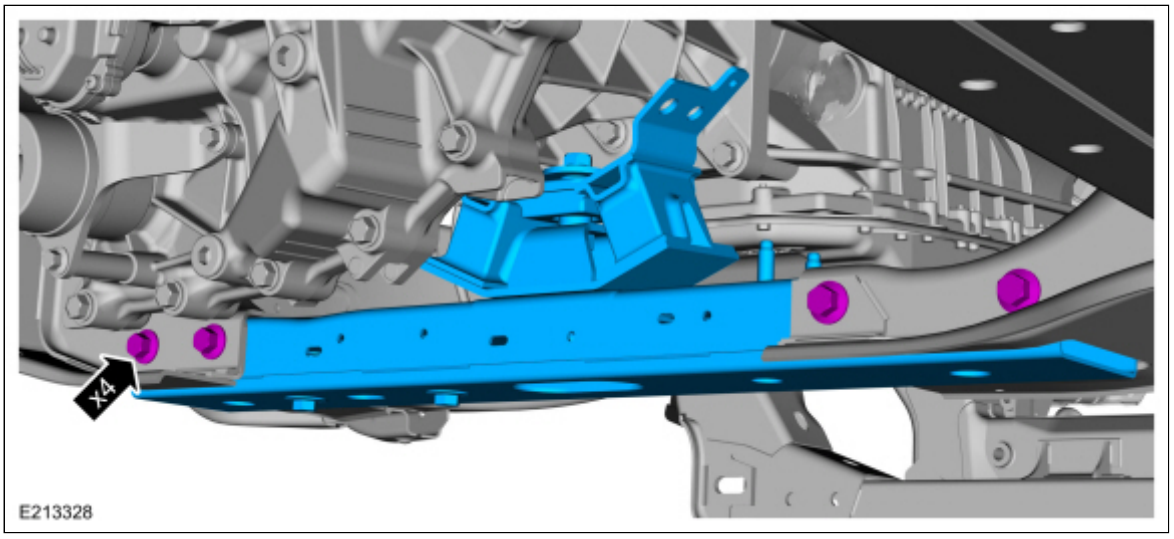
6.



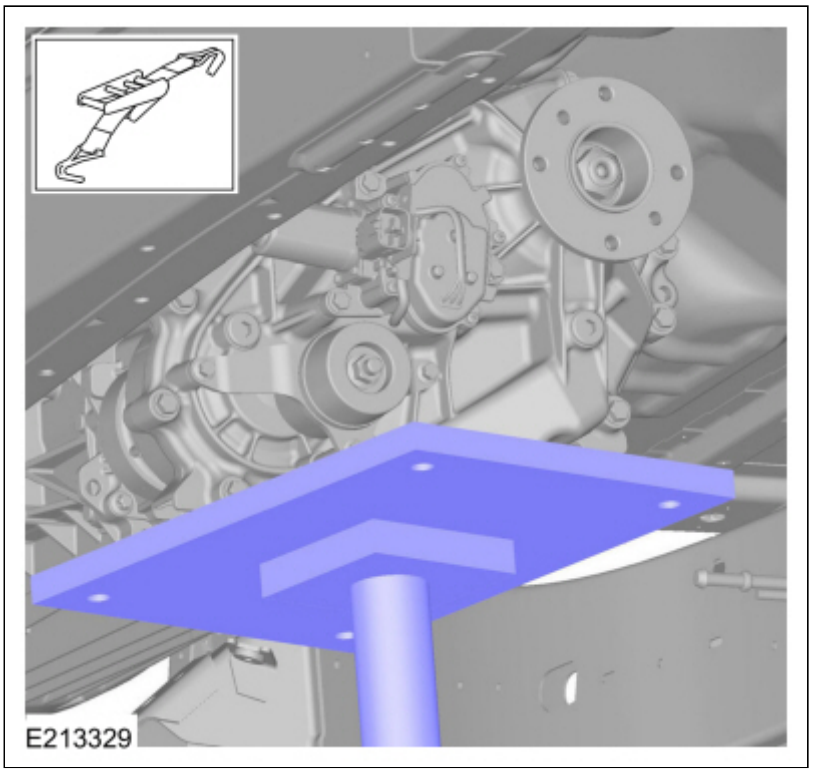
7.



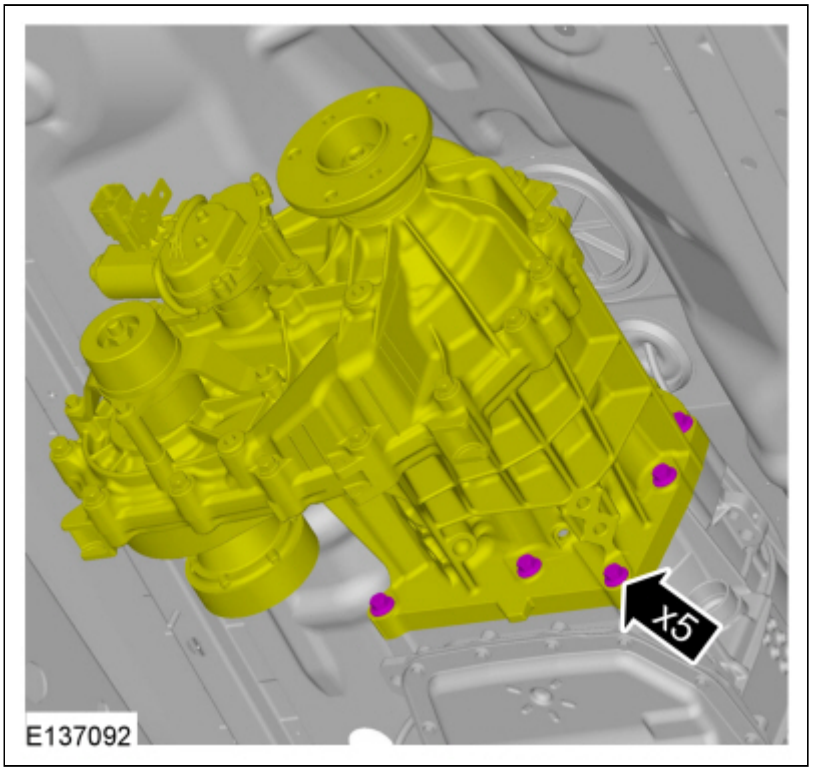
8.



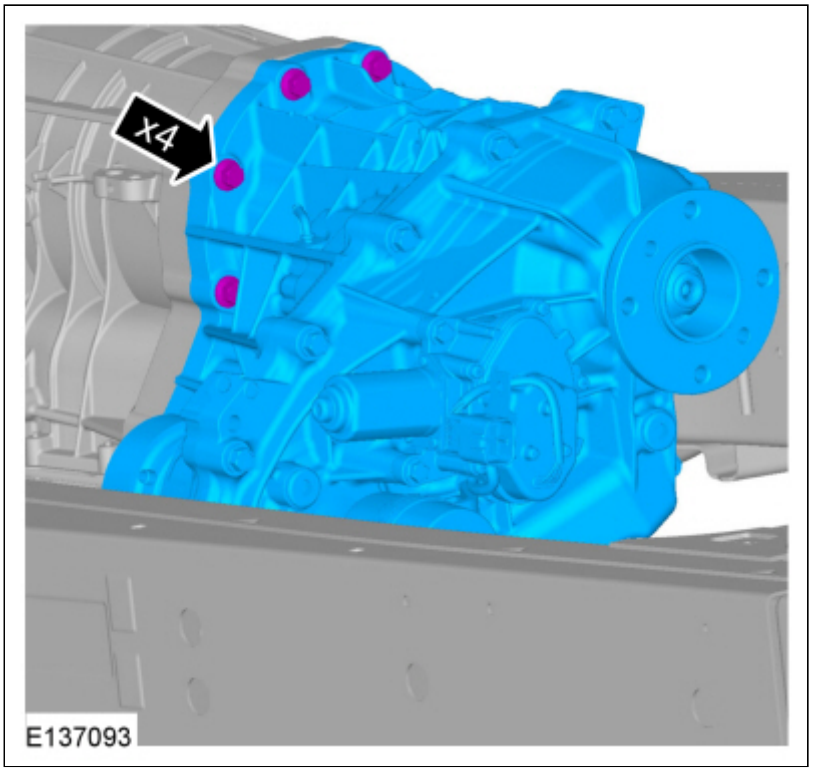
9. Use the General Equipment: Transmission Jack



10.



11.

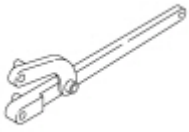
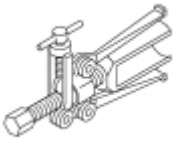
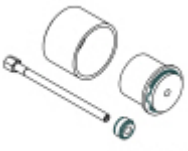


Copyright © 2016 Ford Motor Company

Transfer Case

Base Part Number: 7251

Special Tool(s) / General Equipment

 E129694	100-001 (T50T-100-A) Slide Hammer
 E144131	205-007 Replacer, Pinion Seal
 15030A	205-072 Universal Flange Holding Wrench
 15048	205-078 Remover, Drive Pinion Seal
 15091	205-310 Remover, Bearing/Gear
 E144132	205-509 Remover/Installer, Bushing
 E144133	307-612 Installer, Seal
 308-375	308-375 Remover, Input Shaft Seal

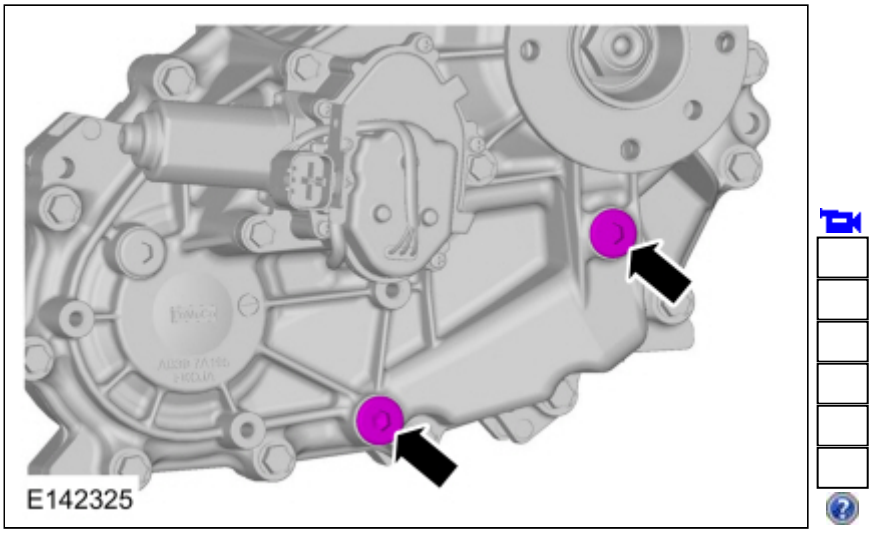
 E144134	308-612 Installer, Input Shaft Seal
 E144135	308-614 Installer, Output Shaft Seal
Hydraulic Press	
Puller	
Punch	
Bearing Separator	

Materials

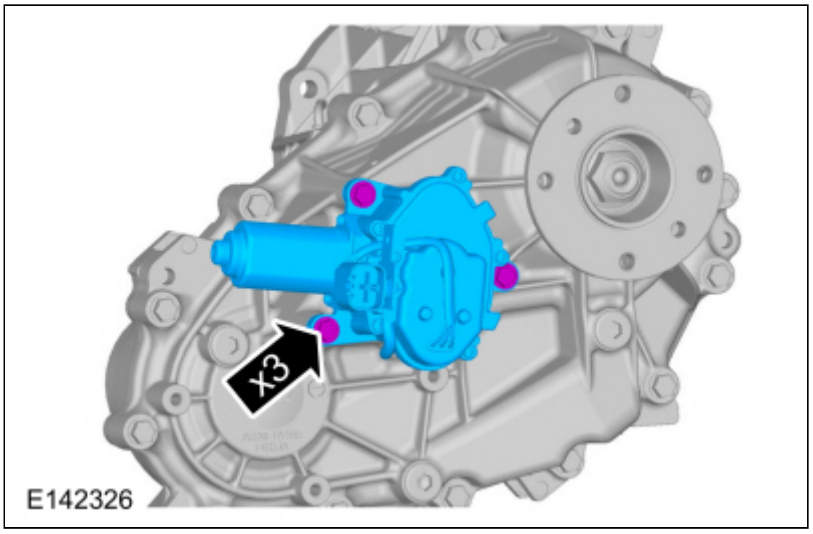
Name	Specification
Silicone Sealant	WSE-M4G323-A4
Automatic Transmission Fluid	MERCON® LV WSS-M2C938-A

DISASSEMBLY

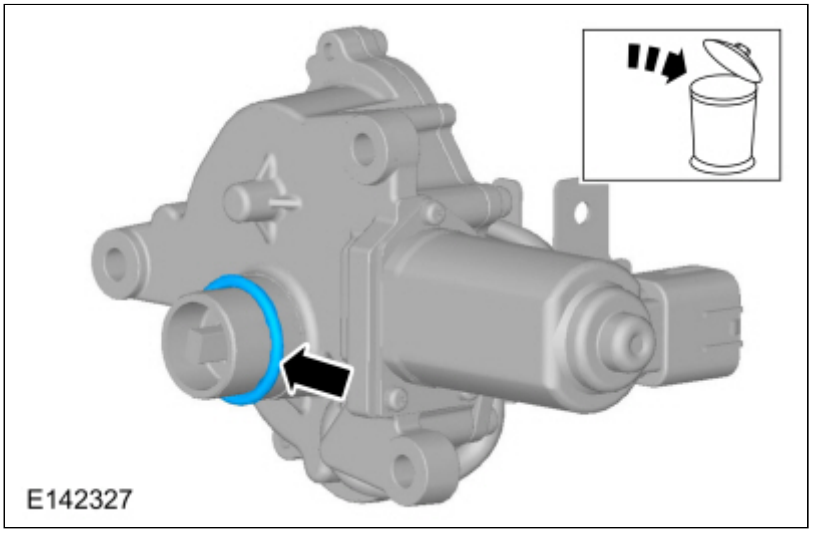
1. **NOTE:** *Be prepared to collect escaping fluids.*



2.

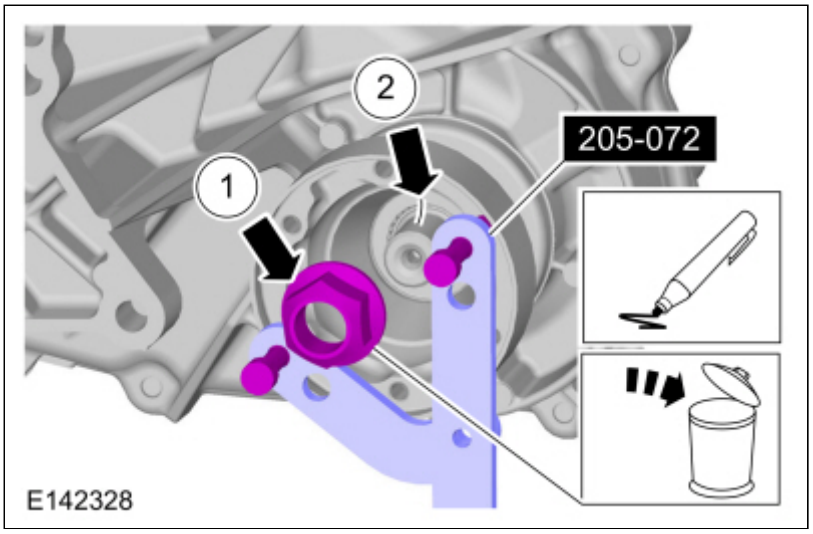


3. **NOTE:** *This step is not necessary when installing a new component.*

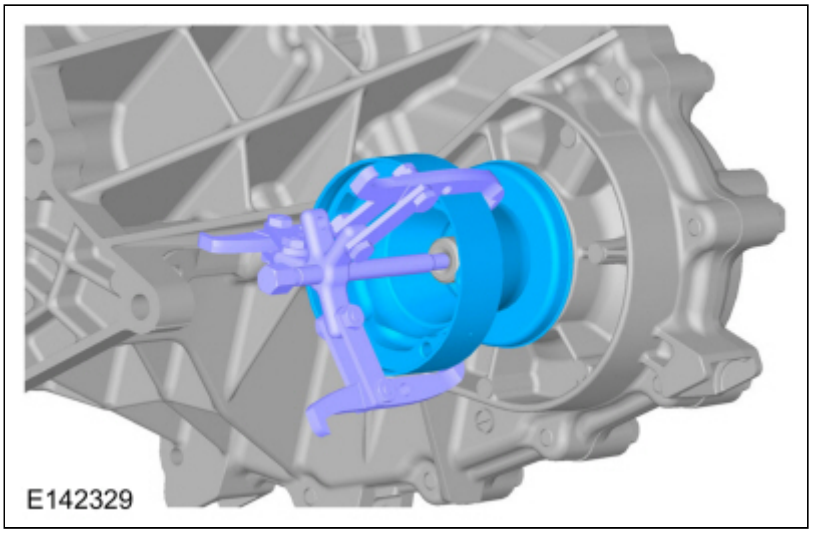


4. **NOTE:** *Note the position of the component before removal.*

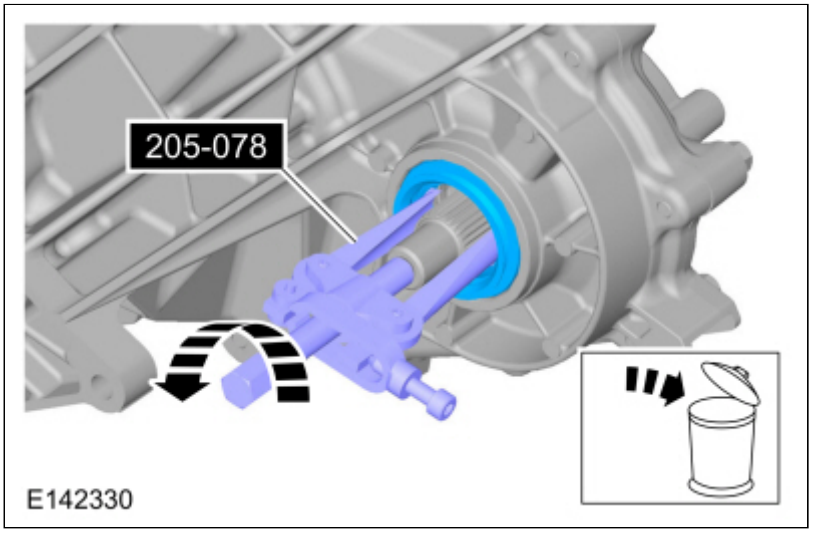
   Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



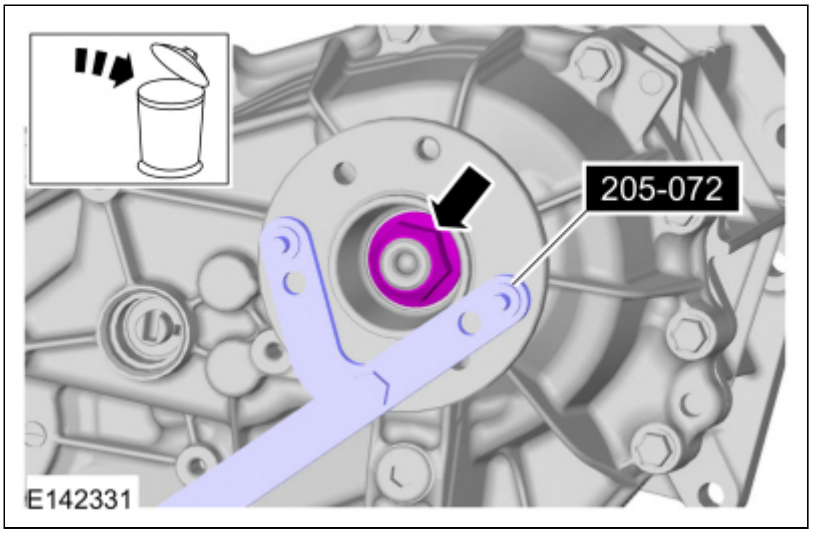
5. Use the General Equipment: Puller



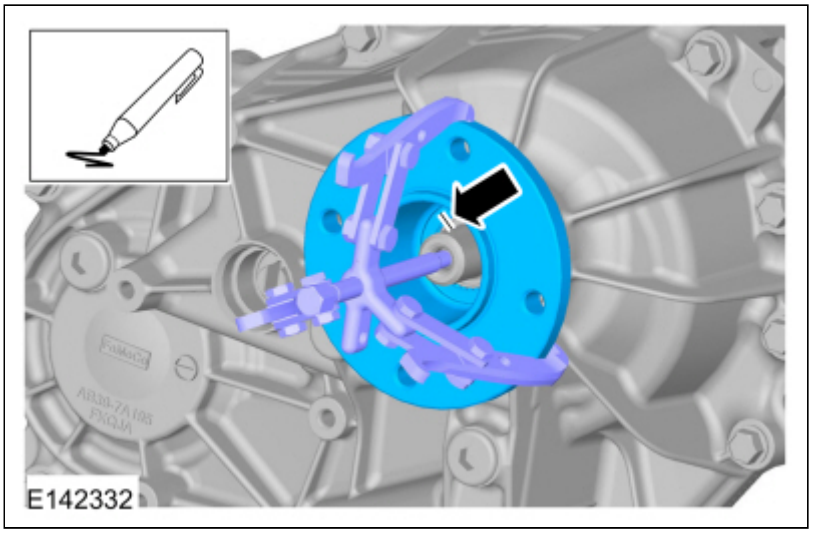
6. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal.



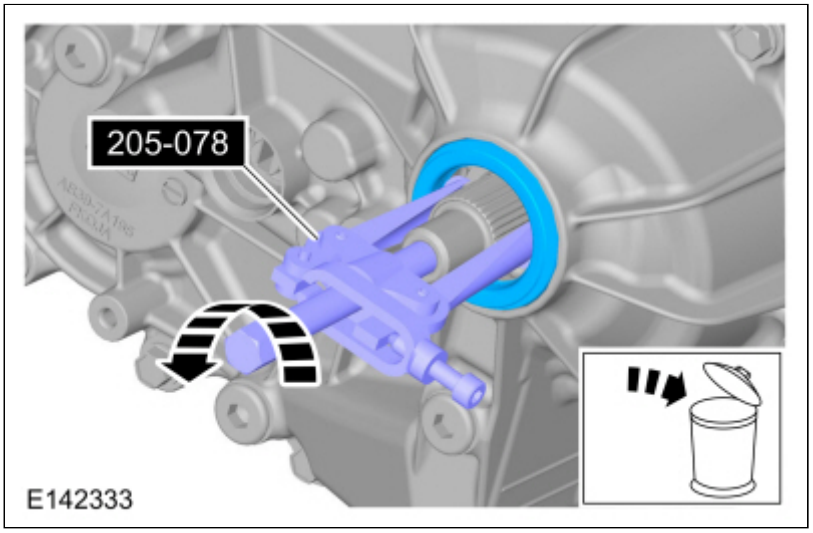
7. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.



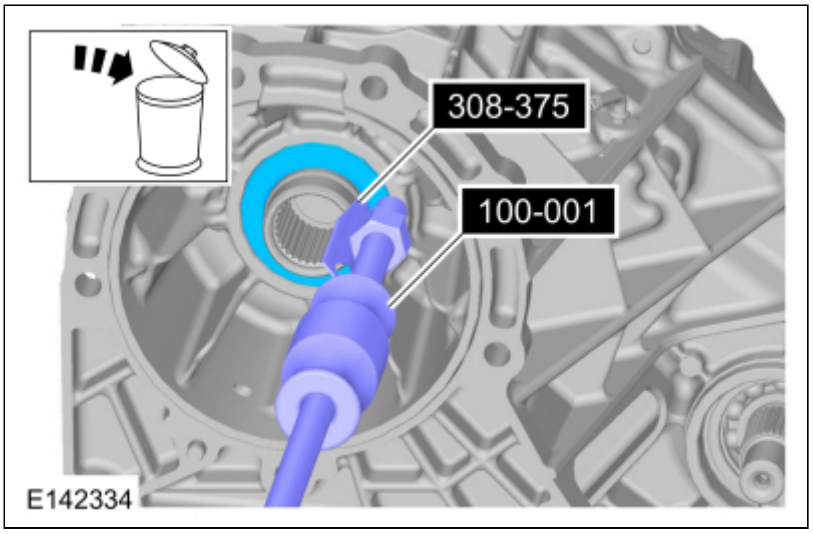
8. Use the General Equipment: Puller



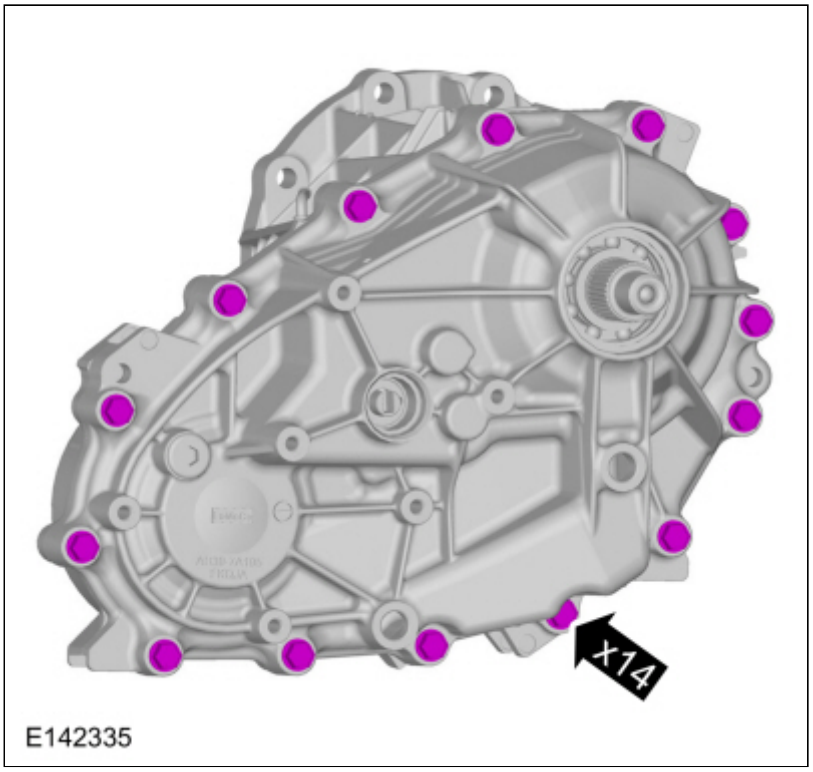
9. Use Special Service Tool: 205-078 Remover, Drive Pinion Seal.



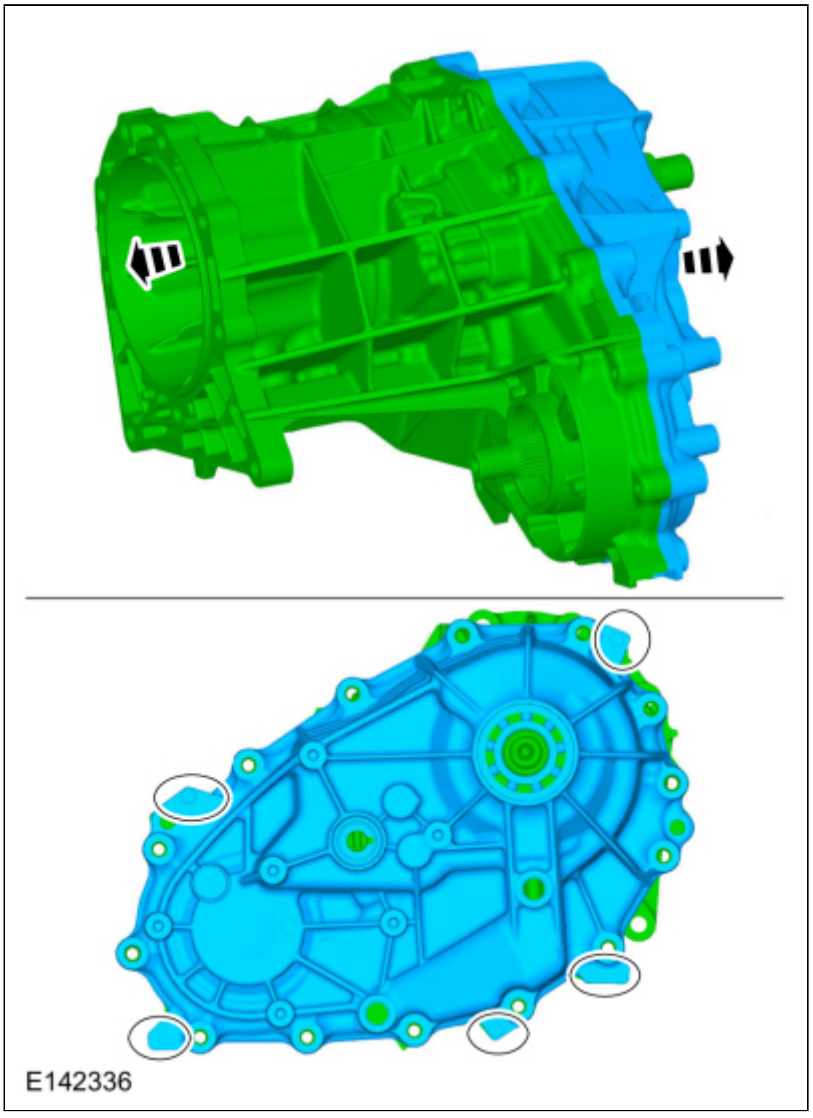
10. Use Special Service Tool: 308-375 Remover, Input Shaft Seal. , 100-001 (T50T-100-A) Slide Hammer.



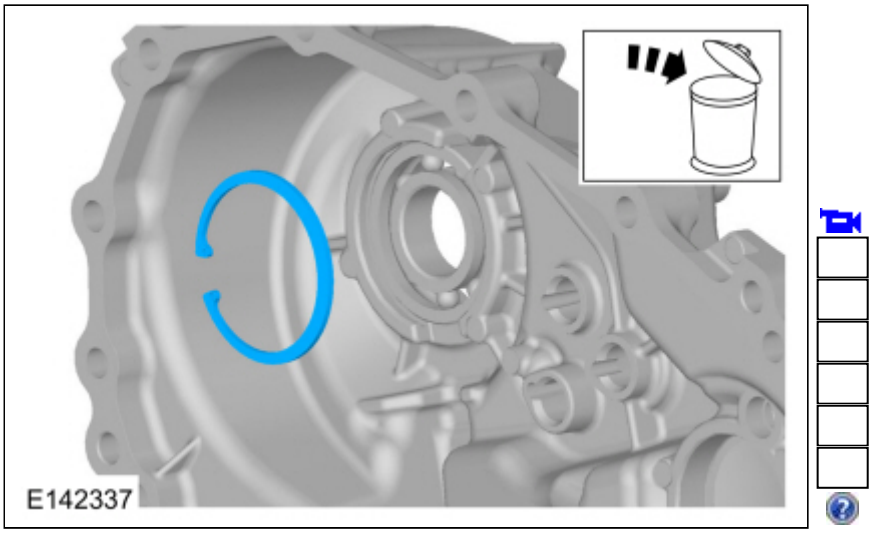
11.



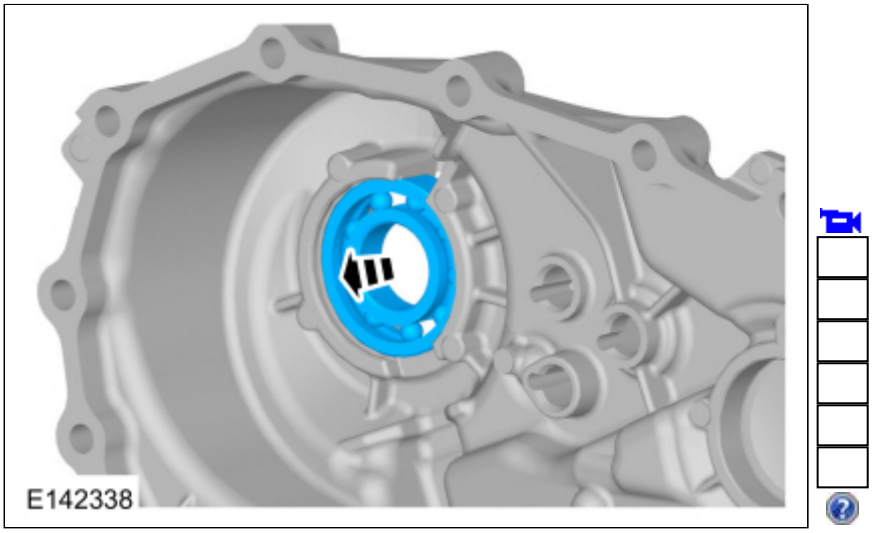
12. Using a suitable separator tool on the locations shown, separate the front and rear casing.



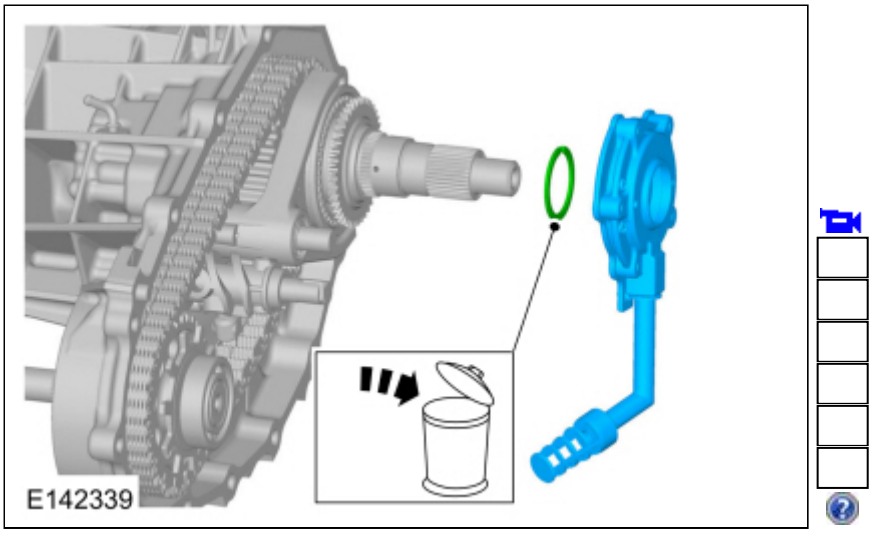
13.



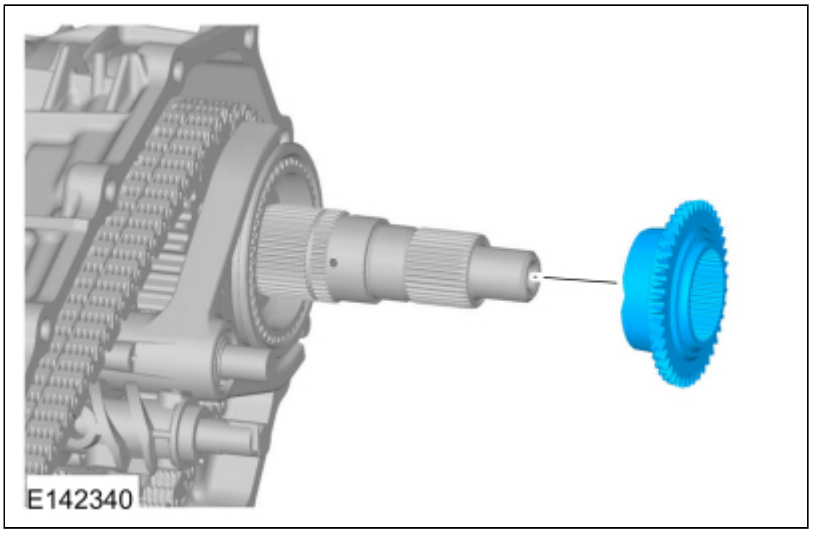
14. Use the General Equipment: Punch



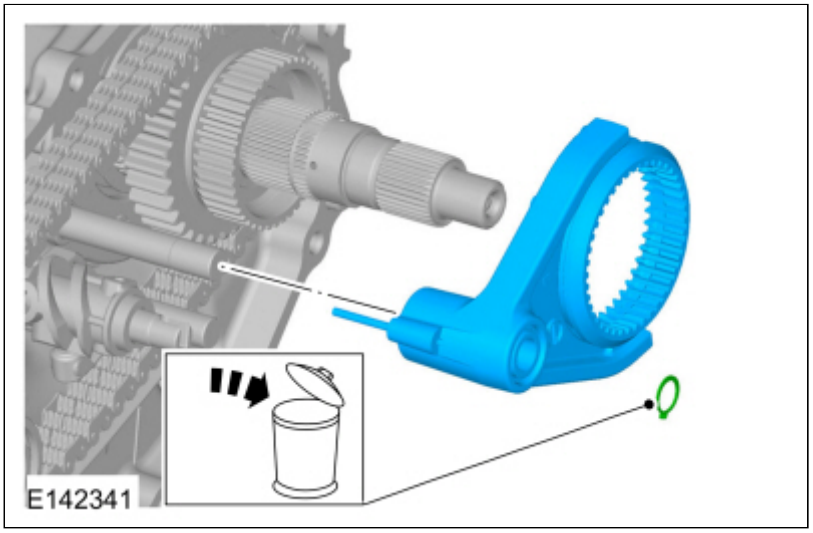
15.



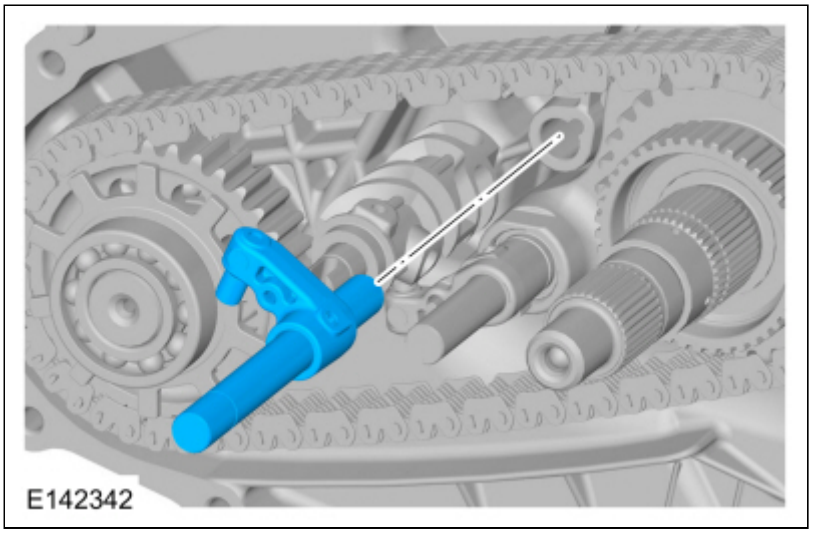
16.



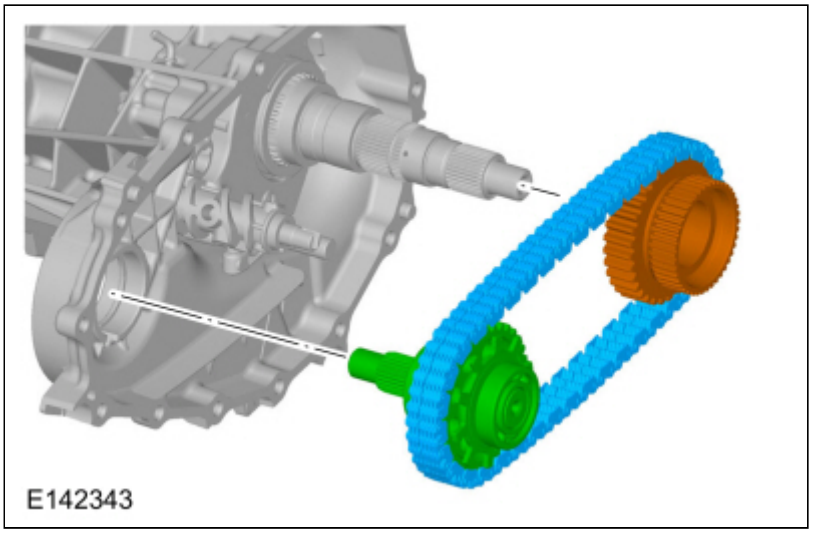
17.



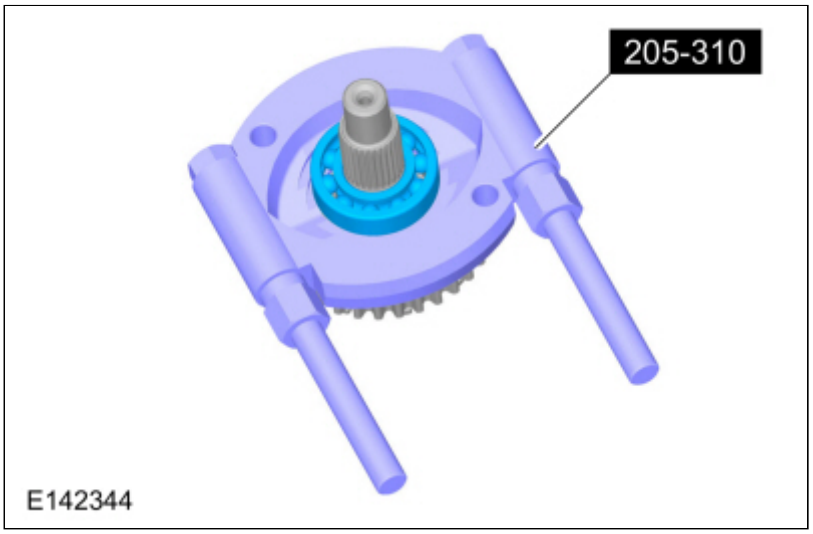
18. **NOTE:** *Remove the dissengage pin from the control shift rod groove.*



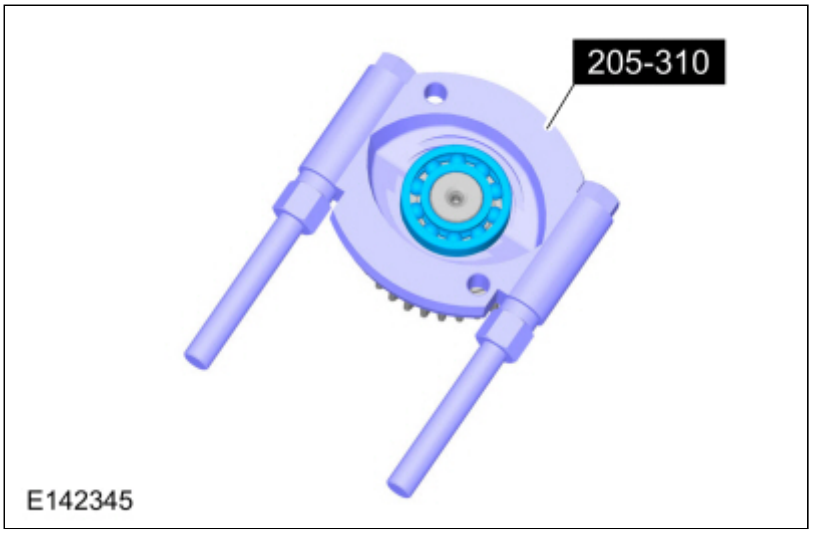
19.



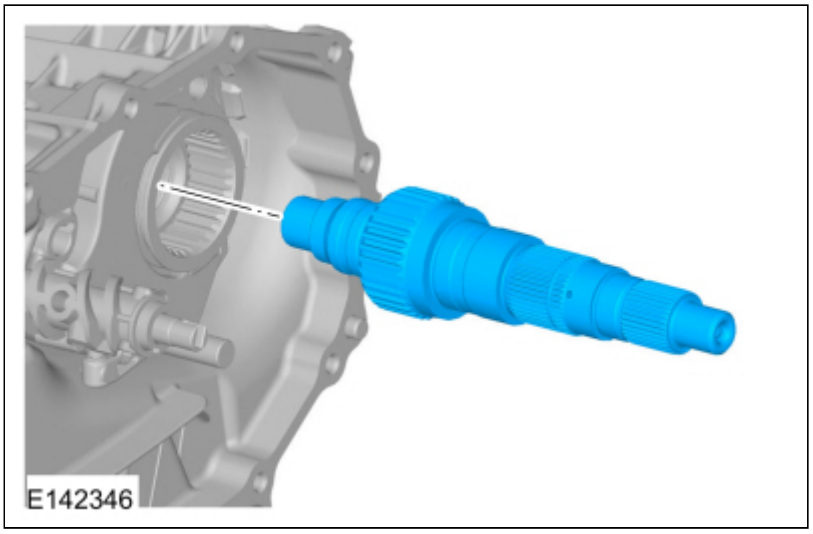
20. Use Special Service Tool: 205-310 Remover, Bearing/Gear.
    Use the General Equipment: Hydraulic Press



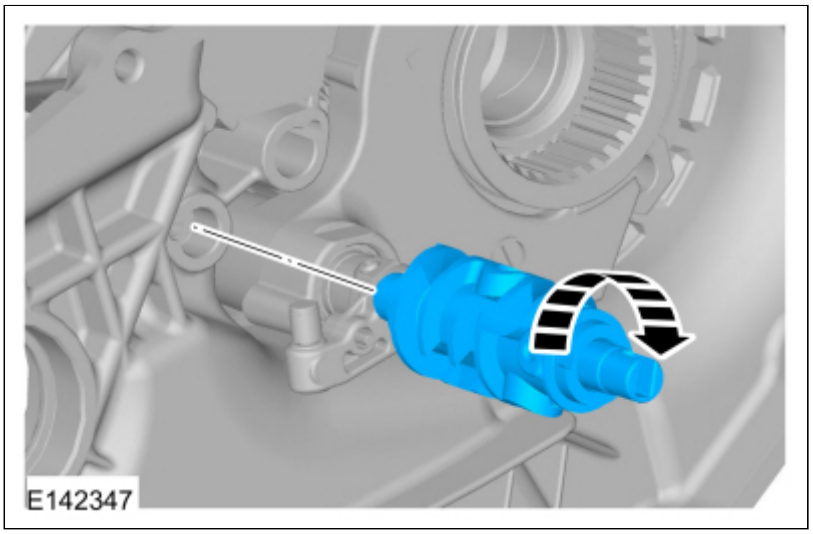
21. Use Special Service Tool: 205-310 Remover, Bearing/Gear.
    Use the General Equipment: Hydraulic Press



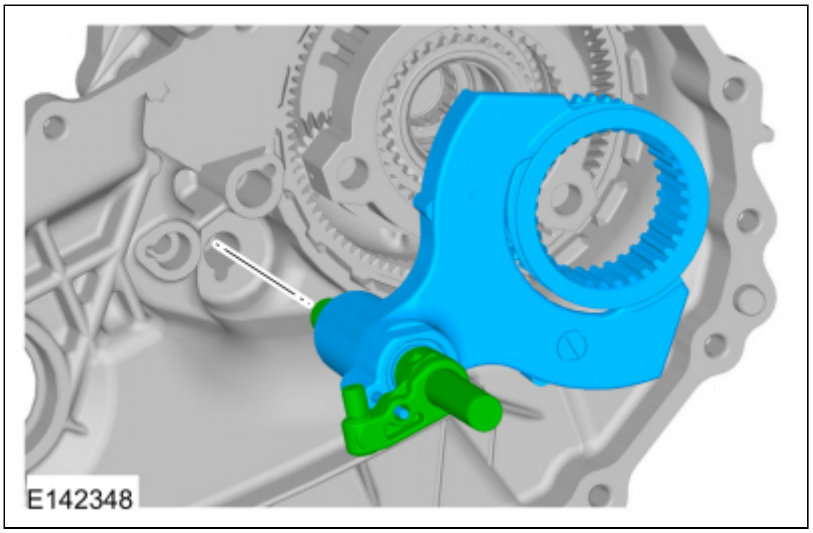
22.



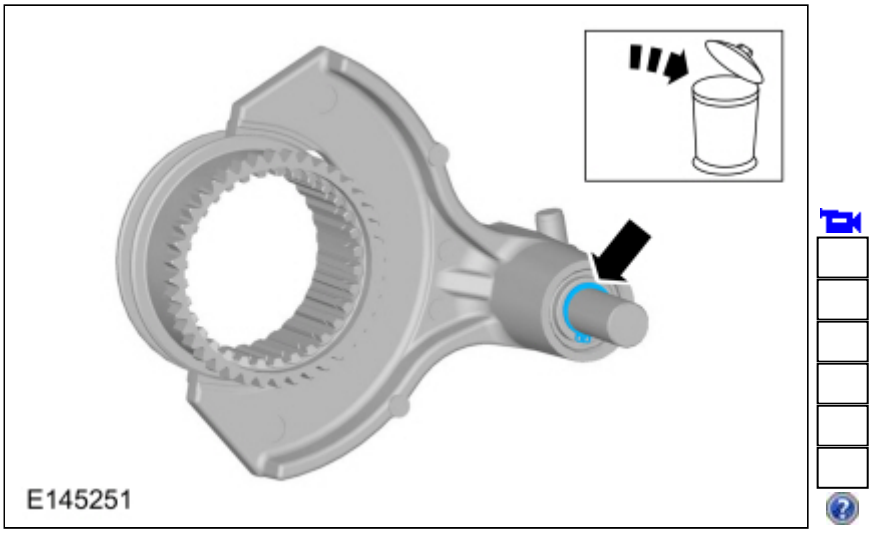
23. **NOTE:** *Rotate the control shift rod until the H-L shift rod assembly pin is aligned with the longitudinal groove of the control shift rod.*



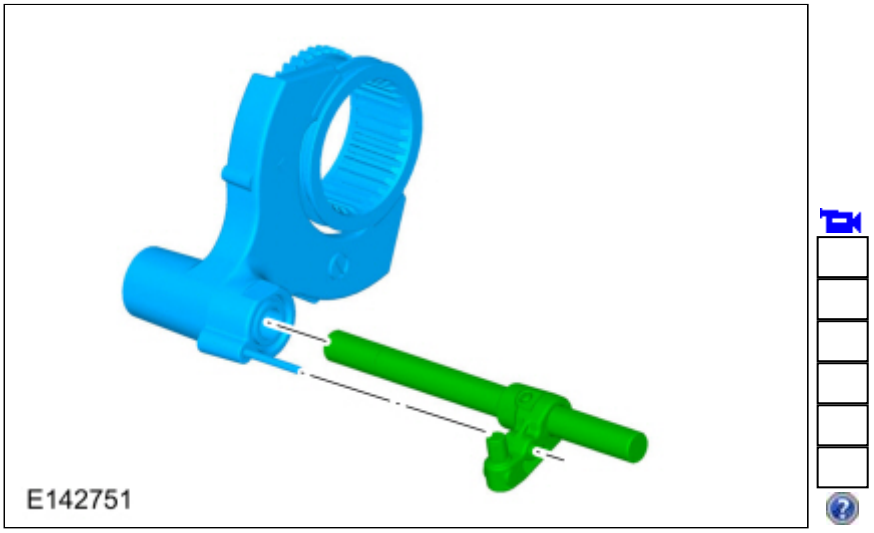
24.



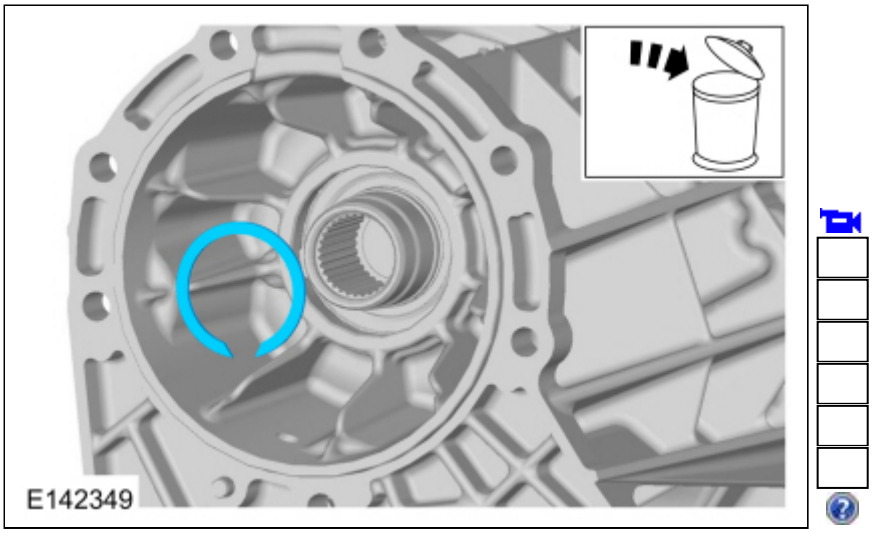
25.



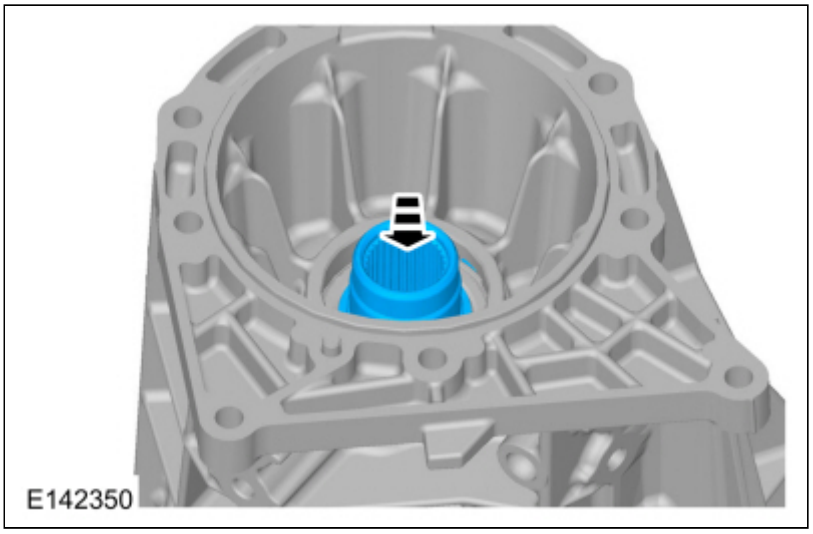
26.



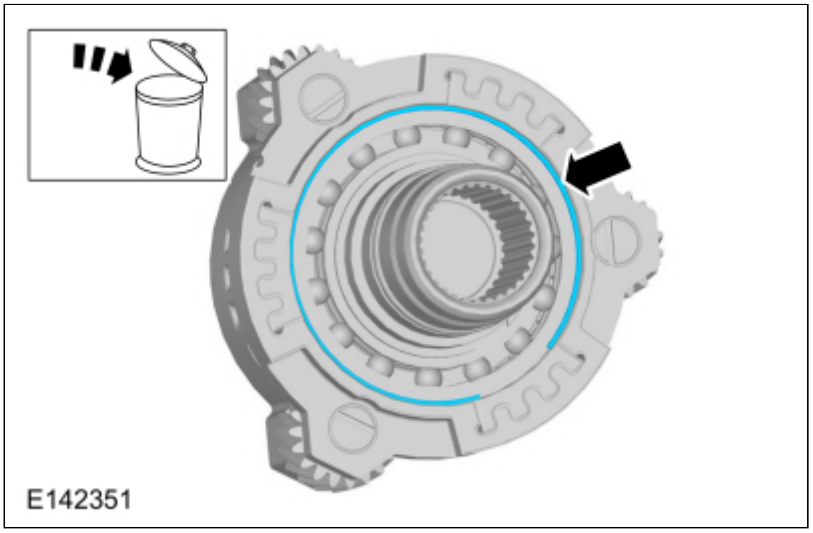
27. **NOTE:** *Make sure that the component is not damaged.*



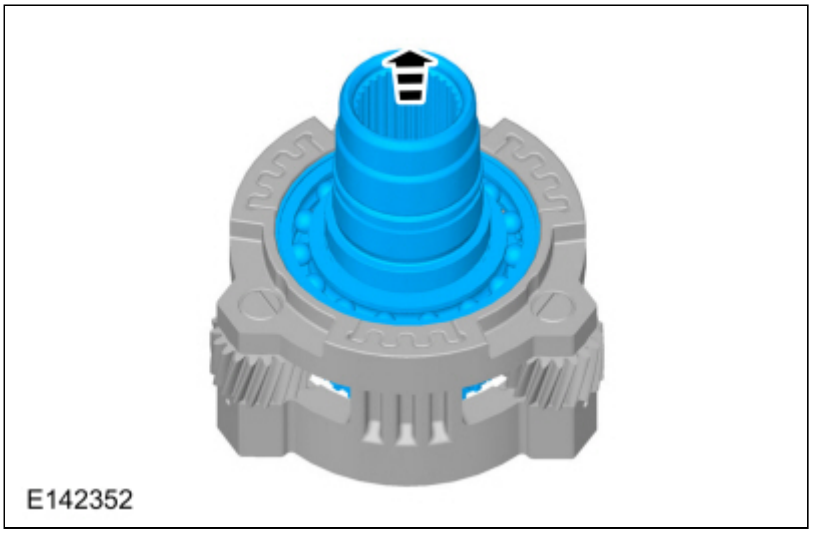
28. Use the General Equipment: Hydraulic Press



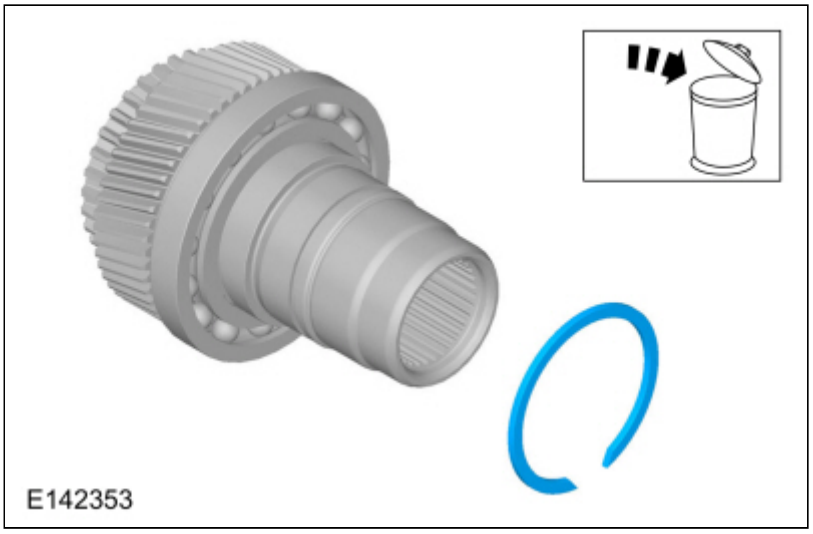
29.



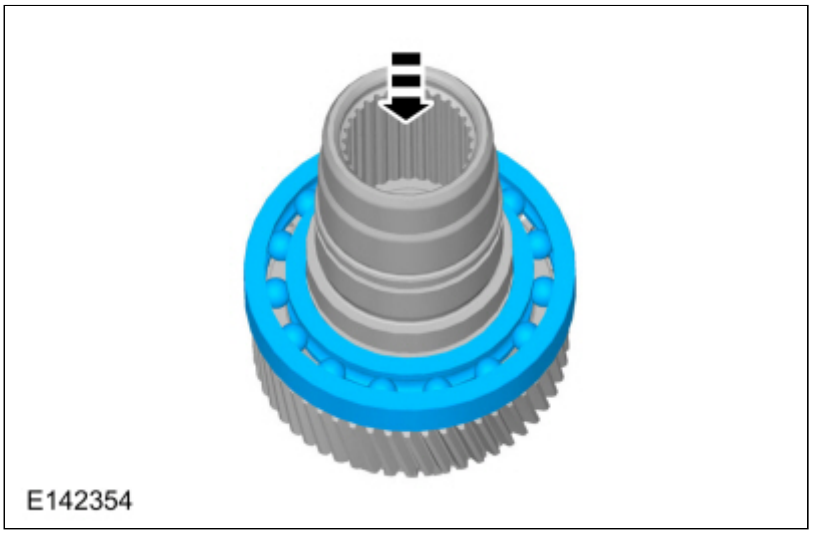
30.



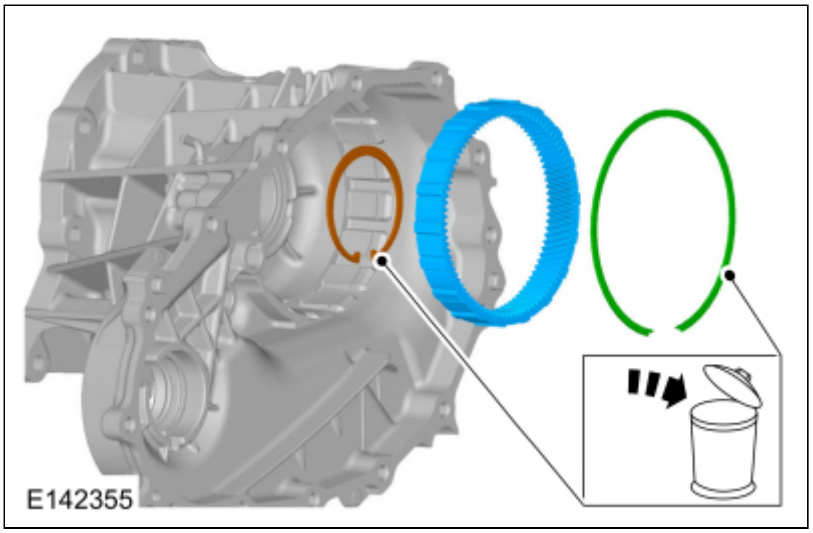
31.



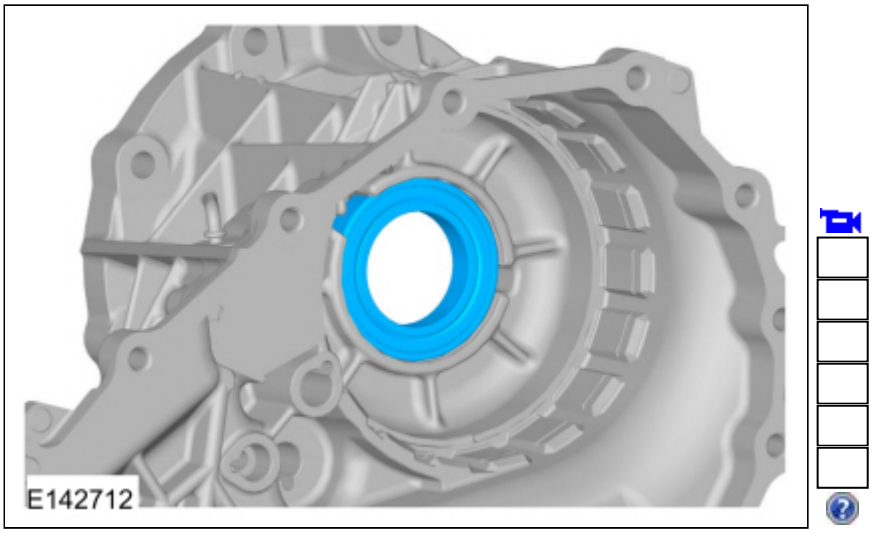
32. Use the General Equipment: Bearing Separator
    Use the General Equipment: Hydraulic Press



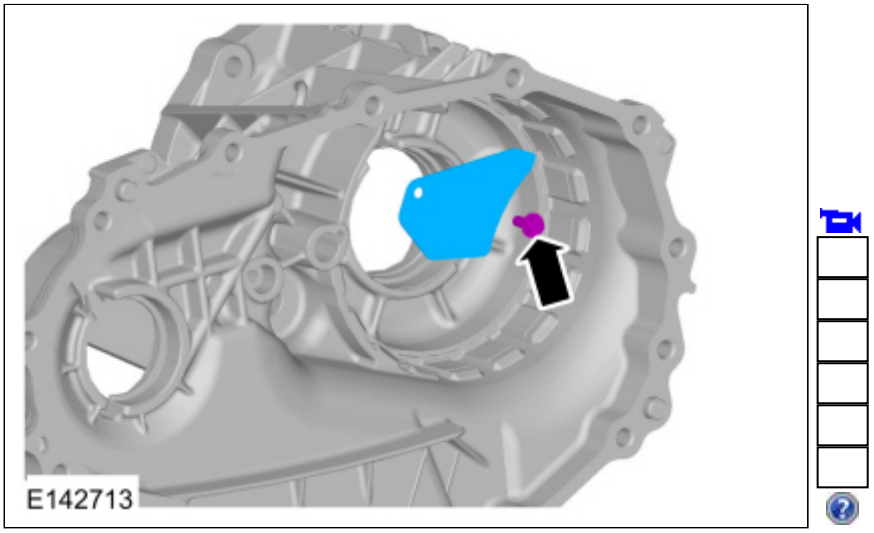
33.



34.

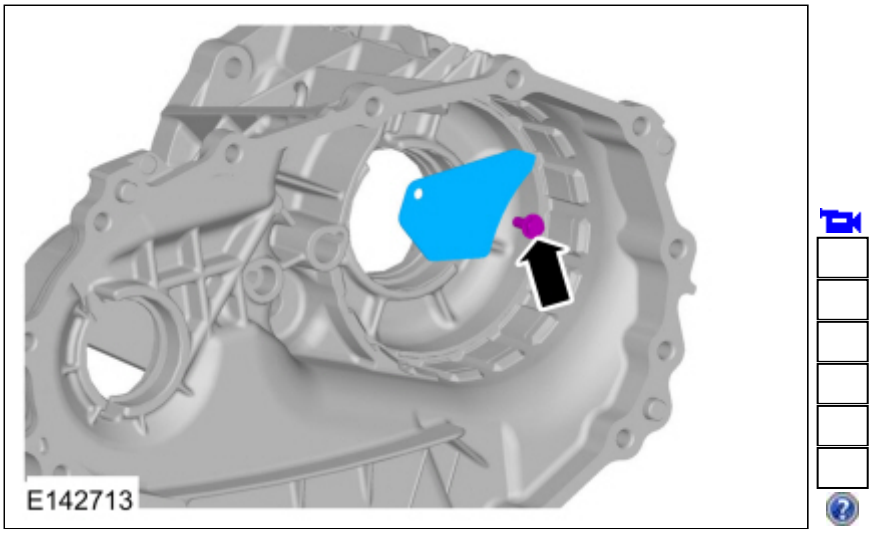


35.

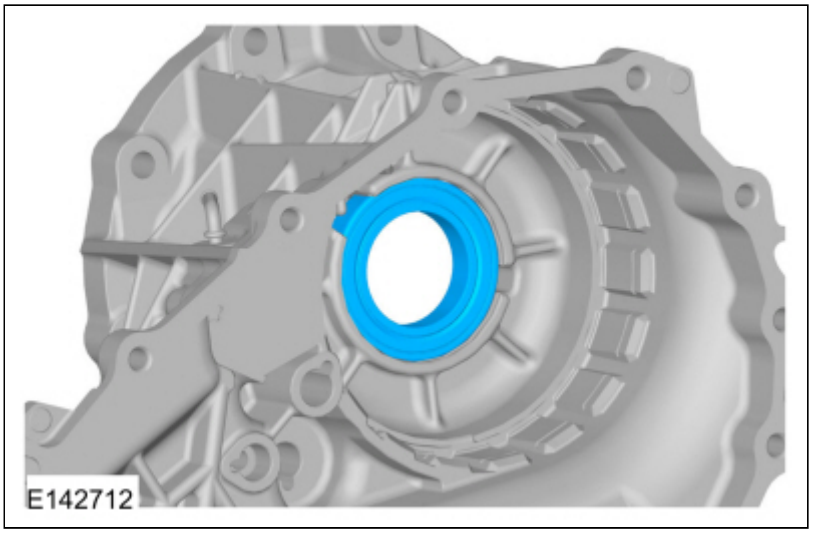


ASSEMBLY

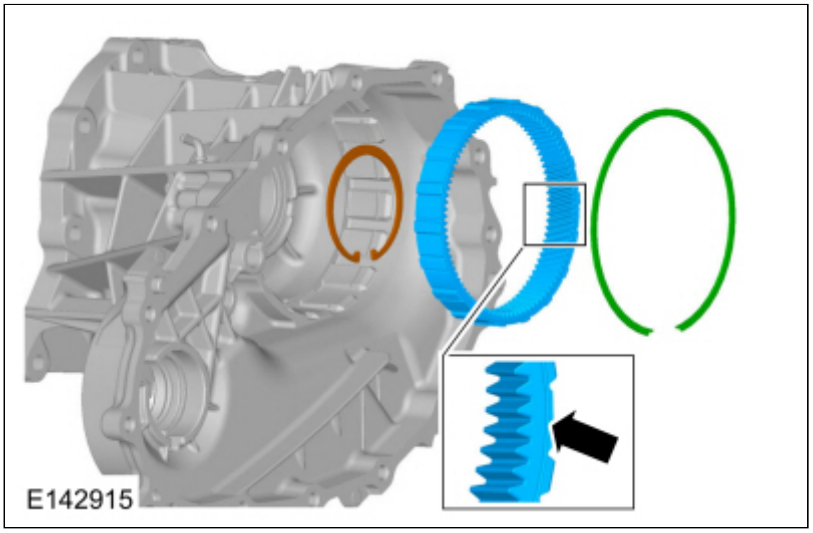
1. *Torque*: 4.5 Nm



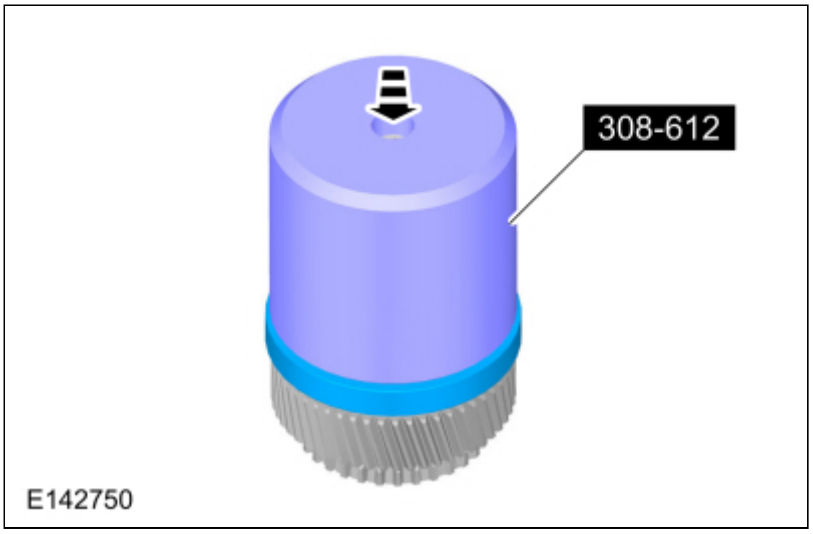
2.



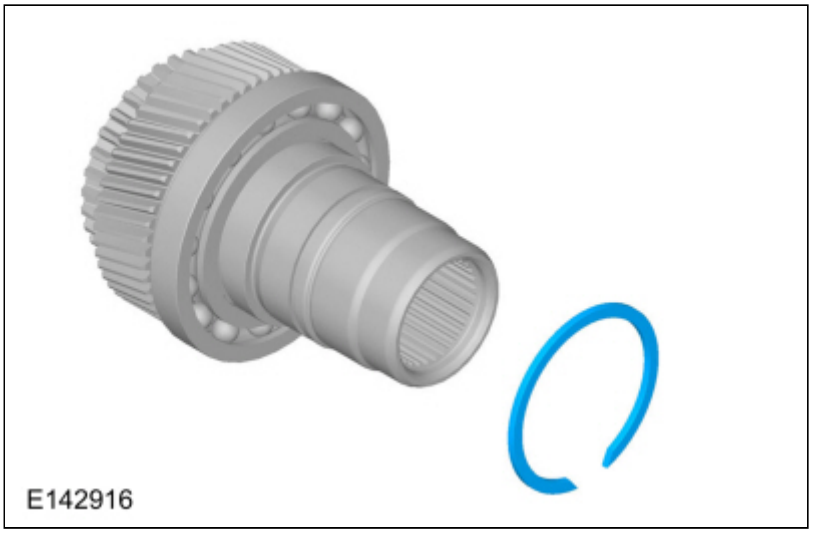
3.



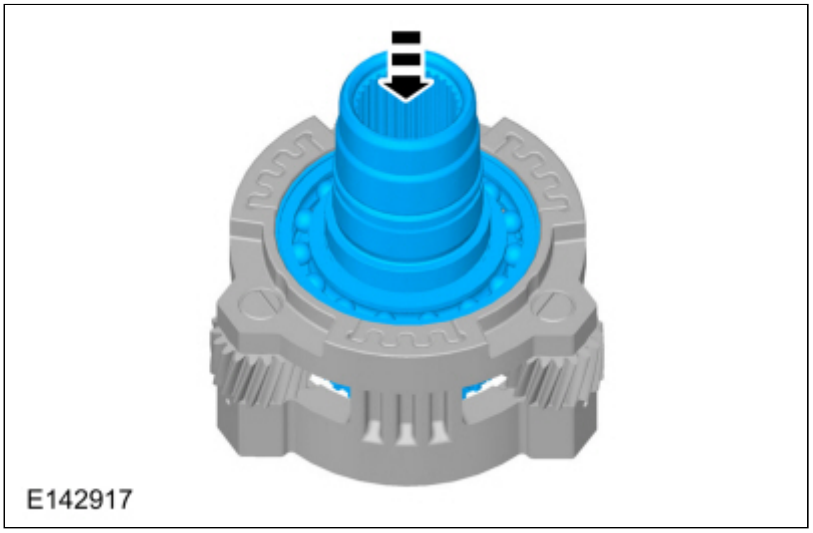
4. Use Special Service Tool: 308-612 Installer, Input Shaft Seal.



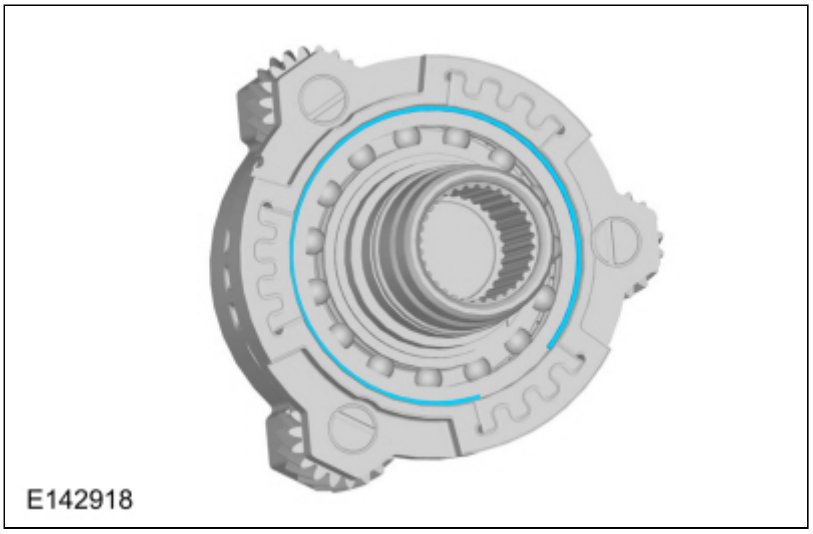
5. **NOTE:** *Make sure that the component is not damaged.*



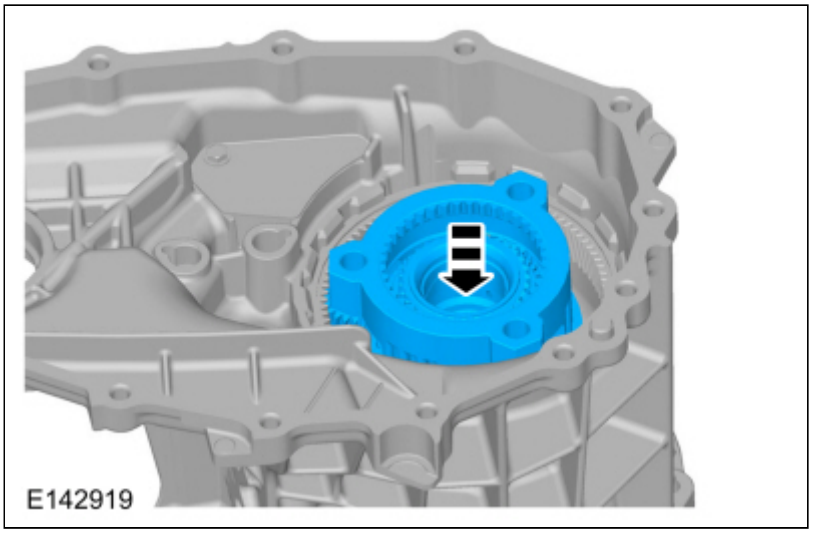
6.



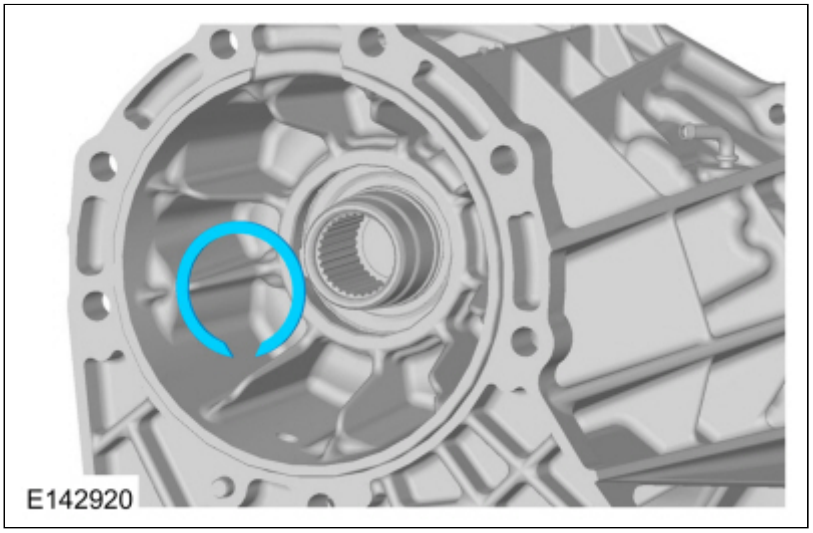
7.



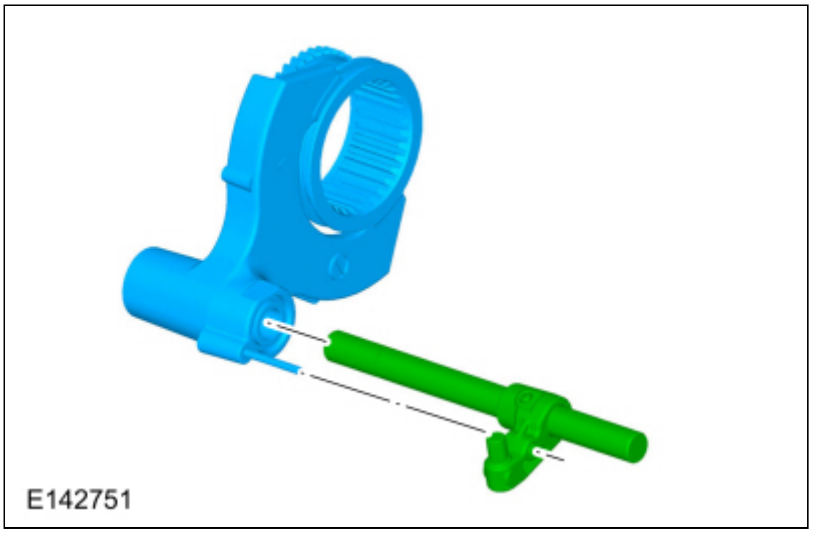
8. Use the General Equipment: Hydraulic Press



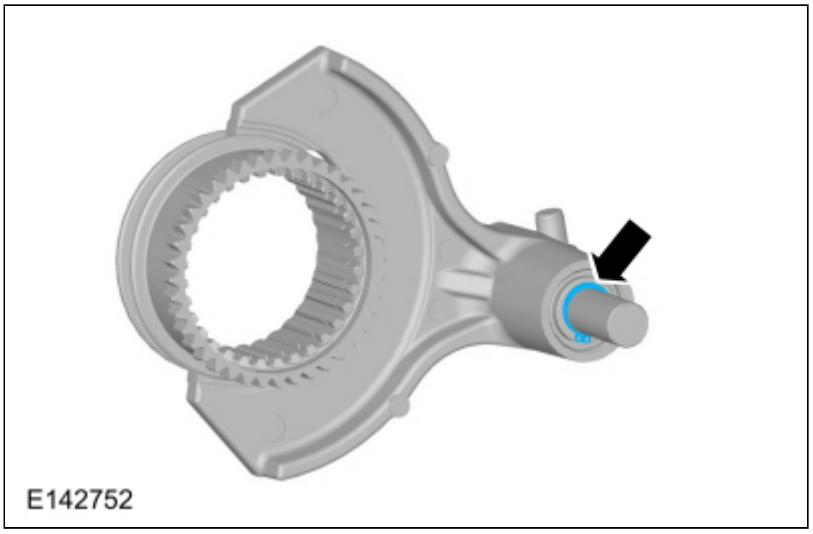
9. **NOTE:** *Make sure that the component is not damaged.*



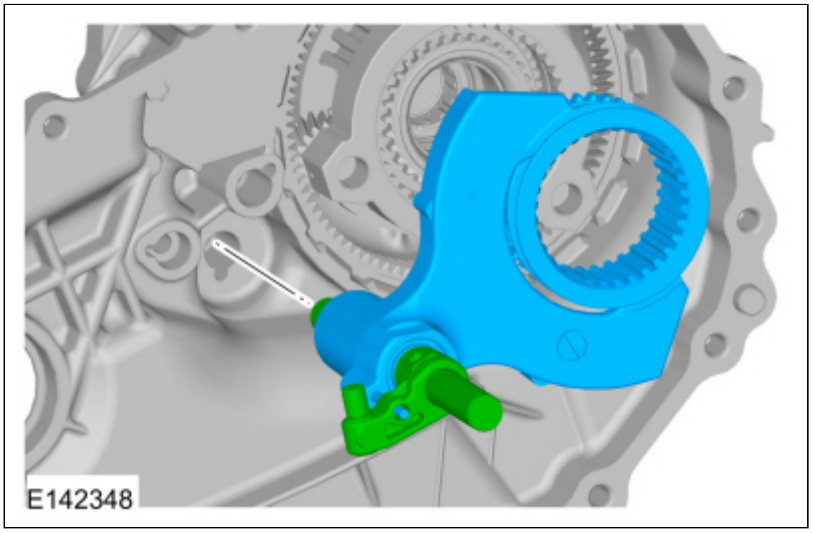
10.



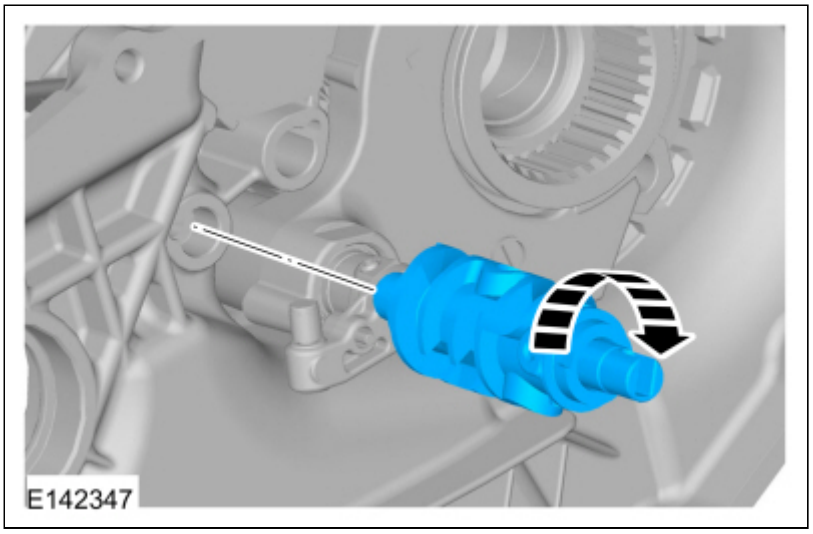
11. **NOTE:** *Use a new snap ring.*



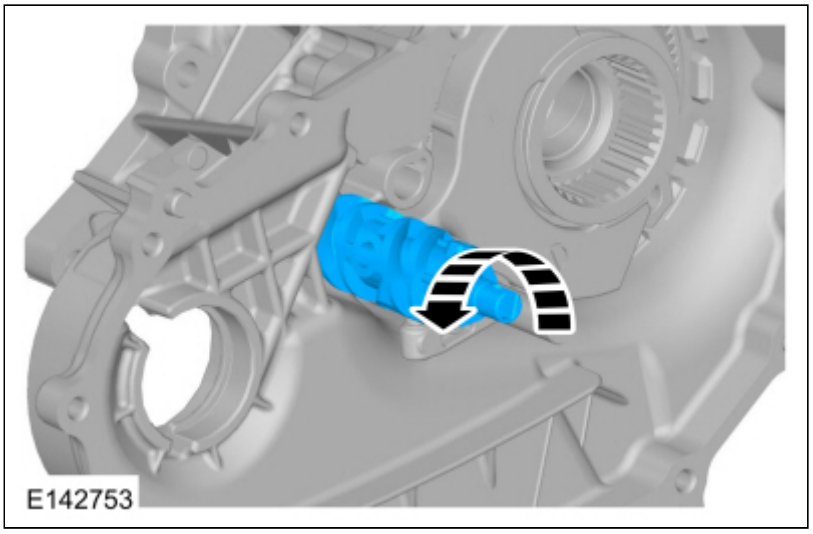
12.



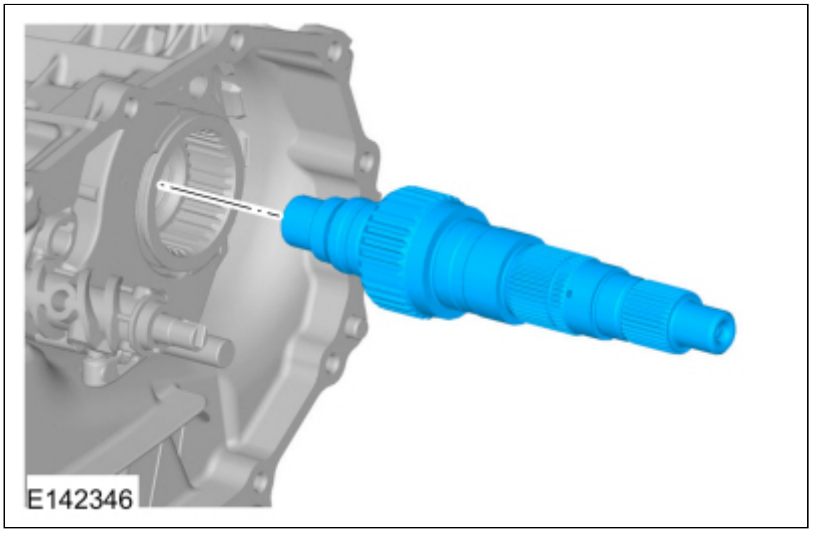
13. **NOTE:** *Set the H-L shift rod assembly pin into the longitudinal groove of the control shift rod.*



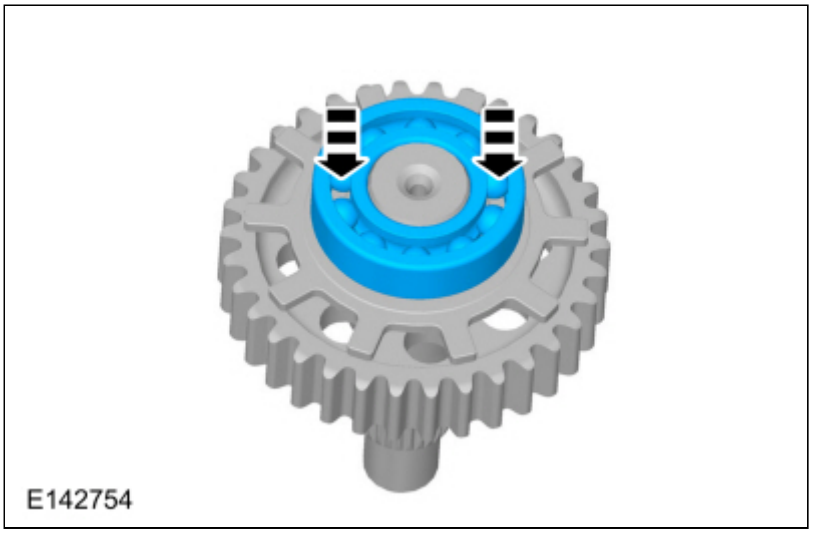
14.



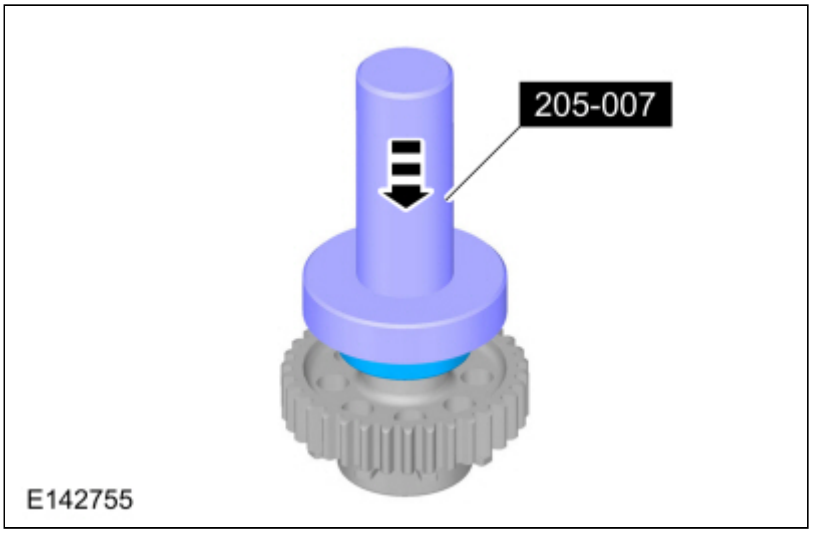
15.



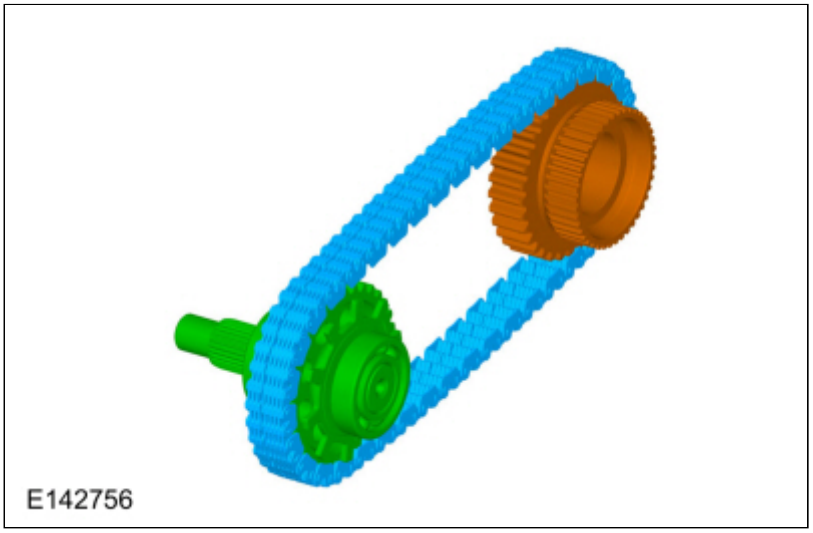
16. Use the General Equipment: Hydraulic Press



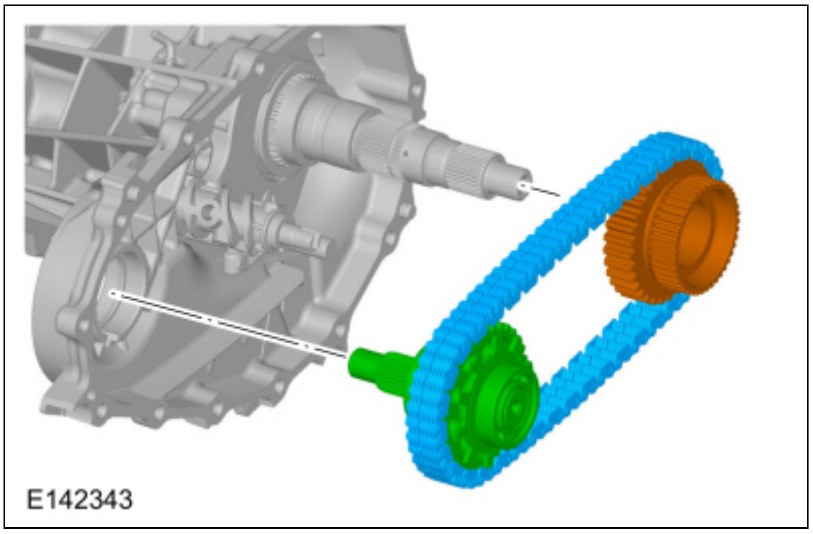
17. Use Special Service Tool: 205-007 Replacer, Pinion Seal.
    Use the General Equipment: Hydraulic Press



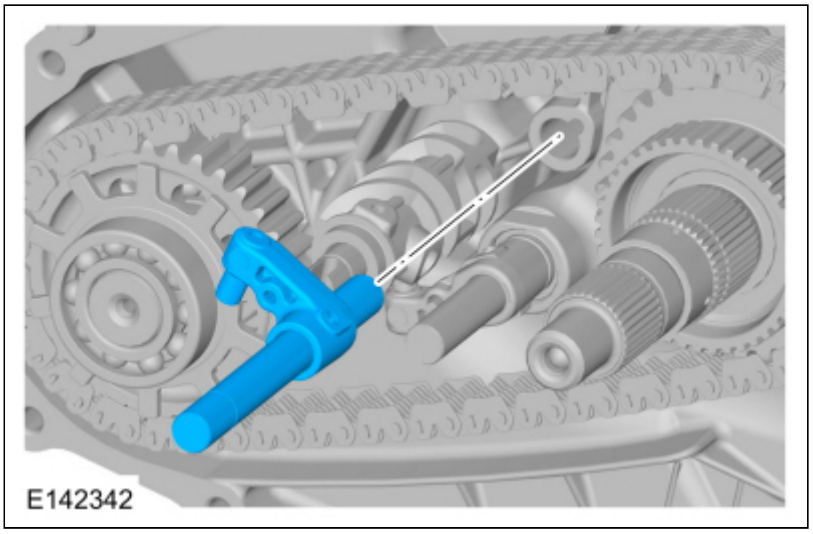
18.



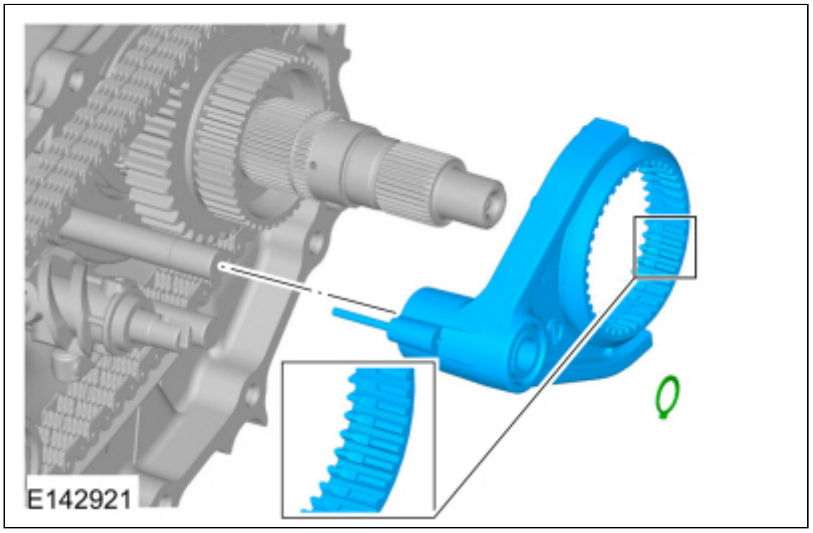
19.



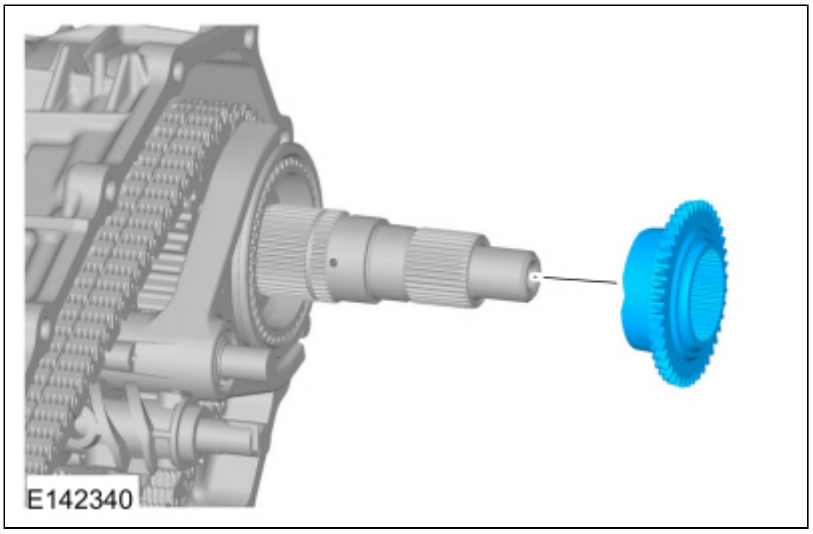
20. **NOTE:** *Set the 2-4 shift rod assembly pin into the groove of the control shift rod.*



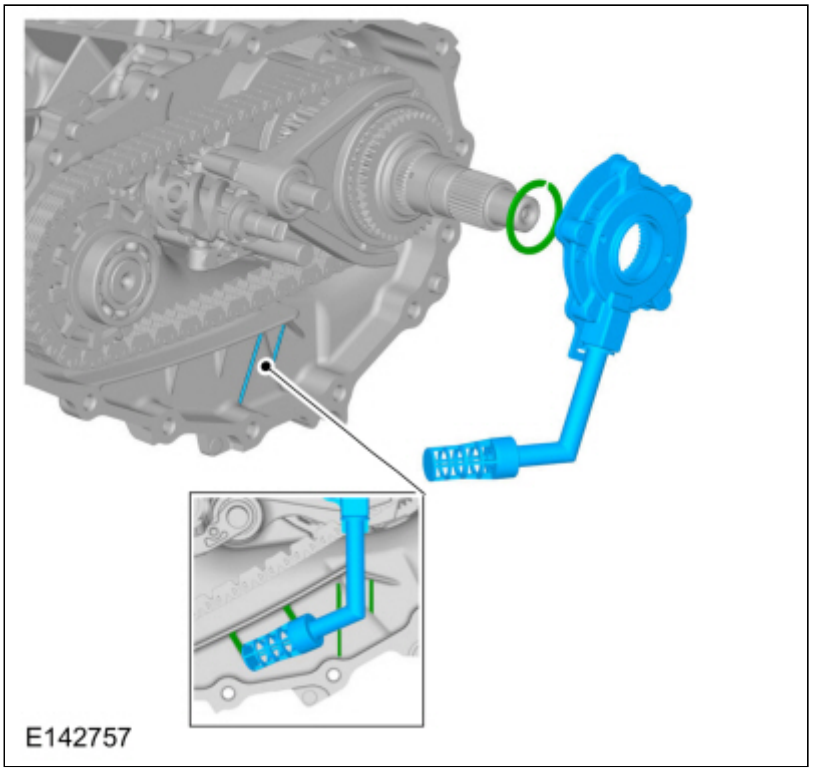
21.



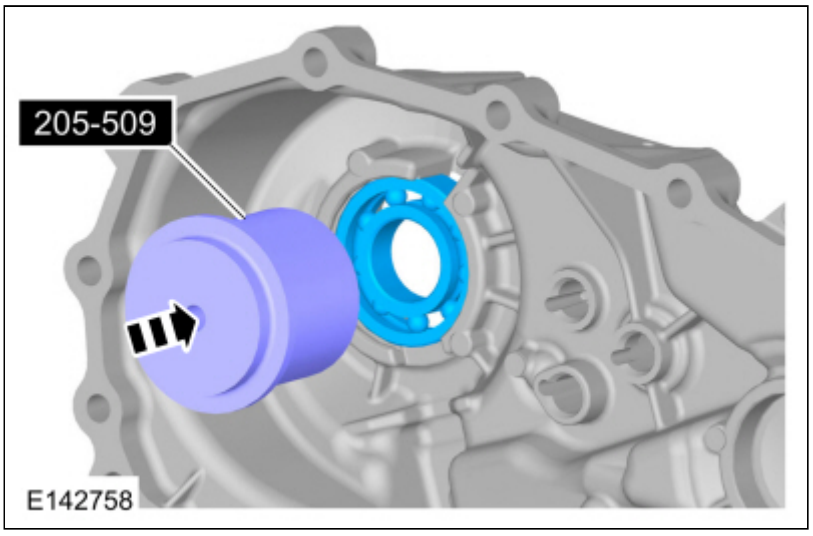
22.



23. **NOTICE: Make sure the oil pump is installed in the range of the rib as shown.**

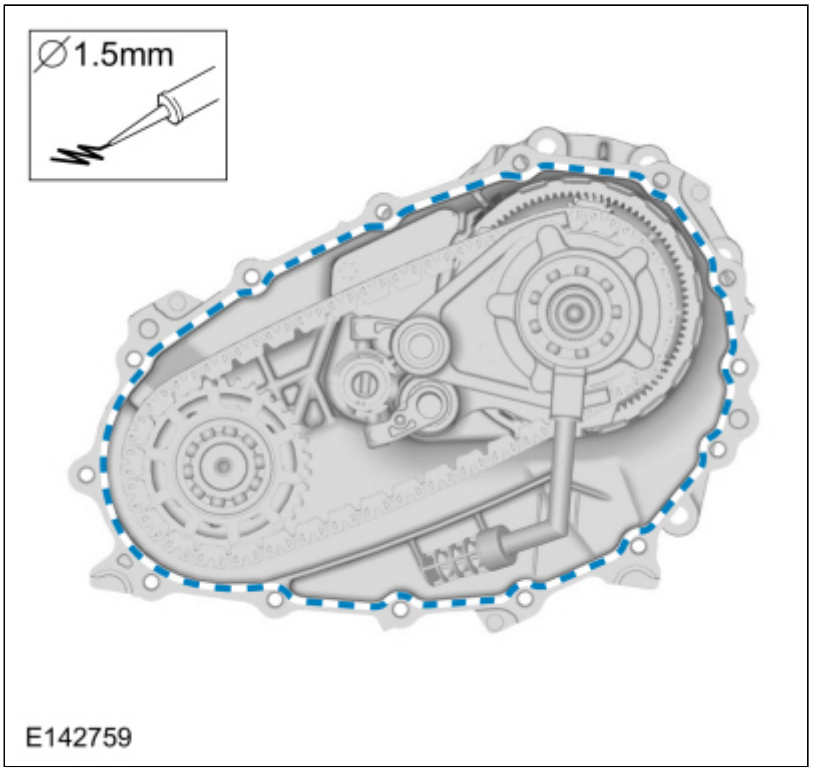


24. Use Special Service Tool: 205-509 Remover/Installer, Bushing.
    Use the General Equipment: Hydraulic Press

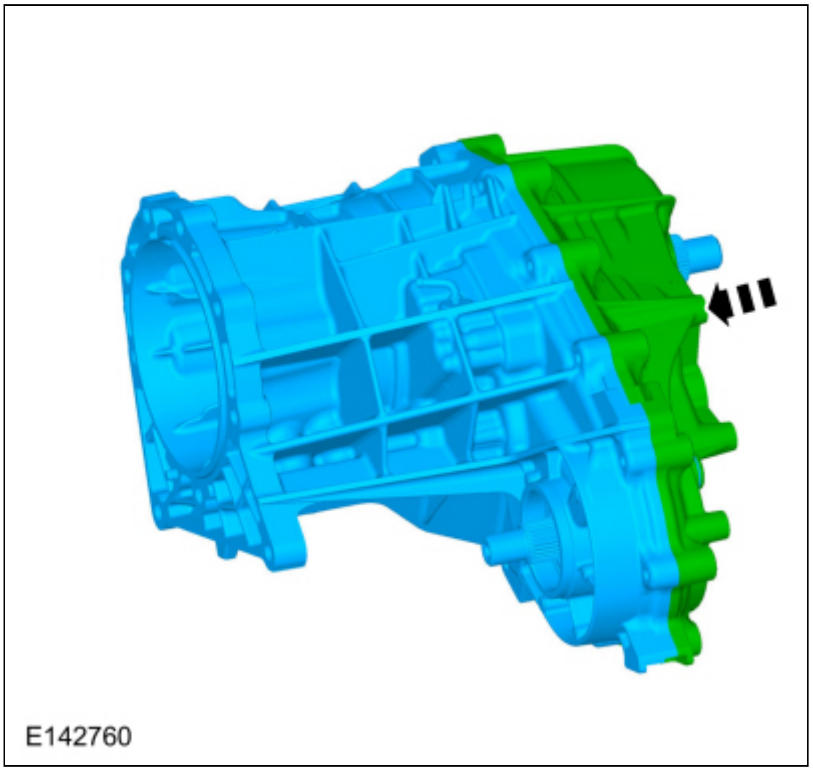


25. **NOTICE: Make sure that no excess sealant residue is evident.**

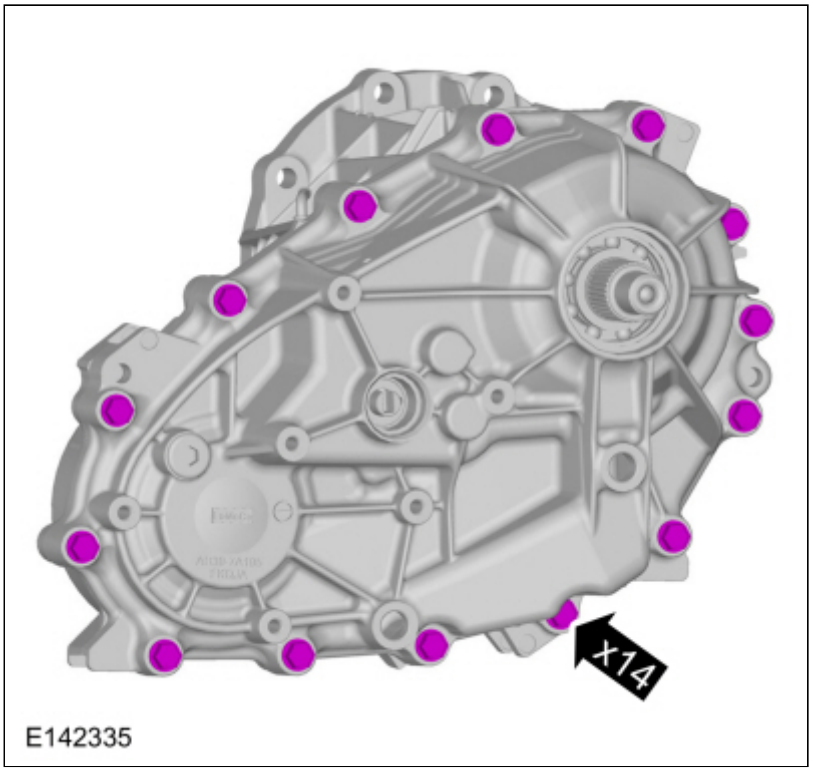
    Material: Silicone Sealant (WSE-M4G323-A4)



26.

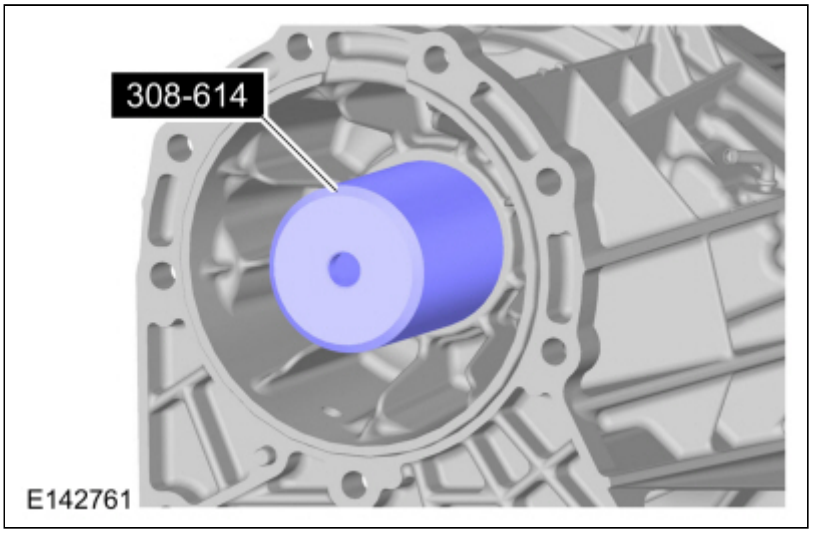


27. *Torque*: 45 Nm



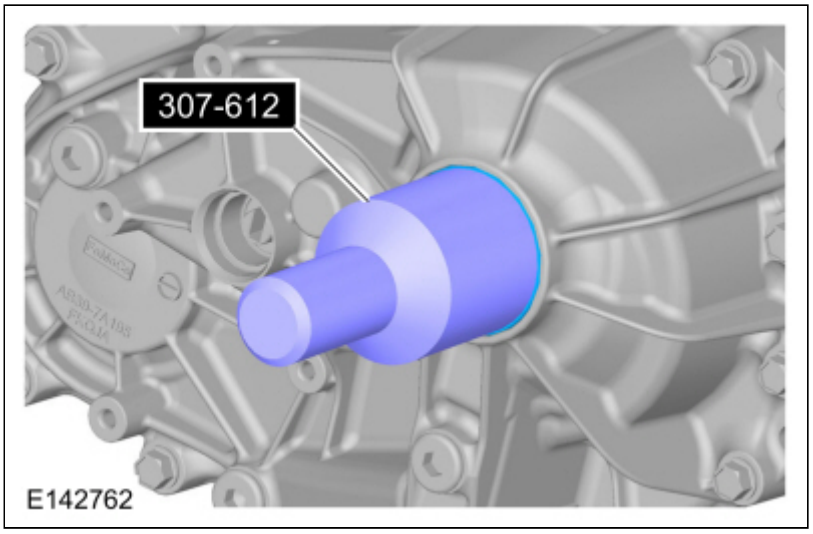
28. **NOTE:** *Apply petroleum jelly to the outer circumference of the oil seal.*

    Use Special Service Tool: 308-614 Installer, Output Shaft Seal.

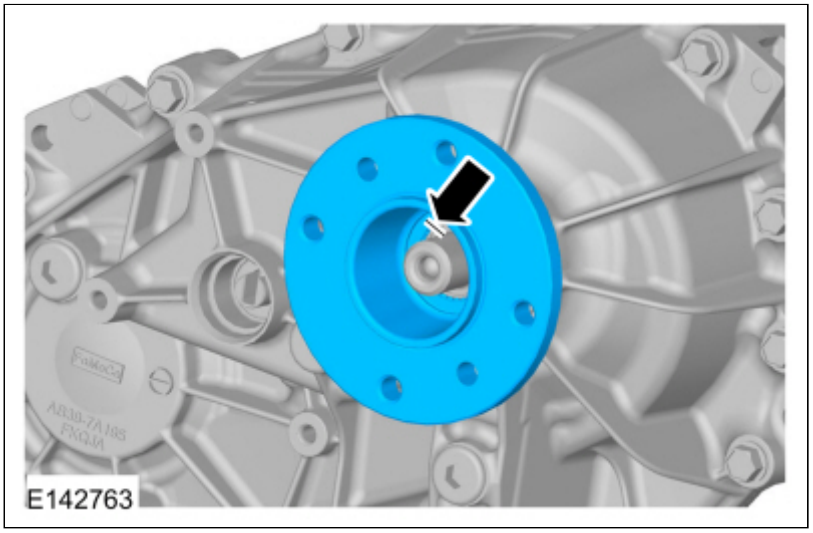


29. **NOTE:** *Apply petroleum jelly to the outer circumference of the oil seal.*

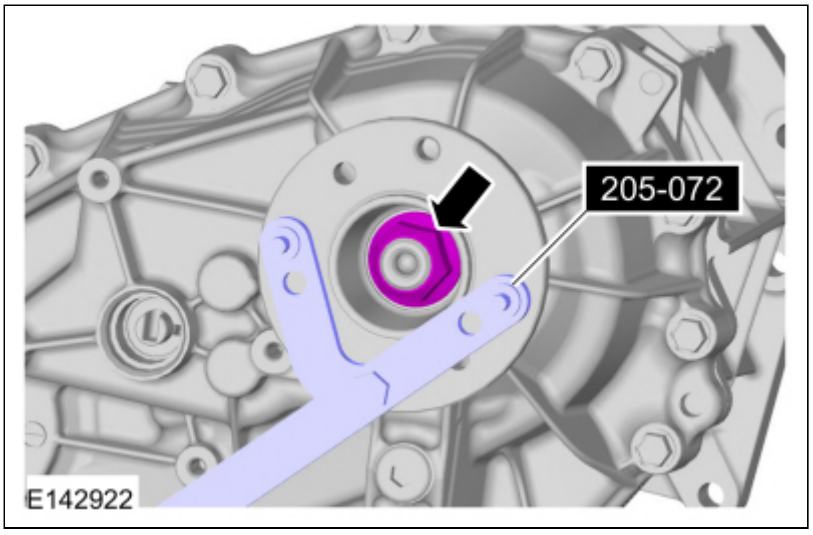
    Use Special Service Tool: 307-612 Installer, Seal.



30.

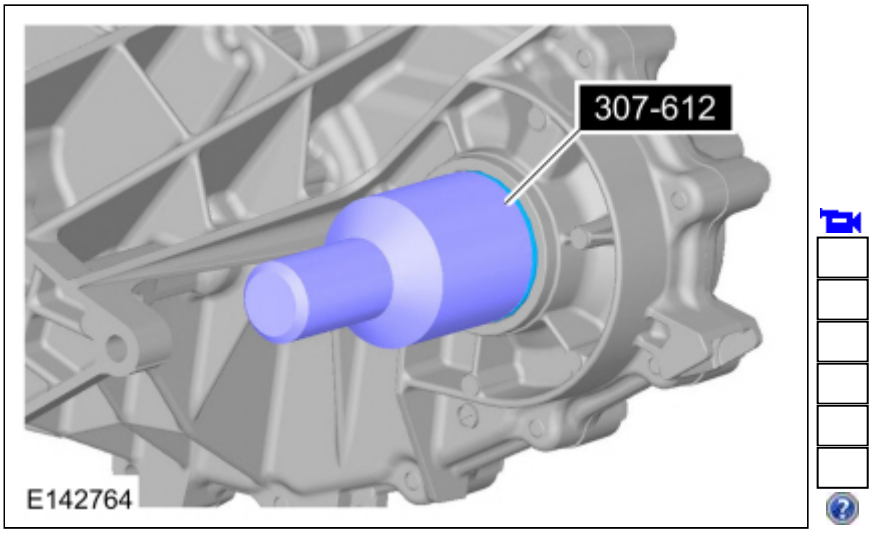


31. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Torque: 373 Nm

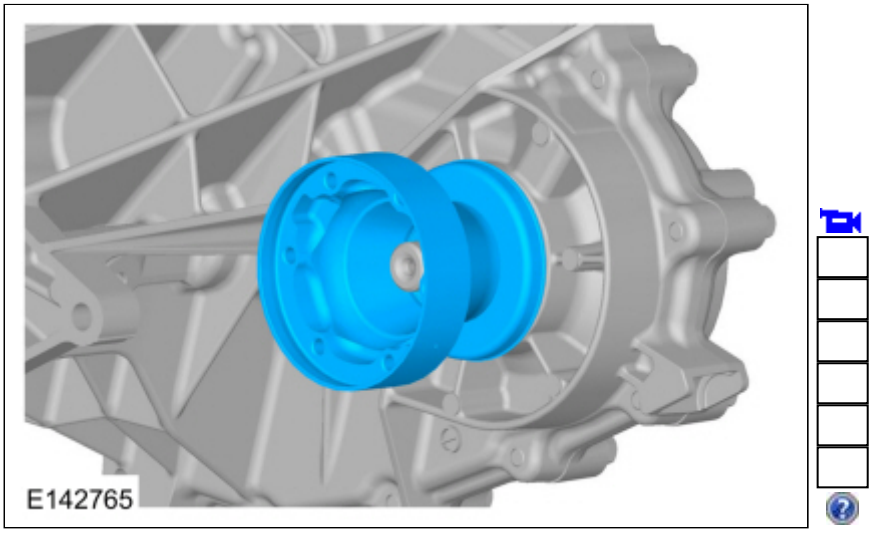


32. **NOTE:** *Apply petroleum jelly to the outer circumference of the oil seal.*

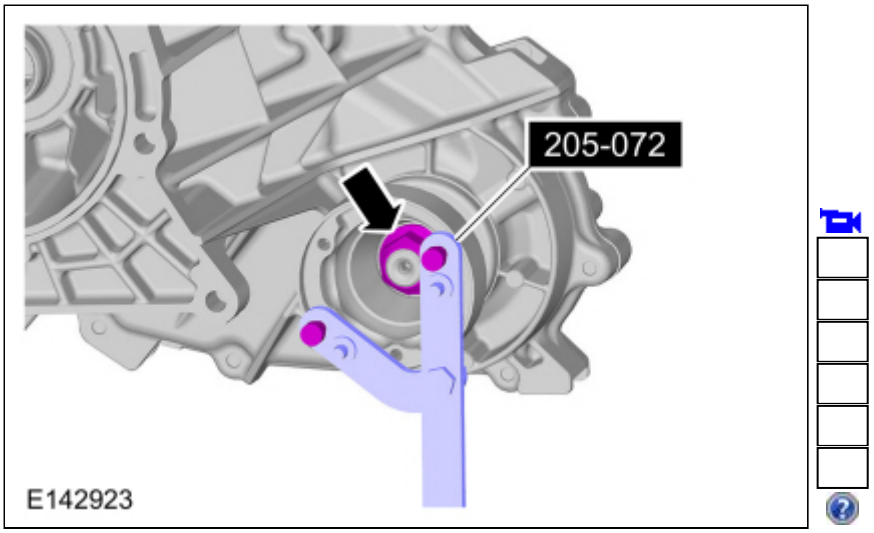
Use Special Service Tool: 307-612 Installer, Seal.



33.

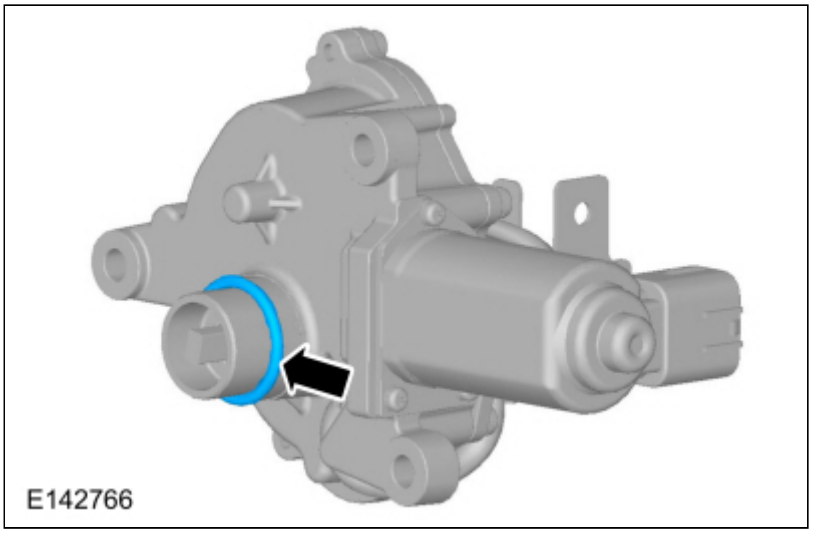


34. Use Special Service Tool: 205-072 Universal Flange Holding Wrench.
Torque: 275 Nm

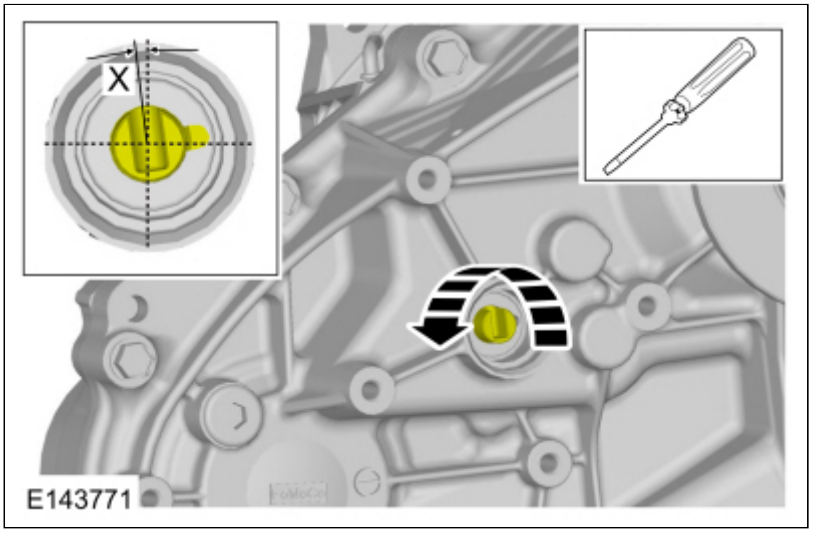


35. **NOTE:** *This step is not necessary when installing a new shift motor.*

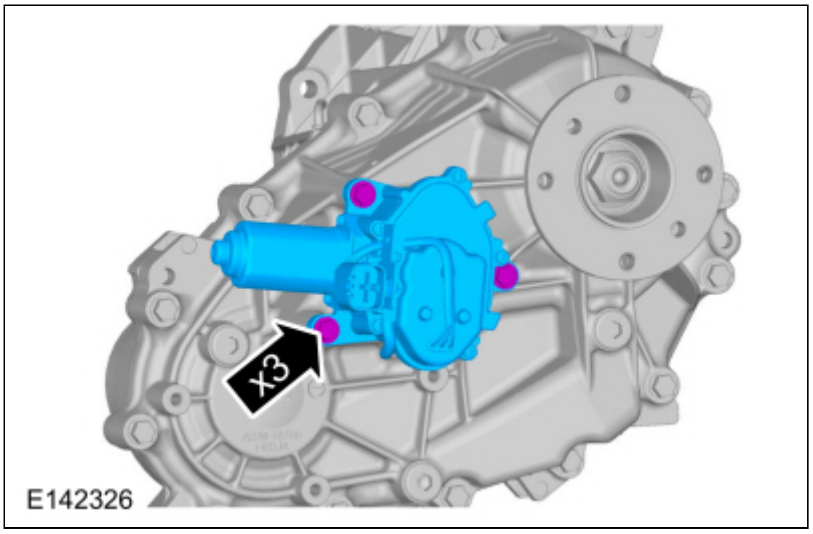
NOTE: *lubricate the "O" ring before installing*



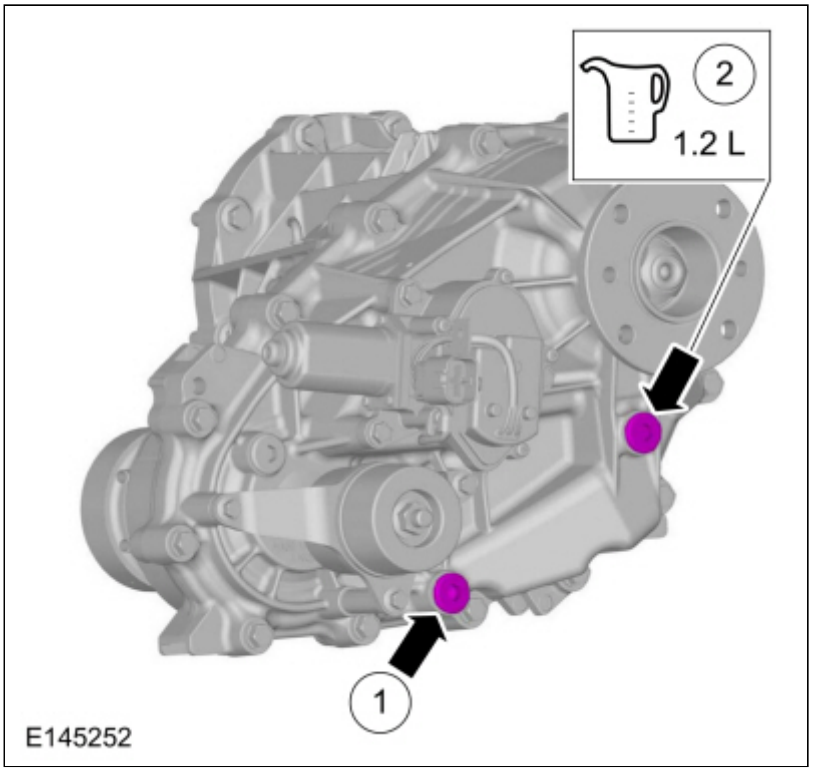
36. **X:** 5.4°



37. *Torque*: 22 Nm



1. *Torque*: 35 Nm
2. *Material*: Automatic Transmission Fluid (MERCON® LV) (WSS-M2C938-A)
   Torque: 35 Nm



Copyright © 2016 Ford Motor Company

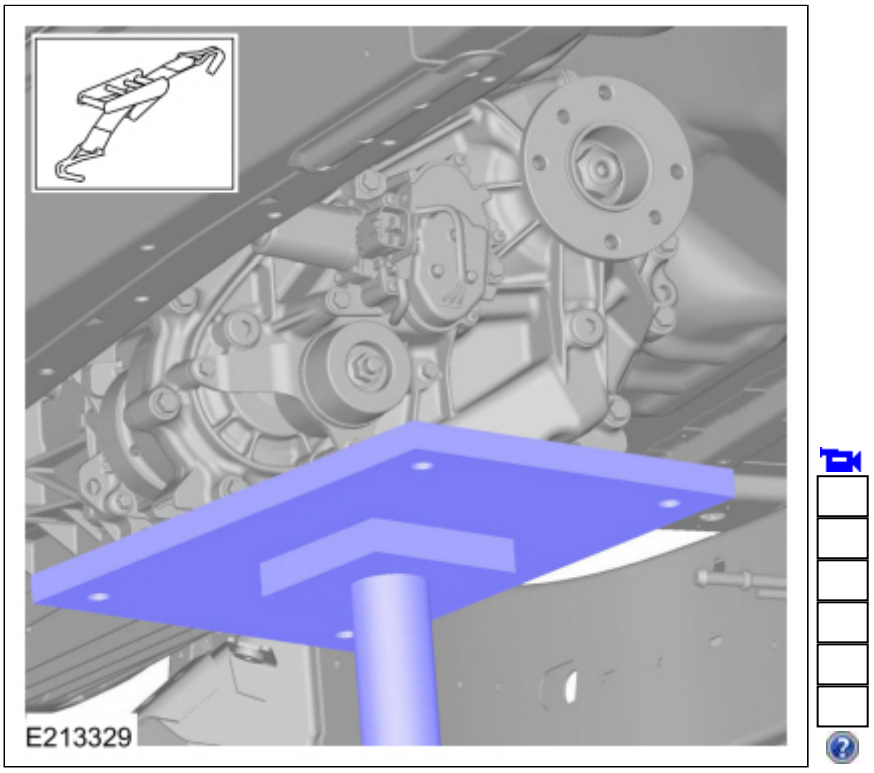
Transfer Case

Base Part Number: 7251

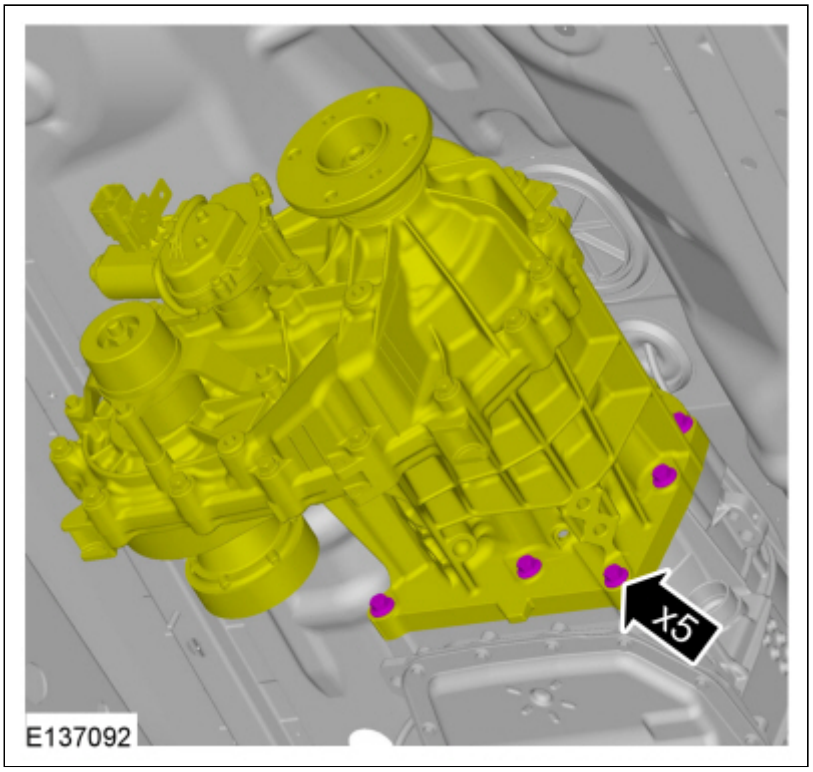
Special Tool(s) / General Equipment

Transmission Jack

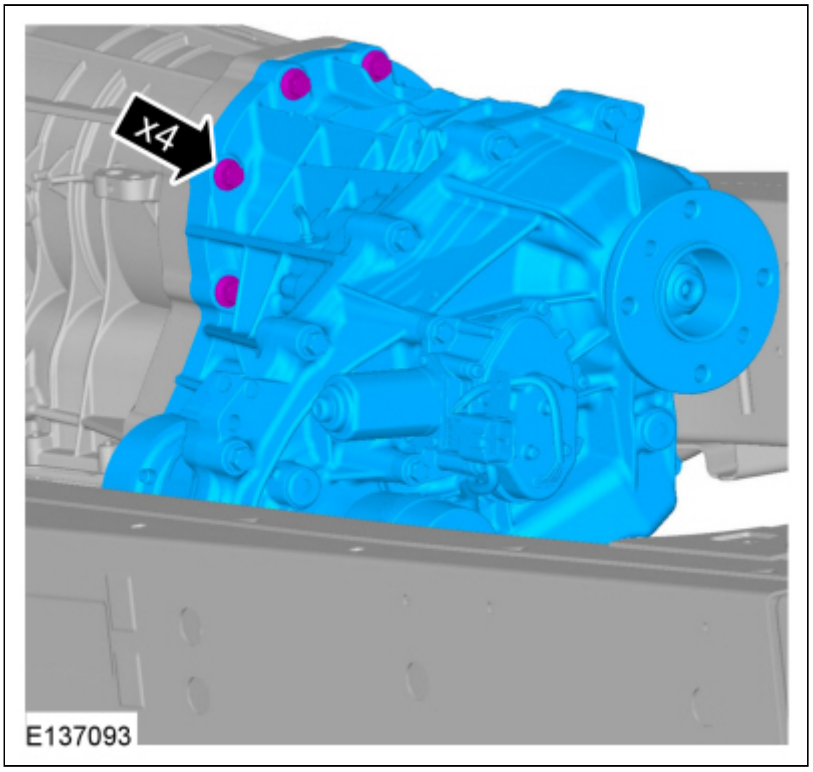
1. Use the General Equipment: Transmission Jack



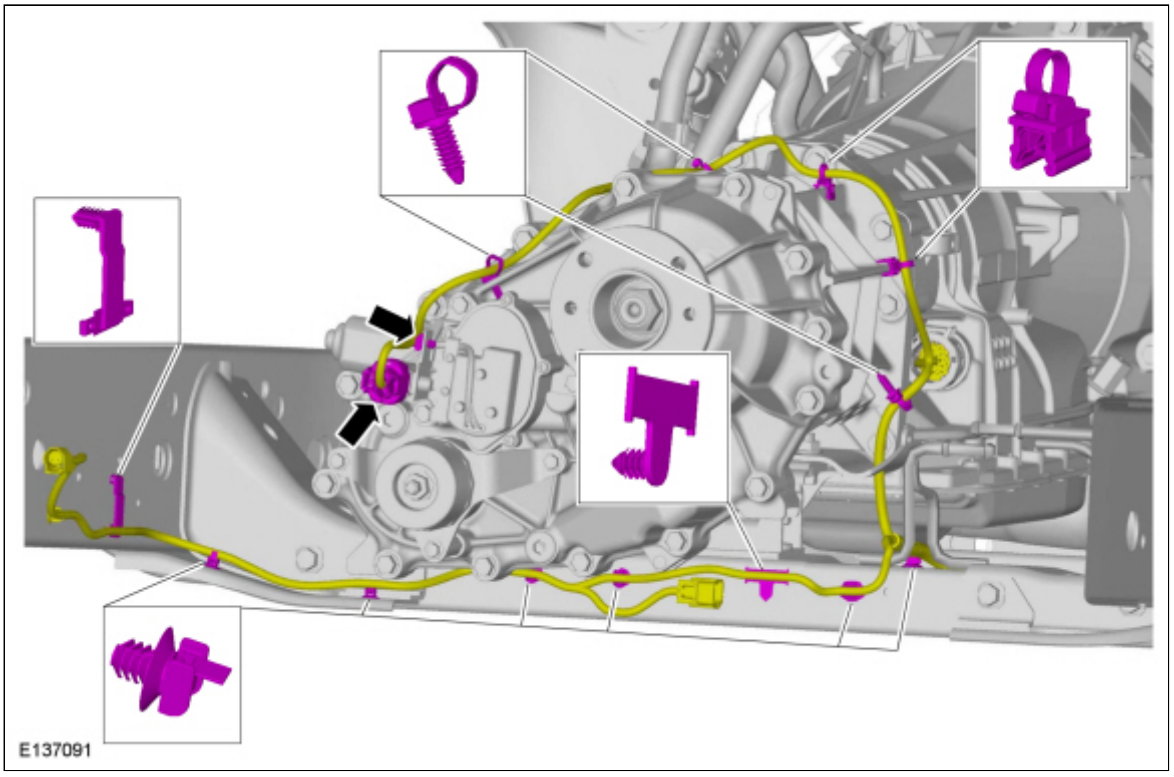
2. *Torque*: 48 Nm



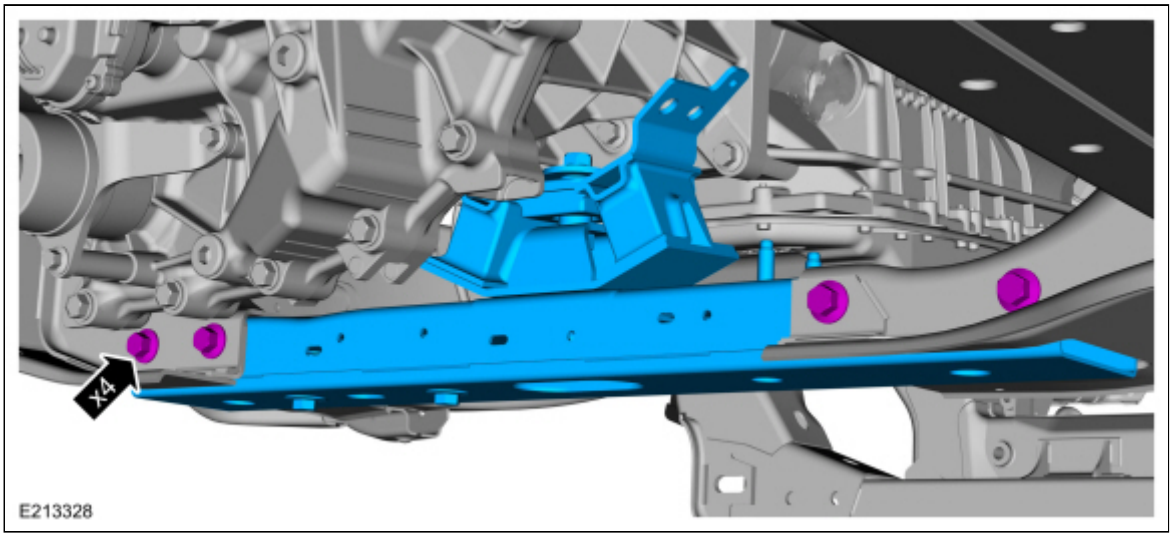
3. *Torque*: 48 Nm



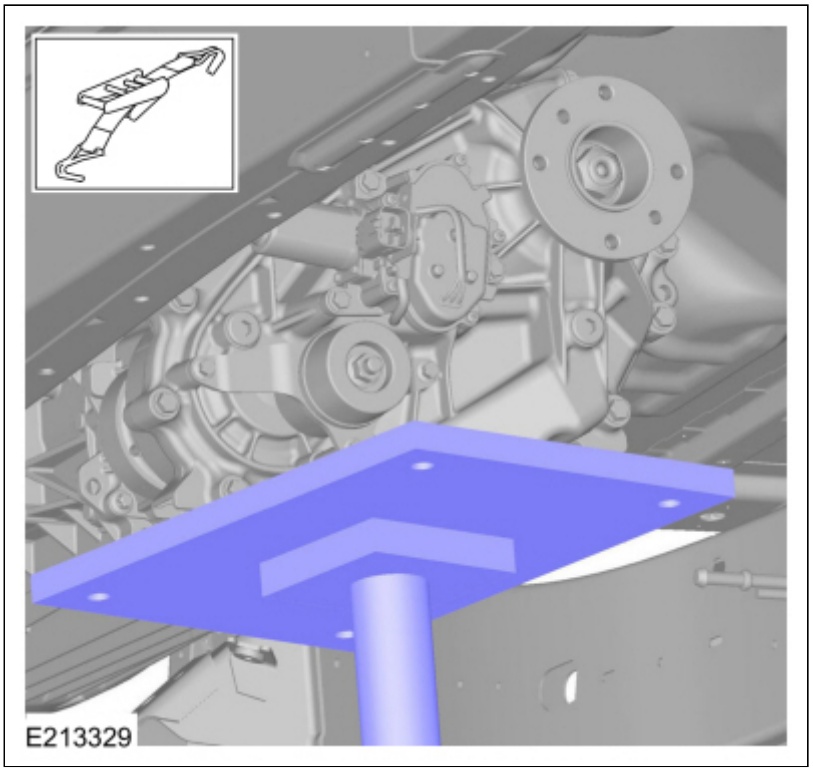
4.



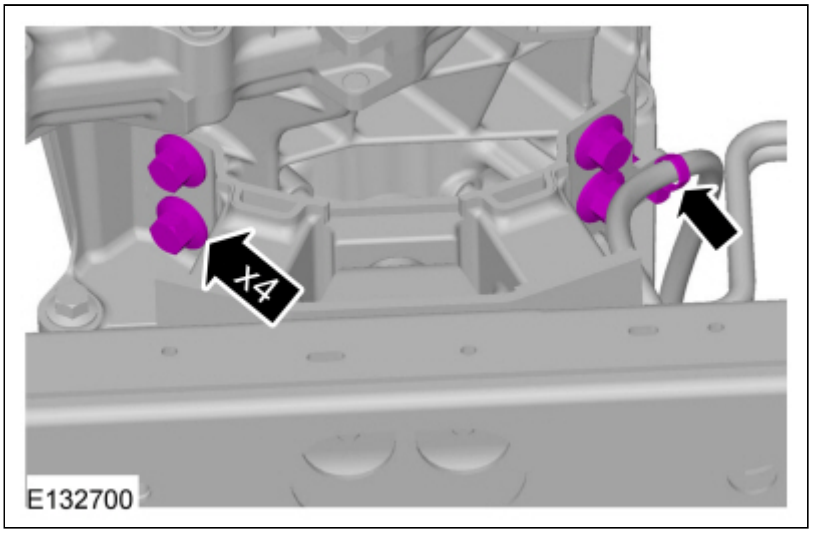
5. *Torque*: 90 Nm



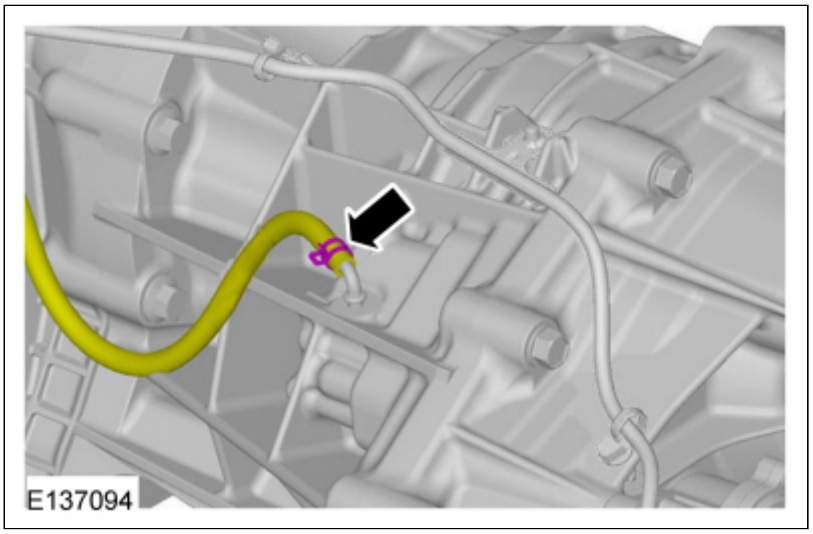
6. Lower the transmission jack.
   Use the General Equipment: Transmission Jack



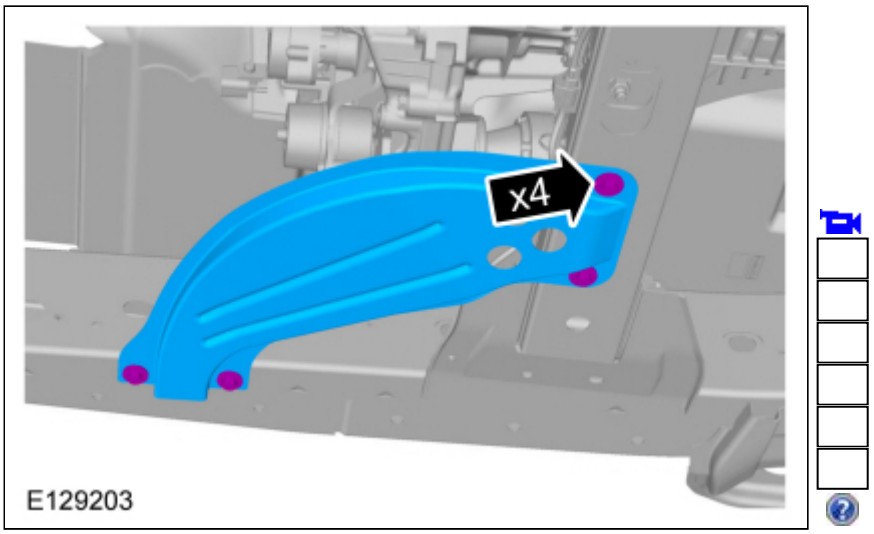
7. *Torque*: 90 Nm



8.



9. *Torque*: 48 Nm



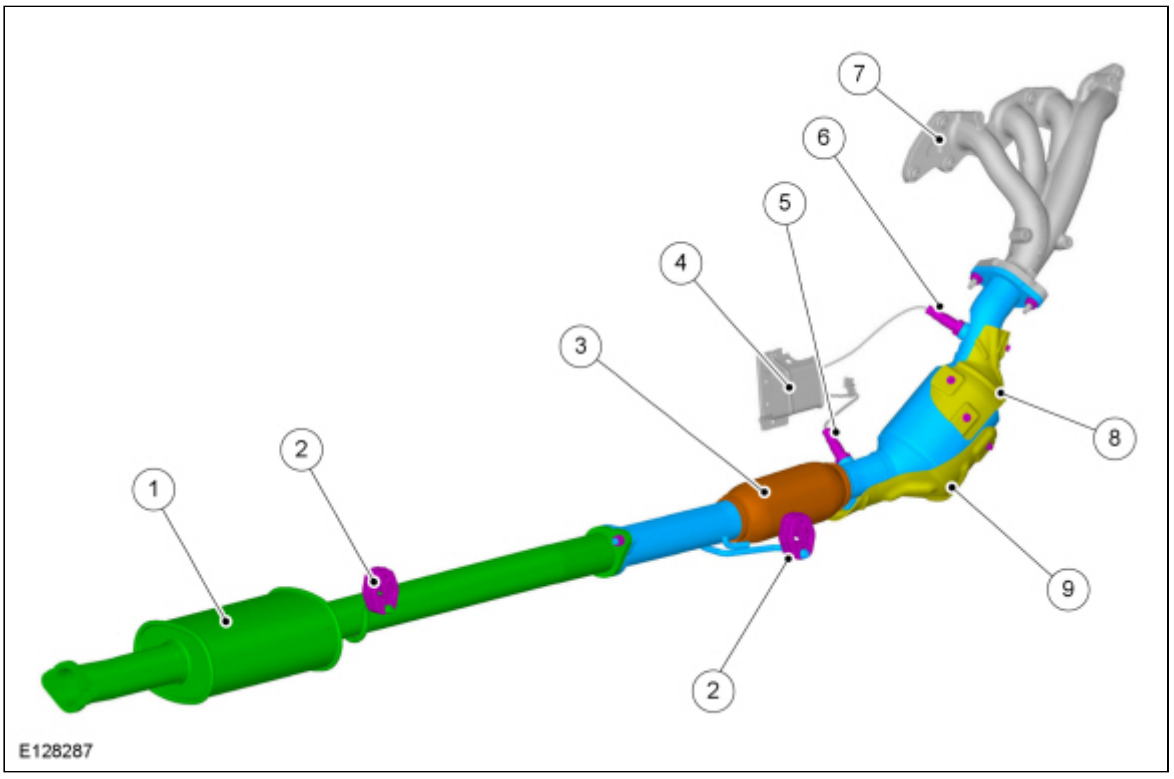
10. Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
    Refer to: Front Driveshaft - 4WD (205-01 Driveshaft, Removal and Installation).
11. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
12. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Exhaust System - Component Location

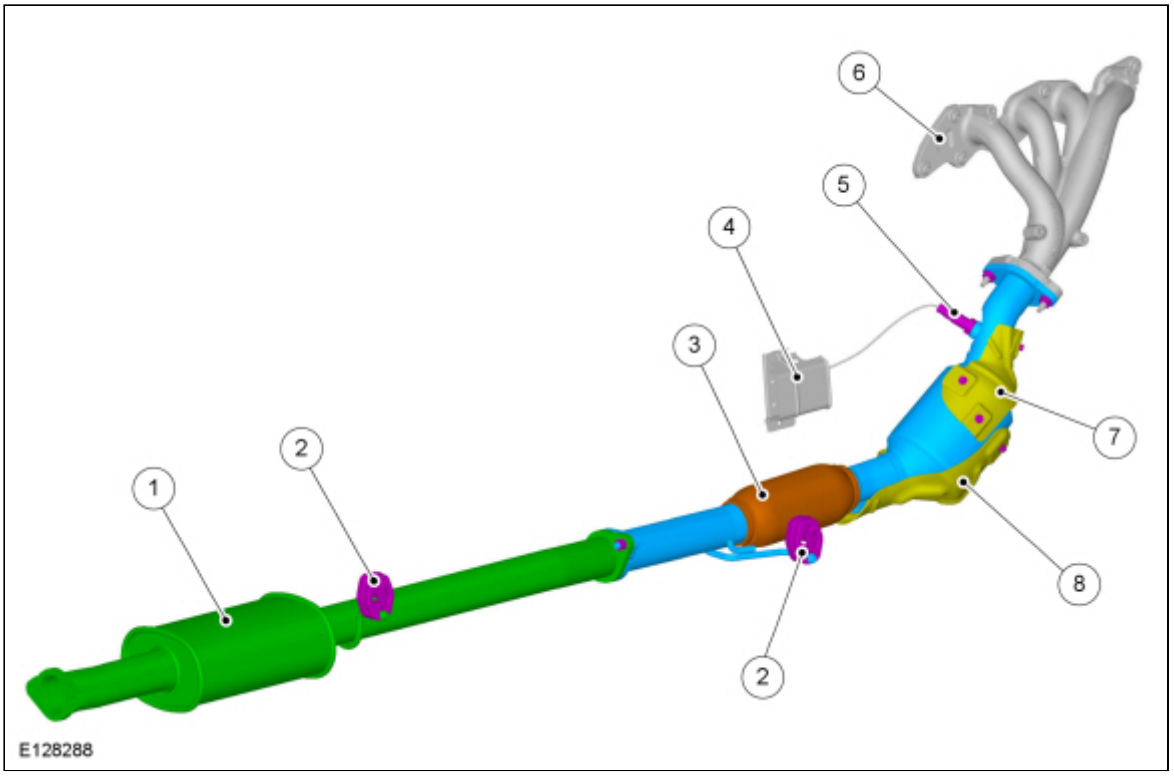
Exhaust flexible pipes are very fragile and must not be subjected to any load. They must be secured against twisting and bending during any work on the exhaust system.

2.5L E100



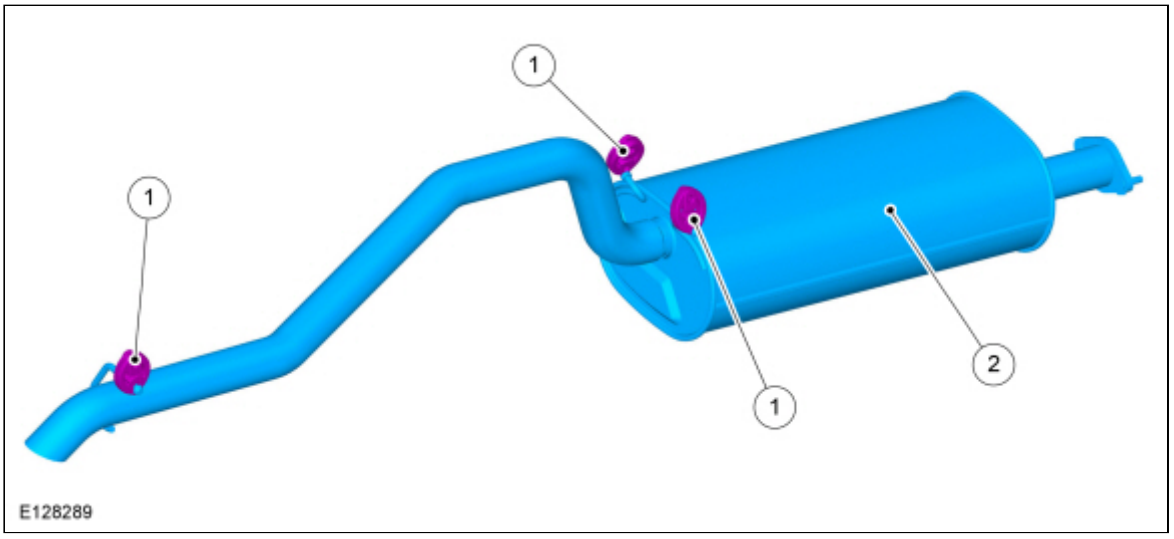
Item	Part Number	Description
1	—	Intermidiate muffler
2	—	Exhaust hanger insulator
3	—	Exhaust flexible pipe
4	—	Heatshield
5	—	Catalyst monitor sensor
6	—	Heated exhaust oxygen sensor
7	—	Exhaust manifold
8	—	Heatshield
9	—	Heatshield

2.5L



Item	Part Number	Description
1	—	Intermediate muffler
2	—	Exhaust hanger insulator
3	—	Exhaust flexible pipe
4	—	Heatshield
5	—	Heated exhaust oxygen sensor
6	—	Exhaust manifold
7	—	Heatshield
8	—	Heatshield

All Vehicles



Item	Part Number	Description
1	—	Exhaust hanger insulator
2	—	Rear muffler

Copyright © 2016 Ford Motor Company

Exhaust System - Overview

Overview

NOTICE: Do not use leaded fuel in a vehicle equipped with a catalytic converter. In a vehicle that is continually misfueled, the lead in the fuel will be deposited in the catalytic converter and completely blanket the catalyst. Lead reacts with platinum to "poison" the catalyst. Continuous use of leaded fuel can destroy the catalyst and render the catalytic converter useless. The addition of lead to the catalytic converter can also solidify the catalyst, causing excessive back pressure in the exhaust system and possibly causing engine damage.

NOTICE: Extremely high temperatures of 1,100°C (2,012°F) or above due to misfiring or an over-rich fuel/air mixture will cause the ceramic substrate to sinter or burn, destroying the catalytic converter. Do not continue to operate the vehicle if the engine is misfiring, there is a power loss or other unusual operating conditions, such as engine overheating and backfiring.

NOTICE: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converters and a muffler assembly. The catalytic converters also play a major role in reducing air pollutants.

The exhaust system consists of:

- a one-piece catalytic converter with exhaust flexible pipe.
- a resonator.
- a muffler and tailpipe assembly with isolators.

The catalytic converter plays a major role in the emission control system. The catalytic converter operates as a gas reactor. Its catalytic function is to speed the heat-producing chemical reaction of components in the exhaust gases in order to reduce air pollutants.

The catalyst material inside the catalytic converter consists of a ceramic substrate.

The catalytic converter is designed to provide a long life. No maintenance is necessary for the catalytic converter.

Sound insulators and shields, attached to the underbody, protect the vehicle from exhaust system heat and should be inspected at regular intervals to make sure they are not dented or out of position. If a sound insulator and shield is damaged or shows evidence of deterioration, install a new insulator and shield. The sound insulators and shields for the muffler, muffler pipe, resonator and catalytic converter pipe are installed separately.

Some exhaust fasteners must be discarded and new ones installed as indicated in the procedures. Also, any damaged or heavily corroded fasteners should be discarded and new ones installed. Some exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

Copyright © 2016 Ford Motor Company

Exhaust System

Symptom Chart(s)

Symptom Chart: Exhaust System

Verify the customer concern. Inspect the components of the exhaust system for obvious signs of damage or other mechanical concerns using the following chart.

Visual Inspection Chart - Mechanical

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Loose or damaged heat shields

Verify the exhaust system is installed correctly, with clamps correctly located and tightened to specifications. If the fault is not visually evident, determine the symptom. GO to Symptom Chart below.

Symptom Chart

Condition	Possible Sources	Actions
Vehicle has low or no power — vehicle performance complaint	• Exhaust pipe pinched or crushed • Damaged catalytic converter • Loose obstruction in exhaust	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	Restricted exhaust (possible frozen condensate in muffler)	CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST the vehicle for normal operation. If the concern is still present, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Burning smell — usually occurs at idle, with possible traces of smoke	• Foreign material caught in exhaust system • Missing heat shields	INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary.
Odor — described as a sulfur or rotten egg smell	• Catalytic converter • Excessive sulfur	At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE the customer no repair is required.

	content in fuel	
	• Rich fuel conditions • Misfire conditions	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Visible rust on surface of exhaust pipes	Catalytic converter/exhaust system	Surface rust is a characteristic of materials used on exhaust systems. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, the condition is normal.

Symptom Chart: NVH

Symptom Chart

Condition	Possible Sources	Actions
Rattle, squeaks or buzz type noise — from the bottom of the vehicle	Loose or damaged heat shield	INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system components. If any heat shields are loose, INSTALL worm gear clamp and tighten to specification. If the heat shields are missing or a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary.
	Loose or damaged exhaust isolators	VERIFY the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Damaged exhaust isolator hanger bracket	INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN the bolts to specification or INSTALL new components as necessary.
	Loose or damaged catalytic converter or muffler	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Drone or clunk type noise — from the bottom of the vehicle	Loose or damaged exhaust isolators	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Whistles, boom, hum or ticking type noise — noise tends to change as the engine warms. The noises are often accompanied by exhaust fumes	Exhaust system leak	INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which indicates exhaust leakage at that point. To magnify a small leak, have an assistant hold a shop towel over the tail pipe outlet while listening for a leak. REPAIR or INSTALL new components as necessary.
	Catalytic converter	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.

	Exhaust muffler/resonator drain hole enlarged due to corrosion	CONFIRM the drain holes are the noise source. INSTALL new components as necessary.
Hissing or rushing noise — high frequency sound and the vehicle performance is unaffected	Exhaust system Exhaust flow through pipes	CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
Pinging noise — occurs when exhaust system is hot, engine turned off	Catalytic converter/exhaust system	Cool down pinging is a result of the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
Vibration — occurs at idle and at low speeds. Also accompanied by a clunk or buzz type noise	Loose or damaged exhaust isolator	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Loose or damaged exhaust isolator hanger brackets	INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary.
	Exhaust system grounded to chassis	REPAIR or INSTALL new components as necessary.
Engine drumming noise — normally accompanied by vibration	Damaged or misaligned exhaust system	INSPECT the exhaust system for loose or damaged fasteners or isolators. REPAIR or INSTALL new components as necessary.
Sputter type noise — noise worse when cold, lessens or disappears when the vehicle is at operating temperature	Damaged or worn exhaust system	INSPECT the exhaust system for leaks or damage. REPAIR as necessary.
Thumping noise — from the bottom of the vehicle, worse during acceleration	Misaligned exhaust system	CHECK the exhaust system to chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary.
Engine vibration — is felt with increases and decreases in engine rpm	Strain on exhaust system isolators	REPAIR or INSTALL new components as necessary.
Drumming noise — occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent	Exhaust system vibration excites the body resonances inducing interior noise	REPAIR or INSTALL new components as necessary.

Copyright © 2016 Ford Motor Company

Catalytic Converter

Base Part Number: 5G232

Removal

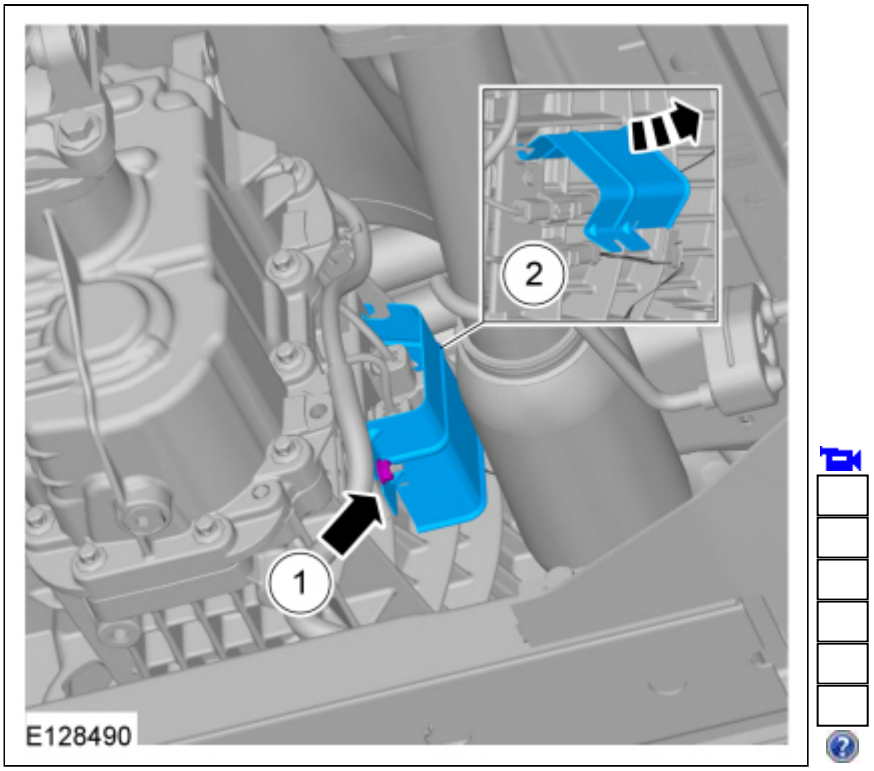
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

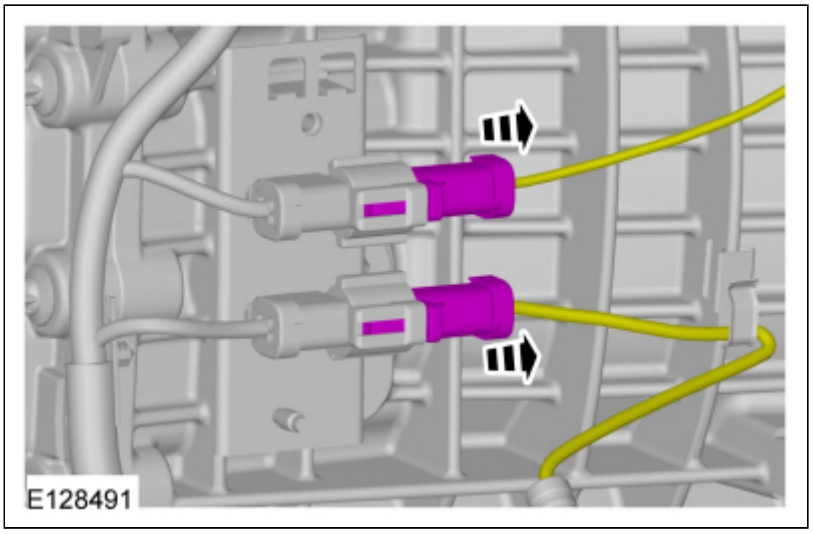
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

All vehicles

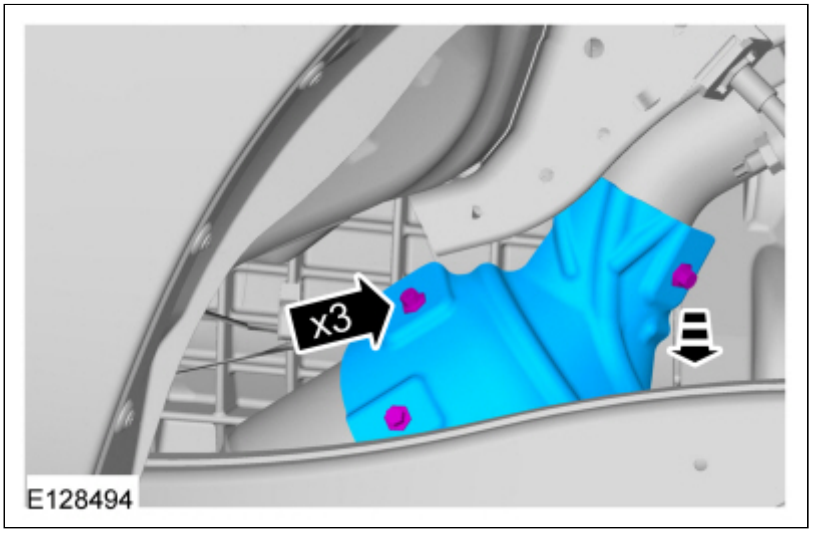
1. *Torque*: 28 Nm



4.

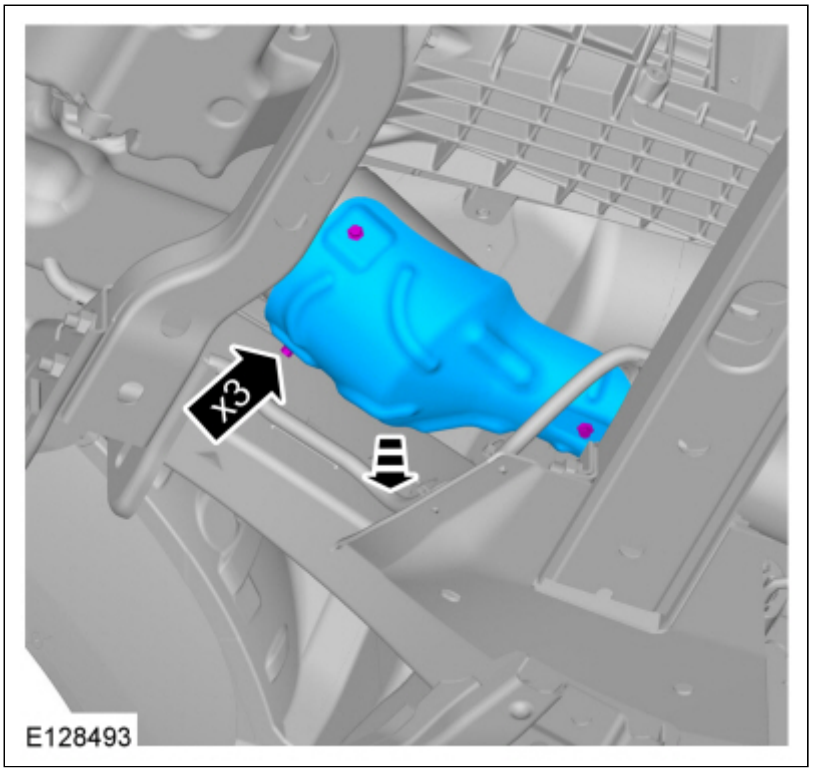


5. *Torque*: 10 Nm



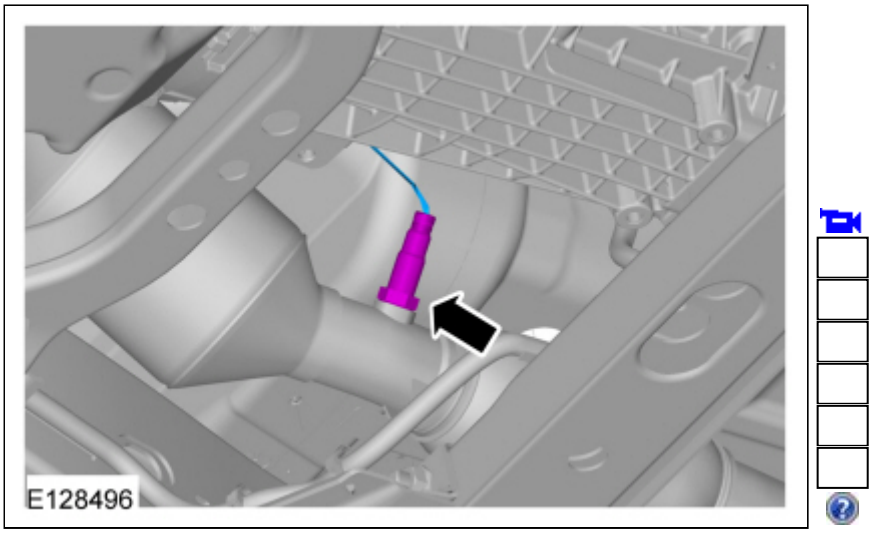
4x4

6. *Torque*: 10 Nm

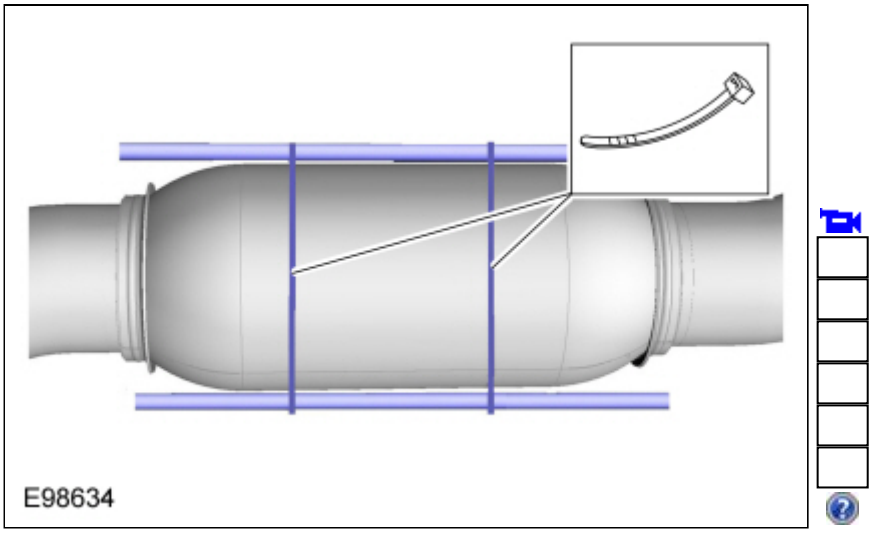


All vehicles

7. *Torque*: 48 Nm

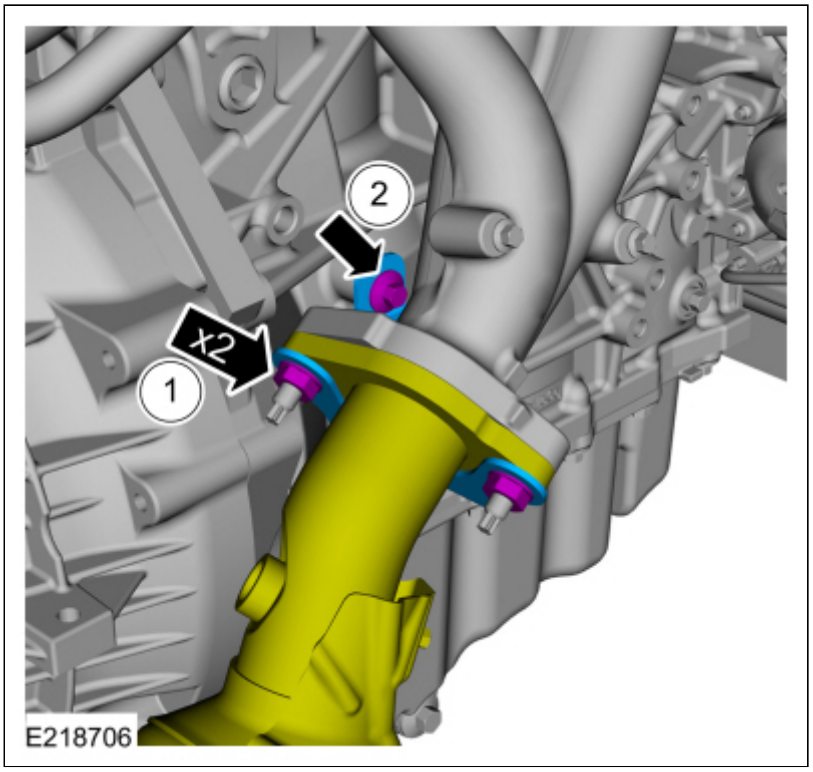


8. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



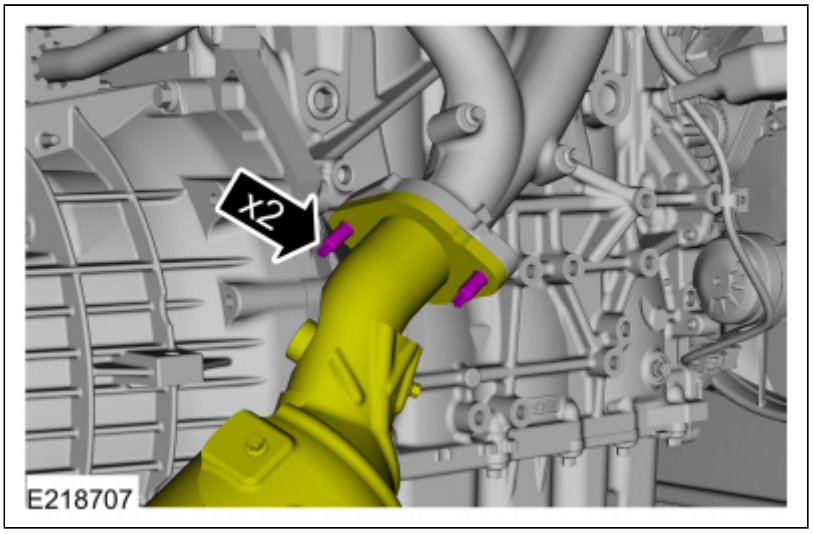
9. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

Torque:
1: 48 Nm
2: 26 Nm



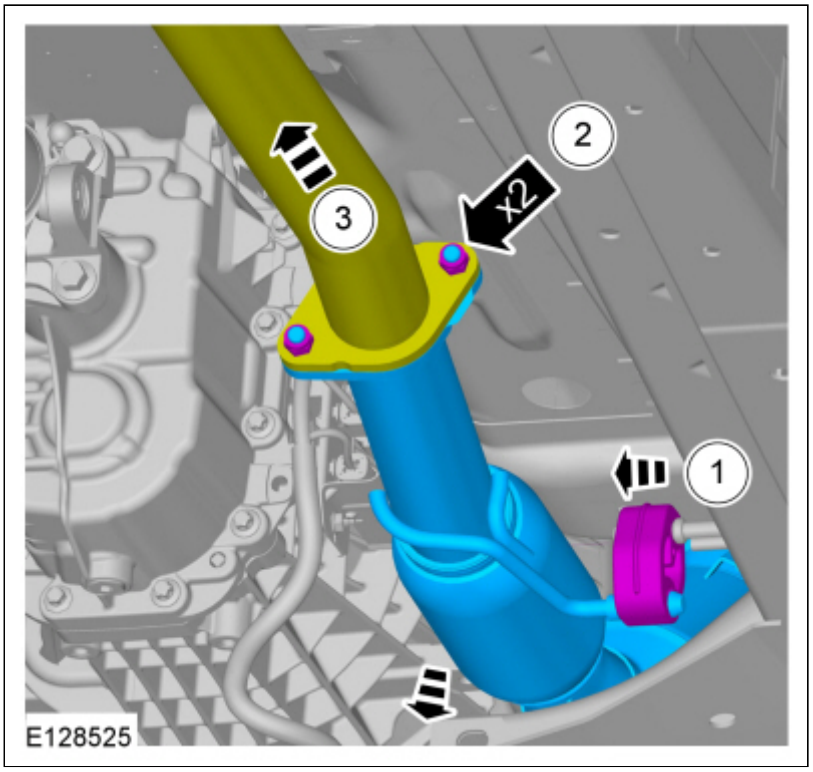
10. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

    Torque: 25 Nm



11. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

    Torque: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

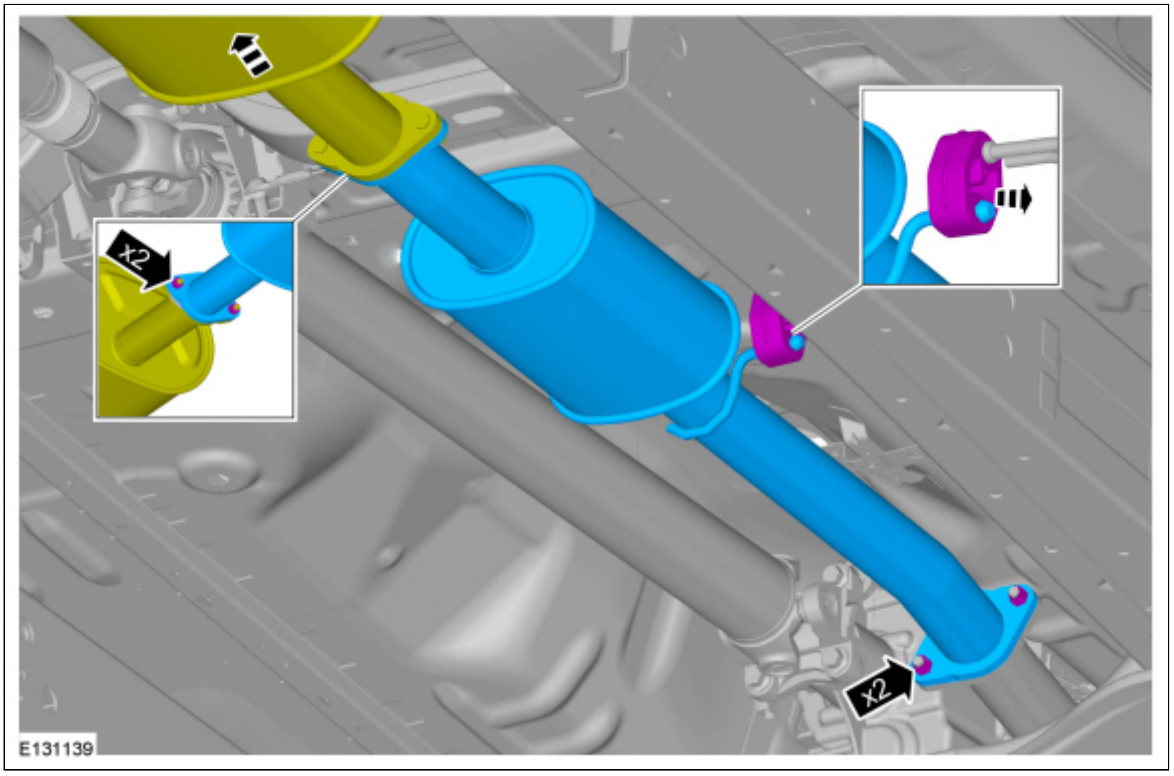
Front Muffler

Removal

WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

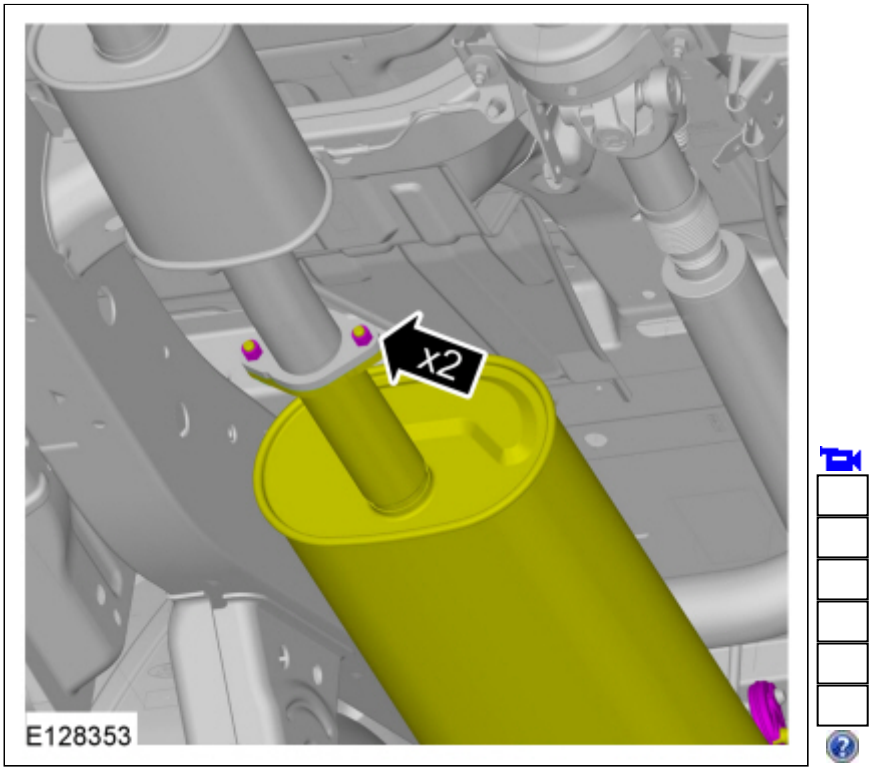
Rear Muffler

Removal

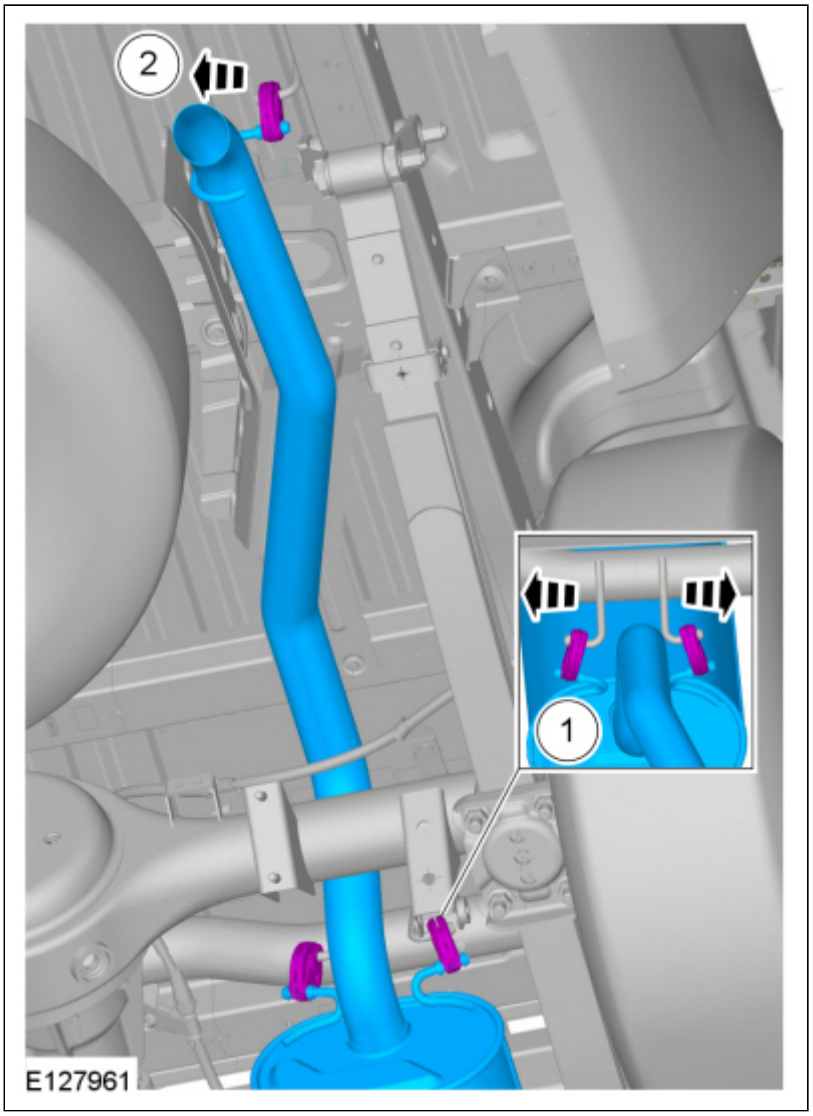
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

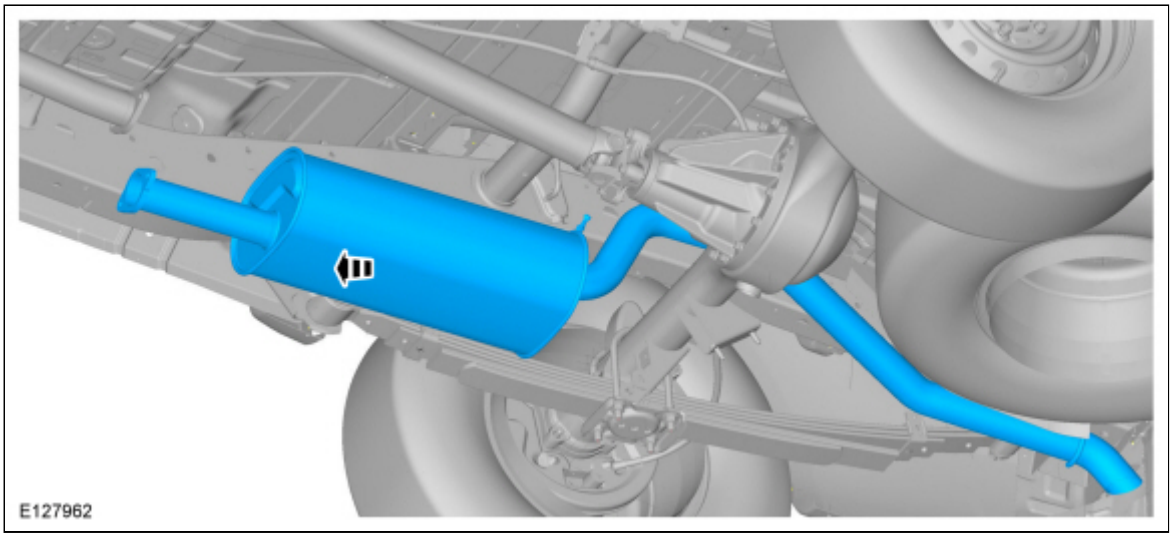
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. *Torque*: 48 Nm



4.



5.



Installation

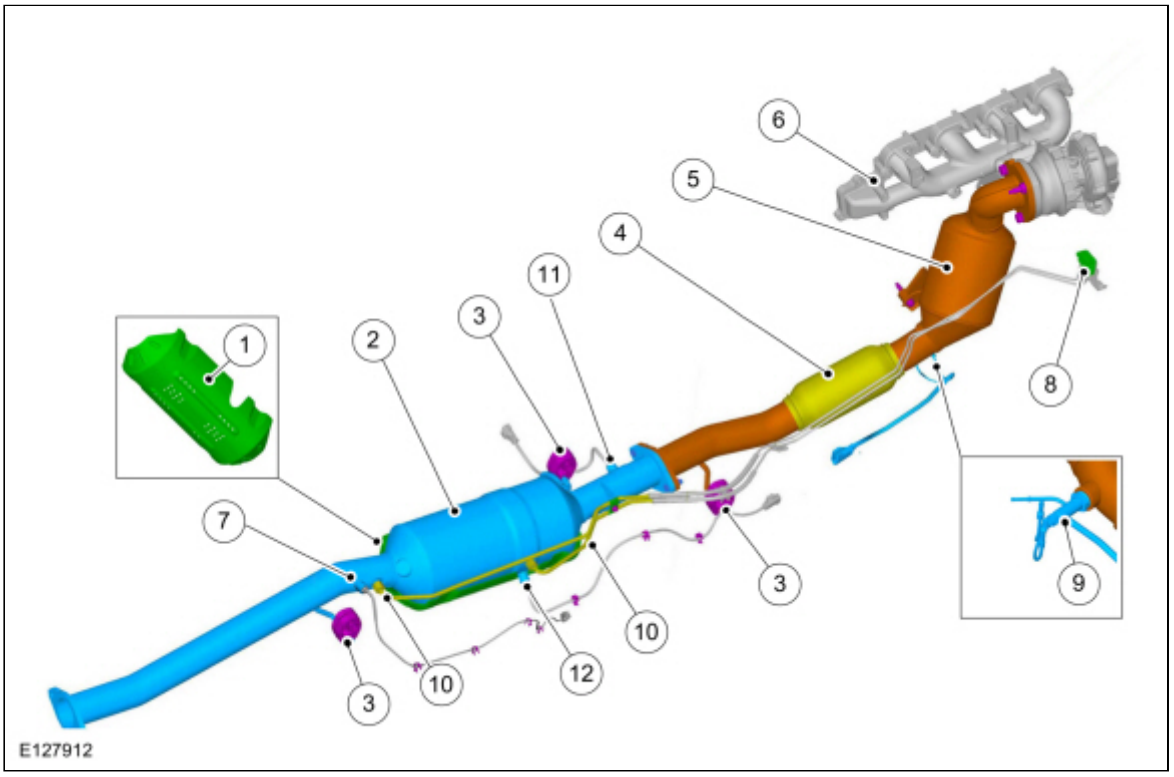
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Exhaust System - Component Location

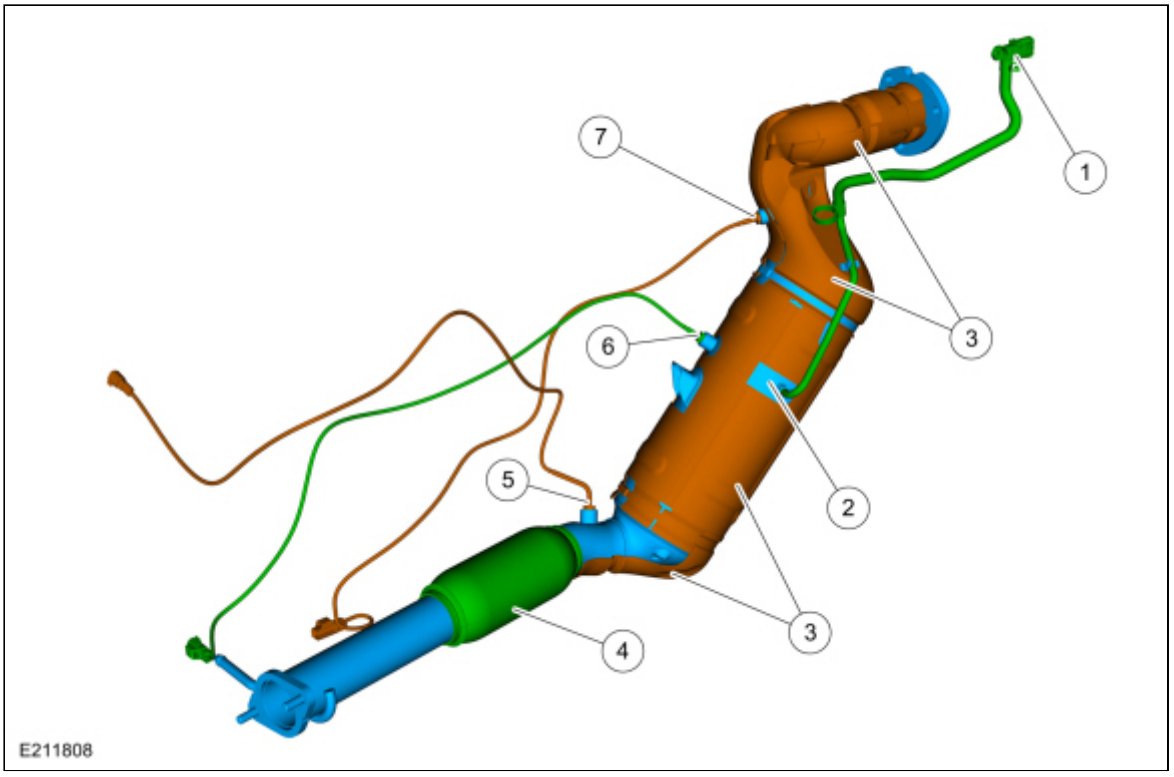
NOTE: *Exhaust flexible pipes are very fragile and must not be subjected to any load. They must be secured against twisting and bending during any work on the exhaust system.*

Vehicles with DPF & catalytic convertor



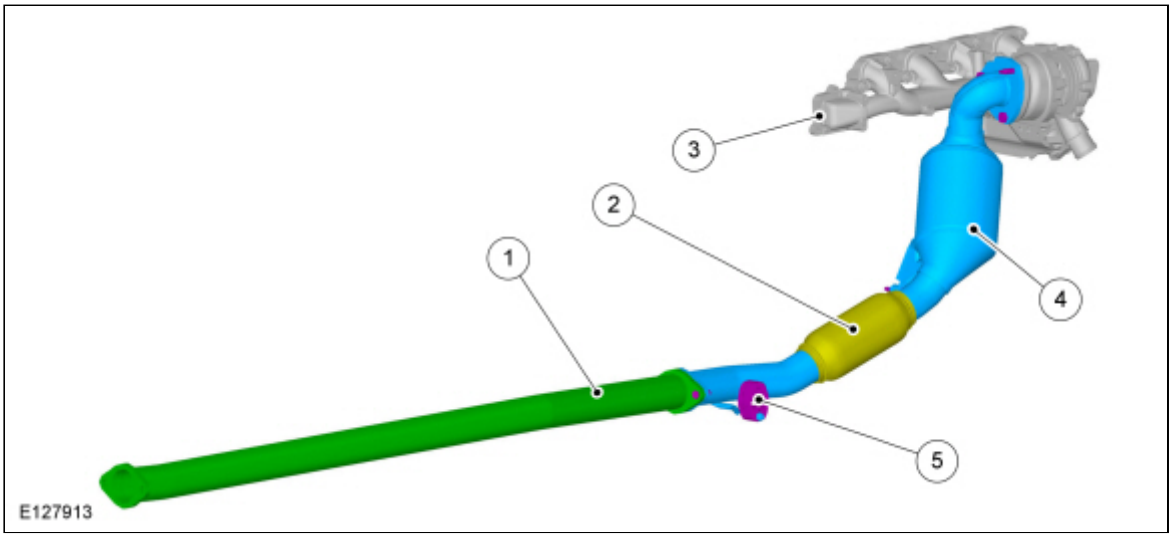
Item	Description
1	DPF Heat shield
2	DPF
3	Exhaust hanger insulator
4	Exhaust flexible pipe
5	Catalytic converter
6	Exhaust manifold
7	Temprature sensor
8	Pressure differential sensor
9	Fuel vapourizer
10	Pressure differential sensor lines
11	Temprature sensor

Vehicles with DPF



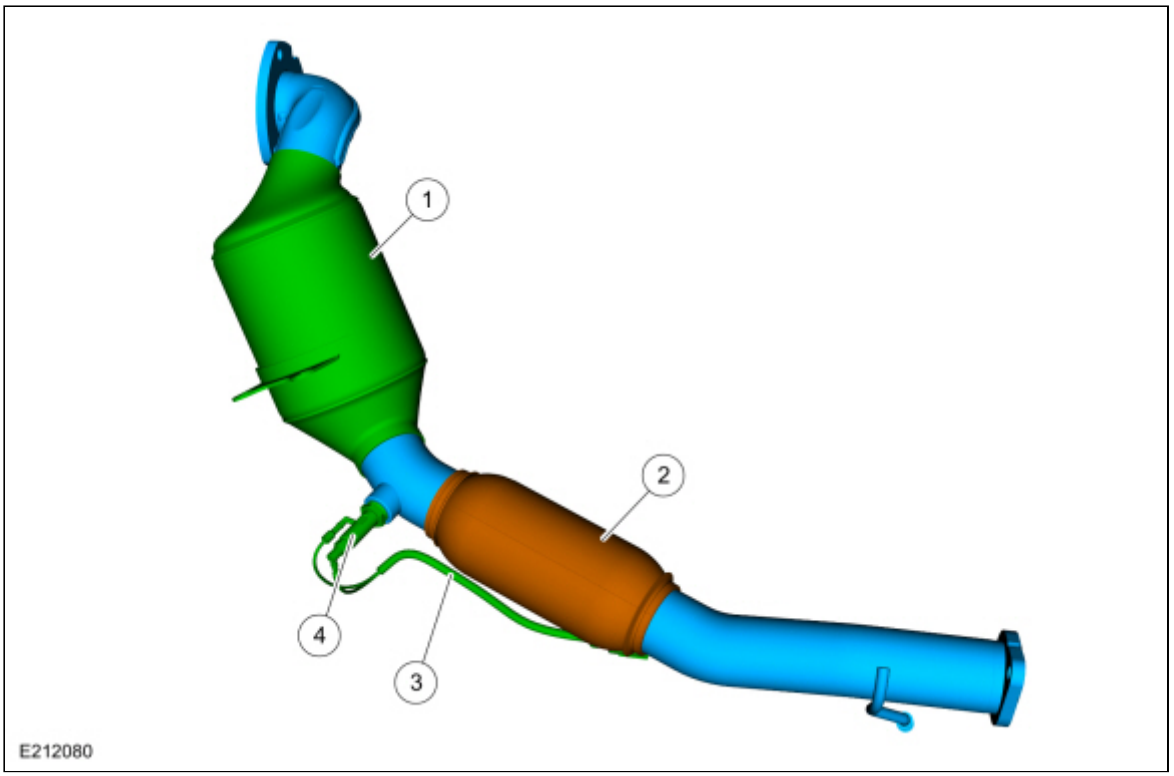
Item	Description
1	Differential pressure sensor
2	DPF
3	DPF heat shield
4	Exhaust flexible pipe
5	DPF temperature sensor
6	DPF temperature sensor
7	DPF exhaust gas temperature sensor

Vehicles with catalytic convertor



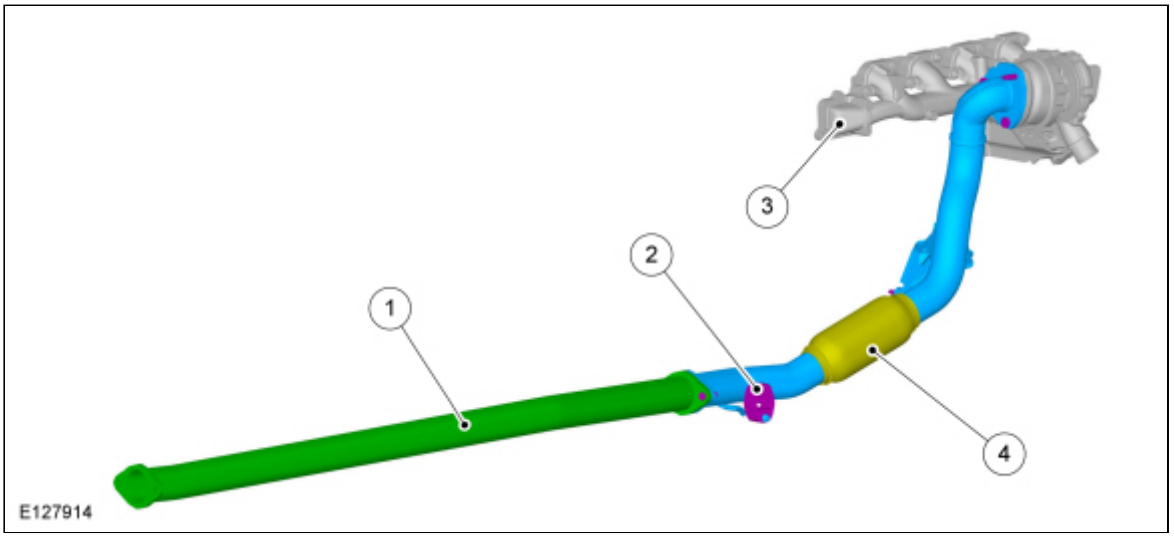
Item	Description
1	Exhaust link pipe
2	Exhaust flexible pipe
3	Exhaust manifold
4	Catalytic converter

5	Exhaust hanger insulator

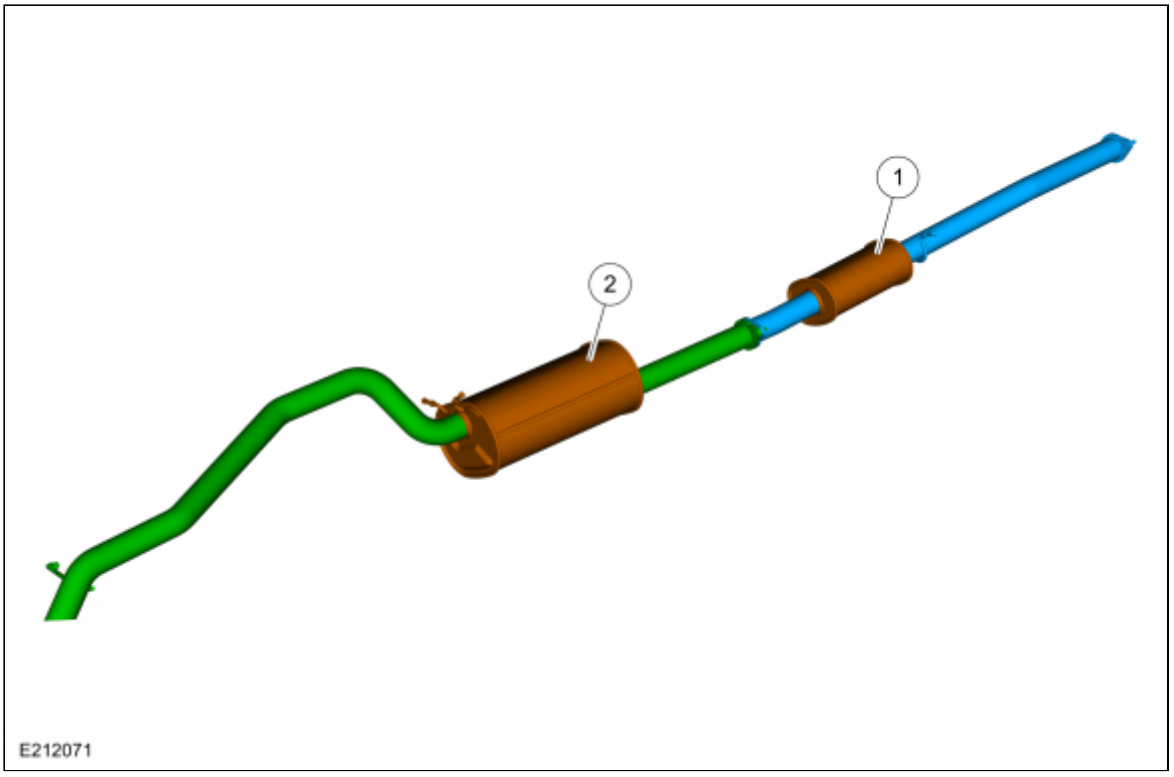


Item	Description
1	Catalytic converter
2	Exhaust flexible pipe
3	Fuel vapourizer electrical connector
4	Fuel vapourizer

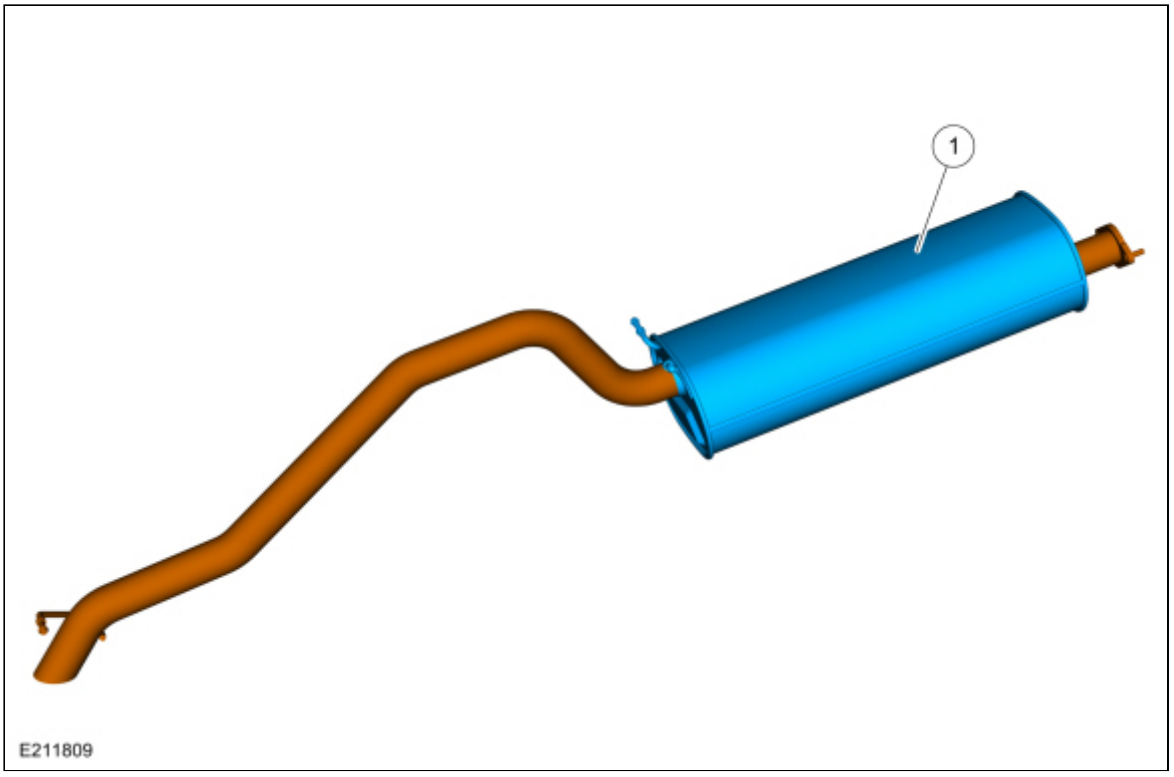
Vehicles without diesel particulate filter & catalytic convertor



Item	Description
1	Exhaust link pipe
2	Exhaust hanger insulator
3	Exhaust manifold
4	Exhaust flexible pipe



Item	Description
1	Front muffler
2	Rear muffler



Item	Description
1	Rear muffler

Copyright © 2016 Ford Motor Company

Exhaust System - Overview

Diesel Particulate Filter (DPF)

The Diesel Particulate Filter (DPF) system consists of the following components:

- DPF
- Pressure differential sensor
- Temperature sensor

The DPF reduces the pollution generated by diesel vehicles by filtering soot and ash particles out of the exhaust gases.

The PCM monitors the pressure differential sensor, DPF temperature sensors and other inputs to control the operation of the DPF system.

Soot particles can accumulate in the post DPF exhaust tailpipe. The accumulation of the soot particles should not be considered a concern, as the DPF is not 100% efficient at filtering the soot particles.

The amount of matter trapped in the DPF is monitored using the pressure sensor which monitors the exhaust pressure before the DPF. As the DPF fills with soot, exhaust flow through it is restricted.

When this occurs the pressure differential in the exhaust before and after the DPF will increase which will indicate to the PCM that a DPF regeneration is required to clean it.

Diesel Particulate Filter (DPF) Regeneration

During the regeneration process, it is possible that white smoke may be emitted from the exhaust tailpipe. This is an inherent by-product of the regeneration process and should not be considered a concern.

The pressure differential sensor is connected to the DPF by the pressure differential sensor line to monitor the exhaust pressure. The pressure differential sensor converts these measurements to a signal voltage, which is then sent to the PCM. The PCM uses the pressure differential sensor information to determine whether to carry out a regeneration.

The PCM will choose the optimum time for the regeneration of the DPF. Under normal operating conditions the regeneration process occurs when the PCM has calculated that the DPF requires regeneration and that predetermined vehicle conditions are met (for example coolant temperature, vehicle speed and engine load).

During the DPF regeneration the temperature of the exhaust gas increases to greater than 550C at the DPF. At this temperature soot burns. Soot particulates that may have accumulated in the diesel particulate filter are burned and the ash is trapped in the diesel particulate filter.

The ash particulates that remain in the diesel particulate filter are mainly comprised of metallic compounds generated during combustion and from corrosion in the exhaust system.

DPF Manual Regeneration

When the DPF becomes blocked a high pressure DTC sets in the PCM, the MIL is illuminated and limp home mode activated.

A blocked DPF can be a result of:

- Excessive soot particles production
- Multiple failed regeneration events
- Mechanical or electrical failure of a related system or sub-system (for example EGR valve stuck open, charge air system leak, fuel injectors)

The DPF manual regeneration function can be used to clear the soot particles from the DPF manually. To do this the

Integrated Diagnostic System (IDS) must be connected to the vehicle select Powertrain> Service Functions>PCM>Diesel Particulate Filter Static Regeneration. For additional information, refer to IDS.

Copyright © 2016 Ford Motor Company

Exhaust System

Symptom Chart(s)

Symptom Chart: Exhaust System

Verify the customer concern. Inspect the components of the exhaust system for obvious signs of damage or other mechanical concerns using the following chart.

Visual Inspection Chart - Mechanical

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Loose or damaged heat shields

Verify the exhaust system is installed correctly, with clamps correctly located and tightened to specifications. If the fault is not visually evident, determine the symptom. GO to Symptom Chart below.

Symptom Chart

Condition	Possible Sources	Actions
Vehicle has low or no power — vehicle performance complaint	• Exhaust pipe pinched or crushed • Damaged catalytic converter • Loose obstruction in exhaust	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	Restricted exhaust (possible frozen condensate in muffler)	CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST the vehicle for normal operation. If the concern is still present, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Burning smell — usually occurs at idle, with possible traces of smoke	• Foreign material caught in exhaust system • Missing heat shields	INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary.
Odor — described as	• Catalytic	At times, a slight sulfur smell is normal for catalytic converters. The

Odor — described as a sulfur or rotten egg smell	• Catalytic converter • Excessive sulfur content in fuel	At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE the customer no repair is required.
	• Rich fuel conditions • Misfire conditions	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Visible rust on surface of exhaust pipes	Catalytic converter/exhaust system	Surface rust is a characteristic of materials used on exhaust systems. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, the condition is normal.

Symptom Chart: NVH

Symptom Chart

Condition	Possible Sources	Actions
Rattle, squeaks or buzz type noise — from the bottom of the vehicle	Loose or damaged heat shield	INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system components. If any heat shields are loose, INSTALL worm gear clamp and tighten to specification. If the heat shields are missing or a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary.
	Loose or damaged exhaust isolators	VERIFY the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Damaged exhaust isolator hanger bracket	INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN the bolts to specification or INSTALL new components as necessary.
	Loose or damaged catalytic converter or muffler	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Drone or clunk type noise — from the bottom of the vehicle	Loose or damaged exhaust isolators	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Whistles, boom, hum or ticking type noise — noise tends to change as the engine warms. The noises are often accompanied by exhaust fumes	Exhaust system leak	INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which indicates exhaust leakage at that point. To magnify a small leak, have an assistant hold a shop towel over the tail pipe outlet while listening for a leak. REPAIR or INSTALL new components as necessary.
	Catalytic converter	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic

		converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	Exhaust muffler/resonator drain hole enlarged due to corrosion	CONFIRM the drain holes are the noise source. INSTALL new components as necessary.
Hissing or rushing noise — high frequency sound and the vehicle performance is unaffected	Exhaust system Exhaust flow through pipes	CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
Pinging noise — occurs when exhaust system is hot, engine turned off	Catalytic converter/exhaust system	Cool down pinging is a result of the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
Vibration — occurs at idle and at low speeds. Also accompanied by a clunk or buzz type noise	Loose or damaged exhaust isolator	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Loose or damaged exhaust isolator hanger brackets	INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary.
	Exhaust system grounded to chassis	REPAIR or INSTALL new components as necessary.
Engine drumming noise — normally accompanied by vibration	Damaged or misaligned exhaust system	INSPECT the exhaust system for loose or damaged fasteners or isolators. REPAIR or INSTALL new components as necessary.
Sputter type noise — noise worse when cold, lessens or disappears when the vehicle is at operating temperature	Damaged or worn exhaust system	INSPECT the exhaust system for leaks or damage. REPAIR as necessary.
Thumping noise — from the bottom of the vehicle, worse during acceleration	Misaligned exhaust system	CHECK the exhaust system to chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary.
Engine vibration — is felt with increases and decreases in engine rpm	Strain on exhaust system isolators	REPAIR or INSTALL new components as necessary.
Drumming noise — occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent	Exhaust system vibration excites the body resonances inducing interior noise	REPAIR or INSTALL new components as necessary.

Copyright © 2016 Ford Motor Company

Catalytic Converter

Base Part Number: 5G232

Removal

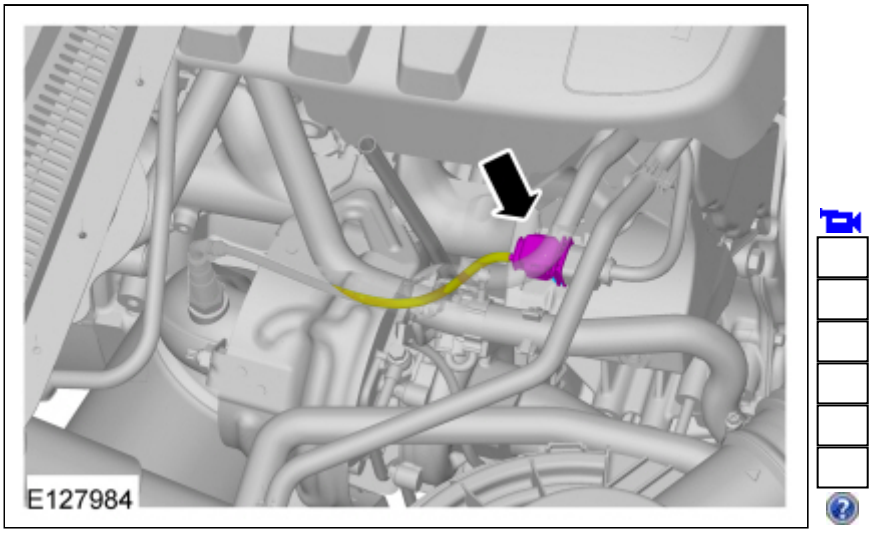
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

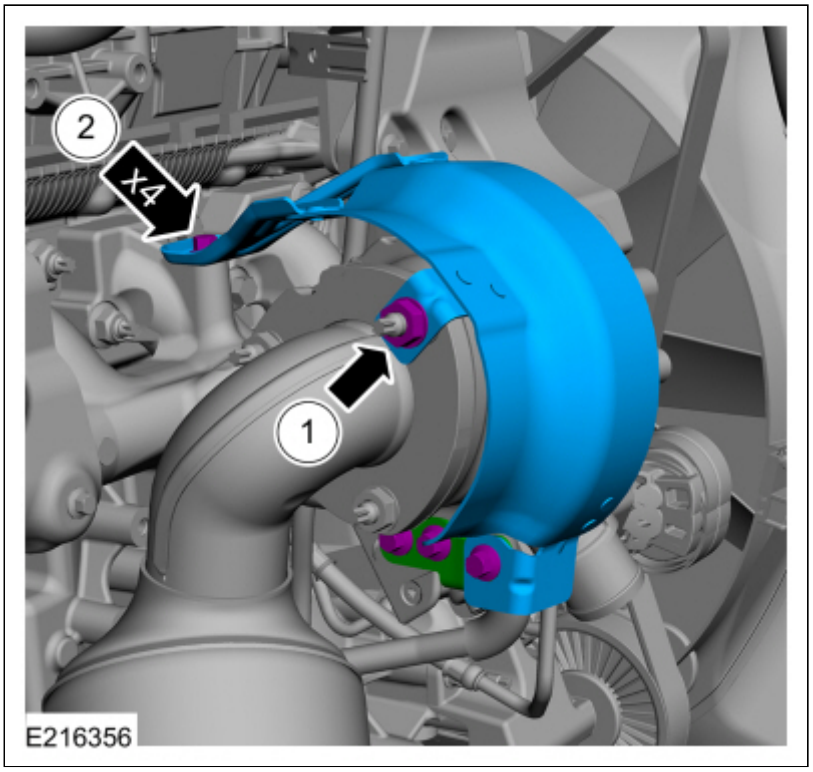
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

Vehicles with diesel particulate filter (DPF)

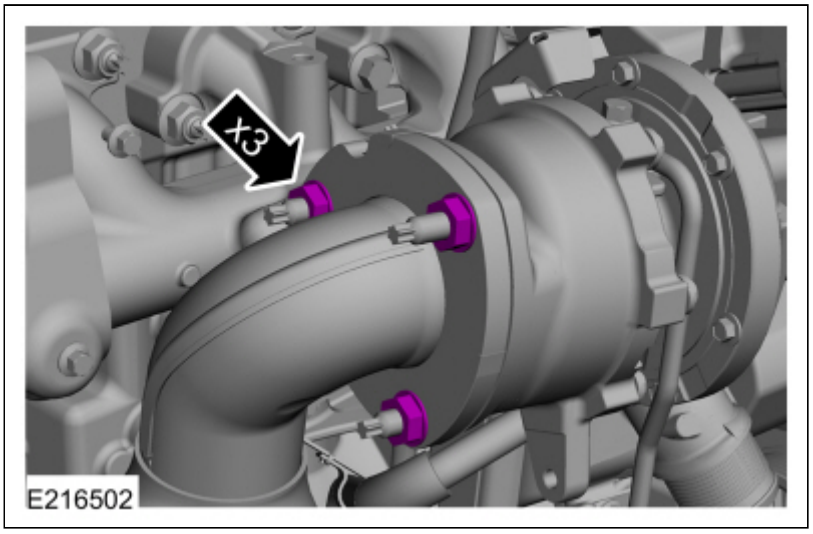
2.



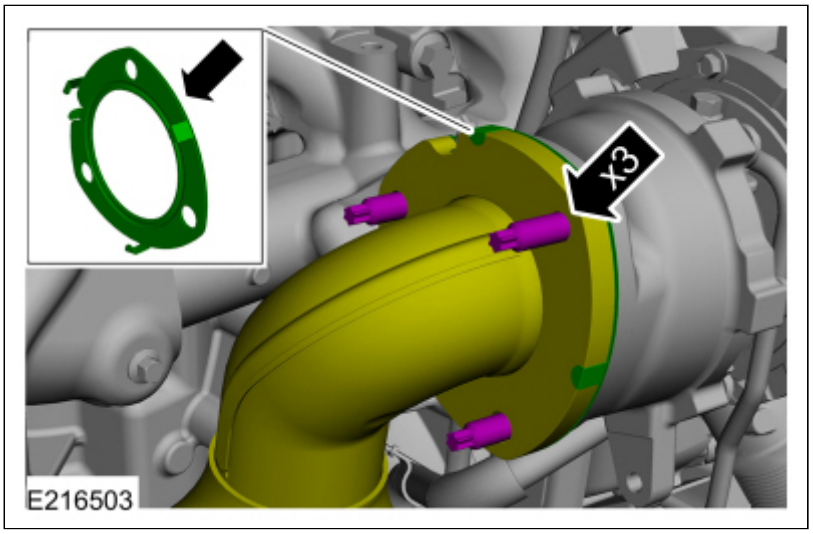
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



4. *Torque*: 48 Nm

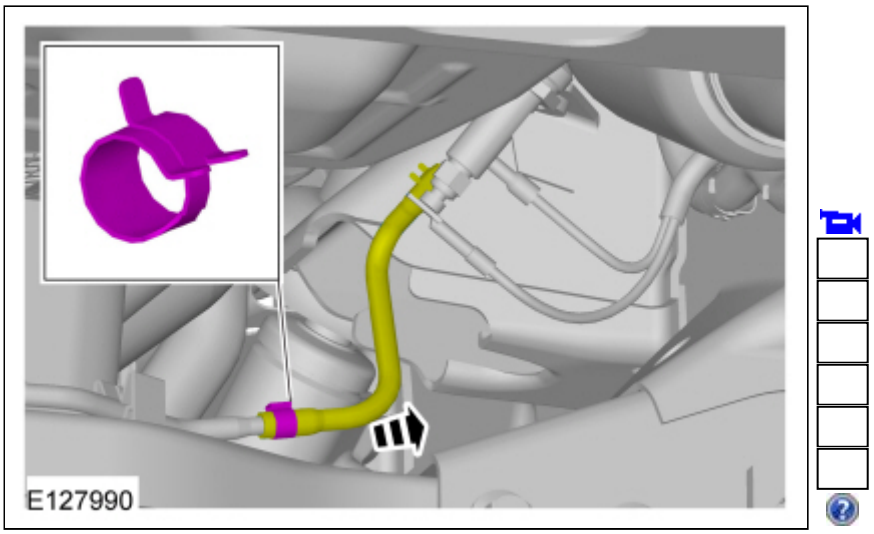


5. *Torque*: 25 Nm

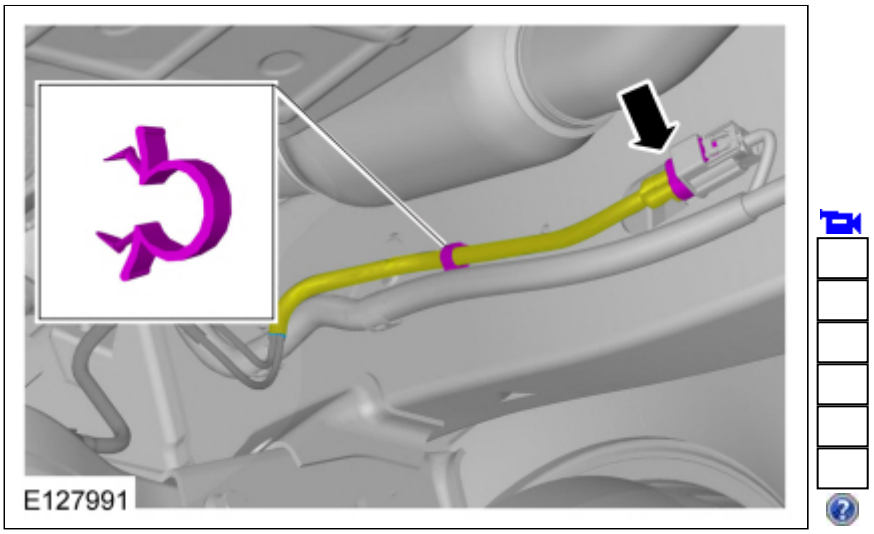


6. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

7.

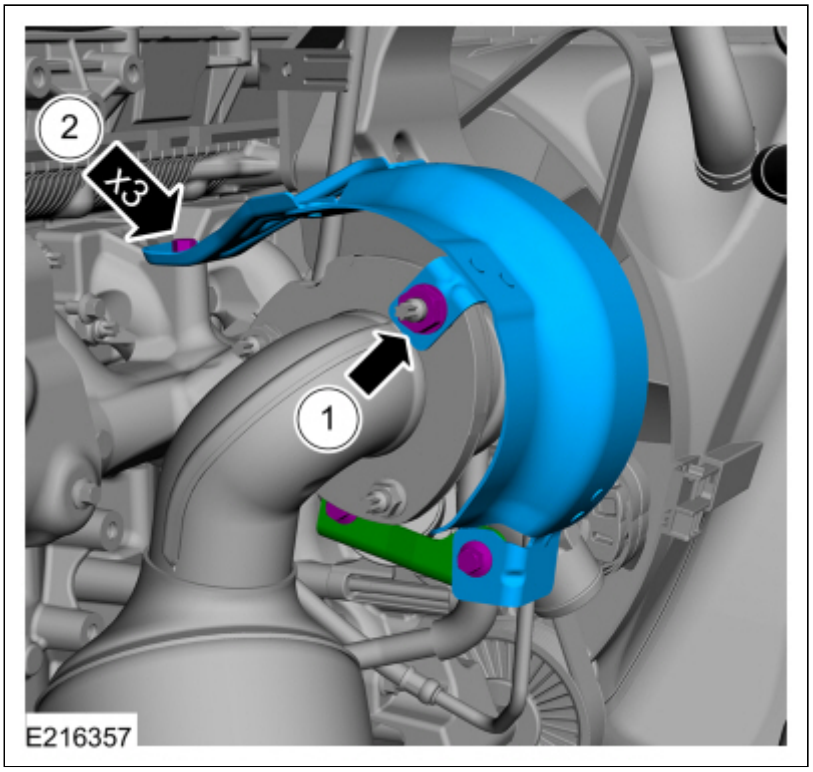


8.

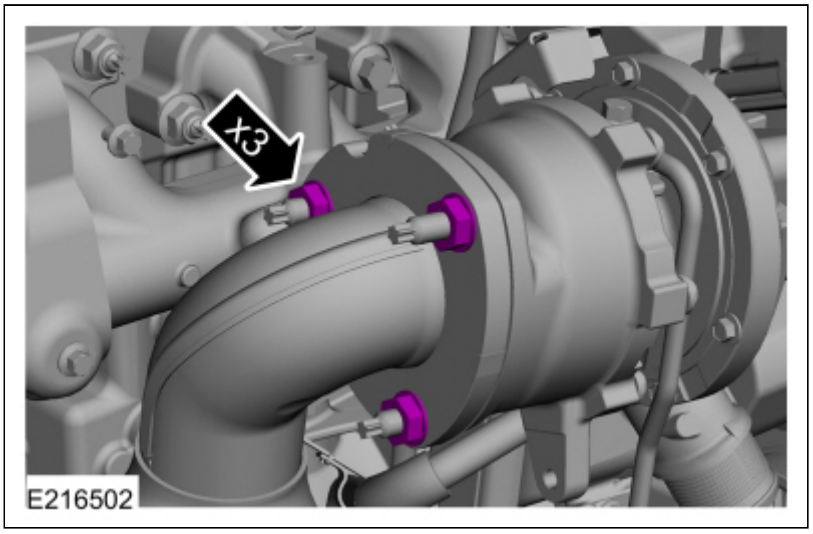


Vehicles without diesel particulate filter (DPF)

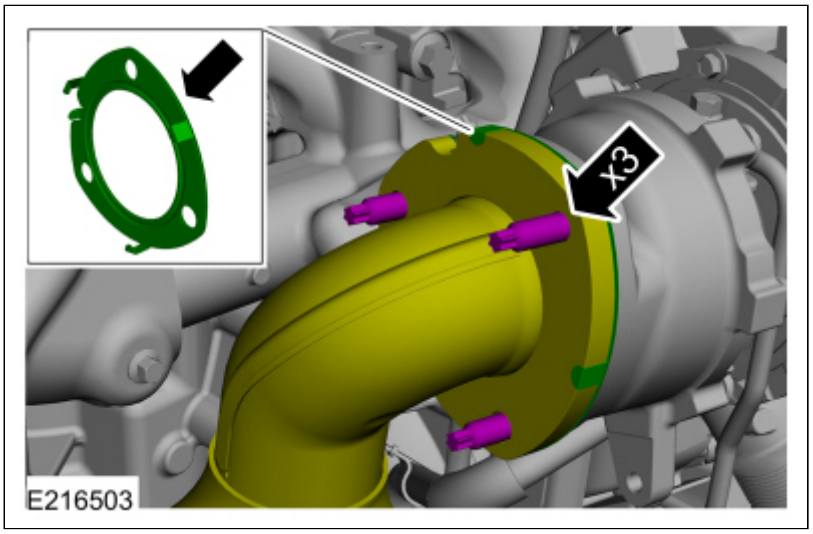
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



10. *Torque*: 48 Nm

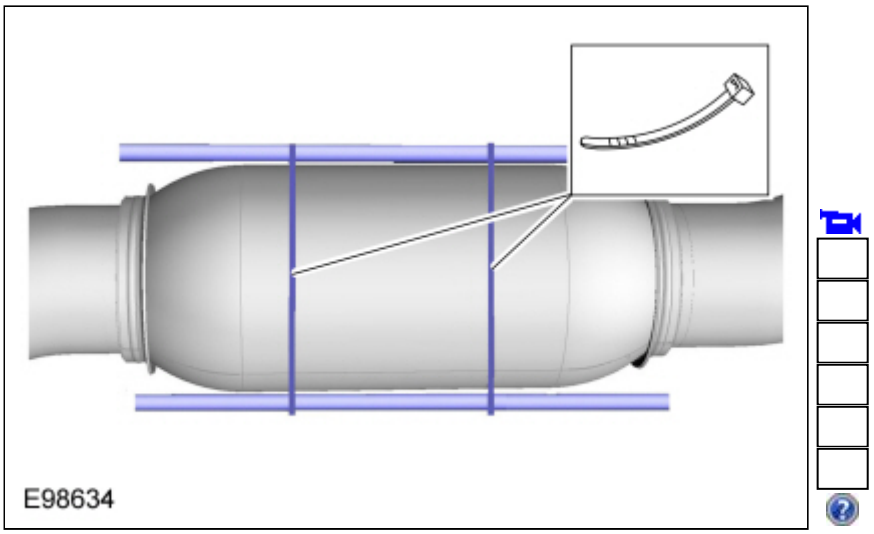


11. *Torque*: 25 Nm

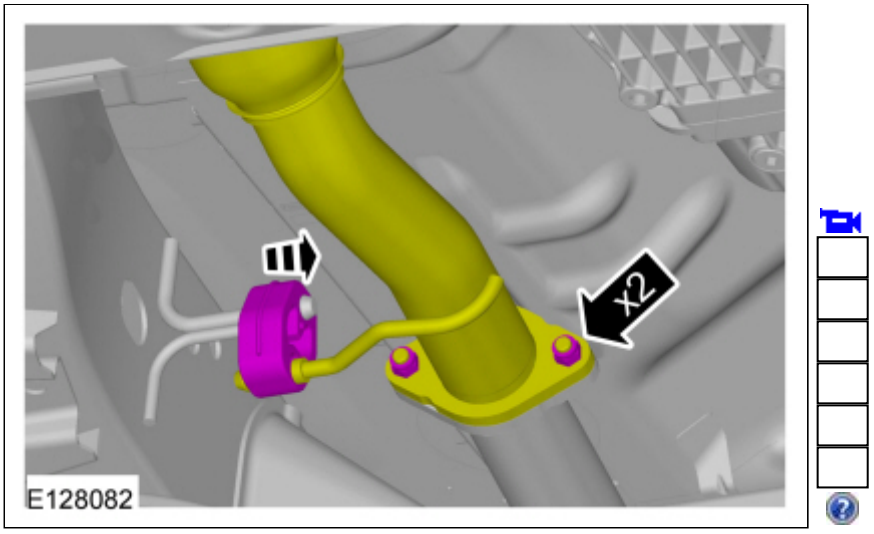


All vehicles

12. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



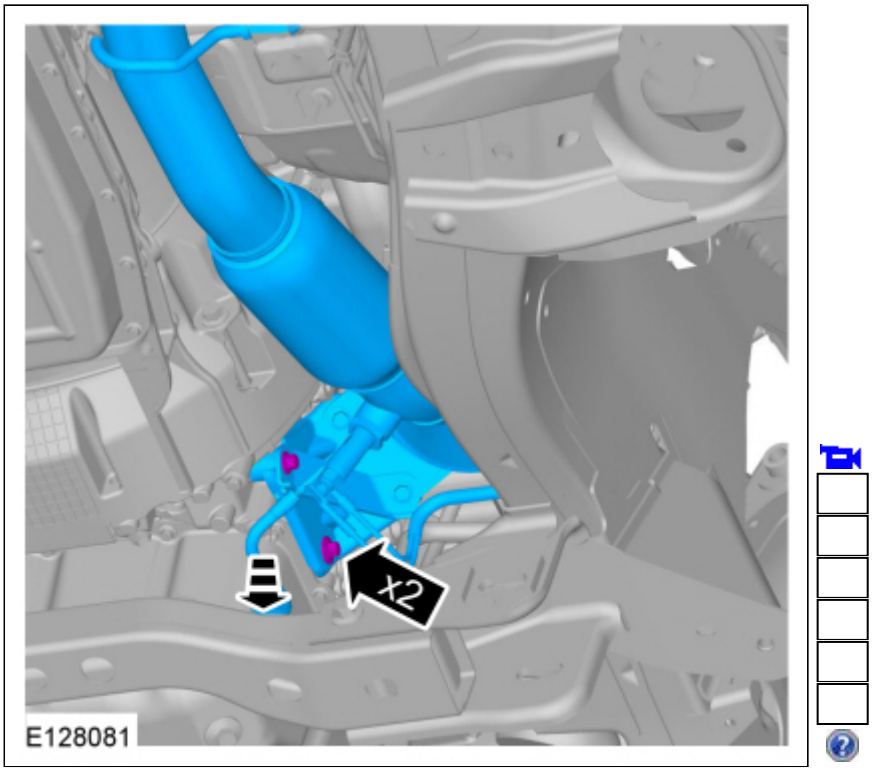
1. *Torque*: 48 Nm



Vehicles with diesel particulate filter (DPF)

14. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**

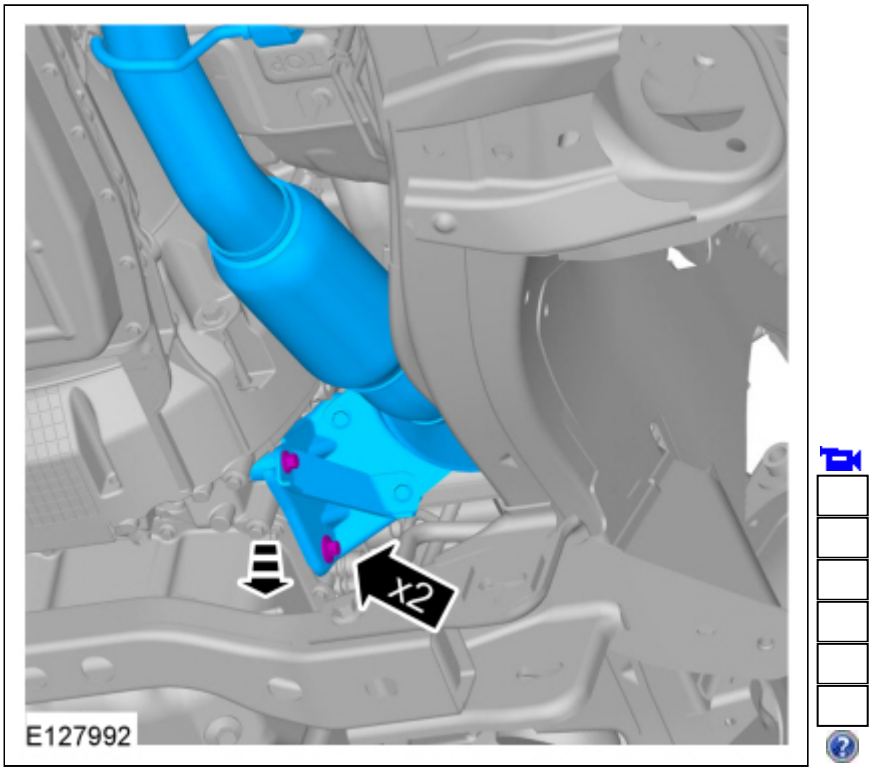
Torque: 25 Nm



Vehicles without diesel particulate filter (DPF)

15. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**

    Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Catalytic Converter - Emission Requirements: EURO Stage V LDT

Base Part Number: 5G232

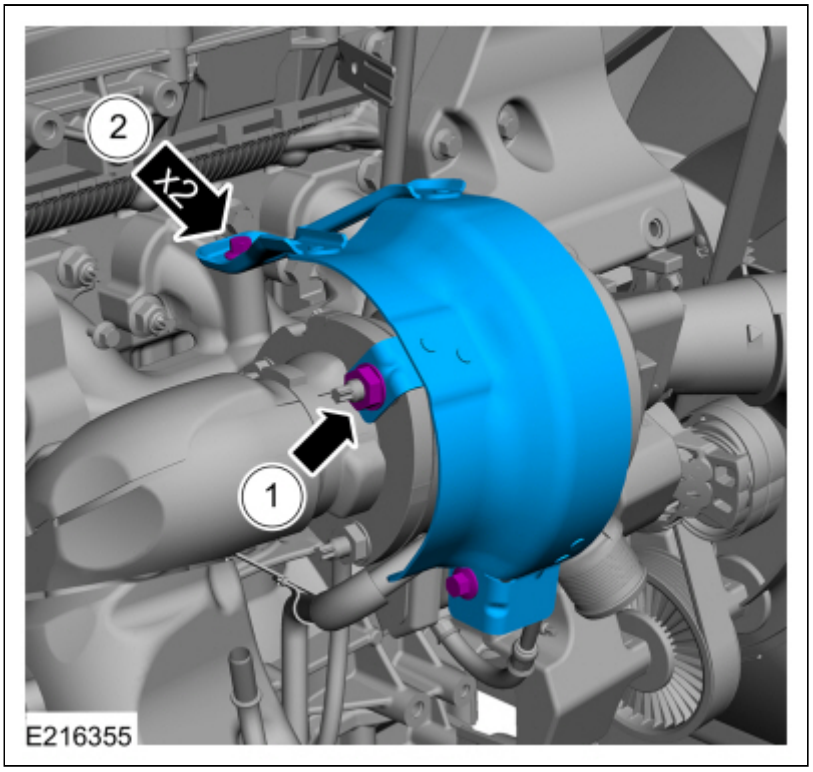
Removal

WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

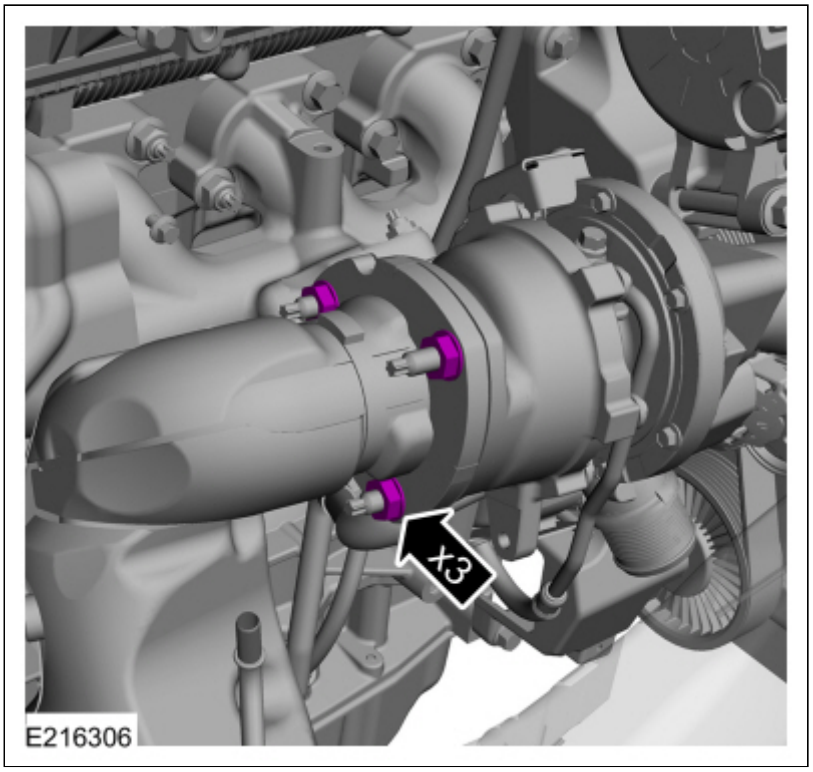
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

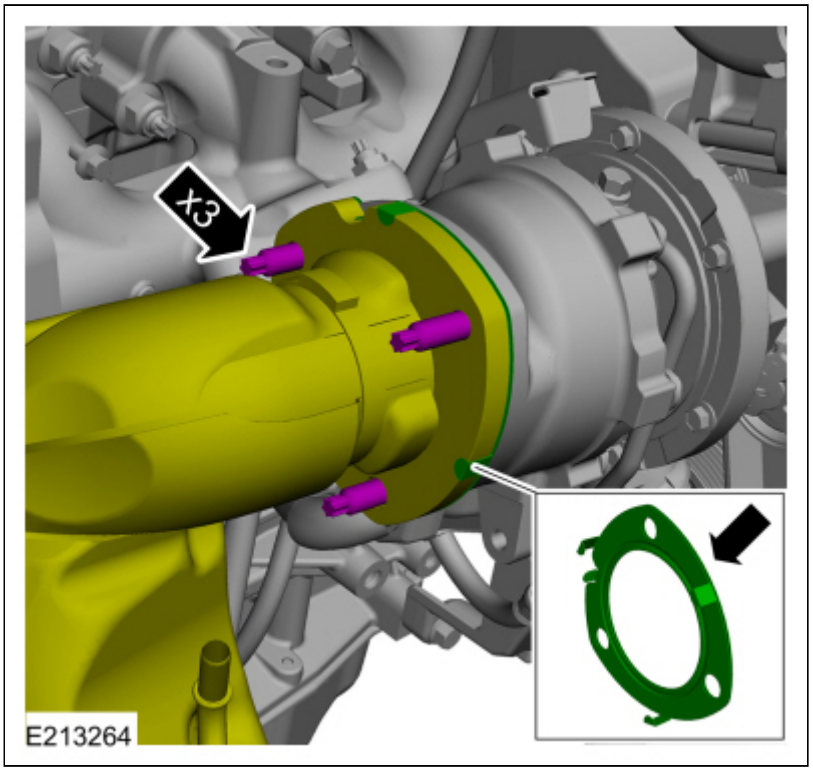
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



3. *Torque*: 48 Nm

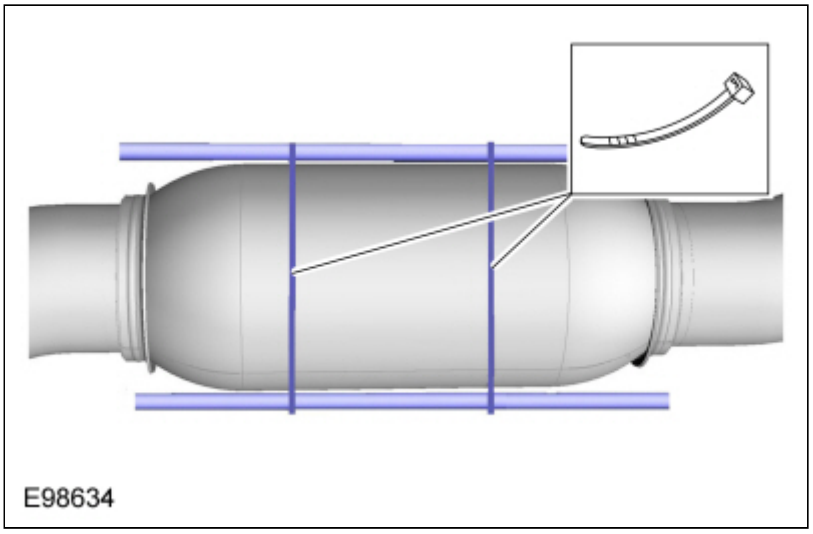


4. *Torque*: 25 Nm

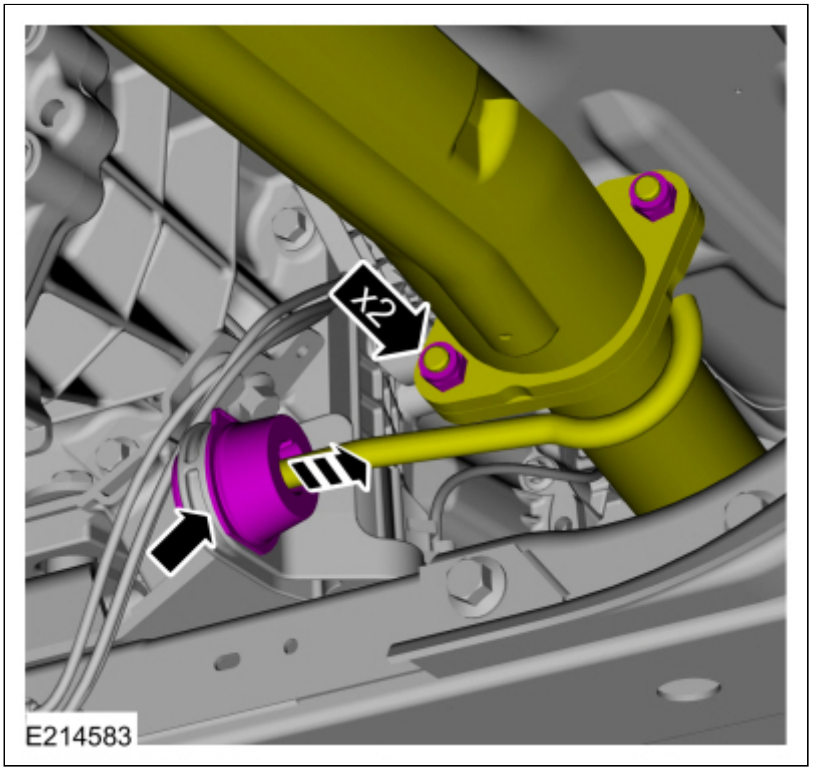


5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

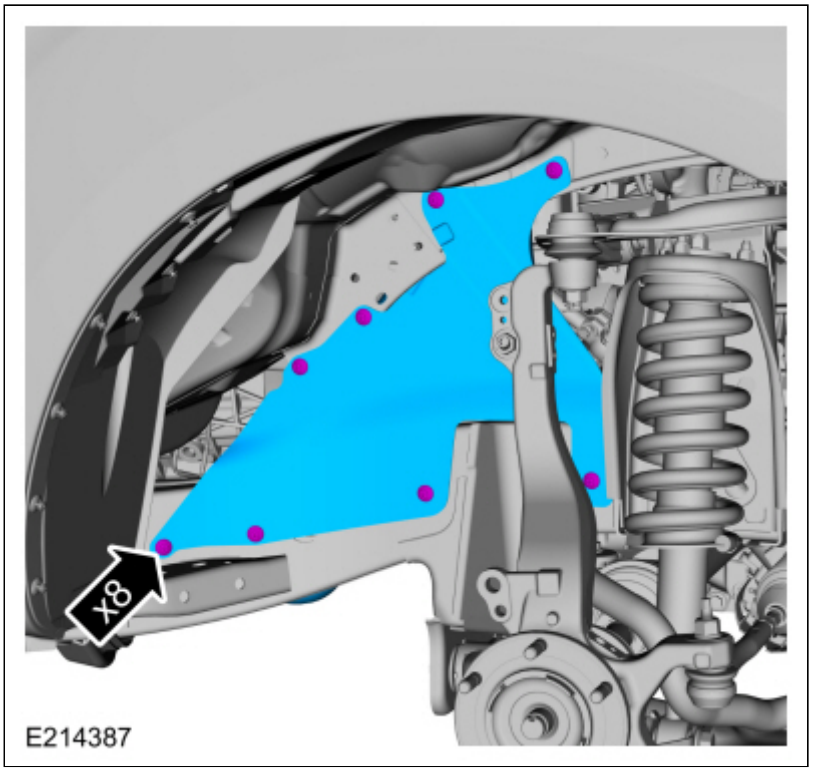
6. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



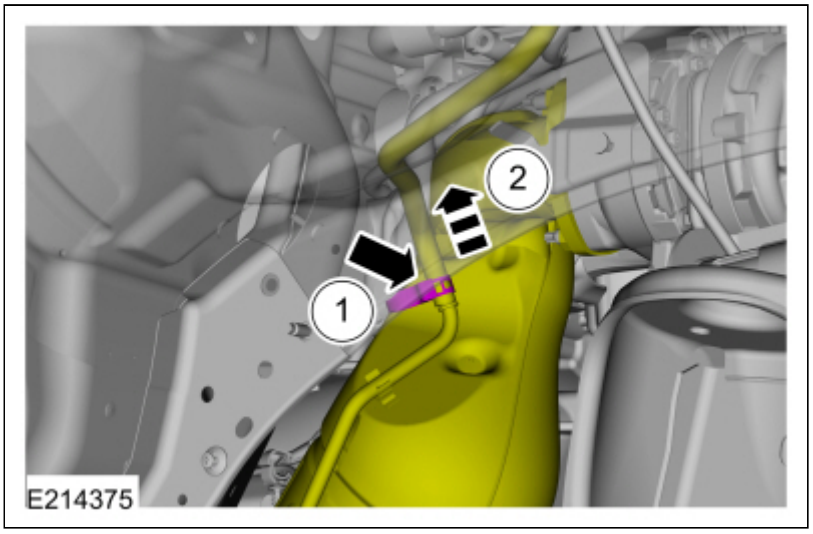
7. *Torque*: 48 Nm



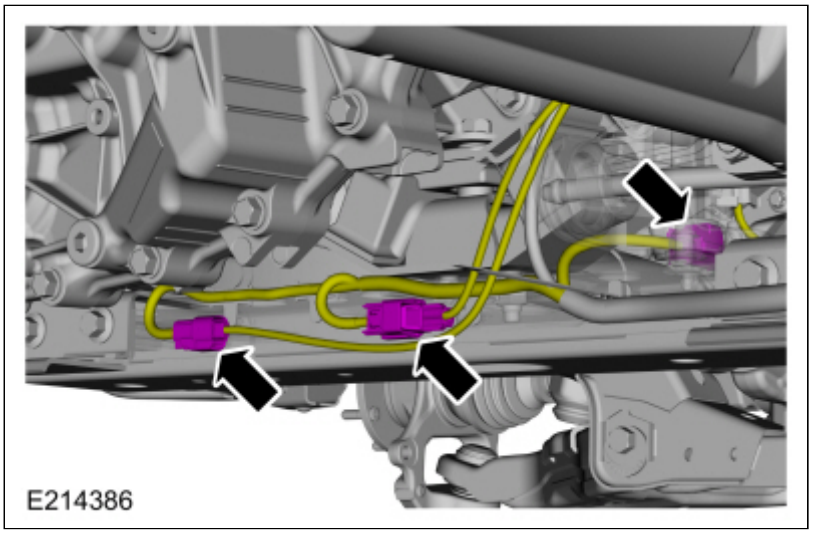
8.



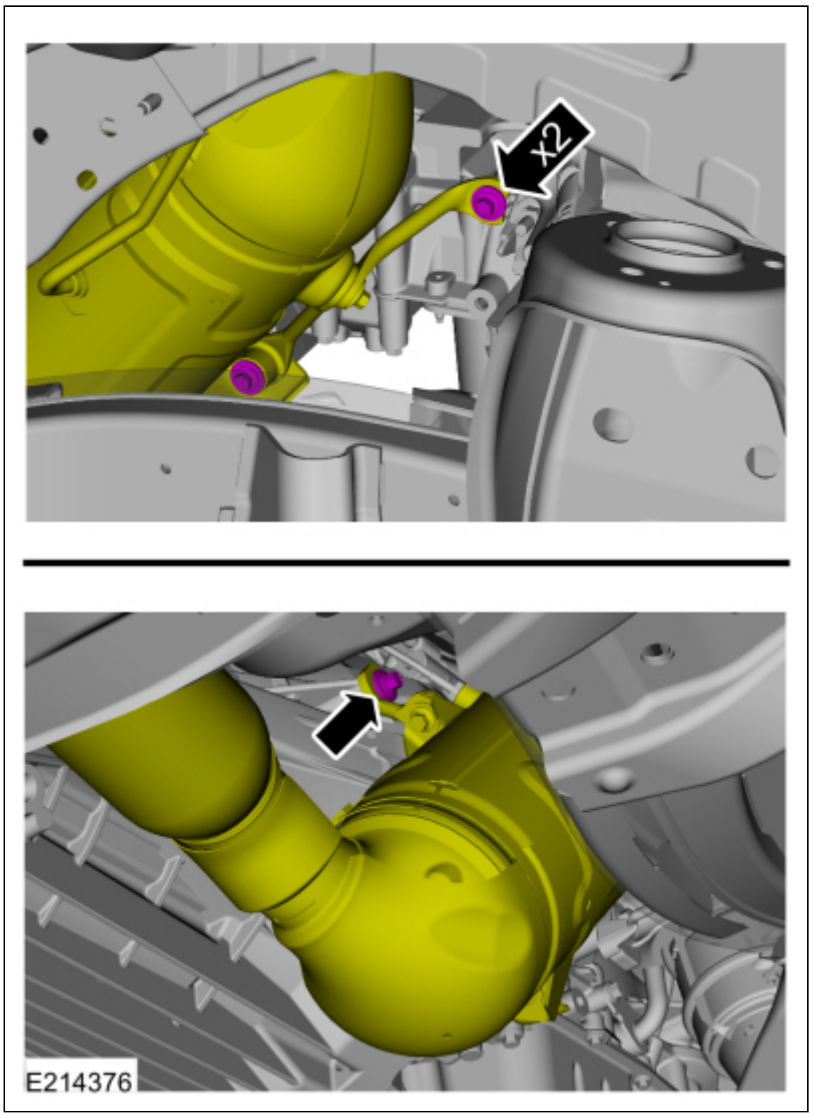
9.



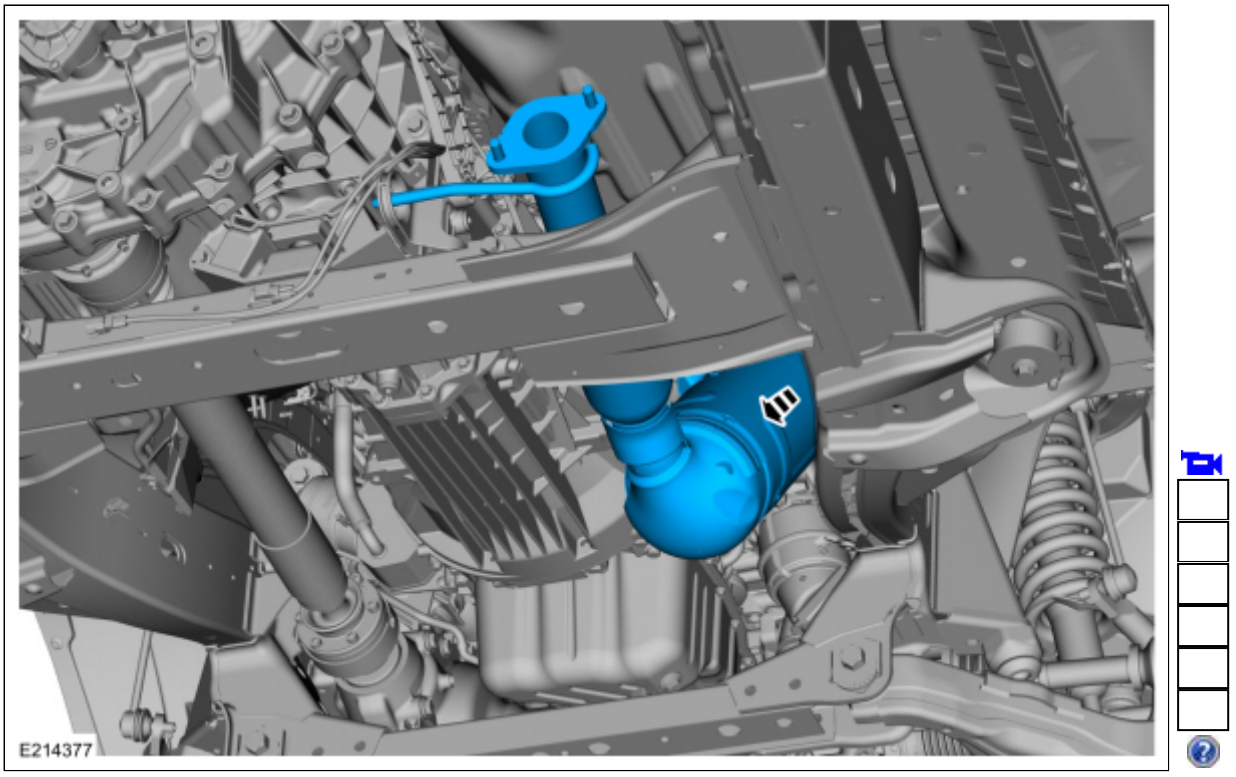
10.



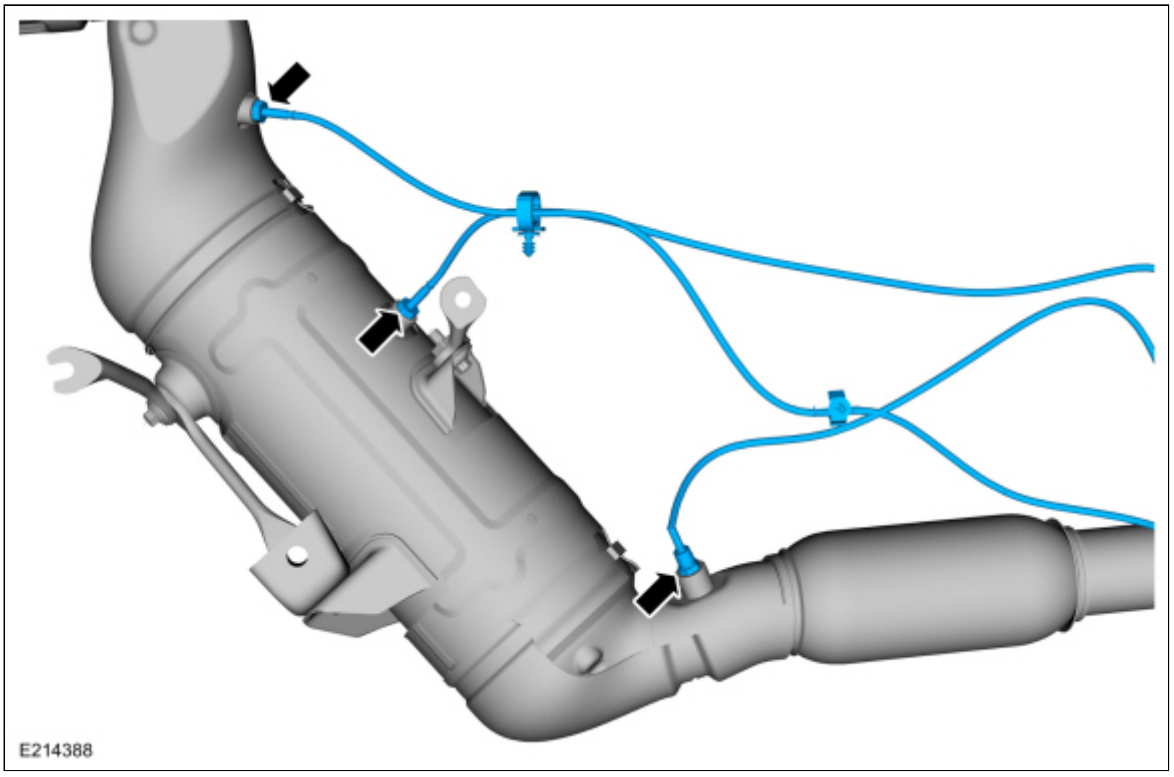
11. *Torque*: 25 Nm



12. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**



13.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

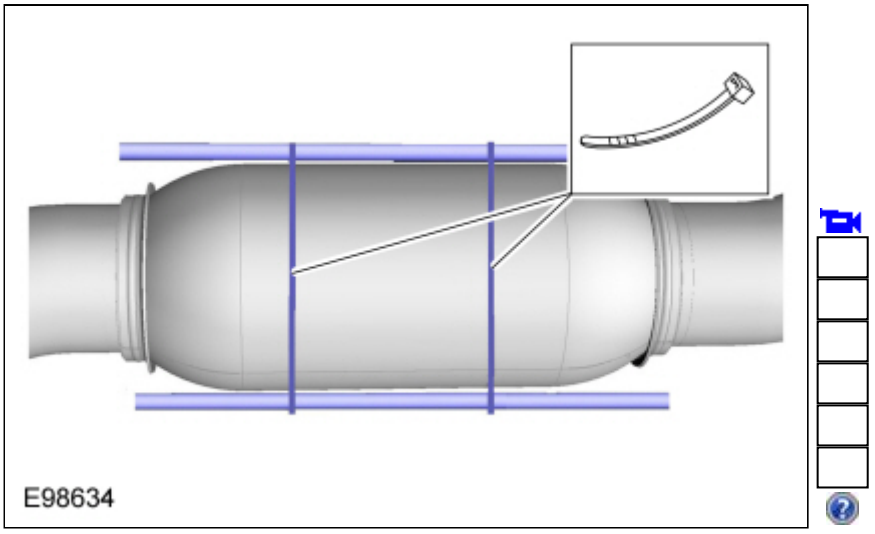
Diesel Particulate Filter (DPF)

Removal

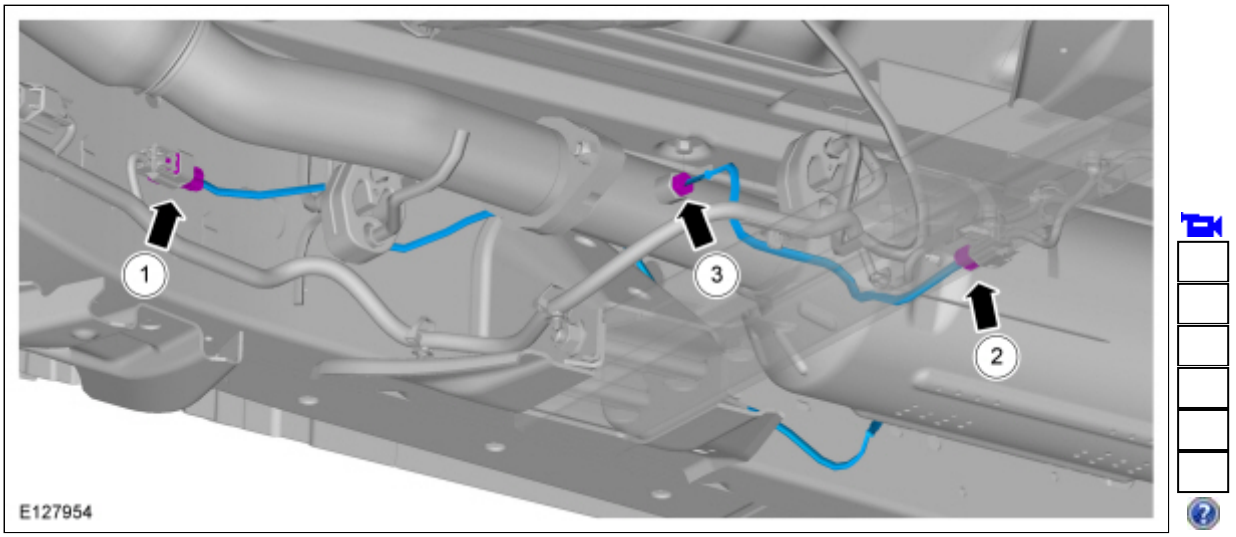
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

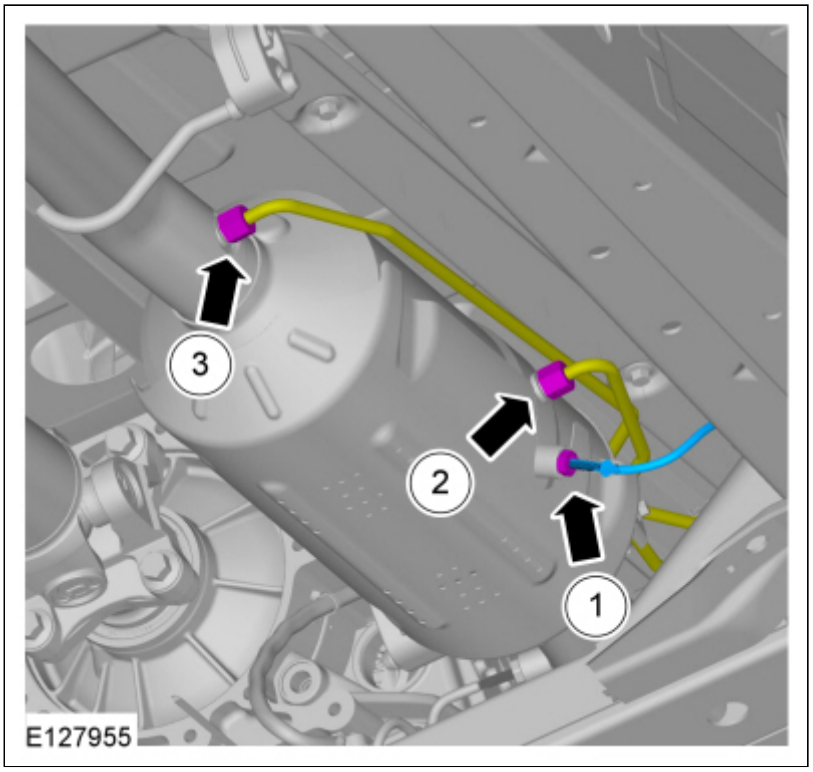
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



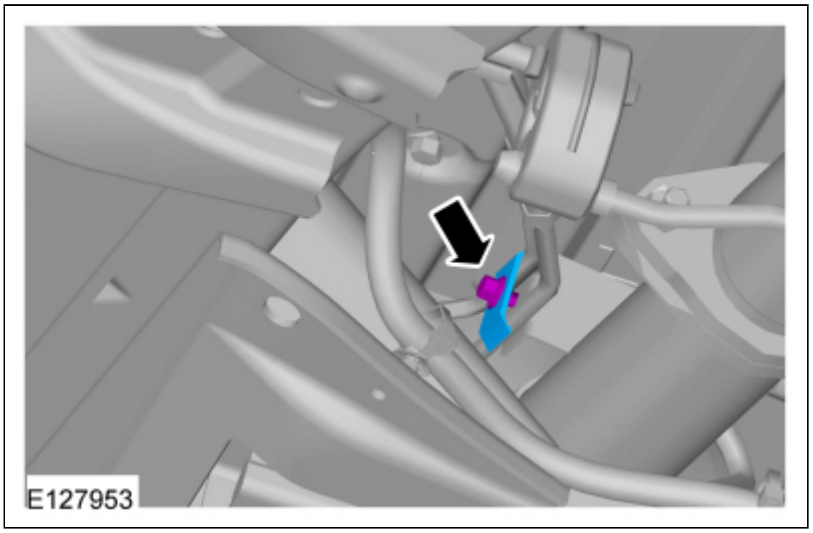
4. *Torque*: 40 Nm



1. *Torque*: 40 Nm
2. *Torque*: 40 Nm
3. *Torque*: 40 Nm

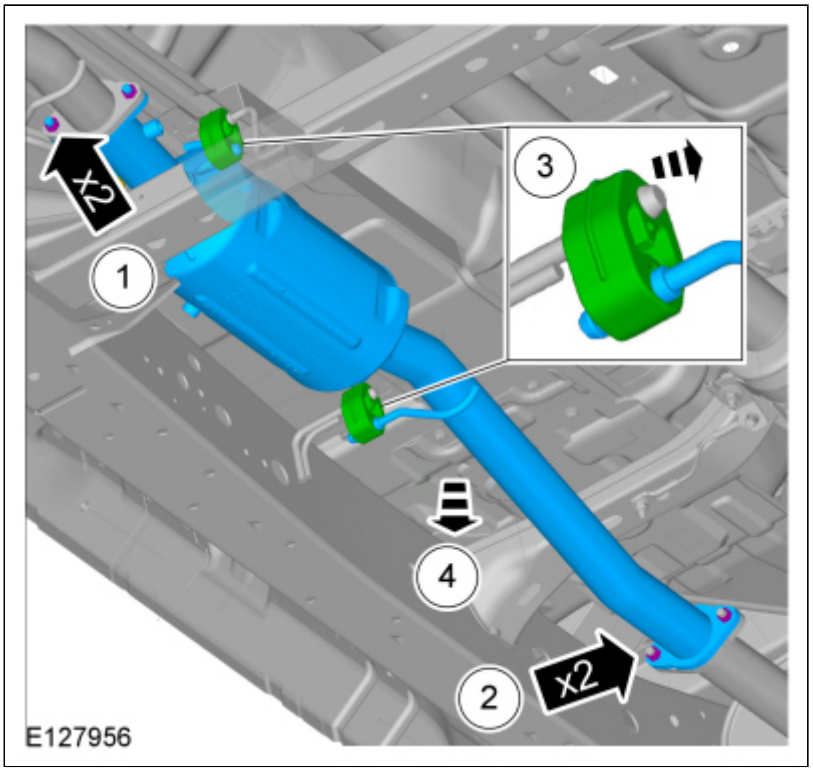


6. *Torque*: 40 Nm



7. **NOTE:** *Discard the gaskets at both the ends.*

    1. *Torque*: 47 Nm
    2. *Torque*: 47 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Diesel Particulate Filter (DPF) - Emission Requirements: EURO Stage V LDT

Removal

1. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Installation

1. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Exhaust Flexible Pipe

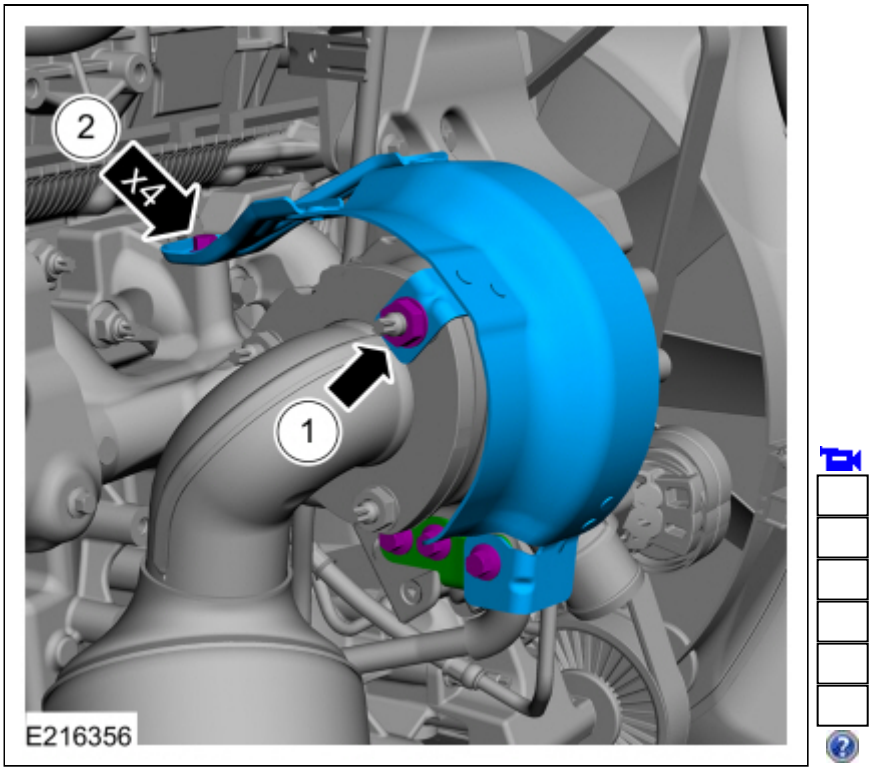
Removal

WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

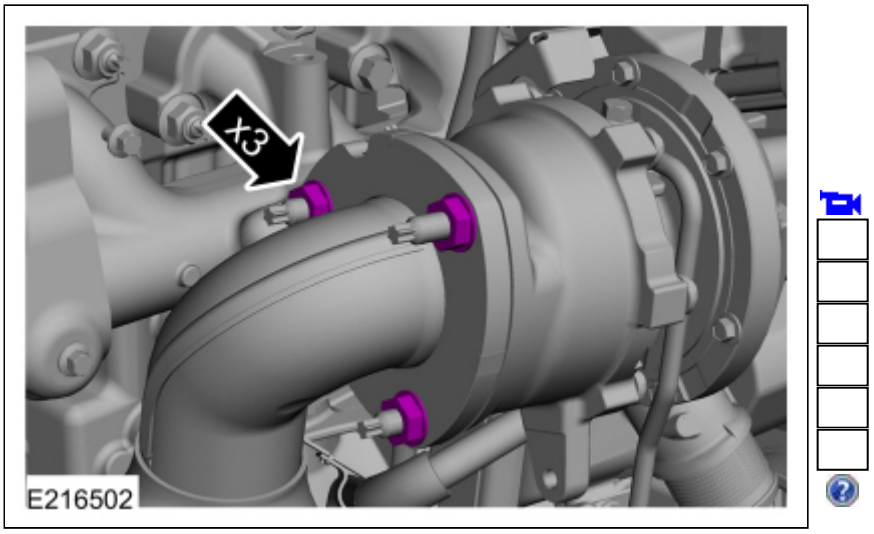
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

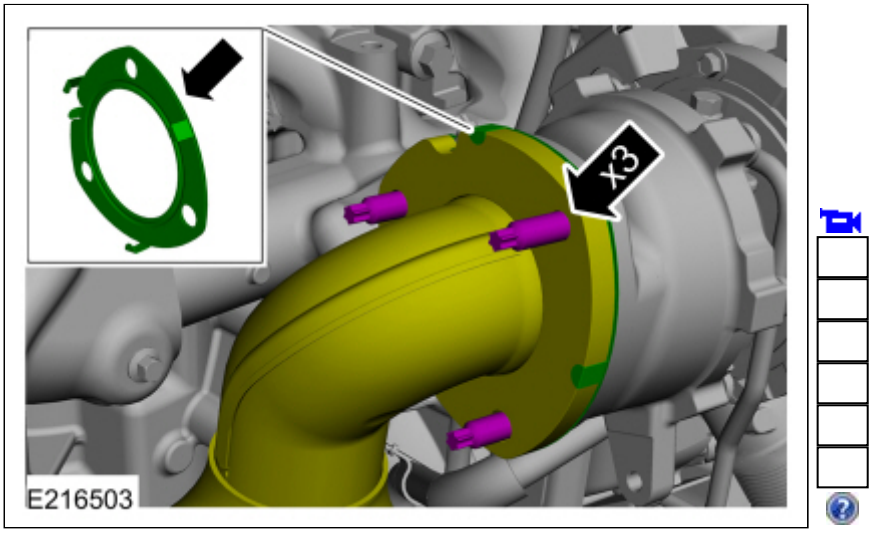
2. *Torque*:
   1: 48 Nm
   2: 23 Nm



3. *Torque*: 48 Nm

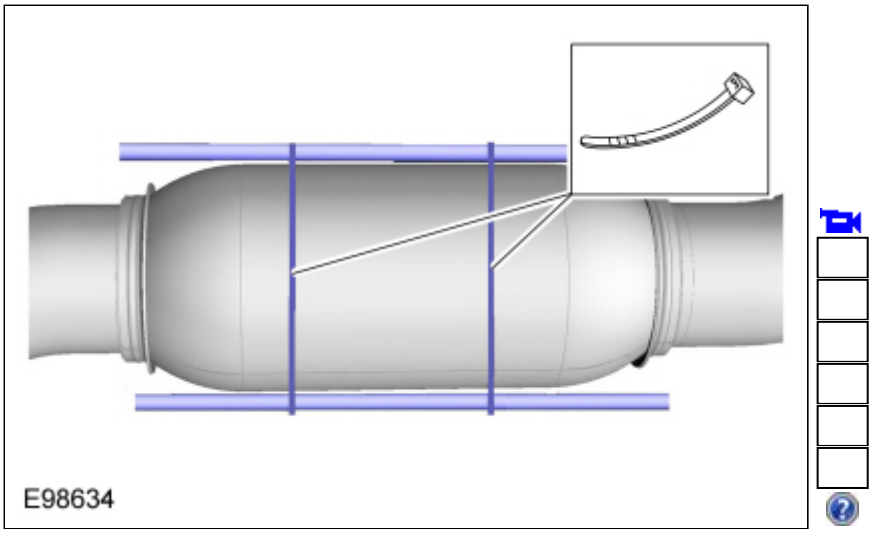


4. *Torque*: 25 Nm

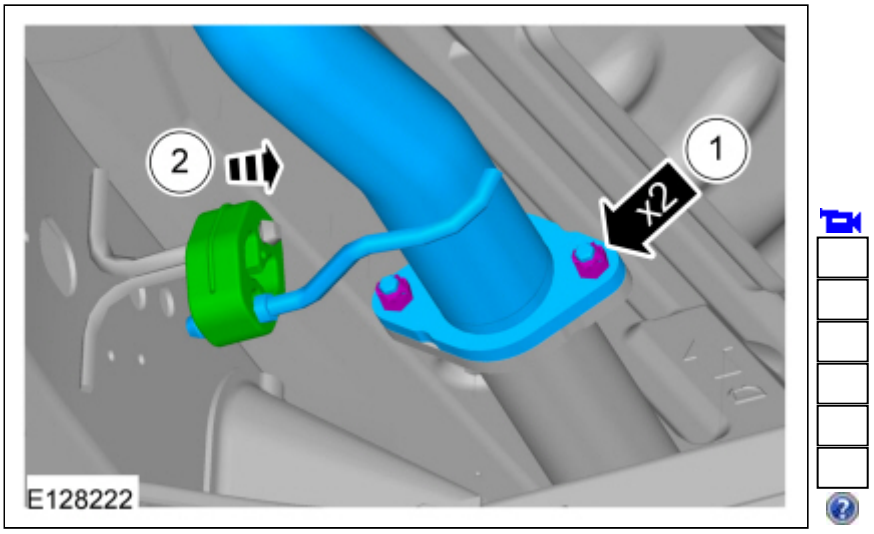


5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

6. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

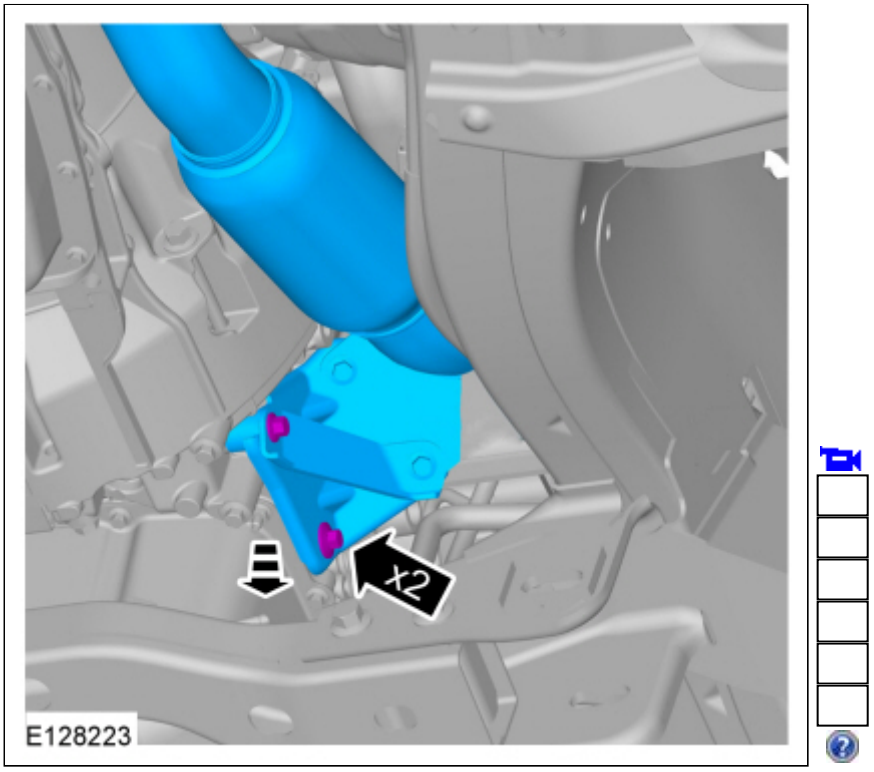


1. *Torque*: 48 Nm



8. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**

   Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

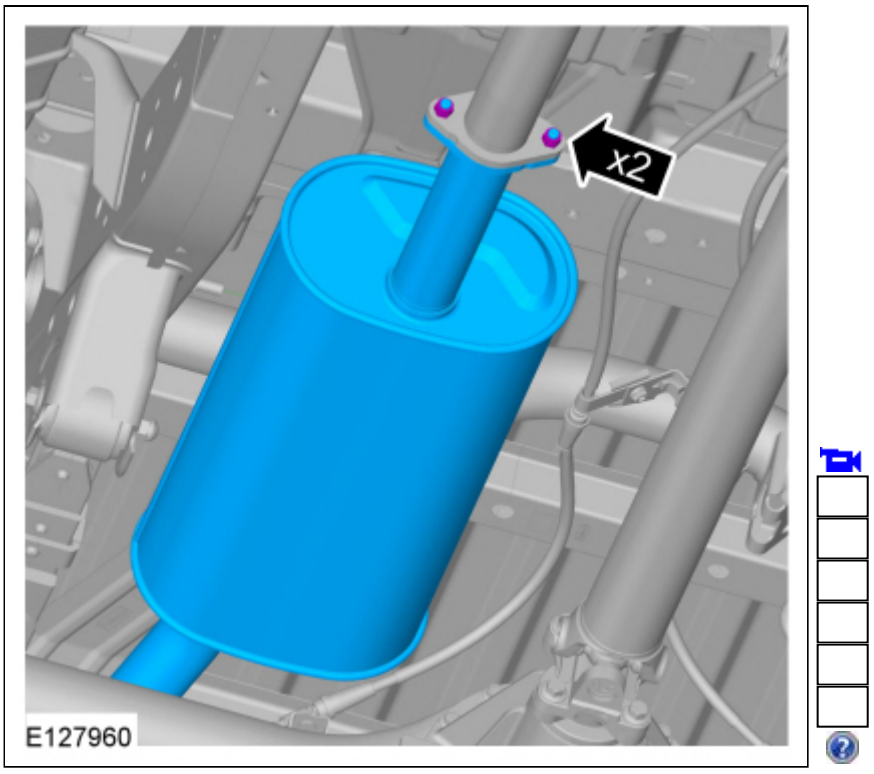
Rear Muffler

Removal

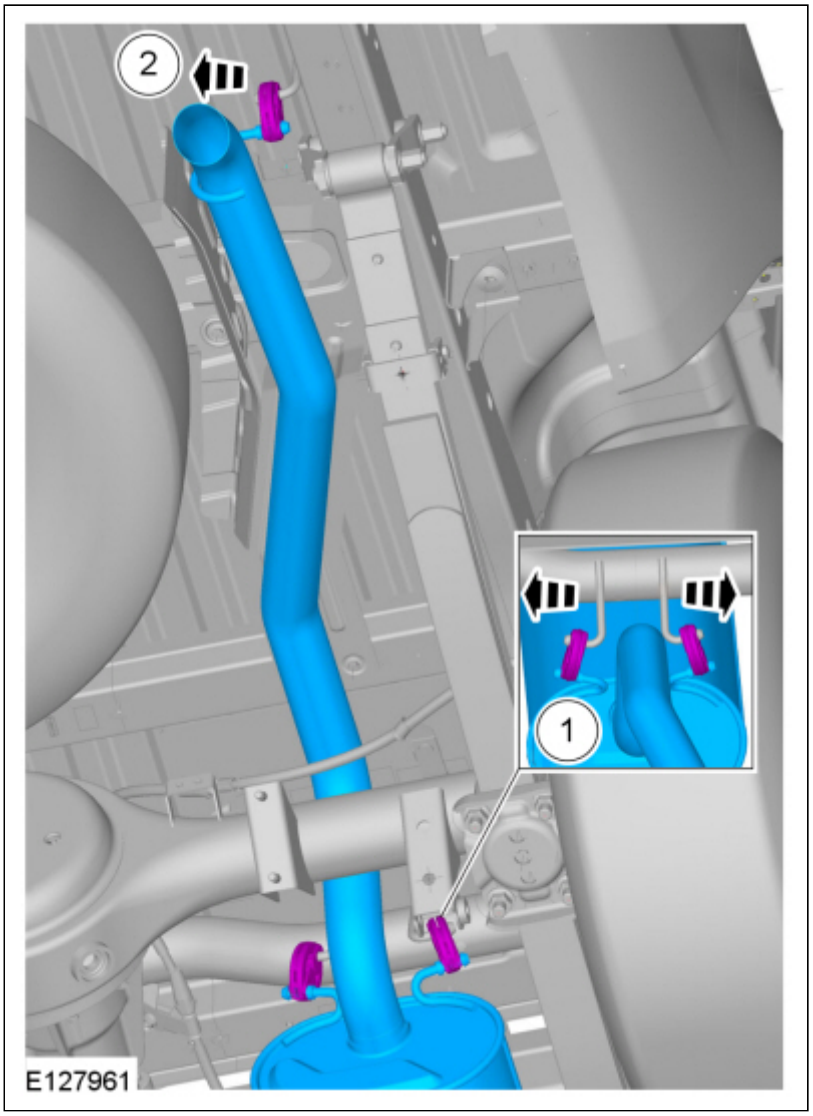
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

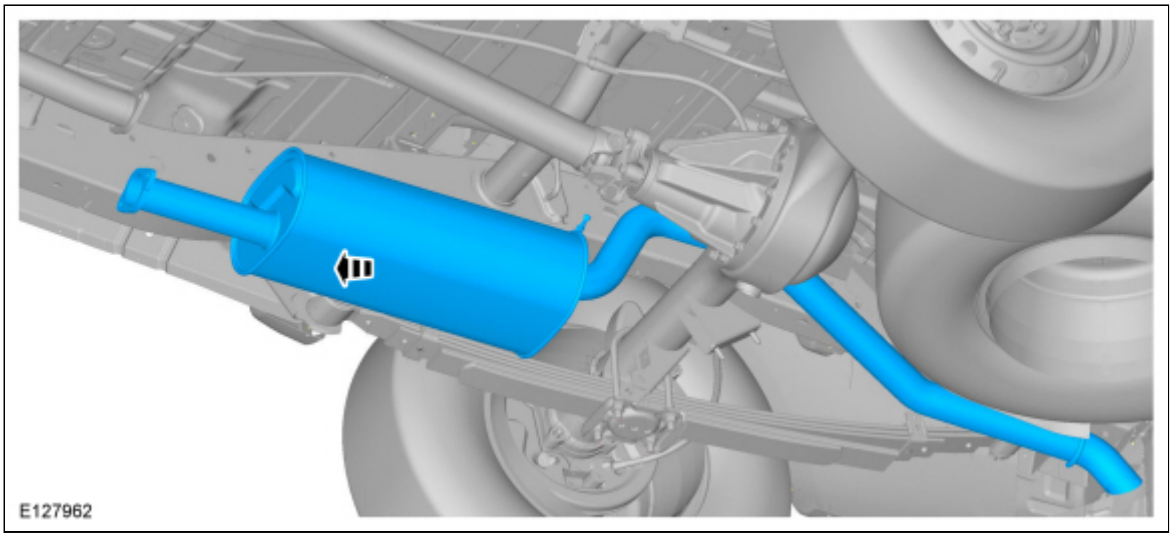
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. *Torque*: 48 Nm



4.



5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

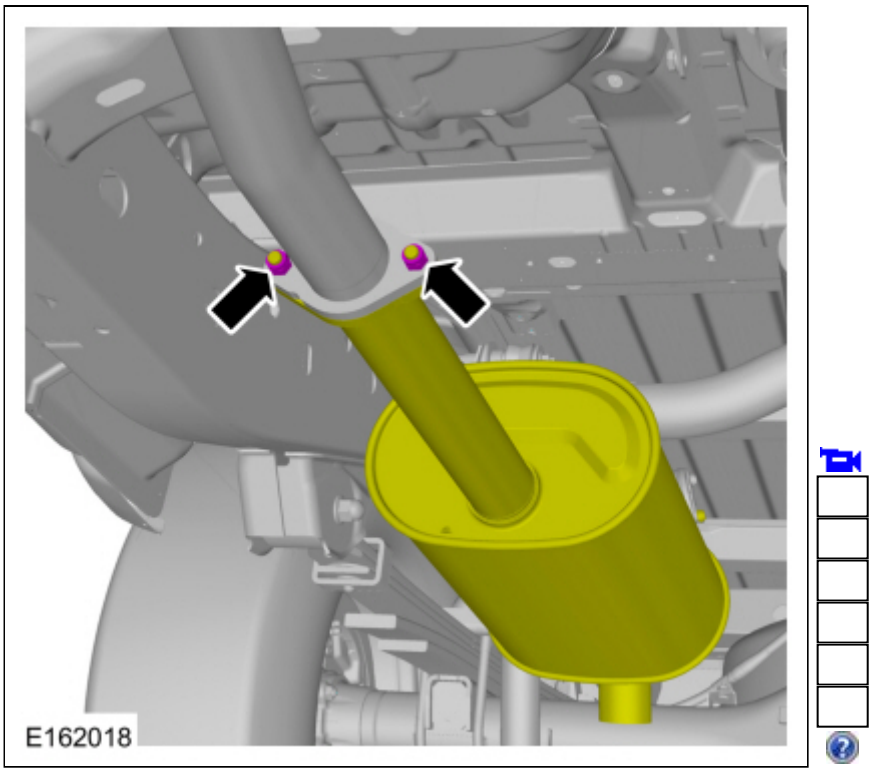
Rear Muffler - Base

Removal

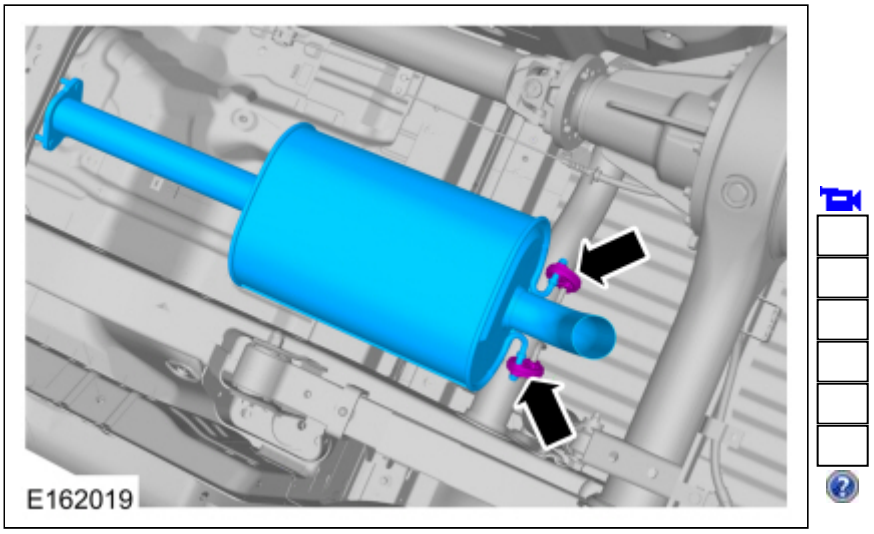
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. *Torque*: 48 Nm



4.



Installation

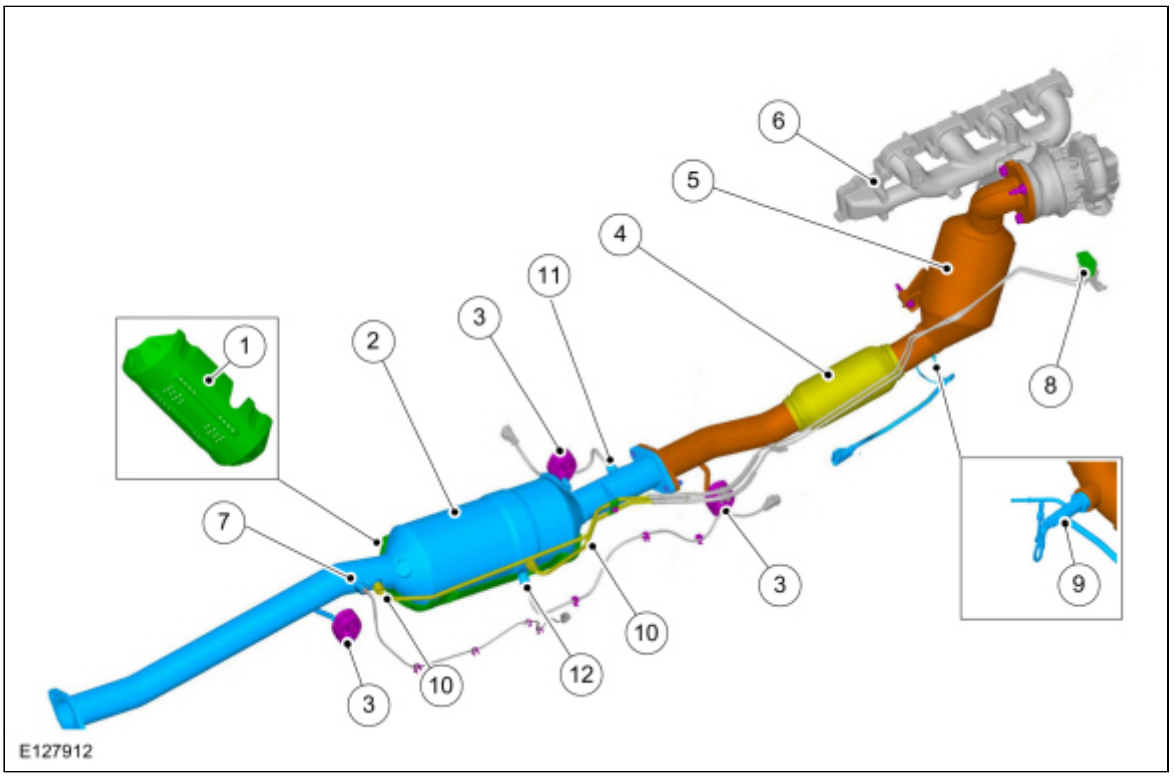
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Exhaust System - Component Location

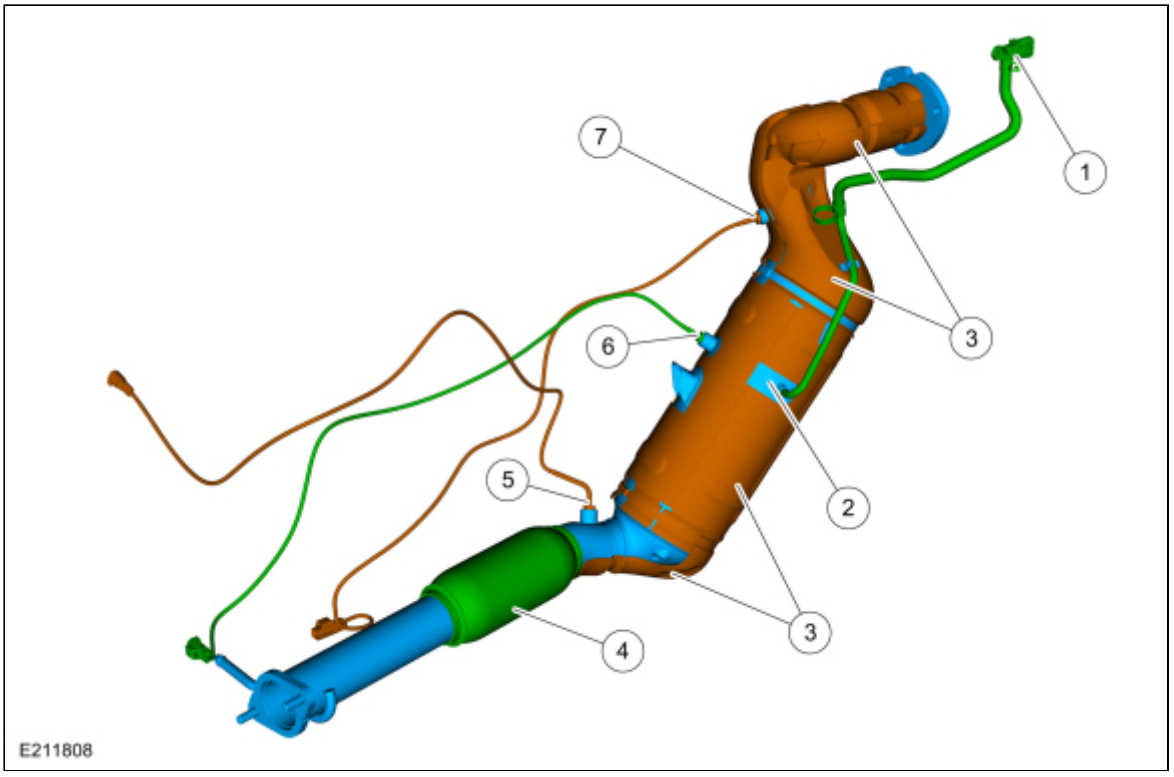
NOTE: *Exhaust flexible pipes are very fragile and must not be subjected to any load. They must be secured against twisting and bending during any work on the exhaust system.*

Vehicles with DPF & catalytic convertor



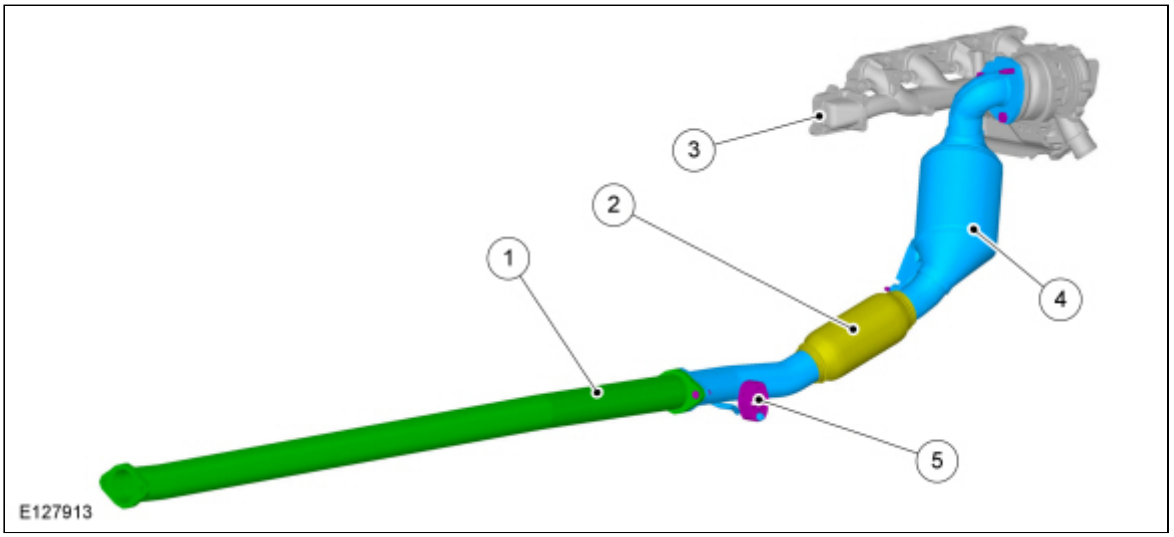
Item	Description
1	DPF Heat shield
2	DPF
3	Exhaust hanger insulator
4	Exhaust flexible pipe
5	Catalytic converter
6	Exhaust manifold
7	Temperature sensor
8	Pressure differential sensor
9	Fuel vapourizer
10	Pressure differential sensor lines
11	DPF temprature sensor

Vehicles with DPF



Item	Description
1	Differential pressure sensor
2	DPF
3	DPF heat shield
4	Exhaust flexible pipe
5	DPF temperature sensor
6	DPF temperature sensor
7	DPF exhaust gas temperature sensor

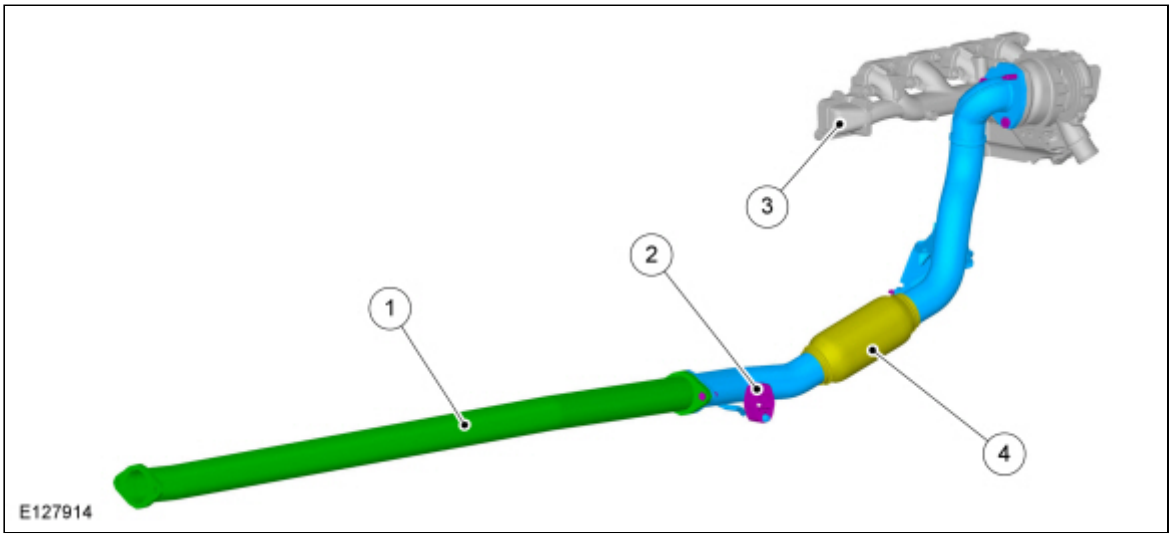
Vehicles with catalytic convertor



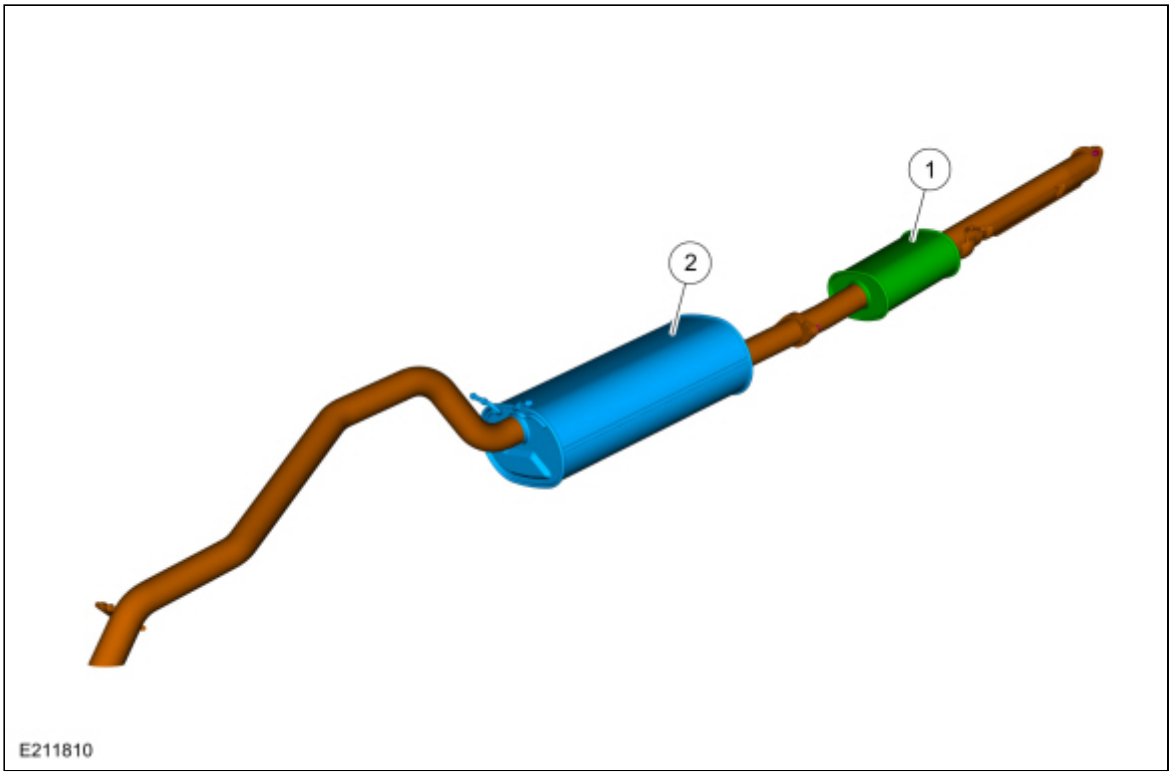
Item	Description
1	Exhaust link pipe
2	Exhaust flexible pipe
3	Exhaust manifold
4	Catalytic converter

5	Exhaust hanger insulator

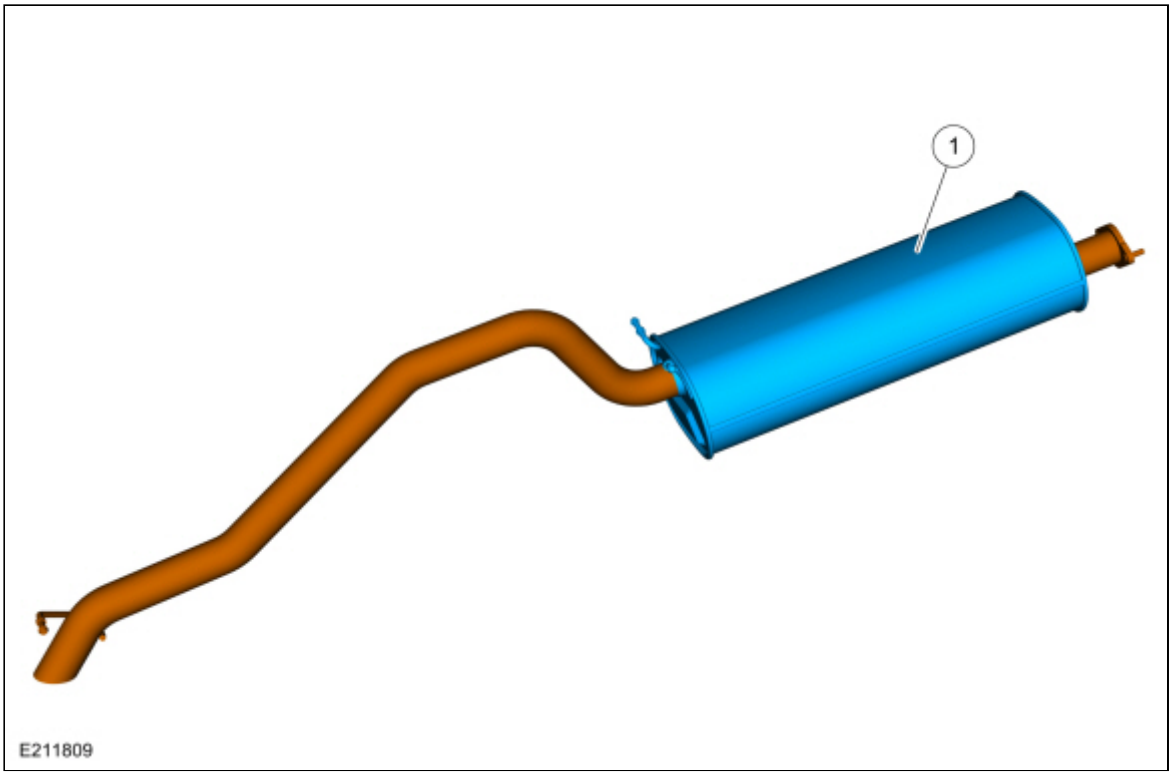
Vehicles without diesel particulate filter & catalytic convertor



Item	Description
1	Exhaust link pipe
2	Exhaust hanger insulator
3	Exhaust manifold
4	Exhaust flexible pipe



Item	Description
1	Front muffler
2	Rear muffler



Item	Description
1	Rear muffler

Copyright © 2016 Ford Motor Company

Exhaust System - Overview

Diesel Particulate Filter (DPF)

The Diesel Particulate Filter (DPF) system consists of the following components:

- DPF
- Pressure differential sensor
- Temperature sensor

The DPF reduces the pollution generated by diesel vehicles by filtering soot and ash particles out of the exhaust gases.

The PCM monitors the pressure differential sensor, DPF temperature sensors and other inputs to control the operation of the DPF system.

Soot particles can accumulate in the post DPF exhaust tailpipe. The accumulation of the soot particles should not be considered a concern, as the DPF is not 100% efficient at filtering the soot particles.

The amount of matter trapped in the DPF is monitored using the pressure sensor which monitors the exhaust pressure before the DPF. As the DPF fills with soot, exhaust flow through it is restricted.

When this occurs the pressure differential in the exhaust before and after the DPF will increase which will indicate to the PCM that a DPF regeneration is required to clean it.

Diesel Particulate Filter (DPF) Regeneration

During the regeneration process, it is possible that white smoke may be emitted from the exhaust tailpipe. This is an inherent by-product of the regeneration process and should not be considered a concern.

The pressure differential sensor is connected to the DPF by the pressure differential sensor line to monitor the exhaust pressure. The pressure differential sensor converts these measurements to a signal voltage, which is then sent to the PCM. The PCM uses the pressure differential sensor information to determine whether to carry out a regeneration.

The PCM will choose the optimum time for the regeneration of the DPF. Under normal operating conditions the regeneration process occurs when the PCM has calculated that the DPF requires regeneration and that predetermined vehicle conditions are met (for example coolant temperature, vehicle speed and engine load).

During the DPF regeneration the temperature of the exhaust gas increases to greater than 550C at the DPF. At this temperature soot burns. Soot particulates that may have accumulated in the diesel particulate filter are burned and the ash is trapped in the diesel particulate filter.

The ash particulates that remain in the diesel particulate filter are mainly comprised of metallic compounds generated during combustion and from corrosion in the exhaust system.

DPF Manual Regeneration

When the DPF becomes blocked a high pressure DTC sets in the PCM, the MIL is illuminated and limp home mode activated.

A blocked DPF can be a result of:

- Excessive soot particles production
- Multiple failed regeneration events
- Mechanical or electrical failure of a related system or sub-system (for example EGR valve stuck open, charge air system leak, fuel injectors)

The DPF manual regeneration function can be used to clear the soot particles from the DPF manually. To do this the Integrated Diagnostic System (IDS) must be connected to the vehicle select Powertrain> Service Functions>PCM>Diesel Particulate Filter Static Regeneration. For additional information, refer to IDS.

Copyright © 2016 Ford Motor Company

Exhaust System

Symptom Chart(s)

Symptom Chart: Exhaust System

Verify the customer concern. Inspect the components of the exhaust system for obvious signs of damage or other mechanical concerns using the following chart.

Visual Inspection Chart - Mechanical

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Loose or damaged heat shields

Verify the exhaust system is installed correctly, with clamps correctly located and tightened to specifications. If the fault is not visually evident, determine the symptom. GO to Symptom Chart below.

Symptom Chart

Condition	Possible Sources	Actions
Vehicle has low or no power — vehicle performance complaint	• Exhaust pipe pinched or crushed • Damaged catalytic converter • Loose obstruction in exhaust	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	Restricted exhaust (possible frozen condensate in muffler)	CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST the vehicle for normal operation. If the concern is still present, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Burning smell — usually occurs at idle, with possible traces of smoke	• Foreign material caught in exhaust system • Missing heat shields	INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary.
Odor — described as a sulfur or rotten egg smell	• Catalytic converter • Excessive sulfur	At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE the customer no repair is required.

	content in fuel	
	• Rich fuel conditions • Misfire conditions	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Visible rust on surface of exhaust pipes	Catalytic converter/exhaust system	Surface rust is a characteristic of materials used on exhaust systems. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, the condition is normal.

Symptom Chart: NVH

Symptom Chart

Condition	Possible Sources	Actions
Rattle, squeaks or buzz type noise — from the bottom of the vehicle	Loose or damaged heat shield	INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system components. If any heat shields are loose, INSTALL worm gear clamp and tighten to specification. If the heat shields are missing or a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary.
	Loose or damaged exhaust isolators	VERIFY the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Damaged exhaust isolator hanger bracket	INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN the bolts to specification or INSTALL new components as necessary.
	Loose or damaged catalytic converter or muffler	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Drone or clunk type noise — from the bottom of the vehicle	Loose or damaged exhaust isolators	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Whistles, boom, hum or ticking type noise — noise tends to change as the engine warms. The noises are often accompanied by exhaust fumes	Exhaust system leak	INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which indicates exhaust leakage at that point. To magnify a small leak, have an assistant hold a shop towel over the tail pipe outlet while listening for a leak. REPAIR or INSTALL new components as necessary.
	Catalytic converter	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.

	Exhaust muffler/resonator drain hole enlarged due to corrosion	CONFIRM the drain holes are the noise source. INSTALL new components as necessary.
Hissing or rushing noise — high frequency sound and the vehicle performance is unaffected	Exhaust system Exhaust flow through pipes	CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
Pinging noise — occurs when exhaust system is hot, engine turned off	Catalytic converter/exhaust system	Cool down pinging is a result of the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
Vibration — occurs at idle and at low speeds. Also accompanied by a clunk or buzz type noise	Loose or damaged exhaust isolator	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Loose or damaged exhaust isolator hanger brackets	INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary.
	Exhaust system grounded to chassis	REPAIR or INSTALL new components as necessary.
Engine drumming noise — normally accompanied by vibration	Damaged or misaligned exhaust system	INSPECT the exhaust system for loose or damaged fasteners or isolators. REPAIR or INSTALL new components as necessary.
Sputter type noise — noise worse when cold, lessens or disappears when the vehicle is at operating temperature	Damaged or worn exhaust system	INSPECT the exhaust system for leaks or damage. REPAIR as necessary.
Thumping noise — from the bottom of the vehicle, worse during acceleration	Misaligned exhaust system	CHECK the exhaust system to chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary.
Engine vibration — is felt with increases and decreases in engine rpm	Strain on exhaust system isolators	REPAIR or INSTALL new components as necessary.
Drumming noise — occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent	Exhaust system vibration excites the body resonances inducing interior noise	REPAIR or INSTALL new components as necessary.

Copyright © 2016 Ford Motor Company

Catalytic Converter

Base Part Number: 5G232

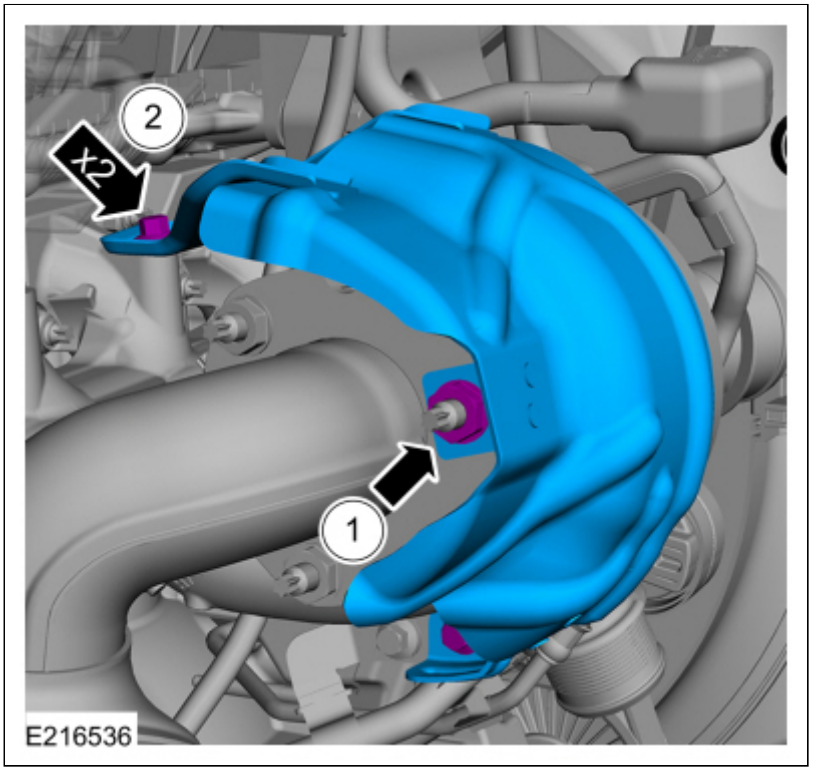
Removal

WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

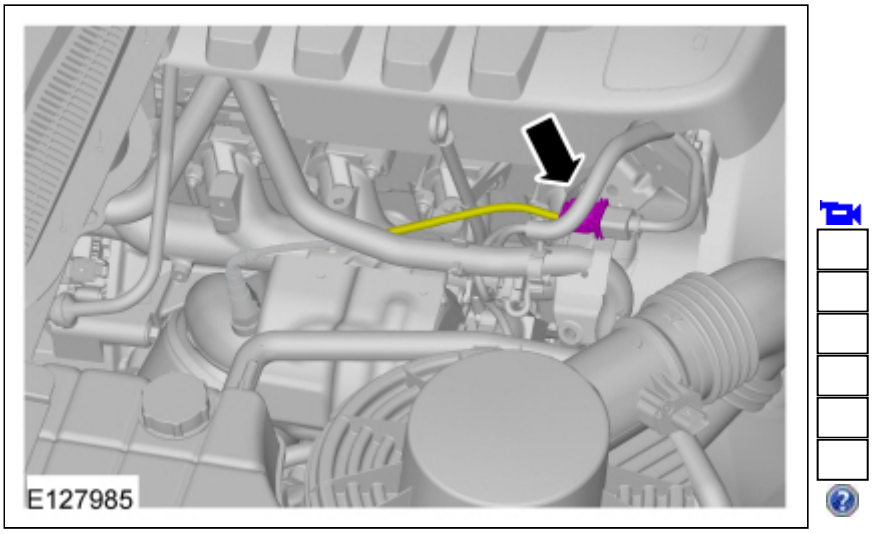
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

1. *Torque*: 48 Nm
2. *Torque*: 23 Nm

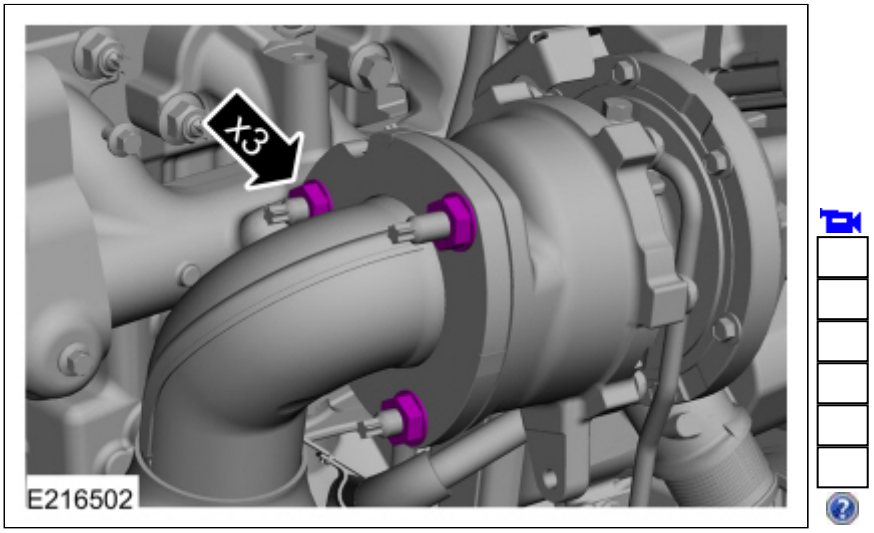


Vehicles with diesel particulate filter (DPF)

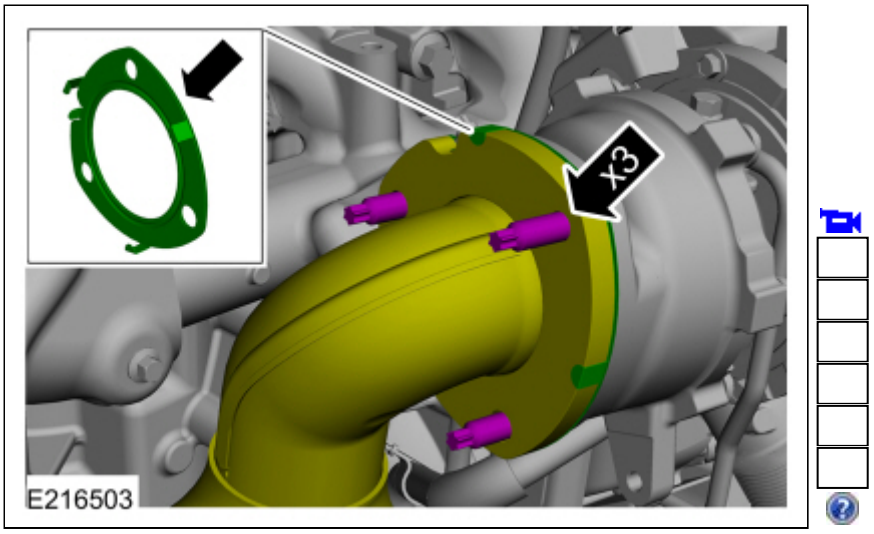
3.



4. *Torque*: 48 Nm

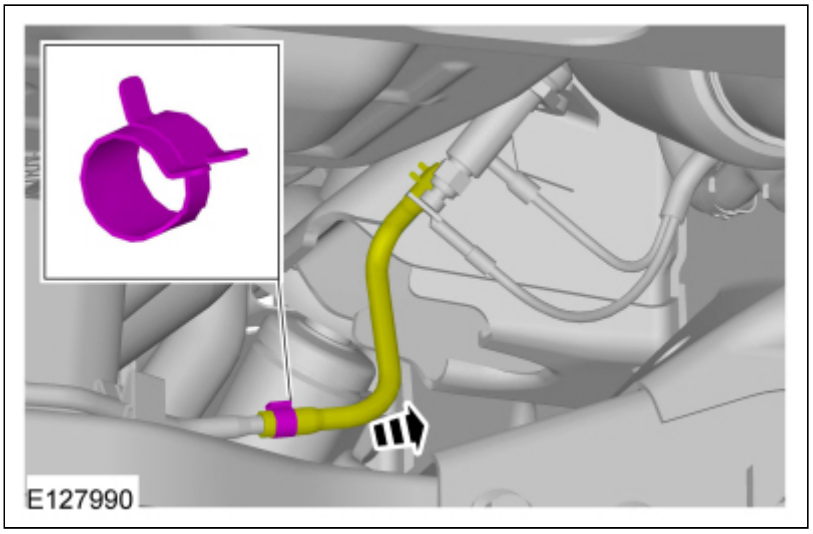


5. *Torque*: 25 Nm

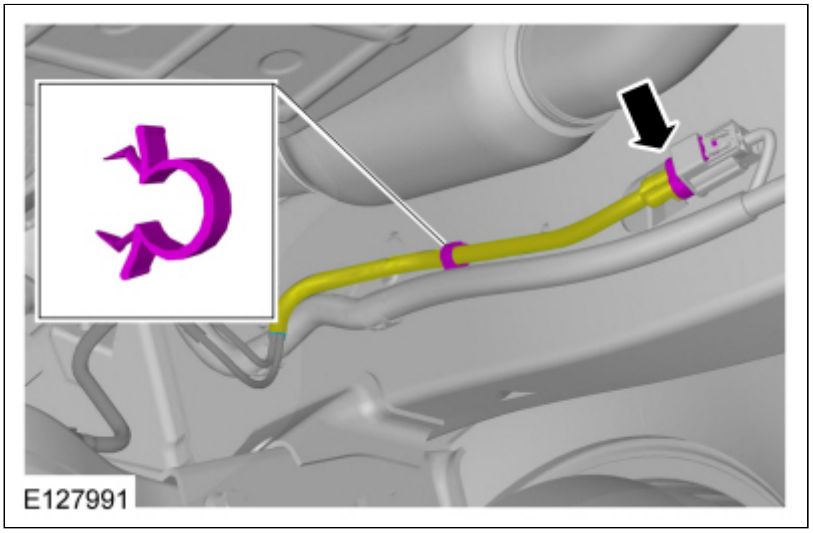


6. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

7.

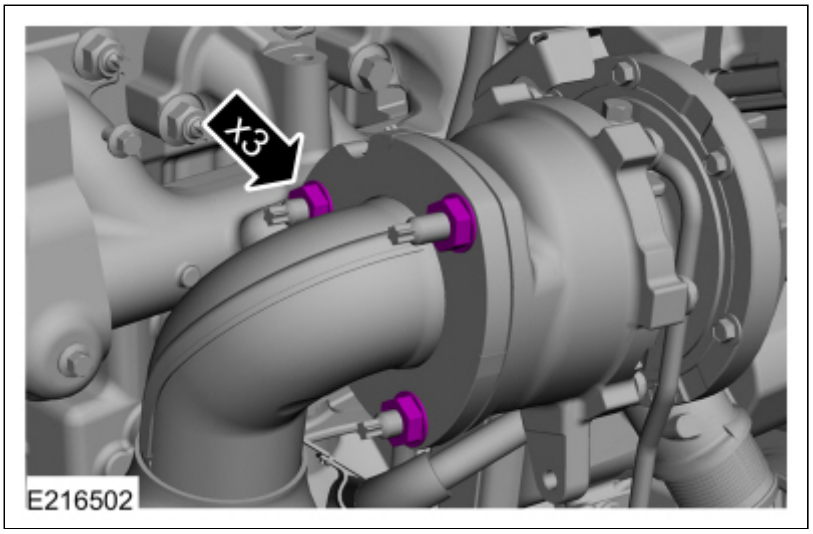


8.

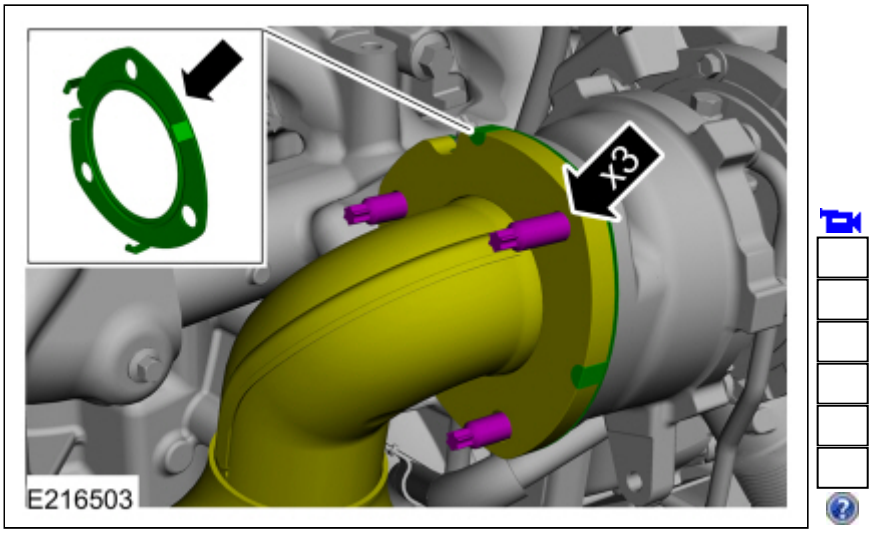


Vehicles without diesel particulate filter (DPF)

9. *Torque*: 48 Nm

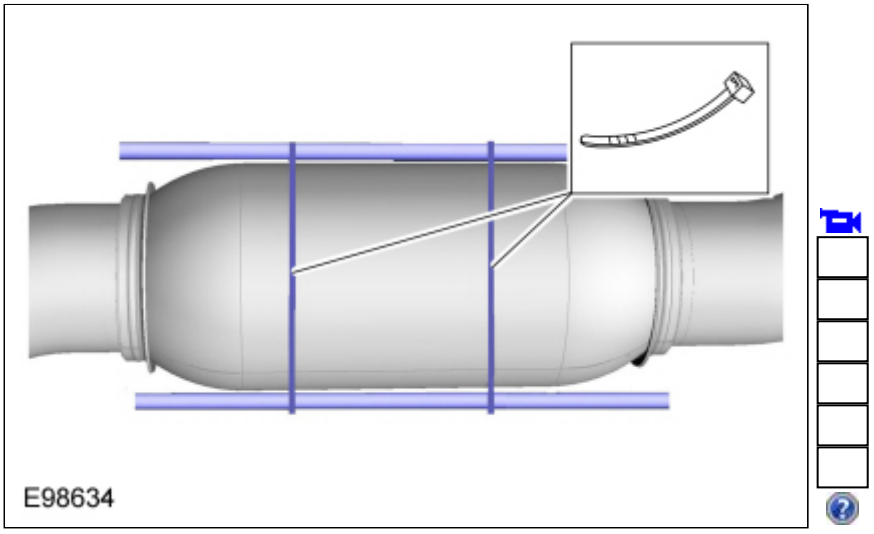


10. *Torque*: 25 Nm

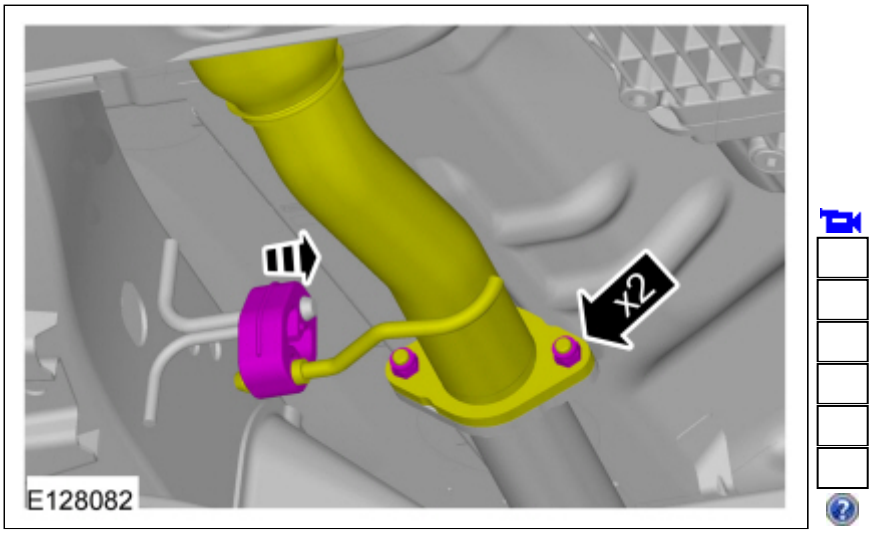


All vehicles

11. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



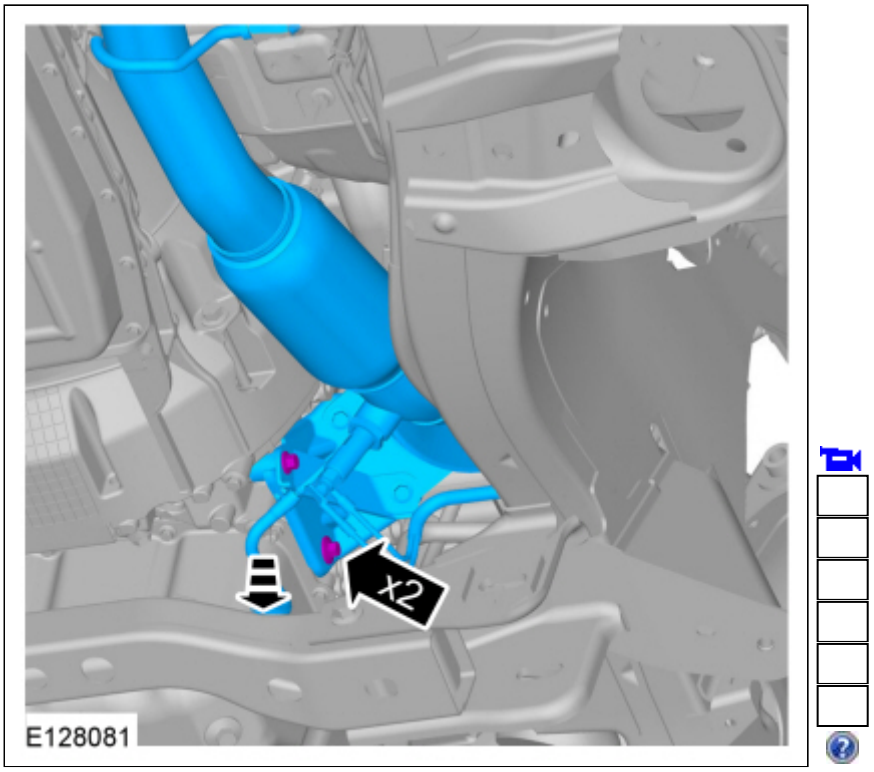
1. *Torque*: 48 Nm



Vehicles with diesel particulate filter (DPF)

13. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**

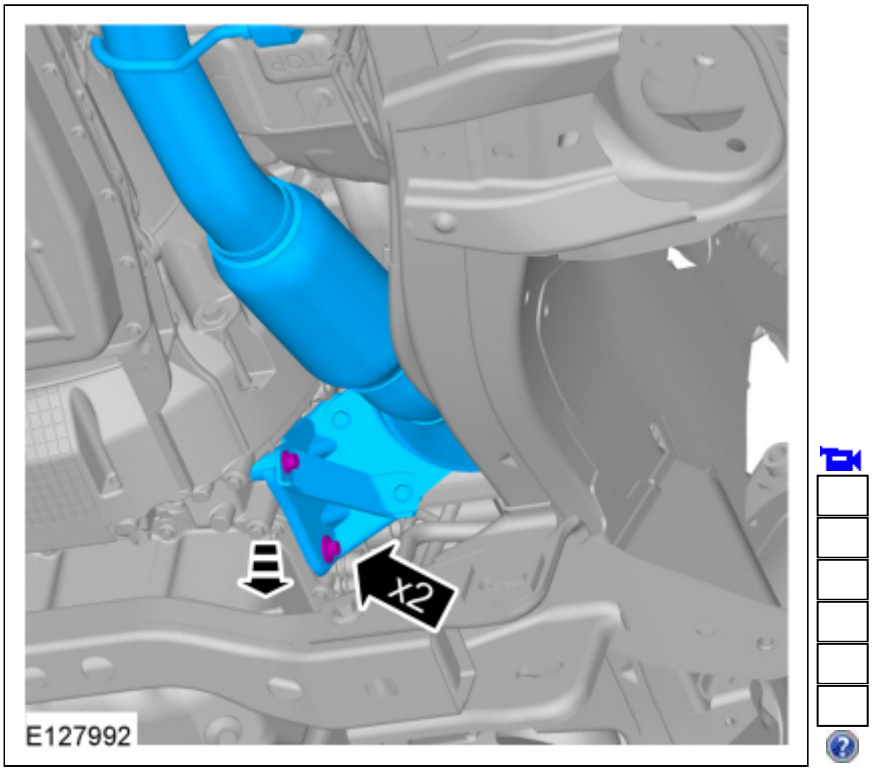
Torque: 25 Nm



Vehicles without diesel particulate filter (DPF)

14. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**

    Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Catalytic Converter - Emission Requirements: EURO Stage V LDT

Base Part Number: 5G232

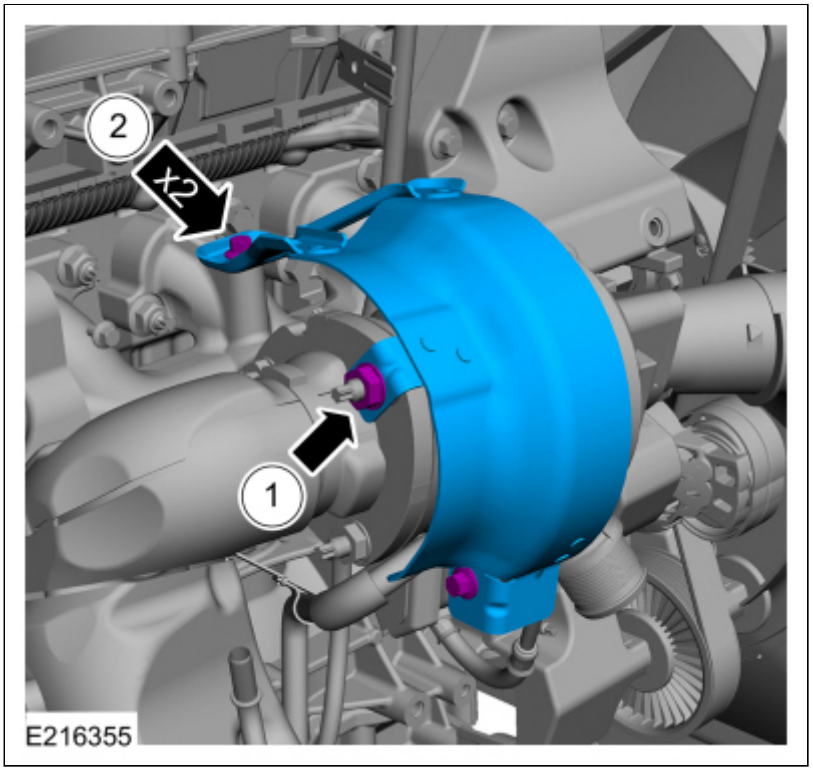
Removal

WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

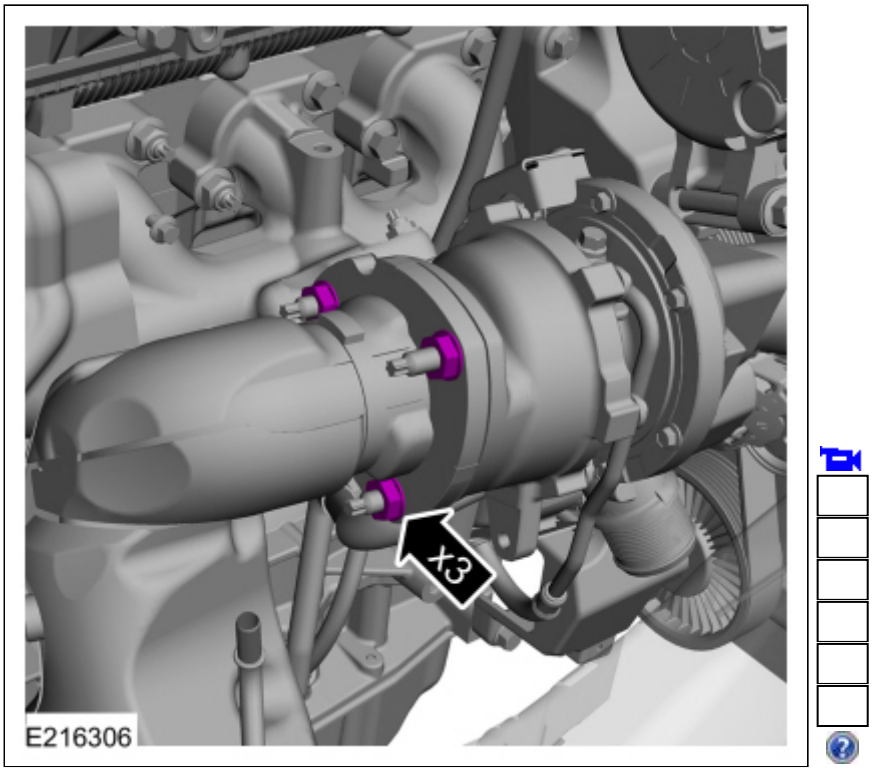
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

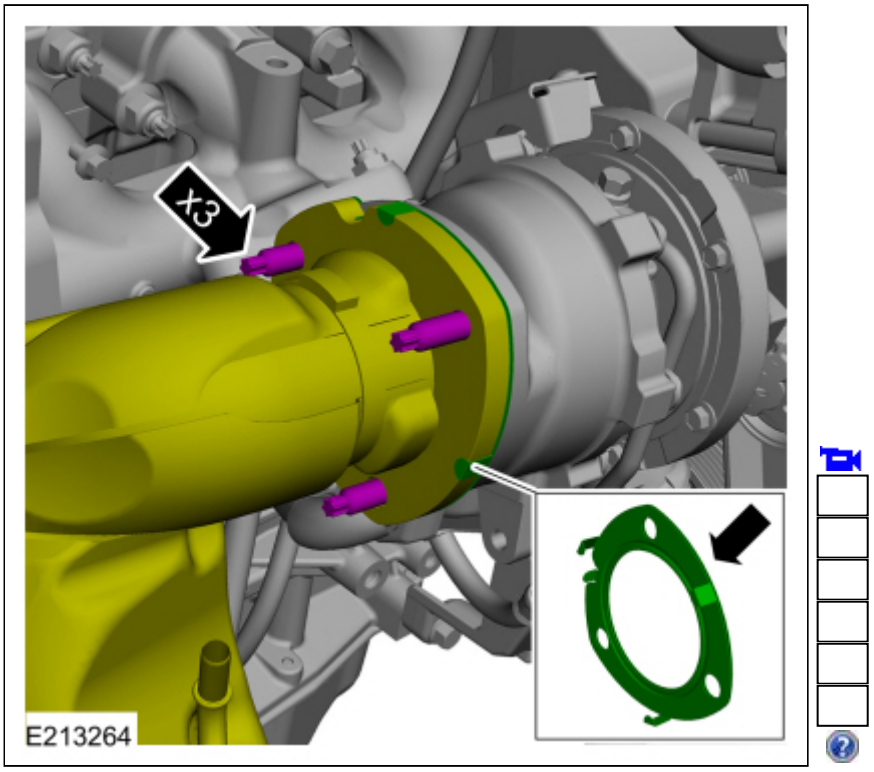
1. *Torque*: 48 Nm
2. *Torque*: 23 Nm



3. *Torque*: 48 Nm

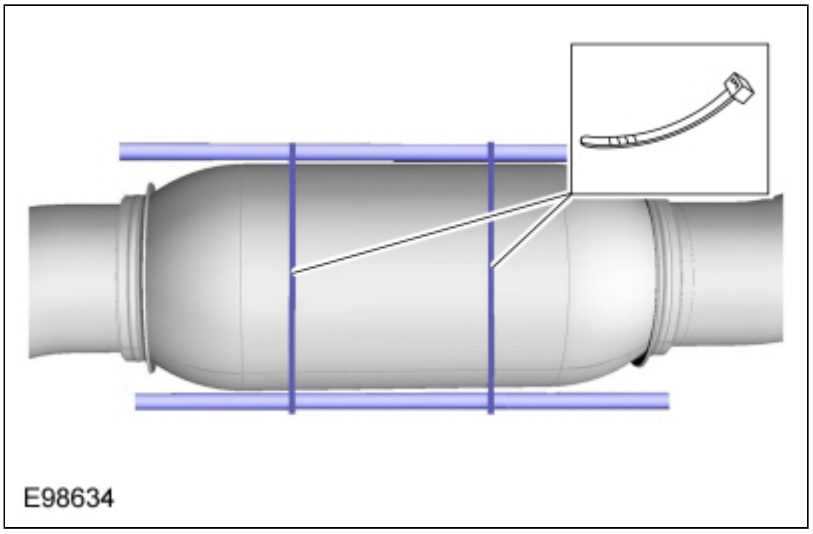


4. *Torque*: 25 Nm

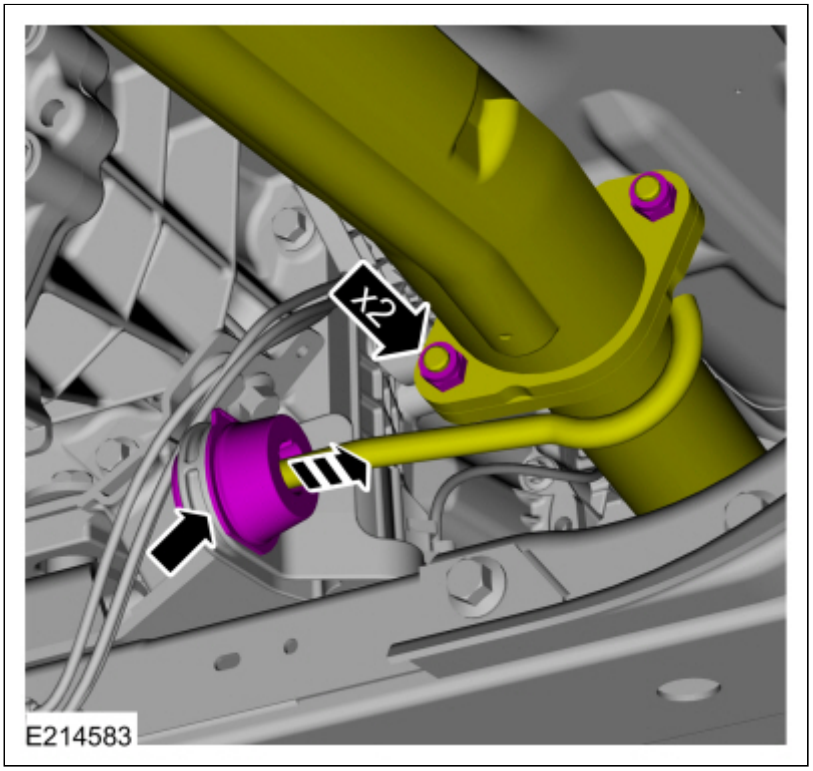


5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

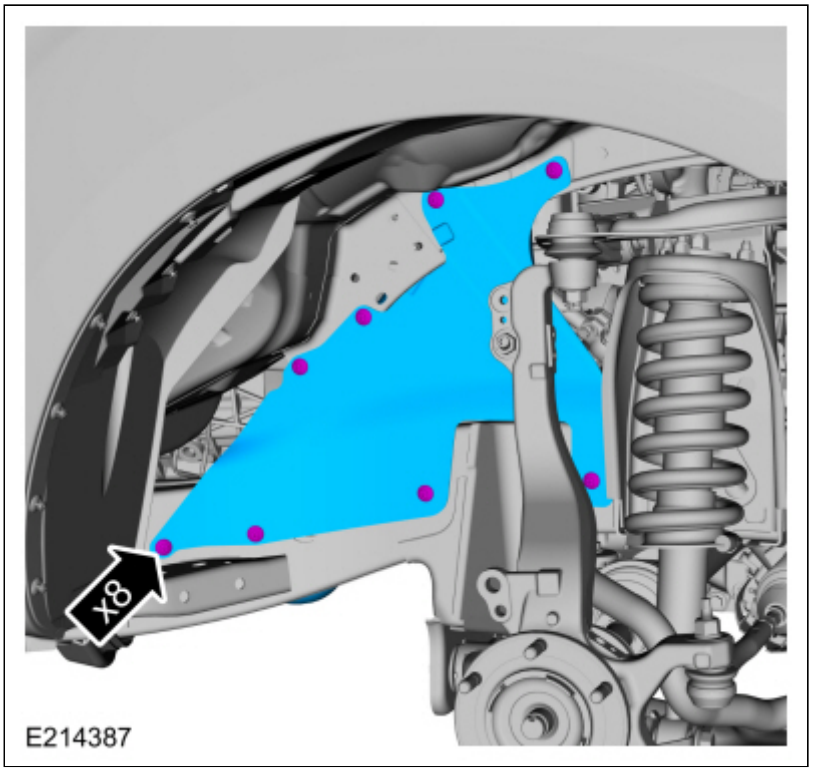
6. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



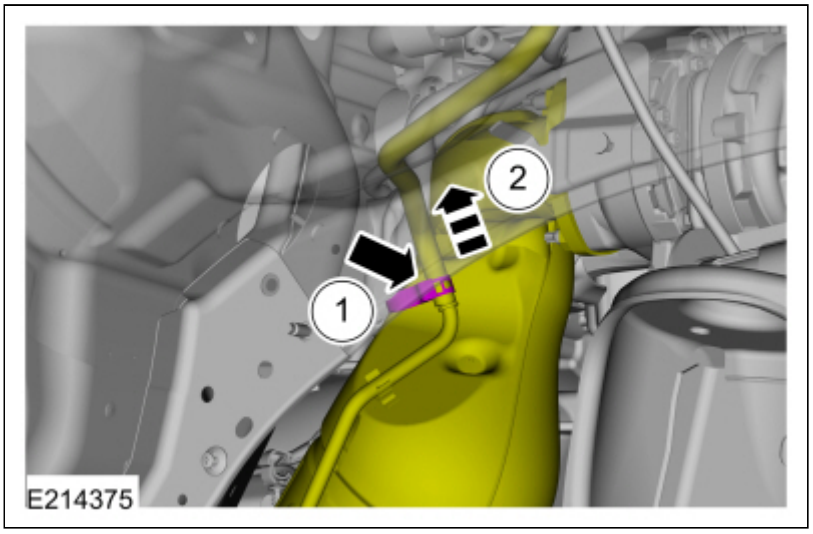
7. *Torque*: 48 Nm



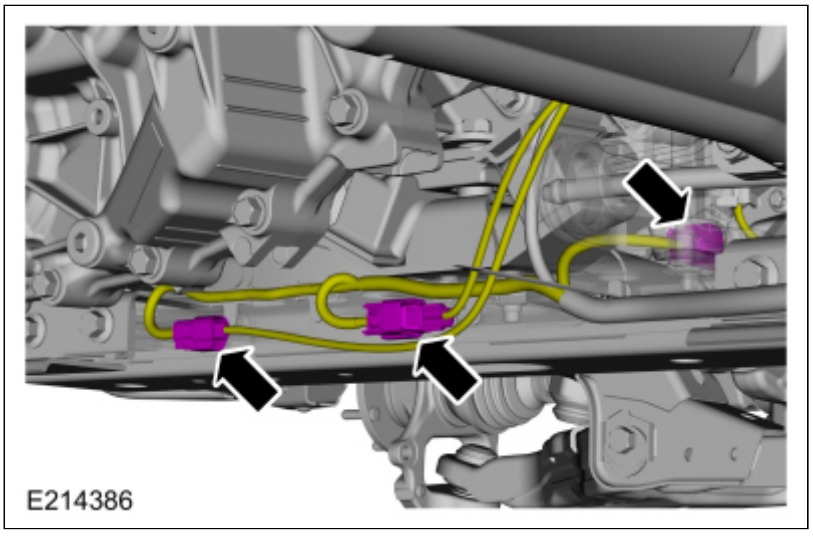
8.



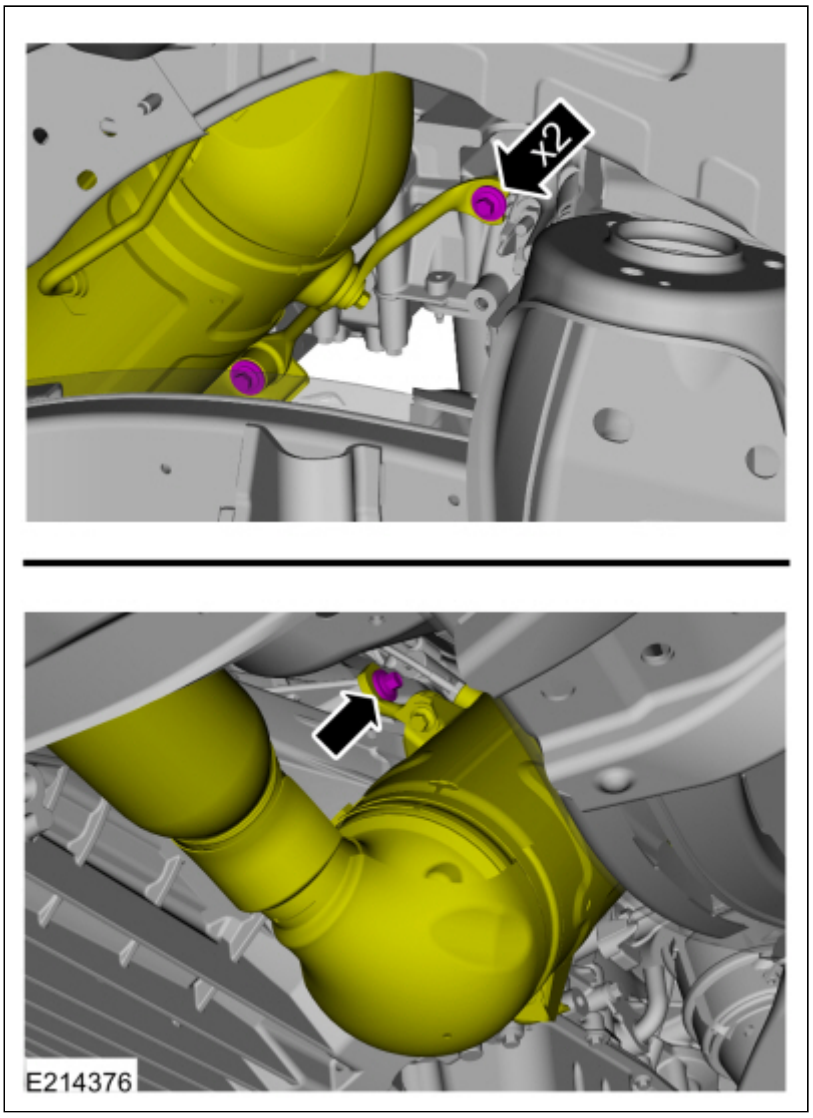
9.



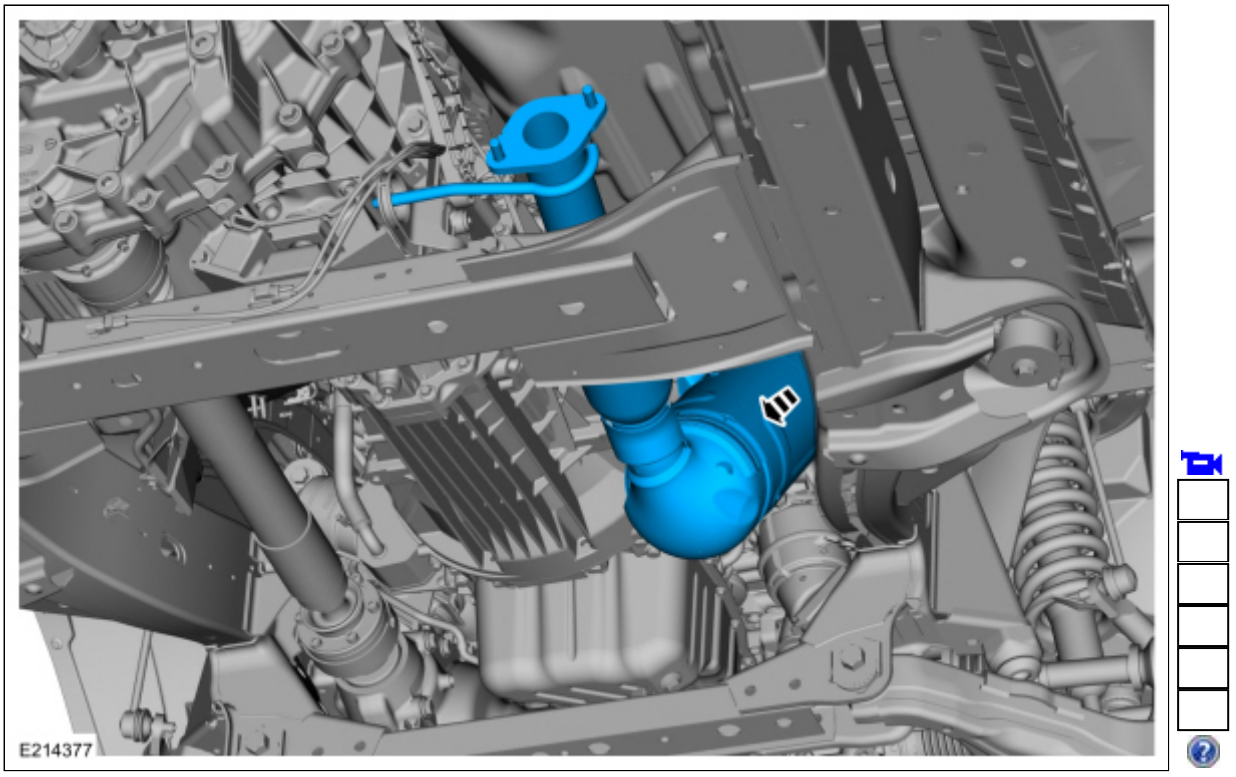
10.



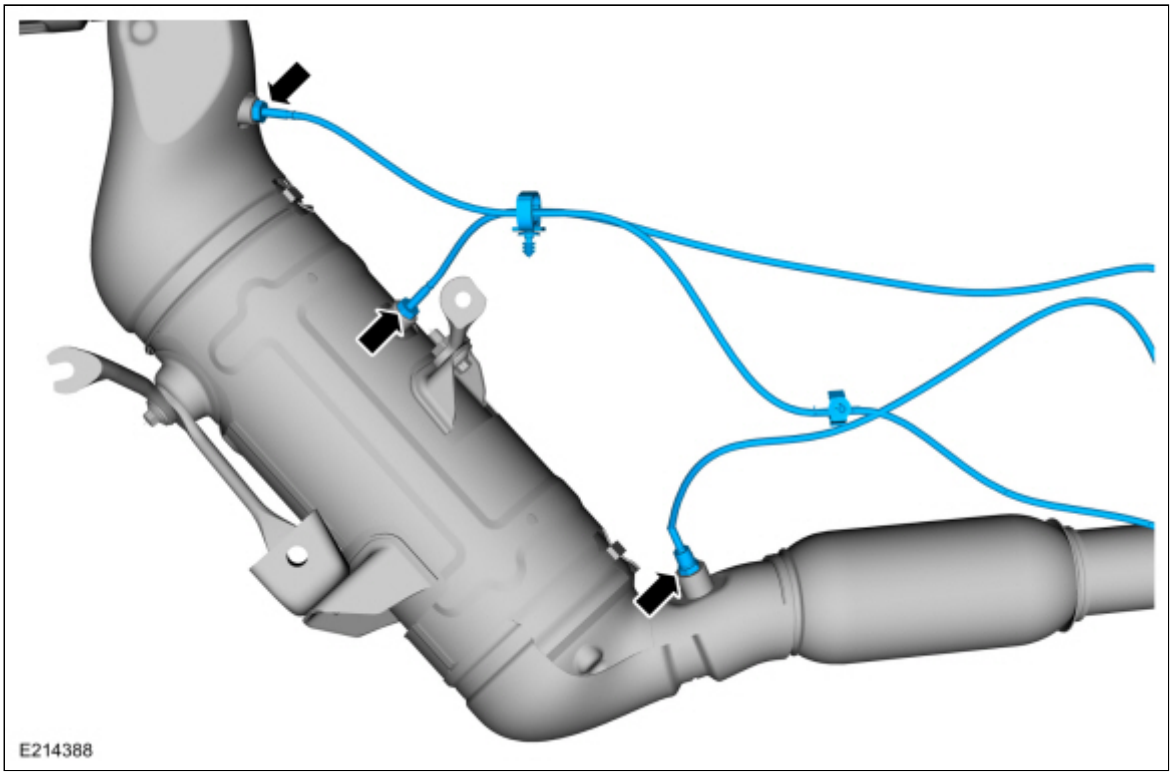
11. *Torque*: 25 Nm



12. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**



13.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

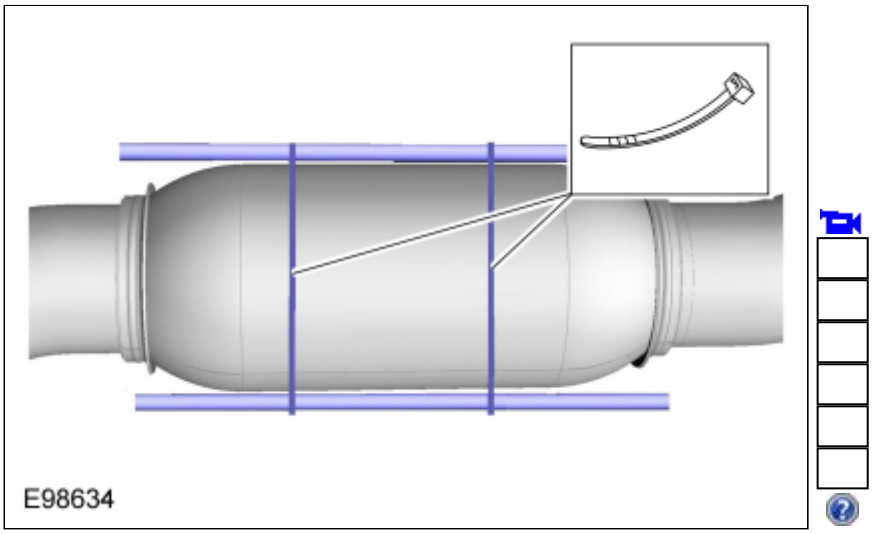
Diesel Particulate Filter (DPF)

Removal

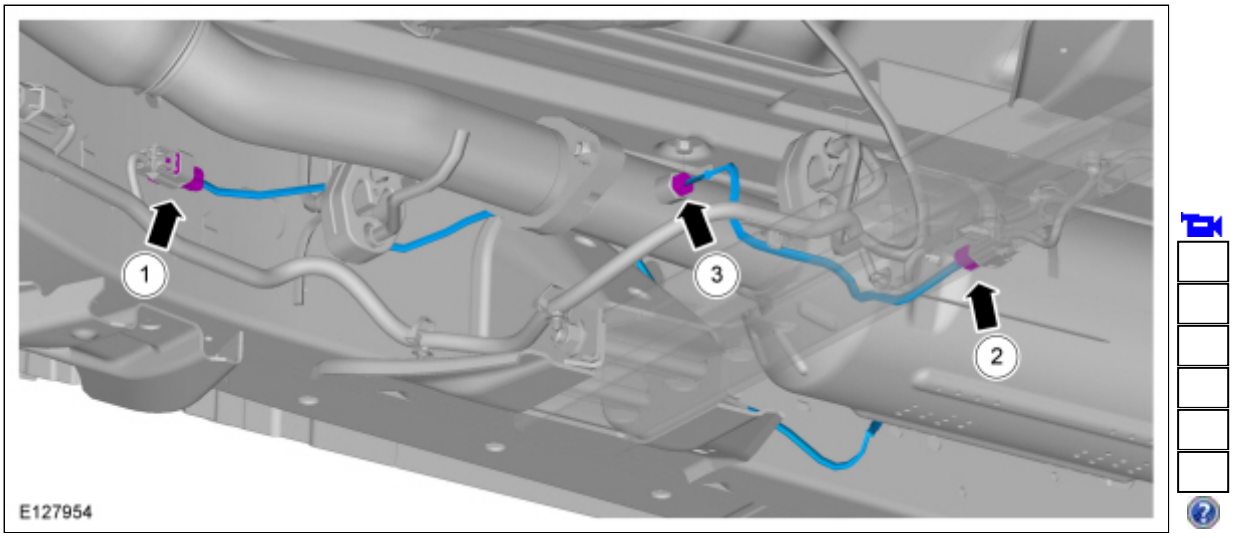
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

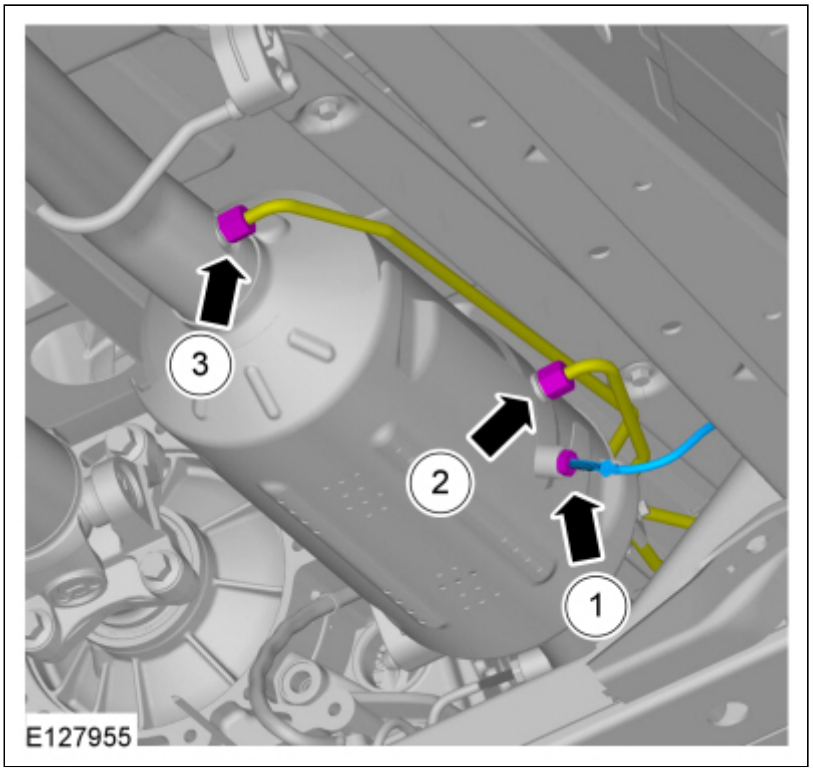
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**



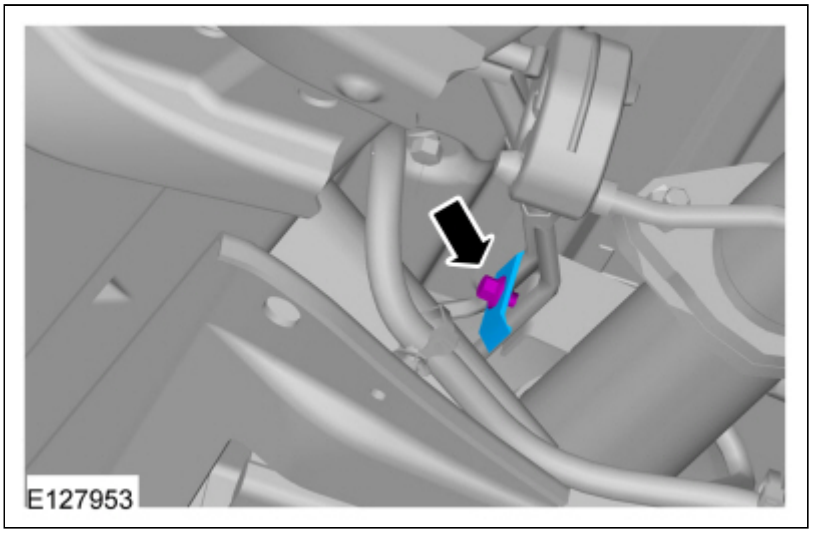
4. *Torque*: 40 Nm



1. *Torque*: 40 Nm
2. *Torque*: 40 Nm
3. *Torque*: 40 Nm

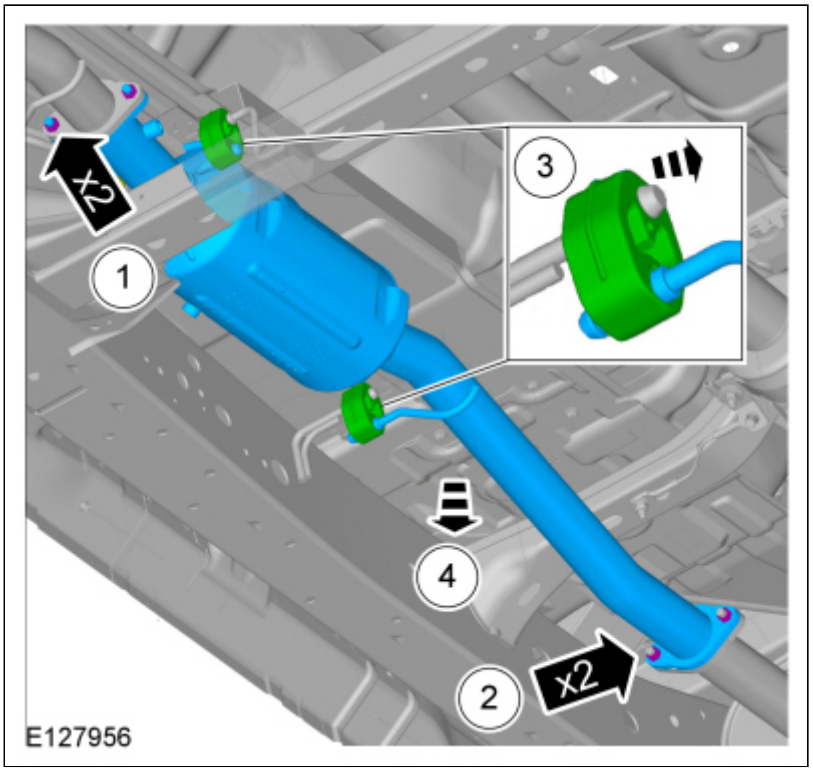


6. *Torque*: 40 Nm



7. **NOTE:** *Discard the gaskets at both the ends.*

    1. *Torque*: 47 Nm
    2. *Torque*: 47 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Diesel Particulate Filter (DPF) - Emission Requirements: EURO Stage V LDT

Removal

1. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Installation

1. Refer to: Catalytic Converter - Emission Requirements: EURO Stage V LDT (309-00B Exhaust System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

Exhaust Flexible Pipe

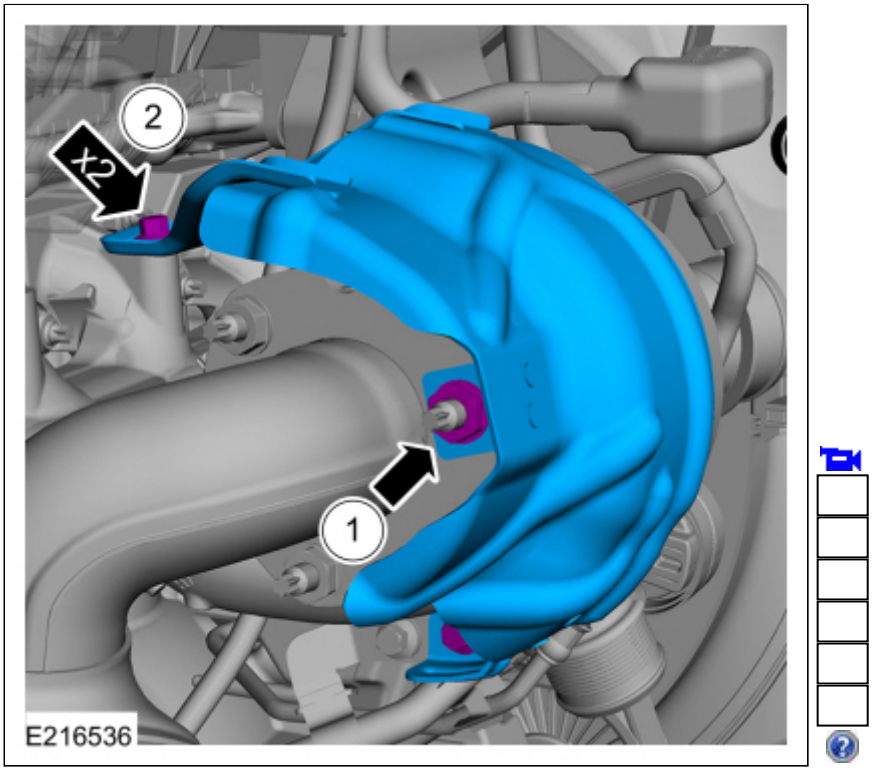
Removal

WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

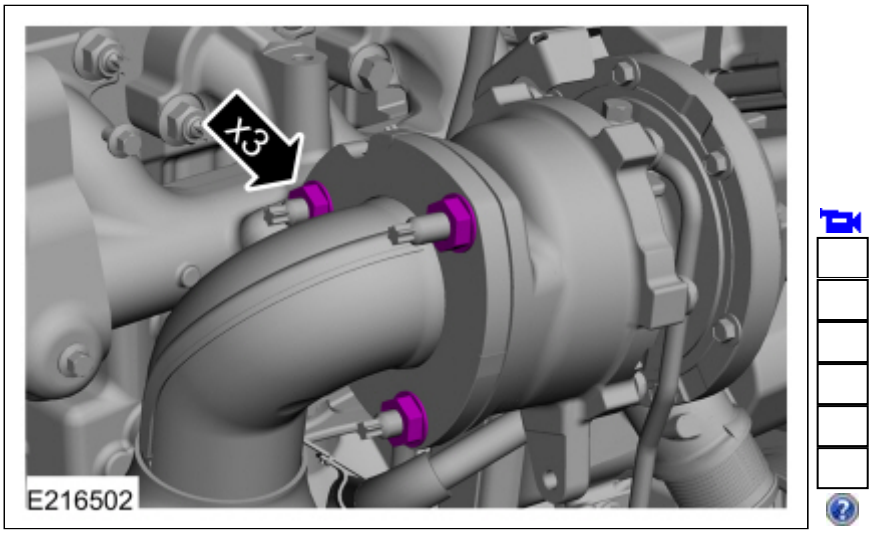
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

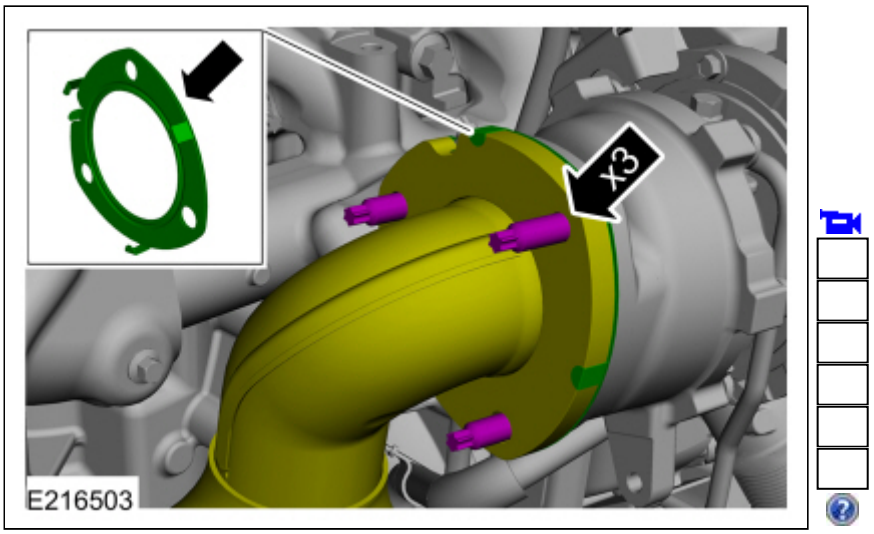
2. *Torque*:
   1: 48 Nm
   2: 23 Nm



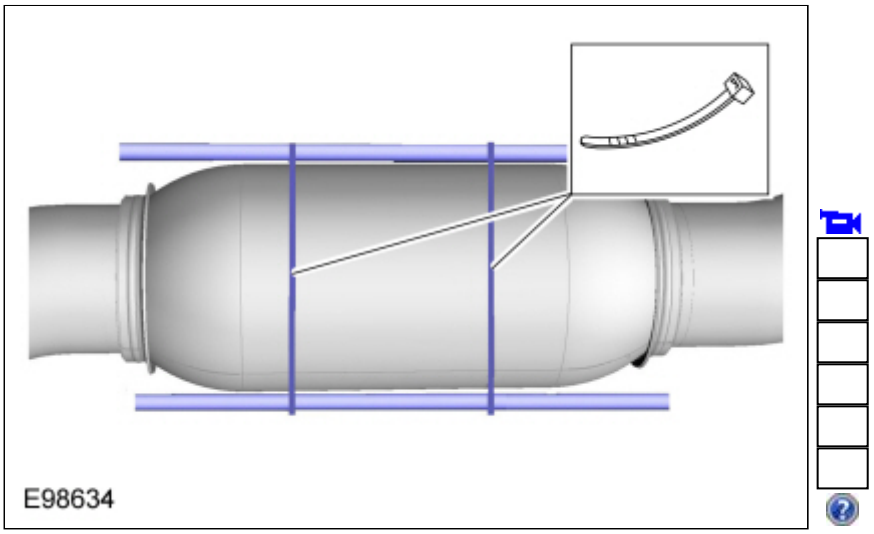
3. *Torque*: 48 Nm



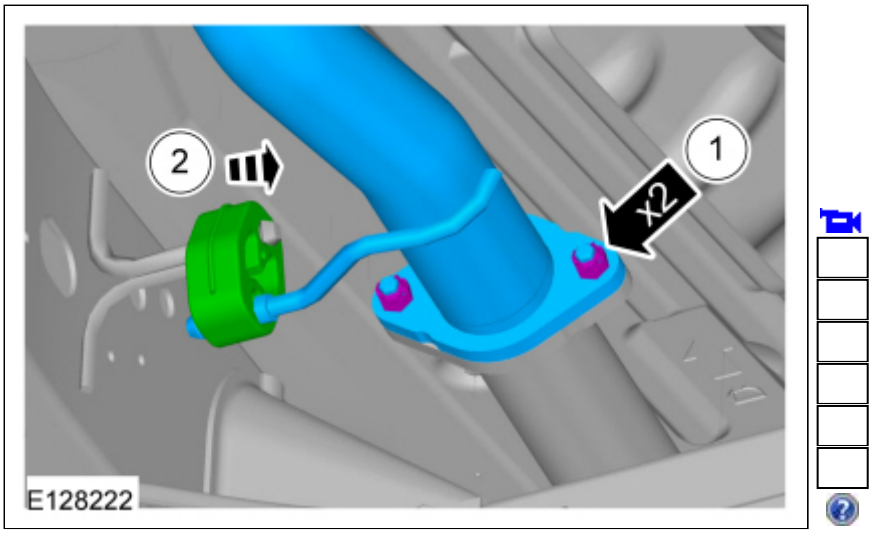
4. *Torque*: 25 Nm



5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. **NOTICE: Over bending the exhaust flexible pipe may cause damage resulting in failure.**

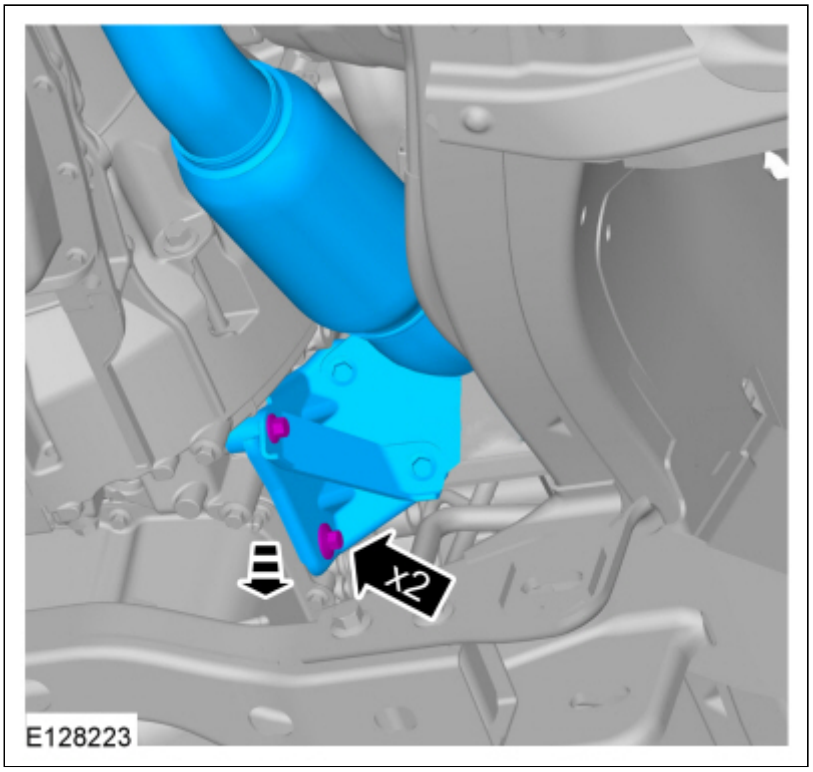


1. *Torque*: 48 Nm



8. **NOTICE: Make sure that the exhaust flexible pipe is not forcibly bent.**

Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

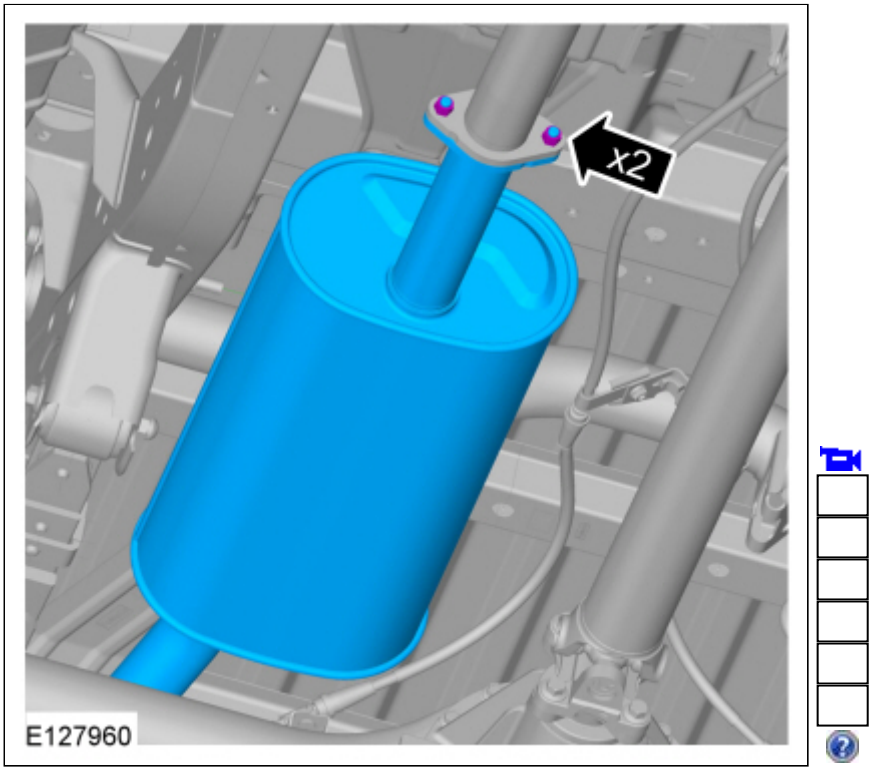
Rear Muffler

Removal

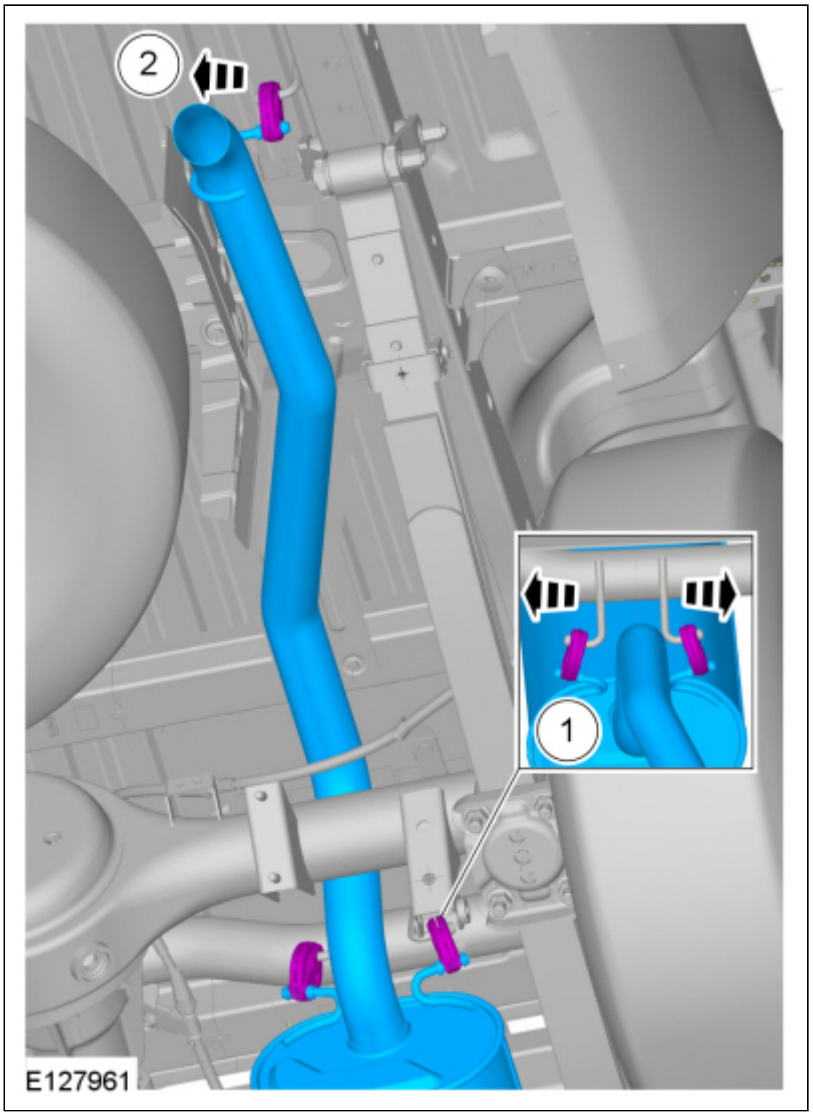
WARNING: When the engine and exhaust system are hot, they can cause severe burns or injury. Turn off the engine and wait until they are cool before removing the exhaust system.

NOTE: *Removal steps in this procedure may contain installation details.*

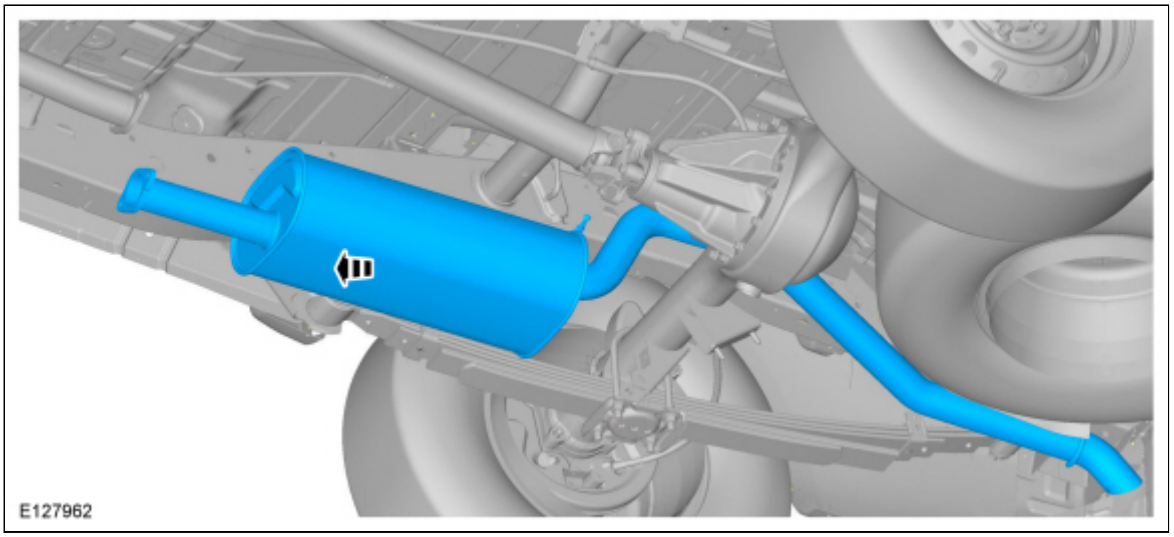
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. *Torque*: 48 Nm



4.



5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

General Specifications

Item	Specification
Fuel Pressure	
Engine running - 2.5L	420 kPa
Key ON Engine OFF (KOEO) for 10 minutes	300–350 kPa
Key ON Engine OFF (KOEO) overnight soak	100–150 kPa
Fuel Tank Capacity	80 L

Copyright © 2016 Ford Motor Company

Fuel System - Overview

Overview

The fuel system consists of:

- A mechanical returnless fuel system.
- An 80L cigar shaped fuel tank.
- A fuel filler pipe with a vented cap.
- A fuel filter with return line back to fuel tank.
- Fuel vapour tubes and evaporative system.
- Fuel feed lines.
- A fuel delivery module containing:
  - A fuel pump with integrated jet pump.
  - A pressure regulator.
  - A serviceable fuel level sender.

Fuel Pump Shut-off Feature

In the event of a moderate to severe collision, the vehicle is equipped with a Fuel Pump and Sender Shut-off Feature that is initiated by the event notification signal.

The event notification signal is a signal provided by the RCM to the FPDM. Signal communication between the RCM and the FPDM allows the PCM to shut-off the Fuel Pump.

Should the vehicle shut off after a collision due to this feature, the vehicle may be restarted by first turning the ignition to the OFF position and then turn the ignition to the ON position. In some instances the vehicle may not start the first time and may take one additional ignition cycle.

Copyright © 2016 Ford Motor Company

Fuel System

Symptom Chart(s)

Symptom Chart: Fuel System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).
for information regarding Ford-specific diagnostic practices.

NOTE: *The following procedure diagnoses a slow to fill concern only. For all other concerns, refer to Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.*

Symptom Chart

Condition	Possible Sources	Actions
Slow to fill	• Fuel tank filler pipe • Fuel tank filler pipe vent tube, if equipped • EVAPsystem • Fuel tank inlet check valve (part of the fuel tank) • Fuel level vent valve (part of the fuel tank)	GO to Pinpoint Test A
All other fuel system concerns	Fuel system components	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Diagnostic Routine(s)

Slow to Fill

Normal Operation and Fault Conditions

Under normal operation, fuel should flow at a steady rate through the fuel tank filler pipe into the fuel tank. As fuel enters the fuel tank air is vented through the evaporative system.

PINPOINT TEST A : SLOW TO FILL

A1 CHECK COMPONENTS FOR SIGNS OF DAMAGE

- Visually inspect the following components for signs of damage:
  - Fuel tank filler pipe
  - Fuel tank filler pipe vent tube, if equipped
  - EVAP system
  - Fuel tank inlet check valve (part of the fuel tank)
  - Fuel level vent valve (part of the fuel tank)

Was the cause of the concern found?

Yes	REPAIR or INSTALL new components to correct the concern.
No	GO to A2

A2 CHECK THE FUEL TANK FILLER PIPE ASSEMBLY FOR BLOCKAGE OR RESTRICTION

- Remove the fuel tank filler pipe assembly.

REFER to: Fuel Tank Filler Pipe - Chassis Cab (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

- Inspect the fuel tank filler pipe and fuel tank filler pipe vent tube (if equipped) for a blockage or restriction.

Is the fuel tank filler pipe or fuel tank filler pipe vent tube (if equipped) blocked or restricted?

Yes	If possible, REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL a new fuel tank filler pipe or fuel tank filler pipe vent tube.
No	GO to A3

A3 CHECK THE FUEL TANK INLET CHECK VALVE

- Inspect the fuel tank inlet check valve for restriction or sticking.

Is the fuel tank inlet check valve restricted or sticking?

Yes	If possible, REPAIR the restriction. If the restriction cannot be repaired, INSTALL a new fuel tank. REFER to: Fuel Tank - Chassis Cab (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
No	INSTALL a new fuel tank. REFER to: Fuel Tank - Chassis Cab (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Copyright © 2016 Ford Motor Company

Fuel System Pressure Release

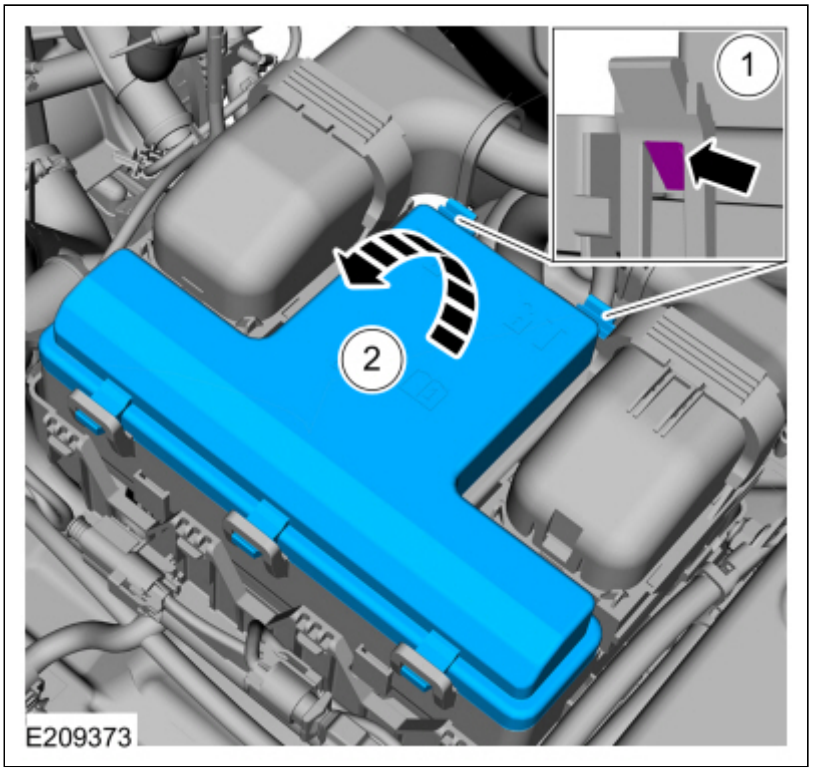
Pressure release

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

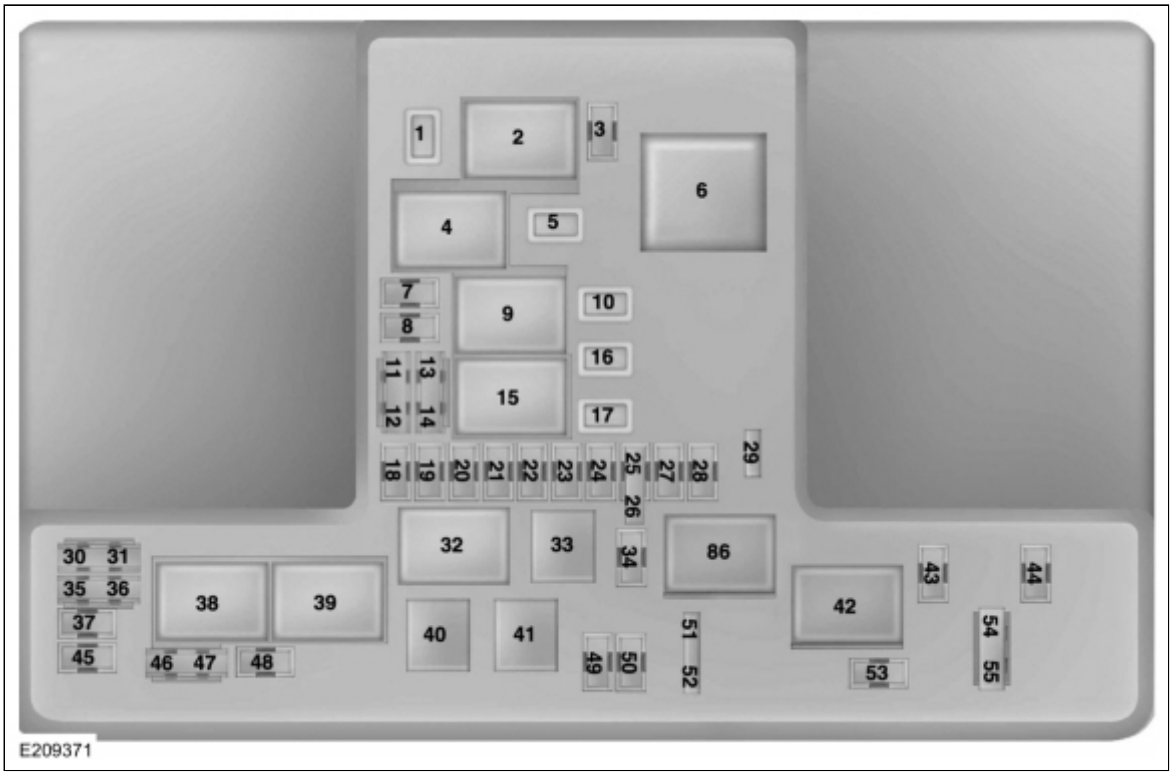
WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

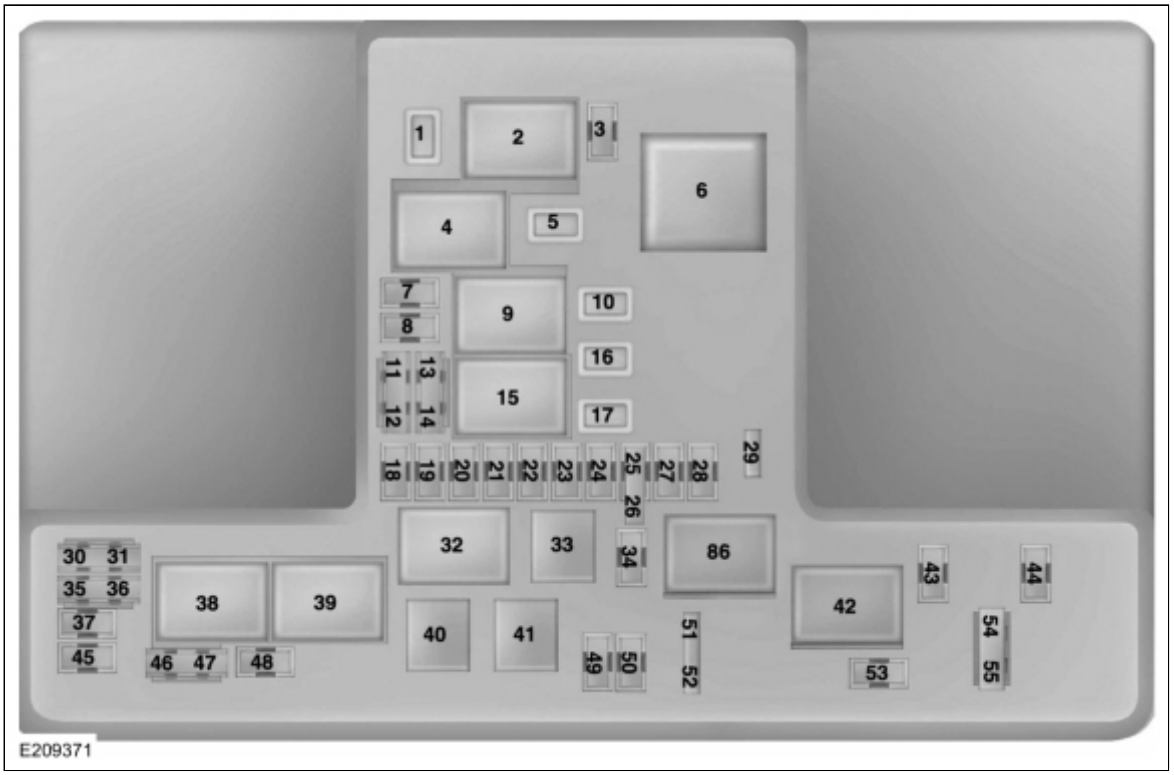
WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. Remove the fuse F32 (fuel pump relay) from the junction box panel.



4. Start and run the engine at idle speed until the engine stops.
5. After the engine stalls, crank the engine for approximately 5 seconds to make sure the fuel rail pressure has been released.
6. Turn the ignition switch to the OFF position.
7. When the fuel system service is complete, install the fuse F32 (fuel pump relay) to the junction box panel.



8. Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.
9. Start the vehicle and check the fuel system for leaks.

Copyright © 2016 Ford Motor Company

Fuel Tank Draining

Special Tool(s) / General Equipment

Fuel Tank Draining Equipment
6 mm Drill Bit

Draining

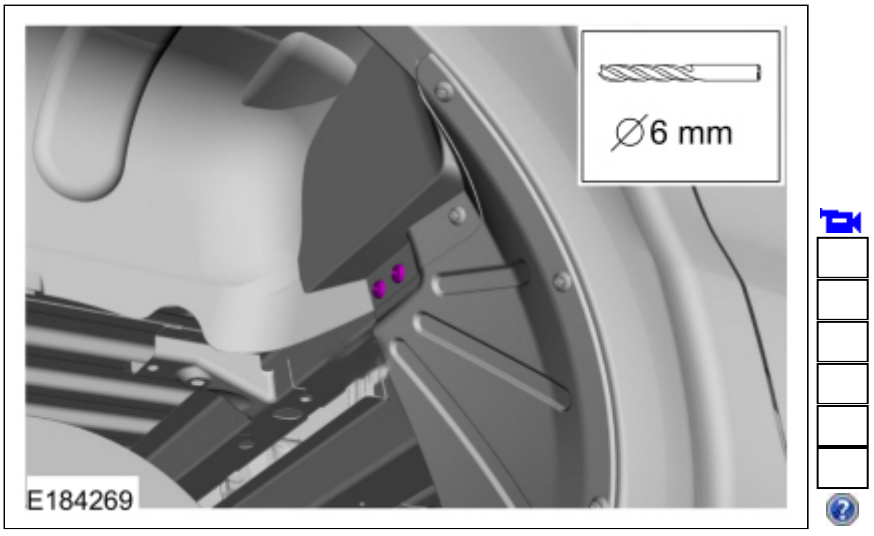
WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

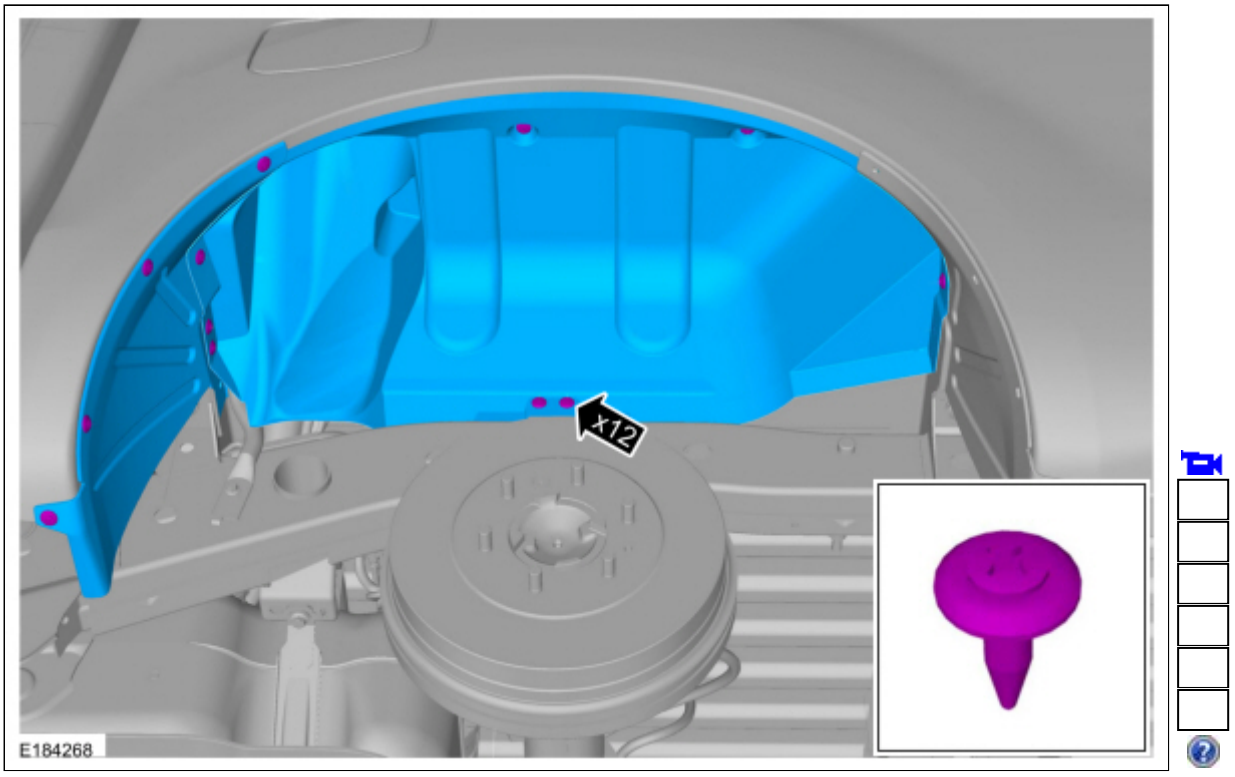
WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

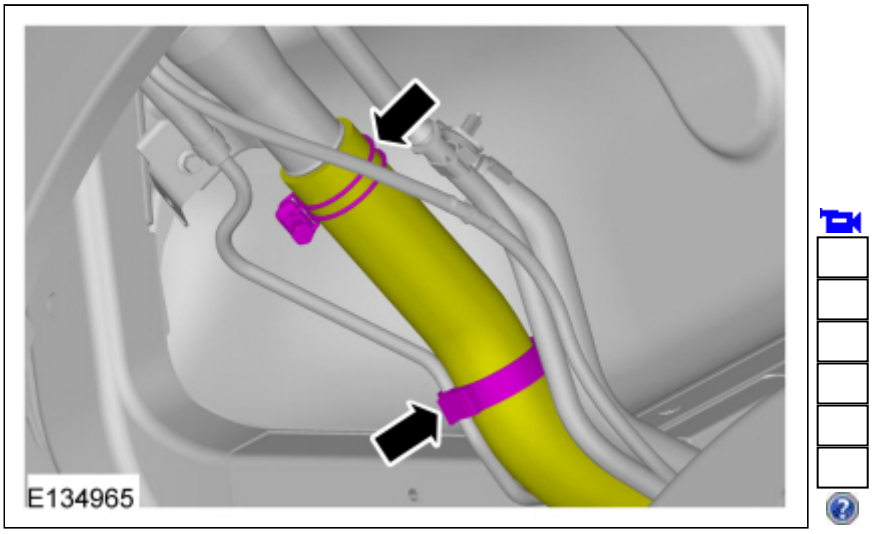
1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Use the General Equipment: 6 mm Drill Bit



6.

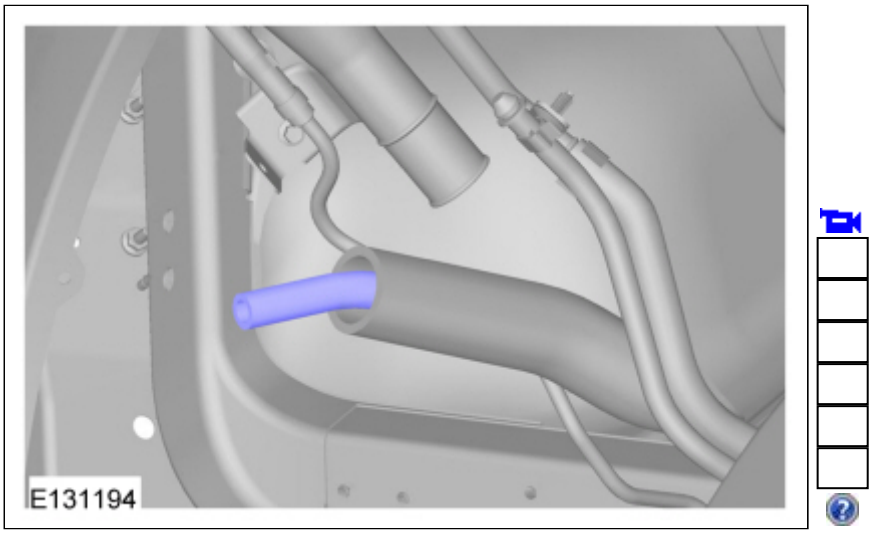


7. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



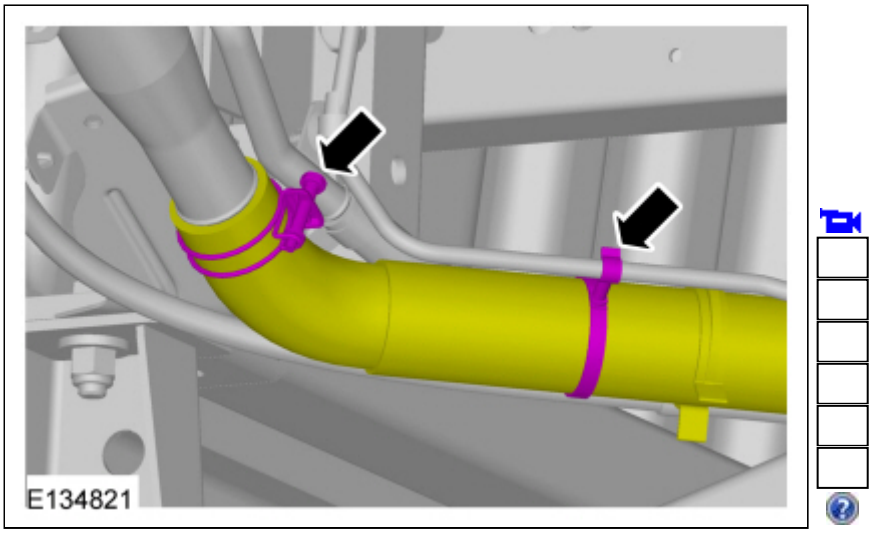
8. **NOTE:** *Follow the operating instructions supplied by the equipment manufacturer.*

   Use the General Equipment: Fuel Tank Draining Equipment



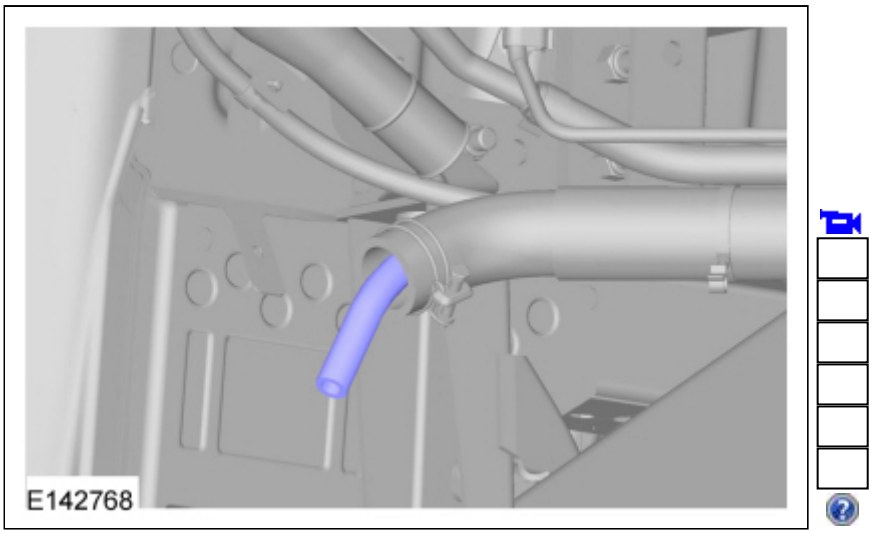
NOTE: *Vehicles with aluminium tray.*

9. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



10. **NOTE:** *Follow the operating instructions supplied by the equipment manufacturer.*

    Use the General Equipment: Fuel Tank Draining Equipment



Copyright © 2016 Ford Motor Company

Quick Release Coupling

Disconnect

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

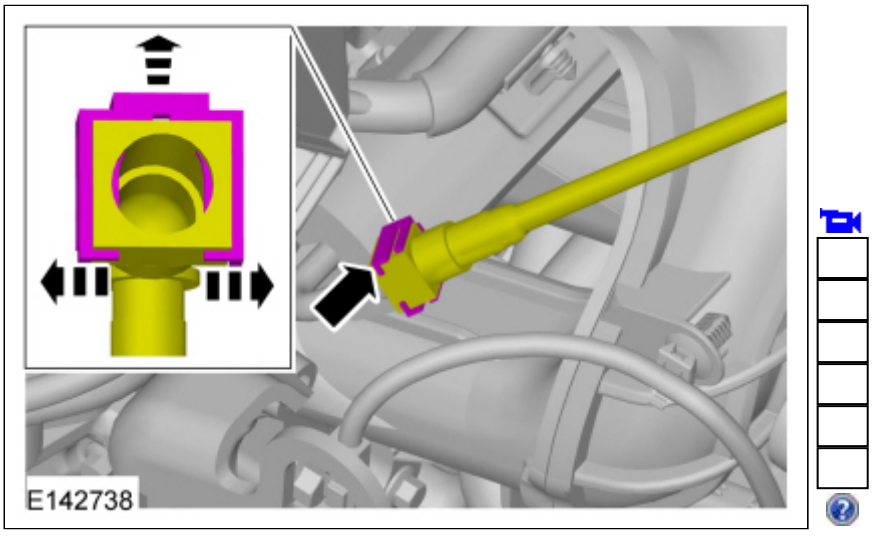
WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not repair the fuel lines. If the fuel lines are found to damaged, a new component must be installed.

NOTE: *Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.*

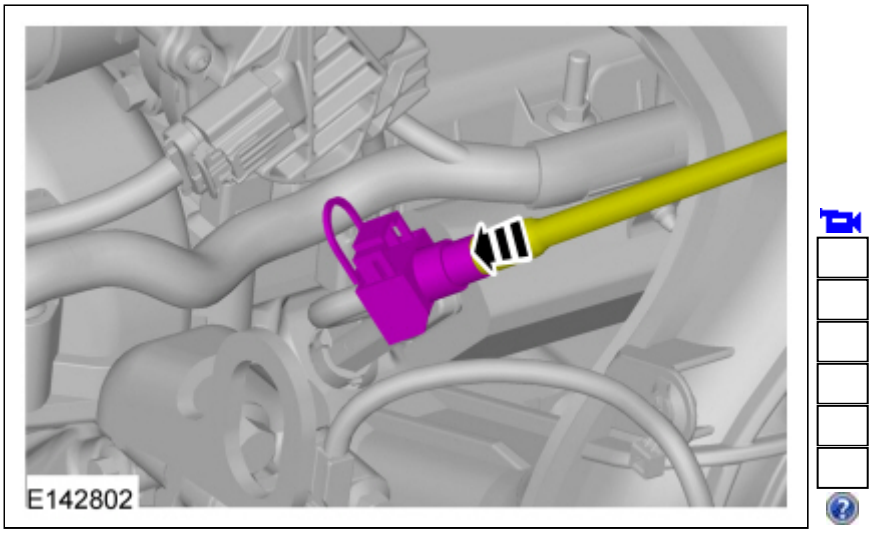
NOTE: *When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.*

1. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.

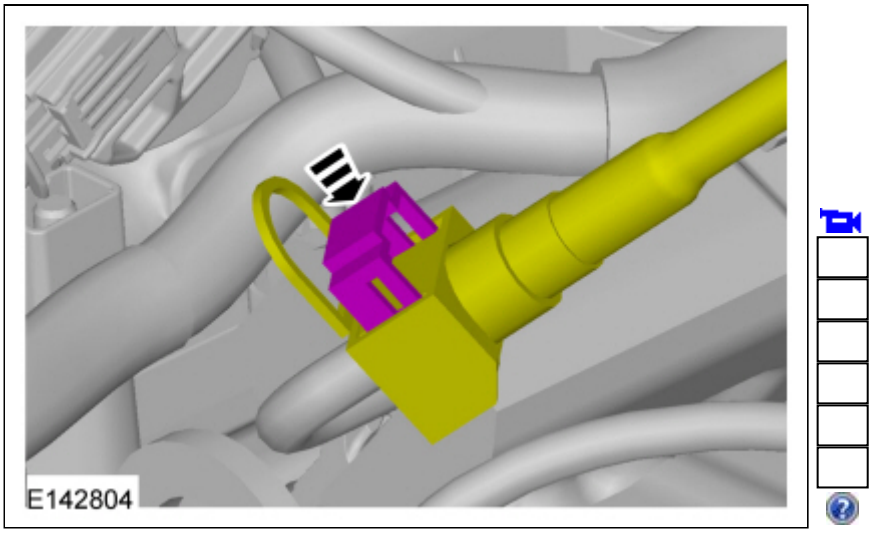


Connect

1.

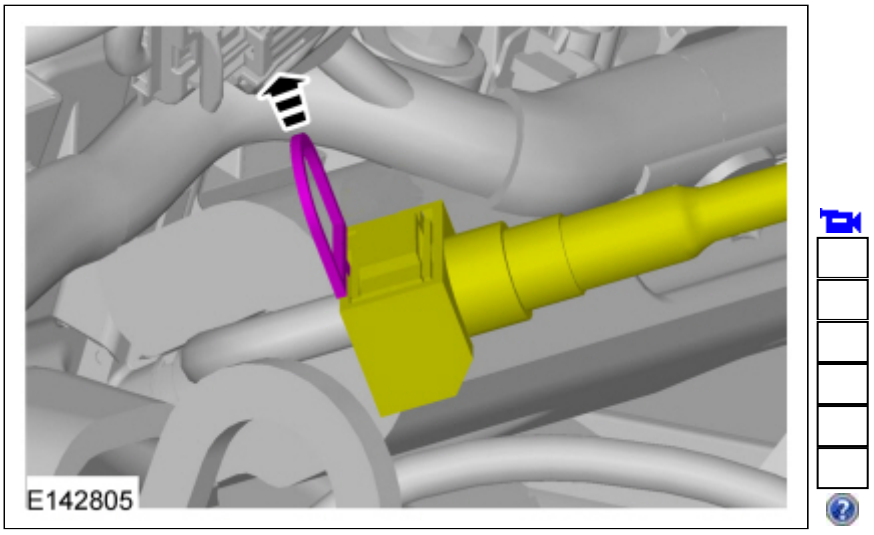


2.



3. **WARNING: Make sure that all fuel connections are checked for leaks.**

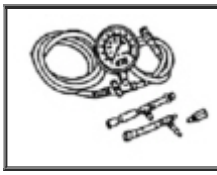
   NOTE: *This step is only neccessary if a new component is installed.*



Copyright © 2016 Ford Motor Company

Fuel System Pressure Check

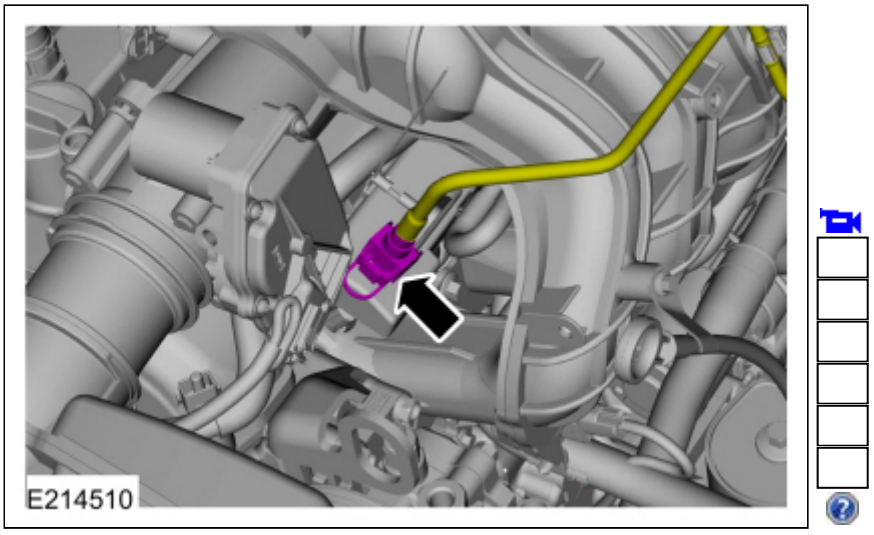
Special Tool(s) / General Equipment

	310-D009 (D95L-7211-A) Fuel Pressure Test Kit

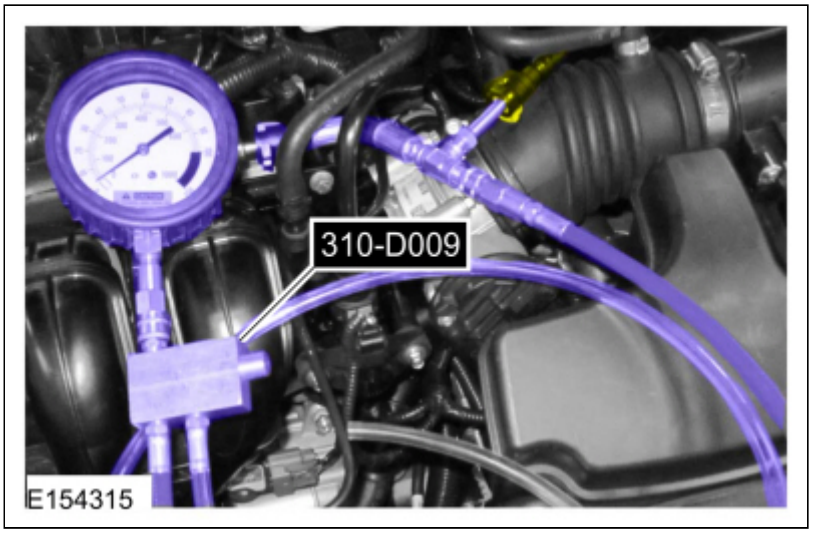
Check

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. **NOTICE: Fuels containing ethanol have a corrosive effect on other materials such as plastic, paint and metal.**

   Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
5. 

6. Use Special Service Tool: 310-D009 (D95L-7211-A) Fuel Pressure Test Kit.



7. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
8. **NOTE:** *Carry out a Key ON Engine OFF (KOEO) visual inspection for fuel leaks prior to completing the fuel system pressure test.*

   NOTE: *After completion of the fuel system pressure test, open the drain valve on the Fuel Pressure Test Kit and release any residual fuel into a suitable container prior to removing the tool.*

   Refer to: Specifications (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, Specifications).

Copyright © 2016 Ford Motor Company

Specifications

Item	Specification
Fuel Pressure	
KOEO - 2.2L Duratorq-TDCi (Low pressure side)	75 kPa
Fuel Tank Capacity	
Four Wheel drive (4WD)	80 L
Rear wheel drive (RWD)	80 L

Copyright © 2016 Ford Motor Company

Fuel System

Overview

The fuel system consists of:

- A mechanical return fuel system.
- An 80L cigar shaped fuel tank.
- A fuel filler pipe with a vented cap.
- Fuel feed & return lines
- A fuel filter with bi-metallic valve (for recirculation) and water in fuel sensor.
- Fuel vapour tubes.
- A diesel delivery module containing:
  - A fuel pump.
  - With Jet pump and 50kPa pressure relief valve.
  - A serviceable fuel level sender.
  - A low level fuel switch.

Fuel Pump Shut-off Feature

In the event of a moderate to severe collision, the vehicle is equipped with a Fuel Pump and Sender Unit Shut-off Feature that is initiated by the event notification signal.

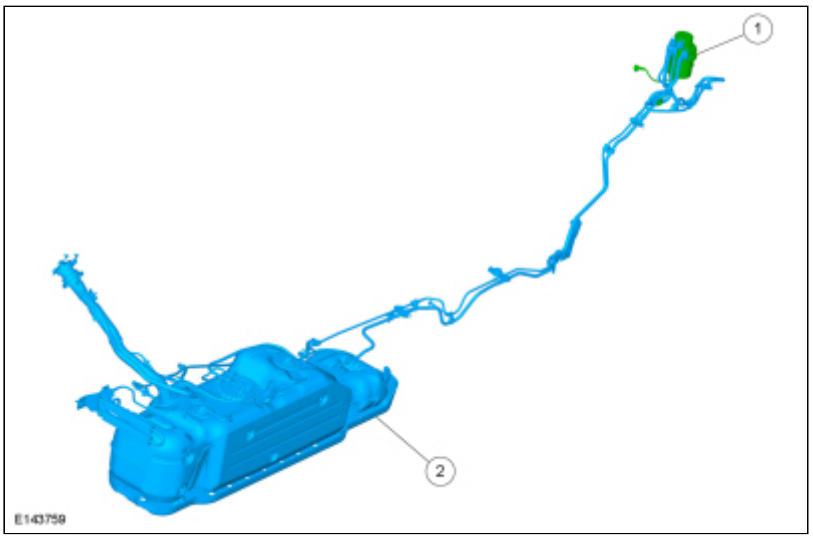
The event notification signal is a signal provided by the RCM to the Fuel Pump Control Module. Signal communication between the RCM and the Fuel Pump Control Module allows the PCM to shut-off the Fuel Pump.

Should the vehicle shut off after a collision due to this feature, the vehicle may be restarted by first turning the ignition to the OFF position and then turn the ignition to the ON position. In some instances the vehicle may not start the first time and may take one additional ignition cycle.

Copyright © 2016 Ford Motor Company

Fuel System - Overview

Diesel Fuel System



The Fuel System comprises of :

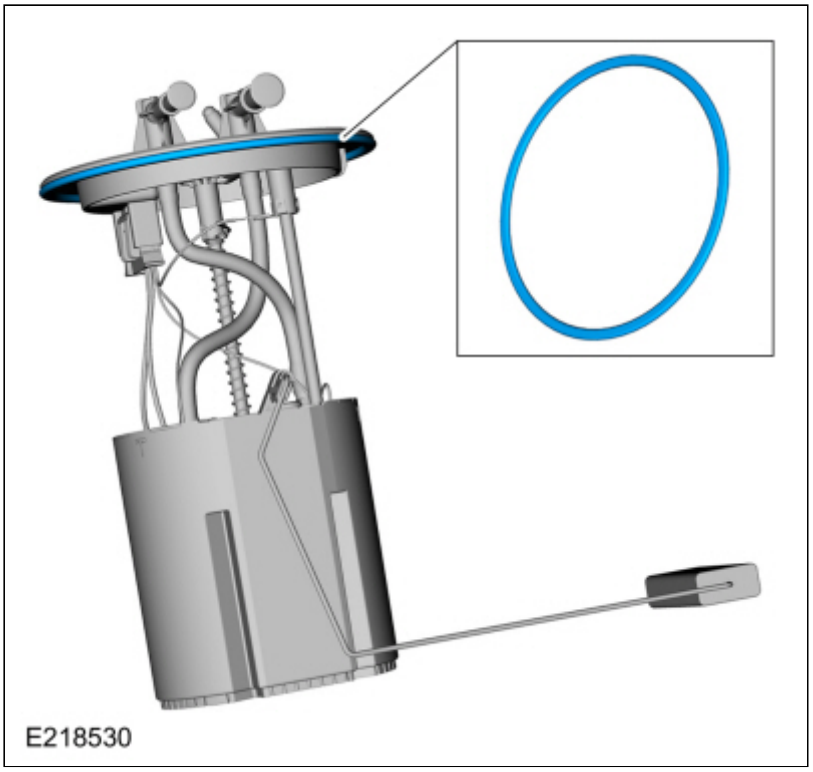
- Fuel tank
- Supply and return lines
- Fuel tank vent valves
- Fuel pump and sender unit
- Fuel filter
- Fuel filler

Fuel Tank

The fuel tank is of plastic construction and is secured to the vehicle by two metal support straps, which are bolted to the chassis side rail.

NOTE: *The diesel fuel tank must contain at least 4 litres of fuel before the fuel pump is operated. Running the fuel pump with less than 4 litres of fuel will cause damage to the fuel pump.*

Fuel Pump and Sender Unit



The pump and sender unit is located in the top of the fuel tank and is retained by a locking ring and seal. The fuel pump is attached to the fuel pump and sender unit flange by spring loaded guide bars, which ensure that the fuel pump is seated against the base of the fuel tank when installed.

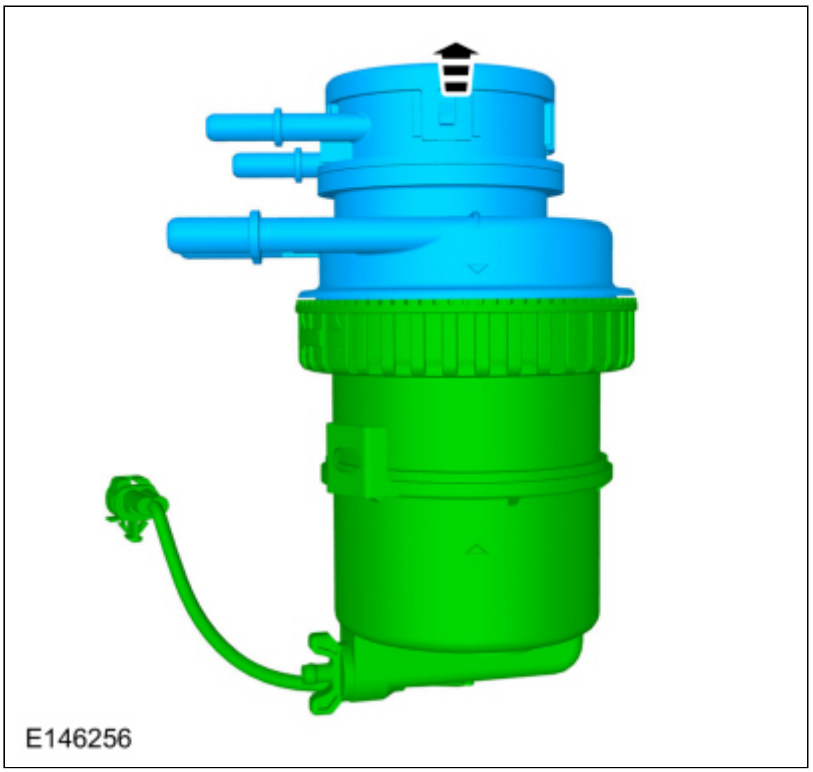
The electric fuel pump delivers fuel to the high pressure mechanical fuel pump.

The fuel level sender consists of a mechanical float attached to a variable resistor card by means of a rigid wire lever.

The base of the fuel pump and sender unit is a chamber that sits in the swirl bowl at the bottom of the fuel tank.

The fuel pump and sender unit also incorporates a fuel jet pump. Fuel from the fuel charging system is passed through a venturi in the jet pump which causes a pressure drop across an open orifice. This draws in fuel through the base of the unit which then passes through the fuel supply tube.

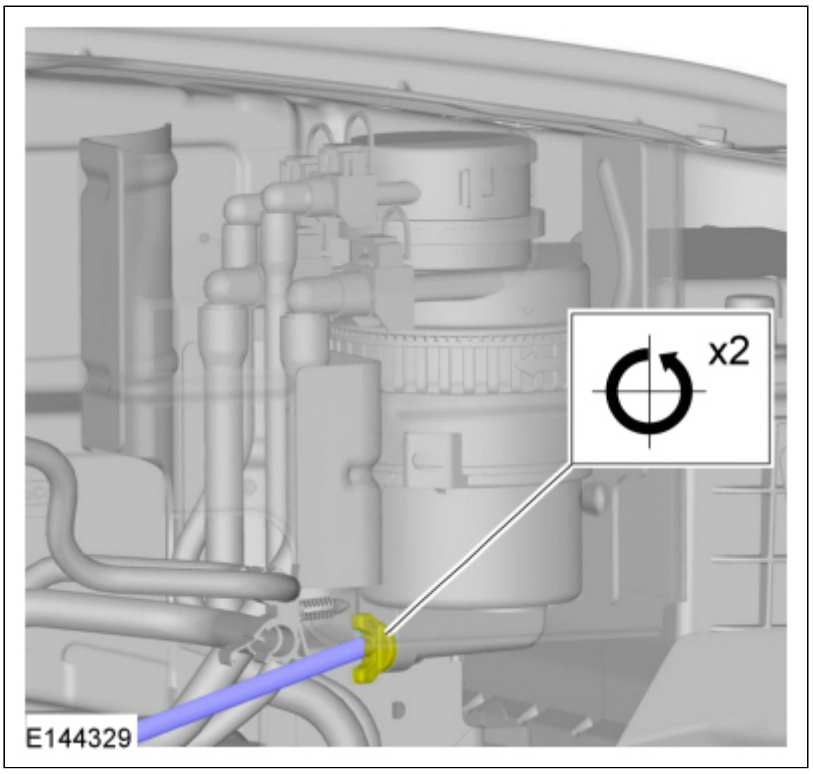
Fuel Filter



The diesel fuel filter separates air, water and other contaminants from fuel, in addition to retaining system back

pressure.

The upper section of the filter incorporates the recirculation valve and the return valve. The recirculation valve controls the flow of warm return fuel from the engine. When fuel temperature drops below 20 C, the valve opens to direct return fuel to the filter, warming the fuel to prevent waxing. When fuel temperature reaches 33 C, the valve closes and return fuel is directed back to the fuel tank.



Water trapped in the fuel filter can be removed by attaching a suitable length of hose to the drain plug and draining it into a suitable container. Refer to the workshop manual for further instructions.

Fuel Filler

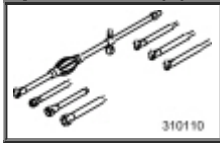
The fuel tank filler neck incorporates a fuel tank breather hose. The fuel tank breather hose is connected to the top of the fuel tank and exits just below the top of the fuel tank filler neck. The fuel tank breather hose allows the displaced vapor above the fuel in the fuel tank to escape, avoiding fuel "spit back" and premature shut off during refueling.

The fuel filler cap seals to the fuel filler neck. This is to prevent the escape of fuel vapor during normal operation and to prevent fuel loss in the event of a vehicle accident.

Copyright © 2016 Ford Motor Company

Fuel System

Special Tool(s)

	Hand Pressure Pump with Adapter Kit 310-110A

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Fuel level • Fuel leak(s) • Fuel line(s) • Fuel filter • Fuel filter element • Fuel tank • Fuel tank ventilation hose • Fuel tank filler pipe/hose	• Fuse(s) • Wiring harness • Electrical connector(s) • Fuel level sensor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Engine cranks but does not start	• Low fuel level.	• Fill the fuel tank with sufficient fuel to enable the engine to start.
	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel	• GO to Pinpoint Test A

	lines.	
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Poor starting	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Engine starts but immediately stops	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
• Poor idling	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

		REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Engine lacks power	• Fuel tank to fuel filter fuel supply line blocked.	• CHECK the fuel supply lines for damage. INSTALL a new fuel filter fuel supply line as necessary.
	• Fuel filter element blocked.	• INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Engine misfire	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
• Excessive fuel consumption	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel	• GO to Pinpoint Test A

	lines. • Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Fuel filler nozzle shuts off prematurely	• Fuel tank ventilation hose or pipe blocked. • Fuel tank ventilation hose or pipe collapsed.	• CHECK the fuel tank ventilation hose for obstruction or damage. INSTALL a new fuel tank ventilation pipe as necessary.
	• Fuel tank filler pipe or hose blocked. • Fuel tank filler pipe or hose collapsed.	• CHECK the fuel tank filler pipe or hose for obstruction or damage. INSTALL a new fuel tank filler pipe as necessary.
	• Fuel gauge indication.	• CHECK the fuel level in the fuel tank. CHECK the fuel indication system. For additional information,
	• Fuel filler nozzle at the fuel filling station not functioning correctly.	• VERIFY the condition by using a known good fuel filler nozzle.
• Fuel loss after nozzle shutoff or during refilling	• Fuel tank filler pipe or hose leaking.	• CHECK the fuel tank filler pipe and hose for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank filler pipe or hose as necessary.
	• Fuel tank leaking.	• CHECK the fuel tank for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank. REFER to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Tank - Chassis Cab (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Fuel tank ventilation pipe or hose leaking.	• CHECK the fuel tank ventilation pipe and hose for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank ventilation pipe or hose as necessary.

Pinpoint Tests

PINPOINT TEST A : AIR INGRESS INTO THE FUEL LINES

A1 CHECK FOR AIR INGRESS INTO THE FUEL SYSTEM
WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel

WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.

NOTICE: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTICE: Always carry out the cleaning process before carrying out any repairs to the fuel system components to prevent foreign material ingress to the components.

- Disconnect the fuel filter fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter fuel supply line and the fuel filter.
- Start the engine, wait a few minutes and observe the clear plastic pipe for signs of air ingress.

Are any signs of air present in the clear plastic pipe?

Yes	GO to A2
No	For additional diagnostics, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).

A2 CHECK WHERE AIR IS ENTERING THE SYSTEM

- Using suitable clean engine oil, apply the oil to each of the fuel supply line and fuel return line connections, unions and joints in turn and observe the clear plastic pipe for visible signs of air after each oil application.

Did the amount of air in the clear plastic fuel pipe decrease when any of the connectors, unions or joints were oiled?

Yes	INSTALL a new fuel pipe(s) as necessary. Test the system for normal operation.
No	GO to A3

A3 CHECK THE FUEL LEVEL SENSOR FOR AIR INGRESS

- Drain the fuel tank.
  REFER to: Fuel Tank Draining (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Fill the fuel tank with 10 liters of diesel.
- Disconnect the fuel filter to fuel pump fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter to fuel pump fuel supply line and the fuel filter.
- **NOTE:** *Make sure that the engine is at normal operating temperature.*

  Start the engine, wait a few minutes and observe the clear plastic pipe for signs of air ingress.

Are any signs of air present in the clear plastic pipe?

Yes	INSTALL a new fuel level sensor or fuel tank to fuel filter supply pipe as necessary.
No	INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

PINPOINT TEST B : FUEL FILTER FUEL SUPPLY LINE BLOCKAGE

B1 CHECK THE FUEL FILTER FUEL SUPPLY LINE FOR BLOCKAGE

WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.

NOTICE: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTICE: Always carry out the cleaning process before carrying out any repairs to the fuel injection system components to prevent foreign material ingress to the components.

- Disconnect the fuel filter fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- **NOTE:** *Make sure that the hand pressure pump arrow indicating the direction of fuel flow is pointing towards the fuel filter.*

  Install the special tool between the fuel filter fuel supply line quick release coupling and the fuel filter union.
- Operate the hand pressure pump at least 30 times.
- Disconnect the fuel pump fuel return line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel pump fuel return line and the fuel return line union.
- Observe the flow of fuel in the clear plastic pipe.

Does the fuel from the fuel tank flow freely with no restrictions?

Yes	GO to Pinpoint Test A
No	REPAIR or INSTALL a new fuel filter fuel supply line as necessary.

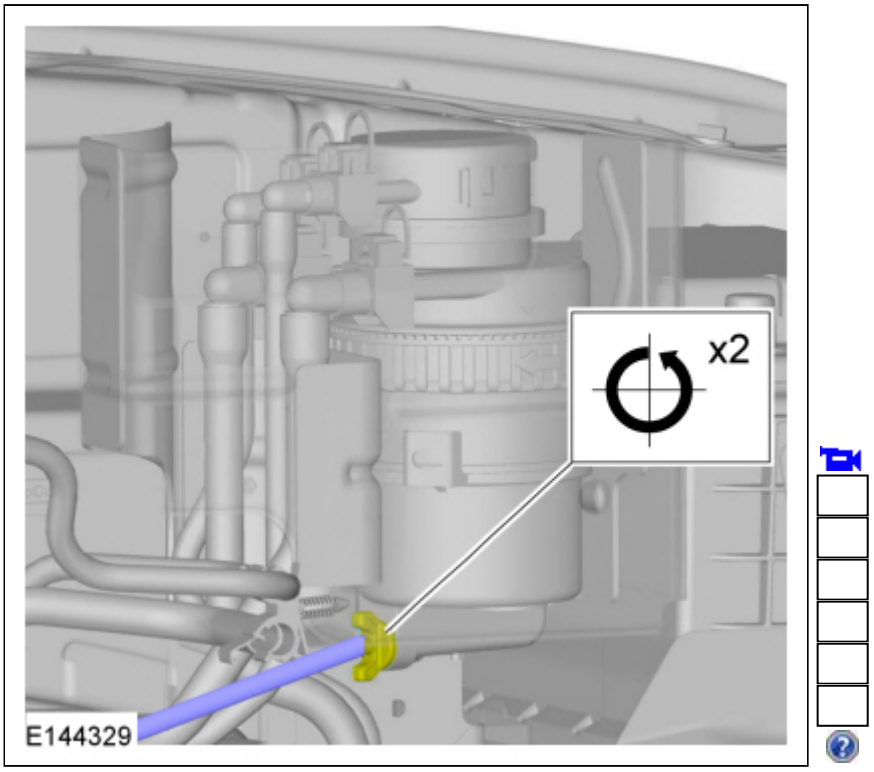
Copyright © 2016 Ford Motor Company

Diesel Filter Water Drain-Off

WARNING: Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.

WARNING: A person charged with static electricity could cause a fire or explosion, resulting in death or serious injury. Before performing work on the fuel system, discharge static electricity by touching the vehicle body.

WARNING: Avoid fuel line spills and leaks by completing the following procedure.

1. For additional information, refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Attach a suitable length of hose to the drain plug and place it into a suitable container.
3. 

4. **WARNING: If fuel does not pass through the fuel filter, foreign material may have penetrated in the supply pump, and this may cause a malfunction resulting in damage to the fuel injection pump.**

   WARNING: Be prepared to collect escaping fluids under pressure.

   Turn ignition ON. Wait for a minimum of 5 seconds, this purges the water and fuel from the filter.
5. Tighten the drain plug and remove the hose and container.

Copyright © 2016 Ford Motor Company

Fuel System Bleeding

Bleeding

1. Turn the ignition key to ON position. Wait for 45 seconds.
2. Start the engine and hold at 1500 rpm.
3. Wait for 20 seconds.
4. If the engine is running smoothly, reduce the rpm to idle speed.
5. Check fuel leaks.
6. Switch the engine off.

Copyright © 2016 Ford Motor Company

Fuel Tank Draining

Special Tool(s) / General Equipment

10 mm Drill Bit
Fuel Tank Draining Equipment

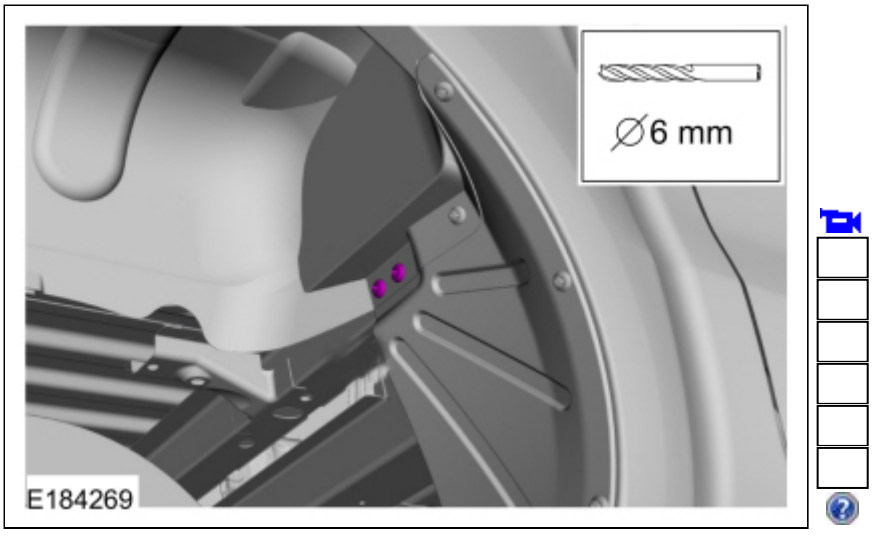
Draining

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

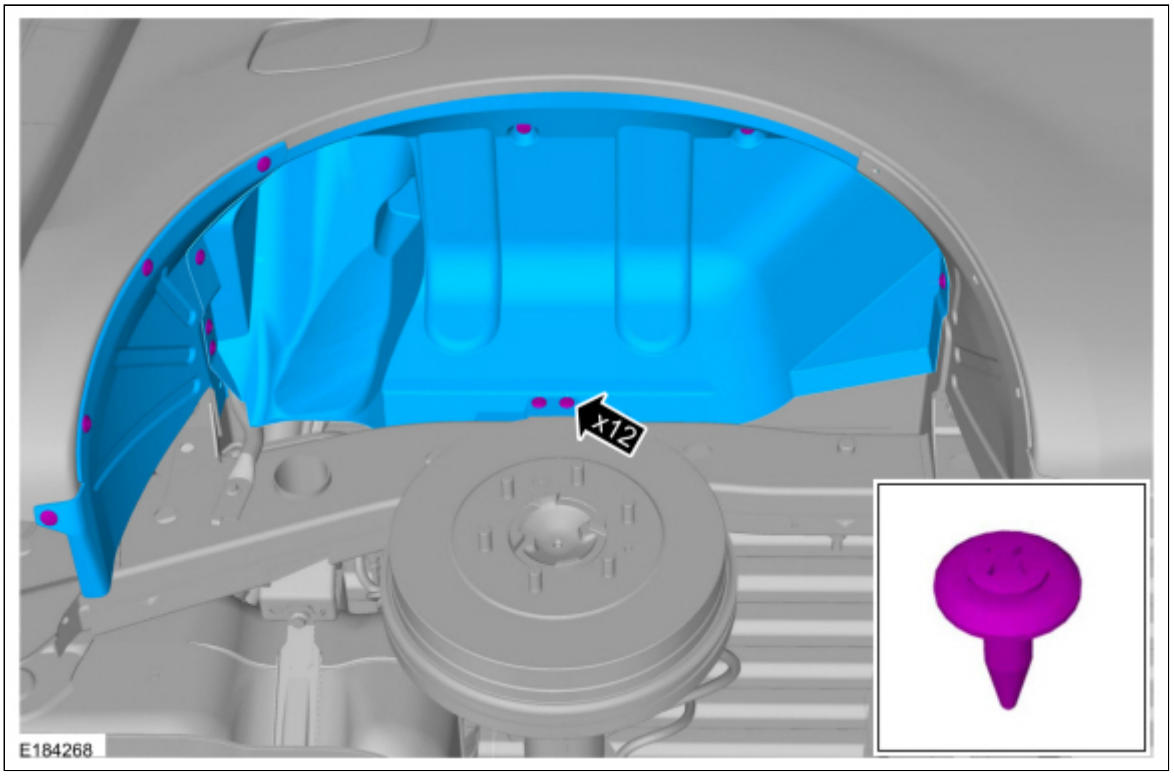
WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

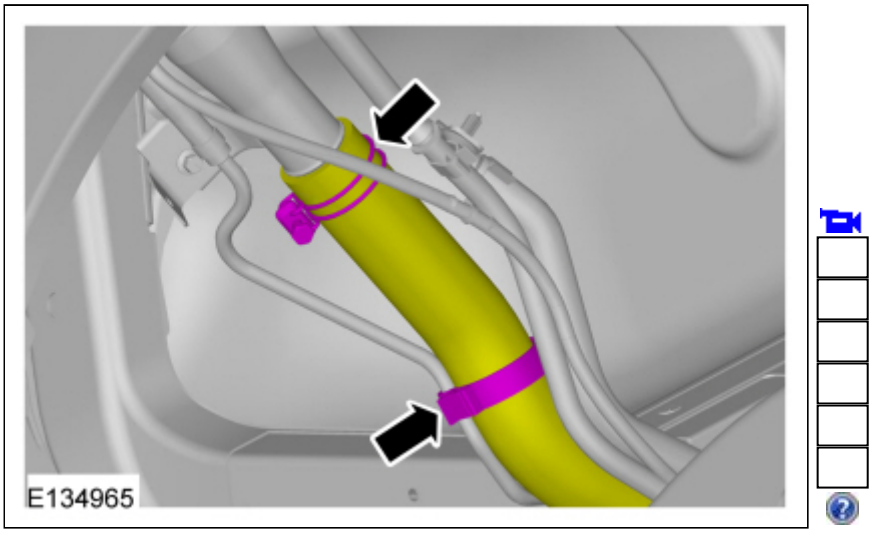
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Use the General Equipment: 10 mm Drill Bit



6.

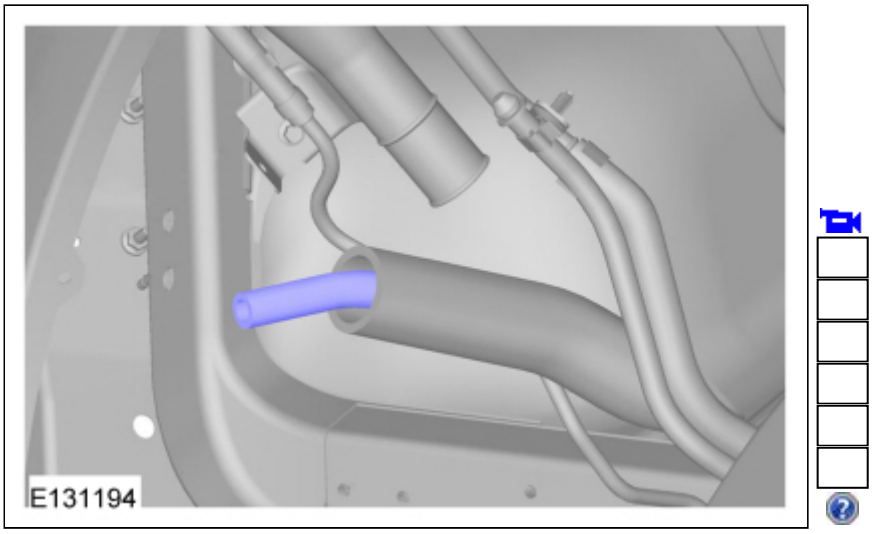


7. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



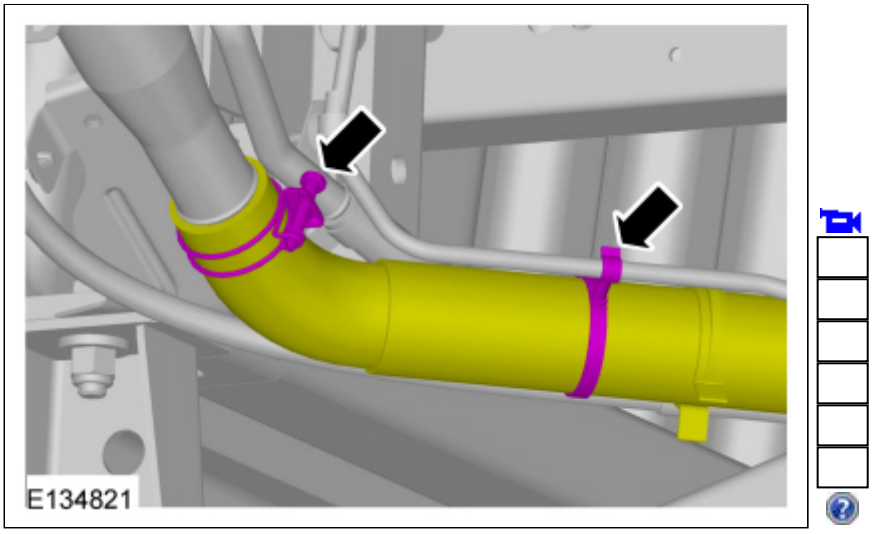
8. **NOTE:** *Follow the operating instructions supplied by the equipment manufacturer.*

Insert the fuel tank drain hose into the fuel tank hose.
Use the General Equipment: Fuel Tank Draining Equipment



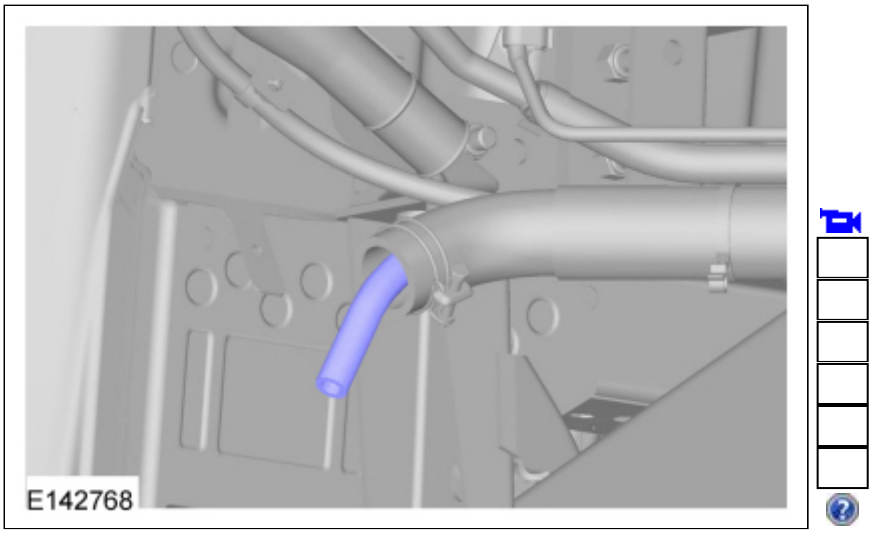
NOTE: *Vehicles with aluminium tray.*

9. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



10. **NOTE:** *Follow the operating instructions supplied by the equipment manufacturer.*

    Insert the fuel tank drain hose into the fuel tank hose.
    Use the General Equipment: Fuel Tank Draining Equipment



Copyright © 2016 Ford Motor Company

Quick Release Coupling

Disconnect

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

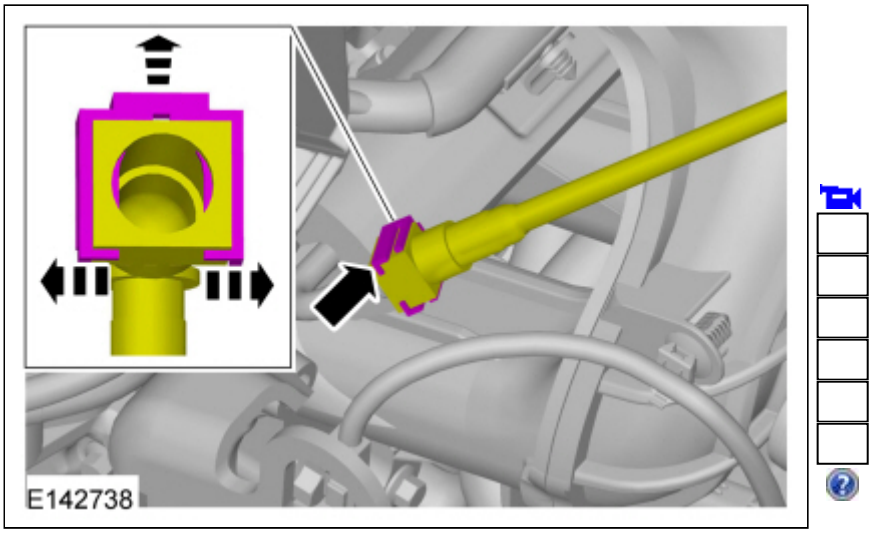
WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not repair the fuel lines. If the fuel lines are found to damaged, a new component must be installed.

NOTE: *Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.*

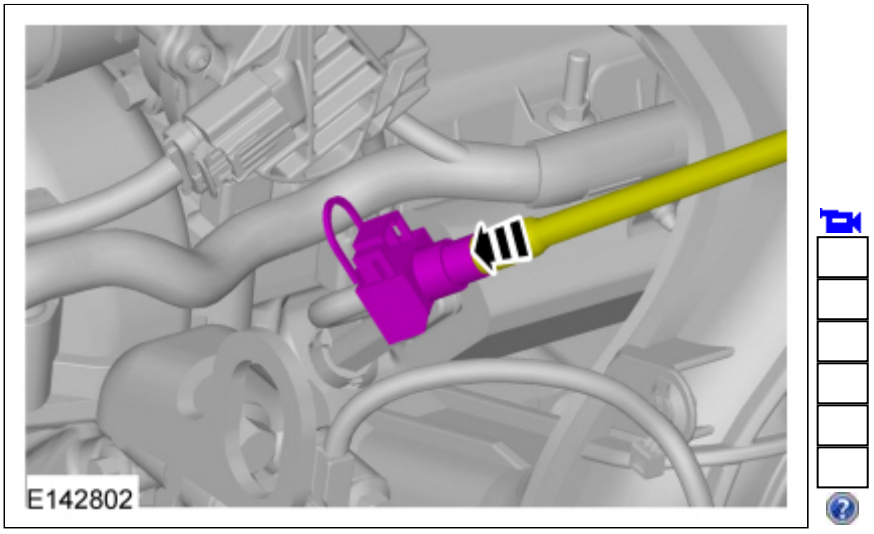
NOTE: *When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.

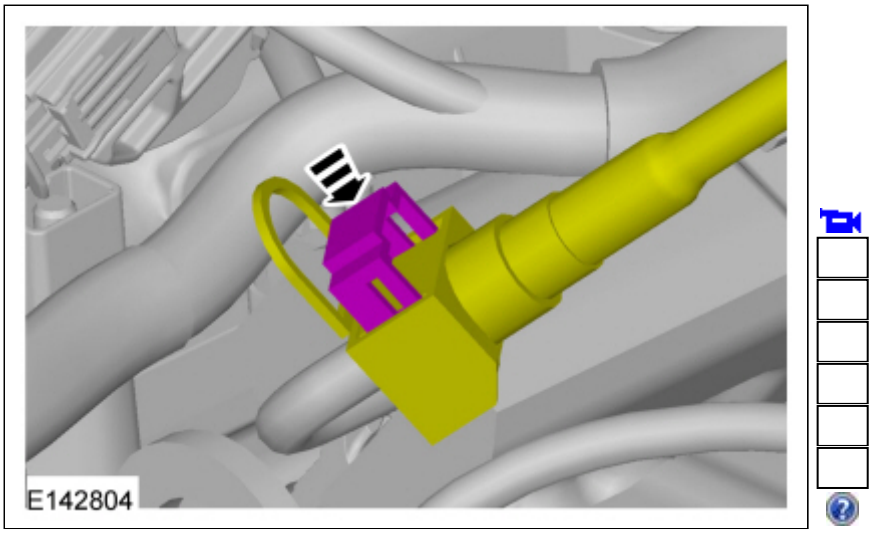


Connect

1.

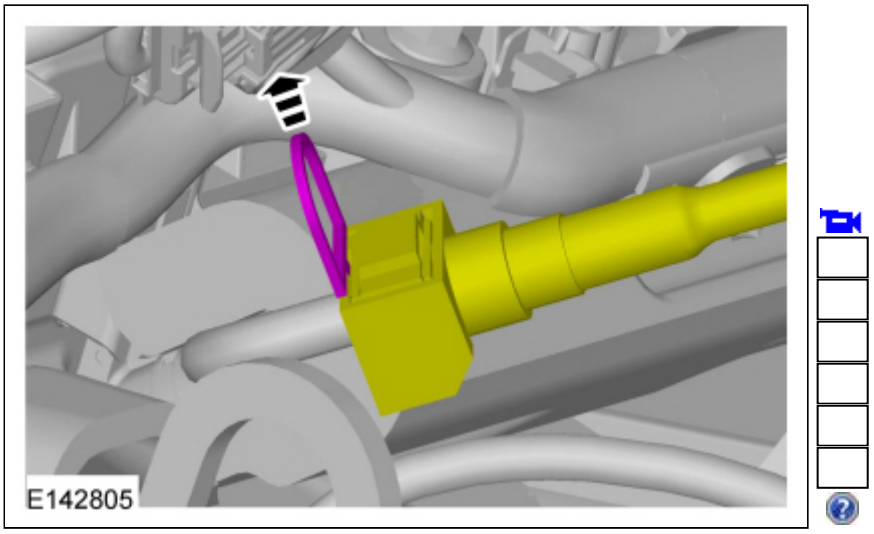


2.



3. **WARNING: Make sure that all fuel connections are checked for leaks.**

NOTE: *This step is only neccessary if a new component is installed.*



4. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Specifications

Item	Specification
Fuel Pressure	
KOEO - 3.2L Duratorq-TDCi (Low pressure side)	75 kPa
Fuel Tank Capacity	
Four Wheel drive (4WD)	80 L
Rear wheel drive (RWD)	80 L

Copyright © 2016 Ford Motor Company

Fuel System

Overview

The fuel system consists of:

- A mechanical return fuel system.
- An 80L cigar shaped fuel tank.
- A fuel filler pipe with a vented cap.
- Fuel feed & return lines
- A fuel filter with bi-metallic valve (for recirculation) and water in fuel sensor.
- Fuel vapour tubes.
- A diesel delivery module containing:
  - A fuel pump.
  - With Jet pump and 50kPa pressure relief valve.
  - A serviceable fuel level sender.
  - A low level fuel switch.

Fuel Pump Shut-off Feature

In the event of a moderate to severe collision, the vehicle is equipped with a Fuel Pump and Sender Unit Shut-off Feature that is initiated by the event notification signal.

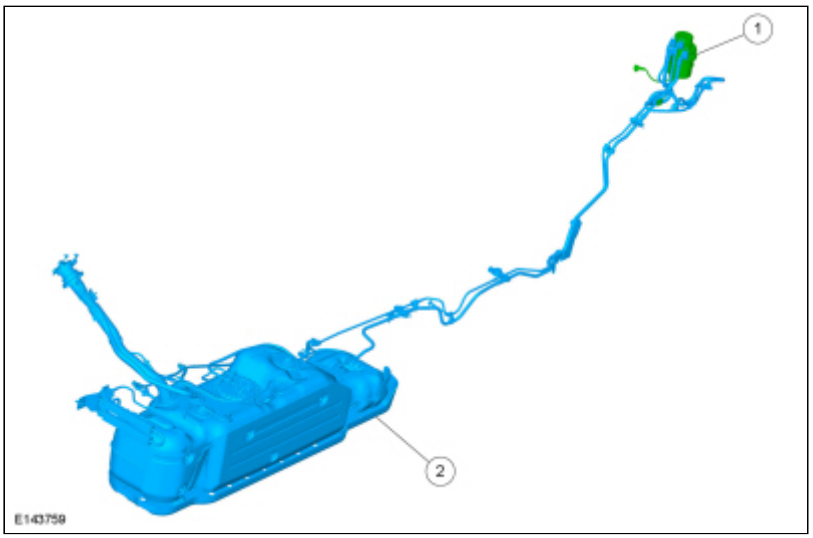
The event notification signal is a signal provided by the RCM to the Fuel Pump Control Module. Signal communication between the RCM and the Fuel Pump Control Module allows the PCM to shut-off the Fuel Pump.

Should the vehicle shut off after a collision due to this feature, the vehicle may be restarted by first turning the ignition to the OFF position and then turn the ignition to the ON position. In some instances the vehicle may not start the first time and may take one additional ignition cycle.

Copyright © 2016 Ford Motor Company

Fuel System - Overview

Diesel Fuel System



The Fuel System comprises of :

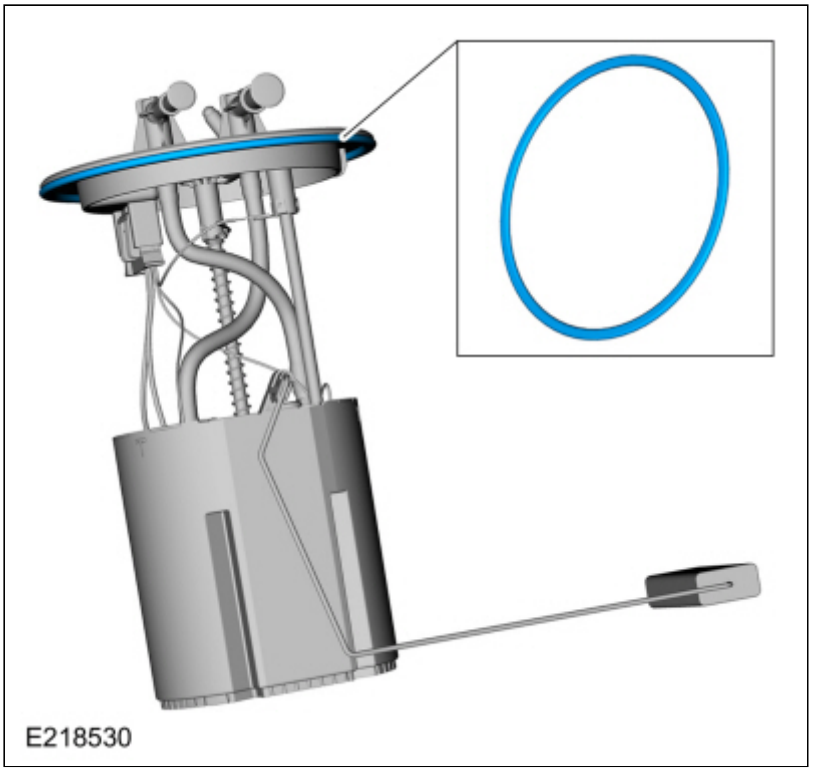
- Fuel tank
- Supply and return lines
- Fuel tank vent valves
- Fuel pump and sender unit
- Fuel filter
- Fuel filler

Fuel Tank

The fuel tank is of plastic construction and is secured to the vehicle by two metal support straps, which are bolted to the chassis side rail.

NOTE: *The diesel fuel tank must contain at least 4 litres of fuel before the fuel pump is operated. Running the fuel pump with less than 4 litres of fuel will cause damage to the fuel pump.*

Fuel Pump and Sender Unit



The pump and sender unit is located in the top of the fuel tank and is retained by a locking ring and seal. The fuel pump is attached to the fuel pump and sender unit flange by spring loaded guide bars, which ensure that the fuel pump is seated against the base of the fuel tank when installed.

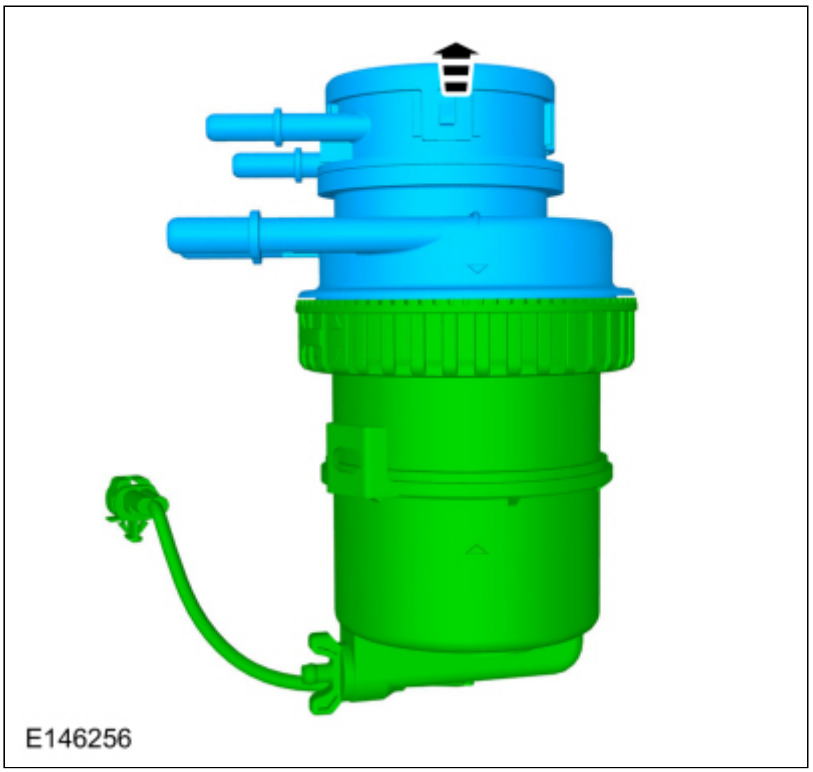
The electric fuel pump delivers fuel to the high pressure mechanical fuel pump.

The fuel level sender consists of a mechanical float attached to a variable resistor card by means of a rigid wire lever.

The base of the fuel pump and sender unit is a chamber that sits in the swirl bowl at the bottom of the fuel tank.

The fuel pump and sender unit also incorporates a fuel jet pump. Fuel from the fuel charging system is passed through a venturi in the jet pump which causes a pressure drop across an open orifice. This draws in fuel through the base of the unit which then passes through the fuel supply tube.

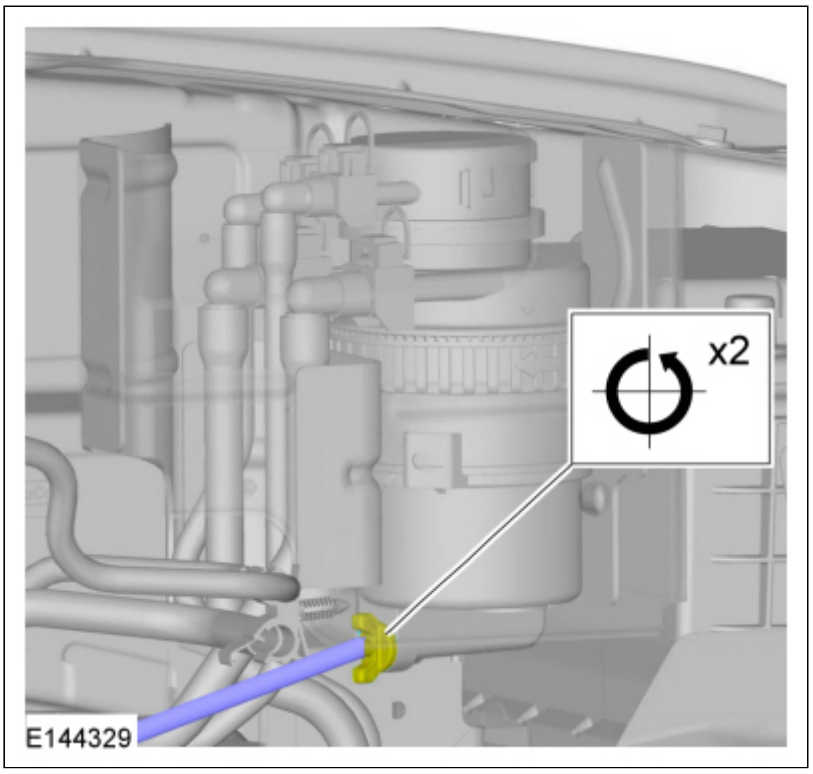
Fuel Filter



The diesel fuel filter separates air, water and other contaminants from fuel, in addition to retaining system back

pressure.

The upper section of the filter incorporates the recirculation valve and the return valve. The recirculation valve controls the flow of warm return fuel from the engine. When fuel temperature drops below 20 C, the valve opens to direct return fuel to the filter, warming the fuel to prevent waxing. When fuel temperature reaches 33 C, the valve closes and return fuel is directed back to the fuel tank.



Water trapped in the fuel filter can be removed by attaching a suitable length of hose to the drain plug and draining it into a suitable container. Refer to the workshop manual for further instructions.

Fuel Filler

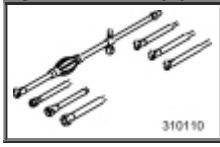
The fuel tank filler neck incorporates a fuel tank breather hose. The fuel tank breather hose is connected to the top of the fuel tank and exits just below the top of the fuel tank filler neck. The fuel tank breather hose allows the displaced vapor above the fuel in the fuel tank to escape, avoiding fuel "spit back" and premature shut off during refueling.

The fuel filler cap seals to the fuel filler neck. This is to prevent the escape of fuel vapor during normal operation and to prevent fuel loss in the event of a vehicle accident.

Copyright © 2016 Ford Motor Company

Fuel System

Special Tool(s)

	Hand Pressure Pump with Adapter Kit 310-110A

General Equipment

Ford diagnostic equipment

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Fuel level • Fuel leak(s) • Fuel line(s) • Fuel filter • Fuel filter element • Fuel tank • Fuel tank ventilation hose • Fuel tank filler pipe/hose	• Fuse(s) • Wiring harness • Electrical connector(s) • Fuel level sensor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• Engine cranks but does not start	• Low fuel level.	• Fill the fuel tank with sufficient fuel to enable the engine to start.
	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel	• GO to Pinpoint Test A

	lines.	
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Poor starting	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Engine starts but immediately stops	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
• Poor idling	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

		REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Engine lacks power	• Fuel tank to fuel filter fuel supply line blocked.	• CHECK the fuel supply lines for damage. INSTALL a new fuel filter fuel supply line as necessary.
	• Fuel filter element blocked.	• INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
	• Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Engine misfire	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel lines.	• GO to Pinpoint Test A
• Excessive fuel consumption	• Fuel charging and controls.	• REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
	• Air ingress into the fuel	• GO to Pinpoint Test A

	lines. • Contaminated fuel.	• DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
• Fuel filler nozzle shuts off prematurely	• Fuel tank ventilation hose or pipe blocked. • Fuel tank ventilation hose or pipe collapsed.	• CHECK the fuel tank ventilation hose for obstruction or damage. INSTALL a new fuel tank ventilation pipe as necessary.
	• Fuel tank filler pipe or hose blocked. • Fuel tank filler pipe or hose collapsed.	• CHECK the fuel tank filler pipe or hose for obstruction or damage. INSTALL a new fuel tank filler pipe as necessary.
	• Fuel gauge indication.	• CHECK the fuel level in the fuel tank. CHECK the fuel indication system. For additional information,
	• Fuel filler nozzle at the fuel filling station not functioning correctly.	• VERIFY the condition by using a known good fuel filler nozzle.
• Fuel loss after nozzle shutoff or during refilling	• Fuel tank filler pipe or hose leaking.	• CHECK the fuel tank filler pipe and hose for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank filler pipe or hose as necessary.
	• Fuel tank leaking.	• CHECK the fuel tank for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank. REFER to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Tank - Chassis Cab (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
	• Fuel tank ventilation pipe or hose leaking.	• CHECK the fuel tank ventilation pipe and hose for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank ventilation pipe or hose as necessary.

Pinpoint Tests

PINPOINT TEST A : AIR INGRESS INTO THE FUEL LINES

A1 CHECK FOR AIR INGRESS INTO THE FUEL SYSTEM
WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel

WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.

NOTICE: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTICE: Always carry out the cleaning process before carrying out any repairs to the fuel system components to prevent foreign material ingress to the components.

- Disconnect the fuel filter fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter fuel supply line and the fuel filter.
- Start the engine, wait a few minutes and observe the clear plastic pipe for signs of air ingress.

Are any signs of air present in the clear plastic pipe?

Yes	GO to A2
No	For additional diagnostics, REFER to: Fuel Charging and Controls (303-04B Fuel Charging and Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).

A2 CHECK WHERE AIR IS ENTERING THE SYSTEM

- Using suitable clean engine oil, apply the oil to each of the fuel supply line and fuel return line connections, unions and joints in turn and observe the clear plastic pipe for visible signs of air after each oil application.

Did the amount of air in the clear plastic fuel pipe decrease when any of the connectors, unions or joints were oiled?

Yes	INSTALL a new fuel pipe(s) as necessary. Test the system for normal operation.
No	GO to A3

A3 CHECK THE FUEL LEVEL SENSOR FOR AIR INGRESS

- Drain the fuel tank.
  REFER to: Fuel Tank Draining (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Fill the fuel tank with 10 liters of diesel.
- Disconnect the fuel filter to fuel pump fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter to fuel pump fuel supply line and the fuel filter.
- **NOTE:** *Make sure that the engine is at normal operating temperature.*

  Start the engine, wait a few minutes and observe the clear plastic pipe for signs of air ingress.

Are any signs of air present in the clear plastic pipe?

Yes	INSTALL a new fuel level sensor or fuel tank to fuel filter supply pipe as necessary.
No	INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

PINPOINT TEST B : FUEL FILTER FUEL SUPPLY LINE BLOCKAGE

B1 CHECK THE FUEL FILTER FUEL SUPPLY LINE FOR BLOCKAGE

WARNING: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.

NOTICE: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

NOTICE: Always carry out the cleaning process before carrying out any repairs to the fuel injection system components to prevent foreign material ingress to the components.

- Disconnect the fuel filter fuel supply line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- **NOTE:** *Make sure that the hand pressure pump arrow indicating the direction of fuel flow is pointing towards the fuel filter.*

  Install the special tool between the fuel filter fuel supply line quick release coupling and the fuel filter union.
- Operate the hand pressure pump at least 30 times.
- Disconnect the fuel pump fuel return line quick release coupling.
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
  REFER to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
- Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel pump fuel return line and the fuel return line union.
- Observe the flow of fuel in the clear plastic pipe.

Does the fuel from the fuel tank flow freely with no restrictions?

Yes	GO to Pinpoint Test A
No	REPAIR or INSTALL a new fuel filter fuel supply line as necessary.

Copyright © 2016 Ford Motor Company

Diesel Filter Water Drain-Off

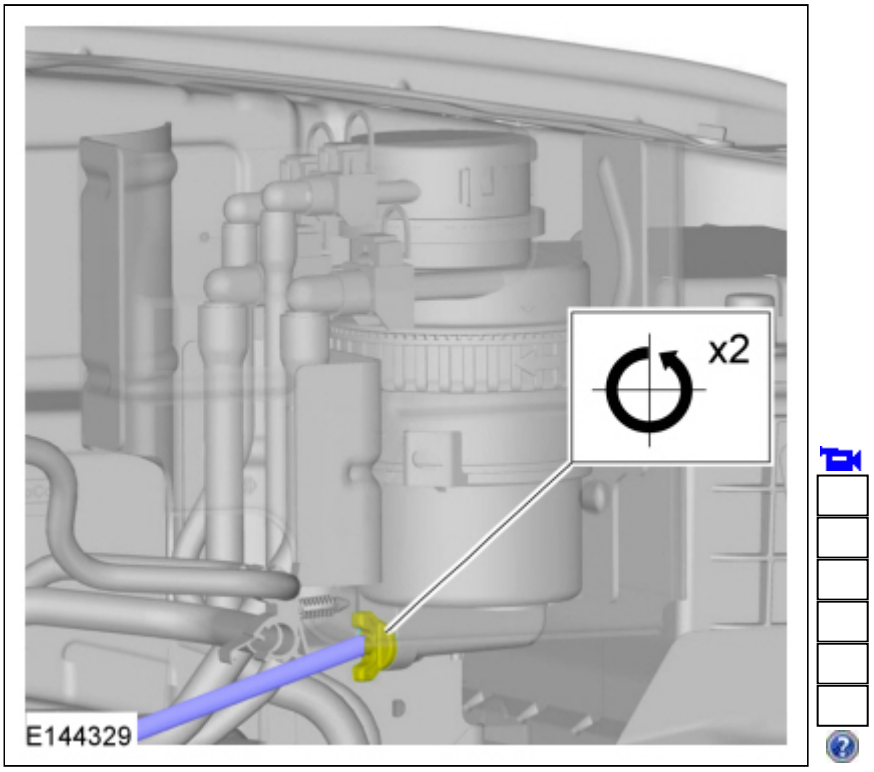
WARNING: Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.

WARNING: A person charged with static electricity could cause a fire or explosion, resulting in death or serious injury. Before performing work on the fuel system, discharge static electricity by touching the vehicle body.

WARNING: Avoid fuel line spills and leaks by completing the following procedure.

1. For additional information, refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Attach a suitable length of hose to the drain plug and place it into a suitable container.

3. 

4. **WARNING: If fuel does not pass through the fuel filter, foreign material may have penetrated in the supply pump, and this may cause a malfunction resulting in damage to the fuel injection pump.**

   WARNING: Be prepared to collect escaping fluids under pressure.

   Turn ignition ON. Wait for a minimum of 5 seconds, this purges the water and fuel from the filter.

5. Tighten the drain plug and remove the hose and container.

Copyright © 2016 Ford Motor Company

Fuel System Bleeding

Bleeding

1. Turn the ignition key to ON position. Wait for 45 seconds.
2. Start the engine and hold at 1500 rpm.
3. Wait for 20 seconds.
4. If the engine is running smoothly, reduce the rpm to idle speed.
5. Check fuel leaks.
6. Switch the engine off.

Copyright © 2016 Ford Motor Company

Fuel Tank Draining

Special Tool(s) / General Equipment

10 mm Drill Bit
Fuel Tank Draining Equipment

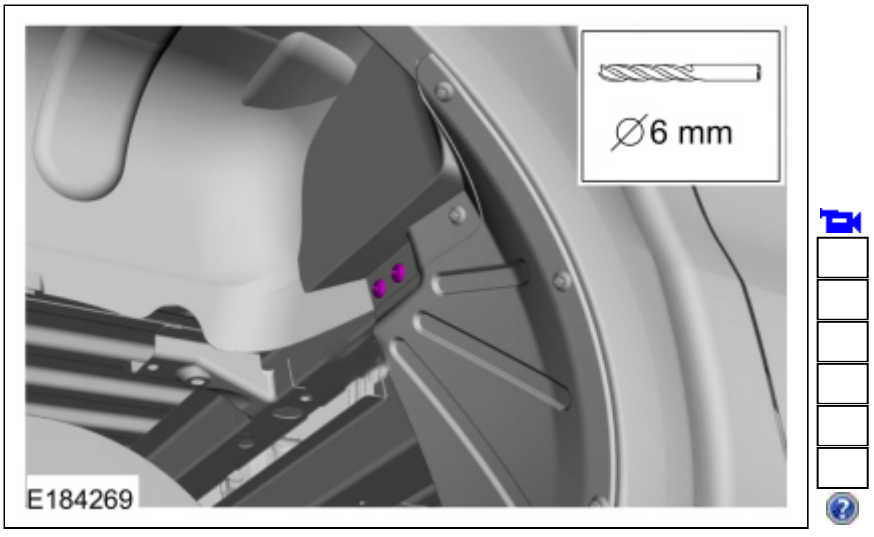
Draining

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

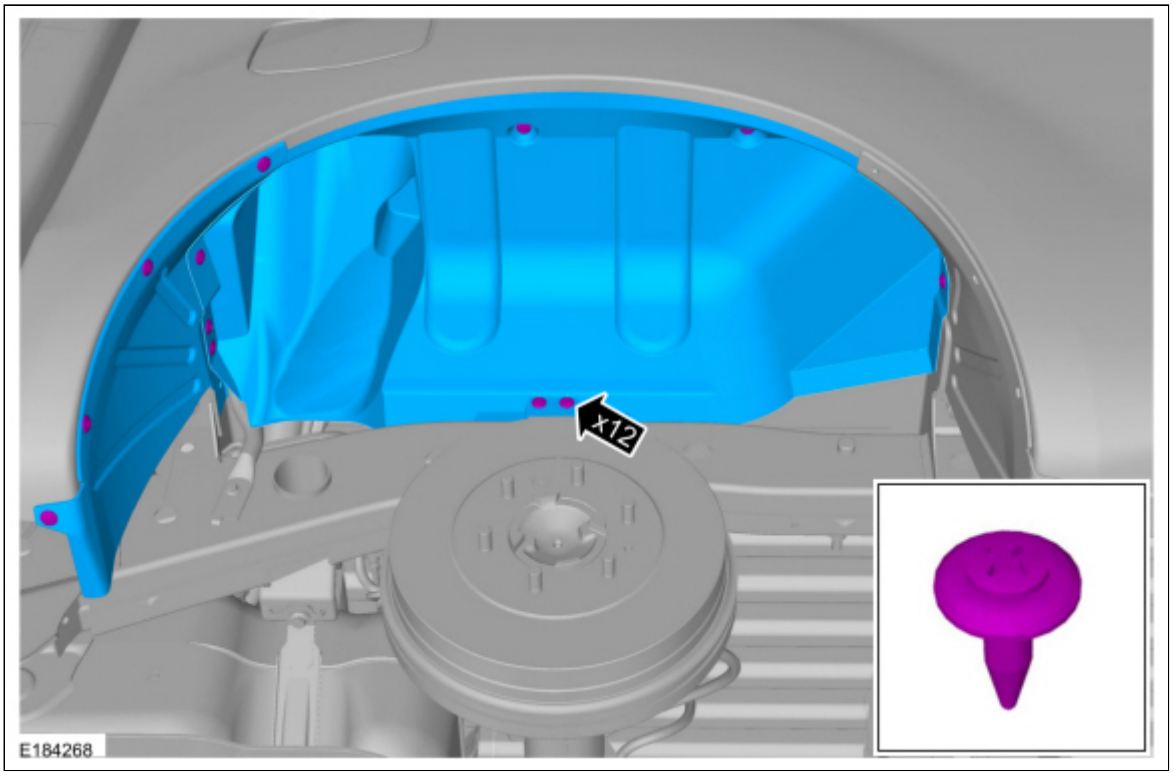
WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

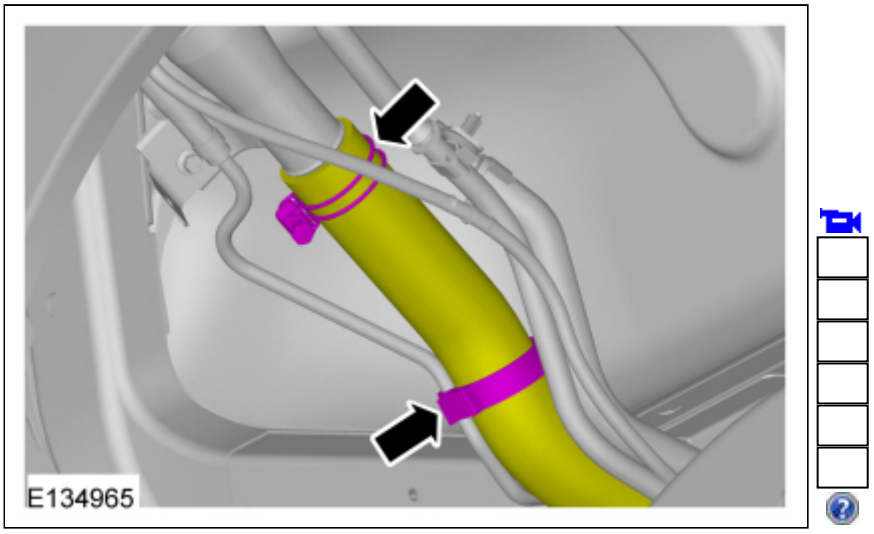
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Use the General Equipment: 10 mm Drill Bit



6.

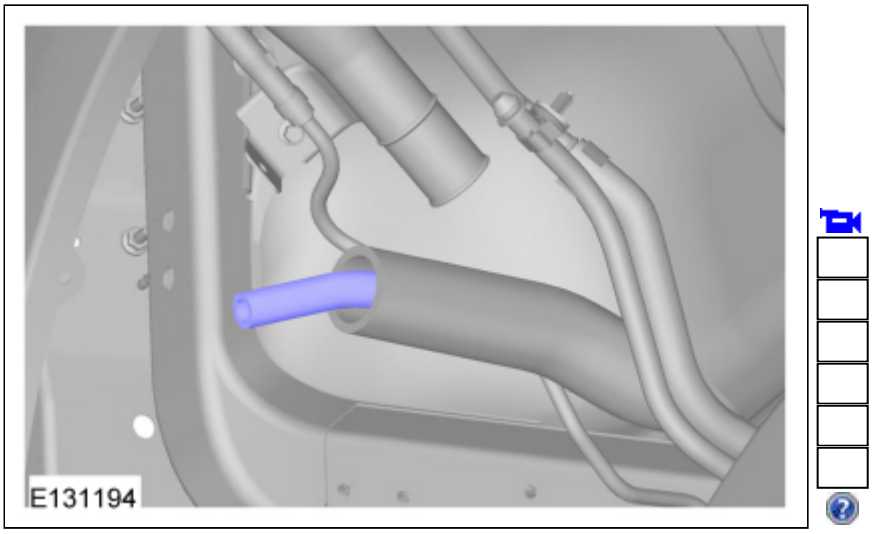


7. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



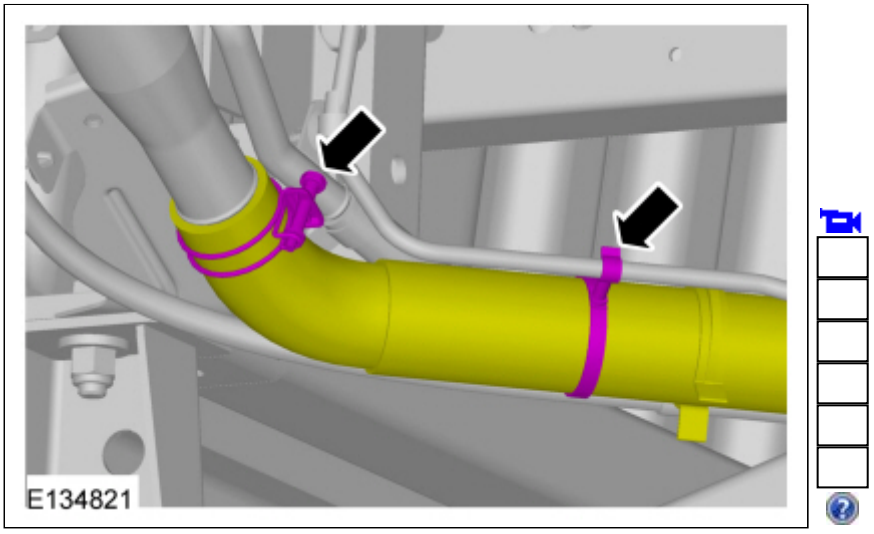
8. **NOTE:** *Follow the operating instructions supplied by the equipment manufacturer.*

Insert the fuel tank drain hose into the fuel tank hose.
Use the General Equipment: Fuel Tank Draining Equipment



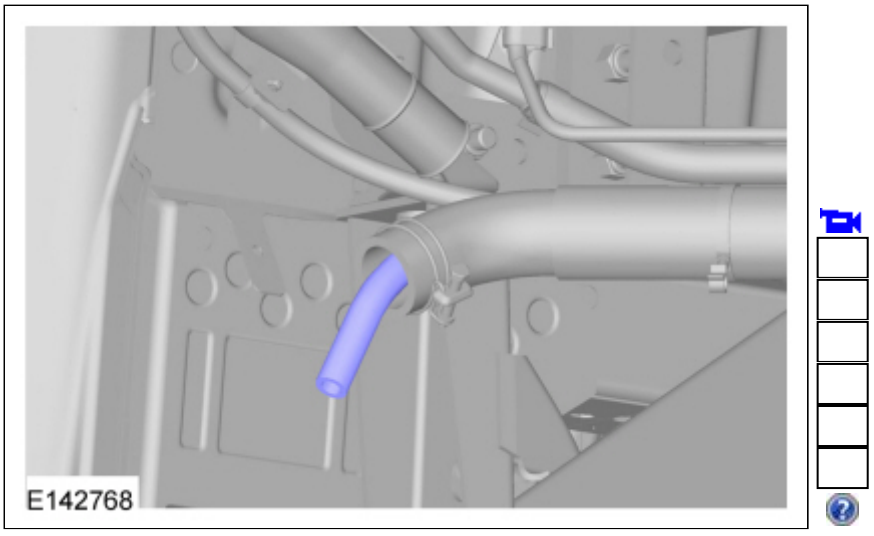
NOTE: *Vehicles with aluminium tray.*

9. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



10. **NOTE:** *Follow the operating instructions supplied by the equipment manufacturer.*

    Insert the fuel tank drain hose into the fuel tank hose.
    Use the General Equipment: Fuel Tank Draining Equipment



Copyright © 2016 Ford Motor Company

Quick Release Coupling

Disconnect

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

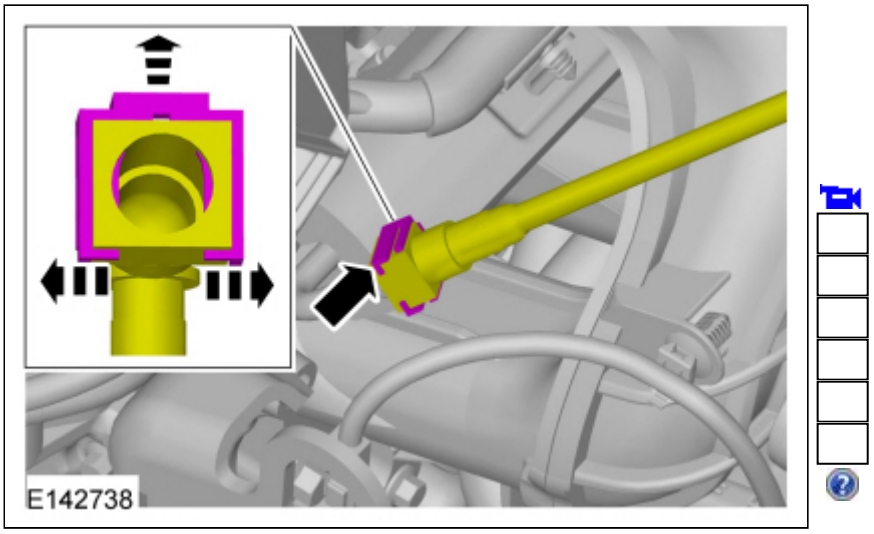
WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not repair the fuel lines. If the fuel lines are found to damaged, a new component must be installed.

NOTE: *Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.*

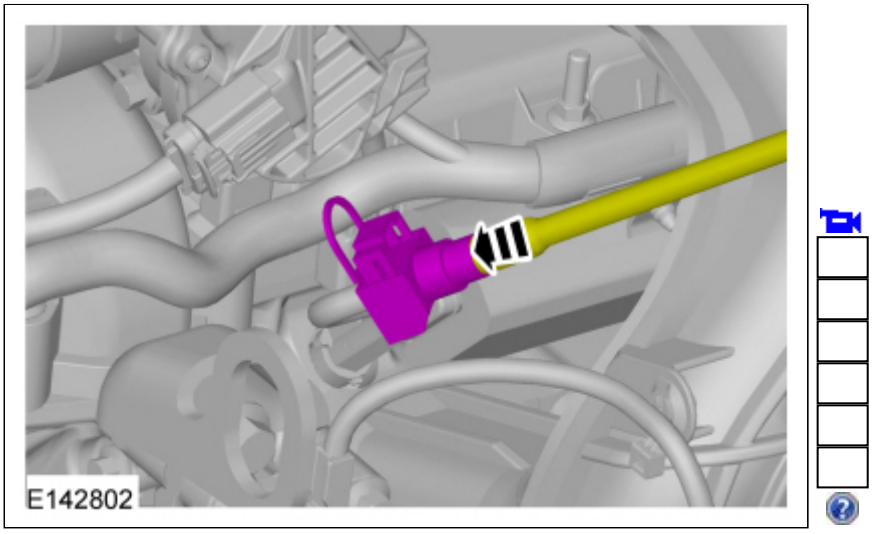
NOTE: *When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.

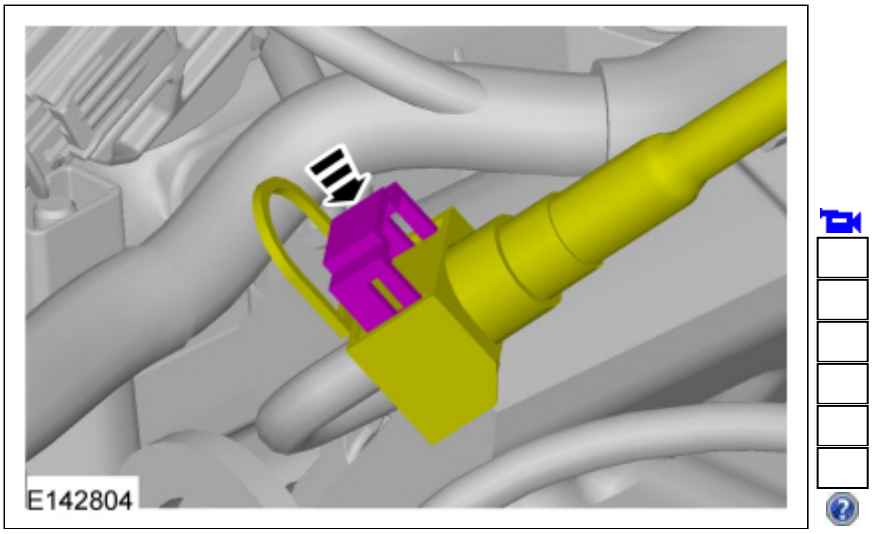


Connect

1.

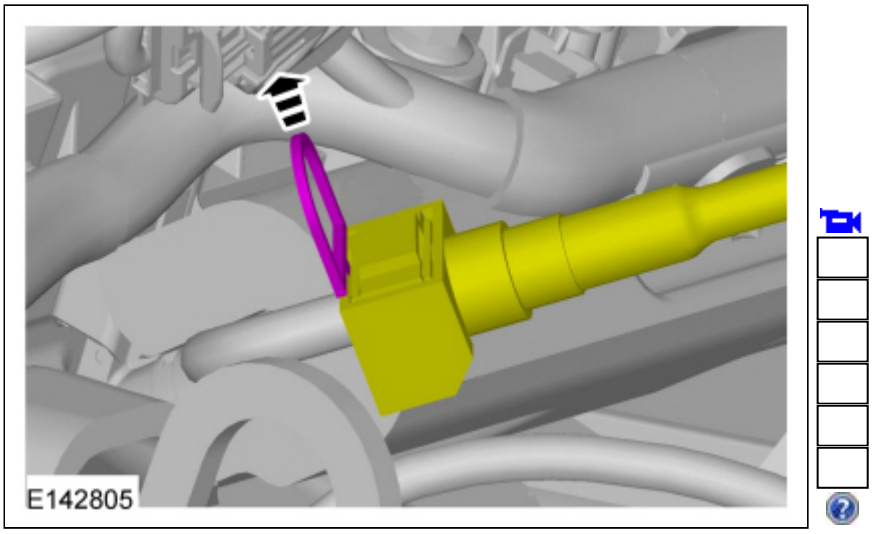


2.



3. **WARNING: Make sure that all fuel connections are checked for leaks.**

NOTE: *This step is only neccessary if a new component is installed.*

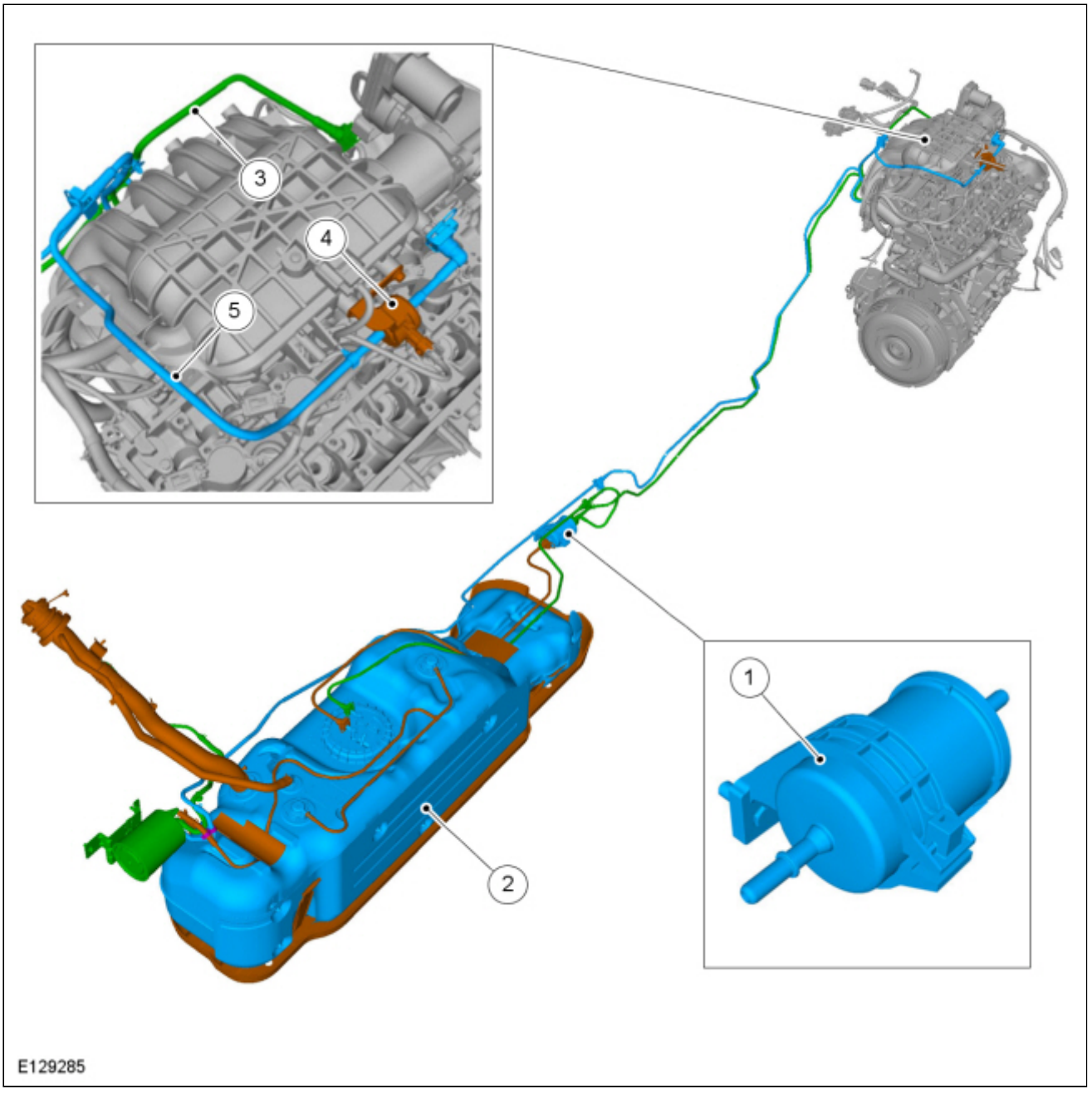


4. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Fuel Tank and Lines

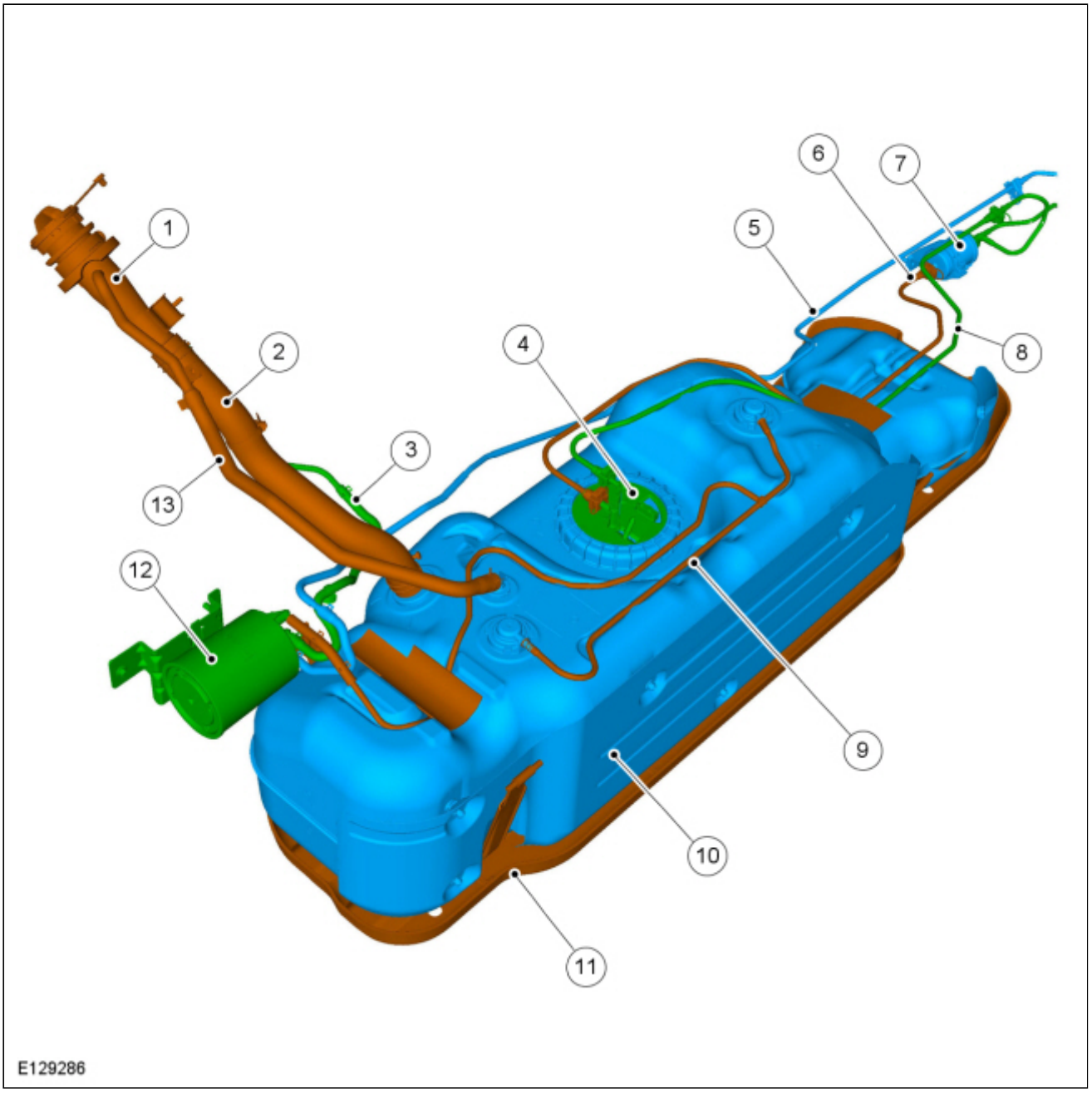
Vehicles with petrol engine



Item	Part Number	Description
1	—	Fuel filter
2	—	Fuel tank
3	—	Supply line to injection rail
4	—	Vapor emission valve
5	—	Vapor line from canister

Fuel is stored in the fuel tank and delivered to the fuel injectors by means of a submersed fuel pump through an inline fuel filter.

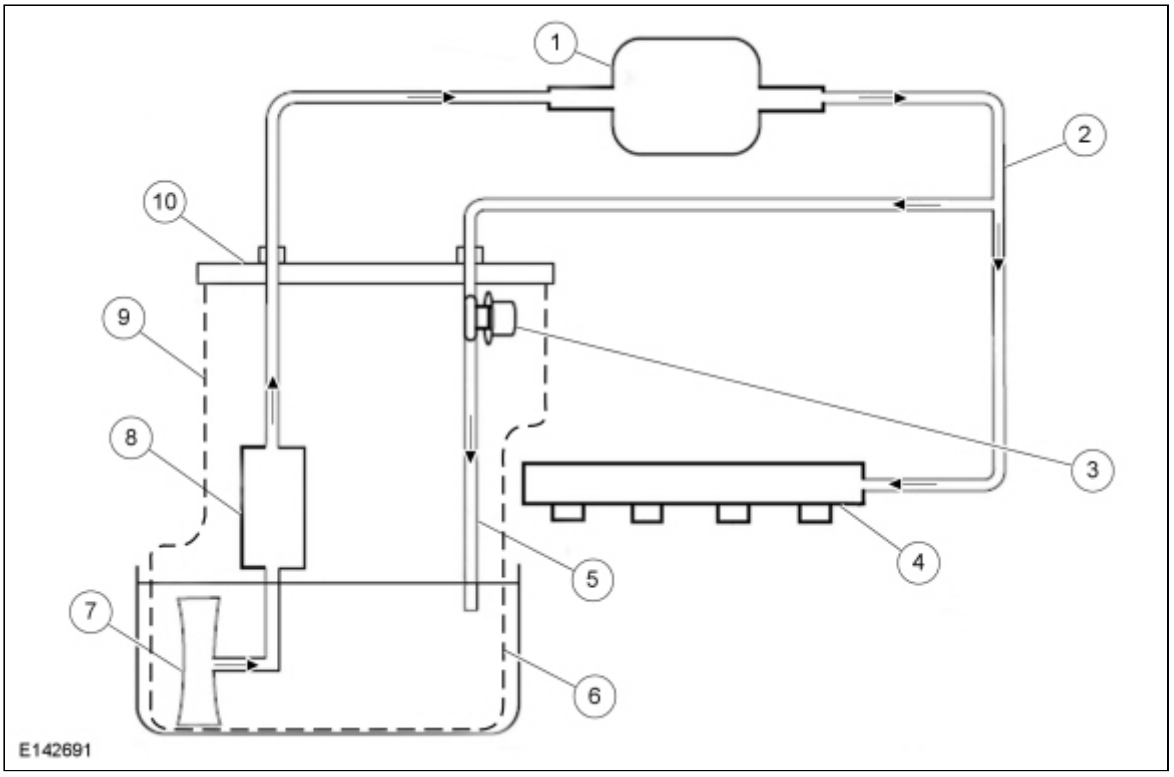
Fuel tank and lines



Item	Part Number	Description
1	—	Fuel tank filler neck
2	—	Fuel tank filler hose
3	—	Atmospheric vent line from canister
4	—	Fuel pump and sender unit
5	—	Vapor line from canister to purge valve
6	—	Supply line from fuel tank to fuel filter
7	—	Fuel filter
8	—	Return line from fuel filter to fuel tank
9	—	Fuel tank vent valve to evaporative emission canister vapor line
10	—	Fuel tank
11	—	Tank protector
12	—	Evaporative emission canister
13	—	Fuel tank breather hose

Repair of fuel system components is not allowed. Ensure that faulty components are replaced with new fuel system components in service.

Fuel return system



Item	Part Number	Description
1	—	Fuel filter
2	—	Fuel line fuel return T-piece
3	—	Fuel pressure regulator
4	—	Fuel rail
5	—	Fuel return line
6	—	Fuel tank
7	—	Fuel jet pump
8	—	Fuel pump
9	—	Fuel pump and sender unit
10	—	Fuel pump and sender unit flange

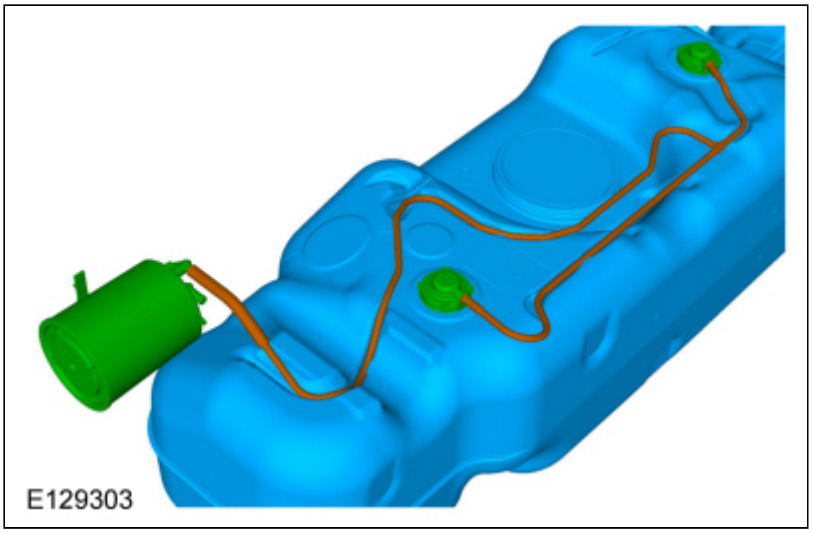
The fuel pressure at the fuel injectors is controlled by a fuel pressure regulator that is integral to the fuel pump and sender unit.

Fuel is pumped from the fuel tank to the fuel filter via the fuel supply line mounted on the left-hand chassis rail. From the fuel filter, fuel is then delivered to the fuel rail.

A "T" piece is fitted to the fuel supply line on the clean side of the filter. The T piece directs excess fuel to the fuel pressure regulator located in the fuel pump and sender unit, via the return port on the fuel pump and sender unit flange.

By allowing excess fuel to return to the tank via the fuel pressure regulator, a constant pressure can be maintained at the fuel rail and injectors.

Fuel tank vent valves

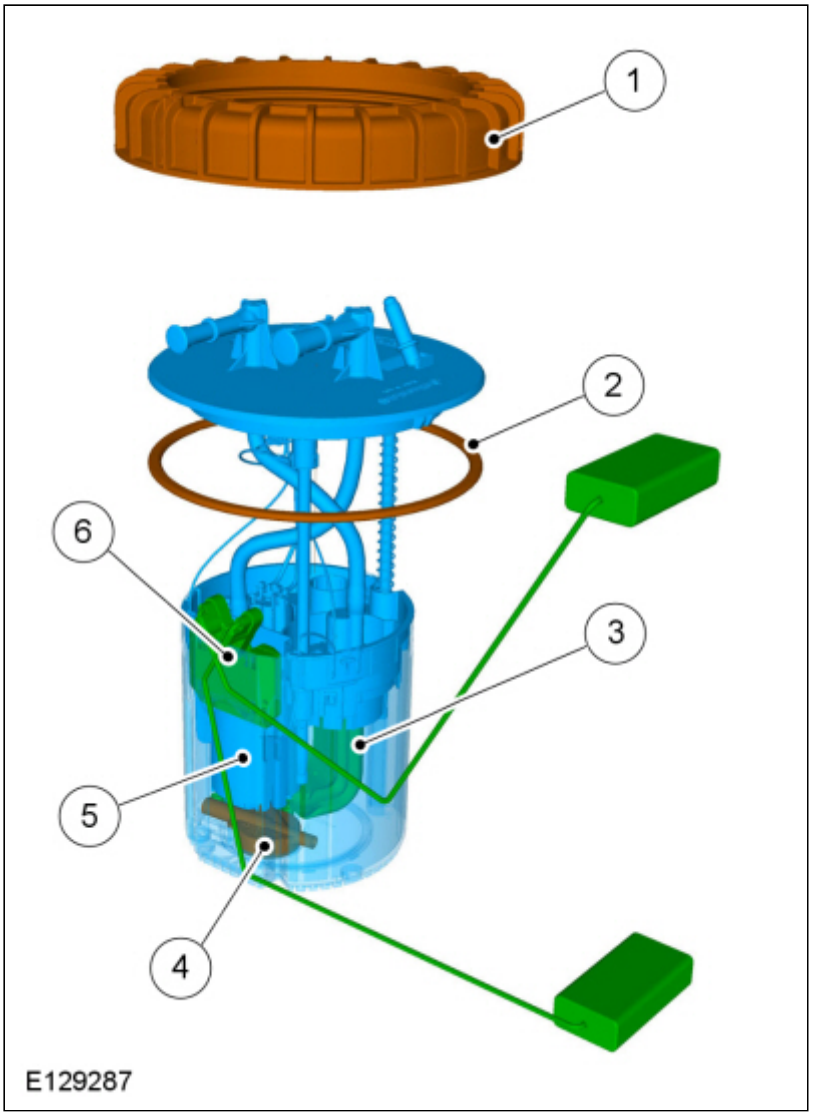


Unlike the fuel tank fitted to vehicles with diesel engines, the petrol fuel tank does not allow fuel vapor to vent to the atmosphere. Instead the fuel vapor is collected in the evaporative emission canister until the correct driving conditions permit the fuel vapor to be burnt in the engine combustion chambers. This reduces the overall emissions from the vehicle.

If the fuel tank becomes inverted, the fuel tank vent valves close preventing the evaporative emission canister being filled with fuel.

If the fuel tank vent valves, fuel vapor lines or the evaporative emission canister become restricted, vehicle performance will become impaired. The inability of the fuel tank to substitute the fuel demanded by the fuel pump with air, will create a negative pressure in the fuel tank . The fuel filler cap has both vacuum and pressure relief valves to prevent excess vacuum or pressure from causing deformation of the fuel tank.

Fuel pump and sender Unit



Item	Part Number	Description
1	—	Fuel pump and sender unit locking ring
2	—	Fuel pump and sender unit sealing ring
3	—	Sock filter
4	—	Fuel jet pump
5	—	Fuel pump
6	—	Fuel level sensor resistor card

The fuel pump and sender unit is located in the top of the fuel tank and is retained by a locking ring and seal.The fuel pump is attached to the fuel pump and sender unit flange by spring loaded guide bars, which ensure that the fuel pump is seated against the base of the fuel tank when installed.

The fuel level sender consists of a mechanical float attached to a variable resistor card by means of a rigid wire lever. The resistor card has two electrical elements. One element is solid and one element is a variable resistor. The resistance value created by the resistor card is sent to the body control module (BCM) through a hard wired circuit. The BCM distributes the information from the fuel pump and sender to the instrument cluster and the powertrain control module (PCM) using the controller area network (CAN) circuits.The fuel pump and sender unit can be sensitive to contaminated fuel. Contaminated fuel can affect the electrical continuity and give false fuel level readings.

The fuel pump and sender resistor card can be susceptible to contaminated fuel, which can affect electrical continuity. This condition is normally temporary and self-rectifying. If the fuel pump and sender has been removed, moving the rigid wire lever from empty to full a minimum of 10 times will normally be as effective as installing a new fuel pump and sender. The most common symptom of contamination occurs after refuelling where the electrical contact moves to an area of the resistor card which has not been used for several days. This results in a very slow movement of the fuel gauge pointer from empty to full over approximately 15 minutes. In more extreme cases where the resistor card resistance is continuously outside the permitted range for more than 33 seconds, a (diagnostic trouble code) DTC will be set in the BCM and the fuel gauge pointer will fall to its key-off position.

The fuel pump supplies fuel to the fuel charging system at a constant regulated pressure. The fuel pressure is controlled by the fuel pressure regulator, built into the fuel pump fuel return circuit.

The fuel pump and sender also incorporates a fuel jet pump. Fuel from the fuel charging system is passed through a venturi in the jet pump which causes a pressure drop across an open orifice. This draws in fuel through the base of the unit which then passes through the sock filter to the fuel pump.

Copyright © 2016 Ford Motor Company

Fuel Tank and Lines

REFER to: Fuel System (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Fuel Tank - Double Cab/Single Cab/Super Cab

Base Part Number: 9002

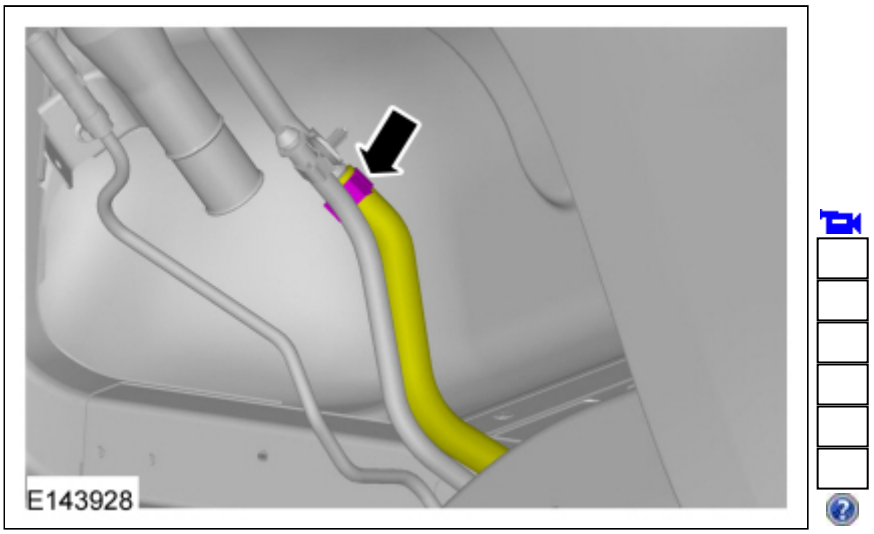
Special Tool(s) / General Equipment

Transmission Jack
Retaining Strap

Removal

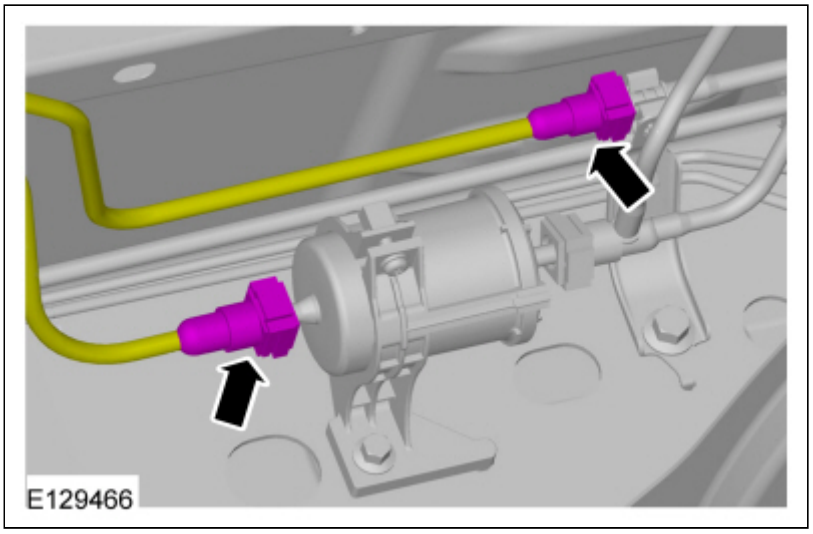
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with load box.*

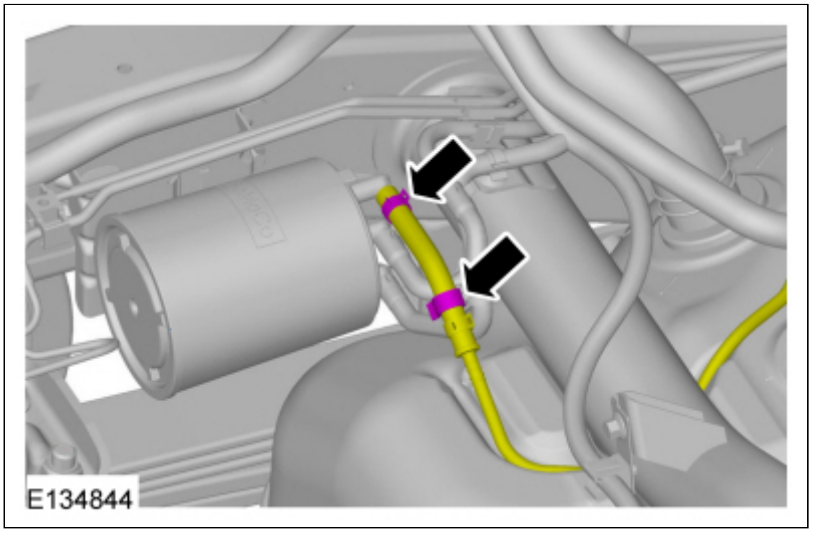
1. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
2. Refer to: Fuel Tank Draining (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
3. 

4. **WARNING: Fuel may still be present in the fuel tank after draining.**

   Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

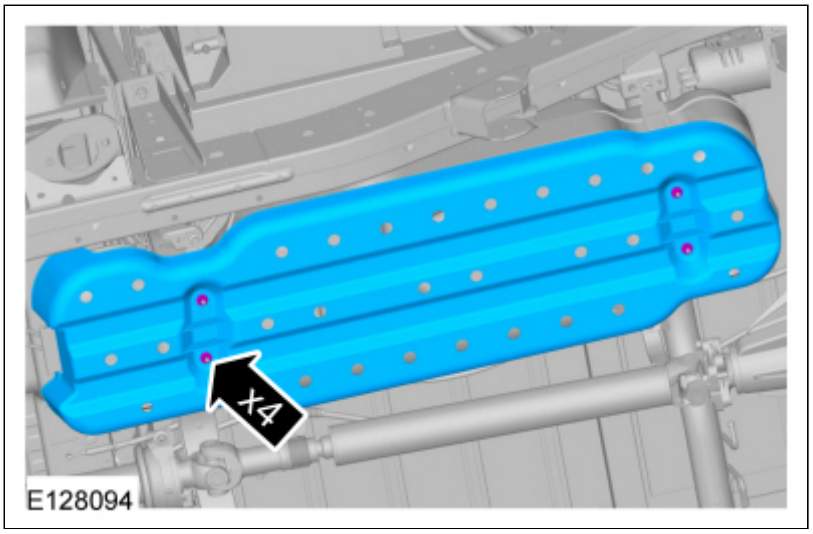


5.



4x4

6. *Torque*: 15 Nm

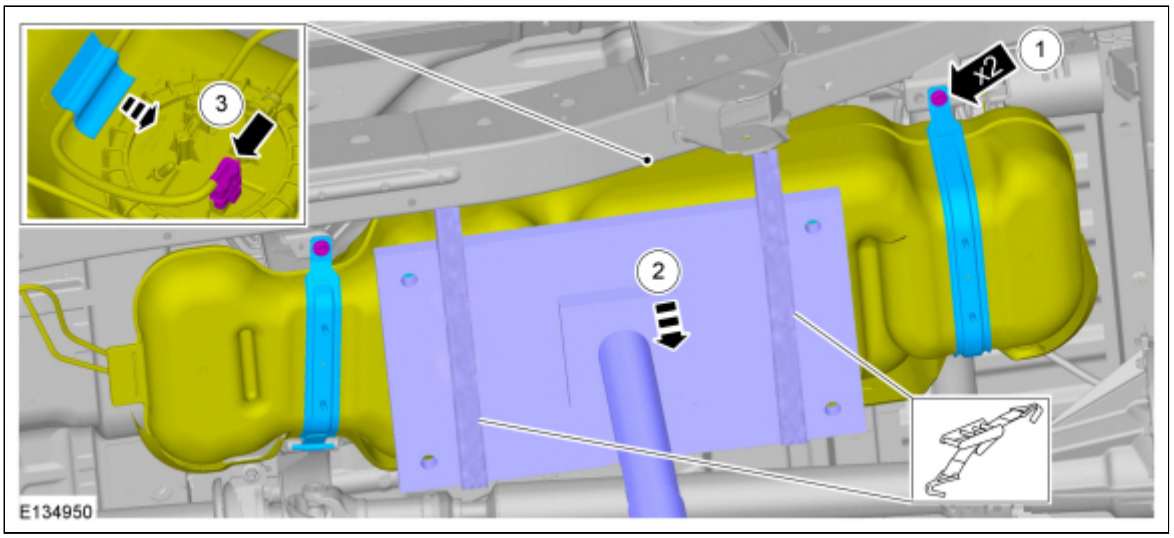


All vehicles

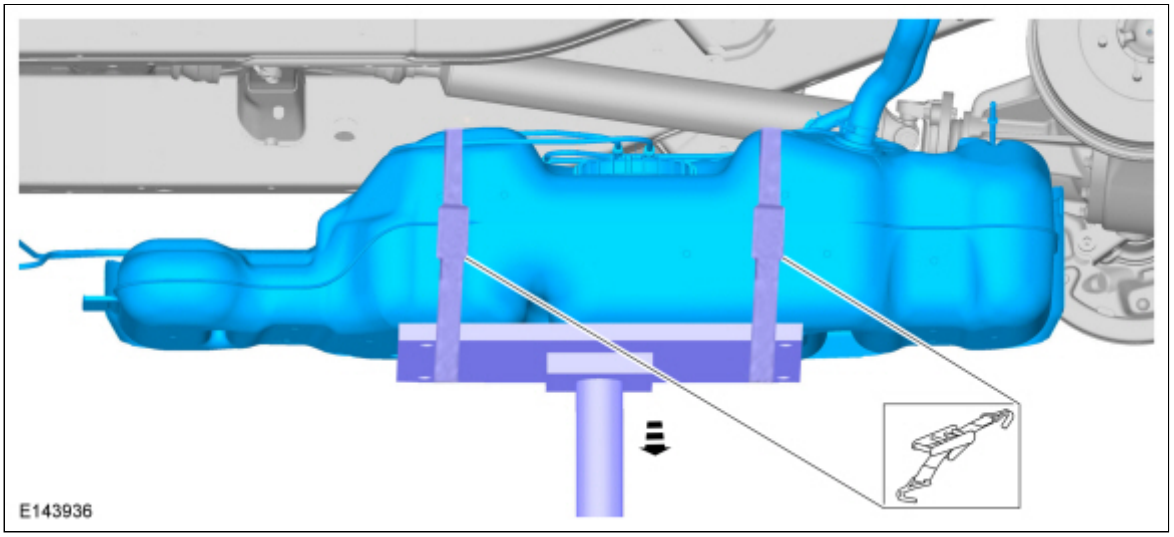
1. Use the General Equipment: Transmission Jack
   Use the General Equipment: Retaining Strap
   Torque: 48 Nm

2. **NOTICE: Make sure that no strain is placed on the wiring harness.**

NOTE: *Slowly lower the fuel tank to access the fuel pump and sender unit electrical connector.*

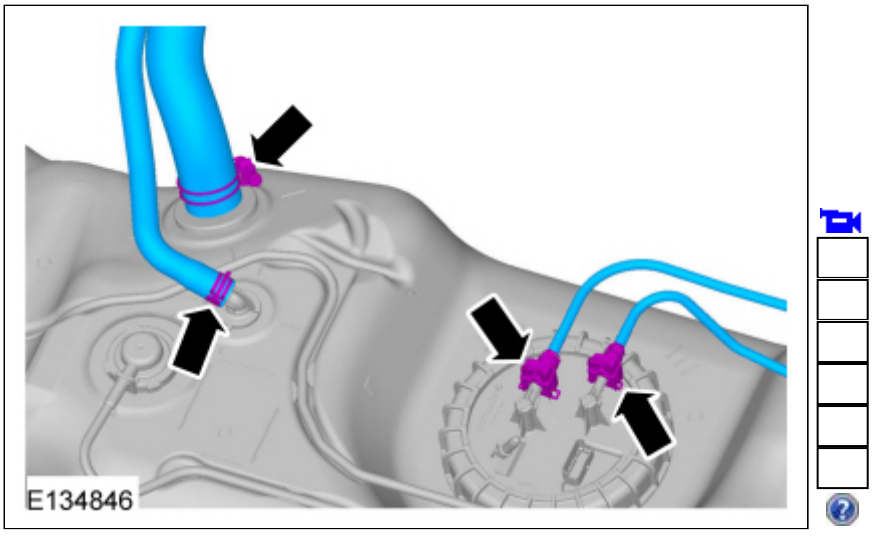


8. Use the General Equipment: Transmission Jack
   Use the General Equipment: Retaining Strap



9. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

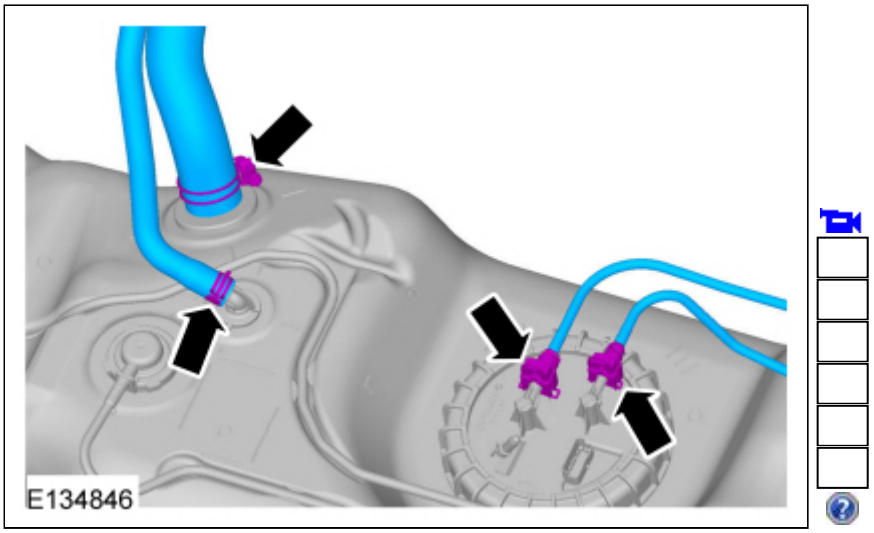
   Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).



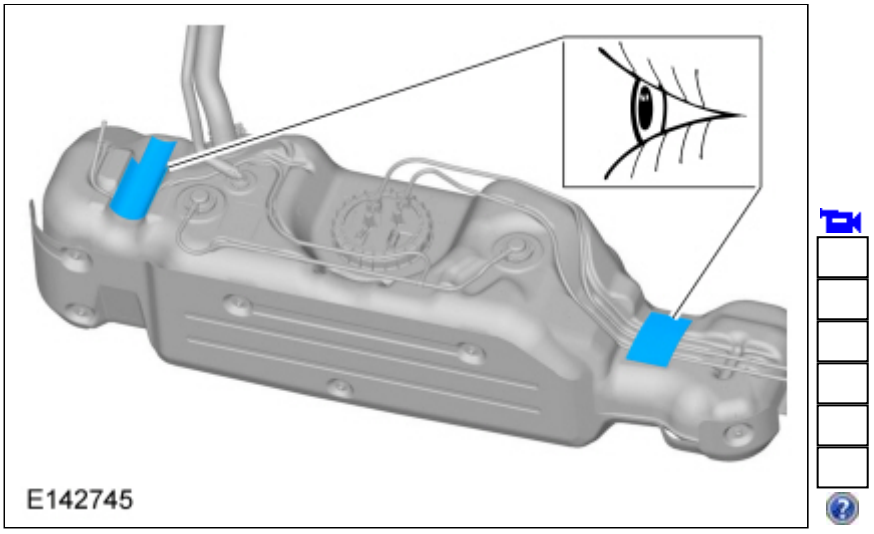
Installation

1. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).



2. **NOTICE: Make sure that the insulator pads are correctly positioned on the fuel tank.**



3. **WARNING: Make sure that all fuel connections are checked for leaks.**

   NOTICE: If the fuel tank has been filled with the wrong type of fuel, the engine must not be started before the fuel system is cleaned.

   NOTE: *Make sure that the correct type of fuel is added after the tank installation.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Tank - Chassis Cab

Base Part Number: 9002

Special Tool(s) / General Equipment

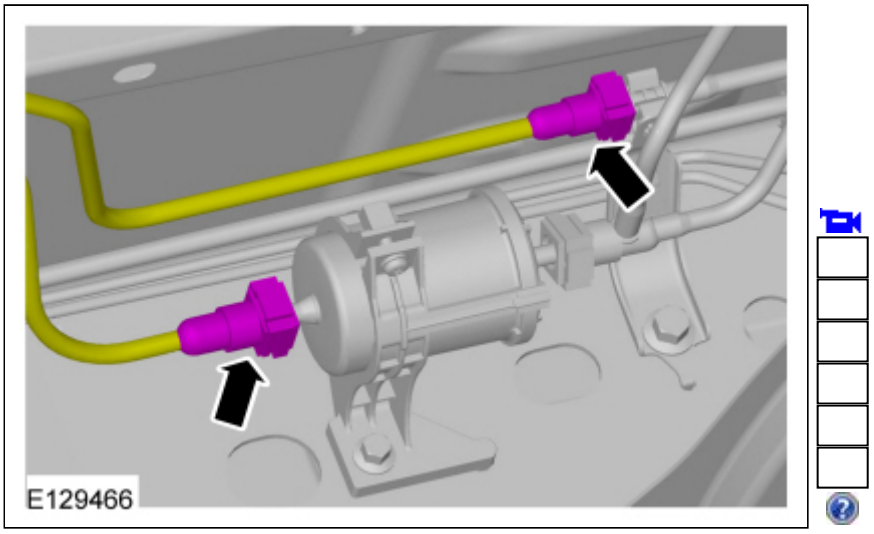
Transmission Jack
Retaining Strap

Removal

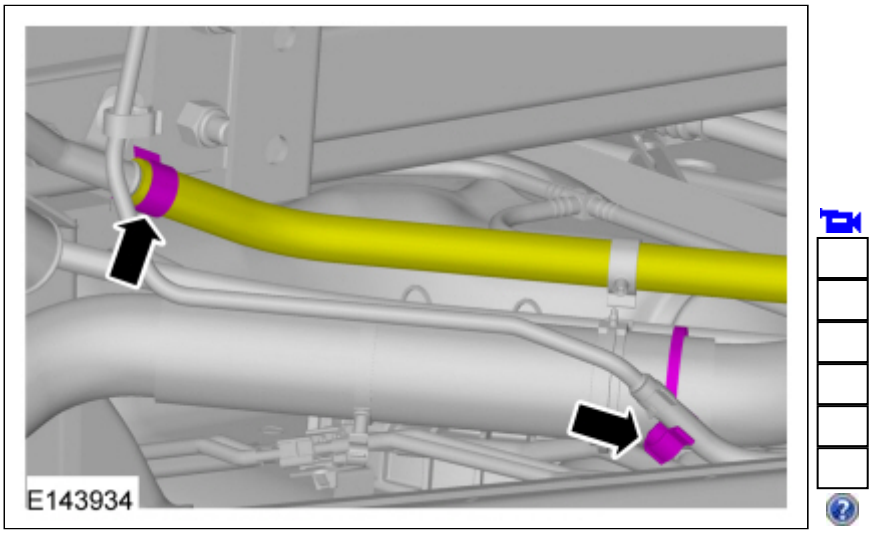
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
2. Refer to: Fuel Tank Draining (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
3. **WARNING: Fuel may still be present in the fuel tank after draining.**

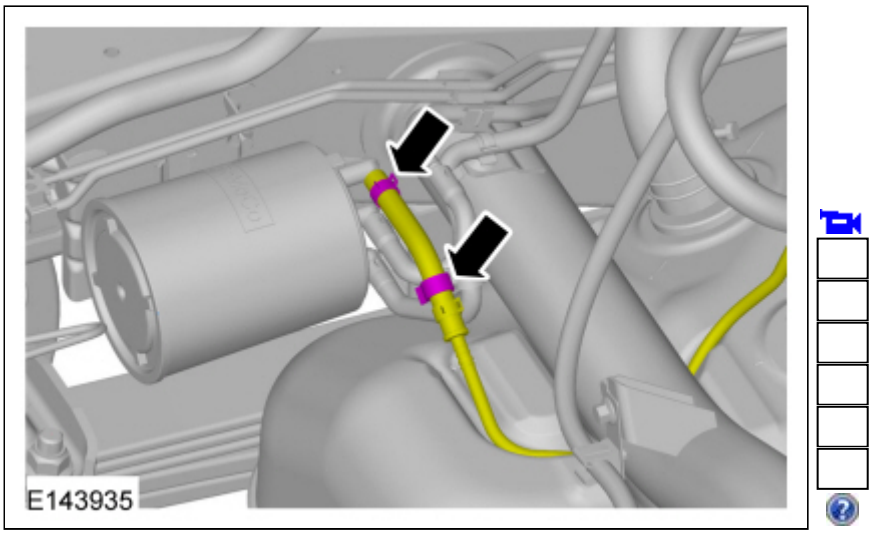
   Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).



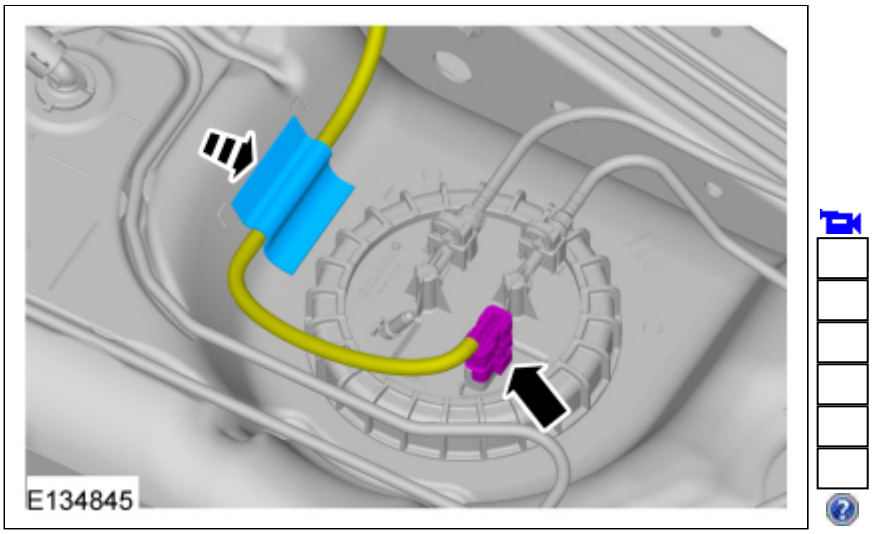
4.



5.

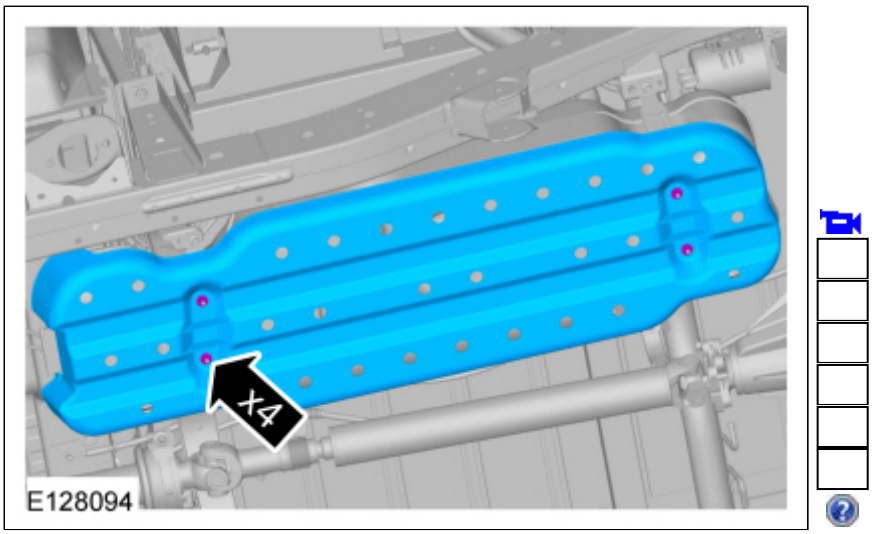


6.



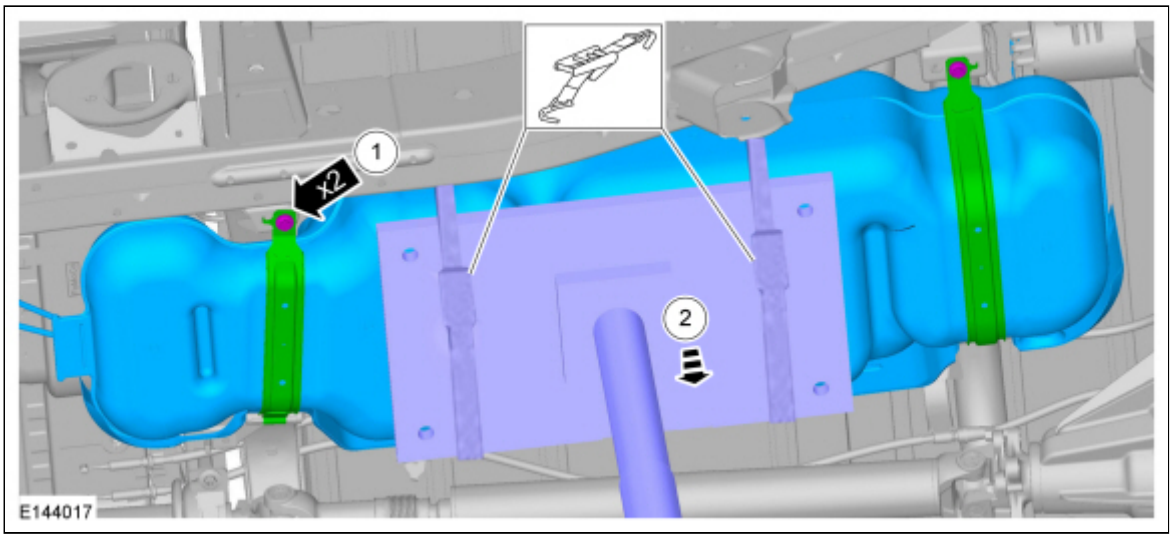
4x4

7. *Torque*: 15 Nm

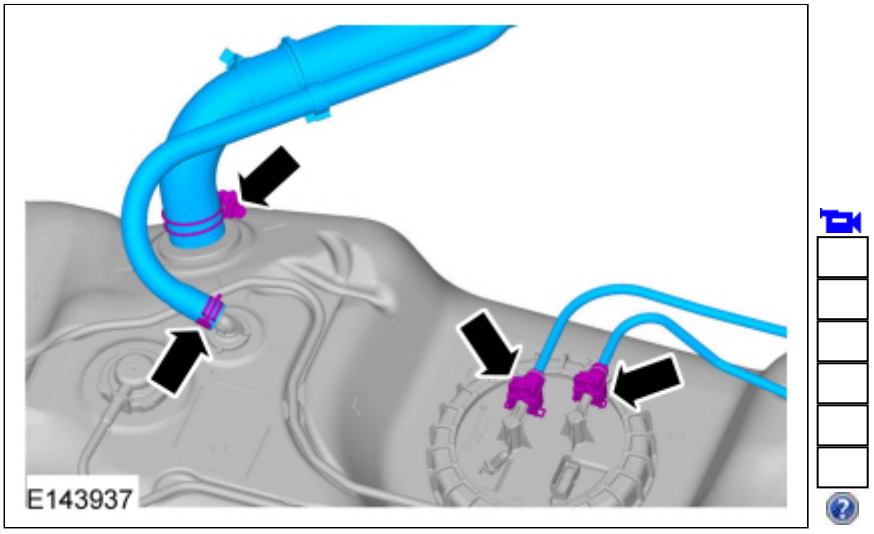


All vehicles

8. Use the General Equipment: Transmission Jack
   Use the General Equipment: Retaining Strap
   Torque: 48 Nm

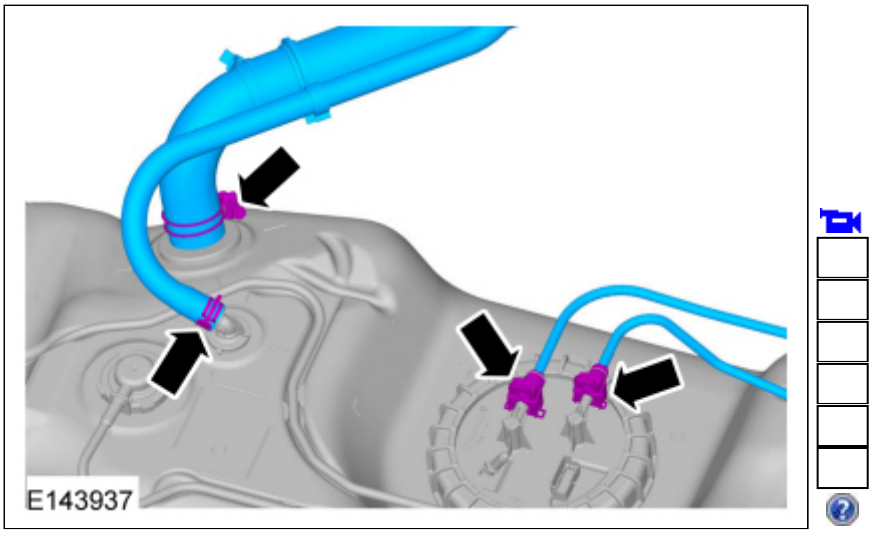


9. Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).

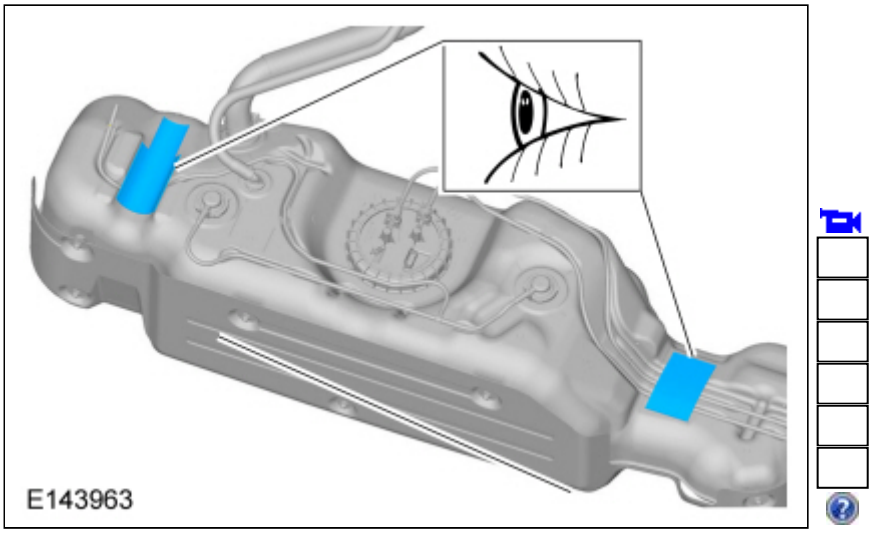


Installation

1. Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).



2. **NOTICE: Make sure that the insulator pads are correctly positioned on the fuel tank.**



3. **WARNING: Make sure that all fuel connections are checked for leaks.**

   NOTICE: If the fuel tank has been filled with the wrong type of fuel, the engine must not be started before the fuel system is cleaned.

   NOTE: *Make sure that the correct type of fuel is added after the tank installation.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Tank Filler Pipe - Double Cab/Single Cab/Super Cab

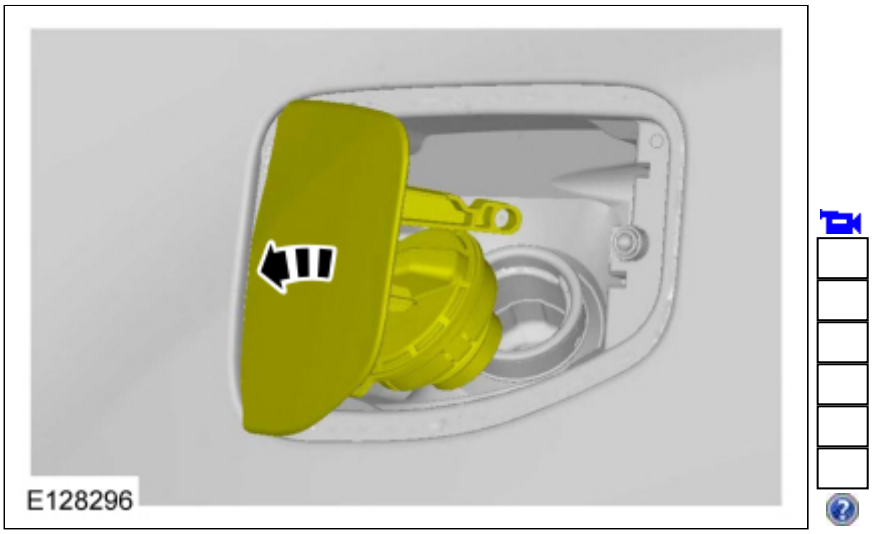
Special Tool(s) / General Equipment

Blind Rivet Gun
6 mm Drill Bit

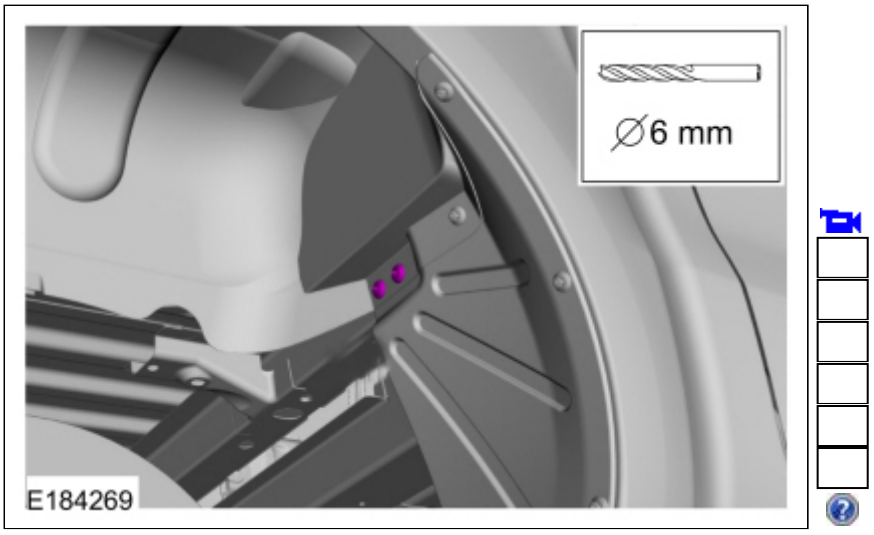
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

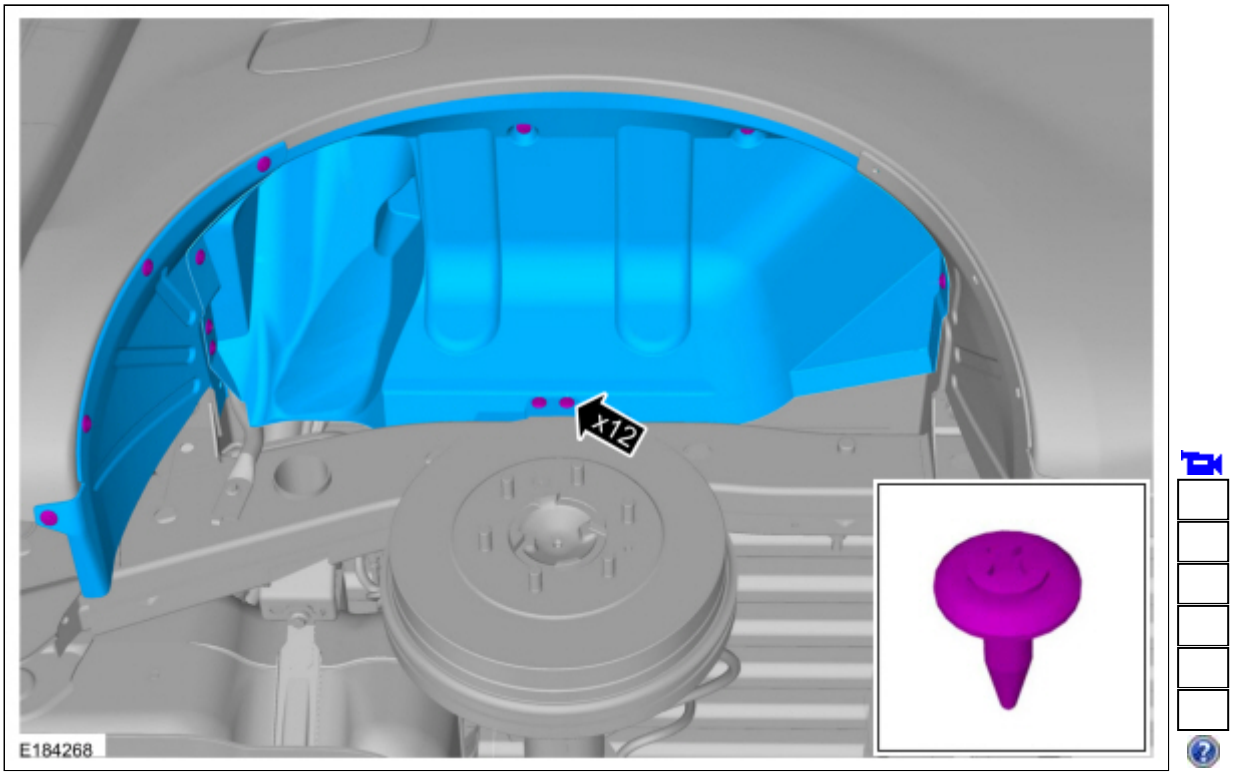
1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Make sure that the fuel tank is no more than 3/4 full.*



3. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
4. Use the General Equipment: 6 mm Drill Bit

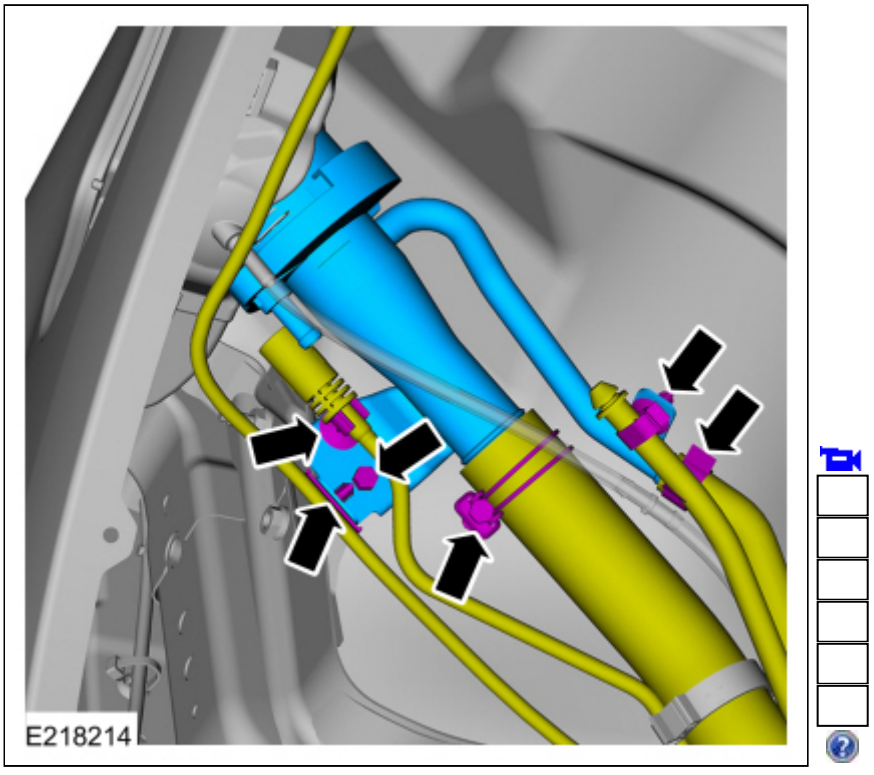


5.



6. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

   Torque: 11 Nm

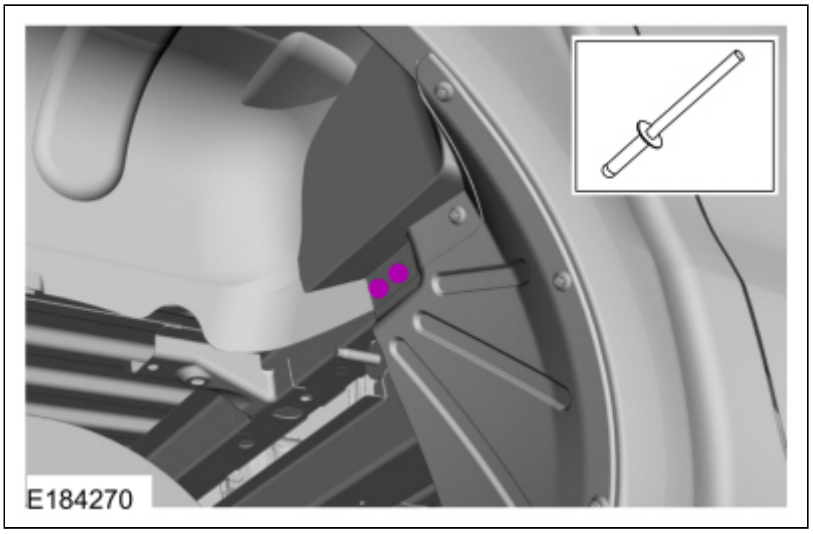


7. **NOTE:** *For removal of the fuel filler pipe and vent hose.*

   Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Blind Rivet Gun



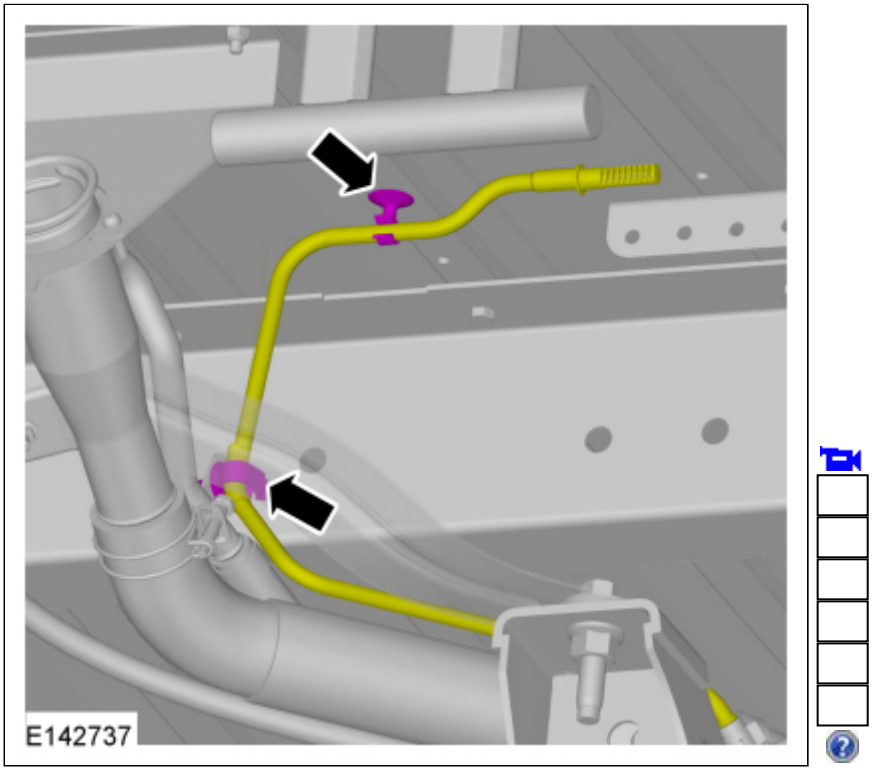
Copyright © 2016 Ford Motor Company

Fuel Tank Filler Pipe - Chassis Cab

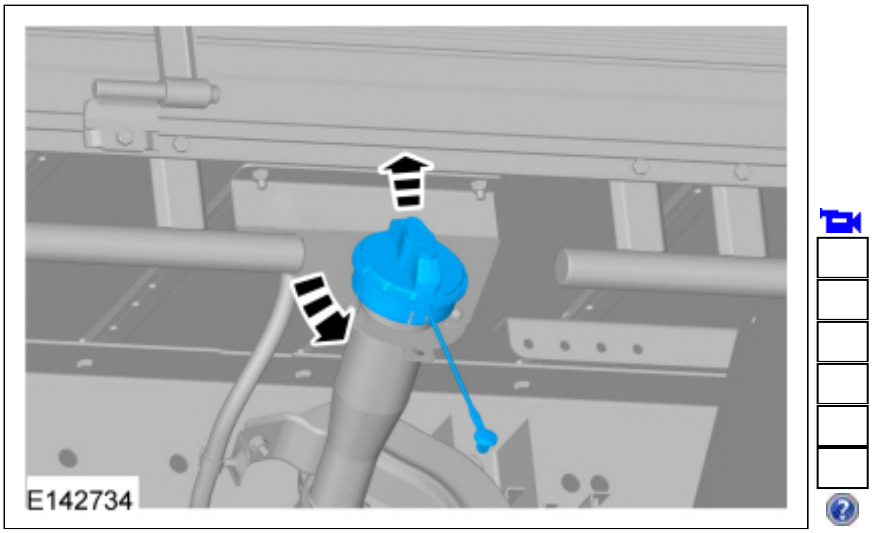
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Gasoline and Gasoline-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **WARNING: Make sure that the fuel tank is no more than 3/4 full.**

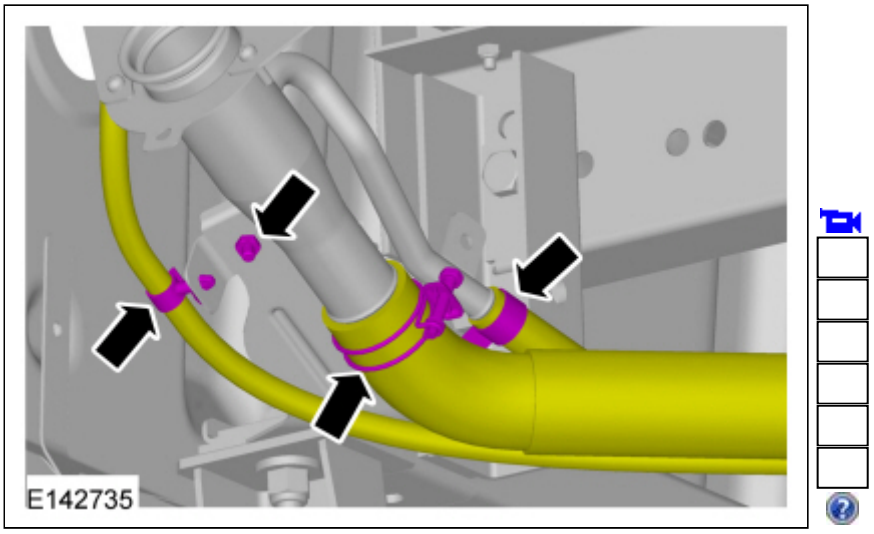


3.

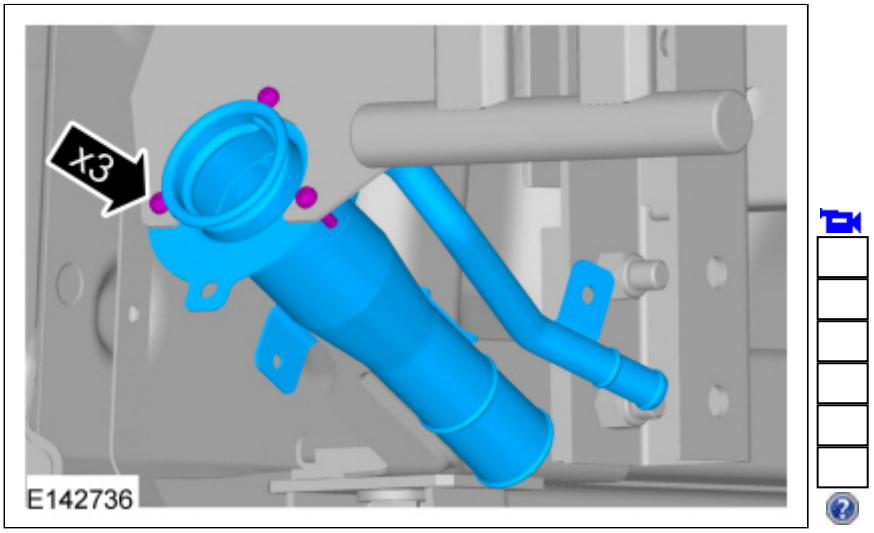


4. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

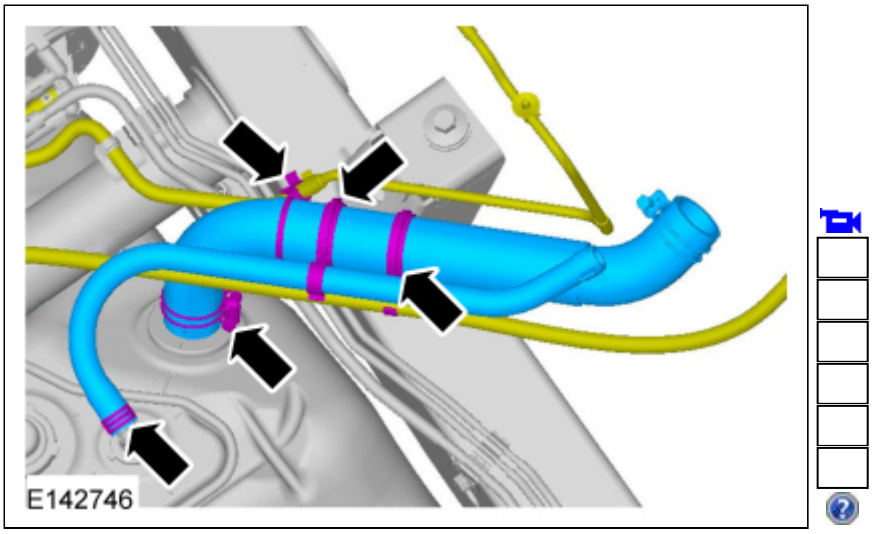
   Torque: 11 Nm



5. *Torque*: 8 Nm



6. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Filter

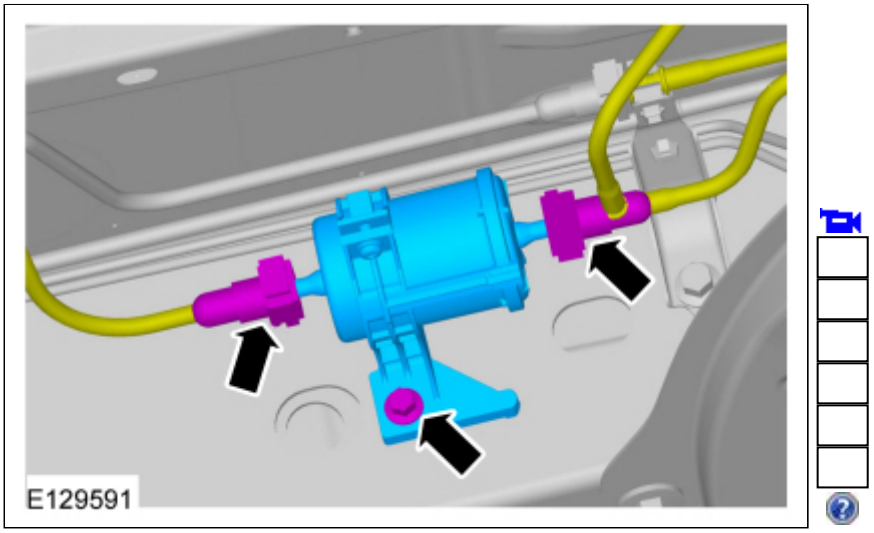
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Fuel System Pressure Release (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
2. **NOTE:** *Be prepared to collect escaping fluids.*

   NOTE: *Make sure that the fuel filter is fully installed into the fuel filter retaining bracket. Observe the direction of flow arrow on the fuel filter*

   Refer to: Quick Release Coupling (310-00A Fuel System - General Information - 2.5L Duratec-HE (122kW/165PS) - MI4, General Procedures).
   Torque: 25 Nm



Installation

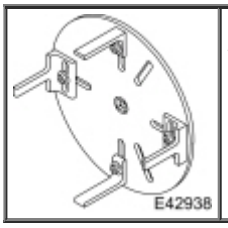
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Pump and Sender Unit

Base Part Number: 9275

Special Tool(s) / General Equipment

 E42938	310-127 Wrench, Fuel Tank Sender Unit

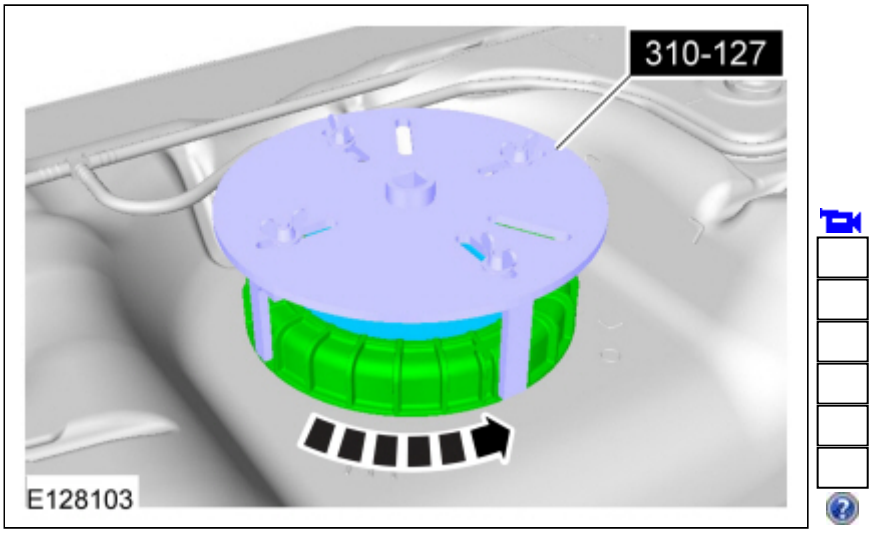
Removal

1. Refer to: Fuel Tank - Chassis Cab (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

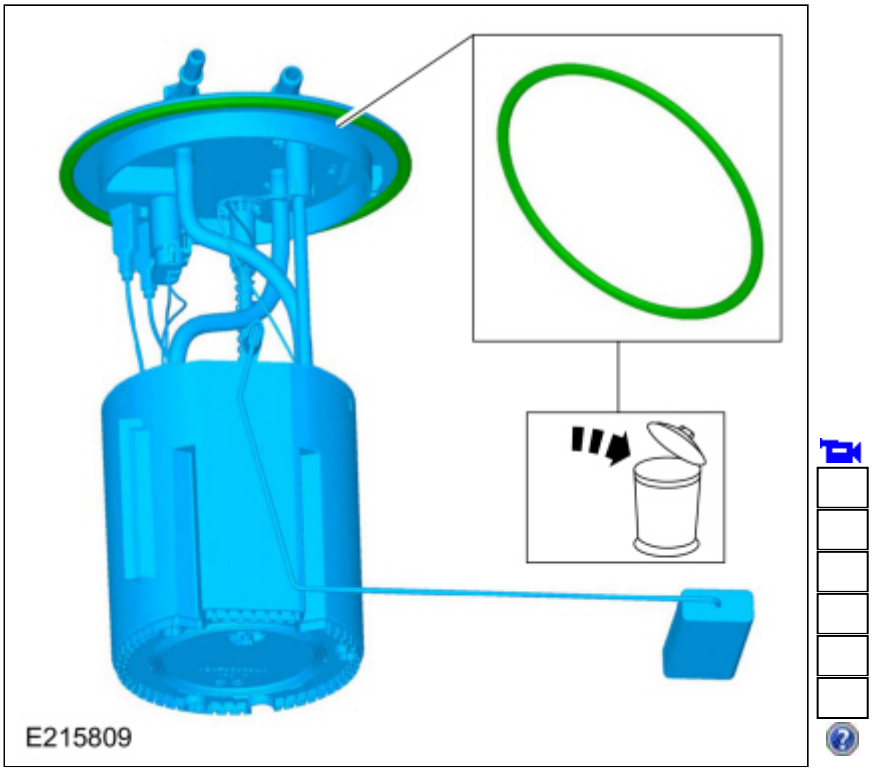
   NOTICE: The fuel pump and sender unit locking ring should be reinstalled to the fuel tank immediately after removal of the fuel pump and sender unit.

   NOTICE: If a new fuel pump and sender unit locking ring is to be installed, a new component must be installed within 15 minutes of removing the old component.

   Use Special Service Tool: 310-127 Wrench, Fuel Tank Sender Unit.

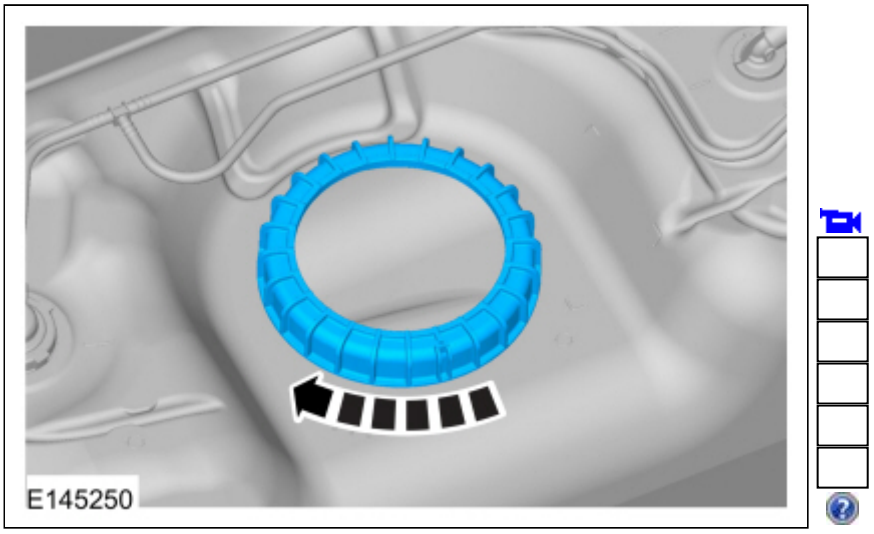


3.



4. **NOTICE: Failure to follow this instruction can lead to permanent deformation of the fuel tank.**

   NOTE: *Make sure that the locking ring is installed temporarily to the fuel tank.*



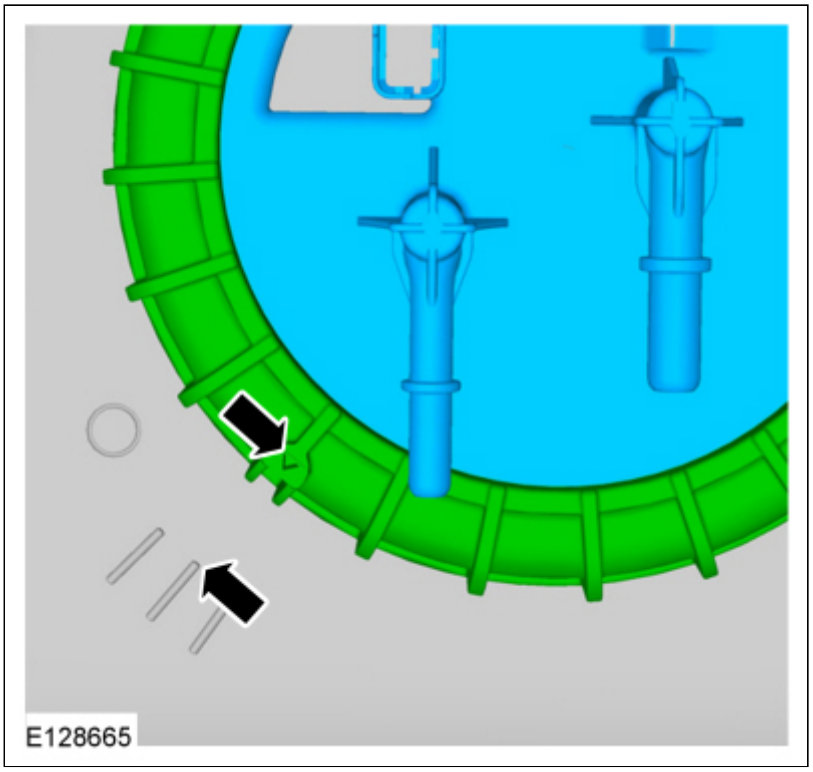
Installation

1. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   NOTE: *Make sure that the seal is correctly located.*

   NOTE: *Make sure that the installation marks are aligned.*

   Torque: 110 Nm



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Level Sender

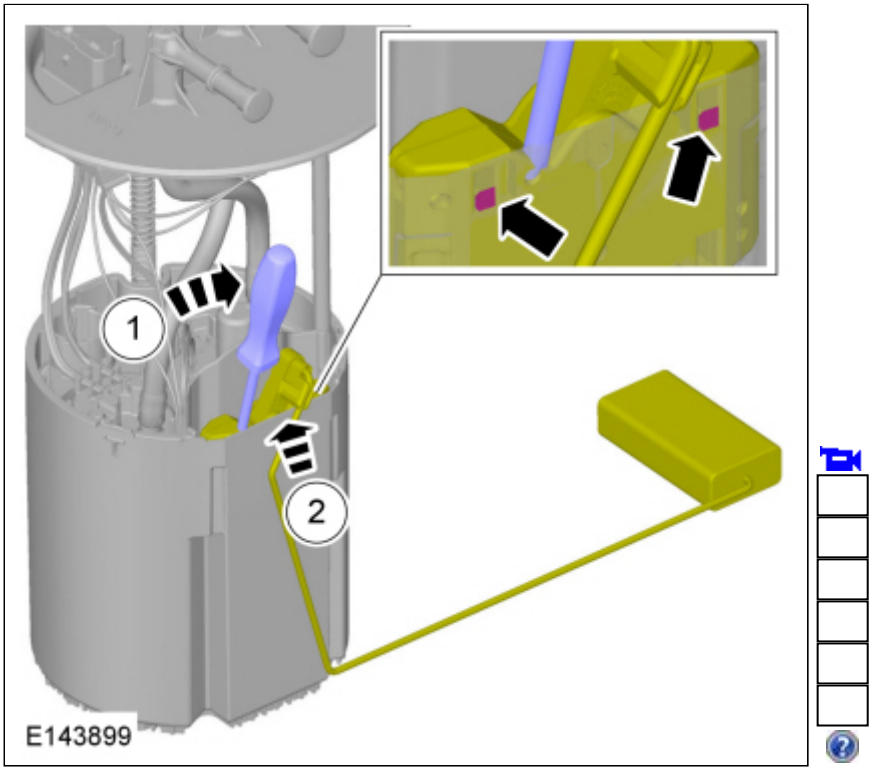
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   Refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

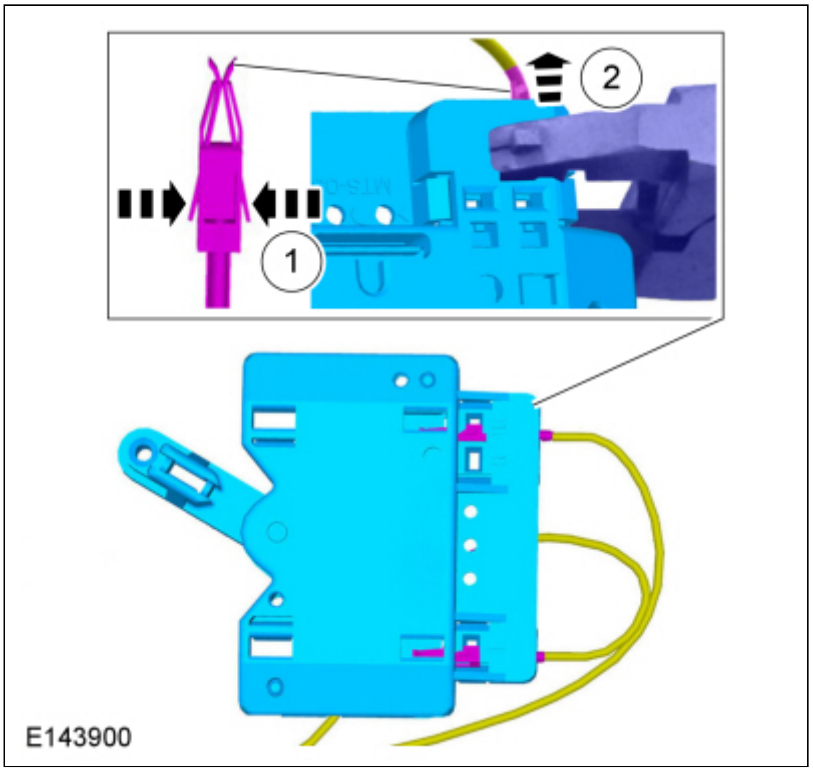
2. **NOTICE: Take extra care not to damage the clips.**



3. **NOTICE: Take extra care when handling the wiring terminals.**

   NOTICE: Make sure that the wiring terminals are not bent or damaged.

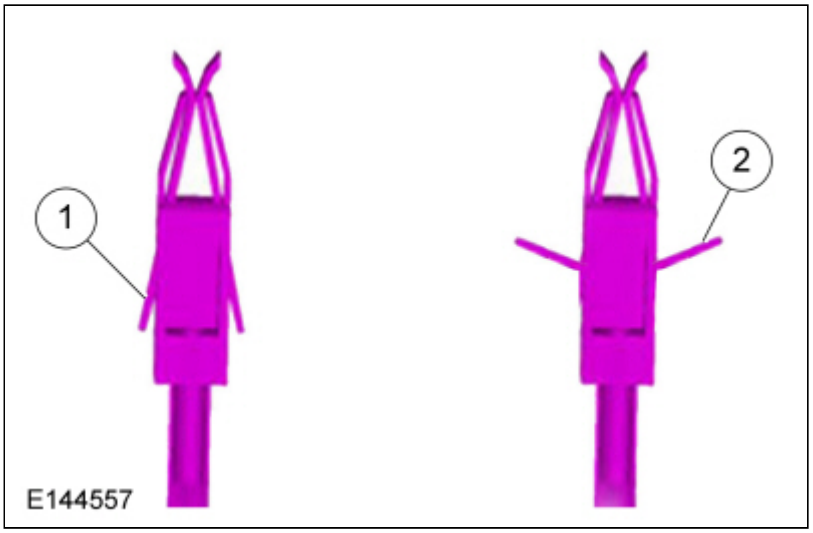
   On both sides.



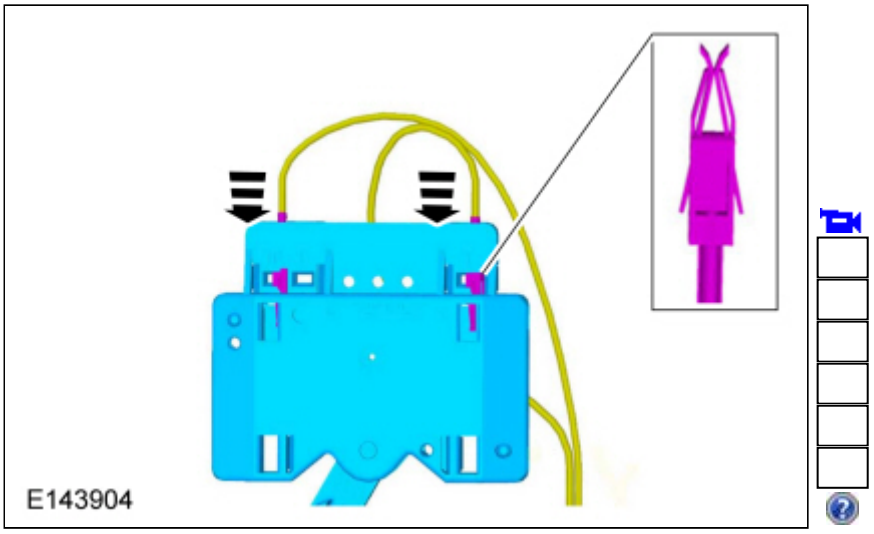
Installation

1. **NOTICE: Make sure that the wiring terminals are not bent or damaged.**

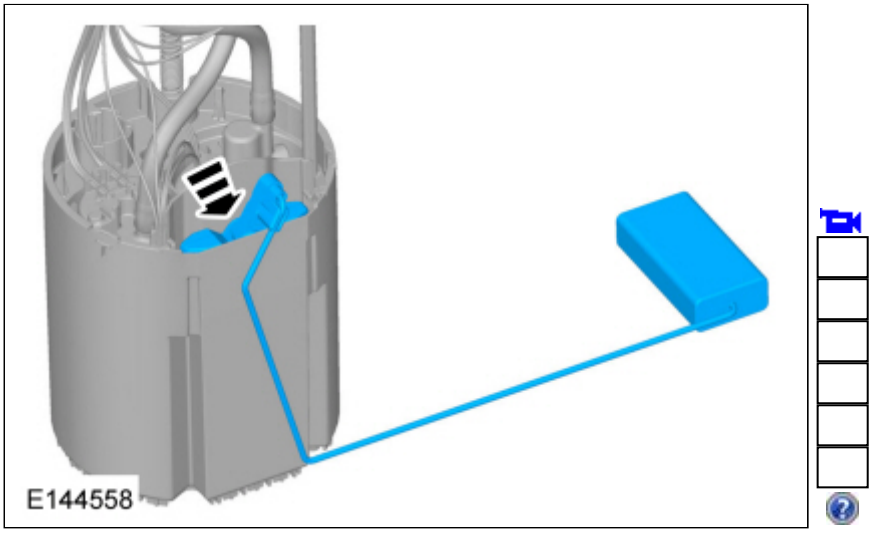
   Undamaged terminal clips
2. Damaged terminal clips



2. **WARNING: Check for correct connections after installation.**



3. **NOTE:** *Make sure that the wires are installed to the same orientation as when removed.*

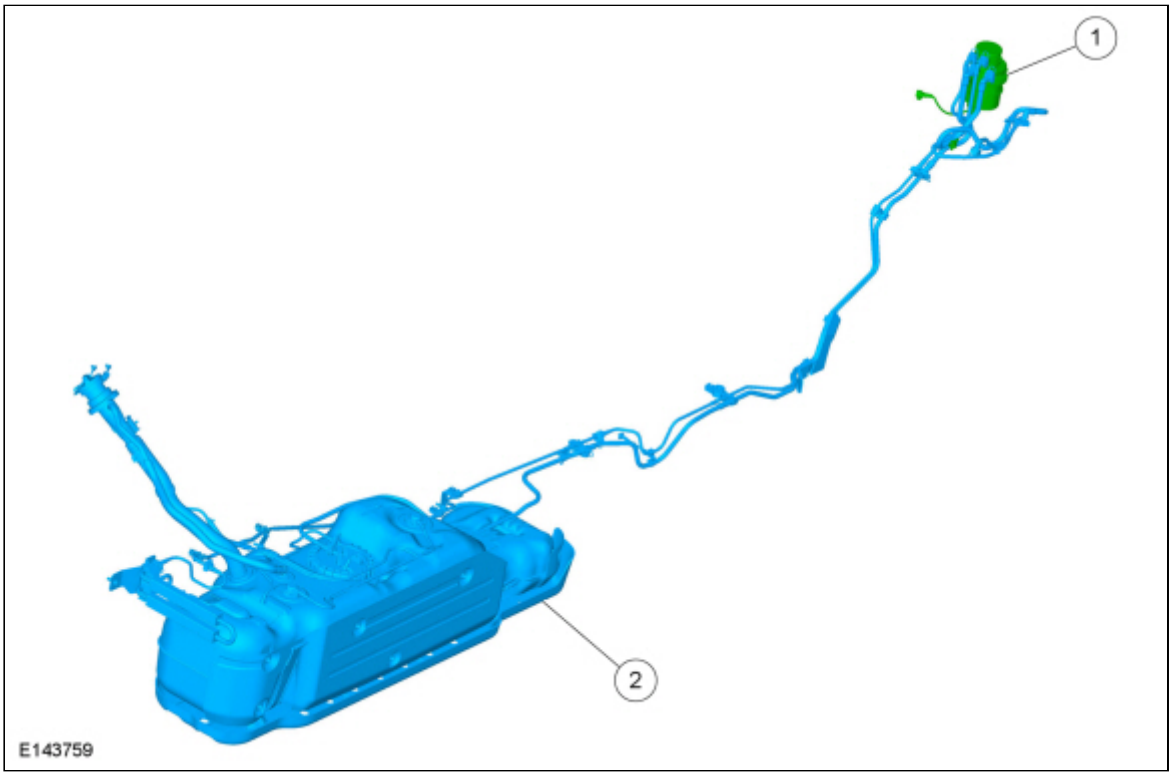


4. Refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Copyright © 2016 Ford Motor Company

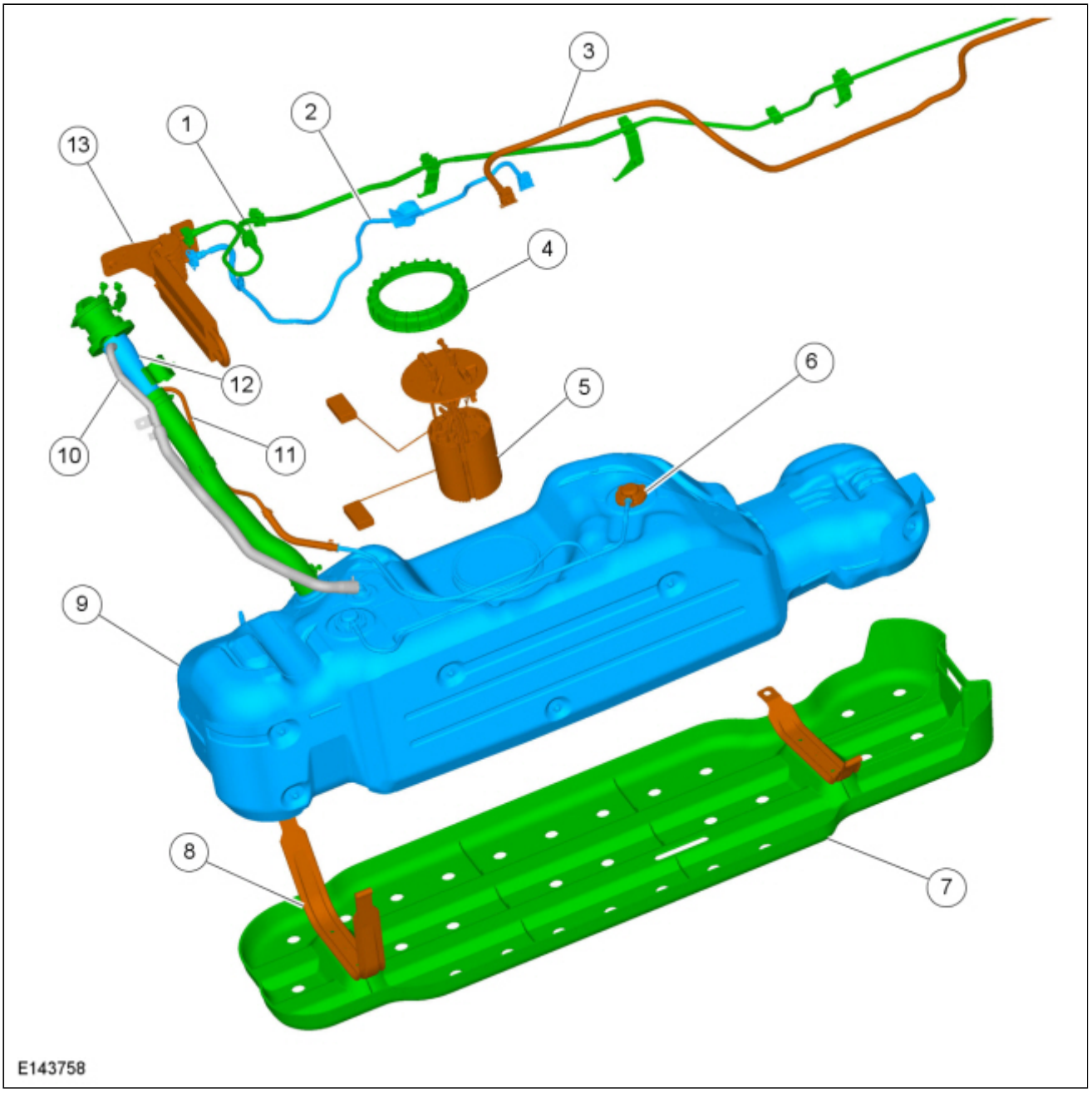
Fuel Tank and Lines

Vehicles with Fuel cooler



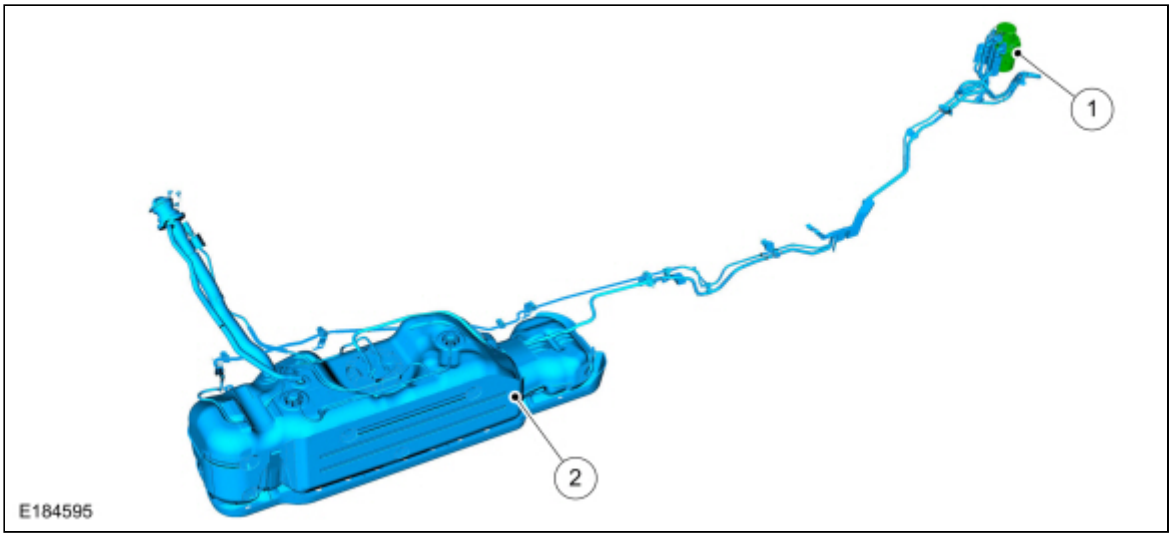
Item	Part Number	Description
1	—	Fuel filter
2	—	Fuel tank

Fuel tank supply and return lines



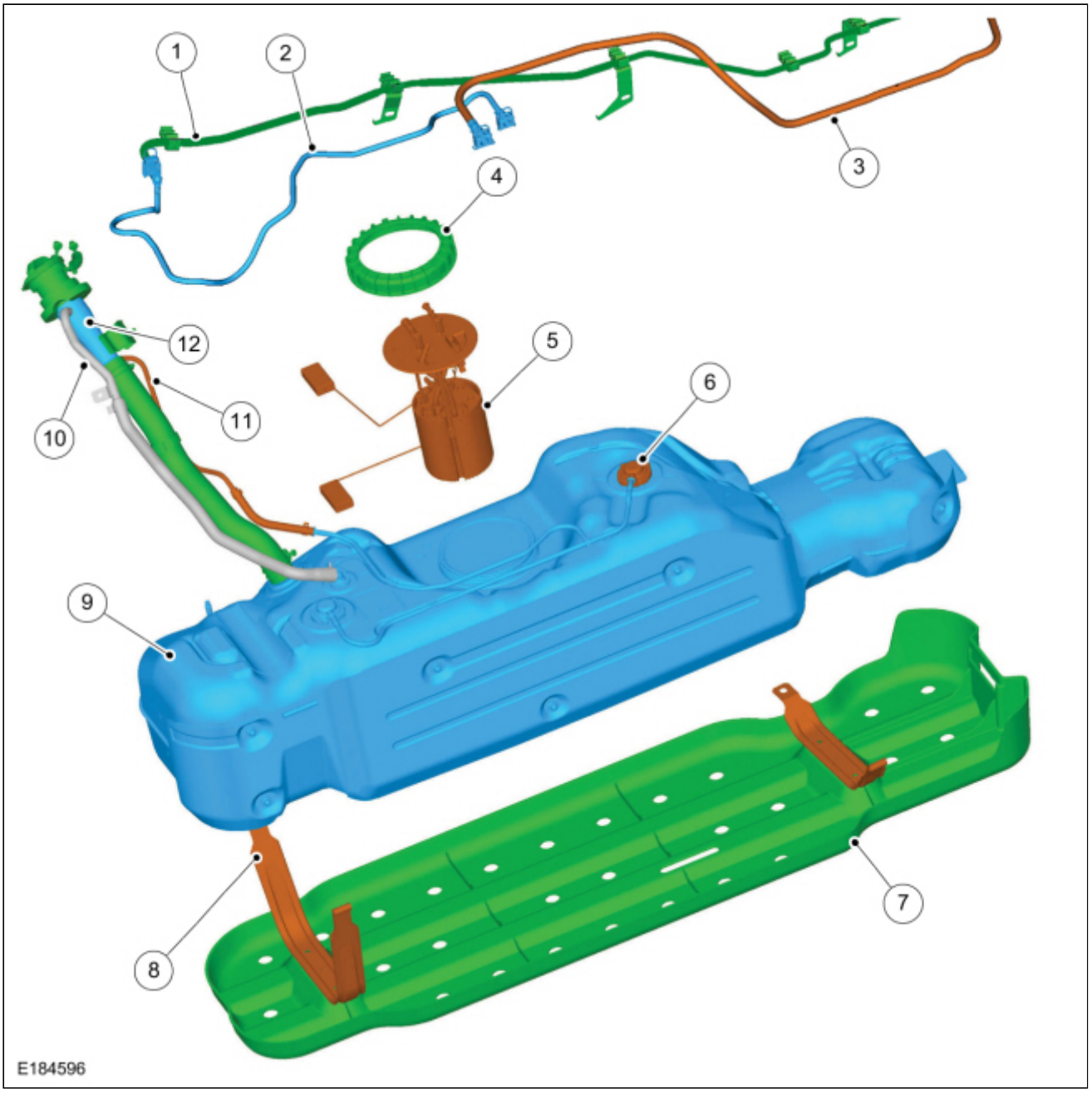
Item	Part Number	Description
1	—	Return line from fuel filter to fuel cooler
2	—	Return line fuel cooler to fuel tank
3	—	Supply line fuel tank to fuel filter
4	—	Fuel level sensor locking ring
5	—	Fuel level sensor/ fuel module
6	—	Fuel tank vent valve(s)
7	—	Tank protector
8	—	Fuel tank support straps
9	—	Fuel tank
10	—	Fuel tank breather hose
11	—	Fuel tank vent valve breather
12	—	Filler neck
13	—	Fuel cooler

Vehicles without Fuel cooler



Item	Part Number	Description
1	—	Fuel filter
2	—	Fuel tank

Fuel tank supply and return lines



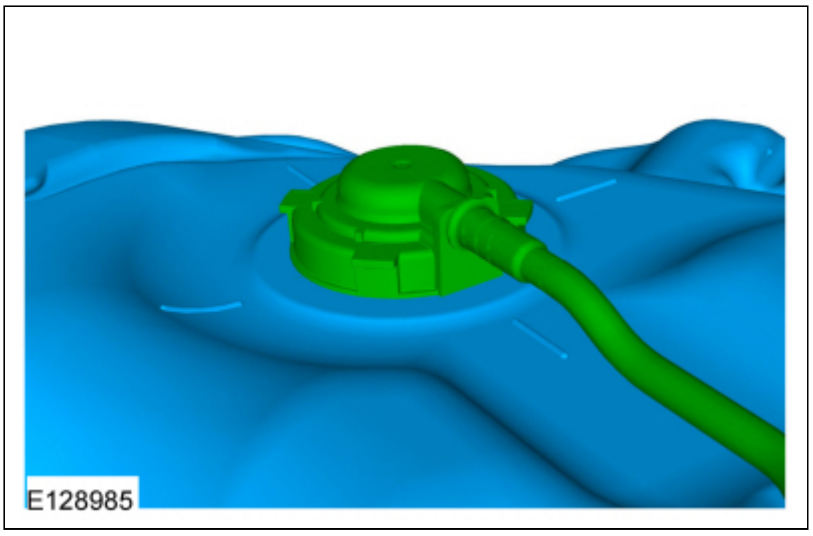
Item	Part Number	Description
1	—	Return line from fuel filter
2	—	Return line from filter to fuel tank
3	—	Supply line fuel tank to fuel filter
4	—	Fuel level sensor locking ring
5	—	Fuel level sensor/ fuel module
6	—	Fuel tank vent valve(s)
7	—	Tank protector
8	—	Fuel tank support straps
9	—	Fuel tank
10	—	Fuel tank breather hose
11	—	Fuel tank vent valve breather
12	—	Filler neck

All Vehicles

Repair of fuel system components is not allowed. Ensure that faulty components are replaced with new fuel system

components in service.

Fuel tank vent valves

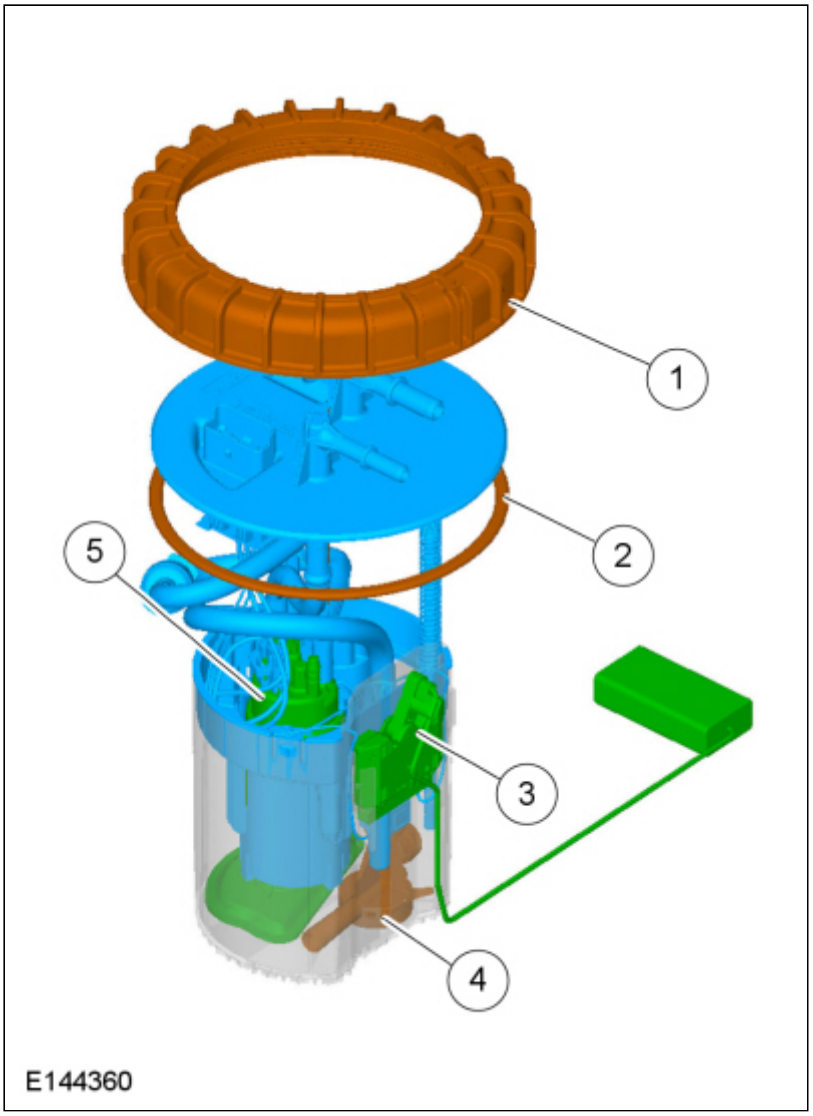


Fuel tank ventilation is achieved by two fuel tank vent valves. The fuel tank vent valves are integral to the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Under normal working conditions, the pressure within the fuel tank is controlled by allowing the fuel vapor to vent through the fuel tank vent valves to atmosphere. If the fuel tank becomes inverted, the fuel tank vent valves close preventing fuel being lost from the fuel tank.

If the fuel tank vent valves or the fuel vapor lines connected to the vent valves become restricted, vehicle performance will become impaired. The inability of the fuel tank to substitute the fuel demanded by the fuel charging system with air, will create a negative pressure in the fuel tank which will result in reduced fuel flow to the fuel pump. The fuel filler cap has both vacuum and pressure relief valves to prevent excess vacuum or pressure from causing deformation of the tank.

Fuel pump and sender unit



Item	Part Number	Description
1	—	Fuel pump and sender unit locking ring
2	—	Fuel pump and sender unit sealing ring
3	—	Fuel level sensor resistor card
4	—	Fuel jet pump
5	—	Fuel pump inlet filter

The pump and sender unit is located in the top of the fuel tank and is retained by a locking ring and seal. The fuel pump is attached to the fuel pump and sender unit flange by spring loaded guide bars, which ensure that the fuel pump is seated against the base of the fuel tank when installed.

The fuel level sender consists of a mechanical float attached to a variable resistor card by means of a rigid wire lever. The resistor card has two electrical elements. One element is solid and one element is a variable resistor. The resistance value created by the resistor card is sent to the central junction box (CJB) through a hard wired circuit. The CJB distributes the information from the fuel level sensor to the instrument cluster and the powertrain control module (PCM) using the controller area network (CAN) circuits.

The fuel level sensor resistor card can be susceptible to contaminated fuel, which can affect electrical continuity and give false fuel level readings. This condition is normally temporary and self-rectifying. If the fuel level sensor has been removed, moving the rigid wire lever from empty to full a minimum of 10 times will normally be as effective as installing a new fuel level sensor. The most common symptom of contamination occurs after refuelling where the electrical contact moves to an area of the resistor card which has not been used for several days. This results in a very slow movement of the fuel gauge pointer from empty to full over approximately 15 minutes. In more extreme cases where the resistor card resistance is continuously outside the permitted range for more than 33 seconds, a DTC will be set in the CJB and the fuel gauge pointer will fall to its key-off position.

The base of the fuel pump and sender unit is a chamber that sits in the swirl bowl at the bottom of the fuel tank. Built

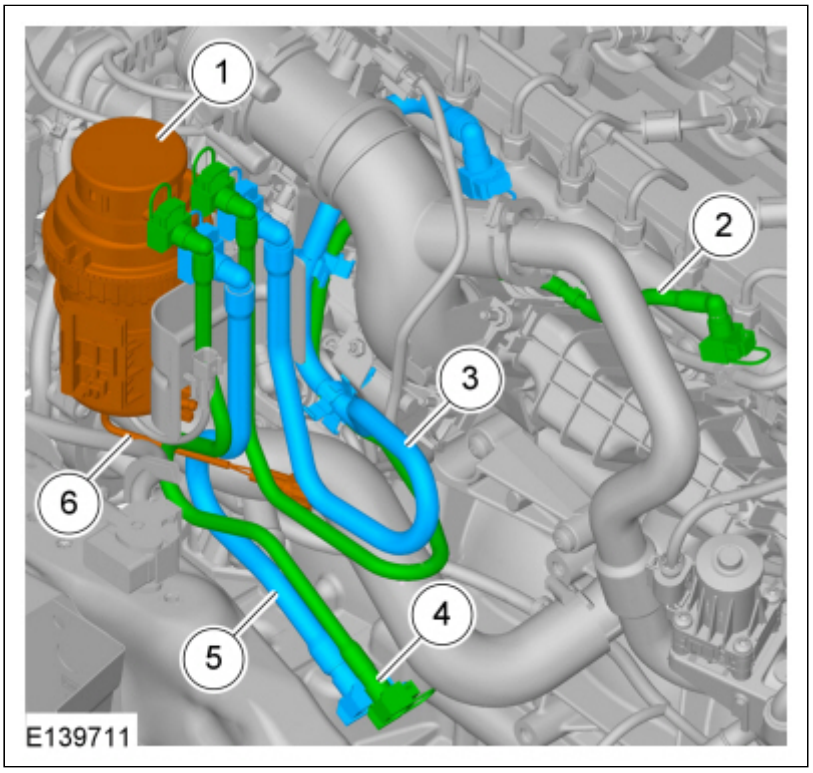
into the chamber is a filter element.

The fuel pump and sender unit also incorporates a fuel jet pump. Fuel from the fuel charging system is passed through a venturi in the jet pump which causes a pressure drop across an open orifice. This draws in fuel through the base of the unit which then passes through the fuel supply tube.

Fuel tank

The fuel tank is of plastic construction and is secured to the vehicle by two metal support straps, which are bolted to the ladder frame cross members. The diesel fuel tank must contain at least 4 litres of fuel before the fuel pump is operated. Running the fuel pump with less than 4 litres of fuel will cause damage to the fuel pump.

Fuel Filter



Item	Part Number	Description
1	—	Fuel filter
2	—	Return line from engine to fuel filter
3	—	Supply line from filter to engine
4	—	Return line from filter to fuel tank
5	—	Supply line from tank to fuel filter
6	—	Water-in fuel sensor

The diesel fuel filter separates air, water and other contaminants from fuel, in addition to retaining system backpressure.

The upper section of the filter incorporates the recirculation valve and the return valve.

The recirculation valve controls the flow of warm return fuel from the engine. When fuel temperature drops below 20 C, the valve opens to direct return fuel to the filter, warming the fuel to prevent waxing. When fuel temperature reaches 33 C, the valve closes and return fuel is directed back to the fuel tank via the fuel cooler. The recirculation valve also has a small bypass that allows any build up of air from the recirculation of fuel to bleed out via the return line into the tank.

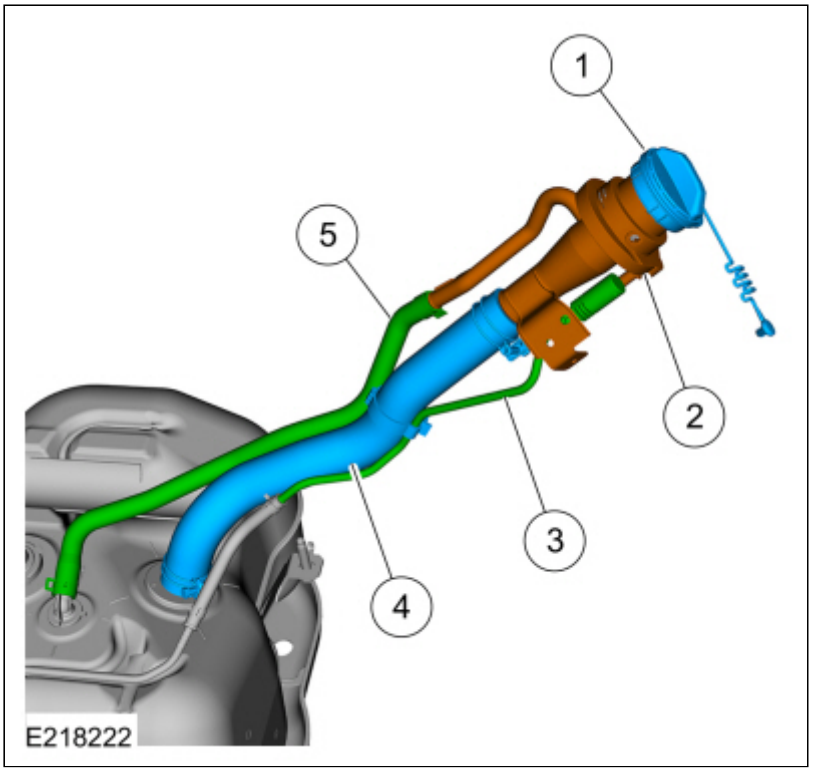
The return valve is positioned in the return circuit of the filter. It controls the flow rate of the return fuel from the engine, and maintains the required backpressure at the fuel rail.

The lower section of the filter houses the filter element, water separator and the water-in-fuel level sensor.

The water separator consists of two layers of foam that encourage the formation of water droplets to separate from

the fuel. Water accumulates at the bottom of the filter, which then lifts the water-in-fuel level sensor float. The water-in-fuel indicator is triggered when 80 ml of water has accumulated in the filter.

Fuel filler



Item	Part Number	Description
1	—	Filler cap
2	—	Fuel tank filler neck
3	—	Fuel tank vent line
4	—	Fuel tank filler hose
5	—	Fuel tank breather hose

The fuel tank filler neck incorporates a fuel tank breather hose. The fuel tank breather hose is connected to the top of the fuel tank and exits just below the top of the fuel tank filler neck. The fuel tank breather hose allows the displaced vapor above the fuel in the fuel tank to escape, avoiding fuel "spit back" and premature shut off during refueling.

The fuel filler cap seals to the fuel filler neck. This is to prevent the escape of fuel vapor during normal operation and to prevent fuel loss in the event of a vehicle accident.

Copyright © 2016 Ford Motor Company

Fuel Tank and Lines

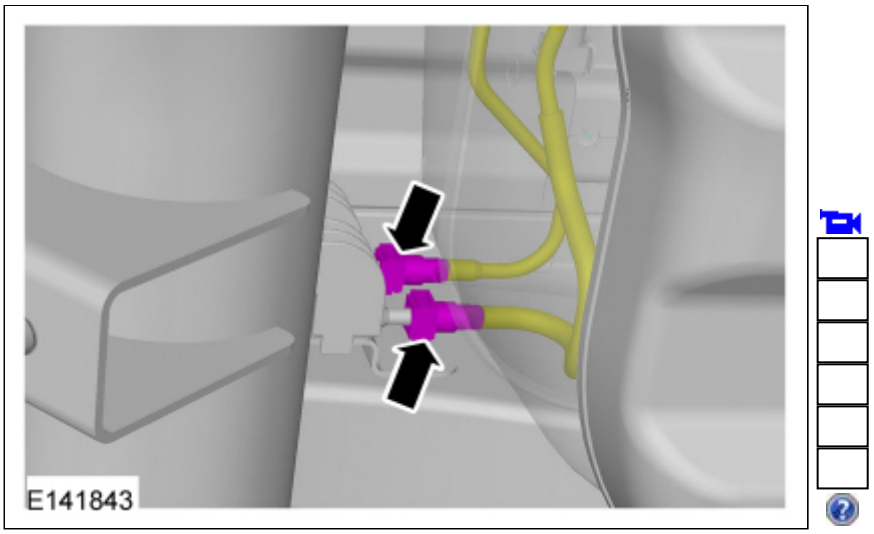
REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

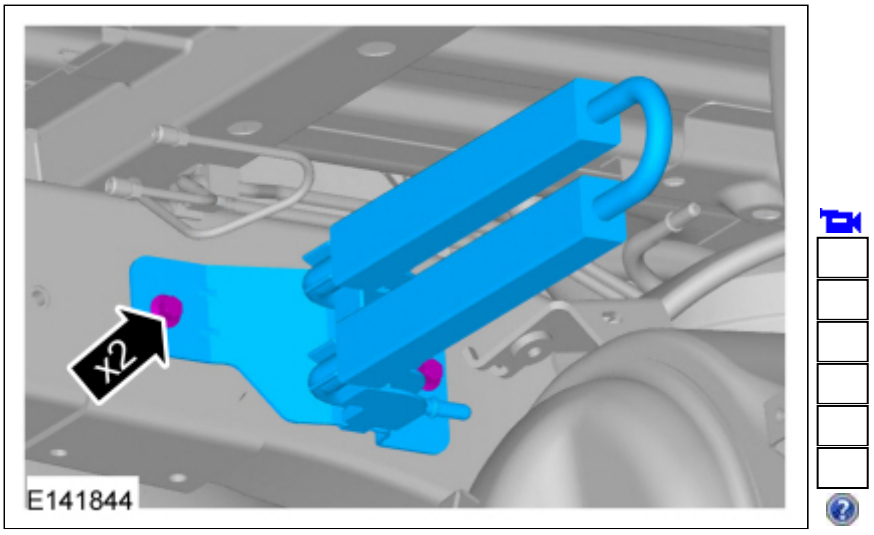
Fuel Cooler

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

5. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Tank - Double Cab/Single Cab/Super Cab

Base Part Number: 9002

Special Tool(s) / General Equipment

10 mm Drill Bit
Blind Rivet Gun
Transmission Jack
Retaining Strap

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with load box.*

1. **WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.**

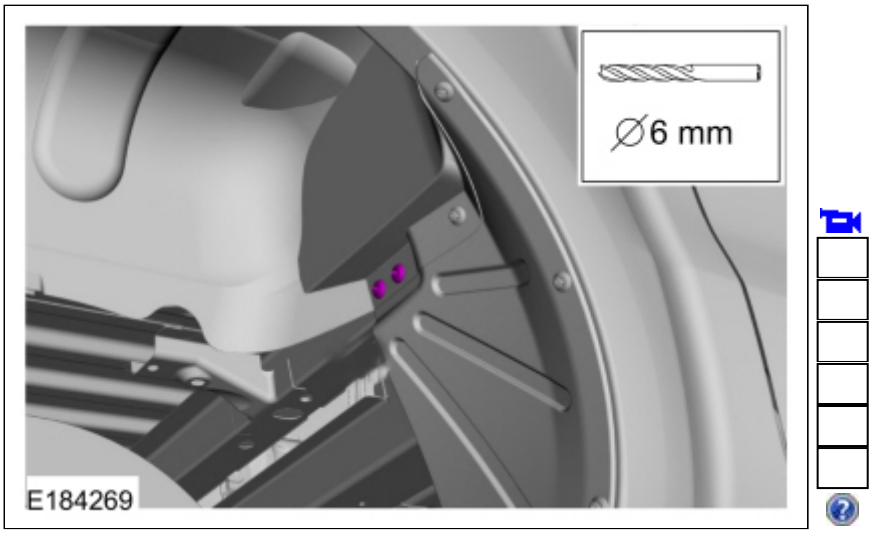
   Refer to: Fuel Tank Draining (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel Tank Draining (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

2. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

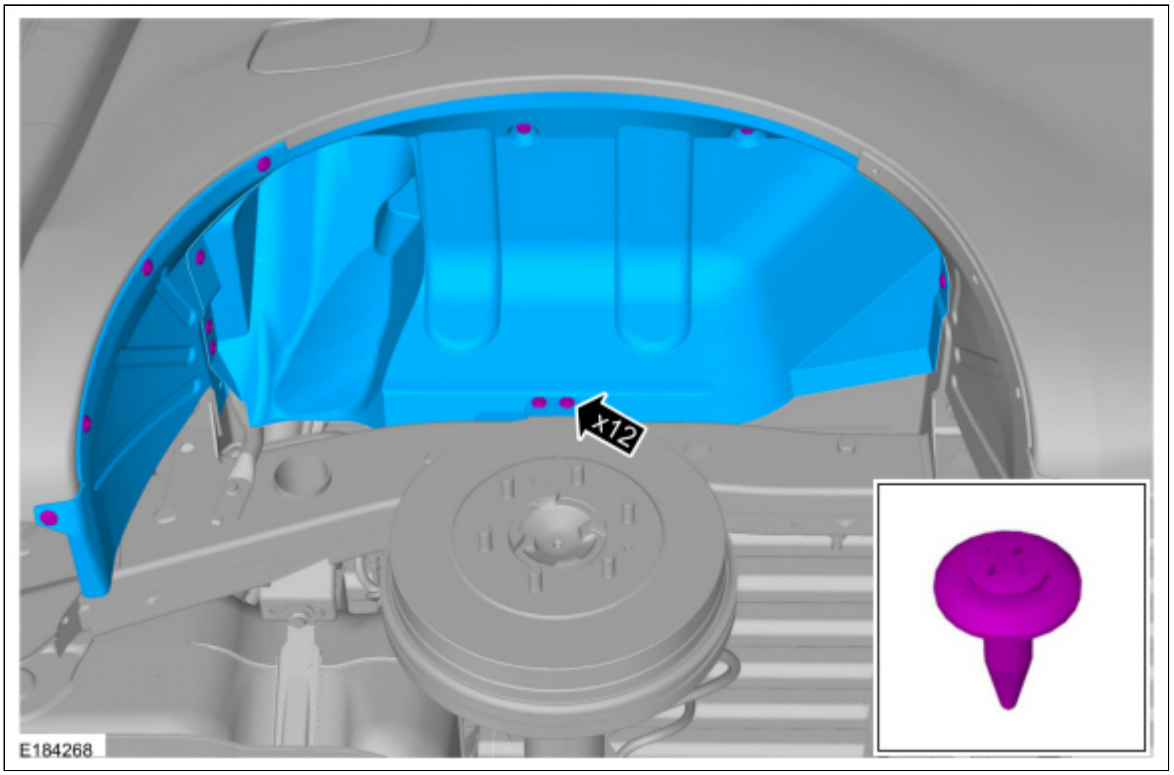
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

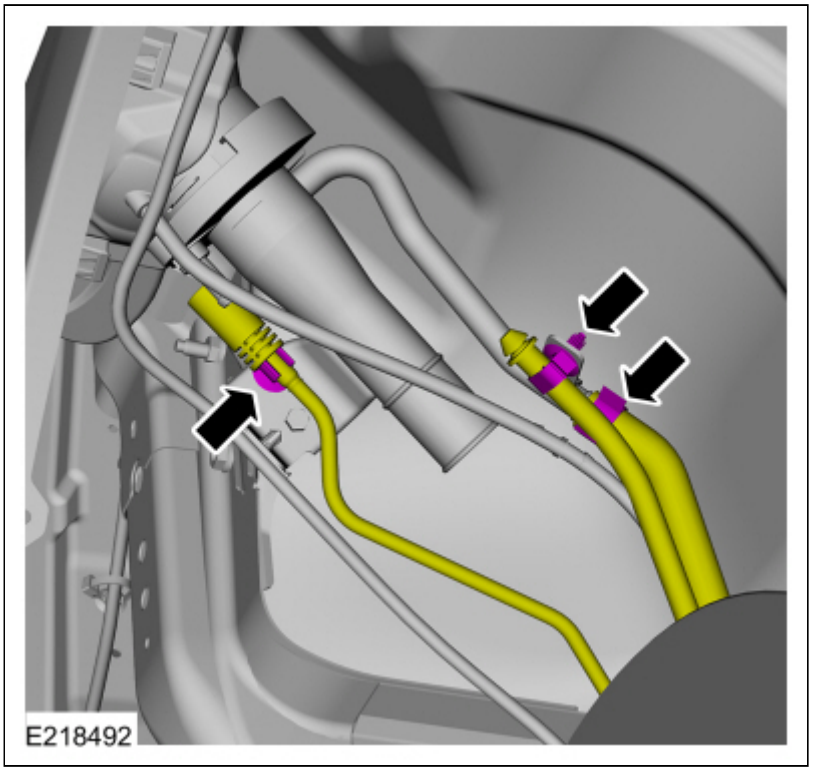
5. Use the General Equipment: 10 mm Drill Bit



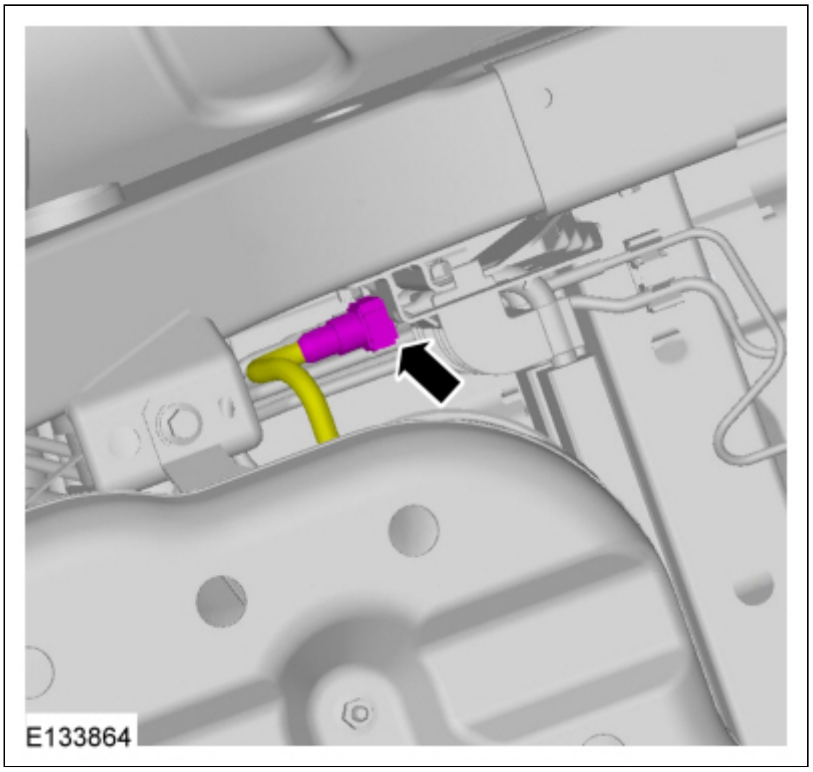
6.



7.

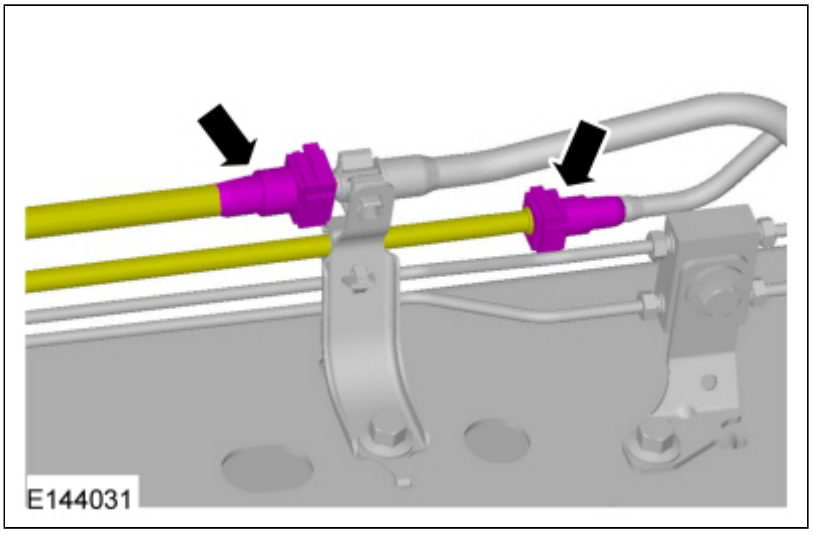


8.



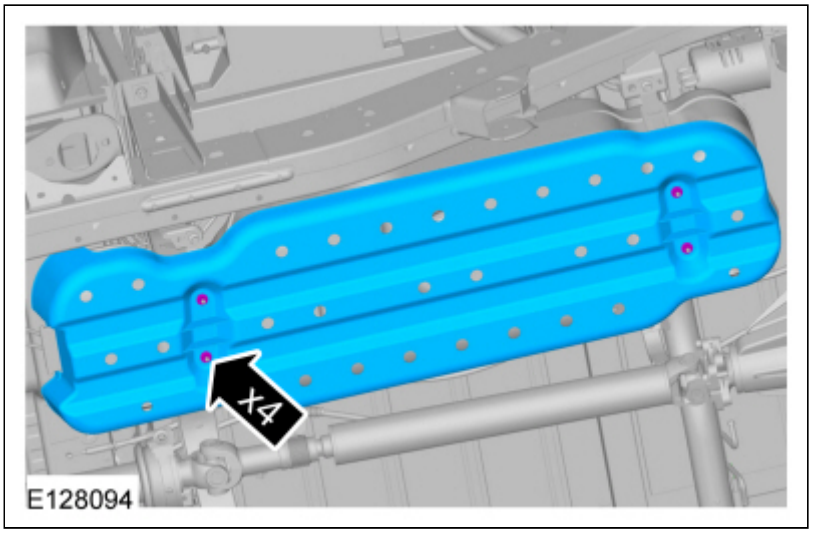
9. **WARNING: Fuel may still be present in the fuel tank after draining.**

   Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



4x4

10. *Torque*: 15 Nm

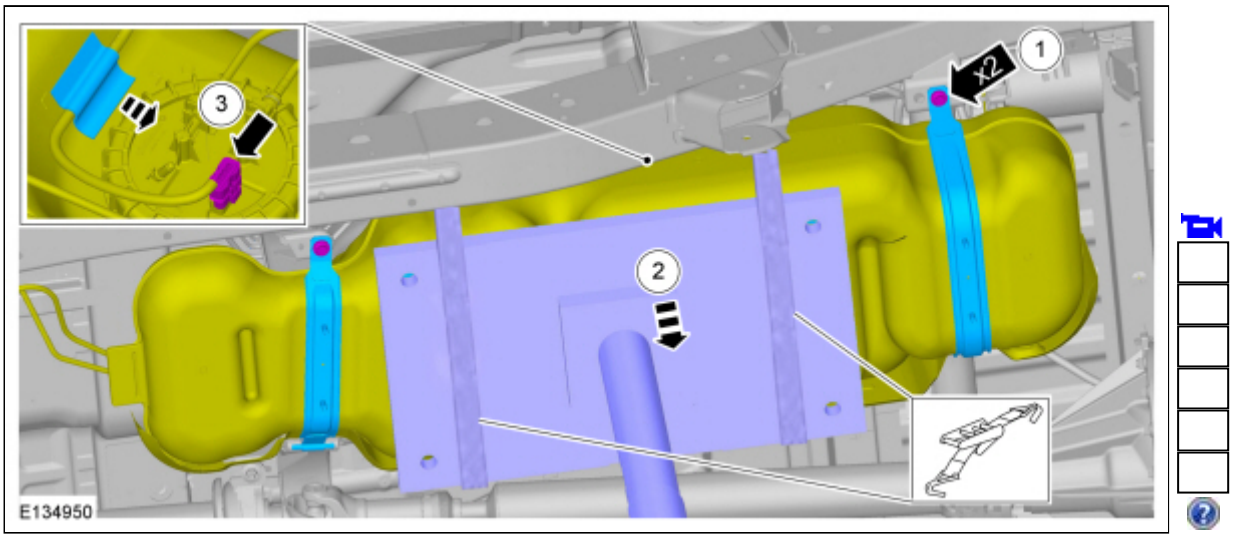


All vehicles

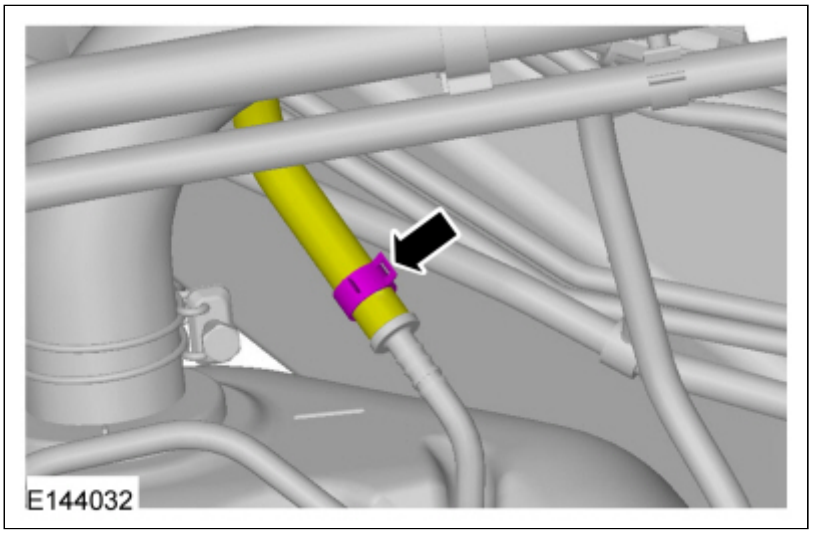
11. **NOTICE: Make sure that no strain is placed on the wiring harness.**

    NOTE: *Slowly lower the fuel tank to access the fuel pump and sender unit electrical connector.*

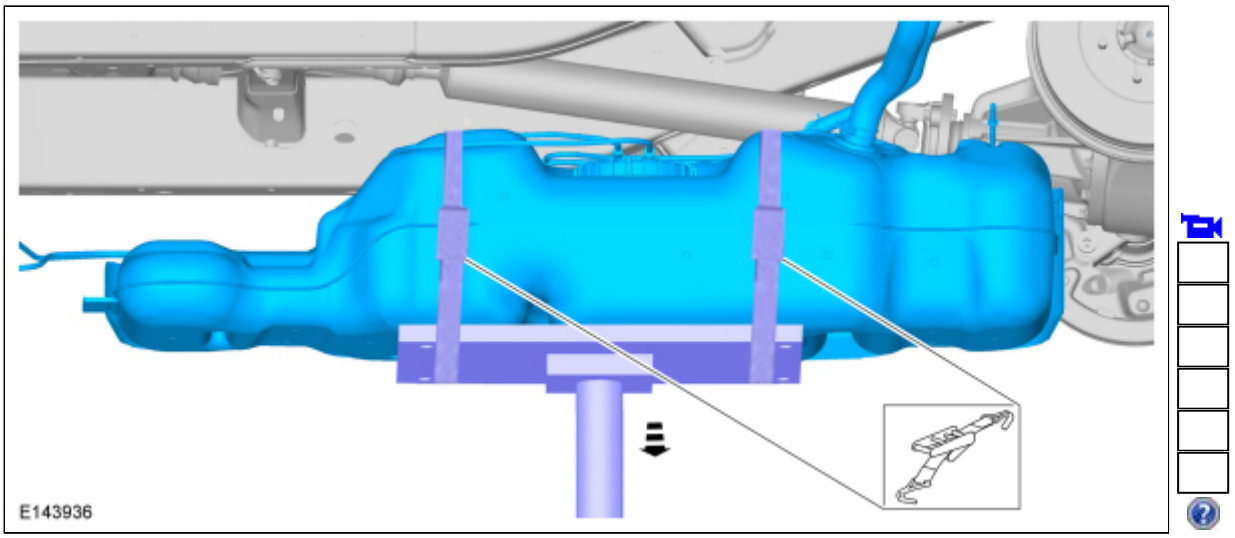
    Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap
    Torque: 48 Nm



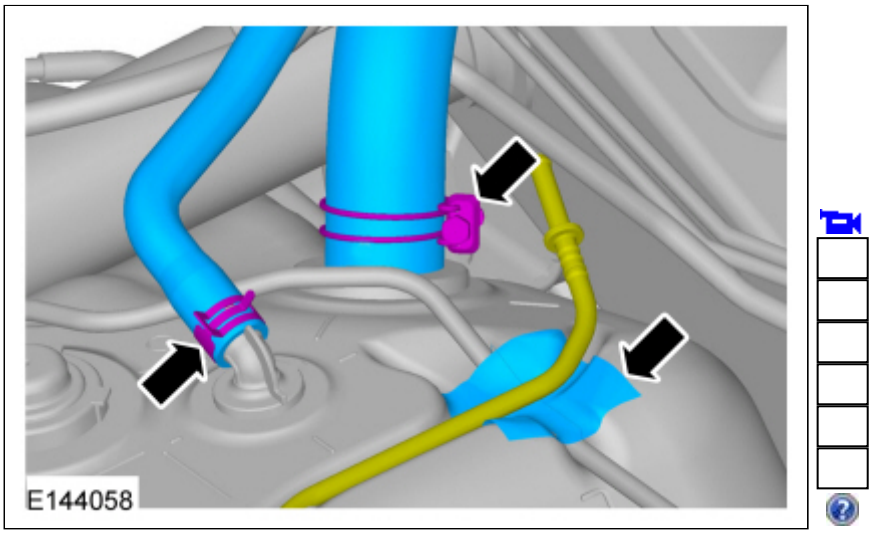
12.



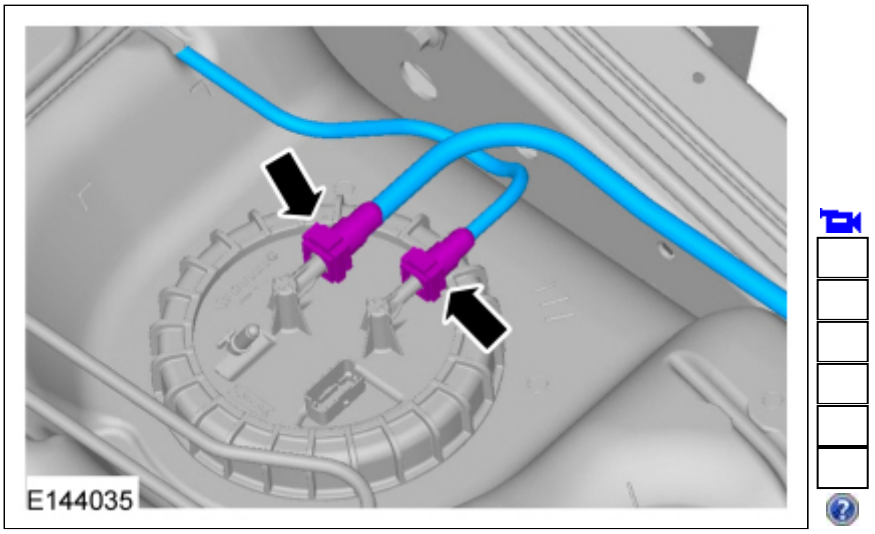
13. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap



14.

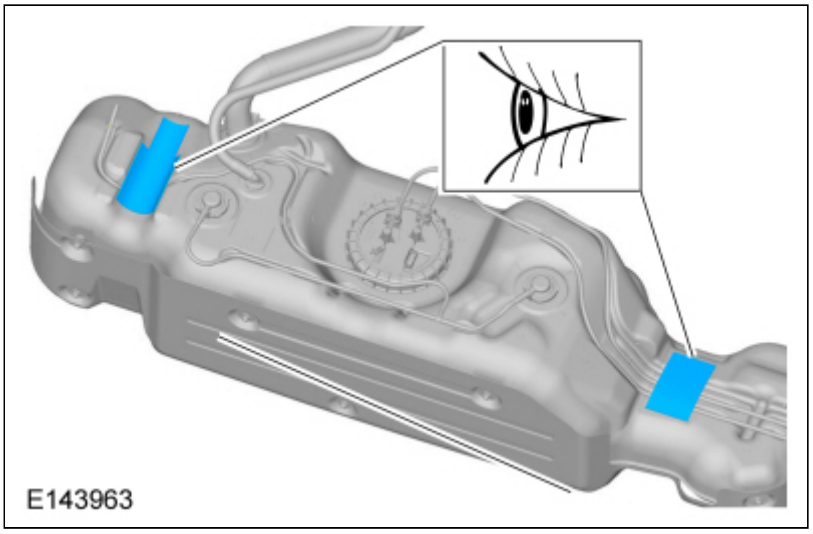


15. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



Installation

1. **NOTICE: Make sure that the insulator pads are correctly positioned on the fuel tank.**



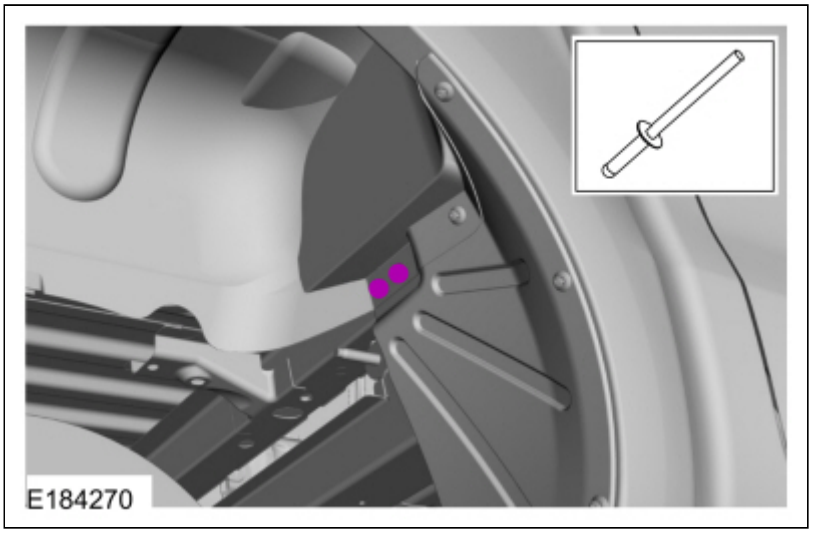
2. **WARNING: Make sure that all fuel connections are checked for leaks.**

   NOTICE: If the fuel tank has been filled with the wrong type of fuel, the engine must not be started before the fuel system is cleaned.

   NOTE: *Make sure that the correct type of fuel is added after the tank installation.*

   To install, reverse the removal procedure.

3. Install the fasteners.
   Use the General Equipment: Blind Rivet Gun



Copyright © 2016 Ford Motor Company

Fuel Tank - Chassis Cab

Base Part Number: 9002

Special Tool(s) / General Equipment

Transmission Jack
Retaining Strap

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with aluminium tray.*

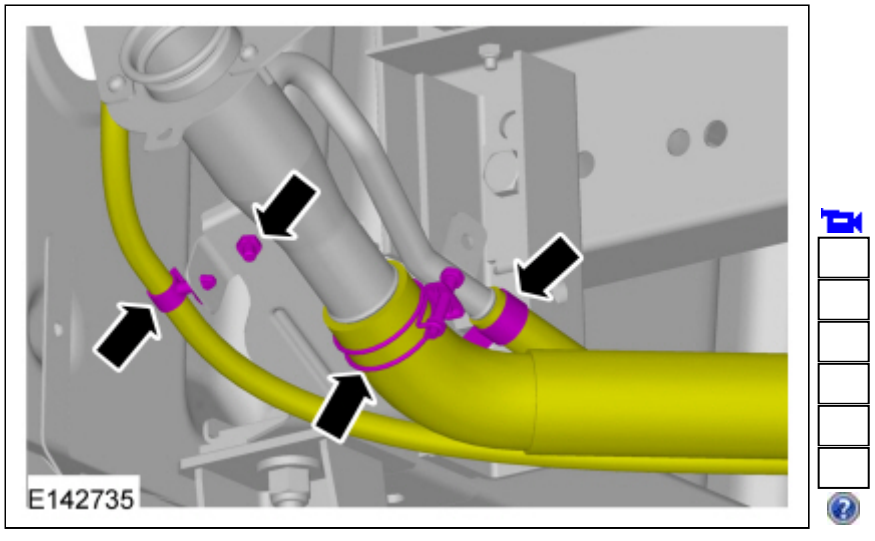
1. **WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.**

   Refer to: Fuel Tank Draining (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel Tank Draining (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

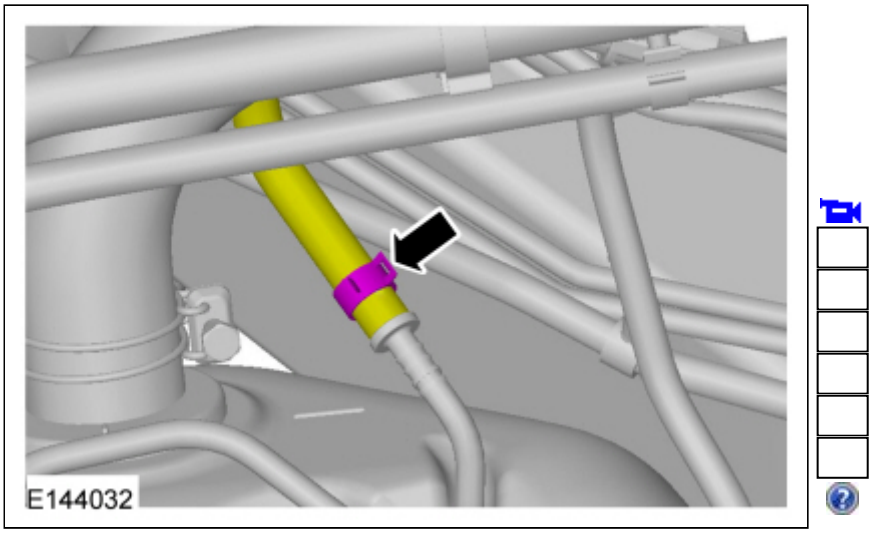
2. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

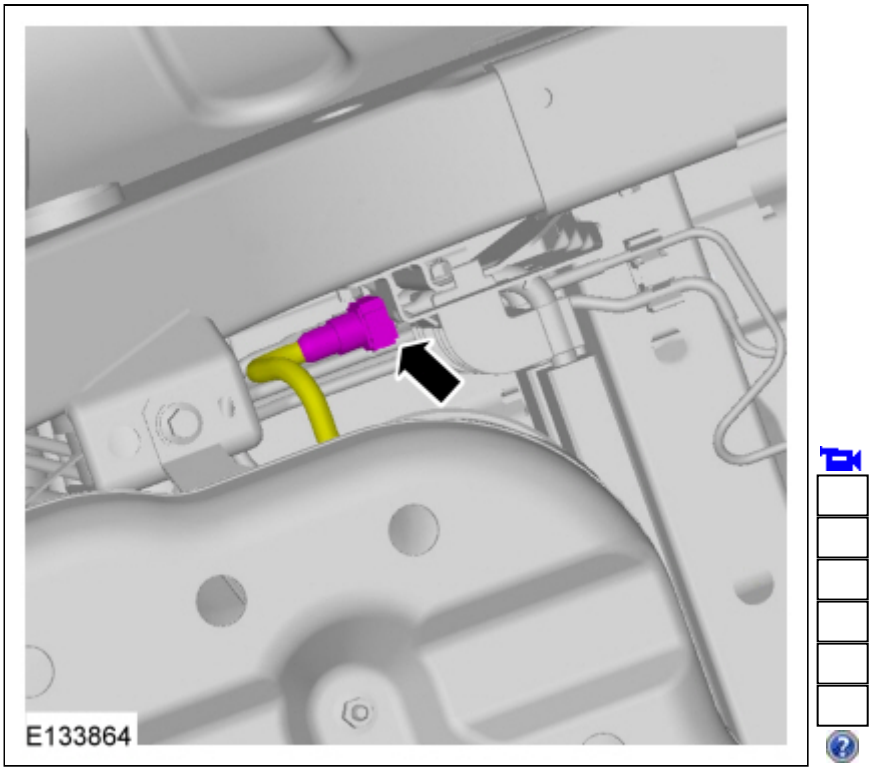
4. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



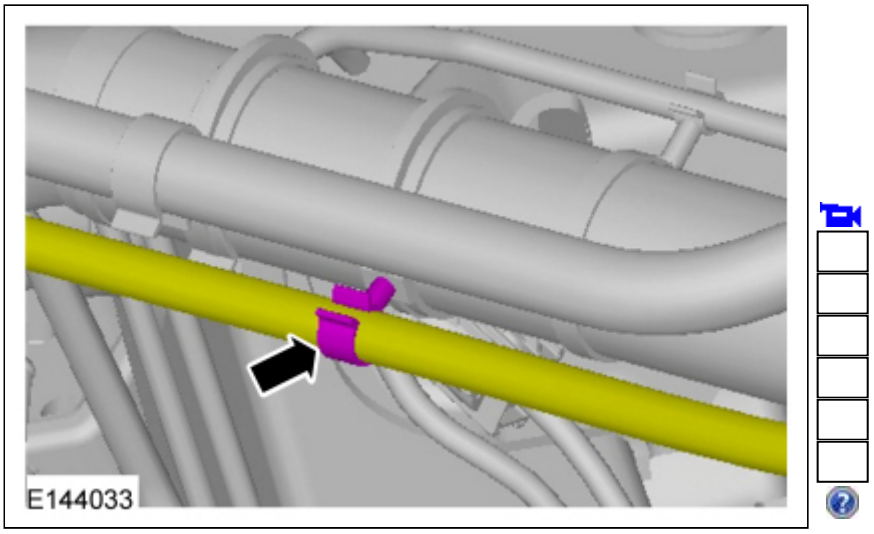
5.



6. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

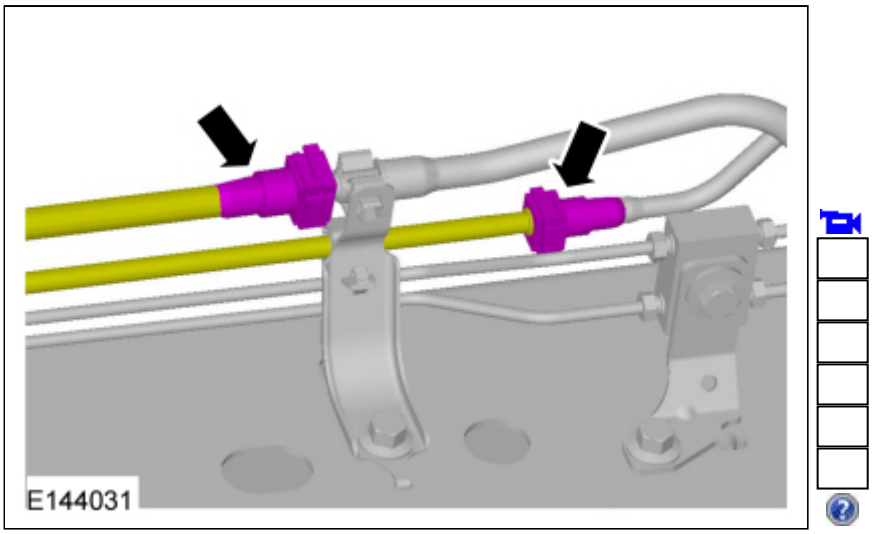


7.

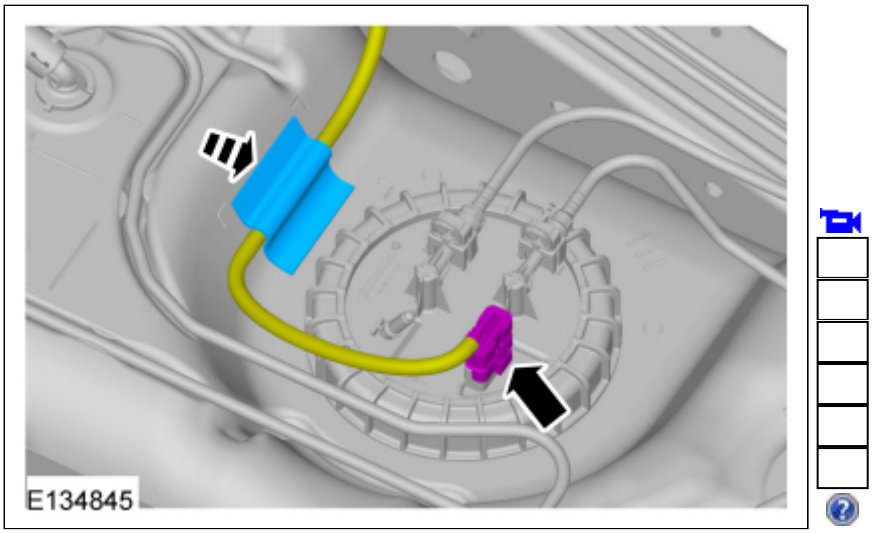


8. **WARNING: Fuel may still be present in the fuel tank after draining.**

   Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

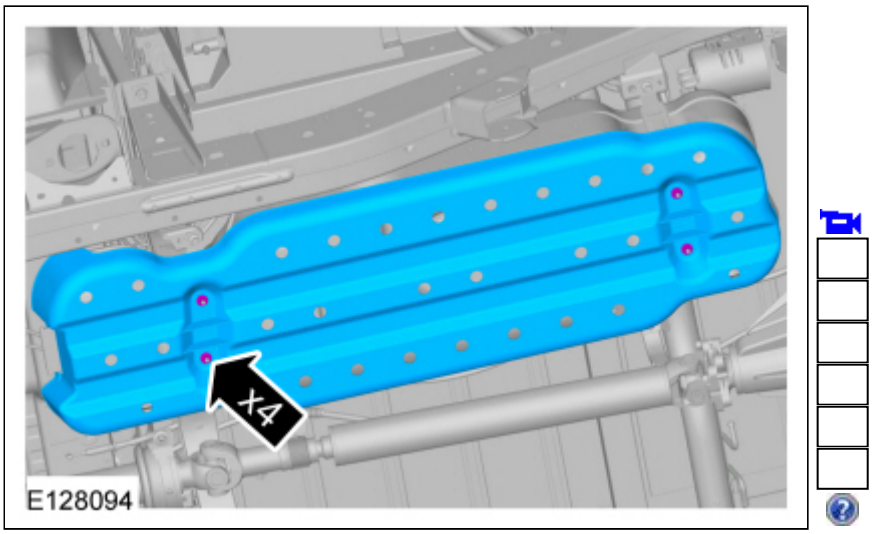


9.



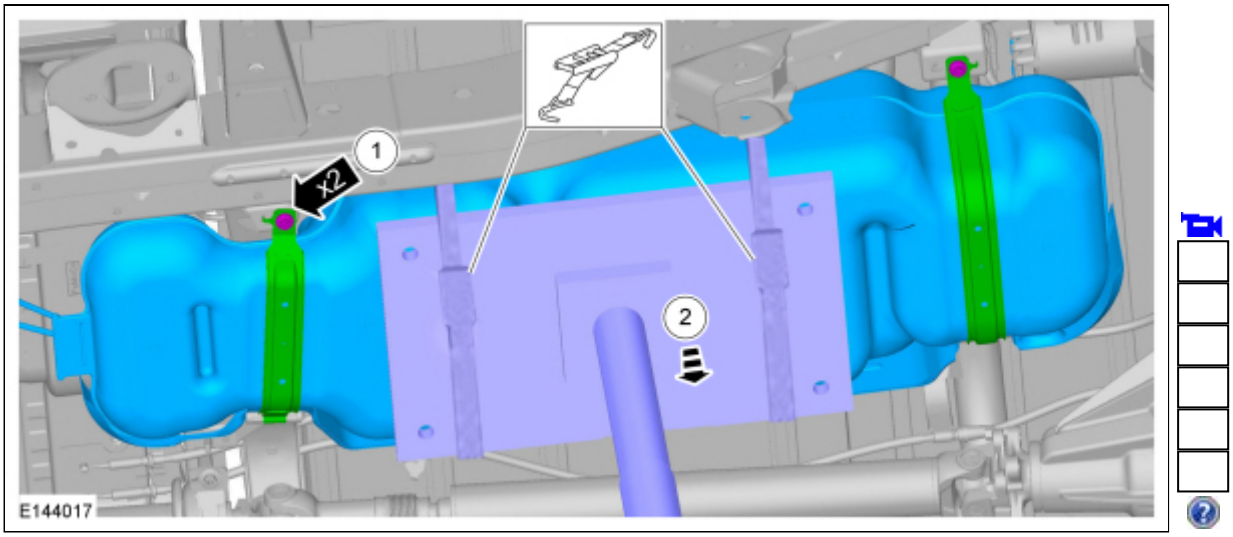
4x4

10. *Torque*: 15 Nm

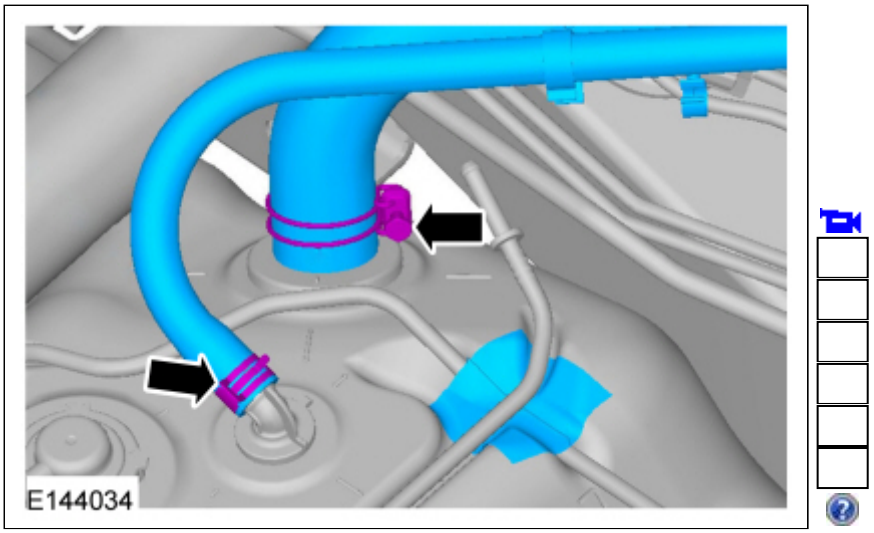


All vehicles

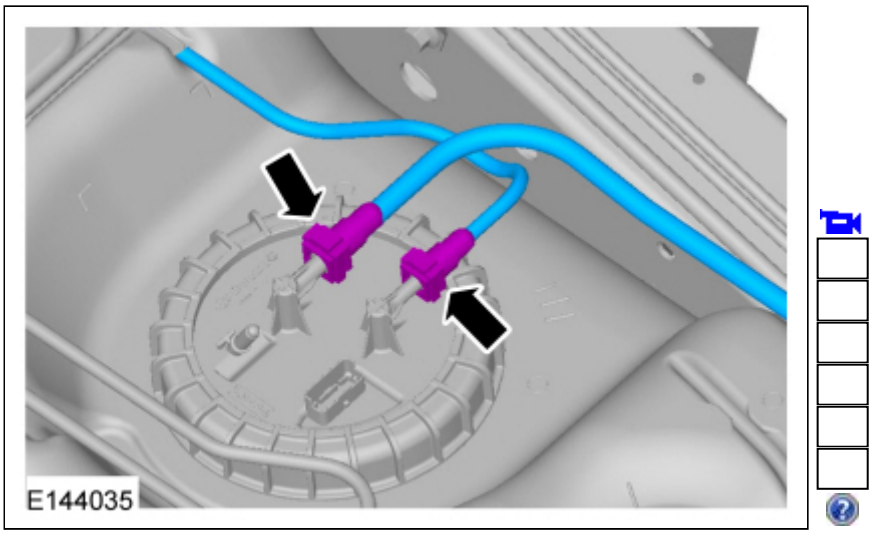
11. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap
    Torque: 48 Nm



12.

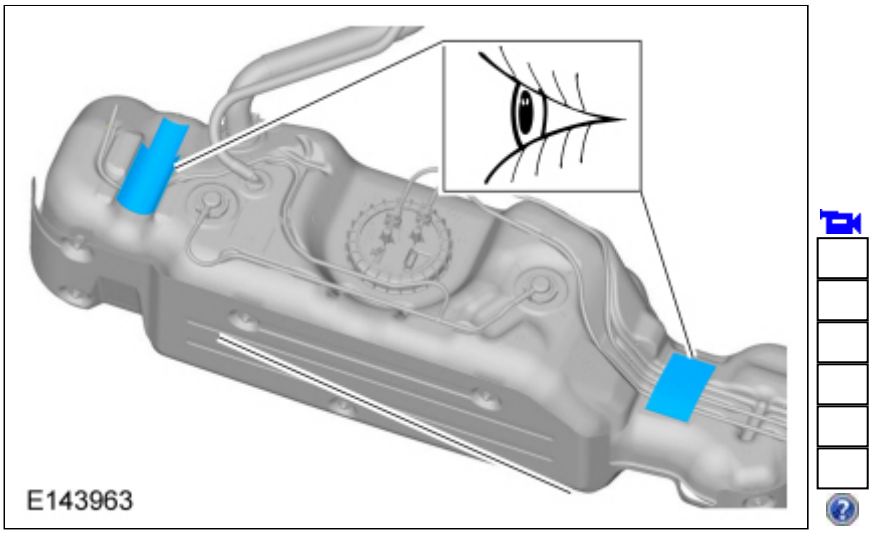


13. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
    Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



Installation

1. **NOTICE: Make sure that the insulator pads are correctly positioned on the fuel tank.**



2. **WARNING: Make sure that all fuel connections are checked for leaks.**

   NOTICE: If the fuel tank has been filled with the wrong type of fuel, the engine must not be started before the fuel system is cleaned.

   NOTE: *Make sure that the correct type of fuel is added after the tank installation.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Tank Filler Pipe - Double Cab/Single Cab/Super Cab

Special Tool(s) / General Equipment

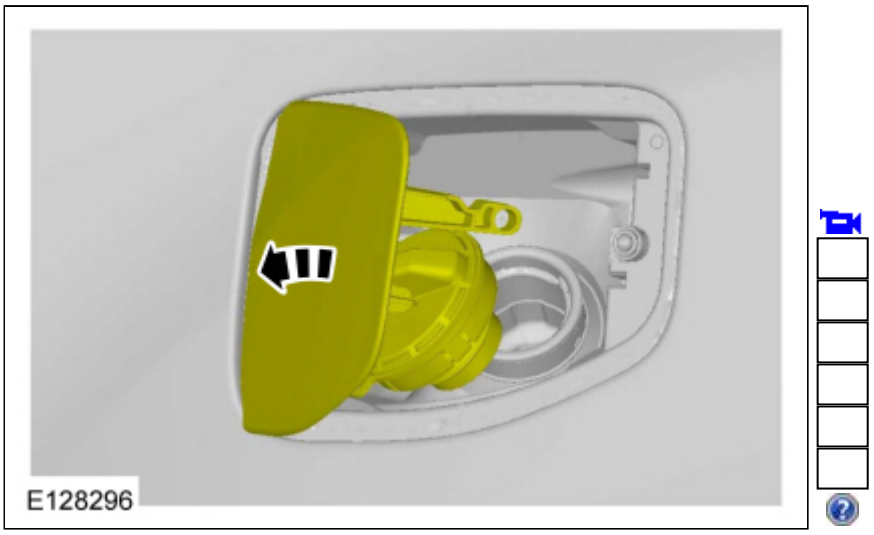
10 mm Drill Bit
Blind Rivet Gun

Removal

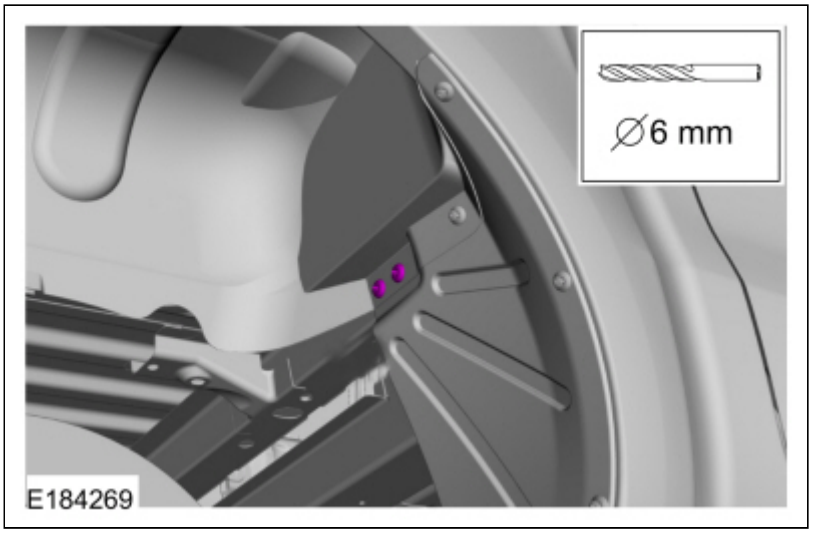
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with load box.*

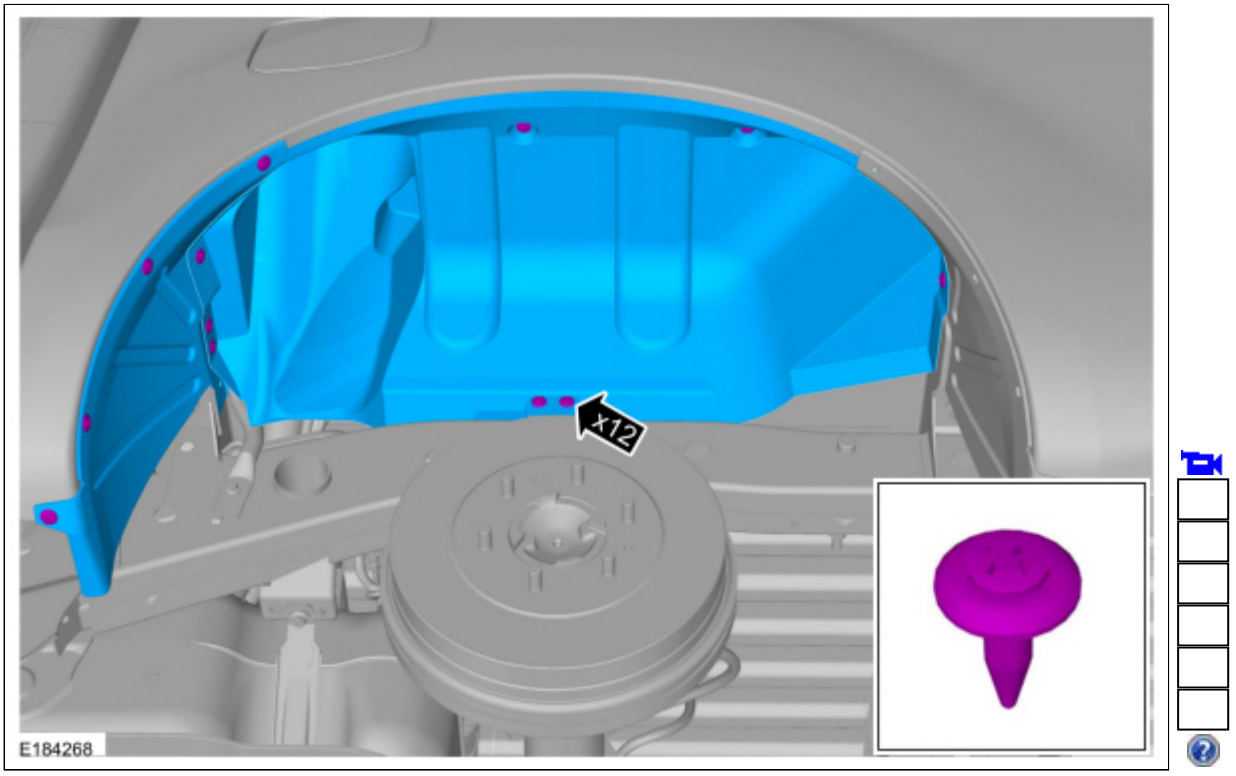
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Make sure that the fuel tank is no more than 3/4 full.*



3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Use the General Equipment: 10 mm Drill Bit

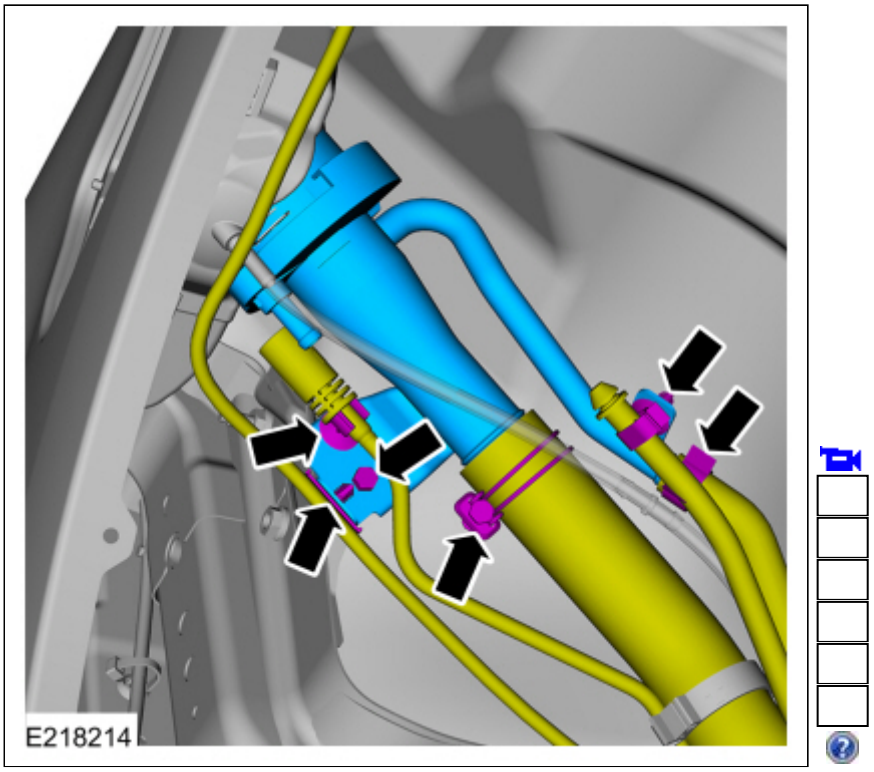


6.



7. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

   Torque: 11 Nm

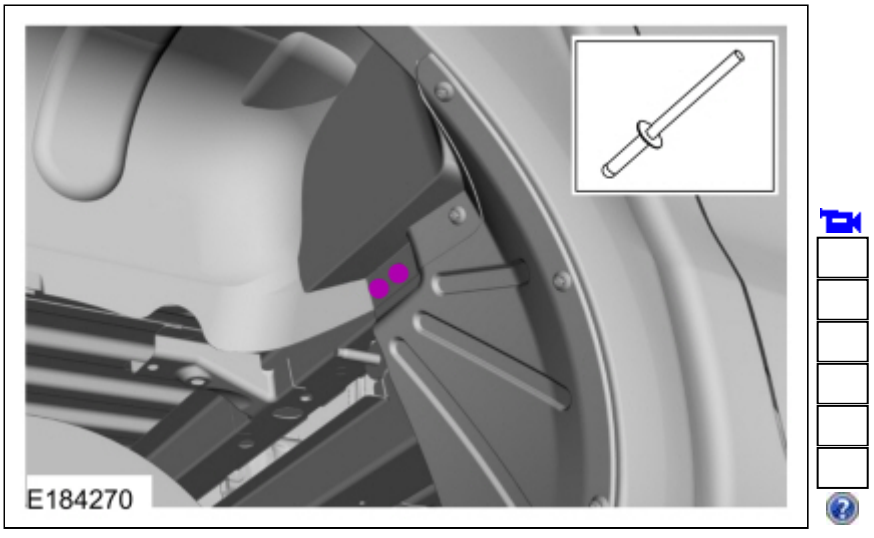


8. **NOTE:** *For removal of the fuel filler pipe and vent hose.*

   Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Installation

1. To install, reverse the removal procedure.
2. Install the fasteners.
   Use the General Equipment: Blind Rivet Gun



Copyright © 2016 Ford Motor Company

Fuel Tank Filler Pipe - Chassis Cab

Removal

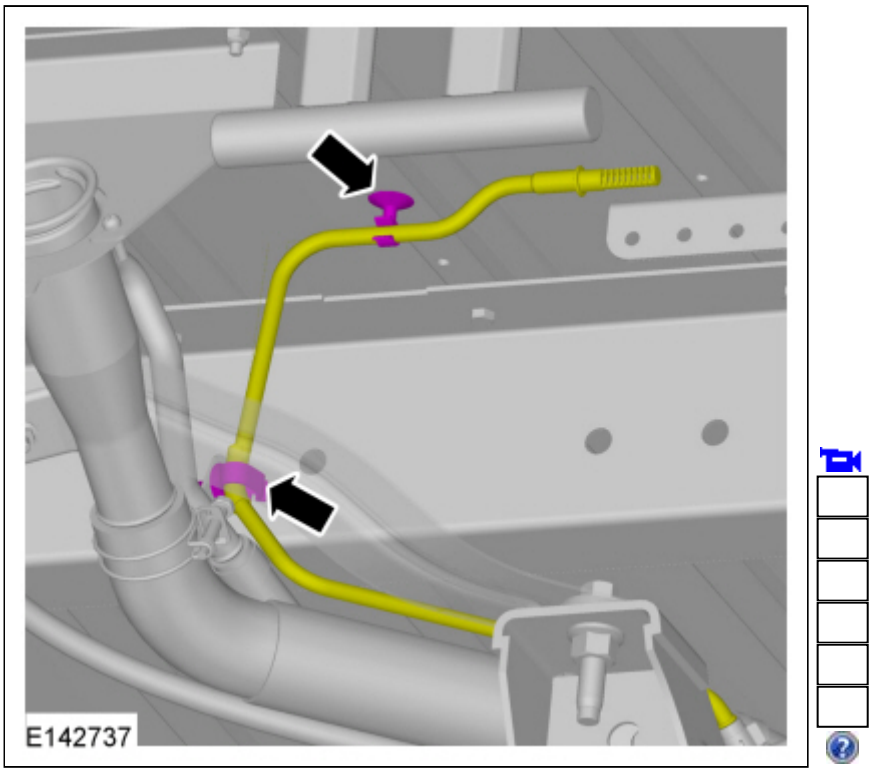
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with aluminium tray.*

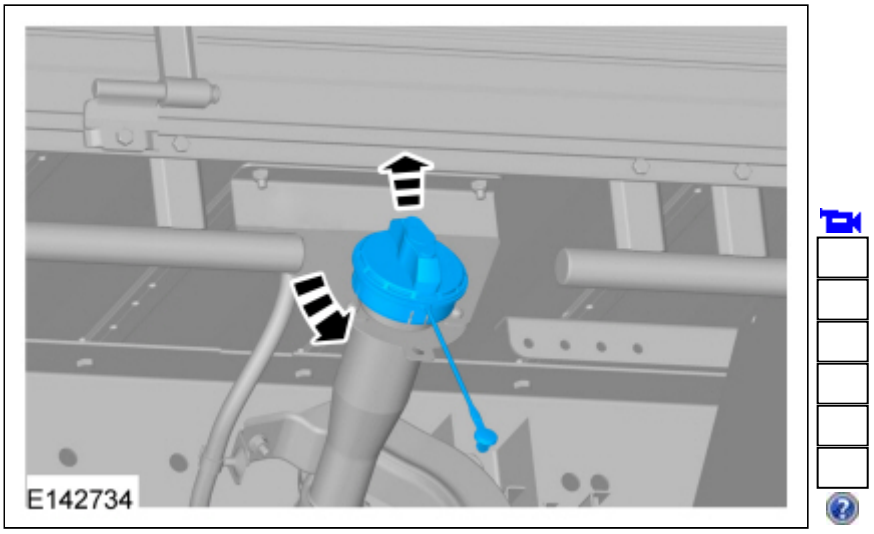
1. **WARNING: Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel system.**

   WARNING: Make sure that the fuel tank is no more than 3/4 full.

   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

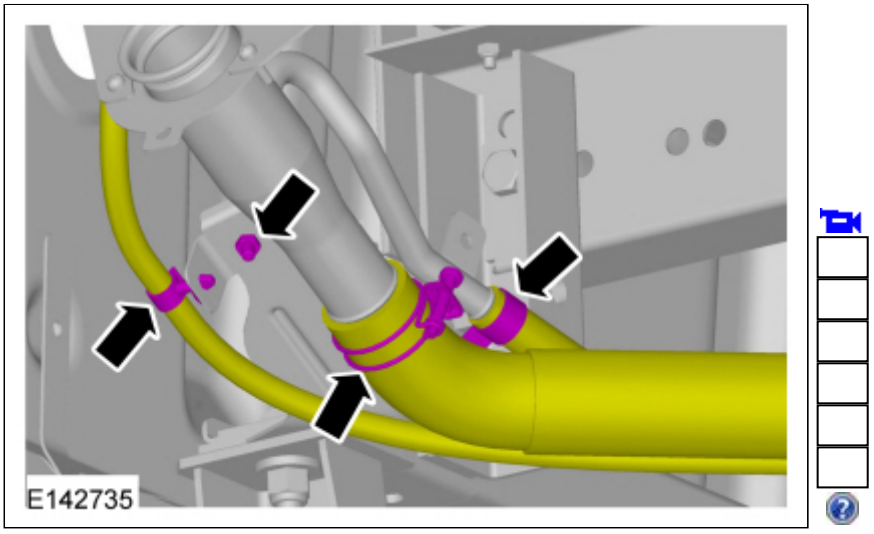
2. 

3.

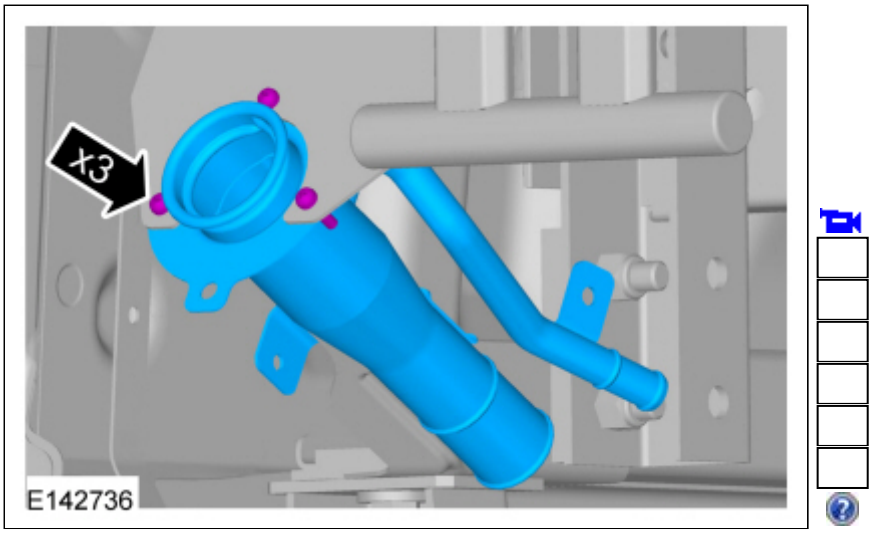


4. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

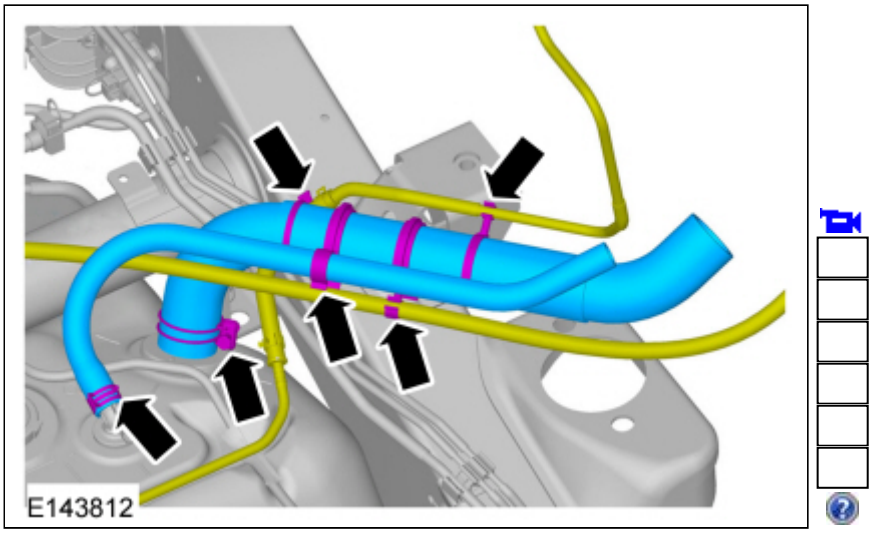
   Torque: 11 Nm



5. *Torque*: 8 Nm



6. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



Installation

1. To install, reverse the removal procedure.

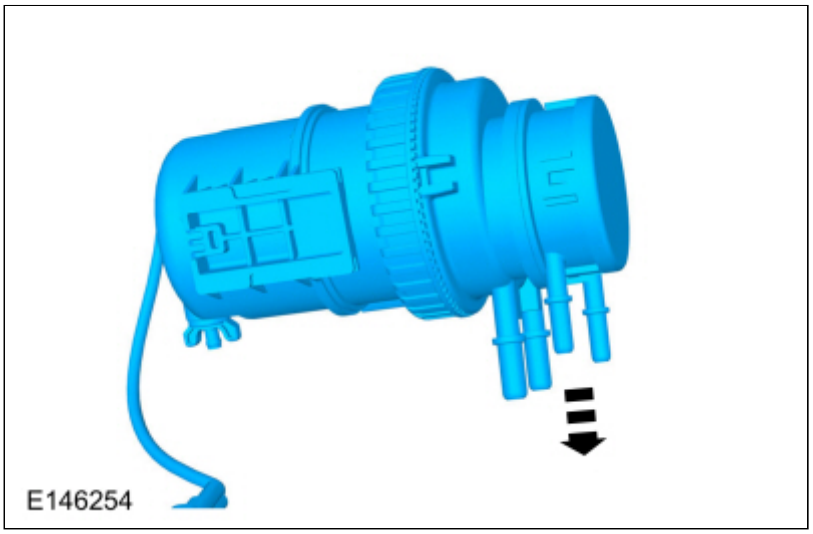
Copyright © 2016 Ford Motor Company

Fuel Filter Element

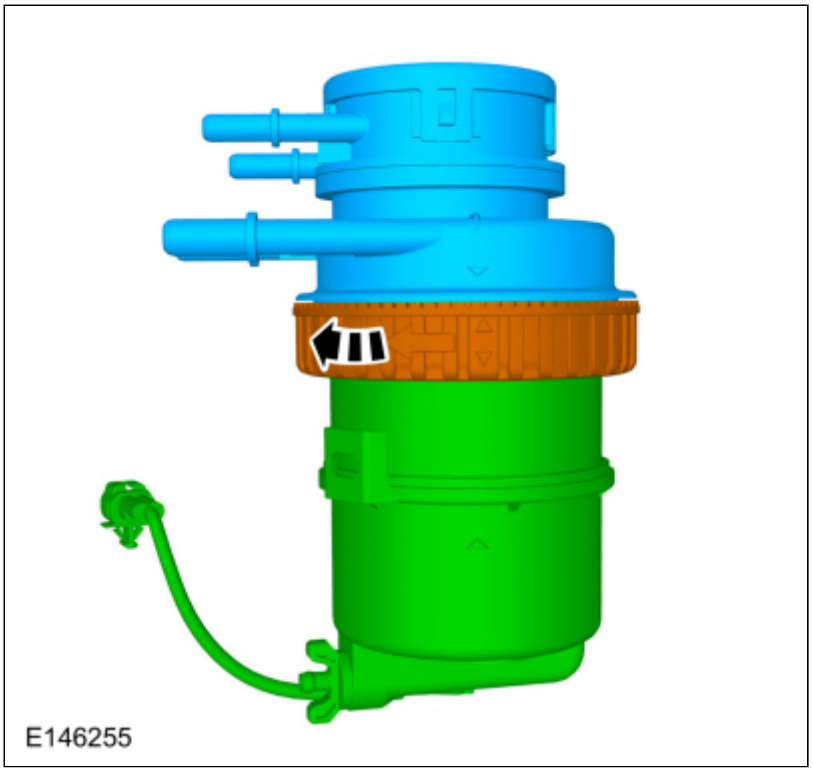
Base Part Number: 9N184

Removal

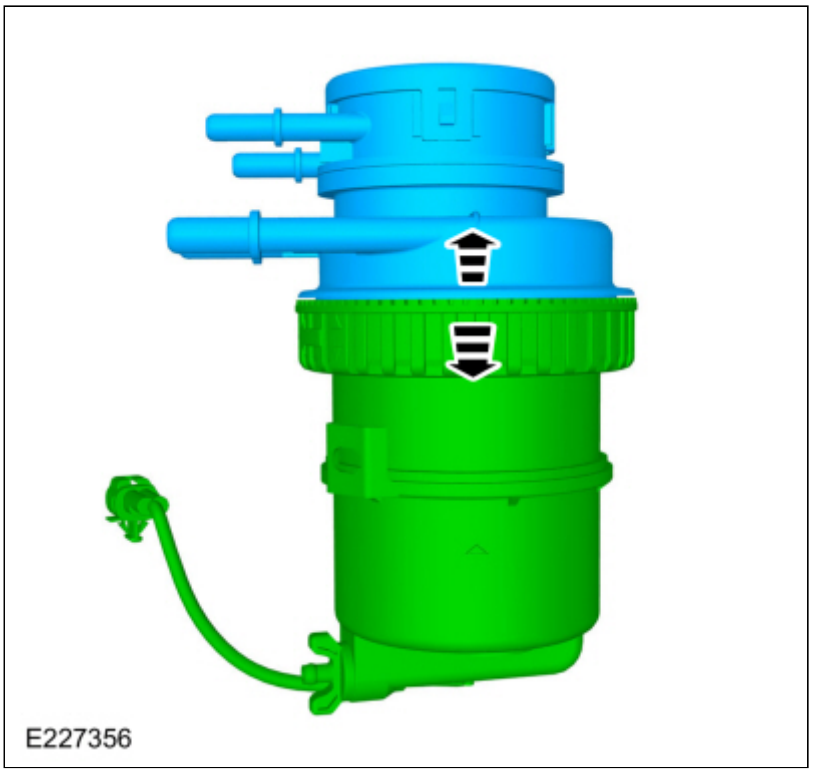
1. Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Filter (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. Drain the fuel into a suitable container.



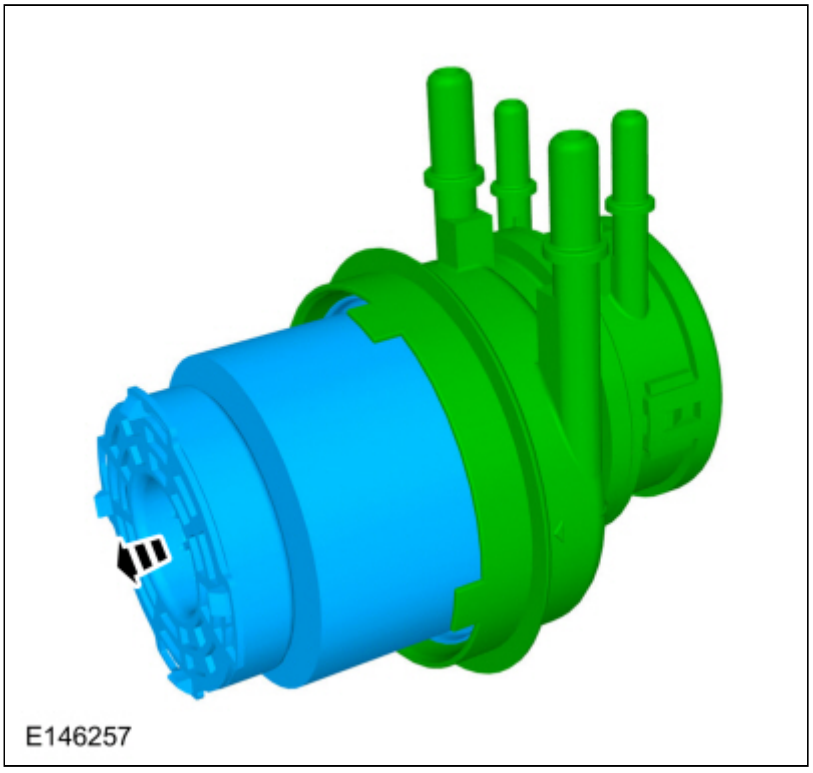
3.



4.

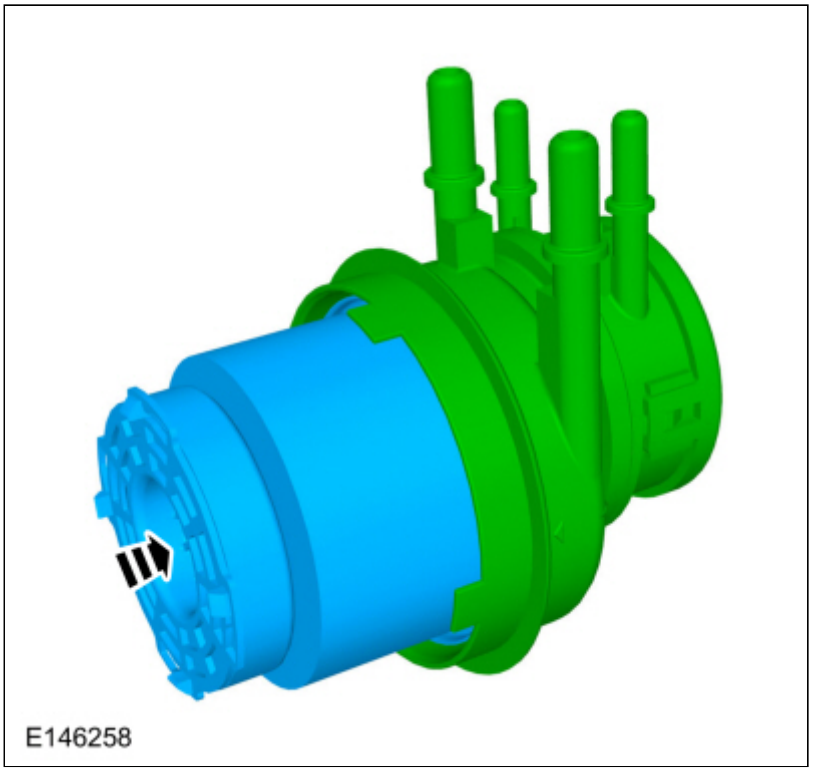


5.

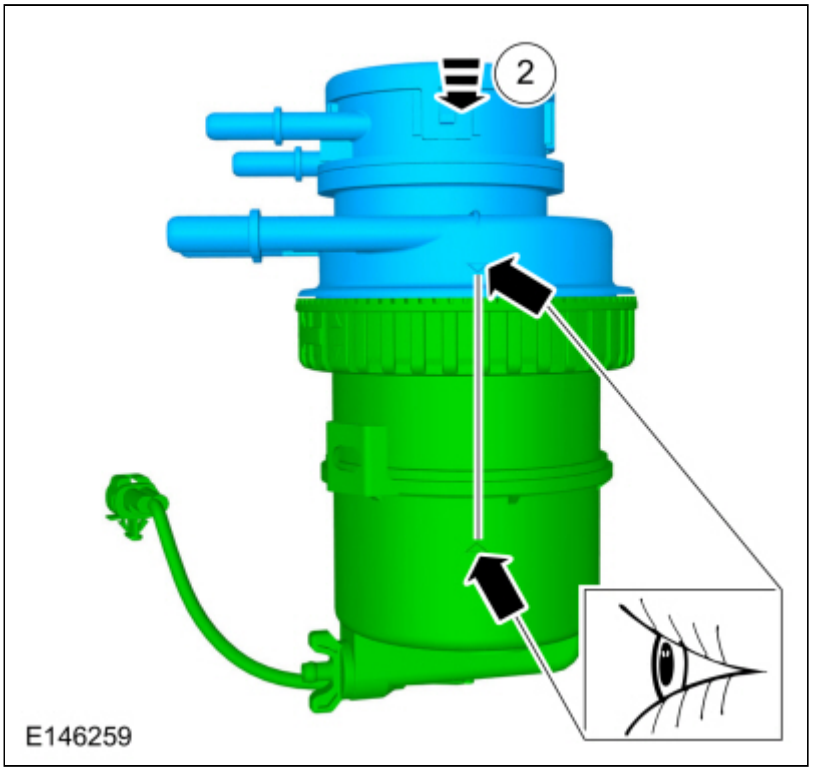


Installation

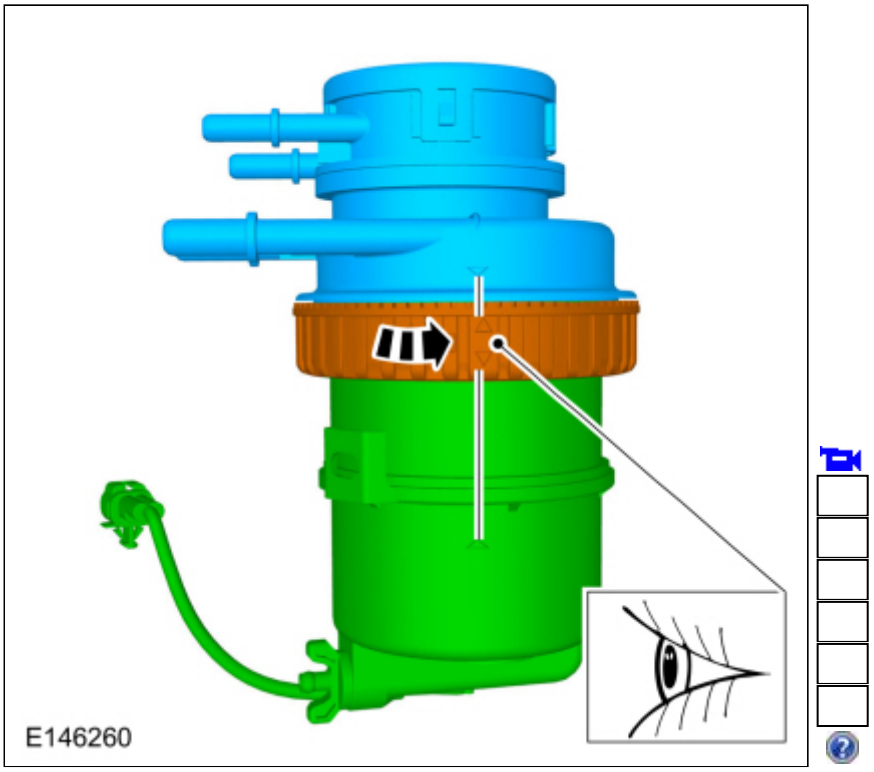
1.



2. **NOTE:** *A firm push may be required.*



3.



4. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel System Bleeding (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

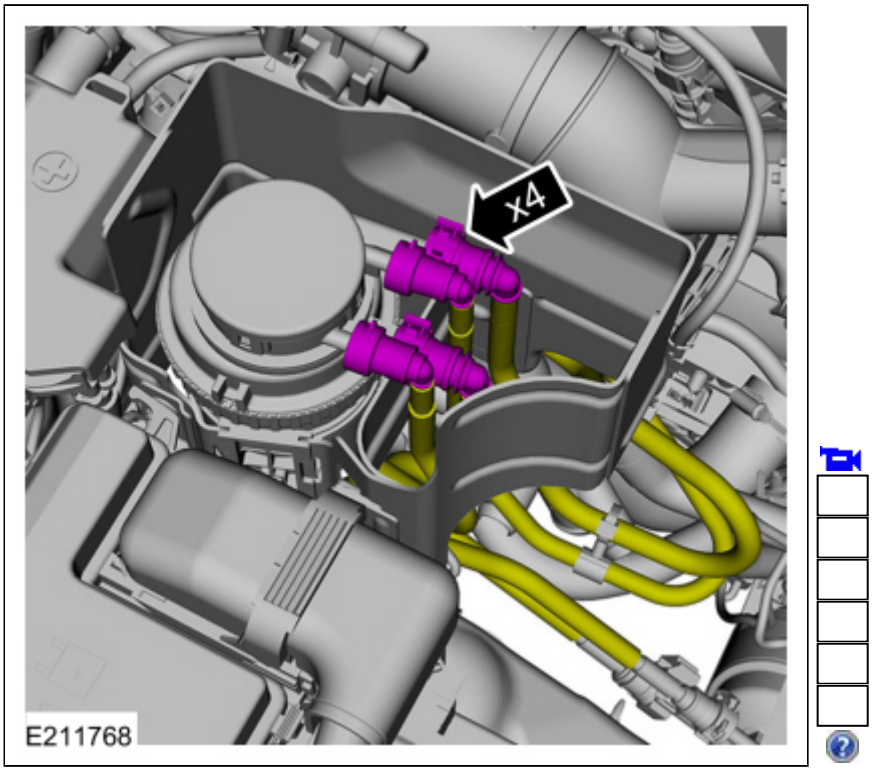
Fuel Filter

Removal

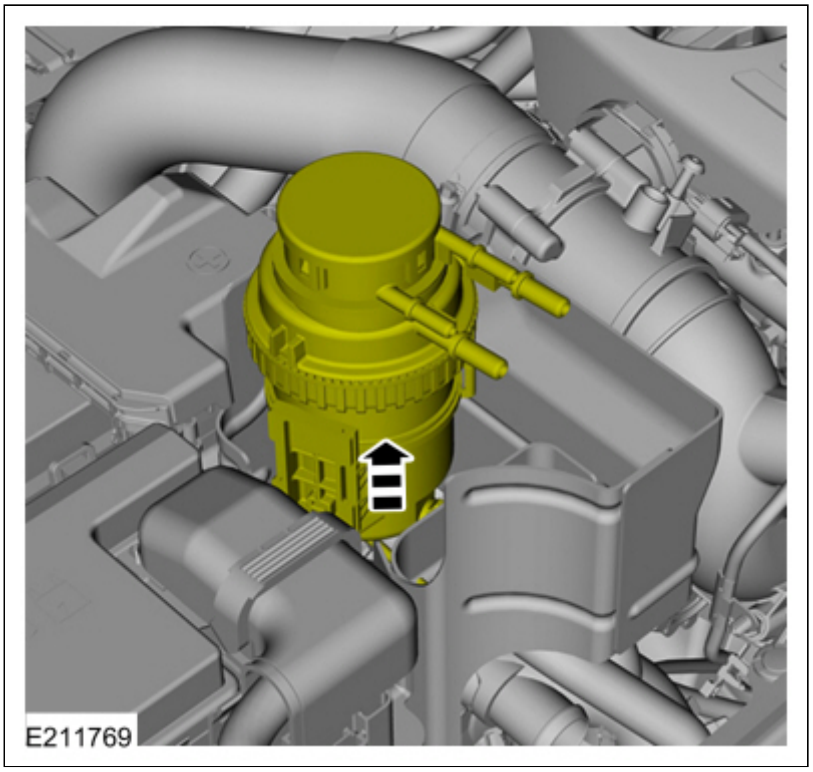
WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

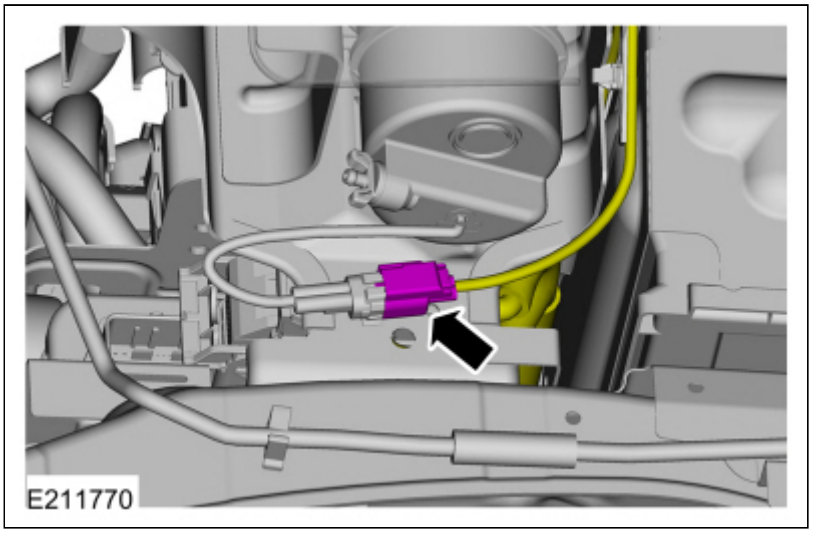
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

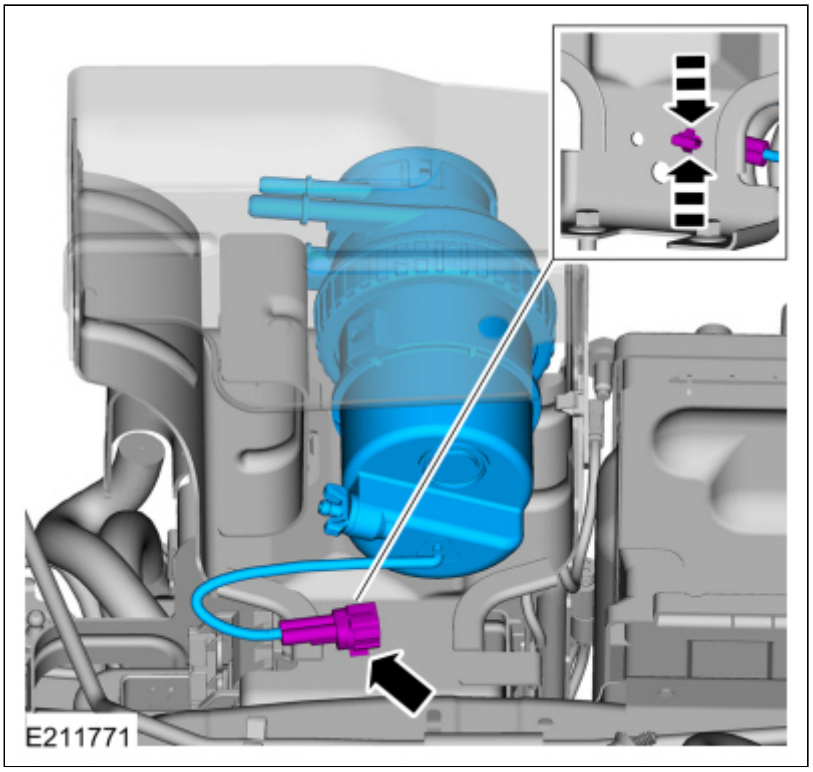
3.



4.

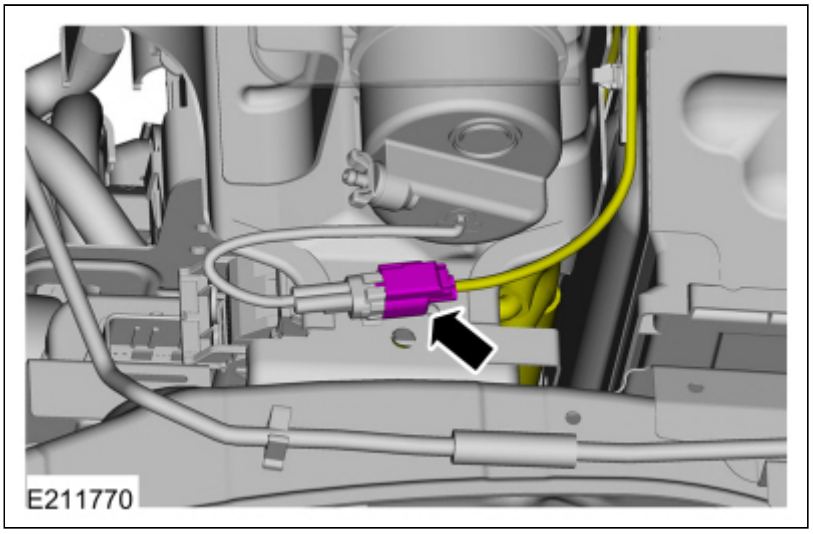


5.

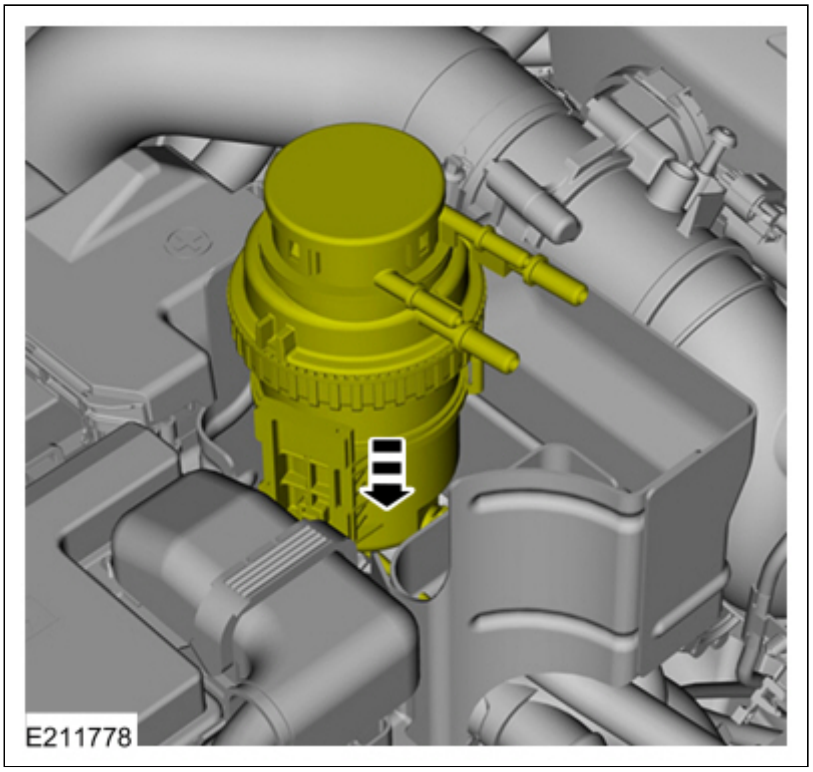


Installation

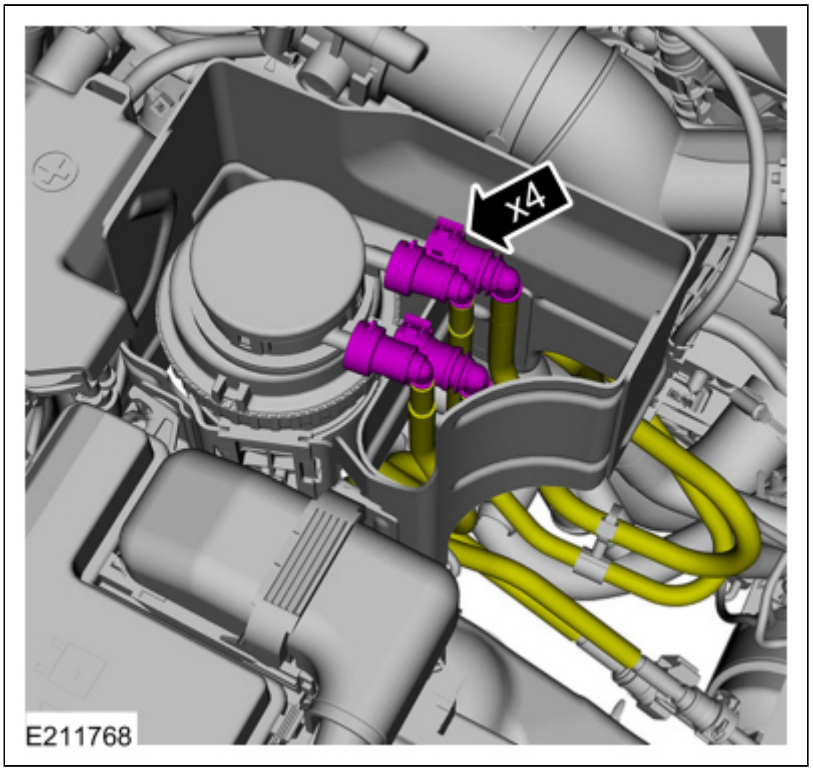
1. **NOTE:** *Make sure that the harness is not looped around fuel lines.*



2.



3. **NOTE:** *Make sure that the tubing is routed as shown.*



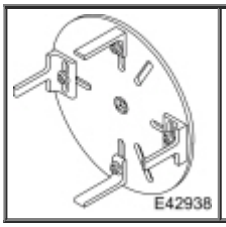
4. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Fuel Pump and Sender Unit

Base Part Number: 9275

Special Tool(s) / General Equipment

	310-127 Wrench, Fuel Tank Sender Unit

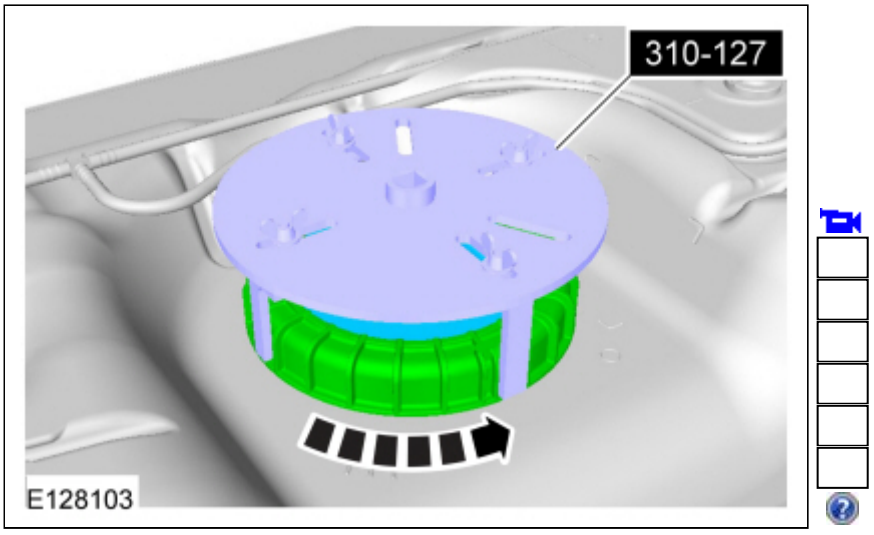
Removal

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

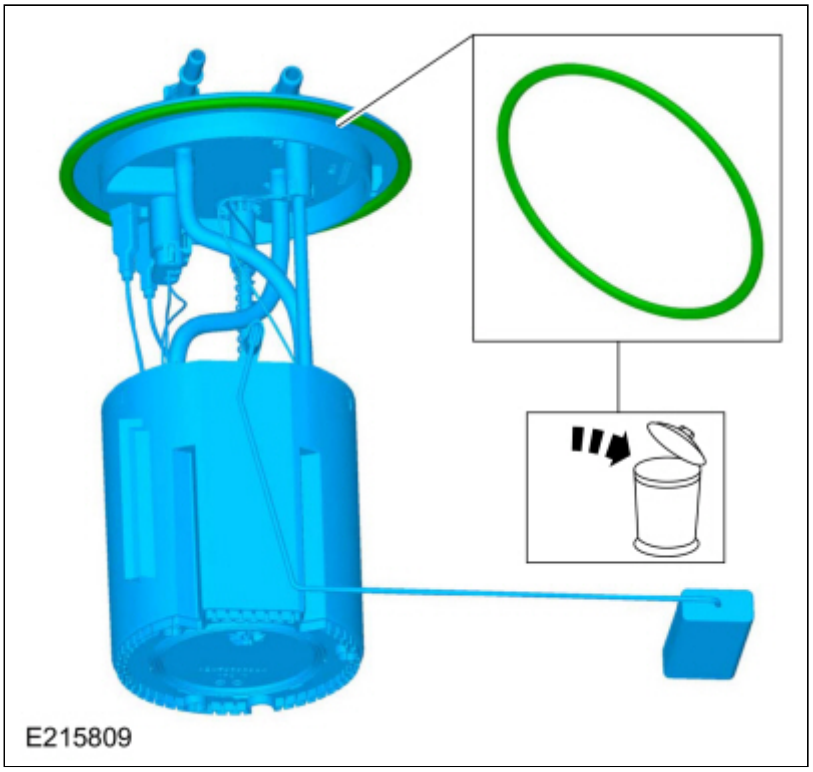
2. Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Tank - Chassis Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

3. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   Use Special Service Tool: 310-127 Wrench, Fuel Tank Sender Unit.



4.



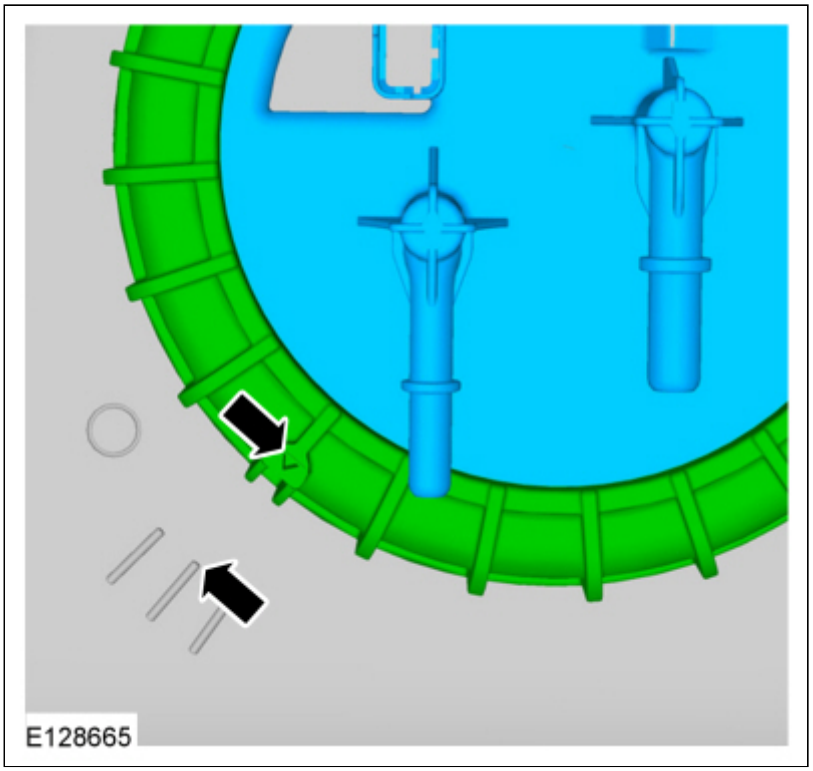
Installation

1. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   NOTE: *Make sure that the seal is correctly located.*

   NOTE: *Make sure that the installation marks are aligned.*

   Torque: 110 Nm



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Level Sender

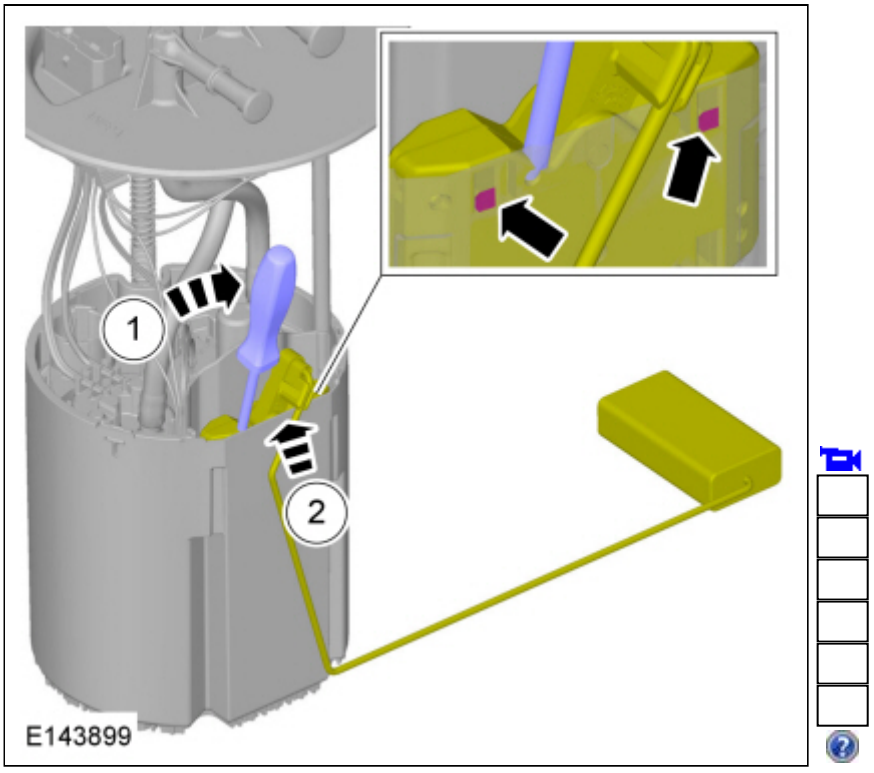
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   Refer to: Fuel Pump and Sender Unit (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Pump and Sender Unit (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

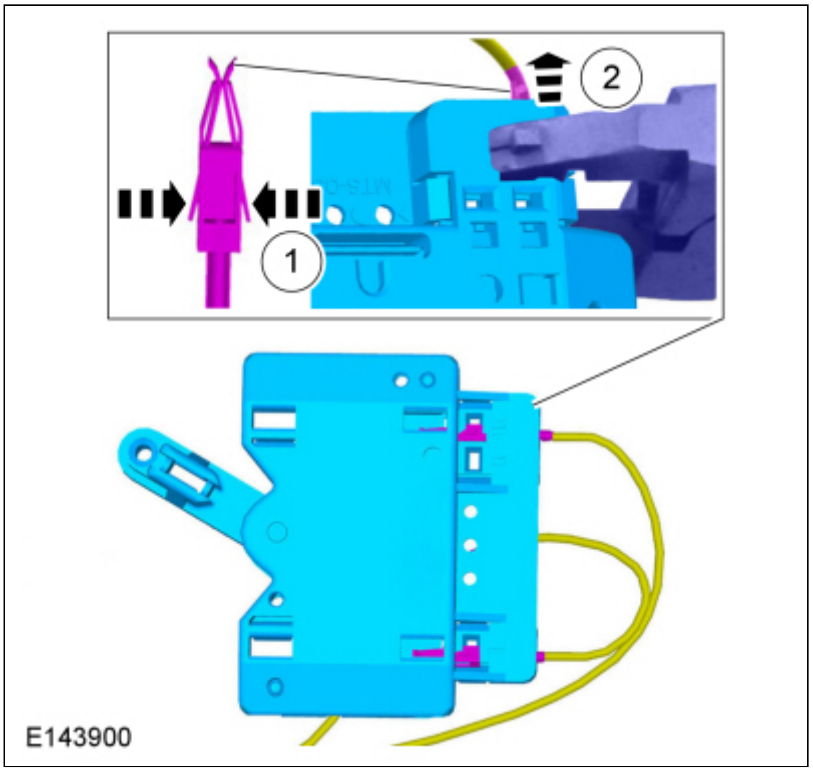
2. **NOTICE: Take extra care not to damage the clips.**



3. **NOTICE: Take extra care when handling the wiring terminals.**

   NOTICE: Make sure that the wiring terminals are not bent or damaged.

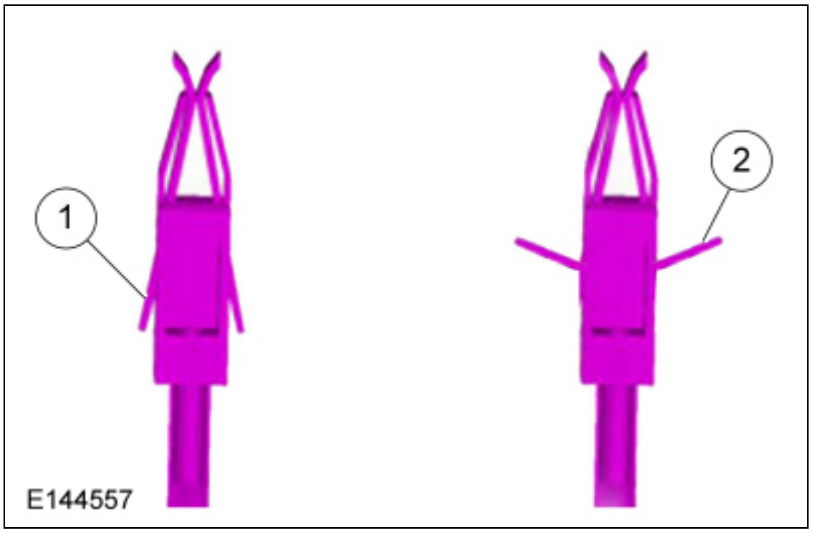
   On both sides.



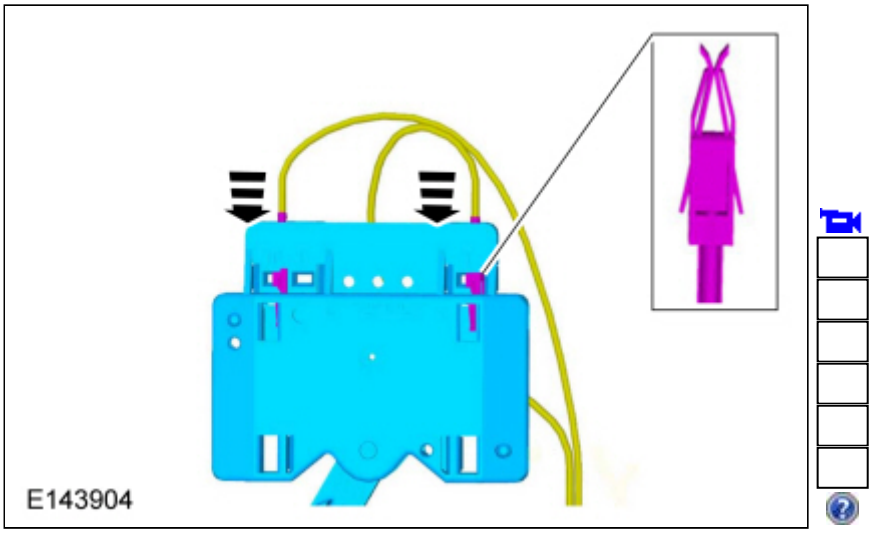
Installation

1. **NOTICE: Make sure that the wiring terminals are not bent or damaged.**

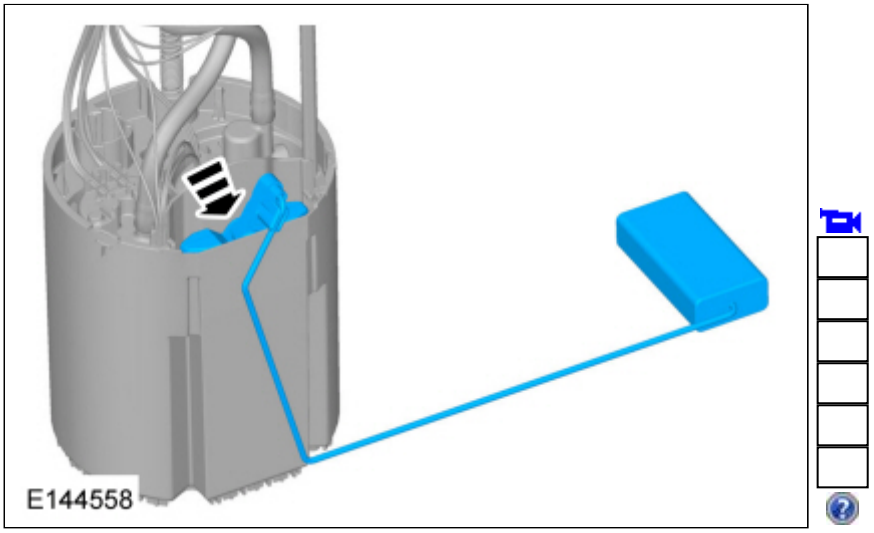
   Undamaged terminal clips
2. Damaged terminal clips



2. **WARNING: Check for correct connections after installation.**



3. **NOTE:** *Make sure that the wires are installed to the same orientation as when removed.*

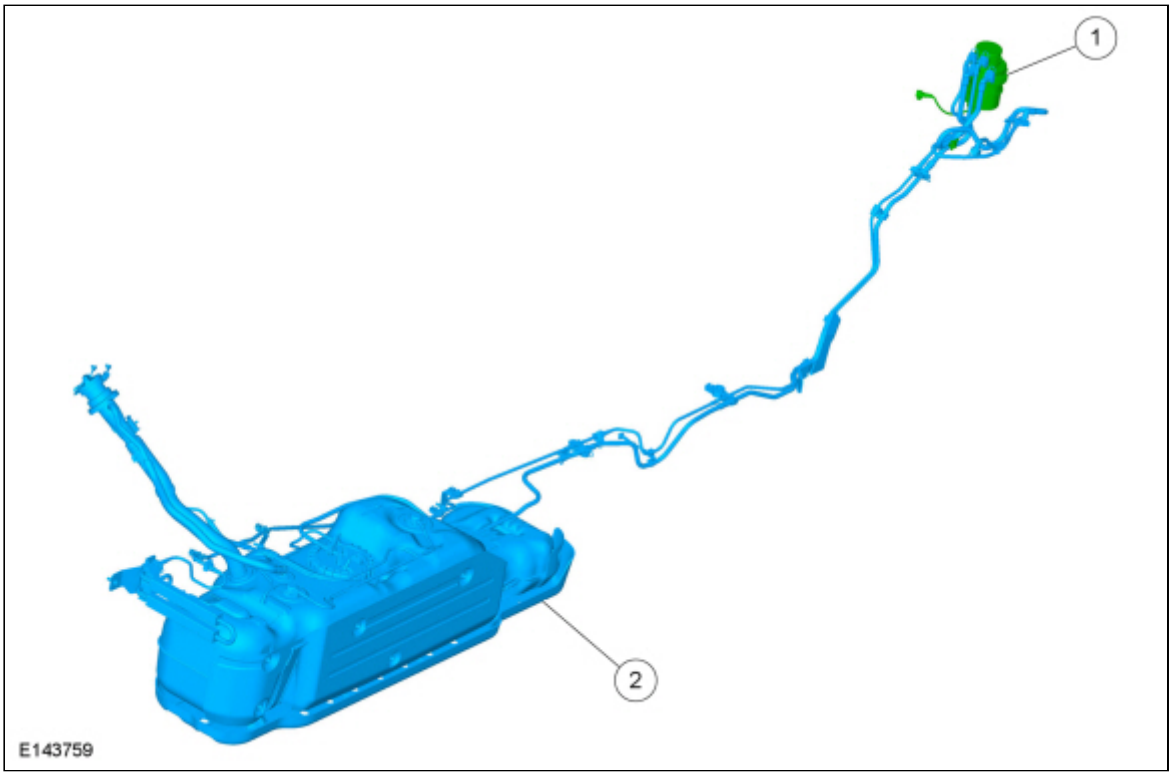


4. Refer to: Fuel Pump and Sender Unit (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Pump and Sender Unit (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

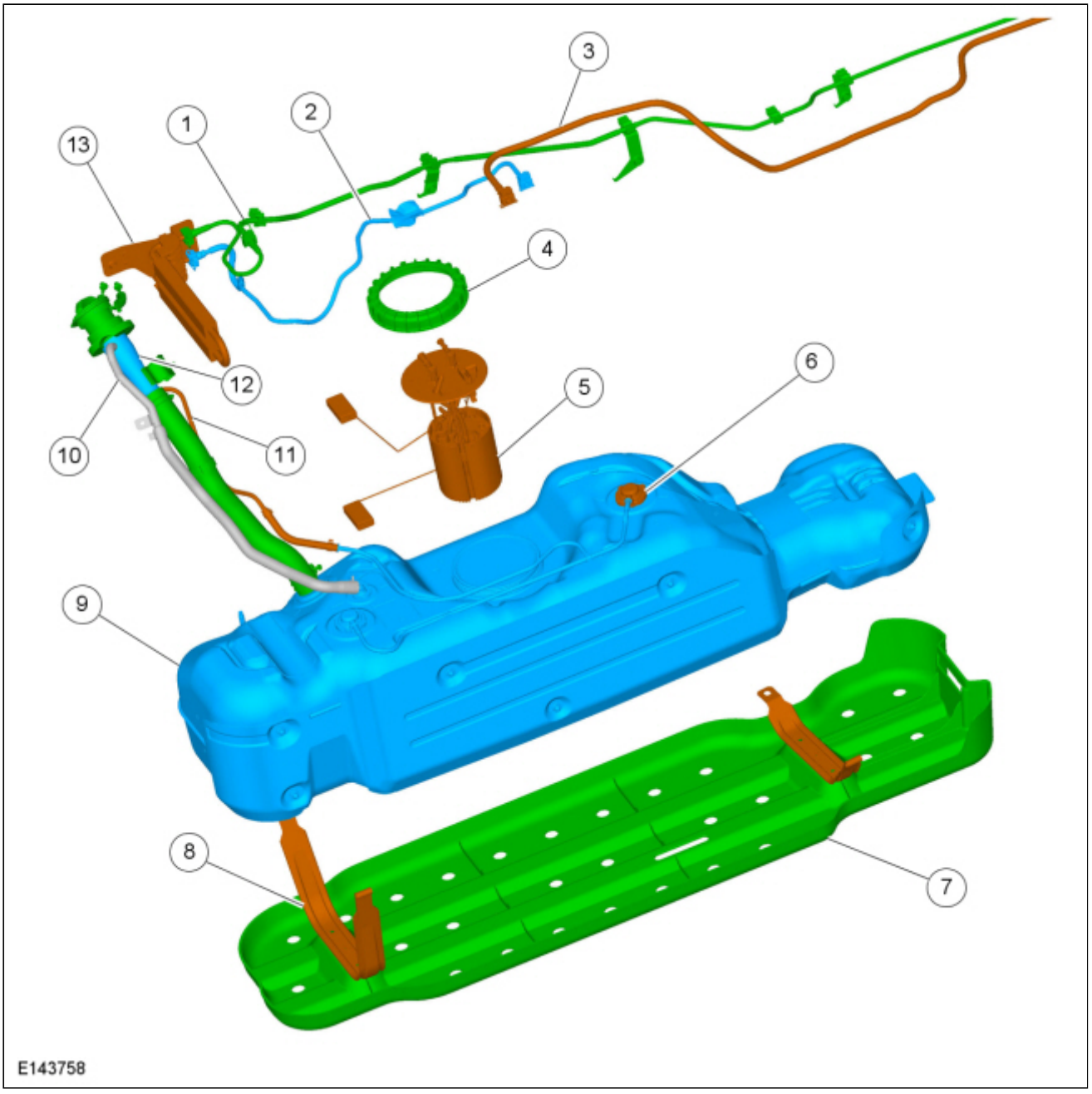
Fuel Tank and Lines

Vehicles with Fuel cooler



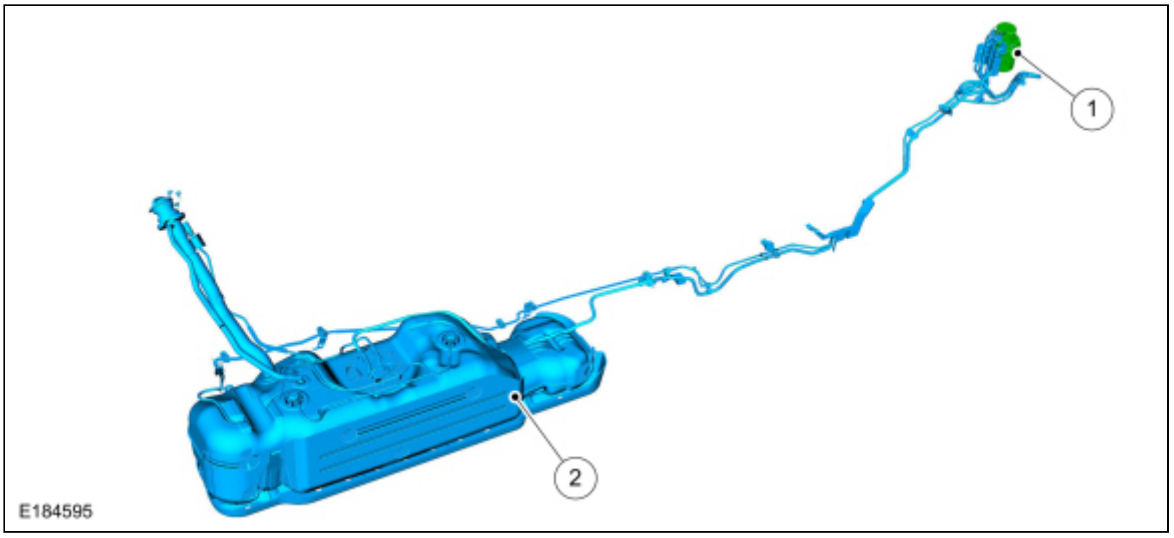
Item	Part Number	Description
1	—	Fuel filter
2	—	Fuel tank

Fuel tank supply and return lines



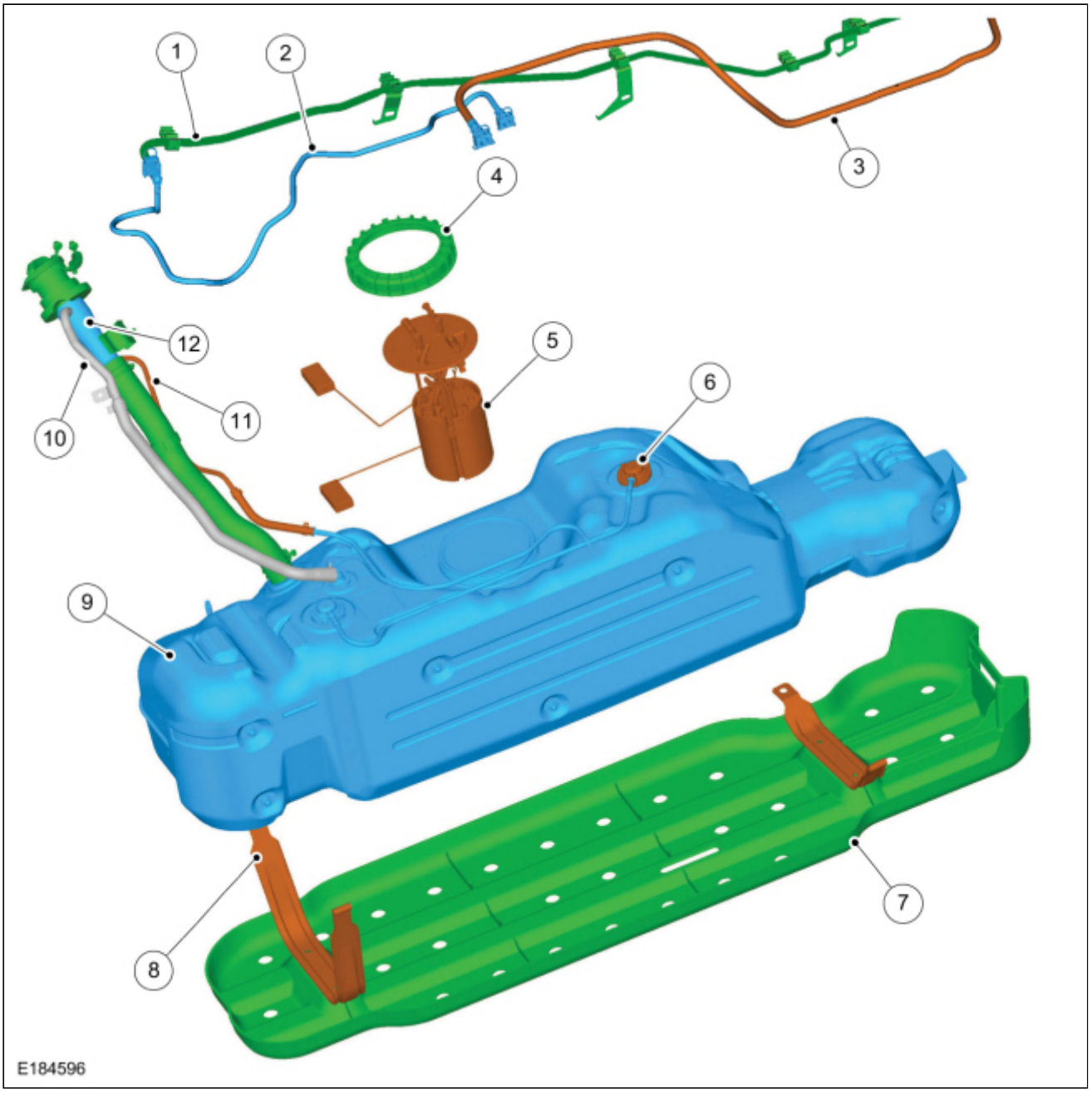
Item	Part Number	Description
1	—	Return line from fuel filter to fuel cooler
2	—	Return line fuel cooler to fuel tank
3	—	Supply line fuel tank to fuel filter
4	—	Fuel level sensor locking ring
5	—	Fuel level sensor/ fuel module
6	—	Fuel tank vent valve(s)
7	—	Tank protector
8	—	Fuel tank support straps
9	—	Fuel tank
10	—	Fuel tank breather hose
11	—	Fuel tank vent valve breather
12	—	Filler neck
13	—	Fuel cooler

Vehicles without Fuel cooler



Item	Part Number	Description
1	—	Fuel filter
2	—	Fuel tank

Fuel tank supply and return lines



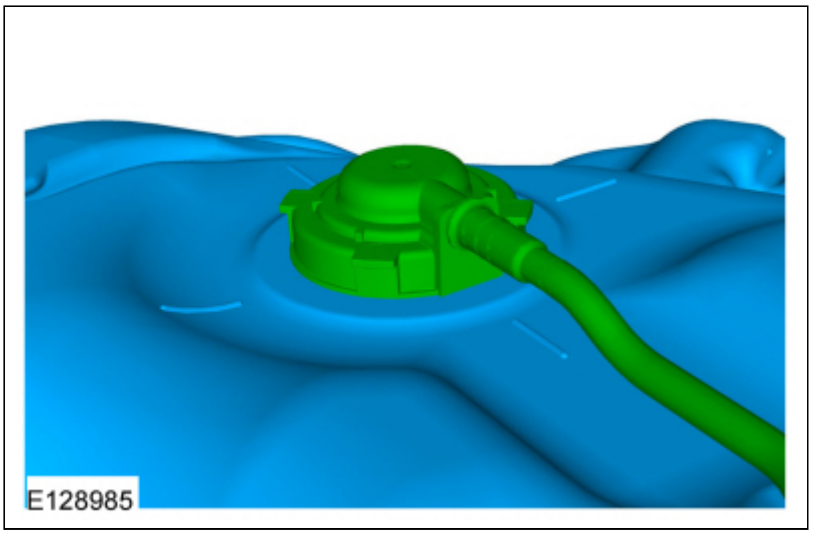
Item	Part Number	Description
1	—	Return line from fuel filter
2	—	Return line from filter to fuel tank
3	—	Supply line fuel tank to fuel filter
4	—	Fuel level sensor locking ring
5	—	Fuel level sensor/ fuel module
6	—	Fuel tank vent valve(s)
7	—	Tank protector
8	—	Fuel tank support straps
9	—	Fuel tank
10	—	Fuel tank breather hose
11	—	Fuel tank vent valve breather
12	—	Filler neck

All Vehicles

Repair of fuel system components is not allowed. Ensure that faulty components are replaced with new fuel system

components in service.

Fuel tank vent valves

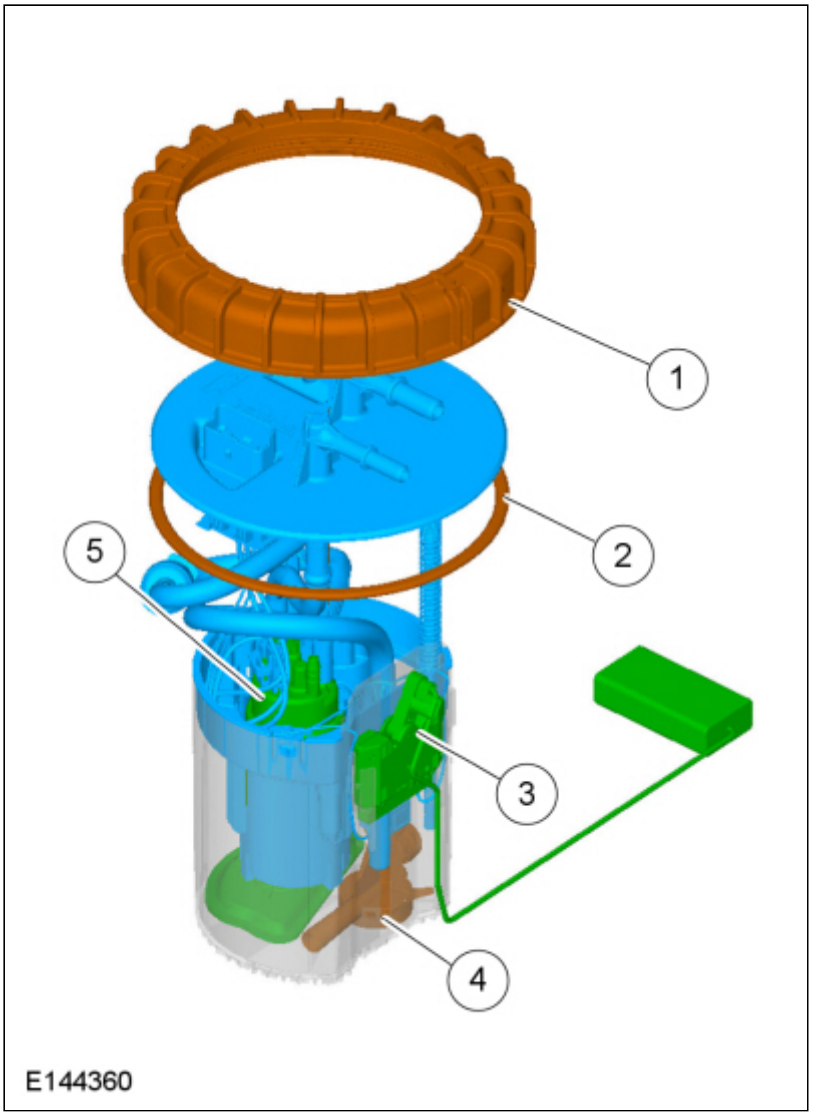


Fuel tank ventilation is achieved by two fuel tank vent valves. The fuel tank vent valves are integral to the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Under normal working conditions, the pressure within the fuel tank is controlled by allowing the fuel vapor to vent through the fuel tank vent valves to atmosphere. If the fuel tank becomes inverted, the fuel tank vent valves close preventing fuel being lost from the fuel tank.

If the fuel tank vent valves or the fuel vapor lines connected to the vent valves become restricted, vehicle performance will become impaired. The inability of the fuel tank to substitute the fuel demanded by the fuel charging system with air, will create a negative pressure in the fuel tank which will result in reduced fuel flow to the fuel pump. The fuel filler cap has both vacuum and pressure relief valves to prevent excess vacuum or pressure from causing deformation of the tank.

Fuel pump and sender unit



Item	Part Number	Description
1	—	Fuel pump and sender unit locking ring
2	—	Fuel pump and sender unit sealing ring
3	—	Fuel level sensor resistor card
4	—	Fuel jet pump
5	—	Fuel pump inlet filter

The pump and sender unit is located in the top of the fuel tank and is retained by a locking ring and seal. The fuel pump is attached to the fuel pump and sender unit flange by spring loaded guide bars, which ensure that the fuel pump is seated against the base of the fuel tank when installed.

The fuel level sender consists of a mechanical float attached to a variable resistor card by means of a rigid wire lever. The resistor card has two electrical elements. One element is solid and one element is a variable resistor. The resistance value created by the resistor card is sent to the central junction box (CJB) through a hard wired circuit. The CJB distributes the information from the fuel level sensor to the instrument cluster and the powertrain control module (PCM) using the controller area network (CAN) circuits.

The fuel level sensor resistor card can be susceptible to contaminated fuel, which can affect electrical continuity and give false fuel level readings. This condition is normally temporary and self-rectifying. If the fuel level sensor has been removed, moving the rigid wire lever from empty to full a minimum of 10 times will normally be as effective as installing a new fuel level sensor. The most common symptom of contamination occurs after refuelling where the electrical contact moves to an area of the resistor card which has not been used for several days. This results in a very slow movement of the fuel gauge pointer from empty to full over approximately 15 minutes. In more extreme cases where the resistor card resistance is continuously outside the permitted range for more than 33 seconds, a DTC will be set in the CJB and the fuel gauge pointer will fall to its key-off position.

The base of the fuel pump and sender unit is a chamber that sits in the swirl bowl at the bottom of the fuel tank. Built

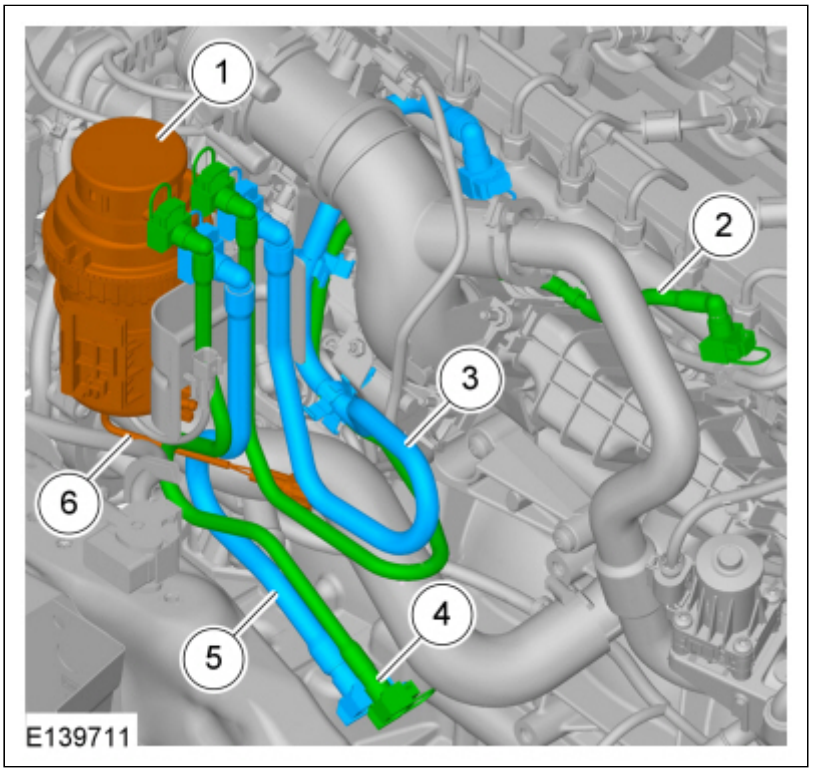
into the chamber is a filter element.

The fuel pump and sender unit also incorporates a fuel jet pump. Fuel from the fuel charging system is passed through a venturi in the jet pump which causes a pressure drop across an open orifice. This draws in fuel through the base of the unit which then passes through the fuel supply tube.

Fuel tank

The fuel tank is of plastic construction and is secured to the vehicle by two metal support straps, which are bolted to the ladder frame cross members. The diesel fuel tank must contain at least 4 litres of fuel before the fuel pump is operated. Running the fuel pump with less than 4 litres of fuel will cause damage to the fuel pump.

Fuel Filter



Item	Part Number	Description
1	—	Fuel filter
2	—	Return line from engine to fuel filter
3	—	Supply line from filter to engine
4	—	Return line from filter to fuel tank
5	—	Supply line from tank to fuel filter
6	—	Water-in fuel sensor

The diesel fuel filter separates air, water and other contaminants from fuel, in addition to retaining system backpressure.

The upper section of the filter incorporates the recirculation valve and the return valve.

The recirculation valve controls the flow of warm return fuel from the engine. When fuel temperature drops below 20 C, the valve opens to direct return fuel to the filter, warming the fuel to prevent waxing. When fuel temperature reaches 33 C, the valve closes and return fuel is directed back to the fuel tank via the fuel cooler. The recirculation valve also has a small bypass that allows any build up of air from the recirculation of fuel to bleed out via the return line into the tank.

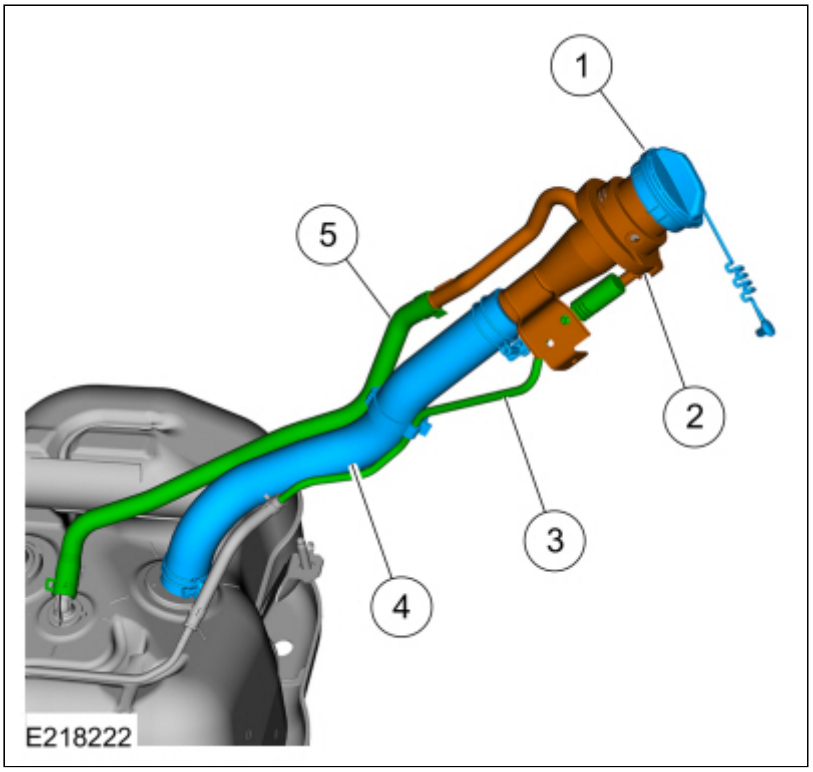
The return valve is positioned in the return circuit of the filter. It controls the flow rate of the return fuel from the engine, and maintains the required backpressure at the fuel rail.

The lower section of the filter houses the filter element, water separator and the water-in-fuel level sensor.

The water separator consists of two layers of foam that encourage the formation of water droplets to separate from

the fuel. Water accumulates at the bottom of the filter, which then lifts the water-in-fuel level sensor float. The water-in-fuel indicator is triggered when 80 ml of water has accumulated in the filter.

Fuel filler



Item	Part Number	Description
1	—	Filler cap
2	—	Fuel tank filler neck
3	—	Fuel tank vent line
4	—	Fuel tank filler hose
5	—	Fuel tank breather hose

The fuel tank filler neck incorporates a fuel tank breather hose. The fuel tank breather hose is connected to the top of the fuel tank and exits just below the top of the fuel tank filler neck. The fuel tank breather hose allows the displaced vapor above the fuel in the fuel tank to escape, avoiding fuel "spit back" and premature shut off during refueling.

The fuel filler cap seals to the fuel filler neck. This is to prevent the escape of fuel vapor during normal operation and to prevent fuel loss in the event of a vehicle accident.

Copyright © 2016 Ford Motor Company

Fuel Tank and Lines

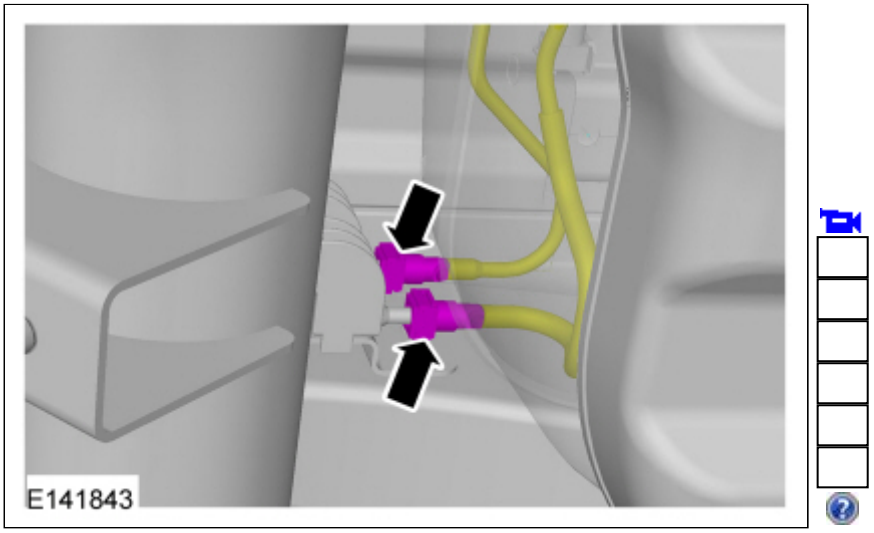
REFER to: Fuel System (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing).

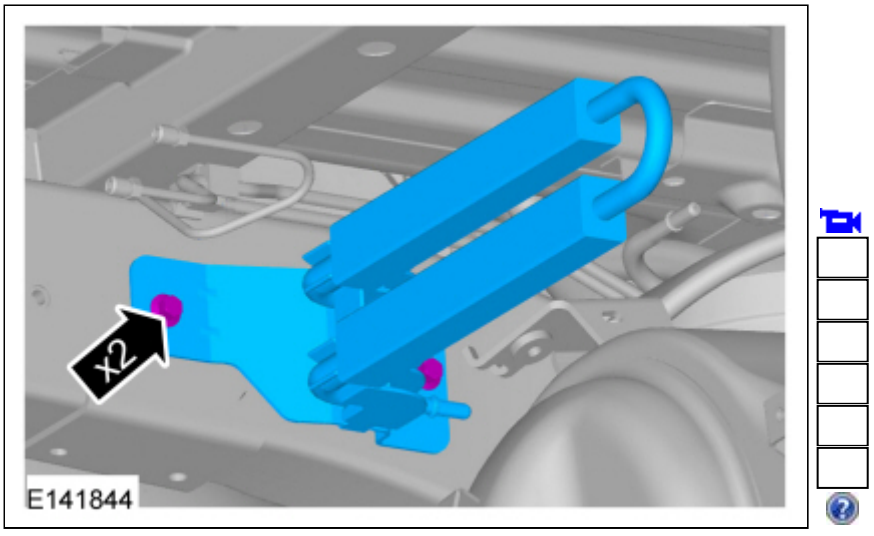
Copyright © 2016 Ford Motor Company

Fuel Cooler

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

5. *Torque*: 25 Nm


Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Tank - Double Cab/Single Cab/Super Cab

Base Part Number: 9002

Special Tool(s) / General Equipment

10 mm Drill Bit
Blind Rivet Gun
Transmission Jack
Retaining Strap

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with load box.*

1. **WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.**

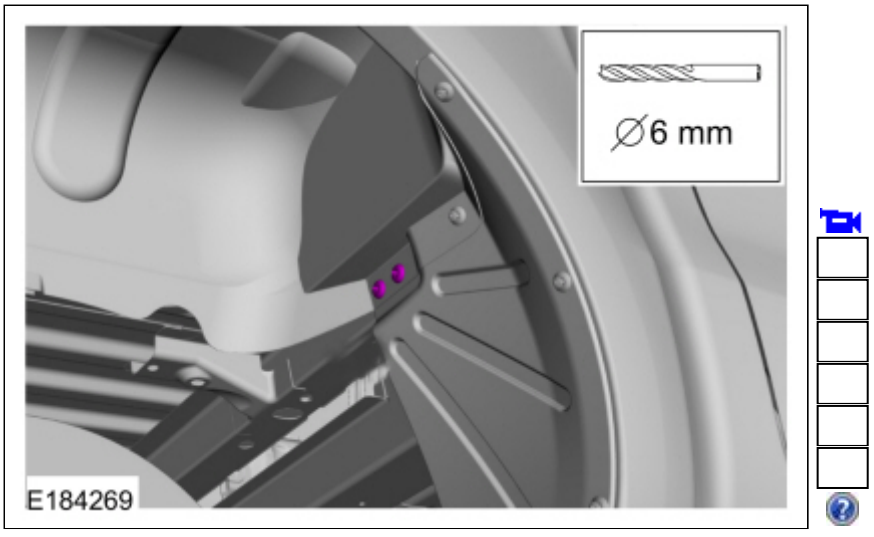
   Refer to: Fuel Tank Draining (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel Tank Draining (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

2. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

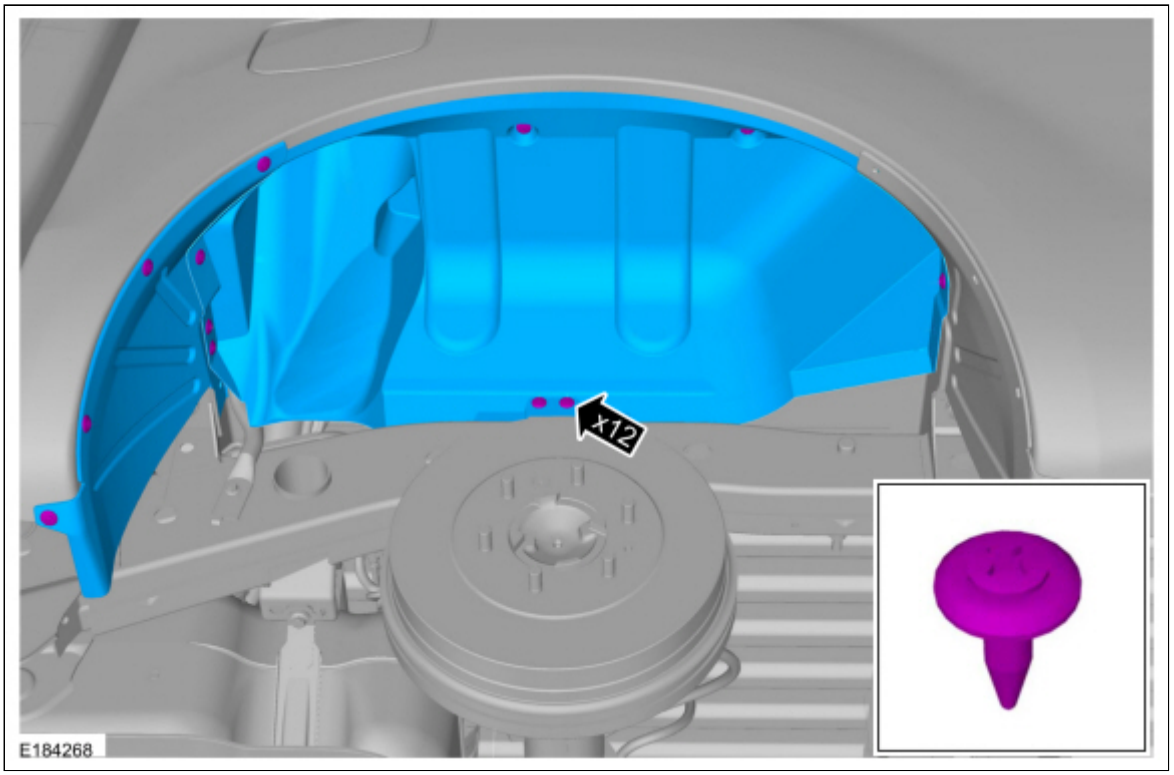
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).

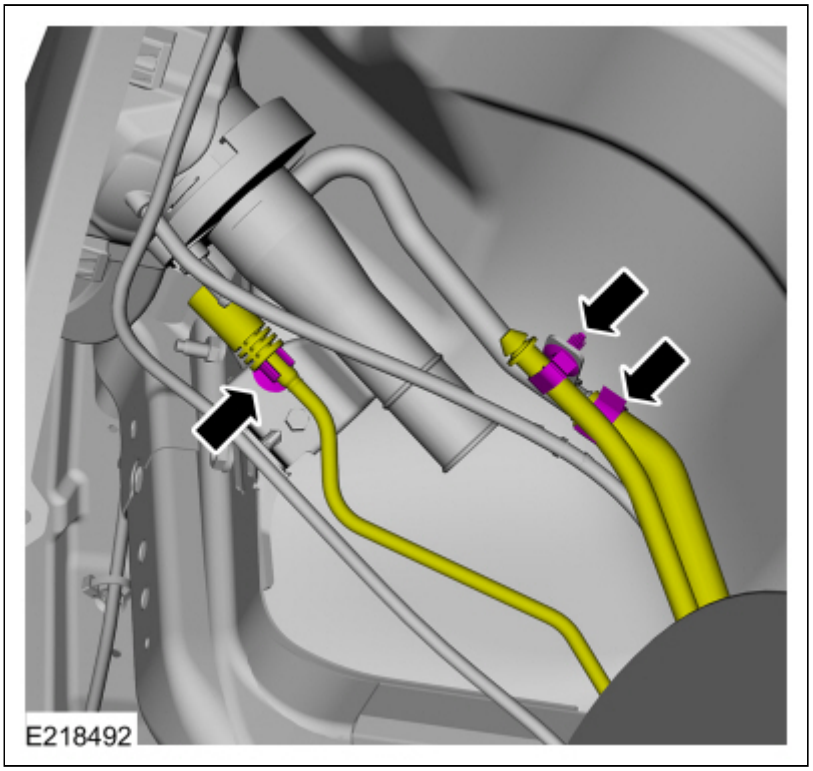
5. Use the General Equipment: 10 mm Drill Bit



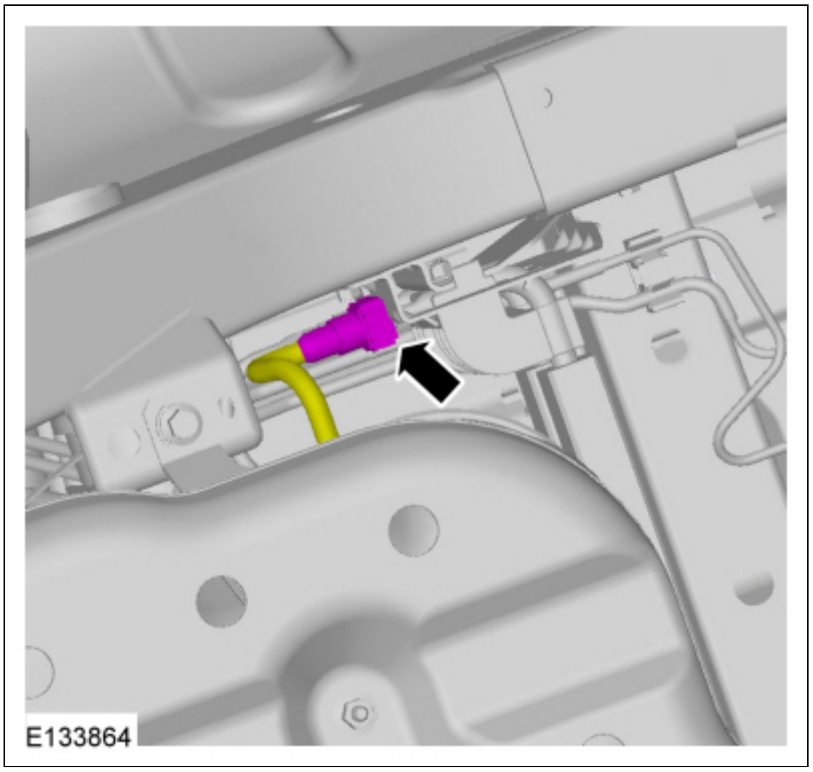
6.



7.

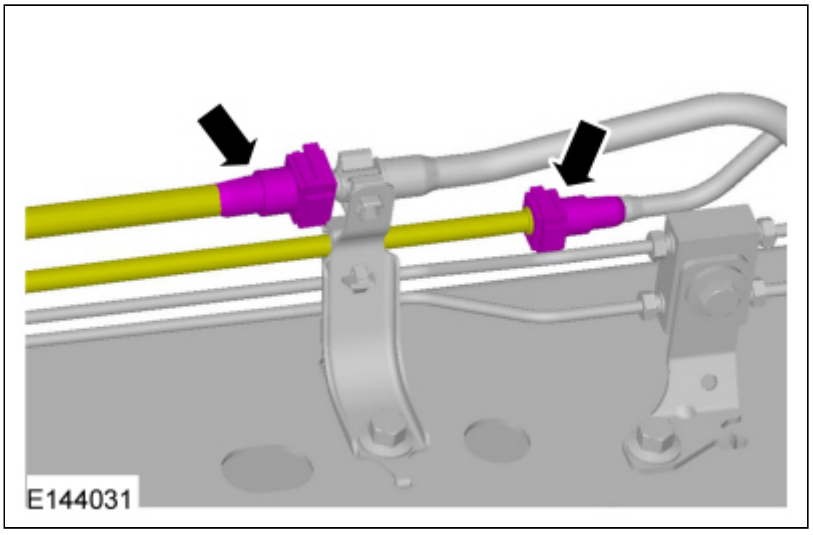


8.



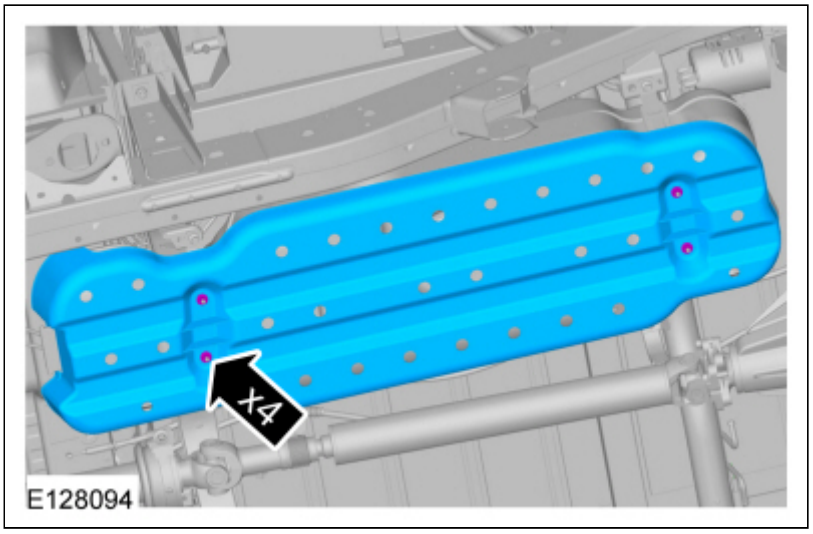
9. **WARNING: Fuel may still be present in the fuel tank after draining.**

   Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



4x4

10. *Torque*: 15 Nm

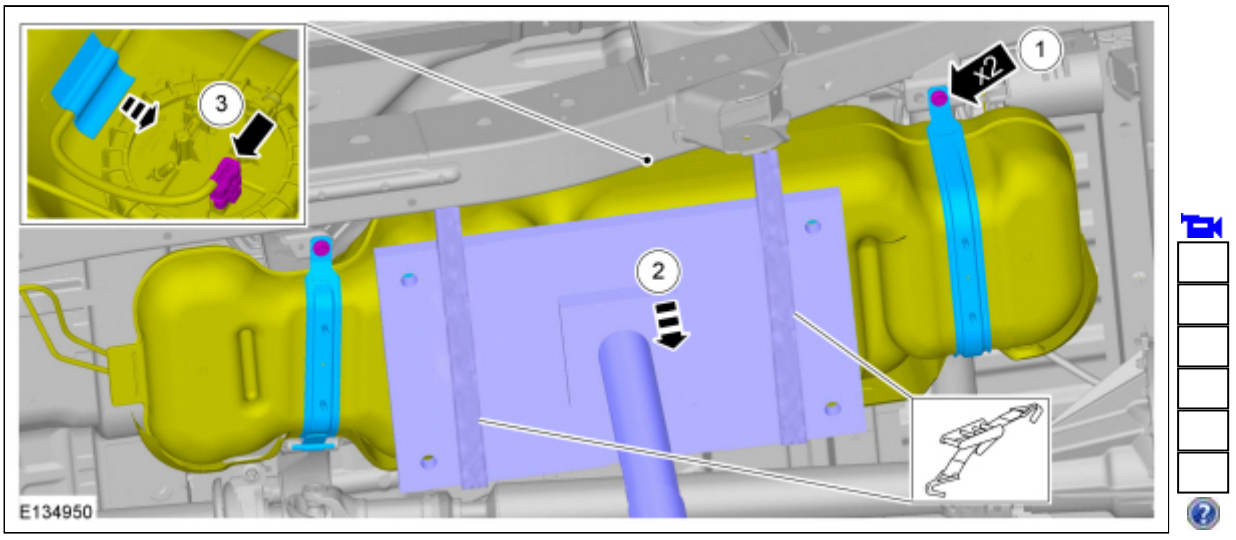


All vehicles

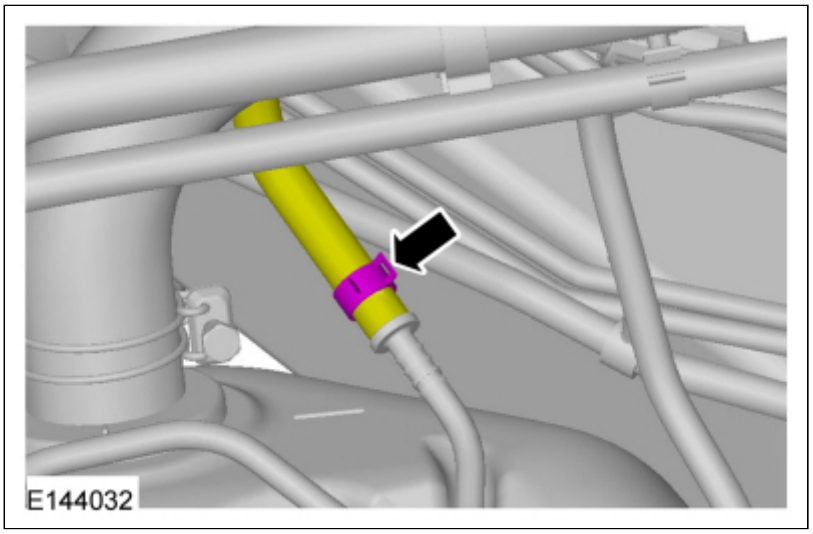
11. **NOTICE: Make sure that no strain is placed on the wiring harness.**

    NOTE: *Slowly lower the fuel tank to access the fuel pump and sender unit electrical connector.*

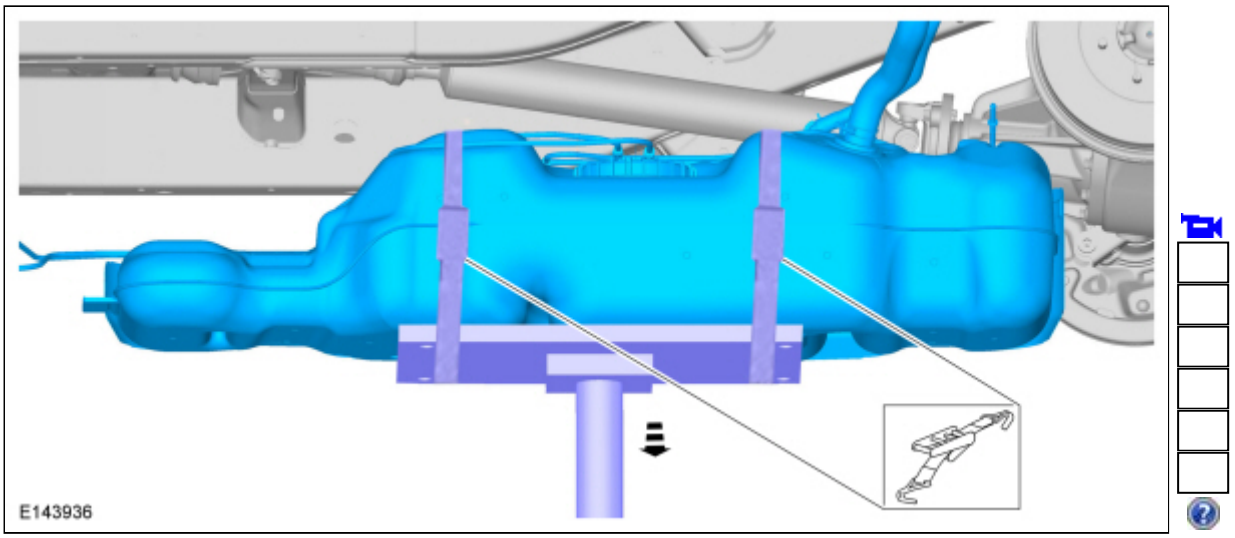
    Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap
    Torque: 48 Nm



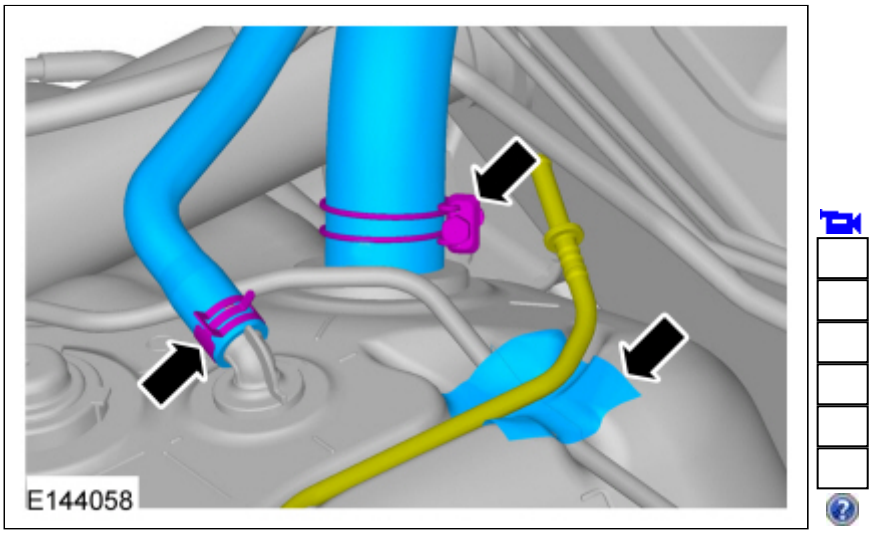
12.



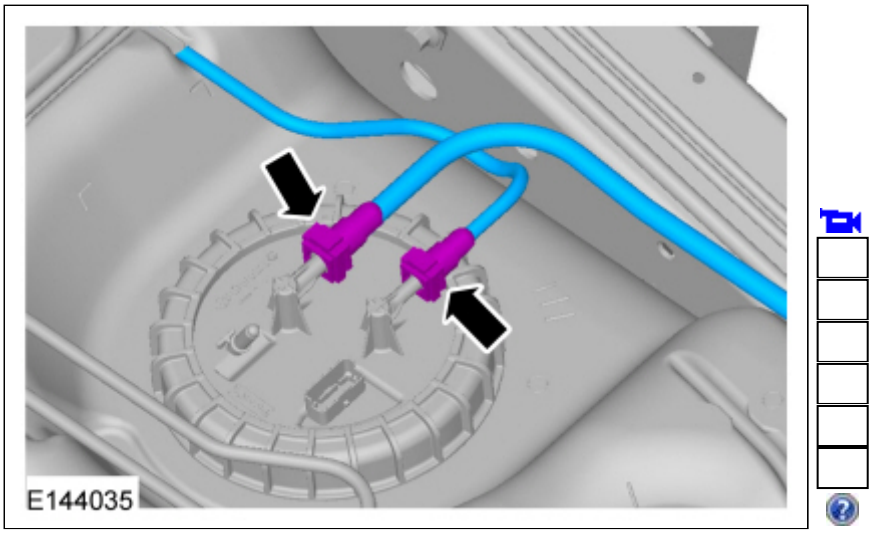
13. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap



14.

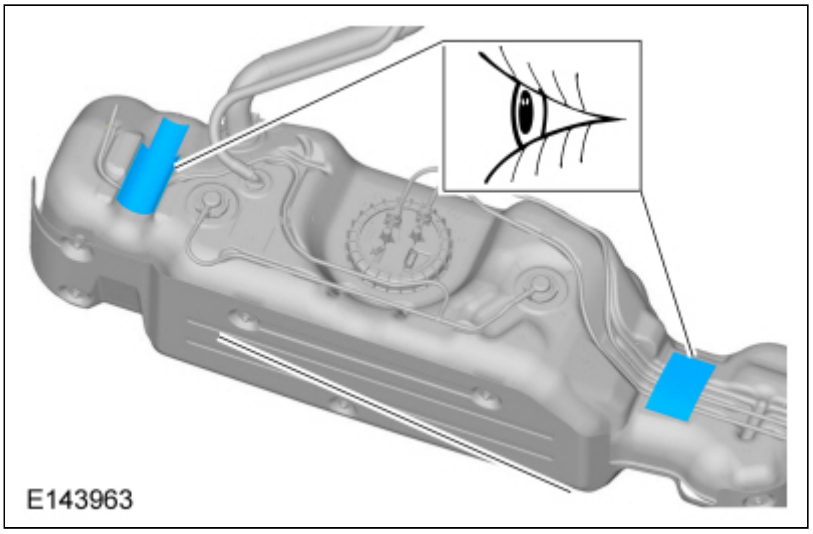


15. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



Installation

1. **NOTICE: Make sure that the insulator pads are correctly positioned on the fuel tank.**



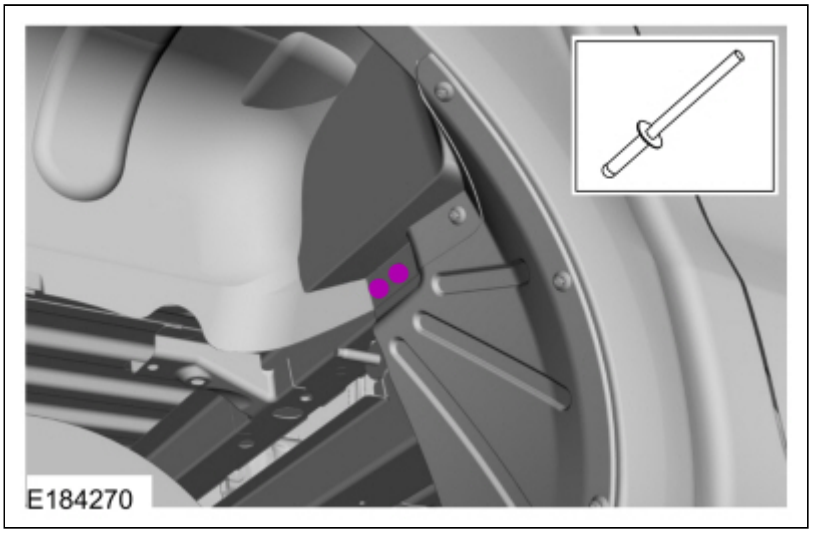
2. **WARNING: Make sure that all fuel connections are checked for leaks.**

   NOTICE: If the fuel tank has been filled with the wrong type of fuel, the engine must not be started before the fuel system is cleaned.

   NOTE: *Make sure that the correct type of fuel is added after the tank installation.*

   To install, reverse the removal procedure.

3. Install the fasteners.
   Use the General Equipment: Blind Rivet Gun



Copyright © 2016 Ford Motor Company

Fuel Tank - Chassis Cab

Base Part Number: 9002

Special Tool(s) / General Equipment

Transmission Jack
Retaining Strap

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with aluminium tray.*

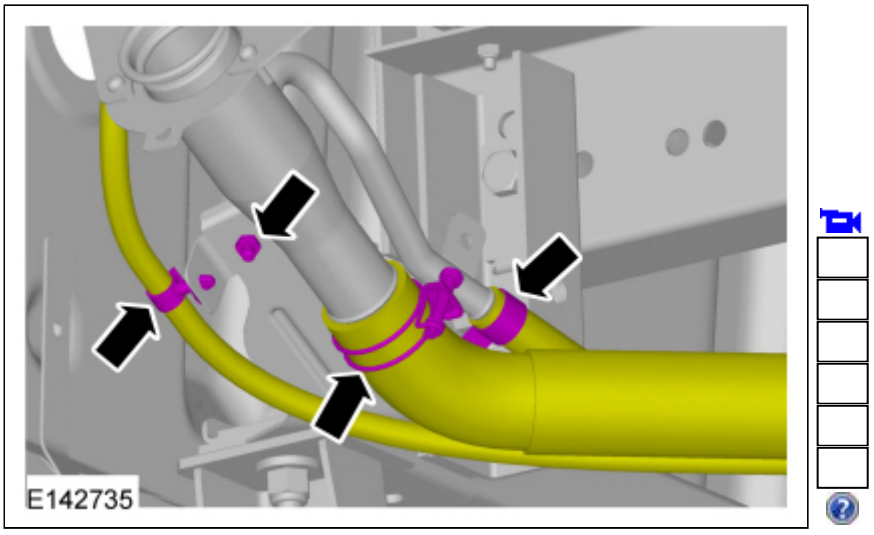
1. **WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient air temperature.**

   Refer to: Fuel Tank Draining (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel Tank Draining (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

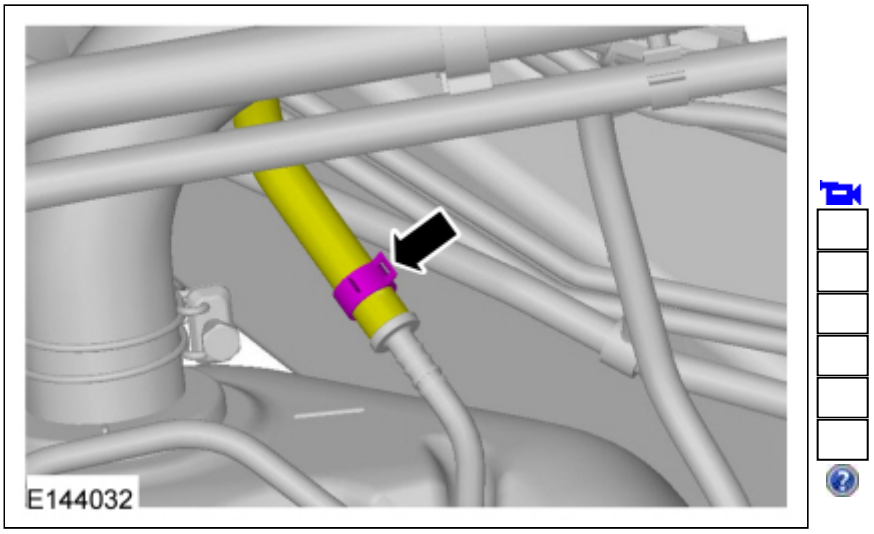
2. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

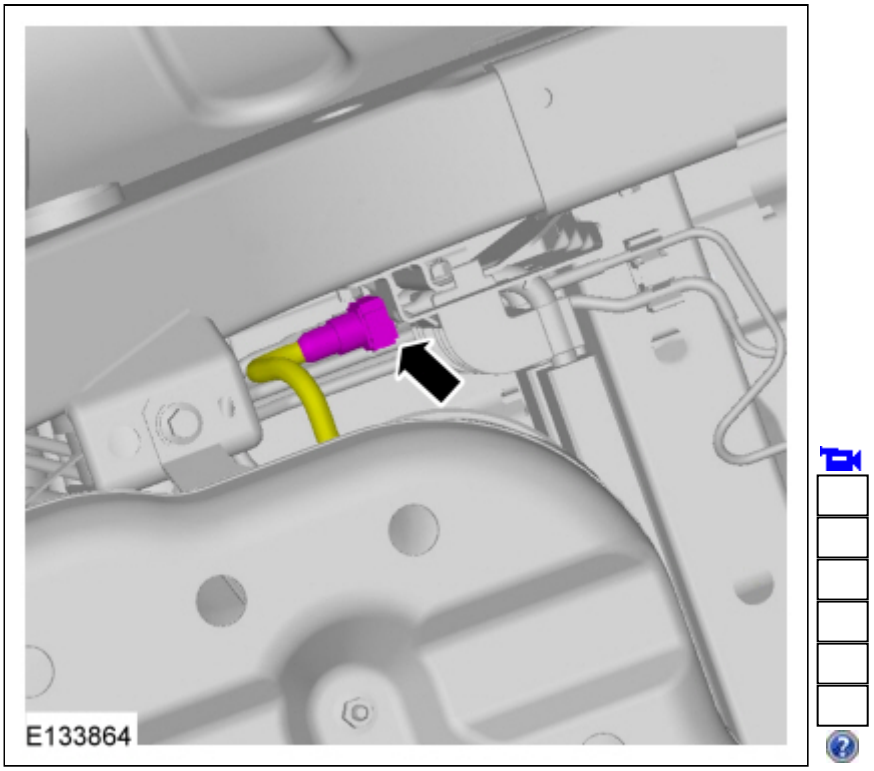
4. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



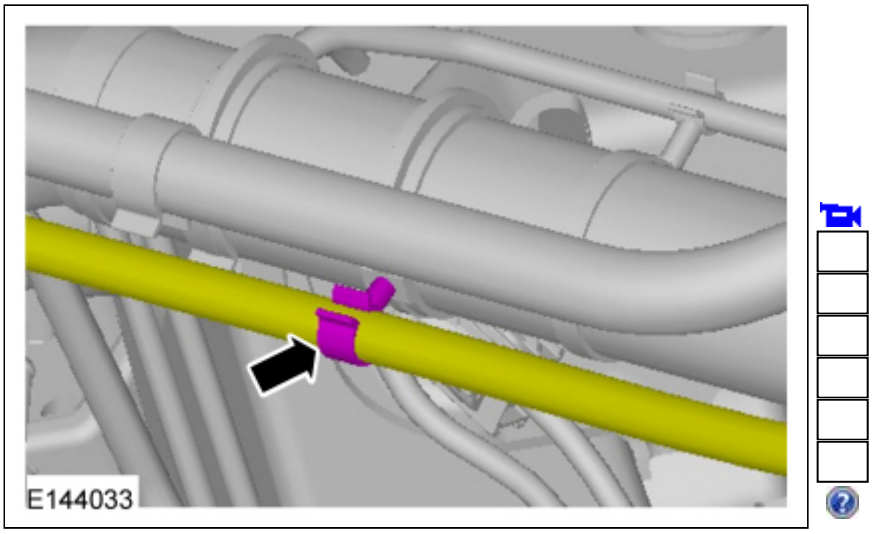
5.



6. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

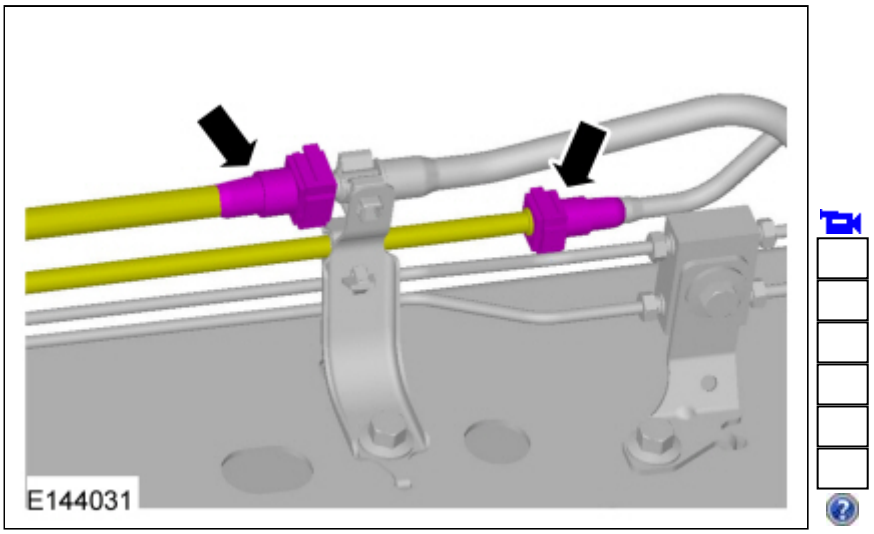


7.

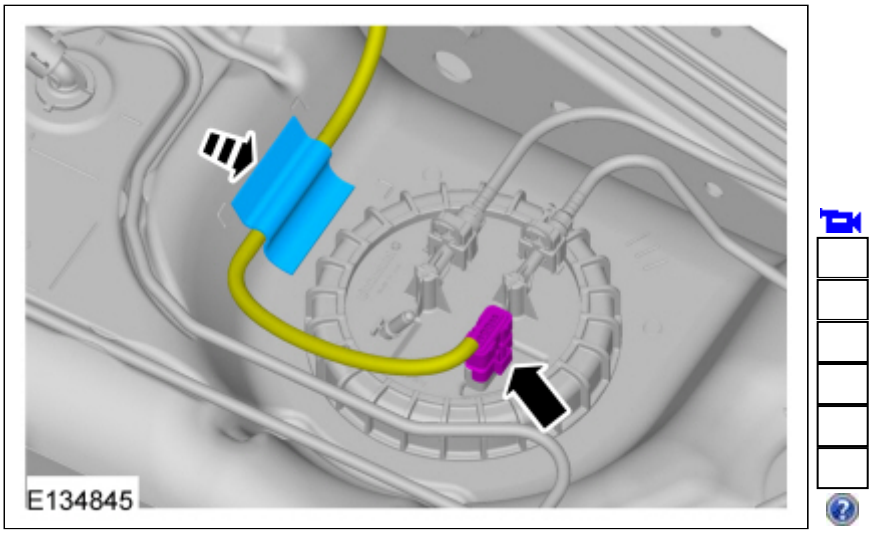


8. **WARNING: Fuel may still be present in the fuel tank after draining.**

   Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

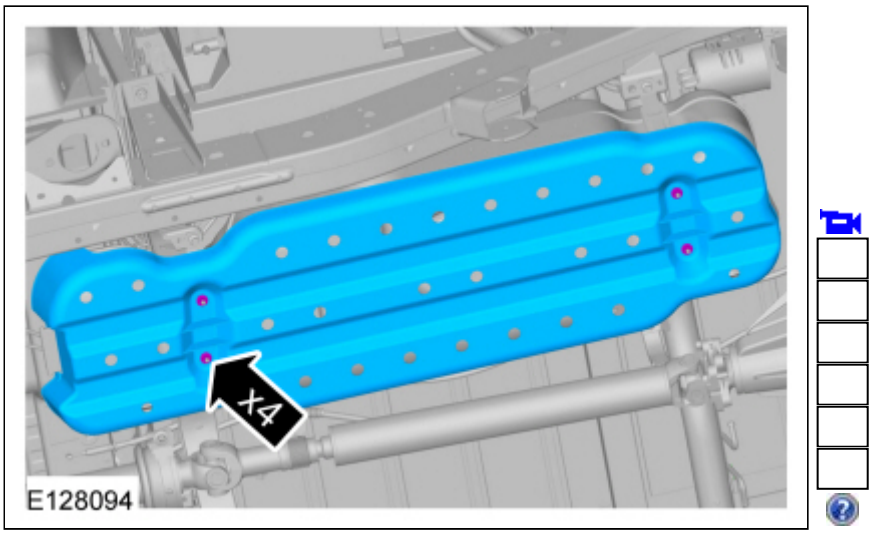


9.



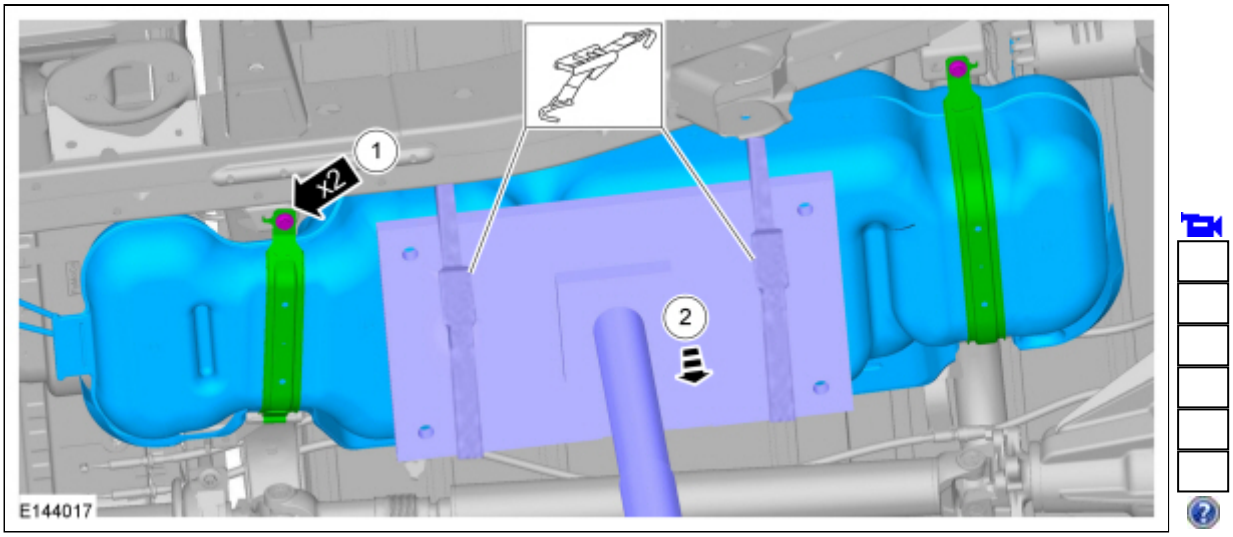
4x4

10. *Torque*: 15 Nm

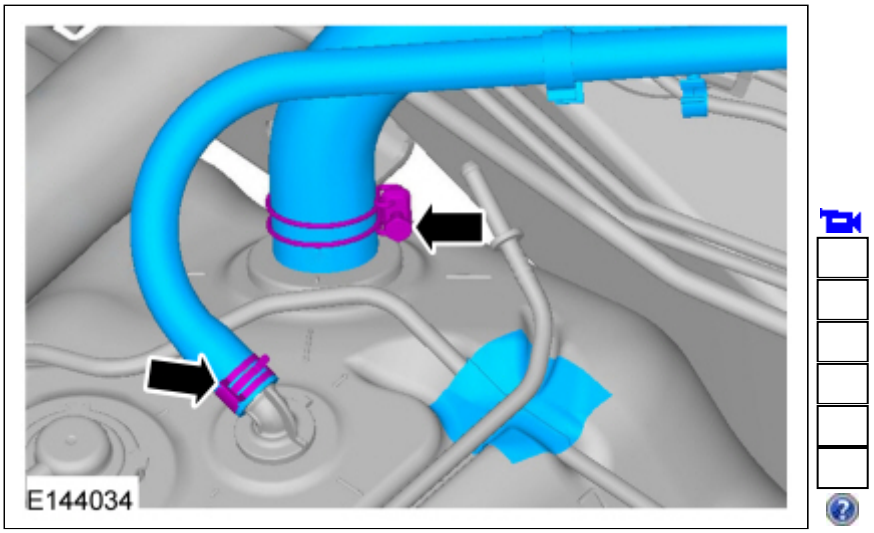


All vehicles

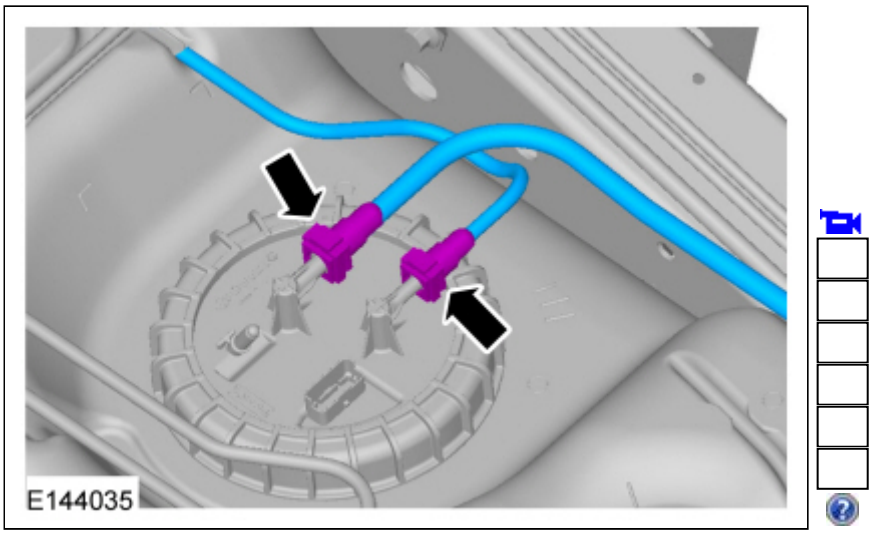
11. Use the General Equipment: Transmission Jack
    Use the General Equipment: Retaining Strap
    Torque: 48 Nm



12.

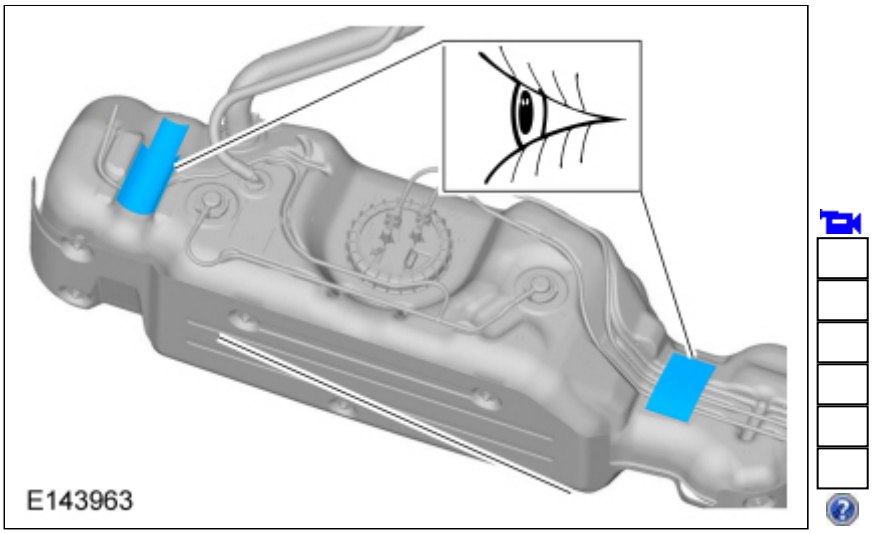


13. Refer to: Quick Release Coupling (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
    Refer to: Quick Release Coupling (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).



Installation

1. **NOTICE: Make sure that the insulator pads are correctly positioned on the fuel tank.**



2. **WARNING: Make sure that all fuel connections are checked for leaks.**

   NOTICE: If the fuel tank has been filled with the wrong type of fuel, the engine must not be started before the fuel system is cleaned.

   NOTE: *Make sure that the correct type of fuel is added after the tank installation.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Tank Filler Pipe - Double Cab/Single Cab/Super Cab

Special Tool(s) / General Equipment

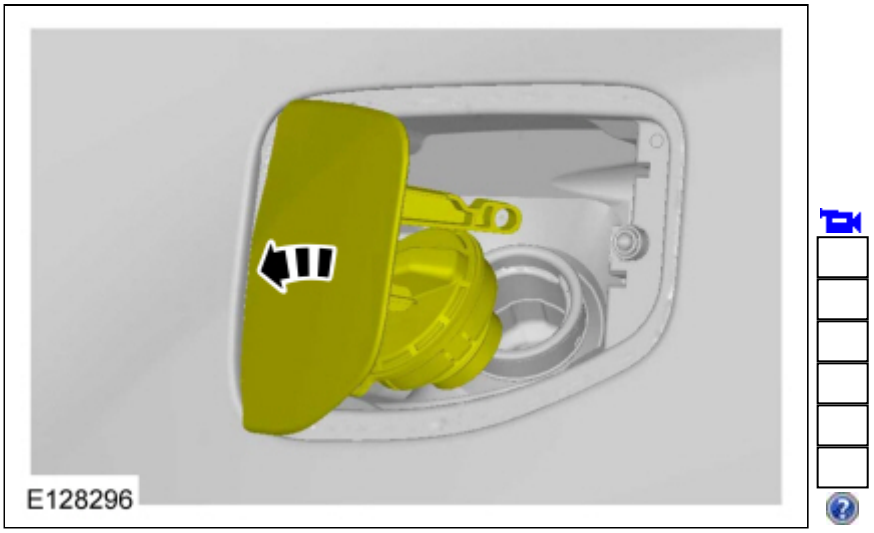
10 mm Drill Bit
Blind Rivet Gun

Removal

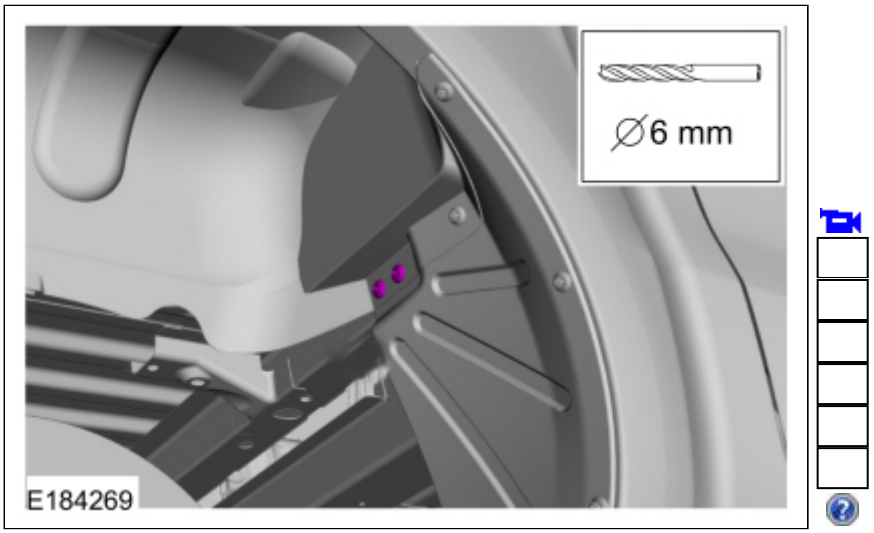
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with load box.*

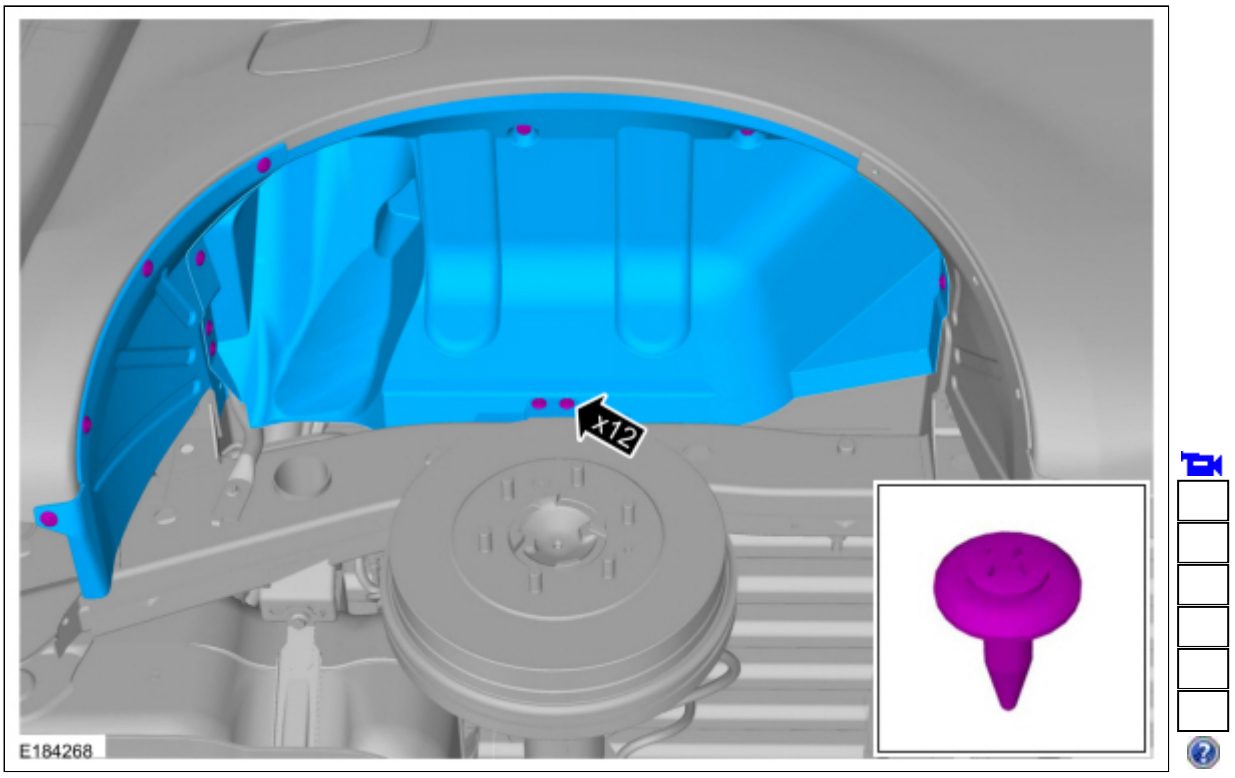
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *Make sure that the fuel tank is no more than 3/4 full.*



3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. Remove the left-hand rear wheel and tire.
   Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
5. Use the General Equipment: 10 mm Drill Bit

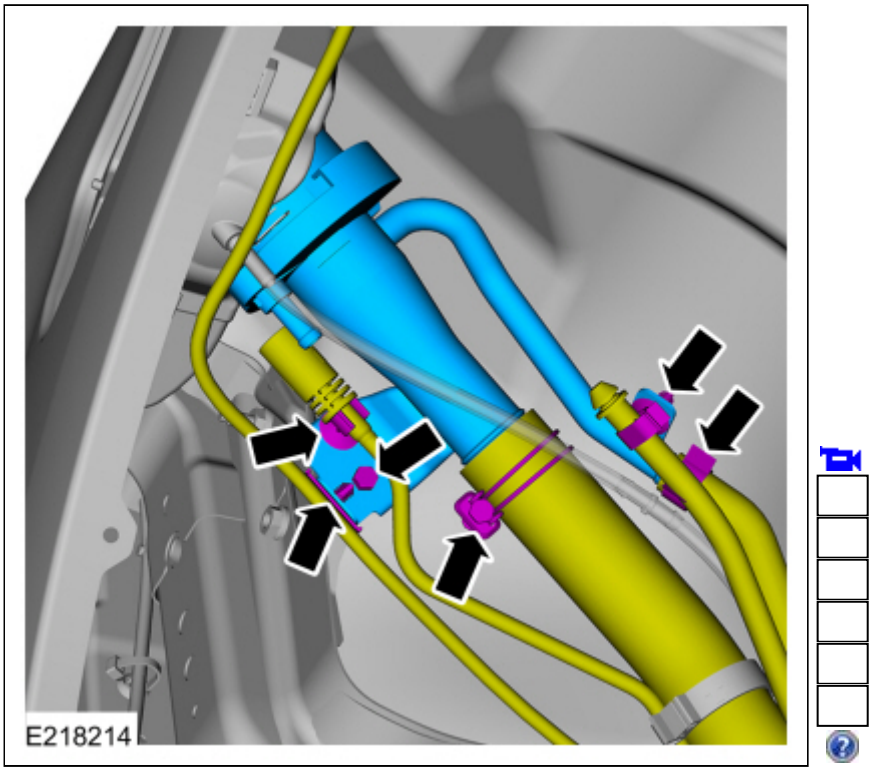


6.



7. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

   Torque: 11 Nm



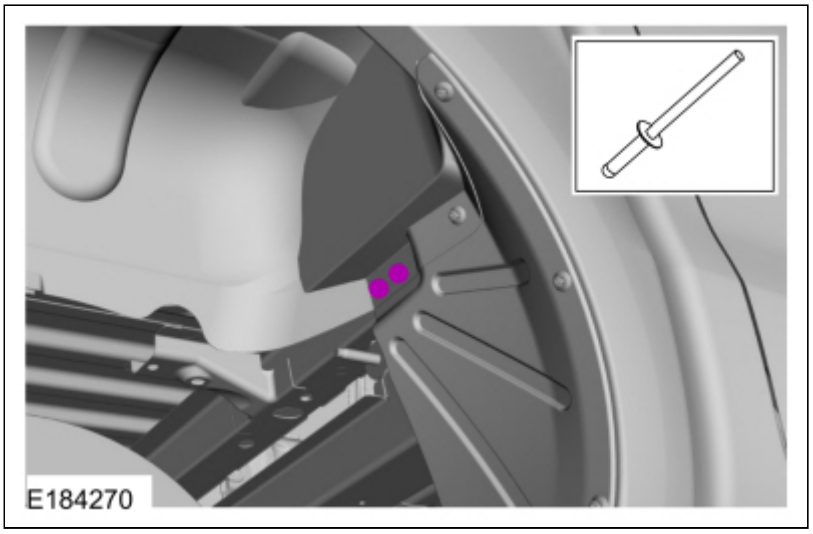
8. **NOTE:** *For removal of the fuel filler pipe and vent hose.*

   Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

2. Install the fasteners.
   Use the General Equipment: Blind Rivet Gun



Copyright © 2016 Ford Motor Company

Fuel Tank Filler Pipe - Chassis Cab

Removal

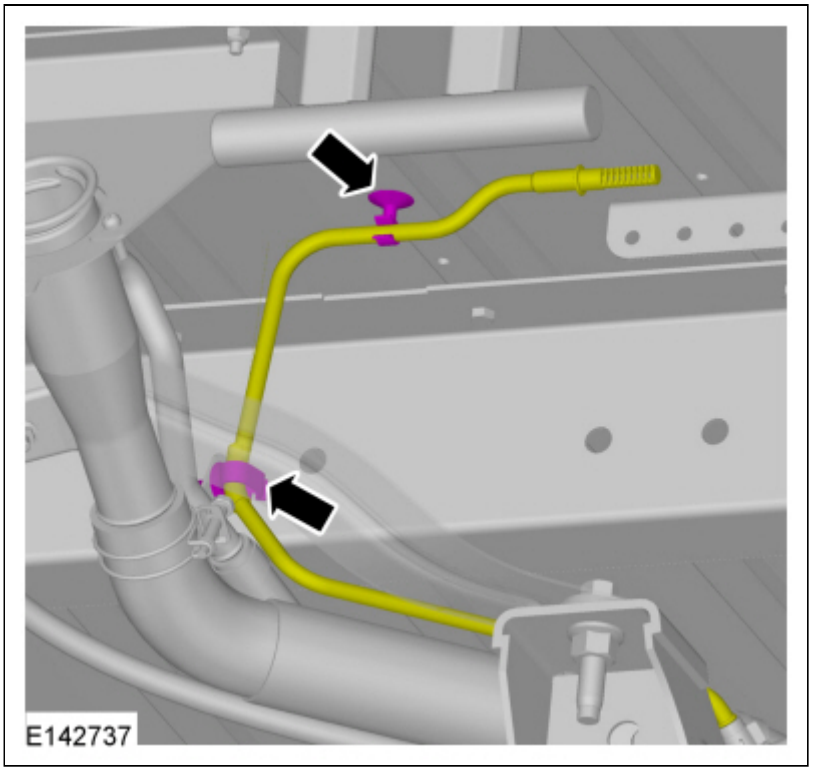
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Vehicles with aluminium tray.*

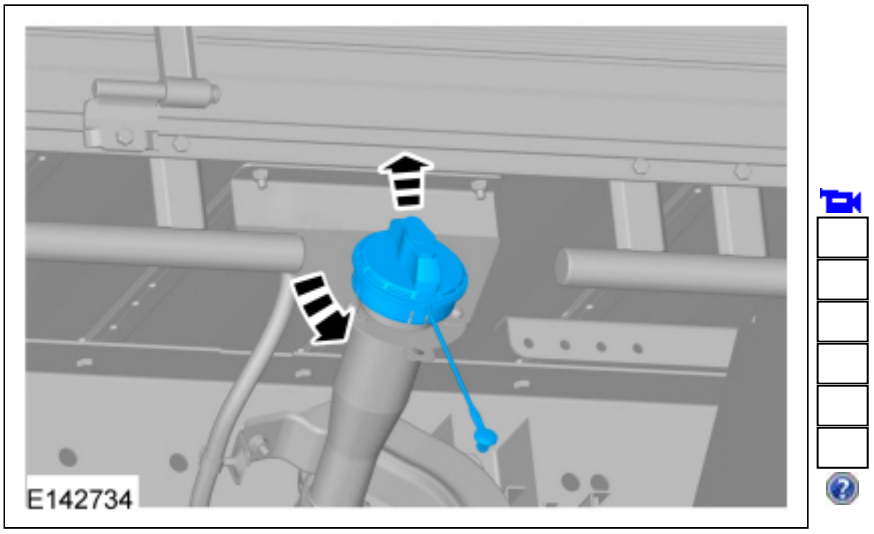
1. **WARNING: Wait for a minimum of 1 minute after the engine has stopped before carrying out any repair to the fuel system.**

   WARNING: Make sure that the fuel tank is no more than 3/4 full.

   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

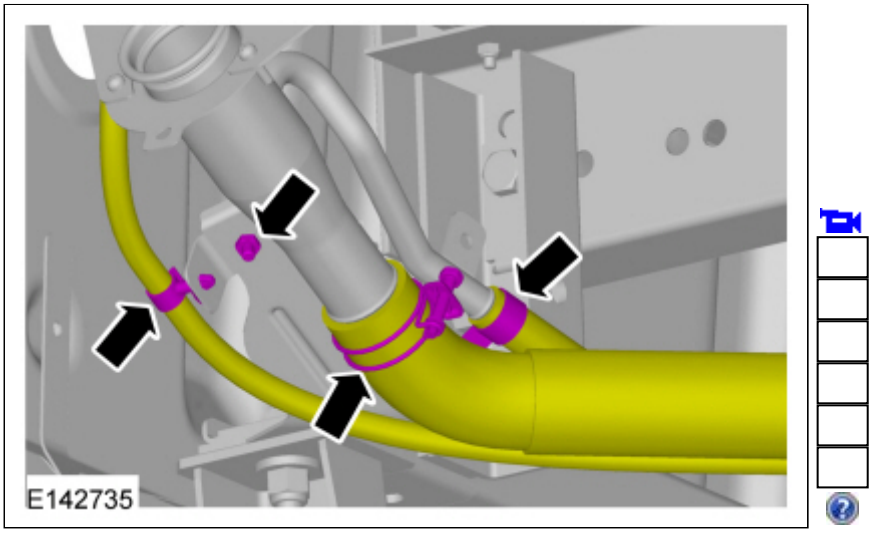
2. 

3.

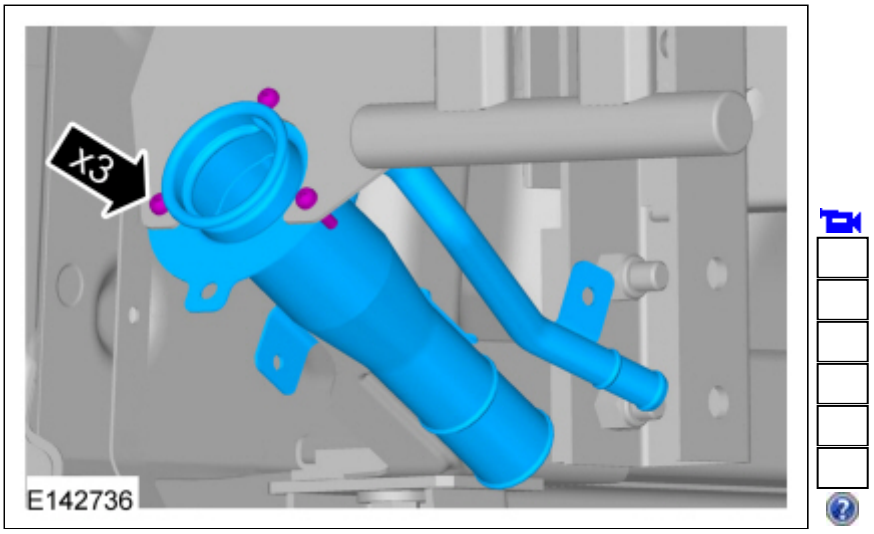


4. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*

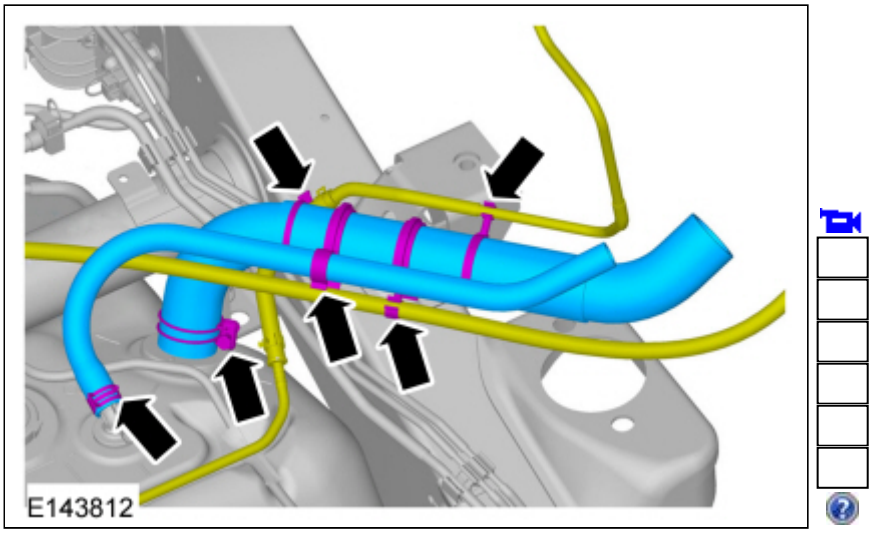
   Torque: 11 Nm



5. *Torque*: 8 Nm



6. **NOTE:** *Make sure that the clamp is installed to the same orientation as when removed.*



Installation

1. To install, reverse the removal procedure.

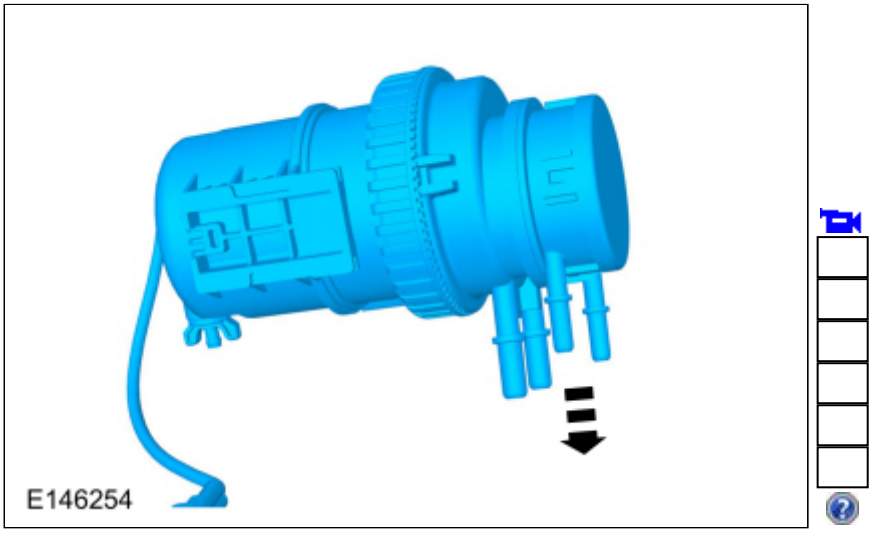
Copyright © 2016 Ford Motor Company

Fuel Filter Element

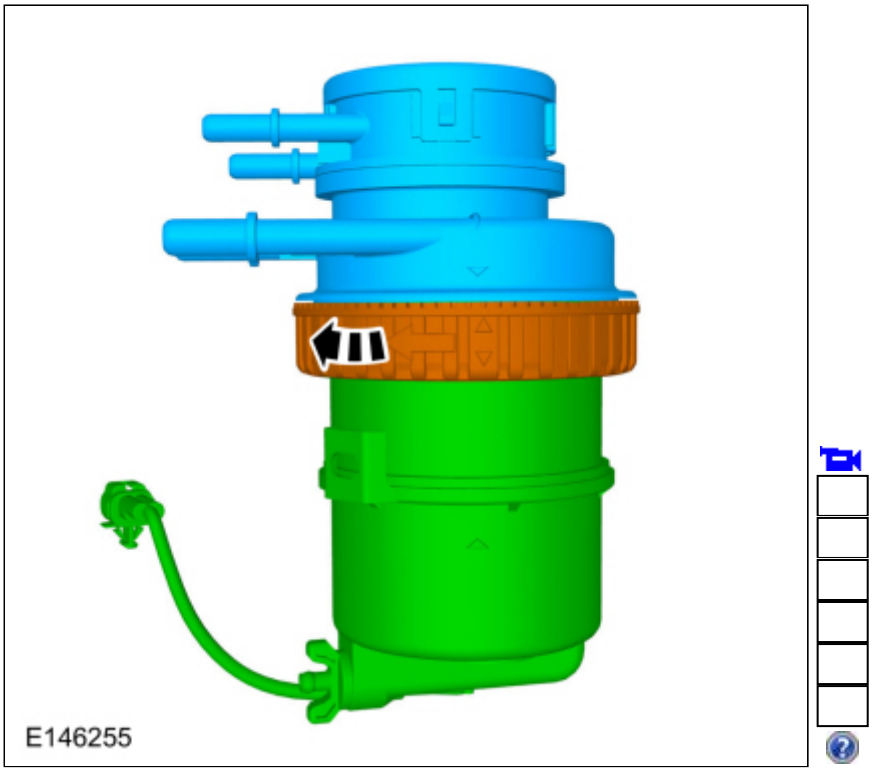
Base Part Number: 9N184

Removal

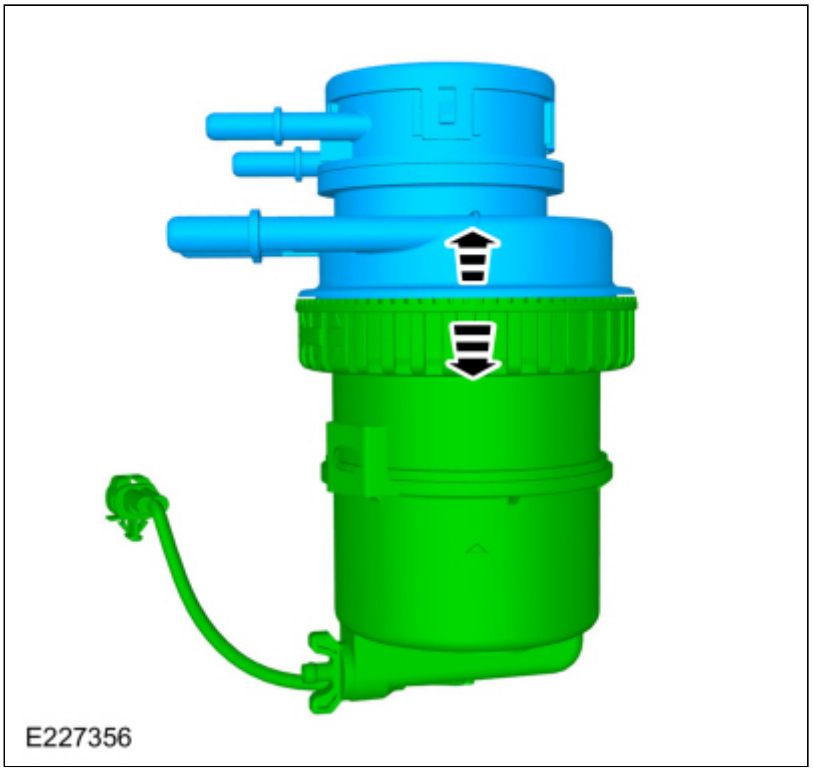
1. Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Filter (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
2. Drain the fuel into a suitable container.



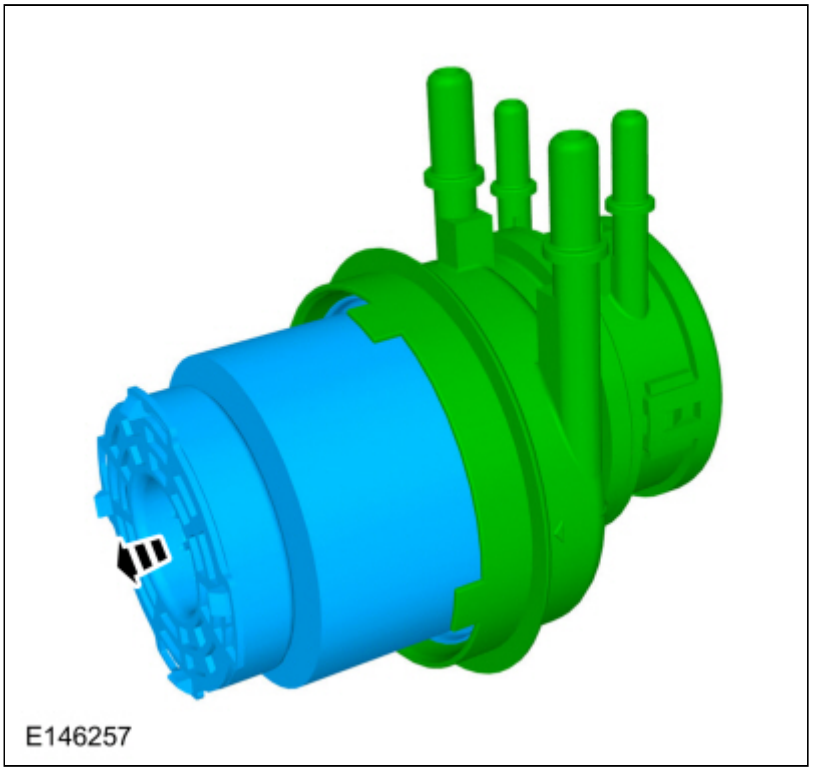
3.



4.

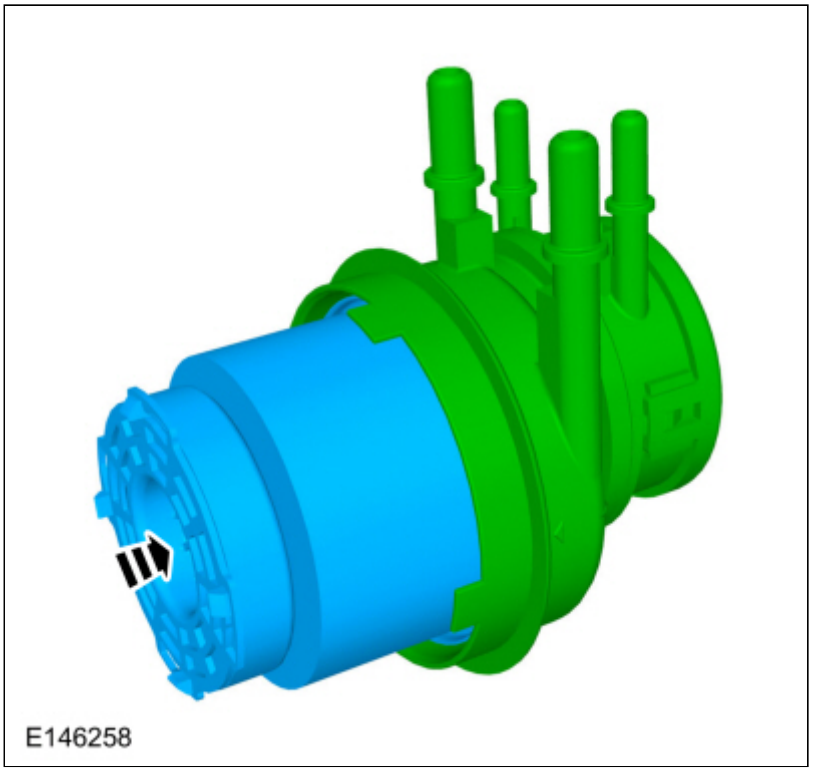


5.

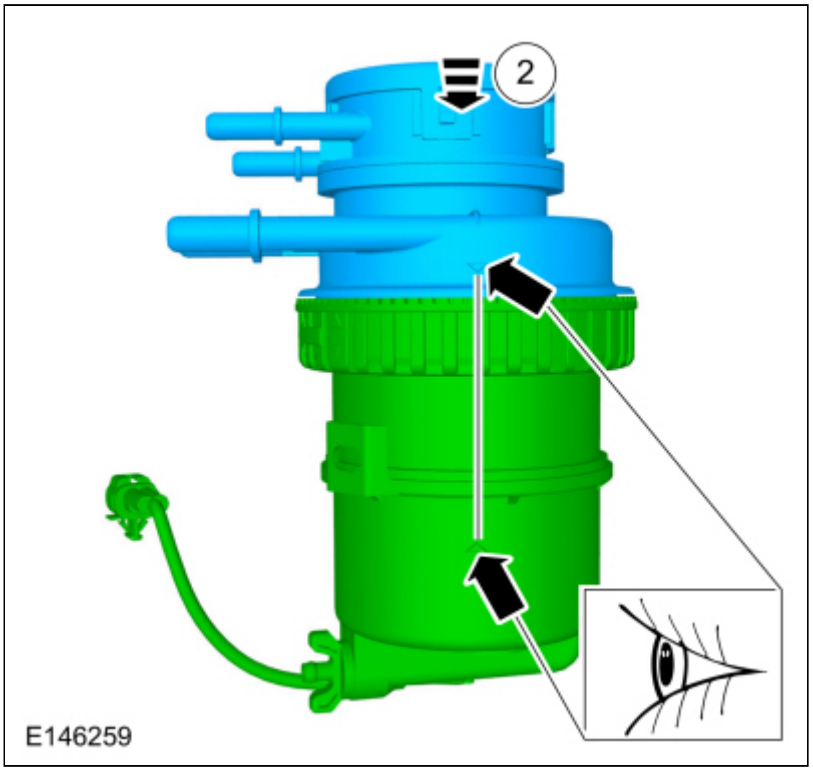


Installation

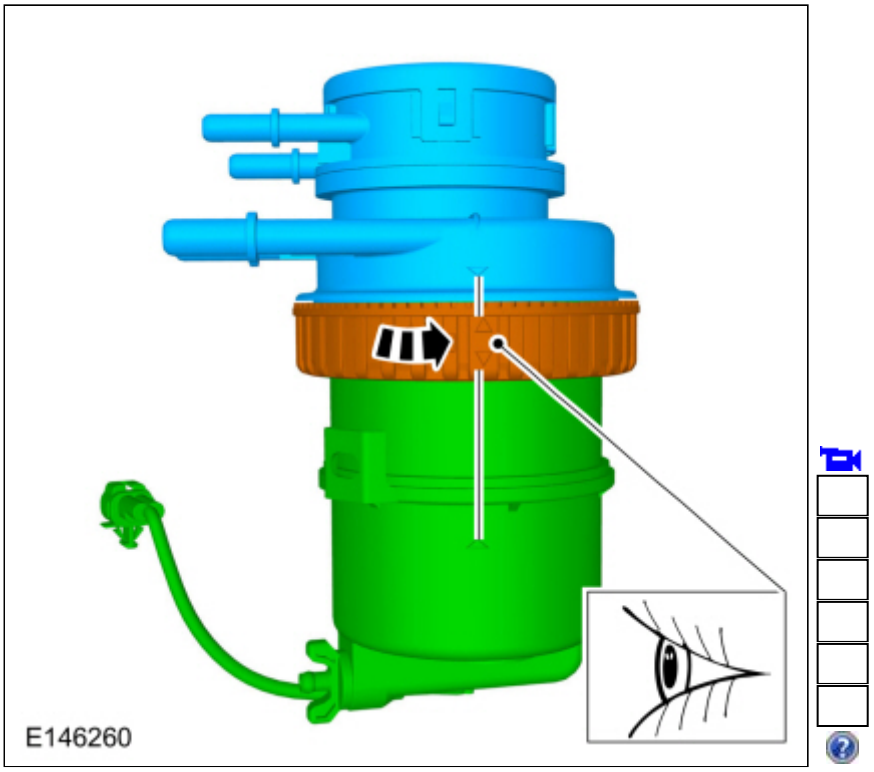
1.



2. **NOTE:** *A firm push may be required.*



3.



4. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel System Bleeding (310-00C Fuel System - General Information - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

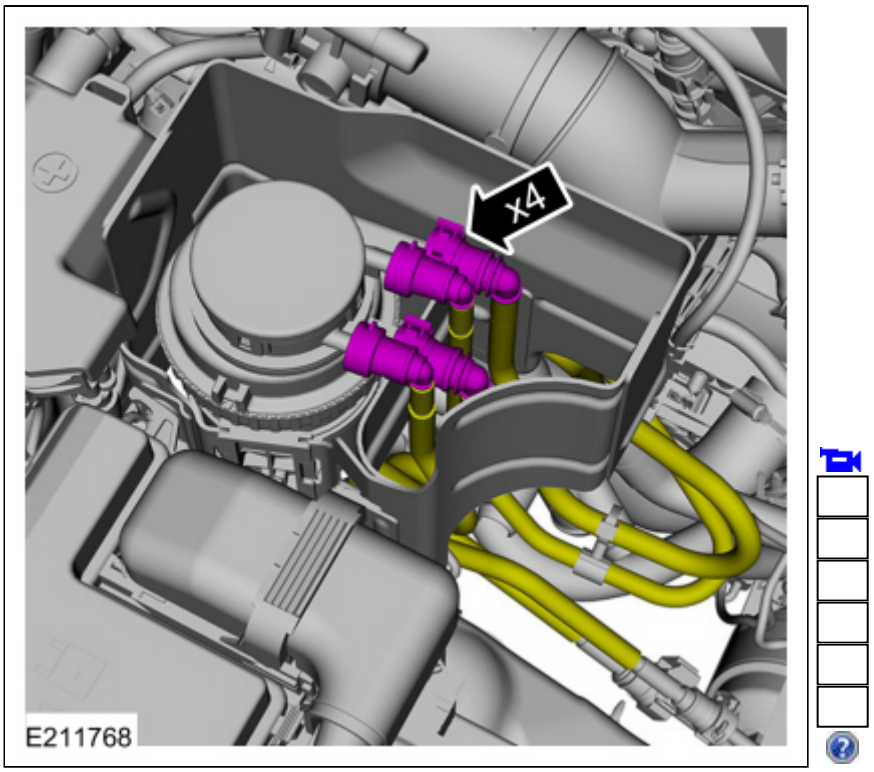
Fuel Filter

Removal

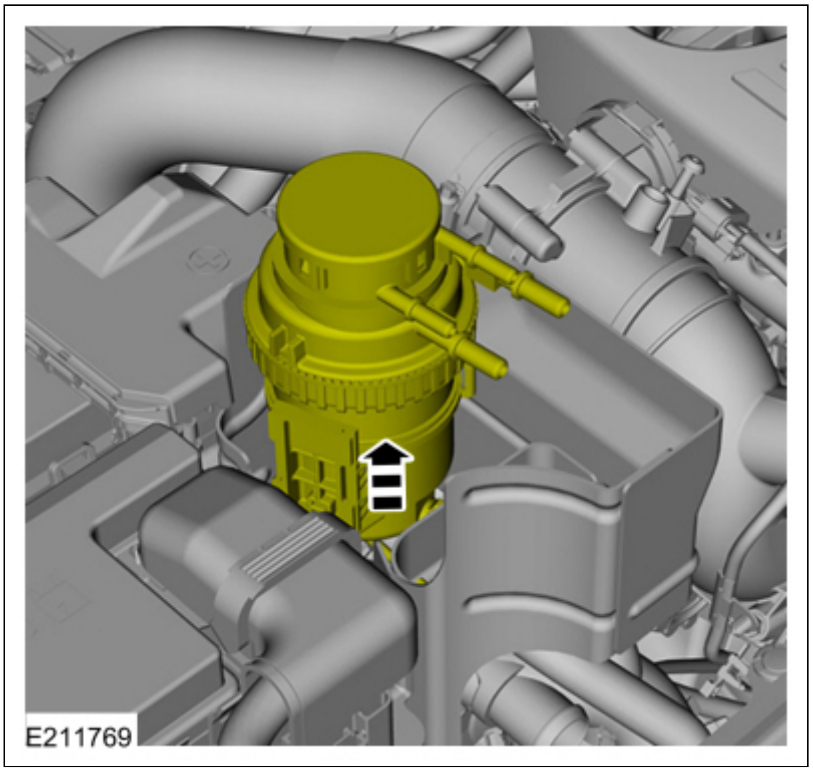
WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

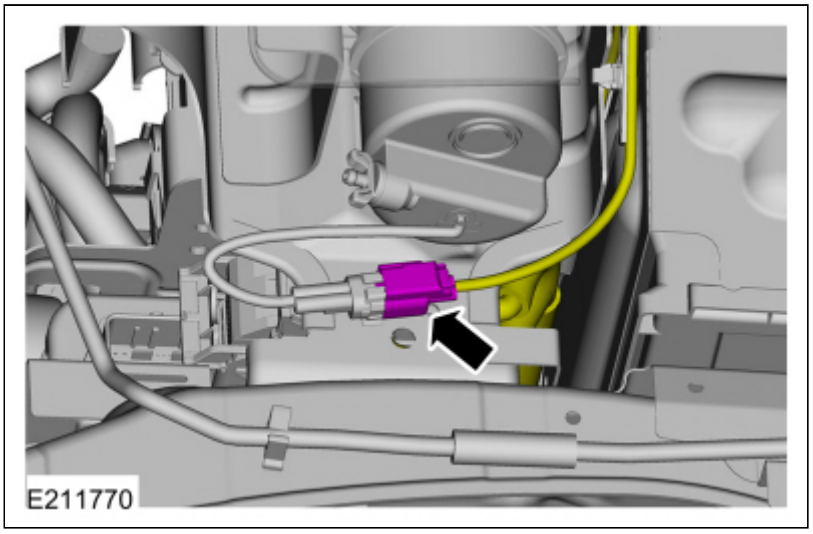
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

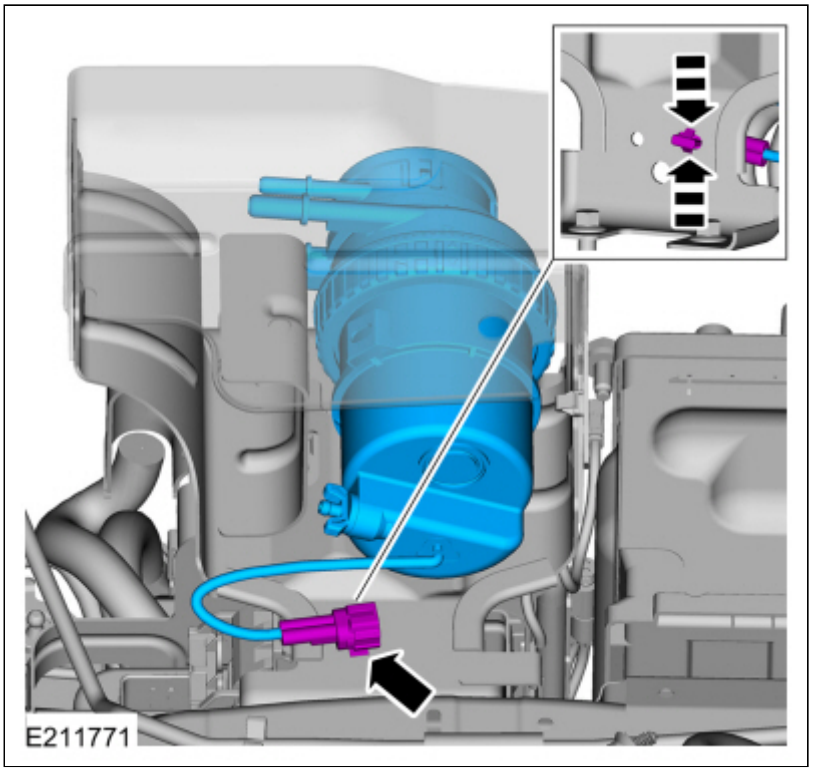
3.



4.

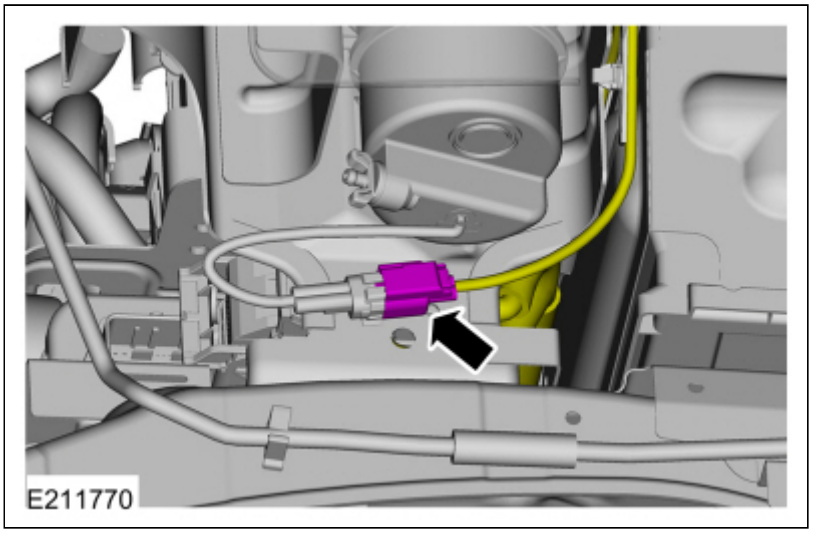


5.

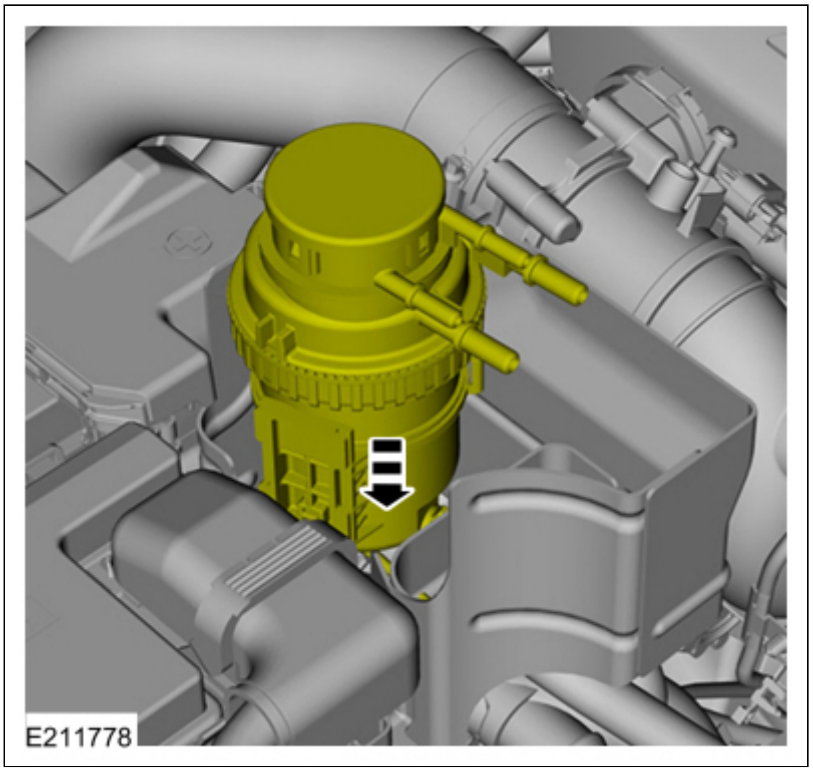


Installation

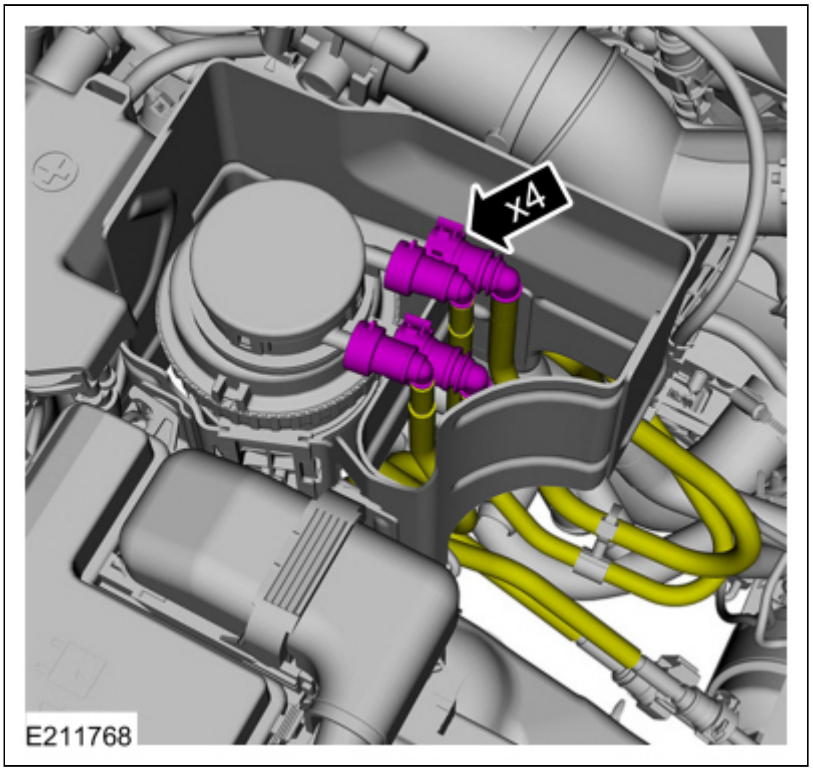
1. **NOTE:** *Make sure that the harness is not looped around fuel lines.*



2.



3. **NOTE:** *Make sure that the tubing is routed as shown.*



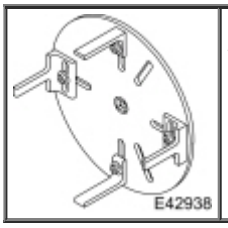
4. Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).
   Refer to: Fuel System Bleeding (310-00B Fuel System - General Information - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, General Procedures).

Copyright © 2016 Ford Motor Company

Fuel Pump and Sender Unit

Base Part Number: 9275

Special Tool(s) / General Equipment

 E42938	310-127 Wrench, Fuel Tank Sender Unit

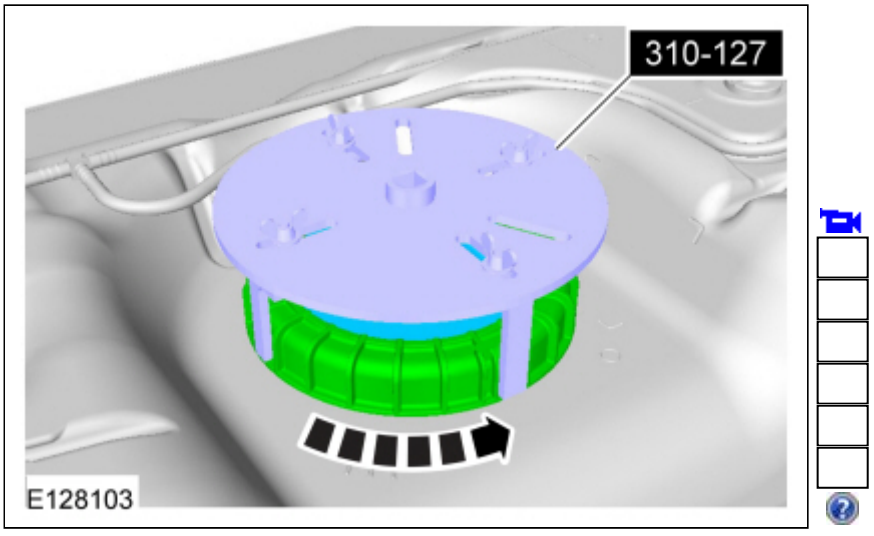
Removal

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

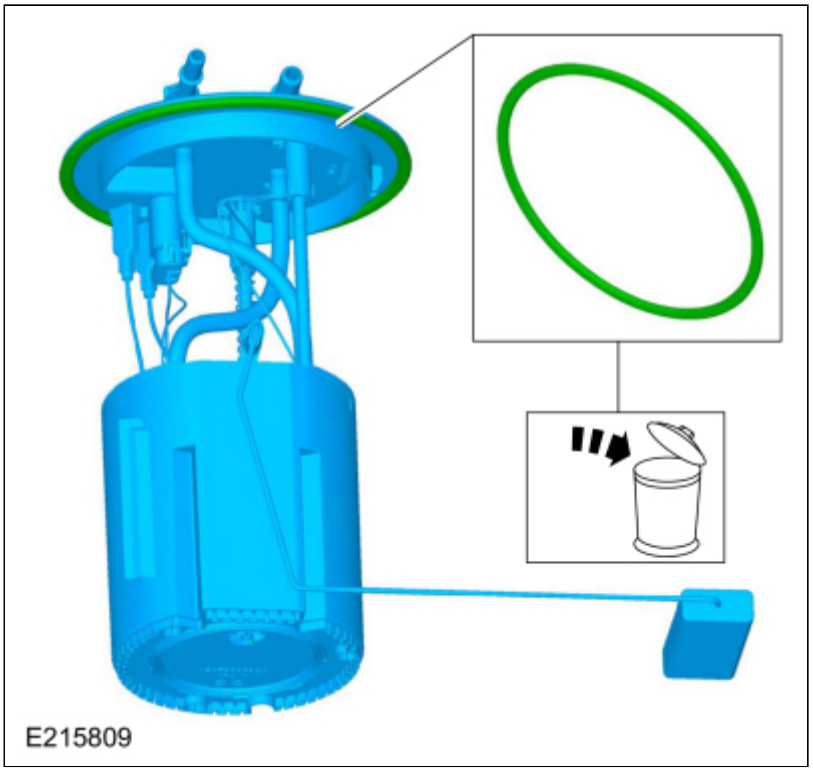
2. Refer to: Fuel Tank - Double Cab/Single Cab/Super Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Tank - Chassis Cab (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

3. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   Use Special Service Tool: 310-127 Wrench, Fuel Tank Sender Unit.



4.



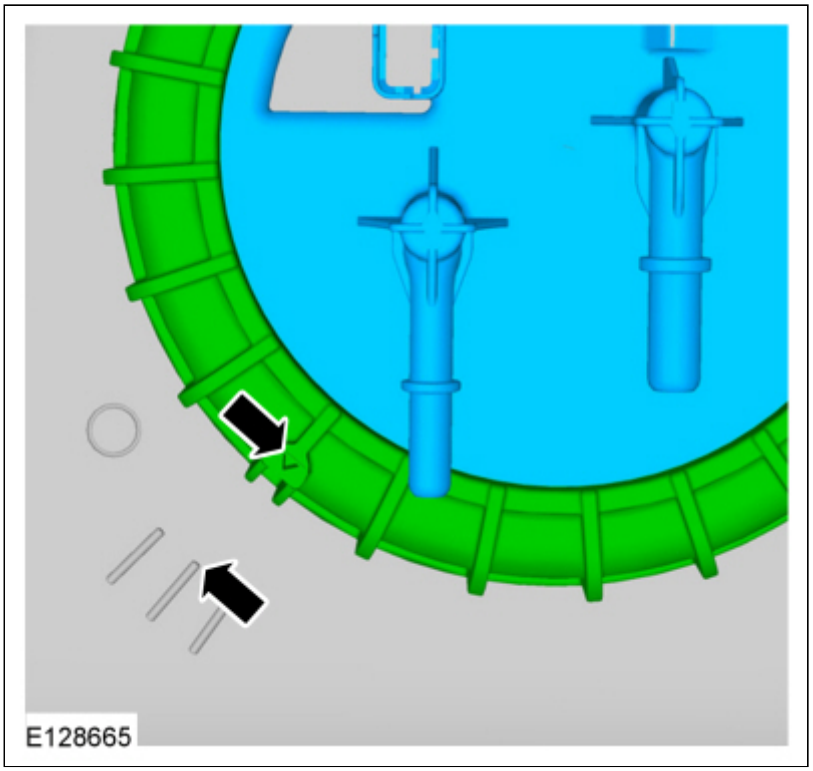
Installation

1. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   NOTE: *Make sure that the seal is correctly located.*

   NOTE: *Make sure that the installation marks are aligned.*

   Torque: 110 Nm



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Level Sender

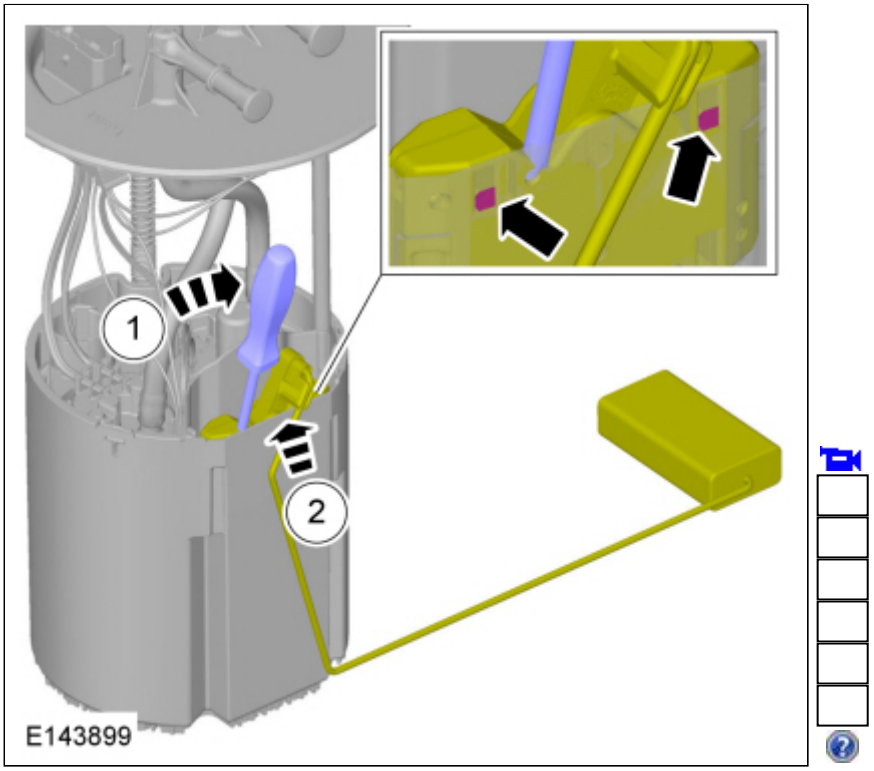
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTICE: Take extra care not to damage the fuel tank level sensor float and arm.**

   Refer to: Fuel Pump and Sender Unit (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Pump and Sender Unit (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

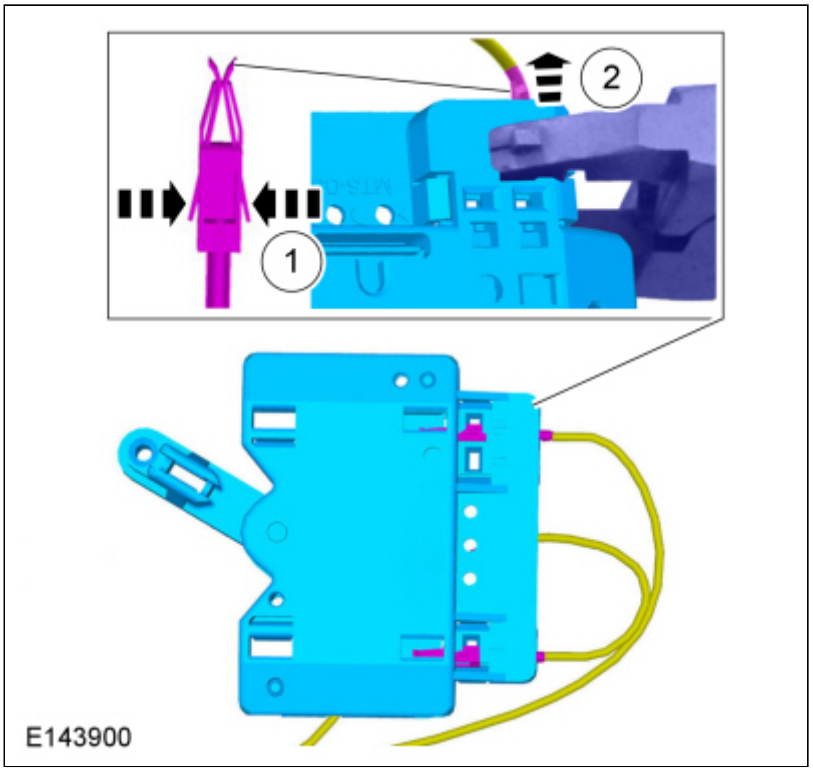
2. **NOTICE: Take extra care not to damage the clips.**



3. **NOTICE: Take extra care when handling the wiring terminals.**

   NOTICE: Make sure that the wiring terminals are not bent or damaged.

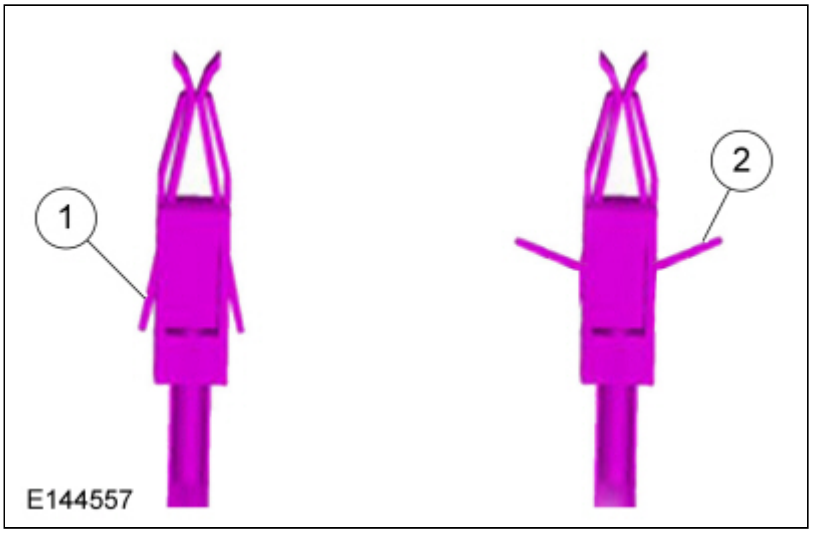
   On both sides.



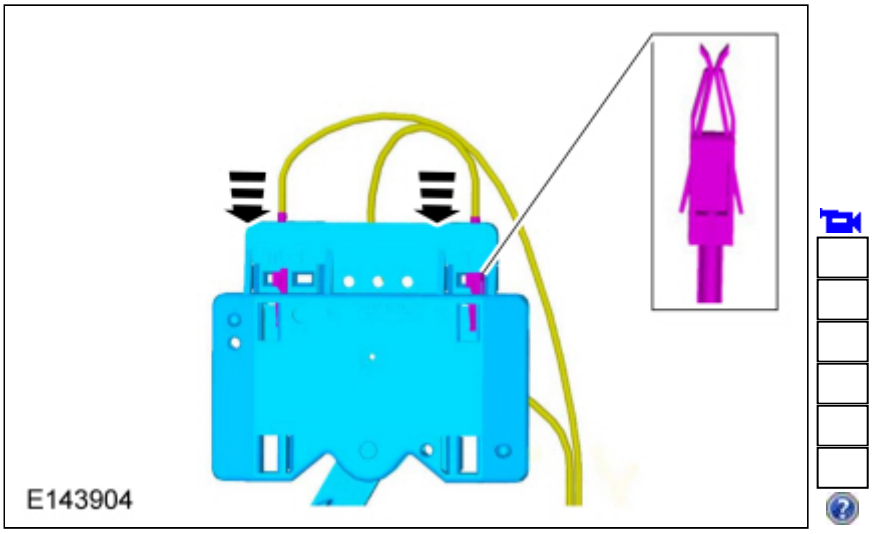
Installation

1. **NOTICE: Make sure that the wiring terminals are not bent or damaged.**

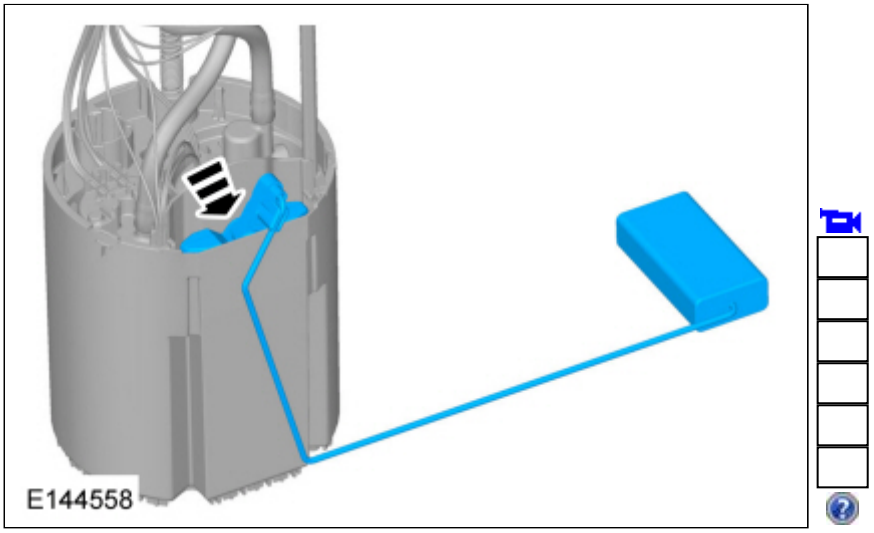
   Undamaged terminal clips
2. Damaged terminal clips



2. **WARNING: Check for correct connections after installation.**



3. **NOTE:** *Make sure that the wires are installed to the same orientation as when removed.*



4. Refer to: Fuel Pump and Sender Unit (310-01B Fuel Tank and Lines - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Fuel Pump and Sender Unit (310-01C Fuel Tank and Lines - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

Copyright © 2016 Ford Motor Company

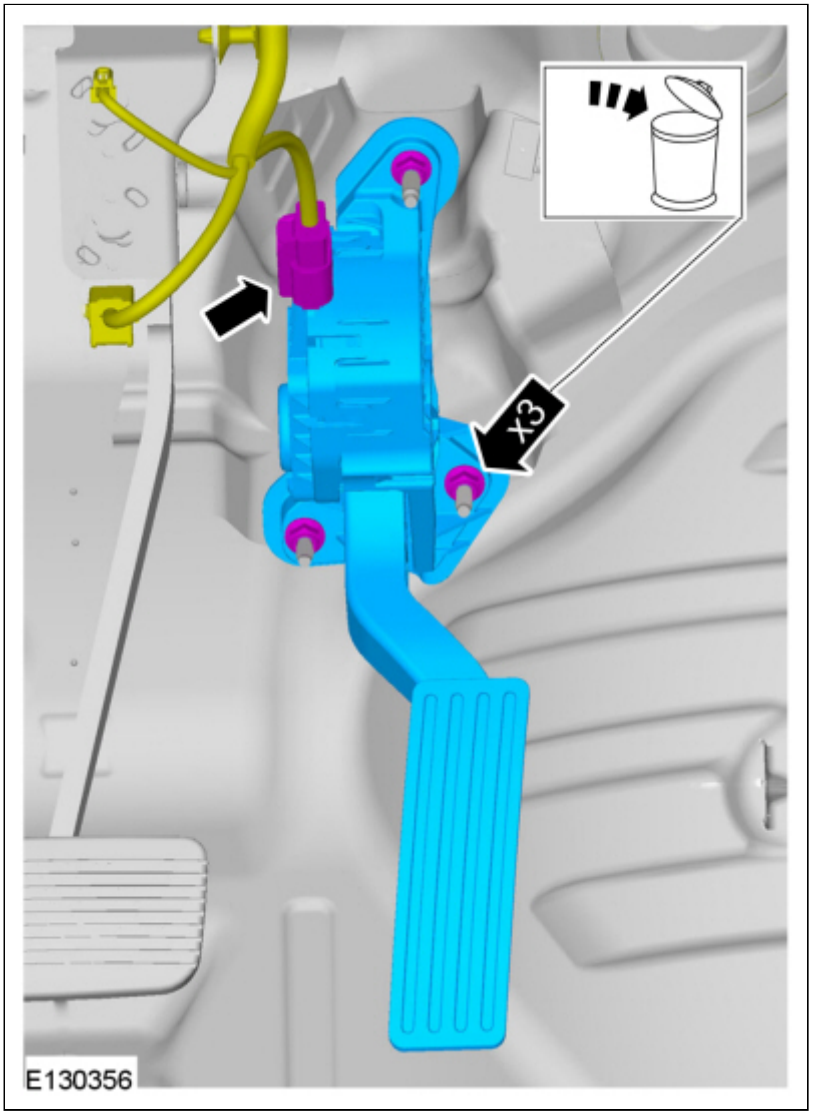
Accelerator Pedal

Base Part Number: 9735

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. *Torque*: 11 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Refrigerant R134a	WSH-M17B19-A
Refrigerant oil	WSH-M1C231-B

Refrigerant Capacities (When a new TXV is installed)

TXV Part Number	Grams
AB39-19849-AC	565 ± 25

Refrigerant Capacities (When Charging)

Vehicles Built Out of AAT	Grams
Vehicles built April 1st 2013 onwards	565 ± 25

Refrigerant Oil Capacities (When Charging)

	Milliliters
Air Conditioning	150

Addition of Refrigerant Oil (When a new compressor is installed)

	Milliliters
Air conditioning compressor if the amount of refrigerant oil taken from the faulty compressor is 50 to 90 ml	Drain 70 from new compressor
Air conditioning compressor if the amount of refrigerant oil taken from the faulty compressor is 91 to 120 ml	Drain 40 from new compressor
Air conditioning compressor if the amount of refrigerant oil taken from the faulty compressor is more than 121 to 150 ml	Drain 0 from new compressor

Addition of Refrigerant Oil (When new components are installed)

	Milliliters
Condenser	add 80
Evaporator	add 40
Every time refrigerant is evacuated	as taken from the system
When all new components are installed (including compressor)	add 0
When A/C system is flushed	150

Clutch air gap

	mm
Compressor clutch air gap	0.35 - 0.65

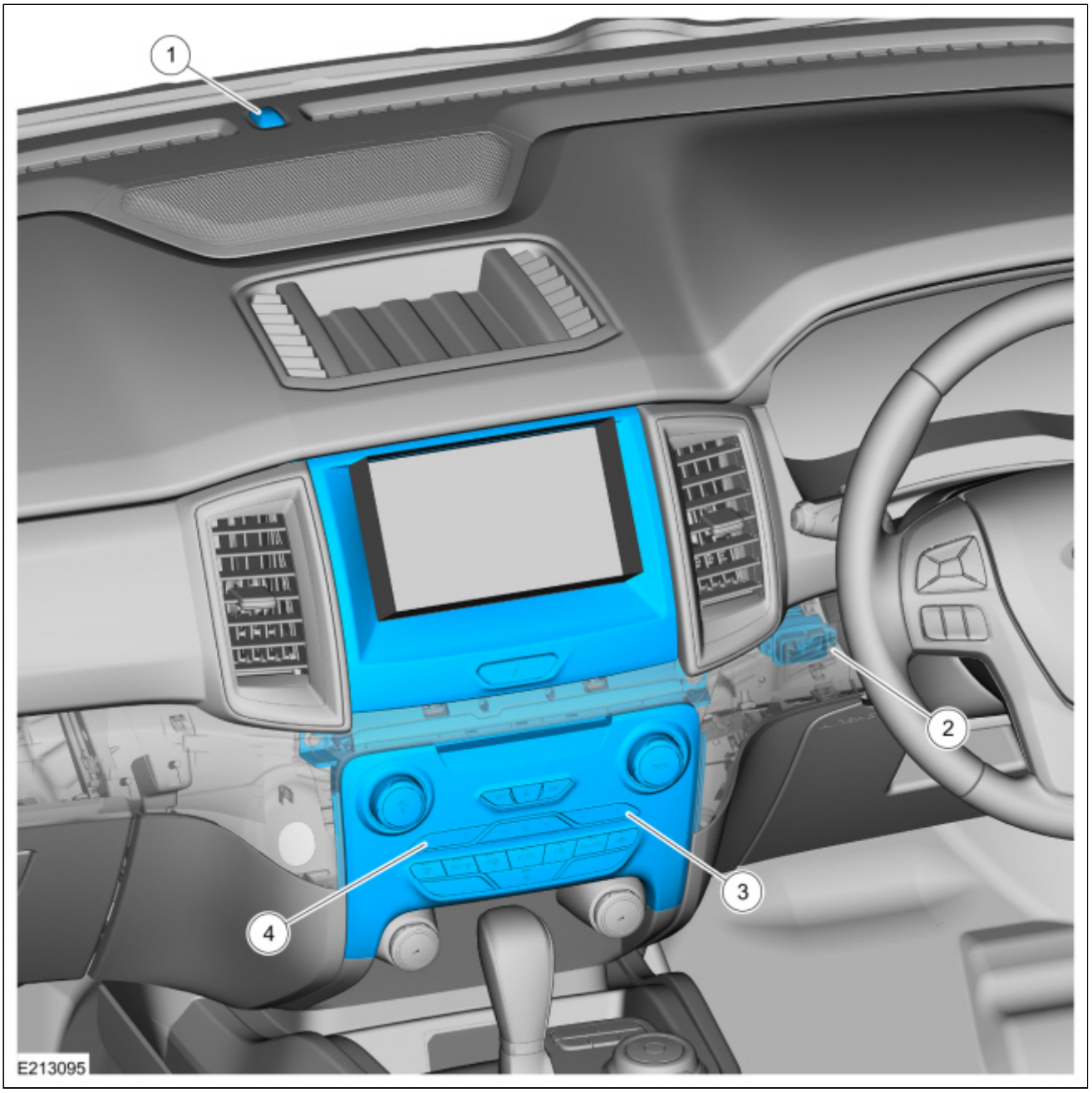
Torque Specifications

Item	Nm	lb-ft	lb-in
Compressor drive plate retaining bolt	13	10	–

Copyright © 2016 Ford Motor Company

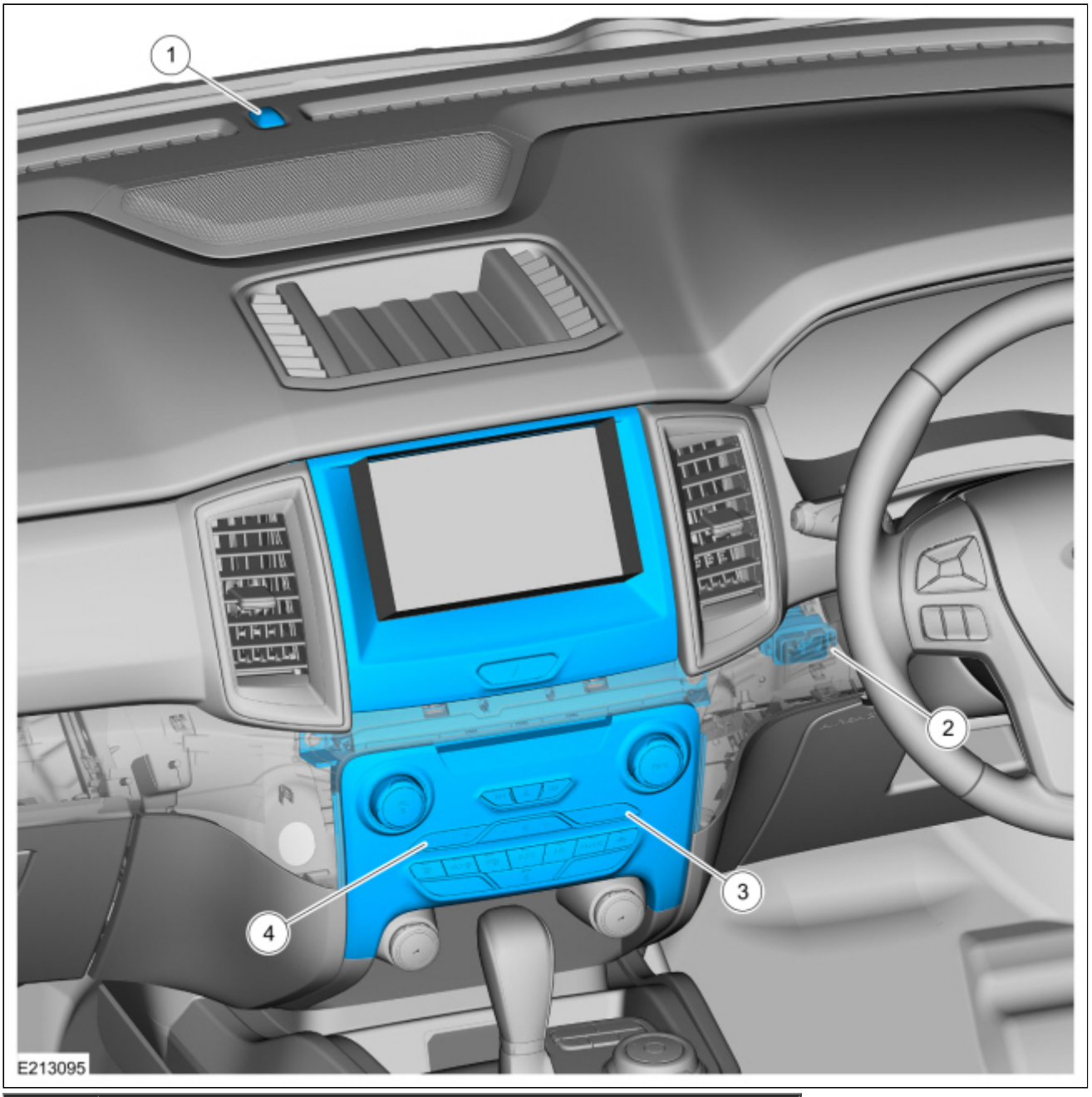
Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - Component Location

Type 1

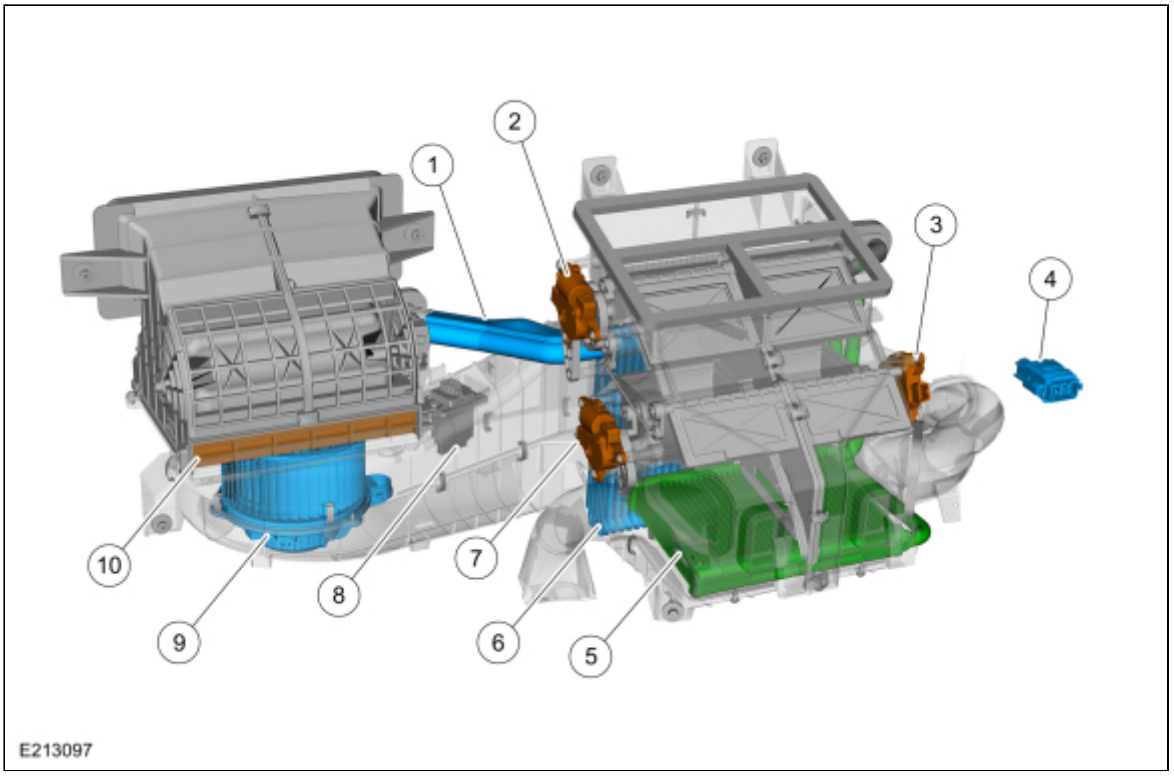


Item	Description
1	Auto lamp & sunload sensor
2	In-Vehicle Temperature & Humidity Sensor
3	Driver side blower control
4	Passenger side blower control

Type 2

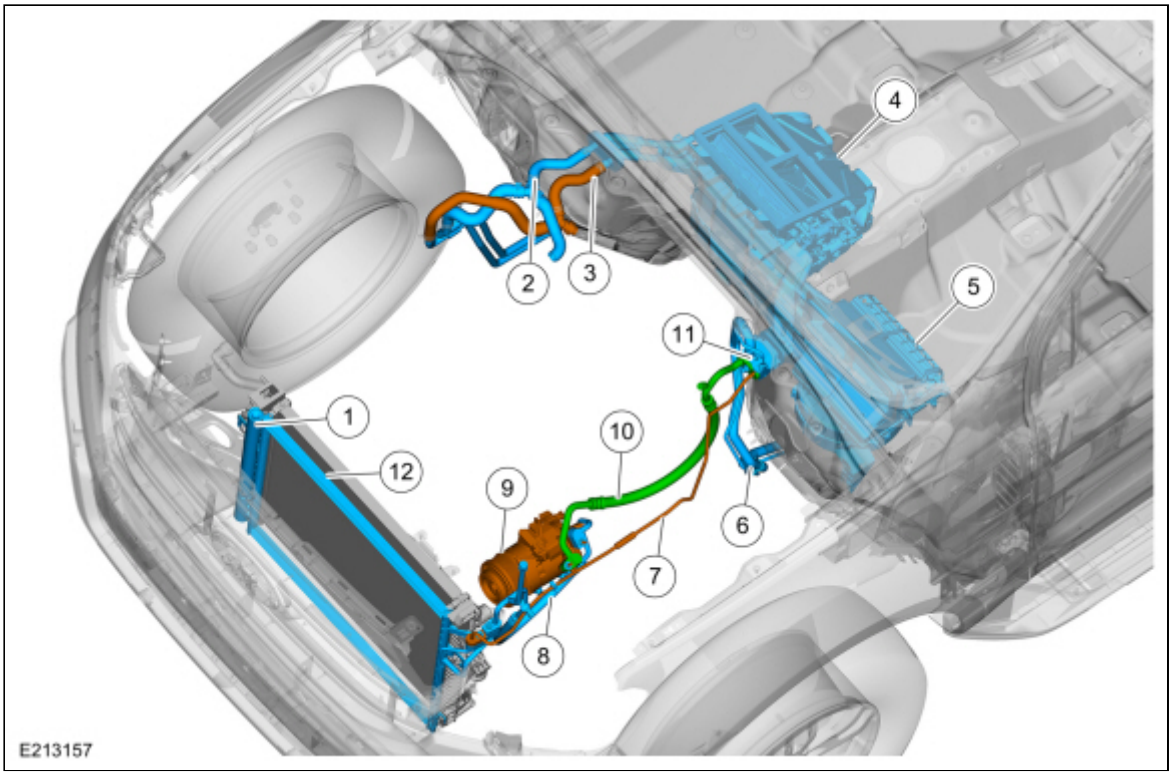


Item	Description
1	Auto lamp & sunload sensor
2	In-Vehicle Temperature & Humidity Sensor
3	Driver side blower control
4	Passenger side blower control



Item	Description
1	Evaporator high pressure and low pressure line
2	Air distribution door actuator
3	Air distribution door actuator
4	Interior air quality sensor
5	Heater core
6	Evaporator
7	Passenger side temperature door actuator
8	Blower motor speed sontrol
9	Blower motor
10	Cabin air filter

5.0L shown, all other engines similar



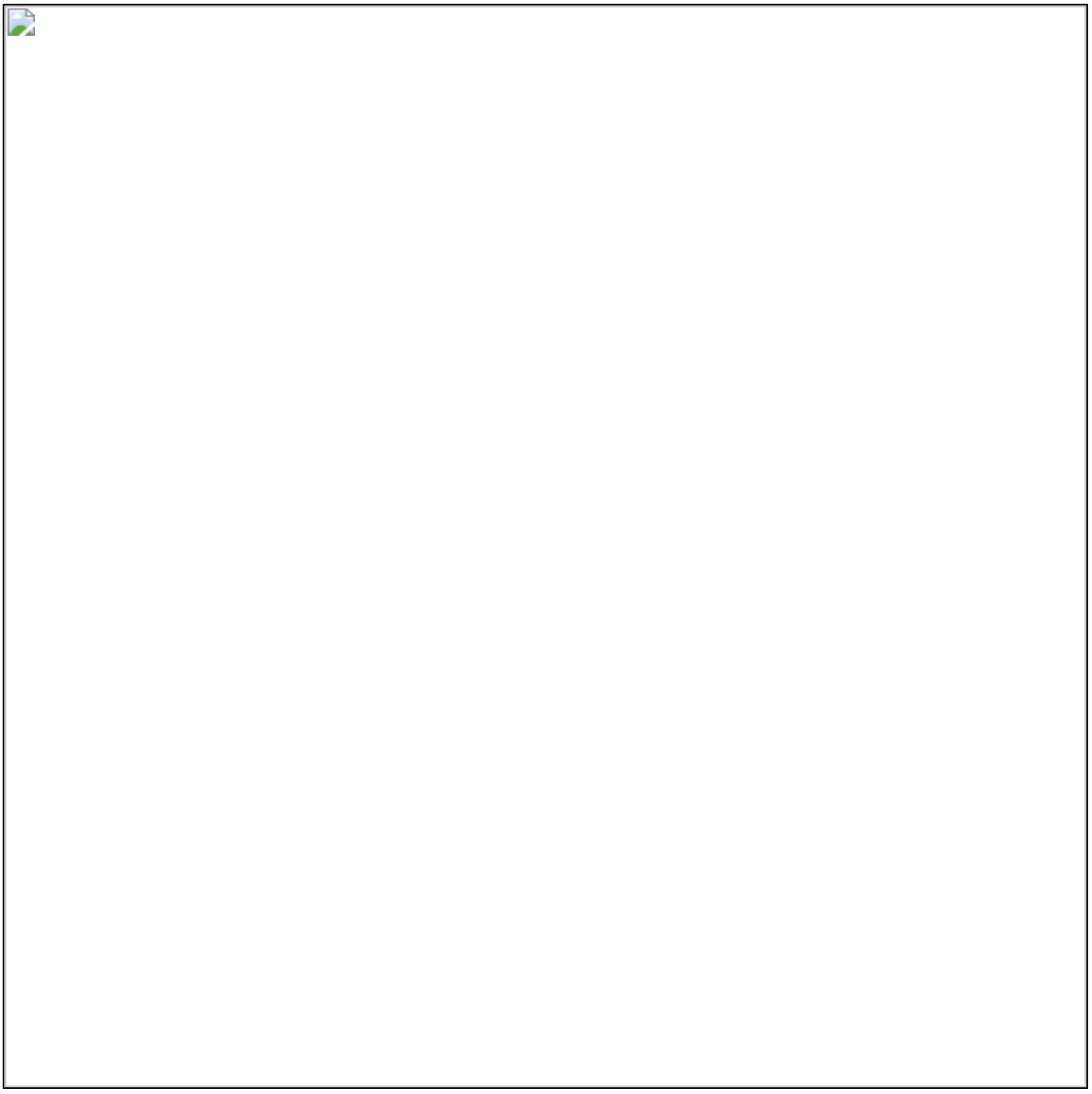
Item	Description
1	Receiver drier element
2	Hot coolant from heater to engine
3	Hot coolant fromengine to heater
4	Heater core and evaporator core housing
5	Blower housing
6	Line to rear A/C
7	High pressure line from condenser to evaporator
8	High pressure line from compressor to condenser
9	A/C compressor
10	Low pressure line from evaporator to compressor
11	Thermostatic expansion valve
12	Condenser

Copyright © 2016 Ford Motor Company

Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages APIM

Broadcast Message	Originating Module	Message Purpose
Climate control button status	FCIM	This message contains the climate control button status.

Module Network Input Messages FCIM

Broadcast Message	Originating Module	Message Purpose
Ambient air temperature	PCM	This message contains raw value from the ambient air temperature sensor.
Climate control requests	APIM	This message contains both the climate control system voice commands as well as all climate control system touchscreen inputs.
A/C clutch status	PCM	This message contains the status of the A/C compressor clutch.

Module Network Input Messages PCM

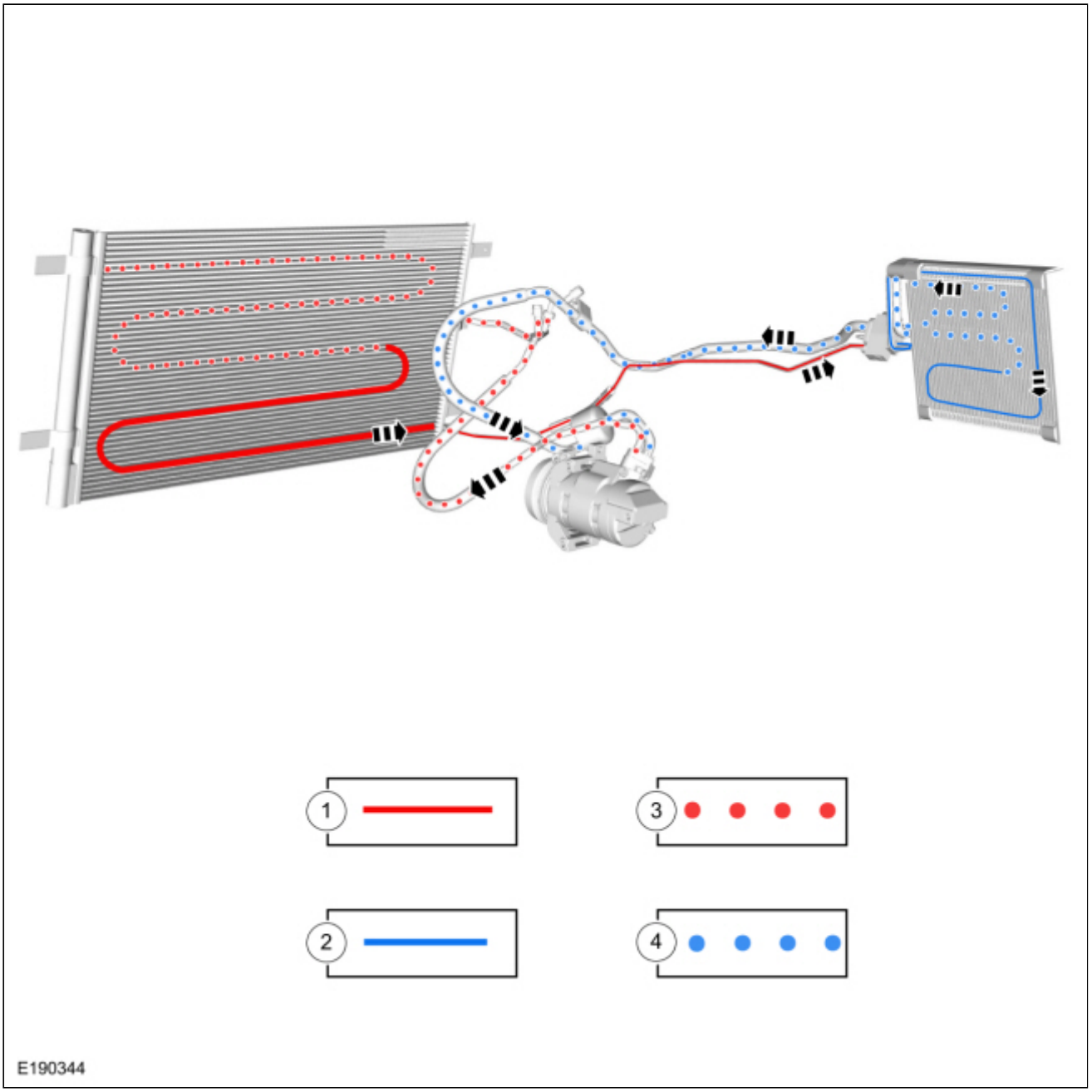
Broadcast Message	Originating Module	Message Purpose
HVAC request	FCIM	This message requests the A/C compressor to be engaged.
Evaporator temperature	FCIM	This message contains the evaporator temperature. The PCM uses the evaporator temperature to determine the A/C compressor output.

The Refrigerant Cycle

For information regarding basic HVAC system refrigerant operation, refer to the current Ford Web Based Technical Training courses. The following diagram shows the refrigerant system state in each component.

The following are characteristics of the DATC system:

- The PCM controls the A/C clutch relay.
- The evaporator temperature sensor monitors the temperature of the air that has passed through the evaporator core and sends a signal to the PCM. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the PCM.
- The line pressure is monitored so that A/C compressor operation is interrupted if the system pressure becomes too high or too low.
- The A/C compressor relief valve opens and vents refrigerant to relieve unusually high system pressure.



Item	Description
1	High pressure liquid
2	Low pressure liquid
3	High pressure vapor
4	Low pressure vapor

Control System Logic

The DATC system customer interface is in one or more locations depending on vehicle option content:

- FCIM
- FDIM (part of APIM)

When the touchscreen FDIM or voice commands are used and A/C is selected, the APIM sends the request message over the HS-CAN3 to the GWM. The GWM sends the message to the FCIM over the Medium Speed Controller Area Network (MS-CAN) and the GWM sends the A/C request to the PCM over the HS-CAN1.

When the customer directly inputs an A/C request into the FCIM, the module sends the request to the GWM over the MS-CAN. The GWM sends the request to the PCM over the HS-CAN1.

The FCIM requires PMI when it is replaced.

A/C Request

When an A/C request is received by the PCM, the A/C clutch relay is engaged when all of the following conditions are met:

- Excessively high or low refrigerant pressure from the A/C pressure transducer is not detected.
- Ambient air temperature is above approximately °C.
- Evaporator temperature is above approximately 1°C.

The PCM monitors the discharge pressure measured by the A/C pressure transducer. The PCM interrupts A/C compressor operation in the event the A/C pressure transducer indicates high system discharge pressures. It is also used to sense low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM does not allow the A/C clutch to engage.

The FCIM adjusts the air inlet door depending on the humidity measured by the in-vehicle temperature and humidity sensor. If the vehicle cabin becomes too humid and recirculated air is selected, the FCIM adjusts the air inlet door to allow more fresh air. When the humidity level drops, it adjusts back to partial recirculated air. The FCIM also adjusts the system based on in-vehicle temperature.

The autolamp-sunload sensor supplies information to the FCIM indicating the intensity of the sun on the vehicle. The FCIM adjusts the system based on the intensity.

Heating and Ventilation

The heating and ventilation system:

- controls the temperature of the air inside the vehicle.
- reduces the relative humidity of the air inside the vehicle (during A/C compressor operation).
- delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.

The heating and ventilation system uses a reheat method to provide conditioned air to the passenger compartment. Temperature blending is controlled by the temperature doors, which regulate the amount of air that flows through and around the heater core, where it is then mixed and distributed. All airflow from the blower motor passes through the A/C evaporator core.

The PTC Heater is a 1000W electrical heater (incorporated into the HVAC unit) that is to increase cabin temperature rapidly after startup where coolant temperature is low.

Air Handling

There are 4 door actuators that control the air flow into the passenger compartment:

- Defrost Vent/Register Door Actuator
- Air inlet
- Temperature door actuator, LH
- Temperature Door Actuator, RH

All of the door actuators contain a reversible electric motor and a potentiometer. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal circuit is connected to a contact wiper, which is driven along the variable resistor by the actuator shaft. The signal to the FCIM from the contact wiper indicates the actuator door position. The FCIM powers the actuator motors to move the doors to the desired positions. The desired door positions are calculated by the FCIM based on the requested temperature, in-vehicle temperature, ambient air temperature and sunload.

When an airflow mode, desired driver or passenger temperature, fresh air, or recirculation mode is selected, the FCIM moves the actuator motor in the desired direction.

The FCIM sends a PWM signal to the blower motor speed control to regulate the blower speed as necessary. The blower motor speed control provides variable ground feed for the blower motor based on the input from the FCIM. A delay function provides a gradual increase or decrease in blower motor speed under all conditions.

AUTO

When AUTO is selected:

- the HVAC system operates to achieve and maintain the temperature requested by the operator.
- the LH and RH temperature door actuators are automatically controlled by the FCIM based on the temperature setting.
- the A/C compressor is automatically controlled by the PCM based on temperature information sent by the

FCIM. °C.
- the blower motor speed is automatically controlled through the blower motor speed control when it receives a PWM signal from the FCIM based on the temperature setting, but can be manually adjusted if desired.
- the FCIM controls the air inlet door to recirculate, partially recirculate or open to the fresh air position depending on the in-car temperature and humidity sensor inputs.

OFF

When OFF is selected:

- the recirculated air request button is disabled.
- the air inlet door closes, preventing outside air and allowing only recirculated air.
- the A/C request button is disabled.
- the blower motor is off.

MAX A/C

When MAX A/C is selected:

- the air inlet door closes, preventing outside air and allowing only recirculated air.
- the recirculated air indicator is illuminated (recirculated air forced on).
- the air distribution doors operate simultaneously to direct airflow to the instrument panel registers.
- the temperature doors move to the full cool position. The air temperature is adjustable.
- the A/C button is illuminated.
- the A/C compressor operates if the outside temperature is above approximately °C .
- the blower motor is commanded to the highest speed, but can be manually adjusted if desired.

PANEL

When PANEL mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the instrument panel registers.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

PANEL/FLOOR

When PANEL/FLOOR mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct is present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

FLOOR

When FLOOR mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters is present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

FLOOR/DEFROST

When FLOOR/DEFROST mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

MAX DEFROST

When MAX DEFROST mode is selected:

- the recirculated air request button is disabled. The air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct is present.
- the A/C is turned on in defrost mode. The A/C compressor operates as long as the outside temperature is above approximately °C.
- the temperature is set to the highest setting and is **not** adjustable.
- the fan is set to the highest speed and is **not** adjustable.
- MAX DEFROST can be exited by pressing the AUTO button.

Component Description

FCIM - DATC

The DATC system uses the FCIM as the HVAC control module. The FCIM also controls the outputs for rear window defrost and climate controlled seats. For vehicles equipped with touchscreen audio, the DATC system uses voice commands or the touchscreen to control the system. For details on the FCIM communication, refer to Control System Logic in this section.

The FCIM utilizes a Field-Effect Transistor (FET) protective circuit strategy for its actuator outputs. Output load (current level) is monitored for excessive current (typically short circuits) and is shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A short circuit DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the Field-Effect Transistor (FET) circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (Field-Effect Transistor (FET) protection) and the circuit is still shorted, the Field-Effect Transistor (FET) protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. The Field-Effect Transistor (FET) protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the Field-Effect Transistor (FET) and the ability of the Field-Effect Transistor (FET) to withstand it. A module lifetime level of fault events is established based upon the durability of the Field-Effect Transistor (FET). If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the short circuit DTC that was stored on the first failure cannot be cleared by a command to clear the Diagnostic Trouble Codes (DTCs). The module does not allow the DTC to be cleared or the circuit to be restored to normal operation until a successful self-test proves the fault has been repaired. After the self-test has successfully completed (no on-demand Diagnostic Trouble Codes (DTCs) present), DTC U1000:00 and the associated DTC (the DTC related to the shorted circuit) automatically clears and the circuit function returns.

When each level is reached, the DTC associated with the short circuit sets along with DTC U1000:00. These Diagnostic Trouble Codes (DTCs) can be cleared using the diagnostic scan tool. The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then Diagnostic Trouble Codes (DTCs) U1000:00 and U3000:49 set along with the associated short circuit DTC. DTC U3000:49 cannot be cleared and a new module must be installed after the repair.

The FCIM requires PMI when it is replaced.

Ambient Air Temperature (AAT) Sensor

The Ambient Air Temperature (AAT) sensor is an input to the PCM. If the outside air temperature is below approximately 0°C (32°F), the PCM does not allow the A/C compressor clutch to engage.

Evaporator Core

The evaporator core is an aluminum plate/fin type and is located in the heater core and evaporator core housing. A mixture of liquid refrigerant and oil enters the bottom of the evaporator through the evaporator inlet tube and continues out of the evaporator through the evaporator outlet tube as a vapor. During A/C compressor operation, airflow from the blower motor is cooled and dehumidified as it flows through the evaporator fins.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer it to air passing through the heater core.

Heater Core and Evaporator Core Housing

The heater core and evaporator core housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is then directed through or around the heater core by the temperature door(s). After passing through the heater core, the airflow is distributed to the selected outlet by the airflow mode doors.

Defrost Vent/Register Door Actuator

The defrost vent/register door actuator contains a reversible electric motor and a potentiometer. The potentiometer allows the FCIM to monitor the position of the airflow mode door.

Air Inlet Door Actuator

The air inlet door actuator contains a reversible electric motor and a potentiometer. The potentiometer allows the FCIM to monitor the position of the airflow mode door. The FCIM drives the actuator motor in the direction necessary to move the door to the position set by the recirculation button and the in-vehicle temperature and humidity sensor information.

LH Temperature Door Actuator

The driver side temperature door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the FCIM to monitor the position of the temperature blend door.

RH Temperature Door Actuator

The passenger side temperature door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the FCIM to monitor the position of the temperature blend door.

A/C Pressure Transducer

The PCM monitors the discharge pressure measured by the A/C pressure transducer. As the refrigerant pressure changes, the resistance of the A/C pressure transducer changes. It is not necessary to recover the refrigerant before removing the A/C pressure transducer.

In-Vehicle Temperature And Humidity Sensor

The in-vehicle temperature and humidity sensor contains a thermistor and a sensing element which separately measures the in-vehicle air temperature and the humidity, then sends those readings to the FCIM. The in-vehicle temperature and humidity sensor has an electric fan within the sensor that draws in-vehicle air across the two sensing elements. The FCIM may adjust the air inlet door based on the in-vehicle temperature and humidity sensor information to maintain the desired humidity of the passenger cabin air.

Autolamp-Sunload Sensor

The autolamp-sunload sensor supplies information to the FCIM indicating the intensity of the sun on the vehicle. The FCIM compensates high sun load with higher blower and reduced discharge temperatures.

Evaporator Temperature Sensor

The evaporator temperature sensor contains a thermistor. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The evaporator temperature sensor is an input to the FCIM and the information is relayed to the PCM over the CAN. If the evaporator temperature is below approximately 1°C (33.8°F), the PCM does not allow the A/C compressor to operate.

Air Discharge Temperature Sensors

There are 2 air discharge temperature sensors in the DATC system:

- Driver side footwell air discharge temperature sensor

- Driver side center register air discharge temperature sensor

The air discharge temperature sensors contain a thermistor and are inputs to the FCIM. The sensors vary their resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The FCIM uses the sensor information to maintain the desired temperature of the passenger cabin air.

Condenser

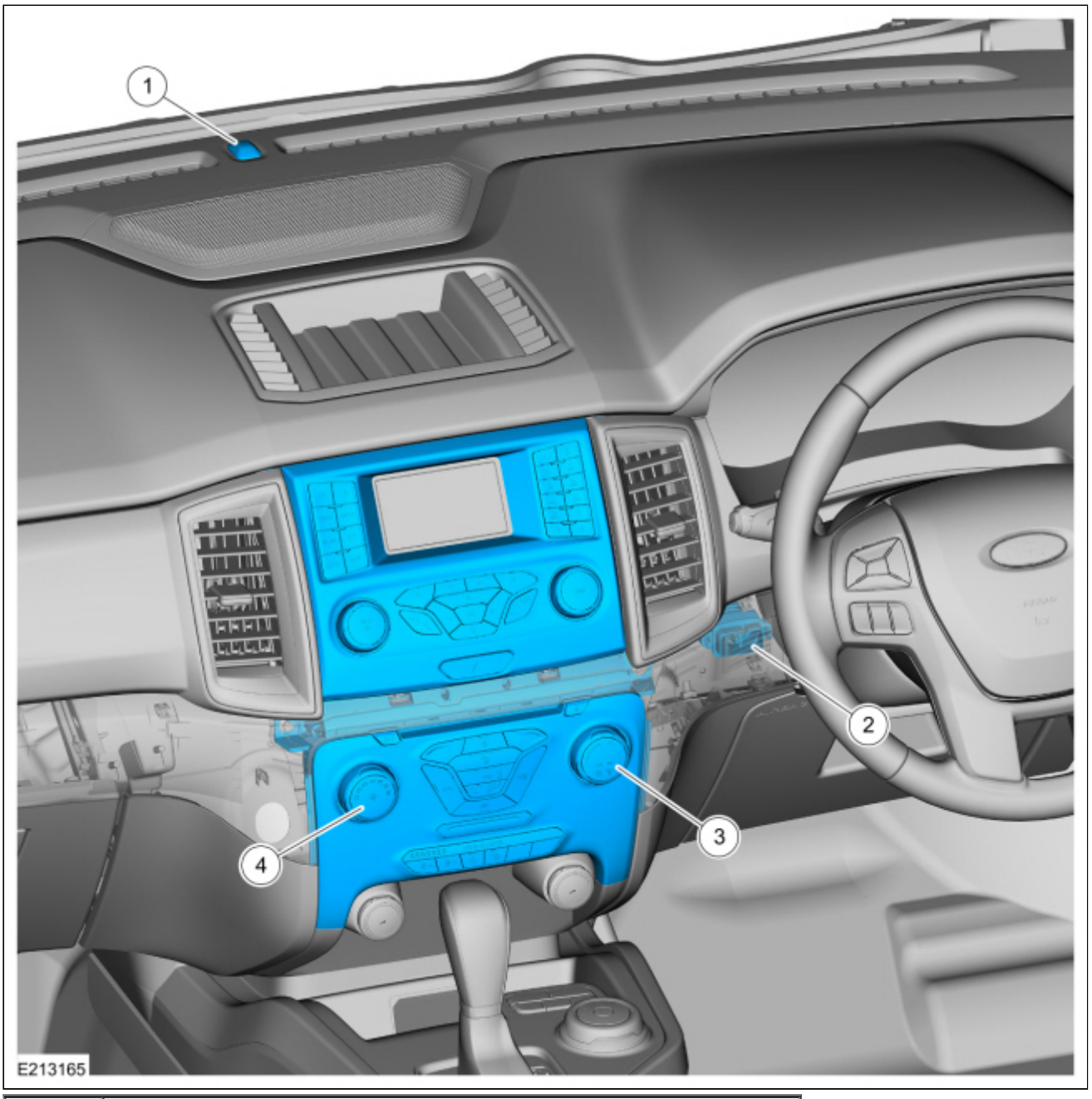
The A/C condenser is an aluminum fin-and-tube design heat exchanger. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat, and condenses gas to liquid refrigerant as it is cooled.

Receiver Drier

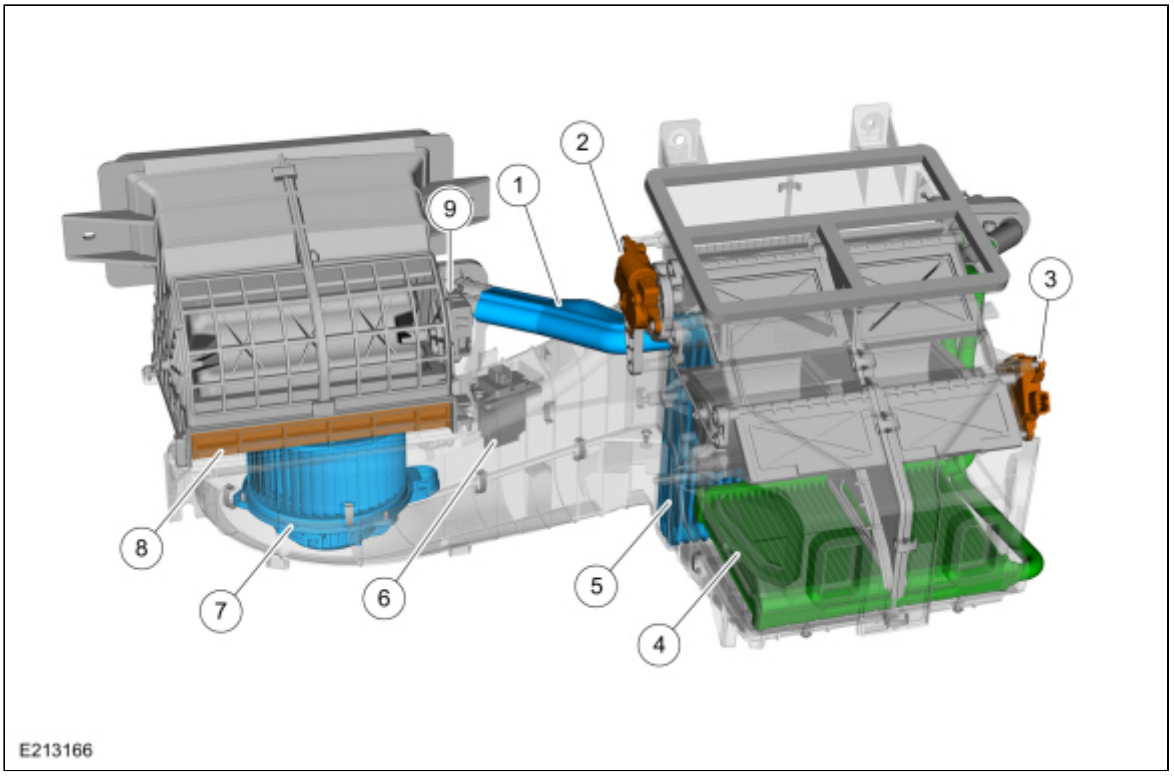
The receiver drier stores high-pressure liquid. The desiccant bag mounted inside the receiver drier removes any retained moisture from the refrigerant. The receiver drier desiccant bag is a separate component and can be removed and installed separately from the condenser.

Copyright © 2016 Ford Motor Company

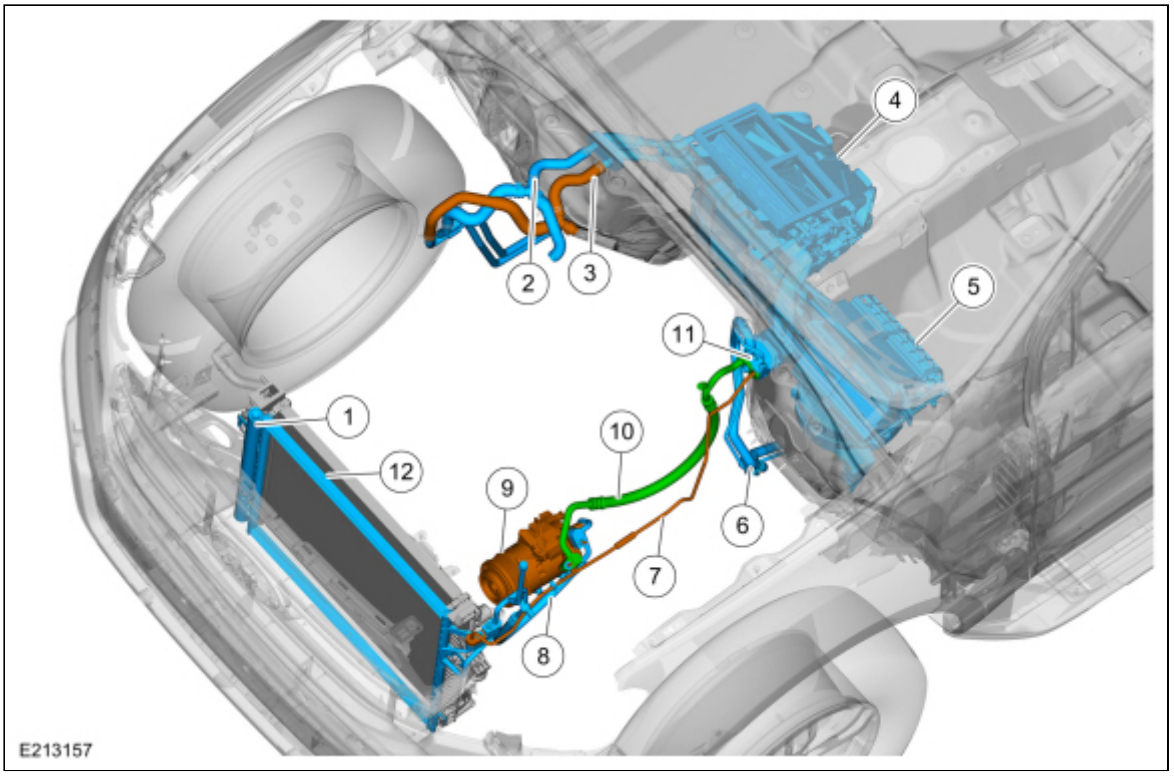
Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - Component Location



Item	Description
1	Ambient light & sunload sensor
2	In-vehicle temperature & humidity sensor
3	Control knob temperature
4	Control knob blower



Item	Description
1	Evaporator high pressure and low pressure line
2	Air distribution door actuator
3	Temperature door actuator
4	Heater core
5	Evaporator
6	Blower motor speed control
7	Blower motor
8	Cabin air filter
9	Air inlet door actuator



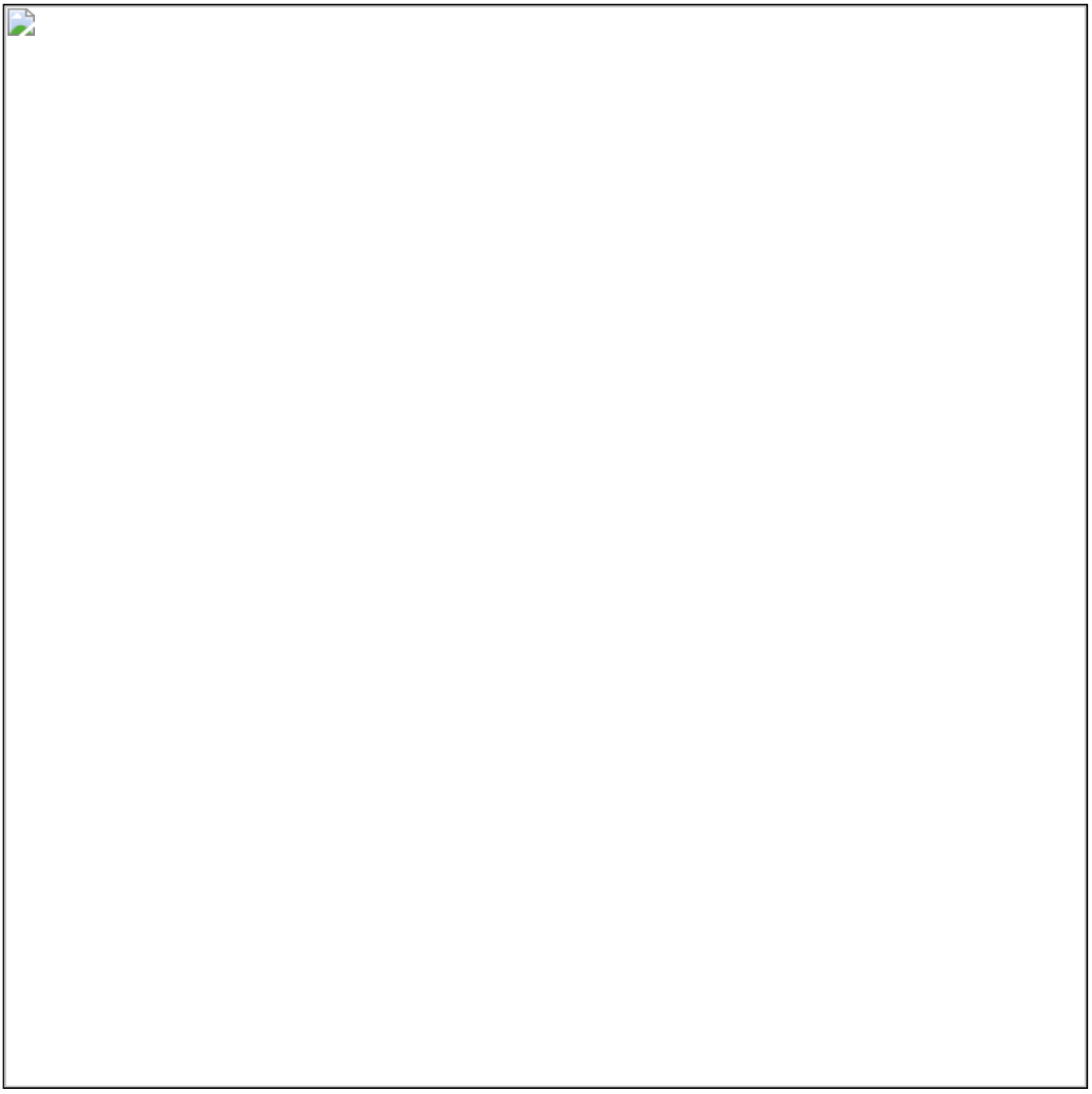
Item	Description
1	Receiver drier element (Integrated with condenser)
2	Hot coolant from heater to engine
3	Hot coolant fromengine to heater
4	Heater core and evaporator core housing
5	Blower housing
6	Line to rear A/C
7	High pressure line from condenser to evaporator
8	High pressure line from compressor to condenser
9	A/C compressor
10	Low pressure line from evaporator to compressor
11	Thermostatic expansion valve
12	Condenser

Copyright © 2016 Ford Motor Company

Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages APIM

Broadcast Message	Originating Module	Message Purpose
Climate control button status	FCIM	This message contains the climate control button status.

Module Network Input Messages FCIM

Broadcast Message	Originating Module	Message Purpose
A/C clutch status	PCM	This message contains the status of the A/C compressor clutch.
Ambient air temperature	PCM	This message contains raw value from the ambient air temperature sensor.

Module Network Input Messages PCM

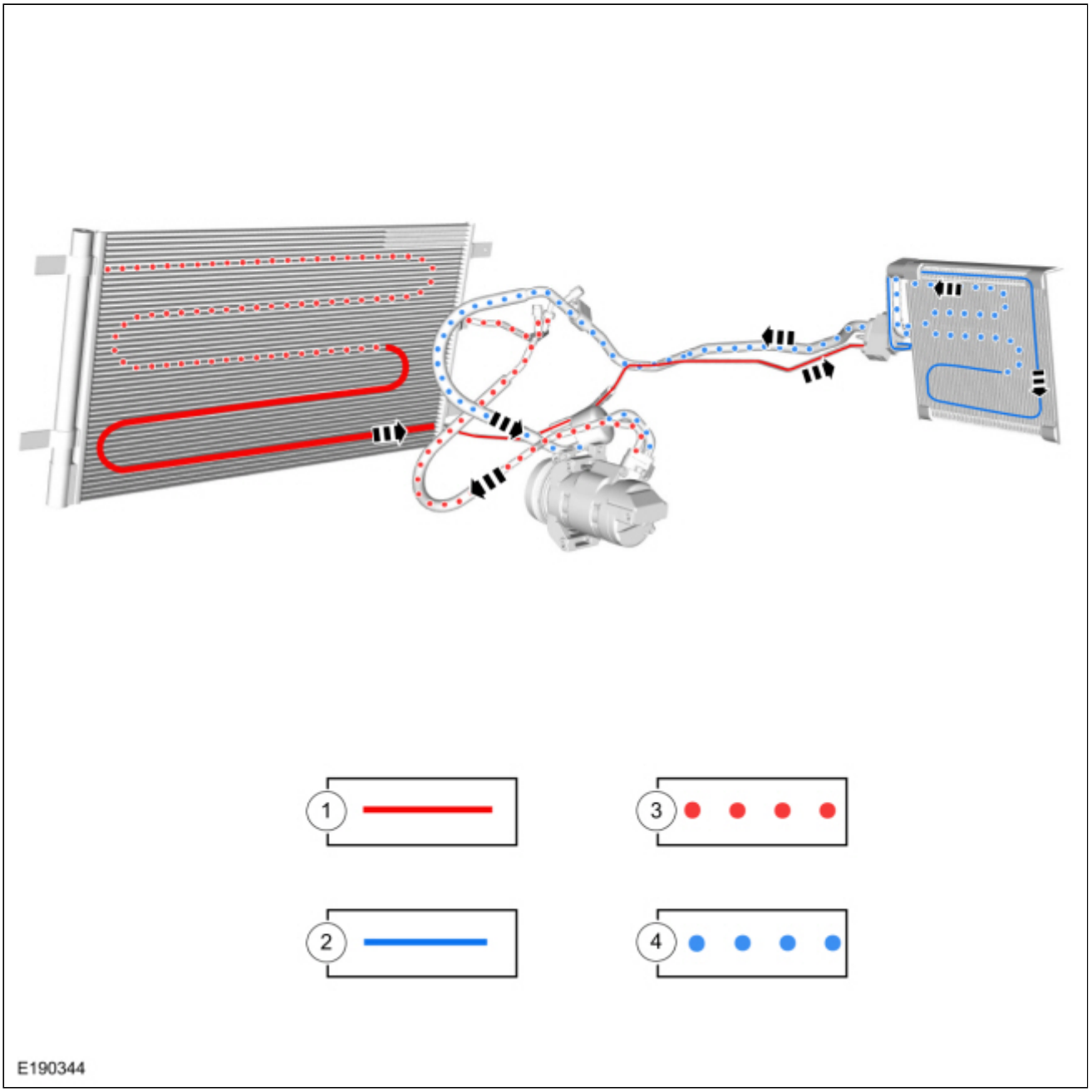
Broadcast Message	Originating Module	Message Purpose
HVAC request	FCIM	This message requests the A/C compressor to be engaged.
Evaporator temperature	FCIM	This message contains the evaporator temperature. The PCM uses the evaporator temperature to determine the A/C compressor output.

The Refrigerant Cycle

For information regarding basic HVAC system refrigerant operation, refer to the current Ford Web Based Technical Training courses. The following diagram shows the refrigerant system state in each component.

The following are characteristics of the EMTC system:

- The PCM controls the A/C clutch relay.
- The evaporator temperature sensor monitors the temperature of the air that has passed through the evaporator core and sends a signal to the PCM. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the PCM.
- The line pressure is monitored so that A/C compressor operation is interrupted if the system pressure becomes too high or too low.
- The A/C compressor relief valve opens and vents refrigerant to relieve unusually high system pressure.



Item	Description
1	High pressure liquid
2	Low pressure liquid
3	High pressure vapor
4	Low pressure vapor

Control System Logic

The EMTC system customer interface is in one or more locations depending on vehicle option content:

- FCIM
- FDIM (part of APIM generation 2 only)

When the customer directly inputs an A/C request into the FCIM, the module sends the request to the GWM over the MS-CAN. The GWM sends the request to the PCM over the HS-CAN1.

SYNC generation 2 only:

When the touchscreen FDIM or voice commands are used, and A/C is selected, the APIM sends the request

message over the HS-CAN3 to the GWM. The GWM sends the message to the FCIM over the MS-CAN and the GWM sends the A/C request to the PCM over the HS-CAN1.

The FCIM requires PMI when it is replaced.

A/C Request

When an A/C request is received by the PCM, the A/C clutch relay is engaged when all of the following conditions are met:

- Excessively high or low refrigerant pressure from the A/C pressure transducer is not detected.
- Ambient air temperature is above approximately °C.
- Evaporator temperature is above approximately 1°C.

The PCM monitors the discharge pressure measured by the A/C pressure transducer. The PCM interrupts A/C compressor operation in the event the A/C pressure transducer indicates high system discharge pressures. It is also used to sense low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM does not allow the A/C clutch to engage.

Heating and Ventilation

The heating and ventilation system:

- controls the temperature of the air inside the vehicle.
- reduces the relative humidity of the air inside the vehicle (during A/C compressor operation).
- delivers heated or cooled air to maintain the vehicle interior temperature and comfort level.

The heating and ventilation system uses a reheat method to provide conditioned air to the passenger compartment. Temperature blending is controlled by the temperature doors, which regulate the amount of air that flows through and around the heater core, where it is then mixed and distributed. All airflow from the blower motor passes through the A/C evaporator core.

Air Handling

There are 3 door actuators that control the air flow into the passenger compartment:

- Air distribution
- Air inlet
- Temperature

All of the door actuators contain a reversible electric motor and a potentiometer. The potentiometer circuit consists of a 5-volt reference signal connected to one end of a variable resistor, and a signal ground connected to the other. A signal circuit is connected to a contact wiper, which is driven along the variable resistor by the actuator shaft. The signal to the FCIM from the contact wiper indicates the actuator door position. The FCIM powers the actuator motors to move the doors to the desired positions. The desired door positions are calculated by the FCIM based on the requested temperature and ambient air temperature.

When an airflow mode, desired temperature, fresh air, or recirculation mode is selected, the FCIM moves the actuator motor in the desired direction.

The FCIM sends a PWM signal to the blower motor speed control to regulate the blower speed as necessary. The blower motor speed control provides variable ground feed for the blower motor based on the input from the FCIM. A delay function provides a gradual increase or decrease in blower motor speed under all conditions.

OFF

When OFF is selected:

- the recirculated air request button is disabled.
- the air inlet door closes, preventing outside air and allowing only recirculated air.
- the A/C request button is disabled.
- the blower motor is off.

MAX A/C

When MAX A/C is selected:

- the air inlet door closes, preventing outside air and allowing only recirculated air.
- the recirculated air indicator is illuminated (recirculated air forced on).
- the air distribution doors operate simultaneously to direct airflow to the instrument panel registers.
- the temperature door moves to the full cool position. The air temperature is adjustable.
- the A/C button is illuminated.

- the A/C compressor operates if the outside temperature is above approximately °C.
- the blower motor is commanded to the highest speed, but can be manually adjusted if desired.

PANEL

When PANEL mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the instrument panel registers.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

PANEL/FLOOR

When PANEL/FLOOR mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct is present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

FLOOR

When FLOOR mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct is present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

FLOOR/DEFROST

When FLOOR/DEFROST mode is selected:

- the recirculated air request button is enabled. If the recirculated air request button is selected (indicator on), the air inlet door closes, preventing outside air from entering the passenger compartment. If the recirculated air request button is not selected (indicator off), the air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct is present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C button (indicator on) can the airflow temperature be cooled below the outside air temperature.
- the blower motor is on and the speed is adjustable.

DEFROST

When DEFROST mode is selected:

- the recirculated air request button is disabled. The air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct is present.
- the A/C is turned on in defrost mode. The A/C compressor operates as long as the outside temperature is above approximately °C.
- blended air temperature is available.
- the blower motor is on and the speed is adjustable.

MAX DEFROST

When MAX DEFROST mode is selected:

- the recirculated air request button is disabled. The air inlet door opens, allowing only outside air into the passenger compartment.
- the air distribution doors operate simultaneously to direct airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct is present.
- the A/C is turned on in defrost mode. The A/C compressor operates as long as the outside temperature is above approximately °C.
- the temperature is set to the highest setting and is **not** adjustable.
- the fan is set to the highest speed and is **not** adjustable.

Remote Start

Remote start is an optional feature. In addition to being able to start the vehicle remotely, the remote start feature also utilizes other vehicle systems to increase the level of comfort to the vehicle occupants upon entering the vehicle. Additional information on the remote start feature and the other vehicle systems, refer to the Owner's Literature.

When the factory remote start feature is used, the EMTC system runs at the setting it was set to when the vehicle was last turned off. You cannot adjust the climate control system during remote start operation. Turn the ignition on to return the system to its previous settings.

Component Description

FCIM - Electronic Manual Temperature Control (EMTC)

The EMTC system uses the FCIM as the HVAC control module. The FCIM also controls the outputs for rear window defrost and climate controlled seats. For details on the FCIM communication, refer to Control System Logic in this section.

The FCIM utilizes a Field-Effect Transistor (FET) protective circuit strategy for its actuator outputs. Output load (current level) is monitored for excessive current (typically short circuits) and is shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A short circuit DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the Field-Effect Transistor (FET) circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (Field-Effect Transistor (FET) protection) and the circuit is still shorted, the Field-Effect Transistor (FET) protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. The Field-Effect Transistor (FET) protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the Field-Effect Transistor (FET) and the ability of the Field-Effect Transistor (FET) to withstand it. A module lifetime level of fault events is established based upon the durability of the Field-Effect Transistor (FET). If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the short circuit DTC that was stored on the first failure cannot be cleared by a command to clear the Diagnostic Trouble Codes (DTCs). The module does not allow the DTC to be cleared or the circuit to be restored to normal operation until a successful self-test proves that the fault has been repaired. After the self-test has successfully completed (no on-demand Diagnostic Trouble Codes (DTCs) present), DTC U1000:00 and the associated DTC (the DTC related to the shorted circuit) automatically clears and the circuit function returns.

When each level is reached, the DTC associated with the short circuit sets along with DTC U1000:00. These Diagnostic Trouble Codes (DTCs) can be cleared using the diagnostic scan tool. The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then Diagnostic Trouble Codes (DTCs) U1000:00 and U3000:49 set along with the associated short circuit DTC. DTC U3000:49 cannot be cleared and a new module must be installed after the repair.

The FCIM requires PMI when it is replaced.

Ambient Air Temperature (AAT) Sensor

The Ambient Air Temperature (AAT) sensor is an input to the PCM. If the outside air temperature is below approximately 0°C (32°F), the PCM does not allow the A/C compressor clutch to engage.

Evaporator Core

The evaporator core is an aluminum plate/fin type and is located in the heater core and evaporator core housing. A mixture of liquid refrigerant and oil enters the bottom of the evaporator through the evaporator inlet tube and continues out of the evaporator through the evaporator outlet tube as a vapor. During A/C compressor operation, airflow from the blower motor is cooled and dehumidified as it flows through the evaporator fins.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer it to air passing through the heater core.

Heater Core and Evaporator Core Housing

The heater core and evaporator core housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is then directed through or around the heater core by the temperature door(s). After passing through the heater core, the airflow is distributed to the selected outlet by the airflow mode doors.

In-Vehicle Temperature And Humidity Sensor

The in-vehicle temperature and humidity sensor contains a thermistor and a sensing element which separately measures the in-vehicle air temperature and the humidity, then sends those readings to the FCIM. The in-vehicle temperature and humidity sensor has an electric fan within the sensor that draws in-vehicle air across the two sensing elements. The FCIM may adjust the air inlet door based on the in-vehicle temperature and humidity sensor information to maintain the desired humidity of the passenger cabin air.

Air Discharge Temperature Sensors

There are 2 air discharge temperature sensors in the EMTC system:

- Driver side footwell air discharge temperature sensor
- Driver side center register air discharge temperature sensor

The air discharge temperature sensors contain a thermistor and are inputs to the FCIM. The sensors vary their resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The FCIM uses the sensor information to maintain the desired temperature of the passenger cabin air.

Defrost Vent/Register Door Actuator

The defrost vent/register door actuator contains a reversible electric motor and a potentiometer. The potentiometer allows the FCIM to monitor the position of the airflow mode door.

Air Inlet Door Actuator

The air inlet door actuator contains a reversible electric motor and a potentiometer. The potentiometer allows the FCIM to monitor the position of the airflow mode door. The FCIM drives the actuator motor in the direction necessary to move the door to the position set by the recirculation button and when the MAX A/C, Defrost or MAX Defrost buttons are selected.

Temperature Door Actuator

The EMTC system has one temperature door actuator located on the top of the heater core and evaporator core housing. The temperature door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the FCIM to monitor the position of the temperature door.

Evaporator Temperature Sensor

The evaporator temperature sensor contains a thermistor. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The evaporator temperature sensor is an input to the FCIM and the information is relayed to the PCM over the CAN. If the evaporator temperature is below approximately 1°C (33.8°F), the PCM does not allow the A/C compressor to operate.

A/C Pressure Transducer

The PCM monitors the discharge pressure measured by the A/C pressure transducer. As the refrigerant pressure changes, the resistance of the A/C pressure transducer changes. It is not necessary to recover the refrigerant before removing the A/C pressure transducer.

Condenser

The A/C condenser is an aluminum fin-and-tube design heat exchanger. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat, and condenses gas to liquid refrigerant as it is cooled.

Receiver Drier

The receiver drier stores high-pressure liquid. The desiccant bag mounted inside the receiver drier removes any retained moisture from the refrigerant. The receiver drier desiccant bag is a separate component and can be removed and installed separately from the condenser.

Copyright © 2016 Ford Motor Company

Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC)

DTC Chart: Front Controls Interface Module (FCIM) - Electronic Manual Temperature Control (EMTC)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Network Diagnostic Trouble Codes (DTCs) (U-codes) are often a result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle repair procedures, such as module reprogramming, often set network Diagnostic Trouble Codes (DTCs). Replacing a module to resolve a network DTC is unlikely to resolve the concern. To prevent repeat network DTC concerns, inspect all network wiring, especially connectors. Test the vehicle battery.
REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
and REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

FCIM - Electronic Manual Temperature Control (EMTC) DTC CHART

DTC	Description	Action
B105A:12	Cabin Temperature Sensor Fan: Circuit Short To Battery	GO to Pinpoint Test O
B105A:14	Cabin Temperature Sensor Fan: Circuit Short To Ground or Open	GO to Pinpoint Test O
B1081:07	Left Temperature Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new temperature door actuator. RHD refer to REFER to: Temperature Door Actuator RH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). LHD refer to REFER to: Temperature Door Actuator RH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation).
B1081:11	Left Temperature Damper Motor: Circuit Short To Ground	GO to Pinpoint Test I
B1081:12	Left Temperature Damper Motor: Circuit Short To Battery	GO to Pinpoint Test I
B1081:13	Left Temperature Damper Motor: Circuit Open	GO to Pinpoint Test I
B1083:07	Recirculation Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new air inlet door actuator. REFER to: Air Inlet Door Actuator (412-00 Climate Control System - General Information, Removal and Installation).
B1083:11	Recirculation Damper Motor: Circuit Short To Ground	GO to Pinpoint Test D
B1083:12	Recirculation Damper Motor: Circuit Short To	GO to Pinpoint Test D

	Battery	
B1083:13	Recirculation Damper Motor: Circuit Open	GO to Pinpoint Test D
B1086:07	Air Distribution Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new air distribution door actuator. RHD refer to REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). LHD refer to REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation).
B1086:11	Air Distribution Damper Motor: Circuit Short To Ground	GO to Pinpoint Test E
B1086:12	Air Distribution Damper Motor: Circuit Short To Battery	GO to Pinpoint Test E
B1086:13	Air Distribution Damper Motor: Circuit Open	GO to Pinpoint Test E
B10AF:11	Blower Fan Relay: Circuit Short To Ground	GO to Pinpoint Test J
B10AF:15	Blower Fan Relay: Circuit Short To Battery or Open	• For an inoperative blower motor, GO to Pinpoint Test J • For all other blower motor symptoms, GO to Pinpoint Test K
B10B3:11	Right Panel Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test P
B10B3:15	Right Panel Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test P
B10B4:11	Right Floor Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test P
B10B4:15	Right Floor Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test P
B10B5:11	Left Panel Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test P
B10B5:15	Left Panel Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test P
B10B6:11	Left Floor Air Discharge Temperature: Circuit Short To	GO to Pinpoint Test P

	Ground	
B10B6:15	Left Floor Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test P
B10B8:63	Push Buttons: Circuit / Component Protection Time-Out	This DTC sets when the buttons are held too long. ATTEMPT to clean buttons. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
B10B9:12	Blower Control: Circuit Short To Battery	GO to Pinpoint Test J
B10B9:14	Blower Control: Circuit Short To Ground or Open	• For an inoperative blower motor, GO to Pinpoint Test J • For all other blower motor symptoms, GO to Pinpoint Test K
B11E5:11	Left HVAC Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test I
B11E5:15	Left HVAC Damper Position Sensor: Circuit Short To Battery or Ground	GO to Pinpoint Test I
B11E7:11	Air Distribution Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test E
B11E7:15	Air Distribution Damper Position Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test E
B11F0:11	Air Intake Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test D
B11F0:15	Air Intake Damper Position Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test D
B1A61:11	Cabin Temperature Sensor: Circuit Short To Ground	GO to Pinpoint Test O
B1A61:15	Cabin Temperature Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test O
B1A69:11	Humidity Sensor: Circuit Short To Ground	GO to Pinpoint Test O
B1A69:15	Humidity Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test O
B1B71:11	Evaporator Temperature Sensor: Circuit Short To Ground	GO to Pinpoint Test L
B1B71:15	Evaporator	GO to Pinpoint Test L

	Temperature Sensor: Circuit Short To Battery or Open	
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	GO to Pinpoint Test M
C1B14:12	Sensor Supply Voltage A: Circuit Short To Battery	GO to Pinpoint Test M
All Other FCIM Diagnostic Trouble Codes (DTCs) not listed in this chart	—	Refer to the appropriate section in Group 415 for the procedure.

DTC Chart: Powertrain Control Module (PCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Powertrain Control Module (PCM) DTC Chart

DTC	Description	Action
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	GO to Pinpoint Test A
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	GO to Pinpoint Test A
P0645	A/C Clutch Relay Control Circuit	GO to Pinpoint Test B
P0646	A/C Clutch Relay Control Circuit Low	GO to Pinpoint Test B
P0647	A/C Clutch Relay Control Circuit High	GO to Pinpoint Test B
P1464	A/C Demand Out Of Self Test Range	If the HVAC selector was not powered off, POWER the HVAC off, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, GO to Pinpoint Test H
P193E	A/C Clutch Request Signal	GO to Pinpoint Test N
All Other PCM Diagnostic Trouble Codes (DTCs)	—	• For 2.5L Duratec-HE (122kW/165PS) - MI4 PCM DTC Chart, REFER to: Electronic Engine Controls (303-14A) . • For 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - PumaPCM DTC Chart, REFER to: Electronic Engine Controls (303-14B) . • For 3.2L Duratorq-TDCi (148kW/200PS) - Puma PCM DTC Chart, REFER to: Electronic Engine Controls (303-14C) .

Symptom Chart(s)

Symptom Chart: Climate Control - Electronic Manual Temperature Control (EMTC)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
A module does not communicate with the diagnostic scan tool	• Fuse(s) • Wiring, terminals or connectors • FCIM	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Unable To Duplicate The Customer Concern And No Diagnostic Trouble Codes (DTCs) Present	Refer to Pinpoint Test	GO to Pinpoint Test C
Reduced outlet airflow	Plugged cabin air filter	INSPECT the cabin air filter. REFER to: Cabin Air Filter (412-00 Climate Control System - General Information, Removal and Installation). If OK, DIAGNOSE for low refrigerant charge, A/C always commanded on or blower motor not operating correctly.
	Improper refrigerant level	CARRY OUT the refrigerant system tests. REFER to: Refrigerant System Tests - Manual Transmission (412-00 Climate Control System - General Information, General Procedures). If refrigerant charge is OK, GO to Pinpoint Test H
	Blower motor	GO to Pinpoint Test K
The air inlet door is inoperative	Refer to Pinpoint Test	GO to Pinpoint Test D
Incorrect or erratic direction of airflow from outlets	Refer to Pinpoint Test	GO to Pinpoint Test E
Insufficient, erratic or no heat	Refer to Pinpoint Test	GO to Pinpoint Test F
The A/C is inoperative	Refer to Pinpoint Test	GO to Pinpoint Test G
The A/C is always on — A/C mode always commanded ON	Refer to Pinpoint Test	GO to Pinpoint Test H
Temperature control is inoperative/does not operate correctly	Refer to Pinpoint Test	GO to Pinpoint Test I
The blower motor is inoperative	Refer to Pinpoint Test	GO to Pinpoint Test J
The blower motor does not operate correctly	Refer to Pinpoint Test	GO to Pinpoint Test K
Insufficient A/C cooling	Improper refrigerant level	CARRY OUT the refrigerant system tests. REFER to: Refrigerant System Tests - Manual Transmission (412-00 Climate Control System - General Information, General Procedures). If OK, DIAGNOSE for a temperature door actuator not operating correctly.
	Temperature door actuator	GO to Pinpoint Test I
A/C pressure relief valve discharging	A/C pressure relief valve	• CHECK the high side system pressure. REFER to: Specifications (412-00 Climate Control System - General Information, Specifications). If the pressure is below the A/C pressure relief valve

		open pressure, INSTALL a new A/C Compressor. • REFER to: Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4 (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
	High system pressure	CHECK the high side system pressure. REFER to: Specifications (412-00 Climate Control System - General Information, Specifications). If the system pressure is above the A/C pressure relief valve open pressure, REPAIR the A/C system for a restriction.
Climate control does not operate only when remote start is used	• IPC information display settings • Non-Ford approved remote start system installed	• VERIFY Remote Start - Message Center Set To Auto, or Remote Start - Message Center Set To Last User Settings. REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). • VERIFY module communications network operation. DIAGNOSE Diagnostic Trouble Codes (DTCs) if present.

Symptom Chart: Noise, Vibration, and Harshness (NVH)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
Noisy A/C compressor	A/C compressor bearing worn	• INSPECT the A/C compressor bearing for roughness. If bearing roughness is found, INSTALL a new A/C Compressor. • REFER to: Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4 (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
Excessive hissing from the plenum when the A/C is on	Incorrect A/C refrigerant level	CHECK the A/C refrigerant level. REFER to: Refrigerant System Tests - Manual Transmission (412-00 Climate Control System - General Information, General Procedures).

Pinpoint Test(s)

P0532, P0533

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal operation and Fault Conditions

The A/C pressure transducer receives a ground from the PCM. A 5-volt reference voltage is supplied to the A/C pressure transducer from the PCM. The A/C pressure transducer then sends a voltage to the PCM to indicate the A/C pressure.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low	This DTC sets if the feedback voltage is less than 0.26 volt for at least 2 seconds and the ambient air temperature is greater than 0°C (32°F).
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High	This DTC sets if the feedback voltage is greater than 4.95 volts for at least 2 seconds and the ambient air temperature is greater than 0°C (32°F).

Possible Sources

- Wiring, terminals or connectors
- A/C pressure transducer
- PCM

Visual Inspection and Diagnostic Pre-checks

- Inspect for loose or corroded PCM and A/C pressure transducer connections.

PINPOINT TEST A : P0532, P0533

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 COMPARE THE PCM (POWERTRAIN CONTROL MODULE) PRESSURE SENSOR (ACP_PRESS) PID (PARAMETER IDENTIFICATION) WITH THE MANIFOLD GAUGE SET READINGS

- Allow the A/C system to stabilize to the outside ambient temperature.
- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the PCM ACP_PRESS PID.

Are the pressure values of the manifold gauge set and the ACP_PRESS PCM PID within ± 103 kPa (15 psi)?

Yes	IGNORE the Diagnostic Trouble Codes (DTCs). REFER to the Symptom Chart in this section.
No	GO to A2

A2 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect PCM, 2.2L Duratorq-TDCi (Puma) Diesel C1232A, 3.2L Duratorq-TDCi (Puma) DieselC1232B, 2.5L Duratec-HEC175.
- Disconnect A/C pressure transducer C1260.

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1260-1	V	Ground
C1260-2	V	Ground
C1260-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A3

A3 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	Ground
C1260-2	Ω	Ground
C1260-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A4
No	REPAIR the circuit.

A4 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR AN OPEN

- Measure:

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C175-40
C1260-2	Ω	C175-16
C1260-3	Ω	C175-28

2.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C1232-23
C1260-2		C1232-50

	Ω	
C1260-3	Ω	C1232-32

3.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C1232-23
C1260-2	Ω	C1232-50
C1260-3	Ω	C1232-32

Are the resistances less than 3 ohms?

Yes	GO to A5
No	REPAIR the circuit.

A5 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C1260-2
C1260-1	Ω	C1260-3
C1260-2	Ω	C1260-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new A/C pressure transducer. REFER to: Air Conditioning (A/C) Pressure Transducer (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to A6
No	REPAIR the circuits.

A6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM.

	For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCi (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCi (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

P0645, P0646, P0647

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Voltage is provided to the A/C clutch relay. When A/C is requested and A/C line pressures allow, a ground is provided to the A/C clutch relay coil from the PCM, energizing the A/C clutch relay.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0645	A/C Clutch Relay Control Circuit	This DTC sets when the PCM grounds the relay circuit and more voltage than expected is detected on the relay circuit. This DTC also sets when the relay circuit is off and no voltage is detected on the relay circuit. The PCM expects to detect voltage coming through the relay coil to the relay circuit when it is not grounding it.
P0646	A/C Clutch Relay Control Circuit Low	This DTC sets when the relay circuit is off and no voltage is detected on the relay circuit. The PCM expects to detect voltage coming through the relay coil to the relay circuit when it is not grounding it.
P0647	A/C Clutch Relay Control Circuit High	This DTC sets when the PCM grounds the relay circuit and more voltage than expected is detected on the relay circuit.

Possible Sources

- Wiring, terminals or connectors
- A/C clutch relay
- PCM

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuses 24 (10A).

PINPOINT TEST B : P0645, P0646, P0647

NOTICE: Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.
B1 CHECK THE VOLTAGE TO THE A/C (AIR CONDITIONING) CLUTCH RELAY VOLTAGE SUPPLY CIRCUIT

- Ignition OFF.
- Disconnect A/C clutch relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 1		Ground

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 3		Ground

Are the voltages greater than 11 volts?

Yes	GO to B2
No	VERIFY BJB fuse 24 (10A) are OK. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. If OK, REPAIR the circuit.

B2 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Carry out the component test on the A/C clutch relay.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the relay pass the component test?

Yes	GO to B3
No	INSTALL a new A/C clutch relay.

B3 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect A/C clutch relay.
- Disconnect PCM, C1752.5L, 2.2LC1232A, 3.2L C1232B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B4

B4 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY CONTROL CIRCUIT FOR A SHORT TO

GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B5
No	REPAIR the circuit.

B5 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY CONTROL CIRCUIT FOR AN OPEN

- Measure:

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	C175-25

2.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	C1232-49

3.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	C1232-49

Is the resistance less than 3 ohms?

Yes	GO to B6
No	REPAIR the circuit.

B6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary

- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Unable To Duplicate The Customer Concern And No Diagnostic Trouble Codes (DTCs) Present

This diagnostic procedure tests the functions of the HVAC system and identifies the correct HVAC symptom pinpoint test.

Normal Operation and Fault Conditions

System Operation
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

PINPOINT TEST C : UNABLE TO DUPLICATE THE CUSTOMER CONCERN AND NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT

C1 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform PCM self-test.

Are any climate control related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the PCM DTC chart in this section.
No	GO to C2

C2 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the FCIM DTC chart in this section.
No	GO to C3

C3 CHECK THE BLOWER MOTOR OPERATION

- Ignition ON.
- Select panel mode.
- Observe blower motor operation and select each blower motor speed.

Does the blower motor operate in all ranges?

Yes	GO to C4
No	If the blower motor does not operate in any setting, GO to Pinpoint Test J If the blower motor does not correctly change speeds or shut off, GO to Pinpoint Test K

C4 CHECK AIRFLOW OPERATION

- Select the highest blower motor setting.
- While observing the airflow, select each of the airflow positions (panel, panel/floor, floor, floor/defrost, defrost).

Is the airflow directed to the correct outlets?

Yes	GO to C5
No	GO to Pinpoint Test E

C5 VERIFY TEMPERATURE CONTROL OPERATION

- Start the vehicle and allow it to reach normal operating temperature.
- With the A/C off, select panel mode.
- Change the temperature setting from the coldest to the warmest and back to the coldest.

Does the temperature change between very warm to cool?

Yes	GO to C6
No	If the temperature does not get very warm, GO to Pinpoint Test F If the temperature does not change at all, GO to Pinpoint Test I

C6 VERIFY THE AIR CONDITIONING COMPRESSOR DOES NOT ENGAGE WITH A/C (AIR CONDITIONING) OFF

- With the engine running and the A/C off, select panel mode.
- Select the coldest temperature setting.

Is the outlet temperature close to ambient air temperature?

Yes	GO to C7
No	If the temperature is warmer than ambient air temperature, GO to Pinpoint Test I If the outlet temperature is significantly colder than ambient air temperature and the A/C compressor clutch is engaged, GO to Pinpoint Test H

C7 VERIFY THE A/C (AIR CONDITIONING) COMPRESSOR IS OPERATIONAL IN THE A/C (AIR CONDITIONING) MODE

- Make sure the ambient air temperature is above 0°C (32°F).
- With the engine running, select panel mode.
- Press the A/C button (indicator on).

Is the A/C compressor operational when the panel and A/C button (indicator on) is pressed?

Yes	GO to C8
No	GO to Pinpoint Test G

C8 CHECK THE RECIRCULATED AIR OPERATION

- With the engine running, press the recirculated air button (indicator off).
- Select panel mode.
- Select the highest blower motor setting.
- Observe airflow noise.
- Press the recirculated air button (indicator on).

Does the airflow noise increase when the recirculated air mode is selected (indicator on)?

Yes	GO to C9
No	GO to Pinpoint Test D

C9 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) LEFT DISCHARGE FLOOR TEMPERATURE (LDFTEMP) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the LDFTEMP PID.

Is the temperature coming out of the driver footwell vent similar to the PID?

Yes	GO to C10
No	GO to Pinpoint Test P

C10 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) LEFT DISCHARGE PANEL TEMPERATURE (LDPT) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the LDPT PID.

Is the temperature coming out of the driver side register similar to the PID?

Yes	GO to C12
No	GO to Pinpoint Test P

C11 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) DISCHARGE AIR TEMPERATURE, RIGHT PANEL (AIRTEMP_RP) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the AIRTEMP_RP PID.

Is the temperature coming out of the passenger side register similar to the PID?

Yes	GO to C12
No	GO to Pinpoint Test P

C12 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) INTERIOR TEMPERATURE SENSOR (INT_TEMP) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a scan tool view the FCIM Parameter Identifications (PIDs).
- Monitor the INT_TEMP PID.

Is the air temperature at the cabin temperature sensor similar to the PID?

Yes	The system is operating correctly.
No	GO to Pinpoint Test O

The Air Inlet Door Is Inoperative

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

To rotate the air inlet door actuator, the FCIM supplies voltage and ground to the air inlet door actuator through the door actuator motor circuits. To reverse the air inlet door actuator rotation, the FCIM reverses the voltage and ground circuits. The air inlet door actuator feedback resistors are supplied a ground from the FCIM by the air inlet door actuator return circuits and a 5-volt reference voltage on the air inlet door actuator reference circuits. The FCIM uses the actuator feedback resistor wiper arm position and the voltage on the air distribution door actuator feedback circuits to determine the air inlet door actuator position.

During an actuator calibration cycle, the FCIM drives the air inlet door until the door reaches both internal stops in the FCIM case. If the air inlet door is temporarily obstructed or binding during a calibration cycle, the FCIM may interpret this as the actual end of travel for the door. When this condition occurs and the FCIM commands the actuator to its end of travel, the air intake may not be from the expected source.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1083:11	Recirculation Damper Motor: Circuit Short To Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1083:12	Recirculation Damper Motor: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1083:13	Recirculation Damper Motor: Circuit Open	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor cannot move.
B11F0:11	Air Intake Damper Position Sensor: Circuit Short to Ground	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating a short to ground.
B11F0:15	Air Intake Damper Position Sensor: Circuit Short to Battery or Open	This DTC sets when the module senses greater than 5 volts on the actuator feedback circuit, indicating a short to voltage. This DTC sets when the module senses no voltage on the actuator feedback circuit, indicating an open circuit.

Possible Sources

- Wiring, terminals or connectors
- Air inlet door actuator
- Air inlet door binding or stuck
- FCIM

PINPOINT TEST D : THE AIR INLET DOOR IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A.
- Disconnect FCIM C2402B.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost vent/register door actuatorC232.
- Disconnect In vehicle temperature and humidity sensor C2247.
- Disconnect Air inlet door actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	V	Ground
C282-5	V	Ground
C282-4	V	Ground
C282-3	V	Ground
C282-7	V	Ground

Is there any voltage present?

Yes	REPAIR the circuit.
No	GO to D2

D2 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	Ω	Ground
C282-5	Ω	Ground
C282-4	Ω	Ground
C282-3	Ω	Ground
C282-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to D3
No	REPAIR the circuit.

D3 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	Ω	C2402A-2
C282-5	Ω	C2402A-16

C282-4	Ω	C2402A-3
C282-3	Ω	C2402A-25
C282-7	Ω	C2402A-24

Are the resistances less than 3 ohms?

Yes	GO to D4
No	REPAIR the circuit.

D4 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	Ω	C282-5
C282-6	Ω	C282-4
C282-6	Ω	C282-3
C282-6	Ω	C282-7
C282-5	Ω	C282-4
C282-5	Ω	C282-3
C282-5	Ω	C282-7
C282-4	Ω	C282-3
C282-4	Ω	C282-7
C282-3	Ω	C282-7

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new air inlet door actuator. REFER to: Air Inlet Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to D5
No	REPAIR the circuit.

D5 CHECK FOR CORRECT FRONT CONTROLS INTERFACE MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the

	appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Incorrect Or Erratic Direction Of Airflow From Outlets

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

To rotate the air distribution door actuator, the FCIM supplies voltage and ground to the air distribution door actuator through the door actuator motor circuits. To reverse the air distribution door actuator rotation, the FCIM reverses the voltage and ground circuits. The air distribution door actuator feedback resistors are supplied a ground from the FCIM by the air distribution door actuator return circuits and a 5-volt reference voltage on the air distribution door actuator reference circuits. The FCIM uses the actuator feedback resistor wiper arm position and the voltage on the air distribution door actuator feedback circuits to determine the air distribution door actuator position.

During an actuator calibration cycle, the FCIM drives the air distribution door until the door reaches both internal stops in the FCIM case. If the air distribution door is temporarily obstructed or binding during a calibration cycle, the FCIM may interpret this as the actual end of travel for the door. When this condition occurs and the FCIM commands the actuator to its end of travel, the airflow may not be from the expected outlets.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1086:11	Air Distribution Damper Motor: Circuit Short to Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1086:12	Air Distribution Damper Motor: Circuit Short to Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1086:13	Air Distribution Damper Motor: Circuit Open	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor cannot move.
B11E7:11	Air Distribution Damper Position Sensor: Circuit Short to Ground	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating a short to ground.
B11E7:15	Air Distribution Damper Position Sensor: Circuit Short to Battery or Open	This DTCsets when the module senses greater than 4 volts on the actuator feedback circuit, indicating an open circuit or a short to voltage.

Possible Sources

- Wiring, terminals or connectors
- Air distribution door actuator
- Air distribution door binding or stuck
- FCIM

PINPOINT TEST E : INCORRECT OR ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
E1 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE
• Ignition OFF. • Disconnect FCIM C2402A.

- Disconnect FCIM C2402B.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost vent/register door actuatorC232.
- Disconnect In vehicle temperature and humidity sensor C2247.
- Disconnect Air inlet door actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-7	V	Ground
C232-6	V	Ground
C232-4	V	Ground
C232-5	V	Ground
C232-3	V	Ground

Is there any voltage present?

Yes	REPAIR the circuit.
No	GO to E2

E2 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-7	Ω	Ground
C232-6	Ω	Ground
C232-4	Ω	Ground
C232-5	Ω	Ground
C232-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to E3
No	REPAIR the circuit.

E3 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-3	Ω	C2402A-20
C232-6	Ω	C2402A-2
C232-4	Ω	C2402A-3
C232-5	Ω	C2402A-22

C232-7	Ω	C2402A-21

Are the resistances less than 3 ohms?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-7	Ω	C232-6
C232-7	Ω	C232-4
C232-7	Ω	C232-5
C232-7	Ω	C232-3
C232-6	Ω	C232-4
C232-6	Ω	C232-5
C232-6	Ω	C232-3
C232-4	Ω	C232-5
C232-4	Ω	C232-3
C232-5	Ω	C232-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new air distribution door actuator, For RHD, refer to REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). For LHD, refer to REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to E5
No	REPAIR the circuit.

E5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the

	appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Insufficient, Erratic Or No Heat

Normal Operation and Fault Conditions

When the engine is at operating temperature hot coolant flows from the electric motor through the heater core and back to the electric motor. Correct coolant temperatures are critical for good heater performance.

Possible Sources

- Wiring, terminals or connectors
- Temperature blend door actuator
- Air trapped in the coolant system
- Heater core

Visual Inspection and Diagnostic Pre-checks

- Inspect for low engine coolant level.

PINPOINT TEST F : INSUFFICIENT, ERRATIC OR NO HEAT

F1 CHECK FOR CORRECT ENGINE COOLANT LEVEL

- Ignition OFF.
- Check the engine coolant level.

Is the engine coolant at the correct level as indicated on the engine coolant recovery reservoir?

Yes	GO to F3
No	GO to F2

F2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS

- Pressure test the cooling system for leaks. Refer to the appropriate section in Group 303 for the procedure..

Does the engine cooling system leak?

Yes	REPAIR the engine coolant leak. Refer to the appropriate section in Group 303 for the procedure. TEST the system for normal operation.
No	FILL and BLEED the cooling system. Refer to the appropriate section in Group 303 for the procedure. After filling and bleeding the cooling system, GO to F3

F3 CHECK FOR COOLANT FLOW TO THE HEATER CORE

- Run the motor until it reaches normal operating temperature. Select the floor position on the control assembly. Set the temperature control to full warm and the blower to the lowest setting.
- Increase engine speed to 3,500 RPM and hold for 30 seconds.
- Allow the engine to idle for 30 seconds.
- Using a suitable temperature measuring device, check the heater core inlet hose to see if it is hot.

Is the heater core inlet hose hot?

Yes	GO to F4
No	BLEED the cooling system per the cooling system draining and vacuum filling general procedure. Refer to the appropriate section in Group 303 for the procedure. After bleeding the cooling system, GO to F4

F4 CHECK FOR A PLUGGED OR RESTRICTED HEATER CORE	
• Using a suitable temperature measuring device, measure the heater core outlet hose temperature. **Is the heater core outlet hose temperature similar to the inlet hose temperature (within approximately 6-17°C [10-30°F])?**	
Yes	DIAGNOSE for a temperature door actuator not operating correctly. For inadequate temperature, GO to Pinpoint Test I
No	INSTALL a new heater core. REFER to: Heater Core (412-00 Climate Control System - General Information, Removal and Installation).

The A/C Is Inoperative

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Control System Logic
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- A/C pressure transducer
- Evaporator temperature sensor
- FCIM
- PCM
- Electric cooling fan

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuses 22 (10A).

PINPOINT TEST G : THE A/C (AIR CONDITIONING) IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.	
G1 CHECK THE A/C (AIR CONDITIONING) SYSTEM PRESSURE	
• Ignition OFF. • With the R-134a manifold gauge set connected, check the A/C system pressure. **Is the A/C system pressure above 290 kPa (42 psi)?**	
Yes	GO to G2
No	CHECK the A/C system for leaks. REFER to: Electronic Leak Detection (412-00 Climate Control System - General Information, General Procedures). REFER to: Fluorescent Dye Leak Detection (412-00 Climate Control System - General Information, General Procedures). After the leak is repaired, RECHARGE the A/C system. REFER to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00

	Climate Control System - General Information, General Procedures).

G2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the network test.

Do the FCIM and the PCM pass the network test?

Yes	GO to G3
No	DIAGNOSE the FCIM or PCM does not communicate with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

G3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) PRESSURE SENSOR (ACP_PRESS) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- With a manifold gauge set connected, compare the pressure readings of the manifold gauge set and the PCM ACP_PRESS PID.

Are the pressure values of the manifold gauge set and the ACP_PRESS PCM PID within ± 103 kPa (15 psi)?

Yes	GO to G4
No	INSTALL a new A/C pressure transducer. REFER to: Air Conditioning (A/C) Pressure Transducer (412-00 Climate Control System - General Information, Removal and Installation).

G4 ELECTRIC COOLING FAN FUNCTIONAL CHECK

- Ignition ON.
- Using a diagnostic scan tool, carry out the PCM KOEO self-test.

Does the electric cooling fan operate during the KOEO self-test?

Yes	GO to G5
No	DIAGNOSE the electric cooling fan operation. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. Section 3 Symptom Charts.

G5 COMPARE THE EVAPORATOR TEMPERATURE SENSOR TO THE PCM (POWERTRAIN CONTROL MODULE) AMBIENT AIR TEMPERATURE (AAT) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Allow the vehicle exterior and interior to stabilize to ambient temperature.
- Disconnect Evaporator Temperature Sensor C296.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1 (component side)	Ω	C296-2(component side)

- Compare the resistance values to the table below:

Ambient Temperature °C	Resistance ohms

-40°C	98,625 - 103,275 ohms
-20°C	28,640 - 29,600 ohms
°C	9695 - 9895 ohms
20°C	3675 - 3810 ohms
25°C	2950 - 3050 ohms
30°C	2370 - 2565 ohms
40°C	1565 - 1635 ohms

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AAT PID.

Are the temperature values similar?

Yes	GO to G6
No	INSTALL a new evaporator temperature sensor. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).

G6 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) A/C (AIR CONDITIONING) SWITCH (CC_SW_AC) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) ON

- Using a diagnostic scan tool, view FCIM Parameter Identifications (PIDs).
- Monitor the CC_SW_AC PID.

Does the PID display Active?

Yes	GO to G7
No	GO to G14

G7 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) ON

- Start the engine.
- Using a diagnostic scan tool, monitor the PCM AC_REQ PID.
- On the HVAC controls, select PANEL and then press the A/C button (indicator on).

Does the PID display Yes when the button is pressed?

Yes	GO to G8
No	GO to G14

G8 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) COMPRESSOR COMMANDED STATE (ACC_CMD) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) COMMANDED ON

- Using a diagnostic scan tool, activate the PCM ACC_CMD PID.

Does the A/C compressor turn on?

Yes	GO to G15
No	GO to G9

G9 CHECK THE VOLTAGE TO THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Ignition OFF.
- Disconnect the A/C clutch relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 1		Ground
A/C clutch relay socket 3		Ground

Are the voltages greater than 11 volts?

Yes	GO to G10
No	VERIFY BJB fuses 24 (10A) are OK. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. If OK, REPAIR the circuit.

G10 BYPASS THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Ignition OFF.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 3		A/C clutch relay socket 5

- Ignition ON.

Does the A/C compressor clutch engage?

Yes	REMOVE the fused jumper wire. INSTALL a new A/C clutch relay.
No	LEAVE the fused jumper wire installed. GO to G11

G11 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH FIELD COIL VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Disconnect A/C compressor clutch field coil C100.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C100-1		Ground

Is the voltage greater than 11 volts?

Yes	REMOVE the fused jumper wire. GO to G12
No	REMOVE the fused jumper wire. REPAIR the circuit.

G12 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH FIELD COIL GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C100-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to G13
No	REPAIR the circuit.

G13 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH AIR GAP

- Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley.
  REFER to: Air Conditioning (A/C) Clutch Air Gap Adjustment (412-00 Climate Control System - General Information, General Procedures).

Is the A/C compressor clutch air gap greater than 0.6 mm (0.0236 in)?

Yes	ADJUST the A/C compressor clutch air gap. REFER to: Air Conditioning (A/C) Clutch Air Gap Adjustment (412-00 Climate Control System - General Information, General Procedures).
No	INSTALL a new A/C compressor clutch field coil. REFER to: Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4 (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

G14 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

G15 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.

- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The A/C Is Always On - A/C Mode Always Commanded On

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Control System Logic
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1464	A/C Demand Out Of Self Test Range	This DTC sets when the PCM senses an A/C request during a PCM self-test.

Possible Sources

- A/C clutch relay
- Wiring, terminals or connectors
- PCM
- FCIM

PINPOINT TEST H : THE A/C (AIR CONDITIONING) IS ALWAYS ON - A/C (AIR CONDITIONING) MODE ALWAYS COMMANDED ON

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
H1 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Carry out the component test on the A/C clutch relay.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the relay pass the component test?

Yes	GO to H2
No	INSTALL a new A/C clutch relay.

H2 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH FIELD COIL VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect A/C compressor clutch field coil C100.
- Disconnect the A/C clutch relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C100-1		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to H3

H3 COMPARE THE EVAPORATOR TEMPERATURE SENSOR TO THE PCM (POWERTRAIN CONTROL MODULE) AMBIENT AIR TEMPERATURE (AAT) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Allow the vehicle exterior and interior to stabilize to ambient temperature.
- Disconnect Evaporator Temperature Sensor C296.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1(component side)	Ω	C296-2(component side)

- Compare the resistance values to the table below:

Ambient Temperature °C	Resistance ohms
-40°C	98,625 - 103,275 ohms
-20°C	28,640 - 29,600 ohms
°C	9695 - 9895 ohms
20°C	3675 - 3810 ohms
25°C	2950 - 3050 ohms
30°C	2370 - 2565 ohms
40°C	1565 - 1635 ohms

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).

- Monitor the AAT PID.

Are the temperature values similar?

Yes	GO to H4
No	INSTALL a new evaporator temperature sensor. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).

H4 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) A/C (AIR CONDITIONING) SWITCH STATUS (CC_SW_AC) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Using a diagnostic scan tool, view FCIM Parameter Identifications (PIDs).
- Monitor the CC_SW_AC PID.
- Select panel mode, press and release the A/C button (indicator off) on the FCIM controls.

Does the PID display Active when pressed and Inactive when released?

Yes	GO to H5
No	GO to H8

H5 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR (ACP_PRESS) PARAMETER IDENTIFICATION (PID)

- Using a diagnostic scan tool, view the PCM Parameter Identification (PIDs).
- With a manifold gauge set connected, compare the pressure readings of the manifold gauge set and the PCM Parameter Identification (PID) ACP_PRESS.

Are the pressure values of the manifold gauge set and the ACP_PRESS PCM PID within ± 103 kPa (15 psi)?

Yes	GO to H6
No	INSTALL a new A/C pressure transducer. REFER to: Air Conditioning (A/C) Pressure Transducer (412-00 Climate Control System - General Information, Removal and Installation).

H6 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) OFF

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AC_REQ PID.
- While in panel mode, release the A/C button (indicator off) on the FCIM controls.

Does the PID display No?

Yes	GO to H9
No	GO to H7

H7 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION) WITH FCIM (FRONT CONTROLS INTERFACE MODULE) DISCONNECTED

- Ignition OFF.
- Disconnect FCIM C2402A.
- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AC_REQ PID.

Does the PID display No?

Yes	GO to H9
No	GO to H8

H8 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

H9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, L a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Temperature Control Is Inoperative Or Does Not Operate Correctly

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Temperature Door Actuator,
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

During an actuator calibration cycle, the FCIM drives the temperature door until the door reaches both internal stops in the HVAC case. If the temperature door is temporarily obstructed or binding during a calibration cycle, the module may interpret this as the actual end of travel for the door. When this condition occurs and the module commands the actuator to its end of travel, the airflow may not be the expected temperature.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1082:11	Right Temperature Damper Motor: Circuit Short To Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1082:12	Right Temperature Damper Motor: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1082:13	Right Temperature Damper Motor: Open Circuit	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor can not move.
B11E6:11	Right HVAC Damper Position Sensor: Circuit Short to Ground	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating an open circuit or a short to ground.
B11E6:15	Right HVAC Damper Position Sensor: Circuit Short to Battery or Ground	This DTC sets when the module senses less than 1 volt, or greater than 5 volts on the actuator feedback circuit, indicating an open circuit, short to ground or short to voltage.

Possible Sources

- Wiring, terminals or connectors
- Temperature door actuator
- FCIM

PINPOINT TEST I : THE TEMPERATURE CONTROL IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK THE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A..
- Disconnect FCIM C2402B..
- Disconnect BCM fuse 21 (5A)..
- Disconnect In-vehicle temperature and humidity sensor C2247.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost Vent/Register Door Actuator C232.
- Disconnect Air Inlet Door Actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C2092-7	V	Ground
C2092-6	V	Ground
C2092-4	V	Ground
C2092-5	V	Ground
C2092-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to I2

I2 CHECK THE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2092-7	Ω	Ground
C2092-6	Ω	Ground
C2092-4	Ω	Ground
C2092-5	Ω	Ground
C2092-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to I3
No	REPAIR the circuit.

I3 CHECK THE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2092-6	Ω	C2402A-2
C2092-4	Ω	C2402A-3
C2092-7	Ω	C2402A-8
C2092-5	Ω	C2402A-10
C2092-3	Ω	C2402A-9

Are the resistances less than 3 ohms?

Yes	GO to I4
No	REPAIR the circuit.

I4 CHECK THE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2092-7	Ω	C2092-6
C2092-7	Ω	C2092-4
C2092-7	Ω	C2092-5
C2092-7	Ω	C2092-3
C2092-6	Ω	C2092-4
C2092-6	Ω	C2092-5
C2092-6	Ω	C2092-3
C2092-4	Ω	C2092-5
C2092-4	Ω	C2092-3
C2092-5	Ω	C2092-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new temperature door actuator. For RHD, refer to REFER to: Temperature Door Actuator RH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation). For LHD, refer to REFER to: Temperature Door Actuator RH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to I5
No	REPAIR the circuit.

I5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Blower Motor Is Inoperative

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Voltage is supplied to the blower motor relay switched contact from the BJB. Ground to the blower motor relay coil is a dedicated circuit. When the blower motor relay coil receives power from the FCIM, the relay coil is energized and voltage is delivered to the blower motor control module. Power and ground for the blower motor is provided by the blower motor control module. The FCIM sends a PWM signal to the blower motor control module to control the blower motor speed.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10AF:11	Blower Fan Relay: Circuit Short To Ground	This DTC sets when the module senses low voltage on the blower motor relay coil voltage circuit when the module is energizing the circuit. The blower motor relay is permanently inactive.
B10AF:15	Blower Fan Relay: Circuit Short To Battery or Open	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit or a short to voltage. The blower motor relay is inactive when circuit is open; the blower motor relay is on all the time when shorted to battery.
B10B9:12	Blower Control: Circuit Short To Battery	This DTC sets when the module senses high voltage on the blower motor control PWM circuit, indicating a short directly to voltage. The blower motor is inoperative.
B10B9:14	Blower Control: Circuit Short To Ground or Open	This DTC sets when the module senses no voltage on the blower motor control PWM circuit, indicating a short directly to ground or an open circuit. The blower motor runs at full speed if the circuit is shorted to ground. The blower motor is inoperative if the circuit is open.

Possible Sources

- Wiring, terminals or connectors
- Fuse
- Blower motor relay
- Blower motor control module
- FCIM

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuse 79 (40A).

PINPOINT TEST J : THE BLOWER MOTOR IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK THE BLOWER MOTOR RELAY

- Ignition OFF.
- Disconnect Blower motor relay.
- Carry out the component test on the blower motor relay.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the relay pass the component test?

Yes	GO to J2
No	INSTALL a new blower motor relay.

J2 CHECK THE BLOWER MOTOR RELAY SWITCH CONTACT SUPPLY VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 3		Ground

Is the voltage greater than 11 volts?

Yes	GO to J3
No	VERIFY BJB fuse 60 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

J3 CHECK THE BLOWER MOTOR RELAY COIL GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to J4
No	REPAIR the circuit.

J4 CHECK THE BLOWER MOTOR RELAY COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to J5
No	REPAIR the circuit.

J5 CHECK THE BLOWER MOTOR RELAY COIL CONTROL CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 1	Ω	C2402A-11

Blower motor relay socket 1		

Is the resistance less than 3 ohms?

Yes	GO to J6
No	REPAIR the circuit.

J6 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Blower motor control module C2004.
- Disconnect Blower motor speed control field effect transistor (FET) C2384.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2004-1	V	Ground
C2384-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to J7

J7 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2004-1	Ω	Ground
C2384-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J8
No	REPAIR the circuit.

J8 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2384-2	Ω	Ground

Positive Lead	Measurement / Action	Negative Lead
C2004-1	Ω	Blower motor relay socket 5

Positive Lead	Measurement / Action	Negative Lead
C2384-3	Ω	C2402A-11

Are the resistances less than 3 ohms?

Yes	GO to J9
No	REPAIR the circuit.

J9 CHECK THE BLOWER MOTOR CONTROL MODULE CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2384-2	Ω	C2004-1
C2384-2	Ω	C2384-3
C2004-1	Ω	C2384-3

Are the resistances greater than 10,000 ohms?

Yes	If C2004blower motor is effected. INSTALL a new blower motor. REFER to: Blower Motor (412-00 Climate Control System - General Information, Removal and Installation). If C2384 field effect transistor (FET) is effected. INSTALL A new FET. REFER to: Blower Motor Speed Control (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to J10
No	REPAIR the circuits.

J10 CHECK FOR CORRECT FRONT CONTROLS INTERFACE MODULE (FCIM) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.

No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Blower Motor Does Not Operate Correctly

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Voltage is supplied to the blower motor relay switched contact from the BJB. Ground to the blower motor relay coil is a dedicated circuit. When the blower motor relay coil receives power from the FCIM, the relay coil is energized and voltage is delivered to the blower motor control module. Power and ground for the blower motor is provided by the blower motor control module. The FCIM sends a PWM signal to the blower motor control module to control the blower motor speed.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10AF:11	Blower Fan Relay: Circuit Short To Ground	This DTC sets when the module senses low voltage on the blower motor relay coil voltage circuit when the module is energizing the circuit. The blower motor relay is permanently inactive.
B10AF:15	Blower Fan Relay: Circuit Short To Battery or Open	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit or a short to voltage. The blower motor relay is inactive when circuit is open; the blower motor relay is on all the time when shorted to battery.
B10B9:12	Blower Control: Circuit Short To Battery	This DTC sets when the module senses high voltage on the blower motor control PWM circuit, indicating a short directly to voltage. The blower motor is inoperative.
B10B9:14	Blower Control: Circuit Short To Ground or Open	This DTC sets when the module senses no voltage on the blower motor control PWM circuit, indicating a short directly to ground or an open circuit. The blower motor runs at full speed if the circuit is shorted to ground. The blower motor is inoperative if the circuit is open.

Possible Sources

- Wiring, terminals or connectors
- Blower motor relay
- Blower motor
- Blower motor speed control, field effect transistor (FET)
- FCIM

PINPOINT TEST K : THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
K1 VERIFY THE BLOWER MOTOR OPERATION
• Ignition ON. • Select panel on the HVAC controls and, starting with LO, operate the blower motor in all settings. Observe the blower motor operation in each setting. **Does the blower motor operate at any setting?**

Yes	GO to K2
No	GO to Pinpoint Test J

K2 CHECK THE BLOWER MOTOR SPEED CONTROL PWM (PULSE WIDTH MODULATION) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Blower motor speed control (field effect transistor (FET))C2384.
- Disconnect FCIM C2402A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-23		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to K3

K3 CHECK THE BLOWER MOTOR SPEED CONTROL PWM (PULSE WIDTH MODULATION) CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-23	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to K4
No	REPAIR the circuit.

K4 CHECK THE BLOWER MOTOR RELAY COIL CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Blower motor relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-11		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to K5

No	GO to K5

K5 CHECK THE BLOWER MOTOR OPERATION WITH THE BLOWER MOTOR RELAY DISCONNECTED

- Ignition OFF.
- Connect Field effect transistor part of Blower motor speed control C2387.
- Connect Blower motor part of Blower motor speed control C2004.
- Connect FCIM C2402A.
- Ignition ON.
- Operate the HVAC system and determine if the concern is still present.

Does the fan still operate all the time?

Yes	REPAIR the blower motor speed control voltage circuit CH402 (YE/GN) for a short to voltage.
No	GO to K6

K6 CHECK FOR CORRECT BLOWER MOTOR SPEED CONTROL OPERATION

- Ignition OFF.
- Disconnect and inspect the blower motor speed control connector field effect transistor C2384and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the blower motor control module connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	INSTALL a new blower motor speed control. REFER to: Blower Motor Speed Control (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to K7
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

K7 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B71:11, B1B71:15

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

Evaporator Temperature Sensor,
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B71:11	Evaporator Temperature Sensor: Circuit Short To Ground	The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground. The module defaults to calculated evaporator temperature and the compressor is shut off.
B1B71:15	Evaporator Temperature Sensor: Circuit Short To Battery or Open	The module senses no voltage drop on the sensor reference voltage circuit, indicating a short directly to voltage or an open circuit. The module defaults to calculated evaporator temperature and the compressor is shut off.

Possible Sources

- Wiring, terminals or connectors
- Evaporator temperature sensor
- FCIM

PINPOINT TEST L : B1B71:11, B1B71:15

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

L1 CHECK THE EVAPORATOR TEMPERATURE SENSOR RESISTANCE

- Ignition OFF.
- Disconnect Evaporator temperature sensor C296.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1(component side)	Ω	C296-2(component side)

- Compare the evaporator temperature sensor measured resistance with the table below.

Ambient Temperature °C	Resistance ohms
-40°C	98,625 - 103,275 ohms
-20°C	28,640 - 29,600 ohms
°C	9695 - 9895 ohms
20°C	3675 - 3810 ohms
25°C	2950 - 3050 ohms
30°C	2370 - 2565 ohms
40°C	1565 - 1635 ohms

Is the resistance within the specified values for the temperatures?

Yes	GO to L2
No	INSTALL a new evaporator temperature sensor. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).

L2 CHECK THE EVAPORATOR TEMPERATURE SENSOR INPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect FCIM C2402A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-19	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to L3

L3 CHECK THE EVAPORATOR TEMPERATURE SENSOR INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-19	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to L4
No	REPAIR the circuit.

L4 CHECK THE EVAPORATOR TEMPERATURE SENSOR INPUT CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-19	Ω	C296-2

Is the resistance less than 3 ohms?

Yes	GO to L5
No	REPAIR the circuit.

L5 CHECK THE EVAPORATOR TEMPERATURE SENSOR SIGNAL AND SIGNAL RETURN CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1	Ω	C296-2

Is the resistance greater than 10,000 ohms?

Yes	GO to L6
No	REPAIR the circuit.

L6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

C1B14:11, C1B14:12

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

A 5-volt reference voltage and ground is supplied to the climate control sensors and actuators from the FCIM.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1B14:11	Sensor Supply Voltage A: Circuit Short to Ground	This DTC sets when the module senses less than 5 volts on the sensor reference voltage circuit, indicating a short to ground.

C1B14:12	Sensor Supply Voltage A: Circuit Short to Battery	This DTC sets when the module senses greater than 5 volts on the sensor reference voltage circuit, indicating a short to voltage.

Possible Sources

- Wiring, terminals or connectors
- FCIM

PINPOINT TEST M : C1B14:11, C1B14:12

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

M1 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) DTCS

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Is DTC C1B14:11 present?

Yes	GO to M2
No	GO to M5

M2 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to M3
No	REPAIR the circuit.

M3 CHECK THE REFERENCE VOLTAGE CIRCUIT AND THE SIGNAL RETURN CIRCUIT FOR A SHORT TOGETHER

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	Ω	C2402A-2

Is the resistance greater than 200 ohms?

Yes	GO to M6
No	GO to M4

M4 CHECK THE A/C (AIR CONDITIONING) COMPONENTS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	Ω	C2402A-2

- While measuring the resistance, disconnect the following components one at a time, in order. Stop disconnecting components if the measured resistance rises above 200 ohms.
  - In-vehicle temperature and humidity sensor (Ambient quality sensor)C2247
  - Evaporator temperature sensor C296
  - Driver side center register air discharge temperature sensor C2438
  - Driver side footwell air discharge temperature sensor C2436
  - Air distribution door actuator C232
  - Passenger side temperature door actuator C2092
  - Air inlet door actuator C282

Did the resistance rise above 200 ohms?

Yes	INSTALL a new sensor or actuator (the last one to be disconnected). Refer to the appropriate section in Group 412 for the procedure. When installing an actuator, CONNECT the actuator electrical connector before the FCIM. This allows the actuator to be calibrated when the FCIM is connected.
No	REPAIR the circuit.

M5 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to M6

M6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the

	appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

P193E

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

The PCM controls the A/C compressor clutch field coil based on messages received from the BCM over the HS-CAN. When the FCIM determines it is necessary to activate the A/C compressor due to driver request or automatic climate control settings, the FCIM sends a message to the BCM over the MS-CAN, the BCM then sends a message to the PCM to activate the A/C compressor.

An internal failure of the PCM, BCM or FCIM, or a failure in the MS-CAN or HS-CAN, causes the PCM to set a DTC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P193E	A/C Clutch Request Signal	This DTC sets when the PCM does not receive the A/C enable request from the BCM.

Possible Sources

- Network concerns
- BCM
- PCM
- FCIM

PINPOINT TEST N : P193E

N1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to N2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, carry out the Network Test.

Do the BCM, PCM and the FCIM pass the Network Test?

Yes	GO to N3
No	DIAGNOSE the BCM, PCM or FCIM does not communicate with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

N3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION)

- Start the engine.
- Using a diagnostic scan tool, monitor the PCM AC_REQ PID.
- On the HVAC controls, select PANEL mode, then press the A/C button (indicator ON).

Does the AC_REQ PID display YES when the A/C button indicator is illuminated?

Yes	GO to N7
No	GO to N4

N4 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) A/C (AIR CONDITIONING) SWITCH (CC_SW_AC) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, monitor the FCIM CC_SW_AC PID while pressing and releasing the A/C button.

Does the PID display Active when the A/C button indicator is illuminated?

Yes	GO to N6
No	GO to N5

N5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N6 VERIFY CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all BCM electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. For LHD REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules,

	Removal and Installation). For RHD REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N7 VERIFY CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

B105A:12, B105A:14, B1A61:11, B1A61:15, B1A69:11, B1A69:15

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

In-Vehicle Temperature and Humidity Sensor,
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B105A:12	Cabin Temperature Sensor Fan: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the in-vehicle temperature and humidity sensor fan motor circuit. The in-vehicle temperature and humidity sensor fan motor is inactive.
B105A:14	Cabin Temperature Sensor Fan: Circuit	This DTC sets when the module senses no voltage on the in-vehicle temperature and humidity sensor fan motor circuit, indicating an open or a short directly to

	Short To Ground or Open	ground. The in-vehicle temperature and humidity sensor fan motor is active.
B1A61:11	Cabin Temperature Sensor: Circuit Short to Ground	This DTC sets when the module senses lower than expected voltage on the in-vehicle temperature and humidity sensor feedback circuit, indicating a short to ground.
B1A61:15	Cabin Temperature Sensor: Circuit Short to Battery or Open	This DTC sets when the module senses greater than expected voltage on the in-vehicle temperature and humidity sensor feedback circuit, indicating a short to voltage or an open circuit or sensor.
B1A69:11	Humidity Sensor: Circuit Short To Ground	This DTCsets when the module senses lower than expected voltage on the in-vehicle temperature and humidity sensor humidity input circuit, indicating a short to ground.
B1A69:15	Humidity Sensor: Circuit Short To Battery or Open	This DTCsets when the module senses greater than expected voltage on the in-vehicle temperature and humidity sensor humidity input circuit, indicating a short to voltage or an open circuit or sensor.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- In-vehicle temperature and humidity sensor
- FCIM

Visual Inspection and Diagnostic Pre-checks

- Make sure the in-vehicle temperature and humidity sensor harness is not chaffed.

PINPOINT TEST O : B105A:12, B105A:14, B1A61:11, B1A61:15, B1A69:11, B1A69:15

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

O1 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A..
- Disconnect FCIM C2402B..
- Disconnect BCM fuse 21 (5A)..
- Disconnect In-vehicle temperature and humidity sensor C2247.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost Vent/Register Door Actuator C232.
- Disconnect Air Inlet Door Actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-1		Ground
C2247-2		Ground
C2247-3		Ground
C2247-4		Ground
C2247-5		Ground
C2247-6		Ground

Is any voltage present?

Yes	REPAIR the circuit.

No	GO to O2

O2 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-1	Ω	Ground
C2247-2	Ω	Ground
C2247-3	Ω	Ground
C2247-4	Ω	Ground
C2247-5	Ω	Ground
C2247-6	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O3
No	REPAIR the circuit.

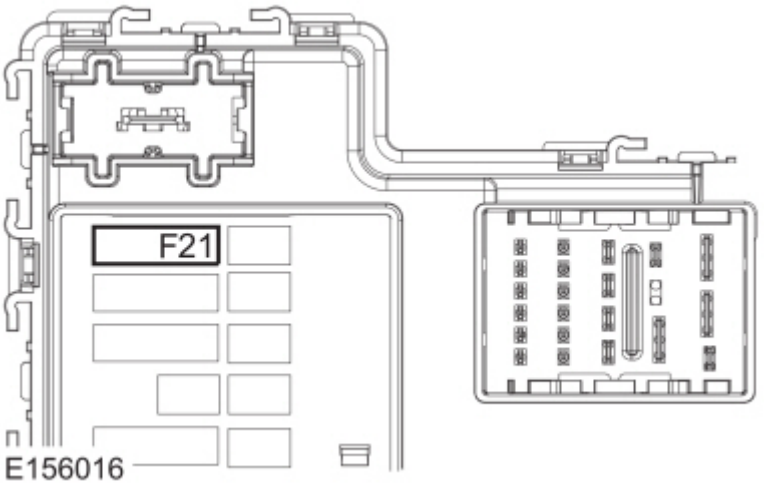
O3 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-3	Ω	C2402A-3
C2247-5	Ω	C2402A-2

Positive Lead	Measurement / Action	Negative Lead
C2247-1	Ω	C2402B-27
C2247-2	Ω	C2402B-29
C2247-4	Ω	C2402B-19

Positive Lead	Measurement / Action	Negative Lead
C2247-6	Ω	BCM fuse 21 cavity, (component

		 side)

Are the resistances less than 3 ohms?

Yes	GO to O4
No	REPAIR the circuit.

O4 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-1	Ω	C2247-2
C2247-1	Ω	C2247-3
C2247-1	Ω	C2247-4
C2247-1	Ω	C2247-5
C2247-1	Ω	C2247-6
C2247-2	Ω	C2247-3
C2247-2	Ω	C2247-4
C2247-2	Ω	C2247-5
C2247-2	Ω	C2247-6
C2247-3	Ω	C2247-4
C2247-3	Ω	C2247-5
C2247-3	Ω	C2247-6
C2247-4	Ω	C2247-5
C2247-4	Ω	C2247-6
C2247-5	Ω	C2247-6

Are the resistances greater than 10,000 ohms?

Yes	GO to O5
No	REPAIR the circuit.

O5 CHECK FOR CORRECT IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR OPERATION

- Ignition OFF.
- Inspect the disconnected connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all disconnected connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	INSTALL a new in-vehicle temperature and humidity sensor. REFER to: Ambient Air Quality Sensor (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to O6
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

O6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Air Discharge Temperature Sensor Circuit Faults

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Normal Operation and Fault Conditions

The 2 air discharge temperature sensors contain a thermistor. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises.
REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10B3:11	Right Panel Air Discharge Temperature:	This DTC sets when the FCIM senses erratic voltages from

	Circuit Short To Ground	the right panel air discharge temperature sensor.
B10B3:15	Right Panel Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the right panel air discharge temperature sensor.
B10B5:11	Left Panel Air Discharge Temperature: Circuit Short To Ground	This DTC sets when the FCIM senses erratic voltages from the left panel air discharge temperature sensor.
B10B5:15	Left Panel Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the left panel air discharge temperature sensor.
B10B6:11	Left Floor Air Discharge Temperature: Circuit Short To Ground	This DTC sets when the FCIM senses erratic voltages from the left floor air discharge temperature sensor.
B10B6:15	Left Floor Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the left floor air discharge temperature sensor.

Possible Sources

- Wiring, terminals or connectors
- Air discharge temperature sensor(s)
- FCIM

PINPOINT TEST P : AIR DISCHARGE TEMPERATURE SENSOR CIRCUIT FAULTS

P1 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR OUTPUT VOLTAGE CIRCUIT

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

- Ignition OFF.
- Disconnect the suspect air discharge temperature sensor:
  - Driver side register air discharge temperature sensor C2438
  - Driver side footwell air discharge temperature sensor C2436
- Ignition ON.
- Turn the HVAC system on.
- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1		C2436-3

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1		C2438-3

Is the voltage between 4.7 and 5.1 volts?

Yes	INSTALL a new air discharge temperature sensor. Refer to the appropriate section in Group 412 for the procedure. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If Diagnostic Trouble Code (DTC) returns, GO to P9
No	GO to P2

P2 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A.
- Disconnect FCIM C2402B.
- Ignition ON.
- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1		Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to P3

P3 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL RETURN CIRCUIT FOR A SHORT TO VOLTAGE

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-3		Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to P4

P4 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1	Ω	Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to P5
No	REPAIR the circuit.

P5 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL RETURN CIRCUIT FOR A SHORT TO GROUND

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-3	Ω	Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to P6
No	REPAIR the circuit.

P6 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead

C2436-1	Ω	C2402B-5

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1	Ω	C2402B-4

Are the resistances less than 3 ohms?

Yes	GO to P7
No	REPAIR the circuit.

P7 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL RETURN CIRCUIT FOR AN OPEN

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-3	Ω	C2402A-2

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-3	Ω	C2402A-2

Is the resistance less than 3 ohms?

Yes	GO to P8
No	REPAIR the circuit.

P8 CHECK AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT AND THE SIGNAL RETURN FOR A SHORT TO TOGETHER

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1	Ω	C2436-3

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1	Ω	C2438-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new air discharge temperature sensor.Refer to the appropriate section in Group 412 for the procedure. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If Diagnostic Trouble Code (DTC) returns, GO to P9
No	REPAIR the circuit.

P9 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC)

DTC Chart: Front Controls Interface Module (FCIM) - Dual Automatic Temperature Control (DATC)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Network Diagnostic Trouble Codes (DTCs) (U-codes) are often a result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle repair procedures, such as module reprogramming, often set network Diagnostic Trouble Codes (DTCs). Replacing a module to resolve a network DTC is unlikely to resolve the concern. To prevent repeat network DTC concerns, inspect all network wiring, especially connectors. Test the vehicle battery.
REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

FCIM - Dual Automatic Temperature Control (DATC) DTC CHART

DTC	Description	Action
B105A:12	Cabin Temperature Sensor Fan: Circuit Short To Battery	GO to Pinpoint Test O
B105A:14	Cabin Temperature Sensor Fan: Circuit Short To Ground or Open	GO to Pinpoint Test O
B1081:07	Left Temperature Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new driver side temperature door actuator. REFER to: Temperature Door Actuator LH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Temperature Door Actuator LH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Temperature Door Actuator RH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Temperature Door Actuator RH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation).
B1081:11	Left Temperature Damper Motor: Circuit Short To Ground	GO to Pinpoint Test J
B1081:12	Left Temperature Damper Motor: Circuit Short To Battery	GO to Pinpoint Test J
B1081:13	Left Temperature Damper Motor: Circuit Open	GO to Pinpoint Test J
B1082:07	Right Temperature Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new passenger side temperature door actuator. REFER to: Temperature Door Actuator LH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Temperature Door Actuator LH - LHD 4WD/LHD RWD (412-

		00 Climate Control System - General Information, Removal and Installation). REFER to: Temperature Door Actuator RH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Temperature Door Actuator RH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation).
B1082:11	Right Temperature Damper Motor: Circuit Short To Ground	GO to Pinpoint Test K
B1082:12	Right Temperature Damper Motor: Circuit Short To Battery	GO to Pinpoint Test K
B1082:13	Right Temperature Damper Motor: Circuit Open	GO to Pinpoint Test K
B1083:07	Recirculation Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new air inlet mode door actuator. REFER to: Air Inlet Door Actuator (412-00 Climate Control System - General Information, Removal and Installation).
B1083:11	Recirculation Damper Motor: Circuit Short To Ground	GO to Pinpoint Test E
B1083:12	Recirculation Damper Motor: Circuit Short To Battery	GO to Pinpoint Test E
B1083:13	Recirculation Damper Motor: Circuit Open	GO to Pinpoint Test E
B1086:07	Air Distribution Damper Motor: Mechanical Failure	INSPECT for a binding or damaged linkage or door. REPAIR as necessary. If no condition is found, INSTALL a new air distribution door actuator. REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation).
B1086:11	Air Distribution Damper Motor: Circuit Short To Ground	GO to Pinpoint Test F
B1086:12	Air Distribution Damper Motor: Circuit Short To Battery	GO to Pinpoint Test F
B1086:13	Air Distribution Damper Motor: Circuit Open	GO to Pinpoint Test F
B10AF:11	Blower Fan Relay: Circuit Short To Ground	GO to Pinpoint Test L
B10AF:12	Blower Fan Relay: Circuit Short To Battery	GO to Pinpoint Test L
B10AF:13	Blower Fan Relay: Circuit Open	GO to Pinpoint Test L
		• For an inoperative blower motor, GO to Pinpoint Test L

B10AF:15	Blower Fan Relay: Circuit Short To Battery or Open	For an inoperative blower motor, GO to Pinpoint Test L • For all other blower motor symptoms, GO to Pinpoint Test M
B10EA:12	Positive Temperature Coefficient Heater: Circuit Short to Battery	GO to Pinpoint Test A
B10EA:14	Positive Temperature Coefficient Heater: Circuit Short to Ground or Open	GO to Pinpoint Test A
B10B3:11	Right Panel Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test N
B10B3:15	Right Panel Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test N
B10B4:11	Right Floor Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test N
B10B4:15	Right Floor Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test N
B10B5:11	Left Panel Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test N
B10B5:15	Left Panel Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test N
B10B6:11	Left Floor Air Discharge Temperature: Circuit Short To Ground	GO to Pinpoint Test N
B10B6:15	Left Floor Air Discharge Temperature: Circuit Short To Battery or Open	GO to Pinpoint Test N
B10B8:63	Push Buttons: Circuit / Component Protection Time-Out	This DTC sets when the buttons are held too long. ATTEMPT to clean buttons. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
B10B9:12	Blower Control: Circuit Short To Battery	GO to Pinpoint Test L
		For an inoperative blower motor, GO to Pinpoint Test L

B10B9:14	Blower Control: Circuit Short To Ground or Open	• For an inoperative blower motor, GO to Pinpoint Test L • For all other blower motor symptoms, GO to Pinpoint Test M
B11E5:11	Left HVAC Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test J
B11E5:15	Left HVAC Damper Position Sensor: Circuit Short To Battery or Ground	GO to Pinpoint Test J
B11E6:11	Right HVAC Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test K
B11E6:15	Right HVAC Damper Position Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test K
B11E7:11	Air Distribution Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test F
B11E7:15	Air Distribution Damper Position Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test F
B11F0:11	Air Intake Damper Position Sensor: Circuit Short To Ground	GO to Pinpoint Test E
B11F0:15	Air Intake Damper Position Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test E
B1A61:11	Cabin Temperature Sensor: Circuit Short To Ground	GO to Pinpoint Test O
B1A61:15	Cabin Temperature Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test O
B1A63:11	Right Solar Sensor: Circuit Short To Ground	GO to Pinpoint Test P
B1A63:15	Right Solar Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test P
B1A64:11	Left Solar Sensor: Circuit Short To Ground	GO to Pinpoint Test P
B1A64:15	Left Solar Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test P
B1A69:11	Humidity Sensor: Circuit Short To Ground	GO to Pinpoint Test P
B1A69:15	Humidity Sensor: Circuit Short To	GO to Pinpoint Test O

	Battery or Open	
B1B71:11	Evaporator Temperature Sensor: Circuit Short To Ground	GO to Pinpoint Test Q
B1B71:15	Evaporator Temperature Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test Q
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	GO to Pinpoint Test R
C1B14:12	Sensor Supply Voltage A: Circuit Short To Battery	GO to Pinpoint Test R
All Other FCIM Diagnostic Trouble Codes (DTCs) not listed in this chart	—	Refer to the appropriate section in Group 415 for the procedure.

DTC Chart: Powertrain Control Module (PCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Powertrain Control Module (PCM) DTC Chart

DTC	Description	Action
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	GO to Pinpoint Test B
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	GO to Pinpoint Test B
P0645	A/C Clutch Relay Control Circuit	GO to Pinpoint Test C
P0646	A/C Clutch Relay Control Circuit Low	GO to Pinpoint Test C
P0647	A/C Clutch Relay Control Circuit High	GO to Pinpoint Test C
P1464	A/C Demand Out Of Self Test Range	If the HVAC selector was not powered off, POWER the HVAC off, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, GO to Pinpoint Test I
P193E	A/C Clutch Request Signal	GO to Pinpoint Test S
All Other PCM Diagnostic Trouble Codes (DTCs)	—	• For 2.5L Duratec-HE (122kW/165PS) - MI4 PCM DTC Chart, REFER to: Electronic Engine Controls (303-14A) . • For 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - PumaPCM DTC Chart, REFER to: Electronic Engine Controls (303-14B) . • For 3.2L Duratorq-TDCi (148kW/200PS) - Puma PCM DTC Chart, REFER to: Electronic Engine Controls (303-14C) .

Symptom Chart(s)

Symptom Chart: Climate Control - Dual Automatic Temperature Control (DATC)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
A module does not communicate with the diagnostic scan tool	• Fuse(s) • Wiring, terminals or connectors • FCIM	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Unable To Duplicate The Customer Concern And No Diagnostic Trouble Codes (DTCs) Present	Refer to Pinpoint Test	GO to Pinpoint Test D
HVAC functions are inoperative/do not operate correctly from touchscreen only	• Communication network • FCIM • APIM	Refer to the appropriate section in Group 415 for the procedure.
Reduced outlet airflow	Plugged cabin air filter	INSPECT the cabin air filter. REFER to: Cabin Air Filter (412-00 Climate Control System - General Information, Removal and Installation). If OK, DIAGNOSE for low refrigerant charge, A/C always commanded on or blower motor not operating correctly.
	Improper refrigerant level	CARRY OUT the refrigerant system tests. REFER to: Refrigerant System Tests - Automatic Transmission (412-00 Climate Control System - General Information, General Procedures). If refrigerant charge is OK, GO to Pinpoint Test I
	Blower motor	GO to Pinpoint Test M
The air inlet door is inoperative	Refer to Pinpoint Test	GO to Pinpoint Test E
Incorrect or erratic direction of airflow from outlets	Refer to Pinpoint Test	GO to Pinpoint Test E
Insufficient, erratic or no heat	Refer to Pinpoint Test	GO to Pinpoint Test G
The A/C is inoperative	Refer to Pinpoint Test	GO to Pinpoint Test H
The A/C is always on — A/C mode always commanded ON	Refer to Pinpoint Test	GO to Pinpoint Test I
Temperature control is inoperative/does not operate correctly — driver side	Refer to Pinpoint Test	GO to Pinpoint Test J
Temperature control is inoperative/does not operate correctly — passenger side	Refer to Pinpoint Test	GO to Pinpoint Test K
The blower motor is inoperative	Refer to Pinpoint Test	GO to Pinpoint Test L
The blower motor does not	Refer to Pinpoint Test	GO to Pinpoint Test M

operate correctly		
Insufficient A/C cooling	Improper refrigerant level	CARRY OUT the refrigerant system tests. REFER to: Refrigerant System Tests - Automatic Transmission (412-00 Climate Control System - General Information, General Procedures). If OK, DIAGNOSE for a temperature door actuator not operating correctly.
	Temperature door actuator	• For inadequate temperature out of the driver side, GO to Pinpoint Test J • For inadequate temperature out of the passenger side, GO to Pinpoint Test K
A/C pressure relief valve discharging	A/C pressure relief valve	• CHECK the high side system pressure. REFER to: Specifications (412-00 Climate Control System - General Information, Specifications). If the pressure is below the A/C pressure relief valve open pressure, INSTALL a new A/C Compressor. • REFER to: Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4 (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
	High system pressure	CHECK the high side system pressure. REFER to: Specifications (412-00 Climate Control System - General Information, Specifications). If the system pressure is above the A/C pressure relief valve open pressure, REPAIR the A/C system for a restriction.
Climate control does not operate only when remote start is used	• IPC information display settings • Non-Ford approved remote start system installed	• VERIFY Remote Start - Message Center Set To Auto, or Remote Start - Message Center Set To Last User Settings. REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation). • VERIFY module communications network operation. DIAGNOSE Diagnostic Trouble Codes (DTCs) if present.

Symptom Chart: Noise, Vibration, and Harshness (NVH)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
Noisy A/C compressor	A/C	• INSPECT the A/C compressor bearing for roughness. If bearing

	compressor bearing worn	roughness is found, INSTALL a new A/C Compressor. • REFER to: Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4 (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation). • REFER to: Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
Excessive hissing from the plenum when the A/C is on	Incorrect A/C refrigerant level	CHECK the A/C refrigerant level. REFER to: Refrigerant System Tests - Automatic Transmission (412-00 Climate Control System - General Information, General Procedures).

Pinpoint Test(s)

The Electric Booster Heater Is Inoperative Or Does Not Operate Correctly

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Supplemental Climate Control - System Operation and Component Description (412-03 Supplemental Climate Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10EA:12	Positive Temperature Coefficient Heater: Circuit Short To Battery	This DTC sets when the BCM detects a short to voltage on the heater control circuit.
B10EA:14	Positive Temperature Coefficient Heater: Circuit Short To Ground Or Open	This DTC sets when the BCM detects a short to ground or an open on the heater control circuit.

Possible Sources

- Fuses
- Wiring, terminals or connectors
- Electric booster (PTC) heater
- Battery junction box (BJB)
- FCIM

Visual Inspection and Diagnostic Pre-checks

- Make sure High Current MIDI fuse (100A) is OK.
- Make sure BJB fuse 27 (5A) is OK.
- Make sure operating conditions for the operation of the electric booster heater are met.
  REFER to: Supplemental Climate Control - System Operation and Component Description (412-03 Supplemental Climate Control, Description and Operation).

NOTE: *Diagnose and repair all FCIM control module Diagnostic Trouble Codes (DTCs) before continuing with this pinpoint test.*

PINPOINT TEST A : THE ELECTRIC BOOSTER PTC HEATER IS INOPERATIVE OR DOES NOT

OPERATE CORRECTLY

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

A1 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the FCIM self-test.

Is DTC B10EA:12 or B10EA:14 retrieved?

Yes	For DTC B10EA:12, GO to A5 For DTC B10EA:14, GO to A6 For all other FCIMDiagnostic Trouble Codes (DTCs), GO to the DTC Chart: FCIMin this section.
No	GO to A2

A2 CHECK THE ELECTRIC BOOSTER PTC HEATER HOT AT ALL TIME VOLTAGE SUPPLY CIRCUIT

- Ignition OFF.
- Disconnect electric booster heater C2603A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2603A-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A3
No	VERIFY High Current BJB MIDI fuse (100A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A3 CHECK THE ELECTRIC BOOSTER PTC HEATER GROUND CIRCUIT

- Disconnect the electric booster heater C2603B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2603B-3	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A4
No	REPAIR the circuit.

A4 CHECK THE ELECTRIC BOOSTER PTC HEATER IGNITION VOLTAGE SUPPLY CIRCUIT

- Disconnect electric booster heater C2603C.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2603C-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A5
No	VERIFY BJB fuse 27 (5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A5 CHECK THE ELECTRIC BOOSTER PTC HEATER CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect the electric booster heater C2603C (if not previously disconnected).
- Disconnect the FCIM C2402B.
- Disconnect the BJB C1035A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2603C-2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A6

A6 CHECK THE ELECTRIC BOOSTER PTC HEATER CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect electric booster heater C2603C (if not previously disconnected).
- Disconnect BJB C1035A.
- Disconnect the FCIM C2402B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2603C-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A7
No	REPAIR the circuit.

A7 CHECK THE ELECTRIC BOOSTER PTC HEATER CONTROL CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2603C-2	Ω	C2402B-6

Is the resistance less than 3 ohms?

Yes	GO to A8
No	REPAIR the circuit.

A8 CHECK FOR CORRECT ELECTRIC BOOSTER PTC HEATER OPERATION

- Disconnect and inspect all electric booster heater electrical and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
- Connect all electric booster heater electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	GO to A9
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

A9 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Disconnect and inspect all FCIMelectrical and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals or pins
  - pushed-out pins - install new pins as necessary
- Connect all FCIM electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

P0532, P0533

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal operation and Fault Conditions

The A/C pressure transducer receives a ground from the PCM. A 5-volt reference voltage is supplied to the A/C pressure transducer from the PCM. The A/C pressure transducer then sends a voltage to the PCM to indicate the A/C

pressure.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low	This DTC sets if the feedback voltage is less than 0.26 volt for at least 2 seconds and the ambient air temperature is greater than 0°C (32°F).
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High	This DTC sets if the feedback voltage is greater than 4.95 volts for at least 2 seconds and the ambient air temperature is greater than 0°C (32°F).

Possible Sources

- Wiring, terminals or connectors
- A/C pressure transducer
- PCM

Visual Inspection and Diagnostic Pre-checks

- Inspect for loose or corroded PCM and A/C pressure transducer connections.

PINPOINT TEST B : P0532, P0533

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 COMPARE THE PCM (POWERTRAIN CONTROL MODULE) PRESSURE SENSOR (ACP_PRESS) PID (PARAMETER IDENTIFICATION) WITH THE MANIFOLD GAUGE SET READINGS

- Allow the A/C system to stabilize to the outside ambient temperature.
- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- With the manifold gauge set connected, compare the pressure readings of the manifold gauge set and the PCM ACP_PRESS PID.

Are the pressure values of the manifold gauge set and the ACP_PRESS PCM PID within ± 103 kPa (15 psi)?

Yes	IGNORE the Diagnostic Trouble Codes (DTCs). REFER to the Symptom Chart in this section.
No	GO to B2

B2 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect PCM, 2.2L Duratorq-TDCi (Puma) Diesel C1232A, 3.2L Duratorq-TDCi (Puma) DieselC1232B, 2.5L Duratec-HEC175.
- Disconnect A/C pressure transducer C1260.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1260-1		Ground
C1260-2		Ground
C1260-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B3

B3 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	Ground
C1260-2	Ω	Ground
C1260-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to B4
No	REPAIR the circuit.

B4 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR AN OPEN

- Measure:

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C175-40
C1260-2	Ω	C175-16
C1260-3	Ω	C175-28

2.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C1232-23
C1260-2	Ω	C1232-50
C1260-3	Ω	C1232-32

3.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C1232-23

C1260-2	Ω	C1232-50
C1260-3	Ω	C1232-32

Are the resistances less than 3 ohms?

Yes	GO to B5
No	REPAIR the circuit.

B5 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1260-1	Ω	C1260-2
C1260-1	Ω	C1260-3
C1260-2	Ω	C1260-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new A/C pressure transducer. REFER to: Air Conditioning (A/C) Pressure Transducer (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to B6
No	REPAIR the circuits.

B6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCi (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCi (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

P0645, P0646, P0647

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Voltage is provided to the A/C clutch relay. When A/C is requested and A/C line pressures allow, a ground is provided to the A/C clutch relay coil from the PCM, energizing the A/C clutch relay.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0645	A/C Clutch Relay Control Circuit	This DTC sets when the PCM grounds the relay circuit and more voltage than expected is detected on the relay circuit. This DTC also sets when the relay circuit is off and no voltage is detected on the relay circuit. The PCM expects to detect voltage coming through the relay coil to the relay circuit when it is not grounding it.
P0646	A/C Clutch Relay Control Circuit Low	This DTC sets when the relay circuit is off and no voltage is detected on the relay circuit. The PCM expects to detect voltage coming through the relay coil to the relay circuit when it is not grounding it.
P647	A/C Clutch Relay Control Circuit High	This DTC sets when the PCM grounds the relay circuit and more voltage than expected is detected on the relay circuit.

Possible Sources

- Wiring, terminals or connectors
- A/C clutch relay
- PCM

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuses 24 (10A).

PINPOINT TEST C : P0645, P0646, P647

NOTICE: Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE VOLTAGE TO THE A/C (AIR CONDITIONING) CLUTCH RELAY VOLTAGE SUPPLY CIRCUITS

- Ignition OFF.
- Disconnect A/C clutch relay located within the BJB..
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 1		Ground
A/C clutch relay socket 3		Ground

Are the voltages greater than 11 volts?

Yes	GO to C2
No	VERIFY BJB fuse 24 (10A) is OK. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. If OK, REPAIR the circuit.

C2 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Carry out the component test on the A/C clutch relay.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the relay pass the component test?

Yes	GO to C3
No	INSTALL a new A/C clutch relay.

C3 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect A/C clutch relay.
- Disconnect PCM, C1752.5L, 2.2LC1232A, 3.2L C1232B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C4

C4 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C5
No	REPAIR the circuit.

C5 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY CONTROL CIRCUIT FOR AN OPEN

- Measure:

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	C175-25

2.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	C1232-49

3.2L Duratorq Puma-Diesel

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 2	Ω	C1232-49

Is the resistance less than 3 ohms?

Yes	GO to C6
No	REPAIR the circuit.

C6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Unable To Duplicate The Customer Concern And No Diagnostic Trouble Codes (DTCs) Present

This diagnostic procedure tests the functions of the HVAC system and identifies the correct HVAC symptom pinpoint test.

Normal Operation and Fault Conditions

System Operation
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

PINPOINT TEST D : UNABLE TO DUPLICATE THE CUSTOMER CONCERN AND NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT

D1 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform PCM self-test.

Are any climate control related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the PCM DTC chart in this section.
No	GO to D2

D2 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the FCIM DTC chart in this section.
No	GO to D3

D3 CHECK THE BLOWER MOTOR OPERATION

- Ignition ON.
- Select panel mode.
- Observe blower motor operation and select each blower motor speed.

Does the blower motor operate in all ranges?

Yes	GO to D4
No	If the blower motor does not operate in any setting, GO to Pinpoint Test L If the blower motor does not correctly change speeds or shut off, GO to Pinpoint Test M

D4 CHECK AIRFLOW OPERATION

- Select the highest blower motor setting.
- While observing the airflow, select each of the airflow positions (panel, panel/floor, floor, floor/defrost, defrost).

Is the airflow directed to the correct outlets?

Yes	GO to D5
No	GO to Pinpoint Test F

D5 VERIFY TEMPERATURE CONTROL OPERATION

- Start the vehicle and allow it to reach normal operating temperature.
- With the A/C off, select panel mode.
- Change the driver and passenger temperature settings from the coldest to the warmest and back to the coldest.

Does the temperature change between very warm to cool?

Yes	GO to D6
No	If the temperature does not get very warm, GO to Pinpoint Test G If the driver side temperature does not change at all, GO to Pinpoint Test J If the passenger side temperature does not change at all, GO to Pinpoint Test K

D6 VERIFY THE AIR CONDITIONING COMPRESSOR DOES NOT ENGAGE WITH A/C (AIR CONDITIONING) OFF

- With the engine running and the A/C off, select panel mode.
- Select the coldest temperature setting.

Is the outlet temperature close to ambient air temperature?

Yes	GO to D7
No	If the driver side temperature is warmer than ambient air temperature, GO to Pinpoint Test J If the passenger side temperature is warmer than ambient air temperature, GO to Pinpoint Test K If the outlet temperature is significantly colder than ambient air temperature and the A/C compressor clutch is engaged, GO to Pinpoint Test I

D7 VERIFY THE A/C (AIR CONDITIONING) COMPRESSOR IS OPERATIONAL IN THE A/C (AIR CONDITIONING) MODE

- Make sure the ambient air temperature is above 0°C (32°F).
- With the engine running, select panel mode.
- Press the A/C button (indicator on).

Is the A/C compressor operational when the panel and A/C button (indicator on) is pressed?

Yes	GO to D8
No	GO to Pinpoint Test H

D8 CHECK THE RECIRCULATED AIR OPERATION

- With the engine running, press the recirculated air button (indicator off).
- Select panel mode.
- Select the highest blower motor setting.
- Observe airflow noise.
- Press the recirculated air button (indicator on).

Does the airflow noise increase when the recirculated air mode is selected (indicator on)?

Yes	GO to D9
No	GO to Pinpoint Test E

D9 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) LEFT DISCHARGE FLOOR TEMPERATURE (LDFTEMP) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the LDFTEMP PID.

Is the temperature coming out of the driver footwell vent similar to the PID?

Yes	GO to D10
No	GO to Pinpoint Test N

D10 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) LEFT DISCHARGE PANEL TEMPERATURE (LDPT) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the LDPT PID.

Is the temperature coming out of the driver side register similar to the PID?

Yes	GO to D13
No	GO to Pinpoint Test N

D11 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) DISCHARGE AIR TEMPERATURE, RIGHT PANEL (AIRTEMP_RP) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the AIRTEMP_RP PID.

Is the temperature coming out of the passenger side register similar to the PID?

Yes	GO to D12
No	GO to Pinpoint Test N

D12 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) DISCHARGE AIR TEMPERATURE, RIGHT FLOOR (AIRTEMP_RF) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a diagnostic scan tool, view the FCIM Parameter Identifications (PIDs).
- Monitor the AIRTEMP_RF PID.

Is the temperature coming out of the passenger side footwell vent similar to the PID?

Yes	GO to D13
No	GO to Pinpoint Test N

D13 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) INTERIOR TEMPERATURE SENSOR (INT_TEMP) PID (PARAMETER IDENTIFICATION) (IF EQUIPPED)

- Using a scan tool view the FCIM Parameter Identifications (PIDs).
- Monitor the INT_TEMP PID.

Is the air temperature at the cabin temperature sensor similar to the PID?

Yes	GO to D14
No	GO to Pinpoint Test O

D14 CHECK THE TOUCHSCREEN CONTROLS OPERATION
• Using the touchscreen controls, select each climate control function. • Using the touchscreen controls, select each audio control function. **Do all touchscreen controls operate?**

Yes	The system is operating correctly.
No	Refer to the appropriate section in Group 415 for the procedure.

The Air Inlet Door Is Inoperative

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

To rotate the air inlet door actuator, the FCIM supplies voltage and ground to the air inlet door actuator through the door actuator motor circuits. To reverse the air inlet door actuator rotation, the FCIM reverses the voltage and ground circuits. The air inlet door actuator feedback resistors are supplied a ground from the FCIM by the air inlet door actuator return circuits and a 5-volt reference voltage on the air inlet door actuator reference circuits. The FCIM uses the actuator feedback resistor wiper arm position and the voltage on the air distribution door actuator feedback circuits to determine the air inlet door actuator position.

During an actuator calibration cycle, the FCIM drives the air inlet door until the door reaches both internal stops in the FCIM case. If the air inlet mode door is temporarily obstructed or binding during a calibration cycle, the FCIM may interpret this as the actual end of travel for the door. When this condition occurs and the FCIM commands the actuator to its end of travel, the air intake may not be from the expected source.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1083:11	Recirculation Damper Motor: Circuit Short To Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1083:12	Recirculation Damper Motor: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1083:13	Recirculation Damper Motor: Circuit Open	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor cannot move.
B11F0:11	Air Intake Damper Position Sensor: Circuit Short to Ground	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating a short to ground.
B11F0:15	Air Intake Damper Position Sensor: Circuit Short to Battery or Open	This DTC sets when the module senses greater than 5 volts on the actuator feedback circuit, indicating a short to voltage. This DTC sets when the module senses no voltage on the actuator feedback circuit, indicating an open circuit.

Possible Sources

- Wiring, terminals or connectors
- Air inlet door actuator

- Air inlet door binding or stuck
- FCIM

PINPOINT TEST E : THE AIR INLET DOOR IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A.
- Disconnect FCIM C2402B.
- Disconnect LH temperature door actuator C2091.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost vent/register door actuatorC232.
- Disconnect In vehicle temperature and humidity sensor C2247.
- Disconnect Air inlet door actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	V	Ground
C282-5	V	Ground
C282-4	V	Ground
C282-3	V	Ground
C282-7	V	Ground

Is there any voltage present?

Yes	REPAIR the circuit.
No	GO to E2

E2 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	Ω	Ground
C282-5	Ω	Ground
C282-4	Ω	Ground
C282-3	Ω	Ground
C282-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to E3
No	REPAIR the circuit.

E3 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	Ω	C2402A-2
C282-5	Ω	C2402A-16
C282-4	Ω	C2402A-3
C282-3	Ω	C2402A-25
C282-7	Ω	C2402A-24

Are the resistances less than 3 ohms?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK THE AIR INLET DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C282-6	Ω	C282-5
C282-6	Ω	C282-4
C282-6	Ω	C282-3
C282-6	Ω	C282-7
C282-5	Ω	C282-4
C282-5	Ω	C282-3
C282-5	Ω	C282-7
C282-4	Ω	C282-3
C282-4	Ω	C282-7
C282-3	Ω	C282-7

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new air inlet door actuator. REFER to: Air Inlet Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to E5
No	REPAIR the circuit.

E5 CHECK FOR CORRECT FRONT CONTROLS INTERFACE MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins

- pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Incorrect Or Erratic Direction Of Airflow From Outlets

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

To rotate the air distribution door actuator (Defrost Vent/Register Door Actuator), the FCIM supplies voltage and ground to the air distribution door actuator through the door actuator motor circuits. To reverse the air distribution door actuator rotation, the FCIM reverses the voltage and ground circuits. The air distribution door actuator feedback resistors are supplied a ground from the FCIM by the air distribution door actuator return circuits and a 5-volt reference voltage on the air distribution door actuator reference circuits. The FCIM uses the actuator feedback resistor wiper arm position and the voltage on the air distribution door actuator feedback circuits to determine the air distribution door actuator position.

During an actuator calibration cycle, the FCIM drives the air distribution door until the door reaches both internal stops in the FCIM case. If the air distribution door is temporarily obstructed or binding during a calibration cycle, the FCIM may interpret this as the actual end of travel for the door. When this condition occurs and the FCIM commands the actuator to its end of travel, the airflow may not be from the expected outlets.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1086:11	Air Distribution Damper Motor: Circuit Short to Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1086:12	Air Distribution Damper Motor: Circuit Short to Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1086:13	Air Distribution Damper Motor: Circuit Open	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor cannot move.
B11E7:11	Air Distribution Damper Position Sensor: Circuit Short to Ground	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating a short to ground.
B11E7:15	Air Distribution Damper Position Sensor: Circuit Short to Battery or Open	This DTCsets when the module senses greater than 4 volts on the actuator feedback circuit, indicating an open circuit or a short to voltage.

Possible Sources

- Wiring, terminals or connectors
- Air distribution door actuator
- Air distribution door binding or stuck

- FCIM

PINPOINT TEST F : INCORRECT OR ERRATIC DIRECTION OF AIRFLOW FROM OUTLETS

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

F1 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A.
- Disconnect FCIM C2402B.
- Disconnect LH temperature door actuator C2091.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost vent/register door actuatorC232.
- Disconnect In vehicle temperature and humidity sensor C2247.
- Disconnect Air inlet door actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-7	V	Ground
C232-6	V	Ground
C232-4	V	Ground
C232-5	V	Ground
C232-3	V	Ground

Is there any voltage present?

Yes	REPAIR the circuit.
No	GO to F2

F2 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-7	Ω	Ground
C232-6	Ω	Ground
C232-4	Ω	Ground
C232-5	Ω	Ground
C232-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to F3
No	REPAIR the circuit.

F3 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-3	Ω	C2402A-20
C232-6	Ω	C2402A-2
C232-4	Ω	C2402A-3
C232-5	Ω	C2402A-22
C232-7	Ω	C2402A-21

Are the resistances less than 3 ohms?

Yes	GO to F4
No	REPAIR the circuit.

F4 CHECK THE AIR DISTRIBUTION DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C232-7	Ω	C232-6
C232-7	Ω	C232-4
C232-7	Ω	C232-5
C232-7	Ω	C232-3
C232-6	Ω	C232-4
C232-6	Ω	C232-5
C232-6	Ω	C232-3
C232-4	Ω	C232-5
C232-4	Ω	C232-3
C232-5	Ω	C232-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new air distribution door actuator, For RHD, refer to REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). For LHD, refer to REFER to: Air Distribution Door Actuator (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to F5
No	REPAIR the circuit.

F5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCIM and related in-line connectors.
- Repair:

- corrosion (install new connector or terminals – clean module pins)
- damaged or bent pins – install new terminals/pins
- pushed-out pins – install new pins as necessary

- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Insufficient, Erratic Or No Heat

Normal Operation and Fault Conditions

When the engine is at operating temperature hot coolant flows from the electric motor through the heater core and back to the electric motor. Correct coolant temperatures are critical for good heater performance.

Possible Sources

- Wiring, terminals or connectors
- Temperature door actuator(s)
- Heater core

Visual Inspection and Diagnostic Pre-checks

- Inspect for low engine coolant level.

PINPOINT TEST G : INSUFFICIENT, ERRATIC OR NO HEAT

G1 CHECK FOR CORRECT ENGINE COOLANT LEVEL

- Ignition OFF.
- Check the engine coolant level.

Is the engine coolant at the correct level as indicated on the engine coolant recovery reservoir?

Yes	GO to G3
No	GO to G2

G2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS

- Pressure test the cooling system for leaks. Refer to the appropriate section in Group 303 for the procedure..

Does the engine cooling system leak?

Yes	REPAIR the engine coolant leak. Refer to the appropriate section in Group 303 for the procedure. TEST the system for normal operation.
No	FILL and BLEED the cooling system. Refer to the appropriate section in Group 303 for the procedure. After filling and bleeding the cooling system, GO to G3

G3 CHECK FOR COOLANT FLOW TO THE HEATER CORE

- Run the motor until it reaches normal operating temperature. Select the floor position on the control

assembly. Set the temperature control to full warm and the blower to the lowest setting.
- Increase engine speed to 3,500 RPM and hold for 30 seconds.
- Allow the engine to idle for 30 seconds.
- Using a suitable temperature measuring device, check the heater core inlet hose to see if it is hot.

Is the heater core inlet hose hot?

Yes	GO to G4
No	BLEED the cooling system per the cooling system draining and vacuum filling general procedure. Refer to the appropriate section in Group 303 for the procedure. After bleeding the cooling system, GO to G4

G4 CHECK FOR A PLUGGED OR RESTRICTED HEATER CORE

- Using a suitable temperature measuring device, measure the heater core outlet hose temperature.

Is the heater core outlet hose temperature similar to the inlet hose temperature (within approximately 6-17°C [10-30°F])?

Yes	DIAGNOSE for a blend door actuator not operating correctly. For inadequate driver side temperature, GO to Pinpoint Test J For inadequate passenger side temperature, GO to Pinpoint Test K
No	INSTALL a new heater core. REFER to: Heater Core (412-00 Climate Control System - General Information, Removal and Installation).

The A/C Is Inoperative

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Control System Logic
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- A/C pressure transducer
- Evaporator temperature sensor
- FCIM
- PCM
- Electric cooling fan

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuse 22(10A).

PINPOINT TEST H : THE A/C (AIR CONDITIONING) IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK THE A/C (AIR CONDITIONING) SYSTEM PRESSURE

- Ignition OFF.
- With the R-134a manifold gauge set connected, check the A/C system pressure.

Is the A/C system pressure above 290 kPa (42 psi)?

Yes	GO to H2
No	CHECK the A/C system for leaks. REFER to: Electronic Leak Detection (412-00 Climate Control System - General Information, General Procedures). REFER to: Fluorescent Dye Leak Detection (412-00 Climate Control System - General Information, General Procedures). After the leak is repaired, RECHARGE the A/C system. REFER to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

H2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out the network test.

Do the FCIM and the PCM pass the network test?

Yes	GO to H3
No	DIAGNOSE the FCIM or PCM does not communicate with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

H3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) PRESSURE SENSOR (ACP_PRESS) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- With a manifold gauge set connected, compare the pressure readings of the manifold gauge set and the PCM ACP_PRESS PID.

Are the pressure values of the manifold gauge set and the ACP_PRESS PCM PID within ± 103 kPa (15 psi)?

Yes	GO to H4
No	INSTALL a new A/C pressure transducer. REFER to: Air Conditioning (A/C) Pressure Transducer (412-00 Climate Control System - General Information, Removal and Installation).

H4 ELECTRIC COOLING FAN FUNCTIONAL CHECK

- Ignition ON.
- Using a diagnostic scan tool, carry out the PCM KOEO self-test.

Does the electric cooling fan operate during the KOEO self-test?

Yes	GO to H5
No	DIAGNOSE the electric cooling fan operation. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. Section 3 Symptom Charts.

H5 COMPARE THE EVAPORATOR TEMPERATURE SENSOR TO THE PCM (POWERTRAIN CONTROL MODULE) AMBIENT AIR TEMPERATURE (AAT) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Allow the vehicle exterior and interior to stabilize to ambient temperature.
- Disconnect Evaporator Temperature Sensor C296.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1 (component side)	Ω	C296-2(component side)

- Compare the resistance values to the table below:

Ambient Temperature °C	Resistance ohms
-40°C	98,625 - 103,275 ohms
-20°C	28,640 - 29,600 ohms
°C	9695 - 9895 ohms
20°C	3675 - 3810 ohms
25°C	2950 - 3050 ohms
30°C	2370 - 2565 ohms
40°C	1565 - 1635 ohms

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AAT PID.

Are the temperature values similar?

Yes	GO to H6
No	INSTALL a new evaporator temperature sensor. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).

H6 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) A/C (AIR CONDITIONING) SWITCH (CC_SW_AC) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) ON

- Using a diagnostic scan tool, view FCIM Parameter Identifications (PIDs).
- Monitor the CC_SW_AC PID.

Does the PID display Active?

Yes	GO to H7
No	GO to H14

H7 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) ON

- Start the engine.
- Using a diagnostic scan tool, monitor the PCM AC_REQ PID.
- On the HVAC controls, select PANEL and then press the A/C button (indicator on).

Does the PID display Yes when the button is pressed?

Yes	GO to H8
No	GO to H14

H8 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING)

COMPRESSOR COMMANDED STATE (ACC_CMD) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) COMMANDED ON

- Using a diagnostic scan tool, activate the PCM ACC_CMD PID.

Does the A/C compressor turn on?

Yes	GO to H15
No	GO to H9

H9 CHECK THE VOLTAGE TO THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Ignition OFF.
- Disconnect the A/C clutch relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 1		Ground
A/C clutch relay socket 3		Ground

Are the voltages greater than 11 volts?

Yes	GO to H10
No	VERIFY BJB fuses 24 (10A) are OK. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. If OK, REPAIR the circuit.

H10 BYPASS THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Ignition OFF.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
A/C clutch relay socket 3		A/C clutch relay socket 5

- Ignition ON.

Does the A/C compressor clutch engage?

Yes	REMOVE the fused jumper wire. INSTALL a new A/C clutch relay.
No	LEAVE the fused jumper wire installed. GO to H11

H11 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH FIELD COIL VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Disconnect A/C compressor clutch field coil C100.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C100-1		Ground

Is the voltage greater than 11 volts?

Yes	REMOVE the fused jumper wire. GO to H12
No	REMOVE the fused jumper wire. REPAIR the circuit.

H12 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH FIELD COIL GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C100-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to H13
No	REPAIR the circuit.

H13 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH AIR GAP

- Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley.
  REFER to: Air Conditioning (A/C) Clutch Air Gap Adjustment (412-00 Climate Control System - General Information, General Procedures).

Is the A/C compressor clutch air gap greater than 0.6 mm (0.0236 in)?

Yes	ADJUST the A/C compressor clutch air gap. REFER to: Air Conditioning (A/C) Clutch Air Gap Adjustment (412-00 Climate Control System - General Information, General Procedures).
No	INSTALL a new A/C compressor clutch field coil. REFER to: Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4 (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation). REFER to: Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).

H14 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

H15 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (replace connector or terminals – clean module pins)
  - damaged or bent pins – replace terminals/pins
  - pushed-out pins – replace pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The A/C Is Always On - A/C Mode Always Commanded On

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Control System Logic
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1464	A/C Demand Out Of Self Test Range	This DTC sets when the PCM senses an A/C request during a PCM self-test.

Possible Sources

- A/C clutch relay
- Wiring, terminals or connectors
- PCM
- FCIM

PINPOINT TEST I : THE A/C (AIR CONDITIONING) IS ALWAYS ON - A/C (AIR CONDITIONING) MODE ALWAYS COMMANDED ON

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK THE A/C (AIR CONDITIONING) CLUTCH RELAY

- Carry out the component test on the A/C clutch relay.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the relay pass the component test?

Yes	GO to I2
No	INSTALL a new A/C clutch relay.

I2 CHECK THE A/C (AIR CONDITIONING) COMPRESSOR CLUTCH FIELD COIL VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect A/C compressor clutch field coil C100.
- Disconnect the A/C clutch relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C100-1		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to I3

I3 COMPARE THE EVAPORATOR TEMPERATURE SENSOR TO THE PCM (POWERTRAIN CONTROL MODULE) AMBIENT AIR TEMPERATURE (AAT) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Allow the vehicle exterior and interior to stabilize to ambient temperature.
- Disconnect Evaporator Temperature Sensor C296.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1(component side)	Ω	C296-2(component side)

- Compare the resistance values to the table below:

Ambient Temperature °C	Resistance ohms
-40°C	98,625 - 103,275 ohms

-20°C	28,640 - 29,600 ohms
°C	9695 - 9895 ohms
20°C	3675 - 3810 ohms
25°C	2950 - 3050 ohms
30°C	2370 - 2565 ohms
40°C	1565 - 1635 ohms

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AAT PID.

Are the temperature values similar?

Yes	GO to I4
No	INSTALL a new evaporator temperature sensor. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).

I4 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) A/C (AIR CONDITIONING) SWITCH STATUS (CC_SW_AC) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Using a diagnostic scan tool, view FCIM Parameter Identifications (PIDs).
- Monitor the CC_SW_AC PID.
- Select panel mode, press and release the A/C button (indicator off) on the FCIM controls.

Does the PID display Active when pressed and Inactive when released?

Yes	GO to I5
No	GO to I8

I5 CHECK THE A/C (AIR CONDITIONING) PRESSURE SENSOR (ACP_PRESS) PARAMETER IDENTIFICATION (PID)

- Using a diagnostic scan tool, view the PCM Parameter Identification (PIDs).
- With a manifold gauge set connected, compare the pressure readings of the manifold gauge set and the PCM Parameter Identification (PID) ACP_PRESS.

Are the pressure values of the manifold gauge set and the ACP_PRESS PCM PID within ± 103 kPa (15) psi?

Yes	GO to I6
No	INSTALL a new A/C pressure transducer. REFER to: Air Conditioning (A/C) Pressure Transducer (412-00 Climate Control System - General Information, Removal and Installation).

I6 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION) WITH THE A/C (AIR CONDITIONING) OFF

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AC_REQ PID.
- While in panel mode, release the A/C button (indicator off) on the FCIM controls.

Does the PID display No?

Yes	GO to I9
No	GO to I7

I7 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION) WITH FCIM (FRONT CONTROLS INTERFACE MODULE) DISCONNECTED

- Ignition OFF.
- Disconnect FCIM C2402A.
- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the AC_REQ PID.

Does the PID display No?

Yes	GO to I9
No	GO to I8

I8 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, L a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

I9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (replace connector or terminals – clean module pins)
  - damaged or bent pins – replace terminals/pins
  - pushed-out pins – replace pins as necessary
- Reconnect all PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, L a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L

	Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Temperature Control Is Inoperative Or Does Not Operate Correctly - Driver Side

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Temperature Door Actuator - Driver Side,
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

During an actuator calibration cycle, the FCIM drives the temperature door until the door reaches both internal stops in the HVAC case. If the temperature door is temporarily obstructed or binding during a calibration cycle, the module may interpret this as the actual end of travel for the door. When this condition occurs and the module commands the actuator to its end of travel, the airflow may not be the expected temperature.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1081:11	Left Temperature Damper Motor: Circuit Short To Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1081:12	Left Temperature Damper Motor: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1081:13	Left Temperature Damper Motor: Open Circuit	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor cannot move.
B11E5:11	Left HVAC Damper Position Sensor: Circuit Short to Ground	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating a short to ground.
B11E5:15	Left HVAC Damper Position Sensor: Circuit Short to Battery or Ground	This DTC sets when the module senses less than 1 volt, or greater than 5 volts on the actuator feedback circuit, indicating an open circuit, short to ground or short to voltage.

Possible Sources

- Wiring, terminals or connectors
- Driver side temperature door actuator
- FCIM

PINPOINT TEST J : THE TEMPERATURE CONTROL IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY - DRIVER SIDE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK THE DRIVER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A..
- Disconnect FCIM C2402B..
- Disconnect BCM fuse 21 (5A)..
- Disconnect In-vehicle temperature and humidity sensor C2247.
- Disconnect LHtemperature door actuator C2091.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost Vent/Register Door Actuator C232.
- Disconnect Air Inlet Door Actuator C282.
- Ignition ON.
- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	V	Ground
C2091-6	V	Ground
C2091-4	V	Ground
C2091-5	V	Ground
C2091-3	V	Ground

RHD

Positive Lead	Measurement / Action	Negative Lead
C2092-7	V	Ground
C2092-6	V	Ground
C2092-4	V	Ground
C2092-5	V	Ground
C2092-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to J2

J2 CHECK THE DRIVER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	Ground

C2091-6	Ω	Ground
C2091-4	Ω	Ground
C2091-5	Ω	Ground
C2091-3	Ω	Ground

RHD

Positive Lead	Measurement / Action	Negative Lead
C2092-7	Ω	Ground
C2092-6	Ω	Ground
C2092-4	Ω	Ground
C2092-5	Ω	Ground
C2092-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J3
No	REPAIR the circuit.

J3 CHECK THE DRIVER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	C2402B-14
C2091-6	Ω	C2402A-2
C2091-4	Ω	C2402A-3
C2091-5	Ω	C2402B-18
C2091-3	Ω	C2402B-13

RHD

Positive Lead	Measurement / Action	Negative Lead
C2092-6	Ω	C2402A-2
C2092-4	Ω	C2402A-3
C2092-7	Ω	C2402A-8
C2092-5	Ω	C2402A-10
C2092-3	Ω	C2402A-9

Are the resistances less than 3 ohms?

Yes	GO to J4
No	REPAIR the circuit.

J4 CHECK THE DRIVER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	C2091-6
C2091-7	Ω	C2091-4
C2091-7	Ω	C2091-5
C2091-7	Ω	C2091-3
C2091-6	Ω	C2091-4
C2091-6	Ω	C2091-5
C2091-6	Ω	C2091-3
C2091-4	Ω	C2091-5
C2091-4	Ω	C2091-3
C2091-5	Ω	C2091-3

RHD

Positive Lead	Measurement / Action	Negative Lead
C2092-7	Ω	C2092-6
C2092-7	Ω	C2092-4
C2092-7	Ω	C2092-5
C2092-7	Ω	C2092-3
C2092-6	Ω	C2092-4
C2092-6	Ω	C2092-5
C2092-6	Ω	C2092-3
C2092-4	Ω	C2092-5
C2092-4	Ω	C2092-3
C2092-5	Ω	C2092-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new driver side temperature door actuator. For LHD, refer to REFER to: Temperature Door Actuator LH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation). For RHD, refer to REFER to: Temperature Door Actuator LH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to J5

No	REPAIR the circuit.

J5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (I new connector or terminals – clean module pins)
  - damaged or bent pins – I new terminals/pins
  - pushed-out pins – I new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Temperature Control Is Inoperative Or Does Not Operate Correctly - Passenger Side

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Temperature Door Actuator - Passenger side,
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

During an actuator calibration cycle, the FCIM drives the temperature door until the door reaches both internal stops in the HVAC case. If the temperature door is temporarily obstructed or binding during a calibration cycle, the module may interpret this as the actual end of travel for the door. When this condition occurs and the module commands the actuator to its end of travel, the airflow may not be the expected temperature.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1082:11	Right Temperature Damper Motor: Circuit Short To Ground	This DTC sets when the module senses lower than expected voltage on an actuator motor circuit when voltage is applied to drive the motor, indicating a short to ground. The motor can move only in one direction.
B1082:12	Right Temperature Damper Motor: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the actuator motor circuit when ground is applied to drive the motor, indicating a short to voltage. The motor can move only in one direction.
B1082:13	Right Temperature Damper Motor: Open Circuit	This DTC sets when the module senses no voltage on the actuator motor circuit when ground is applied to drive the motor, indicating an open circuit. The motor can not move.
B11E6:11	Right HVAC Damper Position Sensor: Circuit Short to Battery	This DTC sets when the module senses less than 1 volt on the actuator feedback circuit, indicating an open circuit or a short to ground.
B11E6:15	Right HVAC Damper Position Sensor: Circuit	This DTC sets when the module senses less than 1 volt, or greater than 5 volts on the actuator feedback circuit, indicating an open circuit, short to

	Short to Battery or Ground	ground or short to voltage.

Possible Sources

- Wiring, terminals or connectors
- Passenger side temperature door actuator
- FCIM

PINPOINT TEST K : THE TEMPERATURE CONTROL IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY - PASSENGER SIDE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

K1 CHECK THE PASSENGER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A..
- Disconnect FCIM C2402B..
- Disconnect BCM fuse 21 (5A)..
- Disconnect In-vehicle temperature and humidity sensor C2247.
- Disconnect LHtemperature door actuator C2091.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost Vent/Register Door Actuator C232.
- Disconnect Air Inlet Door Actuator C282.
- Ignition ON.
- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2092-7	V	Ground
C2092-6	V	Ground
C2092-4	V	Ground
C2092-5	V	Ground
C2092-3	V	Ground

RHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	Ground
C2091-6	Ω	Ground
C2091-4	Ω	Ground
C2091-5	Ω	Ground
C2091-3	Ω	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to K2

K2 CHECK THE PASSENGER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2092-7	Ω	Ground
C2092-6	Ω	Ground
C2092-4	Ω	Ground
C2092-5	Ω	Ground
C2092-3	Ω	Ground

RHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	Ground
C2091-6	Ω	Ground
C2091-4	Ω	Ground
C2091-5	Ω	Ground
C2091-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to K3
No	REPAIR the circuit.

K3 CHECK THE PASSENGER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR AN OPEN

- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2092-6	Ω	C2402A-2
C2092-4	Ω	C2402A-3
C2092-7	Ω	C2402A-8
C2092-5	Ω	C2402A-10
C2092-3	Ω	C2402A-9

RHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	C2402B-14
C2091-6	Ω	C2402A-2
C2091-4	Ω	C2402A-3
C2091-5	Ω	C2402B-18
C2091-3	Ω	C2402B-13

Are the resistances less than 3 ohms?

Yes	GO to K4
No	REPAIR the circuit.

K4 CHECK THE PASSENGER SIDE TEMPERATURE DOOR ACTUATOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

LHD

Positive Lead	Measurement / Action	Negative Lead
C2092-7	Ω	C2092-6
C2092-7	Ω	C2092-4
C2092-7	Ω	C2092-5
C2092-7	Ω	C2092-3
C2092-6	Ω	C2092-4
C2092-6	Ω	C2092-5
C2092-6	Ω	C2092-3
C2092-4	Ω	C2092-5
C2092-4	Ω	C2092-3
C2092-5	Ω	C2092-3

RHD

Positive Lead	Measurement / Action	Negative Lead
C2091-7	Ω	C2091-6
C2091-7	Ω	C2091-4
C2091-7	Ω	C2091-5
C2091-7	Ω	C2091-3
C2091-6	Ω	C2091-4
C2091-6	Ω	C2091-5
C2091-6	Ω	C2091-3
C2091-4	Ω	C2091-5
C2091-4	Ω	C2091-3

C2091-5	Ω	C2091-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new passenger side temperature door actuator. For LHD, refer to REFER to: Temperature Door Actuator RH - LHD 4WD/LHD RWD (412-00 Climate Control System - General Information, Removal and Installation). For RHD, refer to REFER to: Temperature Door Actuator RH - RHD 4WD/RHD RWD (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to K5
No	REPAIR the circuit.

K5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Blower Motor Is Inoperative

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Voltage is supplied to the blower motor relay switched contact from the BJB. Ground to the relay coil is a dedicated circuit. When the blower motor relay coil receives power from the FCIM, the relay coil is energized and voltage is delivered to the blower motor control module. Power and ground for the blower motor is provided by the blower motor control module. The FCIM sends a PWM signal to the blower motor speed control to control the blower speed.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10AF:11	Blower Fan Relay: Circuit Short To Ground	This DTC sets when the module senses low voltage on the blower motor relay coil voltage circuit when the module is energizing the circuit. The blower motor relay is permanently inactive.
B10AF:12	Blower Fan Relay: Circuit Short To	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit or a short to voltage. The blower motor relay is inactive when circuit is open; the blower motor relay is on all the

	Battery	time when shorted to battery.
B10AF:13	Blower Fan Relay: Circuit Open	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit or a short to voltage. The blower motor relay is inactive when circuit is open; the blower motor relay is on all the time when shorted to battery.
B10AF:15	Blower Fan Relay: Circuit Short To Battery or Open	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit or a short to voltage. The blower motor relay is inactive when circuit is open; the blower motor relay is on all the time when shorted to battery.
B10B9:12	Blower Control: Circuit Short To Battery	This DTC sets when the module senses high voltage on the blower motor control PWM circuit, indicating a short directly to voltage. The blower motor is inoperative.
B10B9:14	Blower Control: Circuit Short To Ground or Open	This DTC sets when the module senses no voltage on the blower motor control PWM circuit, indicating a short directly to ground or an open circuit. The blower motor runs at full speed if the circuit is shorted to ground. The blower motor is inoperative if the circuit is open.

Possible Sources

- Wiring, terminals or connectors
- Fuse
- Blower motor relay
- Blower motor speed control field effect transistor (FET)
- FCIM

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuse 79 (40A).

PINPOINT TEST L : THE BLOWER MOTOR IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

L1 CHECK THE BLOWER MOTOR RELAY

- Ignition OFF.
- Disconnect Blower motor relay.
- Carry out the component test on the blower motor relay.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the relay pass the component test?

Yes	GO to L2
No	INSTALL a new blower motor relay.

L2 CHECK THE BLOWER MOTOR RELAY SWITCH CONTACT SUPPLY VOLTAGE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 3		Ground

Is the voltage greater than 11 volts?

Yes	GO to L3

No	VERIFY BJB fuse 79 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

L3 CHECK THE BLOWER MOTOR RELAY COIL GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to L4
No	REPAIR the circuit.

L4 CHECK THE BLOWER MOTOR RELAY COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to L5
No	REPAIR the circuit.

L5 CHECK THE BLOWER MOTOR RELAY COIL CONTROL CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
Blower motor relay socket 1	Ω	C2402A-11

Is the resistance less than 3 ohms?

Yes	GO to L6
No	REPAIR the circuit.

L6 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Blower motor C2004.

- Disconnect Blower motor speed control field effect transistor (FET) C2384.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2004-1		Ground
C2384-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to L7

L7 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2004-1	Ω	Ground
C2384-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to L8
No	REPAIR the circuit.

L8 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2384-2	Ω	Ground

Positive Lead	Measurement / Action	Negative Lead
C2004-1	Ω	Blower motor relay socket 5

Positive Lead	Measurement / Action	Negative Lead
C2384-3	Ω	C2402A-11

Are the resistances less than 3 ohms?

Yes	GO to L9
No	REPAIR the circuit.

L9 CHECK THE BLOWER MOTOR SPEED CONTROL CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2384-2	Ω	C2004-1
C2384-2	Ω	C2384-3
C2004-1	Ω	C2384-3

Are the resistances greater than 10,000 ohms?

Yes	If C2004blower motor is effected. INSTALL a new blower motor. REFER to: Blower Motor (412-00 Climate Control System - General Information, Removal and Installation). If C2384 field effect transistor (FET) is effected. INSTALL A new FET. REFER to: Blower Motor Speed Control (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to L10
No	REPAIR the circuits.

L10 CHECK FOR CORRECT FRONT CONTROLS INTERFACE MODULE (FCIM) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Blower Motor Does Not Operate Correctly

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Voltage is supplied to the blower motor relay switched contact from the BJB. Ground to the relay coil is a dedicated circuit. When the blower motor relay coil receives power from the FCIM, the relay coil is energized and voltage is

delivered to the blower motor speed control field effect transistor (FET). The FCIM sends a PWM signal to the blower motor speed control field effect transistor to control the blower speed.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10AF:11	Blower Fan Relay: Circuit Short To Ground	This DTC sets when the module senses low voltage on the blower motor relay coil voltage circuit when the module is energizing the circuit. The blower motor relay is permanently inactive.
B10AF:12	Blower Fan Relay: Circuit Short To Battery	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating a short to voltage. The blower motor relay is on all the time when shorted to battery.
B10AF:13	Blower Fan Relay: Circuit Open	This DTC sets when the module senses less than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit. The blower motor relay is inactive when circuit is open.
B10AF:15	Blower Fan Relay: Circuit Short To Battery or Open	This DTC sets when the module senses greater than expected voltage on the blower motor relay coil voltage circuit, indicating an open circuit or a short to voltage. The blower motor relay is inactive when circuit is open; the blower motor relay is on all the time when shorted to battery.
B10B9:14	Blower Control: Circuit Short To Ground or Open	This DTC sets when the module senses no voltage on the blower motor control PWM circuit, indicating a short directly to ground or an open circuit. The blower motor runs at full speed if the circuit is shorted to ground. The blower motor is inoperative if the circuit is open.

Possible Sources

- Wiring, terminals or connectors
- Blower motor relay
- Blower motor
- Blower motor speed control, field effect transistor (FET)
- FCIM

PINPOINT TEST M : THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

M1 VERIFY THE BLOWER MOTOR OPERATION

- Ignition ON.
- Select panel on the FCIM controls. Adjust the blower motor setting to the minimum and maximum settings.

Does the blower motor operate at any setting?

Yes	GO to M2
No	GO to Pinpoint Test L

M2 CHECK THE BLOWER MOTOR SPEED CONTROL PWM (PULSE WIDTH MODULATION) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Blower motor speed control (field effect transistor (FET))C2384.
- Disconnect Blower motor C2004.
- Disconnect FCIM C2402A.
- Ignition ON.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-23		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to M3

M3 CHECK THE BLOWER MOTOR SPEED CONTROLPWM (PULSE WIDTH MODULATION) CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-23	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to M4
No	REPAIR the circuit.

M4 CHECK THE BLOWER MOTOR RELAY COIL CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Blower motor relay.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-11		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to M5

M5 CHECK THE BLOWER MOTOR OPERATION WITH THE BLOWER MOTOR RELAY DISCONNECTED

- Ignition OFF.
- Connect Field effect transistor part of Blower motor speed control C2387.
- Connect Blower motor part of Blower motor speed control C2004.
- Connect FCIM C2402A.
- Ignition ON.
- Operate the HVAC system and determine if the concern is still present.

Does the fan still operate all the time?

Yes	REPAIR the blower motor speed control voltage circuit CH402 (YE/GN) for a short to voltage.
No	GO to M6

M6 CHECK FOR CORRECT BLOWER MOTOR SPEED CONTROL OPERATION

- Ignition OFF.
- Disconnect and inspect the blower motor speed control connector field effect transistor C2384and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the blower motor speed control connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	INSTALL a new blower motor speed control. REFER to: Blower Motor Speed Control (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to M7
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Air Discharge Temperature Sensor Circuit Faults

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

The 2 air discharge temperature sensors contain a thermistor. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises.
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and

Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10B3:11	Right Panel Air Discharge Temperature: Circuit Short To Ground	This DTC sets when the FCIM senses erratic voltages from the right panel air discharge temperature sensor.
B10B3:15	Right Panel Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the right panel air discharge temperature sensor.
B10B4:11	Right Floor Air Discharge Temperature: Circuit Short To Ground	This DTC sets when the FCIM senses erratic voltages from the right panel air discharge temperature sensor.
B10B4:15	Right Floor Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the right panel air discharge temperature sensor.
B10B5:11	Left Panel Air Discharge Temperature: Circuit Short To Ground	This DTC sets when the FCIM senses erratic voltages from the left panel air discharge temperature sensor.
B10B5:15	Left Panel Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the left panel air discharge temperature sensor.
B10B6:11	Left Floor Air Discharge Temperature: Circuit Short To Ground	This DTC sets when the FCIM senses erratic voltages from the left floor air discharge temperature sensor.
B10B6:15	Left Floor Air Discharge Temperature: Circuit Short To Battery or Open	This DTC sets when the FCIM senses erratic voltages from the left floor air discharge temperature sensor.

Possible Sources

- Wiring, terminals or connectors
- Air discharge temperature sensor(s)
- FCIM

PINPOINT TEST N : AIR DISCHARGE TEMPERATURE SENSOR CIRCUIT FAULTS

N1 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR OUTPUT VOLTAGE CIRCUIT

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

- Ignition OFF.
- Disconnect the suspect air discharge temperature sensor:
  - Driver side center register air discharge temperature sensor C2438
  - Driver side footwell air discharge temperature sensor C2436
- Ignition ON.
- Turn the HVAC system on.
- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1		C2436-3

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1		C2438-3

Is the voltage between 4.7 and 5.1 volts?

Yes	INSTALL a new air discharge temperature sensor. Refer to the appropriate section in Group 412 for the procedure. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC returns, GO to N9
No	GO to N2

N2 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402B.
- Ignition ON.
- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1		Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to N3

N3 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL RETURN CIRCUIT FOR A SHORT TO VOLTAGE

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-3		Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to N4

N4 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1	Ω	Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N5
No	REPAIR the circuit.

N5 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL RETURN CIRCUIT FOR A SHORT TO GROUND

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-3	Ω	Ground

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N6

No	REPAIR the circuit.

N6 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1	Ω	C2402B-5

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1	Ω	C2402B-4

Are the resistances less than 3 ohms?

Yes	GO to N7
No	REPAIR the circuit.

N7 CHECK THE AIR DISCHARGE TEMPERATURE SENSOR SIGNAL RETURN CIRCUIT FOR AN OPEN

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-3	Ω	C2402A-2

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-3	Ω	C2402A-2

Are the resistances less than 3 ohms?

Yes	GO to N8
No	REPAIR the circuit.

N8 CHECK AIR DISCHARGE TEMPERATURE SENSOR SIGNAL CIRCUIT AND THE SIGNAL RETURN FOR A SHORT TO TOGETHER

- Measure:

Driver side footwell air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2436-1	Ω	C2436-3

Driver side center register air discharge temperature sensor

Positive Lead	Measurement / Action	Negative Lead
C2438-1	Ω	C2438-3

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new air discharge temperature sensor. Refer to the appropriate section in Group 412 for the procedure. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC returns, GO to N9
No	REPAIR the circuit.

N9 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B105A:12, B105A:14, B1A61:11, B1A61:15, B1A69:12, B1A69:14

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

In-Vehicle Temperature and Humidity Sensor,
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B105A:12	Cabin Temperature Sensor Fan: Circuit Short To Battery	This DTC sets when the module senses higher than expected voltage on the in-vehicle temperature and humidity sensor fan motor circuit. The in-vehicle temperature and humidity sensor fan motor is inactive.
B105A:14	Cabin Temperature Sensor Fan: Circuit Short To Ground or Open	This DTC sets when the module senses no voltage on the in-vehicle temperature and humidity sensor fan motor circuit, indicating an open or a short directly to ground. The in-vehicle temperature and humidity sensor fan motor is active.
B1A61:11	Cabin Temperature Sensor: Circuit Short to Ground	This DTC sets when the module senses lower than expected voltage on the in-vehicle temperature and humidity sensor feedback circuit, indicating a short to ground.
B1A61:15	Cabin Temperature Sensor: Circuit Short to Battery or Open	This DTC sets when the module senses greater than expected voltage on the in-vehicle temperature and humidity sensor feedback circuit, indicating a short to voltage or an open circuit or sensor.
B1A69:11	Humidity Sensor: Circuit Short To Ground	This DTCsets when the module senses lower than expected voltage on the in-vehicle temperature and humidity sensor humidity input circuit, indicating a short to ground.
B1A69:15	Humidity Sensor: Circuit Short To Battery or Open	This DTCsets when the module senses greater than expected voltage on the in-vehicle temperature and humidity sensor humidity input circuit, indicating a short to voltage or an open circuit or sensor.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- In-vehicle temperature and humidity sensor
- FCIM

Visual Inspection and Diagnostic Pre-checks

- Make sure the in-vehicle temperature and humidity sensor harness is not chaffed.

PINPOINT TEST O : B105A:12, B105A:14, B1A61:11, B1A61:15, B1A69:11, B1A69:15

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

O1 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A. .
- Disconnect FCIM C2402B..
- Disconnect BCM fuse 21 (5A)..
- Disconnect In-vehicle temperature and humidity sensor C2247.
- Disconnect LHtemperature door actuator C2091.
- Disconnect RH temperature door actuator C2092.
- Disconnect Defrost Vent/Register Door Actuator C232.
- Disconnect Air Inlet Door Actuator C282.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-1		Ground
C2247-2		Ground
C2247-3		Ground
C2247-4		Ground

C2247-5	V	Ground
C2247-6	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to O2

O2 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-1	Ω	Ground
C2247-2	Ω	Ground
C2247-3	Ω	Ground
C2247-4	Ω	Ground
C2247-5	Ω	Ground
C2247-6	Ω	Ground

Are the resistances greater than 10,000 ohms?

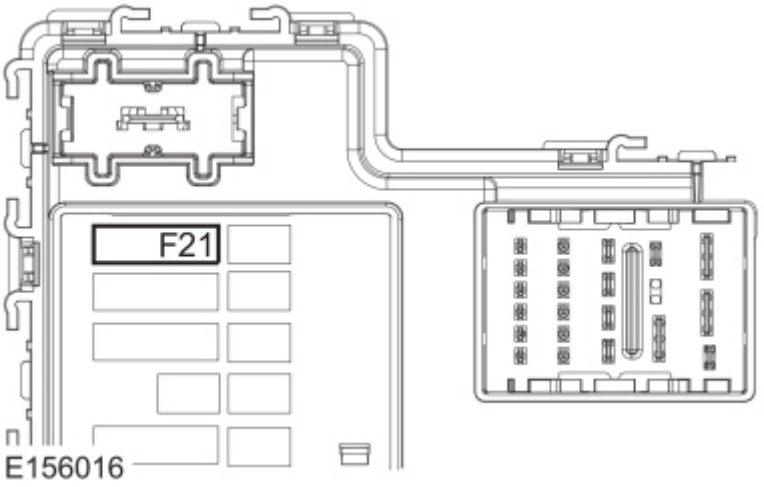
Yes	GO to O3
No	REPAIR the circuit.

O3 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-3	Ω	C2402A-3
C2247-5	Ω	C2402A-2

Positive Lead	Measurement / Action	Negative Lead
C2247-1	Ω	C2402B-27
C2247-2	Ω	C2402B-29
C2247-4	Ω	C2402B-19

Positive Lead	Measurement / Action	Negative Lead
C2247-6	Ω	BCM fuse 21 cavity, (component  side)

Are the resistances less than 3 ohms?

Yes	GO to O4
No	REPAIR the circuit.

O4 CHECK THE IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2247-1	Ω	C2247-2
C2247-1	Ω	C2247-3
C2247-1	Ω	C2247-4
C2247-1	Ω	C2247-5
C2247-1	Ω	C2247-6
C2247-2	Ω	C2247-3
C2247-2	Ω	C2247-4
C2247-2	Ω	C2247-5
C2247-2	Ω	C2247-6
C2247-3	Ω	C2247-4
C2247-3	Ω	C2247-5
C2247-3	Ω	C2247-6
C2247-4	Ω	C2247-5
C2247-4	Ω	C2247-6
C2247-5	Ω	C2247-6

Are the resistances greater than 10,000 ohms?

Yes	GO to O5
No	REPAIR the circuit.

O5 CHECK FOR CORRECT IN-VEHICLE TEMPERATURE AND HUMIDITY SENSOR OPERATION

- Ignition OFF.
- Inspect the disconnected connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all disconnected connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	INSTALL a new in-vehicle temperature and humidity sensor. REFER to: Ambient Air Quality Sensor (412-00 Climate Control System - General Information, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to O6
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

O6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1A63:11, B1A63:15, B1A64:11, B1A64:15

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Sunload Sensor,
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A63:11	Right Solar Sensor: Circuit Short To Ground	This DTC sets when the control module senses lower than expected voltage on the RH sensor feedback circuit, indicating a short to ground.
B1A63:15	Right Solar Sensor: Circuit Short To Battery or Open	This DTC sets when the control module senses higher than expected voltage on the RH sensor feedback circuit, indicating a short to voltage or an open circuit or sensor.
B1A64:11	Left Solar Sensor: Circuit Short To Ground	This DTC sets when the control module senses lower than expected voltage on the LH sensor feedback circuit, indicating a short to ground.
B1A64:15	Left Solar Sensor: Circuit Short To Battery or Open	This DTC sets when the control module senses higher than expected voltage on the LH sensor feedback circuit, indicating a short to voltage or an open circuit or sensor.

Possible Sources

- Wiring, terminals or connectors
- Sunload sensor
- FCIM

Visual Inspection and Diagnostic Pre-checks

- Inspect loose or corroded FCIM and sunload sensor connections.

PINPOINT TEST P : B1A63:11, B1A63:15, B1A64:11, B1A64:15

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

P1 CHECK THE SUNLOAD SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Autolamp/sunload sensor C286.
- Disconnect FCIM C2402B.
- Disconnect BCM C2280G.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C286-1	V	Ground
C286-2	V	Ground
C286-3	V	Ground
C286-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to P2

P2 CHECK THE SUNLOAD SENSOR CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C286-1	Ω	Ground
C286-2	Ω	Ground

C286-2	Ω	Ground
C286-3	Ω	Ground
C286-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to P3
No	REPAIR the circuit.

P3 CHECK THE SUNLOAD SENSOR SIGNAL CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C286-1	Ω	C2402B-22
C286-3	Ω	C2402B-21

Positive Lead	Measurement / Action	Negative Lead
C286-2	Ω	C2280G-24
C286-4	Ω	C2280G-22

Are the resistances less than 3 ohms?

Yes	GO to P4
No	REPAIR the circuit.

P4 CHECK THE SUNLOAD SENSOR SIGNAL CIRCUITS FOR A SHORT TO EACH OTHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C286-1	Ω	C286-2
C286-1	Ω	C286-3
C286-1	Ω	C286-4
C286-2	Ω	C286-3
C286-2	Ω	C286-4
C286-3	Ω	C286-4

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new sunload sensor. REFER to: Sunload Sensor (412-00 Climate Control System - General Information, Removal

	and Installation). TEST the system for normal operation. If the concern is still present, GO to P5
No	REPAIR the circuit.

P5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B71:11, B1B71:15

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

Evaporator Temperature Sensor,
REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) - System Operation and Component Description (412-00 Climate Control System - General Information, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B71:11	Evaporator Temperature Sensor: Circuit Short To Ground	The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground. The module defaults to calculated evaporator temperature and the compressor is shut off.
B1B71:15	Evaporator Temperature Sensor: Circuit Short To Battery or Open	The module senses no voltage drop on the sensor reference voltage circuit, indicating a short directly to voltage or an open circuit. The module defaults to calculated evaporator temperature and the compressor is shut off.

Possible Sources

- Wiring, terminals or connectors
- Evaporator temperature sensor
- FCIM

PINPOINT TEST Q : B1B71:11, B1B71:15

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Q1 CHECK THE EVAPORATOR TEMPERATURE SENSOR RESISTANCE

- Ignition OFF.
- Disconnect Evaporator temperature sensor C296.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1(component side)	Ω	C296-2(component side)

- Compare the evaporator temperature sensor measured resistance with the table below.

Ambient Temperature °C	Resistance ohms
-40°C	98,625 - 103,275 ohms
-20°C	28,640 - 29,600 ohms
°C	9695 - 9895 ohms
20°C	3675 - 3810 ohms
25°C	2950 - 3050 ohms
30°C	2370 - 2565 ohms
40°C	1565 - 1635 ohms

Is the resistance within the specified values for the temperatures?

Yes	GO to Q2
No	INSTALL a new evaporator temperature sensor. REFER to: Evaporator (412-00 Climate Control System - General Information, Removal and Installation).

Q2 CHECK THE EVAPORATOR TEMPERATURE SENSOR INPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect FCIM C2402A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-19	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to Q3

Q3 CHECK THE EVAPORATOR TEMPERATURE SENSOR INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-19	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to Q4
No	REPAIR the circuit.

Q4 CHECK THE EVAPORATOR TEMPERATURE SENSOR INPUT CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-19	Ω	C296-2

Is the resistance less than 3 ohms?

Yes	GO to Q5
No	REPAIR the circuit.

Q5 CHECK THE EVAPORATOR TEMPERATURE SENSOR SIGNAL AND SIGNAL RETURN CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C296-1	Ω	C296-2

Is the resistance greater than 10,000 ohms?

Yes	GO to Q6
No	REPAIR the circuit.

Q6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

C1B14:11, C1B14:12

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

A 5-volt reference voltage and ground is supplied to the climate control sensors and actuators from the FCIM.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1B14:11	Sensor Supply Voltage A: Circuit Short to Ground	This DTC sets when the module senses less than 5 volts on the sensor reference voltage circuit, indicating a short to ground.
C1B14:12	Sensor Supply Voltage A: Circuit Short to Battery	This DTC sets when the module senses greater than 5 volts on the sensor reference voltage circuit, indicating a short to voltage.

Possible Sources

- Wiring, terminals or connectors
- FCIM

PINPOINT TEST R : C1B14:11, C1B14:12

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

R1 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) DTCS

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Is DTC C1B14:11 present?

Yes	GO to R2
No	GO to R5

R2 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to R3
No	REPAIR the circuit.

R3 CHECK THE REFERENCE VOLTAGE CIRCUIT AND THE SIGNAL RETURN CIRCUIT FOR A SHORT TOGETHER

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	Ω	C2402A-2

Is the resistance greater than 200 ohms?

Yes	GO to R6
No	GO to R4

R4 CHECK THE A/C (AIR CONDITIONING) COMPONENTS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-3	Ω	C2402A-2

- While measuring the resistance, disconnect the following components one at a time, in order. Stop disconnecting components if the measured resistance rises above 200 ohms.
  - In-vehicle temperature and humidity sensor (Ambient quality sensor)C2247
  - Evaporator temperature sensor C296
  - Driver side center register air discharge temperature sensor C2438
  - Driver side footwell air discharge temperature sensor C2436
  - Air distribution door actuator C232
  - Passenger temperature door actuator C2092
  - Driver temperature door actuator C2091
  - Air inlet door actuator C282

Did the resistance rise above 200 ohms?

Yes	INSTALL a new sensor or actuator (the last one to be disconnected). Refer to the appropriate section in Group 412 for the procedure. When installing an actuator, CONNECT the actuator electrical connector before the FCIM. This allows the actuator to be calibrated when the FCIM is connected.
No	REPAIR the circuit.

R5 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C2402A-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to R6

R6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

P193E

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

The PCM controls the A/C compressor clutch field coil based on messages received from the BCM over the HS-CAN. When the FCIM determines it is necessary to activate the A/C compressor due to driver request or automatic climate control settings, the FCIM sends a message to the BCM over the MS-CAN, the BCM then sends a message to the PCM to activate the A/C compressor.

An internal failure of the PCM, BCM or FCIM, or a failure in the MS-CAN or HS-CAN, causes the PCM to set a DTC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P193E	A/C Clutch Request Signal	This DTC sets when the PCM does not receive the A/C enable request from the BCM.

Possible Sources

- Network concerns
- BCM
- PCM
- FCIM

PINPOINT TEST S : P193E

S1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to S2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

S2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, carry out the Network Test.

Do the BCM, PCM and the FCIM pass the Network Test?

Yes	GO to S3
No	DIAGNOSE the BCM, PCM or FCIM does not communicate with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

S3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) A/C (AIR CONDITIONING) REQUEST SIGNAL (AC_REQ) PID (PARAMETER IDENTIFICATION)

- Start the engine.
- Using a diagnostic scan tool, monitor the PCM AC_REQ PID.
- On the HVAC controls, select PANEL mode, then press the A/C button (indicator ON).

Does the AC_REQ PID display YES when the A/C button indicator is illuminated?

Yes	GO to S7
No	GO to S4

S4 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) A/C (AIR CONDITIONING) SWITCH (CC_SW_AC) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, monitor the FCIM CC_SW_AC PID while pressing and releasing the A/C button.

Does the PID display Active when the A/C button indicator is illuminated?

Yes	GO to S6
No	GO to S5

S5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all FCIM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

S6 VERIFY CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM electrical connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all BCM electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. For LHD REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). For RHD REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

S7 VERIFY CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line electrical connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all PCM electrical connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

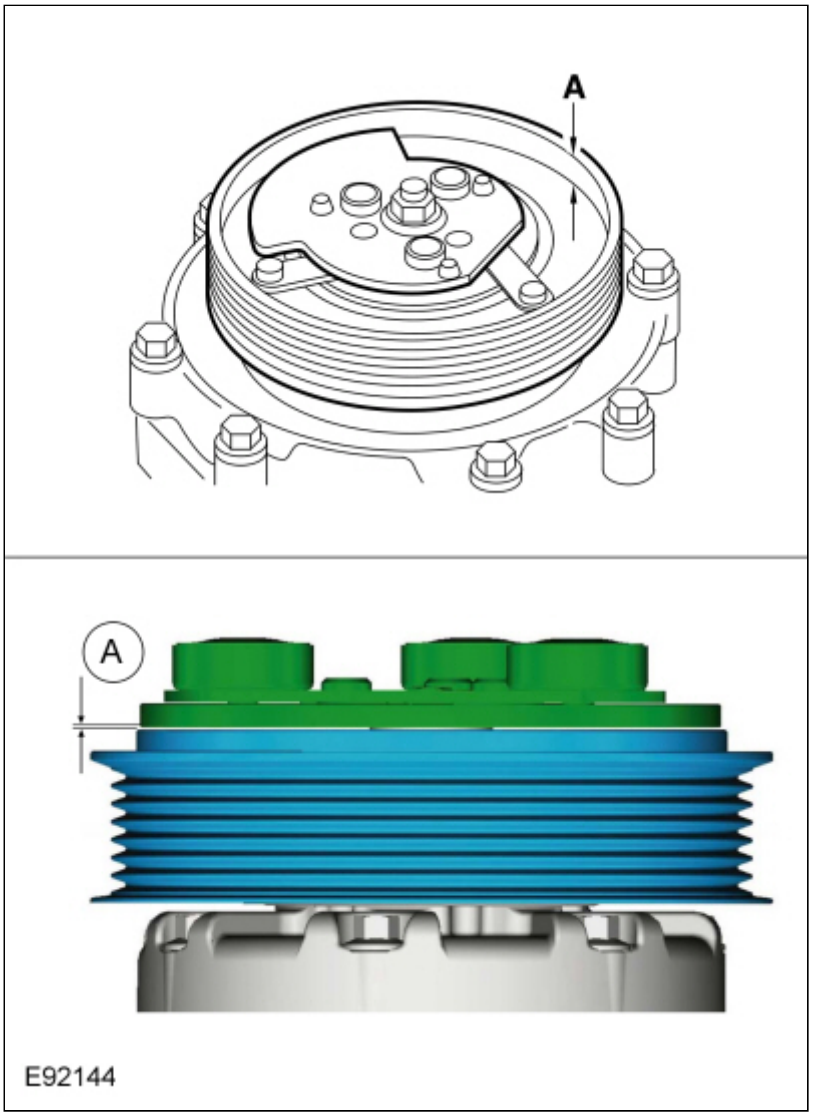
Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.5L Duratec-HE (122kW/165PS)-MI4, REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For 2.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L Duratorq-TDCI (Puma) Diesel, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

	module connections. ADDRESS the root cause of any connector or pin issues.

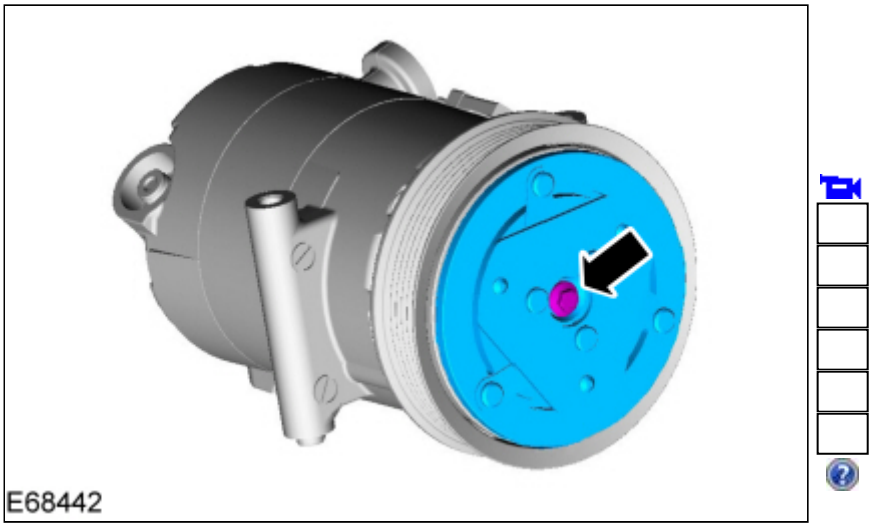
Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Clutch Air Gap Adjustment

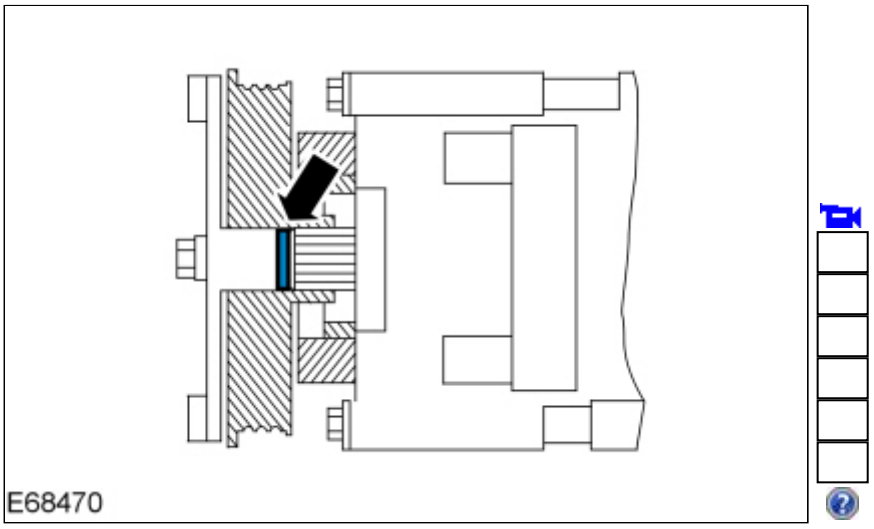
1. Check the gap A (measure the difference between the engaged and disengaged positions of the air conditioning clutch) at 60° intervals around the circumference of the pulley. Operate the air conditioning clutch several times with the aid of a 5 A fused cable. Refer to the relevant wiring diagram for the correct electrical connection. Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).



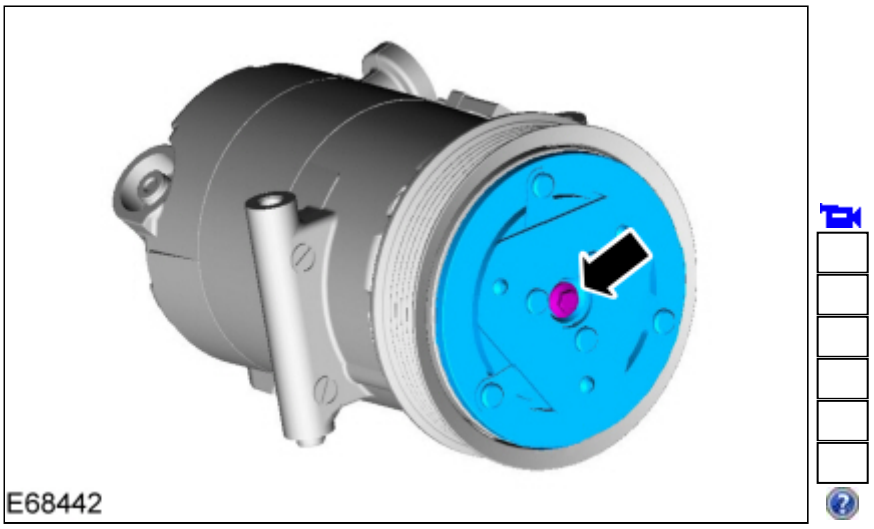
2.



3. If necessary correct the gap A using spacer washers.



4. Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).



5. Check the gap A as described in step 1. If necessary, repeat steps 2-5.

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) System Recovery, Evacuation and Charging

Base Part Number: YN-19

Special Tool(s) / General Equipment

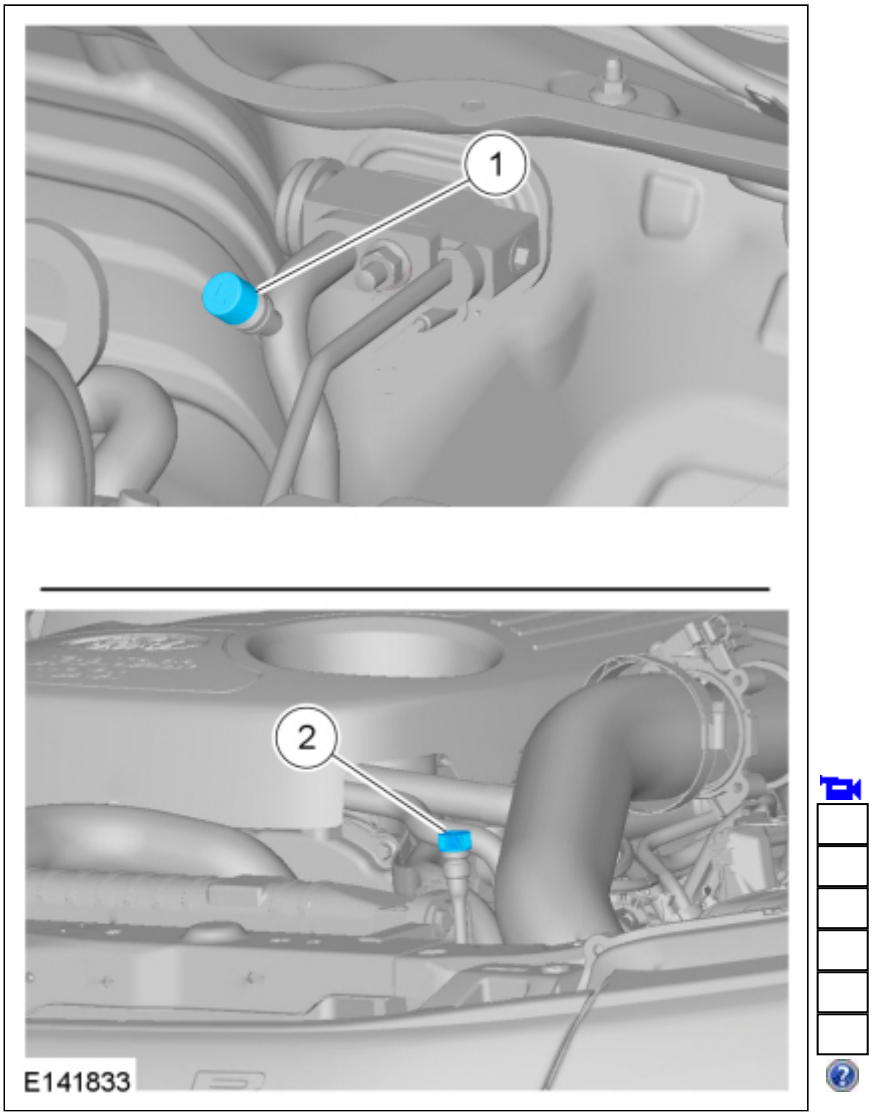
Air Conditioning Service Unit
UV Leak Detector
Electronic Leak Detector
Refrigerant Identification Equipment
Automatic Calibration Halogen Leak Detector

1. Refer to: Climate Control System Health and Safety Precautions (100-00 General Information, Description and Operation).

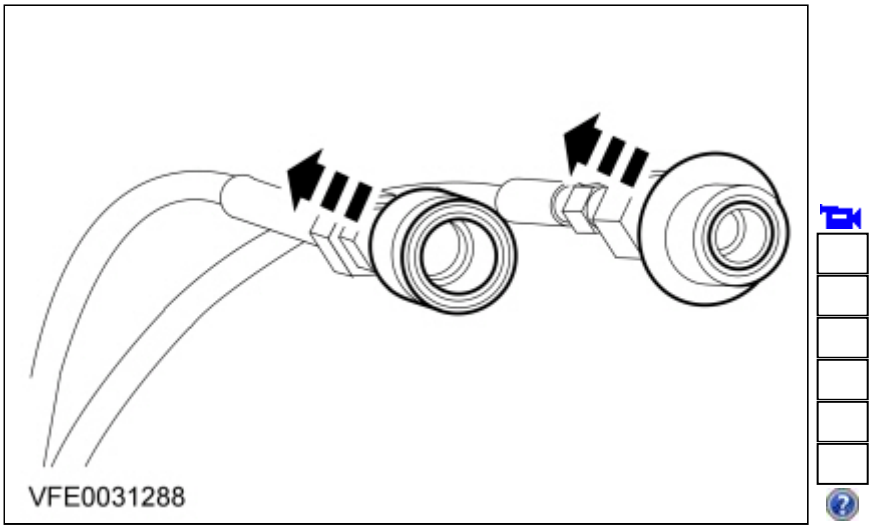
2. **NOTICE: The refrigerant analyzer must be used before recovery, otherwise the refrigerant center may become contaminated. Contaminated refrigerant must be disposed of as hazardous waste. Always follow the manufacturer's instructions when using the refrigerant center and the refrigerant analyzer.**

   Unscrew and remove the protective caps from the A/C charging connections.
   Use the General Equipment: Air Conditioning Service Unit
   Use the General Equipment: Refrigerant Identification Equipment

   1. Low-pressure connection
   2. High-pressure connection



4. Connect the service unit lines to the filling connection of the air conditioning system.



5. Drain the air conditioning system via the low-pressure port in accordance with the service unit manufacturer instructions.

6. **NOTICE: Make sure that the specified amount of refrigerant oil is added.**

   NOTE: *This step is only required when installing a new component.*

   Fill up with refrigerant oil.
   Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).
   Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

7. Evacuate the air conditioning system in accordance with the service unit manufacturer instructions.
8. **NOTE:** *The system is leak-tight if the pressure increase does not exceed 20 mbar.*

   Perform the leak test, by closing the hand valves on the gauge set, switching off the service unit vacuum pump and observing the low pressure gauge.
9. **NOTE:** *This step is only necessary if the pressure increase exceeds 20 mbar.*

   Locate and rectify any leaks in the A/C refrigerant circuit using a leak tester.
   Use the General Equipment: UV Leak Detector
   Use the General Equipment: Electronic Leak Detector
   Use the General Equipment: Automatic Calibration Halogen Leak Detector
10. Add refrigerant oil to the air conditioning system.
    Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).
    Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).
11. Fill the air conditioning system with liquid through the high-pressure connection.
    Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

    1. Open the shut-off valve on the high-pressure side.
    2. Switch the service unit to "Fill" mode and fill the system with the specified quantity of liquid refrigerant (R134a).
13. Fill the air conditioning system with gas through the low-pressure connection.
    Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

    1. Open the shut-off valve on the low-pressure side.
    2. Switch the service unit to "Fill" mode and fill the system with the specified quantity of gaseous refrigerant.
    3. Add the remaining amount of refrigerant with the air conditioning switched on. To do so run the engine at about 1200-1500 rev/min. Set the air conditioning system to full cooling power and fresh air mode. Set the blower motor to the highest setting. Fill with the remainder of the specified fill capacity.
15. Disconnect the service unit.

    1. Close the shut-off valve.
    2. Switch off the service unit.
    3. Disconnect the service unit lines from the filling connections of the air conditioning system.
    4. Screw the protective caps onto the charging connections.
17. Install all components in reverse order.

Copyright © 2016 Ford Motor Company

Refrigerant Oil Adding

NOTICE: Collect the refrigerant oil in a clean measuring cylinder.

1. **NOTE:** *This step only needs to be carried out when removing the A/C compressor.*

   NOTE: *Rotate the compressor shaft at least 6 to 8 turns when draining the refrigerant oil.*

   Drain the refrigerant oil from the defective A/C compressor and dispose of it.

2. **NOTICE: The refrigerant oil top-up quantity must not exceed the refrigerant oil fill quantity.**

   NOTICE: If other A/C components are being renewed in addition to the A/C compressor, there is no need to top up with additional refrigerant oil, apart from filling the compressor.

   Top up with the calculated quantity of new refrigerant oil. See: Specifications (412-00 Heating, Ventilation, Air-Conditioning - General information, Specifications).

Copyright © 2016 Ford Motor Company

Contaminated Refrigerant Handling

1. **NOTICE: Any R134a or R12 refrigerant which is contaminated with unsuitable refrigerant should be extracted only by means of a suitable servicing unit designed for the purpose of collecting and storing contaminated refrigerant, so that the spread to other vehicles can be prevented.**

   Use refrigerant identification equipment to check that there is contaminated refrigerant in the air conditioning system.

2. Inform the customer about the additional costs involved to repair the system because of the contamination.

3. Extract the contaminated refrigerant.

Copyright © 2016 Ford Motor Company

Electronic Leak Detection

Leak detection

1. Refer to: Climate Control System Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **WARNING: Before starting leak detection, make sure that the area where it is to be done is well ventilated. If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Odors from cigarette smoke and other chemicals such as antifreeze, diesel fuel, disc brake cleaner, or other cleaning solvents can cause the same problem. Prevent air movement while performing leak detection.**

   WARNING: The refrigerant identification equipment must be used before attaching the manifold gauge set. Otherwise the manifold gauge set may become contaminated. Contaminated refrigerant must be disposed of as special waste. Follow the manufacturer's instructions when working with the service unit.

   NOTE: *At 24°C with the engine switched off, both manifold gauges should show 4.1 to 5.5 bar.*

   Attach the manifold gauge set to the service gauge port valves.

3. For the leak test, close the manual valves on the gauge set.

4. If little or no pressure is indicated, charge the system with approx. 300g of refrigerant.
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

5. **WARNING: Make sure that the surface is clean and free of foreign material.**

   NOTE: *Make sure that the leak detector is calibrated and set in accordance with the operating instructions.*

   Use the R-134a automatic calibration halogen leak detector to leak test the refrigerant system. Follow the instructions included with leak detector for handling and operation techniques.

6. **NOTICE: Do not let the detector sensing tip contact any substance as this could cause a false reading and may damage the sensor.**

   Position the sensor about 5mm from the point to be checked. Circle each fitting completely.

7. If a leak is detected, repeat the leak detection process after blowing away the chemical detected with compressed air.

8. If a leak is detected again, extract the refrigerant under suction.
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Fluorescent Dye Leak Detection

Special Tool(s) / General Equipment

UV Leak Detector

Leak detection

NOTICE: Make sure that the vehicle is in a low sunlight area before performing any actions.

1. Refer to: Climate Control System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. **NOTE:** *The exact location of leaks can be pinpointed by the bright yellow - green glow of the tracer dye. Since more than one leak can exist, always inspect each component.*
    - Locate the leaks. Check all components, fittings and lines of the A/C system for leaks. Use the General Equipment: UV Leak Detector
3. After the leak is found and rectified, remove any traces of dye with a general purpose solvent.
4. Check the repair by operating the system for some minutes and inspecting with the UV lamp again.

Copyright © 2016 Ford Motor Company

Vacuum Leak Detection

1. Carry out the air conditioning (A/C) system recovery procedure.
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Refrigerant System Tests - Automatic Transmission

Inspection

NOTE: *The following refrigerant system specification information was developed for vehicles with 2.2L Puma diesel and 3.2L Puma diesel engines with automatic transmission.*

1. **NOTE:** *Procedure 1 — Ambient Temperature below 21°C (70°F).*

   NOTE: *Variable compressors need to see a thermal load on the system in order to create normal operating pressures.*

   NOTE: *To perform an accurate test make sure the vehicle ambient temperature is 21°C (70°F) or above. Perform the following steps to achieve normal operating pressures.*

   Drive the vehicle or run the engine until it reaches normal operating temperature.

2. Set the A/C system temperature to the highest possible temperature setting with the dual function disabled (if equipped). Manually set the blower on HI. If the vehicle has a fresh air/recirc button, set it to recirculation. If the vehicle has an A/C switch or compressor on switch, set it to A/C OFF.

3. Close all the vehicle windows and doors.

4. Allow the vehicle to idle for 5 minutes.

5. Confirm the cabin temperature is above 24°C (75°F). Set the A/C switch or compressor on switch to MAX A/C ON.

6. Allow the vehicle to idle for 5 minutes.

7. Turn engine off and proceed to procedure 2 — ambient temperature between 21°C (70°F) and 38°C (100°F).

Inspection

NOTE: *To perform an accurate test make sure the vehicle ambient temperature is 21°C (70°F) or above. Perform the following steps to achieve normal operating pressures.*

1. **NOTE:** *Procedure 2 — Ambient Temperature between 21°C (70°F) and 38°C (100°F)*

   Run the engine until it reaches normal operating temperature.

2. Connect the air conditioning service unit to the refrigerant system.

3. Set the A/C system temperature to the lowest possible temperature setting with the dual function disabled (if equipped). Manually set blower on HI. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.

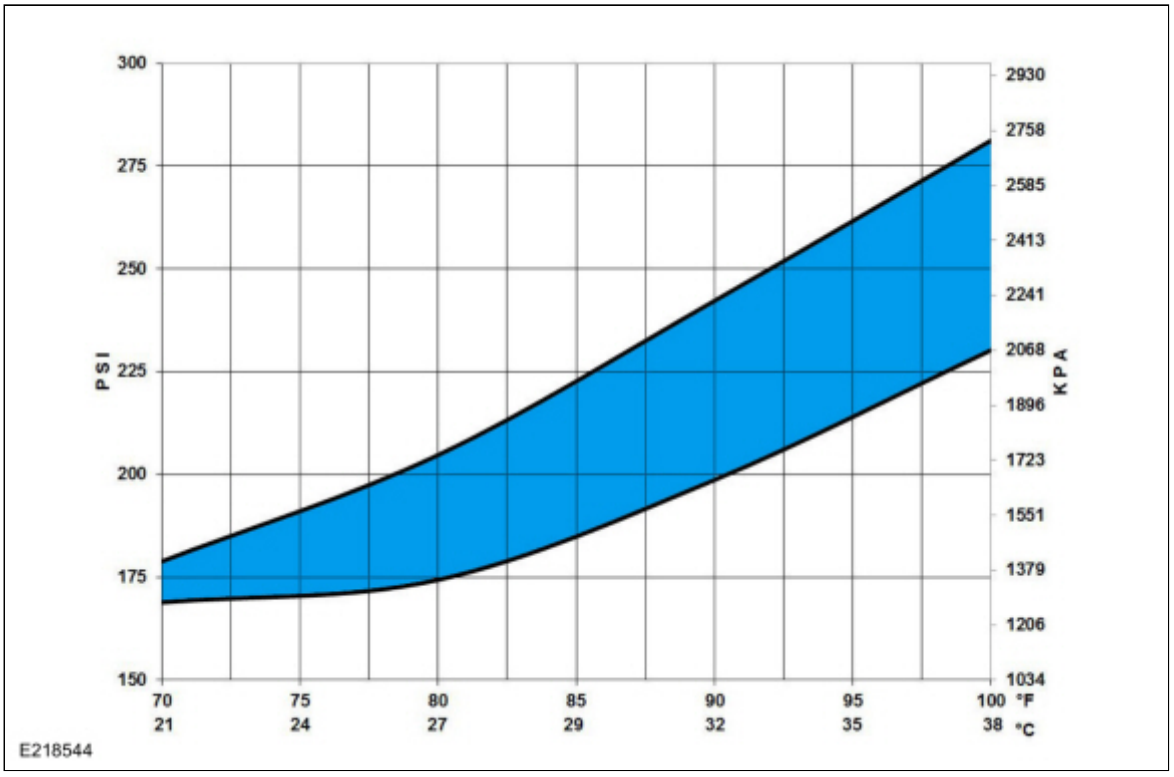
4. Open all vehicle windows and leave the hood open for the test. Open the rear doors.

5. Confirm the compressor is operating and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

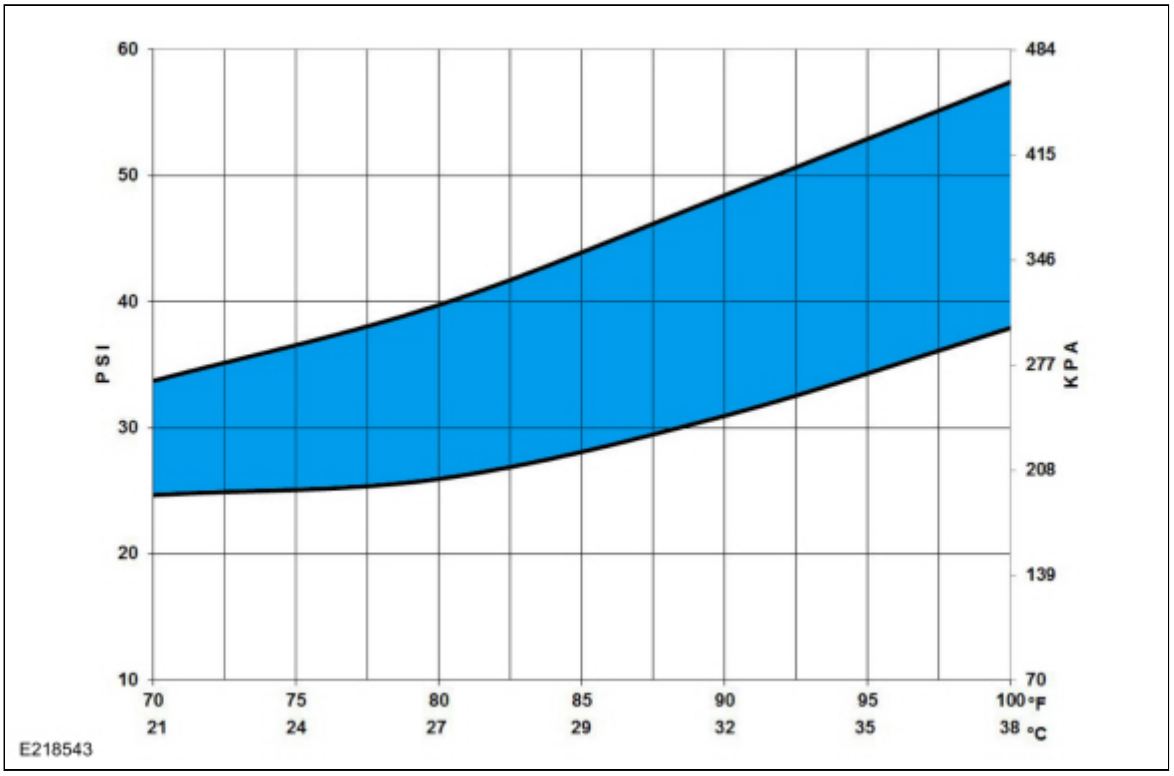
6. Record the ambient (shop) temperature.

7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. A/C **system**, determine if the discharge pressure falls within the normal operating limits using the **Normal Refrigerant Discharge Pressures 21 - 38° C (70 - 100° F) Ambient (30 - 60% Relative Humidity)** chart below.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. A/C **system**, determine if the suction pressure falls within the normal operating limits using the **Normal Refrigerant Suction Pressures 21 - 38° C (70 - 100° F) Ambient (30 - 60% Relative Humidity)** chart below.



11. **NOTE:** *Use the following table to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.*

High (Discharge) Pressure	Low (Suction) Pressure	Component — Causes
High	Normal to High	• Condenser — inadequate airflow. • Engine — overheating.

Normal to High	Normal	• Refrigerant overcharge — air in refrigerant.
Normal to Low	High	• A/C Compressor — low performance.
Normal to Low	Normal to High	• A/C suction line — partially restricted or plugged. [a]
Normal to Low	Low	• Low refrigerant charge — leak in system. • A/C suction line — partially restricted or plugged. [b]
Erratic Operation or Compressor Not Running		• Ambient Air Temperature (AAT) sensor — poor connection. • A/C pressure transducer — poor connection. • Evaporator temperature sensor — poor connection. • Low refrigerant charge — leak in system.
Additional Possible Components or Causes Associated With Inadequate Compressor Operation		
• Compressor drive belt — loose • Compressor clutch — slipping • Clutch coil open — shorted, or loose mounting • Control assembly switch — dirty contacts or sticking open • Clutch wiring circuit — high resistance, open or blown fuse • Compressor operation interrupted by engine computer		
Additional Possible Components or Causes Associated With a Damaged Compressor		
• Incorrect clutch air-gap • Suction accumulator — refrigerant oil bleed hose plugged • Refrigerant leaks		

[a] Low pressure reading will be normal to high if restriction is downstream of service access valve.

[b] Low pressure reading will be low if restriction is upstream of service access valve.

Inspection

1. **NOTE:** *Procedure 3 — Ambient Temperature Above 38°C (100°F)*

   Run the engine until it reaches normal operating temperature.

2. Connect the air conditioning service unit to the refrigerant system.

3. Set temperature to the lowest possible temperature setting with the dual function disabled (if equipped). Manually set blower on HI. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.

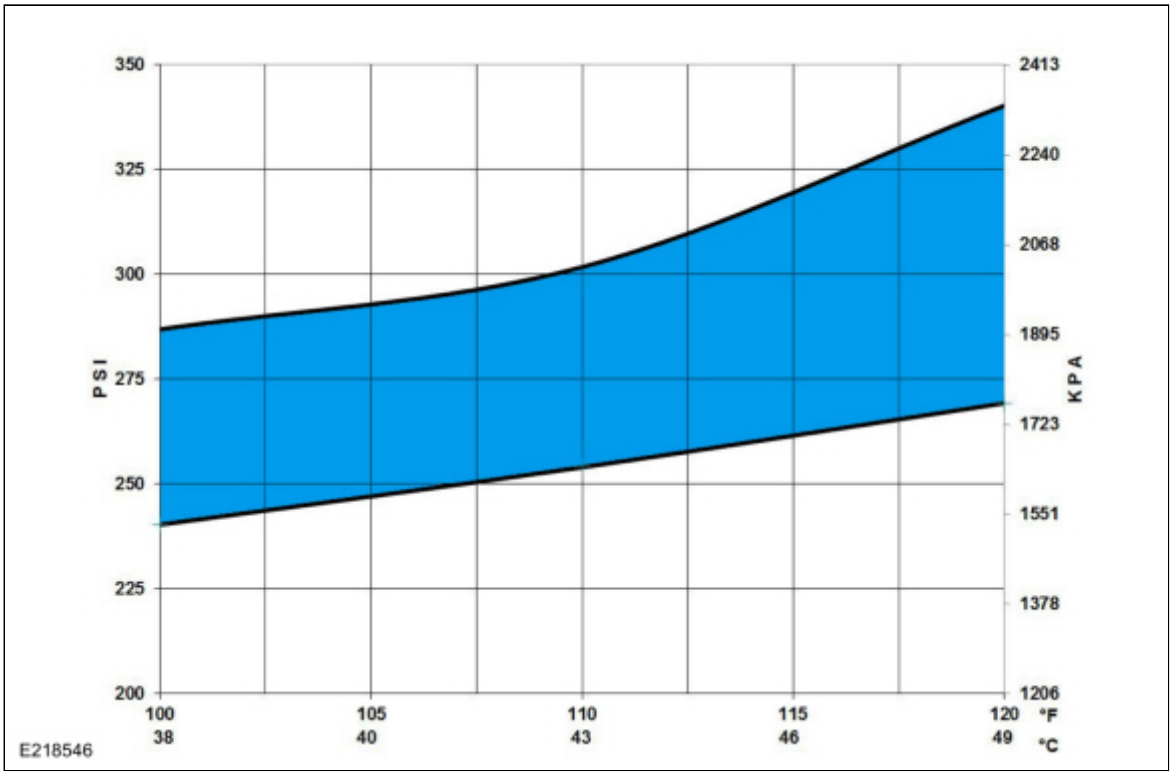
4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).

5. Confirm the compressor is operating and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

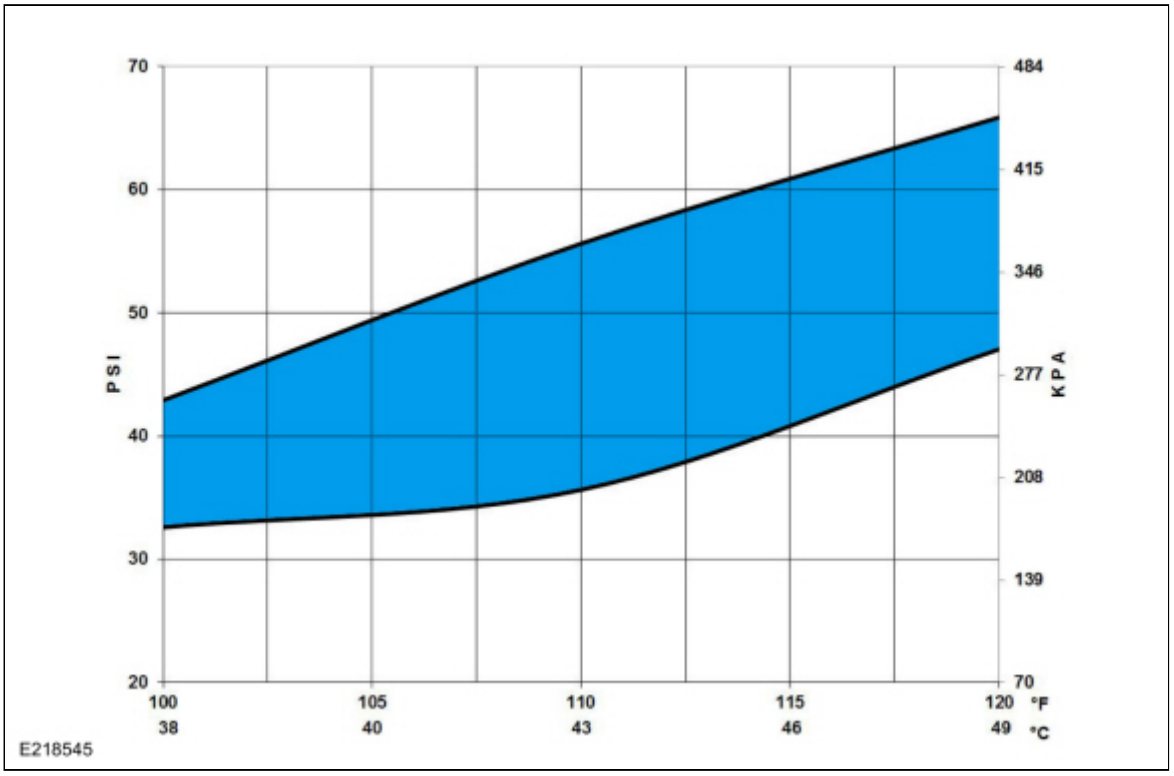
6. Record the ambient (shop) temperature.

7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. A/C **system**, determine if the discharge pressure falls within the normal operating limits using the **Normal Refrigerant Discharge Pressures 38 - 49° C (100 - 120° F) Ambient (15 - 40% Relative Humidity)** chart below.



9. A/C **system**, determine if the suction pressure falls within the normal operating limits using the **Normal Refrigerant Suction Pressures 38 - 49° C (100 - 120° F) Ambient (15 - 40% Relative Humidity)** chart below.



10. Record the suction pressure. If the pressure is fluctuating, record the average value.
11. **NOTE:** *Use the following table to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.*

High (Discharge) Pressure	Low (Suction) Pressure	Component — Causes
High	Normal to High	• Condenser — inadequate airflow. • Engine — overheating.

Normal to High	Normal	• Refrigerant overcharge — air in refrigerant.
Normal to Low	High	• A/C Compressor — low performance.
Normal to Low	Normal to High	• A/C suction line — partially restricted or plugged. [a]
Normal to Low	Low	• Low refrigerant charge — leak in system. • A/C suction line — partially restricted or plugged. [b]
Erratic Operation or Compressor Not Running		• Ambient Air Temperature (AAT) sensor — poor connection. • A/C pressure transducer — poor connection. • Evaporator temperature sensor — poor connection. • Low refrigerant charge — leak in system.
Additional Possible Components or Causes Associated With Inadequate Compressor Operation		
• Compressor drive belt — loose • Compressor clutch — slipping • Clutch coil open — shorted, or loose mounting • Control assembly switch — dirty contacts or sticking open • Clutch wiring circuit — high resistance, open or blown fuse • Compressor operation interrupted by engine computer		
Additional Possible Components or Causes Associated With a Damaged Compressor		
• Incorrect clutch air-gap • Suction accumulator — refrigerant oil bleed hose plugged • Refrigerant leaks		

[a] Low pressure reading will be normal to high if restriction is downstream of service access valve.

[b] Low pressure reading will be low if restriction is upstream of service access valve.

Copyright © 2016 Ford Motor Company

Refrigerant System Tests - Manual Transmission

Inspection

NOTE: *The following refrigerant system specification information was developed for vehicles with 2.2L Puma diesel and 3.2L Puma diesel engines with manual transmission.*

1. **NOTE:** *Procedure 1 — Ambient Temperature below 21°C (70°F).*

   NOTE: *Variable compressors need to see a thermal load on the system in order to create normal operating pressures.*

   NOTE: *To perform an accurate test make sure the vehicle ambient temperature is 21°C (70°F) or above. Perform the following steps to achieve normal operating pressures.*

   Drive the vehicle or run the engine until it reaches normal operating temperature.

2. Set the A/C system temperature to the highest possible temperature setting with the dual function disabled (if equipped). Manually set the blower on HI. If the vehicle has a fresh air/recirc button, set it to recirculation. If the vehicle has an A/C switch or compressor on switch, set it to A/C OFF.

3. Close all the vehicle windows and doors.

4. Allow the vehicle to idle for 5 minutes.

5. Confirm the cabin temperature is above 24°C (75°F). Set the A/C switch or compressor on switch to MAX A/C ON.

6. Allow the vehicle to idle for 5 minutes.

7. Turn engine off and proceed to procedure 2 — ambient temperature between 21°C (70°F) and 38°C (100°F).

Inspection

NOTE: *To perform an accurate test make sure the vehicle ambient temperature is 21°C (70°F) or above. Perform the following steps to achieve normal operating pressures.*

1. **NOTE:** *Procedure 2 — Ambient Temperature between 21°C (70°F) and 38°C (100°F)*

   Run the engine until it reaches normal operating temperature.

2. Connect the air conditioning service unit to the refrigerant system.

3. Set the A/C system temperature to the lowest possible temperature setting with the dual function disabled (if equipped). Manually set blower on HI. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.

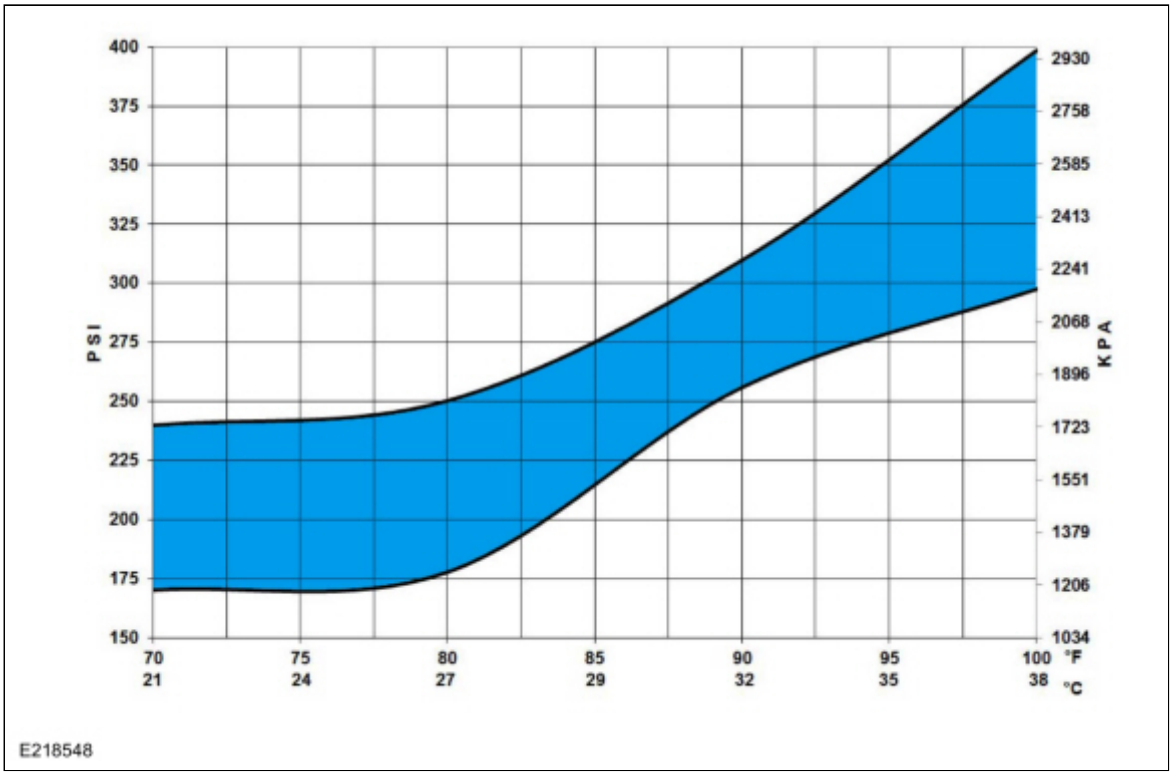
4. Open all vehicle windows and leave the hood open for the test. Open the rear doors.

5. Confirm the compressor is operating and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

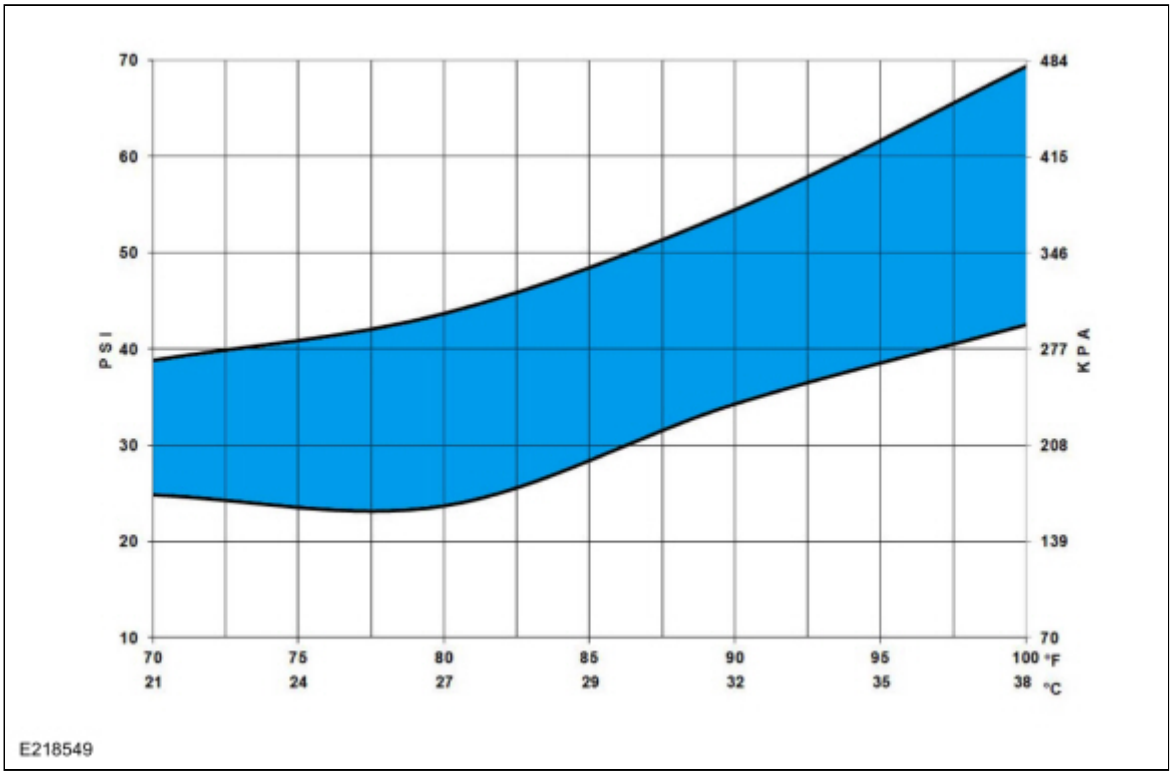
6. Record the ambient (shop) temperature.

7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. A/C **system**, determine if the discharge pressure falls within the normal operating limits using the **Normal Refrigerant Discharge Pressures 21 - 38° C (70 - 100° F) Ambient (30 - 60% Relative Humidity)** chart below.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. A/C **system**, determine if the suction pressure falls within the normal operating limits using the **Normal Refrigerant Suction Pressures 21 - 38° C (70 - 100° F) Ambient (30 - 60% Relative Humidity)** chart below.



11. **NOTE:** *Use the following table to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.*

High (Discharge) Pressure	Low (Suction) Pressure	Component — Causes
High	Normal to High	• Condenser — inadequate airflow. • Engine — overheating.

Normal to High	Normal	• Refrigerant overcharge — air in refrigerant.
Normal to Low	High	• A/C Compressor — low performance.
Normal to Low	Normal to High	• A/C suction line — partially restricted or plugged. [a]
Normal to Low	Low	• Low refrigerant charge — leak in system. • A/C suction line — partially restricted or plugged. [b]
Erratic Operation or Compressor Not Running		• Ambient Air Temperature (AAT) sensor — poor connection. • A/C pressure transducer — poor connection. • Evaporator temperature sensor — poor connection. • Low refrigerant charge — leak in system.
Additional Possible Components or Causes Associated With Inadequate Compressor Operation		
• Compressor drive belt — loose • Compressor clutch — slipping • Clutch coil open — shorted, or loose mounting • Control assembly switch — dirty contacts or sticking open • Clutch wiring circuit — high resistance, open or blown fuse • Compressor operation interrupted by engine computer		
Additional Possible Components or Causes Associated With a Damaged Compressor		
• Incorrect clutch air-gap • Suction accumulator — refrigerant oil bleed hose plugged • Refrigerant leaks		

[a] Low pressure reading will be normal to high if restriction is downstream of service access valve.

[b] Low pressure reading will be low if restriction is upstream of service access valve.

Inspection

1. **NOTE:** *Procedure 3 — Ambient Temperature Above 38°C (100°F)*

   Run the engine until it reaches normal operating temperature.

2. Connect the air conditioning service unit to the refrigerant system.

3. Set temperature to the lowest possible temperature setting with the dual function disabled (if equipped). Manually set blower on HI. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.

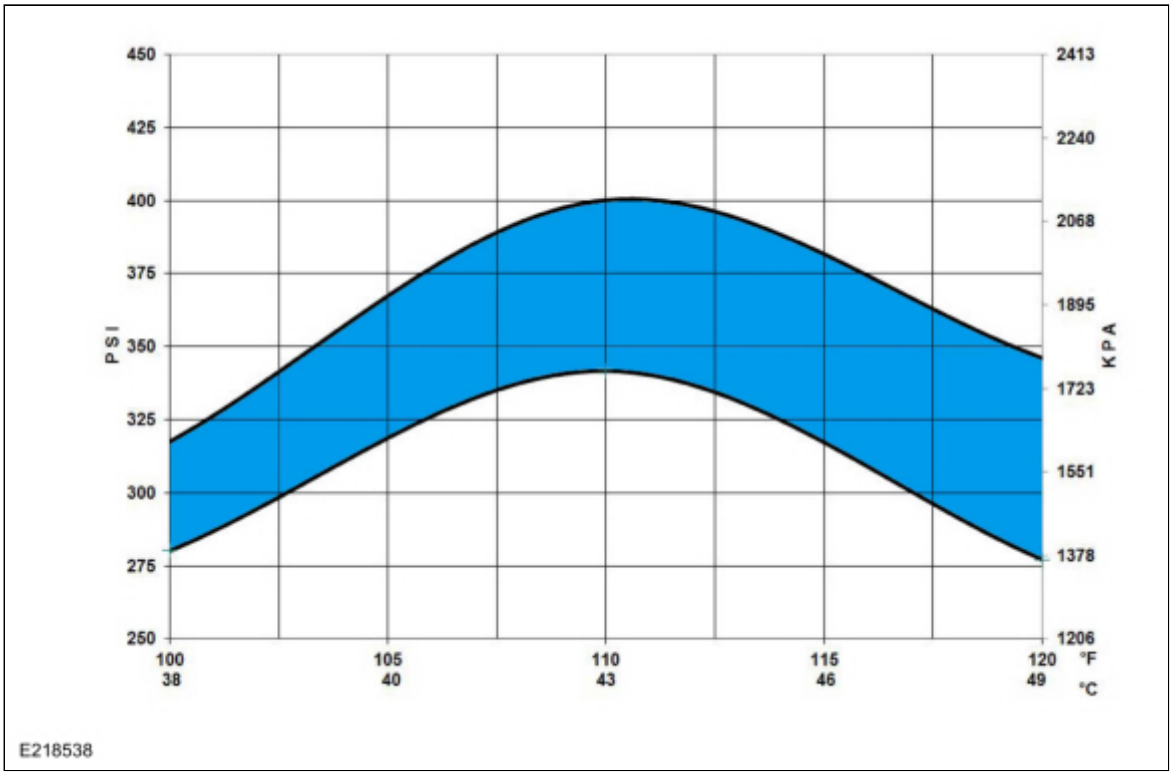
4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).

5. Confirm the compressor is operating and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.

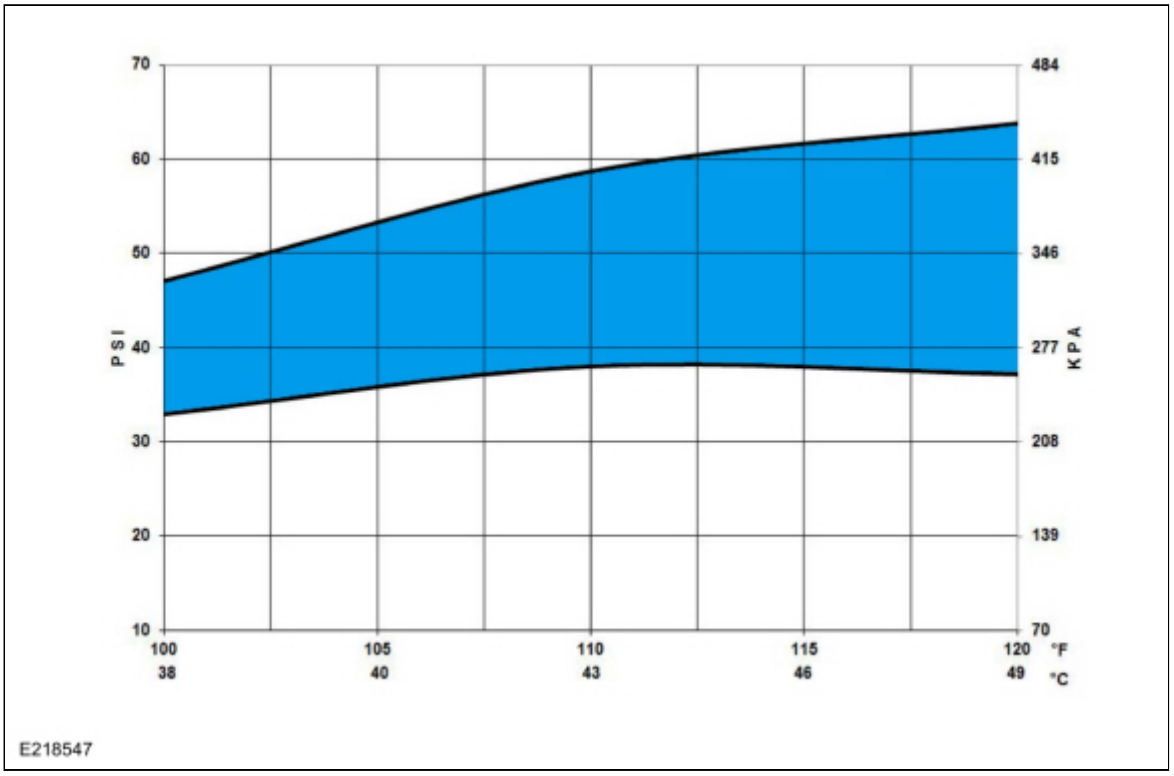
6. Record the ambient (shop) temperature.

7. Record the discharge pressure. If the pressure is fluctuating, record the average value.

8. A/C **system**, determine if the discharge pressure falls within the normal operating limits using the **Normal Refrigerant Discharge Pressures 38 - 49° C (100 - 120° F) Ambient (15 - 40% Relative Humidity)** chart below.



9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. A/C **system**, determine if the suction pressure falls within the normal operating limits using the **Normal Refrigerant Suction Pressures 38 - 49° C (100 - 120° F) Ambient (15 - 40% Relative Humidity)** chart below.



11. **NOTE:** *Use the following table to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.*

High (Discharge) Pressure	Low (Suction) Pressure	Component — Causes
High	Normal to High	• Condenser — inadequate airflow. • Engine — overheating.

Normal to High	Normal	• Refrigerant overcharge — air in refrigerant.
Normal to Low	High	• A/C Compressor — low performance.
Normal to Low	Normal to High	• A/C suction line — partially restricted or plugged. [a]
Normal to Low	Low	• Low refrigerant charge — leak in system. • A/C suction line — partially restricted or plugged. [b]
Erratic Operation or Compressor Not Running		• Ambient Air Temperature (AAT) sensor — poor connection. • A/C pressure transducer — poor connection. • Evaporator temperature sensor — poor connection. • Low refrigerant charge — leak in system.
Additional Possible Components or Causes Associated With Inadequate Compressor Operation		
• Compressor drive belt — loose • Compressor clutch — slipping • Clutch coil open — shorted, or loose mounting • Control assembly switch — dirty contacts or sticking open • Clutch wiring circuit — high resistance, open or blown fuse • Compressor operation interrupted by engine computer		
Additional Possible Components or Causes Associated With a Damaged Compressor		
• Incorrect clutch air-gap • Suction accumulator — refrigerant oil bleed hose plugged • Refrigerant leaks		

[a] Low pressure reading will be normal to high if restriction is downstream of service access valve.

[b] Low pressure reading will be low if restriction is upstream of service access valve.

Copyright © 2016 Ford Motor Company

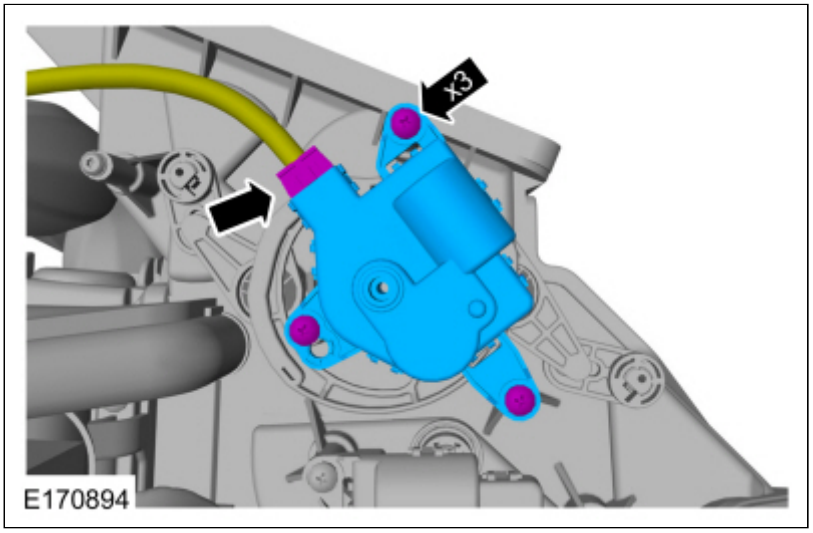
Air Distribution Door Actuator

Base Part Number: 19E616

Removal

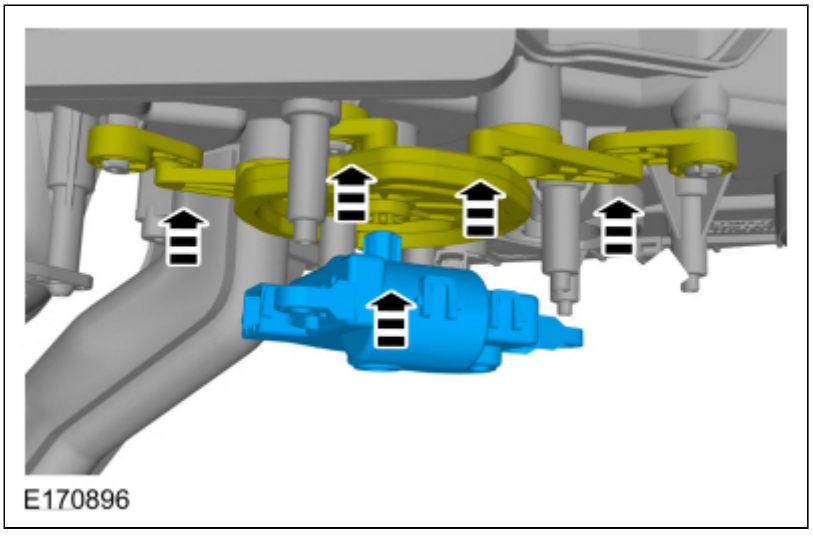
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Instrument Panel - RHD (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Instrument Panel - LHD (501-12 Instrument Panel and Console, Removal and Installation).
2.



Installation

1. **NOTE:** *Align the air distribution door shaft linkages before installing the air distribution door actuator.*



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

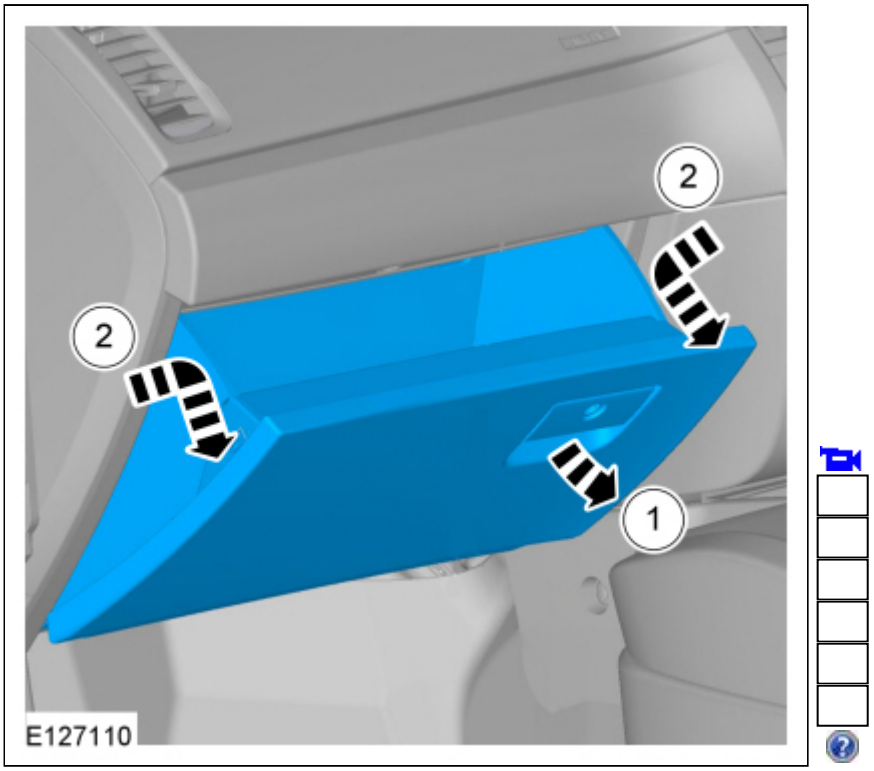
Temperature Door Actuator LH - RHD 4WD/RHD RWD

Special Tool(s) / General Equipment

2 mm Drill Bit
Center Punch
6 mm Drill Bit
Folding Rule

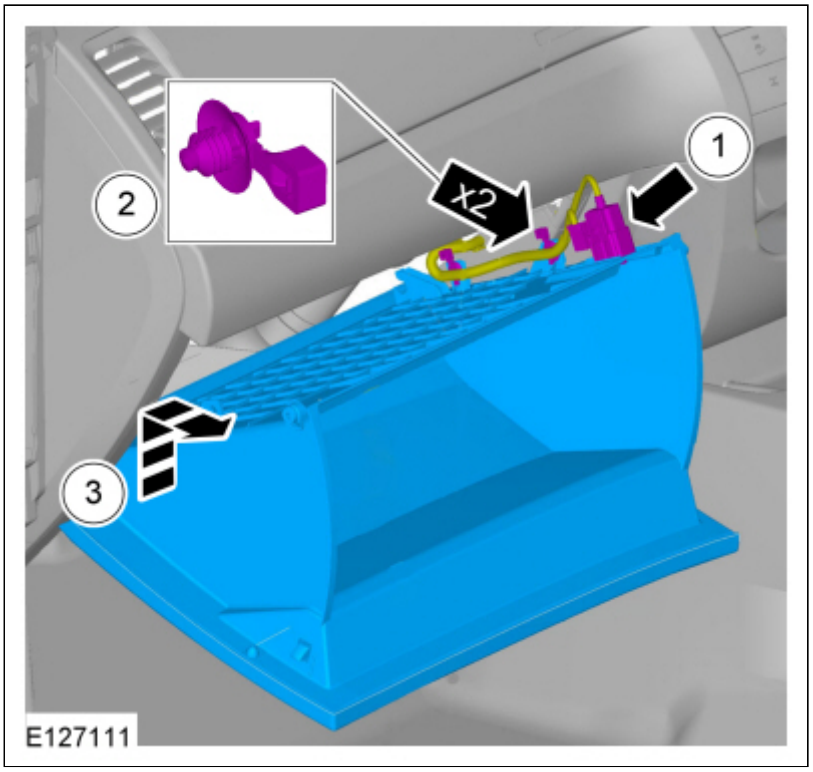
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

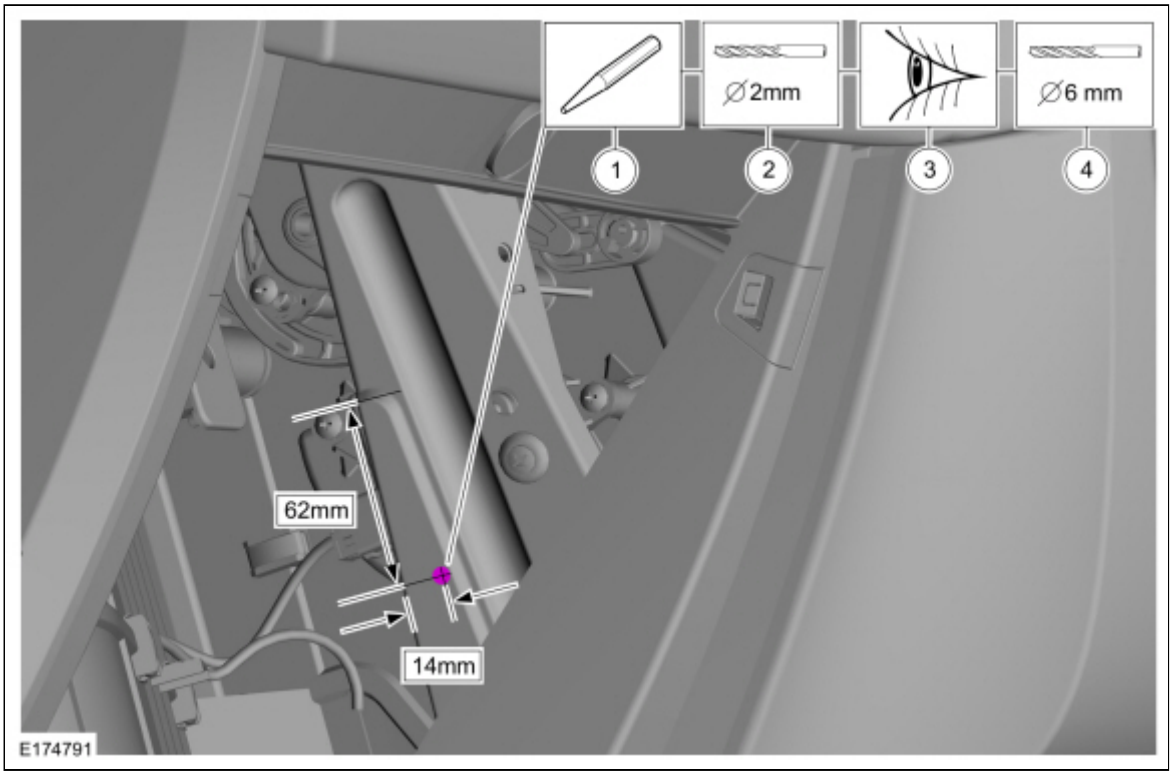
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

NOTE: *Make sure that the passenger glove box lamp is correctly located.*

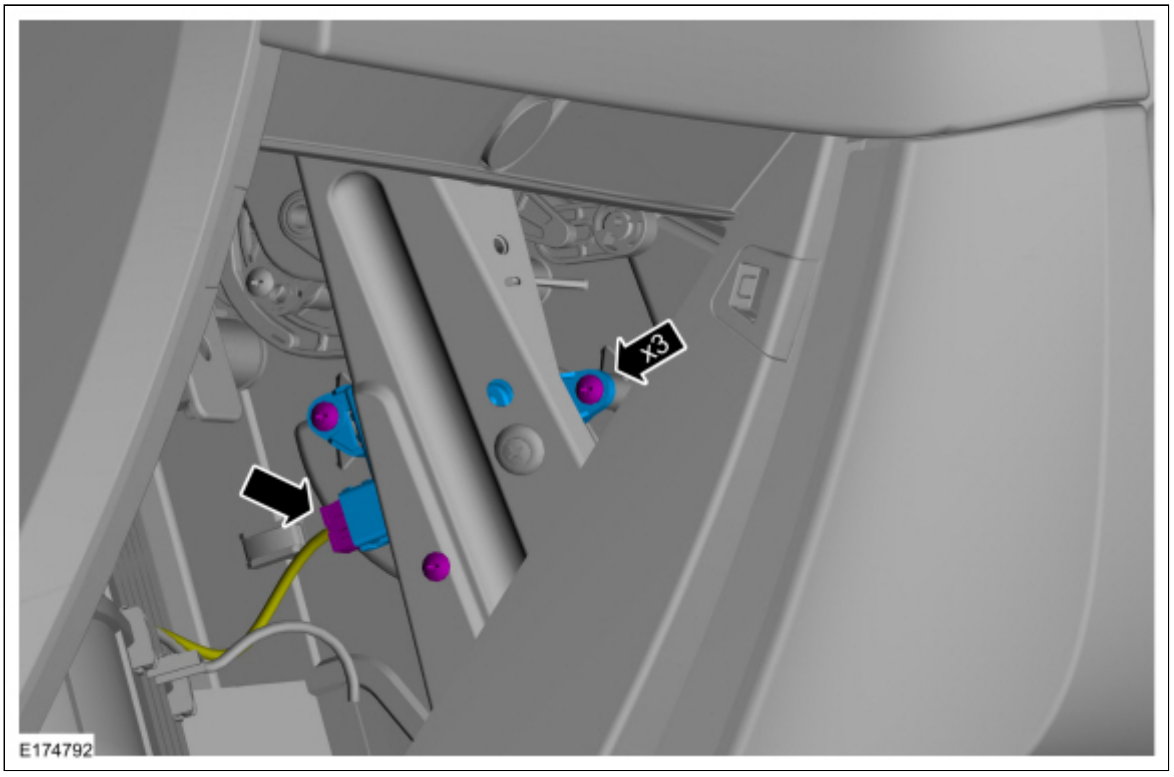
4.



5. Use the General Equipment: Folding Rule
   Use the General Equipment: Center Punch
   Use the General Equipment: 2 mm Drill Bit
   Use the General Equipment: 6 mm Drill Bit



6.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Temperature Door Actuator RH - RHD 4WD/RHD RWD

Special Tool(s) / General Equipment

2 mm Drill Bit
Center Punch
6 mm Drill Bit
Folding Rule

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

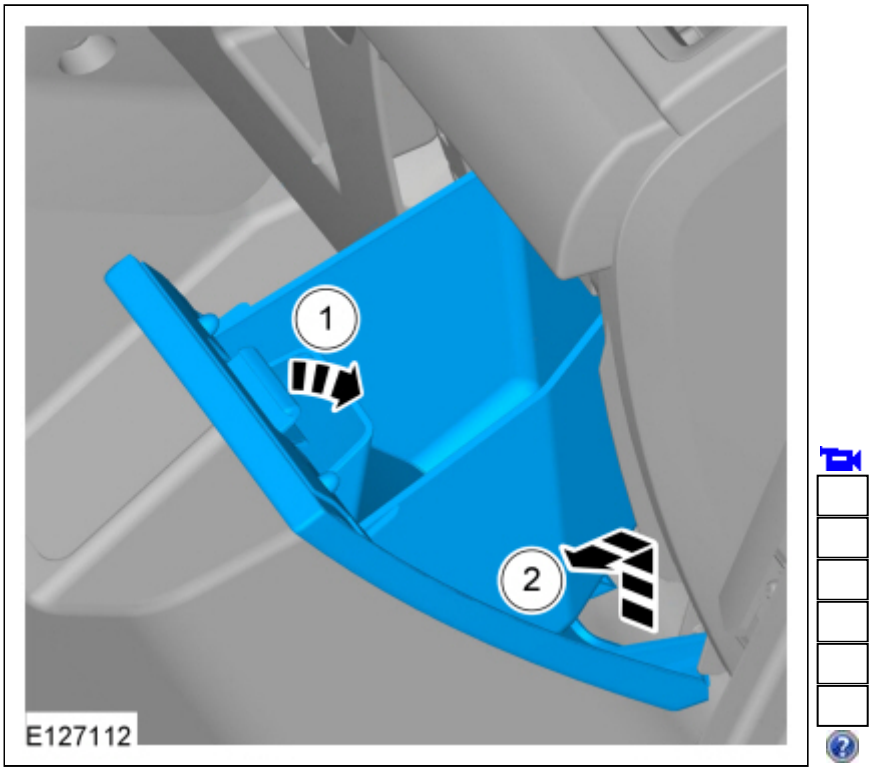
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Vehicles with driver knee air bag

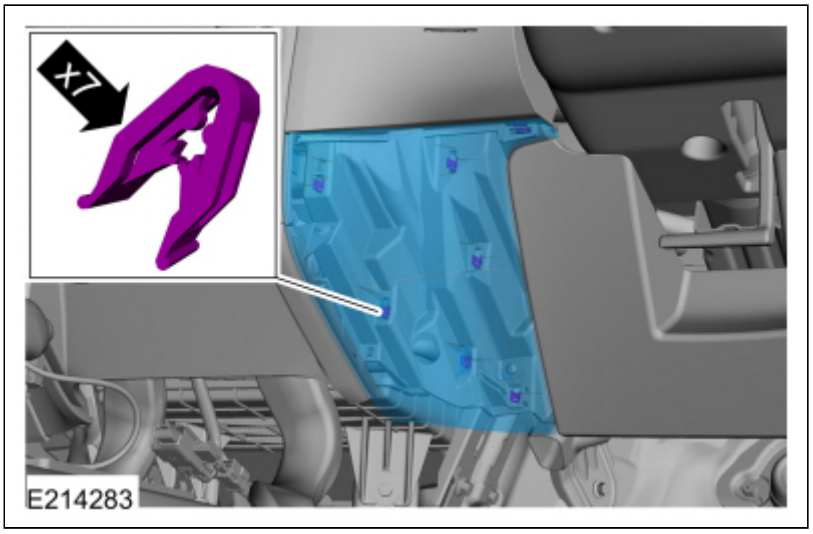
3. Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

All vehicles

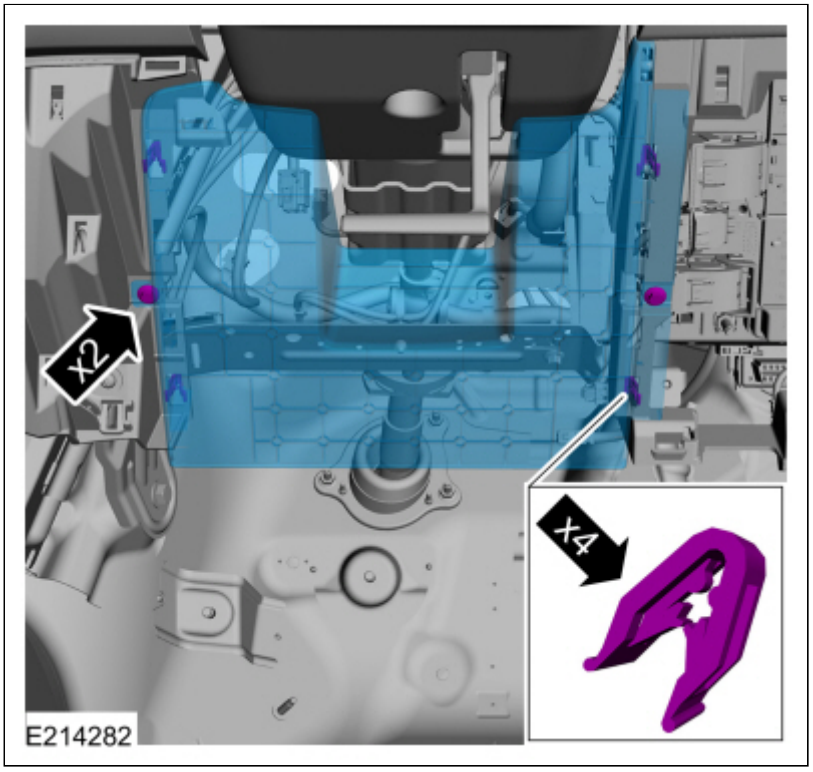
4. All vehicles



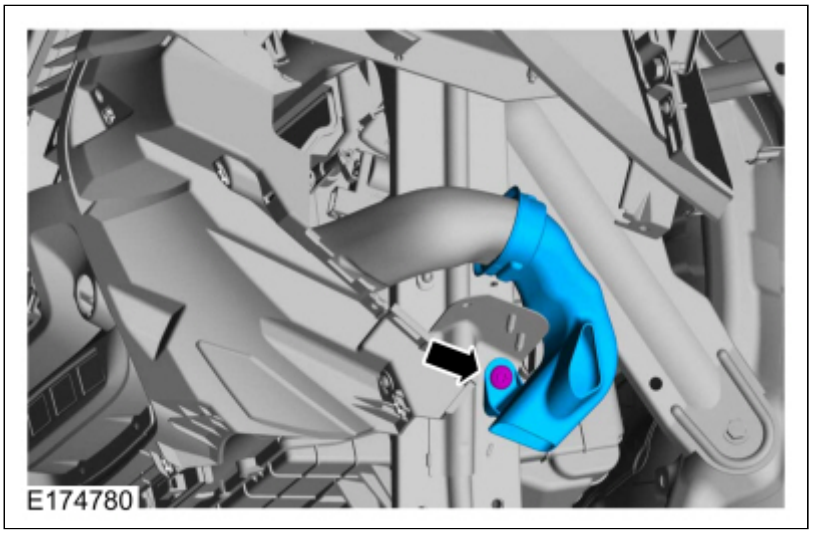
5.



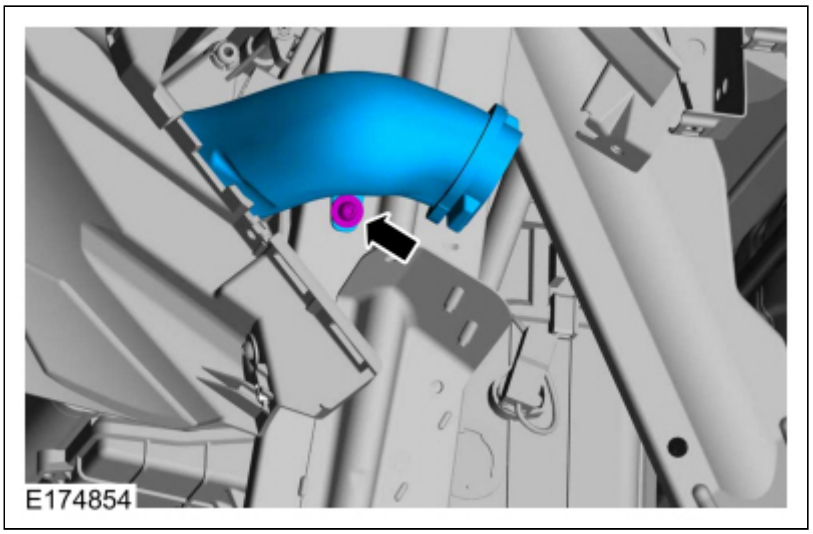
6.



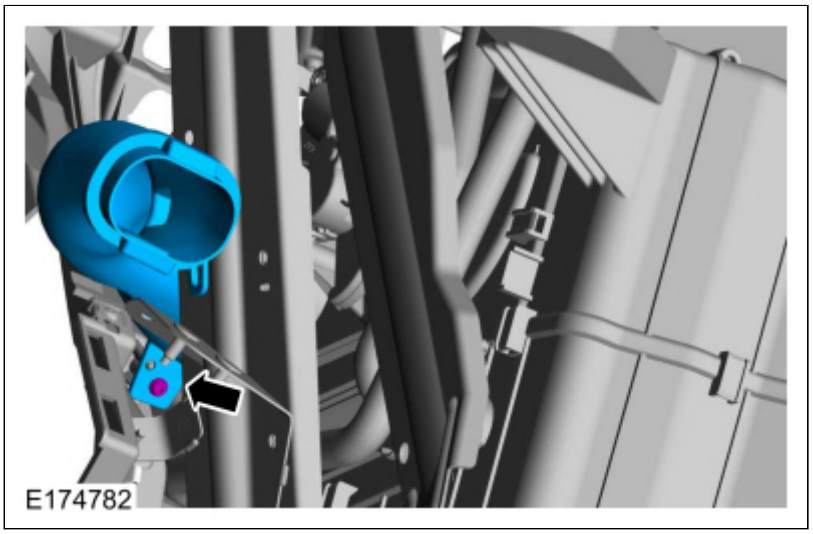
7.



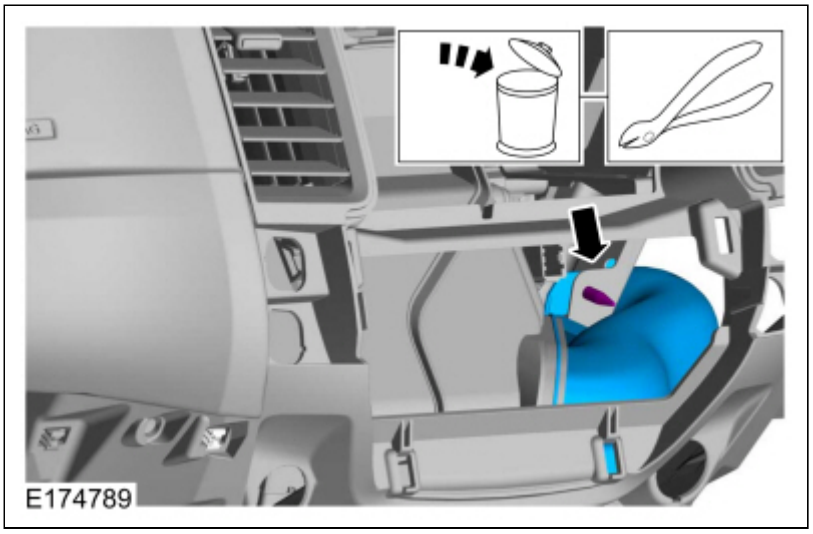
8.



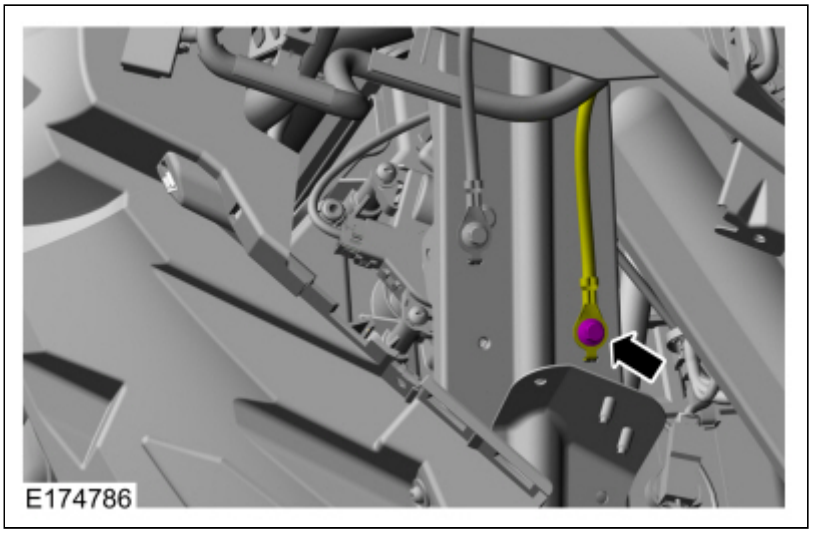
9.



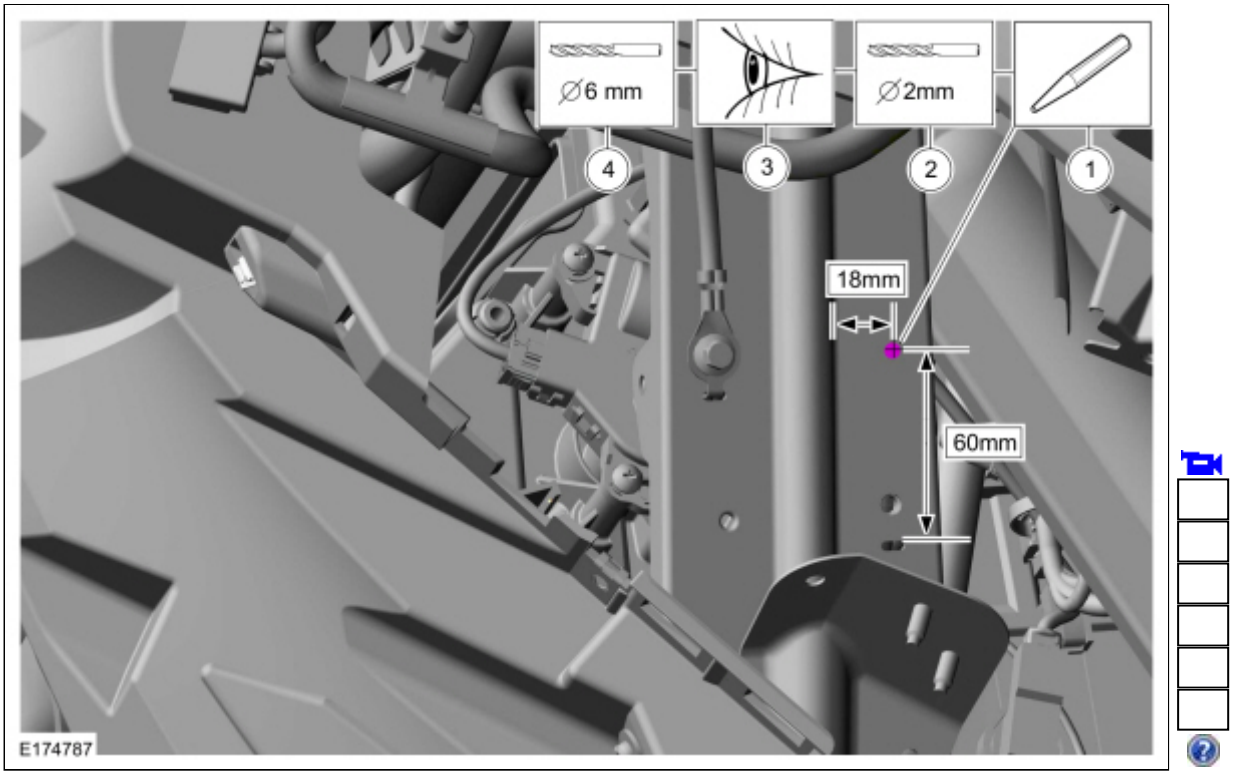
10.



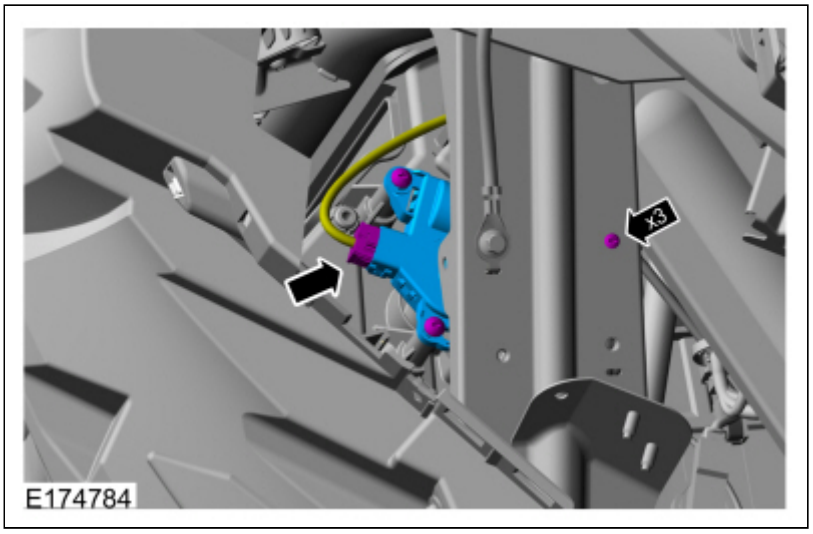
11. *Torque*: 10 Nm



12. Use the General Equipment: Folding Rule
    Use the General Equipment: Center Punch
    Use the General Equipment: 2 mm Drill Bit
    Use the General Equipment: 6 mm Drill Bit



13.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Temperature Door Actuator LH - LHD 4WD/LHD RWD

Removal

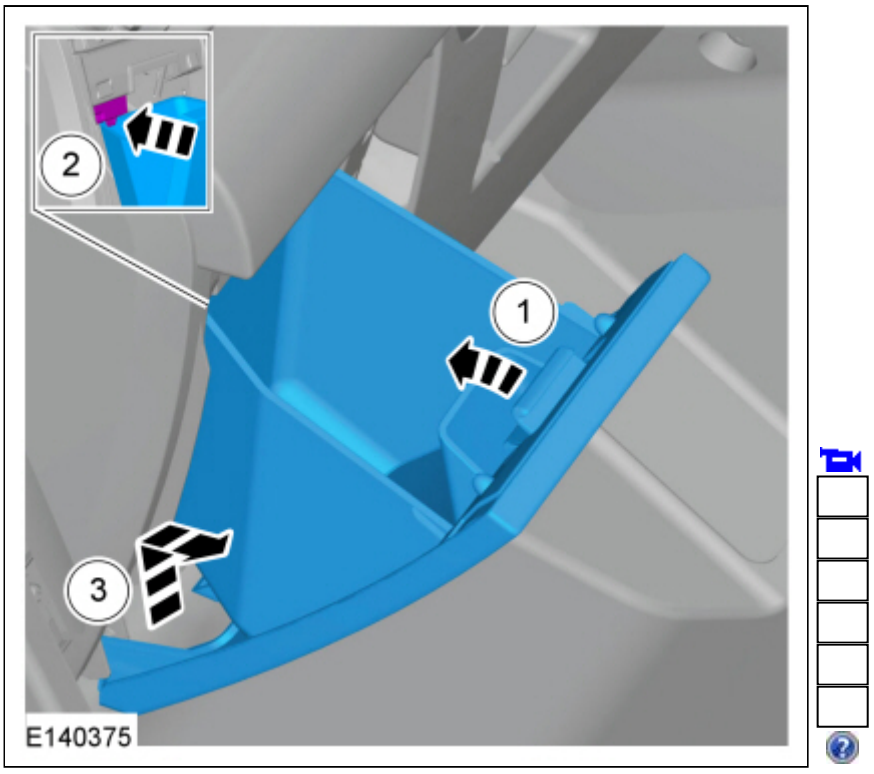
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

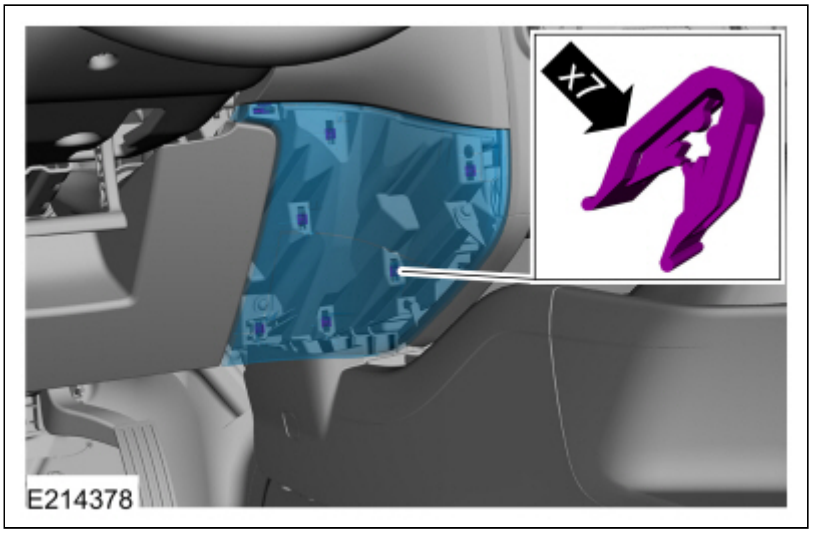
Vehicles with driver knee air bag

3. Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

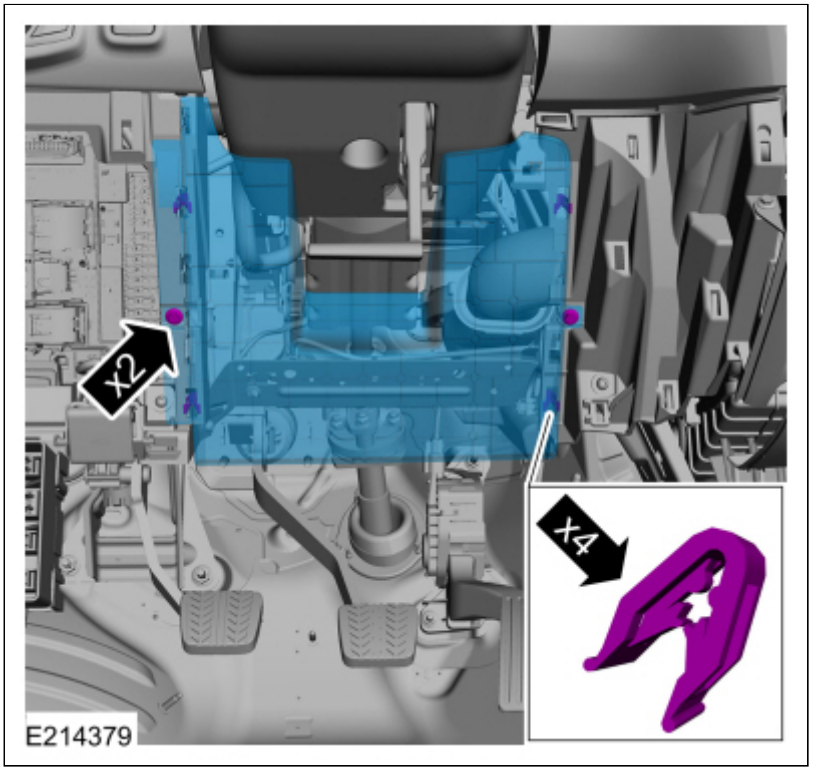
All vehicles

4. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).
5. 

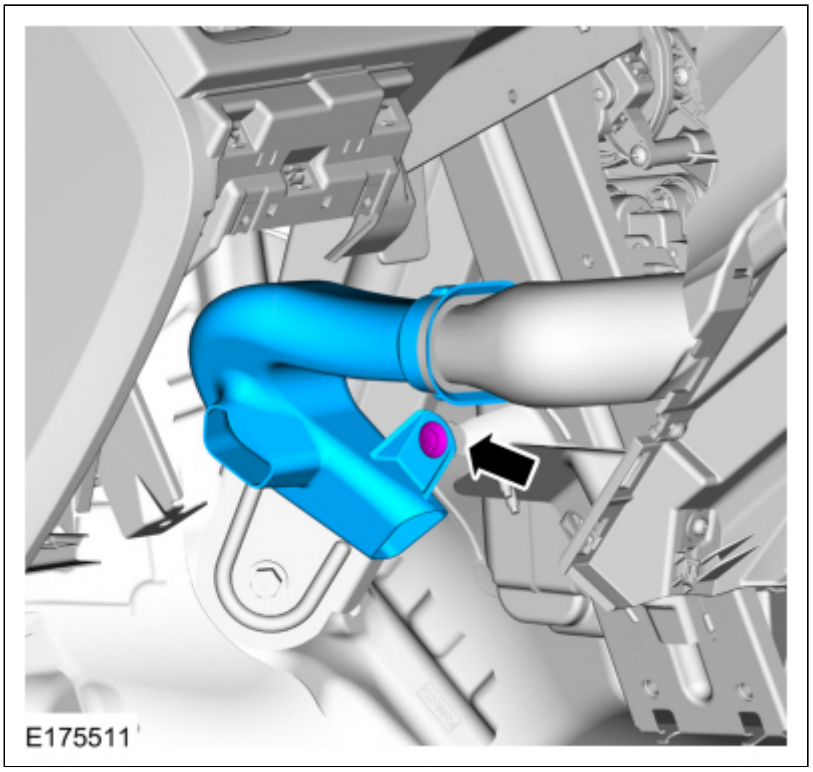
6.



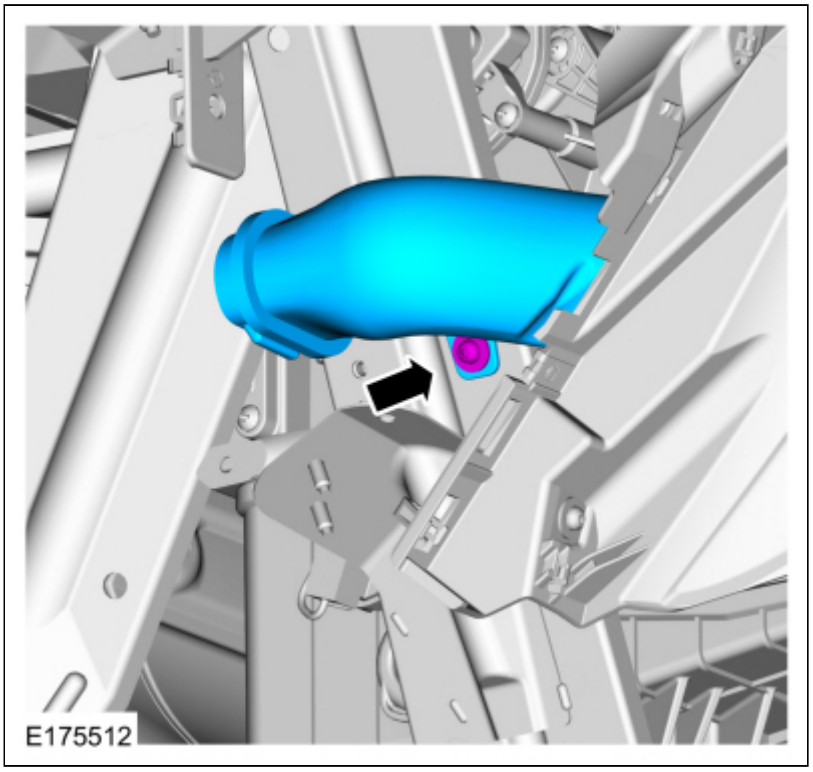
7.



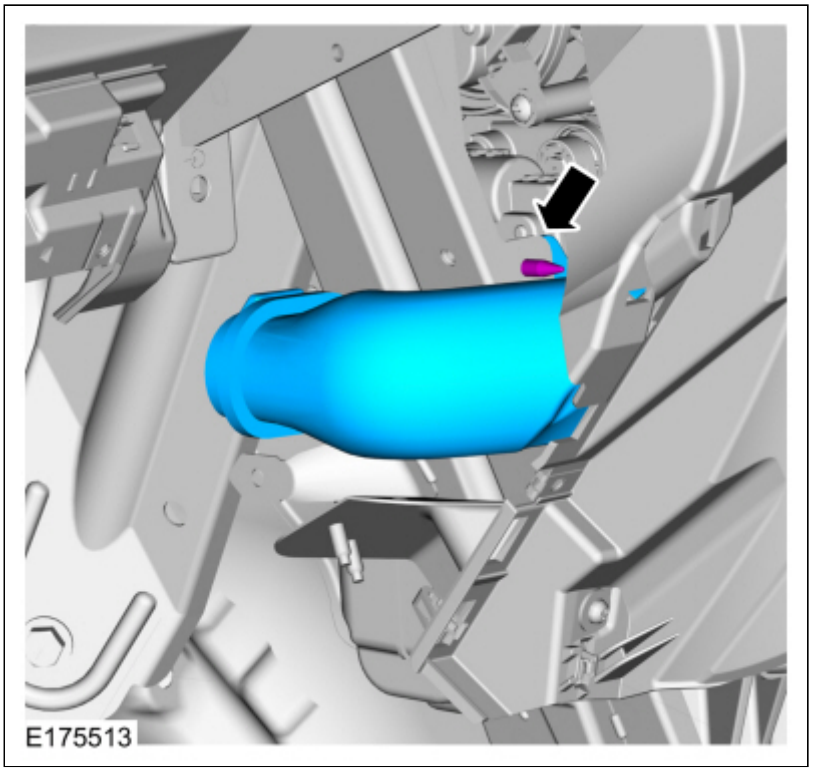
8.



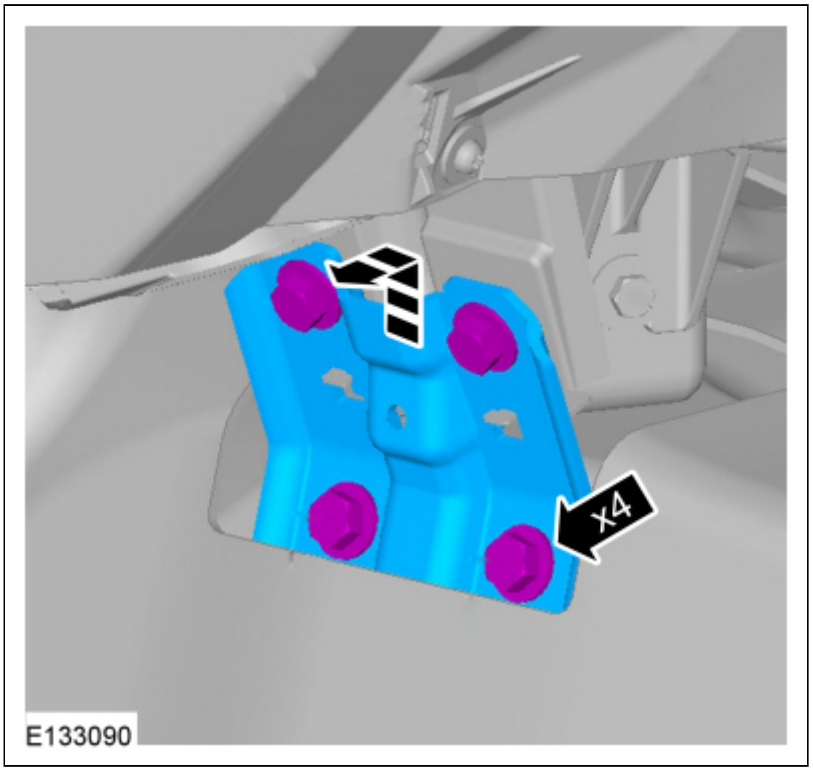
9.



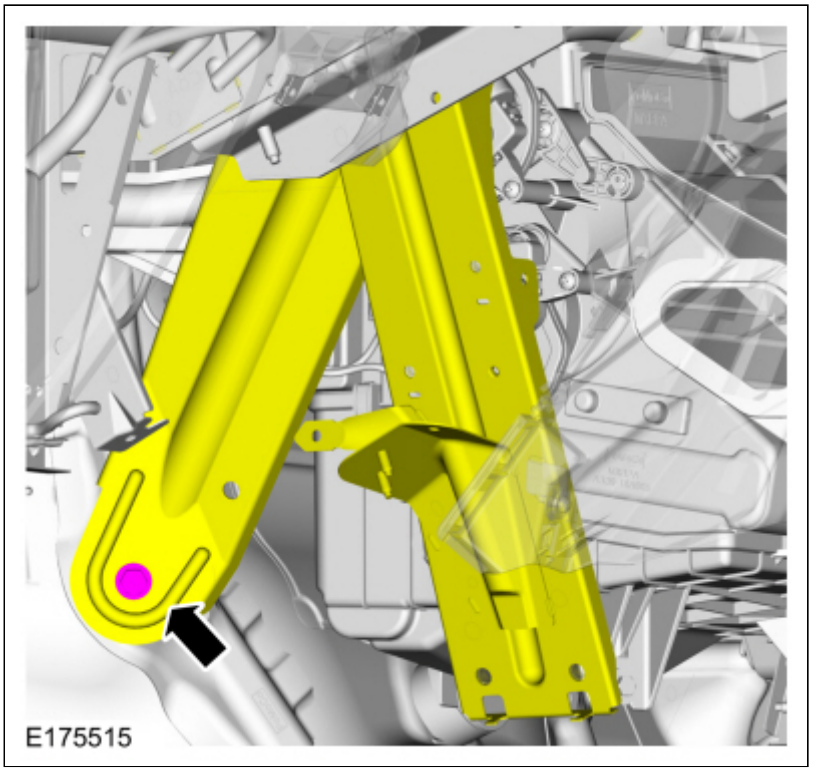
10.



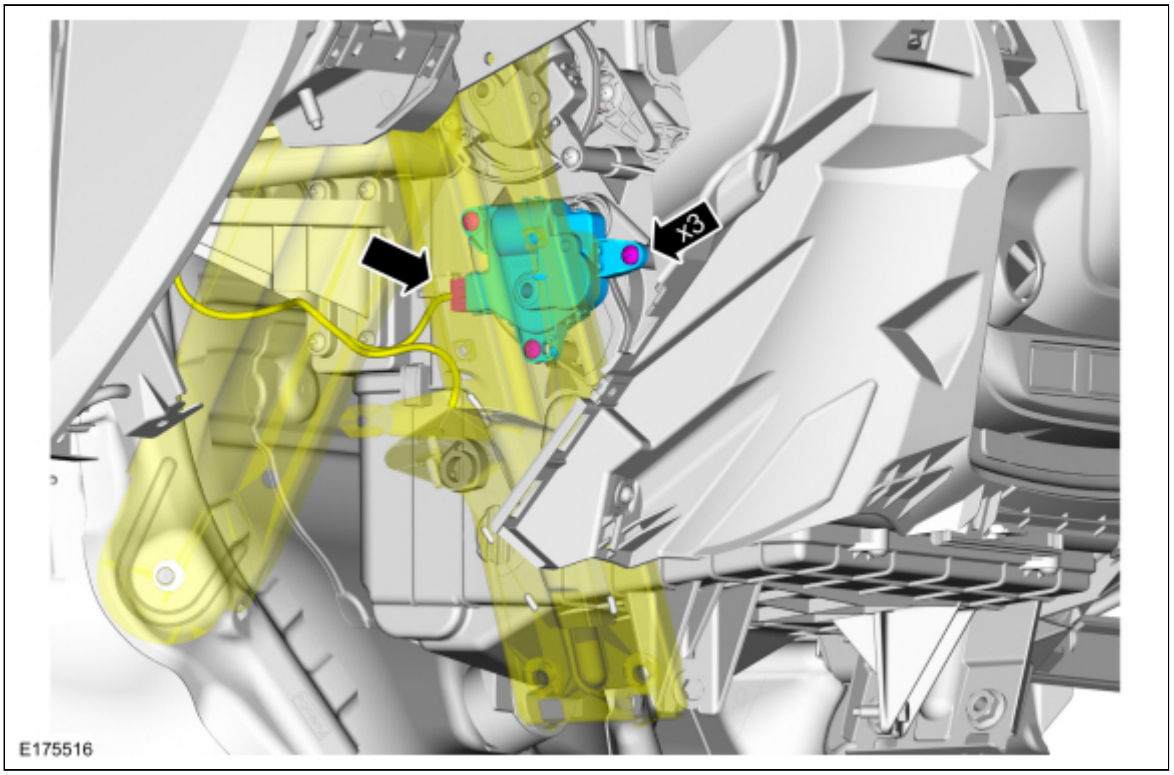
11.



12.



13.



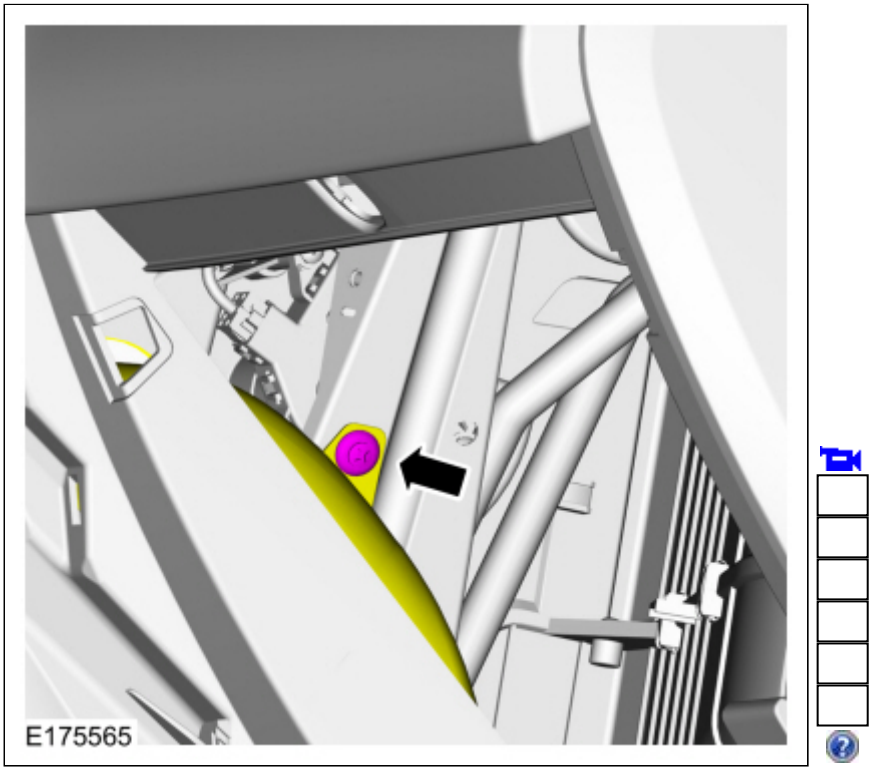
Installation

1. To install, reverse the removal procedure.

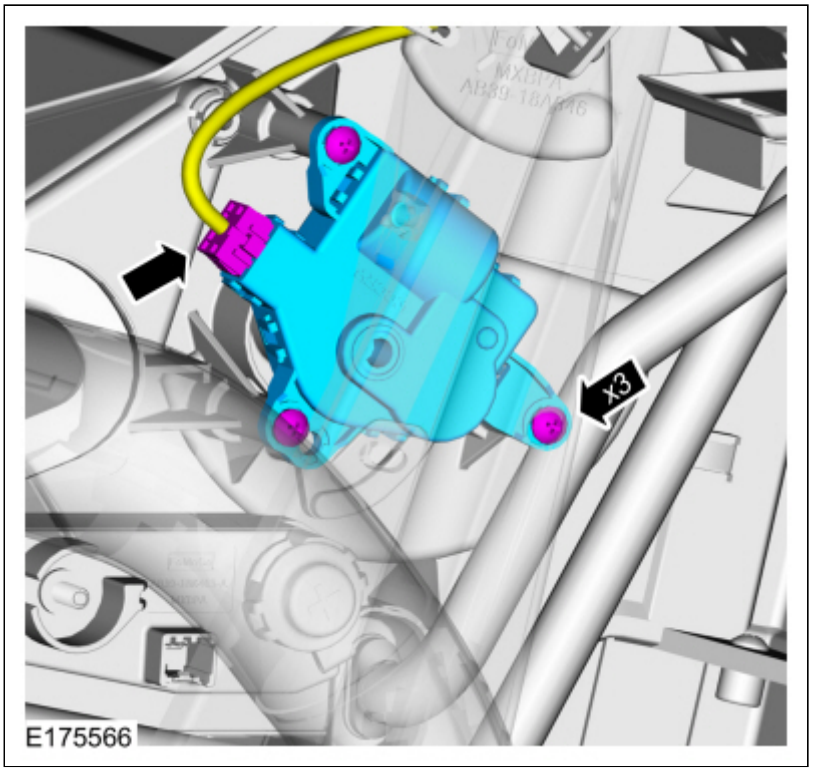
Copyright © 2016 Ford Motor Company

Temperature Door Actuator RH - LHD 4WD/LHD RWD

Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Glove Compartment - Remove for Access (501-12 Instrument Panel and Console, Removal and Installation).
4. 

5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Information not available at this time.

Air Conditioning (A/C) Compressor - 2.5L Duratec-HE (122kW/165PS) - MI4

Base Part Number: 19D629

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

NOTICE: If installing a new A/C compressor due to an internal failure of the old unit, carry out the following procedures to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance and/or damage to the new A/C compressor and other components.

- **If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor.**
- **If A/C flushing equipment is not available, replace all contaminated components after a new A/C compressor has been installed.**
- **Install a new Thermostatic Expansion Valve (TXV) as directed by the A/C flushing.**
- **Install a new receiver drier element as directed by the A/C flushing.**

NOTE: *Installation of a new receiver drier element is not required when repairing the A/C system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver drier element.*

NOTE: *A new A/C compressor may come equipped with an A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil already installed. If these components are not pre-installed, it will be necessary to transfer these parts from the old A/C compressor to the new compressor prior to installation of the A/C compressor if suitable for reuse.*

NOTE: *Removal steps in this procedure may contain installation details.*

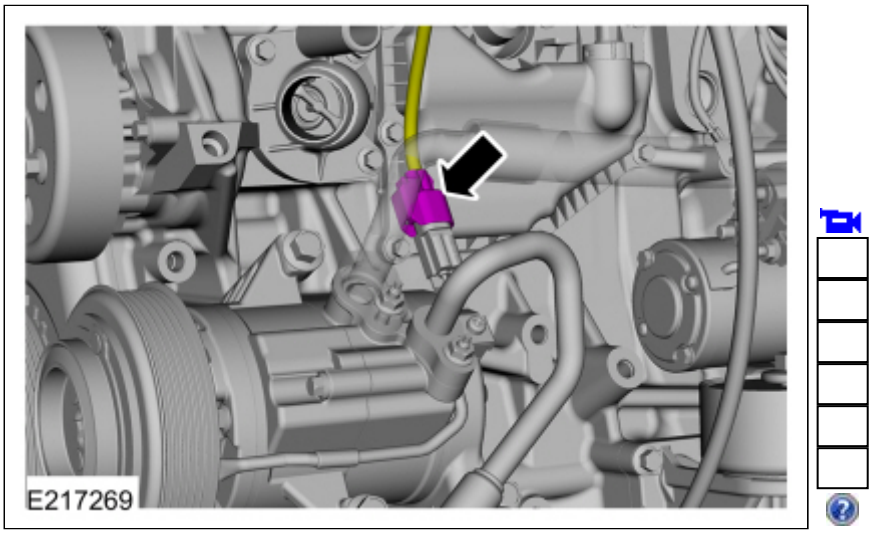
1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

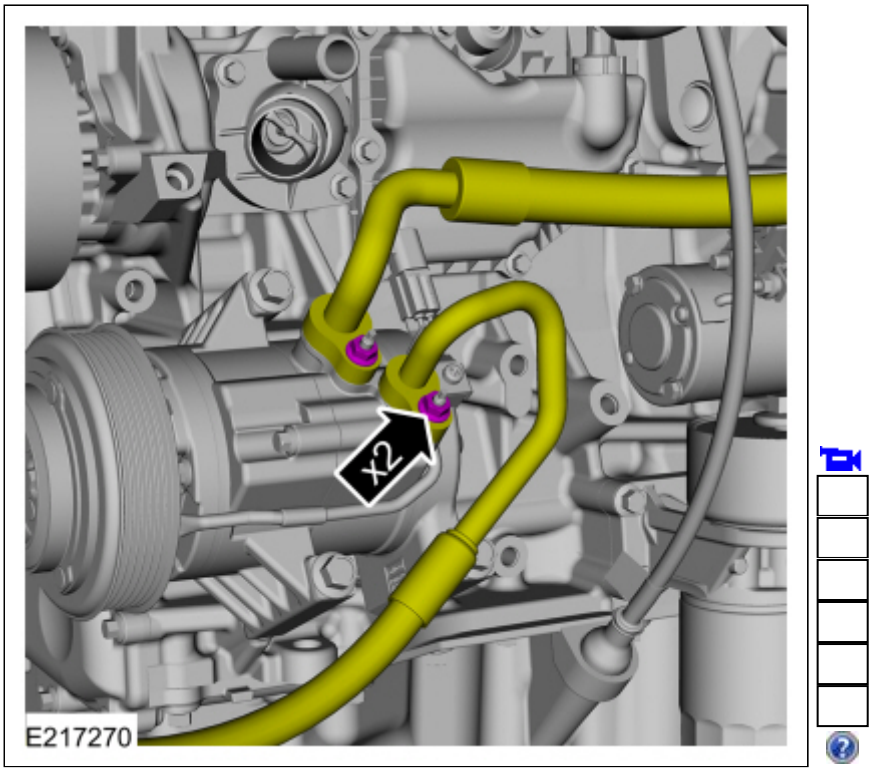
3. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

4.

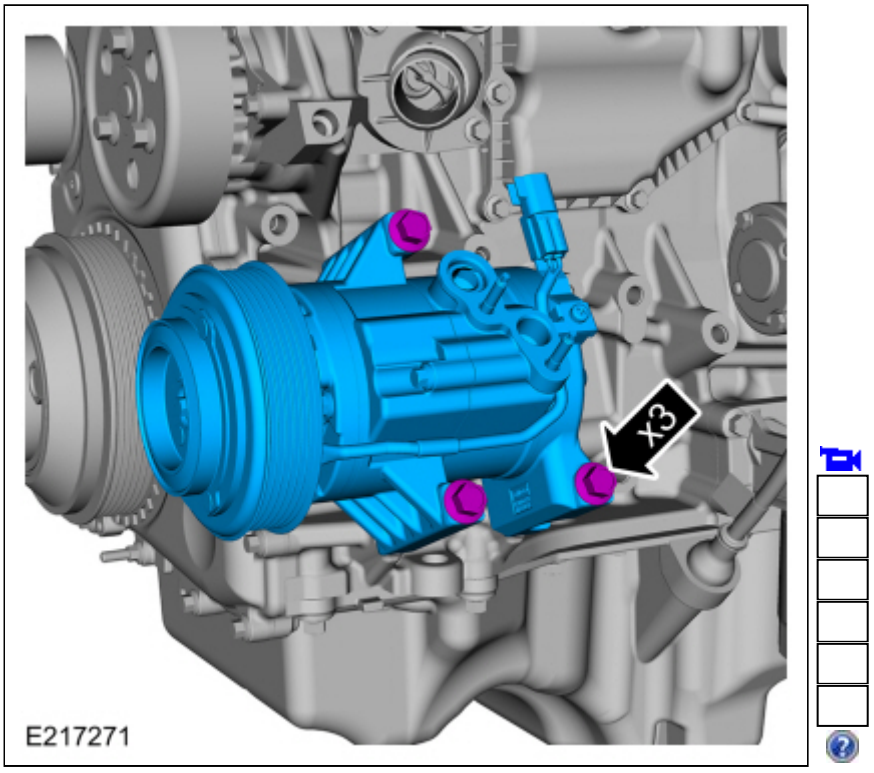


5. **NOTICE: Make sure that all openings are sealed.**

   Torque: 10 Nm



6. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor - 2.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19D629

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

NOTICE: If installing a new A/C compressor due to an internal failure of the old unit, carry out the following procedures to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance and/or damage to the new A/C compressor and other components.

- **If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor.**
- **If A/C flushing equipment is not available, replace all contaminated components after a new A/C compressor has been installed.**
- **Install a new Thermostatic Expansion Valve (TXV) as directed by the A/C flushing.**
- **Install a new receiver drier element as directed by the A/C flushing.**

NOTE: *Installation of a new receiver drier element is not required when repairing the A/C system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver drier element.*

NOTE: *A new A/C compressor may come equipped with an A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil already installed. If these components are not pre-installed, it will be necessary to transfer these parts from the old A/C compressor to the new compressor prior to installation of the A/C compressor if suitable for reuse.*

NOTE: *Removal steps in this procedure may contain installation details.*

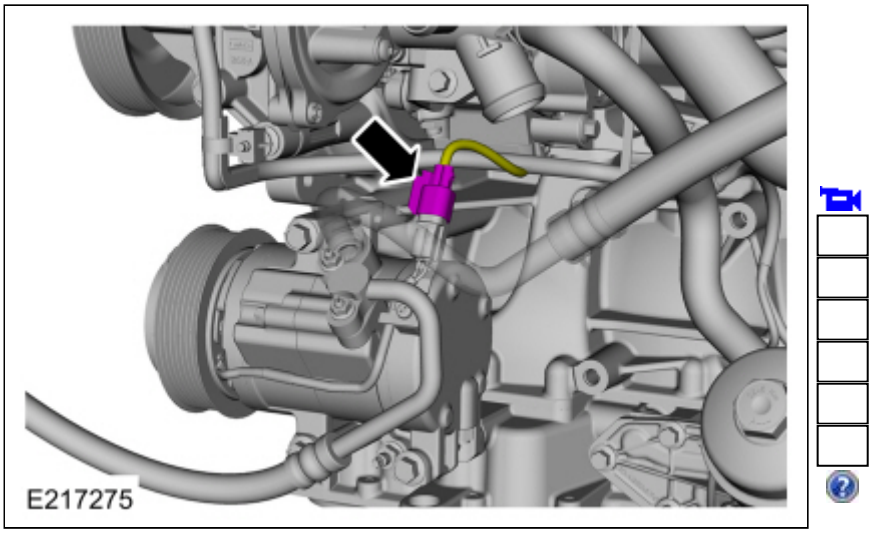
1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

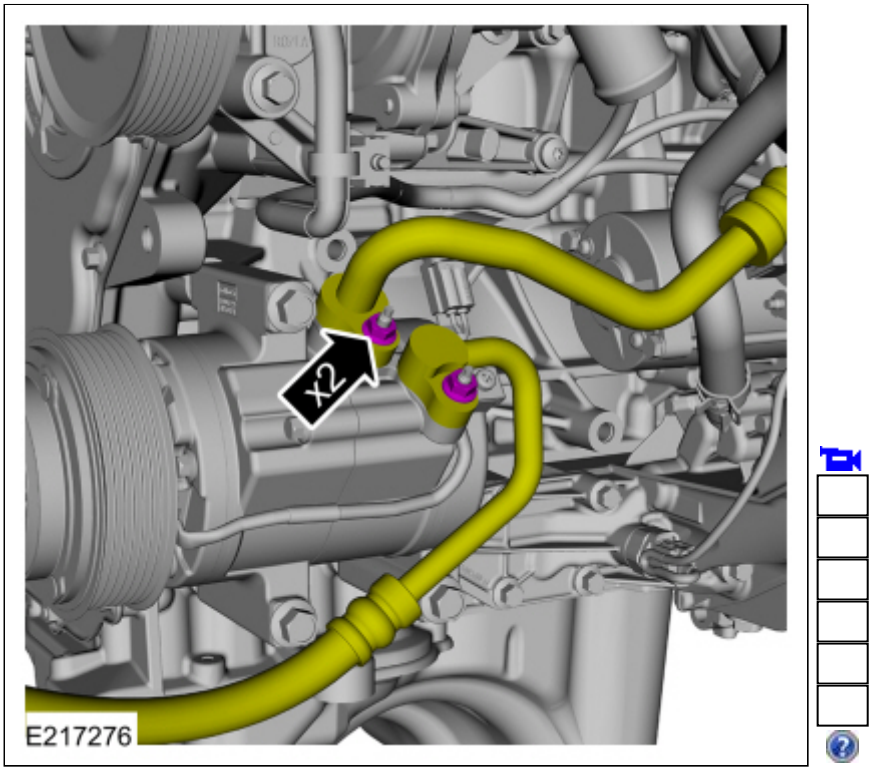
3. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
   Refer to: Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

4.

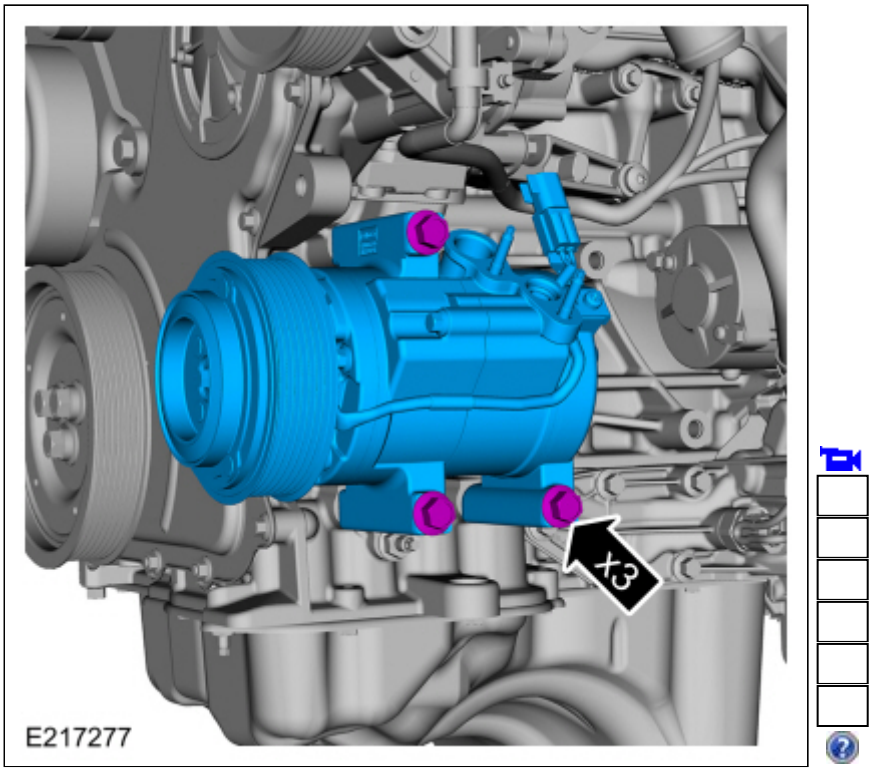


5. **NOTICE: Make sure that all openings are sealed.**

   Torque: 10 Nm



6. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor - 3.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19D629

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

NOTICE: If installing a new A/C compressor due to an internal failure of the old unit, carry out the following procedures to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance and/or damage to the new A/C compressor and other components.

- **If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor.**
- **If A/C flushing equipment is not available, replace all contaminated components after a new A/C compressor has been installed.**
- **Install a new Thermostatic Expansion Valve (TXV) as directed by the A/C flushing.**
- **Install a new receiver drier element as directed by the A/C flushing.**

NOTE: *Installation of a new receiver drier element is not required when repairing the A/C system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the receiver drier element.*

NOTE: *A new A/C compressor may come equipped with an A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil already installed. If these components are not pre-installed, it will be necessary to transfer these parts from the old A/C compressor to the new compressor prior to installation of the A/C compressor if suitable for reuse.*

NOTE: *Removal steps in this procedure may contain installation details.*

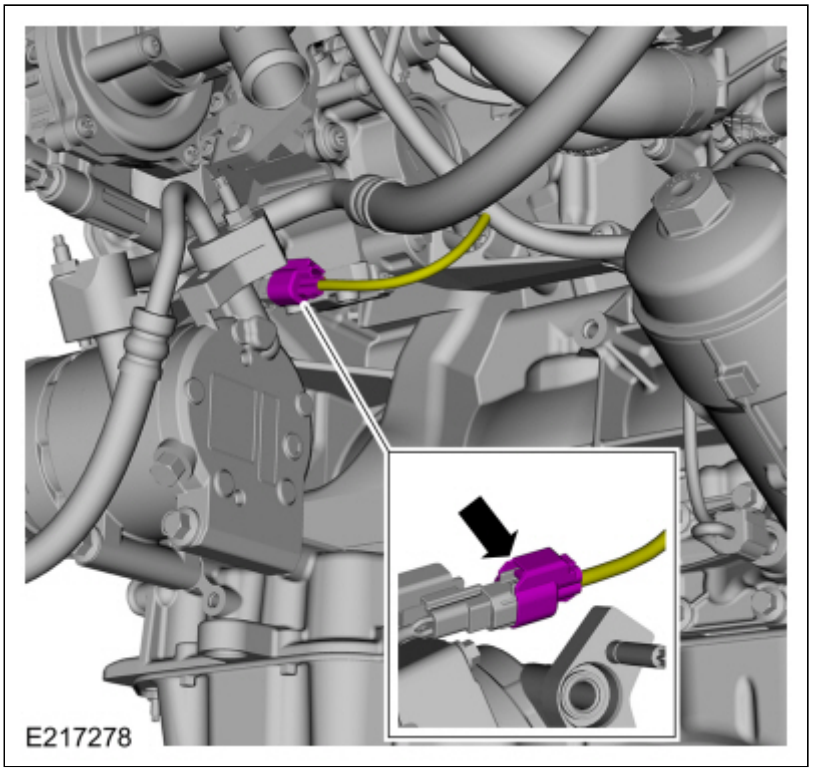
1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

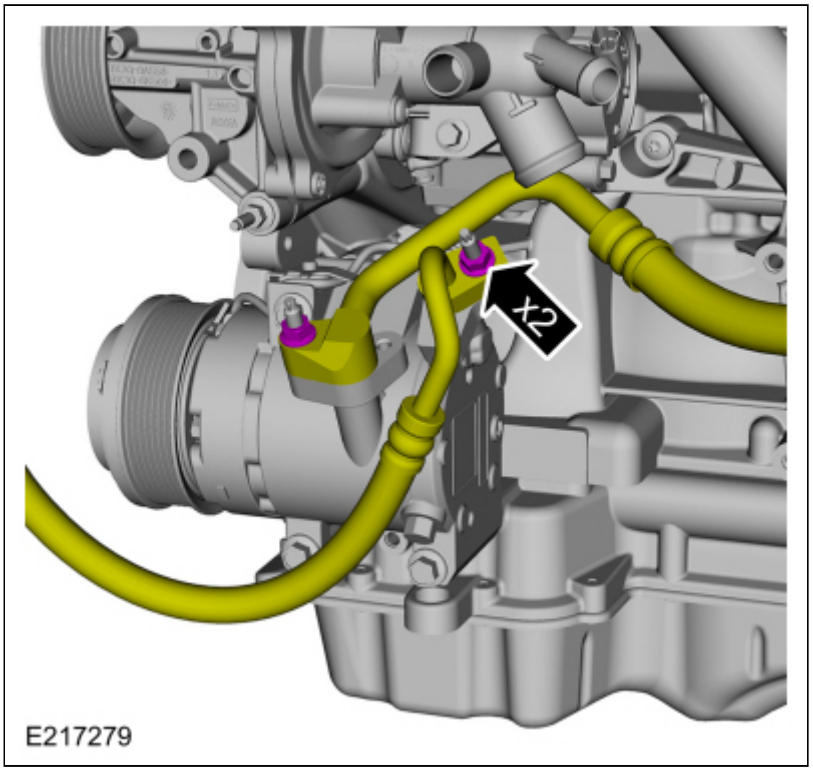
3. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
   Refer to: Accessory Drive Belt - Vehicles With: Electronic Power Assist Steering (EPAS) (303-05C Accessory Drive - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

4.

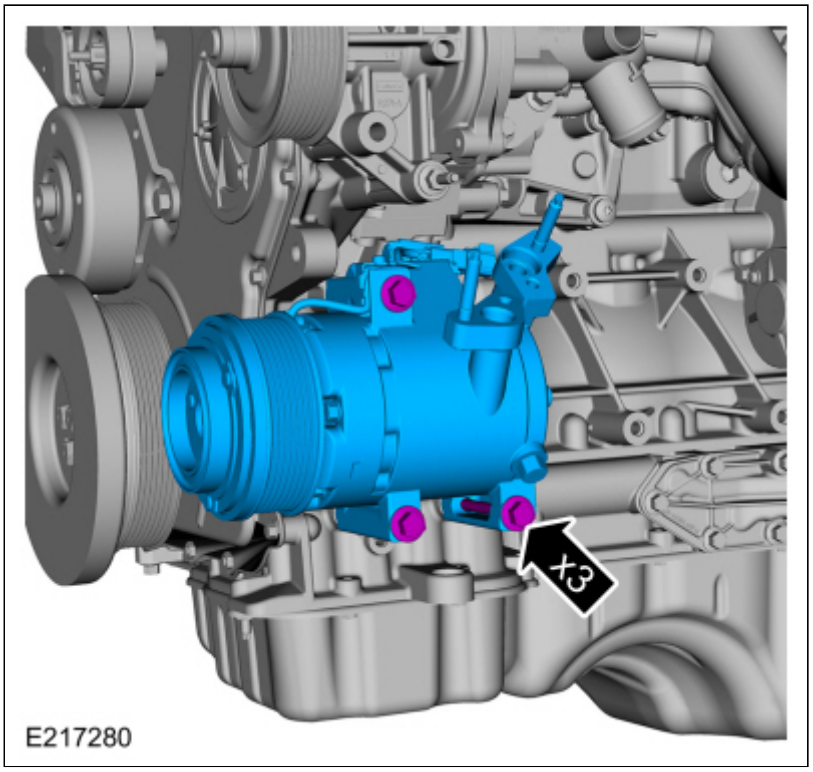


5. **NOTICE: Make sure that all openings are sealed.**

   Torque: 10 Nm



6. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor Inlet Line - 2.5L Duratec-HE (122kW/165PS) - MI4

Base Part Number: 19867

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

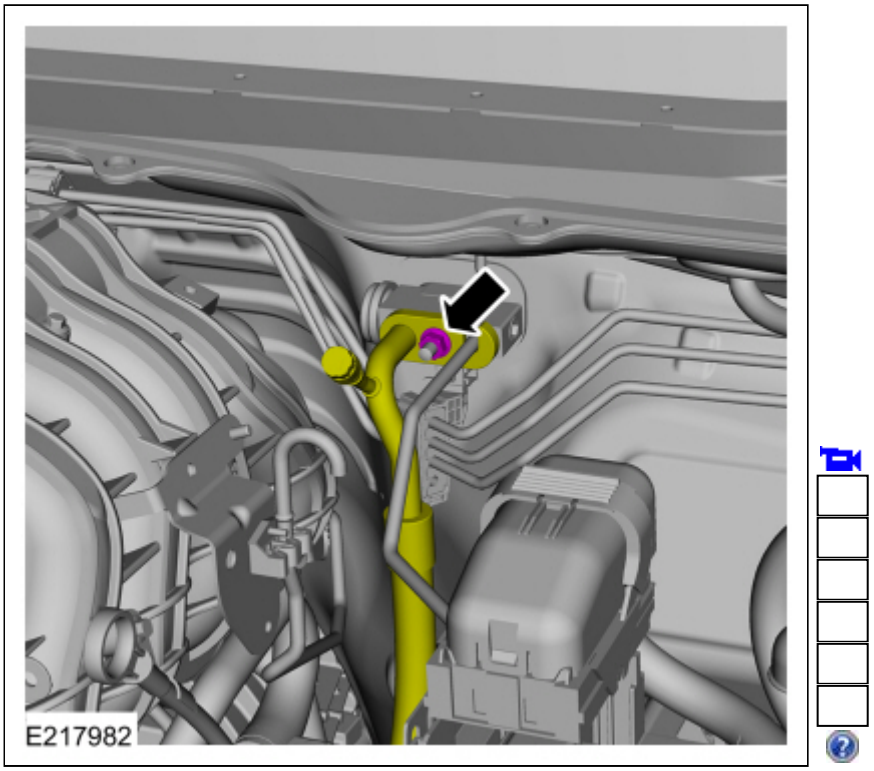
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

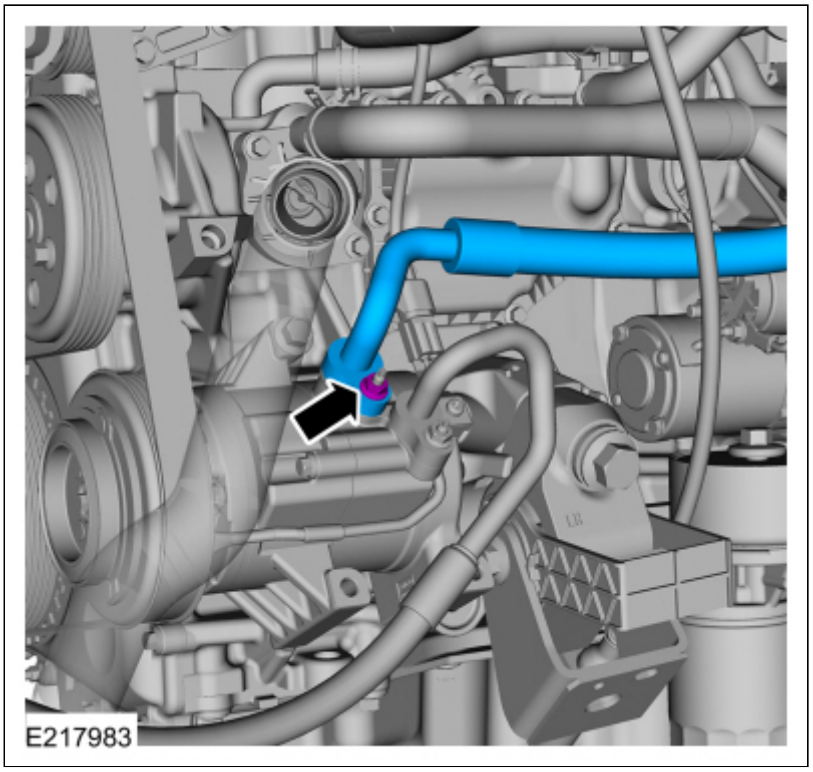
Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. **NOTICE: Make sure that all openings are sealed.**

   Torque: 12 Nm



4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor Inlet Line - 2.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19867

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

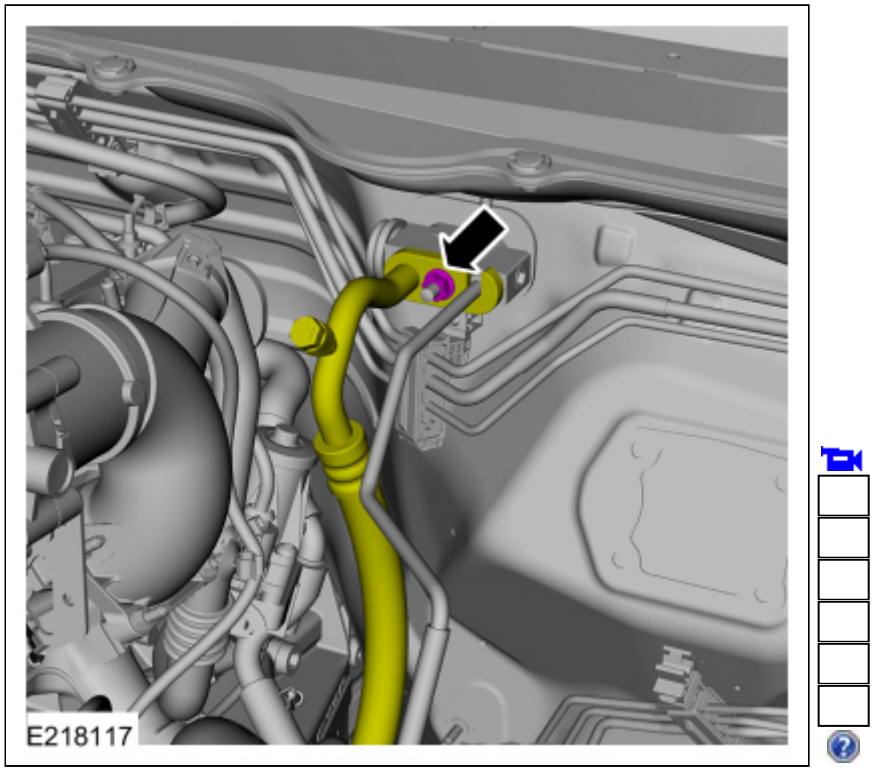
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

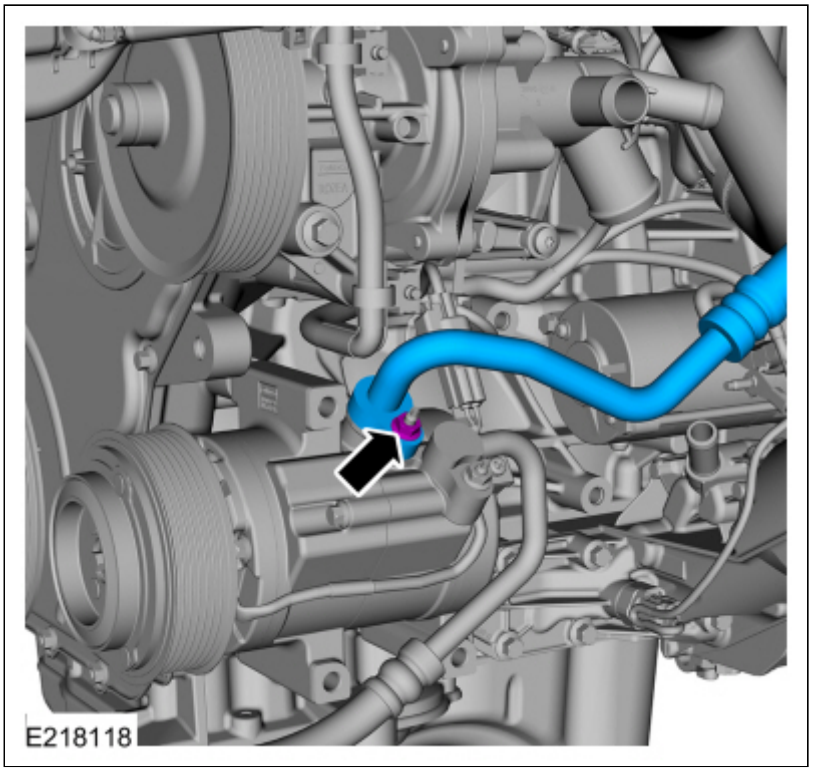
3. **NOTICE: Make sure that all openings are sealed.**

   Torque: 12 Nm



4. **NOTICE: Make sure that all openings are sealed.**

   Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   Install new O-ring seals.
   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor Inlet Line - 3.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19867

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

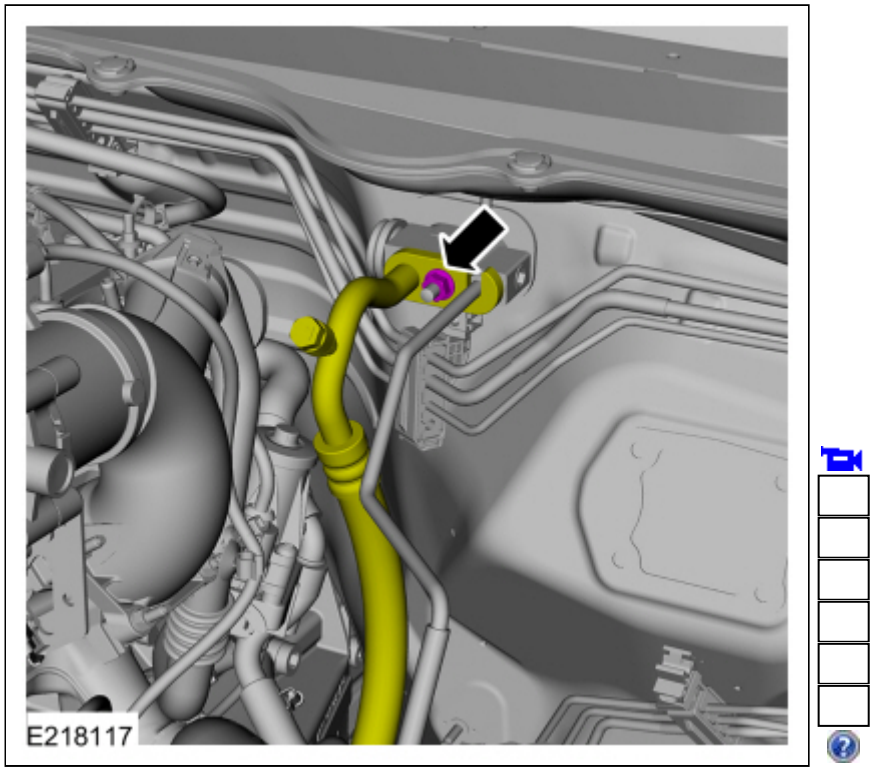
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

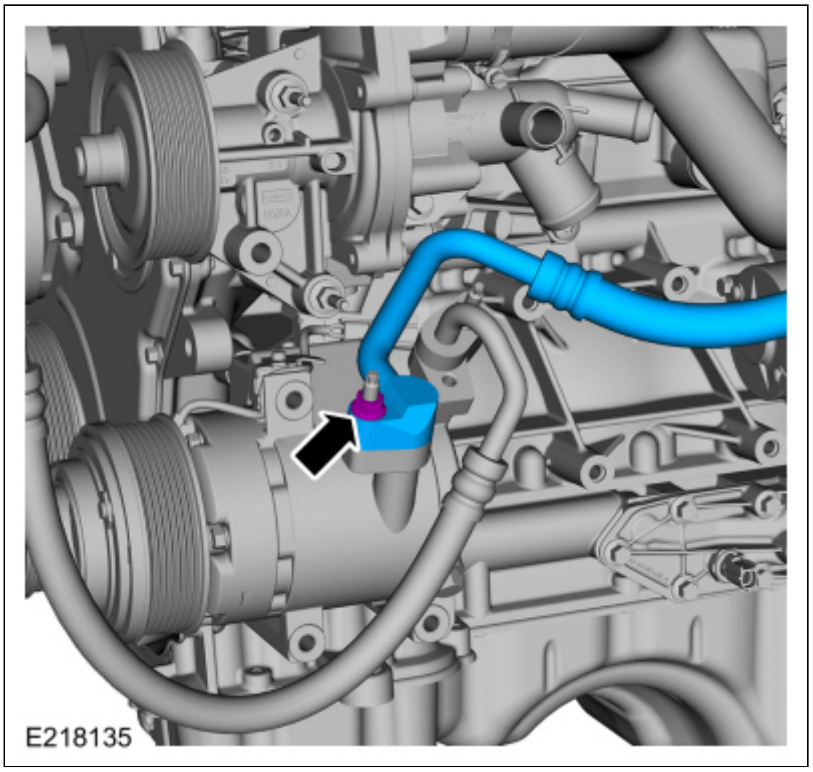
3. **NOTICE: Make sure that all openings are sealed.**

   Torque: 12 Nm



4. **NOTICE: Make sure that all openings are sealed.**

   Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor Outlet Line - 2.5L Duratec-HE (122kW/165PS) - MI4

Base Part Number: 19972

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

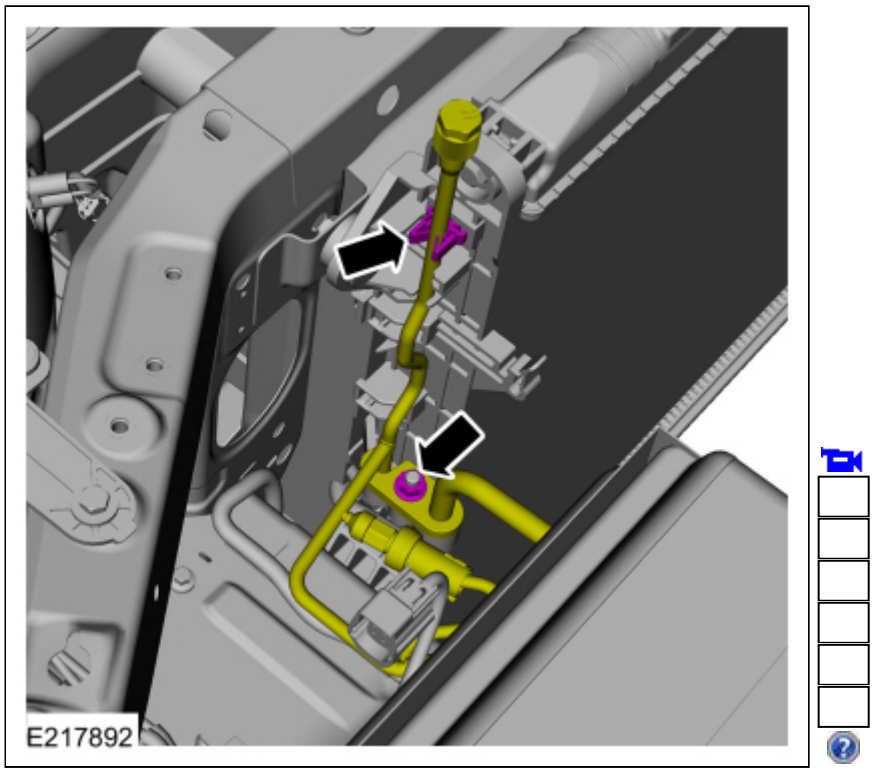
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

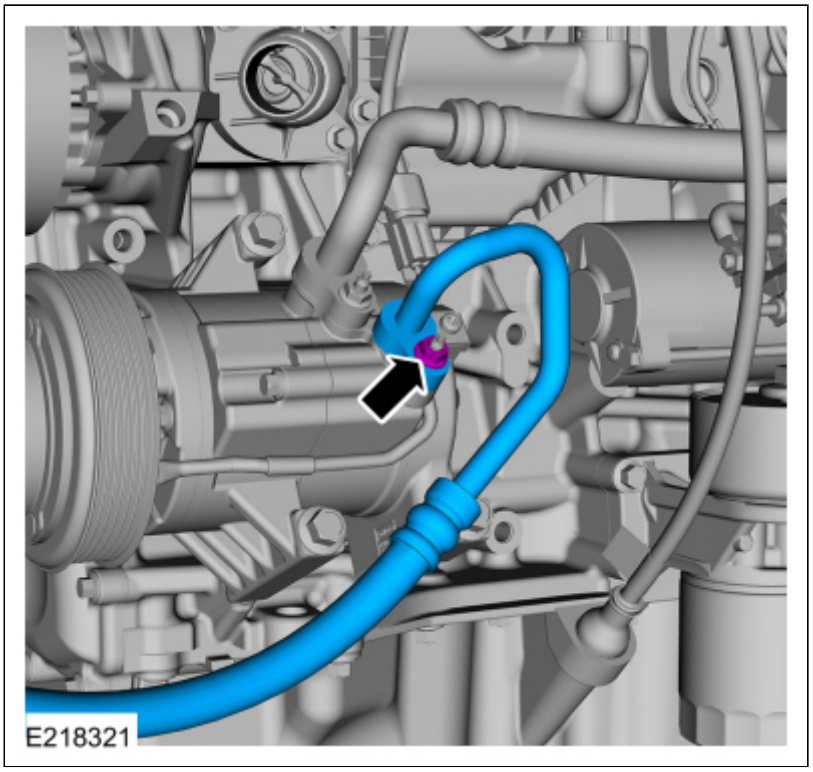
Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. **NOTICE: Make sure that all openings are sealed.**

   Torque: 15 Nm



4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor Outlet Line - 2.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19972

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

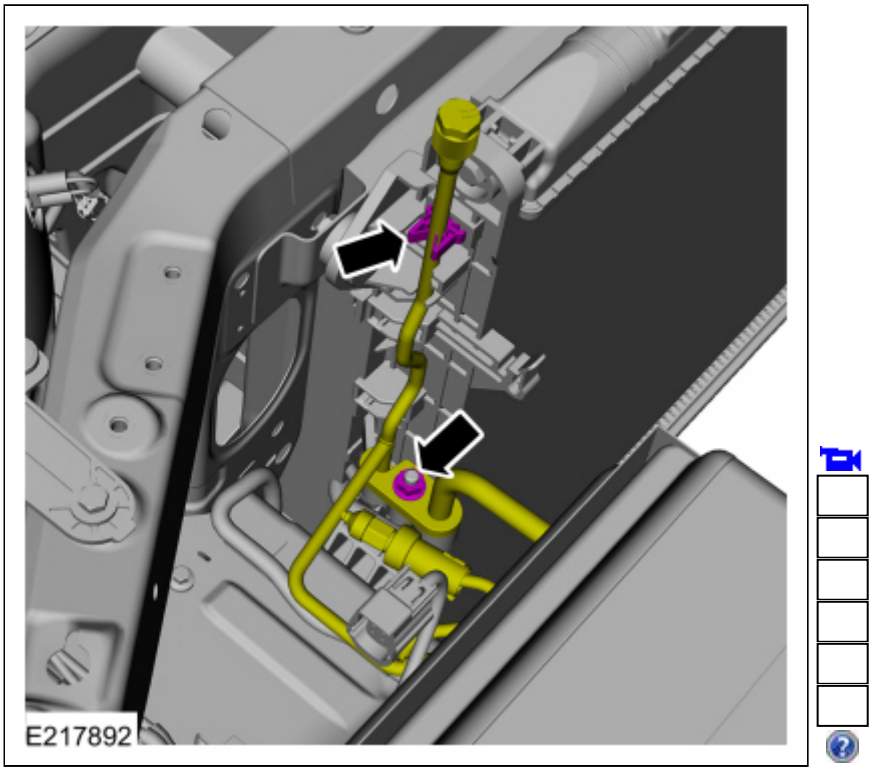
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

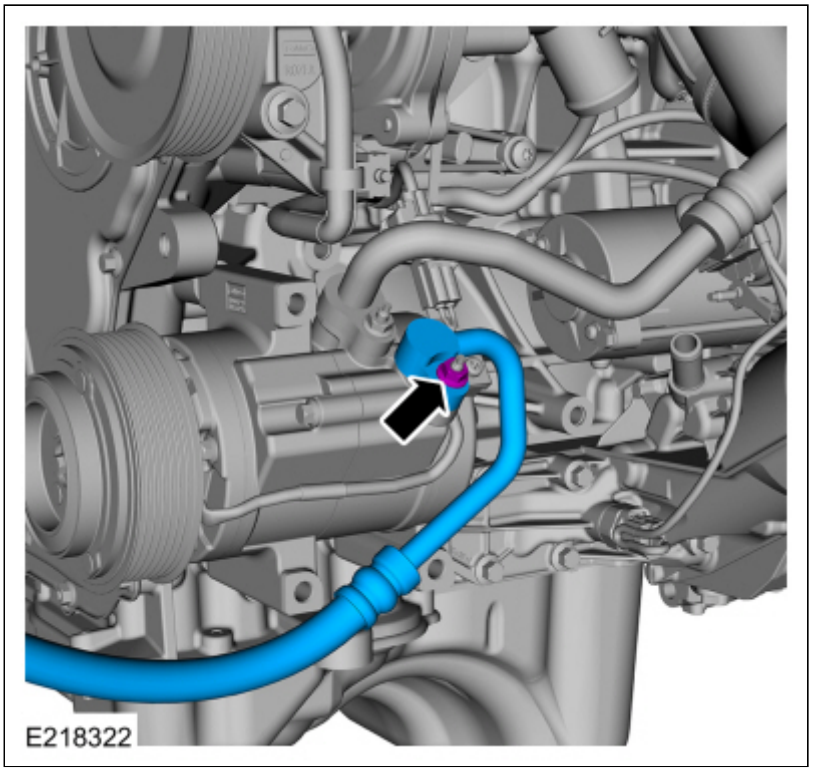
Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. **NOTICE: Make sure that all openings are sealed.**

   Torque: 15 Nm



4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Air Conditioning (A/C) Compressor Outlet Line - 3.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19972

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

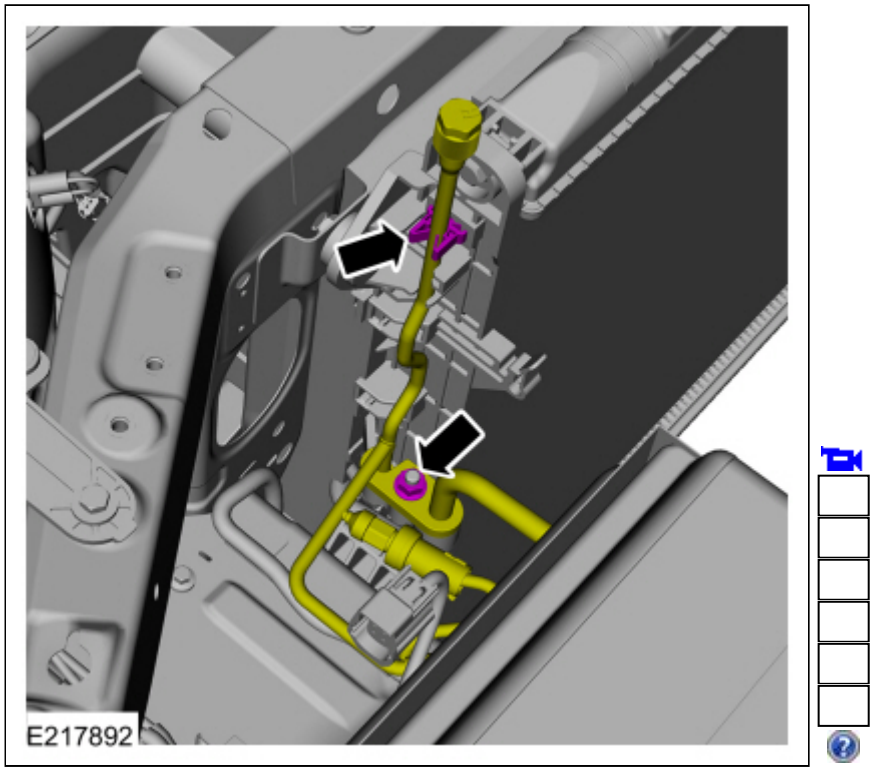
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).

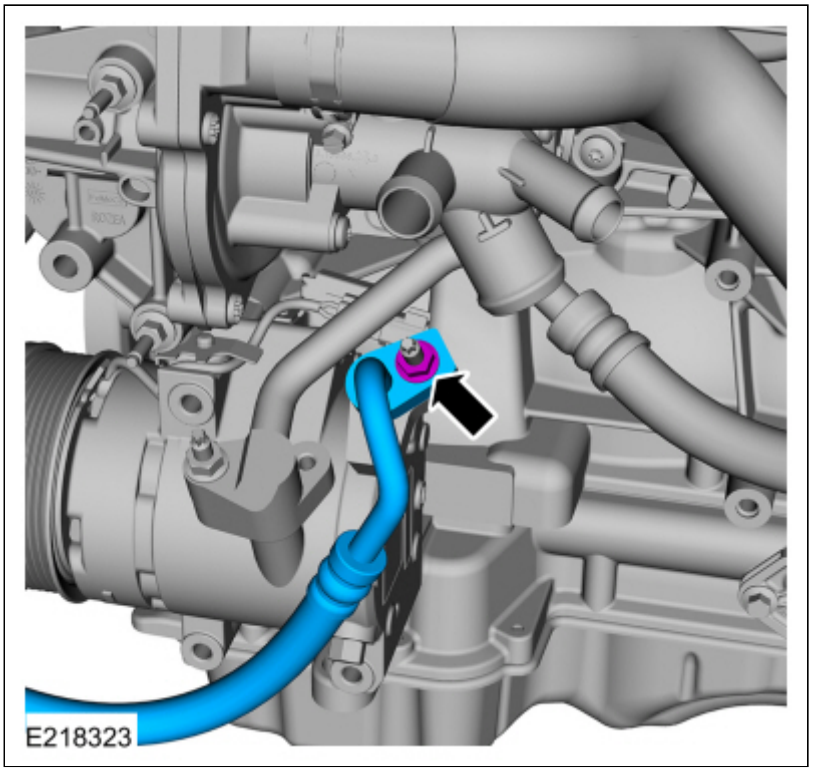
Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

3. **NOTICE: Make sure that all openings are sealed.**

   Torque: 15 Nm



4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   Install new O-ring seals.
   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

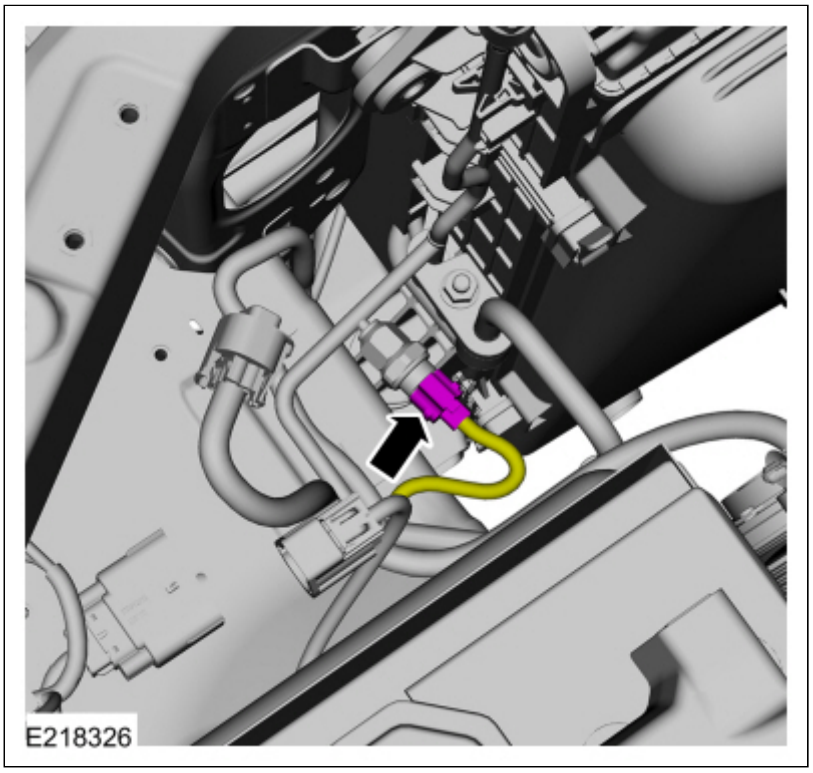
Air Conditioning (A/C) Pressure Transducer

Base Part Number: 19D594

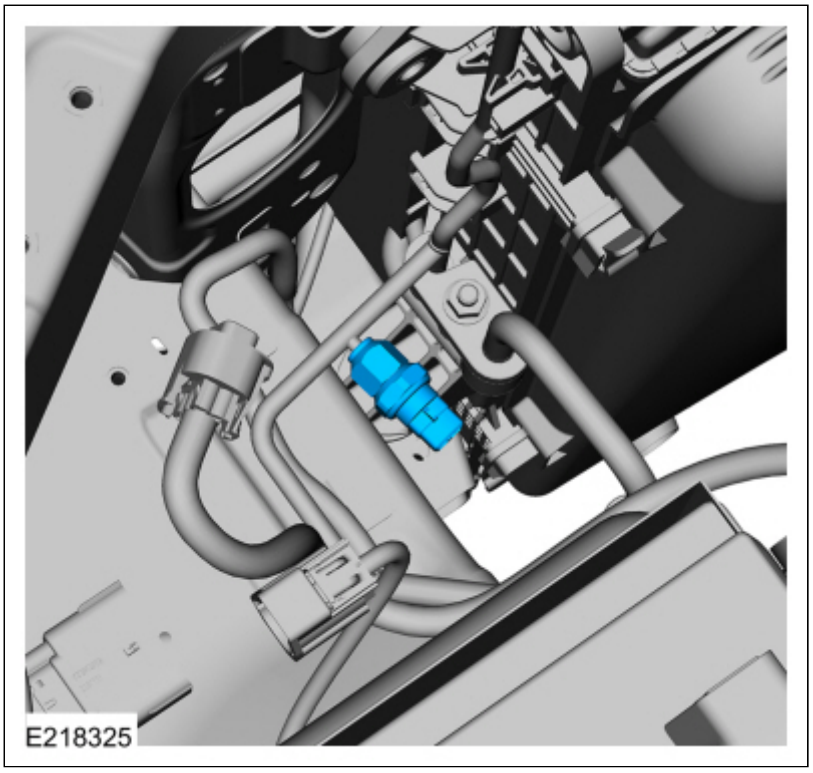
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



2. *Torque*: 7 Nm



Installation

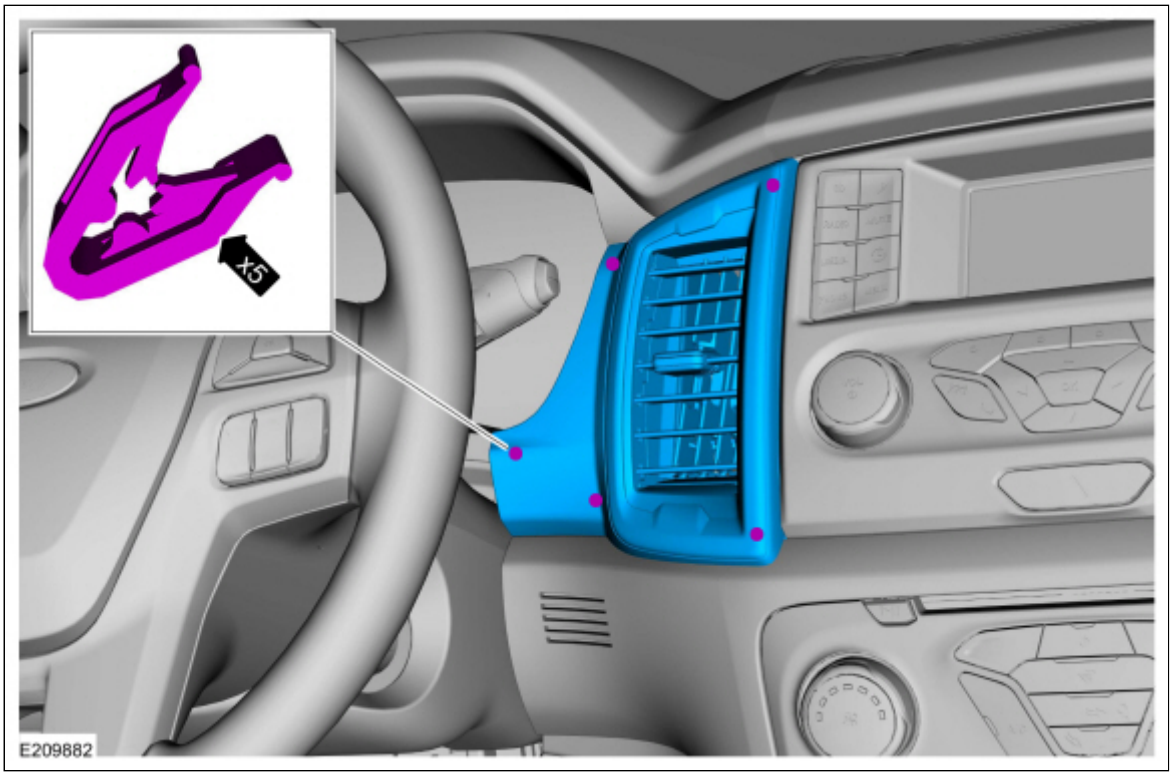
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

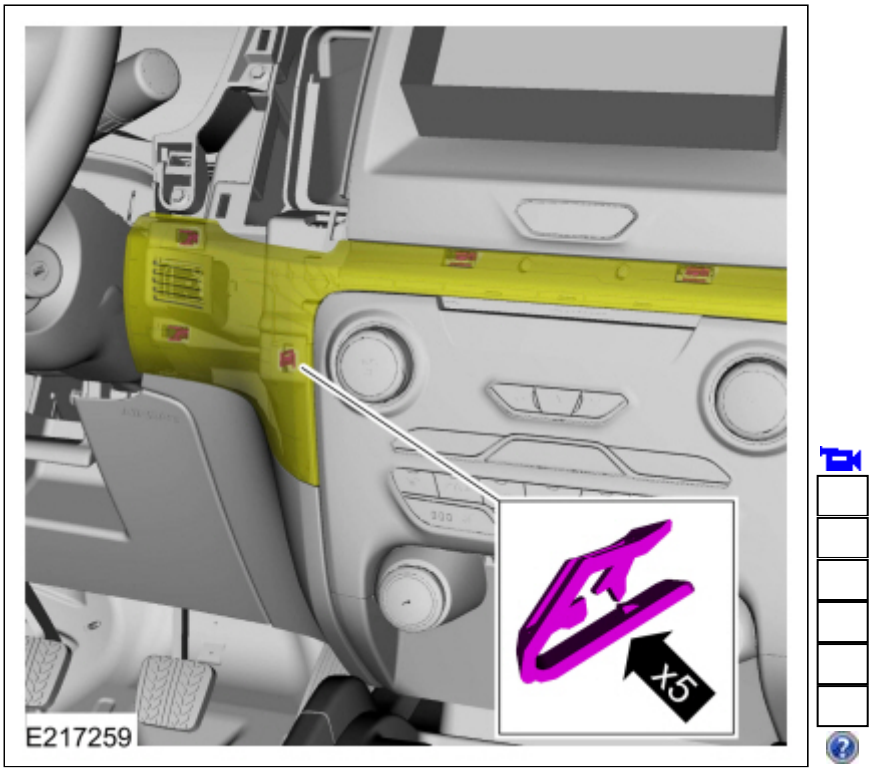
Ambient Air Quality Sensor

Removal

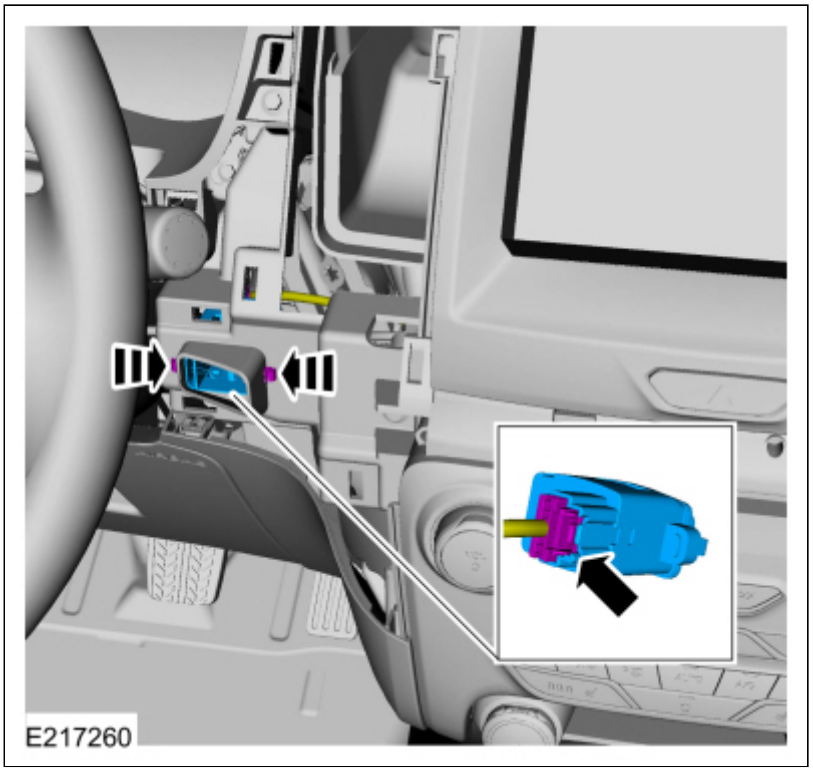
1.



2.



3.



Installation

1. To install, reverse the removal procedure.

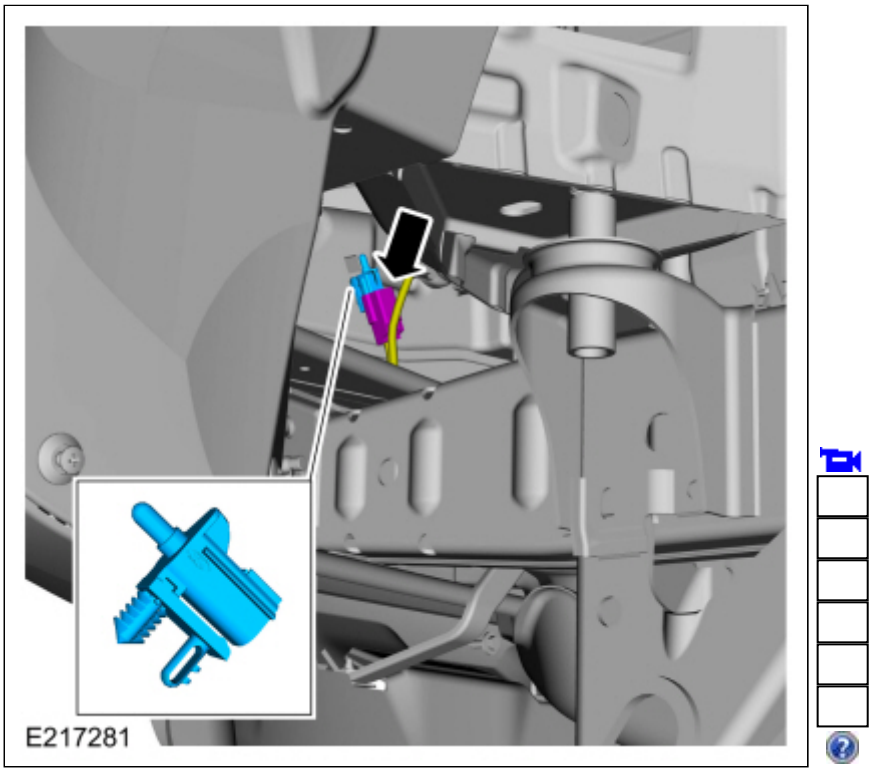
Copyright © 2016 Ford Motor Company

Ambient Air Temperature Sensor

Base Part Number: 12A647

Removal

1. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
2.



Installation

1. To install, reverse the removal procedure.

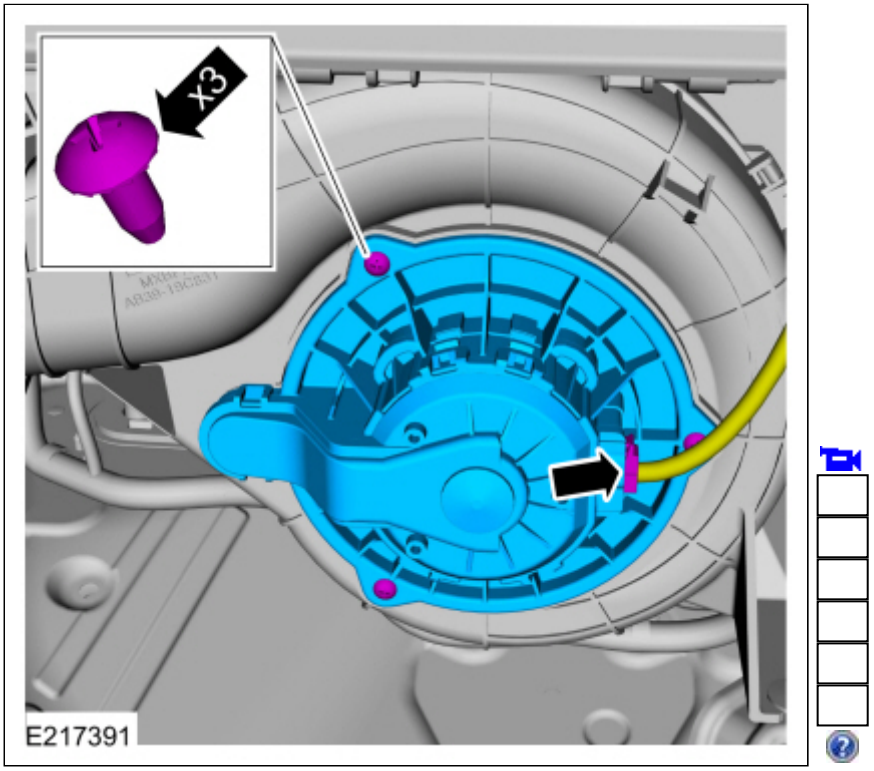
Copyright © 2016 Ford Motor Company

Blower Motor

Base Part Number: 19846

Removal

1. Refer to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
2. *Torque*: 7 Nm



Installation

1. To install, reverse the removal procedure.

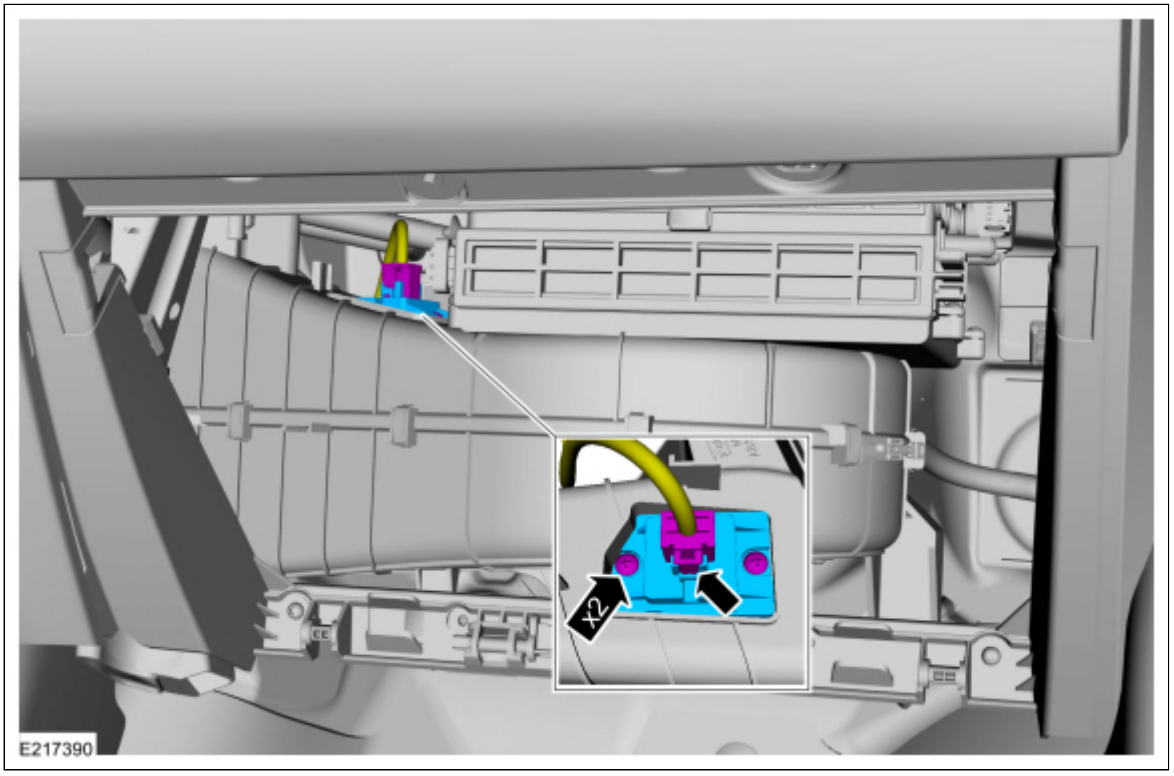
Copyright © 2016 Ford Motor Company

Blower Motor Speed Control

Base Part Number: 19E624

Removal

1. Refer to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
2. *Torque*: 7 Nm



Installation

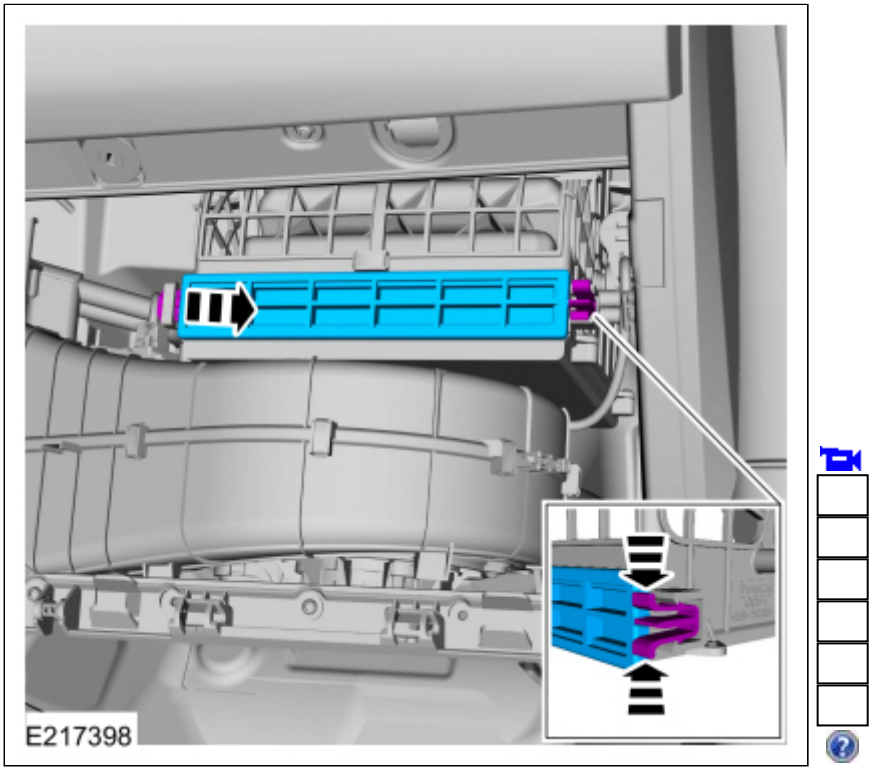
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

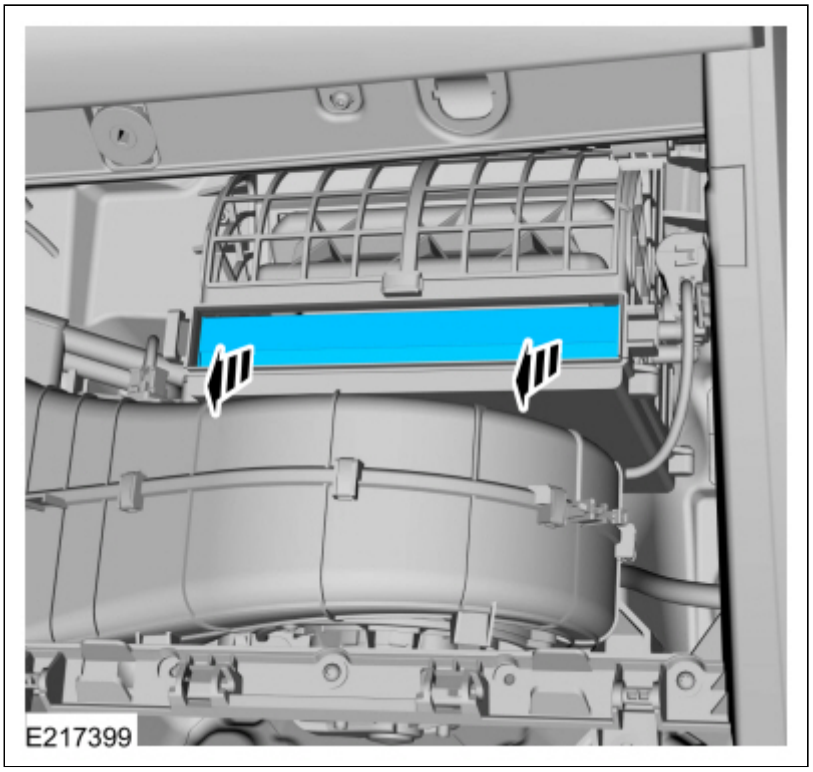
Cabin Air Filter

Base Part Number: 19N619

Removal

1. Refer to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

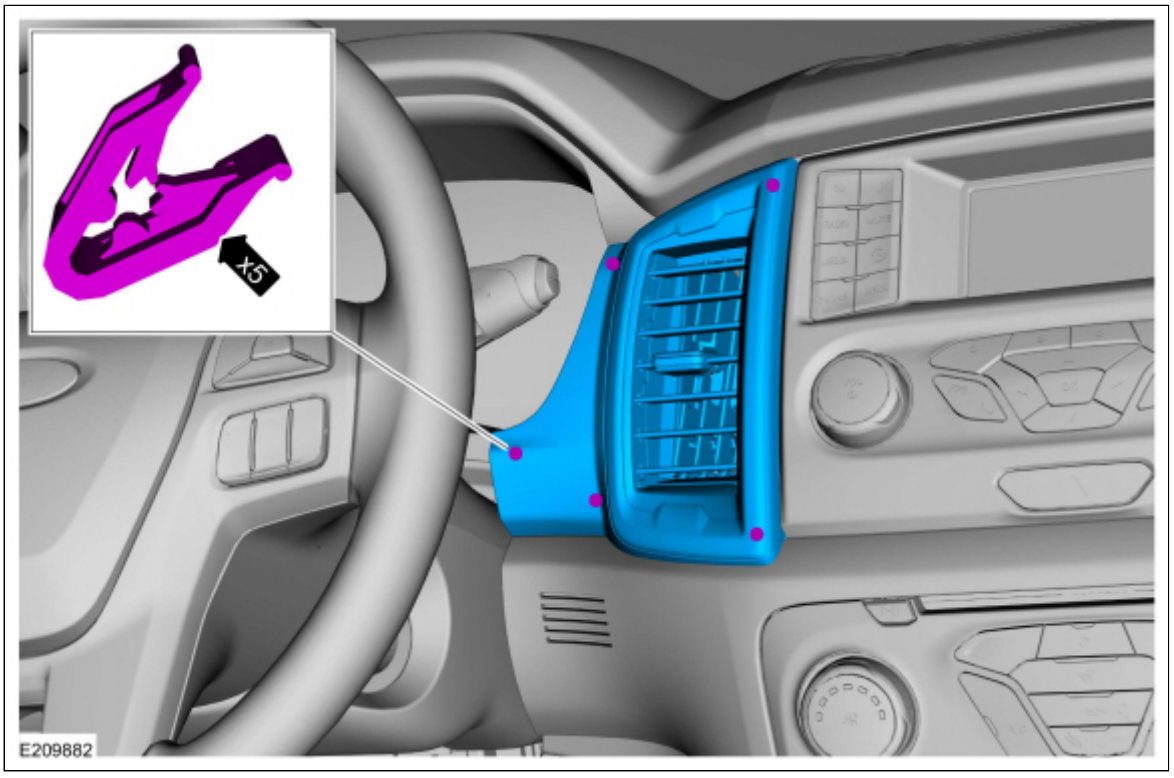
Center Registers

Base Part Number: S018B08

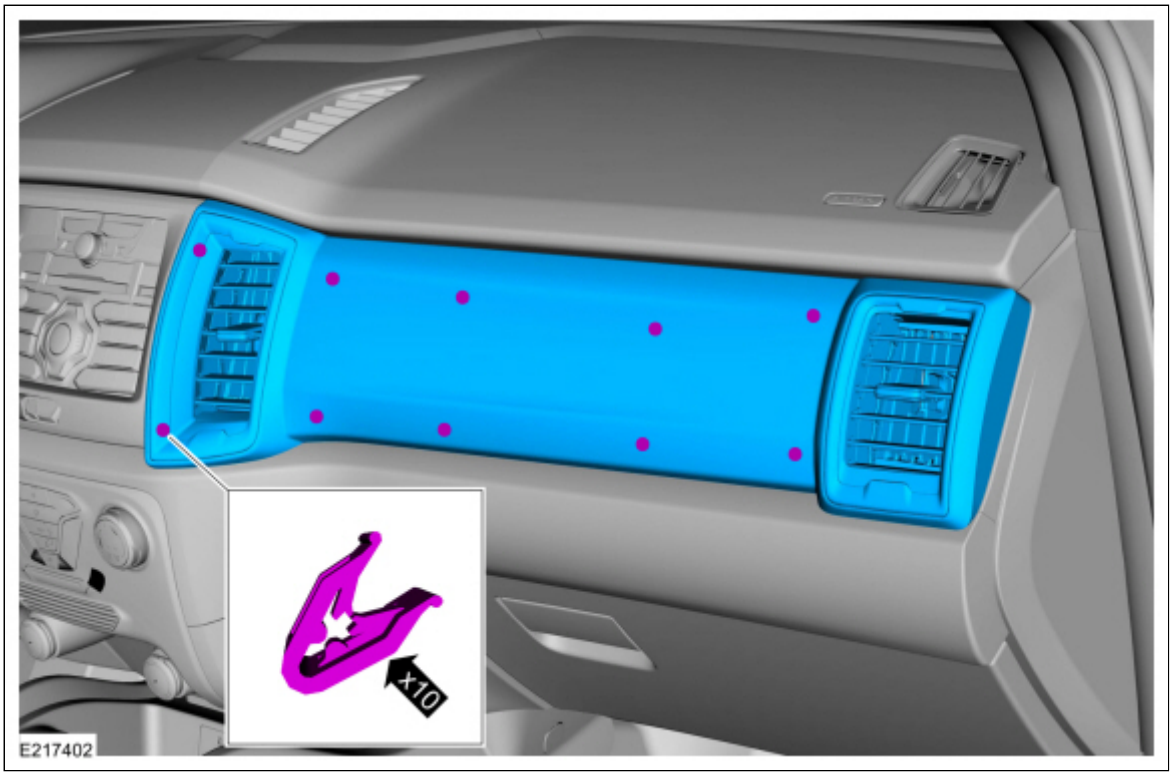
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

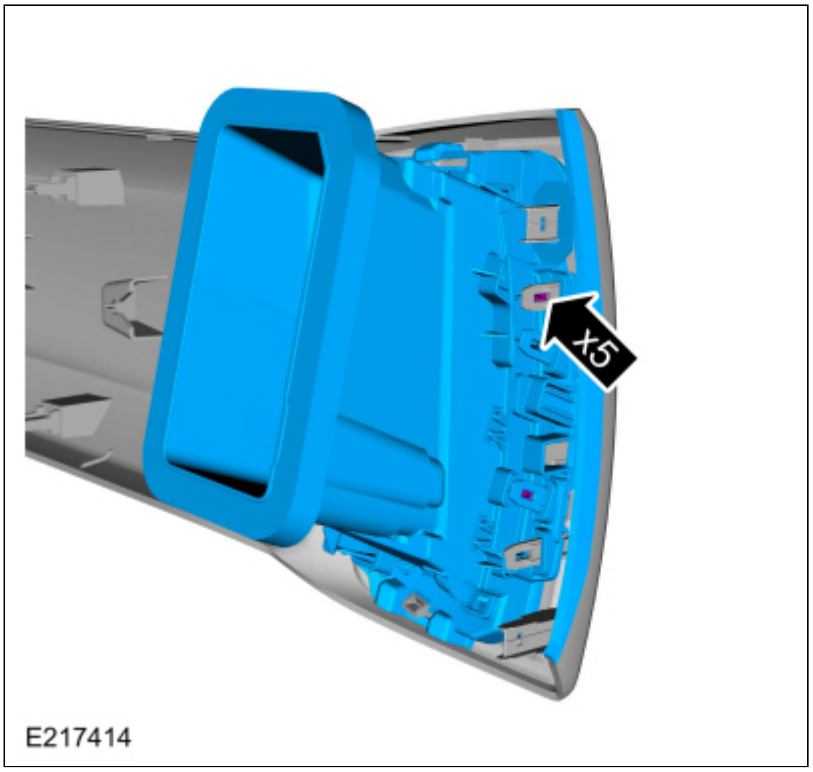
1.



2.



3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Condenser - 2.5L Duratec-HE (122kW/165PS) - MI4

Base Part Number: 19E908

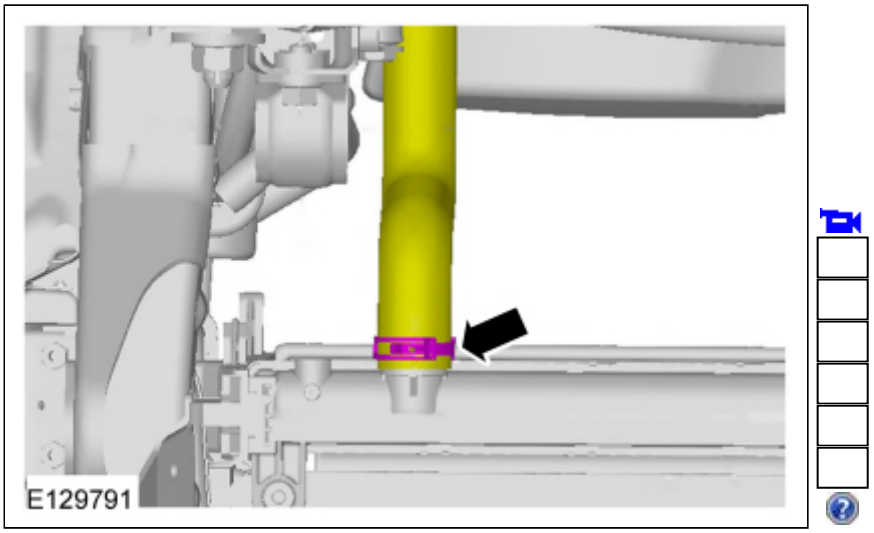
Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

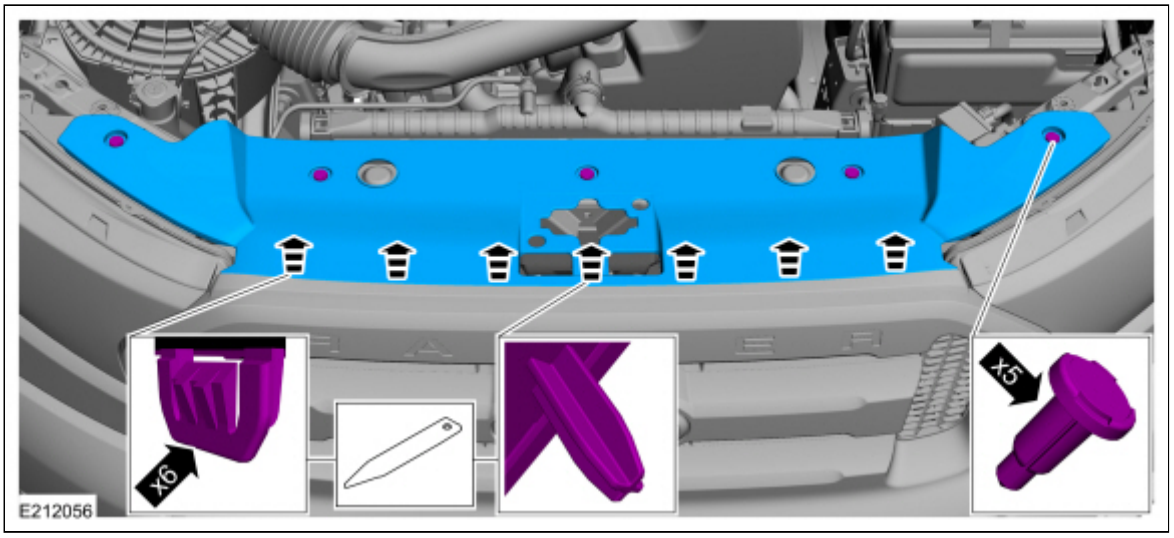
Removal

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

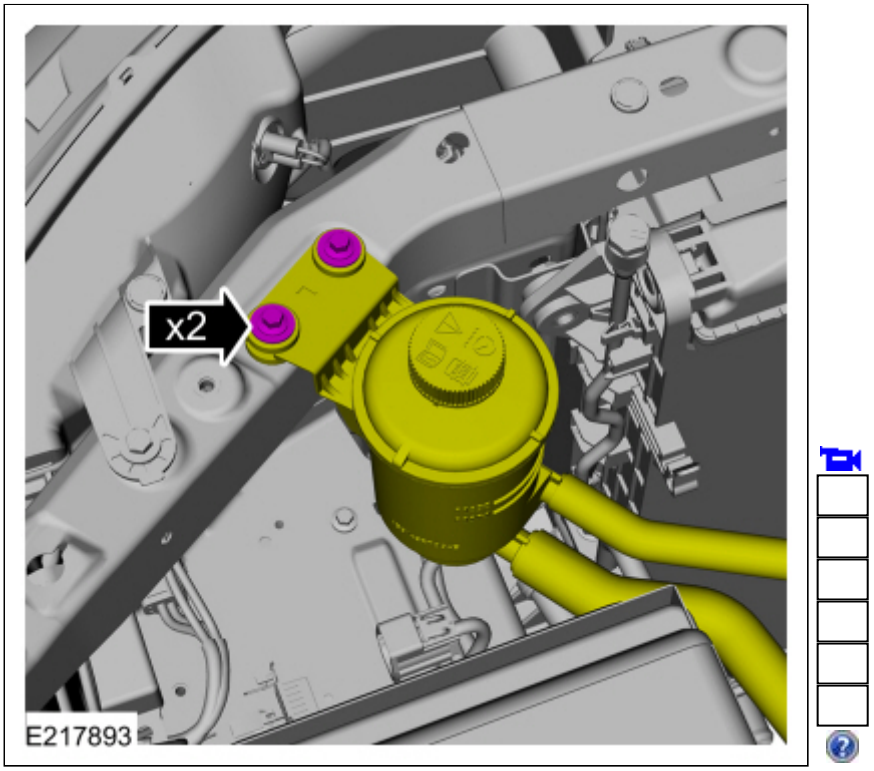
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
3. Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
4. 

5.

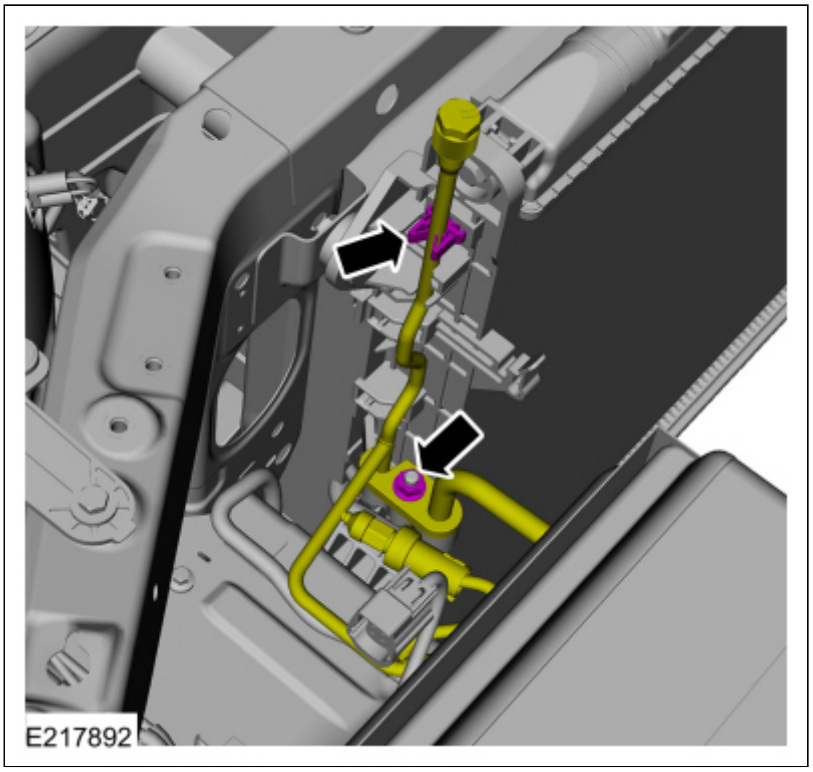


6. If equipped.
   Torque: 9 Nm

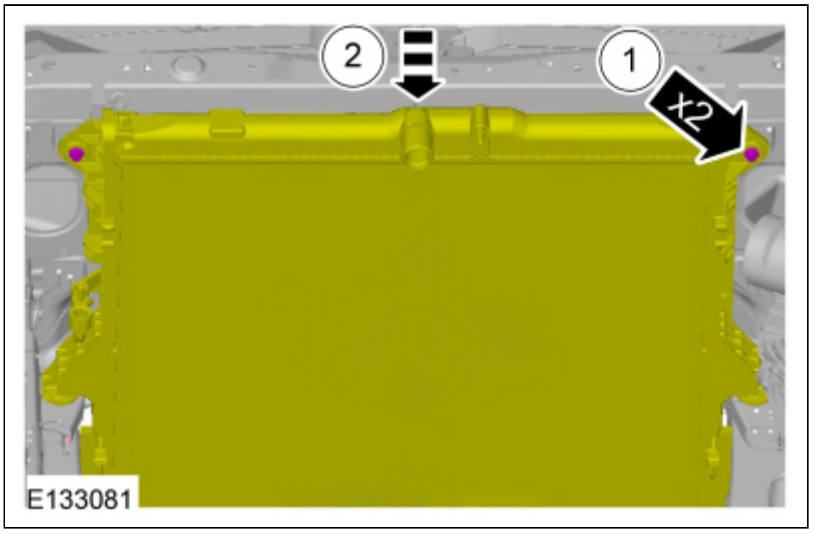


7. **NOTE:** *Take extra care not to damage the A/C refrigerant filling pipe.*

   Torque: 15 Nm



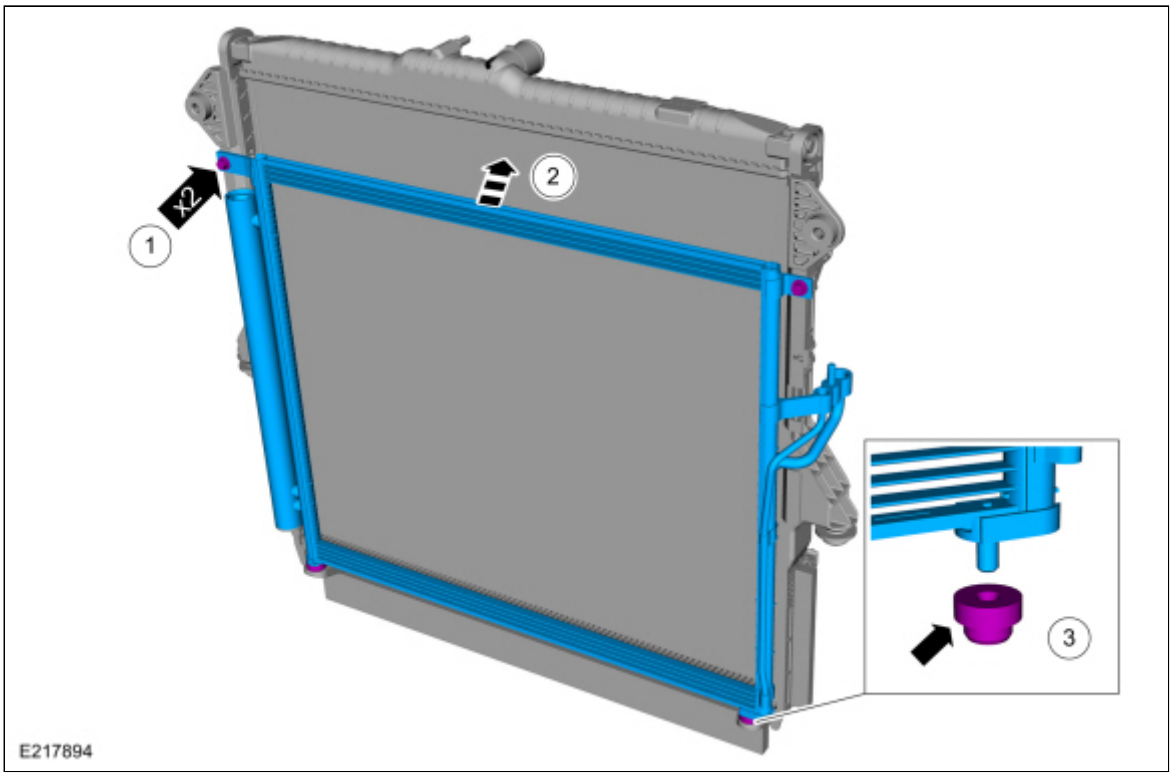
8.



9.



10. *Torque*: 00 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Condenser - 2.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19E908

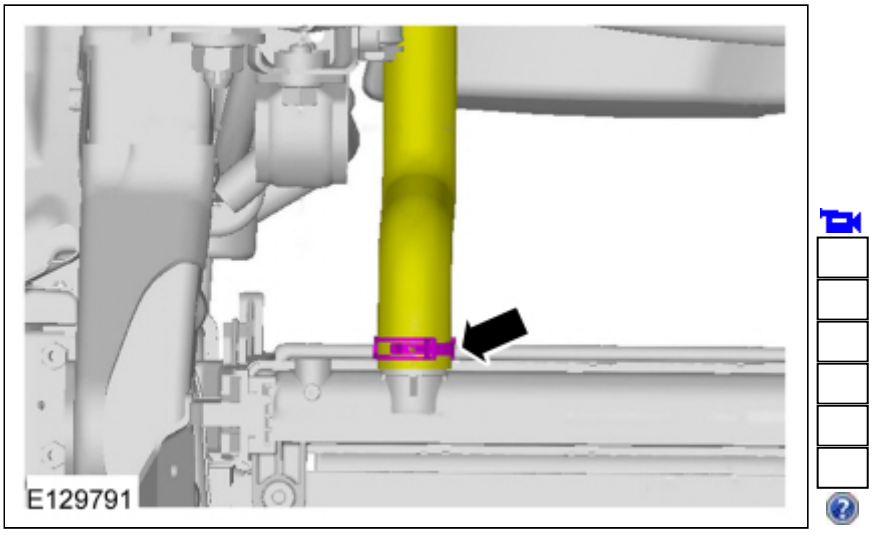
Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

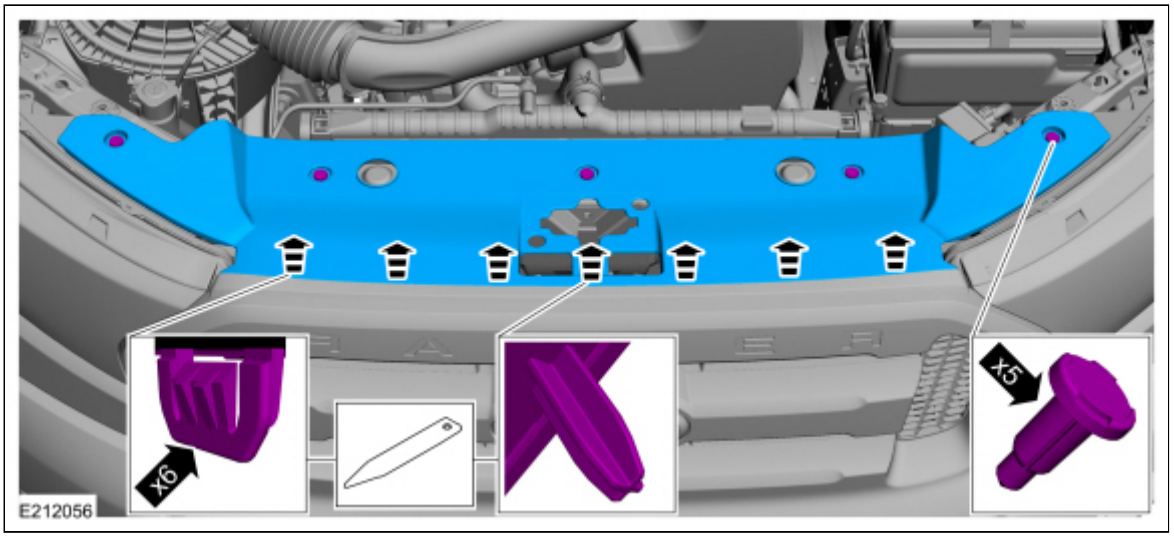
Removal

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

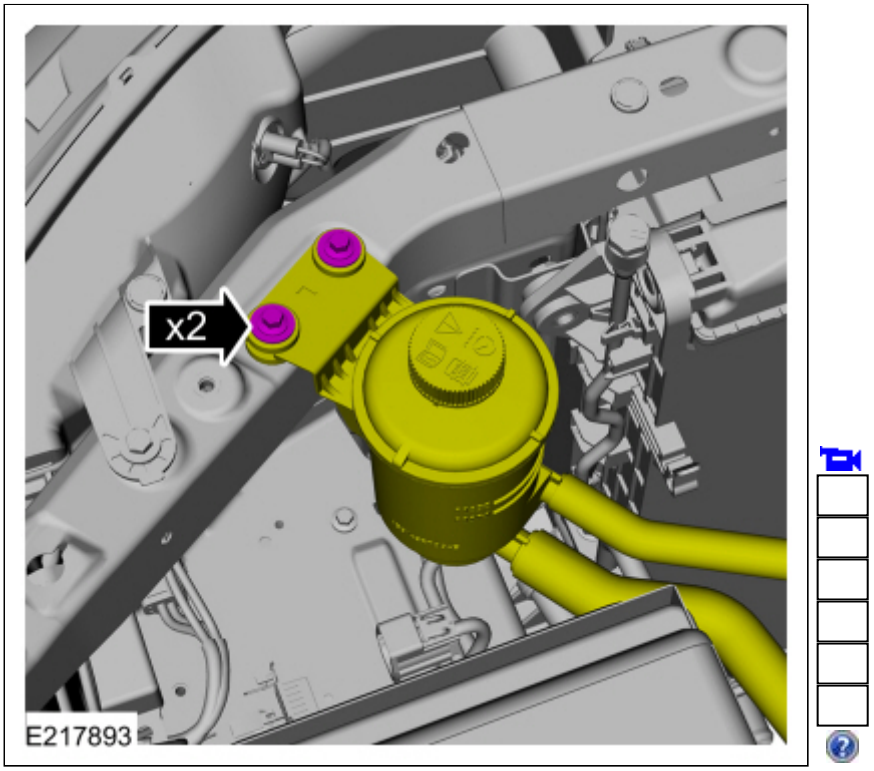
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
3. Refer to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
4. 

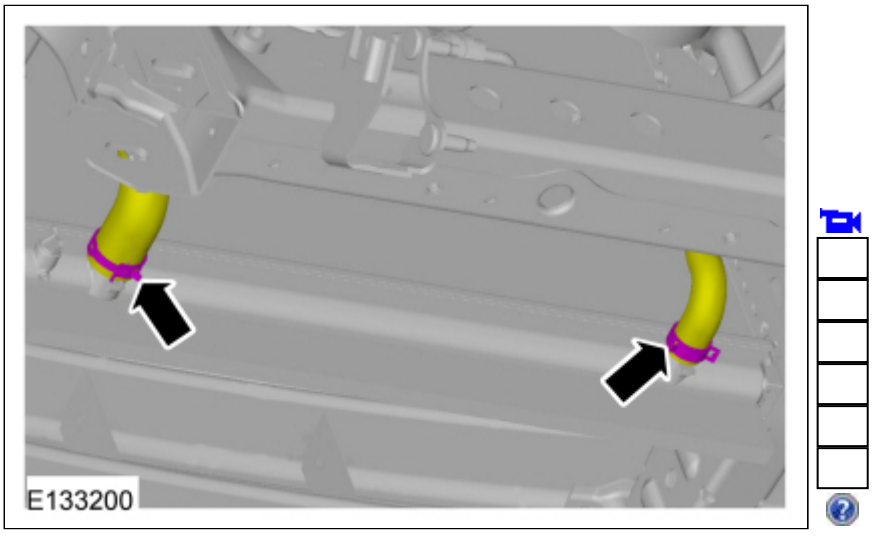
5.



6. if equipped
   Torque: 9 Nm

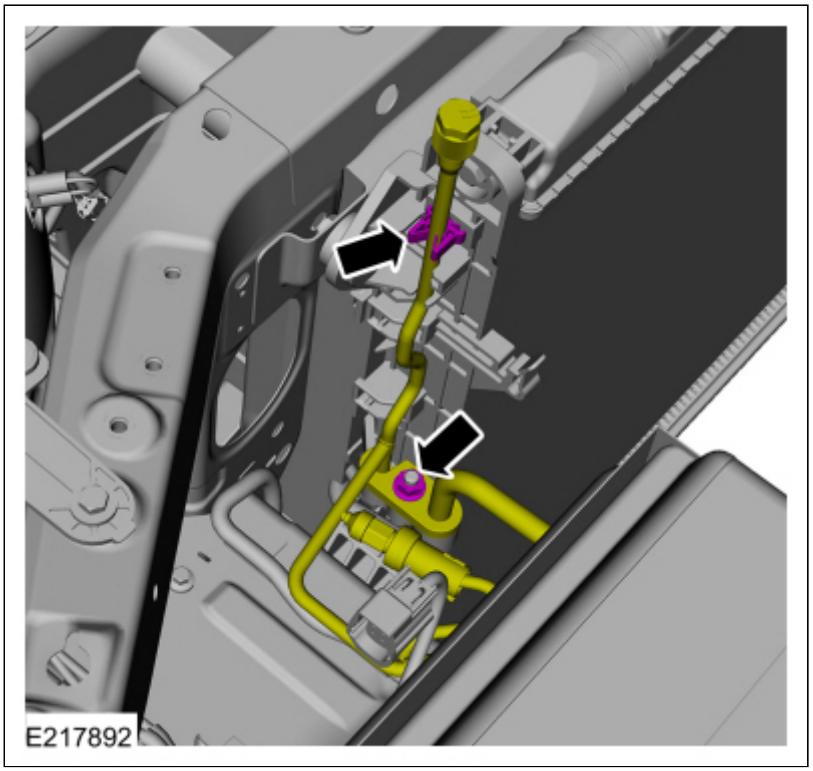


7.

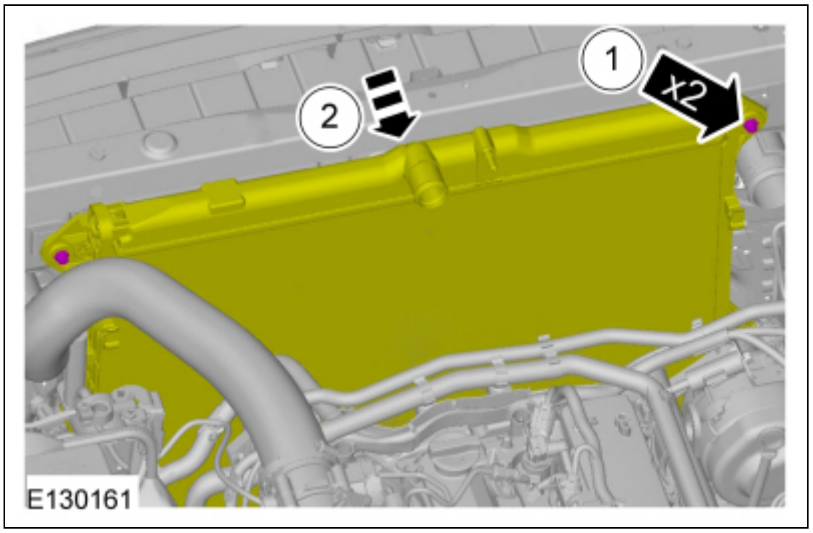


8. **NOTE:** *Take extra care not to damage the A/C refrigerant filling pipe.*

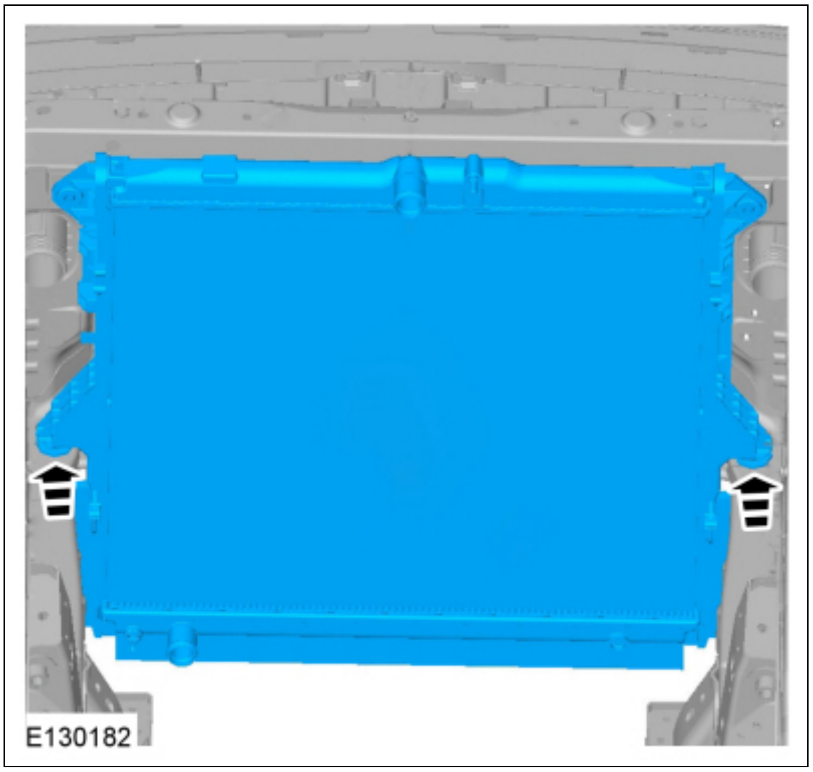
   Torque: 15 Nm



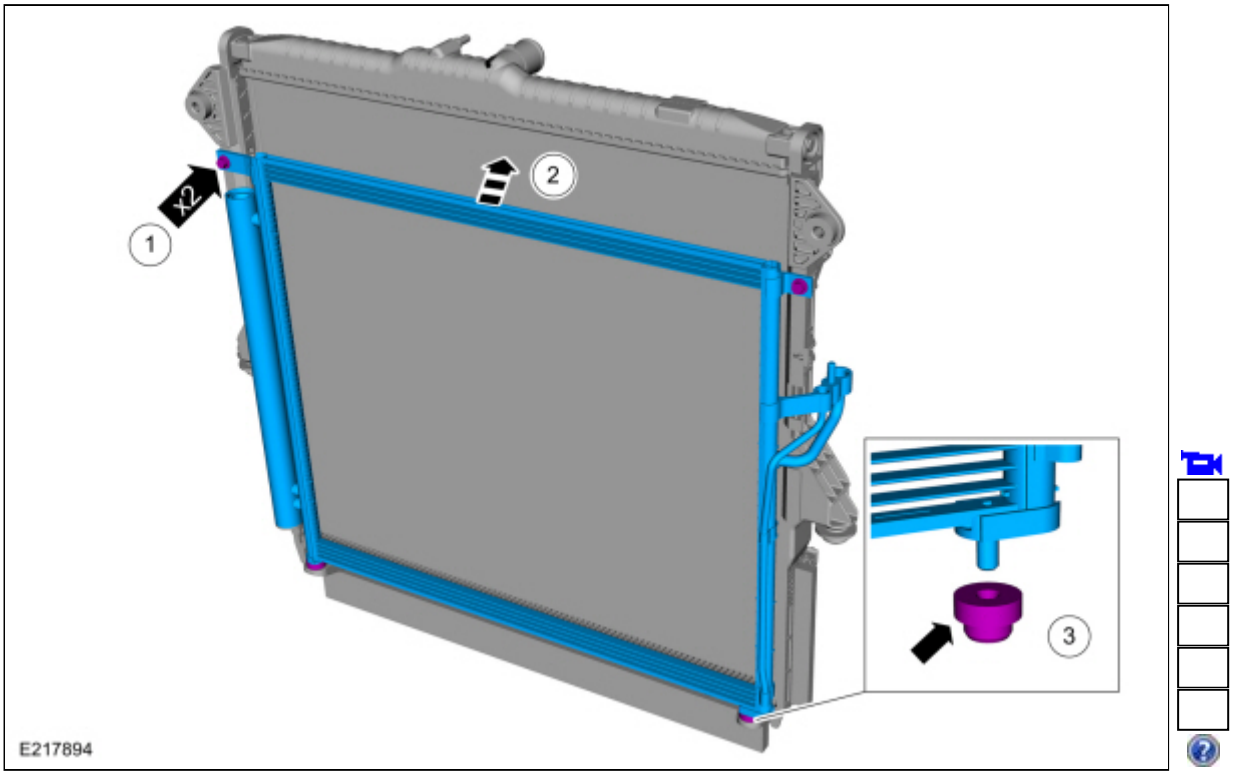
9. *Torque*: 20 Nm



10.



11. *Torque*: 00 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Condenser - 3.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 19E908

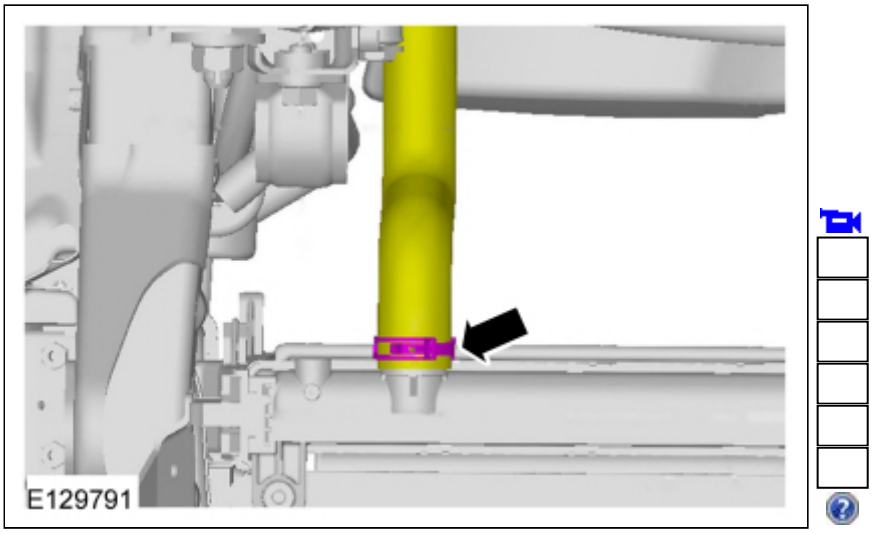
Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

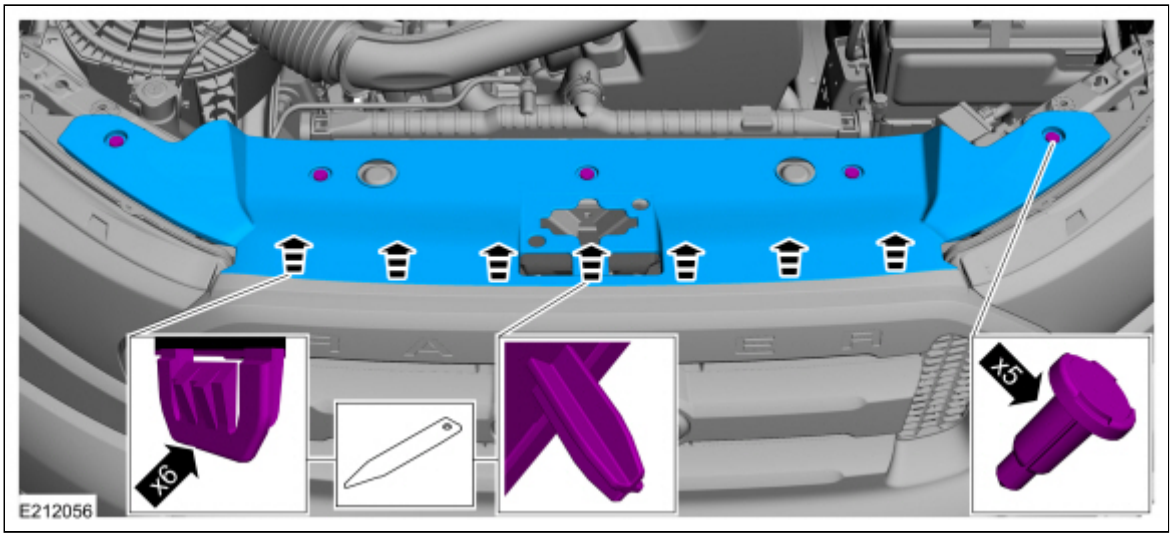
Removal

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

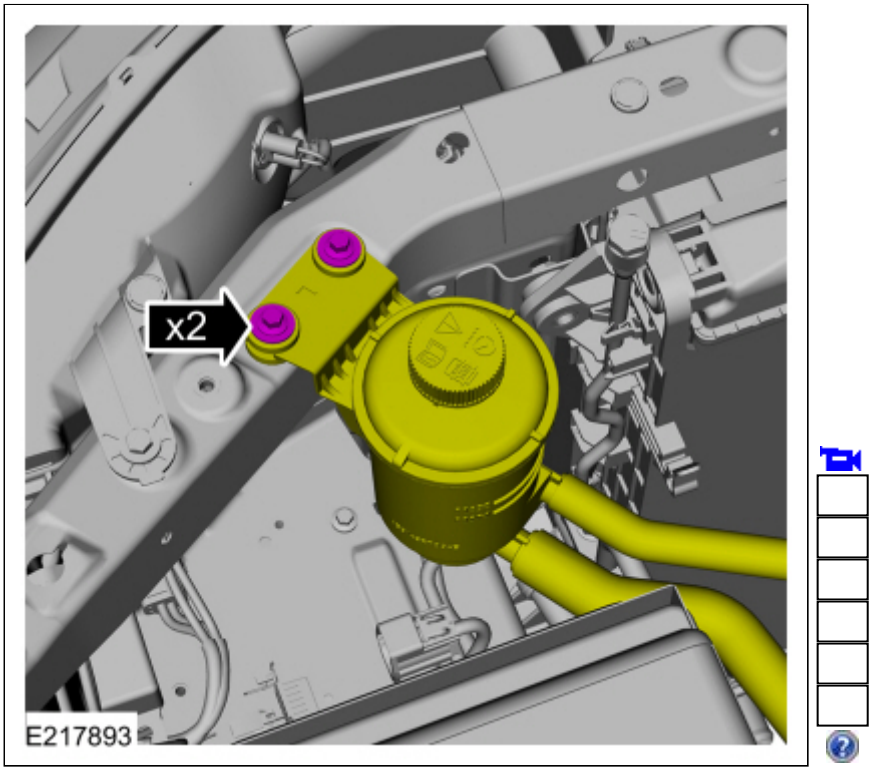
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
3. Refer to: Cooling Fan (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
4. 

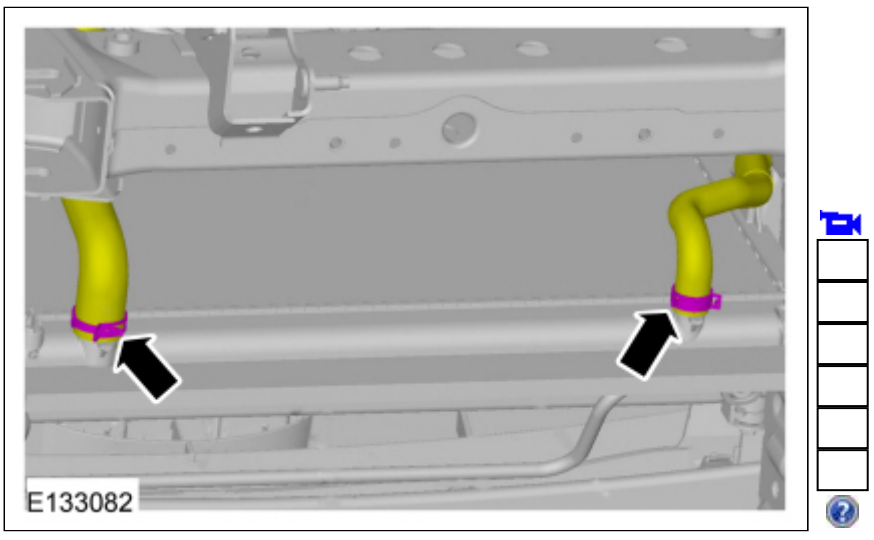
5.



6. If equipped
   Torque: 9 Nm

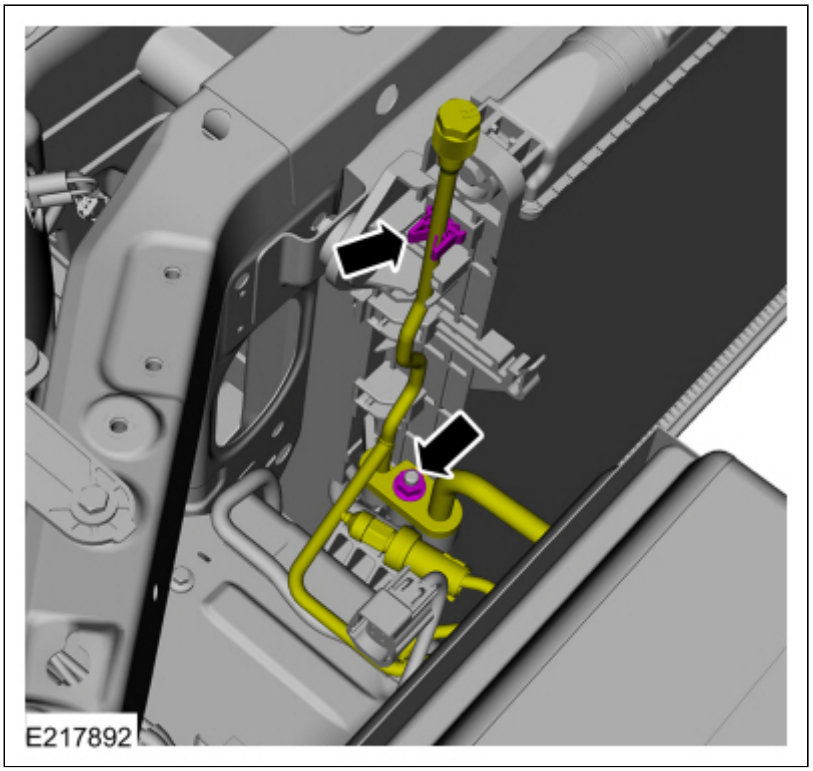


7.

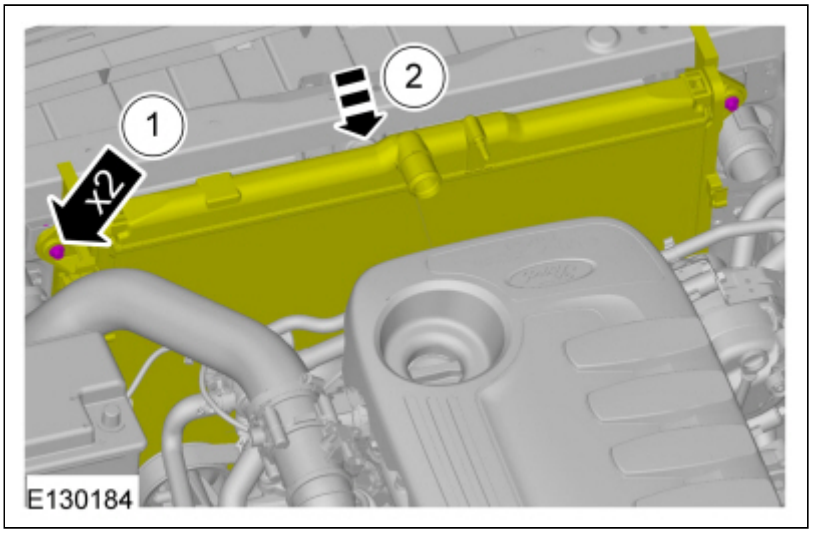


8. **NOTE:** *Take extra care not to damage the A/C refrigerant filling pipe.*

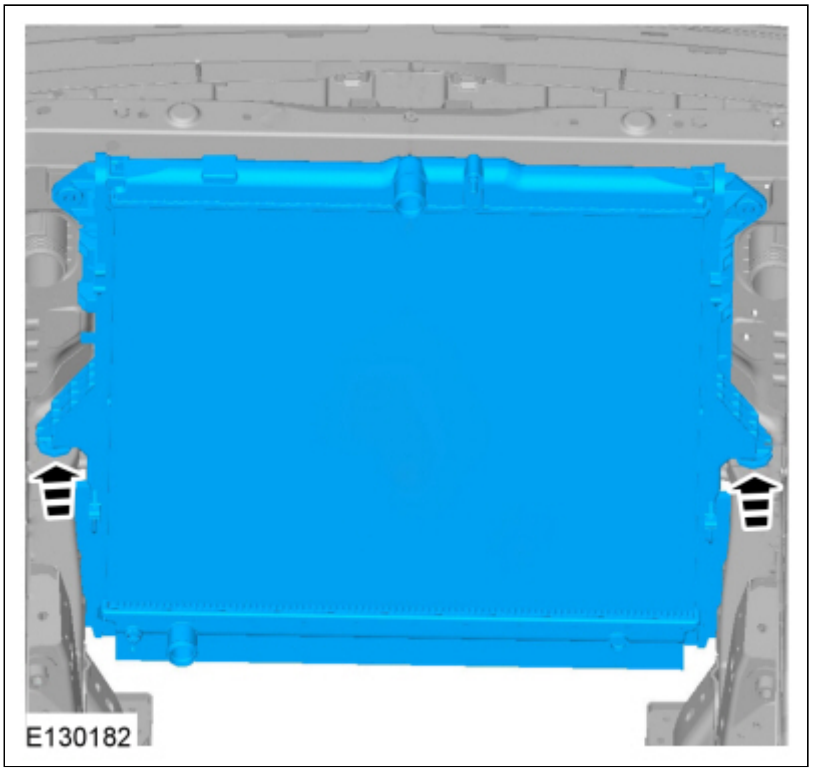
   Torque: 15 Nm



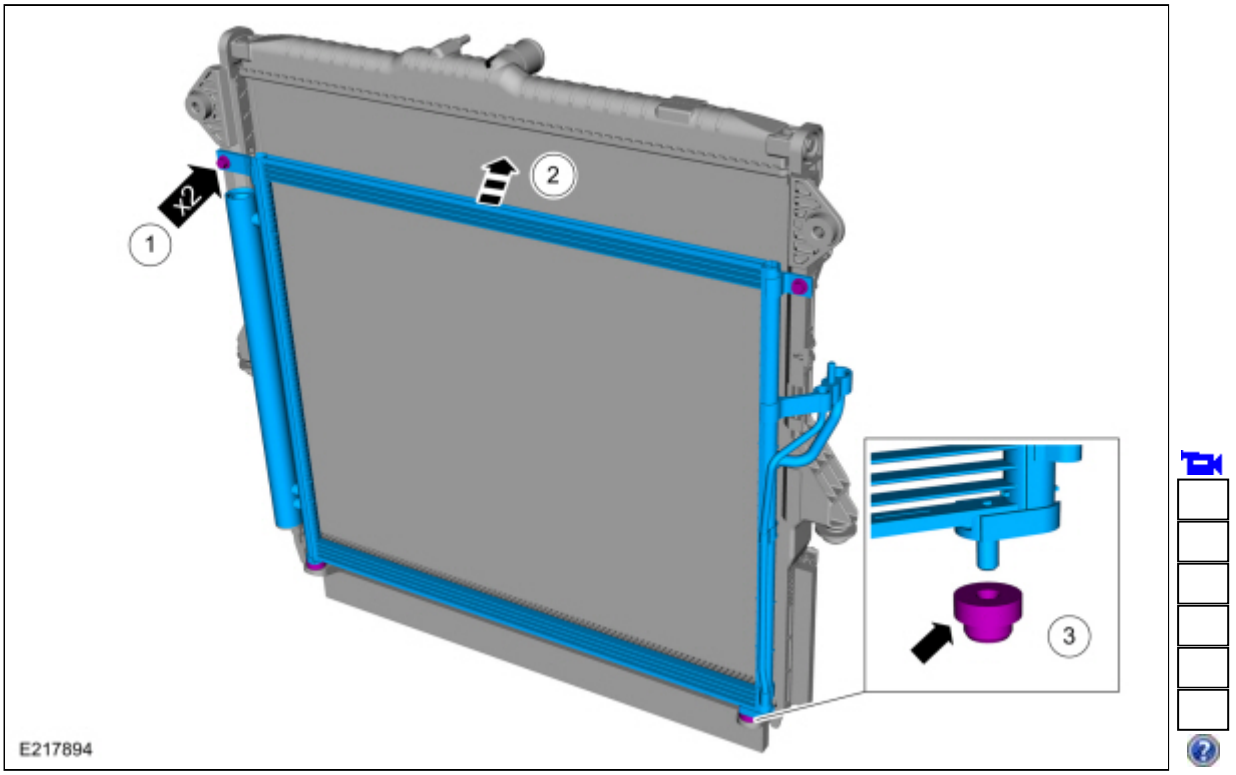
9. *Torque*: 20 Nm



10.



11. *Torque*: 00 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   NOTE: *Make sure that new O-ring seals are installed.*

   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Condenser Outlet Line

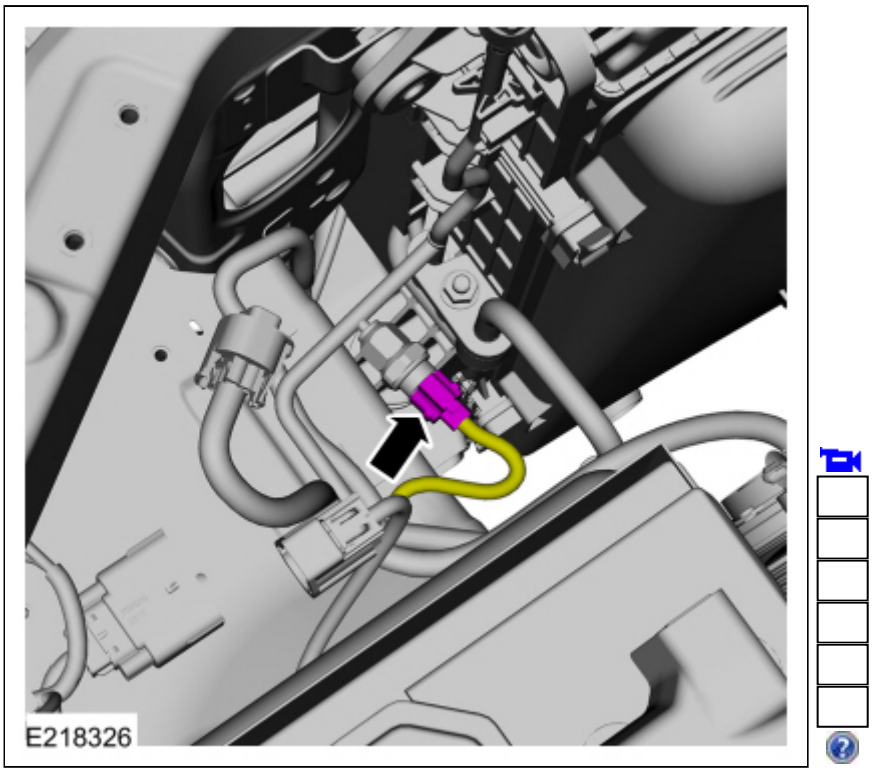
Base Part Number: 19C596

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

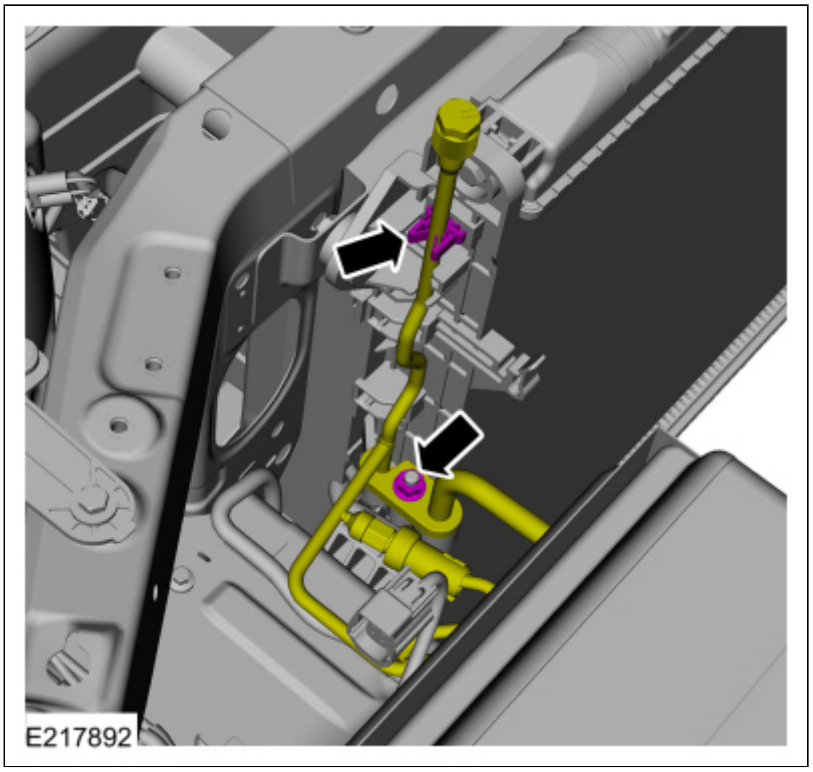
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

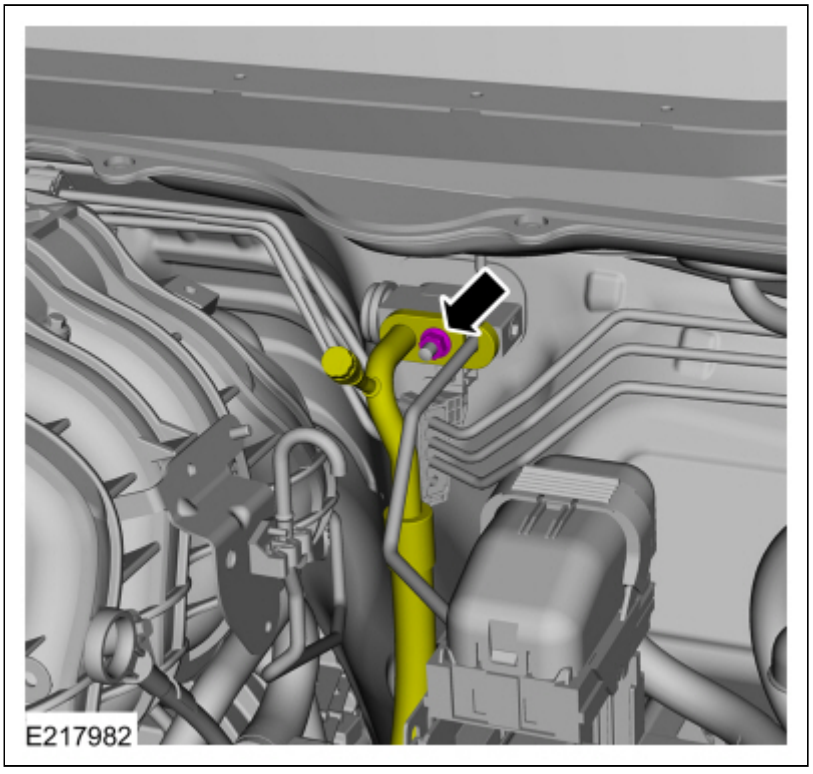
4. **NOTICE: Make sure that all openings are sealed.**

   Torque: 15 Nm

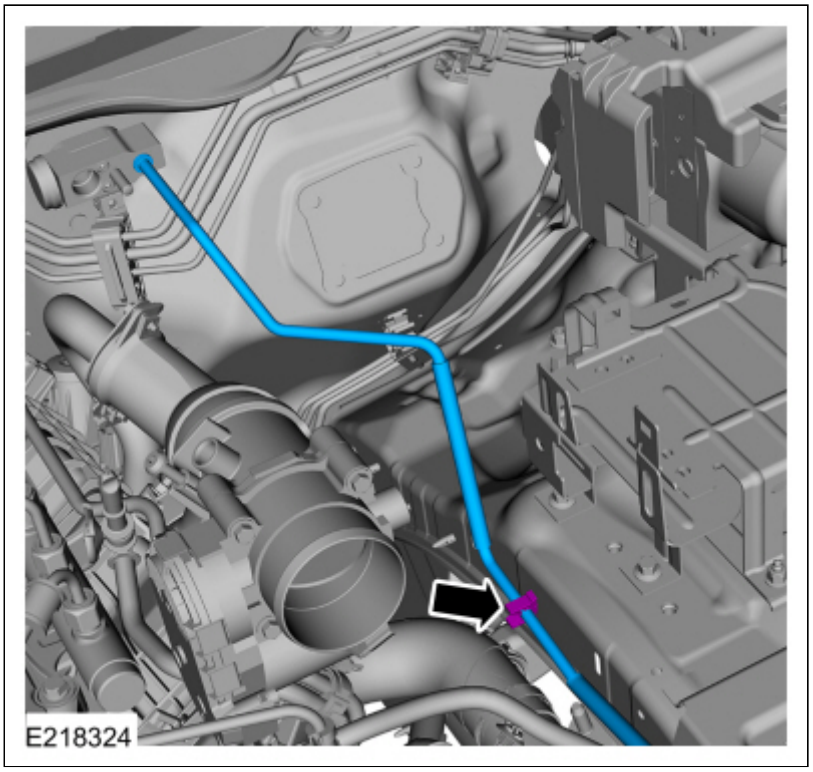


5. **NOTICE: Make sure that all openings are sealed.**

   Torque: 12 Nm



6.



Installation

1. To install, reverse the removal procedure.
2. **NOTICE: Only use the specified material to lubricate the seals.**

   Install new O-ring seals.
   Material: Refrigerant Oil (WSH-M1C231-B)
3. Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

Copyright © 2016 Ford Motor Company

Evaporator

Base Part Number: 10B810

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

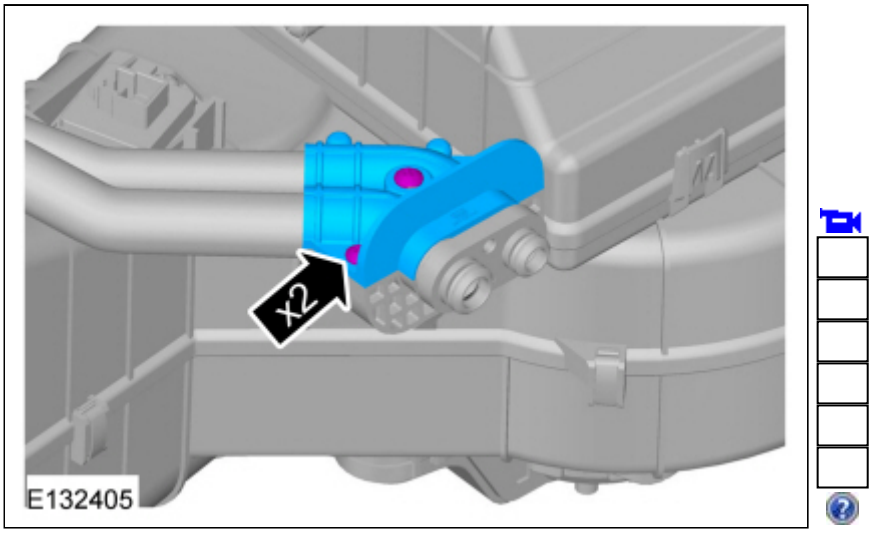
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

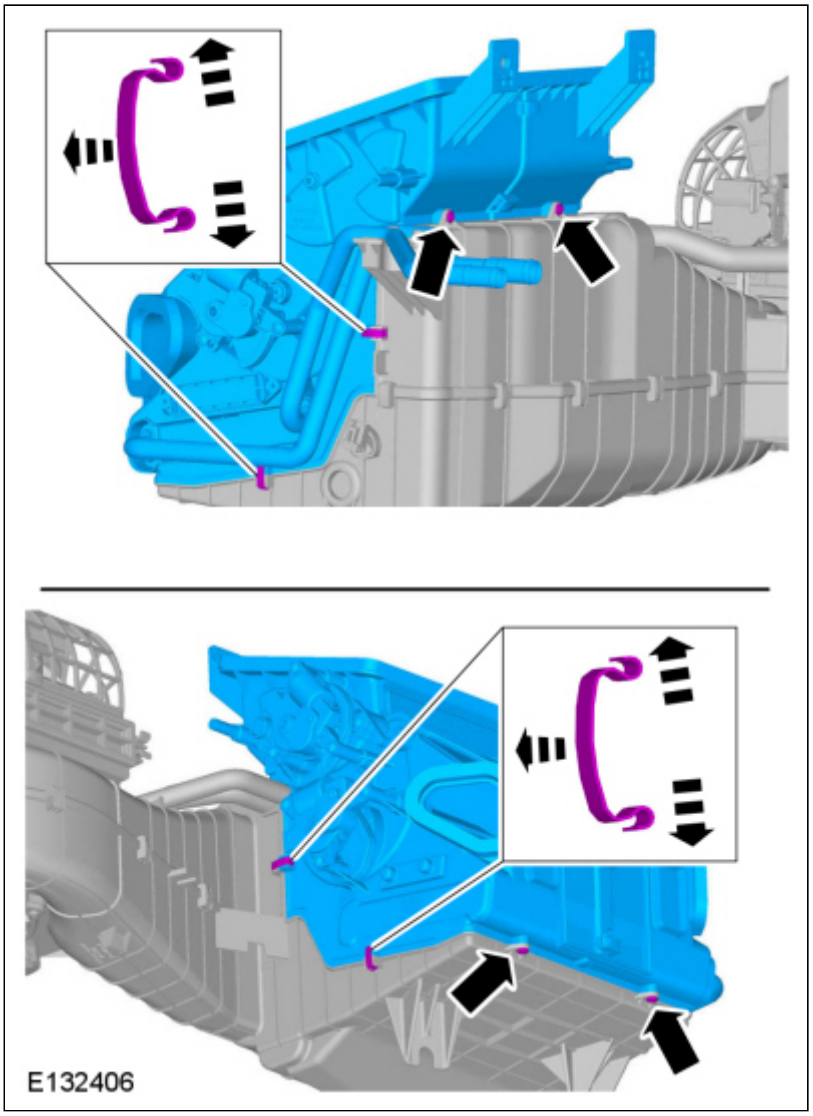
1. Refer to: Heater Core (412-00 Climate Control System - General Information, Removal and Installation).

All vehicles

2.

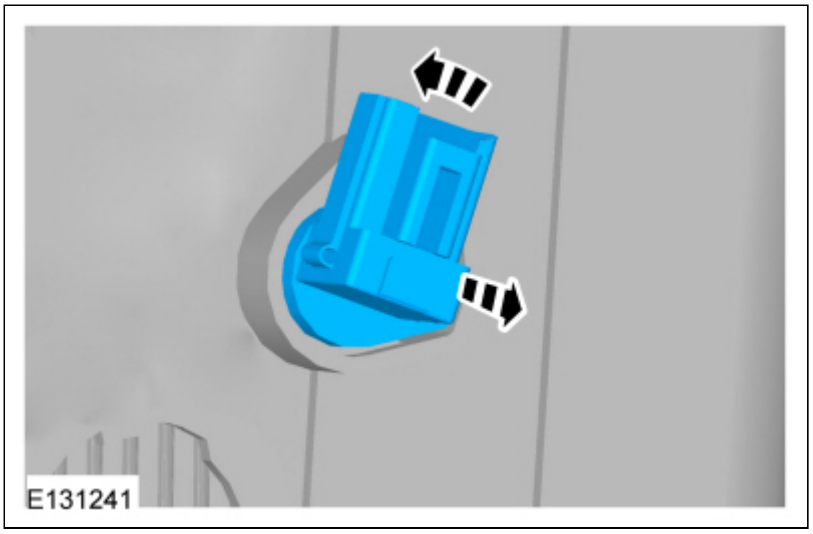


3.



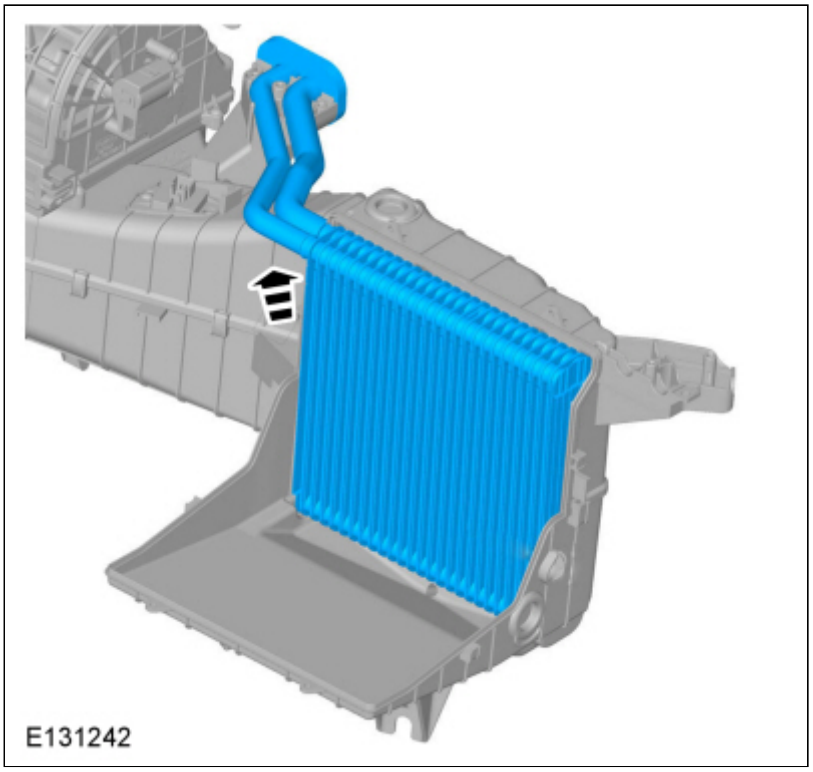
Vehicles with electronic automatic temperature control (EATC)

4.



All vehicles

5.



Installation

1. Coat the O-rings on the refrigerant lines.
   Material: Refrigerant Oil (WSH-M1C231-B)

2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Heater Core

Base Part Number: 18B539

Materials

Name	Specification
Refrigerant Oil	WSH-M1C231-B

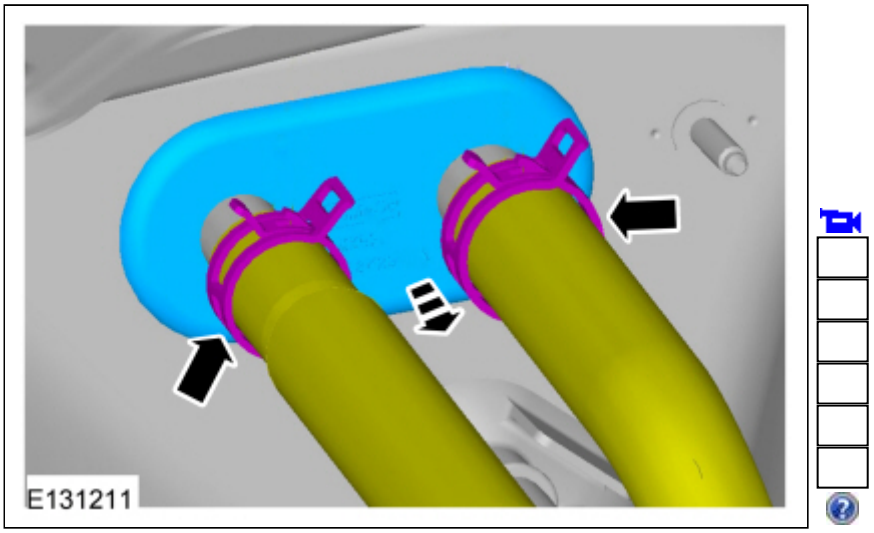
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

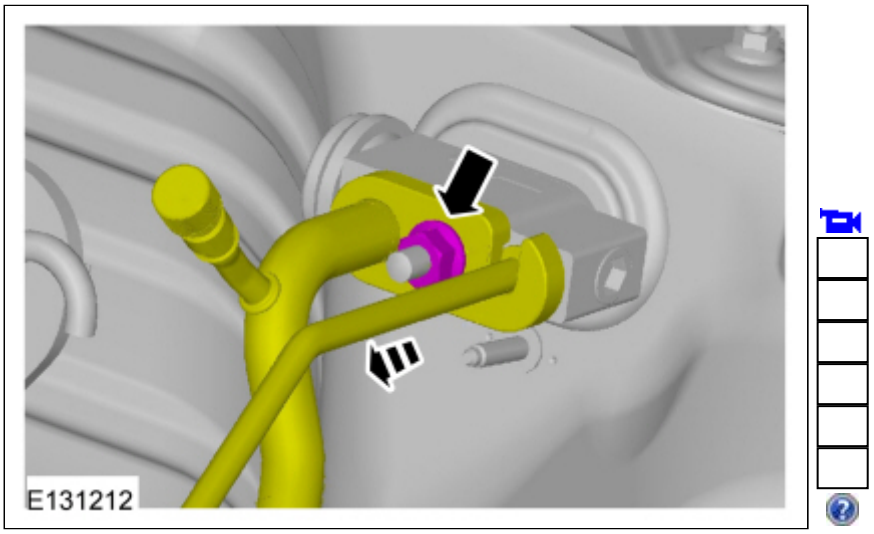
1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Instrument Panel - RHD (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles

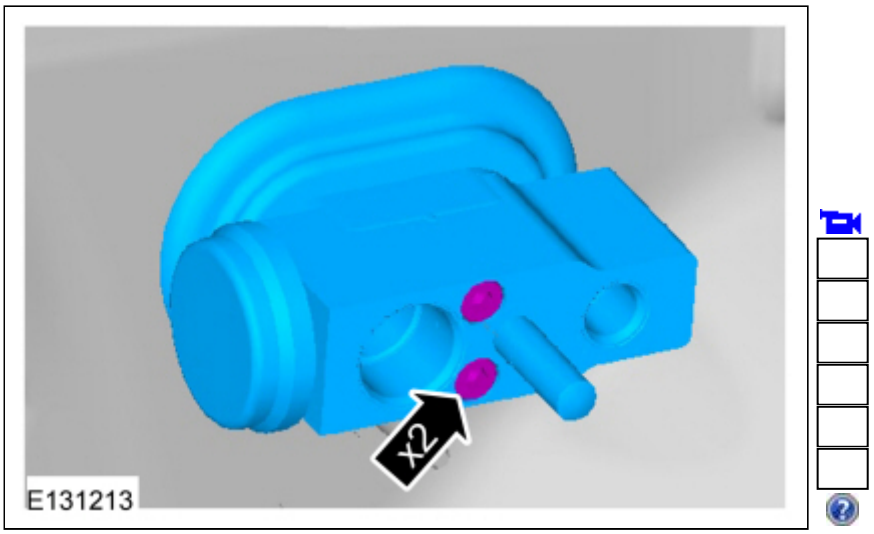
4.



5. *Torque*: 12 Nm

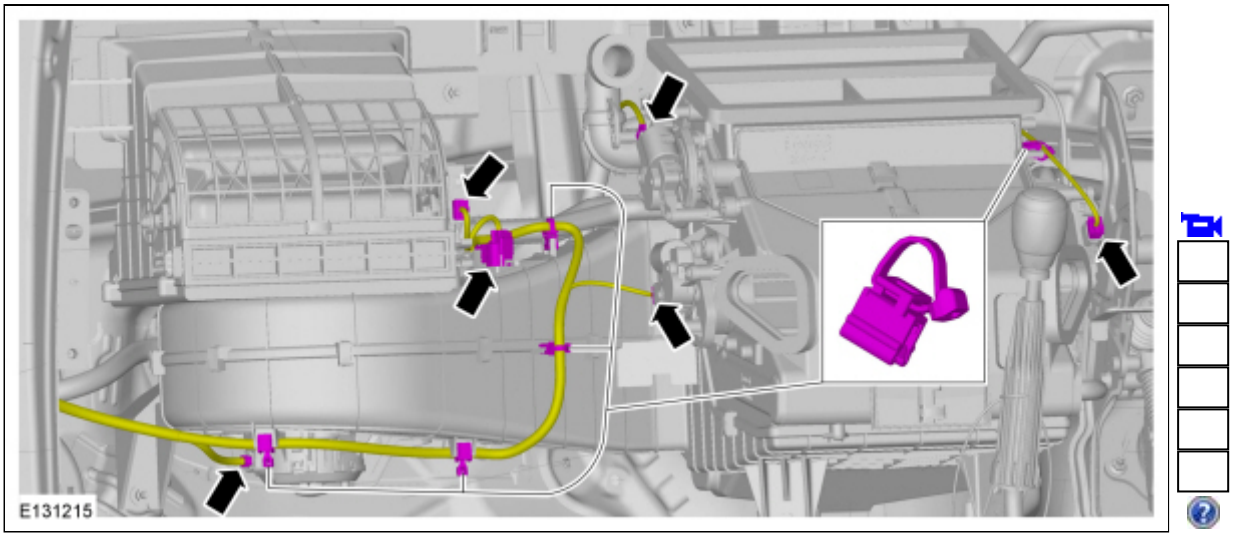


6.

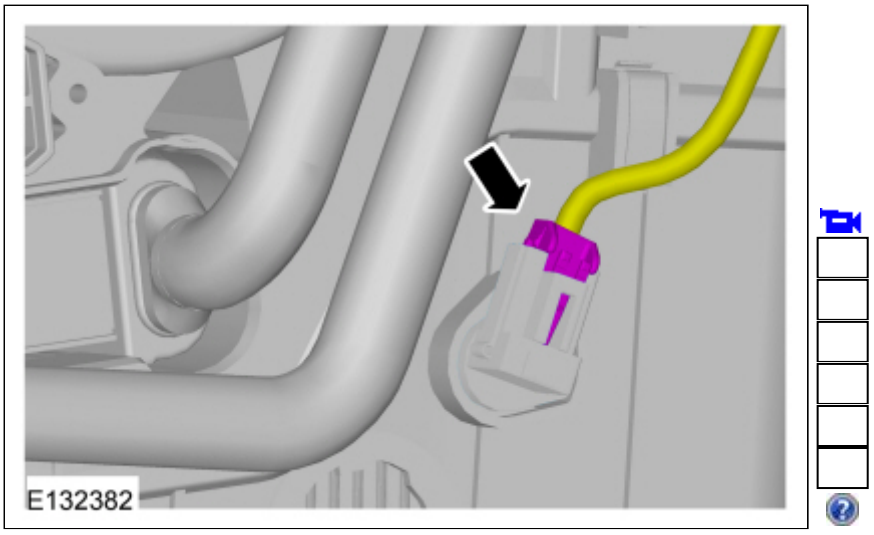


Vehicles with electronic automatic temperature control (EATC)

7.

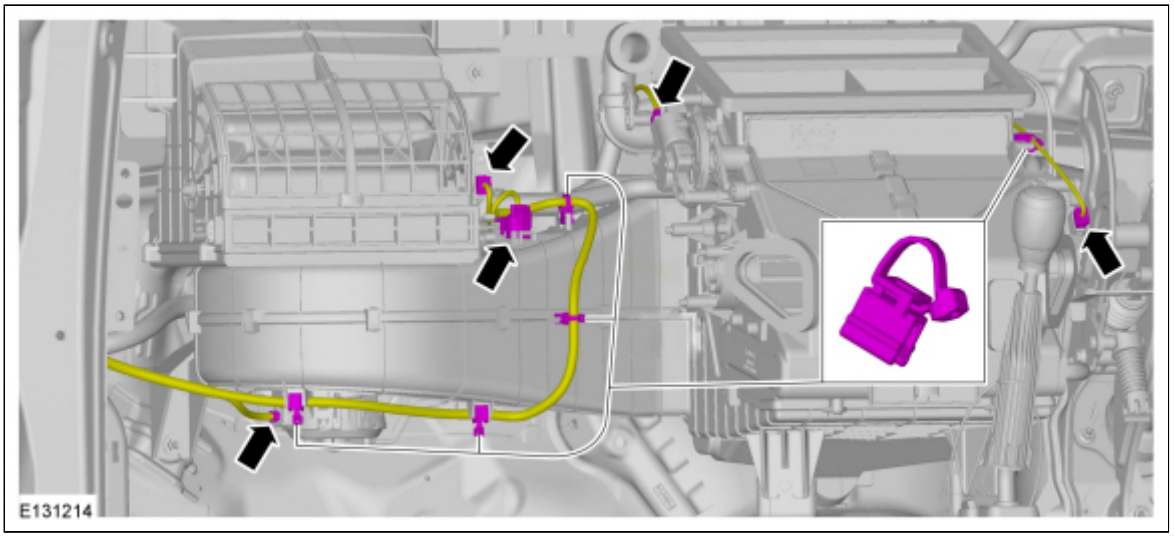


8.



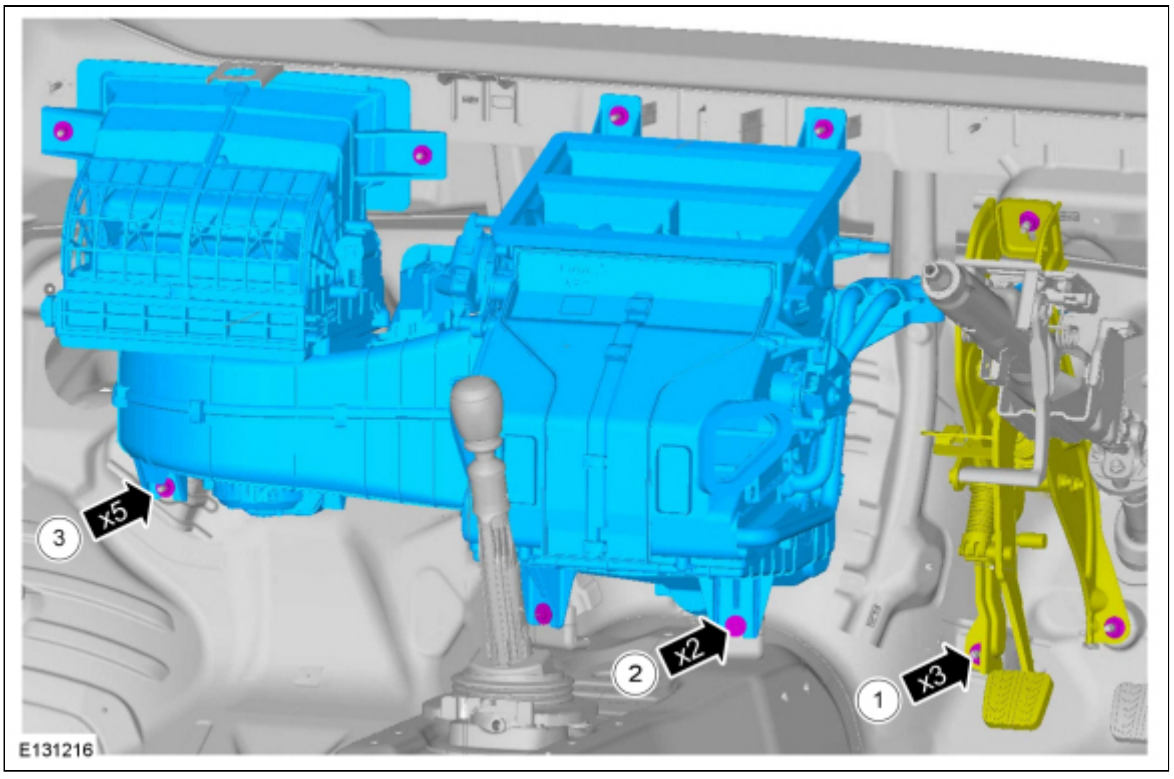
Vehicles with electronic manual temperature control (EMTC)

9.

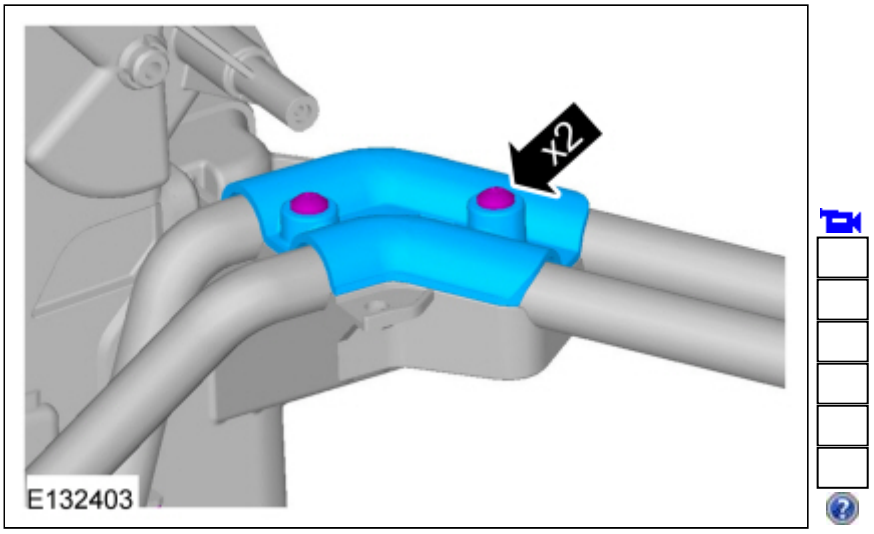


All vehicles

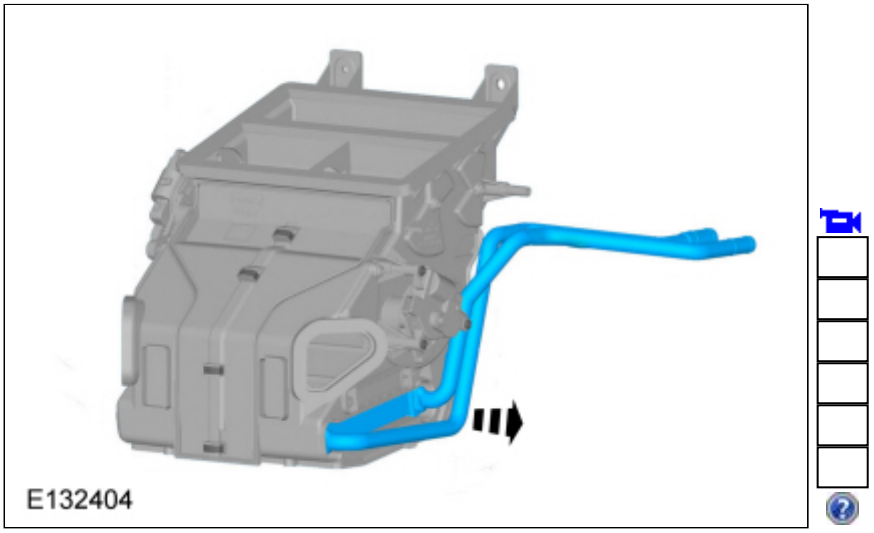
10. *Torque*:
    1: 15 Nm
    2: 7 Nm



11.



12.



Installation

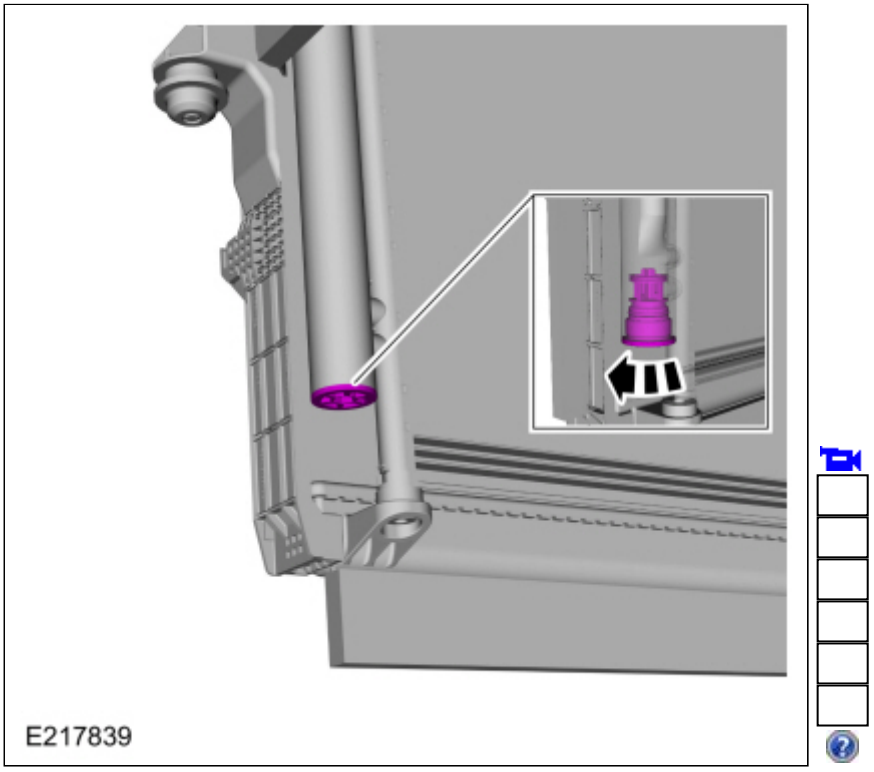
1. Coat the O-rings on the refrigerant lines.
   Material: Refrigerant Oil (WSH-M1C231-B)

2. To install, reverse the removal procedure.

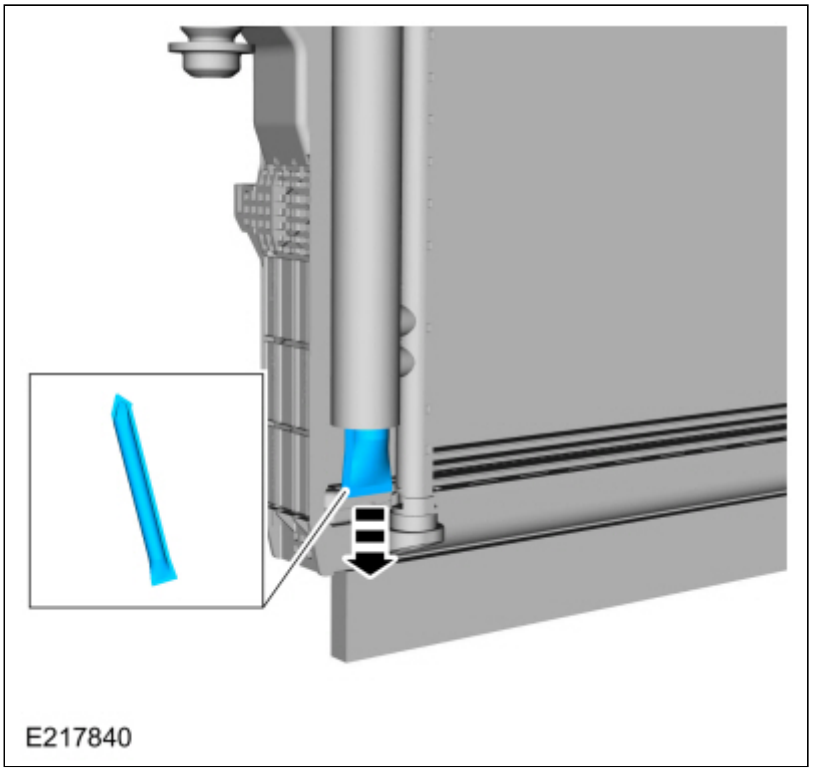
Copyright © 2016 Ford Motor Company

Receiver Drier Element

Removal

1. Refer to: Condenser - 2.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
   Refer to: Condenser - 3.2L Duratorq-TDCi (Puma) Diesel (412-00 Climate Control System - General Information, Removal and Installation).
   Refer to: Condenser Outlet Line (412-00 Climate Control System - General Information, Removal and Installation).
2. 

3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

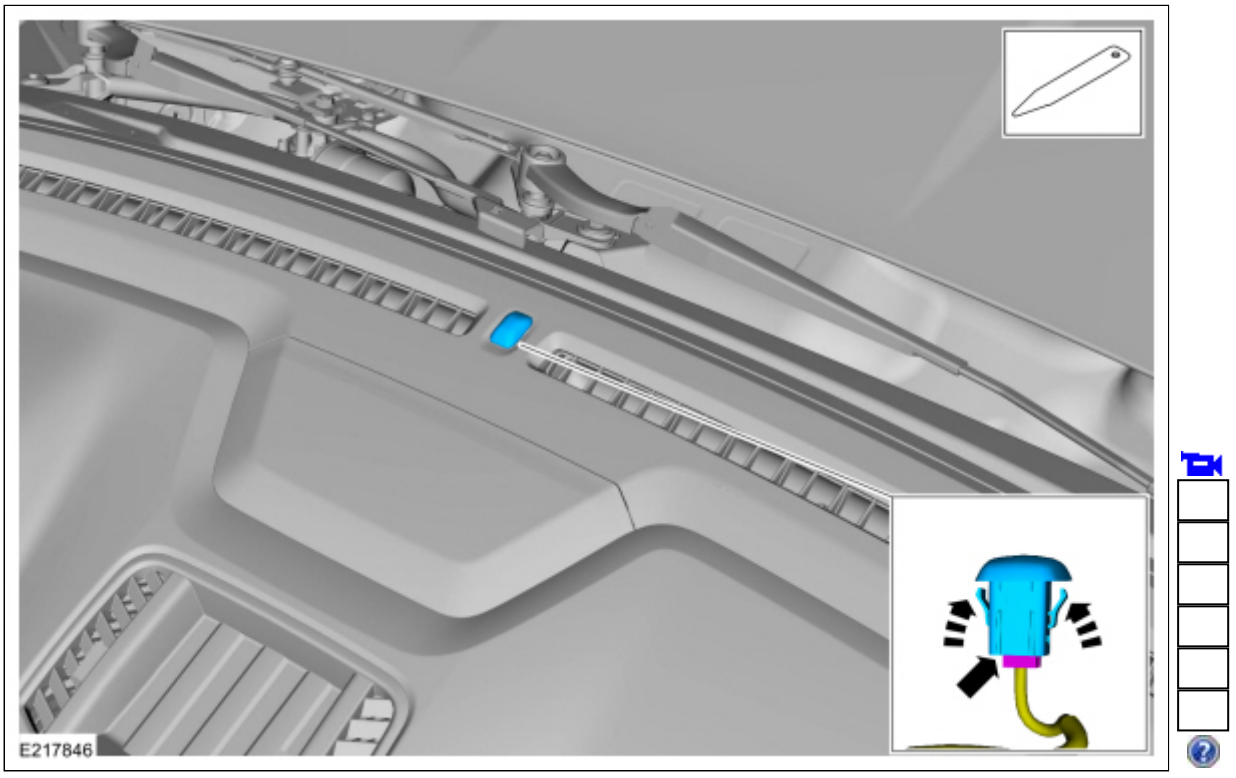
Sunload Sensor

Special Tool(s) / General Equipment

Interior Trim Remover

Removal

1. Use the General Equipment: Interior Trim Remover



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Thermostatic Expansion Valve - 2.5L Duratec-HE (122kW/165PS) - MI4

Materials

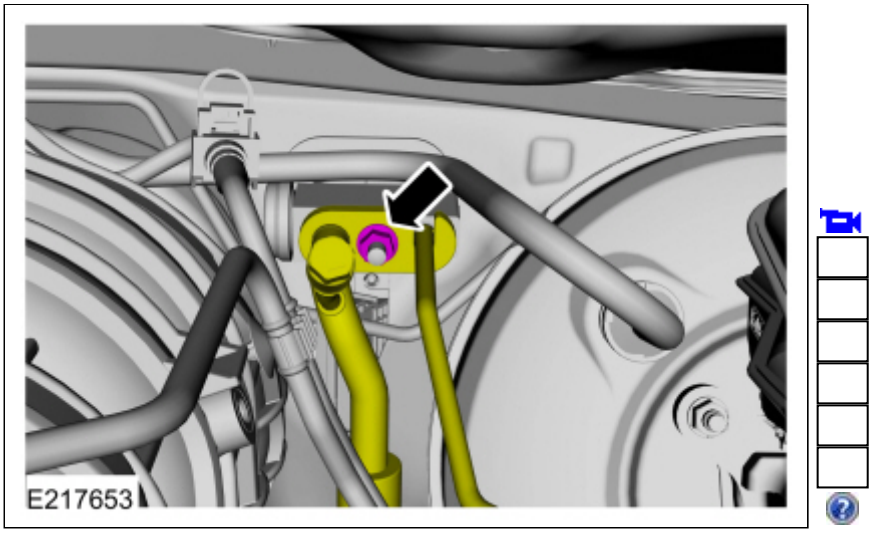
Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

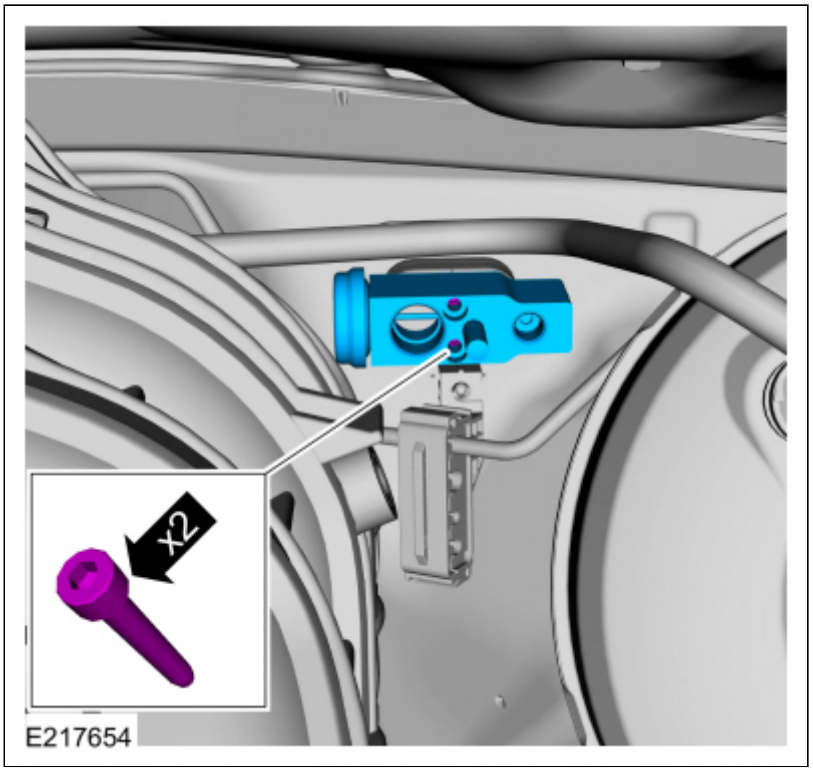
2. **WARNING: Make sure that all openings are sealed.**

   Torque: 12 Nm



3. **WARNING: Make sure that all openings are sealed.**

   Torque: 5 Nm



Installation

1. To install, reverse the removal procedure.
2. Coat the O-ring seals.
   Material: Refrigerant Oil (WSH-M1C231-B)

Copyright © 2016 Ford Motor Company

Thermostatic Expansion Valve - 2.2L Duratorq-TDCi (Puma) Diesel

Materials

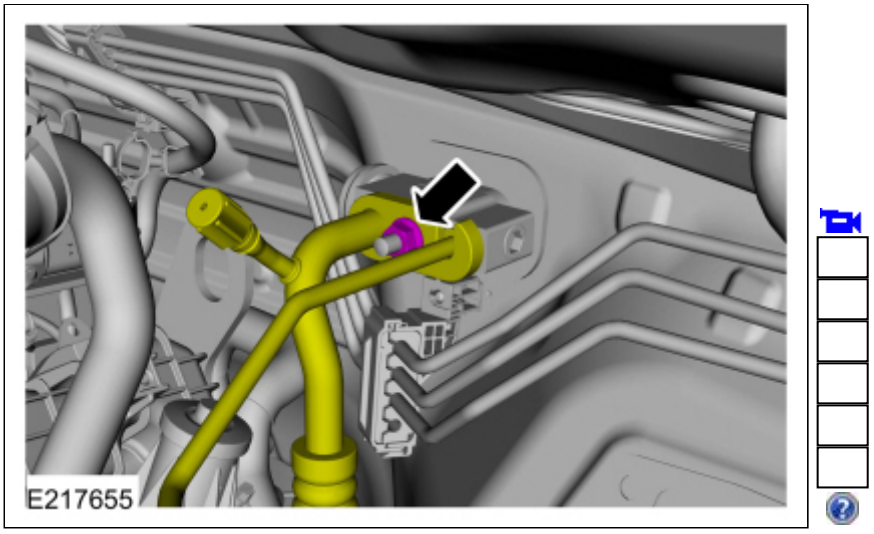
Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

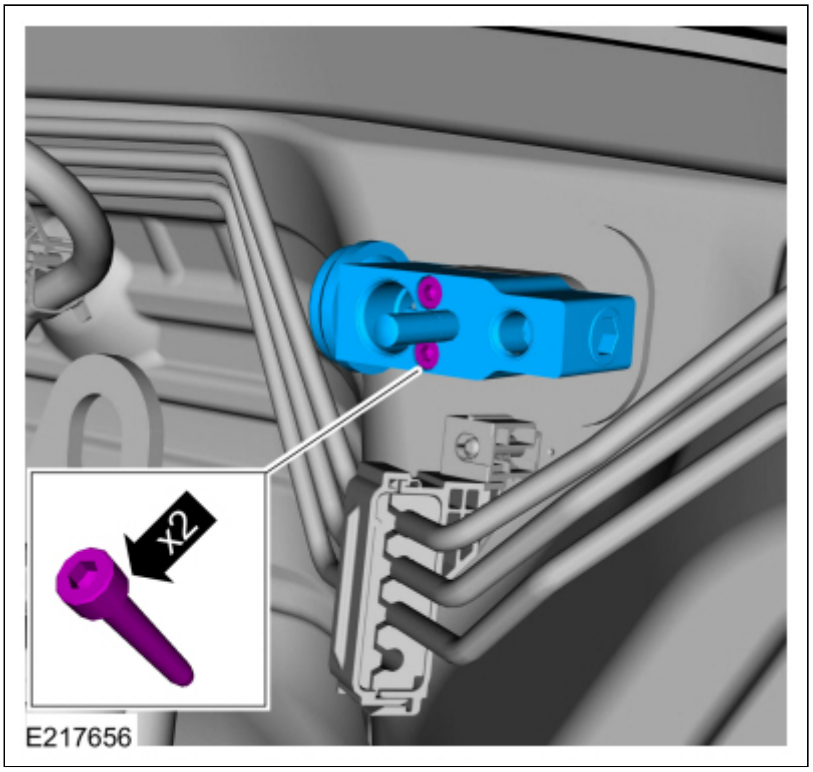
2. **WARNING: Make sure that all openings are sealed.**

   Torque: 12 Nm



3. **WARNING: Make sure that all openings are sealed.**

   Torque: 5 Nm



Installation

1. To install, reverse the removal procedure.
2. Coat the O-ring seals.
   Material: Refrigerant Oil (WSH-M1C231-B)

Copyright © 2016 Ford Motor Company

Thermostatic Expansion Valve - 3.2L Duratorq-TDCi (Puma) Diesel

Materials

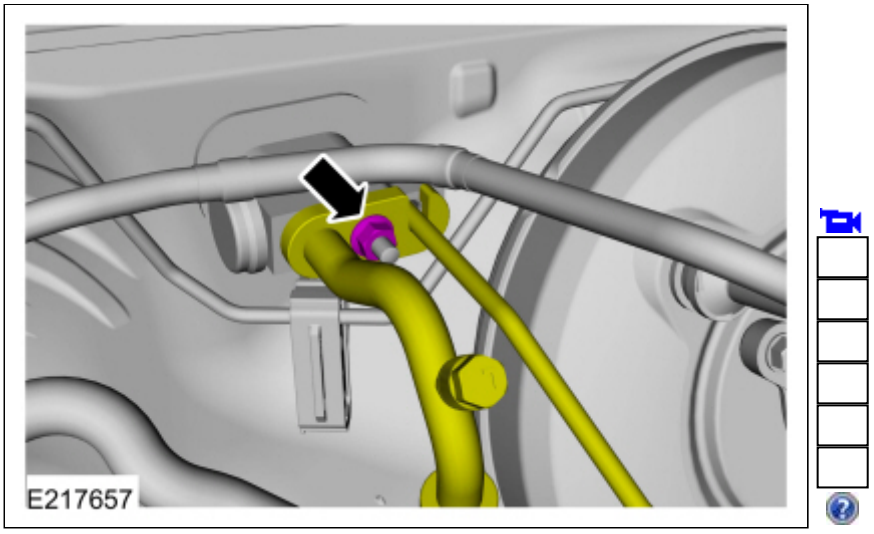
Name	Specification
Refrigerant Oil	WSH-M1C231-B

Removal

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

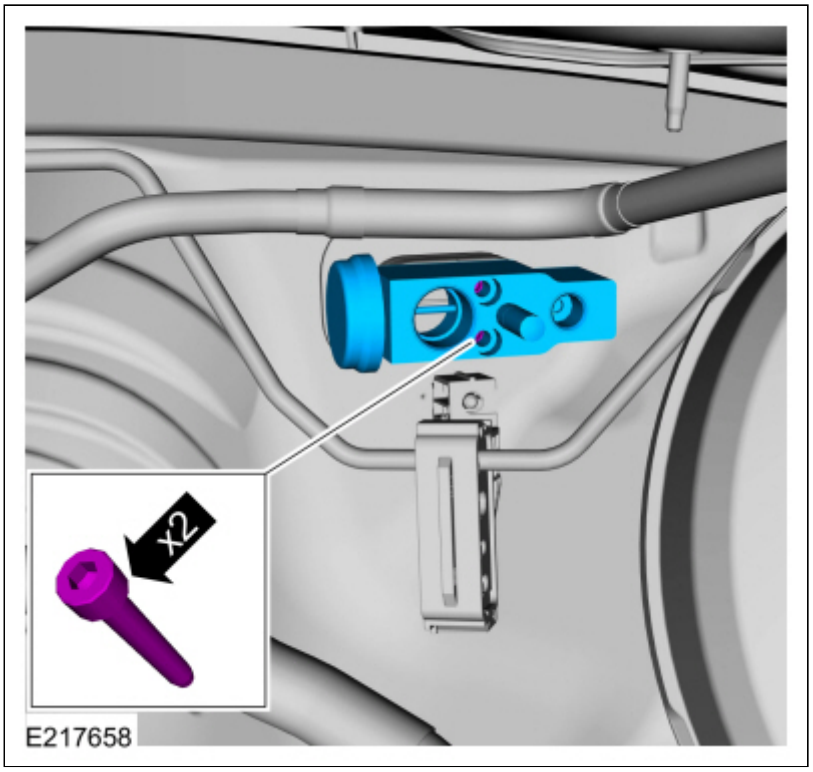
2. **WARNING: Make sure that all openings are sealed.**

   Torque: 12 Nm



3. **WARNING: Make sure that all openings are sealed.**

   Torque: 5 Nm



Installation

1. To install, reverse the removal procedure.
2. Coat the O-ring seals.
   Material: Refrigerant Oil (WSH-M1C231-B)

Copyright © 2016 Ford Motor Company

Supplemental Climate Control - Overview

Overview

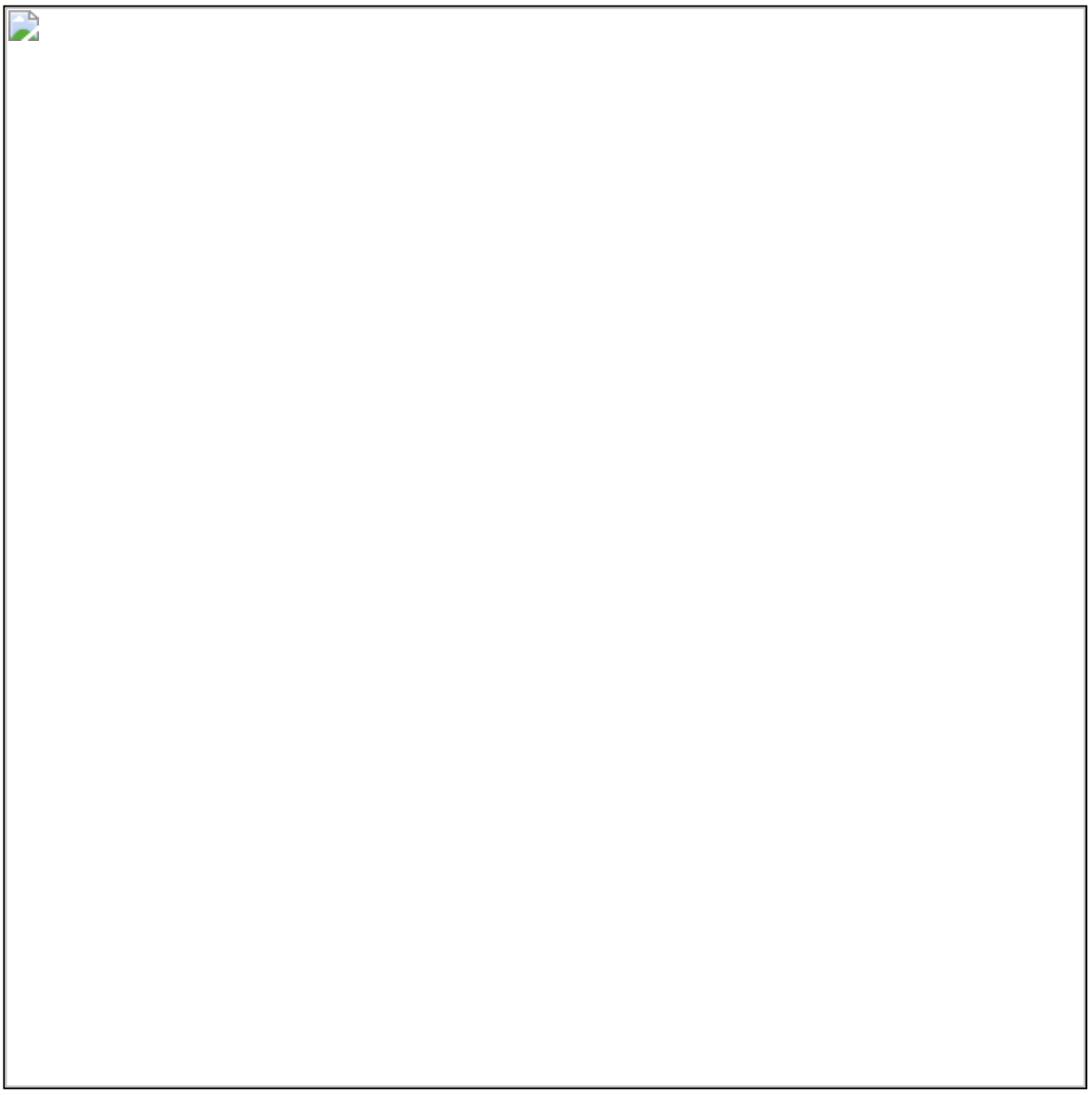
The climate control system uses the electric booster heater to heat the passenger compartment in place of the heater core in low ambient temperatures. Once engine coolant reaches a sufficient temperature to heat the passenger compartment, the climate control system stops using the electric booster heater.

Copyright © 2016 Ford Motor Company

Supplemental Climate Control - System Operation and Component Description

System Operation

System Diagram



Network Message Charts

Module Network Input LIN Messages - PTC

Broadcast Message	Originating Module	Message Purpose
PTC heater request	FCIM	This message contains the request to activate the electric booster heater.

Electric Booster Heater Operation

The FCIM controls the PTC heater through the LIN interface. The FCIM has a set of PTC enabling parameters within its PTC algorithm. When the conditions are set, the FCIM sends messages on the LIN with the PWM value that switches the 3 relays within the PTC module to set the right amount of heat required.

The electric booster heater is deactivated when an engine coolant temperature of 70°C (158°F) or an ambient air temperature of 20°C (68°F) is exceeded.

Component Description

Electric Booster Heater

The electric booster heater is composed of 3 separate PTC elements and a micro-controller. The micro-controller allows the 3 PTC elements to be activated or deactivated individually or together depending on the PWM input from the FCIM.

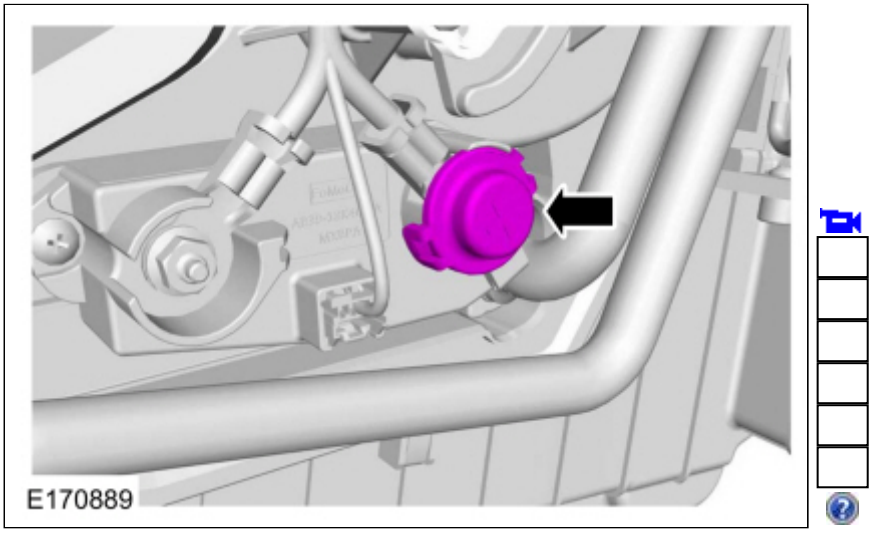
Copyright © 2016 Ford Motor Company

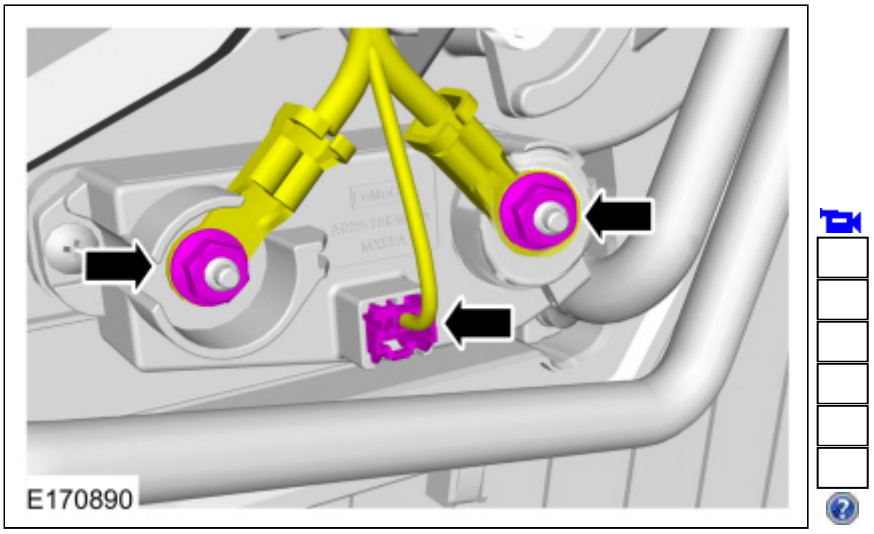
Electric Booster Heater

Base Part Number: 18478

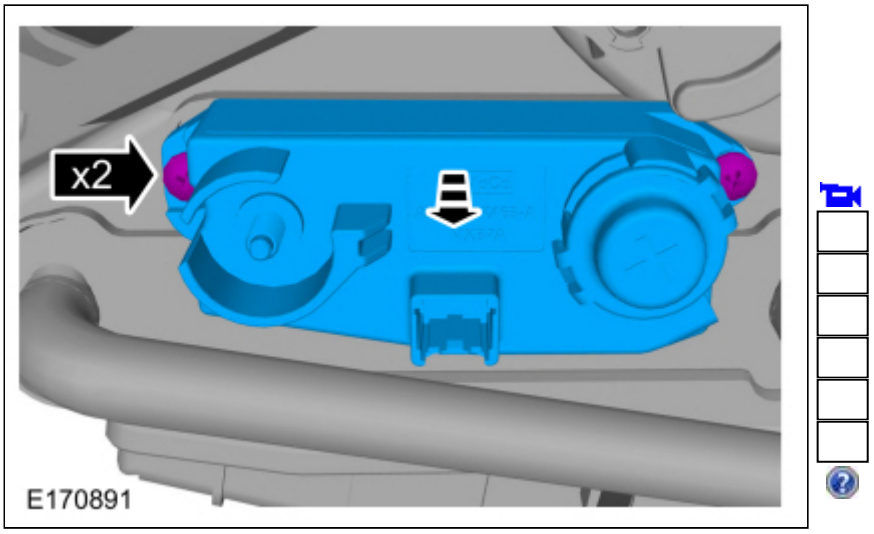
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Instrument Panel - LHD (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Instrument Panel - RHD (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3. *Torque*: 6 Nm


4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Instrument Panel and Interior Switches Illumination - Overview

Overview

Dimmable illumination provides backlighting to switches and control components when the headlamps or parking lamps are on. The level of intensity is adjusted by pressing the illumination dim up switch up to increase intensity or the dim down switch to decrease intensity. The illumination components can be controlled directly (non-networked) or indirectly (networked) by a module.

Copyright © 2016 Ford Motor Company

Instrument Panel and Interior Switches Illumination

DTC Chart: Body Control Module (BCM)

Diagnostics in this manual assume a certian skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action
B1315:11	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Ground	GO to Pinpoint Test B
B1315:15	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Battery or Open	If all non-networked illumination sources are inoperative, GO to Pinpoint Test B If all non-networked illumination sources are always on, GO to Pinpoint Test D
B1436:01	Digital Dimmer Switch Input: General Electrical Failure	GO to Pinpoint Test A
U1000:00	Solid State Driver Protection Active- Driver Disabled: No Sub Type Information	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
U3000:49	Control Module: Internal Electronic Failure	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
All other BCM Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

DTC Chart: Driver Door Module (DDM)

Diagnostics in this manual assume a certian skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action
U2010:00	Switch Illumination: No Sub Type Information	GO to Pinpoint Test E
All other DDM Diagnostic Trouble Codes (DTCs)	-	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

DTC Chart: Passenger Door Module (PDM)

Diagnostics in this manual assume a certian skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action

U2010:00	Switch Illumination: No Sub Type Information	GO to Pinpoint Test F
All other PDM Diagnostic Trouble Codes (DTCs)	-	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

Symptom Chart

Symptom Chart: Instrument Panel and Interior Switches Illumination

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Action
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
All illumination (networked and non-networked) does not dim or increase brightness	Refer to the Pinpoint Test	GO to Pinpoint Test A
All networked illumination is inoperative (non-networked illumination fuctions correctly)	• Network communication concern • BCM	• PERFORM the network test. – If all modules pass the network test, INSTALL a new BCM. – REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). – REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). – If all modules do not pass the network test, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
All non-networked illumination sources are inoperative (networked illumination functions correctly)	Refer to the Pinpoint Test	GO to Pinpoint Test B
All non-networked illumination sources are always on (networked illumination functions correctly)	Refer to the Pinpoint Test	GO to Pinpoint Test D
One or more non-networked illumination source is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test C
A single non-network illuminated switch or component is always on	Illuminated switch or component	INSTALL a new illuminated switch or component.
Steering wheel switch(es) illumination is	Refer to the Pinpoint Test	GO to Pinpoint Test G

inoperative or always on		
The driver front window control switch illumination is inoperative or always on	• Window control switch • Wiring, terminals or connectors • Fuse • Module	• Verify the operation of the power window. – If the power window operates correctly, INSTALL a new window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation). – If the power window does not operate correctly, REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
The passenger front window control switch illumination is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test F
The passenger front door lock switch illumination is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test F
The LH rear window control switch illumination is inoperative or always on	• Window control switch • Wiring, terminals or connectors	• Verify the operation of the power window. – If the power window operates correctly, INSTALL a new window control switch. REFER to: Rear Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation). – If the power window does not operate correctly, REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
The RH rear window control switch illumination is inoperative or always on	• Window control switch • Wiring, terminals or connectors	• Verify the operation of the power window. – If the power window operates correctly, INSTALL a new window control switch. REFER to: Rear Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation). – If the power window does not operate correctly, REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
The IPC illumination is inoperative or does not dim	• Network communication concern • IPC	• PERFORM the network test. – If the IPC passes the network test, INSTALL a new IPC. – REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). – REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). – If the diagnostic scan tool responds with no communication with the IPC, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The FCIM illumination is inoperative or does not dim	• Network communication concern • FCIM	• PERFORM the network test. – If the FCIM passes the network test, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure. – If the diagnostic scan tool responds with no communication with the FCIM, REFER to: Communications Network (418-00

		Module Communications Network, Diagnosis and Testing).
The FDIM illumination is inoperative or does not dim	• APIM • FDIM	• VERIFY that the audio system can be operated from the FDIM. – If the audio system responds normally to FDIM inputs,  Click here to access Guided Routine (APIM). If the FDIM illumination still does not function correctly after the repair, INSTALL a new FDIM. Refer to the appropriate section in Group 415 for the procedure. – If the audio system does not respond normally to FDIM inputs, Refer to the appropriate section in Group 415 for the procedure.

Pinpoint Test

All Illumination (Networked and Non-Networked Sources) Does Not Dim Or Increase Brightness

Refer to Wiring Diagrams Cell 71 for schematic and connector information.

Normal Operation and Fault Conditions

The illumination dimmer switch is integral to the headlamp switch and provides a ground to the BCM corresponding to the switch that is pressed, dim up or dim down.

DTC	Description	Fault Trigger Conditions
B1436:01	Digital Dimmer Switch Input: General Electrical Failure	This DTC sets on-demand and in continuous memory when the BCM detects an open, short to power or ground on the dim up or dim down circuit.

Possible Sources

- Wiring, terminals or connectors
- Dimmer switch (part of the headlamp switch)
- BCM

PINPOINT TEST A : ALL ILLUMINATION (NETWORKED AND NON-NETWORKED SOURCES) DOES NOT DIM OR INCREASE BRIGHTNESS

A1 RETRIEVE AND RECORD DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using the diagnostic scan tool, retrieve all Diagnostic Trouble Codes (DTCs).

Is DTC B1436:01 present?

Yes	GO to A2
No	GO to A7

A2 CHECK THE DIM UP AND DIM DOWN CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect Headlamp switch C205.
- Disconnect BCM C2280G.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-3	V	Ground
C205-6	V	Ground

Is any voltage present?

Yes	REPAIR the affected circuit.
No	GO to A3

A3 CHECK THE DIM UP AND DIM DOWN CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-3	Ω	C2280G-3
C205-6	Ω	C2280G-7

Is the resistance less than 3 ohms?

Yes	GO to A4
No	REPAIR the affected circuit.

A4 CHECK THE DIM UP AND DIM DOWN CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-3	Ω	Ground
C205-6	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A5
No	REPAIR the affected circuit.

A5 CHECK THE DIM UP AND DIM DOWN CIRUCITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-3	Ω	C205-6

Is the resistance greater than 10,000 ohms?

Yes	GO to A6
No	REPAIR the circuits.

A6 CHECK THE HEADLAMP SWITCH ILLUMINATION GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-5	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new dimmer switch (part of the headlamp switch). REFER TO SECTION 417-01
No	REPAIR the circuit.

A7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM and related in-line connectors and all previously disconnected illumination system connectors. Make sure all connectors seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All Non-Networked Illumination Is Inoperative (Networked Illumination Functions Correctly)

Refer to Wiring Diagrams Cell 71 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Instrument Panel and Interior Switches Illumination - System Operation and Component Description (413-00 Instrument Panel and Interior Switches Illumination, Description and Operation).

DTC	Description	Fault Trigger Conditions
B1315:11	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Ground	This DTC sets in continuous memory and on-demand when the BCM detects excessive current draw from the backlighting illumination output circuit.
B1315:15	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Battery or Open	This DTC sets in continuous memory and on-demand when the BCM detects lower than expected current draw from the backlighting illumination output circuit.

Possible Sources

- Wiring, terminals or connectors
- BCM

PINPOINT TEST B : ALL NON-NETWORKED ILLUMINATION SOURCES ARE INOPERATIVE (NETWORKED ILLUMINATION FUNCTIONS CORRECTLY)

B1 BYPASS THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect BCM C2280G.
- **NOTE:** *If the jumper wire fuse fails during this step, refer to the Wiring Diagrams manual to identify the possible causes for a short to ground.*

  Connect:

Positive Lead	Measurement / Action	Negative Lead
C2280G-45		CBATTERY POSITIVE

Do the non-networked components illuminate?

Yes	GO to B2
No	REMOVE the fused jumper wire. REPAIR the illumination circuit. After the repair: If DTC U1000:00 is present in the BCM, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test (required to enable the illumination output driver when DTC U1000:00 is stored in the BCM). If DTC U3000:49 is present in the BCM, INSTALL a new BCM after all other Diagnostic Trouble Codes (DTCs) have been addressed. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).

B2 CHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Connect BCM C2280G.
- Ignition ON.
- Perform the BCM self-test.

Is DTC B1315:11 or DTC U1000:00 currently set, or has DTC U1000:00 set in the past?

Yes	CHECK the illumination circuit for an intermittent short to ground. If DTC U1000:00 is present in the BCM, a successful self-test must be completed before the illumination output

	is enabled.
No	GO to B3

B3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM and related in-line connectors and all previously disconnected illumination system connectors. Make sure all connectors seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

One Or More Non-Networked Illumination Source Is Inoperative

Refer to Wiring Diagrams Cell 71 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM supplies pulse-width modulated voltage to the non-networked illuminated components.

Possible Sources

- Wiring, terminals or connectors
- Illuminated component

PINPOINT TEST C : ONE OR MORE NON-NETWORKED ILLUMINATION SOURCE IS INOPERATIVE

C1 CHECK THE COMPONENT VOLTAGE CIRCUIT

- Ignition OFF.
- **NOTE:** *If the headlamp switch illumination is inoperative, set the instrument panel illumination to the brightest setting with the ignition on prior to disconnecting the headlamp switch.*

  Disconnect: Inoperative Illuminated Component.
- Ignition ON.
- Place a shop light over the ambient light sensor to make sure the illumination can reach maximum brightness.
- Place the headlamp switch in the PARKING LAMPS ON position.
- Press the illumination dim up switch until the illumination reaches full brightness.
- Measure:

Headlamp switch

Positive Lead	Measurement / Action	Negative Lead

C205-15		Ground

Overhead console

Positive Lead	Measurement / Action	Negative Lead
C930-1		Ground

Power fold switch

Positive Lead	Measurement / Action	Negative Lead
C2269-3		Ground

Floor shifter/TCS

Positive Lead	Measurement / Action	Negative Lead
C3245-5		Ground

4WD switch

Positive Lead	Measurement / Action	Negative Lead
C284-4		Ground

Active park assist/Differential lock switch

Positive Lead	Measurement / Action	Negative Lead
C3360-2		Ground

Truck bed lamp switch

Positive Lead	Measurement / Action	Negative Lead
C221-3		Ground

Media Hub

Positive Lead	Measurement / Action	Negative Lead
C3553-1		Ground

Is the voltage greater than 10 volts?

Yes	GO to C2
No	REPAIR the affected circuit.

C2 CHECK THE COMPONENT GROUND CIRCUIT

- Measure:

Headlamp switch

Positive Lead	Measurement / Action	Negative Lead
C205-15		C205-5

Overhead console

Positive Lead	Measurement / Action	Negative Lead
C930-1		C930-2

Power fold mirror

Positive Lead	Measurement / Action	Negative Lead
C2269-3		C2269-2

Floor shifter/TCS

Positive Lead	Measurement / Action	Negative Lead
C3245-5		C3245-9

4WD switch

Positive Lead	Measurement / Action	Negative Lead
C284-4		C284-1

Active park assist/Differential lock switch

Active park assist/Differential lock switch

Positive Lead	Measurement / Action	Negative Lead
C3360-2		C3360-12

Truck bed lamp switch

Positive Lead	Measurement / Action	Negative Lead
C221-3		C221-2

Media Hub

Positive Lead	Measurement / Action	Negative Lead
C3553-1		C3553-2

Is the voltage greater than 10 volts?

Yes	INSTALL a new component in question.
No	REPAIR the affected circuit.

All Non-Networked Illumination Is Always On (Networked Illumination Functions Correctly)

Refer to Wiring Diagrams Cell 71 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM provides pulse-width modulated voltage to all non-networked illuminated components.

DTC	Description	Fault Trigger Conditions
B1315:15	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Battery or Open	This DTC sets in continuous memory and on-demand when the BCM detects lower than expected current draw from the backlighting illumination output circuit.

Possible Sources

- Wiring, terminals or connectors
- Headlamp switch concern
- BCM

PINPOINT TEST D : ALL NON-NETWORKED ILLUMINATION IS ALWAYS ON (NETWORKED ILLUMINATION FUNCTIONS CORRECTLY)

D1 CHECK THE EXTERIOR LIGHTING
• Ignition ON.

- Place the headlamp switch in the OFF position.
- Observe the parking lights.

Are the parking lights illuminated?

Yes	DIAGNOSE a concern with the headlamp switch. REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
No	GO to D2

D2 CHECK FOR BCM (BODY CONTROL MODULE) DTC (DIAGNOSTIC TROUBLE CODE) B1315:15

- Perform the BCM self-test.

Is BCM DTC B1315:15 present?

Yes	GO to D3
No	GO to Pinpoint Test A

D3 CHECK THE BCM (BODY CONTROL MODULE) ILLUMINATION OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280G.
- Ignition ON.

Do the non-networked components continue to illuminate?

Yes	REPAIR the circuit.
No	GO to D4

D4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM and related in-line connectors and all previously disconnected illumination system connectors. Make sure all connectors seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Driver Front Door Lock Switch Illumination Is Inoperative Or Always On

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operation and Fault Conditions

Based on messages recieved from the BCM, the DDM supplies voltage to the driver door lock switch.

DTC	Description	Fault Trigger Conditions
U2010:00	Switch Illumination: No Sub Type Information	This DTC sets on-demand and in continuous memory when the DDM detects an open or short to ground on the switch illumination output circuit.

Possible Sources

- Communication network concern
- Wiring, terminals or connectors
- Front door lock switch
- DDM

PINPOINT TEST E : THE DRIVER FRONT DOOR LOCK SWITCH ILLUMINATION IS INOPERATIVE OR ALWAYS ON

E1 PERFORM A NETWORK TEST

- Ignition ON.
- Perform a network test.

Does the DDM pass the network test?

Yes	GO to E2
No	DIAGNOSE a concern with the network. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E2 VERIFY THE DOOR LOCK SWITCH FUNCTINALITY

- Actuate the door locks from the driver door lock switch.

Can the doors be locked and unlocked from the driver door lock switch?

Yes	If the switch illumination is always on, GO to E3 If the switch illumination is inoperative, GO to E5
No	DIAGNOSE a concern with the door locks. REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

E3 CHECK THE ILLUMINATION CIRCUIT FOR A SHORT TO VOLTAGE

- Place the headlamp switch in the OFF position.
- Ignition OFF.
- Disconnect C505LHD Vehicles.
- Disconnect C605RHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C505-1		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5		Ground

Is any voltage present?

Yes	GO to E4
No	INSTALL a new front door lock control switch. REFER TO 501-14.

E4 CHECK THE ILLUMINATION CIRCUIT FOR A SHORT TO VOLTAGE WITH THE DDM (DRIVER DOOR MODULE) DISCONNECTED

- Ignition OFF.
- Disconnect C501ALHD Vehicles.
- Disconnect C601ARHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C505-1		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E9

E5 CHECK THE ILLUMINATION CIRCUIT FOR VOLTAGE AT THE DOOR LOCK SWITCH

- Ignition OFF.
- Disconnect C505LHD Vehicles.
- Disconnect C605RHD Vehicles.
- Ignition ON.
- Place a shop light over the ambient light sensor so illumination can reach maximum brightness.
- Press the illumination dim up switch until the illumination reaches full brightness.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C505-1		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5		Ground

Is the voltage greater than 10 volts?

Yes	INSTALL a new front door lock control switch. REFER TO SECTION 501-14.
No	GO to E6

E6 CHECK THE ILLUMINATION CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect C501ALHD Vehicles.
- Disconnect C601ARHD Vehicles.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C505-1	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to E7
No	REPAIR the circuit.

E7 CHECK THE ILLUMINATION CIRCUIT FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C505-1	Ω	C501A-15

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5	Ω	C601A-15

Is the resistance less than 3 ohms?

Yes	GO to E8
No	REPAIR the circuit.

E8 CHECK THE ILLUMINATION AND GROUND CIRCUITS FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C505-1	Ω	C505-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5	Ω	C605-3

Is the resistance greater than 10,000 ohms?

Yes	GO to E9
No	REPAIR the circuit.

E9 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Disconnect and inspect all DDM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM and related in-line connectors and all previously disconnected illumination system connectors. Make sure all connectors seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Passenger Front Door Lock And/Or Window Control Switch Illumination Is Inoperative Or Always On

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

Based on messages recieved from the BCM, the PDM supplies voltage to illuminate the passenger window control switch.

DTC	Description	Fault trigger conditions
U2010:00	Switch Illumination: No Sub Type Information	This DTC sets on-demand and in continuous memory when the PDM detects an open or a short to ground on the switch illumination output circuit.

Possible Sources

- Communication network concern
- Wiring, terminals or connectors
- Passenger door lock switch
- Passenger window control switch
- PDM

PINPOINT TEST F : THE PASSENGER FRONT DOOR LOCK AND/OR WINDOW CONTROL SWITCH ILLUMINATION IS INOPERATIVE OR ALWAYS ON

F1 PERFORM A NETWORK TEST

- Ignition ON.
- Perform a network test.

Does the PDM pass the network test?

Yes	If the door lock **and** window control switch illumination is always on, GO to F2 If the door lock **and** window control switch illumination is inoperative, GO to F6 If the door lock control switch illumination is inoperative, GO to F10 If the window control switch illumination is inoperative, GO to F13
No	DIAGNOSE a concern with the network. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

F2 CHECK THE ILLUMINATION CIRCUIT FOR A SHORT TO VOLTAGE

- Place the headlamp switch in the OFF position.
- Ignition OFF.
- Disconnect C6009LHD Vehicles.
- Disconnect C5009RHD Vehicles.
- Ignition ON.
- Make sure all other illuminated switches inside the vehilce have turned OFF before continuing.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6009-1		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5009-1		Ground

Is any voltage present?

Yes	GO to F3
No	INSTALL new window control switch. REFER to: Passenger Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

F3 VERIFY THE DOOR LOCK SWITCH FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect C605LHD Vehicles.
- Disconnect C541RHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C541-1		Ground

Is any voltage present?

Yes	GO to F4
No	INSTALL new door lock control switch. REFER TO 501-14 Front Door Lock Control Sw.

F4 CHECK THE ILLUMINATION CIRCUIT FOR A SHORT TO VOLTAGE WITH THE PDM (PASSENGER DOOR MODULE) DISCONNECTED

- Ignition OFF.
- Disconnect C652ALHD Vehicles.

- Disconnect C552ARHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C652A-15	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C552A-15	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to F5

F5 CHECK THE SWITCH CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.
- Measure:

Window Control Switch LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6009-1	Ω	C6009-2
C6009-1	Ω	C6009-3
C6009-1	Ω	C6009-4

Window Control Switch RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5009-1	Ω	C5009-2
C5009-1	Ω	C5009-3
C5009-1	Ω	C5009-4

Door Lock Switch LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C541-1	Ω	C541-2

C541-1	Ω	C541-3
C541-1	Ω	C541-4
C541-1	Ω	C541-5

Door Lock Switch RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5	Ω	C605-1
C605-5	Ω	C605-2
C605-5	Ω	C605-3
C605-5	Ω	C605-4

Are the resistances greater than 10,000 ohms?

Yes	GO to F16
No	REPAIR the affected circuit.

F6 VERIFY THE DOOR LOCK SWITCH FUNCTIONALITY

- Actuate the door locks from the passenger front door lock switch.

Does the passenger door lock switch function correctly?

Yes	GO to F7
No	DIAGNOSE a concern with the door locks. REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

F7 CHECK THE WINDOW SWITCH ILLUMINATION CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect C6009LHD Vehicles.
- Disconnect C5009RHD Vehicles.
- Place a shop light over the ambient light sensor to make sure the illumination can reach maximum brightness.
- Ignition ON.
- Press the illumination dim up switch until the illumination reaches full brightness.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6009-1	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5009-1	V	Ground

C5009-1	V	Ground

Is the voltage greater than 10 volts?

Yes	The system is functioning correctly at this time, CHECK the illumination output circuit for an intermitent fault condition.
No	GO to F8

F8 CHECK THE WINDOW SWITCH ILLUMINATION CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect PDM C652ALHD Vehicles.
- Disconnect PDM C552ARHD Vehicles.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C652A-15	Ω	C6009-1

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C552A-15	Ω	C5009-1

Is the resistance less than 3 ohms?

Yes	GO to F9
No	Repair the circuit.

F9 CHECK THE WINDOW SWITCH ILLUMINATION CIRCUIT FOR A SHORT TO GROUND

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6009-1	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5009-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to F16
No	REPAIR the circuit.

F10 VERIFY THE PASSENGER DOOR LOCK CONTROL SWITCH OPERATION

- Verify the operation of the door lock from the passenger door lock control switch.

Does the door lock operate correctly?

Yes	GO to F11
No	DIAGNOSE a concern with the door locks. REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

F11 CHECK THE ILLUMINATION CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect C605LHD Vehicles.
- Disconnect C541RHD Vehicles.
- Place a shop light over the ambient light sensor to make sure the illumination can reach maximum brightness.
- Ignition ON.
- Press the illumination dim up switch until the illumination reaches full brightness.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C541-1	V	C541-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5	V	C605-3

Is the voltage greater than 10 volts?

Yes	INSTALL new door lock control switch. REFER TO SECTION 501-14.
No	GO to F12

F12 CHECK THE ILLUMINATION CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect PDM C652ALHD Vehicles.
- Disconnect PDM C552ARHD Vehicles.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C541-1	Ω	C652A-15

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C605-5	Ω	C552A-15

Is the resistance less than 3 ohms?

Yes	GO to F16
No	Repair the circuit.

F13 CHECK THE ILLUMINATION CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect C6009LHD Vehicles.
- Disconnect C5009RHD Vehicles.
- Place a shop light over the ambient light sensor to make sure the illumination can reach maximum brightness.
- Ignition ON.
- Press the illumination dim up switch until the illumination reaches full brightness.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6009-1	V	C6009-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5009-1	V	C5009-4

Is the voltage greater than 10 volts?

Yes	INSTALL new window control switch. REFER TO SECTION 501-11.
No	GO to F14

F14 CHECK THE ILLUMINATION CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect PDM C652ALHD Vehicles.
- Disconnect PDM C552ARHD Vehicles.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C6009-1	Ω	C652A-15

Positive Lead	Measurement / Action	Negative Lead
C5009-1	Ω	C552A-15

Is the resistance less than 3 ohms?

Yes	GO to F15
No	Repair the circuit.

F15 CHECK THE ILLUMINATION GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C6009-4	Ω	C652A-17

Positive Lead	Measurement / Action	Negative Lead
C5009-4	Ω	C552A-17

Is the resistance less than 3 ohms?

Yes	GO to F16
No	Repair the circuit.

F16 CHECK FOR CORRECT PDM (PASSENGER DOOR MODULE) OPERATION

- Disconnect and inspect all PDM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PDM and related in-line connectors and all previously disconnected illumination system connectors. Make sure all connectors seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Steering Wheel Switch(es) Illumination Is Inoperative (Without Active Front Steering)

Refer to Wiring Diagrams Cell 71 for schematic and connector information.

Normal Operation and Fault Conditions

The steering wheel switches receive illumination voltage from the BCM on a common illumination circuit through SCCM and clockspring.

Possible Sources

- Wiring, terminals or connectors
- Steering wheel switch(es)
- Clockspring
- SCCM

PINPOINT TEST G : THE STEERING WHEEL SWITCH(ES) ILLUMINATION IS INOPERATIVE OR ALWAYS ON (WITHOUT ACTIVE FRONT STEERING)

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

G1 INSPECT THE NON-NETWORKED ILLUMINATION COMPONENTS

- Ignition ON.
- Place the headlamp switch in the PARKING LAMPS ON position.
- While pressing the illumination dim up and dim down switch, monitor the non-networked illumination components.

Are all of the non-networked illumination sources inoperative or always on?

Yes	If all non-networked illumination sources are inoperative, GO to Pinpoint Test B If all non-networked illumination sources are always on, GO to Pinpoint Test D
No	If all steering wheel switch illumination is inoperative, GO to G2 If only one steering wheel switch is inoperative, GO to G5

G2 CHECK FOR ILLUMINATION VOLTAGE AT THE CLOCKSPRING

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect Clockspring C218A.
- Place a light source over the ambient light sensor so the illumination can reach maxium brightness.

- Place the headlamp switch in the PARKING LAMPS ON position.
- Ignition ON.

- Press the illumination dim up switch to the full illumination position.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C218A-1		Ground

Is the voltage greater than 10 volts?

Yes	GO to G3
No	REPAIR the circuit

G3 CHECK THE ILLUMINATION GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C218A-1		C218A-4

Is the voltage greater than 10 volts?

Yes	GO to G4
No	REPAIR the circuit.

G4 CHECK THE CLOCKSPRING

- Ignition OFF.
- Connect C218A.
- Disconnect C218B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C218B pin 1 (component side)		C218B pin 11 (component side)

Is the voltage greater than 10 volts?

Yes	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

G5 CHECK THE STEERING WHEEL HARNESS VOLTAGE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental

Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect the faulty switch.
- Disconnect Clockspring C218B.
- Measure:

LH steering wheel switch

Positive Lead	Measurement / Action	Negative Lead
C218B-11	Ω	C2490-8

RH steering wheel switch

Positive Lead	Measurement / Action	Negative Lead
C218B-11	Ω	C2491-8

Is the resistance less then 3 ohms?

Yes	GO to G6
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

G6 CHECK THE STEERING WHEEL HARNESS GROUND CIRCUIT FOR AN OPEN

- Measure:

LH steering wheel switch

Positive Lead	Measurement / Action	Negative Lead
C218B-1	Ω	C2490-2

RH steering wheel switch

Positive Lead	Measurement / Action	Negative Lead
C218B-1	Ω	C2491-2

Is the resistance less then 3 ohms?

Yes	INSTALL a new steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

Copyright © 2016 Ford Motor Company

Instrument Panel Cluster (IPC) - Overview

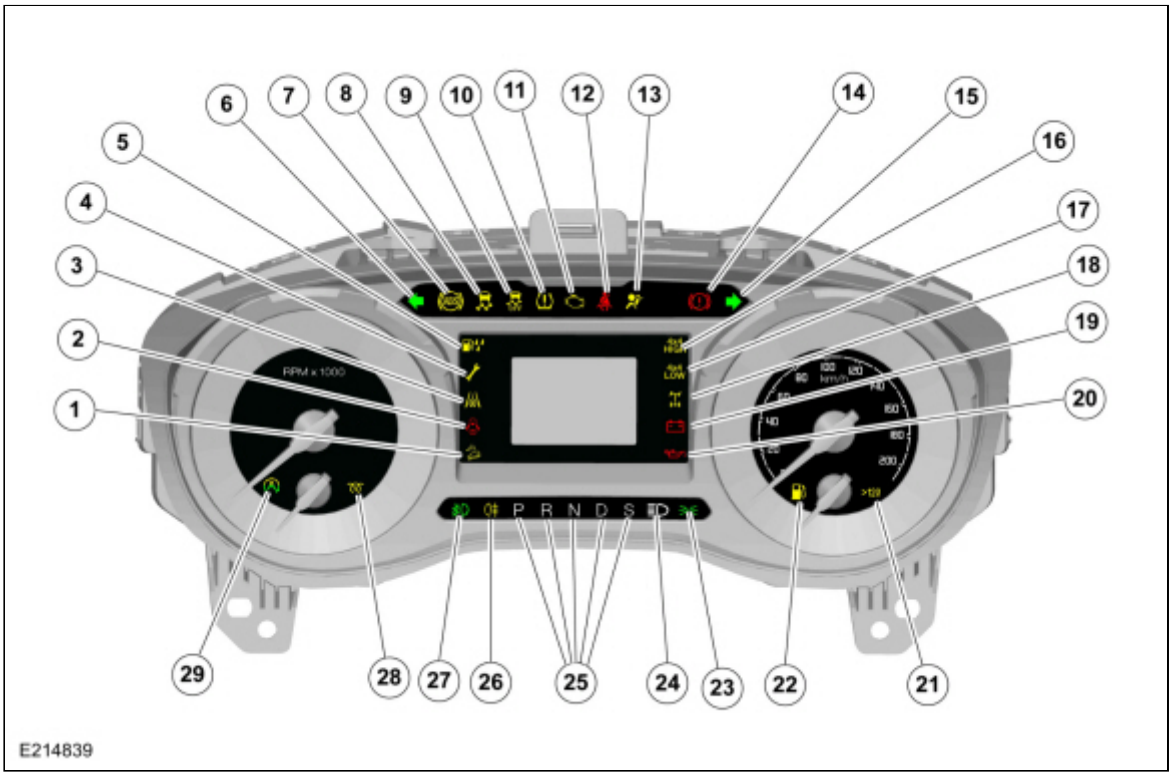
Base Part Number: 10849

Overview

The IPC uses the following methods and functionality to alert the driver of vehicle conditions:

- gauges
- informational indicators
- warning indicators
- warning messages
- warning chimes

Base IPC

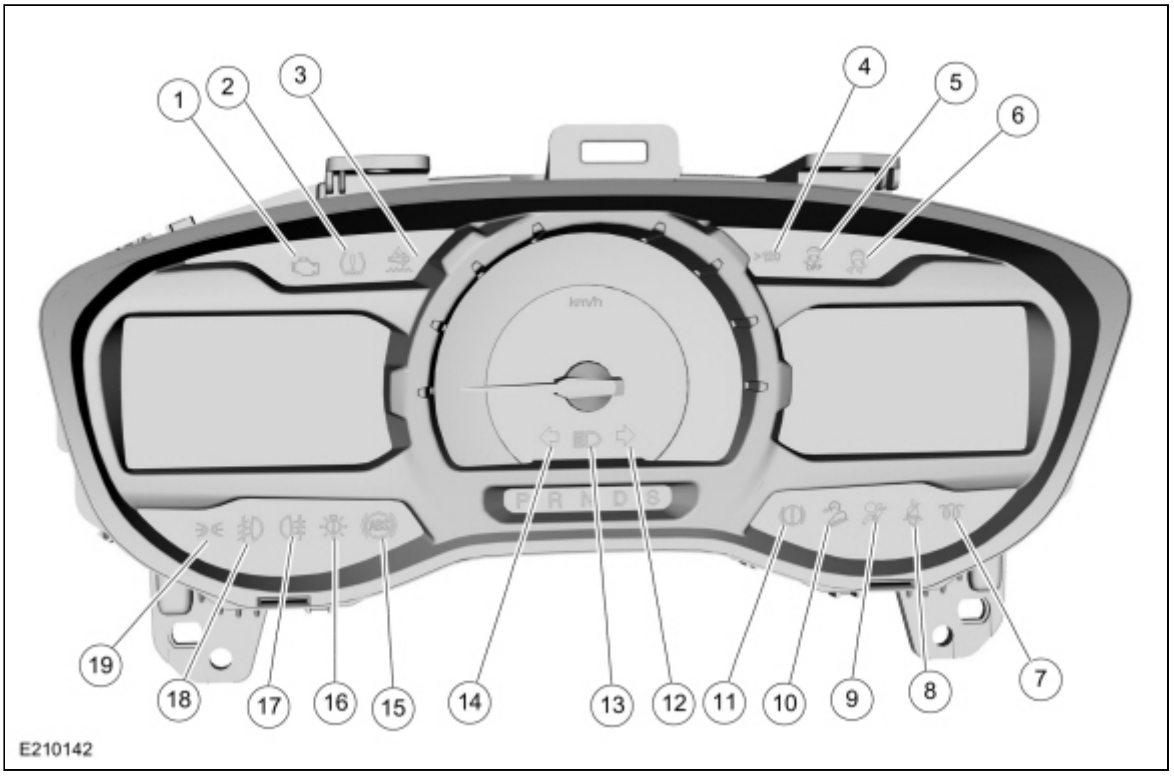


Base IPC

Item	Description
1	HDC
2	Door Ajar Indicator
3	Frost Indication
4	Powertrain malfunction Indicator
5	Diesel Water in Fuel indicator
6	Left Turn Signal / Hazard Indicator
7	ABS Warning
8	IVD Traction Control Event
9	TC/ESC/ RSC Traction Control Off
10	Low Tire Pressure Warning (TPMS)
11	Check Engine Warning / MIL

12	Seat Belt Warning / Belt minder
13	Airbag Failure Warning Light
14	Right Turn Signal / Hazard Indicator
15	Fuel gauge
16	4x4 High
17	4x4 Low
18	Rear Differential Lock indicator
19	Charge System Fault
20	Low Engine Oil Pressure
21	Over speed Warning GCC
22	Low Fuel
23	Park Lamp
24	High Beam
25	PRNDL display
26	Rear Fog
27	Front Fog
28	Wait To Start
29	Auto-start-stop system

High-Level IPC



High-Level IPC

Item	Description
1	Check Engine Warning / MIL
2	Low Tire Pressure Warning (TPMS)
3	Left Turn Signal / Hazard Indicator
4	Over speed Warning GCC

5	TC/ESC/ RSC Traction Control Off
6	IVD Traction Control Event
7	Wait To Start
8	Seat Belt Warning / Belt mindert
9	Airbag Failure Warning Light
10	HDC
11	Brake Warning / Low Brake Fluid / Park Brake
12	Right Turn Signal / Hazard Indicator
13	High Beam
14	Left Turn Signal / Hazard Indicator
15	ABS Warning
16	Lighting Control
17	Rear Fog Switch Indicator
18	Front Fog Switch Indicator
19	Park Lamp

The base IPC uses a dot matrix message centre display to display driver information.

The high-level IPC uses dual RH and LH 4.2" thin film transistor screens to display driver information.

For LHD vehicles, the LH display screen contains the virtual gauge displays and message center information. The RH display screen displays multimedia information (audio, phone and navigation), as well as items such as vehicle direction, outside air temperature and time.

For RHD vehicles, the RH display screen contains the virtual gauge displays and message center information. The LH display screen displays the multimedia information.

The dual screen message center IPC utilizes mostly virtual gauges. Virtual gauges are video displays that provide information in a unique format. The exception is the speedometer, which is still an analog-type gauge. Each virtual gauge is somewhat different in how it is displayed.

Informational indicators inform the driver of conditions that exist in the vehicle. Warning indicators provide information to the driver of conditions that could potentially cause personal injury or alter vehicle performance.

IPC RTT indicators illuminate in the message center and replace the typical informational or warning indicator, using the same graphical representation. The message center displays RTT indicators in both fixed locations and in a rotating display where they are turned on in the order the request was received by the IPC.

Network Messaged Inputs

Module messaging has increased over time and is the standard for sending and receiving information required to operate the IPC. The majority of the inputs required to operate the IPC are received over the HS-CAN.

Hardwired Inputs

The IPC requires hardwired inputs from components that are not on the CAN. These components are required for specific IPC functions.

The hardwired inputs are provided by the following components:

- HDC switch
- ESC switch
- fuel level sensor
- park detect switch (part of the floor shifter assembly)
- low washer fluid level switch

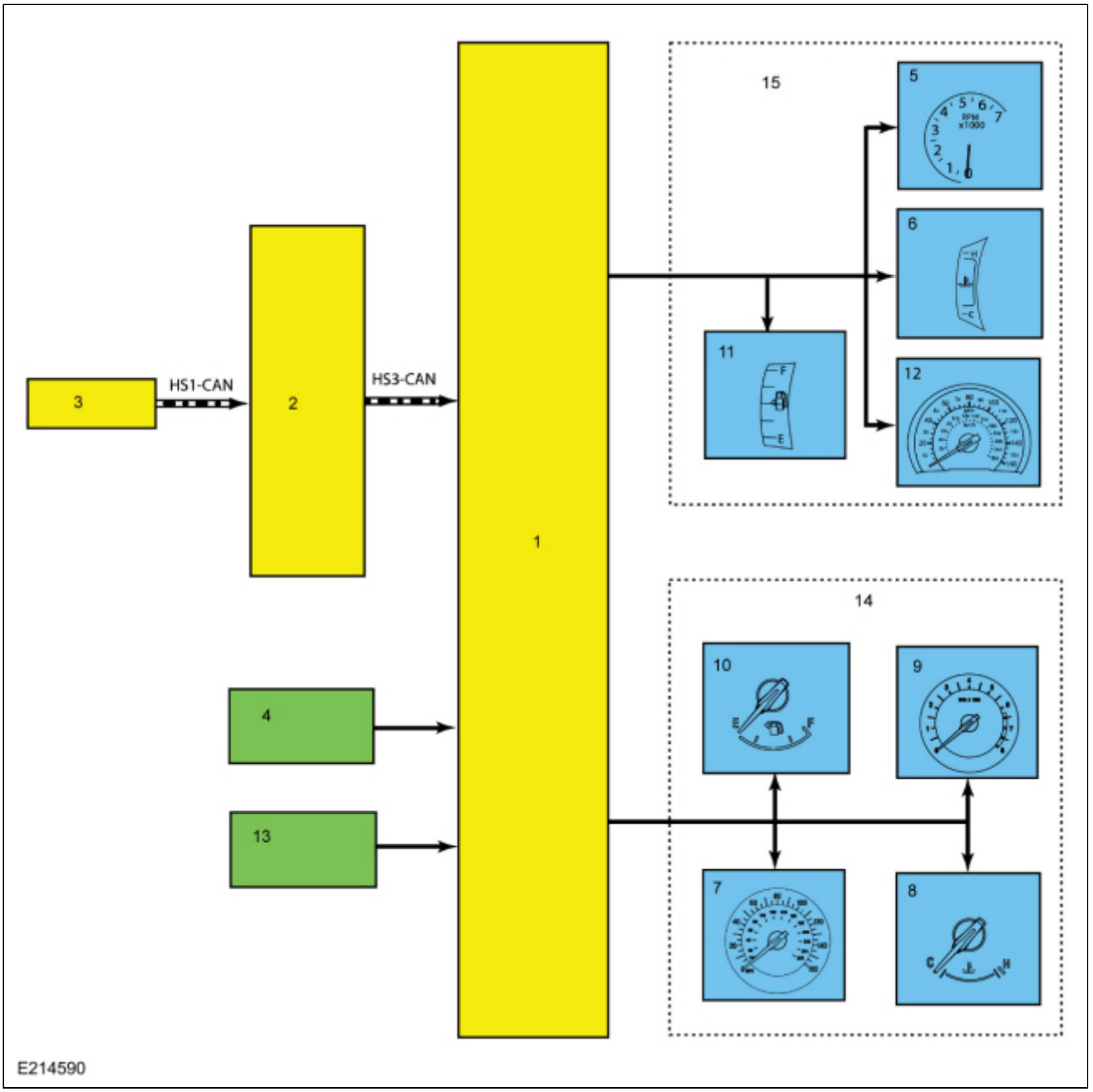
Copyright © 2016 Ford Motor Company

Instrument Panel Cluster (IPC) - System Operation and Component Description

Base Part Number: 10849

System Operation

System Diagram - Gauges



Item	Description
1	IPC
2	GWM
3	PCM
4	Fuel pump assembly
5	Tachometer
6	Temperature
7	Speedometer

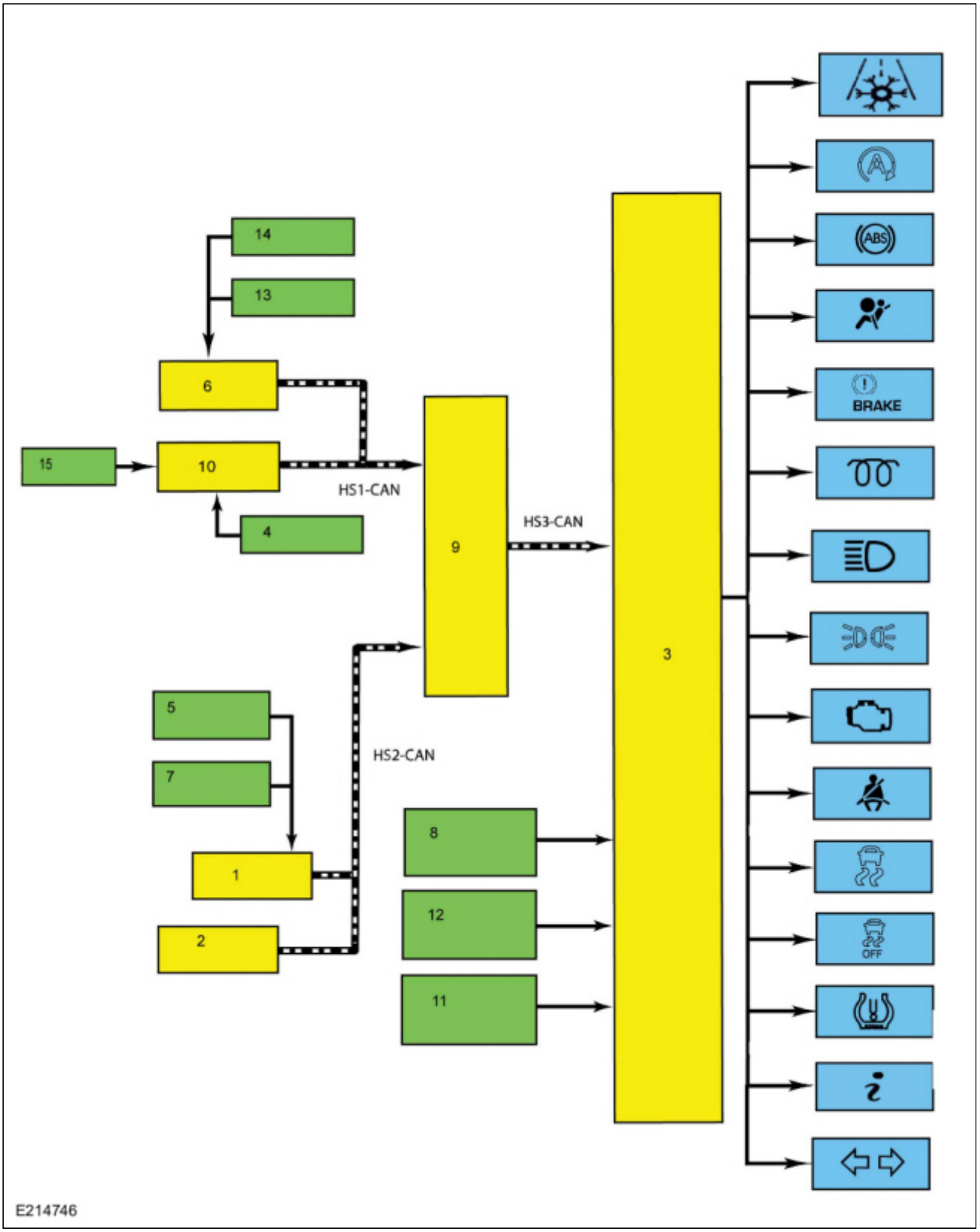
8	Temperature
9	Tachometer
10	Fuel
11	Fuel
12	Speedometer
13	Fuel level sensor
14	Analog gauges
15	Virtual gauges

Network Message Chart - Gauges

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Engine coolant temperature data	PCM	Input used for the analog and virtual temperature gauge indication.
Engine overheat indication request	PCM	Input used to send the analog and virtual temperature gauge pointer to full hot.
Engine RPM data	PCM	Input used for analog and virtual tachometer indication.
Ignition status	BCM	Ignition RUN, START and accessory states required for the IPC operating modes and fault reporting.
Vehicle speed	PCM	Vehicle speed data used for the virtual AWD gauge display and speedometer indication.

System Diagram - Indicators



Item	Description
1	RCM
2	ABS module
3	IPC
4	Brake fluid level switch
5	Driver safety belt buckle
6	PCM
7	Passenger safety belt buckle
8	Park detect switch

9	GWM
10	BCM
11	Fuel level sensor
12	Fuel pump assembly
13	Oil pressure switch
14	Diesel exhaust fluid sensor
15	TCM

Network Message Chart - Indicators

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
ABS warning indicator request	ABS module	Input used to control the ABS warning indicator.
Airbag warning indicator request	RCM	Input used to control the airbag warning indicator.
Brake fluid level low message request	BCM	Input from the BCM for low brake fluid level used to control the brake warning indicator.
Brake (red) warning indicator request	ABS module	Input from the ABS used to control the brake warning indicator.
Driver safety belt buckle status	RCM	Input used to control the safety belt warning indicator.
High beam status	BCM	Input used to control the high beam indicator.
Ignition status	BCM	Ignition RUN, START and accessory states required for the IPC operating modes and fault reporting.
MIL request	PCM	Input used to control the MIL.
Parking brake (red) indicator request	ABS module	Input from the ABS for the parking brake input used to control the brake warning indicator.
Parklamp status	BCM	Input used to control the lights on indicator.
Stability-traction control indicator request	ABS module	Input used to control the stability/traction control (sliding car icon) indicator.
Stop/start standby indicator	PCM	Input used to control the auto stop/start indicator.
Tire pressure warning indicator	BCM	Input used to control the TPMS indicator.
Traction control mode	ABS module	Input used to control the stability/traction control disabled (sliding car OFF icon) indicator.
Turn indication request	BCM	Input used to control the RH turn, LH turn and hazard indicators.
Diesel Exhaust Fluid Indicator request	PCM	Input used to control DEF warning indicator.
Water in Fuel Indicator request	PCM	Input used to control Water in Fuel warning indicator.
Frost Indicator request	FCIM	Input used to control Frost warning indicator.
Door Ajar Indicator request	BCM	Input used to control door ajar warning states.
HDC Indicator request	ABS module	Input used to control HDC warning indicator.
Wait to Start Indicator request	PCM	Input used to control Wait to Start indicator.
4WD Indicator request	PCM	Input used to control 4WD high or 4WD low warning indicators.
Engine Coolant Warning indicator	PCM	Input used to control Engine temperature warning indicator.

Charge warning Indicator request	BCM	Input used to control Charge fail warning indicator.
Oil Pressure Warning indicator request	PCM	Input used to control Oil Pressure warning indicator.
Fog Lamp Indicator request	BCM	Input used to control front and/or rear fog lamp warning indicator.
E Locker indicator request	PCM	Input used to control E Locker warning indicator.

Networked Input Messages and Default States

NOTE: *Whenever a network message is suspected as missing and confirmed by a missing message DTC (U-code), it is important to look for other symptoms that can also be present in the IPC and throughout the vehicle. Once a DTC sets in the IPC, it is helpful to review the complete message list to determine which other modules also rely on the same message and run the self-test for those modules. If the message is missing from other modules, the same or similar lost communication DTC can also be set in those modules. Confirmation of missing messages common to multiple modules can indicate the originating module is the source of the concern or the communication network may be faulted.*

For a list of all the network messages,
Refer to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

The IPC uses input messages from other modules to control the gauges, informational indicators, warning indicators and message center message displays over the communication networks. The IPC receives all networked data over the HS-CAN3.

The vehicle uses 4 communication networks to transmit the data used by the IPC.

- HS-CAN1
- HS-CAN2
- HS-CAN3
- MS-CAN

For overview information,
Refer to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

For system operation information,
Refer to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

All messaged inputs to the IPC from other networks are received from the GWM over the HS-CAN3. The GWM, as the name implies, acts as a gateway to convert messages from one of the other 3 networks to the HS-CAN3, which is recognized by the IPC.

Network messages can drop out or be missing for a variety of reasons, such as high network traffic on the bus. The IPC incorporates a defined strategy for handling missing network messages based on time. The required time for a network message to be missing differs between the various gauges, indicators and message center displays. The strategy is basically the same for all indication outputs (gauges, indicators or chimes), but differs in the length of time required for the network message to be missing. If a required network message is missing or invalid for less than the programmed length of time, the gauge, indicator or message center display that requires the network message remains at the last commanded state based upon the last network message received. If the messaged input is missing for longer than the programmed length of time, the IPC output (gauge, indicator etc.) reacts according to a pre-defined default action.

For example, if the stability-traction control indicator request network message is missing for less than 5 seconds, and the stability-traction control indicator (sliding car icon) was on, the indicator remains in the on state until the next network message is received. If the network message remains missing or invalid for more than 5 seconds, the IPC sets a U-code DTC and the IPC output becomes a default action for the indicator or gauge. The indicator may default on/off or the gauge may default to the rest position.

Each indicator or gauge utilizes a different default strategy depending on the nature of the indication. Refer to the diagnostic overview descriptions located before each pinpoint test for further descriptions of the default action specific to each indicator or gauge. If the missing messaged input to the IPC returns at any time, the normal function of the gauge, indicator or message center display resumes.

It is very important to understand:

- where the input originates.
- all the information necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- which module controls the output of the feature.
- whether the module that receives the input controls the output of the feature, or whether it outputs a message over the communication network to another module.

Startup-Shutdown

The IPC provides a startup/shutdown sequence also known as a welcome/goodbye strategy. The IPC initiates and follows a progressive strategy providing increasing IPC functionality from IPC wake up to ready to drive status. This sequence begins at RKE unlock or driver door open through the ignition RUN state. During this period, the IPC provides increasing functionality from backlighting or illuminating gauge rings, gauge pointers, illuminating the PRNDL, backlighting of the message center display, displaying a message center splash screen, gauge and LED prove out, gauge sweep and finally normal IPC operation.

MyKey®

The MyKey® feature allows the customer to program a restricted driving mode that is tied to one or more keys known as a MyKey® key. The following features are provided by the IPC when a MyKey® key is being used:

- At the beginning of vehicle start up, as part of the welcome strategy, the message center greets the MyKey® driver with MYKEY ACTIVE DRIVE SAFELY displayed in the message center. If the MyKey® speed limiter feature is turned on, the message center also displays the MyKey® administrator selected top speed setting message; SPEED LIMITED TO 128.747 km/h or to the administrator desired setpoint.
- The MyKey® top speed selections are;
  - 104.607 km/h
  - 112.654 km/h
  - 120.7 km/h
  - 128.747 km/h

- The IPC provides a periodic Belt-Minder® warning chime until the driver and passenger safety belts are buckled. When the Belt-Minder® is issued, the ACM is muted and the message center displays BUCKLE UP TO UNMUTE AUDIO.
- If the MyKey® speed limiter feature is turned on and the vehicle speed approaches the selected top speed, the message center displays NEAR VEHICLE TOP SPEED along with a chime.
- If the MyKey® speed limiter feature is turned on and the vehicle speed reaches the selected top speed, the message center displays TOP SPEED MYKEY SETTING along with a chime.
- If the speed warning is selected at one of the preset values and the vehicle approaches the preset speed, the message center displays CHECK SPEED DRIVE SAFELY along with a chime.
- At approximately 1/8 tank of remaining fuel, the IPC illuminates the low fuel message center indicator and the message center displays FUEL LEVEL LOW along with a chime.
- Traction control, Emergency Assist® feature and the Do Not Disturb feature can be set to always on or user selectable in the MyKey® menu.
- If the traction control always on feature is turned on and the MyKey® driver attempts to disable the traction control, the message center displays ADVANCETRAC ON MYKEY SETTING.
- MyKey® miles driven by the MyKey® user can be found in the information display.
- The number of MyKey® programmed and administrator keys can be found in the MyKey® menu.
- The parking aid, lane departure alert and collision avoidance warning menus are disabled in the message center to force these features always on.

When an administrator key is in use, the IPC provides:

- a menu in the message center guiding the user to create a MyKey®. When the maximum MyKey® limit is reached, the MyKey® creation menu is no longer available.
- a menu in the message center with options for setting 6 MyKey® features:
  - MyKey® speed limiter.
  - MyKey® pre-selected speed warning.
  - MyKey® radio volume limiter.
  - traction control always on or user selectable.
  - emergency assist feature always on or user selectable.
  - do not disturb feature always on or user selectable.
- a menu in the message center with the option to clear all MyKey® programmed keys at once.
- MyKey® mileage driven by the MyKey® user can be found in system check function of the message center.
- the number of MyKey® programmed keys and administrator keys can be found in the system check function of the message center.

For information on the MyKey® features, refer to the Owner's Literature.

Configuration

The IPC contains items that are configurable. Most of the configurable items (configurable parameters) are customer preference items, which can be set with a scan tool. The remaining configurable items can only be set through the vehicle configuration parameters. Refer to: (418-01 Module Configuration)

Programmable Module Installation (PMI) (418-01 Module Configuration) .

Prove-Out

The IPC carries out a display prove-out to verify the gauges function and all module controlled warning indicator lamps and monitored systems are functioning correctly within the IPC. The IPC provides a timed prove-out of some indicators while other indicators illuminate upon engine start up or have no prove-out. When the ignition is cycled on, the indicators illuminate to prove-out according to the following table:

Indicator	Indicator Type	Prove-Out Duration
Airbag	Warning	6 seconds
ABS	Warning	3 seconds
Brake	Informational	3 seconds
Diesel Exhaust Fluid	Informational	3 seconds
MIL	Informational	Engine start up
Safety belt	Informational	6 seconds if the safety belt is unbuckled, turns off when the safety belt is buckled
Stability –Traction control ESC	Warning	3 seconds
Stability –Traction control OFFESC OFF	Informational	3 seconds
TPMS	Warning	3 seconds

Dealer Test Mode

NOTE: *The table lists the displays as they appear when navigating using the down arrow button.*

To enter the IPC engineering test mode or dealer test mode, begin with the ignition OFF. Press and hold the RH steering wheel switch OK button. Place the ignition ON and continue to hold the button for 5-8 seconds until the display indicates Test or Gauge Sweep. Press the up or down arrow buttons to navigate through each of the display windows. To exit the IPC dealer test mode, press and hold the OK button for 5-8 seconds or place the ignition in OFF. Each down arrow button press advances the viewing window to the next set of items.

IPC Display	Description
– Engineering Test – Mode – – Use Right – Up/Down – to scroll screens	Initial entry display into the dealer test mode.
– ANALOG GAUGE – TEST	Carries out the gauge sweep of the analog gauges. When the sweep (zero to maximum then return to zero) is complete, the actual data is displayed.
– TELLTALE AND – COLOR TEST	Illuminates all cluster microprocessor controlled LED telltales or indicators. Also displays a color palette of boxes below the title.

– PartNo: xxxx-xx – Core: xxxx-xx – Cal#1: xxxx-xx – ECU S/W: xxxx-xx	Displays the IPC part number information.
– Man Date: xxxxxx – B&A Config Bytes – xx xx xx xx xx – xx xx xx xx xx	• Displays the manufacturing information. • Date in the format of YYMMDD. • B&A configuration bytes
– DTC: HIST CURR – xxxxxx x x – xxxxxx x x	Displays all of the Diagnostic Trouble Codes (DTCs) set (history and current Diagnostic Trouble Codes [DTCs]). An X in the HIST or CURR column means the DTC is active. Three Diagnostic Trouble Codes (DTCs) display on each screen. If more Diagnostic Trouble Codes (DTCs) are present, there will be additional screens listing them. If there are no Diagnostic Trouble Codes (DTCs) in history or current, the display will only be the title row.
– Vehicle Speed: – xxx.x km/h – xxx.x MPH – Tach: xxxx RPM	• **NOTE:** *These are the filtered values used to drive the gauge positions, not the actual positions.* Displays the digital representation of the speedometer gauge in mph and km/h.
– Inst Fuel: xxxx – FLPM: xxxx.xx	Displays the instant fuel level and filtered fuel level in percent. This is used for a single sender fuel level input.
– Inst Fuel1: xxxx – FLPM: xxxx.xx	Displays the instant fuel level and filtered fuel level in percent. This is used for the fuel pump assembly input on a dual sender fuel tank configuration.
– Inst Fuel2: xxxx – FLPM: xxxx.xx	Displays the instant fuel level and filtered fuel level in percent. This is used for the fuel level sensor input on a dual sender fuel tank configuration.
– DTE: Inst 01 Disp – km xxx xxx xxx – mi xxx xxx xxx	Displays the values used for calculating the DTE function.
– RAFE RAFE_01 – xxx.x xxx.x 1/100km – xxx.x xxx.x MPG – xxx.x xxx.x km/l	Displays the running average fuel economy. The values are derived from the DTE function.
– State Val #ofVS	Displays the key ON initialization, key OFF reference, and zero speed reference fuel level values in fuel level for a single sender fuel level input.

– Szero: xxxx xxxx – Off: xxxx xxxx – On: xxxx xxxx	
– State Val #ofVS – Szero1: xxxx xxxx – Off: xxxx xxxx – On: xxxx xxxx	Displays the key ON initialization, key OFF reference, and zero speed reference fuel level values in fuel level for the fuel pump assembly input on a dual sender fuel tank configuration.
– State Val #ofVS – Szero2: xxxx xxxx – Off: xxxx xxxx – On: xxxx xxxx	Displays the key ON initialization, key OFF reference, and zero speed reference fuel level values in fuel level for the fuel level sensor input on a dual sender fuel tank configuration.
– Coolant Temp (°C): – xxx	Displays the digital representation of the coolant temperature gauge indication in degrees Celsius.
– Odo cnts: xx – Trip A: xxxxx.x km – Trip A: xxxxx.x mi	Displays the values from the odometer count signal and the trip A statistics.
– Odo cnts: xx – Trip B: xxxxx.x km – Trip B: xxxxx.x mi	Displays the values from the odometer count signal and the trip B statistics.
• Fuel cnts: xxx • Fuel A: xxxxx.x l • Fuel A: xxxxx.x g	Displays the values of the fuel flow display signal from the PCM and the approximate fuel used for the trip stats A.
• Fuel cnts: xxx • Fuel B: xxxxx.x l • Fuel B: xxxxx.x g	Displays the values of the fuel flow display signal from the PCM and the approximate fuel used for the trip stats B.
– Battery: xx.xV – Compass: xx – Last Chime: xx	• Displays the current battery level. • Displays the compass direction. • Displays the number of the last chime sounded.
– Dim Step:	• Displays the first screen of dimming information.

xx – Dim Gauge: xxxxx – Dim Pointer: xxxxx	• Dim step is the dimming level. • Dim gauge is the internal illumination number for the gauge backlighting (1 to 10,000). • Dim pointer is the internal illumination number for the gauge pointer backlighting (1 to 10,000).
– Dim Step: xx – Dim PRNDL: xxxxx – Dim Display: xxxxx	• Displays the second screen of dimming information. • Dim step is dimming level. • Dim PRNDL is the internal illumination number for PRNDL backlighting (1 to 10,000). • Dim display is the internal illumination number for the display backlighting (1 to 10,000).
– PDS: x – LWS: x	Park detect switch (0 = open/not park, 1 = closed/park).
– HDC: x – TC: x	• LWS Low Washer fluid switch (1 is Empty, 0 if Full). • HDC switch (1 is Switch Pressed, 0 is not pressed). • TC ESP switch (1 is Switch Pressed, 0 is not pressed).
– Engineering Test Mode – – Use Right – Up/Down – to scroll screens	Repeats the test display cycle.

Analog Gauges

Fuel Gauge

The IPC sends a reference voltage to the fuel level sender(s). As the fuel level changes, a float actuates the variable resistor fuel level sender, raising or lowering the fuel level signal voltage. The IPC monitors the changes in voltage from both senders and commands the fuel gauge with a corresponding movement of the pointer.

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

The IPC uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sensor readings caused by fuel moving around in the tank), the fuel gauge takes approximately 40 minutes to go from empty (E) to full (F).

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions to be met:

- The ignition must be in the OFF mode when refueling the vehicle.
- At least 6% of the vehicle's fuel capacity must be added to the fuel tank.
- The IPC must receive a valid ignition ON fuel sensor reading within one second of the ignition being put into the RUN mode. The key ON sample readings are considered valid if the fuel sensor reading is between 10 ohms ± 2 ohms and 180 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

The key ON fueling mode (approximately 60 seconds to read empty [E] to full [F]) requires the following conditions be met:

- The transmission is in PARK (P) or NEUTRAL (N).
- The ignition is in the RUN mode.
- At least 6% of the vehicle's fuel capacity must be added to the fuel tank

In key ON fueling mode, a 30-second timer activates after the transmission is put into the PARK (P) or NEUTRAL (N) position. When the 30-second time has elapsed and at least 9% of the vehicle's fuel capacity has been added, the fuel gauge response time is 60 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P) or NEUTRAL (N), the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the ignition in the RUN mode.

Recovery mode is incorporated into the IPC strategy to recover from a missing fuel level input after a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sensor or its circuits. Recovery mode (empty [E] to full [F] approximately 17 minutes) is initiated when the following 2 conditions are met:

- The IPC is in the anti-slosh (default) mode.
- The actual fuel level in the tank is 5% different from what is being displayed by the fuel gauge.

Speedometer

The IPC receives the vehicle speed data from the GWM over the HS-CAN3. The GWM receives the vehicle speed message from the PCM over the HS-CAN1. The PCM receives the wheel speed data from the ABS module. The PCM uses tire size stored in the vehicle configuration file along with wheel speed inputs to generate a vehicle speed signal.

Tachometer

The IPC receives the engine RPM data message from the GWM over the HS-CAN3. The GWM receives the engine RPM data message from the PCM over the HS-CAN1.

Temperature Gauge

The IPC uses 2 messages to control the temperature gauge. The first is the engine coolant temperature data, which provides the current engine temperature input to the PCM. The second message is the engine overheat indication request, which is sent by the PCM to the IPC when an overheating condition exists. When the IPC receives the engine overheat indication request message, the IPC sends the temperature gauge to full hot and turns on the over-temperature warning indicator.

The IPC receives all the temperature gauge inputs from the GWM over the HS-CAN3. The GWM receives the engine coolant temperature data and the engine overheat indication request messages from the PCM over the HS-CAN1.

Virtual Gauges

The IPCprovides a tolerance that allows the speed indication to display between actual vehicle speed and 10% above vehicle speed. This means that with an actual vehicle speed of 100kmh the speedometer can indicate between 100 and 110. Incorrect axle ratio, tyre size or tyre size configuration can potentially affect the speedometer accuracy.

Fuel Gauge

The IPC sends a reference voltage to the fuel level sender(s). As the fuel level changes, a float actuates the variable resistor fuel level sender, raising or lowering the fuel level signal voltage. The IPC monitors the changes in voltage from both senders and commands the fuel gauge with a corresponding movement of the pointer.

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

The IPC uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

The default fuel gauge mode is called the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sensor readings caused by fuel moving around in the tank), the fuel gauge takes approximately 40 minutes to go from empty (E) to full (F).

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions to be met:

- The ignition must be in the OFF mode when refueling the vehicle.
- At least 6% of the vehicle's fuel capacity must be added to the fuel tank.
- The IPC must receive a valid ignition ON fuel sensor reading within one second of the ignition being put into the RUN mode. The key ON sample readings are considered valid if the fuel sensor reading is between 10 ohms ± 2 ohms and 180 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

The key ON fueling mode (approximately 60 seconds to read empty [E] to full [F]) requires the following conditions be met:

- The transmission is in PARK (P) or NEUTRAL (N).
- The ignition is in the RUN mode.
- At least 6% of the vehicle's fuel capacity must be added to the fuel tank

In key ON fueling mode, a 30-second timer activates after the transmission is put into the PARK (P) or NEUTRAL (N) position. When the 30-second time has elapsed and at least 9% of the vehicle's fuel capacity has been added, the fuel gauge response time is 60 seconds to read from empty (E) to full (F). When the transmission is shifted out of PARK (P) or NEUTRAL (N), the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the ignition in the RUN mode.

Recovery mode is incorporated into the IPC strategy to recover from a missing fuel level input after a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sensor or its circuits. Recovery mode (empty [E] to full [F] approximately 17 minutes) is initiated when the following 2 conditions are met:

- The IPC is in the anti-slosh (default) mode.
- The actual fuel level in the tank is 5% different from what is being displayed by the fuel gauge.

Tachometer

The IPC receives the engine RPM data message from the GWM over the HS-CAN3. The GWM receives the engine RPM data message from the PCM over the HS-CAN1.

Temperature Gauge

The IPC uses 2 messages to control the temperature gauge. The first is the engine coolant temperature data, which provides the current engine temperature input to the PCM. The second message is the engine overheat indication request, which is sent by the PCM to the IPC when an overheating condition exists. When the IPC receives the engine overheat indication request message, the IPC sends the temperature gauge to full hot and turns on the over-temperature warning indicator.

The IPC receives all the temperature gauge inputs from the GWM over the HS-CAN3. The GWM receives the engine coolant temperature data and the engine overheat indication request messages from the PCM over the HS-CAN1.

Indicators

Diesel Exhaust Fluid Indicator

The IPC provides a Diesel Exhaust Fluid Level Warnings indicator to indicate that Diesel Exhaust Fluid level is low on diesel vehicles equipped with SCR emissions system. The IPC receives the DEF message from the GWM over the HS-CAN3. The GWM receives the DEF message from the PCM over the HS-CAN1

Water in Fuel Indicator

The IPC provides a Water in Fuel indicator to indicate that there is water in the fuel system. The IPC receives the Water in Fuel message from the GWM over the HS-CAN3. The GWM receives the Water in Fuel message from the PCM over the HS-CAN1.

Frost Indicator

The IPC provides a Frost indicator to indicate when the roads may be slippery due to frost induced by very low ambient temperatures. It uses the outside air temperature message to determine ambient temperature and thus whether to set indicator. The IPC receives all the required messages from the GWM over the HS-CAN3. The GWM receives the outside air temperature messages from FCIM over HS-CAN1.

Hill Descent Control

The IPC provides a HDC indicator to indicate when the HDC is in ready mode, active control mode, or in an over temperature mode with the system cooling. The IPC receives all the required messages from the GWM over the HS-

CAN3. The GWM receives the HDC messages from ABS over HS-CAN2.

Door Ajar Indicator

The IPC provides a door ajar indicator along with message displays to indicate the status of the doors. The BCM monitors each of the ajar inputs (driver, passenger, left rear, right rear and liftgate) and sends a door ajar status message to the GWM over the HS-CAN1. The IPC receives the driver door ajar status messages from the GWM over the HS-CAN3 to display the door ajar indicator and corresponding warning message.

Wait to Start Indicator

Diesel engines. The IPC provides a Wait to Start indicator which when lit requests the driver to "wait to start" to allow the glow plugs to heat. The IPC receives the required messages from the GWM over the HS-CAN3. The GWM receives the wait to start messages from PCM over HS-CAN1. E100 engines. The IPC provides a Wait to Start indicator which when lit requests the driver to "wait to start" until the E100 fuel is heated by heaters in the fuel rail to where the vehicle will start. The IPC receives the required messages from the GWM over the HS-CAN3. The GWM receives the wait to start messages from PCM over HS-CAN1.

4WD Indicators

The IPC provides a 4WD Low and 4WD High indicators to indicate transmission status. It uses 4WD status display message to set the indicators. The IPC receives all the required messages from the GWM over the HS-CAN3 . The GWM receives the transmission messages from PCM over HS-CAN1.

Charge warning Indicator

The IPC provides a charging system indicator along with message displays indicating the status of the charging system. When a fault is present in the charging system, the BCM sends the battery low state of charge message to display message center warning messages and the charging system RTT indicator. The IPC receives the battery low state of charge message from the GWM over the HS-CAN3. The GWM receives the battery low state of charge message from the BCM over the HS-CAN1.

Oil Pressure Warning indicator

The IPC uses the oil pressure warning indicator request and engine RPM data to control the low oil pressure indicator. The engine oil pressure switch is hardwired to the PCM. The PCM provides the oil pressure warning indicator status request and the engine RPM data to the GWM over the HS-CAN1. The GWM provides the oil pressure warning indicator status request and engine RPM data to the IPC over the HS-CAN3. The IPC requires engine RPM above 400 RPM before the message center displays the low oil pressure warning.

Fog Lamp Indicator Front

The IPC provides a Front Fog Lamp indicator to indicate when the Front Fog Lamp is on. The IPC receives all the required messages from the GWM over the HS-CAN3. The GWM receives the Front Fog Lamp message from BCM over HS-CAN1.

Fog Lamp Indicator Rear

The IPC provides a Rear Fog Lamp indicator to indicate when the Rear Fog Lamp is on. The IPC receives all the required messages from the GWM over the HS-CAN3. The GWM receives the Rear Fog Lamp message from BCM over HS-CAN1.

Engine Coolant Warning indicator

The IPC provides an indicator to alert the driver the engine is over temperature. The IPC receives the engine overheat indication request and the engine coolant temperature data from the GWM over the HS-CAN3. The GWM receives the engine overheat indication request and the engine over-temperature message from the PCM over the HS-CAN1.

E Locker indicator

The IPC provides an elocker indicator to indicate current elocker status. It uses 4WD status display message to set the indicator. The IPC receives all the required messages from the GWM over the HS-CAN3. The GWM receives the transmission messages from PCM over HS-CAN1.

ABS Warning Indicator

The IPC receives the ABS warning indicator request message from the GWM over the HS-CAN3. The GWM receives the ABS warning indicator request message from the ABS module over the HS-CAN2. If a fault condition exists in the ABS, the ABS module sends the ABS warning indicator request message to either flash or illuminate the ABS warning indicator.

Refer to ABS/Brake/Stability-Traction Control System Indication description for information on the conditions when

the ABS warning indicator is turned on.

ABS/Brake/Stability-Traction Control System Indication

The brake/stability-traction control system indication is controlled almost entirely by the ABS module. The ABS module can illuminate multiple indicators for various fault conditions. The following table provides a summary of the basic fault conditions and the indicators that are illuminated for each condition.

NOTE: *Refer to the Normal Operation and Fault Condition description before each brake/stability-traction control system indicator Pinpoint Test (PPT) for the IPC default action for network/missing message conditions.*

Event/Fault Condition	ABS Warning Indicator Status	Brake Warning Indicator Status	Stability-Traction Control Indicator Status	Stability-Traction Control Disabled Indicator Status
Parking brake applied	Off	• Flashing while applying • On when applied	Off	Off
Low brake fluid level or brake fluid level input concern	Off	On	Off	Off
Stability-traction control event	Off	Off	Flashing	Off
Stability-traction control disabled by driver	Off	Off	Off	On
Single wheel speed sensor faults	On	On	On	On
2 wheel speed sensor faults on the same axle or 3 wheel speed sensor faults	On	Flashing or on	On	On
HCU valve fault	On	On	On	On
ABS module fault	On	Flashing or on	On	On
HCU pressure sensor fault (master cylinder pressure input)	Off	On	On	On
ABS battery voltage faults	On	Flashing or on	On	On
ABS pump motor fault	On	On	On	On
ABS low brake booster vacuum or vacuum sensor fault	Off	On	Off	Off
Steering wheel angle sensor center not found fault	Off	On	On	On
ABS to CAN total failure	• Off (4x2) • On (4x4)	Off	On	On
Thermal shutdown to brake over-temperature condition	Off	Off	Off	Off
Parking brake switch fault	Off	Flashing	Off	Off
Configuration mismatch	Off	Off	Off	Off
VIN mismatch	On	On	On	On
ACC and ABS both active	Off	Off	Flashing	Off

Airbag Warning Indicator

The IPC receives the airbag warning indicator request from the GWM over the HS-CAN3. The GWM receives the airbag indicator request from the RCM over the HS-CAN2. If a SRS concern is detected, the RCM sets a DTC and the IPC illuminates the airbag warning indicator.

Auto Stop/Start Indicator

The auto stop/start indicator informs the driver of the following states:

- Solid green - the auto stop/start feature has temporarily turned off the engine.
- Solid amber - a stop/start system concern exists.
- Flash in either green or amber - system state as determined by the PCM.

The IPC receives the stop/start standby request from the GWM over the HS-CAN3. The GWM receives the auto stop/start standby request from the PCM over the HS-CAN1.

Brake Warning Indicator

The brake warning indicator informs the driver the brake fluid level is low, there is a failure in the base brake system or the park brake is applied. The IPC uses 3 messaged inputs to control the brake warning indicator.

- Brake (red) warning indicator request
- Brake fluid level low message request
- Parking brake (red) indicator request

The IPC receives the brake (red) warning indicator request, the brake fluid level low message request and the parking brake (red) indicator request messages from the GWM over the HS-CAN3.

The GWM receives the brake (red) warning indicator request and the parking brake (red) indicator request from the ABS module over the HS-CAN2.

The GWM receives the brake fluid level low message request from the BCM over the HS-CAN2.

Refer to ABS/Brake/Stability-Traction Control System Indication description for information on the conditions when the brake warning indicator is turned on.

High Beam Indicator

The high beam indicator informs the driver that the high beams are on. The IPC receives the high beam status message from the GWM over the HS-CAN3. The GWM receives the high beam status message from the BCM module over the HS-CAN1.

LH/ RH Turn Signal/Hazard Indicator

When the multifunction switch is in the LH or RH turn position or if the hazard switch is on, the BCM sends the turn indication request to the GWM over the HS-CAN1. The GWM sends the turn indication request to the IPC over the HS-CAN3. Upon receipt of the applicable turn signal on/off message, the IPC flashes the turn signal indicator on and off.

Lights On Indicator

When the parking lamps are turned on, the BCM sends the parklamp status message to the GWM over the HS-CAN1. The IPC receives the parklamp status message from the GWM over the HS-CAN3 to illuminate the lights on indicator.

MIL

The IPC receives the MIL request from the GWM over the HS-CAN3. The GWM receives the MIL request from the PCM over the HS-CAN1.

PRNDL Indicator

The IPC uses the following messages to control the PRNDL:

- Battery shed level request
- Ignition status
- Transmission gear display
- Transmission shift mode display
- Transport mode
- Vehicle speed

The IPC receives all messaged inputs from the GWM over the HS-CAN3.

The GWM receives the transmission gear display, transmission shift mode display and vehicle speed messages from the PCM over the HS-CAN1.

The GWM receives the ignition status, transport mode and battery shed level request messages from the BCM over the HS-CAN1.

When the vehicle is in transport mode or during battery load shed operation, the PRNDL is not displayed upon entry or exit from the vehicle to prevent battery drain during longer periods of time when the vehicle is not in use, such as those experienced during vehicle transport.

The IPC also uses a park position detect switch (part of the selector lever) input to signal the IPC the shift lever is fully seated in the PARK (P) position. The IPC compares the park position detect switch input with the transmission gear display message sent from the PCM.

Safety Belt Warning Indicator

The RCM monitors the driver safety belt position through the driver safety belt buckle switch. The RCM provides the driver safety belt buckle status message to the GWM over the HS-CAN2. The GWM provides the driver safety belt status message to the IPC over the HS-CAN3 to either turn on or turn off the safety belt warning indicator.

Stability-Traction Control Indicator (Sliding Car Icon)ESC

The stability-traction control indicator (sliding car icon) informs the driver of the current status of the stability and traction control systems. The stability-traction control indicator illuminates when a fault condition exists or when an active traction control or stability control event is occuring. The IPC receives the stability-traction control indicator request message from the GWM over the HS-CAN3. The GWM receives the stability-traction control indicator request message from the ABS over the HS-CAN2.

Refer to ABS/Brake/Stability-Traction Control System Indication description for information on the conditions when the stability-traction control indicator (sliding car icon) is turned on. Refer to: (206-09 Anti-Lock Brake System (ABS) and Stability Control)

> Anti-Lock Brake System (ABS) and Stability Control - System Operation and Component Description (Description and Operation).

Stability-Traction Control Disabled Indicator (Sliding Car OFF Icon)ESC OFF

The Stability-Traction control (ESP) is configured on/off from the console mounted switch. When the driver enables or disables the stability-traction control system, the ABS module sends the traction control mode message to the GWM over the HS-CAN2. The GWM sends the traction control mode message to the IPC over the HS-CAN3 to illuminate or turn off the stability-traction control disabled indicator (sliding car OFF icon) based upon the system state.

Refer to ABS/Brake/Stability-Traction Control System Indication description for information on the conditions when the stability-traction control disabled indicator (sliding car OFF icon) is turned on.

When a MyKey® administrator has set the AdvanceTrac® feature to always on and a MyKey® programmed key is in use, the stability-traction control system cannot be disabled. The menu selection in the message center used to disable the stability-traction control system does not display when a MyKey® is in use, but remains active for the MyKey® administrator to select the AdvanceTrac® always on feature off. The stability-traction control indicator still functions normally to indicate a stability-traction control system fault and a stability-traction control active event.

TPMS Warning Indicator

The IPC receives the tire pressure warning indicator message from the GWM over the HS-CAN3. The GWM receives the tire pressure warning indicator message from the BCM over the HS-CAN1.

If the BCM determines the tire pressure has exceeded the low tire pressure limits, the tire pressure warning indicator request message is sent to the IPC to illuminate the TPMS warning indicator.

If a TPMS monitor or sensor fault condition exists, the BCM sends the tire pressure warning indicator request message to the IPC to flash the TPMS warning indicator. The IPC flashes the TPMS warning indicator for 75 seconds then turns the indicator on solid.

Component Description

Brake Fluid Level Switch

The brake fluid level switch is mounted in the master cylinder reservoir and is hardwired to the BCM through a signal circuit. The brake fluid level switch is grounded through a separate body ground circuit. The BCM provides a reference voltage to the brake fluid level switch. When the brake fluid level is low the switch closes, pulling the reference voltage low. When the brake fluid level is high, the switch opens, sending the reference voltage high on the signal

circuit to the BCM.

Fuel Level Sender

The fuel level sender is mounted to the fuel pump assembly or the fuel level sensor. The fuel level sender is a dual sweep potentiometer style resistor connected to a float mechanism. The dual sweep design provides a second resistance measurement that reduces the intermittent loss of data due to corrosion between the resistor wires and the sweep arm. As the fuel level changes, the float rises or falls with the fuel level moving the sweep arm across the resistor wires. This movement either increases or decreases the resistance through the unit. The fuel level sensor for Diesel and Petrol fuels resistance ranges from 300 ohms ± 4 ohms at empty (E) to 10 ohms ± 2 ohms at full (F). The fuel level sensor for Flex fuel (E100) resistance ranges from 500 ohms ± 4 ohms at empty (E) to 50 ohms ± 2 ohms at full (F). When the fuel level is low, the fuel level sensor resistance is high. When the fuel level is high, the fuel level sensor resistance is low. The fuel level sensor is hardwired to the IPC through separate signal and return circuits. .

Both the fuel pump assembly and fuel level sensor are hardwired to the IPC through separate signal and return circuits. The fuel level return circuits are grounded internally in the IPC. The IPC provides a reference voltage on the fuel level signal circuit. As the fuel level changes, the change in resistance raises or lowers the fuel level signal voltage depending on the resistance of the fuel level sender.

IPC

The IPC provides the driver with a system status and alerts the driver when certain conditions exist in the vehicle. The IPC receives the ignition status from the BCM through the GWM over the HS-CAN3.

The IPC requires PMI when the IPC is replaced. The IPC lens and mask assembly are replaceable as an assembly.

Oil Pressure Switch

The oil pressure switch is a normally open switch that is hardwired to the PCM through a single signal circuit. The ground is provided by the switch housing when it is mounted on the engine. The PCM provides a reference voltage to the oil pressure switch. When oil pressure is low, the oil pressure switch remains open, sending the reference voltage high. When the oil pressure is sufficient, the oil pressure switch closes, pulling the reference voltage low to the PCM.

Park Position Detect Switch

The park position detect switch is hardwired to the IPC through a single signal circuit and is grounded by a separate circuit through the selector lever. The IPC provides a reference voltage to the park position detect switch. When the selector lever is in PARK (P), the park position detect switch closes to ground, pulling the reference voltage low. When the selector lever is moved out of PARK (P), the park position detect switch opens to ground, sending the reference voltage high to the IPC.

Safety Belt Buckle Sensor

The safety belt buckles contain integrated sensors that are Hall-effect switches. The safety belt buckle sensors are serviced as one component with the safety belt buckle.

Copyright © 2016 Ford Motor Company

Message Center - Overview

Overview

The message center is an integral part of the IPC that receives and acts upon much of the same information that is input and used to operate the IPC (gauges, informational indicators, and warning indicators). The message center uses both hardwired and network-based inputs to receive information. The message center functionality is controlled through the message center switch (part of the LH steering wheel switch for LHD vehicles, and RH steering wheel switch for RHD vehicles).

Whenever conditions are present that require a warning message, the message center replaces the last selected display with the new warning display. Once the message is reset or cleared, the message center returns to the last selected display. If multiple warnings are present, the message center rotates through the messages, displaying each warning for approximately 4 seconds. Warning messages are also generally associated with other observable outputs of the IPC (gauges, informational indicators and RTT (message center) indicators). For example, when the BCM detects a low brake fluid condition, the BCM sends the IPC a request through the GWM to illuminate the brake warning indicator and a request to display the LOW BRAKE FLUID message in the message center. This allows the message center to be a more informative supplement to the IPC gauges and indicators.

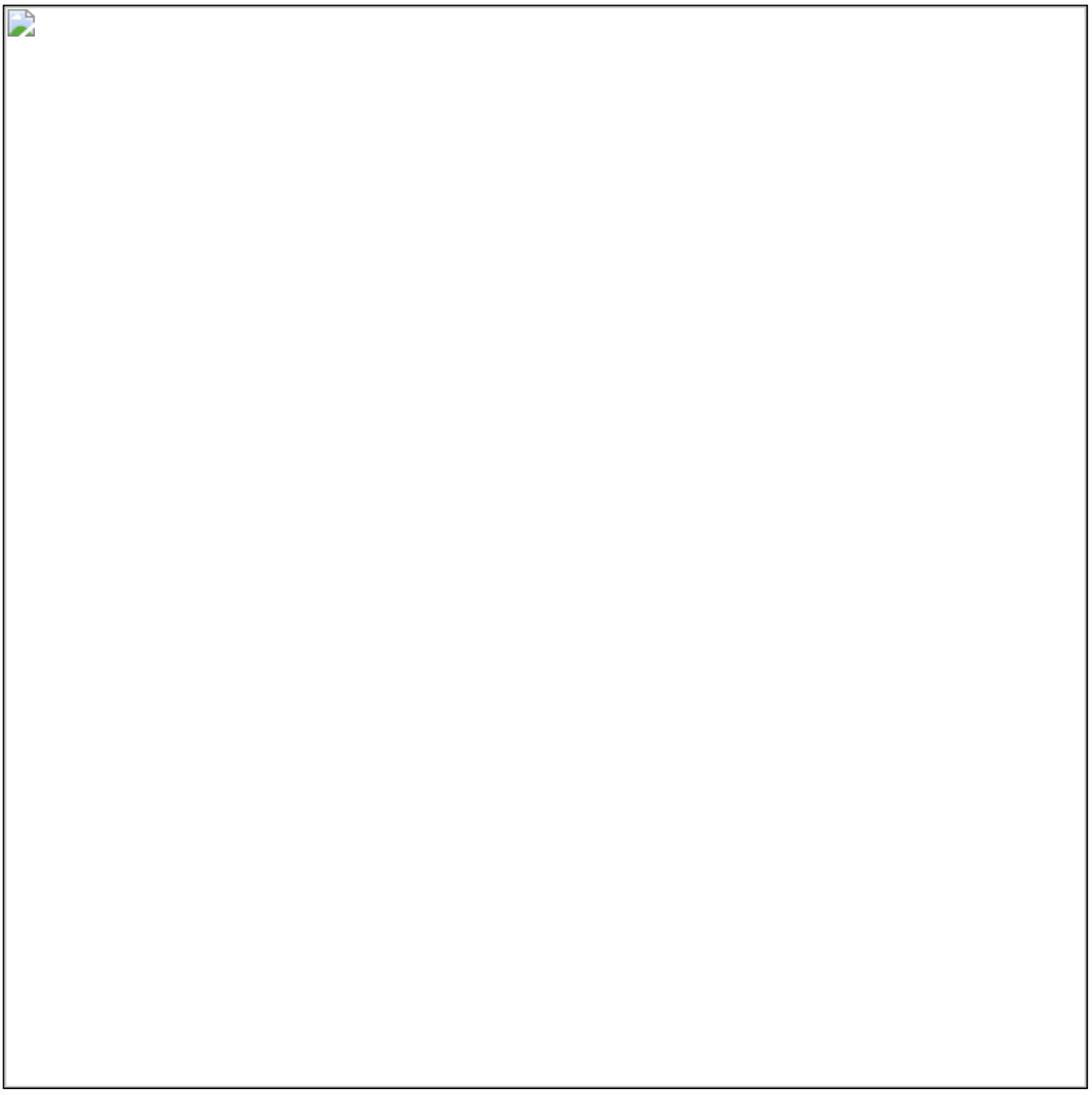
The system warning messages alert the operator to possible concerns or malfunctions in the vehicle operating systems. System warning messages can be stand-alone messages, but are often associated with another form of indication, such as a gauge or an indicator. The message center displays the last selected feature if there are no additional warning messages. Once a warning message has been displayed, the message must be acknowledged to allow full functionality of the message center by pressing the OK button to acknowledge and clear the warning message. For a complete list of warning messages displayed, refer to the message center section of the Owner's Literature.

Copyright © 2016 Ford Motor Company

Message Center - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Adaptive cruise control warning request	CCM	Input used to display the adaptive cruise control warning messages.
Ambient air	FCIM	Filtered input used to display the outside air temperature.

temperature filtered		
Auto high beam indication request	IPMA	Input used to control the auto high beam RTT indicator.
4WD service required	PCM	Input used for the AWD component to control the powertrain malfunction (wrench) RTT indicator.
4WD status display	PCM	Input used to display the AWD messages.
Battery low state of charge	BCM	Input used to control the charging system RTT indicator, check charging system warning message and load shed messages.
Body service required request	BCM	Input used for the BCM controlled system faults input to control the powertrain malfunction (wrench) RTT indicator.
Brake fluid level low message request	BCM	Input used to display the low brake fluid level message center message and the electronic parking brake fault message.
Brake (red) warning indicator request	ABS module	Input used to display the message center brake system messages and to display the electronic parking brake message center warning messages.
Camera status	IPMA	Input used to display the lane keeping system camera malfunction message.
Check fuel fill inlet message request	PCM	Input used to display the check fuel fill inlet message.
Child lock message display request	BCM	Input used to display the child lock system fault message.
Cruise control set speed	PCM	Input used to indicate the cruise control set speed and the digital speedometer displayed in the message center.
Cruise control status	PCM	Input used to control the cruise control RTT indicator and message display based on the system status.
Cruise control override	PCM	Input used to control the adaptive cruise control set speed display when the cruise control is overridden by the driver.
Driver door ajar status	BCM	Input used for the door ajar RTT indicator, driver door ajar warning message, engine on warning message (push button start) and the PRNDL not in park warning message.
EPAS failure	PSCM	Input used to control the service power steering message display.
Engine coolant temperature data	PCM	Input used to control the over-temperature RTT indicator and engine over-temperature warning message.
Diesel Exhaust Fluid Status	PCM	Input used to display diesel exhaust fluid RTT and warnings which indicate low fluid levels or system errors.
Diesel Warnings	PCM	Input used to display diesel specific warnings including low fuel pressure, reduced power, and exhaust over temp.
Dimming Level	BCM	Input used to determine the illumination level that should be displayed.
Front Camera Malfunction	IPMA	Input used to indicate faults with the front camera module
Engine oil life	PCM	Input used for the oil life display.
Engine overheat indication request	PCM	Input used to control the engine over-temperature RTT indicator and engine over-temperature warning message.
Engine rpm data	PCM	Input used to control the low oil pressure RTT indicator and low engine oil pressure warning message. Input is also used to calculate the Average Fuel Economy (AFE)

		and DTE.
Engine service required request	PCM	Input used for the powertrain Electronic Throttle Control (ETC) component to control the powertrain malfunction (wrench) RTT indicator.
Forward collision warning message request	CCM	Input used to display the forward collision malfunction messages.
Fuel flow volume display	PCM	Input used to calculate the Average Fuel Economy (AFE) and DTE.
GPS compass direction	GPSM	Input used to display the current compass heading.
Hill start assist status	ABS module	Input used to display the hill start status messages.
Ignition key type	BCM	Input used to calculate the Average Fuel Economy (AFE) and DTE for MyKey® settings.
Ignition status	BCM	Ignition RUN, START and accessory states required for the IPC operating modes and fault reporting. Also used to display the PRNDL not in park warning message.
Immobilizer message request	BCM	Input used to display the passive entry (no key detected, place key in backup slot, restart now, key programming and accessory power active).
Lane keeping system status display	IPMA	Input used to control the lane keeping system off RTT indicator and the lane keeping system fault messages.
Hill Descent Control	ABS	Input used to display hill descent control warnings.
Lane keeping system hands off display	IPMA	Input used to display the lane keeping system keep hands off the steering wheel warning message.
Left rear door ajar status	BCM	Input used for the door ajar RTT indicator and the left rear door ajar warning message.
Odometer count	PCM	Input used to display the odometer and to calculate the Average Fuel Economy (AFE) and DTE.
Oil pressure warning indicator status	PCM	Input used to control the oil pressure RTT indicator and the low oil pressure message center warning.
Parking aid rear status	PAM	Input used to display the parking aid malfunction message.
Parking brake chime request	BCM	Input used to display the message center brake system messages.
Parking brake message request	ABS module	Input used to display the electronic parking brake status messages.
Parking brake (red) indicator request	ABS module	Input used to display the electronic parking brake status messages.
Passenger door ajar status	BCM	Input used for the door ajar RTT indicator and the passenger door ajar warning message.
Perimeter alarm chime request	BCM	Input used to display the perimeter alarm message when the vehicle is entered before deactivating the perimeter alarm.
Powertrain cooling message request	PCM	Input used to display the reduced power to cool the engine on the Gasoline Turbo Direct Injection (GTDI) engines.

Rear belt monitor	RCM	Input used to display rear belt monitor status.
Remote start status	BCM	Input used to control the remote start informational message display.
Right rear door ajar status	BCM	Input used for the door ajar RTT indicator and the right rear door ajar warning message.
Starting system fault message request	PCM	Input used to display starting system messages.
Stability-traction control chime request	ABS module	Input used to control the service AdvanceTrac® and traction control off warning displays. Also used to control the traction control on/off status messages.
Steering wheel lock message request	BCM	Input used to control the steering wheel lock system messages.
Steering wheel message center switch data	SCCM	Input used to control the message center navigation and functions.
Stop/start message request	PCM	Input used to control the auto stop/start RTT and message displays.
Tire pressure system status	BCM	Input used to display specific tire training instructional messages and TPMS fault messages.
Trailer sway status	ABS module	Input used to display the trailer sway event in progress message.
Transmission shift mode actual	PCM	Input used to display the PRNDL not in park warning message and the engine on message (push button start).
Transmission service required	PCM	Input used for the transmission component to control the powertrain malfunction (wrench) RTT indicator.
Transport mode	BCM	Input used to indicate whether the vehicle is set in factory mode or transport mode, display the PRNDL not in park warning message and to display the appropriate message and power down items such as the PRNDL at key off to conserve the battery.
Vehicle dynamics SOS	ABS module	Input used to control the spin-out detected message.
Vehicle speed	PCM	Input used to display the PRNDL not in park warning message and the engine on warning message (push button start). Input is also used to calculate the Average Fuel Economy (AFE) and DTE.
Transmission gear display	TCM	Transmission gear selection input used for the PRNDL display.
Transmission gear lever position	TCM	Input used to display the manual (M) in the PRNDL.
Transmission message request	TCM	Input used to display transmission related messages.
Transmission malfunction	PCM/ TCM	Input used to illuminate check engine lamp or wrench.
Transmission Overheating	PCM/ TCM	Transmission is overheating and needs to cool.
Transmission too hot	PCM/ TCM	Transmission is getting hot. Stop to let cool.
Transmission	PCM/ TCM	Transmission is overheated and has limited functions.

Limited Function		
Transmission Warming Up Please Wait	PCM/ TCM	Transmission too cold. Wait for it to warm up.
Transmission Not in Park	PCM/ TCM	Shift to park.
Transmission Adjusted	PCM/ TCM	Transmission has adjusted shift strategy
Transmission Adapt Mode	PCM/ TCM	Transmission has adjusted shift strategy
Transmission Indicate Mode Lockup On	PCM/ TCM	Transmission shift lever is locked and unable to select gear
Transmission Indicate Mode Lockup On	PCM/ TCM	Transmission shift lever is unlocked and free to select gear

Module Network Input Messages - PCM

Broadcast Message	Originating Module	Message Purpose
Engine oil life data reset	IPC	Input used to reset the oil life.

Message Center Displays

Compass Display

On the IPC, the compass is displayed as a 1 or 2 character display in the message center that indicates the current direction of the vehicle (N, NE, E, SE, S, SW, W, or NW). The IPC receives the GPS compass direction from the GWM over the HS-CAN3. The GWM receives the GPS compass direction from the GPSM over the MS-CAN.

Digital Speedometer

NOTE: *The digital speed displayed can differ slightly from the analog speedometer due to stepper motor-pointer movement, indication tolerances and gauge bias.*

The IPC provides a redundant digital speedometer display in the message center. The digital speedometer display operates using the same vehicle speed inputs used to control the analog speedometer. See Speedometer. The IPC utilizes software that modifies the display to account for differences between the speedometer gauge indication and the digital display resulting from built in biasing of the indication and tolerances in speedometer stepper motor/needle movement.
Refer to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .

DTE/Average Fuel Economy (AFE)

The DTE is calculated in the IPC using the Running Average Fuel Economy (RAFE), which is the fuel economy over the last 480 km (300 miles), and the fuel level input from the fuel sender(s) to determine how many miles the vehicle can be driven based on the remaining fuel in the tank. The DTE can vary in the short term by up to 50 miles, but is usually within 10 miles. Even if the fuel economy is relatively constant, the DTE can be off over a 50 mile range by -24% to +38%. The DTE display and the fuel gauge both use the fuel level input from the fuel tank to provide their respective functions. If the fuel gauge doesn't function correctly, both the fuel gauge and the DTE display are affected.

The IPC defaults to a preset baseline mpg when the battery is initially connected and changes based on driving habits and conditions.

NOTE: *The actual DTE can be higher or lower than the DTE displayed in the message center due to changes in driving conditions. It is important to understand how the DTE is calculated and the factors that impact the DTE display when determining how to address any DTE concerns.*

Since the DTE is calculated and averaged over a longer period of time (480 km [300 miles]), varying driving conditions can have a significant impact on the current or short term DTE as opposed to the displayed DTE. This difference often leads to customer complaints of incorrect or invalid DTE. The following list provides some (not all) of the driving conditions that may lead to an incorrect or fluctuating DTE concern:

- Changing between towing/not towing
- Changing driving between city and highway
- Allowing the vehicle to idle for long periods of time
- Using the remote start feature frequently to allow the vehicle to warm up, particularly when parked on a grade
- Parking or driving on grades
- Inconsistent use of gasoline or E85 fuels
- Over-fueling or not filling the tank completely (partial refueling)

To better illustrate the affects of how driving conditions can affect DTE, refer to the following 2 examples. The first example below illustrates how the following observations are normal and expected since the low fuel reminder is triggered from a fuel volume and not from a fixed distance to empty.

- If while driving, the low fuel reminder (low fuel indicator and low fuel warning message) displays when the DTE equals 94.4 km (59 miles) and the driver adds 11.36 L (3 gallons) of fuel, the new DTE may become 124.8 km (78 miles). After continued driving, the low fuel reminder may now display when the DTE equals 83.2 km (52 miles).

The second example (below) illustrates what occurs when idling on an incline. In this example, the customer should be made aware of how the condition will correct after a few minutes of idling on a level surface.

- If the customer stops and parks the vehicle on an incline in a driveway, then in the morning remote starts the vehicle, allowing the engine to idle, the DTE may now equal 184 km (115 miles). As the customer drives, the low fuel reminder displays when the DTE equals 148.8 km (93 miles). Finally, after 5 more minutes of driving, the DTE is back to 80 km (50 miles).

Factory-Transport Mode Display

During vehicle build, some modules, such as the IPC and the BCM, are set in factory mode. While in the factory mode the IPC displays FACTORY MODE CONTACT DEALER in the message center. If the vehicle is set in factory mode, the system does not automatically exit the mode and must be manually set to either the transport or normal operation mode.

When the vehicle build is complete, the vehicle is set to transport mode. While in transport mode, the IPC displays TRANSPORT MODE CONTACT DEALER in the message center. Transport mode is used to reduce the drain on the battery during longer periods where the vehicle is not used. Various systems may be altered or are disabled when in the transport mode. The vehicle automatically reverts to normal operation mode after being driven 80 km (50 mi).

The IPC receives the transport mode message from the GWM over the HS-CAN3. The GWM receives the transport mode message from the BCM over the HS-CAN1.

Lane Keeping System

The lane keeping system combines the lane keeping alert and lane keeping aid systems. The lane keeping alert system alerts the driver of unintentional drifting outside of the lane and the lane keeping aid system corrects the vehicle steering to keep the vehicle in the center of the lane. The IPC provides a lane keeping display as an overhead view of the vehicle in the middle of a lane with right and left lane markers to indicate the vehicle position with relation to the lane markings as well as overlay or popup messages to alert the driver when they are drifting out of their lane. The lane markers change color to indicate the condition associated with a specific condition and action or warning as controlled by the lane keeping system. The IPC also provides a lane keeping system message center off indicator to inform the driver that the lane keeping system is turned off. When the lane keeping system is turned off, the IPC turns on the lane keeping system RTT and turns off the lane keeping system display.

The IPC receives the camera status, lane keeping system status display and the lane keeping system hands off display messages from the GWM over the HS-CAN3.

The GWM receives the lane keeping system status display, the lane keeping system hands off display and camera status messages from the IPMA over the HS-CAN2.

MyKey® Function Displays

The IPC provides message center displays for the MyKey® feature. MyKey® displays are controlled through the IPC software based on the MyKey® settings configured through the message center and the type of key in use (MyKey® or administrator key). The MyKey® function also uses other messages received by the IPC for other indications such as vehicle speed for speed limiter displays.

Odometer

The IPC receives the odometer count message from the GWM over the HS-CAN3. The GWM receives the odometer count from the PCM over the HS-CAN1. The IPC monitors the odometer count input from the GWM and commands the odometer with a digital display in the message center.

Oil Life Message Center Display

The IPC provides message center messages to inform the driver about the oil life status and when an oil change is required. The duration of the interval between oil changes is calculated in the PCM and varies due to driving conditions. The PCM assumes a base mileage of 16,090 km (10,000 mi) or 1 year for normal driving. However, this number is adjusted down for conditions such as high engine temperature, high engine rpm, use of flex fuel and possibly low oil level. The PCM calculates and provides the engine oil life percent message to the IPC. The oil change minder can be reset at any time by the driver.

The PCM receives the engine oil life data reset request from the GWM over the HS-CAN1. The GWM receives the engine oil life data reset request from the IPC over the HS-CAN3.

The IPC receives the engine oil life message from the GWM over the HS-CAN3.

The GWM receives the engine oil life message from the PCM over the HS-CAN1.

Outside Air Temperature

The Ambient Air Temperature (AAT) sensor is hardwired to the PCM through separate input and return circuits. The PCM provides a reference voltage to the Ambient Air Temperature (AAT) sensor and monitors the change in voltage resulting from changes in resistance as determined by outside air temperature.

The PCM sends the ambient air temperature data to the GWM through the HS-CAN1. The GWM sends the ambient air temperature message to the HVAC (part of the FCIM) over the MS-CAN. The FCIM filters the data and sends the ambient air temperature filtered data back to the GWM over the MS-CAN. The GWM sends the ambient air temperature filtered message to the IPC over the HS-CAN3.

The FCIM is programmed to update the messaged outside temperature data at different rates depending on several criteria to prevent false temperature displays due to a condition known as heat soaking. Heat soaking is where the outside air temperature is hotter in the location of the Ambient Air Temperature (AAT) sensor than the actual outside air temperature.

The outside air temperature display update strategy requires a starting temperature to update from. This starting temperature is controlled based on the length of time the engine is off and the engine temperature. When the engine has been off for longer than 6 hours, the update strategy begins with the unfiltered ambient air temperature input to the PCM. If the engine has been off for less than 6 hours, and the engine coolant temperature is less than 49° C (120° F), the update strategy begins with the filtered ambient air temperature equal to the unfiltered ambient air temperature. If the engine has been off for less than 6 hours, and the engine coolant temperature is greater than 49° C (120° F), the update strategy begins at the stored previous outside air temperature value.

When the sensed outside temperature rises and the vehicle speed is above 33 km/h (21 mph), the outside air temperature display updates after approximately 90 seconds. As the vehicle speed increases, the outside air temperature display updates at a faster rate that is proportional to the increase in vehicle speed. Once the vehicle speeds exceeds 81 km/h (50 mph), the display updates without any delay. If the vehicle speed drops below 33 km/h (21 mph), the update delays reset. When the sensed outside temperature drops, the display updates more quickly following the drop experienced by the Ambient Air Temperature (AAT) sensor.

TPMS

The IPC receives the tire pressure system status message from the GWM over the HS-CAN3. The GWM receives the tire pressure system status message from the BCMB over the HS-CAN1.

RTT Indicators

Auto High Beam

The IPC provides the auto high beam RTT to inform the driver the auto high beam function is turned on and the high beam status may automatically change. The IPC receives the auto high beam indication request from the GWM over the HS-CAN3. The GWM receives the high beam indication request from the IPMA over the HS-CAN2.

Auto Stop-Start

The IPC provides the auto stop-start RTT along with multiple messages displayed at various times throughout the auto stop-start system operation to inform the driver of the system status and to provide direction for the driver intervention required. The IPC receives the stop-start standby indicator message from the GWM over the HS-CAN1. The GWM receives the stop-start standby indicator message from the PCM over the HS-CAN3.

The auto stop-start indicator informs the driver of the following states:

Indicator Status	System Status
Solid green	The auto stop-start feature has temporarily turned off the engine.
Solid amber	A stop-start system concern exists.
Flash in either green or amber	A system state as determined by the PCM.
Grayed out	Indicates the auto stop-start feature is not available.

The IPC receives the stop/start indicator request from the GWM over the HS-CAN3. The GWM receives the auto stop/start indicator request from the PCM over the HS-CAN1.

Charging System

The IPC provides a charging system RTT indicator along with message displays indicating the status of the charging system. When a fault is present in the charging system, the BCM sends the battery low state of charge message to display message center warning messages and the charging system RTT indicator.

The IPC receives the battery low state of charge message from the GWM over the HS-CAN3. The GWM receives the battery low state of charge message from the BCM over the HS-CAN1.

Cruise Control

The IPC uses the following messaged inputs to control the cruise control RTT indicator:

- cruise control status
- cruise control set speed
- cruise control override

The IPC receives the cruise control messages from the GWM over the HS-CAN3. The GWM receives the cruise control messages from the PCM over the HS-CAN1.

Door Ajar

The IPC provides a door ajar RTT along with message displays to indicate the status of the doors. The BCM monitors each of the ajar inputs (driver, passenger, left rear, right rear and liftgate) and sends a door ajar status (driver door ajar status, passenger door ajar status, left rear door ajar status, right rear door ajar status or liftgate ajar status) message to the GWM over the HS-CAN1. The IPC receives the driver door ajar status, passenger door ajar status, left rear door ajar status, right rear door ajar status or liftgate ajar status messages from the GWM over the HS-CAN3 to display the specific ajar RTT and corresponding warning message.

Engine Over-Temperature

The IPC provides a message center warning indicator to alert the driver the engine is over temperature. The IPC receives the engine overheat indication request and the engine coolant temperature data from the GWM over the HS-CAN3. The GWM receives the engine overheat indication request and the engine over-temperature message from the PCM over the HS-CAN1.

Lane Keeping System Off

The IPC provides the lane keeping system off RTT to indicate the lane keeping system has been turned off or is disabled due to a fault condition. The IPC receives the lane keeping system status display message from the GWM over the HS-CAN3. The GWM receives the lane keeping system status display message from the IPMA over the HS-CAN2.

Elocker

The IPC provides a RTT to indicate current elocker status. It uses 4WD status display message to set RTT. The IPC receives all the required messages from the GWM over the HS-CAN3. The GWM receives the transmission messages from PCM over HS-CAN1.

Frost Indication

The IPC provides a RTT to indicate when the roads may be slippery due to frost induced by very low ambient

temperatures. It uses the outside air temperature message to determine ambient temperature and thus whether to set RTT. The IPC receives all the required messages from the GWM over the HS-CAN3. The GWM receives the outside air temperature messages from FCIM over HS-CAN1.

Low Fuel

To supplement the fuel gauge indication, the IPC provides the low fuel message center warning indicator. When the fuel level reaches approximately 1/16 tank or 1/8 tank for MyKey® users, the IPC turns on the low fuel message center warning indicator.

Low Oil Pressure

The IPC uses the oil pressure warning indicator request and engine rpm data to control the low oil pressure indicator. The engine oil pressure switch is hardwired to the PCM. The PCM provides the oil pressure warning indicator status request and the engine rpm data to the GWM over the HS-CAN1. The GWM provides the oil pressure warning indicator status request and engine rpm data to the IPC over the HS-CAN3. The IPC requires engine rpm above 400 rpm before the message center displays the low oil pressure RTT.

Low Washer Fluid Level

The low washer fluid level switch is hardwired to the IPC through a single signal circuit and is grounded through a separate ground circuit. The IPC provides a reference voltage to the washer fluid level switch. When the washer fluid is low, the washer fluid level switch opens, pulling the reference voltage high. When the IPC detects the washer fluid input is an open circuit, it illuminates the low washer fluid level RTT indicator.

Powertrain Malfunction (Wrench)

The IPC provides a powertrain malfunction (wrench) RTT indicator to indicate transmission, Electronic Throttle Control (ETC), AWD and BCM concerns.

The IPC receives all the required messages from the GWM over the HS-CAN3.

The GWM receives the body service required message from the BCM over the HS-CAN1.

The GWM receives the AWD service required, engine service required and transmission service required messages from the PCM over the HS-CAN1.

4WD Transmission

The IPC provides a 4WD Low and High RTT to indicate transmission status. It uses 4WD status display message to set RTT. The IPC receives 4WD status display message from the GWM over the HS-CAN3. The GWM receives the transmission messages from PCM over HS-CAN1.

Warning Messages

Adaptive Cruise Control

The message center provides messages explaining the need for driver intervention and system status. The adaptive cruise control messages are supplemental to the cruise control RTT and the adaptive cruise control warning chime. The IPC receives the adaptive cruise control message display from the GWM over the HS-CAN3. The GWM receives the adaptive cruise control message display from the CCM over the HS-CAN2.

4WD

The IPC provides message center messages to inform the driver of the status of the 4WD. The IPC receives the 4WD status display message from the GWM over the HS-CAN3. The GWM receives the 4WD status display message from the PCM over the HS-CAN1.

Auto Stop-Start

The message center provides messages explaining the need for driver intervention and system status. The IPC receives the stop/start message request from the GWM over the HS-CAN3. The GWM receives the stop/start message request from the PCM over the HS-CAN1.

Brake System

The IPC provides brake system messages for the following concerns and status:

- Low brake fluid level
- Parking brake status and faults
- ABS concerns that display along with the brake warning indicator operation

When the parking brake is applied, the BCM sends the parking brake chime request to the GWM over the HS-CAN1. The GWM gateways the message to the IPC over the HS-CAN3 to illuminate the brake warning indicator and turn on the parking brake applied message in the message center.

When a low brake fluid level condition exists, the BCM sends the brake fluid level low message request to the GWM over the HS-CAN1. The GWM gateways the message to the IPC over the HS-CAN3 to illuminate the brake warning indicator and turn on the brake fluid level low message in the message center.

When an ABS or parking brake system concern exists, the ABS module sends the brake (red) warning indicator request message to the GWM over the HS-CAN2. The GWM sends the brake (red) warning indicator request message to the IPC over the HS-CAN3 to illuminate the ABS warning indictor and to turn on the check brake system message center warning display.

Charging System

The message center provides a warning message indicating the status of the charging system. When a fault is present in the charging system, the BCM sends the battery low state of charge message to the GWM over the HS-CAN1. The IPC receives the battery low state of charge message from the GWM over the HS-CAN3.

Check Fuel Fill Inlet

The message center provides a check fuel fill inlet message to warn the driver there is a problem with the fuel fill inlet pipe resulting in a significant evaporative emission leak following vehicle refueling. The IPC receives the check fuel fill inlet message request from the GWM over the HS-CAN3. The GWM receives the check fuel fill inlet message request from the PCM over the HS-CAN1.

Check Locking Differential (Elocker)

The IPC provides elocker warnings to indicate an issue with the electronic locking differential. When a fault is present with the elocker the PCM sends the 4WD status message to the GWM over HS-CAN1. The IPC receives the required message from the GWM over the HS-CAN3.

Diesel Low Fuel Pressure

IPC provides diesel fuel pressure warnings to indicate an issue with the diesel fuel system. When a fault is present with the fuel system the PCM sends the Diesel Warnings message to the GWM over HS-CAN1. The IPC receives the required message from the GWM over the HS-CAN3.

Dimming Scroll Bar

IPC displays a dimming scroll bar warning to provide customers feedback on the current dimming status. This warning will be displayed for every dimming button press regardless of a dimming level change. When there is a dimming button press the BCM sends an updated dimming level message to the GWM over HS-CAN1. The IPC receives the required message from the GWM over the HS-CAN3.

EPAS

The IPC provides a message center message to indicate there is an EPAS system concern. When a fault exists in the EPAS, the PSCM sends a request to the IPC through the GWM.

The IPC receives the EPAS failure message from the GWM over the HS-CAN3.

The GWM receives the EPAS failure message from the PSCM over the HS-CAN2.

Engine On

The message center provides the engine on warning message to inform the driver they are exiting the vehicle when the engine is running. The IPC uses multiple inputs to determine the vehicle is stopped and the driver is preparing to exit the vehicle. The messages required to control the engine on warning message are as follows:

- Driver door ajar status
- Power pack status
- Transmission shift mode display
- Vehicle speed

The IPC receives all required messages from the GWM over the HS-CAN3.

The GWM receives the driver door ajar status from the BCM over the HS-CAN1.

The GWM receives the power pack status, transmission shift mode display and the vehicle speed messages from the PCM over the HS-CAN1.

Engine Over-Temperature

The message center provides the engine coolant over-temperature warning message to supplement the engine over-temperature RTT and alert the driver the engine is over temperature. The IPC receives the engine overheat indication request and the engine coolant temperature data from the GWM over the HS-CAN3. The GWM receives the engine overheat indication request and the engine over-temperature message from the PCM over the HS-CAN1.

Forward Collision

The message center provides the forward collision warning messages to inform the driver of the forward collision status. The IPC receives the forward collision warning message request from the GWM over the HS-CAN3. The GWM receives the forward collision warning message request from the CCM over the HS-CAN2.

Front Camera Malfunction

When a fault is present with the front camera the IPMA sends the front camera malfunction message to the GWM over HS-CAN2. The IPC receives the required message from the GWM over the HS-CAN3.

Hill Descent Control

The IPC provides hill descent control warnings to inform the operator that they have entered or exited various states or conditions with respect to the HDC. The ABS sends the HDC message to GWM over HS-CAN2. The IPC receives the required message from the GWM over the HS-CAN3.

Hill Start Assist

The message center provides a message indicating the hill start assist feature is not available due to a fault in the ABS. When a fault is detected and the hill start assist is disabled, the ABS module sends the hill start assist status message to the GWM over the HS-CAN2. The GWM sends the hill start assist status message to the IPC over the HS-CAN3.

Lane Keeping System

The message center provides a warning message for the lane keeping alert and system fault messages for the over all lane keeping system. The IPC receives all required messages from the GWM over the HS-CAN3. The GWM receives the lane keeping system hands off display message, the lane keeping system status display and the camera status message from the IPMA over the HS-CAN2.

Load Shed

The message center provides load shed messages to inform the driver to use less options to conserve battery voltage. The IPC receives the battery low state of charge message from the GWM over the HS-CAN3. The GWM receives the battery low state of charge message from the BCM over the HS-CAN1.

Oil Life

The instrument cluster provides messages to inform the driver about the oil life status, oil life reset status and when an oil change is required. The duration of the interval between oil changes is calculated in the PCM and varies due to driving conditions. The PCM assumes a base mileage of 16,090 km (10,000 mi) or 1 year for normal driving. However, this number is adjusted down for conditions such as high engine temperature, high engine rpm, use of flex fuel and possibly low oil level. The PCM calculates and provides the engine oil life percent message to the IPC. The oil change minder can be reset at any time by the driver.

The IPC receives the engine oil life message from the GWM over the HS-CAN3. The GWM receives the engine oil life message from the PCM over the HS-CAN1.

The PCM receives the engine oil life data reset message from the GWM over the HS-CAN1. The GWM receives the engine oil life data reset message from the IPC over the HS-CAN3.

Parking Aid System

The IPC provides messages to indicate the status of the parking aid system. The IPC receives the parking aid rear status message from the GWM over the HS-CAN3. The GWM receives the parking aid rear status message from the PAM over the HS-CAN1.

PATS And Passive Key And Immobilizer System

The message center provides the starting system fault message to indicate there is a concern with the PATS. The message center provides passive key and immobilizer system messages to indicate the key is in the luggage compartment, the key is left in the vehicle, no key is detected, accessory power is active, to press the brake to start the vehicle or to place the key in the backup slot. The IPC uses the immobilizer message display messaged input from the BCM to display the applicable message center message.

The IPC receives the immobilizer message request from the GWM over the HS-CAN3.

The GWM receives the immobilizer message request from the BCM over the HS-CAN1.

MyKey®

The IPC provides a number of MyKey® related warnings and status messages to indicate restrictions imposed on the MyKey® user. These include MyKey® active, park aid, speed limits, and buckle up warnings among others. MyKey® displays are controlled through the IPC software based on the MyKey® settings configured through the message center and the type of key in use (MyKey® or administrator key). The MyKey® function also uses other messages received by the IPC for other indications such as vehicle speed for speed limiter displays.

Perimeter Alarm Message Display

The IPC provides a display to indicate the perimeter alarm has been activated and to start the vehicle to stop the alarm. The IPC receives the perimeter alarm chime request message from the GWM over the HS-CAN3. The GWM receives the perimeter alarm chime request from the BCM over the HS-CAN1.

Power Child Lock-Switch Inhibit And Low Key Fob

The IPC provides a power child lock warning to inform the driver the child lock feature did not function properly. The power child lock feature is activated through the rear window lockout switch on the driver side master window control switch.

The IPC provides a switch inhibit warning to notify the driver that some switches have been purposely inhibited and are inoperative. For security purposes, interior switches are inhibited by the BCM 20 seconds after the vehicle is electronically locked and prevents someone from using a stick (or other object) through an open window and activating the switch.

The IPC provides a low key fob battery warning to alert the driver the key fob battery needs to be replaced. The low key fob battery warning is not displayed in RUN or START modes if the power child lock warning is active to prevent the BCM from cycling between the two warnings, causing the chime associated with the power child lock warning to repeatedly sound every 4 seconds.

The IPC receives the child lock message request from the GWM over the HS-CAN3. The GWM receives the child lock message request from the BCM over the HS-CAN1.

Powertrain Cooling

On vehicles equipped with a Gasoline Turbo Direct Injection (GTDI) engine, the IPC provides a message to inform the driver that vehicle performance is reduced to allow the engine to cool. This feature is part of the smart cooling function in the PCM and provides powertrain cooling protection under high ambient temperature conditions.

The IPC receives the powertrain cooling message request from the GWM over the HS-CAN3. The GWM receives the powertrain cooling message request from the PCM over the HS-CAN1.

PRNDL Not In Park (Shift To Park)

The message center provides a shift to park message to inform the driver the vehicle is not in PARK (P) under 2 sets of conditions. First, the IPC displays the shift to park message if the selector lever is not in PARK (P), the ignition is OFF and the driver door is open or ajar. Second, the message center displays the shift to park message if the selector lever is not in PARK (P), the ignition is ON or in ACC, the driver door is open or ajar and the brake pedal is not applied with vehicle speed less than 5 km/h (3 mph). The IPC uses multiple messages to control the shift to park message.

The IPC receives all required messages from the GWM over the HS-CAN3.

The GWM receives the transmission shift mode display and vehicle speed messages from the PCM over the HS-CAN1.

The GWM receives the driver door ajar status, transport mode and ignition status message from the BCM over the HS-CAN1.

The IPC also uses the park position detect input to determine whether the vehicle is in PARK (P) along with the transmission gear display mode message.

See Park Position Detect Switch component description.
Refer to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .

Remote Start

The IPC provides remote start messages to inform the driver the vehicle is in the remote start active state and how to change the state to a drivable state. The remote start message display is active as soon as the vehicle is remote

started (that is, the engine is running, but the ignition status is off).

The IPC receives the remote start status message from the GWM over the HS-CAN3. The GWM receives the remote start status message from the BCM over the HS-CAN1.

Rear Belt Monitor

The IPC provides a popup warning to alert the customer of a change in status of the rear belt buckles, or a fault with the rear belt monitor system. The RCM will send the rear belt monitor message to the GWM over HS-CAN2. The IPC receives the required message from the GWM over the HS-CAN3.

Stability - Traction Control

The message center provides stability-traction control system messages to indicate the stability-traction control system status or if the stability-traction control system has a fault and requires service.

When the stability-traction control system has been selected off or on, the ABS module sends the stability-traction control on/off message request to the GWM over the HS-CAN2. The GWM sends the stability-traction control on/off message request to the IPC over the HS-CAN3.

When a fault condition exists in the stability-traction control system, the ABS module sets a DTC and sends the stability-traction control chime request to the GWM over the HS-CAN2. The GWM sends the stability-traction control chime request to the IPC over the HS-CAN3.

Starting System

The message center provides a starting system message to inform the driver of further actions required to start the engine or to explain the reason for the inability to start the engine. The IPC receives the starting system fault message request and stop/start message request from the GWM over the HS-CAN3. The GWM receives the starting system fault message request and stop/start message request from the PCM over the HS-CAN1.

Steering Wheel Lock

The message center provides informational and fault messages to inform the driver of steering wheel lock conditions and to indicate a fault in the system. The IPC receives the steering wheel lock message request from the GWM over the HS-CAN3. The GWM receives the steering wheel lock message request from the BCM over the HS-CAN1.

TPMS

The IPC provides message center displays to indicate the TPMS sensor training status or a malfunction in the TPMS. The IPC receives the tire pressure system status message from the GWM over the HS-CAN3. The GWM receives the tire pressure system status message from the BCM over the HS-CAN1.

Trailer Sway

The message center provides a message to inform the driver to slow the vehicle to reduce trailer sway and bring the trailer under control. The IPC receives the trailer sway status message from the GWM over the HS-CAN3. The GWM receives the trailer sway status message from the ABS module over the HS-CAN2.

Component Description

Low Washer Fluid Level Switch

The low washer fluid switch is hardwired to the IPC through a single signal wire and is grounded to a body ground through a separate circuit. The IPC provides a reference voltage to the low washer fluid level switch. When the washer fluid level is low, the float drops closing the switch and pulling the reference voltage low. When the washer fluid level is high, the float lifts opening the circuit to the IPC and sending the reference voltage high.

Oil Pressure Switch

The oil pressure switch is a normally open switch that is hardwired to the PCM through a single signal circuit. The ground is provided by the switch housing when it is mounted on the engine. The PCM provides a reference voltage to the oil pressure switch. When oil pressure is low, the oil pressure switch remains open, sending the reference voltage high. When the oil pressure is sufficient, the oil pressure switch closes, pulling the reference voltage low to the PCM.

Steering Wheel Switch - Message Center

The message center switch is the 5-way portion of the LH steering wheel switch. The message center switch uses different resistance values associated with each specific button (up, down, left, right and OK). The SCCM sends out a reference voltage to the upper LH steering wheel switch on the input circuit and monitors the voltage drops. The voltage drop varies depending upon the resistance of the specific button pressed, providing indication to the SCCM

which button is pressed.

Copyright © 2016 Ford Motor Company

Warning Chimes - Overview

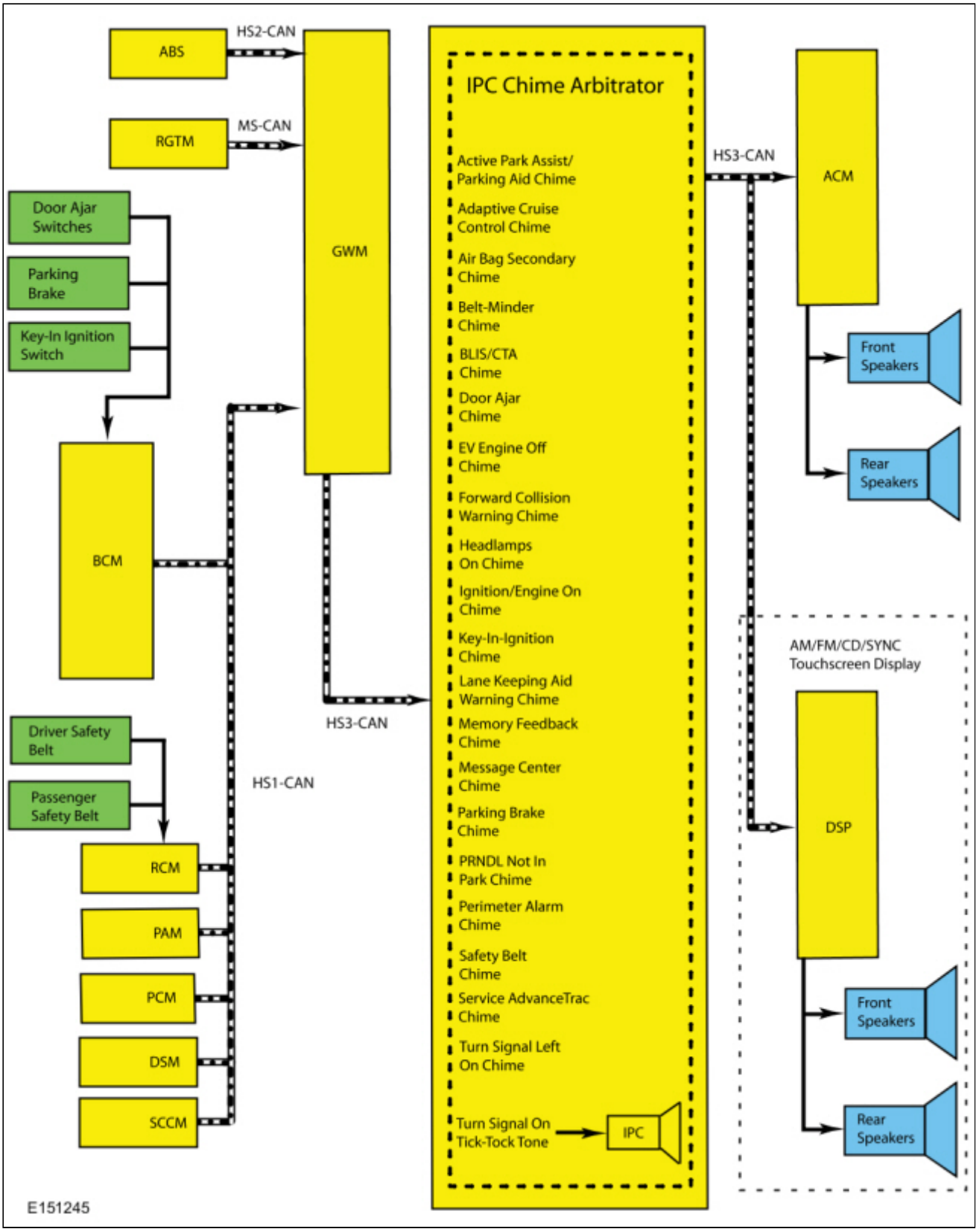
Overview

The warning chimes provide the driver with audible warnings that act as reminders and supplemental alerts to visual IPC indications such as gauges, indicators and message center warnings. The IPC controls all warning chimes based on messages received from external modules. The IPC prioritizes the chimes according to a preset hierarchy programmed into the IPC software. When more than one chime request is received by the IPC, the most important chime sounds. If a lower priority chime is currently sounding, the higher priority request takes over and replaces or delays the lower priority chime.

The warning chimes are sounded through the audio system speakers and the IPC. The turn signal/hazard on (tick-tock) is the only individual chime that sounds through the IPC, not the audio system. The parking aid, lift gate warning, and Blind Spot Information System (BLIS®®)/Cross Traffic Alert (CTA) warning chimes are sounded through the rear speakers. All other warning chimes are sounded through the front audio system speakers.

The IPC also acts as a backup. In the event of an audio system chime failure, the IPC sounds all chimes that are required.

NOTE: *There are instances where some chimes may sound through the IPC and should not be interpreted as a fault in the audio system. An example might be when the ignition is off, with the key in the igntion and the driver door ajar. In this instance, the audio system is offline and the key-in-igntion chime defaults to the IPC.*

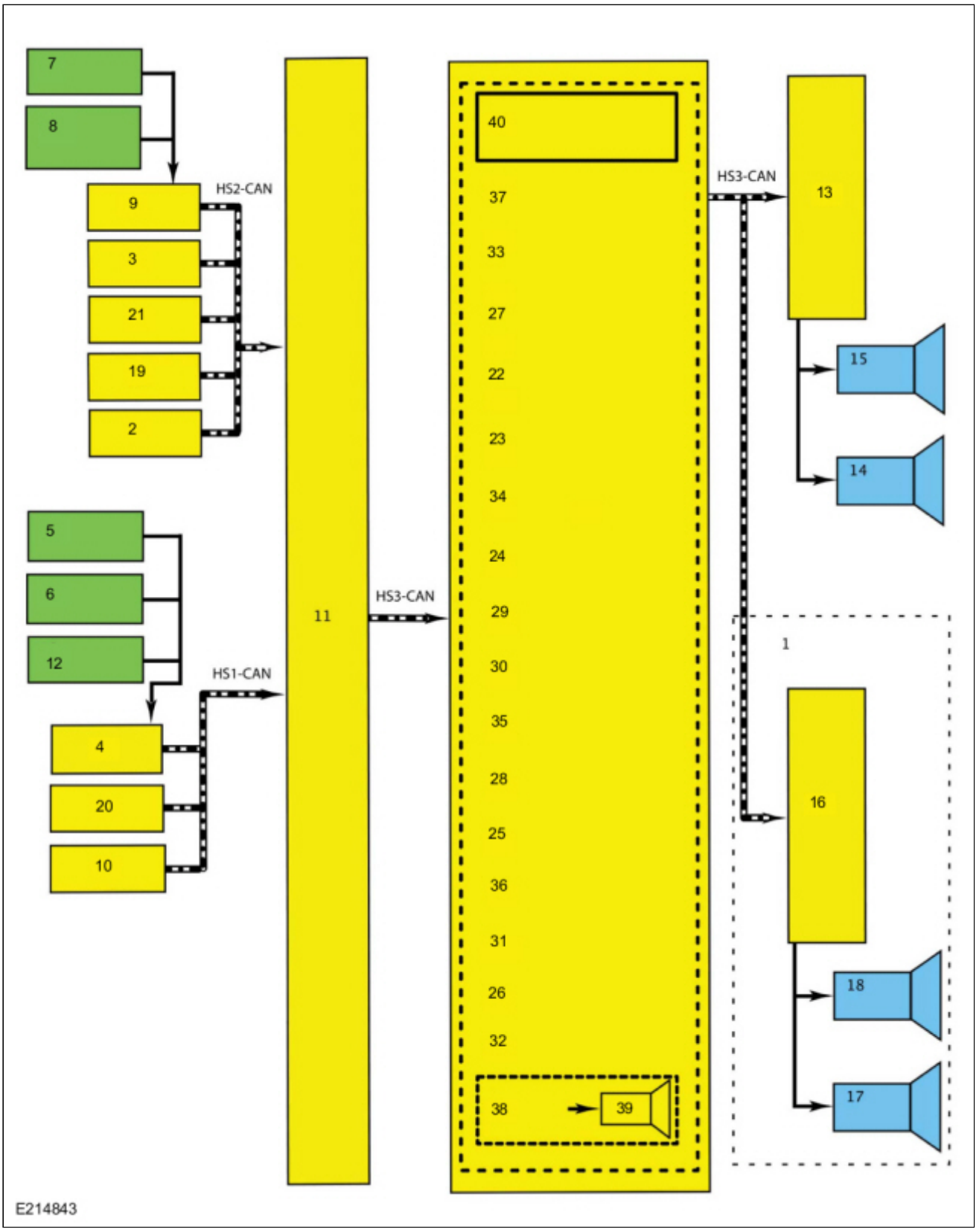


Copyright © 2016 Ford Motor Company

Warning Chimes - System Operation and Component Description

System Operation

System Diagram



Item	Description
1	AM/ FM/ CD/SYNC® touchscreen display

2	ABS module
3	IPMA
4	BCM
5	Door ajar switches
6	Parking brake switch
7	Driver safety belt buckle
8	Passenger safety belt buckle
9	RCM
10	PCM
11	GWM
12	Key-in ignition switch
13	ACM
14	Rear speakers
15	Front speakers
16	FDIM
17	Rear speakers
18	Front speakers
19	CCM
20	PAM
21	SCCM
22	Belt-Minder® chime
23	Door ajar chime
24	Headlamps on chime
25	Parking brake chime
26	Safety belt chime
27	Airbag secondary chime
28	Message center chime
29	Ignition/engine on chime
30	Key-in-ignition chime
31	Perimeter alarm chime
32	Turn signal left on chime
33	Adaptive cruise control chime
34	Forward collision warning chime
35	Lane keeping alert warning chime
36	PRNDL not in park chime
37	Active park assist/parking aid chime
38	Turn signal on tick-tock tone
39	IPC
40	IPC chime arbitrator

Network Message Chart

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose

ACC warning request	CCM	Input used to control the ACC warning chime.
Cruise control status	PCM	Input used to control the ACC warning chime.
Driver door ajar status	BCM	Input used for the ignition-engine on warning chime and the PRNDL not in park warning chime.
Driver safety belt buckle status	RCM	Input used to control the Belt-Minder® and safety belt warning chime.
Forward collision chime request	CCM	Input used for the forward collision warning chime.
Forward collision warning message request	CCM	Input used for the forward collision warning chime.
Front passenger detect status	RCM	Input used to control the Belt-Minder® chime.
Gear lever position	PCM	Input used to control the Belt-Minder® chime.
Headlamp on warning chime	BCM	Input used to control the headlamps on warning chime
Ignition status	BCM	Ignition RUN, START and accessory states required for the IPC operating modes and fault reporting. Also used to control the PRNDL not in park warning chime.
Key-in-ignition status	BCM	Input used to control the key-in-ignition chime status.
Lane keeping system hands off display	IPMA	Input used to control the lane keeping system hands off the steering wheel warning chime.
Parking aid rear status	PAM	Input used to control the parking aid chime status.
Parking brake chime request	ABS module	Input used to control the electric parking brake chime status.
Passenger safety belt buckle status	RCM	Input used to control the Belt-Minder® chime.
Perimeter alarm chime request	BCM	Input used to control the perimeter alarm chime status.
Diesel Warnings	PCM	Input used to display diesel specific warnings including low fuel pressure, reduced power, and exhaust over temp.
Transmission shift mode display	PCM	Input used for the ignition-engine on warning chime and the PRNDL not in park warning chime.
Transport mode	BCM	Input used to control the PRNDL not in park warning chime.
Turn indication request	BCM	Input used for the turn signal-hazard (tick-tock) chime.
Turn signal switch status	SCCM	Input used for the turn signal left on chime.
Vehicle speed	PCM	Input used to control the Belt-Minder® chime, ignition-engine on warning chime, and the PRNDL not in park warning chime.

Module Network Input Messages - ACM and DSP

Broadcast Message	Originating Module	Message Purpose
Belt-Minder® audio mute	IPC	Input from the IPC used to control the Belt-Minder® audio chime output.
Chime source	IPC	Input used to configure the chime source (IPC or the audio system).
IPC chime request	IPC	Input from the IPC used to control the audio chime output.

Power up chime modules	IPC	Input used to initiate the audio system as the chime source, control the chime characteristics and chime location.

Warning Chime Characteristics

The warning chimes use volume, chime frequency, length of time the chime sounds, decay of the chime tone and the number of chime tones to identify which chime is sounding. Most warning chimes have unique characteristics, however, there are chimes that do sound the same. The chime characteristics are defined by the different chime types:

- Information
- Soft-warning
- Hard-warning
- Tick-tock (on-off)

Active Park Assist Chime

The active park assist system uses informational and instructional messages displayed in the centerstack infotainment display to direct the driver's interaction with the system. The active park assist system chimes alert or draw the driver's attention to the requested actions as displayed in the centerstack infotainment display messages. The active park assist chime sounds through the front speakers.

The IPC receives the active park assist chime request from the GWM over the HS-CAN3.

The GWM receives the active park assist chime request from the PAM over the HS-CAN1.

The IPC then sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

ACC Warning Chime

The ACC warning chime supplements the message center displays to draw the driver's attention to the need to intervene and take control of the vehicle. There are 2 levels of chime output (high priority and low priority) based upon the nature and urgency of the warning. The ACC warning chime sounds through the front speakers. The audio system sounds the appropriate warning chime when it receives the adaptive cruise control warning request (high priority chime) or cruise control status (low priority chime) message from the CCM.

The low priority ACC warning chime is a single-tone, 1-second chime that sounds to alert the driver the ACC system has shut itself off due to low vehicle speed (approximately 32 km/h [20 mph]) and the driver needs to intervene if further braking is required or to resume the ACC operation.

The high priority ACC warning chime is a 0.25-second chime that sounds 12 times. The chime alerts the driver the vehicle is approaching the vehicle ahead at a faster rate than the ACC system can brake the vehicle and the driver needs to apply the brakes to slow the vehicle down.

The IPC receives the cruise control status and the adaptive cruise control warning request messages from the GWM over the HS-CAN3.

The GWM receives the cruise control status message from the PCM over the HS-CAN1.

The GWM receives the adaptive cruise control warning request message from the CCM over the HS-CAN2.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Airbag Secondary Warning Chime

The airbag secondary warning chime warns the airbag warning indicator LED is inoperative. The airbag secondary warning chime sounds through the front speakers. If the IPC detects a fault with the airbag warning indicator LED during the bulb prove out, the airbag secondary warning chime sounds. If the IPC detects a fault in the airbag warning indicator when a SRS fault condition exists and the RCM has sent the IPC the airbag indicator request, the airbag secondary warning chime sounds. The airbag chime is a 0.5-second chime that sounds 5 times.

When a fault condition is detected, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Belt-Minder® Feature

NOTE: *Whenever the vehicle is operated using MyKey®, the IPC enables the Belt-Minder®.*

The Belt-Minder® is configurable on or off.
Refer to: Seatbelt Minder Deactivating/Activating (413-01 Instrumentation, Message Center and Warning Chimes, General Procedures).

The Belt-Minder® feature supplements the current safety belt warning function and is enabled after the current safety belt warning is complete. The Belt-Minder® reminds the driver that the driver or front passenger safety belt is unbuckled by intermittently sounding a chime and simultaneously illuminating the safety belt warning indicator through the front speakers. The Belt-Minder® begins once the current safety belt warning has ended and the vehicle speed has exceeded 10 km/h (6 mph) with the driver or front passenger safety belt unbuckled. While activated, the Belt-Minder® chime provides a series of chimes/safety belt warning indicator flash sequences.

If the vehicle speed drops below 5 km/h (3 mph) once the Belt-Minder® chime has activated, the chime turns off and the safety belt warning indicator remains on. When the vehicle speed exceeds 10 km/h (6 mph) again, the Belt-Minder® chime resumes.

When MyKey® is in use, the driver cannot configure the Belt-Minder® off. Once the Belt-Minder® is activated, the Belt-Minder® continues to chime periodically (does not time out after 5 minutes) and the audio system is muted until the driver and passenger safety belts are fastened.

To control the Belt-Minder®, the IPC receives the vehicle speed, gear lever position, driver and passenger safety belt buckle status and front passenger detect status messages from the GWM over the HS-CAN3.

The GWM receives the vehicle speed and gear lever position messages from the PCM over the HS-CAN1.

The IPC receives the driver and passenger safety belt status messages from the RCM over the HS-CAN2.

When the conditions require the Belt-Minder® chime, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Door Ajar Warning Chime

The door ajar warning chime warns that a door is ajar and sounds the chime through the front speakers. When a door becomes ajar while the ignition is in RUN with vehicle speed greater than 5 km/h (3 mph), the IPC displays the appropriate door ajar warning message and sounds a single chime tone for each door opened. The door ajar chime only sounds once for each time the door is opened, and only repeats the chime if the door is closed then reopened.

The IPC receives the driver door ajar status, passenger door ajar status, left rear door ajar status, right rear door ajar status or liftgate ajar status message from the GWM over the HS-CAN3. The GWM receives the driver door ajar status, passenger door ajar status, left rear door ajar status, right rear door ajar status or liftgate ajar status messages from the BCM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Forward Collision Warning Chime

The forward collision warning chime warns that a forward collision potential has been detected or the CCM detects a forward collision warning system concern. Once the forward collision system detects a possible forward collision, the CCM sends the HUD module the heads up flash rate message to flash the forward collision warning, and the forward collision warning message request to the IPC through the GWM to sound a 0.25-second chime tone 12 times.

The forward collision warning system and chime can be disabled or turned off using the message center. When MyKey® is in use, the driver cannot configure the forward collision warning system or chime off. When the driver disables the forward collision warning chime, the CCM sends the IPC the forward collision chime request through the GWM to sound a 0.25-second chime tone 12 times at 50% volume. The forward collision warning chime and confirmation chime are both sounded through the front speakers.

The IPC receives the forward collision warning message request and the forward collision chime request from the GWM over the HS-CAN3.

The GWM receives the forward collision warning message request and the forward collision chime request from the CCM over the HS-CAN2.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Headlamps On Warning Chime

The headlamps on warning chime warns the headlamps are on when exiting the vehicle. When the driver exits the vehicle with the driver door ajar, the headlamp switch is in the PARK or HEADLAMP position and the ignition is OFF, the BCM sends the headlamp switch status message to the IPC through the GWM to sound the headlamps on

chime. The headlamps on chime sounds a 1-second chime tone continuously.

The IPC receives the headlamp on warning chime request from the GWM over the HS-CAN3.

The GWM receives the headlamp on warning chime request from the BCM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Ignition-Engine On Warning Chime

The ignition-engine on chime informs the driver they are exiting the vehicle when the ignition has been left on (engine off) or the engine is running. When the driver exits the vehicle with the ignition on or with the engine running, the ignition-engine on warning chime sounds five 1-second chime tones. The ignition-engine on warning chime sounds through the front speakers. The IPC uses driver door ajar status, transmission shift mode display and vehicle speed messaged inputs to control the ignition-engine on warning chime.

The IPC receives all required messages from the GWM over the HS-CAN3.

The GWM receives the driver door ajar status message from the BCM over the HS-CAN1.

The GWM receives the transmission shift mode display and vehicle speed messages from the PCM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Key-In-Ignition Warning Chime

The key-in-ignition warning chime warns the key is still in the ignition lock cylinder or the ignition is in ACC when the driver door is ajar. The key-in-ignition warning chime sounds repetitive 0.5-second chime tones from the front speakers until either the key is removed from the lock cylinder, the ignition is in RUN or the driver door is closed.

The IPC receives the key-in-ignition status from the GWM over the HS-CAN3.

The GWM receives the key-in-ignition status from the BCM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Lane Keeping Alert Warning System Chime

The lane keeping alert warning chime alerts the driver they have removed their hands from the steering wheel. The lane keeping alert warning chime sounds three 0.25-second chime tones through the front speakers.

The IPC receives the lane keeping system hands off display request from the GWM over the HS-CAN3.

The GWM receives the lane keeping system hands off display request from the IPMA over the HS-CAN2.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Message Center Warning Chime

The message center warning chime feature draws the driver's attention to the message center display to view new warning messages. There are 3 different message center warning chime types that are defined by the length of the chime tone, which are designed to create a greater sense of urgency based on the nature of the condition and message displayed in the message center.

- Informational (1-second chime)
- Soft warning (0.5-second chime)
- Hard warning (0.25-second chime)

When a new message request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Parking Aid Chime

The parking aid system uses a visual display in the centerstack infotainment display and a chime to alert the driver objects are close to the vehicle. The parking aid chime sounds a repetitive chime tone that decreases the time off between chime tones as objects get closer to the sensor until a continuous tone is heard through the rear speakers.

The IPC receives the parking aid rear status request from the GWM over the HS-CAN3.

The GWM receives the parking aid rear status request from the PAM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Parking Brake Warning Chime

The parking brake warning chime warns the parking brake is engaged when the vehicle is in motion. The parking brake warning chime sounds if the ignition is in RUN, the parking brake is engaged, and the vehicle speed is greater than 5 km/h (3 mph). The parking brake warning chime stops sounding and resets if the parking brake is released, the ignition is not in RUN, the vehicle speed is less than 5 km/h (3 mph), or after 90 seconds from the time the chime is activated. The parking brake warning chime sounds a repetitive 0.5 second chime tone through the front speakers.

The IPC receives the parking brake chime request from the GWM over the HS-CAN3.

The GWM receives the parking brake chime request from the ABS module over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Perimeter Alarm Warning Chime

The perimeter alarm warning chime alerts the driver the perimeter alarm is armed when the driver door is unlocked before disarming the alarm. The IPC displays a perimeter alarm message in the message center and the perimeter alarm warning chime sounds for 12 1-second chime tones when the driver door is opened. The perimeter alarm warning chime turns off when the perimeter alarm is disarmed (either by using the key fob or turning the key to the ON position). After the twelve second warning chime duration, the warning chime stops sounding and the perimeter alarm activates, sounding the horn and flashing the turn signal lamps.

The IPC receives the perimeter alarm warning chime request from the GWM over the HS-CAN3.

The GWM receives the perimeter alarm warning chime request from the BCM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

PRNDL Not In Park Warning Chime

The IPC provides a PRNDL not in park warning chime that sounds along with the transmission not in park message center warning message to inform the driver the vehicle is not in PARK (P). The IPC displays the shift to park message and the PRNDL not in park warning chime sounds three 0.5-second chime tones if the selector lever is not in PARK (P), the ignition is OFF and the driver door is open or ajar. The IPC requires the transmission shift mode display, transport mode vehicle speed, driver door ajar and ignition status to control the PRNDL not in park warning chime.

Refer to Shift To Park Message Display for message details.
Refer to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Safety Belt Warning Chime

The safety belt warning chime warns the safety belt is not fastened. The safety belt warning chime sounds a repetitive 1-second chime tone for 6 seconds through the front speakers when the driver safety belt is not fastened and the ignition is transitioned from OFF or ACC to ON or START. The safety belt warning chime stops sounding when the safety belt is fastened, when the ignition is transitioned from ON or START to OFF or ACC, or when the chime has sounded for 6 seconds.

The IPC receives the driver safety belt buckle status message from the GWM over the HS-CAN3.

The GWM receives the driver safety belt buckle status from the RCM over the HS-CAN2.

When the conditions require the safety belt warning chime, the IPC sends the IPC chime request message to the ACM and DSP to sound the chime.

Turn Signal On Chime Tone

The IPC provides a repetitive 1-second on/off tick-tock chime tone along with visual RH or LH turn indicators to

inform the driver the turn signal or hazard lamp function is on.

The IPC receives the turn indication status from the GWM over the HS-CAN3.

The GWM receives the turn indication status from the BCM over the HS-CAN1.

Turn Signal Left On Chime

The turn signal left on or turn signal minder chime uses both odometer and turn signal status messages. The turn signal left on chime sounds a repetitive 1-second chime through the front speakers when the vehicle is driven with the turn signal on for more than 3.2 km (2.0 miles).

The IPC receives the turn signal switch status and odometer count from the GWM over the HS-CAN3.

The GWM receives the turn signal switch status from the BCM over the HS-CAN1.

The GWM receives the odometer count from the PCM over the HS-CAN1.

When a chime request is received, the IPC sends the IPC chime request message to the ACM and the audio DSP to sound the chime.

Copyright © 2016 Ford Motor Company

Instrumentation, Message Center and Warning Chimes

DTC Chart: Instrument Panel Cluster (IPC)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC Chart - IPC

DTC	Description	Action
P0381:01	Glow Plug/Heater Indicator Control Circuit/Open: General Electrical Failure	**NOTE:** *Make sure to test the operation of the glow plug indicator when the engine is cold to ensure the engine isn't too warm to operate the glow plug system and command the glow plug indicator on.* CLEAR the DTC. RETRIEVE the IPC Continuous Module Diagnostic Trouble Codes (CMDTCs) while operating the glow plug system at initial key on. If DTC P0381:01 returns, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
P1346:11	Fuel Level Sensor "B" Circuit: Circuit Short To Ground	GO to Pinpoint Test C
P1346:13	Fuel Level Sensor "B" Circuit: Circuit Open	GO to Pinpoint Test C
P1534:01	Restraint Deployment Indicator Circuit: General Electrical Failure	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). Diagnose all RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
P1706:00	High Vehicle Speed Observed in Park	GO to Pinpoint Test S
U0100:00	Lost Communication With ECM/PCM "A"	GO to Pinpoint Test BB
U0101:00	Lost Communication with TCM	GO to Pinpoint Test BC
U0104:00	Lost Communication With Cruise Control Module	GO to Pinpoint Test BD
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module	GO to Pinpoint Test BE
U0131:00	Lost Communication With Power Steering Control Module	GO to Pinpoint Test BF
U0140:00	Lost Communication With Body Control Module	GO to Pinpoint Test BG
U0146:00	Lost Communication With Gateway "A"	GO to Pinpoint Test BH
U0151:00	Lost Communication With Restraints Control Module	GO to Pinpoint Test BI
U0159:00	Lost Communication With Parking Assist Control Module "A"	GO to Pinpoint Test BJ
U0184:00	Lost Communication With Radio	GO to Pinpoint Test BK
U0199:00	Lost Communication With "Door Control Module A"	GO to Pinpoint Test BL
U0212:00	Lost Communication With Steering Column Control Module	GO to Pinpoint Test BM
U023A:00	Lost Communication With Image Processing Module A	GO to Pinpoint Test BN
U0241:00	Lost Communication With Headlamp Control Module "A"	GO to Pinpoint Test BN
U0401:00	Invalid Data Received from ECM/PCM A: No Sub Type Information	This DTC sets when the IPC receives invalid network data for the speedometer, temperature or odometer data from the PCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the PCM and other modules on the network. Refer to the appropriate section in Group 303 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.
U0401:81	Invalid Data Received from	This DTC sets when the IPC receives invalid network data for the speedometer or temperature gauge from the PCM.

	ECM/PCM A: Invalid Serial Data Received	RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the PCM and other modules on the network. Refer to the appropriate section in Group 303 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.
U0401:82	Invalid Data Received from ECM/PCM A: Alive/Sequence Counter Incorrect/Not Updated	This DTC sets when the IPC fails to receive updated data for the cruise control or adaptive cruise control from the PCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the PCM and other modules on the network. Refer to the appropriate section in Group 303 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.
U0405:56	Invalid Data Received From Cruise Control Module: Invalid/Incompatible Configuration	This DTC sets when the IPC receives invalid network data for adaptive cruise control and forward collision warning from the CCM. CHECK the vehicle service history for recent service actions related to this module. This DTC sets due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, REPEAT the PMI procedure as directed by the scan tool. If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data.
U0415:82	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module: Alive/Sequence Counter Incorrect/Not Updated	This DTC sets when the IPC fails to receive updated ABS data from the ABS module. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the ABS module and other modules on the network. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the ABS module, DIAGNOSE the observable symptom.
U0420:82	Invalid Data Received From Power Steering Control Module: Alive/Sequence Counter Incorrect/Not Updated	This DTC sets when the IPC fails to receive power steering data from the PSCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the PSCM and other modules on the network. REFER to: Power Steering (211-02 Power Steering - Vehicles With: Hydraulic Power Assist Steering (HPAS)) . If no Diagnostic Trouble Codes (DTCs) are present in the PSCM, DIAGNOSE the observable symptom.
U0422:00	Invalid Data Received From Body Control Module	This DTC sets when the IPC receives invalid network TPMS data from the BCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the BCM and other modules on the network. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U0422:82	Invalid Data Received From Body Control Module	This DTC sets when the IPC receives invalid network Battery Charge data from the BCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the BCM and other modules on the network. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U0424:00	Invalid Data Received From HVAC Control Module	This DTC sets when the IPC receives invalid outside air temperature data from the HVAC control module. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the HVAC control module and other modules on the network. REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). or REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the HVAC control module, DIAGNOSE the observable symptom.
U0424:81	Invalid Data Received From HVAC Control Module	This DTC sets when the IPC receives invalid outside air temperature data from the HVAC control module. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the HVAC control module and other modules on the network. REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). or REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the HVAC control module, DIAGNOSE the observable symptom.
U0424:82	Invalid Data Received From HVAC Control Module	This DTC sets when the IPC receives invalid outside air temperature data from the HVAC control module. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the HVAC control module and other modules on the network. REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). or REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the HVAC control module, DIAGNOSE the observable symptom.
U0452:81	Invalid Data Received From Restraints Control Module: Invalid Serial Data Received	This DTC sets when the IPC receives invalid network data from the RCM due to incorrect Belt-Minder® configuration in the IPC. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the RCM and other modules on the network. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the RCM , DIAGNOSE the observable symptom.
U046B:86	Invalid Data Received From Global Positioning System Module: Signal Invalid	This DTC sets when the IPC receives invalid compass data from the GPSM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the GPSM and other modules on the network. Refer to the appropriate section in Group 415 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the GPSM, DIAGNOSE the observable symptom.
U0557:00	Invalid Data Received From Front Controls Interface Module "A": No Sub Type Information	This DTC sets when the IPC fails to receive invalid outside air temperature data from the FCIM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the FCIM and other modules on the network. Refer to the appropriate section in Group 415 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the FCIM, DIAGNOSE the observable symptom.
U0557:80	Invalid Data Received From Front Controls Interface Module "A": ISO/SAE Reserved	This DTC sets when the IPC fails to receive invalid outside air temperature data from the FCIM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the FCIM and other modules on the network. Refer to the appropriate section in Group 415 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the FCIM, DIAGNOSE the observable symptom.
U0557:81	Invalid Data Received From Front Controls Interface Module "A": Invalid Serial Data Received	This DTC sets when the IPC fails to receive unknown outside air temperature data from the FCIM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the FCIM and other modules on the network. Refer to the appropriate section in Group 415 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the FCIM, DIAGNOSE the observable symptom.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CHECK the vehicle service history for recent service actions related to this module. This DTC sets due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, REPEAT the PMI procedure as directed by the scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) .

		If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data.
U3000:41	Control Module: General Checksum Failure	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:41 is retrieved again, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
U3000:42	Control Module: General Memory Failure	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:42 is retrieved again, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
U3000:43	Control Module: Special Memory Failure	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:43 is retrieved again, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
U3000:44	Control Module: Data Memory Failure	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:44 is retrieved again, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
U3000:46	Control Module: Calibration/Parameter Memory Failure	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:46 is retrieved again, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
U3000:54	Control Module: Missing Calibration	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:54 is retrieved again, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test BO
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test BP
U300A:64	Ignition Switch: Signal Plausibility Failure	DTC U300A:64 sets in continuous memory when the IPC detects a messaged START input for 15 seconds or longer. Once the fault condition is detected, the IPC operates with limited functionality for 15 seconds then returns to full functionality. DIAGNOSE any ignition or starting system concerns. REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) .

DTC Chart: Body Control Module (BCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC Chart - BCM

DTC	Description	Action
B1048:01	Brake Fluid Level Switch: General Electrical Failure	GO to Pinpoint Test O
B1048:7B	Brake Fluid Level Switch: Low Fluid Level	GO to Pinpoint Test O
B10F1:14	Key In Switch: Circuit Short To Ground or Open	• If the key in ignition warning chime is inoperative, GO to Pinpoint Test AV • If the key in ignition warning chime always sounds, GO to Pinpoint Test AR
All other DTCs	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .

DTC Chart: Steering Column Control Module (SCCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC Chart - SCCM

DTC	Description	Action
B137F:09	Steering Wheel Left Switch Pack: Component Failure	GO to Pinpoint Test X
B137F:11	Steering Wheel Left Switch Pack: Circuit Short To Ground	GO to Pinpoint Test X
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	GO to Pinpoint Test X

All other DTCs	-	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) .

Symptom Chart(s)

Symptom Chart: Instrument Panel Cluster (IPC)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
A module does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • Communication concern • Module	REFER to: Communications Network (418-00 Module Communications Network) .
The IPC is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
Multiple gauges, indicators, RTT indicators, warnings and chimes are inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The 4WD High/Low indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The PCM (wrench) indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The load shed indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The electronic locking differential indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The hill descent control indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The wait to start indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The frost warning indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
The water in fuel indicator is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test A
A virtual gauge (4WD, tachometer or temperature), is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
Incorrect fuel gauge indication	Refer to the Pinpoint Test	GO to Pinpoint Test C
The speedometer is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test D
Incorrect speedometer indication	Refer to the Pinpoint Test	GO to Pinpoint Test E
The odometer is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test F
The analog tachometer is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test G
Incorrect analog tachometer indication	Refer to the Pinpoint Test	GO to Pinpoint Test H
The analog temperature gauge is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test I
Incorrect analog temperature gauge indication	Refer to the Pinpoint Test	GO to Pinpoint Test J
The ABS warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test K
The airbag warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test L
The auto stop-start indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test M
The brake warning indicator is never on	Refer to the Pinpoint Test	GO to Pinpoint Test N
The brake warning indicator is always on	Refer to the Pinpoint Test	GO to Pinpoint Test O
The LH- RH turn signal or high beam indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test P
The lights on indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test Q
The MIL is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test R
The PRNDL indicator is never on or never displays P	Refer to the Pinpoint Test	GO to Pinpoint Test S
The safety belt warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test T
The stability-traction control indicator (sliding car icon) is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test U
The stability-traction control disabled indicator (sliding car OFF icon) is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test V
The TPMS warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test W

Symptom Chart: Information And Message Center

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The message center is not operating correctly	Refer to the Pinpoint Test	GO to Pinpoint Test X
The LH or RH message center display is blank	Refer to the Pinpoint Test	GO to Pinpoint Test A
A virtual display is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
The compass is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test Y
The child lock malfunction warning message is inoperative or always displayed	Child lock system concern	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
The diesel system malfunction warning message is inopertive or always on	Diesel system concern	Refer to the appropriate section in Group 303 for the procedure.
The DTE-Average Fuel Economy (AFE) display is inoperative	IPC	• CHECK the operation of the fuel gauge, the speedometer and the odometer. – If the fuel gauge does not operate correctly, GO to Pinpoint Test C – If the speedometer does not operate correctly, GO to Pinpoint Test DGO to Pinpoint Test E – If the odometer does not operate correctly, GO to Pinpoint Test F – If the speedometer, the fuel gauge and the odometer operate correctly, INSTALL a new IPC.
The DTE display is incorrect or fluctuates	Refer to the Pinpoint Test	GO to Pinpoint Test Z
The digital speedometer displays the incorrect speed	Refer to the Pinpoint Test	DIAGNOSE the speedometer. GO to Pinpoint Test E
The outside air temperature display is inoperative or incorrect	Refer to the Pinpoint Test	GO to Pinpoint Test AA
The auto high beam RTT is never or always displayed	Refer to the Pinpoint Test	GO to Pinpoint Test AB
The auto stop-start RTT indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AC
The charging system RTT warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AD
The cruise control RTT indicator is never on	Refer to the Pinpoint Test	GO to Pinpoint Test AE
The door ajar RTT warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AF
The engine over-temperature RTT warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AG
The lane keeping system off RTT indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AH
The low fuel RTT warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AI
The low oil pressure RTT warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AJ
The low washer fluid level RTT warning indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AK
The powertrain malfunction (wrench) RTT indicator is never or always on	Refer to the Pinpoint Test	GO to Pinpoint Test AN
The 4WD message is always displayed	4WD concern	DIAGNOSE the 4WD system. REFER to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).
The auto high beam malfunction message is always displayed	Auto high beam concern	DIAGNOSE the auto high beams. REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
The auto stop-start malfunction message is always displayed	Stop-start system concern	DIAGNOSE the auto stop-start system. Refer to the appropriate section in Group 303 for the procedure.
A brake warning (brake fluid level low, parking brake applied or brake system malfunction) message is never or always displayed	• Message center concern • Brake warning indication concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly and the brake warning indicator is never on, GO to Pinpoint Test N • If the driver door ajar message functions correctly and the brake warning indicator is always on, GO to Pinpoint Test O
The charging system warning message is always displayed	Charging system concern	DIAGNOSE the charging system. Refer to the appropriate section in Group 414 for the procedure.
The check fuel fill inlet message is always displayed	Refer to the Pinpoint Test	GO to Pinpoint Test AO
A door or hood ajar warning message is never or always displayed	• Message center concern • Door ajar RTT indication concern	DIAGNOSE the door ajar RTT. GO to Pinpoint Test AF
The EPAS (steering system) malfunction message is always on	• Message center concern • EPAS system concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO

		to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the EPAS. REFER to: Power Steering (211-02 Power Steering - Vehicles With: Hydraulic Power Assist Steering (HPAS)) .
The engine oil change message is never displayed	• Message center concern • The PCM has not reached the programmed mileage/time based on the criteria required to display the message.	**NOTE:** *Using the system check in the message center, verify the oil life is between 1 and 5% for the CHANGE ENGINE OIL SOON message or at 0% for the OIL CHANGE REQUIRED message.* • OPEN then CLOSE the driver door and VERIFY the driver door ajar message functions correctly. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly with the oil life between 0-5%, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). • If the driver door ajar message functions correctly with the oil life **not** at the specified value, INFORM the customer how the message center functions and how the oil life messages are set.
The engine oil change message is always displayed	The oil life needs reset	RESET the oil life. REFER to the Owner's Literature.
The engine on warning message is always displayed	Refer to the Pinpoint Test	DIAGNOSE the igntion-engine on warning chime. GO to Pinpoint Test AU
The engine over-temperature warning message is never or always displayed	• Message center concern • Engine over-temperature indication concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the engine over-temperature warning indicator. GO to Pinpoint Test AG
The factory or transport mode message is always displayed	Vehicle is in factory or transport mode	PLACE the vehicle in normal operation mode. REFER to: Transport and Factory Mode Deactivation (419-10 Multifunction Electronic Modules, General Procedures).
A forward collision warning message is always displayed	Forward collision concern	DIAGNOSE the forward collision warning system. REFER to: Collision Warning and Collision Avoidance System (419-03C Collision Warning and Collision Avoidance System, Diagnosis and Testing).
The hill start assist not available message is always displayed	Hill start assist feature concern	DIAGNOSE the hill start assist feature. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
The hill descent RTT is never or always on	Refer to the Pinpoint Test	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the hill descent switch. GO to Pinpoint Test AL
The ESC RTT is never or always on	Refer to the Pinpoint Test	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the ESC switch. GO to Pinpoint Test AM
The lane keeping alert system warning message (keep hands on wheel) is never or always displayed	• Message center concern • Lane keeping alert warning chime concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the lane keeping alert warning chime. GO to Pinpoint Test AW
A lane keeping system fault message is always displayed	Lane departure warning system concern	DIAGNOSE the lane keeping system. REFER to: Lane Keeping System (419-07 Lane Keeping System) .
A load shed warning message is always displayed	• Message center concern • Charging system indication concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the charging system warning indicator or charging system RTT. GO to Pinpoint Test AD
A MyKey® menu is not available or incorrect	• MyKey® programmed key in use • Number of keys set to unlimited	**NOTE:** *MyKey® may not be compatible with non-Ford approved remote start systems*

	mode • Non-Ford approved remote start system installed	• REFER to the Owner's Literature.
The check parking aid message is always displayed	Parking aid system concern	DIAGNOSE the parking aid system. REFER to: Parking Aid (413-13 Parking Aid - Vehicles With: Rear Parking Aid) .
The perimeter alarm message is always displayed	• Message center concern • Perimeter alarm concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, REFER to: Perimeter Anti-Theft Alarm (419-01 Perimeter Anti-Theft Alarm) .
The powertrain cooling warning message is always displayed	Engine over heating concern	DIAGNOSE the engine cooling system. Refer to the appropriate section in Group 303 for the procedure.
The PRNDL not in park (shift to park) message is always displayed	• Message center concern • PRNDL not in park warning chime concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the PRNDL. GO to Pinpoint Test S
A starting/ignition status (press brake to start or switch ignition off press power) message is always on	• Message center concern • Push button start concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the ignition/starting system concern. REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) .
A TPMS malfunction message is never or always on	• Message center concern • TPMS warning indication concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test AF • If the driver door ajar message functions correctly, DIAGNOSE the TPMS warning indicator. GO to Pinpoint Test W
The tire training complete message is never on	TPMS sensor training incomplete	**NOTE:** *This message only appears during the TPMS sensor training procedure.* • CARRY OUT the TPMS sensor training. REFER to: Tire Pressure Monitoring System (TPMS) Sensor Location Calibration (204-04B Tire Pressure Monitoring System (TPMS), General Procedures).
A tire training message (train left front, right front, left rear or right rear tire) message is never on	• TPMS warning indicator concern • TPMS sensor training concern	**NOTE:** *These messages only appear during the TPMS sensor training procedure.* • VERIFY the TPMS warning indicator functions. • If the TPMS warning indicator does not operate, GO to Pinpoint Test W • If the TPMS warning indicator operates, CARRY OUT the TPMS sensor training. REFER to: Tire Pressure Monitoring System (TPMS) Sensor Location Calibration (204-04B Tire Pressure Monitoring System (TPMS), General Procedures).
The tires not trained message is always on	TPMS sensor training concern	• This message only appears during the TPMS sensor training procedure. • CARRY OUT the TPMS sensor training. REFER to: Tire Pressure Monitoring System (TPMS) Sensor Location Calibration (204-04B Tire Pressure Monitoring System (TPMS), General Procedures).
The water in fuel message is always displayed	• Message center concern • Water in fuel concern	• OPEN then CLOSE the driver door and VERIFY the driver door ajar message displays correctly with the door open and closed. • If the driver door ajar message does not function correctly, GO to Pinpoint Test A • If the driver door ajar message functions correctly, DIAGNOSE all PCM water in fuel Diagnostic Trouble Codes (DTCs). Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart: Warning Chimes

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
All the chimes are inoperative	IPC	GO to Pinpoint Test A
The active park assist chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AP
The adaptive cruise control warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AQ
The airbag secondary warning chime is inoperative	• Normal condition • IPC	• Using a diagnostic scan tool, PERFORM the IPC self-test. • If DTC P1534:01 is present, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). • If DTC P1534:01 is **not** present, the system is operating correctly. The airbag secondary warning chime sounds only when a fault in the airbag warning indicator is present and DTC P1534:01 is recorded.
The airbag secondary warning chime has activated	IPC	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
The Belt-Minder® feature is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AZ
The Belt-Minder® cannot be deactivated	MyKey® programmed key in use	The system is operating correctly. Use an administrator key to disable the Belt-Minder®.
The chime always sounds	Refer to the Pinpoint Test	GO to Pinpoint Test AR
The chime only sounds from the IPC	Refer to the Pinpoint Test	• Using a diagnostic scan tool, perform the IPC self-test. • If any Diagnostic Trouble Codes (DTCs) are present, REFER to the IPC DTCDTC Chart. • If no Diagnostic Trouble Codes (DTCs), DIAGNOSE the audio system. If equipped with the touchscreen audio system, REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
The door ajar warning chime is inoperative	• Door ajar indication concern • IPC	• With the ignition OFF, the headlamps in the PARKING LAMPS position and the doors closed, OPEN the driver door and VERIFY the headlamps on warning chime sounds. • If the headlamps on chime sounds, GO to Pinpoint Test AF • If the headlamps on chime does not sound, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
The forward collision warning chime is inoperative (If Equipped)	Refer to the Pinpoint Test	GO to Pinpoint Test AS
The headlamps on warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AT
The ignition-engine on warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AU
The key-in-ignition warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AV
The lane keeping aid warning chime is inoperative	Refer to the Pinpoint Test	**NOTE:** *The lane keeping aid warning chime only sounds to alert the driver they have their hands off the steering wheel. Normal alerting is done through steering wheel vibrations, which cannot be felt when the driver's hands are not on the steering wheel.* GO to Pinpoint Test AW
The lane keeping aid warning chime sounds with the hands on the steering wheel	Road conditions	Certain road conditions could lead to false activation of the chime. REFER to: Lane Keeping System - System Operation and Component Description (419-07 Lane Keeping System, Description and Operation).
The message center warning chime is inoperative	• No warnings present • IPC	• With all the doors closed and the ignition OFF, PLACE the ignition ON. Once the IPC has completed the prove-out, OPEN the driver door and VERIFY the message center displays the door ajar RTT indicator and the chime sounds once. • If the chime sounds, the system is operating correctly. The message center warning chime only sounds when a new warning is displayed in the message center. • If the door ajar message does not display, GO to Pinpoint Test AF • If the door ajar message displays and the chime does not sound, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
The parking aid chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AP
The parking brake warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AX
	• Perimeter	

The perimeter alarm chime is inoperative	• Perimeter alarm concern • IPC	GO to Pinpoint Test AY
The PRNDL not in park warning chime is inoperative	• PRNDL indication concern • IPC	• With the ignition OFF, the headlamps in the PARKING LAMPS position and the doors closed, OPEN the driver door and VERIFY the headlamps on warning chime sounds. • If the headlamps on chime sounds, DIAGNOSE the PRNDL indicator. GO to Pinpoint Test S • If the headlamps on chime does not sound, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
The safety belt warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test AZ
The turn signal-hazard on warning chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test BA
The turn signal left on chime is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test BA

Pinpoint Tests

The IPC Is Inoperative/Multiple Gauges, Indicators, RTT Indicators, Warnings And Chimes Are Inoperative Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

The IPC receives hot at all times voltage from the BCM. The IPC receives the ignition status message for the RUN/START or ACC input from the BCM through the GWM over the CAN.

Possible Sources

- Fuse
- Communication concern
- GWM
- IPC

Visual Inspection and Diagnostic Pre-checks

Inspect the BCM fuse.

PINPOINT TEST A : THE IPC (INSTRUMENT PANEL CLUSTER) IS INOPERATIVE/MULTIPLE GAUGES, INDICATORS, RTT (RECONFIGURABLE TELLTALE) INDICATORS, WARNINGS AND CHIMES ARE INOPERATIVE OR ALWAYS ON

A1 PERFORM THE NETWORK TEST FOR ALL MODULES

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Do all modules pass the network test?

Yes	GO to A2
No	REFER to: Communications Network (418-00 Module Communications Network) .

A2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to A3

A3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to A4

A4 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the GWM and all related in-line connectors.

- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the GWM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation). CLEAR the DTC. REPEAT the IPC self-test. If the IPC is still inoperative, GO to A5
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A5 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Virtual Gauge (4WD, Tachometer Or Temperature) Is Inoperative

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

4WD Gauge

- If the 4WD data or vehicle speed messages are missing for less than 5 seconds or if the IPC receives invalid torque data for less than 5 seconds, the IPC defaults the display fill area in front of the front wheels and behind the rear wheels to the last setting based upon that last message received.
- If the IPC does not receive the 4WD data or vehicle speed messages for 5 seconds or longer, the IPC defaults the display fill area in front of the front wheels and behind the rear wheels off.

Tachometer

- If the engine rpm message is missing for less than 5 seconds, the IPC defaults the tachometer to the last indication state, based upon the last message received.
- If the engine rpm message is missing for 5 seconds or longer, the IPC defaults the tachometer to 0 rpm.

Temperature Gauge

- If the engine coolant temperature data or engine overheat indication request messages are missing for less than 5 seconds, the IPC defaults the temperature gauge to the last indication state, based upon the last message received.
- If the engine coolant temperature data or engine overheat indication request messages are missing for 5 seconds or longer, the IPC defaults the temperature gauge to the full hot position.

Possible Sources

- Communication concern
- GWM
- PCM
- IPC

PINPOINT TEST B : A VIRTUAL GAUGE (4WD (FOUR-WHEEL DRIVE) , TACHOMETER OR TEMPERATURE) IS INOPERATIVE

B1 VERIFY THE IPC (INSTRUMENT PANEL CLUSTER) IS SET TO DISPLAY THE GAUGE

- Ignition ON.
- **NOTE:** *The IPC and message center navigation can be found in the Owner's Literature.*

  Using the message center controls, make sure the IPC is set to display the gauge in question.

Is the IPC set to display the gauge?

Yes	GO to B2
No	The virtual gauge is operating correctly. The IPC was not set to display the gauge in question.

B2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to B3

B3 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to B4

B4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

Incorrect Fuel Gauge Indication

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1346:11	Fuel Level Sensor "B" Circuit: Circuit Short To Ground	A continuous and on-demand DTC that sets in the IPC if the fuel level input is pulled low out of range on the fuel level input circuit indicating a short to ground for 33 seconds or longer. The IPC defaults the fuel gauge to empty (E).
P1346:13	Fuel Level Sensor "B" Circuit: Circuit Open	A continuous and on-demand DTC that sets in the IPC if the fuel level input is sent high out of range on the fuel level input circuit indicating an open or short to voltage for 33 seconds or longer. The IPC defaults the fuel gauge to empty (E).

Possible Sources

- Wiring, terminals or connectors
- Fuel pump assembly

- Fuel level sender (float and card)
- Fuel level sensor
- Fuel tank
- IPC

Visual Inspection and Diagnostic Pre-checks

Inspect the fuel tank for signs of damage that can affect the float operation inside the tank. For the analog fuel gauge, inspect the gauge needle for signs of binding or damage.

PINPOINT TEST C : INCORRECT FUEL GAUGE INDICATION

NOTE: *Following any fuel gauge repairs, remove BCM fuse for one minute then reinstall to reset the fuel gauge timers.*

C1 CARRY OUT THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	For DTC P1346:11 GO to C2 For DTC P1346:13, GO to C5
No	If equipped with an analog fuel gauge, GO to C9 If not equipped with an analog fuel gauge, GO to C10

C2 CHECK THE FUEL LEVEL INPUT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Fuel Pump Assembly C4330.
- Ignition ON.
- Wait one minute.
- **NOTE:** *DTC P1346:11 can be present when carrying out this step and should be disregarded at this time.*

  Using a diagnostic scan tool, repeat the IPC on-demand self-test.

Is DTC P1346:13 present?

Yes	GO to C11
No	GO to C3

C3 CHECK THE FUEL PUMP ASSEMBLY SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-14	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE FUEL PUMP ASSEMBLY SIGNAL AND RETURN CIRCUITS FOR A SHORT TOGETHER

- Measure:

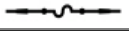
Positive Lead	Measurement / Action	Negative Lead
C220-14	Ω	C220-2

Is the resistance greater than 10,000 ohms?

Yes	GO to C15
No	REPAIR the circuits.

C5 CHECK THE FUEL PUMP ASSEMBLY FOR AN OPEN

- Ignition OFF.
- Disconnect Fuel Pump Assembly C4330.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C4330-1		C4330-2

- Ignition ON.
- Wait one minute.
- **NOTE:** *DTC P1346:11 can be present when carrying out this step and should be disregarded at this time.*

  Using a diagnostic scan tool, repeat the IPC self-test.

Is DTC P1346:11 present?

Yes	GO to C11
No	GO to C6

C6 CHECK THE FUEL LEVEL SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect IPC C220.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-14		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C7

C7 CHECK THE FUEL LEVEL SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-14	Ω	C4330-2

Is the resistance less than 3 ohms?

Yes	GO to C8
No	REPAIR the circuit.

C8 CHECK THE FUEL LEVEL RETURN CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-1	Ω	C4330-1

Is the resistance less than 3 ohms?

Yes	GO to C15
No	REPAIR the circuit.

C9 CARRY OUT THE IPC (INSTRUMENT PANEL CLUSTER) FUEL GAUGE ACTIVE COMMAND

- Ignition ON.
- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC fuel gauge (FUELLEVEL) active command.
- Command the fuel gauge from 0% to 25%, 50%, 75% and 100% while observing the fuel gauge.

Does the fuel gauge begin at E (empty), move to approximately 1/4, 1/2, 3/4 and F (full)?

Yes	GO to C10
No	GO to C15

C10 INSPECT THE FUEL TANK

- Visually inspect the fuel tank for any damage or deformation.

Is the fuel tank in good condition?

Yes	GO to C11
No	VERIFY the fuel level sensor and fuel pump module are in good condition. INSTALL a new fuel tank. Refer to the appropriate section in Group 310 for the procedure.

C11 CHECK THE FUEL PUMP ASSEMBLY

- Disconnect and inspect the fuel pump assembly connector.
- Repair:
  - corrosion (install new connector or terminals-clean module pins)
  - damaged pins-install new terminals/pins
  - pushed-out pins-install new pins as necessary
- Reconnect the fuel pump assembly connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	GO to C12
No	The system is operating correctly at this time. The concern may have been caused by component connections. ADDRESS the root cause of any connector or pin issues.

C12 CHECK THE FUEL PUMP MODULE

NOTE: *The fuel pump module (excluding Flex Fuel) resistance measures between 10 ohms ± 2 ohms at the upper stop position and 300 ohms ± 6 ohms at the lower stop position.*

NOTE: *The Flex Fuel pump module resistance measures between 50 ohms ± 3 ohms at the upper stop position and 540 ohms ± 10 ohms at the lower stop position.*

- Remove the fuel pump module.
- While moving the float arm from the lower stop position to the upper stop position measure the component side of the connector:

Positive Lead	Measurement / Action	Negative Lead
C4330-2	Ω	C4330-1

Does the resistance slowly decrease from the maximum to minimum ohms?

Yes	GO to C14
No	GO to C13

C13 CHECK THE FUEL PUMP ASSEMBLY FOR CORRECT OPERATION

- Disconnect the fuel level sender (float and card) input wire from the fuel pump assembly.
- Measure the resistance between the fuel level sender (float and card) input wire and the fuel level sender (float and card) ground while slowly moving the float arm between the lower and upper stop position.

Positive Lead	Measurement / Action	Negative Lead
Fuel Level Sensor (Component Side) - Pin 1	Ω	Fuel Level Sensor (Component Side) - Pin 2

Does the resistance slowly decrease from the maximum to minimum ohms?

Yes	INSTALL a new fuel pump assembly. Refer to the appropriate section in Group 310 for the procedure.
No	INSTALL a new fuel level sender (float and card). Refer to the appropriate section in Group 310 for the procedure.

C14 CHECK THE FUEL PUMP ASSEMBLY SIGNAL AND RETURN CIRCUITS

- Ignition OFF.
- Disconnect IPC C220.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C4330-1		C4330-2

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-14	Ω	C220-1

Is the resistance less than 3 ohms?

Yes	REMOVE the fused jumper wire. GO to C15
No	REMOVE the fused jumper wire. REPAIR the circuits.

C15 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Speedometer Is Inoperative

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the vehicle speed message is missing or invalid for 5 seconds or longer, the IPC defaults the speedometer to 0 km/h (0 mph).

Possible Sources

- Communication concern
- ABS
- GWM
- PCM
- IPC

PINPOINT TEST D : THE SPEEDOMETER IS INOPERATIVE

D1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to D2

D2 PERFORM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to D3

D3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to D4

D4 PERFORM THE SPEEDOMETER ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC speedometer (SPDOMETER) PID.
- Command the speedometer on and off while monitoring the speedometer.

Does the speed begin at 0 km/h (0 mph) move to 257 km/h (160 mph) and return to 0 km/h (0 mph)?

Yes	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

Incorrect Speedometer Indication

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the vehicle speed message is missing or invalid for less than 5 seconds, the IPC defaults the speedometer to the last indication state, based upon the last message received.

Possible Sources

- Axle ratio configuration
- Tire size configuration
- ABS
- IPC

Visual Inspection and Diagnostic Pre-checks

Verify the tire size on the vehicle matches the tire size listed on the vehicle certification label.
REFER to: Identification Codes (100-01 Identification Codes) .

PINPOINT TEST E : INCORRECT SPEEDOMETER INDICATION

E1 CHECK THE TIRE SIZE CONFIGURATION

- Ignition ON.
- Using a diagnostic scan tool, view Module Programming for the programmed axle ratio.
- **NOTE:** *The vehicle build axle ratio can be found in PTS under the OASIS>HVBoM>Features tab.*

  Locate and determine the vehicle build axle ratio.

Does the programmed axle ratio match the vehicle build axle ratio?

Yes	GO to E2
No	CONFIGURE the correct axle ratio as required.

E2 CHECK THE TIRE SIZE CONFIGURATION

- Ignition ON.
- Using a diagnostic scan tool, view Module Programming for the programmed tire size.
- **NOTE:** *The correct tire size can be found on the vehicle certification label.*

  Verify the size of the tires installed on the vehicle matches the vehicle configuration and the vehicle certification label.
  REFER to: Identification Codes (100-01 Identification Codes) .

Is the tire size correct and is the tire size correctly configured?

Yes	GO to E3
No	INSTALL the correct size tires or CONFIGURE the correct tire size as required.

E3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to E4

E4 PERFORM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to E5

E5 PERFORM THE SPEEDOMETER ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC speedometer (SPDOMETER) PID.
- Command the speedometer in 10% increments while monitoring the speedometer. The speed indicated should increase in increments of approximately 26 km/h (16 mph) for each 10% change.

Command	Indication Range
10% (20 km/h [12 mph])	20-26 km/h (12-16 mph)
20% (40 km/h [25 mph])	40-48 km/h (25-30 mph)
30% (60 km/h [37 mph])	60-70 km/h (37-43 mph)
40% (80 km/h [50 mph])	80-92 km/h (50-57 mph)
50% (100 km/h [62 mph])	100-114 km/h (62-71 mph)
60% (120 km/h [75 mph])	120-136 km/h (75-85 mph)
70% (140 km/h [87 mph])	140-158 km/h (87-98 mph)
80% (160 km/h [99 mph])	160-180 km/h (99-112 mph)
90% (180 km/h [112 mph])	180-202 km/h (112-126 mph)
100% (200 km/h [124 mph])	200-224 km/h (124-139 mph)

Does the speedometer increase within the specified range?

Yes	GO to E6
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

E6 CHECK THE PCM (POWERTRAIN CONTROL MODULE) VEHICLE SPEED PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- **NOTE:** *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*
  Select the PCM VSS PID while driving the vehicle at 32 km/h (20 mph), 64 km/h (40 mph) and 97 km/h (60 mph).

Does the speedometer indicate between 31-34 km/h (19-21 mph), 63-69 km/h (39-43 mph) and 93-103 km/h (58-64 mph) at the 3 PCM PID values?

Yes	GO to E7
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

E7 OBSERVE THE SPEEDOMETER OPERATION

- Observe the speedometer while operating at various speeds and stopping frequently.

Does the speedometer begin at 0 km/h (0 mph) and fully return to the 0 km/h (0 mph) position when the vehicle is stopped?

Yes	The speedometer is operating correctly at this time.
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Odometer Is Inoperative

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the odometer count message is missing from the PCM through the GWM for 5 seconds or longer, the IPC defaults the odometer display to all dashes (------).

If the odometer count message is deemed invalid by the IPC, the IPC defaults the odometer display to all dashes (------). If the NVM becomes corrupted or if any NVM failure occurs, odometer displays ERROR.

Possible Sources

- Communication concern
- GWM
- PCM
- IPC

PINPOINT TEST F : THE ODOMETER IS INOPERATIVE

F1 CHECK FOR CORRUPTED NON-VOLATILE MEMORY (NVM)

- Ignition ON.
- Observe the message center display area.

Does the odometer display ERROR?

Yes	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	GO to F2

F2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to F3

F3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

The Analog Tachometer Is Inoperative

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the IPC does not receive the engine rpm data from the PCM for more than 5 seconds, the IPC defaults the tachometer to 0 rpm.

Possible Sources

- Communication concern
- PCM
- GWM
- IPC

PINPOINT TEST G : THE ANALOG TACHOMETER IS INOPERATIVE

G1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to G2

G2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to G3

G3 PERFORM THE TACHOMETER ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC tachometer (TACH_IND) PID.
- **NOTE:** *Make sure to set the scan tool to 0 rpm before beginning this step.*

  Command the tachometer in 10% increments while monitoring the tachometer.

Does the tachometer increase approximately 800 rpm with each 10% increment?

Yes	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

Incorrect Analog Tachometer Indication

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the rpm data is missing for 5 seconds or less or if the IPC receives invalid rpm data for 5 seconds or less, the IPC defaults the tachometer to the last setting,

based upon the last good message received. If the engine rpm message is missing or invalid for 5 seconds or less, the gauge can appear to momentarily freeze or become erratic.

Possible Sources

- PCM
- IPC

PINPOINT TEST H : INCORRECT ANALOG TACHOMETER INDICATION

H1 RETRIEVE THE RECORDED DTCS FROM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to H2

H2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to H3

H3 PERFORM THE TACHOMETER ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC tachometer (TACH_IND) PID.
- **NOTE:** *Make sure to set the scan tool to 0 rpm before beginning this step.*

  Command the tachometer in 10% increments while monitoring the tachometer.

Does the tachometer increase approximately 800 rpm with each 10% increment?

Yes	GO to H4
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

H4 CHECK THE PCM (POWERTRAIN CONTROL MODULE) RPM PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Select the PCM rpm PID (RPM).
- Set the PID to run the engine at 1,000, 1,500, 2,000 and 2,500 rpm.

Does the tachometer indication range between 944-1,056 at 1,000 rpm, 1,444-1,556 rpm at 1,500 rpm, 1,944-2,056 rpm at 2,000 rpm and 2,444-2,556 rpm at 2,500 rpm?

Yes	The tachometer is operating correctly at this time.
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Analog Temperature Gauge Is Inoperative

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the IPC does not receive the engine coolant temperature message or if the engine coolant temperature message is deemed invalid from the PCM for more than 5 seconds, the IPC defaults the temperature gauge to cold (C).

Possible Sources

- Communication concern
- PCM
- GWM
- IPC

PINPOINT TEST I : THE ANALOG TEMPERATURE GAUGE IS INOPERATIVE

I1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to I2

I2 PERFORM THE TACHOMETER ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC temperature gauge (ENGCOOLNT) PID.
- **NOTE:** *Make sure to set the scan tool to 0 or full cold before beginning this step.*

  Command the temperature gauge on and off while monitoring the temperature gauge.

Does the temperature gauge start at cold (C), move to full hot (H) and return to cold (C)?

Yes	GO to I3
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

I3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

Incorrect Analog Temperature Gauge Indication

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the engine coolant temperature message is missing for 5 seconds or less or if the IPC receives invalid engine temperature data for 5 seconds or less, the IPC defaults the temperature gauge to the last setting, based upon the last known good temperature status message.

Possible Sources

- Engine cooling system concern
- PCM
- IPC

PINPOINT TEST J : INCORRECT ANALOG TEMPERATURE GAUGE INDICATION

J1 CHECK FOR CORRECT OPERATION OF THE COOLING SYSTEM

- Ignition ON.
- Verify the engine cooling system and thermostat are functioning correctly.

Does the engine cooling system and thermostat operate correctly?

Yes	GO to J2
No	REFER to: Engine Cooling (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing). REFER to: Engine Cooling (303-03 Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . REFER to: Engine Cooling (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).

J2 RETRIEVE THE RECORDED DTCS FROM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to J3

J3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to J4

J4 CARRY OUT THE TEMPERATURE GAUGE ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC temperature gauge (ENGCOOLNT) PID.
- **NOTE:** *Make sure to set the scan tool to 0 or full cold before beginning this step.*

  Command the temperature gauge as follows:

Command	Indication Range
0% (under 38° C [100° F])	Full cold (C)
15% (60° C [140° F])	Beginning of the normal range
45% (823° C [180° F]-110° C [230° F])	Center of the gauge
85% (120° C [248° F])	End of the normal range
95% (123° C [255° F])	Hot (H) (red line)

Does the temperature gauge operate according to the above specifications?

Yes	GO to J5
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

J5 CHECK THE PCM (POWERTRAIN CONTROL MODULE) TEMPERATURE PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Start the engine.
- Select the PCM temperature PID CHT.
- With the engine running and temperature increasing, monitor the PCM CHT PID.

Does the PCM PID agree with the temperature gauge indication?

Yes	The temperature gauge is operating correctly at this time.
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The ABS Warning Indicator Is Never Or Always On

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Normal Operation and Fault Conditions

If the ABS warning indicator request message is missing for less than 5 seconds, the IPC defaults the ABS warning indicator to its last indication state (on or off), based upon the last message received.

If the ABS warning indicator request message is missing for 5 seconds or longer, the IPC defaults the ABS warning indicator on.

Possible Sources

- Communication concern
- ABS
- GWM
- IPC

PINPOINT TEST K : THE ABS (ANTI-LOCK BRAKE SYSTEM) WARNING INDICATOR IS NEVER OR ALWAYS ON

K1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to K2

K2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC ABS warning indicator (ABS_LAMP) PID.
- Command the ABS warning indicator on then off. Observe the ABS warning indicator.

Does the ABS warning indicator turn on when commanded on and turn off when commanded off?

Yes	GO to K3
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

K3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	If the ABS warning indicator is never on, the system is operating correctly. If the ABS warning indicator is always on, DIAGNOSE all ABS module Diagnostic Trouble Codes (DTCs). REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).

The Airbag Warning Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the airbag indicator lamp request message is missing for less than 5 seconds, the IPC defaults the airbag warning indicator to its last indication state (on or off), based upon the last message received.

If the airbag indicator lamp request message is missing for 5 seconds or longer, the IPC defaults the airbag warning indicator on.

Possible Sources

- Communication concern
- SRS
- GWM
- IPC

PINPOINT TEST L : THE AIRBAG WARNING INDICATOR IS NEVER OR ALWAYS ON

L1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to L2

L2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to L3

L3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC airbag warning indicator (AIRBAG_LMP) PID.
- Command the airbag warning indicator on then off. Observe the airbag warning indicator.

Does the airbag warning indicator turn on when commanded on and turn off when commanded off?

Yes	If the airbag warning indicator is never on, the system is operating correctly. If the airbag warning indicator is always on, DIAGNOSE the SRS. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Auto Stop-Start Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the stop/start indicator request message is missing for less than 5 seconds, the IPC defaults the auto stop-start warning indicator to its last indication state (on or off), based upon the last message received.

If the stop/start indicator request message is missing for 5 seconds or longer, the IPC defaults the stop/start indicator off.

Possible Sources

- Communication concern
- GWM
- PCM
- IPC

PINPOINT TEST M : THE AUTO STOP-START INDICATOR IS NEVER OR ALWAYS ON

M1 VERIFY THE AUTO STOP-START SWITCH STATUS INDICATOR ILLUMINATION FUNCTION

- Ignition ON.
- Press the auto stop-start momentary contact switch and verify illumination of the status indicator in the switch.

Does the switch illuminate when pressed and turn off when pressed again?

Yes	GO to M2
No	DIAGNOSE the auto stop-start switch. REFER TO SECTION 413-00.

M2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to M3

M3 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to M4

M4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to M5

M5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND USING A SCAN TOOL

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC all lamps (ALL_LAMP) PID.
- Command all the indicators on then off. Observe the auto stop-start indicator.

Does the auto stop-start indicator turn on when commanded on and turn off when commanded off?

Yes	DIAGNOSE the auto stop-start system. REFER TO SECTION 413-00.
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Brake Warning Indicator is Never On

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the brake (red) warning indicator request, brake warning indicator request or red brake warning indicator request messages are missing or invalid for less than

5 seconds, the IPC defaults the ABS warning indicator to the last indication state (on or off), based upon the last message received.

Possible Sources

- Brake fluid level switch
- Parking brake system concern
- BCM
- IPC

Visual Inspection and Diagnostic Pre-checks

Inspect the:

- brake fluid level switch for signs of any external damage.
- wiring harness for signs of a pinched harness causing a shorted circuit.

PINPOINT TEST N : THE BRAKE WARNING INDICATOR IS NEVER ON

N1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Ignition ON.
- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC brake warning indicator (PBA_LMP) PID.
- Command the brake warning indicator on then off. Observe the brake warning indicator.

Does the brake warning indicator turn on when commanded on and turn off when commanded off?

Yes	GO to N2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

N2 DOES THE BRAKE WARNING INDICATOR OPERATES WITH THE PARKING BRAKE APPLIED

- Apply the parking brake while monitoring the brake warning indicator.

Does the brake warning indicator illuminate?

Yes	GO to N4
No	GO to N3

N3 CHECK THE PARKING BRAKE SYSTEM OPERATION

- Apply the parking brake.

Does the parking brake system apply the rear parking brakes?

Yes	GO to N4
No	REFER to: Parking Brake (206-05 Parking Brake and Actuation) .

N4 CHECK THE LOW BRAKE FLUID LEVEL SWITCH OPERATION

- Ignition OFF.
- Disconnect Low Brake Fluid Level Switch C157.
- Ignition ON.
- Wait one minute.

Does the brake warning indicator illuminate?

Yes	VERIFY the brake fluid level is low enough to turn on the brake warning indicator or has been reported low enough to turn on the brake warning indicator. If the brake fluid level is currently low or has been reported low, INSTALL a new brake fluid reservoir. REFER to: Brake Fluid Reservoir (206-06 Hydraulic Brake Actuation, Removal and Installation). If the brake fluid level is not currently low or has not been reported low, the system is operating correctly at this time.
No	GO to N5

N5 CHECK THE LOW BRAKE FLUID LEVEL SWITCH FOR SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280H.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C124-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to N6
No	REPAIR the circuit.

N6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Brake Warning Indicator is Always On

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the brake (red) warning indicator request, brake warning indicator request or red brake warning indicator request messages are missing for 5 seconds longer, the IPC defaults the brake warning indicator on.

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1048:01	Brake Fluid Level Switch: General Electrical Failure	A continuous and on-demand DTC that sets in the BCM when the BCM detects an open on the brake fluid level switch input.
B1048:7B	Brake Fluid Level Switch: Low Fluid Level	An on-demand DTC that sets in the BCM if the BCM detects a low brake fluid level input from the brake fluid level switch.

Possible Sources

- Wiring, terminals or connectors
- Brake fluid level switch
- Parking brake position switch
- Communication concern
- ABS
- GWM
- BCM
- IPC

Visual Inspection and Diagnostic Pre-checks

Inspect the:

- base brake system and the parking brake system for correct operation.
- brake fluid level switch connection and check for signs of connector terminal damage, corrosion or pushed-out pins.
- brake fluid level switch wiring for signs of a cut or opened circuit.
- brake fluid level switch for signs of any external damage.

PINPOINT TEST O : THE BRAKE WARNING INDICATOR IS ALWAYS ON

O1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to O2

O2 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	For DTC B1048:01, GO to O5 For DTC B1048:7B, VERIFY the brake fluid level is low. If the brake fluid level is low, CORRECT the low brake fluid condition. If the brake fluid level is not low, INSTALL a new brake fluid reservoir. REFER to: Brake Fluid Reservoir (206-06 Hydraulic Brake Actuation, Removal and Installation). For all other Diagnostic Trouble Codes (DTCs), REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to O3

O3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to O4

O4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

O5 CHECK THE LOW BRAKE FLUID LEVEL SWITCH INPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280H.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-28		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to O6

O6 CHECK THE LOW BRAKE FLUID LEVEL SWITCH INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Low Brake Fluid Level Switch C157.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-28	Ω	C157-1

Is the resistance less than 3 ohms?

Yes	GO to O7
No	REPAIR the circuit.

O7 CHECK THE LOW BRAKE FLUID LEVEL GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C157-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to O8
No	REPAIR the circuit.

O8 CHECK THE LOW BRAKE FLUID LEVEL SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Connect Low Brake Fluid Level Switch C157.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-28	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to O9
No	GO to O10

O9 CHECK THE LOW BRAKE FLUID LEVEL SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Disconnect Low Brake Fluid Level Switch C157.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-28	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new brake fluid reservoir. REFER to: Brake Fluid Reservoir (206-06 Hydraulic Brake Actuation, Removal and Installation).
No	REPAIR the circuit.

O10 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LH- RH Turn Signal, Front Fog Lamp Or High Beam Indicator Is Never or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the turn indication data or high beam status message is missing for less than 5 seconds, the IPC defaults the turn signal or high beam indicator to its last indication state (on or off), based upon the last message received.

If the turn indication data or high beam status message is missing for 5 seconds or longer, the IPC defaults the turn signal or high beam indicator off.

Possible Sources

- Turn signal concern
- High beam concern
- Communication concern
- BCM
- GWM
- IPC

PINPOINT TEST P : THE LH (LEFT-HAND) - RH (RIGHT-HAND) TURN SIGNAL OR HIGH BEAM INDICATOR IS NEVER OR ALWAYS ON

P1 DETERMINE THE FAULT CONDITION

- Ignition ON.
- Check the operation of the high beams or turn signals.

Do the high beams or turn signals operate correctly?

Yes	GO to P2
No	For high beams, REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing). For turn signals, REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

P2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to P3

P3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	For the LH or RH turn indicator, GO to P4 For the high beam indicator, GO to P5

P4 CHECK THE LH (LEFT-HAND) AND RH (RIGHT-HAND) TURN INDICATOR OPERATION

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC RH or LH turn signal indicator (RH_TURN_L) or (LH_TURN_L) PID.
- Command the RH or LH turn signal indicator on and off while observing the RH or LH turn signal indicator.

Does the RH or LH turn signal indicator illuminate when commanded on and turn off when commanded off?

Yes	DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

P5 CHECK THE HIGH BEAM INDICATOR OPERATION

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).

- Select the IPC high beam indicator (HIGH_BEAM) PID.
- Command the high beam indicator on and off while observing the high beam indicator.

Does the high beam indicator illuminate when commanded on and turn off when commanded off?

Yes	DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Lights On Indicator Is Never or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the park lamp status message is missing for less than 5 seconds, the IPC defaults the lights on indicator to its last indication state (on or off), based upon the last message received.

If the park lamp status message is missing for 5 seconds or longer, the IPC defaults the lights on indicator off.

Possible Sources

- Exterior lighting concern
- Communication concern
- GWM
- BCM
- IPC

PINPOINT TEST Q : THE LIGHTS ON INDICATOR IS NEVER OR ALWAYS ON

Q1 CHECK THE PARKING LAMPS OPERATION

- Place the headlamp switch in the PARKLAMP position.
- Ignition ON.
- Observe the parking lamps.

Do the parking lights operate correctly?

Yes	GO to Q2
No	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

Q2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to Q3

Q3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to Q4

Q4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC lights on indicator (SIDELIGHT_LMP) PID.
- Command the lights on indicator on and off while observing the indicator.

Does the lights on indicator illuminate when commanded on and turn off when commanded off?

Yes	DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .

No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The MIL Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the MIL request message is missing or invalid for less than 5 seconds, the IPC defaults the MIL to its last state (on or off) based upon the last known good message received.

If the MIL request message is missing for 5 seconds or longer, the IPC defaults the MIL on.

Possible Sources

- Communication concern
- GWM
- PCM
- IPC

PINPOINT TEST R : THE MIL (MALFUNCTION INDICATOR LAMP) IS NEVER OR ALWAYS ON

R1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to R2

R2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to R3

R3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC MIL PID.
- Command the MIL on and off while observing the indicator.

Does the MIL illuminate when commanded on and turn off when commanded off?

Yes	If the MIL is never on, the system is operating correctly at this time. If the MIL is always on, DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The PRNDL Indicator Is Never On Or Never Displays P

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the transmission gear display or transmission shift mode display message is missing for less than 5 seconds, the PRNDL display remains in the last indication state (on or off), based upon the last message received.

If the transmission gear display or transmission shift mode display message is missing for 5 seconds or longer, the IPC defaults the PRNDL display off.

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1706:00	High Vehicle Speed Observed in Park: No Sub Type Information	A continuous and on-demand DTC that sets in the IPC if the IPC detects a park detect input with vehicle speed over 16 km/h (10 mph), indicating the vehicle is in park while in motion.

Possible Sources

- Wiring, terminals or connectors
- Selector lever cable adjustment
- Communication concern
- Park detect switch (part of the selector lever)
- Transmission concern
- GWM
- BCM
- IPC

Visual Inspection And Diagnostic Pre-checks

Verify the vehicle is not in transport mode.

PINPOINT TEST S : THE PRNDL INDICATOR IS NEVER ON OR NEVER DISPLAYS P

S1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any DTCs recorded?

Yes	For DTC P1706:00, GO to S5 For all other Diagnostic Trouble Codes (DTCs), REFER to the IPC DTC Chart.
No	GO to S2

S2 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any DTCs recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to S3

S3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to S4

S4 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any transmission related DTCs recorded?

Yes	DIAGNOSIS all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to S5

S5 BYPASS THE SELECTOR LEVER AND CHECK THE IPC (INSTRUMENT PANEL CLUSTER) PARK DETECT INPUT

- Ignition OFF.
- Disconnect Selector Lever C3245.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C3245-6		Ground

- Ignition ON.
- Monitor the PRNDL indicator with the fused jumper wire installed and with the fused jumper wire removed.

Does the PRNDL display P with the fused jumper wire connected and blank with the fused jumper wire disconnected?

Yes	REMOVE the fused jumper wire. GO to S8
No	REMOVE the fused jumper wire. GO to S6

S6 CHECK THE SELECTOR LEVER INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-7	Ω	C3245-6

Is the resistance less than 3 ohms?

Yes	GO to S7
No	REPAIR the circuit.

S7 CHECK THE SELECTOR LEVER INPUT CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-7	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to S15
No	REPAIR the circuit.

S8 CHECK THE PARK DETECT SWITCH CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect IPC C220.
- Disconnect BCM C2280G.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-12		Ground

Is any voltage present?

Yes	GO to S9
No	GO to S10

S9 CHECK THE SELECTOR LEVER CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Selector Lever C3245.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-12	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	INSTALL a new selector lever. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).

S10 CHECK THE PARK DETECT SWITCH CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Selector Lever C3245.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-12	Ω	C3245-10

Is the resistance less than 3 ohms?

Yes	GO to S11
No	REPAIR the circuit.

S11 CHECK THE PARK DETECT SWITCH CONTROL CIRCUIT FOR A SHORT TO GROUND

- Measure:

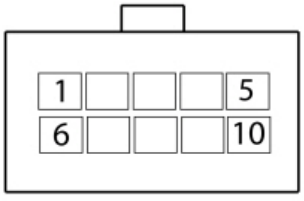
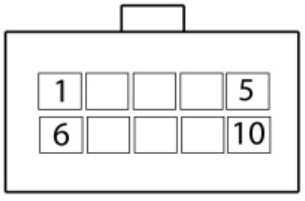
Positive Lead	Measurement / Action	Negative Lead
C2280G-12	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to S12
No	REPAIR the circuit.

S12 CHECK THE PARK DETECT SWITCH OPERATION IN PARK

- Place the selector lever in PARK (P).
- With the selector lever in PARK (P), measure:

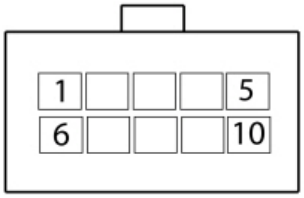
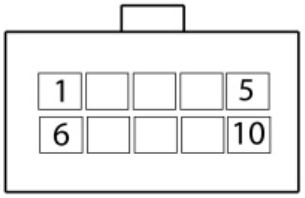
Positive Lead	Measurement / Action	Negative Lead
 E206581 Selector Lever Pin 6 (Component Side)	Ω	 E206581 Selector Lever Pin 10 (Component Side)

Is the resistance less than 3 ohms?

Yes	GO to S13
No	INSTALL a new selector lever. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).

S13 CHECK THE PARK DETECT SWITCH OPERATION OUT OF PARK

- Apply the parking brake.
- Move the selector lever out of PARK (P).
- With the selector lever out of PARK (P), measure:

Positive Lead	Measurement / Action	Negative Lead
 E206581 Selector Lever Pin 6 (Component Side)	Ω	 E206581 Selector Lever Pin 10 (Component Side)

Is the resistance greater than 3 ohms?

Yes	GO to S14
No	INSTALL a new selector lever. REFER to: Selector Lever Assembly (307-05 Automatic Transmission External Controls, Removal and Installation).

S14 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

S15 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

	REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Safety Belt Warning Indicator Is Never or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the driver safety belt status is missing for less than 5 seconds, the IPC defaults the safety belt warning indicator to its last indication state (on or off), based upon the last message received.

If the driver safety belt status message is missing for 5 seconds or longer, the IPC defaults the safety belt warning indicator off.

Possible Sources

- Driver safety belt buckle concern
- Communication concern
- GWM
- SRS
- IPC

PINPOINT TEST T : THE SAFETY BELT WARNING INDICATOR IS NEVER OR ALWAYS ON

T1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to T2

T2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to T3

T3 CHECK THE DRIVER SAFETY BELT BUCKLE STATUS

- Using a diagnostic scan tool, monitor the RCM driver safety belt buckle PID (SBELT_D_ST) while buckling and unbuckling the driver safety belt.

Does the PID display BUCKLED with the safety belt buckled and UNBUCKLED with the safety belt unbuckled?

Yes	GO to T4
No	INSTALL a new safety belt buckle. REFER to: Front Seatbelt Buckle (501-20A Seatbelt Systems, Removal and Installation).

T4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC safety belt warning indicator (SBLT_LAMP) PID PID.
- Command the safety belt warning indicator on and off while observing the safety belt warning indicator.

Does the safety belt warning indicator illuminate when commanded on and turn off when commanded off?

Yes	INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Stability-Traction Control Indicator (Sliding Car Icon) Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the stability-traction control indicator request is missing or invalid for less than 5 seconds, the IPC defaults the stability-traction control indicator (sliding car icon) to the last indication state (on or off), based upon the last message received.

If the IPC does not receive the stability-traction control indicator request for 5 seconds or longer, the IPC defaults the stability-traction control indicator (sliding car icon) on.

Possible Sources

- Communication concern
- Stability-traction control system concern
- GWM
- IPC

PINPOINT TEST U : THE STABILITY-TRACTION CONTROL INDICATOR (SLIDING CAR ICON) IS NEVER OR ALWAYS ON

U1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to U2

U2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to U3

U3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC stability-traction control indicator (TC/IVD/RSCLMP) PID.
- Command the stability-traction control indicator (sliding car icon) on and off while observing the stability-traction control indicator (sliding car icon).

Does the stability-traction control indicator (sliding car icon) illuminate when commanded on and turn off when commanded off?

Yes	If the stability-traction control indicator (sliding car icon) is never on, the system is operating correctly. If the stability-traction control indicator (sliding car icon) is always on, DIAGNOSE all ABS module Diagnostic Trouble Codes (DTCs). REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Stability-Traction Control Disabled Indicator (Sliding Car OFF Icon) Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the stability-traction control disabled indicator request is missing or invalid for less than 5 seconds, the IPC defaults the stability-traction control disabled indicator (sliding car OFF icon) to the last indication state (on or off), based upon the last message received.

If the IPC does not receive the stability-traction control disabled indicator request for 5 seconds or longer, the IPC defaults the stability-traction control disabled indicator (sliding car OFF icon) off.

When a MyKey® programmed key is in use and the AdvanceTrac® on feature is configured always on, the traction control system cannot be disabled and the traction control indicator does not turn on when the traction control disable button is pressed. The traction control indicator still functions correctly to indicate a traction control system fault and a traction control active event.

Possible Sources

- MyKey® programmed key in use
- Stability-traction control system concern
- Stability-traction control system cannot be disabled
- Communication concern
- GWM
- IPC

PINPOINT TEST V : THE STABILITY-TRACTION CONTROL DISABLED INDICATOR (SLIDING CAR OFF ICON) IS NEVER OR ALWAYS ON

V1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to V2

V2 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to V3

V3 CHECK FOR THE KEY TYPE

- Check if the key is a MyKey® programmed key or an administrator key. Refer to the Owner's Literature.

Is the key an administrator key?

Yes	GO to V4
No	GO to V5

V4 CHECK FOR THE ADVANCETRAC® ON FEATURE CONFIGURED ALWAYS ON

- Check if the AdvanceTrac® feature is configured always on. Refer to the Owner's Literature.

Is the AdvanceTrac® feature configured always on?

Yes	The traction control system cannot be disabled when the AdvanceTrac® on feature is configured always on.
No	GO to V5

V5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC stability-traction control disabled indicator (sliding car OFF icon) (STAB_TC_LMP) PID.
- Command the stability-traction control disabled indicator (sliding car OFF icon) on and off while observing the stability-traction control disabled indicator (sliding car OFF icon).

Does the stability-traction control disabled indicator (sliding car OFF icon) illuminate when commanded on and turn off when commanded off?

Yes	GO to V6
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

V6 CHECK THE TRACTION CONTROL SETTING THE EXTERNAL SWITCH

- Press the ESC switch once then again.

Does the stability-traction control disable the indicator (sliding car OFF icon) illuminate when commanded on and turn off when commanded off?

Yes	The system is operating correctly at this time.
No	DIAGNOSE the stability-traction control switch and circuitary. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).

The TPMS Warning Indicator Is Never or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the tire pressure warning indicator message is missing for 5 seconds or less, the TPMS warning indicator remains in its last indication state (on or off), based upon the last message received.

If the tire pressure warning indicator message is missing for 5 seconds or longer, the IPC flashes the TPMS warning indicator for approximately 75 seconds, then illuminates the TPMS warning indicator.

Possible Sources

- Low tire pressure
- Communication concern
- BCM
- GWM
- TPMS
- IPC

PINPOINT TEST W : THE TPMS (TIRE PRESSURE MONITORING SYSTEM) WARNING INDICATOR IS NEVER OR ALWAYS ON

W1 CHECK THE TIRE PRESSURE

- Verify the tire pressure in all tires meets the recommended tire pressures on the vehicle certification label.
  REFER to: Identification Codes (100-01 Identification Codes) .

Do all the tires meet the recommended tire pressures?

Yes	GO to W2
No	CORRECT the tire pressures.

W2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to W3

W3 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any DTCs recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to W4

W4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to W5

W5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) INDICATOR LAMP CONTROL ACTIVE COMMAND USING A SCAN TOOL

- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Select the IPC TPMS warning indicator (TPMWARN_LMP) PID.
- Command the TPMS warning indicator on and off while observing the TPMS warning indicator.

Does the TPMS warning indicator illuminate when commanded on and turn off when commanded off?

Yes	If the TPMS warning indicator is never on, the system is operating correctly. If the TPMS warning indicator is always on, DIAGNOSE the TPMS. REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

	REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

The Message Center Is Not Operating Correctly

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

SCCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B137F:09	Steering Wheel Left Switch Pack: Component Failure	A continuous and on-demand DTC that sets in the SCCM when the SCCM detects a message center switch pressed for 2 minutes or longer.
B137F:11	Steering Wheel Left Switch Pack: Circuit Short To Ground	A continuous and on-demand DTC that sets in the SCCM when the SCCM detects a short to ground on the message center switch input circuit.
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	A continuous and on-demand DTC that sets in the SCCM when the SCCM detects an open or short to voltage on the message center switch input circuit.

Possible Sources

- Wiring, terminals or connectors
- Clockspring
- Message center switch (part of the LH steering wheel switch)
- SCCM
- IPC

PINPOINT TEST X : THE MESSAGE CENTER IS NOT OPERATING CORRECTLY

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

X1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to X2

X2 PERFORM THE SCCM (STEERING COLUMN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	For DTC B137F:09, CLEAR the DTC. REPEAT the self-test. If DTC B137F:09 returns, INSTALL a new LH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). For DTC B137F:11, GO to X5 For DTC B137F:17, GO to X8
No	GO to X3

X3 CHECK THE STEERING WHEEL SWITCH INPUT TO THE SCCM (STEERING COLUMN CONTROL MODULE)

- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Select the LH steering wheel switch Parameter Identifications (PIDs) (L_CURS_LFT, L_CURS_RGT, L_CURS_UP, L_CURS_DWN and L_CURS_OK).

Do the Parameter Identifications (PIDs) match the switch position?

Yes	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

No	GO to X4

X4 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) OUTPUT AT THE LH (LEFT-HAND) STEERING WHEEL SWITCH

- Ignition OFF.
- Disconnect LH Steering Wheel Switch C2490.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	V	C2490-5

Is the voltage approximately 5 volts?

Yes	INSTALL a new LH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

X5 CHECK THE MESSAGE CENTER SWITCH SIGNAL CIRCUIT BETWEEN THE LH (LEFT-HAND) STEERING WHEEL SWITCH AND THE UPPER CLOCKSPRING FOR A SHORT TO GROUND

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20 Supplemental Restraint System) .
- Disconnect Upper Clockspring C218B.
- Ignition ON.
- Using a diagnostic scan tool, perform the SCCM self-test.

Is DTC B137F:17 recorded?

Yes	GO to X6
No	GO to X7

X6 CHECK THE MESSAGE CENTER SWITCH SIGNAL CIRCUIT BETWEEN THE LH (LEFT-HAND) STEERING WHEEL SWITCH AND THE UPPER CLOCKSPRING FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect LH Steering Wheel Switch C2490.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new LH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

X7 CHECK THE MESSAGE CENTER SWITCH SIGNAL CIRCUIT BETWEEN THE LH (LEFT-HAND) STEERING WHEEL SWITCH AND THE UPPER CLOCKSPRING FOR A SHORT TO GROUND

- Ignition OFF.
- Remove the clockspring from the SCCM.
- Ignition ON.
- Using a diagnostic scan tool, perform the SCCM self-test.

Is DTC B137F:17 recorded?

Yes	INSTALL a new clockspring. REFER to: Clockspring (501-20 Supplemental Restraint System) .
No	GO to X13

X8 CHECK THE MESSAGE CENTER SWITCH SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20 Supplemental Restraint System) .
- Disconnect LH Steering Wheel Switch C2490.
- Disconnect SCCM C226A.

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	V	C2490-5

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to X9

X9 CHECK THE MESSAGE CENTER SWITCH SIGNAL CIRCUIT BETWEEN THE LH (LEFT-HAND) STEERING WHEEL SWITCH AND THE UPPER CLOCKSPRING FOR AN OPEN

- Ignition OFF.
- Disconnect Upper Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	C218B-14

Is the resistance less than 3 ohms?

Yes	GO to X10
No	REPAIR the circuit.

X10 CHECK THE MESSAGE CENTER SWITCH RETURN CIRCUIT BETWEEN THE LH (LEFT-HAND) STEERING WHEEL SWITCH AND THE UPPER CLOCKSPRING FOR AN OPEN

- Measure:

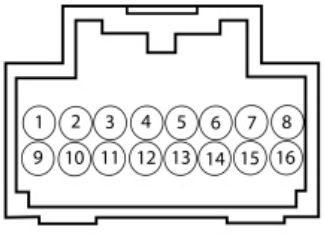
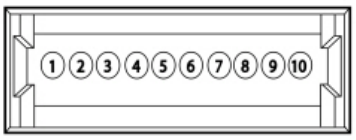
Positive Lead	Measurement / Action	Negative Lead
C2490-5	Ω	C218B-8

Is the resistance less than 3 ohms?

Yes	GO to X11
No	REPAIR the circuit.

X11 CHECK THE MESSAGE CENTER SWITCH SIGNAL CIRCUIT THROUGH THE CLOCKSPRING FOR AN OPEN

- Remove the clockspring from the SCCM.
- Measure:

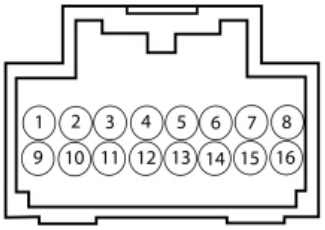
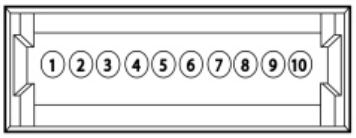
Positive Lead	Measurement / Action	Negative Lead
 E155137 Upper Clockspring (Component Side) - Pin 14	Ω	 E155657 Lower Clockspring (Component Side) - Pin 6

Is the resistance less than 3 ohms?

Yes	GO to X12
No	INSTALL a new clockspring. REFER to: Clockspring (501-20 Supplemental Restraint System) .

X12 CHECK THE MESSAGE CENTER SWITCH RETURN CIRCUIT THROUGH THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
 E155137 Upper Clockspring (Component Side) - Pin 8	Ω	 E155657 Lower Clockspring (Component Side) - Pin 9

Is the resistance less than 3 ohms?

Yes	GO to X13
No	INSTALL a new clockspring. REFER to: Clockspring (501-20 Supplemental Restraint System) .

X13 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the SCCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the SCCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Compass Is Inoperative

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the compass display data messages are missing or invalid for 5 seconds or less, the compass displays the last vehicle direction based upon the last known good compass display message received.

If the compass display data messages are invalid or missing for more than 5 seconds, the IPC defaults the display to all dashes (---).

Possible Sources

- Communication concern
- GPSM
- IPC

PINPOINT TEST Y : THE COMPASS IS INOPERATIVE

Y1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) SELF-TEST

- Ignition ON.

- Using a diagnostic scan tool, perform the GPSM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 415 for the procedure.
No	GO to Y2

Y2 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .

The DTE Display Is Incorrect Or Fluctuates

Normal Operation and Fault Conditions

NOTE: *The DTE display and the fuel gauge both use the fuel level input from the fuel tank to provide their respective functions. If the fuel gauge doesn't function correctly, both the fuel gauge and the DTE display are affected.*

NOTE: *The actual DTE can be higher or lower than the DTE displayed in the message center due to changes in driving conditions. It is important to understand how the DTE is calculated and the factors that impact the DTE display when determining how to address any DTE concerns.*

The DTE is calculated in the IPC using the Running Average Fuel Economy (RAFE), which is the fuel economy over a much longer distance than the Instantaneous Fuel Economy (IFE), and the fuel level input from the fuel sender(s) to determine how many miles the vehicle can be driven based on the remaining fuel in the tank.

NOTE: *Even if the fuel economy is relatively constant, the DTE can vary in the short term by up to 50 miles, but is usually within 10 miles.*

The IPC defaults to a base programmed fuel economy when the battery is initially connected and adjusts upward or downward based on driving habits and conditions.

Since the DTE is calculated and averaged over a longer period of time, varying driving conditions can have a significant impact on the current or short term DTE as opposed to the displayed DTE. This difference often leads to customer complaints of incorrect or invalid DTE.

The following list provides some (not all) of the driving conditions that may lead to an incorrect or fluctuating DTE concern:

- Changing between towing/not towing
- Changing driving between city and highway
- Allowing the vehicle to idle for long periods of time
- Using the remote start feature (if equipped) frequently or allowing the vehicle to warm up, particularly when parked on a grade
- Parking or driving on grades
- Not using a type of fuel consistently
- Over-fueling or not filling the tank completely (partial refueling)

To better illustrate the affects of how driving conditions can affect DTE, please refer to the examples below.

The example below illustrates how the following observations are normal and expected since the low fuel reminder is triggered from a fuel volume and not from a fixed distance to empty.

If while driving, the low fuel reminder (low fuel indicator and low fuel warning message) displays when the DTE equals 94.4 km (59 miles) and the driver adds 11.36 L (3 gallons) of fuel, the new DTE may become 124.8 km (78 miles). After continued driving, the low fuel reminder may now display when the DTE equals 83.2 km (52 miles).

The next example (below) illustrates what occurs when idling on an incline. In this example, the customer should be made aware of how the condition will correct after a few minutes of idling on a level surface.

If the customer stops and parks the vehicle on an incline in a driveway, then in the morning remote starts the vehicle, allowing the engine to idle, the DTE may now equal 184 km (115 miles). As the customer drives, the low fuel reminder displays when the DTE equals 148.8 km (93 miles). Finally, after 5 more minutes of driving, the DTE is back to 80 km (50 miles).

In this example, the fuel gauge and the DTE display can be out of sync, but self-corrects after several minutes of driving.

Possible Sources

- BCM
- Fuel gauge concern
- Changes in driving conditions such as:
  - towing
  - extended idle times
  - parking on any grades
  - alcohol in the fuel
  - refueling patterns
- IPC configuration

Visual Inspection and Diagnostic Prechecks

Make sure to record the Running Average Fuel Economy (RAFE) prior to disconnecting the battery or removing the IPC fuse. If any of the previous conditions occur, the vehicle must be driven over time to allow the DTE calculations to adjust.

PINPOINT TEST Z : THE DTE (DISTANCE TO EMPTY) DISPLAY IS INCORRECT OR FLUCTUATES

Z1 REVIEW AND INVESTIGATE THE FOLLOWING DRIVING CONDITIONS WITH THE CUSTOMER

- Determine whether the driver changes the following driving conditions:
  - changing between towing/not towing, city/highway driving
  - use of extended idle times
  - use of remote start frequently (if equipped)
  - parking/driving on grades
  - use of E85 fuel exclusively or switching to non-Ethanol fuel
  - over filling the fuel tank or not filling the tank completely (partial refueling)

Does the driver change driving conditions?

Yes	Advise the customer how changing driving conditions can affect the current short-term DTE as opposed to the displayed long-term DTE.
No	GO to Z2

Z2 CHECK THE FUEL GAUGE FOR CORRECT OPERATION

- Ignition ON.
- Verify the fuel gauge is functioning and correctly indicating the remaining fuel level.

Is the fuel gauge operating correctly?

Yes	GO to Z3
No	GO to Pinpoint Test C

Z3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to Z4

Z4 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	The vehicle configuration is most likely incorrect for the fuel tank size. INSTALL As-Built data from PTS following scan tool instructions.

The Outside Air Temperature Display Is Inoperative or Incorrect

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the air ambient temperature message is missing or invalid for less than 5 seconds, the IPC defaults the outside air temperature display to the last temperature reading, based upon the last message received.

If the air ambient temperature message is missing or invalid for 5 seconds or longer from the PCM, the IPC displays all dashes (- - - -) in the outside air temperature display area.

Possible Sources

- Communication concern
- Ambient Air Temperature (AAT) sensor input to the PCM
- GWM
- FCIM

PINPOINT TEST AA : THE OUTSIDE AIR TEMPERATURE DISPLAY IS INOPERATIVE OR INCORRECT

AA1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AA2

AA2 PERFORM THE FCIM (FRONT CONTROLS INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCIM module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 415 for the procedure.
No	GO to AA3

AA3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AA4

AA4 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to AA5

AA5 CHECK THE AMBIENT AIR TEMPERATURE INPUT TO THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, view the PCM Parameter Identifications (PIDs).
- Select the ambient air temperature PID (AAT).
- Allow the vehicle to sit out of the sun with the engine off, for approximately 6 hours to remove any potential heat soak at the ambient air temperature sensor.
- Monitor the ambient air temperature PID and compare the PID value with the actual outside air temperature.

Does the ambient air temperature match the actual outside air temperature?

Yes	INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	GO to AA6

AA6 CHECK THE OUTSIDE AIR TEMPERATURE DISPLAY UPDATE

- **NOTE:** *Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.*
  Drive the vehicle above 33 km/h (20 mph) to allow the outside air temperature display to update.

Did the outside air temperature display update toward the actual ambient air temperature?

Yes	The system is operating correctly at this time. Explain to the customer the operation of the system as it relates to the update strategy.
No	GO to AA7

AA7 CHECK THE AMBIENT AIR TEMPERATURE (AAT) SENSOR FOR OBSTRUCTIONS OR DEBRIS

- Check the area around the Ambient Air Temperature (AAT) sensor for any obstructions or debris such as leaves or paper.

Is the area around the Ambient Air Temperature (AAT) sensor free from any obstructions or debris?

Yes	GO to AA8
No	CLEAR all debris or obstructions as necessary to allow for the free flow of air around the Ambient Air Temperature (AAT) sensor.

AA8 CHECK THE AMBIENT AIR TEMPERATURE (AAT) SENSOR OPERATION

- Ignition OFF.
- Disconnect Ambient Air Temperature (AAT) Sensor C132.
- Inspect the connector and wiring:
  - water intrusion
  - corrosion
  - damaged pins
  - pushed-out pins

Are there any signs of water intrusion, corrosion, damaged or pushed out pins?

Yes	REPAIR the Ambient Air Temperature (AAT) sensor connector or wiring for any water intrusion, corrosion, damaged or pushed out pins.
No	INSTALL a new ambient air temperature sensor.

The Auto High Beam RTT Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the auto high beam status display message is missing for less than 5 seconds, the IPC defaults the auto high beam RTT to its last indication state (on or off), based upon the last message received.

If the auto high beam status display message is missing for 5 seconds or longer, the IPC defaults the high beam RTT off.

Possible Sources

- Communication concern
- IPMA
- GWM
- IPC

PINPOINT TEST AB : THE AUTO HIGH BEAM RTT (RECONFIGURABLE TELLTALE) IS NEVER OR ALWAYS ON

AB1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT.

Is the door ajar RTT off with the door closed, and on with the door open?

Yes	GO to AB2
No	GO to Pinpoint Test AF

AB2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AB3

AB3 PERFORM THE IPMA (IMAGE PROCESSING MODULE A) SELF-TEST

- Using a diagnostic scan tool, perform the IPMA self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Lane Keeping System (419-07 Lane Keeping System) .
No	GO to AB4

AB4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE the auto high beams. REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).

The Auto Stop-Start RTT Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the stop/start indicator request message is missing for less than 5 seconds, the IPC defaults the auto stop-start warning indicator to its last indication state (on or off), based upon the last message received.

If the stop/start indicator request message is missing for 5 seconds or longer, the IPC defaults the stop/start indicator off.

Possible Sources

- Communication concern
- Auto stop-start concern
- PCM
- GWM
- IPC

PINPOINT TEST AC : THE AUTO STOP-START RTT (RECONFIGURABLE TELLTALE) INDICATOR IS NEVER OR ALWAYS ON

AC1 VERIFY THE AUTO STOP-START FEATURE IS ENABLED

- Ignition ON.
- **NOTE:** *Refer to the Owner's Literature for message center menu navigation.*

  Using the message center controls, verify the stop-start feature is enabled.

Is the stop-start system enabled?

Yes	GO to AC2
No	ENABLE the stop-start feature and INFORM the customer how to enable the feature.

AC2 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all doors, the hood and the liftgate.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AC3
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AC3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AC4

AC4 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to AC5

AC5 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE the auto stop-start feature. Refer to the appropriate section in Group 303 for the procedure.

The Charging System RTT Warning Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the charging system indication request is missing for less than 5 seconds, the IPC defaults the charging system RTT indicator to the last indication state (on or off), based upon on the last message received.

If the charging system indication request is missing for 5 seconds or longer, the IPC defaults the charging system RTT indicator on.

Possible Sources

- Charging system concern
- Communication concern
- GWM
- IPC

PINPOINT TEST AD : THE CHARGING SYSTEM RTT (RECONFIGURABLE TELLTALE) WARNING INDICATOR IS NEVER OR ALWAYS ON

AD1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AD2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AD2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AD3

AD3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AD4

AD4 CHECK THE CHARGING SYSTEM OPERATION

- Check the charging system operation.

Does the charging system operate correctly?

Yes	If the charging system warning indicator is never on, the system is operating correctly at this time. If the charging system warning indicator is always on, DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	

	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

The Cruise Control RTT Indicator Is Never On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the cruise control status, cruise control override (adaptive cruise) or cruise control set speed (adaptive cruise) message is missing or deemed invalid by the IPC for less than 5 seconds, the IPC defaults the cruise control indicator to the last indication state (on or off), based upon the last message received.

If the cruise control status, cruise control override (adaptive cruise) or cruise control set speed (adaptive cruise) message is missing or if the data is deemed invalid by the IPC for 5 seconds or longer, the IPC defaults the cruise control indicator off.

Possible Sources

- Communication concern
- Cruise control concern
- GWM
- IPC

PINPOINT TEST AE : THE CRUISE CONTROL RTT (RECONFIGURABLE TELLTALE) INDICATOR IS NEVER ON

AE1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AE2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AE2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AE3

AE3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE the cruise control system. REFER to: Cruise Control (419-03 Cruise Control) .

The Door Ajar RTT Warning Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the door status message is missing for less than 5 seconds, the IPC defaults all door ajar message center displays to the last indication state (on or off), based upon the last message received.

If the door status message is missing for 5 seconds or longer, the IPC defaults all door ajar message center displays off.

Possible Sources

- Interior lighting concern
- Communication concern
- Message center concern
- GWM
- BCM
- IPC

PINPOINT TEST AF : THE DOOR AJAR RTT (RECONFIGURABLE TELLTALE) WARNING INDICATOR IS NEVER OR ALWAYS ON

AF1 CHECK THE MESSAGE CENTER OPERATION

- Ignition OFF.
- Disconnect PCM C1232A and C1232B.
- Ignition ON.
- Monitor the message center messages and RTT indicators.

Did multiple message center messages and RTT warning indicators appear?

Yes	GO to AF2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AF2 CHECK THE INTERIOR LIGHTING OPERATION

- Open and close each door while monitoring the interior lamps.

Do the interior lamps operate correctly?

Yes	GO to AF3
No	REFER to: Interior Lighting (417-02 Interior Lighting) .

AF3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AF4

AF4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AF5

AF5 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).

The Engine Over-Temperature RTT Warning Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the engine coolant temperature data or engine overheat indication request messages are missing or invalid for less than 5 seconds, the IPC defaults the engine over-temperature RTT warning indicator to the last indication state (on or off), based upon on the last message received.

If the engine coolant temperature data or engine overheat indication request messages are missing or invalid for 5 seconds or longer, the IPC defaults the engine over-temperature RTT warning indicator on.

Possible Sources

- Communication concern
- GWM
- PCM
- IPC

PINPOINT TEST AG : THE ENGINE OVER-TEMPERATURE RTT (RECONFIGURABLE TELLTALE) WARNING INDICATOR IS NEVER OR ALWAYS ON

AG1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AG2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AG2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AG3

AG3 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to AG4

AG4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	If the engine over-temperature message center is never on, the system is operating correctly at this time. If the engine over-temperature RTT indicator is always on, DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

The Lane Keeping System Off RTT Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the lane departure warning indicator request is missing for less than 5 seconds, the IPC defaults the lane departure RTT indicator to the last indication state (on or off), based upon the last message received.

If the lane departure warning indicator request is missing for 5 seconds or longer, the IPC defaults the lane departure RTT indicator off.

Possible Sources

- Lane departure warning system concern
- Communication concern
- GWM
- IPC

PINPOINT TEST AH : THE LANE KEEPING SYSTEM OFF RTT (RECONFIGURABLE TELLTALE) INDICATOR IS NEVER OR ALWAYS ON

AH1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AH2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AH2 CHECK THE LANE DEPARTURE SWITCH OPERATION

- Press the lane departure switch to turn the system on then off again.

Does the lane departure RTT indicator turn on then off again?

Yes	The system is operating correctly at this time. The system was turned off.
No	GO to AH3

AH3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AH4

AH4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE the lane departure warning system. REFER to: Lane Keeping System (419-07 Lane Keeping System) .

The Low Fuel RTT Warning Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Fuel gauge concern
- Message center concern
- IPC

PINPOINT TEST AI : THE LOW FUEL RTT (RECONFIGURABLE TELLTALE) WARNING INDICATOR IS NEVER OR ALWAYS ON

AI1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AI2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AI2 VERIFY THE OPERATION OF THE FUEL GAUGE

- Ignition ON.
- Verify the fuel gauge operates correctly and there are no customer concerns with the fuel gauge operation.

Does the fuel gauge operate correctly without any customer concerns related to fuel gauge indication?

Yes	GO to AI3
No	GO to Pinpoint Test C

AI3 CONFIRM THE CURRENT FUEL LEVEL

- Enter the Dealer Test Mode.
  REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).
- Scroll to the **Inst Fuel1** display.

Does the FLPM (second value) indicate 104 or less with an administrator key or between 104 and 164 with a MyKey® programmed key?

Yes	If the low fuel RTT warning indicator is always on, the system is operating correctly at this time based on the current fuel level. If the low fuel RTT warning indicator is never on, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	If the low fuel RTT warning indicator is always on, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). If the low fuel RTT warning indicator is never on, the system is operating correctly at this time based on the current fuel level.

The Low Oil Pressure RTT Warning Indicator Is Never Or Always On

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the engine rpm data or oil pressure warning message is missing less than 5 seconds, the IPC defaults the low oil pressure warning indicator to the last state (on or off), based upon the last message received.

If the engine rpm data or oil pressure warning message is missing for 5 seconds or longer, the IPC defaults the low oil pressure warning indicator on.

Possible Sources

- Wiring, terminals or connectors
- Engine oil pressure switch
- Base engine concern
- GWM
- PCM
- IPC

PINPOINT TEST AJ : THE LOW OIL PRESSURE RTT (RECONFIGURABLE TELLTALE) WARNING INDICATOR IS NEVER OR ALWAYS ON

AJ1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AJ2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AJ2 CHECK THE TACHOMETER OPERATION

- Start the engine.
- Verify the tachometer operates.

Does the tachometer operate?

Yes	GO to AJ3
No	For optional IPC, GO to Pinpoint Test B For the base IPC, GO to Pinpoint Test G

AJ3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	If the low oil pressure RTT warning indicator is never on, GO to AJ4 If the low oil pressure RTT warning indicator is always on, GO to AJ6

AJ4 CHECK FOR A STUCK CLOSED ENGINE OIL PRESSURE SWITCH

- Ignition OFF.
- Disconnect Engine Oil Pressure Switch C1642.
- Ignition ON.
- Observe the low oil pressure warning indicator.

Does the low oil pressure warning indicator turn on?

Yes	INSTALL a new engine oil pressure switch. Refer to the appropriate section in Group 303 for the procedure.
No	GO to AJ5

AJ5 CHECK THE OIL PRESSURE INPUT CIRCUIT FOR A SHORT TO GROUND

- Disconnect PCM C1381B 2.2L Engine.
- Disconnect PCM C1551B 2.5L Engine.
- Disconnect PCM C1551B 3.2L Engine.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1642-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to AJ11
No	REPAIR the circuit.

AJ6 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AJ7

AJ7 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to AJ8

AJ8 CHECK FOR A STUCK OPEN ENGINE OIL PRESSURE SWITCH

- Ignition OFF.
- Disconnect Engine Oil Pressure Switch C1642.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C1642-1		Ground

- Ignition ON.
- Observe the low oil pressure warning indicator.

Does the low oil pressure indicator turn off?

Yes	REMOVE the fused jumper wire. GO to AJ9
No	LEAVE the jumper wire connected. GO to AJ10

AJ9 CHECK THE OIL PRESSURE

- Test the engine for low oil pressure.

Was a low oil pressure concern detected?

Yes	REPAIR the low oil pressure concern. REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).
No	INSTALL a new engine oil pressure switch. Refer to the appropriate section in Group 303 for the procedure.

AJ10 CHECK THE ENGINE OIL PRESSURE INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect PCM C1381B 2.2L Engine.
- Disconnect PCM C1551B 2.5L Engine.
- Disconnect PCM C1551B 3.2L Engine.
- Measure:

2.2L Engine

Positive Lead	Measurement / Action	Negative Lead
C1551B-5	Ω	C1642-1

2.5L Engine

Positive Lead	Measurement / Action	Negative Lead
C1232C-5	Ω	C1642-1

3.2L Engine

Positive Lead	Measurement / Action	Negative Lead
C1232C-5	Ω	C1642-1

Is the resistance less than 3 ohms?

Yes	REMOVE the fused jumper wire. GO to AJ11
No	REMOVE the fused jumper wire. REPAIR the circuit.

AJ11 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the PCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Low Washer Fluid Level Message Center Indicator Is Never Or Always On

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- Low washer fluid switch
- IPC

Visual Inspection and Diagnostic Pre-checks

Verify the washer fluid reservoir is full and the ignition has been cycled at least once prior to beginning the pinpoint test for an always on condition or the washer fluid is or has been reported low for a never on condition.

PINPOINT TEST AK : THE LOW WASHER FLUID LEVEL MESSAGE CENTER INDICATOR IS NEVER OR ALWAYS ON

AK1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.

- Monitor the door ajar message center warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar message center warning indicator.

Is the door ajar message center warning indicator off with the door closed then does the message center warning indicator turn on with the door open?

Yes	If the low washer fluid level message center indicator is inoperative, GO to AK2 If the low washer fluid level message center indicator is always on, GO to AK4
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AK2 CHECK THE LOW WASHER FLUID INDICATOR OPERATION

- Ignition OFF.
- Disconnect Low Washer Fluid Level Switch C138.
- Ignition ON.
- Wait one minute.
- Observe the low washer fluid level message center indicator.

Is the low washer fluid level message center indicator on?

Yes	GO to AK3
No	GO to AK5

AK3 CHECK THE WASHER FLUID LEVEL SWITCH GROUND CIRCUIT FOR AN OPEN AT THE WASHER FLUID LEVEL SWITCH

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C138-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to AK4
No	REPAIR the circuit.

AK4 CHECK THE WASHER FLUID LEVEL INPUT CIRCUIT FOR AN OPEN

- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-8	Ω	C138-1

Is the resistance less than 3 ohms?

Yes	GO to AK7
No	REPAIR the circuit.

AK5 CHECK THE WASHER FLUID INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Low Washer Fluid Level Switch C138.
- Ignition ON.
- Wait one minute.
- Observe the low washer fluid level message center indicator.

Did the low washer fluid level message center indicator turn off?

Yes	INSTALL a new washer fluid level switch. REFER to: Windshield Washer Reservoir (501-16 Wipers and Washers) .
No	GO to AK6

AK6 CHECK THE WASHER FLUID INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-8	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to AK7
No	REPAIR the circuit.

AK7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Hill Descent Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the hill descent mode message is missing for less than 5 seconds, the IPC defaults the hill descent indicator or hill descent RTT to its last indication state (on or off), based upon the last message received.

If the hill descent mode message is missing for 5 seconds or longer, the IPC defaults the hill descent indicator or hill descent RTT off.

Possible Sources

- Communication concern
- Message center concern
- Hill descent control system concern
- ABS concern
- GWM concern
- IPC

PINPOINT TEST AL : THE HILL DESCENT INDICATOR IS NEVER OR ALWAYS ON

AL1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AL2

AL2 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) HILL DESCENT INPUT PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, select and monitor the IPC hill descent control PID while selecting hill descent on then off.

Did the IPC PID match the hill descent switch operation?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to AL3

AL3 CHECK THE HILL DESCENT SWITCH INDICATOR OPERATION

- Ignition OFF.
- Disconnect Active Park Assist/Differential Lock Switch C3360.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C3360-4		C3360-12

- Ignition ON.
- Wait one minute.
- Observe the hill descent control message center indicator.

Is the hill descent control message indicator on?

Yes	REMOVE the fused jumper wire. INSTALL a new active park assist/differential lock switch.
No	REMOVE the fused jumper wire. GO to AL4

AL4 CHECK THE HILL DESCENT SWITCH GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-12	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to AL5
No	REPAIR the circuit.

AL5 CHECK THE HILL DESCENT SWITCH INPUT CIRCUIT FOR AN OPEN

- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-10	Ω	C3360-4

Is the resistance less than 3 ohms?

Yes	GO to AL6
No	REPAIR the circuit.

AL6 CHECK THE HILL DESCENT SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-10	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to AL7
No	REPAIR the circuit.

AL7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The ESC Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Instrument Panel Cluster (IPC) - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the ESC disabled indicator request is missing or invalid for less than 5 seconds, the IPC defaults the stability control disabled indicator RTT (sliding car OFF icon) to the last indication state (on or off), based upon the last message received.

If the IPC does not receive the stability control disabled indicator request for 5 seconds or longer, the IPC defaults the stability control disabled indicator RTT (sliding car OFF icon) off.

When a MyKey® programmed key is in use, the stability control is always on, the stability control system cannot be disabled and the indicator or RTT does not turn on when the ESC disable button is pressed. The indicator or RTT still functions correctly to indicate system fault and a stability control active event.

Possible Sources

- MyKey® programmed key in use
- Stability-traction control system concern
- Stability-traction control system cannot be disabled
- Communication concern
- Message center concern
- GWM concern
- IPC

PINPOINT TEST AM : THE ESC (ELECTRONIC STABILITY CONTROL) INDICATOR IS NEVER OR ALWAYS ON

AM1 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AM2

AM2 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) ESC (ELECTRONIC STABILITY CONTROL) INPUT PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, select and monitor the IPC ESC PID while selecting stability control on then off.

Did the IPC PID match the stibility control switch operation?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to AM3

AM3 CHECK THE ESC (ELECTRONIC STABILITY CONTROL) SWITCH INDICATOR OPERATION

- Ignition OFF.
- Disconnect Active Park Assist/Differential Lock Switch C3360.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C3360-1		C3360-12

- Ignition ON.
- Wait one minute.
- Observe the stability control control indicator.

Is the hill stability control indicator on?

Yes	REMOVE the fused jumper wire. INSTALL a new active park assist/differential lock switch.
No	REMOVE the fused jumper wire. GO to AM4

AM4 CHECK THE ESC (ELECTRONIC STABILITY CONTROL) SWITCH GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-12	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to AM5
No	REPAIR the circuit.

AM5 CHECK THE ESC (ELECTRONIC STABILITY CONTROL) SWITCH INPUT CIRCUIT FOR AN OPEN

- Disconnect IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-18	Ω	C3360-1

Is the resistance less than 3 ohms?

Yes	GO to AM6
No	REPAIR the circuit.

AM6 CHECK THE ESC (ELECTRONIC STABILITY CONTROL) SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-18	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to AM7
No	REPAIR the circuit.

AM7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs)

	address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Powertrain Malfunction (Wrench) RTT Indicator Is Never Or Always On

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the transmission service required, engine service required, 4WD service required or body service required message is missing for less than 5 seconds, the IPC defaults the powertrain malfunction (wrench) RTT indicator to the last indication state (on or off), based upon the last message received.

If the transmission service required, engine service required, 4WD service required or body service required message is missing for 5 seconds or longer, the IPC defaults the powertrain malfunction (wrench) RTT indicator on.

Possible Sources

- Communication concern
- BCM
- GWM
- PCM
- IPC

PINPOINT TEST AN : THE POWERTRAIN MALFUNCTION (WRENCH) RTT (RECONFIGURABLE TELLTALE) INDICATOR IS NEVER OR ALWAYS ON

AN1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	GO to AN2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AN2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AN3

AN3 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to AN4

AN4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	If the powertrain malfunction (wrench) RTT indicator is never on, the system is operating correctly at this time. There are currently no vehicle concerns present that require the powertrain malfunction (wrench) RTT indicator display. If the powertrain malfunction (wrench) RTT indicator is always on, DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

The Check Fuel Fill Inlet Message Is Always Displayed

Normal Operation and Fault Conditions

REFER to: Message Center - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

If the check fuel fill inlet message request is missing for less than 5 seconds, the IPC defaults the check fuel fill inlet message center message to the last indication state, based upon the last message received.

If the check fuel fill inlet message request is missing for 5 seconds or longer, the IPC defaults the check fuel fill inlet message center message off.

Possible Sources

- Evaporative emissions system concern
- GWM
- PCM
- IPC

PINPOINT TEST AO : THE CHECK FUEL FILL INLET MESSAGE IS ALWAYS DISPLAYED

AO1 CHECK THE MESSAGE CENTER OPERATION

- Ignition ON.
- Close all the doors and hood.
- Clear all message center warnings by pressing the OK button for each warning present.
- Monitor the door ajar RTT warning indicator.
- Open the driver door.
- Clear the message center popup warning.
- Monitor the door ajar RTT warning indicator.

Is the door ajar RTT warning indicator off with the door closed, and on with the door open?

Yes	
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AO2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AO3

AO3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	If the check fuel fill inlet message is never on, the system is operating correctly at this time. There are currently no vehicle concerns present that require the check fuel fill inlet message display. If the check fuel fill inlet message is always on, DIAGNOSE all PCM Diagnostic Trouble Codes (DTCs). REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) .

	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

The Active Park Assist/Parking Aid Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Parking aid system concern
- Communication concern
- GWM
- IPC

PINPOINT TEST AP : THE ACTIVE PARK ASSIST/PARKING AID CHIME IS INOPERATIVE

AP1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AP2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AP2 VERIFY THE CHIMES FUNCTION THROUGH THE AUDIO SPEAKERS

- Ignition OFF.
- Ignition ON.
- Monitor the location of the safety belt warning chime (front/rear audio speakers or IPC) when the ignition is transitioned from OFF to RUN.

Does the chime sound through the audio speakers?

Yes	GO to AP4
No	GO to AP3

AP3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AP4

AP4 PERFORM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Parking Aid (413-13 Parking Aid - Vehicles With: Rear Parking Aid) .
No	GO to AP5

AP5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	DIAGNOSE the audible parking aid. REFER to: Parking Aid (413-13 Parking Aid - Vehicles With: Rear Parking Aid) .

The Adaptive Cruise Control Warning Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Adaptive cruise control concern
- Communication concern
- GWM
- IPC

PINPOINT TEST AQ : THE ADAPTIVE CRUISE CONTROL WARNING CHIME IS INOPERATIVE

AQ1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AQ2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AQ2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AQ3

AQ3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AQ4

AQ4 CHECK THE CRUISE CONTROL DISPLAY IN THE MESSAGE CENTER

- Verify the adaptive cruise control display functions in the message center when the adaptive cruise control is in operation.

Does the cruise control display operate in the message center?

Yes	DIAGNOSE the cruise control system. REFER to: Cruise Control (419-03 Cruise Control) .
No	GO to Pinpoint Test AE

The Chime Always Sounds

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Exterior lighting concern
- Interior lighting concern
- Wiring, terminals or connectors
- Ignition switch
- Ignition lock cylinder housing
- BCM
- IPC

PINPOINT TEST AR : THE CHIME ALWAYS SOUNDS

AR1 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) FOR MESSAGE CENTER MESSAGES

- Ignition OFF.
- Ignition ON.
- Check the IPC and message center for illuminated warning indicator or message center displays.

Does the IPC have any RTT indicators illuminated or message center messages displayed?

Yes	REPAIR all message center indication concerns first. REFER to Symptom Chart: IPC or Symptom Chart: Information And Message Center.
No	GO to AR2

AR2 CHECK THE EXTERIOR LIGHTING OPERATION

- Place the headlamp switch in the OFF position.
- Close all doors.
- Wait one minute.
- Observe the exterior lights.

Are the headlamps and parking lamps off?

Yes	GO to AR3
No	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing). REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

AR3 CHECK THE INTERIOR LIGHTING OPERATION

- Open and close the driver door.
- Observe the interior lights.

Do the interior lights operate correctly from the driver door?

Yes	GO to AR4
No	REFER to: Interior Lighting (417-02 Interior Lighting) .

AR4 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to AR5

AR5 CHECK THE BCM (BODY CONTROL MODULE) INPUT PIDS FROM THE IGNITION SWITCH

- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Select and monitor the BCM ignition switch (IGN_SW_ACC), (IGN_SW_RUN) and (IGN_SW_KEY_IN) Parameter Identifications (PIDs) while cycling the ignition switch through the ACC, OFF, and RUN states.

Do the BCM Parameter Identifications (PIDs) match the ignition switch position?

Yes	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	For ignition RUN or ACC concerns, DIAGNOSE the ignition switch outputs to the BCM.

	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) . For key-in-ignition concern, GO to AR6

AR6 CHECK THE KEY-IN-IGNITION INPUT CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280G.
- Remove the key from the ignition cylinder.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-38		Ground

Is any voltage present?

Yes	GO to AR7
No	GO to AR9

AR7 CHECK THE KEY-IN-IGNITION INPUT

- Disconnect Ignition Switch C250.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-38		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to AR8

AR8 CHECK THE IGNITION SWITCH OPERATION

- Perform the ignition switch component test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Does the ignition switch pass the component test?

Yes	INSTALL a new ignition lock cylinder housing. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

AR9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Forward Collision Warning Chime Is Inoperative (If Equipped)

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Forward collision system concern
- Communication concern
- GWM
- IPC

PINPOINT TEST AS : THE FORWARD COLLISION WARNING CHIME IS INOPERATIVE (IF EQUIPPED)

AS1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AS2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AS2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AS3

AS3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE the collision warning system. REFER to: Collision Warning and Collision Avoidance System (419-03C Collision Warning and Collision Avoidance System, Diagnosis and Testing).

The Headlamps On Warning Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- BCM
- GWM
- IPC

PINPOINT TEST AT : THE HEADLAMPS ON WARNING CHIME IS INOPERATIVE

AT1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AT2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and

	REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AT2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AT3

AT3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .

The Ignition-Engine On Warning Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Interior lighting concern
- PRNDL indication concern
- BCM
- GWM
- IPC

PINPOINT TEST AU : THE IGNITION-ENGINE ON WARNING CHIME IS INOPERATIVE

AU1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AU2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AU2 CHECK THE DOOR AJAR INDICATION

- Open the driver door.
- Observe the door ajar warning indicator or door ajar RTT warning indicator.

Does the door ajar warning indicator or door ajar RTT warning indicator turn on with the driver door ajar?

Yes	GO to AU3
No	GO to Pinpoint Test AF

AU3 CHECK THE PRNDL OPERATION

- Shift the transmission range selector through the ranges while observing the PRNDL indication.

Does the PRNDL indication match the selected transmission range?

Yes	GO to AU4
No	GO to Pinpoint Test S

AU4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	DIAGNOSE all GWM Diagnostic Trouble Codes (DTCs) REFER to: Communications Network (418-00 Module Communications Network) .

The Key-In-Ignition Warning Chime Is Inoperative

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10F1:14	Key In Switch: Circuit Short To Ground or Open	A continuous and on-demand DTC that sets in the BCM if an open is detected on the key-in-ignition switch input with the ignition ON.

Possible Sources

- Wiring, terminals or connectors
- Interior lighting concern
- Key-in-ignition switch (part of the ignition switch)
- BCM
- GWM
- IPC

PINPOINT TEST AV : THE KEY-IN-IGNITION WARNING CHIME IS INOPERATIVE

AV1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Monitor the safety belt warning chime when the ignition switch is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AV2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AV2 CHECK THE INTERIOR LAMPS OPERATION

- Open and close the driver door.
- Observe the interior lamps.

Do the interior lamps operate correctly from the driver door?

Yes	GO to AV3
No	REFER to: Interior Lighting (417-02 Interior Lighting) .

AV3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AV4

AV4 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B10F1:14 present?

Yes	GO to AV5
No	GO to AV9

AV5 CHECK THE KEY-IN-IGNITION INPUT CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Insert the key into the ignition cylinder.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-38	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to AV9
No	GO to AV6

AV6 CHECK THE KEY-IN-IGNITION INPUT CIRCUIT FOR SHORT TO GROUND

- Remove the key from the ignition cylinder.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-38	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to AV7
No	REPAIR the circuit.

AV7 CHECK THE KEY-IN-IGNITION INPUT CIRCUIT FOR OPEN

- Disconnect Ignition Switch C250.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-38	Ω	C250-5

Is the resistance less than 3 ohms?

Yes	REPAIR the circuit.
No	GO to AV8

AV8 CHECK THE IGNITION SWITCH

- Remove the ignition switch.
  REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
- Perform the ignition switch component test.

Is the ignition switch OK?

Yes	INSTALL a new ignition lock cylinder housing. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new ignition switch. REFER to: Ignition Switch (211-05 Steering Column Switches, Removal and Installation).

AV9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK On-Line Automotive Service Information System (OASIS) for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Lane Keeping Aid Warning Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Communication concern
- Lane departure warning system concern
- GWM
- IPC

PINPOINT TEST AW : THE LANE KEEPING AID WARNING CHIME IS INOPERATIVE

AW1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AW2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AW2 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AW3

AW3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AW4

AW4 CHECK THE LANE DEPARTURE SYSTEM OPERATION

- Verify the lane departure system operates correctly.

Does the lane departure system operate correctly?

Yes	The system is operating correctly at this time. Inform the customer that this chime only operates with the hands off the steering wheel.
No	REFER to: Lane Keeping System (419-07 Lane Keeping System) .

The Parking Brake Warning Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Brake warning indication concern
- Communication concern
- BCM
- GWM
- IPC

Visual Inspection And Diagnostic Pre-checks

Check the operation of the parking brake warning chime with the vehicle moving at least 10 km/h (6.2 mph) and the parking brake slightly applied (just enough to turn the brake warning indicator on without damaging the rear brakes).

PINPOINT TEST AX : THE PARKING BRAKE WARNING CHIME IS INOPERATIVE

AX1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AX2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AX2 CHECK THE BRAKE WARNING INDICATOR FOR CORRECT OPERATION

- Apply the parking brake.
- Observe the brake warning indicator.

Does the brake warning indicator illuminate?

Yes	GO to AX3
No	GO to Pinpoint Test N

AX3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AX4

AX4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs).

	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .

The Perimeter Alarm Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Perimeter alarm concern
- BCM
- GWM
- IPC

PINPOINT TEST AY : THE PERIMETER ALARM CHIME IS INOPERATIVE

AY1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Monitor the safety belt warning chime when the ignition switch is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to AY2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AY2 CHECK THE OPERATION OF THE PERIMETER ALARM

- Arm the perimeter alarm using the remote key locking feature (key fob).
- Wait approximately 15 seconds for the system to arm.
- Open the driver door using the interior door handle.

Does the perimeter alarm sound after 12 seconds?

Yes	GO to AY3
No	REFER to: Perimeter Anti-Theft Alarm (419-01 Perimeter Anti-Theft Alarm) .

AY3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AY4

AY4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	DIAGNOSE all BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .

The Safety Belt Warning Chime Or The Belt-Minder® Feature Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Belt-Minder® deactivated
- Communication concern
- Safety belt warning indication concern
- Vehicle speed input concern
- GWM
- RCM
- IPC

PINPOINT TEST AZ : THE SAFETY BELT WARNING CHIME OR THE BELT-MINDER® FEATURE IS INOPERATIVE

AZ1 CHECK THE HEADLAMPS ON WARNING CHIME

- Ignition OFF.
- Turn the headlamps on.
- Remove the ignition key (except push button start) or place the ignition OFF (with push button start).
- Open the driver door.
- Monitor the headlamps on warning chime.

Does the headlamps on warning chime operate?

Yes	GO to AZ2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

AZ2 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition ON.
- Monitor the safety belt warning chime when the ignition switch is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	For the Belt-Minder®, GO to AZ3 For a safety belt warning chime, GO to AZ4
No	GO to AZ5

AZ3 CHECK THE SPEEDOMETER OPERATION

- Ignition ON.
- Verify the speedometer operates.

Does the speedometer operate?

Yes	GO to AZ4
No	GO to Pinpoint Test D

AZ4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to AZ5

AZ5 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to AZ6

AZ6 PERFORM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the RCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to AZ7

AZ7 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to AZ8

AZ8 CHECK THE DRIVER AND FRONT PASSENGER SAFETY BELT BUCKLE SWITCH

- Using a diagnostic scan tool, monitor the RCM driver and front passenger safety belt buckle Parameter Identifications (PIDs) (SBELT_D_ST) and (SBLT_P_ST) while buckling and unbuckling the safety belt.

Do the Parameter Identifications (PIDs) display BUCKLED with the safety belt buckled and UNBUCKLED with the safety belt unbuckled?

Yes	GO to AZ9
No	INSTALL a new safety belt buckle. SEAT BELT BUCKLE R&I IS UNAVAILABLE AT THIS TIME.

AZ9 CHECK THE BELT-MINDER® CONFIGURATION

NOTE: *Verify that an administrator key is used for this test and not a MyKey® programmed key. When a MyKey® programmed key is used, the Belt-Minder® is automatically turned on and cannot be disabled (if previously disabled by an administrator, the Belt-Minder® remains disabled when an administrator key is used).*

- Verify the Belt-Minder® is activated or configured on for the seating position in question.
  REFER to: Seatbelt Minder Deactivating/Activating (413-01 Instrumentation, Message Center and Warning Chimes, General Procedures).

Is the Belt-Minder activated for the seating position in question?

Yes	If the Belt-Minder® is always on above 10 km/h (6 mph) with the safety belt unfastened, the system is operating correctly. If the Belt-Minder® is always on with the safety belt fastened or never on with the safety belt unfastened above 10 km/h (6 mph), INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	ACTIVATE the Belt-Minder® for the seating position in question. REFER to: Seatbelt Minder Deactivating/Activating (413-01 Instrumentation, Message Center and Warning Chimes, General Procedures).

The Turn Signal-Hazard On Chime Or Turn Signal Left On Chime Is Inoperative

Normal Operation and Fault Conditions

REFER to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Possible Sources

- Turn signal indication concern
- Communication concern
- BCM
- GWM
- IPC

PINPOINT TEST BA : THE TURN SIGNAL-HAZARD ON CHIME OR TURN SIGNAL LEFT ON CHIME IS INOPERATIVE

BA1 CHECK THE SAFETY BELT WARNING CHIME OPERATION

- Ignition OFF.
- Ignition ON.
- Unbuckle the driver safety belt.
- Monitor the safety belt warning chime when the ignition is transitioned from OFF to RUN for 6 seconds.

Does the safety belt warning chime operate for approximately 6 seconds?

Yes	GO to BA2
No	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

BA2 CHECK THE TURN SIGNAL INDICATOR OPERATION

- Verify the RH and LH turn signal indicators operate correctly.

Do the turn signal indicators operate correctly?

Yes	GO to BA3
No	GO to Pinpoint Test P

BA3 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	DIAGNOSE all GWM Diagnostic Trouble Codes (DTCs). REFER to: Communications Network (418-00 Module Communications Network) .

Lost Communication With ECM/ PCM U0100:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the PCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- PCM
- IPC

PINPOINT TEST BB : LOST COMMUNICATION WITH ECM (ENGINE CONTROL MODULE) / PCM (POWERTRAIN CONTROL MODULE) U0100:00

BB1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Connect the scan tool.
- Check that a vehicle session can be established using the scan tool.

Can a vehicle session be established?

Yes	GO to BB2
No	REFER to: Communications Network (418-00 Module Communications Network) .

BB2 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform the IPC self-test.
- Clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0100:00 retrieved again?

Yes	GO to BB3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BB3 PERFORM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) DTC recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) .

	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to BB4

BB4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BB5

BB5 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) set?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BB6

BB6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 OR DTC (DIAGNOSTIC TROUBLE CODE) U0100:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0100:00 set in the ABS module or DTC U0100:87 set in the BCM?

Yes	GO to BB7
No	GO to BB8

BB7 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BB8 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins

- pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connector. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication with TCM U0101:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101:00	Lost Communication with TCM	Sets in continuous memory in the IPC if transmission data messages received from the TCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- TCM
- IPC

PINPOINT TEST BC : LOST COMMUNICATION WITH TCM (TRANSMISSION CONTROL MODULE) U0101:00

BC1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BC2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BC2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Does the TCM pass the network test?

Yes	GO to BC3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BC3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BC4

BC4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BC5

BC5 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0101:00 still present?

Yes	GO to BC6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BC6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN OTHER MODULES

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the PMI or the PMI may not have been carried out.*

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:00 set in the BCM?

Yes	GO to BC7
No	GO to BC8

BC7 CHECK FOR CORRECT TCM (TRANSMISSION CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the TCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TCM. REFER to: Transmission Control Module (TCM) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BC8 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With CCM U0104:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0104:00	Lost Communication With Cruise Control Module: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the CCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- CCM
- IPC

PINPOINT TEST BD : LOST COMMUNICATION WITH CCM (CRUISE CONTROL MODULE) U0104:00

BD1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BD2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BD2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the CCM pass the network test?

Yes	GO to BD3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BD3 PERFORM THE CCM (CRUISE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the CCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Cruise Control (419-03 Cruise Control) .
No	GO to BD4

BD4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BD5

BD5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BD6

BD6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0104:00 still present?

Yes	GO to BD7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BD7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0104:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0104:00 set in the ABS module?

Yes	GO to BD8
No	GO to BD9

BD8 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all CCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the CCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BD9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connector. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With ABS Control Module U0121:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the ABS module through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- ABS module
- IPC

PINPOINT TEST BE : LOST COMMUNICATION WITH ABS (ANTI-LOCK BRAKE SYSTEM) CONTROL MODULE U0121:00

BE1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BE2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BE2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the ABS module pass the network test?

Yes	GO to BE3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BE3 PERFORM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to BE4

BE4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BE5

BE5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BE6

BE6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0121:00 still present?

Yes	GO to BE7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BE7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0121:87 set in the BCM?

Yes	GO to BE8
No	GO to BE9

BE8 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the ABS module and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BE9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With PSCM U0131:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0131:00	Lost Communication With Power Steering Control Module: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the PSCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- PSCM
- IPC

PINPOINT TEST BF : LOST COMMUNICATION WITH PSCM (POWER STEERING CONTROL MODULE) U0131:00

BF1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BF2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BF2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the BCM pass the network test?

Yes	GO to BF3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BF3 PERFORM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PSCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Power Steering (211-02 Power Steering - Vehicles With: Hydraulic Power Assist Steering (HPAS)) .
No	GO to BF4

BF4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BF5

BF5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BF6

BF6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the Programmable Module Installation (PMI), or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0131:00 still present?

Yes	GO to BF7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BF7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0131:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0131:87 set in the BCM?

Yes	GO to BF8
No	GO to BF9

BF8 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the PSCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the PSCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PSCM. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BF9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With BCM U0140:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the BCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- BCM
- IPC

PINPOINT TEST BG : LOST COMMUNICATION WITH BCM (BODY CONTROL MODULE) U0140:00

BG1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BG2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BG2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the BCM pass the network test?

Yes	GO to BG3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BG3 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to BG4

BG4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BG5

BG5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to DTC Chart: IPC in this section.
No	GO to BG6

BG6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0140:00 or DTC U0140:81 still present?

Yes	GO to BG7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BG7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.

- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140:00 set in the ABS, APIM or RCM?

Yes	GO to BG8
No	GO to BG9

BG8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BG9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With GWM U0146:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the GWM over the MS-CAN or HS-CAN are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- IPC

PINPOINT TEST BH : LOST COMMUNICATION WITH GWM (GATEWAY MODULE A) U0146:00

BH1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BH2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BH2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the GWM pass the network test?

Yes	GO to BH3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BH3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BH4

BH4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BH5

BH5 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0146:00 still present?

Yes	GO to BH6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BH6 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the GWM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the GWM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation). CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the IPC self-test. If DTC U0146:00 is still present, GO to BH7
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BH7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

BH7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connector. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With RCM U0151:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the RCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- RCM
- IPC

PINPOINT TEST BI : LOST COMMUNICATION WITH RCM (RESTRAINTS CONTROL MODULE) U0151:00

BI1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BI2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BI2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the RCM pass the network test?

Yes	GO to BI3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BI3 PERFORM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the RCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to BI4

BI4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BI5

BI5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BI6

BI6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0151:00 still present?

Yes	GO to BI7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BI7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0151:87 set in the BCM?

Yes	GO to BI8
No	GO to BI9

BI8 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the RCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the RCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BI9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With PAM U159:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the PAM (part of the BCM) through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- BCM
- IPC

PINPOINT TEST BJ : LOST COMMUNICATION WITH PAM (PARKING ASSIST CONTROL MODULE) U159:00

BJ1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BJ2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BJ2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the PAM pass the network test?

Yes	GO to BJ3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BJ3 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Parking Aid (413-13 Parking Aid - Vehicles With: Rear Parking Aid) .
No	GO to BJ4

BJ4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	

	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BJ5

BJ5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BJ6

BJ6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0159:00 still present?

Yes	GO to BJ7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BJ7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the BCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PAM (part of the BCM). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the IPC self-test. If DTC U0184:00 is still present, GO to BJ8
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BJ8 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With Radio U0184:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0184:00	Lost Communication With Radio: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the ACM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- ACM
- IPC

PINPOINT TEST BK : LOST COMMUNICATION WITH RADIO U0184:00

BK1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BK2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BK2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the ACM pass the network test?

Yes	GO to BK3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BK3 PERFORM THE ACM (AUDIO FRONT CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the ACM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 415 for the procedure.
No	GO to BK4

BK4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BK5

BK5 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the Programmable Module Installation (PMI), or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0184:00 still present?

Yes	GO to BK6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BK6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all ACM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all the ACM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. Refer to the appropriate section in Group 415 for the procedure. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the IPC self-test. If DTC U0184:00 is still present, GO to BK7
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BK7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With Door Control Module "A" U0199:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0199:00	Lost Communication With Door Control Module "A": No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the DDM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- DDM
- IPC

PINPOINT TEST BL : LOST COMMUNICATION WITH DOOR CONTROL MODULE "A" :00

BL1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BL2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BL2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the DDM pass the network test?

Yes	GO to BL3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BL3 PERFORM THE DDM (DRIVER DOOR MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the DDM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
No	GO to BL4

BL4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BL5

BL5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BL6

BL6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0199:00 still present?

Yes	GO to BL7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BL7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0199:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0199:87 set in the BCM?

Yes	GO to BL8
No	GO to BL9

BL8 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the DDM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the DDM and all related in-line connectors. Make sure they seat and latch correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BL9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With SCCM U0212:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0212:00	Lost Communication With Steering Column Control Module: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the SCCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- SCCM
- IPC

PINPOINT TEST BM : LOST COMMUNICATION WITH SCCM (STEERING COLUMN CONTROL MODULE) U0212:00

BM1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BM2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BM2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the SCCM pass the network test?

Yes	GO to BM3
No	

No	REFER to: Communications Network (418-00 Module Communications Network) .

BM3 PERFORM THE SCCM (STEERING COLUMN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) .
No	GO to BM4

BM4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BM5

BM5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BM6

BM6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U0212:00 still present?

Yes	GO to BM7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BM7 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0212:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0212:87 set in the BCM?

Yes	GO to BM8
No	GO to BM9

BM8 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the SCCM and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root

	cause of any connector or pin issues.

BM9 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With IPMA U023A:00 Or U0241:00

Normal Operation and Fault Conditions

REFER to: Communications Network - Overview (418-00 Module Communications Network, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U023A:00	Lost Communication With Image Processing Module A: No Sub Type Information	Sets in continuous memory in the IPC if data messages received from the IPMA through the GWM are missing for 5 seconds or longer.
U0241:00	Lost Communication With Headlamp Control Module "A"	Sets in continuous memory in the IPC if data messages received from the IPMA through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- Battery voltage concern
- GWM
- IPMA
- IPC

PINPOINT TEST BN : LOST COMMUNICATION WITH IPMA (IMAGE PROCESSING MODULE A) U023A:00 OR U0241:00

BN1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to BN2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BN2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the IPMA pass the network test?

Yes	GO to BN3
No	REFER to: Communications Network (418-00 Module Communications Network) .

BN3 PERFORM THE IPMA (IMAGE PROCESSING MODULE A) SELF-TEST

- Using a diagnostic scan tool, perform the IPMA self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Interior Rear View Mirrors (501-09 Interior Rear View Mirrors) .
No	GO to BN4

BN4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to BN5

BN5 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	REFER to the IPC DTC Chart.
No	GO to BN6

BN6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the IPC self-test.

Is DTC U023A:00 still present?

Yes	GO to BN7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

BN7 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPMA and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPMA and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new interior rear view mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation). CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the IPC self-test. If DTC U023A:00 is still present, GO to BN8
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BN8 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).

	REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage Low U3003:16

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Auxiliary Battery System (414-00 Charging System - General Information, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Sets in the IPC in continuous memory if the IPC detects battery voltage below 9 volts on the voltage supply circuit for 5 seconds or longer.

Possible Sources

- Wiring, terminals or connectors
- High circuit resistance
- Charging system concern
- IPC

PINPOINT TEST BO : BATTERY VOLTAGE LOW U3003:16

BO1 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U3003:16 still present?

Yes	GO to BO2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

BO2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) IN THE BCM (BODY CONTROL MODULE)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any charging system Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to BO3

BO3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery Charging (414-00 Charging System - General Information, General Procedures).

Is the battery OK and fully charged?

Yes	GO to BO4
No	If the battery is discharged, DIAGNOSE the cause of the low battery condition. REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). If the battery condition fails, INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables) .

BO4 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) VOLTAGE PID (PARAMETER IDENTIFICATION)

- Measure and record the voltage at the battery.
- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Monitor the IPC voltage (MODULE_VOLT) PID

Is the voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to BO7
No	GO to BO5

BO5 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect IPC C220.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-21		Ground

Is the voltage greater than 11 volts?

Yes	GO to BO6
No	REPAIR the circuit for high circuit resistance.

BO6 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-21		C220-5

Is the voltage greater than 11 volts?

Yes	GO to BO7
No	REPAIR the circuit for high circuit resistance.

BO7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage High U3003:17

Normal Operation and Fault Conditions

REFER to: Auxiliary Battery System (414-00 Charging System - General Information, Description and Operation).

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	Sets in the IPC in continuous memory if the IPC detects battery voltage above 16 volts on the voltage supply circuit for 5 seconds or longer.

Possible Sources

- Charging system concern
- IPC

PINPOINT TEST BP : BATTERY VOLTAGE HIGH U3003:17

NOTE: *DTC U3003:17 may be stored in the module memory due to past battery charging or vehicle jump starting events.*

BP1 CHECK FOR OVERCHARGING DIAGNOSTIC TROUBLE CODES (DTCS) SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, perform self-test on all modules.
- Retrieve the continuous memory DTCs from all modules.

Is DTC B1317, B1676, P0563 (PCM), U3003:17 or U3006:17 set in more than one module?

Yes	DIAGNOSE the overcharging condition. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to BP2

BP2 CHECK THE BATTERY VOLTAGE

- Turn off all interior/exterior lights and accessories.
- Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	DIAGNOSE the overcharging condition. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to BP3

BP3 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, clear the continuous memory DTCs.
- Carry out the IPC self-test.

Is DTC U3003:17 present?

Yes	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

Copyright © 2016 Ford Motor Company

Seatbelt Minder Deactivating/Activating

Activation

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

NOTE: *The driver and passenger seat Belt-Minder® deactivating/activating can be carried out using the scan tool.*

NOTE: *If you are using a MyKey® programmed key, the Belt-Minder® cannot be disabled and does not time out after 5 minutes. If the Belt-Minder® has been previously disabled, it is re-enabled when a MyKey® programmed key is used.*

NOTE: *The driver and front passenger Belt-Minder® are deactivated/activated independently. When deactivating/activating one seating position, do not buckle the other position.*

NOTE: *Clear any message center warnings that are present before and throughout the procedure.*

1. Apply the parking brake before deactivating/activating the Belt-Minder®.
2. Place the selector lever in PARK (P).
3. Place the ignition in OFF.
4. Unbuckle the driver and the front passenger safety belts.
5. Place the ignition in the RUN mode (do not start the engine).
6. Wait until the safety belt warning indicator turns off (approximately 1 minute).
7. **NOTE:** *This step must be completed within 30 seconds after the safety belt warning indicator turns off (step 6).*

   Wait 5 seconds after the safety belt warning indicator turns off then for the seating position to be disabled, buckle then unbuckle the safety belt 3 times at a moderate speed, ending with the safety belt in the unbuckled state. After this step the safety belt warning indicator illuminates for 3 seconds then turns off.
8. **NOTE:** *Clear any message center warnings that are present before proceding with this step.*

   NOTE: *As confirmation of disabling the Belt-Minder® (if currently enabled), the safety belt warning indicator flashes 4 times per second for 3 seconds.*

   NOTE: *As confirmation of enabling the Belt-Minder® (if currently disabled), the safety belt warning indicator flashes 4 times per second for 3 seconds, followed by 3 seconds with the safety belt warning indicator off, followed by another flash sequence of 4 times per second for 3 seconds.*

   Within 7 seconds of the safety belt warning indicator turning off, buckle then unbuckle the safety belt one time at a moderate speed.
9. After confirmation, the deactivation/activation procedure is complete.

Copyright © 2016 Ford Motor Company

Instrument Panel Cluster (IPC) - LHD

Base Part Number: 10849

Special Tool(s) / General Equipment

Interior Trim Remover

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

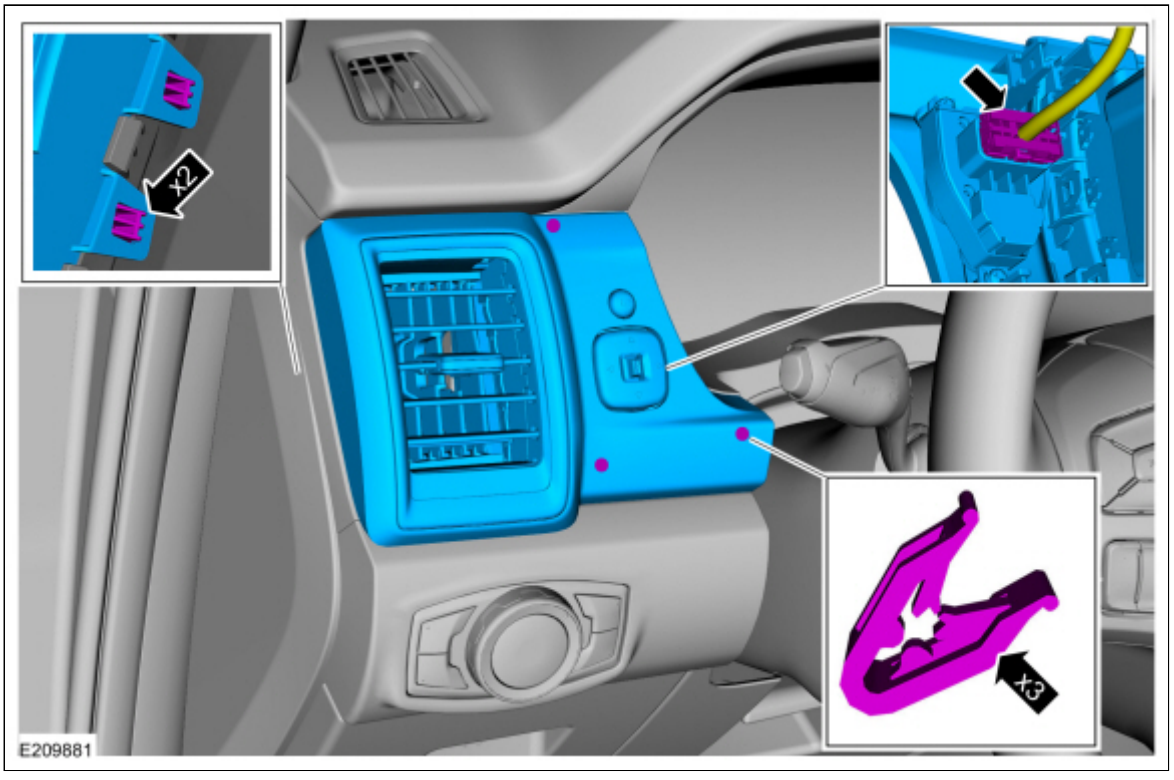
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

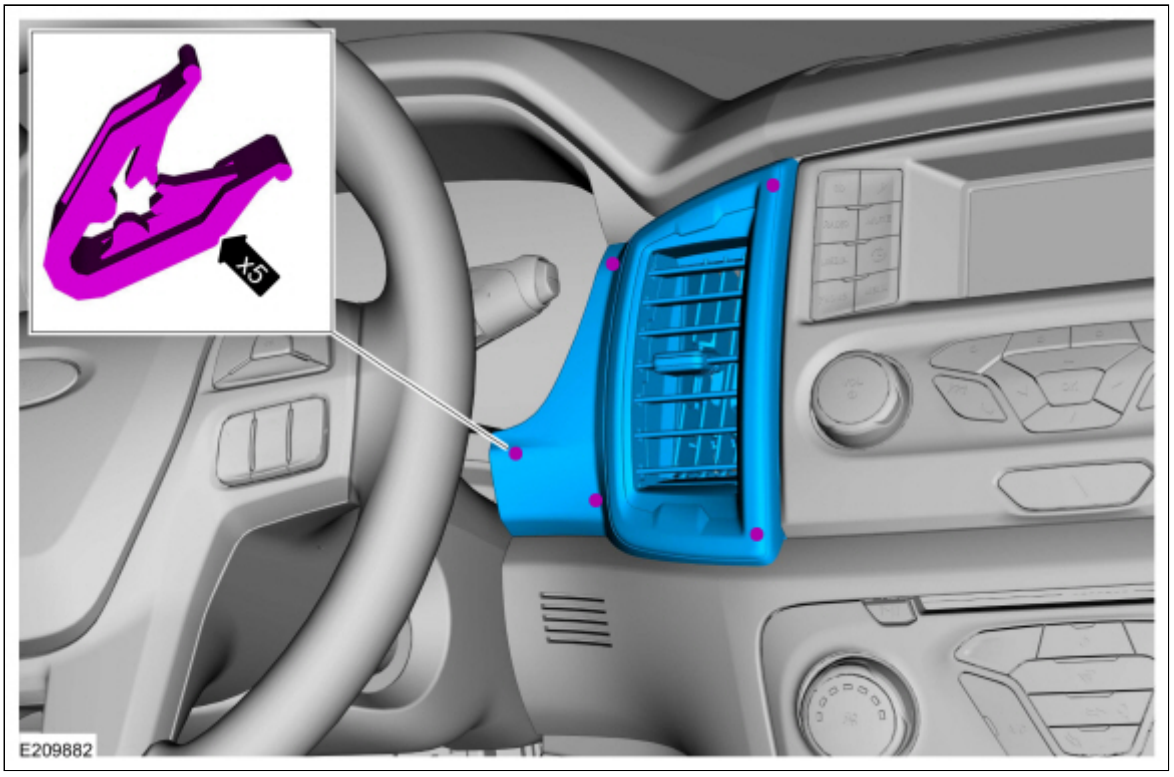
2. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

   Using a diagnostic scan tool, begin the PMI process for the IPC following the on-screen instructions. Record the odometer value from the original IPC. If the odometer value cannot be obtained from the IPC (display failure), perform the diagnostic routine. If the value cannot be obtained after the diagnostic routine, the customer should supply the approximate odometer value.

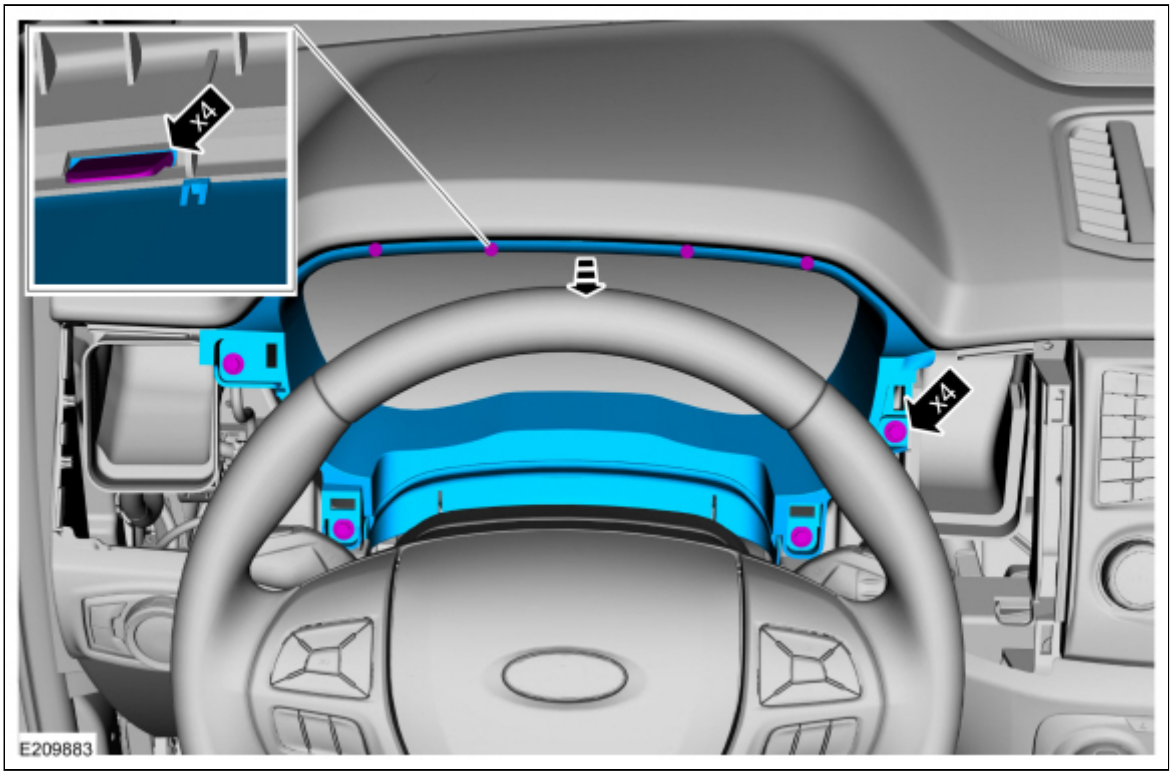
3. Disconnect the electrical connector.
   Use the General Equipment: Interior Trim Remover



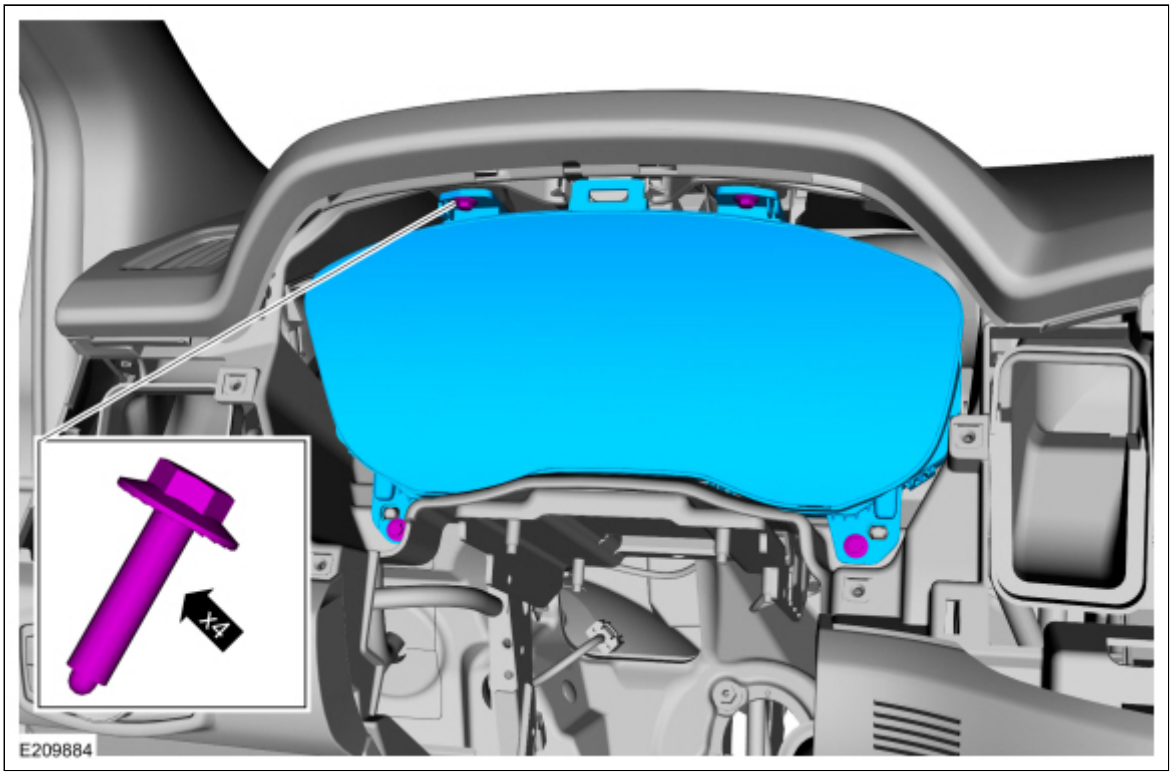
4. Use the General Equipment: Interior Trim Remover



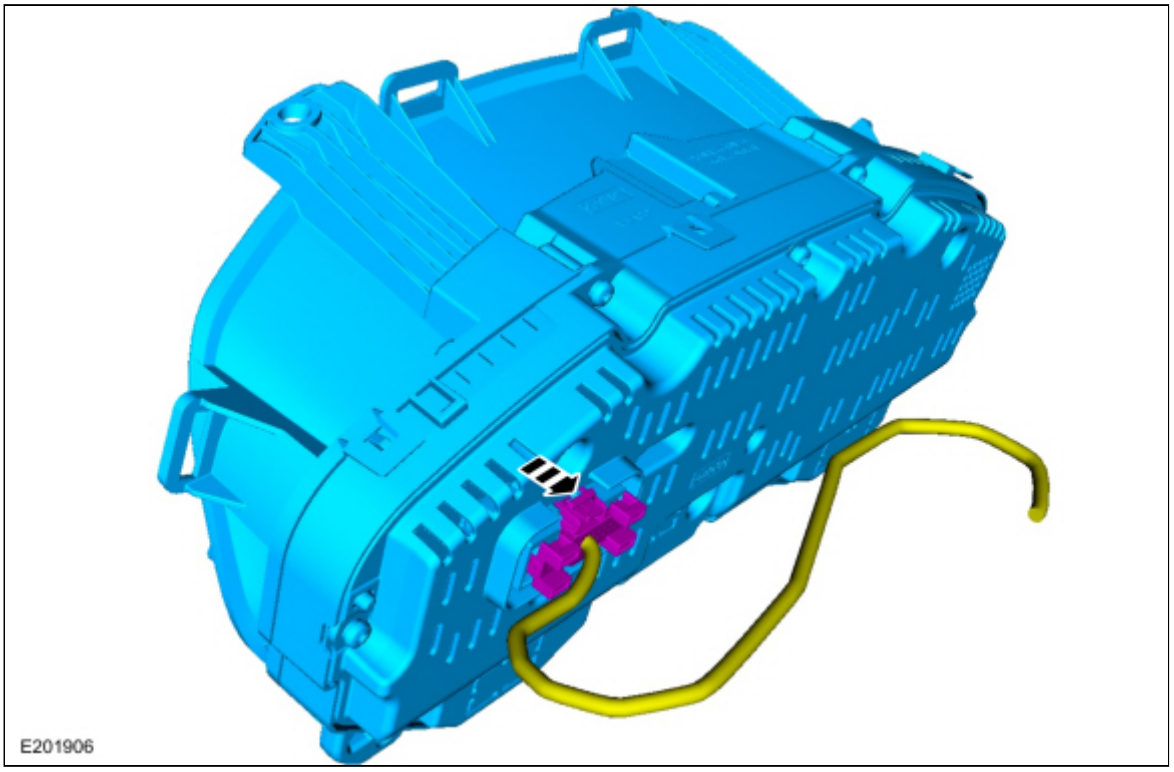
5. Remove bolts, release the clips and remove the IPC bezel.
   Torque: 3 Nm



6. Remove the bolts and the IPC
   Torque: 3 Nm



7. Disconnect the electrical connector.



Installation

1. To install, reverse the removal procedure.
2. Using a diagnostic scan tool, complete the PMI process for the IPC following the on-screen instructions.

Copyright © 2016 Ford Motor Company

Instrument Panel Cluster (IPC) - RHD

Base Part Number: 10849

Special Tool(s) / General Equipment

Interior Trim Remover

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

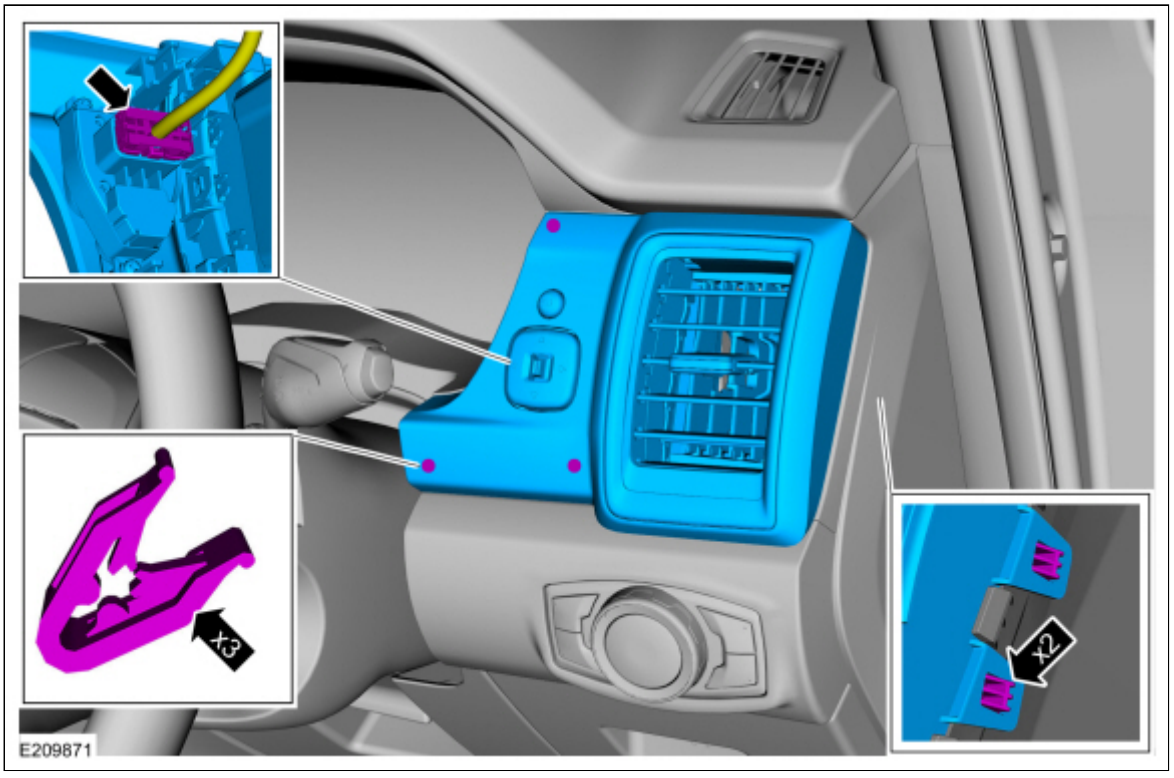
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

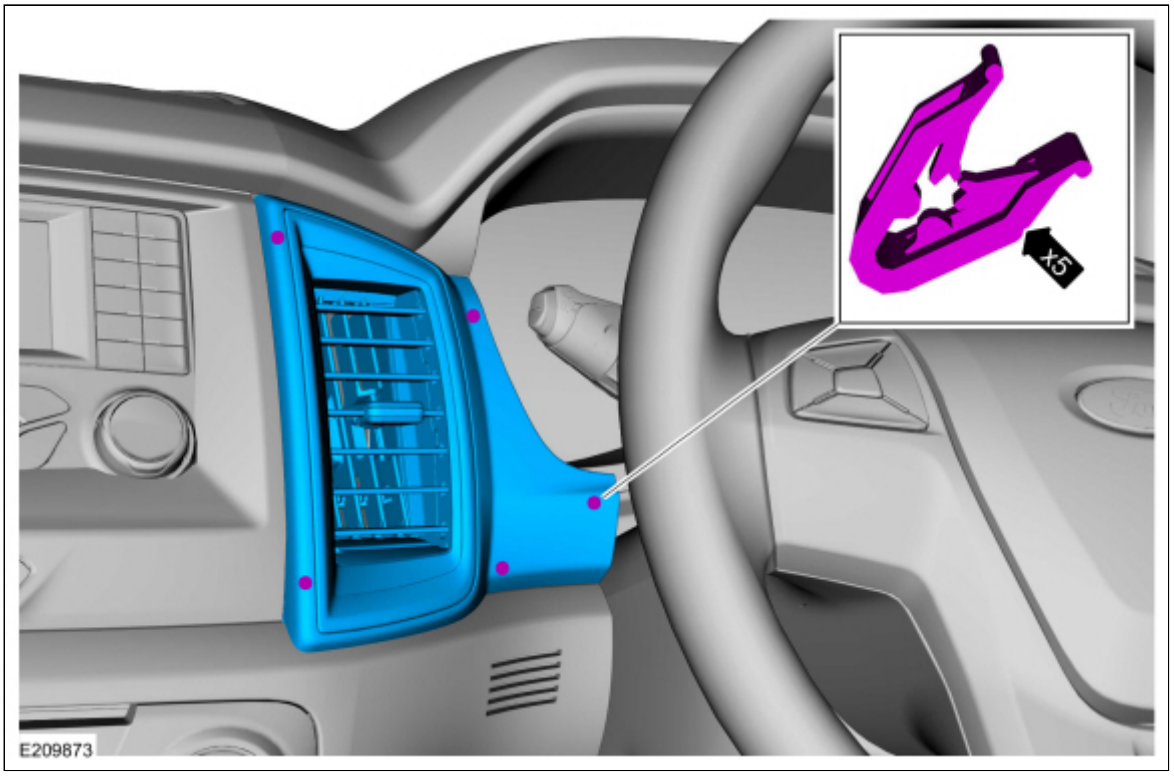
2. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

   Using a diagnostic scan tool, begin the PMI process for the IPC following the on-screen instructions. Record the odometer value from the original IPC. If the odometer value cannot be obtained from the IPC (display failure), perform the diagnostic routine. If the value cannot be obtained after the diagnostic routine, the customer should supply the approximate odometer value.

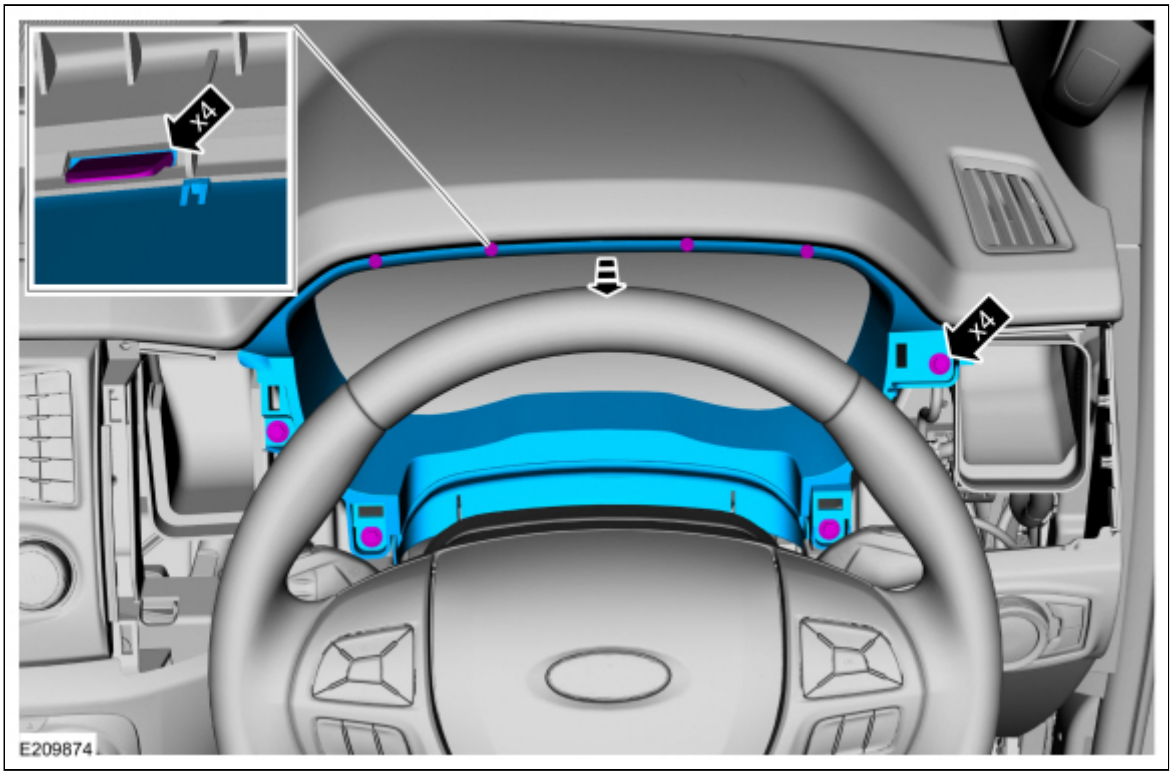
3. Disconnect the electrical connector.
   Use the General Equipment: Interior Trim Remover



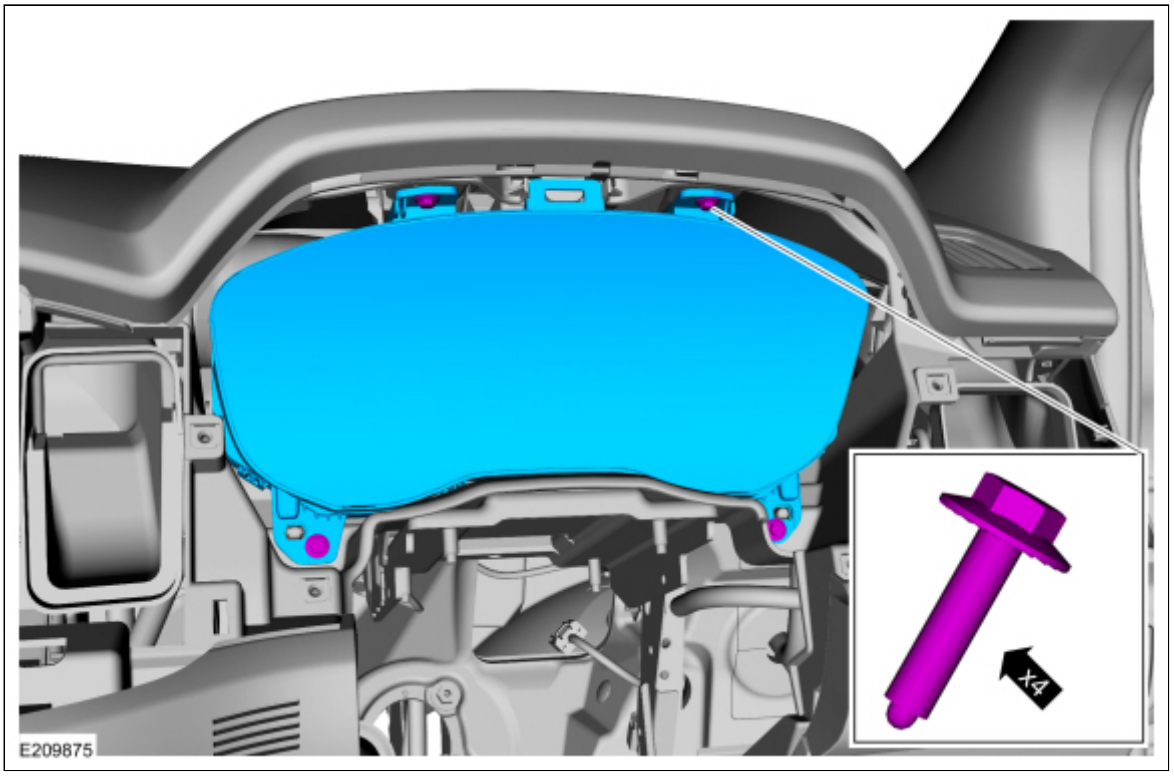
4. Use the General Equipment: Interior Trim Remover



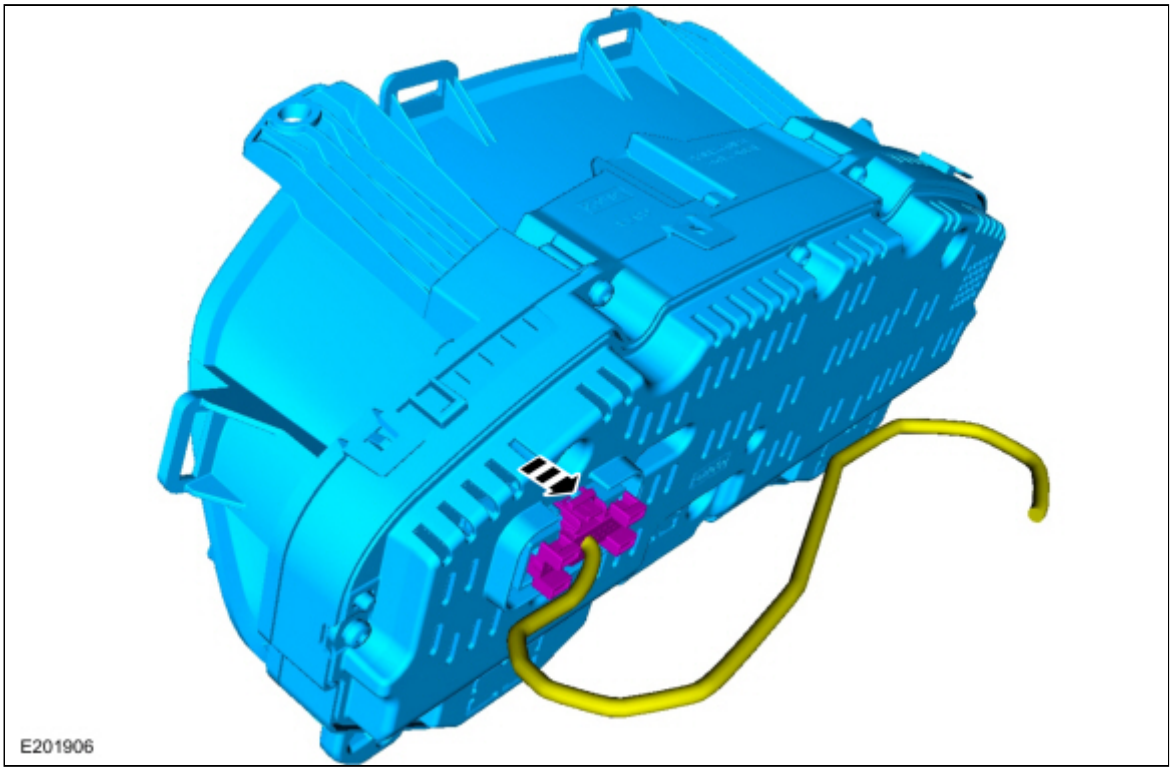
5. Remove bolts, release the clips and remove the IPC bezel.
   Torque: 3 Nm



6. Remove the bolts and the IPC
   Torque: 3 Nm



7. Disconnect the electrical connector.



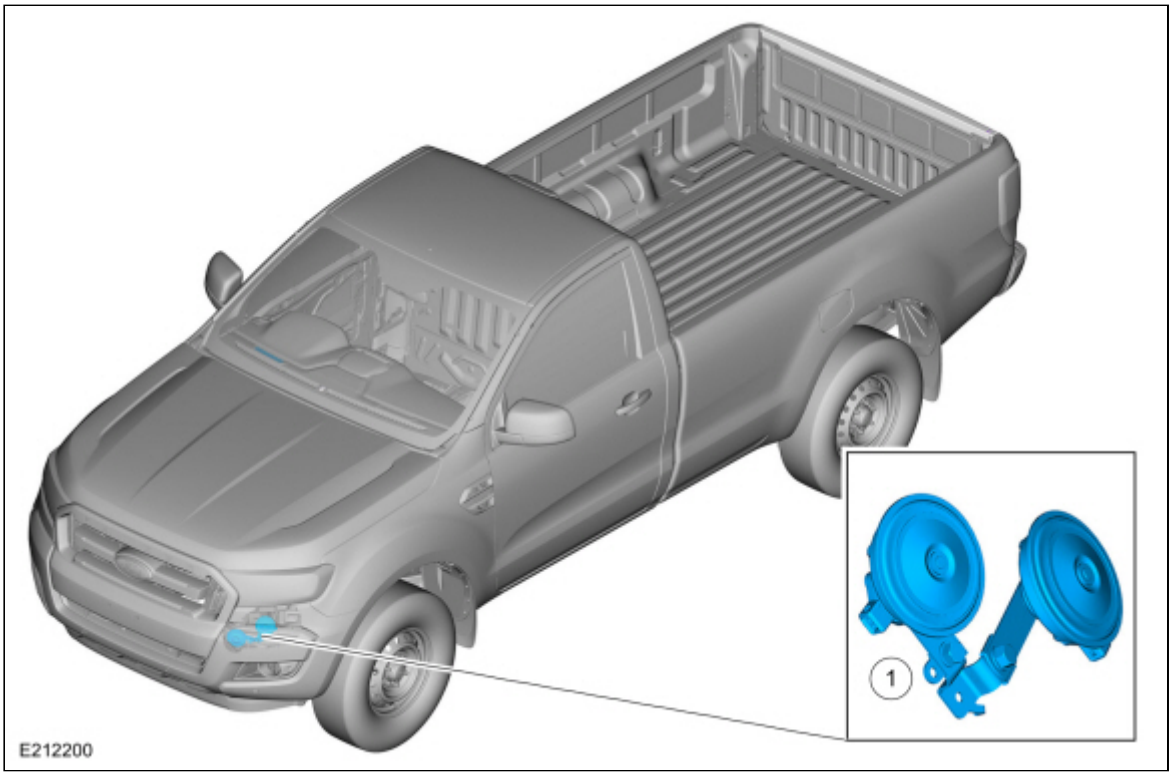
Installation

1. To install, reverse the removal procedure.
2. Using a diagnostic scan tool, complete the PMI process for the IPC following the on-screen instructions.

Copyright © 2016 Ford Motor Company

Horn - Component Location

Base Part Number: 13801



Item	Description
1	Dual Horn

Copyright © 2016 Ford Motor Company

Horn - Overview

Base Part Number: 13801

Overview

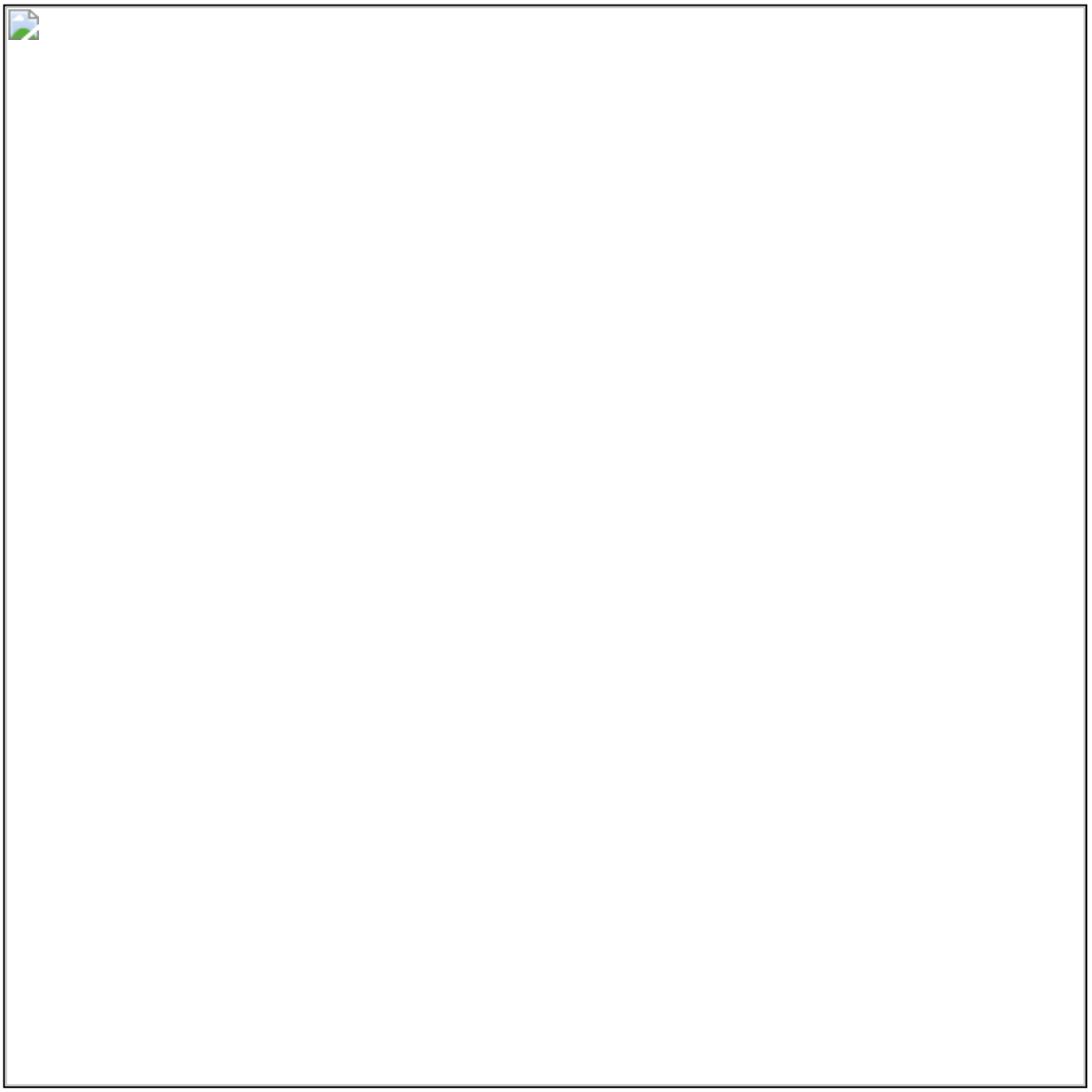
The horn output is controlled by the Horn Pad and BCM. The customer presses the horn switch to make sure the circuit is closed. The BCM energizes the horn relay to have the horn produce the sound.

Copyright © 2016 Ford Motor Company

Horn - System Operation and Component Description

Base Part Number: 13801

System Operation



Horn Operation

The horn switch consists of 2 sets of contacts separated by springs. The lower set is connected to ground and the upper set is connected to the horn signal circuit. When the driver air bag module is pressed, it pushes down on the upper set of contacts, collapsing the springs and allowing the contacts to touch. When the contacts touch, it completes the circuit and provides the ground signal which is routed through the clockspring, the SCCM and then to the horn relay, which is integral to the BJB. The BCM supplies the control and switched (load) voltage to the horn relay. When energized, the horn relay provides voltage to the horn, enabling the horn to sound.

Copyright © 2016 Ford Motor Company

Horn

Base Part Number: 13801

DTC Chart(s)

DTC Chart: Horn

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to
REFER to: Horn - System Operation and Component Description (413-06 Horn, Description and Operation).

Body Control Module (BCM) DTC Chart

DTC	Description	Actions
B1323:11	Horn Switch: Signal Short to Ground	GO to Pinpoint Test B
B1323:23	Horn Switch: Signal Stuck Low	GO to Pinpoint Test B
B1C55:11	Horn Relay: Circuit Short to Ground	GO to Pinpoint Test B
B1C55:12	Horn Relay: Circuit Short to Battery	GO to Pinpoint Test A
B1C55:13	Horn Relay: Circuit Open	GO to Pinpoint Test A
B1C55:14	Horn Relay: Circuit Short to Ground or Open	• If the horn is inoperative, GO to Pinpoint Test A • If the horn is always on, GO to Pinpoint Test B
B1C55:19	Horn Relay: Circuit Current Above Threshold	GO to Pinpoint Test A

Symptom Chart(s)

Symptom Chart: Horn

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to
REFER to: Horn - System Operation and Component Description (413-06 Horn, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The horn is inoperative	Refer to the pinpoint test	GO to Pinpoint Test A
The horn is always on	Refer to the pinpoint test	GO to Pinpoint Test B

Pinpoint Tests

The Horn Is Inoperative

Refer to Wiring Diagrams Cell 413-06 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Horn - System Operation and Component Description (413-06 Horn, Description and Operation).

DTC Chart

DTC	Description	Fault Trigger Condition
B1C55:11	Horn Relay: Circuit Short to Ground	This DTC sets when the BCM detects a short to ground on the horn relay control circuit.
B1C55:12	Horn Relay: Circuit Short To Battery	A Continuous Memory Diagnostic Trouble Code (CMDTC) or On Demand DTC that sets when the BCM detects a high current condition on the horn relay control circuit. The BCM disables the horn when this DTC is set.
B1C55:13	Horn Relay: Circuit Open	A Continuous Memory Diagnostic Trouble Code (CMDTC) that sets when the BCM detects an open on the horn relay control circuit.
B1C55:14	Horn Relay: Circuit Short to Ground or Open	• If the horn is inoperative, GO to Pinpoint Test A • If the horn is always on, GO to Pinpoint Test B
B1C55:19	Horn Relay: Circuit Current Above Threshold	A Continuous Memory Diagnostic Trouble Code (CMDTC) that sets when the BCM detects a high current condition on the horn relay control circuit. The BCM disables the horn when this DTC is set.

Possible Causes

- Fuse
- Wiring, terminals or connectors
- Steering wheel harness (part of steering wheel)
- Steering Column Control Module
- Clockspring
- Horn
- Horn relay
- Horn switch
- BCM

Visual Inspection and Diagnostic Pre-checks

Inspect the BJB fuse 48 (20A).

PINPOINT TEST A : THE HORN IS INOPERATIVE

CHECK THE BCM (BODY CONTROL MODULE) OUTPUT

- Ignition ON.
- Using a diagnostic scan tool, view BCM Parameter Identifications (PIDs).
- Select the active command BCM HORN PID. Command the horn ON and then OFF.

Does the horn sound when commanded on?

Yes	GO to A1
No	VERIFY the EJB fuse 48 (20A) are OK. If OK, GO to A7 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A1 CHECK HORN OPERATION WITH HORN SWITCH CIRCUITS ISOLATED

NOTE: *This test step is carried out with the jumper wire at the female (harness) side of the connector.*

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect Clockspring part of the SCCM.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C226E-1		C226E-4

Does the horn sound?

Yes	REMOVE the fused jumper wire. GO to A5
No	REMOVE the fused jumper wire. GO to A2

A2 CHECK THE HORN CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect BCM.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226E-4		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A3

A3 CHECK THE HORN CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226-4	Ω	Horn switch control circuit pinout

Is the resistance less than 3 ohms?

Yes	GO to A4
No	REPAIR the circuit.

A4 CHECK THE HORN SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226E-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A15
No	REPAIR the circuit.

A5 CHECK HORN OPERATION WITH STEERING WHEEL HARNESS ISOLATED

NOTE: *The switch harness may be temporarily removed from the driver airbag for test purposes.*

- Ignition OFF.
- Connect Clockspring part of SCCM.
- Disconnect Horn Switch control circuit located in the Steering Column Assembly. Or disconnect at the SCCM C226E-4
- Disconnect Horn Switch ground circuit located in the Steering Column Assembly. Or disconnect at the SCCM C226E-1
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
Horn Switch control circuit pinout		Horn Switch ground circuit pinout

Does the horn sound?

Yes	REMOVE the fused jumper wire. INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
No	REMOVE the fused jumper wire. If vehicle is equipped with lower steering wheel switch(es), GO to A6 If vehicle is not equipped with lower steering wheel switch(es), INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .

A6 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

NOTE: *This test step is carried out with the jumper wire at the female (harness) side of the connector. The switch harness can be temporarily removed from the driver airbag for test purposes.*

- Disconnect Clockspring part of SCCM.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Horn switch contol circuit pinout	Ω	C226E-4

Are the resistances less than 3 ohms?

Yes	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .
No	INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).

A7 CHECK THE HORN RELAY

- Ignition OFF.
- Disconnect the Horn Relay.
- Ignition ON.

- Substitute a known good relay and recheck the horn operation.

Does the horn operate?

Yes	REMOVE the known good relay. INSTALL a new horn relay.
No	GO to A8

A8 CHECK THE HORN OPERATION WITH RELAY CONTROL ISOLATED

- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
Horn Relay Pin 3		Horn Relay Pin 5

Does the horn sound?

Yes	REMOVE the fused jumper wire. GO to A9
No	REMOVE the fused jumper wire. GO to A12

A9 CHECK THE HORN OPERATION WITH BCM (BODY CONTROL MODULE) ISOLATED

NOTE: *This test step is carried out with the jumper wire at the female (harness) side of the connector. The switch harness can be temporarily removed from the driver airbag for test purposes.*

- Ignition OFF.
- Install the horn relay.
- Disconnect BCM C2280H.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C2280H-20		Ground

Does the horn sound?

Yes	REMOVE the fused jumper wire. GO to A15
No	REMOVE the fused jumper wire. GO to A10

A10 CHECK THE HORN RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-20		Ground

Is any voltage present?

Yes	REPAIR the circuit.

No	GO to A11

A11 CHECK THE HORN RELAY COIL CIRCUIT FOR VOLTAGE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
Horn Relay Pin 1		Ground

Is the voltage greater than 11 volts?

Yes	REPAIR the horn relay control circuit.
No	REPAIR the horn relay voltage supply circuit.

A12 CHECK THE HORN RELAY LOAD CIRCUIT FOR VOLTAGE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
Horn Relay R3, Pin 3		Ground

Is the voltage greater than 11 volts?

Yes	GO to A13
No	REPAIR the circuit.

A13 CHECK FOR VOLTAGE AT THE HORN

- Install the horn relay.
  - Refer to horn removal and installation.
    REFER to: Horn (413-06 Horn, Removal and Installation).
- Disconnect the Dual Horns.
- Press and hold the horn switch.
- Measure:

LH Lower Horn

Positive Lead	Measurement / Action	Negative Lead
C1101-1		Ground

RH Lower Horn

Positive Lead	Measurement / Action	Negative Lead
C1102-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A14
No	REPAIR the open circuit.

A14 CHECK THE HORN GROUND CIRCUIT FOR AN OPEN

- Press and hold the horn switch.
- Measure:

RH Lower Horn

Positive Lead	Measurement / Action	Negative Lead
C1102-2		C1102-1

LH Lower Horn

Positive Lead	Measurement / Action	Negative Lead
C1101-2		C1101-1

Is the voltage greater than 11 volts?

Yes	INSTALL a new horn. Refer to the horn removal and installation. REFER to: Horn (413-06 Horn, Removal and Installation).
No	REPAIR the circuit.

A15 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect the BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. INSTALL a new BCM. For RHD refer to REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). For LHD refer to REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Horn Is Always On

Refer to Wiring Diagrams Cell 413-06 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Horn - System Operation and Component Description (413-06 Horn, Description and Operation).

DTC Chart

DTC	Description	Fault Trigger Condition
B1323:11	Horn Switch: Circuit Short to Ground	A Continuos Memory Diagnostic Trouble Code (CMDTC) that sets when the BCM detects a short to ground on the horn signal circuit.
B1323:23	Horn Switch: Signal Stuck Low	An on-demand DTC that sets when the BCM detects a short to ground on the horn signal circuit.
B1C55:11	Horn Relay: Circuit Short to Ground	A Continuous Memory Diagnostic Trouble Code (CMDTC) that sets when the BCM detects a short to ground on the horn relay control circuit.
B1C55:13	Horn Relay: Circuit Open	This DTC sets when the BCM detects an open on the horn relay control circuit.
B1C55:14	Horn Relay: Circuit Short To Ground or Open	A Continuous Memory Diagnostic Trouble Code (CMDTC) or On Demand DTC that sets when the BCM detects a short to ground or open on the horn relay control circuit.

Possible Causes

- Wiring, terminals or connectors
- Steering wheel harness (part of steering wheel)
- Clockspring
- Horn relay
- Horn switch
- BCM

PINPOINT TEST B : THE HORN IS ALWAYS ON

ISOLATE THE HORN VOLTAGE SUPPLY CIRCUIT

- Ignition OFF.
- Remove the horn relay.

Does the horn continue to sound?

Yes	DISCONNECT the horn to prevent damage from continuous operation. REPAIR the circuit.
No	GO to B1

B1 CHECK THE HORN RELAY

- Ignition OFF.
- Disconnect the Horn Relay.
- Ignition ON.
- Substitute a known good relay and recheck the horn operation.

Does the horn operate?

Yes	REMOVE the known good relay. INSTALL a new horn relay.
No	GO to B2

B2 ISOLATE THE HORN RELAY CONTROL CIRCUIT

- Install the horn relay.
- Disconnect BCM C2280H.

Does the horn continue to sound?

Yes	REPAIR the circuit for a short to ground.
No	GO to B3

B3 ISOLATE THE BCM (BODY CONTROL MODULE) HORN INPUT CIRCUIT

- Connect BCM C2280H.
- Disconnect SCCM C226.

Does the horn continue to sound?

Yes	GO to B8
No	GO to B4

B4 CHECK THE HORN SWITCH INPUT FOR A SHORT TO GROUND

- Connect BCM C2280C.
- Disconnect the Clockspring part of the SCCM.

Does the horn continue to sound?

Yes	REPAIR the circuit.
No	GO to B5

B5 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Connect Clockspring part of the SCCM.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect the Clockspring part of the SCCM.

Does the horn continue to sound?

Yes	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).
No	GO to B6

B6 CHECK THE HORN SWITCH

- Connect Clockspring C218A.
- Disconnect Horn Switch .

Does the horn continue to sound?

Yes	If the vehicle is equipped with lower steering wheel switches, GO to B7 If vehicle is not equipped with lower steering wheel switch(es), INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .
No	INSTALL a new driver airbag.

	REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).

B7 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Connect Horn Switch .
- Disconnect the Clockspring.

Does the horn continue to sound?

Yes	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .
No	INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).

B8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect the BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. INSTALL a new BCM. For RHD refer to REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). For LHD refer to REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

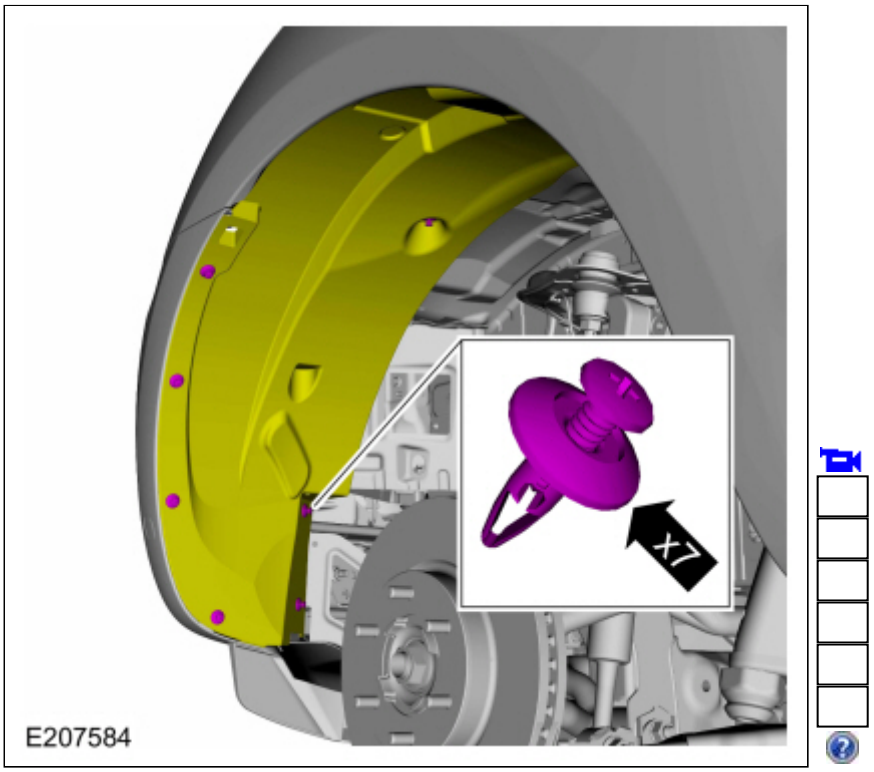
Copyright © 2016 Ford Motor Company

Horn

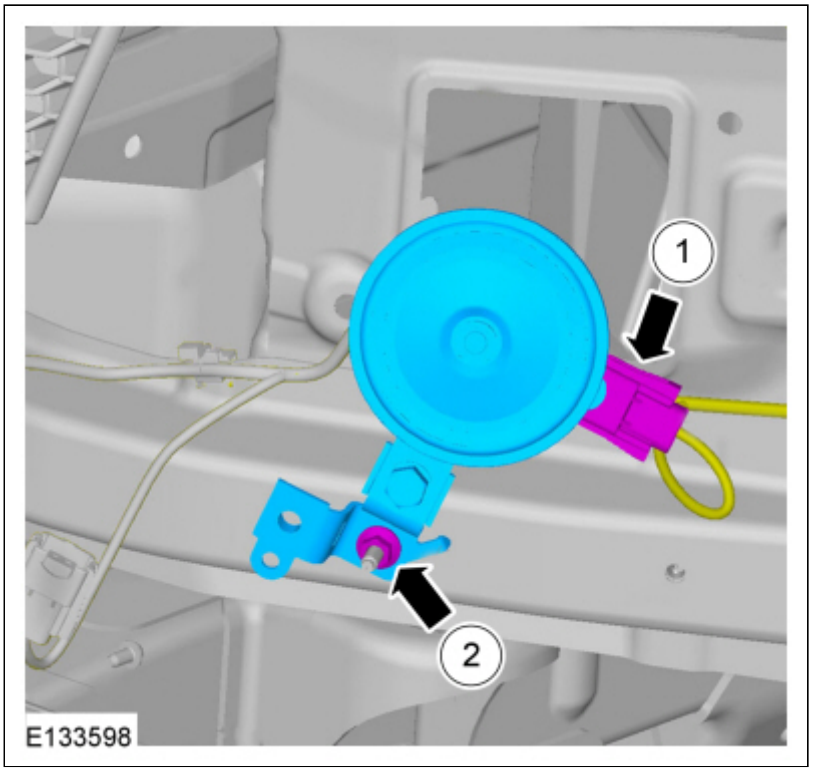
Base Part Number: 13801

Removal

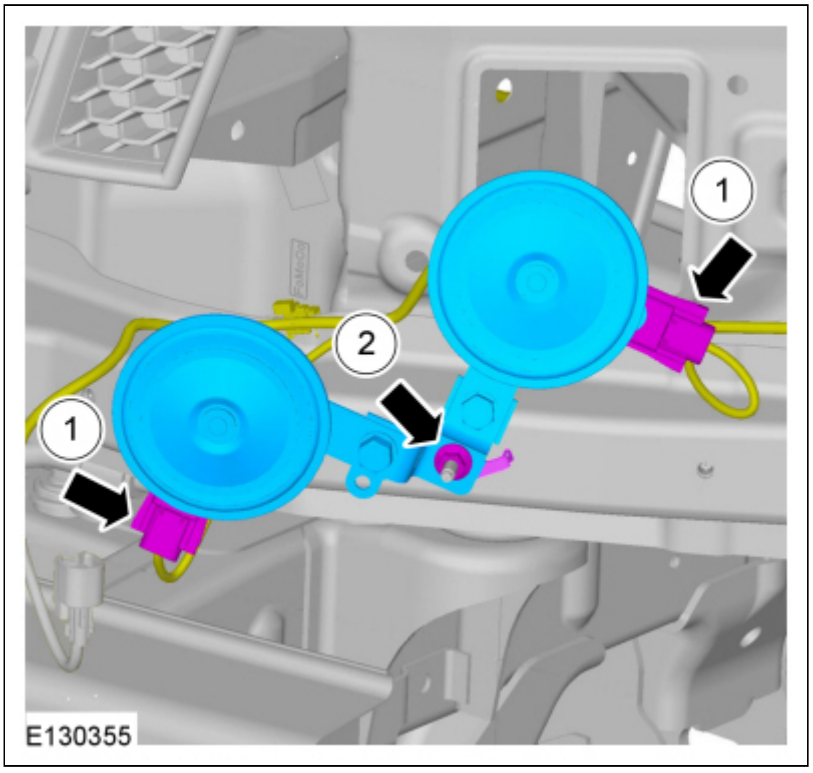
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. 

5. Single horn.
   Torque: 11 Nm



6. Dual horn.
   Torque: 11 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Seatbelt Minder Deactivating/Activating

Preparation

1. Apply the parking brake.
2. Place the transmission selector lever in P (Park) - vehicles with automatic transmission or the neutral position - vehicles with manual transmission.
3. Turn the ignition switch to the OFF position.
4. Close all the vehicle doors from the inside of the vehicle.

Deactivating/Activating

NOTE: *Deactivation of the belt minder may also be carried out using IDS. Follow the instructions on the screen.*

NOTE: *The belt minder can be turned off independently for the driver and the front passenger by performing the following procedure.*

1. **Unbuckle** the driver's safety belt.
2. **Unbuckle** the front passenger's safety belt.
3. Turn the ignition switch to the ON position (do not start the engine).
4. **Wait until the safety belt warning indicator turns off.**
5. **NOTE:** *This step must be completed within 30 seconds or the procedure must be repeated.*

   Buckle then unbuckle the safety belt four times, ending with the safety belt unbuckled. Release the red unbuckle switch **completely** every cycle.
6. The safety belt warning indicator flashes momentarily to confirm the belt minder status change.
7. Turn the ignition switch to the OFF position. The deactivation/activation procedure is now complete.

Copyright © 2016 Ford Motor Company

Specifications

General Specifications - Rear Parking Aid

Item	Specification
Test object position 1 (P1) and position 5 (P5), distance from rear bumper	25 cm (10 in)
Test object position 2 (P2) and position 4 (P4), distance from rear bumper	50 cm (20 in)
Test object position 3 (P3), distance from rear bumper	150 cm (59 in)

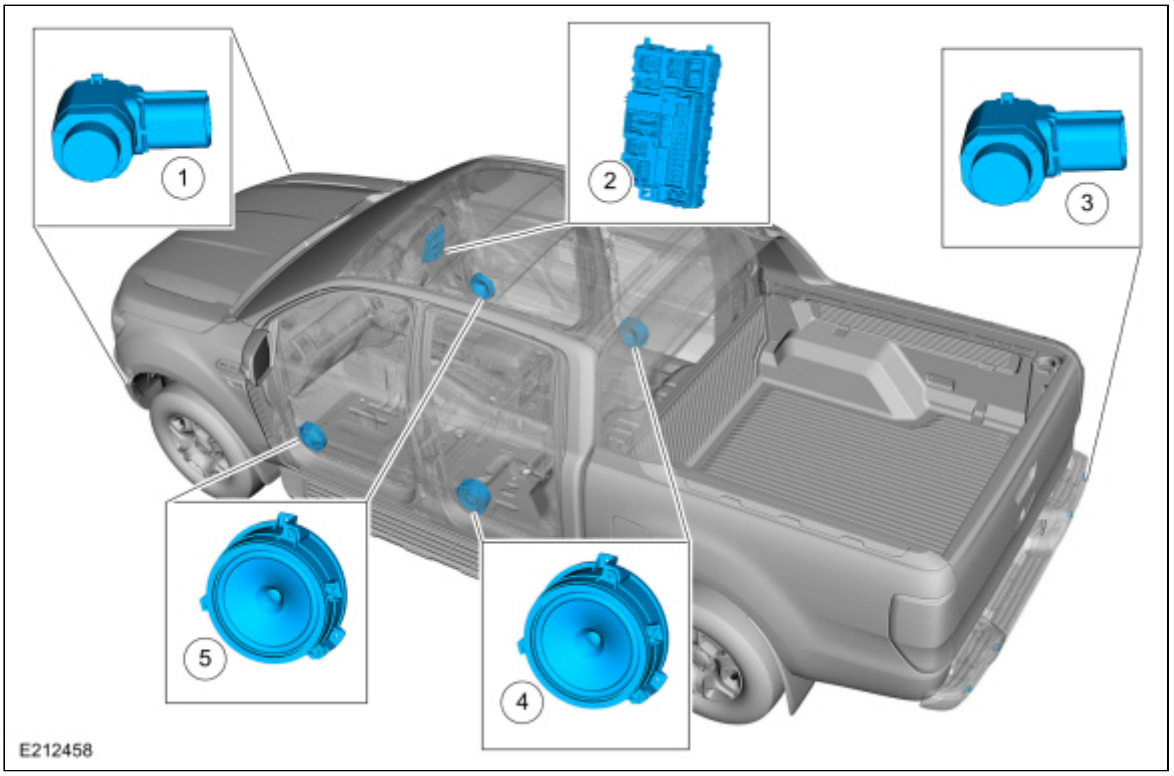
General Specifications - Front Parking Aid

Item	Specification
Test object position 1 (P1) and position 5 (P5), distance from front bumper	20 cm (8 in)
Test object position 2 (P2) and position 4 (P4), distance from front bumper	36 cm (14 in)
Test object position 3 (P3), distance from front bumper	60 cm (24 in)

Copyright © 2016 Ford Motor Company

Parking Aid - Component Location

Component Location, Parking Aid - Audible



Item	Description
1	Front parking aid sensors (4 required)
2	Parking Aid Module (PAM) (integral to the BCM
3	Rear parking aid sensors (4 required)
4	Rear speakers (part of audio system)
5	Front speakers (part of audio system)

Copyright © 2016 Ford Motor Company

Parking Aid - Overview

Parking Aid - Audible

The rear parking aid system sounds a warning tone through the rear audio speakers to alert the driver of stationary objects near the rear bumper when reverse is selected. The rear parking aid system assists the driver in detecting certain objects while the vehicle moves slowly with the transmission in reverse. The rear parking aid system may not detect moving objects.

If equipped, the front parking aid system sounds a warning through the front audio speakers to alert the driver of stationary objects near the front bumper in all transmission gear selections except neutral when the vehicle is moving forward. The front parking aid system may not detect moving objects.

The parking aid system is disabled if a fault is detected in a parking aid sensor, the communications network or the PAM. This is indicated by a parking aid disabled warning message in the message center.

The rear parking aid only system is enabled and disabled through the message center located in the IPC. To disable the rear parking aid, remove the check mark from the parking aid selection box using the message center navigaton buttons. The rear parking aid remains disabled until it is enabled in the IPC message center.

If the vehicle is equipped with rear parking aid and front parking aid, the parking aid switch on the FCIM "B" is used to disable the rear parking aid and front parking aid instead of the IPC message center. When disabled using the FCIM "B" mounted switch, the parking aid remains disabled for one key cycle, or until the switch is pressed again.

If a MyKey® restricted key is in use, the parking aid menu is not available in the message center and cannot be deactivated.

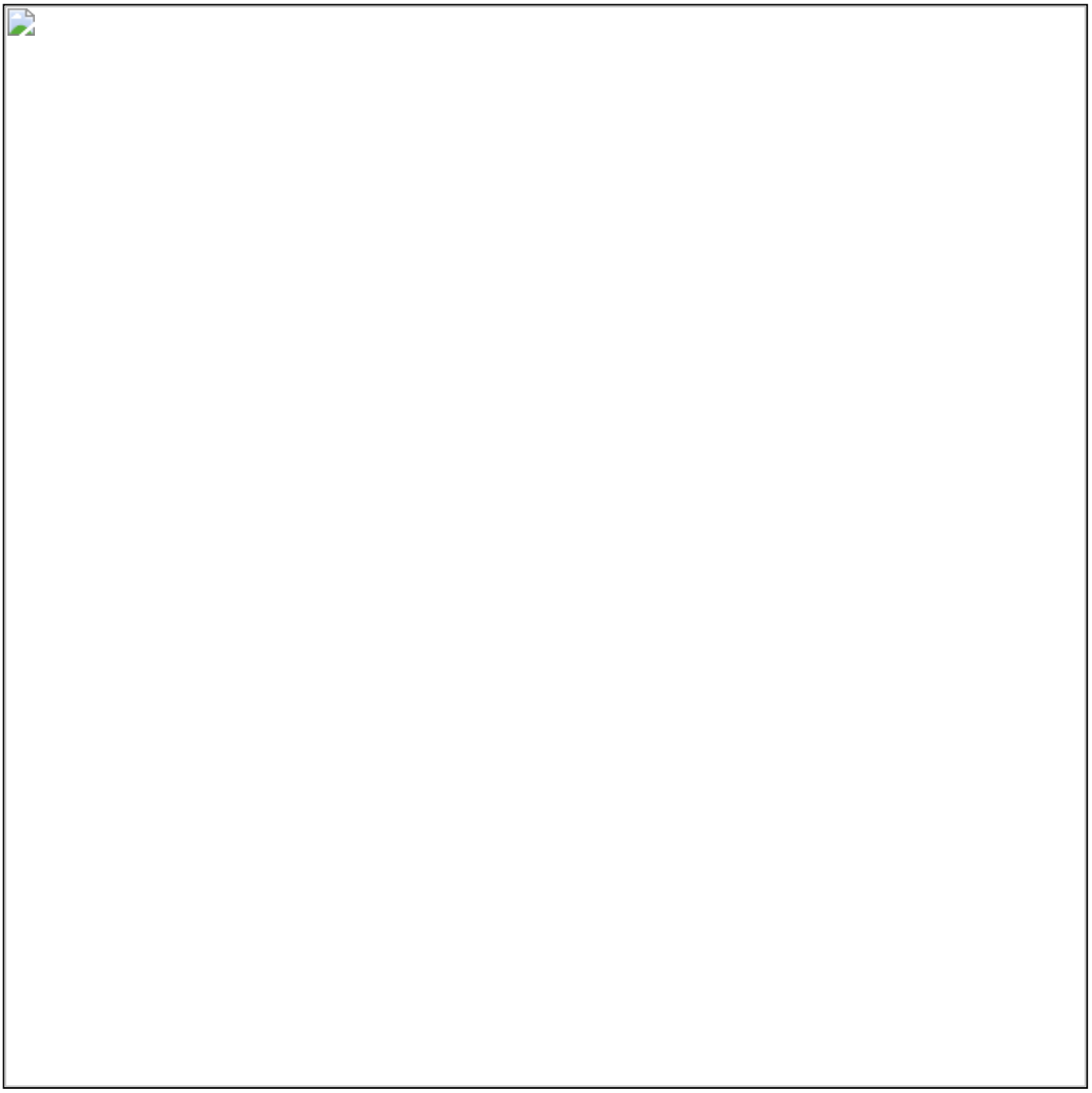
Copyright © 2016 Ford Motor Company

Parking Aid - System Operation and Component Description

System Operation

Parking Aid - Audible

System Diagram



Network Message Chart

PAM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Ignition key type	BCM	Used to disable the parking aid menus if a MyKey® is in use.
Ignition status	BCM	Used to communicate the ignition switch state.
Outside air	FCIM	Used to temperature compensate the parking aid sensors.

temperature		
Parking aid enable request	IPC	Used to enable or disable the rear parking aid.
Parking aid switch request	FCIM	Used to enable or disable the rear parking aid and front parking aid. (Vehicles with rear parking aid and front parking aid)
Gear lever position	TCM	Used to enable or disable the front or rear parking aid depending on the gear lever position.
Trailer lamp connected	TRM	Used to disable the rear parking aid when a trailer is electrically connected to the vehicle.
Vehicle speed	PCM	Used to disable the parking aid if the vehicle speed exceeds a preset threshold.

IPC Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Audio system response status	ACM	Used to provide feedback to the IPC.
DSP Chime request	DSP	Used to provide feedback to the IPC.
Parking aid chime request	PAM	Used to command parking aid warning tones through the audio system speakers.

Audible Parking Aid System Operation

When the rear parking aid and/or front parking aid system is active, the PAM calculates the distance to an object within a 170 degree semicircular area (azimuth) around the rear or front of the vehicle. A variable frequency warning tone is generated through the audio speakers in proportion to the distance from the rear and/or front of the vehicle to the object.

The rear parking aid system calculates the distance to an object around the rear of the vehicle using 4 ultrasonic sensors. The rear parking aid sensors detect objects approximately 180 cm (70 in) from the rear of the vehicle, 50 cm (20 in) from the rear side of the vehicle, and 30 cm (12 in) above the ground. To detect objects behind the vehicle, the PAM supplies voltage and ground to the rear ultrasonic sensors while monitoring a signal return circuit from each sensor. The 4 rear sensors share common voltage and ground circuits.

The front parking aid system calculates the distance to an object around the front of the vehicle using 4 ultrasonic sensors. The front parking aid sensors detect objects approximately 70 cm (27 in) from the front of the vehicle, 50 cm (20 in) from the front side of the vehicle, 30 cm (12 in) above the ground. To detect objects in front of the vehicle, the PAM supplies voltage and ground to the front ultrasonic sensors while monitoring a signal return circuit from each sensor. The 4 front sensors share common voltage and ground circuits. Vehicles equipped with active park assist must be equipped with front parking aid.

Only objects that reflect a sufficient amount of sound waves are detected by the parking aid sensors. The surface properties, size and composition an object can affect the ability of the parking aid system to detect the object.

Also affecting the parking aid operation are:

- Improper sensor installation or alignment
- Dirt or ice covered sensors
- Heavy rain or snow

The parking aid system detects objects under the following conditions:

- The vehicle is in REVERSE (rear parking aid)
- The vehicle is in motion in any gear except NEUTRAL (front parking aid)
- The vehicle is moving toward the object.
- The vehicle is stationary and the object is moving toward the vehicle.
- The vehicle and object are both moving toward one another.

Parking Aid Audible Alert

Audio system volume is automatically reduced when a parking aid alert tone is sounded. The alert tone frequency increases as the vehicle gets closer to an obstacle. When an object is detected within 30 cm (12 in) of the sensors, the warning tone becomes continuous. Objects detected outside the continuous tone area to the side of the vehicle generate a warning tone for 3 seconds. The warning tones are prioritized to the closest object. If the front and rear objects are located the same distance from the vehicle, the rear object is prioritized.

Component Description

Parking Aid Sensors

The parking aid sensors are wide beam ultrasonic sensors. The sensors continuously send out ultrasonic signals to detect objects and communicate the information back to the PAM.

Only objects which reflect enough sound waves are detected by the sensors. This varies due to the shape, surface properties and size of objects being detected. Incorrect sensor alignment, dirt covered sensors, heavy rain or snow can cause objects not to be recognized.

PAM

The PAM calculates and reports (via audio system tones) the distance between the front or rear bumper of the vehicle and an object. The PAM is integral to the BCM and requires PMI when replaced.

Copyright © 2016 Ford Motor Company

Parking Aid

DTC Chart: Parking Aid Module (PAM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PAM DTC Chart

DTC	Description	Action
B1303:11	Parking aid disable switch: Circuit Short To Ground	GO to Pinpoint Test D
B1B36:12	Right Front Outer Sensor: Circuit Short To Battery	GO to Pinpoint Test H
B1B36:14	Right Front Outer Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test I
B1B36:96	Right Front Outer Sensor: Component Internal Failure	GO to Pinpoint Test J
B1B38:12	Right Front Inner Sensor: Circuit Short To Battery	GO to Pinpoint Test H
B1B38:14	Right Front Inner Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test I
B1B38:96	Right Front Inner Sensor: Component Internal Failure	GO to Pinpoint Test J
B1B40:12	Left Front Outer Sensor: Circuit Short To Battery	GO to Pinpoint Test H
B1B40:14	Left Front Outer Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test I
B1B40:96	Left Front Outer Sensor: Component Internal Failure	GO to Pinpoint Test J
B1B42:12	Left Front Inner Sensor: Circuit Short To Battery	GO to Pinpoint Test H
B1B42:14	Left Front Inner Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test I
B1B42:96	Left Front Inner Sensor: Component Internal Failure	GO to Pinpoint Test J
B1B44:12	Right Rear Outer Sensor: Circuit Short To Battery	GO to Pinpoint Test F

B1B44:14	Right Rear Outer Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test E
B1B44:96	Right Rear Outer Sensor: Component Internal Failure	GO to Pinpoint Test G
B1B46:12	Right Rear Inner Sensor: Circuit Short To Battery	GO to Pinpoint Test F
B1B46:14	Right Rear Inner Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test E
B1B46:96	Right Rear Inner Sensor: Component Internal Failure	GO to Pinpoint Test G
B1B48:12	Left Rear Outer Sensor: Circuit Short To Battery	GO to Pinpoint Test F
B1B48:14	Left Rear Outer Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test E
B1B48:96	Left Rear Outer Sensor: Component Internal Failure	GO to Pinpoint Test G
B1B50:12	Left Rear Inner Sensor: Circuit Short To Battery	GO to Pinpoint Test F
B1B50:14	Left Rear Inner Sensor: Circuit Short To Ground or Open	GO to Pinpoint Test E
B1B50:96	Left Rear Inner Sensor: Component Internal Failure	GO to Pinpoint Test G
B1B54:11	Function LED-Park Aid: Circuit Short To Ground	GO to Pinpoint Test K
B1B54:12	Function LED-Park Aid: Circuit Short To Battery	GO to Pinpoint Test K
B1B57:11	Front Sensors Power Circuit: Circuit Short To Ground	GO to Pinpoint Test B
B1B58:11	Rear Sensors Power Circuit: Circuit Short To Ground	GO to Pinpoint Test C
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test L
U0101:00	Lost Communication with TCM: No Sub Type Information	GO to Pinpoint Test M
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test N
U0131:00	Lost Communication With Power Steering Control Module: No	GO to Pinpoint Test O

	Sub Type Information	
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test P
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	GO to Pinpoint Test Q
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test R
U0164:00	Lost Communication With Heating, Ventilation and Air Conditioning (HVAC) Module: No Sub Type Information	GO to Pinpoint Test S
U0252:00	Lost Communication With Lighting Control Module - Rear B: No Sub Type Information	GO to Pinpoint Test T
U0256:00	Lost Communication With Front Controls Interface Module "A"	GO to Pinpoint Test U
U025D:00	Lost Communication With Front Controls Interface Module "B"	GO to Pinpoint Test V
U0401:00	Invalid Data Received From ECM/PCM A: No Sub Type Information	A continuous and on-demand DTC that sets when the PAM receives invalid network data from the PCM with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.
U0402:00	Invalid Data Received From TCM: No Sub Type Information	A continuous and on-demand DTC that sets when the PAM receives invalid network data from the TCM (part of the PCM) with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the TCM (part of the PCM0. DIAGNOSE the observable symptom.
U0415:00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the PAM receives invalid network data from the ABS module with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the ABS module, DIAGNOSE the observable symptom.
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the PAM receives invalid network data from the BCM with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U0423:00	Invalid Data Received from Instrument Panel Cluster Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the PAM receives invalid network data from the IPC with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the IPC, DIAGNOSE the observable symptom.
U0424:00	Invalid Data Received From Heating, Ventilation and Air Conditioning (HVAC) Module: No Sub Type Information	A continuous and on-demand DTC that sets when the PAM receives invalid network data from the HVAC module with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the HVAC, DIAGNOSE the observable symptom.
U0557:00	Invalid Data Received	A continuous and on-demand DTC that sets when the PAM receives invalid

	From Front Controls Interface Module "A": No Sub Type Information	network data from the FCIM with a faulted signal data input. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in other modules on the network. If no Diagnostic Trouble Codes (DTCs) are present in the FCIM, DIAGNOSE the observable symptom.
U2024:41	Control Module Cal-Config Data: General Checksum Failure	CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the PAM self-test. If DTC U2024:41 is retrieved again, PROGRAM the PAM using as-built data. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). REPEAT the self-test. If DTC U2024:41 is retrieved again, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CHECK the vehicle service history for recent service actions related to the PAM. This DTC sets due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, REPEAT the PMI procedure using as-built data. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). If there have been no recent service actions, INSTALL a new REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	CHECK the vehicle service history for recent service actions related to the PAM. This DTC sets due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, REPEAT the PMI procedure using as-built data. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). If there have been no recent service actions, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

Symptom Chart(s)

Symptom Chart: Parking Aid

Condition	Possible Sources	Actions
A module does not communicate with the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Parking Aid Module (PAM)	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The audible parking aid is inoperative	• Refer to the Pinpoint Test	GO to Pinpoint Test A
Continuous or intermittent tone when no obstacles or fault codes are present	• Dirty or iced over parking aid sensor(s)	CLEAN the rear bumper and sensors with high-pressure water.
	• Ice between parking aid sensor(s) and bezel(s)	ALLOW time for the ice between the parking aid sensor(s) and bezel(s) to melt.
	• Parking aid sensor(s) locked into the rear bumper incorrectly	INSTALL the parking aid sensor(s) into the bezel(s) correctly.

	• Parking aid sensor(s) are not aligned correctly	CARRY OUT the elevation system check. REFER to: Elevation System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).
	• Parking aid sensor(s) isolator ring missing, damaged or misaligned	INSTALL a new parking aid sensor. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation). REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
The parking aid audio tones are inoperative	• Refer to the Pinpoint Test	GO to Pinpoint Test A
The parking aid disable switch is inoperative	• Refer to the Pinpoint Test	GO to Pinpoint Test D
The parking aid menu is not available in the message center and cannot be deactivated	• A MyKey® restricted key is in use	Normal operation.

Pinpoint Test(s)

The Audible Parking Aid Is Inoperative

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

NOTE: *If a MyKey® restricted key is in use, the parking aid menu is not available in the message center and cannot be deactivated.*

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

Possible Sources

- Parking aid system disabled
- Communication concern
- PAM (integral to the BCM)
- IPC concern
- TR input concern

PINPOINT TEST A : THE AUDIBLE PARKING AID IS INOPERATIVE

A1 PERFORM A NETWORK TEST
• Ignition ON. • Using a diagnostic scan tool, perform a network test. **Do all modules pass the network test?**

Yes	GO to A2
No	DIAGNOSE any communication concerns. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 CHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS

- Using the diagnostic scan tool, perform the PAM self-test.

Are any PAM Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the DTC Chart in this section.
No	GO to A3

A3 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using the diagnostic scan tool, perform the IPC self-test.

Are any IPC Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to A4

A4 VERIFY THE PARKING AID IS ENABLED

- Verify the rear parking aid and front parking aid (if equipped) is enabled in the IPC message center.

Is the parking aid system enabled?

Yes	If equipped with Automatic Transmission GO to A5 If equipped with Manual Transmission GO to A6
No	ENABLE the parking aid system.

A5 CHECK FOR CORRECT GEAR INPUT

- Apply the parking brake.
- Ignition ON.
- While monitoring the IPC PRNDL display, briefly select each gear in the entire gear range.

Does the IPC PRNDL indicator match the gear selection throughout the entire range?

Yes	GO to A6
No	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

A6 CHECK THE AUDIO CHIMES

- Ignition OFF.
- Open the driver door.
- Place the headlamp switch in the ON position.

Does the warning chime operate through the audio system?

Yes	GO to A7
No	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

A7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect all BCM and related in-line connectors.
• Repair:
  • corrosion (install new connector or terminals – clean module pins)
  • damaged or bent pins – install new terminals/pins
  • pushed-out pins – install new pins as necessary
• Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B57:11

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM supplies voltage to the front parking aid sensors via a common circuit.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B57:11	Front Sensors Power Circuit: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the front sensor voltage supply circuit is shorted to ground or the signal return circuit.

Possible Sources

- Wiring, terminals or connectors
- Front parking aid sensor
- Front active park assist sensor (if equipped)
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST B : B1B57:11

B1 CHECK THE FRONT BUMPER WIRING HARNESS
• Ignition OFF. • Inspect the front bumper wiring harness for opens, shorts, grounds, or corrosion. **Is the front bumper wiring harness OK?**

Yes	GO to B2
No	REPAIR or INSTALL a new bumper wiring harness.

B2 CHECK THE LHF (LEFT-HAND FRONT) OUTER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Disconnect: LHF Front Outer Parking Aid Sensor C1428.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B57:11 present?

Yes	GO to B3
No	INSTALL a new LHF outer parking aid sensor. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

B3 CHECK THE LHF (LEFT-HAND FRONT) INNER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect:LHF Inner Parking Aid Sensor C1429.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B57:11 present?

Yes	If the vehicle is NOT equipped with active park assist, GO to B4
No	INSTALL a new LHF inner parking aid sensor. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

B4 CHECK THE RHF (RIGHT-HAND FRONT) INNER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect: RHF inner parking aid sensor C1430.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B57:11 present?

Yes	GO to B5
No	INSTALL a new RHF inner parking aid sensor. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

B5 CHECK THE RHF (RIGHT-HAND FRONT) OUTER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect: RHF Outer Parking Aid Sensor C1431.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B57:11 present?

Yes	GO to B6
No	INSTALL a new RHF outer parking aid sensor. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

B6 CHECK THE FRONT PARKING AID SENSOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: BCM C2280H.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-7	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B7
No	REPAIR the circuit.

B7 CHECK THE FRONT PARKING AID SENSOR VOLTAGE SUPPLY CIRCUIT AND GROUND CIRCUIT FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-7	Ω	C2280H-35

Is the resistance greater than 10,000 ohms?

Yes	GO to B8
No	REPAIR the circuit.

B8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).

	REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B58:11

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM supplies voltage to the rear parking aid sensors via a common circuit.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B58:11	Rear Sensors Power Circuit: Circuit Short To Ground	A continuous and on-demand DTC that sets when the rear sensor voltage supply circuit is shorted to ground or to the signal return circuit.

Possible Sources

- Wiring, terminals or connectors
- Rear parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST C : B1B58:11

C1 CHECK THE REAR BUMPER WIRING HARNESS

- Ignition OFF.
- Inspect the rear bumper wiring harness for opens, shorts, grounds, or corrosion.

Is the bumper wiring harness OK?

Yes	GO to C2
No	REPAIR or INSTALL a new bumper wiring harness.

C2 CHECK THE LHR (LEFT-HAND REAR) OUTER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Disconnect: LHR Outer Parking Aid Sensor C4009.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B58:11 present?

Yes	GO to C3
No	INSTALL a new LHR outer parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

C3 CHECK THE LHR (LEFT-HAND REAR) INNER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect: LHR Inner Parking Aid Sensor C4010.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B58:11 present?

Yes	GO to C4
No	INSTALL a new LHR inner parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

C4 CHECK THE RHR (RIGHT-HAND REAR) INNER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect: RHR Inner Parking Aid Sensor C4012.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B58:11 present?

Yes	GO to C5
No	INSTALL a new RHR inner parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

C5 CHECK THE RHR (RIGHT-HAND REAR) OUTER PARKING AID SENSOR FOR AN INTERNAL SHORT

- Ignition OFF.
- Disconnect: RHR Outer Parking Aid Sensor C4011.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is DTC B1B58:11 present?

Yes	GO to C6
No	REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).

C6 CHECK THE REAR PARKING AID SENSOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: BCM C2280E.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-26	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C7
No	REPAIR the circuit.

C7 CHECK THE PARKING AID SENSOR VOLTAGE SUPPLY CIRCUIT AND GROUND CIRCUIT FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-26	Ω	C2280E-27

Is the resistance greater than 10,000 ohms?

Yes	GO to C8
No	REPAIR the circuit.

C8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Parking Aid Disable Switch is Inoperative

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

When pressed, the parking aid disable switch supplies a ground signal to the PAM to disable the parking aid system and illuminate the parking aid LED. The switch is a normally open, momentary contact switch. The switch is disabled when a MyKey® is in use.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1303:11	Park Assist Switch: Circuit Short To Ground	A continuous and on-demand DTC that sets when the PAM detects that the parking aid disable switch signal circuit is shorted to ground or the parking aid disable switch has been closed for at least 10 seconds.

Possible Sources

- MyKey® restricted key in use
- Wiring, terminals or connectors
- Parking aid disable switch
- PAM (integral to the BCM)

Visual Inspection and Diagnostic Pre-checks

- Verify that a MyKey® is not in use

NOTE: *Before disconnecting the BCM or any other connectors verify they are properly seated and latched.*

PINPOINT TEST D : THE PARKING AID DISABLE SWITCH IS INOPERATIVE

D1 CHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, retrieve the PAM Diagnostic Trouble Codes (DTCs).

Is DTC B1303:11 present?

Yes	GO to D2
No	GO to D4

D2 CHECK THE PARKING AID DISABLE SWITCH FOR AN INTERNAL SHORT

- Disconnect: Active Park Assist/Differential Lock Switch C3360
- Ignition ON.
- Using a diagnostic scan tool, clear the PAM Diagnostic Trouble Codes (DTCs).
- Perform the PAM self-test.

Is DTC B1303:11 present?

Yes	GO to D3
No	Active Park Assist/Differential Lock Switch.

D3 CHECK THE PARKING AID DISABLE SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-7	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to D7
No	REPAIR the circuit.

No	REPAIR the circuit.

D4 CHECK THE PARKING AID DISABLE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect the Active Park Assist/Differential Lock Switch C3360.
- Connect a fused jumper wire between:

Positive Lead	Measurement / Action	Negative Lead
C3360-7		C3360-12

- Using a diagnostic scan tool, repeat the PAM self-test.

Is DTC B1303:11 present?

Yes	REMOVE the fused jumper wire. INSTALL a new parking aid disable switch.
No	REMOVE the fused jumper wire. GO to D5

D5 CHECK THE PARKING AID DISABLE SWITCH SIGNAL CIRCUIT FOR AN OPEN BETWEEN THE SWITCH AND THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-7	Ω	C2280G-4

Is the resistance less than 3 ohms?

Yes	GO to D6
No	REPAIR the circuit.

D6 CHECK THE GROUND CIRCUIT TO THE PARKING AID SWITCH FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-12	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to D7
No	Repair the circuit.

D7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B44:14, B1B46:14, B1B48:14, B1B50:14

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B44:14	Right Rear Outer Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the RHR outer parking aid sensor circuits are open or shorted to ground.
B1B46:14	Right Rear Inner Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the RHR inner parking aid sensor circuits are open or shorted to ground.
B1B48:14	Left Rear Outer Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the LHR outer parking aid sensor circuits are open or shorted to ground.
B1B50:14	Left Rear Inner Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the LHR inner parking aid sensor circuits are open or shorted to ground.

Possible Sources

- Wiring, terminals or connectors
- Rear parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST E : B1B44:14, B1B46:14, B1B48:14, B1B50:14

E1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST

CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.
- Check the PAM Diagnostic Trouble Codes (DTCs).

Are multiple rear parking aid sensor Diagnostic Trouble Codes (DTCs) recorded?

Yes	GO to E2
No	For DTC B1B44:14, B1B46:14, B1B48:14 or B1B50:14, GO to E3 For all other Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart in this section.

E2 CHECK THE REAR BUMPER WIRING HARNESS

- Ignition OFF.
- Inspect the rear bumper wiring harness for opens, shorts, grounds, or corrosion.

Is the rear bumper wiring harness OK?

Yes	GO to E3
No	REPAIR or INSTALL a new rear bumper wiring harness.

E3 CHECK THE REAR PARKING AID SENSOR CIRCUITRY FOR OPENS

- Disconnect: suspect parking aid sensor.
- Disconnect: BCM C2280E.
- For DTC B1B44:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-26	Ω	C4011-1
C2280E-7	Ω	C4011-2
C2280E-27	Ω	C4011-3

- For DTC B1B46:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-26	Ω	C4012-1
C2280E-8	Ω	C4012-2
C2280E-27	Ω	C4012-3

- For DTC B1B48:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-26	Ω	C4009-1
C2280E-23	Ω	C4009-2
C2280E-27	Ω	C4009-3

- For DTC B1B50:14, measure:

Positive Lead	Measurement / Action	Negative Lead

C2280E-26	Ω	C4010-1
C2280E-24	Ω	C4010-2
C2280E-27	Ω	C4010-3

Is resistance less than 3 ohms?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK THE REAR PARKING AID SENSOR SIGNAL CIRCUITRY FOR SHORTS TO GROUND

- For DTC B1B44:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C4011-2	Ω	Ground

- For DTC B1B46:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C4012-2	Ω	Ground

- For DTC B1B48:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C4009-2	Ω	Ground

- For DTC B1B50:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C4010-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	If all of the parking aid sensors recorded Diagnostic Trouble Codes (DTCs), GO to E5 If one or more (but not all) parking aid sensor(s) recorded Diagnostic Trouble Codes (DTCs), INSTALL a new sensor(s) for the one(s) in question. REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
No	REPAIR the circuit.

E5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:

- corrosion (install new connector or terminals – clean module pins)
- damaged or bent pins – install new terminals/pins
- pushed-out pins – install new pins as necessary

- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B44:12, B1B46:12, B1B48:12, B1B50:12

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B44:12	Right Rear Outer Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the RHR outer parking aid sensor signal circuit is shorted to battery voltage.
B1B46:12	Right Rear Inner Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the RHR inner parking aid sensor signal circuit is shorted to battery voltage.
B1B48:12	Left Rear Outer Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the LHR outer parking aid sensor signal circuit is shorted to battery voltage.
B1B50:12	Left Rear Inner Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the LHR inner parking aid sensor signal circuit is shorted to battery voltage.

Possible Sources

- Wiring, terminals or connectors
- Rear parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST F : B1B44:12, B1B46:12, B1B48:12, B1B50:12

F1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST
• Using a diagnostic scan tool, perform the PAM self-test. • Check the PAM Diagnostic Trouble Codes (DTCs) from the self-test.

Are multiple rear parking aid sensor Diagnostic Trouble Codes (DTCs) recorded?

Yes	GO to F2
No	For Diagnostic Trouble Codes (DTCs) B1B44:12, B1B46:12, B1B48:12 or B1B50:12, GO to F3 For all other Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart in this section.

F2 CHECK THE REAR BUMPER WIRING HARNESS

- Ignition OFF.
- Inspect the rear bumper wiring harness for opens, shorts, grounds, or corrosion.

Is the rear bumper wiring harness OK?

Yes	GO to F3
No	REPAIR or INSTALL a new rear bumper wiring harness.

F3 CHECK THE REAR PARKING AID SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: Suspect Parking Aid Sensor(s).
- Disconnect: BCM C2280E
- Ignition ON.
- For DTC B1B44:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4011-2		Ground

- For DTC B1B46:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4012-2		Ground

- For DTC B1B48:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4009-2		Ground

- For DTC B1B50:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4010-2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to F4

F4 CHECK THE REAR PARKING AID SENSOR SIGNAL AND VREF CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.
- For DTC B1B44:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4011-2	Ω	C4011-1

- For DTC B1B46:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4012-2	Ω	C4012-1

- For DTC B1B48:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4009-2	Ω	C4009-1

- For DTC B1B50:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C4010-2	Ω	C4010-1

Is the resistance greater than 10,000 ohms?

Yes	If all the sensor Diagnostic Trouble Codes (DTCs) are set, GO to F5 If one or more (but not all) parking aid sensor(s) recorded Diagnostic Trouble Codes (DTCs), INSTALL a new sensor(s) for the one in question. REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
No	REPAIR the circuit.

F5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules,

	Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B44:96, B1B46:96, B1B48:96, B1B50:96

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B44:96	Right Rear Outer Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the RHR outer parking aid sensor has internally failed or has an incorrect attenuation time.
B1B46:96	Right Rear Inner Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the RHR inner parking aid sensor has internally failed or has an incorrect attenuation time.
B1B48:96	Left Rear Outer Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the LHR outer parking aid sensor has internally failed or has an incorrect attenuation time.
B1B50:96	Left Rear Inner Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the LHR inner parking aid sensor has internally failed or has an incorrect attenuation time.

Possible Sources

- Wiring, terminals or connectors
- Rear parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST G : B1B44:96, B1B46:96, B1B48:96, B1B50:96

G1 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.
- Check the PAM Diagnostic Trouble Codes (DTCs) from the self-test.

Are parking aid Diagnostic Trouble Codes (DTCs) other than B1B44:96, B1B46:96, B1B48:96 or B1B50:96 recorded?

Yes	GO to G2
No	For all other Diagnostic Trouble Codes (DTCs) REFER to the DTC Chart in this section.

G2 CHECK THE PARKING AID SENSOR DISTANCE PARAMETER IDENTIFICATIONS (PIDS) WITH NO OBJECTS BEHIND THE VEHICLE

NOTE: *Make sure the area around the vehicle is clear of anything that can activate the parking aid system.*

- Clean the rear bumper and sensors with high-pressure water.
- Make sure the suspect parking aid sensor(s) is flush-mounted in the bezel.
- Ignition ON.
- Using a diagnostic scan tool, monitor the PAM parking aid sensor distance Parameter Identifications (PIDs) (LRI_DIST, LRO_DIST, RRI_DIST, RRO_DIST). The PID reads 2,540 mm (100 in) on a correctly functioning sensor.

Does the PID read 2,540 mm (100 in)?

Yes	GO to G3
No	GO to G4

G3 CHECK THE PARKING AID SENSOR DISTANCE PARAMETER IDENTIFICATIONS (PIDS) WITH A TEST OBJECT BEHIND THE VEHICLE

NOTE: *Make sure the area around the vehicle is clear of anything that can activate the parking aid system.*

- Using a diagnostic scan tool, monitor the PAM parking aid sensor distance Parameter Identifications (PIDs) (LRI_DIST, LRO_DIST, RRI_DIST, RRO_DIST).
- While monitoring the Parameter Identifications (PIDs), move a test object into and out of the detection zone behind each sensor. For an example of a test object,
  REFER to: Azimuth System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).

Does the PID approximately match the distance from the test object to the rear bumper of the vehicle?

Yes	GO to G5
No	GO to G4

G4 CHECK THE PARKING AID SENSORS

- Ignition OFF.
- Install a known good sensor for the suspect parking aid sensor.
  REFER to: Rear Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the PAM self-test.

Is the concern still present?

Yes	GO to G5
No	The cause of the concern was an inoperative parking aid sensor. The system is now operating correctly.

G5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB

	addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B36:12, B1B38:12, B1B40:12, B1B42:12

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B36:12	Right Front Outer Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the RHF outer parking aid sensor signal circuit is shorted to battery voltage.
B1B38:12	Right Front Inner Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the RHF inner parking aid sensor signal circuit is shorted to battery voltage.
B1B40:12	Left Front Outer Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the LHF outer parking aid sensor signal circuit is shorted to battery voltage.
B1B42:12	Left Front Inner Sensor: Circuit Short To Battery	A continuous and on-demand DTC that sets when the LHF inner parking aid sensor signal circuit is shorted to battery voltage.

Possible Sources

- Wiring, terminals or connectors
- Front parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST H : B1B36:12, B1B38:12, B1B40:12, B1B42:12

H1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.
- Check the PAM Diagnostic Trouble Codes (DTCs) from the self-test.

Are multiple rear parking aid sensor Diagnostic Trouble Codes (DTCs) recorded?

Yes	GO to H2
No	For Diagnostic Trouble Codes (DTCs) B1B44:12, B1B46:12, B1B48:12 or B1B50:12, GO to H3 For all other Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart in this section.

H2 CHECK THE FRONT BUMPER WIRING HARNESS

H2 CHECK THE FRONT BUMPER WIRING HARNESS

- Ignition OFF.
- Inspect the front bumper wiring harness for opens, shorts, grounds, or corrosion.

Is the front bumper wiring harness OK?

Yes	GO to H3
No	REPAIR or INSTALL a new front bumper wiring harness.

H3 CHECK THE FRONT PARKING AID SENSOR CIRCUITRY FOR A SHORT TO VOLTAGE

- Disconnect: suspect parking aid sensor(s).
- Disconnect BCM C2280H.
- Ignition ON.
- For DTC B1B36:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1431-2		Ground

- For DTC B1B38:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1430-2		Ground

- For DTC B1B40:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1428-2		Ground

- For DTC B1B42:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1429-2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to H4

H4 CHECK THE FRONT PARKING AID SENSOR SIGNAL AND VREF CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.
- For DTC B1B36:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1431-2	Ω	C1431-1

- For DTC B1B38:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1430-2	Ω	C1430-1

- For DTC B1B40:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1428-2	Ω	C1428-1

- For DTC B1B42:12, measure:

Positive Lead	Measurement / Action	Negative Lead
C1429-2	Ω	C1429-1

Is the resistance greater than 10,000 ohms?

Yes	If all the sensor Diagnostic Trouble Codes (DTCs) are set, GO to H5 If one or more (but not all) parking aid sensor(s) recorded Diagnostic Trouble Codes (DTCs), INSTALL a new sensor(s) for the one in question. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
No	REPAIR the circuit.

H5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B36:14	Right Front Outer Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the RHF outer parking aid sensor circuits are open, or the sensor signal line is shorted to ground.
B1B38:14	Right Front Inner Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the RHF inner parking aid sensor circuits are open, or the sensor signal line is shorted to ground.
B1B40:14	Left Front Outer Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the LHF outer parking aid sensor circuits are open, or the sensor signal line is shorted to ground.
B1B42:14	Left Front Inner Sensor: Circuit Short To Ground Or Open	A continuous and on-demand DTC that sets when any of the LHF inner parking aid sensor circuits are open, or the sensor signal line is shorted to ground.

Possible Sources

- Wiring, terminals or connectors
- Front parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST I : B1B36:14, B1B38:14, B1B40:14, B1B42:14

I1 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.
- Check the PAM Diagnostic Trouble Codes (DTCs).

Are multiple front parking aid sensor Diagnostic Trouble Codes (DTCs) recorded?

Yes	GO to I2
No	For DTC B1B36:14, B1B38:14, B1B40:14 or B1B42:14, GO to I3 For all other Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart in this section.

I2 CHECK THE FRONT BUMPER WIRING HARNESS

- Ignition OFF.
- Inspect the front bumper wiring harness for opens, shorts, grounds, or corrosion.

Is the front bumper wiring harness OK?

Yes	GO to I3
No	REPAIR or INSTALL a new front bumper wiring harness.

I3 CHECK THE FRONT PARKING AID SENSOR CIRCUITRY FOR OPENS

- Disconnect: Suspect Parking Aid Sensor(s).
- Disconnect: BCM C2280C.
- For DTC B1B36:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-7	Ω	C1431-1
C2280H-21	Ω	C1431-2
C2280H-35	Ω	C1431-3

- For DTC B1B38:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-7	Ω	C1430-1
C2280H-22	Ω	C1430-2
C2280H-35	Ω	C1430-3

- For DTC B1B40:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-7	Ω	C1428-1
C2280H-31	Ω	C1428-2
C2280H-35	Ω	C1428-3

- For DTC B1B42:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-7	Ω	C1429-1
C2280H-32	Ω	C1429-2
C2280H-35	Ω	C1429-3

Is the resistance less than 3 ohms?

Yes	GO to I4
No	REPAIR the circuit.

I4 CHECK THE FRONT PARKING AID SENSOR CIRCUITRY FOR SHORTS TO GROUND

- For DTC B1B36:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C1431-2	Ω	Ground

- For DTC B1B38:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C1430-2	Ω	Ground

- For DTC B1B40:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C1428-2	Ω	Ground

- For DTC B1B42:14, measure:

Positive Lead	Measurement / Action	Negative Lead
C1429-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	If all of the parking aid sensors recorded Diagnostic Trouble Codes (DTCs), GO to I5 If one or more (but not all) parking aid sensor(s) recorded Diagnostic Trouble Codes (DTCs), INSTALL a new sensor(s) for the one(s) in question. REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
No	REPAIR the circuit.

I5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B36:96, B1B38:96, B1B40:96, B1B42:96

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B36:96	Right Front Outer Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the RHF outer parking aid sensor has internally failed or has an incorrect attenuation time.
B1B38:96	Right Front Inner Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the RHF inner parking aid sensor has internally failed or has an incorrect attenuation time.
B1B40:96	Left Front Outer Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the LHF outer parking aid sensor has internally failed or has an incorrect attenuation time.
B1B42:96	Left Front Inner Sensor: Component Internal Failure	A continuous and on-demand DTC that sets when the LHF inner parking aid sensor has internally failed or has an incorrect attenuation time.

Possible Sources

- Wiring, terminals or connectors
- Front parking aid sensor
- PAM (integral to the BCM)

NOTE: *Before disconnecting the BCM or any of the parking aid sensors, verify the connectors are properly seated and latched.*

PINPOINT TEST J : B1B36:96, B1B38:96, B1B40:96, B1B42:96

J1 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.
- Check the PAM Diagnostic Trouble Codes (DTCs).

Are parking aid Diagnostic Trouble Codes (DTCs) other than B1B36:96, B1B38:96, B1B40:96 or B1B42:96 recorded?

Yes	GO to J2
No	For all other Diagnostic Trouble Codes (DTCs) REFER to the DTC Chart in this section

J2 CHECK THE PARKING AID SENSOR DISTANCE PARAMETER IDENTIFICATIONS (PIDS) WITH NO OBJECTS IN FRONT OF THE VEHICLE

NOTE: *Make sure the area around the vehicle is clear of anything that can activate the parking aid system.*

- Clean the front bumper and sensors with high-pressure water.
- Make sure the suspect parking aid sensor(s) is flush-mounted in the bezel.
- Ignition ON.
- Using a diagnostic scan tool, monitor the PAM parking aid sensor distance Parameter Identifications (PIDs) (LFI_DIST, LFO_DIST, RFI_DIST, RFO_DIST). The PID reads 2,540 mm (100 in) on a correctly functioning sensor.

Does the PID read 2,540 mm (100 in)?

Yes	GO to J3
No	GO to J4

No	GO to J4

J3 CHECK THE PARKING AID SENSOR DISTANCE PARAMETER IDENTIFICATIONS (PIDS) WITH A TEST OBJECT IN FRONT OF THE VEHICLE

NOTE: *Make sure the area around the vehicle is clear of anything that can activate the parking aid system.*

- Using a diagnostic scan tool, monitor the PAM parking aid sensor distance Parameter Identifications (PIDs) (LFI_DIST, LFO_DIST, RFI_DIST, RFO_DIST).
- While monitoring the Parameter Identifications (PIDs), move a test object into and out of the detection zone behind each sensor. For an example of a test object,
  REFER to: Azimuth System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).

Does the PID approximately match the distance from the test object to the front bumper of the vehicle?

Yes	GO to J5
No	GO to J4

J4 CHECK THE PARKING AID SENSORS

- Ignition OFF.
- Install a new sensor for the suspect parking aid sensor.
  REFER to: Front Parking Aid Sensor (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Removal and Installation).
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the self-test. Operate the system and verify the concern is still present.

Is the concern still present?

Yes	GO to J5
No	The cause of the concern was an inoperative parking aid sensor. The system is now operating correctly.

J5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B1B54:11, B1B5412

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM supplies voltage to the parking aid switch status LED when the parking aid system is disabled.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1B54:11	Function LED - Park Aid: Circuit Short To Ground	A continuous and on-demand DTC that sets when the parking aid switch status LED circuit is shorted to ground.
B1B54:12	Function LED - Park Aid: Circuit Short To Battery	A continuous and on-demand DTC that sets when the parking aid switch status LED circuit is shorted to battery voltage or is open.

Possible Sources

- Wiring, terminals or connectors
- PAM
- Parking aid switch

PINPOINT TEST K : THE PARKING AID SWITCH STATUS LED (LIGHT EMITTING DIODE) IS INOPERATIVE OR ALWAYS ON

K1 CHECK THE PAM (PARKING ASSIST CONTROL MODULE) CONTINUOUS AND ON-DEMAND DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the PAM Diagnostic Trouble Codes (DTCs).
- Perform the PAM self-test.

Is DTC B1B54:11 or B1B54:12 still present?

Yes	GO to K2
No	If the LED is inoperative GO to K6 If the LED is always on GO to K4

K2 CHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS) WITH THE PARKING AID SWITCH DISCONNECTED

- Ignition OFF.
- Disconnect: Active Park Assist/Differential Lock Switch C3360.
- Ignition ON.
- Using a diagnostic scan tool, clear the PAM Diagnostic Trouble Codes (DTCs).
- Perform the PAM self-test.

Is DTC B1B54:11 or B1B54:12 still present?

Yes	GO to K3
No	INSTALL a new parking aid switch.

K3 CHECK THE PARKING AID SWITCH STATUS LED (LIGHT EMITTING DIODE) CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

- Disconnect: BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-34	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to K4
No	REPAIR the circuit.

K4 CHECK THE PARKING AID SWITCH STATUS LED (LIGHT EMITTING DIODE) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: BCM C2280G.
- Connect: Active Park Assist/Differential Lock Switch C3360.
- Ignition ON.

Does the parking aid switch status LED continue to illuminate?

Yes	GO to K5
No	GO to K9

K5 CHECK FOR VOLTAGE ON THE PARKING AID SWITCH STATUS LED (LIGHT EMITTING DIODE) CIRCUIT

- Disconnect: Parking aid switch C3258.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-8	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	INSTALL a new Active Park Assist/Differential Lock Switch.

K6 CHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS) WITH THE PARKING AID SWITCH STATUS LED (LIGHT EMITTING DIODE) CIRCUIT JUMPERED TO GROUND

- Ignition OFF.
- Disconnect: Active Park Assist/Differential Lock Switch C3360.
- Connect a fused jumper wire between:

Positive Lead	Measurement / Action	Negative Lead
C3360-8		C3360-12

- Ignition ON.
- Using a diagnostic scan tool, clear the PAM Diagnostic Trouble Codes (DTCs).
- Perform the PAM self-test.

Is DTC B1B54:11 or B1B54:12 still present?

Yes	REMOVE the jumper wire. INSTALL a new Active Park Assist/Differential Lock Switch.
No	REMOVE the jumper wire. GO to K7

K7 CHECK THE PARKING AID SWITCH STATUS LED (LIGHT EMITTING DIODE) CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-8	Ω	C2280G-34

Is the resistance less than 3 ohms?

Yes	GO to K8
No	REPAIR the circuit.

K8 CHECK THE PARKING AID SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3360-12	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to K9
No	REPAIR the circuit.

K9 CHECK FOR CORRECT PAM (PARKING ASSIST CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PAM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PAM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB

	addresses this concern, INSTALL a new PAM (part of the BCM). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0100:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the PCM on the HS-CAN1.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the PCM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- PAM (integral to the BCM)
- PCM

PINPOINT TEST L : U0100:00

L1 VERIFY THAT A VEHICLE SESSION CAN BE ESTABLISHED USING THE DIAGNOSTIC SCAN TOOL

- Ignition ON.
- Verify that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to L2
No	REPAIR the communication fault. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

L2 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the PAM Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:00 present?

Yes	GO to L3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

L3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 303 for the procedure.
No	GO to L4

L4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0100:00 set in other modules?

Yes	GO to L5
No	GO to L6

L5 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new PCM. Refer to the appropriate section in Group 303 for the procedure.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

L6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0101:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the PCM on the HS-CAN1.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101:00	Lost Communication with TCM: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the TCM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- TCM
- PAM (integral to the BCM)

PINPOINT TEST M : U0101:00

M1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to M2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the TCM pass the network test?

Yes	GO to M3

No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

M3 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0101:00 present?

Yes	GO to M4
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE TCM (TRANSMISSION CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 303 for the procedure.
No	GO to M5

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0101:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0101:00 set in other modules?

Yes	GO to M6
No	GO to M7

M6 CHECK FOR CORRECT TCM (TRANSMISSION CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all TCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new TCM.Refer to the appropriate section in Group 303 for the procedure.

No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0121:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the ABS module through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the ABS module through the GWM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- ABS module
- GWM concern
- PAM (integral to the BCM)

PINPOINT TEST N : U0121:00

N1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to N2
No	Clear the DTC code. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Do the ABS module and the GWM pass the network test?

Yes	GO to N3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

N3 PERFORM THE ABS (ANTI-LOCK BRAKE SYSTEM) CONTROL MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to N4

N4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to N5

N5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0121:00 present?

Yes	GO to N6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).

- Ignition OFF.
- Wait 10 seconds.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0121:00 set in other modules?

Yes	GO to N7
No	GO to N8

N7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect all ABS module connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the ABS module and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

N8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0131:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the PSCM through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0131:00	Lost Communication with Power Steering Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the PSCM through the GWM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- PSCM (part of the steering gear)
- GWM concern
- PAM (integral to the BCM)

PINPOINT TEST O : U0131:00

O1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to O2
No	Clear the DTC code. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Do the PSCM and the GWM pass the network test?

Yes	GO to O3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

O3 PERFORM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PSCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	GO to O4

O4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to O5

O5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0131:00 present?

Yes	GO to O6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0131:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0131:00 set in other modules?

Yes	GO to O7
No	GO to O8

O7 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PSCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PSCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new PSCM (part of the steering gear). REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or

	corroded connector. ADDRESS the root cause of any connector or pin issues.

O8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0140:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the BCM through the HS-CAN1.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the BCM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- BCM
- PAM (integral to the BCM)

PINPOINT TEST P : U0140:00

P1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to P2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

P2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the BCM pass the network test?

Yes	GO to P3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

P3 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to P4

P4 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test the system for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0140:00 present?

Yes	GO to P5
No	GO to P6

P5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140:00 set in other modules?

Yes	GO to P6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

P6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0146:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the GWM through the HS-CAN1.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the GWM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- GWM
- PAM (integral to the BCM)

PINPOINT TEST Q : U0146:00

Q1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to Q2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the GWM pass the network test?

Yes	GO to Q3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Q3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to Q4

Q4 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0146:00 present?

Yes	GO to Q5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0146:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0146:00 set in other modules?

Yes	GO to Q6
No	GO to Q7

Q6 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect all GWM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins

- pushed-out pins – install new pins as necessary
- Reconnect the GWM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new GWM.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Q7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0155:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the IPC through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the IPC through the GWM are missing for 5 seconds or more.

Possible Sources

- Communication concern

- GWM concern
- IPC
- PAM (integral to the BCM)

PINPOINT TEST R : U0155:00

R1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to R2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

R2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Do the IPC and the GWM pass the network test?

Yes	GO to R3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

R3 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to R4

R4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to R5

R5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 present?

Yes	GO to R6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

R6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0155:00 set in other modules?

Yes	GO to R7
No	GO to R8

R7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect all IPC and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

R8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules,

	Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0164:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the SCCM through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0164:00	Lost Communication With Heating, Ventilation and Air Conditioning (HVAC) Module: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the HVAC module through the GWM are missing for 5 seconds or more.

Possible Sources

- Communication concern
- GWM concern
- HVAC
- PAM (integral to the BCM)

PINPOINT TEST S : U0164:00

S1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to S2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

S2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Do the HVAC module and the GWM pass the network test?

Yes	GO to S3
No	. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

S3 PERFORM THE HVAC (HEATING, VENTILATION AND AIR CONDITIONING) SELF-TEST

- Using a diagnostic scan tool, perform the HVAC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). REFER to: Climate Control System - Vehicles With: Electronic Automatic Temperature Control (EATC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
No	GO to S4

S4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs)

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to S5

S5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0164:00 present?

Yes	GO to S6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

S6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0164:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0164:00 set in other modules?

Yes	GO to S7
No	GO to S8

S7 CHECK FOR CORRECT HVAC (HEATING, VENTILATION AND AIR CONDITIONING) OPERATION

- Ignition OFF.
- Disconnect and inspect all HVAC and related in-line connectors.

- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the HVAC and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new HVAC module.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

S8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0252:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the APIM through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0252:00	Lost Communication With Lighting Control Module - Rear B: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the LCM -Rear B are missing for 5 seconds or more.

Possible Sources

- Communication concern
- GWM concern
- LCM -Rear B
- PAM (integral to the BCM)

PINPOINT TEST T : U0252:00

T1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to T2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

T2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the LCM- Rear B pass the network test?

Yes	GO to T3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

T3 PERFORM THE LCM (LIGHTING CONTROL MODULE) - REAR B SELF-TEST

- Using a diagnostic scan tool, perform the LCM- Rear B self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 417 for the procedure.
No	GO to T4

T4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to T5

T5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0252:00 present?

Yes	GO to T6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

T6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0252:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0252:00 set in other modules?

Yes	GO to T8
No	GO to T7

T7 CHECK FOR CORRECT LCM (LIGHTING CONTROL MODULE) - REAR B OPERATION

- Ignition OFF.
- Disconnect and inspect all LCM- Rear B and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the LCM- Rear B and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new LCM- Rear B. Refer to the appropriate section in Group 417 for the procedure.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

T8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U0256:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the FCIM through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the FCIM "A" are missing for 5 seconds or more.

Possible Sources

- Communication concern
- GWM concern
- FCIM
- PAM (integral to the BCM)

PINPOINT TEST U : U0256:00

U1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to U2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

U2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Do the FCIM and the GWM pass the network test?

Yes	GO to U3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

U3 PERFORM THE FCIM (FRONT CONTROLS INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCIM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 415 for the procedure.
No	GO to U4

U4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to U5

U5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0256:00 present?

Yes	GO to U6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

U6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00 IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0256:00 set in other modules?

Yes	GO to U7
No	GO to U8

U7 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

U025D:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The PAM communicates with the FCDIM through the GWM.
REFER to: Parking Aid - System Operation and Component Description (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U025D:00	Lost Communication With Front Controls Interface Module B: No Sub Type Information	A continuous and on-demand DTC that sets when the messages received from the FCIMB are missing for 5 seconds or more.

Possible Sources

- Communication concern
- GWM concern
- FCIMB
- PAM (integral to the BCM)

PINPOINT TEST V : U025D:00

V1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to V2
No	Clear the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Do the FCIMB and the GWM pass the network test?

Yes	GO to V3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

V3 PERFORM THE FCIMB (FRONT CONTROLS INTERFACE MODULE B) SELF-TEST

- Using a diagnostic scan tool, perform the FCIMB self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	Refer to the appropriate section in Group 415 for the procedure.
No	GO to V4

V4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to V5

V5 RECHECK THE PAM (PARKING ASSIST CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Operate the system and test for normal operation.
- Check the PAM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U025D:00 present?

Yes	GO to V6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U025D:00 IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U025D:00 set in other modules?

Yes	GO to V7
No	GO to V8

V7 CHECK FOR CORRECT FCIMB (FRONT CONTROLS INTERFACE MODULE B) OPERATION

- Ignition OFF.
- Disconnect and inspect all FCIMB and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the FCIMB and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new FCIMB. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

V8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Azimuth System Check

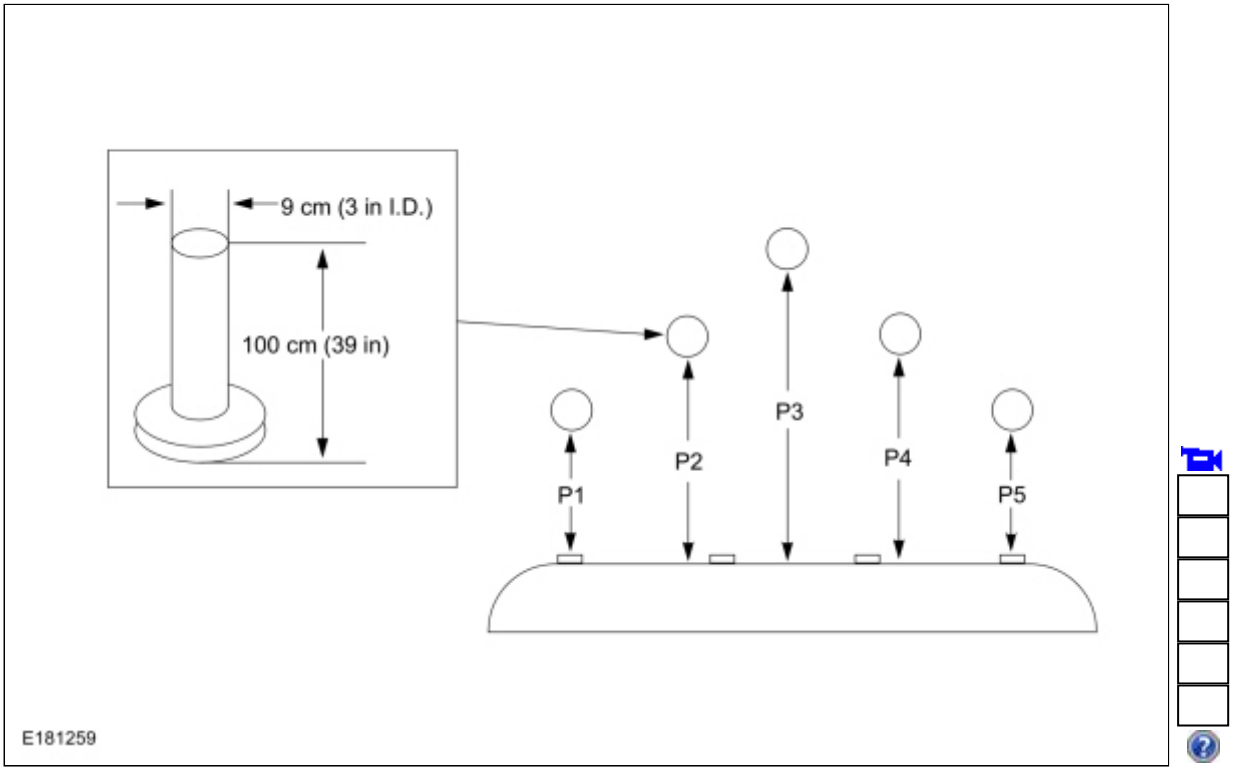
Check

1. **NOTE:** *The object used in this system check can be fabricated using a 9 cm diameter (3 in I.D.) pipe, 100 cm (39 in) in length (available as Polyvinyl Chloride (PVC) pipe, or similar from a hardware or plumbing supply.*

   NOTE: *The following system check should be carried out with the vehicle on a level surface.*

   NOTE: *Actual sensor arrangement may differ from the configuration shown.*

   Distribute the test objects evenly across the bumper as shown. Refer to the specifications in this section.



2. Turn the ignition switch to the ON position, engine off.
3. Apply the parking brake.
4. Select REVERSE (R) for rear parking aid.
5. Select DRIVE (D) for front parking aid.
6. **NOTE:** *The system provides audio warnings only when the vehicle is moving or when the vehicle is stationary and the detected obstacle is less than 12 in (30 cm) away from the bumper.*

   NOTE: *If the PAM does not detect the object above, refer to Diagnosis and Testing.*

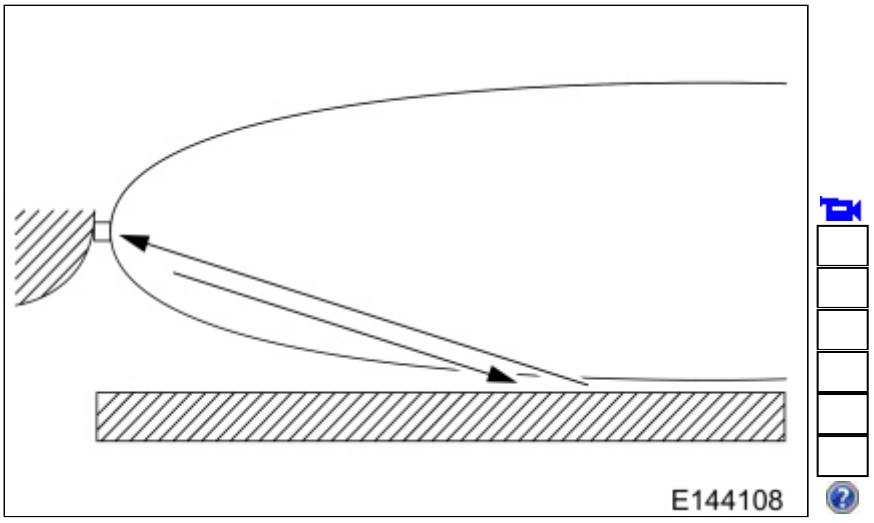
   Using a diagnostic scan tool, monitor the PAM parking aid sensor distance Parameter Identifications (PIDs) to verify the PAM detects the objects when placed in the specified locations (P1, P2, P3, P4 and P5).

Copyright © 2016 Ford Motor Company

Elevation System Check

Check

1. Turn the ignition ON, engine OFF.



2. Set the parking brake.
3. Place the gearshift in REVERSE (R) for rear parking aid sensors.
4. Place the gearshift in DRIVE (D) for front parking aid sensors.
5. Using a diagnostic scan tool, monitor the PAM parking aid sensor distance Parameter Identifications (PIDs) to verify the PAM detects no objects.
6. If the audible warning is heard or if the Parameter Identifications (PIDs) indicate an object is detected, check to make sure the bumper is correctly installed and is not tilted downward so the sensor is pointing at the ground. Refer to Diagnosis and Testing.

Copyright © 2016 Ford Motor Company

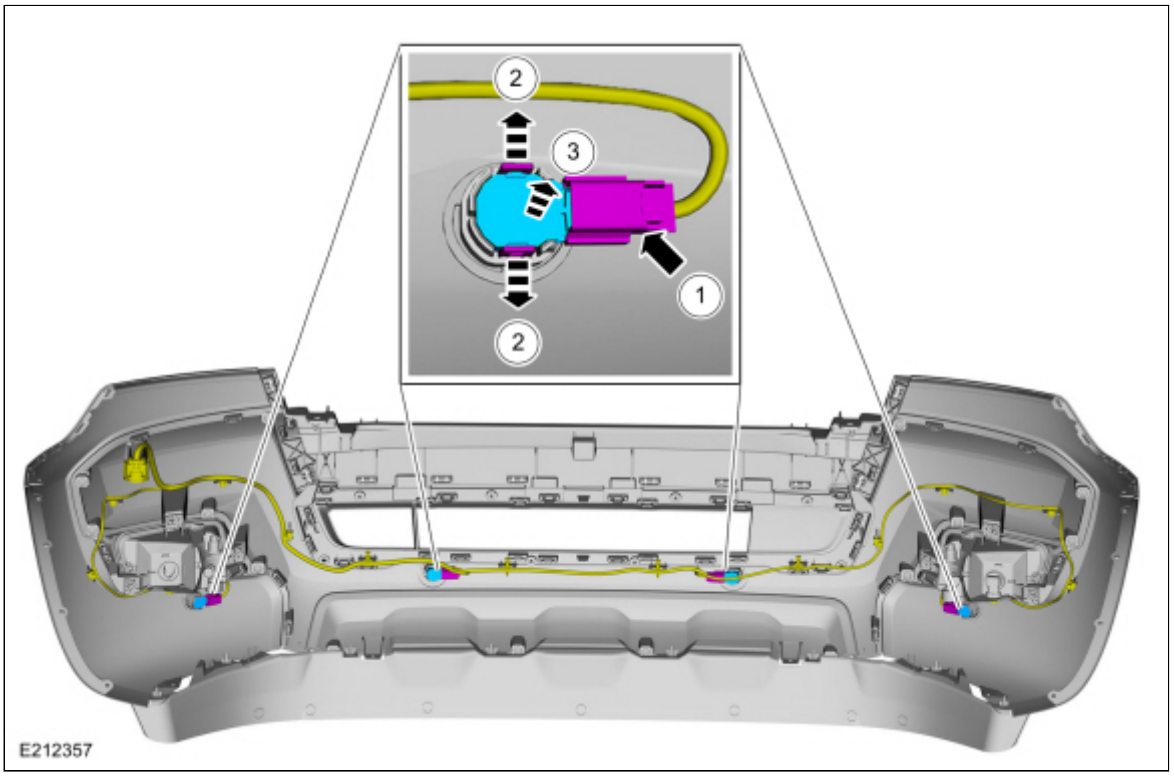
Front Parking Aid Sensor

Removal

NOTE: *This procedure can be used for all locations of the component.*

1. Remove the front bumper cover.
   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

2. Remove the front parking aid sensor.
   1. Disconnect the front parking aid sensor electrical connector.
   2. Release the tabs.
   3. Remove the front parking aid sensor.



Installation

1. To install, reverse the removal procedure.

2. Carry out the azimuth and elevation system checks.
   Refer to: Azimuth System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).
   Refer to: Elevation System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).

3. If any sensor fails the checks, diagnose the sensor fault.
   Refer to: Parking Aid (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

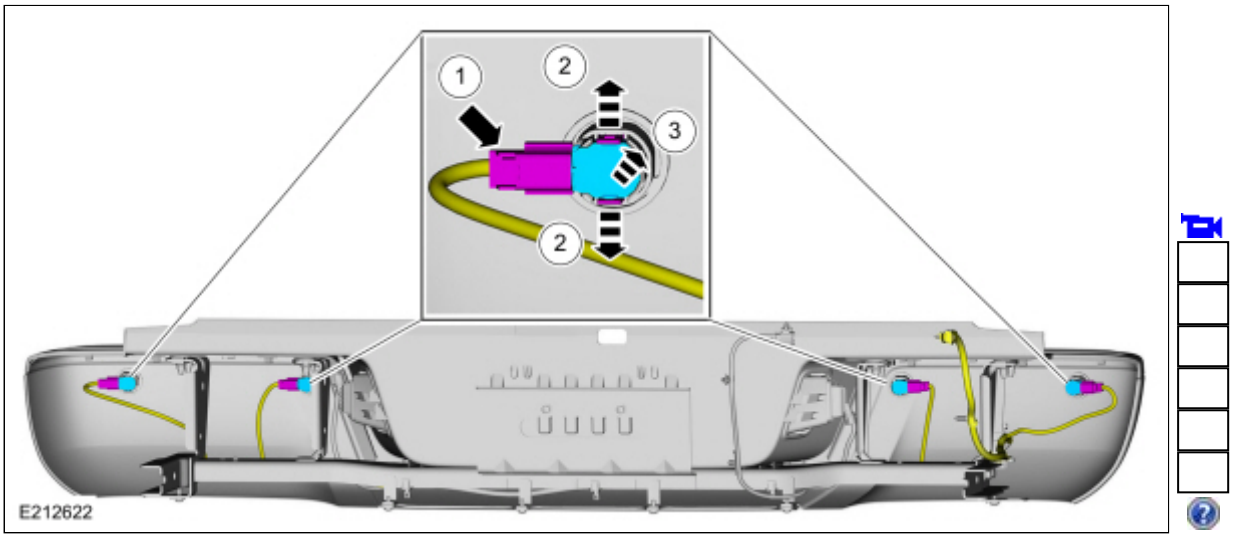
Rear Parking Aid Sensor

Removal

NOTE: *This procedure can be used for all locations of the component.*

1. Remove the rear bumper cover.
   Refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).

2. Remove the rear park aid sensor.
   1. Disconnect the rear park aid sensor electrical connector.
   2. Release the tabs.
   3. Remove the park aid sensor from the bracket.



Installation

1. To install, reverse the removal procedure.

2. Carry out the azimuth and elevation system checks.
   Refer to: Azimuth System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).
   Refer to: Elevation System Check (413-13A Parking Aid - Vehicles With: Rear Parking Aid, General Procedures).

3. If any sensor fails the system checks, diagnose the sensor fault.
   Refer to: Parking Aid (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Parking Assist Control Module (PAM)

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
   Refer to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

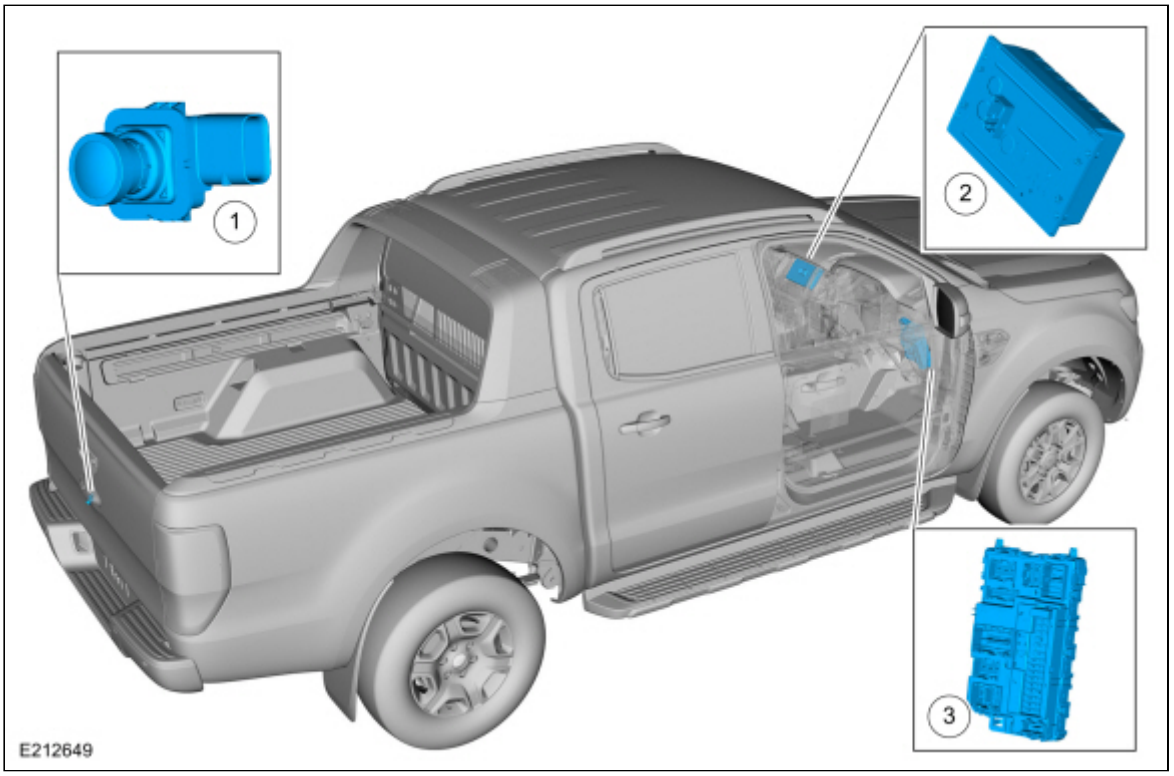
Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Parking Aid - Component Location

Component Location - Parking Aid Camera



Item	Description
1	Rear parking aid camera
2	Centerstack infotainment display (FDIM shown FCDIM similar)
3	BCM (rear only parking aid camera system)

Copyright © 2016 Ford Motor Company

Parking Aid - Overview

Overview

The vehicle may be equipped with:

- Rear only parking aid camera system

Rear Only Parking Aid Camera

The rear parking aid camera system visually aids the driver while reversing or reverse parking the vehicle. The camera system has features that provide fixed and active guideline overlays on the video image to assist the driver in aligning the vehicle and a visual alert function that provides a visual highlight in the zone where an object is detected by the audible parking aid system. The rear parking aid camera communicates with the BCM through a LIN circuit.

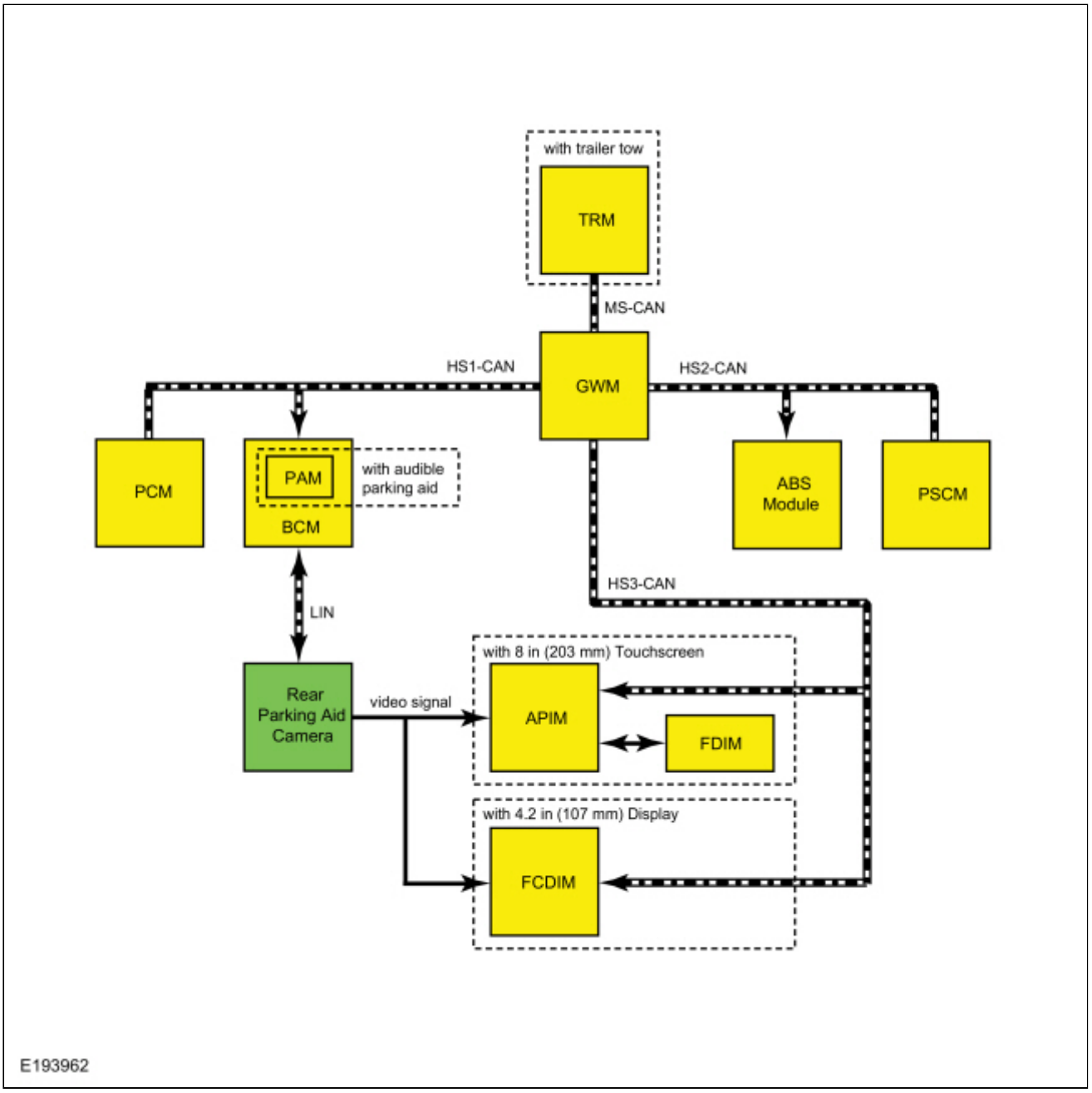
Copyright © 2016 Ford Motor Company

Parking Aid - System Operation and Component Description

System Operation

Rear Only Parking Aid Camera

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Camera commands	APIM	Used to command the zoom level on and off based on driver inputs through the FDIM.
Gear lever position	PCM	Used to support the rear parking aid camera standby mode. Turns the camera image output on when reverse gear is selected.

Parking aid sensor data	PAM	Used to generate the visual highlights in the zone where an object is detected by the rear parking aid system.
Steering angle	ABS Module	Used to generate the intended vehicle path for the active guideline feature.
Trailer lamp connected	TRM	Disables the guidelines and visual park aid alert when a trailer is electrically connected to the vehicle (if equipped with trailer tow).
Vehicle speed	PCM	Used to support the rear parking aid camera standby mode. Turns the camera image output off when vehicle speed is 10 mph (16 km/h) or greater and turns the camera image output on when the vehicle speed is 5 mph (8 km/h) or less.

ABS Module Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Steering wheel angle sensor data	PSCM	The ABS module uses the steering angle sensor data to generate the steering angle message that is sent to the BCM to support the active guideline feature.

FCDIM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear lever position	PCM	Used to enable and disable the rear video display.
Parking aid sensor data	PAM	Used to generate the visual highlights in the zone where an object is detected by the rear parking aid system.
Vehicle speed	PCM	When the video delay feature is turned on, this message is used to turn the rear camera display off after the vehicle speed exceeds a preset threshold.

APIM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Camera status	IPMB	Used to display the current status for active guidelines and visual park aid alert.
Gear lever position	PCM	Used to enable the video display when reverse gear is selected.
Parking aid sensor data	PAM	Used to generate the visual highlights in the zone where an object is detected by the rear parking aid system.
Vehicle speed	PCM	When the video delay feature is turned on, this message is used to turn the rear camera display off after the vehicle speed exceeds a preset threshold.

Image Display - 8 in (203 mm) Touchscreen

NOTE: *The liftgate must be fully closed for correct operation of the rear parking aid camera system.*

The rear parking aid camera image is displayed by the FDIM when reverse gear is selected. To determine the selector lever position and enable the camera display, the PCM sends the gear position message to the GWM on the HS-CAN1. The GWM then sends the message to the APIM via the HS-CAN3.

The camera is on any time it receives voltage (when the ignition is ON), but a video signal is only generated under certain conditions. When reverse gear is selected, the camera continuously generates a video signal. When any gear except reverse is selected, the camera turns the video signal off when the vehicle speed reaches 10 mph (16 km/h), and turns the video signal on when vehicle speed falls below 5 mph (8 km/h). If the camera is not configured properly, some features may be inoperative. The camera sends the video signal on shielded twisted pair wires to the APIM, which displays the image on the FDIM.

The following parking aid camera system features are driver selectable:

- Visual park aid alert — assists the driver to visually see the object causing the parking aid system to sound.
- Manual zoom — allows the driver to manually zoom the image.
- Video delay — allows the driver to see the image behind the vehicle after the vehicle is shifted out of reverse into any gear other than park.

The following camera system features are not driver selectable:

- Fixed guidelines — assists the driver with aligning the vehicle with an object.
- Active guidelines — displays the intended path of the vehicle based upon steering wheel input.

The FDIM settings menu is used to turn the visual park aid alert and video delay on and off. The visual park aid alert and video delay features are generated within the APIM.

To turn the manual zoom feature on and off, the driver uses an on screen button located on the FDIM while in reverse. The driver generated commands originate at the FDIM, which is hardwired to the APIM. The APIM sends the driver generated commands over the HS-CAN3 to the GWM. The GWM then sends the commands to the BCM on the HS-CAN1. The BCM sends the zoom command to the rear parking aid camera via the LIN circuit. The zoom is generated by the rear parking aid camera.

The fixed and active guidelines are generated by the rear parking aid camera and are not selectable by the driver.

Image Display - 4.2 in (107 mm) Display

NOTE: *The lifgate must be fully closed for correct operation of the rear parking aid camera system.*

The rear parking aid camera image is displayed by the FCDIM when reverse gear is selected. To determine the selector lever position and enable the camera display, the PCM sends the gear position message to the GWM on the HS-CAN1. The GWM then sends the message to the FCDIM via the HS-CAN3.

The camera is on any time it receives voltage (when the ignition is ON), but a video signal is only generated under certain conditions. When reverse gear is selected, the camera continuously generates a video signal. When any gear except reverse is selected, the camera turns the video signal off when the vehicle speed reaches 10 mph (16 km/h), and turns the video signal on when vehicle speed falls below 5 mph (8 km/h). If the camera is not configured properly, some features may be inoperative. The camera sends the video signal on shielded twisted pair wires to the FCDIM.

The following parking aid camera system are driver selectable:

- Visual park aid alert — assists the driver to visually see the object causing the parking aid system to sound.
- Manual zoom — allows the driver to manually zoom the image.
- Video delay — allows the driver to see the image behind the vehicle after the vehicle is shifted out of reverse into any gear other than park.
- Active guidelines — displays the intended path of the vehicle based upon steering wheel input.

The following camera system features are not driver selectable:

- Fixed guidelines — assists the driver with aligning the vehicle with an object.

The visual park aid alert and video delay are turned on and off in the FCDIM. The visual park aid alert feature is generated by the rear parking aid camera and video delay feature is generated within the FCDIM.

To turn the visual park aid alert and manual zoom features on and off, the driver generated commands originate from the FCDIM on the HS-CAN3. The GWM sends the commands from the HS-CAN3 to the BCM on the HS-CAN1. The BCM then sends the command to the rear parking aid camera via the LIN circuit.

The fixed and active guidelines and the manual zoom are generated by the rear parking aid camera.

LIN Communication

The BCM and the rear parking aid camera communicate via a LIN circuit which is a dedicated single wire

communication network.

The messages sent from the BCM to the camera are:

- Camera configuration data
- Display manual zoom request
- Guideline on/off request
- Trailer connection status (if equipped with trailer tow)
- Steering angle
- Standby enable/disable request

The messages sent from the camera to the BCM are:

- Camera status
- Display zoom status
- Camera part number data
- Guideline status

Visual Park Aid Alert

NOTE: *The on-screen alert transitions may not match changes in the audible parking aid alert tone frequency.*

The visual park aid alert feature displays a visual highlight in the zone where an object has been detected by the rear parking aid system. This feature utilizes the parking aid sensor data from the PAM to generate the visual highlights on the video image. When reverse gear is selected and an object is detected by a rear parking aid sensor, the parking aid sensor data message from the PAM is used by the FCDIM or APIM to generate the alert.

If the visual park aid alert feature is enabled, the feature is still operational even if the rear parking aid system has been disabled by the driver.

Fixed Guidelines

NOTE: *The color-coded lines cannot indicate accurate or consistent distances between the rear of the vehicle and objects shown in the video image. This normal condition is due to variances in vehicle ride height, including, but not limited to, vehicle loading.*

The video camera fixed guidelines feature displays guidelines on top of the video image to assist the driver with alignment of the vehicle. A dashed line on the displayed image represents the center of the vehicle and 3 color-coded lines (red, yellow, green) identify different zones between the rear of the vehicle and objects.

The guidelines are not shown when reverse is not selected (video delay active).

If the vehicle is equipped with a TRM, the fixed guidelines are not shown when a trailer is electrically connected to the vehicle.

Active Guidelines

NOTE: *If the battery has been disconnected or discharged, or a module is disconnected or replaced, the active guidelines may be inoperative until the vehicle is driven on a flat and smooth road at 32 km/h (20 mph) or more, with hands placed loosely on the steering wheel and minimal steering correction for approximately 30 seconds.*

If the guidelines remain inoperative, it may be necessary to disconnect the battery for 5 minutes with the driver's door open, then drive the vehicle for 5 miles in normal city driving before performing the procedure described above.

The active guidelines feature displays dynamic guidelines that correspond to the projected path of vehicle travel, based on the current steering angle. Several modules are involved in generating the steering angle data used to support the active guidelines. The PSCM monitors the steering angle sensor and sends the steering wheel angle sensor data to the ABS module via the HS-CAN2. The ABS module uses this message from the PSCM to generate the steering angle message that is sent to the GWM on the HS-CAN2. The GWM then sends the message to the BCM via the HS-CAN1. The BCM sends the steering angle data to the rear parking aid camera via the LIN circuit. The camera uses this data to generate the active guidelines over the video image.

If the steering wheel is in the straight-ahead position, the active guidelines are not shown.

The guidelines are not shown when reverse is not selected (video delay active).

If the vehicle is equipped with a TRM, the active guidelines are not shown when a trailer is electrically connected to the vehicle.

Manual Zoom

The manual zoom feature is generated by the rear parking aid camera and has one level of zoom. If the manual zoom

feature is on and the vehicle is shifted out of reverse gear, the manual zoom feature is disabled and must be re-enabled the next time reverse gear is selected. When the driver turns the zoom on or off at the FDIM or FCDIM, the zoom command is sent through HS-CAN3 to the GWM then over HS-CAN1 to the BCM. The BCM then sends the manual zoom request message to the rear parking aid camera via the LIN circuit. The camera then turns the zoom on or off.

Video Delay

When the video delay is turned on, the display keeps the rear video display enabled after the transmission is shifted out of reverse gear, into any gear other than park, until the vehicle speed reaches 8 km/h (5 mph). With the delay off (default), the image displays until the transmission is shifted out of reverse gear.

Component Description

Rear Camera

The rear parking aid camera is located on the liftgate. On vehicles equipped with the front and rear parking aid camera system, the rear camera communicates with the IPMB through a LIN circuit. On vehicles equipped with the rear only parking aid camera system, the rear camera communicates with the BCM through a LIN circuit. The camera must be configured using a diagnostic scan tool after replacement in order for all features to operate properly.

BCM (vehicles equipped with rear only parking aid camera)

The BCM serves as a gateway between the rear parking aid camera and other modules on the HS-CAN1. It communicates with the rear camera via the LIN and stores Diagnostic Trouble Codes (DTCs) for the camera and the LIN in the event of a concern.

Copyright © 2016 Ford Motor Company

Parking Aid

DTC Chart(s)

DTC Chart: BCM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action
B115E:01	Camera Module: General Electrical Failure	GO to Pinpoint Test A
B115E:02	Camera Module: General Signal Failure	GO to Pinpoint Test A
B115E:08	Camera Module: Bus Signal/Message Failure	GO to Pinpoint Test A
B115E:49	Camera Module: Internal Electronic Failure	• Sets in continuous memory and on-demand in the BCM when an internal fault in the rear parking aid camera is detected. – CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the BCM self-test. – If DTC B115E:49 returns, INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation).
B115E:55	Camera Module: Not Configured	• Sets in continuous memory and on-demand in the BCM when the rear parking aid camera is not configured. – PERFORM the rear parking aid camera configuration using a diagnostic scan tool under Electrical>Service Functions>LIN New Module Initialization.
B115E:9A	Camera Module: Component or System Operating Conditions	• Sets as an on-demand DTC in the BCM when the prerequisite conditions are not met for the on-demand self test. – INSPECT the liftgate to make sure it is fully closed and DIAGNOSE any other Diagnostic Trouble Codes (DTCs) present in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

DTC Chart: APIM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action
C1001:01	Vision System Camera: General Electrical Failure	• If the vehicle is equipped with a rear only parking aid camera, GO to Pinpoint Test A
All other Diagnostic Trouble Codes (DTCs)	—	Refer to the appropriate section in Group 415 for the procedure.

DTC Chart: FCDIM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action
C1001:01	Vision System Camera: General Electrical Failure	GO to Pinpoint Test A
All other Diagnostic Trouble Codes (DTCs)	—	REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).

Symptom Chart(s)

Rear Only Parking Aid Camera

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Actions
The rear parking aid camera is inoperative	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). − If the concern is still present after the APIM reset, GO to Pinpoint Test A • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test A
The FDIM or FCDIM displays REAR VIDEO CAMERA IS UNAVAILABLE or CAMERA IS UNAVAILABLE PLEASE CONTACT YOUR DEALERSHIP and a black screen/no image	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With:

		AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If the concern is still present after the APIM reset, GO to Pinpoint Test A • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test A
Static/flashing/blinking/flickering/scrolling or rolling image/screen/scrolling horizontal lines	Refer to the Pinpoint Test	GO to Pinpoint Test B
Poor image quality (foggy/cloudy/fuzzy/blurry/hazy image or moisture/water in lens or black spots)	Refer to the Pinpoint Test	GO to Pinpoint Test B
Frozen screen or slow screen transitions (vehicles with an 8 in (203 mm) touchscreen)	• FDIM • APIM	PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present after the APIM reset, DIAGNOSE the APIM and FDIM. REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
Frozen screen or slow screen transitions (vehicles with a 4.2 in (107 mm) centerstack infotainment display)	• FCDIM	DIAGNOSE the FCDIM. REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).
Manual zoom function is inoperative	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If the concern is still present after the APIM reset, GO to Pinpoint Test E • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test E
Visual park aid alert is inoperative	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM]

		(415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If the concern is still present after the APIM reset, GO to Pinpoint Test C • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test C
Active guidelines are inoperative or do no operate correctly	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If the concern is still present after the APIM reset, GO to Pinpoint Test D • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test D
Fixed guidelines are inoperative or do not operate correctly	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If the concern is still present after the APIM reset, GO to Pinpoint Test D • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test D
The video delay feature is inoperative or does not operate correctly	Refer to the Pinpoint Test	• If the vehicle is equipped with an 8 in (203 mm) touchscreen, PERFORM an APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment

		System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If the concern is still present after the APIM reset, GO to Pinpoint Test F • If the vehicle is equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to Pinpoint Test F
Video image is upside down	• Internal parking aid camera failure • Incorrect parking aid camera installed on vehicle	INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation).
All other image concerns	Refer to the Pinpoint Test	GO to Pinpoint Test A

Pinpoint Test(s)

The Rear Parking Aid Camera Is Inoperative - Vehicles With Rear Only Parking Aid Camera

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B115E:01	Camera Module: General Electrical Failure	A continuous and on-demand DTC that sets in the BCM when an internal electrical failure is detected from the camera.
B115E:02	Camera Module: General Signal Failure	A continuous and on-demand DTC that sets in the BCM when invalid LIN data is received from the video camera.
B115E:08	Camera Module: Bus Signal/Message Failure	A continuous and on-demand DTC that sets in the BCM when there is a LIN communication fault from the video camera.

APIM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1001:01	Vision System Camera: General Electrical Failure	A continuous and on-demand DTC that sets in the APIM when no video signal is detected from the rear parking aid camera when the vehicle is in REVERSE.

FCDIM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1001:01	Vision System Camera: General Electrical Failure	A continuous and on-demand DTC that sets in the FCDIM when no video signal is detected from the rear parking aid camera when the vehicle is in REVERSE.

Possible Causes

- Wiring, terminals or connectors
- Fuse
- Communication network concern
- Rear parking aid camera
- TR input concern
- Infotainment display concern
- LIN concern
- BCM
- APIM (vehicles equipped with 8 in (203 mm) touchscreen)

Visual Inspection and Diagnostic Pre-Checks

- If the vehicle is equipped with an 8 in (203 mm) touchscreen display, perform an APIM reset and reevaluate the concern prior to following this pinpoint test.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- BJB fuse 23 (15A).
- Verify the liftgate is fully closed.
- If the rear parking aid camera is not configured after replacement, some video functions will be inoperative. Verify the rear parking aid camera configuration using the diagnostic scan tool.

NOTE: *Before disconnecting the camera, verify the connector is properly seated and latched.*

PINPOINT TEST A : THE REAR PARKING AID CAMERA IS INOPERATIVE - VEHICLES WITH REAR ONLY PARKING AID CAMERA

A1 CHECK AND CLEAN THE REAR PARKING AID CAMERA LENS

- Clean and make sure the rear video camera lens is clear of any debris.
- Ignition ON.
- Select REVERSE.
- Test the rear parking aid camera system and monitor the video image.
- Select PARK.

Is the concern still present?

Yes	For vehicles equipped with Automatic Transmissions GO to A2 For vehicles equipped with Manual Transmissions GO to A3
No	The system is operating correctly at this time. The concern may have been caused by dirt or debris on the camera lens.

A2 CHECK FOR CORRECT GEAR INPUT AT THE IPC (INSTRUMENT PANEL CLUSTER)

- While monitoring the IPC PRNDL indicator, briefly select each gear in the entire range.

Does the IPC PRNDL indicator match the actual gear selection?

Yes	GO to A3
No	

	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

A3 PERFORM A NETWORK TEST

- Using a diagnostic scan tool, perform a network test.

Do all modules pass the network test?

Yes	GO to A4
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using the diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For BCM Diagnostic Trouble Codes (DTCs) B115E:01, B115E:02 or B115E:08, GO to A9 For all other Diagnostic Trouble Codes (DTCs), REFER to the DTC chart in this section.
No	For vehicles equipped with a 8 in (203 mm) touchscreen, GO to A5 For vehicles equipped with a 4.2 in (107 mm) centerstack infotainment display, GO to A7

A5 PERFORM THE APIM (SYNC MODULE) RESET

- Perform the APIM reset.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- Test the system to determine if the concern is still present.

Is the concern still present?

Yes	GO to A6
No	The system is operating correctly at this time. The concern may have been caused by an intermittent APIM concern.

A6 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the APIM self-test.

Are any Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For DTC C1001:01, GO to A9 For all other Diagnostic Trouble Codes (DTCs), REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to A8

A7 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCDIM self-test.

- Using a diagnostic scan tool, perform the FCDIM self-test.

Are any Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For DTC C1001:01, GO to A9 For all other Diagnostic Trouble Codes (DTCs), REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).
No	GO to A8

A8 CHECK THE VIDEO DISPLAY

- Observe the FDIM (if equipped) or FCDIM (if equipped) display.
- Select REVERSE.
- Wait 30 seconds.

Does the display switch to rear parking camera display mode?

Yes	Select PARK. GO to A9
No	Select PARK. DIAGNOSE the display. REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing). REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).

A9 CHECK FOR VOLTAGE TO THE REAR CAMERA

- Ignition OFF.
- Disconnect Rear Parking Aid Camera C4357.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A10
No	INSPECT BJB fuse 23 (15A). If the fuse is OK, repair the circuit for an open. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the short circuit.

A10 CHECK FOR GROUND AT THE REAR CAMERA

- Measure:

Positive Lead	Measurement / Action	Negative Lead

C4357-1		C4357-5

Is the voltage greater than 11 volts?

Yes	GO to A12
No	For vehicles with an 8 in (203 mm) touchscreen, GO to A11 For vehicles with a 4.2 in (107 mm) centerstack infotainment display, REPAIR the circuit.

A11 CHECK THE CAMERA GROUND/SHIELD CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect APIM C3342.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-6	Ω	C3342-33

Is the resistance less than 3 ohms?

Yes	GO to A18
No	REPAIR the circuit.

A12 CHECK THE VIDEO SIGNAL CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect APIM C3342 (vehicles with an 8 in (203 mm) touchscreen).
- Disconnect FCDIM C2123 (vehicles with a 4.2 in (107 mm) centerstack infotainment display).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-3		Ground
C4357-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to A13

A13 CHECK THE VIDEO SIGNAL CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	Ground

C4357-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A14
No	REPAIR the circuit in question.

A14 CHECK VIDEO SIGNAL CIRCUITS FOR AN OPEN

- Measure:

8 in (203 mm) Touchscreen

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	C3342-15
C4357-4	Ω	C3342-14

4.2 in (107 mm) Centerstack Infotainment Display

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	C2123-12
C4357-4	Ω	C2123-6

Are the resistances less than 3 ohms?

Yes	GO to A15
No	REPAIR the circuit in question.

A15 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect BCM C2280G.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-2	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A16

A16 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Ignition OFF

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-2	Ω	C2280G-37

Is resistance less than 3 ohms ?

Yes	GO to A17
No	REPAIR the circuit.

A17 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-2	Ω	Ground

Is resistance greater than 10,000 ohms?

Yes	GO to A19
No	REPAIR the circuit.

A18 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

A19 CHECK FOR CORRECT REAR PARKING AID CAMERA OPERATION

- Ignition OFF.
- Disconnect and inspect the rear parking aid camera connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the rear parking aid camera connector and related in-line connectors. Make sure they seat and

latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation). If the concern is still present after camera replacement, GO to A20
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

A20 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Poor Image Quality - Rear Parking Aid Camera

Refer to Wiring Diagrams Cell 145 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

Possible Causes

- Dirty or scratched camera lens
- Wiring, terminals or connectors
- Fuse
- Rear parking aid camera
- APIM (vehicles with 8 in (203 mm) touchscreen)
- Interference from other sources

Visual Inspection and Diagnostic Pre-Checks

- Make sure the rear video camera lens is clear of any debris.
- BJB Fuse 23 (15A).
- If the vehicle is equipped with an 8 in (203 mm) touchscreen display, perform an APIM reset and reevaluate the concern prior to following this pinpoint test.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

NOTE: *Before disconnecting the camera, verify the connector is properly seated and latched.*

PINPOINT TEST B : POOR IMAGE QUALITY - REAR PARKING AID CAMERA

B1 CHECK AND CLEAN THE CAMERA LENS

- Clean and make sure the rear parking aid camera lens is clear of any debris and scratches.
- Test the rear parking aid camera system while observing the video camera image.

Is the concern still present?

Yes	GO to B2
No	The system is operating correctly at this time. The concern may have been caused by dirt or debris on the camera lens or intermittent electromagnetic interference from an outside source.

B2 CHECK THE VOLTAGE TO THE REAR CAMERA

- Ignition OFF.
- Disconnect Rear Parking Aid Camera C4357.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to B3
No	INSPECT BJB fuse 23 (15A). If the fuse is OK, repair the circuit for an open. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the short circuit.

B3 CHECK THE REAR CAMERA GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-1		C4357-5

Is the voltage greater than 11 volts?

Yes	GO to B5
No	For vehicles with an 8 in (203 mm) touchscreen, GO to B4 For vehicles with a 4.2 in (107 mm) centerstack infotainment display, REPAIR the circuit.

B4 CHECK THE REAR CAMERA GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect APIM C3342.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-6	Ω	C3342-33

Is the resistance less than 3 ohms?

Yes	GO to B9
No	REPAIR the circuit.

B5 CHECK THE VIDEO SIGNAL CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect APIM C2342 (vehicles with an 8 in (203 mm) touchscreen).
- Disconnect FCDIM C2123 (vehicles with a 4.2 in (107 mm) centerstack infotainment display).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-3	V	Ground
C4357-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to B6

B6 CHECK THE VIDEO SIGNAL CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	Ground
C4357-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to B7
No	REPAIR the circuit in question.

B7 CHECK THE VIDEO SIGNAL CIRCUITS FOR A SHORT TO VIDEO SHIELD

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	C4357-6
C4357-4	Ω	C4357-6

Are the resistances greater than 10,000 ohms?

Yes	GO to B8
No	REPAIR the circuit in question.

B8 CHECK VIDEO SIGNAL CIRCUITS FOR AN OPEN

- Measure:

8 in (203 mm) Touchscreen

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	C3342-15
C4357-4	Ω	C3342-14

4.2 in (107 mm) Centerstack Infotainment Display

Positive Lead	Measurement / Action	Negative Lead
C4357-3	Ω	C2807-12
C4357-4	Ω	C2807-6

Are the resistances less than 3 ohms?

Yes	GO to B10
No	REPAIR the circuit in question.

B9 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical

	Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B10 CHECK FOR CORRECT REAR PARKING AID CAMERA OPERATION

- Ignition OFF.
- Disconnect and inspect the rear parking aid camera connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the rear parking aid camera connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Visual Park Aid Alert Is Inoperative - Vehicles With Rear Only Parking Aid Camera

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

Possible Causes

- Communication network concern
- Rear parking aid camera
- PAM (integral to the BCM)
- BCM concern
- FCDIM (vehicles equipped with 4.2 in (107 mm) display)
- APIM (vehicles equipped with 8 in (203 mm) touchscreen)

Visual Inspection and Diagnostic Pre-Checks

- If the vehicle is equipped with an 8 in (203 mm) touchscreen display, perform an APIM reset and reevaluate the concern prior to following this pinpoint test.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- If the rear parking aid camera is not configured after replacement, some video functions will be inoperative. Verify the rear video camera configuration using the diagnostic scan tool.

PINPOINT TEST C : THE VISUAL PARK AID ALERT IS INOPERATIVE - VEHICLES WITH REAR ONLY PARKING AID CAMERA

C1 VERIFY THE VISUAL PARK AID ALERT IS ENABLED

- Ignition ON.

- Verify that the visual park aid alert is enabled in the infotainment system settings menu. Refer to the Owner's Literature.

Is the visual park aid alert enabled?

Yes	GO to C2
No	ENABLE the visual park aid alert.

C2 PERFORM A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Do all modules pass the network test?

Yes	GO to C3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

C3 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PAM (PARKING ASSIST CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PAM self-test.

Are any PAM Diagnostic Trouble Codes (DTCs) recorded?

Yes	REPAIR all PAM Diagnostic Trouble Codes (DTCs) before continuing this test. REFER to: Parking Aid (413-13A Parking Aid - Vehicles With: Rear Parking Aid, Diagnosis and Testing).
No	GO to C4

C4 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any BCM Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the BCM DTC chart in this section.
No	For vehicles with an 8 in (203 mm) touchscreen, GO to C8 For vehicles with a 4.2 in (107 mm) centerstack infotainment display, GO to C5

C5 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCDIM self-test.

Are any FCDIM Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).
No	GO to C6

C6 CHECK FOR CORRECT REAR PARKING AID CAMERA OPERATION

- Ignition OFF.
- Disconnect and inspect the rear parking aid camera connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the rear parking aid camera connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation). If the concern is still present after camera replacement, GO to C7
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

C7 CHECK FOR CORRECT FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCDIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the FCDIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

C8 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the APIM self-test.

Are any APIM Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to C9

C9 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Guidelines Are Inoperative Or Do Not Operate Correctly - Vehicles With Rear Only Parking Aid Camera

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

Possible Causes

- Communication network concern
- Rear parking aid camera
- Liftgate position data concern
- LIN concern
- TRM concern
- ABS module concern (active guidelines only)
- PSCM concern (active guidelines only)
- BCM

Visual Inspection and Diagnostic Pre-Checks

- If the vehicle is equipped with an 8 in (203 mm) touchscreen display, perform an APIM reset and reevaluate the concern prior to following this pinpoint test.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- Verify the inoperative feature is enabled in the settings menu. Refer to the Owner's Literature.
- Verify that a trailer is not electrically connected to the vehicle.
- Verify the liftgate is fully closed.
- If the rear parking aid camera is not configured after replacement, some video functions will be inoperative. Verify the rear video camera configuration using the diagnostic scan tool.
- For active guideline concerns, verify the concern was not caused by the steering wheel being in the straight ahead position. Active guidelines are not displayed unless the steering wheel is rotated.

NOTE: *If the battery has been disconnected or discharged, or a module is disconnected or replaced, the active guidelines may be inoperative until the vehicle is driven on a flat and smooth road at 32 km/h (20 mph) or more, with hands placed loosely on the steering wheel and minimal steering correction for approximately 30 seconds.*

If the guidelines are remain inoperative, it may be necessary to disconnect the battery for 5 minutes with the driver's door open, then drive the vehicle for 5 miles in normal city driving before performing the procedure described above.

PINPOINT TEST D : THE GUIDELINES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY - VEHICLES WITH REAR ONLY PARKING AID CAMERA

D1 PERFORM A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Do all modules pass the network test?

Yes	If the vehicle is equipped with factory trailer tow, GO to D2 If the vehicle is **not** equipped with factory trailer tow, GO to D3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D2 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE TRM (TRAILER MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TRM self-test.

Are any TRM Diagnostic Trouble Codes (DTCs) retrieved?

Yes	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
No	GO to D3

D3 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a scan tool, perform the BCM self-test.

Are any BCM Diagnostic Trouble Codes (DTCs) retrieved?

Yes	REFER to the BCM DTC chart in this section.
No	For an active guideline concern, GO to D4 For a fixed guideline concern, GO to D7

D4 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any ABS module Diagnostic Trouble Codes (DTCs) retrieved?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	GO to D5

D5 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PSCM self-test.

Are any PSCM Diagnostic Trouble Codes (DTCs) retrieved?

Yes	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column

	Switches, Diagnosis and Testing).
No	GO to D6

D6 CHECK THE LIFTGATE AJAR PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Monitor the liftgate ajar PID while opening and closing the liftgate.

Does the PID consistently agree with the liftgate position?

Yes	GO to D7
No	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

D7 CHECK FOR CORRECT REAR PARKING AID CAMERA OPERATION

- Ignition OFF.
- Disconnect and inspect the rear parking aid camera connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the rear parking aid camera connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation). If the concern is still present after camera replacement, GO to D8
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

D8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or

	corroded connector. ADDRESS the root cause of any connector or pin issues.

The Manual Zoom Is Inoperative -Vehicles With Rear Only Parking Aid Camera

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

Possible Causes

- Communication network concern
- Rear parking aid camera
- LIN concern
- FCDIM concern (vehicles with a 4.2 in (107 mm) centerstack infotainment display)
- APIM concern (vehicles with an 8 in (203 mm) touchscreen)

Visual Inspection and Diagnostic Pre-Checks

- If the vehicle is equipped with an 8 in (203 mm) touchscreen display, perform an APIM reset and reevaluate the concern prior to following this pinpoint test.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- If the rear parking aid camera is not configured after replacement, some video functions will be inoperative. Verify the rear video camera configuration using the diagnostic scan tool.

PINPOINT TEST E : THE MANUAL ZOOM IS INOPERATIVE - VEHICLES WITH REAR ONLY PARKING AID CAMERA

E1 PERFORM A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Do all modules pass the network test?

Yes	GO to E2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E2 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the BCM DTC chart in this section.
No	For vehicles with an 8 in (203 mm) touchscreen, GO to E3 For vehicles with a 4.2 in (107 mm) centerstack infotainment display, GO to E4

E3 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the APIM self-test.

Are any Diagnostic Trouble Codes present?

Yes	For DTC C1001:01, GO to Pinpoint Test A For all other Diagnostic Trouble Codes (DTCs), REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to E5

E4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCDIM self-test.

Are any Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For DTC C1001:01, GO to Pinpoint Test A For all other Diagnostic Trouble Codes (DTCs), REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).
No	GO to E5

E5 CHECK FOR CORRECT REAR PARKING AID CAMERA OPERATION

- Ignition OFF.
- Disconnect and inspect the rear parking aid camera connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the rear parking aid camera connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new rear parking aid camera. REFER to: Rear Parking Aid Camera (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Video Delay Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Parking Aid - System Operation and Component Description (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Description and Operation).

Possible Causes

- Communication network concern
- TR data concern
- FCDIM concern (vehicles with a 4.2 in (107 mm) centerstack infotainment display)
- APIM concern (vehicles with an 8 in (203 mm) touchscreen)

Visual Inspection and Diagnostic Pre-Checks

- If the vehicle is equipped with an 8 in (203 mm) touchscreen display, perform an APIM reset and reevaluate the concern prior to following this pinpoint test.
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
  REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- Verify the video delay feature is turned on in the settings menu. Refer to the Owner's Literature.

PINPOINT TEST F : THE VIDEO DELAY IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

F1 PERFORM A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Do all modules pass the network test?

Yes	GO to F2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

F2 CHECK THE FOR CORRECT GEAR INPUT

- Apply the parking brake.
- While monitoring the reversing lamps, move the selector lever through the entire range.

Do the reversing lamps illuminate only when reverse gear is selected?

Yes	For vehicles with an 8 in (203 mm) touchscreen, GO to F3 For vehicles with a 4.2 in (107 mm) centerstack infotainment display, GO to F4
No	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

F3 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the APIM self-test.

Are any Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For DTC C1001:01, GO to Pinpoint Test A For all other Diagnostic Trouble Codes (DTCs), REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to F5

F4 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCDIM self-test.

Are any Diagnostic Trouble Codes (DTCs) retrieved?

Yes	For DTC C1001:01, GO to Pinpoint Test A For all other Diagnostic Trouble Codes (DTCs),

	REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).
No	GO to F6

F5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

F6 CHECK FOR CORRECT FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCDIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the FCDIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

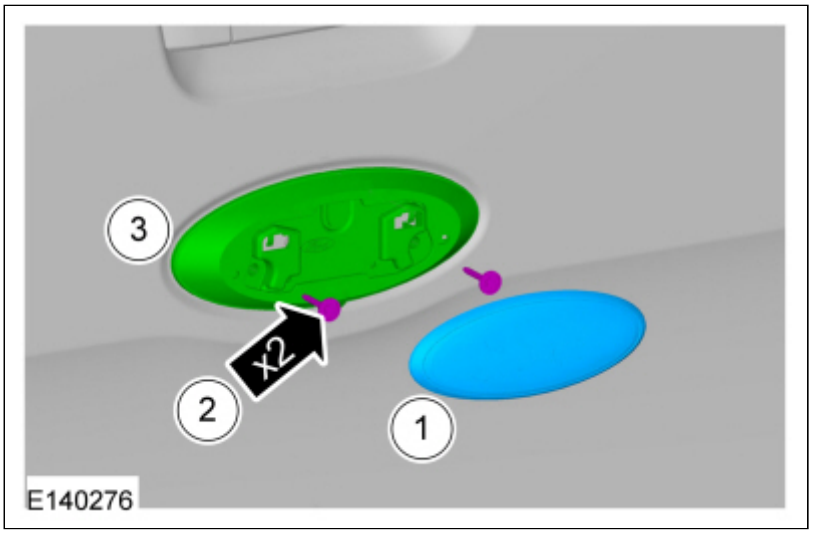
Copyright © 2016 Ford Motor Company

Rear Parking Aid Camera

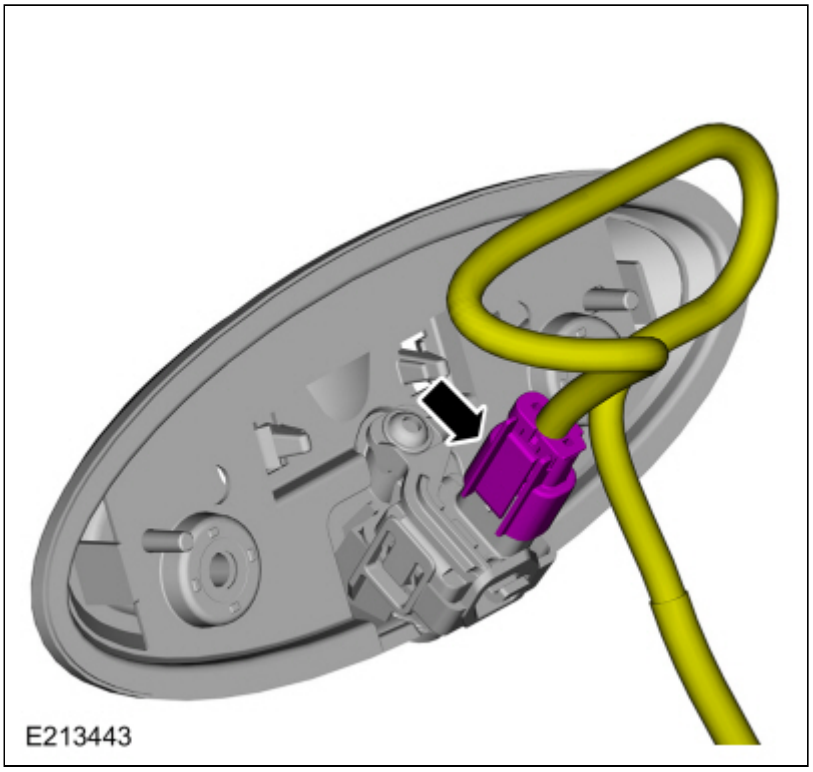
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

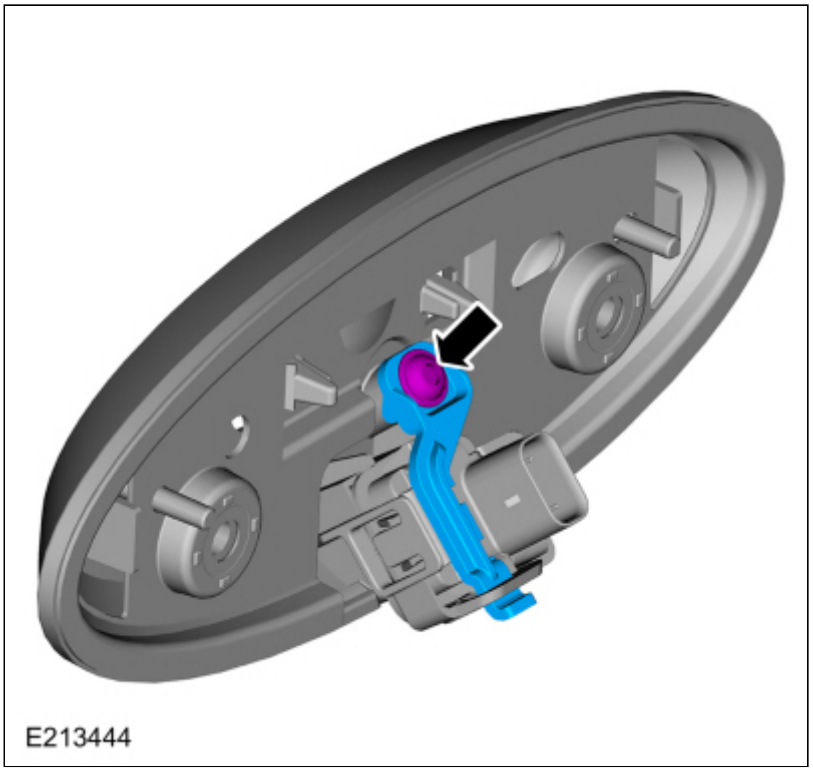
1.



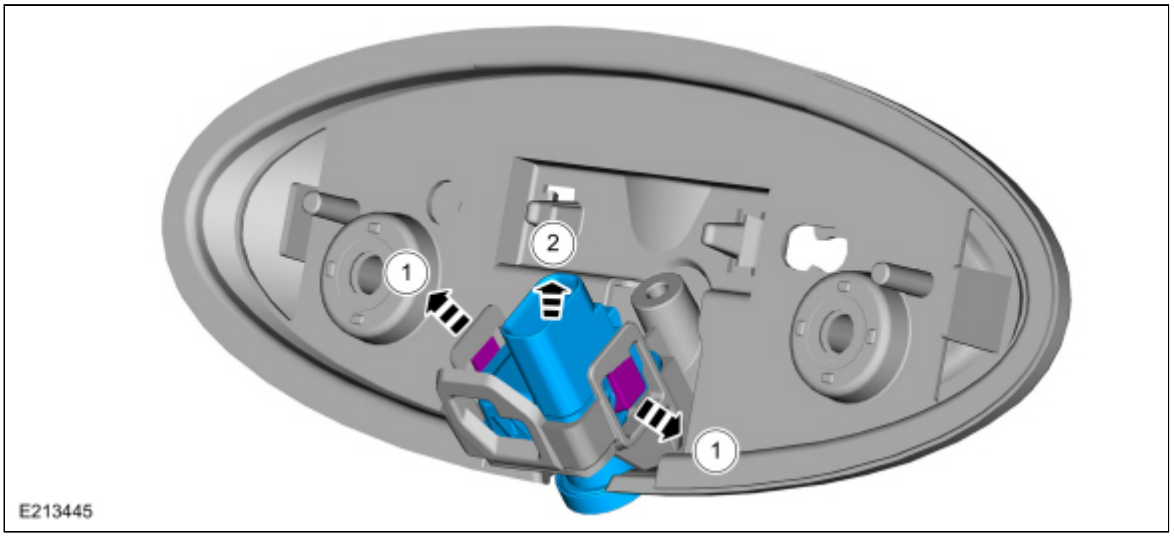
2. Remove the screws and the rear view camera bracket.



3. Remove the screws and the rear view camera bracket.



4. Disconnect and remove the rear view camera.



Installation

1. To install, reverse the removal procedure.
2. Follow the instructions on the scan tool to configure the rear view camera.

Copyright © 2016 Ford Motor Company

Image Processing Module B (IPMB)

Removal

1. Refer to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
   Refer to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Auxiliary Battery System

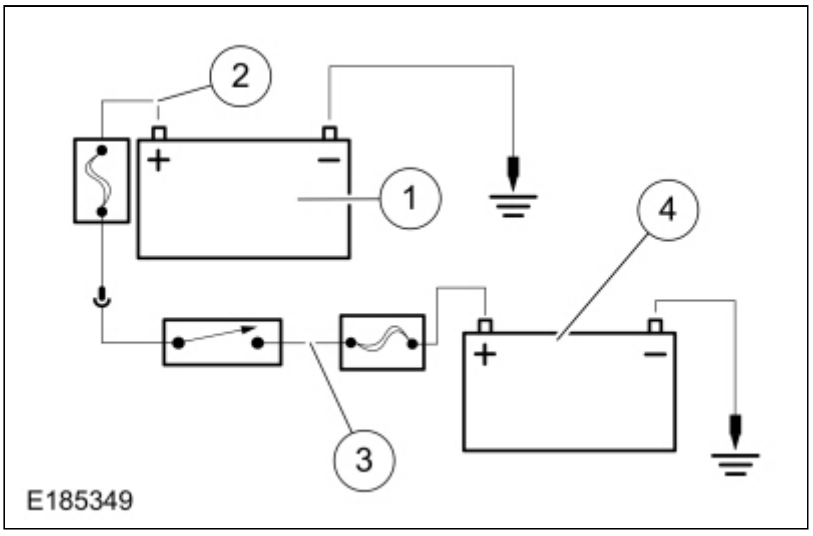
Auxiliary Battery System

WARNING: The Battery Monitor System (BMS) fitted to Ranger models cannot be used in conjunction with an auxiliary battery system, as a direct connection to the battery terminals (such as in a voltage sensitive relay based auxiliary battery charging system) will prevent correct operation of the BMS.

WARNING: Vehicles fitted with non-sealed type auxiliary batteries (non-maintenance free), must have regular checks made to determine that the electrolyte levels are correctly maintained.

WARNING: Batteries used in the auxiliary battery system must be suitable for off road excursions.

NOTE: *If a battery is disconnected, there is no requirement to reprogram the vehicle; the vehicle retains its 'normal' power management setting and remembers exactly what its previous configuration was (although the central locking latches may cycle if one of these was opened manually in the intervening period). With the radio, all of the settings are retained, but the key code needs to be entered to restore functionality. The clock will need resetting. The power windows will need to be re calibrated.*



The auxiliary battery system consists of the following components:

1. Primary Battery
2. Auxiliary Battery Cable
3. Auxiliary Battery Wiring Harness (with integrated battery isolator and fuse box)
4. Auxiliary Battery

Auxiliary Battery Cable

The auxiliary battery cable provides electrical power from the primary battery/generator to the auxiliary battery wiring harness.

Auxiliary Battery Wiring Harness

NOTE: *The auxiliary battery wiring harness contains the wiring harness, isolator, fuse box, mounting assembly, input cables, output cables, battery connections and associated components. The assembly must not be disassembled and is serviced as a complete unit if replacement is required.*

The auxiliary battery wiring harness incorporates the battery isolator, 125A MIDI fuse, fuse block, auxiliary battery connection terminals, output connections for auxiliary loads and a mounting assembly. The wiring harness facilitates both input charge to the auxiliary battery and output charge to the auxiliary loads.

Auxiliary Battery

The auxiliary battery is a 12-volt direct current (DC) 80 ampere-hour, 800CCA, DIN H7 size, 140 RC, absorption glass matt (AGM) deep cycle unit. The battery is connected to the vehicle using negative grounding. The auxiliary

battery provides electrical power supply for accessory loads when the engine is not running.

Auxiliary Battery Mount

NOTICE: Cab chassis vehicles must not be driven with the auxiliary battery still mounted on the auxiliary battery carrier. This method of mounting the auxiliary battery is only suitable for delivery of the vehicle from the plant.

The auxiliary battery is mounted at the rear of the vehicle in the following model specific locations:

- Cab chassis vehicles have the auxiliary battery mounted on a temporary auxiliary battery carrier located across the chassis rails at the rear of the vehicle.
- Style side box vehicles have the auxiliary battery mounted in a dedicated steel framed battery box in the rear right corner of the load tray.

Normal Operation

- When the engine is running, the generator supplies electrical power to both the primary and the auxiliary battery. Electrical power to the auxiliary battery is supplied through the auxiliary battery cable and is then regulated through the isolator located within the auxiliary battery wiring harness.
- When the engine is not running and the generator is no longer supplying electrical power to the batteries, the battery isolator in the auxiliary battery wiring harness is opened, protecting the primary battery from being depleted and allowing the auxiliary battery to provide output power to accessory loads.
- Once the engine is running and the primary battery measures 13.2V, the battery isolator will close the circuit, allowing the auxiliary battery to be charged. By not reconnecting the auxiliary battery until the primary battery is charged, the alternator is protected from excessive current draw.

Copyright © 2016 Ford Motor Company

Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 - Overview

Overview

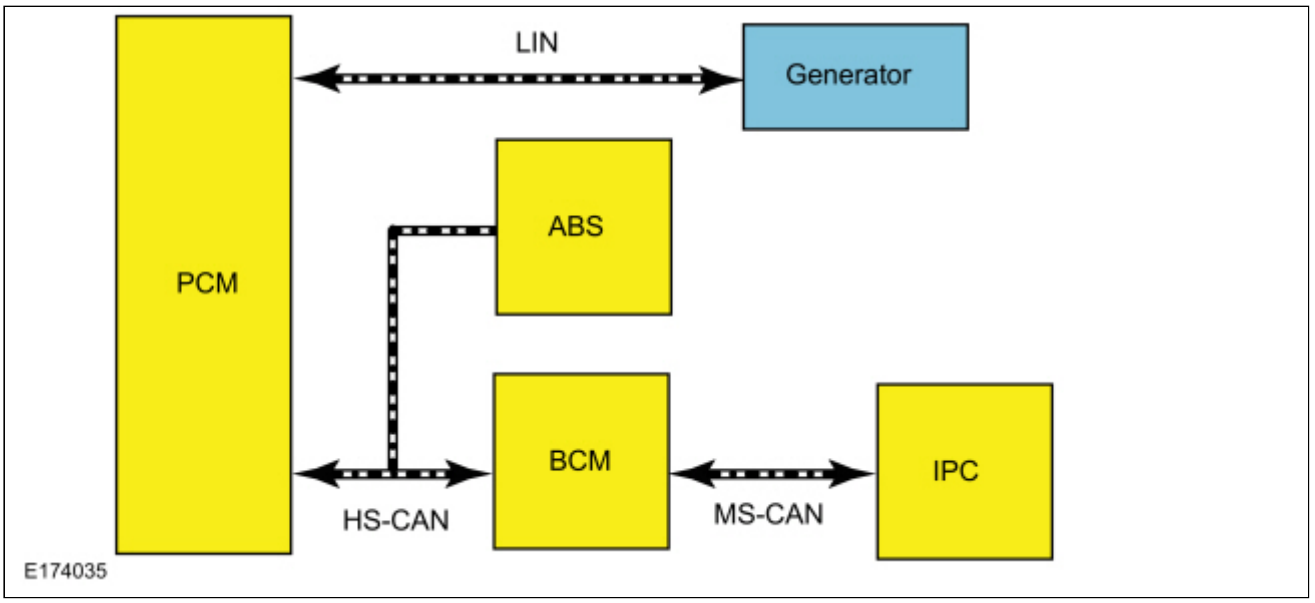
The generator is driven by the FEAD belt. When the engine is started, the generator begins to generate AC voltage which is internally converted to DC voltage. The DC voltage level is controlled by the internal voltage regulator and is supplied to the battery. The PCM controls the voltage regulation setpoint, communicating with the generator internal voltage regulator over a dedicated LIN communication circuit

Copyright © 2016 Ford Motor Company

Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages — Body Control Module (BCM)

Broadcast Message	Originating Module	Message Purpose
Alternator fault	PCM	The PCM has detected a fault in the generator or generator circuits.

Module Network Input Messages — Instrument Panel Cluster (IPC)

Broadcast Message	Originating Modle	Message Purpose
Power system status	BCM	Reports any generator/charging system faults. Used for charging system fault indicator.

Module Network Input Messages — Powertrain Control Module (PCM)

Broadcast Message	Originating Module	Message Purpose
Vehicle speed	ABS module	Vehicle speed is reported via High Speed Controller Area Network (HS-CAN). Used by the PCM during charging system voltage calculation.

Charging System

The PCM-controlled, or Smart Charge charging system determines the optimal voltage setpoint for the charging

system and communicates this information to the voltage regulator. The Smart Charge charging system is designed to set 1 of 7 Diagnostic Trouble Codes (DTCs) any time a charging system fault is present. All of the Diagnostic Trouble Codes (DTCs) can set continuous faults, but not all Diagnostic Trouble Codes (DTCs) set as on-demand faults.

Diagnostic Trouble Code (DTC)	Key ON Engine OFF (KOEO)	Key ON Engine Running (KOER)	Continuous
P0562	X	X	X
P0563		X Requires vehicle speed above 8 mph.	X
P065B		X	X
P065C		X	X
P0A3B		X	X
P1397	X	X	
U012D	X	X	X
U042E		X	X

Parameter Identification (PID)	Description	Normal Display
GEN_FAULT	Generator Fault Status	No Fault
GEN_LOSTCOMM	Lost Communication with Starter/Generator Control Module	No Fault
GENFIL	Generator Fault Indicator Lamp	OFF
GENREG_ELEC_F	Generator Regulator Reporting Electrical Fault	No Fault
GENREG_INVCMD	Generator Regulator Receiving Invalid Commands	No Fault
GENREG_MECH_F	Generator Regulator Reporting Mechanical Fault	No Fault
GENREG_NOCMD	Generator Regulator Indicating Missing Commands	No Fault
GENREG_OVRTMP	Generator Regulator Indicating Over Temperature	No Fault
GENVDSD	Generator Voltage Desired	Voltage varies by vehicle needs - May be controlled by an output state control
RPM	Engine Revolutions Per Minute	Engine Revolutions Per Minute (RPM) - May be controlled by an output state control
VPWR	Module Supply Voltage	Within 0.5 volt of battery voltage

The PCM simultaneously controls and monitors the output of the generator. When the current consumption is high or the battery is discharged, the PCM raises engine speed as needed to increase generator output. The generator charges the battery and at the same time supplies power for all of the electrical loads that are required. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm.

The PCM turns off the generator during cranking to reduce the generator load and improve cranking speed. Once the engine starts, the PCM slowly increases generator output to the desired voltage.

The PCM reports any charging system faults and sends a message through the HS-CAN to the BCM. The BCM then sends a message over the MS-CAN to the IPC , which controls the charging system warning indicator. The status of

the PCM charging system warning indicator message can be confirmed by viewing the PCM Generator Fault Indicator Lamp (GENFIL) PID. Any charging system fault detected by the PCM results in 1 or more Diagnostic Trouble Codes (DTCs) being set and the GENFIL PID having a status of ON. The IPC turns the charging system warning indicator ON and the message center may display a corresponding message to notify the driver of the condition.

Under certain circumstances, the charging system may have a concern but still keep the battery charged while the vehicle is running. The LIN is normally used to initiate charging, but with a fault on this circuit, the generator can self-excite, or begin charging on its own. The engine may need to operate at more than 2,000 RPM momentarily for this to occur. The charging system warning indicator illuminates, the corresponding message is displayed and the generator operates in a default mode (approximately 13.5 volts).

Engine Off Load Shed

When the ignition is in ACC or ON mode and the BCM determines the battery voltage or the battery state of charge has dropped below set levels, a low battery warning message may display in the message center. Should the battery voltage or the battery state of charge continue to drop, the audio system is powered down to save the remaining battery charge. This load shed state clears once the vehicle is started and battery state of charge is allowed to recover.

When the ignition is in the ON mode and if load shed occurs, the message center may display a corresponding message to notify the driver that battery protection actions are active. The audio system shuts down after the message center displays the warning.

Another engine off load shed strategy is a 45 minute timer. After 45 minutes have elapsed, the audio system turns off. To clear the load shed state, restart the engine.

Battery Charging

When it is required to charge the vehicle battery, connect the positive connection to the battery positive post, and attach the charger negative connection to a body or engine ground. The placement of the battery is such that the battery negative terminal is located under a sheet metal shroud making sheet metal ground the obvious choice for the charger.

Jump Starting

Connect the positive connection to the battery positive post, and connect the Jump Start negative to the vehicle ground. For a convenient ground location look for the body ground cable coming off the clamp and connect in this location (typically on the shock tower sheet metal).

Battery Replacement

Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Component Description

Generator

The generator is equipped with an electronic internal voltage regulator.

Powertrain Control Module (PCM)

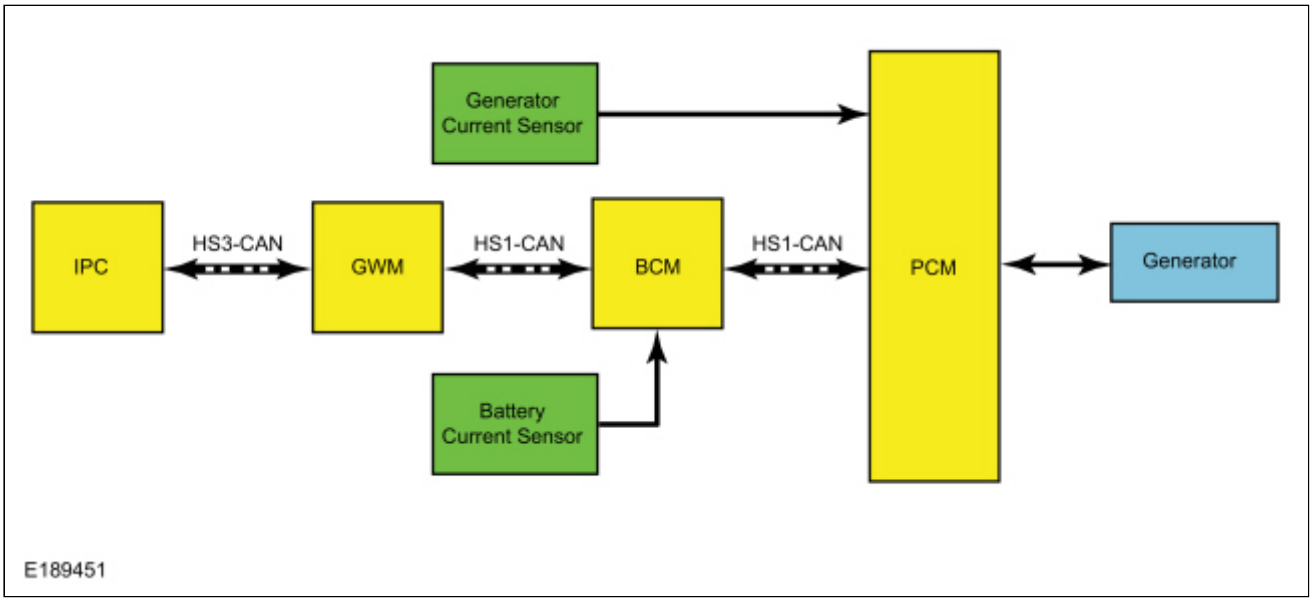
The PCM monitors and controls the charging system.

Copyright © 2016 Ford Motor Company

Charging System - 2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Module Network Input Messages — Body Control Module (BCM)

Broadcast Message	Originating Module	Message Purpose
Alternator fault	PCM	The PCM has detected a fault in the generator or generator circuits.

Module Network Input Messages — Instrument Panel Cluster (IPC)

Broadcast Message	Originating Module	Message Purpose
Power system status	BCM	Reports any generator/charging system faults. Used for charging system fault indicator.
Load Shed Request	BCM	Used to indicate what level of load shed is commanded.

Module Network Input Messages — Powertrain Control Module (PCM)

Broadcast Message	Originating Module	Message Purpose
Load Shed Request	BCM	Used to indicate what level of load shed is commanded.

Charging System

The smart regenerative charge system primary strategy is stored in the BCM. The BCM receives all of the important information relating to the battery condition from the battery monitoring sensor via the LIN. The BCM calculates and sends the set value needed for the generator charging voltage via the High Speed Controller Area Network (HS-CAN) to the PCM. The PCM then adjusts the value received (if necessary) and sends it to the generator via the LIN. The charging voltage is adjusted depending on various parameters, such as the current level of engine efficiency. The smallest possible set value for the generator voltage is 12.2 volts, while the maximum charging voltage can be anywhere between 14.5 and 14.9 volts. However, when the battery is in a refresh phase, the voltage may occasionally reach up to 15.2 volts. These refresh phases are required when the battery charge status is 80% over long periods of time, which increases the risk of sulfation in the battery cells.

The PCM simultaneously controls and monitors the generator output. When the current consumption is high or the battery is discharged, the PCM raises engine speed as needed to increase generator output. The generator charges the battery and at the same time supplies power for all of the electrical loads. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm.

The PCM turns off the generator during cranking to reduce the generator load and improve cranking speed. Once the engine starts, the PCM slowly increases generator output to the desired voltage.

The PCM reports any charging system faults and sends a message through the High Speed Controller Area Network (HS-CAN) to the BCM. The BCM controls the charging system warning indicator by sending a message over the High Speed Controller Area Network (HS-CAN) to the IPC. The IPC then controls charging system warning indication based on the message from the PCM through the BCM. The status of the PCM charging system warning indicator and/or message is confirmed by viewing PCM PID generator fault indicator lamp (GENFIL). Any charging system fault detected by the PCM results in 1 or more Diagnostic Trouble Codes (DTCs) being set and the PID GENFIL having a status of On. If equipped with a charging system warning indicator, the IPC turns the indicator on or off. If equipped with a message center, the IPC displays a CHECK CHARGING SYSTEM message. In some instances, the CHECK CHARGING SYSTEM message may not display if the ignition is on and the engine is off.

Under certain circumstances, the charging system may have a concern but still charge the battery while the vehicle is running. The LIN is normally used to initiate charging, but with a fault on this circuit, the generator can self-excite, or begin charging on its own. The engine may need to operate at more than 2,000 RPM momentarily for this to occur. The charging system warning indicator illuminates, the corresponding message is displayed and the generator operates in a default mode (approximately 13.5 volts).

Electrical Energy Management System

NOTICE: When any vehicle module is being programmed, connect an external battery charger to make sure the module programming is completed without interruption due to the load shedding feature becoming active. The external battery charger must maintain a system voltage above 13 volts. This may require a charger setting higher than the lowest charge setting. The external battery charger negative connection must be made to an engine or vehicle chassis ground and not the negative battery terminal. If the connection is to the negative battery terminal, load shedding may begin and module programming may be corrupted. After charging has begun, start the engine to clear any load shed states and then turn the engine off and proceed with programming.

This vehicle is equipped with an Electrical Energy Management system which manages battery charging and monitors the battery state of charge. The Electrical Energy Management system software is housed in the BCM. It has the algorithms and control structure for the Smart Regenerative Charging, and Load Shed Control Strategy. The Electrical Energy Management system is equipped with a battery monitor sensor and generator current sensor to monitor the battery. These sensors serve as input to the Electrical Energy Management system software. If the sensors malfunction due to wiring issues or failure, a DTC will be set. In most cases the Electrical Energy Management system functions will be turned off until the sensor operation is restored.

Battery State of Charge

The BCM uses the battery current sensor to keep track of the battery state of charge. During a drive cycle the Electrical Energy Management software adjusts the battery state of charge up during charging, and down during discharge.

During rest periods with the key off, and the vehicle enters sleep mode, the BCM automatically recalibrates the Battery State of Charge. It takes 4 hours in sleep mode, with the vehicle undisturbed, no doors opened or keyless entry buttons pressed, and the total vehicle current draw less than 500mA, to calibrate the battery state of charge to a high accuracy. If the system draw has not allowed the battery state of charge to calibrate over the previous 7 days, the state of charge quality factor changes to identify this and some Electrical Energy Management system functions may be temporarily turned off until a calibration takes place.

Engine Off Load Shed

When the engine is off, and the BCM determines the battery state of charge is below 40% or 45 minutes have elapsed, a load shed message is sent over the CAN. This message turns off the audio/navigation system to save the remaining battery charge. Under this condition, the FDIM displays SYS OFF TO SAVE BATT (without navigation) or

BATTERY SAVER — SYSTEM OFF PLEASE START THE ENGINE (with navigation) to notify the driver that battery protection actions are active.

Engine off load shed occurs when the engine is not running, and the ignition is in the ACC or RUN position. To clear the load shed state, restart the engine.

NOTE: *To maintain correct operation of the load shed system, any electrical devices or equipment must be grounded to the engine or chassis ground and not the negative battery terminal. A connection to the negative battery terminal may cause an inaccurate measurement of the battery state of charge and may cause incorrect load shed system operation.*

When the ignition is in the RUN position and load shed occurs, the IPC message center displays either TURN POWER OFF TO SAVE BATT (base message center) or TURN POWER OFF TO SAVE BATTERY (optional message center). The audio/navigation system will shut down after the message center displays it's warning.

If a fault occurs with the battery current sensor or circuit(s), the only engine off load shed strategy is a 45 minute timer. After 45 minutes have elapsed, the audio/navigation system turns off. To clear the load shed state, restart the engine.

Engine Running Load Shed

When the BCM and/or PSCM voltage is low, with the engine running, a message is sent by the BCM to either minimize or shut down the climate controlled seats, rear defrost, heated mirrors and DATC blower motor to improve system voltage. Under this condition, the IPC message center displays either LOW BATTERY LESS FEATURES (base message center) or LOW BATTERY FEATURES TEMPORARILY TURNED OFF (optional message center) to notify the driver that battery protection actions are active.

For more information on message center messages, Refer to the Owner's Literature or
Refer to: Message Center (413-01) .

There are 3 states of engine running load shed:

Load Shed State	Entry Conditions	Impact to Features	Clear Conditions
Load shed 1	If vehicle speed is **below 16 km/h (10 mph)**, and voltage to the PSCM is less than 11.5-volts or the PSCM measures current draw greater than 0 amps. If vehicle speed is **above 16 kp/h (10 mph)**, and the voltage to the BCM is less than 11.6 volts.	These loads are incrementally reduced (if equipped): Heated steering wheel and climate controlled seats. These loads are turned off (if equipped): smart trailer tow battery charge, heated mirrors, heated backglass, and heated windshield.	Voltage to the BCM is greater than 12.7 volts **or** the generator field duty cycle is less than 80%.
Load shed 2 transient	PSCM indicating reduced voltage and increased current. System voltage less than 11.5 volts	• If equipped, climate controlled seats are disabled, but the indicators remain illuminated. • If equipped, rear defrost and heated mirrors are disabled, but the indicator remain illuminated.	Voltage to the BCM is greater than 12.7 volts.
Load shed 2 continuous	Load Shed 2 Transient condition in excess of 20 seconds	• If equipped, climate controlled seats are disabled and the indicators are off. • If equipped, rear defrost and heated mirrors are disabled and the indicator is off. • If equipped with DATC, the blower motor is reduced to 50% speed. • If equipped, DC/AC inverter (AC powerpoint) is disabled. • The base IPC message center displays LOW BATTERY LESS FEATURES. • The optional IPC message center displays LOW BATTERY FEATURES TEMPORARILY TURNED OFF.	Voltage to the BCM is greater than 12.4 volts for more than 60 seconds.

Battery Charging or Jump Starting

To charge or jump start the vehicle, connect the positive cable to the battery positive post. It is preferred to connect the negative cable to a vehicle ground and **not** the battery negative post. Connecting directly to the negative battery post can have an adverse effect on the Electrical Energy Management system. For a good connection point, follow the cable from the battery negative post to the vehicle body connection (typically on the shock tower sheet metal) and connect there.

If the battery is jump started or charged, the BCM**must** recalibrate the battery state of charge. Engine off load shedding may occur if the vehicle is operated before the BCM calibrates the new battery state of charge.

NOTICE: DO NOT reset the battery monitoring system using the diagnostic scan tool. This reset is reserved for new battery installation. Resetting the battery monitoring system will clear the learned battery data, the battery time in service, and will affect the aging algorithm parameters, which have been learned since the installation of the battery.

Battery Replacement

If the vehicle battery is replaced, it is very important to perform the BMS Reset using a diagnostic scan tool. If the battery monitoring system reset is not carried out, it holds the old battery parameters and time in service counter in memory. Additionally it tells the system the battery is in an aged state and may limit the Electrical Energy Management system functions. For more information,
Refer to: Battery Disconnect and Connect (414-01) .

Component Description

Generator

The generator is equipped with an electronic internal voltage regulator.

Generator Current Sensor

The generator current sensor is attached to the generator B+ cable. It is supplied a 5-volt reference voltage and a ground from the PCM. The generator current sensor is a Hall-effect sensor that supplies an analog feedback signal to the PCM. The PCM uses this information for battery charging strategy and idle stability and torque control.

Battery Monitoring Sensor

Vehicles with the Auto-start-stop system are equipped with a battery monitoring sensor. The battery monitoring sensor is integrated with the negative battery terminal clamp and cable assembly, which provides a ground to the sensor. The battery monitoring sensor measures voltage, current, and temperature of the battery and uses these inputs to calculate the battery condition. The sensor transmits this information through a LIN circuit to the BCM. The battery monitoring sensor has a 2-pin connector providing battery voltage and LIN connections.

Powertrain Control Module (PCM)

The PCM monitors and controls the charging system.

Generator Clutch

The generator clutch (if equipped) primary function is to separate the generator rotor inertia from the FEAD belt, lowering belt tension at high Revolutions Per Minute (RPM) and reducing NVH.

Copyright © 2016 Ford Motor Company

Charging System - 2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma - Overview

Overview

The generator is driven by the FEAD belt. When the engine is started, the generator begins to generate AC, which is internally converted to DC. The DC is controlled by the voltage regulator and supplied to the battery. The PCM controls the voltage regulation setpoint, communicating with the generator internal voltage regulator over a dedicated LIN communication circuit.

Copyright © 2016 Ford Motor Company

Charging System

Refer to Wiring Diagrams Section 414-02 for schematic and connector information.

General Equipment

Midtronics EXP-1050 battery tester
Midtronics GRX-3590 battery diagnostic station
Ford diagnostic equipment

Inspection and Verification

WARNING: Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
– Accessory drive belt – Generator	– Fuse(s) – Wiring harness – Electrical connector(s) – Charging system warning indicator – Generator – Battery – Battery cables – Battery monitoring sensor – Engine junction box (EJB) – Central junction box (CJB) – Powertrain control module (PCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Check the operation of the charging system warning indicator lamp, located in the instrument cluster. Normal operation is as follows:

Normal Charging System Voltages

Ignition Switch Position	I Circuit	Generator B+ Circuit	Battery	Engine to battery ground	Charging System Warning Indicator Operation
Position 0	0V	10-12V	10-12V	0V	OFF

Position II	0V	10-12V	10-12V	0V	Illuminated
Position II with the engine running	13-15V	13-15V	13-15V	0V	OFF

5. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• The charging system warning indicator is on with the engine running (The charging system voltage does not increase)	• Accessory drive belt.	• CHECK the accessory drive belt condition, REFER to: Accessory Drive (303-05A) , Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Circuit. • Generator. • Voltage regulator.	• CARRY OUT the generator tests, REFER to the Generator On-Vehicle Tests in Component Tests in this section.
• The charging system warning indicator is off with the ignition switch in the RUN position and the engine off	• Bulb/LED.	• REFER to: Instrument Panel Cluster (IPC) (413-01) .
	• Ignition switch.	• CHECK the ignition switch.
	• Circuit. • Generator.	• CARRY OUT the generator tests, REFER to the Generator On-Vehicle Tests in Component Tests in this section.
• Radio interference	• Circuit. • Generator.	• REFER to the Ford diagnostic equipment
• The generator is noisy	• Accessory drive belt.	• REFER to: Accessory Drive (303-05A) , Accessory Drive (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Diagnosis and Testing).
	• Loose generator mounting bolts.	• TIGHTEN the generator mounting bolts.
	• Generator.	• INSTALL a new generator. REFER to: (414-02) Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02) , Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02) , Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02) .
• Vehicle electrical systems inoperative	• Battery.	• CARRY OUT the battery tests, REFER to the Battery Tests in Component Tests in this section.
• The engine cranks slowly	• Battery.	• CARRY OUT the battery tests, REFER to the Battery Tests in Component Tests in this section.
	• Battery cable(s).	• REFER to: Starting System (303-06A) ,

	• Starter motor.	Starting System (303-06B) .

Component Tests

Generator On-Vehicle Tests - No-Load Test

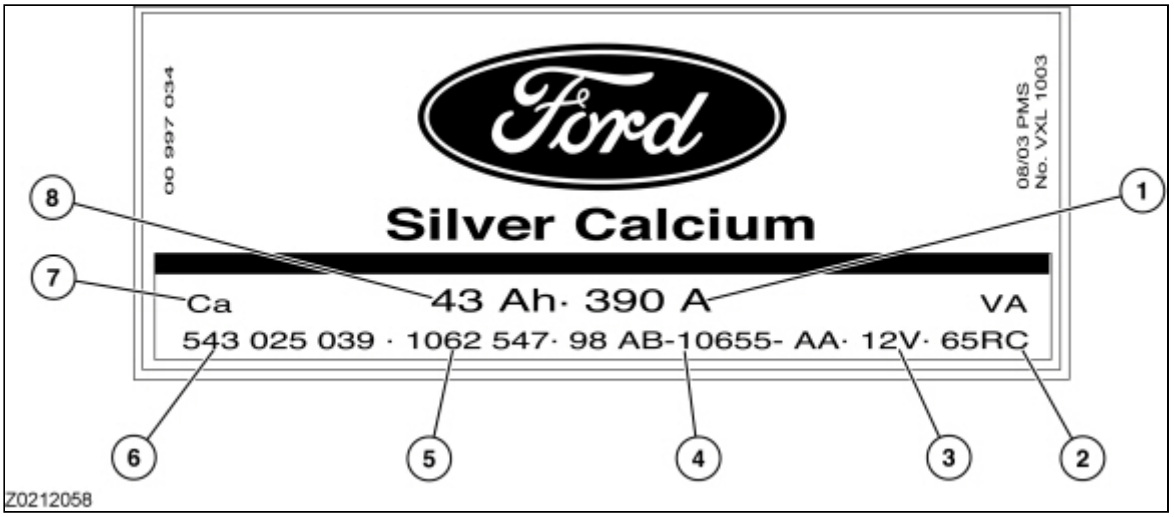
1. Turn off all electrical loads and the ignition switch.
2. Switch the multimeter to the voltage function.
3. Connect the leads of the multimeter across the battery terminals.
4. Read the voltage (base voltage).
5. Start the engine.
6. Run the engine at 1500 rpm with no electrical load.
7. Read the voltage. The voltage should be in the range of 14.1 volts to 15.1 volts. If the voltage increase is less than 2.5 volts above the base voltage, carry out the Load Test. If the voltage increase is greater than 2.5 volts, REFER to the Ford diagnostic equipment.

Generator On-Vehicle Tests - Load Test

1. With the engine running, turn on the air conditioning (if equipped), turn the blower motor to high speed and the headlamps to high beam.
2. Increase the engine speed to 2000 rpm. The voltage should increase a minimum of 0.5 volts above the base voltage. If the voltage does not increase as specified, REFER to the Ford diagnostic equipment. If the voltage increases as specified, the charging system is charging correctly.

Battery Tests

Battery Identification



Item	Part Number	Description
1	—	Cold crank amp (CCA) rating
2	—	Reserve capacity (RC) rating (minutes)
3	—	Battery voltage
4	—	Ford Part number
5	—	FINIS code
6	—	EN number (European Norm)
7	—	Battery type: Ca = Silver/Calcium; Sb = Lead/Antimony
8	—	Amp hour rating



Item	Part Number	Description
1	—	Battery performance data
2	—	Motorcraft internal labelling
3	—	DIN labelling

Battery Performance Data

NOTE: *The data only applies to a new fully-charged battery.*

- The first group of digits (12V) indicates the battery voltage (12 volts).
- The second group of digits (590A) indicates that the battery delivers a current of 590 amps at -18°C without the terminal voltage falling below 7.2 volts.
- The third group of digits (90RC) indicates the time in minutes in which the battery voltage falls to 10.5 volts in the case of a 25 amp load and an ambient temperature of 22°C.

DIN Labelling

- The first group of letters (WF) indicates that the battery is maintenance-free.
- The first digit (5) indicates that the battery is 12 volts.
- The second and third digits (58) indicates the battery capacity is 58 Ah, which means it could power a 58 amp load for 1 hour.
- The last two digits (11) is a sequential serial number.

Midtronics EXP-1050 Battery Tester

The Midtronics EXP-1050 battery tester is the only battery tester recommended by Ford to test latest technology batteries including Absorbent Glass Mat (AGM) and Enhanced Flooded Battery (EFB), previously known as Improved Flooded Battery (IFB) used on Ford Start-Stop vehicles.



Main specifications of the Midtronics EXP-1050 battery tester

- Tests 6/12V batteries
- Tests discharged batteries down to 1V both in and out of the vehicle
- Ratings in battery tester: CCA, JIS, EN, DIN, IEC, SAE
- CCA range: By Ford battery type 100-1700 A SAE / EN / CCA 100-1000 A DIN / IEC All current JIS codes
- Large LCD display with adjustable backlight
- Detects short-circuited cells
- Surface charge removal procedure
- Dynamic Response procedure for refined decisiveness on battery diagnostics
- Upgradeable by SD card
- Export data feature to send data to infra red printer
- Voltmeter function
- Date and time indication with every test
- 23 languages included within the battery tester

Using the Midtronics EXP-1050 Battery Tester

- Disconnect the battery ground cable at the battery negative (-) post. Note: if using this battery tester on models where the ground cable is not accessible, the battery does not have to be removed from the vehicle and may be tested using the vehicle's 'jump start post' if the battery tester is set to the correct mode. In this case, the battery must be disconnected at the positive (+) post before testing.
- Connect the positive red clamp of the Midtronics EXP-1050 battery tester to the battery positive (+) post.
- Connect the negative black clamp of the Midtronics EXP-1050 battery tester to the battery negative (-) post or jump start post as appropriate.

A poor connection will prevent testing and the battery tester will display the message CHECK CONNECTION. If this message appears after you have correctly reconnected the clamps, clean the terminals and reconnect.

It is recommended that batteries are always tested using both battery posts. However, if used in 'jump start post' mode, the Midtronics EXP-1050 battery tester will compensate for the extra resistance of the additional cable.

1. Select BATTERY TEST or START-STOP BATTERY TEST.
    - Press the NEXT key to continue.
2. Select the BATTERY LOCATION
    - UNDER HOOD
    - UNDER SEAT
    - OUT OF VEHICLE
    - Press the NEXT key to continue.
3. Select the negative POST TYPE (IN-VEHICLE ONLY)
    - BATTERY POST
    - JUMP START POST
    - JUMP START POST (Battery Monitoring Sensor)
    - Press the NEXT key to continue.
4. Select the BATTERY RATING from the drop down list.
    - Press the NEXT key to test the battery.
5. If the battery under test is not listed in the drop down list, it can still be selected with the MANUAL ENTRY mode. This is item 11 of 11 in the list.

The Midtronics EXP-1050 battery tester will display the word TESTING while it evaluates the battery.

Battery Tester Results and Required Actions

Battery Tester Reading	Action
GOOD BATTERY	Return the battery to service
GOOD - RECHARGE	Fully recharge the battery and return it to service
CHARGE & RETEST	Fully charge the battery and retest (failure to fully charge the battery before retesting may cause false readings)
REPLACE BATTERY or BAD CELL BATTERY	**WARNING: Do not recharge the battery.** Make sure that the surface charge was removed. A "REPLACE BATTERY" result could also mean a poor connection between the battery cables and the battery. Check the connections are OK and retest. If the result remains the same, INSTALL a NEW battery
In addition it is advisable to check the vehicle electrical system. Check that the generator is functioning correctly and the vehicle does not have an excessive key-off load (in general this should be under 20mA after 40 minutes of key off).	

Midtronics EXP-1050 Battery Tester Test Code

At the end of the test, use the arrow keys to scroll down the screens to see additional information. One of these is the TEST CODE.

The TEST CODE has 11 digits, for example: 0021U-B88WKX.

Midtronics GRX-3590 Battery Diagnostic Station

Using the Midtronics GRX-3590



Item	Description
1	GRX-3590 stand-alone version with integrated keypad and display
2	GRX-3590 docking station

The Midtronics GRX-3590 is both a battery charger and battery tester and automatically removes the surface charge as part of the normal operating procedure.

The Midtronics GRX-3590 can be used on a battery in-vehicle or out-of-vehicle.

- Disconnect the battery ground cable.
- Connect the positive red clamp from the Midtronics GRX-3590 to the battery positive terminal.
- Connect the negative black clamp from the Midtronics GRX-3590 to the battery negative terminal.
- Connect the AC power cable to the mains outlet and switch ON.
- Follow the instructions supplied with the Midtronics GRX-3590 to charge the battery.
- To disconnect the Midtronics GRX-3590, reverse the connection procedure.

The Midtronics GRX-3590 will automatically carry out a charge cycle before giving the resulting test code. The TEST CODE has 13 digits, for example: Y74NH-58R36-ESV. It will bring the battery into a serviceable condition and if required can proceed to fully charge the battery.

Copyright © 2016 Ford Motor Company

Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma

Inspection and Verification

1. Verify the customer concern by operating the charging system.
2. Before diagnosing or repairing the charging system inspect the following items:

- Check the battery for loose, damaged or corroded connections.
- Check the generator for loose, damaged or corroded connections.
- Check the engine and battery grounds for loose, damaged or corroded connections.
- Check the high current BJB for loose or corroded connections.
- Verify fuses or fusible links.
- Inspect the wiring, terminals and connectors.

3. Check the battery condition and state of charge.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
4. Check for abnormal ignition-off current drain(s).
   REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
5. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.
6. Using the diagnostic scan tool, retrieve all Diagnostic Trouble Codes (DTCs). Refer to the appropriate DTC Chart in this section.

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

PCM DTC Chart

DTC	Description	Action
P0562	System Voltage Low	GO to Pinpoint Test B
P0563	System Voltage High	GO to Pinpoint Test A
P1632	Smart Alternator Fault Sensor / Circuit	If system voltage is high, GO to Pinpoint Test A If system voltage is low, GO to Pinpoint Test B
U0120	Lost Communication With Generator Control Module	GO to Pinpoint Test E
All Other DTCs	—	Refer to: Electronic Engine Controls.

BCM DTC Chart

DTC	Description	Action
All DTCs	—	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Charging System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
System voltage high	Refer to the Pinpoint Test	GO to Pinpoint Test A
System voltage low or battery is discharged	Refer to the Pinpoint Test	GO to Pinpoint Test B
The generator is noisy	Refer to the Pinpoint Test	GO to Pinpoint Test C
Radio interference	Refer to the Pinpoint Test	GO to Pinpoint Test D
Charging system warning indicator is never or always	• IPC • Generator	RETRIEVE Diagnostic Trouble Codes (DTCs) from all modules. If any Diagnostic Trouble Codes (DTCs) are found, Refer to DTC Chart in this section. If no Diagnostic Trouble Codes (DTCs) are found,

on	• PCM • Wiring, terminals or connectors	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).

Pinpoint Tests

System Voltage High

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

NOTE: *DTC P0563 can set if the vehicle has been recently jump started or the battery has been recently charged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if vehicle accessories have been operating for an extended period of time without the engine running.*

Normal Operation and Fault Conditions

With the engine running, the charging system supplies voltage to the battery and the vehicle electrical system through the high current BJB and battery B+ cable. The voltage that is supplied to the vehicle electrical system is used for the operation of the various vehicle systems and modules. Many modules monitor this voltage and if it rises above or below their calibrated setpoints, a DTC sets.

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0563	System Voltage High	This DTC sets in the PCM when the PCM detects voltage from the charging system greater than 15.9 volts with vehicle speed above 8 km/h (5 mph).

Possible Sources

- Battery
- Generator
- Engine, generator or battery ground
- PCM
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Inspect engine and battery grounds for loose or corroded connections.
- Inspect the high current BJB for loose or corroded connections.
- Inspect BJB fuse F29 (15A).

PINPOINT TEST A : SYSTEM VOLTAGE HIGH

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

A1 PERFORM INSPECTION AND VERIFICATION

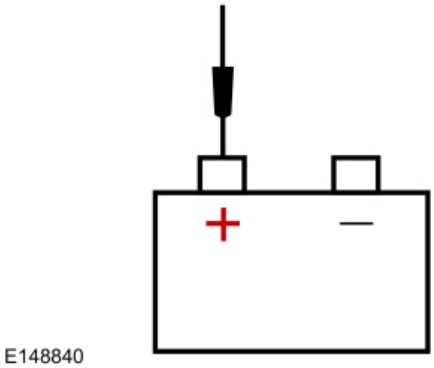
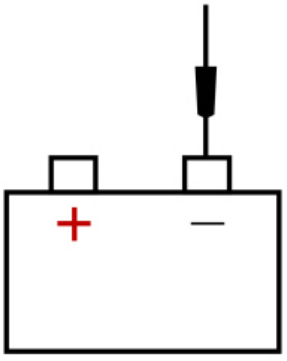
- Perform the Inspection and Verification in this section.

Was an obvious cause for an observed or reported concern found?

Yes	CORRECT the cause as necessary.
No	GO to A2

A2 COMPARE THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID (PARAMETER IDENTIFICATION) WITH BATTERY VOLTAGE

- Start the engine.
- With the engine still running at idle, measure and record:

Positive Lead	Measurement / Action	Negative Lead
		

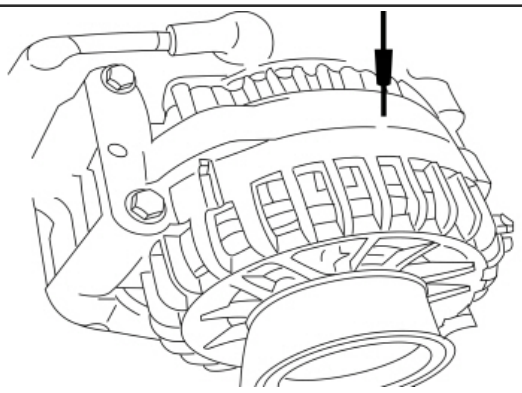
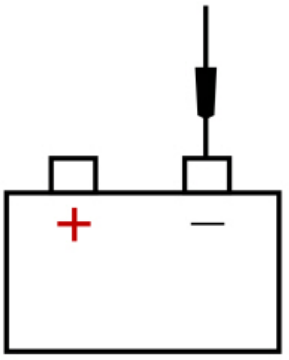
- Using a diagnostic scan tool, view the PCM PID GENVDSD.

Is the recorded battery voltage within ±0.5 volt of the PID?

Yes	GO to A5
No	GO to A3

A3 CHECK THE VOLTAGE DROP IN THE VEHICLE GROUNDS

- With the engine still running at idle, headlamps on and heater blower on high, measure the voltage drop between generator case and the battery negative terminal
- Measure and record:

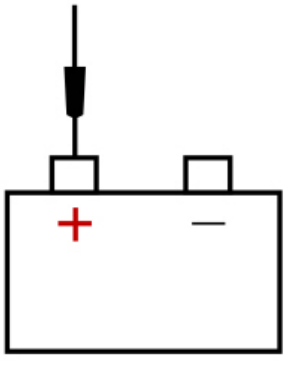
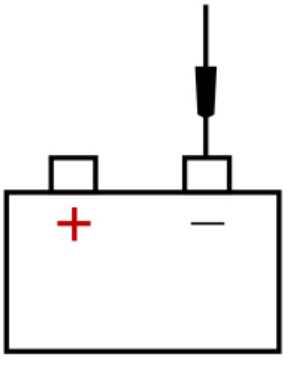
Positive Lead	Measurement / Action	Negative Lead
 Generator case		 E148841

Is the voltage drop less than 0.5 volt?

Yes	GO to A4
No	INSPECT and REPAIR the engine ground, generator ground or the battery ground for corrosion.

A4 MONITOR THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID (PARAMETER IDENTIFICATION) WHILE COMMANDED

- Using a diagnostic scan tool, view the PCM GENVDSD PID.
- Using a diagnostic scan tool active command, set the PCM PID GENVDSD to 14 volts.
- With the engine still running at idle, measure battery and record:

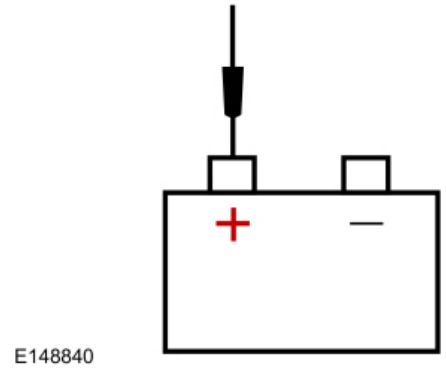
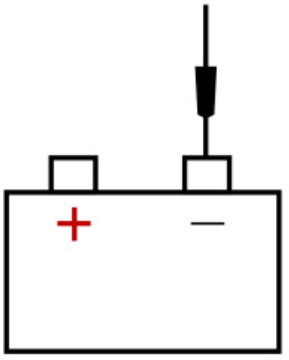
Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

Is the recorded battery voltage within ±0.5 volt of the PID?

Yes	GO to A5
No	INSTALL a new generator. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).

A5 COMPARE THE PCM (POWERTRAIN CONTROL MODULE) SUPPLY VOLTAGE (VPWR) PID (PARAMETER IDENTIFICATION) TO BATTERY VOLTAGE

- With the engine still running at idle, measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

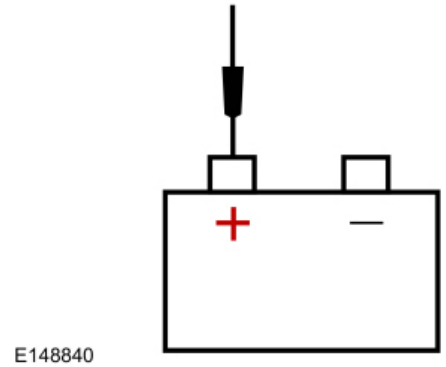
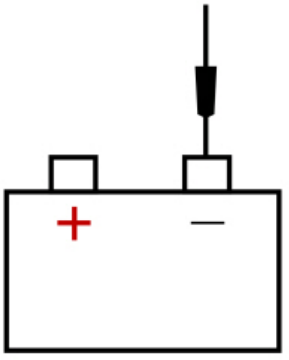
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the PCM PID VPWR.

Does the PID accurately display battery voltage within ±0.5 volt of the recorded battery voltage?

Yes	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.
No	GO to A6

A6 CHECK PCM (POWERTRAIN CONTROL MODULE) VOLTAGE SUPPLY CIRCUITS

- Ignition OFF.
- Disconnect PCM C1232A.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-5		Ground
C1232A-17		Ground
C1232A-29		Ground

Are the voltages within 0.5 volt of the recorded battery voltage?

Yes	GO to A7
No	REPAIR the affected circuit(s).

A7 CHECK PCM (POWERTRAIN CONTROL MODULE) GROUND CIRCUITS

NOTE: *The following step will load test the circuit. A headlamp bulb would be an effective load. To avoid connector terminal damage, use the Flex Probe Kit for connector connections.*

- Connect the load to a suitable 12 volt power connection.

- Ignition OFF.
- Connect the load to each circuit and measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-2		Ground
C1232A-3		Ground
C1232A-7		Ground
C1232A-42		Ground
C1232A-53		Ground

Is the voltage drop less than 0.5 volt?

Yes	GO to A8
No	REPAIR the affected circuit(s).

A8 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

System Voltage Low or Battery is Discharged

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

With the engine running, the charging system supplies voltage to the battery and the vehicle electrical system through the high current BJB and battery B+ cable. The PCM monitors this B+ voltage through its own voltage supply circuit.

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0562	System Voltage Low	If voltage drops 1.5 volts or more below the generator voltage desired (calculated by the PCM), this DTC sets after 30 seconds.

Possible Sources

- Battery
- Fuses or fusible links
- Generator
- PCM
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Verify in-line Generator fuse 3.
- Inspect the generator clutch.

PINPOINT TEST B : SYSTEM VOLTAGE LOW OR BATTERY IS DISCHARGED

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

B1 PERFORM INSPECTION AND VERIFICATION

- Perform the Inspection and Verification in this section.

Was an obvious cause for an observed or reported concern found?

Yes	CORRECT the cause as necessary.
No	GO to B2

B2 RETRIEVE DIAGNOSTIC TROUBLE CODES (DTCS)

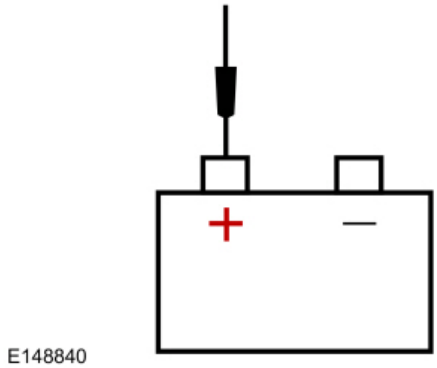
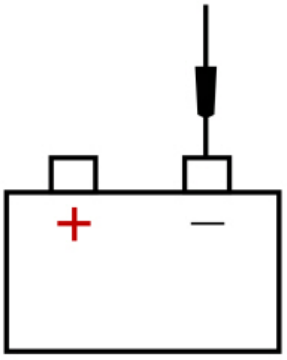
- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P1632, or U0120 present?

Yes	If P1632 is present INSTALL a new generator. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). If U0120 is present, GO to Pinpoint Test E
No	GO to B3

B3 CHECK THE GENERATOR CONNECTIONS

- Ignition OFF.
- Disconnect all of the generator connectors and inspect for:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the generator connectors. Make sure they seat and latch correctly.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
		

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102C-1		Ground

Is the voltage within 0.5 volt of the recorded battery voltage?

Yes	GO to B4
No	TIGHTEN or INSTALL a new generator B+ nut as needed. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). VERIFY high current BJB MEGA fuse (125A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

B4 CHECK THE VOLTAGE DROP IN THE GENERATOR B+ CIRCUIT

- Start the engine.
- With the engine running at idle, headlamps on and blower on high, measure:

Positive Lead	Measurement / Action	Negative Lead
C102C-1		

- Perform a wiggle test of the generator wiring and connections while measuring voltage drop.

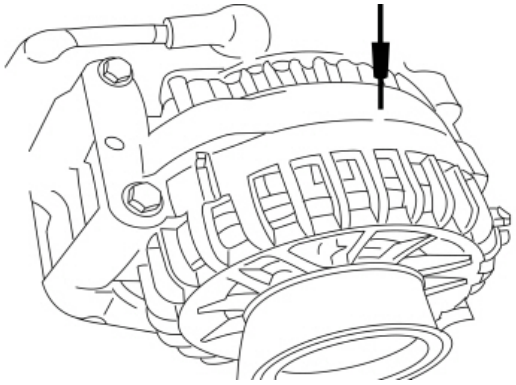
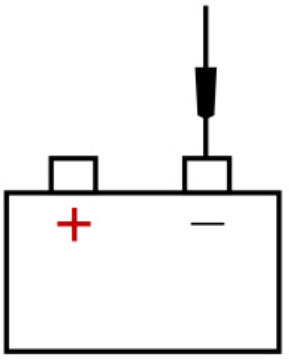
Is the voltage drop less than 0.5 volt?

Yes	GO to B5

No	INSPECT and REPAIR any corrosion in the generator B+ circuit or positive battery cable connections.

B5 CHECK THE VOLTAGE DROP IN THE VEHICLE GROUNDS

- With the engine still running at idle, headlamps on and heater blower on high, measure:

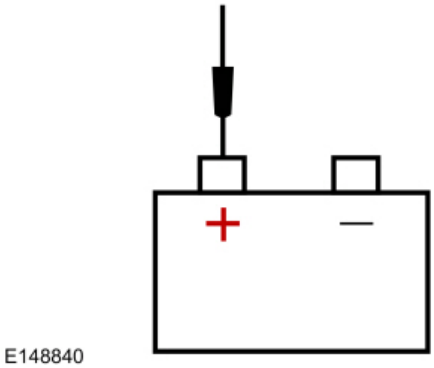
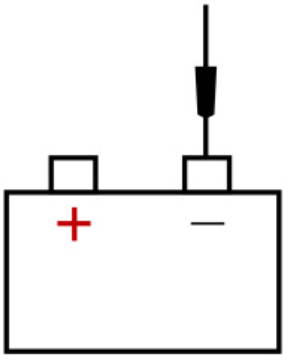
Positive Lead	Measurement / Action	Negative Lead
 Generator case		 E148841

Is the voltage drop less than 0.5 volt?

Yes	GO to B6
No	INSPECT and REPAIR the engine ground, generator ground or the battery ground for corrosion.

B6 MONITOR THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID (PARAMETER IDENTIFICATION) WHILE COMMANDED

- Using a diagnostic scan tool, view the PCM GENVDSD PID.
- Using a diagnostic scan tool active command, set the PCM PID GENVDSD to 14 volts.
- With the engine still running at idle, measure battery and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

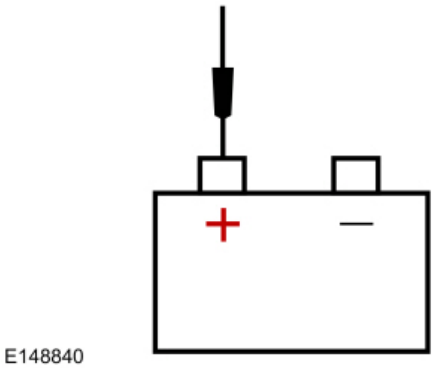
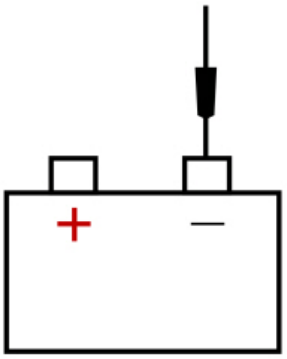
Is the recorded battery voltage within ±0.5 volt of the PID?

Yes	GO to B7
No	INSTALL a new generator. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).

B7 COMPARE THE SUPPLY VOLTAGE (VPWR) PID (PARAMETER IDENTIFICATION) TO BATTERY VOLTAGE

- With the engine still running at idle, headlamps on and blower on high, measure and record:

Positive Lead	Measurement / Action	Negative Lead

 E148840		 E148841

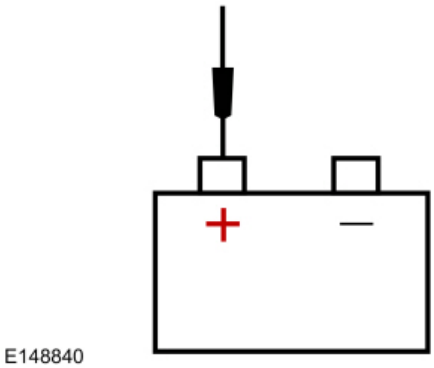
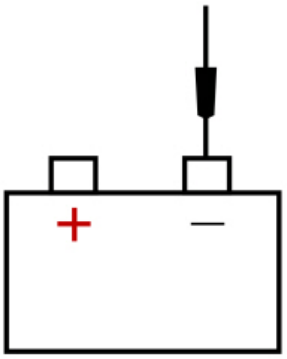
- Using a diagnostic scan tool, view the PCM PID VPWR.

Does the PID accurately display battery voltage within ±0.5 volt of the recorded battery voltage?

Yes	GO to B8
No	REPAIR high resistance or loose connections in the affected PCM power circuit(s).

B8 CHECK PCM (POWERTRAIN CONTROL MODULE) VOLTAGE SUPPLY CIRCUITS

- Ignition OFF.
- Disconnect PCM C1232A.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-5		Ground
C1232A-17		Ground
C1232A-29		Ground

Are the voltages within 0.5 volt of the recorded battery voltage?

Yes	GO to B9
No	REPAIR the affected circuit(s).

B9 CHECK PCM (POWERTRAIN CONTROL MODULE) GROUND CIRCUITS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1232A-2		Ground
C1232A-3		Ground
C1232A-7		Ground
C1232A-42		Ground

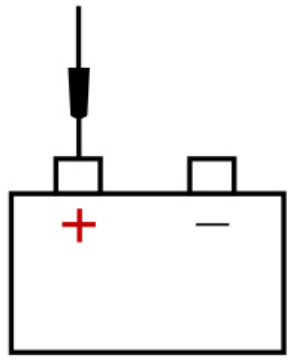
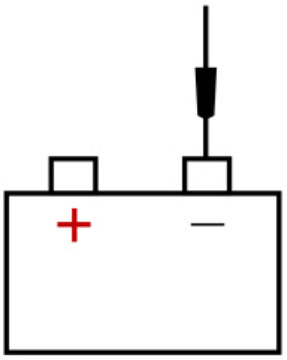
C1232A-53		Ground

Is the voltage drop less than 0.5 volt?

Yes	GO to B10
No	REPAIR the affected circuit(s).

B10 MONITOR THE SUPPLY VOLTAGE (VPWR) PID (PARAMETER IDENTIFICATION)

- **NOTE:** *Measure battery voltage at the battery.*
  With the engine still running at idle, turn off all accessory loads.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Using a diagnostic scan tool, view PCM PID VPWR and record.
- Momentarily accelerate the engine to Wide Open Throttle (WOT) and release. Repeat this step 4-5 times while continuing to monitor the PID .

Does the PID stay within 0.5 volt of the recorded battery voltage when the engine Revolutions Per Minute (RPM) are increased?

Yes	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. INSPECT and REPAIR any connector or pin issues found. REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
No	GO to B11

B11 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Generator Noise or Mechanical Performance

Normal Operation and Fault Conditions

The generator is belt-driven by the engine FEAD system. There are several sources of generator noise which include bearing noise, electrical fault noise, generator or belt pulley misalignment. A generator with certain types of diode or stator failures can also produce an audible noise.

Possible Sources

- FEAD belt
- Loose bolts/brackets
- Generator/pulleys

Visual Inspection and Diagnostic Pre-checks

- Inspect the FEAD belt.
- Inspect for loose bolts/brackets.
- Inspect the generator/pulley.

PINPOINT TEST C : GENERATOR NOISE OR MECHANICAL PERFORMANCE

C1 CHECK FOR ACCESSORY DRIVE BELT NOISE AND LOOSE MOUNTING BRACKETS

- Ignition OFF.
- Check the FEAD belt and tensioner for damage and correct installation.
  REFER to: Accessory Drive - Component Location (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Description and Operation).

Is the accessory drive OK?

Yes	GO to C2
No	REPAIR as necessary.

C2 CHECK THE GENERATOR MOUNTING

- Check the generator mounting for loose bolts or misalignment.

Is the generator mounted correctly?

Yes	GO to C3
No	REPAIR as necessary.

C3 CHECK THE GENERATOR FOR NOISE

- Start the engine.
- With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise.

Is the generator the noise source?

Yes	INSTALL a new generator. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
No	Diagnose the source of the engine noise. REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing).

Radio Interference

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

NOTE: *If the Original Equipment Manufacturer (OEM) ACM has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to Original Equipment Manufacturer (OEM) condition before following this pinpoint test.*

NOTE: *Inspect for any aftermarket accessories. Check the wiring for these accessories and be sure they have not been attached to the generator circuits and are positioned away from the generator wiring.*

Possible Sources

- Generator
- In-vehicle entertainment system
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Inspect the generator.
- Inspect the in-vehicle entertainment system.

PINPOINT TEST D : RADIO INTERFERENCE

D1 VERIFY THE GENERATOR IS THE SOURCE OF THE AUDIO SYSTEM INTERFERENCE

- Start the engine.
- Allow the engine to idle.
- Tune the audio system to a station where interference is present.
- Ignition OFF.
- Disconnect Generator C102B.
- Start the engine.
- Allow the engine to idle.

Is the interference present with the generator disconnected?

Yes	DIAGNOSE the audio system. Refer to the appropriate section in Group 415 for the procedure.
No	INSTALL a new generator.

	REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).

DTC U0120

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

The charging system supplies voltage to the battery and the vehicle electrical system through the battery B+ cable. The PCM monitors the generator output through a dedicated LIN communication circuit. The PCM uses this LIN circuit to communicate the desired voltage setpoint to the generator internal voltage regulator. The generator also uses this to communicate the generator load and error conditions to the PCM.

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0120	Lost Communication With Generator Control Module	This DTC sets if the PCM does not detect communication through the LIN circuit. This can be a result of an open or short in the LIN circuit. This DTC also sets if the generator B+ circuit is open.

Possible Sources

- BCM
- Generator
- PCM
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Inspect engine and battery grounds for loose or corroded connections.
- Inspect high current BJB for loose or corroded connections.
- Inspect the FEAD belt.
- Inspect the battery monitoring sensor.
- Verify the BJB fuse F29 (15A).

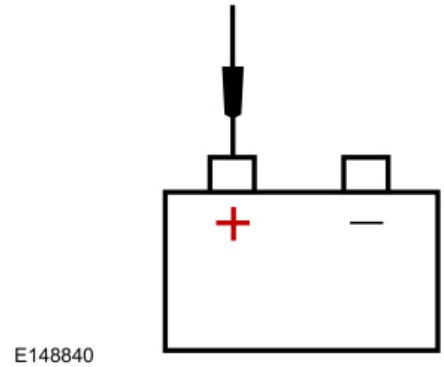
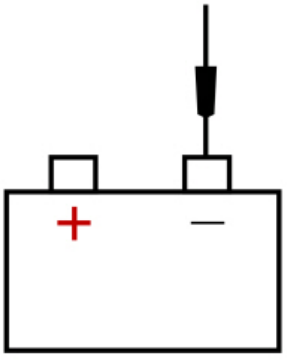
PINPOINT TEST E : DTC U0120

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

E1 COMPARE THE GENERATOR B+ CIRCUIT TO BATTERY VOLTAGE

- Ignition OFF.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
		

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102C-1		Ground

Is the voltage within 0.5 volt of the recorded battery voltage?

Yes	GO to E2
No	TIGHTEN or INSTALL a new generator B+ nut as needed. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).

	VERIFY high current BJB fuse MEGA (125A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

E2 CHECK THE GENERATOR LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Generator C102B.
- Disconnect PCM C1232C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102B-1		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E3

E3 CHECK THE GENERATOR LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102B-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK THE GENERATOR LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102B-1	Ω	C1232C-30

Is the resistance less than 3 ohms?

Yes	INSTALL a new generator. REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REPEAT the PCM self-test. If DTC U012D is retrieved again, GO to E5
No	REPAIR the affected circuit.

E5 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).
for information about these practices.

PCM DTC Chart

DTC	Description	Action
PCM DTCs	PCM Diagnostic Trouble Codes (DTCs) not listed in this chart	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) Section 3 Symptom Charts.
P065B	Generator Control Circuit Range/Performance	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
P065C	Generator Mechanical Performance	GO to Pinpoint Test C
P0A3B	Generator Over Temperature	CARRY OUT self-test of the PCM and DIAGNOSE any cooling fan Diagnostic Trouble Codes (DTCs). If no cooling fan Diagnostic Trouble Codes (DTCs) are present, INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
U012D	Lost Communication With Generator Control Module	GO to Pinpoint Test E
U0469	Invalid Data Received From Generator Control Module	GO to Pinpoint Test E

BCM DTC Chart

DTC	Description	Action
BCM DTCs	BCM Diagnostic Trouble Codes (DTCs) not listed in this chart	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). .

Symptom Chart(s)

Symptom Chart: Charging System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).
for information about these practices.

Symptom Chart

Condition	Possible Sources	Actions
System voltage high	Refer to the Diagnostic Routine	GO to Pinpoint Test A
System voltage low or battery is discharged	Refer to the Diagnostic Routine	GO to Pinpoint Test B
The generator is noisy	Refer to the Diagnostic Routine	GO to Pinpoint Test C
Radio interference	Refer to the Diagnostic Routine	GO to Pinpoint Test D
Charging system warning indicator is never or always on	• Wiring, terminals or connectors • IPC • Generator • PCM	RETRIEVE Diagnostic Trouble Codes (DTCs) from all modules. If any charging system Diagnostic Trouble Codes (DTCs) are found, Refer to DTC Chart in this section. If no charging system Diagnostic Trouble Codes (DTCs) are found, REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing). .

Pinpoint Tests

System Voltage High

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

NOTE: *Diagnostic Trouble Codes can be set if the vehicle has been recently jump started or the battery has been recently charged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if vehicle accessories have been operating for an extended period of time without the engine running.*

Normal Operation and Fault Conditions

With the engine running, the charging system supplies voltage to the battery and the vehicle electrical system through the high current BJB and battery B+ cable. The voltage that is supplied to the vehicle electrical system is used for the operation of the various vehicle systems and modules. Many modules monitor this voltage and if it rises above or below their calibrated setpoints, a DTC sets.

Possible Sources

- Wiring, terminals or connectors
- Engine, generator or battery ground
- Battery
- Generator
- PCM

Visual Inspection and Diagnostic Pre-checks

- Inspect high current BJB for loose or corroded connections.

PINPOINT TEST A : SYSTEM VOLTAGE HIGH

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

A1 CHECK BATTERY CONDITION

- Check the battery condition and state of charge.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
  .

Does the battery pass the condition test?

Yes	GO to A2
No	CHARGE or INSTALL a new battery as necessary. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation). .

A2 MONITOR THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID

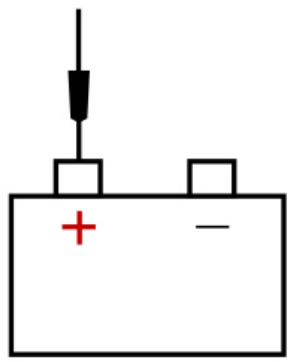
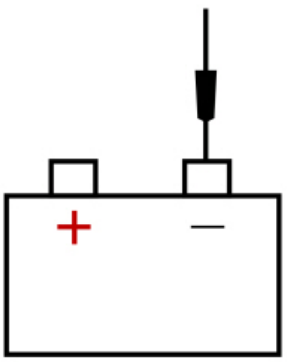
- Start the engine.
- Using a diagnostic scan tool, view the PCM Parameter Identification (PID) GENVDSD.

Does the Parameter Identification (PID) indicate 15.9 volts or less?

Yes	GO to A3
No	GO to A9

A3 COMPARE THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID WITH BATTERY VOLTAGE

- With the engine still running at idle, measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

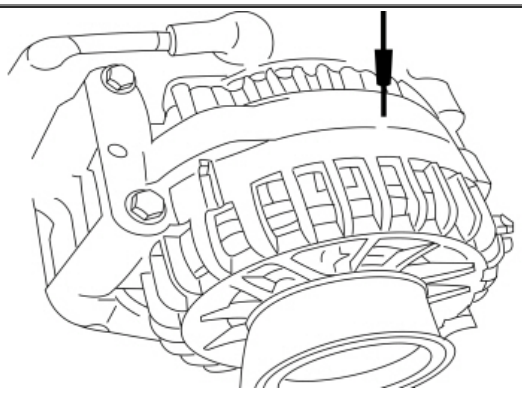
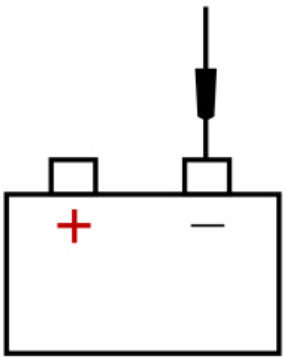
- Using a diagnostic scan tool, view the PCM Parameter Identification (PID) GENVDSD.

Is the recorded battery voltage within ±0.5 volt of the Parameter Identification (PID)?

Yes	The system is operating correctly at this time. The concern may have been caused by an intermittently loose or corroded connector. ADDRESS the root cause of any connector or pin issues.
No	GO to A4

A4 CHECK THE VEHICLE GROUND VOLTAGE DROP

- With the engine still running at idle, headlamps on and heater blower on high, measure:

Positive Lead	Measurement / Action	Negative Lead
 Generator case		 E148841

Is the voltage drop less than 0.5 volt?

Yes	GO to A5
No	INSPECT and REPAIR the engine ground, generator ground or the battery ground for corrosion.

A5 MONITOR THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID WHILE COMMANDED

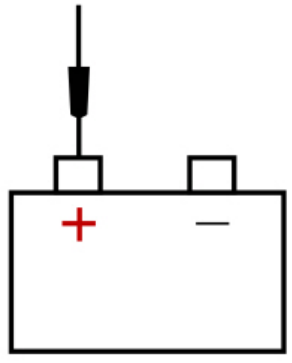
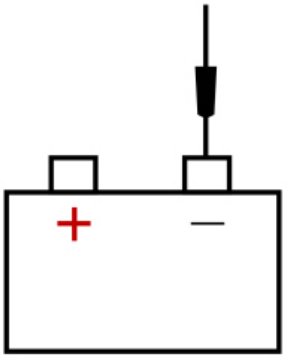
- Using a diagnostic scan tool, view the PCM Parameter Identification (PID) GENVDSD.
- Using a diagnostic scan tool, active command, set the PCM Parameter Identification (PID) GENVDSD to 14 volts.
- With the engine still running at idle, measure battery voltage and record.

Is the recorded battery voltage within ±0.5 volt of the Parameter Identification (PID)?

Yes	GO to A6
No	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .

A6 CHECK THE GENERATOR OUTPUT

- Increase engine Revolutions Per Minute (RPM) until generator starts to generate output.
- With the engine running, measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

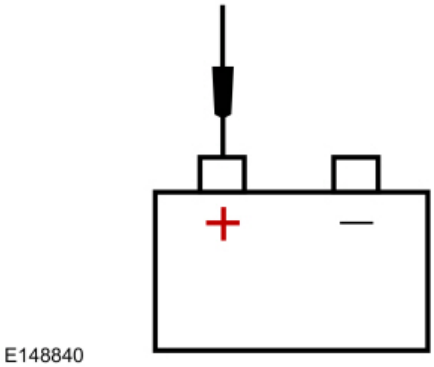
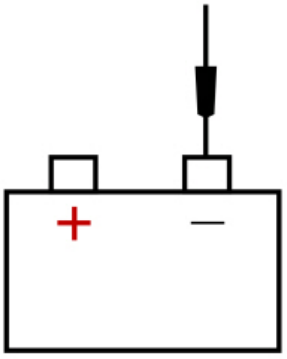
Is the voltage greater than 15.2 volts?

Yes	INSTALL a new generator.

	REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
No	GO to A7

A7 COMPARE THE SUPPLY VOLTAGE (VPWR) PID TO BATTERY VOLTAGE

- With the engine still running at idle, measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

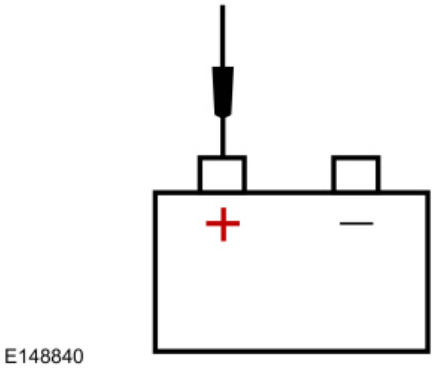
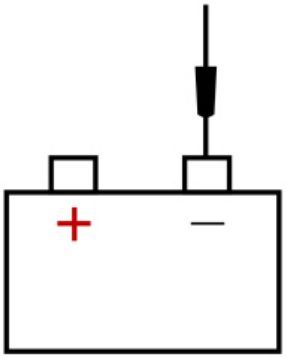
- Using a diagnostic scan tool, view the PCM Parameter Identification (PID) VPWR.

Does the Parameter Identification (PID) accurately display battery voltage within ±0.5 volt of the recorded battery voltage?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
No	GO to A8

A8 CHECK PCM SUPPLY VOLTAGE CIRCUITS

- Ignition OFF.
- Disconnect PCM C175C.
- Ignition ON.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C175C-39		Ground

Are the voltages within 0.5 volt of the recorded battery voltage?

Yes	GO to A9
No	REPAIR the affected circuit(s) for high resistance. CLEAR all Diagnostic Trouble Codes (DTCs) in all modules.

A9 CHECK FOR CORRECT PCM OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). CLEAR all Diagnostic Trouble Codes (DTCs) in all modules.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

System Voltage Low or Battery is Discharged

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

With the engine running, the charging system supplies voltage to the battery and the vehicle electrical system through the high current BJB and battery B+ cable. The PCM monitors this B+ voltage through its own voltage supply circuit.

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P065B	Generator Control Circuit Range/Performance	This DTC sets when the generator reports an internal regulator failure to the PCM.

Possible Sources

- Wiring, terminals or connectors
- Excessive ignition-OFF current drain
- Battery
- Generator
- PCM
- High current BJB

Visual Inspection and Diagnostic Pre-checks

- Inspect for abnormal ignition-off current drain(s).
- Inspect the battery.
- Inspect high current BJB for loose or corroded connections.
- Inspect the generator clutch.

PINPOINT TEST B : SYSTEM VOLTAGE LOW OR BATTERY IS DISCHARGED

NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

B1 RETRIEVE PCM DTCS

- Ignition ON.
- Using a diagnostic scan tool, perform PCM self-test.

Is DTC P065B present?

Yes	If P065B is present, INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
No	For all other PCM Diagnostic Trouble Codes (DTCs) REFER to the PCM DTC Chart in this section. If no Diagnostic Trouble Codes (DTCs) are present, GO to B2

B2 CHECK BATTERY CONDITION

- Ignition OFF.
- Check the battery condition and state of charge.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
  .

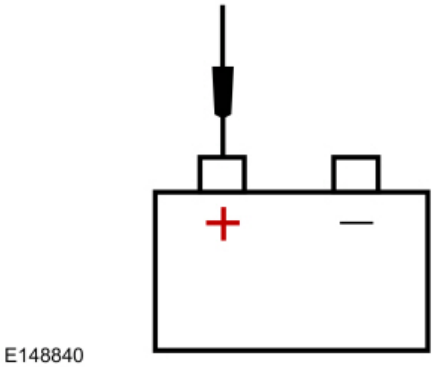
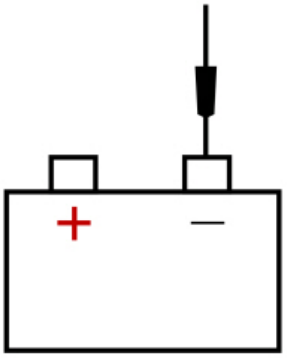
Does the battery pass the condition test?

Yes	GO to B3

No	INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation). .

B3 CHECK THE GENERATOR CONNECTIONS

- Disconnect and inspect all generator connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the generator connectors. Make sure they seat and latch correctly.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
		

- Measure at the Generator B+ Nut connection:

Positive Lead	Measurement / Action	Negative Lead
C102C-1		Ground

Is the voltage within 0.5 volt of the recorded battery voltage?

Yes	GO to B4
No	TIGHTEN or INSTALL a new Generator B+ nut as needed. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). . VERIFY high current BJB MEGA 2 fuse (150A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

B4 CHECK THE VOLTAGE DROP IN THE GENERATOR B+ CIRCUIT

- Start the engine.
- With the engine running at idle, headlamps on and blower on high, measure:

Positive Lead	Measurement / Action	Negative Lead
C102C-1		

- Carry out a wiggle test of the generator wiring and connections while measuring voltage drop.

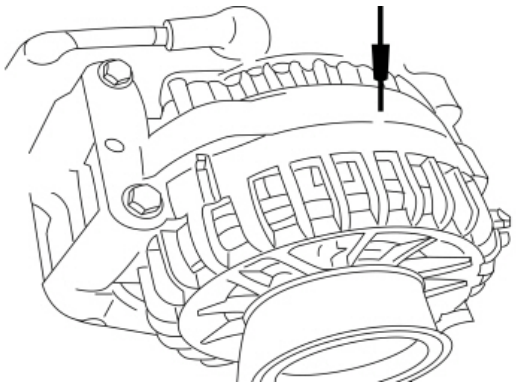
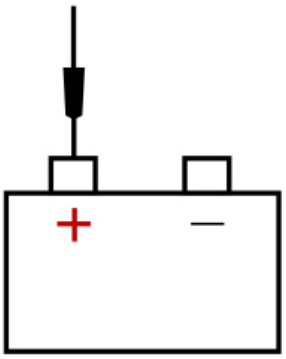
Is the voltage drop less than 0.5 volt?

Yes	GO to B5
No	INSPECT and REPAIR any corrosion in the generator B+ circuit or positive battery cable connections.

B5 CHECK THE VOLTAGE DROP IN THE VEHICLE GROUNDS

- With the engine still running at idle, headlamps on and heater blower on high, measure:

Positive Lead	Measurement / Action	Negative Lead

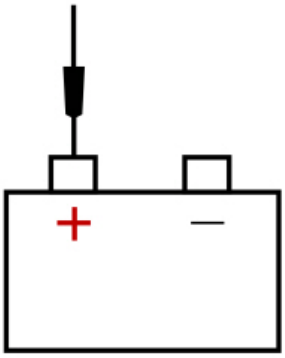
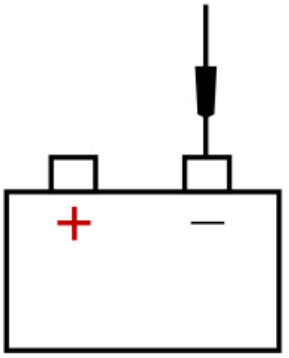
 Generator case		 E148840

Is the voltage drop less than 0.5 volt?

Yes	GO to B6
No	INSPECT and REPAIR the engine ground, generator ground or the battery ground for corrosion.

B6 MONITOR THE GENERATOR VOLTAGE DESIRED (GENVDSD) PID WHILE COMMANDED

- Using a diagnostic scan tool, view the PCM GENVDSD Parameter Identification (PID).
- Using a diagnostic scan tool active command, set the PCM Parameter Identification (PID) GENVDSD to 14 volts.
- With the engine still running at idle, measure battery and record:

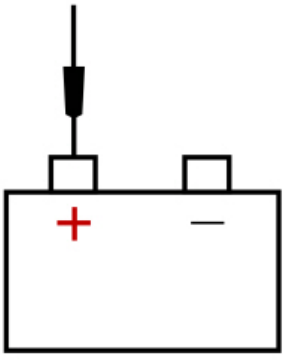
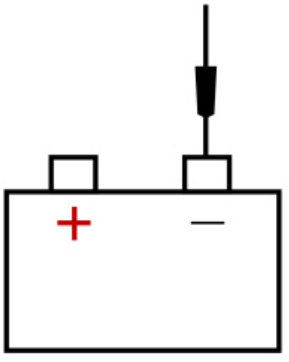
Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

Is the recorded battery voltage within ±0.5 volt of the Parameter Identification (PID)?

Yes	GO to B7
No	GO to B10

B7 COMPARE THE SUPPLY VOLTAGE (VPWR) PID TO BATTERY VOLTAGE

- With the engine still running at idle, headlamps on and blower on high, measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

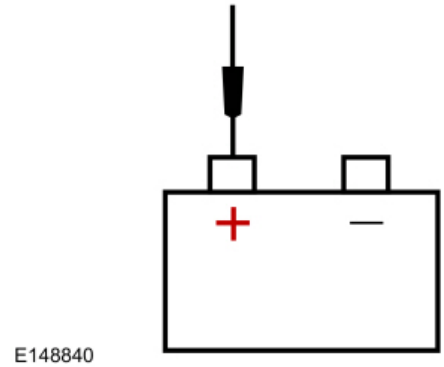
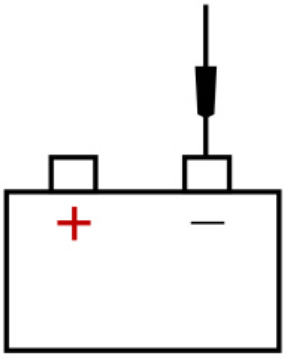
- Using a diagnostic scan tool, view the PCM Parameter Identification (PID) VPWR.

Does the Parameter Identification (PID) accurately display battery voltage within ±0.5 volt of the recorded battery voltage?

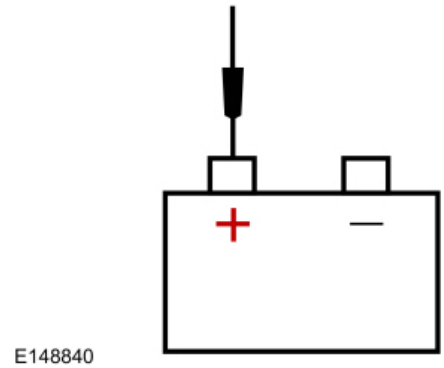
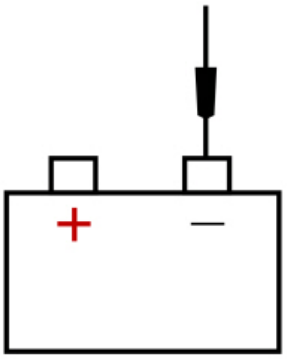
Yes	GO to B8
No	REPAIR high resistance or loose connections in the affected PCM power circuit(s).

B8 CHECK PCM GROUND FOR HIGH RESISTANCE

- **NOTE:** *Measure battery voltage at the battery.*
  With the engine still running at idle, turn off all accessory loads, measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Using a diagnostic scan tool, view PCM Parameter Identification (PID) VPWR and record.
- With the engine still running at idle, turn headlamps on and blower on high.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Using a diagnostic scan tool, view PCM Parameter Identification (PID) VPWR and record.

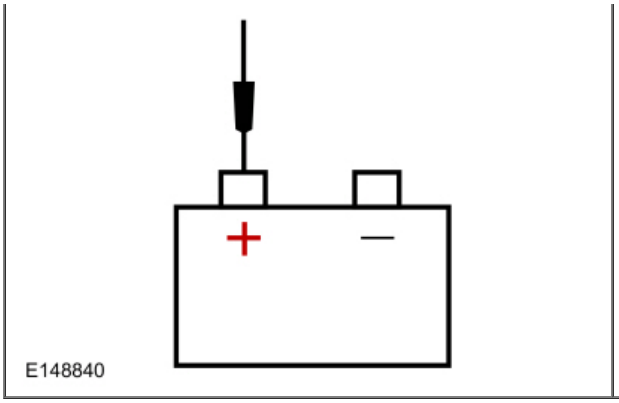
Does the Parameter Identification (PID) read within ±0.5 volt of battery voltage with accessory loads on and off?

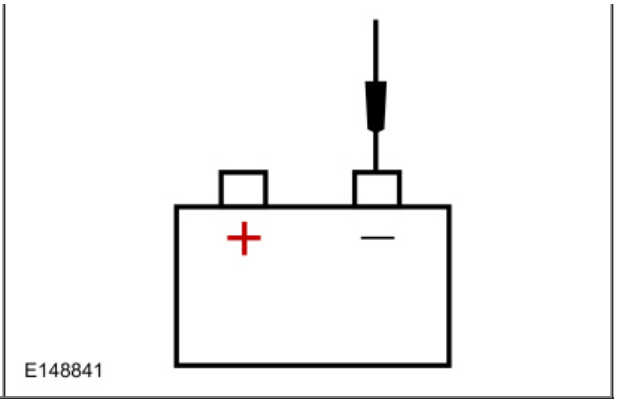
Yes	GO to B9
No	REPAIR the affected PCM ground circuit(s).

B9 MONITOR THE SUPPLY VOLTAGE (VPWR) PID

- **NOTE:** *Measure battery voltage at the battery.*
  With the engine still running at idle, turn off all accessory loads.
- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
		





- Using a diagnostic scan tool, view PCM Parameter Identification (PID) VPWR and record.
- Momentarily accelerate the engine to Wide Open Throttle (WOT) and release. Repeat this step 4-5 times while continuing to monitor the Parameter Identification (PID).

Does the Parameter Identification (PID) stay within 0.5 volt of the recorded battery voltage when the engine Revolutions Per Minute (RPM) are increased?

Yes	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. INSPECT and REPAIR any connector or pin issues found. REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures). .
No	GO to B11

B10 CHECK GENERATOR CLUTCH OPERATION

- Ignition OFF.
- Carry out the generator clutch component test in this section.

Is the generator clutch OK?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
No	INSTALL a new generator clutch. Refer to : Generator Pully in section 414-02.

B11 CHECK FOR CORRECT PCM OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). . CLEAR all Diagnostic Trouble Codes (DTCs) in all modules.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Generator is Noisy

Normal Operation and Fault Conditions

The generator is belt-driven by the engine accessory drive system. There are several sources of generator noise which include bearing noise, electrical fault noise, generator or belt pulley misalignment. A generator with certain types of diode or stator failures can also produce an audible noise.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P065C	Generator Mechanical Performance	This DTC sets when the generator reports an internal mechanical failure.

Possible Sources

- FEAD belt
- Loose bolts/brackets
- Generator/pulleys

Visual Inspection and Diagnostic Pre-checks

- Inspect the FEAD belt.
- Inspect for loose bolts/brackets.
- Inspect the generator/pulley.

PINPOINT TEST C : THE GENERATOR IS NOISY

C1 CHECK FOR ACCESSORY DRIVE BELT NOISE AND LOOSE MOUNTING BRACKETS

- Ignition OFF.
- Check the FEAD belt and tensioner for damage and correct installation.
  REFER to: Accessory Drive - Component Location (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Description and Operation).
  .

Is the accessory drive OK?

Yes	GO to C2
No	REPAIR as necessary.

C2 CHECK THE GENERATOR MOUNTING

- Check the generator mounting for loose bolts or misalignment.

Is the generator mounted correctly?

Yes	GO to C3
No	REPAIR as necessary.

C3 CHECK THE GENERATOR FOR NOISE

- Start the engine.
- With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise.

Is the generator the noise source?

Yes	GO to C4
No	REFER to: Engine (303-00 Engine System - General Information, Diagnosis and Testing). to diagnose the source of the engine noise.

C4 CHECK GENERATOR CLUTCH OPERATION

- Ignition OFF.
- Carry out the generator clutch component test in this section.

Is the generator clutch OK?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .
No	INSTALL a new generator clutch. Refer to : Generator Pully in section 414-02.

Radio Interference

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

NOTE: *If the Original Equipment Manufacturer (OEM) Audio Control Module (ACM) has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to Original Equipment Manufacturer (OEM) condition before following this pinpoint test.*

NOTE: *If the engine is operated at greater than 2,000 Revolutions Per Minute (RPM) momentarily, the generator self-excites. Make sure when the generator is disconnected the engine rpm stays below 2,000 Revolutions Per Minute (RPM). If it rises above 2,000 Revolutions Per Minute (RPM), turn the ignition to the OFF position and start the test over again.*

NOTE: *Inspect for any aftermarket accessories that have been added to the vehicle. Check the wiring for these accessories and be sure they have not been attached to the generator circuits and are positioned away from the generator wiring.*

Possible Sources

- Generator
- Wiring, terminals or connectors
- In-vehicle entertainment system

Visual Inspection and Diagnostic Pre-checks

- Inspect the generator.
- Inspect the in-vehicle entertainment system.

PINPOINT TEST D : RADIO INTERFERENCE

D1 VERIFY THE GENERATOR IS THE SOURCE OF THE AUDIO SYSTEM INTERFERENCE

- Start the engine and allow the engine to idle.
- Tune the audio system to a station where interference is present.
- Ignition OFF.
- Disconnect Generator C102C.
- Start the engine and allow the engine to idle.

Is the interference present with the generator disconnected?

Yes	REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). (Base), or REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). (w/Navigation).
No	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). .

U012D, U0469

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

The charging system supplies voltage to the battery and the vehicle electrical system through the battery B+ cable. The PCM monitors the generator output through a dedicated LIN communication circuit. The generator uses this LIN circuit to communicate the desired voltage setpoint from the PCM to the internal voltage regulator. The generator also uses this LIN circuit to communicate the generator load and error conditions to the PCM.

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U012D	Lost Communication With Generator Control Module	This DTC sets if the PCM does not detect communication through the LIN circuit. This can be a result of an open or short in the LIN circuit. This DTC also sets if the generator B+ circuit is open.
U0469	Invalid Data Received From Generator Control Module	This DTC sets when the PCM receives invalid data from the generator.

Possible Sources

- PCM
- Generator
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Inspect high current BJB fuse 2 (150A).
- Inspect high current BJB for loose or corroded connections.

PINPOINT TEST E : U012D, U0469

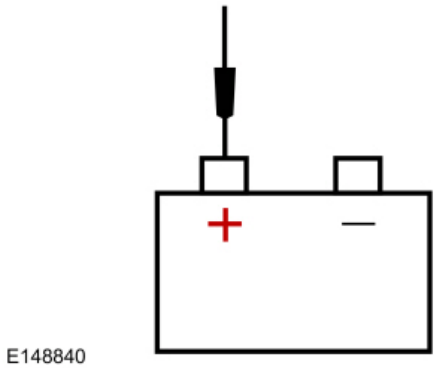
NOTE: *Make sure battery voltage is greater than 12.2 volts prior to and during this pinpoint test.*

NOTE: *Do not have a battery charger attached during vehicle testing.*

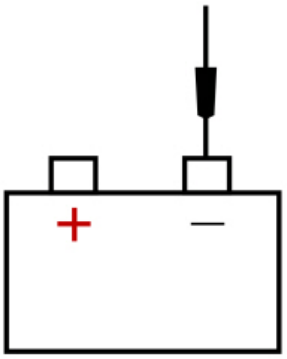
E1 COMPARE THE GENERATOR B+ CIRCUIT TO BATTERY VOLTAGE

- Measure and record:

Positive Lead	Measurement / Action	Negative Lead
		



E148840



E148841

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102C-1	V	Ground

Is the voltage within 0.5 volt of the recorded battery voltage?

Yes	GO to E2
No	TIGHTEN or INSTALL a new Generator B+ nut as needed. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). . VERIFY high current BJB MEGA 2 fuse (150A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

E2 CHECK THE GENERATOR LIN CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Generator C102B.
- Disconnect PCM C175C.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102B-1	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E3

E3 CHECK THE GENERATOR LIN CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102B-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK THE GENERATOR LIN CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C102B-1	Ω	C1232C-30

Is the resistance less than 3 ohms?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). . CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the PCM self-test. If DTC U012D is retrieved again, GO to E5
No	REPAIR the affected circuit.

E5 CHECK FOR CORRECT PCM OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). . CLEAR all Diagnostic Trouble Codes (DTCs) in all modules.
No	The system is operating correctly at this time. The concern may have been caused by loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Battery Charging

General Equipment

Midtronics GR-590 Battery Management Center
Battery Charger

WARNING: Always observe the battery charger equipment manufacturer's instructions.

WARNING: Do not jump/slave start using a battery charging system from another vehicle.

WARNING: Do not overfill a battery as this can cause acid leakage that will result in damage to the vehicle and possible personal injury.

NOTICE: Do not rely on the generator to recharge a discharged battery. It would take in excess of eight hours of continuous driving with no additional loads placed on the charging system.

NOTICE: Make sure that the battery electrolyte reaches the indicated maximum mark.

NOTICE: Connect the battery charger cables to the battery before switching the battery charger on.

NOTICE: Switch the battery charger off before disconnecting the battery charger cables from the battery.

NOTE: *Ford batteries generally require no maintenance however, in certain conditions, it is possible for the electrolyte in a battery to fall below the minimum level.*

NOTE: *The use of the Midtronics GR-590 Battery Management Center, which has been specifically designed for use on silver calcium type batteries is recommended. Once connected to the battery, the battery charger detects the state of battery charge and then applies the appropriate charge rate and duration. When the battery is fully charged, the battery charger switches to stand-by, keeping the battery in a fully charged state preventing excessive gassing and overcharging. The Midtronics GR-590 Battery Management Center also incorporates a software program that has the capability to assist in the recovery of deeply discharged (sulphated) batteries.*

NOTE: *Charging methods and types of battery chargers vary widely. Whichever method is utilized it must be carried out carefully to avoid damage to the battery and possible personal injury. Specific instructions accompanying each battery charger and must be followed exactly. Safeguards provided by the equipment manufacturer should not be disregarded by the operator.*

NOTE: *A battery which has been stored in a highly discharged state may be slow to accept a charge at first. In such cases the initial charging rate may be so low that the ammeter on some battery testers will not show any indication of charge for 5 to 10 minutes.*

NOTE: *Automatic battery chargers are also protected against reverse polarity connection and require no adjustment or monitoring.*

NOTE: *Slow-charging will readily restore a battery to a full state of charge and, since the charging current is relatively low, the possibility of overcharging a battery are minimized. The charge rate used should be approximately equal to 5% of the reserve capacity of the battery being charged (approximately three to six Amps depending on battery size). The charging current should be adjusted 10 minutes after initial setting and again after 1 hour before being left to charge the battery for between 8 and 12 hours.*

NOTE: *A constant voltage battery charger will charge a battery at a set maximum voltage. The voltage used depends upon the design and condition of the battery charger and the age and temperature of the battery. This type of battery charger initially charges at a high rate of current that reduces as battery voltage is restored. When using a constant voltage battery charger, the charging current should be recorded after five minutes and the battery charger switched off when the charging current falls to one–third of the recorded value, or after eight hours whichever occurs first.*

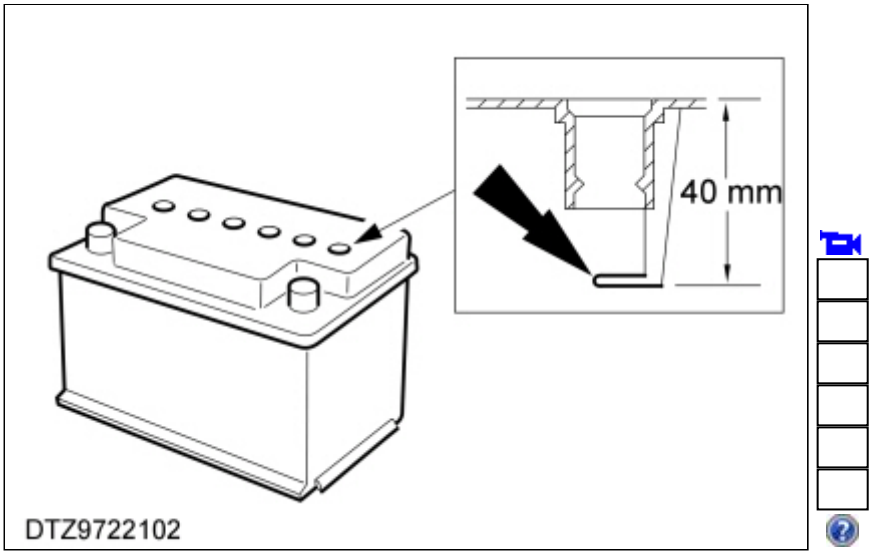
NOTE: *Multiple battery chargers are designed to charge a number of batteries, simultaneously. Of the two different types of multiple battery chargers available, only those that charge batteries in series should be used and it is important that batteries are of the same or very similar ratings and voltages. Multiple battery chargers that charge batteries in parallel are not recommended.*

NOTE: *The use of a fast (boost) battery charger is not recommended as it can cause damage to a battery. Fast charging will only restore a battery to a state of charge that will enable it to carry out it's critical function of cranking the engine. Fast charging will not restore a battery to a full state of charge and must therefore be followed by a period of slow charging. Excessively fast charging can cause damage to a battery. For this reason, charging times must be carefully controlled. Fast battery chargers vary widely in design so it is very important to strictly adhere to the equipment manufacturer's instructions. A charge of 30 amps for up to 30 minutes is the most common fast charging application. If the battery is very discharged and requires additional restoration, an additional charge of 20 amps for a period up to one and a half hours should be applied. Fast charging for a period in excess of two hours significantly increases the risk of causing damage to the battery.*

NOTE: *When connecting and disconnecting the battery from the vehicle, make sure that the battery ground cable is disconnected first and connected last and that all electrical items are switched off. Record the audio unit keycode and preset radio frequencies before disconnecting the battery.*

1. Remove the battery (Focus C-MAX 2003.75, Focus 2004.75, S-MAX/Galaxy 2006.50, Mondeo 2007.50 only).
2. Disconnect the battery ground cable (All, except the vehicles mentioned in the previous step).
3. **NOTE:** *The maximum battery electrolyte level is approximately 40 mm below the very top of the battery casing. This corresponds to a point just below the lower rim of the battery casing.*

   Check that the battery electrolyte reaches the indicated maximum level. Top up with distilled/de-ionized water, as necessary.



4. Connect the positive red clamp from the battery charger to the positive battery terminal.
5. Connect the negative black clamp from the battery charger to the negative battery terminal.
6. Connect the AC power cable to the mains outlet and switch on.
7. Follow the instructions supplied with the battery charger to charge the battery.
8. To disconnect the battery charger, reverse the connection procedure.

Copyright © 2016 Ford Motor Company

Auxiliary Battery

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Auxiliary Battery Check

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

WARNING: Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

WARNING: Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

1. Turn the ignition OFF.
   REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
   REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Symptom Chart

Auxiliary Battery

Symptom	Possible Sources	Action
• Auxiliary Electrical Systems Inoperative/Malfunction	• Auxiliary Battery • Auxiliary Battery Wiring Assembly	• Carry out the battery test. Refer to the Battery Test in Component Tests in this section. • Check the electrical connections on the auxiliary battery wiring assembly. • Check the auxiliary battery fuse panel for blown fuses.
• Auxiliary Battery will not charge	• Fuses (125A MIDI) • Auxiliary Battery Wiring Assembly • Auxiliary Battery Cable Assembly • Ground Point Defective	• Check the 125A MIDI fuse in the auxiliary battery cable. • Check the 125A MIDI fuse in the auxiliary battery wiring. • Check the electrical connections on the auxiliary battery wiring assembly. • Check the electrical connections on the auxiliary battery cable assembly.

Copyright © 2016 Ford Motor Company

Battery

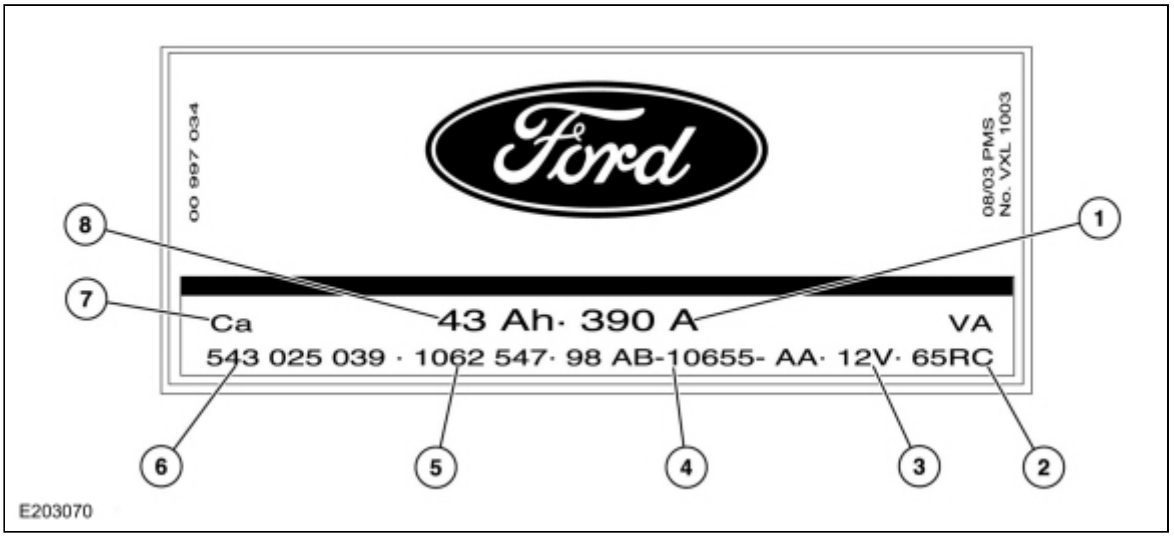
Base Part Number: 10655

Battery inspection

REFER to: Battery and Battery Charging Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Inspecting the Battery before starting the test, visually inspect the battery for:
2. Cracked, buckled or leaking case. If you see any of these defects, replace the battery. DO NOT CHARGE THE BATTERY.
3. Corroded, loose or damaged cables and connections. If you see any of these defects, repair or replace as needed.
4. Corrosion on the battery terminals, dirt or acid on the case top. If you see any of these defects, Clean the case and terminals using a wire brush and a mixture of water and baking soda.
5. Low electrolyte level. If the electrolyte level is too low, add distilled water to the level indicated by the battery manufacturer. Do not overfill.

Battery Identification



Item	Part Number	Description
1	—	Cold crank amp (CCA) rating
2	—	Reserve capacity (RC) rating (minutes)
3	—	Battery voltage
4	—	Ford Part number
5	—	FINIS code
6	—	EN number (European Norm)
7	—	Battery type: Ca = Calcium; Sb = Lead/Antimony
8	—	Amp hour rating

Battery test equipment

NOTE: *Anyone of the Ford approved battery test equipment can be used from the list below.*

- *Midtronics MDX-650 (Example) or P-300/P-600/490/1050*
- *Midtronics GRX-3590 (Example) or 3000*
- *Voltmeter/Hydrometer*

MDX-650



NOTE: *Before performing the test disconnect the battery, as the BCM draws current for upto 45 minutes even when the ignition is off and the key is removed from the ignition. Failure to follow the instruction may give an incorrect reading.*

- Disconnect the battery ground cable at the battery negative (-) post.
- Connect the positive red clamp of the Midtronics MDX-650 battery tester to the battery positive (+) post.
- Connect the negative black clamp of the Midtronics MDX-650 battery tester to the battery negative (-) post.

A poor connection will prevent testing and the battery tester will display the message CHECK CONNECTION. If this message appears after you have correctly reconnected the clamps, clean the terminals and reconnect.

1. Select BATTERY TEST or START-STOP BATTERY TEST.
    - Press the NEXT key to continue.
2. Select the BATTERY LOCATION
    - UNDER HOOD
    - UNDER SEAT
    - OUT OF VEHICLE
    - Press the NEXT key to continue.
3. Select the negative POST TYPE (IN-VEHICLE ONLY)
    - BATTERY POST
    - JUMP START POST
    - JUMP START POST (Battery Monitoring Sensor)
    - Press the NEXT key to continue.
4. Select the BATTERY RATING from the drop down list.
    - Press the NEXT key to test the battery.
5. If the battery under test is not listed in the drop down list, it can still be selected with the MANUAL ENTRY

mode. This is item 11 of 11 in the list.

The Midtronics MDX-650 battery tester will display the word TESTING while it evaluates the battery.

If battery fails test, charge battery for 2 hours and repeat test. If battery fails a retest replace the battery.

End of this Diagnosis

Battery tester results and required actions

Battery Tester Reading	Action
GOOD BATTERY	Return the battery to service
GOOD-RECHARGE	Fully charge the battery and return it to service
CHARGE & RETEST	Fully charge the battery and retest (failure to fully charge the battery before retesting may cause false readings)
REPLACE BATTERY	If the battery initially fails the test, charge the battery for 2 hours, this assures that the battery was not just highly discharged. For example (Lights left on overnight) then repeat the test; if the battery fails a secondary test then replace the battery.
BAD CELL BATTERY	**WARNING: Do not recharge the battery.** Make sure that the surface charge was removed. A "REPLACE BATTERY" result could also mean a poor connection between the battery cables and the battery. Check the connections are OK and retest. If the result remains the same, INSTALL a NEW battery

Midtronics MDX-650 Battery Tester Test Code

At the end of the test, use the arrow keys to scroll down the screens to see additional information. One of these is the TEST CODE.

The TEST CODE has 11 digits, for example: 0021U-B88WKX will be included in the print out.

Midtronics GRX-3590 (Example) or 3000

Using the GRX-3590



The Midtronics GRX-3590 is both a battery charger and battery tester and automatically removes the surface charge as part of the normal operating procedure.

The Midtronics GRX-3590 can be used on a battery in-vehicle or out-of-vehicle.

- Disconnect the battery ground cable.
- Connect the positive red clamp from the Midtronics GRX-3590 to the battery positive terminal.
- Connect the negative black clamp from the Midtronics GRX-3590 to the battery negative terminal.
- Connect the AC power cable to the mains outlet and switch ON.
- To disconnect the Midtronics GRX-3590, reverse the connection procedure.

The Midtronics GRX-3590 will automatically carry out a charge cycle before giving the resulting test code. It will bring the battery into a serviceable condition and if required can proceed to fully charge the battery.

Diagnostic charging

- Select the battery LOCATION: UNDER HOOD, UNDER SEAT or OUT OF VEHICLE. Press NEXT to continue.
- In case of UNDER HOOD or UNDER SEAT, please enter the TEST LOCATION: BATTERY POST, JUMP START POST or JUMPER POST (BMS). Press NEXT to continue.
- Select the BATTERY RATING. Press NEXT to continue.
- When the charge cycle is completed, the GRX sounds an alarm and displays the results. These results can also be printed (OPTIONAL).

Voltmeter/Hydrometer

TEST PREPARATION

- Battery surface charge has to be removed before battery testing. Turn the headlights on for 5 seconds. Remove the key from the ignition and ensure all electrical items are turned off and that all doors /deck lid / lift gate are closed and allow the key off loads to reach their steady state value.
- Inspecting the battery before starting the test, visually inspect the battery for:
- Cracked, buckled, or leaking case. If you see any of these defects, replace the battery. DO NOT CHARGE THE BATTERY.
- Corroded, loose or damaged cables and connections. If you see any of these defects, Repair or replace as needed.
- Corrosion on the battery terminals, dirt or acid on the case top. If you see any of these defects, Clean the case and terminals using a wire brush and a mixture of water and baking soda.
- Low electrolyte level. If the electrolyte level is too low, add distilled water to the level indicated by the battery manufacturer. Do not overfill.
- Corroded or loose battery terminals, tray and holddown fixture. If you see any of these defects, Tighten or replace as needed.

1. MEASURE BATTERY "IN VEHICLE" CONDITION

Use multi-meter/voltmeter to measure voltage. If the battery voltage is below 12.5 Volts carry out a hydrometer test. If no voltage is measured, do not charge battery, instead replace defective unit.

NOTICE: Remove the battery from the vehicle.

2. BATTERY TEST WITH BATTERY REMOVED FROM VEHICLE



- Remove battery from vehicle, check for damage or leakage.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
- Ensure that the battery temperature is below 40°C.
- Use hydrometer for measuring specific gravity (SG). If difference of SG is more than 0.04 in any of the cells, replace the battery. If the SG measured is within 0.04 of each other then follow the below process.
- Securely connect charger cable clamp to battery post/terminal , please note that battery cell caps have vent feature and do not have to be opened during charging process.
- Initiate battery charge process for duration indicated in table, Referencing results of SG test. (refer to the battery charge procedure within this document)
- During charging process the current will decrease as battery charge acceptance decreases. The battery should be monitored for gassing and leakage during the charging process.
- The charger connection should be disconnected at the end of charging duration.
- When the charging process is complete, allow the battery to rest for 10 minutes to stabilize it.
- Voltage and SG should be measured, voltage should be above 12.5V and the difference in SG between cells <0.04.
- If the battery fails the retest, replace the battery.
- Install the recharged battery into vehicle.
- End of the Diagnosis

Charging time based on specific gravity (manual charging)

SG. before charging	Charging Time
1.250-1.240	3 Hrs.
1.239-1.230	4 Hrs.
1.229-1.200	5 Hrs.
1.199-1.180	7 Hrs.
1.179-1.160	8 Hrs.
1.159-1.140	9 Hrs.
1.139-1.120	10 Hrs.
1.199-1.000	12 Hrs.

Battery Charging

NOTICE: Batteries contain sulphuric acid, avoid contact with skin, eyes or clothing. Wear safety goggles when working near the battery to protect against possible splashing of the acid solution.

NOTICE: Batteries normally produce explosive gases. Do not allow naked flames, sparks or lighted substances to come near the battery.

NOTICE: When charging the battery shield your face and wear safety goggles. Provide adequate ventilation.

NOTICE: Boost charging with excessive current or voltage above 16 volts will damage the battery.

Using the table below calculate the required charging current.

NOTE: *Charging current should be approximately 10% of the battery Ah rating.*

Indicative Charge Table

Specification	Charging current
36Ah,290CCA	3.6A
43Ah, 390CCA	4.3 A
60Ah, 590CCA	6.0 A
68Ah, 740CCA	6.8 A
70Ah, 680CCA	7.0 A

80Ah, 800CCA	8.0 A

NOTE: *Always read the manufacturer's instructions before attempting to charge a battery and ensure you have a good quality approved battery charger. The battery type and its internal components will determine which type of charger is required.*

- Using a suitable battery charger, charge the battery.

Copyright © 2016 Ford Motor Company

Battery

Base Part Number: 10655

Special Tool(s)

 E165532	GR1 190 V3.0 Intelligent Diagnostic Charger 162-00036

Battery Condition Test

Battery condition is determined by measuring battery terminal voltage after a specific discharge current is applied for a specified time period.

Visual Inspection and Diagnostic Pre-checks

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

- Inspect wiring, terminals and connectors.
- Inspect the battery.
- Inspect battery mounting.
- Inspect high current BJB connections.

PINPOINT TEST A : BATTERY CONDITION TEST

A1 TEST THE BATTERY CONDITION

NOTE: *Failure to fully charge the battery/batteries before retesting may cause false readings.*

- Using the Intelligent Diagnostic Charger and the battery cables removed from the battery/batteries, verify the battery/batteries condition.

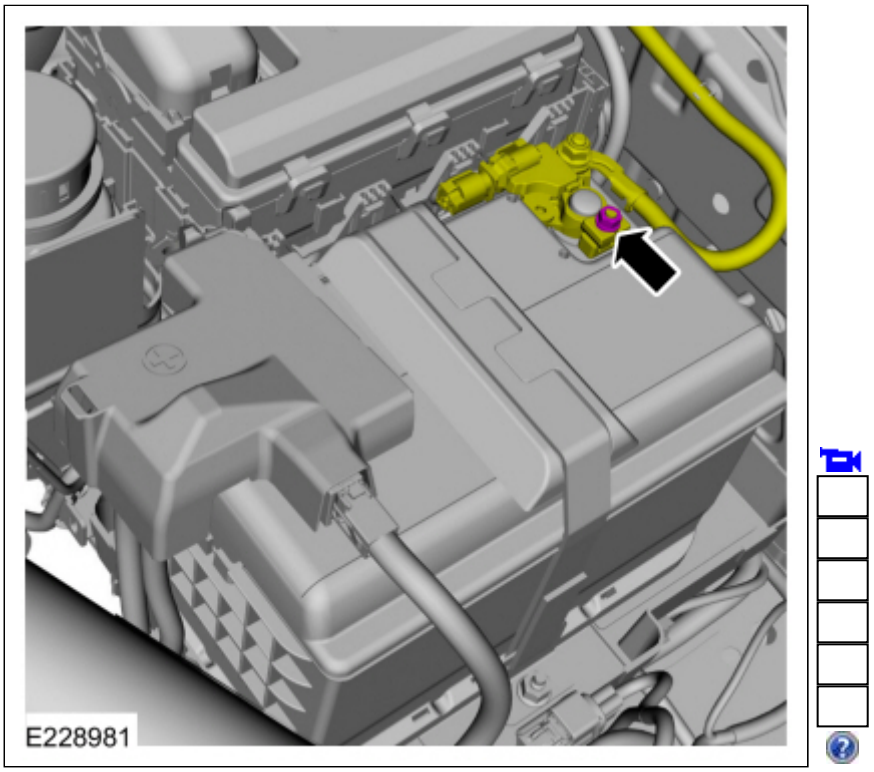
Is the battery OK?

Yes	RETURN the battery/batteries to service.
No	If the analyzer reads REPLACE BATTERY or REPLACE-BAD CELL, INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Copyright © 2016 Ford Motor Company

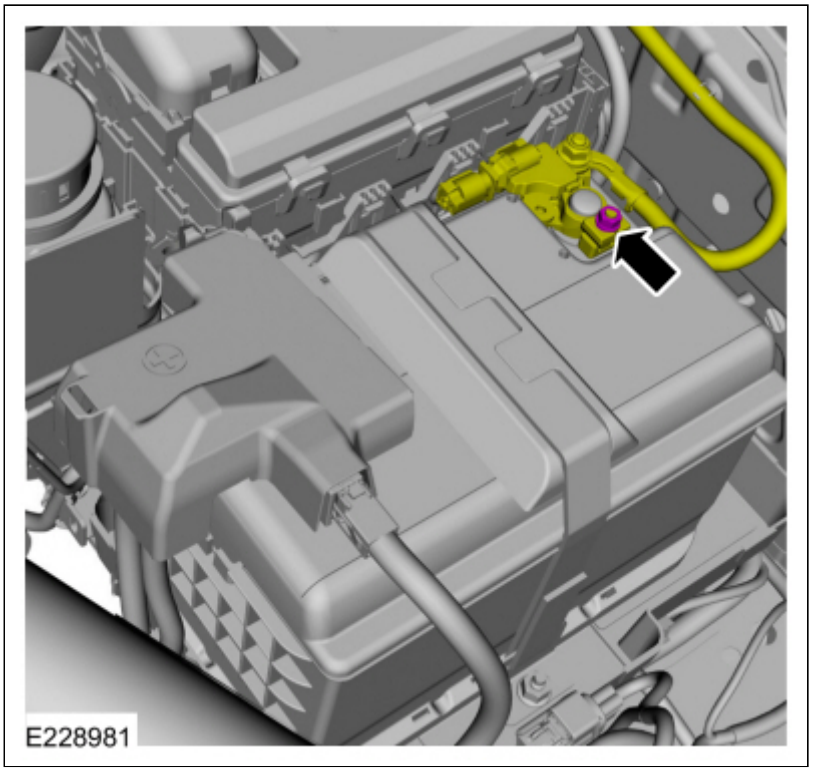
Battery Disconnect and Connect

Disconnect

1. Refer to: Battery and Battery Charging Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

Connect

1. *Torque*: 5 Nm



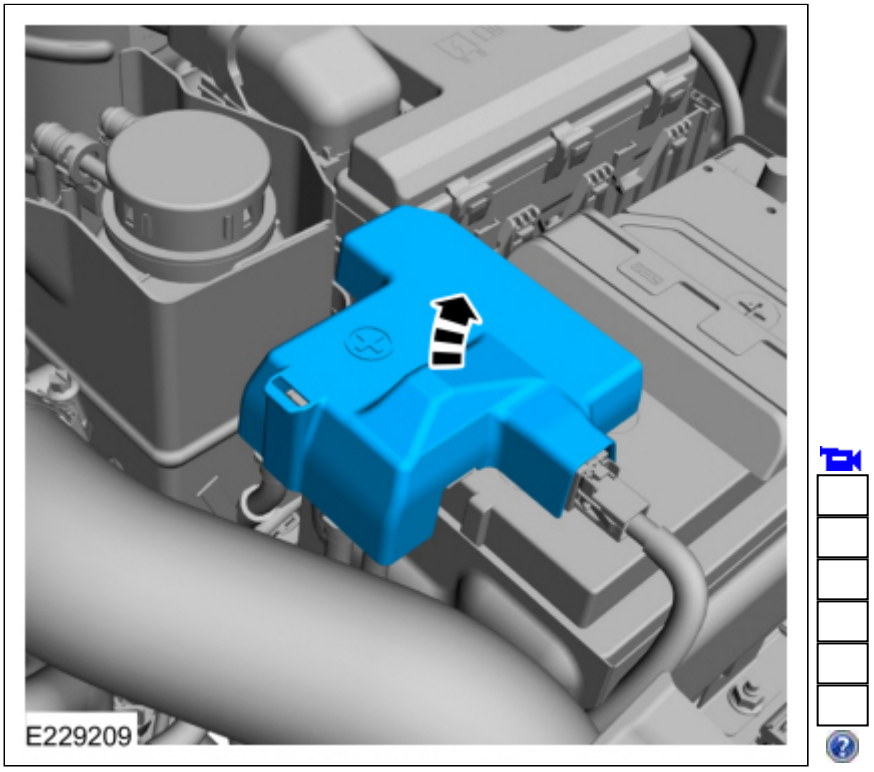
2. Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

Copyright © 2016 Ford Motor Company

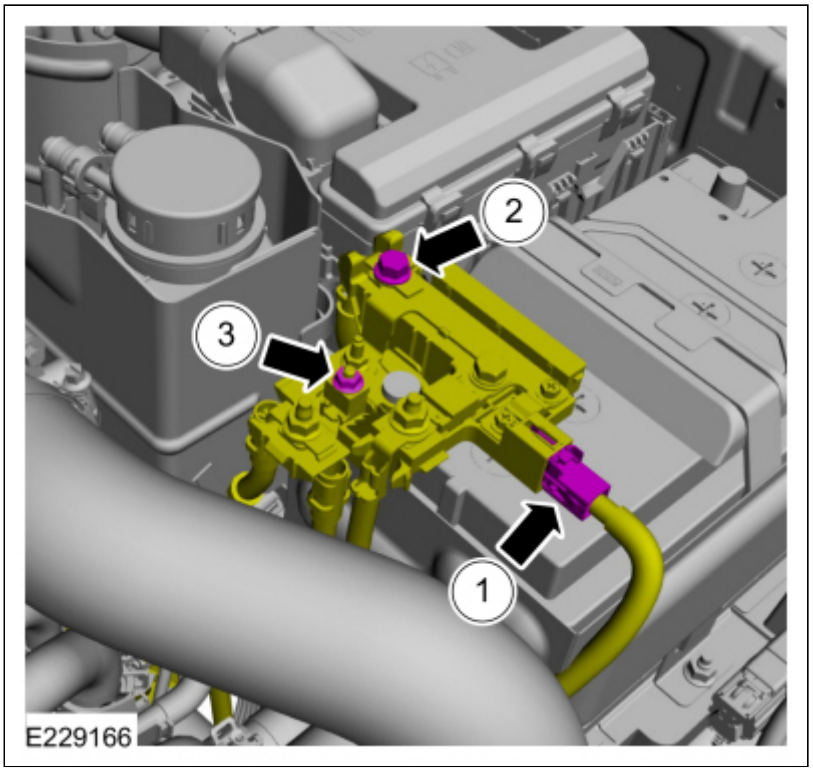
Battery

Base Part Number: 10655

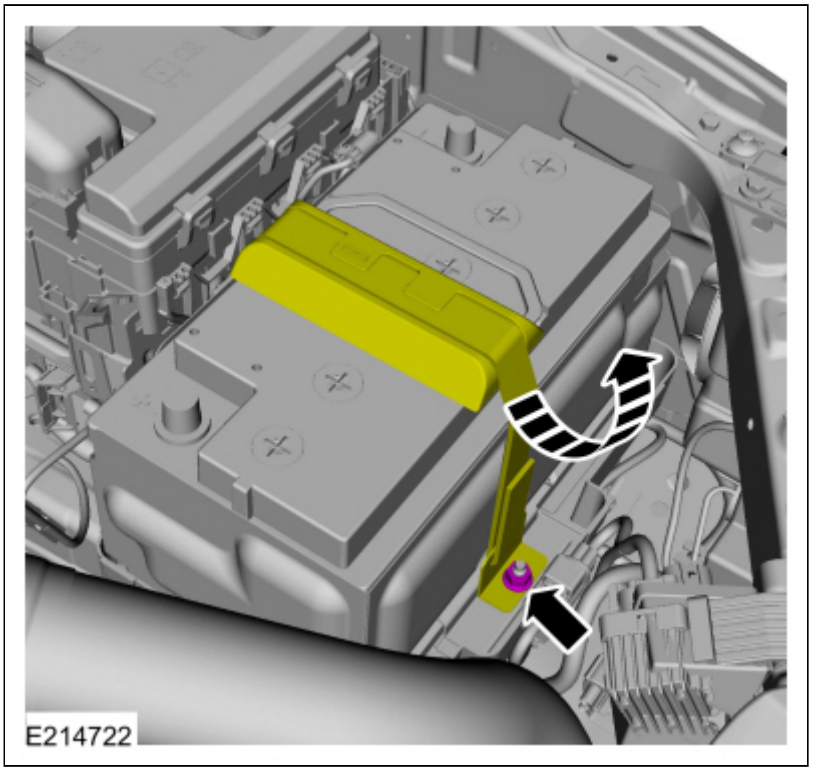
Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

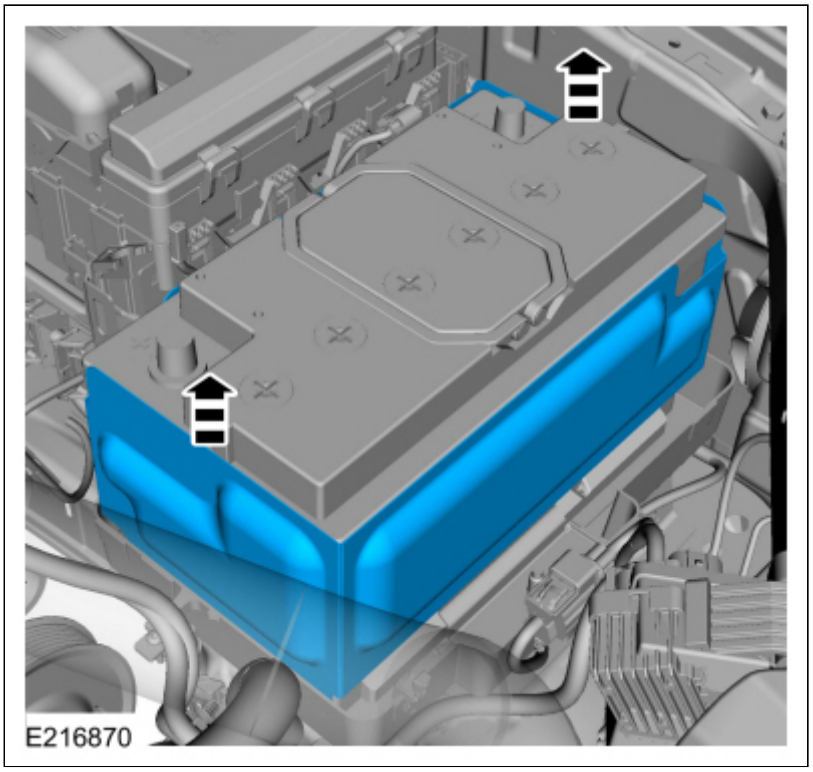
4. **NOTE:** *Note the position of the components before removal.*



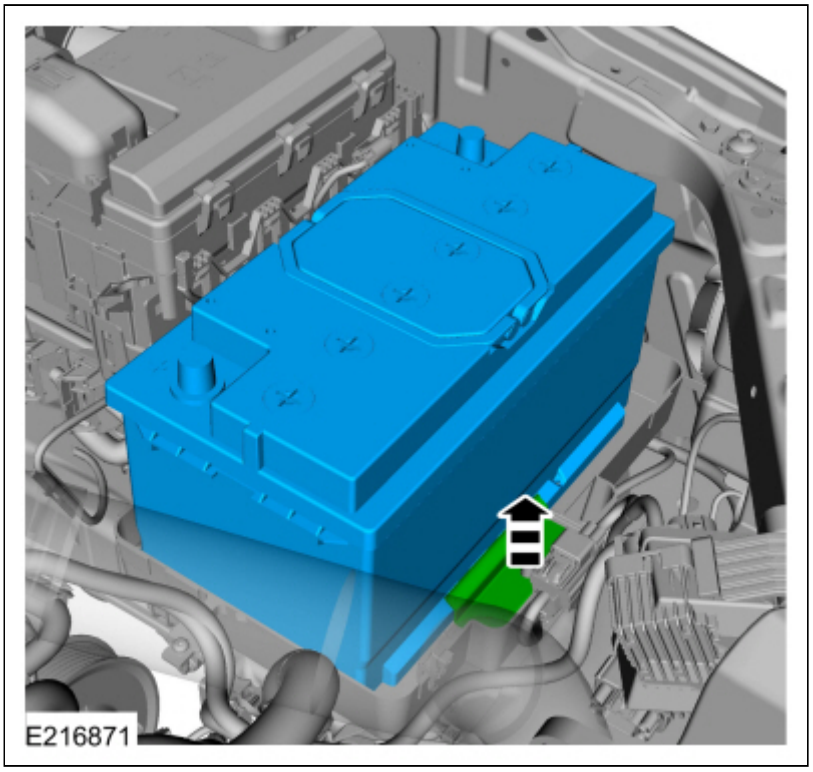
5.



6.

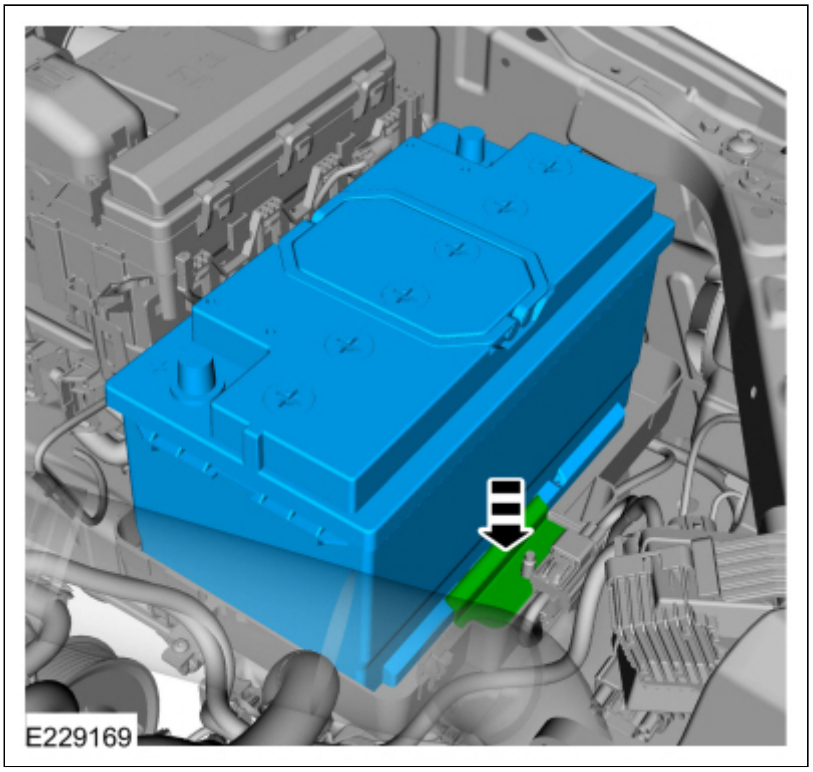


7.

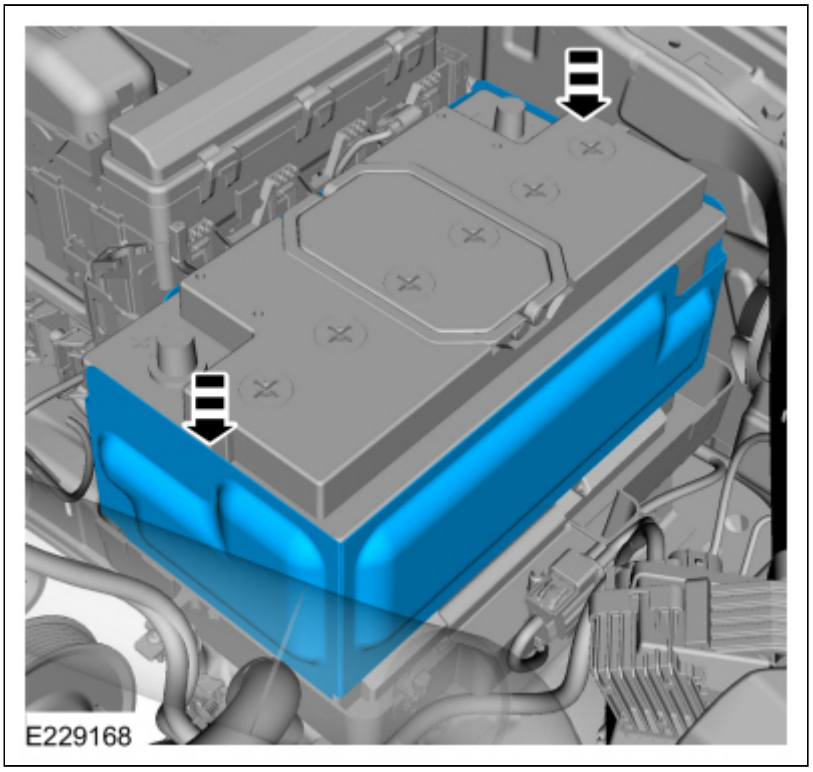


Installation

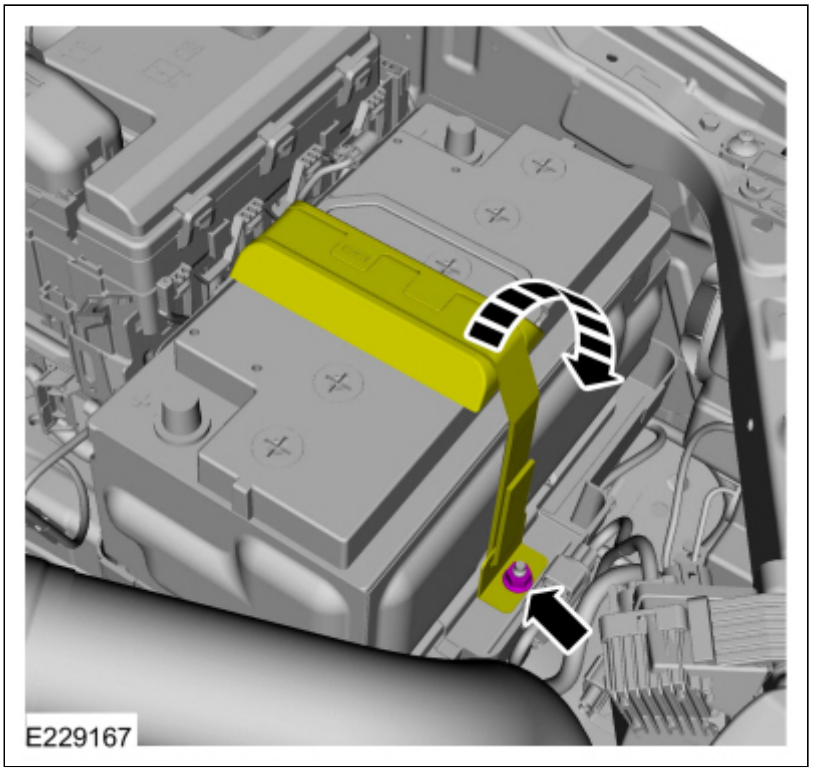
1.



2.

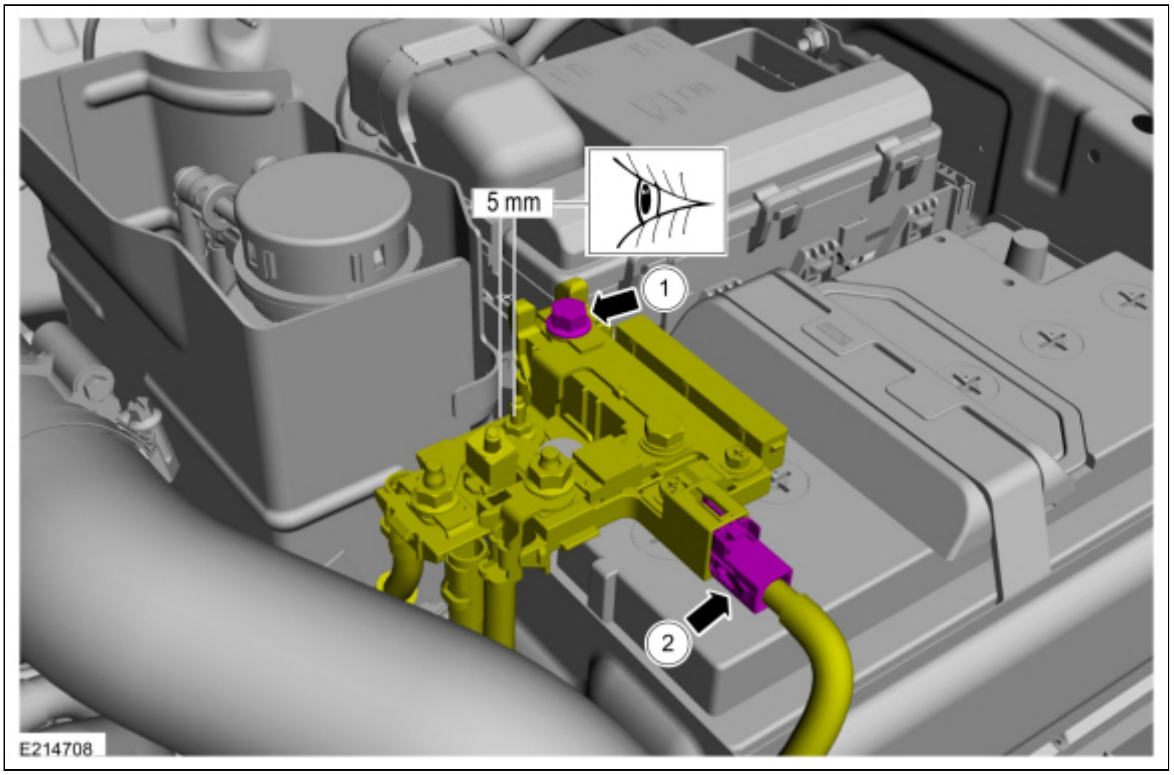


3. *Torque*: 25 Nm

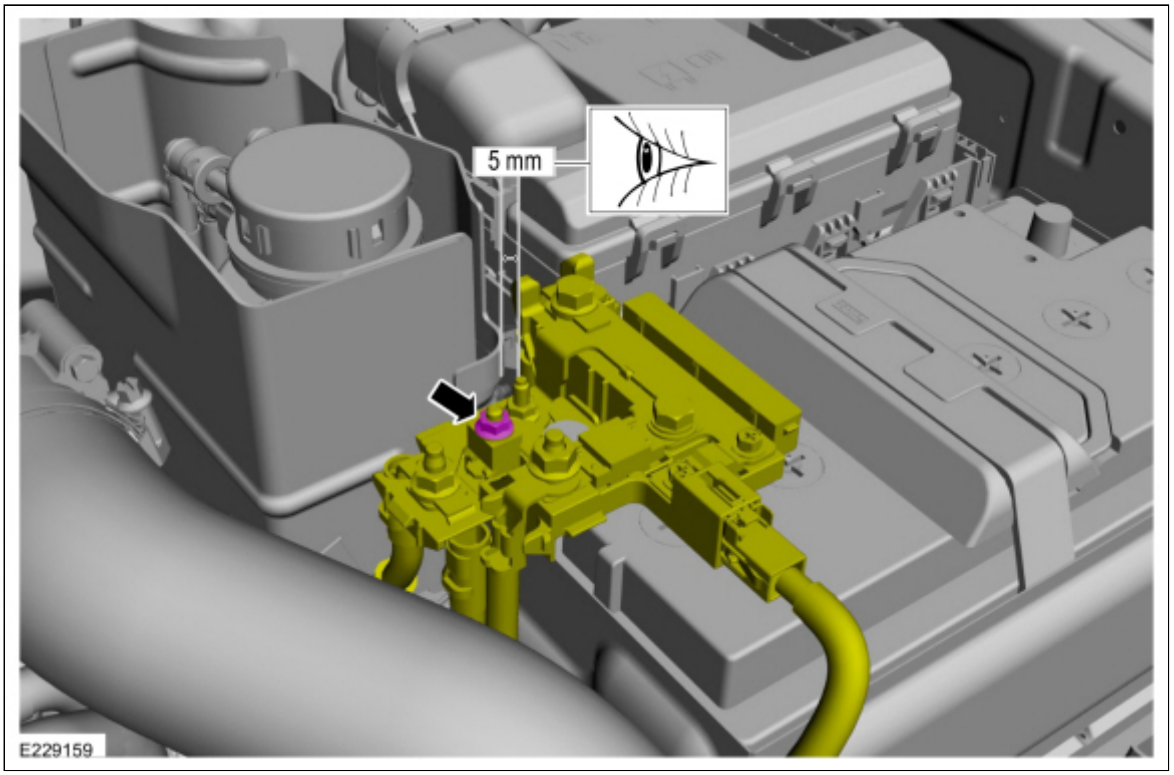


1. **NOTE:** *Make sure that the components are installed to the position noted before removal.*

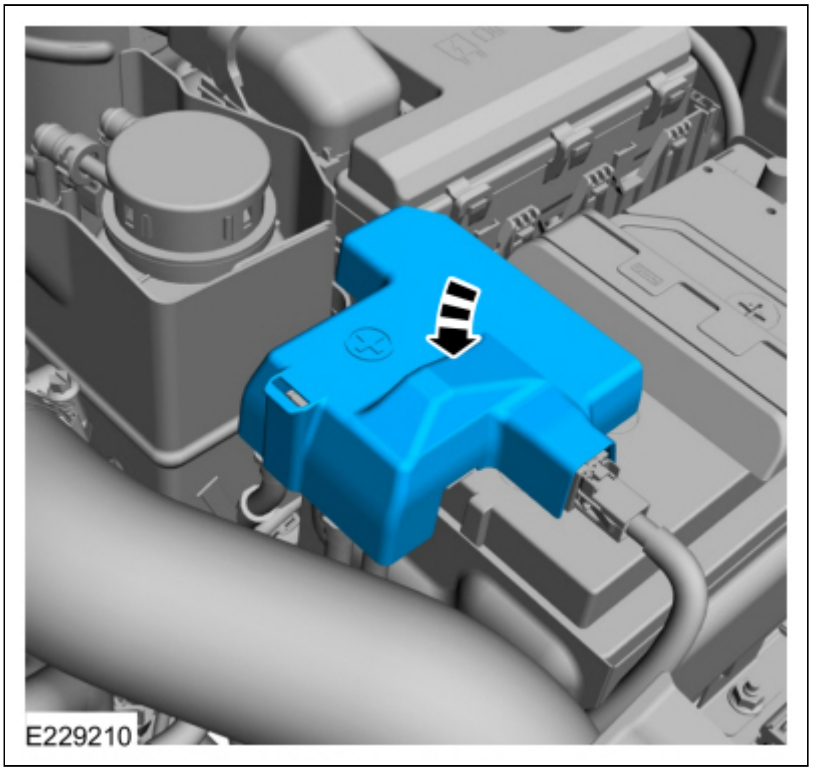
   Torque: 14 Nm



5. *Torque*: 5 Nm



6.



7. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Copyright © 2016 Ford Motor Company

Auxiliary Battery - Chassis Cab

Removal

WARNING: Batteries may produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Use caution when removing or installing the auxiliary battery, as it may weigh 50 pounds. Failure to follow these instructions may result in personal injury.

NOTICE: Failure to accurately follow the battery disconnect procedures described in this section may result in vehicle or component damage.

NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *If a battery is disconnected, there is no requirement to reprogram the vehicle; the vehicle retains its 'normal' power management setting and remembers exactly what its previous configuration was (although the central locking latches may cycle if one of these was opened manually in the intervening period).*

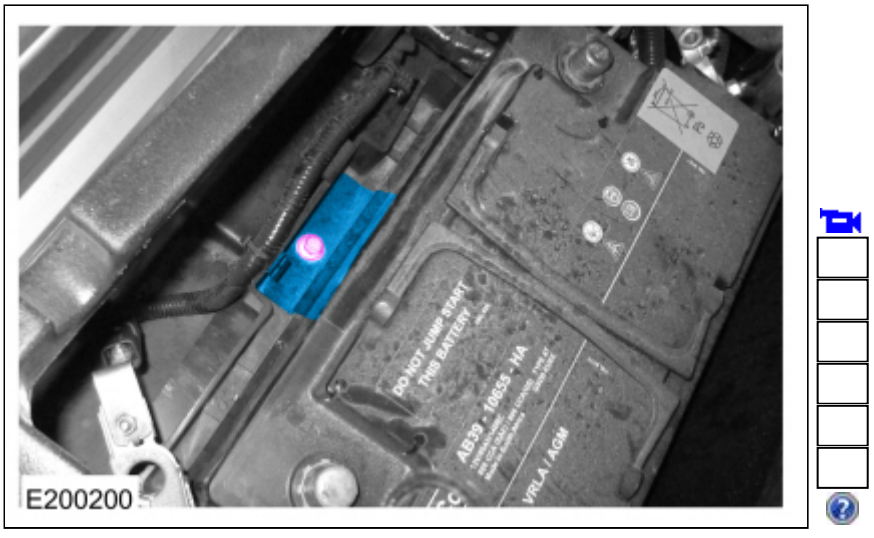
NOTE: *If a battery is disconnected, the radio, settings are retained, but the key code needs to be entered to restore functionality.*

NOTE: *If a battery is disconnected, the clock will need resetting.*

NOTE: *If a battery is disconnected, the power windows will need to be re calibrated.*

1. Refer to: Auxiliary Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .
   Torque: 5 Nm

2. *Torque*: 20 Nm



WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Auxiliary Battery - Pickup

Removal

WARNING: Batteries may produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

WARNING: Use caution when removing or installing the auxiliary battery, as it may weigh 50 pounds. Failure to follow these instructions may result in personal injury.

NOTICE: Failure to accurately follow the battery disconnect procedures described in this section may result in vehicle or component damage.

NOTE: *Removal steps in this procedure may contain installation details.*

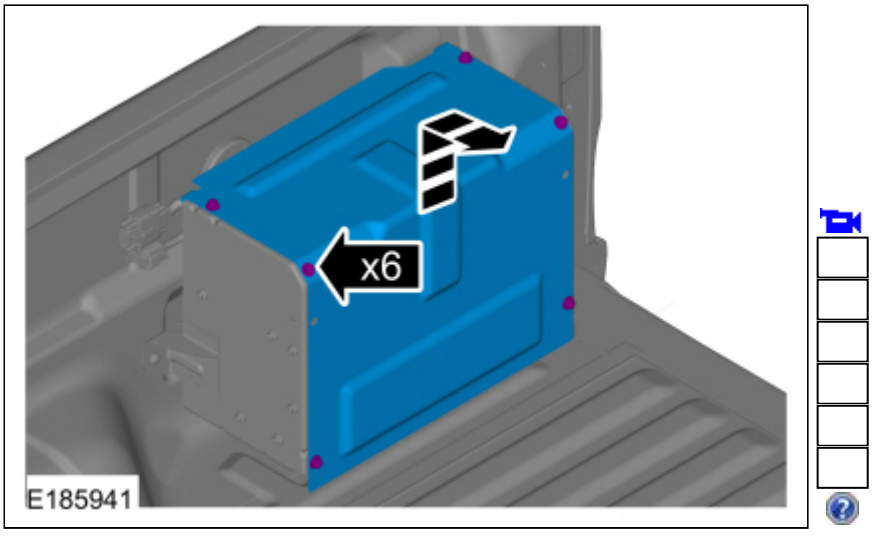
NOTE: *If a battery is disconnected, there is no requirement to reprogram the vehicle; the vehicle retains its 'normal' power management setting and remembers exactly what its previous configuration was (although the central locking latches may cycle if one of these was opened manually in the intervening period).*

NOTE: *If a battery is disconnected, the radio settings are retained but the key code needs to be entered to restore functionality.*

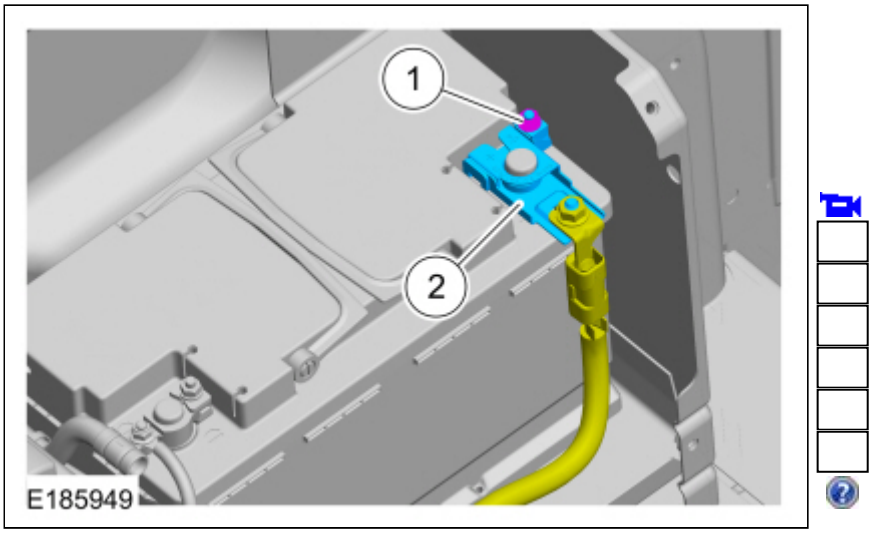
NOTE: *If a battery is disconnected, the clock will need resetting.*

NOTE: *If a battery is disconnected, the power windows will need to be re calibrated.*

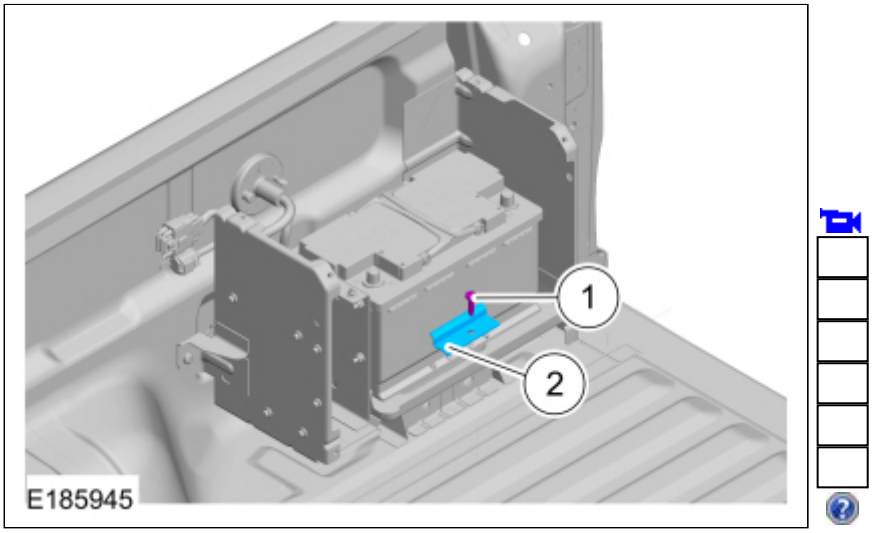
1. Refer to: Auxiliary Battery Disconnect and Connect - Pickup (414-01 Battery, Mounting and Cables) .
2. *Torque*: 5 Nm



3. *Torque*: 5 Nm

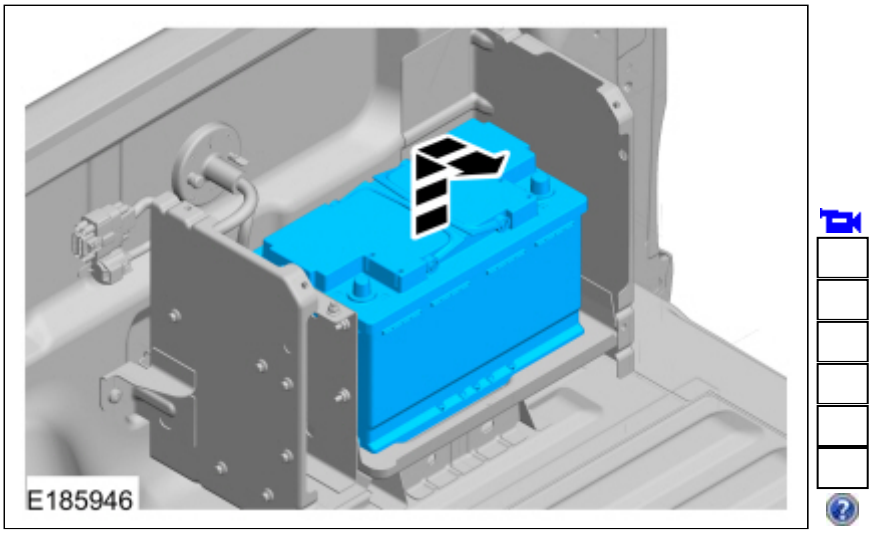


4. *Torque*: 20 Nm



WARNING: When lifting a battery, excessive pressure on the end walls could cause acid to spew through the vent caps, resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners. Failure to follow these instructions may result in personal injury.

5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

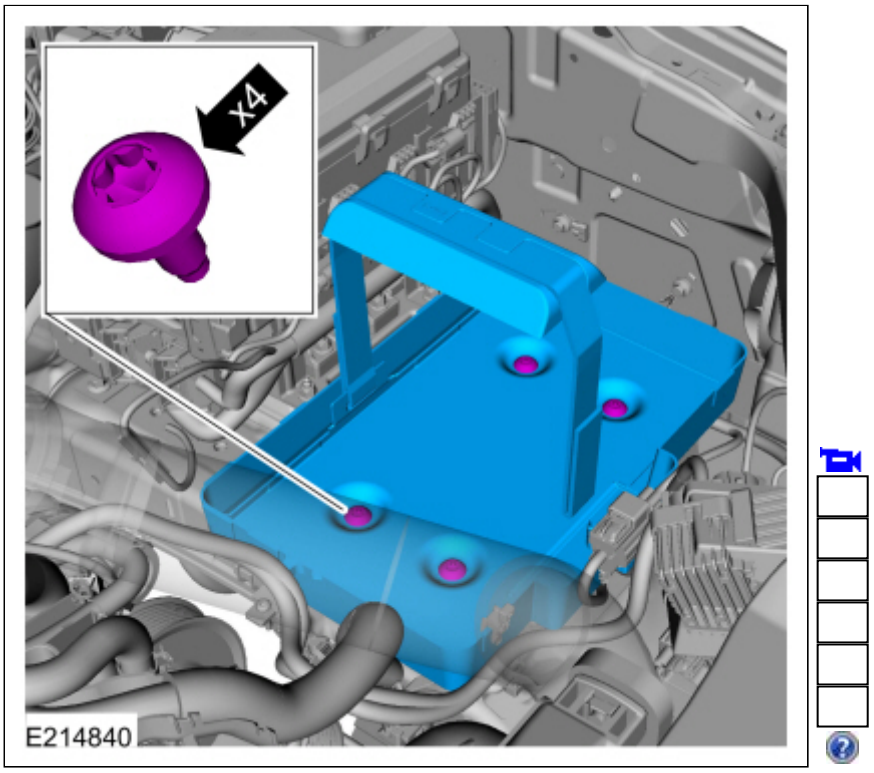
Battery Tray

Base Part Number: 10732

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
3. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Auxiliary Battery Cable - Chassis Cab

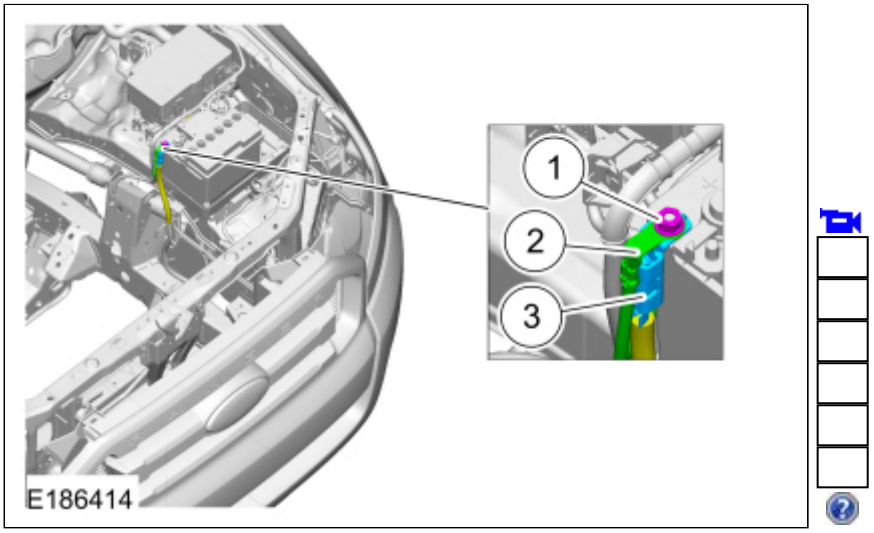
Removal

NOTICE: Failure to accurately follow the battery disconnect procedures outlined in this section will result in vehicle or component damage.

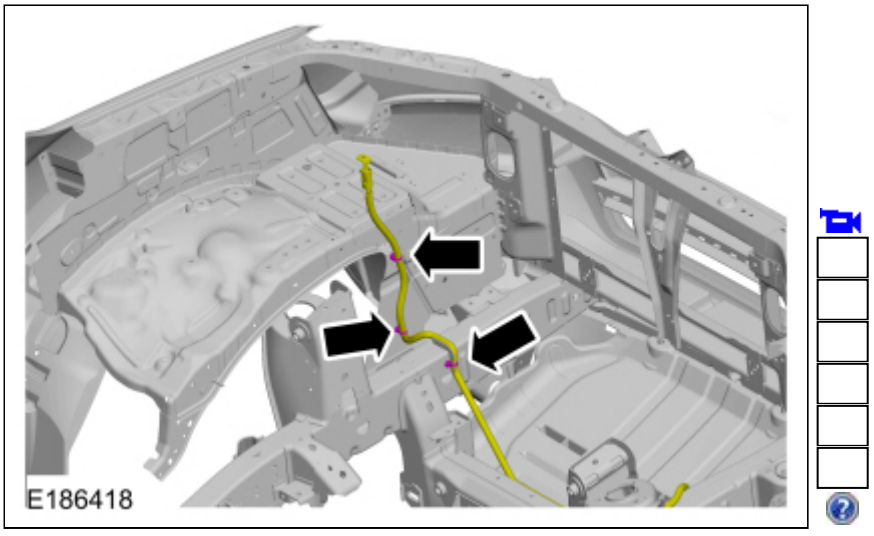
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Auxiliary Battery Disconnect and Connect - Chassis Cab (414-01 Battery, Mounting and Cables) .
2. **NOTE:** *Ensure the correct order is followed when installing the cables onto the primary battery.*

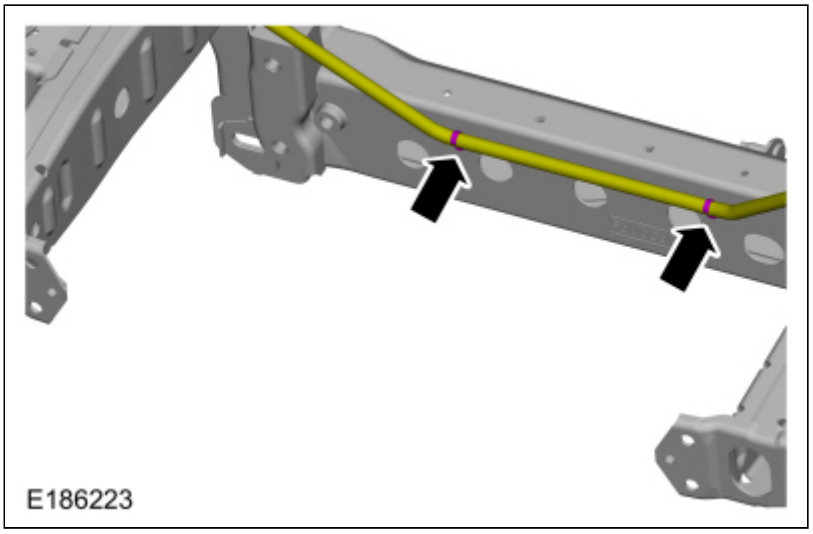
   Torque: 13.5 Nm



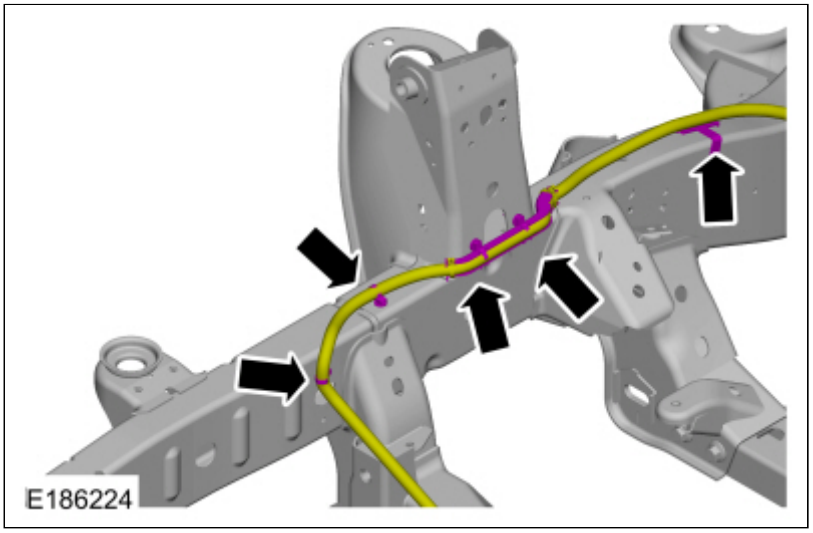
3.



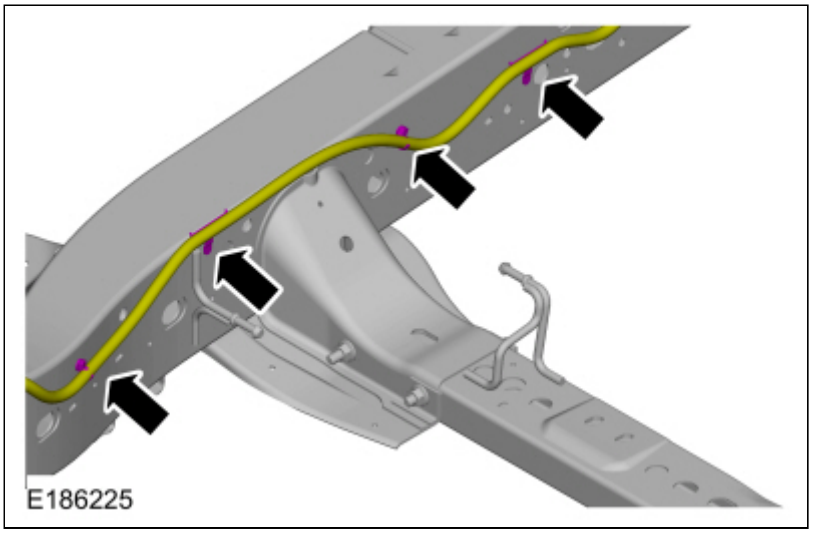
4.



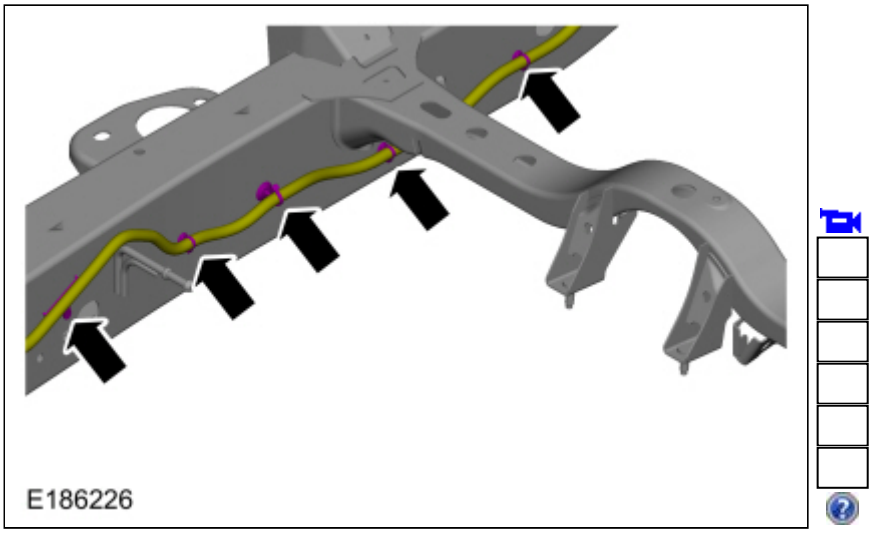
5.



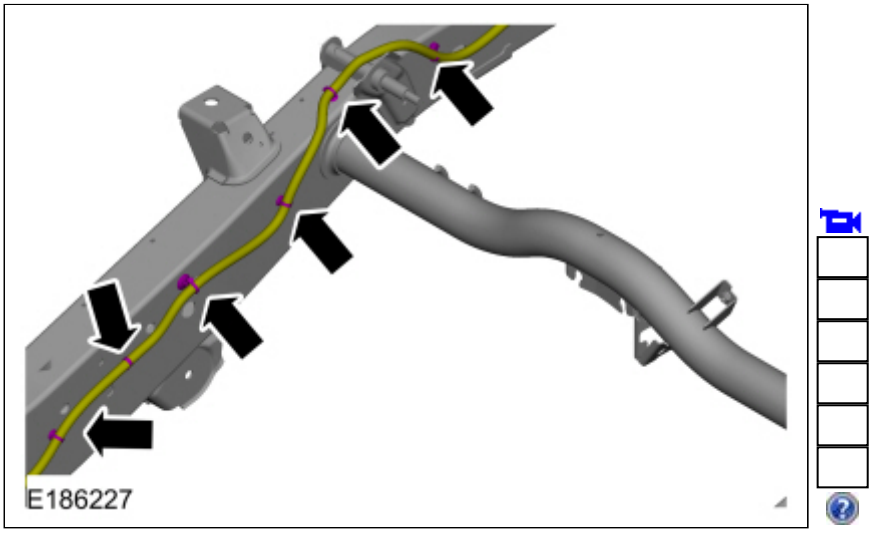
6.



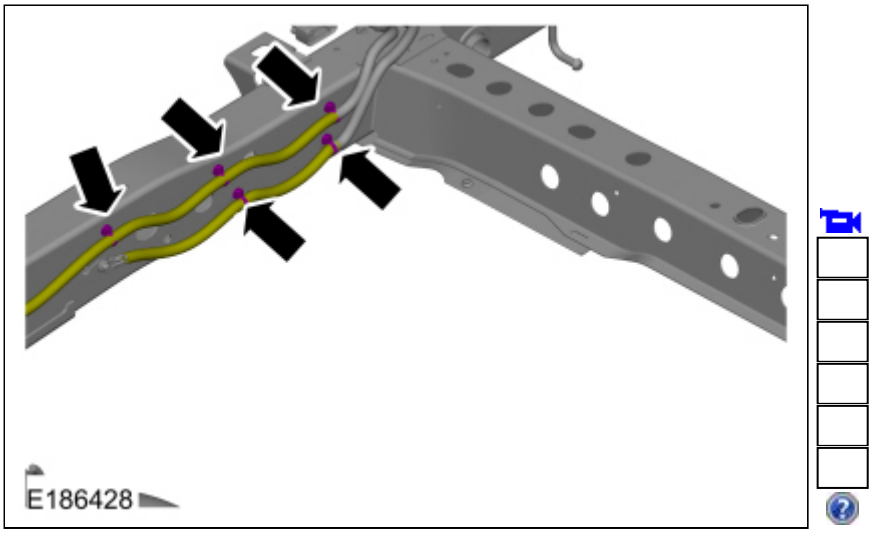
7.



8.

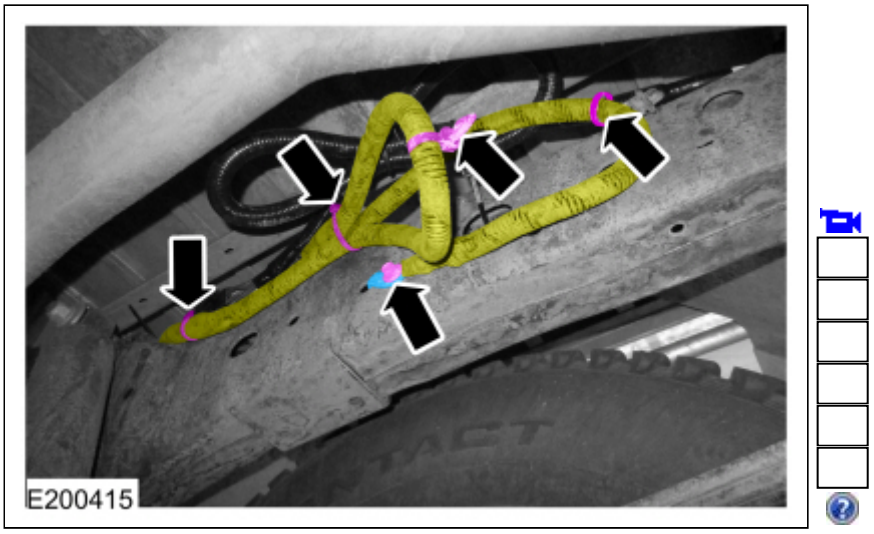


9.

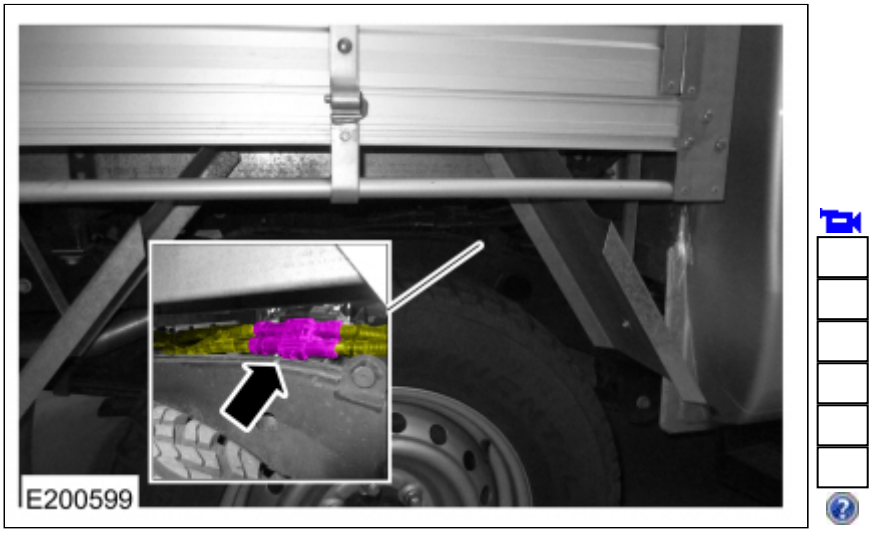


10. **NOTE:** *Make sure that threads are clear before installing the ground cable fixture.*

    Torque: 20 Nm



11.



Installation

NOTICE: Failure to accurately follow the battery reconnect procedures outlined in this section will result in vehicle or component damage.

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Auxiliary Battery Wiring Harness - Chassis Cab

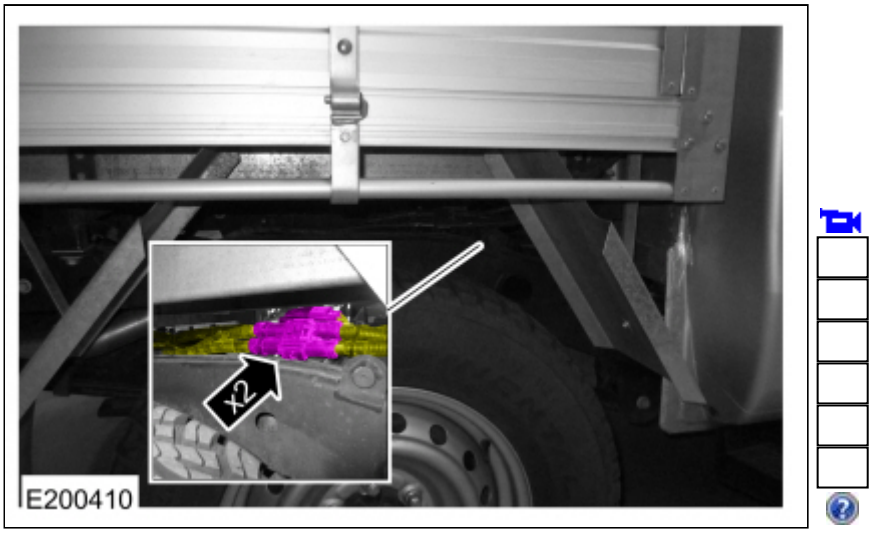
Removal

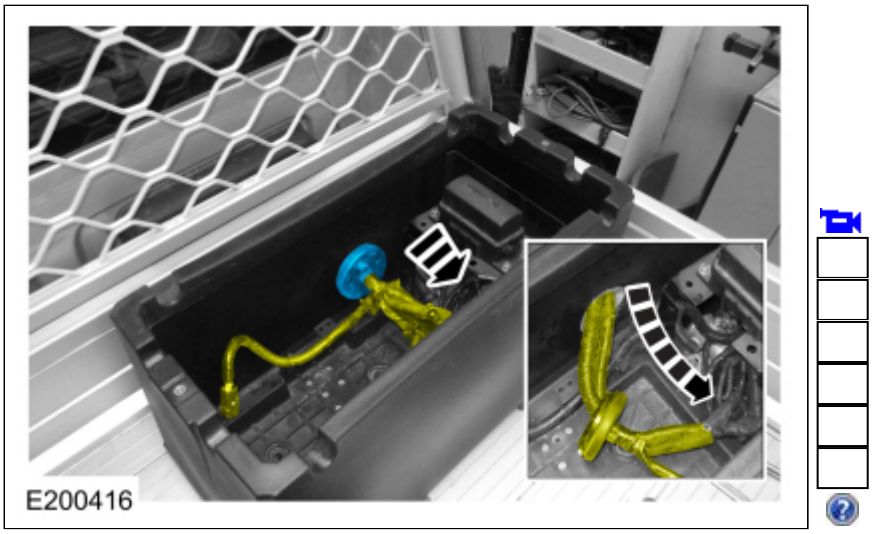
NOTICE: Failure to accurately follow the battery disconnect procedures outlined in this section will result in vehicle or component damage.

NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *The auxiliary battery wiring harness contains the wiring, isolator, fuse box, mounting assembly, input cables, output cables, battery connections and associated components. The wiring harness must not be disassembled.*

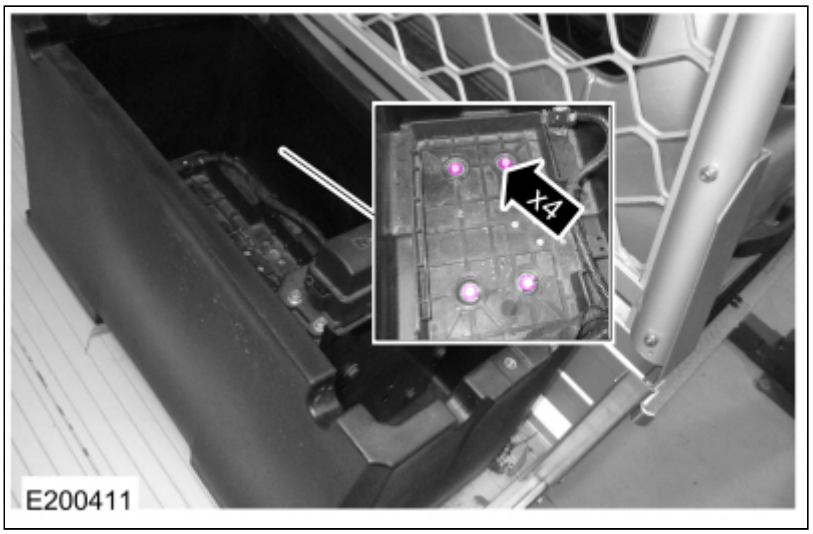
NOTE: *Disconnect any customer fitted accessories from the auxliliary fuse box prior to removing the auxiliary battery wiring harness.*

1. Refer to: Battery Disconnect and Connect - Vehicles Built From: 17-08-2015 (414-01 Battery, Mounting and Cables) .
2. Refer to: Auxiliary Battery - Chassis Cab (414-01 Battery, Mounting and Cables, Removal and Installation).
3. 

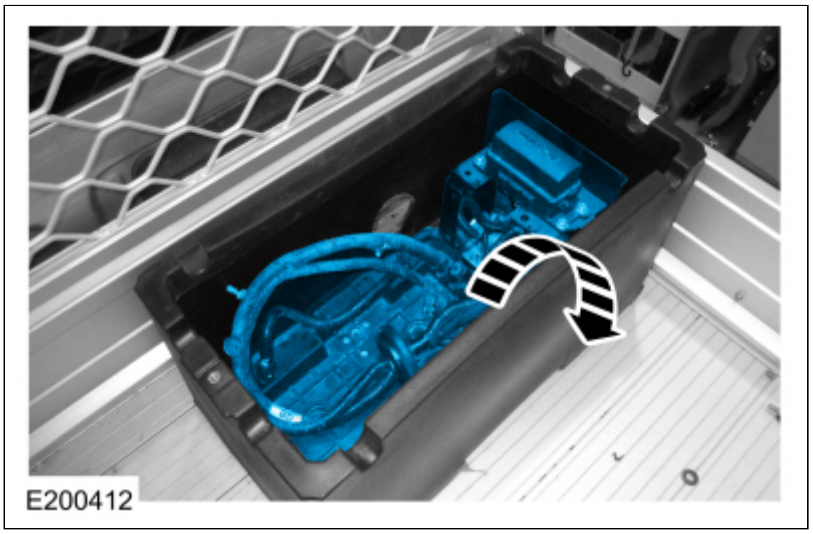
4. 

5. **NOTE:** *Make sure that, mark the location of the box prior to removing the four bolts.*

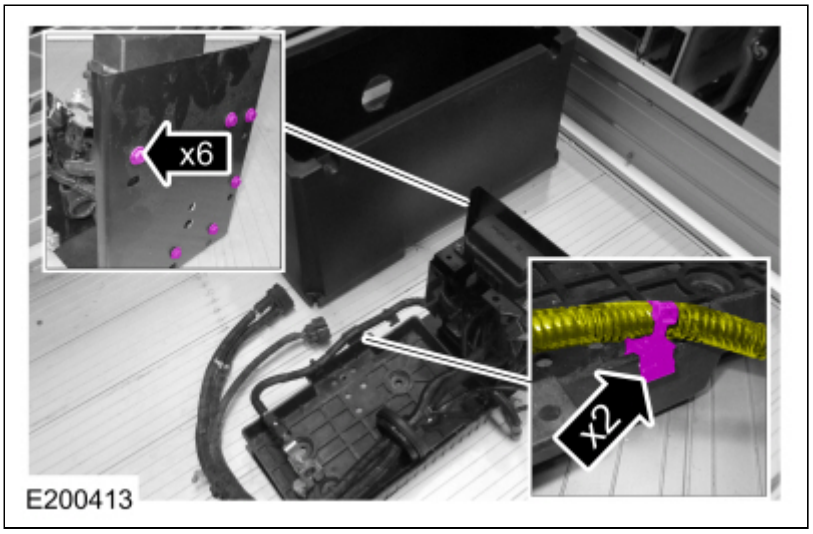
   Torque: 12 Nm



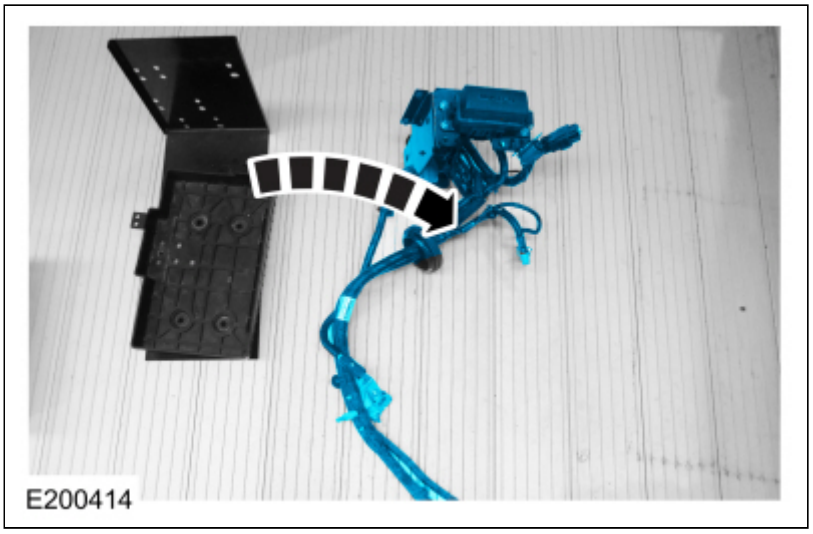
6.



7.



8.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Auxiliary Battery Cable - Pickup

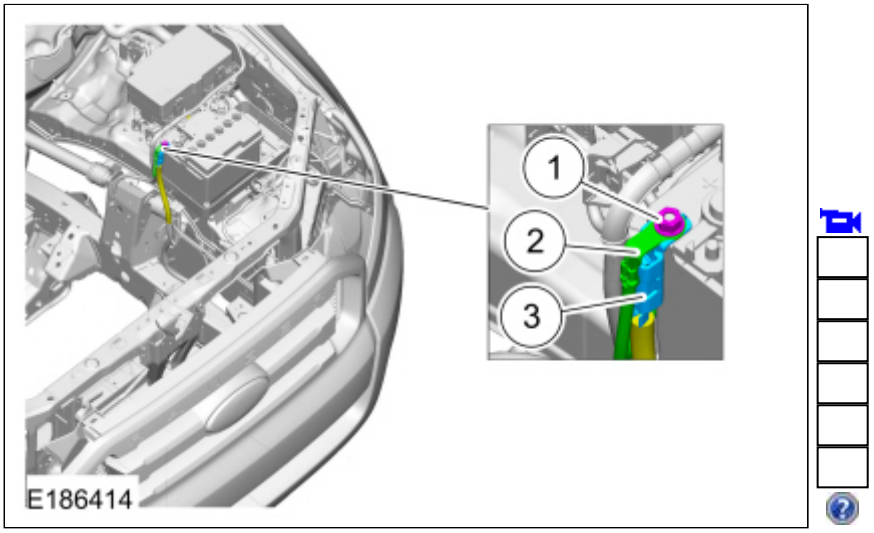
Removal

NOTICE: Failure to accurately follow the battery disconnect procedures outlined in this section will result in vehicle or component damage.

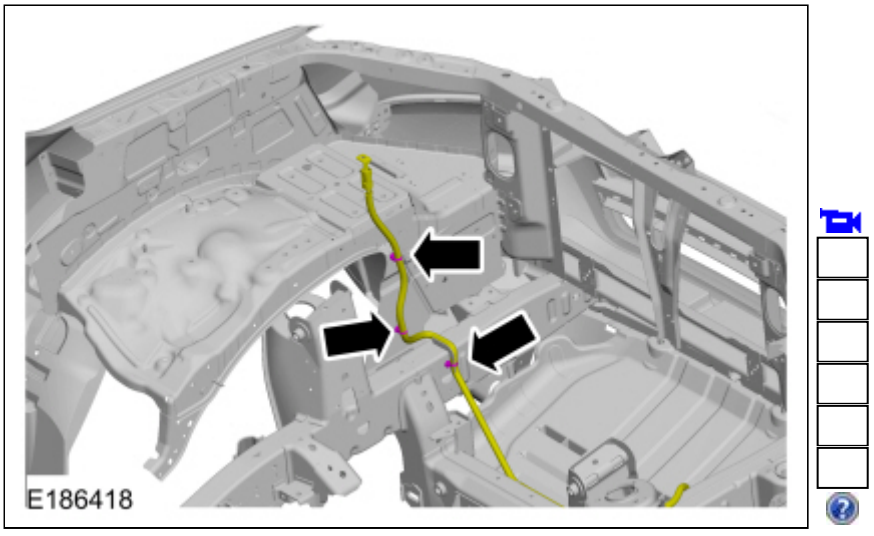
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Auxiliary Battery Disconnect and Connect - Pickup (414-01 Battery, Mounting and Cables) .
2. **NOTE:** *Ensure the correct order is followed when installing the cables onto the primary battery.*

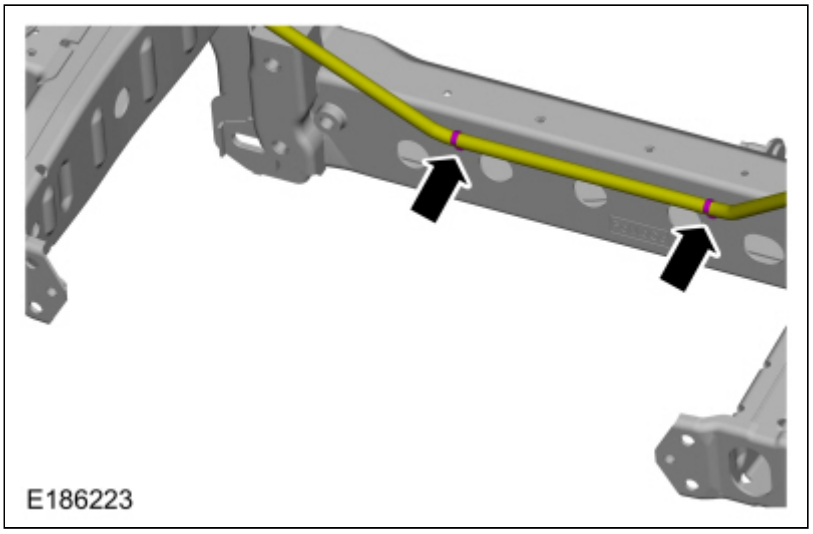
   Torque: 13.5 Nm



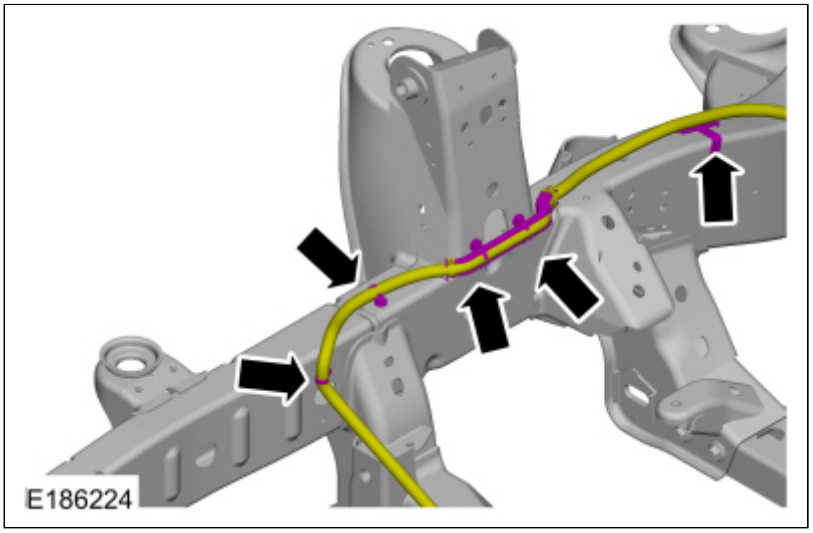
3.



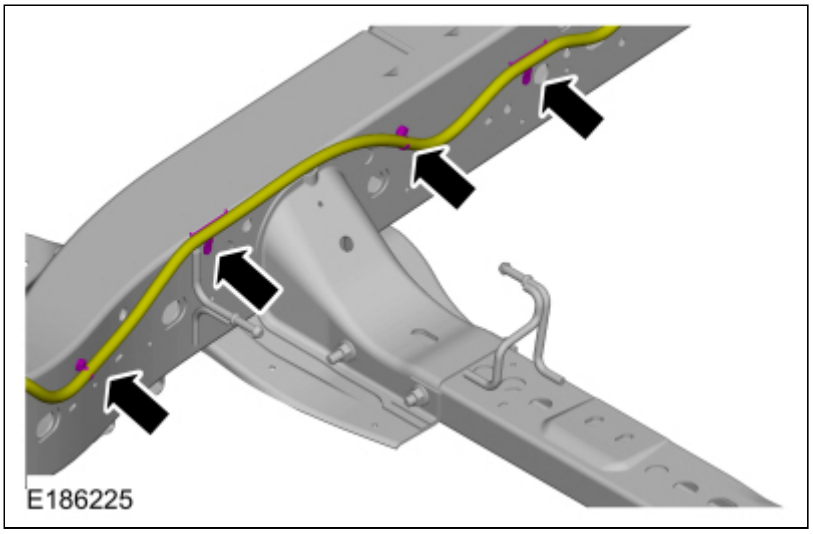
4.



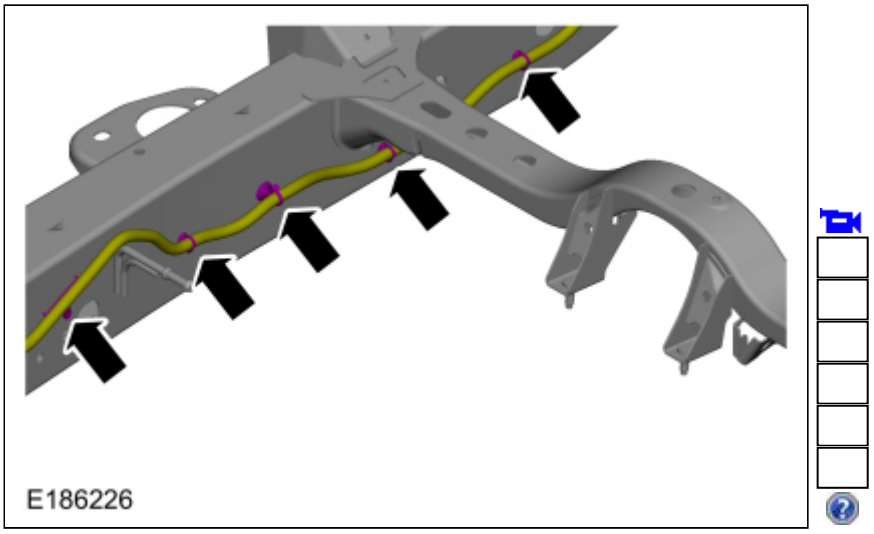
5.



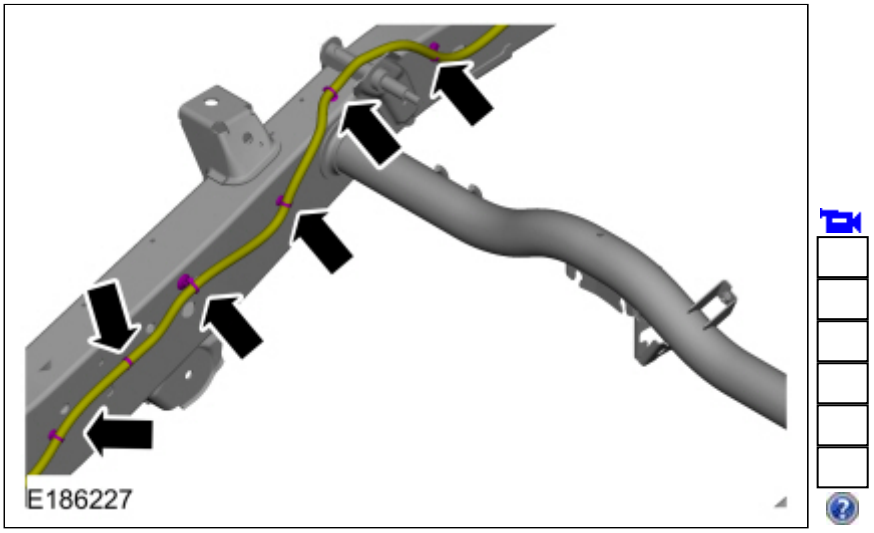
6.



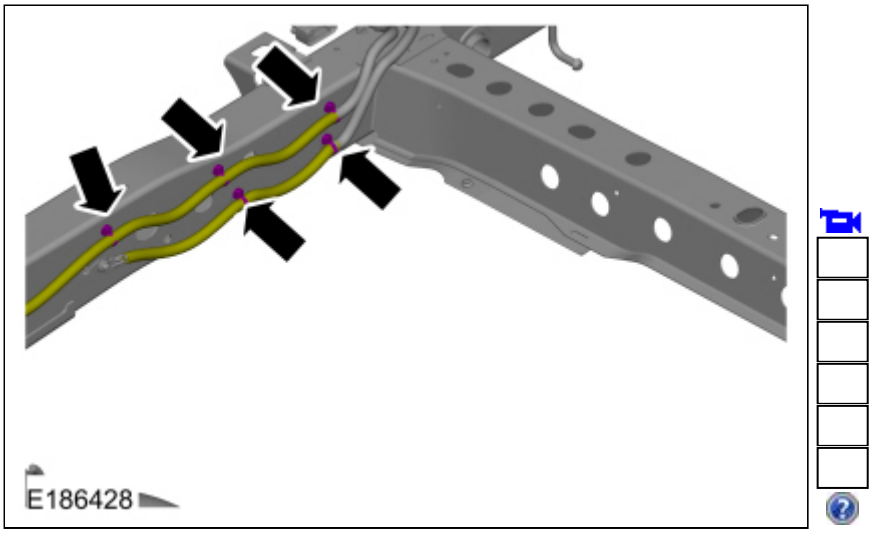
7.



8.

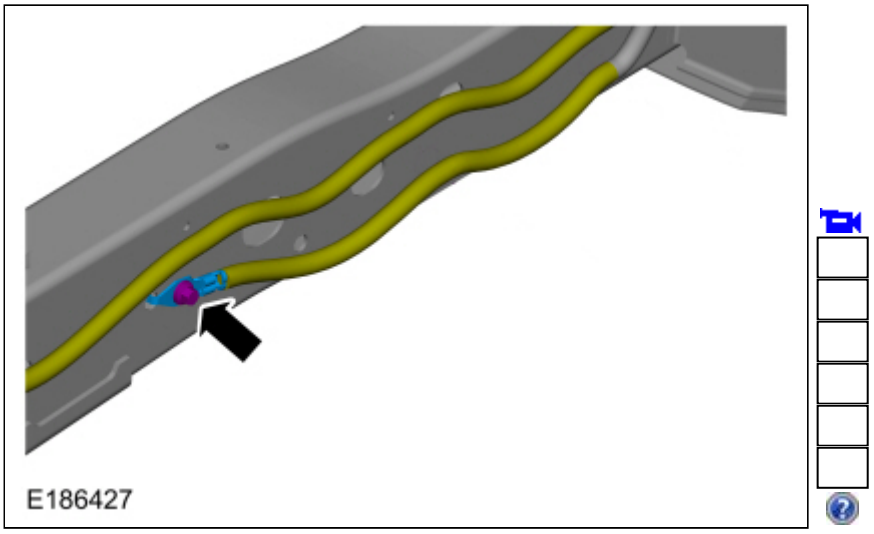


9.

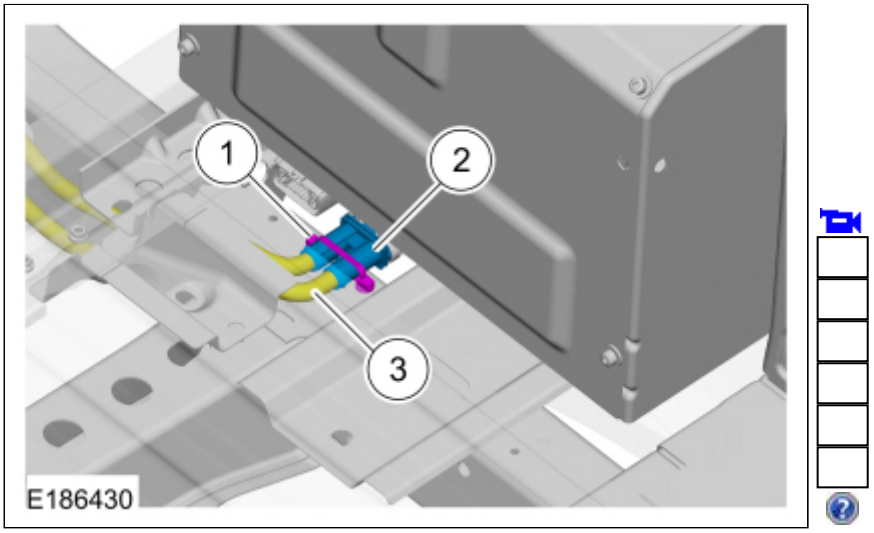


10. **NOTE:** *Make sure that threads are clear before installing the ground cable fixture.*

    Torque: 20 Nm



11.



Installation

NOTICE: Failure to accurately follow the battery reconnect procedures outlined in this section will result in vehicle or component damage.

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

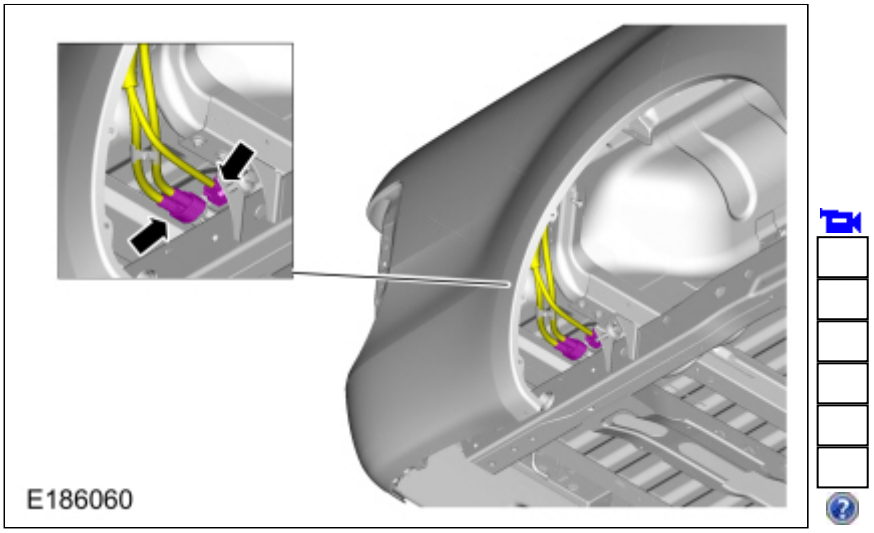
Auxiliary Battery Wiring Harness - Pickup

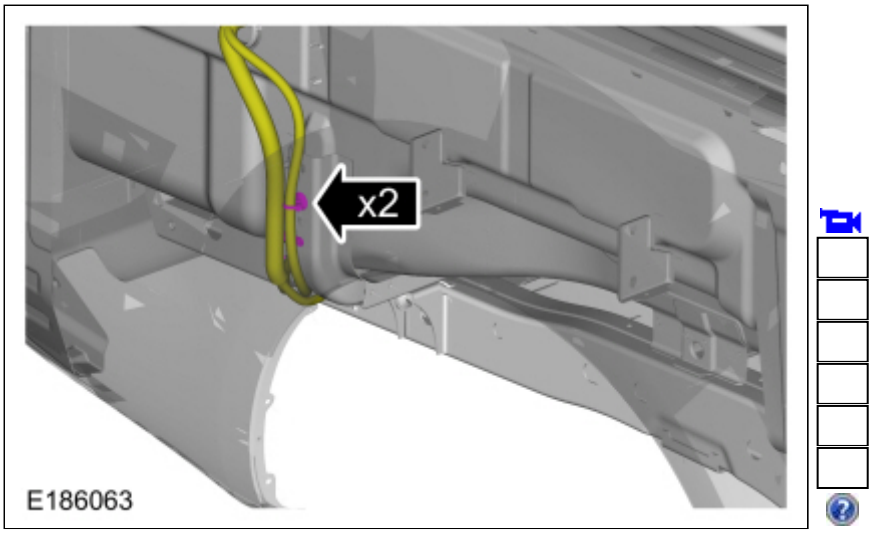
Removal

NOTICE: Failure to accurately follow the battery disconnect procedures outlined in this section will result in vehicle or component damage.

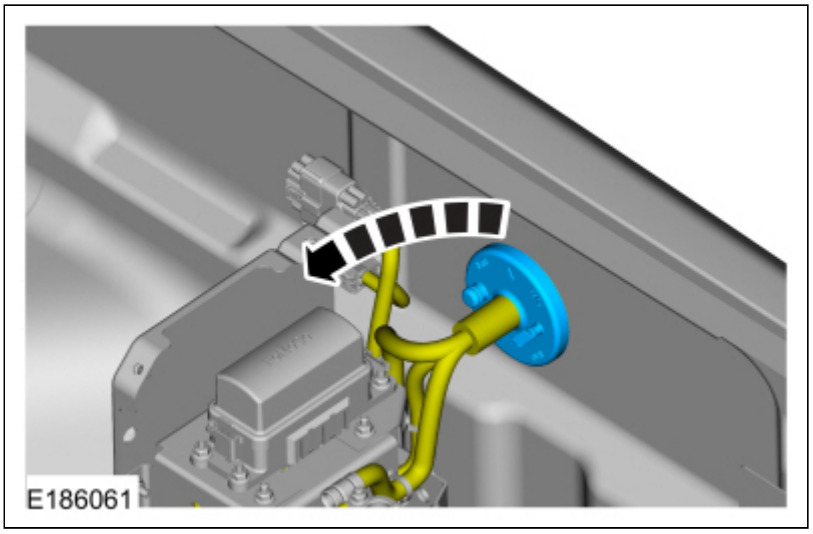
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *The auxiliary battery wiring harness contains the wiring, isolator, fuse box, mounting assembly, input cables, output cables, battery connections and associated components. The wiring harness must not be disassembled.*

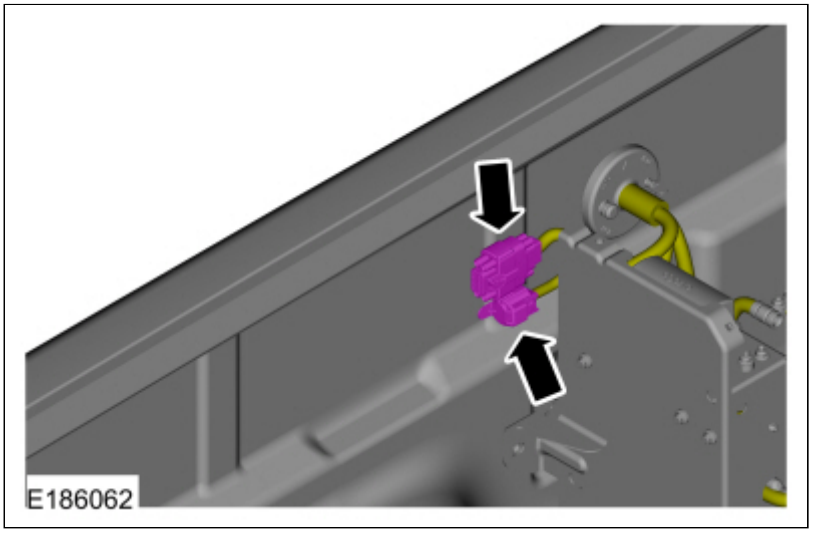
1. Refer to: Auxiliary Battery Disconnect and Connect - Pickup (414-01 Battery, Mounting and Cables) .
2. Refer to: Auxiliary Battery - Pickup (414-01 Battery, Mounting and Cables, Removal and Installation).
3. 

4. 

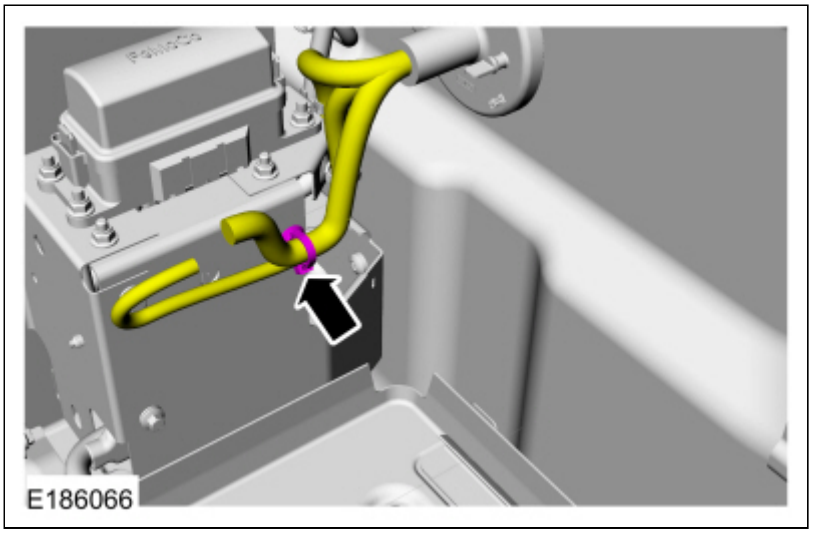
5. **NOTE:** *Make sure that after installation the arrow on the grommet should be pointing upward*



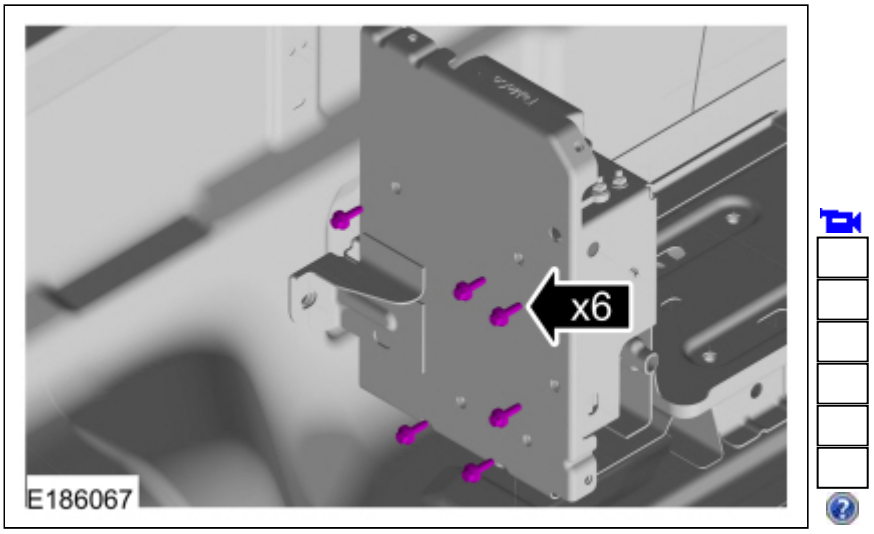
6.



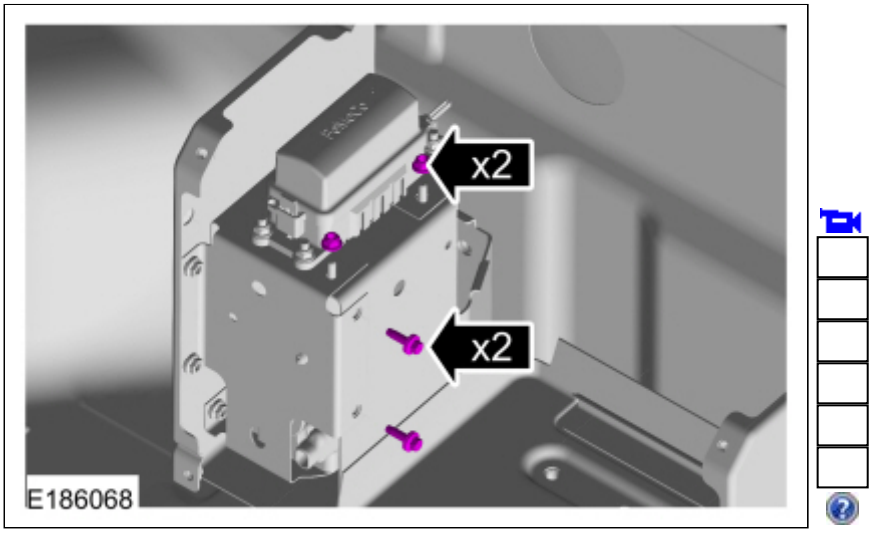
7.



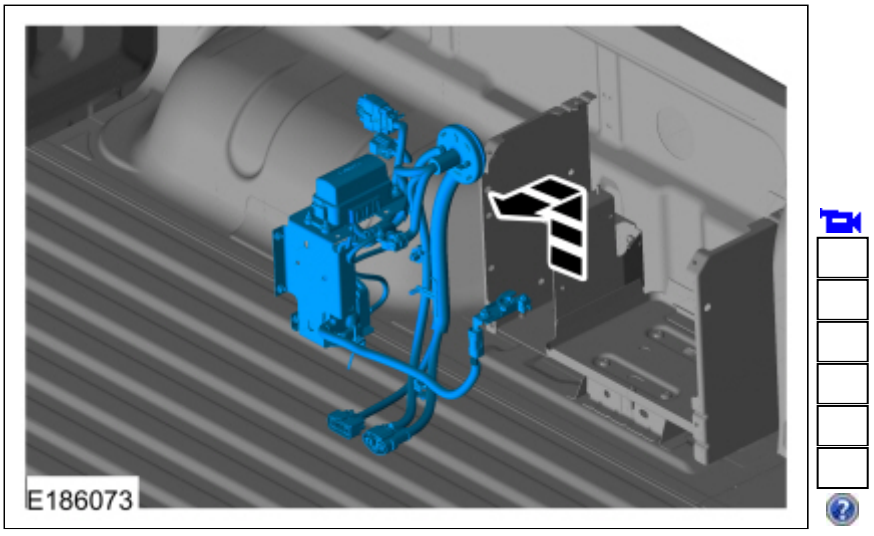
8. *Torque*: 12 Nm



9. *Torque*: 12 Nm
10. *Torque*: 12 Nm



11. **NOTICE: Care must be taken when removing the auxiliary battery wiring harness, to prevent it and the connectors being damaged.**



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Generator - 2.5L Duratec-HE (122kW/165PS) - MI4

Base Part Number: 10300

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: When the battery cables are connected, touching the vehicle body with generator terminal B will generate sparks. This can cause personal injury, fire, and damage to the electrical components. Always disconnect the battery negative cable before performing the following operation.**

   NOTICE: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

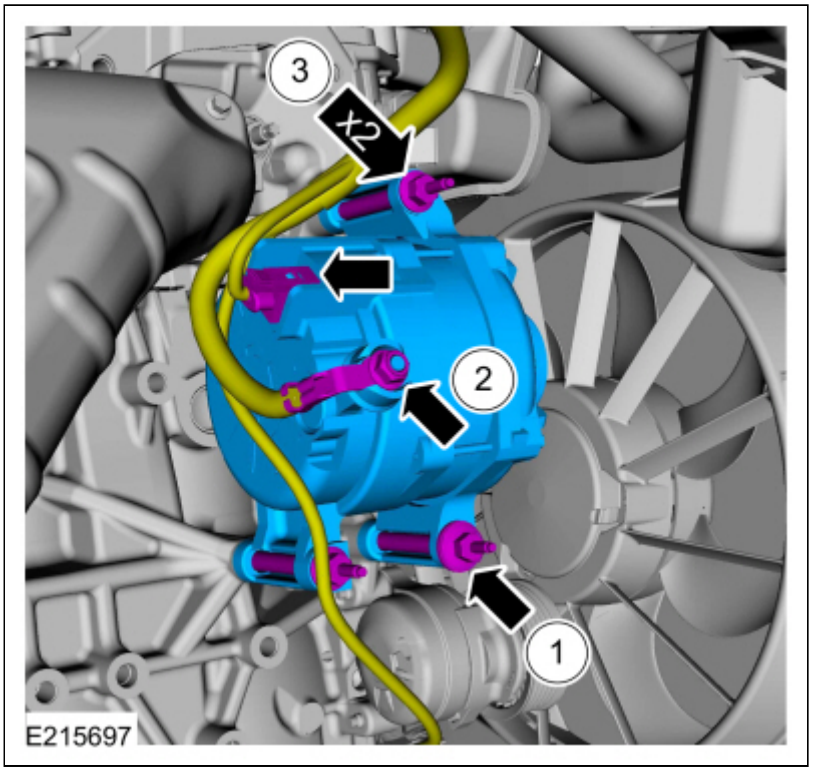
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).

Vehicles With: Electronic Power Assist Steering (EPAS)

3. **NOTICE: Take extra care not to damage the wiring harnesses.**

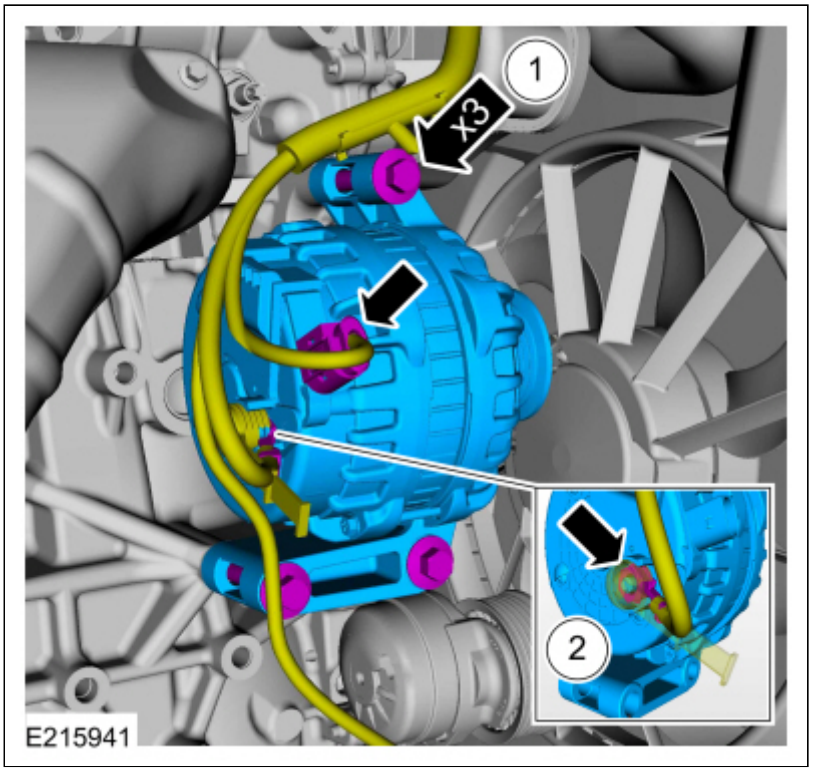
   1. *Torque*: 48 Nm
   2. *Torque*: 15 Nm
   3. *Torque*: 48 Nm



Vehicles With: Hydraulic Power Assist Steering (HPAS)

4. **NOTICE: Take extra care not to damage the wiring harnesses.**

   1. *Torque*: 48 Nm
   2. *Torque*: 15 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Generator - 2.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 10300

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Always disconnect the battery negative cable before performing the following operation. When the battery cables are connected, touching the vehicle body with generator terminal B will generate sparks. Failure to follow the instructions below may result in damage to components, fire or personal injury**

   NOTICE: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. Failure to follow this instruction may cause damage to the components.

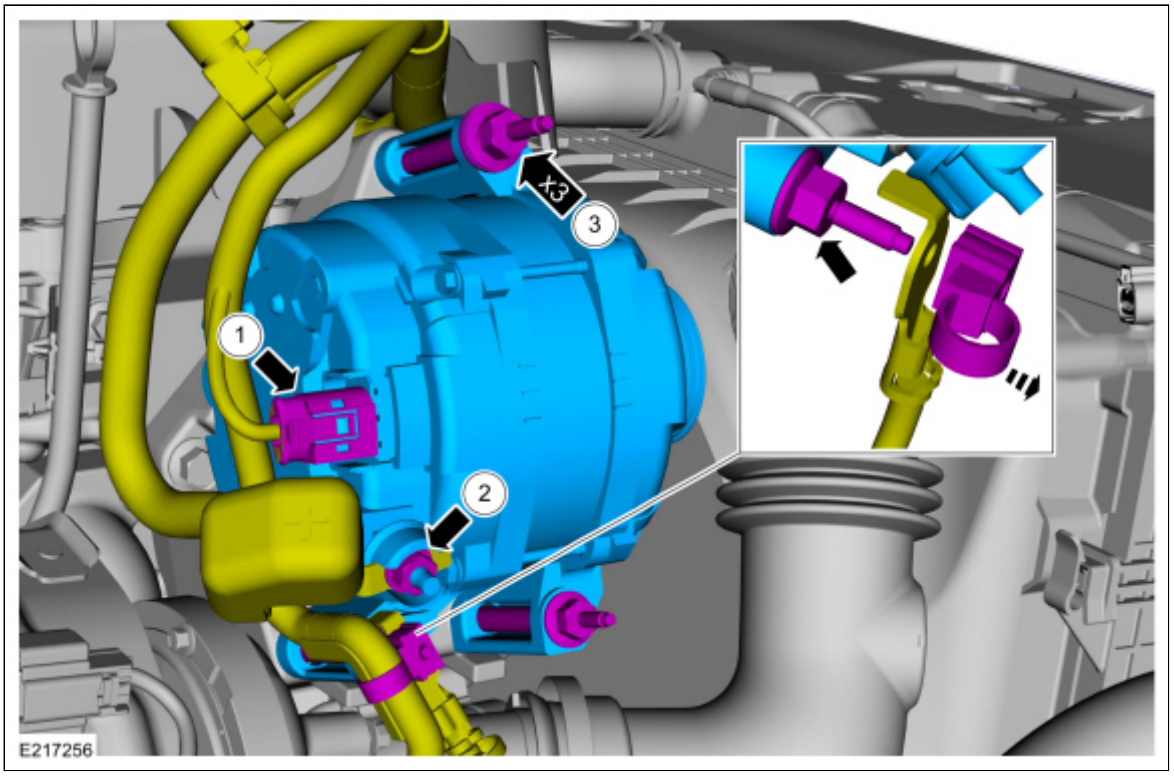
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Vehicles With: Electronic Power Assist Steering (EPAS)

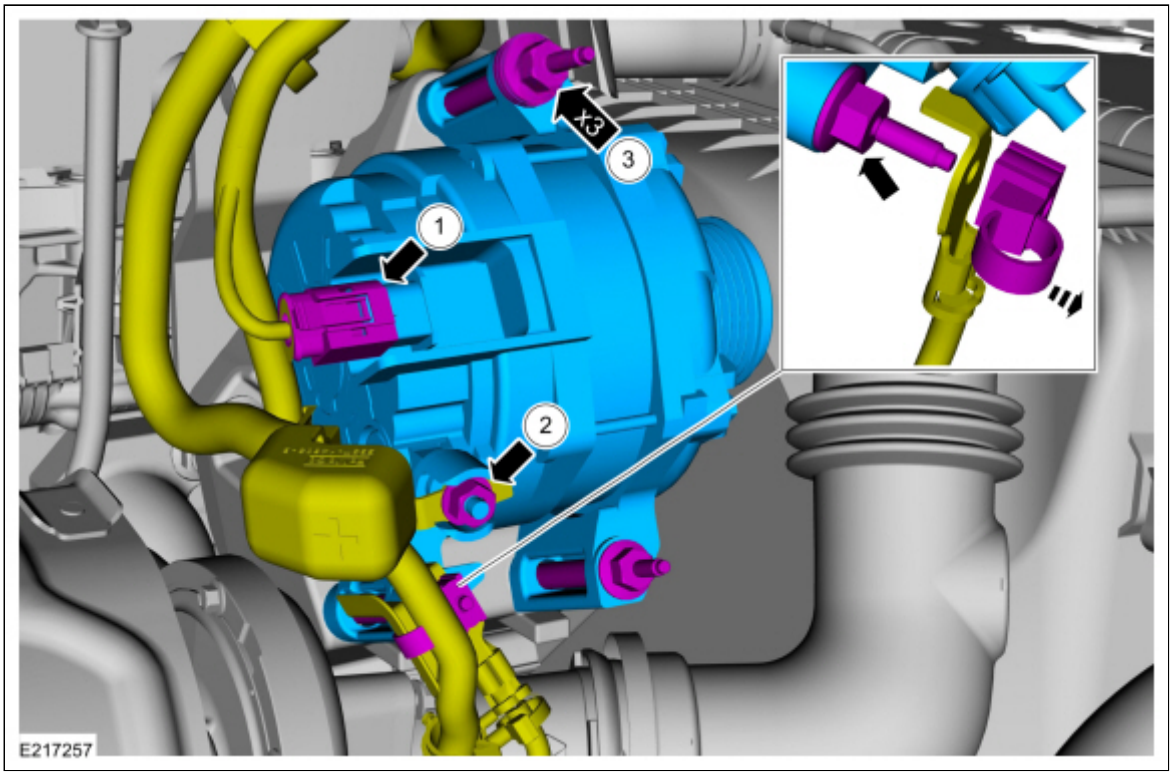
3. **NOTICE: Take extra care not to damage the wiring harnesses.**

   If equipped
   Torque:
   2: 15 Nm
   3: 48 Nm



4. **NOTICE: Take extra care not to damage the wiring harnesses.**

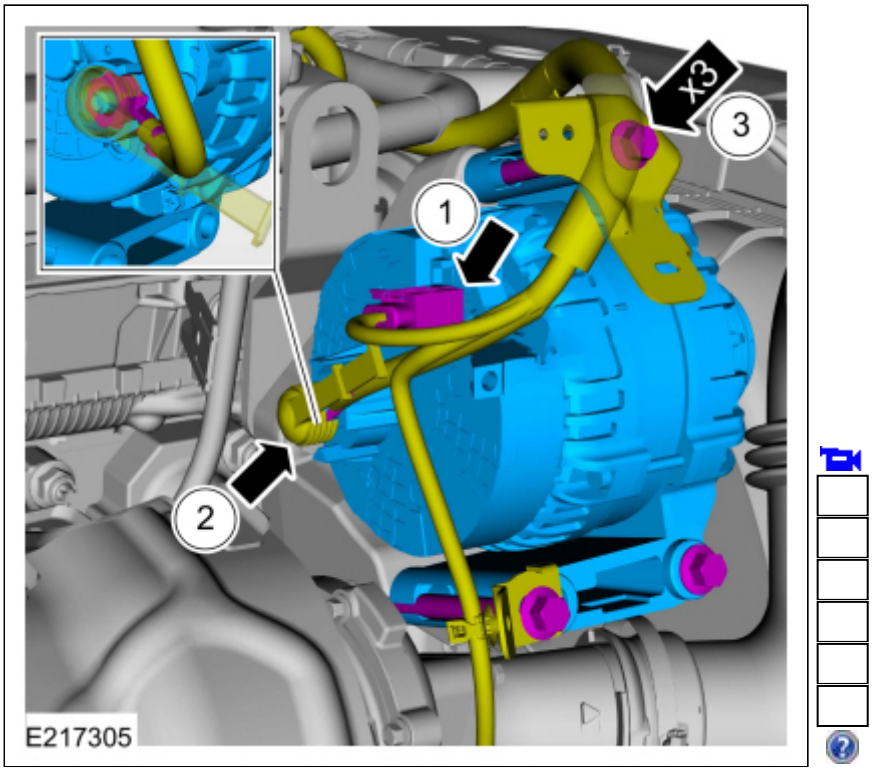
   2. *Torque*: 15 Nm
   3. *Torque*: 48 Nm



Vehicles With: Hydraulic Power Assist Steering (HPAS)

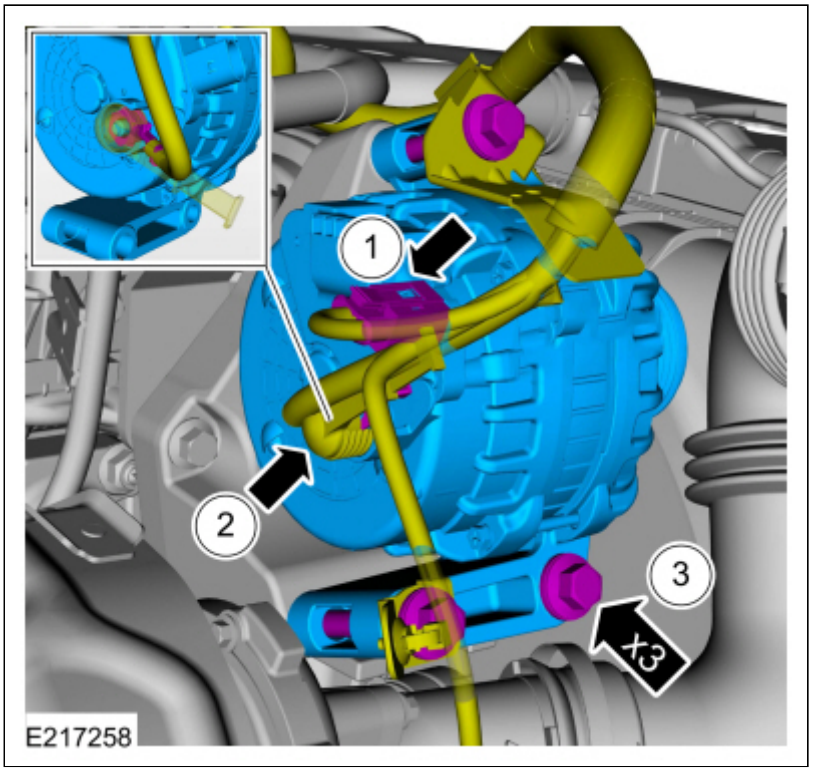
5. **NOTICE: Take extra care not to damage the wiring harnesses.**

   If equipped
   Torque:
   2: 15 Nm
   3: 48 Nm



6. **NOTICE: Take extra care not to damage the wiring harnesses.**

   2. *Torque*: 15 Nm
   3. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Generator - 3.2L Duratorq-TDCi (Puma) Diesel

Base Part Number: 10300

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Always disconnect the battery negative cable before performing the following operation. When the battery cables are connected, touching the vehicle body with generator terminal B will generate sparks. Failure to follow the instructions below may result in damage to components, fire or personal injury .**

   NOTICE: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. Failure to follow this instruction may cause damage to the components.

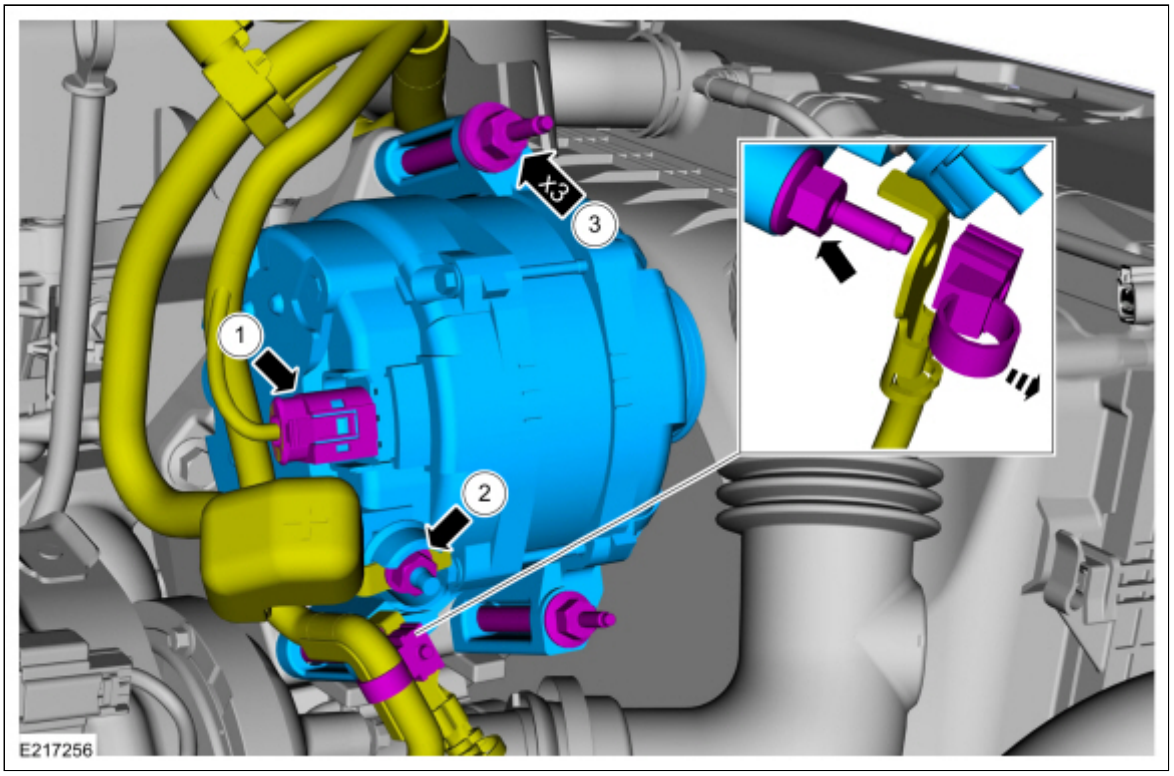
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Refer to: Accessory Drive Belt - Vehicles With: Hydraulic Power Assist Steering (HPAS) (303-05B Accessory Drive - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

Vehicles With: Electronic Power Assist Steering (EPAS)

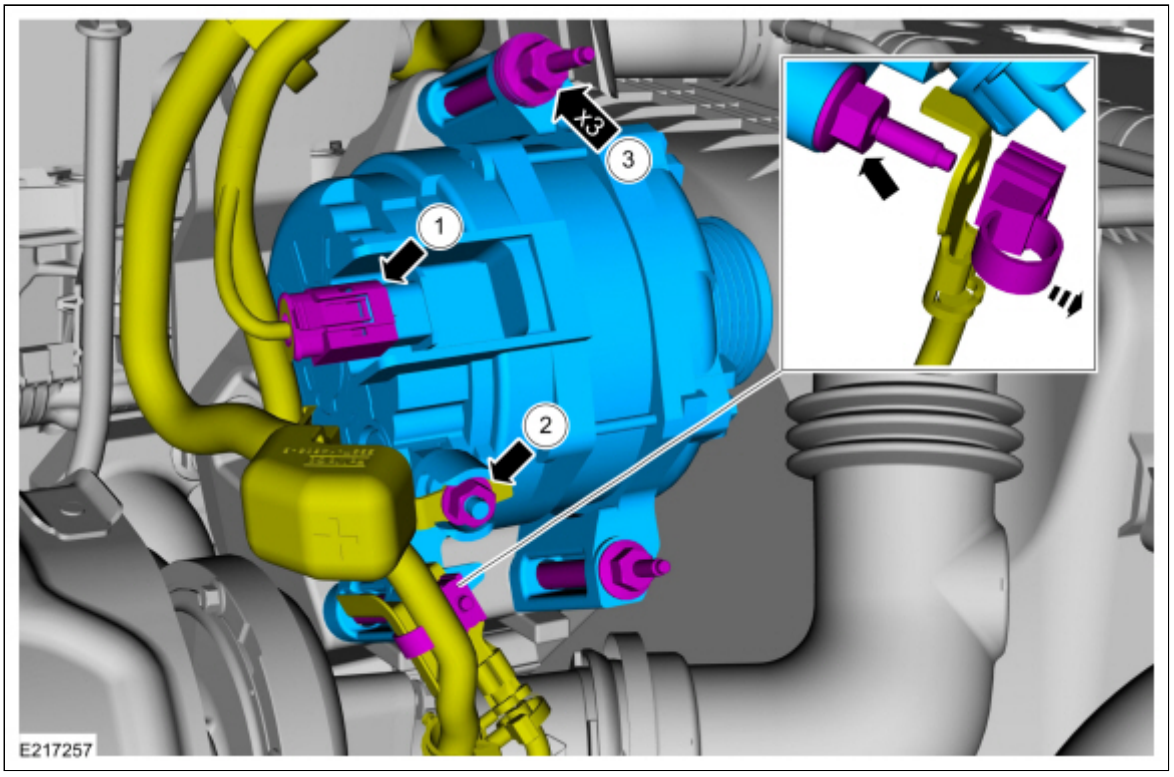
3. **NOTICE: Take extra care not to damage the wiring harnesses.**

   If equipped
   Torque:
   2: 15 Nm
   3: 48 Nm



4. **NOTICE: Take extra care not to damage the wiring harnesses.**

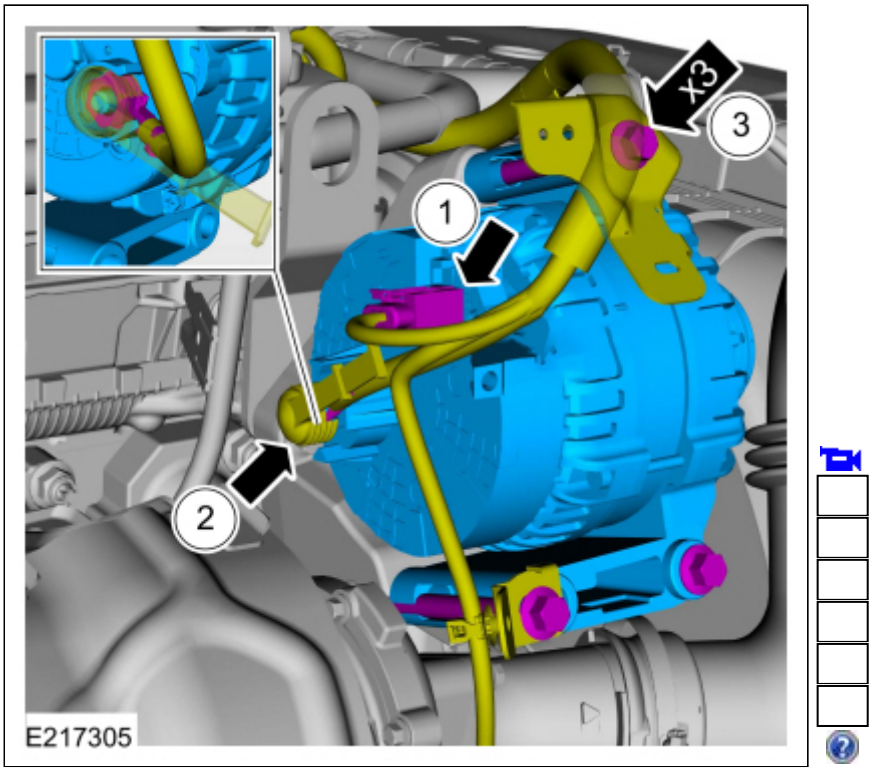
   2. *Torque*: 15 Nm
   3. *Torque*: 48 Nm



Vehicles With: Hydraulic Power Assist Steering (HPAS)

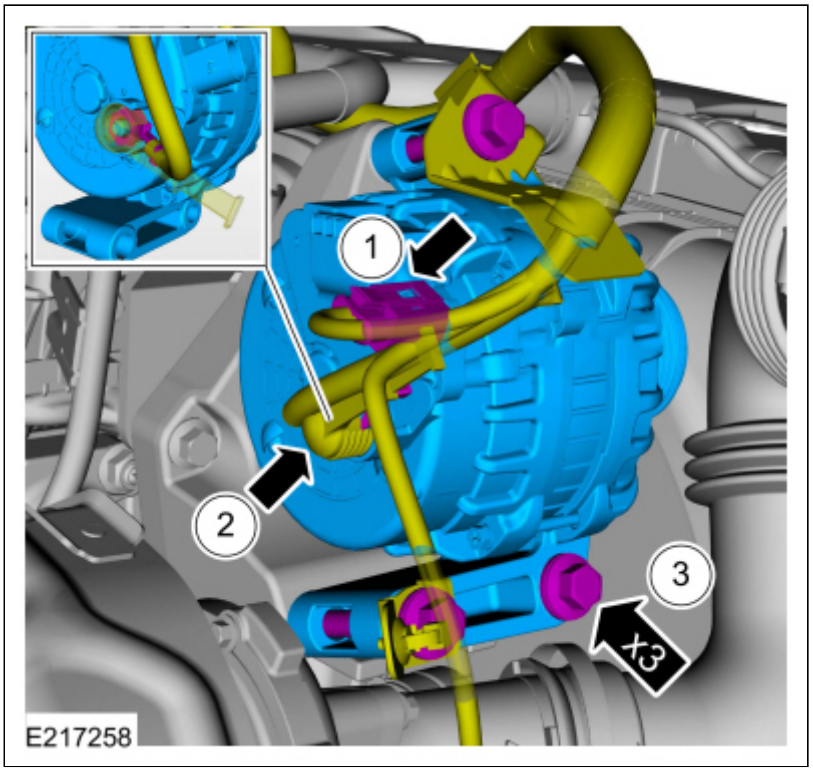
5. **NOTICE: Take extra care not to damage the wiring harnesses.**

   If equipped
   Torque:
   2: 15 Nm
   3: 48 Nm



6. **NOTICE: Take extra care not to damage the wiring harnesses.**

   2. *Torque*: 15 Nm
   3. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Direct Current/Alternating Current (DC/AC) Inverter - Overview

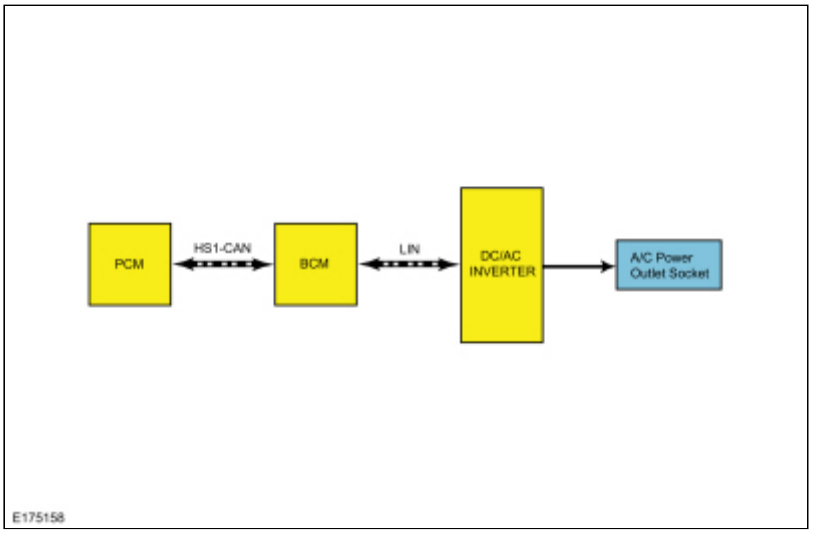
Overview

The DC- AC inverter converts 12 volts DC to 230 or 110 volts AC to power AC devices rated 150 watts or less.

Copyright © 2016 Ford Motor Company

Direct Current/Alternating Current (DC/AC) Inverter - System Operation and Component Description

System Diagram



System Operation

Network Message Chart

Broadcast Message	Originating Module	Message Purpose
Power pack torque status	PCM	Used to determine if the engine is started.

AC OUTLETS (POWER POINTS)

This vehicle is equipped with a 230 or 110 volts AC outlet on the center floor console. The AC outlet is equipped with an amber LED that indicates the system status. The LED is illuminated continuously when the inverter is ON and the system is operating normally. If the LED has a series of three flashes, the power point is overloaded. The LED flashes constantly if the ignition is on and a fault is detected.

DC/AC INVERTER

The direct current/alternating current (DC/AC) inverter converts 12 volts DC to 230 or 110 volts AC to power AC devices rated 150 watts or less.

The 230 or 110 volts AC created by the inverter measures differently than conventional, utility generated AC with some multi-meters.

SYSTEM OPERATION

When the ignition is turned to RUN and the engine started, the LED will flash as the inverter runs a self-test. The LED will then illuminate constantly and the inverter supplies 230 or 110 volts to the AC outlet. The engine **must** be started for the AC outlet to begin to operate. In **accessory delay mode**, the direct current/alternating current (DC/AC) inverter shuts off after 13 minutes. When the direct current/alternating current (DC/AC) inverter stops receiving information from the BCM over the LIN circuit indicating the engine is started, it begins counting the elapsed time. After 13 minutes the direct current/alternating current (DC/AC) inverter shuts down. Cycling the ignition from RUN to OFF and back to RUN will reset the timer is and the inverter is powered back on by but only for another 13 minutes. This prevents the 12-volt battery from being fully discharged. If the vehicle is started, the inverter operation is not time-limited.

The direct current/alternating current (DC/AC) inverter has a self-protection feature for the following conditions:

- Short circuits on the inverter output circuits: The inverter shuts down if it detects a short on the output circuit(s). After 6 seconds, it restarts and checks for a short condition. If the condition still exists, the inverter

shuts down again. The inverter restarts 5 times and if the short still exists on the 5th restart, the inverter disables AC output and the green LED indicator flashes.
- Low voltage input: The inverter does not operate when the input voltage is less than 11 volts.
- High voltage input: The inverter does not operate when the input voltage is greater than 16 volts.
- Load exceeds 150 watts
- High temperature: The inverter does not operate if it has overheated or if ambient (cabin) temperatures exceed 75°C .

If the self-protection feature is activated, the LED indicator flashes and the direct current/alternating current (DC/AC) inverter does not provide power output to the AC outlet. If the LED is flashing, the problem must be corrected before direct current/alternating current (DC/AC) inverter operation resumes.

Refer to the Owner's Literature for a list of appropriate electrical loads and devices.

Component Description

COMPONENT OPERATION

The AC power outlet and inverter module are replaced as separate components. The AC outlets are standard 3-prong outlets, similar to a standard wall outlet. The contacts of the outlet exert a more powerful grip on the plug so that it does not shake loose on poor road surfaces.

Copyright © 2016 Ford Motor Company

Direct Current/Alternating Current (DC/AC) Inverter

Inspection and Verification

Before diagnosing or repairing the Direct Current/Alternating Current (DC/AC) Inverter system refer to the Owner's Literature and
REFER to: Direct Current/Alternating Current (DC/AC) Inverter - System Operation and Component Description (414-05 Voltage Converter/Inverter, Description and Operation).
for proper system operation.

DTC Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Body Control Module (BCM) DTC Chart

DTC	Description	Action
B1330:01	DC/AC Inverter Module: General Electrical Failure	GO to Pinpoint Test A
B1330:02	DC/AC Inverter Module: General Signal Failure	GO to Pinpoint Test C
B1330:08	DC/AC Inverter Module: Bus Signal / Message Failure	GO to Pinpoint Test C
B1330:49	DC/AC Inverter Module: Internal Electronic Failure	CLEAR the DTC. REPEAT the self-test. If DTC B1330:49 is retrieved again, INSTALL a new Direct Current/Alternating Current (DC/AC) Inverter.
B1330:55	DC/AC Inverter Module: Not Configured	CLEAR the DTC. REPEAT the self-test. If DTC B1330:55 is retrieved again, INSTALL a new Direct Current/Alternating Current (DC/AC) Inverter.
B1330:9A	DC/AC Inverter Module: Component or System Operating Conditions	ADDRESS all other Diagnostic Trouble Codes (DTCs) first. If no other Diagnostic Trouble Codes (DTCs) are present ADDRESS any symptoms. REFER to SYMPTOM CHART in this section. If no symptoms are present clear the DTC. If the DTC returns and no symptoms are present INSTALL a new Direct Current/Alternating Current (DC/AC) Inverter.
All Other DTCs	—	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Direct Current/Alternating Current (DC/AC) Inverter

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
• The AC power point LED indicator is always flashing with the key in the ON position.	• Refer to the Pinpoint Test	• DISCONNECT all electrical accessories from the AC outlet and VERIFY that cabin temperature is below 75°C (167°F). CYCLE the ignition. TEST the system for normal operation. If the system is operating normally, RETURN the vehicle to the customer. If the AC outlet LED indicator is still flashing, GO to Pinpoint Test A
• No power at the AC power point	• Refer to the Pinpoint Test	• GO to Pinpoint Test A
• The AC power point LED indicator is never on	• Refer to the Pinpoint Test	• GO to Pinpoint Test B
• The AC power point turns off after 13 minutes	• Refer to the Pinpoint Test	• GO to Pinpoint Test C

Pinpoint Tests

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

No Power at the AC Power Point or the AC Power Point LED Indicator Flashes with the Key in the ON Position

Refer to Wiring Diagrams Cell 44 for schematic and connector information.

Normal Operation and Fault Conditions

The engine **must** be started for the AC outlet to begin to operate.
REFER to: Direct Current/Alternating Current (DC/AC) Inverter - System Operation and Component Description (414-05 Voltage Converter/Inverter, Description and Operation).

NOTE: *The electrical device that is powered by the AC power point must not exceed 150 watts.*

NOTE: *If the LED is flashing, the AC power point may be overloaded, overheated or shorted. Unplug the electrical device from the AC power point and cycle the ignition. Refer to the Owner's Literature to determine if the electrical device is appropriate for the AC power point.*

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1330:01	DC/AC Inverter Module: General Electrical Failure	Sets in the BCM when the general electrical fault is detected by the direct current/alternating current (DC/AC) inverter.

Possible Sources

- Fuse(s)
- Direct current/alternating current (DC/AC) inverter
- AC power point
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Verify that any device being used in the AC outlet is rated at less than 150 watts.
- Verify the AC outlet is not being used with the engine off for a period longer than 13 minutes without starting the engine or cycling the ignition.
- Verify the cabin temperature is less than 75ºC (167ºF).
- Verify the BCM fuse 23 (10A) is OK.
- Verify the BJB fuse 81 (40A) is OK.
- Inspect the AC outlet for damage.

PINPOINT TEST A : NO POWER AT THE AC (ALTERNATING CURRENT) POWER POINT OR THE AC (ALTERNATING CURRENT) POWER POINT LED (LIGHT EMITTING DIODE) INDICATOR FLASHES WITH THE KEY IN THE ON POSITION

NOTICE: Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE POWER OUTLET LED (LIGHT EMITTING DIODE) STATUS

- Start the engine.
- Check the LED on the AC outlet

Is the LED flashing?

Yes	GO to A2
No	GO to A3

A2 DETERMINE IF THE DC/AC INVERTER IS OVERHEATED

- Determine if the direct current/alternating current (DC/AC) inverter is overheated.

Is the vehicle cabin temperature is greater than 75º C (167º F) or has the inverter been in continuous use for a long period of time?

Yes	The inverter does not operate if it has overheated or if ambient (cabin) temperatures have exceeded 75º C (166.9º F). Cycle the ignition off and ALLOW to cool. Test the system for normal operation.
No	GO to A3

A3 CHECK AC (ALTERNATING CURRENT) POWER OUTLET OPERATION

- Start the engine.
- With the engine running, plug a device rated less than 150 watts into AC power outlet.

Is the device operating?

Yes	If the 110V device is operating and the LED is NOT illuminated, GO to Pinpoint Test B If the device is operating and the LED is illuminated solid, the AC power outlet is operating correctly at this time.
No	GO to A4

A4 CHECK THE INVERTER MODULE POWER SUPPLY CIRCUITS FOR VOLTAGE

- Ignition OFF.
- Disconnect Direct current/Alternating current (DC/AC) Inverter C3501.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-5		Ground
C3501-6		Ground

Are the voltages greater than 11 volts?

Yes	GO to A5
No	VERIFY BCM fuse 23 (10A) and BJB fuse 81 (40A) are OK. If OK, REPAIR the open circuit or high resistance on the affected circuit(s). If not OK, REFER to the Wiring Diagrams manual to identify the possible cause of the circuit short.

A5 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-12	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A6
No	REPAIR the circuit.

A6 CHECK THE AC (ALTERNATING CURRENT) CIRCUITS FOR AN OPEN

- Disconnect AC Outlet C3429.
- Disconnect Direct current/Alternating current (DC/AC) Inverter C3501.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-1	Ω	C3429-1
C3501-7	Ω	C3429-6

Are the resistances less than 3 ohms?

Yes	GO to A7
No	REPAIR the affected circuit(s).

A7 CHECK THE AC (ALTERNATING CURRENT) CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-1	Ω	C3501-7

Is the resistance greater than 10,000 ohms?

Yes	GO to A8
No	REPAIR the circuits.

A8 CHECK THE AC (ALTERNATING CURRENT) CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-1	Ω	Ground
C3501-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A9
No	REPAIR the affected circuit(s).

A9 CHECK AC (ALTERNATING CURRENT) OUTLET FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
pin 1 (component side)	Ω	pin 6 (component side)

Positive Lead	Measurement / Action	Negative Lead
pin 2 (component side)	Ω	pin 1 (component side)

Are the resistances less than 3 ohms?

Yes	INSTALL a new direct current/alternating current (DC/AC) inverter.
No	INSTALL a new AC Outlet.

The AC Power Point LED Indicator is Never On

Refer to Wiring Diagrams Cell 44 for schematic and connector information.

Normal Operation and Fault Conditions

The engine **must** be started for the AC outlet to begin to operate. The DC/AC inverter supplies 12V DC and ground to the indicator LED.
REFER to: Direct Current/Alternating Current (DC/AC) Inverter - System Operation and Component Description (414-05 Voltage Converter/Inverter, Description and Operation).

Possible Sources

- Fuse(s)
- Direct current/alternating current (DC/AC) inverter
- AC power point
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-checks

- Verify the BCM fuse 23 (10A) is OK.
- Verify the BJB fuse 81 (40A) is OK.
- Inspect the AC outlet for damage.

PINPOINT TEST B : THE AC (ALTERNATING CURRENT) POWER POINT LED INDICATOR IS NEVER ON

NOTICE: Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK AC (ALTERNATING CURRENT) POWER OUTLET OPERATION

- Start the engine.
- With the engine running, plug a device rated less than 150 watts into the AC power outlet.

Is the device operating?

Yes	GO to B2
No	GO to Pinpoint Test A

B2 CHECK THE POWER OUTLET LED CONTROL CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect direct current/alternating current (DC/AC) Inverter C3501.
- Disconnect AC Outlet C3429.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-10	Ω	C3429-4
C3501-11	Ω	C3429-3

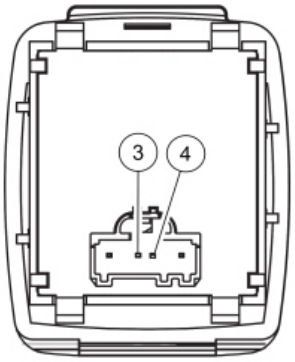
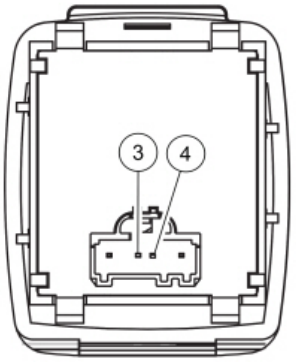
Are the resistances less than 3 ohms?

Yes	GO to B3

No	REPAIR the affected circuit(s).

B3 CHECK THE AC (ALTERNATING CURRENT) OUTLET LED (LIGHT EMITTING DIODE)

- Measure the diode in both directions:

Positive Lead	Measurement / Action	Negative Lead
 E157835 pin 3(component side)	Ω	 E157835 pin 4 (component side)

Is the resistance greater than 10,000 ohms in one direction and between 10-20 ohms in the opposite direction?

Yes	INSTALL a new DC/ AC inverter.
No	INSTALL a new AC outlet.

The AC Power Point Turns Off After 13 Minutes

Refer to Wiring Diagrams Cell 44 for schematic and connector information.

Normal Operation and Fault Conditions

The DC/ AC inverter receives a signal from the BCM over the LIN whenever the engine is running. If the DC/ AC inverter does not receive this message for 13 minutes, the inverter stops supplying 110 volts to the power outlet and the LED indicator flashes. The system can be reset by cycling the ignition from ON to OFF and back to ON, however the system only operates for another 13 minutes unless the signal is received from the BCM that the engine is running.

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1330:02	DC/AC Inverter Module: General Signal Failure	Sets in the BCM when sets when a general signal failure occurs on the LIN.
B1330:08	DC/AC Inverter Module: Bus Signal / Message Failure	Sets in the BCM when there is a LIN communication fault from the DC/ AC inverter.

Possible Sources

- Wiring, terminals or connectors
- DC/ AC inverter
- BCM

Visual Inspection and Diagnostic Pre-checks

- Verify the concern by monitoring the AC outlet LED indicator for 13 minutes with the engine running. If the LED indicator starts to flash after 13 minutes, continue to the pinpoint test. If the system continues to operate normally after 13 minutes, make sure the customer is aware of the DC/ AC inverter time-out function.

PINPOINT TEST C : THE AC (ALTERNATING CURRENT) POWER POINT TURNS OFF AFTER 13 MINUTES

NOTICE: Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 RETRIEVE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform BCM self-test.

Is DTC U0100:00 present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to C2

C2 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) COMMUNICATION CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280G.
- Disconnect Inline connector C214.
- Disconnect DC/ AC Inverter module C3501.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-9		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C3

C3 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) COMMUNICATION CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-9	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) COMMUNICATION CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3501-9	Ω	C2280G-37

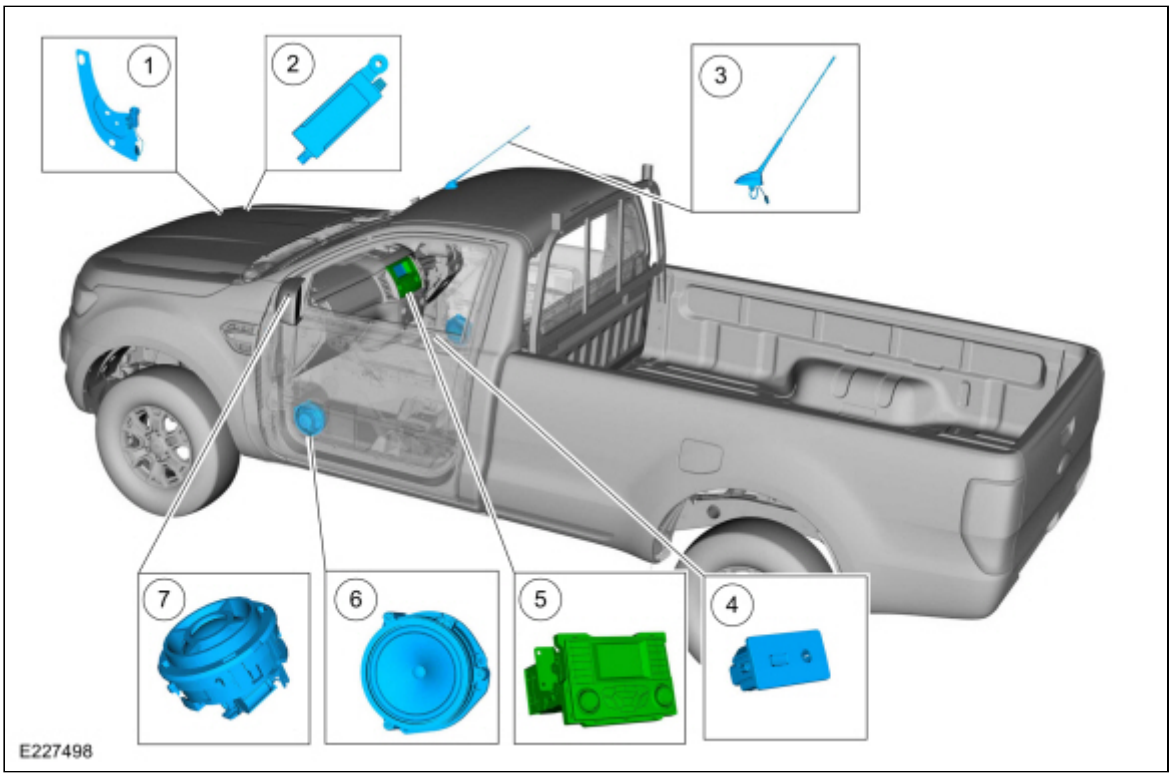
Is the resistance less than 3 ohms?

Yes	INSTALL a new DC/ AC inverter module. TEST the system for normal operation. If the AC outlet still turns off after 13 minutes when the engine is running, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	REPAIR the circuit.

Copyright © 2016 Ford Motor Company

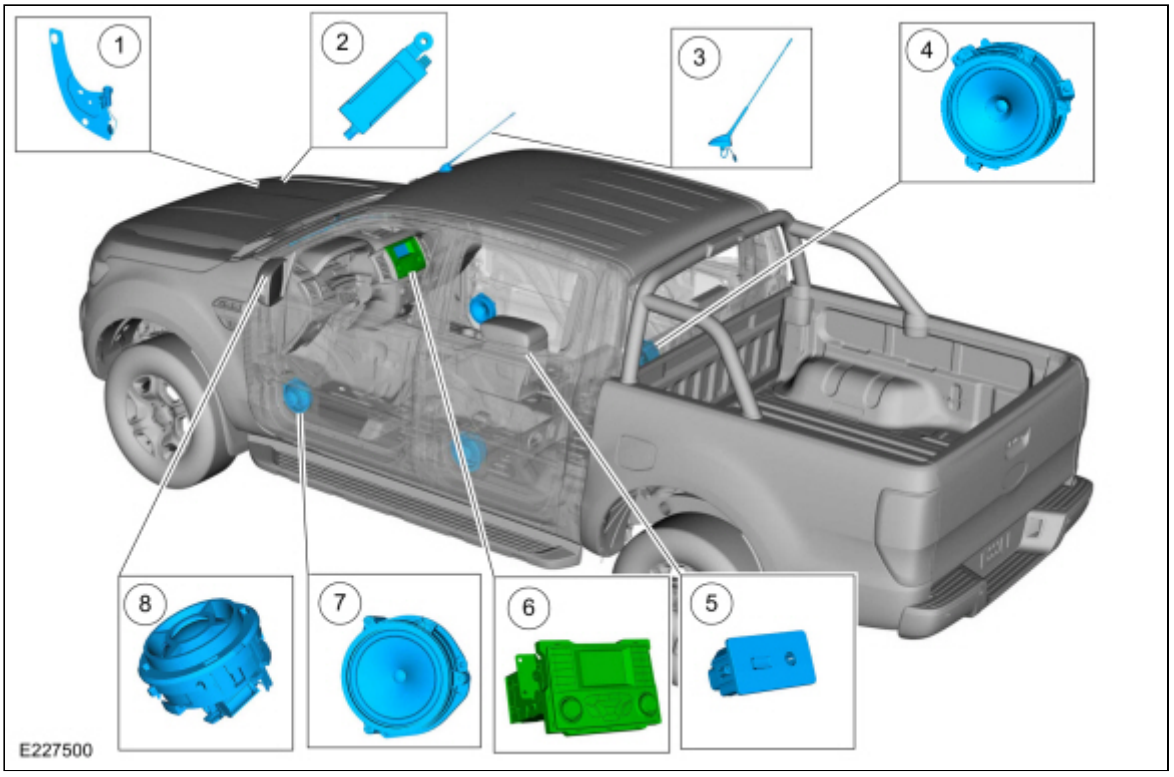
Information and Entertainment System - Component Location

SINGLE CAB



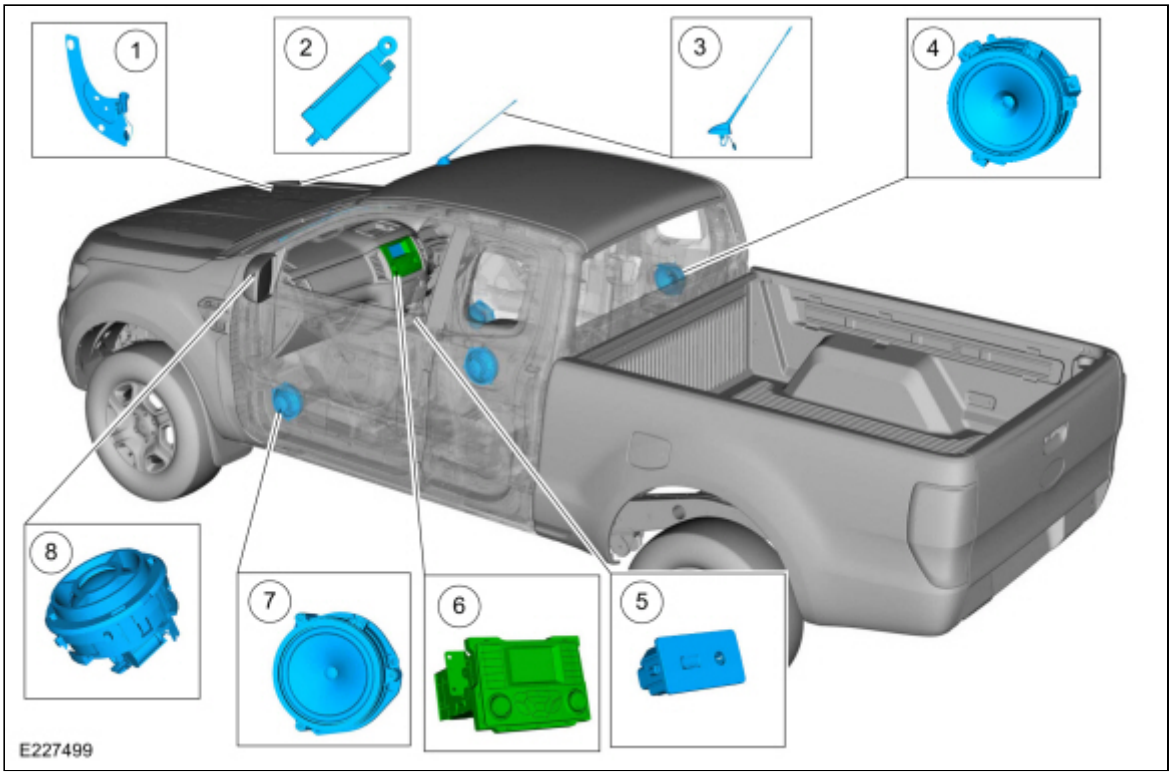
Item	Part Number	Description
1	—	Front fender mounted antenna-FM (frequency modulation) 2 diversity antenna
2	—	Audio unit antenna amplifier
3	—	Roof mounted antenna-AM (amplitude modulation)/FM (frequency modulation) 1/DAB (digital audio broadcasting) antennna
4	—	Audio input jack
5	—	ACM (audio front control module)
6	—	Front door speaker
7	—	Front tweeter speaker

DOUBLE CAB



Item	Part Number	Description
1	—	Front fender mounted antenna-FM (frequency modulation) 2 diversity antenna
2	—	Audio unit antenna amplifier
3	—	Roof mounted antenna-AM (amplitude modulation)/FM (frequency modulation) 1/DAB (digital audio broadcasting) antennna
4	—	Rear door speaker
5	—	Audio input jack
6	—	ACM (audio front control module)
7	—	Front door speaker
8	—	Front tweeter speaker

STRETCH CAB



Item	Part Number	Description
1	—	Front fender mounted antenna-FM (frequency modulation) 2 diversity antenna
2	—	Audio unit antenna amplifier
3	—	Roof mounted antenna-AM (amplitude modulation)/FM (frequency modulation) 1/DAB (digital audio broadcasting) antennna
4	—	Rear door speaker
5	—	Audio input jack
6	—	ACM (audio front control module)
7	—	Front door speaker
8	—	Front tweeter speaker

Copyright © 2016 Ford Motor Company

Information and Entertainment System - Overview

Overview

The audio system consists of the following:

Main Components:

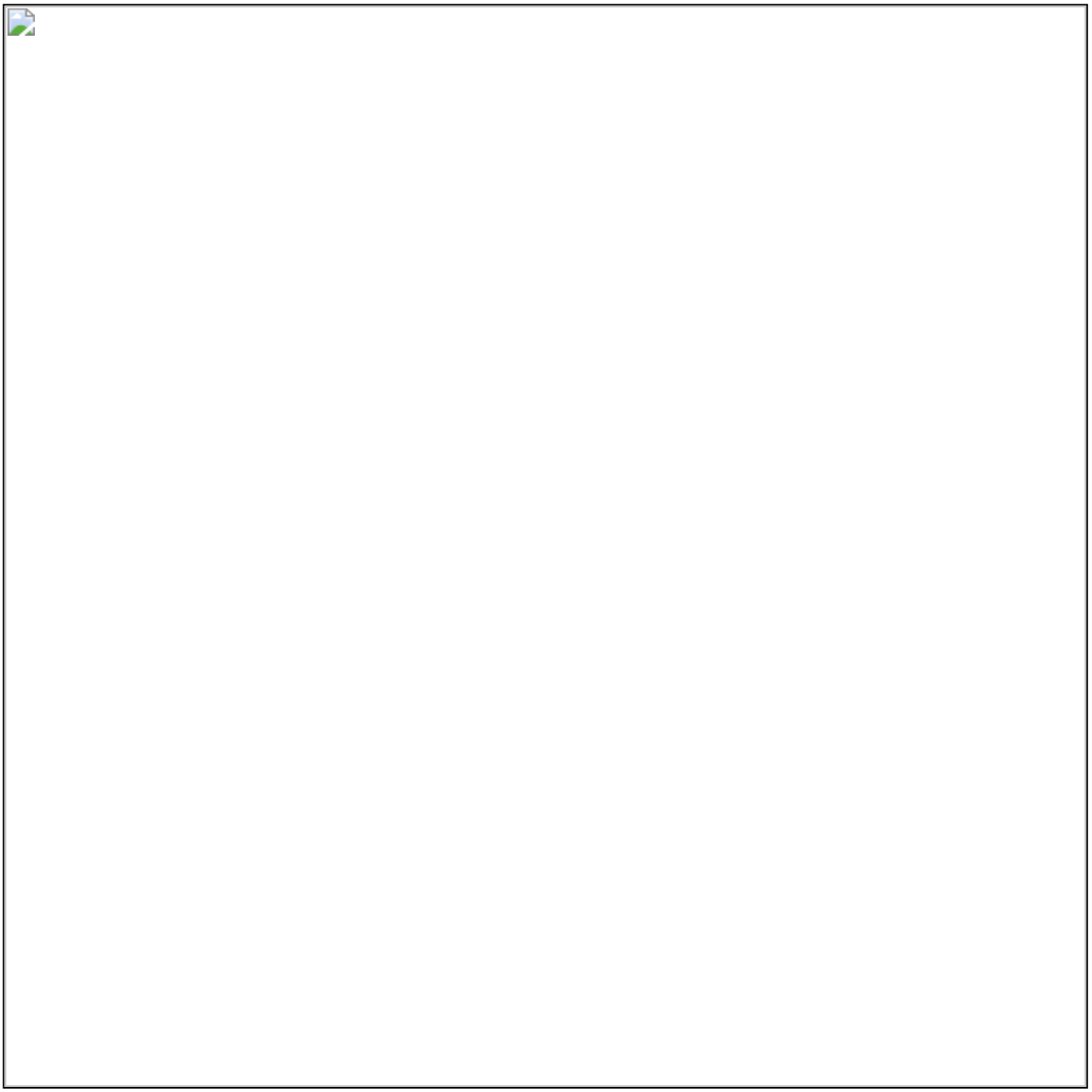
- AM/ FM antenna
- Front door speakers
- Rear door speakers
- Front door tweeters
- ACM (with integral USB port and Bluetooth)
- Audio input jack

Copyright © 2016 Ford Motor Company

Information and Entertainment System - System Operation and Component Description

System Operation

System Diagram



AM/ FM1/ FM2/ DAB Radio With Diversity Antenna

The AM/ FM1/ DAB antennas receives analog radio waves and sends them through the antenna amplifier and AM/ FM1/ DAB antenna coaxial cable to the ACM. The FM2 antenna receives analog radio waves and sends them through the FM2 diversity antenna amplifier and FM2 antenna coaxial cable to the ACM. The radio waves are converted into fluctuating AC voltage and sent as left and right analog audio signals to the audio amplifier and all speakers.

AM/ FM1/ FM2 Radio Without Diversity Antenna

The AM/ FM1 antenna receives the AM/ FM radio signals. The antenna modules sends the radio signals to the ACM.

Audio Input Jack Mode

When a portable audio device, such as an iPod® or other MP3 player, is connected to the vehicle audio system through the audio input jack, audio from the device can be played through the vehicle speakers. When using the audio input jack, only the volume is controlled by the vehicle audio controls. All other functions such as seek, fast forward, pause, etc. must be carried out on the device itself.

No metadata (information such as artist, album title, song title, and genre) is transferred when a device is connected to the audio input jack.

Bluetooth Mode

Bluetooth is a secure, short-range radio frequency that allows devices to communicate wirelessly through radio waves. The operating range of a Bluetooth signal is application specific, but will have a minimum range of 10 meters (33 feet). The Bluetooth interface can accommodate both Bluetooth-enabled mobile phones and Bluetooth-enabled media devices. The ACM contains an on-board Bluetooth chipset, which enables certain wireless devices to interact with the system.

Any Bluetooth device used with the audio system must first be paired with the ACM on-board Bluetooth chipset before it can become operational. Pairing a Bluetooth device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the ACM generates a unique PIN that must be entered on the Bluetooth device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For information on the pairing process, refer to the Owner's Literature.

The system can store up to 12 unique Bluetooth devices, but only one Bluetooth device can be connected to the system at any one time. If an additional Bluetooth device is paired and made active, the ACM disconnects any active connection and establishes a connection with the new device.

USB Mode

When a portable media device, such as an iPod® with its available cable or portable mass storage such as a USB thumb drive, is connected to the vehicle audio system through the USB port, audio from the device can be played through the vehicle speakers. Functions such as volume, seek, fast forward, pause, etc. can be controlled by the vehicle audio controls.

When playing media files stored on a mass storage device such as a flash drive, the audio system only plays files that do not have DRM protection.

In addition to audio information (track length, track number, etc.), song metadata (information such as artist, album title, song title, and genre) may also be retrieved from a device connected to the USB port. The ACM uses the metadata to create indexes that can be used to sort for particular music based on the customer’s preferences. When a new media device is connected to the USB port, the ACM automatically indexes the information. This may take several minutes depending on the amount of data on the device, and is considered normal operation.

Component Description

ACM

The ACM can be operated with the ignition in RUN, ACC or OFF. This feature allows the audio system to operate with the ignition OFF, regardless of door latch position. When the power button is pressed ON, audio system functionality is enabled and remains active for a period of 60 minutes. Audio extended play will not function if the battery load shed is active. To turn the audio system off, press the power button OFF.

The ACM processes all inputs from the various audio sources and sends stereo or mono audio signals to the speakers as fluctuating AC voltage.

The USB port and Bluetooth interface are integral to the ACM.

Antenna

The AM/ FM radio uses the roof-mounted combination AM/ FM antenna to receive analog radio waves. The DAB radio waves are sent through the AM/ FM2 antenna coaxial cable to the ACM, where they are amplified. A second FM 2 foil antenna is mounted under the splash shield next to the bumper for diversity functionality.

Audio Input Jack

The audio input jack can be used to play audio files from an audio device connected through a 1/8-inch (3.5 mm) audio jack. Audio signals are sent from the audio input jack through shielded circuits to the ACM.

There are no power or ground circuits connected to the audio input jack.

Copyright © 2016 Ford Motor Company

Information and Entertainment System

DTC Chart: ACM

DTC	Description	Action
B10B8:23	Push Buttons - Signal Stuck Low	GO to Pinpoint Test L
B10BD:11	Multifunction Switch: Circuit Short To Ground	GO to Pinpoint Test O
B10BD:13	Multifunction Switch: Circuit Open	GO to Pinpoint Test O
B10BD:23	Multifunction Switch: Signal Stuck Low	GO to Pinpoint Test O
B1A01:11	Speaker #1: Circuit Short To Ground	• For a LHF door speaker concern, GO to Pinpoint Test E • For a LHF door tweeter speaker concern, GO to Pinpoint Test F
B1A01:15	Speaker #1: Circuit Short To Battery Or Open	• For a LHF door speaker concern, GO to Pinpoint Test E • For a LHF door tweeter speaker concern, GO to Pinpoint Test F
B1A02:11	Speaker #2: Circuit Short To Ground	• For a RHF door speaker concern, GO to Pinpoint Test G • For a RHF door tweeter speaker concern, GO to Pinpoint Test H
B1A02:15	Speaker #2: Circuit Short To Battery Or Open	• For a RHF door speaker concern, GO to Pinpoint Test G • For a RHF door tweeter speaker concern, GO to Pinpoint Test H
B1A03:11	Speaker #3: Circuit Short To Ground	• For a RHR door speaker concern, GO to Pinpoint Test I
B1A03:15	Speaker #3: Circuit Short To Battery Or Open	• For a RHR door speaker concern, GO to Pinpoint Test I
B1A04:11	Speaker #4: Circuit Short To Ground	• For a LHR door speaker concern, GO to Pinpoint Test J
B1A04:15	Speaker #4: Circuit Short To Battery Or Open	• For a LHR door speaker concern, GO to Pinpoint Test J
B1A56:11	Antenna #1 Circuit Short To Ground	GO to Pinpoint Test A
B1A56:15	Antenna #1 Circuit Short To Battery Or Open	GO to Pinpoint Test A
B1D55:11	Antenna #2 Circuit Short To Ground	GO to Pinpoint Test A
B1D55:15	Antenna #2 Circuit Short To Battery Or Open	GO to Pinpoint Test A
B1252:11	USB Port: Circuit Short To Ground	GO to Pinpoint Test M
B1D79:11	Microphone Input: Circuit Short To Ground	GO to Pinpoint Test P
B1D79:15	Microphone Input: Circuit Short To Battery Or Open	GO to Pinpoint Test P
U0074:88	Control Module Communication	• The module could not communicate on the network at a point

	Bus "B" Off: Bus Off	in time. The fault is not currently present since the module had to communicate with the diagnostic scan tool to report this DTC • CLEAR the DTC. • Wait at least 10 seconds. • REPEAT the network test. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). • VERIFY the integrity of the connectors and wiring. Refer to Wiring Diagrams Cell 14 for schematic and connector information.
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test Q
U0422:68	Invalid Data Received From Body Control Module: Event Information	This DTC sets when the ACM receives invalid network data from the BCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the BCM and other modules on the network. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the BCM , DIAGNOSE the observable symptom.
U0423:68	Invalid Data Received From Instrument Panel Cluster (IPC) Control Module: Event Information	This DTC sets when the ACM receives invalid network data from the IPC. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the IPC and other modules on the network. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the IPC, DIAGNOSE the observable symptom.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM the ACM PMI procedure as directed by the diagnostic scan tool. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:49 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test R
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test S

DTC Chart: SCCM

DTC	Description	Action
B1380:09	Steering Wheel Right Switch Pack: Component Failure	GO to Pinpoint Test N
B1380:09	Steering Wheel Right Switch Pack: Circuit Short To Ground	GO to Pinpoint Test N
B1380:09	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	GO to Pinpoint Test N
All other Diagnostic Trouble Codes (DTCs)	—	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Symptom Charts

Symptom Chart: General Audio System

Condition	Possible Sources	Actions
The ACM is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test L
One or more ACM buttons are inoperative or do not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test L
The speed compensated volume does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test B
The ACM illumination is inoperative	• Illumination system concern • ACM	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
The audio input jack is inoperative or does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test K
The USB port is inoperative or does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test M
During a phone call, poor quality or no outgoing audio is heard on the outside device or the microphone is inoperable	Refer to the Pinpoint Test	GO to Pinpoint Test P

Symptom Chart: Sound Quality

Condition	Possible Sources	Actions
Poor reception - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
Continuous seek or scan - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
Poor sound quality or distorted sound from one or more speakers (not all speakers)	Refer to the Pinpoint Test	GO to Pinpoint Test C
No sound from all speakers	Refer to the Pinpoint Test	GO to Pinpoint Test D
The LHF door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test E
The LHF door tweeter speaker is inoperative	Refer to the Pinpoint	GO to Pinpoint

	Test	Test F
The RHF door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test G
The RHF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test H
The RHR door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test I
The LHR door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test J

Pinpoint Tests

Poor Reception Or Continuous Seek Or Scan - AM/ FM

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A56:11	Antenna #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the FM1 antenna coaxial cable for more than 1 second.
B1A56:15	Antenna #1: Circuit Short To Battery or Open	Set by the ACM when a short to voltage or open is detected on the FM1 antenna coaxial cable for more than 1 second.
B1D55:11	Antenna #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the FM2 antenna coaxial cable for more than 1 second.
B1D55:15	Antenna #2: Circuit Short To Battery or Open	Set by the ACM when a short to voltage or open is detected on the FM2 antenna coaxial cable for more than 1 second.

Possible Sources

- No channel found in the selected RDS category
- Charging system
- Wiring, terminals, or connectors
- Ignition system
- FM2 antenna
- AM/ FM1 antenna coaxial cable
- FM2 antenna coaxial cable
- AM/ FM1 antenna
- Mounting surface corrosion
- FM2 diversity antenna amplifier
- ACM

PINPOINT TEST A : POOR RECEPTION OR CONTINUOUS SEEK OR SCAN - AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION)

A1 CHECK THE AUDIO SYSTEM RECEPTION WITH THE ENGINE RUNNING
• Operate the audio system in AM/ FM mode.

- Check the reception with the engine running, and with the engine off.

Is poor reception only present with the engine running?

Yes	GO to A2
No	GO to A3

A2 CHECK THE GENERATOR

- Ignition OFF.
- Disconnect Generator B+ Cable C102C.**NOTICE: Do not allow the generator B+ cable terminal to make contact with a conductive surface. Failure to follow this instruction may result in personal injury or damage to the vehicle.**
- Start the engine.
- Operate the audio system in AM/ FM mode.

Is the reception OK?

Yes	INSTALL a new generator. Refer to the appropriate section in Group 414 for the procedure.
No	GO to A3

A3 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR CORRECT VOLTAGE

- Ignition OFF.
- Disconnect Antenna C4823.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4823-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A6
No	GO to A4

A4 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect ACM C240A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4823-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A5
No	REPAIR the circuit

No	REPAIR the circuit.

A5 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4823-1	Ω	C240A-2

Is the resistance less than 3 ohms?

Yes	GO to A21
No	REPAIR the circuit.

A6 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: AM/ FM1 antenna coaxial cable at the ACM.
- Disconnect: FM2 antenna coaxial cable at the ACM.
- Disconnect: AM/ FM1 antenna coaxial cable at the antenna.
- Disconnect: FM2 antenna inline coaxial cable at the antenna.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	V	Ground
AM/ FM1 antenna coaxial cable shield at the ACM	V	Ground
FM2 antenna coaxial cable core at the ACM	V	Ground
FM2 antenna coaxial cable shield at the ACM	V	Ground

Is any voltage present?

Yes	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable.
No	GO to A7

A7 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground
FM2 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A8
No	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable.

A8 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna connection
AM/ FM1 antenna coaxial cable shield at the ACM	Ω	AM/ FM1 antenna connection
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna connection
FM2antenna coaxial cable shield at the ACM	Ω	FM2 antenna connection

Are the resistances less than 1 ohm?

Yes	GO to A9
No	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable.

A9 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna coaxial cable shield at the ACM
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A10
No	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable.

A10 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: AM/ FM1 antenna coaxial cable at the antenna unit.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

AM/ FM1 antenna coaxial cable core at the ACM		Ground
AM/ FM1 antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to A11

A11 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	INSTALL a new AM/ FM1 antenna. REFER to: Roof Mounted Antenna (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).

A12 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A13
No	INSTALL a new AM/ FM1 antenna. REFER to: Roof Mounted Antenna (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).

A13 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A15
No	GO to A14

A14 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the AM/ FM1 antenna unit.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna unit shield at the antenna unit (component side)	Ω	AM/ FM1 antenna base (unpainted surface)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on the antenna unit base and/or vehicle mounting surface. REINSTALL the antenna and ensure the proper torque value is achieved. REFER to: Roof Mounted Antenna (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	INSTALL a new AM/ FM1 antenna. REFER to: Roof Mounted Antenna (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).

A15 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: FM2 antenna coaxial cable at the FM2 Diversity Antenna Amplifier.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	V	Ground
FM2 antenna coaxial cable shield at the ACM	V	Ground

Is any voltage present?

Yes	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to A16

A16 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A17
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

A17 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A18
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

A18 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A20
No	GO to A19

A19 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the FM2 diversity antenna amplifier.
  REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna shield at the FM2 diversity antenna amplifier (component side)	Ω	FM2 diversity antenna amplifier base (unpainted surface on the mounting tab)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on theFM2 diversity antenna amplifier base and/or vehicle mounting surface. REINSTALL the FM2 diversity antenna amplifier and ensure the proper torque value is achieved. REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

A20 CHECK THE FM (FREQUENCY MODULATION) 2 ANTENNA COMPONENTS

- Disconnect and inspect the FM2 diversity antenna amplifier connector for the FM2 antenna circuits.
  REFER to: Audio Unit Antenna Amplifier (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Inspect the FM2 antenna circuits and connectors.

Is any damage present on the FM2 antenna circuits or connections?

Yes	REPAIR or REPLACE as necessary.
No	GO to A21

A21 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Speed Compensated Volume Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

Possible Sources

- Speed compensated volume setting
- ACM

PINPOINT TEST B : THE SPEED COMPENSATED VOLUME DOES NOT OPERATE CORRECTLY

B1 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and observe the speedometer.

Does the speedometer operate correctly?

Yes	GO to B2
No	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

B2 CHECK THE SPEED COMPENSATED VOLUME SETTING

- Turn the speed compensated volume off. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- Set the speed compensated volume to maximum compensation. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.

Does the volume remain constant with the speed compensated volume turned off, and increase and decrease with vehicle speed with the speed compensated volume set to maximum?

Yes	The system is operating correctly at this time. INSTRUCT the customer in the correct usage of the speed compensated volume feature.
No	GO to B3

B3 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 retrieved in any audio system module?

Yes	GO to Pinpoint Test Q
No	GO to B4

B4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Poor Sound Quality Or Distorted Sound From One Or More Speakers (Not All Speakers)

Normal Operation and Fault Conditions

The ACM sends audio signals to the speakers in the form of AC voltage, resulting in clear audio output.

Possible Sources

- Loose component fasteners
- Loose door handle, lock, and other trim panel components and fasteners
- Loose items in storage areas
- Loose speaker grilles
- Loose wire harnesses or wire harness fasteners
- Speaker(s)
- Water shield bonding and placement

Visual Inspection and Diagnostic Pre-checks

Inspect the suspect area for any possible rattle conditions such as:

- Any storage compartments including cup holders (if equipped)
- Door map pockets for contents that can rattle (if equipped)
- Door pull cup attachments (if equipped)
- Door switch bezels (if equipped)
- Package tray (if equipped)
- Speaker grilles
- Loose trim panels and/or fasteners

PINPOINT TEST C : POOR SOUND QUALITY OR DISTORTED SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

C1 ISOLATE THE ZONE

- Ignition ON.
- Operate the audio system using digital media (Bluetooth or USB input).
- Using the audio system fade and balance feature, adjust the audio sound to each of the four zones (Left Front (LF), Right Front (RF), Left Rear (LR), and Right Rear (RR) of the vehicle to isolate the poor sound quality.
- Locate and apply pressure to the trim panel(s) around the poor sound quality area in question.

Does applying pressure to a trim panel reduce or eliminate the audible noise?

Yes	REPAIR or REPLACE the trim panel as needed.
No	GO to C2

C2 REMOVE AND INSPECT BEHIND/UNDERNEATH THE SUSPECT TRIM PANEL(S)

- Remove the trim panel to access the suspect speaker.
- Operate the audio system using digital media USB input.
- Validate where the poor sound quality area is located.
- Check:
  - Trim panel for loose components around the speaker area such as the speaker grille.

- Trim panel joining components for missing or broken pieces.
- Lock and handle mechanical parts for correct attachment.
- Wire harnesses for correct routing.
- Wire harness fasteners for correct attachment.
- Water shield for correct placement (speaker air path not blocked).
- Water shield for correct bonding to sheet metal.
- Storage areas for loose items.
- All child safety belt anchors (if equipped).
- All safety belt retractors.
- All speaker bracket fasteners and other fasteners are secured and tightened to specified torque.

Was the source of the noise located?

Yes	REPAIR or REPLACE any loose or broken component or fastener as needed.
No	GO to C3

C3 CHECK THE SUSPECT SPEAKER FOR WATER INTRUSION

- Inspect for watermarks.
- Check the:
  - Cone
  - Magnet
  - Basket

Are any watermarks present on the speaker?

Yes	VERIFY the water shield is in the correct location, REPAIR or REPLACE any trim, door, or speaker seal as required. DRY the speaker in question and TEST the system for normal operation.
No	GO to C4

C4 ISOLATE SPEAKER TO VERIFY NOISE

- Remove the suspect speaker from its location and leave the speaker connected to the harness.
- Hold the speaker away from any trim panel(s) and ensure the speaker is isolated from contact.
- Operate the audio system using digital media USB input.

Is the noise still present in the suspect speaker?

Yes	INSTALL a new speaker for the one in question.
No	LOCATE the source of the noise and REPAIR as needed.

No Sound From All Speakers

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

A short to ground in the circuitry to one of the speakers may cause multiple speakers to lose sound due to the built-in overload protection feature of the ACM. In this case, a speaker fault DTC sets.

Possible Source Diagnosed In This Pinpoint Test

- Wiring, terminals, or connectors
- ACM

PINPOINT TEST D : NO SOUND FROM ALL SPEAKERS

D1 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM pass the network test?

Yes	GO to D2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D2 CHECK FOR SPEAKER DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the ACM self-test.

Are any speaker fault Diagnostic Trouble Codes (DTCs) present?

Yes	See DTC Chart: ACM.
No	GO to D3

D3 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - corrosion (clean module pins or install new connectors or terminals)
  - damaged or bent pins (install new terminals or pins)
  - pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:11	Speaker #1: Circuit	Set by the ACM when a short to ground is detected on the LHF door or LHF door

	Short To Ground	tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:15	Speaker #1: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or an open is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:15 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST E : THE LHF (LEFT-HAND FRONT) DOOR SPEAKER IS INOPERATIVE

E1 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C6003RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	V~	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	V~	C6003-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to E2

E2 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	+ V~ −	Ground

C5003-4	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	V	Ground
C6003-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to E3

E3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C536LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C613RHD Vehicles .
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	Ground
C5003-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	Ground
C6003-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to E4
No	REPAIR the circuit in question.

E4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C240A-22
C5003-4	Ω	C240A-10

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C240A-23
C6003-4	Ω	C240A-11

Are the resistances less than 3 ohms?

Yes	GO to E5
No	REPAIR the circuit in question.

E5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C6003-4

Is the resistance greater than 10,000 ohms?

Yes	GO to E6
No	REPAIR the circuit in question.

E6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)

- Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:15	Speaker #1: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or an open is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:15 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST F : THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

F1 CHECK THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the LHF door speaker operate correctly?

Yes	GO to F2
No	GO to Pinpoint Test E

F2 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C536LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C613RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	V~	C536-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	V~	C613-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	GO to F3

F3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C6003RHD Vehicles .
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	+ V −	Ground
C536-3	+ V −	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	+ V −	Ground
C613-3	+ V −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to F4

F4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	Ω	Ground
C536-3	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	Ω	Ground
C613-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to F5
No	REPAIR the circuit in question.

F5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	Ω	C5003-2
C536-3	Ω	C5003-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	Ω	C6003-2
C613-3	Ω	C6003-3

Are the resistances less than 3 ohms?

Yes	GO to F6
No	REPAIR the circuit in question.

F6 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	Ω	C536-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	Ω	C613-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHF Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

The RHF door speaker and RHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:15	Speaker #2: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or an open is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:15 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST G : THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER IS INOPERATIVE

G1 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles .
- Disconnect RHF Door Speaker C5015RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	V~	C6015-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	V~	C5015-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to G2

G2 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	V	Ground
C6015-4	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1		Ground
C5015-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to G3

G3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles.
- Disconnect RHF Door Tweeter Speaker C5012RHD Vehicles.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	Ground
C6015-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	Ground
C5015-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to G4
No	REPAIR the circuit in question.

G4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C240A-23

C6015-4	Ω	C240A-11

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C240A-22
C5015-4	Ω	C240A-10

Are the resistances less than 3 ohms?

Yes	GO to G5
No	REPAIR the circuit in question.

G5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C6015-4

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C5015-4

Is the resistance greater than 10,000 ohms?

Yes	GO to G6
No	REPAIR the circuit in question.

G6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

The RHF door speaker and RHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:15	Speaker #2: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or an open is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:15 is set, the speaker output is disabled.

PINPOINT TEST H : THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

H1 CHECK THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the RHF door speaker operate correctly?

Yes	GO to H2
No	GO to Pinpoint Test G

H2 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles.
- Disconnect RHF Door Tweeter Speaker C5012RHD Vehicles.
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1		C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1		C5012-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	GO to H3

H3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles.
- Disconnect RHF Door Speaker C5015RHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1		Ground
C6012-3		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1		Ground
C5012-3		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to H4

H4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	Ground
C6012-3	Ω	Ground

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	Ground
C5012-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to H5
No	REPAIR the circuit in question.

H5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6015-2
C6012-3	Ω	C6015-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5015-2
C5012-3	Ω	C5015-3

Are the resistances less than 3 ohms?

Yes	GO to H6
No	REPAIR the circuit in question.

H6 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5012-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A03:11	Speaker #3: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHR door circuits. When DTC B1A03:11 is set, the speaker output is disabled.
B1A03:15	Speaker #3: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or an open is detected on the RHR door circuits. When DTC B1A03:15 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST I : THE RHR (RIGHT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

I1 CHECK THE AUDIO SIGNAL TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER
• Ignition OFF. • Disconnect RHR Door Speaker C802.

- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	V~	C802-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHR door speaker. REFER to: Rear Door Speaker RH (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	GO to I2

I2 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	+ V⎓ −	Ground
C802-4	+ V⎓ −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to I3

I3 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	Ground
C802-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to I4
No	REPAIR the circuit in question.

I4 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C240A-24
C802-4	Ω	C240A-12

Are the resistances less than 3 ohms?

Yes	GO to I5
No	REPAIR the circuit in question.

I5 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C802-4

Is the resistance greater than 10,000 ohms?

Yes	GO to I6
No	REPAIR the circuit in question.

I6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A04:11	Speaker #4: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHR door circuits. When DTC B1A04:11 is set, the speaker output is disabled.
B1A04:15	Speaker #4: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or an open is detected on the LHR door circuits. When DTC B1A04:15 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST J : THE LHR (LEFT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

J1 CHECK THE AUDIO SIGNAL TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHR Door Speaker C702.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	V~	C702-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHR door speaker. REFER to: Rear Door Speaker LH (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	GO to J2

J2 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C702-1	V	Ground
C702-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to J3

J3 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	Ground
C702-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J4
No	REPAIR the circuit in question.

J4 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C240A-21
C702-4	Ω	C240A-9

Are the resistances less than 3 ohms?

Yes	GO to J5
No	REPAIR the circuit in question.

J5 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C702-4

Is the resistance greater than 10,000 ohms?

Yes	GO to J6
No	REPAIR the circuit in question.

J6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - corrosion (clean module pins or install new connectors or terminals)
  - damaged or bent pins (install new terminals or pins)
  - pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Audio Input Jack Is Inoperative Or Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

Possible Sources

- Customer's device
- Wiring, terminals, or connectors
- Audio input jack
- ACM

PINPOINT TEST K : THE AUDIO INPUT JACK IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

K1 CHECK THE AUDIO INPUT JACK AUDIO FUNCTIONALITY

- Connect MIT 420-373 .
- Ignition ON.
- Using the MIT 420-373, attempt to play an audio file using the audio input jack.
- Operate the audio system in line mode and observe the audio output.

Is the audio output operating correctly for the audio input jack?

Yes	The system is operating correctly at this time. The concern is with the customer's device.
No	GO to K2

K2 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE

K2 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Audio Input Jack C3077.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3077-1	V	Ground
C3077-3	V	Ground
C3077-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to K3

K3 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3077-1	Ω	Ground
C3077-3	Ω	Ground
C3077-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to K4
No	REPAIR the circuit.

K4 CHECK THE AUDIO INPUT JACK CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3077-1	Ω	C240A-17
C3077-3	Ω	C240A-18
C3077-4	Ω	C240A-5

Are the resistances less than 3 ohms?

Yes	GO to K5

No	REPAIR the circuit in question.

K5 ISOLATE THE AUDIO INPUT JACK

- Install a new audio input jack.
  REFER to: Audio Input Jack (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
- Connect ACM C240A.
- Connect MIT 420-373.
- Ignition ON.
- Using the MIT 420-373, attempt to play an audio file using the audio input jack.

Is the audio output OK for the audio input jack?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative audio input jack.
No	GO to K6

K6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - corrosion (clean module pins or install new connectors or terminals)
  - damaged or bent pins (install new terminals or pins)
  - pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

ACM Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10B8:23	Push Buttons: Signal Stuck Low	Set by the ACM when a short to ground is detected.

Possible Sources

- Fuse(s)
- Wiring, terminals, or connectors
- Dust, dirt or other debris
- ACM

PINPOINT TEST L : THE ACM (AUDIO FRONT CONTROL MODULE) IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

L1 VERIFY THE OPERATION OF THE ACM (AUDIO FRONT CONTROL MODULE) BUTTONS

- Ignition ON.
- Operate all of the ACM buttons and check for proper operation.

Do all of the buttons work properly?

Yes	The system is operating correctly at this time.
No	If some (but not all) of the buttons do not work properly, GO to L2 If all of the buttons do not work properly or the ACM does not turn on, GO to L3

L2 CHECK FOR DEBRIS

- Ignition OFF.
- Carefully inspect the suspect ACM buttons for dust, dirt or other debris.

Is any dust, dirt or other debris found?

Yes	CLEAN as necessary.
No	INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).

L3 CHECK THE ACM (AUDIO FRONT CONTROL MODULE) VOLTAGE SUPPLY

- Disconnect ACM C240A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to L4
No	VERIFY that BCM fuse is in good condition. If fuse is in good condition, REPAIR the circuit.

L4 CHECK THE ACM (AUDIO FRONT CONTROL MODULE) GROUND CIRCUITS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-13	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to L5
No	REPAIR the circuit.

L5 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - corrosion (clean module pins or install new connectors or terminals)
  - damaged or bent pins (install new terminals or pins)
  - pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The USB Port Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1252:11	USB Port: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the USB input.

Possible Sources

- Customer device
- USB port
- USB cable
- ACM

PINPOINT TEST M : THE USB (UNIVERSAL SERIAL BUS) PORT IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

M1 CHECK THE USB (UNIVERSAL SERIAL BUS) PORTS

- Remove any devices connected to the USB port.
- Ignition OFF.
- Ensure the front doors of the vehicle are closed, then open and close the driver's door and wait at least 10 seconds to disable the accessory delay feature.
- Ignition ON.
- Connect MIT 420-373 to the USB port.

- Select USB mode on the MIT.
- Operate the audio system in USB mode and observe the audio output.

Is the audio system USB output OK with the MIT 420-373 connected to the USB port?

Yes	GO to M2
No	GO to M3

M2 RETEST THE CUSTOMER'S DEVICE

- Connect the customer's device and test the audio output to the USB port.

Is the audio system USB output OK with the customer's device connected to the USB port?

Yes	The system is operating correctly at this time. The concern may have been caused by a faulty USB device previously connected to the USB port.
No	The fault is with the customer's device.

M3 VERIFY THE OPERATION OF THE USB (UNIVERSAL SERIAL BUS) CABLE

- Disconnect: USB cable from the USB port.
  REFER to: Media Hub (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
- Connect MIT 420-373 to the USB Adaptor.
- Select USB mode on the MIT 420-373.
- Operate the audio system in USB mode and observe the audio output.

Is the audio system USB output OK?

Yes	INSTALL a new USB port. REFER to: Media Hub (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	GO to M4

M4 INSPECT THE USB (UNIVERSAL SERIAL BUS) CABLE AND ACM (AUDIO FRONT CONTROL MODULE)

- Ignition OFF.
- Disconnect: USB cable from the ACM.
  REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
- Inspect the USB cable, USB cable ends, and the ACM USB connector port for damage. Remove any debris.

Is any damage present?

Yes	• For the USB cable, INSTALL a new USB cable. • For the ACM, INSTALL a new ACM
No	GO to M5

M5 ISOLATE THE USB (UNIVERSAL SERIAL BUS) CABLE

- Install a new USB cable.
- Connect: USB cable to the ACM.
- Connect: MIT 420-373 to the USB Adaptor.
- Select USB mode on the MIT 420-373.
- Operate the audio system in USB mode and observe the audio output.

Is the audio system USB output OK?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative USB cable.
No	GO to M6

M6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - corrosion (clean module pins or install new connectors or terminals)
  - damaged or bent pins (install new terminals or pins)
  - pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Steering Wheel Multifunction Switches Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1380:09	Steering Wheel Right Switch Pack: Component Failure	Set by the SCCM when the steering wheel switch is input is shorted to ground.
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	Set by the SCCM when an open is detected on the input.
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	Set by the SCCM when the steering wheel switch is stuck for more than 2 minutes during normal operation.

Possible Sources

- Steering wheel switch
- Wiring, terminals, or connectors
- Clockspring
- SCCM

PINPOINT TEST N : THE STEERING WHEEL MULTIFUNCTION SWITCHES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

N1 CHECK THE STEERING WHEEL PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Monitor the steering wheel switch Parameter Identifications (PIDs) while pressing each multimedia steering wheel switch.
  - Voice (SW_VOICE)
  - Mute (SW_MUTE)
  - Volume + (SW_VOLUP)
  - Volume - (SW_VOLDOWN)
  - Seek-/Phone (SW_SEEKMINUS)/(SW_PHONE)
  - Seek+/End (SW_SEEKPLUS)/(SW_END)

Do the PID values agree with the switch positions?

Yes	GO to N10
No	• If one or more, but not all PID values are incorrect or always read one particular switch position, INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). • If all PID values are incorrect or always read one particular switch position, GO to N2

N2 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DTC (DIAGNOSTIC TROUBLE CODE) U0212:00

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) from the IPC.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U0212:00 present?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to N3

N3 CHECK FOR VOLTAGE FROM THE SCCM (STEERING COLUMN CONTROL MODULE)

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect Steering Wheel Switch C2491.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	V	C2491-5
C2491-6	V	C2491-5
C2491-7	V	C2491-5

Is approximately 5 volts present?

Yes	INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	GO to N4

N4 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	Ω	Ground
C2491-5	Ω	Ground
C2491-6	Ω	Ground
C2491-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N5
No	INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).

N5 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	Ω	C218B-6
C2491-5	Ω	C218B-7
C2491-6	Ω	C218B-16
C2491-7	Ω	C218B-15

Are the resistances less than 3 ohms?

Yes	GO to N6
No	INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).

N6 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	Ω	C2491-6
C2491-4	Ω	C2491-7
C2491-4	Ω	C2491-5
C2491-6	Ω	C2491-7
C2491-6	Ω	C2491-5
C2491-7	Ω	C2491-5

Are the resistances greater than 10,000 ohms?

Yes	GO to N7
No	INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).

N7 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Connect Clockspring C218B.
- Disconnect Clockspring C218C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	Ω	Ground
C2491-5	Ω	Ground
C2491-6	Ω	Ground
C2491-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N8
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

N8 CHECK THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	Ω	C218C-5
C2491-5	Ω	C218C-7
C2491-6	Ω	C218C-10
C2491-7	Ω	C218C-8

Are the resistances less than 3 ohms?

Yes	GO to N9
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

N9 CHECK THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-4	Ω	C2491-6
C2491-4	Ω	C2491-7
C2491-4	Ω	C2491-5
C2491-6	Ω	C2491-7
C2491-6	Ω	C2491-5
C2491-7	Ω	C2491-5

Are the resistances greater than 10,000 ohms?

Yes	GO to N10
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

N10 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Steering Wheel Multifunction Switches Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10BD:11	Multifunction Switch: Circuit Short To Ground	Set by the ACM when the steering wheel switch is input is shorted to ground.
B10BD:13	Multifunction Switch: Circuit Open	Set by the ACM when an open is detected on the input.
B10BD:23	Multifunction Switch: Signal Stuck Low	Set by the ACM when the steering wheel switch is stuck for more than 2 minutes during normal operation.

Possible Sources

- Steering wheel switch
- Wiring, terminals, or connectors
- Clockspring
- ACM

PINPOINT TEST O : THE STEERING WHEEL MULTIFUNCTION SWITCHES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

O1 CHECK THE STEERING WHEEL SWITCH PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view the Parameter Identifications (PIDs).
- Monitor the steering wheel switch Parameter Identifications (PIDs) while pressing each steering wheel switch.
  - Voice (SW_VOICE)
  - Seek+ (SW_SEEKPLUS)
  - Seek– (SW_SEEKMINUS)
  - Volume+ (SW_VOLUP)
  - Volume- (SW_VOLDOWN)

Do the PID values agree with the switch positions?

Yes	GO to O15
No	• If one or more, but not all PID values are incorrect or always read one particular switch position, INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). • If all PID values are incorrect or always read one particular switch position, GO to O2

O2 CHECK FOR VOLTAGE FROM THE ACM (AUDIO FRONT CONTROL MODULE)

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect Steering Wheel Switch C2998.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-7	V	C2491-5

Is approximately 5 volts present?

Yes	INSTALL a new steering wheel multifunction switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	GO to O3

O3 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Clockspring C218C.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-7	V	Ground
C2491-5	V	Ground

Is any voltage present?

Yes	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .
No	GO to O4

O4 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-7	Ω	Ground
C2491-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O5
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .

O5 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead

C2491-7	Ω	C218C-11
C2491-5	Ω	C218C-10

Are the resistances less than 3 ohms?

Yes	GO to O6
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .

O6 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	C2998-4

Is the resistance greater than 10,000 ohms?

Yes	GO to O7
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .

O7 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Connect Clockspring C218C.
- Disconnect Clockspring C218B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	V	Ground
C2998-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to O8

O8 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	Ground
C2998-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O9
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

O9 CHECK THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	C218B-14 (Component Side)
C2998-4	Ω	C218B-12 (Component Side)

Are the resistances less than 3 ohms?

Yes	GO to O10
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

O10 CHECK THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	C2998-4

Is the resistance greater than 10,000 ohms?

Yes	GO to O11
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

O11 CHECK THE CIRCUITRY TO THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Connect Clockspring C218B.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	V	Ground
C2998-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to O12

O12 CHECK THE CIRCUITRY TO THE CLOCKSPRING FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	Ground
C2998-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O13
No	REPAIR the circuit in question.

O13 CHECK THE CIRCUITRY TO THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	C2383-46
C2998-4	Ω	C2383-47

Are the resistances less than 3 ohms?

Yes	GO to O14
No	REPAIR the circuit in question.

O14 CHECK THE CIRCUITRY TO THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-2	Ω	C2998-4

Is the resistance greater than 10,000 ohms?

Yes	GO to O15
No	REPAIR the circuit in question.

O15 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect the ACM and related in-line connectors.
• Repair:
  • corrosion (clean module pins or install new connectors or terminals)
  • damaged or bent pins (install new terminals or pins)
  • pushed-out pins (install new pins as necessary)
• Reconnect the ACM and related in-line connectors. Make sure it seats and latches correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

During a phone call, poor quality or no outgoing audio is heard on the outside device or the microphone is inoperable

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D79:11	Microphone Input: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the microphone circuits.
B1D79:15	Microphone Input: Circuit Short To Battery Or Open	Set by the ACM when a short to voltage or open is detected on the microphone circuits.

Possible Sources

- Wiring, terminals, or connectors
- Microphone
- ACM

PINPOINT TEST P : DURING A PHONE CALL, POOR QUALITY OR NO OUTGOING AUDIO IS HEARD ON THE OUTSIDE DEVICE OR THE MICROPHONE IS INOPERABLE

P1 CHECK THE AUDIBLE PROMPT FUNCTIONALITY
• Operate the audio system in AM/ FM mode. • Operate the VOICE steering wheel switch and listen for the audible prompt. **Does the system produce an audible prompt correctly; indicating voice recognition mode has been entered?**

Yes	GO to P3
No	GO to P2

P2 CHECK THE OPERATION OF THE STEERING WHEEL SWITCHES

- Operate the audio system in AM/ FM mode.
- Operate the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches.

Do the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches operate correctly?

Yes	GO to Pinpoint Test D
No	GO to P3

P3 CHECK THE MICROPHONE CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-4	V	Ground
C240A-16	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to P4

P4 CHECK THE MICROPHONE CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Microphone C9221.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-4	Ω	Ground
C240A-16	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to P5
No	REPAIR the circuit in question.

P5 CHECK THE MICROPHONE CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-16	Ω	C9221-2
C240A-4	Ω	C9221-3

Are the resistances less than 3 ohms?

Yes	GO to P6
No	REPAIR the circuit in question.

P6 CHECK THE MICROPHONE CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-4	Ω	C240A-16

Is the resistance greater than 10,000 ohms?

Yes	GO to P7
No	REPAIR the circuit in question.

P7 ISOLATE THE MICROPHONE

- Connect ACM C240A.
- Install a new microphone.
  REFER to: Microphone (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the audible prompt.
- Speak a command to test the voice recognition for normal operation.

Is the voice recognition functioning correctly?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative microphone.
No	GO to P8

P8 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With IPC U0155:00

Normal Operation and Fault Conditions

REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With IPC Control Module: No Sub Type Information	Set by the ACM when network messages are missing from the IPC for more than 5 seconds with the ignition in RUN.

Possible Source

- IPC

PINPOINT TEST Q : LOST COMMUNICATION WITH IPC (INSTRUMENT PANEL CLUSTER) U0155:00

Q1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to Q2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 set in the ACM?

Yes	GO to Q3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q3 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the IPC self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to Q4

Q4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test R • For DTC U3003:17, GO to Pinpoint Test S
No	GO to Q5

Q5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0155:00 set in more than one module?

Yes	GO to Q6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q6 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the IPC and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. For LHD vehicles, REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). For RHD vehicles, REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage Low U3003:16

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Set by the ACM when the supply voltage falls below 10 volts for at least 10 seconds during normal operation or for more than 250 milliseconds during the self-test.

Possible Sources

- Previous low battery voltage
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST R : BATTERY VOLTAGE LOW U3003:16

R1 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:16

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 15 seconds.
- Using a diagnostic scan tool, repeat the self-test for the module in question.

Is DTC U3003:16 still present?

Yes	GO to R2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

R2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test

Are any voltage-related DTC set in the PCM?

Yes	Refer to the appropriate section in Group 414 for the procedure.
No	GO to R3

R3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery fully charged and in good condition?

Yes	GO to R4
No	Refer to the appropriate section in Group 414 for the procedure.

R4 CHECK THE MODULE VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-1		Ground

Is the voltage within 0.2 volts of the recorded battery voltage?

Yes	GO to R5
No	REPAIR the circuit.

R5 CHECK THE MODULE GROUND CIRCUIT FOR CONTINUITY

- Measure the voltage at the suspect module.
- For the ACM, measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-1		C240A-13

Is the suspect module voltage greater than 11 volts?

Yes	GO to R6
No	REPAIR the circuit.

R6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage High U3003:17

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	Set by the ACM when the supply voltage is more than 15.8 volts for more than 250 milliseconds during normal operation or the self-test.

Possible Sources

- ACM

PINPOINT TEST S : BATTERY VOLTAGE HIGH U3003:17

S1 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the self-test for the module in question.

Is DTC U3003:17 present?

Yes	GO to S2
No	The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

S2 CHECK FOR HIGH VOLTAGE DIAGNOSTIC TROUBLE CODES (DTCS) SET IN MULTIPLE MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are high voltage Diagnostic Trouble Codes (DTCs) such as B1676, P0563, or U3003:17 set in more than one module?

Yes	Refer to the appropriate section in Group 414 for the procedure.
No	GO to S3

S3 CHECK THE BATTERY VOLTAGE

- Turn off all interior lights, exterior lights, and accessories.
- Start and run the engine at approximately 2,000 RPM for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	Refer to the appropriate section in Group 414 for the procedure.
No	GO to S4

S4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)

- Pushed-out pins (install new pins as necessary)

- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Audio Front Control Module (ACM) Self-Test

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *If the ACM, FCDIM (if equipped), FCIM, or FDIM (if equipped) are inoperative (blank or do not power on), obtain the ACM part number by referencing the label attached to the ACM chassis.*

   Turn the ACM on.

3. Operate the audio system in radio tuner AM/ FM mode.

4. Press and hold the eject button, and within 1 second, press and hold the seek up button. If supported, the speaker walk around test will begin, and the display will indicate each speaker as it is tested.

NOTE: *AHU Diagnostics refers to the ACM, EFP Diagnostics refers to the FCIM that communicates on the CAN (if equipped), and MFD Diagnostics (if supported) refers to the FCDIM (if equipped).*

5. To exit the self-diagnostic mode, turn the ACM off, or select "Exit Diagnostics."

Copyright © 2016 Ford Motor Company

Reset the SYNC Module [APIM]

Programming

NOTE: *An APIM Reset consists of a battery disconnect and a SYNC® system Master Reset. It may **not** be necessary to perform a Master Reset after disconnecting the battery if the concern is resolved.*

NOTE: *This procedure clears all Continuous Memory Diagnostic Trouble Codes (CMDTCs). The Diagnostic Trouble Codes (DTCs) must be recorded now if other non-SYNC® diagnoses are to be performed after this procedure.*

1. Remove any devices connected to the USB port(s), audio input jack/socket (if equipped), SD slot (if equipped), or RCA jacks (if equipped).

2. Disconnect the negative battery cable for 1 minute, then reconnect it.
   Refer to: Battery Disconnect and Connect - Vehicles With: Single Battery (414-01 Battery, Mounting and Cables) .

3. **NOTE:** *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, and deletes any Bluetooth devices paired with the SYNC® system. For vehicles with navigation, the customer's saved destinations (home, favorites, and previous) are erased. For vehicles with a TCU, any devices paired with the MyFord® Mobile or MyLincoln Mobile™ phone application will be deleted.*

   Perform a Master Reset. If necessary, refer to "Master Reset" in the Owner's Literature.

4. Verify system function using the MIT 105-00120 to test the audio output for the USB port(s), audio input jack/socket (if equipped), and Bluetooth. If equipped, test the audio output for the RCA jacks using RCA Adapter 105-00121.

5. **NOTE:** *If the concern remains after completing the APIM Reset procedure, advise the customer to power their device off and back on for a simple reboot. In some cases, if possible, the device's battery may also need to be removed and re-installed to complete a reboot. Delete SYNC® from the device's Bluetooth menu prior to re-pairing the phone to the SYNC® system. If necessary, the customer can also perform a Master Clear, Master Reset, or Factory Data Reset on their device following the manufacturer's instructions in the device's owner's manual and/or website. Customer devices may affect the operation of SYNC® and this should be understood to prevent unnecessary diagnosis or repairs to the system.*

   If a concern is still present, return to the Symptom Charts.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Programming

Special Tool(s) / General Equipment

SYNC USB 2.0 A Male to A Male Cable

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. If a new APIM is being installed, install the new APIM before carrying out the following procedure.
   Refer to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

3. **NOTE:**

   - *This programming procedure deletes any phones that were paired with the SYNC® system.*
   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A file of approximately 80 megabytes (MB) needs to be downloaded from the online database for the programming. Allow extra time for the file to download.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*

4. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

5. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

6. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

7. Connect one end of the USB cable (male type A 4-pin to male type a 4-pin) to the diagnostic scan tool's USB port, and the other end to the vehicle's USB port.
   Use the General Equipment: SYNC USB 2.0 A Male to A Male Cable

8. Close the IDS software program.

9. Place the ignition in the ON/RUN position. For ON/RUN position information with Push Button Start vehicles, Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

10. **NOTE:**

    - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
    - *Run OASIS using "Read VIN & DTCs."*
      - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
      - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
    - *If the "SYNC - Software Programming" document is not followed, the programming may stop or encounter errors due to improperly configured Internet browser settings.*

11. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

12. **NOTE:** *There are 3 types of APIM programming available:*

    - *Standard — Used to update the APIM and any currently installed Applications to the latest software*

levels.

- *Custom — Used to show all the available software options (including Applications that may not have been installed previously) that can be programmed into the APIM. Use this selection when upgrades become available or as directed by a TSB or FSA.*
- *Module Replacement — Used when the APIM has been replaced. This type of programming performs the required provisioning (restores software for newly installed hardware).*

13. Scroll to the bottom of the screen, select 1 of the 3 options (Standard, Custom, or Module Replacement), and select the "Read SYNC" button. The current APIM assembly, Vehicle Interface Processor (VIP), and Consumer Interface Processor (CIP) software levels are compared to the last recorded state in the Ford online database, and the available software is displayed.

14. **NOTE:** *Do **not** disconnect the VCM or USB cable during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

    Select the "Program SYNC" button to begin the APIM programming process.

15. Follow the diagnostic scan tool on-screen directions. After programming is complete, the diagnostic scan tool displays "Programming has been successfully completed."

Copyright © 2016 Ford Motor Company

Audio Front Control Module (ACM)

Special Tool(s) / General Equipment

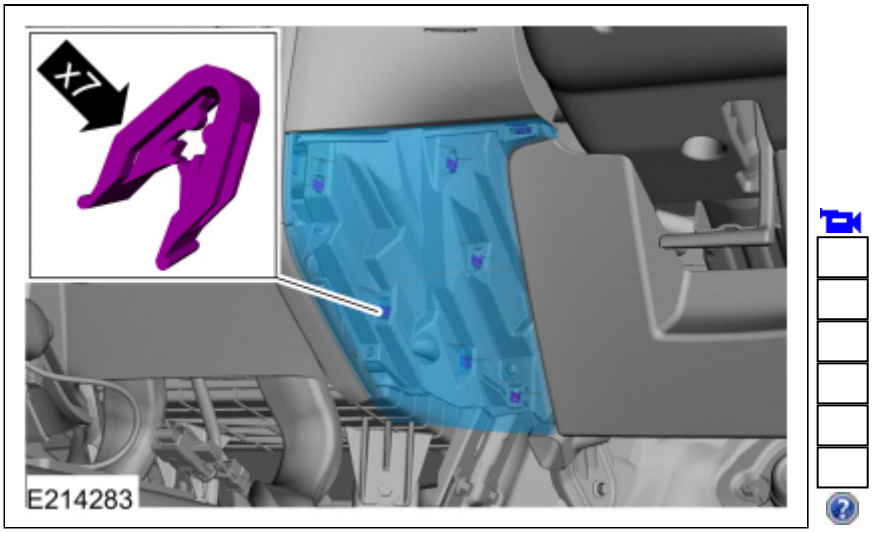
Interior Trim Remover

Removal

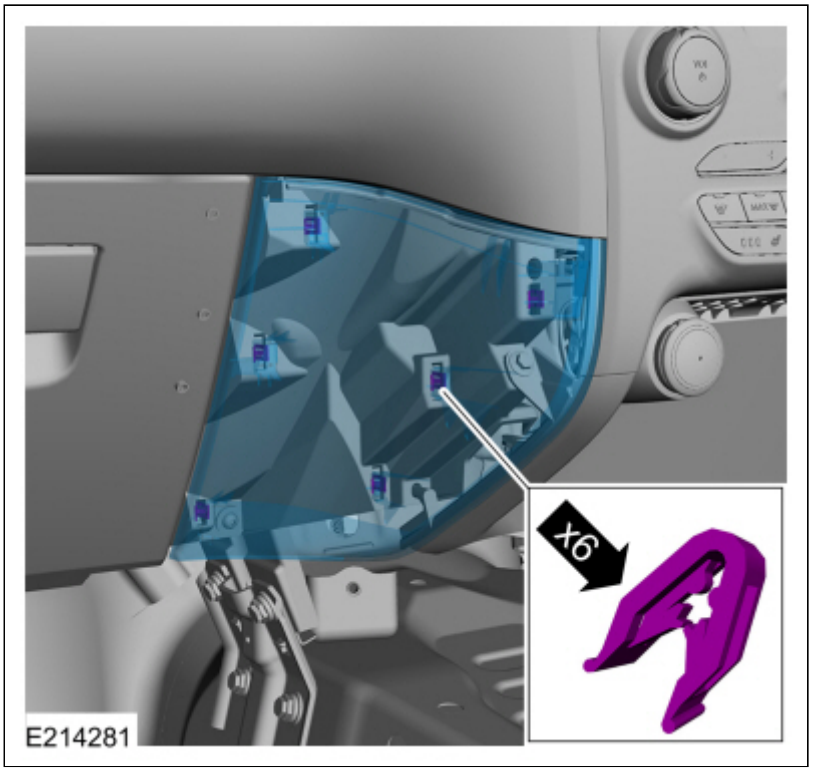
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

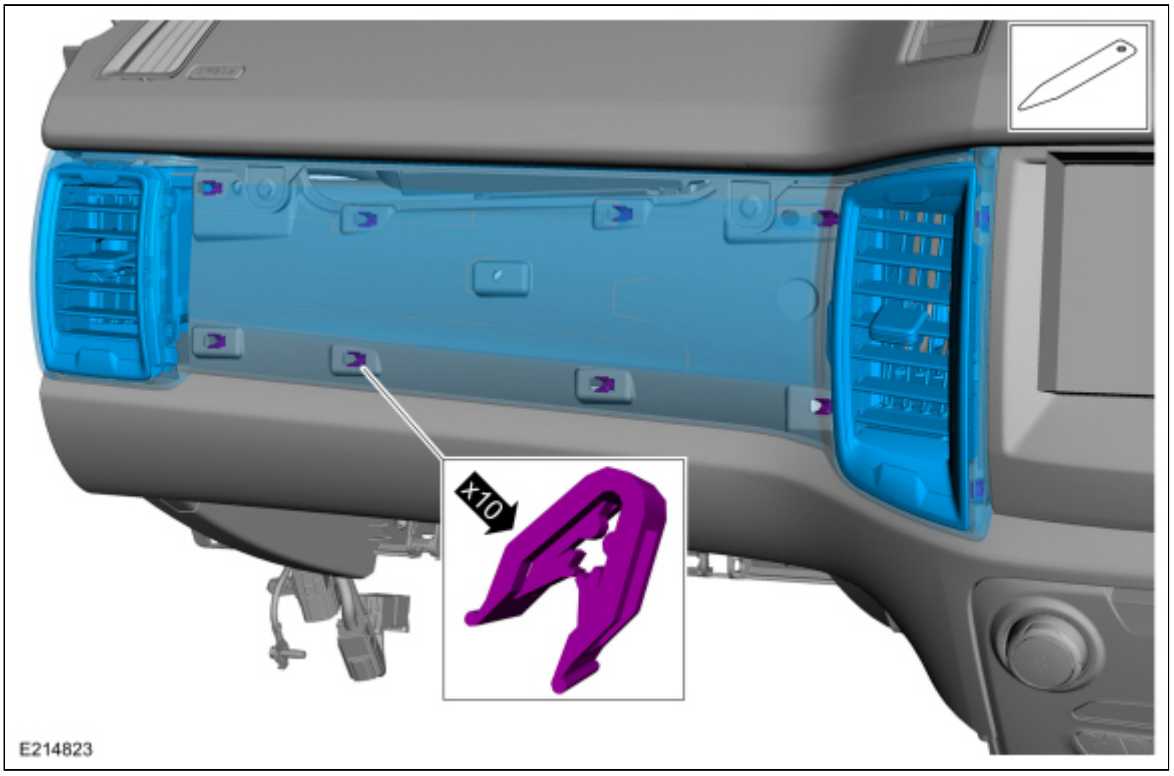
   Using a diagnostic scan tool, begin the PMI process for the FCIM following the on-screen instructions.

2. 

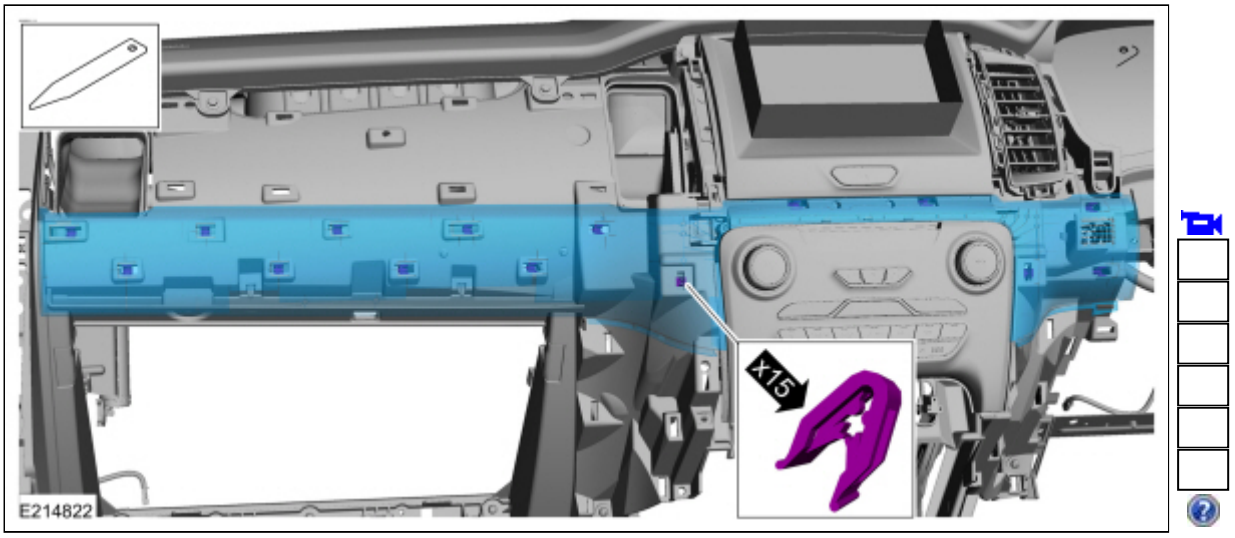
3.



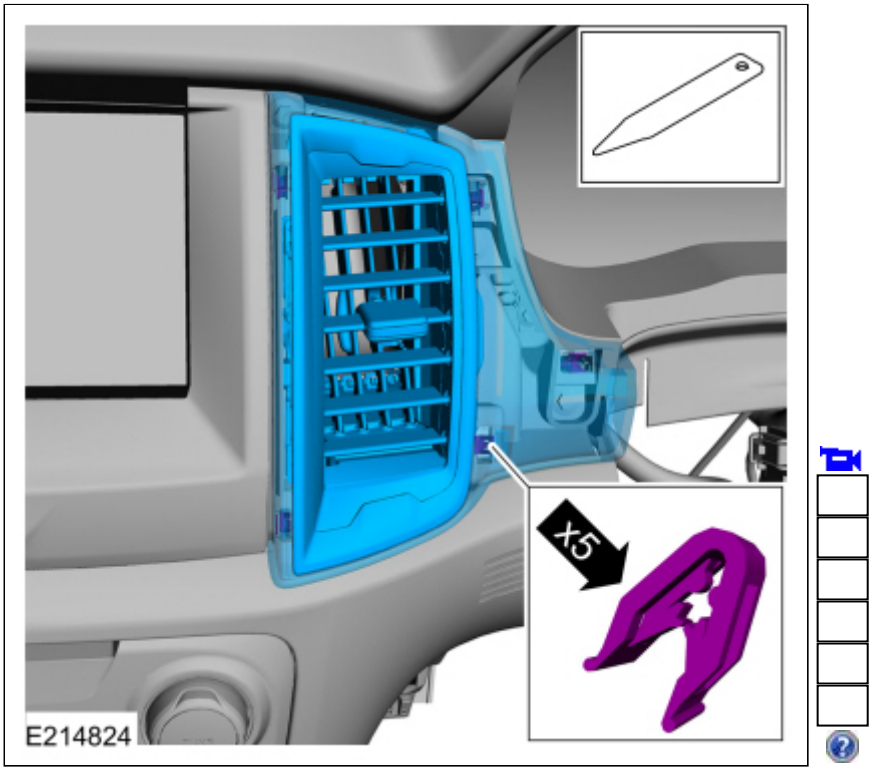
4. Use the General Equipment: Interior Trim Remover



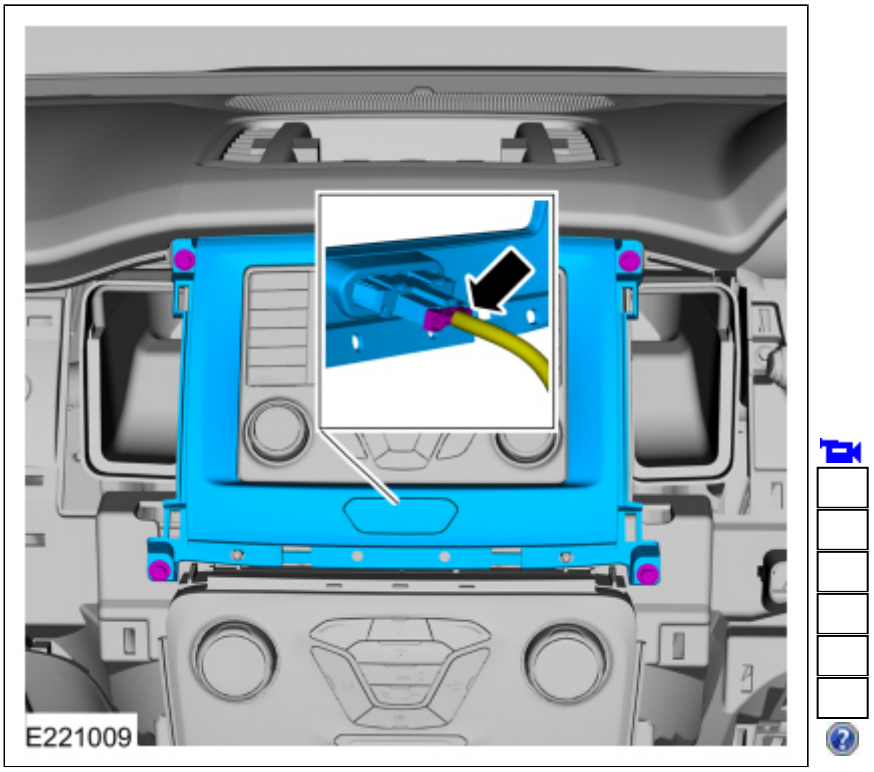
5. Use the General Equipment: Interior Trim Remover



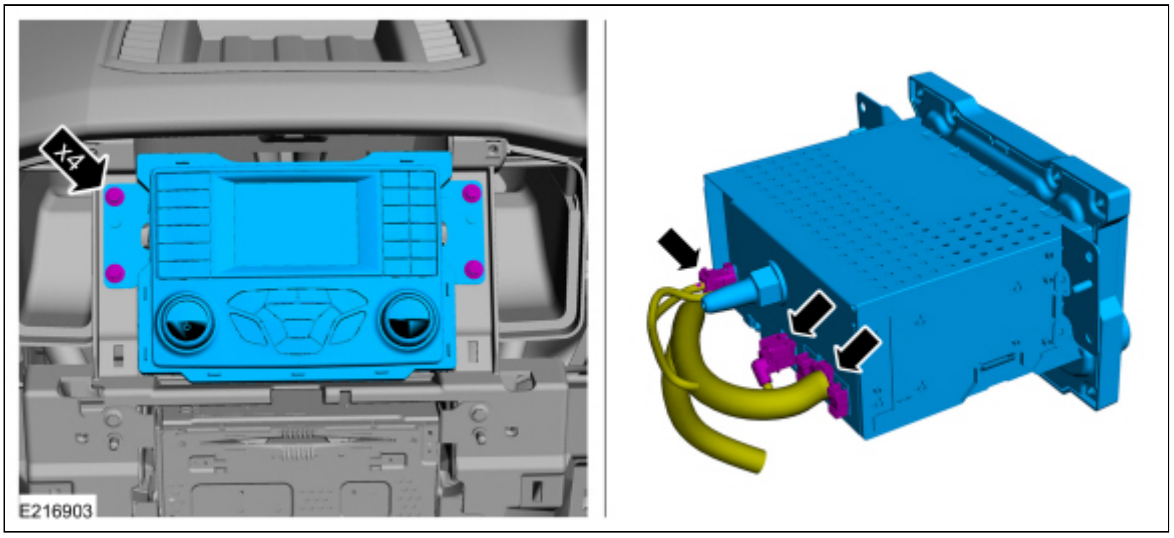
6. Use the General Equipment: Interior Trim Remover



7. *Torque*: 3 Nm



8. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the FCIM following the on-screen instructions.

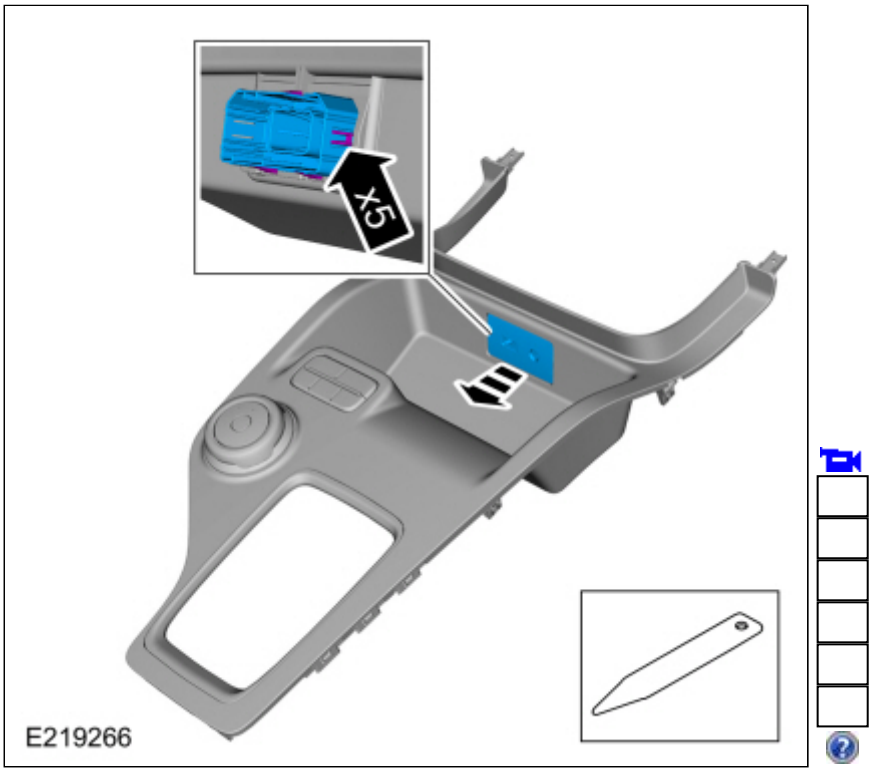
Copyright © 2016 Ford Motor Company

Audio Input Jack

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



Installation

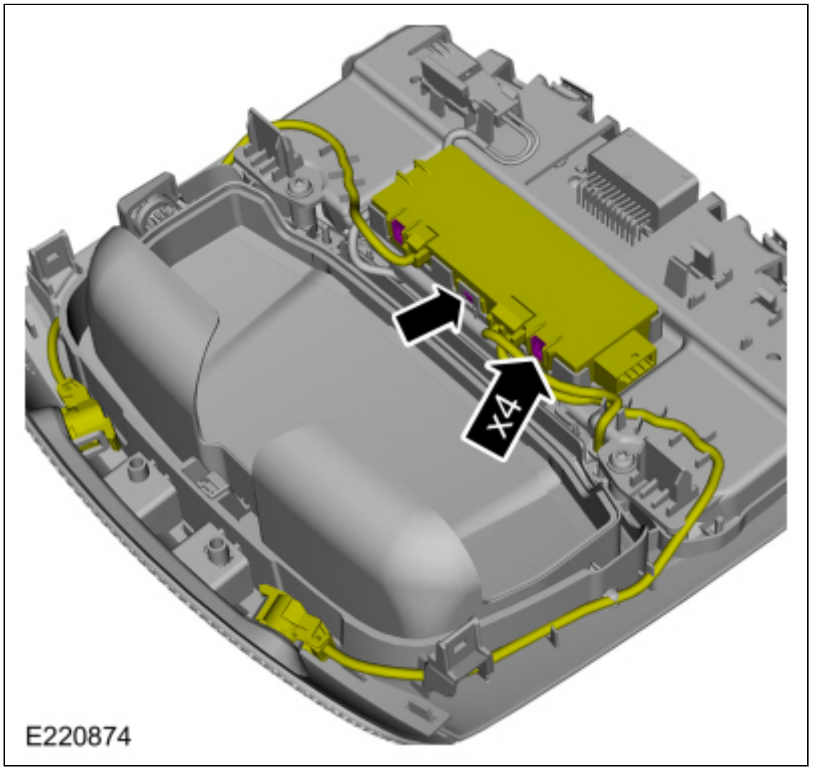
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

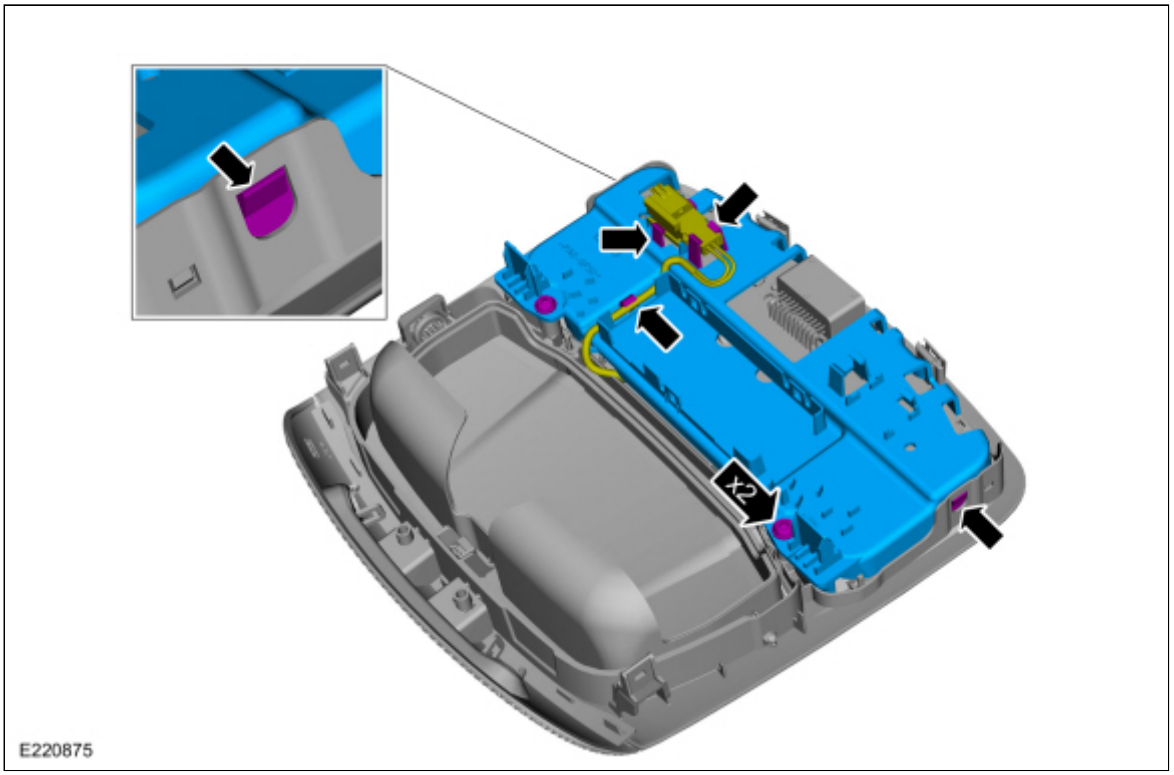
Voice Microphone

Removal

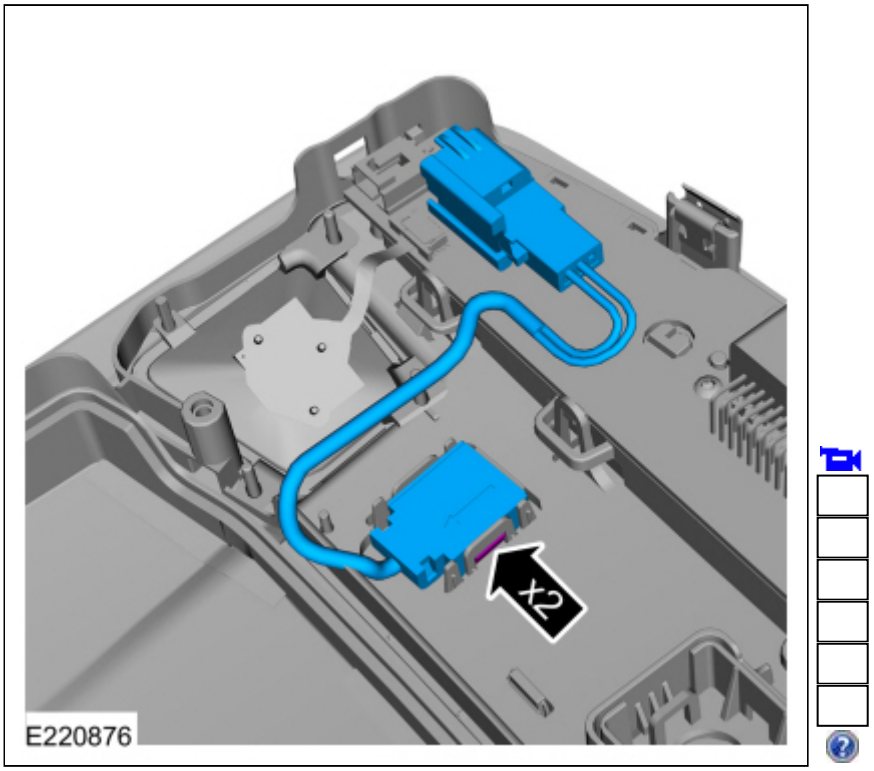
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Overhead Console (501-12) .
2. 

3.



4.



Installation

1. To install, reverse the removal procedure.

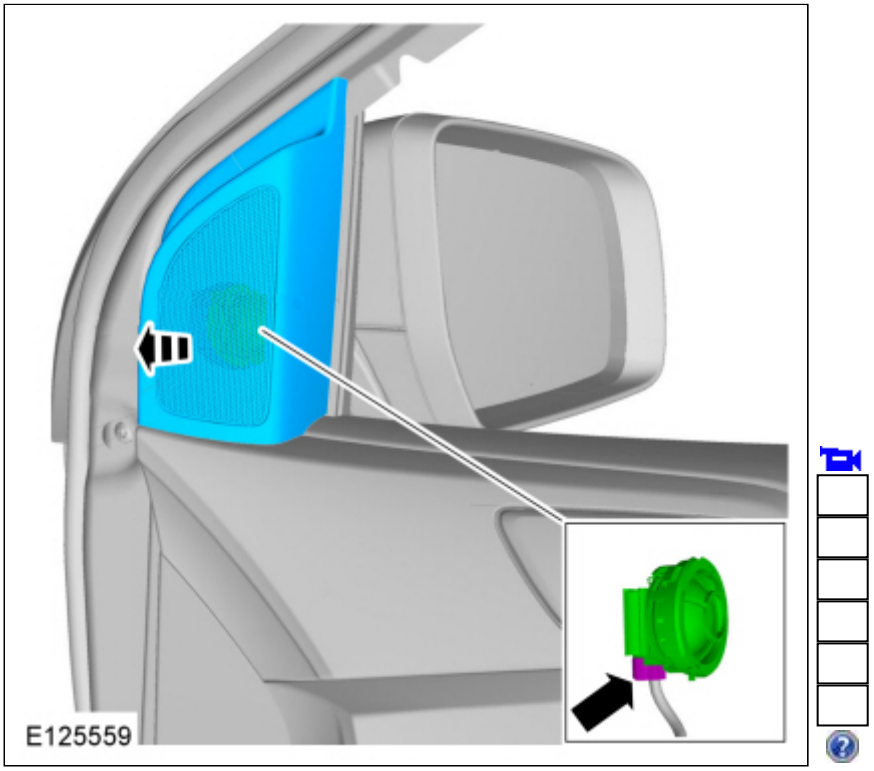
Copyright © 2016 Ford Motor Company

Front Door Tweeter Speaker

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2.



Installation

1. To install, reverse the removal procedure.

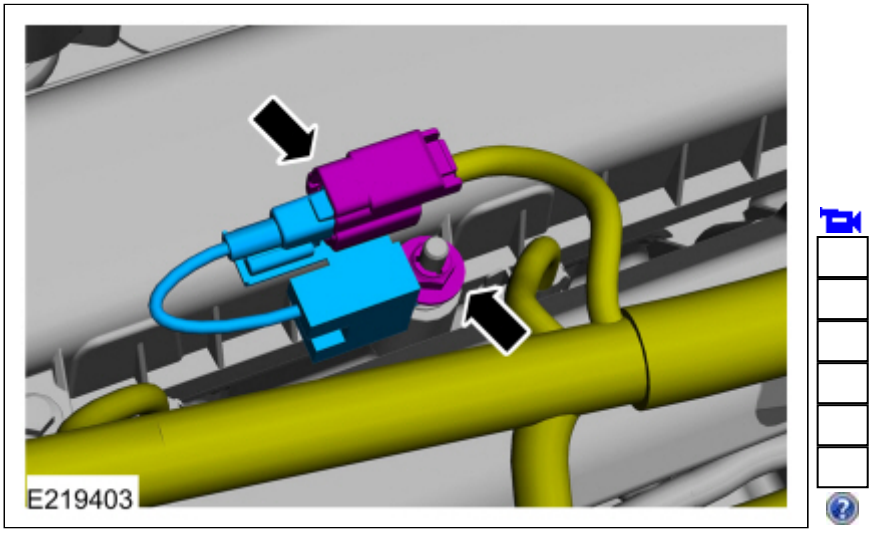
Copyright © 2016 Ford Motor Company

Noise Suppression Filter

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. *Torque*: 9 Nm



Installation

1. To install, reverse the removal procedure.

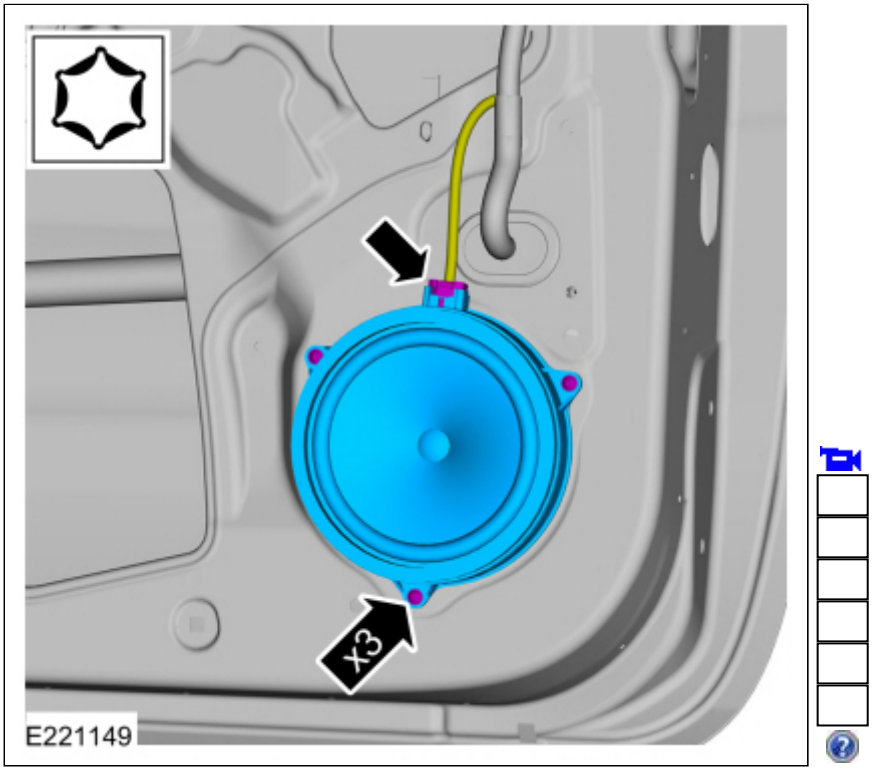
Copyright © 2016 Ford Motor Company

Front Door Speaker LH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

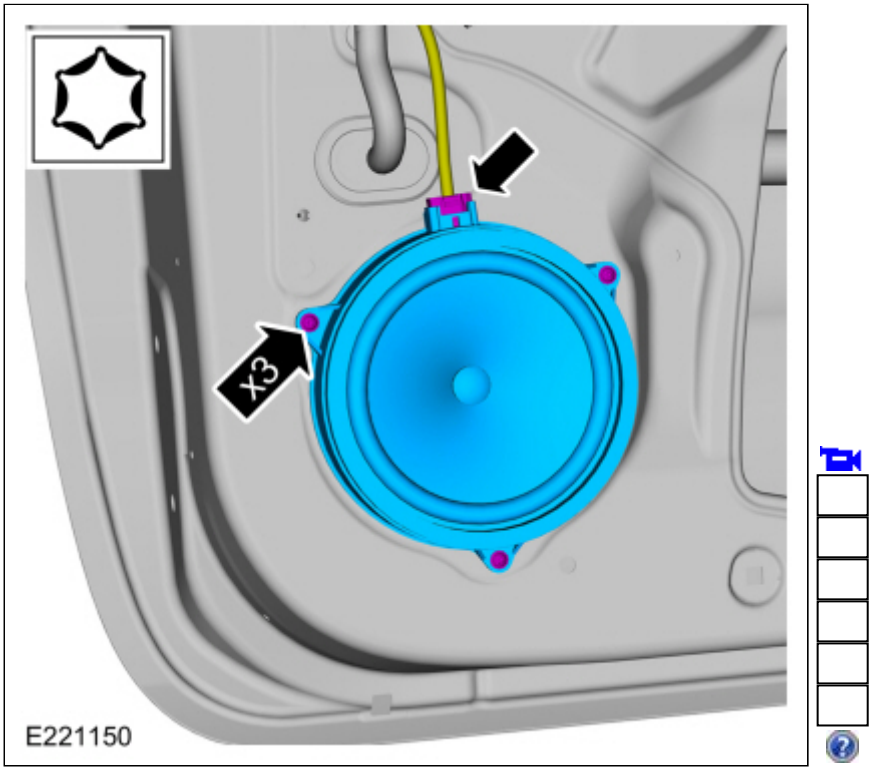
Copyright © 2016 Ford Motor Company

Front Door Speaker RH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker LH

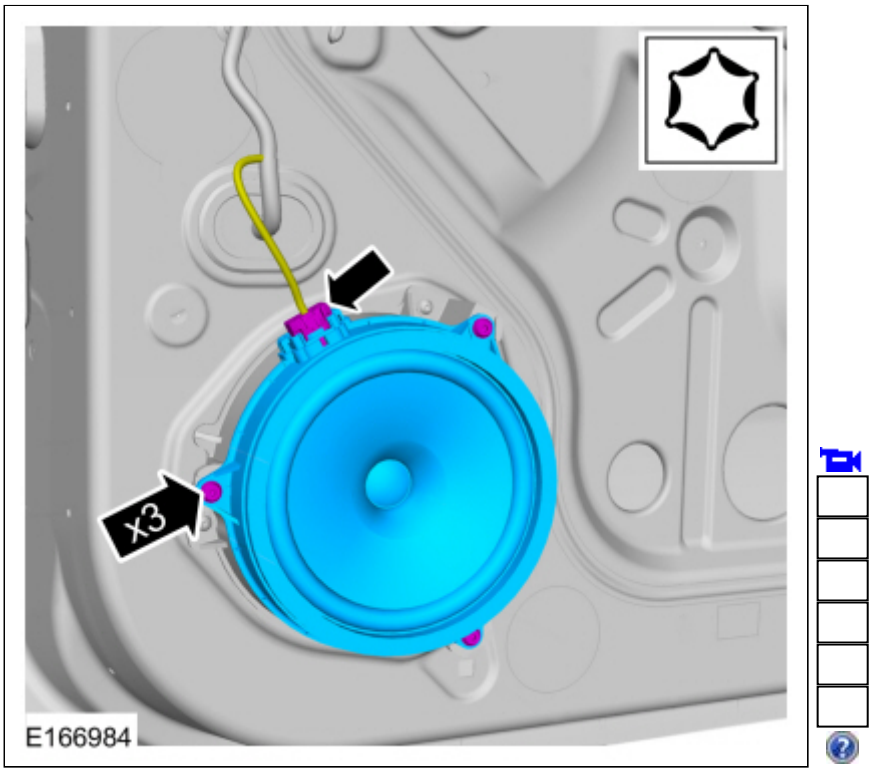
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

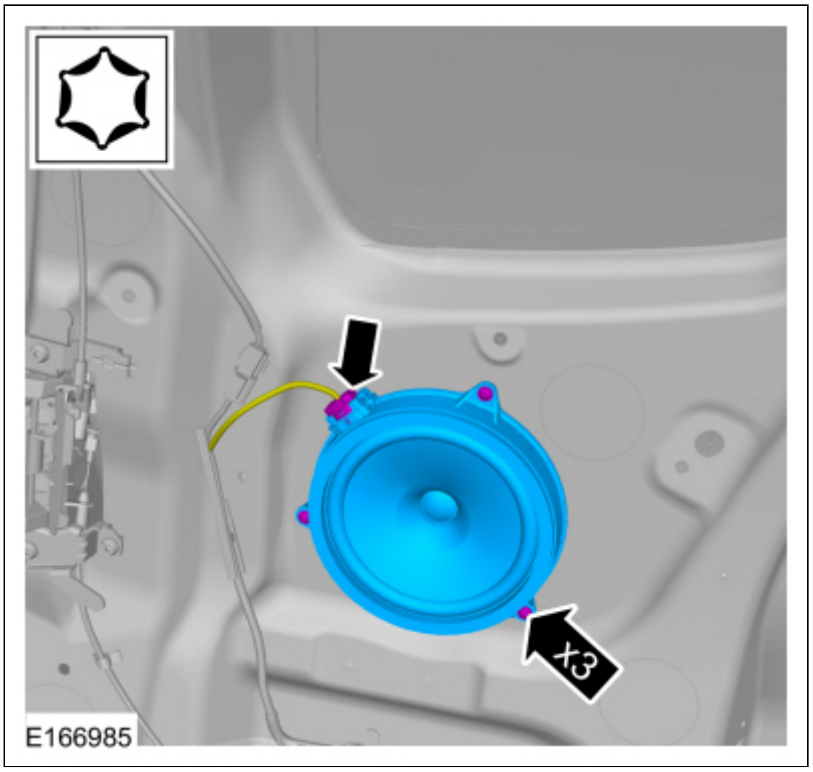
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker RH

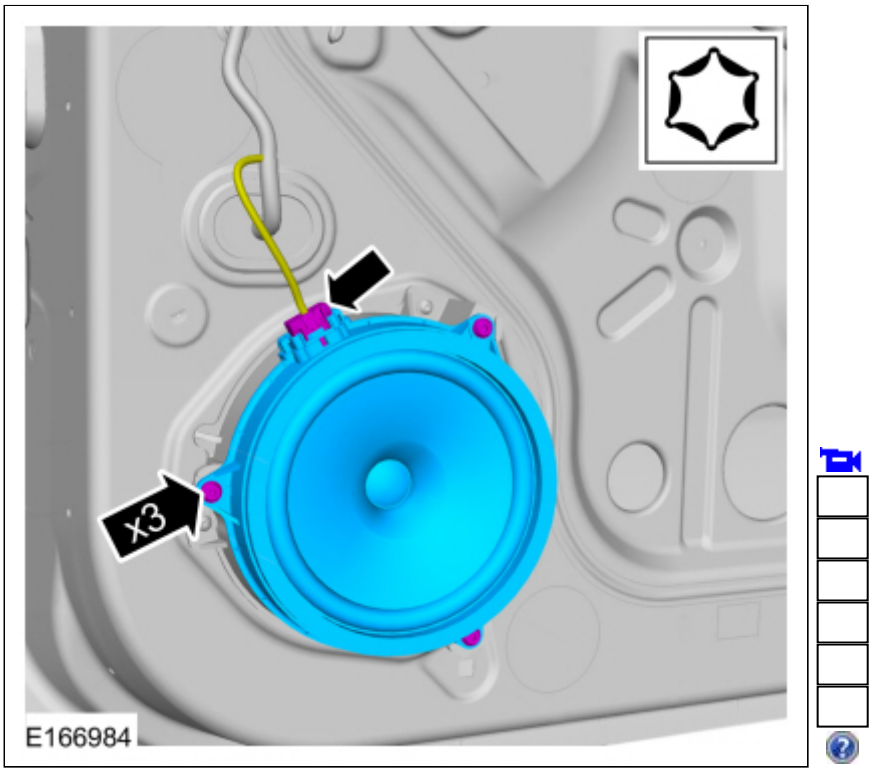
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

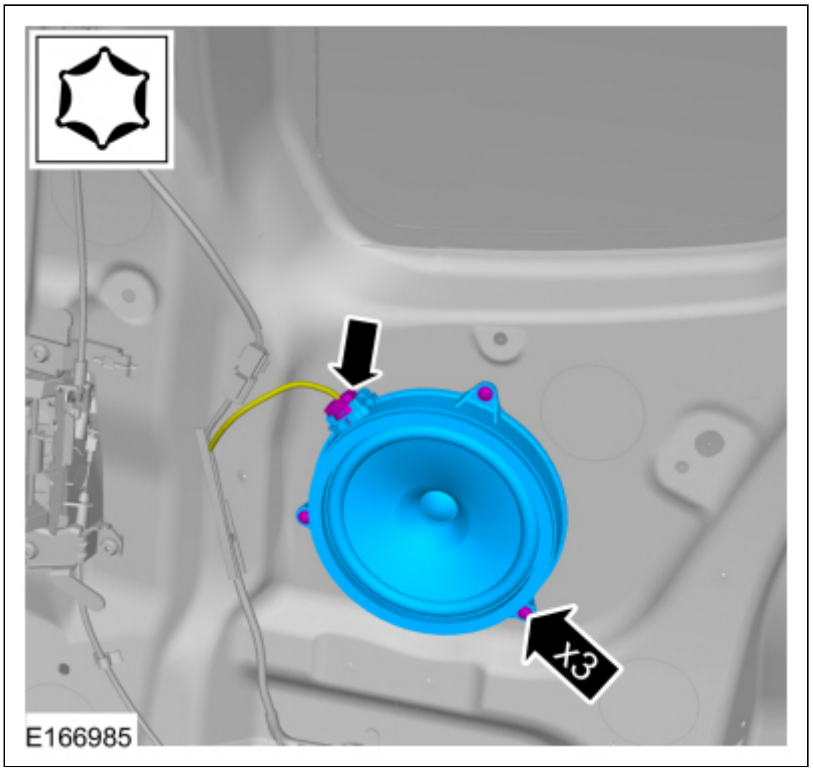
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



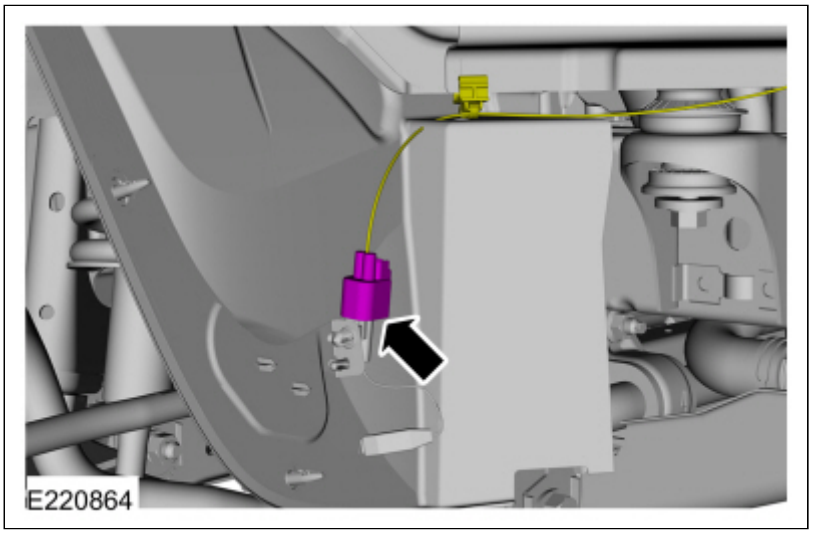
Installation

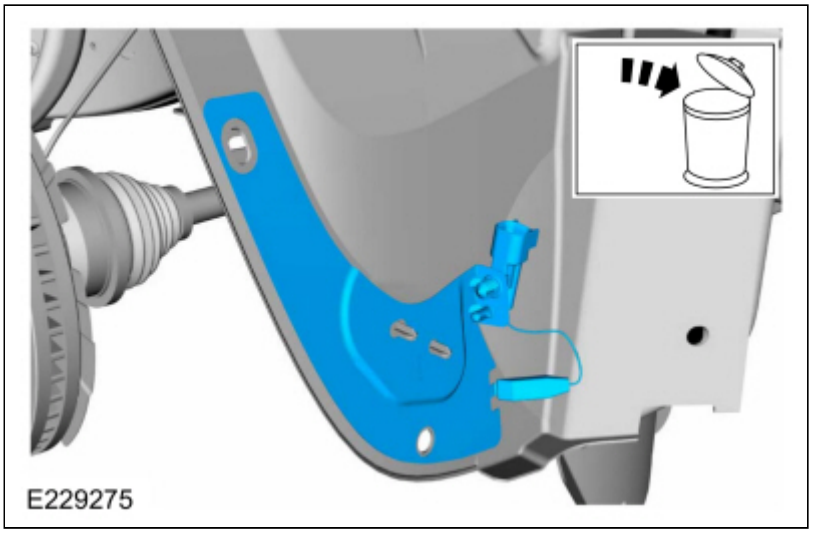
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Fender Mounted Antenna

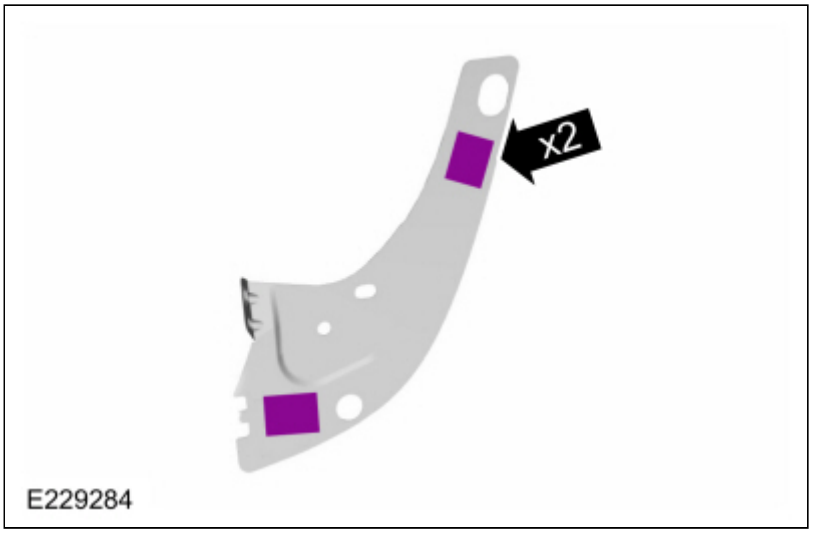
Removal

1. Refer to: Front Bumper Cover (501-19) .
2. 

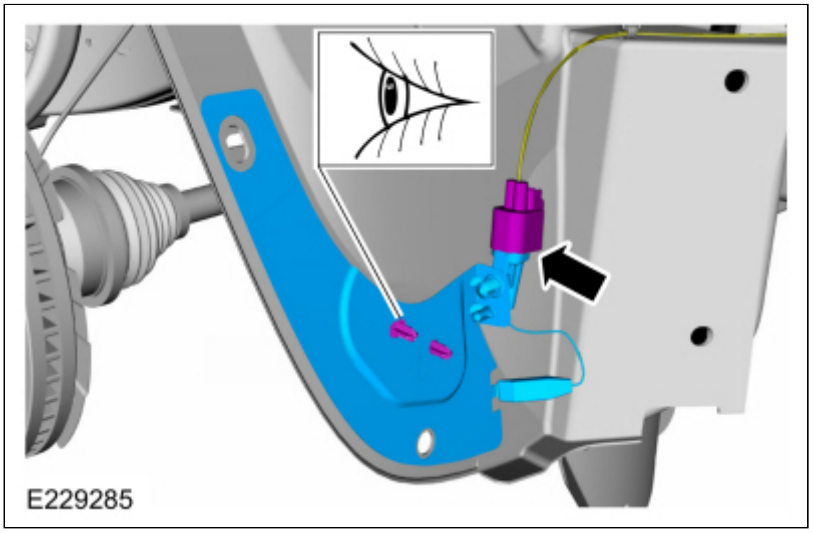
3. 

Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. **NOTE:** *Make sure that the installation marks are aligned.*



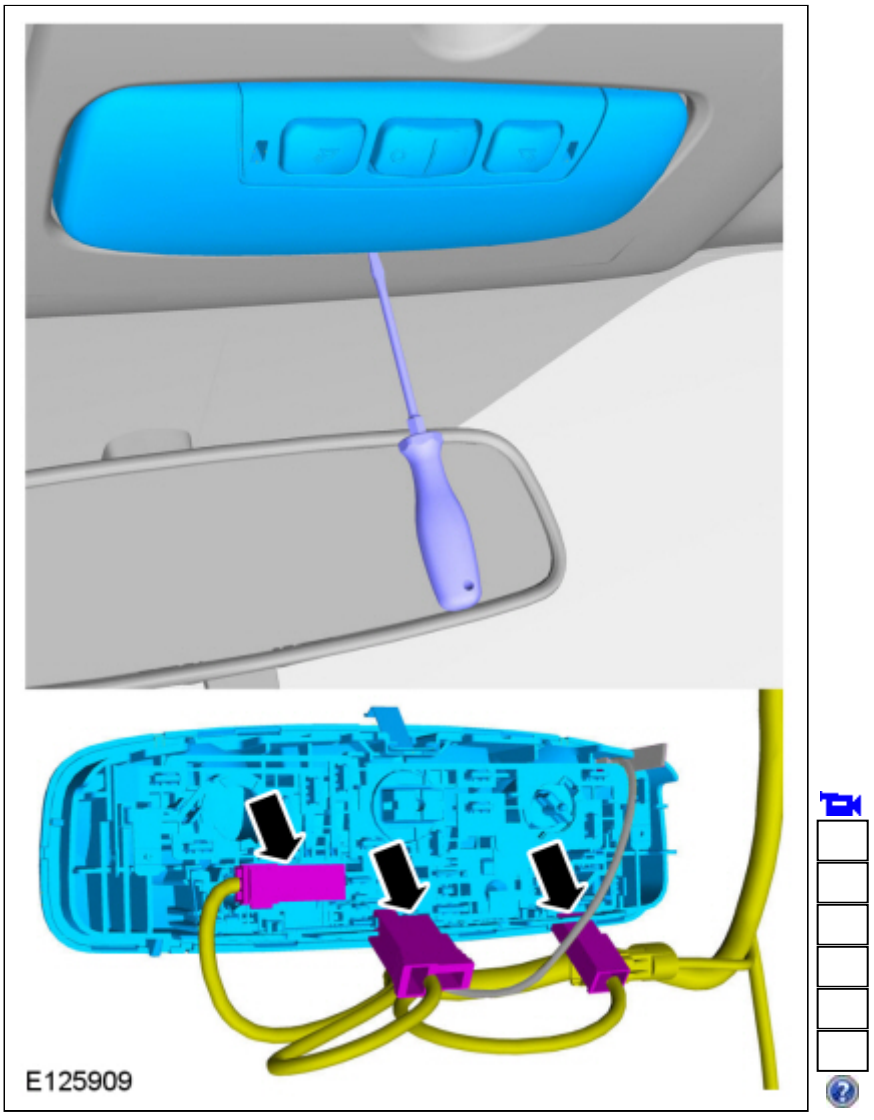
3. Refer to: Front Bumper Cover (501-19) .

Copyright © 2016 Ford Motor Company

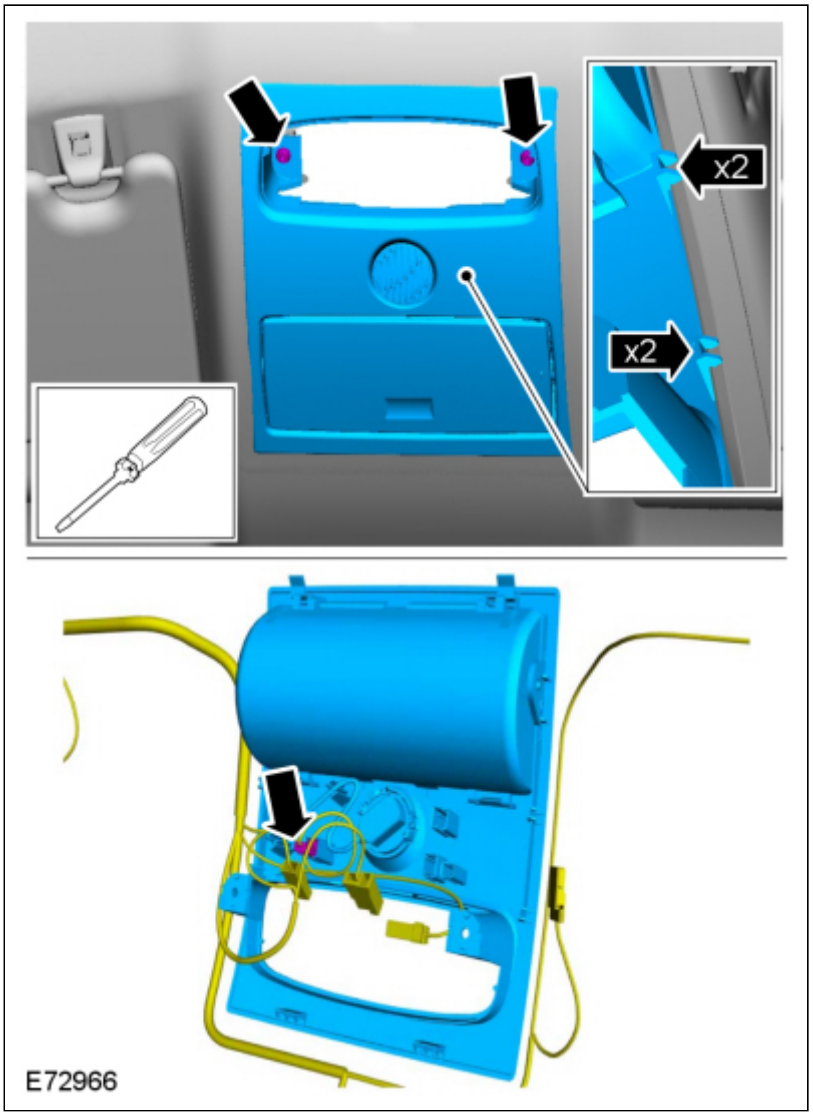
Roof Mounted Antenna

Removal

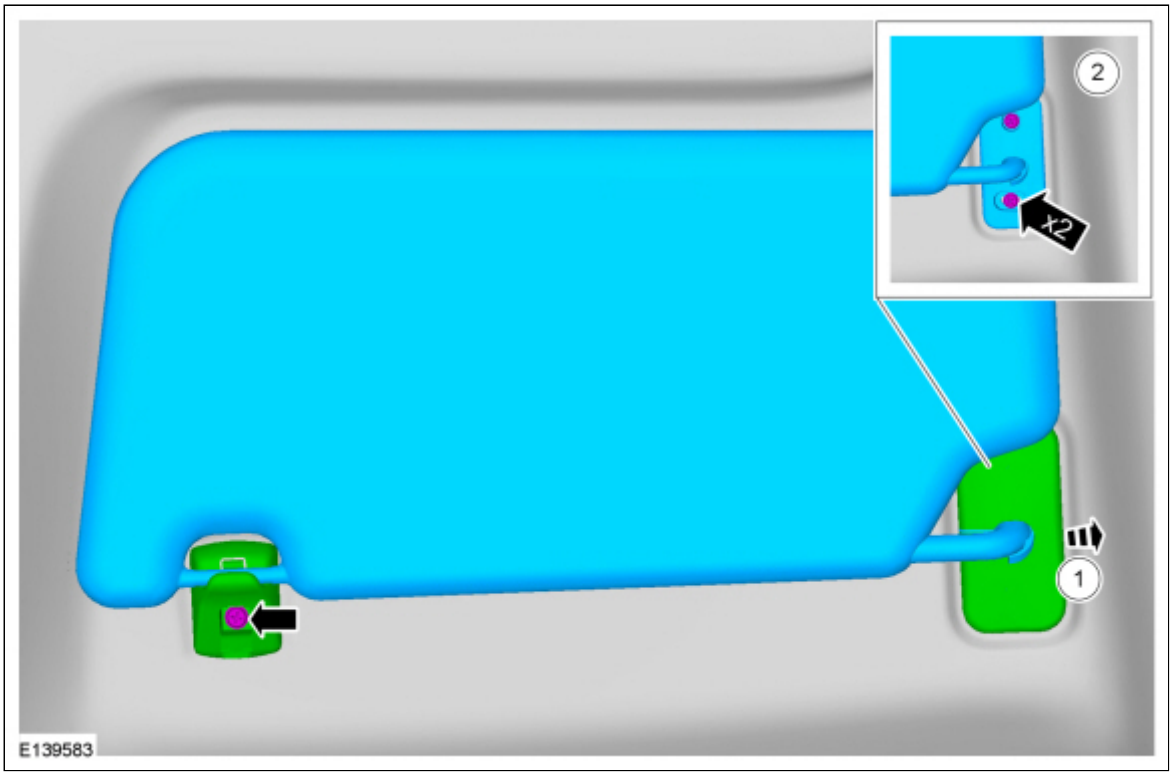
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: A-Pillar Trim Panel (501-05) .
2. Refer to: B-Pillar Upper Trim Panel (501-05) .
   Refer to: B-Pillar Lower Trim Panel (501-05) .
3. 

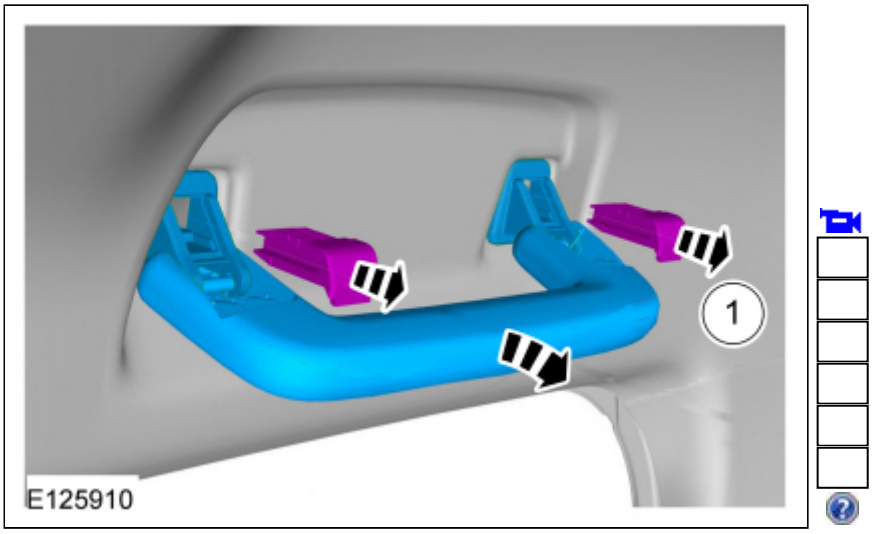
4. **NOTE:** *This step is not necessary when installing a new component.*



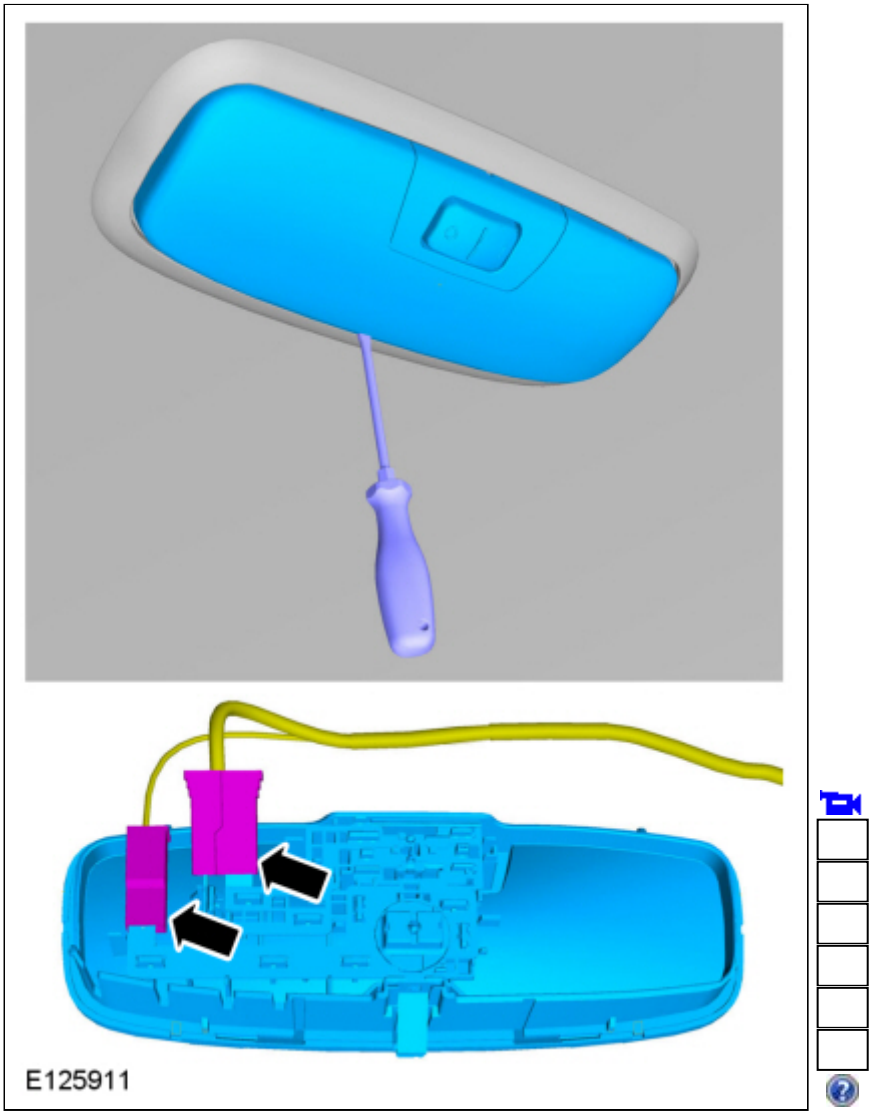
5. On both sides.



6.

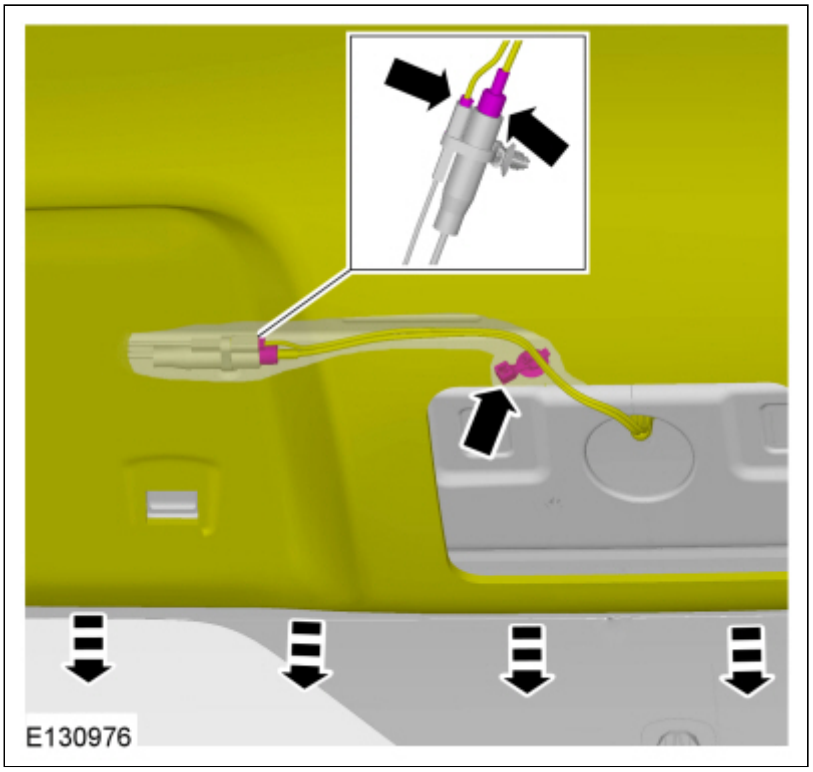


7.



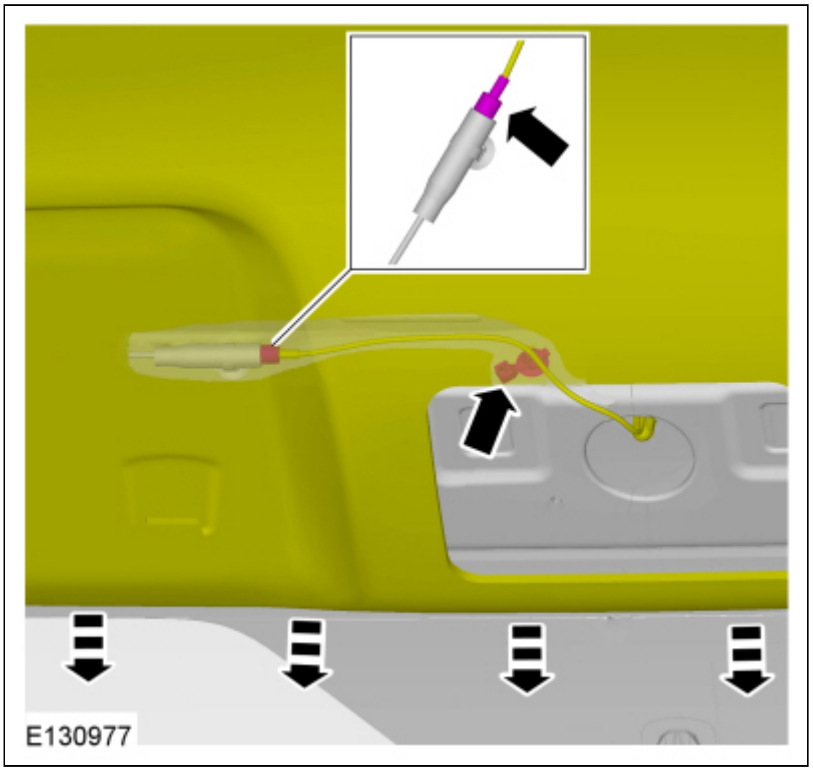
8. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*

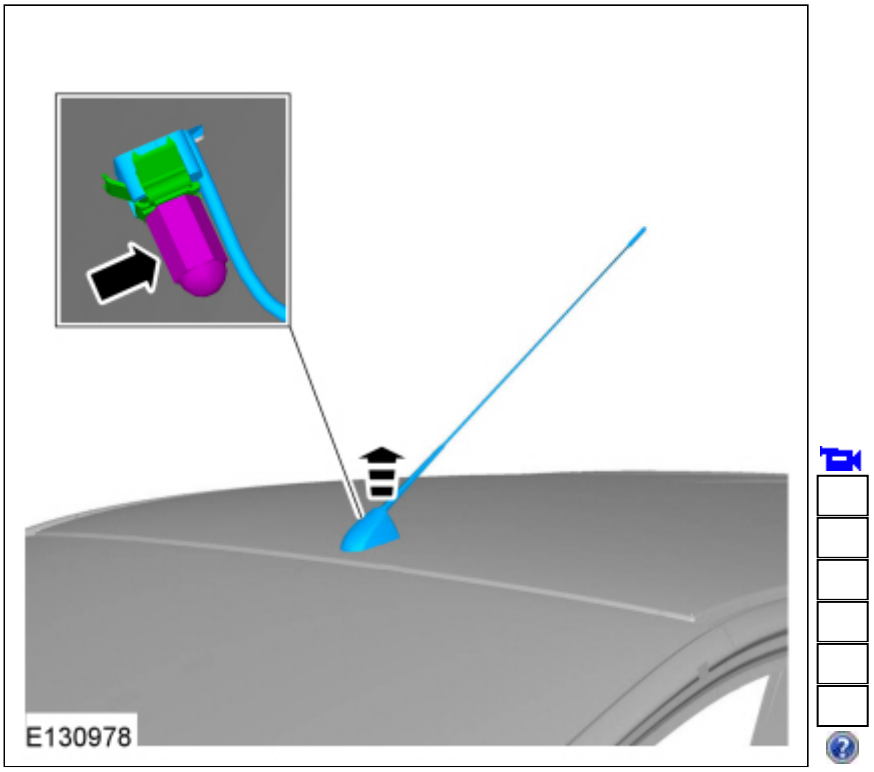


9. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*



10.



Installation

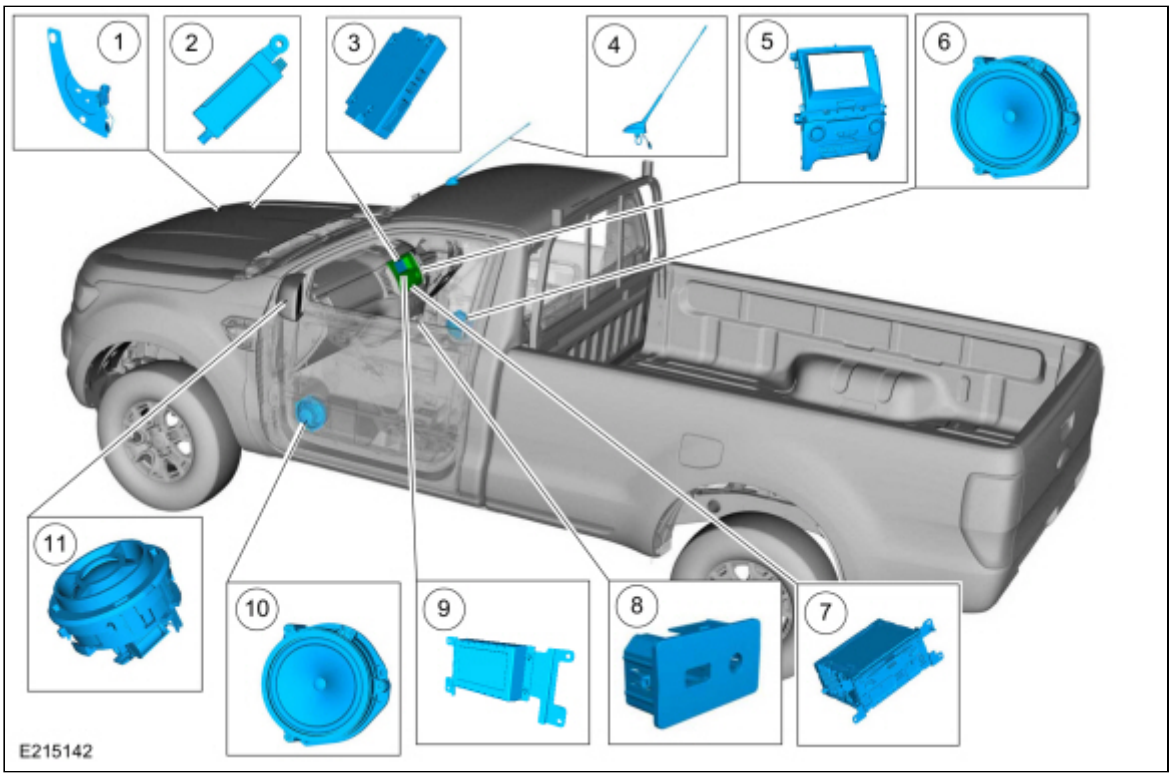
1. **NOTE:** *The antenna cable must be installed to the same routing as when removed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

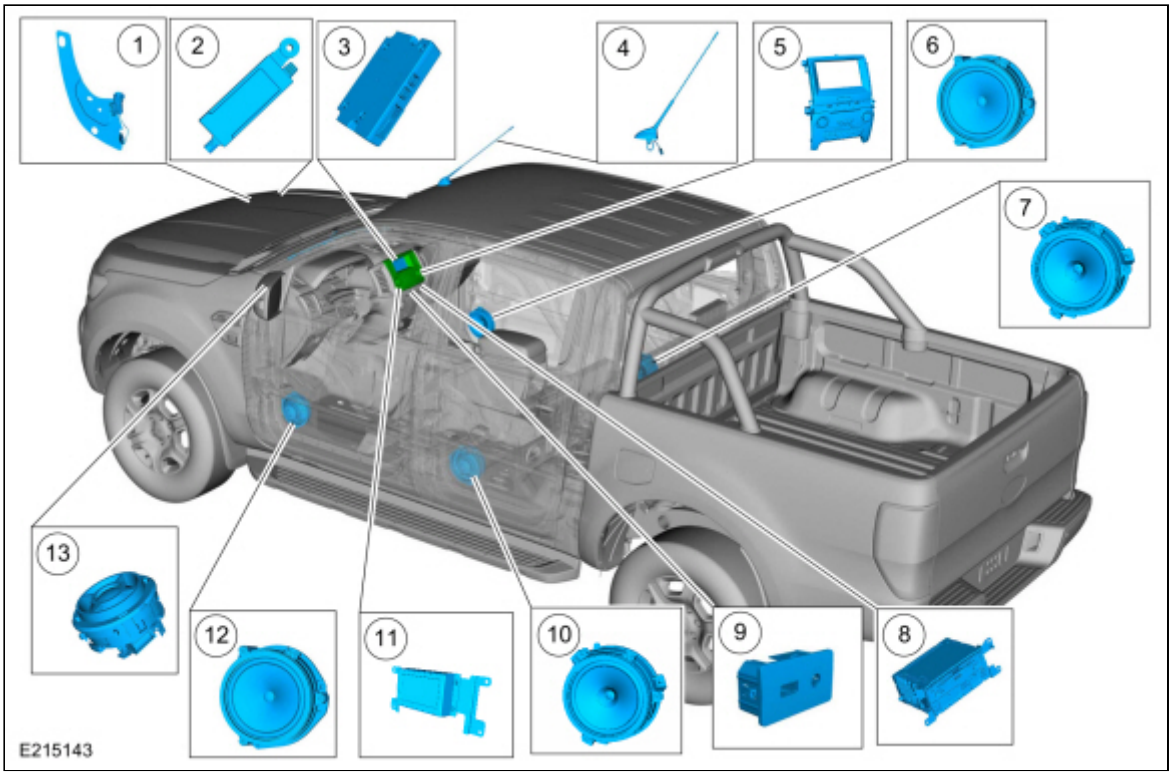
Information and Entertainment System - Component Location

SINGLE CAB



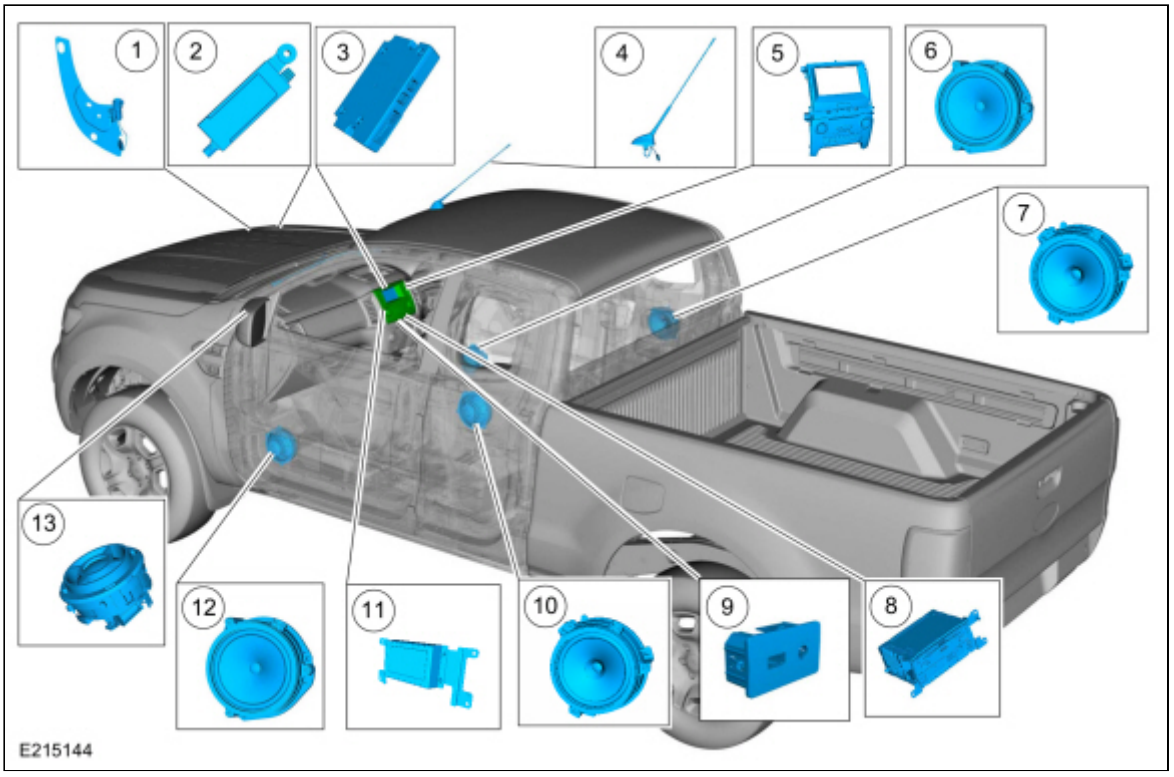
Item	Part Number	Description
1	—	Front fender mounted antenna-FM (frequency modulation) 2 diversity antenna
2	—	Audio unit antenna amplifier
3	—	APIM (SYNC module)
4	—	Roof mounted antenna-AM (amplitude modulation)/FM (frequency modulation) 1/DAB (digital audio broadcasting) antennna
5	—	FCIM (front controls interface module)
6	—	Front door RH speaker
7	—	ACM (audio front control module)
8	—	Media hub
9	—	FCDIM (front control/display interface module)
10	—	Front door LH speaker
11	—	Front door tweeter

DOUBLE CAB



Item	Part Number	Description
1	—	Front fender mounted antenna-FM (frequency modulation) 2 diversity antenna
2	—	Audio unit antenna amplifier
3	—	APIM (SYNC module)
4	—	Roof mounted antenna-AM (amplitude modulation)/FM (frequency modulation) 1/DAB (digital audio broadcasting) antennna
5	—	FCIM (front controls interface module)
6	—	Front door RH speaker
7	—	Rear door RH speaker
8	—	ACM (audio front control module)
9	—	Media hub
10	—	Rear door LH speaker
11	—	FCDIM (front control/display interface module)
12	—	Front door LH speaker
13	—	Front door tweeter

STRETCH CAB



Item	Part Number	Description
1	—	Front fender mounted antenna-FM (frequency modulation) 2 diversity antenna
2	—	Audio unit antenna amplifier
3	—	APIM (SYNC module)
4	—	Roof mounted antenna-AM (amplitude modulation)/FM (frequency modulation) 1/DAB (digital audio broadcasting) antennna
5	—	FCIM (front controls interface module)
6	—	Front door RH speaker
7	—	Rear door RH speaker
8	—	ACM (audio front control module)
9	—	Media hub
10	—	Rear door LH speaker
11	—	FCDIM (front control/display interface module)
12	—	Front door LH speaker
13	—	Front door tweeter

Copyright © 2016 Ford Motor Company

Information and Entertainment System - Overview

Overview

The audio system consists of the following:

Main Components

- 4 to 6 speakers
- 4.2-inch (107 mm) non-touchscreen FCDIM
- ACM
- APIM
- Audio input jack
- FCIM
- USB port
- GPSM
- Media hub
- Audio steering wheel switches

Main Features

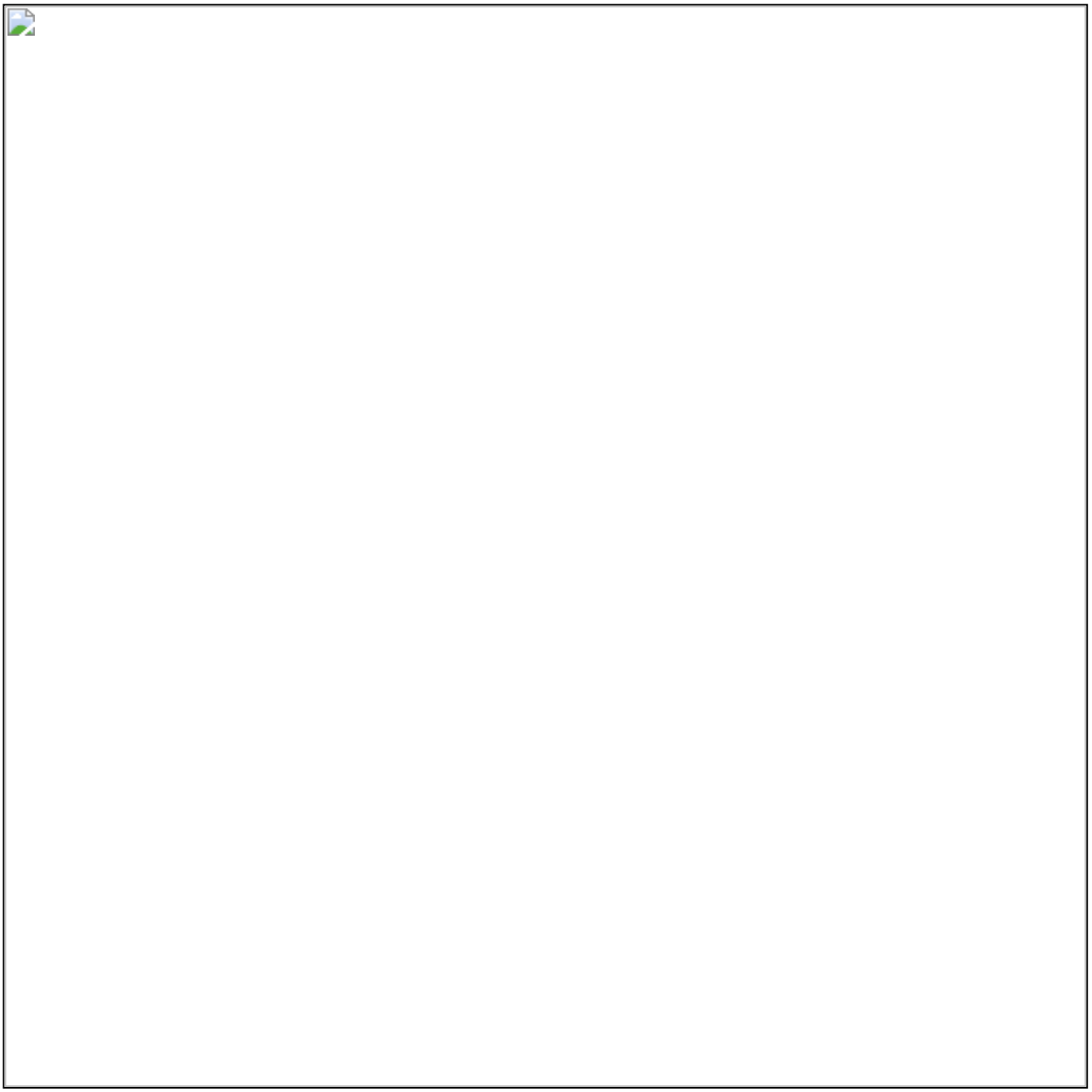
- Audio extended play
- Battery load shed
- MyKey®
- Speed compensated volume
- SYNC®

Copyright © 2016 Ford Motor Company

Information and Entertainment System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

A missing network message can set a DTC (U-code) and can be the result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle repair procedures such as module reprogramming can set these Diagnostic Trouble Codes (DTCs). When a missing network message DTC (U-code) sets, it is important to look for symptoms present in the audio system and throughout the vehicle, and to review the complete message list to determine which other modules rely on the same message.
Refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
See CAN Multiplex Messages.

When other modules are identified, run the self-test for those modules. If the same message is missing from those modules, the identical, or similar lost communication Diagnostic Trouble Codes (DTCs) may be set in those modules.

Confirmation of missing messages common to multiple modules can indicate the originating module is the source of the concern, or the communication network may be at fault.

It is very important to understand the following:

- Where the input originates
- All of the information necessary for a feature to operate
- Which module(s) receive(s) the input or command message
- Which module controls the output of the feature
- If the module that receives the input controls the output of the feature, or whether it outputs a message over the CAN to another module.

NOTE: *Emergency Assistance may not call emergency service in some countries. Visit the regional Ford website for the latest details.*

Module Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
Audio settings	IPC	Used to select the audio system listening source (AM or FM) from the steering wheel switch.
Audio source select	IPC	Used to set the audio system listening source (AM/ FM/ DAB, CD, etc.) from the steering wheel switch through the IPC RH infotainment display.
Battery saver status	BCM	Used to disable the functionality of the ACM due to the load shedding feature.
Chime request	IPC	Used to control the priority, characteristics, volume, and speaker output of the warning chime tones played through the audio system speakers.
Chime source	IPC	Used to set the audio system or IPC as the source for the chime tones.
Factory mode	BCM	Used to disable the functionality of the ACM while the vehicle is in factory mode.
Ignition key type	BCM	Used to determine if a MyKey® is enabled and in use.
Ignition status	BCM	Used to indicate the ignition state (OFF, CRANK, RUN, and START) required for ACM operating modes and fault reporting.
MyKey® Belt-Minder® audio mute	IPC	Used to mute speaker output so the Belt-Minder® tone can be more easily heard. This message only applies to vehicles with a MyKey® enabled and in use. The audio system is muted until the safety belt(s) are buckled.
Power up chime modules	IPC	Used to initiate the audio system as the chime source.
Set point volume	FCIM	Used to set the ACM volume using the FCIM.
Transport mode	BCM	Used to disable the functionality of the ACM until the vehicle is taken out of transport mode.
Turn signal lamp on request	BCM	Used to enable the turn signal tone to be played through the audio system speakers.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.
Voice recognition audio source request	IPC	Used to reduce the volume from the audio system so an IPC warning notification or parking aid chime can be more easily heard.

Module Network Input Messages - APIM

Broadcast Message	Originating Module	Message Purpose
Emergency Assist override status	IPC	Used to enable or disable the “Always on” Emergency Assist MyKey® feature as selected through the IPC while using an administrator MyKey®.
Accessory delay status	BCM	Used to determine the audio system operating mode.
Airbag deployment status	RCM	Used to notify the dispatcher of the airbag deployment status during the vehicle emergency data information provided in a Emergency Assist call.
Do Not Disturb override status	IPC	Used to enable or disable the “Always on” Do Not Disturb MyKey® feature as selected through the IPC while using an administrator MyKey®.
Door ajar status	BCM	Used to determine the door ajar status for the accessory delay feature.
Driver safety belt status	RCM	Used to notify the dispatcher of the driver’s seat belt status during the vehicle emergency data information provided in a Emergency Assist call.
eCall notification	RCM	Used to notify the vehicle occupant(s) of a Emergency Assist call being initiated due to an airbag deployment.
FCIM button state	FCIM	Used to indicate when a button is pressed on the FCIM so the audio system can make the desired setting change.
Factory mode	BCM	Used to disable the functionality of the APIM while the vehicle is in factory mode.
GPS data	GPSM	Used to notify the dispatcher of the vehicle position during the vehicle emergency data information provided in a Emergency Assist call.
Ignition key type	BCM	Used to determine if a MyKey® is enabled and in use.
Ignition status	BCM	Used to indicate the ignition state (OFF, CRANK, RUN, and START) required for APIM operating modes and fault reporting.
Language update status	IPC	Used to confirm the language change performed using the FDIM was updated in the IPC.
Low beam and high beam headlamp usage status	BCM	Used to dim the FDIM backlight intensity when the headlamps are turned on and the screen dimming mode is set to auto.
MyKey® Belt-Minder® audio mute	IPC	Used to mute speaker output so the Belt-Minder® tone can be more easily heard. This message only applies to vehicles with a MyKey® enabled and in use. The audio system is muted until the safety belt(s) are buckled.
Passenger safety belt status	RCM	Used to notify the dispatcher of the passenger’s seat belt status during the vehicle emergency data information provided in a Emergency Assist call.
Transport mode	BCM	Used to disable the functionality of the APIM until the vehicle is taken out of transport mode.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.

Module Network Input Messages - BCM

Broadcast Message	Originating Module	Message Purpose
eCall confirmation	APIM	Used to temporarily disable the horn while the post-crash alert is active so the Emergency Assist phone call can be more easily heard.

Module Network Input Messages - FCDIM

Broadcast Message	Originating	Message Purpose

	Module	
Door ajar status	BCM	Used to determine the door ajar status for the accessory delay feature.
Vehicle configuration data	IPC	Used to verify vehicle configuration data such as the VIN and system module configuration.

Module Network Input Messages - FCIM

Broadcast Message	Originating Module	Message Purpose
Audio source status	ACM	Used to confirm the audio source selected from the FCIM .
Day/night status	BCM	Used for day/night illumination status for the FCIM.
Factory mode	BCM	Used to disable the functionality of the FCIM while the vehicle is in factory mode.
Illumination dimming level	BCM	Used to control the backlight intensity of the FCIM based on the dimmer switch input.
Transport mode	BCM	Used to disable the functionality of the FCIM until the vehicle is taken out of transport mode.

Module Network Input Messages - GPSM

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	Used to indicate the ignition state (OFF, CRANK, RUN, and START) required for GPSM operating modes and fault reporting.
Vehicle configuration data	BCM	Used to verify vehicle configuration data and system module configuration.

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Audio chimes	ACM	Used to indicate the status of the warning chimes being played through the audio system.
Date and time	FCDIM	Used to display the date and time information on the IPC.
Display language request	FCDIM	Used to display information on the IPC in the language selected from the FCIM.
Date and time adjustment request	FCDIM	Used to adjust the date and time information stored in the IPC from the FCIM buttons.

Module Network Input Messages - RCM

Broadcast Message	Originating Module	Message Purpose

eCall confirmation	APIM	Used to confirm the configuration of the Emergency Assist feature and to confirm the status of the Emergency Assist phone call.

Accessory Delay Feature

The accessory delay feature is a BCM controlled software function that allows the audio system to be operated for a preset period of time after the ignition is turned off and a front door has not been opened.

AM/ FM Radio

The AM/ FM roof-mounted antenna receives analog radio waves and sends them through the AM/ FM antenna coaxial cable to the ACM. The radio waves are converted into fluctuating AC voltage and sent as left and right analog audio signals to the speakers.

AM/ FM1/ FM2 Radio Without Diversity Antenna

The AM/ FM1 antenna receives the AM/ FM radio signals. The antenna modules sends the radio signals to the ACM through a splitter which connects both antenna inputs of the ACM.

APIM Programming

The APIM requires specific programming procedures for correct operation when it is replaced, when upgrades are available and requested, or when directed by a TSB, FSA, SSM, or Electronic Field Communication (EFC) to resolve SYNC® performance concerns. For more information,
Refer to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Audio Extended Play

This software feature allows the audio system to operate with the ignition OFF, regardless of the door latch position. When the power button on the FCIM is pressed, the audio system functionality is enabled and remains active for a period of 20-60 minutes, depending on configuration settings. Audio extended play will not function if the battery load shed is active. To turn the audio system off, press the FCIM power button.

Audio Input Jack Mode

When a portable audio device, such as an iPod® with its available cable, is connected to the vehicle audio system through the audio input jack, audio from the device can be played through the vehicle speakers. Only the volume can be controlled with the vehicle audio controls. All other functions such as seek, fast forward, pause, etc. must be carried out on the device itself.

No metadata (information such as artist, album title, song title, and genre) is transferred when a device is connected to the audio input jack.

Battery Load Shed

The BCM uses the battery current sensor to monitor the battery state of charge. The battery current sensor is attached to the battery ground cable. With the ignition in RUN, ACC, or OFF, a load shed message is sent over the CAN when the BCM determines the battery state of charge is below 40%, 45 minutes have elapsed, or 10% of the charge has drained. This message turns off the audio system to save the remaining battery charge. Under this condition, "Battery Saver - System Off" is displayed on the centerstack infotainment display to notify the driver that battery protection actions are active. To clear the load shed state, start the vehicle.

Bluetooth Mode

Bluetooth is a secure, short-range radio frequency that allows devices to communicate wirelessly through radio waves. The operating range of a Bluetooth signal is application specific, but will have a minimum range of 10 meters (33 feet).

The Bluetooth interface can accommodate both Bluetooth-enabled mobile phones and Bluetooth-enabled media devices. The SYNC® system allows interaction with several types of customer Bluetooth devices, including mobile phones and media devices. The APIM contains an on-board Bluetooth chipset, which enables certain wireless devices to interact with the system.

Any Bluetooth device used with the SYNC® system must first be paired with the APIM on-board Bluetooth chipset before it can become operational. Pairing a Bluetooth device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC® system generates a unique PIN that must be entered on the Bluetooth device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For information on the pairing process, refer to the Owner's Literature.

Multiple Bluetooth phones and Bluetooth media devices can be paired to the APIM at the same time. The APIM supports an active connection with one Bluetooth phone and one Bluetooth media device at a time. If an additional device of either type is paired and made active, the APIM ends any active connection with an already-paired device, and establishes an active connection with the new device.

It is important to understand that while most Bluetooth devices can pair with the SYNC® system, not all Bluetooth devices have the same level of features available when interacting with the SYNC® system. To determine if a Bluetooth device or feature is supported, review the device compatibility list. Refer to www.syncmyride.com.

Chimes

Various vehicle systems send chime requests over the CAN to the IPC. The following are determined as the IPC processes these requests:

- Chime characteristics (tone, tone length, number of repetitions, time between tones, etc.)
- Chime output volume
- Priority of the chime request
- Which speakers (all, front, or rear) will play the specific chime

The IPC sends the processed requests over the CAN to the ACM. The ACM outputs the left and right analog chime tones to the appropriate audio system speakers as fluctuating AC voltage.

For more information,
Refer to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

MyKey® Audio Operation

- The following MyKey® features are always enabled when a MyKey® is in use, and are not configurable on/off with an administrator key:
  - Belt-Minder®: The audio system is muted, and “MyKey Buckle Up to Unmute Audio" is displayed in the information display until the safety belts are buckled.

- The following MyKey® features are configurable with an administrator key:
  - Emergency Assist: If the administrator has selected "Always On" in the MyKey® menu, Emergency Assist is enabled and cannot be disabled.
  - Do Not Disturb: If the administrator has selected "Always On" in the MyKey® menu, the Do Not Disturb feature is enabled and cannot be disabled.
  - Speed Compensated Volume: If the administrator has enabled the Volume Limiter feature, the speed compensated volume feature will be disabled.
  - Speed Limiter: If the administrator has enabled the Speed Limiter feature, the audio volume level is temporarily reduced so the top speed alert chime can be heard when the preselected top vehicle speed is reached.
  - Speed Minder: If the administrator has enabled the Speed Minder feature, the audio volume level is temporarily reduced so the speed alert chime can be heard when the preselected Speed Minder vehicle speed is exceeded.
  - Volume Limiter: If the administrator has enabled the Volume Limiter feature, the audio system volume is limited to 45%. In an attempt to exceed the limited volume, “MyKey® VOLUME LIMITED” is displayed in the information display.

For more information, refer to “MyKey®” in the Owner's Literature.

Speed Compensated Volume

The ACM compensates for wind and road noise by adjusting the audio system volume based on the Vehicle Speed Sensor signal and customer-defined setting.

When a MyKey® is in use and the MyKey® Volume Limiter is enabled, the speed compensated volume is disabled.

Steering Wheel Switch Functions

The RH 9-way steering wheel switch operates the seek +/-, volume +/-, audio mode, send/receive call, end call, mute, and voice functions.

SYNC® AppLink™

SYNC® AppLink™ allows the customer to control smartphone Applications by using voice commands and in-vehicle controls. Data is transferred from the customer’s device to the APIM through Bluetooth, or through the USB port with Apple® devices.

For more information, refer to “AppLink” in the Owner's Literature.

SYNC® System

The SYNC® system is a hands-free communication and entertainment system that supports many features. All features are not available with every phone/device.

The SYNC® system provides the following abilities:

- Connect media devices in order to play audio files
- Control the entertainment system using voice commands
- Initiate an emergency assistance call when the airbags deploy (for more information, refer to “Emergency Assistance” in the Owner's Literature).
- Play media files via a paired Bluetooth-enabled audio device
- Send and receive phone calls via a paired Bluetooth-enabled phone
- Send and receive text messages via a paired Bluetooth-enabled phone

USB Mode

When a portable media device, such as an iPod® with its available cable or portable mass storage such as a USB thumb drive, is connected to the vehicle audio system through the USB port, audio from the device can be played through the vehicle speakers. Functions such as volume, seek, fast forward, pause, etc. can be controlled with the vehicle’s audio controls.

When playing media files stored on a mass storage device such as a flash drive, the SYNC® system only plays files that do not have DRM protection.

In addition to audio information (track length, track number, etc.), metadata (information such as artist, album title, song title, and genre) may also be sent to the APIM from a device connected to the USB port. The APIM uses the metadata to create indexes that can be used to sort for particular music based on the customer’s preferences. Not all USB devices can send metadata to the APIM. When a new media device is connected to the SYNC® system, the APIM automatically indexes the information. This may take several minutes depending on the amount of data on the device, and is considered normal operation. When a device that was previously connected to the SYNC® system is reconnected, the APIM updates the index rather than creating a new one. This reduces the time needed to index the device.

Voice Recognition

Voice recognition allows certain phone and audio system functions to be controlled with voice commands to reduce or eliminate the need to interact with the centerstack infotainment display and/or device while driving.

When the voice steering wheel switch is pressed, an audible prompt originating from the APIM is heard from the speakers. Based on the customer’s setting, audible prompts will either be a voice or a simple tone. When interaction mode is set to standard, detailed voice guidance is provided. When interaction mode is set to advanced, most prompts are tones only, and minimal voice guidance is provided. The microphone receives the voice commands and sends them to the APIM. For more information, refer to “voice recognition” in the Owner's Literature.

Component Description

ACM

The ACM can be operated with the ignition in RUN, ACC, or OFF.

The ACM receives radio waves containing audio from the antenna coaxial cable(s) and converts them into fluctuating AC voltage. The ACM receives stereo and mono audio signals from the APIM in the form of fluctuating AC voltage. The ACM processes all inputs, and depending on the input received, sends stereo or mono analog audio signals to the speakers as fluctuating AC voltage.

The ACM requires PMI when it is replaced.

Antenna

The AM/ FM radio uses the roof-mounted combination AM/ FM antenna to receive analog radio waves. The radio waves are sent through the AM/ FM antenna coaxial cable to the ACM, where they are amplified. A second FM 2 foil antenna is mounted under the splash shield next to the bumper for diversity functionality.

APIM

The APIM can be operated with the ignition in RUN, ACC, or OFF.

The APIM receives stereo and mono inputs. Stereo inputs include audio from the USB port, audio input jack, and connected Bluetooth media device. Mono inputs include audio from the outside device during a phone call and inputs from the SYNC® microphone.

The APIM sends stereo and mono audio signals to the ACM as fluctuating AC voltage. Stereo outputs include audio from the USB port, audio input jack, and connected Bluetooth media device. Mono outputs include audio from the TTS feature, incoming call ringtone, ringback tone, outside device during a phone call, voice or tone prompts initiated from the steering wheel switches and infotainment centerstack, and SYNC® system instructions.

The TTS setting allows the customer to hear incoming caller information and incoming text messages through the audio system speakers so it does not have to be read from the centerstack infotainment display and/or device while driving.

The APIM consists of two internal modules: the CIP and the VIP. The modules are not replaceable individually, but can be programmed independently if required.

The CIP interfaces with all of the customer inputs to the APIM. It contains an analog-to-digital-to-analog converter, as well as the Bluetooth chipset.

The VIP provides an interface between the CIP and the vehicle inputs. Its main functions are controlling the APIM power management and translating inbound and outbound CAN signals.

The APIM requires programming when it is replaced.

Audio Input Jack

The audio input jack can be used to play audio files from an audio device connected through the 1/8-inch (3.5 mm) audio jack.

Audio signals are sent from the audio input jack to the APIM.

There are no power or ground circuits to the audio input jack.

FCDIM

The FCDIM can be operated with the ignition in RUN, ACC, or OFF.

The FCDIM displays infotainment data received from various modules over the CAN. If the FCDIM loses the signal from any of these modules, only those specific displays will be inoperative. For more information,
Refer to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The FCDIM requires PMI when replaced.

FCIM

The FCIM audio functions can be operated with the ignition in RUN, ACC, or OFF.

The FCIM audio system buttons provide one of the methods with which the customer interacts with the infotainment system.

The FCIM is separate from the ACM.

The FCIM requires PMI when replaced.

GPSM

The GPSM provides vehicle location information for identifying the vehicle location in the event of a collision.

The GPSM requires PMI when it is replaced.

Media Hub

The media hub allows for various audio and video devices to play content through the vehicle speakers and to be viewed on the FDIM. The media hub contains:

- 1 USB port
  - Data is sent from the USB ports to the APIM through the USB cable.
  - Although there is one USB port and cable connecting the media hub to the APIM.
  - The USB port is powered through circuits from the APIM, and can be used to power and/or charge a device if the device supports this feature. If the device does not support this feature, an external power source is needed in order to power the device.
- 1 set of component RCA jacks (left audio, right audio, video)
  - The media hub contains an internal composite audio/video translator connected to the external RCA jacks, which outputs video and audio signals to the APIM through shielded audio and video circuits.

Noise Suppression Equipment

The radio frequency suppression equipment reduces interference transmitted through the speakers by the engine, ignition, and electrical systems. When installing any new radio suppression equipment components, make sure that a good contact is made at all connections. (Not applicable on vehicles with diesel engines).

Steering Wheel Switches

The RH steering wheel switches contain series of resistors. Each steering wheel switch function corresponds with a specific resistance value within the switch.

The SCCM sends a 5-volt reference voltage to the RH steering wheel switches on the input circuit. When a switch is pressed, the voltage is routed through the corresponding resistor(s), through the return circuit to ground through the SCCM. The SCCM monitors the voltage drop to determine which switch was pressed. The voltage drop varies depending upon the resistance of the specific switch pressed.

The left, right, up, down, and OK steering wheel switch inputs are sent as network messages from the SCCM to the FCDIM to control the infotainment display.

The seek +/-, audio mode, mute, and volume +/- steering wheel switch inputs are sent as network messages from the CCM to the ACM to control audio functions.

The voice, send/receive call, and end call steering wheel switch inputs are sent as network messages from the SCCM to the APIM to control SYNC® functions.

SYNC® Microphone

The SYNC® microphone receives SYNC® system voice commands and outgoing audio during a phone call. The monitored sounds are converted into analog signals by the microphone and sent to the APIM.

USB Port/Cables

Data is sent from the USB port to the APIM through the USB cable.

The USB port is part of the USB cable, and cannot be replaced separately.

The USB port is powered through the USB cable by the APIM and can be used to power and/or charge a device if the device supports this feature. If the device does not support this feature, an external power source is needed in order to power the device.

Copyright © 2016 Ford Motor Company

Information and Entertainment System

For a SYNC®-related concern, refer to the SYNC® Symptom Chart before connecting the scan tool and beginning DTC-based diagnostics.

DTC Chart: ACM

DTC	Description	Action
B1142:27	Ignition Status 1: Signal Rate of Change Above Threshold	GO to Pinpoint Test E
B1A01:01	Speaker #1: General Electrical Failure	• For a LHF door speaker concern, GO to Pinpoint Test F • For a LHF door tweeter speaker concern, GO to Pinpoint Test G
B1A01:11	Speaker #1: Circuit Short To Ground	• For a LHF door speaker concern, GO to Pinpoint Test F • For a LHF door tweeter speaker concern, GO to Pinpoint Test G
B1A01:12	Speaker #1: Circuit Short To Battery	• For a LHF door speaker concern, GO to Pinpoint Test F • For a LHF door tweeter speaker concern, GO to Pinpoint Test G
B1A01:13	Speaker #1: Circuit Open	GO to Pinpoint Test F
B1A02:01	Speaker #2: General Electrical Failure	• For a RHF door speaker concern, GO to Pinpoint Test H • For a RHF door tweeter speaker concern, GO to Pinpoint Test I
B1A02:11	Speaker #2: Circuit Short To Ground	• For a RHF door speaker concern, GO to Pinpoint Test H • For a RHF door tweeter speaker concern, GO to Pinpoint Test I
B1A02:12	Speaker #2: Circuit Short To Battery	• For a RHF door speaker concern, GO to Pinpoint Test H • For a RHF door tweeter speaker concern, GO to Pinpoint Test I
B1A02:13	Speaker #2: Circuit Open	GO to Pinpoint Test H
B1A03:01	Speaker #3: General Electrical Failure	GO to Pinpoint Test J
B1A03:11	Speaker #3: Circuit Short To Ground	GO to Pinpoint Test J
B1A03:12	Speaker #3: Circuit Short To Battery	GO to Pinpoint Test J
B1A03:13	Speaker #3: Circuit Open	GO to Pinpoint Test J
B1A04:01	Speaker #4: General Electrical Failure	GO to Pinpoint Test K
B1A04:11	Speaker #4: Circuit Short To Ground	GO to Pinpoint Test K
B1A04:12	Speaker #4: Circuit Short To Battery	GO to Pinpoint Test K
B1A04:13	Speaker #4: Circuit Open	GO to Pinpoint Test K
B1A56:21	Antenna: Signal Amplitude <	If DTC B1A56:21 sets after running the bezel diagnostic tests, DISREGARD this DTC. This test is used for end of line or repair bay testing at the assembly plant.

	Minimum	Each plant has its own assigned frequency and signal strength requirements. The running and passing of this test depends on local radio stations. If no local station is broadcasting on the required frequency, the test will fail.
B1D19:49	Compact Disc Unit: Internal Electronic Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B1D19:49 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
B1D19:4B	Compact Disc Unit: Over Temperature	The ACM was over temperature. This may occur during extended use. Audio operation can resume after the ACM cools. CLEAR the DTC.
B1D55:11	Antenna #2 Circuit Short To Ground	GO to Pinpoint Test A
B1D55:15	Antenna #2 Circuit Short To Battery Or Open	GO to Pinpoint Test A
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test V
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test W
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test Y
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	GO to Pinpoint Test AC
U0256:00	Lost Communication With Front Controls Interface Module “A”: No Sub Type Information	GO to Pinpoint Test AD
U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	GO to Pinpoint Test AE
U201A:51	Control Module Main Calibration Data: Not Programmed	This DTC sets due to an incorrect or incomplete ACM configuration. Using a diagnostic scan tool, PERFORM the ACM programming procedure using as-built data. For information on as-built data.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	This DTC sets due to an incorrect or incomplete ACM configuration. Using a diagnostic scan tool, PERFORM the ACM programming procedure using as-built data. For information on as-built data.
U2101:00	Control Module	This DTC sets due to an incorrect or incomplete ACM configuration. Using a

	Configuration Incompatible: No Sub Type Information	diagnostic scan tool, PERFORM the ACM programming procedure using as-built data. For information on as-built data.
U3000:41	Control Module: General Checksum Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:96	Control Module: Component Internal Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:96 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AF
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AG

DTC Chart: APIM

DTC	Description	Action
B1252:04	USB Port: System Internal Failure	GO to Pinpoint Test Q
B1252:11	USB Port: Circuit Short To Ground	GO to Pinpoint Test Q
B1D79:01	Microphone Input: General Electrical Failure	GO to Pinpoint Test O
B1D79:11	Microphone Input: Circuit Short To Ground	GO to Pinpoint Test O
B1D79:12	Microphone Input: Circuit Short To Battery	GO to Pinpoint Test O
B1D79:13	Microphone Input: Circuit Open	GO to Pinpoint Test O
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test W
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test X
U0155:00	Lost Communication With Instrument Panel Cluster (IPC)	GO to Pinpoint Test Y

	Control Module: No Sub Type Information	
U016A:00	Lost Communication With Global Positioning System Module: No Sub Type Information	GO to Pinpoint Test AA
U0184:00	Lost Communication With Radio: No Sub Type Information	GO to Pinpoint Test AB
U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	GO to Pinpoint Test AE
U0422:00	Invalid Data Received from Body Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). • If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U0423:00	Invalid Data Received From Instrument Panel Cluster Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the IPC. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). • If no Diagnostic Trouble Codes (DTCs) are present in the IPC, DIAGNOSE the observable symptom.
U0452:00	Invalid Data Received From Restraints Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • If no Diagnostic Trouble Codes (DTCs) are present in the RCM, DIAGNOSE the observable symptom.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	This DTC sets due to an incorrect or incomplete APIM programming/provisioning. Using a diagnostic scan tool, PERFORM the APIM programming procedure. REFER to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	This DTC sets due to an incorrect or incomplete APIM programming/provisioning. Using a diagnostic scan tool, PERFORM the APIM programming procedure. REFER to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
U3000:04	Control Module: System Internal Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:04 is retrieved again, INSTALL a new APIM. PERFORM the APIM programming procedure. REFER to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new APIM. PERFORM the APIM programming procedure.

		REFER to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
U3000:42	Control Module: General Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new APIM. PERFORM the APIM programming procedure. REFER to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
U3000:88	Control Module: Bus Off	**NOTE:** *The module was unable to communicate on the network at a point in time. The fault is not currently present since the module had to communicate with the diagnostic scan tool to report this DTC.* **To avoid repeat network concerns:** • INSPECT for damaged or corroded wiring at the APIM. • CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the network test with the diagnostic scan tool.
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AF
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AG

DTC Chart: FCDIM

DTC	Description	Action
C1001:01 (only for vehicles that display the rear video camera image in the FCDIM)	Vision System Camera: General Electrical Failure	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing). See FCDIM DTC Chart.
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test W
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test Y
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	GO to Pinpoint Test Z
U0184:00	Lost Communication With Radio: No Sub Type Information	GO to Pinpoint Test AB
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	GO to Pinpoint Test AC
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	GO to Pinpoint Test AD

U2013:87	Switch Pack: Missing Message	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U2013:87 is retrieved again, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U201A:51	Control Module Main Calibration Data: Not Programmed	This DTC sets due to an incorrect or incomplete FCDIM configuration. Using a diagnostic scan tool, PERFORM the FCDIM programming procedure using as-built data. For information on as-built data.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	This DTC sets due to an incorrect or incomplete FCDIM configuration. Using a diagnostic scan tool, PERFORM the FCDIM programming procedure using as-built data.
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	This DTC sets due to an incorrect or incomplete FCDIM configuration. Using a diagnostic scan tool, PERFORM the FCDIM programming procedure using as-built data.
U3000:41	Control Module: General Checksum Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AF
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AG

DTC Chart: FCIM

DTC	Description	Action
B00D5:01	Restraint System Passenger Disable Indicator: General Electrical Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B00D5:01 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
B1202:01	Restraint System Passenger Enable Indicator: General Electrical Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B1202:01 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B

		Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test W
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test Y
U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	GO to Pinpoint Test AE
U0422:00	Invalid Data Received from Body Control Module: No Sub Type Information	RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). • If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U2013:63	Switch Pack: Circuit / Component Protection Time-Out	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U2013:63 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U201A:51	Control Module Main Calibration Data: Not Programmed	This DTC sets due to an incorrect or incomplete FCIM configuration. Using a diagnostic scan tool, PERFORM the FCIM programming procedure using as-built data. For information on as-built data.
U3000:41	Control Module: General Checksum Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AF
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AG

DTC Chart: GPSM

DTC	Description	Action
U0100:00	Lost Communication with ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test V
U0140:00	Lost Communication With Body Control Module: No Sub Type	GO to Pinpoint Test W

	Information	
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test Y
U0401:00	Invalid Data Received from ECM/PCM A: No Sub Type Information	• REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) . • **NOTE:** *If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.*
U0422:00	Invalid Data Received from Body Control Module: No Sub Type Information	RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). • If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U0423:00	Invalid Data Received from Instrument Panel Cluster Control Module: No Sub Type Information	RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the IPC. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). • If no Diagnostic Trouble Codes (DTCs) are present in the IPC, DIAGNOSE the observable symptom.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	This DTC sets due to an incorrect or incomplete GPSM configuration. Using a diagnostic scan tool, PERFORM the GPSM programming procedure using as-built data. For information on as-built data.
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	This DTC sets due to an incorrect or incomplete GPSM configuration. Using a diagnostic scan tool, PERFORM the GPSM programming procedure using as-built data. For information on as-built data.
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U3000:42	Control Module: General Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AF
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AG

DTC Chart: SCCM

DTC	Description	Action
B1380:09	Steering Wheel Right Switch Pack: Component Failure	GO to Pinpoint Test S
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	GO to Pinpoint Test S
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	GO to Pinpoint Test S
All other Diagnostic Trouble Codes (DTCs)	—	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Symptom Charts

Symptom Chart: General Audio System

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals, or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The RH steering wheel switches are inoperative or do not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test S
The CD player is inoperative or does not operate correctly	Refer to the Pinpoint Test	• INSPECT the CD for scratches, fingerprints, a loose paper label, incorrect format, or damage. INSERT a known good CD and TEST the system. – If the system operates correctly, the concern was caused by a damaged CD. – If the system does not operate correctly, INSTALL a new ACM . REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
The speed compensated volume does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test B
The audio system does not operate correctly from the FCIM	Refer to the Pinpoint Test	GO to Pinpoint Test T
The FCIM illumination is inoperative or does not dim	• Illumination system concern • FCIM	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
The FCDIM is inoperative or does not operate	Refer to the Pinpoint Test	GO to Pinpoint Test U

correctly		
The FCDIM illumination is inoperative or does not dim	• Illumination system concern • FCIM	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).

Symptom Chart: Sound Quality

Condition	Possible Sources	Actions
Poor reception - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
Continuous seek or scan - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
A loud popping sound is heard when cycling the ignition	Refer to the Pinpoint Test	GO to Pinpoint Test C
Poor sound quality or distorted sound from one or more speakers (not all speakers)	Refer to the Pinpoint Test	GO to Pinpoint Test D
No sound from all speakers	Refer to the Pinpoint Test	GO to Pinpoint Test E
The LF door midwoofer speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test F
The LF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test G
The RF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test H
The RF door midwoofer speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test I
The RR door full-range speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test J
The LR door full-range speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test K

Symptom Chart: SYNC® System

Condition	Possible Sources	Actions
The SYNC® system is inoperative (no response is received from phone, voice, and media inputs)	Refer to the Pinpoint Test	GO to Pinpoint Test L
All APIM stereo outputs are inoperative or do not operate correctly. Refer to the Owners Literature for additional information.	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test M
All APIM mono outputs are inoperative or do not operate correctly. Refer to the Owners Literature for additional information.	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test N
Voice recognition is	Refer to the	PERFORM the APIM Reset.

inoperative or does not operate correctly	Pinpoint Test	REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). Check phone and perform a full power cycle, OFF then ON. Confirm voice quality performance. Delete all previously paired phones on the phone and pair the phone again to the SYNC. Check voice quality performance. Check phone is listed on the phone compatibility list. REPEAT with known phone from the phone compatibility list and confirm voice quality performance. If the concern is still present, GO to Pinpoint Test O
During a phone call, no outgoing audio is heard on the outside device	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test O
The SYNC® steering wheel switches are inoperative or do not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test S
The audio input jack is inoperative or does not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test P
The USB port is inoperative or does not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test Q
Unable to pair Bluetooth device	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test R
An individual Bluetooth device feature is inoperative (text messaging, media playback or controls, phone book download, call history, or call waiting)	Customer's device compatibility	• PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). • INSTRUCT the customer to review the device compatibility list. REFER to www.syncmyride.com. It is normal operation for unsupported or incompatible Bluetooth features to be unavailable through the SYNC® system. • If the inoperative feature is compatible, ADVISE the customer to check their device for firmware updates, and if required, reset their device following the manufacturer's instructions.
SYNC® AppLink™ is inoperative or does not operate correctly	Customer's device compatibility	• PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). • If the concern is still present, INSTRUCT the customer to review the mobile device platform, application, and application version compatibility list. REFER to www.syncmyride.com. It is normal operation for incompatible mobile device platforms, applications, and application versions to be unavailable through SYNC® AppLink™. • If the mobile device platform, application, and application version

		are compatible, and the device is connected through Bluetooth only, GO to Pinpoint Test R • If the mobile device platform, application, and application version are compatible, and the device is connected through Bluetooth and the USB port, GO to Pinpoint Test Q

Pinpoint Tests

Poor Reception Or Continuous Seek Or Scan - AM/ FM

Refer to Wiring Diagrams Cell 131 for schematic and connector information.

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D55:11	Antenna #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the FM2 antenna coaxial cable for more than 1 second.
B1D55:15	Antenna #2: Circuit Short To Battery or Open	Set by the ACM when a short to voltage or open is detected on the FM2 antenna coaxial cable for more than 1 second.

Possible Sources

- No channel found in the selected RDS category
- Noise suppression equipment
- Charging system
- Wiring, terminals, or connectors
- Ignition system
- FM2 antenna
- AM/ FM1 antenna coaxial cable
- FM2 antenna coaxial cable
- AM/ FM1 antenna
- Mounting surface corrosion
- FM2 diversity antenna amplifier
- ACM

PINPOINT TEST A : POOR RECEPTION OR CONTINUOUS SEEK OR SCAN - AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION)

A1 CHECK THE AUDIO SYSTEM RECEPTION WITH THE ENGINE RUNNING

- Operate the audio system in AM/ FM mode.
- Check the reception with the engine running, and with the engine off.

Is poor reception only present with the engine running?

Yes	GO to A2
No	GO to A4

A2 CHECK THE GENERATOR

- Ignition OFF.
- **NOTICE: Do not allow the generator B+ cable terminal to make contact with a conductive surface. Failure to follow this instruction may result in personal injury or damage to the vehicle.**
- Disconnect Generator B+ Cable C102C.
- Start the engine.
- Operate the audio system in AM/ FM mode.

Is the reception OK?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
No	GO to A3

A3 CHECK THE IGNITION CIRCUITS

- Ignition OFF.
- Connect Generator B+ Cable C102C.
- Inspect all the wiring harnesses and connectors for damaged insulation and loose or broken conditions.

Are the ignition components OK?

Yes	USE a jumper cable to temporarily ground various parts of the vehicle (examples include: engine, fenders, quarter panels, body sheet metal) to the frame. When the noise is eliminated, PROVIDE a permanent ground where necessary.
No	REPAIR or REPLACE the harness or components as necessary.

A4 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR CORRECT VOLTAGE

- Ignition OFF.
- Disconnect Antenna C9021.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9021-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to A7
No	GO to A5

A5 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect ACM C240A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9021-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A6
No	REPAIR the circuit.

A6 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9021-2	Ω	C240A-2

Is the resistance less than 3 ohms?

Yes	GO to A22
No	REPAIR the circuit.

A7 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: AM/ FM1 antenna coaxial cable at the ACM.
  REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Disconnect: FM2 antenna coaxial cable at the ACM.
  REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Disconnect: AM/ FM1 antenna coaxial cable at the antenna.
  REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Disconnect: FM2 antenna inline coaxial cable at the antenna.
  REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	V	Ground
AM/ FM1 antenna coaxial cable shield at the ACM	V	Ground
FM2 antenna coaxial cable core at the ACM	V	Ground

FM2 antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	REPAIR, or INSTALL a new front AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
No	GO to A8

A8 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground
FM2 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A9
No	REPAIR, or INSTALL a new front AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A9 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna connection
AM/ FM1 antenna coaxial cable shield at the ACM	Ω	AM/ FM1 antenna connection
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna connection
FM2antenna coaxial cable shield at the ACM	Ω	FM2 antenna connection

Are the resistances less than 1 ohm?

Yes	GO to A10
No	REPAIR, or INSTALL a new front AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A10 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna coaxial cable shield at the ACM
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A11
No	REPAIR, or INSTALL a new front AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A11 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: AM/ FM1 antenna coaxial cable at the antenna unit.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM		Ground
AM/ FM1 antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
No	GO to A12

A12 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A13
No	INSTALL a new AM/ FM1 antenna.

	REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A13 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A14
No	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A14 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A16
No	GO to A15

A15 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the AM/ FM1 antenna unit.
  REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna unit shield at the antenna unit (component side)	Ω	AM/ FM1 antenna base (unpainted surface)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on the antenna unit base and/or vehicle mounting surface. REINSTALL the antenna and ensure the proper torque value is achieved.

	REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
No	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A16 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: FM2 antenna coaxial cable at the FM2 Diversity Antenna Amplifier.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM		Ground
FM2 antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
No	GO to A17

A17 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A18
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A18 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A19
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A19 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A21
No	GO to A20

A20 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the FM2 diversity antenna amplifier.
  REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna shield at the FM2 diversity antenna amplifier (component side)	Ω	FM2 diversity antenna amplifier base (unpainted surface on the mounting tab)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on theFM2 diversity antenna amplifier base and/or vehicle mounting surface. REINSTALL the FM2 diversity antenna amplifier and ensure the proper torque value is achieved. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .

A21 CHECK THE FM (FREQUENCY MODULATION) 2 ANTENNA COMPONENTS

- Disconnect and inspect the FM2 diversity antenna amplifier connector for the FM2 antenna circuits.
  REFER to: Audio Unit Antenna (415-00A) .
- Inspect the FM2 antenna circuits and connectors.

Is any damage present on the FM2 antenna circuits or connections?

Yes	REPAIR or REPLACE as necessary.
No	GO to A22

A22 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Speed Compensated Volume Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Sources

- Speed compensated volume setting
- ACM

PINPOINT TEST B : THE SPEED COMPENSATED VOLUME DOES NOT OPERATE CORRECTLY

B1 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and observe the speedometer.

Does the speedometer operate correctly?

Yes	GO to B2
No	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

B2 CHECK THE SPEED COMPENSATED VOLUME SETTING

- Turn the speed compensated volume off. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- Set the speed compensated volume to maximum compensation. Refer to the Owner's Literature.

- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.

Does the volume remain constant with the speed compensated volume turned off, and increase and decrease with vehicle speed with the speed compensated volume set to maximum?

Yes	The system is operating correctly at this time. INSTRUCT the customer in the correct usage of the speed compensated volume feature.
No	GO to B3

B3 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 retrieved in any audio system module?

Yes	GO to Pinpoint Test Y
No	GO to B4

B4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Loud Popping Sound Is Heard When Cycling The Ignition

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 20 for schematic and connector information.

Normal Operation and Fault Conditions

The ACM receives voltage on a start signal circuit when the ignition is in the START position, and mutes the audio signal output. This prevents voltage spikes from producing popping noises through the speakers.

Possible Sources

- Wiring, terminals, or connectors
- ACM

PINPOINT TEST C : A LOUD POPPING SOUND IS HEARD WHEN CYCLING THE IGNITION

C1 CHECK THE START SENSE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect ACM C4821A.
- Disconnect BJB C1035D.
- Disconnect PCM C1232C 2.2L Engine .
- Disconnect PCM C175B 2.5L Engine .
- Disconnect PCM C1232C 3.2L Engine .
- Measure:

2.2L Duratorq

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	C1035D-13
C4821A-3	Ω	C1232C-37

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	C1035D-13
C4821A-3	Ω	C175A-37

3.2L Duratorq

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	C1035D-13
C4821A-3	Ω	C1232C-37

Are the resistances less than 3 ohms?

Yes	GO to C2
No	REPAIR the circuit.

C2 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment

	System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Poor Sound Quality Or Distorted Sound From One Or More Speakers (Not All Speakers)

Normal Operation and Fault Conditions

The ACM sends audio signals to the speakers in the form of AC voltage, resulting in clear audio output.

Possible Sources

- Loose component fasteners
- Loose door handle, lock, and other trim panel components and fasteners
- Loose items in storage areas
- Loose speaker grilles
- Loose wire harnesses or wire harness fasteners
- Speaker(s)
- Water shield bonding and placement

Visual Inspection and Diagnostic Pre-checks

Inspect the suspect area for any possible rattle conditions such as:

- Any storage compartments including cup holders (if equipped)
- Door map pockets for contents that can rattle (if equipped)
- Door pull cup attachments (if equipped)
- Door switch bezels (if equipped)
- Package tray (if equipped)
- Speaker grilles (if equipped)
- Trim panels and fasteners

PINPOINT TEST D : POOR SOUND QUALITY OR DISTORTED SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

D1 ISOLATE THE ZONE

- Operate the audio system using digital media such as a CD or MP3.
- Using the audio system fade and balance feature, adjust the audio sound to each of the four zones (LHF, RHF, LHR, and RHR) of the vehicle to isolate the poor sound quality.
- Locate and apply pressure to the trim panel(s) around the poor sound quality area in question.

Does applying pressure to a trim panel reduce or eliminate the audible noise?

Yes	REPAIR or REPLACE the trim panel as needed.
No	GO to D2

D2 REMOVE AND INSPECT BEHIND/UNDERNEATH THE SUSPECT TRIM PANEL(S)

- Remove the trim panel to access the suspect speaker.
- Operate the audio system using digital media such as a CD or MP3.
- Validate where the poor sound quality area is located.
- Check:
  - All child safety belt anchors (if equipped).
  - All safety belt retractors.
  - All speaker bracket fasteners and other fasteners are secured and tightened to specified torque.
  - Lock and handle mechanical parts for correct attachment.
  - Storage areas for loose items.
  - Trim panel for loose components around the speaker area such as the speaker grille.
  - Trim panel joining components for missing or broken pieces.
  - Water shield for correct bonding to sheet metal.
  - Water shield for correct placement (speaker air path not blocked).
  - Wire harness fasteners for correct attachment.

- Wire harnesses for correct routing.

Was the source of the noise located?

Yes	REPAIR or REPLACE any loose or broken component or fastener as needed.
No	GO to D3

D3 CHECK THE SUSPECT SPEAKER FOR WATER INTRUSION

- Inspect for watermarks.
- Check the:
  - Basket
  - Cone
  - Magnet

Are any watermarks present on the speaker?

Yes	VERIFY the water shield is in the correct location, REPAIR or REPLACE any trim, door, or speaker seal as required. DRY the speaker in question and TEST the system for normal operation.
No	GO to D4

D4 ISOLATE SPEAKER TO VERIFY NOISE

- Remove the suspect speaker from its location and leave the speaker connected to the harness.
- Hold the speaker away from any trim panel(s) and ensure the speaker is isolated from contact.
- Operate the audio system using digital media such as a CD or MP3.

Is the noise still present in the suspect speaker?

Yes	INSTALL a new speaker for the one in question.
No	LOCATE the source of the noise and REPAIR as needed.

No Sound From All Speakers

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

To prevent voltage spikes from producing popping noises through the speakers when the ignition is in the START position, the BCM provides an Ignition Status CAN message, and the PCM applies voltage on the ACM start signal circuit. When the CAN message and/or voltage is received by the ACM, the audio signal output is muted. A short to voltage on this circuit causes the ACM output to be muted continuously, and will cause the warning chimes to only sound from the IPC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

B1142:27	Ignition Status 1: Signal Rate of Change Above Threshold	Set by the ACM when a short to voltage is detected on the start signal circuit.

Possible Sources

- Wiring, terminals, or connectors
- Fuse
- ACM

PINPOINT TEST E : NO SOUND FROM ALL SPEAKERS

E1 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM pass the network test?

Yes	GO to E2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E2 CHECK THE START SENSE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Disconnect BJB Starter Relay.
- Disconnect PCM C1232A 2.2L Engine.
- Disconnect PCM C175B 2.5L Engine.
- Disconnect PCM C1232A 3.2L Engine .
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E3

E3 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical

	Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Midwoofer Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:01	Speaker #1: General Electrical Failure	Set by the ACM when a failure is detected on the LHF door or LHF door tweeter speaker circuits.
B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:12	Speaker #1: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:12 is set, the speaker output is disabled.
B1A01:13	Speaker #1: Circuit Open	Set by the ACM when an open is detected on the LHF door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST F : THE LHF (LEFT-HAND FRONT) DOOR MIDWOOFER SPEAKER IS INOPERATIVE

F1 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C6003RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	~	C5003-4

	V	

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1		C6003-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to F2

F2 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1		Ground
C5003-4		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1		Ground
C6003-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to F3

F3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	Ground
C5003-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	Ground
C6003-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to F4
No	REPAIR the circuit in question.

F4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C4821A-10
C5003-4	Ω	C4821A-22

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C4821A-10
C6003-4	Ω	C4821A-22

Are the resistances less than 3 ohms?

Yes	GO to F5
No	REPAIR the circuit in question.

F5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Measure.

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C6003-4

Is the resistance greater than 10,000 ohms?

Yes	GO to F6
No	REPAIR the circuit in question.

F6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:01	Speaker #1: General Electrical Failure	Set by the ACM when a failure is detected on the LHF door or LHF door tweeter speaker circuits.
B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:12	Speaker #1: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST G : THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

G1 CHECK THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the LHF door speaker operate correctly?

Yes	GO to G2
No	GO to Pinpoint Test F

G2 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C5002LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C6002RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	V~	C5002-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	V~	C6002-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to G3

G3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C6003RHD Vehicles .
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	V	Ground
C5002-3	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	V	Ground
C6002-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to G4

G4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	Ω	Ground
C5002-3	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	Ω	Ground
C6002-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to G5
No	REPAIR the circuit in question.

G5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	Ω	C5003-3
C5002-3	Ω	C5003-2

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	Ω	C6003-3
C6002-3	Ω	C6003-2

Are the resistances less than 3 ohms?

Yes	GO to G6
No	REPAIR the circuit in question.

G6 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	Ω	C5002-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead

C6002-1	Ω	C6002-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHF Door Midwoofer Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The door speaker and door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:01	Speaker #2: General Electrical Failure	Set by the ACM when a failure is detected on the RHF door or RHF door tweeter speaker circuits.
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:12	Speaker #2: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:12 is set, the speaker output is disabled.
B1A02:13	Speaker #2: Circuit Open	Set by the ACM when an open is detected on the RHF door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST H : THE RHF (RIGHT-HAND FRONT) DOOR MIDWOOFER SPEAKER IS INOPERATIVE

H1 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles .
- Disconnect RHF Door Speaker C5015RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1		C6015-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1		C5015-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to H2

H2 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1		Ground
C6015-4		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1		Ground
C5015-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to H3

H3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A

H3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	Ground
C6015-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	Ground
C5015-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to H4
No	REPAIR the circuit in question.

H4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C4821A-23
C6015-4	Ω	C4821A-11

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C4821A-23
C5015-4	Ω	C4821A-11

Are the resistances less than 3 ohms?

Yes	GO to H5
No	REPAIR the circuit in question.

H5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C6015-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C5015-4

Is the resistance greater than 10,000 ohms?

Yes	GO to H6
No	REPAIR the circuit in question.

H6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The door speaker and door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:01	Speaker #2: General Electrical Failure	Set by the ACM when a failure is detected on the RHF door or RHF door tweeter speaker circuits.
B1A02:11	Speaker # 2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:12	Speaker #2: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST I : THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

I1 CHECK THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the RHF door speaker operate correctly?

Yes	GO to I2
No	GO to Pinpoint Test H

I2 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles .
- Disconnect RHF Door Tweeter Speaker C5012RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	≂V	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	≂V	C5012-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to I3

I3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles .
- Disconnect RHF Door Speaker C5015RHD Vehicles .
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	V	Ground
C6012-3	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	V	Ground
C5012-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to I4

I4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	Ground
C6012-3	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	Ground
C6012-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to I5
No	REPAIR the circuit in question.

I5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6015-3
C6012-3	Ω	C6015-2

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5015-3
C5012-3	Ω	C5015-2

Are the resistances less than 3 ohms?

Yes	GO to I6
No	REPAIR the circuit in question.

I6 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5012-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A03:01	Speaker #3: General Electrical Failure	Set by the ACM when a failure is detected on the RHR door speaker circuits.
B1A03:11	Speaker #3: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHR door speaker circuits.
B1A03:12	Speaker #3: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHR door speaker circuits.
B1A03:13	Speaker #3: Circuit Open	Set by the ACM when an open is detected on the RHR door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST J : THE RHR (RIGHT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

J1 CHECK THE AUDIO SIGNAL TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Disconnect RHR Door Speaker C802.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	~V	C802-4

	V	

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHR door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to J2

J2 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	V	Ground
C802-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to J3

J3 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	Ground
C802-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J4
No	REPAIR the circuit in question.

J4 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead

C802-1	Ω	C4821A-24
C802-4	Ω	C4821A-12

Are the resistances less than 3 ohms?

Yes	GO to J5
No	REPAIR the circuit in question.

J5 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C802-4

Is the resistance greater than 10,000 ohms?

Yes	GO to J6
No	REPAIR the circuit in question.

J6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B

Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A04:01	Speaker #4: General Electrical Failure	Set by the ACM when a failure is detected on the LHR door speaker circuits.
B1A04:11	Speaker #4: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHR door speaker circuits.
B1A04:12	Speaker #4: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHR door speaker circuits.
B1A04:13	Speaker #4: Circuit Open	Set by the ACM when an open is detected on the LHR door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST K : THE LHR (LEFT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

K1 CHECK THE AUDIO SIGNAL TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHR Door Speaker C702.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	V~	C702-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHR door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to K2

K2 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	+ V~ −	Ground
C702-4	+ V~ −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to K3

K3 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	Ground
C702-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to K4
No	REPAIR the circuit in question.

K4 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C4821A-21
C702-4	Ω	C4821A-9

Are the resistances less than 3 ohms?

Yes	GO to K5
No	REPAIR the circuit in question.

K5 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C702-4

Is the resistance greater than 10,000 ohms?

Yes	GO to K6
No	REPAIR the circuit in question.

K6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The SYNC® System Is Inoperative (No Response Is Received From Phone, Voice, And Media Inputs)

Refer to Wiring Diagrams Cell 132 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Sources

- Customer's device
- APIM

PINPOINT TEST L : THE SYNC® SYSTEM IS INOPERATIVE (NO RESPONSE IS RECEIVED FROM PHONE, VOICE, AND MEDIA INPUTS)

L1 VERIFY THE APIM (SYNC MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the APIM pass the network test?

Yes	GO to L2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

L2 CHECK THE SYNC® SYSTEM INPUTS FOR FUNCTIONALITY

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, and deletes any devices paired with the SYNC® system.*

- Connect: Multi-Media Interface Tester 420-373.

- Using the Multi-Media Interface Tester 420-373, test the audio output for the SYNC® audio sources (Bluetooth, USB, audio input jack) using the VOICE steering wheel switch to enter each mode.

Do all of the SYNC® inputs function correctly?

Yes	The SYNC® system is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature. REVIEW the SYNC® system operation with the customer. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	GO to L3

L3 RESET THE APIM (SYNC MODULE) AND RECHECK SYNC® SYSTEM OPERATION

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, and deletes any devices paired with the SYNC® system.*

- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, test the audio output for the SYNC® audio sources (Bluetooth, USB, audio input jack) using the VOICE steering wheel switch to enter each mode.

Do all of the SYNC® inputs function correctly?

Yes	The SYNC® system is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature. REVIEW the SYNC® system operation with the customer. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	• If there is a concern with one or more, but not all SYNC® audio sources, REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). • If there is a concern with the VOICE steering wheel switch, GO to Pinpoint Test S • If all inputs are inoperative, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

All APIM Stereo Outputs Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Sources

- Customer's device
- Wiring, terminals, or connectors
- APIM
- ACM

PINPOINT TEST M : ALL APIM (SYNC MODULE) STEREO OUTPUTS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

M1 VERIFY THE OPERATION OF THE SYNC® SYSTEM AUDIO SOURCES

- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, test the audio output for the SYNC® audio sources (Bluetooth, USB ports, and audio input jack).

Is there poor quality, distorted, or no sound from all SYNC® audio sources?

Yes	GO to M2
No	• If there is a concern with one or more, but not all SYNC® audio sources, REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). • If all SYNC® audio sources operate correctly with the Multi-Media Interface Tester 420-373, the concern is with the customer's device.

M2 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE)

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Play an audio file through the audio system using a SYNC® audio source (Bluetooth, USB ports, or audio input jack).
- While back-probing ACM C4821B, measure the AC voltage.

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	~V	C4821B-25
C4821B-13	~V	C4821B-26

Is a fluctuating AC voltage present?

Yes	GO to M8
No	GO to M3

M3 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821B.
- Disconnect APIM C2383.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	+ V −	Ground
C4821B-13	+ V −	Ground
C4821B-25	+ V −	Ground
C4821B-26	+ V −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to M4

M4 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	Ground
C4821B-13	Ω	Ground
C4821B-25	Ω	Ground
C4821B-26	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to M5
No	REPAIR the circuit in question.

M5 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	C2383-25
C4821B-13	Ω	C2383-23
C4821B-25	Ω	C2383-26
C4821B-26	Ω	C2383-24

Are the resistances less than 3 ohms?

Yes	GO to M6
No	REPAIR the circuit in question.

M6 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	C4821B-13
C4821B-12	Ω	C4821B-25
C4821B-12	Ω	C4821B-26
C4821B-13	Ω	C4821B-25
C4821B-13	Ω	C4821B-26

C4821B-25	Ω	C4821B-26

Are the resistances greater than 10,000 ohms?

Yes	GO to M7
No	REPAIR the circuit in question.

M7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connector.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connector. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M8 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All APIM Mono Outputs Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Sources

- Customer's setting
- Wiring, terminals, or connectors
- APIM
- ACM

PINPOINT TEST N : ALL APIM (SYNC MODULE) MONO OUTPUTS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

N1 CHECK THE AUDIBLE PROMPT FUNCTIONALITY

- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.

Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has been entered?

Yes	The system is operating correctly at this time. INSTRUCT the customer in the correct operation of the audible prompt feature. REFER to "SYNC® Voice Recognition Feature" in the Owner's Literature.
No	GO to N2

N2 CHECK THE OPERATION OF THE OTHER RH (RIGHT-HAND) STEERING WHEEL SWITCHES

- Operate the audio system in AM/ FM mode.
- Operate the SEEK +/-, VOLUME +/-, AUDIO MODE, SEND/RECEIVE CALL, END CALL, and MUTE steering wheel switches.

Do the SEEK +/-, VOLUME +/-, AUDIO MODE, SEND/RECEIVE CALL, END CALL, and MUTE steering wheel switches operate correctly?

Yes	GO to N3
No	GO to Pinpoint Test S

N3 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE)

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Operate the audio system in AM/ FM mode.
- While back-probing ACM C4821B, measure the AC voltage while repeatedly operating the VOICE steering wheel switch.

Positive Lead	Measurement / Action	Negative Lead
C4821B-8		C4821B-21

Is a fluctuating AC voltage present each time the VOICE steering wheel switch is operated?

Yes	GO to N9
No	GO to N4

N4 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821B.
- Disconnect APIM C2383.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	V	Ground
C4821B-21	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to N5

N5 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	Ω	Ground
C4821B-21	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N6
No	REPAIR the circuit in question.

N6 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	Ω	C2383-3
C4821B-21	Ω	C2383-4

Are the resistances less than 3 ohms?

Yes	GO to N7
No	REPAIR the circuit in question.

N7 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8		C4821B-21

Is the resistance greater than 10,000 ohms?

Yes	GO to N8
No	REPAIR the circuit in question.

N8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N9 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment

	System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Voice Recognition Is Inoperative Or Does Not Operate Correctly, Or During A Phone Call, Poor Quality Or No Outgoing Audio Is Heard On The Outside Device

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D79:01	Microphone Input: General Electrical Failure	Set by the APIM when a microphone is not detected during the on-demand self-test.
B1D79:11	Microphone Input: Circuit Short To Ground	Set by the APIM when a short to ground is detected on the microphone circuits.
B1D79:12	Microphone Input: Circuit Short To Battery	Set by the APIM when a short to battery voltage is detected on the microphone circuits.
B1D79:13	Microphone Input: Circuit Open	Set by the APIM when an open is detected on the microphone circuits.

Possible Sources

- Wiring, terminals, or connectors
- Insufficiently quiet vehicle
- Microphone
- Inadequate phone reception
- APIM

PINPOINT TEST O : VOICE RECOGNITION IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY, OR DURING A PHONE CALL, POOR QUALITY OR NO OUTGOING AUDIO IS HEARD ON THE OUTSIDE DEVICE

O1 CHECK THE AUDIBLE PROMPT FUNCTIONALITY

- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.

Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has been entered?

Yes	GO to O3
No	GO to O2

O2 CHECK THE OPERATION OF THE OTHER RH (RIGHT-HAND) STEERING WHEEL SWITCHES

- Operate the audio system in AM/ FM mode.
- Operate the SEEK +/-, VOLUME +/-, AUDIO MODE, SEND/RECEIVE CALL, END CALL, and MUTE

steering wheel switches.

Do the SEEK +/-, VOLUME +/-, AUDIO MODE, SEND/RECEIVE CALL, END CALL, and MUTE steering wheel switches operate correctly?

Yes	GO to Pinpoint Test N
No	GO to Pinpoint Test S

O3 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect APIM C2383.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-16	V	Ground
C2383-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to O4

O4 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Microphone C9221.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-16	Ω	Ground
C2383-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O5
No	REPAIR the circuit in question.

O5 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-16	Ω	C9221-1
C2383-4	Ω	C9221-2

Are the resistances less than 3 ohms?

Yes	GO to O6
No	REPAIR the circuit in question.

O6 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-16	Ω	C2383-4

Is the resistance greater than 10,000 ohms?

Yes	GO to O7
No	REPAIR the circuit in question.

O7 ISOLATE THE MICROPHONE

- Connect APIM C2383.
- Install a new microphone.
  REFER to: Microphone (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.
- Speak a command to test the voice recognition for normal operation.

Is the voice recognition functioning correctly?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative microphone.
No	GO to O8

O8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure they seat and latch correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Audio Input Jack Is Inoperative Or Does Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Sources

- Customer's device
- Wiring, terminals, or connectors
- Audio input jack
- APIM

PINPOINT TEST P : THE AUDIO INPUT JACK IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

P1 RESET THE APIM (SYNC MODULE) AND RECHECK SYNC® SYSTEM OPERATION

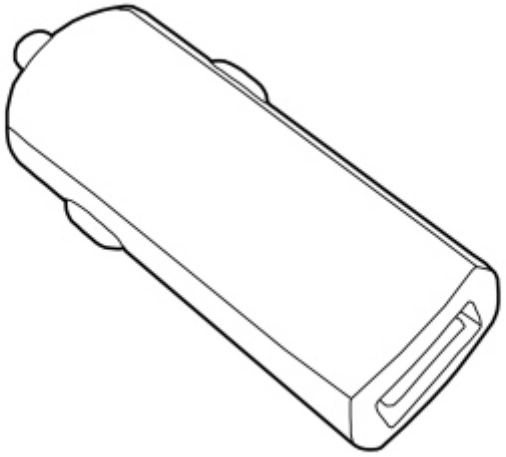
- Remove any devices connected to the USB port and audio input jack.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Ignition ON.
- Wait at least 2 minutes for the APIM to re-initialize.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, play an audio file using the audio input jack.

Is the audio output working correctly for the audio input jack?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	• If a power point to USB adapter **is** available, GO to P2 • If a power point to USB adapter is **not** available, GO to P3

P2 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE AUDIO INPUT JACK CIRCUITS TO THE APIM

- Ignition OFF.
- Disconnect APIM C2383.
- Connect: Power point to USB adapter to the instrument panel power point.



E210068

- Connect: Multi-Media Interface Tester 420-373 to the power point to USB adapter.
- Ignition ON.
- Using the Multi-Media Interface Tester 420-373, play an audio file using the audio input jack.
- Measure the AC voltage:

Positive Lead	Measurement / Action	Negative Lead
C2383-45	~V	C2383-46
C2383-47	~V	C2383-46

Is a fluctuating AC voltage present?

Yes	GO to P7
No	GO to P3

P3 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Audio Input Jack C3077.
- Disconnect APIM C2383.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3077-1	+ V −	Ground
C3077-3	+ V −	Ground
C3077-4	+ V −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to P4

P4 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3077-1	Ω	Ground
C3077-3	Ω	Ground
C3077-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to P5
No	REPAIR the circuit in question.

P5 CHECK THE AUDIO INPUT JACK CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3077-1	Ω	C2383-47
C3077-3	Ω	C2383-46
C3077-4	Ω	C2383-45

Are the resistances less than 3 ohms?

Yes	• If a power point to USB adapter **is** available, INSTALL a new audio input jack. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) . • If a power point to USB adapter is **not** available, GO to P6
No	REPAIR the circuit in question.

P6 ISOLATE THE AUDIO INPUT JACK

- Connect APIM C2383.
- Install a new audio input jack.
  REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using the audio input jack.

Is the audio output working correctly for the audio input jack?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative audio input jack.
No	GO to P7

P7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.

- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The USB Port Is Inoperative Or Does Not Operate Correctly

Refer to Wiring Diagrams Cell 132 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The Multi-Media Interface Tester 420-373 is powered by the USB port

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1252:04	USB Port: System Internal Failure	Set by the APIM when an over-temperature condition is detected on the USB cable. This can be caused by a fault on the USB cable/ port, or customer's USB device.
B1252:11	USB Port: Circuit Short to Ground	Set by the APIM when a short to ground or over-current condition is detected in the USB cable. This can be caused by a fault in the USB cable/port, or customer's USB device.

Possible Sources

- Customer's device
- USB cable/port
- USB cable/port connection
- APIM

PINPOINT TEST Q : THE USB (UNIVERSAL SERIAL BUS) PORT IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

Q1 CHECK THE USB (UNIVERSAL SERIAL BUS) PORT FOR POWER OUTPUT

- Connect: Multi-Media Interface Tester 420-373.

Does the Multi-Media Interface Tester 420-373 power on from the USB port?

Yes	GO to Q2

No	GO to Q3

Q2 RESET THE APIM (SYNC MODULE) AND RECHECK SYNC® SYSTEM OPERATION

- Remove any devices connected to the USB port and audio input jack.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using the USB port.

Is the audio output working correctly for the USB port?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	GO to Q3

Q3 CHECK THE APIM (SYNC MODULE) FOR DTC (DIAGNOSTIC TROUBLE CODE) B1252:04 OR DTC (DIAGNOSTIC TROUBLE CODE) B1252:11

- Using a diagnostic scan tool, clear the APIM Diagnostic Trouble Codes (DTCs).
- Perform the APIM self-test.

Is DTC B1252:04 or DTC B1252:11 present?

Yes	GO to Q4
No	GO to Q6

Q4 INSPECT THE USB (UNIVERSAL SERIAL BUS) CABLE AND APIM (SYNC MODULE)

- Ignition OFF.
- Disconnect: USB cable at APIM.
  REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Inspect the APIM connector port and both ends of the USB cable for damage. Remove any debris.

Is any damage present?

Yes	• For the USB cable, INSTALL a new USB cable/port. • For the APIM, PERFORM the APIM reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures).
No	GO to Q5

Q5 CHECK THE USB (UNIVERSAL SERIAL BUS) PORT FOR FUNCTIONALITY

- Connect: USB Cable At APIM.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using the USB port.

Is the audio output working correctly for the USB port?

Yes	The system is operating correctly at this time. The concern was caused by the USB connector not being seated correctly.
No	GO to Q6

Q6 ISOLATE THE USB (UNIVERSAL SERIAL BUS) CABLE/PORT

- Install a new USB cable/port.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play a file using the USB port.

Is the audio output working correctly for the USB port?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative USB cable.
No	GO to Q7

Q7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Unable To Pair Bluetooth Device

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Sources

- Incompatible Bluetooth device
- APIM

PINPOINT TEST R : UNABLE TO PAIR BLUETOOTH DEVICE

R1 CHECK THE BLUETOOTH CONNECTION

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, erases navigation and address data, deletes any devices paired with the SYNC® system, and deletes any devices paired with the MyLincoln Mobile™ phone application.*

- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, connect to the SYNC® system using Bluetooth. Follow the tool instructions.
- Using a diagnostic scan tool, view the APIM Parameter Identifications (PIDs).
- Monitor the Bluetooth device paired PID (BT_PAIR) and the Bluetooth device connected PID (BT_CONN).

Do the Parameter Identifications (PIDs) both read "Yes"?

Yes	The SYNC® system is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature. REVIEW the pairing process with the customer. If the customer's device still does not pair, the fault is with the customer's device.
No	GO to R2

R2 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RH Steering Wheel Switches Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1380:09	Steering Wheel Right Switch Pack: Component Failure	Set by the SCCM when the RH steering wheel switch is stuck for more than 2 minutes during normal operation.
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	Set by the SCCM when a short to ground is detected on the RH steering wheel switch circuits.
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	Set by the SCCM when a short to voltage is detected on the RH steering wheel switch circuits.

Possible Sources

- Steering wheel switch

- Wiring, terminals, or connectors
- Clockspring
- SCCM

PINPOINT TEST S : THE RH (RIGHT-HAND) STEERING WHEEL SWITCHES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

S1 CHECK THE RH (RIGHT-HAND) LOWER STEERING WHEEL SWITCH PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Monitor the steering wheel switch Parameter Identifications (PIDs) while pressing each RH steering wheel switch.

RH Steering Wheel Switch
- Seek + (SW_SEEKPLUS)
- Seek - (SW_SEEKMINUS)
- Volume + (SW_VOLUP)
- Volume - (SW_VOLDOWN)
- Mode (SW_MODE)
- Send/Receive Call (SW_SEND)
- End Call (SW_END)
- Mute (SW_MUTE)
- Voice (SW_VOICE)

Do the PID values agree with the switch positions?

Yes	GO to S10
No	• If one or more, but not all PID values are incorrect or always read one particular switch position, INSTALL a new RH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). • If all PID values are incorrect or always read one particular switch position, GO to S2

S2 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DTC (DIAGNOSTIC TROUBLE CODE) U0212:00

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) from the IPC.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U0212:00 set in the IPC?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to S3

S3 CHECK FOR VOLTAGE FROM THE SCCM (STEERING COLUMN CONTROL MODULE)

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.

REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect RH Steering Wheel Switch C2491.
- Disconnect LH Steering Wheel Switch C2490.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	V	C2491-5
C2491-4	V	C2491-5
C2491-6	V	C2491-5
C2491-7	V	C2491-5

Is approximately 5 volts present?

Yes	INSTALL a new RH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	GO to S4

S4 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	Ω	Ground
C2491-4	Ω	Ground
C2491-5	Ω	Ground
C2491-6	Ω	Ground
C2491-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to S5
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

S5 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	Ω	C218B-6
C2491-4	Ω	C218B-7
C2491-5	Ω	C218B-16

C2491-6	Ω	C218B-15
C2491-7	Ω	C218B-14

Are the resistances less than 3 ohms?

Yes	GO to S6
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

S6 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	Ω	C2491-4
C2491-3	Ω	C2491-5
C2491-3	Ω	C2491-6
C2491-3	Ω	C2491-7
C2491-4	Ω	C2491-5
C2491-4	Ω	C2491-6
C2491-4	Ω	C2491-7
C2491-5	Ω	C2491-6
C2491-5	Ω	C2491-7
C2491-6	Ω	C2491-7

Are the resistances greater than 10,000 ohms?

Yes	GO to S7
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

S7 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Connect Clockspring C218B.
- Disconnect Clockspring C218C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	Ω	Ground
C2491-4	Ω	Ground
C2491-5	Ω	Ground
C2491-6	Ω	Ground
C2491-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to S8
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

S8 CHECK THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	Ω	C218C-5
C2491-4	Ω	C218C-7
C2491-5	Ω	C218C-9
C2491-6	Ω	C218C-10
C2491-7	Ω	C218C-8

Are the resistances less than 3 ohms?

Yes	GO to S9
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

S9 CHECK THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2491-3	Ω	C2491-4
C2491-3	Ω	C2491-5
C2491-3	Ω	C2491-6
C2491-3	Ω	C2491-7
C2491-4	Ω	C2491-5
C2491-4	Ω	C2491-6
C2491-4	Ω	C2491-7
C2491-5	Ω	C2491-6
C2491-5	Ω	C2491-7
C2491-6	Ω	C2491-7

Are the resistances greater than 10,000 ohms?

Yes	GO to S10
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

S10 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Audio System Does Not Operate Correctly From The FCIM

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Source

- FCIM

PINPOINT TEST T : THE AUDIO SYSTEM DOES NOT OPERATE CORRECTLY FROM THE FCIM (FRONT CONTROLS INTERFACE MODULE)

T1 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) , APIM (SYNC MODULE) , FCDIM, AND FCIM (FRONT CONTROLS INTERFACE MODULE) PASS THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM, APIM, FCDIM, and FCIM pass the network test?

Yes	GO to T2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

T2 RESET THE AUDIO SYSTEM MODULES AND RECHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Disconnect the battery for 1 minute, then reconnect it.
- Turn the infotainment system on.
- Test the FCIM for normal operation.

Does the FCIM operate correctly?

Yes	The FCIM is operating correctly at this time. The concern was corrected by resetting the audio system modules.
No	GO to T3

No	GO to T3

T3 RETRIEVE THE ACM (AUDIO FRONT CONTROL MODULE) , APIM (SYNC MODULE) , FCDIM, AND FCIM (FRONT CONTROLS INTERFACE MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCDIM
  - FCIM

Are any Diagnostic Trouble Codes (DTCs) recorded in the ACM, APIM, FCDIM, or FCIM?

Yes	REFER to the module DTC Chart in which the DTC is present.
No	GO to T4

T4 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

The FCDIM Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

Possible Source

- FCDIM

PINPOINT TEST U : THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

U1 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition ON.
- Turn the audio system on.
- Press each FCIM button and check for proper operation.

Does each FCIM button perform the correct operation?

Yes	GO to U2
No	GO to Pinpoint Test T

U2 VERIFY THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the FCDIM pass the network test?

Yes	GO to U3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

U3 OBSERVE THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) DISPLAY

- Observe the FCDIM display while carrying out various operations using the FCIM controls.

Is the FCDIM screen completely inoperative or blank?

Yes	GO to U5
No	GO to U4

U4 CHECK FOR LOST COMMUNICATION DIAGNOSTIC TROUBLE CODES (DTCS) SET IN THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE)

- Ignition ON.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any lost communication Diagnostic Trouble Codes (DTCs) (U-codes) recorded in the FCDIM?

Yes	REFER to the DTC Chart for the FCDIM.
No	GO to U5

U5 CHECK FOR CORRECT FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCDIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCDIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication with ECM/PCM U0100:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication with ECM/PCM "A": No Sub Type Information	Set by the ACM, and GPSM when network messages are missing from the PCM for more than 5 seconds with the ignition in RUN.

Possible Source

- PCM

PINPOINT TEST V : LOST COMMUNICATION WITH ECM/PCM U0100:00

V1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify if there is an observable symptom present.

Is an observable symptom present?

Yes	GO to V2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:00 set in the ACM or GPSM?

Yes	GO to V3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the PCM?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to V4

V4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - GPSM

Are low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM or the GPSM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to V5

V5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0100:00 set in both the ACM and GPSM?

Yes	GO to V6
No	• If there is an observable symptom, REFER to Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the PCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the PCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal

	and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With BCM U0140:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	Set by the ACM, APIM, FCDIM, FCIM, and GPSM when network messages are missing from the BCM for more than 5 seconds with the ignition in RUN.

Possible Source

- BCM

PINPOINT TEST W : LOST COMMUNICATION WITH BCM (BODY CONTROL MODULE) U0140:00

W1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify if there is an observable symptom present.

Is an observable symptom present?

Yes	GO to W2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

W2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0140:00 set in the ACM, APIM, FCDIM, FCIM, or the GPSM?

Yes	GO to W3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

W3 CHECK THE BCM (BODY CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the BCM?

Yes	If DTC U3006:16, U3006:17 and/or U3006:1C are set, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to W4

W4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCDIM
  - FCIM
  - GPSM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM, APIM, FCDIM, FCIM, or the GPSM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to W5

W5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0140:00 set in more than one module?

Yes	GO to W6
No	• If there is an observable symptom, REFER to Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

W6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

	REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With RCM U0151:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	Set by the APIM when the airbag deployment notification message from the RCM is missing for more than 5 seconds with the ignition in RUN.

Possible Source

- RCM

PINPOINT TEST X : LOST COMMUNICATION WITH RCM (RESTRAINTS CONTROL MODULE) U0151:00

X1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to X2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

X2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0151:00 set in the APIM?

Yes	GO to X3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

X3 CHECK THE RCM (RESTRAINTS CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the RCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the RCM?

Yes	If DTC U3003:16 and/or U3003:17 are set, REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to X4

X4 CHECK THE APIM FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the APIM self-test for the following modules:

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the APIM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to X5

X5 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the RCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the RCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With IPC U0155:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

U0155:00	Lost Communication With IPC Control Module: No Sub Type Information	Set by the ACM, APIM, FCDIM, FCIM, and GPSM when network messages are missing from the IPC for more than 5 seconds with the ignition in RUN.

Possible Source

- IPC

PINPOINT TEST Y : LOST COMMUNICATION WITH IPC (INSTRUMENT PANEL CLUSTER) U0155:00

Y1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to Y2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Y2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 set in the ACM, APIM, FCDIM, FCIM, or the GPSM?

Yes	GO to Y3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Y3 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the IPC self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the IPC?

Yes	If DTC U3003:16 and/or U3003:17 is set, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to Y4

Y4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCDIM
  - FCIM
  - GPSM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM, APIM, FCDIM, FCIM, or GPSM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to Y5

Y5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0155:00 set in more than one module?

Yes	GO to Y6
No	• If there is an observable symptom, REFER to Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Y6 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the IPC and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With PAM U0159:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

The PAM is integral to the BCM.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0159:00	Lost Communication With Parking Assist	Set by the ECDIM when network messages are missing

U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	Set by the FCDIM when network messages are missing from the PAM for more than 5 seconds with the ignition in RUN.

Possible Source

- PAM

PINPOINT TEST Z : LOST COMMUNICATION WITH PAM (PARKING ASSIST CONTROL MODULE) U0159:00

Z1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify if there is an observable symptom present.

Is an observable symptom present?

Yes	GO to Z2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Z2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0159:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0159:00 set in the FCDIM?

Yes	GO to Z3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Z3 CHECK THE BCM (BODY CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the BCM?

Yes	If DTC U3006:16, U3006:17 and/or U3006:1C are set, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to Z4

Z4 CHECK THE FCDIM FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the FCDIM self-test.

Are low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the FCDIM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to Z5

Z5 CHECK FOR CORRECT PAM (PARKING ASSIST CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With GPSM U016A:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U016A:00	Lost Communication With Global Positioning System Module: No Sub Type Information	Set by the APIM when it is missing network messages from the GPSM for more than 5 seconds with the ignition in RUN.

Possible Source

- GPSM

PINPOINT TEST AA : LOST COMMUNICATION WITH GPSM (GLOBAL POSITIONING SYSTEM MODULE) U016A:00

AA1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AA2

No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AA2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U016A:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U016A:00 set in the APIM?

Yes	GO to AA3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AA3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - APIM
  - GPSM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the APIM or the GPSM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to AA4

AA4 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connector.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With The Radio U0184:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0184:00	Lost Communication With Radio: No Sub Type Information	Set by the APIM and FCDIM when network messages are missing from the ACM for more than 5 seconds with the ignition in RUN.

Possible Source

- ACM

PINPOINT TEST AB : LOST COMMUNICATION WITH THE RADIO U0184:00

AB1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AB2
No	The system is operating normally at this time. This DTC may have been set due to high network traffic or an intermittent fault condition.

AB2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0184:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0184:00 set in the APIM or the FCDIM?

Yes	GO to AB3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AB3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCDIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM, APIM or the FCDIM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to AB4

AB4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect all the ACM and related in-line connectors.
• Repair:
  • Corrosion (clean module pins or install new connectors or terminals)
  • Damaged or bent pins (install new terminals or pins)
  • Pushed-out pins (install new pins as necessary)
• Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With The APIM U0253:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	Set by the ACM and FCDIM when network messages are missing from the APIM for more than 5 seconds with the ignition in RUN.

Possible Source

- APIM

PINPOINT TEST AC : LOST COMMUNICATION WITH THE APIM (SYNC MODULE) U0253:00

AC1 VERIFY THE CUSTOMER'S CONCERN
• Ignition ON. • Verify there is an observable symptom present. **Is an observable symptom present?**

Yes	GO to AC2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00

- Ignition ON.
- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0253:00 set in the ACM or FCDIM?

Yes	GO to AC3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCDIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM, APIM or the FCDIM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to AC4

AC4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0253:00 set in both the ACM and FCDIM?

Yes	GO to AC5
No	• If there is an observable symptom, REFER to Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With The FCIM U0256:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	Set by the ACM and FCDIM when network messages are missing from the FCIM for more than 5 seconds with the ignition in RUN.

Possible Source

- FCIM

PINPOINT TEST AD : LOST COMMUNICATION WITH THE FCIM (FRONT CONTROLS INTERFACE MODULE) U0256:00

AD1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AD2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0256:00 set in the ACM or FCDIM?

Yes	GO to AD3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - FCDIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM, FCDIM or FCIM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to AD4

AD4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0256:00 set in both the ACM and FCDIM?

Yes	GO to AD5
No	• If there is an observable symptom, REFER to Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

Lost Communication With The FCDIM U0257:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	Set by the ACM, FCDIM and FCIM when network messages are missing from the APIM for more than 5 seconds with the ignition in RUN. This DTC may be set in conjunction with DTC U0253:00.

Possible Source

- APIM

PINPOINT TEST AE : LOST COMMUNICATION WITH THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) U0257:00

AE1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AE2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0257:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0257:00 set in the ACM, FCDIM or the FCIM?

Yes	GO to AE3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCDIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded in the ACM, APIM, FCDIM or FCIM?

Yes	• For DTC U3003:16, GO to Pinpoint Test AF • For DTC U3003:17, GO to Pinpoint Test AG
No	GO to AE4

AE4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0257:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0257:00 set in more than one module?

Yes	GO to AE5
No	• If there is an observable symptom, REFER to Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage Low U3003:16

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Set by the ACM, APIM, FCDIM, FCIM and GPSM when the supply voltage falls below 10 volts for at least 10 seconds during normal operation or for more than 250 milliseconds during the self-test.

Possible Sources

- Previous low battery voltage
- Wiring, terminals, or connectors
- ACM
- APIM
- FCDIM
- FCIM
- GPSM

PINPOINT TEST AF : BATTERY VOLTAGE LOW U3003:16

AF1 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:16

- Ignition ON.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.

- Wait at least 15 seconds.
- Using a diagnostic scan tool, repeat the self-test for the module in question.

Is DTC U3003:16 still present?

Yes	GO to AF2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

AF2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, perform the PCM self-test

Are any voltage-related Diagnostic Trouble Codes (DTCs) set in the PCM?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to AF3

AF3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

Is the battery fully charged and in good condition?

Yes	GO to AF4
No	REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing).

AF4 CHECK THE MODULE VOLTAGE SUPPLY

- Ignition OFF.
- Measure and record the voltage at the battery.
- Disconnect the audio system module setting DTC U3003:16.
- Ignition ON.
- Measure the voltage between the module setting DTC U3003:16 and ground.
- For the ACM, measure:

Positive Lead	Measurement / Action	Negative Lead

C4821A-1		Ground

- For the APIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-1		Ground

- For the FCDIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2123-1		Ground

- For the FCIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2402-1		Ground

- For the GPSM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2398-1		Ground

Is the voltage within 0.2 volts of the recorded battery voltage?

Yes	GO to AF5
No	REPAIR the circuit for high resistance.

AF5 CHECK THE SUSPECT MODULE GROUND CIRCUIT FOR CONTINUITY

- Measure the voltage at the suspect module.
- For the ACM, measure:

Positive Lead	Measurement / Action	Negative Lead
C4821A-1		C240A-13

- For the APIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-1		C2383-37
C2383-1		C2383-38

- For the FCDIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2123-1		C2123-9

- For the FCIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2402-1		C2402-6

- For the GPSM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2398-1		C2398-6

Is the suspect module voltage greater than 11 volts?

Yes	• For the ACM, GO to AF6 • For the APIM, GO to AF7 • For the FCDIM, GO to AF8 • For the FCIM, GO to AF9 • For the GPSM, GO to AF10
No	REPAIR the circuit for high resistance.

AF6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AF7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)

- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AF8 CHECK FOR CORRECT FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCDIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCDIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AF9 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AF10 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.

- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage High U3003:17

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	Set by the ACM, APIM, FCDIM, FCIM, and GPSM when the supply voltage is more than 15.8 volts for more than 250 milliseconds during normal operation or the self-test.

Possible Sources

- ACM
- APIM
- FCDIM
- FCIM
- GPSM

PINPOINT TEST AG : BATTERY VOLTAGE HIGH U3003:17

AG1 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the self-test for the module in question.

Is DTC U3003:17 present?

Yes	GO to AG2
No	The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

AG2 CHECK FOR HIGH VOLTAGE DIAGNOSTIC TROUBLE CODES (DTCS) SET IN MULTIPLE MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are high voltage Diagnostic Trouble Codes (DTCs) such as B1676, P0563, or U3003:17 set in more than one module?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AG3

AG3 CHECK THE BATTERY VOLTAGE

- Turn off all interior lights, exterior lights, and accessories.
- Start and run the engine at approximately 2,000 RPM for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	• For the ACM, GO to AG4 • For the APIM, GO to AG5 • For the FCDIM, GO to AG6 • For the FCIM, GO to AG7 • For the GPSM, GO to AG8

AG4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AG5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AG6 CHECK FOR CORRECT FCDIM OPERATION

- Ignition OFF.
- Disconnect and inspect the FCDIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCDIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AG7 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AG8 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Audio Front Control Module (ACM) Self-Test

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *If the ACM, FCDIM (if equipped), FCIM, or FDIM (if equipped) are inoperative (blank or do not power on), obtain the ACM part number by referencing the label attached to the ACM chassis.*

   Turn the ACM on.

3. Operate the audio system in radio tuner AM/ FM mode.

4. Press and hold the eject button, and within 1 second, press and hold the seek up button. If supported, the speaker walk around test will begin, and the display will indicate each speaker as it is tested.

NOTE: *AHU Diagnostics refers to the ACM, EFP Diagnostics refers to the FCIM that communicates on the CAN (if equipped), and MFD Diagnostics (if supported) refers to the FCDIM (if equipped).*

5. To exit the self-diagnostic mode, turn the ACM off, or select "Exit Diagnostics."

Copyright © 2016 Ford Motor Company

Reset the SYNC Module [APIM]

Programming

NOTE: *An APIM Reset consists of a battery disconnect and a SYNC® system Master Reset. It may **not** be necessary to perform a Master Reset after disconnecting the battery if the concern is resolved.*

NOTE: *This procedure clears all Continuous Memory Diagnostic Trouble Codes (CMDTCs). The Diagnostic Trouble Codes (DTCs) must be recorded now if other non-SYNC® diagnoses are to be performed after this procedure.*

1. Remove any devices connected to the USB port(s), audio input jack/socket (if equipped), SD slot (if equipped), or RCA jacks (if equipped).

2. Disconnect the negative battery cable for 1 minute, then reconnect it.
   Refer to: Battery Disconnect and Connect - Vehicles With: Single Battery (414-01 Battery, Mounting and Cables) .

3. **NOTE:** *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, and deletes any Bluetooth devices paired with the SYNC® system. For vehicles with navigation, the customer's saved destinations (home, favorites, and previous) are erased. For vehicles with a TCU, any devices paired with the MyFord® Mobile or MyLincoln Mobile™ phone application will be deleted.*

   Perform a Master Reset. If necessary, refer to "Master Reset" in the Owner's Literature.

4. Verify system function using the MIT 105-00120 to test the audio output for the USB port(s), audio input jack/socket (if equipped), and Bluetooth. If equipped, test the audio output for the RCA jacks using RCA Adapter 105-00121.

5. **NOTE:** *If the concern remains after completing the APIM Reset procedure, advise the customer to power their device off and back on for a simple reboot. In some cases, if possible, the device's battery may also need to be removed and re-installed to complete a reboot. Delete SYNC® from the device's Bluetooth menu prior to re-pairing the phone to the SYNC® system. If necessary, the customer can also perform a Master Clear, Master Reset, or Factory Data Reset on their device following the manufacturer's instructions in the device's owner's manual and/or website. Customer devices may affect the operation of SYNC® and this should be understood to prevent unnecessary diagnosis or repairs to the system.*

   If a concern is still present, return to the Symptom Charts.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Programming

Special Tool(s) / General Equipment

SYNC USB 2.0 A Male to A Male Cable

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. If a new APIM is being installed, install the new APIM before carrying out the following procedure.
   Refer to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

3. **NOTE:**

   - *This programming procedure deletes any phones that were paired with the SYNC® system.*
   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A file of approximately 80 megabytes (MB) needs to be downloaded from the online database for the programming. Allow extra time for the file to download.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*

4. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

5. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

6. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

7. Connect one end of the USB cable (male type A 4-pin to male type a 4-pin) to the diagnostic scan tool's USB port, and the other end to the vehicle's USB port.
   Use the General Equipment: SYNC USB 2.0 A Male to A Male Cable

8. Close the IDS software program.

9. Place the ignition in the ON/RUN position. For ON/RUN position information with Push Button Start vehicles, Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

10. **NOTE:**

    - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
    - *Run OASIS using "Read VIN & DTCs."*
      - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
      - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
    - *If the "SYNC - Software Programming" document is not followed, the programming may stop or encounter errors due to improperly configured Internet browser settings.*

11. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

12. **NOTE:** *There are 3 types of APIM programming available:*

    - *Standard — Used to update the APIM and any currently installed Applications to the latest software*

levels.

- *Custom — Used to show all the available software options (including Applications that may not have been installed previously) that can be programmed into the APIM. Use this selection when upgrades become available or as directed by a TSB or FSA.*
- *Module Replacement — Used when the APIM has been replaced. This type of programming performs the required provisioning (restores software for newly installed hardware).*

13. Scroll to the bottom of the screen, select 1 of the 3 options (Standard, Custom, or Module Replacement), and select the "Read SYNC" button. The current APIM assembly, Vehicle Interface Processor (VIP), and Consumer Interface Processor (CIP) software levels are compared to the last recorded state in the Ford online database, and the available software is displayed.

14. **NOTE:** *Do **not** disconnect the VCM or USB cable during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

    Select the "Program SYNC" button to begin the APIM programming process.

15. Follow the diagnostic scan tool on-screen directions. After programming is complete, the diagnostic scan tool displays "Programming has been successfully completed."

Copyright © 2016 Ford Motor Company

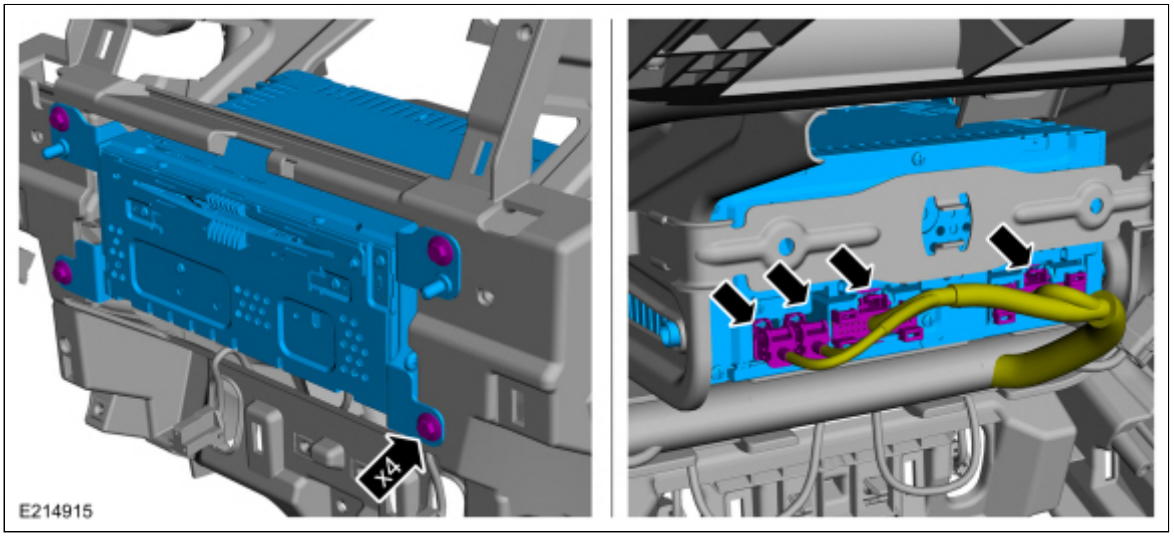
Audio Front Control Module (ACM)

Removal

NOTE: *Eject any media from the ACM. If a disc fails to eject, do not forceably remove the disc from the ACM.*

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*
2. Refer to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
3. *Torque*: 3 Nm



Installation

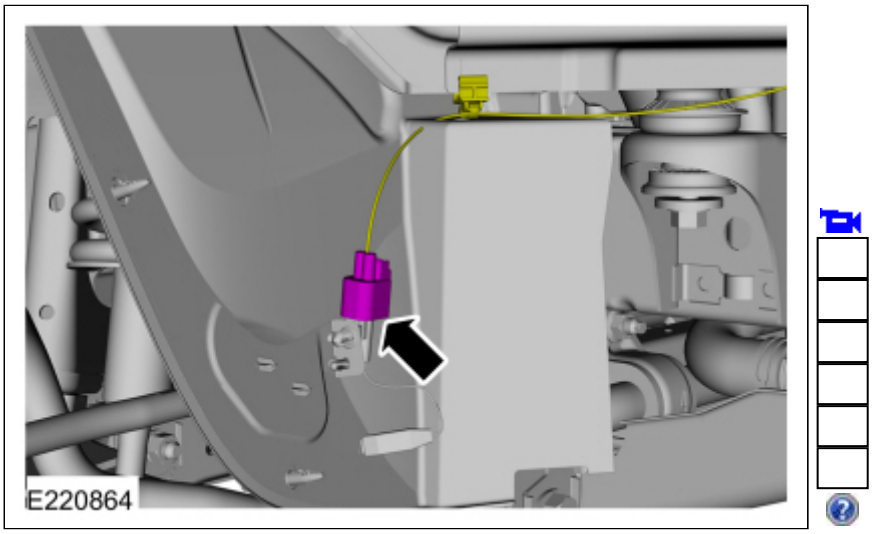
1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the ACM following the on-screen instructions.

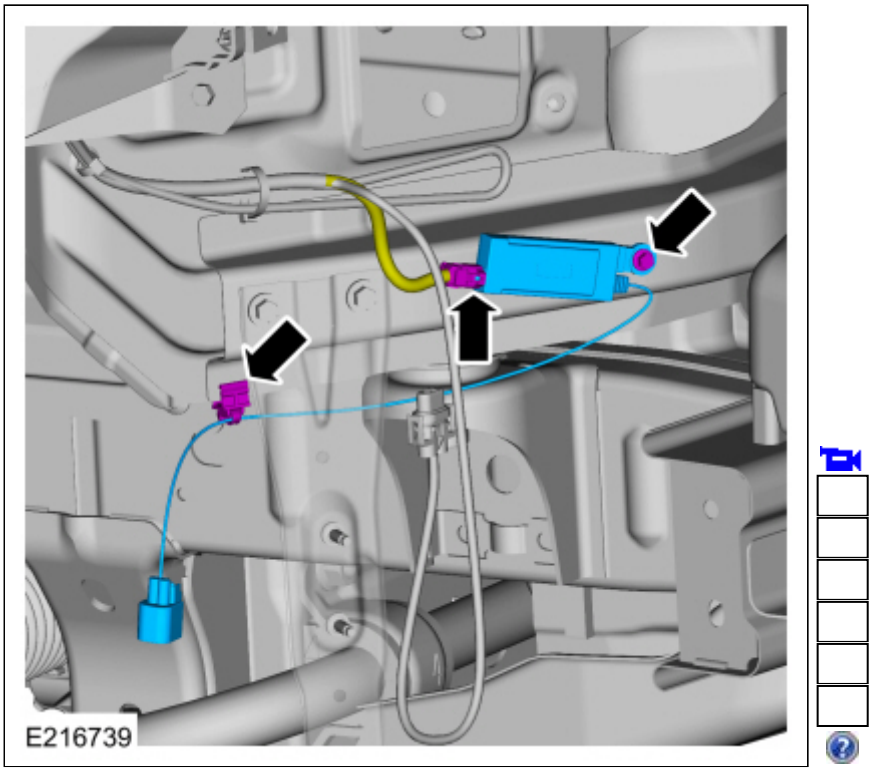
Copyright © 2016 Ford Motor Company

Audio Unit Antenna Amplifier

Removal

1. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
2. 

3. *Torque*: 8 Nm



Installation

1. To install, reverse the removal procedure.

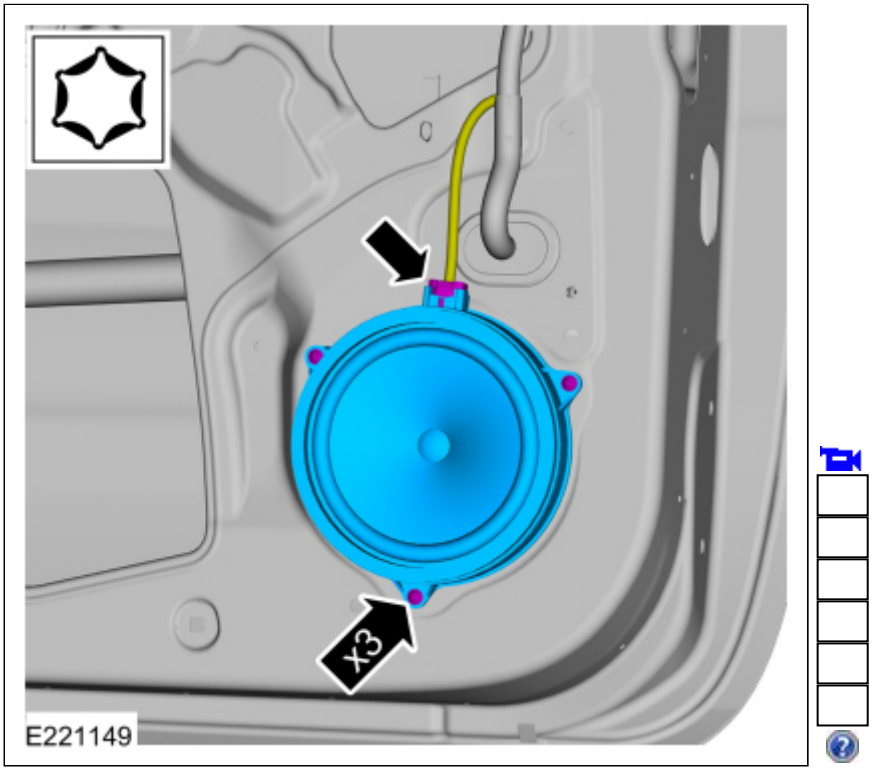
Copyright © 2016 Ford Motor Company

Front Door Speaker LH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Controls Interface Module (FCIM)

Special Tool(s) / General Equipment

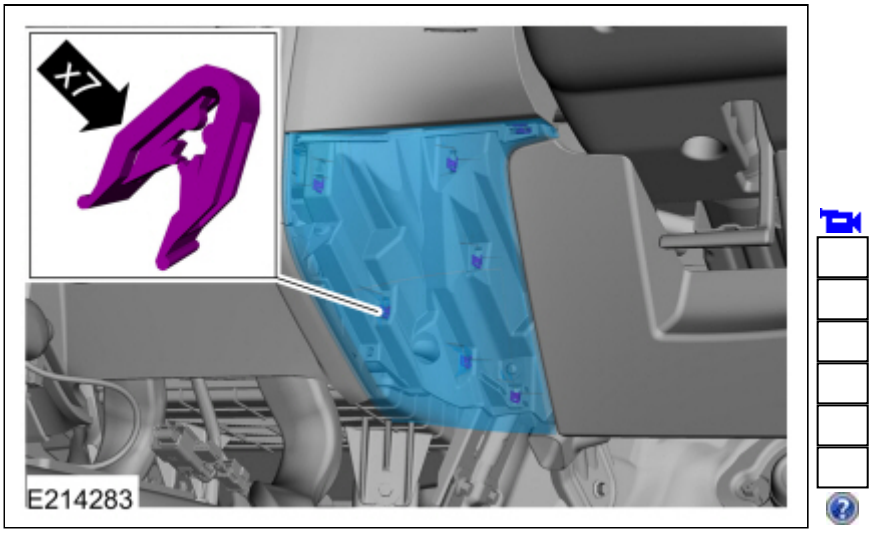
Interior Trim Remover

Removal

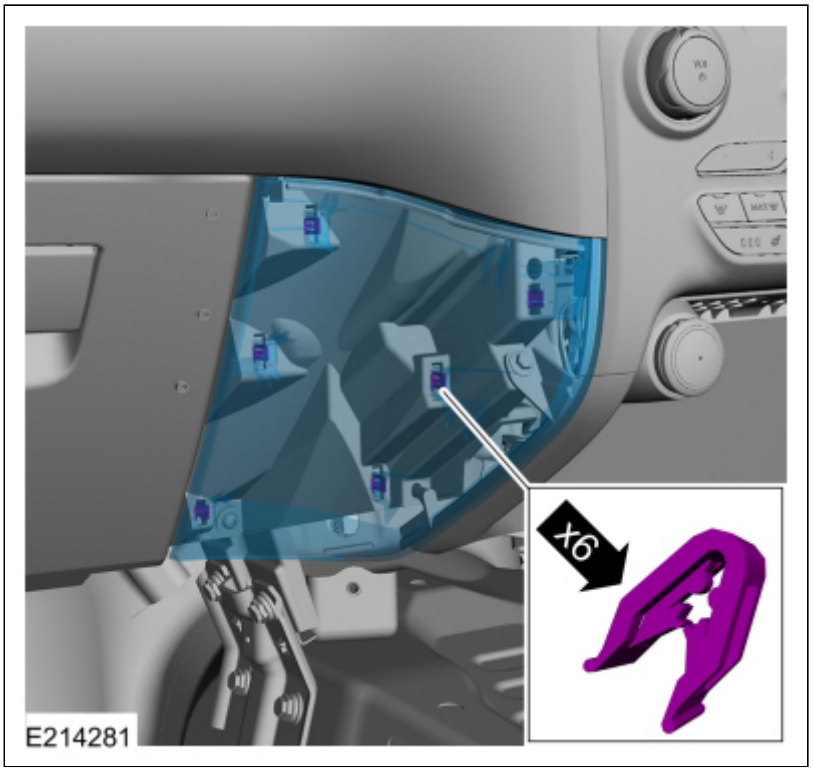
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

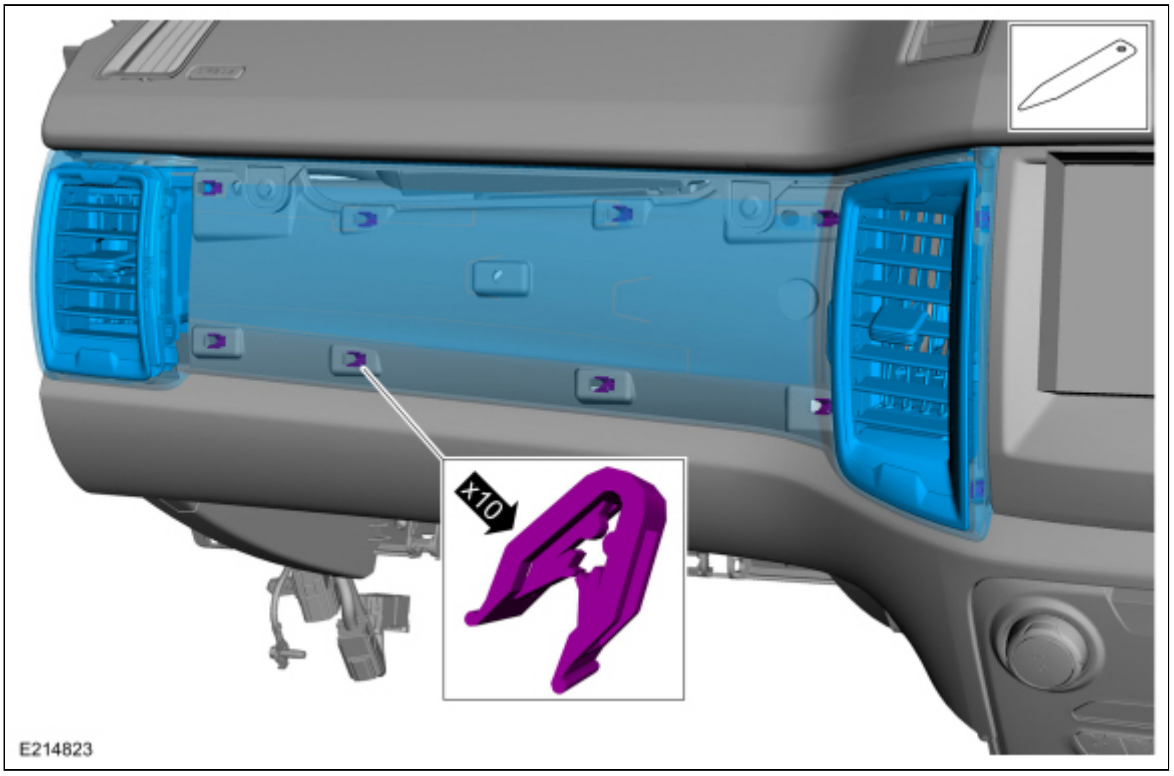
   Using a diagnostic scan tool, begin the PMI process for the FCIM following the on-screen instructions.

2. 

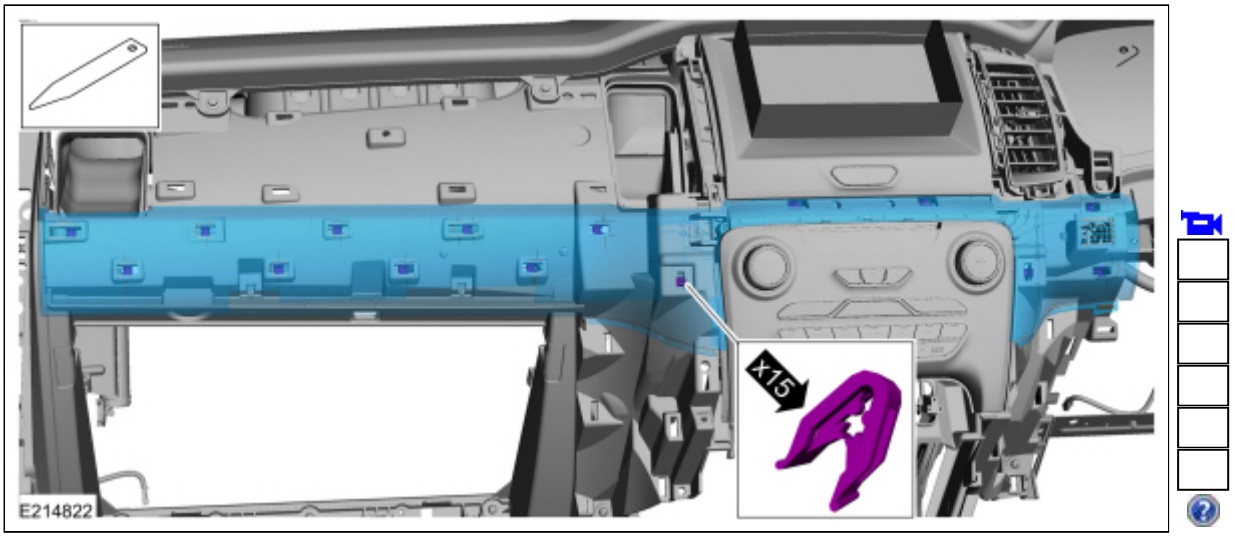
3.



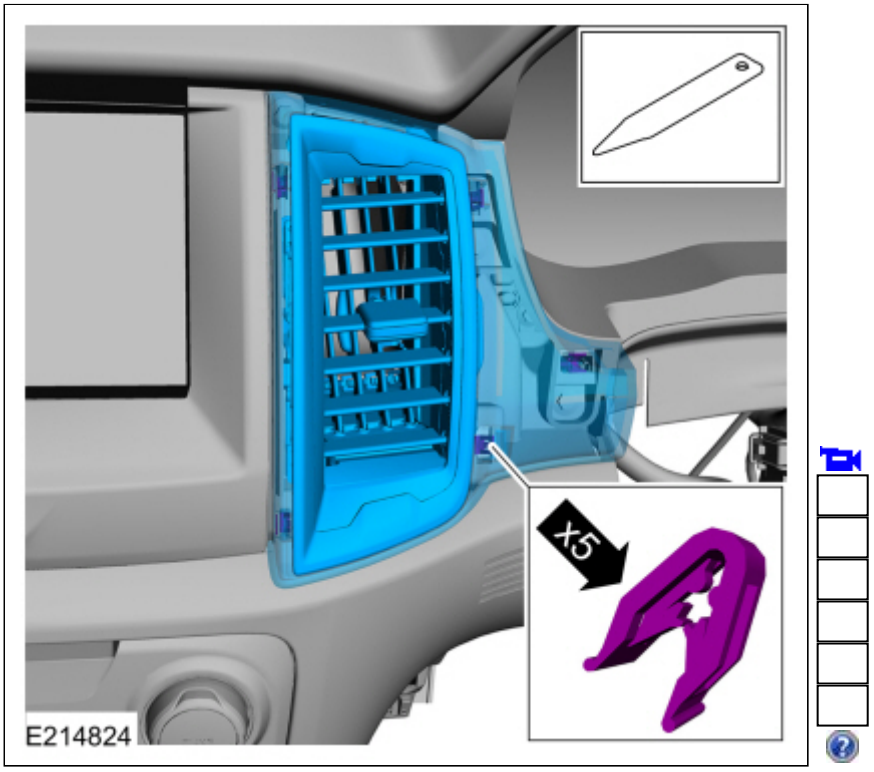
4. Use the General Equipment: Interior Trim Remover



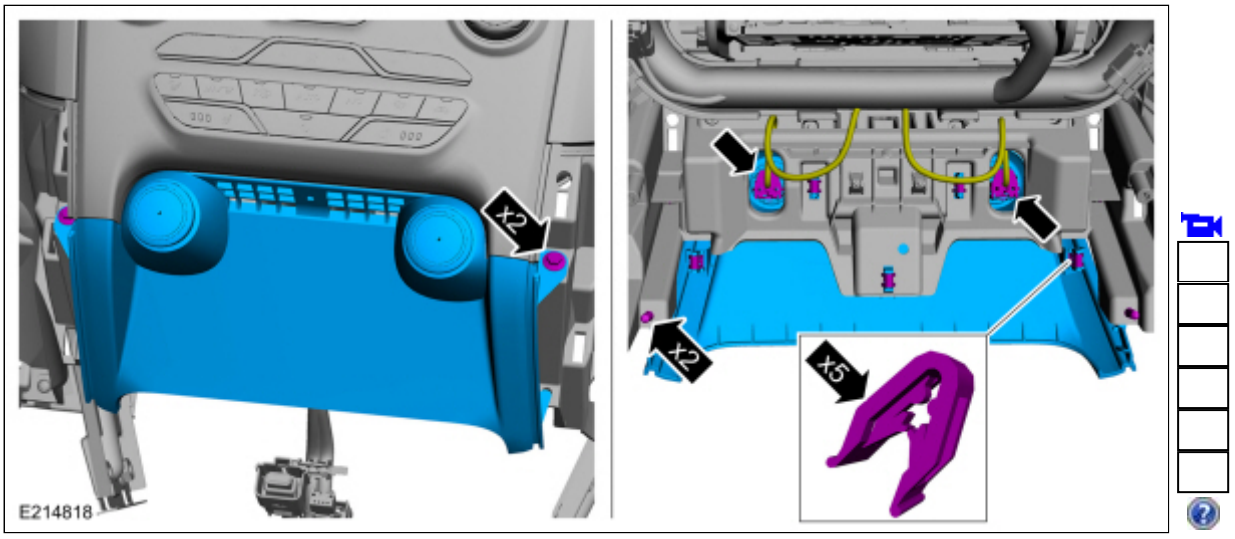
5. Use the General Equipment: Interior Trim Remover



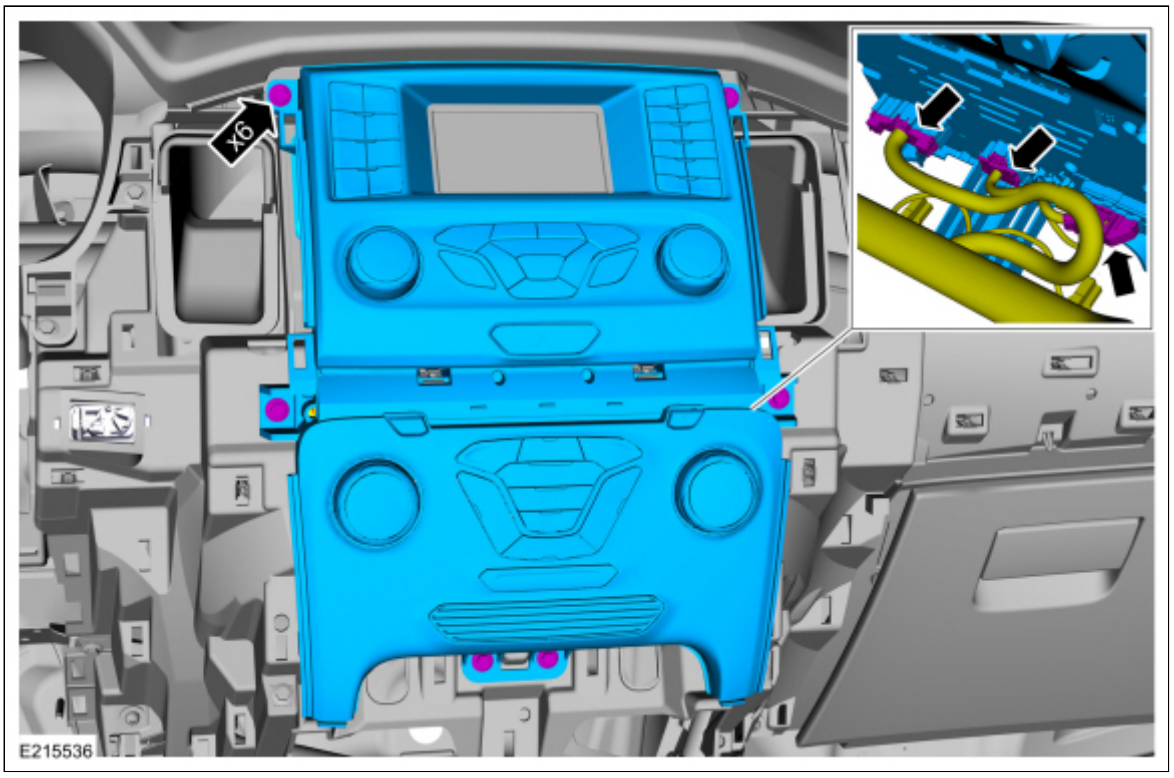
6. Use the General Equipment: Interior Trim Remover



7. *Torque*: 3 Nm



8. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the FCIM following the on-screen instructions.

Copyright © 2016 Ford Motor Company

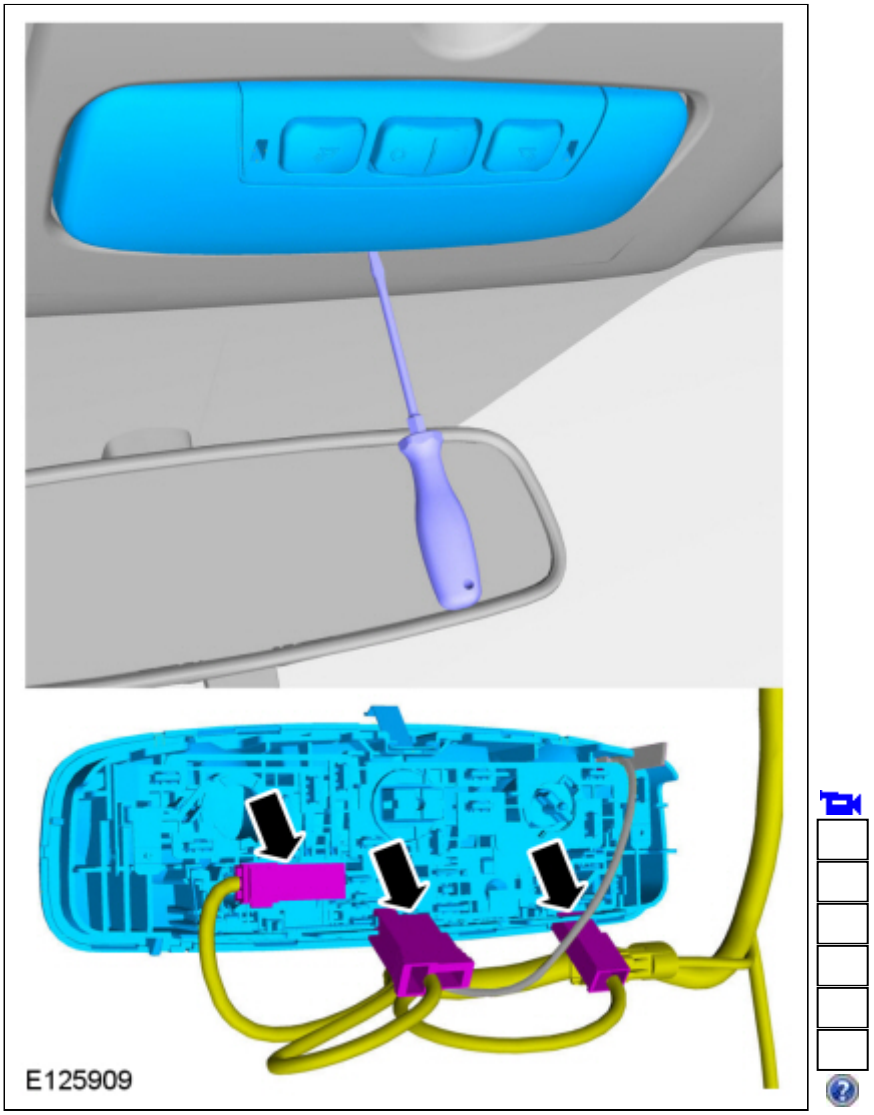
Audio Unit Antenna

Removal

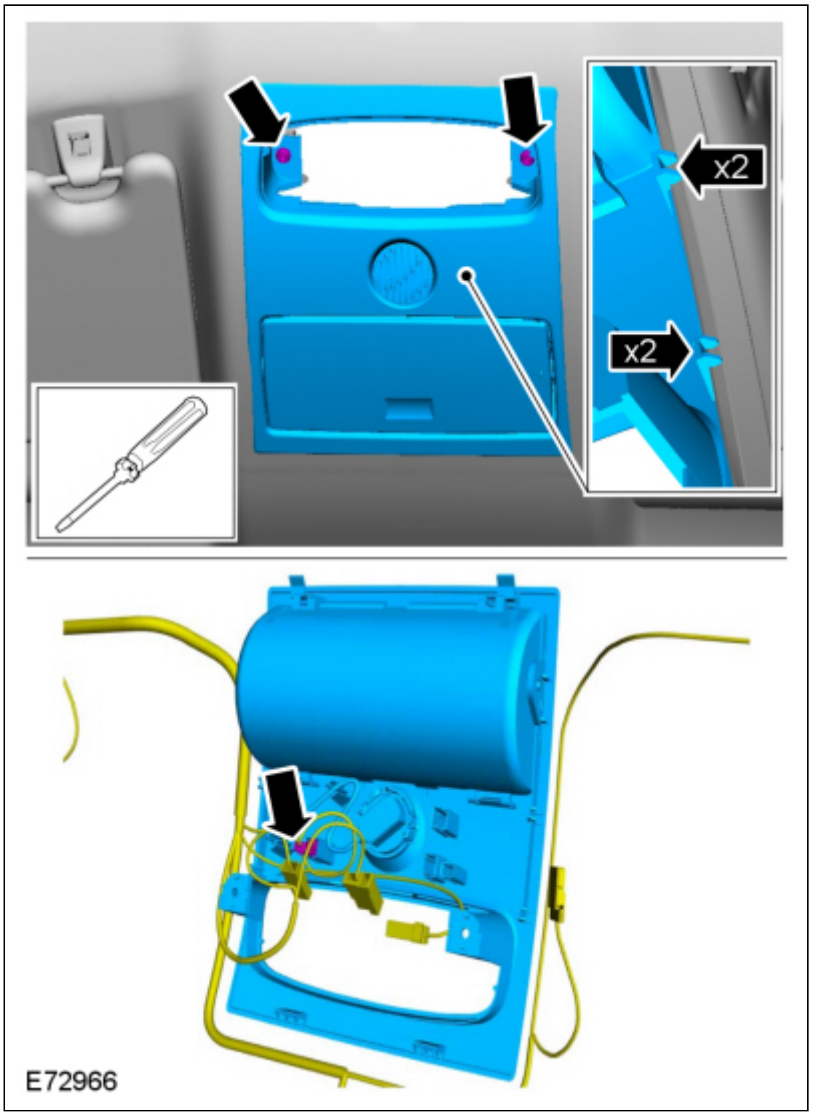
NOTE: *Removal steps in this procedure may contain installation details.*

1. On both sides.
   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation) .

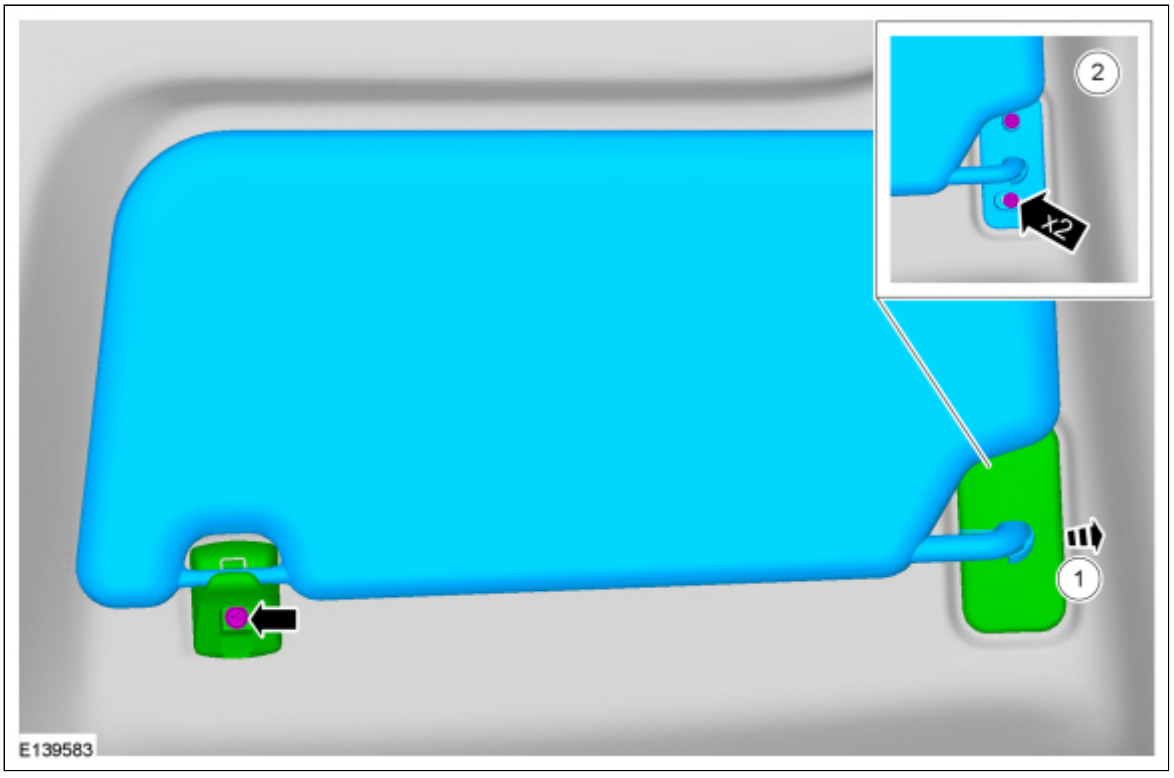
2. On both sides.
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation) .
   Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation) .

3. 

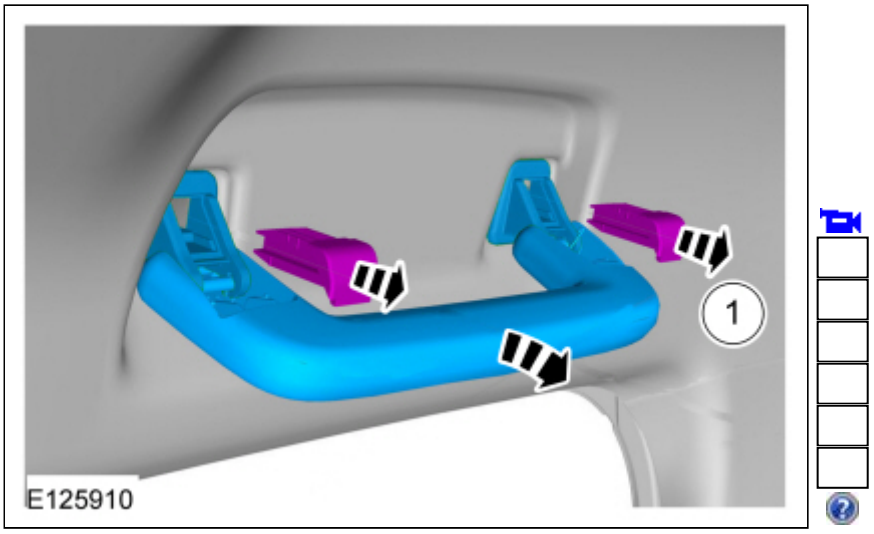
4. **NOTE:** *This step is not necessary when installing a new component.*



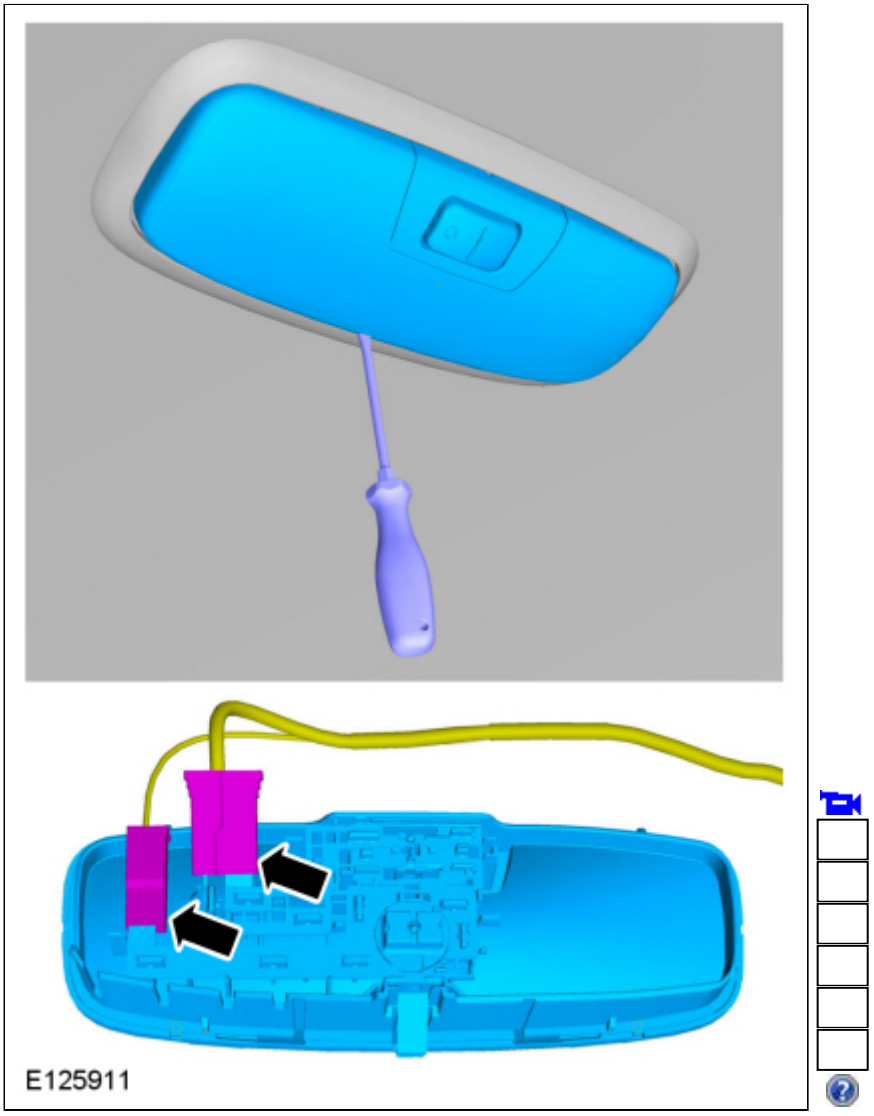
5. On both sides.



6.

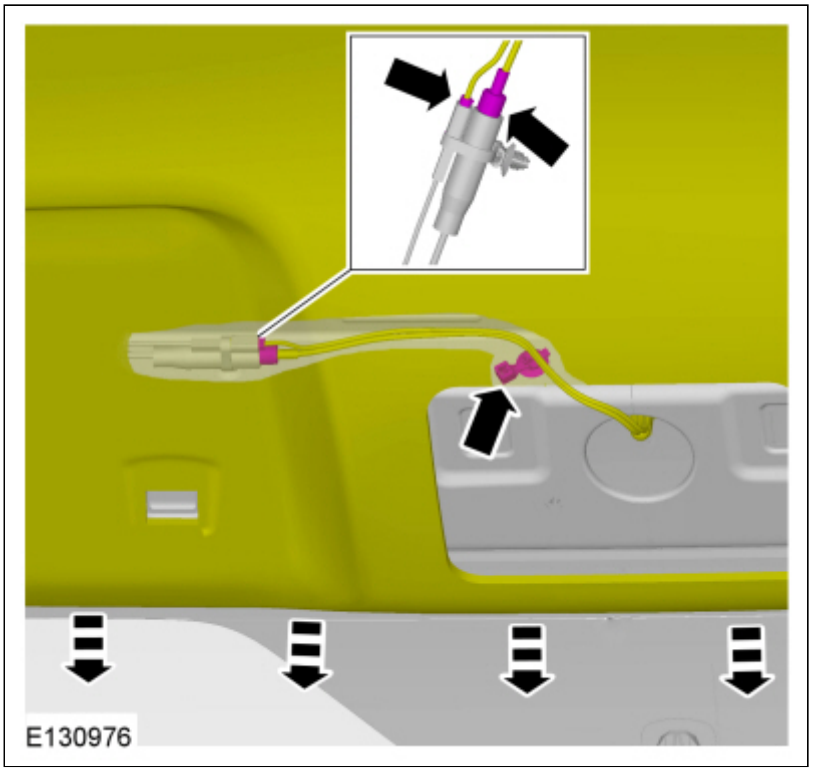


7.



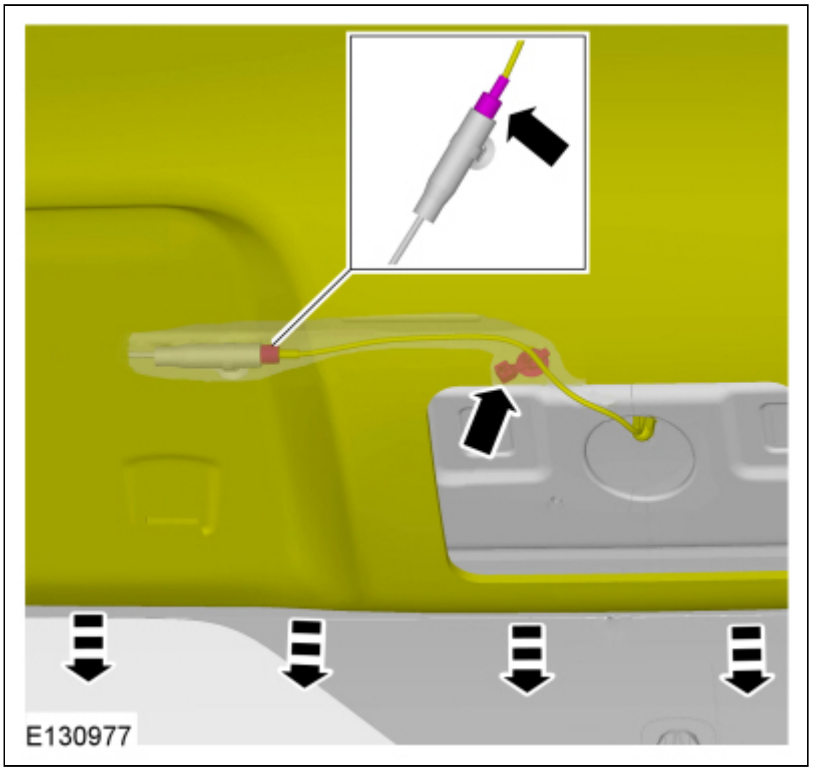
8. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*

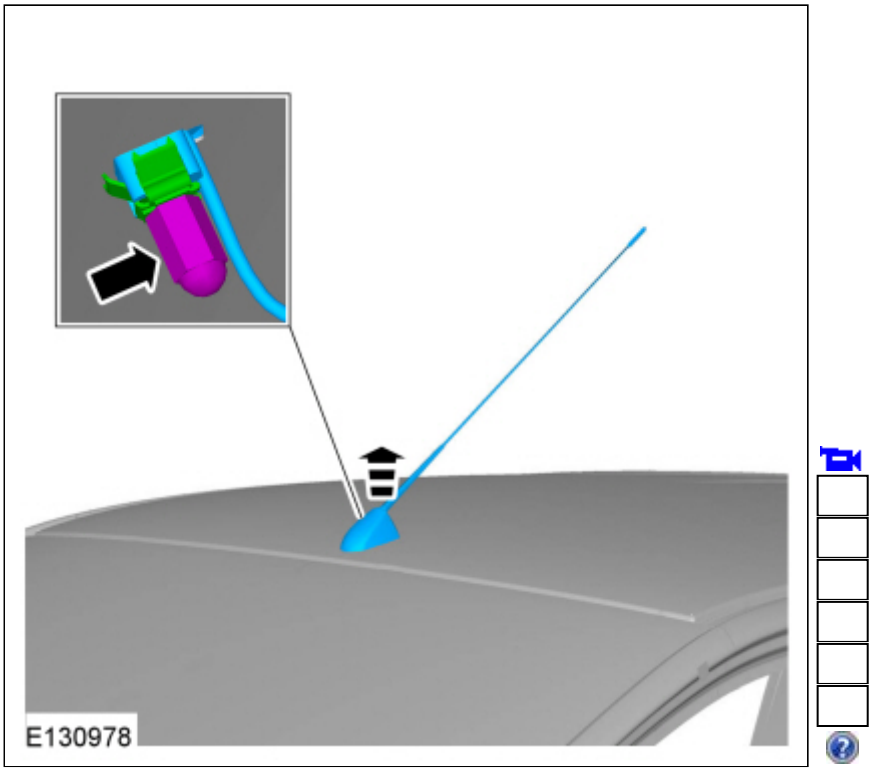


9. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*



10.



Installation

1. **NOTE:** *The antenna cable must be installed to the same routing as when removed.*

   To install, reverse the removal procedure.

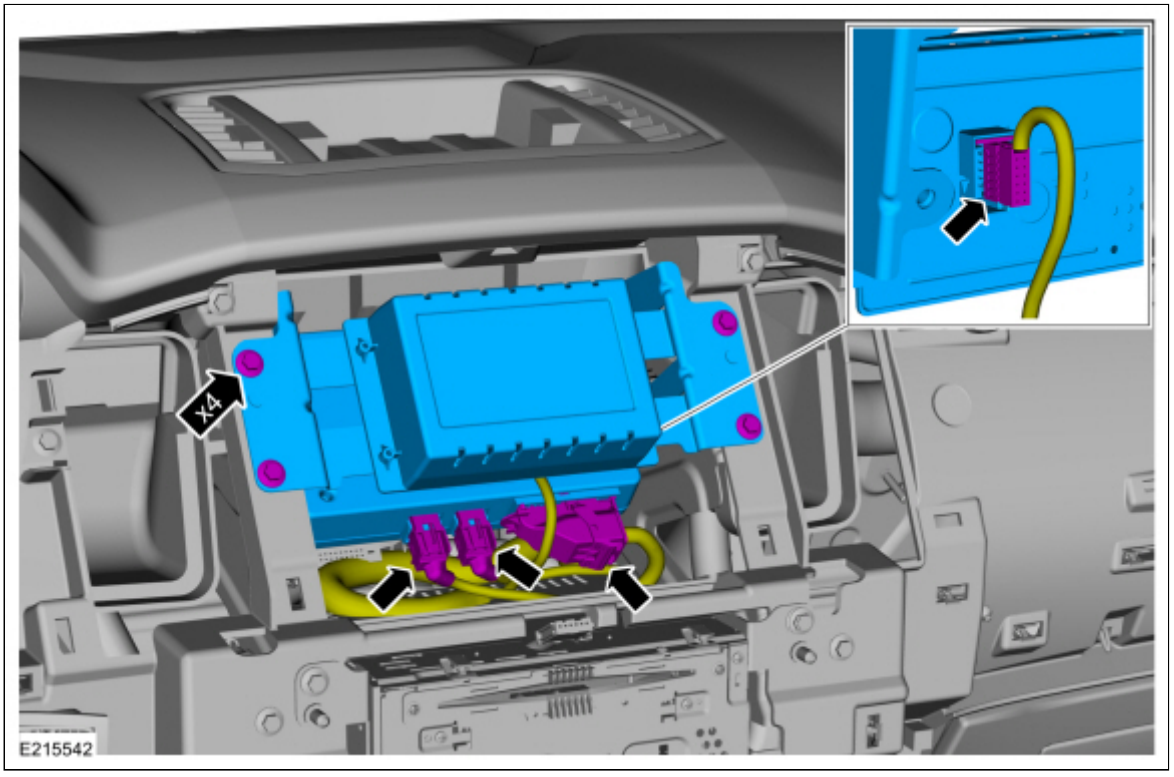
Copyright © 2016 Ford Motor Company

Front Control/Display Interface Module (FCDIM)

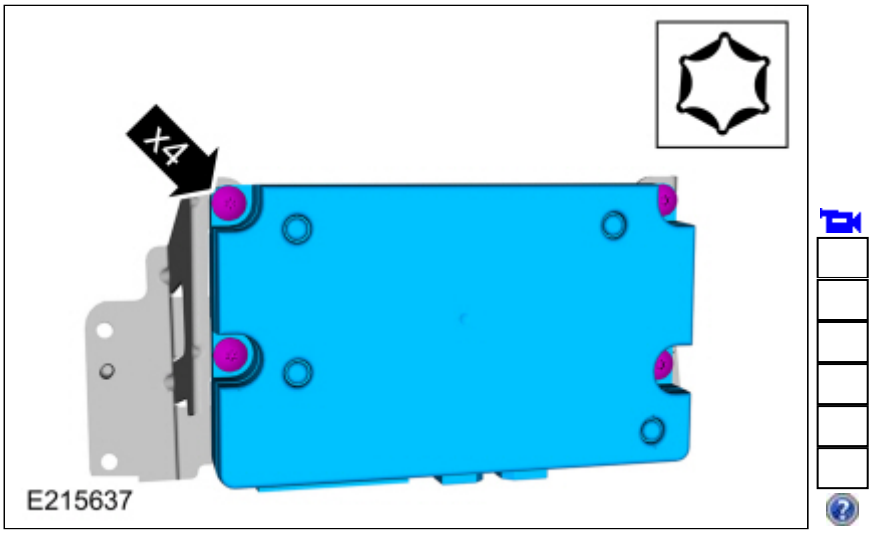
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*
2. Refer to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
3. *Torque*: 3 Nm



4.



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the componet.*

   Using a diagnostic scan tool, complete the PMI process for the FCDIM following the on-screen instructions.
3. If a new APIM is being installed, program the APIM to the correct software level.
   Refer to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures).

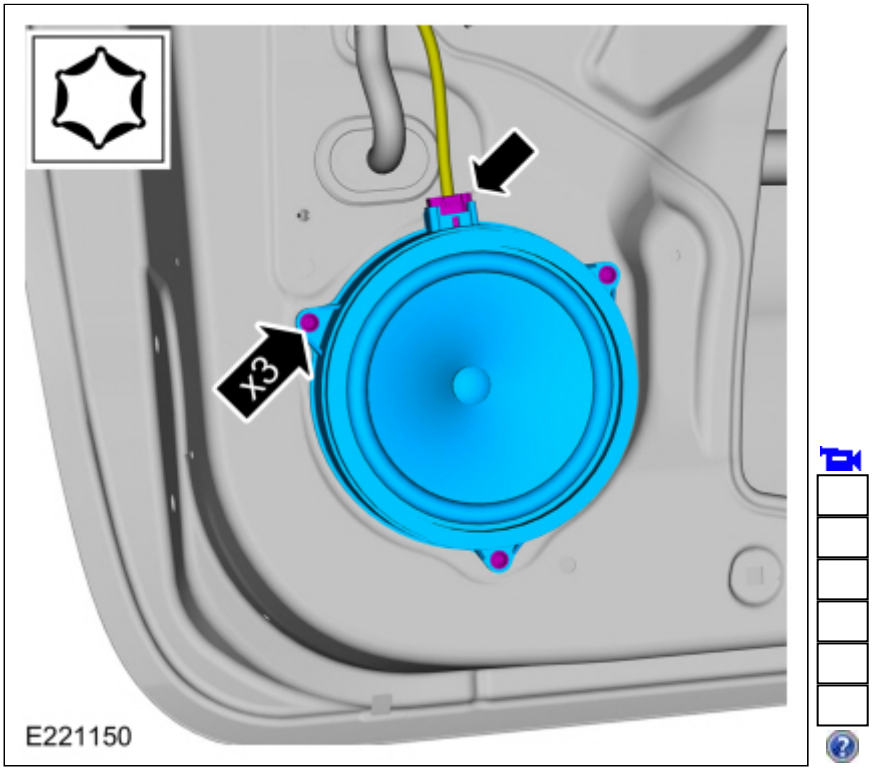
Copyright © 2016 Ford Motor Company

Front Door Speaker RH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker LH

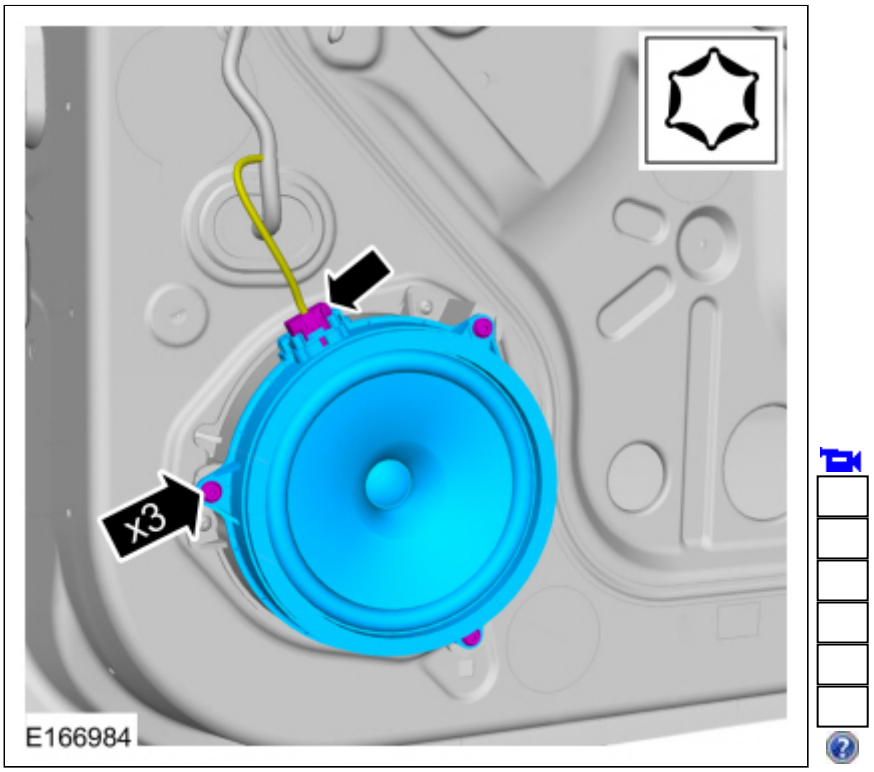
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

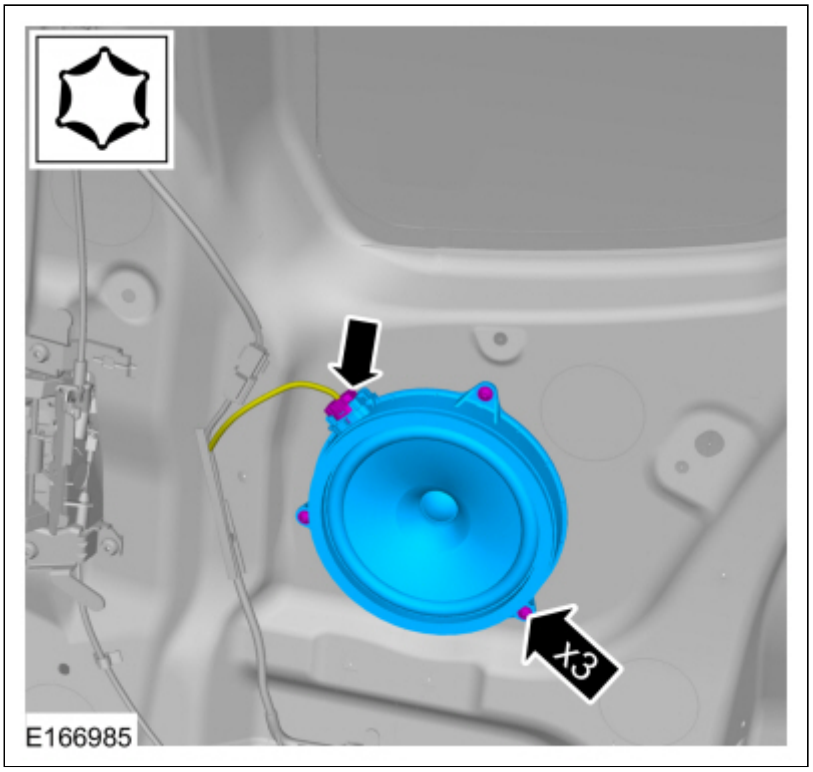
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

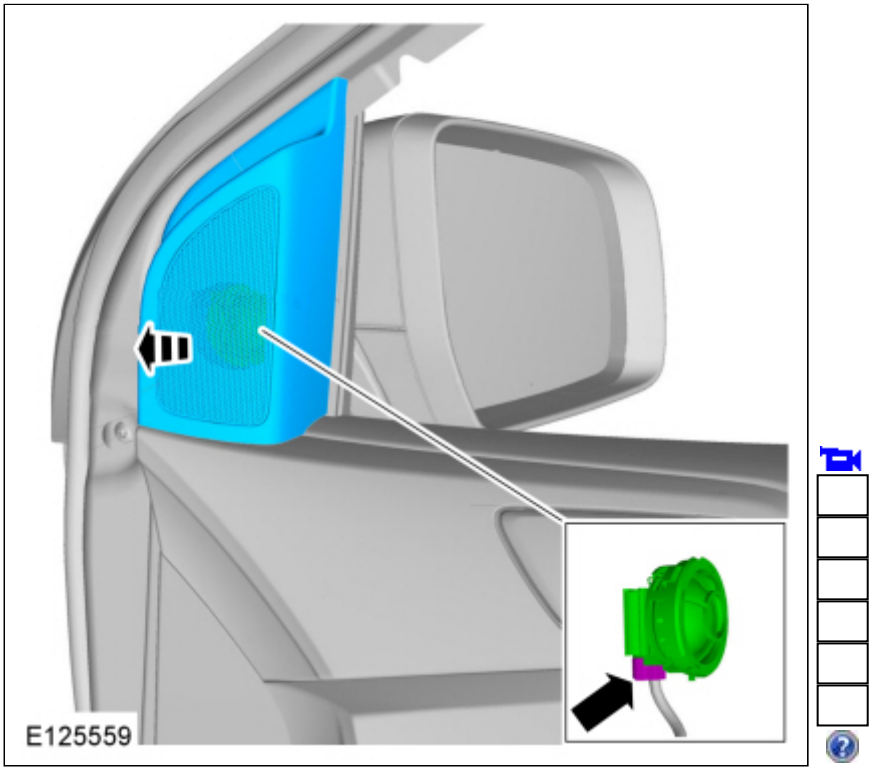
Copyright © 2016 Ford Motor Company

Front Door Tweeter Speaker

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2.



Installation

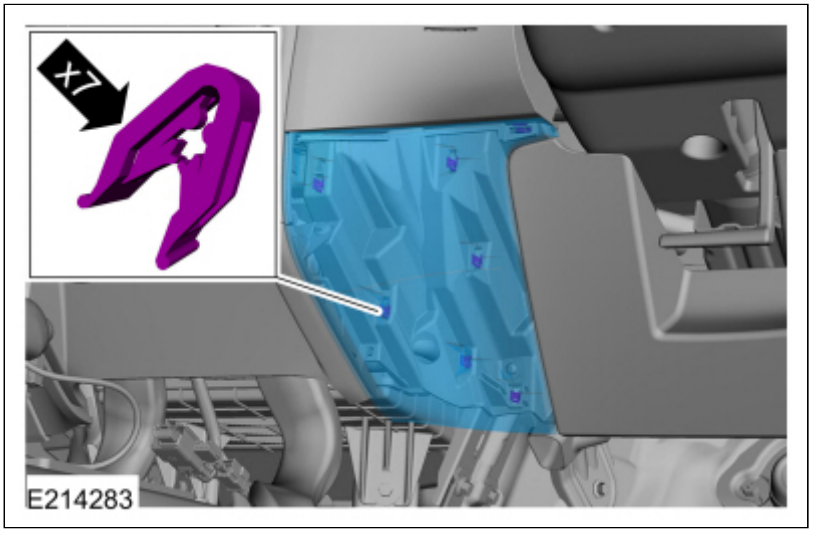
1. To install, reverse the removal procedure.

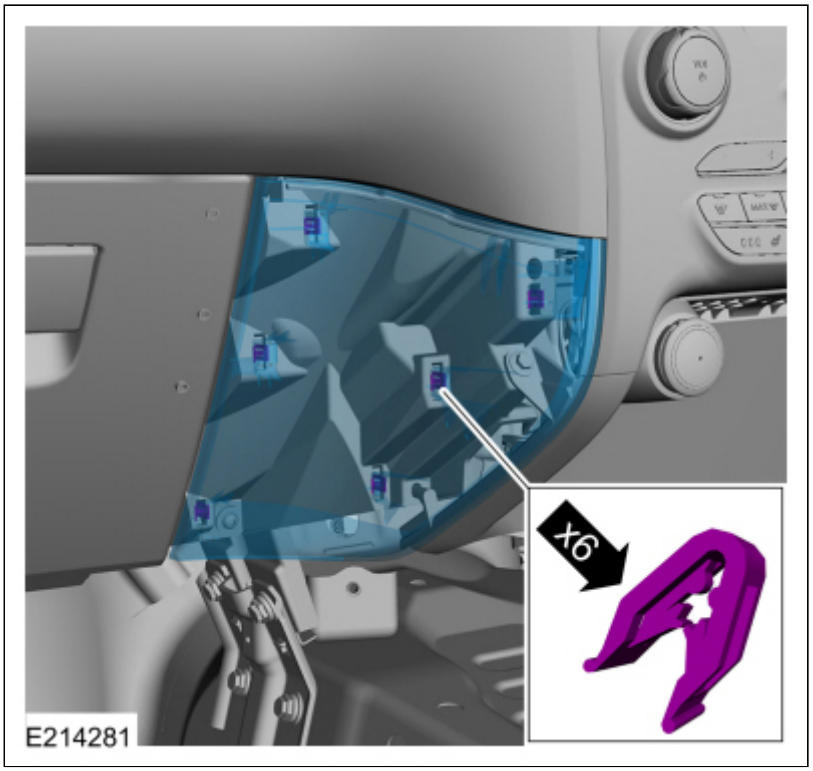
Copyright © 2016 Ford Motor Company

Media Hub

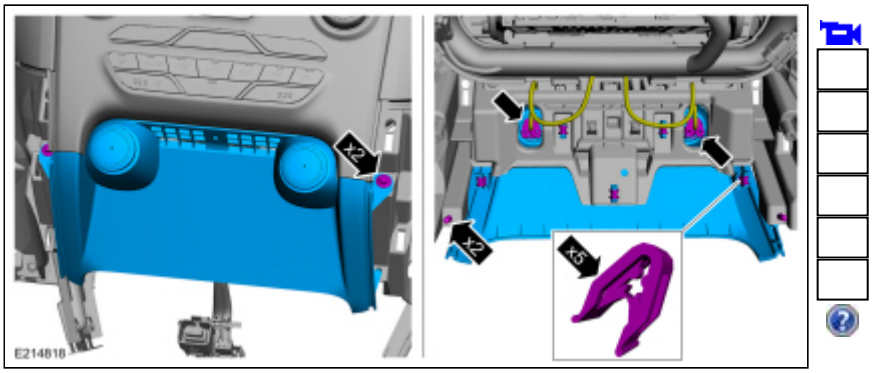
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. 

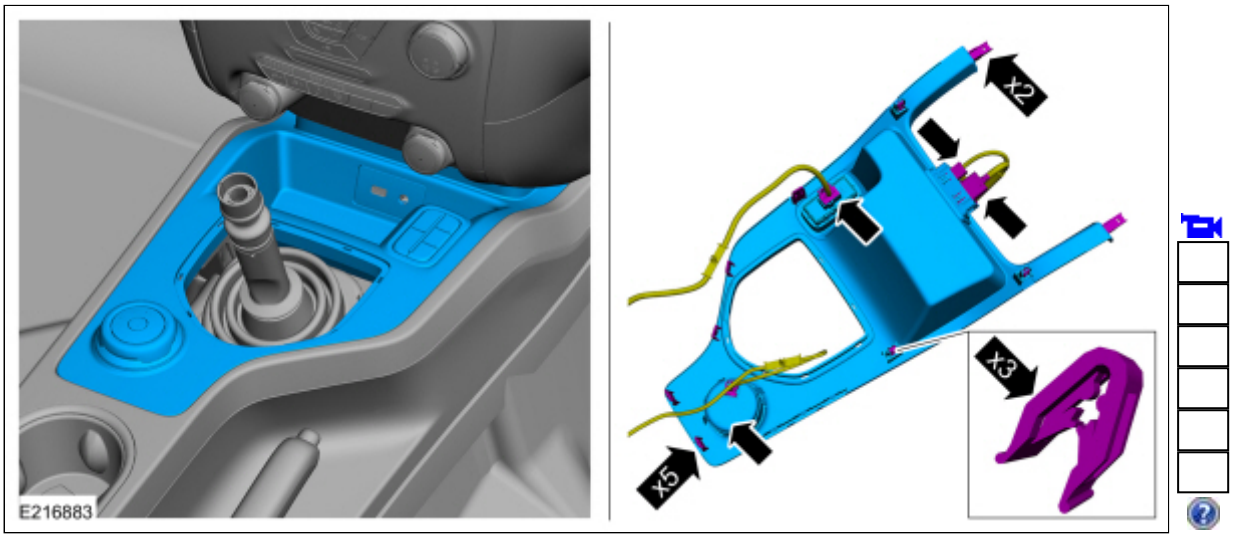
4.



6-Speed Manual Transmission - MT82

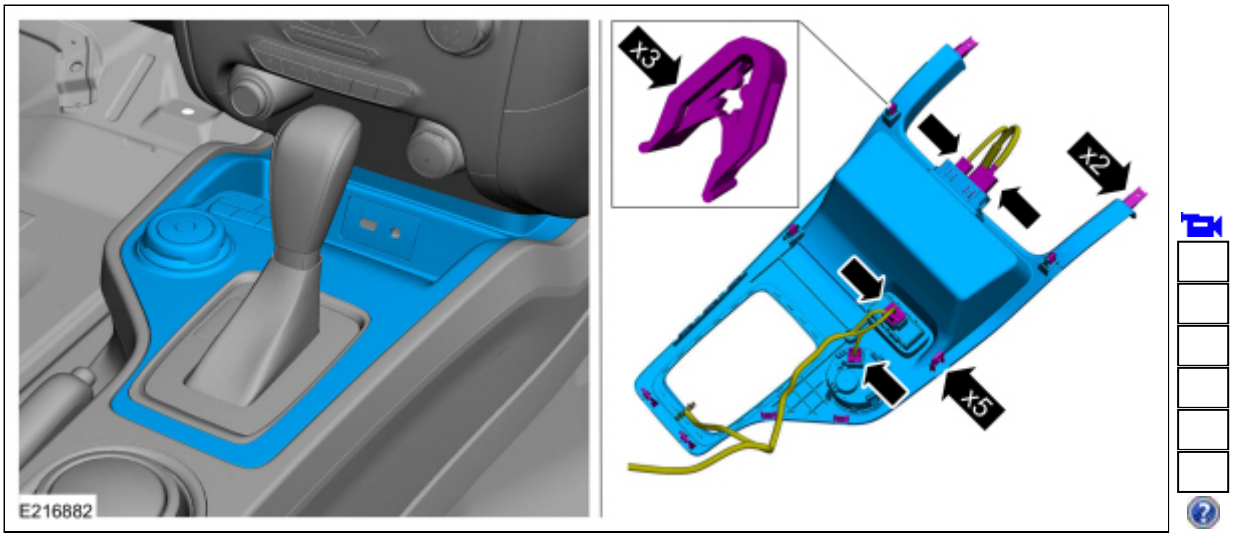
5. Refer to: Gearshift Lever Boot (308-06) .

6.



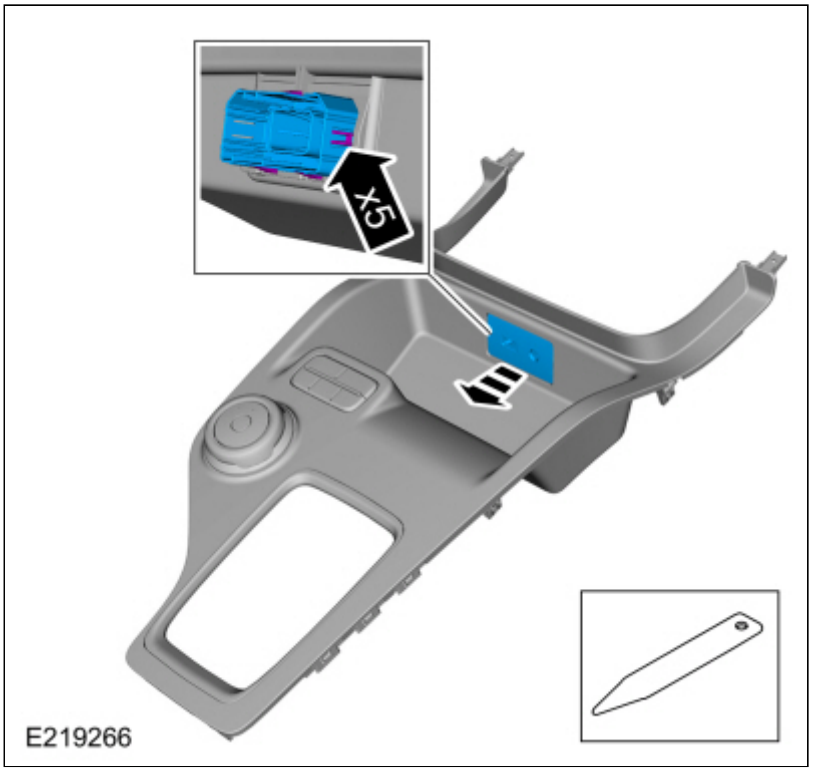
6-Speed Automatic Transmission - 6R80

7.



All vehicles

8.



Installation

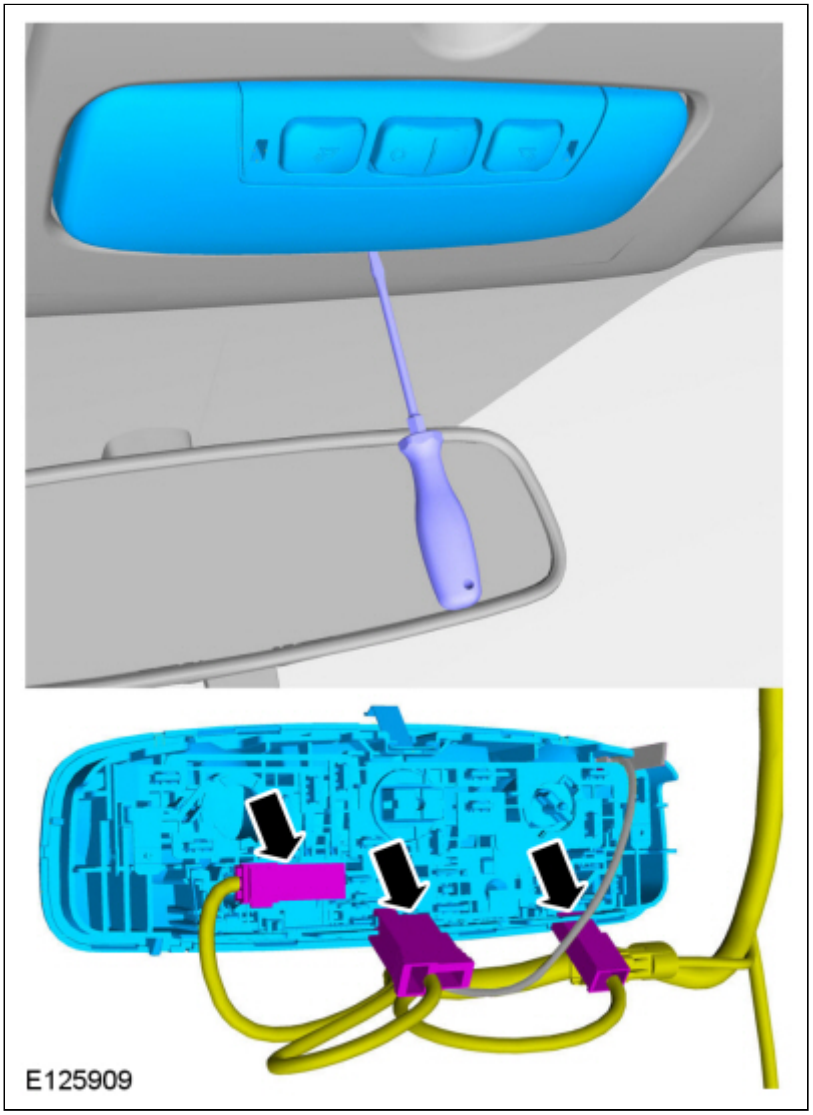
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

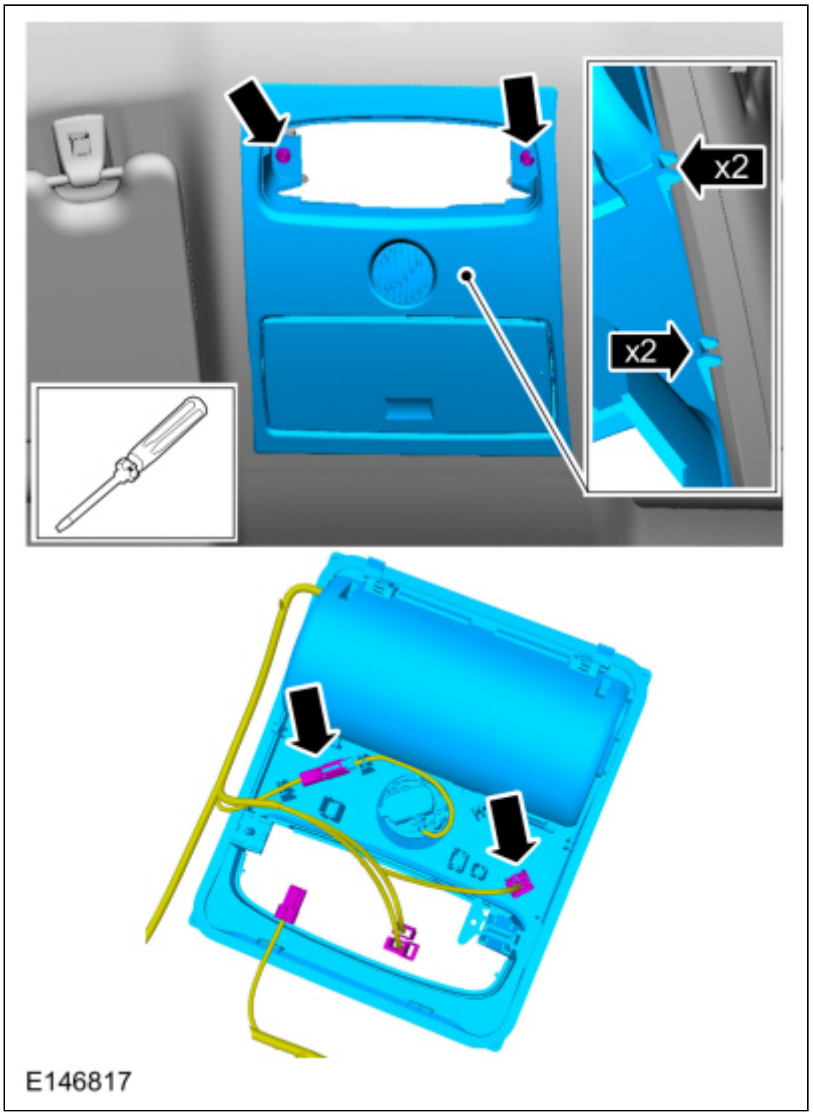
Microphone

Removal

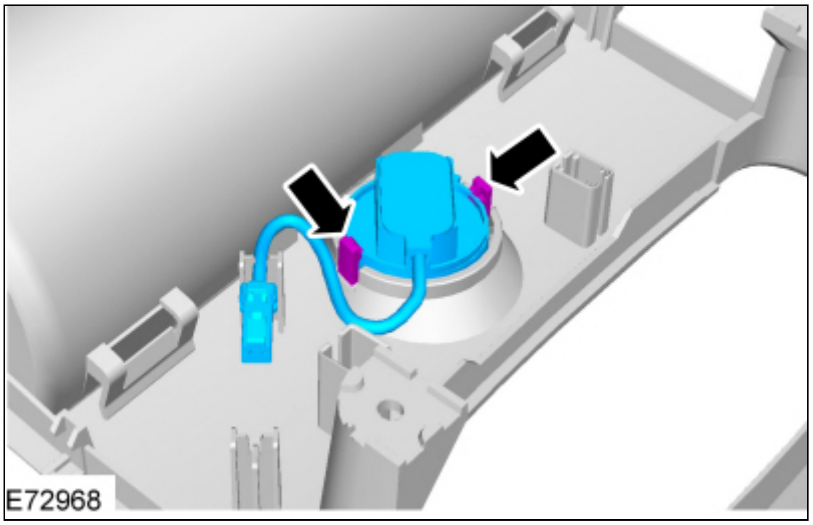
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3.



4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker RH

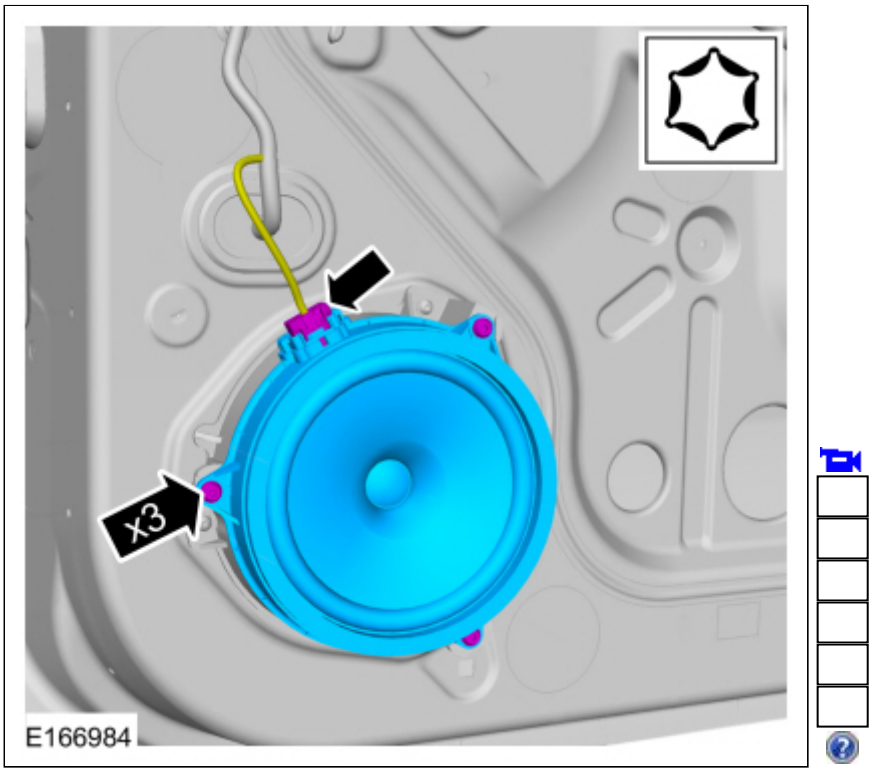
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

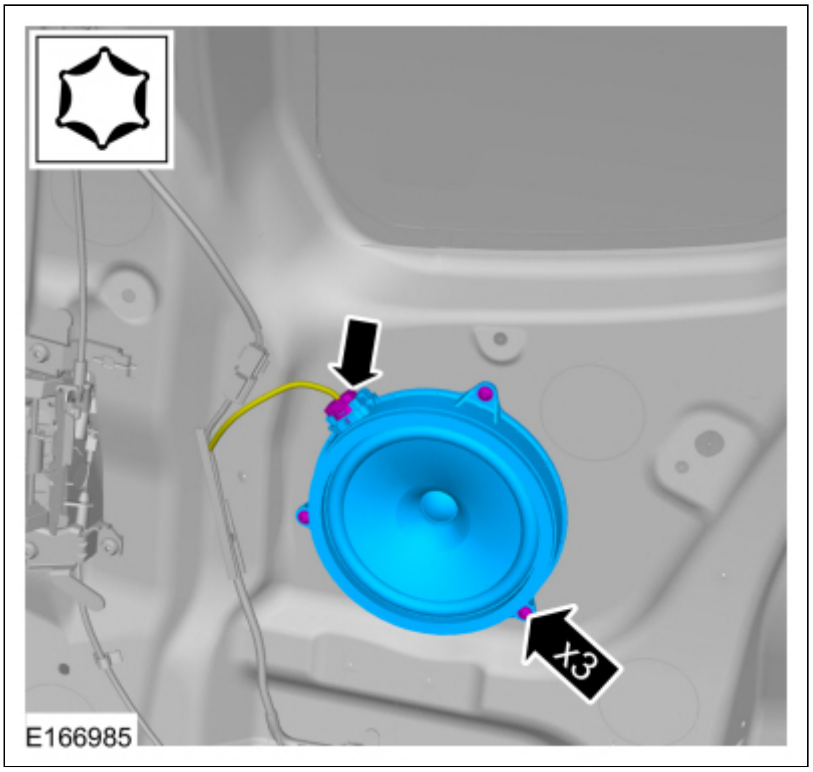
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM]

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

Installation

1. To install, reverse the removal procedure.
2. If a new APIM is being installed, program the APIM to the correct software level.
   Refer to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

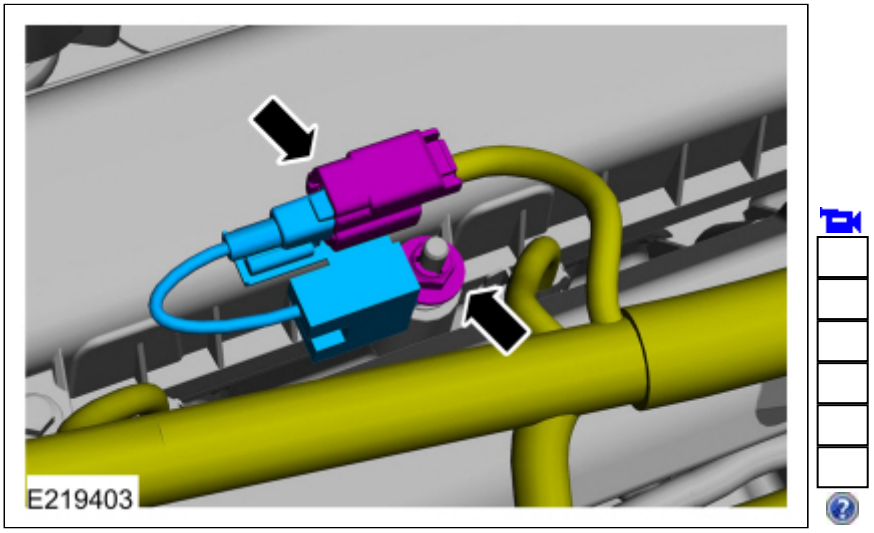
Copyright © 2016 Ford Motor Company

Noise Suppression Filter

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. *Torque*: 9 Nm



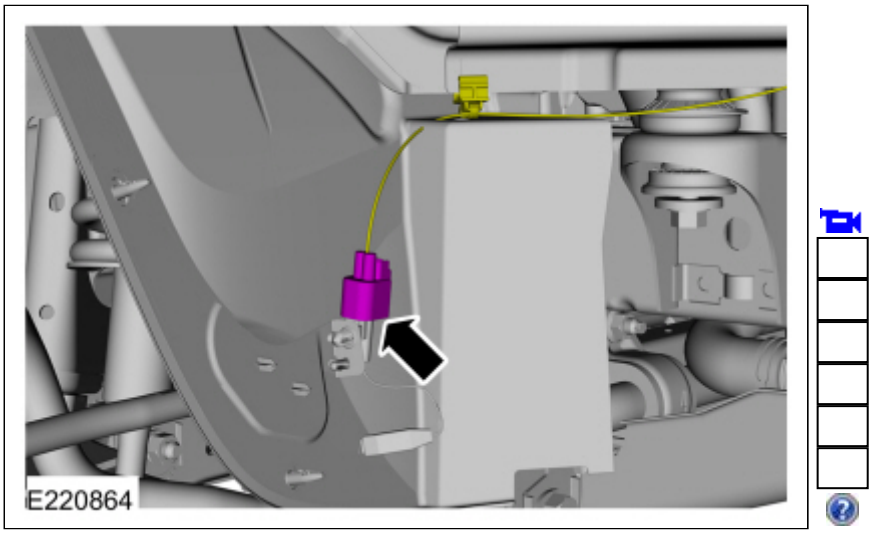
Installation

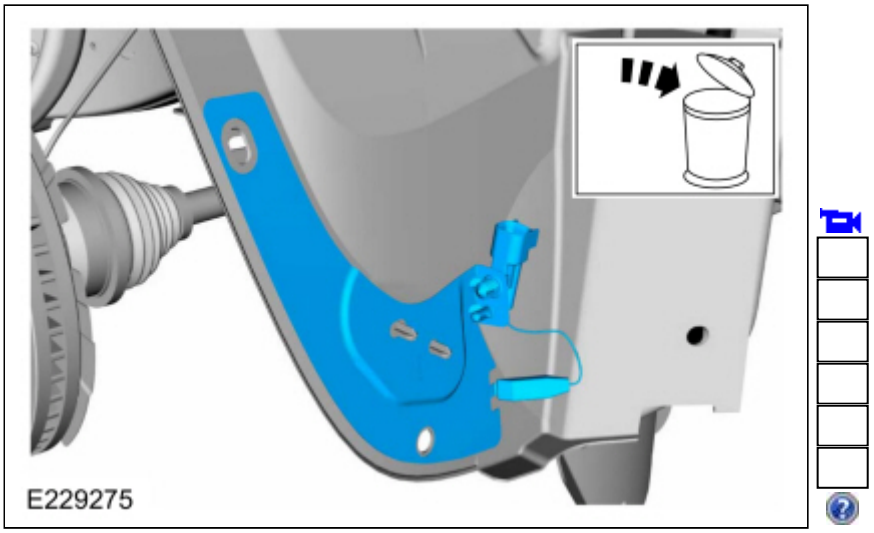
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Fender Mounted Antenna

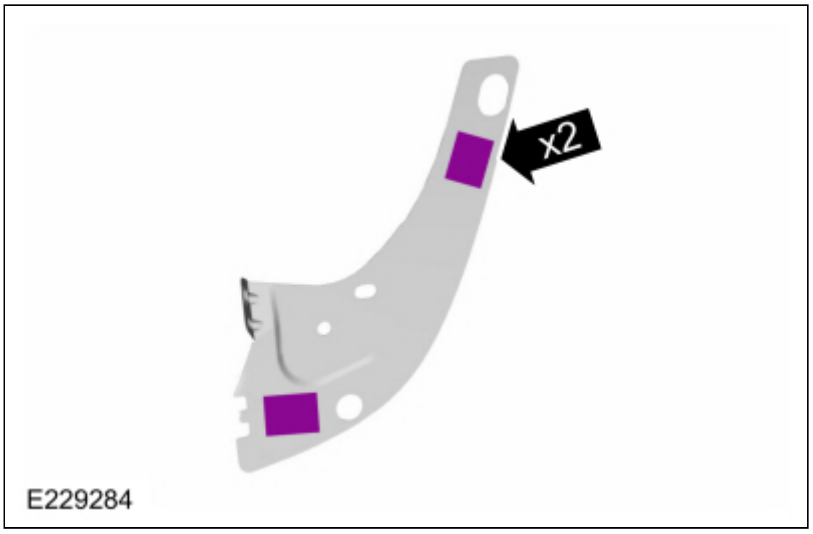
Removal

1. Refer to: Front Bumper Cover (501-19) .
2. 

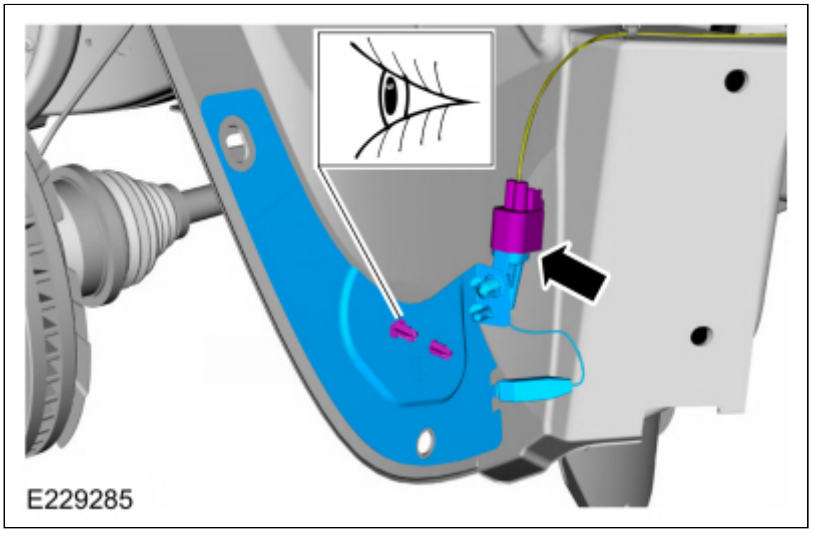
3. 

Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. **NOTE:** *Make sure that the installation marks are aligned.*



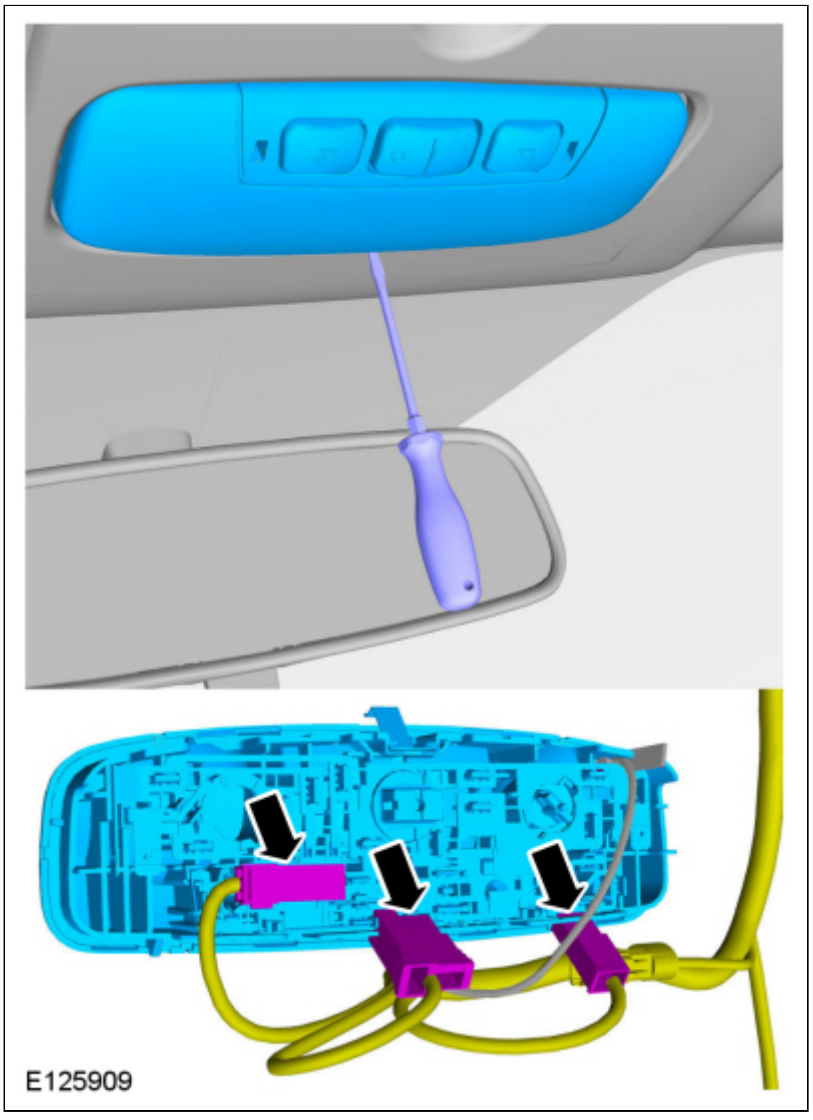
3. Refer to: Front Bumper Cover (501-19) .

Copyright © 2016 Ford Motor Company

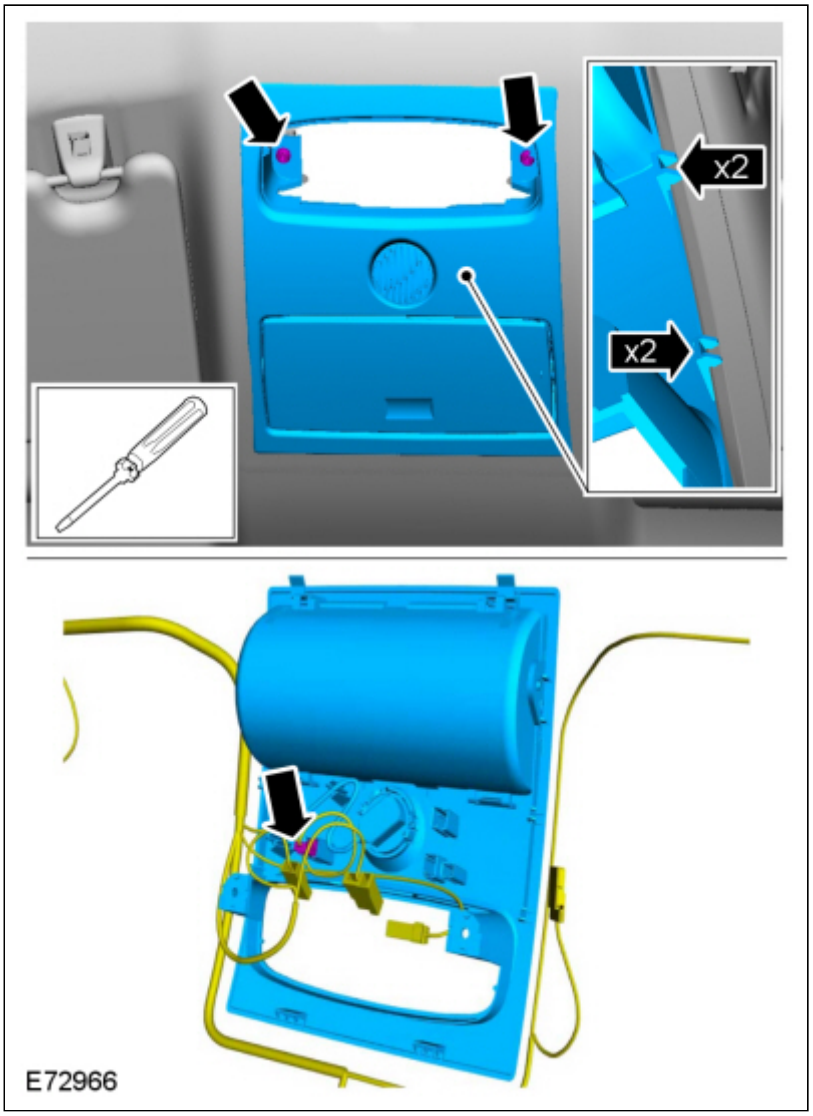
Roof Mounted Antenna

Removal

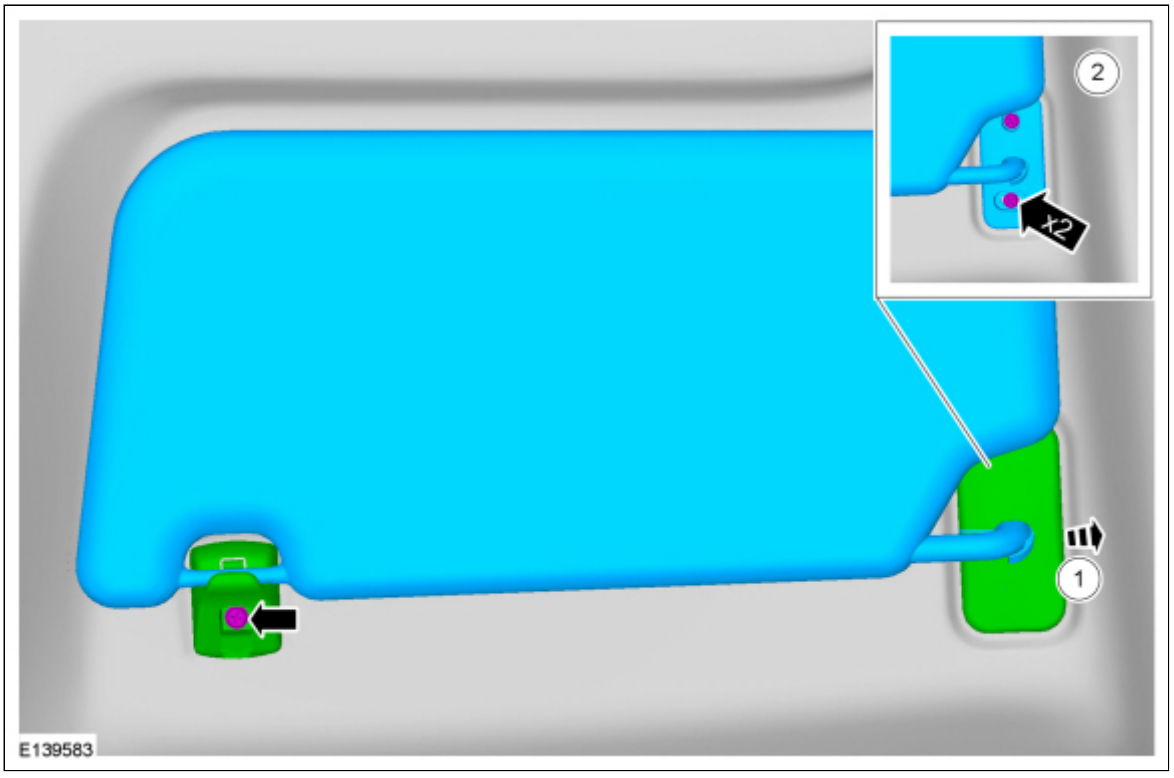
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: A-Pillar Trim Panel (501-05) .
2. Refer to: B-Pillar Upper Trim Panel (501-05) .
   Refer to: B-Pillar Lower Trim Panel (501-05) .
3. 

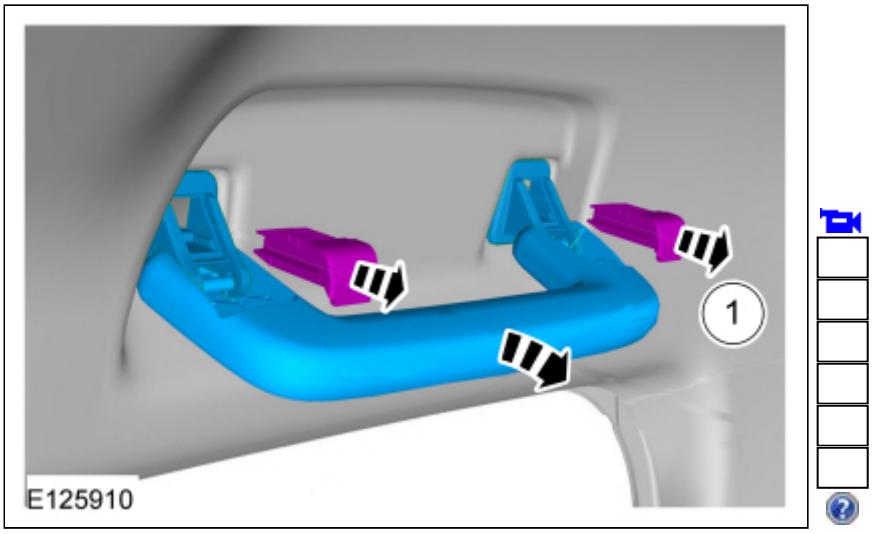
4. **NOTE:** *This step is not necessary when installing a new component.*



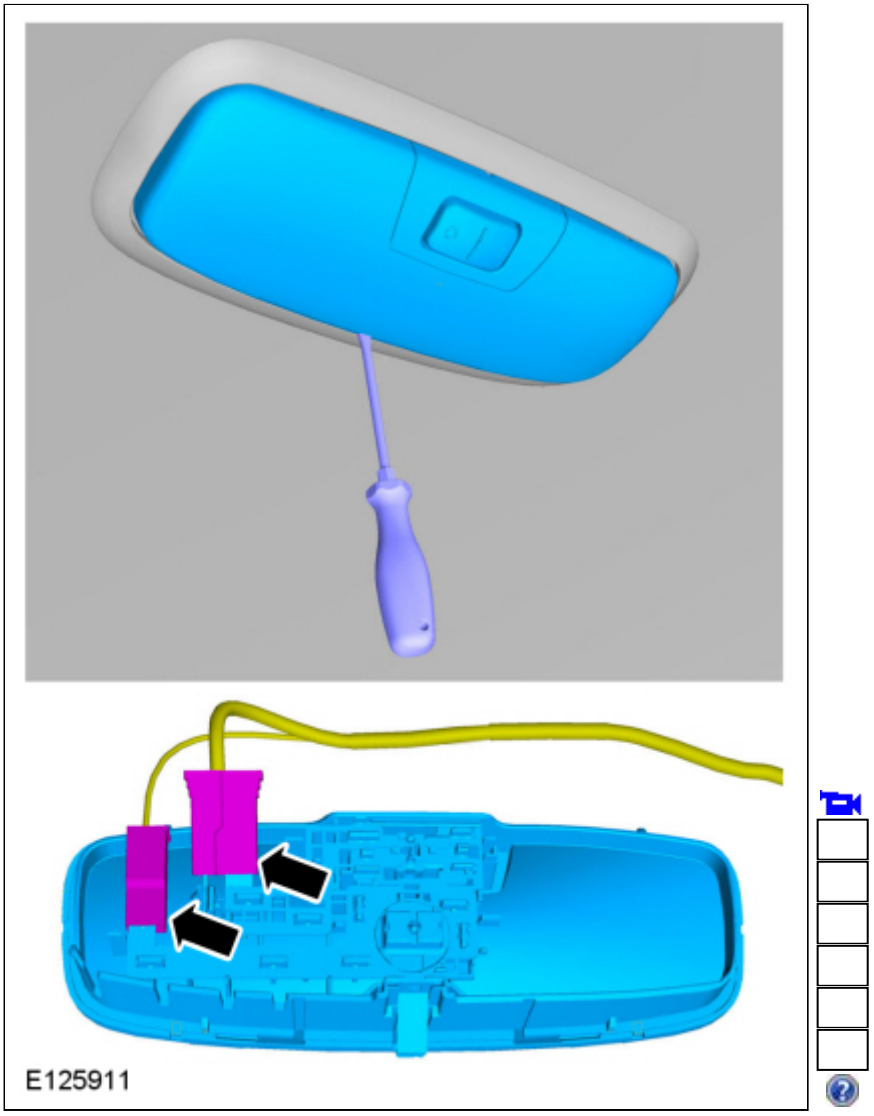
5. On both sides.



6.

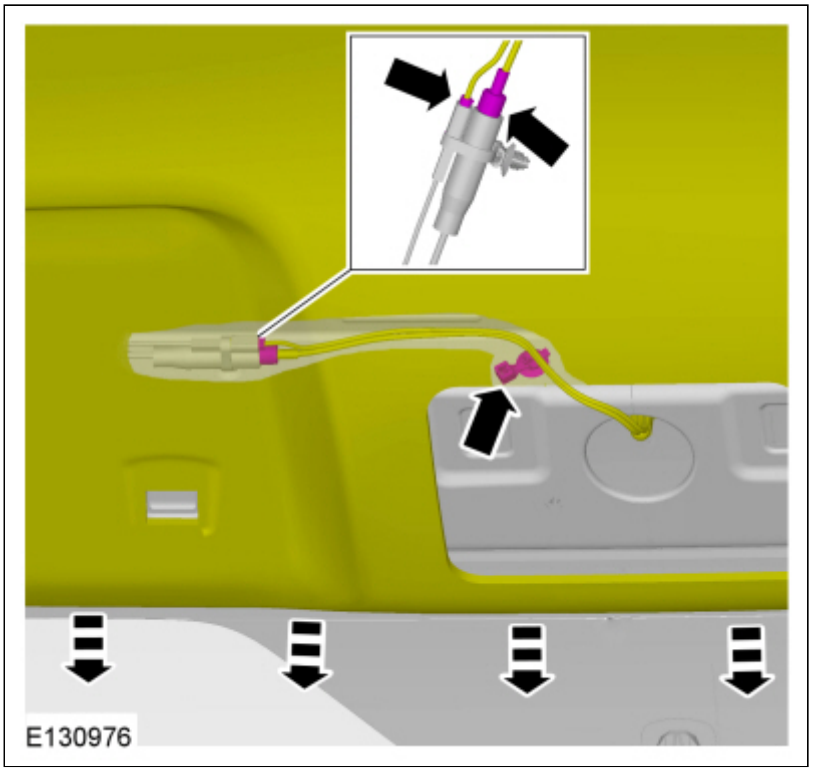


7.



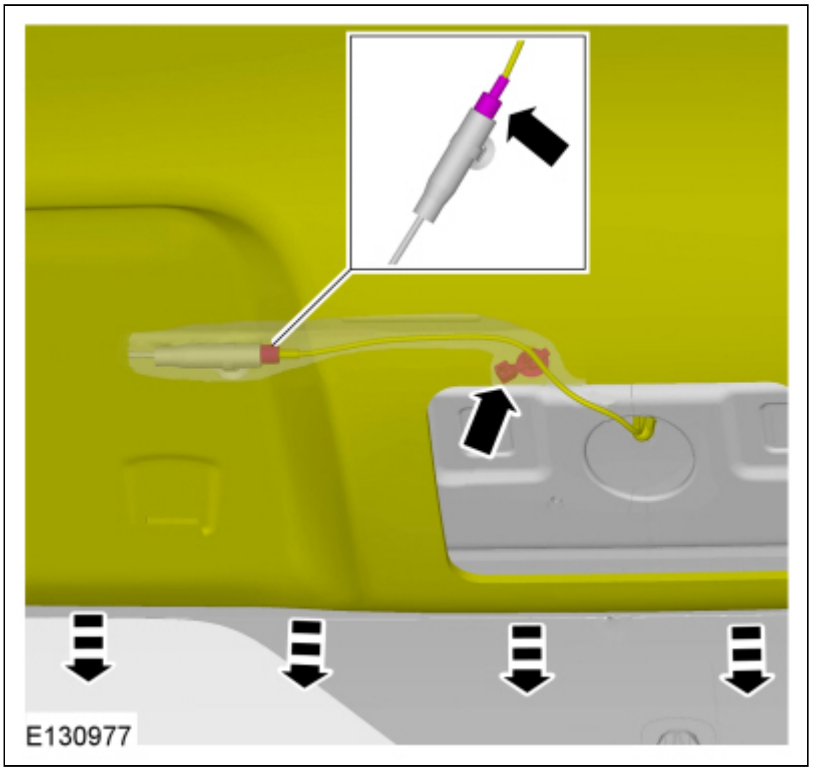
8. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*

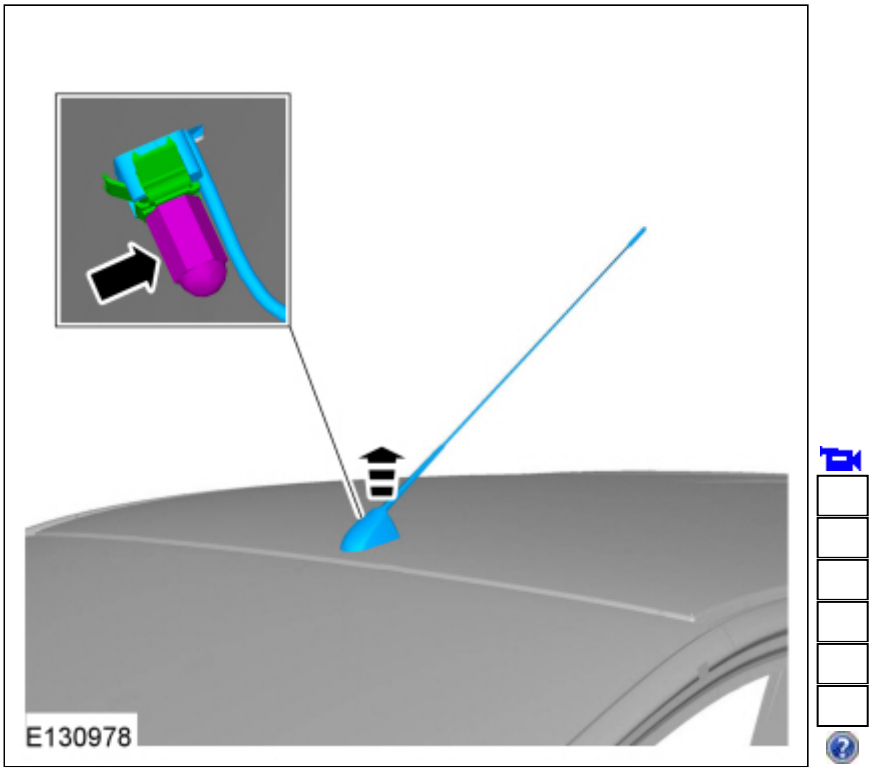


9. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*



10.



Installation

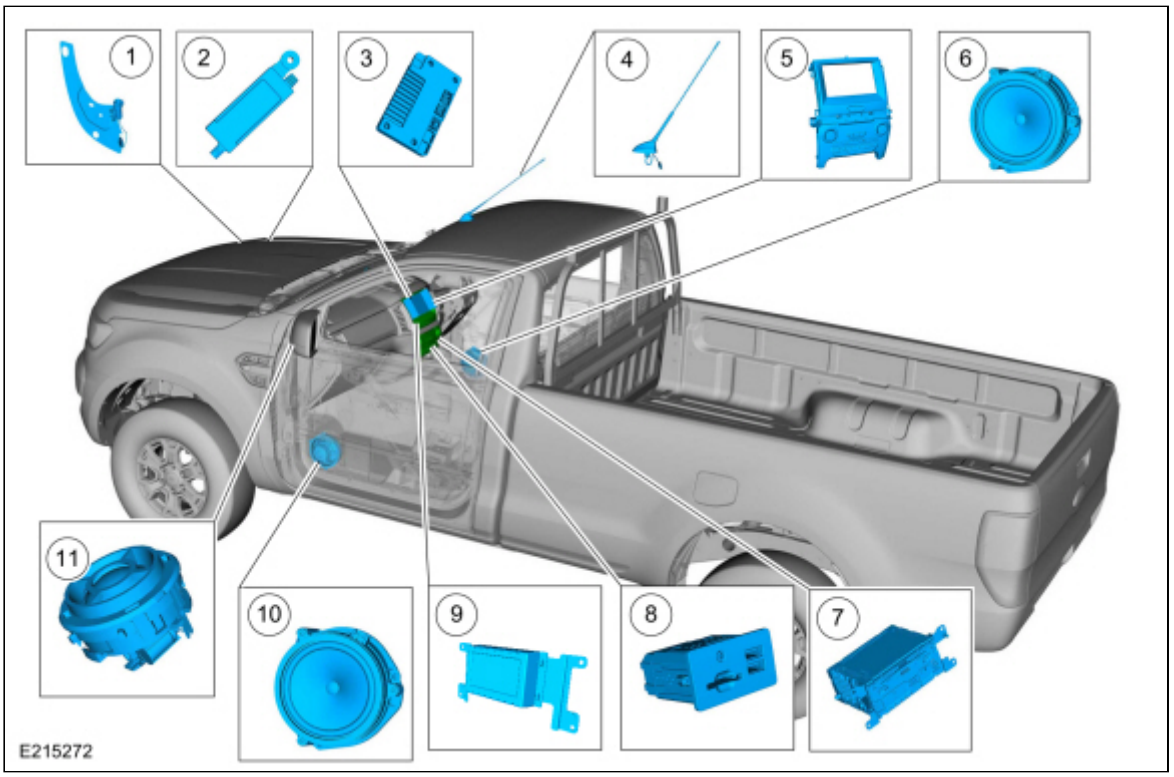
1. **NOTE:** *The antenna cable must be installed to the same routing as when removed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

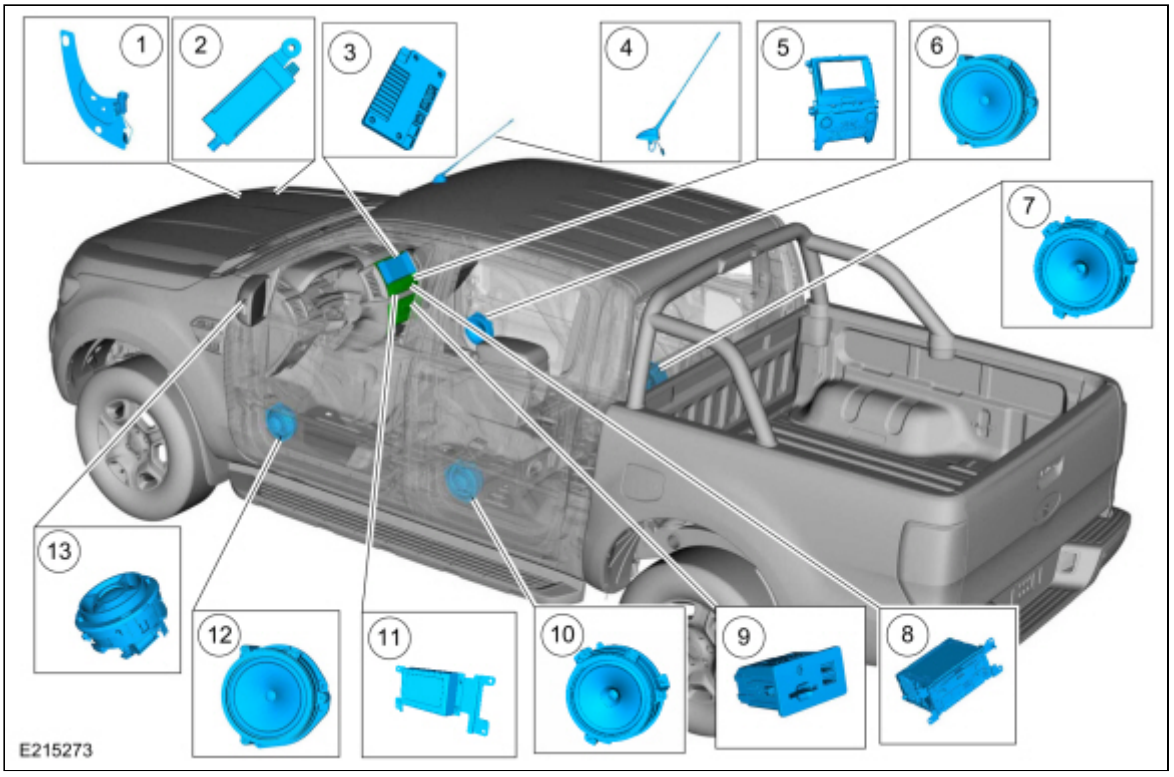
Information and Entertainment System - Component Location

SINGLE CAB



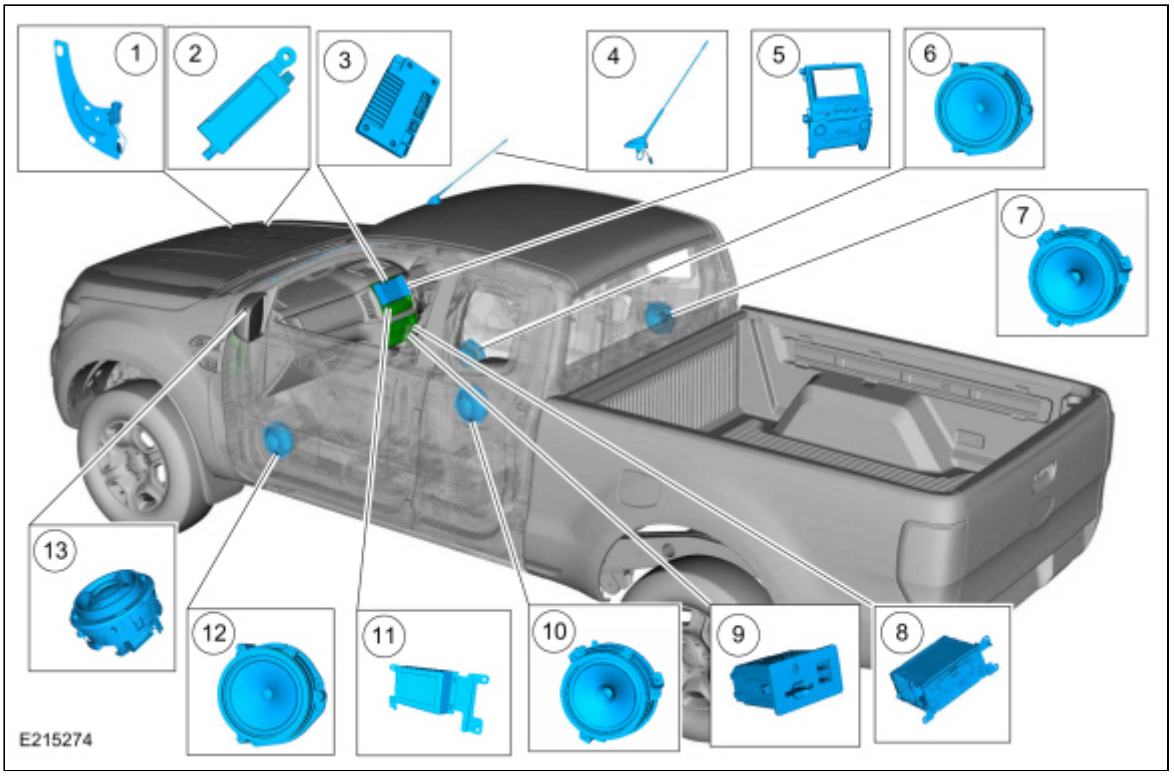
Item	Description
1	Front fender mounted antenna-FM 2 diversity antenna
2	Audio unit antenna amplifier
3	APIM
4	Roof Mounted Antenna-AM/ FM 1/ DAB antenna
5	FCIM
6	Front door RH speaker
7	ACM
8	Media hub
9	FCDIM
10	Front door LH speaker
11	Front door tweeter

DOUBLE CAB



Item	Description
1	Front fender mounted antenna-FM 2 diversity antenna
2	Audio unit antenna amplifier
3	APIM
4	Roof Mounted Antenna-AM/ FM 1/ DAB antenna
5	FCIM
6	Front door RH speaker
7	Rear door RH speaker
8	ACM
9	Media hub
10	Rear door LH speaker
11	FCDIM
12	Front door LH speaker
13	Front door tweeter

STRETCH CAB



Item	Description
1	Front fender mounted antenna-FM 2 diversity antenna
2	Audio unit antenna amplifier
3	APIM
4	Roof Mounted Antenna-AM/ FM 1/ DAB antenna
5	FCIM
6	Front door RH speaker
7	Rear door RH speaker
8	ACM
9	Media hub
10	Rear door LH speaker
11	FCDIM
12	Front door LH speaker
13	Front door tweeter

Copyright © 2016 Ford Motor Company

Information and Entertainment System - Overview

Overview

The audio system consists of the following:

Main Components

- 4 to 6 speakers
- 8-inch (203 mm) FDIM touchscreen
- ACM
- APIM
- FCIM
- GPSM
- Media hub
- Redundant steering wheel switches

Main Features

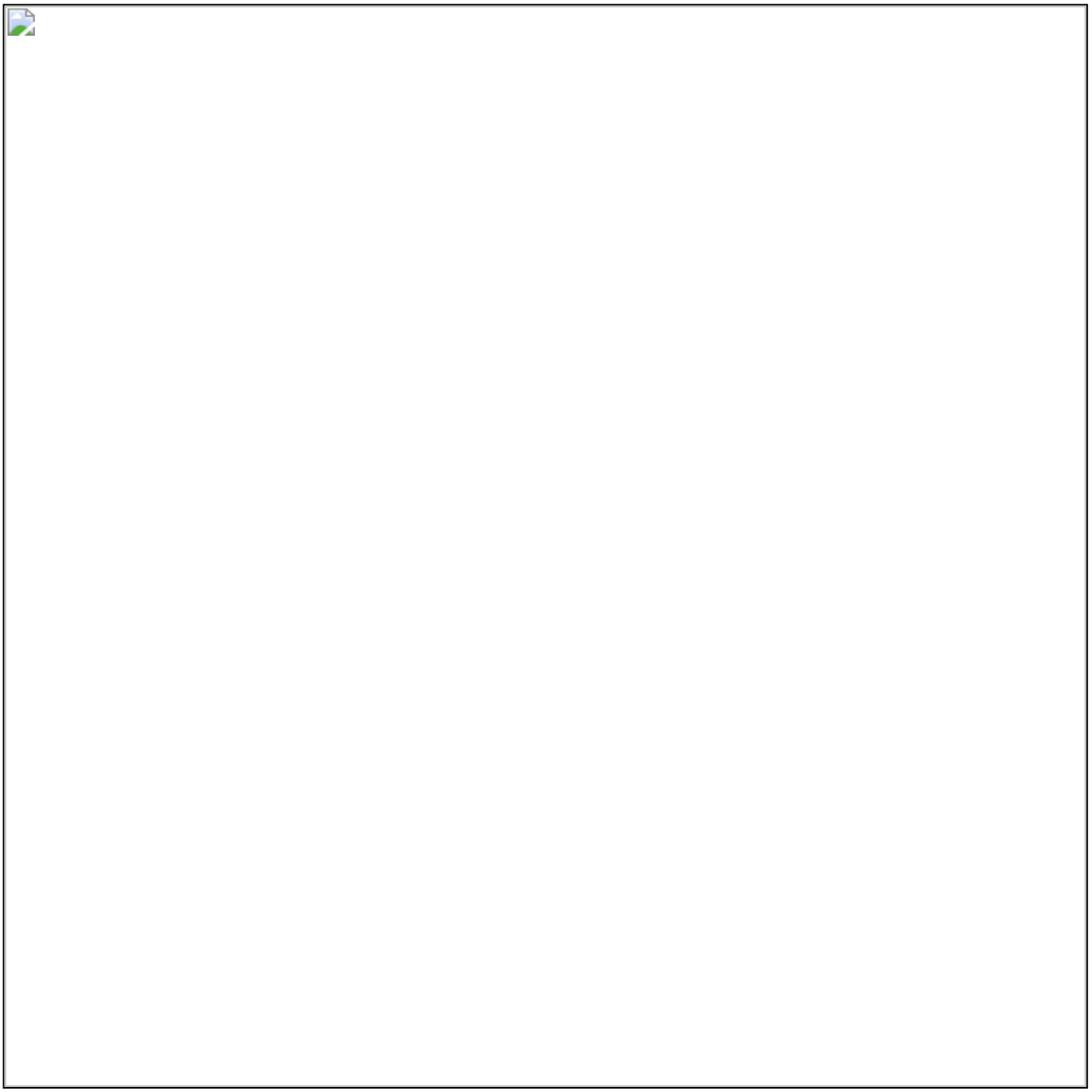
- Audio extended play
- Battery load shed
- Compass
- MyKey®
- Navigation
- Speed compensated volume
- SYNC®
- SYNC® Services - if equipped
- TMC
- DAB

Copyright © 2016 Ford Motor Company

Information and Entertainment System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

A missing network message is indicated by a DTC (U-code) and can be the result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle repair procedures such as module reprogramming can set these Diagnostic Trouble Codes (DTCs). When a missing message DTC (U-code) sets, it is important to look for symptoms present in the audio system and throughout the vehicle, and to review the complete message list to determine which other modules rely on the same message.
Refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

When the other modules have been identified, run the self-test for those modules. If the same message is missing from those modules, the identical, or similar lost communication Diagnostic Trouble Codes (DTCs) may be set in those modules. Confirmation of missing messages common to multiple modules can indicate that the originating

module is the source of the concern, or that the communication network may be at fault.

It is very important to understand the following:

- Where the input originates
- All of the information necessary for a feature to operate
- Which module(s) receive(s) the input or command message
- Which module controls the output of the feature
- If the module that receives the input controls the output of the feature, or whether it outputs a message over the CAN to another module.

NOTE: *Emergency Assistance may not be available in some countries. Visit the regional Ford website for latest details.*

Module Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
Audio settings	IPC	Used to set the radio listening source AM/ FM and DAB from the steering wheel switch.
Audio source select	IPC	Used to set the audio system listening source (AM/ FM/ DAB, CD, etc.) from the steering wheel switch through the IPC RH infotainment display.
Belt-Minder® audio mute	IPC	Used to mute speaker output so the Belt-Minder® tone can be more easily heard. This message only applies to vehicles with a MyKey® enabled and in use. The audio system is muted until the safety belt(s) are buckled.
CD request signals	CD player	Used to request audio source priority when the CD listening source is selected.
Day/night status	BCM	Used to adjust the AM radio reception sensitivity when using the seek button.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for ACM operating modes and fault reporting.
Instrument panel cluster chime	IPC	Used to request a warning chime to be played through the audio system.
MyKey® volume limit status	IPC	Used to limit the maximum audio system volume when a MyKey® restricted key is in use.
Power mode	IPC	Used to disable the functionality of the ACM due to the load shedding feature.
Power up chime modules	IPC	Used to initiate the audio system as the chime source.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.

Module Network Input Messages - APIM

Broadcast Message	Originating Module	Message Purpose
Airbag deployment status	RCM	Used to monitor airbag deployment status for Emergency Assist.
Audio settings	IPC	Used to set the radio listening source AM/ FM and Satellite from the steering wheel switch through the IPC RH infotainment display.
Day/night status	BCM	Used for day/night illumination status for the FDIM.

Display language selection	IPC	Used to display information on the FDIM in the selected language.
eCall notification	RCM	Used to notify of a Emergency Assist call being initiated due to airbag deployment.
FCIM bezel diagnostic status	GWM	Used to display the requested bezel diagnostics operations in the centerstack infotainment display.
FCIM button state	FCIM	Used to indicate when a button is pressed on the FCIM so the audio system can make the desired setting change.
Selector lever position	IPC	Used to verify the gear selector position for bezel diagnostics.
GPS compass direction	GPSM	Used to display the compass direction on the FDIM.
GPS data	GPSM	Used for vehicle positioning, heading, and direction for navigation and Emergency Assist.
Ignition key type	BCM	Used to determine if a MyKey® is enabled and in use.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for APIM operating modes and fault reporting.
MyKey® volume limit status	IPC	Used to limit the maximum audio system volume when a MyKey® restricted key is in use.
Navigation rolling wheel count and direction	ABS module	Used to provide more accurate vehicle position tracking when the GPS signal is temporarily unavailable.
Steering wheel switch status	SCCM	Used to indicate the button press status of the steering wheel switches.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.
Vehicle speed	PCM	Used for navigation functionality.

Module Network Input Messages - DACMC

Broadcast Message	Originating Module	Message Purpose
Accelerator pedal position	PCM	Used to determine the throttle position status for the ANC system operation.
Driver's door ajar status	BCM	Used to enable the ANC system if the driver’s door (and all other doors and luggage compartment lid) is closed, or to disable the ANC system if the driver's door is ajar.
Engine RPM data	PCM	Used to determine the engine rotation speed for the ANC system operation.
Engine status	PCM	Used to enable the ANC system if the engine is ON, or to disable the ANC system if the engine is OFF.
Engine torque	PCM	Used for ANC system operation by indicating the amount of engine torque being produced.
Ignition status	GWM	Used to indicate the ignition state (OFF, ACCESSORY, CRANK, RUN, and START) required for DACMC operating modes and fault reporting.
LHR door ajar status	BCM	Used to enable the ANC system if the LHR door (and all other doors and luggage compartment lid) is closed, or to disable the ANC system if the LHR door is ajar.
Luggage compartment lid ajar status	BCM	Used to enable the ANC system if the luggage compartment lid (and all other doors) is closed, or to disable the ANC system if the luggage compartment lid is ajar.
Passenger door ajar status	BCM	Used to enable the ANC system if the front passenger door (and all other doors and luggage compartment lid) is closed, or to disable the ANC system if the front passenger door is ajar.
Power up chime modules	IPC	Used to initiate the audio system as the chime source.

RHR door ajar status	BCM	Used to enable the ANC system if the RHR door (and all other doors and luggage compartment lid) is closed, or to disable the ANC system if the RHR door is ajar.

Module Network Input Messages - FCIM

Broadcast Message	Originating Module	Message Purpose
Audio source selection	ACM	Used to indicate the selected audio system source.
Day/night status	BCM	Used for day/night illumination status for the FCIM.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for FCIM operating modes and fault reporting.
Power mode	IPC	Used to disable the functionality of the FCIM due to the load shedding feature.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.

Module Network Input Messages - GFM (CD Player)

Broadcast Message	Originating Module	Message Purpose
CD display	APIM	Used to control the CD functions from the FDIM touchscreen.
CD multifunction control	IPC	Used to control the CD functions from the steering wheel switches through the IPC infotainment display.

Module Network Input Messages - GPSM

Broadcast Message	Originating Module	Message Purpose
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for GPSM operating modes and fault reporting.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.
Vehicle yaw rate	RCM	Used to verify the vehicle acceleration data for navigation.
Wheel rotation count	BCM	Used to provide more accurate vehicle position tracking when the GPS signal is temporarily unavailable.
Wheel rotation direction	BCM	Used to determine wheel rotation direction for navigation.

Module Network Input Messages - IPC

Broadcast Message	Originating	Message Purpose

	Module	
Audio source selection	ACM	Used to display the selected audio source on the IPC.
CD function status	ACM	Used to indicate the loading status of a CD.
Display language request	APIM	Used to display information on the IPC in the selected language.
Multimedia player total play time status	APIM	Used to indicate the total play time of the audio track being played.

Accessory Delay Feature

The accessory delay feature allows the audio system to be operated for a preset period of time after the ignition is turned off and a front door has not been opened.

AM/ FM/ DAB Radio

The AM/ FM1/ DAB antennas receives analog radio waves and sends them through the antenna amplifier and AM/ FM1/ DAB antenna coaxial cable to the ACM. The FM2 antenna receives analog radio waves and sends them through the FM2 diversity antenna amplifier and FM2 antenna coaxial cable to the ACM. The radio waves are converted into fluctuating AC voltage and sent as left and right analog audio signals to the audio amplifier and all speakers.

APIM Programming

The APIM requires specific programming procedures for correct operation. APIM programming is required when:

- The APIM is replaced.
- Directed by a TSB. Updates to resolve SYNC® performance concerns should only be performed when directed by a TSB.
- Feature upgrades are requested. Occasional feature upgrades and/or new applications can be programmed when they become available. This type of programming is available upon customer request and expense.

There are 3 types of APIM programming available:

- Module Replacement — Used when the APIM has been replaced. This type of programming performs the required provisioning (restores software for newly installed hardware).
- Standard — Used to update the APIM and any currently installed applications to the latest software level.
- Custom — Used to show all the available software options (including applications that may not have been installed previously) that can be programmed into the APIM. Use this selection when upgrades become available or as directed by a TSB.

There are 3 types of software installation methods:

- Full Flash [Force CIP] — A CIP program is the entire software package for the APIM. Performing a Full Flash erases the existing APIM software and installs the complete program. A Full Flash should only be performed if a Service Pack is not available. If a Full Flash is performed, all applications must be re-installed. Performing a Full Flash by selecting Force CIP requires additional programming time and is not necessary unless directed by a TSB.
- Service Pack — A Service Pack update only provides the necessary software to update the existing APIM program to a new level. For example, a Service Pack changes the software program from an 'AA' to an 'AB' version level. It does not delete or overwrite the existing APIM software. A Service Pack is a much smaller program than a Full Flash and requires less downloading and programming time. A Service Pack software installation should always be performed instead of a Full Flash, if possible.
- Applications — Applications are special software programs that may be installed on the APIM. Applications necessary for each vehicle are determined by the vehicle build information stored in the Ford online database. Selecting individual applications for installation may not be necessary every time the APIM is programmed.

NOTE: *VIP programming is not selectable because the VIP is configured automatically during programming.*

There are some general programming guidelines that are applicable to multiple types of programming:

- Full Flash/Force CIP
  - The media hub must be removed for programming.
  - The diagnostic scan tool and SYNC® Re-Flash Kit (or equivalent), are required to complete the flash procedure.
  - All previously paired phones are deleted from the SYNC® system.
  - The file needs to be downloaded from the Ford online database. Allow for extra time in order to complete the download. The compressed files are between 200 and 400 megabytes (MB), and once downloaded,

are extracted to the full size of approximately 2 gigabytes (GB).
    - Once diagnostic scan tool programming is complete, Applications need to be installed with the USB flash drive. This should be accomplished by reinstalling the media hub and connecting the USB flash drive to the media hub.
- Service Pack and Applications
    - A USB flash drive with a minimum 1 gigabyte (GB) storage capacity is required.
    - The file is downloaded from the Ford online database onto the flash drive. The files are then transferred via the flash drive to the APIM through the vehicle USB port.

To perform module replacement programming,
Refer to: SYNC Module [APIM] Replacement Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

To perform standard programming,
Refer to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

To perform custom programming,
Refer to: SYNC Module [APIM] Custom Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Audio Extended Play

This feature allows the audio system to operate with the ignition OFF, regardless of door latch position. When the power button on the FCIM is pressed, audio system functionality is enabled and remains active for a period of 20-60 minutes, depending on configuration settings. Audio extended play will not function if the battery load shed is active. To turn the audio system off, press the FCIM power button.

Audio Input Jack Mode

When a portable audio device, such as an iPod® with its available cable, is connected to the vehicle audio system through the audio input jack, audio from the device can be played through the vehicle speakers. Only the volume can be controlled with the vehicle audio controls. All other functions such as seek, fast forward, pause, etc. must be carried out on the device itself.

No metadata (information such as artist, album title, song title, and genre) is transferred when a device is connected to the audio input jack.

Battery Load Shed

The BCM uses the battery current sensor to monitor the battery state of charge. The battery current sensor is attached to the battery ground cable. With the ignition in RUN, ACC, or OFF, a load shed message is sent over the CAN when the BCM determines that the battery state of charge is below 40%, 45 minutes have elapsed, or 10% of the charge has been drained. This message turns off the audio system to save the remaining battery charge. Under this condition, "Battery Saver - System Off" is displayed on the centerstack infotainment display to notify the driver that battery protection actions are active. To clear the load shed state, start the vehicle.

Bluetooth Mode

Bluetooth is a secure, short-range radio frequency that allows devices to communicate wirelessly through radio waves. The operating range of a Bluetooth signal is application specific, but will have a minimum range of 10 meters (33 feet).

The Bluetooth interface can accommodate both Bluetooth-enabled mobile phones and Bluetooth-enabled media devices. The SYNC® system allows interaction with several types of customer Bluetooth devices, including mobile phones and media devices. The APIM contains an on-board Bluetooth chipset, which enables certain wireless devices to interact with the system.

Any Bluetooth device used with the SYNC® system must first be paired with the APIM on-board Bluetooth chipset before it can become operational. Pairing a Bluetooth device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC® system generates a unique PIN that must be confirmed on the Bluetooth device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For information on the pairing process, refer to the Owner's Literature.

Multiple Bluetooth phones and Bluetooth media devices can be paired to the APIM at the same time. The APIM supports an active connection with one Bluetooth phone and one Bluetooth media device at a time. If an additional device of either type is paired and made active, the APIM ends any active connection with an already-paired device, and establishes an active connection with the new device.

It is important to understand that while most Bluetooth devices can pair with the SYNC® system, not all Bluetooth

devices have the same level of features available when interacting with the SYNC® system. To determine if a Bluetooth device or feature is supported, review the device compatibility list. Refer to www.syncmyride.com.

Chimes

Various vehicle systems send chime requests over the CAN to the IPC. The following are determined as the IPC processes these requests:

- Chime characteristics (tone, tone length, number of repetitions, time between tones, etc.)
- Chime output volume
- Priority of the chime request
- Which speakers (all, front, or rear) will play the specific chime

The IPC sends the processed requests over the CAN to the ACM. The ACM outputs the left and right analog chime tones to the appropriate audio system speakers as fluctuating AC voltage.

For additional information on chimes,
Refer to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Compass

The GPS antenna integral to the GPSM is used to acquire the compass heading. The compass heading is sent over the CAN to be displayed on the centerstack infotainment display.

MyKey® Audio Operation

- The following MyKey® features are always enabled when a MyKey® is in use, and are not configurable on/off with an administrator key:
  - Belt-Minder®: The audio system is muted, and “MyKey Buckle Up to Unmute Audio" is displayed in the information display until the safety belts are buckled.

- The following MyKey® features are configurable with an administrator key:
  - Emergency Assist: If the administrator has selected "Always On" in the MyKey® menu, Emergency Assist is enabled and cannot be disabled.
  - Do Not Disturb: If the administrator has selected "Always On" in the MyKey® menu, the Do Not Disturb feature is enabled and cannot be disabled.
  - Speed Compensated Volume: If the administrator has enabled the Volume Limiter feature, the speed compensated volume feature will be disabled.
  - Speed Limiter: If the administrator has enabled the Speed Limiter feature, the audio volume level is temporarily reduced so the top speed alert chime can be heard when the preselected top vehicle speed is reached.
  - Speed Minder: If the administrator has enabled the Speed Minder feature, the audio volume level is temporarily reduced so the speed alert chime can be heard when the preselected Speed Minder vehicle speed is exceeded.
  - Volume Limiter: If the administrator has enabled the Volume Limiter feature, the audio system volume is limited to 45%. In an attempt to exceed the limited volume, “MyKey® VOLUME LIMITED” is displayed in the information display.

Refer to the Owner's Literature for more information on MyKey®.

Speed Compensated Volume

The ACM compensates for wind and road noise by adjusting the audio system volume based on the VSS signal and customer-defined setting.

When a MyKey® is in use and the MyKey® Volume Limiter is enabled, the speed compensated volume is disabled.

Steering Wheel Switch Functions

The RH steering wheel switches consist of an upper 5-way switch, and a lower 6-way switch. The upper 5-way steering wheel switch operates the IPC infotainment display. The lower 6-way steering wheel switch operates the volume +/-, seek +/end call, seek-/send call/receive call, voice, and mute functions.

SYNC® AppLink™

SYNC® AppLink™ allows the customer to control smartphone Applications by using voice commands and in-vehicle controls. Data is transferred from the customer’s device to the APIM through Bluetooth, or through the USB port with Apple® devices.

For more information, refer to “AppLink” in the Owner's Literature.

SYNC® System

The SYNC® system is a hands-free communication and entertainment system that supports many features. All features are not available with every phone.

The SYNC® system provides the following abilities:

- Connect media devices in order to play audio files
- Control the entertainment system using voice commands
- Initiate an emergency assistance call when the airbags deploy (for more information, refer to “Emergency Assistance” in the Owner's Literature).
- Play media files via a paired Bluetooth-enabled audio device
- Send and receive phone calls via a paired Bluetooth-enabled phone
- Send and receive text messages via a paired Bluetooth-enabled phone

TMC

Many stations that brodcast on the FM waveband have a TP code to signify that they carry traffic program information. Before traffic anouncements can be received, the TA or TRAFFIC button must be pressed. A TA display will appear to show the feature is switched on. When traffic information is broadcast, normal radio or CD playback will be interrupted. The audio unit will return to normal operation at the end of each traffic announcement.

USB Mode

When a portable media device, such as an iPod® with its available cable or portable mass storage such as a USB thumb drive, is connected to the vehicle audio system through the USB ports, audio from the device can be played through the vehicle speakers. Functions such as volume, seek, fast forward, pause, etc. can be controlled by the vehicle audio controls.

When playing media files stored on a mass storage device such as a flash drive, the SYNC® system only plays files that do not have DRM protection.

In addition to audio information (track length, track number, etc.), metadata (information such as artist, album title, song title, and genre) may also be sent to the APIM from a device connected to the USB port. The APIM uses the metadata to create indexes that can be used to sort for particular music based on the customer’s preferences. Not all USB devices can send metadata to the APIM. When a new media device is connected to the SYNC® system, the APIM automatically indexes the information. This may take several minutes depending on the amount of data on the device, and is considered normal operation. When a device that was previously connected to the SYNC® system is reconnected, the APIM updates the index rather than creating a new one. This reduces the time needed to index the device.

The USB port can be used to upload vehicle Application upgrades to the APIM from a mass storage device such as a flash drive.

Image files can be saved to the APIM from a USB device in order to be used as wallpaper backgrounds displayed on the FDIM.

Voice Recognition

Voice recognition allows certain phone, navigation system, audio system, and climate control system functions to be controlled with voice commands. This minimizes driver distraction by reducing or eliminating the need to interact with the centerstack infotainment display and/or device while driving.

When the voice steering wheel switch is pressed, an audible prompt originating at the APIM is heard from the speakers. Based on the customer’s setting, audible prompts will either be a voice or a simple tone. When interaction mode is set to standard, detailed voice guidance is provided. When interaction mode is set to advanced, most prompts are tones only, and minimal voice guidance is provided. The microphone receives the voice commands and sends them to the APIM. Refer to the Owner's Literature for more information on voice recognition.

Component Description

ACM

The ACM can be operated with the ignition in RUN, ACC, or OFF.

The ACM receives radio waves containing audio from the antenna coaxial cables and converts them into fluctuating AC voltage. The ACM processes all inputs and depending on the input received, sends stereo or mono analog audio signals to the audio amplifier and door speakers.

Antenna

The AM/ FM radio uses the roof-mounted combination AM/ FM antenna to receive analog radio waves. The DAB radio waves are sent through the AM/ FM2 antenna coaxial cable to the ACM, where they are amplified. A second FM 2 foil antenna is mounted under the splash shield next to the bumper for diversity functionality.

APIM

The APIM can be operated with the ignition in RUN, ACC, or OFF.

The APIM receives stereo and mono inputs. Stereo inputs include audio from USB port and connected Bluetooth media device. Mono inputs include audio from the outside device during a phone call and inputs from the SYNC® microphone.

The APIM sends stereo and mono audio signals to the ACM as fluctuating AC voltage. Stereo outputs include audio from the USB port and connected Bluetooth media device, ringback tone, outside device during a phone call, and voice or tone prompts initiated from the steering wheel switches.

The APIM consists of 2 internal modules: the CIP and the VIP. The modules are not replaceable individually, but can be flashed independently if required.

The CIP interfaces with all of the customer inputs to the APIM. It contains an analog-to-digital-to-analog converter, as well as the Bluetooth chipset. Any Application upgrades that are available to the customer are loaded directly to the CIP through the USB port.

The VIP provides an interface between the CIP and the vehicle inputs. Its main functions are controlling the APIM power management and translating inbound and outbound CAN signals. In addition, the VIP queries the modules on the network to retrieve any DTCs.

The Touchscreen Calibration must be performed every time the APIM is separated from the FDIM.

The APIM requires programming when it is replaced.

Audio Input Jack

The audio input jack can be used to play audio files from an audio device connected through the 1/8-inch (3.5 mm) audio jack.

Audio signals are sent from the audio input jack to the APIM.

There are no power or ground circuits to the audio input jack.

Built-In Antenna Amplifier

The audio unit antenna amplifier receives AM/ FM radio waves from the antenna. The antenna amplifier is powered by the ACM and amplifies AM audio signals to improve reception. The AM/ FM radio waves are sent through the AM/ FM antenna coaxial cable to the ACM.

FCIM

The FCIM can be operated with the ignition in RUN, ACC, or OFF.

The FCIM audio system buttons provide one of the methods with which the customer interacts with the infotainment system.

The FCIM is separate from the ACM.

The FCIM requires PMI when it is replaced.

FDIM

The FDIM can be operated with the ignition in RUN, ACC, or OFF.

The FDIM touchscreen provides one of the methods with which the customer interacts with the infotainment system.

The FDIM plugs directly into the APIM, and therefore does not communicate directly on any network, and no external circuits are connected.

The Touchscreen Calibration must be performed every time the FDIM is separated from the APIM.

GPSM

For vehicles equipped with SYNC Services® or SIRIUS Data Services, the GPSM provides vehicle location information for real-time traffic reports and for traffic avoidance re-routing.

The GPS antenna integral to the GPSM is used to acquire the compass heading. The compass heading is sent over the CAN to be displayed on the centerstack infotainment display.

The GPSM provides vehicle location information for identifying the vehicle location in the event of a collision.

The GPSM acts as the antenna for the navigation system.

The GPSM requires PMI when it is replaced.

Media Hub

The media hub allows for various audio and video devices to play content through the vehicle speakers and to be viewed on the FDIM. The media hub contains:

- 1 USB port
  - Data is sent from the USB ports to the APIM through the USB cable.
  - Although there is one USB port and cable connecting the media hub to the APIM.
  - The USB port is powered through circuits from the APIM, and can be used to power and/or charge a device if the device supports this feature. If the device does not support this feature, an external power source is needed in order to power the device.
- 1 set of component RCA jacks (left audio, right audio, video)
  - The media hub contains an internal composite audio/video translator connected to the external RCA jacks, which outputs video and audio signals to the APIM through shielded audio and video circuits.

Steering Wheel Switches

The RH upper and lower steering wheel switches contain series of resistors. Each steering wheel switch function corresponds with a specific resistance value within the switch.

The SCCM sends a 5-volt reference voltage to the RH upper and lower steering wheel switches on the input circuit. When a switch is pressed, the voltage is routed through the corresponding resistor(s), through the return circuit, and then to ground through the SCCM. The SCCM monitors the resultant voltage drop to determine which switch was pressed. The voltage drop varies depending upon the resistance of the specific switch pressed.

The upper steering wheel switch inputs are sent as network messages from the SCCM to the IPC to control the IPC infotainment display.

The lower steering wheel switch inputs are sent as network messages from the SCCM to the APIM to control SYNC® functions, or to the ACM to control audio functions.

SYNC® Microphone

The SYNC® microphone receives SYNC® system voice commands and outgoing audio during a phone call. The monitored sounds are converted into analog signals by the microphone and sent to the APIM.

Copyright © 2016 Ford Motor Company

Information and Entertainment System

For a SYNC®-related concern, refer to the SYNC® System Symptom Chart before connecting the scan tool and beginning DTC-based diagnostics.

DTC Chart: ACM

DTC	Description	Action
B1142:27	Ignition Status 1: Signal Rate of Change Above Threshold	GO to Pinpoint Test E
B1A01:01	Speaker #1: General Electrical Failure	• For a LHF door speaker concern, GO to Pinpoint Test F • For a LHF door tweeter speaker concern, GO to Pinpoint Test G
B1A01:11	Speaker #1: Circuit Short To Ground	• For a LHF door speaker concern, GO to Pinpoint Test F • For a LHF door tweeter speaker concern, GO to Pinpoint Test G
B1A01:12	Speaker #1: Circuit Short To Battery	• For a LHF door speaker concern, GO to Pinpoint Test F • For a LHF door tweeter speaker concern, GO to Pinpoint Test G
B1A01:13	Speaker #1: Circuit Open	GO to Pinpoint Test F
B1A02:01	Speaker #2: General Electrical Failure	• For a RHF door speaker concern, GO to Pinpoint Test H • For a RHF door tweeter speaker concern, GO to Pinpoint Test I
B1A02:11	Speaker #2: Circuit Short To Ground	• For a RHF door speaker concern, GO to Pinpoint Test H • For a RHF door tweeter speaker concern, GO to Pinpoint Test I
B1A02:12	Speaker #2: Circuit Short To Battery	• For a RHF door speaker concern, GO to Pinpoint Test H • For a RHF door tweeter speaker concern, GO to Pinpoint Test I
B1A02:13	Speaker #2: Circuit Open	GO to Pinpoint Test H
B1A03:01	Speaker #3: General Electrical Failure	• For a RHR door speaker concern, GO to Pinpoint Test J
B1A03:11	Speaker #3: Circuit Short To Ground	• For a RHR door speaker concern, GO to Pinpoint Test J
B1A03:12	Speaker #3: Circuit Short To Battery	• For a RHR door speaker concern, GO to Pinpoint Test J
B1A03:13	Speaker #3: Circuit Open	GO to Pinpoint Test J
B1A04:01	Speaker #4: General Electrical Failure	• For a LHR door speaker concern, GO to Pinpoint Test K
B1A04:11	Speaker #4: Circuit Short To Ground	• For a LHR door speaker concern, GO to Pinpoint Test K
B1A04:12	Speaker #4: Circuit Short To Battery	• For a LHR door speaker concern, GO to Pinpoint Test K
B1A04:13	Speaker #4: Circuit Open	GO to Pinpoint Test K
B1A56:21	Antenna: Signal Amplitude <	If DTC B1A56:21 sets after running the bezel diagnostic tests, DISREGARD this DTC. This test is used for end of line or repair bay testing at the Ford plant. Each

	Minimum	plant has its own assigned frequency and signal strength requirements. The running and passing of this test depends on local radio stations. If no local station is broadcasting on the required frequency, the test will fail.
B1D19:49	Compact Disc Unit: Internal Electronic Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B1D19:49 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
B1D19:4B	Compact Disc Unit: Over Temperature	The ACM was over temperature. This may occur during extended use. Audio operation can resume after the ACM cools. CLEAR the DTC.
B1D55:11	Antenna #2 Circuit Short To Ground	GO to Pinpoint Test A
B1D55:15	Antenna #2 Circuit Short To Battery Or Open	GO to Pinpoint Test A
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test AA
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AB
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AD
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	GO to Pinpoint Test AH
U0256:00	Lost Communication With Front Controls Interface Module “A”: No Sub Type Information	GO to Pinpoint Test AI
U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	**NOTE:** *Despite the description, this DTC applies to the FDIM, not the FCDIM.* GO to Pinpoint Test AJ
U201A:51	Control Module Main Calibration Data: Not Programmed	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM the ACM PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM the ACM PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM.

		REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM the ACM PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:96	Control Module: Component Internal Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:96 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AK
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AL

DTC Chart: APIM

DTC	Description	Action
B108E:01	Display: General Electrical Failure	GO to Pinpoint Test W
B116A:01	Handset Microphone: General Electrical Failure	GO to Pinpoint Test O
B1215:00	External Memory Card: No Sub Type Information	GO to Pinpoint Test X
B1252:11	USB Port: Circuit Short To Ground	• For an inoperative USB port, GO to Pinpoint Test Q • For an inoperative SD card slot, GO to Pinpoint Test R
B1252:13	USB Port: Circuit Open	• For an inoperative USB port, GO to Pinpoint Test Q • For an inoperative SD card slot, GO to Pinpoint Test R

B12B8:11	USB Port #2: Circuit Short To Ground	**NOTE:** *This DTC refers to USB port #2 on the APIM itself, which is not used.* • INSPECT the APIM USB port #2 for damage and REMOVE any debris. • CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B12B8:11 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
C1001:01	Vision System Camera: General Electrical Failure	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AB
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test AC
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AD
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	GO to Pinpoint Test AE
U0162:00	Lost Communication With Navigation Display Module: No Sub Type Information	GO to Pinpoint Test W
U016A:00	Lost Communication With Global Positioning System Module: No Sub Type Information	GO to Pinpoint Test AF
U0184:00	Lost Communication With Radio: No Sub Type Information	GO to Pinpoint Test AG
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	GO to Pinpoint Test AI
U0423:00	Invalid Data Received From Instrument Panel Cluster Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the IPC. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). • RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the IPC.
U0452:00	Invalid Data Received From Restraints Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). • RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the RCM.
U2017:45	Control Module Software #2: Program Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U2017:45 is retrieved again, INSTALL a new APIM.

		REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2017:51	Control Module Software #2: Not Programmed	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2017:52	Control Module Software #2: Not Activated	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2017:54	Control Module Software #2: Missing Calibration	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

		– If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:04	Control Module: System Internal Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:04 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:88	Control Module: Bus Off	**NOTE:** *The module was unable to communicate on the network at a point in time. The fault is not currently present since the module had to communicate with the diagnostic scan tool to report this DTC.* **To avoid repeat network concerns:** • INSPECT for damaged or corroded wiring at the APIM. • CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the network test with the diagnostic scan tool.
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AK
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AL

DTC Chart: FCIM

DTC	Description	Action
B00D5:01	Restraint System Passenger Disable Indicator: General Electrical Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B00D5:01 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
B1034:11	Left Front Seat Heater Element: Circuit Short To Ground	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1034:12	Left Front Seat Heater Element: Circuit Short To Battery	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1034:13	Left Front Seat Heater Element: Circuit Open	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1036:11	Right Front Seat Heater Element: Circuit Short To Ground	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1036:12	Right Front Seat Heater Element: Circuit Short To Battery	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1036:13	Right Front Seat Heater Element: Circuit Open	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1038:11	Left Front Seat Heater Sensor: Circuit Short To Ground	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B1038:15	Left Front Seat Heater Sensor: Circuit Short To Battery or Open	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B103A:11	Right Front Seat Heater Sensor: Circuit Short To Ground	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B103A:15	Right Front Seat Heater Sensor: Circuit Short To Battery or Open	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
B105A:12	Cabin Temperature Sensor Fan: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B105A:14	Cabin Temperature Sensor Fan: Circuit Short To Ground or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1081:07	Left Temperature Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1081:11	Left Temperature Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1081:12	Left Temperature Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General

		Information, Diagnosis and Testing).
B1081:13	Left Temperature Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1082:07	Right Temperature Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1082:11	Right Temperature Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1082:12	Right Temperature Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1082:13	Right Temperature Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1083:07	Recirculation Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1083:11	Recirculation Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1083:12	Recirculation Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1083:13	Recirculation Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1086:07	Air Distribution Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1086:11	Air Distribution Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1086:12	Air Distribution Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1086:13	Air Distribution Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B10AF:11	Blower Fan Relay: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).

B10AF:12	Blower Fan Relay: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10AF:13	Blower Fan Relay: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B3:11	Right Panel Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B3:15	Right Panel Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B4:11	Right Floor Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B4:15	Right Floor Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B5:11	Left Panel Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B5:15	Left Panel Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B6:11	Left Floor Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B6:15	Left Floor Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B8:63	Push Buttons: Circuit / Component Protection Time-Out	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B10B8:63 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
B10B9:12	Blower Control: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B10B9:14	Blower Control: Circuit	

	Short To Ground or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B113C:11	Hazard Switch Illumination: Circuit Short To Ground	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
B11E5:11	Left HVAC Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11E5:15	Left HVAC Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11E6:11	Right HVAC Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11E6:15	Right HVAC Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11E7:11	Air Distribution Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11E7:15	Air Distribution Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11F0:11	Air Intake Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B11F0:15	Air Intake Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1202:01	Restraint System Passenger Enable Indicator: General Electrical Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B1202:01 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
B1A61:11	Cabin Temperature Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A61:15	Cabin Temperature Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A63:11	Right Solar Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).

		See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A63:15	Right Solar Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A64:11	Left Solar Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A64:15	Left Solar Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A69:11	Humidity Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A69:15	Humidity Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1B71:11	Evaporator Temperature Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1B71:15	Evaporator Temperature Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1C83:12	Rear Defog Relay: Circuit Short To Battery	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1C83:14	Rear Defog Relay: Circuit Short To Ground or Open	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
C1B14:12	Sensor Supply Voltage A: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing).
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AB
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test AC
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AD
U0253:00	Lost Communication With	GO to Pinpoint Test AH

	Accessory Protocol Interface Module: No Sub Type Information	
U0401:00	Invalid Data Received from ECM/PCM A: No Sub Type Information	• REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0401:68	Invalid Data Received from ECM/PCM A: Event Information	• REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0401:81	Invalid Data Received from ECM/PCM A: Invalid Serial Data Received	• REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0401:82	Invalid Data Received from ECM/PCM A: Alive / Sequence Counter Incorrect / Not Updated	• REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0422:68	Invalid Data Received From Body Control Module: Event Information	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
U0422:81	Invalid Data Received	

	From Body Control Module: Invalid Serial Data Received	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
U0452:82	Invalid Data Received From Restraints Control Module: Alive / Sequence Counter Incorrect / Not Updated	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	**NOTE:** *The FCIM has temporarily disabled a HVAC control output because an excessive current draw exists (such as a short to ground). The FCIM cannot enable the output until the cause of the short is corrected.* • ADDRESS all other FCIM Diagnostic Trouble Codes (DTCs) first. • After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U1000:00 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to an incomplete or incorrect FCIM PMI. CHECK the vehicle service history for recent service actions related to the FCIM. – If there have been recent service actions with the FCIM, PERFORM the FCIM PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the FCIM has failed to retain configuration data. INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	• ADDRESS all other FCIM Diagnostic Trouble Codes (DTCs) first. • After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:49 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AK
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AL

DTC Chart: GPSM

DTC	Description	Action
U0100:00	Lost Communication with	GO to Pinpoint Test AA

	ECM/PCM "A": No Sub Type Information	
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AB
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AD
U0401:00	Invalid Data Received from ECM/PCM A: No Sub Type Information	• REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0422:00	Invalid Data Received from Body Control Module: No Sub Type Information	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
U0423:00	Invalid Data Received from Instrument Panel Cluster Control Module: No Sub Type Information	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to an incomplete or incorrect GPSM PMI. CHECK the vehicle service history for recent service actions related to the GPSM. – If there have been recent service actions with the GPSM, PERFORM the GPSM PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the GPSM has failed to retain configuration data. INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• This DTC sets due to an incomplete or incorrect GPSM PMI. CHECK the vehicle service history for recent service actions related to the GPSM. – If there have been recent service actions with the GPSM, PERFORM the GPSM PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the GPSM has failed to retain configuration data. INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U3000:09	Control Module: Component Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:09 is retrieved again, DISCONNECT the battery for 1 minute, then reconnect it.

		• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:09 is retrieved again, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U3000:42	Control Module: General Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AK
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AL

DTC Chart: SCCM

DTC	Description	Action
B1380:09	Steering Wheel Right Switch Pack: Component Failure	• For a RH steering wheel switch concern, GO to Pinpoint Test U
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	• For a RH steering wheel switch concern, GO to Pinpoint Test U
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	• For a RH steering wheel switch concern, GO to Pinpoint Test U
All other Diagnostic Trouble Codes (DTCs)	—	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Symptom Charts

Symptom Chart: General Audio System

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals,	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

	or connectors • Module	
The RH lower steering wheel switches are inoperative or do not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test U
The CD player is inoperative or does not operate correctly	Refer to the Pinpoint Test	INSPECT the CD for scratches, fingerprints, a loose paper label, incorrect format or damage. INSERT a known good CD and TEST the system. If the system operates correctly, the concern was caused by a damaged CD. If the system does not operate correctly, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
The speed compensated volume does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test B
The compass is inoperative or does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test Y
The audio system does not operate correctly from the FCIM	Refer to the Pinpoint Test	GO to Pinpoint Test V
The FCIM illumination is inoperative or does not dim	• Illumination system concern • FCIM	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
The FDIM touchscreen is inoperative or does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test W

Symptom Chart: Navigation

Condition	Possible Sources	Actions
Navigation application is inoperative or unresponsive	Refer to the Pinpoint Test	GO to Pinpoint Test X
Map does not load or show what is expected	Refer to the Pinpoint Test	GO to Pinpoint Test X
Navigation does not track vehicle correctly on map	Refer to the Pinpoint Test	GO to Pinpoint Test X
GPS icon displayed over red X with FDIM navigation tab selected	Refer to the Pinpoint Test	GO to Pinpoint Test X
Voice recognition does not operate correctly to voice navigate to a destination	Refer to the Pinpoint Test	GO to Pinpoint Test Z

Symptom Chart: Sound Quality

Condition	Possible Sources	Actions

Poor reception - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
Continuous seek or scan - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
A loud popping sound is heard when cycling the ignition	Refer to the Pinpoint Test	GO to Pinpoint Test C
Poor sound quality or distorted sound from one or more speakers (not all speakers)	Refer to the Pinpoint Test	GO to Pinpoint Test D
No sound from all speakers	Refer to the Pinpoint Test	GO to Pinpoint Test E
The LHF door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test F
The LHF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test G
The RHF door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test H
The RHF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test I
The RHR door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test J
The LHR door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test K

Symptom Chart: SYNC® System

Condition	Possible Sources	Actions
All SYNC® Services features are inoperative or inaccurate (traffic, directions, and information)	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test L
All APIM stereo outputs are inoperative or do not operate correctly REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation). See APIM for a list of stereo outputs.	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test M
All APIM mono outputs are inoperative or do not operate correctly REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation). See APIM for a list of mono outputs.	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test N
Voice recognition is inoperative or does not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC

		Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test O
During a phone call, no outgoing audio is heard on the outside device	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test O
The SYNC® steering wheel switches are inoperative or do not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test U
All media hub functions are inoperative or do not operate correctly (USB ports, SD card, and RCA jacks)	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test P
The USB port(s) is/are inoperative or does/do not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test Q
The SD card slot is inoperative or does not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test R
The RCA jacks are inoperative or do not operate correctly	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General

		Procedures). If the concern is still present, GO to Pinpoint Test S
Unable to pair Bluetooth device	Refer to the Pinpoint Test	PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). If the concern is still present, GO to Pinpoint Test T
An individual Bluetooth device feature is inoperative (text messaging, media playback or controls, phone book download, call history, or call waiting)	Customer's device compatibility	• PERFORM the APIM Reset. REFER to: Reset the SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, General Procedures). • INSTRUCT the customer to review the device compatibility list. REFER to www.syncmyride.com. It is normal operation for unsupported or incompatible Bluetooth features to be unavailable through the SYNC® system. • If the inoperative feature is compatible, ADVISE the customer to check their device for firmware updates, and if required, reset their device following the manufacturer's instructions.
Emergency Assistance is inoperative or does not operate correctly	• Unregistered owner account • RCM misconfiguration • IPC misconfiguration	• Verify the customer has an account. • This error message appears due to incomplete or incorrect PMI procedures. CHECK the vehicle service history for recent service actions related to the IPC or RCM. – If there have been recent service actions with the IPC or RCM, PERFORM the PMI procedure as directed by the diagnostic scan tool. – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new

		APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

Pinpoint Tests

Poor Reception Or Continuous Seek Or Scan - AM/ FM

Refer to Wiring Diagrams Cell 131 for schematic and connector information.

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D55:11	Antenna #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the FM2 antenna coaxial cable for more than 1 second.
B1D55:15	Antenna #2: Circuit Short To Battery or Open	Set by the ACM when a short to voltage or open is detected on the FM2 antenna coaxial cable for more than 1 second.

Possible Sources

- No channel found in the selected RDS category
- Charging system
- Wiring, terminals, or connectors
- Ignition system
- FM2 antenna
- AM/ FM1 antenna coaxial cable
- FM2 antenna coaxial cable
- AM/ FM1 antenna
- Mounting surface corrosion
- FM2 diversity antenna amplifier
- ACM

PINPOINT TEST A : POOR RECEPTION OR CONTINUOUS SEEK OR SCAN - AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION)

A1 CHECK THE AUDIO SYSTEM RECEPTION WITH THE ENGINE RUNNING
• Operate the audio system in AM/ FM mode. • Check the reception with the engine running, and with the engine off.

Is poor reception only present with the engine running?

Yes	GO to A2
No	GO to A4

A2 CHECK THE GENERATOR

- Ignition OFF.
- **NOTICE: Do not allow the generator B+ cable terminal to make contact with a conductive surface. Failure to follow this instruction may result in personal injury or damage to the vehicle.**
- Disconnect Generator B+ Cable C102C.
- Start the engine.
- Operate the audio system in AM/ FM mode.

Is the reception OK?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation). REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel (414-02 Generator and Regulator, Removal and Installation).
No	GO to A3

A3 CHECK THE IGNITION CIRCUITS

- Ignition OFF.
- Connect Generator B+ Cable C102C.
- Inspect all the wiring harnesses and connectors for damaged insulation and loose or broken conditions.

Are the ignition components OK?

Yes	USE a jumper cable to temporarily ground various parts of the vehicle (examples include: engine, fenders, quarter panels, body sheet metal) to the frame. When the noise is eliminated, PROVIDE a permanent ground where necessary.
No	REPAIR or REPLACE the harness or components as necessary.

A4 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR CORRECT VOLTAGE

- Ignition OFF.
- Disconnect Antenna C9021.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9021-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to A7
No	GO to A5

A5 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect ACM C240A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9021-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A6
No	REPAIR the circuit.

A6 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA ENABLE CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9021-2	Ω	C240A-2

Is the resistance less than 3 ohms?

Yes	GO to A22
No	REPAIR the circuit.

A7 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: AM/ FM1 antenna coaxial cable at the ACM.
  REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Disconnect: FM2 antenna coaxial cable at the ACM.
  REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Disconnect: AM/ FM1 antenna coaxial cable at the antenna.
  REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Disconnect: FM2 antenna inline coaxial cable at the antenna.
  REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC) .
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM		Ground
AM/ FM1 antenna coaxial cable shield at the ACM		Ground
FM2 antenna coaxial cable core at the ACM		Ground
FM2 antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	GO to A8

A8 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground
FM2 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A9
No	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .

A9 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna connection
AM/ FM1 antenna coaxial cable shield at the ACM	Ω	AM/ FM1 antenna connection
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna connection
FM2antenna coaxial cable shield at the ACM	Ω	FM2 antenna connection

Are the resistances less than 1 ohm?

Yes	GO to A10
No	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable.

	REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .

A10 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 AND FM (FREQUENCY MODULATION) 2 ANTENNA COAXIAL CABLE CORES AND SHIELDS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna coaxial cable shield at the ACM
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A11
No	REPAIR, or INSTALL a new AM/ FM1 or FM2 antenna coaxial cable. REFER to: Audio Unit Antenna Cable (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .

A11 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: AM/ FM1 antenna coaxial cable at the antenna unit.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM		Ground
AM/ FM1 antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00G) .
No	GO to A12

A12 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground

AM/ FM1 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A13
No	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00G) .

A13 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable core at the ACM	Ω	AM/ FM1 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A14
No	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00G) .

A14 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A16
No	GO to A15

A15 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) 1 ANTENNA UNIT SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the AM/ FM1 antenna unit.
  REFER to: Audio Unit Antenna (415-00G) .
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM1 antenna unit shield at the antenna unit (component side)	Ω	AM/ FM1 antenna base (unpainted surface)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on the antenna unit base and/or vehicle mounting surface. REINSTALL the antenna and ensure the proper torque value is achieved. REFER to: Audio Unit Antenna (415-00G) .
No	INSTALL a new AM/ FM1 antenna. REFER to: Audio Unit Antenna (415-00G) .

A16 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: FM2 antenna coaxial cable at the FM2 Diversity Antenna Amplifier.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	V	Ground
FM2 antenna coaxial cable shield at the ACM	V	Ground

Is any voltage present?

Yes	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	GO to A17

A17 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A18
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).

A18 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable core at the ACM	Ω	FM2 antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A19
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).

A19 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A21
No	GO to A20

A20 CHECK THE FM (FREQUENCY MODULATION) 2 DIVERSITY ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the FM2 diversity antenna amplifier.
  REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
FM2 antenna shield at the FM2 diversity antenna amplifier (component side)	Ω	FM2 diversity antenna amplifier base (unpainted surface on the mounting tab)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on theFM2 diversity antenna amplifier base and/or vehicle mounting surface. REINSTALL the FM2 diversity antenna amplifier and ensure the proper torque value is achieved. REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	INSTALL a new FM2 diversity antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System -

	General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).

A21 CHECK THE FM (FREQUENCY MODULATION) 2 ANTENNA COMPONENTS

- Disconnect and inspect the FM2 diversity antenna amplifier connector for the FM2 antenna circuits. REFER to: Audio Unit Antenna Amplifier (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
- Inspect the FM2 antenna circuits and connectors.

Is any damage present on the FM2 antenna circuits or connections?

Yes	REPAIR or REPLACE as necessary.
No	GO to A22

A22 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Speed Compensated Volume Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Sources

- Speed compensated volume setting
- ACM

PINPOINT TEST B : THE SPEED COMPENSATED VOLUME DOES NOT OPERATE CORRECTLY

B1 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and observe the speedometer.

Does the speedometer operate correctly?

Yes	GO to B2
No	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

B2 CHECK THE SPEED COMPENSATED VOLUME SETTING

- Turn the speed compensated volume off. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- Set the speed compensated volume to maximum compensation. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.

Does the volume remain constant with the speed compensated volume turned off, and increase and decrease with vehicle speed with the speed compensated volume set to maximum?

Yes	The system is operating correctly at this time. INSTRUCT the customer in the correct usage of the speed compensated volume feature.
No	GO to B3

B3 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 retrieved in any audio system module?

Yes	GO to Pinpoint Test AD
No	GO to B4

B4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Loud Popping Sound Is Heard When Cycling The Ignition

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

The ACM receives voltage on a start signal circuit when the ignition is in the START position and mutes the audio signal output. This prevents voltage spikes from producing popping noises through the speakers. An open on this circuit between splice CS157 and the ACM could cause voltage spikes to produce popping noises through the speakers.

Possible Sources

- Wiring, terminals, or connectors
- ACM

PINPOINT TEST C : A LOUD POPPING SOUND IS HEARD WHEN CYCLING THE IGNITION

C1 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR DTC (DIAGNOSTIC TROUBLE CODE) P0615, P0616 OR P0617

- Using a diagnostic scan tool, perform the PCM self-test.

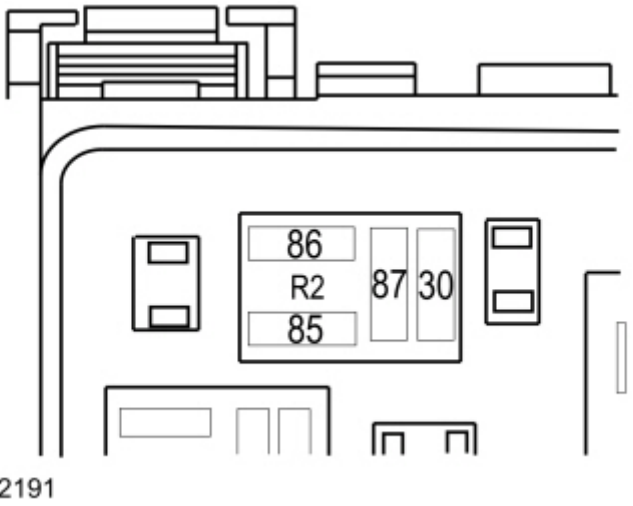
Is DTC P0615, P0616 or P0617 set?

Yes	REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing). REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
No	GO to C2

C2 CHECK THE START SENSE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect ACM C4821A.
- Disconnect BJB Starter Relay C1035D.
- Disconnect PCM C1232C 2.2L Engine .
- Disconnect PCM C175B 2.5L Engine .
- Disconnect PCM C1232C 3.2L Engine .
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	



BJB Starter Relay Socket 86

2.2L Duratorq

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	C1035D-13
C4821A-3	Ω	C1232C-37

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	C1035D-13
C4821A-3	Ω	C175A-37

3.2L Duratorq

Positive Lead	Measurement / Action	Negative Lead
C4821A-3	Ω	C1035D-13
C4821A-3	Ω	C1232C-37

Are the resistances less than 3 ohms?

Yes	GO to C3
No	REPAIR the circuit.

C3 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:

- Corrosion (clean module pins or install new connectors or terminals)
- Damaged or bent pins (install new terminals or pins)
- Pushed-out pins (install new pins as necessary)

- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Poor Sound Quality Or Distorted Sound From One Or More Speakers (Not All Speakers)

Normal Operation and Fault Conditions

The ACM sends audio signals to the speakers in the form of AC voltage, resulting in clear audio output.

Possible Sources

- Loose component fasteners
- Loose door handle, lock, and other trim panel components and fasteners
- Loose items in storage areas
- Loose speaker grilles
- Loose wire harnesses or wire harness fasteners
- Speaker(s)
- Water shield bonding and placement

Visual Inspection and Diagnostic Pre-checks

Visually inspect around the suspect area for any possible rattle conditions such as:

- Any storage compartments including cup holders (if equipped)
- Door map pockets for contents that can rattle (if equipped)
- Door pull cup attachments (if equipped)
- Door switch bezels (if equipped)
- Package tray (if equipped)
- Speaker grilles
- Trim panels and fasteners

PINPOINT TEST D : POOR SOUND QUALITY OR DISTORTED SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

D1 ISOLATE THE ZONE

- Operate the audio system using digital media such as a CD or MP3.
- Using the audio system fade and balance feature, adjust the audio sound to each of the four zones (LHF, RHF, LHR, and RHR) of the vehicle to isolate the poor sound quality.
- Locate and apply pressure to the trim panel(s) around the poor sound quality area in question.

Does applying pressure to a trim panel reduce or eliminate the audible noise?

Yes	REPAIR or REPLACE the trim panel as needed.
No	GO to D2

D2 REMOVE AND INSPECT BEHIND/UNDERNEATH THE SUSPECT TRIM PANEL(S)

- Remove the trim panel to access the suspect speaker.

- Operate the audio system using digital media such as a CD or MP3.
- Validate where the poor sound quality area is located.
- Check:
  - Trim panel for loose components (e.g. speaker grille) around the speaker area.
  - Trim panel joining components for missing or broken pieces.
  - Lock and handle mechanical parts for correct attachment.
  - Wire harnesses for correct routing.
  - Wire harness fasteners for correct attachment.
  - Water shield for correct placement (speaker air path not blocked).
  - Water shield for correct bonding to sheet metal.
  - Storage areas for loose items.
  - All child safety belt anchors (if equipped).
  - All safety belt retractors.
  - All speaker bracket fasteners and other fasteners are secured and tightened to specified torque.

Was the source of the noise located?

Yes	REPAIR or REPLACE any loose or broken component or fastener as needed.
No	GO to D3

D3 CHECK THE SUSPECT SPEAKER FOR WATER INTRUSION

- Inspect for watermarks.
- Check the:
  - Cone
  - Magnet
  - Basket

Are any watermarks present on the speaker?

Yes	VERIFY the water shield is in the correct location, REPAIR or REPLACE any trim, door, or speaker seal as required. DRY the speaker in question and TEST the system for normal operation.
No	GO to D4

D4 ISOLATE SPEAKER TO VERIFY NOISE

- Remove the suspect speaker from its location and leave the speaker connected to the harness.
- Hold the speaker away from any trim panel(s) and ensure the speaker is isolated from contact.
- Operate the audio system using digital media such as a CD or MP3.

Is the noise still present in the suspect speaker?

Yes	INSTALL a new speaker for the one in question.
No	LOCATE the source of the noise and REPAIR as needed.

No Sound From All Speakers

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen

Display/Navigation System, Description and Operation).

To prevent voltage spikes from producing popping noises through the speakers when the ignition is in the START position, the BCM provides an ignition status CAN message and also applies voltage on the ACM start signal circuit. When the CAN message and/or voltage is received by the ACM, the audio signal output is muted. A short to voltage on this circuit causes the ACM output to be muted continuously, and will cause the warning chimes to only sound from the IPC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1142:27	Ignition Status 1: Signal Rate of Change Above Threshold	Set by the ACM when a short to voltage is detected on the start signal circuit.

Possible Sources

- Wiring, terminals, or connectors
- Fuse
- ACM

PINPOINT TEST E : NO SOUND FROM ALL SPEAKERS

E1 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM pass the network test?

Yes	GO to E2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) P0615, P0616 OR P0617

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0615, P0616 or P0617 set?

Yes	REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing). REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing).
No	GO to E3

E3 CHECK THE START SENSE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Disconnect BJB Starter Relay.
- Disconnect PCM C1232A 2.2L Engine .

- Disconnect PCM C175B 2.5L Engine .
- Disconnect PCM C1232A 3.2L Engine .
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821A-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E4

E4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:01	Speaker #1: General Electrical Failure	Set by the ACM when a failure is detected on the LHF door or LHF door tweeter speaker circuits.

B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:12	Speaker #1: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:12 is set, the speaker output is disabled.
B1A01:13	Speaker #1: Circuit Open	Set by the ACM when an open is detected on the LHF door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST F : THE LHF (LEFT-HAND FRONT) DOOR SPEAKER IS INOPERATIVE

F1 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C6003RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	V~	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	V~	C6003-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to F2

F2 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	V	Ground
C5003-4	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	V	Ground
C6003-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to F3

F3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C5002LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C6002RHD Vehicles .
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	Ground
C5003-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	Ground
C6003-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to F4
No	REPAIR the circuit in question.

F4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C4821A-10
C5003-4	Ω	C4821A-22

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C4821A-10
C6003-4	Ω	C4821A-22

Are the resistances less than 3 ohms?

Yes	GO to F5
No	REPAIR the circuit in question.

F5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C6003-4

Is the resistance greater than 10,000 ohms?

Yes	GO to F6
No	REPAIR the circuit in question.

F6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:

- Corrosion (clean module pins or install new connectors or terminals)
- Damaged or bent pins (install new terminals or pins)
- Pushed-out pins (install new pins as necessary)

- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:01	Speaker #1: General Electrical Failure	Set by the ACM when a failure is detected on the LHF door or LHF door tweeter speaker circuits.
B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:12	Speaker #1: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST G : THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

G1 CHECK THE LHF (LEFT-HAND FRONT) DOOR SPEAKER
• Ignition OFF. • Operate the audio system in AM/ FM mode. **Does the LHF door speaker operate correctly?**

Yes	GO to G2

No	GO to Pinpoint Test F

G2 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C5002LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C6002RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	V~	C5002-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	V~	C6002-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to G3

G3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C5002LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C6002RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	+ V-	Ground
C5002-3	+ V-	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1		Ground
C6002-3		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to G4

G4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	Ω	Ground
C5002-3	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	Ω	Ground
C6002-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to G5
No	REPAIR the circuit in question.

G5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5002-1	Ω	C5003-2
C5002-3	Ω	C5003-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6002-1	Ω	C6003-2
C6002-3	Ω	C6003-3

Are the resistances less than 3 ohms?

Yes	GO to G6
No	REPAIR the circuit in question.

G6 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-2	Ω	C5003-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-2	Ω	C6003-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHF Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The RHF door speaker and RHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:01	Speaker #2: General Electrical Failure	Set by the ACM when a failure is detected on the RHF door or RHF door tweeter speaker circuits.
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:12	Speaker #2: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:12 is set, the speaker output is disabled.
B1A02:13	Speaker #2: Circuit Open	Set by the ACM when an open is detected on the RHF door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST H : THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER IS INOPERATIVE

H1 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles .
- Disconnect RHF Door Speaker C5015RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	V~	C6015-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	V~	C5015-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to H2

H2 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.

- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	V	Ground
C6015-4	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	V	Ground
C5015-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to H3

H3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles.
- Disconnect RHF Door Tweeter Speaker C5012RHD Vehicles.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	Ground
C6015-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	Ground
C5015-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to H4
No	REPAIR the circuit in question.

H4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C4821A-11
C6015-4	Ω	C4821A-23

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C4821A-11
C5015-4	Ω	C4821A-23

Are the resistances less than 3 ohms?

Yes	GO to H5
No	REPAIR the circuit in question.

H5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C6015-4

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C5015-4

Is the resistance greater than 10,000 ohms?

Yes	GO to H6
No	REPAIR the circuit in question.

H6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect all the ACM and related in-line connectors.
• Repair:
  • Corrosion (clean module pins or install new connectors or terminals)
  • Damaged or bent pins (install new terminals or pins)
  • Pushed-out pins (install new pins as necessary)
• Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The RHF door speaker and RHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:01	Speaker #2: General Electrical Failure	Set by the ACM when a failure is detected on the RHF door or RHF door tweeter speaker circuits.
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:12	Speaker #2: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST I : THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

I1 CHECK THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER
• Ignition OFF.

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the RHF door speaker operate correctly?

Yes	GO to I2
No	GO to Pinpoint Test H

I2 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles.
- Disconnect RHF Door Tweeter Speaker C5012RHD Vehicles.
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	V~	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	V~	C5012-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to I3

I3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles.
- Disconnect RHF Door Speaker C5015RHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	+ V~ −	Ground
C6012-3	+ V~ −	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1		Ground
C5012-3		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to I4

I4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	Ground
C6012-3	Ω	Ground

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	Ground
C5012-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to I5
No	REPAIR the circuit in question.

I5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6015-3
C6012-3	Ω	C6015-2

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5015-3
C5012-3	Ω	C5015-2

Are the resistances less than 3 ohms?

Yes	GO to I6
No	REPAIR the circuit in question.

I6 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5012-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The RHR door tweeter speaker and the RHR door speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A03:01	Speaker #3: General Electrical Failure	Set by the ACM when a failure is detected on the RHR door or RHR door tweeter speaker circuits.
B1A03:11	Speaker #3: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHR door or RHR door tweeter speaker circuits. When DTC B1A03:11 is set, the speaker output is disabled.
B1A03:12	Speaker #3: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHR door or RHR door tweeter speaker circuits. When DTC B1A03:12 is set, the speaker output is disabled.
B1A03:13	Speaker #3: Circuit Open	Set by the ACM when an open is detected on the RHR door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST J : THE RHR (RIGHT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

J1 CHECK THE AUDIO SIGNAL TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Disconnect RHR Door Speaker C802.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	V~	C802-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHR door speaker. REFER to: Rear Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to J2

J2 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	+ V~ −	Ground
C802-4	+ V~ −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to J3

J3 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect RHR Door Tweeter Speaker C830.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	Ground
C802-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J4
No	REPAIR the circuit in question.

J4 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C4821A-12
C802-4	Ω	C4821A-24

Are the resistances less than 3 ohms?

Yes	GO to J5
No	REPAIR the circuit in question.

J5 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C802-4

Is the resistance greater than 10,000 ohms?

Yes	GO to J6
No	REPAIR the circuit in question.

J6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A04:01	Speaker #4: General Electrical Failure	Set by the ACM when a failure is detected on the LHR door or LHR door tweeter speaker circuits.
B1A04:11	Speaker #4: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHR door or LHR door tweeter speaker circuits. When DTC B1A04:11 is set, the speaker output is disabled.
B1A04:12	Speaker #4: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHR door or LHR door tweeter speaker circuits. When DTC B1A04:12 is set, the speaker output is disabled.
B1A04:13	Speaker #4: Circuit Open	Set by the ACM when an open is detected on the LHR door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST K : THE LHR (LEFT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

K1 CHECK THE AUDIO SIGNAL TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHR Door Speaker C702.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	$\tilde{V}$	C702-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHR door speaker. REFER to: Rear Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to K2

K2 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	+ $\bar{V}$ −	Ground
C702-4	+ $\bar{V}$ −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to K3

K3 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect LHR Door Tweeter Speaker C730.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	Ground
C702-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to K4
No	REPAIR the circuit in question.

K4 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C4821A-9
C702-4	Ω	C4821A-21

Are the resistances less than 3 ohms?

Yes	GO to K5
No	REPAIR the circuit in question.

K5 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C702-4

Is the resistance greater than 10,000 ohms?

Yes	GO to K6
No	REPAIR the circuit in question.

K6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment

	System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All SYNC® Services Features Are Inoperative Or Inaccurate (Traffic, Directions, And Information)

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Sources

- Unregistered Owner Account
- Unregistered, inactive, or expired subscription
- Unregistered mobile phone number
- Mobile phone being used not selected as "Active"
- Inadequate phone reception
- Obstructions in the GPS antenna's line of sight
- APIM
- GPSM

PINPOINT TEST L : ALL SYNC® SERVICES FEATURES ARE INOPERATIVE OR INACCURATE (TRAFFIC, DIRECTIONS, AND INFORMATION)

L1 VERIFY THE CUSTOMER'S PHONE CONNECTION TO SYNC® SERVICES WHILE AWAY FROM THE VEHICLE

NOTE: *Caller ID blocking must be disabled on the customer's mobile phone so the SYNC® Services server can recognize the registered and "Active" phone number.*

- Advise the customer to call SYNC® Services from their mobile phone.
- Verify the phone call is placed and that the phone connects to SYNC® Services.
- Observe whether the SYNC® Services subscription commercial plays, or if the system asks which service is wanted.

Does the SYNC® Services subscription commercial play?

Yes	GO to L2
No	GO to L4

L2 VERIFY THE CUSTOMER'S SYNC® OWNER ACCOUNT AND SYNC® SERVICES REGISTRATION AND SUBSCRIPTION

- Verify the customer has a SYNC® Owner Account on www.syncmyride.com.
- Verify the customer has registered for SYNC® Services and has an active subscription.

Does the customer have a SYNC® Owner Account and an active SYNC® Services subscription?

Yes	GO to L3
No	• If the customer does not have a SYNC® Owner Account, INFORM the customer that an account must be created in order to sign up for SYNC® Services. REFER to www.syncmyride.com. • If the customer does not have an active SYNC® Services subscription, INFORM the customer that in order for SYNC® Services to function, the subscription needs to be activated. REFER to www.syncmyride.com.

L3 VERIFY THE CUSTOMER'S REGISTERED PHONE NUMBER AND STATUS

NOTE: *Only one mobile phone number can be selected as "Active" at a time, and only the "Active" mobile phone number has access to SYNC® Services.*

- Verify the mobile phone being used has the correct mobile phone number registered with the SYNC® Owner Account on www.syncmyride.com.
- Verify the mobile phone being used is selected as "Active" on www.syncmyride.com.

Is the customer using the registered and active mobile phone associated with the SYNC® Services account?

Yes	GO to L5
No	INFORM the customer that the correct mobile phone number must be registered on the SYNC® website and selected as "Active." REFER to www.syncmyride.com.

L4 VERIFY THE CUSTOMER'S PHONE CONNECTION TO SYNC® SERVICES FROM INSIDE THE VEHICLE

- Ensure the registered and "Active" mobile phone is paired with the SYNC® system. For information on the pairing process, refer to the Owner's Literature. If necessary, review the device compatibility list found on support.ford.com/sync-technology/device-compatibility-sync.
- Ensure the customer's mobile phone has adequate reception.
- Ensure the vehicle is in an open location that is free from obstacles such as tall buildings or large trees.
- Start the vehicle.
- Connect to SYNC® Services from the vehicle controls.
- Verify the phone call is placed and that the phone is connected to SYNC® Services.
- When prompted, select "Directions," and follow the audible prompts to get directions to an address or Saved Point.

Did SYNC® Services indicate that the vehicle location was being obtained, the route was being sent, and that the route download from the server to the vehicle was complete?

Yes	SYNC® Services is operating correctly at this time.
No	• If SYNC® Services indicated the vehicle location was **not** able to be obtained, GO to L5 • If SYNC® Services indicated the vehicle location was being obtained, but did not indicate that the route was being sent, there is a potential SYNC® Services server issue. The problem does not reside in the vehicle's audio system. • If SYNC® Services indicated the vehicle location was being obtained, the route was being sent, but did not indicate that the route download from the server to the vehicle was complete, GO to L8 • If SYNC® Services did **not** indicate the vehicle location was being obtained, the route was being sent, and that the route download from the server to the vehicle was complete, there is a potential SYNC® Services server issue. The problem does not reside in the vehicle's audio system.

L5 CHECK FOR APIM (SYNC MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform the APIM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded in the APIM?

Yes	REFER to the DTC Chart: APIM.
No	GO to L6

L6 CHECK FOR GPSM (GLOBAL POSITIONING SYSTEM MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the GPSM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded in the GPSM?

Yes	REFER to the DTC Chart: GPSM.
No	GO to L7

L7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern. If the concern is still present, GO to L8
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

L8 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- **NOTE:** *Before operating the system to determine if the concern is still present, ensure that the vehicle is in an open location that is free from obstacles such as tall buildings or large trees so an adequate GPS signal can be obtained.*

  Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All APIM Stereo Outputs Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen

Display/Navigation System, Description and Operation).

Possible Sources

- Customer's device
- Wiring, terminals, or connectors
- APIM
- ACM

PINPOINT TEST M : ALL APIM (SYNC MODULE) STEREO OUTPUTS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

M1 VERIFY THE OPERATION OF THE SYNC® SYSTEM AUDIO SOURCES

- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373 and RCA adapter, test the audio output for the SYNC® audio sources (Bluetooth, USB ports, and RCA jacks).

Is there poor quality, distorted, or no sound from all SYNC® audio sources?

Yes	GO to M2
No	• If there is a concern with one or more, but not all SYNC® audio sources, REFER to Symptom Chart: SYNC® System. • If all SYNC® audio sources operate correctly with the Multi-Media Interface Tester 420-373 and RCA adapter, the concern is with the customer's device.

M2 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE)

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Play an audio file through the audio system using a SYNC® audio source (Bluetooth, USB ports, RCA jacks).
- While back-probing ACM C4821B, measure the AC voltage.

Positive Lead	Measurement / Action	Negative Lead
C4821B-12		C4821B-25
C4821B-13		C4821B-26

Is a fluctuating AC voltage present?

Yes	GO to M8
No	GO to M3

M3 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821B.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	V	Ground
C4821B-13	V	Ground
C4821B-25	V	Ground
C4821B-26	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to M4

M4 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	Ground
C4821B-13	Ω	Ground
C4821B-25	Ω	Ground
C4821B-26	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to M5
No	REPAIR the circuit in question.

M5 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	C3342-23
C4821B-13	Ω	C3342-25
C4821B-25	Ω	C3342-24
C4821B-26	Ω	C3342-26

Are the resistances less than 3 ohms?

Yes	GO to M6
No	REPAIR the circuit in question.

M6 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	C4821B-13
C4821B-12	Ω	C4821B-25
C4821B-12	Ω	C4821B-26
C4821B-13	Ω	C4821B-25
C4821B-13	Ω	C4821B-26
C4821B-25	Ω	C4821B-26

Are the resistances greater than 10,000 ohms?

Yes	GO to M7
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

M7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M8 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All APIM Mono Outputs Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Sources

- Customer's setting
- Wiring, terminals, or connectors
- APIM
- ACM

PINPOINT TEST N : ALL APIM (SYNC MODULE) MONO OUTPUTS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

N1 CHECK THE AUDIBLE PROMPT FUNCTIONALITY

- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.

Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has been entered?

Yes	The system is operating correctly at this time. INSTRUCT the customer in the correct operation of the audible prompt feature. REFER to "SYNC® Voice Recognition Feature" in the Owner's Literature.
No	GO to N2

N2 CHECK THE OPERATION OF THE RH (RIGHT-HAND) LOWER STEERING WHEEL SWITCHES

- Operate the audio system in AM/ FM mode.
- Operate the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches.

Do the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches operate correctly?

Yes	GO to N3
No	GO to Pinpoint Test U

N3 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE)

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Operate the audio system in AM/ FM mode.
- While back-probing ACM C4821B, measure the AC voltage while repeatedly operating the VOICE steering wheel switch.

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	$\tilde{V}$	C4821B-21

Is a fluctuating AC voltage present each time the VOICE steering wheel switch is operated?

Yes	GO to N9
No	GO to N4

N4 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821B.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	+ $\bar{V}$ −	Ground
C4821B-21	+ $\bar{V}$ −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to N5

N5 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	Ω	Ground
C4821B-21	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N6

No	REPAIR the circuit in question.

N6 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	Ω	C3342-3
C4821B-21	Ω	C3342-4

Are the resistances less than 3 ohms?

Yes	GO to N7
No	REPAIR the circuit in question.

N7 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	V~	C4821B-21

Is the resistance greater than 10,000 ohms?

Yes	GO to N8
No	REPAIR the circuit in question.

N8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N9 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect all the ACM and related in-line connectors.
• Repair:
  • Corrosion (clean module pins or install new connectors or terminals)
  • Damaged or bent pins (install new terminals or pins)
  • Pushed-out pins (install new pins as necessary)
• Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Voice Recognition Is Inoperative Or Does Not Operate Correctly, Or During A Phone Call, Poor Quality Or No Outgoing Audio Is Heard On The Outside Device

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B116A:01	Handset Microphone: General Electrical Failure	Set by the APIM when a short to voltage, short to ground, or open is detected on the microphone circuits.

Possible Sources

- Wiring, terminals, or connectors
- Microphone
- APIM

PINPOINT TEST O : VOICE RECOGNITION IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY, OR DURING A PHONE CALL, POOR QUALITY OR NO OUTGOING AUDIO IS HEARD ON THE OUTSIDE DEVICE

O1 CHECK THE AUDIBLE PROMPT FUNCTIONALITY
• Operate the audio system in AM/ FM mode. • Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt. **Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has**

been entered?

Yes	GO to O3
No	GO to O2

O2 CHECK THE OPERATION OF THE LOWER STEERING WHEEL SWITCHES

- Operate the audio system in AM/ FM mode.
- Operate the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches.

Do the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches operate correctly?

Yes	GO to Pinpoint Test N
No	GO to Pinpoint Test U

O3 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12	V	Ground
C3342-13	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to O4

O4 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Microphone C9221.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12	Ω	Ground
C3342-13	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O5
No	REPAIR the circuit in question.

O5 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12	Ω	C9221-2
C3342-13	Ω	C9221-3

Are the resistances less than 3 ohms?

Yes	GO to O6
No	REPAIR the circuit in question.

O6 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-12	Ω	C2383-13

Is the resistance greater than 10,000 ohms?

Yes	GO to O7
No	REPAIR the circuit in question.

O7 ISOLATE THE MICROPHONE

- Connect APIM C2383.
- Install a new microphone.
  REFER to: Microphone (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.
- Speak a command to test the voice recognition for normal operation.

Is the voice recognition functioning correctly?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative microphone.
No	GO to O8

O8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)

- Reconnect the APIM and related in-line connectors. Make sure they seat and latch correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All Media Hub Functions Are Inoperative Or Do Not Operate Correctly (USB Ports, SD Card, And RCA Jacks)

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The media hub requires a power and ground circuit from the APIM to operate. Loss of power or ground disables all media hub functionality.

Possible Sources

- Customer's device
- Media hub
- Wiring, terminals, or connectors
- APIM

PINPOINT TEST P : ALL MEDIA HUB FUNCTIONS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY (USB (UNIVERSAL SERIAL BUS) PORTS, SD (SECURE DIGITAL) CARD, AND RCA JACKS)

P1 CHECK FOR APIM (SYNC MODULE) BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the APIM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to P2

P2 RESET THE APIM (SYNC MODULE)

- Remove any devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Test the system for normal operation.

Does the system operate correctly?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with

	the customer's device.
No	GO to P3

P3 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT

- Ignition OFF.
- Disconnect Media Hub C2809.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to P4
No	GO to P5

P4 CHECK THE MEDIA HUB GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1		C2809-10

Is the voltage greater than 11 volts?

Yes	INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	GO to P5

P5 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT AND GROUND CIRCUIT FOR A SHORT TOGETHER

- Ignition OFF.
- Disconnect APIM C3342.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1	Ω	C2809-10

Is the resistance greater than 10,000 ohms?

Yes	GO to P6
No	Repair the circuit in question.

P6 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT AND GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1	Ω	C3342-8
C2809-10	Ω	C3342-38

Are the resistances less than 3 ohms?

Yes	GO to P7
No	Repair the circuit in question.

P7 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to P8
No	REPAIR the circuit.

P8 CHECK THE MEDIA HUB GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-10	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to P9

P9 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The USB Port(s) Is/Are Inoperative Or Does/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The Multi-Media Interface Tester 420-373 is powered by the USB port.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1252:11	USB Port: Circuit Short to Ground	Set by the APIM when a short to ground or over-current condition is detected on the USB cable. This can be caused by a fault on the USB cable, USB port, or by the customer's USB or SD card device.
B1252:13	USB Port: Circuit Open	Set by the APIM when an open is detected on the USB cable.

Possible Sources

- Media hub
- Customer's device
- USB cable
- USB cable connection
- APIM

PINPOINT TEST Q : THE USB (UNIVERSAL SERIAL BUS) PORT(S) IS/ARE INOPERATIVE OR DOES/DO NOT OPERATE CORRECTLY

Q1 CHECK THE USB (UNIVERSAL SERIAL BUS) PORTS FOR POWER

- Connect: Multi-Media Interface Tester 420-373.

Does the Multi-Media Interface Tester 420-373 power on from both USB ports?

Yes	GO to Q2
No	• If the Multi-Media Interface Tester 420-373 powers on from one USB port, INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .

	• If the Multi-Media Interface Tester 420-373 does not power on from both USB ports, GO to Pinpoint Test P

Q2 RESET THE APIM (SYNC MODULE)

- Remove all devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	• If the audio output is not working properly from one USB port, INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . • If the audio output is not working properly from both USB ports, GO to Q3

Q3 VERIFY THE OPERATION OF THE USB (UNIVERSAL SERIAL BUS) CABLE

- Insert a known good non-navigation SD card containing music files.
- Operate the audio system in SD card mode and attempt to play an audio file.

Is the audio output working properly for the SD card slot?

Yes	INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	GO to Q4

Q4 CHECK THE APIM (SYNC MODULE) FOR DTC (DIAGNOSTIC TROUBLE CODE) B1252:11 OR B1252:13

- Using a diagnostic scan tool, clear the APIM Diagnostic Trouble Codes (DTCs).
- Perform the APIM self-test.

Is DTC B1252:11 or B1252:13 present?

Yes	GO to Q5
No	GO to Q7

Q5 INSPECT THE USB (UNIVERSAL SERIAL BUS) CABLE, MEDIA HUB, AND APIM (SYNC MODULE)

- Ignition OFF.
- Disconnect: USB cable at the media hub.
- Disconnect: USB cable at the APIM.
- Inspect the USB cable, USB cable ends, media hub USB connector port, and APIM USB connector port for damage. Remove any debris.

Is any damage present?

Yes	• For the USB cable, INSTALL a new USB cable. • For the media hub, INSTALL a new media hub.

	REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . • For the APIM, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to Q6

Q6 CHECK EACH USB (UNIVERSAL SERIAL BUS) PORT FOR FUNCTIONALITY

- Connect: USB cable at the media hub.
- Connect: USB cable at the APIM.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	The system is operating correctly at this time. The concern was caused by the USB connector not being seated correctly.
No	GO to Q7

Q7 ISOLATE THE USB (UNIVERSAL SERIAL BUS) CABLE

- INSTALL a new USB cable.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative USB cable.
No	GO to Q8

Q8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The SD Card Slot Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1252:11	USB Port: Circuit Short to Ground	Set by the APIM when a short to ground or an over-current condition is detected on the USB cable. This can be caused by a fault in the USB cable, USB port, or by the customer's USB or SD card device.
B1252:13	USB Port: Circuit Open	Set by the APIM when an open is detected on the USB cable.

Possible Sources

- Customer's device
- Media hub
- USB cable
- APIM

PINPOINT TEST R : THE SD (SECURE DIGITAL) CARD SLOT IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

R1 RESET THE APIM (SYNC MODULE)

- Remove all devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Insert a known good non-navigation SD card containing music files.
- Operate the audio system in SD card mode and attempt to play an audio file.

Is the audio output working properly for the SD card slot?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	GO to R2

R2 VERIFY THE OPERATION OF THE USB (UNIVERSAL SERIAL BUS) CABLE

- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	• If the audio output is not working properly from one USB port, install a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . • If the audio output is not working properly from both USB ports, GO to R3

R3 CHECK THE APIM (SYNC MODULE) FOR DTC (DIAGNOSTIC TROUBLE CODE) B1252:11 OR B1252:13

- Using a diagnostic scan tool, clear the APIM Diagnostic Trouble Codes (DTCs).

- Using a diagnostic scan tool, clear the APIM Diagnostic Trouble Codes (DTCs).
- Perform the APIM self-test.

Is DTC B1252:11 or B1252:13 present?

Yes	GO to R4
No	GO to R6

R4 INSPECT THE USB (UNIVERSAL SERIAL BUS) CABLE, MEDIA HUB, AND APIM (SYNC MODULE)

- Ignition OFF.
- Disconnect: USB cable at the media hub.
- Disconnect: USB cable at the APIM.
- Inspect the USB cable, USB cable ends, media hub USB connector port, and APIM USB connector port for damage and remove any debris.

Is any damage present?

Yes	• For the USB cable, install a new USB cable. • For the media hub, install a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . • For the APIM, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to R5

R5 RECHECK FOR APIM (SYNC MODULE) DTC (DIAGNOSTIC TROUBLE CODE) B1252:11 OR B1252:13

- Using a diagnostic scan tool, clear the APIM Diagnostic Trouble Codes (DTCs).
- Perform the APIM self-test.

Is DTC B1252:11 or B1252:13 present?

Yes	GO to R7
No	GO to R6

R6 ISOLATE THE USB (UNIVERSAL SERIAL BUS) CABLE

- INSTALL a new USB cable.
- Insert a known good non-navigation SD card containing music files.
- Operate the audio system in SD card mode and attempt to play an audio file.

Is the audio output working properly for the SD card slot?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative USB cable.
No	GO to R7

R7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
    - Corrosion (clean module pins or install new connectors or terminals)

- Damaged or bent pins (install new terminals or pins)
- Pushed-out pins (install new pins as necessary)

- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RCA Jacks Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Sources

- Customer's device
- Wiring, terminals, or connectors
- Media hub
- APIM

PINPOINT TEST S : THE RCA JACKS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

S1 RESET THE APIM (SYNC MODULE)

- Remove all devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Connect: Multi-Media Interface Tester 420-373 and RCA adapter.
- Using the Multi-Media Interface Tester 420-373 and RCA adapter, attempt to play audio content using the RCA jacks.

Is the audio output working properly for the RCA jacks?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset.
No	GO to S2

S2 CHECK THE RCA CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Media Hub C2809.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-2		Ground

C2809-2	V	Ground
C2809-3	V	Ground
C2809-4	V	Ground
C2809-5	V	Ground
C2809-6	V	Ground
C2809-9	V	Ground
C2809-11	V	Ground
C2809-12	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to S3

S3 CHECK THE RCA CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-2	Ω	Ground
C2809-3	Ω	Ground
C2809-4	Ω	Ground
C2809-5	Ω	Ground
C2809-6	Ω	Ground
C2809-9	Ω	Ground
C2809-11	Ω	Ground
C2809-12	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to S4
No	REPAIR the circuit in question.

S4 CHECK THE RCA CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-2	Ω	C3342-36
C2809-3	Ω	C3342-34
C2809-4	Ω	C3342-9
C2809-5	Ω	C3342-10
C2809-6	Ω	C3342-11

C2809-9	Ω	C3342-35
C2809-11	Ω	C3342-28
C2809-12	Ω	C3342-29

Are the resistances less than 3 ohms?

Yes	INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . RETEST the system for normal operation. If the concern is still present, GO to S5
No	REPAIR the circuit in question.

S5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Unable To Pair Bluetooth Device

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Sources

- Incompatible Bluetooth device
- APIM

PINPOINT TEST T : UNABLE TO PAIR BLUETOOTH DEVICE

T1 CHECK THE BLUETOOTH CONNECTION

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, erases navigation and address data, deletes any devices paired with the SYNC® system, and deletes any devices paired with the MyLincoln Mobile™ phone application.*

- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, connect to the SYNC® system using Bluetooth. Follow the tool instructions.
- Using a diagnostic scan tool, view the APIM Parameter Identifications (PIDs).

- Monitor the Bluetooth device paired PID (BT_PAIR) and the Bluetooth device connected PID (BT_CONN).

Do the Parameter Identifications (PIDs) both read "Yes"?

Yes	The SYNC® system is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature. REVIEW the pairing process with the customer. If the customer's device still does not pair, the fault is with the customer's device.
No	GO to T2

T2 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RH Steering Wheel Switches Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1380:09	Steering Wheel Right Switch Pack: Component Failure	Set by the SCCM when the RH steering wheel switch is stuck for more than 2 minutes during normal operation.
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	Set by the SCCM when a short to ground is detected on the RH steering wheel switch circuits.
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	Set by the SCCM when a short to voltage is detected on the RH steering wheel switch circuits.

Possible Sources

- Steering wheel switch
- Wiring, terminals, or connectors
- Clockspring
- SCCM

PINPOINT TEST U : THE RH (RIGHT-HAND) STEERING WHEEL SWITCHES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

U1 CHECK THE RH (RIGHT-HAND) STEERING WHEEL SWITCH PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Monitor the steering wheel switch Parameter Identifications (PIDs) while pressing each RH lower steering wheel switch.
  - Voice (SW_VOICE)
  - Mute (SW_MUTE)
  - Volume + (SW_VOLUP)
  - Volume - (SW_VOLDOWN)
  - Seek-/Phone (SW_SEEKMINUS)/(SW_PHONE)
  - Seek+/End (SW_SEEKPLUS)/(SW_END)

Do the PID values agree with the switch positions?

Yes	GO to U10
No	• If one or more, but not all PID values are incorrect or always read one particular switch position, INSTALL a new RH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). • If all PID values are incorrect or always read one particular switch position, GO to U2

U2 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DTC (DIAGNOSTIC TROUBLE CODE) U0212:00

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) from the IPC.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U0212:00 present?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to U3

U3 CHECK FOR VOLTAGE FROM THE SCCM (STEERING COLUMN CONTROL MODULE)

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect RH Steering Wheel Switch C2490.
- Ignition ON.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	V	C2490-4
C2490-3	V	C2490-4
C2490-5	V	C2490-4

Is approximately 5 volts present?

Yes	INSTALL a new RH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	GO to U4

U4 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	Ω	Ground
C2490-3	Ω	Ground
C2490-4	Ω	Ground
C2490-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to U5
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

U5 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	Ω	C218B-6
C2490-3	Ω	C218B-7
C2490-4	Ω	C218B-16
C2490-5	Ω	C218B-15

Are the resistances less than 3 ohms?

Yes	GO to U6

No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

U6 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	Ω	C2490-3
C2490-2	Ω	C2490-4
C2490-2	Ω	C2490-5
C2490-3	Ω	C2490-4
C2490-3	Ω	C2490-5
C2490-4	Ω	C2490-5

Are the resistances greater than 10,000 ohms?

Yes	GO to U7
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

U7 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Connect Clockspring C218B.
- Disconnect Clockspring C218C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	Ω	Ground
C2490-3	Ω	Ground
C2490-4	Ω	Ground
C2490-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to U8
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

U8 CHECK THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	Ω	C218C-5
C2490-3	Ω	C218C-7

C2490-4	Ω	C218C-10
C2490-5	Ω	C218C-8

Are the resistances less than 3 ohms?

Yes	GO to U9
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

U9 CHECK THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-2	Ω	C2490-3
C2490-2	Ω	C2490-4
C2490-2	Ω	C2490-5
C2490-3	Ω	C2490-4
C2490-3	Ω	C2490-5
C2490-4	Ω	C2490-5

Are the resistances greater than 10,000 ohms?

Yes	GO to U10
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

U10 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Audio System Does Not Operate Correctly From The FCIM

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Source

- FCIM

PINPOINT TEST V : THE AUDIO SYSTEM DOES NOT OPERATE CORRECTLY FROM THE FCIM (FRONT CONTROLS INTERFACE MODULE)

V1 CHECK THE FDIM (FRONT DISPLAY INTERFACE MODULE) OPERATION

- Verify the FDIM screen operation.

Does the FDIM operate correctly?

Yes	GO to V2
No	GO to Pinpoint Test W

V2 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) , APIM (SYNC MODULE) AND FCIM (FRONT CONTROLS INTERFACE MODULE) PASS THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM, APIM and FCIM pass the network test?

Yes	GO to V3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

V3 RESET THE AUDIO SYSTEM MODULES AND RECHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Disconnect the battery for 1 minute, then reconnect it.
- Turn the infotainment system on.
- Test the FCIM for normal operation.

Does the FCIM operate correctly?

Yes	The FCIM is operating correctly at this time. The concern was corrected by resetting the audio system modules.
No	GO to V4

V4 RETRIEVE THE ACM (AUDIO FRONT CONTROL MODULE) , APIM (SYNC MODULE) , FCIM (FRONT CONTROLS INTERFACE MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM

Are any Diagnostic Trouble Codes (DTCs) present in the ACM, APIM and/or FCIM?

Yes	• For ACM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: ACM. • For APIM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: APIM.

	• For FCIM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: FCIM.
No	GO to V5

V5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

The FDIM Touchscreen Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B108E:01	Display: General Electrical Failure	Set by the APIM when an error is detected in the touch sensing ability of the FDIM.
U0162:00	Lost Communication With Navigation Display Module: No Sub Type Information	Set by the APIM when communication is missing from the FDIM for more than 1 second with the ignition in RUN.

Possible Sources

- Object pressed against the touchscreen
- FDIM
- Uncalibrated touchscreen
- APIM

NOTE: *The FDIM touchscreen can only sense one touch command at a time. If any objects are pressed against the touchscreen (including wiring or components behind the trim panel surrounding the touchscreen), the FDIM can appear to be inoperative.*

PINPOINT TEST W : THE FDIM (FRONT DISPLAY INTERFACE MODULE) TOUCHSCREEN IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

W1 VERIFY THE TOUCHSCREEN RESPONSE TO TOUCH COMMANDS

- Ignition ON.
- Press each tab of the 4 corners on the FDIM and observe the touchscreen operation.

Does the FDIM touchscreen respond correctly when each tab is pressed?

Yes	VERIFY the customer's specific concern by duplicating the steps that were taken when the original concern was generated. If the concern is not duplicated, the system is operating correctly at this time. INSTRUCT the customer in the correct operation of the FDIM touchscreen.
No	• If the FDIM**is not** completely inoperative or blank, GO to W2 • If the FDIM**is** completely inoperative or blank, GO to W3

W2 MAKE SURE THE TOUCHSCREEN IS CALIBRATED

- Calibrate the touchscreen.
  REFER to: Touchscreen Calibration (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- Verify the touchscreen operation.

Does the FDIM touchscreen respond correctly?

Yes	The system is operating correctly at this time. The concern was a result of the touchscreen not being calibrated.
No	GO to W5

W3 VERIFY THE APIM (SYNC MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the APIM pass the network test?

Yes	GO to W4
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

W4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0162:00 SET IN THE APIM (SYNC MODULE)

- Using a diagnostic scan tool, perform the APIM self-test.

Is DTC U0162:00 present?

Yes	INSTALL a new FDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to W5

W5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) B108E:01 SET IN THE APIM (SYNC MODULE)

- Using a diagnostic scan tool, perform the APIM self-test.

Is DTC B108E:01 present?

Yes	INSTALL a new FDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

No	GO to W6

W6 RESET THE APIM (SYNC MODULE) AND RECHECK THE SYSTEM OPERATION

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, erases navigation and address data, deletes any devices paired with the SYNC® system, and deletes any devices paired with the MyLincoln Mobile™ phone application.*

- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Turn the infotainment system on.
- While pressing each tab of the 4 corners on the FDIM, observe the touchscreen operation.

Does the touchscreen operate correctly?

Yes	The FDIM is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature.
No	GO to W7

W7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Navigation Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Removal of the map data SD card results in loss of navigation while the card is removed. This is normal operation.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1215:00	External Memory Card: No Sub Type Information	Set by the APIM when the map data SD card is missing.

Possible Sources

- Media hub
- Map data SD card not present, not fully seated, or damaged
- GPSM
- APIM

PINPOINT TEST X : NAVIGATION IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

X1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH A FACTORY-INSTALLED NAVIGATION SYSTEM

- Make sure the correct VIN was entered on the technician service publication website.
- Hover the mouse cursor over or click on the OASIS tab toward the top left of the screen.
- Select "HVBoM (Historical Vehicle Bill of Material)."
- Locate the **Limit to Base:** text entry box toward the center of the screen.
- Enter the map data SD card base part number 19H449.
- Press Enter on the keyboard or click on "View BoM (Build of Material)."
  - If the vehicle is equipped with a factory-installed navigation system, a row will appear indicating "CARD - MEMORY" in the DESCRIPTION column.
  - If the vehicle is **not** equipped with a factory-installed navigation system, a row will **not** appear and the DESCRIPTION column will be blank.

Does the technician service publication website indicate the vehicle is equipped with a factory-installed navigation system?

Yes	GO to X2
No	Ford Motor Company does not support the addition of a navigation system to vehicles not equipped with a factory-installed navigation system.

X2 VERIFY THE APIM (SYNC MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the APIM pass the network test?

Yes	GO to X3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

X3 CHECK THE USB (UNIVERSAL SERIAL BUS) PORTS FOR POWER OUTPUT

- Connect: Multi-Media Interface Tester 420-373.

Does the Multi-Media Interface Tester 420-373 power on from both USB ports?

Yes	GO to X4
No	• If the Multi-Media Interface Tester 420-373 powers on from only one USB port, INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . • If the Multi-Media Interface Tester 420-373 does not power on from either USB port, GO to Pinpoint Test P

X4 RESET THE APIM (SYNC MODULE) AND VERIFY THE OPERATION OF THE USB (UNIVERSAL SERIAL BUS) CABLE

- Remove all devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Connect: Multi-Media Interface Tester 420-373.
- Using the Multi-Media Interface Tester 420-373, attempt to play an audio file using each USB port.

Is the audio output operating correctly for each USB port?

Yes	GO to X5
No	• If the audio output is not operating correctly from one USB port, INSTALL a new media hub. REFER to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . • If the audio output is not operating correctly from both USB ports, GO to Pinpoint Test Q

X5 CHECK FOR A MAP DATA SD (SECURE DIGITAL) CARD FAULT MESSAGE

- Ignition ON.
- Observe the FDIM display.

Does the FDIM display "Insert Nav SD Card" or "Navigation SD Card Fault?"

Yes	GO to X6
No	GO to X9

X6 VERIFY THE MAP DATA SD (SECURE DIGITAL) CARD IS PRESENT

- Check for the presence of a map data SD card in the media hub SD card slot.

Is the map data SD card present and fully seated?

Yes	GO to X7
No	INSTALL the map data SD card. TEST the system for normal operation.

X7 INSPECT THE MAP DATA SD (SECURE DIGITAL) CARD

- **NOTE:** *The media hub SD card slot is spring loaded. The SD card is removed by pushing the card inward until a faint click is heard and the card is released outward. Attempting to remove the card without properly releasing it may cause damage to the SD card pins.*

  Remove the map data SD card.
- Inspect the map data SD card case and pins for damage.

Is any damage present?

Yes	INSTALL a new map data SD card.
No	If a known good map data SD card is available, GO to X8 If a known good map data SD card is **not** available, GO to X9

X8 VERIFY NAVIGATION SYSTEM OPERATION WITH KNOWN GOOD MAP DATA SD (SECURE DIGITAL) CARD

- Insert a known good map data SD card with the correct software version level.
- Confirm the navigation system operates correctly.

Does the navigation system operate correctly with the known good map data SD card?

Yes	INSTALL a new map data SD card.

No	GO to X9

X9 VERIFY THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the GPSM pass the network test?

Yes	GO to X10
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

X10 RETRIEVE THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) AND GPSM (GLOBAL POSITIONING SYSTEM MODULE)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - APIM
  - GPSM

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	• For APIM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: APIM. • For GPSM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: GPSM.
No	GO to X11

X11 REPROGRAM THE APIM (SYNC MODULE)

- Perform the APIM Standard Programming.
  REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- Override the Service Pack installation and perform a Full Flash/Force CIP.
- Once the APIM programming is complete and the system has re-initialized, confirm the navigation system operates correctly.

Does the navigation system operate correctly?

Yes	The navigation system is operating correctly at this time. The concern was resolved by reprogramming the APIM.
No	GO to X12

X12 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- **NOTE:** *Before operating the system to determine if the concern is still present, ensure that the vehicle is in an open location that is free from obstacles such as tall buildings or large trees so an adequate GPS signal can be obtained.*

  Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) . RETEST the system for normal operation. If the concern is still present, GO to X13
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

X13 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Compass Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Possible Source

- GPSM

PINPOINT TEST Y : THE COMPASS IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

Y1 VERIFY THE APIM (SYNC MODULE) AND GPSM (GLOBAL POSITIONING SYSTEM MODULE) PASS THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the APIM and GPSM pass the network test?

Yes	GO to Y2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Y2 RETRIEVE THE APIM (SYNC MODULE) AND GPSM (GLOBAL POSITIONING SYSTEM MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - APIM
  - GPSM

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	• For APIM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: APIM. • For GPSM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: GPSM.
No	GO to Y3

Y3 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- **NOTE:** *Before operating the system to determine if the concern is still present, ensure that the vehicle is in an open location that is free from obstacles such as tall buildings or large trees so an adequate GPS signal can be obtained.*

  Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Voice Recognition Does Not Operate Correctly To Voice Navigate To A Destination

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

Visual Inspection and Diagnostic Pre-checks

- Verify the ignition is ON.
- Verify the vehicle is located in a clear, open area to ensure the satellite information can be received by the vehicle.
- Verify the navigation SD card is present and fully seated in the SD card slot.
- Run the vehicle for at least one minute before testing the system in order for the navigation and voice recognition application to load properly.

PINPOINT TEST Z : VOICE RECOGNITION DOES NOT OPERATE CORRECTLY TO VOICE NAVIGATE TO A DESTINATION

Z1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH A FACTORY-INSTALLED NAVIGATION SYSTEM

- Make sure the correct VIN was entered on the technician service publication website.
- Hover the mouse cursor over or click on the OASIS tab toward the top left of the screen.

- Select "HVBoM (Historical Vehicle Bill of Material)."
- Locate the **Limit to Base:** text entry box toward the center of the screen.
- Enter the map data SD card base part number 19H449.
- Press Enter on the keyboard or click on "View BoM (Build of Material)."
  - If the vehicle is equipped with a factory-installed navigation system, a row will appear indicating "CARD - MEMORY" in the DESCRIPTION column.
  - If the vehicle is **not** equipped with a factory-installed navigation system, a row will **not** appear and the DESCRIPTION column will be blank.

Does the technician service publication website indicate the vehicle is equipped with a factory-installed navigation system?

Yes	GO to Z2
No	Ford Motor Company does not support the addition of a navigation system to vehicles not equipped with a factory-installed navigation system.

Z2 REPROGRAM THE APIM (SYNC MODULE)

- Perform the APIM Standard Programming.
  REFER to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
- Override the Service Pack installation and perform a Full Flash/Force CIP.
- Once the APIM programming is complete and the system has re-initialized, confirm that that the navigation system operates correctly.

Does the navigation system operate correctly?

Yes	The navigation system is operating correctly at this time. The concern was resolved by reprogramming the APIM.
No	GO to Z3

Z3 VERIFY NO ROUTE PREFERENCE, NAVIGATION, TRAFFIC, OR AVOID AREA RESTRICTIONS ARE SELECTED

- Verify the Navigation Route Preferences are not set to avoid freeways, toll roads, ferries, and car trains. Refer to the Owner's Literature.
- Verify Traffic Preferences are set properly. Refer to the Owner's Literature.
- Verify the destination being entered is not located within the boundaries of a “to avoid” area. Refer to the Owner's Literature.
- Change preferences as necessary, and operate the Voice Navigation system.

Does the Voice Navigation system operate as expected?

Yes	If the concern is not duplicated, the system is operating correctly at this time. INSTRUCT the customer in the correct operation of the route preference, navigation, traffic, and avoid area restrictions.
No	GO to Z4

Z4 CHECK THE AUDIBLE PROMPT FUNCTIONALITY

- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.

Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has been entered?

Yes	GO to Z5
No	GO to Pinpoint Test N

Z5 CHECK THE VOICE RECOGNITION OPERATION
• Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt. • **NOTE:** *Make sure the interior of the vehicle is as quiet as possible. Excessive noise may prevent the system from correctly recognizing spoken commands.* Clearly speak the word "help." **Does the SYNC® system respond correctly to the "help" voice command?**

Yes	The voice recognition of the navigation destination concern may have been caused by an insufficiently quiet vehicle or a destination not being present in the map database. GO to Z6
No	GO to Pinpoint Test O

Z6 CHECK OPERATION OF NAVIGATION SYSTEM WITH MANUAL DESTINATION ENTRY
NOTE: *Dragging your finger and pinching two fingers will not scroll to a location or zoom in or out as in other devices on the market. Holding your finger on a location off-center will cause the map to scroll to that location. Refer to the Owner's Literature for more information about navigating the map screen.* • Using the map feature, touch the screen at the requested destination. • Verify a road is present on the map at the requested location and verify the address of the destination is correct. **Does the navigation system properly navigate to the destination requested?**

Yes	The information on the navigation SD card may not include the correct map data, or is in a different format than what was expected. The system is operating correctly at this time. NOTIFY the customer that there may be an updated map upgrade available for purchase.
No	GO to Pinpoint Test X

Lost Communication with ECM/PCM U0100:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication with ECM/PCM "A": No Sub Type Information	Set by the ACM and GPSM when network messages are missing from the PCM for more than 5 seconds with the ignition in RUN.

Possible Source

- PCM

PINPOINT TEST AA : LOST COMMUNICATION WITH ECM/PCM U0100:00

AA1 VERIFY THE CUSTOMER'S CONCERN
• Ignition ON.

- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AA2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AA2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:00 set in the ACM, and GPSM?

Yes	GO to AA3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AA3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AA4

AA4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - GPSM

Are low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AA5

AA5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0100:00 set in more than one module?

Yes	GO to AA6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AA6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect the PCM and related in-line connectors.
• Repair:
  • Corrosion (clean module pins or install new connectors or terminals)
  • Damaged or bent pins (install new terminals or pins)
  • Pushed-out pins (install new pins as necessary)
• Reconnect the PCM and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With BCM U0140:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	Set by the ACM, APIM, FCIM and GPSM when network messages are missing from the BCM for more than 5 seconds with the ignition in RUN.

Possible Source

- BCM

PINPOINT TEST AB : LOST COMMUNICATION WITH BCM (BODY CONTROL MODULE) U0140:00

AB1 VERIFY THE CUSTOMER'S CONCERN
• Ignition ON. • Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AB2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AB2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0140:00 set in the ACM, APIM, FCIM or the GPSM?

Yes	GO to AB3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AB3 CHECK THE BCM (BODY CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to AB4

AB4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM
  - GPSM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AB5

AB5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0140:00 set in more than one module?

Yes	GO to AB6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC

	may have been set due to high network traffic or an intermittent fault condition.

AB6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. For LHD vehicles, REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). For RHD vehicles, REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With RCM U0151:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	Set by the APIM and FCIM when the airbag deployment notification message from the RCM is missing for more than 5 seconds with the ignition in RUN.

Possible Source

- RCM

PINPOINT TEST AC : LOST COMMUNICATION WITH RCM (RESTRAINTS CONTROL MODULE) U0151:00

AC1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AC2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0151:00 set in the APIM or FCIM?

Yes	GO to AC3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC3 CHECK THE RCM (RESTRAINTS CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the RCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Pinpoint Test - DTC: AH (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to AC4

AC4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - APIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AC5

AC5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0151:00 set in both the APIM and FCIM?

Yes	GO to AC6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC6 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the RCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the RCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With IPC U0155:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With IPC Control Module: No Sub Type Information	Set by the ACM, APIM, FCIM, (CD player) and the GPSM when network messages are missing from the IPC for more than 5 seconds with the ignition in RUN.

Possible Source

- IPC

PINPOINT TEST AD : LOST COMMUNICATION WITH IPC (INSTRUMENT PANEL CLUSTER) U0155:00

AD1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AD2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 set in the ACM, APIM, FCIM, (CD player) or the GPSM?

Yes	GO to AD3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD3 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the IPC self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to AD4

AD4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM
  - GPSM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AD5

AD5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0155:00 set in more than one module?

Yes	GO to AD6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD6 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the IPC and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. For LHD vehicles, REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). For RHD vehicles, REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With PAM U0159:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

The PAM is integral to the BCM.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	Set by the APIM when network messages are missing from the PAM for more than 5 seconds with the ignition in RUN.

Possible Source

- PAM

PINPOINT TEST AE : LOST COMMUNICATION WITH PAM (PARKING ASSIST CONTROL MODULE) U0159:00

AE1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AE2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0159:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.

- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0159:00 set in the APIM?

Yes	GO to AE3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE3 CHECK THE BCM (BODY CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to AE4

AE4 CHECK THE APIM (SYNC MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the APIM self-test.

Are low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AE5

AE5 CHECK FOR CORRECT PAM (PARKING ASSIST CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. For LHD vehicles, REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). For RHD vehicles, REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With GPS Module U016A:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U016A:00	Lost Communication With Global Positioning System Module: No Sub Type Information	Set by the APIM when it is missing network messages from the GPSM for more than 5 seconds with the ignition in RUN.

Possible Source

- GPSM

PINPOINT TEST AF : LOST COMMUNICATION WITH GPS (GLOBAL POSITIONING SYSTEM) MODULE U016A:00

AF1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AF2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AF2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U016A:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U016A:00 set in the APIM?

Yes	GO to AF3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AF3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - APIM
  - GPSM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AF4

AF4 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connector.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With Radio U0184:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0184:00	Lost Communication With Radio: No Sub Type Information	Set by the APIM when network messages are missing from the ACM for more than 5 seconds with the ignition in RUN.

Possible Source

- ACM

PINPOINT TEST AG : LOST COMMUNICATION WITH RADIO U0184:00

AG1 VERIFY THE CUSTOMER'S CONCERN

- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AG2
No	The system is operating normally at this time. This DTC may have been set due to high

	network traffic or an intermittent fault condition.

AG2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0184:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0184:00 set in the APIM?

Yes	GO to AG3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AG3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AG4

AG4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With APIM U0253:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen

Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	Set by the ACM and the FCIM when network messages are missing from the APIM for more than 5 seconds with the ignition in RUN.

Possible Source

- APIM

PINPOINT TEST AH : LOST COMMUNICATION WITH APIM (SYNC MODULE) U0253:00

AH1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AH2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AH2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0253:00 set in the ACM, and/or the FCIM?

Yes	GO to AH3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AH3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AH4

AH4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0253:00 set in the ACM and/or the FCIM?

Yes	GO to AH5
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AH5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With FCIM U0256:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	Set by the ACM and APIM when network messages are missing from the FCIM for more than 5 seconds with the ignition in RUN.

Possible Source

- FCIM

PINPOINT TEST AI : LOST COMMUNICATION WITH FCIM (FRONT CONTROLS INTERFACE MODULE) U0256:00

AI1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AI2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AI2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0256:00 set in the ACM or APIM?

Yes	GO to AI3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AI3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AI4

AI4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0256:00 set in both the ACM and the APIM?

Yes	GO to AI5
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AI5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition ON.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

Lost Communication With FDIM U0257:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System - System Operation and Component Description (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	**NOTE:** *The FDIM is a non-networked module attached to the APIM. The APIM acts as the gateway module for messages sent over the Infotainment Controller Area Network (I-CAN) between the FDIM, ACM, and FCIM.* Set by the ACM when network messages are missing from the APIM for more than 5 seconds with the ignition in RUN. This DTC may be set in conjunction with DTC U0253:00.

Possible Source

- APIM

PINPOINT TEST AJ : LOST COMMUNICATION WITH FDIM (FRONT DISPLAY INTERFACE MODULE) U0257:00

AJ1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AJ2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AJ2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0257:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0257:00 set in the ACM?

Yes	GO to AJ3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AJ3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AK • For DTC U3003:17, GO to Pinpoint Test AL
No	GO to AJ4

AJ4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0257:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0257:00 set in the ACM?

Yes	INSTALL a new FDIM. CLEAR the DTCs. Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs). If DTC U0257:00 is still present, GO to AJ5
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AJ5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage Low U3003:16

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Set by the ACM, APIM, FCIM and GPSM when the supply voltage falls below 10 volts for at least 10 seconds during normal operation or for more than 250 milliseconds during the self-test.

Possible Sources

- Previous low battery voltage
- Wiring, terminals, or connectors
- ACM
- APIM
- FCIM
- GPSM

PINPOINT TEST AK : BATTERY VOLTAGE LOW U3003:16

AK1 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:16

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 15 seconds.
- Using a diagnostic scan tool, repeat the self-test for the module in question.

Is DTC U3003:16 still present?

Yes	GO to AK2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

AK2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test

Are any voltage-related DTC set in the PCM?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AK3

AK3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery fully charged and in good condition?

Yes	GO to AK4
No	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

AK4 CHECK THE MODULE VOLTAGE SUPPLY

- Ignition OFF.
- Measure and record the voltage at the battery.
- Disconnect the audio system module setting DTC U3003:16.
- Ignition ON.
- Measure the voltage between the module setting DTC U3003:16 and ground.
- For the ACM, measure:

Positive Lead	Measurement / Action	Negative Lead
C4821A-1		Ground

- For the APIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-1		Ground

- For the FCIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-26		Ground

- For the GPSM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2398-1		Ground

Is the voltage within 0.2 volts of the recorded battery voltage?

Yes	GO to AK5
No	REPAIR the circuit for high resistance.

AK5 CHECK THE SUSPECT MODULE GROUND CIRCUIT FOR CONTINUITY

- Measure the voltage at the suspect module.
- For the ACM, measure:

Positive Lead	Measurement / Action	Negative Lead
C4821A-1		C4821A-13

- For the APIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2383-1		C2383-37

- For the FCIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-26		C2402A-1

- For the GPSM, measure:

Positive Lead	Measurement / Action	Negative Lead
C2398-1		C2398-6

Is the suspect module voltage greater than 11 volts?

Yes	• For the ACM, GO to AK6 • For the APIM, GO to AK7 • For the FCIM, GO to AK8 • For the GPSM, GO to AK9
No	REPAIR the circuit for high resistance.

AK6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AK7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AK8 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIMand related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AK9 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage High U3003:17

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage:	Set by the ACM, APIM, FCIM and the GPSM when the supply voltage is more

	Circuit Voltage Above Threshold	than 15.8 volts for more than 250 milliseconds during normal operation or the self-test.

Possible Sources

- ACM
- APIM
- FCIM
- GPSM

PINPOINT TEST AL : BATTERY VOLTAGE HIGH U3003:17

AL1 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the self-test for the module in question.

Is DTC U3003:17 present?

Yes	GO to AL2
No	The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

AL2 CHECK FOR HIGH VOLTAGE DIAGNOSTIC TROUBLE CODES (DTCS) SET IN MULTIPLE MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are high voltage Diagnostic Trouble Codes (DTCs) such as B1676, P0563, or U3003:17 set in more than one module?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AL3

AL3 CHECK THE BATTERY VOLTAGE

- Turn off all interior lights, exterior lights, and accessories.
- Start and run the engine at approximately 2,000 RPM for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	• For the ACM, GO to AL4 • For the APIM, GO to AL5 • For the FCIM, GO to AL6 • For the GPSM, GO to AL7

AL4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)

- Damaged or bent pins (install new terminals or pins)
- Pushed-out pins (install new pins as necessary)

- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AL5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AL6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AL7 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the GPSM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. REFER to: Global Positioning System Module (GPSM) - Vehicles Built From: 17-08-2015 (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Audio Front Control Module (ACM) Self-Test

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *If the ACM, FCDIM (if equipped), FCIM, or FDIM (if equipped) are inoperative (blank or do not power on), obtain the ACM part number by referencing the label attached to the ACM chassis.*

   Turn the ACM on.

3. Operate the audio system in radio tuner AM/ FM mode.

4. Press and hold the eject button, and within 1 second, press and hold the seek up button. If supported, the speaker walk around test will begin, and the display will indicate each speaker as it is tested.

NOTE: *AHU Diagnostics refers to the ACM, EFP Diagnostics refers to the FCIM that communicates on the CAN (if equipped), and MFD Diagnostics (if supported) refers to the FCDIM (if equipped).*

5. To exit the self-diagnostic mode, turn the ACM off, or select "Exit Diagnostics."

Copyright © 2016 Ford Motor Company

Reset the SYNC Module [APIM]

Programming

NOTE: *An APIM Reset consists of a battery disconnect and a SYNC® system Master Reset. It may **not** be necessary to perform a Master Reset after disconnecting the battery if the concern is resolved.*

NOTE: *This procedure clears all Continuous Memory Diagnostic Trouble Codes (CMDTCs). The Diagnostic Trouble Codes (DTCs) must be recorded now if other non-SYNC® diagnoses are to be performed after this procedure.*

1. Remove any devices connected to the USB port(s), audio input jack/socket (if equipped), SD slot (if equipped), or RCA jacks (if equipped).

2. Disconnect the negative battery cable for 1 minute, then reconnect it.
   Refer to: Battery Disconnect and Connect - Vehicles With: Single Battery (414-01 Battery, Mounting and Cables) .

3. **NOTE:** *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, and deletes any Bluetooth devices paired with the SYNC® system. For vehicles with navigation, the customer's saved destinations (home, favorites, and previous) are erased. For vehicles with a TCU, any devices paired with the MyFord® Mobile or MyLincoln Mobile™ phone application will be deleted.*

   Perform a Master Reset. If necessary, refer to "Master Reset" in the Owner's Literature.

4. Verify system function using the MIT 105-00120 to test the audio output for the USB port(s), audio input jack/socket (if equipped), and Bluetooth. If equipped, test the audio output for the RCA jacks using RCA Adapter 105-00121.

5. **NOTE:** *If the concern remains after completing the APIM Reset procedure, advise the customer to power their device off and back on for a simple reboot. In some cases, if possible, the device's battery may also need to be removed and re-installed to complete a reboot. Delete SYNC® from the device's Bluetooth menu prior to re-pairing the phone to the SYNC® system. If necessary, the customer can also perform a Master Clear, Master Reset, or Factory Data Reset on their device following the manufacturer's instructions in the device's owner's manual and/or website. Customer devices may affect the operation of SYNC® and this should be understood to prevent unnecessary diagnosis or repairs to the system.*

   If a concern is still present, return to the Symptom Charts.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Programming

Special Tool(s) / General Equipment

SYNC USB 2.0 A Male to A Male Cable

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. If a new APIM is being installed, install the new APIM before carrying out the following procedure.
   Refer to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

3. **NOTE:**

   - *This programming procedure deletes any phones that were paired with the SYNC® system.*
   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A file of approximately 80 megabytes (MB) needs to be downloaded from the online database for the programming. Allow extra time for the file to download.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*

4. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

5. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

6. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

7. Connect one end of the USB cable (male type A 4-pin to male type a 4-pin) to the diagnostic scan tool's USB port, and the other end to the vehicle's USB port.
   Use the General Equipment: SYNC USB 2.0 A Male to A Male Cable

8. Close the IDS software program.

9. Place the ignition in the ON/RUN position. For ON/RUN position information with Push Button Start vehicles, Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

10. **NOTE:**

    - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
    - *Run OASIS using "Read VIN & DTCs."*
      - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
      - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
    - *If the "SYNC - Software Programming" document is not followed, the programming may stop or encounter errors due to improperly configured Internet browser settings.*

11. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

12. **NOTE:** *There are 3 types of APIM programming available:*

    - *Standard — Used to update the APIM and any currently installed Applications to the latest software*

levels.

- *Custom — Used to show all the available software options (including Applications that may not have been installed previously) that can be programmed into the APIM. Use this selection when upgrades become available or as directed by a TSB or FSA.*
- *Module Replacement — Used when the APIM has been replaced. This type of programming performs the required provisioning (restores software for newly installed hardware).*

13. Scroll to the bottom of the screen, select 1 of the 3 options (Standard, Custom, or Module Replacement), and select the "Read SYNC" button. The current APIM assembly, Vehicle Interface Processor (VIP), and Consumer Interface Processor (CIP) software levels are compared to the last recorded state in the Ford online database, and the available software is displayed.

14. **NOTE:** *Do **not** disconnect the VCM or USB cable during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

    Select the "Program SYNC" button to begin the APIM programming process.

15. Follow the diagnostic scan tool on-screen directions. After programming is complete, the diagnostic scan tool displays "Programming has been successfully completed."

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Custom Programming

Special Tool(s) / General Equipment

SYNC USB 2.0 A Male to A Male Cable
SYNC USB 2.0 A Female to Mini B Female 5-Pin Adapter

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *Use this procedure to show all available software options, including Applications, that can be programmed into the APIM when upgrades become available, or as directed by a TSB or FSA. For additional information about choosing the correct APIM programming procedure, see Accessory Protocol Interface Module (APIM) Programming.*

   Refer to: Information and Entertainment System - Component Location (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

3. **NOTE:**

   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A USB flash drive with a minimum storage size of 1 gigabyte (GB) may be required for this procedure.*
     - *Some programming files are large (greater than 2GB). It is important that the diagnostic scan tool has enough available hard drive space to accommodate the programming file download.*
     - *If a "Disk Space Error" is received, create additional free space on the hard drive.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*
   - *During programming, the vehicle display may momentarily go blank.*

4. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

5. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

6. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

7. Close the IDS software program.

8. Place the ignition in the ON/RUN position. For ON/RUN position information with Push Button Start vehicles, Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

9. **NOTE:**

   - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
   - *Run OASIS using "Read VIN & DTCs."*
     - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
     - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
   - *If the "SYNC - Software Programming" document is not followed, the programming may stop or encounter errors due to improperly configured Internet browser settings.*

10. **NOTE:** *This procedure clears all Continuous Memory Diagnostic Trouble Codes (CMDTCs). The Diagnostic*

Trouble Codes (DTCs) must be recorded now if other diagnoses are to be performed after this procedure.

Select "Toolbox" from the technician service publications website to retrieve and record all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

11. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

    - Scroll to the bottom of the screen, select "Custom," and select the "Read SYNC" button. The current APIM assembly, Vehicle Interface Processor (VIP), Consumer Interface Processor (CIP), and Application software levels are compared to the last recorded state in the Ford online database, and the available software is displayed.
    - Select the software level needed as indicated by the TSB or FSA. If the software level is not known, stop this procedure and perform standard programming, which automatically selects the latest software levels.
      Refer to: SYNC Module [APIM] Standard Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).
    - Applications may require selection for installation. Applications with a green check mark next to them indicates the APIM already has the latest level installed (no reinstallation is required).
    - Depending on the software level required, the diagnostic scan tool automatically selects either the Service Pack or Full Flash programming method.
    - Although there may be an option available to override the Service Pack installation and perform a Full Flash/Force Consumer Interface Processor (CIP), choosing this option requires additional programming time and is not recommended unless directed by a TSB or FSA.
    - Select the customer-requested upgrade or the Application directed by the TSB or FSA.

13. **NOTE:** *Only Applications on a flash drive may be loaded into the APIM through the media hub.*

    NOTE: *If not performing a Full Flash/Force Consumer Interface Processor (CIP), go to step 16.*

    - Disconnect the vehicle's USB cable by removing the media hub.
      Refer to: Media Hub (415-00D) .
    - If the USB cable cannot be accessed by removing the media hub, access and disconnect the USB inline connector.

    - Connect the USB adaptor (female type A 4-pin to female type Mini-B 5-pin) to the vehicle's USB cable.
      Use the General Equipment: SYNC USB 2.0 A Female to Mini B Female 5-Pin Adapter
    - Connect one end of the USB cable (male type A 4-pin to male type a 4-pin) to the diagnostic scan tool's USB port, and the other end to the USB adaptor.
      Use the General Equipment: SYNC USB 2.0 A Male to A Male Cable

15. **NOTE:** *Do **not** disconnect the VCM or USB cable during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

16. **NOTE:** *Diagnostic scan tools that have never been used to program SYNC® may encounter a Hardware Wizard pop-up requesting a "WMA SBOOT" driver installation. If this request is encountered, install the driver and select the diagnostic scan tool "Retry" button to continue programming.*

    NOTE: *This step may take 20 minutes or longer.*

    - Select the "Program SYNC" button to begin the APIM programming process.
    - When prompted by the diagnostic scan tool, disconnect the battery charger, start the engine, and select "OK." Once "OK" is selected, do not interrupt this step, which may take 20 minutes or longer.

17. **NOTE:** *This step may take 20 minutes or longer.*

    Connect the USB flash drive to the diagnostic scan tool and follow the on-screen instructions to download Service Pack and Application files onto the USB flash drive. (If the diagnostic scan tool does not have an available USB port, the USB cable that is connected to the vehicle's USB cable can be unplugged at this time to make room for the USB flash drive. Do **not** disconnect the VCM from the diagnostic scan tool).

    - Install the media hub if it was removed.
      Refer to: Media Hub (415-00D) .
    - Reconnect the USB inline connector if it was accessed and disconnected.

19. **NOTE:** *This step may take 20 minutes or longer.*

    - When prompted by the diagnostic scan tool, remove the USB flash drive from the diagnostic scan tool

and connect it to the media hub to install the Applications into the APIM.
- The update should start automatically, and may take 20 minutes or longer.
- It is normal for the APIM to reset during this step.

20. Once the diagnostic scan tool programming and USB flash drive programming are complete, reinstall the flash drive into the diagnostic scan tool and select "OK." This initiates the remaining automated configuration steps and reports the software installation to the Ford online database. Failure to do so results in the loss of features such as navigation (if equipped) and SYNC® Services.

21. **NOTE:** *Calibrate the touchscreen.*

    Refer to: Touchscreen Calibration (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Replacement Programming

Special Tool(s) / General Equipment

SYNC USB 2.0 A Male to A Male Cable
SYNC USB 2.0 A Female to Mini B Female 5-Pin Adapter

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *Use this procedure to program and provision the module when a new APIM is being installed. For additional information about choosing the correct APIM programming procedure, see Accessory Protocol Interface Module (APIM) Programming.*

   Refer to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing).

3. Install the new APIM before performing this procedure.
   Refer to: SYNC Module [APIM] (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).

4. **NOTE:**

   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A USB flash drive with a minimum storage size of 1 gigabyte (GB) may be required for this procedure.*
     - *Some programming files are large (greater than 2GB). It is important that the diagnostic scan tool has enough available hard drive space to accommodate the programming file download.*
     - *If a "Disk Space Error" is received, create additional free space on the hard drive.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*
   - *During programming, the vehicle display may momentarily go blank.*

5. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

6. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

7. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

8. Close the IDS software program.

9. Place the ignition in the ON/RUN position. For ON/RUN position information with Push Button Start vehicles, Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

10. **NOTE:**

    - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
    - *Run OASIS using "Read VIN & DTCs."*
      - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
      - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
    - *If the "SYNC - Software Programming" document is not followed, the programming may stop or*

encounter errors due to improperly configured Internet browser settings.

11. **NOTE:** *This procedure clears all Continuous Memory Diagnostic Trouble Codes (CMDTCs). The Diagnostic Trouble Codes (DTCs) must be recorded now if other diagnoses are to be performed after this procedure.*

    Select "Toolbox" from the technician service publications website to retrieve and record all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

12. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

    - Scroll to the bottom of the screen, select "Module Replacement," and select the "Read SYNC" button. The current APIM assembly, Vehicle Interface Processor (VIP), Consumer Interface Processor (CIP), and Application software levels are compared to the last recorded state in the Ford online database, and the diagnostic scan tool automatically selects the latest software for programming.
    - Applications may require selection for installation. Applications with a green check mark next to them indicates the APIM already has the latest level installed (no reinstallation is required).
    - Depending on the software level required, the diagnostic scan tool automatically selects either the Service Pack or Full Flash programming method.
    - Although there may be an option available to override the Service Pack installation and perform a Full Flash/Force Consumer Interface Processor (CIP), choosing this option requires additional programming time and is not recommended unless directed by a TSB or FSA.

14. **NOTE:** *Only Applications on a flash drive may be loaded into the APIM through the media hub.*

    NOTE: *If not performing a Full Flash/Force Consumer Interface Processor (CIP), go to step 17.*

    - Disconnect the vehicle's USB cable by removing the media hub.
      Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).
    - If the USB cable cannot be accessed by removing the media hub, access and disconnect the USB inline connector.

    - Connect the USB adaptor (female type A 4-pin to female type Mini-B 5-pin) to the vehicle's USB cable.
      Use the General Equipment: SYNC USB 2.0 A Female to Mini B Female 5-Pin Adapter
    - Connect one end of the USB cable (male type A 4-pin to male type a 4-pin) to the diagnostic scan tool's USB port, and the other end to the USB adaptor.
      Use the General Equipment: SYNC USB 2.0 A Male to A Male Cable

16. **NOTE:** *Do **not** disconnect the VCM or USB cable during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

17. **NOTE:** *Diagnostic scan tools that have never been used to program SYNC® may encounter a Hardware Wizard pop-up requesting a "WMA SBOOT" driver installation. If this request is encountered, install the driver and select the diagnostic scan tool "Retry" button to continue programming.*

    NOTE: *This step may take 20 minutes or longer.*

    - Select the "Program SYNC" button to begin the APIM programming process.
    - When prompted by the diagnostic scan tool, disconnect the battery charger, start the engine, and select "OK." Once "OK" is selected, do not interrupt this step, which may take 20 minutes or longer.

18. **NOTE:** *This step may take 20 minutes or longer.*

    Connect the USB flash drive to the diagnostic scan tool and follow the on-screen instructions to download Service Pack and Application files onto the USB flash drive. (If the diagnostic scan tool does not have an available USB port, the USB cable that is connected to the vehicle's USB cable can be unplugged at this time to make room for the USB flash drive. Do **not** disconnect the VCM from the diagnostic scan tool).

    - Install the media hub if it was removed.
      Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).
    - Reconnect the USB inline connector if it was accessed and disconnected.

20. **NOTE:** *This step may take 20 minutes or longer.*

    - When prompted by the diagnostic scan tool, remove the USB flash drive from the diagnostic scan tool and connect it to the media hub to install the Applications into the APIM.
    - The update should start automatically, and may take 20 minutes or longer.

- It is normal for the APIM to reset during this step.

21. **NOTE:** *Reinstalling the USB flash drive into the diagnostic scan tool initiates the remaining automated configuration steps. Failure to do so results in the loss of feature functionality such as navigation and SYNC® traffic, directions, and information services.*

    Once diagnostic scan tool programming and USB flash drive programming are complete, reinstall the flash drive into the diagnostic scan tool and select "OK" to report software installation to the Ford online database.

22. **NOTE:** *Calibrate the touchscreen.*

    Refer to: Touchscreen Calibration (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Standard Programming

Special Tool(s) / General Equipment

SYNC USB 2.0 A Male to A Male Cable
SYNC USB 2.0 A Female to Mini B Female 5-Pin Adapter

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *Use this procedure to update the APIM and any installed Applications to the latest level. For additional information about choosing the correct APIM programming procedure, see Accessory Protocol Interface Module (APIM) Programming.*

   Refer to: Information and Entertainment System - Component Location (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Description and Operation).

3. **NOTE:**

   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A USB flash drive with a minimum storage size of 1 gigabyte (GB) may be required for this procedure.*
     - *Some programming files are large (greater than 2GB). It is important that the diagnostic scan tool has enough available hard drive space to accommodate the programming file download.*
     - *If a "Disk Space Error" is received, create additional free space on the hard drive.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*
   - *During programming, the vehicle display may momentarily go blank.*

4. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

5. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

6. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

7. Close the IDS software program.

8. Place the ignition in the ON/RUN position. For ON/RUN position information with Push Button Start vehicles, Refer to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

9. **NOTE:**

   - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
   - *Run OASIS using "Read VIN & DTCs."*
     - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
     - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
   - *If the "SYNC - Software Programming" document is not followed, the programming may stop or encounter errors due to improperly configured Internet browser settings.*

10. **NOTE:** *This procedure clears all Continuous Memory Diagnostic Trouble Codes (CMDTCs). The Diagnostic Trouble Codes (DTCs) must be recorded now if other diagnoses are to be performed after this procedure.*

Select "Toolbox" from the technician service publications website to retrieve and record all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

11. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

    - Scroll to the bottom of the screen, select "Standard," and select the "Read SYNC" button. The current APIM assembly, Vehicle Interface Processor (VIP), Consumer Interface Processor (CIP), and Application software levels are compared to the last recorded state in the Ford online database, and the diagnostic scan tool automatically selects the latest software for programming.
    - Applications may require selection for installation. Applications with a green check mark next to them indicates the APIM already has the latest level installed (no reinstallation is required).
    - Depending on the software level required, the diagnostic scan tool automatically selects either the Service Pack or Full Flash programming method.
    - Although there may be an option available to override the Service Pack installation and perform a Full Flash/Force Consumer Interface Processor (CIP), choosing this option requires additional programming time and is not recommended unless directed by a TSB, FSA or specific pinpoint test.

13. **NOTE:** *Only Applications on a flash drive may be loaded into the APIM through the media hub.*

    NOTE: *If not performing a Full Flash/Force Consumer Interface Processor (CIP), go to step 16.*

    - Disconnect the vehicle's USB cable by removing the media hub.
      Refer to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display) .
    - If the USB cable cannot be accessed by removing the media hub, access and disconnect the USB inline connector.

    - Connect the USB adaptor (female type A 4-pin to female type Mini-B 5-pin) to the vehicle's USB cable.
      Use the General Equipment: SYNC USB 2.0 A Female to Mini B Female 5-Pin Adapter
    - Connect one end of the USB cable (male type A 4-pin to male type a 4-pin) to the diagnostic scan tool's USB port, and the other end to the USB adaptor.
      Use the General Equipment: SYNC USB 2.0 A Male to A Male Cable

15. **NOTE:** *Do **not** disconnect the VCM or USB cable during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

16. **NOTE:** *Diagnostic scan tools that have never been used to program SYNC® may encounter a Hardware Wizard pop-up requesting a "WMA SBOOT" driver installation. If this request is encountered, install the driver and select the diagnostic scan tool "Retry" button to continue programming.*

    NOTE: *This step may take 20 minutes or longer.*

    - Select the "Program SYNC" button to begin the APIM programming process.
    - When prompted by the diagnostic scan tool, disconnect the battery charger, start the engine, and select "OK." Once "OK" is selected, do not interrupt this step, which may take 20 minutes or longer.

17. **NOTE:** *This step may take 20 minutes or longer.*

    Connect the USB flash drive to the diagnostic scan tool and follow the on-screen instructions to download Service Pack and Application files onto the USB flash drive. (If the diagnostic scan tool does not have an available USB port, the USB cable that is connected to the vehicle's USB cable can be unplugged at this time to make room for the USB flash drive. Do **not** disconnect the VCM from the diagnostic scan tool).

    - Install the media hub if it was removed.
      Refer to: Media Hub (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display) .
    - Reconnect the USB inline connector if it was accessed and disconnected.

19. **NOTE:** *This step may take 20 minutes or longer.*

    - When prompted by the diagnostic scan tool, remove the USB flash drive from the diagnostic scan tool and connect it to the media hub to install the Applications into the APIM.
    - The update should start automatically, and may take 20 minutes or longer.
    - It is normal for the APIM to reset during this step.

20. Once the diagnostic scan tool programming and USB flash drive programming are complete, reinstall the flash drive into the diagnostic scan tool and select "OK." This initiates the remaining automated configuration steps and reports the software installation to the Ford online database. Failure to do so results in the loss of features

such as navigation (if equipped) and SYNC® Services.

21. **NOTE:** *Calibrate the touchscreen.*

    Refer to: Touchscreen Calibration (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Copyright © 2016 Ford Motor Company

Touchscreen Calibration

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: *Calibrate the touchscreen by following the diagnostic scan tool prompts, or the steps below.*

2. Make sure the vehicle battery is fully charged in order to avoid an inoperative touchscreen.
3. Turn the ACM on.
4. Operate the audio system in radio tuner AM/ FM mode.
5. Press and hold the eject button, and within 1 second, press and hold the seek up button until the speaker walk around test begins.
6. Press and hold the seek down button to enter the touchscreen calibration.
7. Touch and hold the touch points as they appear on the touchscreen (a stylus is not required).
8. If following message will be displayed -New calibration settings have been measured. Press the Enter key to accept the new settings.-, touch anywhere on the screen to accept the new settings.
9. Clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Copyright © 2016 Ford Motor Company

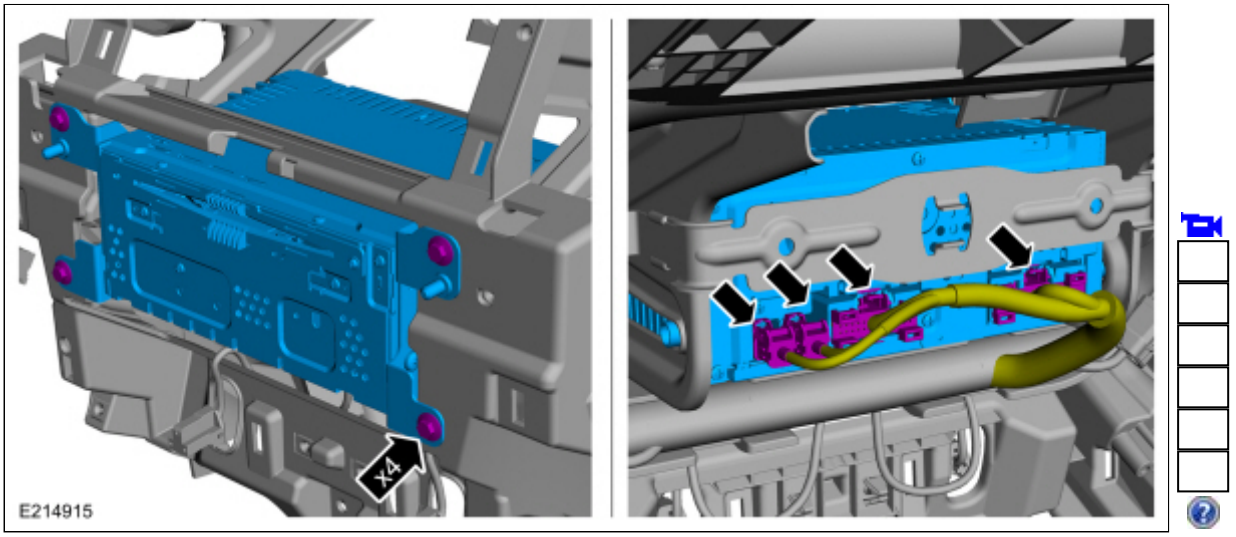
Audio Front Control Module (ACM)

Removal

NOTE: *Eject any media from the ACM. If a disc fails to eject, do not forceably remove the disc from the ACM.*

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*
2. Refer to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
3. *Torque*: 3 Nm



Installation

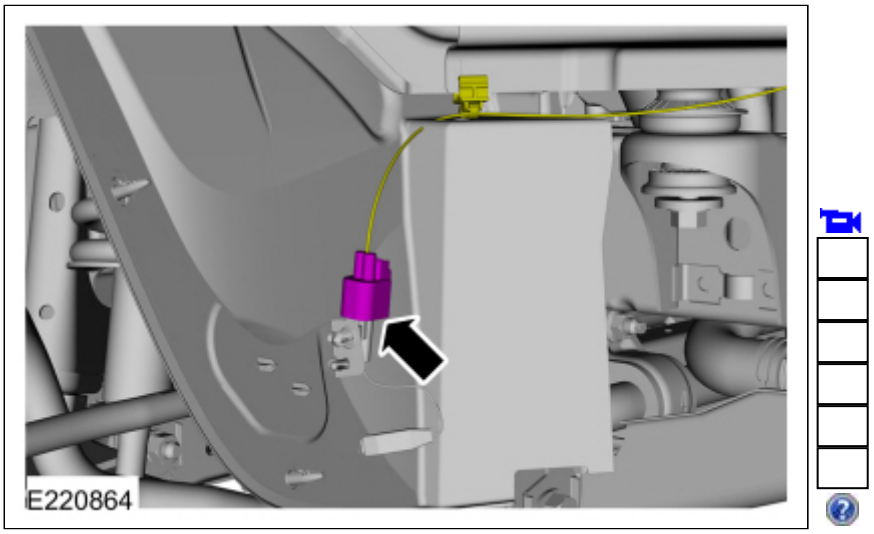
1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the ACM following the on-screen instructions.

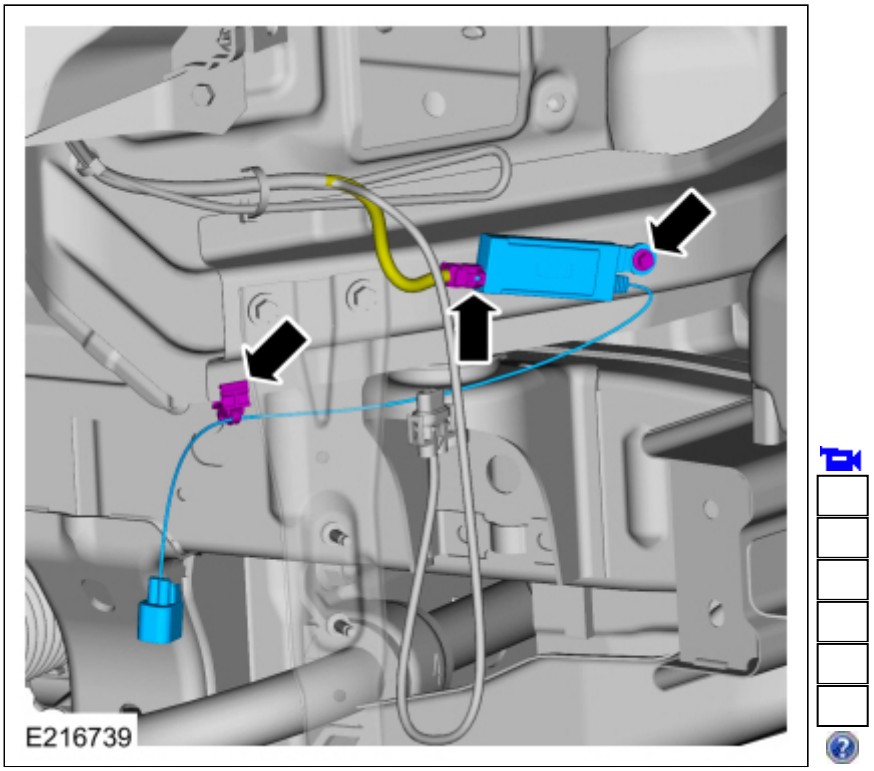
Copyright © 2016 Ford Motor Company

Audio Unit Antenna Amplifier

Removal

1. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
2. 

3. *Torque*: 8 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

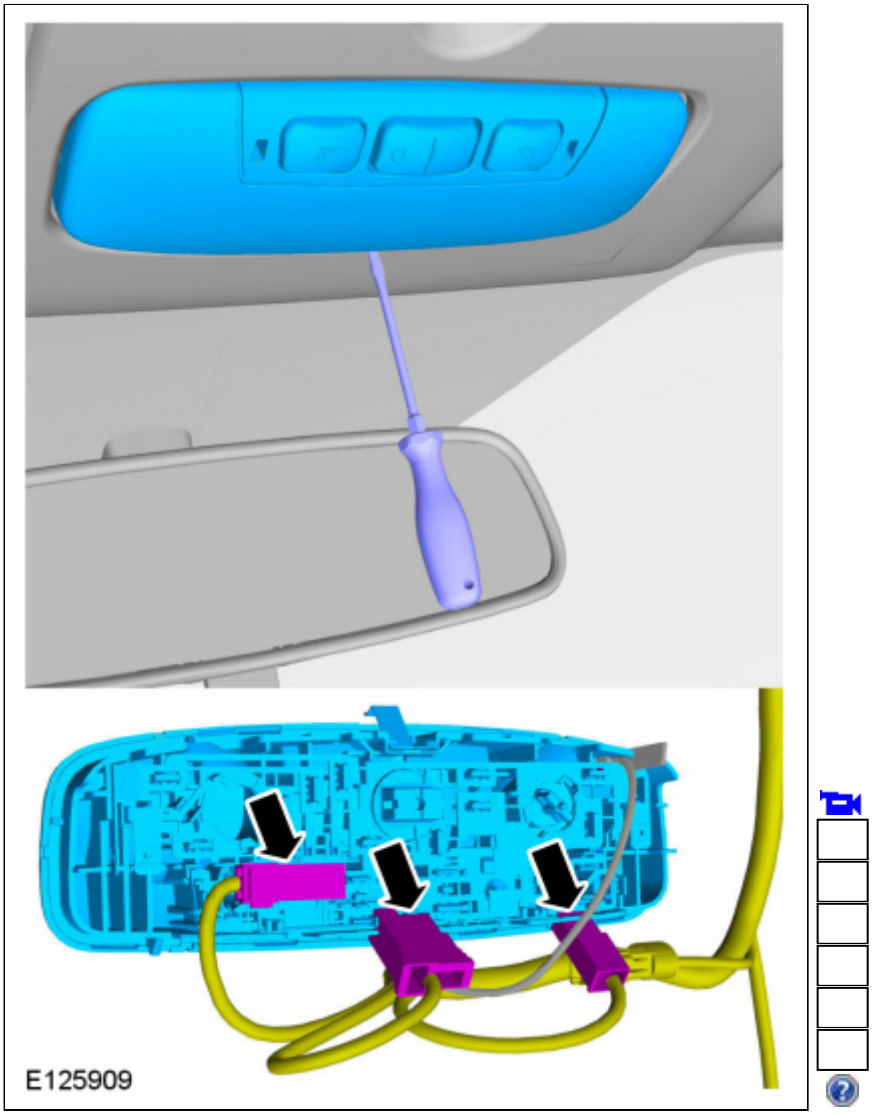
Audio Unit Antenna

Removal

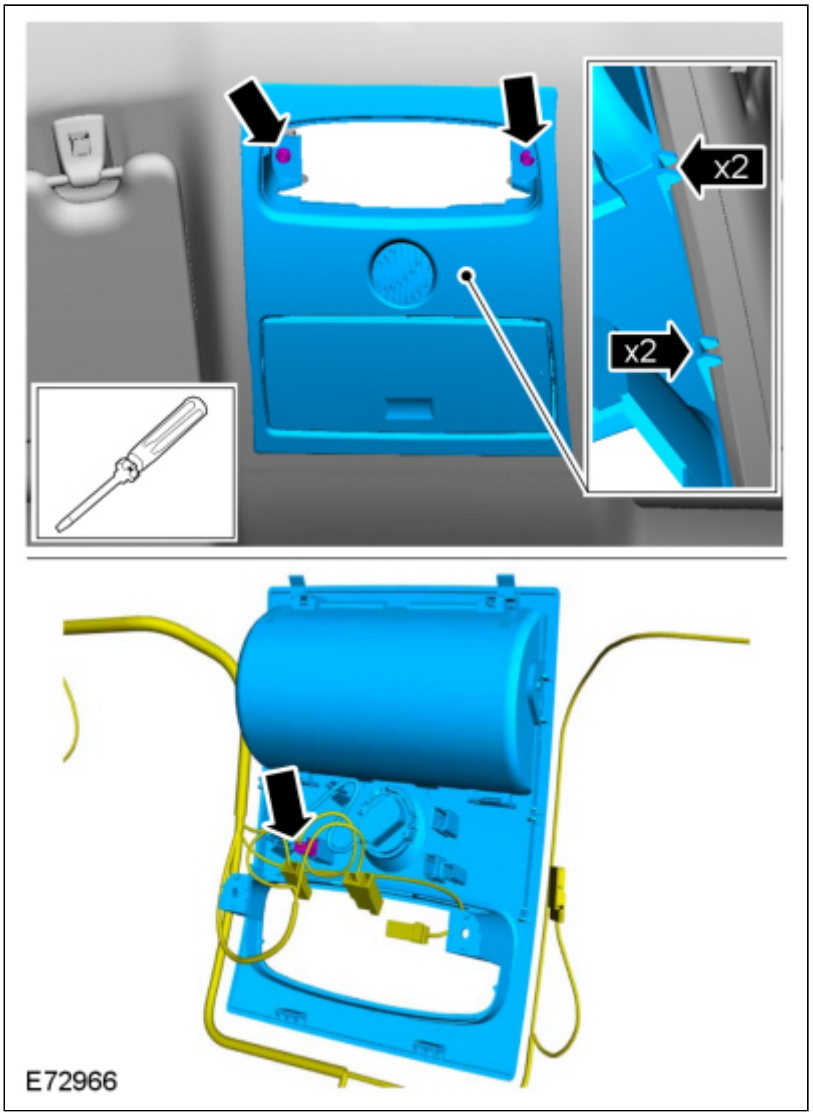
NOTE: *Removal steps in this procedure may contain installation details.*

1. On both sides.
   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation) .

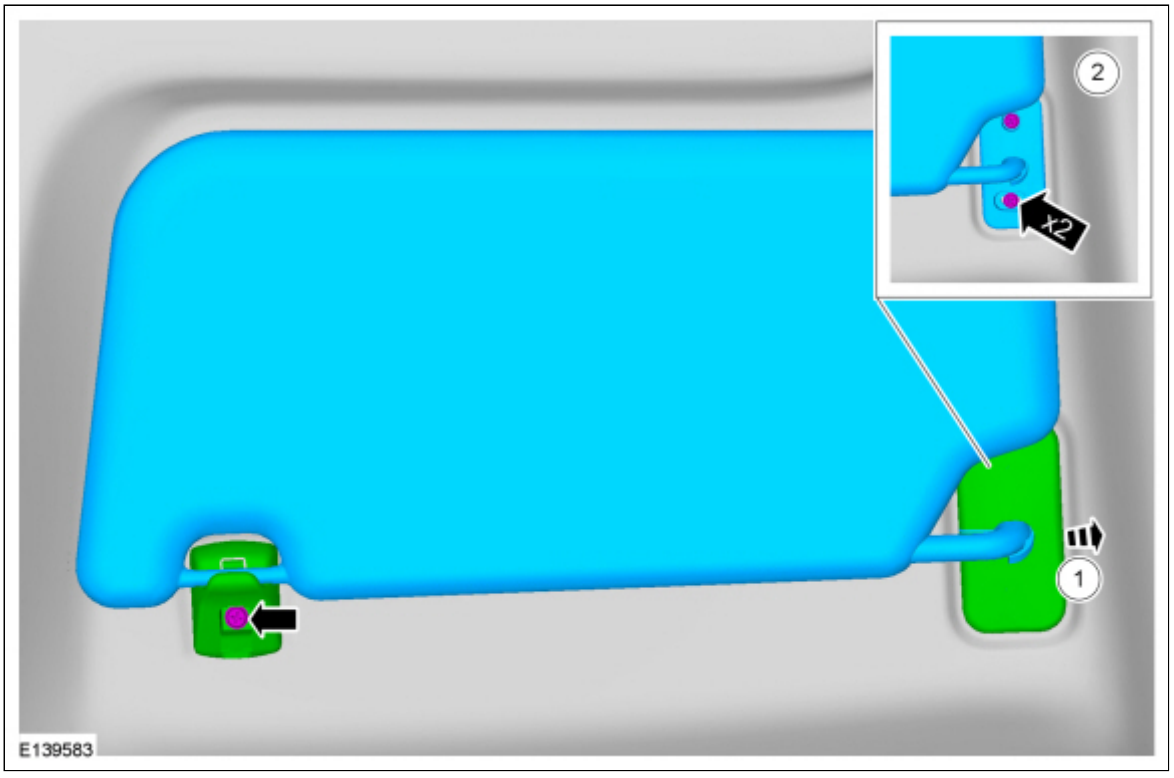
2. On both sides.
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation) .
   Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation) .

3. 

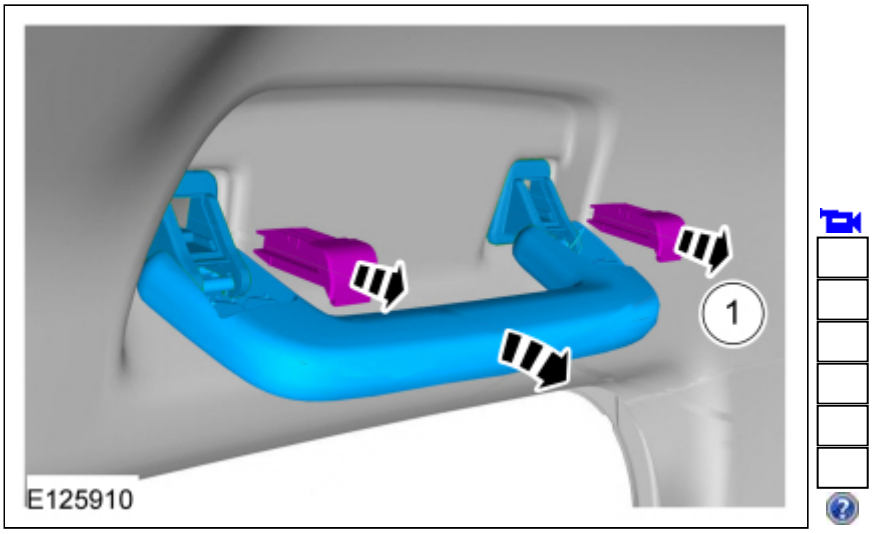
4. **NOTE:** *This step is not necessary when installing a new component.*



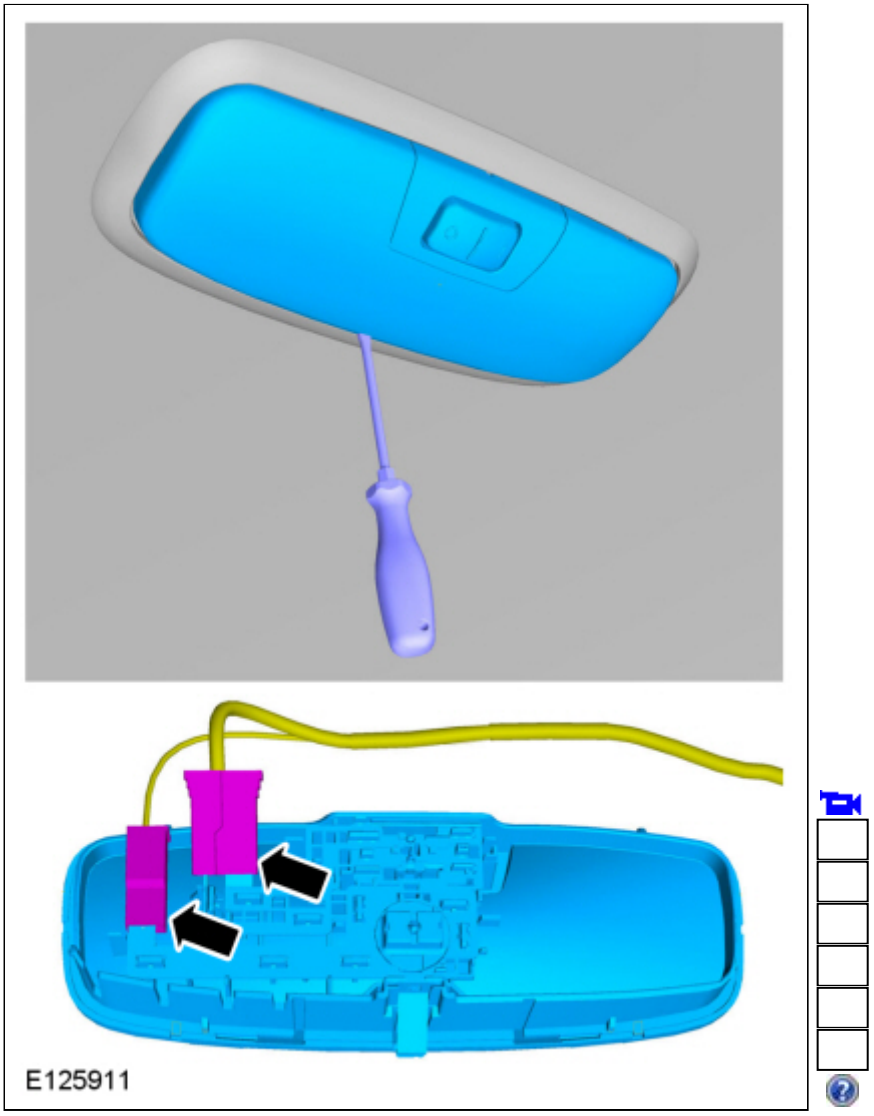
5. On both sides.



6.

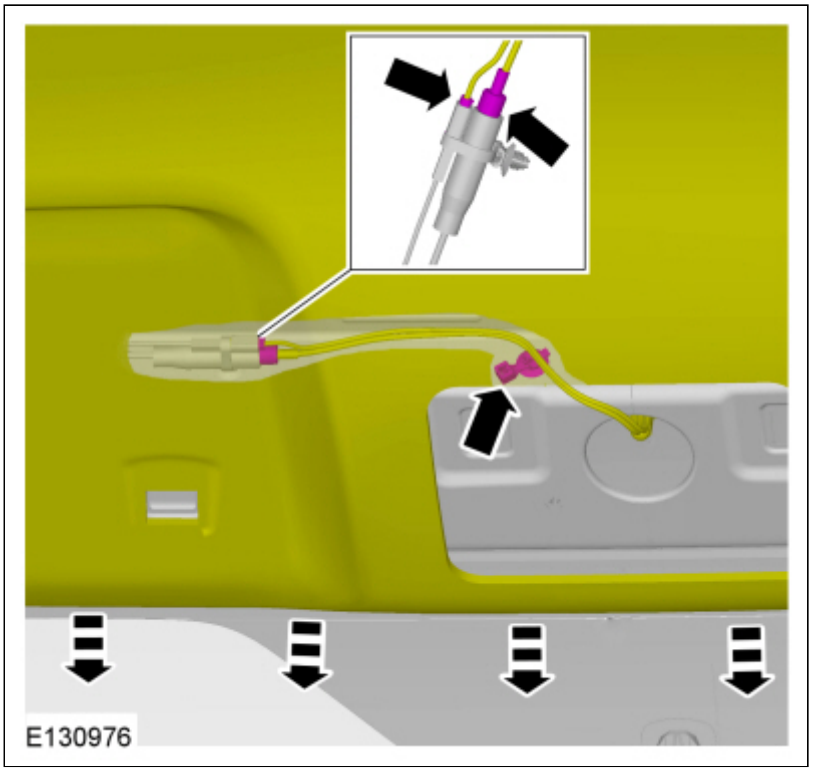


7.



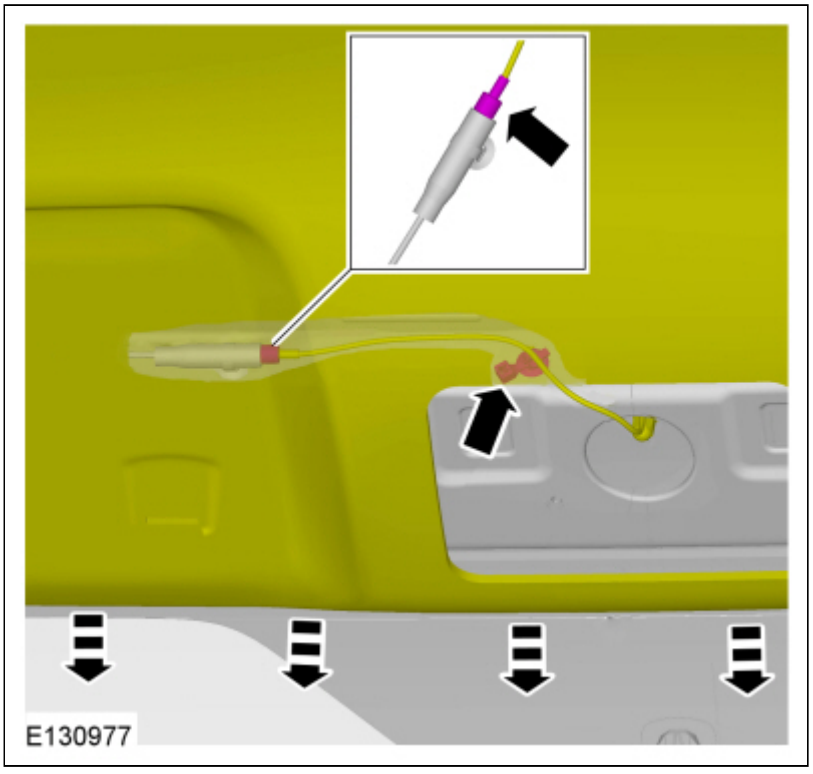
8. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*

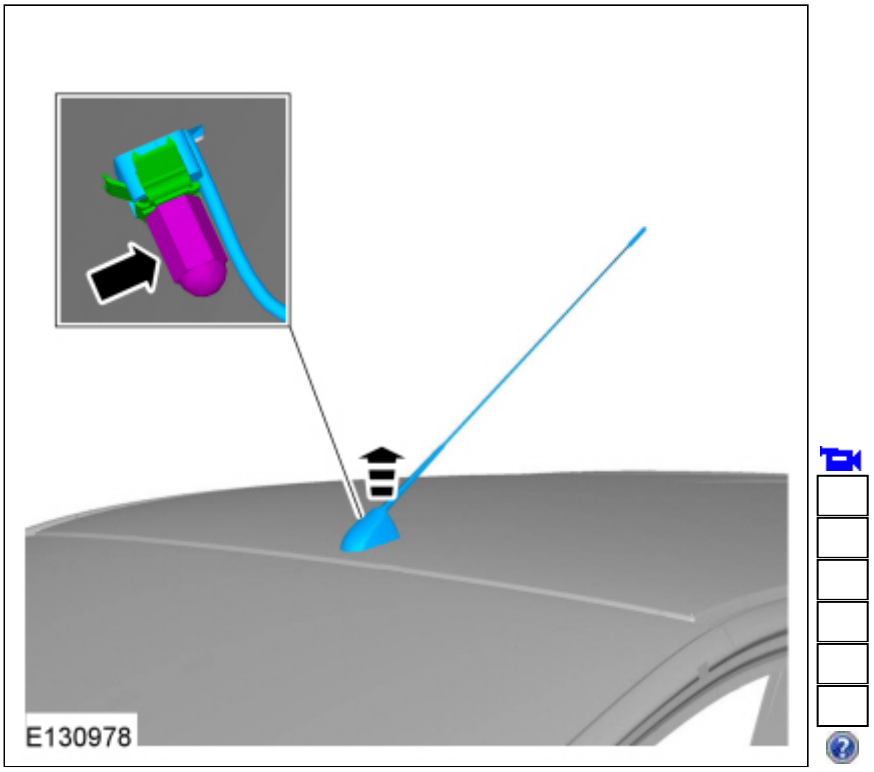


9. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*



10.



Installation

1. **NOTE:** *The antenna cable must be installed to the same routing as when removed.*

   To install, reverse the removal procedure.

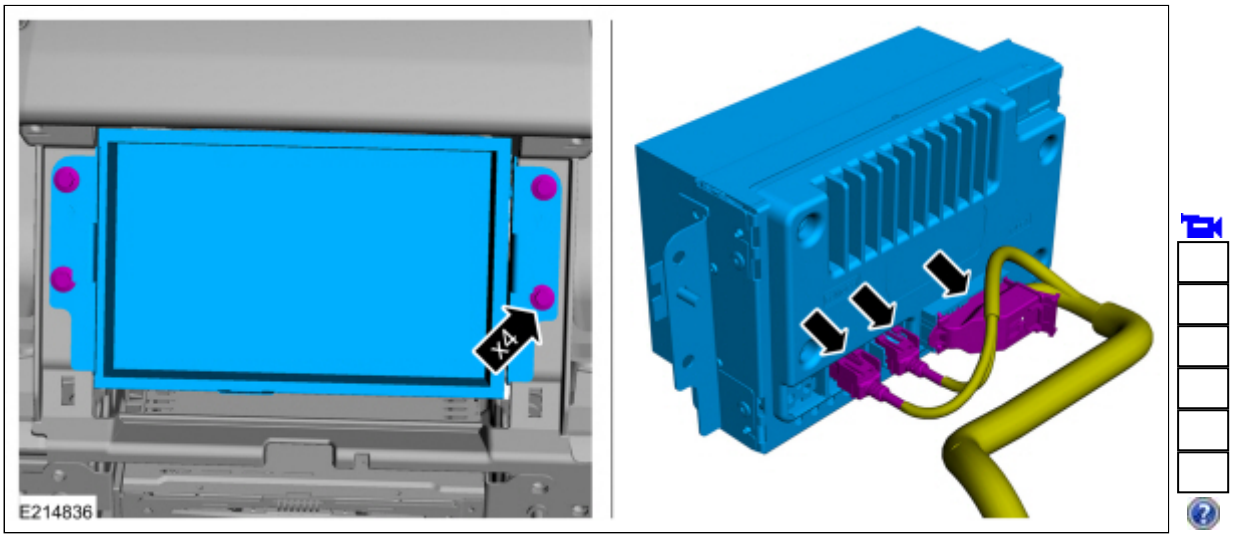
Copyright © 2016 Ford Motor Company

Front Control/Display Interface Module (FCDIM)

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*
2. Refer to: Front Controls Interface Module (FCIM) (415-00D) .
3. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the componet.*

   Using a diagnostic scan tool, complete the PMI process for the FCDIM following the on-screen instructions.

Copyright © 2016 Ford Motor Company

Front Controls Interface Module (FCIM)

Special Tool(s) / General Equipment

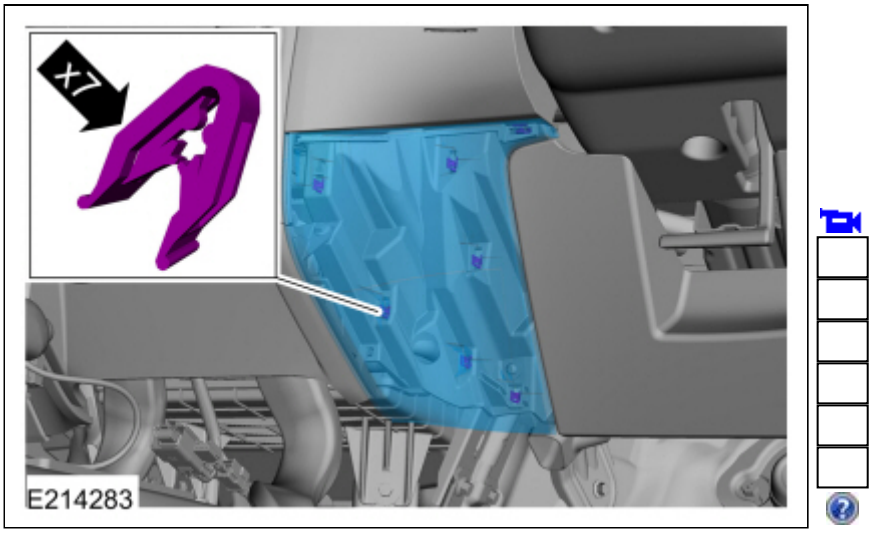
Interior Trim Remover

Removal

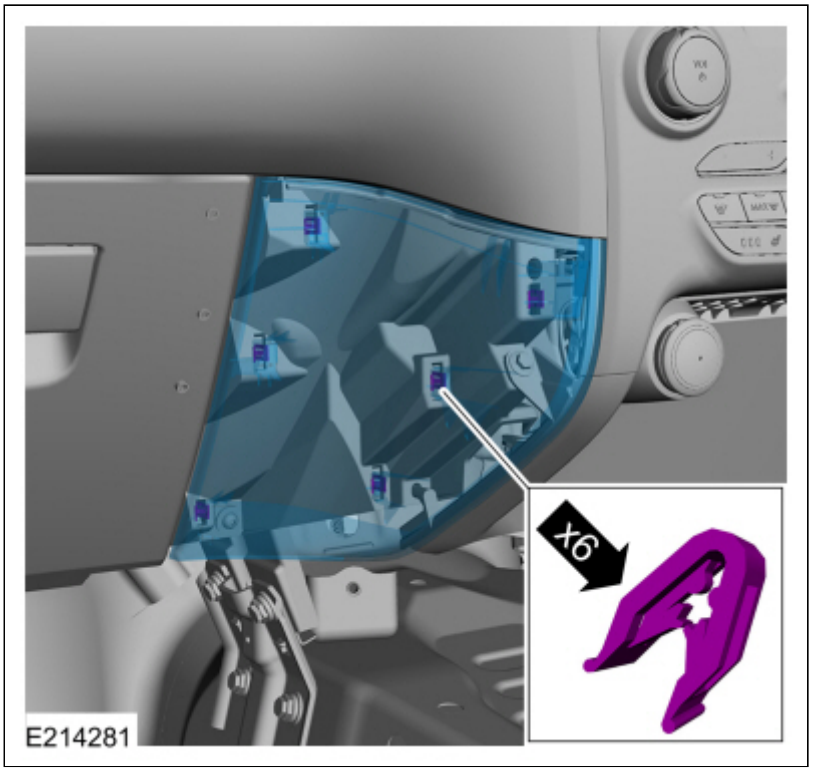
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

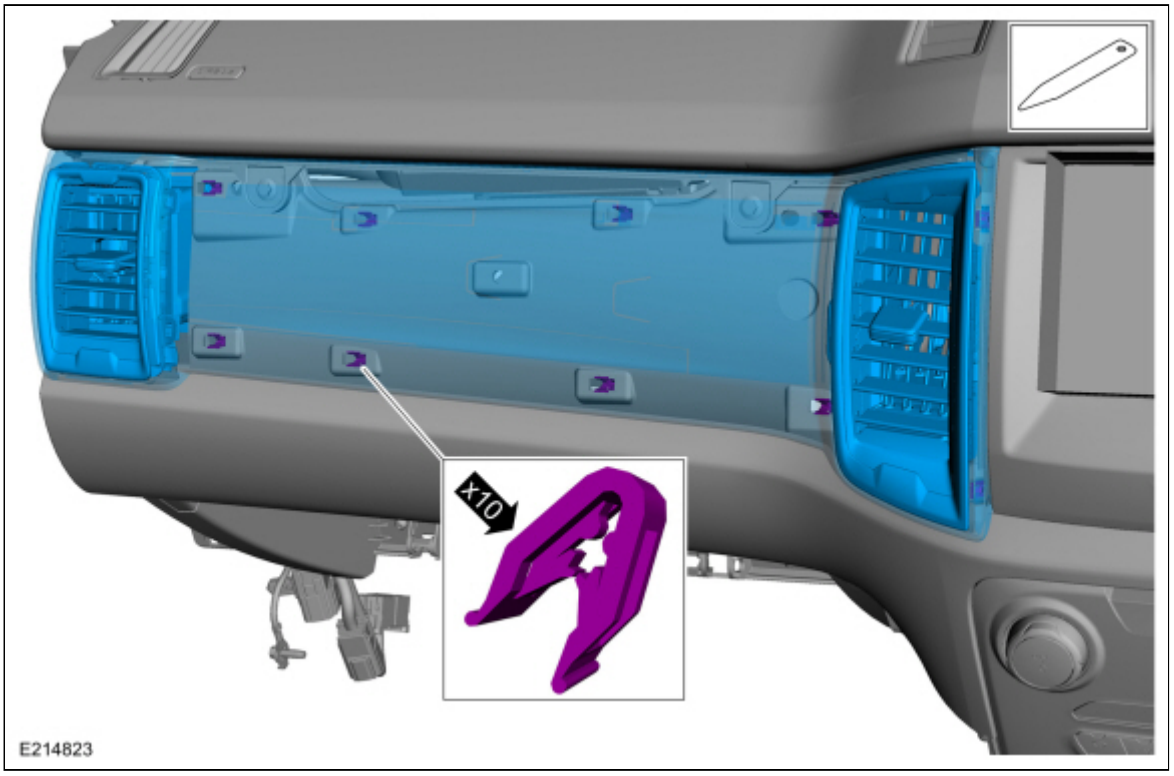
   Using a diagnostic scan tool, begin the PMI process for the FCIM following the on-screen instructions.

2. 

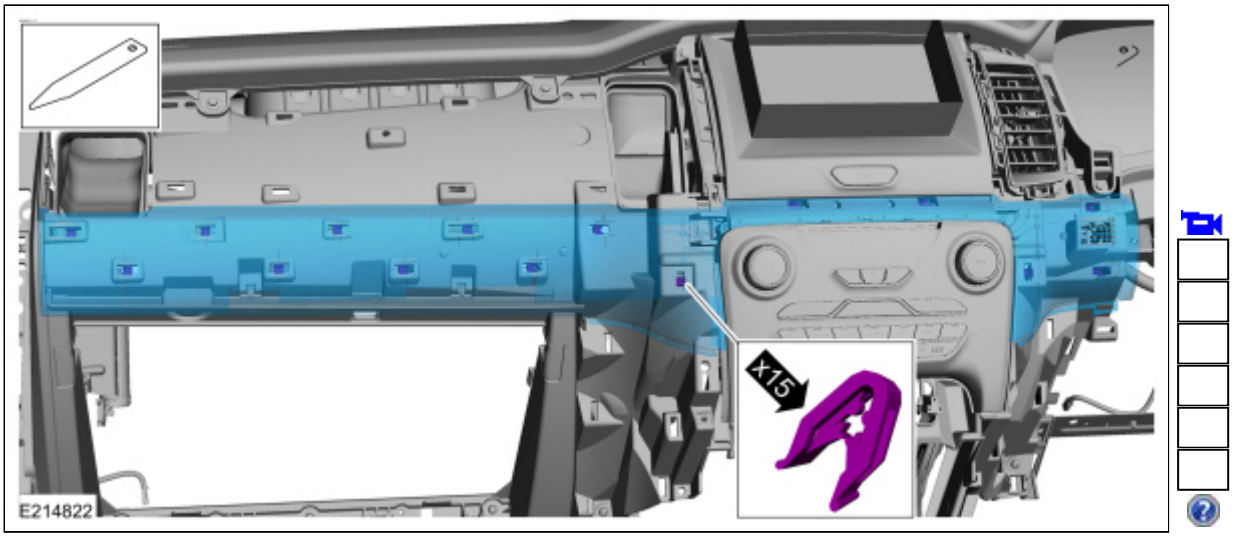
3.



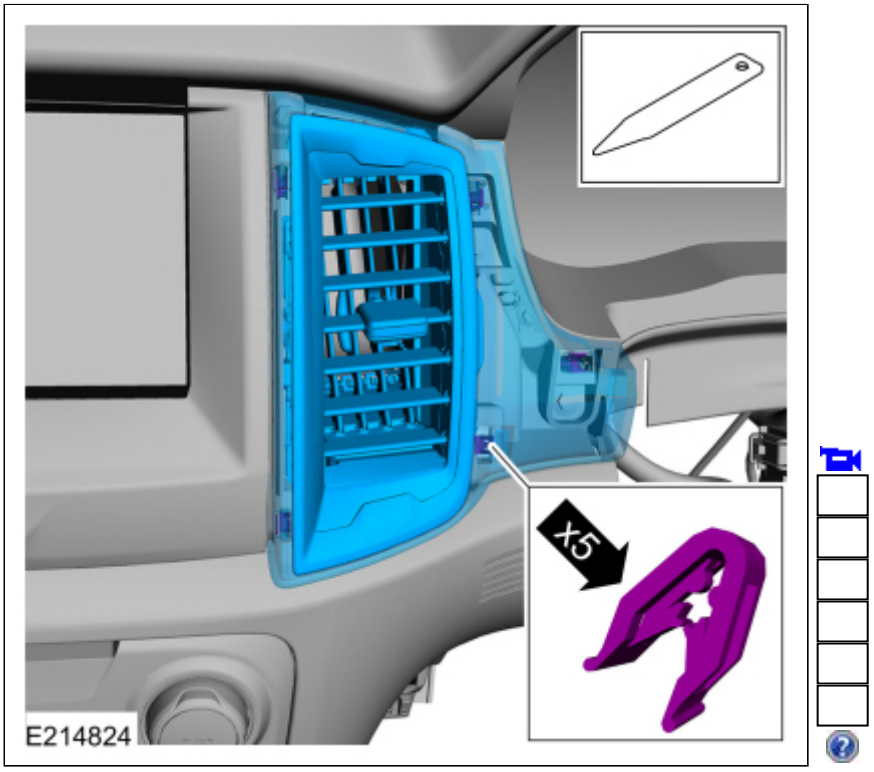
4. Use the General Equipment: Interior Trim Remover



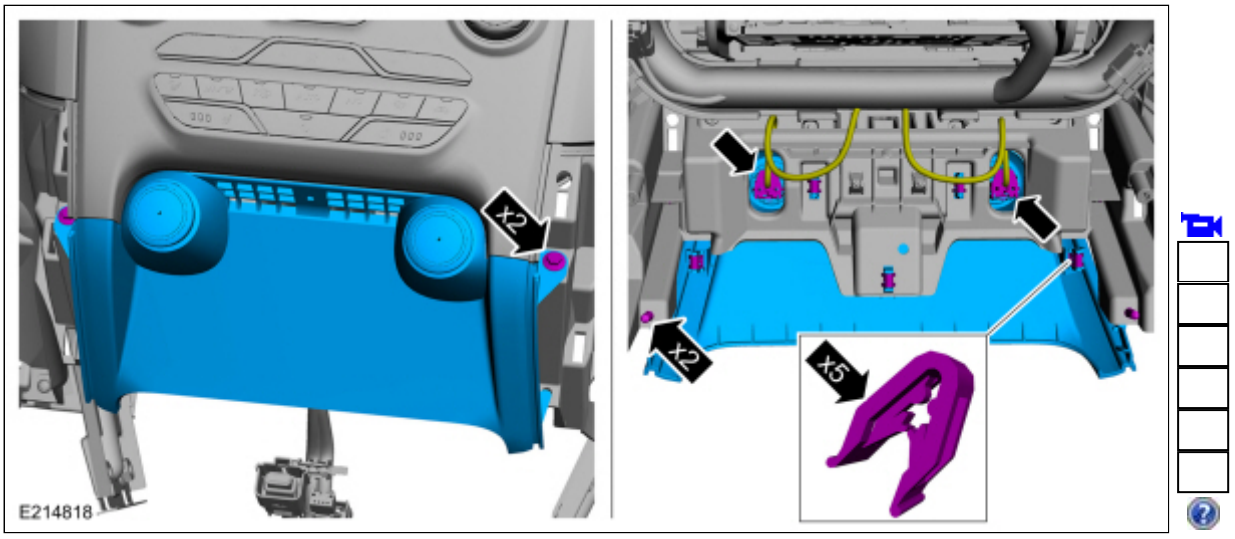
5. Use the General Equipment: Interior Trim Remover



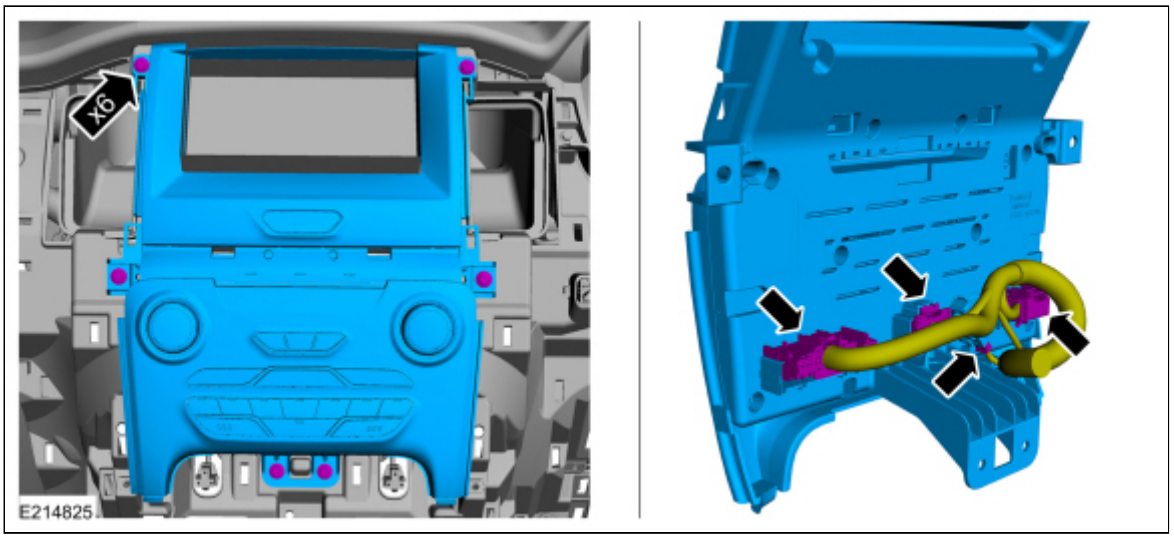
6. Use the General Equipment: Interior Trim Remover



7. *Torque*: 3 Nm



8. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the FCIM following the on-screen instructions.

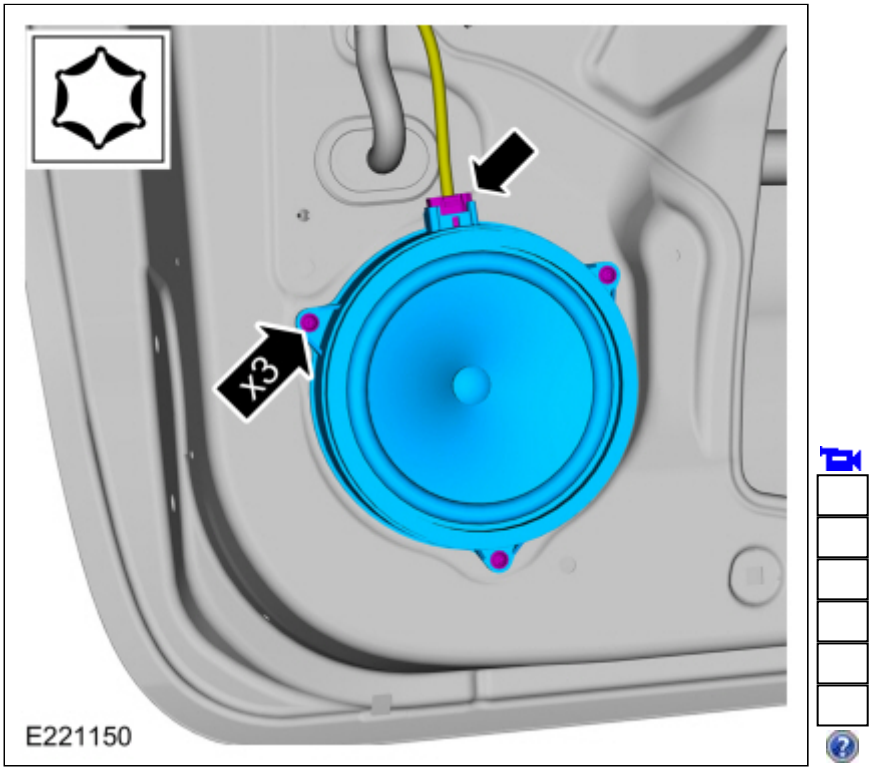
Copyright © 2016 Ford Motor Company

Front Door Speaker RH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

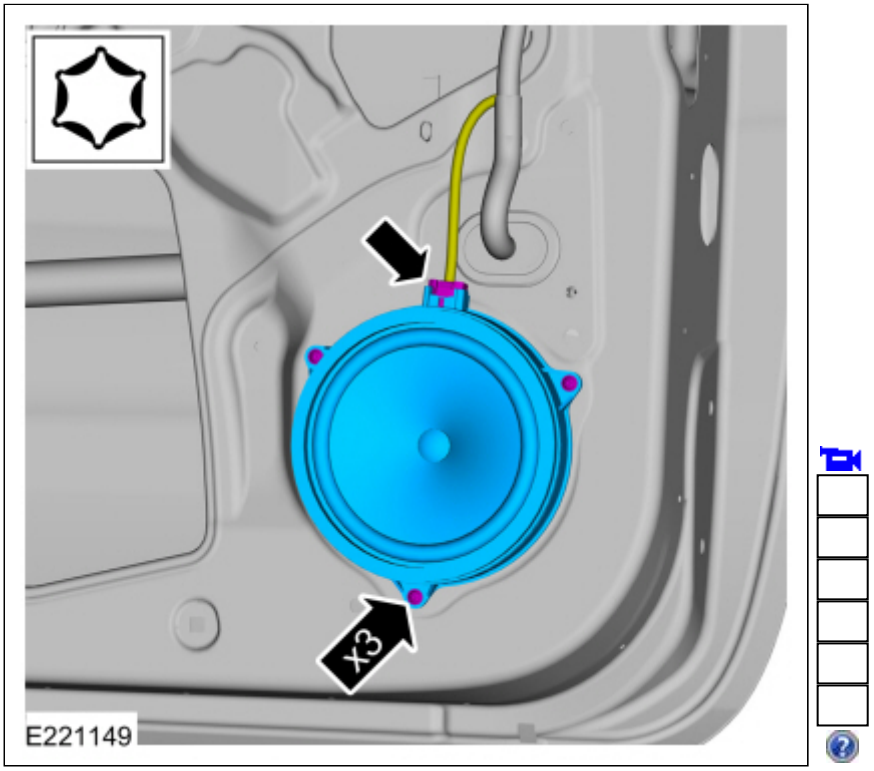
Copyright © 2016 Ford Motor Company

Front Door Speaker LH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

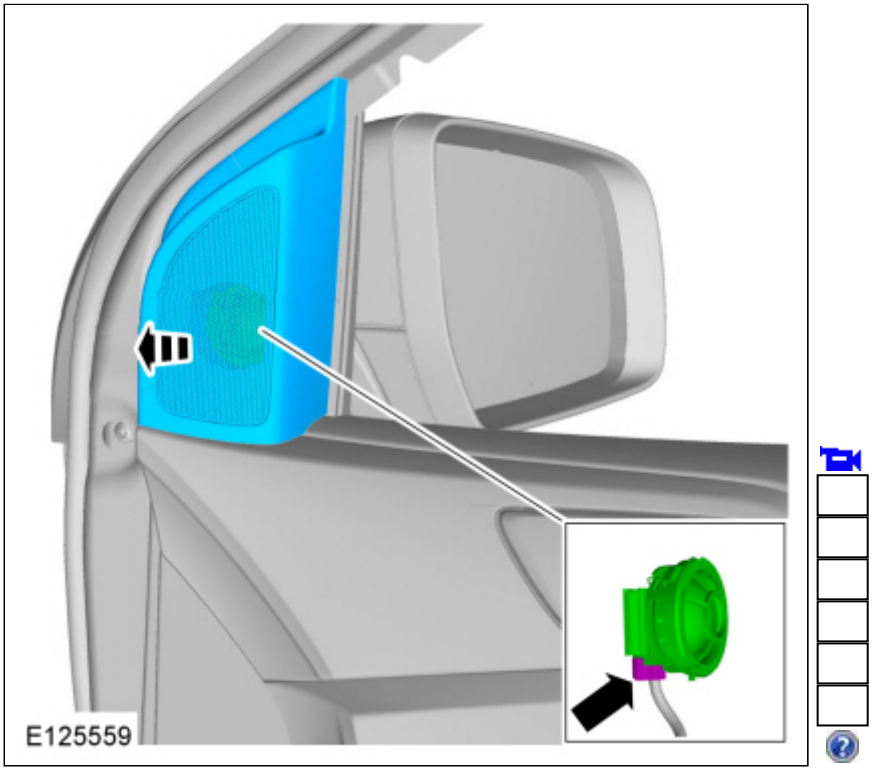
Copyright © 2016 Ford Motor Company

Front Door Tweeter Speaker

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2.



Installation

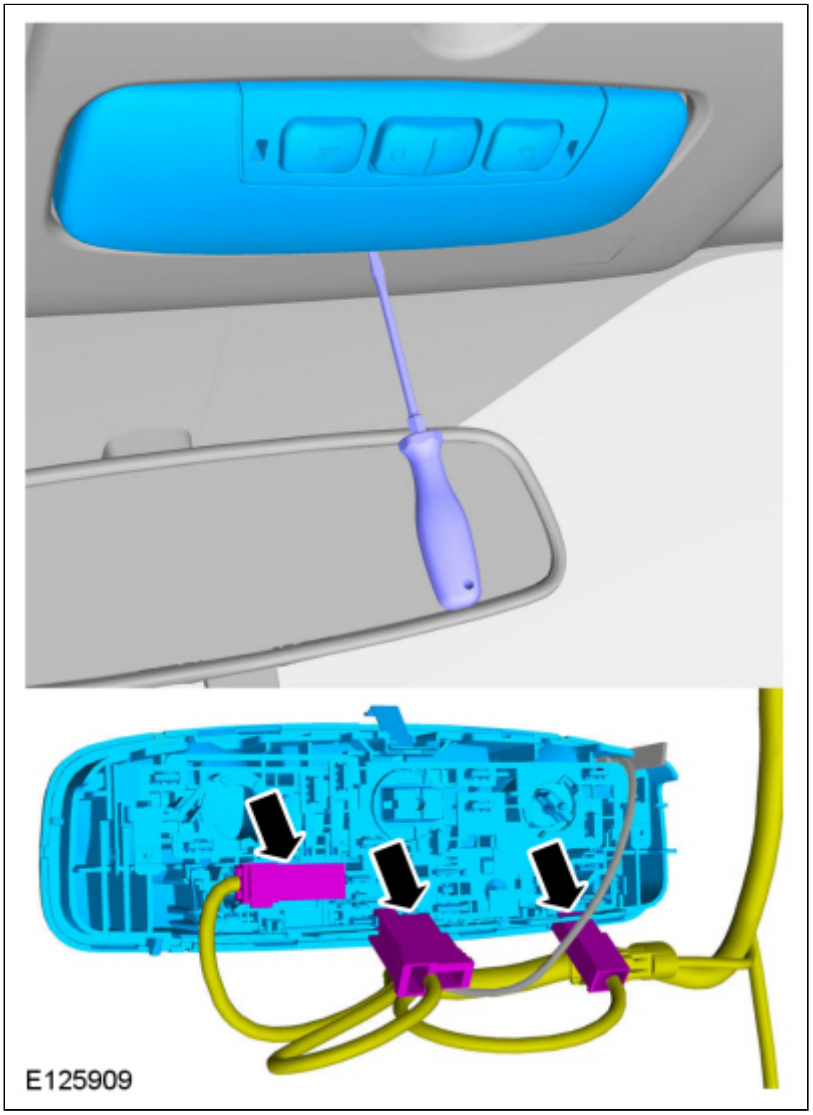
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

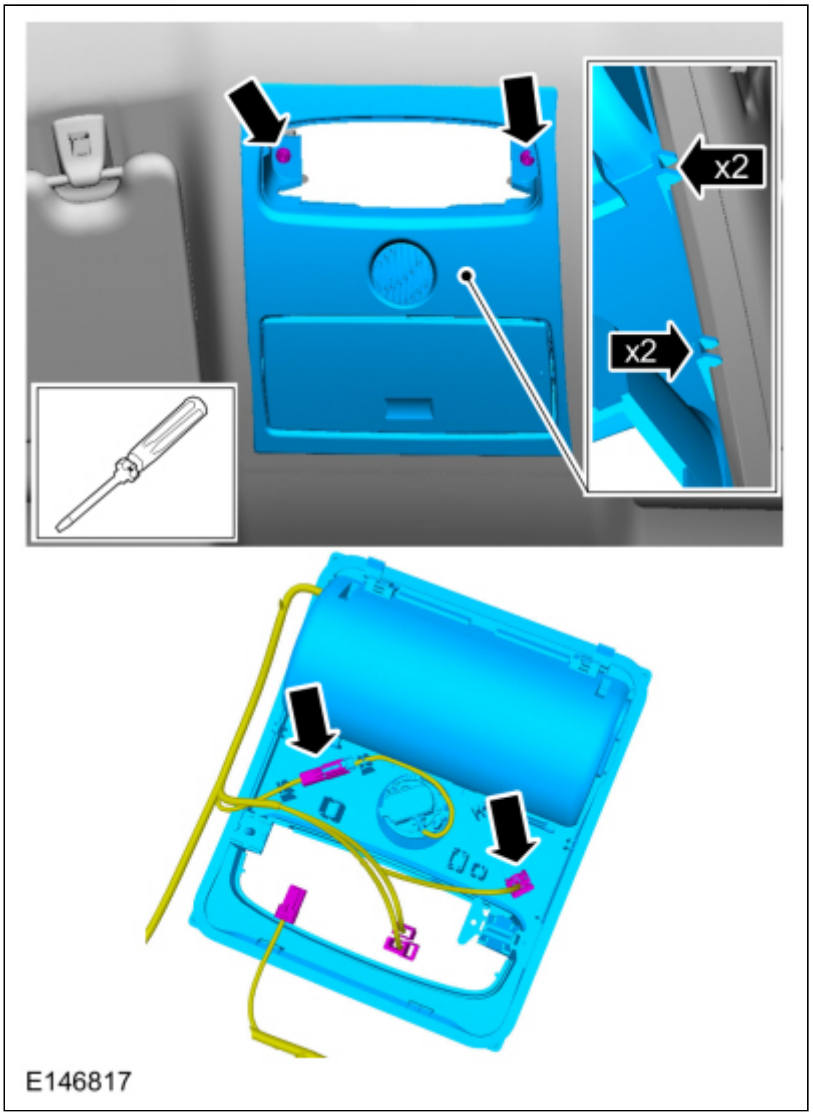
Microphone

Removal

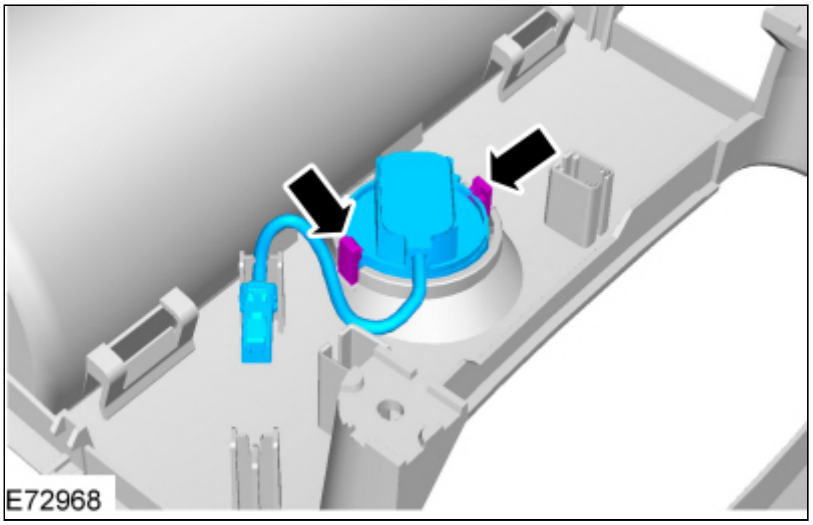
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3.



4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

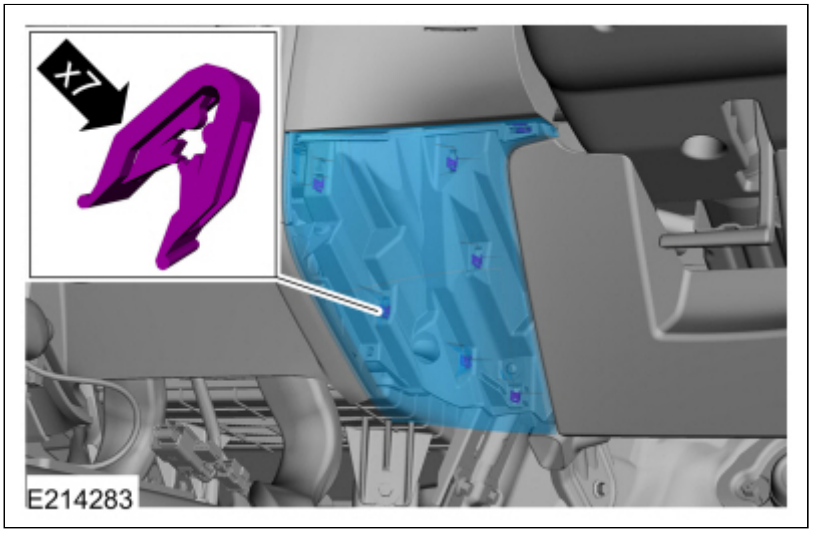
Media Hub

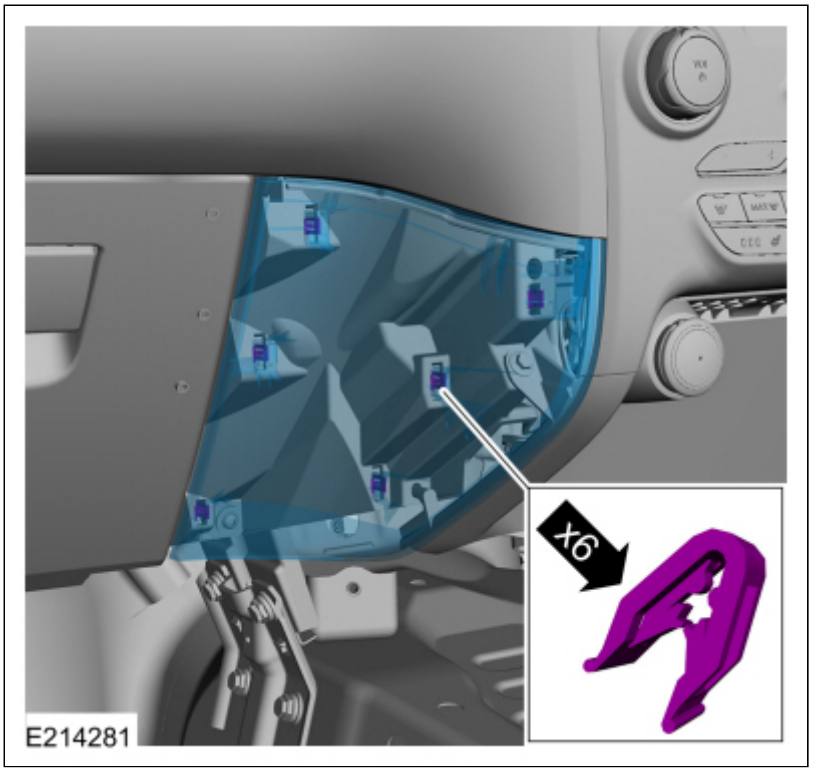
Special Tool(s) / General Equipment

Interior Trim Remover

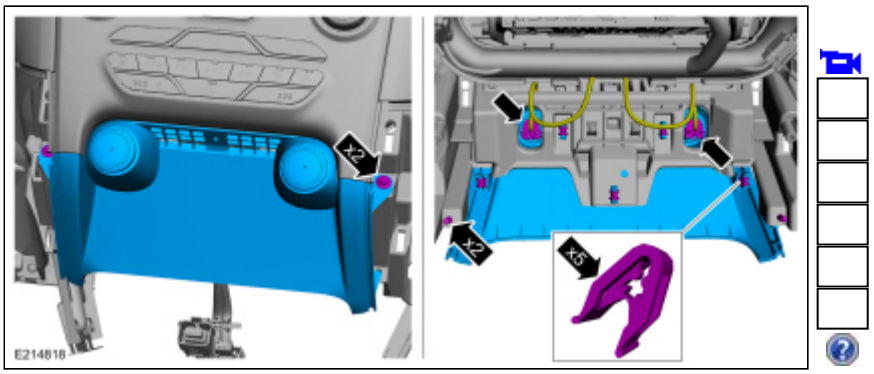
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

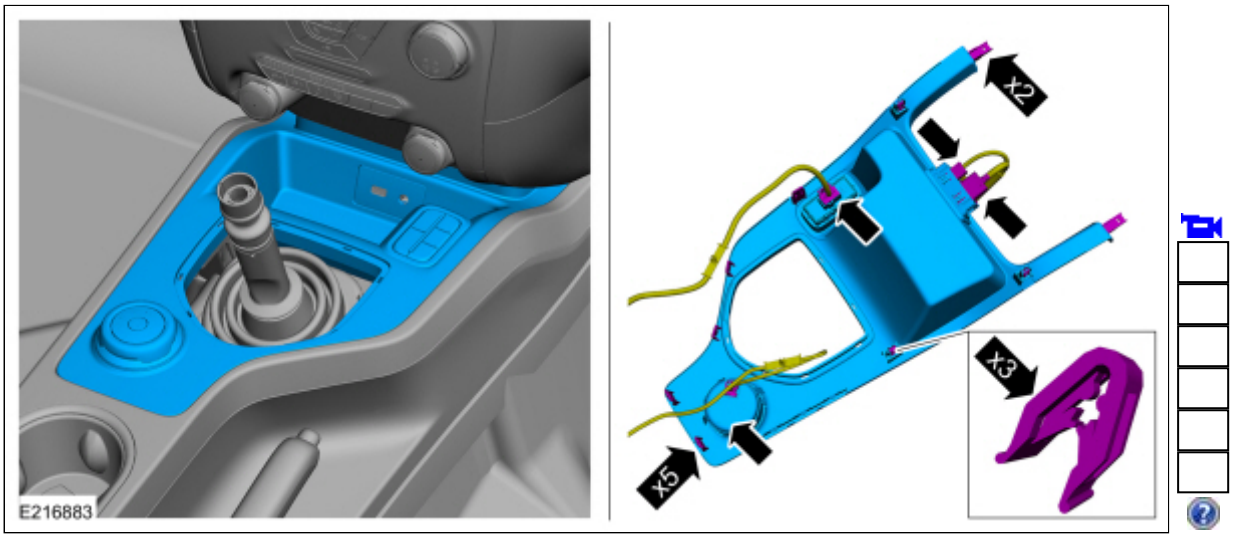
3. 

4.



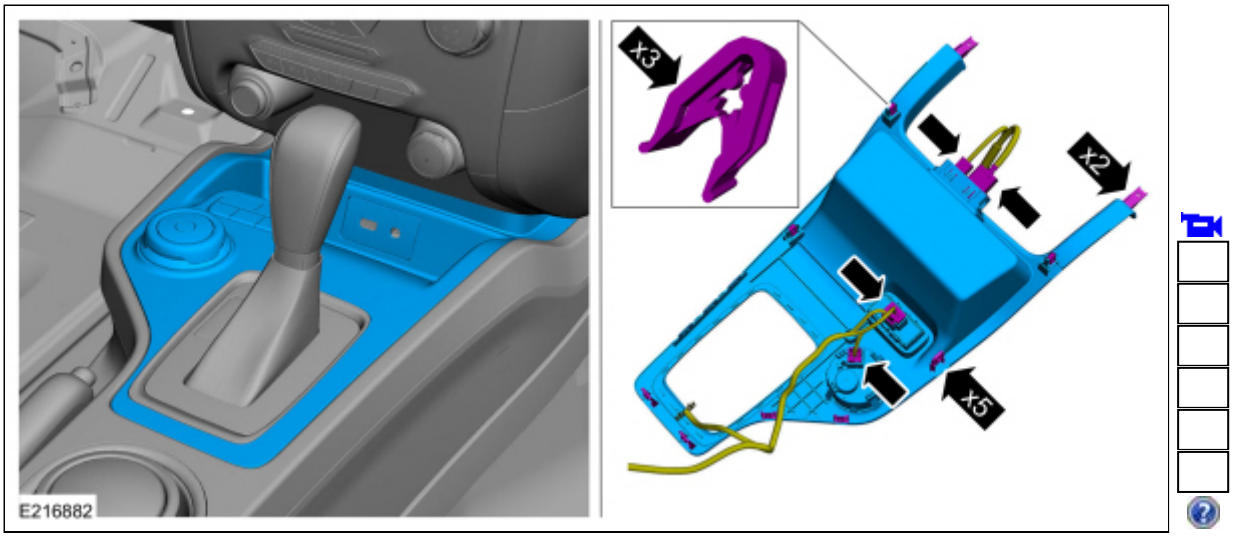
6-Speed Manual Transmission - MT82

5. Refer to: Gearshift Lever Boot (308-06) .
6.



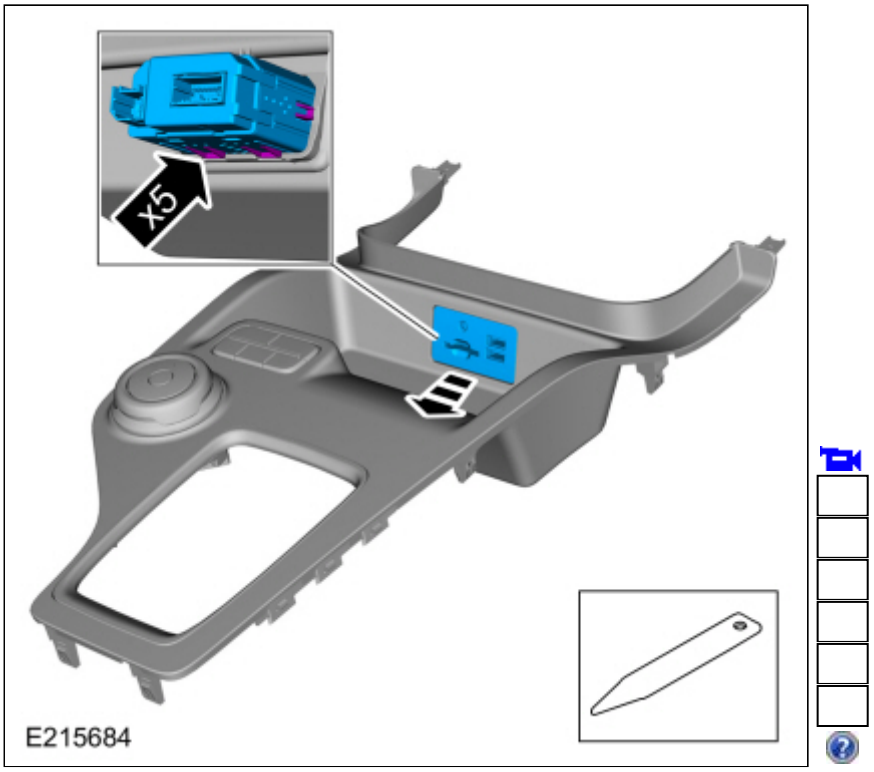
6-Speed Automatic Transmission - 6R80

7.



All vehicles

8. Use the General Equipment: Interior Trim Remover



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker LH

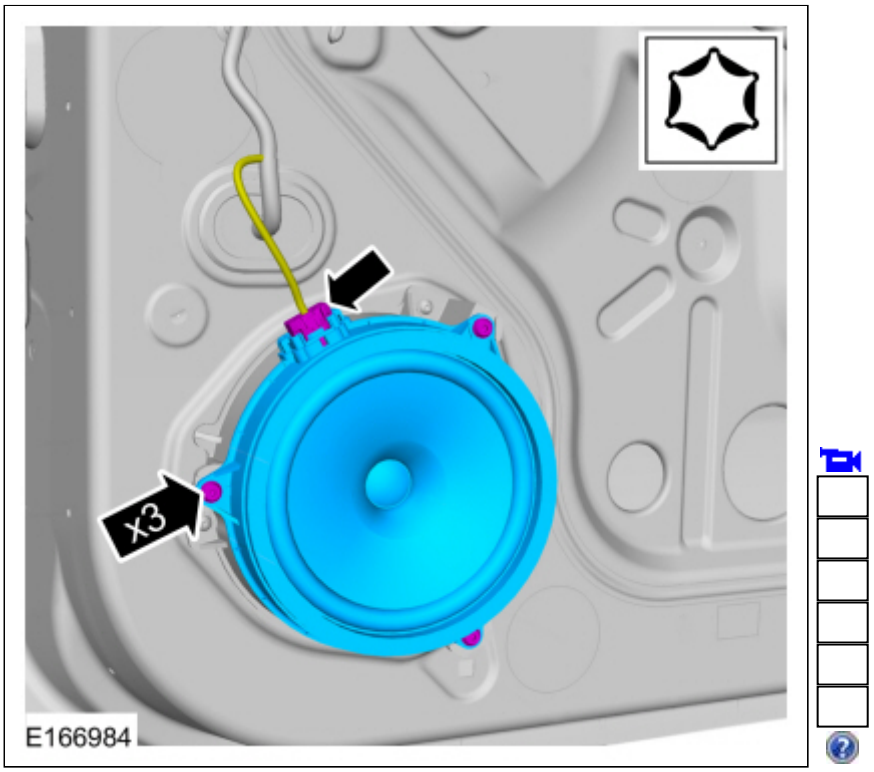
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

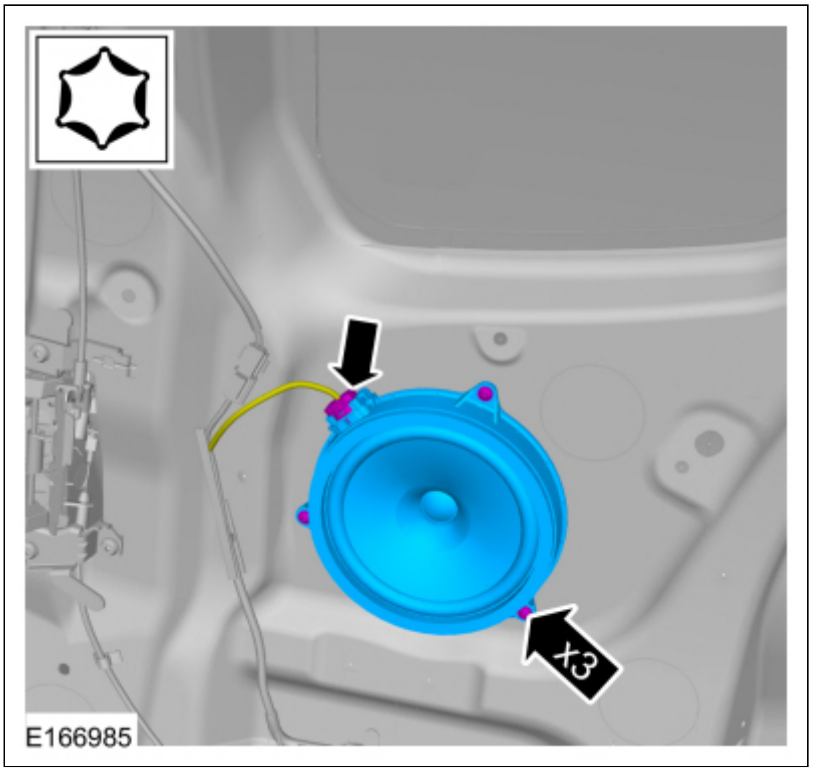
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker RH

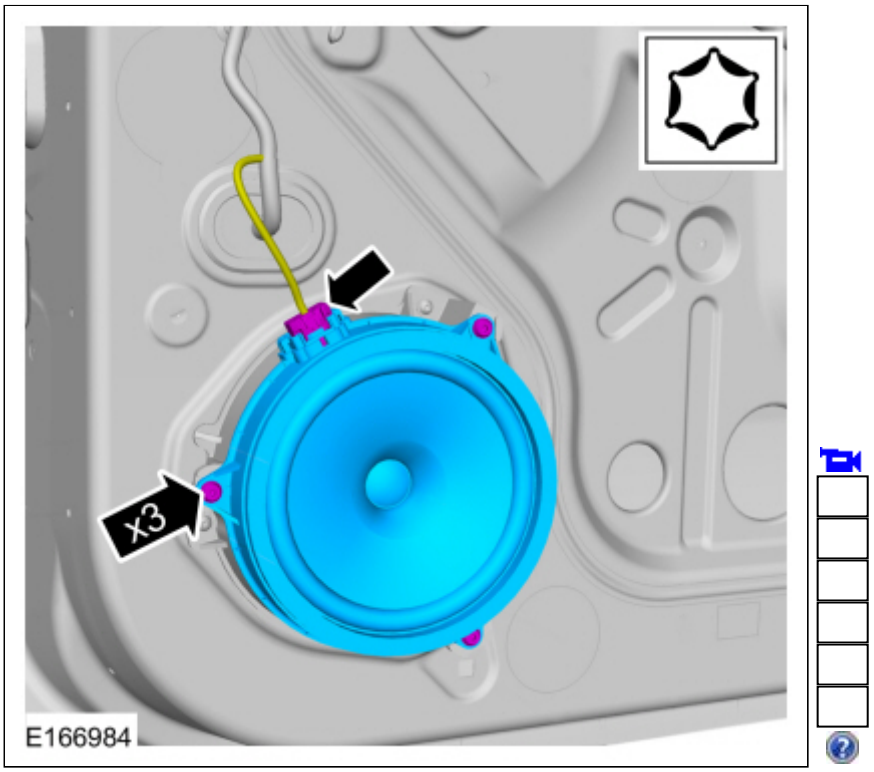
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

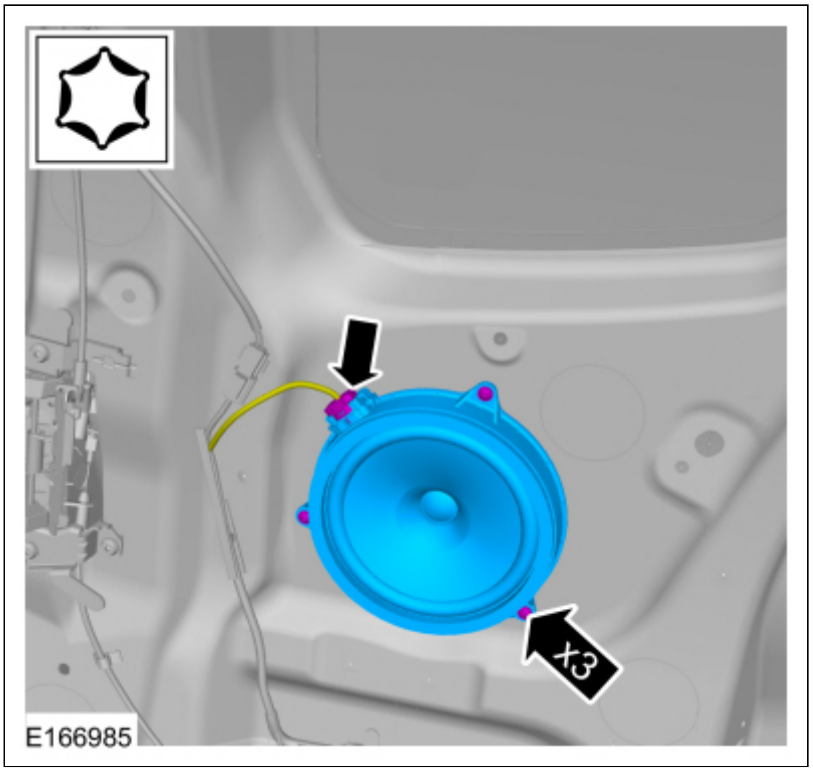
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

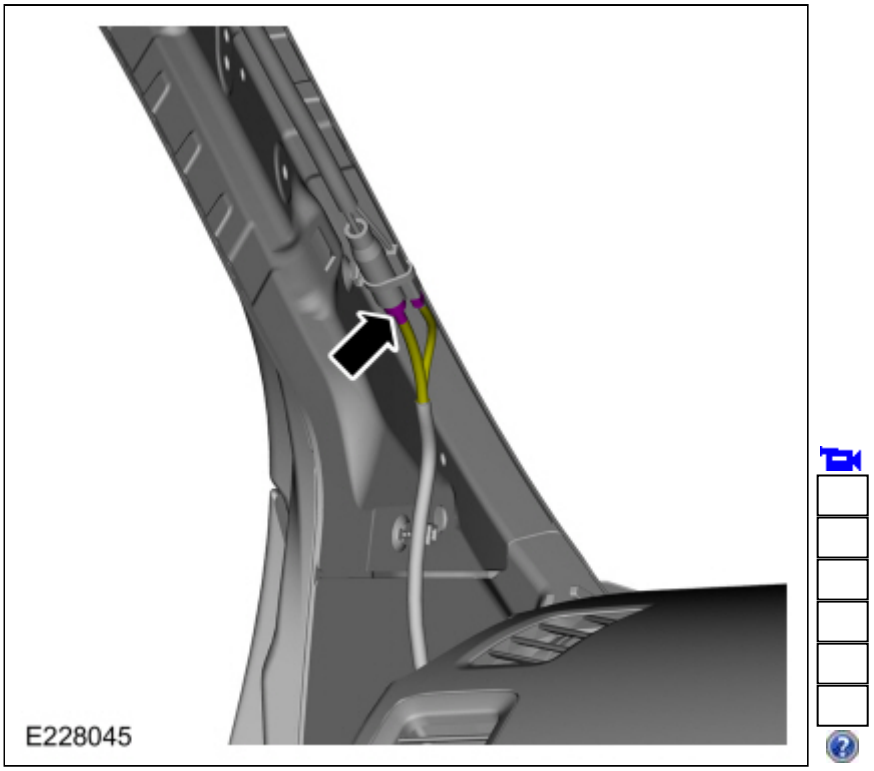
Satellite Radio Antenna Cable

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01) .
2. Refer to: Audio Front Control Module (ACM) (415-00B) .
3. Refer to: Glove Compartment (501-12) .
4. Refer to: A-Pillar Trim Panel (501-05) .
5. **NOTE:** *This procedure refers to add a cable into the wiring harness; the original cable is part of the wiring harness and remains in the vehicle.*

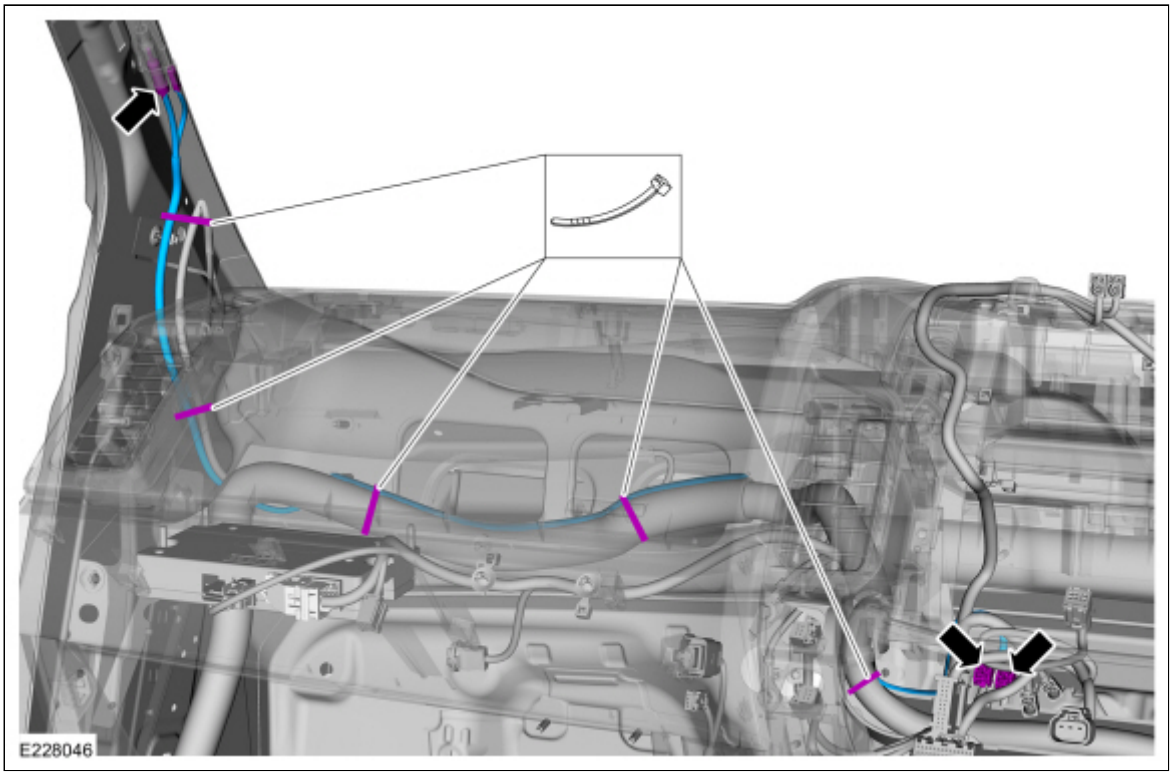
   NOTE: *Cut both ends of the original cable.*



Installation

NOTE: *Make sure that the wiring harnesses are correctly located.*

1. Connect the new cable.



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM]

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Display Interface Module (FDIM) (415-00D) .

Installation

1. To install, reverse the removal procedure.
2. If a new APIM is being installed, program the APIM to the correct software level.
   Refer to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

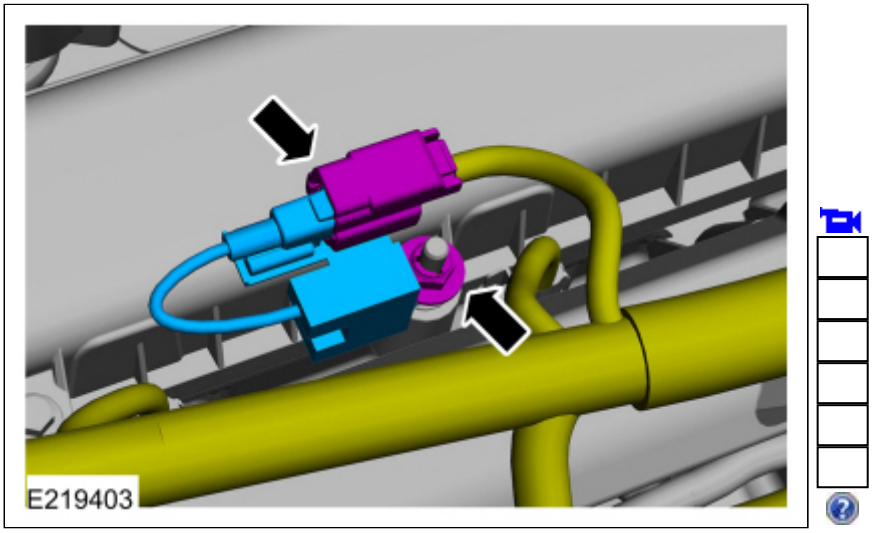
Copyright © 2016 Ford Motor Company

Noise Suppression Filter

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. *Torque*: 9 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

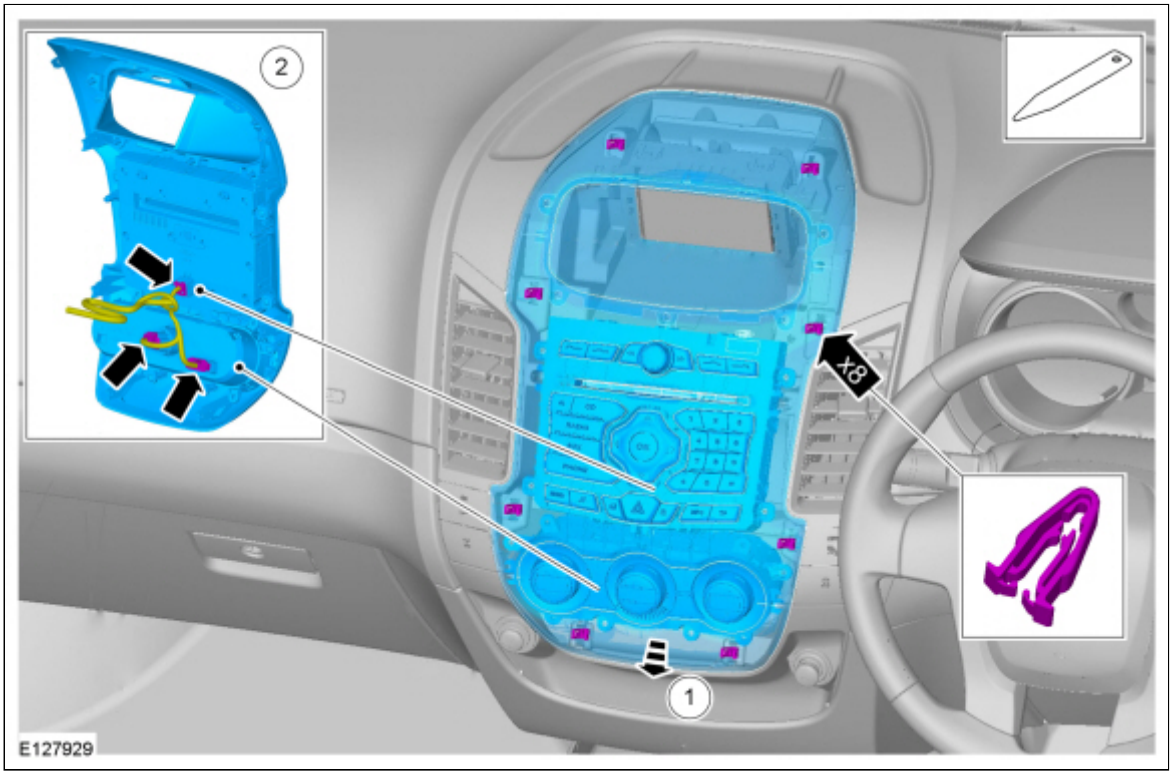
SYNC Module [APIM] to Universal Serial Bus (USB) Port Cable

Special Tool(s) / General Equipment

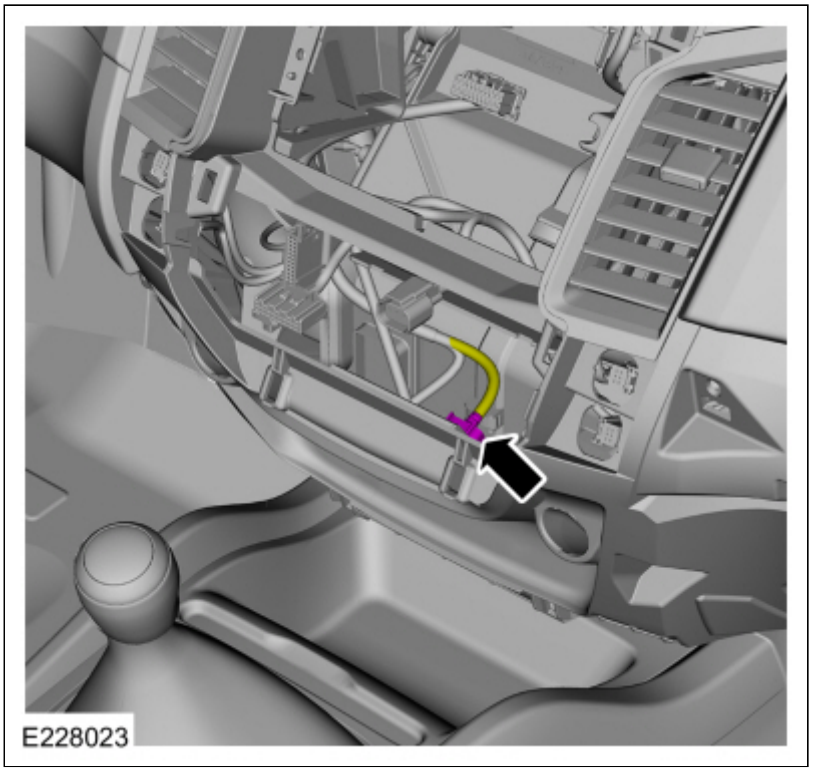
Ford Diagnostic Equipment

Removal

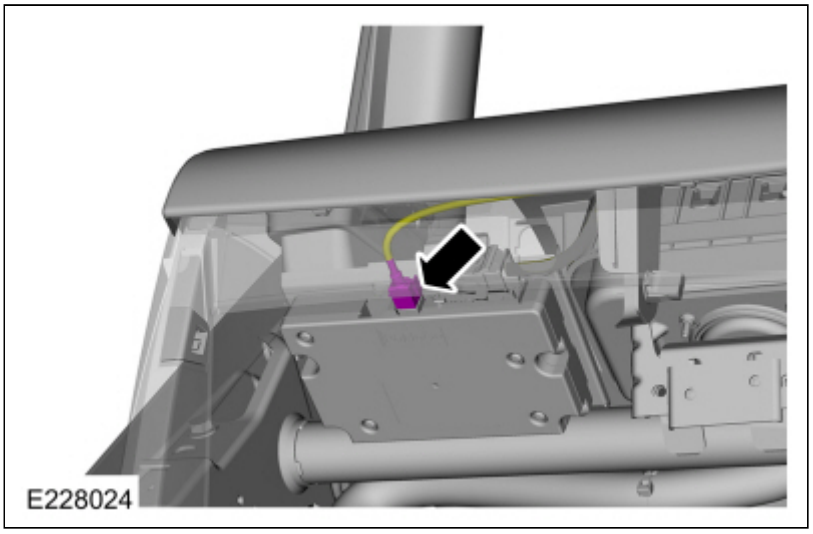
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01) .
2. 

3. Strap the unplugged connector to the wiring.

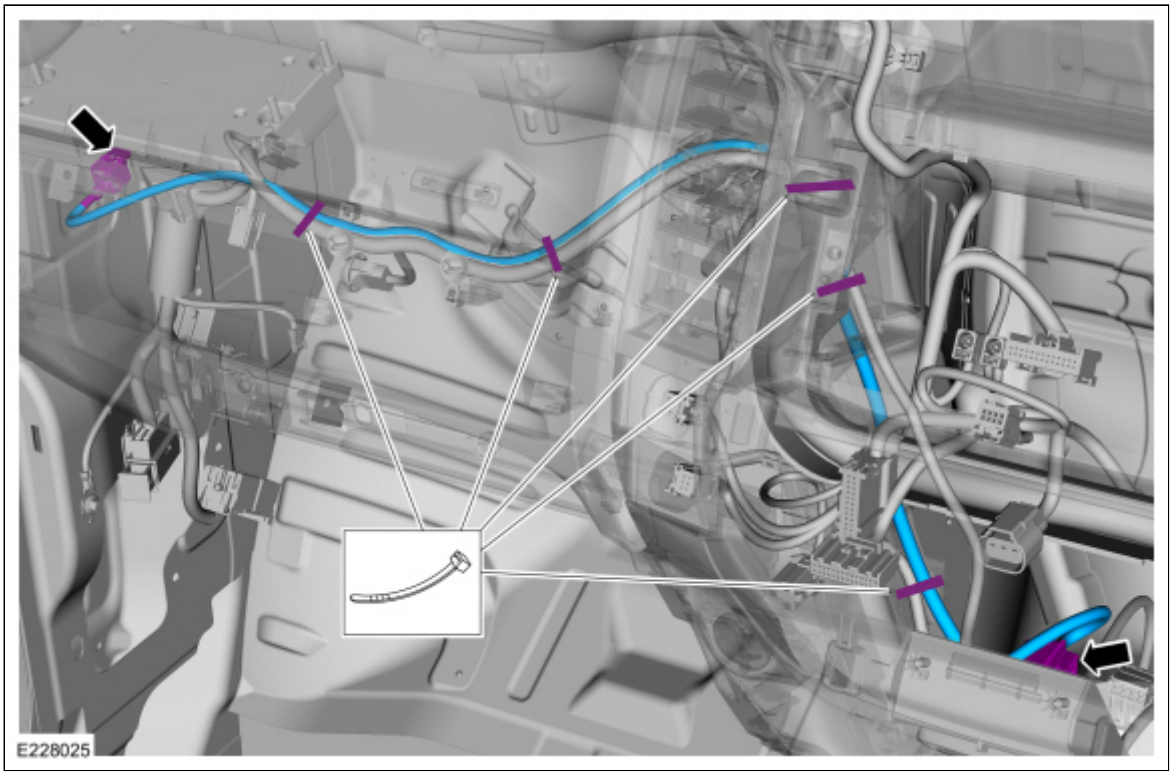


4. Refer to: Glove Compartment (501-12) .
5. Strap the unplugged connector to the wiring.



Installation

1. Connect the new cable.



2. To install, reverse the removal procedure.

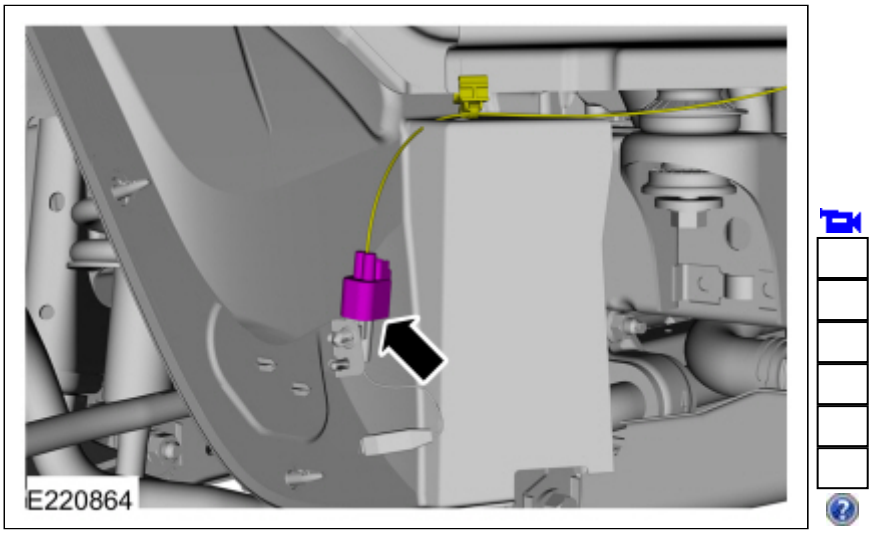
3. **NOTE:** *This step is only necessary when installing a new component.*

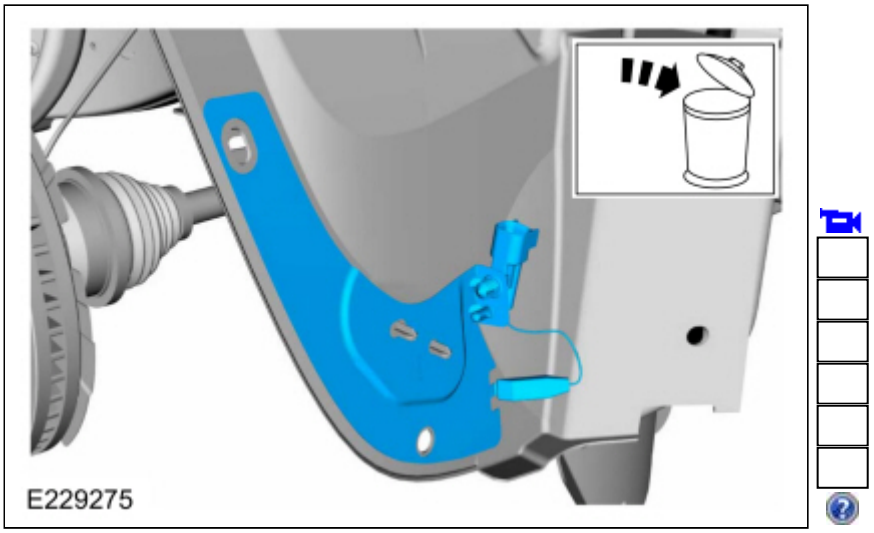
   Upload the FCDIM configuration information into the FCDIM, using the Programmable Modules Installation routine.
   Refer to: Programmable Module Installation (PMI) (418-01) .
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Front Fender Mounted Antenna

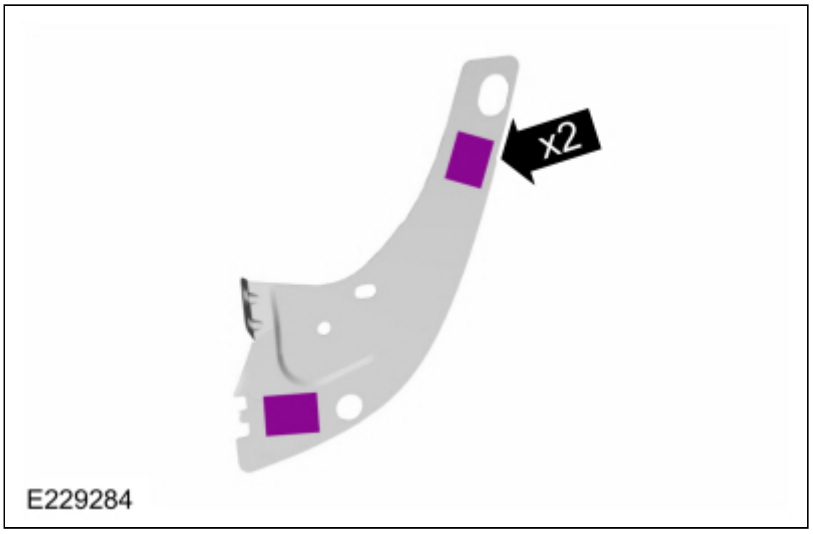
Removal

1. Refer to: Front Bumper Cover (501-19) .
2. 

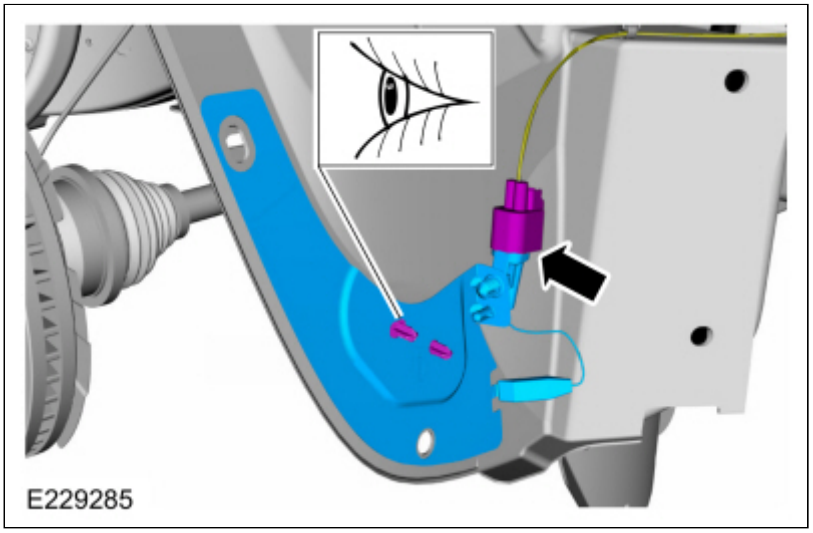
3. 

Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. **NOTE:** *Make sure that the installation marks are aligned.*



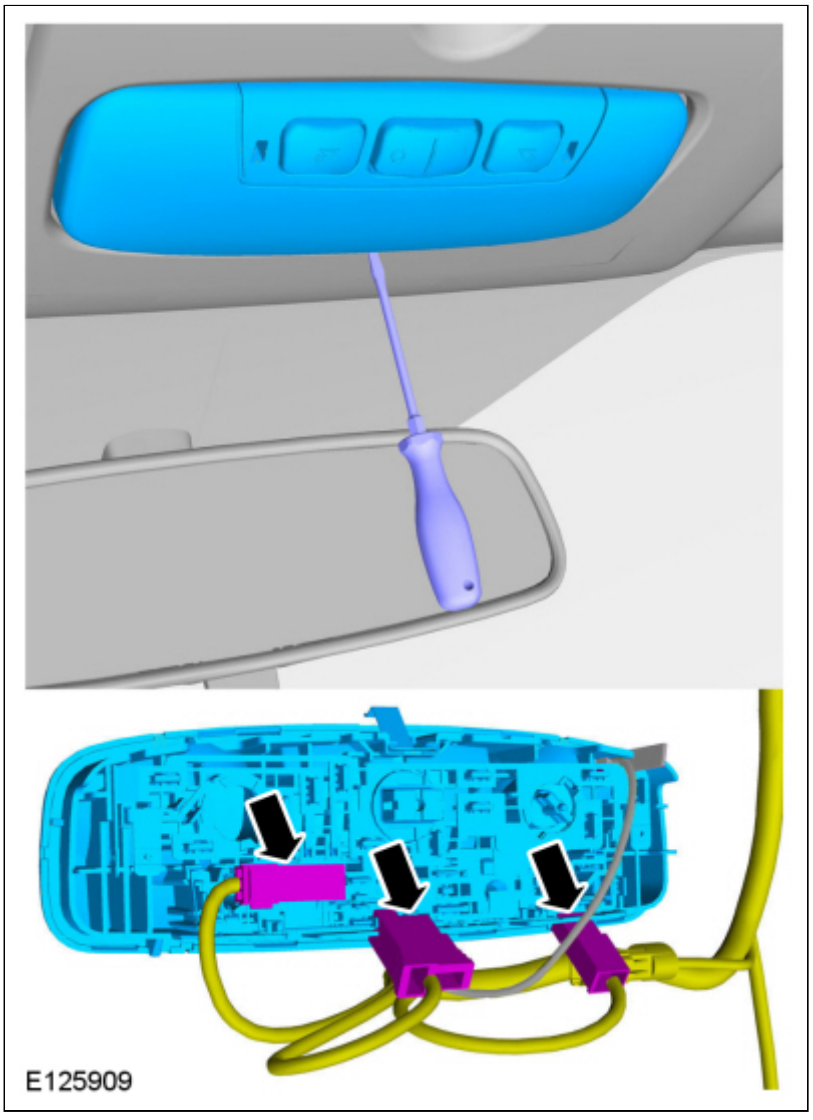
3. Refer to: Front Bumper Cover (501-19) .

Copyright © 2016 Ford Motor Company

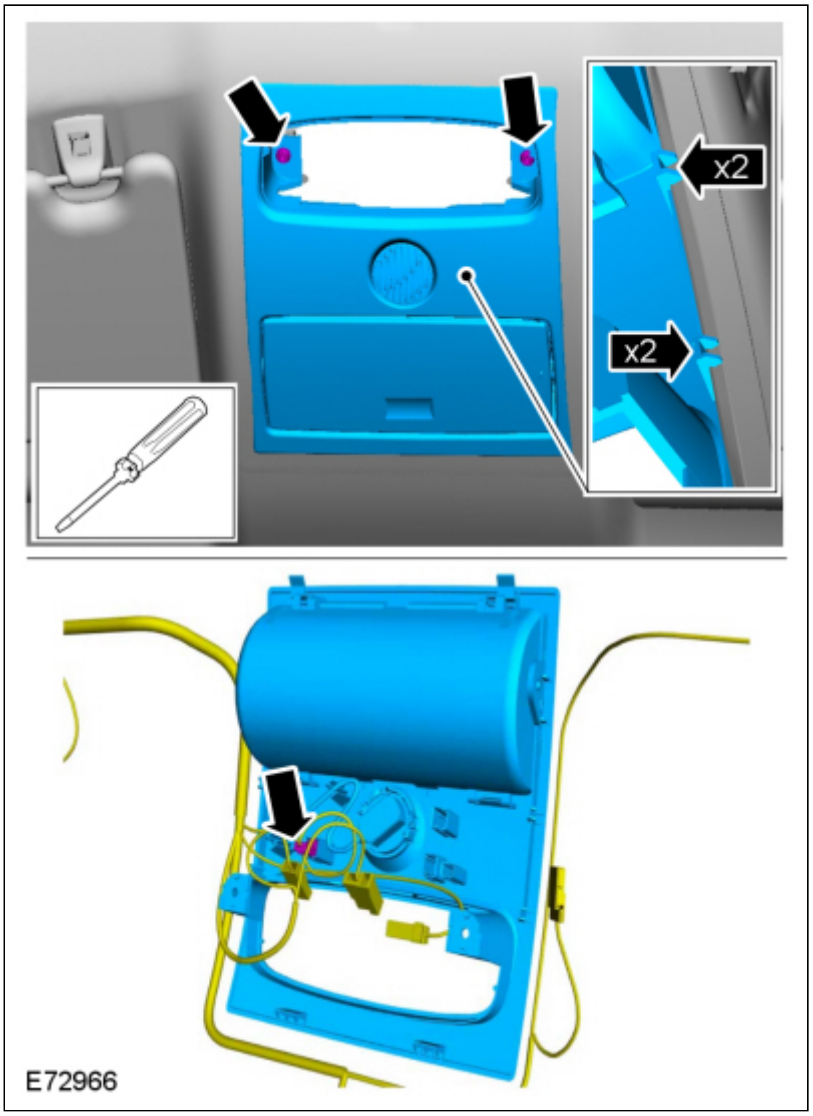
Roof Mounted Antenna

Removal

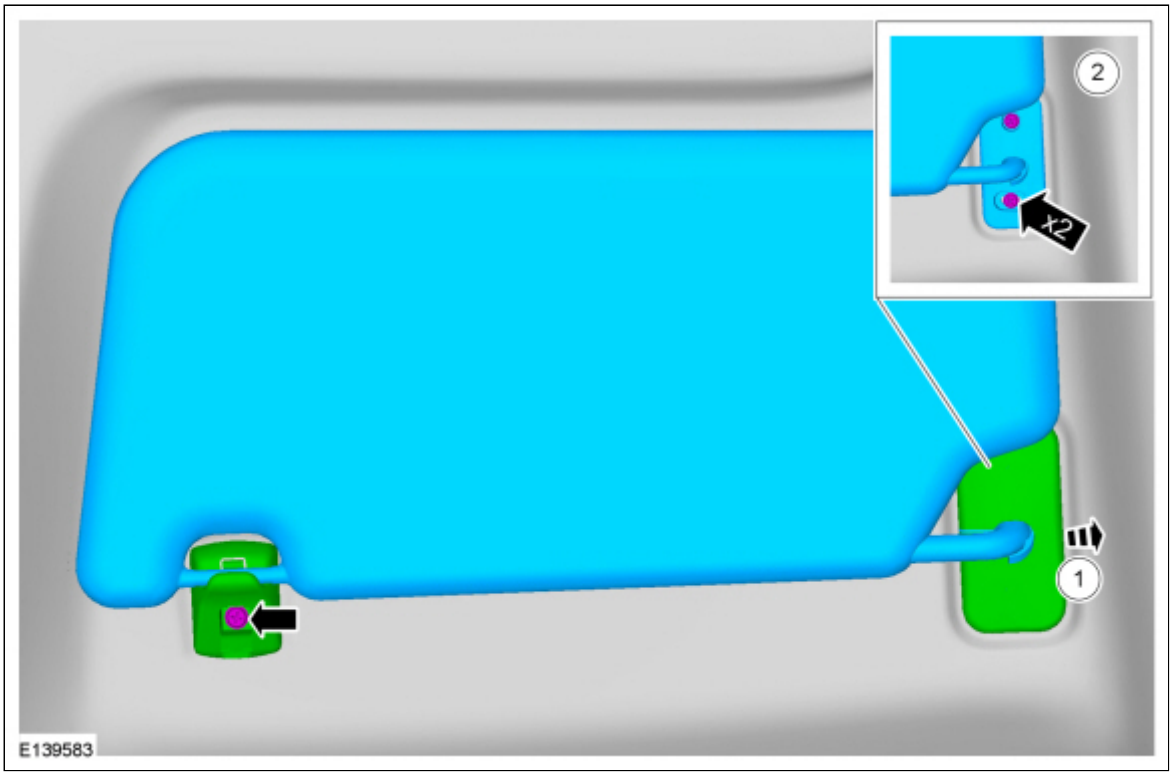
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: A-Pillar Trim Panel (501-05) .
2. Refer to: B-Pillar Upper Trim Panel (501-05) .
   Refer to: B-Pillar Lower Trim Panel (501-05) .
3. 

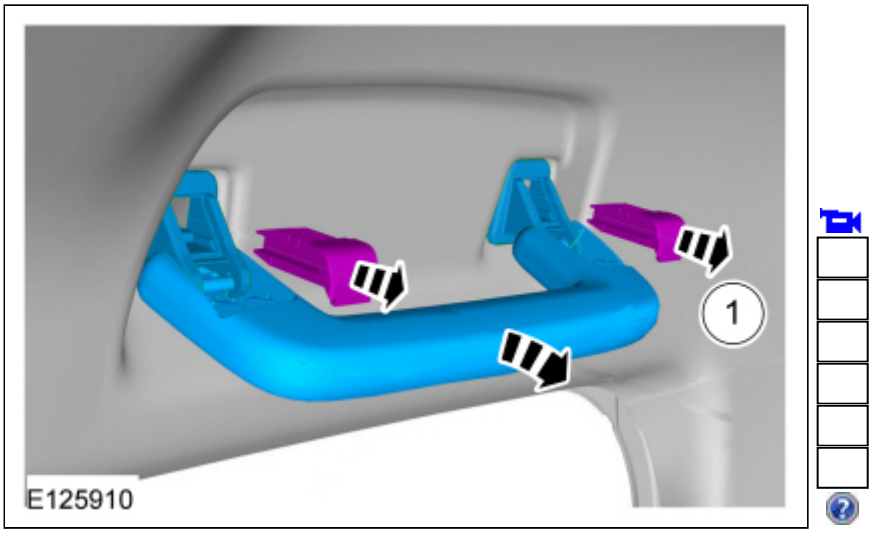
4. **NOTE:** *This step is not necessary when installing a new component.*



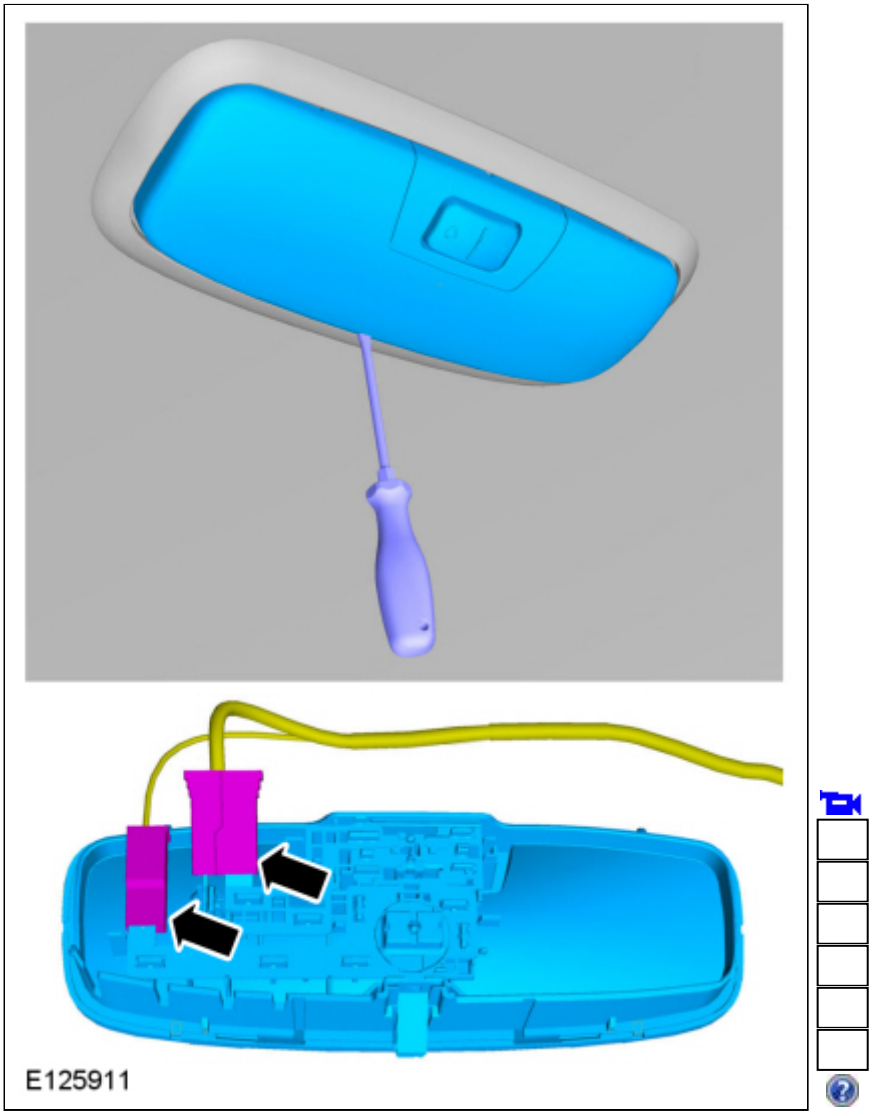
5. On both sides.



6.

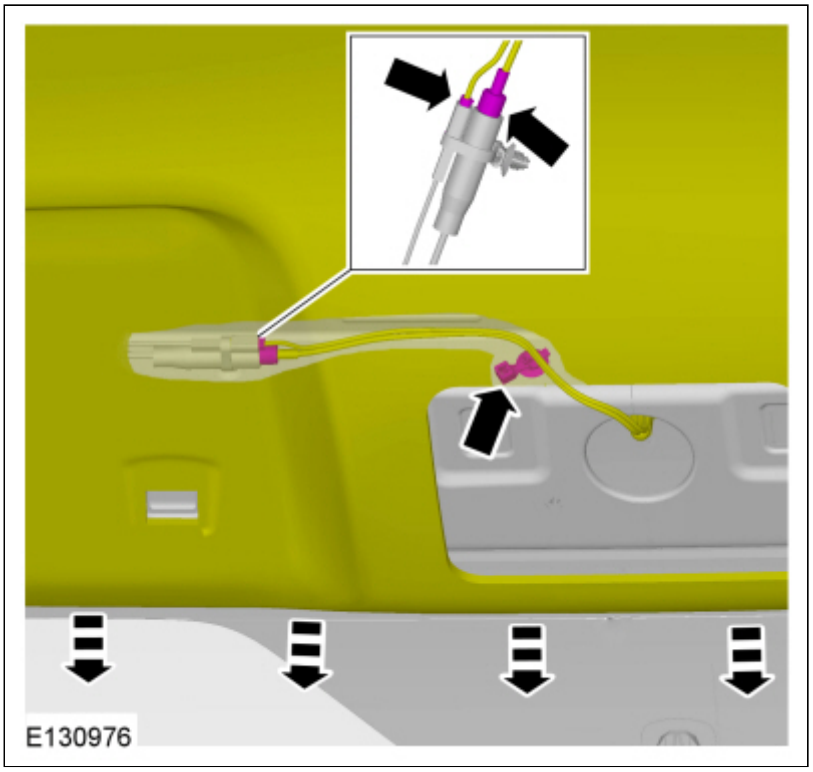


7.



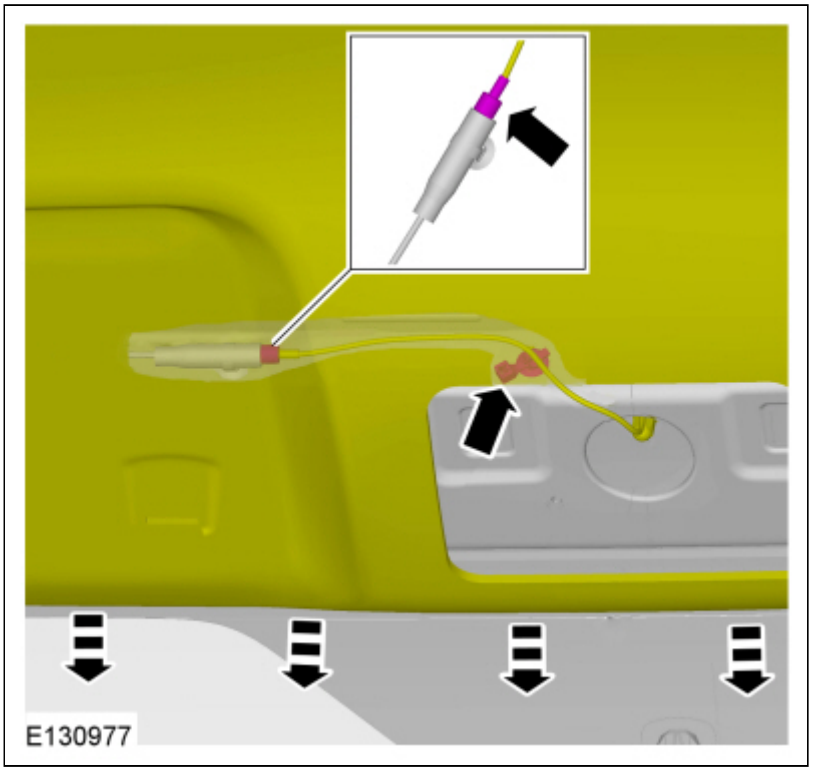
8. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*

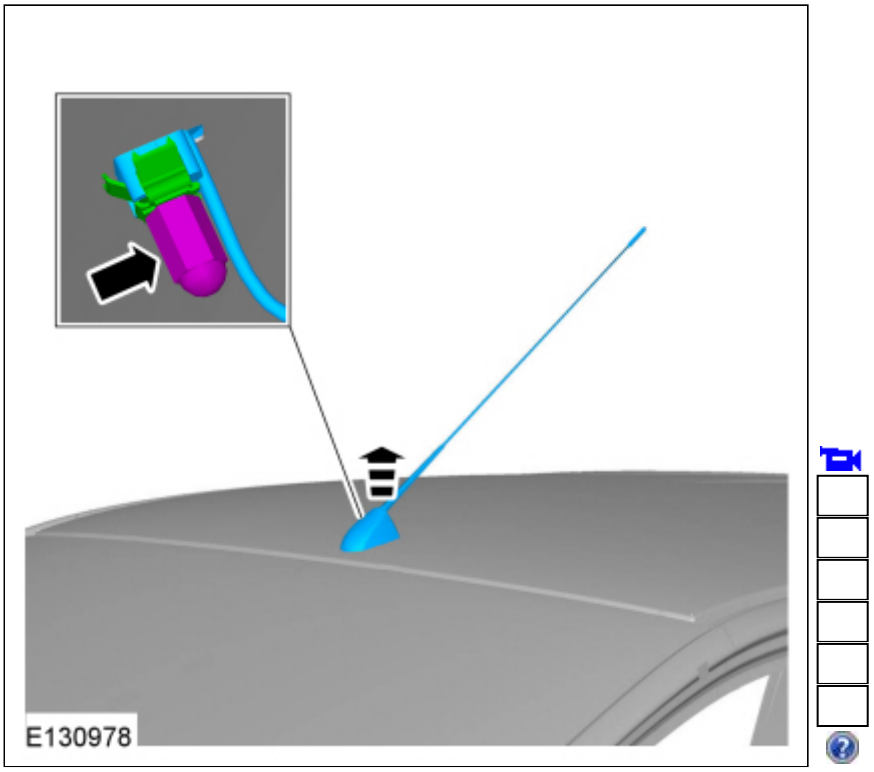


9. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*



10.



Installation

1. **NOTE:** *The antenna cable must be installed to the same routing as when removed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Information and Entertainment System - Overview

Overview

The audio system consists of the following:

Main Components

- 10 speakers
- 8-inch (203 mm) FDIM touchscreen
- ACM
- APIM
- FCIM
- Media hub
- Steering wheel switches

Main Features

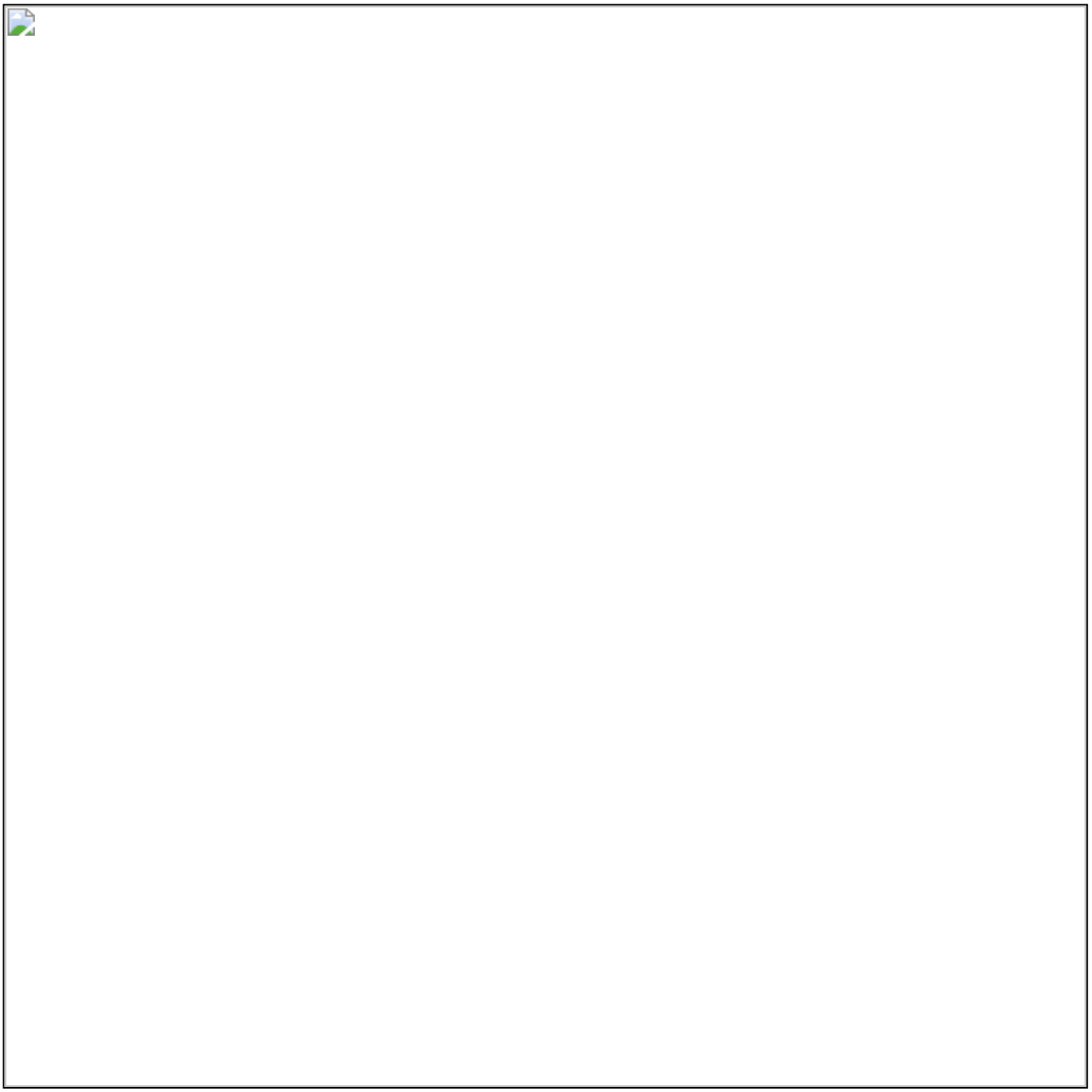
- Audio extended play
- Battery load shed
- Compass
- MyKey®
- Navigation - If equipped
- Speed compensated volume
- SYNC®
- TMC (if applicable)
- DAB (if applicable)

Copyright © 2016 Ford Motor Company

Information and Entertainment System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

A missing network message is indicated by a DTC (U-code) and can be the result of intermittent concerns such as damaged wiring or low battery voltage occurrences. Additionally, vehicle repair procedures such as module reprogramming can set these Diagnostic Trouble Codes (DTCs). When a missing message DTC (U-code) sets, it is important to look for symptoms present in the audio system and throughout the vehicle, and to review the complete message list to determine which other modules rely on the same message.
Refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

When the other modules have been identified, run the self-test for those modules. If the same message is missing from those modules, the identical, or similar lost communication Diagnostic Trouble Codes (DTCs) may be set in those modules. Confirmation of missing messages common to multiple modules can indicate that the originating

module is the source of the concern, or that the communication network may be at fault.

It is very important to understand the following:

- Where the input originates
- All of the information necessary for a feature to operate
- Which module(s) receive(s) the input or command message
- Which module controls the output of the feature
- If the module that receives the input controls the output of the feature, or whether it outputs a message over the CAN to another module.

NOTE: *Emergency Assistance may not be available in some countries. Visit the regional Ford website for latest details.*

Module Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
Audio settings	SCCM	The SCCM sends the commands to the ACM and the resulting status is displayed on the APIM. Used to set the radio listening source AM/ FM and DAB from the steering wheel switch.
Audio source select	IPC	Used to set the audio system listening source (AM/ FM/ DAB, CD, etc.) from the steering wheel switch through the IPC RH infotainment display.
Chime request	IPC	Used to control the priority, characteristics, volume and speaker output of the warning chime tones played through the audio system speakers.
Chime source	IPC	Used to set the audio system or IPC as the source for the chime tones.
Belt-Minder® audio mute	IPC	Used to mute speaker output so the Belt-Minder® tone can be more easily heard. This message only applies to vehicles with a MyKey® enabled and in use. The audio system is muted until the safety belt(s) are buckled.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for ACM operating modes and fault reporting.
Ignition key type	BCM	Used to determine if a MyKey® is enabled and in use.
Instrument panel cluster chime	IPC	Used to request a warning chime to be played through the audio system.
MyKey® volume limit status	IPC	Used to limit the maximum audio system volume when a MyKey® restricted key is in use.
Power mode	IPC	Used to disable the functionality of the ACM due to the load shedding feature.
Power up chime modules	IPC	Used to initiate the audio system as the chime source.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.
Voice recognition audio source request	IPC	Used to reduce the volume from the audio system so an IPC warning notification or parking aid chime can be more easily heard.

Module Network Input Messages - APIM

Broadcast Message	Originating Module	Message Purpose

Airbag deployment status	RCM	Used to monitor airbag deployment status for Emergency Assist.
Audio settings	IPC	Used to set the radio listening source AM/ FM and DAB from the steering wheel switch through the IPC RH infotainment display.
Day/night status	BCM	Used for day/night illumination status for the FDIM.
Display language selection	IPC	Used to display information on the FDIM in the selected language.
eCall notification	RCM	Used to notify of Emergency Assist status.
FCIM bezel diagnostic status	GWM	Used to display the requested bezel diagnostics operations in the centerstack infotainment display.
FCIM button state	FCIM	Used to indicate when a button is pressed on the FCIM so the audio system can make the desired setting change.
Selector lever position	GWM	Used to determine if reverse gear is active in order to switch to reverse camera screen on.
GPS compass direction	APIM	Used to display the compass direction on the FDIM.
GPS data	APIM	Used for vehicle positioning, heading, and direction for navigation and Emergency Assist.
Ignition key body info	BCM	Used to determine if a MyKey® is enabled and in use.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for APIM operating modes and fault reporting.
MyKey® volume limit status	IPC	Used to limit the maximum audio system volume when a MyKey® restricted key is in use.
Navigation rolling wheel count and direction	ABS module	Used to provide more accurate vehicle position tracking when the GPS signal is temporarily unavailable.
Steering wheel switch status	SCCM	Used to indicate the button press status of the steering wheel switches.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.
Vehicle speed	PCM	Used for navigation functionality.

Module Network Input Messages - FCIM

Broadcast Message	Originating Module	Message Purpose
Audio source selection	ACM	Used to indicate the selected audio system source.
Day/night status	BCM	Used for day/night illumination status for the FCIM.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START) required for FCIM operating modes and fault reporting.
Power mode	IPC	Used to disable the functionality of the FCIM due to the load shedding feature.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose

Audio source selection	ACM	Used to display the selected audio source on the IPC.
CD function status	ACM	Used to indicate the loading status of a CD.
Display language request	APIM	Used to display information on the IPC in the selected language.
Multimedia player total play time status	APIM	Used to indicate the total play time of the audio track being played.

Accessory Delay Feature

The accessory delay feature allows the audio system to be operated for a preset period of time after the ignition is turned off and a front door has not been opened.

AM/ FM1/ FM2/ DAB Radio With Diversity Antenna

The AM/ FM1/ DAB antennas receives analog radio waves and sends them through the antenna amplifier and AM/ FM1/ DAB antenna coaxial cable to the ACM. The FM2 antenna receives analog radio waves and sends them through the FM2 diversity antenna amplifier and FM2 antenna coaxial cable to the ACM. The radio waves are converted into fluctuating AC voltage and sent as left and right analog audio signals to the audio amplifier and all speakers.

AM/ FM1/ FM2 Radio Without Diversity Antenna

The AM/ FM1 antenna receives the AM/ FM radio signals. The antenna modules sends the radio signals to the ACM through a splitter which connects both antenna inputs of the ACM.

APIM Programming

The APIM requires specific programming procedures for correct operation when it is replaced, when upgrades are available and requested or when directed by a TSB (Technical Service Bulletin), FSA (Field Service Action), SSM (special service message) or Electronic Field Communication (EFC) to resolve SYNC® performance concerns.

Audio Extended Play

This feature allows the audio system to operate with the ignition OFF, regardless of door latch position. When the power button on the FCIM is pressed, audio system functionality is enabled and remains active for a period of 20-60 minutes, depending on configuration settings. Audio extended play will not function if the battery load shed is active. To turn the audio system off, press the FCIM power button.

Battery Load Shed

The BCM uses the battery current sensor to monitor the battery state of charge. The battery current sensor is attached to the battery ground cable. With the ignition in RUN, ACC, or OFF, a load shed message is sent over the CAN when the BCM determines that the battery state of charge is below 40%, 45 minutes have elapsed, or 10% of the charge has been drained. This message turns off the audio system to save the remaining battery charge. Under this condition, "Battery Saver - System Off" is displayed on the centerstack infotainment display to notify the driver that battery protection actions are active. To clear the load shed state, start the vehicle.

Bluetooth Mode

Bluetooth is a secure, short-range radio frequency that allows devices to communicate wirelessly through radio waves. The operating range of a Bluetooth signal is application specific, but will have a minimum range of 10 meters (33 feet).

The Bluetooth interface can accommodate both Bluetooth-enabled mobile phones and Bluetooth-enabled media devices. The SYNC® system allows interaction with several types of customer Bluetooth devices, including mobile phones and media devices. The APIM contains an on-board Bluetooth chipset, which enables certain wireless devices to interact with the system.

Any Bluetooth device used with the SYNC® system must first be paired with the APIM on-board Bluetooth chipset before it can become operational. Pairing a Bluetooth device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC® system generates a unique PIN that must be confirmed on the Bluetooth device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For information on the pairing process, refer to the Owner's Literature.

Multiple Bluetooth phones and Bluetooth media devices can be paired to the APIM at the same time. The APIM supports an active connection with one Bluetooth phone and one Bluetooth media device at a time. If an additional device of either type is paired and made active, the APIM ends any active connection with an already-paired device, and establishes an active connection with the new device.

It is important to understand that while most Bluetooth devices can pair with the SYNC® system, not all Bluetooth devices have the same level of features available when interacting with the SYNC® system. To determine if a Bluetooth device or feature is supported, review the device compatibility list. Refer to www.syncmyride.com.

Chimes

Various vehicle systems send chime requests over the CAN to the IPC. The following are determined as the IPC processes these requests:

- Chime characteristics (tone, tone length, number of repetitions, time between tones, etc.)
- Chime output volume
- Priority of the chime request
- Which speakers (all, front, or rear) will play the specific chime

The IPC sends the processed requests over the CAN to the ACM. The ACM outputs the left and right analog chime tones to the appropriate audio system speakers as fluctuating AC voltage.

For additional information on chimes,
Refer to: Warning Chimes - System Operation and Component Description (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Compass

The GPS antenna is used to acquire the compass heading. The compass heading is sent through the GPS coaxial cable to the APIM. The APIM displays the compass heading on the FDIM.

MyKey® Audio Operation

- The following MyKey® features are always enabled when a MyKey® is in use, and are not configurable on/off with an administrator key:
  - Belt-Minder®: The audio system is muted, and “MyKey Buckle Up to Unmute Audio" is displayed in the information display until the safety belts are buckled.

- The following MyKey® features are configurable with an administrator key:
  - Emergency Assist: If the administrator has selected "Always On" in the MyKey® menu, Emergency Assist is enabled and cannot be disabled.
  - Do Not Disturb: If the administrator has selected "Always On" in the MyKey® menu, the Do Not Disturb feature is enabled and cannot be disabled.
  - Speed Compensated Volume: If the administrator has enabled the Volume Limiter feature, the speed compensated volume feature will be disabled.
  - Speed Limiter: If the administrator has enabled the Speed Limiter feature, the audio volume level is temporarily reduced so the top speed alert chime can be heard when the preselected top vehicle speed is reached.
  - Speed Minder: If the administrator has enabled the Speed Minder feature, the audio volume level is temporarily reduced so the speed alert chime can be heard when the preselected Speed Minder vehicle speed is exceeded.
  - Volume Limiter: If the administrator has enabled the Volume Limiter feature, the audio system volume is limited to 45%. In an attempt to exceed the limited volume, “MyKey® VOLUME LIMITED” is displayed in the information display.

Refer to the Owner's Literature for more information on MyKey®.

Navigation

The navigation system guides the customer to a pre-entered destination.

The GPS antenna receives GPS data and sends it through the GPS coaxial cable to the APIM. The APIM uses this GPS data in addition to transmission gear selection (used to detect vehicle direction) and vehicle speed CAN messages to calculate route information and provide accurate navigation tracking. The navigation display is shown on the FDIM.

The voice recognition system allows the user to interface with the system without using the FDIM. A microphone located overhead provides a direct input to the APIM.

For more information, refer to Navigation in the Owner's Literature.

Speed Compensated Volume

The ACM compensates for wind and road noise by adjusting the audio system volume based on the VSS signal and customer-defined setting.

When a MyKey® is in use and the MyKey® Volume Limiter is enabled, the speed compensated volume is disabled.

Steering Wheel Switch Functions

The multimedia steering wheel switches consist of an upper 5-way switch, and a lower 6-way switch. The upper 5-way steering wheel switch operates the IPC infotainment display. The lower 6-way steering wheel switch operates the volume +/-, seek +/end call, seek-/send call/receive call, voice, and mute functions.

SYNC® AppLink™

SYNC® AppLink™ allows Applications installed on the customer's device to be controlled using the steering wheel switches, FCIM and/or FDIM.

All devices must be paired with the SYNC® system via Bluetooth, and Apple® devices must also be connected to a USB port.

Data is transmitted back and forth between the customer's device and the APIM through Bluetooth or through the USB port with Apple® devices.

For more information, refer to Apps and AppLink in the Owner's Literature.

SYNC® System

The SYNC® system is a hands-free communication and entertainment system that supports many features. Not all features are not available with every phone.

The SYNC® system provides the following abilities:

- Connect media devices in order to play audio files
- Control the system using voice commands
- Initiate an emergency assistance call when the airbags deploy (for more information, refer to "Emergency Assistance" in the Owner's Literature).
- Play media files via a paired Bluetooth-enabled audio device
- Send and receive phone calls via a paired Bluetooth-enabled phone
- Control the climate system

Traffic Announcement

Many stations that broadcast on the FM waveband have a Traffic Program code to signify that they carry traffic program information. Before traffic announcements can be received, the TA or TRAFFIC button must be pressed. A TA icon will appear to show the feature is switched on. When traffic information is broadcast, normal radio or CD playback will be interrupted. The audio unit will return to normal operation at the end of each traffic announcement. TA is only supported in certain countries.

USB Mode

When a portable media device, such as an iPod® with its available cable or portable mass storage such as a USB thumb drive, is connected to the vehicle audio system through the USB ports, audio from the device can be played through the vehicle speakers. Functions such as volume, seek, fast forward, pause, etc. can be controlled by the vehicle audio controls.

When playing media files stored on a mass storage device such as a flash drive, the SYNC® system only plays files that do not have DRM protection.

In addition to audio information (track length, track number, etc.), metadata (information such as artist, album title, song title, and genre) may also be sent to the APIM from a device connected to the USB port. The APIM uses the metadata to create indexes that can be used to sort for particular music based on the customer's preferences. Not all USB devices can send metadata to the APIM. When a new media device is connected to the SYNC® system, the APIM automatically indexes the information. This may take several minutes depending on the amount of data on the device, and is considered normal operation. When a device that was previously connected to the SYNC® system is reconnected, the APIM updates the index rather than creating a new one. This reduces the time needed to index the device.

The USB port can be used to upload vehicle Application upgrades to the APIM from a mass storage device such as a flash drive.

Image files can be saved to the APIM from a USB device in order to be used as wallpaper backgrounds displayed on the FDIM.

Voice Recognition

Voice recognition allows certain phone, navigation system (if equipped), audio system, and climate control system

functions to be controlled with voice commands. This minimizes driver distraction by reducing or eliminating the need to interact with the centerstack infotainment display and/or device while driving.

When the voice steering wheel switch is pressed, an audible prompt originating at the APIM is heard from the speakers. Based on the customer's setting, audible prompts will either be a voice or a simple tone. When interaction mode is set to standard, detailed voice guidance is provided. When interaction mode is set to advanced, most prompts are tones only, and minimal voice guidance is provided. The microphone receives the voice commands and sends them to the APIM. Refer to the Owner's Literature for more information on voice recognition.

Component Description

ACM

The ACM can be operated with the ignition in RUN, ACC, or OFF.

The ACM receives radio waves containing audio from the antenna coaxial cables and converts them into fluctuating AC voltage. The ACM processes all inputs and depending on the input received, sends stereo or mono analog audio signals to the audio amplifier and door speakers.

Antenna

The AM/ FM radio uses the roof-mounted combination AM/ FM antenna to receive analog radio waves. The DAB radio waves are sent through the AM/ FM2 antenna coaxial cable to the ACM, where they are amplified. A second FM 2 foil antenna is mounted under the splash shield next to the bumper for diversity functionality.

APIM

The APIM can be operated with the ignition in RUN, ACC, or OFF.

The APIM receives stereo and mono inputs. Stereo inputs include audio from USB port and connected Bluetooth media device. Mono inputs include audio from the outside device during a phone call and inputs from the SYNC® microphone.

The APIM sends stereo and mono audio signals to the ACM as fluctuating AC voltage. Stereo outputs include audio from the USB port and connected Bluetooth media device, ringback tone, outside device during a phone call, and voice or tone prompts initiated from the steering wheel switches.

The APIM consists of 2 internal modules: the CIP and the VIP. The modules are not replaceable individually, but can be flashed independently if required.

The CIP interfaces with all of the customer inputs to the APIM. It contains an analog-to-digital-to-analog converter, as well as the Bluetooth chipset. Any Application upgrades that are available to the customer are loaded directly to the CIP through the USB port.

The VIP provides an interface between the CIP and the vehicle inputs. Its main functions are controlling the APIM power management and translating inbound and outbound CAN signals. In addition, the VIP queries the modules on the network to retrieve any DTCs.

The Touchscreen Calibration must be performed every time the APIM is separated from the FDIM.

The APIM receives GPS data through the GPS coaxial cable.

The APIM requires programming when it is replaced.

Built-In Antenna Amplifier

The audio unit antenna amplifier receives AM/ FM radio waves from the antenna. The antenna amplifier is powered by the ACM and amplifies AM/ FM audio signals to improve reception. The AM/ FM radio waves are sent through the AM/ FM antenna coaxial cable to the ACM.

FCIM

The FCIM can be operated with the ignition in RUN, ACC, or OFF.

The FCIM audio system buttons provide one of the methods with which the customer interacts with the infotainment system.

The FCIM is separate from the ACM.

The FCIM requires PMI when it is replaced.

FDIM

The FDIM can be operated with the ignition in RUN, ACC, or OFF.

The FDIM touchscreen provides one of the methods with which the customer interacts with the infotainment system.

The FDIM plugs directly into the APIM, and therefore does not communicate directly on any network, and no external circuits are connected.

The Touchscreen Calibration must be performed every time the FDIM is separated from the APIM.

LVDS Cable

The LVDS cable between the APIM and FDIM contains 4 shielded circuits that provide power and ground to the FDIM from the APIM and is also the means by which data is transmitted from the APIM to the FDIM and from the FDIM to the APIM.

TMC

The TMC is a specific application of the FM RDS and is used for data related to traffic flows, incidents, weather etc. and are gathered from traffic monitoring systems, emergency services, motorists' calls etc. and are collated at a central traffic information centre. They are then passed to the TMC traffic information service provider, who generates TMC messages according to the ALERT-C coding protocol.

Standard TMC user messages provide five basic items of broadcast information:

- event description, details of the weather situation or traffic problem and its severity
- location, the area, highway segment or point location affected
- direction and extent, identifying the adjacent segments or point locations affected, and the direction of traffic affected
- duration, how long the problem is expected to last
- diversion advice, whether or not drivers are advised to find an alternative route

The service provider sends the coded messages to the appropriate FM radio broadcaster for transmission as an RDS signal within normal FM radio transmissions. The TMC data is received by the vehicle radio and antenna, and decoded. It takes about 30 seconds from the first report of a traffic incident to the traffic information centre until the same information is available in the vehicle. The user can select the language used to present the traffic information by the TMC receiver, typically a navigation system or car radio. The user can also opt to filter messages, so only those concerning the immediate route is selected.

Media Hub

The media hub allows for various audio devices to play content through the vehicle speakers. The media hub contains:

- 2 USB ports
  - Data is sent from the USB ports to the APIM through the USB cable.
  - Although there are 2 USB ports, there is only 1 USB cable connecting the media hub to the APIM.
  - The USB port is powered through circuits from the vehicle harness and can be used to power and/or charge a device if the device supports this feature. If the device does not support this feature, an external power source is needed in order to power the device.

Noise Suppression Equipment

The radio frequency suppression equipment reduces interference transmitted through the speakers by the engine, ignition, and electrical systems. When installing any new radio suppression equipment components, make sure that a good contact is made at all connections.

Steering Wheel Switches

The upper and lower multimedia steering wheel switches contain series of resistors. Each steering wheel switch function corresponds with a specific resistance value within the switch.

The SCCM sends a 5-volt reference voltage to the upper and lower multimedia steering wheel switches on the input circuit. When a switch is pressed, the voltage is routed through the corresponding resistor(s), through the return circuit, and then to ground through the SCCM. The SCCM monitors the resultant voltage drop to determine which switch was pressed. The voltage drop varies depending upon the resistance of the specific switch pressed.

The upper steering wheel switch inputs are sent as network messages from the SCCM to the IPC to control the IPC infotainment display.

The lower steering wheel switch inputs are sent as network messages from the SCCM to the APIM to control

SYNC® functions, or to the ACM to control audio functions.

SYNC® Microphone

The SYNC® microphone receives SYNC® system voice commands and incoming audio during a phone call. The monitored sounds are converted into analog signals by the microphone and sent to the APIM.

Copyright © 2016 Ford Motor Company

Information and Entertainment System

For a SYNC®-related concern, refer to the SYNC® System Symptom Chart before connecting the scan tool and beginning DTC-based diagnostics.

DTC Chart: ACM

DTC	Description	Action
B1142:27	Ignition Status 1: Signal Rate of Change Above Threshold	GO to Pinpoint Test E
B1A01:01	Speaker #1: General Electrical Failure	• For a LHF door speaker concern, GO to Pinpoint Test G • For a LHF door tweeter speaker concern, GO to Pinpoint Test H
B1A01:11	Speaker #1: Circuit Short To Ground	• For a LHF door speaker concern, GO to Pinpoint Test G • For a LHF door tweeter speaker concern, GO to Pinpoint Test H
B1A01:12	Speaker #1: Circuit Short To Battery	• For a LHF door speaker concern, GO to Pinpoint Test G • For a LHF door tweeter speaker concern, GO to Pinpoint Test H
B1A01:13	Speaker #1: Circuit Open	GO to Pinpoint Test G
B1A02:01	Speaker #2: General Electrical Failure	• For a RHF door speaker concern, GO to Pinpoint Test J • For a RHF door tweeter speaker concern, GO to Pinpoint Test K
B1A02:11	Speaker #2: Circuit Short To Ground	• For a RHF door speaker concern, GO to Pinpoint Test J • For a RHF door tweeter speaker concern, GO to Pinpoint Test K
B1A02:12	Speaker #2: Circuit Short To Battery	• For a RHF door speaker concern, GO to Pinpoint Test J • For a RHF door tweeter speaker concern, GO to Pinpoint Test K
B1A02:13	Speaker #2: Circuit Open	GO to Pinpoint Test J
B1A03:01	Speaker #3: General Electrical Failure	• For a RHR door speaker concern, GO to Pinpoint Test L • For a RHR door tweeter speaker concern, GO to Pinpoint Test M
B1A03:11	Speaker #3: Circuit Short To Ground	• For a RHR door speaker concern, GO to Pinpoint Test L • For a RHR door tweeter speaker concern, GO to Pinpoint Test M
B1A03:12	Speaker #3: Circuit Short To Battery	• For a RHR door speaker concern, GO to Pinpoint Test L • For a RHR door tweeter speaker concern, GO to Pinpoint Test M
B1A03:13	Speaker #3: Circuit Open	GO to Pinpoint Test L
B1A04:01	Speaker #4: General Electrical Failure	• For a LHR door speaker concern, GO to Pinpoint Test N • For a LHR door tweeter speaker concern, GO to Pinpoint Test O
B1A04:11	Speaker #4: Circuit Short To Ground	• For a LHR door speaker concern, GO to Pinpoint Test N • For a LHR door tweeter speaker concern, GO to Pinpoint Test O
B1A04:12	Speaker #4: Circuit Short To Battery	• For a LHR door speaker concern, GO to Pinpoint Test N • For a LHR door tweeter speaker concern, GO to Pinpoint Test O

B1A04:13	Speaker #4: Circuit Open	GO to Pinpoint Test N
B1A05:02	Speaker #5: General Signal Failure	GO to Pinpoint Test F
B1A06:02	Speaker #6: General Signal Failure	GO to Pinpoint Test I
B1A06:11	Speaker #6: Circuit Short To Ground	GO to Pinpoint Test I
B1A06:12	Speaker #6: Circuit Short To Battery	GO to Pinpoint Test I
B1A06:13	Speaker #6: Circuit Open	GO to Pinpoint Test I
B1A56:21	Antenna: Signal Amplitude < Minimum	If DTC B1A56:21 sets after running the bezel diagnostic tests, DISREGARD this DTC. This test is used for end of line or repair bay testing at the Ford plant. Each plant has its own assigned frequency and signal strength requirements. The running and passing of this test depends on local radio stations. If no local station is broadcasting on the required frequency, the test will fail.
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test AC
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AE
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AG
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	GO to Pinpoint Test AJ
U0256:00	Lost Communication With Front Controls Interface Module “A”: No Sub Type Information	GO to Pinpoint Test AK
U0257:00	Lost Communication With Front Controls / Display Interface Module: No Sub Type Information	**NOTE:** *Despite the description, this DTC applies to the FDIM, not the FCDIM.* GO to Pinpoint Test AL
U201A:51	Control Module Main Calibration Data: Not Programmed	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM the ACM PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM

	Information	the ACM PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• This DTC sets due to an incomplete or incorrect ACM PMI. CHECK the vehicle service history for recent service actions related to the ACM. – If there have been recent service actions with the ACM, PERFORM the ACM PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . – If there have been no recent service actions, the ACM has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:96	Control Module: Component Internal Failure	• CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:96 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AM
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AN

DTC Chart: APIM

DTC	Description	Action
B108E:01	Display: General Electrical Failure	GO to Pinpoint Test Z
B108E:63	Display: Circuit / Component Protection Time-Out	GO to Pinpoint Test Z
B119F:01	GPS Antenna: General Electrical Failure	GO to Pinpoint Test AA

B119F:13	GPS Antenna: Circuit Open	GO to Pinpoint Test AA
B1252:11	USB Port: Circuit Short To Ground	For an inoperative USB port, GO to Pinpoint Test U
B1252:13	USB Port: Circuit Open	For an inoperative USB port, GO to Pinpoint Test U
B14FD:11	External Media Control Connectivity: Circuit Short To Ground	GO to Pinpoint Test U
B1D79:11	Microphone Input: Circuit Short To Ground	GO to Pinpoint Test S
B1D79:12	Microphone Input: Circuit Short To Battery	GO to Pinpoint Test S
B1D79:13	Microphone Input: Circuit Open	GO to Pinpoint Test S
C1001:01	Vision System Camera: General Electrical Failure	REFER to: Parking Aid (413-13 Parking Aid) .
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test AD
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AE
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test AF
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AG
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	GO to Pinpoint Test AH
U0162:00	Lost Communication With Navigation Display Module: No Sub Type Information	GO to Pinpoint Test Z
U0184:00	Lost Communication With Radio: No Sub Type Information	GO to Pinpoint Test AI
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	GO to Pinpoint Test AK
U0415:00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the ABS control module. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . • RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the ABS control module.
U0423:00	Invalid Data Received From Instrument Panel Cluster Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the IPC. REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) . • RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the IPC.
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . • RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs)

		present in the BCM.
U0452:00	Invalid Data Received From Restraints Control Module: No Sub Type Information	• RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the RCM. REFER to: Airbag Supplemental Restraint System (SRS) - LHD 4WD/LHD RWD/RHD 4WD/RHD RWD (501-20 Supplemental Restraint System) . • RETRIEVE and FOLLOW Diagnostic Trouble Codes (DTCs) present in the RCM.
U2017:45	Control Module Software #2: Program Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U2017:45 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U2017:51	Control Module Software #2: Not Programmed	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).
U2017:52	Control Module Software #2: Not Activated	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U2017:54	Control Module Software #2: Missing Calibration	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new

		APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• This DTC sets due to incomplete or incorrect APIM programming/provisioning. CHECK the vehicle service history for recent service actions related to the APIM. – If there have been recent service actions with the APIM, PERFORM the APIM programming as directed by the diagnostic scan tool. REFER to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures). – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U3000:04	Control Module: System Internal Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:04 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U3000:09	Control Module: Component Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:09 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System,

		Removal and Installation).
U3000:88	Control Module: Bus Off	**NOTE:** *The module was unable to communicate on the network at a point in time. The fault is not currently present since the module had to communicate with the diagnostic scan tool to report this DTC.* **To avoid repeat network concerns:** • INSPECT for damaged or corroded wiring at the APIM. • CLEAR the DTC. • WAIT at least 10 seconds. • REPEAT the network test with the diagnostic scan tool.
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AM
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AN

DTC Chart: DACMC

DTC	Description	Action
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test AC
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AE
U2024:00	Control Module Cal-Config Data: No Sub Type Information	• This DTC sets due to an incomplete or incorrect DACMC PMI. CHECK the vehicle service history for recent service actions related to the DACMC or ACM. – If there have been recent service actions with the DACMC or ACM, PERFORM the DACMC PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . – If there have been no recent service actions, the DACMC has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to an incomplete or incorrect DACMC PMI. CHECK the vehicle service history for recent service actions related to the DACMC or ACM. – If there have been recent service actions with the DACMC or ACM, PERFORM the DACMC PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . – If there have been no recent service actions, the DACMC has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	• This DTC sets due to an incomplete or incorrect DACMC PMI. CHECK the vehicle service history for recent service actions related to the DACMC or ACM. – If there have been recent service actions with the DACMC or ACM, PERFORM the DACMC PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01

		Module Configuration) . – If there have been no recent service actions, the DACMC has failed to retain configuration data. INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:41 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3000:42	Control Module: General Memory Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:42 is retrieved again, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AM
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AN

DTC Chart: FCIM

DTC	Description	Action
B00D5:01	Restraint System Passenger Disable Indicator: General Electrical Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B00D5:01 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
B1034:11	Left Front Seat Heater Element: Circuit Short To Ground	REFER to: Seats (501-10 Seating) .
B1034:12	Left Front Seat Heater Element: Circuit Short To Battery	REFER to: Seats (501-10 Seating) .
B1034:13	Left Front Seat Heater Element: Circuit Open	REFER to: Seats (501-10 Seating) .
B1036:11	Right Front Seat Heater Element: Circuit Short To Ground	REFER to: Seats (501-10 Seating) .
B1036:12	Right Front Seat Heater Element: Circuit Short To Battery	REFER to: Seats (501-10 Seating) .
B1036:13	Right Front Seat Heater Element: Circuit Open	REFER to: Seats (501-10 Seating) .
B1038:11	Left Front Seat Heater Sensor: Circuit Short To Ground	REFER to: Seats (501-10 Seating) .

B1038:15	Left Front Seat Heater Sensor: Circuit Short To Battery or Open	REFER to: Seats (501-10 Seating) .
B103A:11	Right Front Seat Heater Sensor: Circuit Short To Ground	REFER to: Seats (501-10 Seating) .
B103A:15	Right Front Seat Heater Sensor: Circuit Short To Battery or Open	REFER to: Seats (501-10 Seating) .
B105A:12	Cabin Temperature Sensor Fan: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B105A:14	Cabin Temperature Sensor Fan: Circuit Short To Ground or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1081:07	Left Temperature Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1081:11	Left Temperature Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1081:12	Left Temperature Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1081:13	Left Temperature Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1082:07	Right Temperature Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1082:11	Right Temperature Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1082:12	Right Temperature Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1082:13	Right Temperature Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1083:07	Recirculation Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1083:11	Recirculation Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .

B1083:12	Recirculation Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1083:13	Recirculation Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1086:07	Air Distribution Damper Motor: Mechanical Failure	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1086:11	Air Distribution Damper Motor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1086:12	Air Distribution Damper Motor: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1086:13	Air Distribution Damper Motor: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B10AF:11	Blower Fan Relay: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10AF:12	Blower Fan Relay: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10AF:13	Blower Fan Relay: Circuit Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B3:11	Right Panel Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B3:15	Right Panel Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B4:11	Right Floor Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B4:15	Right Floor Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B5:11	Left Panel Air Discharge	

	Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B5:15	Left Panel Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B6:11	Left Floor Air Discharge Temperature: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B6:15	Left Floor Air Discharge Temperature: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B10B8:63	Push Buttons: Circuit / Component Protection Time-Out	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B10B8:63 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
B10B9:12	Blower Control: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B10B9:14	Blower Control: Circuit Short To Ground or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B113C:11	Hazard Switch Illumination: Circuit Short To Ground	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
B11E5:11	Left HVAC Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11E5:15	Left HVAC Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11E6:11	Right HVAC Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11E6:15	Right HVAC Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11E7:11	Air Distribution Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11E7:15	Air Distribution Damper Position Sensor: Circuit	REFER to: Climate Control System - Vehicles With: Electronic Manual

	Short To Battery or Open	Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11F0:11	Air Intake Damper Position Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B11F0:15	Air Intake Damper Position Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
B1202:01	Restraint System Passenger Enable Indicator: General Electrical Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC B1202:01 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
B1A61:11	Cabin Temperature Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A61:15	Cabin Temperature Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A63:11	Right Solar Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A63:15	Right Solar Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A64:11	Left Solar Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A64:15	Left Solar Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A69:11	Humidity Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1A69:15	Humidity Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1B71:11	Evaporator Temperature Sensor: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .

		See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1B71:15	Evaporator Temperature Sensor: Circuit Short To Battery or Open	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) . See DTC Chart: FCIM - DATC (Dual Automatic Temperature Control).
B1C83:12	Rear Defog Relay: Circuit Short To Battery	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms) .
B1C83:14	Rear Defog Relay: Circuit Short To Ground or Open	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms) .
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
C1B14:12	Sensor Supply Voltage A: Circuit Short To Battery	REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information) .
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test AE
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test AF
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test AG
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	GO to Pinpoint Test AJ
U0401:00	Invalid Data Received from ECM/PCM A: No Sub Type Information	• REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0401:68	Invalid Data Received from ECM/PCM A: Event Information	• REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0401:81	Invalid Data Received from ECM/PCM A: Invalid Serial Data Received	• REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) .

		• REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0401:82	Invalid Data Received from ECM/PCM A: Alive / Sequence Counter Incorrect / Not Updated	• REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . • REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
U0422:68	Invalid Data Received From Body Control Module: Event Information	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
U0422:81	Invalid Data Received From Body Control Module: Invalid Serial Data Received	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
U0452:82	Invalid Data Received From Restraints Control Module: Alive / Sequence Counter Incorrect / Not Updated	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	**NOTE:** *The FCIM has temporarily disabled a HVAC control output because an excessive current draw exists (such as a short to ground). The FCIM cannot enable the output until the cause of the short is corrected.* • ADDRESS all other FCIM Diagnostic Trouble Codes (DTCs) first. • After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U1000:00 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
U2100:00	Initial Configuration Not Complete: No Sub Type Information	• This DTC sets due to an incomplete or incorrect FCIM PMI. CHECK the vehicle service history for recent service actions related to the FCIM. − If there have been recent service actions with the FCIM, PERFORM the FCIM PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . − If there have been no recent service actions, the FCIM has failed to retain configuration data. INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
U3000:41	Control Module: General Checksum Failure	• CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test.

		• If DTC U3000:41 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
U3000:49	Control Module: Internal Electronic Failure	• ADDRESS all other FCIM Diagnostic Trouble Codes (DTCs) first. • After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). • WAIT at least 10 seconds. • REPEAT the self-test. • If DTC U3000:49 is retrieved again, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test AM
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test AN

DTC Chart: SCCM

DTC	Description	Action
B1380:09	Steering Wheel Right Switch Pack: Component Failure	• For a RH lower steering wheel switch concern, GO to Pinpoint Test W • For a RH upper steering wheel switch concern, GO to Pinpoint Test X
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	• For a RH lower steering wheel switch concern, GO to Pinpoint Test W • For a RH upper steering wheel switch concern, GO to Pinpoint Test X
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	• For a RH lower steering wheel switch concern, GO to Pinpoint Test W • For a RH upper steering wheel switch concern, GO to Pinpoint Test X
All other Diagnostic Trouble Codes (DTCs)	—	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches) .

Symptom Charts

Symptom Chart: General Audio System

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals, or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network) .
The multimedia lower steering wheel switches are	Refer to the Pinpoint Test	GO to Pinpoint Test W

inoperative or do not operate correctly		
The multimedia upper steering wheel switches are inoperative or do not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test X
The CD player is inoperative or does not operate correctly	Refer to the Pinpoint Test	INSPECT the CD for scratches, fingerprints, a loose paper label, incorrect format or damage. INSERT a known good CD and TEST the system. If the system operates correctly, the concern was caused by a damaged CD. If the system does not operate correctly, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
The speed compensated volume does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test B
The audio system does not operate correctly from the FCIM	Refer to the Pinpoint Test	GO to Pinpoint Test Y
The FCIM illumination is inoperative or does not dim	• Illumination system concern • FCIM	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
The FDIM touchscreen is inoperative or does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test Z

Symptom Chart: Navigation

Condition	Possible Sources	Actions
Navigation application is inoperative or unresponsive	Refer to the Pinpoint Test	GO to Pinpoint Test AA
The compass is inoperative or does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test AA

Symptom Chart: Sound Quality

Condition	Possible Sources	Actions
Poor reception - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
Continuous seek or scan - AM/ FM	Refer to the Pinpoint Test	GO to Pinpoint Test A
A loud popping sound is heard when cycling the ignition	Refer to the Pinpoint Test	GO to Pinpoint Test C
Poor sound quality or distorted sound from one or more speakers (not all speakers)	Refer to the Pinpoint Test	GO to Pinpoint Test D
No sound from all speakers	Refer to the Pinpoint Test	GO to Pinpoint Test E
Reduced or no sound from subwoofer	Refer to the Pinpoint Test	GO to Pinpoint Test F
The LHF door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test G

The LHF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test H
The center instrument panel speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test I
The RHF door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test J
The RHF door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test K
The RHR door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test L
The RHR door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test M
The LHR door speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test N
The LHR door tweeter speaker is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test O

Symptom Chart: SYNC® System

Condition	Possible Sources	Actions
All SYNC® Services features are inoperative or inaccurate (traffic, directions, and information)	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test P
All APIM stereo outputs are inoperative or do not operate correctly REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) . See APIM for a list of stereo outputs.	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test Q
All APIM mono outputs are inoperative or do not operate correctly REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) . See APIM for a list of mono outputs.	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test R
Voice recognition is inoperative or does not operate correctly	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test S
During a phone call, no outgoing audio is heard on the outside device	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming

		(415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test S
The SYNC® steering wheel switches are inoperative or do not operate correctly	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test W
All media hub functions are inoperative or do not operate correctly (USB ports and audio input jack)	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test T
The USB port(s) is/are inoperative or does/do not operate correctly	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test U
Unable to pair Bluetooth device	Refer to the Pinpoint Test	PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). If the concern is still present, GO to Pinpoint Test V
An individual Bluetooth device feature is inoperative (text messaging, media playback or controls, phone book download, call history, or call waiting)	Customer's device compatibility	• PERFORM the SYNC® Module Programming in General Procedures. REFER to: SYNC Module [APIM] Programming (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures). • INSTRUCT the customer to review the device compatibility list. REFER to www.support.ford.com. It is normal operation for unsupported or incompatible Bluetooth features to be unavailable through the SYNC® system. • If the inoperative feature is compatible, ADVISE the customer to check their device for firmware updates, and if required, reset their device following the manufacturer's instructions.
Emergency Assistance is inoperative or does not operate correctly	• APIM misconfiguration • RCM	• Verify country is supported by Emergency Assistance feature. • This error message appears due to

	misconfiguration • IPC misconfiguration • Country NOT supported	incomplete or incorrect PMI procedures. CHECK the vehicle service history for recent service actions related to the IPC or APIM. – If there have been recent service actions with the IPC or APIM, PERFORM the PMI procedure as directed by the diagnostic scan tool. REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) . – If there have been no recent service actions, the APIM has failed to retain configuration data. INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).

Pinpoint Tests

Poor Reception Or Continuous Seek Or Scan - AM- FM

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 12 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Sources

- No channel found in the selected RDS category
- Noise suppression equipment
- Charging system
- Wiring, terminals, or connectors
- Ignition system
- Wiring, terminals, or connectors
- AM/ FM antenna coaxial cable
- FM2 diversity antenna amplifier
- AM/ FM/ DAB antenna
- FM2 antenna
- Mounting surface corrosion
- ACM

PINPOINT TEST A : POOR RECEPTION OR CONTINUOUS SEEK OR SCAN - AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION)

A1 CHECK THE AUDIO SYSTEM RECEPTION WITH THE ENGINE RUNNING
• Operate the audio system in AM/ FM mode. • Check the reception with the engine running, and with the engine off. **Is poor reception only present with the engine running?** **Yes** GO to A2 **No** GO to A4

A2 CHECK THE GENERATOR

- Ignition OFF.
- Disconnect Generator B+ Cable C102C.**NOTICE: Do not allow the generator B+ cable terminal to make contact with a conductive surface. Failure to follow this instruction may result in personal injury or damage to the vehicle.**
- Start the engine.
- Operate the audio system in AM/ FM mode.

Is the audio reception acceptable?

Yes	INSTALL a new generator. REFER to: Generator - 2.5L Duratec-HE (122kW/165PS) - MI4, Vehicles Built Up To: 16-08-2015 (414-02 Generator and Regulator) . REFER to: Generator - 2.2L Duratorq-TDCi (Puma) Diesel, Vehicles Built Up To: 16-08-2015 (414-02 Generator and Regulator) . REFER to: Generator - 3.2L Duratorq-TDCi (Puma) Diesel, Vehicles Built Up To: 16-08-2015 (414-02 Generator and Regulator) .
No	GO to A3

A3 CHECK THE IGNITION CIRCUITS

- Ignition OFF.
- Connect Generator B+ Cable C102C.
- Inspect all the wiring harnesses and connectors for damaged insulation and loose or broken conditions.

Is the wiring harnesses and components in good condition?

Yes	USE a jumper cable to temporarily ground various parts of the vehicle (examples include: engine, fenders, quarter panels, body sheet metal) to the frame. When the noise is eliminated, PROVIDE a permanent ground where necessary.
No	REPAIR the wiring harness and components as necessary.

A4 CHECK THE ANTENNA ENABLE CIRCUIT FOR CORRECT VOLTAGE

- Ignition OFF.
- Disconnect Audio Unit Antenna Amplifier C4823.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4823-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A7
No	GO to A5

A5 CHECK THE ANTENNA ENABLE CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4823-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A6
No	REPAIR the circuit.

A6 CHECK THE ANTENNA ENABLE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect ACM C4821A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4823-1	Ω	C4821A-2

Is the resistance less than 3 ohms?

Yes	GO to A16
No	REPAIR the circuit.

A7 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) ANTENNA COAXIAL CABLE CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: AM/ FM antenna coaxial cable at the ACM. Refer to the appropriate section in Group 415 for the procedure.
- Disconnect: AM/ FM antenna coaxial cable at the Audio Unit Antenna Amplifier. Refer to the appropriate section in Group 415 for the procedure.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM		Ground
AM/ FM antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	INSTALL a new AM/ FM antenna coaxial cable.
No	GO to A8

A8 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) ANTENNA COAXIAL CABLE CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A9
No	INSTALL a new AM/ FM antenna coaxial cable.

A9 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) ANTENNA COAXIAL CABLE CORE AND SHIELD FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM	Ω	AM/ FM antenna coaxial cable core at the audio unit antenna amplifier
AM/ FM antenna coaxial cable shield at the ACM	Ω	AM/ FM antenna coaxial cable shield at the audio unit antenna amplifier

Are the resistances less than 1 ohm?

Yes	GO to A10
No	INSTALL a new AM/ FM antenna coaxial cable.

A10 CHECK THE AM (AMPLITUDE MODULATION) / FM (FREQUENCY MODULATION) ANTENNA COAXIAL CABLE CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM	Ω	AM/ FM antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A11
No	INSTALL a new AM/ FM antenna coaxial cable.

A11 CHECK THE AUDIO UNIT ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Connect: AM/ FM antenna coaxial cable at the Audio Unit Antenna Amplifier.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM		Ground
AM/ FM antenna coaxial cable shield at the ACM		Ground

Is any voltage present?

Yes	INSTALL a new audio unit antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	GO to A12

A12 CHECK THE AUDIO UNIT ANTENNA AMPLIFIER CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A13
No	INSTALL a new audio unit antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .

A13 CHECK THE AUDIO UNIT ANTENNA AMPLIFIER CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable core at the ACM	Ω	AM/ FM antenna coaxial cable shield at the ACM

Is the resistance greater than 10,000 ohms?

Yes	GO to A14
No	INSTALL a new audio unit antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .

A14 CHECK THE AUDIO UNIT ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna coaxial cable shield at the ACM	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A16
No	GO to A15

A15 CHECK THE AUDIO UNIT ANTENNA AMPLIFIER SHIELD FOR CONTINUITY TO ANTENNA UNIT BASE

- Remove the audio unit antenna amplifier.
  REFER to: Audio Unit Antenna Amplifier (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
- Measure:

Positive Lead	Measurement / Action	Negative Lead
AM/ FM antenna shield at the audio unit antenna amplifier (component side)	Ω	Audio unit antenna amplifier base (unpainted surface on the mounting tab)

Is the resistance less than 1 ohm?

Yes	INSPECT and REPAIR any corrosion on the audio unit antenna amplifier and/or vehicle mounting surface. REINSTALL the audio unit antenna amplifier and ensure the proper torque value is achieved. REFER to: Audio Unit Antenna Amplifier (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	INSTALL a new AM/ FM antenna amplifier. REFER to: Audio Unit Antenna Amplifier (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .

A16 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Speed Compensated Volume Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Sources

- Speed compensated volume setting
- ACM

PINPOINT TEST B : THE SPEED COMPENSATED VOLUME DOES NOT OPERATE CORRECTLY

B1 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and observe the speedometer.

Does the speedometer operate correctly?

Yes	GO to B2
No	REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .

B2 CHECK THE SPEED COMPENSATED VOLUME SETTING

- Turn the speed compensated volume off. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- Set the speed compensated volume to maximum compensation. Refer to the Owner's Literature.
- Operate the audio system in AM/ FM mode.
- Drive the vehicle at various speeds and observe the speaker volume.

Does the volume remain constant with the speed compensated volume turned off, and increase and decrease with vehicle speed with the speed compensated volume set to maximum?

Yes	The system is operating correctly at this time. INSTRUCT the customer in the correct usage of the speed compensated volume feature.
No	GO to B3

B3 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 retrieved in any audio system module?

Yes	GO to Pinpoint Test AG
No	GO to B4

B4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Loud Popping Sound Is Heard When Cycling The Ignition

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

The ACM receives voltage on a start signal circuit when the ignition is in the START position and mutes the audio signal output. This prevents voltage spikes from producing popping noises through the speakers. An open on this circuit between splice CS157 and the ACM could cause voltage spikes to produce popping noises through the speakers.

Possible Sources

- Wiring, terminals, or connectors
- ACM

PINPOINT TEST C : A LOUD POPPING SOUND IS HEARD WHEN CYCLING THE IGNITION

C1 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR DTC (DIAGNOSTIC TROUBLE CODE) P0615, P0616 OR P0617

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0615, P0616 or P0617 set?

Yes	REFER to: Starting System (303-06 Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . REFER to: Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-06 Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to C2

C2 CHECK THE START SENSE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect ACM C4821A.
- Disconnect BCM C2280B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C4821A-3	Ω	C2280B-14

Are the resistances less than 3 ohms?

Yes	GO to C3
No	REPAIR the circuit.

C3 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Poor Sound Quality Or Distorted Sound From One Or More Speakers (Not All Speakers)

Normal Operation and Fault Conditions

The ACM sends audio signals to the speakers in the form of AC voltage, resulting in clear audio output.

Possible Sources

- Loose component fasteners
- Loose door handle, lock, and other trim panel components and fasteners
- Loose items in storage areas
- Loose speaker grilles
- Loose wire harnesses or wire harness fasteners
- Speaker(s)
- Water shield bonding and placement

Visual Inspection and Diagnostic Pre-checks

Visually inspect around the suspect area for any possible rattle conditions such as:

- Any storage compartments including cup holders (if equipped)
- Door map pockets for contents that can rattle (if equipped)
- Door pull cup attachments (if equipped)
- Door switch bezels (if equipped)
- Package tray (if equipped)
- Speaker grilles
- Trim panels and fasteners

PINPOINT TEST D : POOR SOUND QUALITY OR DISTORTED SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS)

D1 ISOLATE THE ZONE

- Download the diagnostic sound tracks to a suitable USB storage device, then install the USB storage device in a vehicle audio system USB port.
  REFER to: Speaker Audio Test (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures).
- Operate the audio system in USB mode.
- Using the audio system fade and balance feature, adjust the audio sound to each of the four zones (LHF, RHF, LHR, and RHR) of the vehicle to isolate the poor sound quality. Allow each track to play for 10 seconds, then use the SEEK +/- audio system buttons to change to the next diagnostic sound track.
- Locate and apply pressure to the trim panel(s) around the poor sound quality area in question.

Does applying pressure to a trim panel reduce or eliminate the audible noise?

Yes	REPAIR or REPLACE the trim panel as needed.
No	GO to D2

D2 REMOVE AND INSPECT BEHIND/UNDERNEATH THE SUSPECT TRIM PANEL(S)

- Remove the trim panel to access the suspect speaker.
- Operate the audio system using digital media such as a CD or MP3.
- Validate where the poor sound quality area is located.
- Check:
  - Trim panel for loose components (e.g. speaker grille) around the speaker area.
  - Trim panel joining components for missing or broken pieces.
  - Lock and handle mechanical parts for correct attachment.
  - Wire harnesses for correct routing.
  - Wire harness fasteners for correct attachment.
  - Water shield for correct placement (speaker air path not blocked).
  - Water shield for correct bonding to sheet metal.
  - Storage areas for loose items.
  - All child safety belt anchors (if equipped).
  - All safety belt retractors.
  - All speaker bracket fasteners and other fasteners are secured and tightened to specified torque.

Was the source of the noise located?

Yes	REPAIR or REPLACE any loose or broken component or fastener as needed.
No	GO to D3

D3 CHECK THE SUSPECT SPEAKER FOR WATER INTRUSION

- Inspect for watermarks.
- Check the:
  - Cone
  - Magnet
  - Basket

Are any watermarks present on the speaker?

Yes	VERIFY the water shield is in the correct location, REPAIR or REPLACE any trim, door, or speaker seal as required. DRY the speaker in question and TEST the system for normal operation.
No	GO to D4

D4 ISOLATE SPEAKER TO VERIFY NOISE

- Remove the suspect speaker from its location and leave the speaker connected to the harness.
- Hold the speaker away from any trim panel(s) and ensure the speaker is isolated from contact.
- Operate the audio system using digital media such as a CD or MP3.

Is the noise still present in the suspect speaker?

Yes	INSTALL a new speaker for the one in question.
No	LOCATE the source of the noise and REPAIR as needed.

No Sound From All Speakers

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

To prevent voltage spikes from producing popping noises through the speakers when the ignition is in the START position, the BCM provides an ignition status CAN message and also applies voltage on the ACM start signal circuit. When the CAN message and/or voltage is received by the ACM, the audio signal output is muted. A short to voltage on this circuit causes the ACM output to be muted continuously, and will cause the warning chimes to only sound from the IPC.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1142:27	Ignition Status 1: Signal Rate of Change Above Threshold	Set by the ACM when a short to voltage is detected on the start signal circuit.

Possible Sources

- Wiring, terminals, or connectors
- Fuse
- ACM

PINPOINT TEST E : NO SOUND FROM ALL SPEAKERS

E1 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) PASSES THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM pass the network test?

Yes	GO to E2
No	REFER to: Communications Network (418-00 Module Communications Network) .

E2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) P0615, P0616 OR P0617

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0615, P0616 or P0617 set?

Yes	REFER to: Starting System (303-06 Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4) .

	REFER to: Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma (303-06 Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . REFER to: Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma (303-06 Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to E3

E3 CHECK THE START SENSE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Disconnect BCM C2280B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821A-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E4

E4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Reduced Or No Sound From Subwoofer Speaker

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

If the audio unit amplifier detects an open, short to ground, or less than 4.5 volts on the enable circuit, the speaker output will be muted for the subwoofer speaker.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A05:02	Speaker #5: General Signal Failure	Set by the ACM when a failure is detected on the audio signal circuits to the audio unit amplifier or when a failure is detected on the audio unit amplifier enable circuit.

Possible Sources

- Fuse
- Wiring, terminals, or connectors
- ACM
- Subwoofer amplifier

PINPOINT TEST F : REDUCED OR NO SOUND FROM SUBWOOFER SPEAKER

F1 CHECK THE SUBWOOFER AMPLIFIER VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect Subwoofer Amplifier C2982A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-5		Ground

Is the voltage greater than 11 volts?

Yes	GO to F2
No	VERIFY the BCM fuse 18 (20A) is in good condition and not open. If the fuse is blown, REPAIR the circuit.

F2 CHECK THE SUBWOOFER AMPLIFIER GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-5		C2982A-2

Is the voltage greater than 11 volts?

Yes	GO to F3
No	REPAIR the circuit.

F3 CHECK THE SUBWOOFER AMPLIFIER ENABLE CIRCUIT FOR CORRECT VOLTAGE

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Ignition OFF.
- Connect Subwoofer Amplifier C2982A.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-1	V	Ground

Is the voltage between 3.5 and 5 volts?

Yes	GO to F7
No	GO to F4

F4 CHECK THE SUBWOOFER AMPLIFIER ENABLE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Subwoofer Amplifier C2982A.
- Disconnect ACM C4821B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-1	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to F5

F5 CHECK THE SUBWOOFER AMPLIFIER ENABLE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to F6
No	REPAIR the circuit.

F6 CHECK THE SUBWOOFER AMPLIFIER ENABLE CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-1	Ω	C4821B-18

Is the resistance less than 3 ohms?

Yes	GO to F7
No	REPAIR the circuit.

F7 CHECK THE AUDIO SIGNAL TO THE SUBWOOFER AMPLIFIER

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Ignition OFF.
- Connect Subwoofer Amplifier C2982A.
- Connect ACM C4821B.
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-7	~V	C2982A-8

Is a fluctuating AC voltage present?

Yes	GO to F13
No	GO to F8

F8 CHECK THE AUDIO CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Subwoofer Amplifier C2982A.
- Disconnect ACM C4821B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-7	+ V −	Ground
C2982A-8	+ V −	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to F9

F9 CHECK THE AUDIO CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-7	Ω	Ground
C2982A-8	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to F10
No	REPAIR the circuit in question.

F10 CHECK THE AUDIO CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-7	Ω	C4821B-4
C2982A-8	Ω	C4821B-17

Are the resistances less than 3 ohms?

Yes	GO to F11
No	REPAIR the circuit in question.

F11 CHECK THE AUDIO CIRCUITS TO THE SUBWOOFER AMPLIFIER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2982A-7	Ω	C2982A-8

Is the resistance greater than 10,000 ohms?

Yes	GO to F12
No	REPAIR the circuit in question.

F12 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

F13 CHECK FOR CORRECT SUBWOOFER AMPLIFIER OPERATION

- Ignition OFF.
- Disconnect and inspect all the subwoofer amplifier connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect all the subwoofer amplifier connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new subwoofer amplifier.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:01	Speaker #1: General Electrical Failure	Set by the ACM when a failure is detected on the LHF door or LHF door tweeter speaker circuits.

B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:12	Speaker #1: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:12 is set, the speaker output is disabled.
B1A01:13	Speaker #1: Circuit Open	Set by the ACM when an open is detected on the LHF door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST G : THE LHF (LEFT-HAND FRONT) DOOR SPEAKER IS INOPERATIVE

G1 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C5015RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	V~	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	V~	C5015-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to G2

G2 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	V	Ground
C5003-4	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	V	Ground
C5015-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to G3

G3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C536LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C5012RHD Vehicles .
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	Ground
C5003-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	Ground
C5015-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to G4
No	REPAIR the circuit in question.

G4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C4821A-22
C5003-4	Ω	C4821A-10

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C4821A-22
C5015-4	Ω	C4821A-10

Are the resistances less than 3 ohms?

Yes	GO to G5
No	REPAIR the circuit in question.

G5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5003-1	Ω	C5003-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5015-1	Ω	C5015-4

Is the resistance greater than 10,000 ohms?

Yes	GO to G6
No	REPAIR the circuit in question.

G6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:

- Corrosion (clean module pins or install new connectors or terminals)
- Damaged or bent pins (install new terminals or pins)
- Pushed-out pins (install new pins as necessary)

- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The LHF door speaker and LHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A01:01	Speaker #1: General Electrical Failure	Set by the ACM when a failure is detected on the LHF door or LHF door tweeter speaker circuits.
B1A01:11	Speaker #1: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:11 is set, the speaker output is disabled.
B1A01:12	Speaker #1: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHF door or LHF door tweeter speaker circuits. When DTC B1A01:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST H : THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

H1 CHECK THE LHF (LEFT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the LHF door speaker operate correctly?

Yes	GO to H2
No	GO to Pinpoint Test G

	GO to Pinpoint Test C

H2 CHECK THE AUDIO SIGNAL TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect LHF Door Tweeter Speaker C536LHD Vehicles .
- Disconnect LHF Door Tweeter Speaker C5012RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	V~	C536-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	V~	C5012-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	GO to H3

H3 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect LHF Door Speaker C5003LHD Vehicles .
- Disconnect LHF Door Speaker C5015RHD Vehicles .
- Ignition ON.
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	+ V̄ −	Ground
C536-3	+ V̄ −	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead

C5012-1	V	Ground
C5012-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to H4

H4 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	Ω	Ground
C536-3	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	Ground
C5012-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to H5
No	REPAIR the circuit in question.

H5 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	Ω	C5003-2
C536-3	Ω	C5003-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5015-2
C5012-3	Ω	C5015-3

Are the resistances less than 3 ohms?

Yes	GO to H6
No	REPAIR the circuit in question.

H6 CHECK THE AUDIO CIRCUITS TO THE LHF (LEFT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C536-1	Ω	C536-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C5012-1	Ω	C5012-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new LHF door speaker. REFER to: Front Door Speaker LH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The Center Instrument Panel Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

B1A06:02	Speaker #6: General Signal Failure	Set by the ACM when a failure is detected on the center instrument panel speaker circuits.
B1A06:11	Speaker #6: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the center instrument panel speaker circuits.
B1A06:12	Speaker #6: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the center instrument panel speaker circuits.
B1A06:13	Speaker #6: Circuit Open	Set by the ACM when an open is detected on the center instrument panel speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST I : THE CENTER INSTRUMENT PANEL SPEAKER IS INOPERATIVE

I1 CHECK THE AUDIO SIGNAL TO THE CENTER INSTRUMENT PANEL SPEAKER

- Ignition OFF.
- Disconnect Center Instrument Panel Speaker C2359.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2359-1		C2359-2

Is a fluctuating AC voltage present?

Yes	INSTALL a new center instrument panel speaker.
No	GO to I2

I2 CHECK THE AUDIO CIRCUITS TO THE CENTER INSTRUMENT PANEL SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2359-1		Ground
C2359-2		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to I3

I3 CHECK THE AUDIO CIRCUITS TO THE CENTER INSTRUMENT PANEL SPEAKER FOR A SHORT

I3 CHECK THE AUDIO CIRCUITS TO THE CENTER INSTRUMENT PANEL SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2359-1	Ω	Ground
C2359-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to I4
No	REPAIR the circuit in question.

I4 CHECK THE AUDIO CIRCUITS TO THE CENTER INSTRUMENT PANEL SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2359-1	Ω	C4821A-20
C2359-2	Ω	C4821A-8

Are the resistances less than 3 ohms?

Yes	GO to I5
No	REPAIR the circuit in question.

I5 CHECK THE AUDIO CIRCUITS TO THE CENTER INSTRUMENT PANEL SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2359-1	Ω	C2359-2

Is the resistance greater than 10,000 ohms?

Yes	GO to I6
No	REPAIR the circuit in question.

I6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)

- Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RHF Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The RHF door speaker and RHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:01	Speaker #2: General Electrical Failure	Set by the ACM when a failure is detected on the RHF door or RHF door tweeter speaker circuits.
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:12	Speaker #2: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:12 is set, the speaker output is disabled.
B1A02:13	Speaker #2: Circuit Open	Set by the ACM when an open is detected on the RHF door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST J : THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER IS INOPERATIVE

J1 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles .
- Disconnect RHF Door Speaker C6003RHD Vehicles .
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1		C6015-4

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1		C6003-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	GO to J2

J2 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1		Ground
C6015-4		Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1		Ground
C6003-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to J3

J3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles.
- Disconnect RHF Door Tweeter Speaker C613RHD Vehicles.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	Ground
C6015-4	Ω	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	Ground
C6003-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to J4
No	REPAIR the circuit in question.

J4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C4821A-23
C6015-4	Ω	C4821A-11

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C4821A-23
C6003-4	Ω	C4821A-11

Are the resistances less than 3 ohms?

Yes	GO to J5

No	REPAIR the circuit in question.

J5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6015-1	Ω	C6015-4

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6003-1	Ω	C6003-4

Is the resistance greater than 10,000 ohms?

Yes	GO to J6
No	REPAIR the circuit in question.

J6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RHF Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The RHF door speaker and RHF door tweeter speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A02:01	Speaker #2: General Electrical Failure	Set by the ACM when a failure is detected on the RHF door or RHF door tweeter speaker circuits.
B1A02:11	Speaker #2: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:11 is set, the speaker output is disabled.
B1A02:12	Speaker #2: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHF door or RHF door tweeter speaker circuits. When DTC B1A02:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST K : THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER IS INOPERATIVE

K1 CHECK THE RHF (RIGHT-HAND FRONT) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the RHF door speaker operate correctly?

Yes	GO to K2
No	GO to Pinpoint Test J

K2 CHECK THE AUDIO SIGNAL TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect RHF Door Tweeter Speaker C6012LHD Vehicles.
- Disconnect RHF Door Tweeter Speaker C613RHD Vehicles.
- Operate the audio system in AM/ FM mode.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	V~	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	V~	C613-3

	▼	

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHF door tweeter speaker. REFER to: Front Door Tweeter Speaker (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	GO to K3

K3 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect RHF Door Speaker C6015LHD Vehicles.
- Disconnect RHF Door Speaker C6003RHD Vehicles.
- Ignition ON.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	V	Ground
C6012-3	V	Ground

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	V	Ground
C613-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to K4

K4 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	Ground
C6012-3	Ω	Ground

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	Ω	Ground
C613-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to K5
No	REPAIR the circuit in question.

K5 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6015-2
C6012-3	Ω	C6015-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	Ω	C6003-2
C613-3	Ω	C6003-3

Are the resistances less than 3 ohms?

Yes	GO to K6
No	REPAIR the circuit in question.

K6 CHECK THE AUDIO CIRCUITS TO THE RHF (RIGHT-HAND FRONT) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

LHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C6012-1	Ω	C6012-3

RHD Vehicles

Positive Lead	Measurement / Action	Negative Lead
C613-1	Ω	C613-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new RHF door speaker. REFER to: Front Door Speaker RH (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	REPAIR the circuit in question.

The RHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The RHR door tweeter speaker and the RHR door speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A03:01	Speaker #3: General Electrical Failure	Set by the ACM when a failure is detected on the RHR door or RHR door tweeter speaker circuits.
B1A03:11	Speaker #3: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHR door or RHR door tweeter speaker circuits. When DTC B1A03:11 is set, the speaker output is disabled.
B1A03:12	Speaker #3: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHR door or RHR door tweeter speaker circuits. When DTC B1A03:12 is set, the speaker output is disabled.
B1A03:13	Speaker #3: Circuit Open	Set by the ACM when an open is detected on the RHR door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST L : THE RHR (RIGHT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

L1 CHECK THE AUDIO SIGNAL TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER
• Ignition OFF. • Disconnect RHR Door Speaker C802. • Operate the audio system in AM/ FM mode.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1		C802-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHR door speaker. REFER to: Rear Door Speaker (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	GO to L2

L2 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1		Ground
C802-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to L3

L3 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect RHR Door Tweeter Speaker C830.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	Ground
C802-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to L4
No	REPAIR the circuit in question.

L4 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR AN

L4 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C4821A-24
C802-4	Ω	C4821A-12

Are the resistances less than 3 ohms?

Yes	GO to L5
No	REPAIR the circuit in question.

L5 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C802-1	Ω	C802-4

Is the resistance greater than 10,000 ohms?

Yes	GO to L6
No	REPAIR the circuit in question.

L6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RHR Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The RHR door tweeter speaker and the RHR door speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A03:01	Speaker #3: General Electrical Failure	Set by the ACM when a failure is detected on the RHR door or RHR door tweeter speaker circuits.
B1A03:11	Speaker #3: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the RHR door or RHR door tweeter speaker circuits. When DTC B1A03:11 is set, the speaker output is disabled.
B1A03:12	Speaker #3: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the RHR door or RHR door tweeter speaker circuits. When DTC B1A03:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST M : THE RHR (RIGHT-HAND REAR) DOOR TWEETER SPEAKER IS INOPERATIVE

M1 CHECK THE RHR (RIGHT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the RHR door speaker operate correctly?

Yes	GO to M2
No	GO to Pinpoint Test L

M2 CHECK THE AUDIO SIGNAL TO THE RHR (RIGHT-HAND REAR) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect RHR Door Tweeter Speaker C830.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C830-1	$\tilde{V}$	C830-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new RHR door tweeter speaker.
No	GO to M3

No	GO to M3

M3 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect RHR Door Speaker C802.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C830-1	V	Ground
C830-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to M4

M4 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C830-1	Ω	Ground
C830-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to M5
No	REPAIR the circuit in question.

M5 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C830-1	Ω	C802-3
C830-3	Ω	C802-2

Are the resistances less than 3 ohms?

Yes	GO to M6
No	REPAIR the circuit in question.

M6 CHECK THE AUDIO CIRCUITS TO THE RHR (RIGHT-HAND REAR) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C830-1	Ω	C830-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new RHR door speaker. REFER to: Rear Door Speaker (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	REPAIR the circuit in question.

The LHR Door Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The LHR door tweeter speaker and the LHR door speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A04:01	Speaker #4: General Electrical Failure	Set by the ACM when a failure is detected on the LHR door or LHR door tweeter speaker circuits.
B1A04:11	Speaker #4: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHR door or LHR door tweeter speaker circuits. When DTC B1A04:11 is set, the speaker output is disabled.
B1A04:12	Speaker #4: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHR door or LHR door tweeter speaker circuits. When DTC B1A04:12 is set, the speaker output is disabled.
B1A04:13	Speaker #4: Circuit Open	Set by the ACM when an open is detected on the LHR door speaker circuits.

Possible Sources

- Speaker
- Wiring, terminals, or connectors
- ACM

PINPOINT TEST N : THE LHR (LEFT-HAND REAR) DOOR SPEAKER IS INOPERATIVE

N1 CHECK THE AUDIO SIGNAL TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Disconnect LHR Door Speaker C702.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	V~	C702-4

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHR door speaker. REFER to: Rear Door Speaker (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	GO to N2

N2 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	+ V-	Ground
C702-4	+ V-	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to N3

N3 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect LHR Door Tweeter Speaker C730.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	Ground
C702-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to N4
No	REPAIR the circuit in question.

N4 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C4821A-9
C702-4	Ω	C4821A-21

Are the resistances less than 3 ohms?

Yes	GO to N5
No	REPAIR the circuit in question.

N5 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C702-1	Ω	C702-4

Is the resistance greater than 10,000 ohms?

Yes	GO to N6
No	REPAIR the circuit in question.

N6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The LHR Door Tweeter Speaker Is Inoperative

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The LHR door tweeter speaker and the LHR door speaker share the same audio signal.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A04:01	Speaker #4: General Electrical Failure	Set by the ACM when a failure is detected on the LHR door or LHR door tweeter speaker circuits.
B1A04:11	Speaker #4: Circuit Short To Ground	Set by the ACM when a short to ground is detected on the LHR door or LHR door tweeter speaker circuits. When DTC B1A04:11 is set, the speaker output is disabled.
B1A04:12	Speaker #4: Circuit Short To Battery	Set by the ACM when a short to voltage is detected on the LHR door or LHR door tweeter speaker circuits. When DTC B1A04:12 is set, the speaker output is disabled.

Possible Sources

- Speaker
- Wiring, terminals, or connectors

PINPOINT TEST O : THE LHR (LEFT-HAND REAR) DOOR TWEETER SPEAKER IS INOPERATIVE

O1 CHECK THE LHR (LEFT-HAND REAR) DOOR SPEAKER

- Ignition OFF.
- Operate the audio system in AM/ FM mode.

Does the LHR door speaker operate correctly?

Yes	GO to O2
No	GO to Pinpoint Test L

O2 CHECK THE AUDIO SIGNAL TO THE LHR (LEFT-HAND REAR) DOOR TWEETER SPEAKER

- Ignition OFF.
- Disconnect LHR Door Tweeter Speaker C730.
- Operate the audio system in AM/ FM mode.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C730-1		C730-3

Is a fluctuating AC voltage present?

Yes	INSTALL a new LHR door tweeter speaker.
No	GO to O3

O3 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR TWEETER SPEAKER FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect LHR Door Speaker C702.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C730-1	V	Ground
C730-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to O4

O4 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR TWEETER SPEAKER FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C730-1	Ω	Ground
C730-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to O5
No	REPAIR the circuit in question.

O5 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR TWEETER SPEAKER FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C730-1	Ω	C702-3
C730-3	Ω	C702-2

Are the resistances less than 3 ohms?

Yes	GO to O6

No	REPAIR the circuit in question.

O6 CHECK THE AUDIO CIRCUITS TO THE LHR (LEFT-HAND REAR) DOOR TWEETER SPEAKER FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C730-1	Ω	C730-3

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new LHR door speaker. REFER to: Rear Door Speaker (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	REPAIR the circuit in question.

All SYNC® Services Features Are Inoperative Or Inaccurate (Traffic, Directions, And Information)

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Sources

- Unregistered Owner Account
- Unregistered, inactive, or expired subscription
- Unregistered mobile phone number
- Mobile phone being used not selected as "Active"
- Inadequate phone reception
- Obstructions in the GPS antenna's line of sight
- APIM

PINPOINT TEST P : ALL SYNC® SERVICES FEATURES ARE INOPERATIVE OR INACCURATE (TRAFFIC, DIRECTIONS, AND INFORMATION)

P1 VERIFY THE CUSTOMER'S PHONE CONNECTION TO SYNC® SERVICES WHILE AWAY FROM THE VEHICLE

NOTE: *Caller ID blocking must be disabled on the customer's mobile phone so the SYNC® Services server can recognize the registered and "Active" phone number.*

- Advise the customer to call SYNC® Services from their mobile phone.
- Verify the phone call is placed and that the phone connects to SYNC® Services.
- Observe whether the SYNC® Services subscription commercial plays, or if the system asks which service is wanted.

Does the SYNC® Services subscription commercial play?

Yes	GO to P2
No	GO to P4

P2 VERIFY THE CUSTOMER'S SYNC® OWNER ACCOUNT AND SYNC® SERVICES REGISTRATION

P2 VERIFY THE CUSTOMER'S SYNC® OWNER ACCOUNT AND SYNC® SERVICES REGISTRATION AND SUBSCRIPTION

- Verify the customer has a SYNC® Owner Account on www.syncmyride.com.
- Verify the customer has registered for SYNC® Services and has an active subscription.

Does the customer have a SYNC® Owner Account and an active SYNC® Services subscription?

Yes	GO to P3
No	• If the customer does not have a SYNC® Owner Account, INFORM the customer that an account must be created in order to sign up for SYNC® Services. REFER to www.syncmyride.com. • If the customer does not have an active SYNC® Services subscription, INFORM the customer that in order for SYNC® Services to function, the subscription needs to be activated. REFER to www.service.ford.com.

P3 VERIFY THE CUSTOMER'S REGISTERED PHONE NUMBER AND STATUS

NOTE: *Only one mobile phone number can be selected as "Active" at a time, and only the "Active" mobile phone number has access to SYNC® Services.*

- Verify the mobile phone being used has the correct mobile phone number registered with the SYNC® Owner Account on www.syncmyride.com.
- Verify the mobile phone being used is selected as "Active" on www.service.ford.com.

Is the customer using the registered and active mobile phone associated with the SYNC® Services account?

Yes	GO to P5
No	INFORM the customer that the correct mobile phone number must be registered on the SYNC® website and selected as "Active." REFER to www.service.ford.com.

P4 VERIFY THE CUSTOMER'S PHONE CONNECTION TO SYNC® SERVICES FROM INSIDE THE VEHICLE

- Ensure the registered and "Active" mobile phone is paired with the SYNC® system. For information on the pairing process, refer to the Owner's Literature. If necessary, review the device compatibility list found on support.ford.com/sync-technology/device-compatibility-sync.
- Ensure the customer's mobile phone has adequate reception.
- Ensure the vehicle is in an open location that is free from obstacles such as tall buildings or large trees.
- Start the vehicle.
- Connect to SYNC® Services from the vehicle controls.
- Verify the phone call is placed and that the phone is connected to SYNC® Services.
- When prompted, select "Directions," and follow the audible prompts to get directions to an address or Saved Point.

Did SYNC® Services indicate that the vehicle location was being obtained, the route was being sent, and that the route download from the server to the vehicle was complete?

Yes	SYNC® Services is operating correctly at this time.
No	• If SYNC® Services indicated the vehicle location was **not** able to be obtained, GO to P5 • If SYNC® Services indicated the vehicle location was being obtained, but did not indicate that the route was being sent, there is a potential SYNC® Services server issue. The problem does not reside in the vehicle's audio system. • If SYNC® Services did **not** indicate the vehicle location was being obtained, the route was being sent, and that the route download from the server to the vehicle was complete, there is a potential SYNC® Services server issue. The problem does not reside in the vehicle's audio system.

P5 CHECK FOR APIM (SYNC MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.

- Using a diagnostic scan tool, perform the APIM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded in the APIM?

Yes	REFER to the DTC Chart: APIM.
No	GO to P6

P6 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All APIM Stereo Outputs Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Sources

- Customer's device
- Wiring, terminals, or connectors
- APIM
- ACM

PINPOINT TEST Q : ALL APIM (SYNC MODULE) STEREO OUTPUTS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

Q1 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE)

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Use the special back-probe tool POM6411. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Access Bezel Diagnostics.
  REFER to: Bezel Diagnostics (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures).
- Back-probe the ACM C4821B and perform the Tones Test.
- Ignition ON.
- Measure:

Stereo Right

Positive Lead	Measurement / Action	Negative Lead
C4821B-13		C4821B-26

Stereo Left

Positive Lead	Measurement / Action	Negative Lead
C4821B-12		C4821B-25

Is the AC voltage between 2.8-4.6 volts when the Stereo Right and Stereo Left are being tested?

Yes	GO to Q7
No	GO to Q2

Q2 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821B.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12		Ground
C4821B-13		Ground
C4821B-25		Ground
C4821B-26		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to Q3

Q3 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12		Ground

C4821B-13	Ω	Ground
C4821B-25	Ω	Ground
C4821B-26	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to Q4
No	REPAIR the circuit in question.

Q4 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	C3342-23
C4821B-13	Ω	C3342-25
C4821B-25	Ω	C3342-24
C4821B-26	Ω	C3342-26

Are the resistances less than 3 ohms?

Yes	GO to Q5
No	REPAIR the circuit in question.

Q5 CHECK THE APIM (SYNC MODULE) STEREO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-12	Ω	C4821B-13
C4821B-12	Ω	C4821B-25
C4821B-12	Ω	C4821B-26
C4821B-13	Ω	C4821B-25
C4821B-13	Ω	C4821B-26
C4821B-25	Ω	C4821B-26

Are the resistances greater than 10,000 ohms?

Yes	GO to Q6
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

Q6 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Q7 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All APIM Mono Outputs Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Sources

- Customer's setting
- Wiring, terminals, or connectors
- APIM
- ACM

PINPOINT TEST R : ALL APIM (SYNC MODULE) MONO OUTPUTS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

R1 CHECK FOR AN AC (ALTERNATING CURRENT) VOLTAGE SIGNAL ON THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE)

NOTICE: This pinpoint test step directs testing circuits using a back-probe method. Do not force test leads or other probes into connectors. Adequate care must be exercised to avoid connector terminal damage, while ensuring that good electrical contact is made with the circuit or terminal. Failure to follow these instructions may cause damage to wiring, terminals, or connectors, and may cause subsequent electrical faults.

- Access Bezel Diagnostics.
  REFER to: Bezel Diagnostics (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures).
- Ignition ON.
- Back-probe the ACM and perform the Tones Test.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8		C4821B-21

Is the AC voltage momentarily between 2.8-4.6 volts when the Mono Alert 1 and Mono Alert 2 are being tested?

Yes	GO to R7
No	GO to R2

R2 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect ACM C4821B.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8		Ground
C4821B-21		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to R3

R3 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	Ω	Ground
C4821B-21	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to R4
No	REPAIR the circuit in question.

R4 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	Ω	C3342-3
C4821B-21	Ω	C3342-4

Are the resistances less than 3 ohms?

Yes	GO to R5
No	REPAIR the circuit in question.

R5 CHECK THE APIM (SYNC MODULE) MONO OUTPUT CIRCUITS TO THE ACM (AUDIO FRONT CONTROL MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4821B-8	$\tilde{V}$	C4821B-21

Is the resistance greater than 10,000 ohms?

Yes	GO to R6
No	REPAIR the circuit in question.

R6 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

R7 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Voice Recognition Is Inoperative Or Does Not Operate Correctly, Or During A Phone Call, Poor Quality Or No Outgoing Audio Is Heard On The Outside Device

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D79:11	Microphone Input: Circuit Short To Ground	Set by the APIM when a short to ground is detected on the microphone circuits.
B1D79:12	Microphone Input: Circuit Short To Battery	Set by the APIM when a short to battery voltage is detected on the microphone circuits.
B1D79:13	Microphone Input: Circuit Open	Set by the APIM when an open is detected on the microphone circuits.

Possible Sources

- Wiring, terminals, or connectors
- Microphone
- APIM

PINPOINT TEST S : VOICE RECOGNITION IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY, OR DURING A PHONE CALL, POOR QUALITY OR NO OUTGOING AUDIO IS HEARD ON THE OUTSIDE DEVICE

S1 CHECK THE AUDIBLE PROMPT FUNCTIONALITY

- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.

Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has been entered?

Yes	GO to S3
No	GO to S2

S2 CHECK THE OPERATION OF THE LOWER STEERING WHEEL SWITCHES

- Operate the audio system in AM/ FM mode.
- Operate the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches.

Do the VOLUME +/-, SEEK +/END CALL, SEEK-/SEND CALL/RECEIVE CALL, VOICE, and MUTE steering wheel switches operate correctly?

Yes	GO to Pinpoint Test R
No	GO to Pinpoint Test W

S3 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect APIM C3342.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12		Ground
C3342-13		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to S4

S4 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Microphone C9221.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12	Ω	Ground
C3342-13	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to S5
No	REPAIR the circuit in question.

S5 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12	Ω	C9221-2
C3342-13	Ω	C9221-3

Are the resistances less than 3 ohms?

Yes	GO to S6
No	REPAIR the circuit in question.

S6 CHECK THE MICROPHONE CIRCUITS TO THE APIM (SYNC MODULE) FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-12	Ω	C3342-13

Is the resistance greater than 10,000 ohms?

Yes	GO to S7
No	REPAIR the circuit in question.

S7 ISOLATE THE MICROPHONE

- Connect APIM C3342.
- Install a new microphone.
  REFER to: Microphone (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).
- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.
- Speak a command to test the voice recognition for normal operation.

Is the voice recognition functioning correctly?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative microphone.
No	GO to S8

S8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure they seat and latch correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All Media Hub Functions Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The media hub requires power and ground to operate. Loss of power or ground disables all media hub functionality.

Possible Sources

- Customer's device
- Media hub
- Wiring, terminals, or connectors
- APIM

PINPOINT TEST T : ALL MEDIA HUB FUNCTIONS ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

T1 CHECK FOR APIM (SYNC MODULE) BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the APIM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to T2

T2 RESET THE APIM (SYNC MODULE)

- Remove any devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Test the system for normal operation.

Does the system operate correctly?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	GO to T3

T3 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT

- Ignition OFF.
- Disconnect Media Hub C2809.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to T4
No	GO to T5

T4 CHECK THE MEDIA HUB GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1		C2809-4

Is the voltage greater than 11 volts?

Yes	INSTALL a new media hub. REFER to: Media Hub (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).
No	GO to T5

T5 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT AND GROUND CIRCUIT FOR A SHORT TOGETHER

- Ignition OFF.
- Disconnect APIM C3342.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1	Ω	C2809-4

Is the resistance greater than 10,000 ohms?

Yes	GO to T6
No	Repair the circuit in question.

T6 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT AND GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1	Ω	C3342-8
C2809-4	Ω	C3342-38

Are the resistances less than 3 ohms?

Yes	GO to T7
No	Repair the circuit in question.

T7 CHECK THE MEDIA HUB VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to T8
No	REPAIR the circuit.

T8 CHECK THE MEDIA HUB GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2809-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to T9

T9 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The USB Port(s) Is/Are Inoperative Or Does/Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The MIT 105-00120-GEN2 is powered by the USB port.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1252:11	USB Port: Circuit Short to Ground	Set by the APIM when a short to ground or over-current condition is detected on the USB cable. This can be caused by a fault on the USB cable, USB port, or by the customer's USB.
B1252:13	USB Port: Circuit Open	Set by the APIM when an open is detected on the USB cable.
B14FD:11	External Media Control Connectivity: Circuit Short To Ground	Set by the APIM when an short to ground is detected on the USB hub power circuit for more than one second during normal operation.

Possible Sources

- Media hub
- Customer's device
- USB cable
- USB cable connection

- APIM

PINPOINT TEST U : THE USB (UNIVERSAL SERIAL BUS) PORT(S) IS/ARE INOPERATIVE OR DOES/DO NOT OPERATE CORRECTLY

U1 CHECK THE USB (UNIVERSAL SERIAL BUS) PORTS FOR POWER

- Connect: MIT 105-00120-GEN2.

Does the Multi-Media Interface Tester 420-373 power on from both USB ports?

Yes	GO to U2
No	• If the MIT 105-00120-GEN2 powers on from one USB port, INSTALL a new media hub. REFER to: Media Hub (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation). • If the MIT 105-00120-GEN2 does not power on from both USB ports, GO to Pinpoint Test T

U2 RESET THE APIM (SYNC MODULE)

- Remove all devices connected to the media hub.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Connect: MIT 105-00120-GEN2.
- Using the MIT 105-00120-GEN2, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	The system is operating correctly at this time. The concern was corrected by performing the APIM power reset. If the customer's device still does not operate correctly, the fault is with the customer's device.
No	• If the audio output is not working properly from one USB port, INSTALL a new media hub. REFER to: Media Hub (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation). • If the audio output is not working properly from both USB ports, GO to U3

U3 VERIFY THE OPERATION OF THE USB (UNIVERSAL SERIAL BUS) CABLE

- Insert a known good non-navigation USB containing music files.
- Operate the audio system attempt to play an audio file.

Is the audio output working properly?

Yes	INSTALL a new media hub. REFER to: Media Hub (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).
No	GO to U4

U4 CHECK THE APIM (SYNC MODULE) FOR DTC (DIAGNOSTIC TROUBLE CODE) B1252:11 OR B1252:13

- Using a diagnostic scan tool, clear the APIM Diagnostic Trouble Codes (DTCs).
- Perform the APIM self-test.

Is DTC B1252:11 or B1252:13 present?

Yes	GO to U5

No	GO to U7

U5 INSPECT THE USB (UNIVERSAL SERIAL BUS) CABLE, MEDIA HUB, AND APIM (SYNC MODULE)

- Ignition OFF.
- Disconnect: USB cable at the media hub.
- Disconnect: USB cable at the APIM.
- Inspect the USB cable, USB cable ends, media hub USB connector port, and APIM USB connector port for damage. Remove any debris.

Is any damage present?

Yes	• For the USB cable, INSTALL a new USB cable. • For the media hub, INSTALL a new media hub. REFER to: Media Hub (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation). • For the APIM, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	GO to U6

U6 CHECK EACH USB (UNIVERSAL SERIAL BUS) PORT FOR FUNCTIONALITY

- Connect: USB cable at the media hub.
- Connect: USB cable at the APIM.
- Connect: MIT 105-00120-GEN2.
- Using the MIT 105-00120-GEN2, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	The system is operating correctly at this time. The concern was caused by the USB connector not being seated correctly.
No	GO to U7

U7 ISOLATE THE USB (UNIVERSAL SERIAL BUS) CABLE

- INSTALL a new USB cable.
- Connect: MIT 105-00120-GEN2.
- Using the MIT 105-00120-GEN2, attempt to play an audio file using each USB port.

Is the audio output working properly for each USB port?

Yes	The system is operating correctly at this time. The concern was caused by an inoperative USB cable.
No	GO to U8

U8 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Unable To Pair Bluetooth Device

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Sources

- Incompatible Bluetooth device
- APIM

PINPOINT TEST V : UNABLE TO PAIR BLUETOOTH DEVICE

V1 CHECK THE BLUETOOTH CONNECTION

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, erases navigation and address data, deletes any devices paired with the SYNC® system.*

- Connect: MIT 105-00120-GEN2.
- Using the MIT 105-00120-GEN2, connect to the SYNC® system using Bluetooth. Follow the tool instructions.
- Using a diagnostic scan tool, view the APIM Parameter Identifications (PIDs).
- Monitor the Bluetooth device paired PID (BT_PAIR) and the Bluetooth device connected PID (BT_CONN).

Do the Parameter Identifications (PIDs) both read "Yes"?

Yes	The SYNC® system is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature. REVIEW the pairing process with the customer. If the customer's device still does not pair, the fault is with the customer's device.
No	GO to V2

V2 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Multimedia Lower Steering Wheel Switches Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1380:09	Steering Wheel Right Switch Pack: Component Failure	Set by the SCCM when the multimedia lower or multimedia upper steering wheel switch is stuck for more than 2 minutes during normal operation.
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	Set by the SCCM when a short to ground is detected on the multimedia lower or multimedia upper steering wheel switch circuits.
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	Set by the SCCM when a short to voltage is detected on the multimedia lower or multimedia upper steering wheel switch circuits.

Possible Sources

- Steering wheel switch
- Wiring, terminals, or connectors
- Clockspring
- SCCM

PINPOINT TEST W : THE MULTIMEDIA LOWER STEERING WHEEL SWITCHES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

W1 CHECK THE MULTIMEDIA LOWER STEERING WHEEL SWITCH PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Monitor the steering wheel switch Parameter Identifications (PIDs) while pressing each multimedia lower steering wheel switch.
  - Voice (SW_VOICE)
  - Mute (SW_MUTE)
  - Volume + (SW_VOLUP)
  - Volume - (SW_VOLDOWN)
  - Seek-/Phone (SW_SEEKMINUS)/(SW_PHONE)
  - Seek+/End (SW_SEEKPLUS)/(SW_END)

Do the PID values agree with the switch positions?

Yes	GO to W10

No	• If one or more, but not all PID values are incorrect or always read one particular switch position, INSTALL a new multimedia lower steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches) . • If all PID values are incorrect or always read one particular switch position, GO to W2

W2 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DTC (DIAGNOSTIC TROUBLE CODE) U0212:00

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) from the IPC.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U0212:00 present?

Yes	REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .
No	GO to W3

W3 CHECK FOR VOLTAGE FROM THE SCCM (STEERING COLUMN CONTROL MODULE)

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect LH Lower Steering Wheel Switch C2490.
- Disconnect RH Lower Steering Wheel Switch C2491.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3		C2490-5
C2490-4		C2490-5
C2490-6		C2490-5
C2490-7		C2490-5

Is approximately 5 volts present?

Yes	INSTALL a new multimedia lower steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
No	GO to W4

W4 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Clockspring C226B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	Ground
C2490-4	Ω	Ground
C2490-6	Ω	Ground
C2490-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to W5
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

W5 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	C226B-14
C2490-4	Ω	C226B-7
C2490-5	Ω	C226B-8
C2490-6	Ω	C226B-6
C2490-7	Ω	C226B-15

Are the resistances less than 3 ohms?

Yes	GO to W6
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

W6 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	C2490-4
C2490-3	Ω	C2490-5
C2490-3	Ω	C2490-6
C2490-3	Ω	C2490-7
C2490-4	Ω	C2490-5
C2490-4	Ω	C2490-6
C2490-4	Ω	C2490-7
C2490-5	Ω	C2490-6
C2490-5	Ω	C2490-7
C2490-6	Ω	C2490-7

Are the resistances greater than 10,000 ohms?

Yes	GO to W7
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

W7 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Connect Clockspring C226B.
- Disconnect Clockspring C226C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	Ground
C2490-4	Ω	Ground
C2490-6	Ω	Ground
C2490-7	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to W8
No	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

W8 CHECK THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	C226C-14
C2490-4	Ω	C226C-7
C2490-5	Ω	C226C-8
C2490-6	Ω	C226C-6
C2490-7	Ω	C226C-15

Are the resistances less than 3 ohms?

Yes	GO to W9
No	INSTALL a new clockspring. REFER to: Clockspring - Vehicles Built Up To: 16-08-2015 (501-20 Supplemental Restraint System) .

W9 CHECK THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2490-3	Ω	C2490-4
C2490-3	Ω	C2490-5
C2490-3	Ω	C2490-6
C2490-3	Ω	C2490-7
C2490-4	Ω	C2490-5
C2490-4	Ω	C2490-6
C2490-4	Ω	C2490-7
C2490-5	Ω	C2490-6
C2490-5	Ω	C2490-7
C2490-6	Ω	C2490-7

Are the resistances greater than 10,000 ohms?

Yes	GO to W10
No	INSTALL a new clockspring. REFER to: Clockspring - Vehicles Built Up To: 16-08-2015 (501-20 Supplemental Restraint System) .

W10 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Multimedia Upper Steering Wheel Switches Are Inoperative Or Do Not Operate Correctly

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1380:09	Steering Wheel Right Switch Pack: Component Failure	Set by the SCCM when the multimedia lower or multimedia upper steering wheel switch is stuck for more than 2 minutes during normal operation.
B1380:11	Steering Wheel Right Switch Pack: Circuit Short To Ground	Set by the SCCM when a short to ground is detected on the multimedia lower or multimedia upper steering wheel switch circuits.
B1380:17	Steering Wheel Right Switch Pack: Circuit Voltage Above Threshold	Set by the SCCM when a short to voltage is detected on the multimedia lower or multimedia upper steering wheel switch circuits.

Possible Sources

- Steering wheel switch
- Wiring, terminals, or connectors
- Clockspring
- SCCM

PINPOINT TEST X : THE MULTIMEDIA UPPER STEERING WHEEL SWITCHES ARE INOPERATIVE OR DO NOT OPERATE CORRECTLY

X1 CHECK THE MULTIMEDIA UPPER STEERING WHEEL SWITCH PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Monitor the steering wheel switch Parameter Identifications (PIDs) while pressing each multimedia upper steering wheel switch.
  - Up (R_CURS_UP)
  - Left (R_CURS_LFT)
  - Down (R_CURS_DWN)
  - Right (R_CURS_RGT)
  - Ok (R_CURS_OK)

Do the PID values agree with the switch positions?

Yes	GO to X13
No	• If one or more, but not all PID values are incorrect or always read one particular switch position, INSTALL a new MULTIMEDIA upper steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches) . • If all PID values are incorrect or always read one particular switch position, GO to X2

X2 CHECK FOR IPC (INSTRUMENT PANEL CLUSTER) DTC (DIAGNOSTIC TROUBLE CODE) U0212:00

- Ignition ON.
- Using a diagnostic scan tool, clear the DTCs from the IPC.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC U0212:00 present?

Yes	REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .
No	GO to X3

X3 CHECK FOR VOLTAGE FROM THE SCCM (STEERING COLUMN CONTROL MODULE)

WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect RH Upper Steering Wheel Switch C2999.
- Disconnect LH Upper Steering Wheel Switch C2998.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	V	C2999-3

Is approximately 5 volts present?

Yes	INSTALL a new multimedia upper steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches) .
No	GO to X4

X4 CHECK THE AIRBAG HARNESS FOR A SHORT TO GROUND

- Disconnect In-line C2606.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	Ground
C2999-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to X5
No	INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).

X5 CHECK THE AIRBAG HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	C2606-2
C2999-3	Ω	C2606-4

Are the resistances less than 3 ohms?

Yes	GO to X6
No	INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).

X6 CHECK THE AIRBAG HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	C2999-3

Is the resistance greater than 10,000 ohms?

Yes	GO to X7
No	INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).

X7 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TO GROUND

- Connect In-line C2606.
- Disconnect Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	Ground
C2999-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to X8
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

X8 CHECK THE STEERING WHEEL HARNESS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	C218B-14
C2999-3	Ω	C218B-16

Are the resistances less than 3 ohms?

Yes	GO to X9
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

X9 CHECK THE STEERING WHEEL HARNESS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	C2999-3

Is the resistance greater than 10,000 ohms?

Yes	GO to X10
No	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column, Removal and Installation).

X10 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Connect Clockspring C218B.
- Disconnect Clockspring C218C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	Ground
C2999-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to X11
No	INSTALL a new clockspring. REFER to: Clockspring - Vehicles Built Up To: 16-08-2015 (501-20 Supplemental Restraint System) .

X11 CHECK THE CLOCKSPRING FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	C218C-6
C2999-3	Ω	C218C-10

Are the resistances less than 3 ohms?

Yes	GO to X12
No	INSTALL a new clockspring.

	REFER to: Clockspring - Vehicles Built Up To: 16-08-2015 (501-20 Supplemental Restraint System) .

X12 CHECK THE CLOCKSPRING FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2999-2	Ω	C2999-3

Is the resistance greater than 10,000 ohms?

Yes	GO to X13
No	INSTALL a new clockspring. REFER to: Clockspring - Vehicles Built Up To: 16-08-2015 (501-20 Supplemental Restraint System) .

X13 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Audio System Does Not Operate Correctly From The FCIM

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Possible Source

- FCIM

PINPOINT TEST Y : THE AUDIO SYSTEM DOES NOT OPERATE CORRECTLY FROM THE FCIM (FRONT CONTROLS INTERFACE MODULE)

Y1 CHECK THE FDIM (FRONT DISPLAY INTERFACE MODULE) OPERATION

- Verify the FDIM screen operation.

Does the FDIM operate correctly?

Yes	GO to Y2
No	GO to Pinpoint Test Z

Y2 VERIFY THE ACM (AUDIO FRONT CONTROL MODULE) , APIM (SYNC MODULE) AND FCIM (FRONT CONTROLS INTERFACE MODULE) PASS THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Did the ACM, APIM and FCIM pass the network test?

Yes	GO to Y3
No	REFER to: Communications Network (418-00 Module Communications Network) .

Y3 RESET THE AUDIO SYSTEM MODULES AND RECHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Disconnect the battery for 1 minute, then reconnect it.
- Turn the infotainment system on.
- Test the FCIM for normal operation.

Does the FCIM operate correctly?

Yes	The FCIM is operating correctly at this time. The concern was corrected by resetting the audio system modules.
No	GO to Y4

Y4 RETRIEVE THE ACM (AUDIO FRONT CONTROL MODULE) , APIM (SYNC MODULE) , FCIM (FRONT CONTROLS INTERFACE MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM

Are any Diagnostic Trouble Codes (DTCs) present in the ACM, APIM and/or FCIM?

Yes	• For ACM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: ACM. • For APIM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: APIM. • For FCIM Diagnostic Trouble Codes (DTCs), REFER to the DTC Chart: FCIM.
No	GO to Y5

Y5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

The FDIM Is Inoperative Or Does Not Operate Correctly

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B108E:01	Display: General Electrical Failure	Set by the APIM when an error is detected in the touch sensing ability of the FDIM.
B108E:63	Display: Circuit / Component Protection Time-Out	Set by the APIM when the FDIM detects a touch input for more than 2 minutes during normal operation.
U0162:00	Lost Communication With Navigation Display Module: No Sub Type Information	Set by the APIM when communication is missing from the FDIM for more than 1 second with the ignition in RUN.

Possible Sources

- Object pressed against the touchscreen
- FDIM
- APIM
- LVDS Cable

NOTE: *The FDIM touchscreen can only sense one touch command at a time. If any objects are pressed against the touchscreen (including wiring or components behind the trim panel surrounding the touchscreen), the FDIM can appear to be inoperative.*

PINPOINT TEST Z : THE FDIM (FRONT DISPLAY INTERFACE MODULE) IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

Z1 VERIFY THE FDIM (FRONT DISPLAY INTERFACE MODULE) RESPONSE TO TOUCH COMMANDS

- Ignition ON.
- Turn the infotainment system on.
- **NOTE:** *The touchscreen is a capacitive touch panel. This means that an ungloved finger will result in a more responsive touch panel, due to the conductivity of the skin touching the panel. Touches on the panel made with an object that does not have a path to ground will not be registered.*

Perform various FDIM touch commands and observe the FDIM operation.

Does the FDIM respond correctly to each touch command?

Yes	VERIFY the customer's specific concern by duplicating the steps that were taken when the original concern was generated. If the concern is not duplicated, the system is operating correctly at this time. INSTRUCT the customer in the correct operation of the FDIM touchscreen.
No	• If the FDIM is inoperative but not blank, GO to Z7 • If the FDIM is blank, GO to Z2

Z2 VERIFY THE APIM (SYNC MODULE) IGNITION STATE PID

- Using a diagnostic scan tool, monitor the APIM PID: KEYPOS.
  REFER to: Touchscreen Calibration (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display) .
- Ignition OFF.
- Ignition ON.

Does the PID match the actual ignition switch positions?

Yes	GO to Z3
No	GO to Z4

Z3 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Ignition ON.
- Inspect the IPC for correct operation. For indicator prove-out information,
  REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .

Does the IPC operate correctly?

Yes	REFER to: Communications Network (418-00 Module Communications Network) . See: The APIM Does Not Respond To The Diagnostic Scan Tool.
No	Diagnose the IPC. REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .

Z4 VERIFY THAT THE HS-CAN3 MODULES PASS THE NETWORK TEST

- **NOTE:** *A concern with the HS-CAN3 will cause the FDIM touchscreen to be blank.*
  Using a diagnostic scan tool, perform the network test.

Did the APIM, ACM, and IPC pass the network test?

Yes	GO to Z5
No	REFER to: Communications Network (418-00 Module Communications Network) .

Z5 CHECK THE LVDS (LOW VOLTAGE DIFFERENTIAL SIGNALING) CABLE FOR AN OPEN

- Ignition OFF.
- Disconnect APIM C3342.
- Disconnect FDIM C2123.
- **NOTE:** *Use the male Flex Probe 300-08057 (.5mm) or equivalent to perform measurements at the LVDS cable connections.*
  Measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-1	Ω	C2123-4
C3342-2	Ω	C2123-3
C3342-3	Ω	C2123-2
C3342-4	Ω	C2123-1
C3342-Shield	Ω	C2123-Shield

- Using a diagnostic scan tool, perform the APIM self-test.

Are the resistances less than 3 ohms?

Yes	GO to Z6
No	INSTALL a new LVDS Cable. REFER to: SYNC Module [APIM] to Front Display Interface Module (FDIM) Cable (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).

Z6 CHECK FOR CORRECT VOLTAGE OUTPUT FROM THE APIM (SYNC MODULE) TO THE FDIM (FRONT DISPLAY INTERFACE MODULE)

- Ignition OFF.
- Connect APIM C3342.
- Ignition ON.
- **NOTE:** *Use the male Flex Probe 300-08057 (.5mm) or equivalent to perform measurements at the LVDS cable connections.*

  Using the multimeter mVDC (voltage direct current) range setting, measure the following: (if necessary, refer to the multimeter's owner's manual for information on how to access the mV range)

Positive Lead	Measurement / Action	Negative Lead
C2123-3	Ω	Ground (ensure that the LVDS cable ground is not used for this measurement)

- Using a diagnostic scan tool, perform the APIM self-test.

Is the voltage between .5 and 10 millivolts?

Yes	INSTALL a new FDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	GO to Z9

Z7 TEMPORARILY REMOVE THE POWER FROM THE APIM (SYNC MODULE) AND RECHECK THE SYSTEM OPERATION

NOTE: *Performing a Master Reset returns all preference settings to the factory defaults, erases the phone book and call histories, erases navigation and address data, deletes any devices paired with the SYNC® system.*

- Ignition OFF.
- Carry out an APIM power reset by disconnecting the battery for 1 minute, then reconnecting it.
- Wait at least 2 minutes for the APIM to re-initialize.
- Ignition ON.
- Turn the infotainment system on.
- Perform various FDIM touch commands and observe the FDIM operation.

Does the touchscreen operate correctly?

Yes	The FDIM is operating correctly at this time. PERFORM a Master Reset. REFER to the Owner's Literature.
No	GO to Z8

Z8 REMOVE THE FCIM (FRONT CONTROLS INTERFACE MODULE) AND RECHECK THE SYSTEM OPERATION

NOTE: *The FDIM can only sense one touch command at a time. If any objects are pressed against the touchscreen (including wiring or components behind the trim panel surrounding the FDIM), the FDIM can appear to be inoperative.*

- Remove the FCIM, but do not disconnect any connectors.
  REFER to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
- Perform various FDIM touch commands and observe the FDIM operation.

Does the FDIM respond correctly to each touch command?

Yes	The FDIM is operating correctly at this time. REINSTALL the FCIM and ensure the FDIM opening is properly aligned with the FDIM and that no objects are in contact with the FDIM touchscreen.
No	GO to Z9

Z9 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The GPS Is Inoperative Or Does Not Operate Correctly - If Equipped With Navigation

Refer to Wiring Diagrams Cell 132 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B119F:01	GPS Antenna: General Electrical Failure	Set by the APIM when a short to ground or short to battery voltage is detected on the GPS coaxial cable for more than 250 milliseconds.
B119F:13	GPS Antenna: Circuit	Set by the APIM when an open is detected on the GPS coaxial cable for more

	Open	than 250 milliseconds.

Possible Sources

- Obstructions in the GPS antenna's line of sight
- Incorrectly matched ESN
- GPS coaxial cable
- Wiring, terminals, or connectors
- ACM
- APIM

PINPOINT TEST AA : GPS (GLOBAL POSITIONING SYSTEM) IS INOPERATIVE OR DOES NOT OPERATE CORRECTLY

AA1 CHECK THE GPS (GLOBAL POSITIONING SYSTEM) ANTENNA RECEPTION

- Ignition ON.
- Access Bezel Diagnostics.
  REFER to: Bezel Diagnostics (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, General Procedures).
- Monitor the "Number of Satellites" and "Fix Mode" in APIM Location Information.
- If the values read less than 3 for "Number of Satellites" or "No GPS Fix" for "Fix Mode," drive the vehicle to an outdoor location that is free from obstacles such as tall buildings or large trees until at least 3 satellites are listed for "Number of Satellites" **and** "3D" is listed for "Fix Mode."

Can 3 or more satellites and a 3D fix be obtained?

Yes	GO to AA2
No	GO to AA4

AA2 CHECK NAVIGATION FOR CORRECT OPERATION

- Operate various navigation features (including a short, guided route) and observe their functionality.

Does navigation operate correctly?

Yes	The system is operating correctly at this time. The concern was a result of obstructions in the antenna's line of sight for an extended period of time.
No	GO to AA3

AA3 CHECK FOR ABS (ANTI-LOCK BRAKE SYSTEM) MODULE TO APIM (SYNC MODULE) COMMUNICATION

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0121:00 set in the APIM?

Yes	GO to AA4
No	GO to AA10

AA4 CHECK THE APIM (SYNC MODULE) FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC B119F:01 or B119F:13 set in the APIM?

Yes	GO to AA5
No	GO to AA10

AA5 CHECK FOR CORRECT APIM (SYNC MODULE) OUTPUT VOLTAGE FROM THE GPS (GLOBAL POSITIONING SYSTEM) COAXIAL CABLE CONNECTION

- Ignition OFF.
- Remove the GPS Coaxial Cable from the APIM.
- Ignition ON.
- **NOTE:** *Use female Flex Probe 300-08058 (.5mm x .5mm) or equivalent.*

Measure:

Positive Lead	Measurement / Action	Negative Lead
GPS coaxial cable core at the APIM**(component side)**	V	Ground



E231524

Is the voltage between 4.7 and 5.8 volts?

Yes	GO to AA6
No	GO to AA10

AA6 CHECK THE GPS (GLOBAL POSITIONING SYSTEM) ANTENNA COAXIAL CABLE CORE AND SHIELD FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
GPS antenna coaxial cable core at the APIM		Ground
GPS antenna coaxial cable shield at the APIM		Ground

Is any voltage present?

Yes	INSTALL a new GPS coaxial cable.
No	GO to AA7

AA7 CHECK THE GPS (GLOBAL POSITIONING SYSTEM) ANTENNA COAXIAL CABLE CORE FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
GPS antenna coaxial cable core at the APIM	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to AA8
No	INSTALL a new GPS coaxial cable.

AA8 CHECK THE GPS (GLOBAL POSITIONING SYSTEM) ANTENNA COAXIAL CABLE CORE AND SHIELD FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
GPS antenna coaxial cable core at the APIM	Ω	Front GPS antenna coaxial cable core at the in-line connection
GPS antenna coaxial cable shield at the APIM	Ω	Front GPS antenna coaxial cable shield at the in-line connection

Are the resistances less than 1 ohm?

Yes	GO to AA9
No	INSTALL a new GPS coaxial cable.

AA9 CHECK THE GPS (GLOBAL POSITIONING SYSTEM) ANTENNA COAXIAL CABLE CORE AND SHIELD FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
GPS antenna coaxial cable core at the APIM	Ω	GPS antenna coaxial cable shield at the APIM

Is the resistance greater than 10,000 ohms?

Yes	GO to AA10
No	INSTALL a new GPS coaxial cable.

AA10 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and all related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Voice Recognition Does Not Operate Correctly To Voice Navigate To A Destination

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

Visual Inspection and Diagnostic Pre-checks

- Verify the ignition is ON.
- Run the vehicle for at least one minute before testing the system in order for the navigation and voice recognition application to load properly.
- Verify the media hub and microphone is functioning correctly before proceeding.

PINPOINT TEST AB : VOICE RECOGNITION DOES NOT OPERATE CORRECTLY TO VOICE NAVIGATE TO A DESTINATION

AB1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH A FACTORY-INSTALLED NAVIGATION SYSTEM

- Make sure the correct VIN was entered on the technician service publication website.
- Hover the mouse cursor over or click on the OASIS tab toward the top left of the screen.
- Select "HVBoM (Historical Vehicle Bill of Material)."
- Locate the **Limit to Base:** text entry box toward the center of the screen.

Does the technician service publication website indicate the vehicle is equipped with a factory-installed navigation system?

Yes	GO to AB2
No	Ford Motor Company does not support the addition of a navigation system to vehicles not equipped with a factory-installed navigation system.

AB2 REPROGRAM THE APIM (SYNC MODULE)

- Perform the APIM Programming.
  REFER to: SYNC Module [APIM] Programming (415-00A Information and Entertainment System - General Information - Vehicles With: AM/FM/CD, General Procedures).
- Override the Service Pack installation and perform a Full Flash/Force CIP.
- Once the APIM programming is complete and the system has re-initialized, confirm that the navigation system operates correctly.

Does the navigation system operate correctly?

Yes	The navigation system is operating correctly at this time. The concern was resolved by reprogramming the APIM.
No	GO to AB3

AB3 VERIFY NO ROUTE PREFERENCE, NAVIGATION, TRAFFIC, OR AVOID AREA RESTRICTIONS ARE SELECTED

- Verify the Navigation Route Preferences are not set to avoid freeways, toll roads, ferries, and car trains.

Refer to the Owner's Literature.
- Verify Traffic Preferences are set properly. Refer to the Owner's Literature.
- Verify the destination being entered is not located within the boundaries of a “to avoid” area. Refer to the Owner's Literature.
- Change preferences as necessary, and operate the Voice Navigation system.

Does the Voice Navigation system operate as expected?

Yes	If the concern is not duplicated, the system is operating correctly at this time. INSTRUCT the customer in the correct operation of the route preference, navigation, traffic, and avoid area restrictions.
No	GO to AB4

AB4 CHECK THE AUDIBLE PROMPT FUNCTIONALITY

- Operate the audio system in AM/ FM mode.
- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.

Does the SYNC® system produce an audible prompt correctly; indicating voice recognition mode has been entered?

Yes	GO to AB5
No	GO to Pinpoint Test R

AB5 CHECK THE VOICE RECOGNITION OPERATION

- Operate the VOICE steering wheel switch and listen for the SYNC® audible prompt.
- **NOTE:** *Make sure the interior of the vehicle is as quiet as possible. Excessive noise may prevent the system from correctly recognizing spoken commands.*

  Clearly speak the word "help."

Does the SYNC® system respond correctly to the "help" voice command?

Yes	The voice recognition of the navigation destination concern may have been caused by an insufficiently quiet vehicle or a destination not being present in the map database. GO to AB6
No	GO to Pinpoint Test S

AB6 CHECK OPERATION OF NAVIGATION SYSTEM WITH MANUAL DESTINATION ENTRY

NOTE: *Dragging your finger and pinching two fingers will not scroll to a location or zoom in or out as in other devices on the market. Holding your finger on a location off-center will cause the map to scroll to that location. Refer to the Owner's Literature for more information about navigating the map screen.*

- Using the map feature, touch the screen at the requested destination.
- Verify a road is present on the map at the requested location and verify the address of the destination is correct.

Does the navigation system properly navigate to the destination requested?

Yes	The system is operating correctly at this time. NOTIFY the customer that there may be an updated map upgrade available for purchase.
No	GO to Pinpoint Test AA

Lost Communication with ECM/PCM U0100:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication with ECM/PCM "A": No Sub Type Information	Set by the ACM when network messages are missing from the PCM for more than 5 seconds with the ignition in RUN.

Possible Source

- PCM

PINPOINT TEST AC : LOST COMMUNICATION WITH ECM/PCM U0100:00

AC1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AC2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:00 set in the ACM?

Yes	GO to AC3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC3 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AC4

AC4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the ACM.

Are low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AC5

AC5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0100:00 set in more than one module?

Yes	GO to AC6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AC6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the PCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the PCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Powertrain Control Module (PCM) - Vehicles Built Up To: 16-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . REFER to: Powertrain Control Module (PCM) - Vehicles Built Up To: 16-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With ABS Control Module U0121:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	Set by the APIM when network messages are missing from the ABS module for more than 5 seconds with the ignition in RUN.

Possible Source

- Communication network concern
- ABS Module
- APIM

PINPOINT TEST AD : LOST COMMUNICATION WITH ABS (ANTI-LOCK BRAKE SYSTEM) CONTROL MODULE U0121:00

AD1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AD2
No	CLEAR the DTC. The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test

Does the ABS module pass the network test?

Yes	GO to AD3
No	REFER to: Communications Network (418-00 Module Communications Network) .

AD3 PERFORM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE all non-network Diagnostic Trouble Codes (DTCs). REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to AD4

AD4 PERFORM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the APIM self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE all non-network Diagnostic Trouble Codes (DTCs). REFER to the APIM DTC chart.
No	GO to AD5

AD5 RECHECK THE APIM (SYNC MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE

CODES (CMDTCS)

- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the APIM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0121:00 still present?

Yes	GO to AD6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AD6 CHECK FOR OTHER CAUSES OF COMMUNICATION NETWORK CONCERN

- CHECK the vehicle service history for recent service actions related to the ABS module or APIM. If recent service history is found:
  - verify correct replacement module was installed
    - HVBOM may be used to verify correct part fitment
  - verify the configuration of replacement module was correct
    - re-configure module using as-built data if prior configuration is suspect
  - verify the module was not obtained from a like vehicle and installed into customer vehicle
    - return the swapped module to source vehicle and obtain new replacement module
- Operate the system and determine if the observable symptom is still present.

Is the observable symptom still present?

Yes	GO to AD7
No	The system is operating correctly at this time. The concern may have been due to incorrect parts replacement procedures or incorrect module configuration.

AD7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module and all related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ABS module and all related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With BCM U0140:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General

Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	Set by the ACM, APIM and FCIM when network messages are missing from the BCM for more than 5 seconds with the ignition in RUN.

Possible Source

- BCM

PINPOINT TEST AE : LOST COMMUNICATION WITH BCM (BODY CONTROL MODULE) U0140:00

AE1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AE2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0140:00 set in the ACM or the APIM, FCIM?

Yes	GO to AE3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE3 CHECK THE BCM (BODY CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to AE4

AE4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:

- ACM
- APIM
- FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AE5

AE5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0140:00 set in more than one module?

Yes	GO to AE6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AE6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - Vehicles Built Up To: 16-08-2015 (419-10 Multifunction Electronic Modules) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With RCM U0151:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	Set by the APIM and FCIM when the airbag deployment notification message from the RCM is missing for more than 5 seconds with the ignition in RUN.

Possible Source

- RCM

PINPOINT TEST AF : LOST COMMUNICATION WITH RCM (RESTRAINTS CONTROL MODULE) U0151:00

AF1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AF2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AF2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0151:00 set in the APIM or FCIM?

Yes	GO to AF3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AF3 CHECK THE RCM (RESTRAINTS CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the RCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Airbag Supplemental Restraint System (SRS) - LHD 4WD/LHD RWD/RHD 4WD/RHD RWD (501-20 Supplemental Restraint System) .
No	GO to AF4

AF4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - APIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AF5

AF5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:00 SET IN MULTIPLE MODULES
• Review the recorded results from the self-test. **Is DTC U0151:00 set in both the APIM and FCIM?**

Yes	GO to AF6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AF6 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

• Ignition OFF.
• Disconnect and inspect all the RCM and related in-line connectors.
• Repair:
  • Corrosion (clean module pins or install new connectors or terminals)
  • Damaged or bent pins (install new terminals or pins)
  • Pushed-out pins (install new pins as necessary)
• Reconnect the RCM and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) - Vehicles Built Up To: 16-08-2015 (501-20 Supplemental Restraint System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With IPC U0155:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With IPC Control Module: No Sub Type Information	Set by the ACM, APIM, FCIM and (CD player) when network messages are missing from the IPC for more than 5 seconds with the ignition in RUN.

Possible Source

- IPC

PINPOINT TEST AG : LOST COMMUNICATION WITH IPC (INSTRUMENT PANEL CLUSTER) U0155:00

AG1 VERIFY THE CUSTOMER'S CONCERN
• Ignition ON. • Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AG2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AG2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:00 set in the ACM, APIM, FCIM or the (CD player)?

Yes	GO to AG3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AG3 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the IPC self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .
No	GO to AG4

AG4 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AG5

AG5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0155:00 set in more than one module?

Yes	GO to AG6
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AG6 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the IPC and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) (413-01 Instrument Panel Cluster (IPC)) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With PAM U0159:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

The PAM is integral to the BCM.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0159:00	Lost Communication With Parking Assist Control Module "A": No Sub Type Information	Set by the APIM when network messages are missing from the PAM for more than 5 seconds with the ignition in RUN.

Possible Source

- PAM

PINPOINT TEST AH : LOST COMMUNICATION WITH PAM (PARKING ASSIST CONTROL MODULE) U0159:00

AH1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AH2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AH2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0159:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0159:00 set in the APIM?

Yes	GO to AH3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AH3 CHECK THE BCM (BODY CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to AH4

AH4 CHECK THE APIM (SYNC MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the APIM self-test.

Are low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AH5

AH5 CHECK FOR CORRECT PAM (PARKING ASSIST CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - Vehicles Built Up To: 16-08-2015 (419-10 Multifunction Electronic Modules) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With Radio U0184:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0184:00	Lost Communication With Radio: No Sub Type Information	Set by the APIM when network messages are missing from the ACM for more than 5 seconds with the ignition in RUN.

Possible Source

- ACM

PINPOINT TEST AI : LOST COMMUNICATION WITH RADIO U0184:00

AI1 VERIFY THE CUSTOMER'S CONCERN

- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AI2
No	The system is operating normally at this time. This DTC may have been set due to high network traffic or an intermittent fault condition.

AI2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0184:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0184:00 set in the APIM?

Yes	GO to AI3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AI3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN

No	GO to AI4

AI4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With APIM U0253:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	Set by the ACM and the FCIM when network messages are missing from the APIM for more than 5 seconds with the ignition in RUN.

Possible Source

- APIM

PINPOINT TEST AJ : LOST COMMUNICATION WITH APIM (SYNC MODULE) U0253:00

AJ1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AJ2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AJ2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0253:00 set in the ACM, and/or the FCIM?

Yes	GO to AJ3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AJ3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM
  - FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AJ4

AJ4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0253:00 set in the ACM and/or the FCIM?

Yes	GO to AJ5
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AJ5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Lost Communication With FCIM U0256:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0256:00	Lost Communication With Front Controls Interface Module "A": No Sub Type Information	Set by the ACM and APIM when network messages are missing from the FCIM for more than 5 seconds with the ignition in RUN.

Possible Source

- FCIM

PINPOINT TEST AK : LOST COMMUNICATION WITH FCIM (FRONT CONTROLS INTERFACE MODULE) U0256:00

AK1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AK2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AK2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0256:00 set in the ACM or APIM?

Yes	GO to AK3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AK3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:

- ACM
- APIM
- FCIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AK4

AK4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0256:00 set in both the ACM and the APIM?

Yes	GO to AK5
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AK5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition ON.
- Disconnect and inspect the FCIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the FCIM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00D Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

Lost Communication With FDIM U0257:00

Normal Operation and Fault Conditions

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/DAB/Touchscreen Display/Navigation System) .

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0257:00	Lost Communication With	**NOTE:** *The FDIM is a non-networked module attached to the APIM. The*

	Front Controls / Display Interface Module: No Sub Type Information	*APIM acts as the gateway module for messages sent over the Infotainment Controller Area Network (I-CAN) between the FDIM, ACM, and FCIM.* Set by the ACM when network messages are missing from the APIM for more than 5 seconds with the ignition in RUN. This DTC may be set in conjunction with DTC U0253:00.

Possible Source

- APIM

PINPOINT TEST AL : LOST COMMUNICATION WITH FDIM (FRONT DISPLAY INTERFACE MODULE) U0257:00

AL1 VERIFY THE CUSTOMER'S CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to AL2
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AL2 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0257:00

- Ignition ON.
- Using a diagnostic scan tool, clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0257:00 set in the ACM?

Yes	GO to AL3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AL3 CHECK FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the self-test for the following modules:
  - ACM
  - APIM

Are any low or high voltage Diagnostic Trouble Codes (DTCs) present?

Yes	• For DTC U3003:16, GO to Pinpoint Test AM • For DTC U3003:17, GO to Pinpoint Test AN
No	GO to AL4

AL4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0257:00 SET IN MULTIPLE MODULES

- Review the recorded results from the self-test.

Is DTC U0257:00 set in the ACM?

Yes	INSTALL a new FDIM. CLEAR the DTCs. Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs). If DTC U0257:00 is still present, GO to AL5
No	• If there is an observable symptom, REFER to the Symptom Chart: General Audio System, to diagnose the observed symptom. • If there is no observable symptom, the system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

AL5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage Low U3003:16

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Set by the ACM, APIM and FCIM when the supply voltage falls below 10 volts for at least 10 seconds during normal operation or for more than 250 milliseconds during the self-test.

Possible Sources

- Previous low battery voltage
- Wiring, terminals, or connectors
- ACM
- APIM

PINPOINT TEST AM : BATTERY VOLTAGE LOW U3003:16

AM1 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:16

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 15 seconds.

- Using a diagnostic scan tool, repeat the self-test for the module in question.

Is DTC U3003:16 still present?

Yes	GO to AM2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

AM2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test

Are any voltage-related DTC set in the PCM?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AM3

AM3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery fully charged and in good condition?

Yes	GO to AM4
No	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

AM4 CHECK THE MODULE VOLTAGE SUPPLY

- Ignition OFF.
- Measure and record the voltage at the battery.
- Disconnect the audio system module setting DTC U3003:16.
- Ignition ON.
- Measure the voltage between the module setting DTC U3003:16 and ground.
- For the ACM, measure:

Base 4 Speaker

Positive Lead	Measurement / Action	Negative Lead
C240A-1		Ground

Uplevel 10 Speaker

Positive Lead	Measurement / Action	Negative Lead
C4821A-1		Ground

- For the APIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-1		Ground

Is the voltage within 0.2 volts of the recorded battery voltage?

Yes	GO to AM5
No	REPAIR the circuit for high resistance.

AM5 CHECK THE SUSPECT MODULE GROUND CIRCUIT FOR CONTINUITY

- Measure the voltage at the suspect module.
- For the ACM, measure:

Base 4 Speaker

Positive Lead	Measurement / Action	Negative Lead
C240A-1		C240A-13

Uplevel 10 Speaker

Positive Lead	Measurement / Action	Negative Lead
C4821A-1		C4821A-13

- For the APIM, measure:

Positive Lead	Measurement / Action	Negative Lead
C3342-1		C3342-37

Is the suspect module voltage greater than 11 volts?

Yes	• For the ACM, GO to AM6 • For the APIM, GO to AM7
No	REPAIR the circuit for high resistance.

AM6 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AM7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Battery Voltage High U3003:17

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	Set by the ACM, APIM and FCIM when the supply voltage is more than 15.8 volts for more than 250 milliseconds during normal operation or the self-test.

Possible Sources

- ACM
- APIM

PINPOINT TEST AN : BATTERY VOLTAGE HIGH U3003:17

AN1 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) for the module in question.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the self-test for the module in question.

Is DTC U3003:17 present?

Yes	GO to AN2
No	The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

AN2 CHECK FOR HIGH VOLTAGE DIAGNOSTIC TROUBLE CODES (DTCS) SET IN MULTIPLE MODULES

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are high voltage Diagnostic Trouble Codes (DTCs) such as B1676, P0563, or U3003:17 set in more than one module?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to AN3

AN3 CHECK THE BATTERY VOLTAGE

- Turn off all interior lights, exterior lights, and accessories.
- Start and run the engine at approximately 2,000 RPM for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	• For the ACM, GO to AN4 • For the APIM, GO to AN5

AN4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)
  - Pushed-out pins (install new pins as necessary)
- Reconnect the ACM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

AN5 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM and related in-line connectors.
- Repair:
  - Corrosion (clean module pins or install new connectors or terminals)
  - Damaged or bent pins (install new terminals or pins)

- Pushed-out pins (install new pins as necessary)
- Reconnect the APIM and related in-line connectors. Make sure it seats and latches correctly.
- Wait at least 2 minutes for the APIM to re-initialize.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. REFER to: SYNC Module [APIM] (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Bezel Diagnostics

Check

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00) .

NOTE: *If there is a concern with one of the following components and Bezel Diagnostics cannot be accessed, obtain the module part number by referencing the label attached to the module.*

- *Inoperative (blank or does not power on) FDIM*
- *Inoperative FCIM*
- *Inoperative steering wheel switch (for vehicles without a CD player)*

Refer to appropriate section in Group 415 to diagnose the inoperative component.

2. Ignition ON.
3. Operate the audio system in AM/ FM mode.

• For vehicles **with** a CD player, press and hold the EJECT button, and within 1 second, press and hold the SEEK UP button. If supported, the Speaker Walk-Around Test will begin, and the display will indicate each speaker as it is tested.
• For vehicles **without** a CD player, simultaneously press and hold the steering wheel SEEK UP switch and FCIM TUNE UP button. If supported, the Speaker Walk-Around Test will begin, and the display will indicate each speaker as it is tested.

4. Once the Speaker Walk-Around Test (All Speaker Test) is complete, the following information is available:

Menu	Submenu
APIM Diagnostics	Part Numbers
	Software Versions
	Configuration Status
	Location Information
	Tones Test
	Touchscreen Activation Test
	Display Test Pattern
	RGB Pixel Test
	IVSU Versions
	Exit Diagnostics
AHU Diagnostics (AHU refers to the ACM)	AHU Part Numbers (also displays SIRIUS ESN)
	Radio Signal Strength
	Speaker Walk-Around Test Active (if **not** equipped with audio DSP module)

	Exit Diagnostics
DSP Diagnostics (if equipped)	DSP Part Numbers
	Speaker Walk-Around Test Active
	Exit Diagnostics
EFP Diagnostics - if equipped (EFP refers to the FCIM that communicates on the CAN)	EFP Part Numbers
	Exit Diagnostics

5. To exit the bezel diagnostics, press the FCIM on/off button or select "Exit Diagnostics."

Copyright © 2016 Ford Motor Company

Speaker Audio Test

Activation

NOTE: *The procedure used to download the audio files will be different depending on the web browser that you use. Instructions have been included on how to download the files using INTERNET EXPLORER, GOOGLE CHROME, and MOZILLA FIREFOX. The instructions were valid at the time this procedure was written and may vary with a different version of INTERNET EXPLORER, GOOGLE CHROME, or MOZILLA FIREFOX.*

1. **NOTE:** *To download the file in INTERNET EXPLORER, click on each link. When the link is clicked on an audio player will launch. After the player has launched select Switch to Library/Go to Library>File>Save As... and save the file to the USB drive.*

   NOTE: *To download the file in GOOGLE CHROME click on each link. When the link is clicked a new tab will open and the audio file will start playing. Right click on the screen and click Save As... and save the file to the USB drive.*

   NOTE: *To download the file in MOZILLA FIREFOX click on each link. When the link is clicked a new tab will open and the audio file will start playing. Right click on the play button and click Save Audio As... and save the file to the USB drive.*

   Download all of the diagnostic sound tracks to a suitable USB drive.

Click here to view a video version of this procedure.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] Programming

Activation

1. **WARNING: Before beginning any service procedure in this section, refer to Health and Safety Precautions in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information) .

2. If a new APIM is being installed, install the new APIM before carrying out the following procedure.
   Refer to: SYNC Module [APIM] (415-00A) .

3. **NOTE:**

   - *This programming procedure deletes any phones that were paired with the SYNC® system.*
   - *To prevent timeout errors and to minimize programming time, a hardwired Internet connection is strongly recommended when programming.*
   - *A file of approximately 80 megabytes (MB) needs to be downloaded from the online database for the programming. Allow extra time for the file to download.*
   - *The diagnostic scan tool is required.*
     - *Ensure that the IDS version and patch software levels are up to date.*

4. Connect a battery charger to the vehicle and select the low charge setting. The negative battery charger lead must be connected to a clean chassis ground, not the negative battery post.

5. Plug the diagnostic scan tool into a power supply due to the length of time the programming requires.

6. Connect the diagnostic scan tool to the VCM, and the VCM to the DLC.

7. Close the IDS software program.

8. Ignition ON.

9. **NOTE:**

   - *Using the diagnostic scan tool, open Internet Explorer and access the technician service publication website.*
   - *Run OASIS using "Read VIN & DTCs."*
     - *If the "Read VIN & DTCs" button is green with a red VCM icon, refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
     - *If the "Read VIN & DTCs" button is red with a grey VCM icon, ensure pop-ups are enabled, follow the Internet Explorer pop-ups, and then refer to the "SYNC - Software Programming" document under the "Service Tips" tab.*
   - *If the "SYNC - Software Programming" document is not followed, the programming may stop or encounter errors due to improperly configured Internet browser settings.*

10. From the OASIS tab, select the "SYNC" button. The Last Recorded State — Software is displayed.

11. **NOTE:** *There are 3 types of APIM programming available:*

    - *Standard — Used to update the APIM and any currently installed Applications to the latest software levels.*
    - *Custom — Used to show all the available software options (including Applications that may not have been installed previously) that can be programmed into the APIM. Use this selection when upgrades become available or as directed by a TSB or FSA.*
    - *Module Replacement — Used when the APIM has been replaced. This type of programming performs the required provisioning (restores software for newly installed hardware).*

12. Scroll to the bottom of the screen, select 1 of the 3 options (Standard, Custom, or Module Replacement), and select the "Read SYNC" button. The VIN, current APIM assembly, VIP, and CIP software levels are compared to the last recorded state in the Ford online database, and the available software is displayed.

13. **NOTE:** *Do **not** disconnect the VCM during APIM programming unless directed by the diagnostic scan tool on-screen prompts.*

    Select the "Program SYNC" button to begin the APIM programming process.

14. Follow the diagnostic scan tool on-screen directions.

15. When prompted, connect the USB flash drive to the diagnostic scan tool.

16. Ensure the USB flash drive being used is formatted correctly. To see the available drives, hold down the Windows icon keyboard key and press the E keyboard key. Right click on the USB flash drive, and select Properties. If “File system” under the General tab is not exFAT, the drive must be formatted. To format the USB flash drive, right click on the USB flash drive, select Format, select “exFAT” for the File system, and select “Default allocation size” for the Allocation unit size. De-selecting Quick Format is not necessary, and will result in a more lengthy operation.

17. Follow the on-screen instructions to download software onto the USB flash drive.

18. When prompted by the diagnostic scan tool, remove the USB flash drive from the diagnostic scan tool and connect it to the USB hub to install the software into the APIM. The update should start automatically, and may take 10 minutes or longer. It is normal for the APIM to reset during this step.

19. After programming is complete, the diagnostic scan tool displays "Programming has been successfully completed."

20. Reinstall the flash drive into the diagnostic scan tool and select "OK" to report the software installation to the Ford online database.

Copyright © 2016 Ford Motor Company

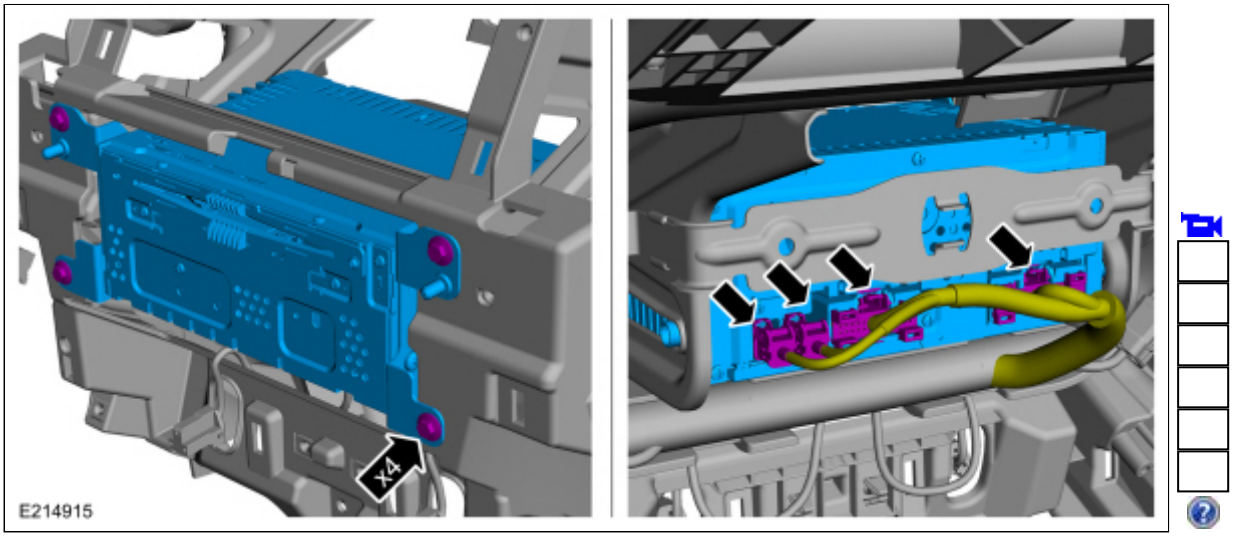
Audio Front Control Module (ACM)

Removal

NOTE: *Eject any media from the ACM. If a disc fails to eject, do not forceably remove the disc from the ACM.*

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*
2. Refer to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
3. *Torque*: 3 Nm



Installation

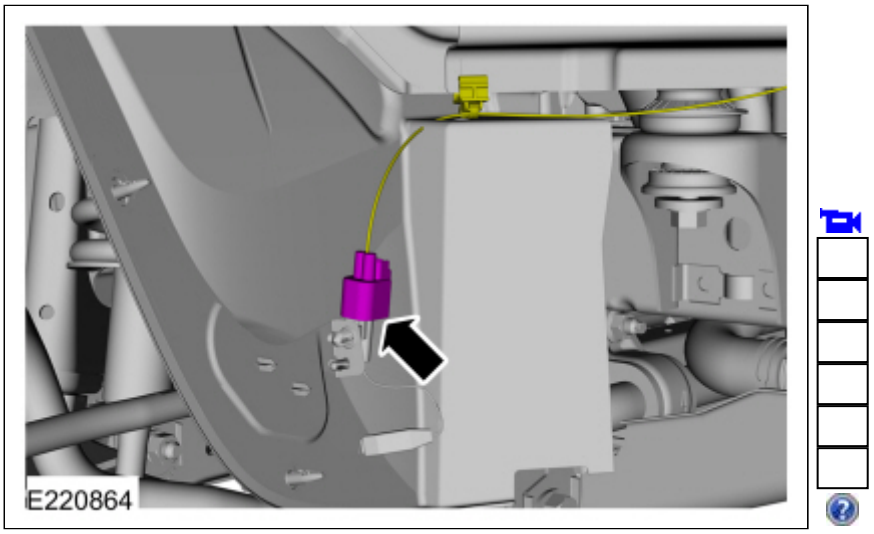
1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the ACM following the on-screen instructions.

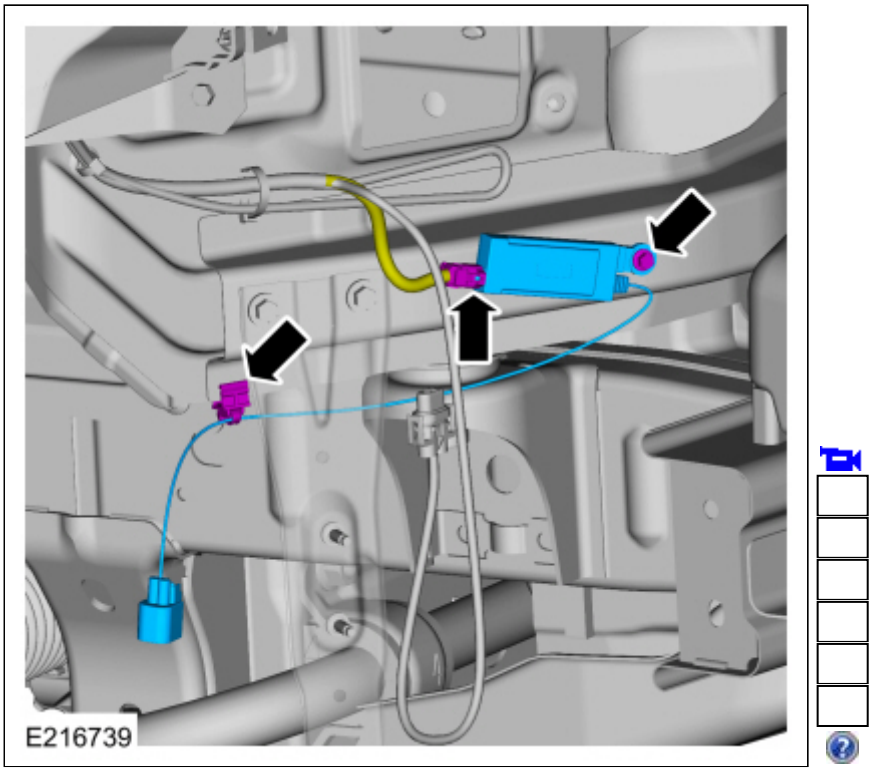
Copyright © 2016 Ford Motor Company

Audio Unit Antenna Amplifier

Removal

1. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
2. 

3. *Torque*: 8 Nm



Installation

1. To install, reverse the removal procedure.

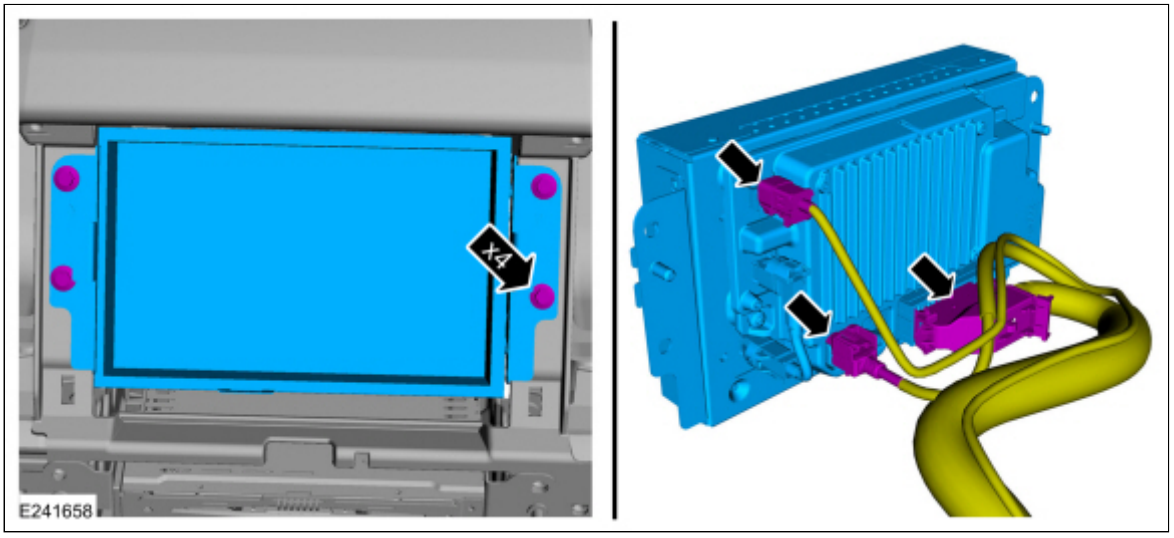
Copyright © 2016 Ford Motor Company

Front Display Interface Module (FDIM)

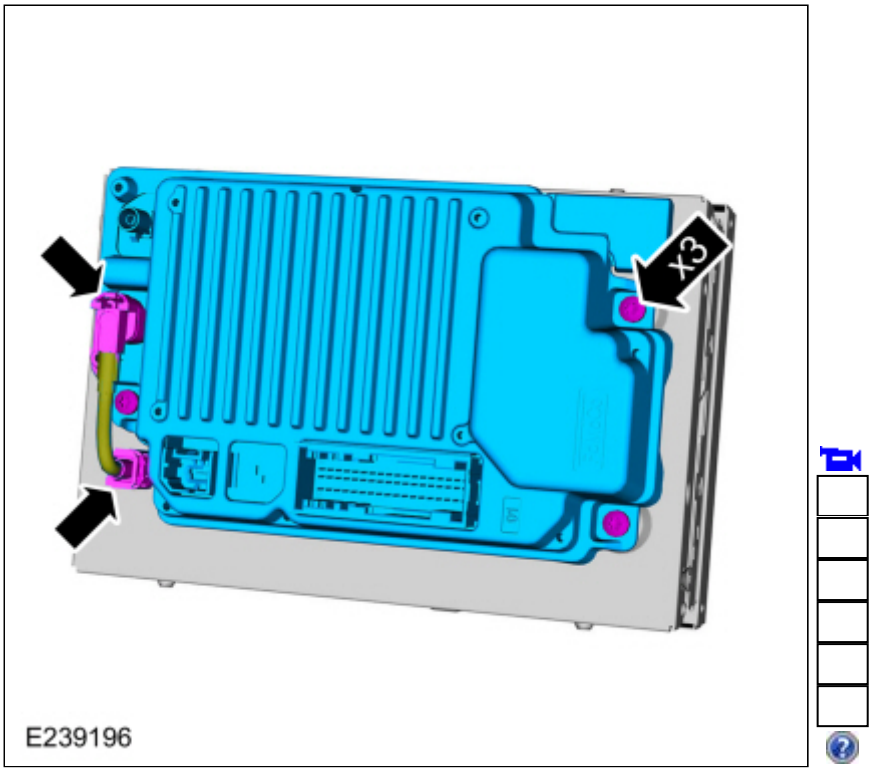
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*
2. Refer to: Front Controls Interface Module (FCIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System) .
3. *Torque*: 3 Nm



4.



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the componet.*

   Using a diagnostic scan tool, complete the PMI process for the FCDIM following the on-screen instructions.
3. If a new APIM is being installed, program the APIM to the correct software level.
   Refer to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Copyright © 2016 Ford Motor Company

Front Controls Interface Module (FCIM)

Special Tool(s) / General Equipment

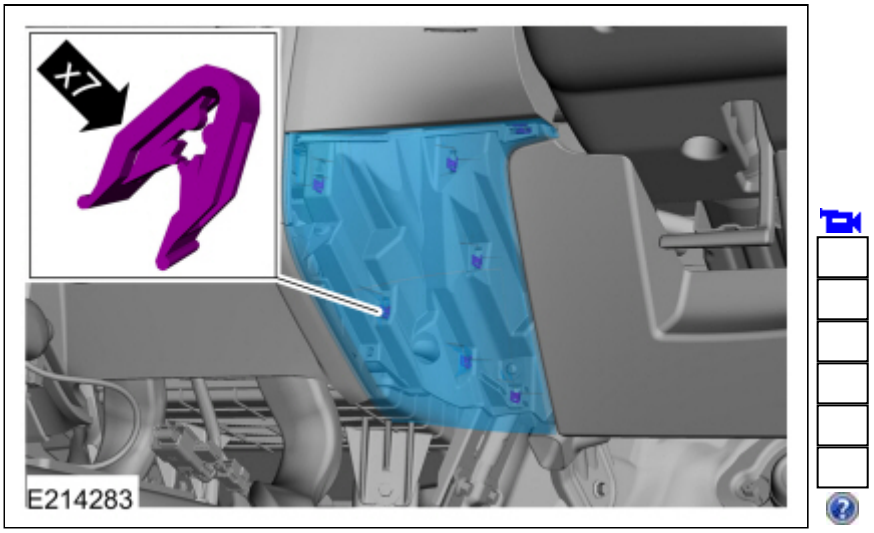
Interior Trim Remover

Removal

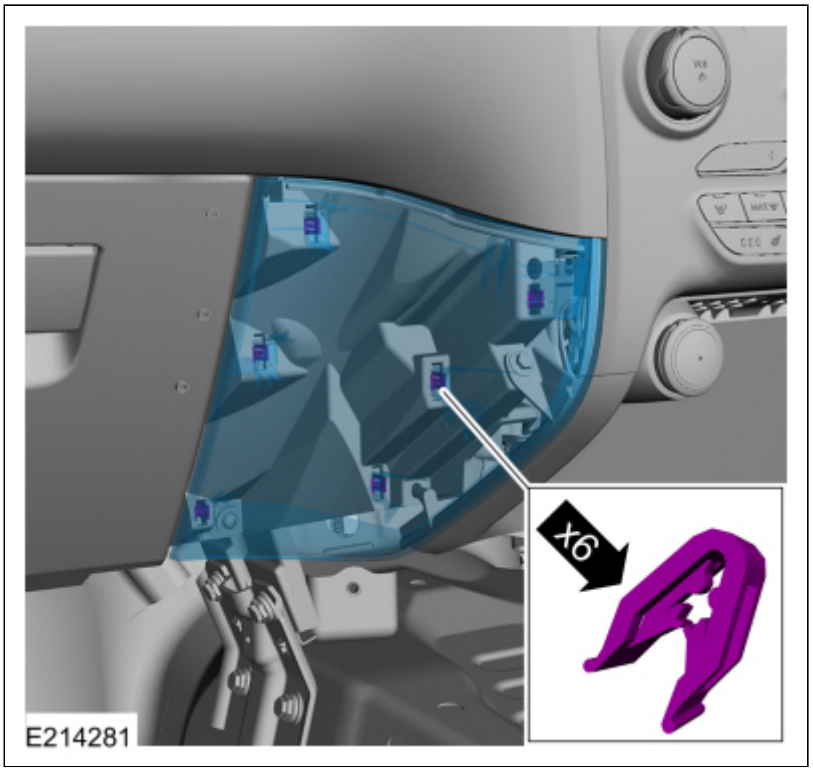
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

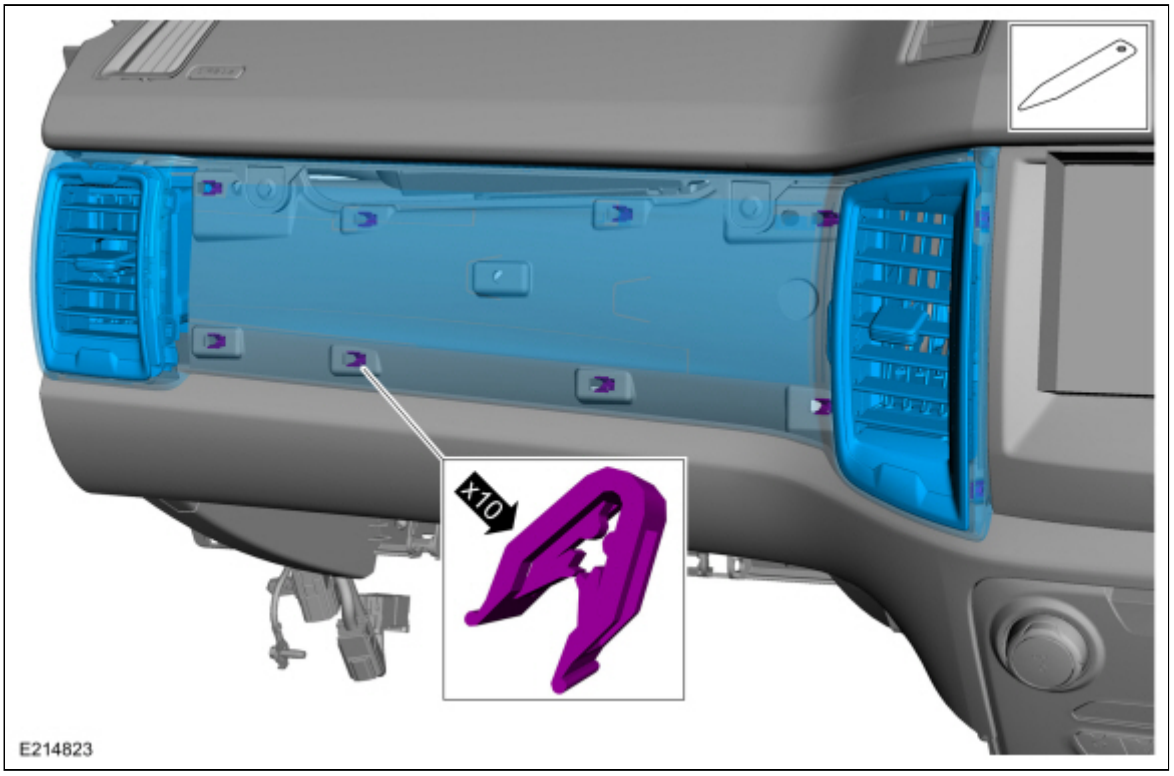
   Using a diagnostic scan tool, begin the PMI process for the FCIM following the on-screen instructions.

2. 

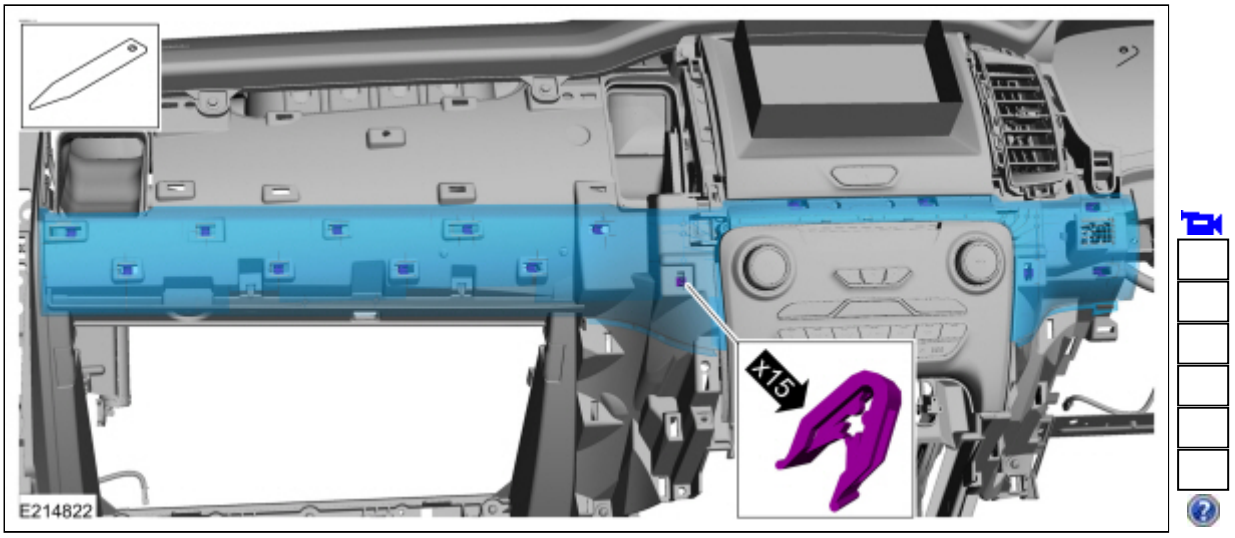
3.



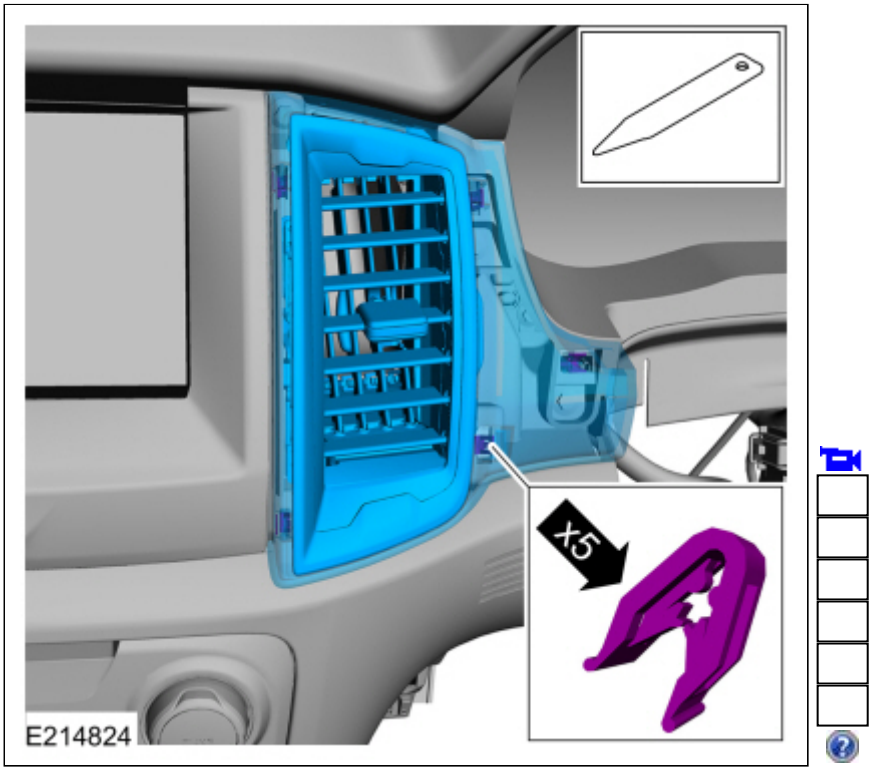
4. Use the General Equipment: Interior Trim Remover



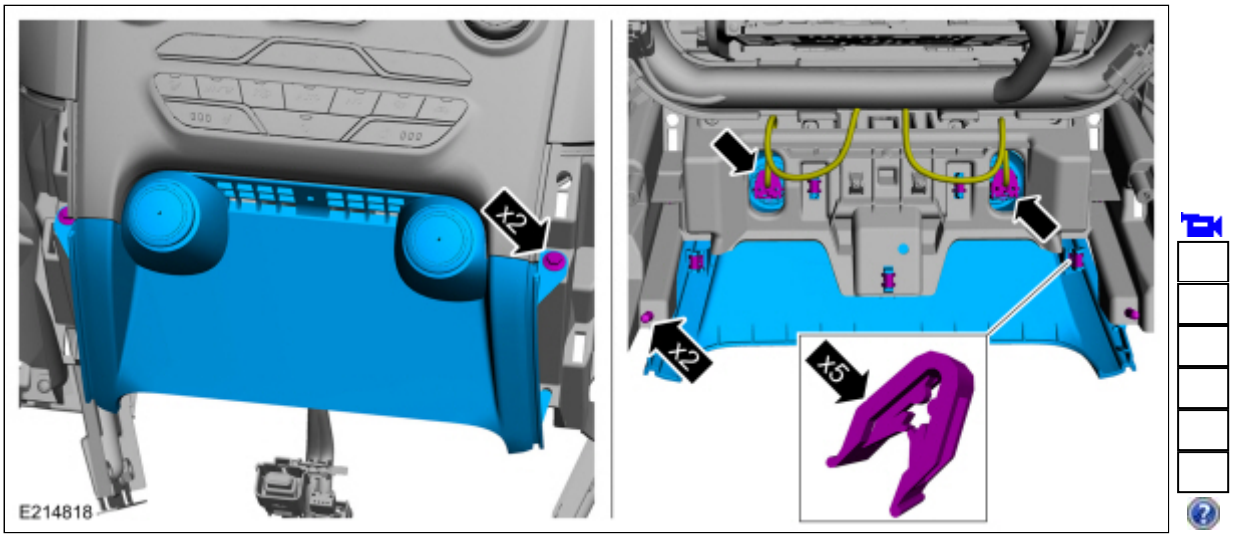
5. Use the General Equipment: Interior Trim Remover



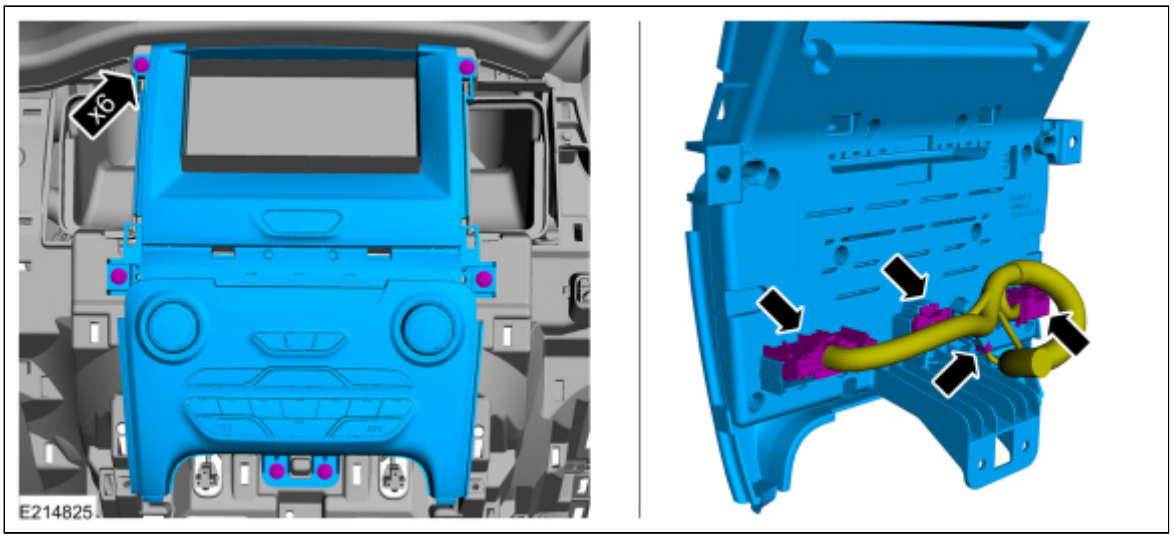
6. Use the General Equipment: Interior Trim Remover



7. *Torque*: 3 Nm



8. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary if replacing the component.*

   Using a diagnostic scan tool, complete the PMI process for the FCIM following the on-screen instructions.

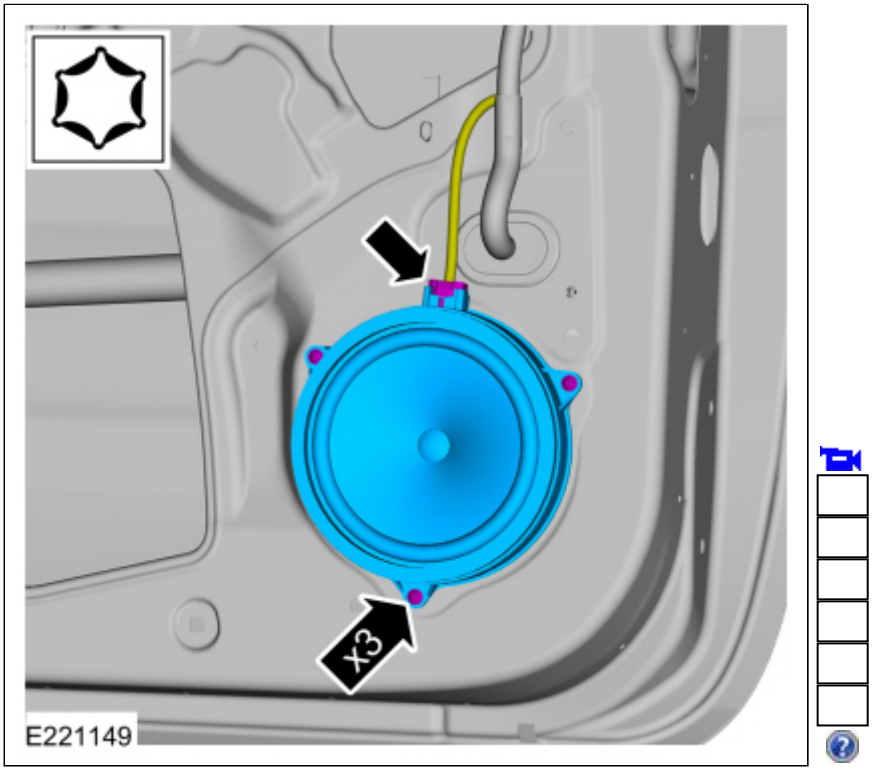
Copyright © 2016 Ford Motor Company

Front Door Speaker LH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

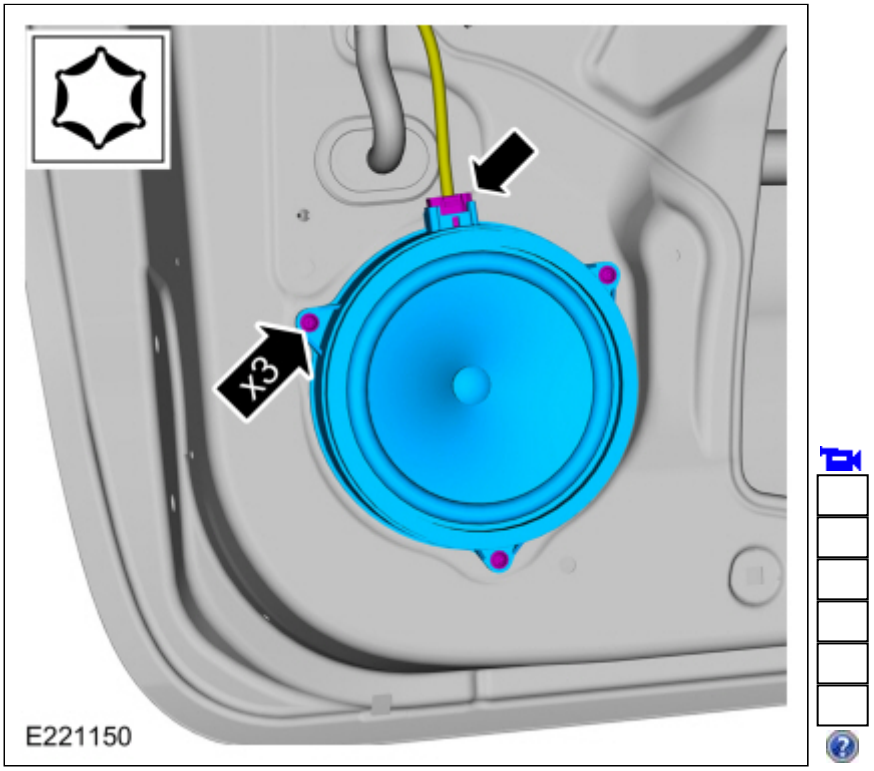
Copyright © 2016 Ford Motor Company

Front Door Speaker RH

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Door Trim Panel (501-05) .
2. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

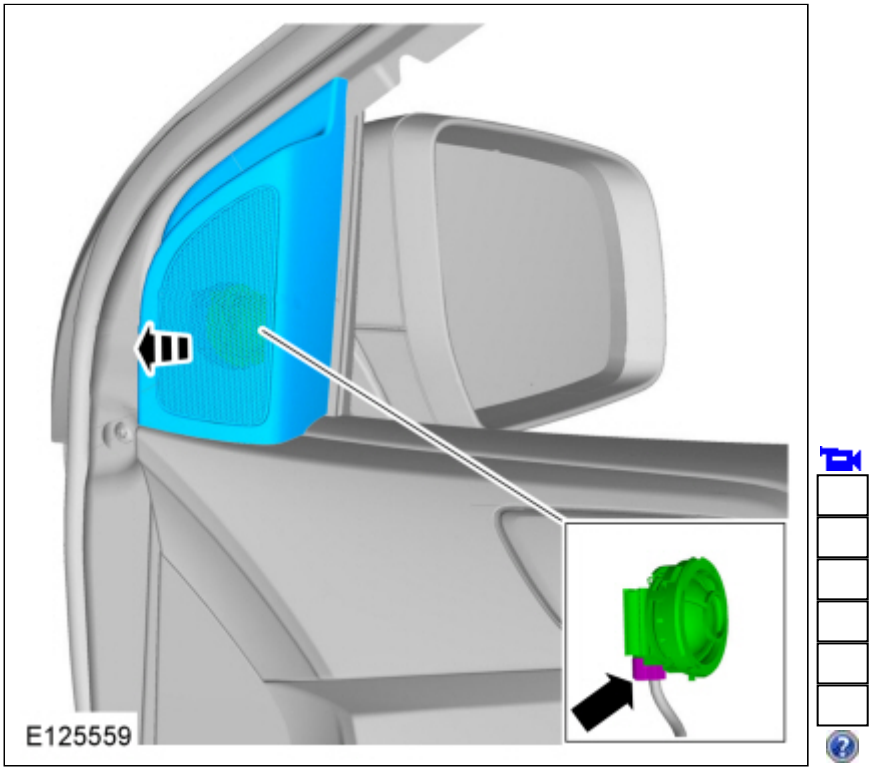
Copyright © 2016 Ford Motor Company

Front Door Tweeter Speaker

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2.



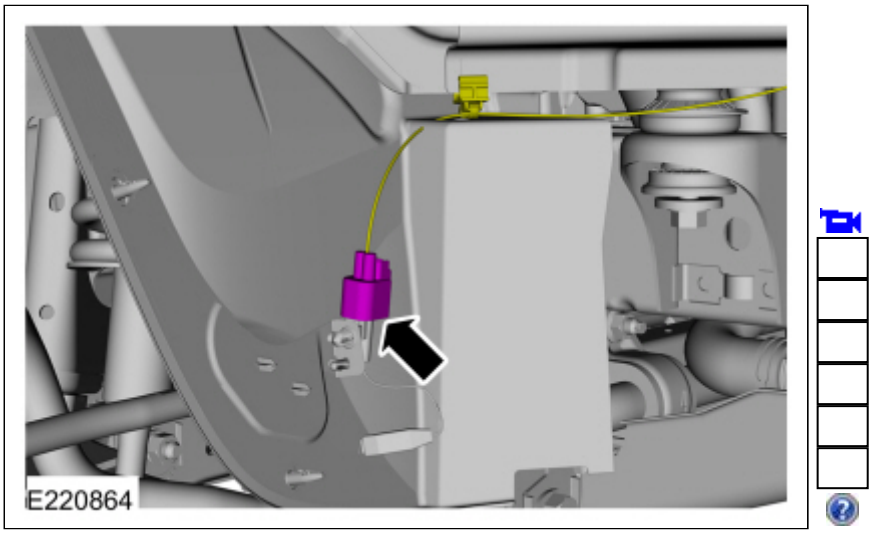
Installation

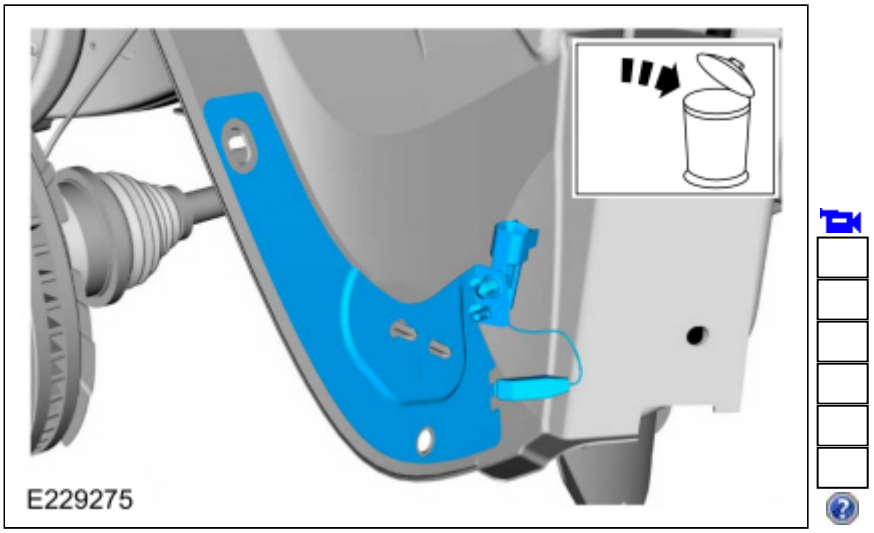
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Fender Mounted Antenna

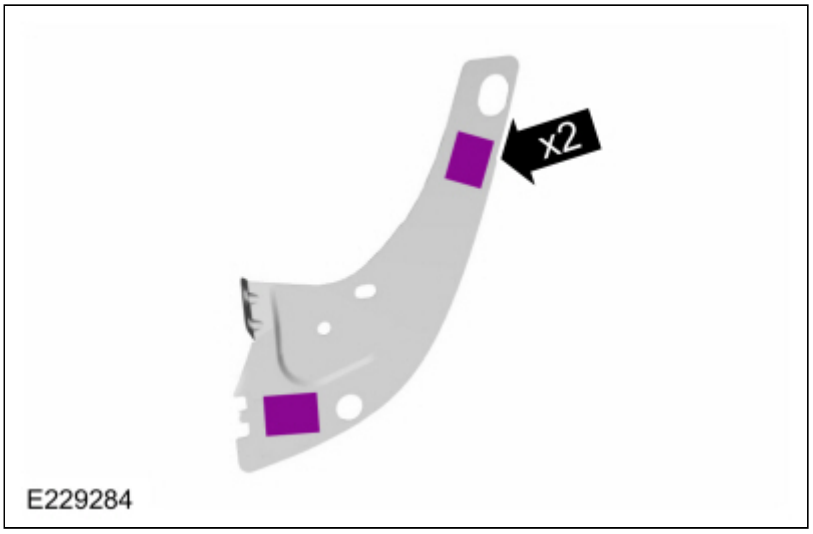
Removal

1. Refer to: Front Bumper Cover (501-19) .
2. 

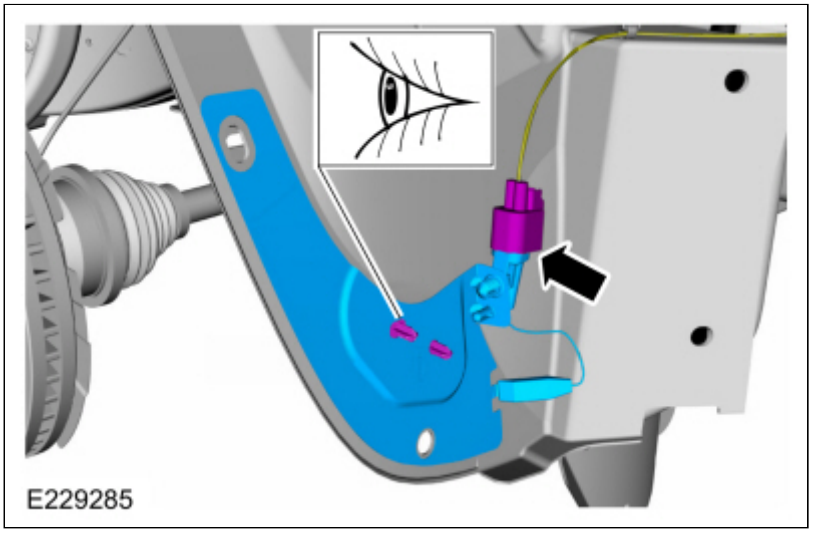
3. 

Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. **NOTE:** *Make sure that the installation marks are aligned.*



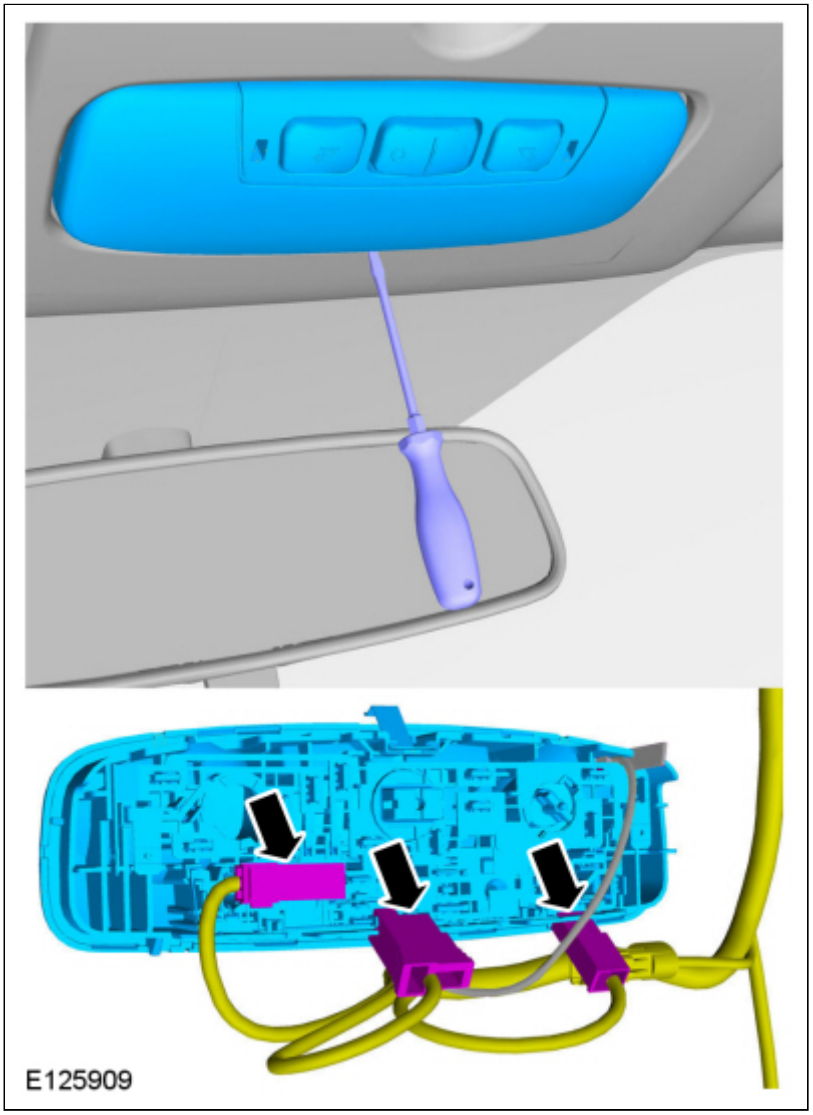
3. Refer to: Front Bumper Cover (501-19) .

Copyright © 2016 Ford Motor Company

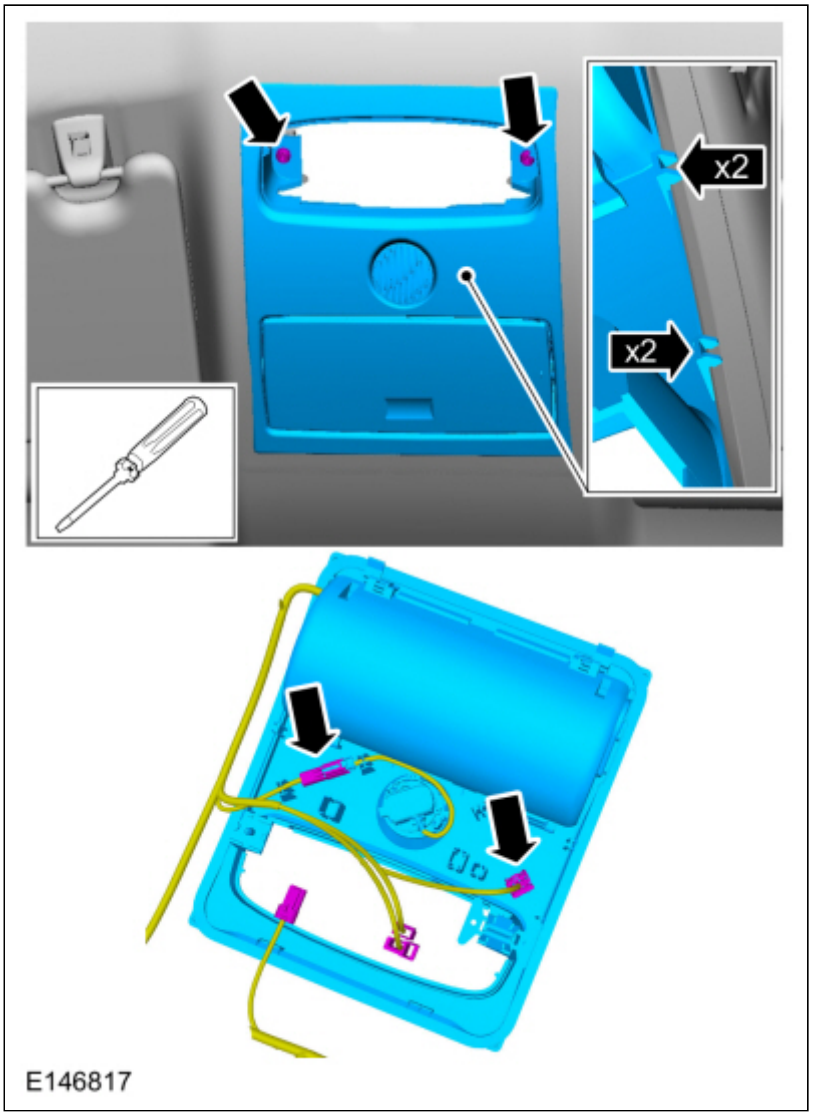
Microphone

Removal

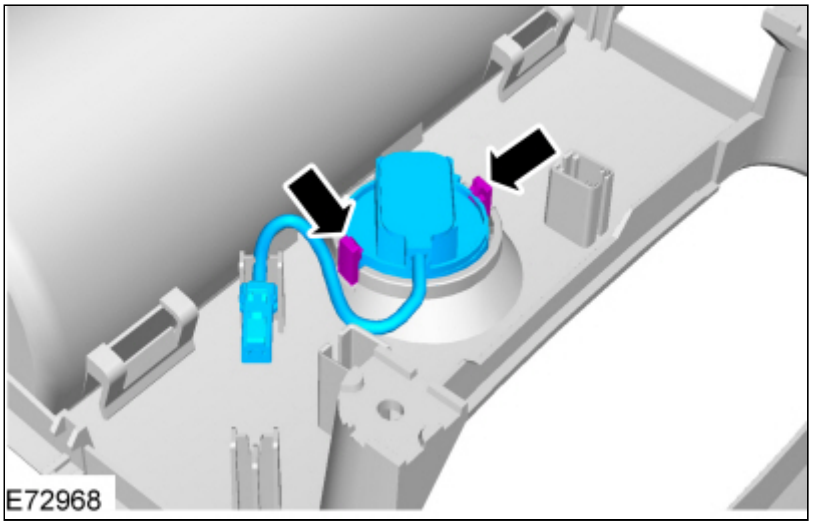
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3.



4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

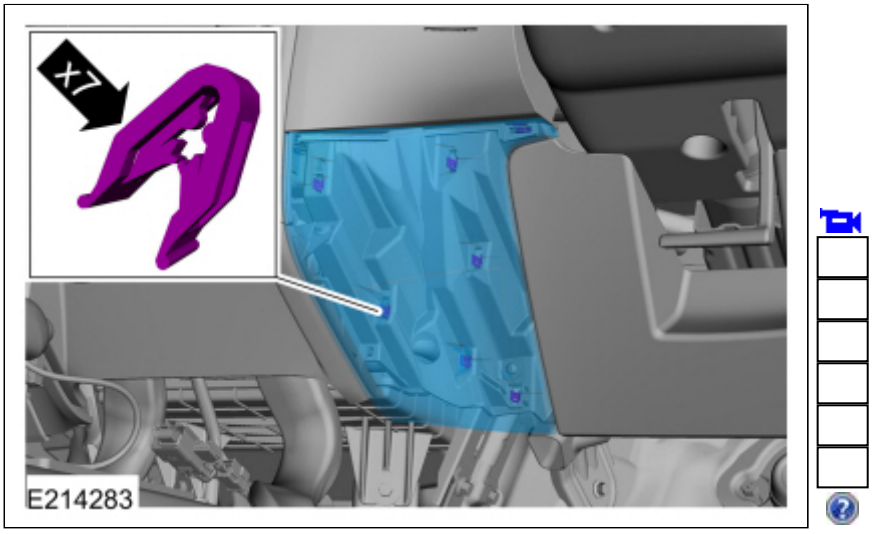
Media Hub

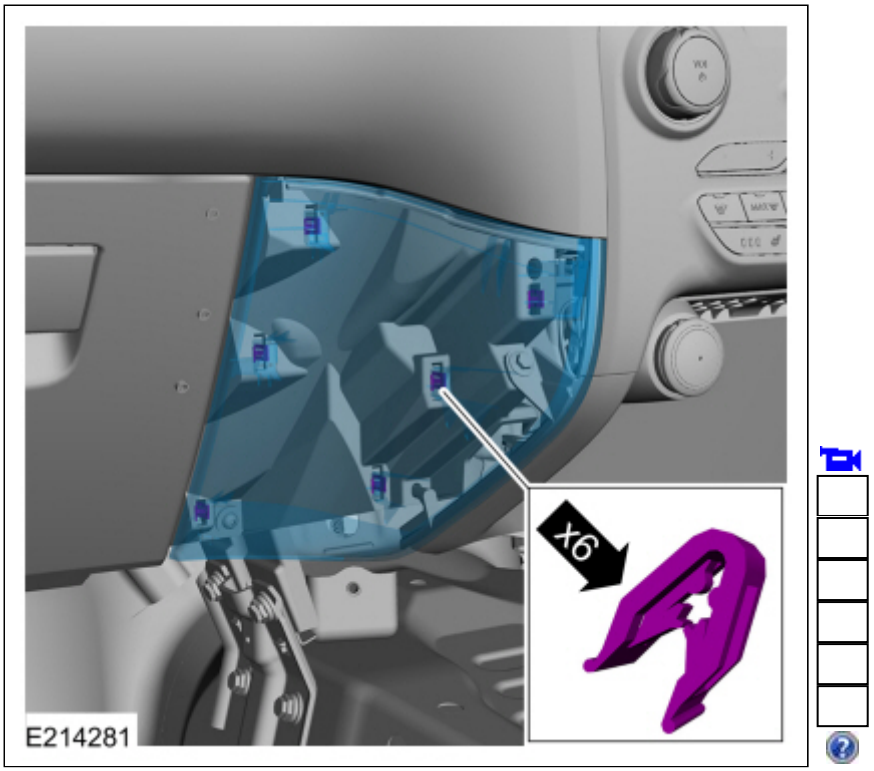
Special Tool(s) / General Equipment

Interior Trim Remover

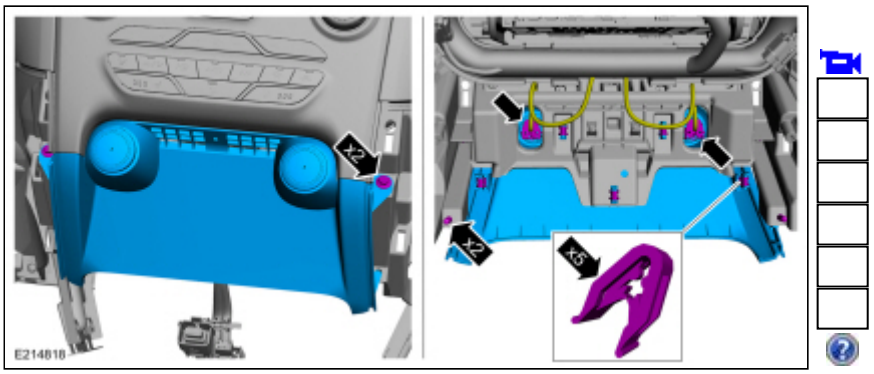
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. 

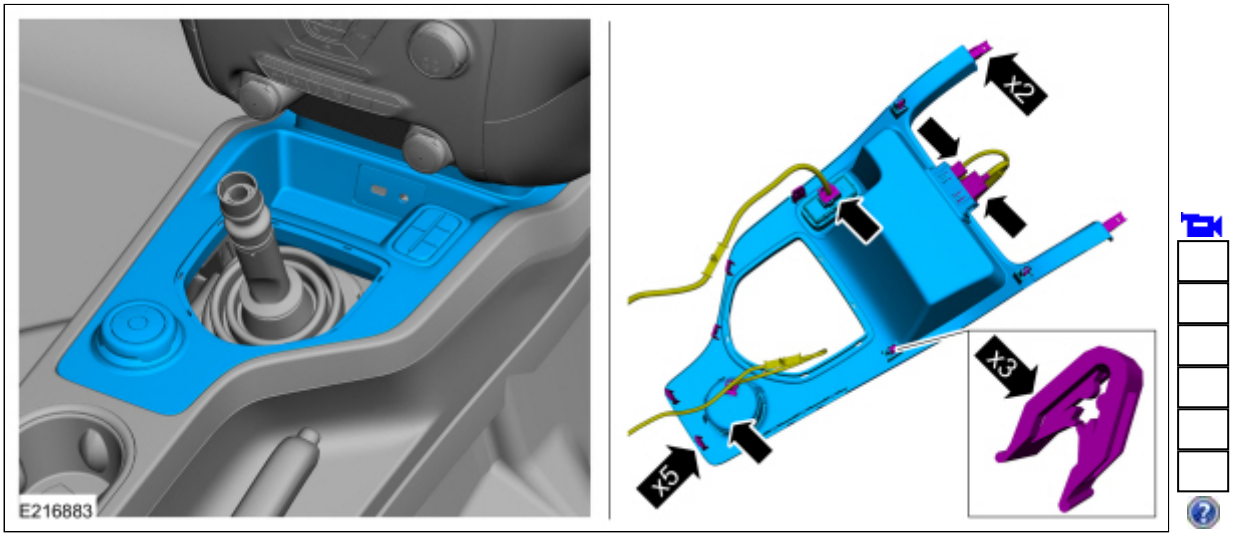
4.



6-Speed Manual Transmission - MT82

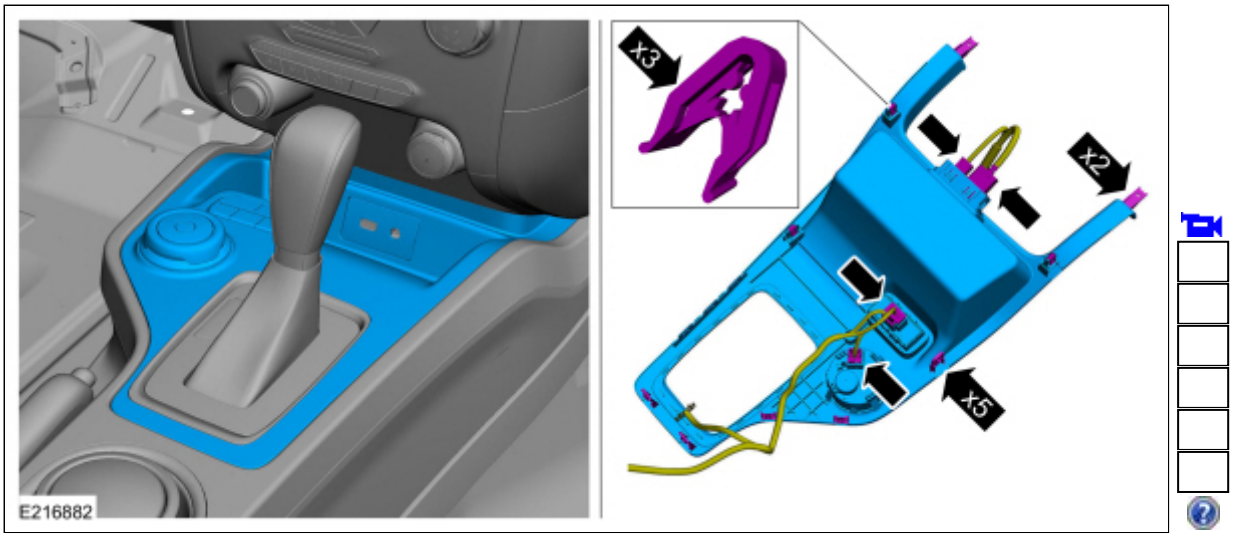
5. Refer to: Gearshift Lever Boot (308-06 Manual Transmission External Controls - 6-Speed Manual Transmission - MT82) .

6.



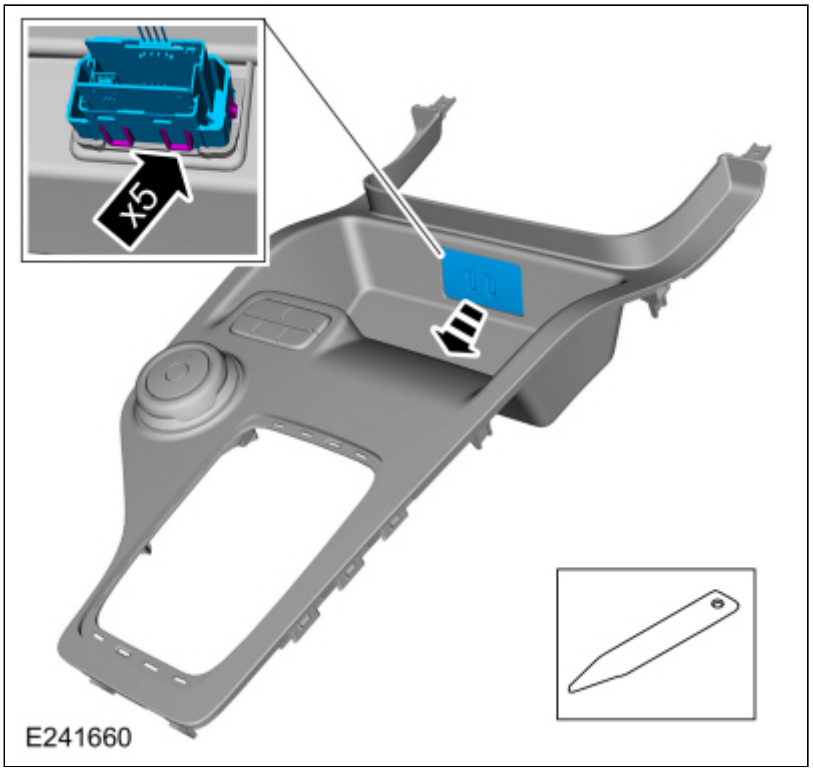
6-Speed Automatic Transmission - 6R80

7.



All vehicles

8. Use the General Equipment: Interior Trim Remover



Installation

1. To install, reverse the removal procedure.

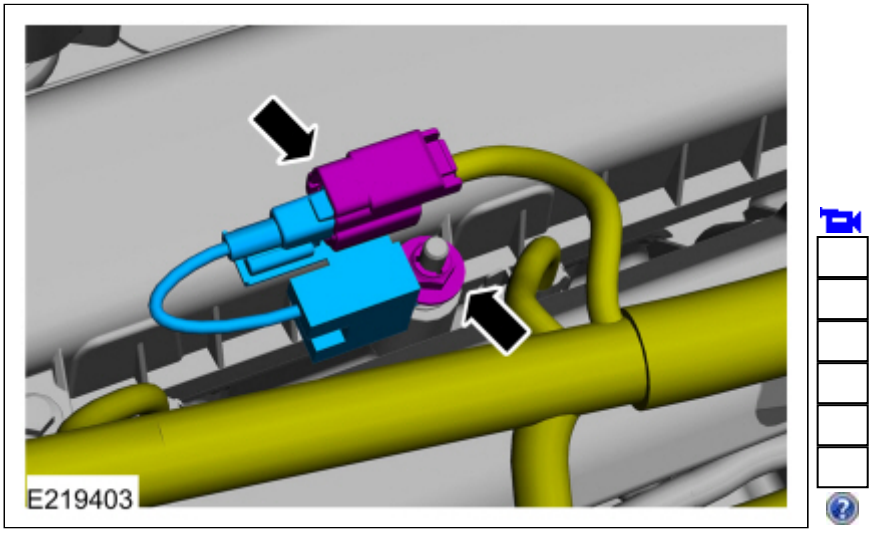
Copyright © 2016 Ford Motor Company

Noise Suppression Filter

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Intake Manifold (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
2. *Torque*: 9 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker LH

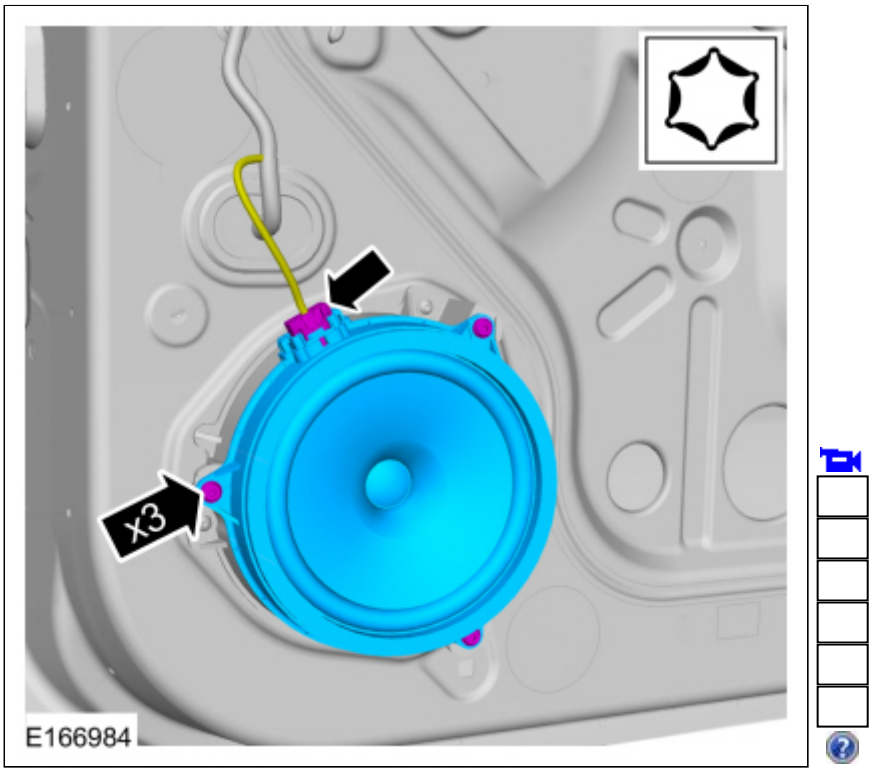
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

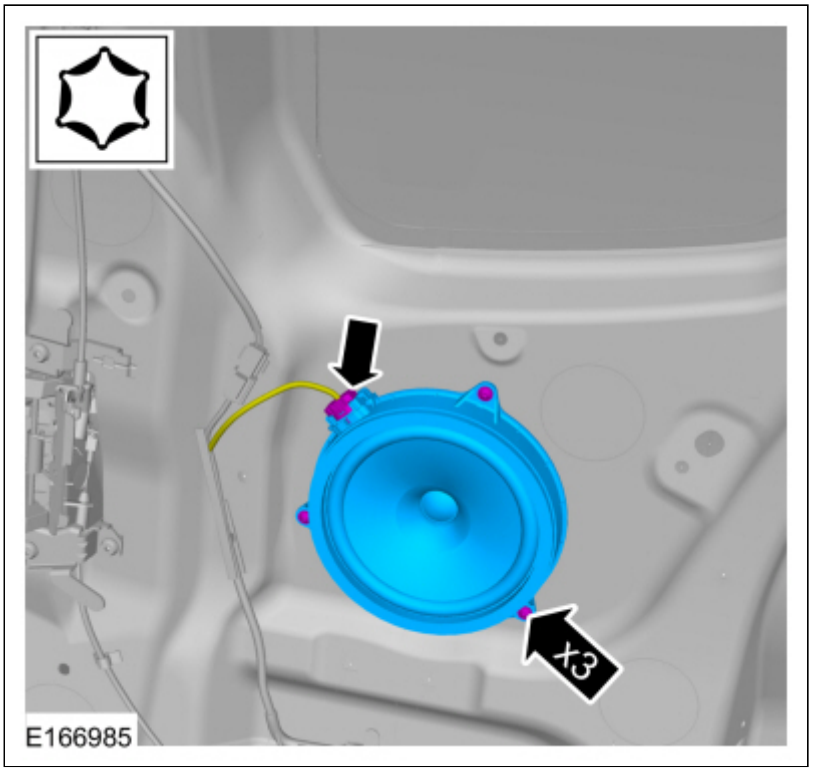
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Speaker RH

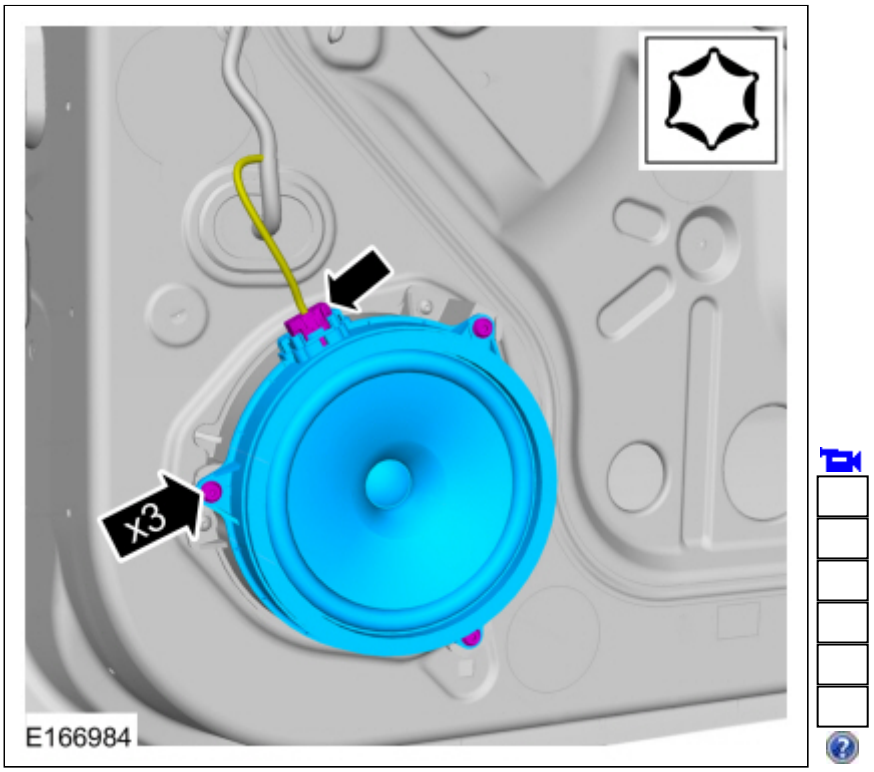
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

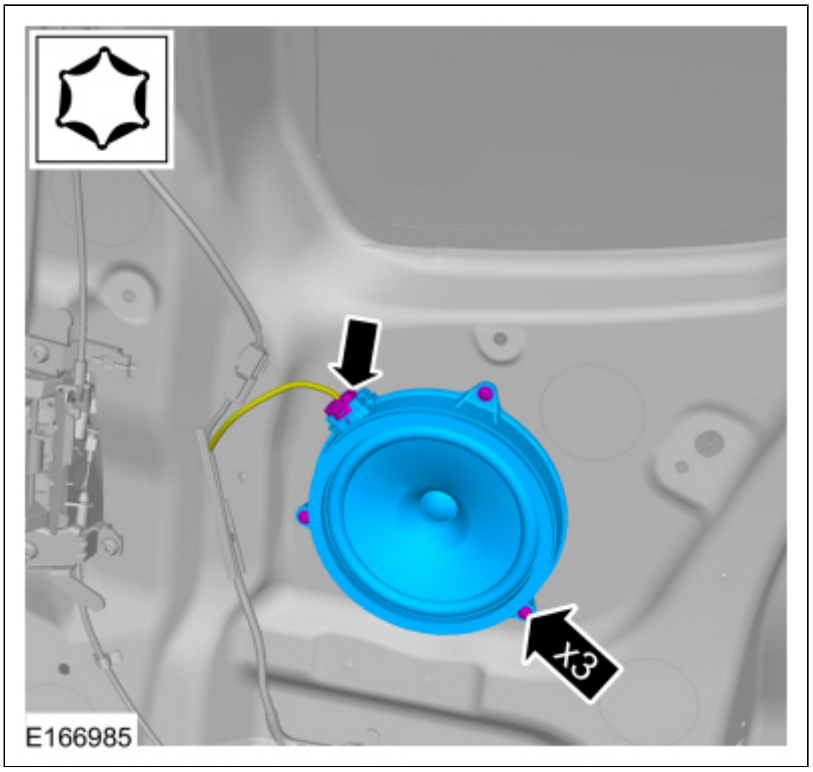
Double cab

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 3 Nm



Stretch cab

4. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. *Torque*: 3 Nm



Installation

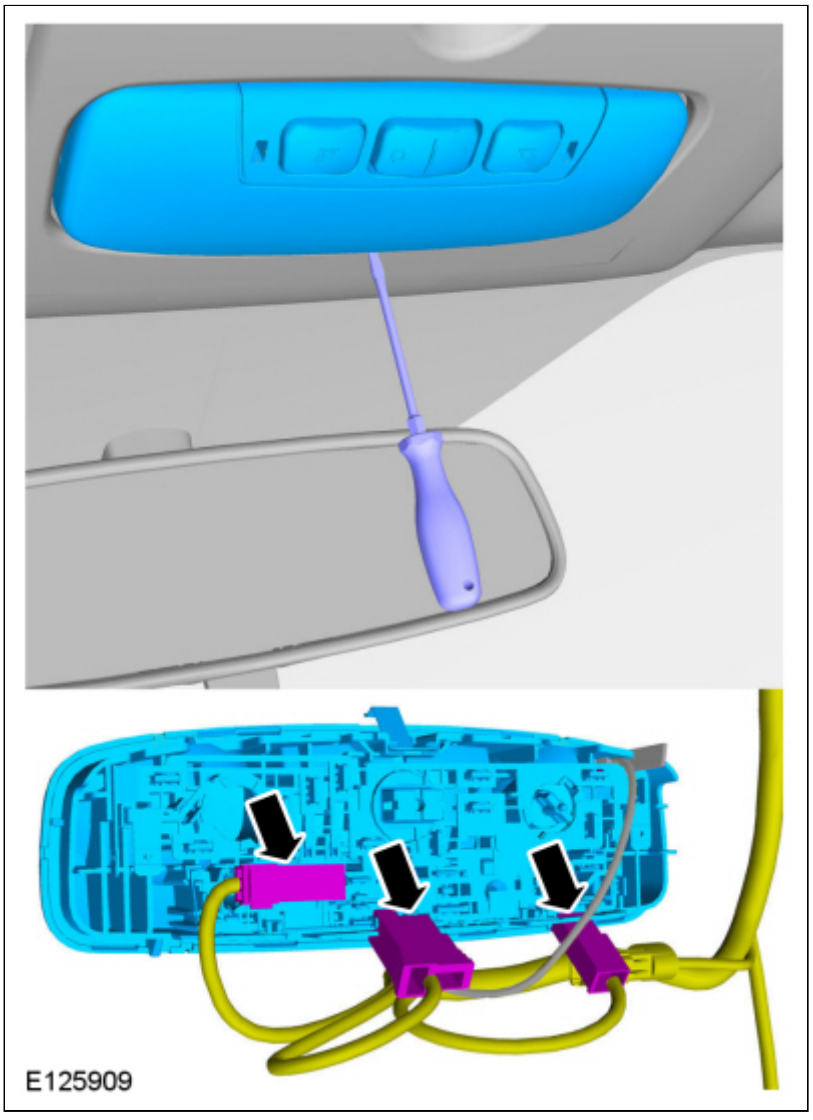
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

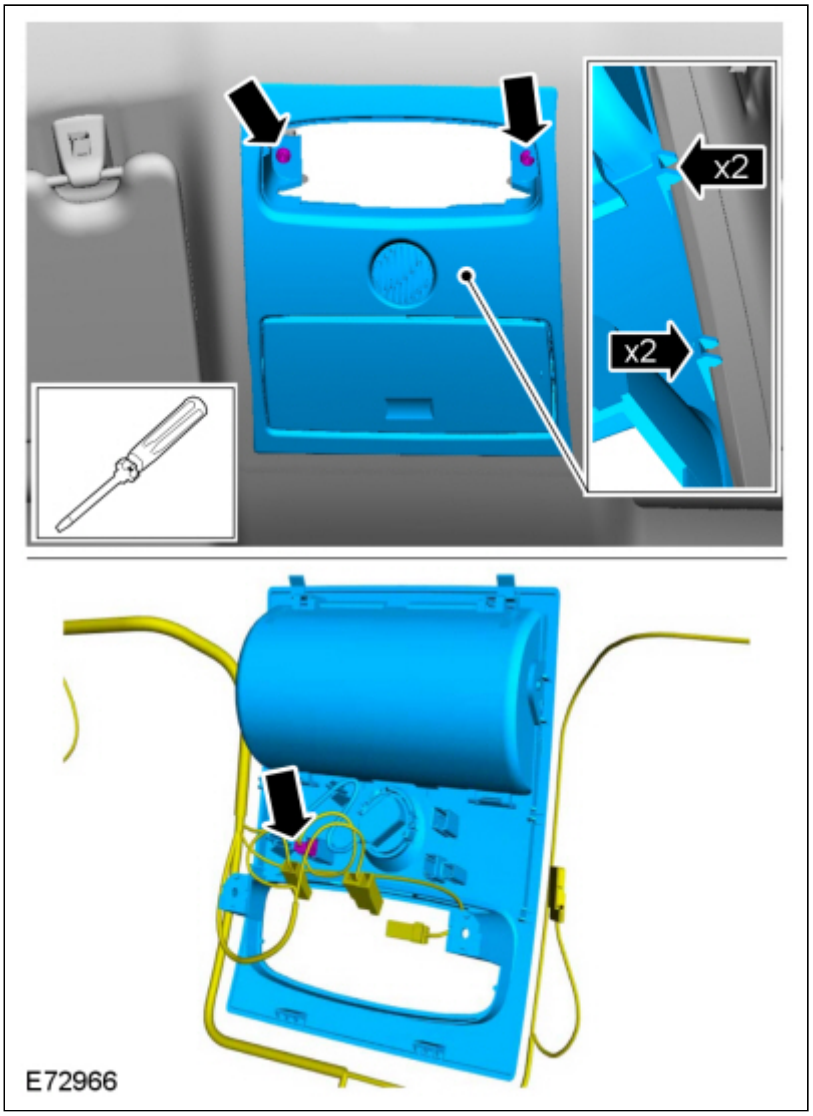
Roof Mounted Antenna

Removal

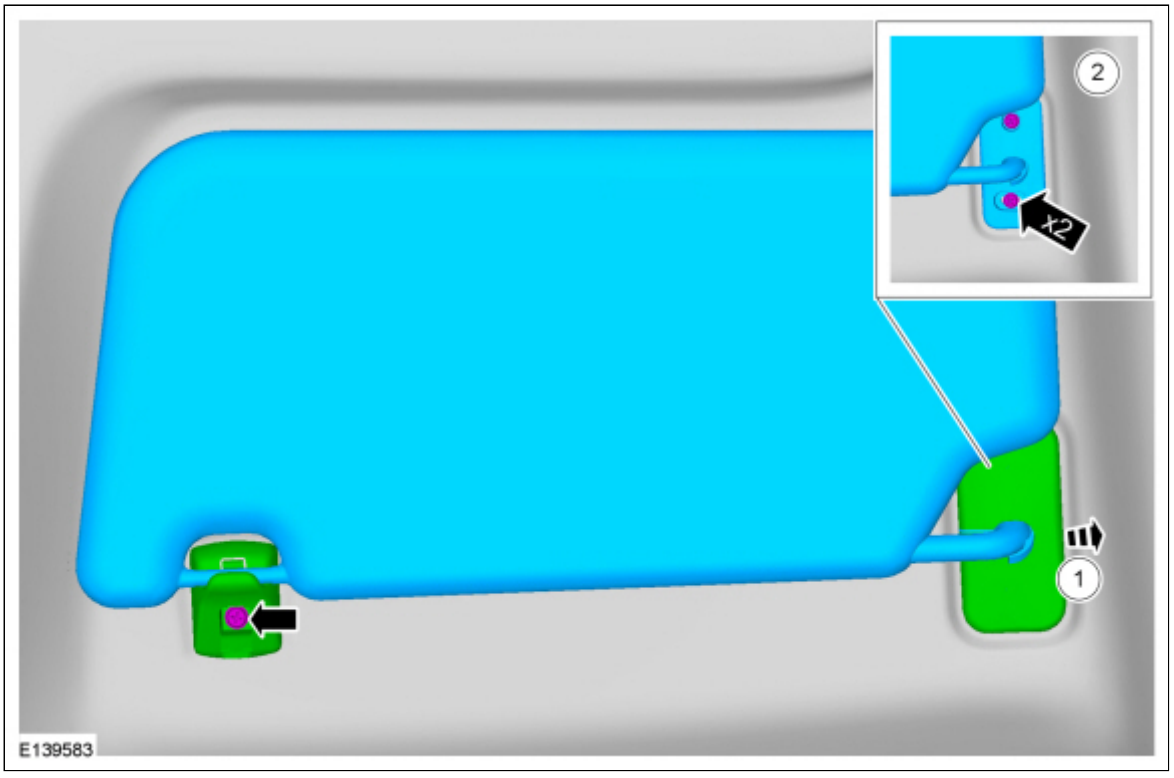
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: A-Pillar Trim Panel (501-05) .
2. Refer to: B-Pillar Upper Trim Panel (501-05) .
   Refer to: B-Pillar Lower Trim Panel (501-05) .
3. 

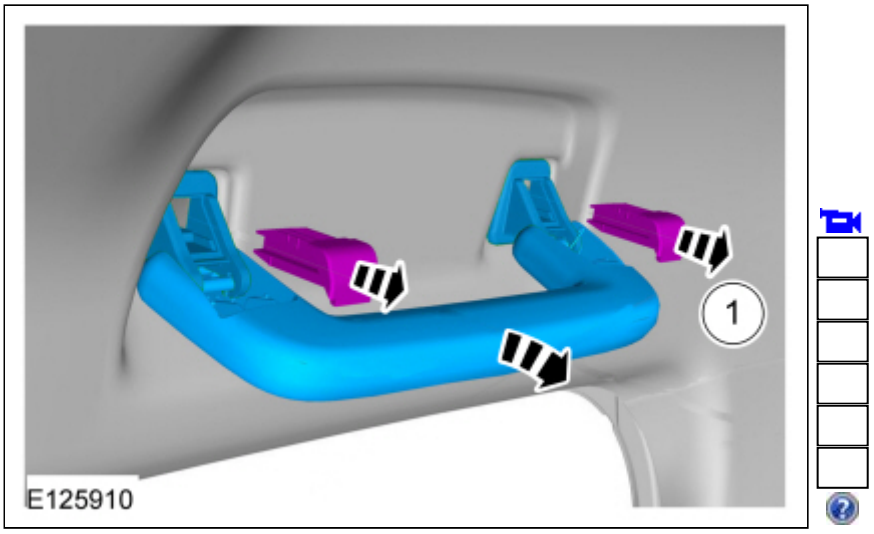
4. **NOTE:** *This step is not necessary when installing a new component.*



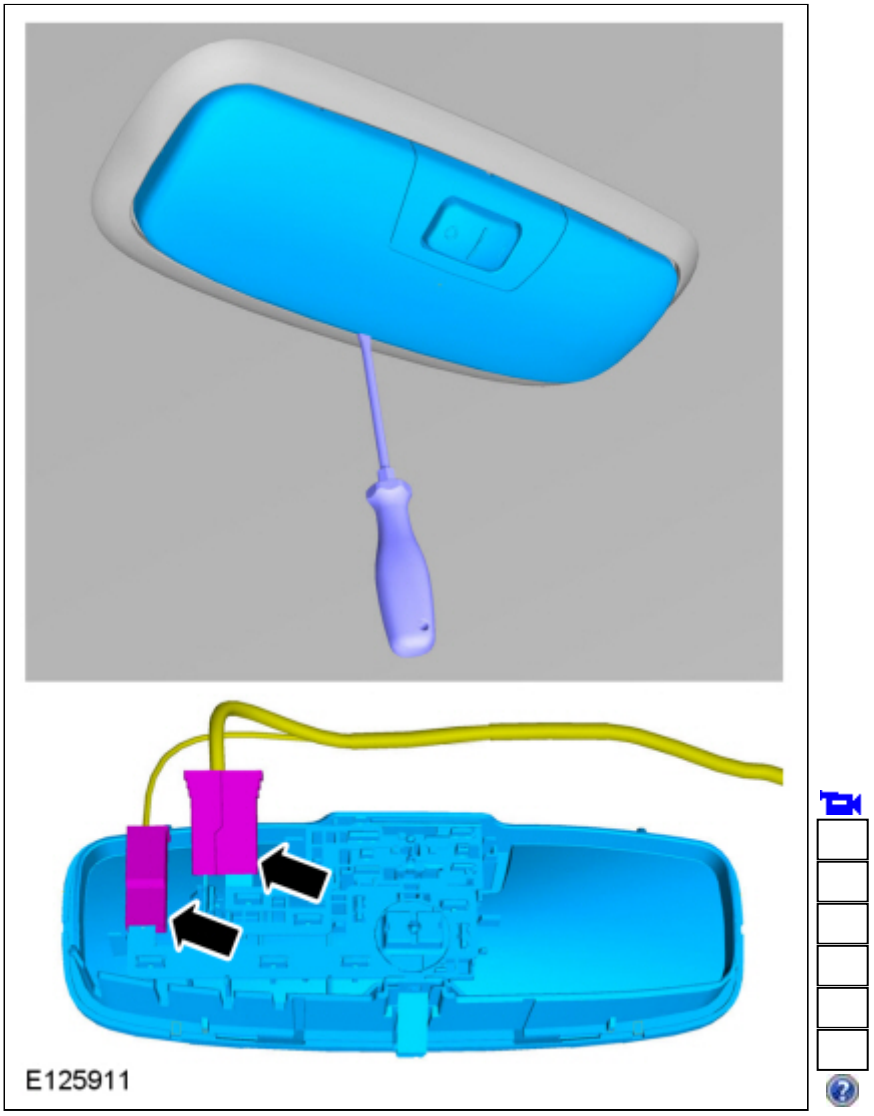
5. On both sides.



6.

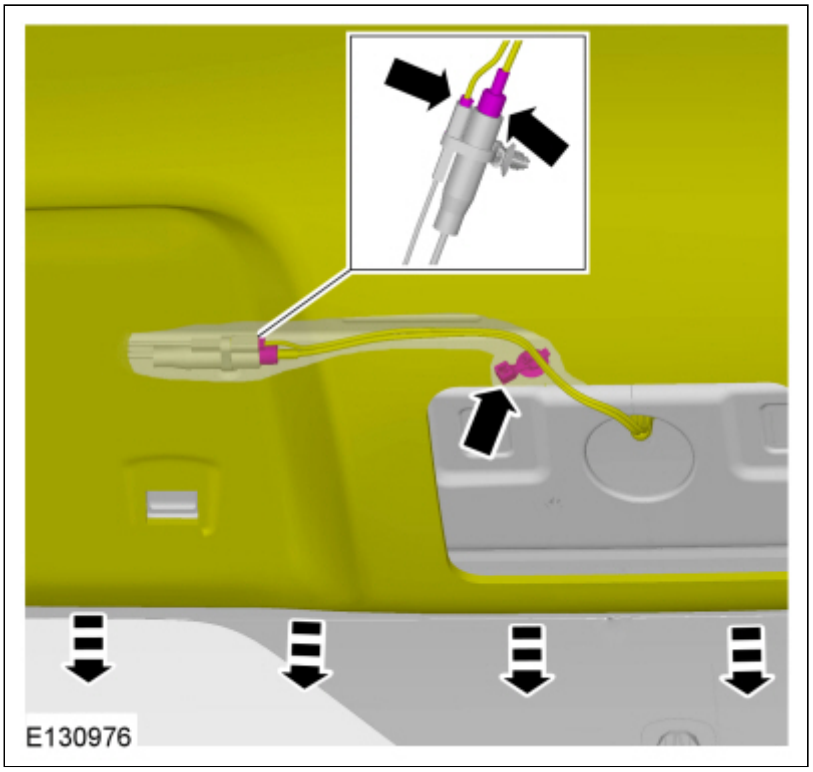


7.



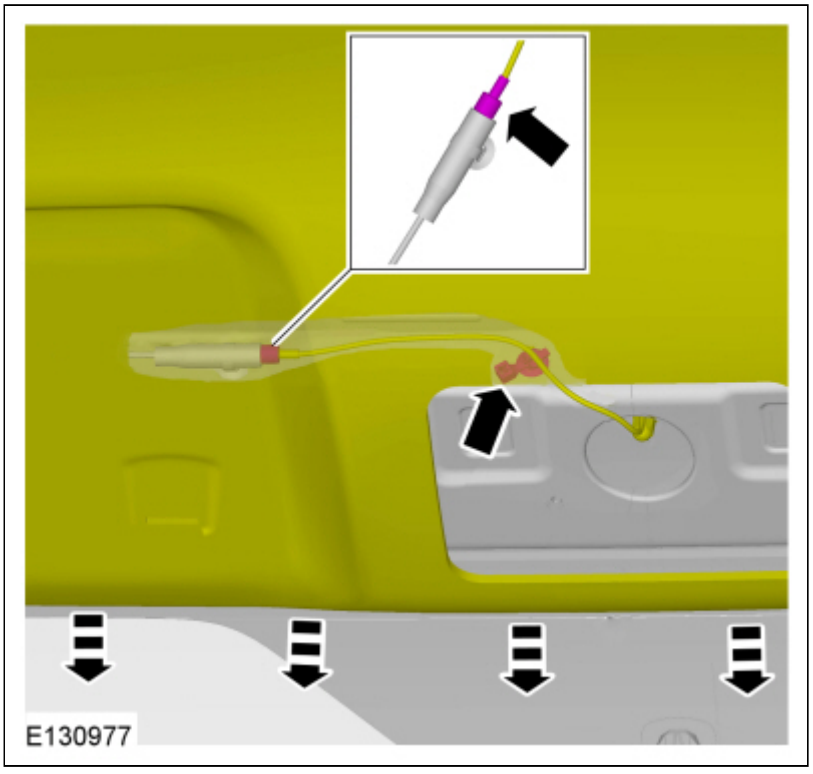
8. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*

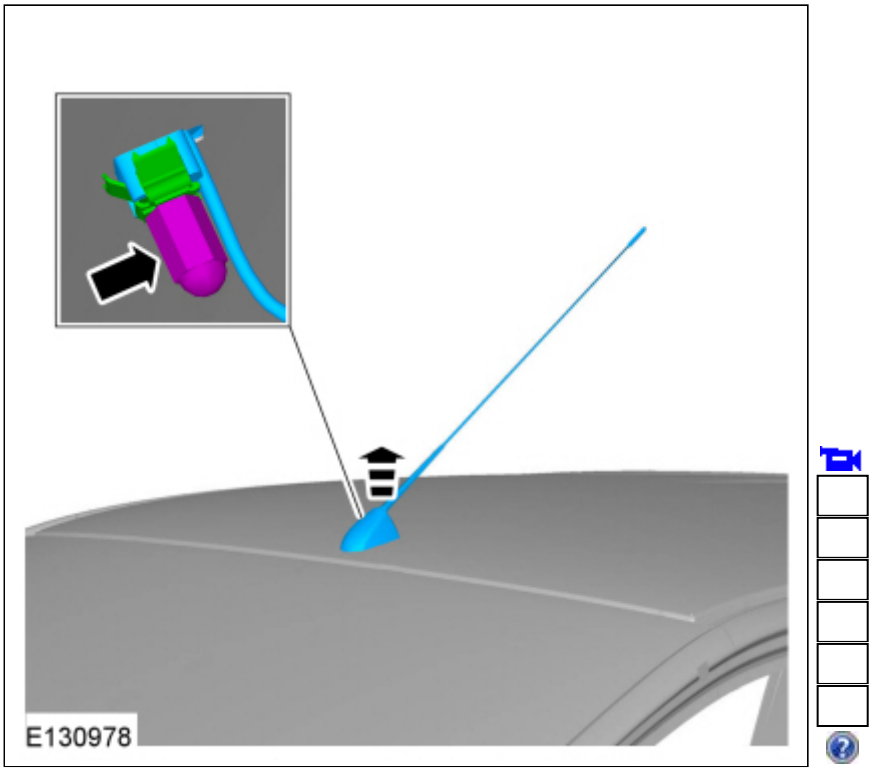


9. **NOTICE: Take extra care not to crease the headliner.**

   NOTE: *Make a note of the routing of the antenna cable.*



10.



Installation

1. **NOTE:** *The antenna cable must be installed to the same routing as when removed.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Satellite Radio Antenna

Removal

1. Refer to: Audio Unit Antenna (415-00E) .

Installation

1. Refer to: Audio Unit Antenna (415-00E) .

Copyright © 2016 Ford Motor Company

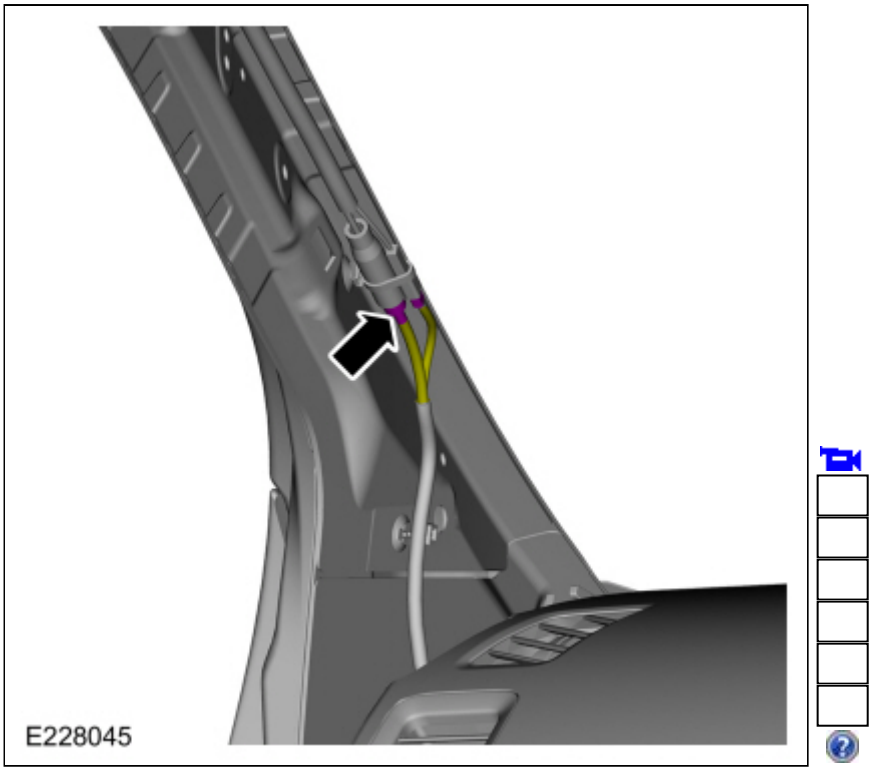
Satellite Radio Antenna Cable

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01) .
2. Refer to: Audio Front Control Module (ACM) (415-00B) .
3. Refer to: Glove Compartment (501-12) .
4. Refer to: A-Pillar Trim Panel (501-05) .
5. **NOTE:** *This procedure refers to add a cable into the wiring harness; the original cable is part of the wiring harness and remains in the vehicle.*

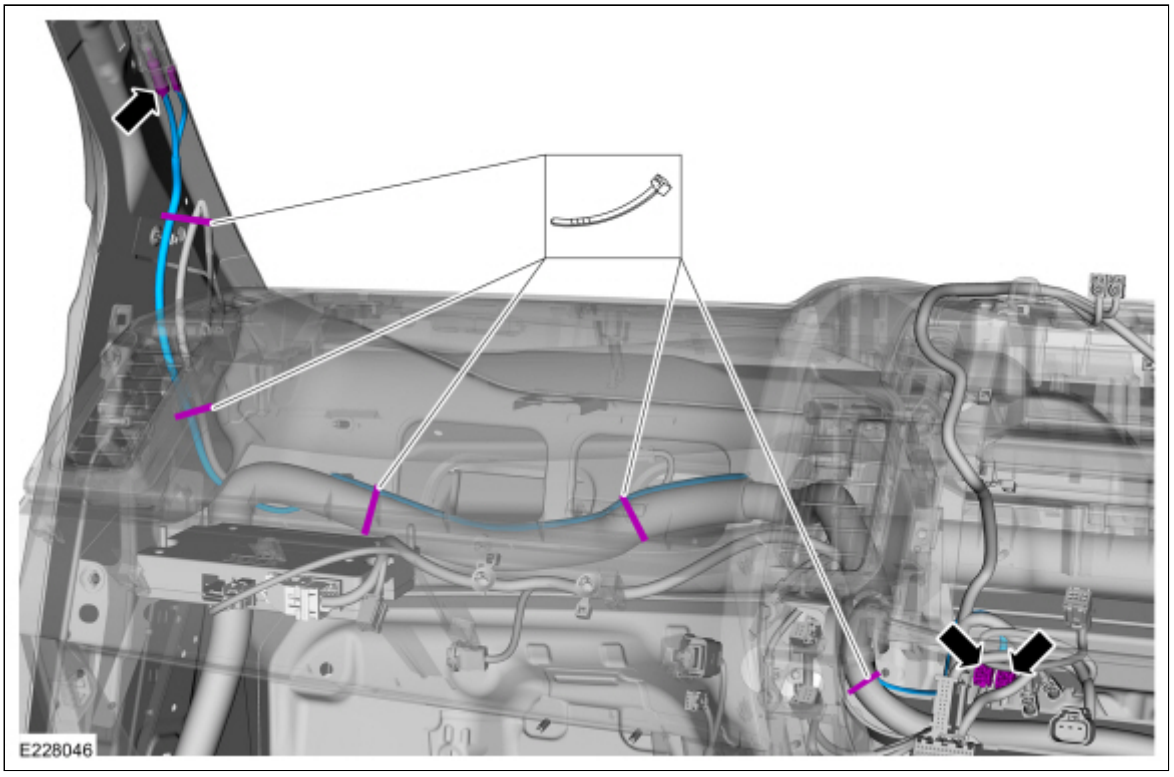
   NOTE: *Cut both ends of the original cable.*



Installation

NOTE: *Make sure that the wiring harnesses are correctly located.*

1. Connect the new cable.



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

SYNC Module [APIM]

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Display Interface Module (FDIM) (415-00D) .

Installation

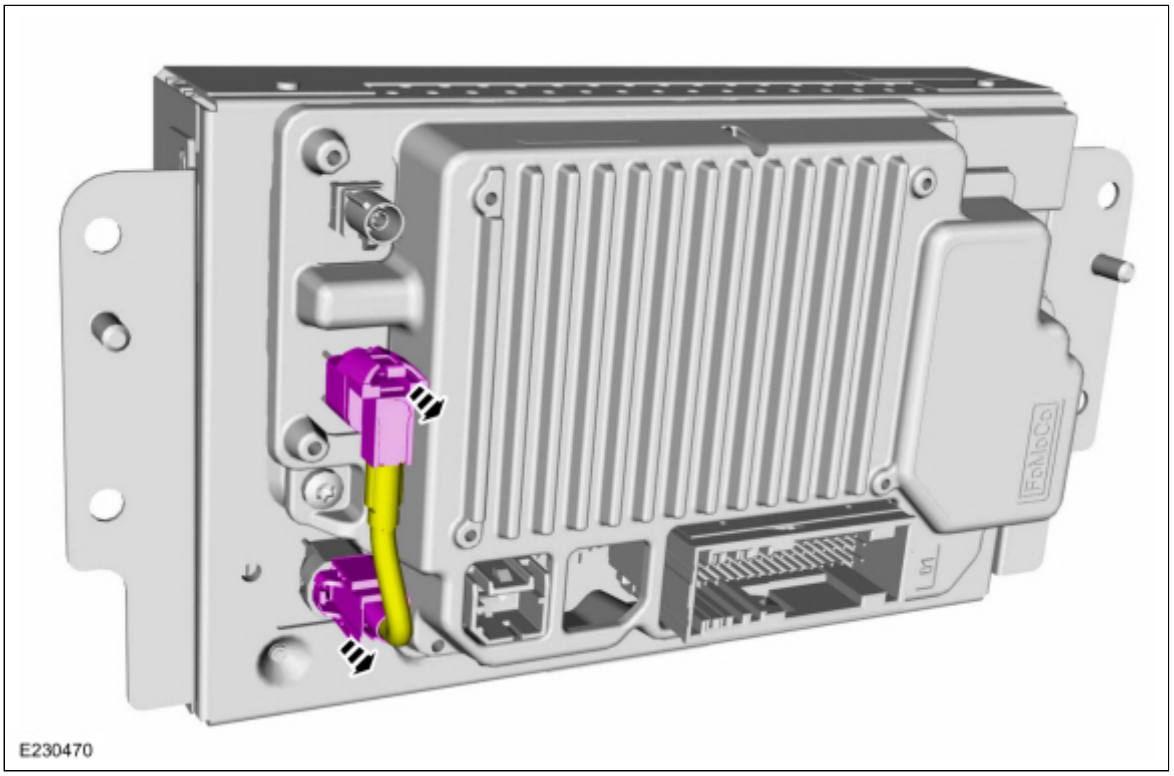
1. To install, reverse the removal procedure.
2. If a new APIM is being installed, program the APIM to the correct software level.
   Refer to: SYNC Module [APIM] Programming (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, General Procedures).

Copyright © 2016 Ford Motor Company

SYNC Module [APIM] to Front Display Interface Module (FDIM) Cable

Removal

1. Remove the FDIM.
   Refer to: Front Display Interface Module (FDIM) (415-00C) .
2. Disconnect the electrical connectors and remove the APIM to FDIM cable.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

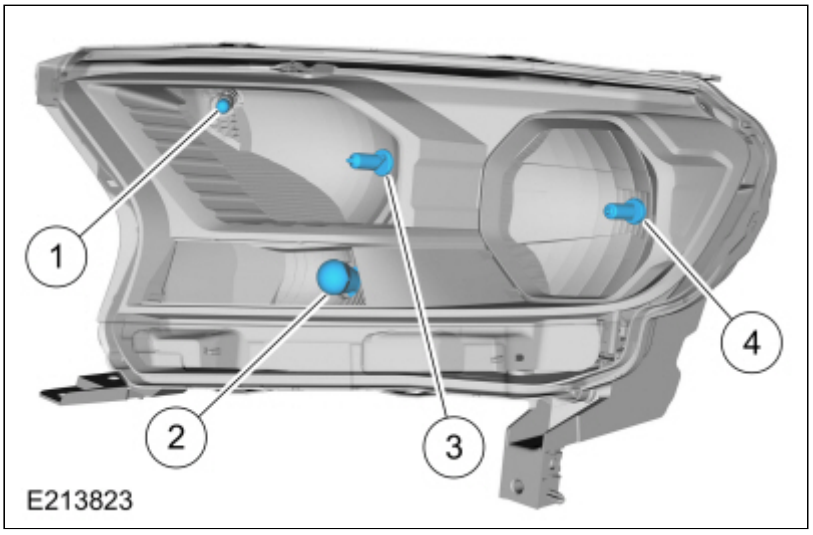
Specifications

Item	Bulb Type	Specifications (W)	Quantity
Headlight bulb	H15 (High-beam with DTRL)	55	2
	HB3 (High-beam without DTRL)	60	2
	H7 (Low-beam (Reflector))	55	2
	H11 (Low-beam (Projector))		
Front position lamp	W5W	5	2
Daytime running lamp	H15	15	2
Front fog lamp	H8	35	2
	H11	55	
Front direction indicator	P21W	21	2
	PY21W		
Side direction indicator	W5W	5	2
Rear direction indicator	WY21W	21	2
Rear position/brake lamp	W21/5W	21/5	2
Reversing lamp	W21W	21	2
Rear fog lamp	W21W	21	1
Number plate lamp	W5W	5	2
High mount brake lamp	W5W	5	4

Copyright © 2016 Ford Motor Company

Exterior Lighting - Component Location

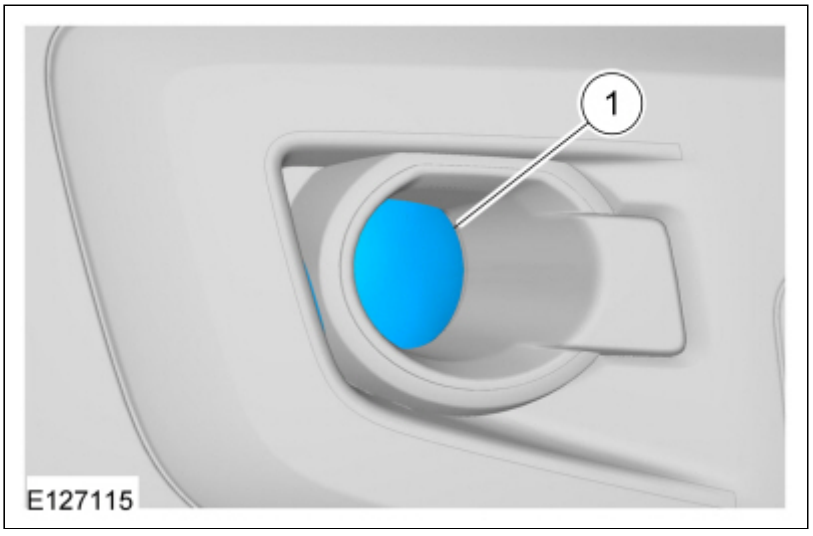
Front headlamps



Item	Part Number	Description
1	—	Front position lamp
2	—	Front direction indicator
3	—	High beam / day time running lamp
4	—	Low beam headlamp

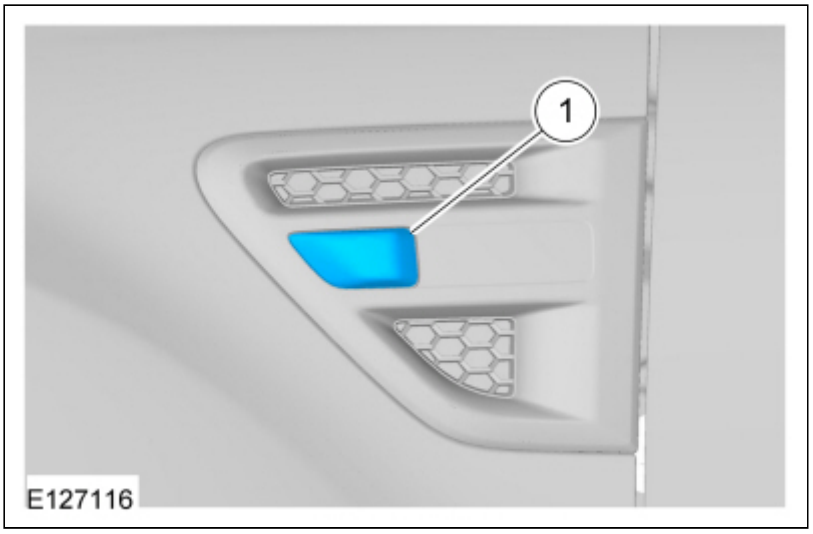
The headlamps form a unit with the front turn signal lamps and the side lamps. They are made entirely of plastic and can be serviced individually.

Front fog lamps

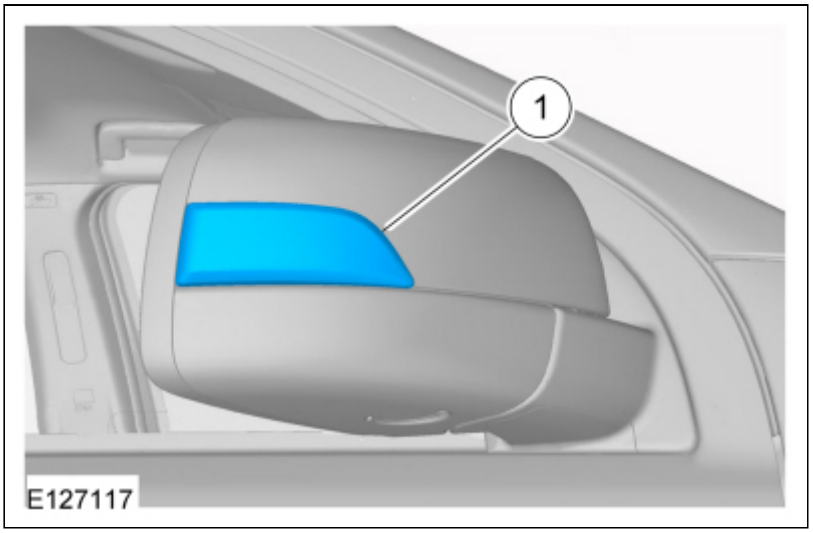


Item	Part Number	Description
1	—	Front fog lamp bulb

Side repeater / turn signal lamps



Item	Part Number	Description
1	—	Side repeater lamp

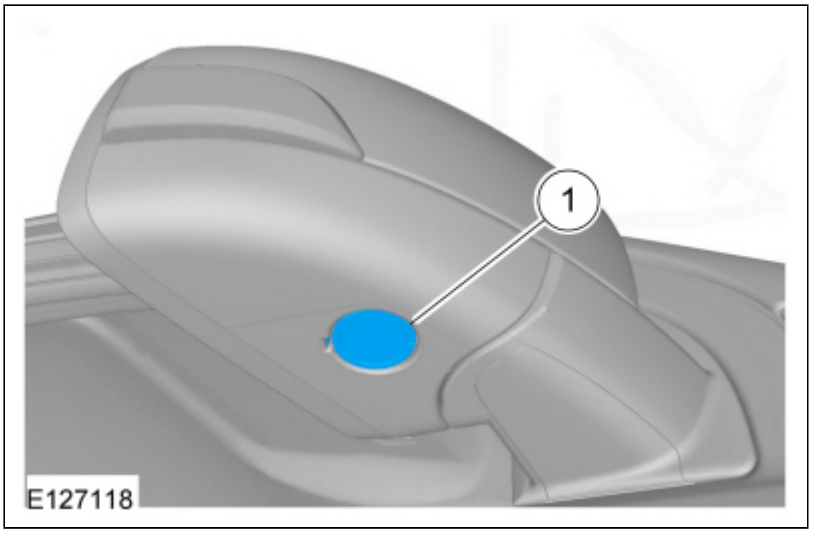


Item	Part Number	Description
1	—	Direction indicator lamp

The direction indicator lamps are used to indicate a turn signal and for the hazard warning lights.

The sound generator for the acoustic turn signal check is integrated in the instrument cluster.

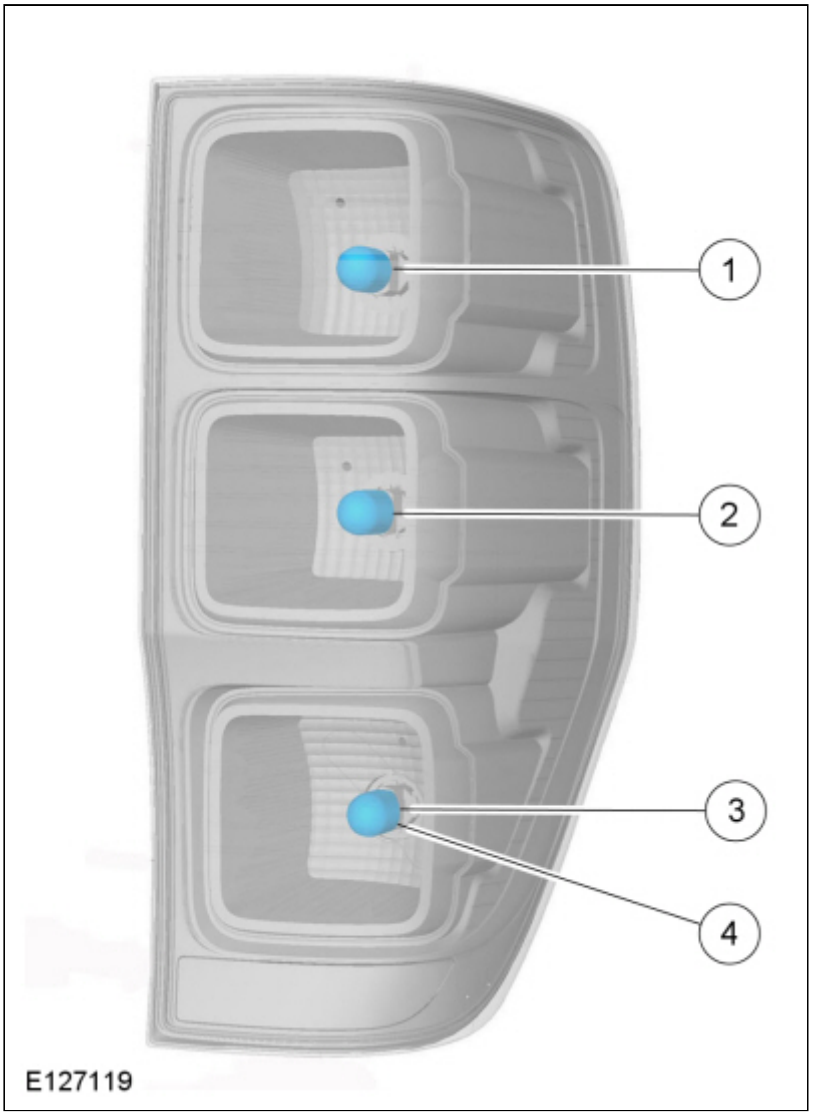
Puddle lamps



Item	Part Number	Description
1	—	Puddle lamp

This illuminates the area where a passenger is going to step when the door is opened.

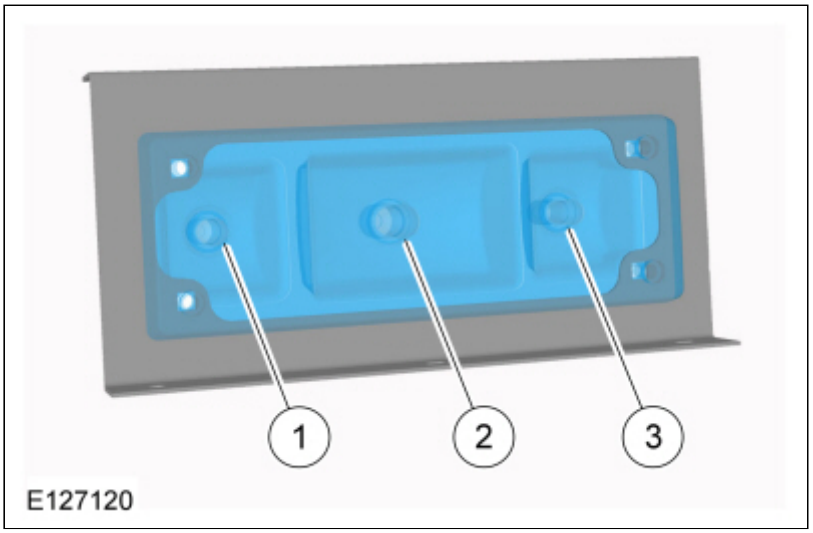
Rear combination lamps



Item	Part Number	Description
1	—	Side and brake lamp bulb

2	—	Direction indicator bulb
3	—	Reverse lamp bulb
4	—	Fog lamp bulb (Right for RHD)

Rear combination lamps (Chassis cab)



Item	Part Number	Description
1	—	Direction indicator bulb
2	—	Side and brake lamp bulb
3	—	Reverse lamp bulb

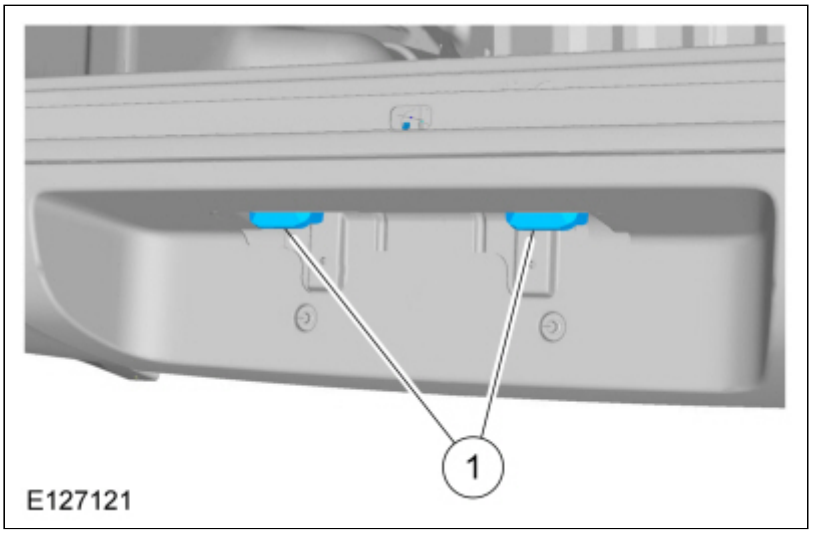
The rear lamp clusters incorporate all rearward facing lights with exception of the license plate lamp and the additional high-mounted stoplamp.

The rear lamps can only be replaced as a complete unit.

Brake lamp bulbs are illuminated when the driver applies the brake.

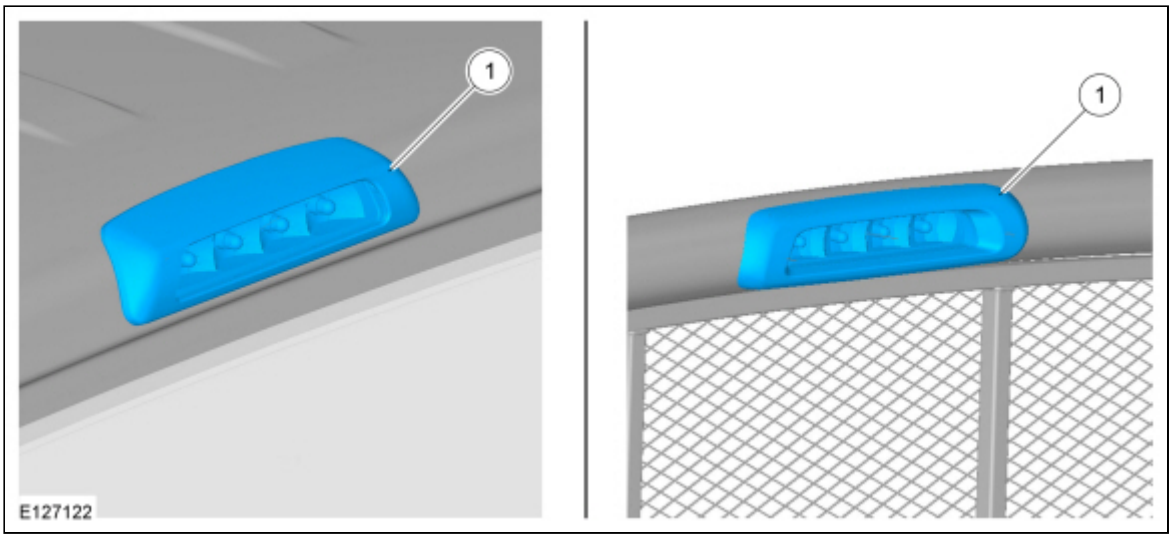
The reversing lamps (21W bulb) are used to illuminate the road when reversing the vehicle. The rear fog lamp is illuminated when the rear fog lamp switch is activated.

License plate lamp



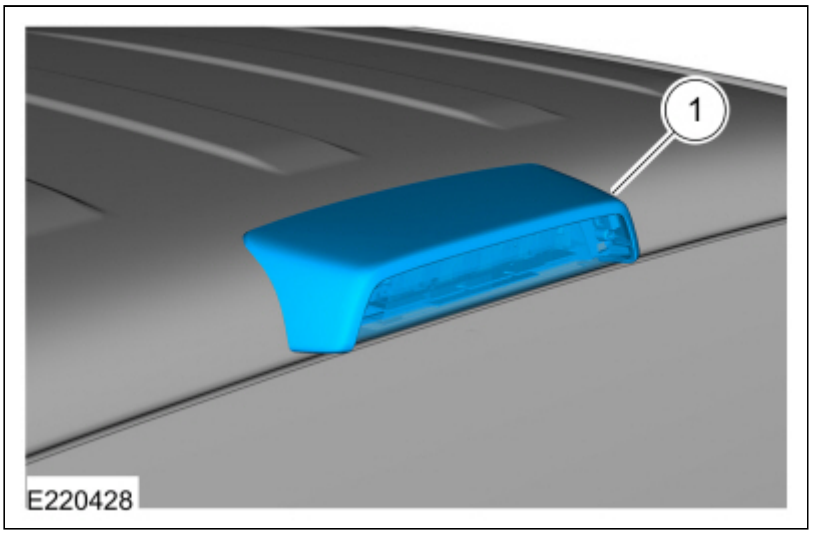
Item	Part Number	Description
1	—	License plate lamp

Center high mounted stop lamp - Bulb



Item	Part Number	Description
1	—	Center high mounted stop lamp

Center high mounted stop lamp - LED



Item	Part Number	Description
1	—	Center high mounted stop lamp

Four W5W glass base bulbs are used.

The stoplamps (21/W5W bulb) are switched on by the stoplamp switch on the brake pedal as soon as the brake pedal is depressed.

Trailer Tow

Vehicles with a factory fitted tow bar also come with a trailer plug control module for lighting. In addition to providing the trailer plug functionality, the trailer plug control module protects the primary electrical circuits of the vehicle from any electrical concern or failure that the customer's trailer may experience.

For vehicles fitted without a tow bar as standard, a genuine Ford accessory trailer tow electrical kit has been developed to enable a tow bar to be installed. The kit comprises of the trailer plug control module, trailer plug, wiring and associated hardware components.

Once the kit is installed, the vehicle must then be configured using IDS.

All trailer tow electrical connections must use the genuine Ford accessory trailer tow kit. Installation of aftermarket

trailer tow electrical kits or directly splicing into the vehicle wiring in order to install trailer lamps or other electrical devices may overload the system and impact the operation of other vehicle systems.

Copyright © 2016 Ford Motor Company

Exterior Lighting - Overview

Headlamps

The headlamp system consists of:

- Headlamp assemblies
- Headlamp switch
- Steering column multifunction switch
- BCM
- SCCM
- IPMA

The headlamp system is a quad-beam pattern system. It consists of replaceable low and high beam bulbs in each headlamp assembly. The front turn/parking lamps are integrated into the headlamp assembly.

DRL

The DRL system consists of:

- H15 Twin filament bulb
- BCM

Autolamps

The autolamp system consists of:

- Light sensor
- Headlamp switch
- BCM

The autolamp system provides light sensitive automatic on/off control of the exterior lamps. The autolamp system keeps the exterior lamps on for a preselected period of time after the ignition is turned OFF (20 seconds is the factory default setting). The preselected time is adjustable up to approximately 3 minutes by using the message center controls.

Stoplamps

The stoplamp system consists of:

- Stoplamp switch
- Rear lamp assemblies
- High mounted stoplamp
- BCM

The stoplamp switch is located on the brake pedal assembly. Voltage is supplied to the rear lamps and high mounted stoplamp when the brake pedal is applied.

Turn Signal and Hazard Lamps

The turn lamp system consists of:

- Front turn lamps (part of the headlamp assembly)
- Rear lamp assemblies
- Outside rear view mirrors
- Steering column multifunction switch
- Hazard flasher lamp switch
- BCM
- SCCM

When the steering column multifunction switch is placed in the LH TURN or RH TURN position, the corresponding turn lamps flash on and off.

When the hazard function is active, all the turn lamps flash on and off.

Parking, Rear and License Plate Lamps

The parking, rear and license plate lamp system consists of:

- Front position lamps
- Rear lamp assemblies
- License plate lamps
- Headlamp switch
- BCM

Front Fog Lamps

The front fog lamp system consists of:

- Front fog lamps
- Front fog lamps switch (integrated into the headlamp switch)
- BCM

The front fog lamp can be turned on when the ignition is in RUN, the parking lamps are on, and the high beams are off.

Rear Fog Lamps

The rear fog lamp system consists of:

- Rear fog lamps
- Rear fog lamps switch (integrated into the headlamp switch)
- BCM

The rear fog lamp can be turned on when the ignition is in RUN, the parking lamps are on.

Reversing Lamps

The reverse lamp system consists of:

- Reverse lamps
- PCM
- BCM

When the transmission is placed in REVERSE, the reversing lamps are illuminated.

Trailer Lamps

The trailer tow system consists of the following components:

- Trailer tow connector
- TRM
- BJB
- BCM

The TRM supplies voltage to the trailer stop/turn lamps, parking lamps, reversing lamps, trailer fog lamps and trailer battery charging.

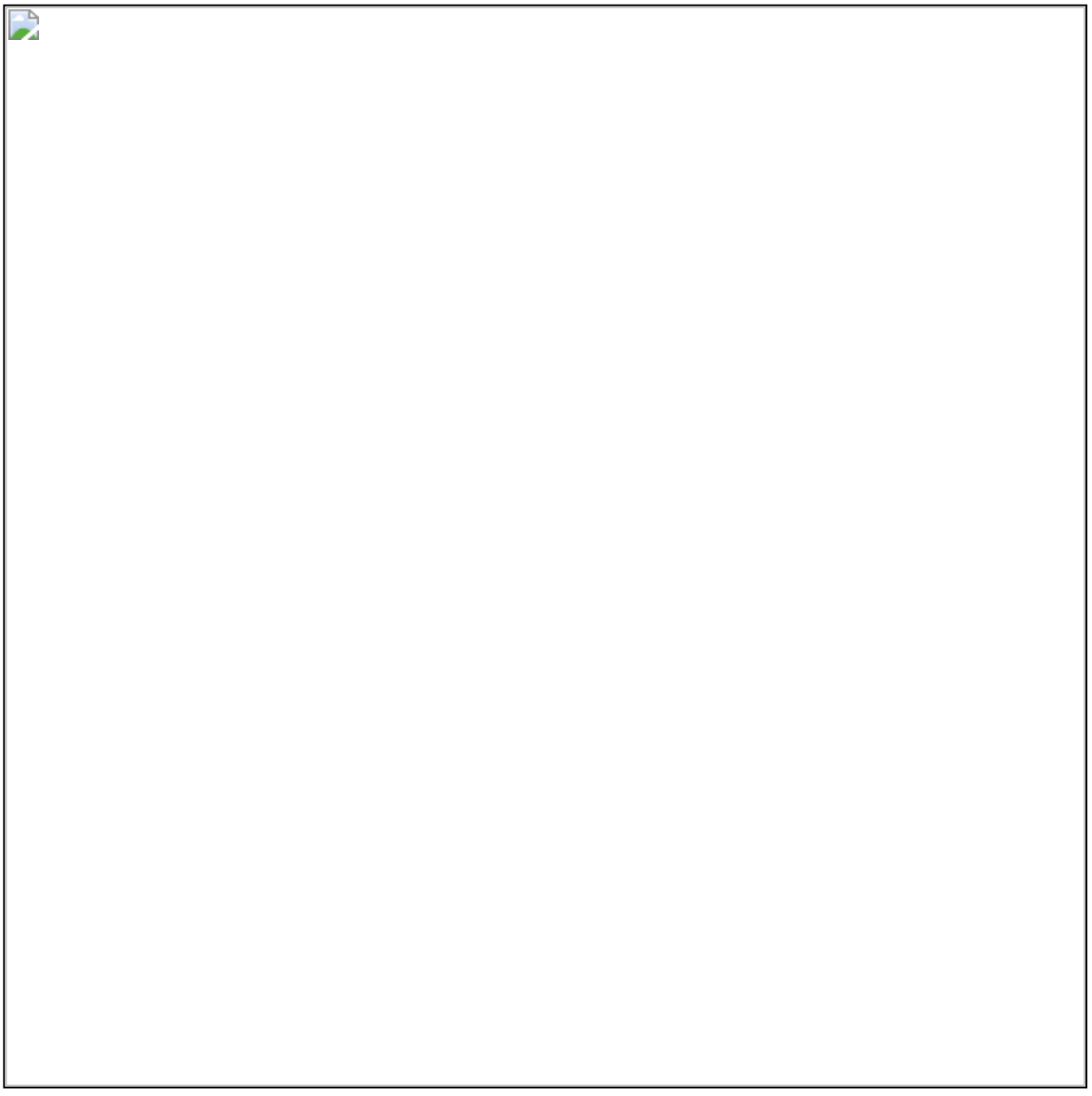
Copyright © 2016 Ford Motor Company

Exterior Lighting - System Operation and Component Description

System Operation

Headlamps

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Headlamp flash to pass status	GWM	Indicates to the BCM a request for the high beams or flash-to-pass.

GWM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Headlamp flash to pass status	SCCM	Indicates to the GWM a request for the high beams or flash-to-pass.
Auto high beam request	IPMA	Indicates to the GWM a request for the high beams based on the IPMA camera input.

Low Beams

The BCM monitors the headlamp switch position by sending voltage signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is switched to ground to indicate the headlamp switch position.

The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

When the BCM receives a message requesting the headlamps on, it supplies voltage to the headlamp bulbs within each headlamp assembly.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and low beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

High Beams

The SCCM monitors the steering column multifunction switch for a high beam request. When the steering column multifunction switch is in the HIGH BEAMS position, the SCCM sends a message over the HS-CAN2 to the GWM, then the GWM sends the message to the BCM over the HS-CAN1.

When the low beams are on and the BCM receives a request for high beams, the low beam bulbs remain powered on and the high beam bulbs are also illuminated. This changes the headlamp beam pattern to illuminate a greater distance.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and high beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Flash-To-Pass

The SCCM monitors the steering column multifunction switch for a flash-to-pass request. When the steering column multifunction switch is in the FLASH-TO-PASS position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1.

When the ignition is in RUN and the flash-to-pass is requested, the high beams are activated as long as the steering column multifunction switch is held in the flash-to-pass position.

Headlamp Exit Delay

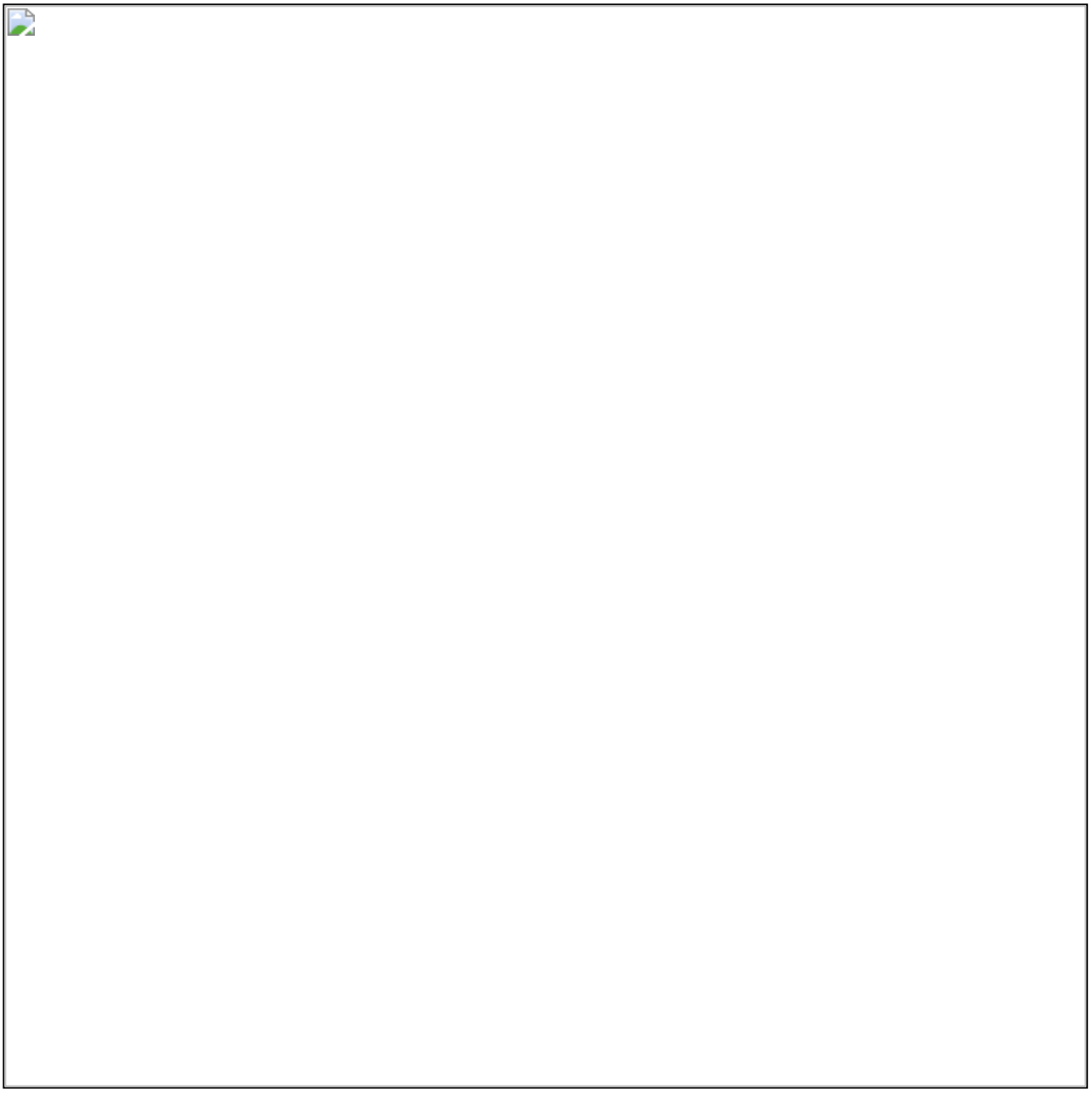
When the ignition is OFF and the steering column multifunction switch is placed in the FLASH-TO-PASS position and released, the parking lamps and low beams are illuminated. They remain illuminated until:

- 3 minutes have elapsed with a door open.
- 30 seconds have elapsed after all doors are closed.
- the steering column multifunction switch is placed in the flash-to-pass position again.
- the ignition switches to RUN.

Within the 30 second delay and all the doors closed, opening any door results in the 3 minute timer restarting.

Manual Headlamp Leveling

System Diagram

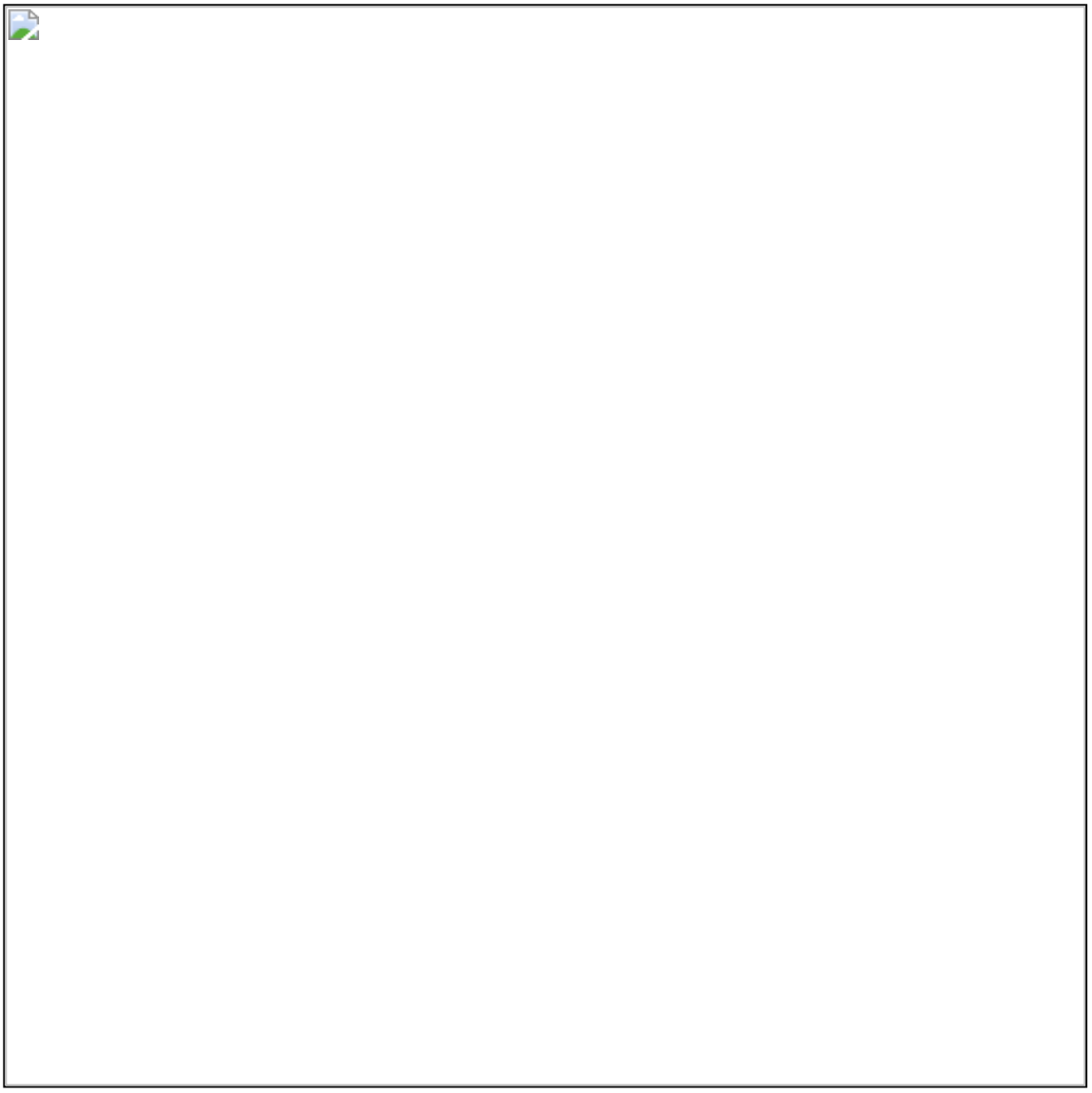


Manual Headlamp Leveling

By pressing the headlamp button and releasing it into the popped out position, the switch can be rotated into one of 4 headlamp level positions. This allows headlamp beam height to be adjusted according to vehicle load. Once the beam is adjusted, the button can be pressed again to lock in the headlamp beam height.

DRL

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the GSM request to the BCM. When the gear shift has selected any position other than park, the BCM activates the DRL.

DRL

The BCM monitors the ignition status, the headlamp switch and autolamp status.

There are two types of DRL. Conventional (where it is required) and configurable.

When equipped with conventional DRL, the DRL are active in any headlamp switch position except the HEADLAMPS position.

When equipped with configurable DRL, the DRL may be enabled through the IPC message center. When enabled, the DRL are active only in the AUTOLAMPS headlamp position. When autolamps request the headlamps on, the DRL are de-activated.

The DRL are activated when the following conditions are met:

- the ignition is in run
- the headlamps have not been turned on by the autolamp system or the headlamp switch
- the transmission is not in park

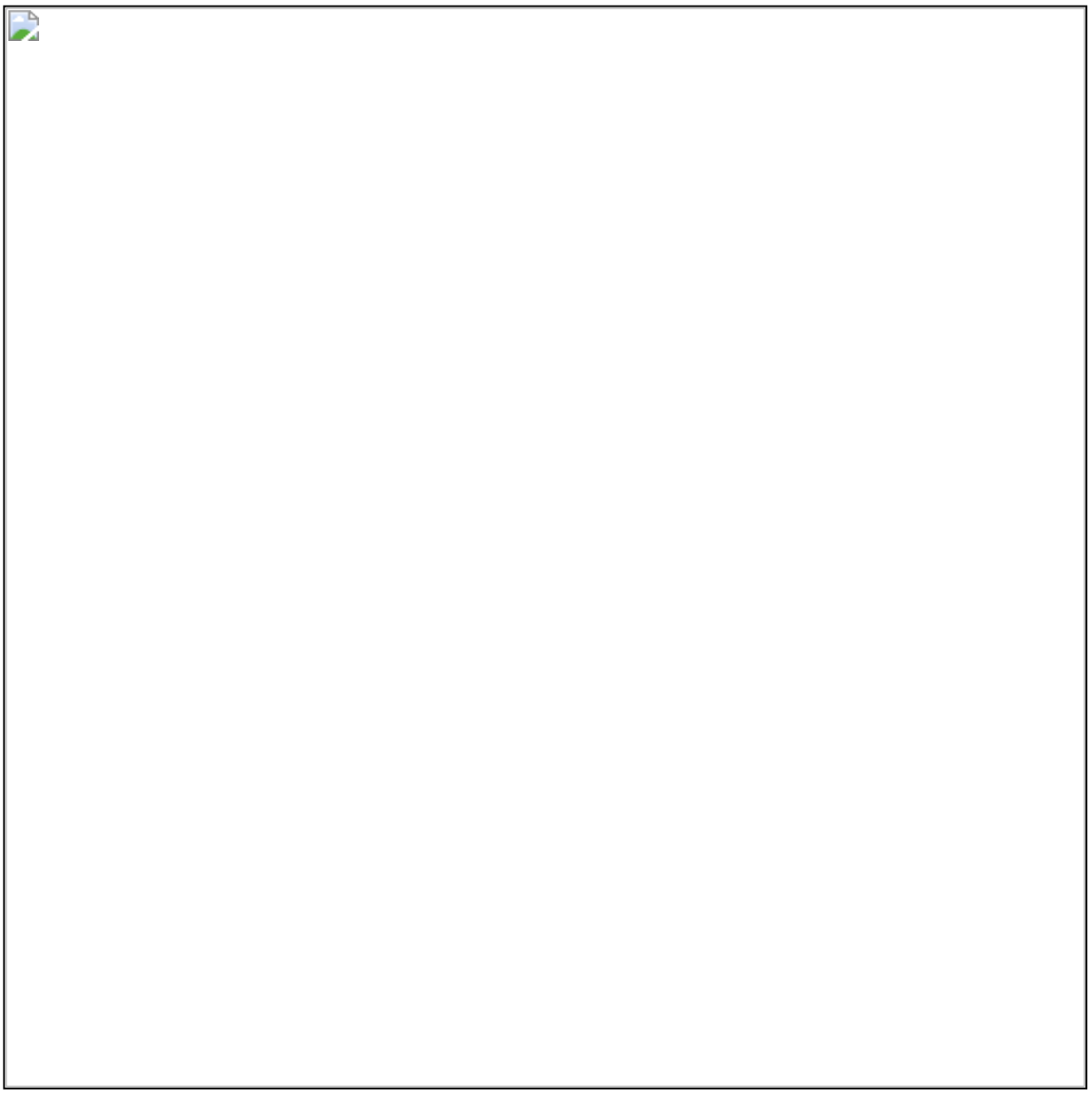
When the transmission is in not in PARK, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is not in PARK.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and DRL output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Autolamps

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Front wiper status	SCCM	The BCM uses the wiper status information for the operation of the wiper activated headlamps feature.

Autolamps

The BCM monitors the light sensor with a voltage signal. The light sensor input to the BCM varies with the ambient light conditions.

The BCM monitors the headlamp switch circuits to indicate the headlamp switch position.

When the BCM receives a headlamp switch status indicating a request for the autolamps, the BCM monitors the light sensor for the ambient light condition. If the BCM determines the ambient light level is dark, the BCM supplies voltage to the exterior lamps.

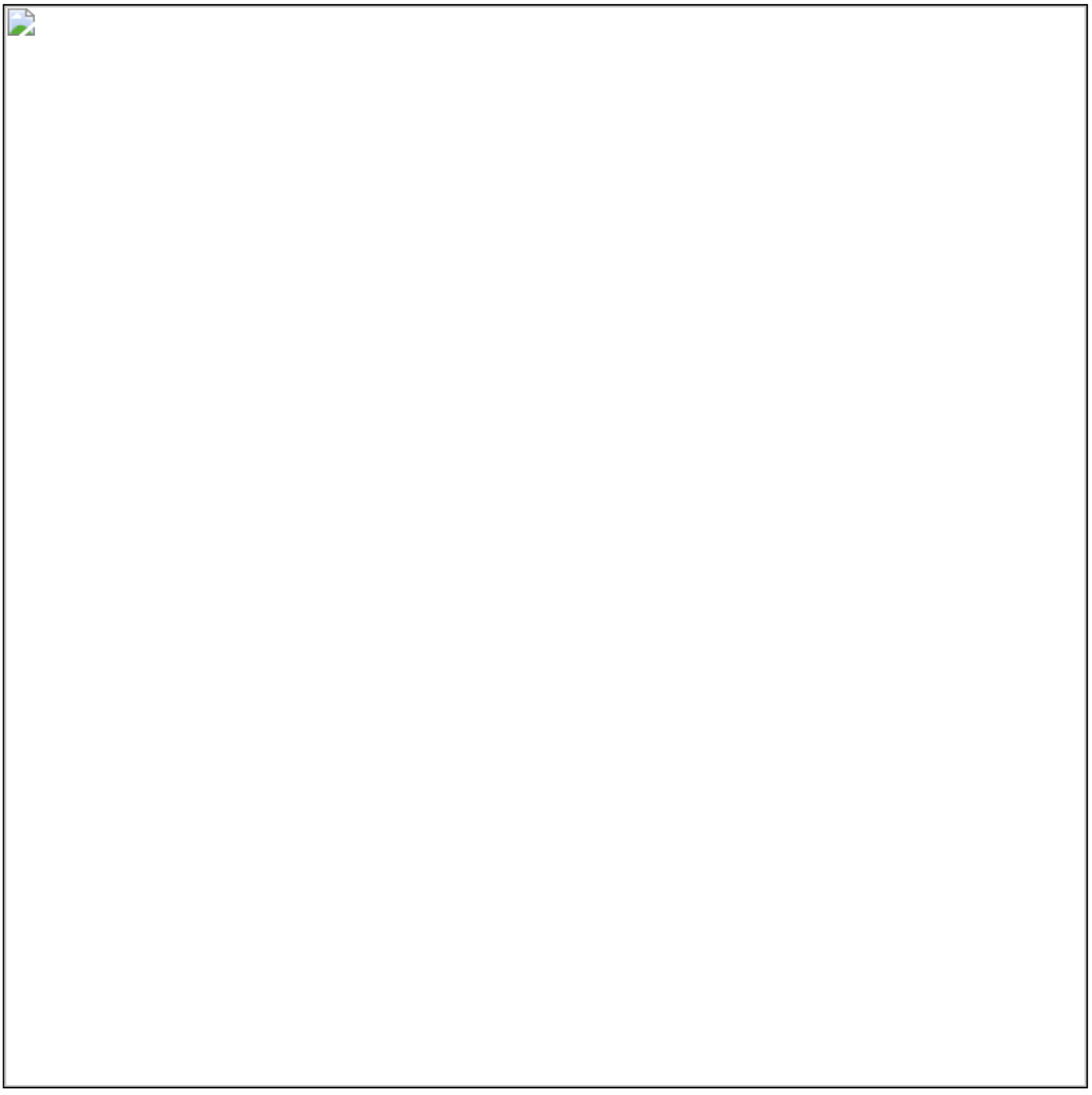
Headlamps On With Wipers On Function

When the headlamp switch is in the autolamps position, the exterior lamps turn on when the front wipers are in low or high. This feature does not activate the exterior lamps during a mist wipe, while the wipers are on to clear washer fluid during a wash condition or if the wipers are in automatic or intermittent modes.

The exterior lamps turn off when the ignition switches OFF or to ACC mode, the headlamp switch is placed in the off position, or the front wipers are turned off. The exception to this is when the exterior lights are on because of darkness determined by the autolamp system.

Stoplamps

System Diagram



Stoplamps

The BCM monitors the input from the stoplamp switch. When the brake pedal is applied, voltage is routed to the BCM, indicating a request for the stoplamps. The BCM then supplies voltage to the stoplamps.

The BCM does not activate the stoplamps when the ignition is in OFF or ACC.

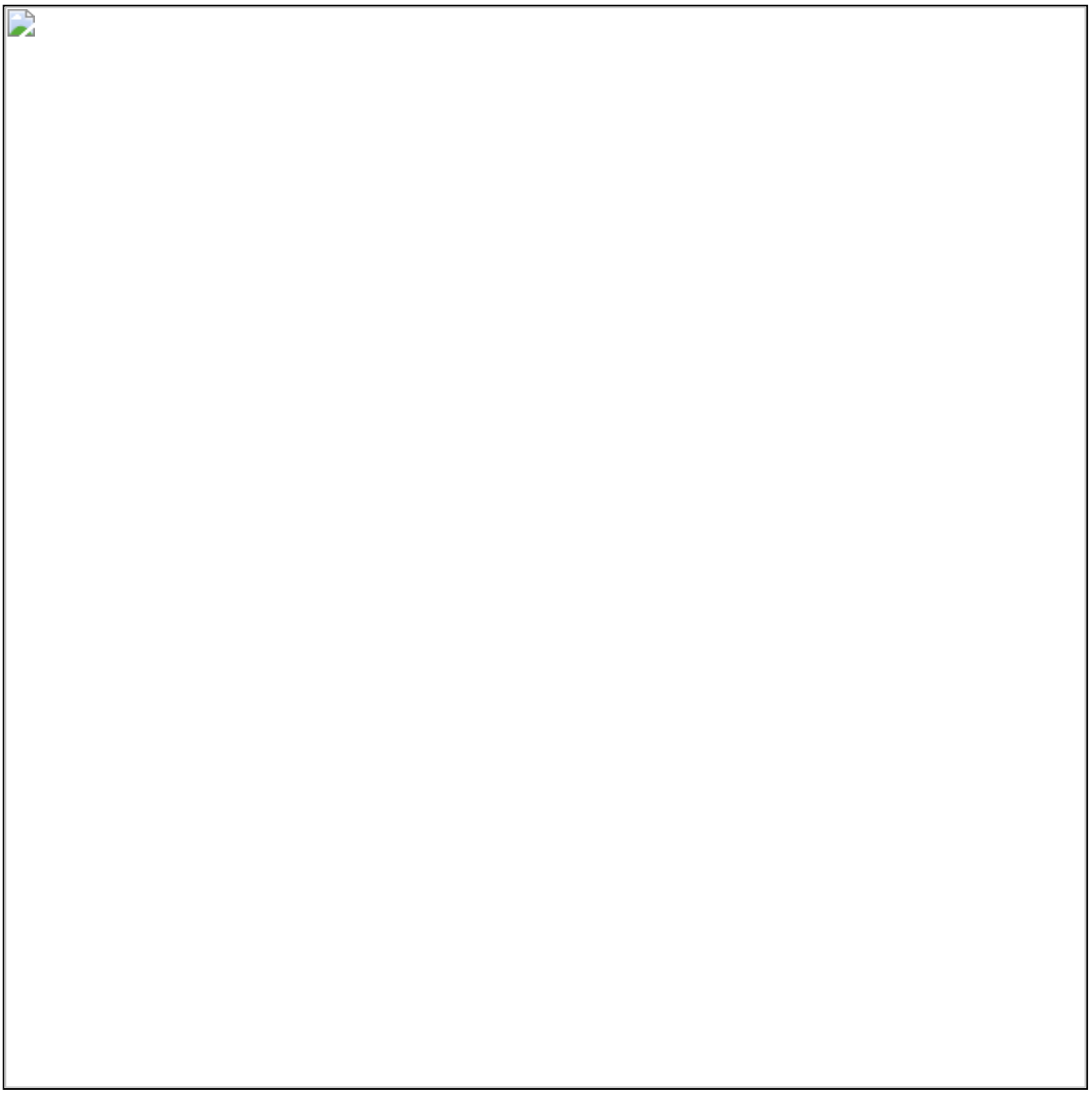
The BCM uses 3 separate output circuits. The LH shared turn/stop lamp output circuit, RH shared turn/stop lamp output circuit and high-mounted stoplamp output circuit.

The BCM also provides Field Effect Transistor (FET) protection of the stoplamp output circuits. When an excessive current draw is detected, the BCM disables the affected stoplamp circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Turn Signal and Hazard Lamps

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn signal switch status	GWM	Indicates the turn signal stalk position on the steering column multifunction switch (left/right lane change or turn signal on or off). The BCM activates the left/right turn signals based on this input.

GWM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn signal switch status	SCCM	Indicates the turn signal stalk position on the steering column multifunction switch (left/right lane change or turn signal on or off).
Turn indication request	BCM	A command to activate/deactivate the exterior mirror turn indicator.

Turn Signals

The SCCM monitors the steering column multifunction switch position. When the steering column multifunction switch is in the left or right turn position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM supplies on/off voltage to the appropriate turn lamps. The BCM sends a turn indicator command message over the MS-CAN to the door modules for the exterior mirror turn lamps.

The timed on/off cycle for turn lamps is determined by the BCM and is set to flash approximately 70 times per minute if both the front and rear turn signal lamps operate correctly.

If a front or rear turn signal lamp is inoperative, the BCM fast flashes the remaining turn lamp(s) approximately 150 times per minute to indicate a bulb outage to the driver.

The steering column multifunction switch has 2 detents for the left turn position and 2 detents for the right turn position. When placed in the first detent and released, the corresponding turn signals flash 3 times and turn off. When the steering column multifunction switch is moved to the second detent, the turn signal flashes until the steering wheel is turned in the opposite direction.

The BCM also provides Field Effect Transistor (FET) protection of the turn lamp output circuits. When an excessive current draw is detected, the BCM disables the affected turn lamp circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Hazard Lamps

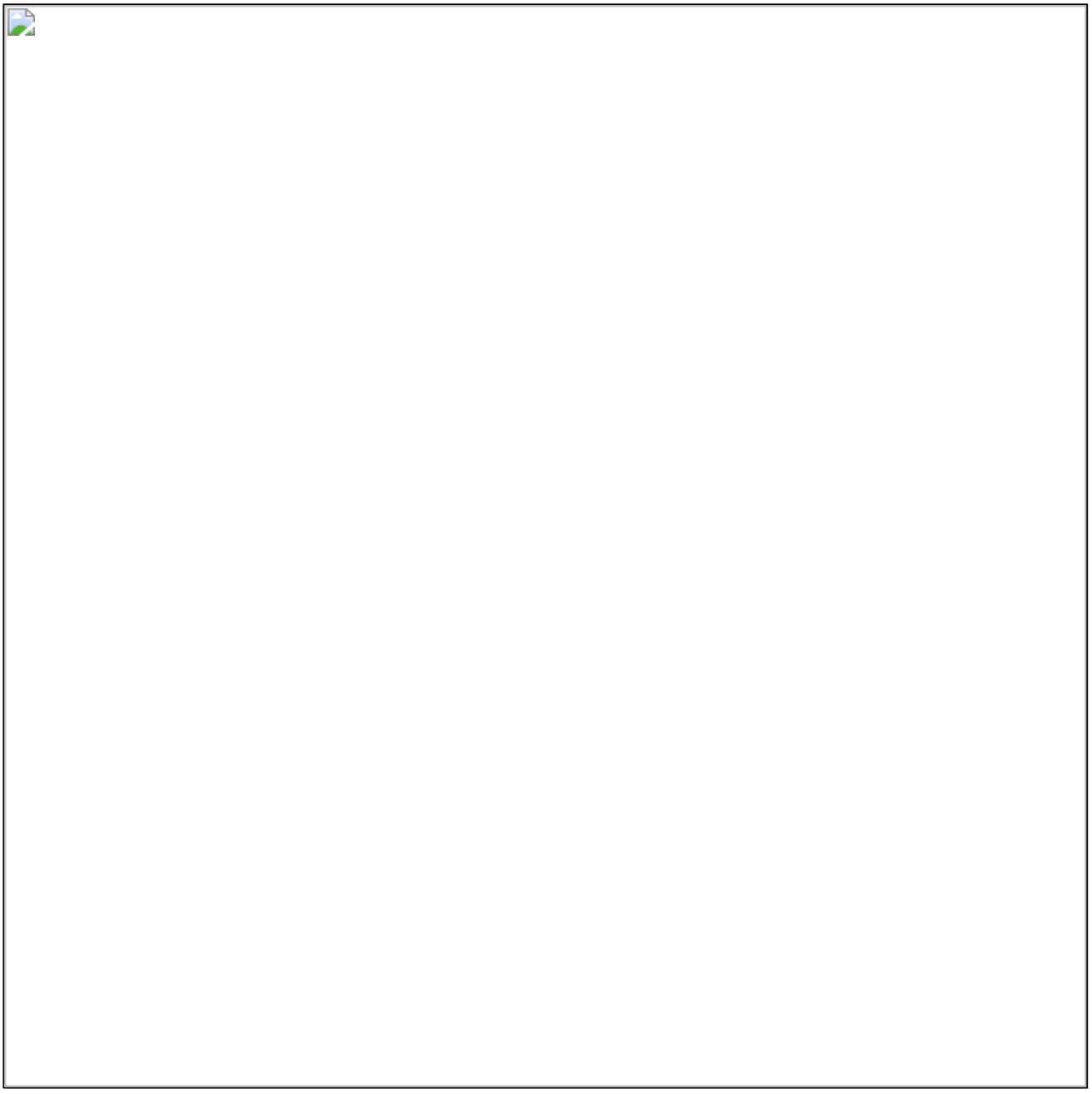
The BCM sends a voltage signal to the hazard flasher lamp switch to monitor for a hazard lamp function request. When the hazard flasher lamp switch is pressed, the voltage signal is routed to ground, indicating a request to activate or deactivate the hazard lamp function.

When the BCM receives a request for the hazard lamps, the BCM supplies on/off voltage to all the turn lamps.

The timed on/off cycle for the hazard lamps is approximately 70 times per minute, regardless of bulb outage.

Parking, Rear, and License Plate Lamps

System Diagram



Parking Lamps

The BCM monitors the headlamp switch position by sending voltage signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is switched to ground to indicate the headlamp switch position.

If the BCM detects a fault from the headlamp switch or loses communication with the headlamp switch, the BCM turns the parking and headlamps on. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

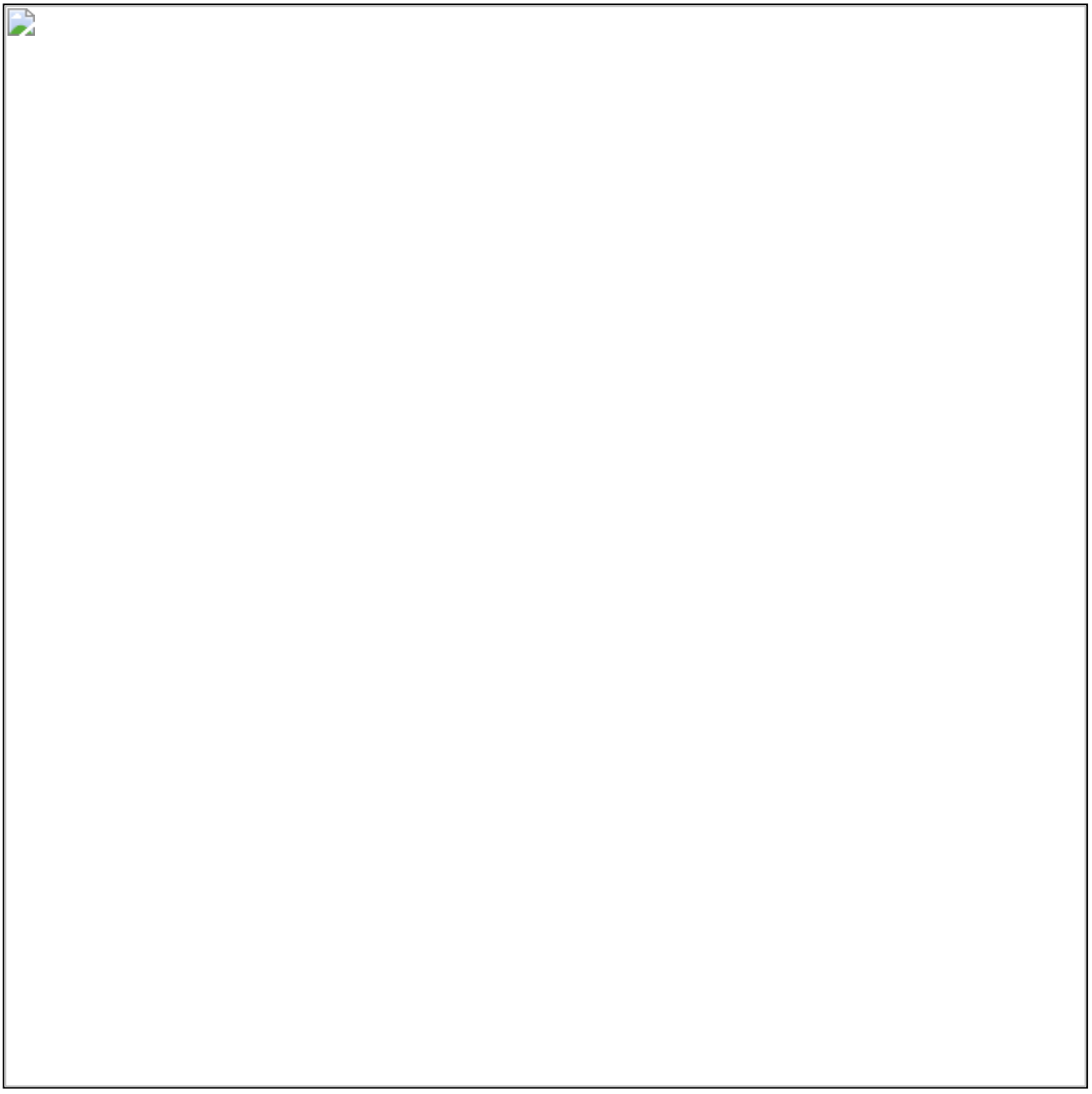
When the BCM receives an input requesting the parking lamps on, it provides voltage to the parking lamps.

The BCM also provides Field Effect Transistor (FET) protection of the parking lamps output circuits. When an excessive current draw is detected, the BCM disables the affected parking lamps circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Fog Lamps

System Diagram



Front Fog Lamps

The BCM monitors the headlamp switch position by sending voltage signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is switched to ground to indicate the headlamp switch position.

When the BCM receives input from the headlamp switch indicating a request for the front fog lamps, the BCM provides voltage to the front fog lamps.

The BCM also provides Field Effect Transistor (FET) protection of the front fog lamp output circuit. When an excessive current draw is detected, the BCM disables the front fog lamp output circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Rear Fog Lamps

The BCM monitors the headlamp switch position by sending voltage signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is switched to ground to indicate the headlamp switch position.

When the BCM receives input from the headlamp switch indicating a request for the rear fog lamps, the BCM provides voltage to the rear fog lamps.

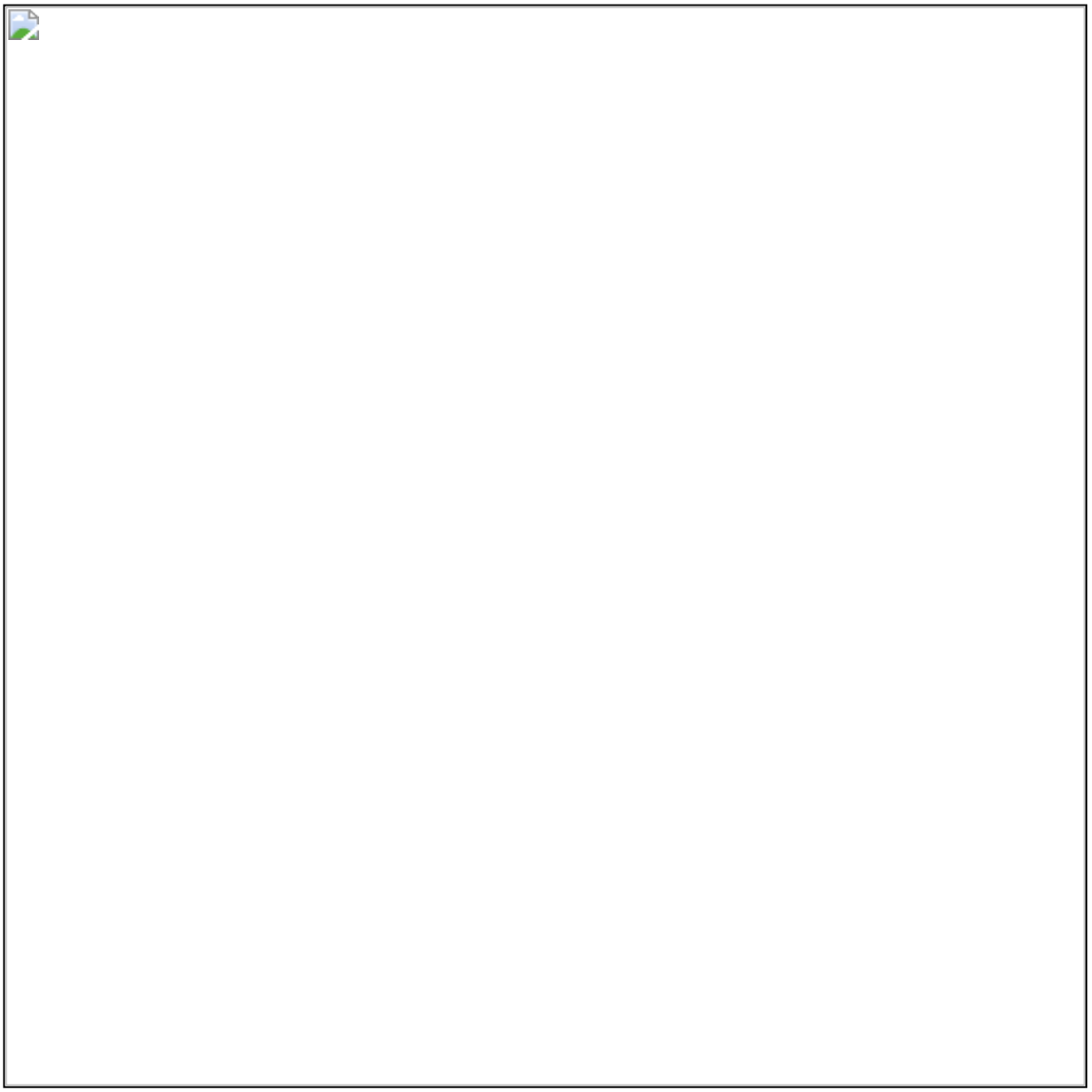
The BCM also provides Field Effect Transistor (FET) protection of the rear fog lamp output circuit. When an

excessive current draw is detected, the BCM disables the rear fog lamp output circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Reversing Lamps

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the transmission is in reverse gear to the BCM. When the transmission is in REVERSE and the ignition in RUN, the BCM provides voltage to the reversing lamps.

Reversing Lamps

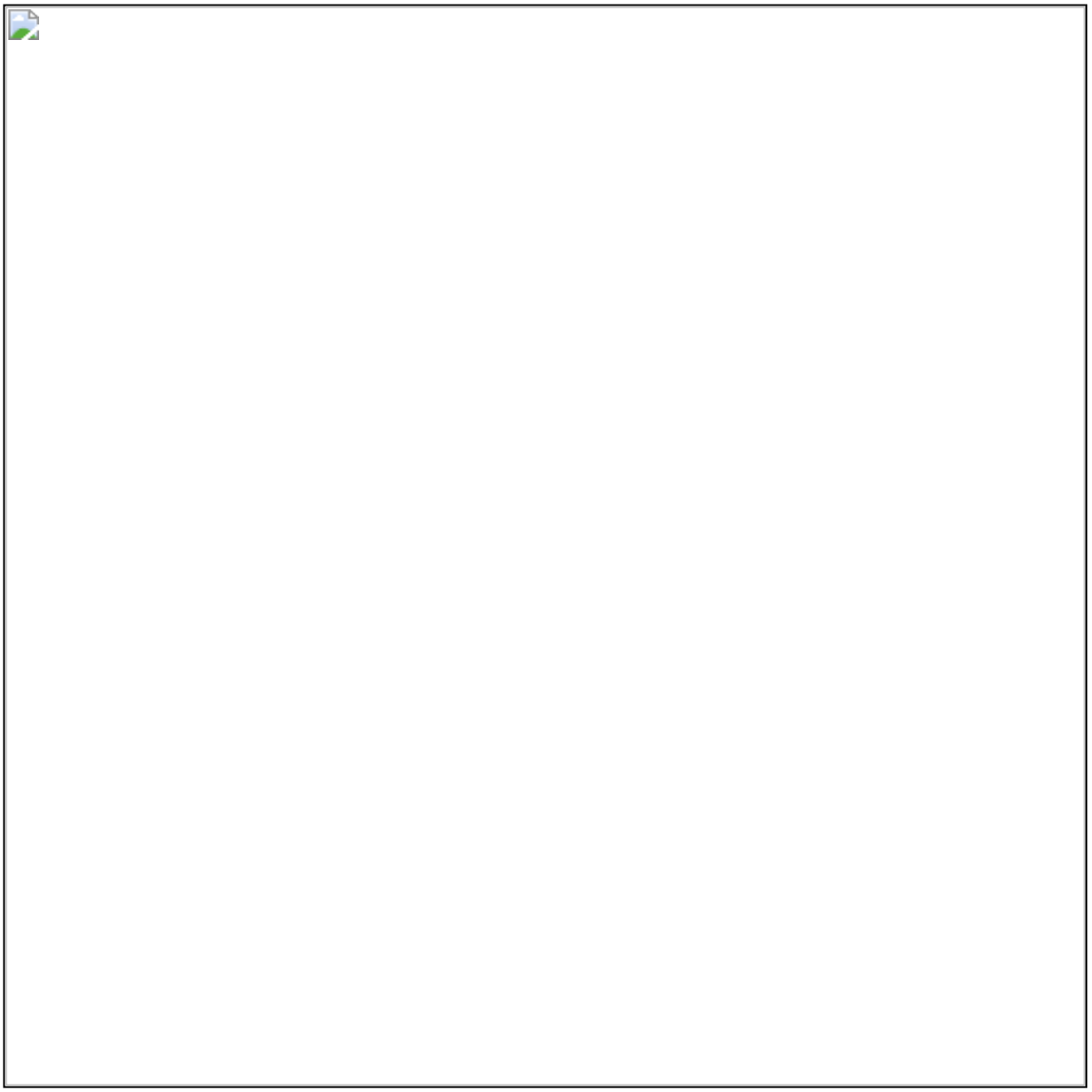
When the transmission is in REVERSE, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is in REVERSE. The BCM provides voltage to the reversing lamps when it receives the message that the transmission is in REVERSE and the ignition is in RUN.

The BCM also provides Field Effect Transistor (FET) protection of the reversing lamps output circuit. When an excessive current draw is detected, the BCM disables the affected reversing lamps circuit driver.

Refer to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

Trailer Lamps

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the transmission is in reverse gear to the BCM. When the transmission is in REVERSE and the ignition in RUN, the BCM provides voltage to the reversing lamps.

GWM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn signal switch status	SCCM	Indicates the turn signal stalk position on the steering column multifunction switch (left/right lane change or turn signal on or off).

Turn indication request	BCM	A command to activate/deactivate the exterior mirror turn indicator.
Stop lamp brake request	BCM	A command to activate/deactivate the stop lamps output.

TRM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn indication request	BCM	A command to the TRM to activate/deactivate the turn indicator output to the trailer tow connector.
Stoplamp request	BCM	A command to the TRM to activate/deactivate the stop lamps output to the trailer tow connector.

Trailer Stop-Turn Lamps

The SCCM monitors the steering column multifunction switch position. When the steering column multifunction switch is in the left or right turn position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM sends a turn indicator command message over the MS-CAN to the TRM to activate the requested stop/turn indicator output to the trailer tow connector.

When the BCM receives input from the stoplamp switch indicating that the brake pedal is being pressed, the TRM receives a stoplamp activation message over the MS-CANto activate the requested stop/turn indicator output to the trailer tow connector.

Trailer Fog Lamps

The BCM monitors the rear fog lamp switch position by sending voltage signals on multiple circuits to the rear fog lamp switch. At any given time, the signal circuits is switched to ground to indicate the rear fog lamp switch position.

When the rear fog lamps position is selected, the BCM sends a rear fog lamp command message over the MS-CAN to the TRM to activate rear fog lamp voltage to the trailer tow connector.

Trailer Parking Lamps

The BCM monitors the headlamp switch position by sending voltage signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is switched to ground to indicate the headlamp switch position.

When the parking lamps or headlamps position is selected, the BCM sends a parking lamp command message over the MS-CAN to the TRM to activate parking lamp voltage to the trailer tow connector.

Trailer Reversing Lamps

When the transmission is in REVERSE, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is in REVERSE. The BCM sends a reversing lamp command message over the MS-CAN to the TRM to activate the reversing lamp voltage to the trailer tow connector.

Trailer Battery Charging

The TRM provides voltage to the trailer tow connector for trailer battery charging when the ignition switch is in the RUN position.

The TRM is supplied voltage for trailer battery charging from the BJB.

Field Effect Transistor (FET) Protection

The TRM utilizes a Field Effect Transistor (FET) protective circuit strategy for its lamp output circuits. Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected.

A Field Effect Transistor (FET) is a type of transistor that the control module software uses to control and monitor current flow on module outputs. The Field Effect Transistor (FET) protection strategy prevents module damage in the event of excessive current flow.

Output loads (current level) are monitored for excessive current draw (typically short circuits). When a fault event is detected the Field Effect Transistor (FET) turns off and a short circuit DTC sets. The module resets the Field Effect Transistor (FET) protection and allows the circuit to function when the fault is corrected or the ignition state is cycled off and then back on.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each Field Effect Transistor (FET) protected circuit has 3 predefined levels of short circuit tolerance based on a module lifetime level of fault events based upon the durability of the Field Effect Transistor (FET).

When each level is reached, the DTC associated with the short circuit sets along with DTC U1000:00. These Diagnostic Trouble Codes (DTCs) can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then Diagnostic Trouble Codes (DTCs) U1000:00 and U3000:49 set along with the associated short circuit DTC. DTC**U3000:49 cannot be cleared** and the module **must** be replaced after the repair.

Component Description

Headlamp Assembly

Exterior lamps are vented to accommodate normal changes in pressure. Condensation can be a natural by-product of this design. When moist air enters the lamp assembly through the vents, there is a possibility that condensation can occur if the temperature is cold. When normal condensation occurs, a thin mist forms on the interior of the lens. The thin mist eventually clears and exits through the vents during normal operation. The amount of time it takes to clear the lens of acceptable mist varies with ambient humidity and lamp types. Normal condensation clears from any lamp in 48 hours under dry conditions.

Do not replace a lamp assembly with acceptable levels of condensation such as:

- presence of thin mist (no streaks, drip marks or droplets are present)
- fine mist covers less than 50% of the lens

Examples of unacceptable moisture (usually caused by a lamp housing leak):

- water puddling inside the lamp
- large water droplets, drip marks or streaks present on the interior of the lens

Headlamp Switch

The BCM monitors the headlamp switch position by sending voltage signals on multiple circuits to the headlamp switch. There is one circuit for each headlamp switch position. At any given time, one of the signal circuits is switched to ground to indicate the headlamp switch position.

On vehicles equipped with an optional manual headlamp leveling system, the switch has a headlamp button that can be rotated into one of 4 headlamp level positions.

Light Sensor

The BCM sends a voltage signal to the light sensor. The light sensor provides resistance between the voltage signal and ground. The resistance varies depending on the amount of ambient light detected by the light sensor. The brighter the ambient light, the lower the resistance. By varying the resistance, the BCM can determine the amount of ambient light.

Stoplamp Switch

The stoplamp switch is a normally open switch and is provided voltage at all times. When the brake pedal is applied, the switch closes and routes voltage to the BCM.

TRM

The TRM receives inputs from the BCM to control voltage to the trailer tow connector for the LH stop/turn, RH stop/turn lamps and trailer battery charging.

Copyright © 2016 Ford Motor Company

Autolamps

DTC Chart: BCM

NOTE: *The BCM is also known as the CJB*

BCM DTC Chart

DTC	Description	Action
B1A85:11	Ambient Light Sensor: Circuit Short To Ground	GO to Pinpoint Test B
B1A85:13	Ambient Light Sensor: Circuit Open	GO to Pinpoint Test B

Symptom Chart: Autolamps

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The autolamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
The autolamps are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test B

Pinpoint Tests

The Autolamps Are Inoperative

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Sunload sensor
- multifunction switch (headlamp switch)
- BCM

PINPOINT TEST A : THE AUTOLAMPS ARE INOPERATIVE

A1 CHECK THE MANUAL HEADLAMP OPERATION
• Place the headlamp switch in the HEADLAMPS and then OFF positions. **Do the headlamps operate correctly?** **Yes** GO to A2

No	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).

A2 CHECK FOR VOLTAGE TO THE LIGHT SENSOR

- Ignition OFF.
- Disconnect Autolamp Sensor C287 (vehicles with EMTC)..
- Disconnect Sunload Sensor C286 (vehicles with DATC)..
- Ignition ON.
- Place the headlamp switch in the AUTOLAMPS position.
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2		Ground

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2		Ground

Is the voltage approximately 5 volts?

Yes	INSTALL a new sunload sensor.
No	GO to A3

A3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Autolamps Are On Continuously

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A85:11	Ambient Light Sensor: Circuit Short to Ground	Sets when the BCM detects a short to ground from the light sensor input circuit.
B1A85:13	Ambient Light Sensor: Circuit Open	Sets when the BCM detects an open or short to voltage from the light sensor input circuit.

Possible Sources

- Wiring, terminals or connectors
- Light sensor
- multifunction switch (headlamp switch)
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the multifunction switch (headlamp switch) for damage.
- Inspect the light sensor for damage.

PINPOINT TEST B : THE AUTOLAMPS ARE ON CONTINUOUSLY

B1 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODE (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B1A85:11 or B1A85:13 present?

Yes	For DTC B1A85:11, GO to B3 For DTC B1A85:13, GO to B5
No	GO to B2

B2 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (NO DTC (DIAGNOSTIC TROUBLE CODE))

- Ignition OFF.
- Disconnect Autolamp Sensor C287 (vehicles with EMTC)..
- Disconnect Sunload Sensor C286 (vehicles with DATC)..
- Ignition ON.
- Place the headlamp switch in the AUTOLAMPS position.
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2		Ground

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2		Ground

Is the voltage approximately 5 volts?

Yes	INSTALL a new sunload sensor.
No	GO to B10

B3 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC (DIAGNOSTIC TROUBLE CODE) B1A85:11)

- Ignition OFF.
- Disconnect Autolamp Sensor C287 (vehicles with EMTC)..
- Disconnect Sunload Sensor C286 (vehicles with DATC)..
- Ignition ON.
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2		Ground

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2		Ground

Is the voltage approximately 5 volts?

Yes	INSTALL a new sunload sensor.
No	GO to B4

B4 CHECK THE LIGHT SENSOR INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: BCM C2280G.
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2	Ω	Ground

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B10
No	REPAIR the circuit.

B5 CHECK FOR VOLTAGE TO THE LIGHT SENSOR (DTC (DIAGNOSTIC TROUBLE CODE) B1A85:13)

- Ignition OFF.
- Disconnect Autolamp Sensor C287 (vehicles with EMTC)..
- Disconnect Sunload Sensor C286 (vehicles with DATC)..
- Ignition ON.
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2	V	Ground

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2	V	Ground

Is the voltage approximately 5 volts?

Yes	GO to B6
No	GO to B7

B6 CHECK THE LIGHT SENSOR FOR GROUND

- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2	V	C287-4

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead

C286-2		C286-4

Is the voltage approximately 5 volts?

Yes	INSTALL a new light sensor.
No	GO to B7

B7 CHECK THE LIGHT SENSOR GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280G..
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-4	Ω	C2280G-22

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-4	Ω	C2280G-22

Is the resistance less than 3 ohms?

Yes	GO to B10
No	REPAIR the circuit.

B8 CHECK THE LIGHT SENSOR INPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect BCM C2280G..
- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2		Ground

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B9

B9 CHECK THE LIGHT SENSOR INPUT CIRCUIT FOR AN OPEN

- Measure:

Vehicles With EMTC

Positive Lead	Measurement / Action	Negative Lead
C287-2	Ω	C2280G-24

Vehicles With DATC

Positive Lead	Measurement / Action	Negative Lead
C286-2	Ω	C2280G-24

Is the resistance less than 3 ohms?

Yes	GO to B10
No	REPAIR the circuit.

B10 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Daytime Running Lamps (DRL)

Symptom Chart(s)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart: Daytime Running Lamps (DRL)

Symptom Chart

Condition	Possible Sources	Actions
A module does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The Daytime Running Lamps (DRL) are inoperative	Refer to the Diagnostic Routine	GO to Pinpoint Test A

Pinpoint Tests

The Daytime Running Lamps (DRL) Are Inoperative

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the multifunction switch (headlamp switch) for damage.

PINPOINT TEST A : THE DAYTIME RUNNING LAMPS (DRL) ARE INOPERATIVE

A1 CHECK THAT THE DAYTIME RUNNING LAMPS (DRL) ARE ENABLED

- Ignition ON.
- Using a diagnostic scan tool, make sure the Daytime Running Lamps (DRL) are enabled.

Are the Daytime Running Lamps (DRL) enabled?

Yes	GO to A2
No	Enable the Daytime Running Lamps (DRL).

A2 CHECK THE OPERATION OF THE PARKING LAMPS AND HEADLAMPS (HALOGEN HEADLAMPS)

- Ignition OFF.

- Place the headlamp switch in the headlamps on position.

Do the parking lamps and headlamps (halogen headlamps) operate correctly?

Yes	GO to A3
No	For parking lamps inoperative, REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing). For halogen headlamps, diagnose the low beam headlamps. REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).

A3 CHECK THE IGNITION SWITCH PARAMETER IDENTIFICATION (PID)

- Ignition ON.
- Using a scan tool, view Body Control Module (BCM) Parameter Identifications (PIDs).
- Monitor the Body Control Module (BCM) IGN_SW_RUN Parameter Identification (PID) while cycling the ignition ON and OFF.

Does the ignition switch Parameter Identification (PID) value agree with the ignition state?

Yes	GO to A4
No	Replace the multifunction switch (headlamp switch). REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation).

A4 CHECK FOR CORRECT BODY CONTROL MODULE (BCM) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Fog Lamps

DTC Chart: BCM

NOTE: *The BCM is also known as the CJB*

BCM DTC Chart

DTC	Description	Action
B1046:11	Front Fog Lamp Control Switch: Circuit Short to Ground	GO to Pinpoint Test C
B1047:11	Rear Fog Lamp Control Switch: Circuit Short to Ground	GO to Pinpoint Test F
B1147:11	Left Front Fog Lamp: Circuit Short to Ground	GO to Pinpoint Test B
B1147:15	Left Front Fog Lamp: Circuit Short to Battery or Open	• If the fog lamp is on continuously, GO to Pinpoint Test C • If the fog lamp is inoperative, GO to Pinpoint Test B
B1148:11	Right Front Fog Lamp: Circuit Short to Ground	GO to Pinpoint Test B
B1148:15	Right Front Fog Lamp: Circuit Short to Battery or Open	• If the fog lamp is on continuously, GO to Pinpoint Test C • If the fogl lamp is inoperative, GO to Pinpoint Test B
B1A79:11	Rear Fog Lamp: Circuit Short to Ground	GO to Pinpoint Test D
B1A79:15	Rear Fog Lamp: Circuit Short to Battery or Open	GO to Pinpoint Test E

Symptom Chart: Fog Lamps

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Both front fog lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
An individual front fog lamp is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
The front fog lamps are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test C
Both rear fog lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test D
An individual rear fog lamp is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test E
The rear fog lamps are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test F

Pinpoint Tests

Both Front Fog Lamps Are Inoperative

Refer to Wiring Diagrams Cell 86-1, for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the fog lamp bulbs and make sure they are OK.
- Inspect the BCM fuse(s).
- Inspect the headlamp switch for damage.

PINPOINT TEST A : BOTH FRONT FOG LAMPS ARE INOPERATIVE

A1 CHECK THE BCM (BODY CONTROL MODULE) HEADLAMP SWITCH INPUT

- Ignition OFF.
- Disconnect BCM C2280G.
- Place the front fog lamp switch in the ON position.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-20	V	Battery Positive

Is the voltage greater than 11 volts?

Yes	VERIFY the BCM fuse(s) are OK. If OK, GO to A3 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.
No	GO to A2

A2 CHECK THE HEADLAMP SWITCH HEADLAMPS ON CIRCUIT FOR AN OPEN

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-14	Ω	C2280G-20

Is the resistance less than 3 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit.

A3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

An Individual Front Fog Lamp Is Inoperative

Refer to Wiring Diagrams Cell 86-1, for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1147:11	Left Front Fog Lamp: Circuit Short to Ground	Sets when the BCM detects the left front fog lamp supply circuit is grounded during an on-demand self-test.
B1147:15	Left Front Fog Lamp: Circuit Short to Battery or Open	Sets when the BCM detects the left front fog lamp control circuit is open or shorted to voltage during an on-demand self-test.
B1148:11	Right Front Fog Lamp: Circuit Short to Ground	Sets when the BCM detects the right front fog lamp supply circuit is grounded during an on-demand self-test.
B1148:15	Right Front Fog Lamp: Circuit Short to Battery or Open	Sets when the BCM detects the right front fog lamp control circuit is open or shorted to voltage during an on-demand self-test.

Possible Sources

- Bulb
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-check

- Inspect the fog lamp bulb and make sure it is OK.

PINPOINT TEST B : AN INDIVIDUAL FRONT FOG LAMP IS INOPERATIVE

B1 CHECK FOR VOLTAGE TO THE INOPERATIVE FOG LAMP

- Ignition OFF.

- Disconnect Inoperative LH Fog Lamp C152 or RH Fog Lamp C162.
- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON / LOW BEAM position.
- Place the front fog lamp switch in the FOG LAMPS ON position.
- Measure:

LH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C152-A		Ground

RH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C162-A		Ground

Is the voltage greater than 11 volts?

Yes	GO to B2
No	GO to B3

B2 CHECK FOG LAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C152-A		C152-B

RH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C162-A		C162-B

Is the voltage greater than 11 volts?

Yes	INSTALL a new fog lamp bulb.
No	REPAIR the circuit.

B3 CHECK THE FOG LAMP SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Place the headlamp switch in the HEADLAMPS OFF position.
- Place the front fog lamp switch in the FOG LAMPS OFF position.

- Disconnect: BCM C2280B.
- Measure:

LH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C152-A	Ω	C2280B-12

RH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C162-A	Ω	C2280B-5

Is the resistance less than 3 ohms?

Yes	GO to B4
No	REPAIR the circuit.

B4 CHECK THE FOG LAMP SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Measure:

LH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C152-A	Ω	Ground

RH Fog Lamp

Positive Lead	Measurement / Action	Negative Lead
C162-A	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B5
No	REPAIR the circuit.

B5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Front Fog Lamps Are On Continuously

Refer to Wiring Diagrams Cell 86-1, for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1046:11	Front Fog Lamp Control Switch: Circuit Short to Ground	Sets when the BCM detects the fog lamp switch circuit is grounded during an on-demand self-test.
B1147:15	Left Front Fog Lamp: Circuit Short to Battery or Open	Sets when the BCM detects the left front fog lamp control circuit is open or shorted to voltage during an on-demand self-test.
B1148:15	Right Front Fog Lamp: Circuit Short to Battery or Open	Sets when the BCM detects the right front fog lamp control circuit is open or shorted to voltage during an on-demand self-test.

Possible Sources

- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-check

- Inspect the headlamp switch for damage.

PINPOINT TEST C : THE FRONT FOG LAMPS ARE ON CONTINUOUSLY

C1 CHECK BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Place the headlamp switch in the HEADLAMPS OFF position.
- Place the front fog lamp switch in the FOG LAMPS OFF position.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B1046:11 present?

Yes	GO to C2
No	GO to C4

C2 CHECK THE BCM (BODY CONTROL MODULE) HEADLAMP SWITCH INPUT

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-20	V	Battery Positive

Is any voltage present?

Yes	GO to C3
No	GO to C5

C3 CHECK THE FOG LAMP SWITCH CIRCUIT FOR A SHORT TO GROUND

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-20	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit.

C4 CHECK THE FOG LAMP VOLTAGE SUPPLY CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280D.
- Disconnect LH Fog Lamp C152 and RH Fog Lamp C162.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280D-12	V	Ground
C2280D-5	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to C5

C5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Both Rear Fog Lamps Are Inoperative

Refer to Wiring Diagrams Cell 86-1, for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A79:11	Rear Fog Lamp: Circuit Short to Ground	Sets when the BCM detects the fog lamp supply circuit is grounded during an on-demand self-test.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the fog lamp bulbs and make sure they are OK.
- Inspect the BCM fuse(s).
- Inspect the headlamp switch for damage.

PINPOINT TEST D : BOTH REAR FOG LAMPS ARE INOPERATIVE

D1 CHECK THE BCM (BODY CONTROL MODULE) REAR FOG LAMP SWITCH INPUT

- Ignition OFF.
- Disconnect BCM C2280G.
- Place the rear fog lamp switch in the ON position.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C2280G-8		Battery Positive

Is the voltage greater than 11 volts?

Yes	VERIFY the BCM fuse(s) are OK. If OK, GO to D3 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.
No	GO to D2

D2 CHECK THE HEADLAMP SWITCH REAR FOG LAMP ON CIRCUIT FOR AN OPEN

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-2	Ω	C2280G-8

Is the resistance less than 3 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit.

D3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

An Individual Rear Fog Lamp Is Inoperative

Refer to Wiring Diagrams Cell 86-1, for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1A79:15	Rear Fog Lamp: Circuit Short to Battery or Open	Sets when the BCM detects the fog lamp supply circuit is shorted to Battery or Open during an on-demand self-test.

Possible Sources

- Bulb
- Wiring, terminals or connectors

Visual Inspection and Diagnostic Pre-check

- Inspect the fog lamp bulb and make sure it is OK.

PINPOINT TEST E : AN INDIVIDUAL REAR FOG LAMP IS INOPERATIVE

E1 CHECK FOR VOLTAGE TO THE INOPERATIVE FOG LAMP

- Ignition OFF.
- Disconnect Inoperative LH Rear Lamp Assembly C412 or RH Rear Lamp Assembly C415 (Ranger).
- Disconnect Inoperative LH Rear Fog Lamp C437 or RH Rear Fog Lamp C436 (Everest).
- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON / LOW BEAM position.
- Place the rear fog lamp switch in the FOG LAMPS ON position.
- Measure:

LH Rear Lamp Assembly (Ranger)

Positive Lead	Measurement / Action	Negative Lead
C412-3		Ground

RH Rear Lamp Assembly (Ranger)

Positive Lead	Measurement / Action	Negative Lead
C415-3		Ground

LH Rear Fog Lamp (Everest)

Positive Lead	Measurement / Action	Negative Lead
C437-1		Ground

RH Rear Fog Lamp (Everest)

Positive Lead	Measurement / Action	Negative Lead
C436-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to E2
No	GO to E3

E2 CHECK FOG LAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Rear Lamp Assembly (Ranger)

Positive Lead	Measurement / Action	Negative Lead
C412-3		C412-6

RH Rear Lamp Assembly (Ranger)

Positive Lead	Measurement / Action	Negative Lead
C415-3		C415-6

LH Rear Fog Lamp (Everest)

Positive Lead	Measurement / Action	Negative Lead
C437-1		C437-2

RH Rear Fog Lamp (Everest)

Positive Lead	Measurement / Action	Negative Lead
C436-1		C436-2

Is the voltage greater than 11 volts?

Yes	INSTALL a new fog lamp bulb.
No	REPAIR the circuit.

E3 CHECK THE FOG LAMP SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Place the headlamp switch in the HEADLAMPS OFF position.
- Place the rear fog lamp switch in the FOG LAMPS OFF position.
- Disconnect: BCM C2280F.
- Measure:

LH Rear Lamp Assembly (Ranger)

Positive Lead	Measurement / Action	Negative Lead
C412-3	Ω	C2280F-25

RH Rear Lamp Assembly (Ranger)

Positive Lead	Measurement / Action	Negative Lead
C415-3	Ω	C2280F-25

LH Rear Fog Lamp (Everest)

Positive Lead	Measurement / Action	Negative Lead
C437-1	Ω	C2280F-25

RH Rear Fog Lamp (Everest)

Positive Lead	Measurement / Action	Negative Lead
C436-1	Ω	C2280F-25

Is the resistance less than 3 ohms?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Rear Fog Lamps Are On Continuously

Refer to Wiring Diagrams Cell 86-1, for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Overview (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1047:11	Rear Fog Lamp Control Switch: Circuit Short to Ground	Sets when the BCM detects the fog lamp switch circuit is grounded during an on-demand self-test.

Possible Sources

- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-check

- Inspect the headlamp switch for damage.

PINPOINT TEST F : THE REAR FOG LAMPS ARE ON CONTINUOUSLY

F1 CHECK BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Place the multifunction switch (headlamp switch) in the HEADLAMPS OFF position.
- Place the multifunction switch (fog lamp switch) in the FOG LAMPS OFF position.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B1047:11 present?

Yes	GO to F2
No	GO to F4

F2 CHECK THE BCM (BODY CONTROL MODULE) REAR FOG LAMP SWITCH INPUT

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-8		Battery Positive

Is any voltage present?

Yes	GO to F3
No	GO to F5

F3 CHECK THE FOG LAMP SWITCH CIRCUIT FOR A SHORT TO GROUND

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-8	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit.

F4 CHECK THE FOG LAMP VOLTAGE SUPPLY CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280F.
- Disconnect Inoperative LH Rear Lamp Assembly C412 and RH Rear Lamp Assembly C415 (Ranger).
- Disconnect Inoperative LH Rear Fog Lamp C437 and RH Rear Fog Lamp C436 (Everest).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-25	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to F5

F5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Headlamps

DTC Chart: BCM

BCM

DTC	Description	Action
B143B:11	Autolamp On Input: Circuit Short to Ground	GO to Pinpoint Test C
B143C:11	Headlamp Off Input: Circuit Short to Ground	GO to Pinpoint Test C
B143D:11	Headlamp On Input: Circuit Short to Ground	GO to Pinpoint Test C
B143E:11	Headlamp Switch Input: Circuit Short to Ground	GO to Pinpoint Test C
B1447:11	Parklamp On Switch Input: Circuit Short to Ground	GO to Pinpoint Test C
B1D00:11	Left Low Beam: Circuit Short to Ground	GO to Pinpoint Test A
B1D00:15	Left Low Beam: Circuit Short to Battery or Open	• If the low beam is inoperative, GO to Pinpoint Test A • If the low beam is always on, GO to Pinpoint Test C
B1D01:11	Right Low Beam: Circuit Short to Ground	GO to Pinpoint Test A
B1D01:15	Right Low Beam: Circuit Short to Battery or Open	• If the low beam is inoperative, GO to Pinpoint Test A • If the low beam is always on, GO to Pinpoint Test C
B1D02:11	Left High Beam: Circuit Short to Ground	GO to Pinpoint Test B
B1D02:15	Left High Beam: Circuit Short to Battery or Open	• If the high beam is inoperative, GO to Pinpoint Test B • If the high beam is always on, GO to Pinpoint Test D
B1D03:11	Right High Beam: Circuit Short to Ground	GO to Pinpoint Test B
B1D03:15	Right High Beam: Circuit Short to Battery or Open	• If the high beam is inoperative, GO to Pinpoint Test B • If the high beam is always on, GO to Pinpoint Test D
U1000:00	Solid State Driver Protection Active -Driver Disabled: No	The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The BCM cannot enable the output until the cause of the short is corrected. ADDRESS all other DTCs first. After the cause of the concern is corrected, CLEAR the DTCs. REPEAT the self-test.

	Sub Type Information	
U3000:49	Control Module: Internal Electronic Failure	The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the BCM can withstand. The cause of the excessive current draw MUST be corrected before a new BCM is installed. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
For other BCM DTCs	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .

DTC Chart: SCCM

DTC	Description	Fault Trigger Conditions
B1007:09	High-Beam Headlamp Switch: Component Failure	**NOTE:** *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam/Low-Beam operation.* • INSTALL a new steering column multifunction switch. If the concern still exists, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
B1D36:09	Turn Indicator Switch: Component Failure	**NOTE:** *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam/Low-Beam operation.* • INSTALL a new steering column multifunction switch. If the concern still exists, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
All other SCCM DTCs	-	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

DTC Chart: IPMA

DTC	Description	Fault Trigger Conditions
B11C7:46	High Beam Sensor: Calibration / Parameter Memory Failure	GO to Pinpoint Test F
B11C7:97	High Beam Sensor: Component or System Operation Obstructed or Blocked	GO to Pinpoint Test F
All other IPMA DTCs	-	REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing).

Symptom Chart: Headlamps

Condition	Possible Sources	Actions
A module does not respond to the	• Fuse	

diagnostic scan tool	• Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network) .
One or both low beams is inoperative	Refer to the Pinpoint Test	VERIFY the bulb(s) are OK. If OK, GO to Pinpoint Test A
One or both high beams is inoperative	Refer to the Pinpoint Test	VERIFY the bulb(s) are OK. If OK, GO to Pinpoint Test B
The low beams are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test C
The high beams are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test D
The flash-to-pass feature is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test E
The automatic high beam feature is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test F
The manual headlamp leveling is inoperative/does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test G

Pinpoint Tests

One Or Both Low Beams is Inoperative

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D00:11	Left Low Beam: Circuit Short To Ground	Sets when the BCM detects a short to ground from the left low beam output circuit.
B1D00:15	Left Low Beam: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the left low beam output circuit.
B1D01:11	Right Low Beam: Circuit Short To Ground	Sets when the BCM detects a short to ground from the right low beam output circuit.
B1D01:15	Right Low Beam: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the right low beam output circuit.

Possible Sources

- Bulb
- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the bulbs and make sure they are OK.
- Inspect the headlamp assembly for damage.

NOTE: *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam Low-Beam operation.*

PINPOINT TEST A : ONE OR BOTH LOW BEAMS IS INOPERATIVE

A1 DETERMINE IF ONE OR BOTH LOW BEAMS ARE INOPERATIVE

- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON position.

Are both low beams inoperative?

Yes	GO to A6
No	GO to A2

A2 CHECK FOR VOLTAGE TO THE HEADLAMP

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect Inoperative LH Headlamp C1021 or RH Headlamp C1285.
- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON position.
- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-2	V	Ground

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-2	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A3
No	GO to A4

A3 CHECK THE HEADLAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-2	V	C1021-1

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-2		C1285-1

Is the voltage greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit.

A4 CHECK THE LOW BEAM SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect BCM C2280B.
- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-2	Ω	Ground

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A5
No	REPAIR the circuit.

A5 CHECK THE LOW BEAM SUPPLY CIRCUIT FOR AN OPEN

- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-2	Ω	C2280B-4

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-2	Ω	C2280B-2

Is the resistance less than 3 ohms?

Yes	GO to A9
No	REPAIR the circuit.

A6 CHECK THE BCM (BODY CONTROL MODULE) HEADLAMP SWITCH INPUT

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-15		Battery Positive

- Place the headlamp switch in the HEADLAMPS ON position.

Is the voltage greater than 11 volts?

Yes	GO to A9
No	GO to A7

A7 CHECK THE HEADLAMP SWITCH HEADLAMPS ON CIRCUIT FOR AN OPEN

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-12	Ω	C2280G-15

Is the resistance less than 3 ohms?

Yes	GO to A8
No	REPAIR the circuit.

A8 CHECK THE HEADLAMP SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-4	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit.

No	REPAIR the circuit.

A9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect the BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

One Or Both High Beams Is Inoperative

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D02:11	Left High Beam: Circuit Short To Ground	Sets when the BCM detects a short to ground from the left high beam output circuit.
B1D02:15	Left High Beam: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the left high beam output circuit.
B1D03:11	Right High Beam: Circuit Short To Ground	Sets when the BCM detects a short to ground from the right high beam output circuit.
B1D03:15	Right High Beam: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the right high beam output circuit.

Possible Sources

- Fuse
- Bulb
- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the BCM fuse(s).

NOTE: *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam Low-Beam operation.*

PINPOINT TEST B : ONE OR BOTH HIGH BEAMS IS INOPERATIVE

B1 CHECK THE LOW BEAM OPERATION

- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON position and observe the headlamps.
- Place the steering column multifunction switch in the HIGH BEAMS position and observe the headlamps.
- Place the steering column multifunction switch in the LOW BEAMS position and observe the headlamps.

Do the low beams illuminate?

Yes	If an individual high beam is inoperative, GO to B3 If both high beams are inoperative, GO to B2
No	GO to Pinpoint Test A

B2 CHECK THE MULTIFUNCTION SWITCH INPUT

- Ignition OFF.
- Using a diagnostic scan tool, view SCCM Parameter Identifications (PIDs).
- Monitor the SCCM High Beam Switch (HIGH_BEAM_SW) PID while placing the steering column multifunction switch in the HIGH BEAM and LOW BEAM positions.

Do the PID values agree with the steering column multifunction switch position?

Yes	GO to B8
No	INSTALL a new steering column multifunction switch. If the concern still exists, GO to B7 REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation).

B3 CHECK FOR VOLTAGE FROM THE HEADLAMP HIGH BEAM CIRCUIT

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect LH Headlamp C1021 or RH Headlamp C1285.
- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON position and the steering column multifunction switch in the HIGH BEAM position.
- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-4		Ground

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-4		Ground

Is the voltage greater than 11 volts?

Yes	GO to B6
No	GO to B4

B4 CHECK THE HIGH BEAM CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect BCM C2280B.
- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-4	Ω	Ground

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B5
No	REPAIR the circuit.

B5 CHECK THE HIGH BEAM SUPPLY CIRCUIT FOR AN OPEN

- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-4	Ω	C2280B-11

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-4	Ω	C2280B-6

Is the resistance less than 3 ohms?

Yes	GO to B8
No	REPAIR the circuit.

B6 CHECK THE HEADLAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-4		C1021-3

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-4		C1285-3

Is the voltage greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the high beam ground circuit for an open.

B7 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all SCCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

B8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins

- pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

One or Both Low Beams Are On Continuously

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B143B:11	Autolamp On Input: Circuit Short to Ground	Sets when the BCM detects a short to ground on the autolamp on input circuit.
B143C:11	Headlamp Off Input: Circuit Short to Ground	Sets when the BCM detects a short to ground on the headlamp off input circuit.
B143D:11	Headlamp On Input: Circuit Short to Ground	Sets when the BCM detects a short to ground on the headlamp on input circuit.
B143E:11	Headlamp Switch Input: Circuit Short to Ground	Sets when the BCM detects a short to ground on the headlamp switch input circuits.
B1447:11	Parklamp On Switch Input: Circuit Short to Ground	Sets when the BCM detects a short to ground on the parklamps on input circuit.
B1D00:15	Left Low Beam: Circuit Short to Battery or Open	Sets when the BCM detects an open or short to voltage from the left low beam output circuit.
B1D01:15	Right Low Beam: Circuit Short to Battery or Open	Sets when the BCM detects an open or short to voltage from the right low beam output circuit.

Possible Sources

- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the headlamp switch for damage.

NOTE: *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam Low-Beam operation.*

PINPOINT TEST C : ONE OR BOTH LOW BEAMS ARE ON CONTINUOUSLY

C1 DETERMINE IF ONE OR BOTH LOW BEAMS ARE ALWAYS ON

- Ignition ON.
- Place the headlamp switch in the OFF position.
- Observe the operation of the low beam headlamps.

Do both low beams illuminate?

Yes	GO to C2
No	GO to C7

C2 CHECK THE HEADLAMP SWITCH

- Ignition OFF.
- Disconnect Headlamp Switch C205.
- Carry out the headlamp switch component test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Does the headlamp switch pass the component test?

Yes	GO to C3
No	INSTALL a new headlamp switch.

C3 CHECK THE HEADLAMP SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-4	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE HEADLAMP SWITCH CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect BCM C2280G.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-10	V	C205-4
C205-11	V	C205-4
C205-12	V	C205-4
C205-13	V	C205-4

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to C5

C5 CHECK THE HEADLAMP SWITCH CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-10	Ω	Ground
C205-11	Ω	Ground
C205-12	Ω	Ground
C205-13	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to C6
No	REPAIR the circuit in question

C6 CHECK THE HEADLAMP SWITCH CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-10	Ω	C2280G-16
C205-11	Ω	C2280G-2
C205-12	Ω	C2280G-15
C205-13	Ω	C2280G-21

Are the resistances less than 3 ohms?

Yes	GO to C8
No	REPAIR the circuit in question

C7 CHECK THE LOW BEAM VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280B.
- Disconnect LH Headlamp C1021 or RH Headlamp C1285.
- Ignition ON.
- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-2		Ground

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C8

C8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

One or Both High Beams Are On Continuously

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D02:15	Left High Beam: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the left high beam output circuit.
B1D03:15	Right High Beam: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the right high beam output circuit.

Possible Sources

- Wiring, terminals or connectors
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the headlamp switch for damage.

NOTE: *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam Low-Beam operation.*

PINPOINT TEST D : ONE OR BOTH HIGH BEAMS ARE ON CONTINUOUSLY

D1 DETERMINE IF ONE OR BOTH HIGH BEAMS ARE ALWAYS ON

- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON position.
- Place the steering column multifunction switch in the HIGH BEAMS position and observe the headlamps.
- Place the steering column multifunction switch in the LOW BEAMS position and observe the headlamps.

Do both high beams illuminate continuously?

Yes	GO to D2
No	GO to D3

D2 CHECK THE MULTIFUNCTION SWITCH INPUT

- Using a diagnostic scan tool, view SCCM Parameter Identifications (PIDs).
- Monitor the SCCM High Beam Switch (HIGH_BEAM_SW) PID while placing the steering column multifunction switch in the HIGH BEAM and LOW BEAM positions. Place the headlamp switch in the OFF position.

Do the PID values agree with the steering column multifunction switch position?

Yes	GO to D5
No	INSTALL a new steering column multifunction switch. If the concern still exists, GO to D4 REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation).

D3 CHECK THE HIGH BEAM SUPPLY CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280B.
- Disconnect LH Headlamp C1021 or RH Headlamp C1285.
- Ignition ON.
- Measure:

LH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1021-4		Ground

RH Headlamp

Positive Lead	Measurement / Action	Negative Lead
C1285-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to D5

D4 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all SCCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

D5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

	REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Flash-To-Pass Function Is Inoperative

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- Steering column multifunction switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the steering column multifunction switch for damage.

NOTE: *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam Low-Beam operation.*

PINPOINT TEST E : THE FLASH-TO-PASS FUNCTION IS INOPERATIVE

E1 CHECK THE HIGH BEAM OPERATION

- Ignition ON.
- Place the headlamp switch in the HEADLAMPS ON position and observe the headlamps.
- Activate and deactivate the high beams using the high beam function of the steering column multifunction switch.

Do the high beams operate correctly?

Yes	GO to E2
No	If one or both high beams are inoperative, GO to Pinpoint Test B If one or both high beams are always on, GO to Pinpoint Test D

E2 CHECK THE MULTIFUNCTION SWITCH INPUT

- Using a diagnostic scan tool, view SCCM Parameter Identifications (PIDs).
- Monitor the SCCM Flash to Pass Switch (FLASH-to-PASS) PID while placing the steering column multifunction switch in the FLASH-TO-PASS position.

Does the PID value agree with the steering column multifunction switch position?

Yes	GO to E4
No	INSTALL a new steering column multifunction switch. If the concern still exists, GO to E3 REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation).

E3 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all SCCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

E4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Automatic High Beam Feature Is Inoperative

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA controls the automatic high beam feature when active.

The IPMA turns the high beam headlamps on when the following conditions are met:

- The feature has been enabled using the message center
- The headlamp switch is in the AUTOLAMPS position and the autolamps feature has turned the exterior lamps on

- The vehicle speed is greater than 40 km/h
- The IPMA determines the ambient lighting conditions are dark enough
- The IPMA does not detect any light source that can be interpreted as an illuminated vehicle lamp

The IPMA turns the high beams off if any of the following occur:

- The IPMA detects any light source that can be interpreted as an illuminated vehicle lamp
- The IPMA determines the ambient lighting conditions are not dark enough
- The vehicle speed falls below 30 km/h
- The autolamps are turned off
- The IPMA determines the view is blocked

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B11C7:46	High Beam Sensor: Calibration / Parameter Memory Failure	A continuous memory DTC that sets when the IPMA detects a software problem with the calibrations.
B11C7:97	High Beam Sensor: Component or System Operation Obstructed or Blocked	A continuous memory and on-demand DTC that sets when the IPMA detects a blockage in front of the high beam sensor.

Possible Sources

- Windshield debris
- IPMA (part of the interior rear view mirror)

PINPOINT TEST F : THE AUTOMATIC HIGH BEAM FEATURE IS INOPERATIVE

NOTE: *In cold weather conditions (4°C [40°F] or less), the auto high beams are inhibited for 10 minutes to allow the camera windshield defrost heater to clear the windshield in front of the auto high beam camera.*

NOTE: *Check vehicle option. The headlamp system may have a LH or RH steering column multifunction switch to control Headlamp and High-Beam Low-Beam operation.*

F1 VERIFY THE HIGH BEAM HEADLAMP OPERATION

- Place the headlamp switch in the HEADLAMPS ON position.
- Place the steering column multifunction switch in the HIGH BEAM position while observing the headlamps.

Do the high beam headlamps illuminate?

Yes	GO to F2
No	GO to Pinpoint Test B

F2 CHECK FOR IPMA (IMAGE PROCESSING MODULE A) DIAGNOSTIC TROUBLE CODE (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform the IPMA self-test.

Is DTC B11C7:97 present?

Yes	GO to F4
No	If no Diagnostic Trouble Code (DTCs) are present or only DTC B11C7:46 is present, GO to F3 If any IPMA Diagnostic Trouble Code (DTCs) are present, REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing).

F3 IPMA (IMAGE PROCESSING MODULE A) PMI (PROGRAMMABLE MODULE INSTALLATION)

- Carry out the IPMA PMI.
  REFER to: Programmable Module Installation (PMI) (418-01 Module Configuration) .
- Clear the Diagnostic Trouble Codes (DTCs). Repeat the self-test.

Is the concern still present?

Yes	INSTALL a new interior rear view mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a temporary sensor obstruction.

F4 VERIFY THE AUTOMATIC HIGH BEAM SENSOR IS NOT BLOCKED

- Visually verify the automatic high beam sensor is not blocked. Sources of blockage can include:
  - stickers, window decals or tags.
  - non-OEM window tinting.

Was the automatic high beam sensor blocked?

Yes	If possible, REMOVE the blockage. If the blockage cannot be removed, REVIEW the operation of the automatic high beams with the customer.
No	INSTALL a new interior rear view mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

The Manual Headlamp Leveling Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 85 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - System Operation and Component Description (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Headlamp assembly

PINPOINT TEST G : THE MANUAL HEADLAMP LEVELING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

G1 CHECK HEADLAMP LEVELING OPERATION

- Ignition ON.
- Place the headlamp switch in the ON position.
- While observing both headlamps,
  - Press and release the headlamp leveling switch.
  - Adjust the headlamp leveling setting to 4.
  - Press the headlamp leveling switch until it locks down.

Does either headlamp beam change?

Yes	GO to G3
No	GO to G2

No	GO to G2

G2 CHECK FOR VOLTAGE TO THE HEADLAMP SWITCH

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect Headlamp switch C205.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-9		Ground

Is the voltage greater than 11 volts?

Yes	GO to G5
No	Repair the circuit.

G3 CHECK THE INOPERATIVE HEADLAMP LEVELING MOTOR VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect LH Motor C1024.
- Disconnect RH Motor C1044.
- Ignition ON.
- Measure:

LH Motor

Positive Lead	Measurement / Action	Negative Lead
C1024-3		Ground

RH Motor

Positive Lead	Measurement / Action	Negative Lead
C1044-3		Ground

Is the voltage greater than 11 volts?

Yes	GO to G4
No	Repair the circuit.

G4 CHECK THE INOPERATIVE HEADLAMP LEVELING MOTOR GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Motor

Positive Lead	Measurement / Action	Negative Lead
C1024-1	V	C1024-3

RH Motor

Positive Lead	Measurement / Action	Negative Lead
C1044-1	V	C1044-3

Is the voltage greater than 11 volts?

Yes	GO to G5
No	REPAIR the circuit.

G5 CHECK THE HEADLAMP LEVELING CIRCUIT TO THE HEADLAMP LEVELING MOTOR FOR AN OPEN

- Disconnect Headlamp switch C205.
- Disconnect LH Motor C1024 and RH Motor C1044 (both inoperative).
- Disconnect LH Motor C1024 (LH only inoperative).
- Disconnect RH Motor C1044 (RH only inoperative).
- Measure:

Both or LH only inoperative

Positive Lead	Measurement / Action	Negative Lead
C1024-2	Ω	C205-1

RH only inoperative

Positive Lead	Measurement / Action	Negative Lead
C1044-2	Ω	C205-1

Is the resistance less than 3 ohms?

Yes	If the only the LH or RH is inoperative, INSTALL a new headlamp assembly. REFER to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation). If both are inoperative, GO to G6
No	REPAIR the circuit.

G6 CHECK THE HEADLAMP LEVELING CIRCUIT TO THE HEADLAMP LEVELING MOTOR FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-1		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to G7

G7 CHECK THE HEADLAMP LEVELING CIRCUIT TO THE HEADLAMP LEVELING MOTOR FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit.

Copyright © 2016 Ford Motor Company

Parking, Rear and License Plate Lamps

DTC Chart: BCM

BCM DTC Chart

DTC	Description	Action
B10F3:11	Left Front Position Light: Circuit Short to Ground	GO to Pinpoint Test A
B10F3:15	Left Front Position Light: Circuit Short to Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test A • If the lamp is always on, GO to Pinpoint Test B
B10F4:11	Right Front Position Light: Circuit Short to Ground	GO to Pinpoint Test A
B10F4:15	Right Front Position Light: Circuit Short to Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test A • If the lamp is always on, GO to Pinpoint Test B
B1445:11	Rear Park Lamps Output: Circuit Short to Ground	GO to Pinpoint Test A
B1445:15	Rear Park Lamps Output: Circuit Short to Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test A • If the lamp is always on, GO to Pinpoint Test B
B1446:11	Front Park Lamps Output: Circuit Short To Ground	GO to Pinpoint Test A
B1446:15	Front Park Lamps Output: Circuit Short To Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test A • If the lamp is always on, GO to Pinpoint Test B
B1447:11	Parklamp On Switch Input: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).

Symptom Chart: Parking, Rear, and License Plate Lamps

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
One or more parking, rear or license plate lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
The parking, rear and/or license plate lamps are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test B

Pinpoint Tests

One Or More Parking, Rear, Or License Plate Lamps Are Inoperative

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10F3:11	Left Front Position Light: Circuit Short to Ground	Sets when the BCM detects a short to ground from the LH front parking lamps output circuit.
B10F3:15	Left Front Position Light: Circuit Short to Battery or Open	Sets when the BCM detects an open or a short to voltage from the LH front parking lamps output circuit.
B10F4:11	Right Front Position Light: Circuit Short to Ground	Sets when the BCM detects a short to ground from the RH front parking lamps output circuit.
B10F4:15	Right Front Position Light: Circuit Short to Battery or Open	Sets when the BCM detects an open or a short to voltage from the RH front parking lamps output circuit.
B1445:11	Rear Park Lamps Output: Circuit Short to Ground	Sets when the BCM detects a short to ground from the rear parking lamps output circuit.
B1445:15	Rear Park Lamps Output: Circuit Short to Battery or Open	Sets when the BCM detects an open or a short to voltage from the rear parking lamps output circuit.
B1446:11	Front Park Lamps Output: Circuit Short To Ground	Sets when the BCM detects a short to ground from the front parking lamp output circuit.
B1446:15	Front Park Lamps Output: Circuit Short To Battery or Open	Sets when the BCM detects an open or a short to voltage from the front parking lamp output circuit.

Possible Sources

- Wiring, terminals or connectors
- Bulb
- Headlamp switch
- BCM

Visual Inspection and Diagnostic Pre-check

- Inspect the bulbs and make sure they are OK.

PINPOINT TEST A : ONE OR MORE PARKING, REAR, OR LICENSE PLATE LAMPS ARE INOPERATIVE

A1 DETERMINE IF ALL THE PARKING LAMPS ARE INOPERATIVE

- Ignition ON.
- Place the headlamp switch in the PARKING LAMPS ON position.

Are all the parking lamps inoperative?

Yes	GO to A2
No	GO to A5

A2 CHECK THE BCM (BODY CONTROL MODULE) HEADLAMP SWITCH INPUT

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C2280G-2	V	Battery Positive

- Place the headlamp switch in the PARKING LAMPS ON position.

Is the voltage greater than 11 volts?

Yes	GO to A9
No	GO to A3

A3 CHECK THE HEADLAMP SWITCH PARKING LAMPS ON CIRCUIT FOR AN OPEN

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-11	Ω	C2280G-2

Is the resistance less than 3 ohms?

Yes	GO to A4
No	REPAIR the circuit. TEST the system for normal operation.

A4 CHECK THE HEADLAMP SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C205-4	Ω	Ground
C205-5	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit. TEST the system for normal operation.

A5 CHECK FOR VOLTAGE TO THE PARKING LAMP

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect Inoperative Lamp.
- Ignition ON.
- Place the headlamp switch in the PARKING LAMPS ON position.
- For a front parking lamp, measure:

LH Daytime Running Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-7	V	Ground

RH Daytime Running Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-7		Ground

LH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-6		Ground

RH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-6		Ground

- For a rear parking lamp, measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-5		Ground

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-5		Ground

- For a license plate lamp, measure:

LH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C452-1		Ground

RH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C462-1		Ground

C462-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A6
No	GO to A7

A6 CHECK THE PARKING LAMP GROUND CIRCUIT FOR AN OPEN

- For a front parking lamp, measure:

LH Daytime Running Lamps

Positive Lead	Measurement / Action	Negative Lead
C1021-7		C1021-5

RH Daytime Running Lamps

Positive Lead	Measurement / Action	Negative Lead
C1285-7		C1285-5

LH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-6		C1021-5

RH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-6		C1285-5

- For a rear parking lamp, measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-5		C412-6

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead

C415-5		C415-6

- For a license plate lamp, measure:

LH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C452-1		C452-2

RH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C462-1		C462-2

Is the voltage greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit. TEST the system for normal operation.

A7 CHECK THE PARKING LAMP SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Place the multifunction switch (headlamp switch) in the OFF position.
- Disconnect BCM C2280C (parking lamp and daytime running lamp).
- Disconnect BCM C2280B (license plate lamp).
- For a front parking lamp, measure:

LH Daytime Running Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-7	Ω	Ground

RH Daytime Running Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-7	Ω	Ground

LH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-6	Ω	Ground

RH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-6	Ω	Ground

- For a rear parking lamp, measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-5	Ω	Ground

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-5	Ω	Ground

- For a license plate lamp, measure:

LH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C452-1	Ω	Ground

RH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C462-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A8
No	REPAIR the circuit. TEST the system for normal operation.

A8 CHECK THE PARKING LAMP SUPPLY CIRCUIT FOR AN OPEN

- For a front parking lamp, measure:

LH Daytime Running Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-7	Ω	C2280C-40

RH Daytime Running Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-7	Ω	C2280C-36

LH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1021-6	Ω	C2280C-30

RH Front Park Lamp

Positive Lead	Measurement / Action	Negative Lead
C1285-6	Ω	C2280C-37

- For a rear parking lamp, measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-5	Ω	C2280C-30

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-5	Ω	C2280C-37

- For a license plate lamp, measure:

LH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C452-1	Ω	C2280B-3

RH License Plate Lamp

Positive Lead	Measurement / Action	Negative Lead
C462-1	Ω	C2280B-3

Is the resistance less than 3 ohms?

Yes	GO to A9
No	REPAIR the circuit. TEST the system for normal operation.

A9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

The Parking, Rear And/Or License Plate Lamps Are On Continuously

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10F3:15	Left Front Position Light: Circuit Short to Battery or Open	Sets when the BCM detects an open or a short to voltage from the LH front parking lamps output circuit.
B10F4:15	Right Front Position Light: Circuit Short to Battery or Open	Sets when the BCM detects an open or a short to voltage from the RH front parking lamps output circuit.
B1445:15	Rear Park Lamps Output: Circuit Short to Battery or Open	Sets when the BCM detects an open or a short to voltage from the rear parking lamps output circuit.
B1446:15	Front Park Lamps Output: Circuit Short To Battery or Open	Sets when the BCM detects an open or a short to voltage from the front parking lamp output circuit.

Possible Sources

- Wiring, terminals or connectors
- Headlamp switch
- BCM

PINPOINT TEST B : THE PARKING, REAR AND/OR LICENSE PLATE LAMPS ARE ON CONTINUOUSLY

B1 CHECK THE BCM (BODY CONTROL MODULE) PARKING LAMP OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect BCM C2280C (parking lamp and daytime running lamp).
- Disconnect BCM C2280B (license plate lamp).
- Ignition ON.

Do the parking lamps continue to illuminate?

Yes	REPAIR the affected parking lamp output circuit.
No	GO to B2

B2 CHECK THE BCM (BODY CONTROL MODULE) HEADLAMP SWITCH INPUT

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-2		Battery Positive

Is any voltage present?

Yes	GO to B3
No	GO to B4

B3 CHECK THE HEADLAMP SWITCH PARKING LAMPS ON CIRCUIT FOR A SHORT TO GROUND

- Disconnect Headlamp Switch C205.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new headlamp switch.
No	REPAIR the circuit. TEST the system for normal operation.

B4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)

- damaged or bent pins – install new terminals/pins
- pushed-out pins – install new pins as necessary

- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

Copyright © 2016 Ford Motor Company

Reversing Lamps

DTC Chart: Powertrain Control Module (PCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Fault Trigger Conditions
P0812:00 (with Manual Transmission)	Reverse Input Circuit: No Sub Type Information	• If the reversing lamps are inoperative, GO to Pinpoint Test A • If the reversing lamps are always on, GO to Pinpoint Test C

Symptom Chart: Reversing Lamps

NOTE: *The BCM is also known as the CJB*

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
All the reversing lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
An individual reversing lamp is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
The reversing lamps are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test C

Pinpoint Tests

All the Reversing Lamps Are Inoperative

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0812:00 (with Manual Transmission)	Reverse Input Circuit: No Sub Type Information	A DTC that sets in the PCM if a failure is detected on the reverse input circuit.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Reversing lamp switch (manual transmission)
- BCM
- PCM (vehicles with manual transmissions)

Visual Inspection and Diagnostic Pre-check

- Inspect BCM fuse(s).

PINPOINT TEST A : ALL THE REVERSING LAMPS ARE INOPERATIVE

NOTE: *Diagnose any TCM Diagnostic Trouble Codes (DTCs) before continuing this test.*

A1 CHECK THE REVERSING LAMP VOLTAGE CIRCUIT FOR AN OPEN

- Place the gear selector lever in PARK or NEUTRAL.
- Ignition OFF.
- Disconnect LH Rear Lamp Assembly C412 and RH Rear Lamp Assembly C415.
- Disconnect BCM C2280F.
- Measure:

LH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-2	Ω	C2280F-11

Is the resistance less than 3 ohms?

Yes	GO to A2
No	REPAIR the circuit. TEST the system for normal operation.

A2 CHECK THE REVERSING LAMP VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Measure:

LH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A3
No	REPAIR the circuit. TEST the system for normal operation.

A3 DETERMINE THE TRANSMISSION TYPE

- Connect LH Rear Lamp Assembly C412 and RH Rear Lamp Assembly C415

- Connect LH Rear Lamp Assembly C412 and RH Rear Lamp Assembly C410.
- Connect BCM C2280F.
- Check the vehicle for a manual transmission.

Is the vehicle equipped with a manual transmission?

Yes	GO to A4
No	GO to A8

A4 CHECK FOR VOLTAGE TO THE REVERSING LAMP SWITCH

- Ignition OFF.
- Disconnect Reversing Lamp Switch C169.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C169-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A6
No	GO to A5

A5 CHECK THE REVERSING LAMP SWITCH VOLTAGE CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect PCM C175B (2.5L Duratec-HE).
- Disconnect PCM C1232B (2.2L Duratorq-TDCi or 3.2L Duratorq-TDCi).
- Ignition ON.
- Measure:

2.5L Duratec-HE

Positive Lead	Measurement / Action	Negative Lead
C169-1	Ω	C175B-5

2.2L Duratorq-TDCi or 3.2L Duratorq-TDCi

Positive Lead	Measurement / Action	Negative Lead
C169-1	Ω	C1232B-52

Is the resistance less than 3 ohms?

Yes	GO to A9
No	REPAIR the circuit. TEST the system for normal operation.

A6 CHECK THE REVERSING LAMP SWITCH GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C169-1		C169-2

Is the voltage greater than 11 volts?

Yes	GO to A7
No	REPAIR the circuit. TEST the system for normal operation.

A7 BYPASS THE REVERSING LAMP SWITCH

- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C169-1		C169-2

Do the reversing lamps illuminate?

Yes	INSTALL a new reversing lamp switch.
No	GO to A9

A8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

An Individual Reversing Lamp Is Inoperative

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Bulb
- Wiring, terminals or connectors
- BCM

Visual Inspection and Diagnostic Pre-check

- Verify AJB fuse is OK (mining option).

PINPOINT TEST B : AN INDIVIDUAL REVERSING LAMP IS INOPERATIVE

B1 CHECK FOR VOLTAGE TO THE REVERSING LAMP

- Ignition OFF.
- Apply the parking brake.
- Disconnect Inoperative LH Rear Lamp Assembly C412 or RH Rear Lamp Assembly C415.
- Ignition ON.
- Place the gear selector lever in REVERSE.
- Measure:

LH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-2		Ground

RH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to B3
No	GO to B2

B2 CHECK THE REVERSING LAMP VOLTAGE CIRCUIT FOR AN OPEN

- Place the gear selector lever in PARK or NEUTRAL.
- Ignition OFF.
- Disconnect BCM C2280F.
- Ignition ON.
- Measure:

LH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-2	Ω	C2280F-11

RH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-2	Ω	C2280F-11

Is the resistance less than 3 ohms?

Yes	GO to B4
No	REPAIR the circuit. TEST the system for normal operation.

B3 CHECK THE REVERSING LAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-2	V	C412-6

RH Reversing Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-2	V	C415-6

Is the voltage greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit. TEST the system for normal operation.

B4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Reversing Lamps Are On Continuously

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0812:00 (with Manual Transmission)	Reverse Input Circuit: No Sub Type Information	A DTC that sets in the PCM if a failure is detected on the reverse input circuit.

Possible Sources

- Wiring, terminals or connectors
- Reversing lamp switch (manual transmission)
- BCM

PINPOINT TEST C : THE REVERSING LAMP IS ON CONTINUOUSLY

NOTE: *Diagnose any TCM Diagnostic Trouble Codes (DTCs) before continuing this test.*

C1 DETERMINE THE TRANSMISSION TYPE

- Check the vehicle for a manual transmission.

Is the vehicle equipped with a manual transmission?

Yes	GO to C2
No	GO to C4

C2 CHECK THE REVERSING LAMP SWITCH

- Ignition OFF.
- Disconnect Reversing Lamp Switch C169.
- Ignition ON.

Are the reversing lamps off?

Yes	INSTALL a new reversing lamp switch.
No	GO to C3

C3 CHECK THE REVERSING LAMP SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect PCM C175B (2.5L Duratec-HE).
- Disconnect PCM C1232B (2.2L Duratorq-TDCi or 3.2L Duratorq-TDCi).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C169-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit. TEST the system for normal operation.

C4 CHECK THE REVERSING LAMP SUPPLY CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280E.
- Disconnect Inoperative LH Rear Lamp Assembly C412 or RH Rear Lamp Assembly C415.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-11	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to C5

C5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)

- damaged or bent pins – install new terminals/pins
- pushed-out pins – install new pins as necessary

- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Stoplamps

DTC Chart: Body Control Module (BCM)

NOTE: *The BCM is also known as the CJB*

BCM DTC Chart

DTC	Description	Action
B1115:11	High Mounted Stop Lamp Control: Circuit Short to Ground	GO to Pinpoint Test B
B1115:15	High Mounted Stop Lamp Control: Circuit Short to Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test B • If the lamp is always on, GO to Pinpoint Test C
B1444:11	Left Rear Stop/Position Lamp Output: Circuit Short to Ground	GO to Pinpoint Test B
B1444:15	Left Rear Stop/Position Lamp Output: Circuit Short to Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test B • If the lamp is always on, GO to Pinpoint Test C
B1448:11	Right Rear Stop/Position Lamp Output: Circuit Short to Ground	GO to Pinpoint Test B
B1448:15	Right Rear Stop/Position Lamp Output: Circuit Short to Battery or Open	• If the lamp is inoperative, GO to Pinpoint Test B • If the lamp is always on, GO to Pinpoint Test C
C0040:12	Brake Pedal Switch A: Circuit Short to Battery	GO to Pinpoint Test C

Symptom Chart: Stoplamps

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
All the stoplamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
One or more stoplamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
The stoplamps are on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test C

Pinpoint Tests

All The Stoplamps Are Inoperative

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Brake Pedal Position (BPP) Switch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the bulbs and make sure they are OK.
- Verify BCM fuse(s) is OK.

PINPOINT TEST A : ALL THE STOPLAMPS ARE INOPERATIVE

A1 CHECK THE BRAKE PEDAL POSITION (BPP) SWITCH VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Brake Pedal Position (BPP) Switch C278.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C278-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to A2
No	VERIFY the CJB fuse(s) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagram manual to identify the possible causes of the circuit short.

A2 BYPASS THE BRAKE PEDAL POSITION (BPP) SWITCH

- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C278-4		C278-1

- Ignition ON.

Do the stoplamps illuminate?

Yes	REMOVE the fused jumper wire. INSTALL a new Brake Pedal Position (BPP) Switch.
No	LEAVE the fused jumper wire connected. GO to A3

A3 CHECK THE BRAKE PEDAL POSITION (BPP) SWITCH INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280H.

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-1		Ground

Is the voltage greater than 11 volts?

Yes	REMOVE the fused jumper wire. GO to A4
No	REMOVE the fused jumper wire. REPAIR the circuit

A4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

One Or More Stoplamps Are Inoperative

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1115:11	High Mounted Stop Lamp Control: Circuit Short To Ground	Sets when the BCM detects a short to ground from the high mounted stoplamp voltage supply circuit.
B1115:15	High Mounted Stop Lamp Control: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the high mounted stoplamp voltage supply circuit.
B1444:11	Left Rear Stop/Position Lamp Output: Circuit Short to Ground	Sets when the BCM detects a short to ground from the LH rear stoplamp voltage supply circuit.
B1444:15	Left Rear Stop/Position Lamp Output:	Sets when the BCM detects an open or short to voltage from

	Circuit Short to Battery or Open	the LH rear stoplamp voltage supply circuit.
B1448:11	Right Rear Stop/Position Lamp Output: Circuit Short to Ground	Sets when the BCM detects an short to ground from the RH rear stoplamp voltage supply circuit.
B1448:15	Right Rear Stop/Position Lamp Output: Circuit Short to Battery or Open	Sets when the BCM detects an open or short to voltage from the brake pedal switch voltage supply circuit.

Possible Sources

- Wiring, terminals or connectors
- Bulb
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the bulbs and make sure they are OK.

PINPOINT TEST B : ONE OR MORE STOPLAMPS ARE INOPERATIVE

B1 IDENTIFY THE INOPERATIVE STOPLAMP

- Ignition ON.
- Apply the brake pedal and observe the stoplamps.

Are all the stoplamps inoperative?

Yes	GO to Pinpoint Test A
No	For the high mounted stoplamp, GO to B2 For a rear stoplamp, GO to B10

B2 CHECK FOR VOLTAGE TO THE HIGH MOUNTED STOPLAMP

- Ignition OFF.
- Disconnect High Mounted Stoplamp C475 (without sport bar).
- Disconnect High Mounted Stoplamp C904 (with sport bar).
- Ignition ON.
- While applying the brake pedal, measure:

Without Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C475-1		Ground

With Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C904-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to B3
No	GO to B4

B3 CHECK THE HIGH MOUNTED STOPLAMP GROUND CIRCUIT FOR AN OPEN

- While applying the brake pedal, measure:

Without Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C475-1	V	C475-2

With Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C904-2	V	C904-4

Is the voltage greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit. TEST the system for normal operation.

B4 CHECK THE HIGH MOUNTED STOPLAMP SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Stop Light Relay in BJB.
- Measure:

Without Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C475-1	Ω	Ground

With Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C904-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B5
No	VERIFY the BJB fuse(s) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagram manual to identify the possible causes of the circuit short.

B5 CHECK THE HIGH MOUNTED STOPLAMP SUPPLY CIRCUIT FOR AN OPEN

- Measure:

Without Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C475-1	Ω	Stop Light Relay, Component Side

With Sport Bar

Positive Lead	Measurement / Action	Negative Lead
C904-2	Ω	Stop Light Relay, Component Side

Is the resistance less than 3 ohms?

Yes	GO to B6
No	REPAIR the circuit. TEST the system for normal operation.

B6 CHECK THE STOP LIGHT RELAY

- Carry out the Relay component test. Refer to Wiring Diagrams Cell 149 for component testing.

Did the Stop Light Relay pass the component test?

Yes	GO to B7
No	INSTALL a new Stop Light Relay. TEST the system for normal operation.

B7 CHECK THE HIGH MOUNTED STOPLAMP SUPPLY CIRCUIT FOR AN OPEN

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Stop Light Relay, Component Side	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to B8
No	VERIFY the BJB fuse(s) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

B8 CHECK THE STOP LIGHT RELAY GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

Stop Light Relay, Component Side, Pin 1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to B9
No	REPAIR the circuit. TEST the system for normal operation.

B9 CHECK THE STOP LIGHT RELAY CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280D.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
Stop Light Relay, Component Side, Pin 2	Ω	C2280D-13

Is the resistance less than 3 ohms?

Yes	GO to B14
No	REPAIR the circuit. TEST the system for normal operation.

B10 CHECK FOR VOLTAGE TO THE REAR LAMP ASSEMBLY

- Ignition OFF.
- Disconnect Inoperative LH Rear Lamp C412 or RH Rear Lamp C415.
- Ignition ON.
- While applying the brake pedal, measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-4	V	Ground

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-4	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to B11
No	GO to B12

B11 CHECK THE REAR STOPLAMP GROUND CIRCUIT FOR AN OPEN

- While applying the brake pedal, measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-4	V	C412-6

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-4	V	C415-6

Is the voltage greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit. TEST the system for normal operation.

B12 CHECK THE REAR STOPLAMP SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-4	Ω	Ground

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B13
No	REPAIR the circuit. TEST the system for normal operation.

B13 CHECK THE REAR STOPLAMP SUPPLY CIRCUIT FOR AN OPEN

- Measure:

LH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-4	Ω	C2280F-12

RH Rear Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-4	Ω	C2280F-12

Is the resistance less than 3 ohms?

Yes	GO to B14
No	REPAIR the circuit. TEST the system for normal operation.

B14 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Stoplamps Are On Continuously

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1115:15	High Mounted Stop Lamp Control:	Sets when the BCM detects an open or short to voltage from

	Circuit Short To Battery Or Open	the high mounted stoplamp voltage supply circuit.
B1444:15	Left Rear Stop/Position Lamp Output: Circuit Short to Battery or Open	Sets when the BCM detects an open or short to voltage from the LH rear stoplamp voltage supply circuit.
B1448:15	Right Rear Stop/Position Lamp Output: Circuit Short to Battery or Open	Sets when the BCM detects an open or short to voltage from the RH rear stoplamp voltage supply circuit.
C0040:12	Brake Pedal Switch A: Circuit Short to Battery	Sets when the BCM detects a short to voltage from the RH rear stoplamp voltage supply circuit.

Possible Sources

- Wiring, terminals or connectors
- Brake Pedal Position (BPP) Switch
- BCM

PINPOINT TEST C : THE STOPLAMPS ARE ON CONTINUOUSLY

C1 IDENTIFY THE CONTINUOUSLY ILLUMINATED STOPLAMPS

- Ignition ON.
- Observe the stoplamps.

Are all the stoplamps illuminated?

Yes	GO to C6
No	For the high mounted stoplamp, GO to C2 For a rear stoplamp, GO to C5

C2 CHECK THE HIGH MOUNT STOPLAMP OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Stop Light Relay in BJB.
- Ignition ON.

Is the high mounted stoplamp illuminated?

Yes	REPAIR the affected circuit. TEST the system for normal operation.
No	GO to C3

C3 CHECK THE STOP LIGHT RELAY

- Carry out the Relay component test. Refer to Wiring Diagrams Cell 149 for component testing.

Did the Stop Light Relay pass the component test?

Yes	GO to C4
No	INSTALL a new Stop Light Relay. TEST the system for normal operation.

C4 CHECK THE STOP LIGHT RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280D.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280D-13	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C8
No	REPAIR the circuit. TEST the system for normal operation.

C5 CHECK THE BCM (BODY CONTROL MODULE) STOPLAMP OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280F.
- Ignition ON.

Do the stoplamps continue to illuminate?

Yes	REPAIR the affected circuit. TEST the system for normal operation.
No	GO to C8

C6 CHECK THE BRAKE PEDAL POSITION (BPP) SWITCH

- Ignition OFF.
- Disconnect Brake Pedal Position (BPP) Switch C278.
- Ignition ON.

Do the stoplamps continue to illuminate?

Yes	GO to C7
No	INSTALL a new Brake Pedal Position (BPP) Switch.

C7 CHECK THE BRAKE PEDAL POSITION (BPP) SWITCH INPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280H.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C278-4		Ground

Is any voltage present?

Yes	REPAIR the circuit. TEST the system for normal operation.
No	GO to C8

C8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins

- pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Trailer Lamps

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

General Equipment

Ford diagnostic equipment

DTC Chart: Body Control Module (BCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B132B:12	Left Stop/Turn Lamp: Circuit Short To Battery	GO to Pinpoint Test B
B132B:14	Left Stop/Turn Lamp: Circuit Short To Ground or Open	GO to Pinpoint Test B
B132C:12	Right Stop/Turn Lamp: Circuit Short To Battery	GO to Pinpoint Test B
B132C:14	Right Stop/Turn Lamp: Circuit Short To Ground or Open	GO to Pinpoint Test B
B1449:12	Trailer Tow Park/Tail Lamp Output: Circuit Short To Battery	GO to Pinpoint Test C
B1449:14	Trailer Tow Park/Tail Lamp Output: Circuit Short To Ground or Open	GO to Pinpoint Test C
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The BCM cannot enable the output until the cause of the short is corrected. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test.
U3000:49	Control Module: Internal Electronic Failure	The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the BCM can withstand. The cause of the excessive current draw MUST be corrected before a new BCM is installed. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

For other BCM Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

DTC Chart: Trailer Module (TRM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

TRM DTC Chart

DTC	Description	Action
B10E8:11	Secondary Battery Relay A: Circuit Short To Ground	GO to Pinpoint Test E
B1102:11	Trailer Stop Lamp: Circuit Short To Ground	GO to Pinpoint Test B
B1102:12	Trailer Stop Lamp: Circuit Short To Battery	GO to Pinpoint Test B
B1277:11	Reverse Lamp: Circuit Short To Ground	GO to Pinpoint Test D
B1277:12	Reverse Lamp: Circuit Short To Battery	GO to Pinpoint Test D
B12EF:11	Trailer Fog Lamp: Circuit Short To Ground	GO to Pinpoint Test D
B12EF:12	Trailer Fog Lamp: Circuit Short To Battery	GO to Pinpoint Test D
B1449:11	Trailer Tow Park/Tail Lamp Output: Circuit Short To Ground	GO to Pinpoint Test C
B1449:12	Trailer Tow Park/Tail Lamp Output: Circuit Short To Battery	GO to Pinpoint Test C
B1D08:11	Left Trailer Direction Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B1D08:12	Left Trailer Direction Indicator: Circuit Short To Battery	GO to Pinpoint Test B
B1D09:11	Right Trailer Direction Indicator: Circuit Short To Ground	GO to Pinpoint Test B

B1D09:12	Right Trailer Direction Indicator: Circuit Short To Battery	GO to Pinpoint Test B
U0146:00	Lost Communication with Gateway A: No Sub Type Information	This DTC sets when data is invalid from the BCM. CLEAR the DTC. REPEAT the self-test. If DTC returns, RETRIEVE and REPAIR all Diagnostic Trouble Codes (DTCs) set in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The TRM cannot enable the output until the cause of the short is corrected. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test.
U3000:49	Control Module: Internal Electronic Failure	The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the TRM can withstand. The cause of the excessive current draw MUST be corrected before a new TRM is installed. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
All the trailer lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
One or more trailer stop/turn lamps are inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test B
The trailer parking lamps are inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test C
The trailer reversing lamps are inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test D
The trailer fog lamps are inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test D
The trailer battery charging is inoperative/does not operate correctly	Refer to the Pinpoint Test	GO to Pinpoint Test E

Pinpoint Tests

All The Trailer Lamps Are Inoperative

Refer to Wiring Diagrams Cell 95 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- Trailer tow connector
- Trailer concern

Visual Inspection and Diagnostic Pre-checks

- Inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

PINPOINT TEST A : ALL THE TRAILER LIGHTS ARE INOPERATIVE

A1 CHECK THE TRAILER TOW GROUND CIRCUIT FOR CONTINUITY TO GROUND

- Ignition OFF.
- Disconnect Trailer from Trailer Tow Connector C439 (13-pin connector) or C473 (7-pin connector).
- Disconnect Negative Battery Cable.
- Measure:

7-Pin Connector

Positive Lead	Measurement / Action	Negative Lead
C473-3	Ω	Ground

13-pin Connector

Positive Lead	Measurement / Action	Negative Lead
C439-3	Ω	Ground
C439-10	Ω	Ground

Is the resistance less than 3 ohms?

Yes	The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
No	REPAIR the circuit.

One Or More Trailer Stop/Turn Lamps Are Inoperative Or Always On

Refer to Wiring Diagrams Cell 95 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1102:11	Trailer Stop Lamp: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the TRM detects a short to ground from the trailer stoplamp signal output circuit.
B1102:12	Trailer Stop Lamp: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the TRM detects a short to voltage from the trailer stoplamp signal output circuit.
B1D08:11	Left Trailer Direction Indicator: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the TRM detects a short to ground from the LH trailer stoplamp/turn signal output circuit.
B1D08:12	Left Trailer Direction Indicator: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the TRM detects a short to voltage from the LH trailer stoplamp/turn signal output circuit.
B1D09:11	Right Trailer Direction Indicator: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the TRM detects a short to ground from the RH trailer stoplamp/turn signal output circuit.
B1D09:12	Right Trailer Direction Indicator: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the TRM detects a short to voltage from the RH trailer stoplamp/turn signal output circuit.
B132B:12	Left Stop/Turn Lamp: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the BCM detects a short to voltage from the LH trailer stoplamp/turn signal output circuit.
B132B:14	Left Stop/Turn Lamp: Circuit Short To Ground or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to ground from the LH trailer stoplamp/turn signal output circuit.
B132C:12	Right Stop/Turn Lamp: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the BCM detects a short to voltage from the RH trailer stoplamp/turn signal output circuit.
B132C:14	Right Stop/Turn Lamp: Circuit Short To Ground or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to ground from the RH trailer stoplamp/turn signal output circuit.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Trailer concern
- Trailer tow connector
- TRM

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse is OK.
- Inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

PINPOINT TEST B : ONE OR MORE TRAILER STOP/TURN LAMPS ARE INOPERATIVE OR ALWAYS ON

B1 CHECK FOR STOP LAMP CIRCUIT VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- Ignition OFF.
- Disconnect Trailer from Trailer Tow Connector C439 (13 pin connector) or C473 (7 pin connector).
- Ignition ON.
- If equipped with a 7-pin connector, while applying and releasing the brake pedal, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-6		Ground

- If equipped with a 13-pin connector, while applying and releasing the brake pedal, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-6		Ground

Is the voltage greater than 11 volts when the brake pedal is pressed and 0 volts when the brake pedal is released?

Yes	GO to B2
No	If both stop lamps are inoperative, GO to B3 If only one stop lamp is inoperative, GO to B5 If one/both stop lamp is on all the time, GO to B7

B2 CHECK FOR TURN LAMP CIRCUIT VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- If equipped with a 7-pin connector, while turning the turn signal switch on and off, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-1		Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-4		Ground

- If equipped with a 13-pin connector, while turning the turn signal switch on and off, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-1		Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-4		Ground

Does the voltage alternate from 0 to greater than 11 volts?

Yes	The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
No	If both turn lamps are inoperative, GO to B3 If only one turn lamp is inoperative, GO to B8 If one/both turn lamp is on all the time, GO to B10

B3 CHECK FOR VOLTAGE TO THE TRM (TRAILER MODULE)

- Ignition OFF.
- Disconnect TRM C4397A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to B4
No	VERIFY the BJB fuse is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

B4 CHECK THE TRM (TRAILER MODULE) GROUND CIRCUIT

- Ignition OFF.
- Disconnect TRM C4397B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1	V	C4397B-1

Is the voltage greater than 11 volts?

Yes	GO to B11
No	REPAIR the circuit.

B5 CHECK TRAILER STOP LAMP CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TRM C4397C.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-6	Ω	C4397C-7

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-6	Ω	C4397C-7

Is the resistance less than 3 ohms?

Yes	GO to B6
No	REPAIR the circuit.

B6 CHECK TRAILER STOP LAMP CIRCUITS FOR A SHORT TO GROUND

- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-6	Ω	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-6	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B11
No	REPAIR the circuit.

B7 CHECK TRAILER STOP LAMP CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TRM C4397C.
- Ignition ON.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-6	V	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-6	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B11

B8 CHECK TRAILER TURN LAMP CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TRM C4397C.

- If equipped with a 7-pin connector, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-1	Ω	C4397C-1

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-4	Ω	C4397C-2

- If equipped with a 13-pin connector, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-1	Ω	C4397C-1

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-4	Ω	C4397C-2

Is the resistance less than 3 ohms?

Yes	GO to B9
No	REPAIR the circuit.

B9 CHECK TRAILER TURN LAMP CIRCUITS FOR A SHORT TO GROUND

- If equipped with a 7-pin connector, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-1	Ω	Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-4	Ω	Ground

- If equipped with a 13-pin connector, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-1	Ω	Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B11
No	REPAIR the circuit.

B10 CHECK TRAILER TURN LAMP CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TRM C4397C..
- Ignition ON.
- If equipped with a 7-pin connector, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-1	V	Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C473-4	V	Ground

- If equipped with a 13-pin connector, measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-1	V	Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C439-4		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B11

B11 CHECK FOR CORRECT TRM (TRAILER MODULE) OPERATION

- Disconnect and inspect all TRM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the TRM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Trailer Parking Lamps Are Inoperative Or Always On

Refer to Wiring Diagrams Cell 95 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1449:11	Trailer Tow Park/Tail Lamp Output: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground from the trailer parking lamps relay enable circuit.
B1449:12	Trailer Tow Park/Tail Lamp Output: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the BCM detects a short to voltage from the trailer parking lamps relay enable circuit.
B1449:14	Trailer Tow Park/Tail Lamp Output: Circuit Short To Ground or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to ground from the trailer parking lamps relay enable circuit.

Possible Sources

- Fuse(s)
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer concern
- TRM

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse is OK.
- Inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

PINPOINT TEST C : THE TRAILER PARKING LAMPS ARE INOPERATIVE OR ALWAYS ON

C1 CHECK FOR VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- Ignition OFF.
- Disconnect Trailer from Trailer Tow Connector C439 (13-pin connector) or C473 (7-pin connector).
- Ignition ON.
- Place the headlamp switch in the PARKING LAMPS position.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-7	V	Ground
C473-5	V	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-7	V	Ground

- Place the headlamp switch in the OFF position.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-7	V	Ground
C473-5	V	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-7	V	Ground

Is the voltage greater than 11 volts when the headlamp switch in the PARKING LAMPS position and 0 volts when the headlamp switch in the OFF position?

Yes	The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
No	If the trailer parking lamp(s) is inoperative, GO to C2 If the trailer parking lamps are always on, GO to C4

C2 CHECK TRAILER PARKING LAMP CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TRM C4397C.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-7	Ω	C4397C-3
C473-5	Ω	C4397C-3

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-7	Ω	C4397C-3

Is the resistance less than 3 ohms?

Yes	GO to C3
No	REPAIR the circuit.

C3 CHECK TRAILER PARKING LAMP CIRCUITS FOR A SHORT TO GROUND

- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-7	Ω	Ground
C473-5	Ω	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-7	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C5
No	REPAIR the circuit.

C4 CHECK TRAILER PARKING LAMP CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TRM C4397C.
- Ignition ON.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead

C473-5		Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-7		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C5

C5 CHECK FOR VOLTAGE TO THE TRM (TRAILER MODULE)

- Ignition OFF.
- Disconnect TRM C4397A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to C6
No	VERIFY the BJB fuse is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

C6 CHECK THE TRM (TRAILER MODULE) GROUND CIRCUIT

- Ignition OFF.
- Disconnect TRM C4397B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1		C4397B-1

Is the voltage greater than 11 volts?

Yes	GO to C7
No	REPAIR the circuit.

C7 CHECK FOR CORRECT TRM (TRAILER MODULE) OPERATION

- Disconnect and inspect all TRM connectors.

- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the TRM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Trailer Reversing Or Rear Fog Lamps Are Inoperative Or Always On

Refer to Wiring Diagrams Cell 95 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1277:11	Reverse Lamp: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground from the trailer reverse lamp enable circuit.
B1277:12	Reverse Lamp: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the BCM detects a short to voltage from the trailer reverse lamp enable circuit.
B12EF:11	Trailer Fog Lamp: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground from the trailer fog lamps circuit.
B12EF:12	Trailer Fog Lamp: Circuit Short To Battery	A continuous memory and on-demand DTC that sets when the BCM detects a short to voltage from the trailer fog lamps circuit.

Possible Sources

- Fuse(s)
- Wiring, terminals or connectors
- Trailer tow connector
- Trailer concern
- TRM

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse is OK.
- Inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

PINPOINT TEST D : THE TRAILER REVERSING OR REAR FOG LAMPS ARE INOPERATIVE OR ALWAYS ON

D1 CHECK FOR REVERSING LAMP CIRCUIT VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- Ignition OFF.
- Disconnect Trailer from Trailer Tow Connector C439 (13-pin connector) or C473 (7-pin connector).
- Ignition ON.
- Place the gear selector lever in REVERSE.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2		Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-2		Ground

- Place the gear selector lever in PARK.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2		Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-2		Ground

Is the voltage greater than 11 volts when the gear selector lever is in REVERSE and 0 volts when the gear selector lever is in PARK?

Yes	GO to D2
No	If the trailer reversing lamps are inoperative, GO to D3 If the trailer reversing lamps are always on, GO to D5

D2 CHECK FOR REAR FOG LAMP CIRCUIT VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- Place the rear fog lamp switch in the ON position.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2		Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-11		Ground

- Place the rear fog lamp switch in the OFF position.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2		Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-11		Ground

Is the voltage greater than 11 volts when the rear fog lamps are ON and 0 volts when the rear fog lamps are OFF?

Yes	The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
No	If the trailer rear fog lamps are inoperative, GO to D6 If the trailer rear fog lamps are always on, GO to D8

D3 CHECK TRAILER REVERSING LAMP CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TRM C4397C.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2	Ω	C4397C-5

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-2	Ω	C4397C-5

Is the resistance less than 3 ohms?

Yes	GO to D4
No	REPAIR the circuit.

D4 CHECK TRAILER REVERSING LAMP CIRCUITS FOR A SHORT TO GROUND

- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2	Ω	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to D9
No	REPAIR the circuit.

D5 CHECK TRAILER REVERSING LAMP CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TRM C4397C.
- Ignition ON.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2	V	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-2	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to D9

D6 CHECK TRAILER REAR FOG LAMP CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TRM C4397C.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2	Ω	C4397C-8

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-11	Ω	C4397C-8

Is the resistance less than 3 ohms?

Yes	GO to D7
No	REPAIR the circuit.

D7 CHECK TRAILER REAR FOG LAMP CIRCUITS FOR A SHORT TO GROUND

- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2	Ω	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-11	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to D9
No	REPAIR the circuit.

D8 CHECK TRAILER REAR FOG LAMP CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TRM C4397C.
- Ignition ON.
- If equipped with a 7-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C473-2	V	Ground

- If equipped with a 13-pin connector, measure:

Positive Lead	Measurement / Action	Negative Lead
C439-11	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to D9

D9 CHECK FOR VOLTAGE TO THE TRM (TRAILER MODULE)

- Ignition OFF.

- Disconnect TRM C4397A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to D10
No	VERIFY the BJB fuse is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

D10 CHECK THE TRM (TRAILER MODULE) GROUND CIRCUIT

- Ignition OFF.
- Disconnect TRM C4397B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1		C4397B-1

Is the voltage greater than 11 volts?

Yes	GO to D11
No	REPAIR the circuit.

D11 CHECK FOR CORRECT TRM (TRAILER MODULE) OPERATION

- Disconnect and inspect all TRM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the TRM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Trailer Battery Charging Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 95 for schematic and connector information.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10E8:11	Secondary Battery Relay A: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground on the secondary battery relay circuit.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Trailer tow connector
- TRM
- Trailer concern

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse is OK.
- Inspect the trailer tow connector for signs of corrosion or damage. Repair or install a new trailer tow connector as required.

PINPOINT TEST E : THE TRAILER BATTERY CHARGING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

E1 CHECK FOR CHARGING VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- Ignition OFF.
- Disconnect Trailer from Trailer Tow Connector C439 (13-pin connector).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C439-8	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to E2
No	GO to E3

E2 CHECK FOR BATTERY FEED VOLTAGE THROUGH THE TRAILER TOW CONNECTOR

- Ignition OFF.
- Disconnect Trailer from Trailer Tow Connector C439 (13-pin connector).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C439-8	V	Ground

Is the voltage greater than 11 volts?

Yes	The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility.
No	VERIFY the BJB fuse is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

E3 CHECK FOR CHARGING VOLTAGE SUPPLY TO THE TRM (TRAILER MODULE)

- Ignition OFF.
- Disconnect: TRM C4397A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397A-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to E4
No	VERIFY the BJB fuse is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

E4 CHECK THE TRAILER TOW BATTERY CHARGE CIRCUIT FOR AN OPEN

- Disconnect: TRM C4397C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397C-6	Ω	C439-8

Is the resistance less than 3 ohms?

Yes	GO to E5
No	REPAIR the circuit.

E5 CHECK THE TRAILER TOW BATTERY CHARGE CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C4397C-6	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to E6
No	REPAIR the circuit.

No	REPAIR the circuit.

E6 CHECK FOR CORRECT TRM (TRAILER MODULE) OPERATION

- Disconnect and inspect all TRM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the TRM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Turn Signal and Hazard Lamps

DTC Chart: BCM

BCM DTC Chart

DTC	Description	Action
B123A:11	Left Front Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B123A:15	Left Front Turn Indicator: Circuit Short To Battery Or Open	GO to Pinpoint Test B
B123B:11	Right Front Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B123B:15	Right Front Turn Indicator: Circuit Short To Battery Or Open	GO to Pinpoint Test B
B1247:11	Left Rear Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B1247:15	Left Rear Turn Indicator: Circuit Short To Battery Or Open	GO to Pinpoint Test B
B1248:11	Right Rear Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B1248:15	Right Rear Turn Indicator: Circuit Short To Battery Or Open	GO to Pinpoint Test B
B1D35:11	Hazard Switch: Circuit Short to Ground	GO to Pinpoint Test C
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The BCM cannot enable the output until the cause of the short is corrected. ADDRESS all other DTCs first. After the cause of the concern is corrected, CLEAR the DTCs. REPEAT the self-test.
U3000:49	Control Module: Internal Electronic Failure	The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the BCM can withstand. The cause of the excessive current draw MUST be corrected before a new BCM is installed. ADDRESS all other DTCs first. After the cause of the concern is corrected, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
For other BCM DTCs	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

DTC Chart: DDM

DDM DTC Chart

DTC	Description	Action
B1D06:11	Left Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B1D07:11	Right Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
For other DDM DTCs	-	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

DTC Chart: PDM

PDM DTC Chart

DTC	Description	Action
B1D06:11	Left Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
B1D07:11	Right Turn Indicator: Circuit Short To Ground	GO to Pinpoint Test B
For other PDM DTCs	-	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

DTC Chart: SCCM

SCCM DTC Chart

DTC	Description	Action
B1D36:09	Turn Indicator Switch: Component Failure	INSTALL a new steering column function switch. REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern still exists, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
For other SCCM DTCs	-	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Symptom Chart: Turn Signal and Hazard Lamps

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

The turn signal function is inoperative or always on	Refer to the Pinpoint test	GO to Pinpoint Test A
One or more turn signal lamps are inoperative or always on	Refer to the Pinpoint test	GO to Pinpoint Test B
The hazard lamp function is inoperative or always on	Refer to the Pinpoint test	GO to Pinpoint Test C

Pinpoint Tests

The Turn Signal Function Is Inoperative Or Always On

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

Possible Sources

- steering column multifunction switch (headlamp switch)
- SCCM
- BCM

PINPOINT TEST A : THE TURN SIGNAL FUNCTION IS INOPERATIVE OR ALWAYS ON

A1 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) TURN SIGNAL PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view SCCM Parameter Identifications (PIDs).
- Monitor the Turn Signal Left Switch Input Status (TRN_SIG_SW_L) and Turn Signal Right Switch Input Status (TRN_SIG_SW_R) while placing the steering column multifunction switch in the left and right turn positions.

Do the Parameter Identifications (PIDs) match the steering column multifunction switch position?

Yes	GO to A2
No	INSTALL a new steering column multifunction switch (headlamp switch). REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to A3

A2 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).

	REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A3 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all SCCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

One Or More Turn Signal Lamps Are Inoperative Or Always On

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B123A:11	Left Front Turn Indicator: Circuit Short To Ground	Sets when the BCM detects a short to ground from the LH front turn lamp voltage supply circuit.
B123A:15	Left Front Turn Indicator: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the LH front turn lamp voltage supply circuit.
B123B:11	Right Front Turn Indicator: Circuit Short To Ground	Sets when the BCM detects a short to ground from the RH front turn lamp voltage supply circuit.
B123B:15	Right Front Turn Indicator: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the RH front turn lamp voltage supply circuit.
B1247:11	Left Rear Turn Indicator: Circuit Short To Ground	Sets when the BCM detects a short to ground from the LH rear turn lamp voltage supply circuit.
B1247:15	Left Rear Turn Indicator: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the LH rear turn lamp voltage supply circuit.
B1248:11	Right Rear Turn Indicator: Circuit Short To Ground	Sets when the BCM detects a short to ground from the RH rear turn lamp voltage supply circuit.
B1248:15	Right Rear Turn Indicator: Circuit Short To Battery Or Open	Sets when the BCM detects an open or short to voltage from the RH rear turn lamp voltage supply circuit.

B1D06:11	Left Turn Indicator: Circuit Short To Ground	Sets when the BCM detects a short to ground from the RH turn lamp voltage supply circuit.
B1D07:11	Right Turn Indicator: Circuit Short To Ground	Sets when the BCM detects a short to ground from the RH turn lamp voltage supply circuit.

Possible Sources

- Bulb
- Wiring, terminals or connectors
- Exterior mirror
- BCM

PINPOINT TEST B : ONE OR MORE TURN SIGNAL LAMPS ARE INOPERATIVE OR ALWAYS ON

B1 DETERMINE IF A TURN LAMP IS ALWAYS ON

- Ignition ON.
- Activate the hazard lamp function.
- Observe the front and the rear turn lamps.

Are any turn lamps always on?

Yes	GO to B2
No	Deactivate the hazard lamp function. For a front turn signal or side repeater lamp, GO to B3 For an exterior mirror turn lamp, GO to B5 For a rear turn signal lamp, GO to B9

B2 CHECK THE TURN LAMP VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280C (front lamps and side repeater lamps).
- Disconnect BCM C2280D (rear lamps and exterior mirror lamps).
- Ignition ON.

Does the turn lamp in question continue to illuminate?

Yes	REPAIR the circuit in question.
No	GO to B13

B3 CHECK FOR VOLTAGE TO THE FRONT TURN LAMP

- Ignition OFF.
- Disconnect Inoperative LH Turn Signal Lamp C156 or RH Turn Signal Lamp C166.
- Disconnect Inoperative LH Side Repeater Lamp C1127 or RH Side Repeater Lamp C1126.
- Ignition ON.
- Activate the hazard flasher lamp function.
- Measure:

LH Turn Signal Lamp

Positive Lead	Measurement / Action	Negative Lead
C156-1		Ground

RH Turn Signal Lamp

Positive Lead	Measurement / Action	Negative Lead
C166-1		Ground

LH Side Repeater Lamp

Positive Lead	Measurement / Action	Negative Lead
C1127-1		Ground

RH Side Repeater Lamp

Positive Lead	Measurement / Action	Negative Lead
C1126-1		Ground

Does the voltage alternate from 0 to greater than 11 volts?

Yes	GO to B4
No	GO to B7

B4 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Turn Signal Lamp

Positive Lead	Measurement / Action	Negative Lead
C156-1		C156-2

RH Turn Signal Lamp

Positive Lead	Measurement / Action	Negative Lead
C166-1		C166-2

LH Side Repeater Lamp

Positive Lead	Measurement / Action	Negative Lead
C1127-1		C1127-2

RH Side Repeater Lamp

Positive Lead	Measurement / Action	Negative Lead
C1126-1		C1126-2

Does the voltage alternate from 0 to greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit.

B5 CHECK FOR VOLTAGE TO THE EXTERIOR MIRROR TURN LAMP

- Ignition OFF.
- Disconnect LH Exterior Mirror C520 LHD or C5201 RHD.
- Disconnect RH Exterior Mirror C6262 LHD or C626 RHD.
- Ignition ON.
- Activate the hazard flasher lamp function.
- Measure:

LH Exterior Mirror

Positive Lead	Measurement / Action	Negative Lead
C520-3		Ground
C5201-3		Ground

RH Exterior Mirror

Positive Lead	Measurement / Action	Negative Lead
C6262-3		Ground
C626-3		Ground

Does the voltage alternate from 0 to greater than 11 volts?

Yes	GO to B6
No	GO to B11

B6 CHECK THE EXTERIOR MIRROR GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Exterior Mirror

Positive Lead	Measurement / Action	Negative Lead
C520-3		C520-1
C5201-3		C5201-1

RH Exterior Mirror

Positive Lead	Measurement / Action	Negative Lead
C6262-3	V	C6262-1
C626-3	V	C626-1

Does the voltage alternate from 0 to greater than 11 volts?

Yes	CHECK the exterior mirror harness for open or shorted circuits and damaged or pushed-out pins. If the harness is OK, INSTALL a new bulb. If the harness is not OK, REPAIR the harness. If the harness cannot be repaired, INSTALL a new exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors) .
No	REPAIR the circuit.

B7 CHECK THE FRONT TURN SIGNAL AND SIDE REPEATER VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Deactivate the hazard flasher lamp function.
- Disconnect BCM C2280C.
- Disconnect LH Turn Signal Lamp C156 and LH Side Repeater Lamp C1127.
- Disconnect RH Turn Signal Lamp C166 and RH Side Repeater Lamp C1126).
- Measure:

LH Turn Signal and Side Repeater

Positive Lead	Measurement / Action	Negative Lead
C2280C-39	Ω	Ground

RH Turn Signal and Side Repeater

Positive Lead	Measurement / Action	Negative Lead
C2280C-38	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B8
No	REPAIR the circuit.

B8 CHECK THE FRONT TURN SIGNAL AND SIDE REPEATER VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Measure:

LH Turn Signal Lamp

Positive Lead	Measurement / Action	Negative Lead

C156-1	Ω	C2280C-39

RH Turn Signal Lamp

Positive Lead	Measurement / Action	Negative Lead
C166-1	Ω	C2280C-38

LH Side Repeater Lamp

Positive Lead	Measurement / Action	Negative Lead
C1127-1	Ω	C2280C-39

RH Side Repeater Lamp

Positive Lead	Measurement / Action	Negative Lead
C1126-1	Ω	C2280C-38

Is the resistance less than 3 ohms?

Yes	GO to B13
No	REPAIR the circuit.

B9 CHECK FOR VOLTAGE TO THE REAR TURN LAMP

- Ignition OFF.
- Disconnect Inoperative LH Rear Lamp C412 and RH Rear Lamp C415.
- Ignition ON.
- Activate the hazard flasher lamp function.
- Measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-1	V	Ground

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-1	V	Ground

Does the voltage alternate from 0 to greater than 11 volts?

Yes	GO to B10
No	GO to B11

B10 CHECK THE REAR LAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-1		C412-6

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-1		C415-6

Does the voltage alternate from 0 to greater than 11 volts?

Yes	INSTALL a new bulb.
No	REPAIR the circuit.

B11 CHECK THE REAR TURN LAMP AND EXTERIOR MIRROR LAMP VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Deactivate the hazard flasher lamp function.
- Disconnect BCM C2280D.
- Measure:

LH Turn Lamp and Exterior Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C2280D-26	Ω	Ground

RH Turn Lamp and Exterior Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C2280D-52	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B12
No	REPAIR the circuit.

B12 CHECK THE REAR TURN LAMP AND EXTERIOR MIRROR LAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Measure:

LH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C412-1	Ω	C2280D-26

RH Turn Lamp

Positive Lead	Measurement / Action	Negative Lead
C415-1	Ω	C2280D-52

LH Exterior Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C520-3	Ω	C2280D-26
C5201-3	Ω	C2280D-26

RH Exterior Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C6262-3	Ω	C2280D-52
C626-3	Ω	C2280D-52

Is the resistance less than 3 ohms?

Yes	GO to B13
No	REPAIR the circuit.

B13 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Hazard Lamp Function Is Inoperative Or Always On

Refer to Wiring Diagrams Section 417-01 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Lighting - Component Location (417-01 Exterior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1D35:11	Hazard Switch: Circuit Short to Ground	Sets when the BCM detects a short to ground from the hazard lamp function input circuit during an on-demand self-test.

Possible Sources

- Wiring, terminals or connectors
- Hazard switch
- FCIM
- BCM

PINPOINT TEST C : THE HAZARD LAMP FUNCTION IS INOPERATIVE OR ALWAYS ON

C1 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B1D35:11 present?

Yes	GO to C2
No	GO to C4

C2 ISOLATE THE HAZARD FLASHER LAMP SWITCH

- Ignition OFF.
- Disconnect FCIM C2402B.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the BCM self-test.

Is DTC B1D35:11 retrieved again?

Yes	GO to C3
No	INSTALL a new FCIM.

C3 CHECK THE HAZARD FLASHER SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

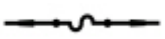
Positive Lead	Measurement / Action	Negative Lead
C2280G-19	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C7
No	REPAIR the circuit.

C4 BYPASS THE HAZARD FLASHER SWITCH

- Ignition OFF.
- Disconnect FCIM C2402B.
- Ignition ON.
- Using a scan tool, monitor the BCM Hazard Switch Signal (HAZARD_LP_SW) PID.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C2402B-20		Ground

Does the PID indicate the hazard switch is active?

Yes	REMOVE the fused jumper wire. GO to C6
No	REMOVE the fused jumper wire. GO to C5

C5 CHECK THE HAZARD FLASHER SWITCH INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402B-20	Ω	C2280G-19

Is the resistance less than 3 ohms?

Yes	GO to C7
No	REPAIR the circuit.

No	REPAIR the circuit.

C6 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Disconnect and inspect the FCIM connector.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the FCIM connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

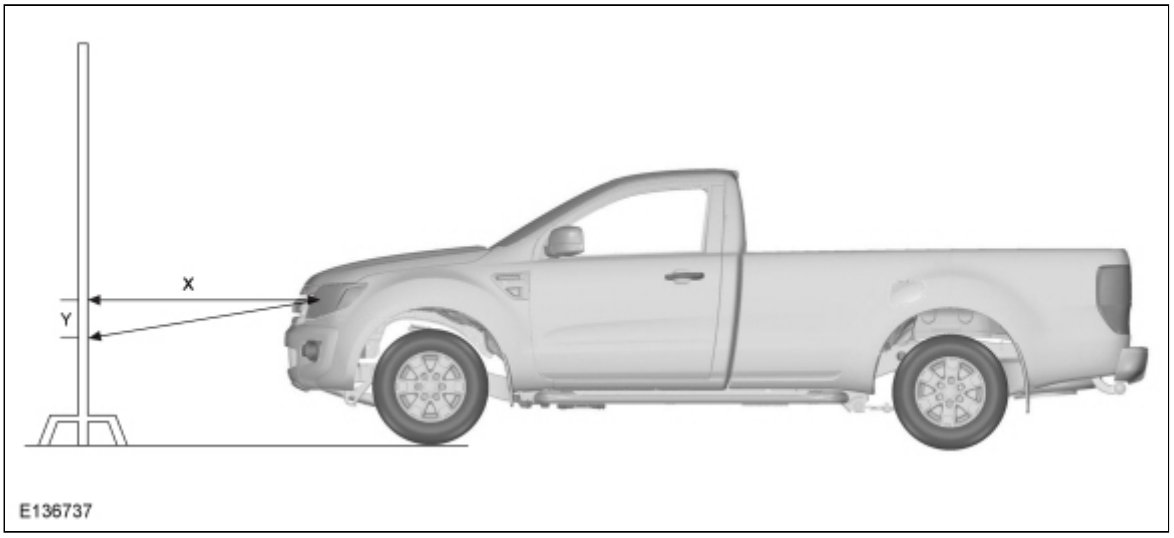
Headlamp Adjustment

Special Tool(s) / General Equipment

Headlamp Beam Setter

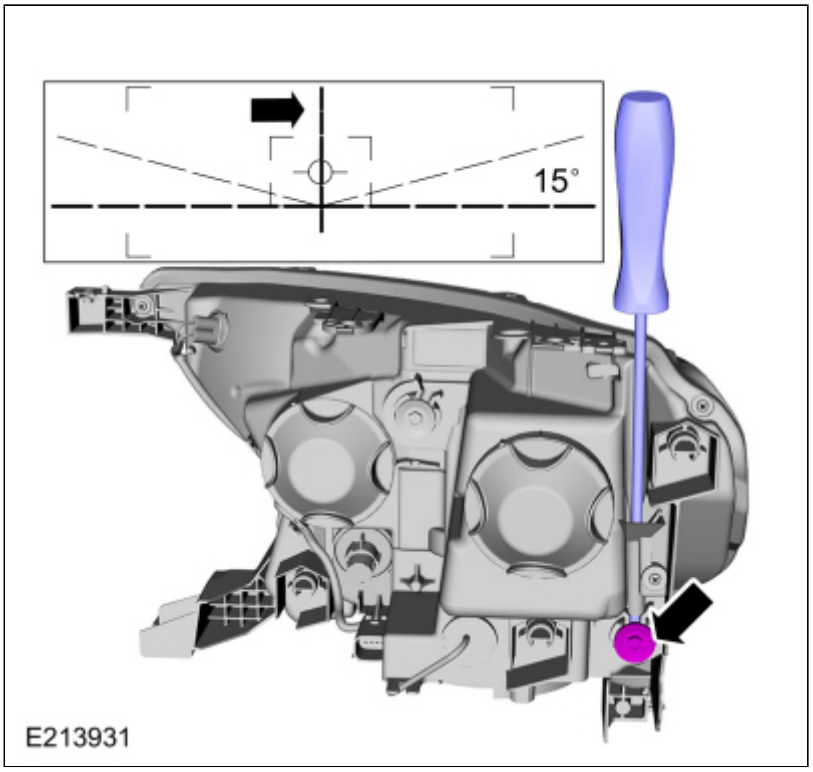
Adjustment

1. Adjust the tire pressure to the specification.
2. Fill the tank with fuel.
3. Position the unloaded vehicle on a flat, level surface.
4. Leave the gear selector lever in neutral position and hand brakes off.
5. Seat one person in the driver's seat.
6. Position the vehicle straight ahead and perpendicular to the white screen.
7. Repeatedly operate the headlamp leveling switch and then set it to "0" (if fitted).
8. Set the measuring screen of the beam setting equipment to the correct headlamp adjustment setting. Use the General Equipment: Headlamp Beam Setter
9. **X:** 3 m [9.8 ft], **Y:** 30mm [1.2 inch] (1.0% of X).



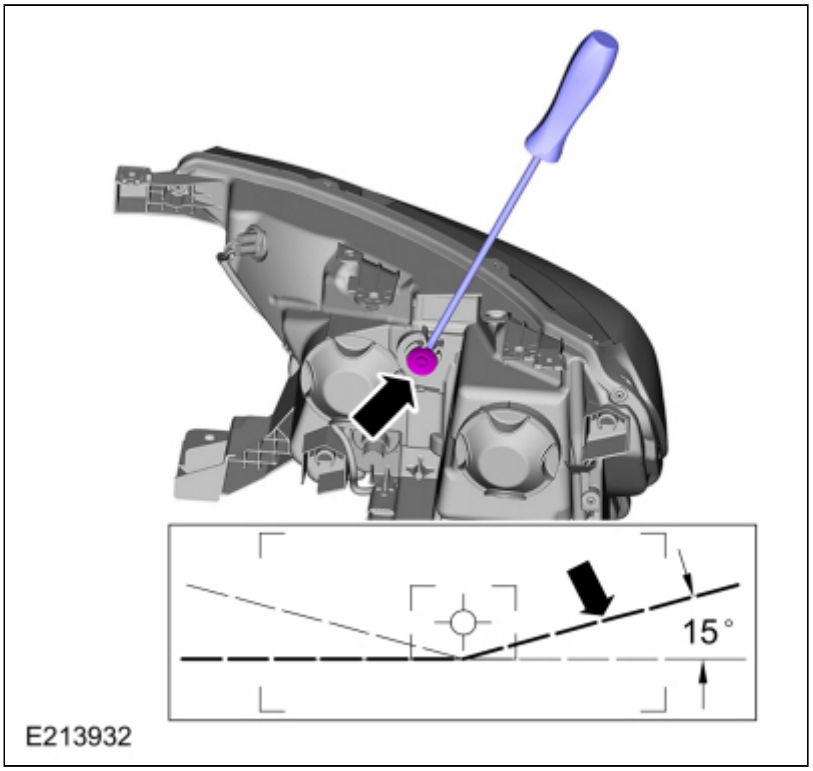
10. Place an object in front of the headlight not being adjusted to block its light beam.
11. Start the engine so that the battery remains charged.
12. Turn on the headlamp.
13. **NOTE:** *LHD shown, reverse for RHD.*

    Adjust the horizontal aim of the headlamp using the adjusting screw shown in the picture.



14. **NOTE:** *LHD shown, reverse for RHD.*

    Adjust the vertical aim of the headlamp using the adjusting screw shown in the figure below.

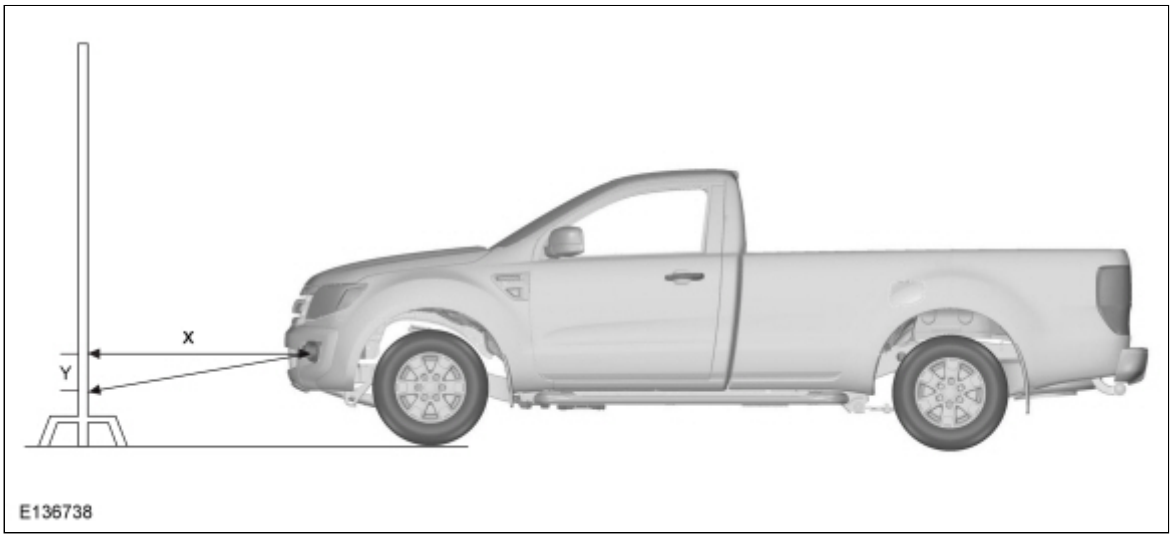


Copyright © 2016 Ford Motor Company

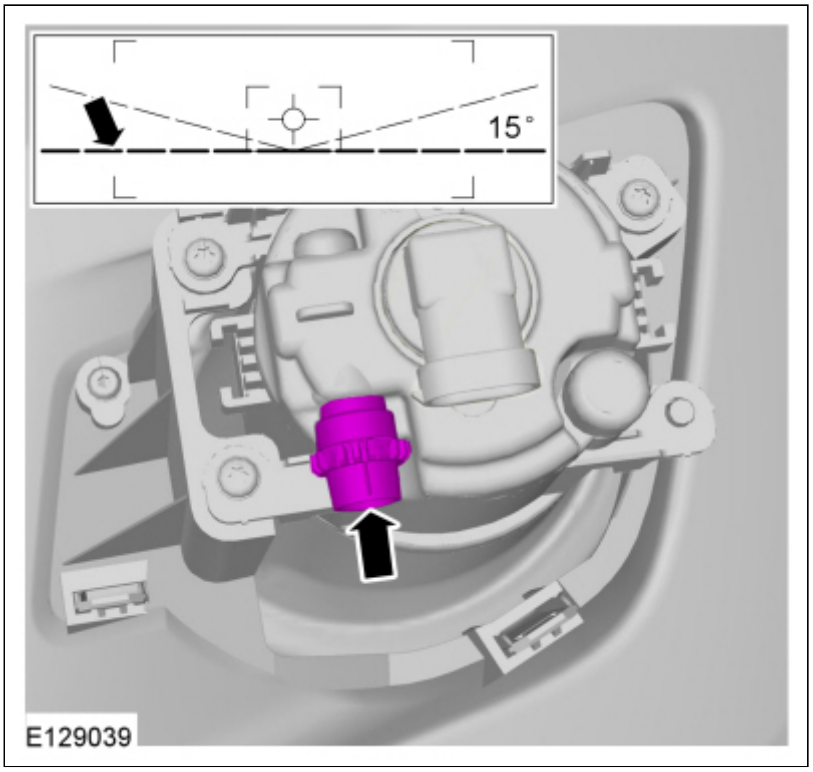
Front Fog Lamp Adjustment

Adjustment

1. Make an adjustment screen using double-weight, white paper.
2. Fill the tank with fuel.
3. Adjust the tire pressure to the specification.
4. Leave the gear selector lever in neutral position and hand brakes off.
5. Position the unloaded vehicle on a flat, level surface.
6. Seat one person in the driver's seat.
7. **X:** 3 m [9.8 ft], **Y:** 60 mm [2.4 inch] (2.0% of X).



8. Place an object in front of the fog light not being adjusted to block its light beam.
9. Start the engine so that the battery remains charged.
10. Turn the front fog lights on.
11. Adjust the fog lamp so that the cut-off line touches the horizontal line.



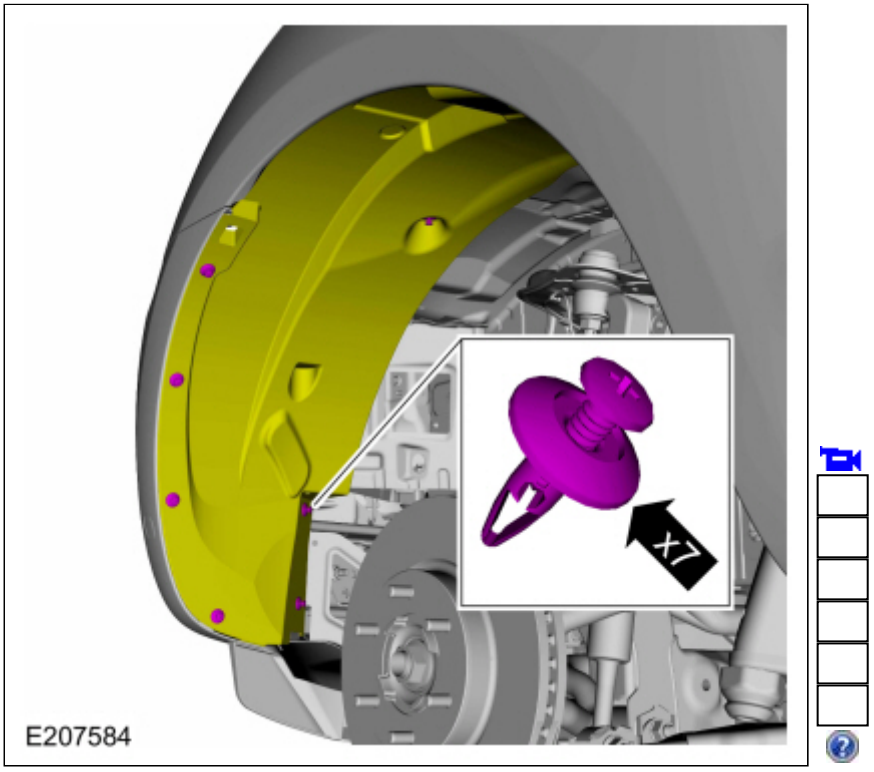
Copyright © 2016 Ford Motor Company

Front Fog Lamp

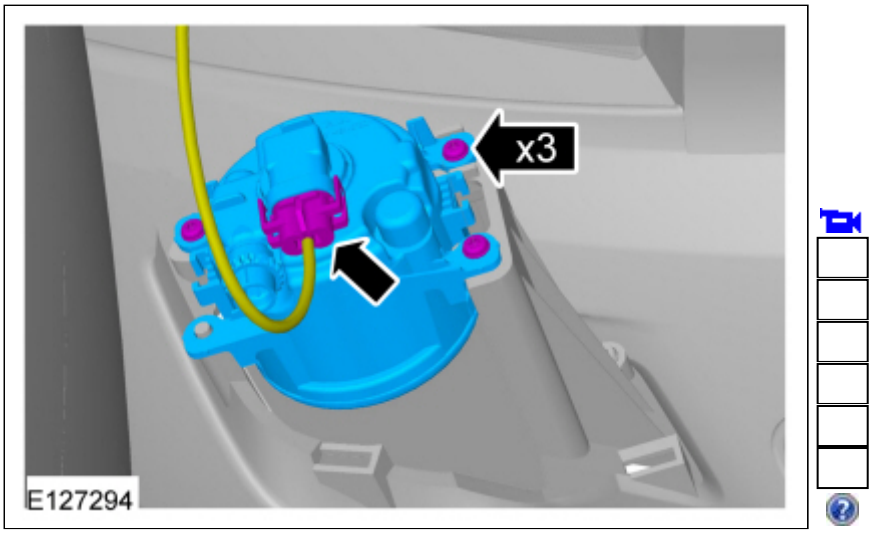
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. **NOTE:** *On both sides.*



4. **NOTE:** *On both sides.*



Installation

1. To install, reverse the removal procedure.
2. Refer to: Front Fog Lamp Adjustment (417-01 Exterior Lighting, General Procedures).

Copyright © 2016 Ford Motor Company

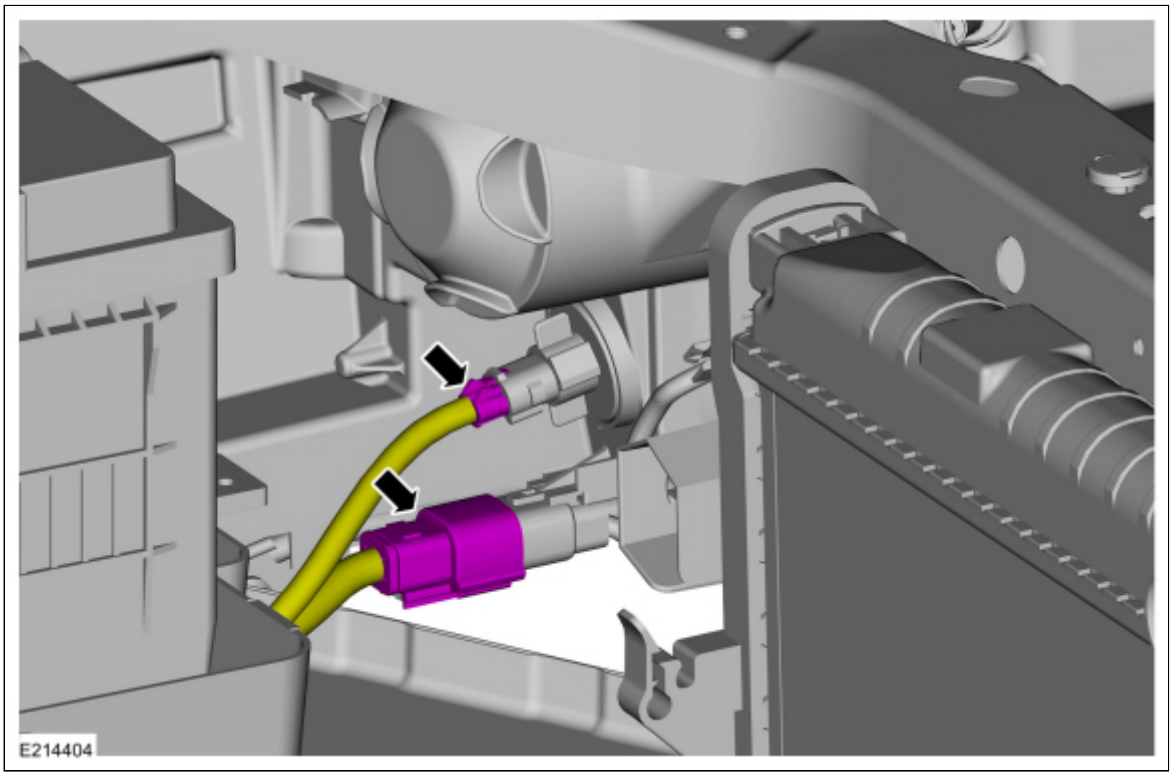
Headlamp Assembly

Base Part Number: 13005

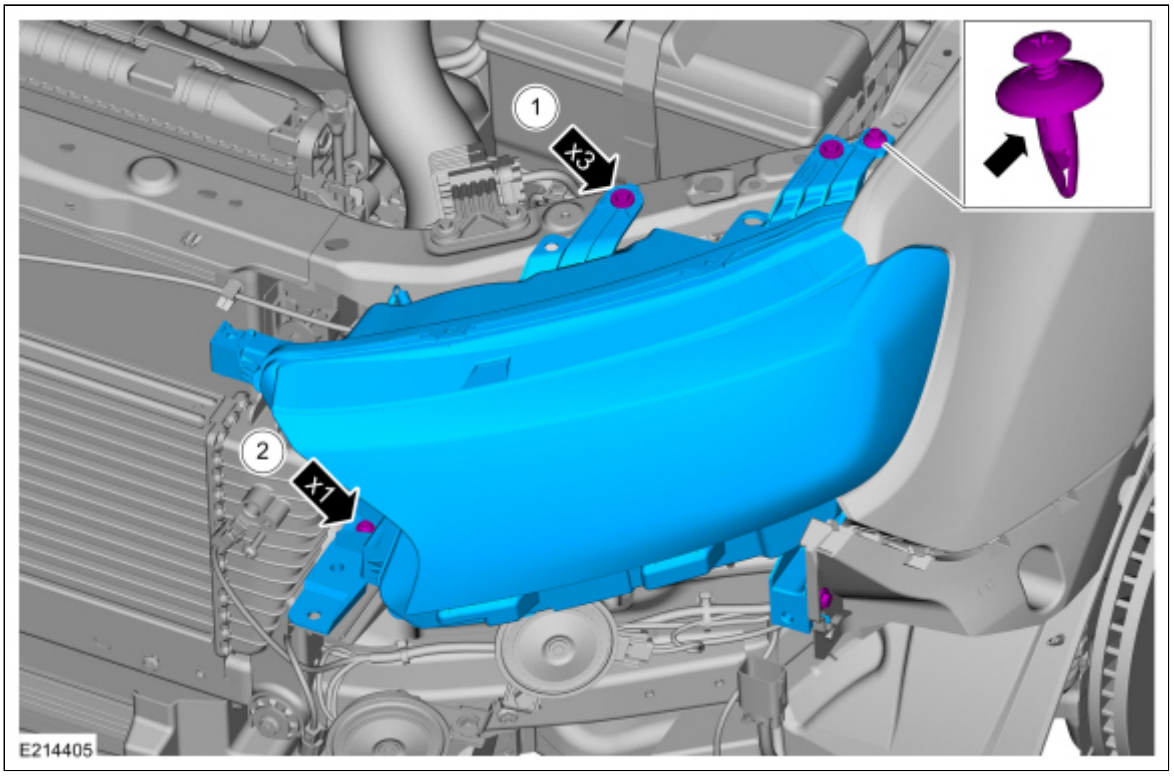
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
3. On both sides.



4. On both sides.
   Torque:
   1.: 5 Nm
   2.: 1 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Headlamp Adjustment (417-01 Exterior Lighting, General Procedures).

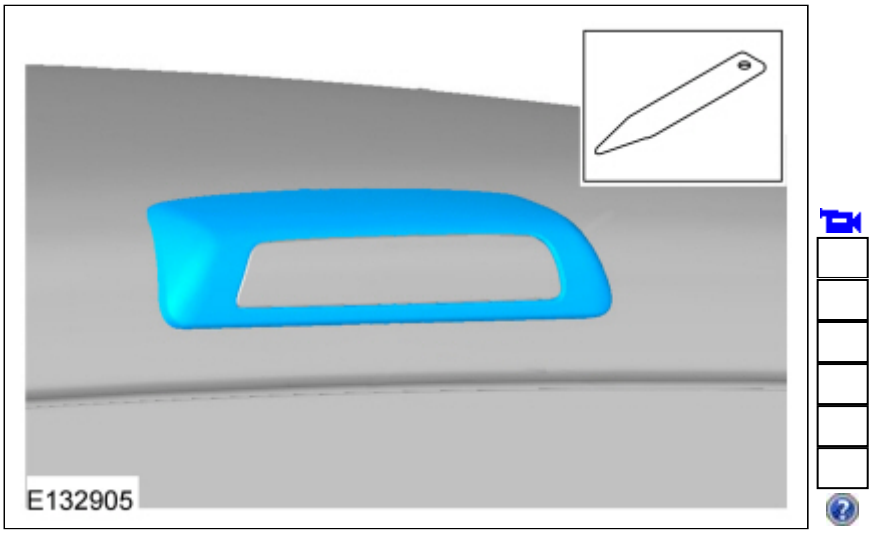
Copyright © 2016 Ford Motor Company

High Mounted Stoplamp

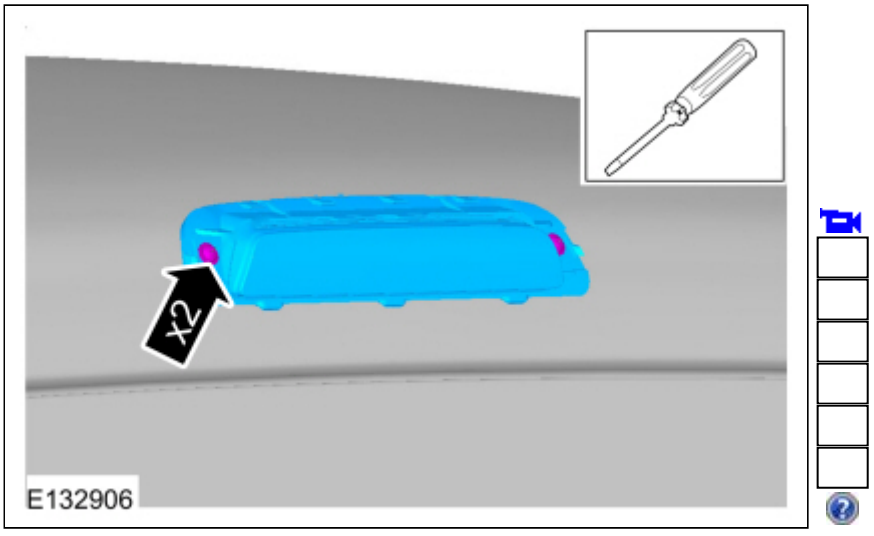
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.

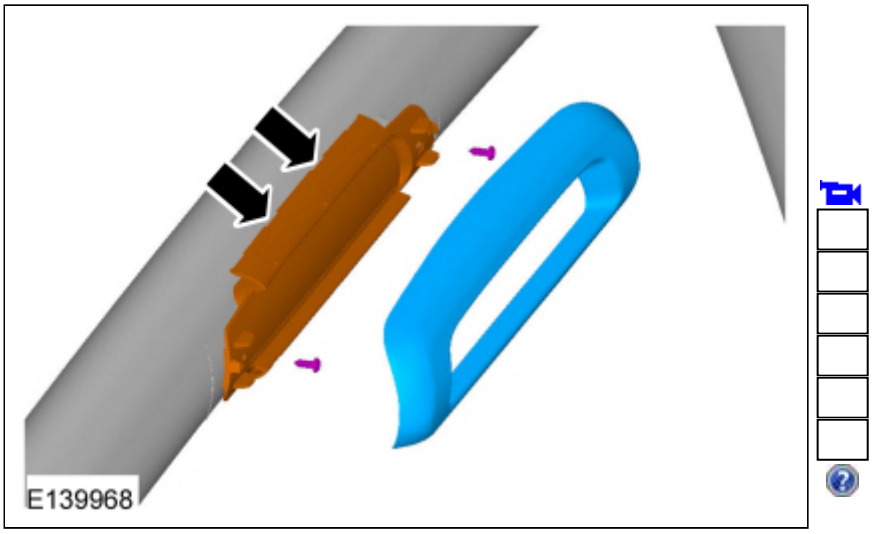


2. *Torque*: 1 Nm

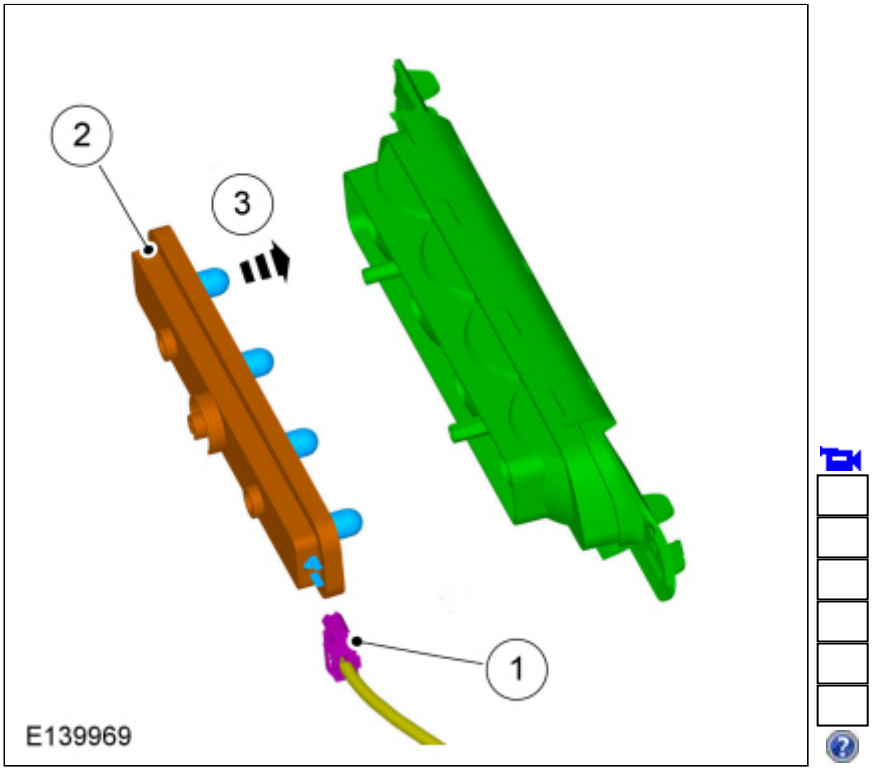


NOTE: *Following steps are applicable to the vehicles fitted with tubular sports bar.*

3.



4.



Installation

1. To install, reverse the removal procedure.

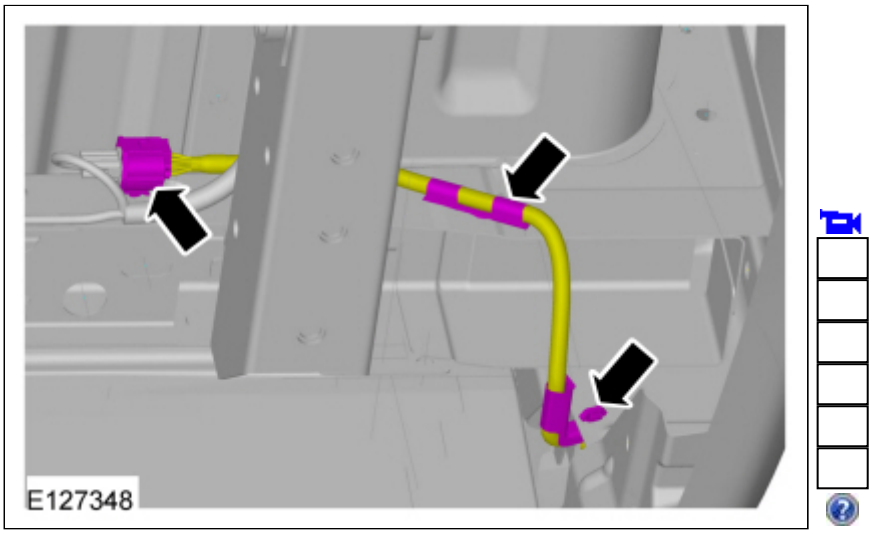
Copyright © 2016 Ford Motor Company

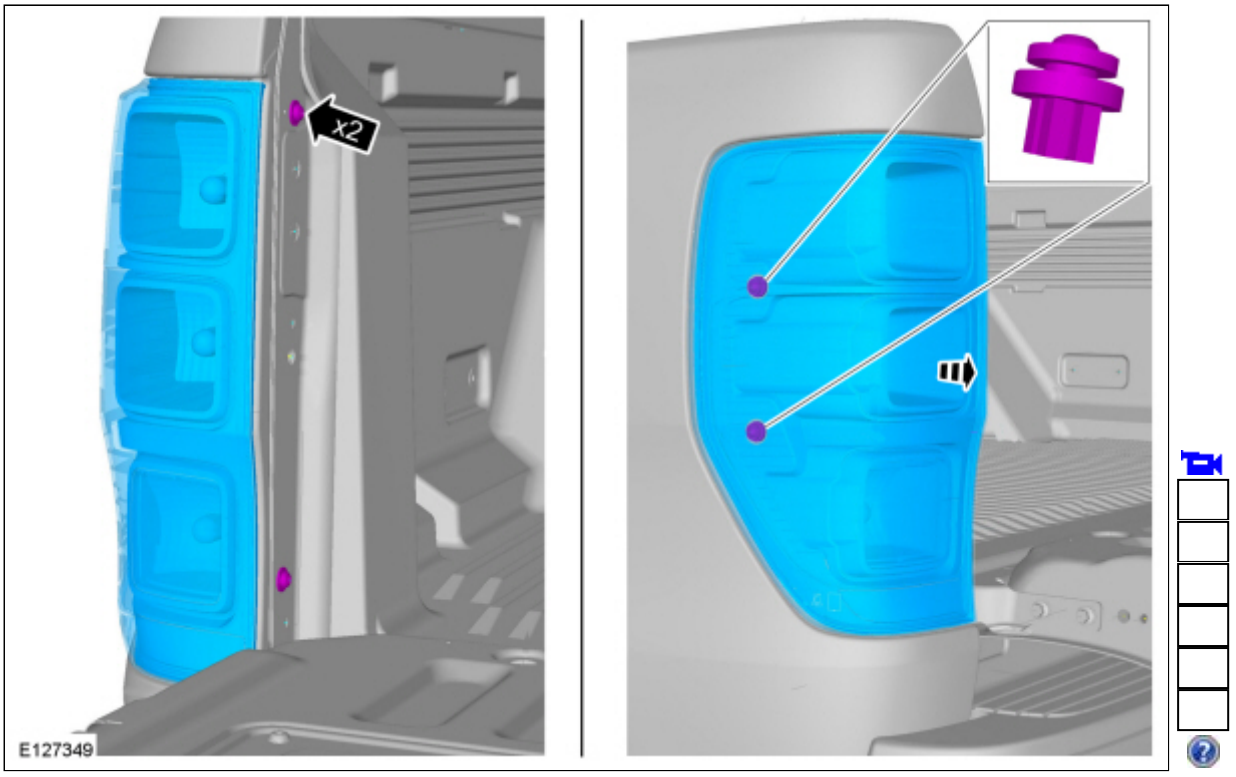
Rear Lamp Assembly

Base Part Number: 13404

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

4. 

Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

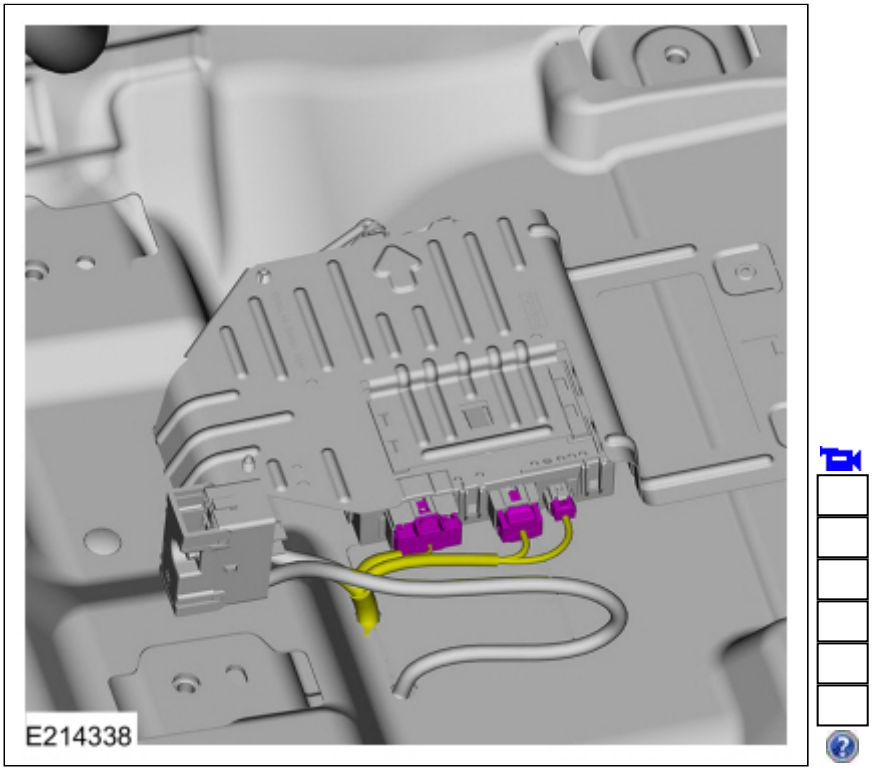
Trailer Module (TRM)

Removal

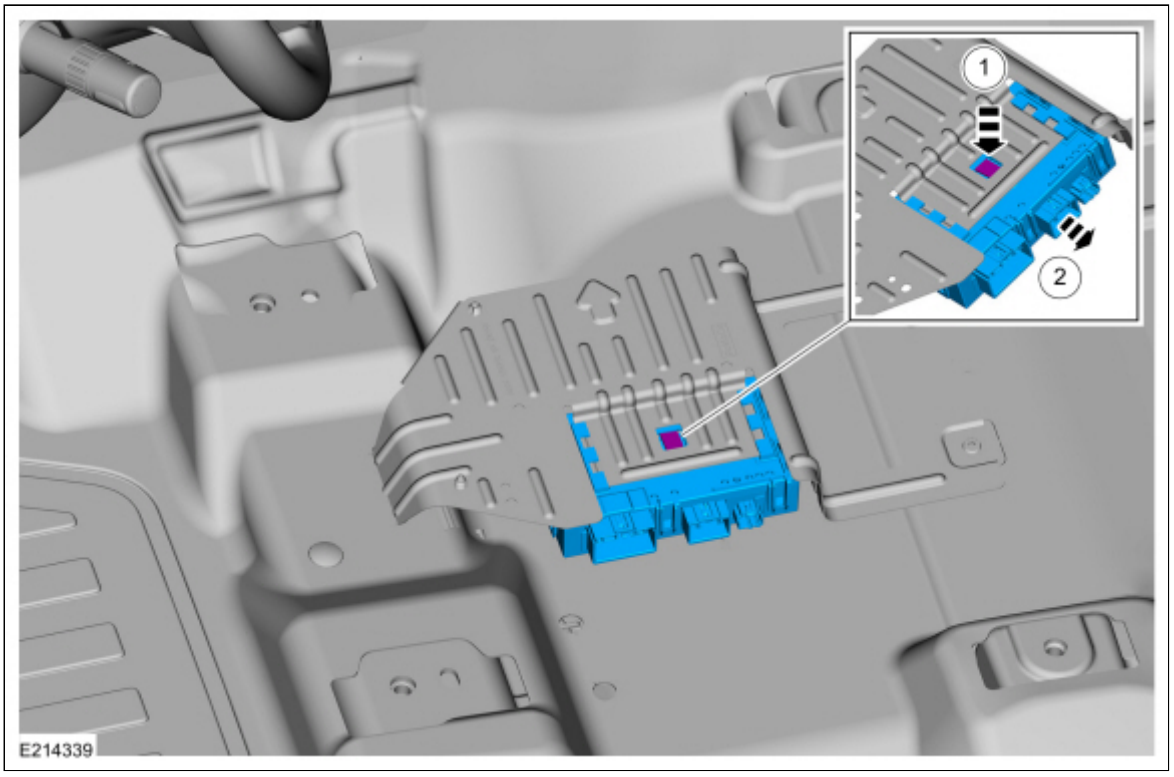
NOTE: *Removal steps in this procedure may contain installation details.*

1. Remove front Driver side seat only.
   Refer to: Front Seat (501-10A Seating, Removal and Installation).

2.



3.



Installation

1. To install, reverse the removal procedure.

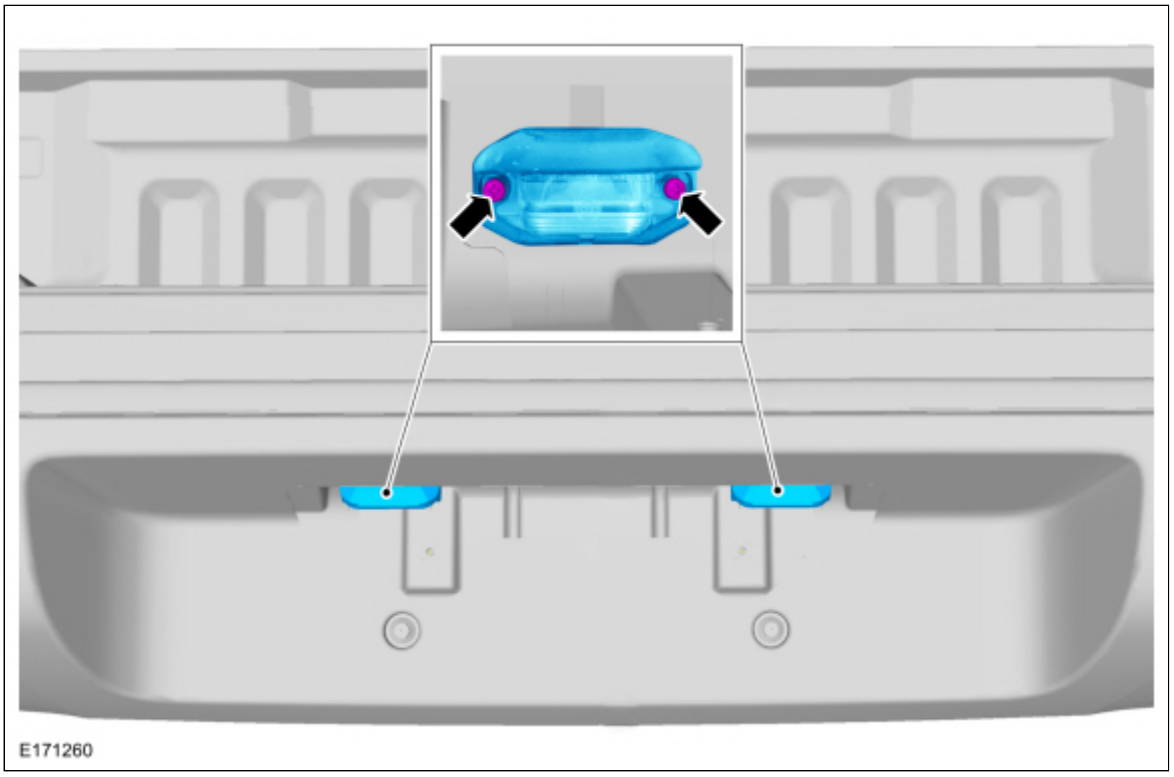
Copyright © 2016 Ford Motor Company

License Plate Lamp

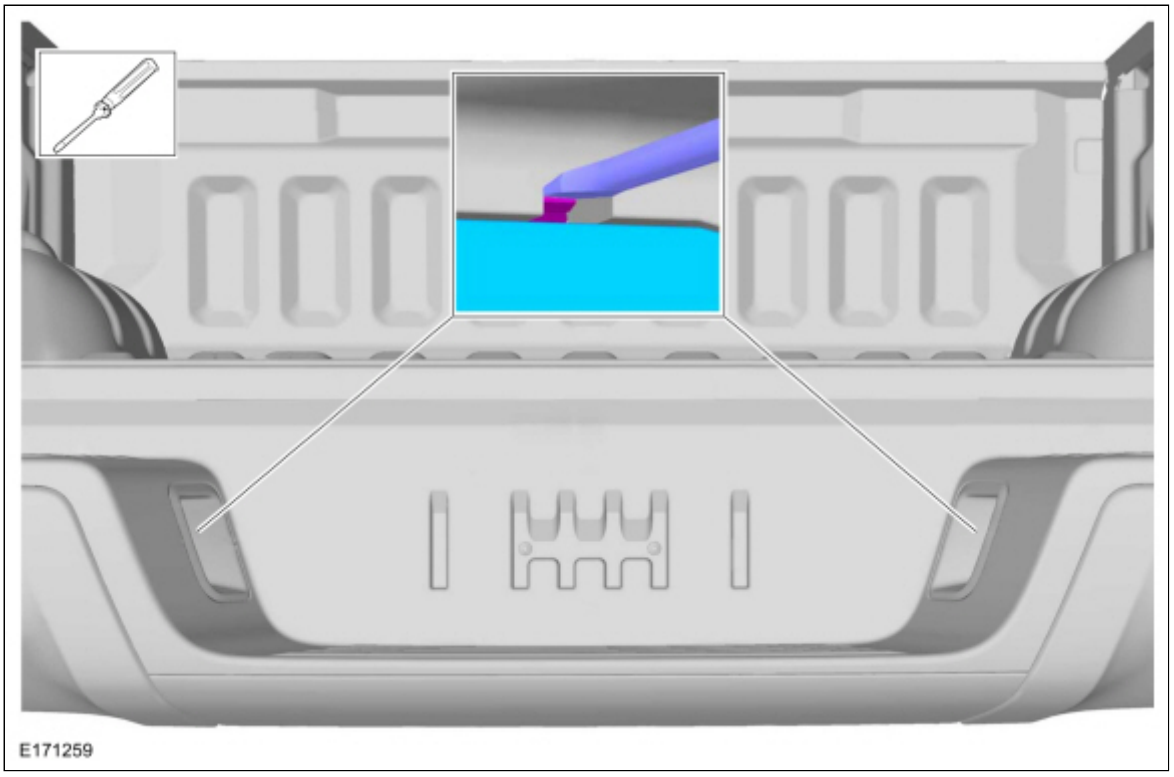
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. If equipped



2. If equipped



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Interior Lighting - Overview

Overview

The interior lighting system consists of:

- Courtesy lamps
- Demand lamps
- Ambient lighting

The courtesy lamps subsystem consists of:

- Interior lamps
- Puddle lamps
- Door ajar switches (integrated into the door latches)
- Courtesy lamp switch (integrated into the front interior lamp)
- Cargo lamps
- DDM
- PDM
- BCM

The courtesy lamps provide illumination to the vehicle interior and below the exterior mirrors when entering or exiting the vehicle or when requested using the courtesy lamp switch located on the front interior lamp assembly.

The demand lamps subsystem consists of:

- Interior lamps (map lamps)
- Vanity mirror lamps
- Cargo lamps
- Cargo lamp switch
- BCM

The demand lamps provide illumination to specific areas within the vehicle when needed.

The BCM energizes the demand lamp relay to supply voltage to the demand lamps when the battery saver feature is not active.

The ambient lighting subsystem consists of:

- Ambient lighting Light Emitting Diodes (LEDs)
- FDIM (touchscreen)
- BCM

The ambient lighting is controlled using the FDIM (touchscreen) controls. The ambient lighting provides aesthetically colored illumination to the following locations for illuminated entry or when the ignition is in RUN with the parking lamps on:

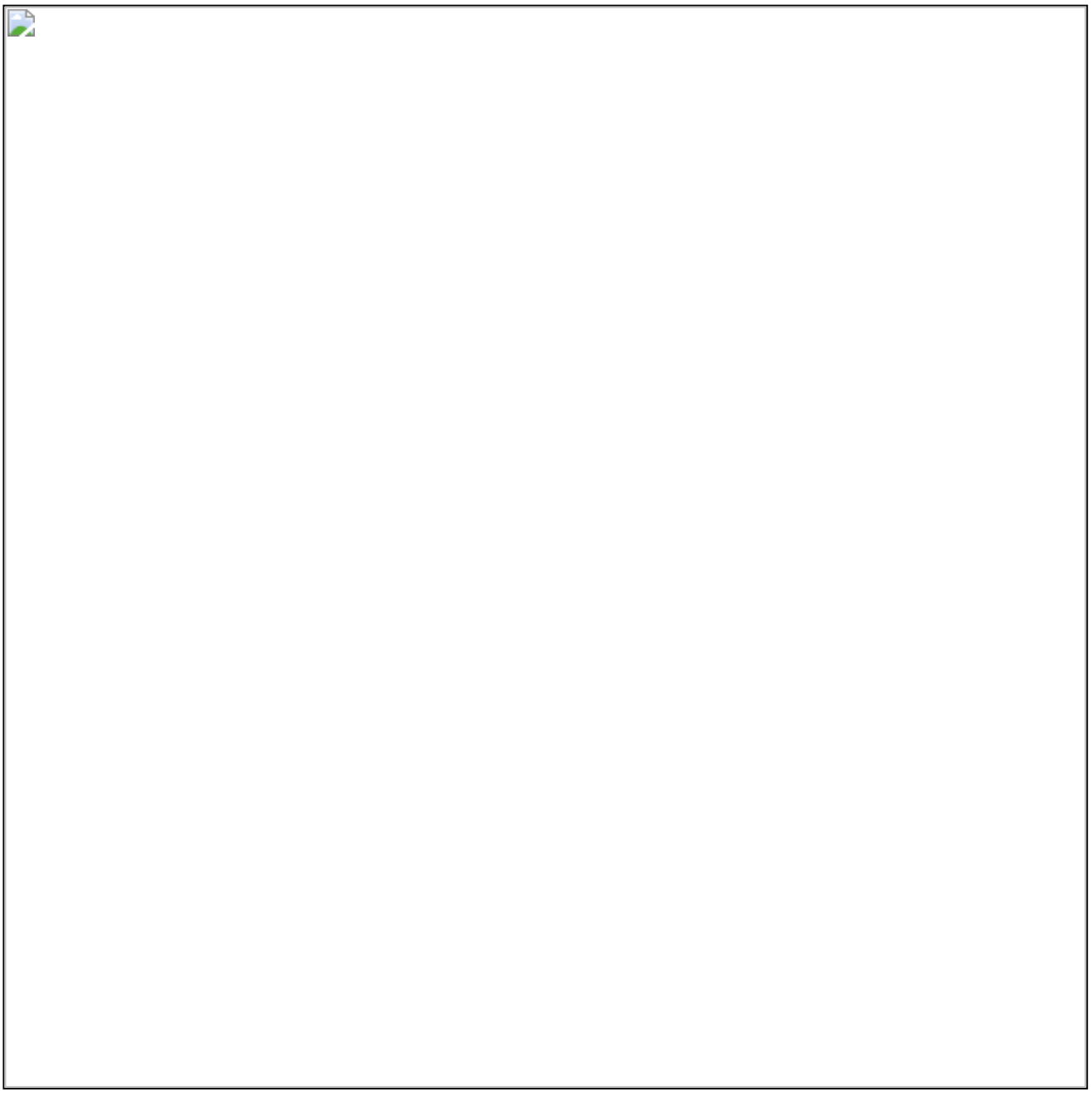
- Front door release handles
- Front footwells
- Front door map pockets
- Media hub

Copyright © 2016 Ford Motor Company

Interior Lighting - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

GWM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Ambient light color/intensity request	APIM	Indicates the color and brightness setting selected from the display interface. This commands the ambient color and brightness setting as requested by the operator.

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Ambient light color/intensity request	GWM	Indicates the color and brightness setting selected from the display interface. This commands the ambient color and brightness setting as requested by the operator.

Battery Saver

NOTE: *Time-out is 10 seconds if the vehicle is in factory mode or 1 minute if the vehicle is in transport mode.*

The BCM provides automatic shut-off of the courtesy and demand lamps after a time-out period when the ignition is OFF. A timer in the BCM starts when:

- the ignition transitions to OFF.
- the front or rear interior lamp was switched ON.
- any door becomes ajar.
- any button of a RKE transmitter is pressed.
- a door is unlocked using the passive entry feature.
- a valid code was entered on the keyless entry keypad.

When 10 minutes (30 minutes for demand lamps) have elapsed, the BCM automatically shuts off voltage to the lamps. The timer restarts (voltage is restored if the BCM is in battery saver mode) when:

- the ignition transitions out of OFF.
- the front or rear interior lamp was switched ON.
- any door becomes ajar.
- any button of a RKE transmitter is pressed.
- a door is unlocked using the passive entry feature.

Courtesy Lamps

The BCM controls the courtesy lighting functions and timing by monitoring inputs from the following:

- Ignition state
- Courtesy lamp switch (integrated into the front interior lamp assembly)
- Door ajar switches
- RKE system

The BCM sends a voltage signal to each door ajar switch. When the doors are closed, the circuit is switched to ground and the voltage is pulled low, indicating closed doors.

The BCM monitors the ignition state and inputs from the RKE system to determine when to energize the interior light relay. When the interior light relay is energized, voltage is provided to the interior lamps. The BCM controls the voltage side of the courtesy lamps for the illuminated entry and exit features.

For keyless entry, the BCM monitors input from the RKE transmitter (directly from the integrated keyhead transmitters (IKTs) to determine when to activate/deactivate the illuminated entry and exit functions.

When the puddle lamps are requested, the BCM provides voltage to the left and right puddle lamps.

The interior courtesy lamps can also be activated from the courtesy lamp switch mounted on the front interior lamp. The front interior lamp controls the courtesy lamp function of the rear interior lamps. When the courtesy lamp button is pressed on the front interior lamp, the courtesy lamp function for all the lamps is turned on/off. If any door is open, the BCM command overrides the function of the front courtesy lamp switch and activates the courtesy lamps.

There are three control switches on the front row lamp:

- Global On
- Global Off
- Door Defeat

The global on and off buttons activate or de-activate the courtesy lamps while the doors are closed.

The door defeat button deactivates the courtesy lamps so when the doors are opened the courtesy lamps remain off.

When the door defeat function is activated, the door defeat button illuminates amber in color and when de-activated, the button illuminates blue and the courtesy lamps return to normal operation.

If any door is open and the door defeat function is activated, the global on and off buttons will continue to function and activate or de-activate the courtesy lamps.

Illuminated Entry and Exit

The illuminated entry and exit features provide temporary illumination of the parking lamps, the dimmable backlighting, the ambient backlighting and the courtesy lamps. Refer to the table for additional information.

NOTE: *An arbitrator (software programming) within the BCM determines which actions take precedence over others (for example, an open door keeps the courtesy lamps on even when a command to lock the doors is received).*

Action	Parking Lamps	Courtesy Lamps	Dimmable Backlighting	Ambient Lighting
RKE transmitter or mechanical unlocking of the doors	On for 25 seconds	On for 25 seconds	On for 25 seconds	Off
RKE transmitter or mechanical locking of the doors	Off	Off	Off	Off 3 seconds after courtesy lamps turned off
Open a closed door after previously unlocking (no ignition state change since unlock)	Off (on for remaining time if unlocked from transmitter or mechanical unlocking of the doors)	On	Off	On
Close all doors	Off	On for 25 seconds	On for 25 seconds	On for 25 seconds
Ignition changed to ON	Off	On for 25 seconds	Off	On
Ignition changed out of ON	Off	On for 25 seconds	On for 25 seconds	On for 25 seconds
Open a door after the ignition is changed to OFF	Off	On	Off	On (color is red on the open door)
Ignition is OFF and doors are unlocked from the door lock switch	Off	On for 25 seconds	Off	Off
Ignition is OFF and doors are locked from the door lock switch	Off	Off	Off	Off

Demand Lamps

When the BCM is in not in battery saver mode, the interior light output is energized to provide voltage to the demand lamps.

The cargo lamps illuminate with the courtesy lamps. They can also be illuminated by using the cargo lamp switch.

Ambient Lighting

The ambient lighting subsystem consists of the BCM, and the Light Emitting Diodes (LEDs) located within the front door panels, media hub and front footwell areas. The ambient lighting is operational when the ignition is in any state other than OFF (the exception is when it is used in conjunction with the illuminated entry/exit features), the headlamps are on and the outside ambient light level is low. The BCM provides the voltage to the ambient lighting system, while the touchscreen (FDIM) is used to cycle through the different color variations or turn the ambient lighting feature on or off. A LIN circuit is routed from the BCM to all of the Light Emitting Diodes (LEDs). There are 3 Light Emitting Diodes (LEDs) (red, blue and green) housed within each LED assembly. By illuminating various color combinations, the Light Emitting Diodes (LEDs) are able to produce different colors of ambient light.

The APIM uses software to monitor the user interface from the touchscreen. Based on the ambient lighting system

selections made using the touchscreen, the APIM sends ambient light color request and ambient light intensity request messages over the communication network for color and brightness settings. The BCM retains the last color and brightness setting between uses.

Dark Car Feature

The dark car feature disables activation of courtesy lamps due to a door unlock, door ajar or removing the key from the ignition cylinder. The courtesy lamps may still be activated by the dome lamp switch, post crash alert, and perimeter and panic alarms.

The dark car feature is enabled/disabled through programmable parameters in the BCM.

Component Description

Door Ajar Switch

The door ajar switches (ground switches) each receive a voltage signal from the BCM on independent circuits. When the door is closed, the door ajar switch is closed, routing the signal to ground. When the door is opened, the door ajar switch opens.

Interior Lamp

All of the interior demand lamps receive voltage from the demand lamp relay (integrated into the BCM) when the battery saver feature is not active. This is used by each interior lamp to power the demand LED within it.

All of the interior courtesy lamps receive voltage from the interior lighting output of the BCM. This is used by each interior lamp to power the courtesy LED within it.

For vehicles without an overhead console, the front interior lamp provides ground to the rear lamp to activate/deactivate the rear lamp.

For vehicles with an overhead console, the front interior lamp sends a message to the rear lamps to activate/deactivate them through a LIN circuit.

Copyright © 2016 Ford Motor Company

Interior Lighting

DTC Chart: Body Control Module (BCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B1175:01	Driver Door Ajar Switch: General Electrical Failure	• If the courtesy lamps are always on, GO to Pinpoint Test C • If the courtesy lamps are inoperative, GO to Pinpoint Test A
B1176:01	Passenger Door Ajar Switch: General Electrical Failure	• If the courtesy lamps are always on, GO to Pinpoint Test C • If the courtesy lamps are inoperative, GO to Pinpoint Test A
B11C0:01	Driver Side Rear Door Ajar Switch: General Electrical Failure	• If the courtesy lamps are always on, GO to Pinpoint Test C • If the courtesy lamps are inoperative, GO to Pinpoint Test A
B11C1:01	Passenger Side Rear Door Ajar Switch: General Electrical Failure	• If the courtesy lamps are always on, GO to Pinpoint Test C • If the courtesy lamps are inoperative, GO to Pinpoint Test A
B12C2:11	Puddle Lamp: Circuit Short To Ground	GO to Pinpoint Test J
B12C2:15	Puddle Lamp: Circuit Short To Battery or Open	GO to Pinpoint Test J
B1313:11	Interior Lighting Output: Circuit Short To Ground	GO to Pinpoint Test B
B1313:15	Interior Lighting Output: Circuit Short To Battery or Open	• If the interior courtesy lamps are always on, GO to Pinpoint Test D • If the interior courtesy lamps are inoperative, GO to Pinpoint Test B
B145C:11	Ambient Lighting Power Supply Output: Circuit Short To Ground	GO to Pinpoint Test H
B145C:15	Ambient Lighting Power Supply Output: Circuit Short To Battery or Open	GO to Pinpoint Test H
B1465:00	Ambient Lighting Bus 1: No Sub Type	• If all the ambient lighting is inoperative, always on or does not change color/intensity, GO to Pinpoint Test H • If one or more of the ambient lighting Light Emitting Diodes (LEDs) are

	Information	inoperative or do not change color/intensity, GO to Pinpoint Test I
B1466:00	Ambient Lighting Bus 2: No Sub Type Information	• If all the ambient lighting is inoperative, always on or does not change color/intensity, GO to Pinpoint Test H • If one or more of the ambient lighting Light Emitting Diodes (LEDs) are inoperative or do not change color/intensity, GO to Pinpoint Test I
B1467:00	Ambient Lighting Bus 3: No Sub Type Information	• If all the ambient lighting is inoperative, always on or does not change color/intensity, GO to Pinpoint Test H • If one or more of the ambient lighting Light Emitting Diodes (LEDs) are inoperative or do not change color/intensity, GO to Pinpoint Test I
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The BCM cannot enable the output until the cause of the short is corrected. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test.
U3000:49	Control Module: Internal Electronic Failure	The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the BCM can withstand. The cause of the excessive current draw MUST be corrected before a new BCM is installed. ADDRESS all other Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
For other BCM Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart(s)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart: Interior Lighting

Symptom Chart

Condition	Possible Sources	Actions
A module does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The courtesy lamps do not illuminate with a door open	Refer to the Pinpoint Test	GO to Pinpoint Test A
One or more interior courtesy lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
A puddle lamp is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test G
All the courtesy lamps stay on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test C

The interior courtesy lamps stay on continuously	Refer to the Pinpoint Test	GO to Pinpoint Test D
One or more demand lamps are inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test E
The cargo lamp is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test J
The battery saver does not deactivate after time-out	Refer to the Pinpoint Test	GO to Pinpoint Test F
The ambient lighting is inoperative or always on	Refer to the Pinpoint Test	GO to Pinpoint Test H
One or more of the ambient lighting Light Emitting Diodes (LEDs) are inoperative or do not change color/intensity	Refer to the Pinpoint Test	GO to Pinpoint Test I

Pinpoint Tests

The Courtesy Lamps Do Not Illuminate With a Door Open

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1175:01	Driver Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the LH front door ajar circuit.
B1176:01	Passenger Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the RH front door ajar circuit.
B11C0:01	Driver Side Rear Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the LH rear door ajar circuit.
B11C1:01	Passenger Side Rear Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the RH rear door ajar circuit.

Possible Sources

- Wiring, terminals or connectors
- Door latch
- BCM

PINPOINT TEST A : THE COURTESY LAMPS DO NOT ILLUMINATE WITH A DOOR OPEN

NOTE: *Make sure the dark car feature is not enabled in the BCM. The dark car feature disables activation of courtesy lamps due to a door unlock, door ajar or removing the key from the ignition cylinder. The feature can be disabled using a scan tool.*
A1 CHECK THE OPERATION OF THE COURTESY LAMP FUNCTION FROM THE FRONT/DRIVER INTERIOR LAMP
• Ignition OFF. • Use the courtesy lamp switch on the front interior lamp to activate the overhead courtesy lamps. **Do the overhead courtesy lamps illuminate?**

Yes	GO to A2
No	GO to Pinpoint Test B

A2 CHECK THE DOOR AJAR SWITCH OPERATION

- Deactivate the overhead courtesy lamps from the front interior lamp.
- Disconnect suspect door latch.

Do the courtesy lamps illuminate?

Yes	For a front door, INSTALL a new front door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). For a rear door, INSTALL a new rear door latch. REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	GO to A3

A3 CHECK THE DOOR AJAR SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Disconnect BCM C2280D.
- Measure:

LH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C5005-3	Ω	Ground

LH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C6005-3	Ω	Ground

RH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C6011-6	Ω	Ground

RH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C5011-6	Ω	Ground

LH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C705-3	Ω	Ground

RH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C805-6	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A4
No	REPAIR the circuit.

A4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

One Or More Interior Courtesy Lamps Are Inoperative

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1313:11	Interior Lighting Output: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground from the interior lighting output circuit.
B1313:15	Interior Lighting Output: Circuit Short To Battery or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to voltage from the interior lighting output circuit.
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	This DTC sets when the BCM has temporarily shut down the output driver. The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The BCM cannot enable the output until the cause of the short is corrected, the Diagnostic Trouble Codes (DTCs) have been cleared and a successful self-test is run.
U3000:49	Control Module: Internal Electronic Failure	This DTC sets when the BCM has permanently shut down the output driver. The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the BCM can withstand. CORRECT the cause of the excessive current draw before installing a new BCM.

Possible Sources

- Wiring, terminals or connectors
- Interior lamp
- BCM

PINPOINT TEST B : ONE OR MORE INTERIOR COURTESY LAMPS ARE INOPERATIVE

B1 CHECK THE OPERATION OF ALL THE INTERIOR COURTESY LAMPS

- Open a door and observe the interior courtesy lamps.

Are all the interior lamps inoperative?

Yes	GO to B2
No	If only the overhead console lamp is inoperative, GO to B2 If only the rear interior lamp is inoperative, GO to B7

B2 CHECK FOR VOLTAGE TO THE OVERHEAD CONSOLE LAMP

- Close the door.
- Disconnect Overhead Console C930.
- Ignition ON.
- Open a door.
- Measure:

Overhead Console

Positive Lead	Measurement / Action	Negative Lead
C930-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to B6
No	GO to B3

B3 REPEAT THE ON DEMAND SELF TEST AND CHECK FOR VOLTAGE TO THE OVERHEAD

B3 REPEAT THE ON-DEMAND SELF-TEST AND CHECK FOR VOLTAGE TO THE OVERHEAD CONSOLE LAMP

- Using a diagnostic scan tool, perform the BCM self-test.
- Clear the Diagnostic Trouble Codes (DTCs) and repeat the self-test (required to enable the lamp output driver if DTC U1000:00 is present).
- Measure:

Overhead Console

Positive Lead	Measurement / Action	Negative Lead
C930-2		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new overhead console. REFER to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
No	GO to B4

B4 CHECK THE BCM (BODY CONTROL MODULE) COURTESY LAMP OUTPUT CIRCUIT FOR A SHORT TO GROUND

- Disconnect: BCM C2280F.
- Measure:

Overhead Console

Positive Lead	Measurement / Action	Negative Lead
C930-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B5
No	REPAIR the circuit. After the repair: If no Diagnostic Trouble Codes (DTCs) are present, TEST the system for normal operation. If DTC U1000:00 is present, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test (required to enable the lamp output driver if DTC U1000:00 is present). If DTC U3000:49 is present, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

B5 CHECK THE BCM (BODY CONTROL MODULE) COURTESY LAMP OUTPUT CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C930-2	Ω	C2280F-14

Is the resistance less than 3 ohms?

Yes	GO to B9
No	REPAIR the circuit.

B6 CHECK THE OVERHEAD CONSOLE LAMP GROUND CIRCUIT

- Measure:

Overhead Console

Positive Lead	Measurement / Action	Negative Lead
C930-2		C930-1

Is the voltage greater than 11 volts?

Yes	INSTALL a new overhead console. REFER to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
No	REPAIR the circuit.

B7 CHECK FOR VOLTAGE TO THE REAR INTERIOR LAMP

- Close the door.
- Disconnect: Rear Interior Lamp C901A and C901B.
- Ignition ON.
- Open the door.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C901B-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to B8
No	REPAIR the open circuit.

B8 CHECK THE REAR INTERIOR LAMP GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C901A-1		C901B-2

Is the voltage greater than 11 volts?

Yes	INSTALL a new rear interior lamp.
No	REPAIR the circuit.

B9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

All The Courtesy Lamps Stay On Continuously

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1175:01	Driver Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the LH front door ajar circuit.
B1176:01	Passenger Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the RH front door ajar circuit.
B11C0:01	Driver Side Rear Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the LH rear door ajar circuit.
B11C1:01	Passenger Side Rear Door Ajar Switch: General Electrical Failure	An on-demand DTC that sets when the BCM detects a fault on the RH rear door ajar circuit.

Possible Sources

- Wiring, terminals or connectors
- Ajar switch
- BCM

PINPOINT TEST C : ALL THE COURTESY LAMPS STAY ON CONTINUOUSLY

C1 CHECK THE DOOR AJAR SWITCH PARAMETER IDENTIFICATIONS (PIDS)

- Ignition ON.
- Using a diagnostic scan tool, view BCM Parameter Identifications (PIDs).
- Monitor the BCM DOOR_SW_DRVR, DOOR_SW_PSGR, DOOR_SW_LR and DOOR_SW_RR Parameter Identifications (PIDs) while opening and closing all the doors.

Do all the door ajar switch PID values agree with the door positions?

Yes	For the interior courtesy lamps, GO to Pinpoint Test D For the puddle lamps, GO to Pinpoint Test G
No	GO to C2

C2 BYPASS THE SUSPECT DOOR LATCH

- Disconnect suspect door latch.
- Connect a fused jumper wire:

LH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C5005-3		C5005-5

LH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C6005-3		C6005-5

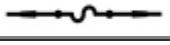
RH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C6011-6		C6011-4

RH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C5011-6		C5011-4

LH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C705-3		C705-5

RH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C805-6		C805-4

- Using a diagnostic scan tool, view BCM Parameter Identifications (PIDs).
- Monitor the BCM DOOR_SW_DRVR, DOOR_SW_PSGR, DOOR_SW_LR and DOOR_SW_RR Parameter Identifications (PIDs).

Does the PID indicate the door in question is closed?

Yes	REMOVE the fused jumper wire. For a front door, INSTALL a new front door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). For a rear door, INSTALL a new rear door latch. REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	REMOVE the fused jumper wire. GO to C3

C3 BYPASS THE DOOR LATCH GROUND CIRCUIT

- Connect a fused jumper wire:

LH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C5005-3		Ground

LH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C6005-3		Ground

RH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C6011-6		Ground

RH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead

Positive Lead	Measurement / Action	Negative Lead
C5011-6		Ground

LH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C705-3		Ground

RH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C805-6		Ground

- Monitor the BCM DOOR_SW_DRVR, DOOR_SW_PSGR, DOOR_SW_LR and DOOR_SW_RR Parameter Identifications (PIDs).

Does the PID indicate the door in question is closed?

Yes	REMOVE the fused jumper wire. REPAIR the ground circuit for an open.
No	REMOVE the fused jumper wire. GO to C4

C4 CHECK THE SUSPECT DOOR AJAR SWITCH INPUT CIRCUIT FOR AN OPEN

- Disconnect BCM C2280D.
- Measure:

LH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C5005-3	Ω	C2280D-33

LH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C6005-3	Ω	C2280D-33

RH Front Door Ajar Switch - LHD

Positive Lead	Measurement / Action	Negative Lead
C6011-6	Ω	C2280D-21

RH Front Door Ajar Switch - RHD

Positive Lead	Measurement / Action	Negative Lead
C5011-6	Ω	C2280D-21

LH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C705-3	Ω	C2280D-46

RH Rear Door Ajar Switch

Positive Lead	Measurement / Action	Negative Lead
C805-6	Ω	C2280D-19

Is the resistance less than 3 ohms?

Yes	GO to C5
No	REPAIR the door ajar input circuit in question.

C5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

The Interior Courtesy Lamps Stay On Continuously

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1313:15	Interior Lighting Output: Circuit Short To Battery or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to voltage from the interior lighting output circuit.

Possible Sources

- Wiring, terminals or connectors
- Interior lamp
- BCM

PINPOINT TEST D : THE INTERIOR COURTESY LAMPS STAY ON CONTINUOUSLY

D1 CHECK THE OPERATION OF ALL THE INTERIOR COURTESY LAMPS

- Close all doors and observe the courtesy lamps.

Are the interior courtesy lamp(s) always on?

Yes	GO to D2
No	The system is operating correctly at this time.

D2 ISOLATE THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect: BCM C2280F.
- Ignition ON.

Do the interior courtesy lamps continue to illuminate?

Yes	GO to D3
No	GO to D4

D3 CHECK THE BCM (BODY CONTROL MODULE) COURTESY LAMP OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect For vehicles with overhead console, Overhead Console C930.
- Disconnect For vehicles without overhead console, Rear Interior Lamps C901A and C901B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-13		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	For vehicles without an overhead console, INSTALL a new rear interior lamp. For vehicles with an overhead console, INSTALL a new overhead console. REFER to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).

D4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

One Or More Demand Lamps Are Inoperative

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- Demand lamp
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the interior lamps for damage.

PINPOINT TEST E : ONE OR MORE DEMAND LAMPS ARE INOPERATIVE

E1 CHECK THE DEMAND LAMP OPERATION

- Ignition ON.
- Check the operation of the LH vanity mirror, RH vanity mirror and overhead lamps.

Do any of the LH vanity mirror, RH vanity mirror, rear interior lamp or overhead map lamps illuminate?

Yes	If a vanity mirror lamp is inoperative, GO to E3 If an overhead map lamp is inoperative, GO to E5

No	VERIFY BCM fuse(s) is OK. If OK, GO to E2 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

E2 CHECK THE DEMAND LAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280F.
- Disconnect LH Vanity Mirror Lamp C907.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C907-1	Ω	C2280F-14

Is the resistance less than 3 ohms?

Yes	GO to E7
No	REPAIR the circuit.

E3 CHECK THE VANITY MIRROR VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Inoperative LH Vanity Mirror Lamp C907 or RH Vanity Mirror Lamp C906.
- Ignition ON.
- Measure:

LH Vanity Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C907-1	V	Ground

RH Vanity Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C906-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to E4
No	REPAIR the circuit.

E4 CHECK THE VANITY MIRROR GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Vanity Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead

C907-1		C907-2

RH Vanity Mirror Lamp

Positive Lead	Measurement / Action	Negative Lead
C906-1		C906-2

Is the voltage greater than 11 volts?

Yes	INSTALL a new sun visor for the lamp in question.
No	REPAIR the circuit.

E5 CHECK THE OVERHEAD INTERIOR LAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Overhead Console C930.
- Ignition ON.
- Measure:

Overhead Console

Positive Lead	Measurement / Action	Negative Lead
C930-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to E6
No	REPAIR the circuit.

E6 CHECK THE OVERHEAD INTERIOR LAMP GROUND CIRCUIT FOR AN OPEN

- Measure:

Overhead Console

Positive Lead	Measurement / Action	Negative Lead
C930-2		C930-1

Is the voltage greater than 11 volts?

Yes	INSTALL a new overhead console. REFER to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
No	REPAIR the circuit.

E7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

The Battery Saver Does Not Deactivate After Time-out

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- BCM

PINPOINT TEST F : THE BATTERY SAVER DOES NOT DEACTIVATE AFTER TIME-OUT

F1 CHECK THE DEMAND LAMP VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: BCM C2280F.
- Turn any demand (map or vanity mirror) lamp on.

Does the demand lamp turn on?

Yes	REPAIR the circuit.
No	GO to F2

F2 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

A Puddle Lamp Is Inoperative Or Always On

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- Puddle lamp
- Exterior mirror

Visual Inspection and Diagnostic Pre-checks

- Inspect the exterior mirror for damage.

PINPOINT TEST G : A PUDDLE LAMP IS INOPERATIVE OR ALWAYS ON

G1 CHECK THE OPERATION OF THE INTERIOR COURTESY LAMPS

- Ignition ON.
- Ignition OFF.
- Open and close a door.
- Observe the interior courtesy lamp operation for 30 seconds.

Do the interior courtesy lamps operate correctly?

Yes	If a puddle lamp is always on, GO to G2 If a puddle lamp is inoperative, GO to G3
No	REFER to the Interior Lamps Symptom Chart in this section and diagnose the interior courtesy lamps.

G2 CHECK THE PUDDLE LAMP POWER SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect BCM C2280F.
- Ignition ON.

Do the puddle lamps continue to illuminate?

Yes	REPAIR the circuit.
No	GO to G8

G3 CHECK THE MIRROR OPERATION

- Ignition ON.
- Using the exterior mirror control switch, operate the exterior power mirrors.

Do the exterior power mirrors operate?

Yes	GO to G4
No	REFER to: Exterior Rear View Mirrors (501-09A Exterior Rear View Mirrors, Diagnosis and Testing).

G4 CHECK FOR VOLTAGE TO THE PUDDLE LAMP

- Ignition OFF.
- Disconnect Inoperative LH Exterior Mirror C520 or RH Exterior Mirror C6262 (LHD).
- Disconnect Inoperative LH Exterior Mirror C626 or RH Exterior Mirror C5201 (RHD).
- Ignition ON.
- Open any door.
- Measure:

LH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C520-2		Ground

LH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C626-2		Ground

RH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C6262-2		Ground

RH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C5201-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to G7
No	GO to G5

G5 CHECK THE PUDDLE LAMP VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

LH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C520-2	Ω	Ground

LH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C626-2	Ω	Ground

RH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C6262-2	Ω	Ground

RH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C5201-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to G6
No	REPAIR the circuit. After the repair: If no Diagnostic Trouble Codes (DTCs) are present, TEST the system for normal operation. If DTC U1000:00 is present, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test (required to enable the lamp output driver if DTC U1000:00 is present). If DTC U3000:49 is present, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

G6 CHECK THE PUDDLE LAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Measure:

LH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C520-2	Ω	C2280F-26

LH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C626-2	Ω	C2280F-26

RH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C6262-2	Ω	C2280F-26

RH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C5201-2	Ω	C2280F-26

Is the resistance less than 3 ohms?

Yes	GO to G8
No	REPAIR the circuit.

G7 CHECK THE EXTERIOR MIRROR GROUND CIRCUIT FOR AN OPEN

- Measure:

LH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C520-2	+ V −	C520-10

LH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C626-2	+ V −	C626-10

RH Exterior Mirror (LHD)

Positive Lead	Measurement / Action	Negative Lead
C6262-2		C6262-10

RH Exterior Mirror (RHD)

Positive Lead	Measurement / Action	Negative Lead
C5201-2		C5201-10

Is the voltage greater than 11 volts?

Yes	CHECK the exterior mirror jumper harness between the vehicle harness and the puddle lamp for open circuits and damaged or pushed-out pins. If the jumper harness is OK, INSTALL a new puddle lamp. If the jumper harness is not OK, REPAIR the jumper harness.
No	REPAIR the circuit.

G8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

The Ambient Lighting Is Inoperative Or Always On

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B145C:11	Ambient Lighting Power Supply Output: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground from the ambient light module conditioned power supply output circuit.
B145C:15	Ambient Lighting Power Supply Output: Circuit Short To Battery or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to voltage from the ambient light module conditioned power supply output circuit.
B1465:00	Ambient Lighting Bus 1: No Sub Type Information	A continuous memory DTC that sets when the BCM detects a fault on an ambient lighting LIN circuit.
B1467:00	Ambient Lighting Bus 3: No Sub Type Information	A continuous memory DTC that sets when the BCM detects a fault on an ambient lighting LIN circuit.
U1000:00	Solid State Driver Protection Active -Driver Disabled: No Sub Type Information	This DTC sets when the BCM has temporarily shut down the output driver. The module has temporarily disabled an output because an excessive current draw exists (such as a short to ground). The BCM cannot enable the output until the cause of the short is corrected, the Diagnostic Trouble Codes (DTCs) have been cleared and a successful self-test is run.
U3000:49	Control Module: Internal Electronic Failure	This DTC sets when the BCM has permanently shut down the output driver. The module has permanently disabled an output because an excessive current draw fault (such as a short to ground) has exceeded the limits that the BCM can withstand. CORRECT the cause of the excessive current draw before installing a new BCM.

Possible Sources

- Wiring, terminals or connectors
- FDIM
- BCM

PINPOINT TEST H : THE AMBIENT LIGHTING IS INOPERATIVE OR ALWAYS ON

H1 CHECK THE FDIM (FRONT DISPLAY INTERFACE MODULE) AUDIO CONTROLS

- Ignition ON.
- Check the operation of the audio system using the FDIM (touchscreen) controls.

Does the audio system operate correctly from the touchscreen controls?

Yes	GO to H2
No	REFER to: Information and Entertainment System (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Diagnosis and Testing). REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).

H2 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B1465:00, B1467:00, B145C:11 or B145C:15 present?

Yes	For DTC B1465:00 or B1467:00, GO to H3 For DTC B145C:11, GO to H6 For DTC B145C:15, GO to H7
No	GO to H9

H3 CHECK THE AMBIENT LIGHTING LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280F.
- Ignition ON.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-13	V	Ground

Is voltage present?

Yes	REPAIR the circuit.
No	GO to H4

H4 CHECK THE AMBIENT LIGHTING LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect LH Footwell Lamp C209.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-13	Ω	C209-2

Is the resistance less than 3 ohms?

Yes	GO to H5
No	REPAIR the circuit.

H5 CHECK THE AMBIENT LIGHTING LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Disconnect RH Footwell Lamp C266.
- Disconnect Driver Interior Front Door Handle Ambient Lighting Lamp C506 LHD / C606 RHD.
- Disconnect Passenger Interior Front Door Handle Ambient Lighting Lamp C6016 LHD / C5016 RHD.
- Disconnect Driver Door Map Pocket Ambient Lighting Lamp C5172 LHD / C6150 RHD.
- Disconnect Passenger Door Map Pocket Ambient Lighting Lamp C650 LHD / C572 RHD.
- Disconnect Media Hub Illumination C3510.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-13	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to H9
No	REPAIR the circuit.

H6 CHECK THE AMBIENT LIGHTING VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Disconnect BCM C2280F.
- Disconnect LH Footwell Lamp C209.
- Disconnect RH Footwell Lamp C266.
- Disconnect Driver Interior Front Door Handle Ambient Lighting Lamp C506 LHD / C606 RHD.
- Disconnect Passenger Interior Front Door Handle Ambient Lighting Lamp C6016 LHD / C5016 RHD.
- Disconnect Driver Door Map Pocket Ambient Lighting Lamp C5172 LHD / C6150 RHD.
- Disconnect Passenger Door Map Pocket Ambient Lighting Lamp C650 LHD / C572 RHD.
- Disconnect Media Hub Illumination C3510.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to H9
No	REPAIR the circuit. After the repair: If no Diagnostic Trouble Codes (DTCs) are present, TEST the system for normal operation. If DTC U1000:00 is present, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test (required to enable the lamp output driver if DTC U1000:00 is present). If DTC U3000:49 is present, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

H7 CHECK THE AMBIENT LIGHTING VOLTAGE CIRCUIT FOR AN OPEN

- Disconnect BCM C2280F.
- Disconnect LH Front Footwell Lamp C209.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-4	Ω	C209-1

Is the resistance greater than 10,000 ohms?

Yes	GO to H8
No	REPAIR the circuit.

H8 CHECK THE AMBIENT LIGHTING VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-4		Ground

Is voltage present?

Yes	REPAIR the circuit.
No	GO to H9

H9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

One Or More Of The Ambient Lighting LEDs Are Inoperative Or Do Not Change Color/Intensity

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1465:00	Ambient Lighting Bus 1: No Sub Type Information	Sets when the BCM detects a fault in the LIN circuit to the door ambient lighting Light Emitting Diodes (LEDs).
B1467:00	Ambient Lighting Bus 3: No Sub Type Information	Sets when the BCM detects a fault in the LIN circuit to the footwell and center console ambient lighting Light Emitting Diodes (LEDs).

Possible Sources

- Wiring, terminals or connectors
- Ambient lighting LED

- BCM

PINPOINT TEST I : ONE OR MORE OF THE AMBIENT LIGHTING LIGHT EMITTING DIODES (LEDS) ARE INOPERATIVE OR DO NOT CHANGE COLOR/INTENSITY

I1 CHECK THE AMBIENT LIGHTING LIGHT EMITTING DIODES (LEDS)

- Ignition ON.
- Place the headlamp switch in the PARKING LAMPS ON position.
- Observe the operation of all the ambient lighting Light Emitting Diodes (LEDs).

Are all the ambient lighting Light Emitting Diodes (LEDs) inoperative?

Yes	GO to Pinpoint Test H
No	GO to I2

I2 CHECK FOR VOLTAGE TO THE LED (LIGHT EMITTING DIODE)

- Ignition OFF.
- Disconnect Inoperative ambient lighting LED.
- Place the headlamp switch in the PARKLAMPS position.
- Measure:

Media Hub Illumination

Positive Lead	Measurement / Action	Negative Lead
C3510-1	V	Ground

LH Footwell Lamp

Positive Lead	Measurement / Action	Negative Lead
C209-1	V	Ground

RH Footwell Lamp

Positive Lead	Measurement / Action	Negative Lead
C266-1	V	Ground

Driver Interior Front Door Handle Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C506-1	V	Ground

Driver Interior Front Door Handle Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead

C606-1		Ground

Passenger Interior Front Door Handle Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C6016-1		Ground

Passenger Interior Front Door Handle Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C5016-1		Ground

Driver Door Map Pocket Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C5172-1		Ground

Driver Door Map Pocket Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C6150-1		Ground

Passenger Door Map Pocket Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C650-1		Ground

Passenger Door Map Pocket Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C572-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to I3

No	REPAIR the LED voltage supply circuit in question.

I3 CHECK THE LED (LIGHT EMITTING DIODE) GROUND CIRCUIT FOR AN OPEN

- Measure:

Media Hub Illumination

Positive Lead	Measurement / Action	Negative Lead
C3510-1		C3510-3

LH Footwell Lamp

Positive Lead	Measurement / Action	Negative Lead
C209-1		C209-3

RH Footwell Lamp

Positive Lead	Measurement / Action	Negative Lead
C266-1		C266-3

Driver Interior Front Door Handle Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C506-1		C506-3

Driver Interior Front Door Handle Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C606-1		C606-3

Passenger Interior Front Door Handle Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C6016-1		C6016-3

Passenger Interior Front Door Handle Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C5016-1		C5016-3

Driver Door Map Pocket Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C5172-1		C5172-3

Driver Door Map Pocket Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C6150-1		C6150-3

Passenger Door Map Pocket Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C650-1		C650-3

Passenger Door Map Pocket Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C572-1		C572-3

Is the voltage greater than 11 volts?

Yes	GO to I4
No	REPAIR the ground circuit in question.

I4 CHECK THE AMBIENT LIGHTING LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Ignition OFF.
- Place the headlamp switch in the OFF position.
- Disconnect BCM C2280G.
- Measure:

Media Hub Illumination

Positive Lead	Measurement / Action	Negative Lead
C2510-2		C2280G-13

C3510-2	Ω	C2280G-13

LH Footwell Lamp

Positive Lead	Measurement / Action	Negative Lead
C209-2	Ω	C2280G-13

RH Footwell Lamp

Positive Lead	Measurement / Action	Negative Lead
C266-2	Ω	C2280G-13

Driver Interior Front Door Handle Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C506-2	Ω	C2280G-13

Driver Interior Front Door Handle Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C606-2	Ω	C2280G-13

Passenger Interior Front Door Handle Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C6016-2	Ω	C2280G-13

Passenger Interior Front Door Handle Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C5016-2	Ω	C2280G-13

Driver Door Map Pocket Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead

C5172-2	Ω	C2280G-13

Driver Door Map Pocket Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C6150-2	Ω	C2280G-13

Passenger Door Map Pocket Ambient Lighting Lamp - LHD

Positive Lead	Measurement / Action	Negative Lead
C650-2	Ω	C2280G-13

Passenger Door Map Pocket Ambient Lighting Lamp - RHD

Positive Lead	Measurement / Action	Negative Lead
C572-2	Ω	C2280G-13

Is the resistance less than 3 ohms?

Yes	INSTALL a new ambient lighting LED in question.
No	REPAIR the circuit.

The Cargo Lamp Is Inoperative Or Always On

Refer to Wiring Diagrams Cell 89 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B12C2:11	Puddle Lamp: Circuit Short To Ground	A continuous memory and on-demand DTC that sets when the BCM detects a short to ground from the cargo and trailer assist lamps output circuit.
B12C2:15	Puddle Lamp: Circuit Short To Battery or Open	A continuous memory and on-demand DTC that sets when the BCM detects an open or short to voltage from the cargo and trailer assist lamps output circuit.

Possible Sources

- Wiring, terminals or connectors
- Cargo lamp bulb
- Cargo lamp (integrated into the high mounted stoplamp)
- Cargo lamp switch
- BCM

PINPOINT TEST J : THE CARGO LAMP IS INOPERATIVE OR ALWAYS ON

J1 CHECK THE OPERATION OF THE CARGO AND PUDDLE LAMPS

- Close all the doors and observe the cargo and puddle lamps.
- Observe the cargo and puddle lamp operation for 30 seconds.

Do the lamps stay on after 30 seconds?

Yes	GO to J2
No	If only the cargo lamp is inoperative, refer to GO to J6 If all cargo and puddle lamps are inoperative, GO to Pinpoint Test G

J2 CHECK THE CARGO LAMP SWITCH INPUT CIRCUIT FOR GROUND

- Ignition OFF.
- Disconnect BCM C2280D.
- Make sure the truck bed lamp switch is OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280D-8	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to J5
No	GO to J3

J3 ISOLATE THE CARGO LAMP SWITCH

- Disconnect Truck Bed Lamp Switch C221.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280D-8	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to J4
No	REPAIR the circuit.

J4 CHECK THE CARGO LAMP SWITCH GROUND CIRCUIT FOR AN OPEN

- Measure:

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C221-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new truck bed lamp switch.
No	REPAIR the circuit.

J5 CHECK THE BCM (BODY CONTROL MODULE) CARGO/PUDDLE LAMP OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280F.
- Ignition ON.

Are the lamps still illuminated?

Yes	REPAIR the circuit.
No	GO to J11

J6 CHECK FOR VOLTAGE TO THE CARGO LAMP

- Disconnect High Mounted Stoplamp C475 W/O Sports Bar.
- Disconnect High Mounted Stoplamp C904 With Sports Bar.
- Ignition ON.
- Open a door.
- Measure:

W/O Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C475-3	V	Ground

With Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C904-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to J10
No	GO to J7

J7 REPEAT THE ON-DEMAND SELF-TEST AND CHECK FOR VOLTAGE TO THE CARGO LAMP

- Using a diagnostic scan tool, perform the BCM self-test.

- Clear the Diagnostic Trouble Codes (DTCs) and repeat the self-test (required to enable the lamp output driver if DTC U1000:00 is present).
- Measure:

W/O Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C475-3		Ground

With Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C904-1		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new high mounted stoplamp. REFER to: High Mounted Stoplamp (417-01 Exterior Lighting, Removal and Installation).
No	GO to J8

J8 CHECK THE BCM (BODY CONTROL MODULE) CARGO LAMP OUTPUT CIRCUIT FOR A SHORT TO GROUND

- Disconnect BCM C2280F.
- Measure:

W/O Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C475-3	Ω	Ground

With Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C904-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to J9
No	REPAIR the circuit. After the repair: If no Diagnostic Trouble Codes (DTCs) are present, TEST the system for normal operation. If DTC U1000:00 is present, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test (required to enable the lamp output driver if DTC U1000:00 is present). If DTC U3000:49 is present, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules,

	Removal and Installation).

J9 CHECK THE BCM (BODY CONTROL MODULE) CARGO LAMP OUTPUT CIRCUIT FOR AN OPEN

- Measure:

Halogen High Mounted Stoplamp

Positive Lead	Measurement / Action	Negative Lead
C475-3	Ω	C2280F-26

LED High Mounted Stoplamp

Positive Lead	Measurement / Action	Negative Lead
C904-1	Ω	C2280F-26

Is the resistance less than 3 ohms?

Yes	GO to J11
No	REPAIR the circuit.

J10 CHECK THE CARGO LAMP GROUND CIRCUIT

- Measure:

W/O Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C475-3	V	C475-2

With Sports Bar

Positive Lead	Measurement / Action	Negative Lead
C904-1	V	C904-3

Is the voltage greater than 11 volts?

Yes	INSTALL a new high mounted stoplamp. REFER to: High Mounted Stoplamp (417-01 Exterior Lighting, Removal and Installation).
No	REPAIR the circuit.

J11 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:

- corrosion (install new connector or terminals – clean module pins)
- damaged or bent pins – install new terminals/pins
- pushed-out pins – install new pins as necessary

- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. CLEAR the Diagnostic Trouble Codes (DTCs).

Copyright © 2016 Ford Motor Company

Center Interior Lamp

Special Tool(s) / General Equipment

Flat-Bladed Screwdriver

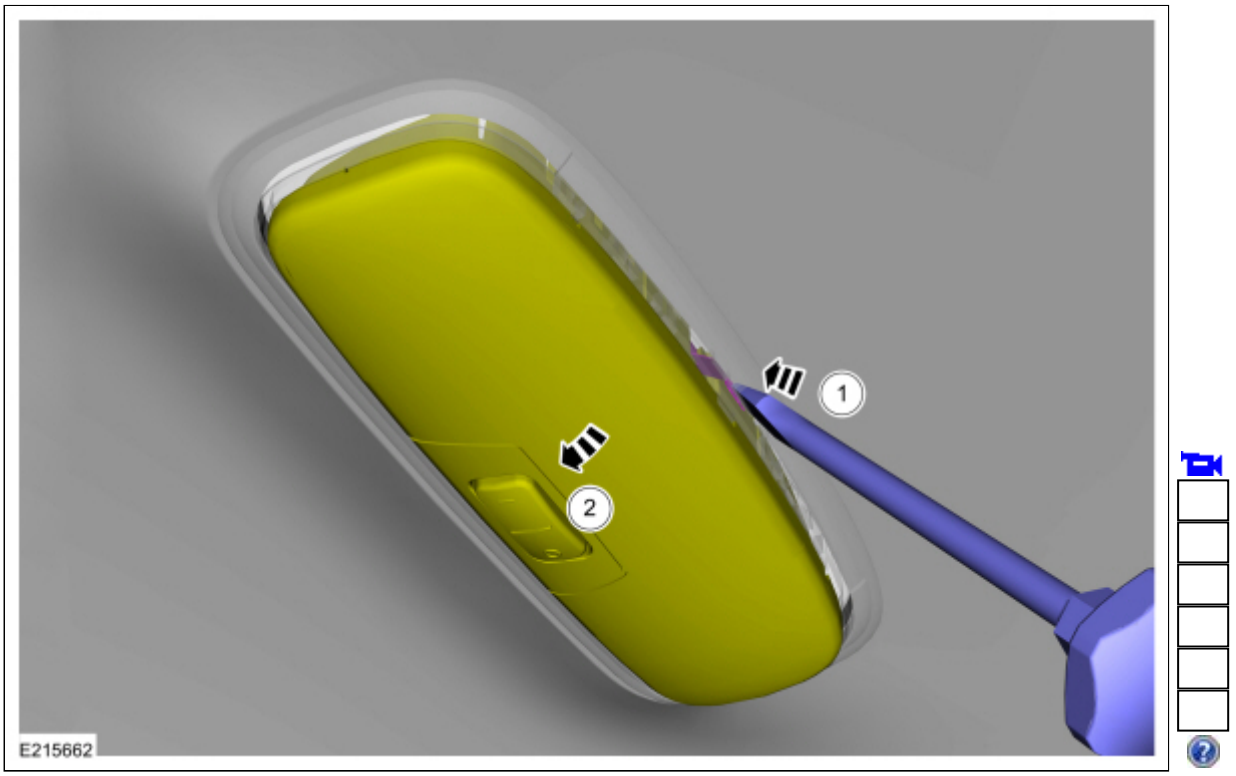
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

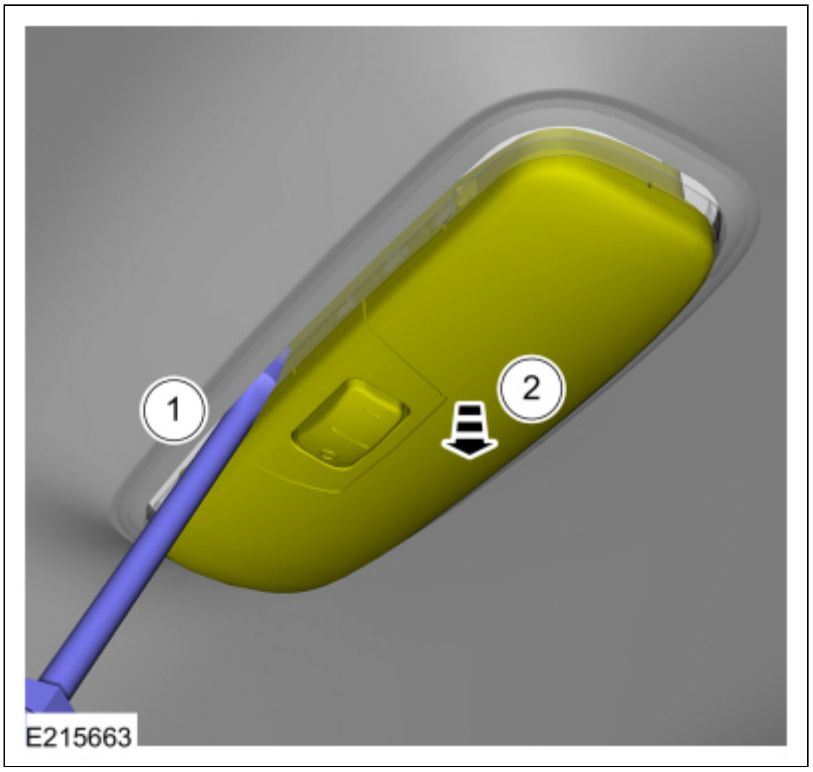
1. **NOTICE: Take extra care when handling the component.**

   NOTICE: Take extra care not to scratch the Interiorlamp lens.

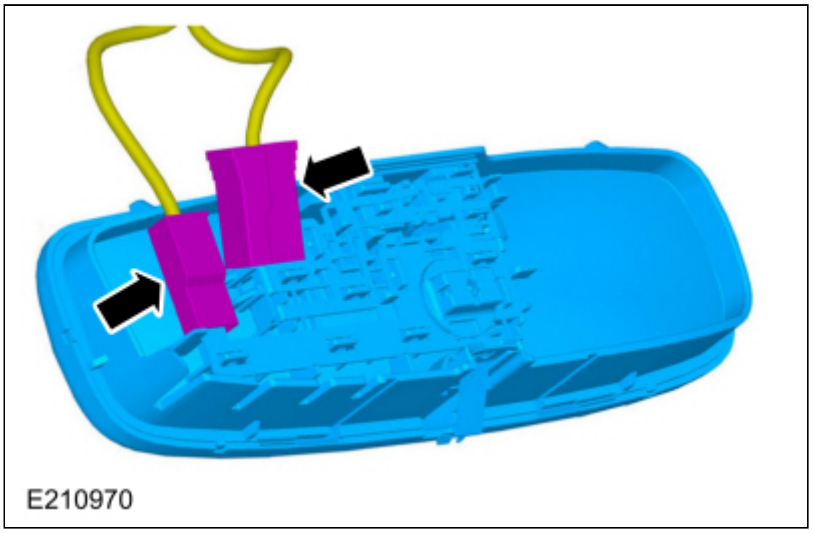
   Use the General Equipment: Flat-Bladed Screwdriver



2. Use the General Equipment: Flat-Bladed Screwdriver



3. **NOTE:** *Before remove the connectors, pull plastic housing of the connector to prevent damage.*



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Daytime Running Lamps (DRL)

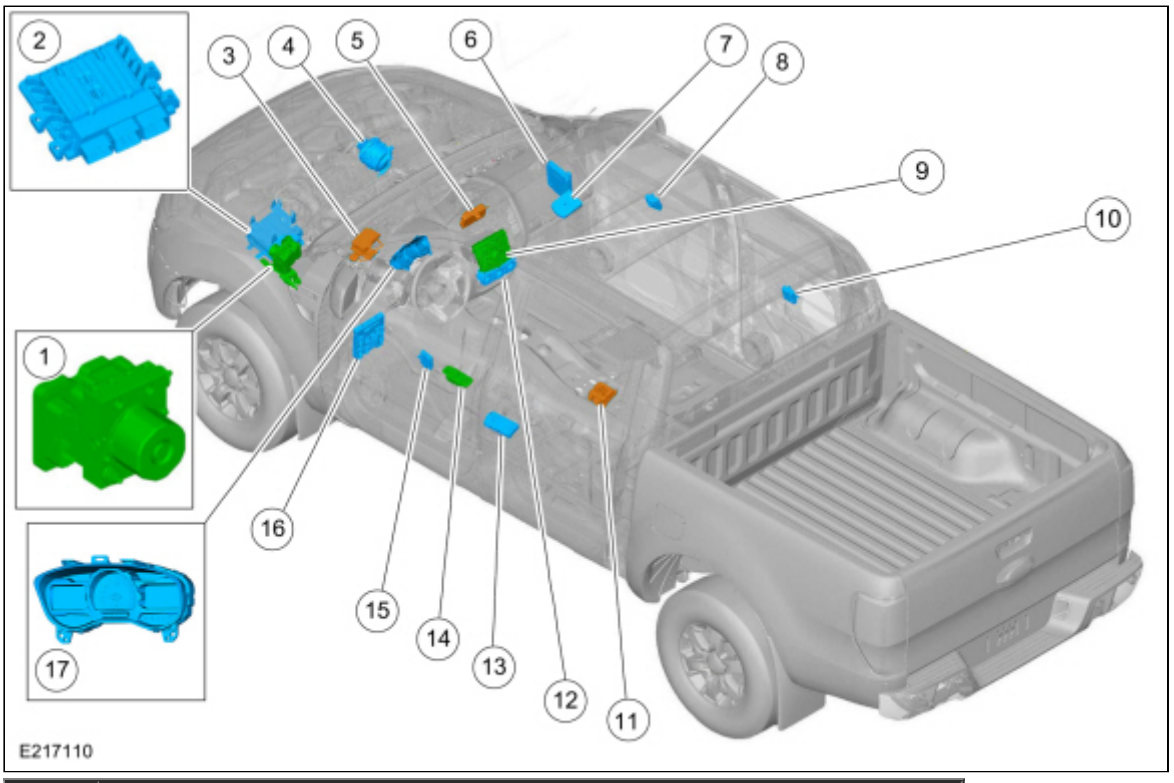
In areas in which daytime running lamps (DRL) are required by law, the body control module (BCM) switches on the DRL when the ignition is switched on.

The configuration in the BCM can be changed using the Integrated Diagnostic System (IDS). This makes aftermarket configuration of vehicles fitted with DRL possible (e.g. on customer request or in response to changes in the law).

Vehicles with DRL can be combined with autolamps.

Copyright © 2016 Ford Motor Company

Communications Network - Component Location



Item	Description
1	ABS module or ESP module
2	Powertrain control module (PCM)
3	Anti theft control module
4	Alternator
5	Multifunction display/Navigation multifunction display
6	Transmission control module
7	Bluetooth/Voice control
8	Passenger front door module
9	Audio head unit
10	Rear door module
11	Restraints control module
12	Dual zone electronic temperature control
13	Trailer module
14	Multi-power window switch pack
15	Driver front door module
16	Body control module (BCM)
17	Instrument panel cluster

Copyright © 2016 Ford Motor Company

Communications Network - Overview

Overview

Multiplexing allows 2 or more electronic modules (nodes) to communicate over a twisted wire pair [data (+) and data (-)] network. The information or messages that can be communicated on these wires consists of commands, status or data. Multiplexing reduces the weight of the vehicle by reducing the number of redundant components and electrical wiring.

The vehicle has 2 module communication networks connected to the DLC, located under the instrument panel. The communication networks are:

- HS-CAN1
- HS-CAN2

The vehicle has 2 module communication networks that communicate on the network, but do not communicate directly with the diagnostic scan tool. The GWM translates the messages on these 2 networks, and transfers the signals to the HS-CAN2 to communicate with the diagnostic scan tool. The communication networks are:

- HS-CAN3
- MS-CAN)

Copyright © 2016 Ford Motor Company

Communications Network

DTC Chart: Gateway Module (GWM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC	Description	Action
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CHECK the vehicle service history for recent service actions related to this module. This DTC sets due to incomplete or incorrect PMI procedures. INSTALL As-Built data from Professional Technician Society (PTS) following diagnostic scan tool instructions under Module Programming>As-Built.
U3000:44	RAM Error During Normal Operation: Data Memory Failure	RETRIEVE all Continuous Memory Diagnostic Trouble Codes (CMDTCs). If DTC U3000:44 is retrieved, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation). If DTC U3000:44 is not retrieved, the module is operating correctly at this time. The concern may have been caused by an intermittent concern.
U3000:45	RAM Error During Normal Operation: Program Memory Failure	RETRIEVE all Continuous Memory Diagnostic Trouble Codes (CMDTCs). If DTC U3000:45 is retrieved, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation). If DTC U3000:45 is not retrieved, the module is operating correctly at this time. The concern may have been caused by an intermittent concern.
U3000:49	RAM Error During Normal Operation: Internal Electronic Failure	RETRIEVE all Continuous Memory Diagnostic Trouble Codes (CMDTCs). If DTC U3000:49 is retrieved, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation). If DTC U3000:49 is not retrieved, the module is operating correctly at this time. The concern may have been caused by an intermittent concern.

Symptom Chart(s)

Symptom Chart: Communication Network

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The vehicle does not start with the diagnostic scan tool connected to the DLC and/or multiple malfunction indicators are only on when the diagnostic scan tool is connected to the DLC	Refer to the Pinpoint Test	GO to Pinpoint Test Z
No HS-CAN1 communication, all modules are not responding	Refer to the Pinpoint Test	GO to Pinpoint Test V
No HS-CAN2 communication, all modules are not responding	Refer to the Pinpoint Test	GO to Pinpoint Test W

No HS-CAN3 communication, all modules are not responding	Refer to the Pinpoint Test	GO to Pinpoint Test X
No MS-CAN communication, all modules are not responding	Refer to the Pinpoint Test	GO to Pinpoint Test Y
The PCM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test A
The ABS module does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test B
The RCM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test C
The SCCM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test D
The IPC does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test E
The BCM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test F
The FCIM module does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test G
The ACM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test H
The FCDIM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test I
The IPMA does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test J
The GPSM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test K
The APIM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test L
The DACMC does not respond to the diagnostic scan tool (integrated with the ACM)	Refer to the Pinpoint Test	GO to Pinpoint Test H
The RTM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test M
The PSCM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test N
The DDM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test O
The PDM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test P
The CCM does not respond to the diagnostic scan tool	Refer to the Pinpoint	GO to Pinpoint

	Test	Test Q
The HUD module does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test R
The TRM does not respond the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test S
The SCCM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test T
The GWM does not respond to the diagnostic scan tool	Refer to the Pinpoint Test	GO to Pinpoint Test U
No power to the DLC	Refer to the Pinpoint Test	GO to Pinpoint Test Z

Pinpoint Tests

The Powertrain Control Module (PCM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 23 for schematic and connector information.

Refer to Wiring Diagrams Cell 24 for schematic and connector information.

Refer to Wiring Diagrams Cell 25 for schematic and connector information.

Normal Operation and Fault Conditions

The PCM communicates with the diagnostic scan tool through the HS-CAN1. An IDS session cannot be established if the PCM communication fails when attempting to identify the vehicle.

Possible Sources

- Fuse
- Wiring, terminals and connectors
- PCM

PINPOINT TEST A : THE POWERTRAIN CONTROL MODULE (PCM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

A1 VERIFY WHETHER OTHER HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) MODULES PASS THE NETWORK TEST

- Using a diagnostic scan tool, perform the network test.

Is the text "pass" or a DTC listed next to any of the following modules (if equipped): APIM, BCM, or PCM?

Yes	If "pass" or a DTC was listed next to the PCM, a network fault is not currently present. If "pass" or a DTC was listed next to one or more modules other than the PCM, GO to A2
No	No modules are currently communicating on the HS-CAN1. GO to Pinpoint Test V

A2 PC/ED (POWERTRAIN CONTROL/EMISSIONS DIAGNOSIS) MANUAL PINPOINT TEST QA VERIFICATION CHECK

- Verify PC/ED manual pinpoint test QA has been performed.

Has pinpoint test QA been performed?

Yes	GO to A3
No	Refer to PC/ED manual.

A3 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) TERMINATION RESISTANCE

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

Is the resistance between 54 and 66 ohms?

Yes	GO to A5
No	GO to A4

A4 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) CIRCUITS BETWEEN THE PCM (POWERTRAIN CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Disconnect PCM C1232A (2.2L & 3.2L Duratorq) or C175B (2.5L Duratec).
- Measure:

2.2L & 3.2L Duratorq Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-10	Ω	C251-6
C1232A-11	Ω	C251-14

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
C175B-10	Ω	C251-6
C175B-11	Ω	C251-14

Are the resistances less than 3 ohms?

Yes	GO to A5
No	REPAIR the circuit in question.

A5 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.

- Disconnect and inspect all the PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Anti-Lock Brake System (ABS) Module Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Normal Operation and Fault Conditions

The ABS module communicates with the diagnostic scan tool through the HS-CAN2.

Possible Sources

- Fuse
- Wiring, terminals and connectors
- ABS module

Visual Inspection and Diagnostic Pre-checks

Verify BJB fuses 25 (10A), 69 (30A) and 82 (60A) are OK.

PINPOINT TEST B : THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

B1 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: ABS module C135
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-1		Ground
C135-25		Ground
C135-28		Ground

Are the voltages greater than 11 volts?

Yes	GO to B2
No	VERIFY BJB fuses 25 (10A), 69 (30A) and 82 (60A) are OK. If OK, REPAIR the circuit in question. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

B2 CHECK THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-13	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to B3
No	REPAIR the circuit.

B3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C135-26	Ω	C251-3
C135-14	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to B4
No	REPAIR the circuit in question.

B4 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Restraints Control Module (RCM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

The RCM communicates with the diagnostic scan tool through the HS-CAN2.

Possible Causes

- Fuse
- Wiring, terminals and connectors
- RCM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 35 (5A) is OK.

PINPOINT TEST C : THE RESTRAINTS CONTROL MODULE (RCM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

WARNING: Never probe the electrical connectors on airbag, Safety Canopy® or side air curtain assemblies. Failure to follow this instruction may result in the accidental deployment of these assemblies, which increases the risk of serious personal injury or death.

WARNING: Never disassemble or tamper with seat belt deployable components, including pretensioners, load limiters and inflators. Never back probe deployable device electrical connectors. Tampering or back probing may cause an accidental deployment and result in personal injury or death.

NOTE: *The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.*

C1 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CONNECTION

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect: RCM C310A and C310B.

Are RCM C310A pin 19 and C310B pins 47 and 48 OK?

Yes	GO to C2
No	INSTALL a new wiring harness. REPOWER the Supplemental Restraint System (SRS). REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

C2 CHECK THE RCM (RESTRAINTS CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Repower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-19		Ground

Is the voltage greater than 11 volts?

Yes	GO to C3
No	VERIFY the BCM fuse 35 (5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

C3 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CASE GROUND

- Ignition OFF.
- Measure the resistance between the RCM case and a good chassis ground.

Is the resistance less than 3 ohms?

Yes	GO to C4
No	REPAIR the RCM case ground as necessary.

C4 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE RCM (RESTRAINTS CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Depower the SRS.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310B-48	Ω	C251-3
C310B-47	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to C5
No	REPAIR the circuit in question.

C5 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the RCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Repower the Supplemental Restraint System (SRS).

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Steering Column Control Module (SCCM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

The SCCM communicates with the diagnostic scan tool through the HS-CAN2.

Possible Causes

- Fuse
- Wiring, terminals and connector
- SCCM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 13 (7.5A) is OK.

PINPOINT TEST D : THE STEERING COLUMN CONTROL MODULE (SCCM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

D1 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) TERMINATION RESISTANCE

- Ignition OFF.
- Disconnect the diagnostic scan tool cable from the DLC.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

Is the resistance between 54 and 66 ohms?

Yes	GO to D3
No	GO to D2

D2 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE SCCM (STEERING COLUMN CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Disconnect SCCM C226A
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-3	Ω	C251-3
C226A-4	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to D5
No	REPAIR the circuit in question.

D3 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-7	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to D4
No	VERIFY the BCM fuse 13 (7.5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

D4 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-5	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to D5
No	REPAIR the circuit.

D5 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary

- Reconnect the SCCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. Without active front steering, REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Instrument Panel Cluster (IPC) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

The IPC communicates on the HS-CAN3, and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and translated through the GWM to the HS-CAN3.

Possible Sources

- Fuse
- Wiring, terminals and connector
- IPC

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 13 (7.5A) is OK.

PINPOINT TEST E : THE INSTRUMENT PANEL CLUSTER (IPC) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

E1 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) TERMINATION RESISTANCE

- Ignition OFF.
- Disconnect negative battery cable.
- Disconnect the diagnostic scan tool cable from the DLC.
- Disconnect GWM C2431
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	C2803-15

Is the resistance between 108 and 132 ohms?

Yes	GO to E3
No	GO to E2

E2 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) CIRCUITS BETWEEN THE IPC (INSTRUMENT PANEL CLUSTER) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect IPC C220
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-25	Ω	C2803-16
C220-26	Ω	C2803-15

Are the resistances less than 3 ohms?

Yes	GO to E5
No	REPAIR the circuit in question.

E3 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) VOLTAGE SUPPLY CIRCUIT

- Disconnect: IPC C220.
- Connect negative battery cable.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-21		Ground

Is the voltage greater than 11 volts?

Yes	GO to E4
No	VERIFY the BCM fuse 13 (7.5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

E4 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) GROUND CIRCUIT

- Ignition OFF.
- Disconnect negative battery cable.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-5	Ω	Ground

Is the resistance less than 3 ohms?

Yes	CONNECT negative battery cable. GO to E5
No	REPAIR the circuit.

E5 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPC connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Body Control Module (BCM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM communicates with the diagnostic scan tool through the HS-CAN1.

Possible Causes

- Fuse
- Wiring, terminals and connector
- BCM

Visual Inspection and Diagnostic Pre-checks

Verify High Current BJB fuse 2 (125A) is OK.

PINPOINT TEST F : THE BODY CONTROL MODULE (BCM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

F1 CHECK THE BCM (BODY CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280A-1		Ground

Is the voltage greater than 11 volts?

Yes	Connect BCM C2280A. GO to F2
No	VERIFY the High Current BJB fuse 2 (125A) is OK. If OK, repair the circuit in question. If not

No	VERIFY the High Current BUD fuse 2 (125A) is OK. If OK, repair the circuit in question. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

F2 CHECK THE BCM (BODY CONTROL MODULE) GROUND CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C C2280F-6	Ω	Ground
C C2280F-7	Ω	Ground
C C2280F-10	Ω	Ground

Are the resistances less than 3 ohms?

Yes	GO to F3
No	REPAIR the circuit in question.

F3 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) CIRCUITS BETWEEN THE BCM (BODY CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Disconnect: BCM C2280B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C C2280B-10	Ω	C251-6
C C2280B-9	Ω	C251-14

Are the resistances less than 3 ohms?

Yes	GO to F4
No	REPAIR the circuit in question.

F4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect the BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules,

	Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Front Controls Interface Module (FCIM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 54 for schematic and connector information.

Refer to Wiring Diagrams Cell 55 for schematic and connector information.

Normal Operation and Fault Conditions

The FCIM communicates on the MS-CAN, and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and translated through the GWM to the MS-CAN.

Possible Sources

- Fuse
- Wiring, terminals and connector
- FCIM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 12 (7.5A) is OK.

PINPOINT TEST G : THE FRONT CONTROLS INTERFACE MODULE (FCIM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

G1 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) TERMINATION RESISTANCE

- Ignition OFF.
- Disconnect negative battery cable.
- Disconnect the diagnostic scan tool cable from the DLC.
- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	C2803-22

Is the resistance between 108 and 132 ohms?

Yes	GO to G3
No	GO to G2

G2 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE FCIM (FRONT CONTROLS INTERFACE MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-17	Ω	C2803-23
C2402A-18	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to G5
No	REPAIR the circuit in question.

G3 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Connect negative battery cable.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-26	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to G4
No	VERIFY the BCM fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

G4 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect negative battery cable.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	CONNECT negative battery cable. GO to G5
No	REPAIR the circuit.

G5 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCIM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins

- pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Audio Control Module (ACM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 131 for schematic and connector information.

Refer to Wiring Diagrams Cell 132 for schematic and connector information.

Normal Operation and Fault Conditions

The ACM communicates on the HS-CAN3, and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and translated through the GWM to the HS-CAN3.

Possible Sources

- Fuse
- Wiring, terminals and connector
- ACM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 33 (20A) is OK.

PINPOINT TEST H : THE AUDIO CONTROL MODULE (ACM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

H1 CHECK THE ACM (AUDIO FRONT CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: ACM C240A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to H2
No	VERIFY the BCM fuse 33 (20A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the

No	VERIFY the BCM fuse 35 (20A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

H2 CHECK THE ACM (AUDIO FRONT CONTROL MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-13	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to H3
No	REPAIR the circuit.

H3 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) CIRCUITS BETWEEN THE ACM (AUDIO FRONT CONTROL MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect GWM C2431.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C240A-14	Ω	C2803-16
C240A-15	Ω	C2803-15

Are the resistances less than 3 ohms?

Yes	GO to H4
No	REPAIR the circuit in question.

H4 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ACM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Front Control/Display Interface Module (FCDIM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Normal Operation and Fault Conditions

The FCDIM communicates on the HS-CAN3, and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and translated through the GWM to the HS-CAN3.

Possible Sources

- Fuse
- Wiring, terminals and connector
- FCDIM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 32 (10A) is OK.

PINPOINT TEST I : THE FRONT CONTROL/DISPLAY INTERFACE MODULE (FCDIM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

I1 CHECK THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: FCDIM C2123.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2123-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to I2
No	VERIFY the BCM fuse 32 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

I2 CHECK THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2123-9	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to I3

No	REPAIR the circuit.

I3 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) CIRCUITS BETWEEN THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2123-4	Ω	C2803-16
C2123-5	Ω	C2803-15

Are the resistances less than 3 ohms?

Yes	GO to I4
No	REPAIR the circuit in question.

I4 CHECK FOR CORRECT FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCDIM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the FCDIM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. REFER to: Front Control/Display Interface Module (FCDIM) (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/Navigation System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Image Processing Module A (IPMA) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the diagnostic scan tool through the HS-CAN2.

Possible Sources

- Fuse

- Wiring, terminals and connector
- IPMA

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 36 (15A) is OK.

PINPOINT TEST J : THE IMAGE PROCESSING MODULE A (IPMA) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

J1 CHECK THE IPMA (IMAGE PROCESSING MODULE A) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: IPMA C9012.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9012-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to J2
No	VERIFY the BCM fuse 36 (15A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

J2 CHECK THE IPMA (IMAGE PROCESSING MODULE A) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9012-7	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to J3
No	REPAIR the circuit.

J3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE IPMA (IMAGE PROCESSING MODULE A) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9012-12	Ω	C251-3
C9012-13	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to J4
No	REPAIR the circuit in question.

J4 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPMA connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Global Positioning System Module (GPSM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 131 for schematic and connector information.

Refer to Wiring Diagrams Cell 132 for schematic and connector information.

Normal Operation and Fault Conditions

The GPSM communicates on the MS-CAN, and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and translated through the GWM to the MS-CAN.

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 32 (10A) is OK.

PINPOINT TEST K : THE GLOBAL POSITIONING SYSTEM MODULE (GPSM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

K1 CHECK THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: GPSM C9050.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C9050-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to K2
No	VERIFY BCM fuse 32 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

K2 CHECK THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9050-6	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to K3
No	REPAIR the circuit.

K3 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9050-2	Ω	C2803-23
C9050-3	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to K4
No	REPAIR the circuit in question.

K4 CHECK FOR CORRECT GPSM (GLOBAL POSITIONING SYSTEM MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GPSM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Accessory Protocol Interface Module (APIM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 130 for schematic and connector information.

Refer to Wiring Diagrams Cell 131 for schematic and connector information.

Refer to Wiring Diagrams Cell 132 for schematic and connector information.

Normal Operation and Fault Conditions

The APIM communicates with the diagnostic scan tool through the HS-CAN1 and communicates with other modules through the HS-CAN3 and the MS-CAN (8-inch touchscreen). Diagnostic messages to modules on the HS-CAN3 and MS-CAN are sent/received between the DLC and the diagnostic scan tool through the HS-CAN2 circuits at the DLC, and translated through the GWM.

Possible Sources

- Fuse
- Wiring, terminals and connector
- APIM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 32 (10A) is OK.

PINPOINT TEST L : THE ACCESSORY PROTOCOL INTERFACE MODULE (APIM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

L1 CHECK THE APIM (SYNC MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: APIM C2383 (4.2-inch display) or C2389 (8-inch touchscreen).
- Ignition ON.
- Measure:

4.2-inch display

Positive Lead	Measurement / Action	Negative Lead
C2383-1		Ground

8-inch touchscreen

Positive Lead	Measurement / Action	Negative Lead
C2389-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to L2
No	VERIFY the BCM fuse 32 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

L2 CHECK THE APIM (SYNC MODULE) GROUND CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure:

4.2-inch display

Positive Lead	Measurement / Action	Negative Lead
C2383-37	Ω	Ground
C2383-38	Ω	Ground

8-inch touchscreen

Positive Lead	Measurement / Action	Negative Lead
C2389-37	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to L3
No	REPAIR the circuit.

L3 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) CIRCUITS BETWEEN THE APIM (SYNC MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

4.2-inch display

Positive Lead	Measurement / Action	Negative Lead
C2383-53	Ω	C251-6
C2383-54	Ω	C251-14

8-inch touchscreen

Positive Lead	Measurement / Action	Negative Lead
C2389-53	Ω	C251-6
C2389-54	Ω	C251-14

Are the resistances less than 3 ohms?

Yes	GO to L4
No	REPAIR the circuit in question.

L4 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) CIRCUITS BETWEEN THE APIM (SYNC MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect GWM C2803
- Measure:

4.2-inch display

Positive Lead	Measurement / Action	Negative Lead
C2383-16	Ω	C2803-16
C2383-17	Ω	C2803-15

8-inch touchscreen

Positive Lead	Measurement / Action	Negative Lead
C2389-19	Ω	C2803-16
C2389-20	Ω	C2803-15

Are the resistances less than 3 ohms?

Yes	If equipped with touchscreen, GO to L5 If not equipped with touchscreen, GO to L6
No	REPAIR the circuit in question.

L5 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE APIM (SYNC MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2389-16	Ω	C2803-23
C2389-17	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to L6
No	REPAIR the circuit in question.

L6 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Radio Transceiver Module (RTM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operation and Fault Conditions

The RTM communicates on the MS-CAN and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and are translated through the GWM to the MS-CAN.

Possible Sources

- Fuse
- Wiring, terminals and connector
- RTM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 32 (10A) is OK.

PINPOINT TEST M : THE RADIO TRANSCEIVER MODULE (RTM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

M1 CHECK THE RTM (RADIO TRANSCEIVER MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: RTM C9026.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9026-6		Ground

Is the voltage greater than 11 volts?

Yes	GO to M2

No	VERIFY the BCM fuse 32 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

M2 CHECK THE RTM (RADIO TRANSCEIVER MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9026-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to M3
No	REPAIR the circuit.

M3 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE RTM (RADIO TRANSCEIVER MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9026-4	Ω	C2803-23
C9026-3	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to M4
No	REPAIR the circuit in question.

M4 CHECK FOR CORRECT RTM (RADIO TRANSCEIVER MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the RTM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RTM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RTM. REFER to: Radio Transceiver Module (RTM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Power Steering Control Module (PSCM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operation and Fault Conditions

The PSCM communicates with the diagnostic scan tool through the HS-CAN2.

Possible Sources

- Fuse
- Wiring, terminals and connector
- PSCM

Visual Inspection and Diagnostic Pre-checks

Verify high current BJB fuse (125A) and BJB fuse 19 (10A) are OK.

PINPOINT TEST N : THE POWER STEERING CONTROL MODULE (PSCM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

N1 CHECK THE PSCM (POWER STEERING CONTROL MODULE) VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: PSCM C1463A and C1463B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1463A-1	V	Ground

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1463B-2	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to N2
No	VERIFY high current BJB fuse (125A) or BJB fuse 19 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

N2 CHECK THE PSCM (POWER STEERING CONTROL MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1463B-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to N3
No	REPAIR the circuit.

N3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE PSCM (POWER STEERING CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1463A-2	Ω	C251-3
C1463A-3	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to N4
No	REPAIR the circuit in question.

N4 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the PSCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PSCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, REFER to the EPAS Symptom Chart.   Click here to access Guided Routine (EPAS).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Driver Door Module (DDM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

The DDM communicates on the MS-CAN and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and are translated through the GWM to the MS-CAN.

Possible Sources

- Fuse
- Wiring, terminals and connector
- DDM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 25 (30A) is OK.

PINPOINT TEST O : THE DRIVER DOOR MODULE (DDM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

O1 CHECK THE DDM (DRIVER DOOR MODULE) VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: DDM LHD C501A or RHD C601A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C501A-1	V	Ground
RHD C653A-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to O2
No	VERIFY the BCM fuse 25 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

O2 CHECK THE DDM (DRIVER DOOR MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C501A-2	Ω	Ground
RHD C653A-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to O3
No	REPAIR the circuit.

O3 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE DDM (DRIVER DOOR MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C501A-7	Ω	C2803-23
LHD C501A-6	Ω	C2803-22
RHD C653A-7	Ω	C2803-23
RHD C653A-6	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to O4
No	REPAIR the circuit in question.

O4 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the DDM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Passenger Door Module (PDM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

The PDM communicates on the MS-CAN and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and are translated through the GWM to the MS-CAN.

Possible Sources

- Fuse
- Wiring, terminals and connector
- PDM

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 26 (30A) is OK.

PINPOINT TEST P : THE PASSENGER DOOR MODULE (PDM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

P1 CHECK THE PDM (PASSENGER DOOR MODULE) VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: PDM LHD C652A or RHD C590A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-1	V	Ground
RHD C590A-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to P2
No	VERIFY the BCM fuse 26 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

P2 CHECK THE PDM (PASSENGER DOOR MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-2	Ω	Ground
RHD C590A-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to P3
No	REPAIR the circuit.

P3 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE PDM (PASSENGER DOOR MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-7	Ω	C2803-23
LHD C652A-6	Ω	C2803-22
RHD C590A-7	Ω	C2803-23
RHD C590A-6	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to P4
No	REPAIR the circuit in question.

P4 CHECK FOR CORRECT PDM (PASSENGER DOOR MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the PDM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PDM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Cruise Control Module (CCM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

The CCM communicates with the diagnostic scan tool through the HS-CAN2.

Possible Sources

- Fuse
- Wiring, terminals and connector
- CCM

Visual Inspection and Diagnostic Pre-checks

Verify BJB fuse 23 (15A) is OK.

PINPOINT TEST Q : THE CRUISE CONTROL MODULE (CCM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

Q1 CHECK THE CCM (CRUISE CONTROL MODULE) VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: CCM C1582.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1582-10		Ground

Is the voltage greater than 11 volts?

Yes	GO to Q2
No	VERIFY the BJB fuse 23 (15A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

Q2 CHECK THE CCM (CRUISE CONTROL MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1582-4	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to Q3
No	REPAIR the circuit.

Q3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE CCM (CRUISE CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1582-8	Ω	C251-3
C1582-7	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to Q4
No	REPAIR the circuit in question.

Q4 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the CCM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the CCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Head Up Display (HUD) Module Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

The HUD module communicates with the diagnostic scan tool through the HS-CAN2.

Possible Sources

- Fuse
- Wiring, terminals and connector
- HUD module

Visual Inspection and Diagnostic Pre-checks

Verify BJB fuse 23 (15A) is OK.

PINPOINT TEST R : THE HEAD UP DISPLAY (HUD) MODULE DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

R1 CHECK THE HUD (HEAD UP DISPLAY) MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: HUD Module C2395.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2395-4	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to R2
No	VERIFY the BJB fuse 23 (15A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

R2 CHECK THE HUD (HEAD UP DISPLAY) MODULE GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2395-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to R3

No	REPAIR the circuit.

R3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE HUD (HEAD UP DISPLAY) MODULE AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2395-3	Ω	C251-3
C2395-2	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to R4
No	REPAIR the circuit in question.

R4 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Trailer Module (TRM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 95 for schematic and connector information.

Normal Operation and Fault Conditions

The TRM communicates on the MS-CAN and communicates with the diagnostic scan tool through the HS-CAN2. Diagnostic messages are sent/received through the HS-CAN2 circuits at the DLC, and translated through the GWM to the MS-CAN.

Visual Inspection and Diagnostic Pre-checks

Verify BJB fuse 87 (40A) is OK.

PINPOINT TEST S : THE TRM (TRAILER MODULE) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

S1 CHECK THE TRM (TRAILER MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: TRM C2498.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2498A-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to S2
No	VERIFY BJB fuse 87 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

S2 CHECK THE TRM (TRAILER MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: TRM C4397B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2498B-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to S3
No	REPAIR the circuit.

S3 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE TRM (TRAILER MODULE) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2498B-3	Ω	C2803-23
C2498B-2	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to S4
No	REPAIR the circuit in question.

S4 CHECK FOR CORRECT TRM (TRAILER MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TRM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the TRM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The SCCM Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 43 for schematic and connector information.

Normal Operation and Fault Conditions

The SCCM communicates on the HS-CAN2.

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 13 (7.5A) is OK.

PINPOINT TEST T : THE SCCM (STEERING COLUMN CONTROL MODULE) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

T1 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: SCCM C226.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-7		Ground

Is the voltage greater than 11 volts?

Yes	GO to T2
No	VERIFY BCM fuse 13 (7.5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

T2 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-5	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to T3
No	REPAIR the circuit.

T3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE SCCM (STEERING COLUMN CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-3	Ω	C251-3
C226A-4	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to T4
No	REPAIR the circuit in question.

T4 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM/clockspring assembly. REFER to: Clockspring (501-20 Supplemental Restraint System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Gateway Module (GWM) Does Not Respond To The Diagnostic Scan Tool

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The GWM communicates with the diagnostic scan tool through the HS-CAN1 and HS-CAN2. The GWM operates as a gateway for communication between the modules on HS-CAN1, HS-CAN2, HS-CAN3 and MS-CAN.

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuses 13 (7.5A) and fuse 15 (10A) is OK.

PINPOINT TEST U : THE GATEWAY MODULE (GWM) DOES NOT RESPOND TO THE DIAGNOSTIC SCAN TOOL

U1 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) TERMINATION RESISTANCE

- Ignition OFF.
- Disconnect negative battery cable.
- Disconnect the diagnostic scan tool cable from the DLC.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

Is the resistance between 54 and 66 ohms?

Yes	GO to U3
No	GO to U2

U2 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) CIRCUITS BETWEEN THE GWM (GATEWAY MODULE A) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Disconnect GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-20 (component side)	Ω	C251-6
C2803-19 (component side)	Ω	C251-14

Are the resistances less than 3 ohms?

Yes	GO to U3
No	GO to U9

U3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) TERMINATION RESISTANCE

- Measure:

Positive Lead	Measurement / Action	Negative Lead

C251-3	Ω	C251-11

Is the resistance between 54 and 66 ohms?

Yes	GO to U5
No	GO to U4

U4 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE GWM (GATEWAY MODULE A) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-18 (component side)	Ω	C251-3
C2803-17 (component side)	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to U5
No	GO to U9

U5 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) TERMINATION RESISTANCE, COMPONENT SIDE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23 (component side)	Ω	C2803-22 (component side)

Is the resistance between 108 and 132 ohms?

Yes	GO to U6
No	GO to U9

U6 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) TERMINATION RESISTANCE, COMPONENT SIDE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16 (component side)	Ω	C2803-15 (component side)

Is the resistance between 108 and 132 ohms?

Yes	GO to U7

No	GO to U9

U7 CHECK THE GWM (GATEWAY MODULE A) VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Connect negative battery cable.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-13		Ground
C2803-24		Ground

Is the voltage greater than 11 volts?

Yes	GO to U8
No	VERIFY BCM fuse 13 (7.5A) and fuse 15 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

U8 CHECK THE GWM (GATEWAY MODULE A) GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-1	Ω	Ground
C2803-14	Ω	Ground

Are the resistances less than 3 ohms?

Yes	GO to U9
No	REPAIR the circuit in question.

U9 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect all GWM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

	module connections. ADDRESS the root cause of any connector or pin issues.

No High Speed Controller Area Network 1 (HS-CAN1) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The HS-CAN1 modules communicate with the diagnostic scan tool directly through the DLC circuits.
REFER to: Communications Network (418-00 Module Communications Network) .

Possible Sources

- Fuse
- Wiring, terminals or connectors
- APIM
- BCM
- GWM
- PCM

PINPOINT TEST V : NO HIGH SPEED CONTROLLER AREA NETWORK 1 (HS-CAN1) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

NOTE: *Various modules set network DTCs during this test procedure. Clear DTCs from all modules after completing the diagnostic procedure.*

V1 CHECK THE DLC (DATA LINK CONNECTOR) PINS FOR DAMAGE

- Ignition OFF.
- Disconnect the diagnostic scan tool cable from the DLC.
- Inspect the DLC pins 6 and 14 for damage.

Are DLC pins 6 and 14 OK?

Yes	GO to V2
No	REPAIR the DLC as necessary.

V2 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) TERMINATION RESISTANCE

- Disconnect the negative battery cable.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

Is the resistance between 54 and 66 ohms?

Yes	GO to V3
No	GO to V5

V3 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (+) AND HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (-) CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	Ground
C251-14	Ω	Ground

Are the resistances greater than 1,000 ohms?

Yes	GO to V4
No	GO to V11

V4 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (+) AND HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect the negative battery cable.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	V	Ground
C251-14	V	Ground

Is the voltage greater than 6 volts on either circuit?

Yes	REPAIR the circuit in question.
No	GO to V12

V5 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) TERMINATION RESISTOR

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

Is the resistance between 108 and 132 ohms?

Yes	GO to V6
No	GO to V8

V6 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) TERMINATION RESISTOR WITH THE PCM (POWERTRAIN CONTROL MODULE) DISCONNECTED

- Disconnect PCM C1232A (2.2L & 3.2L Duratorq).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

C251-6	Ω	C251-14

Is the resistance between 108 and 132 ohms?

Yes	GO to V7
No	GO to V16

V7 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) CIRCUITS BETWEEN THE PCM (POWERTRAIN CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Measure:

2.2L and 3.2L Duratorq

Positive Lead	Measurement / Action	Negative Lead
C1232A-10	Ω	C251-6
C1232A-11	Ω	C251-14

2.5L Duratec

Positive Lead	Measurement / Action	Negative Lead
C175A-10	Ω	C251-6
C175A-11	Ω	C251-14

Are the resistances less than 3 ohms?

Yes	GO to V12
No	REPAIR the circuit in question.

V8 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (+) AND HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (-) CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

Is the resistance less than 3 ohms?

Yes	GO to V10
No	GO to V9

V9 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (+) AND HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (-) CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

Is the resistance greater than 10,000 ohms?

Yes	REPAIR the DLC or REPAIR the circuit in question.
No	A capacitor internal to a module can still be draining, causing irregular resistance readings. WAIT 5 minutes. REPEAT the pinpoint test. If the concern is still present, REPAIR the circuit.

V10 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (+) AND HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (-) CIRCUITS FOR A SHORT TOGETHER WITH THE MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	C251-14

- Disconnect modules one at a time until the resistance is greater than 3 ohms.
  - APIM C2383 (4.2-inch display) or C2389 (8-inch touchscreen)
  - BCM C2280
  - PCM C1232A (2.2L & 3.2L Duratorq) or C175 (2.5L Duratec)

Did the resistance change to greater than 3 ohms with one of the modules disconnected?

Yes	For the APIM, GO to V19 For the BCM, GO to V18 For the PCM, GO to V17
No	REPAIR the circuit in question. CONNECT all modules.

V11 CHECK THE HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (+) AND HS-CAN1 (HIGH SPEED-CONTROLLER AREA NETWORK 1) (-) CIRCUITS FOR A SHORT TO GROUND WITH THE MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-6	Ω	Ground
C251-14	Ω	Ground

- Disconnect modules one at a time until the resistance to ground is greater than 1,000 ohms.
  - APIM C2383 (4.2-inch display) or C2389 (8-inch touchscreen)
  - BCM C2280B
  - PCM C1232A (2.2L & 3.2L Duratorq) or C175 (2.5L Duratec)

Did the resistance change to greater than 1,000 ohms with one of the modules disconnected?

Yes	For the APIM, GO to V19

	For the BCM, GO to V18 For the PCM, GO to V17
No	REPAIR the circuit in question. CONNECT all modules.

V12 CHECK FOR RESTORED COMMUNICATION WITH THE PCM (POWERTRAIN CONTROL MODULE) DISABLED

NOTE: *Establish an IDS session prior to disabling the PCM in this test step. If the PCM has failed communication during multiple attempts to identify the vehicle, first identify the vehicle manually by entering a PCM part number, calibration number or tear tag when prompted by IDS. When a vehicle is manually identified by a PCM part number, calibration number or tear tag, the IDS does not automatically run a network test. Manually select and run the network test. When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BJB fuses 7 (20A) and 26 (10A).
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test A
No	INSTALL the removed fuse. GO to V13

V13 CHECK FOR RESTORED COMMUNICATION WITH THE GWM (GATEWAY MODULE A) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 13 (7.5A) and fuse 15 (10A).
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test U
No	INSTALL the removed fuse. GO to V14

V14 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE BCM (BODY CONTROL MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: High current BJB fuse 2 (125A) to disable the BCM.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN1 modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test F
No	INSTALL the removed fuse. GO to V15

V15 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE APIM (SYNC MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 32 (10A) to disable the APIM.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN1 modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test L
No	INSTALL the removed fuse. GO to V16

V16 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the GWM connector and related in-line connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

V17 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

V18 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.

- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM module. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

V19 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

No High Speed Controller Area Network 2 (HS-CAN2) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The HS-CAN2 modules communicate with the diagnostic scan tool directly through the DLC circuits.
REFER to: Communications Network (418-00 Module Communications Network) .

Possible Sources

- Fuse
- Wiring, terminals or connectors
- ABS module
- CCM (if equipped)
- GWM
- HUD module (if equipped)
- IPMA (if equipped)
- PSCM
- SCCM (connected to the clockspring assembly)
- RCM

PINPOINT TEST W : NO HIGH SPEED CONTROLLER AREA NETWORK 2 (HS-CAN2) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

NOTE: *Various modules set network DTCs during this test procedure. Clear DTCs from all modules after completing the diagnostic procedure.*

completing the diagnostic procedure.

W1 CHECK THE DLC (DATA LINK CONNECTOR) PINS FOR DAMAGE

- Ignition OFF.
- Disconnect the diagnostic scan tool cable from the DLC.
- Inspect the DLC pins 3 and 11 for damage.

Are DLC pins 3 and 11 OK?

Yes	GO to W2
No	REPAIR the DLC as necessary.

W2 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) TERMINATION RESISTANCE

- Disconnect negative battery cable.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

Is the resistance between 54 and 66 ohms?

Yes	GO to W3
No	GO to W5

W3 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (+) AND HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (-) CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	Ground
C251-11	Ω	Ground

Are the resistances greater than 1,000 ohms?

Yes	GO to W4
No	GO to W11

W4 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (+) AND HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect negative battery cable.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3		Ground
C251-11		Ground

C251-11	V	Ground

Is the voltage greater than 6 volts on either circuit?

Yes	REPAIR the circuit in question.
No	GO to W12

W5 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) TERMINATION RESISTOR

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

Is the resistance between 108 and 132 ohms?

Yes	GO to W6
No	GO to W8

W6 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) TERMINATION RESISTOR WITH THE GWM (GATEWAY MODULE A) DISCONNECTED

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

Is the resistance between 108 and 132 ohms?

Yes	GO to W7
No	GO to W25

W7 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) CIRCUITS BETWEEN THE SCCM (STEERING COLUMN CONTROL MODULE) AND THE DLC (DATA LINK CONNECTOR) FOR AN OPEN

- Disconnect: SCCM C226A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226A-3	Ω	C251-3
C226A-4	Ω	C251-11

Are the resistances less than 3 ohms?

Yes	GO to W32
No	REPAIR the circuit in question.

W8 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (+) AND HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (-) CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

Is the resistance less than 3 ohms?

Yes	GO to W10
No	GO to W9

W9 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (+) AND HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (-) CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

Is the resistance greater than 10,000 ohms?

Yes	REPAIR the DLC or REPAIR the circuit in question.
No	A capacitor internal to a module can still be draining, causing irregular resistance readings. WAIT 5 minutes. REPEAT the pinpoint test. If the concern is still present, REPAIR the circuit.

W10 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (+) AND HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (-) CIRCUITS FOR A SHORT TOGETHER WITH THE MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	C251-11

- Disconnect modules one at a time until the resistance is greater than 3 ohms.
  - ABS module C135
  - CCM C1582 (if equipped)
  - HUD module C2395 (if equipped)
  - IPMA C9012 (if equipped)
  - PSCM C1463
  - RCM C310B
  - SASM C226 (if equipped)

- SCCM C226

Did the resistance change to greater than 3 ohms with one of the modules disconnected?

Yes	For the ABS module, GO to W24 For the CCM, GO to W26 For the HUD module, GO to W27 For the IPMA, GO to W28 For the PSCM, GO to W29 For the RCM, GO to W30 For the SASM, GO to W31 For the SCCM, GO to W32
No	REPAIR the circuits.

W11 CHECK THE HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (+) AND HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) (-) CIRCUITS FOR A SHORT TO GROUND WITH THE MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-3	Ω	Ground
C251-11	Ω	Ground

- Disconnect modules one at a time until the resistance to ground is greater than 1,000 ohms.
  - ABS module C135
  - CCM C1582 (if equipped)
  - HUD module C2395 (if equipped)
  - IPMA C9012 (if equipped)
  - PSCM C1463
  - RCM C310
  - SASM C226 (if equipped)
  - SCCM C226

Did the resistance change to greater than 1,000 ohms with one of the modules disconnected?

Yes	For the ABS module, GO to W24 For the CCM, GO to W26 For the HUD module, GO to W27 For the IPMA, GO to W28 For the PSCM, GO to W29 For the RCM, GO to W30 For the SASM, GO to W31 For the SCCM, GO to W32
No	REPAIR the circuit in question. CONNECT all modules.

W12 CHECK FOR RESTORED COMMUNICATION WITH THE GWM (GATEWAY MODULE A) AND THE SCCM (STEERING COLUMN CONTROL MODULE) DISABLED

- **NOTE:** *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

  Disconnect: BCM fuse 13 (7.5A).
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	INSTALL the removed fuse. GO to W13
No	INSTALL the removed fuse. GO to W14

W13 CHECK FOR RESTORED COMMUNICATION WITH THE SCCM (STEERING COLUMN CONTROL MODULE) DISCONNECTED

- **NOTE:** *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

  Disconnect: SCCM C226.
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	CONNECT the SCCM. GO to Pinpoint Test D
No	CONNECT the SCCM. GO to Pinpoint Test U

W14 CHECK FOR RESTORED COMMUNICATION WITH THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE DISABLED

- **NOTE:** *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

  Disconnect: BJB fuses 25 (10A), 69 (30A) and 82 (60A).
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	INSTALL the removed fuses. GO to Pinpoint Test B
No	INSTALL the removed fuses. GO to W15

W15 VERIFY VEHICLE EQUIPMENT - ADAPTIVE CRUISE CONTROL OR SPLIT VIEW CAMERA

- Inspect the vehicle for an adaptive cruise control system or a split view camera.

Is the vehicle equipped with adaptive cruise control or a split view camera?

Yes	GO to W16
No	GO to W18

W16 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE CCM (CRUISE CONTROL MODULE) , HUD (HEAD UP DISPLAY) MODULE AND IPMB (IMAGE PROCESSING MODULE B) THE DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BJB fuse 23 (15A) to disable the HUD module, CCM and IPMB (if equipped).
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN2 modules pass the network test?

Yes	INSTALL the removed fuse. GO to W17
No	INSTALL the removed fuse. GO to W18

W17 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE HUD (HEAD UP DISPLAY) MODULE AND CCM (CRUISE CONTROL MODULE) DISCONNECTED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: HUD module C2395 (if equipped).
- Using a diagnostic scan tool, perform the network test.

- Disconnect: HUD module C2395 (if equipped).
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN2 modules pass the network test with each module disconnected?

Yes	CONNECT the modules. For restored communication with the HUD module disconnected, GO to Pinpoint Test R For restored communication with the CCM disconnected, GO to Pinpoint Test Q
No	CONNECT the modules. GO to W18

W18 VERIFY VEHICLE EQUIPMENT - IPMA (IMAGE PROCESSING MODULE A)

- Inspect the vehicle for an IPMA.

Is the vehicle equipped with an IPMA?

Yes	GO to W19
No	GO to W20

W19 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE IPMA (IMAGE PROCESSING MODULE A) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 36 (15A) to disable the IPMA (if equipped)
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN2 modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test J
No	INSTALL the removed fuse. GO to W20

W20 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE SASM (STEERING ANGLE SENSOR MODULE)

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 13 (7.5A) to disable the SASM.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN2 modules pass the network test?

Yes	INSTALL the removed fuse. GO to W21
No	INSTALL the removed fuse. GO to W22

W21 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE SASM (STEERING ANGLE SENSOR MODULE) DISCONNECTED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: SASM C226.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN2 modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test T

No	INSTALL the removed fuse. GO to W22

W22 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE PSCM (POWER STEERING CONTROL MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: High Current BJB (125A) and BJB fuse 19 (10A) to disable the PSCM.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN2 modules pass the network test?

Yes	INSTALL the removed fuses. GO to Pinpoint Test N
No	INSTALL the removed fuses. GO to W23

W23 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RCM (RESTRAINTS CONTROL MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 19 (5A) to disable the RCM.
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test C
No	INSTALL the removed fuse. GO to W24

W24 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module - Vehicles With: Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W25 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the GWM connector and related in-line connectors.
- Repair:

- corrosion (install new connector or terminals - clean module pins)
- damaged or bent pins - install new terminals/pins
- pushed-out pins - install new pins as necessary

- Reconnect the GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W26 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the CCM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the CCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W27 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W28 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPMA connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W29 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the PSCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PSCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, REFER to the EPAS Symptom Chart.   Click here to access Guided Routine (EPAS).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W30 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the RCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W31 CHECK FOR CORRECT SASM (STEERING ANGLE SENSOR MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the SASM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SASM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new clockspring assembly. REFER to: Clockspring (501-20 Supplemental Restraint System) .
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

W32 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

No High Speed Controller Area Network 3 (HS-CAN3) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

Diagnostic messages sent/received between the diagnostic scan tool and the HS-CAN3 modules are accessed through the HS-CAN2 circuits on the DLC.
REFER to: Communications Network (418-00 Module Communications Network) .

Possible Sources

- Fuse
- Wiring, terminals or connectors
- ACM
- APIM

- DSP (if equipped)
- FCDIM (if equipped)
- IPC
- GWM

PINPOINT TEST X : NO HIGH SPEED CONTROLLER AREA NETWORK 3 (HS-CAN3) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

NOTE: *Various modules set network DTCs during this test procedure. Clear DTCs from all modules after completing the diagnostic procedure.*

X1 CHECK THE DLC (DATA LINK CONNECTOR) PINS FOR DAMAGE

- Ignition OFF.
- Disconnect the diagnostic scan tool cable from the DLC.
- Inspect the DLC pins 3 and 11 for damage.

Are DLC pins 3 and 11 OK?

Yes	GO to X2
No	REPAIR the DLC as necessary.

X2 CHECK FOR HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) COMMUNICATION

- Using a diagnostic scan tool, perform a network test.

Does the RCM pass the network test?

Yes	GO to X3
No	GO to Pinpoint Test W

X3 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) TERMINATION RESISTANCE

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	C2803-15

Is the resistance between 108 and 132 ohms?

Yes	GO to X4
No	GO to X6

X4 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (+) AND HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (-) CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	Ground
C2803-15	Ω	Ground

Are the resistances greater than 1,000 ohms?

Yes	GO to X5
No	GO to X11

X5 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (+) AND HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16		Ground
C2803-15		Ground

Are the voltages greater than 6 volts?

Yes	REPAIR the circuit in question.
No	GO to X12

X6 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) TERMINATION RESISTOR, COMPONENT SIDE

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16 (component side)	Ω	C2803-15 (component side)

Is the resistance between 108 and 132 ohms?

Yes	GO to X8
No	GO to X7

X7 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) TERMINATION RESISTOR, HARNESS SIDE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	C2803-15

Is the resistance between 108 and 132 ohms?

Yes	GO to X9
No	GO to X21

No	GO to X21

X8 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) CIRCUITS BETWEEN THE IPC (INSTRUMENT PANEL CLUSTER) AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: IPC C220.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C220-25	Ω	C2803-16
C220-26	Ω	C2803-15

Are the resistances less than 3 ohms?

Yes	GO to X20
No	REPAIR the circuit in question.

X9 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (+) AND HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (-) CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	C2803-15

Is the resistance less than 3 ohms?

Yes	GO to X10
No	GO to X12

X10 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (+) AND HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (-) CIRCUITS FOR A SHORT TOGETHER WITH THE MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	C2803-15

- Disconnect modules one at a time until the resistance is greater than 3 ohms.
  - APIM C2383 (4.2-inch display) or C2389 (8-inch touchscreen)
  - ACM C240A
  - FCDIM C2123 (if equipped)
  - IPC C220

Did the resistance change to greater than 3 ohms with one of the modules disconnected?

Yes	For the APIM, GO to X17 For the ACM, GO to X18 For the FCDIM, GO to X19

	For the IPC, GO to X20
No	REPAIR the circuits in question.

X11 CHECK THE HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (+) AND HS-CAN3 (HIGH SPEED-CONTROLLER AREA NETWORK 3) (-) CIRCUITS FOR A SHORT TO GROUND WITH THE MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-16	Ω	Ground
C2803-15	Ω	Ground

- Disconnect modules one at a time until the resistance to ground is greater than 1,000 ohms.
  - APIM C2383 (4.2-inch display) or C2389 (8-inch touchscreen)
  - ACM C240A
  - FCDIM C2123 (if equipped)
  - IPC C220

Are the resistances greater than 1,000 ohms?

Yes	For the APIM, GO to X17 For the ACM, GO to X18 For the FCDIM, GO to X19 For the IPC, GO to X20
No	REPAIR the circuit in question. CONNECT all modules.

X12 CHECK FOR RESTORED COMMUNICATION WITH THE GWM (GATEWAY MODULE A) AND IPC (INSTRUMENT PANEL CLUSTER) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 13 (7.5A) to disable the IPC and GWM.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN3 modules pass the network test?

Yes	INSTALL the fuse. GO to X13
No	INSTALL the fuse. GO to X16

X13 CHECK FOR RESTORED COMMUNICATION WITH THE IPC (INSTRUMENT PANEL CLUSTER) DISCONNECTED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: IPC C220.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN3 modules pass the network test?

Yes	CONNECT the IPC. GO to Pinpoint Test E
No	CONNECT the IPC. GO to Pinpoint Test U

X14 CHECK FOR RESTORED COMMUNICATION WITH THE APIM (SYNC MODULE) AND FCDIM

X14 CHECK FOR RESTORED COMMUNICATION WITH THE APIM (SYNC MODULE) AND FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 32 (10A) to disable the APIM and FCDIM (if equipped).
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN3 modules pass the network test?

Yes	INSTALL the removed fuse. If equipped with a FCDIM, GO to X15 If not equipped with a FCDIM, GO to Pinpoint Test L
No	INSTALL the removed fuse. GO to X16

X15 CHECK FOR RESTORED COMMUNICATION WITH THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) DISCONNECTED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: FCDIM C2123.
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN3 modules pass the network test?

Yes	CONNECT the FCDIM. GO to Pinpoint Test I
No	CONNECT the FCDIM. GO to Pinpoint Test L

X16 CHECK FOR RESTORED COMMUNICATION WITH THE ACM (AUDIO FRONT CONTROL MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 33 (20A).
- Using a diagnostic scan tool, perform the network test.

Do all other HS-CAN3 modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test H
No	INSTALL the removed fuse. GO to X17

X17 CHECK THE APIM (SYNC MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. The concern may have been caused by

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

X18 CHECK THE ACM (AUDIO FRONT CONTROL MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect all the ACM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ACM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

X19 CHECK THE FCDIM (FRONT CONTROL/DISPLAY INTERFACE MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the FCDIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the FCDIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCDIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

X20 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPC connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center

	and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

X21 CHECK THE GWM (GATEWAY MODULE A) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the GWM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

No Medium Speed Controller Area Network (MS-CAN) Communication, All Modules Are Not Responding

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

Diagnostic messages sent/received between the diagnostic scan tool and the MS-CAN modules are accessed through the HS-CAN2 circuits on the DLC.
REFER to: Communications Network (418-00 Module Communications Network) .

Possible Sources

- Fuse
- Wiring, terminals or connectors
- APIM (if equipped with 8-inch touchscreen)
- DDM
- FCIM
- GPSM
- GWM
- HSWM (if equipped)
- PDM
- RGTM (if equipped)
- RTM
- SCME (if equipped)
- SODL (if equipped)
- SODR (if equipped)
- TRM (if equipped)

PINPOINT TEST Y : NO MEDIUM SPEED CONTROLLER AREA NETWORK (MS-CAN) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

NOTE: *Various modules set network DTCs during this test procedure. Clear DTCs from all modules after completing the diagnostic procedure.*

Y1 CHECK THE DLC (DATA LINK CONNECTOR) PINS FOR DAMAGE

Y1 CHECK THE DLC (DATA LINK CONNECTOR) PINS FOR DAMAGE

- Ignition OFF.
- Disconnect the diagnostic scan tool cable from the DLC.
- Inspect the DLC pins 3 and 11 for damage.

Are DLC pins 3 and 11 OK?

Yes	GO to Y2
No	REPAIR the DLC as necessary.

Y2 CHECK FOR HS-CAN2 (HIGH SPEED-CONTROLLER AREA NETWORK 2) COMMUNICATION

- Using a diagnostic scan tool, perform a network test.

Does the RCM pass the network test?

Yes	GO to Y3
No	GO to Pinpoint Test W

Y3 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) TERMINATION RESISTANCE

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	C2803-22

Is the resistance between 108 and 132 ohms?

Yes	GO to Y4
No	GO to Y6

Y4 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (+) AND MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (-) CIRCUITS FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	Ground
C2803-22	Ω	Ground

Are the resistances greater than 1,000 ohms?

Yes	GO to Y5
No	GO to Y11

Y5 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (+) AND MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect the negative battery cable.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23		Ground
C2803-22		Ground

Are the voltages greater than 6 volts?

Yes	REPAIR the circuit in question.
No	GO to Y12

Y6 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) TERMINATION RESISTOR, COMPONENT SIDE

- Disconnect: GWM C2803.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23 (component side)	Ω	C2803-22 (component side)

Is the resistance between 108 and 132 ohms?

Yes	GO to Y8
No	GO to Y7

Y7 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) TERMINATION RESISTOR, HARNESS SIDE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	C2803-22

Is the resistance between 108 and 132 ohms?

Yes	GO to Y9
No	GO to Y21

Y8 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) CIRCUITS BETWEEN THE FCIM AND THE GWM (GATEWAY MODULE A) FOR AN OPEN

- Disconnect: FCIM C2402A
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-17	Ω	C2803-23
C2402A-18	Ω	C2803-22

Are the resistances less than 3 ohms?

Yes	GO to Y20
No	REPAIR the circuit in question.

Y9 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (+) AND MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (-) CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	C2803-22

Is the resistance less than 3 ohms?

Yes	GO to Y10
No	GO to Y12

Y10 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (+) AND MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (-) CIRCUITS FOR A SHORT TOGETHER WITH MODULES DISCONNECTED

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	C2803-22

- Disconnect modules one at a time until the resistance is greater than 3 ohms.
  - APIM C2389 (if equipped)
  - DDM C501ALHD or C653ARHD
  - FCIM C2402A
  - GPSM C9050
  - PDM C652ALHD or C590ARHD
  - RGTM C4174 (if equipped)
  - RTM C9026
  - TRM C4297 (if equipped)

Did the resistance change to greater than 3 ohms with one of the modules disconnected?

Yes	For the APIM, GO to Y19 For the DDM, GO to Y22 For the GPSM, GO to Y23 For the FCIM, GO to Y20 For the PDM, GO to Y24 For the RTM, GO to Y26 For the RGTM, GO to Y25 For the TRM, GO to Y27
No	REPAIR the circuits

No	REPAIR the circuits.

Y11 CHECK THE MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (+) AND MS-CAN (MEDIUM SPEED-CONTROLLER AREA NETWORK) (-) CIRCUITS FOR A SHORT TO GROUND WITH THE MODULES DISCONNECTED

- Measure

Positive Lead	Measurement / Action	Negative Lead
C2803-23	Ω	Ground
C2803-22	Ω	Ground

- Disconnect modules one at a time until the resistance to ground is greater than 1,000 ohms.
  - APIM C2389 (if equipped)
  - DDM C501ALHD or C653ARHD
  - FCIM C2402A
  - GPSM C9050
  - PDM C652ALHD or C590ARHD
  - RGTM C4174 (if equipped)
  - RTM C9026
  - TRM C4297 (if equipped)

Did the resistance change to greater than 1,000 ohms with one of the modules disconnected?

Yes	For the APIM, GO to Y19 For the DDM, GO to Y22 For the GPSM, GO to Y23 For the FCIM, GO to Y20 For the PDM, GO to Y24 For the RGTM, GO to Y25 For the RTM, GO to Y26 For the TRM, GO to Y27
No	REPAIR the circuit in question.

Y12 CHECK FOR RESTORED COMMUNICATION WITH THE GWM (GATEWAY MODULE A) DISABLED

- **NOTE:** *When re-running the network test, close the Network Test application first or the screen display reverts back to the prior run Network Test results.*

  Disconnect BCM fuse 13 (7.5A).
- Using a diagnostic scan tool, perform the network test.

Do all other MS-CAN modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test U
No	INSTALL the removed fuse. GO to Y13

Y13 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE FCIM (FRONT CONTROLS INTERFACE MODULE) DISABLED

- Disconnect: BCM fuse 12 (7.5A) to disable the FCIM.
- Using a diagnostic scan tool, perform the network test.

Do all other MS-CAN modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test G
No	INSTALL the removed fuse. GO to Y14

	GO to Y14

Y14 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE DDM (DRIVER DOOR MODULE) AND PDM (PASSENGER DOOR MODULE) DISABLED

- **NOTE:** *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

  Disable modules one at a time until other MS-CAN modules pass the network test. Skip to the end once network operation is restored.
- Disconnect: BCM fuse 25 (30A) to disable the DDM.
- Using a diagnostic scan tool, perform a network test.
- Disconnect:BCM fuse 26 (30A) to disable the PDM.
- Using a diagnostic scan tool, perform a network test.

Do all other MS-CAN modules pass the network test?

Yes	INSTALL the removed fuses. For restored communication with the DDM disabled, GO to Pinpoint Test O For restored communication with the PDM disabled, GO to Pinpoint Test P
No	INSTALL the removed fuses. GO to Y15

Y15 CHECK FOR RESTORED COMMUNICATION WITH THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) , APIM (SYNC MODULE) AND RTM (RADIO TRANSCEIVER MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BCM fuse 32 (10A) to disable the GPSM, APIM (if equipped with touchscreen) and RTM (if equipped).
- Using a diagnostic scan tool, perform the network test.

Do all other MS-CAN modules pass the network test?

Yes	INSTALL the removed fuse. GO to Y16
No	INSTALL the removed fuse. GO to Y16

Y16 CHECK FOR RESTORED COMMUNICATION WITH THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) AND RTM (RADIO TRANSCEIVER MODULE) DISCONNECTED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: GPSM C2398.
- Using a diagnostic scan tool, perform the network test.
- Disconnect: RTM C9026 (if equipped).
- Using a diagnostic scan tool, perform the network test.

Do all other MS-CAN modules pass the network test?

Yes	CONNECT the module. For a communication failure with the GPSM, GO to Pinpoint Test K For a communication failure with the RTM, GO to Pinpoint Test M
No	CONNECT the module. If equipped with a touchscreen, GO to Pinpoint Test L If not equipped with a touchscreen, the system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y17 VERIFY VEHICLE EQUIPMENT - TRM (TRAILER MODULE)

- Inspect the vehicle for a TRM.

Is the vehicle equipped with a TRM?

Yes	GO to Y18
No	GO to Y19

Y18 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE TRM (TRAILER MODULE) DISABLED

NOTE: *When re-running the network test, close the network test application first or the screen display reverts back to the prior network test results.*

- Disconnect: BJB fuse 87 (40A) to disable the TRM (if equipped).
- Using a diagnostic scan tool, perform the network test.

Do all other modules pass the network test?

Yes	INSTALL the removed fuse. GO to Pinpoint Test S
No	GO to Y19

Y19 CHECK THE APIM (SYNC MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the APIM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the APIM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (APIM).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y20 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCIM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS or any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y21 CHECK THE GWM (GATEWAY MODULE A) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the GWM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y22 CHECK THE DDM (DRIVER DOOR MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect all the DDM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y23 CHECK THE GPSM (GLOBAL POSITIONING SYSTEM MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the GPSM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GPSM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GPSM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y24 CHECK THE PDM (PASSENGER DOOR MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the PDM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PDM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y25 CHECK THE RGTM (REAR GATE TRUNK MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the RGTM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RGTM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RGTM.Refer to the appropriate section in Group 501 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y26 CHECK THE RTM (RADIO TRANSCEIVER MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the RTM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RTM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RTM. REFER to: Radio Transceiver Module (RTM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Y27 CHECK THE TRM (TRAILER MODULE) FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect and inspect the TRM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the TRM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

No Power To The Data Link Connector (DLC)

Normal Operation and Fault Conditions

The diagnostic scan tool is connected to the DLC to communicate with the HS-CAN1 and HS-CAN2. The GWM translates diagnostic messages for the HS-CAN3 and the MS-CAN from the HS-CAN2. A loss of ground or poor ground at the DLC can result in network faults while the diagnostic scan tool is connected.

A DLC is fitted to the GWM. For diagnostic scan tool access, a DLC is mounted under the instrument panel, with a harness connected to the DLC at the GWM.

Possible Sources

- Fuse
- Wiring, terminals or connector
- DLC
- Diagnostic scan tool

Visual Inspection and Diagnostic Pre-checks

Verify BCM fuse 15 (10A) are OK.

PINPOINT TEST Z : NO POWER TO THE DATA LINK CONNECTOR (DLC)

Z1 CHECK THE DLC (DATA LINK CONNECTOR) PINS FOR DAMAGE

- Ignition OFF.
- Disconnect the diagnostic scan tool cable from the DLC.
- Inspect DLC pins 4, 5 and 16 for damage.

Are DLC pins 4, 5 and 16 OK?

Yes	GO to Z2
No	REPAIR the DLC as necessary.

Z2 CHECK THE DLC (DATA LINK CONNECTOR) VOLTAGE SUPPLY FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-16		Ground

Is the voltage greater than 11 volts?

Yes	GO to Z3
No	VERIFY BCM fuse 15 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

Z3 CHECK THE DLC (DATA LINK CONNECTOR) GROUND CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C251-4	Ω	Ground
C251-5	Ω	Ground

Are the resistances less than 3 ohms?

Yes	REPAIR the diagnostic scan tool.
No	REPAIR the circuit in question.

Copyright © 2016 Ford Motor Company

No Communication Between the Integrated Diagnostic System (IDS) and the Vehicle

Configuration

1. **WARNING: Before beginning any service procedure in this section, REFER to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Establish a scan tool session.

3. Turn ignition to RUN.

4. The scan tool first attempts to communicate with the PCM. After establishing communication with the PCM, the scan tool then attempts to communicate with all other modules on the vehicle.

5. If an IDS session cannot be established with the vehicle, IDS may state "No communication can be established with the Powertrain Control Module (PCM)."

6. Choose "NO" when the scan tool prompts whether or not to retry communication.

7. Enter a PCM part number, tear tag or calibration number to identify the vehicle and start a session. The PCM part number and 4-character tear tag number are printed on the PCM label. If the PCM part number or tear tag number cannot be found, double-click on the Vehicle Identification Number (VIN) in the top LH corner of the PTS screen. The tear tag number is listed on the Detailed Vehicle Specification.

8. If the scan tool cannot communicate with the vehicle after manually entering the PCM part number, diagnose the PCM does not respond to the scan tool.
   Refer to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Gateway Module A (GWM)

Removal

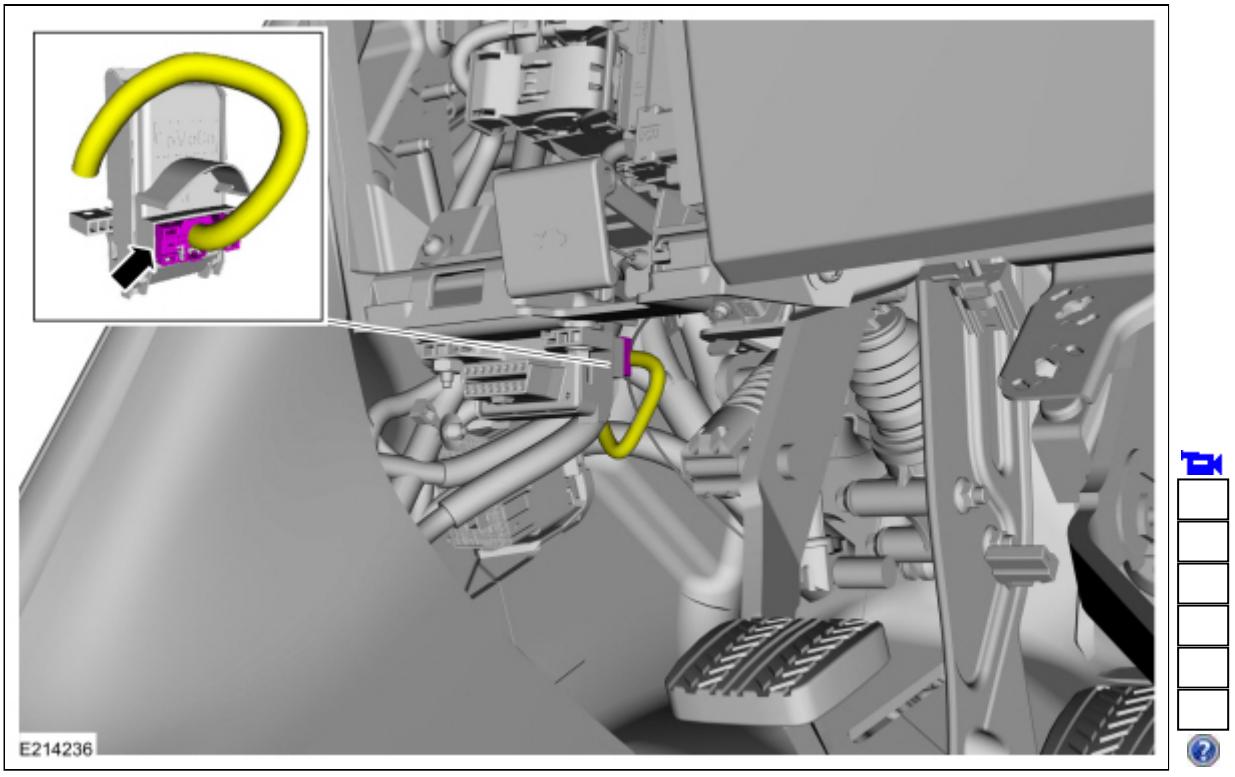
NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

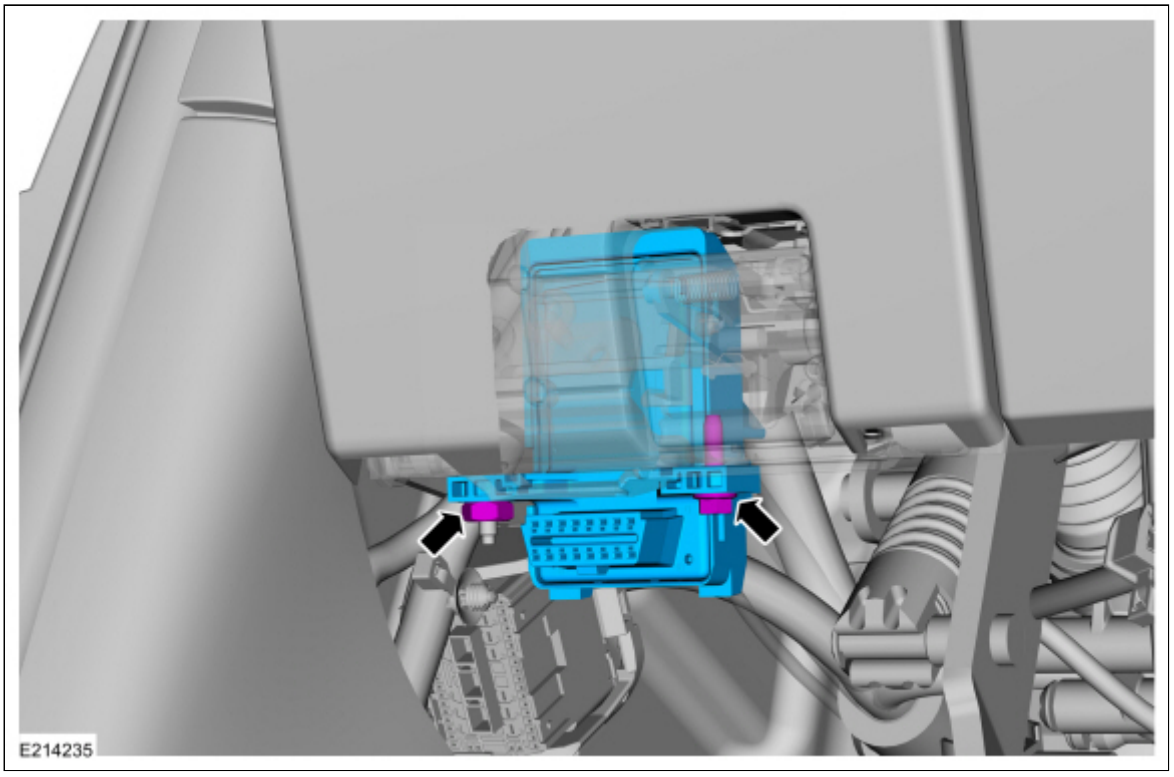
   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

   Upload the GWM configuration to the scan tool by following the scan tool on-screen instructions.

3. 

4. *Torque*: 4 Nm



Installation

1. To install, reverse the removal procedure.
2. Download the GWM configuration information from the scan tool to the new GWM following the scan tool on-screen instructions.

Copyright © 2016 Ford Motor Company

Module Configuration - System Operation and Component Description

System Operation

Programmable Module Installation (PMI)

Programmable Module Installation (PMI) is a scan tool process which configures settings in a new module. Data used for the Programmable Module Installation (PMI) process is automatically downloaded from the original module and stored when a scan tool session is started. If this data cannot be retrieved from the module being replaced, the scan tool may prompt for As-Built data entry or display a list of parameter values that need to be manually selected. Some modules are reprogrammed during Programmable Module Installation (PMI) when a strategy/calibration update is available.

It is important that the scan tool identifies the vehicle and obtains configuration data prior to removing any modules. The new module must be able to communicate with the scan tool in order to carry out Programmable Module Installation (PMI).

Module Programming

Module reprogramming (also referred to as "flashing") is a scan tool process which updates the strategy/calibration in a module. Reprogramming a module with the same level of software does not improve module operation or repair a hardware failure. Module reprogramming is automatically carried out during Programmable Module Installation (PMI) when a later strategy/calibration is available.

Limit module reprogramming to circumstances where a published TSB procedure recommends doing so.

A module cannot communicate with other modules on the communication network while being reprogrammed. After the reprogramming process, clear any network communication Diagnostic Trouble Codes (DTCs) which may have been set in other modules.

Some modules are reprogrammed in coordination with other modules. Follow the IDS key cycling instructions carefully to avoid reprogramming errors, including failure of programming one or more of the modules.

Programmable Parameters

Programmable parameters are customer preference items that may be modified by the dealer via the scan tool or in some cases, modified by the customer following a procedure listed in the Owner's Literature. While many configuration options may exist for a module, only a few of these options are programmable parameters. Some parameters must be changed in multiple modules at the same time.

Adaptive Learning and Calibration

Some modules require a separate learning procedure be carried out if replaced as part of a repair procedure. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

Vehicle Identification (VID) Block

Vehicle identification block commonly stores powertrain configuration items such as VIN, tire size, axle ratio, and whether or not the vehicle is equipped with cruise control.

As-Built Data

As-Built data is a VIN-specific module configuration record. During vehicle build, the configuration from all modules is downloaded and stored in the As-Built database. As-Built data does not reflect customer preference items that have been changed from the default state. These items need to be changed using programmable parameters after the module is configured.

It is not necessary to obtain As-Built data unless directed to do so by the scan tool. This data may be accessed from the technician service publication web site.

Module Configuration and Parameter Chart

The chart describes specific module configuration information:

Module Name	Programmable Module Installation (PMI) Available	Reprogram/Flash Capable	Requires Adaptive Learning or Calibration	Available Progammable Parameters
APIM	Yes	Yes	No	None
ABS module	Yes	Yes	• IVD initialization	None
ACM	Yes	Yes	No	None
BCM	Yes	Yes	LIN slave device configuration	None
CCM	Yes	Yes	Radar horizontal and vertical alignment calibration	None
DC/ DC Converter Control Module (Voltage Quality Module)	Yes	Yes	No	None
DDM	Yes	Yes	Windows initialization	None
FCIM	Yes	Yes	No	None
FCDIM (4.2-inch screen)	Yes	Yes	No	None
GWM	Yes	Yes	No	None
GPSM	Yes	Yes	No	None
HUD Module	Yes	Yes	No	None
IPMA	Yes	Yes	• Camera calibration	None
IPC	Yes	Yes	No	• Driver Beltminder • Mid-passenger Beltminder • Passenger Beltminder • Remote Start Features • My Key • Digital Speedometer • Off road screen • Maintenance settings
PAM (integrated with BCM)	Yes	Yes	No	• Configuration after Tow Bar installation • Configuration after Bull Bar installation
PSCM	Yes	Yes	No	None
PCM	Yes	Yes	No	None
PDM	Yes	Yes	Windows initialization	None

RTM	Yes	Yes	No	None
RCM	Yes	Yes	No	None
SCCM	Yes	Yes	No	None
TCM	Yes	Yes	No	None

Copyright © 2016 Ford Motor Company

Perimeter Anti-Theft Alarm - Overview

Overview

The perimeter alarm system deters unauthorized entry into the vehicle by sounding the horn and flashing all the turn signals and interior courtesy lamps. When an unauthorized entry occurs, the horn and lamps activate for 30 seconds. After 30 seconds, the horn stops sounding, but the lamps continue to flash for up to 5 minutes.

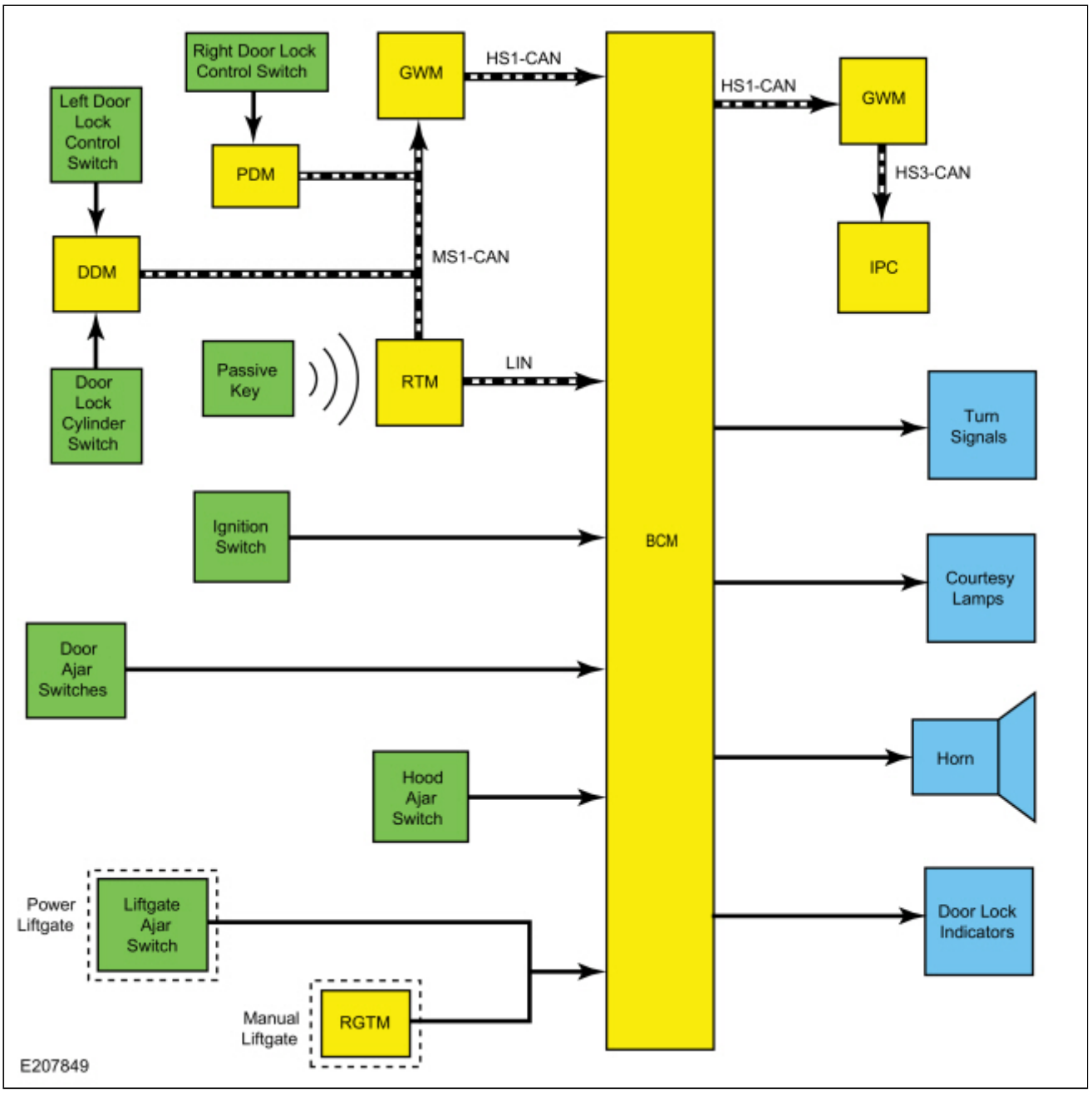
The panic alarm is fitted on selected markets only and operates similarily to the perimeter alarm, but only activates using the panic button on the RKE transmitter. The panic alarm feature only operates when the ignition mode is off.

Copyright © 2016 Ford Motor Company

Perimeter Anti-Theft Alarm - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

IPC Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Perimeter alarm chime request	BCM	Used by the IPC to sound the perimeter alarm chime during the 12-second delay.

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
RKE data	RTM	Used by the BCM to arm/disarm the perimeter alarm or to activate/deactivate the panic alarm.
Driver door lock switch status	DDM	Used by the BCM to arm the perimeter alarm.
Passenger door lock switch status	PDM	Used by the BCM to arm the perimeter alarm.

Perimeter Alarm

The BCM controls the operation of the perimeter alarm. It monitors inputs from the RKE system, the passive entry system, the power door lock system, the door ajar status and the PATS to determine when to arm the perimeter alarm.

The BCM monitors all of the door ajar inputs, the liftgate ajar input and the hood ajar input to determine when to activate the perimeter alarm. When the BCM detects an input indicating an unauthorized entry into the vehicle, the BCM activates the perimeter alarm by sounding the horn and flashing all the turn signals and interior courtesy lamps at regular intervals.

The BCM monitors the RKE system, the passive entry system, and the PATS to determine when to disarm the perimeter alarm.

A switch inhibit feature temporarily disables the door lock control switches and the liftgate release switch 20 seconds after the vehicle is electronically locked. For detailed information of the switch inhibit feature,
Refer to: Handles, Locks, Latches and Entry Systems - Component Location (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Additionally, there is a door lock LED indicator located on each door window sill. The indicators provide lock/unlock indication for each door. They illuminate when the door is locked and are off when the door is unlocked. For detailed information of the door lock LED indicators,
Refer to: Handles, Locks, Latches and Entry Systems - Component Location (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Visual and audible feedback is also provided when locking or unlocking the vehicle. For detailed information of the vehicle locking and unlocking feedback,
Refer to: Handles, Locks, Latches and Entry Systems - Component Location (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Arming The Perimeter Alarm

The perimeter alarm is ready to arm any time the ignition is off. The perimeter alarm pre-arms when any of the following actions are carried out:

- Pressing the lock button on a RKE transmitter
- Pressing the door lock control switch to the lock position with a front door open, and then closing the door
- Touching the 7/8 and 9/0 buttons simultaneously on the keyless entry keypad
- Locking the vehicle with the passive entry feature

Once the system is pre-armed, there is a 20-second countdown before the perimeter alarm is armed. Each entry point to the vehicle (hood, door and liftgate) is armed separately and must be closed before that entry point begins the 20-second countdown to become armed. If all entry points are closed, the turn signals flash upon locking to indicate all entry points are entering the 20-second countdown.

Perimeter Alarm Activation

The perimeter alarm has a 12-second delay when the driver front door is opened without using a valid programmed RKE transmitter, the keyless entry keypad or a passive key to unlock the vehicle. During the delay, a chime sounds. If the perimeter alarm is not disarmed within the 12-second delay, the alarm activates.

The perimeter alarm activates when any of the following actions are carried out:

- The driver front door is opened without first receiving an unlock command from the passive entry feature, the keyless entry keypad or a valid programmed RKE transmitter, and the 12-second delay has expired.

- Any other door, the liftgate or the hood is opened without first receiving an electronic unlock command from the passive entry feature, the keyless entry keypad or a valid programmed RKE transmitter.

The perimeter alarm only activates 10 times per arming cycle. After that, the alarm does not activate. To enable the perimeter alarm again, disarm the perimeter alarm and then arm it again.

Disarming The Perimeter Alarm

The perimeter alarm disarms when any of the following actions are carried out:

- Pressing the unlock button on a door lock control switch within the 20-second pre-arm
- The smart unlock feature activates within the initial 20-second pre-arm
- Pressing the unlock button on a valid programmed RKE transmitter
- Pressing the liftgate release button on a programmed RKE transmitter (this only disarms the liftgate entry point with the rest of the vehicle remaining armed)
- Using a valid programmed key to change the ignition to RUN
- Entering the correct vehicle unlock code on the keyless entry keypad
- Unlocking a front door or opening the liftgate using the passive entry feature

Component Description

Door Latch

The door ajar switch, the lock/unlock solenoid, door lock cylinder lock/unlock switches, and the lock/unlock status input switch are part of the door latch and not serviceable separately.

The door ajar switch is monitored by the BCM and the primary function is for the courtesy lamps system.
Refer to: Interior Lighting - System Operation and Component Description (417-02 Interior Lighting, Description and Operation).

The lock/unlock solenoid is controlled by the BCM for locking and unlocking the door.
Refer to: Handles, Locks, Latches and Entry Systems - Component Location (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

The lock/unlock status input switch is used to illuminate the door lock status indicator.
Refer to: Handles, Locks, Latches and Entry Systems - Component Location (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Hood Latch

The hood ajar switch is part of the hood latch and not serviceable separately.

BCM

The BCM controls the perimeter alarm.

The BCM requires PMI when replaced. Additionally, at least 2 keys must be programmed and the parameter reset procedure carried out.

Copyright © 2016 Ford Motor Company

Perimeter Anti-Theft Alarm

BCM DTC Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B1305:01	Hood Switch: General Electrical Failure	GO to Pinpoint Test C
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Symptom Chart

Symptom Chart: Anti-Theft - Perimeter

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The alarm system does not activate from an unauthorized entry at the hood	• Refer to the Pinpoint Test	GO to Pinpoint Test A
The alarm system does not activate from an unauthorized entry at a door	• Door ajar input	DIAGNOSE the courtesy lamps not illuminating when a door is open. REFER to: Interior Lighting (417-02) .
The alarm system does not activate from an unauthorized entry at the liftgate	• Liftgate ajar input	DIAGNOSE the courtesy lamps not illuminating when a liftgate is open. REFER to: Interior Lighting (417-02) .
The alarm system does not arm or no turn signals flash confirmation	• Refer to the Pinpoint Test	GO to Pinpoint Test B
No horn output during alarm activation	• Horn output concern	REFER to: Horn (413-06 Horn, Diagnosis and Testing).
False alarm activation	• Door ajar input • Hood switch input • Liftgate ajar input • Panic button pressed on a RKE transmitter • A valid PATS key read was NOT received when the ignition	• An intermittent fault exists. MONITOR the BCM alarm event Parameter Identifications (PIDs) to identify and isolate the cause of the last alarm activation. – Most Recent Alarm Trigger Event (ALARM_EVT_1) – 2nd Most Recent Alarm Trigger Event (ALARM_EVT_2)

	transitioned to RUN	– 3rd Most Recent Alarm Trigger Event (ALARM_EVT_3) – 4th Most Recent Alarm Trigger Event (ALARM_EVT_4)

Pinpoint Tests

The Alarm System Does Not Activate from an Unauthorized Entry at the Hood

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- Hood latch
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the hood latch for damage

PINPOINT TEST A : THE ALARM SYSTEM DOES NOT ACTIVATE FROM AN UNAUTHORIZED ENTRY AT THE HOOD

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 MONITOR THE BCM (BODY CONTROL MODULE) HOOD AJAR SWITCH (HOOD_SW) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, monitor the BCM HOOD_SW PID.
- Disconnect Hood Ajar Switch C127.

Does the PID read AJAR when the switch is disconnected?

Yes	INSTALL a new hood latch. REFER to: Hood Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	GO to A2

A2 CHECK THE HOOD AJAR SWITCH INPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280H.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C127-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A3
No	REPAIR the circuit.

A3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect all BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSB. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Alarm System Does Not Arm or No Turn Signals Flash Confirmation

Normal Operations and Fault Conditions

REFER to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

Possible Causes

- Door ajar input
- Hood switch input
- Liftgate ajar input
- Turn signal output
- RKE transmitter concern
- BCM

PINPOINT TEST B : THE ALARM SYSTEM DOES NOT ARM OR NO TURN SIGNALS FLASH CONFIRMATION

B1 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

NOTE: *DTC B1305:01 sets if the hood is open. Make sure the hood is closed prior to running the self-test.*

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC B1305:01 present?

Yes	GO to Pinpoint Test C
No	GO to B2

B2 CHECK THE DOOR AJAR SWITCH INPUT

- Close all the doors.

- Observe the IPC.

Does the IPC indicate a door is ajar?

Yes	DIAGNOSE the courtesy lamps staying on continuously. REFER to: Interior Lighting (417-02) .
No	GO to B3

B3 MONITOR THE LIFTGATE AJAR SWITCH INPUT

- Close the liftgate.
- Observe the IPC.

Does the IPC indicate the liftgate is ajar?

Yes	DIAGNOSE the courtesy lamps staying on continuously. REFER to: Interior Lighting (417-02) .
No	GO to B4

B4 VERIFY THE HAZARD FLASHER LAMP OPERATION

- Ignition OFF.
- Activate the hazard flasher lamp function and observe the turn signals.

Do all the turn signals flash on and off?

Yes	GO to B5
No	DIAGNOSE the inoperative turn signals. REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

B5 CHECK THE RKE (REMOTE KEYLESS ENTRY) TRANSMITTER FUNCTION

- Using the RKE transmitter, lock and unlock the doors.

Do the doors lock and unlock?

Yes	GO to B6
No	DIAGNOSE the inoperative RKE transmitter. REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

B6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSB. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

	REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

B1305:01

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Perimeter Anti-Theft Alarm - System Operation and Component Description (419-01A Perimeter Anti-Theft Alarm, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1305:01	Hood Switch: General Electrical Failure	Sets when the BCM detects an open from the hood ajar switch input during a self-test.

Possible Causes

- Wiring, terminals or connectors
- Hood latch
- BCM

Visual Inspection and Diagnostic Pre-checks

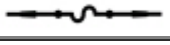
- Inspect the hood latch for damage

PINPOINT TEST C : B1305:01

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE HOOD AJAR SWITCH

- Disconnect Hood Ajar Switch C127.
- Ignition ON.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C127-1		C127-2

- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC B1305:01 still present?

Yes	REMOVE the fused jumper wire. GO to C2
No	REMOVE the fused jumper wire. INSTALL a new hood latch. REFER to: Hood Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

C2 CHECK THE HOOD AJAR SWITCH GROUND CIRCUIT FOR AN OPEN

- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C127-2		Ground

- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC B1305:01 still present?

Yes	REMOVE the fused jumper wire. GO to C3
No	REMOVE the fused jumper wire. REPAIR the hood ajar switch ground circuit.

C3 CHECK THE HOOD AJAR SWITCH INPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280H.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C127-2	Ω	C2280H-14

Is the resistance less than 3 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

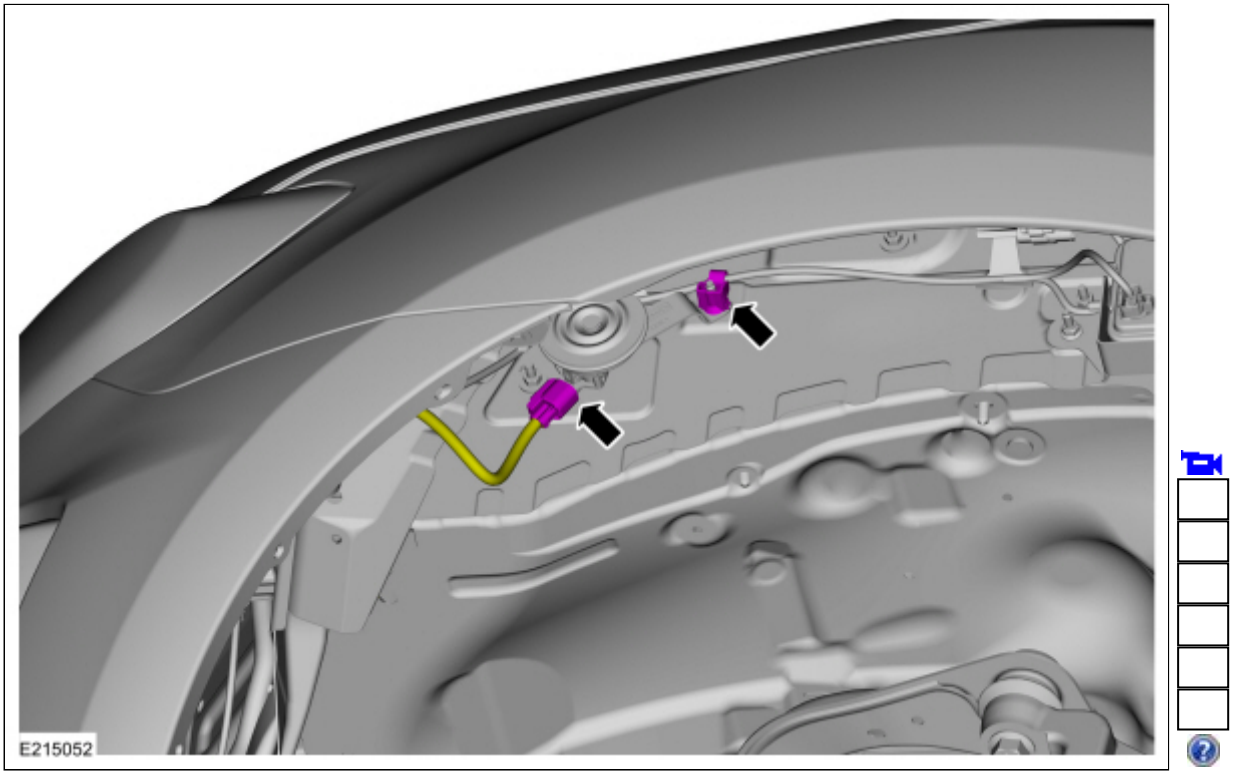
Yes	CHECK OASIS for any applicable TSB. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSB addresses this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

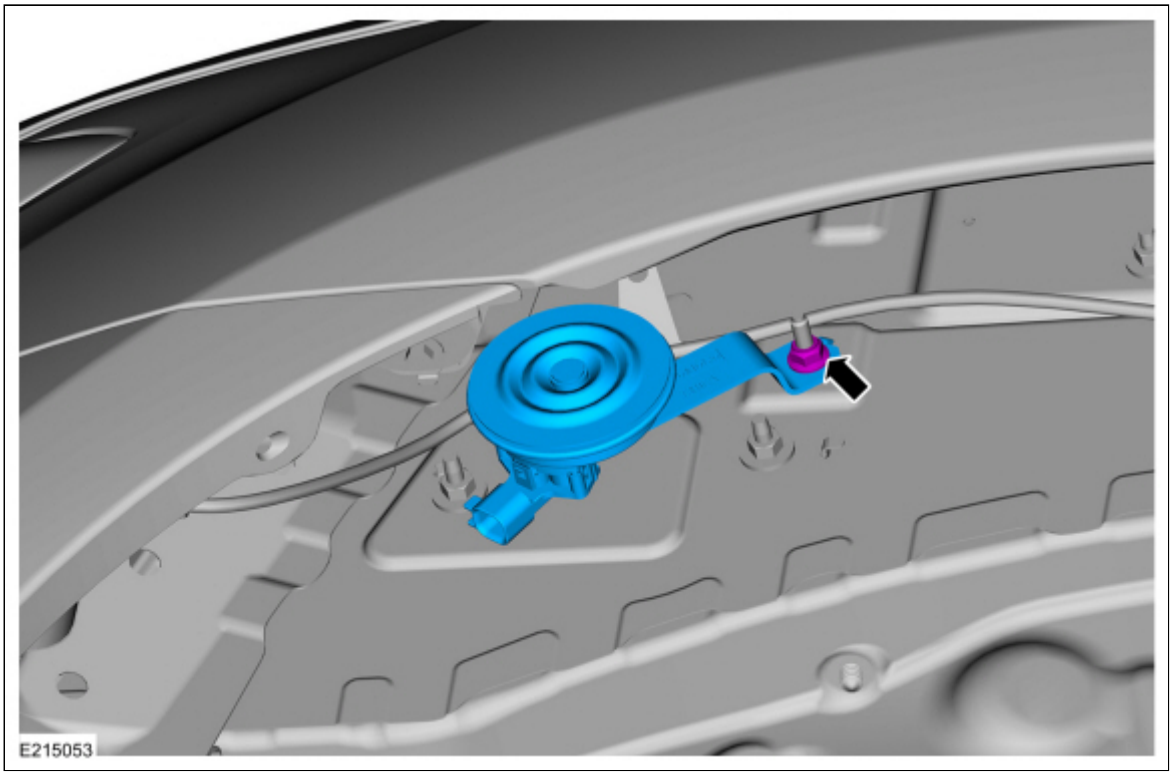
Anti-Theft Alarm Horn

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove front LH Fender splash shield only.
   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
3. 

4. *Torque*: 12 Nm



Installation

1. To install, reverse the removal procedure.

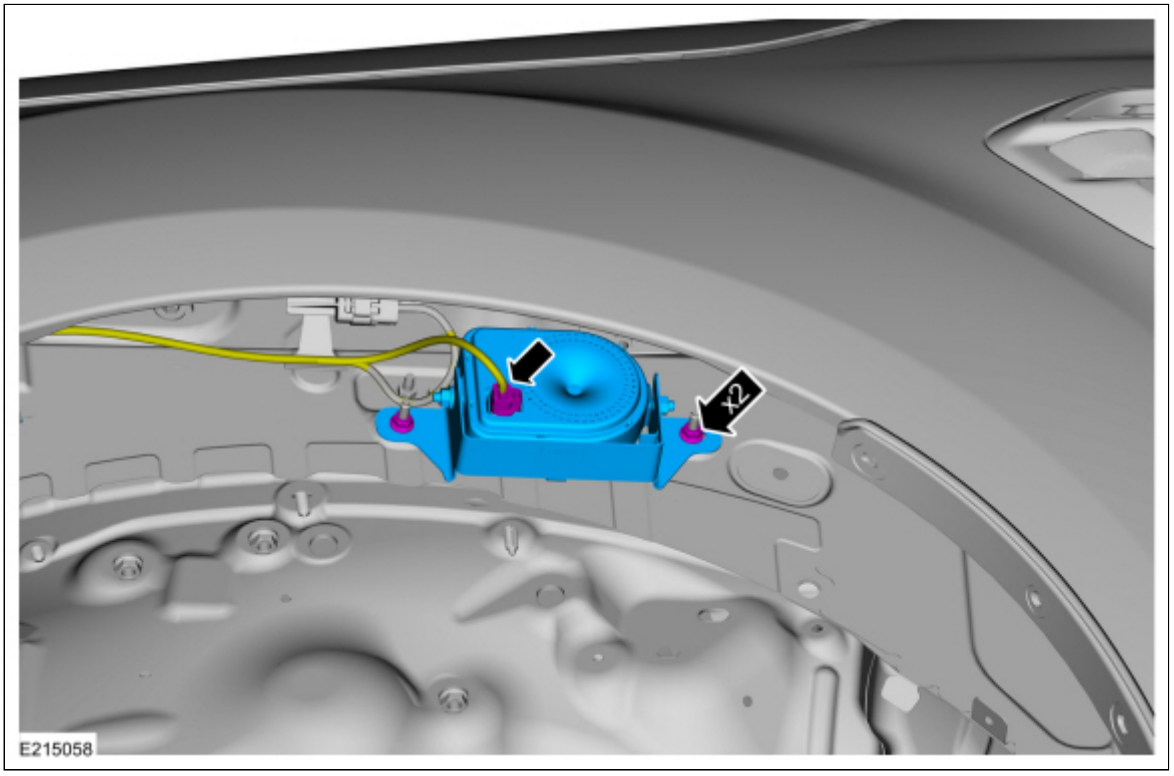
Copyright © 2016 Ford Motor Company

Anti-Theft Alarm Horn with Integral Battery

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove front LH Fender splash shield only.
   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
3. *Torque*: 12 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Intrusion Sensor

Special Tool(s) / General Equipment

Flat-Bladed Screwdriver

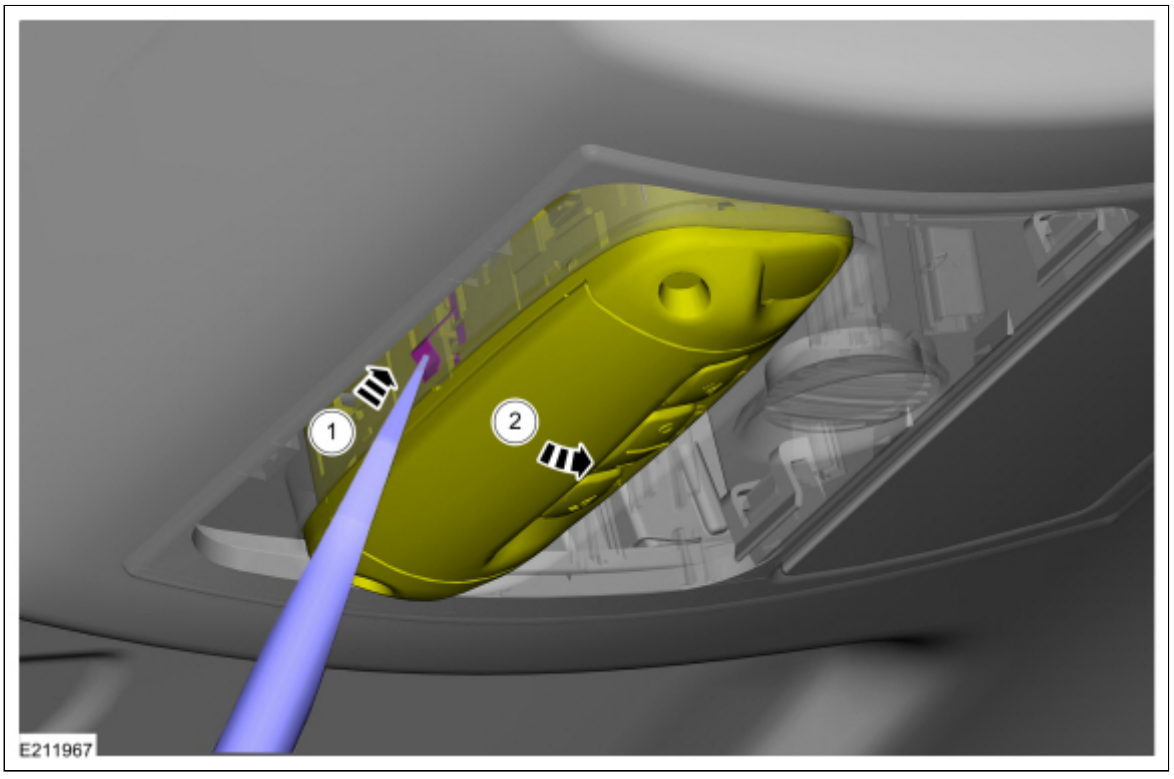
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

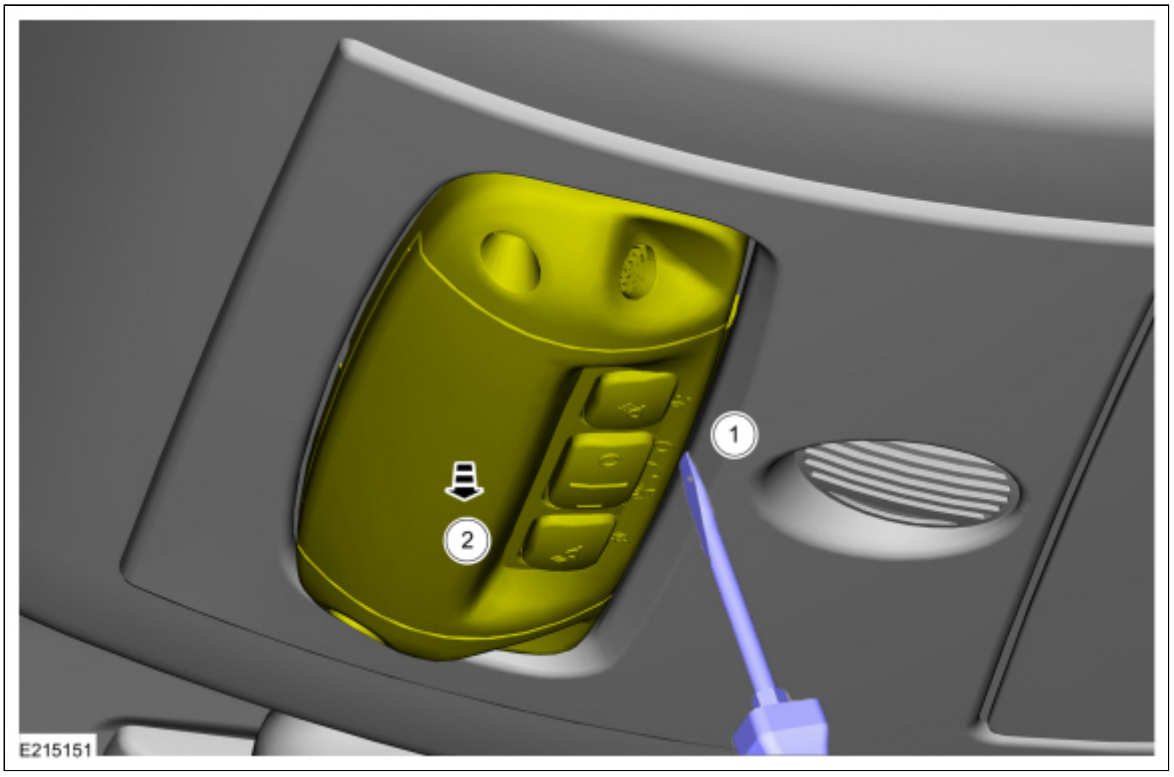
1. **NOTICE: Take extra care when handling the component.**

   NOTICE: Take extra care not to scratch the Interiorlamp lens.

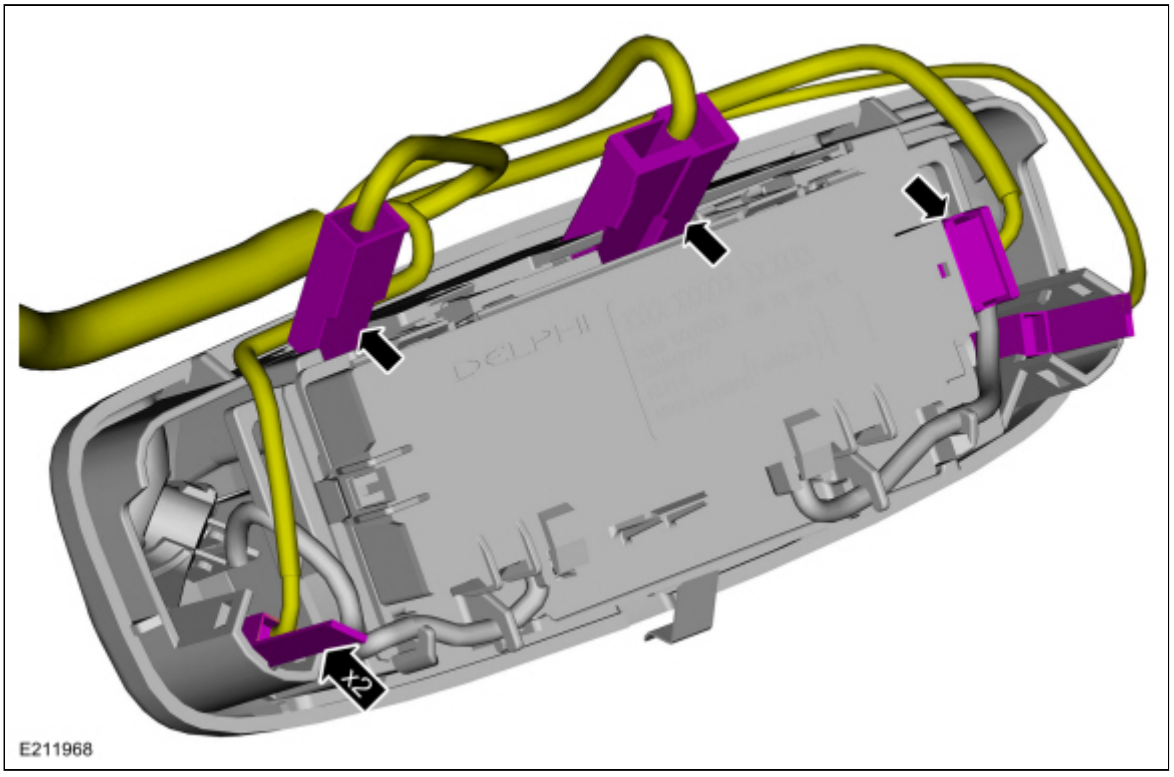
   Use the General Equipment: Flat-Bladed Screwdriver



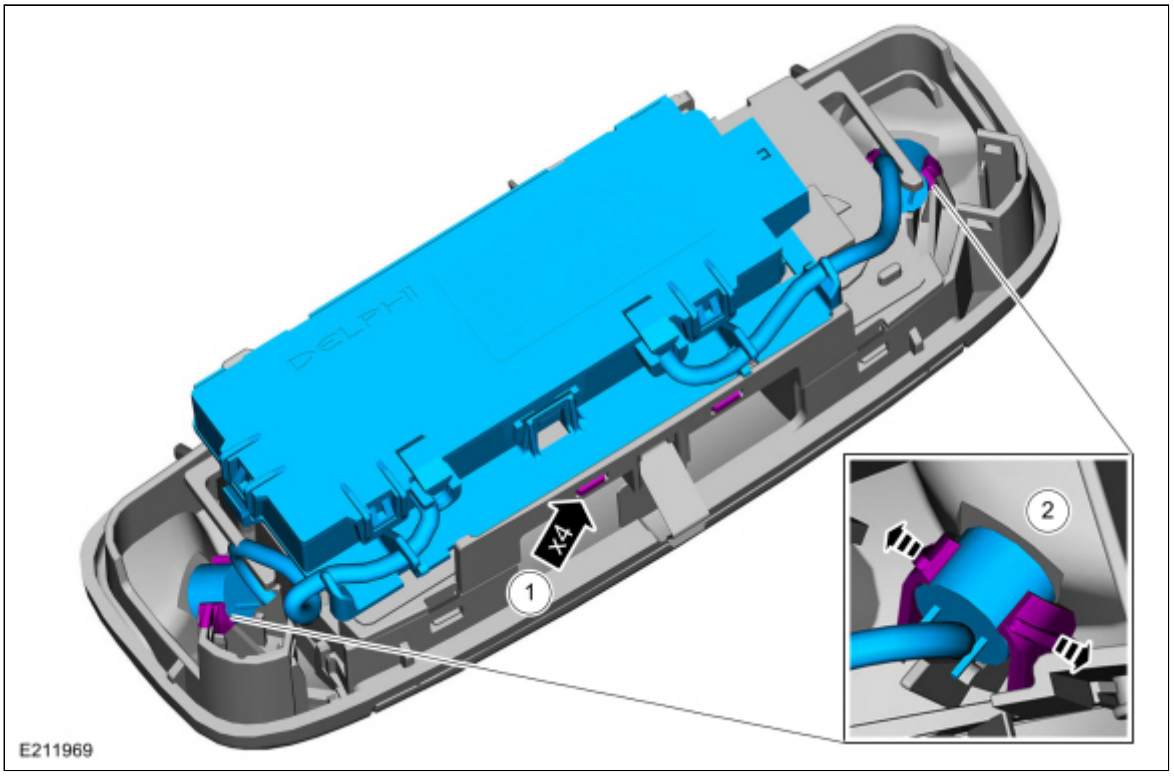
2. Use the General Equipment: Flat-Bladed Screwdriver



3.



4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Passive Anti-Theft System (PATS) - Overview

Overview

The PATS deters the vehicle from theft by preventing the vehicle from starting unless a programmed PATS key is in the ignition lock cylinder.

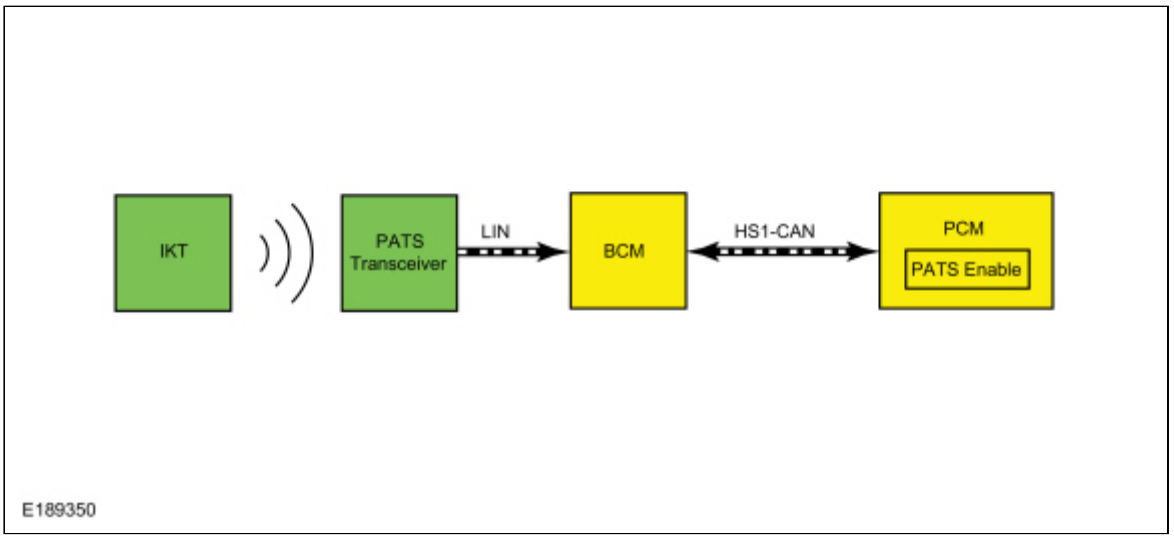
The PATS does not disable an already running vehicle.

Copyright © 2016 Ford Motor Company

Passive Anti-Theft System (PATS) - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
PATS target data	PCM	The PCM sends the BCM a challenge request for a valid ID.

PCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
PATS control command	BCM	The response from the BCM supplying the PCM challenge ID. If the BCM ID response is incorrect, then PATS prevents the vehicle from starting.

PATS

The PATS function is controlled by the BCM and the PCM. There are 2 main checks the PATS carries out before allowing the vehicle to start. These 2 checks are:

- The BCM verifying a programmed key when it is inserted into the ignition lock cylinder.
- The PCM verifying the BCM identification to make sure it matches the identification stored in memory when the ignition state changes to RUN or START.

If either of these checks fail, the PATS does not allow the vehicle to start.

When the BCM detects a key inserted into the ignition lock cylinder, it generates a challenge message. It sends the challenge message to the PATS transceiver over a LIN-based circuit. The transceiver reads the key and generates a response message to the BCM. If the message received from the PATS transceiver does not match a key stored in the BCM memory, the BCM does not respond to the PCM challenge request when the ignition transitions out of off.

The BCM activates the wake-up control circuit when a key is inserted into the ignition lock cylinder or a remote start

request is received (if equipped with factory remote start). or driver door opend.

The BCM wakes up the PCM by supplying voltage on the wake-up control circuit.

Once the PCM is awake, the PCM sends the BCM a second challenge message over the HS-CAN. When the BCM receives the challenge message, it generates a response and sends it back to the PCM. If the response from the BCM does not match the data in the PCM memory, this check fails and the vehicle does not start.

If both the PCM identification and key verification pass, the PATS allows the vehicle to start. The PATS cannot disable or stall a vehicle that is already running.

PATS Parameter Identifications (PIDs)

In conjunction with Diagnostic Trouble Codes (DTCs), the PATS Parameter Identifications (PIDs) are a useful tool when diagnosing PATS concerns.

BCM PID Chart

Acronym	Name	Description
KEYS_PROGMD	PATS number of ignition key codes supported	Displays the number of keys currently programmed into the BCM (if unlimited key mode is enabled, this PID only reads 2 regardless of how many keys are programmed).
MIN_KEYS_RQD	Minimum number of keys required	Minimum number of programmed keys required. This PID always reads 2.
SPAREKEY	Spare Key Programming State	Displays the customer spare key programming mode (Enabled/Disabled). When disabled, keys cannot be programmed using 2 programmed keys.
UNL_KEY_MODE	PATS Unlimited Key Mode	Displays the status of unlimited key mode (Enable/Disable). When disabled, a maximum of 8 keys can be programmed.

PCM PID Chart

Acronym	Name	Description
PATSENABL	Vehicle enable status	Indicates if PATS allows the vehicle to be driven. Must read enabled for the vehicle to be driven.

Component Description

IKT

The IKT incorporates both the PATS functions and the RKE transmitter functions in a single device.

During key programming procedures, the PATS and the RKE transmitter of an IKT are programmed into the BCM. Conventional PATS keys can also be programmed to the vehicle if requested by the customer.

A minimum of 2 and a maximum of 8 keys can be programmed (unless in unlimited key mode).

PATS Transceiver

The PATS transceiver reads any key placed in the ignition lock cylinder. When the ignition changes to RUN or START, the BCM activates the PATS transceiver. Once the PATS transceiver activates, it activates the key in the ignition lock cylinder and receives the key data. Once the PATS transceiver receives the key data, it sends the data to the BCM.

BCM

When the BCM is replaced, program at least 2 keys and carry out the parameter reset procedure.

The BCM requires PMI when replaced.

PCM

When the PCM is replaced, carry out the parameter reset procedure. There is no need to program keys if the PCM is replaced.

The PCM requires PMI when replaced.

Copyright © 2016 Ford Motor Company

Passive Anti-Theft System (PATS)

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B10D5:13	PATS Antenna: Circuit Open	INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).
B10D7:05	PATS Key: System Programming Failure	GO to Pinpoint Test B
B10D7:51	PATS Key: Not Programmed	PROGRAM the PATS key in question. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
B10D7:55	PATS Key: Not Configured	The CEI Lock Configuration within the BODY>SERVICE FUNCTIONS tab was not completed during the PMI procedure. CARRY OUT the CEI Lock Configuration as part of the PMI procedure.
B10D7:87	PATS Key: Missing Message	GO to Pinpoint Test D
B10D7:8F	PATS Key: Erratic	GO to Pinpoint Test C
B10D8:00	PATS Key Less Than Minimum Programmed: No Sub Type Information	Less than 2 keys are programmed (minimum of 2 keys must be programmed). CYCLE the customer's second key in the ignition key cylinder to program (when less than 2 keys are programmed, the BCM automatically programs the first 2 keys that are cycled in the ignition key cylinder).
B10D9:87	PATS Transponder: Missing Message	GO to Pinpoint Test E
B10DA:51	PATS Target Identifier: Not Programmed	There is no PCM ID stored in the BCM memory. CARRY OUT the parameter reset procedure. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
C113A:11	Wakeup Control: Circuit Short To Ground	GO to Pinpoint Test F
C113A:15	Wakeup Control: Circuit Short To Battery or Open	GO to Pinpoint Test F
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action
P161A	Incorrect Response from Immobilizer Control Module	The BCM ID received by the PCM does not match the ID stored in the PCM memory. CARRY OUT the parameter reset procedure. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
All other Diagnostic Trouble Codes (DTCs)	-	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Symptom Chart

Symptom Chart: PATS

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Actions
The vehicle does not start	• Refer to the Pinpoint Test	• GO to Pinpoint Test A
Unable to program keys using two programmed keys	• Spare key programming disabled	• ENABLE the spare key programming. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
Unable to program keys using a diagnostic scan tool	• Base PATS concern • PATS transceiver	• CARRY OUT the BCM self-test. – If any Diagnostic Trouble Codes (DTCs) are present, REFER to the BCM DTC Chart in this section. – If no Diagnostic Trouble Codes (DTCs) are present, INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).

Pinpoint Tests

The Vehicle Does Not Start

Normal Operation and Fault Conditions

REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

Possible Causes

- Communication system concern
- Key not programmed
- PATS concern
- Starting system concern
- Powertrain system concern

PINPOINT TEST A : THE VEHICLE DOES NOT START

NOTE: *This pinpoint test requires a second programmed PATS key. If only one key is available, obtain a*

second programmed PATS key.

A1 CHECK THE OPERATION OF THE SECOND PROGRAMMED KEY

- Using the second programmed PATS key, attempt to start the vehicle.

Does the second programmed key start the vehicle?

Yes	REPROGRAM the first PATS key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures). TEST the system for normal operation. If the concern is still present, DISCARD the PATS key in question and program a new PATS key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
No	GO to A2

A2 CHECK FOR COMMUNICATION WITH THE PCM (POWERTRAIN CONTROL MODULE) AND THE BCM (BODY CONTROL MODULE)

- Ignition ON.
- Using a diagnostic scan tool, carry out the network test.

Does the PCM and the BCM pass the network test?

Yes	GO to A3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A3 CHECK IF THE ENGINE CRANKS

- Attempt to start the engine.

Does the engine crank?

Yes	The no-start condition is not PATS-related. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
No	GO to A4

A4 CHECK FOR PCM (POWERTRAIN CONTROL MODULE) AND BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PCM and the BCM self-tests.

Are any PCM or BCM Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the PCM DTC Chart or the BCM DTC Chart in this section.
No	DIAGNOSE the starting system. Refer to the appropriate section in Group 303 for the procedure.

B10D7:05

Normal Operation and Fault Conditions

When the BCM enters a key programming state, it activates the PATS transceiver to read the key in the ignition lock cylinder. If a valid PATS key is used and there are no concerns with PATS, the key is programmed into the BCM

memory.

REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10D7:05	PATS Key: System Programming Failure	Sets when a PATS key is not successfully programmed into the BCM.

Possible Causes

- PATS key not programmed

Visual Inspection and Diagnostic Pre-checks

- Inspect the PATS key for damage.
- Verify the correct key is used.

PINPOINT TEST B : B10D7:05

B1 CHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE SELF-TEST

- Review the Diagnostic Trouble Codes (DTCs) from the BCM self-test.

Is DTC B10D5:13, B10D7:87, B10D9:87, C113A:11 or C113A:15 present?

Yes	For DTC B10D5:13, INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation). For DTC B10D7:87, GO to Pinpoint Test D For DTC B10D9:87, GO to Pinpoint Test E For DTC C113A:11 or C113A:15, GO to Pinpoint Test F
No	GO to B2

B2 CHECK THE PATS (PASSIVE ANTI-THEFT SYSTEM) KEY

- Verify the correct PATS keys are used with the vehicle. Refer to the PATS Job Aid in the Service Tips tab on the Professional Technician Society (PTS) web page or the parts catalog.

Are the correct PATS keys used?

Yes	PROGRAM the key again. If key programming fails, DISCARD the suspect key and PROGRAM a new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
No	OBTAIN the correct key for the vehicle. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

B10D7:8F

Normal Operation and Fault Conditions

When the ignition transitions to RUN or START, the BCM activates the PATS transceiver to read the key in the ignition lock cylinder. If the BCM does not receive a PATS key code or if the code is invalid, the PATS prevents the vehicle from starting.

REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10D7:8F	PATS Key: Erratic	Sets when the BCM reads a partial or corrupt PATS key read.

Possible Causes

- Radio Frequency (RF) interference
- PATS key
- PATS transceiver

Visual Inspection and Diagnostic Pre-checks

- Inspect the PATS key for damage.
- Verify the correct key is used.

PINPOINT TEST C : B10D7:8F

NOTE: *This pinpoint test requires a second programmed PATS key. If only one key is available, obtain a second programmed PATS key.*

C1 CHECK THE PATS (PASSIVE ANTI-THEFT SYSTEM) KEY

- Verify the correct PATS keys are used with the vehicle. Refer to the PATS Job Aid in the Service Tips tab on the Professional Technician Society (PTS) web page or the parts catalog.

Are the correct PATS keys used?

Yes	GO to C2
No	OBTAIN the correct key(s) for the vehicle. PROGRAM the new key(s). REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

C2 CHECK FOR RADIO FREQUENCY (RF) INTERFERENCE

- Check for metallic objects or other electronic devices on the same key ring, such as a second PATS key for another vehicle or other transponder type of device.

Are any items identified on the key ring that may cause Radio Frequency (RF) interference?

Yes	REMOVE the programmed key from the key ring. TEST the system for normal operation. If the concern is still present, GO to C3 If the concern is no longer present, INFORM the customer of the cause of the concern.
No	GO to C3

C3 ISOLATE THE PATS (PASSIVE ANTI-THEFT SYSTEM) KEYS

- Place the first PATS key in the ignition lock cylinder.
- Ignition ON.
- Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test. Record the results.
- Record the results from the BCM self-test.
- Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Insert the customer's second key.
- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test. Record the results.
- Record the results from the BCM self-test.

Is DTC B10D7:8F retrieved for both keys?

Yes	INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).
No	DISCARD the key in question and PROGRAM a new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

B10D7:87

Normal Operation and Fault Conditions

REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10D7:87	PATS Key: Missing Message	Sets when the BCM does not receive a key read from the PATS transceiver when communication is present.

Possible Causes

- Radio Frequency (RF) interference
- PATS key
- PATS transceiver

PINPOINT TEST D : B10D7:87

NOTE: *This pinpoint test requires a second programmed PATS key. If only one key is available, obtain a second programmed PATS key.*

D1 CHECK FOR RADIO FREQUENCY (RF) INTERFERENCE

- Check for metallic objects or other electronic devices on the same key ring, such as a second PATS key for another vehicle or other transponder type of device.

Are any items identified on the key ring that may cause Radio Frequency (RF) interference?

Yes	REMOVE the programmed key from the key ring. TEST the system for normal operation. If the concern is still present, GO to D2 If the concern is no longer present, INFORM the customer of the cause of the concern.
No	GO to D2

D2 CHECK IF THE CONCERN IS PRESENT FOR BOTH PROGRAMMED KEYS
• Place the first PATS key in the ignition lock cylinder. • Ignition ON. • Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs). • Ignition OFF. • Ignition ON. • Using a diagnostic scan tool, carry out the BCM self-test. • Record the results from the BCM self-test. • Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs). • Ignition OFF. • Insert the customer's second key. • Ignition ON. • Using a diagnostic scan tool, carry out the BCM self-test. • Record the results from the BCM self-test. **Is DTC B10D7:87 present for both keys?**

Yes	INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).
No	DISCARD the key in question and PROGRAM a new key. DISCARD the key in question and PROGRAM a new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

B10D9:87

Refer to Wiring Diagrams Cell 112 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10D9:87	PATS Transponder: Missing Message	Sets when the BCM loses communication with the PATS transceiver.

Possible Causes

- Wiring, terminals or connectors
- PATS transceiver
- BCM

PINPOINT TEST E : B10D9:87

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
E1 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) C113A:11 OR C113A:15
• Review the results from the BCM self-test. **Is DTC C113A:11 or C113A:15 present?**

Yes	GO to Pinpoint Test F
No	GO to E2

E2 CHECK FOR VOLTAGE TO THE PATS (PASSIVE ANTI-THEFT SYSTEM) TRANSCEIVER

- Ignition OFF.
- Disconnect PATS Transceiver C252.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to E4
No	GO to E3

E3 CHECK THE PATS (PASSIVE ANTI-THEFT SYSTEM) TRANSCEIVER VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-1	Ω	C2280G-47

Is the resistance less than 3 ohms?

Yes	GO to E8
No	REPAIR the circuit.

E4 CHECK THE PATS (PASSIVE ANTI-THEFT SYSTEM) TRANSCEIVER GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-1	V	C252-4

Is the voltage greater than 11 volts?

Yes	GO to E5
No	REPAIR the circuit.

E5 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-3		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to E6

E6 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Connect BCM C2280G.
- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to E7
No	REPAIR the circuit.

E7 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-3	Ω	C2280G-52

Is the resistance less than 3 ohms?

Yes	INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation). CLEAR the Diagnostic Trouble Codes (DTCs) and repeat the BCM self-test. If DTC B10D9:87 is retrieved again, GO to E8
No	REPAIR the circuit.

E8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

• Disconnect and inspect all of the BCM connectors.
• Repair:
  • corrosion (install new connectors or terminals, clean module pins)
  • damaged or bent pins - install new terminals/pins
  • pushed-out pins - install new pins as necessary
• Reconnect all the BCM connectors and make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

C113A:11 or C113A:15

Refer to Wiring Diagrams Cell 112 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Passive Anti-Theft System (PATS) - System Operation and Component Description (419-01B Passive Anti-Theft System (PATS), Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C113A:11	Wakeup Control: Circuit Short To Ground	Sets when the BCM detects a short to ground from the wakeup control output circuit.
C113A:15	Wakeup Control: Circuit Short To Battery or Open	Sets when the BCM detects an open short to voltage from the wakeup control output circuit.

Possible Causes

- Wiring, terminals or connectors
- PATS transceiver
- BCM
- PCM

PINPOINT TEST F : C113A:11 OR C113A:15

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
F1 REVIEW THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE SELF-TEST
• Review the Diagnostic Trouble Codes (DTCs) from the BCM self-test.: **Is DTC C113A:11 present?**

Yes	GO to F2
No	GO to F5

F2 ISOLATE THE PCM (POWERTRAIN CONTROL MODULE) AS THE CAUSE FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect PCM C1232C (3.2L).
- Disconnect PCM C1232C (2.2L).
- Disconnect PCM C175C (2.5L).
- Ignition ON.
- Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC C113A:11 still present?

Yes	GO to F3
No	GO to F9

F3 ISOLATE THE PATS (PASSIVE ANTI-THEFT SYSTEM) TRANSCEIVER AS THE CAUSE FOR A SHORT TO GROUND

- Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Disconnect PATS Transceiver C252.
- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC C113A:11 still present?

Yes	GO to F4
No	INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).

F4 CHECK THE WAKEUP CONTROL OUTPUT CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-47	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to F10
No	REPAIR the circuit in question.

F5 CHECK THE WAKEUP CONTROL CIRCUIT FOR AN OPEN OR SHORT TO VOLTAGE

- Attempt to start the vehicle.

Does the vehicle start?

Yes	GO to F7
No	GO to F6

F6 CHECK THE WAKEUP CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect PATS Transceiver C252.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C252-1	Ω	C2280G-47

Is the resistance less than 3 ohms?

Yes	GO to F10
No	REPAIR the circuit.

F7 ISOLATE THE PCM (POWERTRAIN CONTROL MODULE) AS THE CAUSE FOR A SHORT TO VOLTAGE

- Ignition ON.
- Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Disconnect PCM C1232C (3.2L).
- Disconnect PCM C1232C (2.2L).
- Disconnect PCM C175C (2.5L).
- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC C113A:15 still present?

Yes	GO to F8
No	GO to F9

F8 CHECK THE PATS (PASSIVE ANTI-THEFT SYSTEM) TRANSCEIVER WAKEUP CONTROL CIRCUIT AS THE CAUSE FOR A SHORT TO VOLTAGE

- Disconnect BCM C2280G.
- Disconnect PATS Transceiver C252.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280G-47		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to F10

F9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all of the PCM connectors.
- Repair:
  - corrosion (install new connectors or terminals, clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect all the PCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. Refer to the appropriate section in Group 303 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

F10 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all of the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals, clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect all the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, discontinue this test and follow TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. Address the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Anti-Theft Security Access

Programming

NOTE: *In order to gain module security access, the diagnostic scan tool **must** have an active connection to the internet. A hardwired internet connection is strongly recommended.*

NOTE: *When programming keys, the RKE transmitter and the PATS portion of the key are programmed at the same time.*

NOTE: *Common anti-theft security access choices are:*

- ***Program Additional Key***
- ***Erase and Program Keys***
- ***Parameter Reset***
- ***Customer Spare Key Programming Enable/Disable***
- ***Unlimited Key Mode ON/OFF (vehicles with Integrated Keyhead Transmitter (IKT) only)***
- ***Program Unlimited Key Code (vehicles with Integrated Keyhead Transmitter (IKT) only)***

1. **NOTE:** *If no valid programmed keys are available and the perimeter alarm activates when the scan tool is connected, carry out the following steps.*
    - *Wait 10 minutes after triggering the alarm. A single horn chirp sounds to indicate a 1 minute data link access time period begins.*
    - *Connect the scan tool to the DLC and begin a scan tool session.*
    - *Access the PATS Functions to gain security access. Once security access is obtained, the 1 minute data link access time period extends indefinitely.*
    - *Follow the procedure to erase and program keys.*

    Follow the procedure to establish a session with the vehicle.
    Refer to: Diagnostic Methods (100-00 General Information, Description and Operation).
2. From the diagnostic scan tool, enter TOOLBOX. Select Body>Security> PATS Functions.
3. Select Yes when Gaining Security Access displays.
4. Select either Dealer or Aftermarket and enter a valid username and password when prompted.
5. Return to the diagnostic scan tool window.
6. **NOTE:** *If programming a passive key, refer to the Owner's Literature for the backup starting passive key location. The passive key must be placed in this location for the passive key to successfully program.*

    Select the appropriate procedure and follow the on-screen instructions.

Copyright © 2016 Ford Motor Company

Erasing All Key Codes Using Diagnostic Equipment

General Equipment

Worldwide Diagnostic System (WDS) (418-F224)

NOTE: *This procedure is used when a customer needs ignition keys programmed into the system. This procedure is also useful when programmed ignition key(s) have been lost or when the ignition lock cylinder has been replaced or when it is necessary to erase a key(s) from the passive anti-theft alarm system (PATS) memory.*

NOTE: *During this procedure it will be necessary to utilize the Anti-Theft System (PATS) Security Access Procedure. PATS security access must be granted to erase or program ignition keys. The anti-theft security access procedure requires access to the GSEVIN database in order to obtain the coded security access.*

NOTE: *This procedure will erase all programmed ignition keys from the passive anti-theft alarm system (PATS) memory and the engine will not start until two keys have been reprogrammed to the system.*
For additional information, refer to: Key Programming Using Diagnostic Equipment - .

NOTE: *Two PATS encoded keys with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the original keys.*

NOTE: *If the remaining keys are with the customer and are not available with the vehicle, instruct the customer that the remaining keys are no longer valid to start the vehicle. If the customer wants to have these keys to be valid for the vehicle, the keys must be programmed using WDS.*
For additional information, refer to: Key Programming Using Diagnostic Equipment - .

1. Turn the ignition lock cylinder from the 0 position to the II position.
2. From the diagnostic tool menu Select: **Body/Security/PATS Functions** from the menu. Follow the instructions on the screen.
3. From the diagnostic tool menu Select: **Ignition Key Erase**. Follow the instructions on the screen.
4. From the diagnostic tool menu Select: **Ignition Key Programming**. Follow the instructions on the screen.

Copyright © 2016 Ford Motor Company

Key Programming Using Two Programmed Keys

NOTE: *A maximum of 8 ignition keys can be programmed to a vehicle equipped with a passive anti-theft system (PATS).*

1. **NOTE:** *This procedure works only if 2 or more programmed keys are available.*

   For additional information, refer to: Key and Remote Transmitter Programming Using Diagnostic Equipment (419-01B Passive Anti-Theft System (PATS), General Procedures).

2. **NOTE:** *This procedure only works if the customer spare key programming is enabled.*

   For additional information, refer to: Key and Remote Transmitter Programming Using Diagnostic Equipment (419-01B Passive Anti-Theft System (PATS), General Procedures).

3. Insert the first programmed passive anti-theft system (PATS) key into the ignition and turn the key from the OFF position to the ON position (maintain the key in the ON position for approximately 3 seconds).
4. Turn the first key to the OFF position and remove the key from the ignition.
5. Within 10 seconds of turning the key to the OFF position, insert a second programmed passive anti-theft system (PATS) key into the ignition and turn the key from the OFF position to the ON position (maintain the key in the ON position for approximately 3 seconds).
6. Turn the second key to the OFF position and remove the key from the ignition.
7. Within 10 seconds of turning the second key to the OFF position, insert the new, unprogrammed passive anti-theft system (PATS) key into the ignition and turn the key from the OFF position to the ON position (maintain the key in the ON position for approximately 6 seconds).
8. Turn the new key to the OFF position and remove the key from the ignition.
9. If it is desired to program additional keys, repeat steps 3 - 9 for each additional key.

Copyright © 2016 Ford Motor Company

Key and Remote Transmitter Programming Using Diagnostic Equipment

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

NOTE: *This procedure requires access to the Global Secure Vehicle Information System (GSEVIN) database in order to obtain the coded security access.*

NOTE: *This procedure will not erase programmed ignition keys from the passive anti-theft system (PATS).*

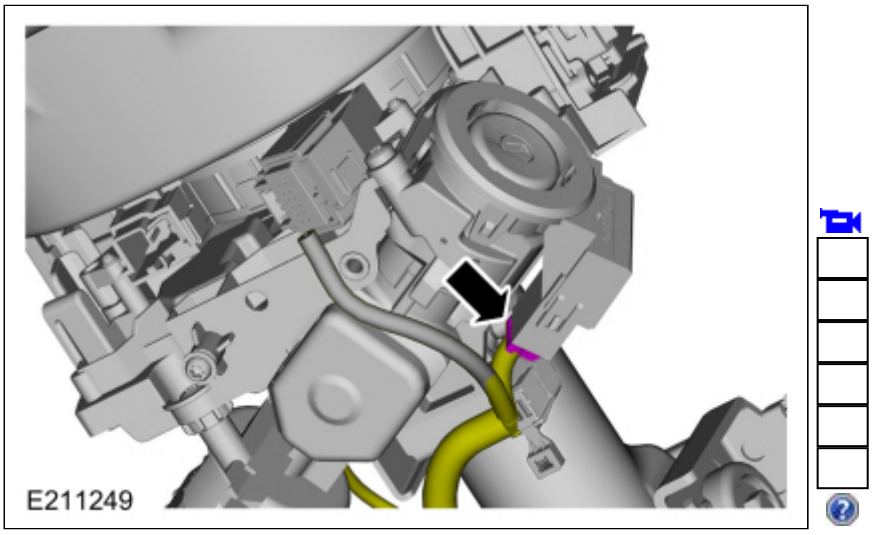
NOTE: *A maximum of 8 ignition keys can be programmed to a vehicle equipped with a passive anti-theft system (PATS).*

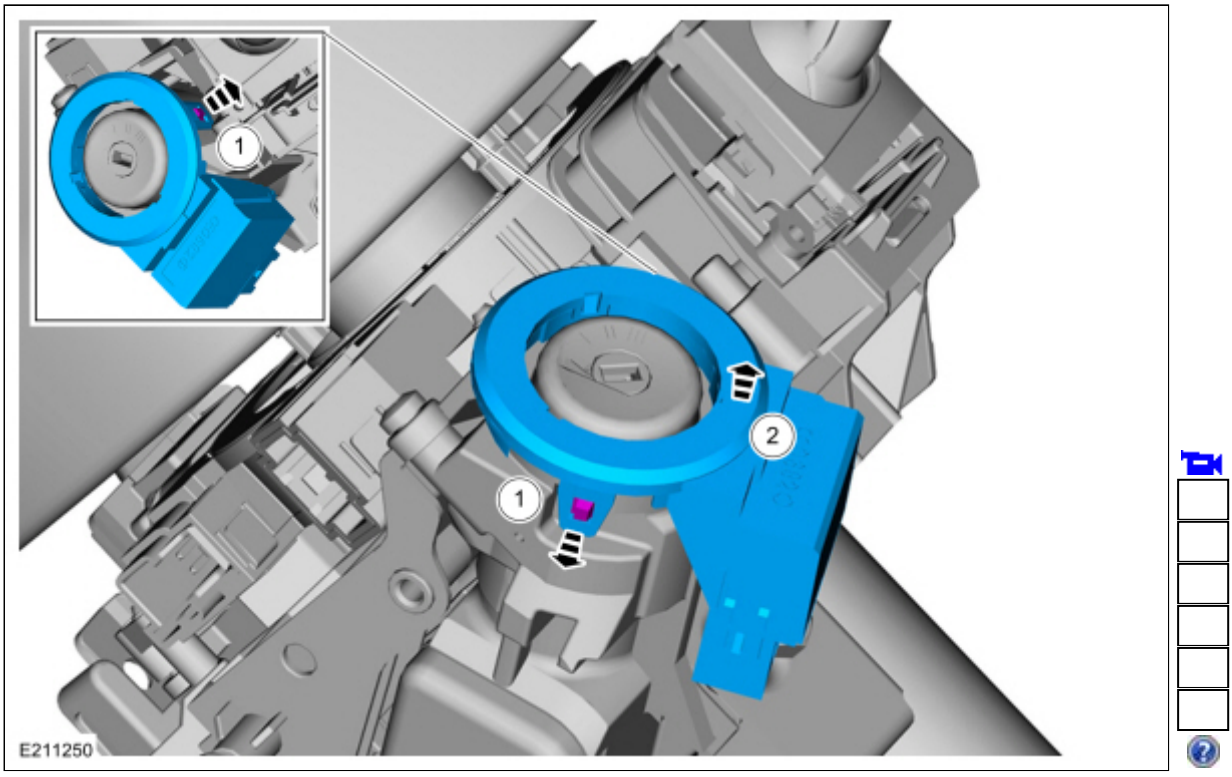
1. From the diagnostic tool menu Select: Body/Security/PATS Functions. Follow the instructions on the screen. Use the General Equipment: Ford Diagnostic Equipment
2. From the diagnostic tool menu Select: Ignition Key Programming. Follow the instructions on the screen.

Copyright © 2016 Ford Motor Company

Passive Anti-Theft System (PATS) Transceiver

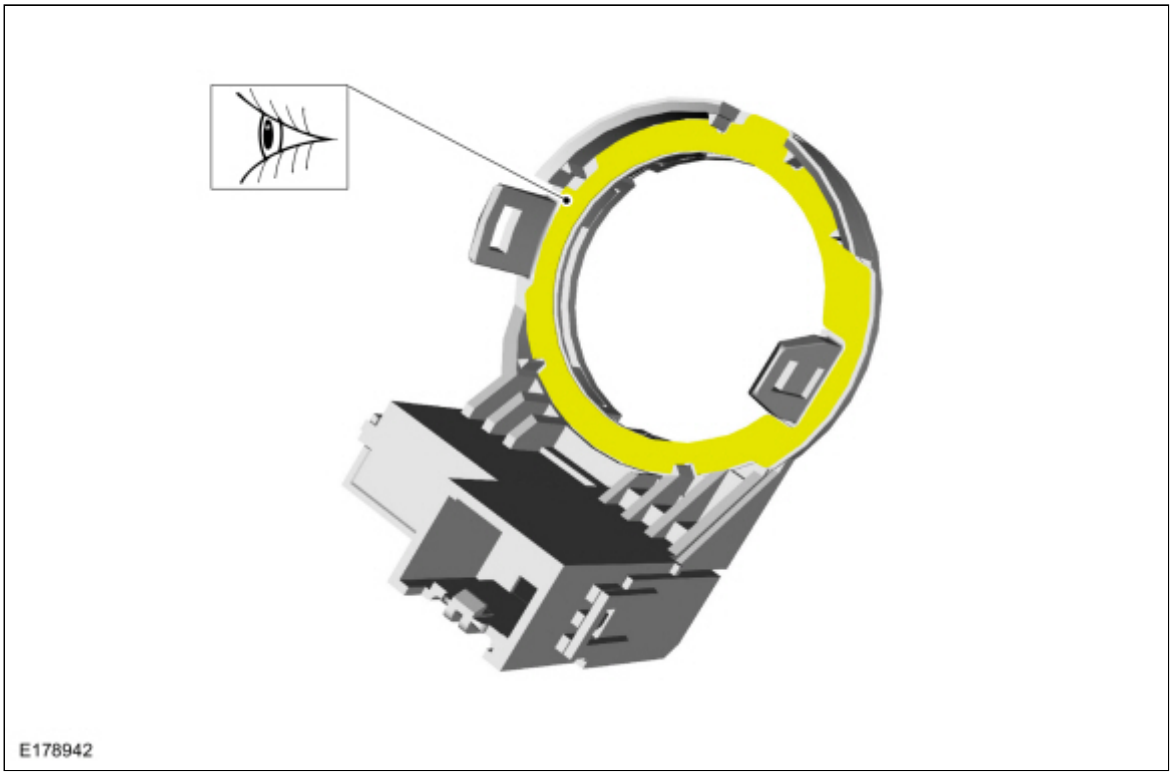
Removal

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. 

4. 

Installation

1. Visually inspect to verify the ring is installed on the PATS transceiver.



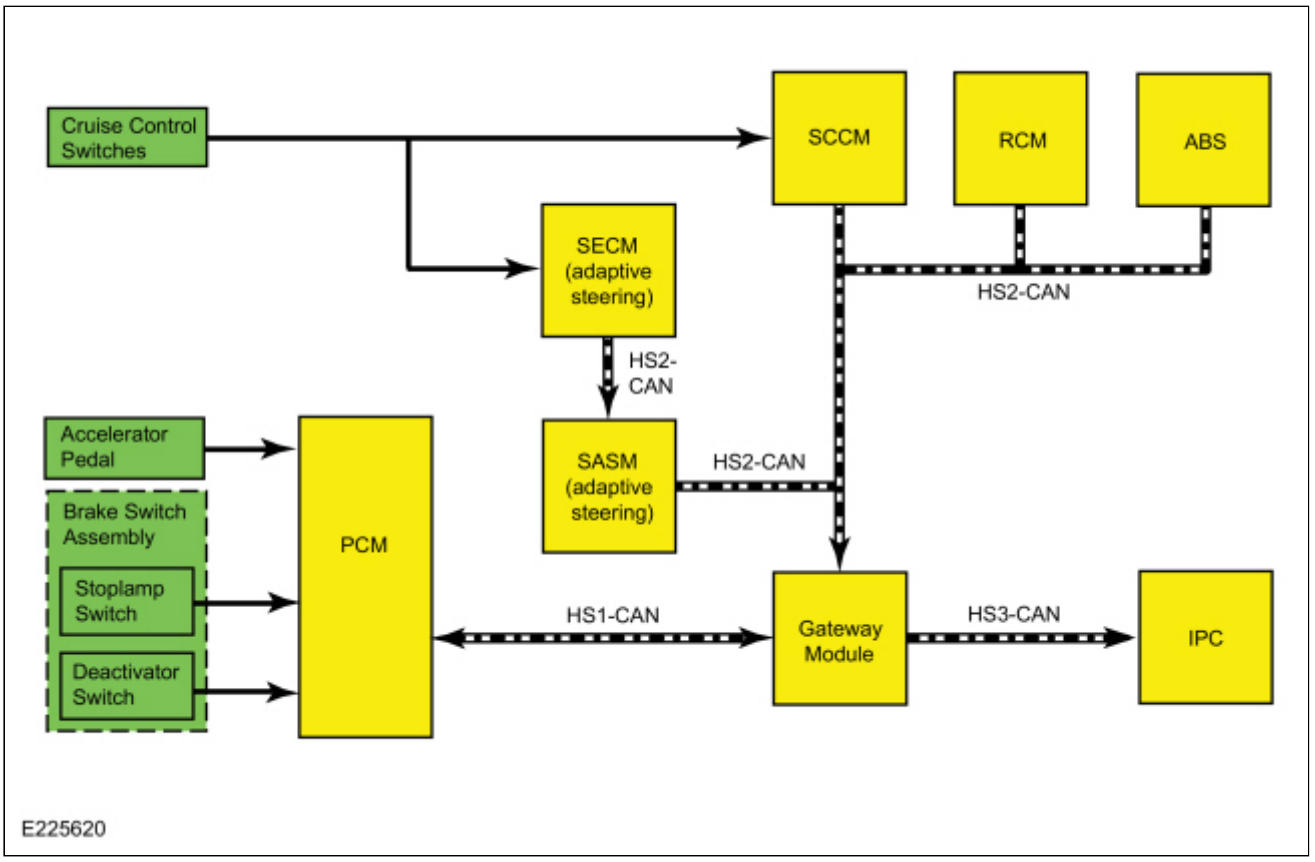
2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Cruise Control - System Operation and Component Description

System Operation

Non-Adaptive Cruise Control



Network Message Chart

Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Cruise control override	PCM	Driver overriding cruise control with accelerator pedal.
Cruise control status	PCM	Data used for speed control indicator status.
Cruise control set speed	PCM	Data used to display the driver selected vehicle speed

Network Input Messages - PCM

Broadcast Message	Originating Module	Message Purpose
Steering wheel switch speed control	SCCM	Used for cruise control enable/disable and operating mode request.
Stability control event in progress	ABS module	Deactivates speed control when requested.
Traction control event in progress		

Vehicle lateral acceleration	RCM	Deactivates speed control when requested.
Vehicle longitudinal acceleration		
Vehicle yaw rate		

Network Input Messages - SCCM (Adaptive Steering)

Broadcast Message	Originating Module	Message Purpose
Cruise control switch commands	SASM	Used for cruise control switch enable/disable and operating mode commands on vehicles equipped with adaptive steering.

Cruise Control Operation

The cruise control functions include:

- turning on the cruise control system.
- setting and maintaining the desired vehicle speed.
- accelerating the vehicle speed.
- coasting down to a lower speed.
- resuming the prior vehicle speed.
- turning off the cruise control system.

The cruise control system maintains a selected vehicle speed within a range between 32 km/h (20 mph), or 30 km/h (18 mph) if equipped with a metric cluster, and the maximum limited vehicle speed. When a MyKey® restricted key is in use, the vehicle speed will not exceed the MyKey® maximum limited speed. During normal driving conditions, the vehicle speed can fluctuate slightly from the selected set speed due to road conditions. The vehicle speed can fluctuate more noticably when driving up and down steep hills.

Certain conditions cause the cruise control system to deactivate:

- Application of the parking brake
- Transmission gear selector is placed into a position other than D or OD
- Cruise control set speed is overridden with the accelerator pedal for a period longer than 5 minutes
- Cruise control switch is pressed or stuck longer than 2 minutes
- Vehicle speed decreases more than 16 km/h (10 mph) below the set speed
- ABS fault

The BPP switch assembly (contains the stoplamp switch and cruise control deactivator switch) and APP sensor are hardwired inputs to the PCM.

Electronic Throttle Body (ETB) command is a hardwired output of the PCM.

The vehicle speed is controlled by the PCM through the Electronic Throttle Control (ETC) subsystem.

The cruise control system provides self-diagnostics. Cruise control is disabled anytime an error is detected in the system. No IPC indicator or message center messages are displayed when faults occur. Fault codes are logged by the PCM or SCCM.

An Electronic Throttle Control (ETC) system fault also causes the cruise control system to be disabled. In this case, an Electronic Throttle Control (ETC) system powertrain malfunction (wrench) warning indicator is displayed.

Cruise Control Indicator

The cruise control indicator, located in the IPC, illuminates to indicate the cruise control system is active.

Steering Wheel Switch Function

Cruise control switch inputs are received by the SCCM and sent to the PCM through the GWM to the HS-CAN1.

Pressing (ON) and releasing the ON/OFF switch turns the cruise control system on. Pressing (SET+) or (SET-) on the SET switch while the vehicle is traveling at the desired speed activates the cruise control system.

Pressing up or down on the SET switch while in the active mode increases or decreases the maintained vehicle

speed by 2 kmh per press when displayed units are "kmh" and 1 mph per press when displayed units are "mph". If the respective switch is pressed and held, the vehicle speed continues to accelerate or decelerate until the switch is released.

Pressing down (OFF) and releasing the ON/OFF switch, or turning the ignition switch to the OFF position, turns the cruise control system off. While the cruise control system is active, applying the brake pedal or pressing the CNCL (CANCEL) switch puts the cruise control system into standby mode. Pressing the RES (RESUME) switch when the cruise control system is in standby mode causes the vehicle to accelerate to the last speed. Resume does not function if the OFF switch is pressed, the ignition switch is cycled OFF, or if the current vehicle speed is below the minimum operational speed.

Steering Wheel Switches

The cruise control steering wheel mounted switches are momentary contact switches that toggle up and down for the switch state. On vehicles without adaptive steering, the switches are an input to the SCCM. On vehicles with adaptive steering, the switches are an input to the SECM. The SECM sends switch data to the SASM (part of the clockspring assembly), and the SASM sends the switch data to the SCCM over the HS-CAN2.

Brake Switch

When the brake pedal is applied, the cruise control deactivator switch, integrated in the BPP switch, opens and removes the ground signal from the PCM input circuit releasing the throttle, immediately deactivating the cruise control system.

Copyright © 2016 Ford Motor Company

Cruise Control

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC Chart: Powertrain Control Module (PCM)

PCM DTC Chart

DTC	Description	Action
P0504	Brake Switch A / B Correlation	GO to Pinpoint Test B
P0572	Brake Switch A Circuit Low	GO to Pinpoint Test B
P0573	Brake Switch A Circuit High	GO to Pinpoint Test B
P0833	Clutch Pedal Switch B Circuit	GO to Pinpoint Test D
P1703	Brake Switch Out Of Self-Test Range	GO to Pinpoint Test B
All other Diagnostic Trouble Codes (DTCs)	–	REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma) . REFER to: Electronic Engine Controls - Vehicles Built From: 17-08-2015 (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .

DTC Chart: Steering Column Control Module (SCCM)

SCCM DTC Chart

DTC	Description	Action
B137F:09	Steering Wheel Left Switch Pack: Component Failure	GO to Pinpoint Test A
B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	GO to Pinpoint Test A
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	GO to Pinpoint Test A
All other Diagnostic Trouble Codes (DTCs)	–	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis

		and Testing).

Symptom Chart(s)

Symptom Chart: Cruise Control

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The cruise control is inoperative - without active front steering	Refer to the Pinpoint Test	GO to Pinpoint Test A
The cruise control switch is inoperative/does not operate correctly - without active front steering	Refer to the Pinpoint Test	GO to Pinpoint Test A
The cruise control does not disengage when clutch pedal is applied	Refer to the Pinpoint Test	GO to Pinpoint Test C
The cruise control indicator lamp is never/always on	• Wiring, terminals and connectors • PCM • IPC	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
The cruise control cannot set above 105 kmh (65 mph), 113 kmh (70 mph), 121 kmh (75 mph), or 129 kmh (80 mph)	A MyKey® restricted key is in use and MyKey® max speed limiter is turned on	VERIFY whether a MyKey® restricted key is in use. With an admin key, VERIFY if MyKey® max speed limiter is turned on. REFER to the Owner's Literature. If necessary, VERIFY cruise control normal operation with an admin key.

Pinpoint Tests

The Cruise Control Is Inoperative - Without Active Front Steering

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - System Operation and Component Description (211-05 Steering Column Switches, Description and Operation).

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

DTC Fault Trigger Conditions - SCCM

DTC	Description	Action
B137F:09	Steering Wheel Left Switch Pack: Component Failure	A continuous and on-demand DTC that sets when one or more of the cruise control switches are stuck.

B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	A continuous and on-demand DTC that sets when the cruise control switch circuits are shorted to ground.
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	A continuous and on-demand DTC that sets when the cruise control switch circuits are shorted to voltage.

Possible Sources

- Wiring, terminals or connectors
- Cruise control switch
- Digital TR sensor
- PCM
- SCCM
- BPP switch

PINPOINT TEST A : THE CRUISE CONTROL IS INOPERATIVE - WITHOUT ACTIVE FRONT STEERING

A1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test.
- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	If PCM Diagnostic Trouble Codes (DTCs) were retrieved, REFER to the PCM DTC Chart in this section. If SCCM DTC B137F:09, B137F:11 or B137F:17 was retrieved, GO to A3 For other SCCM Diagnostic Trouble Codes (DTCs), REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
No	GO to A2

A2 CHECK THE STOPLAMP SWITCH (BOO1) AND CRUISE CONTROL DEACTIVATOR SWITCH (BOO2) PARAMETER IDENTIFICATIONS (PIDS)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Using the table, monitor the Parameter Identifications (PIDs) BOO1 (stoplamp switch) and BOO2 (cruise control deactivator switch) while applying and releasing the brake pedal.

Brake Pedal Position	BOO1 PID	BOO2 PID
Released	Off	Off
Applied	On	On

Do the PID values agree with the brake pedal position?

Yes	GO to A3
No	GO to Pinpoint Test B

A3 CHECK THE CRUISE CONTROL SWITCH PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view SCCM Parameter Identifications (PIDs).
- Using the table, press each cruise control switch while monitoring the cruise control switch PID.

Cruise Control Switch	PID Value
Cruise On (pressed/released)	On/Off
Cruise Off (pressed/released)	On/Off

Cruise Off (pressed/released)	On/Off
Resume (pressed/released)	On/Off
Cancel (pressed/released)	On/Off
SET + (pressed/released)	On/Off
SET - (pressed/released)	On/Off

Does the PID value agree with the switch position?

Yes	GO to A4
No	If only one switch does not display the correct PID value, INSTALL a new LH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). If multiple switches do not display the correct PID value, GO to A5

A4 MONITOR THE PCM (POWERTRAIN CONTROL MODULE) TR (TRANSMISSION RANGE) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the PCM PID TR.
- Select DRIVE.

Does the PID value agree with the TR selector lever position?

Yes	GO to A9
No	REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).

A5 CHECK FOR VOLTAGE TO THE CRUISE CONTROL SWITCHES

- Ignition OFF.
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect LH Steering Wheel Switch C2998.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-4	V	C2998-5
C2998-6	V	C2998-5
C2998-7	V	C2998-5

Is the voltage approximately 5 volts?

Yes	TURN the ignition off and WAIT one minute. INSTALL a new LH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation). INSTALL the driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
No	GO to A6

No	GO to A6

A6 CHECK THE STEERING WHEEL SWITCH HARNESS FOR AN OPEN

- Ignition OFF.
- Disconnect Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-4	Ω	C218B-15
C2998-5	Ω	C218B-8
C2998-6	Ω	C218B-6
C2998-7	Ω	C218B-7

Are the resistances less than 3 ohms?

Yes	GO to A7
No	Install a new steering wheel. REFER to: Steering Wheel (211-04 Steering Column) .

A7 CHECK THE STEERING WHEEL SWITCH CIRCUITS THROUGH THE CLOCKSPRING FOR AN OPEN

- Disconnect Clockspring C218G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C218B-6 (component side)	Ω	C218G-5 (component side)
C218B-7 (component side)	Ω	C218G-7 (component side)
C218B-15 (component side)	Ω	C218G-8 (component side)

Are the resistances less than 3 ohms?

Yes	GO to A8
No	Install a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

A8 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A9 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P0504, P0572, P0573 OR P1703

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0504	Brake Switch A / B Correlation	A DTC that sets when the PCM does not sense the correct sequence of the brake pedal input signal from both the cruise control deactivator and stoplamp switches when the brake pedal is pressed and released.
P0572	Brake Switch "A" Circuit Low	A DTC that sets when the PCM detects an open in the stoplamp switch signal. The PCM monitors the vehicle speed, the engine speed, the engine torque and the stoplamp input during start and stop driving cycles. If the stoplamp switch input to the PCM is always off during start and stop driving cycles, this DTC sets in continuous memory.

P0573	Brake Switch "A" Circuit High	A DTC that sets when the PCM detects a short to voltage on the stoplamp switch signal. The PCM monitors the vehicle speed, the engine speed, the engine torque and the stoplamp switch input during start and stop driving cycles. If the stoplamp lamp switch input to the PCM is always on during start and stop driving cycles, this DTC sets in continuous memory.
P1703	Brake Switch Out Of Self - Test Range	A DTC that sets in the PCM during the self-test when the stoplamp switch input signal is high or does not cycle high and low.

Possible Sources

- Wiring, terminals or connectors
- Stoplamp switch
- PCM

PINPOINT TEST B : P0504, P0572, P0573 OR P1703

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK THE OPERATION OF THE STOPLAMPS

- Ignition ON.
- Operate the stoplamps.

Do the stoplamps and high mounted stoplamp operate correctly?

Yes	GO to B2
No	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).

B2 CHECK THE STOPLAMP SWITCH (BOO1) AND CRUISE CONTROL DEACTIVATOR SWITCH (BOO2) PARAMETER IDENTIFICATIONS (PIDS)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Using the table, monitor the Parameter Identifications (PIDs) BOO1 (stoplamp switch) and BOO2 (cruise control deactivator switch) while applying and releasing the brake pedal.

Brake Pedal Position	BOO1 PID	BOO2 PID
Released	Off	Off
Applied lightly	On	Off
Applied firmly	On	On

Do the PID values agree with the brake pedal position?

Yes	GO to B8
No	For an incorrect BOO1 PID value, GO to B3 For an incorrect BOO2 PID value, GO to B4

B3 CHECK THE STOPLAMP SWITCH CIRCUIT

- Ignition OFF.
- Disconnect: PCM C175B (2.5L), C1232A (2.2L Diesel) or (3.2L Diesel).
- Ignition ON.
- While applying and releasing the brake pedal, measure:

2.5L

Positive Lead	Measurement / Action	Negative Lead
C175B-2		Ground

2.2L or 3.2L Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-46		Ground

Is the voltage greater than 11 volts with the brake pedal applied and no voltage with the brake pedal released?

Yes	GO to B8
No	REPAIR the circuit.

B4 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect: PCM C175B (2.5L), C1232A (2.2L Diesel) or (3.2L Diesel).
- While firmly applying and releasing the brake pedal, measure:

2.5L

Positive Lead	Measurement / Action	Negative Lead
C175B-2	Ω	Ground

2.2L or 3.2L Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-46	Ω	Ground

Is the resistance less than 3 ohms with the brake pedal released, and greater than 10,000 ohms with the brake pedal firmly applied?

Yes	GO to B8
No	GO to B5

B5 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH GROUND CIRCUIT FOR AN OPEN

- Disconnect: BPP switch C280.
- Measure:

Positive Lead	Measurement / Action	Negative Lead

C280-3	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to B6
No	REPAIR the circuit.

B6 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C280-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B7
No	REPAIR the circuit.

B7 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH SIGNAL CIRCUIT FOR AN OPEN

- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C277-2		C277-3

- Measure:

2.5L

Positive Lead	Measurement / Action	Negative Lead
C175B-66	Ω	Ground

2.2L Diesel or 3.2L Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-46	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new BPP switch.
No	REPAIR the signal circuit for an open.

B8 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Cruise Control Does Not Disengage When The Clutch Pedal Is Pressed

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

Possible Sources

- CPP switch
- PCM
- Wiring, terminals and connectors

PINPOINT TEST C : THE CRUISE CONTROL DOES NOT DISENGAGE WHEN THE CLUTCH PEDAL IS PRESSED

C1 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH (CPP_TOP) PARAMETER IDENTIFICATION (PID)

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the PCM Parameter Identification (PID) CPP_TOP while pressing and releasing the clutch pedal.

Does the Parameter Identification (PID) value read "YES" with the clutch pedal pressed?

Yes	GO to C5
No	GO to C2

C2 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH

- Ignition OFF.

- Disconnect the CPP switch connector C277.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C277-2		C277-1

- Ignition ON.
- Using a diagnostic scan tool, monitor the PCM Parameter Identification (PID) CPP_TOP.

Does the Parameter Identification (PID) value read YES?

Yes	INSTALL a new CPP switch.
No	GO to C3

C3 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect CPP switch connector C277.
- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C277-2		Ground

- Ignition ON.
- Using a diagnostic scan tool, monitor the PCM Parameter Identification (PID) CPP_TOP.

Does the Parameter Identification (PID) value read YES?

Yes	REPAIR the ground circuit.
No	GO to C4

C4 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect:
  - On vehicles equipped with a 2.5L engine disconnect PCM connector C175B
  - On vehicles equipped with a 2.2L Diesel or 3.2L Diesel engine disconnect PCM connector. C1232A
- Measure:

2.5L:

Positive Lead	Measurement / Action	Negative Lead
C277-2	Ω	C175B-3

- Measure

2.2L or 3.2L Diesel:

Positive Lead	Measurement / Action	Negative Lead
C277-2	Ω	C1232A-12

Is the resistance less than 3 ohms?

Yes	GO to C5
No	REPAIR the circuit.

C5 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- REPAIR:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new PCM. For vehicles equipped with a 2.5L engine: REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For vehicles equipped with a 2.2L Duratorq engine:REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For vehicles equipped with a 3.2L Duratorq engine: REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P0833

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

NOTE: *Jump (push) starting the engine will cause an engine RPM correlation error when the engine rotates without a starter motor crank command. Incorrectly installed or aftermarket alarm systems may induce this fault, also.*

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0833	Clutch Pedal Switch "B" Circuit	A DTC that sets when the PCM receives the vehicle speed input, indicating movement and does not detect the switching input signal from the CPP switch. This condition disables cruise control

Possible Sources

- Wiring, terminals and connectors
- CPP switch
- PCM

PINPOINT TEST D : CPP (CLUTCH PEDAL POSITION) SWITCH "B" CIRCUIT DIAGNOSIS

D1 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH (CPP_TOP) PARAMETER IDENTIFICATION (PID)

- Ignition ON.
- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the PCM PID CPP_TOP while pressing and releasing the clutch pedal.

Does the Parameter Identification (PID) value read "YES" with the clutch pedal pressed, and "NO' with the clutch pedal released?

Yes	GO to D4
No	For Parameter Identification (PID) always reads "NO", GO to Pinpoint Test For Parameter Identification (PID) always reads "YES", GO to D2

D2 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect:
  - 2.5L Engine: PCM Connector C175B
  - 2.2L or 3.2L Dieselt: PCM Connector C1232A
- Measure:

2.5L Engine:

Positive Lead	Measurement / Action	Negative Lead
C175B-3	Ω	Ground

- Measure

2.2L or 3.2L Diesel:

Positive Lead	Measurement / Action	Negative Lead
C1232A-12	Ω	Ground

Is the resistance value greater than 10,000 ohms?

Yes	GO to D4
No	GO to D3

D3 CHECK THE CPP (CLUTCH PEDAL POSITION) SWITCH SIGNAL CIRCUIT FOR A SHORT TO GROUND WITH THE CPP (CLUTCH PEDAL POSITION) SWITCH DISCONNECTED

- Disconnect the -CPP switch connector C277
- Disconnect:
  - 2.5L Engine: PCM connector C175B
  - 2.2L or 3.2L Diesel: PCM connector C1232A
- Measure:

2.5L Engine:

Positive Lead	Measurement / Action	Negative Lead
C175B-3	Ω	Ground

- Measure

2.2L or 3.2L Diesel:

Positive Lead	Measurement / Action	Negative Lead
C1232A-12	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	Install a new CPP switch
No	Repair the circuit short to ground

D4 RECHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Reconnect all connectors.
- Using a scan-tool clear the PCM Diagnostic Trouble Codes (DTCs).
- Repeat the PCM self-test.

Are any PCM Diagnostic Trouble Codes(DTCs) recorded?

Yes	INSTALL a new PCM. For vehicles equipped with a 2.5L engine: REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For vehicles equipped with a 2.2L Diesel:REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For vehicles equipped with a 3.2L Diesel: REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	GO to D5

D5 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no TSB addresses this concern, INSTALL a new PCM. For vehicles equipped with a 2.5L engine: REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). For vehicles equipped with a 2.2L Diesel:REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).

	For vehicles equipped with a 3.2L Diesel: REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Cruise Control Radar Alignment

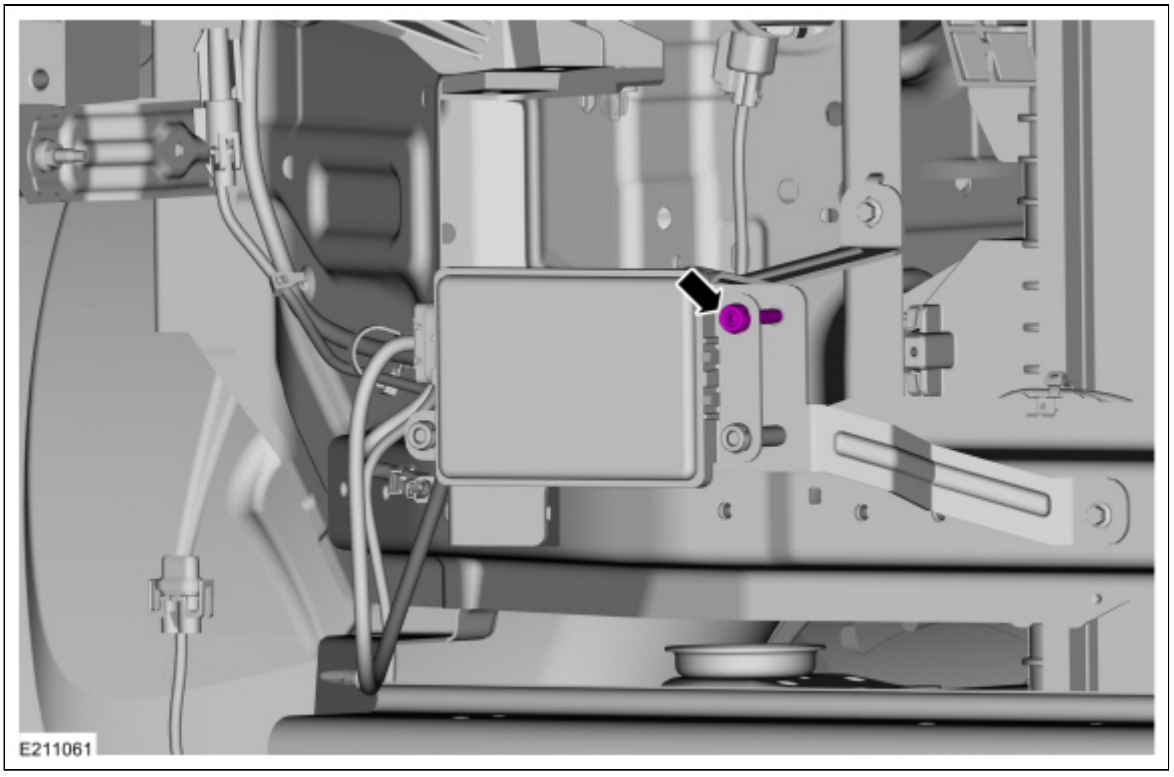
Activation

Vertical Alignment

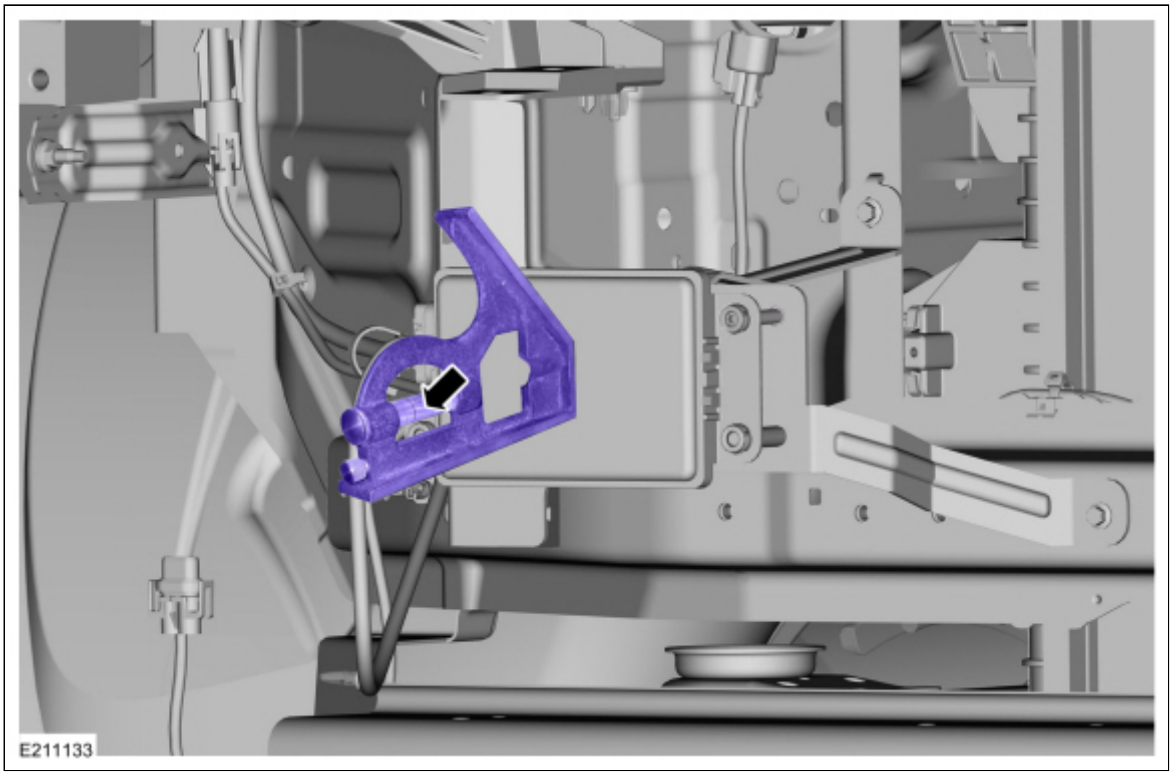
NOTE: *In order to align the CCM, the front bumper cover must be removed to access the sensor and the vehicle must be in a wheel alignment bay station so that the vehicle is level.*

NOTE: *Damage to the CCM bracket may affect correct alignment. When aligning the CCM, inspect the CCM bracket for damage and repair as necessary before carrying out the alignment procedure.*

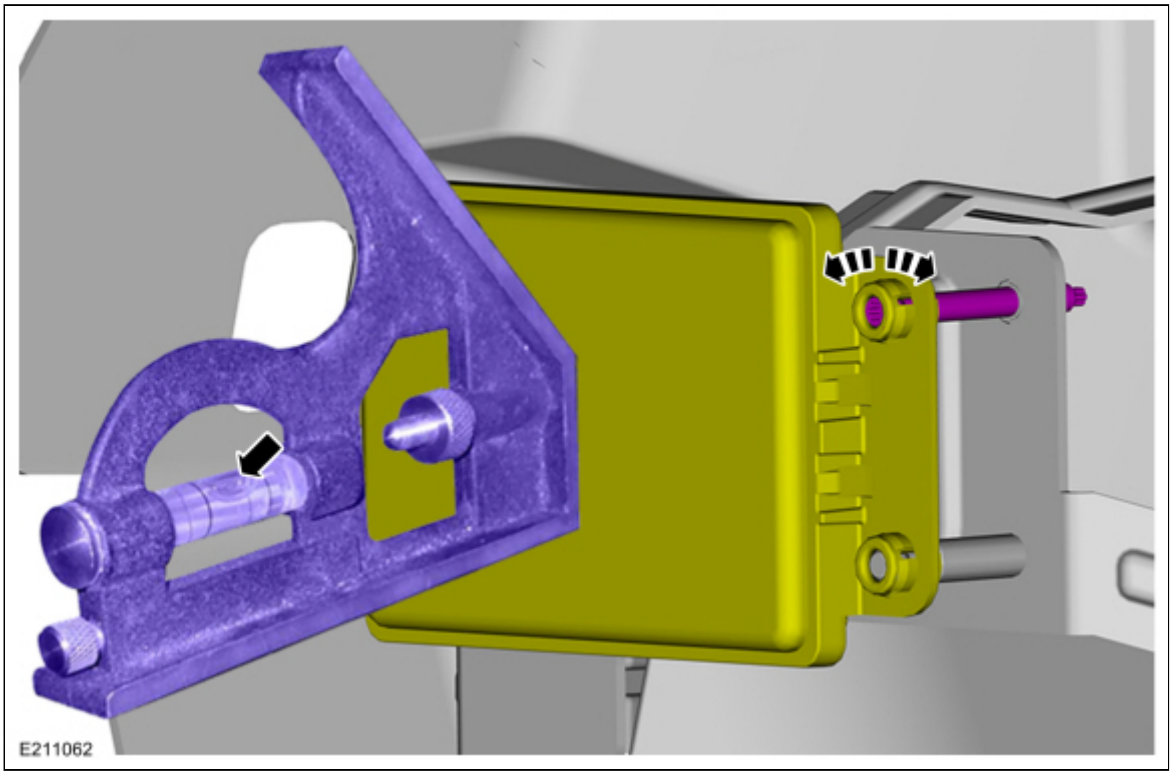
1. Remove the front bumper cover.
   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
2. Place the vehicle on a wheel alignment bay station.
3. Locate the CCM alignment screw.



4. Place a combination square level on the face of the CCM and check the alignment.



5. Keeping the combination square level on the face of the CCM, adjust the pitch by using an E20 Torx® bit to adjust the screw until the CCM is vertical and level.



6. **NOTE:** *Prior to installing the front bumper cover, clean and remove any debris on the front or back of the cover.*

   Install the front bumper cover.

Horizontal Alignment

NOTE: *The horizontal alignment for the CCM is a software calibration. No manual adjustment is needed for this procedure. The scan tool calibrates the CCM through the CCM procedure in programmable parameters.*

7. **NOTICE: The vehicle's engine must be running during the horizontal alignment procedure. Failure to leave the engine running throughout the entire procedure results in the cancellation of the alignment procedure and the system remains non-functional.**

Start the engine.

8. Follow the scan tool on-screen instructions to carry-out the CCM calibration procedure.

Copyright © 2016 Ford Motor Company

Cruise Control Module (CCM)

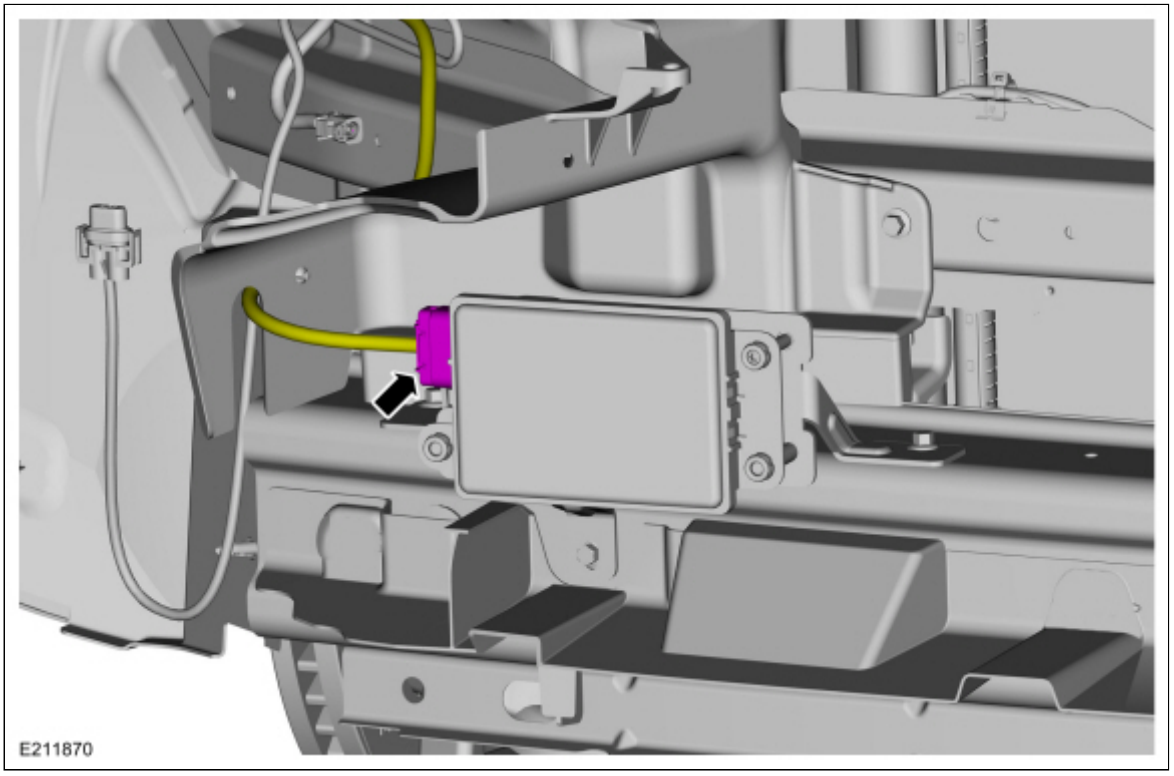
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

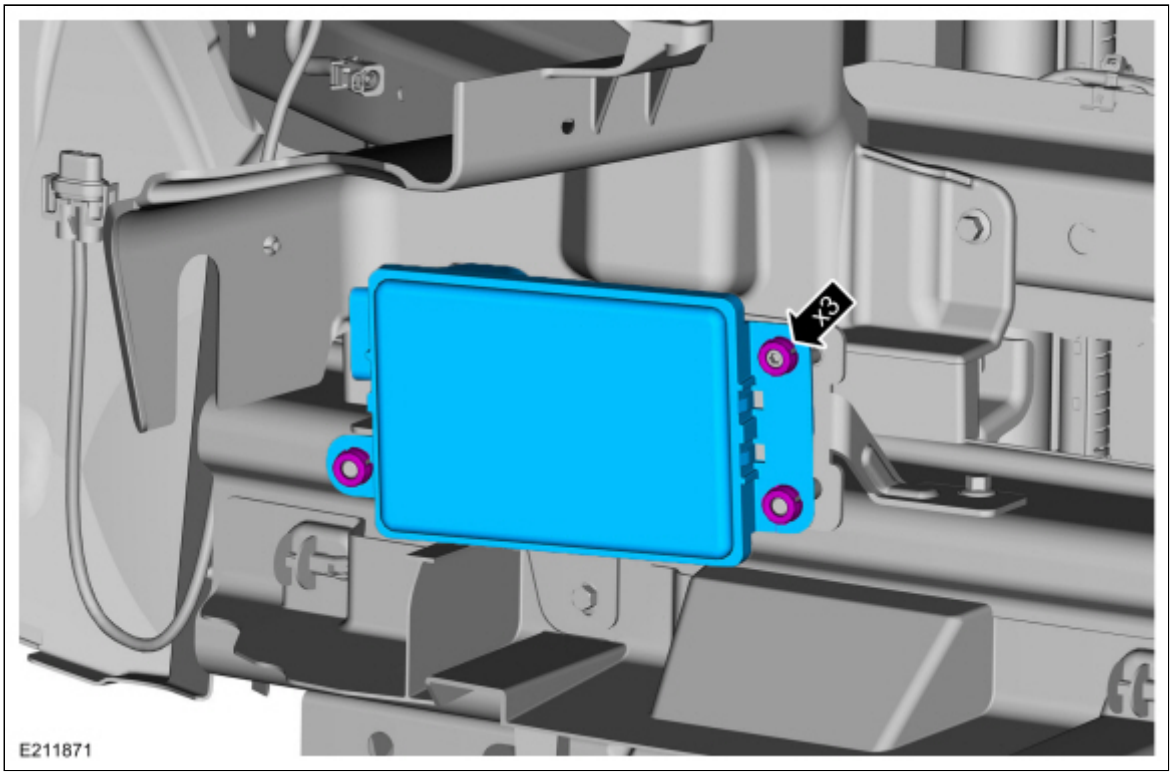
Cruise control module (CCM)

1. Remove the front bumper cover.
   Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).

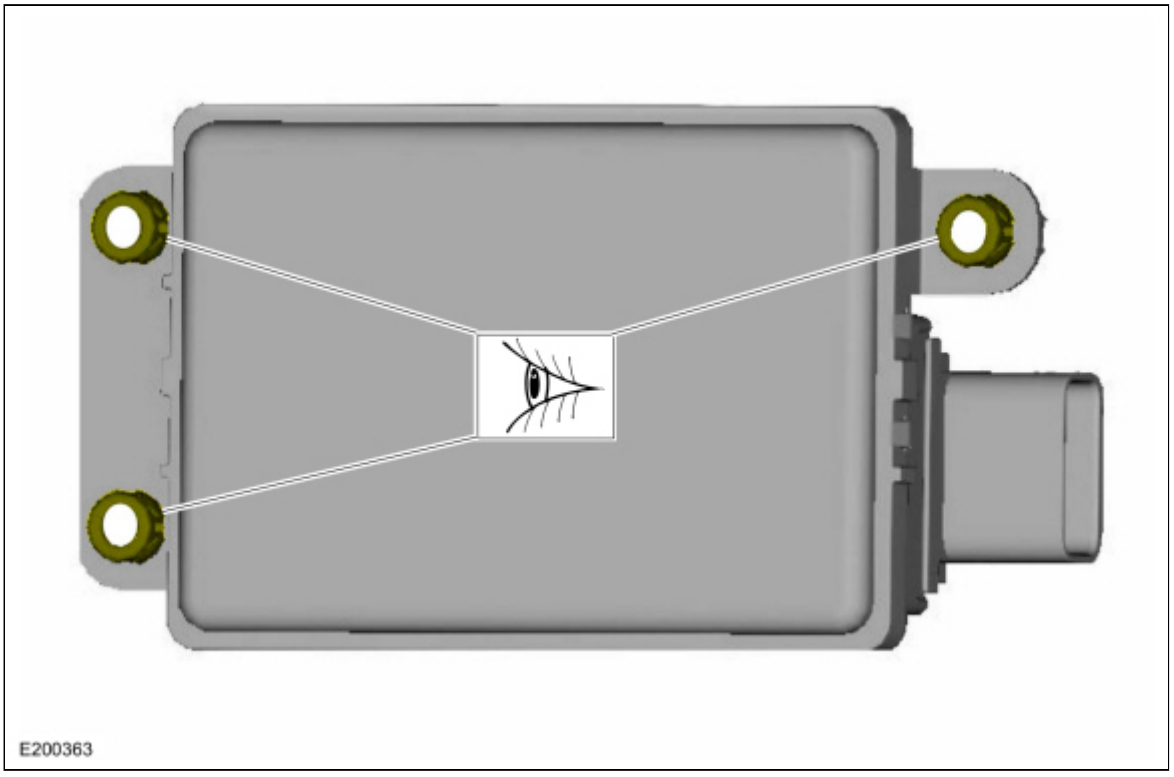
2. Disconnect the CCM electrical connector.



3. Separate the CCM grommets and remove the CCM.



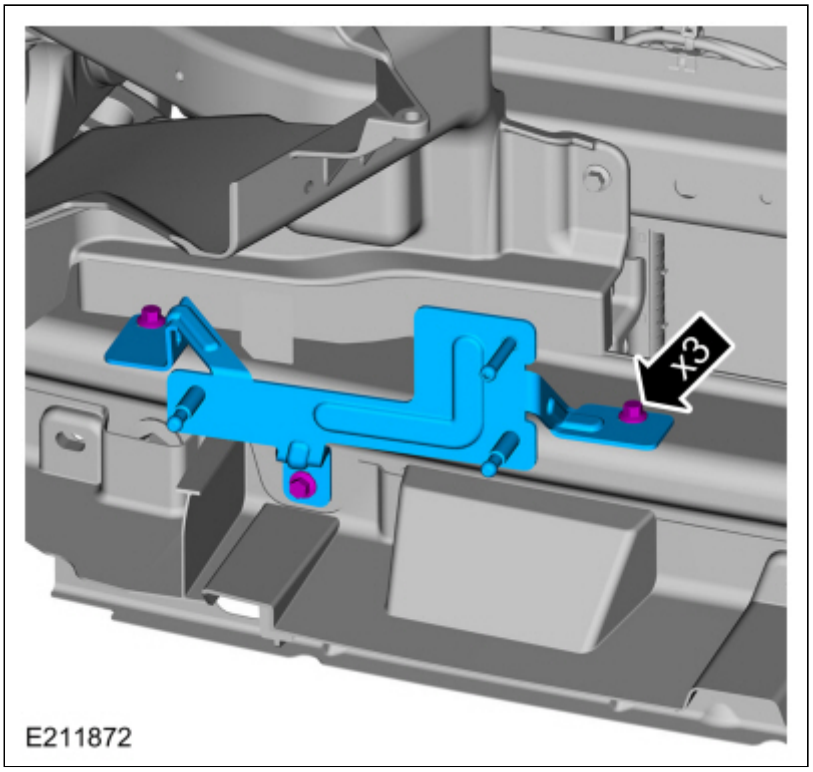
4. Inspect the grommets for damage. If damaged, install new grommets.



Cruise control module (CCM) bracket

5. Remove the CCM.

1. Remove the CCM bracket.
   Torque: 12 Nm

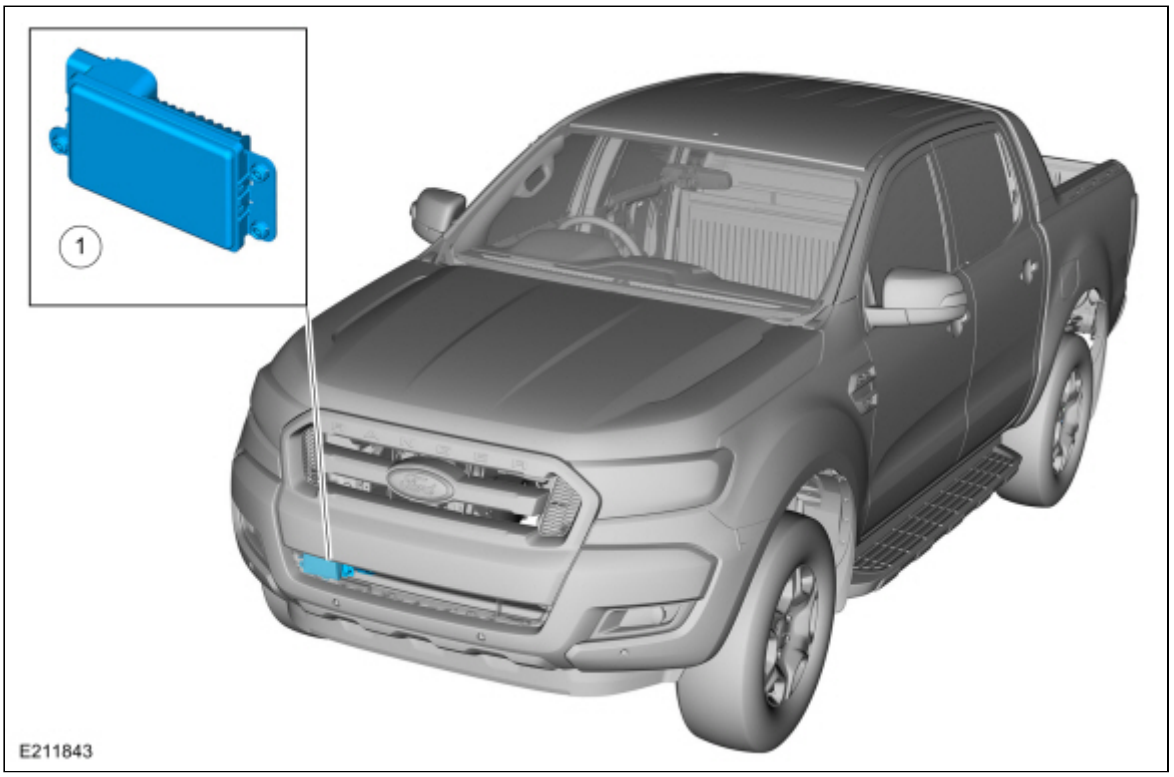


Installation

1. To install, reverse the removal procedure.
2. Align the CCM.
   Refer to: Cruise Control Radar Alignment (419-03A Cruise Control, General Procedures).

Copyright © 2016 Ford Motor Company

Cruise Control - Component Location



Item	Description
1	CCM

Copyright © 2016 Ford Motor Company

Cruise Control - Overview

Overview

The cruise control system is controlled by the PCM.

The cruise control modes are selected from the steering wheel mounted switches (ON/OFF, SET+, SET-, GAP+, GAP- and CAN/RES), which are integrated into the LH steering wheel switch.

The cruise control system maintains a selected vehicle speed between 29 km/h (18 mph) and 160 km/h (99 mph). When a MyKey® restricted key is in use and max speed limiter is turned on, vehicle speed is limited to 129 km/h (80 mph).

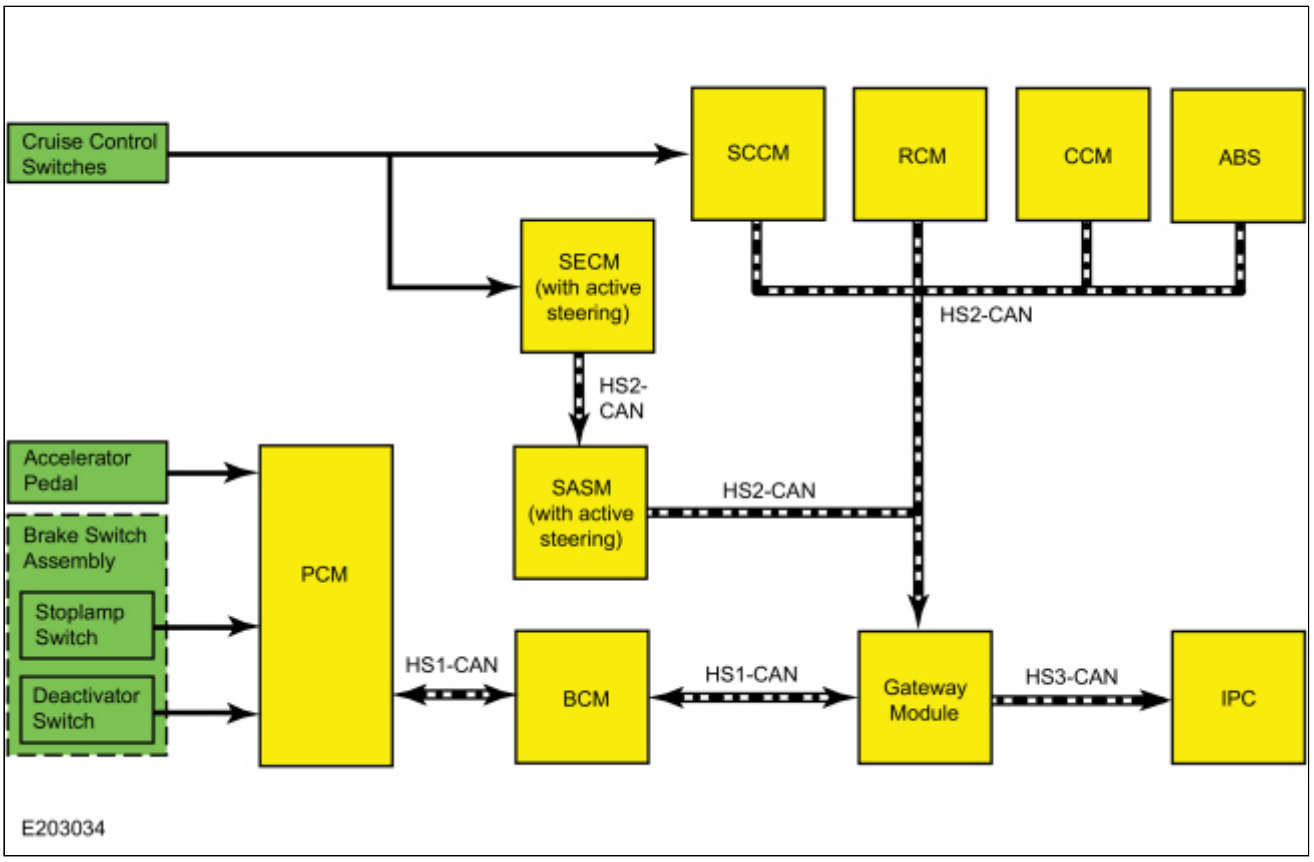
During normal driving, the vehicle speed can vary slightly from the set speed due to road conditions. The vehicle speed can fluctuate when driving up and down a steep hill.

Copyright © 2016 Ford Motor Company

Cruise Control - System Operation and Component Description

System Operation

Adaptive Cruise Control



Network Message Chart

Network Input Messages - ABS Module

Broadcast Message	Originating Module	Message Purpose
Adaptive cruise control brake deceleration request	CCM	Used for cruise control automatic braking.
Brake pedal applied	PCM	Used for brake switch input.
Vehicle lateral acceleration	RCM	Deactivates cruise control when requested.
Vehicle longitudinal acceleration		

Network Input Messages - CCM

Broadcast Message	Originating Module	Message Purpose
Accelerator pedal position	PCM	Used for accelerator pedal status.
Brake pedal applied	PCM	Used for brake switch input.
Cruise control override	PCM	Driver overriding cruise control with accelerator pedal.

Ignition status	BCM	Used for ignition switch position input.
Stability control event in progress	ABS module	Deactivates cruise control when requested.
Traction control event in progress		
Vehicle yaw rate		
Vehicle lateral acceleration	RCM	Deactivates cruise control when requested.
Vehicle longitudinal acceleration		
Vehicle configuration data	BCM	Used for comparison checking adaptive cruise control configuration.

Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Adaptive cruise control gap distance display	CCM	Data used to generate message center display indicating adaptive cruise control gap setting.
Cruise control mode	PCM	Toggles between speed control and adaptive cruise control.
Cruise control override	PCM	Driver overriding cruise control with accelerator pedal.
Cruise control status	PCM	Data used for speed control indicator status.
Cruise control set speed	PCM	Data used to display the driver selected vehicle speed.

Network Input Messages - PCM

Broadcast Message	Originating Module	Message Purpose
Adaptive cruise control commands	CCM	Used for cruise control enable/disable and operating mode request.
Stability control event in progress	ABS module	Deactivates speed control when requested.
Traction control event in progress		
Vehicle lateral acceleration	RCM	Deactivates speed control when requested.
Vehicle longitudinal acceleration		
Vehicle yaw rate		

Network Input Messages - SCCM (Active Front Steering)

Broadcast Message	Originating Module	Message Purpose
Cruise control switch commands	SASM	Used for cruise control switch enable/disable and operating mode commands on vehicles equipped with active front steering.

Cruise Control Operation

NOTE: *For a complete illustration of the adaptive cruise control indicators and graphic displays, refer to the Owner's Literature.*

The adaptive cruise control system functions much like a standard cruise control system. The adaptive cruise control system automatically adjusts the vehicle speed to maintain a set distance gap from the front of the vehicle and the vehicle in the same path of travel. When the adaptive cruise control system is on and is following a vehicle or a vehicle enters the same driving lane, a follow vehicle graphic is displayed in the message center.

The adaptive cruise control system does not function if the vehicle speed is below 20 km/h (12 mph). As the vehicle slows down during automatic braking, the adaptive cruise control system discontinues braking at 20 km/h (12 mph). At that speed, an audible alarm sounds and the automatic braking from the ABS module is released. The driver must take over the vehicle braking control.

The cruise control deactivator switch (which is integral to the BPP switch) is an additional safety feature. When the brake pedal is pressed, an electrical signal is sent from the BPP switch to the PCM deactivating the cruise control system. Under increased brake pedal effort, the cruise control system deactivator switch opens and removes the ground signal from the PCM input circuit, releasing the throttle and immediately deactivating the system.

The CCM monitors the yaw rate signal from the ABS module and compares it to the wheel speed and steering wheel angle signals. If the ABS module determines the yaw rate is invalid, the CCM disables the adaptive cruise control. The message center displays the message COLLISION WARNING MALFUNCTION and/or ADAPTIVE CRUISE MALFUNCTION.

The CCM monitors the environment in front of the vehicle while active. If the radar beam is obstructed by a buildup of snow, ice, rain or other debris, or the vehicle is driven in a desert environment with no other traffic for extended periods of time, the sensor will trigger a "Radar Blocked" message and will disable the adaptive cruise control. The adaptive cruise control will resume once the obstruction is cleared and the radar is able to detect targets, or upon a key cycle.

The ABS module estimates brake temperature by monitoring applied brake pressure over a period of time and sends a message to the CCM when the estimated temperature is above a given threshold. An alarm sounds and the adaptive cruise control system is deactivated until the estimated brake temperature returns to cooler operating conditions. This condition can happen in a hilly or mountainous driving terrain.

Cruise Control Indicator

The adaptive cruise control indicator located in the IPC illuminates gray and the previous gap setting and SET graphic is displayed indicating the system is in standby mode. This notifies the driver the system is ready and the vehicle can be accelerated to the desired speed.

Steering Wheel Switch Function

The adaptive cruise control steering wheel mounted switches are momentary contact switches that toggle up and down for the cruise control switch state. Pressing and releasing the steering wheel cruise control ON/OFF switch turns the cruise control system on. Pressing up and releasing the SET+ switch sets the vehicle's speed and stores the set speed in memory. The adaptive cruise control indicator illuminates and the message center displays the set speed and gap setting graphic.

There are 2 ways to change the set speed. The first way is to accelerate or brake to the desired speed and press and release the SET cruise control switch until the desired set speed is shown on the message center. The second way is by tapping the SET+ or the SET- switch while in the set mode, increasing or decreasing the displayed set speed by 2 km/h (1 mph) in (Australia and New Zeland) and 5 km/h (3 mph) everywhere else per tap. If the respective button is pressed and held, the displayed set speed continues to increase or decrease until the button is released. The adaptive cruise control system may apply the brakes to slow the vehicle down to the new set speed. The set speed displays continuously in the message center while the adaptive cruise control system is active.

Pressing and releasing the OFF switch, or switching the ignition to OFF, turns the adaptive cruise control system off. The adaptive cruise control set speed memory is erased.

Pressing the brake pedal or pressing the CNCL switch puts the adaptive cruise control system in standby mode and the last set speed is displayed in the message center with a strike through. Pressing the RES button when the adaptive cruise control system is in standby mode causes the vehicle to accelerate to the last set speed. The set speed continuously displays in the message center while the adaptive cruise control system is active. The RES button does not function if the OFF button is pressed, the ignition is cycled OFF, or if the current vehicle speed is below the minimum operational speed.

The adaptive cruise control system has the capability for the driver to change from adaptive cruise control to standard cruise control. The LH 5-way steering wheel switch is used to switch from the adaptive cruise control system to standard cruise control system within the message center. For information on selecting the standard cruise control in

the message center, refer to Owner's Literature. Once the driver has selected the standard cruise control in the message center, the adaptive cruise control indicator is replaced by the standard cruise control indicator. The vehicle no longer responds to lead vehicles or automatic braking. Upon the next vehicle ignition cycle, the vehicle defaults back to the adaptive cruise control system.

Gap Setting

When a vehicle ahead enters the same lane or a slower vehicle is ahead in the same lane, the vehicle speed adjusts automatically to maintain a preset distance gap. A bar graph graphic with 4 preset distance gap settings are displayed in the message center. Pressing up (decrease) or down (increase) on the steering wheel cruise control gap switch increases or decreases the distance from the vehicle ahead. If all of the bars are illuminated, this is the longest gap setting. If only one bar is illuminated, that is the shortest gap setting.

The vehicle maintains the distance gap to the vehicle ahead until:

- the vehicle ahead accelerates to a speed above the set speed.
- the vehicle ahead moves out of the lane or out of view.
- the vehicle speed falls below 20 km/h (12 mph).
- a new gap distance is set.

After each ignition cycle, the previous gap setting is remembered and the system is set to that gap setting.

The distance gap can be overridden by pressing the accelerator pedal. The follow vehicle graphic is not displayed in the message center and the green indicator illuminates. When the accelerator pedal is released, the adaptive cruise control system returns to normal operation and the vehicle speed decreases to the set speed or a lower speed if following a vehicle ahead.

Deceleration Control

The CCM commands the ABS module, which controls the brakes, to automatically apply the brakes to slow the vehicle to maintain a safe distance to the vehicle in front.

Steering Wheel Switches

The cruise control steering wheel mounted switches are momentary contact switches that toggle up and down for the switch state. On vehicles without active front steering, the switches are an input to the SCCM. On vehicles with active front steering, the switches are an input to the SECM. The SECM sends switch data to the SASM (part of the clockspring assembly), and the SASM sends switch data to the SCCM over the HS-CAN2.

Brake Switch

When the brake pedal is applied, the cruise control deactivator switch, integrated in the BPP switch, opens and removes the ground signal from the PCM input circuit releasing the throttle, immediately deactivating the system.

Cruise Control Module (C-CM)

The CCM contains a radar sensing unit which measures the relative speed and the distance between the front of the vehicle and the vehicle being followed. The CCM is responsible for requesting the PCM to increase vehicle speed and the ABS module to brake, when necessary.

Copyright © 2016 Ford Motor Company

Cruise Control

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DTC Chart: Powertrain Control Module (PCM)

PCM DTC Chart

DTC	Description	Action
P0504	Brake Switch A / B Correlation	GO to Pinpoint Test C
P0572	Brake Switch A Circuit Low	GO to Pinpoint Test C
P0573	Brake Switch A Circuit High	GO to Pinpoint Test C
P1703	Brake Switch Out Of Self-Test Range	GO to Pinpoint Test C
U0104	Lost Communication With Cruise Control Module	GO to Pinpoint Test E
U0121	Lost Communication With Anti-Lock Brake System (ABS) Module	GO to Pinpoint Test D
All other Diagnostic Trouble Codes (DTCs)	–	Refer to the appropriate section in Group 303 for the procedure.

DTC Chart: Steering Column Control Module (SCCM)

SCCM DTC Chart

DTC	Description	Action
B137F:09	Steering Wheel Left Switch Pack: Component Failure	GO to Pinpoint Test A
B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	GO to Pinpoint Test A
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	GO to Pinpoint Test A
All other Diagnostic Trouble Codes (DTCs)	–	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

DTC Chart: Steering Effort Control Module (SECM) - Active Front Steering

Steering Effort Control Module (SECM) DTC Chart

DTC	Description	Action
B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	GO to Pinpoint Test B
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	GO to Pinpoint Test B
B137F:2A	Steering Wheel Left Switch Pack:	GO to Pinpoint Test B

	Signal Stuck in Range	
B137F:4A	Steering Wheel Left Switch Pack: Incorrect Component Installed	GO to Pinpoint Test B
All other Diagnostic Trouble Codes (DTCs)	–	REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).

DTC Chart: Cruise Control Module (CCM)

Cruise Control Module (CCM) DTC Chart

DTC	Description	Action
B142E:78	Forward Looking Sensor Horizontal Alignment: Alignment or Adjustment Incorrect	GO to Pinpoint Test F
B1432:78	Forward Looking Sensor Vertical Alignment: Alignment or Adjustment Incorrect	This DTC can only be set at the assembly plant during the plant alignment process. If DTC B1432:78 sets, a reflash of the CCM and the vertical and horizontal aim procedure must be performed. REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
B1433:54	Forward Looking Sensor Alignment: Missing Calibration	GO to Pinpoint Test F
C0072:00	Brake Temperature Too High: No Sub Type Information	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
C1001:08	Vision System Camera: Bus Signal/Message Failure	This DTC sets when the CCM receives invalid network data from the IPMA, which disables the adaptive cruise control system. To diagnose the IPMA, REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing).
C1132:4B	Head Up Display: Over Temperature	REFER to: Collision Warning and Collision Avoidance System (419-03C Collision Warning and Collision Avoidance System, Diagnosis and Testing).
C1A67:96	Forward Looking Sensor: Component Internal Failure	GO to Pinpoint Test G
C1A67:97	Forward Looking Sensor: Component or System Operation Obstructed or Blocked	GO to Pinpoint Test H
C1A67:98	Forward Looking Sensor: Component or System Over Temperature	The CCM was over-temperature. This may occur during extended use in extremely high weather temperatures. The adaptive cruise control system operation resumes after the CCM cools.
U0001:88	High Speed CAN Communication Bus: Bus Off	A HS-CAN2 fault was present as a point in time. The fault is not currently present since the module is communicating with the diagnostic scan tool. CLEAR the DTC. REPEAT the network test with the diagnostic scan tool. VERIFY the integrity of the connectors and wiring. Refer to Wiring Diagrams Cell 14 for schematic and connector information.
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test I
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test D
U0140:00	Lost Communication	GO to Pinpoint Test J

	With Body Control Module: No Sub Type Information	
U0151:00	Lost Communication With Restraints Control Module: No Sub Type Information	GO to Pinpoint Test K
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	GO to Pinpoint Test L
U0158:00	Lost Communication With Head Up Display: No Sub Type Information	GO to Pinpoint Test M
U0212:00	Lost Communication With Steering Column Control Module: No Sub Type Information	GO to Pinpoint Test N
U0265:00	Lost Communication With Image Processing Module Sensor A: No Sub Type Information	GO to Pinpoint Test O
U0401:86	Invalid Data Received From ECM/PCM "A": Signal Invalid	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the PCM. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.
U0418:86	Invalid Data Received From Brake System Control Module: Signal Invalid	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the ABS module. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the ABS module, DIAGNOSE the observable symptom.
U0423:82	Invalid Data Recevied From Instrument Panel Cluster Control Module: Alive/Sequence Counter Incorrect/ Not Updated	GO to Pinpoint Test S
U0429:86	Invalid Data Received From Steering Column Control Module: Signal Invalid	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the SCCM. REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the SCCM, DIAGNOSE the observable symptom.
U0452:86	Invalid Data Received From Restraints Control Module: Signal Invalid	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the RCM. If no Diagnostic Trouble Codes (DTCs) are present in the RCM, DIAGNOSE the observable symptom.
U053B:64	Invalid Data Received From Image Processing Module A: Signal Plausibility Failure	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the IPMA. REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the IPMA, DIAGNOSE the observable symptom.
U053B:83	Invalid Data Received From Image Processing Module A: Value of Signal Protection Calculation Incorrect	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the IPMA. REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the IPMA, DIAGNOSE the observable symptom.
U2018:51	Control Module Software #3: Not Programmed	This DTC sets when the CCM configuration has not been completed. CARRY OUT the PMI (when the original module is not available) for the module in question as directed by the diagnostic scan tool.

		REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	This DTC sets when the CCM configuration has not been completed. CARRY OUT the PMI (when the original module is not available) for the module in question as directed by the diagnostic scan tool. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).
U2300:55	Central Configuration: Not Configured	This DTC sets when the CCM detects the BCM is not configured correctly. CARRY OUT the PMI procedure (when the original module is not available) for the module in question as directed by the diagnostic scan tool. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).
U2300:64	Central Configuration: Signal Plausibility Failure	This DTC sets when the CCM detects the BCM is not configured correctly. CARRY OUT the PMI procedure (when the original module is not available) for the module in question as directed by the diagnostic scan tool. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).
U3000:41	Control Module: General Checksum Failure	CLEAR the Diagnostic Trouble Codes (DTCs). RETEST the adaptive cruise control system. REPEAT the self-test. If DTC U3000:41 is retrieved again, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
U3000:42	Control Module: General Memory Failure	CLEAR the Diagnostic Trouble Codes (DTCs). RETEST the adaptive cruise control system. REPEAT the self-test. If DTC U3000:42 is retrieved again, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
U3000:44	Control Module: Data Memory Failure	CLEAR the Diagnostic Trouble Codes (DTCs). RETEST the adaptive cruise control system. REPEAT the self-test. If DTC U3000:44 is retrieved again, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	If DTC U3000:49 is retrieved again, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
U3000:63	Control Module: Circuit/Component Protection Time-Out	GO to Pinpoint Test P
U3002:62	Vehicle Identification Number: Signal Compare Failure	This DTC sets when the stored VIN in the CCM does not match the VIN defined in the BCM. This may indicate that the original CCM is not installed in the vehicle, and has not been configured correctly. CARRY OUT the PMI (when the original module is not available) for the module in question as directed by the diagnostic scan tool.
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test Q
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	GO to Pinpoint Test R

DTC Chart: Anti-Lock Brake System (ABS) Module

ABS Module DTC Chart

DTC	Description	Action
U0405:41	Invalid Data Received From Cruise Control Module: General Checksum Failure	This DTC sets when the ABS module receives invalid network data from the CCM. RETRIEVE and REPAIR all non network diagnostic trouble codes (DTCs) in the CCM.
U0405:82	Invalid Data	This DTC sets when the ABS module receives invalid network data from the

	Received From Cruise Control Module: Alive/Sequence Counter Incorrect/Not Updated	CCM. RETRIEVE and REPAIR all non-network diagnostic trouble codes (DTCs) in the CCM.
U0405:86	Invalid Data Received From Cruise Control Module: Signal Invalid	This DTC sets when the ABS module receives invalid network data from the CCM. RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the CCM and other modules on the network.
U2107:00	Collision Mitigation By Braking: No Sub Type Information	This DTC sets in the ABS module due to long and too frequent collision mitigation brake requests from the CCM RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) in the CCM and other modules on the network.
U2107:68	Collision Mitigation By Braking: Event Information	This DTC is set in the ABS module due to a high acceleration value detected that differs from request, which can be caused by an abrupt vehicle stop or module failure. RETRIEVE and REPAIR all Diagnostic Trouble Codes (DTCs) in the CCM and ABS module.
U2108:68	Adaptive Cruise Control: Event Information	This DTC is set in the ABS module when the module detects over-braking during automated vehicle deceleration. If the vehicle deceleration exceeds the 3.2 m/s^2 threshold, the DTC is stored and the adaptive cruise control is deactivated until the next ignition cycle. RETRIEVE and REPAIR all Diagnostic Trouble Codes (DTCs) in the CCM and ABS module.
All other Diagnostic Trouble Codes (DTCs)	–	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Adaptive Cruise Control

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
The adaptive cruise control is inoperative - without active front steering	Refer to the Pinpoint Test	GO to Pinpoint Test A
The adaptive cruise control is inoperative - with active front steering	Refer to the Pinpoint Test	GO to Pinpoint Test B
The cruise control switch is inoperative/does not operate correctly - without active front steering	Refer to the Pinpoint Test	GO to Pinpoint Test A
The cruise control switch is inoperative/does not operate correctly - with active front steering	Refer to the Pinpoint Test	GO to Pinpoint Test B

The adaptive cruise control does not function in rain or snow conditions	Refer to the Pinpoint Test	GO to Pinpoint Test H
ADAPTIVE CRUISE NOT AVAILABLE SENSOR BLOCKED SEE MANUAL message in the IPC message center	Refer to the Pinpoint Test	GO to Pinpoint Test H
The adaptive cruise control indicator lamp is never/ always on	• Wiring, terminals and connectors • PCM • IPC	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
Unexpected adaptive cruise control braking	• CCM • Front bumper cover	The adaptive cruise control system can occasionally detect and respond to out-of path vehicles, especially on curves, entry/exit ramps or when changing lanes. CHECK the CCM and front bumper cover for damage. RETEST the adaptive cruise control system.
Lack of adaptive cruise control braking	• CCM • Front bumper cover	The adaptive cruise control system may not detect and respond to vehicles performing close cut-ins or on tight curves (especially for vehicles on the passenger side) due to limited CCM field of view. CHECK the CCM and front bumper cover for damage. If no damage is observed, RETEST the adaptive cruise control system.
Noise during adaptive cruise control braking	• Low speeds • Brake concern	The driver can detect some noise at low speeds when adaptive cruise control braking occurs. If braking noise continues, REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
The cruise control cannot set above 105 kmh (65 mph), 113 kmh (70 mph), 121 kmh (75 mph), or 129 kmh (80 mph)	A MyKey® restricted key is in use and MyKey® max speed limiter is turned on	VERIFY whether a MyKey® restricted key is in use. With an admin key, VERIFY if MyKey® max speed limiter is turned on. REFER to the Owner's Literature. If necessary, VERIFY cruise control normal operation with an admin key.

Pinpoint Tests

The Adaptive Cruise Control Is Inoperative

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - Overview (211-05 Steering Column Switches, Description and Operation).

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Action
B137F:09	Steering Wheel Left Switch Pack:	A continuous and on-demand DTC that sets when one or more

	Component Failure	of the cruise control switches are stuck.
B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	A continuous and on-demand DTC that sets when the cruise control switch circuits are shorted to ground.
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	A continuous and on-demand DTC that sets when the cruise control switch circuits are shorted to voltage.

Possible Sources

- Wiring, terminals or connectors
- Cruise control switch
- BPP switch
- Digital TR sensor
- Stoplamp switch
- Vehicle speed signal
- PCM
- ABS module
- BCM
- CCM
- SCCM

PINPOINT TEST A : THE ADAPTIVE CRUISE CONTROL IS INOPERATIVE

A1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform PCM self-test.
- Using a diagnostic scan tool, perform SCCM self-test.
- Using a diagnostic scan tool, perform CCM self-test.
- Using a diagnostic scan tool, perform ABS module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	For PCM, CCM and ABS module Diagnostic Trouble Codes (DTCs), REFER to the DTC Charts in this section. For SCCM DTC B137F:09, B137F:11 or B137F:17, GO to A4 For all other SCCM Diagnostic Trouble Codes (DTCs), REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
No	GO to A2

A2 CHECK FOR LOST COMMUNICATION DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Clear Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds. Retrieve Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Are any lost communication Diagnostic Trouble Codes (DTCs) set in the CCM?

Yes	REFER to the DTC Chart in this section.
No	GO to A3

A3 CHECK THE STOPLAMP SWITCH (BOO1) AND CRUISE CONTROL DEACTIVATOR SWITCH (BOO2) PARAMETER IDENTIFICATIONS (PIDS)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Using the table, monitor the Parameter Identifications (PIDs) BOO1 (stoplamp switch) and BOO2 (cruise control deactivator switch) while applying and releasing the brake pedal.

Brake Pedal Position	BOO1 PID	BOO2 PID
Released	On	On
Applied lightly	On	Off
Applied firmly	Off	Off

Do the PID values agree with the brake pedal position?

Yes	GO to A4
No	GO to Pinpoint Test C

A4 CHECK THE CRUISE CONTROL SWITCH PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view SCCM Parameter Identifications (PIDs).
- Using the table, press each cruise control switch while monitoring the cruise control switch PID.

Cruise Control Switch	PID Value
Cruise On/Off (pressed/released)	On/Off
Cruise Cancel/Resume (pressed/released)	On/Off
SET + (pressed/released)	On/Off
SET - (pressed/released)	On/Off
GAP + (pressed/released)	On/Off
GAP - (pressed/released)	On/Off

Does the PID value agree with the switch position?

Yes	GO to A5
No	If only one switch does not display the correct PID value, INSTALL a new LH steering wheel switch. REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). If multiple switches do not display the correct PID value, GO to A6

A5 MONITOR THE PCM (POWERTRAIN CONTROL MODULE) TR (TRANSMISSION RANGE) PID

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the PCM TR PID.
- Select DRIVE.

Does the PID value agree with the TR selector lever position?

Yes	GO to A10
No	REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).

A6 CHECK FOR VOLTAGE TO THE CRUISE CONTROL SWITCHES

- Ignition OFF.

- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect LH Steering Wheel Switch C2998.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-4	V	C2998-5
C2998-6	V	C2998-5
C2998-7	V	C2998-5

Is the voltage approximately 5 volts?

Yes	TURN the ignition off and WAIT one minute. INSTALL a new LH steering wheel switch. INSTALL the driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
No	GO to A7

A7 CHECK THE STEERING WHEEL SWITCH HARNESS FOR AN OPEN

- Ignition OFF.
- Disconnect Clockspring C218B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2998-4	Ω	C218B-15
C2998-5	Ω	C218B-8
C2998-6	Ω	C218B-6
C2998-7	Ω	C218B-7

Are the resistances less than 3 ohms?

Yes	GO to A8
No	Install a new steering wheel. REFER to: Steering Wheel (211-04) .

A8 CHECK THE STEERING WHEEL SWITCH CIRCUITS THROUGH THE CLOCKSPRING FOR AN OPEN

- Disconnect Clockspring C218G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C218B-6 (component side)	Ω	C218G-5 (component side)
C218B-7 (component side)	Ω	C218G-7 (component side)
C218B-15 (component side)	Ω	C218G-8 (component side)

Are the resistances less than 3 ohms?

Yes	GO to A9
No	Install a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

A9 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A10 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.2L, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Cruise Control Is Inoperative - With Active Front Steering

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Steering Wheel and Column Electrical Components - Overview (211-05 Steering Column Switches, Description and Operation).

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

DTC Fault Trigger Conditions - Steering Effort Control Module (SECM)

DTC	Description	Action
B137F:11	Steering Wheel Left Switch Pack: Circuit Short to Ground	A continuous memory DTC that sets when the cruise control switch circuits are shorted to ground.
B137F:17	Steering Wheel Left Switch Pack: Circuit Voltage Above Threshold	A continuous memory DTC that sets when the cruise control switch circuits are shorted to voltage.
B137F:2A	Steering Wheel Left Switch Pack: Signal Stuck in Range	A continuous memory DTC that sets when a cruise control switch is stuck in position.
B137F:4A	Steering Wheel Left Switch Pack: Incorrect Component Installed	A continuous memory DTC that sets when the SECM detects a switch is installed that does not correspond with the switch configuration in the module.

Possible Sources

- Wiring, terminals or connectors
- Cruise control switch
- Digital TR sensor
- PCM
- SCCM
- SASM
- SECM
- BPP switch

PINPOINT TEST B : THE CRUISE CONTROL IS INOPERATIVE - WITH ACTIVE FRONT STEERING

B1 PERFORM A NETWORK TEST

- Using a diagnostic scan tool, perform the a network test.

Does the SECM, SASM or SCCM communicate on the network?

Yes	GO to B2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

B2 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM self-test.
- Using a diagnostic scan tool, perform the SECM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	If PCM Diagnostic Trouble Codes (DTCs) were retrieved, REFER to the PCM DTC Chart in this section. If SECM DTC B137F:11, B137F:17, B137F:2A or B237F:4A was retrieved, GO to B4 If other SECM Diagnostic Trouble Codes (DTCs) were retrieved,

No	GO to B3

B3 CHECK THE STOPLAMP SWITCH (BOO1) AND CRUISE CONTROL DEACTIVATOR SWITCH (BOO2) PARAMETER IDENTIFICATIONS (PIDS)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Using the table, monitor the Parameter Identifications (PIDs) BOO1 (stoplamp switch) and BOO2 (cruise control deactivator switch) while applying and releasing the brake pedal.

Brake Pedal Position	BOO1 PID	BOO2 PID
Released	Off	Off
Applied	On	On

Do the PID values agree with the brake pedal position?

Yes	GO to B4
No	GO to Pinpoint Test C

B4 CHECK THE CRUISE CONTROL SWITCH PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view Steering Effort Control Module (SECM) Parameter Identifications (PIDs).
- Using the table, press each cruise control switch while monitoring the cruise control switch PID.

Cruise Control Switch	PID Value
ON/OFF (pressed/released)	On/Off
RES/CNCL (pressed/released)	On/Off
GAP + (pressed/released)	On/Off
GAP - (pressed/released)	On/Off
SET + (pressed/released)	On/Off
SET - (pressed/released)	On/Off

Does the PID value agree with the switch position?

Yes	GO to B5
No	If only one switch does not display the correct PID value, INSTALL a new LH steering wheel switch. REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). If multiple switches do not display the correct PID value, GO to B6

B5 MONITOR THE PCM (POWERTRAIN CONTROL MODULE) TR (TRANSMISSION RANGE) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Monitor the PCM PID TR.
- Select DRIVE.

Does the PID value agree with the TR selector lever position?

Yes	GO to B7
No	REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).

B6 CHECK THE LH STEERING WHEEL CRUISE CONTROL SWITCHES

- Disconnect the LH steering wheel switch.
  REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).
- While pressing the cruise control ON/OFF and RES/CNCL switches, measure:

Positive Lead	Measurement / Action	Negative Lead
LH steering wheel switch C2998 pin 4, component side	Ω	LH steering wheel switch C2998 pin 5, component side

Resistance Specification

Button Pressed	Resistance Range
Button not pressed	488-540 ohms
ON/OFF	57-63 ohms
RES/CNCL	175-193 ohms

- While pressing the cruise control GAP+/GAP- switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LH steering wheel switch C2998 pin 7, component side	Ω	LH steering wheel switch C2998 pin 5, component side

Resistance Specification

Button Pressed	Resistance Range
Button not pressed	488-540 ohms
GAP-	57-63 ohms
GAP+	175-193 ohms

- While pressing the cruise control SET+ and SET- switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LH steering wheel switch C2998 pin 6, component side	Ω	LH steering wheel switch C2998 pin 5, component side

Resistance Specification

Button Pressed	Resistance Range
Button not pressed	488-540 ohms
SET+	175-193 ohms
SET-	57-63 ohms

Do the resistances fall between the specified ranges?

Yes	INSTALL a new steering wheel. REFER to: Steering Wheel (211-04) .
No	INSTALL a new LH steering wheel switch. REFER to: Steering Wheel Multifunction Switch (211-05 Steering Column Switches, Removal and Installation).

B7 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.2L, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P0504, P0572, P0573 OR P1703

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0504	Brake	A DTC that sets when the PCM does not sense the correct sequence of the brake pedal input

	Switch A / B Correlation	signal from both the cruise control deactivator and stoplamp switches when the brake pedal is pressed and released.
P0572	Brake Switch A Circuit Low	A DTC that sets when the PCM detects an open in the stoplamp switch signal. The PCM monitors the vehicle speed, the engine speed, the engine torque and the stoplamp input during start and stop driving cycles. If the stoplamp switch input to the PCM is always off during start and stop driving cycles, this DTC sets in continuous memory.
P0573	Brake Switch A Circuit High	A DTC that sets when the PCM detects a short to voltage on the stoplamp switch signal. The PCM monitors the vehicle speed, the engine speed, the engine torque and the stoplamp switch input during start and stop driving cycles. If the stoplamp lamp switch input to the PCM is always on during start and stop driving cycles, this DTC sets in continuous memory.
P1703	Brake Switch Out Of Self - Test Range	A DTC that sets in the PCM during the self-test when the stoplamp switch input signal is high or does not cycle high and low.

Possible Sources

- Wiring, terminals or connectors
- Stoplamp switch
- PCM

PINPOINT TEST C : P0504, P0572, P0573 OR P1703

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE OPERATION OF THE STOPLAMPS

- Ignition ON.
- Operate the stoplamps.

Do the stoplamps and high mounted stoplamp operate correctly?

Yes	GO to C2
No	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).

C2 CHECK THE STOPLAMP SWITCH (BOO1) AND CRUISE CONTROL DEACTIVATOR SWITCH (BOO2) PARAMETER IDENTIFICATIONS (PIDS)

- Using a diagnostic scan tool, view PCM Parameter Identifications (PIDs).
- Using the table, monitor the Parameter Identifications (PIDs) BOO1 (stoplamp switch) and BOO2 (cruise control deactivator switch) while applying and releasing the brake pedal.

Brake Pedal Position	BOO1 PID	BOO2 PID
Released	Off	Off
Applied lightly	On	Off
Applied firmly	On	On

Do the PID values agree with the brake pedal position?

Yes	GO to C8
No	For an incorrect BOO1 PID value, GO to C3 For an incorrect BOO2 PID value, GO to C4

C3 CHECK THE STOPLAMP SWITCH CIRCUIT

- Ignition OFF.
- Disconnect: PCM C1232A (2.2L or 3.2L Diesel).
- Ignition ON.
- While applying and releasing the brake pedal, measure:

2.2L or 3.2L Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-12		Ground

Is the voltage greater than 11 volts with the brake pedal applied and no voltage with the brake pedal released?

Yes	GO to C8
No	REPAIR the circuit.

C4 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect: PCM C1232A (2.2L or 3.2L Diesel).
- While firmly applying and releasing the brake pedal, measure:

2.2L or 3.2L Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-46	Ω	Ground

Is the resistance less than 3 ohms with the brake pedal released, and greater than 10,000 ohms with the brake pedal firmly applied?

Yes	GO to C8
No	GO to C5

C5 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH GROUND CIRCUIT FOR AN OPEN

- Disconnect: BPP switch C277.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C277-3	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to C6
No	REPAIR the circuit.

C6 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH SIGNAL CIRCUIT FOR A SHORT TO

GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C277-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C7
No	REPAIR the circuit.

C7 CHECK THE CRUISE CONTROL DEACTIVATOR SWITCH SIGNAL CIRCUIT FOR AN OPEN

- Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C277-2		C277-3

- Measure:

2.2L or 3.2L Diesel

Positive Lead	Measurement / Action	Negative Lead
C1232A-46	Ω	Ground

Is the resistance less than 3 ohms?

Yes	INSTALL a new BPP switch.
No	REPAIR the signal circuit for an open.

C8 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. For 2.2L, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0121:00 Or U0121

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

DTC Fault Trigger Condition-CCM

DTC	Description	Fault Trigger Conditions
U0121:00	Lost Communication with Anti-Lock Brake System (ABS) Control Module: No Sub-Type Information	Sets in the CCM if data messages received from the ABS module over the HS-CAN2 are missing.

DTC Fault Trigger Condition-PCM

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Sets in the PCM if data messages received from the ABS module over the HS-CAN2 or from the GWM over the HS-CAN1 are missing.

Possible Sources

- ABS module
- CCM
- GWM
- PCM

PINPOINT TEST D : U0121:00 OR U1021

D1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to D2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Does the ABS module pass the network test?

Yes	GO to D3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) , ABS (ANTI-LOCK BRAKE SYSTEM) MODULE AND PCM (POWERTRAIN CONTROL MODULE) SELF-TESTS

- Using a diagnostic scan tool, perform a CCM self-test.
- Using a diagnostic scan tool, perform a ABS module self-test
- Using a diagnostic scan tool, perform a PCM self-test

Are any low or high voltage Diagnostic Trouble Codes (DTCs) recorded?

Yes	For CCM DTC U3003:16, GO to Pinpoint Test Q For CCM DTC U3003:17, GO to Pinpoint Test R For all others, REFER to the PCM DTC Chart or the ABS Module DTC Chart in this section.
No	GO to D4

D4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to D5

D5 RECHECK THE CCM (CRUISE CONTROL MODULE) AND PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programable Module Installation (PMI) or the Programable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM and PCM self-tests.

Is CCM DTC U0121:00 or PCM DTC U0121 still present?

Yes	GO to D6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121:00 OR U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform a self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Does the CCM set DTC U0121:00 and the PCM set DTC U0121?

Yes	INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	If the CCM sets DTC U0121:00, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation). If the PCM sets U0121, INSTALL a new PCM. For 2.2L, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

U0104

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Cruise Control - System Operation and Component Description (419-03A Cruise Control, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0104	Lost Communication With Cruise Control Module	Sets in the PCM if data messages received from the CCM over the HS-CAN2 or from the GWM over the HS-CAN1 are missing for greater than 5 seconds.

Possible Sources

- CCM
- PCM
- GWM

PINPOINT TEST E : U0104

E1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to E2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

E2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Does the CCM pass the network test?

Yes	GO to E3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E3 CHECK THE CCM (CRUISE CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the CCM self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test Q For DTC U3003:17, GO to Pinpoint Test R
No	GO to E4

E4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to E5

E5 RECHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC U0104 still present?

Yes	GO to E6
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

E6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0104 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the continuous memory Diagnostic Trouble Codes (DTCs) from all modules.

Does DTC U0104 set in other modules?

Yes	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	INSTALL a new PCM. For 2.2L, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

B142E:78 or B1433:54

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B142E:78	Forward Looking Sensor Horizontal Alignment: Alignment or Adjustment Incorrect	Set by the CCM as a continuous memory and on-demand DTC if the CCM detects a misalignment of the radar due to the horizontal alignment angle being out of range.
B1433:54	Forward Looking Sensor Horizontal Alignment: Missing Calibration	Set by the CCM as a continuous memory and on-demand DTC if the CCM detects a misalignment of the radar due to the alignment angle being out of range.

Possible Sources

- CCM alignment
- CCM bracket
- CCM

PINPOINT TEST F : B142E:78 OR B1433:54

F1 INSPECT THE CCM (CRUISE CONTROL MODULE) BRACKET

- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Remove the front bumper cover.
- Inspect for damage to the CCM bracket.

Is the CCM bracket damaged?

Yes	REPAIR or INSTALL a new CCM bracket as necessary. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	GO to F2

F2 PERFORM THE VERTICAL AND HORIZONTAL ALIGNMENT

NOTE: *Remove the front bumper cover to carry-out the vertical alignment procedure.*

- Perform the alignment procedures for the CCM.

Does the CCM align correctly?

Yes	The system is operating correctly at this time. The concern was caused by a misaligned sensor.
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

C1A67:96

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1A67:96	Forward Looking Sensor: Component Internal Failure	Sets when the CCM detects an internal failure or invalid radar data with the radar sensor.

Possible Sources

- CCM

PINPOINT TEST G : C1A67:96

G1 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM BOTH THE CONTINUOUS AND ON-DEMAND CCM (CRUISE CONTROL MODULE) SELF-TESTS

- Igntion ON.
- Clear Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the CCM self-test.
- Check the CCM Diagnostic Trouble Codes (DTCs) from the continuous and on-demand self-tests.

Is DTC C1A67:96 recorded?

Yes	GO to G2
No	The system is operating correctly at this time. The DTC may have been set due to an intermittent fault condition. CHECK the CCM connector and the HS-CAN2 bus wires for corrosion.

G2 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all CCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the CCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Adaptive Cruise Control Does Not Function In Rain Or Snow Conditions

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1A67:97	Forward Looking Sensor: Component Or System Operation Obstructed Or Blocked	Set by the CCM as a continuous memory and on-demand DTC if the CCM detects an obstruction or if the sensor is blocked. This DTC may also set when the CCM does not see a vehicle or object on the road for an extended period.

Possible Sources

- Front bumper cover
- Blockage or obstruction
- CCM mounting bracket
- CCM alignment
- CCM

PINPOINT TEST H : THE ADAPTIVE CRUISE CONTROL DOES NOT FUNCTION IN RAIN OR SNOW CONDITIONS

H1 INSPECT THE FRONT BUMPER COVER FOR DAMAGE

- With the vehicle in NEUTRAL, position it on a hoist.
  REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
- Inspect for damage on the front and back of the front bumper cover.

Is the front bumper cover damaged?

Yes	REPAIR or INSTALL a new front bumper cover as necessary. If installing a new front bumper cover, REFER to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
No	GO to H2

H2 INSPECT THE CCM (CRUISE CONTROL MODULE) AND FRONT BUMPER COVER FOR DEBRIS, MOISTURE, SNOW OR ICE

- Inspect for debris, moisture, snow or ice on the front and back of the front bumper cover and radar sensor.

Is the CCM obstructed or blocked?

Yes	CLEAN the front bumper cover and radar sensor portion as necessary.
No	GO to H3

H3 INSPECT THE CCM (CRUISE CONTROL MODULE) BRACKET FOR CORRECT MOUNTING

- Inspect the CCM bracket for a loose connection or damage at the connection points.

Is the CCM bracket loose, bent or damaged?

Yes	Correctly INSTALL the bracket or INSTALL new grommets as necessary. ALIGN the sensor. REFER to: Cruise Control Radar Alignment (419-03A Cruise Control, General Procedures).
No	GO to H4

H4 INSPECT THE CCM (CRUISE CONTROL MODULE) FOR EXTREME VERTICAL MISALIGNMENT

- Visually inspect the CCM for extreme vertical misalignment. The CCM plastic face should be perpendicular to the ground.

Is the CCM visually misaligned vertically?

Yes	PERFORM vertical alignment and horizontal alignment test procedures. REFER to: Cruise Control Radar Alignment (419-03A Cruise Control, General Procedures).
No	GO to H5

H5 PERFORM HORIZONTAL AIM

- Using a diagnostic scan tool, perform the horizontal aim procedure.
- Using a diagnostic scan tool, perform the CCM self-test.

Does horizontal aim procedure finish successfully without setting DTC C1A67:97?

Yes	The system is operating normally at this time. This condition may have been cause by previous snow or water build up or driving on very sparse rural roads.
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0100:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	Sets in continuous memory if data messages received from the PCM over the HS-CAN1 or from the GWM over the HS-CAN2 to the CCM are missing for more than 5 seconds.

Possible Sources

- CCM
- PCM
- GWM

PINPOINT TEST I : U0100:00

I1 VERIFY THAT THE DIAGNOSTIC SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, verify a vehicle session can be established.

Can a vehicle session be established?

Yes	GO to I2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

I2 CHECK THE CCM (CRUISE CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Clear Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.
- Ignition OFF.
- Ignition ON.
- Wait at least 10 seconds.
- Using a diagnostic scan tool, perform the CCM self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from the CCM.

Is DTC U0100:00 retrieved again?

Yes	GO to I3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to I4

I4 CHECK FOR CONTINOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform a PCM KOEO self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the PCM DTC Chart in this section.
No	GO to I5

I5 CHECK THE CCM (CRUISE CONTROL MODULE) FOR BATTERY VOLTAGE OUT-OF-RANGE DTCS
• Using a diagnostic scan tool, perform a CCM self-test? **Is DTC U3003:16 or DTC U3003:17 recorded?**

Yes	For DTC U3003:16, GO to Pinpoint Test Q For DTC U3003:17, GO to Pinpoint Test R
No	GO to I6

I6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN OTHER MODULES
• Ignition ON. • Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules. **Is DTC U0100:00 set in multiple modules?**

Yes	INSTALL a new PCM. For 2.2L, REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). For 3.2L, REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0140:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	Sets in the CCM if data messages received from the BCM over the HS-CAN1 or from the GWM over the HS-CAN2 are missing.

Possible Sources

- BCM
- CCM
- GWM

PINPOINT TEST J : U0140:00

J1 VERIFY THE CUSTOMER CONCERN
• Ignition ON.

- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to J2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the BCM pass the network test?

Yes	GO to J3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

J3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to J4

J4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) AND BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the CCM and BCM self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For CCM, DTC U3003:16: GO to Pinpoint Test Q For CCM, DTC U3003:17: GO to Pinpoint Test R For the BCM, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to J5

J5 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM self-test.

Is DTC U0140:00 still present?

Yes	GO to J6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140:00 set in other modules?

Yes	INSTALL a new BCM. REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0151:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:00	Lost Communication With Restraints Control Module: Missing Message	The yaw rate sensor is integral to the RCM. This DTC sets in the CCM if yaw rate sensor data messages received from the RCM over the HS-CAN2 are missing.

Possible Sources

- CCM
- RCM

PINPOINT TEST K : U0151:00

K1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to K2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

K2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the RCM pass the network test?

Yes	GO to K3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

K3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) AND THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the CCM and RCM self-tests.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For CCM, DTC U3003:16: GO to Pinpoint Test Q For CCM DTC U3003:17: GO to Pinpoint Test R For the RCM, REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to K4

K4 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM self-test.

Is DTC U0151:00 still present?

Yes	GO to K5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

K5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151:00 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0151:00 set in other modules?

Yes	INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0155:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	Sets in the CCM if data messages received from the IPC over the HS-CAN3 or from the GWM over the HS-CAN2 are missing.

Possible Sources

- CCM
- IPC
- GWM

PINPOINT TEST L : U0155:00

L1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to L2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

L2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the IPC pass the network test?

Yes	GO to L3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

L3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to L4

L4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) AND THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the CCM and IPC self-tests.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For CCM, DTC U3003:16, GO to Pinpoint Test Q For CCM DTC U3003:17:, GO to Pinpoint Test R For the IPC, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to L5

L5 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM self-test.

Is DTC U0155:00 still present?

Yes	GO to L6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

L6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0155:00 set in other modules?

Yes	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0158:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0158:00	Lost Communication With Head Up Display: No Sub Type Information	Sets in the CCM if data messages received from the HUD module over the HS-CAN2 are missing.

Possible Sources

- CCM
- HUD module

PINPOINT TEST M : U0158:00

M1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to M2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the HUD module pass the network test?

Yes	GO to M3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

M3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) AND THE HUD (HEAD UP DISPLAY) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the CCM and HUD module self-tests.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For CCM, DTC U3003:16, GO to Pinpoint Test Q For CCM DTC U3003:17, GO to Pinpoint Test R For the HUD module, REFER to: Collision Warning and Collision Avoidance System (419-03C Collision Warning and Collision Avoidance System, Diagnosis and Testing).
No	GO to M4

M4 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM self-test.

Is DTC U0158:00 still present?

Yes	GO to M5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0158:00 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0158:00 set in other modules?

Yes	INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0212:00

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0212:00	Lost Communication With Steering Column Control Module: No Sub Type Information	Sets in the CCM if data messages received from the SCCM over the HS-CAN2 are missing.

Possible Sources

- CCM
- SCCM

PINPOINT TEST N : U0212:00

N1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to N2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the SCCM pass the network test?

Yes	GO to N3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

N3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) AND SCCM (STEERING COLUMN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the CCM and SCCM self-tests.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For CCM, DTC U3003:16, GO to Pinpoint Test Q For CCM DTC U3003:17, GO to Pinpoint Test R For the SCCM, REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
No	GO to N4

N4 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM self-test.

Is DTC U0212:00 still present?

Yes	GO to N5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0212:00 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0212:00 set in other modules?

Yes	INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

	or
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U0265:00

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0265:00	Lost Communication With Image Processing Module Sensor A: No Sub Type Information	Sets in the CCM if data messages received from the IPMA over the HS-CAN2 are missing.

Possible Sources

- CCM
- IPMA

PINPOINT TEST O : U0265:00

O1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to O2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the IPMA pass the network test?

Yes	GO to O3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

O3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the CCM self-test.

Is DTC U3003:16 or DTC U3003:17 recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test Q For DTC U3003:17, GO to Pinpoint Test R
No	GO to O4

O4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPMA (IMAGE PROCESSING MODULE A) SELF-TEST

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, perform the IPMA self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing).
No	GO to O5

O5 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the Programmable Module Installation (PMI) or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the CCM self-test.

Is DTC U0265:00 still present?

Yes	GO to O6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0265:00 SET IN OTHER MODULES

- Clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0265:00 set in other modules?

Yes	INSTALL a new IPMA. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U3000:63

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3000:63	Control Module: Circuit/Component Protection Time-Out	Set by the CCM as a continuous memory and on-demand DTC if the CCM detects too many collision mitigation by braking activation requests.

Possible Sources

- Front bumper cover
- CCM mounting bracket
- CCM

PINPOINT TEST P : U3000:63

P1 INSPECT THE CCM (CRUISE CONTROL MODULE) , BRACKET AND FRONT BUMPER COVER	
• Inspect for damage to the CCM, bracket and front bumper cover. **Is the CCM, bracket or front bumper cover damaged?**	
Yes	REPAIR or REPLACE the CCM, bracket or front bumper cover as necessary. For the CCM or bracket, REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation). For the front bumper cover, REFER to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
No	If a software update is available, update the CCM to the latest software level. PERFORM the module programming. REFER to direction provided by the diagnostic scan tool. If a software update is not available, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).

U3003:16

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Set by the CCM as a continuous memory and on-demand DTC if the CCM detects low battery voltage below 9.5 volts for more than 500 ms.

Possible Sources

- Wiring, terminals and connectors
- Battery
- Generator
- CCM
- PCM

PINPOINT TEST Q : U3003:16

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: *Failure to disconnect the battery when instructed results in false resistance readings. Refer to Section 414-01.*

Q1 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform the self-test.

Is DTC U3003:16 still present?

Yes	GO to Q2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

Q2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, perform the PCM self-test.

Are any charging system Diagnostic Trouble Codes (DTCs) present in the PCM?

Yes	For 2.2L Diesel, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). .
No	GO to Q3

Q3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery OK and fully charged?

Yes	GO to Q4
No	INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Q4 CHECK THE CCM (CRUISE CONTROL MODULE) VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect CCM C9224.
- Ignition ON.
- Measure and record the voltage at the battery.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9224-10		Ground

Is the voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to Q5

No	REPAIR the circuit for high resistance.

Q5 CHECK THE CCM (CRUISE CONTROL MODULE) GROUND CIRCUIT

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9224-4	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to Q6
No	REPAIR the circuit for high resistance.

Q6 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the CCM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the CCM connector and related in-line connector. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U3003:17

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	Sets as a continuous memory and on-demand DTC if the CCM detects high battery voltage above 16.5 volts for 500 ms.

Possible Sources

- Generator
- CCM
- PCM

PINPOINT TEST R : U3003:17

NOTE: *DTC U3003:17 may be stored in the module memory due to past battery charging or vehicle jump starting events.*

R1 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17, P0563 OR P0626 SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U3003:17, P0563 (PCM) or P0626 (PCM) set in more than one module?

Yes	For 2.2L or 3.2L Diesel, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). .
No	GO to R2

R2 CHECK THE BATTERY VOLTAGE

- Turn off all the interior/exterior lights and accessories.
- Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	For 2.2L or 3.2L Diesel, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). .
No	GO to R3

R3 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:17

- Turn the engine off.
- Ignition ON.
- Using a diagnostic scan tool, clear the DTC Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Using a diagnostic scan tool, perform the CCM self-test.

Is DTC U3003:17 still present?

Yes	INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

U0423:82

Refer to Wiring Diagrams Cell 31 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0423:82	Invalid Data Received From Instrument Panel Cluster Control Module: Alive/Sequence Counter Incorrect/Not Updated	Sets in continuous memory in the CCM if adaptive cruise control data received from the GWM over the HS-CAN2 or from the IPC over the HS-CAN3 is missing for 5 seconds or longer.

Possible Sources

- CCM
- IPC
- GWM

PINPOINT TEST S : U0423:82

S1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to S2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

S2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the IPC pass the network test?

Yes	GO to S3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

S3 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to S4

S4 PERFORM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation,

	Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to S5

S5 PERFORM THE CCM (CRUISE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the CCM self-test.

Are any Diagnostic Trouble Codes (DTCs) other than U0423:82 recorded?

Yes	REFER to CCM DTC Chart in this section.
No	GO to S6

S6 RECHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the Programmable Module Installation (PMI), or the Programmable Module Installation (PMI) may not have been carried out.*

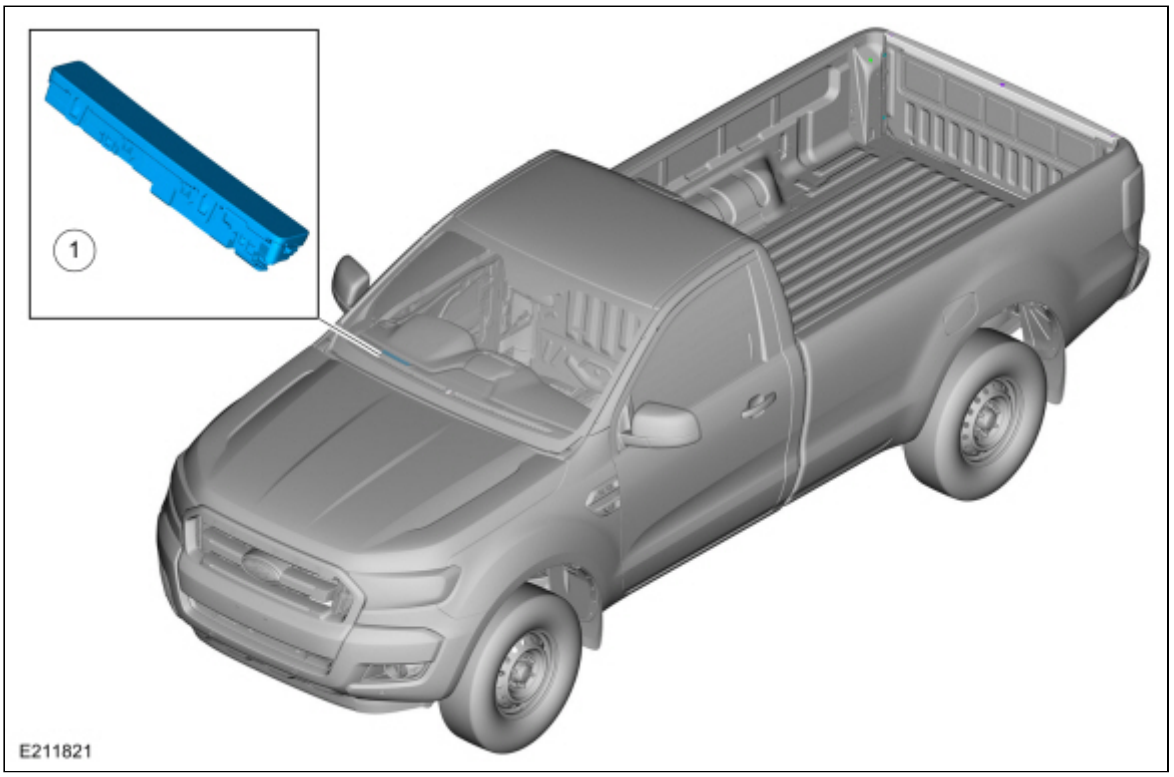
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the CCM self-test.

Is DTC U0423:82 still present?

Yes	INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Copyright © 2016 Ford Motor Company

Collision Warning and Collision Avoidance System - Component Location



Item	Description
1	HUD module

Copyright © 2016 Ford Motor Company

Collision Warning and Collision Avoidance System - Overview

Overview

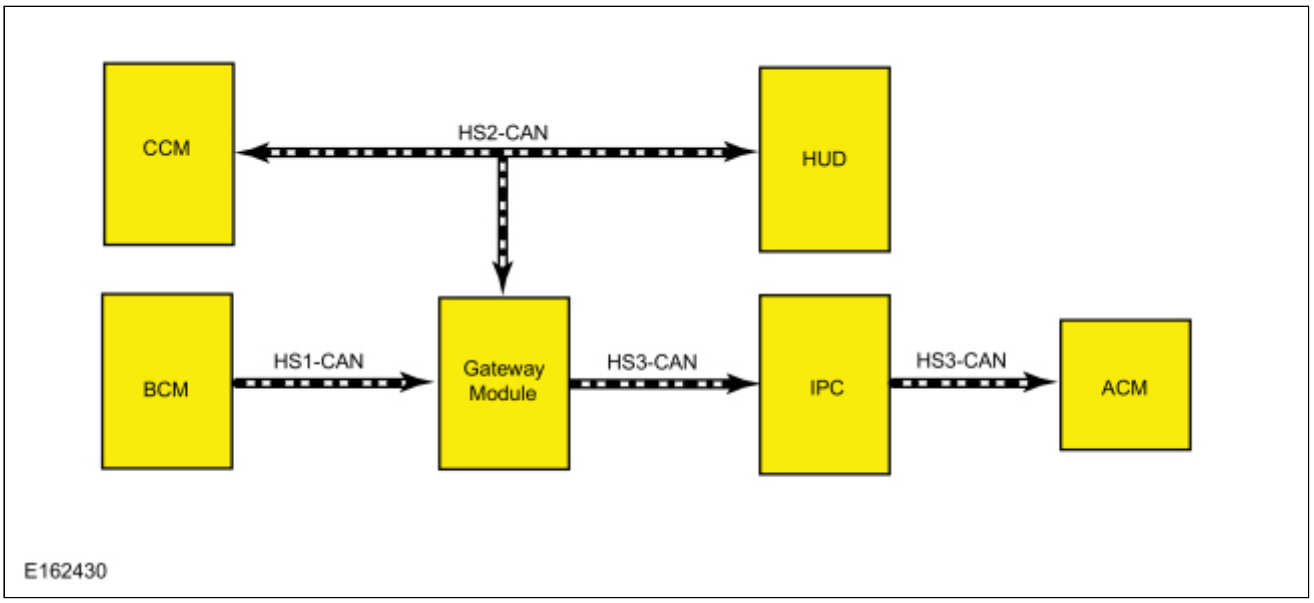
The forward collision warning system alerts the driver of a collision risk with a red warning LED indicator bar (which is part of the HUD module) located above the instrument panel and an audible warning chime from the IPC.

Copyright © 2016 Ford Motor Company

Collision Warning and Collision Avoidance System - System Operation and Component Description

System Operation

System Diagram



Network Message Chart

Network Input Messages - ACM

Broadcast Message	Originating Module	Message Purpose
Instrument panel cluster chime	IPC	Data used to command a warning chime during possible collision event and audio mute so that the warning chime can be heard.

Network Input Messages - CCM

Broadcast Message	Originating Module	Message Purpose
HUD data	HUD module	Used for HUD module active, available and fault status.

Network Input Messages - HUD

Broadcast Message	Originating Module	Message Purpose
HUD flash command	CCM	Flashes the HUD module LED array when commanded.
Ignition status	BCM	Used for ignition switch position input.

Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Forward collision chime request	CCM	Data used to command warning chime during possible collision event. When this message is received, the IPC sends the audio mute message to the ACM.
Forward collision warning message request	CCM	Data used to command warning chime and messages during possible collision event.

Forward Collision Warning System Operation

The forward collision warning system works in conjunction with the adaptive cruise control system. During a possible collision event, the CCM commands:

- the HUD to flash red warning Light Emitting Diodes (LEDs).
- the IPC to activate a chime and commands.
- the ACM to mute audio volume.

The forward collision warning system is activated when the vehicle is moving forward at a speed greater than 8 kmh (5 mph). The CCM determines the distance and relative speed of the vehicle that is in the path of travel, utilizing a radar sensor (integral to the CCM) to detect other vehicles that are moving in the same direction. If the CCM determines that a collision is possible, the CCM commands the HUD module Light Emitting Diodes (LEDs) to flash and the IPC to chime.

The forward collision warning system and audible warning chime can be enabled and disabled through the message center display in the IPC. The system reverts to ON each ignition cycle. The HUD module and/or chime activates briefly to confirm the last setting.

The forward collision system has three levels of sensitivity detection (HIGH, NORMAL and LOW) that are changed in the message center display.

If a MyKey® restricted key is in use, the MyKey® turns on the forward collision warning and will not allow the MyKey® user to disable the audio or visual forward collision warning system. However, the MyKey® user is able to adjust the forward collision warning sensitivity.

When a system fault is detected with the forward collision warning system, the message COLLISION WARNING NOT AVAILABLE, COLLISION WARNING NOT AVAILABLE SENSOR BLOCKED SEE MANUAL, or COLLISION WARNING MALFUNCTION is displayed in the IPC message center.

Component Description

CCM

The CCM contains a radar sensor unit that determines the distance and relative speed of the vehicle that is in the path of travel.

HUD

The HUD contains the red Light Emitting Diodes (LEDs) that warn the driver of a possible collision event when commanded by the CCM.

There are certain situations when the warning Light Emitting Diodes (LEDs) cannot be seen, such as strong sunlight or when wearing sunglasses. The HUD module has a temperature sensor circuit that is integral to the module that senses the temperature of the Light Emitting Diodes (LEDs) internal to the module. When a high passenger compartment temperature such as strong sunlight is sensed by the temperature sensor, the warning Light Emitting Diodes (LEDs) can be temporarily disengaged. If this occurs, only the audible warning chime is used.

Warnings may not appear if there is little distance to the vehicle ahead or abrupt steering wheel and pedal movements are made.

Copyright © 2016 Ford Motor Company

Collision Warning and Collision Avoidance System

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

HUD DTC Chart

DTC	Description	Action
U0104:00	Lost Communication With Cruise Control Module: No Sub Type Information	GO to Pinpoint Test C
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	GO to Pinpoint Test D
U0405:68	Invalid Data Received From Cruise Control Module: Event Information	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the CCM. REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the CCM, DIAGNOSE the observable symptom.
U0447:68	Invalid Data Received From Gateway "A": Event Information	RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the GWM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the GWM, DIAGNOSE the observable symptom.
U210A:16	Temperature Sensor: Circuit Voltage Below Threshold	GO to Pinpoint Test F
U210A:17	Temperature Sensor: Circuit Voltage Above Threshold	GO to Pinpoint Test F
U3000:41	Control Module: General Checksum Failure	CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If DTC U3000:41 is retrieved again, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	GO to Pinpoint Test G
U3003:1C	Battery Voltage: Circuit Voltage Out of Range	GO to Pinpoint Test H

CCM DTC Chart

DTC	Description	Action
C1132:4B	Head Up Display: Over Temperature	GO to Pinpoint Test E

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
Module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • HUD module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The forward collision warning system is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test A
The HUD module is inoperative	Refer to the Pinpoint Test	GO to Pinpoint Test B
COLLISION WARN NOT AVAILABLE SENSOR BLOCKED SEE MANUAL message in the IPC message center	CCM	REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
The forward collision warning system cannot be deactivated	A MyKey® restricted key is in use	VERIFY whether a MyKey® restricted key is in use. With an admin key, VERIFY forward collision warning system normal operation.
Too many forward collision warning events occur	• A MyKey® restricted key is in use • Forward collision warning sensitivity is set to the most sensitive value	• VERIFY whether a MyKey® restricted key is in use. With an admin key, VERIFY forward collision warning system normal operation. • CHECK the forward collision warning sensitivity setting in the message center menu.

Pinpoint Tests

The Forward Collision Warning System Is Inoperative

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Collision Warning and Collision Avoidance System - System Operation and Component Description (419-03C Collision Warning and Collision Avoidance System, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- CCM
- HUD module
- IPC

PINPOINT TEST A : THE FORWARD COLLISION WARNING SYSTEM IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.
A1 VERIFY THE CCM (CRUISE CONTROL MODULE) AND HUD (HEAD UP DISPLAY) MODULE PASS THE NETWORK TEST
• Using a diagnostic scan tool, perform the network test.

- Using a diagnostic scan tool, perform the network test.

Do both the CCM and the HUD module pass the network test?

Yes	GO to A2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CONTINUOUS AND ON-DEMAND HUD (HEAD UP DISPLAY) MODULE SELF-TESTS

- Using a diagnostic scan tool, perform the HUD module self-test.

Are any HUD module Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to HUD Module DTC Chart in this section.
No	GO to A3

A3 CHECK THE CCM (CRUISE CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the CCM self-tests.

Are any CCM Diagnostic Trouble Codes (DTCs) recorded?

Yes	REPAIR all CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
No	GO to A4

A4 CHECK THE MESSAGE CENTER FOR CORRECT OPERATION

- Check the IPC message center for correct operation.

Does the message center operate correctly?

Yes	GO to A5
No	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).

A5 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision

	Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Head Up Display (HUD) Module Is Inoperative

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Collision Warning and Collision Avoidance System - System Operation and Component Description (419-03C Collision Warning and Collision Avoidance System, Description and Operation).

Possible Sources

- CCM
- HUD module

PINPOINT TEST B : THE HEAD UP DISPLAY (HUD) MODULE IS INOPERATIVE

B1 CHECK FOR HUD (HEAD UP DISPLAY) MODULE LED PROVE OUT TEST

NOTE: *Remove the vehicle from the extreme heat source or sunload condition prior to testing the vehicle.*

- Ignition ON.
- While placing the ignition switch in RUN, observe the HUD module Light Emitting Diodes (LEDs).

Do the HUD module Light Emitting Diodes (LEDs) illuminate?

Yes	The HUD module Light Emitting Diodes (LEDs) are operating correctly at this time. The concern may have been caused by extreme temperatures.
No	GO to B2

B2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the HUD module pass the network test?

Yes	GO to B3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

B3 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE HUD (HEAD UP DISPLAY) MODULE SELF-TEST

- Using a diagnostic scan tool, perform a HUD module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the HUD Module DTC Chart in this section.
No	GO to B4

B4 CHECK THE DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) SELF-TEST
• Using a diagnostic scan tool, perform a CCM self-test. **Are any Diagnostic Trouble Codes (DTCs) recorded?**

Yes	REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
No	GO to B5

B5 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

• Ignition OFF.
• Disconnect and inspect HUD module connector and related in-line connectors.
• Repair:
  • corrosion (install new connector or terminals - clean module pins)
  • damaged or bent pins - install new terminals/pins
  • pushed-out pins - install new pins as necessary
• Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
• Operate the system and determine if the concern is still present.
 	
Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0104:00

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Collision Warning and Collision Avoidance System - System Operation and Component Description (419-03C Collision Warning and Collision Avoidance System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0104:00	Lost Communication With Cruise Control Module: No Sub Type Information	Sets in the HUD module if data messages received from the CCM over the HS-CAN2 are missing.

Possible Sources

- CCM

- HUD module

PINPOINT TEST C : U0104:00

C1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to C2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

C2 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the CCM pass the network test?

Yes	GO to C3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

C3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE CCM (CRUISE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform a CCM self-test.

Is DTC C1132:4B recorded?

Yes	If DTC C1132:4B is recorded, GO to Pinpoint Test E For any other Diagnostic Trouble Codes (DTCs), REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control, Diagnosis and Testing).
No	GO to C4

C4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE HUD (HEAD UP DISPLAY) MODULE SELF-TEST

- Using a diagnostic scan tool, perform a HUD module self-test.

Is DTC U3003:16 or U3003:1C recorded?

Yes	For DTC U3003:16, GO to Pinpoint Test G For DTC U3003:1C, GO to Pinpoint Test H
No	GO to C5

C5 RECHECK THE HUD (HEAD UP DISPLAY) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the Programmable Module Installation (PMI), or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Wait 10 seconds. Repeat the HUD module self-test.

Is DTC U0104:00 still present?

Yes	GO to C6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

C6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0104:00 set in other modules on the network?

Yes	GO to C7
No	GO to C8

C7 CHECK FOR CORRECT CCM (CRUISE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect CCM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the CCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new CCM. REFER to: Cruise Control Module (CCM) (419-03A Cruise Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C8 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision

	Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0146:00

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Collision Warning and Collision Avoidance System - System Operation and Component Description (419-03C Collision Warning and Collision Avoidance System, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	Sets in the HUD module if data messages received from the GWM over the HS-CAN2 are missing.

Possible Sources

- HUD module
- GWM

PINPOINT TEST D : U0146:00

D1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable concern.

Is an observable symptom present?

Yes	GO to D2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the GWM pass the network test?

Yes	GO to D3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D3 CHECK GWM (GATEWAY MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, retrieve GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Continuous Memory Diagnostic Trouble Codes (CMDTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to D4

D4 PERFORM THE HUD (HEAD UP DISPLAY) MODULE SELF-TEST

- Using a diagnostic scan tool, perform a HUD module self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the HUD Module DTC Chart in this section.
No	GO to D5

D5 RECHECK THE HUD (HEAD UP DISPLAY) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the Programmable Module Installation (PMI), or the Programmable Module Installation (PMI) may not have been carried out.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the HUD module self-test.

Is DTC U0146:00 still present?

Yes	GO to D6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0146:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0146:00 set in other modules?

Yes	GO to D7
No	GO to D8

D7 CHECK FOR CORRECT GWM (GATEWAY MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect GWM connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the GWM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

D8 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C1132:4B

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

The HUD module is designed with a temperature sensor internal to the module. Due to extremely hot weather conditions, the temperature sensor circuit allows the HUD module to disable under high temperature conditions, which could damage the HUD module Light Emitting Diodes (LEDs). The HUD module is designed with a LED prove-out test. Upon each ignition cycle when the ignition switch is in RUN, the Light Emitting Diodes (LEDs) illuminate for a period of time indicating the HUD module is functional.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1132:4B	Head Up Display: Over Temperature	Sets as a continuous memory and on-demand DTC in the CCM if the HUD module is over-temperature.

Possible Sources

- HUD module

PINPOINT TEST E : C1132:4B

E1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, perform the network test.

Does the HUD module pass the network test?

Yes	GO to E2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E2 CHECK FOR HUD (HEAD UP DISPLAY) MODULE LED (LIGHT EMITTING DIODE) PROVE-OUT TEST

NOTE: *Remove the vehicle from the extreme heat source or sunload condition prior to testing the vehicle.*

- Ignition ON.
- While placing the ignition switch in RUN, observe the HUD module Light Emitting Diodes (LEDs).

Do the HUD module light emitting diodes (LEDs) illuminate?

Yes	The HUD module Light Emitting Diodes (LEDs) are operating correctly at this time. The concern may have been caused by extreme temperatures.
No	GO to E3

E3 CHECK THE DTCS FROM THE HUD (HEAD UP DISPLAY) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the HUD module self-test.

Are any HUD module Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the HUD Module DTC Chart in this section.
No	GO to E4

E4 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by

	module connections. ADDRESS the root cause of any connector or pin issues.

U210A:16 Or U210A:17

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U210A:16	Temperature Sensor: Circuit Voltage Below Threshold	Sets in continuous memory in the HUD module when the internal temperature sensor circuit is below the lowest valid temperature value.
U210A:17	Temperature Sensor: Circuit Voltage Above Threshold	Sets in continuous memory in the HUD module when the internal temperature sensor circuit is above the highest valid temperature value.

Possible Sources

- HUD module

PINPOINT TEST F : U210A:16 OR U210A:17

F1 CHECK FOR HUD (HEAD UP DISPLAY) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Engine OFF.
- Ignition ON.
- Using a diagnostic scan tool, clear the HUD module Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Retrieve Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U210A:16 or U210A:17 recorded?

Yes	GO to F2
No	The system is operating normally at this time. The DTC may have been set previously due to an internal intermittent fault with the temperature sensor circuit.

F2 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).

	REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U3003:16

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	Set by the HUD module in continuous memory if the HUD module detects low battery voltage below 7 volts for more than 500 ms.

Possible Sources

- Wiring, terminals or connectors
- Battery
- Generator
- PCM
- HUD module

PINPOINT TEST G : U3003:16

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

G1 CHECK THE HUD (HEAD UP DISPLAY) MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs). Repeat the HUD module self-test.

Is DTC U3003:16 still present?

Yes	GO to G2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

G2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) IN THE PCM (POWERTRAIN CONTROL MODULE)

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	For 2.2L, REFER to: Electronic Engine Controls (303-14B) . For 3.2L, REFER to: Electronic Engine Controls (303-14C) .
No	GO to G3

G3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery OK and fully charged?

Yes	GO to G4
No	REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

G4 CHECK THE HUD (HEAD UP DISPLAY) MODULE VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect HUD module C2395.
- Ignition ON.
- Measure and record the voltage at the battery.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2395-4		Ground

Is the voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to G5
No	REPAIR the circuit.

G5 CHECK THE HUD (HEAD UP DISPLAY) MODULE GROUND CIRCUIT

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2395-4		C2395-1

Is the voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to G6
No	REPAIR the circuit.

G6 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U3003:1C

Refer to Wiring Diagrams Cell 146 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:1C	Battery Voltage: Circuit Voltage Out of Range	Sets in continuous memory if the HUD module detects battery voltage outside the valid range.

Possible Sources

- Wiring, terminals or connectors
- Battery
- Generator
- HUD module

PINPOINT TEST H : U3003:1C

NOTE: *DTC U3003:1C may be stored in the module memory due to past battery charging or vehicle jump starting events.*

H1 CHECK FOR BATTERY VOLTAGE DTCS SET IN OTHER MODULES

- Ignition ON.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Do any charging system Diagnostic Trouble Codes (DTCs) set in more than one module?

Yes	For 2.2L or 3.2L, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to H2

H2 CHECK THE BATTERY VOLTAGE

- Turn off all the interior/exterior lights and accessories.
- Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	For 2.2L or 3.2L, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and

	Testing).
No	GO to H3

H3 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U3003:1C

- Engine OFF.
- Ignition ON.
- Clear the HUD module Continuous Memory Diagnostic Trouble Codes (CMDTCs).
- Using a diagnostic scan tool, perform the HUD module self-test.

Is DTC U3003:1C present?

Yes	GO to H4
No	The system is operating normally at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

H4 CHECK FOR CORRECT HUD (HEAD UP DISPLAY) OPERATION

- Ignition OFF.
- Disconnect and inspect HUD module connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the HUD module connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

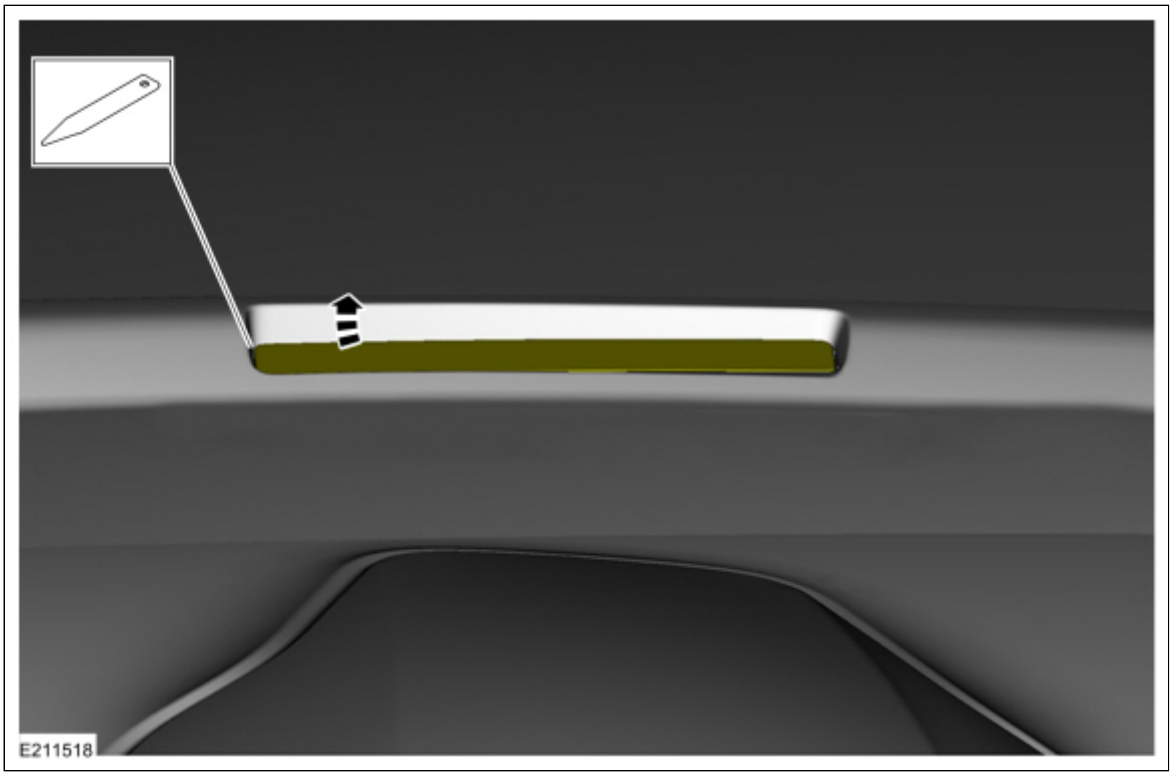
Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new HUD module. REFER to: Head Up Display (HUD) Module - RHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation). REFER to: Head Up Display (HUD) Module - LHD (419-03C Collision Warning and Collision Avoidance System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

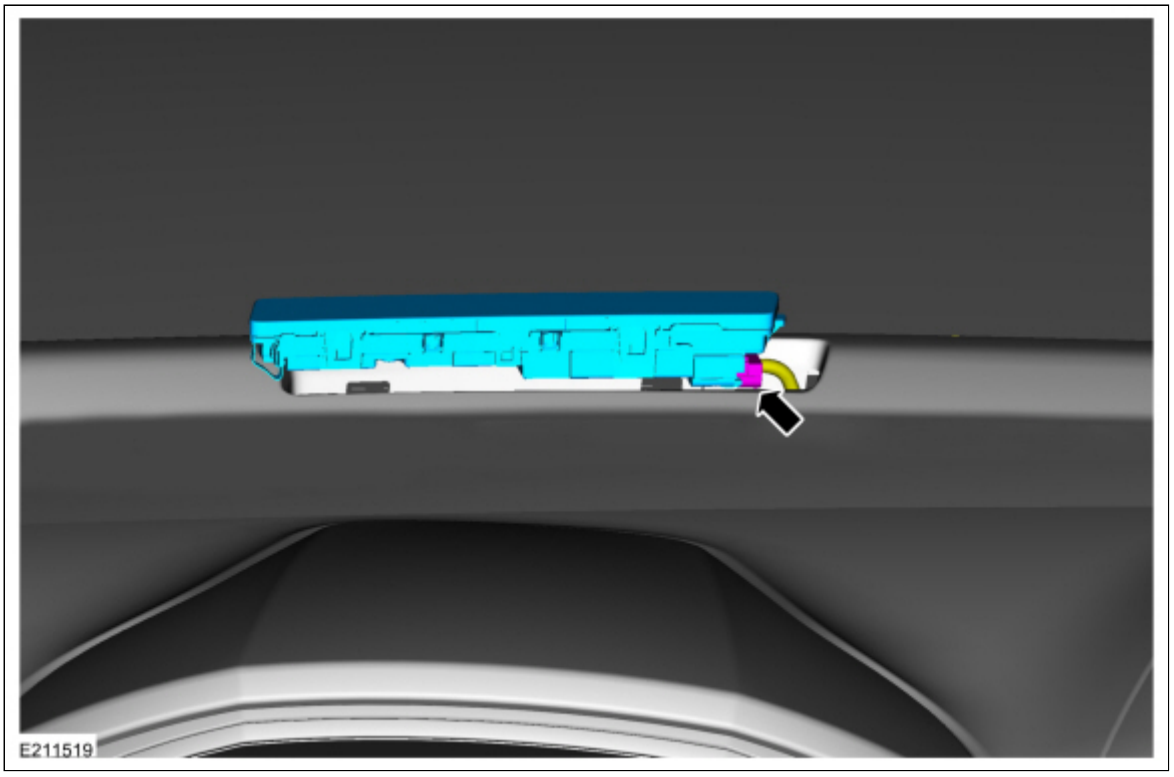
Head Up Display (HUD) Module - LHD

Removal

1. Using a non-marring tool, release and position the HUD.



2. Disconnect and remove the HUD.



Installation

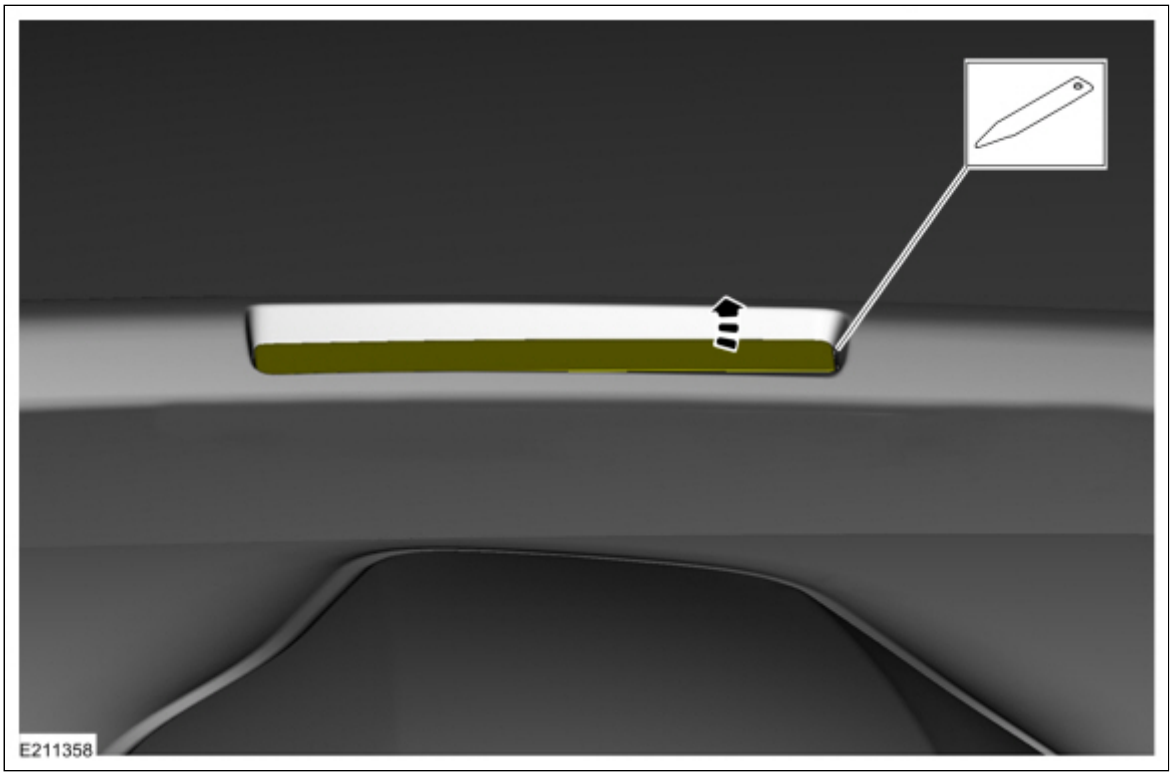
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

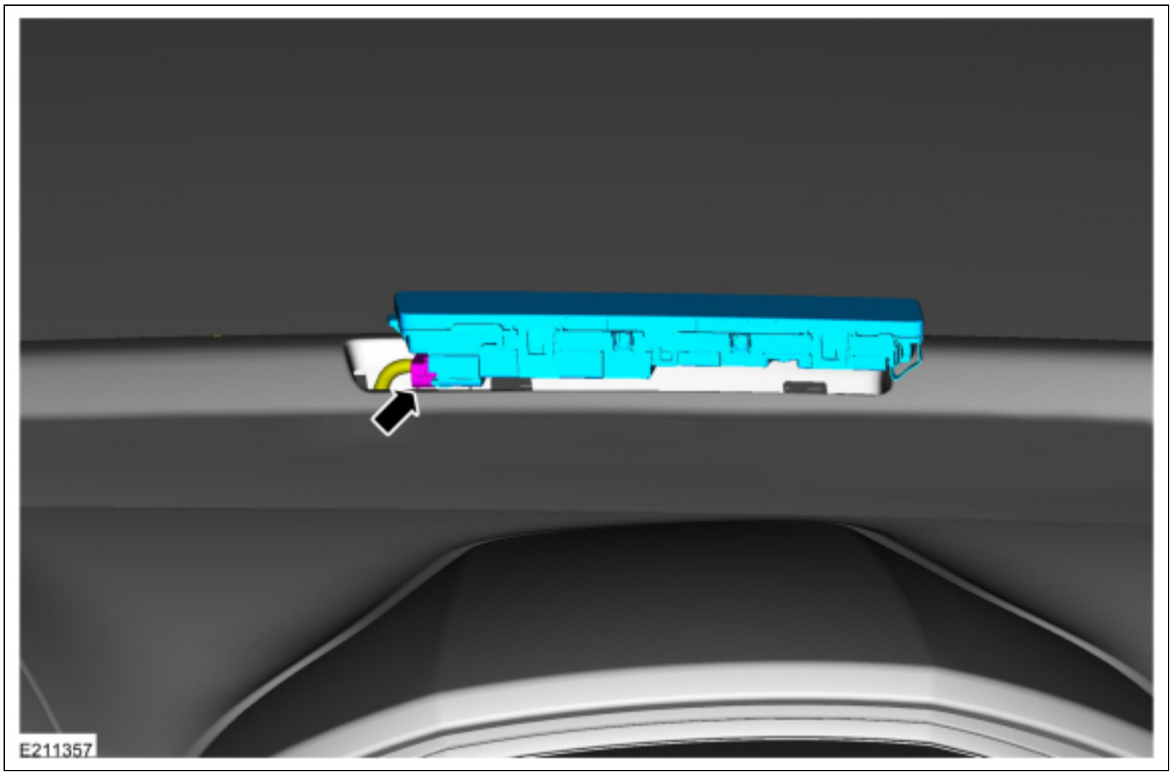
Head Up Display (HUD) Module - RHD

Removal

1. Using a non-marring tool, release and position the HUD.



2. Disconnect and remove the HUD.

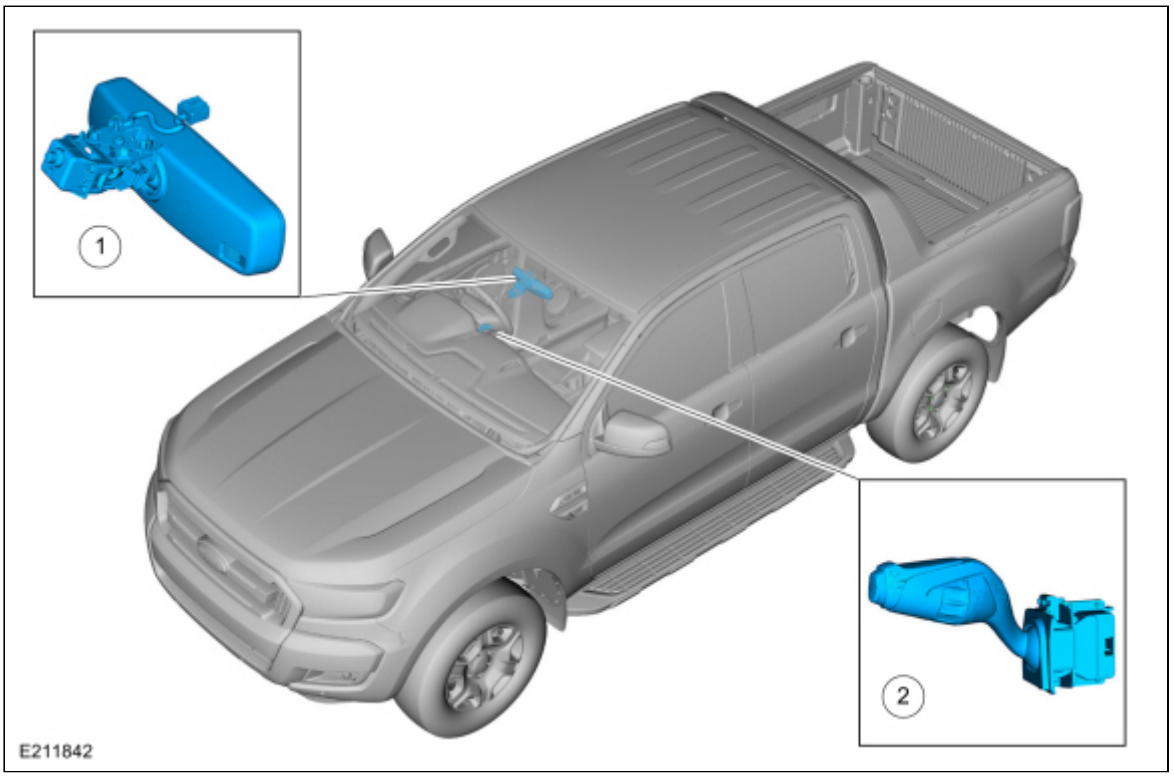


Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Lane Keeping System - Component Location



Item	Description
1	IPMA (integral to the interior rear view mirror)
2	Lane Keeping System (LKS) switch (integral to the LH steering column multifunction switch)

Copyright © 2016 Ford Motor Company

Lane Keeping System - Overview

Overview

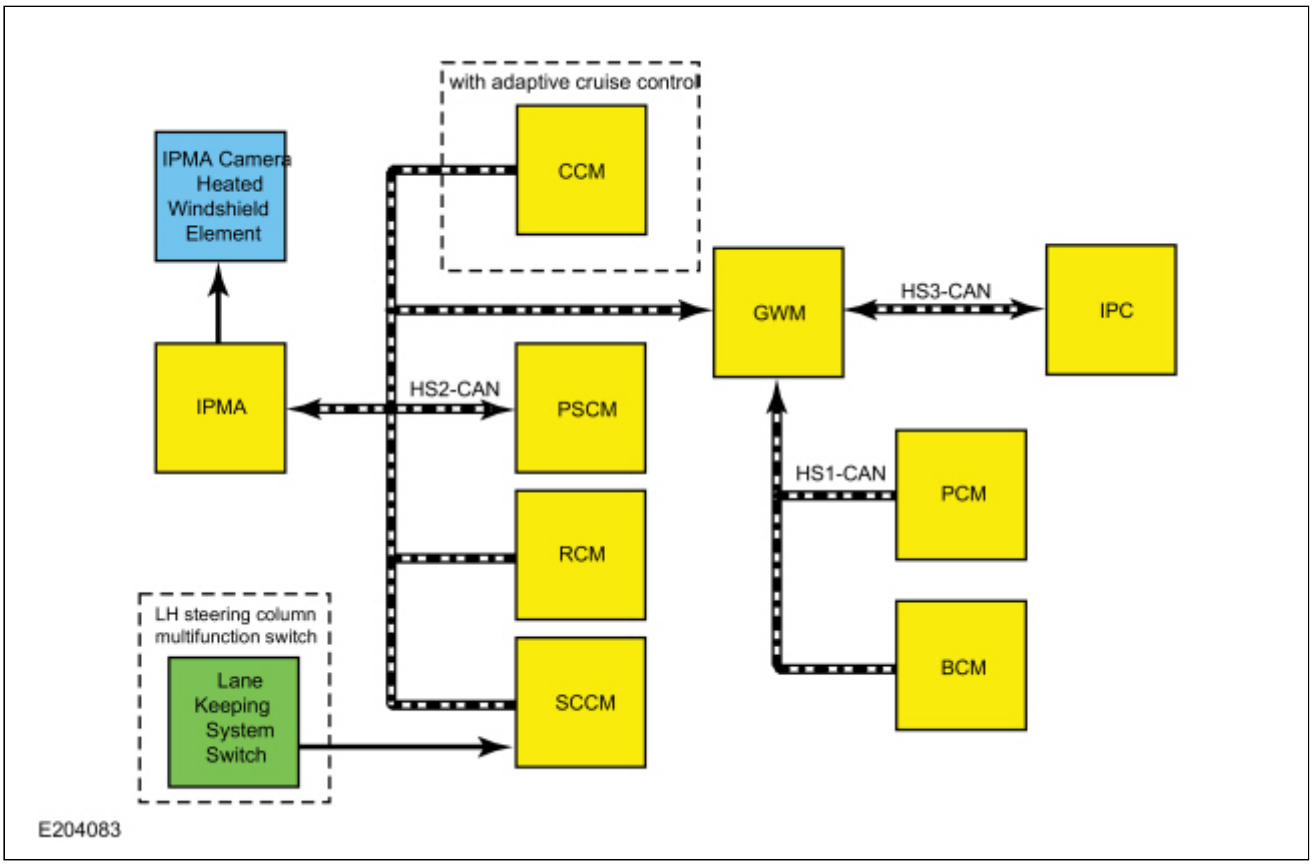
The Lane Keeping System (LKS) has 2 functions, lane keeping aid and lane keeping alert. The Lane Keeping System (LKS) utilizes the camera located in the IPMA to detect and track the road lane markings. The lane keeping alert detects unintentional drifting toward the outside of the lane and alerts the driver through steering wheel vibrations and a visual alert in the IPC message center. The lane keeping aid assists the driver by automatically providing steering torque to help the driver keep the vehicle in the lane.

Copyright © 2016 Ford Motor Company

Lane Keeping System - System Operation and Component Description

System Operation

Lane Keeping Alert and Lane Keeping Aid



Network Message Chart

Module Network Input Messages - IPMA

Broadcast Message	Originating Module	Message Purpose
Ambient air temperature	PCM	Used to control the IPMA camera heated windshield element operation. The IPMA may turn the heated windshield element on when the ambient temperature is below 5°C (41°F).
Hands off status	PSCM	Used to determine if a driver's hands are on the steering wheel when the lane keeping aid system is active. If a hands off condition is detected, the driver is alerted via the message center.
Head up display flash rate	CCM	Disables the lane keeping system in the event of a collision warning
Ignition key type	BCM	Prevents the lane keeping system from being disabled when a MyKey® is in use.
Ignition status	BCM	Enables and disables the IPMA based on the ignition switch position.
Lane keeping system suppression	PSCM	Disables the lane keeping system in the event of an evasive steering maneuver by the driver.
Lane keeping system switch status	SCCM	Used to communicate the lane keeping switch state to the IPMA

Personalization mode	IPC	Used to configure the personalized options for the lane keeping system (mode and intensity).
Restraint impact event status	RCM	Disables the lane keeping system when a SRS event occurs.
Turn signal status	SCCM	When the turn signal is activated, this message is used to suppress the lane keeping on the side of the vehicle corresponding with the turn signal direction.
Vehicle yaw rate	RCM	Used for the lane tracking and feedback calculation.
Vehicle lateral acceleration	RCM	Used to temporary disable the lane keeping system in the event that the lateral acceleration of the vehicle exceeds a predetermined threshold.
Vehicle longitudinal acceleration	RCM	Used to temporary disable the lane keeping system in the event that the longitudinal acceleration of the vehicle exceeds a predetermined threshold.
Vehicle speed	PCM	The lane keeping system is only active when the vehicle speed is above 64 km/h (40 mph).

Module Network Input Messages - PSCM

Broadcast Message	Originating Module	Message Purpose
Calculated steering angle	IPMA	Provides a reference steering angle for PSCM intervention
Lane keeping alert request	IPMA	Request to provide haptic feedback (vibration) through the steering wheel to alert the driver of a lane departure.
Lane keeping aid request	IPMA	Request for steering torque when a lane departure is detected and the lane keeping aid is on.
Road curvature data	IPMA	Provides road curvature as detected by the camera. Used to calculate required steering torque for lane keeping aid interventions.

Module Network Input Messages - IPC

Broadcast Message	Originating Module	Message Purpose
Camera status	IPMA	Used to display camera status messages.
Hands off warning	IPMA	Used to display a hands off warning message and sounds a chime through the audio system
Lane keeping aid status	IPMA	Used to display the lane keeping system status (suppressed, available and active states).
Lane keeping aid switch status display	IPMA	Turns the lane keeping aid system display on and off

Lane Keeping System Operation

The lane keeping system is turned on and off using the lane keeping system switch on the LH steering column multifunction switch. The last known on/off setting for the lane keeping system is recalled every time the ignition is turned on. When a MyKey® is in use, the system defaults the lane keeping alert mode to on and cannot be turned off but the driver can add the aid mode. When the system is on, it is active only when the vehicle speed is above 64 km/h (40 mph) and at least one lane marking can be detected by the camera. The system can be turned off at any time by pressing the lane keeping system switch. When a MyKey® is in use, if the lane keeping system switch is pressed, the IPC message center displays 'Lane Keeping Alert On MyKey Setting' and the feature cannot be turned

off.

The system can be temporarily suppressed at any time by the following:

- Rapid braking or acceleration
- Evasive steering maneuver
- Using the turn signal indicator

Lane Keeping Alert

The lane keeping alert generates vibration through the steering wheel when an unintended lane departure is detected by the IPMA. When commanded by the IPMA, the PSCM rapidly oscillates the power steering left to right, simulating the vehicle driving on a rumble strip. The intensity of the steering wheel vibration can be adjusted using the Driver Assist options in the message center. The system also provides a visual alert in the message center when a lane departure is detected.

Lane Keeping Aid

The lane keeping aid provides steering torque to help the driver keep the vehicle in the lane when an unintended lane departure is detected. The IPMA sends the road curvature and calculated steering angle messages to the PSCM. The PSCM uses these messages to calculate and generate the intervention torque.

Hands-Off Warning

When the lane keeping aid is active, the PSCM continuously monitors the torque sensor in the EPAS system to determine if a hand is on the steering wheel and sends the data to the IPMA. If the IPMA detects that the driver's hands are off the wheel for more than a few seconds, the hands-off warning is generated.

The hands-off warning is generated in 2 levels. The first level is a message center warning only and is triggered after 3 seconds of hands-off driving is detected. The second level warning consists of a message center warning and an audio chime and is generated after 6 seconds of hands-off driving.

NOTE: *Due to certain road conditions and the driver's individual grip/touch on the steering wheel, the system may generate a hands-off warning when hand(s) are still on the steering wheel.*

IPMA Camera Heated Windshield Element

The IPMA camera heated windshield element keeps the windshield in front of the IPMA clear of condensation, frost and ice. The IPMA uses input from the IPMA camera and the ambient air temperature to turn the IPMA camera heated windshield element on and off. Voltage and ground is supplied to the heated windshield element by the IPMA. The IPMA camera heated windshield element may be commanded on if the ambient temperature is below 5°C (41°F).

System Display

When the lane keeping system is turned on, an overhead graphic of a vehicle and lane markings is displayed in the LH IPC display. If the lane keeping aid mode is selected when the system is on, a separate icon also appear in the IPC. When the system is off, the lane marking graphics are not displayed. The overhead vehicle graphic may still be displayed if adaptive cruise control is enabled. While the system is on, the color of the lane markings change to indicate the system status.

Gray: Indicates the system is temporarily unable to provide a lane keeping aid or alert activation on the indicated side(s). This may be caused by:

- The vehicle speed is under the activation limit
- High sunload on the IPMA camera lens
- Too close to lane markings
- Lane markings are too narrow or wide
- Road has no or poor lane markings in the camera field-of-view
- Following vehicle in front too closely
- IPMA camera blocked
- Windshield dirty or damaged
- Standing water on road
- Environmental conditions (significant sun angles, shadows, snow, heavy rain or fog)
- Turn signal is active
- Vehicle is in a dynamic maneuver
- Tight curves on the road

Green: Indicates the system is available or ready to provide a lane keeping aid or alert activation on the indicated side(s).

Yellow: Indicates the system is providing or has just provided a lane keeping aid activation.

Red: Indicates the system is providing or has just provided a lane keeping alert activation.

Message Center Settings

The system has 2 optional setting menus available through the Driver Assist menu in the message center. The last-known selection for each setting is stored by the IPMA and does not need to be set again after the key is cycled.

The **Mode** setting allows the driver to select which of the system features is enabled and turned on when the button is pressed. The 3 options in this menu are:

- Lane Keeping Alert only - provides a steering wheel vibration when an unintended lane departure is detected.
- Lane Keeping Aid only - provides steering input toward the center of the lane when an unintended lane departure is detected.
- Lane Keeping Alert and Lane Keeping Aid - provides both a warning and steering input towards the center of the lane.

The **Intensity** setting allows the driver to select the intensity of the steering wheel vibration used in lane keeping alert mode. This setting does not impact the lane keeping aid mode. The 3 options in this menu are:

- Low
- Normal
- High

Camera Alignment

Camera alignment is required for the lane keeping alert and lane keeping aid to function correctly. The procedure is initiated using the scan tool and requires about 10 minutes of driving above 64 km/h (40 mph) to complete. If the alignment is unsuccessful, check the interior mirror for proper installation. The IPMA camera alignment procedure should be performed when any of the following occur:

- Windshield replacement
- Change in tire size
- Suspension repair, alignment or modifications
- Front air bag deployment
- Interior mirror replacement

Component Description

IPMA

The IPMA is integral to the interior rear view mirror. The IPMA contains a forward-looking camera that is used to detect the position of the vehicle within the lane.

IPMA Camera Heated Windshield Element

The IPMA camera heated windshield element is a resistive-type heater grid that is adhered to the inside of the windshield directly in front of the IPMA camera.

The IPMA camera heated windshield element uses a jumper harness between the component and the vehicle harness. Before replacing the IPMA camera heated windshield element or the IPMA for an IPMA camera heated windshield element concern, verify the integrity of the wiring, connectors and terminals on the jumper harness.

Lane Keeping System Switch

The lane keeping system switch is a momentary contact switch located on the LH steering column multifunction switch. The lane keeping system switch inputs directly to the SCCM, which provides a switch state message to the IPMA.

Copyright © 2016 Ford Motor Company

Lane Keeping System

DTC Chart(s)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

IPMA DTC Chart

DTC	Description	Action
B11C7:46	High Beam Sensor: Calibration/Parameter Memory Failure	DIAGNOSE the automatic high beam feature. REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B11C7:97	High Beam Sensor: Component or System Operation Obstructed or Blocked	DIAGNOSE the automatic high beam feature. REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1286:14	Interior Mirror: Circuit Short To Ground or Open	REFER to: Interior Rear View Mirrors (501-09B Interior Rear View Mirrors, Diagnosis and Testing).
B12D8:11	Mirror Heater Output: Circuit Short To Ground	GO to Pinpoint Test C
B12D8:13	Mirror Heater Output: Circuit Open	GO to Pinpoint Test C
C1001:78	Vision System Camera: Alignment or Adjustment Incorrect	This continuous memory DTC sets when a new IPMA has been installed without performing the camera alignment. PERFORM the camera alignment using a diagnostic scan tool.
U0100:87	Lost Communication With ECM/PCM "A": Missing Message	GO to Pinpoint Test E
U0131:87	Lost Communication With Power Steering Control Module: Missing Message	GO to Pinpoint Test F
U0140:87	Lost Communication With Body Control Module: Missing Message	GO to Pinpoint Test G
U0151:87	Lost Communication With Restraints Control Module: Missing Message	GO to Pinpoint Test H
U0155:87	Lost Communication With Instrument Panel Cluster (IPC): Missing Message	GO to Pinpoint Test I
U0212:87	Lost Communication With Steering Column Control Module: Missing Message	GO to Pinpoint Test J

U0401:00	Invalid Data Received From ECM/PCM A: No Sub Type Information	This continuous memory DTC can set due to a fault in the PCM or an input to the PCM. RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the PCM. Refer to the appropriate section in Group 303 for the procedure. If no Diagnostic Trouble Codes (DTCs) are present in the PCM, DIAGNOSE the observable symptom.
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	This continuous memory DTC can set due to a fault in the BCM or an input to the BCM. RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the BCM, DIAGNOSE the observable symptom.
U0423:00	Invalid Data Received From Instrument Panel Cluster Control Module: No Sub Type Information	This continuous memory DTC can set due to a fault in the IPC or an input to the IPC. RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the IPC. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the IPC, DIAGNOSE the observable symptom.
U0429:00	Invalid Data Received From Steering Column Control Module: No Sub Type Information	This continuous memory DTC can set due to a fault in the SCCM or an input to the SCCM. RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the SCCM. REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the SCCM, DIAGNOSE the observable symptom.
U0452:00	Invalid Data Received From Restraints Control Module: No Sub Type Information	This continuous memory DTC can set due to a fault in the RCM or an input to the RCM. RETRIEVE and FOLLOW non-network Diagnostic Trouble Codes (DTCs) from the RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). If no Diagnostic Trouble Codes (DTCs) are present in the RCM, DIAGNOSE the observable symptom.
U1000:11	Solid State Driver Protection Activated: Circuit Short To Ground	A continuous memory DTC that set in the IPMA when the IPMA has temporarily disabled the IPMA camera heated windshield element output because an excessive current draw exists (such as a short to ground). The IPMA cannot enable the output driver until the short is corrected. ADDRESS all other IPMA Diagnostic Trouble Codes (DTCs) first. After the cause of the concern is corrected, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the IPMA self-test to enable the output driver.
U201A:54	Control Module Main Calibration Data: Missing Calibration	CHECK the vehicle service history for recent service actions related to this module. This continuous memory DTC can set due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, INSTALL As-Built data from Professional Technician Society (PTS), following the diagnostic scan tool instructions under Module Programming>As-Built. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CHECK the vehicle service history for recent service actions related to this module. This continuous memory DTC can set due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, INSTALL As-Built data from Professional Technician Society (PTS), following the diagnostic scan tool instructions under Module Programming>As-Built. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	CHECK the vehicle service history for recent service actions related to this module. This continuous memory DTC can set due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, INSTALL As-Built data from Professional Technician Society (PTS), following the

		diagnostic scan tool instructions under Module Programming>As-Built. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U2200:00	Control Module Configuration Memory Corrupt: No Sub Type Information	CHECK the vehicle service history for recent service actions related to this module. This continuous memory DTC can set due to incomplete or incorrect PMI procedures. If there have been recent service actions with this module, INSTALL As-Built data from Professional Technician Society (PTS), following the diagnostic scan tool instructions under Module Programming>As-Built. REFER to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation). If there have been no recent service actions, INSTALL a new module to correct the failure to retain configuration data. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U3000:42	Control Module: General Memory Failure	ADDRESS all other IPMA Diagnostic Trouble Codes (DTCs) first. If this continuous memory DTC is still present after all other Diagnostic Trouble Codes (DTCs) have been addressed, INSTALL a new interior mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	The IPMA has permanently disabled the IPMA camera heated windshield element output because an excessive current draw has occurred more times than the module can withstand. ADDRESS all other IPMA Diagnostic Trouble Codes (DTCs). If this continuous memory DTC is still present after all other IPMA Diagnostic Trouble Codes (DTCs) have been addressed, INSTALL a new interior mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U3000:93	Control Module: No Operation	ADDRESS all other IPMA Diagnostic Trouble Codes (DTCs). If this DTC is still present on-demand or in continuous memory after all other IPMA Diagnostic Trouble Codes (DTCs) have been addressed, INSTALL a new interior mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
U3000:96	Control Module: Component Internal Failure	ADDRESS all other IPMA Diagnostic Trouble Codes (DTCs). After all other IPMA Diagnostic Trouble Codes (DTCs) have been addressed, INSTALL a new interior mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

SCCM DTC Chart

DTC	Description	Action
B13A6:09	Lane Departure Warning (LDW) Switch Input: Component Failure	• INSTALL a new LH steering column multifunction switch. REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). • CLEAR the DTC and repeat the self-test. If DTC B13A6:09 is retrieved again, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

Symptom Chart(s)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Action
A module does not communicate with the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The lane keeping aid or lane keeping alert does not turn on or activate	Refer to the Pinpoint Test	GO to Pinpoint Test A
The lane keeping aid or lane keeping alert does not provide driver feedback once activated	Refer to the Pinpoint Test	GO to Pinpoint Test B
The display lines in the IPC do not turn green after the Lane Keeping System (LKS) is turned on	Road conditions	**NOTE:** *The display lines are gray when the IPMA cannot detect lane marking(s) on the road in front of the vehicle.* VERIFY the road conditions described under System Display. REFER to: Lane Keeping System - System Operation and Component Description (419-07 Lane Keeping System, Description and Operation).
The lane keeping aid or lane keeping alert provides early feedback on one side of the lane and late feedback on the other side of the lane	Dirty or cracked windshield	CLEAN and INSPECT the windshield in front of the camera.
	Loose or incorrectly installed interior rear view mirror	INSPECT the interior rear view mirror for proper installation. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
	Camera alignment	Using a diagnostic scan tool, PERFORM the front camera alignment.
Degraded performance from the lane keeping aid or lane keeping alert system	Dirty or cracked windshield	CLEAN and INSPECT the windshield in front of the camera.
	Camera alignment	Using a diagnostic scan tool, PERFORM the front camera alignment.
LANE KEEPING SYSTEM MALFUNCTION - SERVICE REQUIRED message in the IPC	PSCM concern	RETRIEVE and REPAIR all PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
FRONT CAMERA TEMPORARILY NOT AVAILABLE message in the IPC	Temporary temperature related condition	ALLOW the vehicle to warm up or REMOVE the vehicle from direct sunlight. RECHECK after 10 minutes.
FRONT CAMERA LOW VISIBILITY - CLEAN SCREEN message in the IPC	Dirty or cracked windshield	CLEAN and INSPECT the windshield in front of the camera. REPAIR or REPLACE the windshield as necessary if damage is found.
	Dirt or debris in between the camera and the windshield	CLEAN the area between the front camera and the windshield.
	IPMA camera heated windshield element	INSPECT the IPMA camera heated windshield element for damage and DIAGNOSE any IPMA heater Diagnostic Trouble Codes (DTCs) that are present.
FRONT CAMERA MALFUNCTION - SERVICE REQUIRED message in the IPC	Refer to the Pinpoint Test	GO to Pinpoint Test D
The lane keeping aid and lane keeping alert	MyKey® in use	Normal operation.

will not turn off		

Pinpoint Tests

The Lane Keeping System Does Not Turn On Or Activate

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Lane Keeping System - System Operation and Component Description (419-07 Lane Keeping System, Description and Operation).

Possible Causes

- Communication network concern
- Dirty, scratched or obstructed windshield and/or camera
- IPMA overheating condition
- Lane keeping system switch (integral to the LH steering column multifunction switch)
- IPMA concern
- PSCM concern
- SCCM concern
- BCM concern
- PCM concern
- RCM concern
- IPC concern
- CCM concern

Visual Inspection and Diagnostic Pre-Chacks

- Certain lane keeping system concerns can be caused by the IPMA being to cold or overheating due to heavy sunload. Prior to diagnosing a lane keeping system concern, allow the vehicle to warm up or remove the vehicle from direct sunlight. RECHECK after 10 minutes.

PINPOINT TEST A : THE LANE KEEPING SYSTEM DOES NOT TURN ON OR ACTIVATE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector. Use only Rotunda Flex Probes (NUD105-R025D)

A1 VERIFY THE CONCERN

- Verify the operation of the lane keeping aid and lane keeping alert.

Does the lane keeping aid and lane keeping alert operate correctly?

Yes	The system is operating correctly at this time. The concern may have been caused by high network traffic or the driver's perception of how the lane keeping systems operate. REFER to the Owner's Literature.
No	GO to A2

A2 PERFORM A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Do the PSCM, SCCM, IPMA, BCM, PCM, RCM, IPC and CCM pass the network test?

Yes	GO to A3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A3 CHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the IPMA DTC chart in this section.
No	GO to A4

A4 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the PSCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	GO to A5

A5 CHECK THE SCCM (STEERING COLUMN CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the SCCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the SCCM Diagnostic Trouble Codes (DTCs). REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
No	GO to A6

A6 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to A7

A7 CHECK THE CCM (CRUISE CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the CCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the CCM Diagnostic Trouble Codes (DTCs). REFER to: Cruise Control (419-03B Cruise Control - Vehicles With: Adaptive Cruise Control,

	Diagnosis and Testing).
No	GO to A8

A8 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the IPC Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the IPC Diagnostic Trouble Codes (DTCs). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to A9

A9 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the RCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to A10

A10 CHECK THE PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the PCM Diagnostic Trouble Codes (DTCs). Refer to the appropriate section in Group 303 for the procedure.
No	GO to A11

A11 VERIFY THE IPMA (IMAGE PROCESSING MODULE A) LANE KEEPING SYSTEM SWITCH PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the IPMA lane keeping system switch PID (LKS_SW_ST).
- While monitoring the Parameter Identification (PID), press and release the lane keeping system switch several times.

Does the Parameter Identification (PID) consistently match the switch position?

Yes	GO to A13
No	GO to A12

A12 VERIFY THE SCCM (STEERING COLUMN CONTROL MODULE) LANE KEEPING SYSTEM SWITCH PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the SCCM lane keeping system switch PID (LANE_ASSISTSW).
- While monitoring the Parameter Identification (PID), press and release the lane keeping system switch several times.

Does the Parameter Identification (PID) consistently match the switch position?

Yes	GO to A13
No	INSTALL a new LH steering column multifunction switch. REFER to: Steering Column Multifunction Switch LH (211-05 Steering Column Switches, Removal and Installation). If the concern is still present after the repair, GO to A14

A13 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A14 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect theSCCM connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Lane Keeping System Does Not Provide Feedback When Activated

Normal Operation and Fault Conditions

REFER to: Lane Keeping System - System Operation and Component Description (419-07 Lane Keeping System, Description and Operation).

Possible Causes

- Communication network concern
- Lane keeping system settings
- PSCM (integral to the steering gear)
- IPMA (integral to the interior rear view mirror)

Visual Inspection and Diagnostic Pre-Checks

- Verify the lane keeping system turns on and the display lines in the IPC turn green when the system is active and available. If the lines do NOT turn green, GO to Pinpoint Test A

PINPOINT TEST B : THE LANE KEEPING SYSTEM DOES NOT PROVIDE FEEDBACK WHEN ACTIVATED

B1 CHECK THE PSCM (POWER STEERING CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Ignition ON.
- Using a diagnostic scan tool, check the PSCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	GO to B2

B2 CHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the IPMA DTC chart in this section.
No	GO to B3

B3 CHECK THE STEERING WHEEL VIBRATION

- Change the intensity setting in the lane keeping system message center menu.

Does the steering wheel perform a test vibration after the intensity setting is changed?

Yes	GO to B5
No	GO to B4

B4 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the PSCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PSCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

B5 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPMA connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

DTC B12D8:11, DTC B12D8:13

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Lane Keeping System - System Operation and Component Description (419-07 Lane Keeping System, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- IPMA camera heated windshield element
- IPMA (integral to the interior rear view mirror)

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B12D8:11	Mirror Heater Output: Circuit Short To Ground	An on-demand and continuous memory DTC that sets in the IPMA if an excessive current draw is detected on the IPMA camera heated windshield element output circuit.
B12D8:13	Mirror Heater Output: Circuit	An on-demand and continuous memory DTC that sets in the IPMA if a lower than expected current draw is detected on the IPMA camera heated windshield element

	Open	output circuit.

Visual Inspection and Diagnostic Pre-Checks

Inspect the integrity of the wiring, terminals and connectors on the jumper harness between the vehicle harness and the IPMA camera heated windshield element.

PINPOINT TEST C : DTC (DIAGNOSTIC TROUBLE CODE) B12D8:11, DTC (DIAGNOSTIC TROUBLE CODE) B12D8:13

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector. Use only Rotunda Flex Probes (NUD105-R025D)

NOTE: *Before replacing the IPMA camera heated windshield element or the IPMA for an IPMA camera heated windshield element concern, verify the integrity of the wiring, connectors and terminals on the IPMA camera heated windshield element jumper harness.*

C1 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPMA (IMAGE PROCESSING MODULE A) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, perform the IPMA self-test.

Is DTC B12D8:11 or DTC B12D8:13 present?

Yes	For DTC B12D8:11, GO to C2 For DTC B12D8:13, GO to C5
No	The system is operating correctly at this time. INSPECT the connectors, wiring and the IPMA camera heated windshield element for damage or poor connections.

C2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) B12D8:11 WITH THE IPMA (IMAGE PROCESSING MODULE A) CAMERA HEATED WINDSHIELD ELEMENT DISCONNECTED

- Ignition OFF.
- Disconnect Inline C9805.
- Ignition ON.
- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Perform the IPMA self-test.

Is DTC B12D8:11 present?

Yes	GO to C3
No	INSTALL a new IPMA camera heated windshield element.

C3 CHECK THE IPMA (IMAGE PROCESSING MODULE A) CAMERA HEATED WINDSHIELD ELEMENT OUTPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Interior Rear View Mirror C9012.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9012-11	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C4
No	REPAIR the circuit.

C4 CHECK THE IPMA (IMAGE PROCESSING MODULE A) CAMERA HEATED WINDSHIELD ELEMENT CIRCUITS FOR A SHORT TOGETHER

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9012-11	Ω	C9012-14

Is the resistance greater than 10,000 ohms?

Yes	GO to C7
No	REPAIR the circuits.

C5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) B12D8:11 WITH THE IPMA (IMAGE PROCESSING MODULE A) CAMERA HEATED WINDSHIELD ELEMENT CIRCUITS JUMPERED TOGETHER

- Ignition OFF.
- Disconnect Inline C9805.
- Connect:

Lead 1	Measurement / Action	Lead 2
C9805-1 (Male side)		C9805-3 (Male side)

- Ignition ON.
- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Perform the IPMA self-test.

Is DTC B12D8:11 present?

Yes	REMOVE the fused jumper wire. INSTALL a new IPMA camera heated windshield element.
No	REMOVE the fused jumper wire. GO to C6

C6 CHECK THE IPMA (IMAGE PROCESSING MODULE A) CAMERA HEATED WINDSHIELD ELEMENT CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Interior Rear View Mirror C9012.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9012-11	Ω	C9805-3 (Male side)
C9012-14	Ω	C9805-1 (Male side)

Are the resistances less than 3 ohms?

Yes	GO to C7
No	REPAIR the affected circuit

No	REPAIR the affected circuit.

C7 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Message Center Displays A FRONT CAMERA MALFUNCTION SERVICE REQUIRED Message

Normal Operation and Fault Conditions

In addition to certain fault conditions, the FRONT CAMERA MALFUNCTION SERVICE REQUIRED message is displayed in the message center when the IPMA camera alignment has been initiated, but is incomplete.

Possible Causes

- Communication network concern
- IPMA camera alignment incomplete
- IPMA (integral to the interior rear view mirror)

Visual Inspection and Diagnostic Pre-Checks

Verify the IPMA camera alignment is complete using a diagnostic scan tool.

PINPOINT TEST D : THE MESSAGE CENTER DISPLAYS A 'FRONT CAMERA MALFUNCTION SERVICE REQUIRED' MESSAGE

D1 PERFORM A NETWORK TEST

- Ignition ON.
- Using a diagnostic scan tool, perform a network test.

Does the IPMA pass the network test?

Yes	GO to D2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D2 CHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, check the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the IPMA DTC chart in this section.
No	GO to D3

D3 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

DTC U0100:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the PCM through the GWM.

Possible Causes

- Communication network concern
- PCM
- GWM concern
- IPMA (integral to the interior rear view mirror)

DTC	Description	Fault Trigger Conditions
U0100:87	Lost Communication With ECM/PCM "A": Missing Message	A continuous memory DTC that sets in the IPMA if messages received from the PCM over the HS-CAN1 through the GWM are missing for 0.5 second or more.

PINPOINT TEST E : DTC (DIAGNOSTIC TROUBLE CODE) U0100:87

E1 VERIFY THAT THE DIAGNOSTIC SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect the diagnostic scan tool.
- Check that a vehicle session can be established using the diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to E2
No	REFER to: No Communication Between the Integrated Diagnostic System (IDS) and the Vehicle (418-00 Module Communications Network, General Procedures).

E2 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE any PCM Diagnostic Trouble Codes (DTCs). Refer to the appropriate section in Group 303 for the procedure.
No	GO to E3

E3 CHECK THE GWM (GATEWAY MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to E4

E4 RECHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:87 retrieved again?

Yes	GO to E5
No	The system is operating correctly at this time. This DTC may have been set due to high network traffic or an intermittent fault condition.

E5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0100 set in any other module?

Yes	GO to E6
No	GO to E7

E6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. Refer to the appropriate section in Group 303 for the procedure.
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

E7 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC U0131:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the PSCM through the HS-CAN2.

Possible Causes

- Communication network concern
- PSCM (integral to the steering gear)
- IPMA (integral to the interior rear view mirror)

DTC	Description	Fault Trigger Conditions
U0131:87	Lost Communication With Power	A continuous memory DTC that sets in the IPMA if messages

	Steering Control Module: Missing Message	received from the PSCM over the HS-CAN2 are missing for 0.5 second or more.

PINPOINT TEST F : DTC (DIAGNOSTIC TROUBLE CODE) U0131:87

F1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is there an observable symptom present?

Yes	GO to F2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

F2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the PSCM pass the network test?

Yes	GO to F3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

F3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PSCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE the PSCM Diagnostic Trouble Codes (DTCs). REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	GO to F4

F4 RECHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0131:87 still present?

Yes	GO to F5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

F5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0131 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0131 set in any other module?

Yes	GO to F6
No	GO to F7

F6 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PSCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the PSCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, REFER to: Power Steering (211-02A Power Steering, Diagnosis and Testing).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

F7 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC U0140:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the BCM through the GWM.

Possible Causes

- Communication network concern
- GWM concern
- BCM
- IPMA (integral to the interior rear view mirror)

DTC	Description	Fault Trigger Conditions
U0140:87	Lost Communication With Body Control Module: Missing Message	A continuous memory DTC that sets in the IPMA if messages received from the BCM over the HS-CAN1 through the GWM are missing for 10 seconds or more.

PINPOINT TEST G : DTC (DIAGNOSTIC TROUBLE CODE) U0140:87

G1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify that there is an observable symptom present.

Is there an observable symptom present?

Yes	GO to G2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

G2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Do the BCM and the GWM pass the network test?

Yes	GO to G3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

G3 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the BCM Diagnostic Trouble Codes (DTCs). REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to G4

G4 CHECK THE GWM (GATEWAY MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to G5

G5 RECHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0140:87 still present?

Yes	GO to G6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

G6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140 set in any other module?

Yes	GO to G7
No	GO to G8

G7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

G8 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC U0151:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the RCM through the HS-CAN2.

Possible Causes

- Communication network concern
- RCM
- IPMA (integral to the interior rear view mirror)

DTC	Description	Fault Trigger Conditions
U0151:87	Lost Communication With Restraints Control Module: Missing Message	A continuous memory DTC that sets in the IPMA if messages received from the RCM over the HS-CAN2 are missing for 0.5 second or more.

PINPOINT TEST H : DTC (DIAGNOSTIC TROUBLE CODE) U0151:87

H1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify that there is an observable symptom present.

Is there an observable symptom present?

Yes	GO to H2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

H2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the RCM pass the network test?

Yes	GO to H3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

H3 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the RCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to H4

H4 RECHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0151:87 still present?

Yes	GO to H5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

H5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0151 set in any other module?

Yes	GO to H6
No	GO to H7

H6 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all RCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins

- pushed-out pins – install new pins as necessary
- Reconnect the RCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

H7 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC U0155:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the IPC through the GWM.

Possible Causes

- Communication network concern
- GWM concern
- IPC
- IPMA (integral to the interior rear view mirror)

DTC	Description	Fault Trigger Conditions
U0155:87	Lost Communication With Instrument Panel Cluster (IPC) Control Module: Missing Message	A continuous memory DTC that sets in the IPMA if messages received from the IPC over the HS-CAN3 through the GWM are missing for 10 seconds or more.

PINPOINT TEST I : DTC (DIAGNOSTIC TROUBLE CODE) U0155:87

I1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is there an observable symptom present?

Yes	GO to I2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Do the IPC and the GWM pass the network test?

Yes	GO to I3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

I3 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the IPC Diagnostic Trouble Codes (DTCs). REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to I4

I4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
No	GO to I5

I5 RECHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Wait 10 seconds.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:87 still present?

Yes	GO to I6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0155 set in any other module?

Yes	GO to I7
No	GO to I8

I7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC connector and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the IPC connector and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

I8 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror).

	REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC U0212:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

The IPMA communicates with the SCCM through the HS-CAN2.

Possible Causes

- Communication network concern
- SCCM
- IPMA (integral to the interior rear view mirror)

DTC	Description	Fault Trigger Conditions
U0212:87	Lost Communication With Steering Column Control Module: Missing Message	A continuous memory DTC that sets in the IPMA if messages received from the SCCM over the HS-CAN2 are missing for 10 seconds or more.

PINPOINT TEST J : DTC (DIAGNOSTIC TROUBLE CODE) U0212:87

J1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is there an observable symptom present?

Yes	GO to J2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the SCCM pass the network test?

Yes	GO to J3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

J3 CHECK FOR RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE SCCM (STEERING COLUMN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the SCCM Diagnostic Trouble Codes (DTCs). REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
No	GO to J4

J4 RECHECK THE IPMA (IMAGE PROCESSING MODULE A) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the IPMA Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 15 seconds.
- Retrieve the IPMA Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0212:87 still present?

Yes	GO to J5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0212 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0212 set in any other module?

Yes	GO to J6
No	GO to J7

J6 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the SCCM connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

J7 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior rear view mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

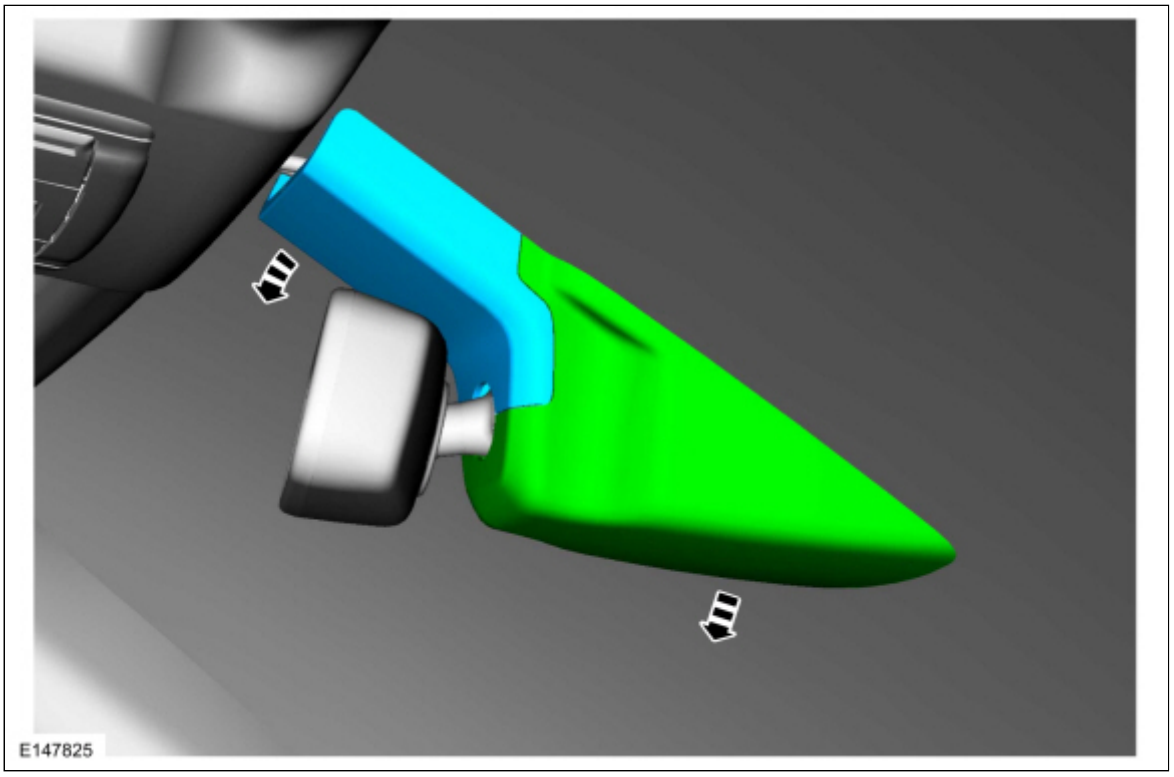
Copyright © 2016 Ford Motor Company

Image Processing Module A (IPMA)

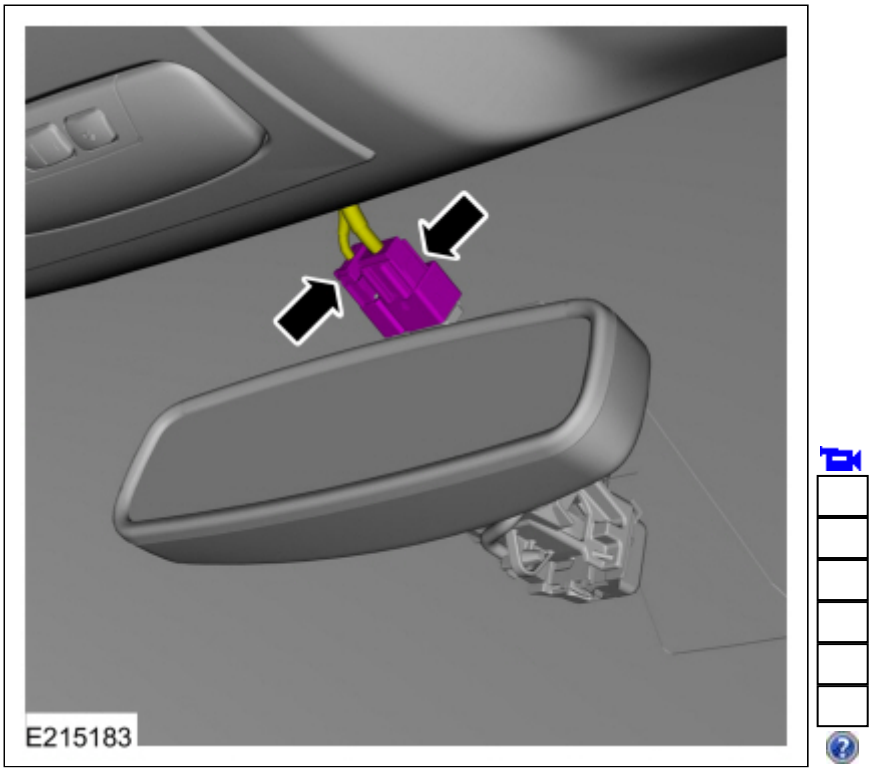
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Remove the rain sensor covers.

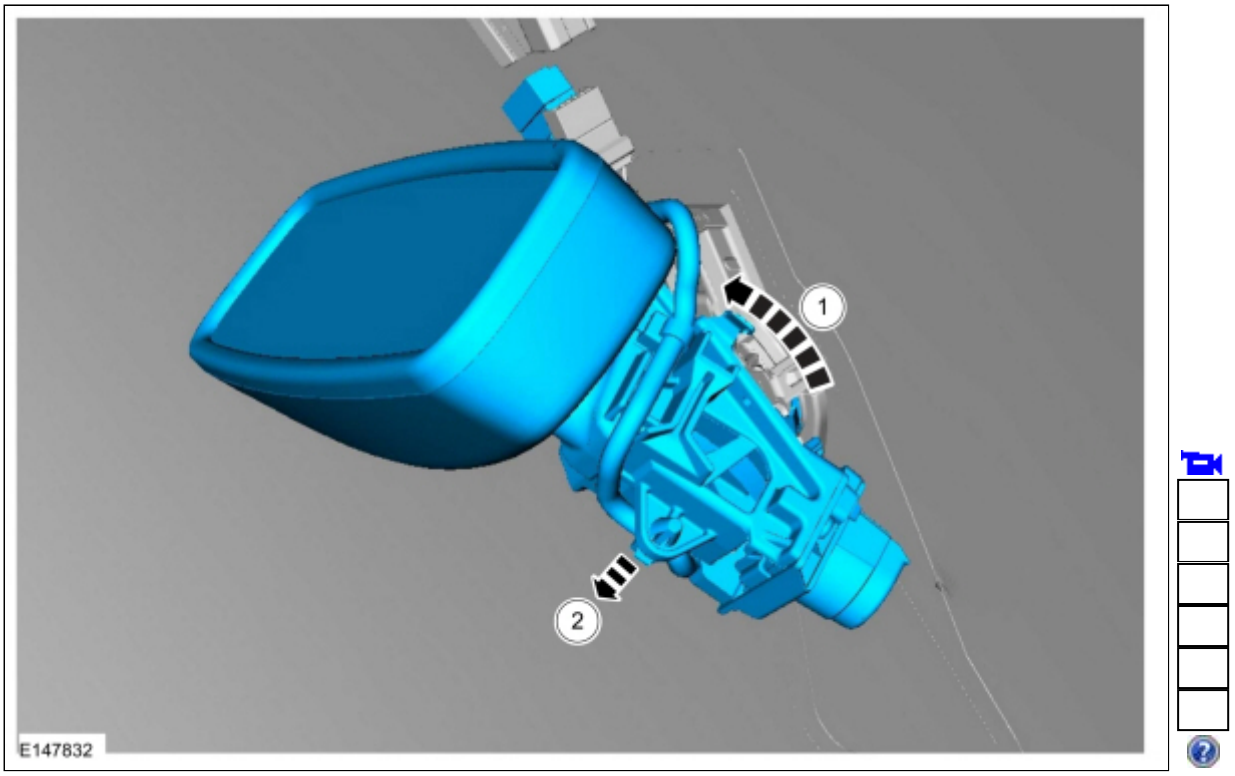


2. Disconnect the interior mirror electrical connector.



Remove the interior mirror.

1. Turn the interior mirror assembly counter clock-wise.
2. Remove the interior mirror off the mirror mount.

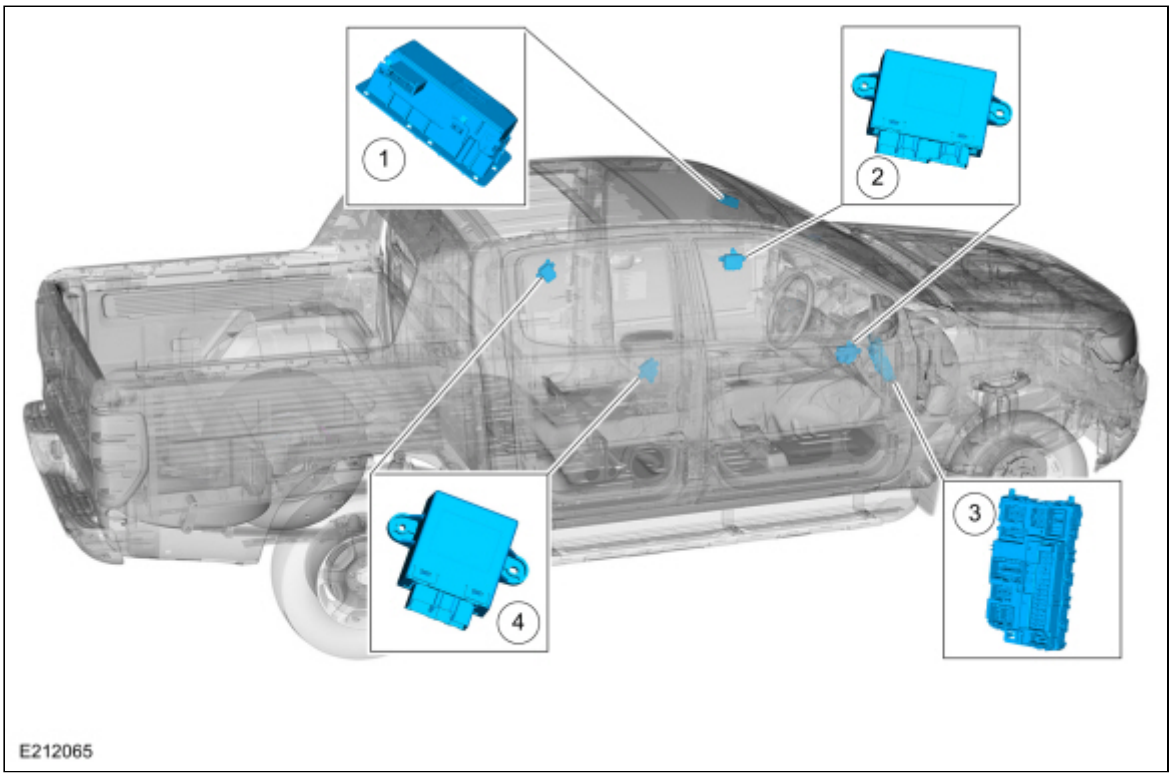


Installation

1. If a new mirror is being installed, use a diagnostic scan tool, begin the PMI process for the IPMAfollowing the on-screen instructions.
2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Module Controlled Functions - Component Location



Item	Description
1	RTM
2	DDM or PDM
3	BCM
4	RDM

Copyright © 2016 Ford Motor Company

Module Controlled Functions - Overview

Body Control Module (BCM)

The BCM controls the following:

- Battery load shed function
- Battery saver function
- Brake shift interlock
- Delayed accessory function
- Dimmable backlighting
- Exterior lighting
- Heated rear windows
- Heated exterior mirrors
- Horn
- Ignition state messaging
- Interior lighting
- Keyless entry keypad
- PATS
- Perimeter alarm
- Post crash alert function
- Power door locks
- Push-button start function (if equipped)
- RKE system
- TPMS
- Transport mode function
- Wipers and washers

Copyright © 2016 Ford Motor Company

Module Controlled Functions - System Operation and Component Description

System Operation

Body Control Module (BCM)

The BCM controls various systems by monitoring inputs from switches, sensors and network messages from other modules on the HS-CAN1 and from the GWM. Based on the inputs received, the BCM activates outputs. For example, the BCM monitors the headlamp switch position. Based on this input, the BCM may provide voltage to the exterior lamps.

Battery Saver

The battery saver feature is used to conserve battery voltage. The BCM provides automatic shut-off of the interior lamps after a time-out period when the ignition is off.

Refer to: Interior Lighting - Overview (417-02 Interior Lighting, Description and Operation).

Battery Load Shed

The BCM monitors the battery state of charge and when necessary will shut off accessories in order to save the remaining battery charge.

Refer to: Auxiliary Battery System (414-00 Charging System - General Information, Description and Operation).

Field Effect Transistor (FET) Protection

The BCM utilizes an Field Effect Transistor (FET) protective circuit strategy for many of its outputs, for example, lamp output circuits. Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected.

A Field Effect Transistor (FET) is a type of transistor that the control module software uses to control and monitor current flow on module outputs. The Field Effect Transistor (FET) protection strategy prevents module damage in the event of excessive current flow.

Output loads (current level) are monitored for excessive current draw (typically short circuits). When a fault event is detected the Field Effect Transistor (FET) turns off and a short circuit DTC sets. The module resets the Field Effect Transistor (FET) protection and allows the circuit to function when the fault is corrected or the ignition state is cycled off and then back on.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each Field Effect Transistor (FET) protected circuit has 3 predefined levels of short circuit tolerance based on a module lifetime level of fault events based upon the durability of the Field Effect Transistor (FET). If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each level is reached, the DTC associated with the short circuit sets along with DTC U1000:00. These Diagnostic Trouble Codes (DTCs) can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then Diagnostic Trouble Codes (DTCs) U1000:00 and U3000:49 set along with the associated short circuit DTC. DTC**U3000:49 cannot be cleared** and the module **must** be replaced after the repair.

Post Crash Alert Function

The post crash alert is a function controlled by the BCM. If the RCM determines an impact of enough severity has occurred (the airbags may or may not be deployed), the post crash alert function activates.

The post crash alert function:

- sounds the horn.

- turns on the hazard lights.
- turns on the interior lights.
- unlocks the doors.

The post crash alert function can be turned off by:

- pressing the hazard flasher lamp switch (which may need to be pressed twice).
- pressing the transmitter unlock button.
- pressing the RKE transmitter PANIC button.
- cycling the ignition switch (RUN-OFF-RUN-OFF-RUN).
- opening the driver door.

Factory-Transport Mode

During vehicle build, some modules (such as the IPC and the BCM) are set to factory mode. When the vehicle build is complete, the vehicle is set to transport mode.

Transport mode is used to reduce the drain on the battery during longer periods when the vehicle is not used. Various system functions can be altered or disabled when in the transport mode. While in transport mode, the IPC displays TRANSPORT MODE in the message center. Transport mode can be disabled and placed into normal operation mode. Refer to: Transport and Factory Mode Deactivation (419-10 Multifunction Electronic Modules, General Procedures).

Car Configuration Parameters

The parameters are set in the BCM. The parameters are also set in the IPC as backup data for service, in case online As-Built data is not available. For more information,
Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

Component Description

BCM

The BCM is a multifunction module that requires a PMI when replaced.

Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

DDM

The DDM receives power window commands from the driver door window control switch through a LIN. The DDM supplies voltage and ground to operate the driver door window regulator motor. The DDM also communicates driver door window control switch requests to the PDM through the MS-CAN.

For the power mirror functions, the DDM controls the LH exterior mirror glass position by supplying voltage and ground to the LH exterior mirror motors based on inputs from the master window control switch. When the RH exterior mirror is selected, the DDM forwards the movement requests to the PDM through the MS-CAN. To control the heated mirror function, the DDM supplies voltage and ground to the LH exterior mirror glass heating element based on messages received from the FCIM. For the memory mirror function, the DDM supplies voltage and ground to the LH mirror motor potentiometers. The DDM monitors the feedback from these potentiometers to determine the mirror glass position. Memory mirror positions are stored in the DDM memory. For more information:

- Refer to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).
- Refer to: Glass, Frames and Mechanisms - System Operation and Component Description (501-11 Glass, Frames and Mechanisms, Description and Operation).
-

The DDM requires PMI when replaced.

Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

PDM

For the power window function, the PDM receives power window commands from the passenger door window control switch or from the DDM through the MS-CAN.

For the power mirror function, the PDM controls the RH exterior mirror glass position by supplying voltage and ground to the RH exterior mirror motors based on messages received from the DDM. To control the heated mirror function, the PDM supplies voltage and ground to the RH exterior mirror glass heating element based on messages received from the FCIM. For the memory mirror function, the PDM supplies voltage and ground to the RH mirror motor potentiometers. The PDM monitors the feedback from these potentiometers to determine the mirror glass position. Passenger mirror positions are stored in the PDM memory. For more information:

- Refer to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).
- Refer to: Glass, Frames and Mechanisms - System Operation and Component Description (501-11 Glass, Frames and Mechanisms, Description and Operation).

The PDM requires PMI when replaced.

Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

RTM

The RTM communicates all RKE and passive key information to the BCM over a LIN circuit and (when the network is awake) the CAN. The RTM is an antenna that receives the high frequency signals from passive keys.

- Refer to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).
- Refer to: Tire Pressure Monitoring System (TPMS) (204-04B Tire Pressure Monitoring System (TPMS), Description and Operation).

The RTM requires PMI when replaced.

Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

Copyright © 2016 Ford Motor Company

Body Control Module (BCM)

DTC Chart: Body Control Module (BCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

NOTE: *Diagnostic Trouble Codes (DTCs) which are not listed in the DTC charts are often retrieved as a result of incorrect repair procedures. Before attempting any repairs for unlisted Diagnostic Trouble Codes (DTCs):*

- *repair all other Diagnostic Trouble Codes (DTCs).*
- *if no other Diagnostic Trouble Codes (DTCs) are retrieved, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test.*
- *if the unlisted Diagnostic Trouble Codes (DTCs) return, VERIFY that the correct part number module is installed for the vehicle and if correct, install As-Built data from Professional Technician Society (PTS) following the diagnostic scan tool instructions under Module Programming > As-Built.*

BCM DTC Chart

DTC	Description	Action
B1046:11	Front Fog Lamp Control Switch: Circuit Short To Ground	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1047:11	Rear Fog Lamp Control Switch: Circuit Short To Ground	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1048:01	Brake Fluid Level Switch: General Electrical Failure	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
B1048:7B	Brake Fluid Level Switch: Low Fluid Level	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
B109F:01	Intrusion Sensor Module: General Electrical Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B109F:02	Intrusion Sensor Module: General Signal Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B109F:08	Intrusion Sensor Module: Bus Signal/Message Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B109F:49	Intrusion Sensor Module: Internal Electronic Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B109F:55	Intrusion Sensor Module: Not Configured	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B109F:97	Intrusion Sensor Module: Component or System Operation Obstructed or Blocked	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B109F:9A	Intrusion Sensor Module: Component or System Operating Conditions	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10AB:00	Remote Keyless Entry Synchronization: No Sub Type Information	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B10AD:9A	Rain Sensor: Component or System Operating Conditions	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10C7:01	Interior Trunk Antenna: General Electrical Failure	• For a starting concern, REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing). • For a luggage compartment lid passive entry feature concern, REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B10C8:01	Interior Centre Antenna: General Electrical Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10C9:01	Interior Front Antenna: General Electrical Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D5:13	PATS Antenna: Circuit Open	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D7:05	PATS Key: System Programming Failure	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D7:51	PATS Key: Not Programmed	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D7:55	PATS Key: Not	

	Configured	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D7:87	PATS Key: Missing Message	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D7:8F	PATS Key: Erratic	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D8:00	PATS Key Less Than Minimum Programmed: No Sub Type Information	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10D9:87	PATS Transponder: Missing Message	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10DA:51	PATS Target Identifier: Not Programmed	REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
B10F1:14	Key In Switch: Circuit Short To Ground or Open	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
B10F3:11	Left front position light: Circuit Short To Ground	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B10F3:15	Left front position light: Circuit Short To Battery or Open	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B10F4:11	Right front position light: Circuit Short To Ground	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B10F4:15	Right front position light: Circuit Short To Battery or Open	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B110C:13	Rear Door Driver Side Power Child Locking Motor: Circuit Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B110C:62	Rear Door Driver Side Power Child Locking Motor: Signal Compare Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B110D:13	Rear Door Passenger Side Power Child Locking Motor: Circuit Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B110D:62	Rear Door Passenger Side Power Child Locking Motor: Signal Compare Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1115:11	High Mounted Stop Lamp control: Circuit Short To Ground	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1115:15	High Mounted Stop Lamp control: Circuit Short To Battery or Open	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1147:11	Left Front Fog Lamps: Circuit Short To Ground	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1147:15	Left Front Fog Lamps: Circuit Short To Battery or Open	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1148:11	Right Front Fog Lamps: Circuit Short To Ground	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1148:15	Right Front Fog Lamps: Circuit Short To Battery or Open	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1142:29	Ignition Status 1: Signal Invalid	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
B115E:01	Camera Module: General Electrical Failure	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
B115E:02	Camera Module: General Signal Failure	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
B115E:08	Camera Module: Bus Signal / Message Failure	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
B115E:49	Camera Module: Internal Electronic Failure	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
B115E:55	Camera Module: Not Configured	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
B115E:9A	Camera Module: Component or System Operating Conditions	REFER to: Parking Aid (413-13B Parking Aid - Vehicles With: Parking Aid Camera, Diagnosis and Testing).
B1175:01	Drivers Door Ajar Switch: General Electrical Failure	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1176:01	Passenger Door Ajar Switch: General Electrical Failure	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1182:00	Tire Pressure Monitoring	

	System: No Sub Type Information	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B1182:55	Tire Pressure Monitoring System: Not Configured	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B11C0:01	Driver Side Rear Door Ajar Switch: General Electrical Failure	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B11C1:01	Passenger Side Rear Door Ajar Switch: General Electrical Failure	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B11C6:01	Passenger Door External Antenna: General Electrical Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B11CA:01	Driver Door External Antenna: General Electrical Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B11D8:01	Restraint Event Notification: General Electrical Failure	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
B11DA:01	Driver Door Key Cylinder Switch: General Electrical Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B11DB:02	Battery Monitoring Module "A": General Signal Failure	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B11DB:08	Battery Monitoring Module "A": Bus Signal / Message Failure	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B11DB:11	Battery Monitoring Module "A": Circuit Short To Ground	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B11DB:49	Battery Monitoring Module "A": Internal Electronic Failure	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B11DB:55	Battery Monitoring Module "A": Not Configured	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B11DB:9A	Battery Monitoring Module "A": Component or System Operating Conditions	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B1218:00	Transmitter Identification Code: No Sub Type Information	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B121A:11	Keypad Illumination Output: Circuit Short To Ground	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B121A:15	Keypad Illumination Output: Circuit Short To Battery or Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B121B:01	Keypad Input Switch: General Electrical Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B123A:11	Left Front Turn Indicator: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B123A:15	Left Front Turn Indicator: Circuit Short To Battery or Open	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B123B:11	Right Front Turn Indicator: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B130F:12	Run Accessory Control: Circuit Short to Battery	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B130F:14	Run Accessory Control: Circuit Short to Ground or	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).

	Open	
B123B:15	Right Front Turn Indicator: Circuit Short To Battery or Open	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1247:11	Left Rear Turn Indicator: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1247:15	Left Rear Turn Indicator: Circuit Short To Battery or Open	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1248:11	Right Rear Turn Indicator: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1248:15	Right Rear Turn Indicator: Circuit Short To Battery or Open	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B124A:11	Right Daytime Running Light: Circuit Short To Ground	REFER to: Daytime Running Lamps (DRL) (417-01 Exterior Lighting, Diagnosis and Testing).
B124A:15	Right Daytime Running Light: Circuit Short To Battery or Open	REFER to: Daytime Running Lamps (DRL) (417-01 Exterior Lighting, Diagnosis and Testing).
B124B:11	Left Daytime Running Light: Circuit Short To Ground	REFER to: Daytime Running Lamps (DRL) (417-01 Exterior Lighting, Diagnosis and Testing).
B124B:15	Left Daytime Running Light: Circuit Short To Battery or Open	REFER to: Daytime Running Lamps (DRL) (417-01 Exterior Lighting, Diagnosis and Testing).
B124D:02	Tire Pressure Sensor: General Signal Failure	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B1251:00	Tire Pressure Sensor Low Battery: No Sub Type Information	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B1254:51	Right Rear (Outside on Dual Wheel) Tire Pressure Sensor and Transmitter Assembly: Not Programmed	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B1255:51	Left Rear (Outside On Dual Wheel) Tire Pressure Sensor and Transmitter Assembly: Not Programmed	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B1256:51	Inner Right Rear (Only on Dual Wheel) Tire Pressure Sensor and Transmitter Assembly: Not Programmed	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B1257:51	Inner Left Rear (Only On Dual Wheel) Tire Pressure Sensor and Transmitter Assembly: Not Programmed	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
B126A:01	Drivers Door Interior Lock Switch: General Electrical Failure	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1277:11	Reverse Lamp: Circuit Short To Ground	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1277:15	Reverse Lamp: Circuit Short To Battery or Open	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B12C2:11	Puddle Lamp: Circuit Short To Ground	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B12C2:15	Puddle Lamp: Circuit Short To Battery or Open	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1305:01	Hood Switch: General Electrical Failure	REFER to: Perimeter Anti-Theft Alarm (419-01A Perimeter Anti-Theft Alarm, Diagnosis and Testing).
B130C:12	Load Shed Control: Circuit Short To Battery	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B130C:14	Load Shed Control: Circuit Short To Ground or Open	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B130F:12	Run Accessory Control: Circuit Short To Battery	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B130F:14	Run Accessory Control:	

	Circuit Short To Ground or Open	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1313:11	Interior Lighting Output: Circuit Short To Ground	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1313:15	Interior Lighting Output: Circuit Short To Battery or Open	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1315:11	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Ground	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
B1315:15	Backlighting (Non Reflective Controls) Illumination Output: Circuit Short To Battery or Open	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
B1319:11	Shift Interlock (BSI) Output Circuit: Circuit Short To Ground	REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).
B1319:15	Shift Interlock (BSI) Output Circuit: Circuit Short To Battery or Open	REFER to: External Controls (307-05 Automatic Transmission External Controls, Diagnosis and Testing).
B1323:11	Horn Switch: Circuit Short To Ground	REFER to: Horn (413-06 Horn, Diagnosis and Testing).
B132B:12	Left Stop/Turn Lamp: Circuit Short to Battery	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B132B:14	Left Stop/Turn Lamp: Circuit Short to Ground or Open	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B132C:12	Right Stop/Turn Lamp: Circuit Short to Battery	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B132C:14	Right Stop/Turn Lamp: Circuit Short to Ground or Open	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1330:01	DC/AC Inverter Module: General Electrical Failure	REFER to: Direct Current/Alternating Current (DC/AC) Inverter (414-05 Voltage Converter/Inverter, Diagnosis and Testing).
B1330:02	DC/AC Inverter Module: General Signal Failure	REFER to: Direct Current/Alternating Current (DC/AC) Inverter (414-05 Voltage Converter/Inverter, Diagnosis and Testing).
B1330:08	DC/AC Inverter Module: Bus Signal / Message Failure	REFER to: Direct Current/Alternating Current (DC/AC) Inverter (414-05 Voltage Converter/Inverter, Diagnosis and Testing).
B1330:49	DC/AC Inverter Module: Internal Electronic Failure	REFER to: Direct Current/Alternating Current (DC/AC) Inverter (414-05 Voltage Converter/Inverter, Diagnosis and Testing).
B1330:55	DC/AC Inverter Module: Not Configured	REFER to: Direct Current/Alternating Current (DC/AC) Inverter (414-05 Voltage Converter/Inverter, Diagnosis and Testing).
B1330:9A	DC/AC Inverter Module: Component or System Operating Conditions	REFER to: Direct Current/Alternating Current (DC/AC) Inverter (414-05 Voltage Converter/Inverter, Diagnosis and Testing).
B1381:11	Left Front Door Handle Proximity Sensor: Circuit Short To Ground	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1381:15	Left Front Door Handle Proximity Sensor: Circuit Short To Battery or Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1381:29	Left Front Door Handle Proximity Sensor: Signal Invalid	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1382:11	Right Front Door Handle Proximity Sensor: Circuit Short To Ground	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1382:15	Right Front Door Handle Proximity Sensor: Circuit Short To Battery or Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1382:29	Right Front Door Handle Proximity Sensor: Signal Invalid	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1383:11	Left Rear Door Handle Proximity Sensor: Circuit Short To Ground	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1383:15	Left Rear Door Handle Proximity Sensor: Circuit Short To Battery or Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1383:29	Left Rear Door Handle Proximity Sensor: Signal Invalid	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

B1384:11	Right Rear Door Handle Proximity Sensor: Circuit Short To Ground	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1384:15	Right Rear Door Handle Proximity Sensor: Circuit Short To Battery or Open	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1384:29	Right Rear Door Handle Proximity Sensor: Signal Invalid	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
B1430:12	Power Point Relay Reset Output: Circuit Short To Battery	GO to Pinpoint Test T
B1430:14	Power Point Relay Reset Output: Circuit Short To Ground or Open	GO to Pinpoint Test T
B1435:12	Power Point Relay Set Output: Circuit Short To Battery	GO to Pinpoint Test T
B1435:14	Power Point Relay Set Output: Circuit Short To Ground or Open	GO to Pinpoint Test T
B1436:01	Digital Dimmer Switch Input: General Electrical Failure	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
B1438:03	Battery Current Sensor: FM (Frequency Modulated) / PWM (Pulse Width Modulated) Failure	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B143A:11	Crash Event Detection Output : Circuit Short To Ground	GO to Pinpoint Test N
B143B:11	Autolamp On Input: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B143C:11	Headlamp Off Input: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B143D:11	Headlamp On Input: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B143E:11	Headlamp Switch Input: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1444:11	Left Rear Stop/Position Lamp Output: Circuit Short To Ground	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1444:15	Left Rear Stop/Position Lamp Output: Circuit Short To Battery or Open	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1445:11	Rear Park Lamps Output: Circuit Short To Ground	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1445:15	Rear Park Lamps Output: Circuit Short To Battery or Open	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1446:11	Front Park Lamps Output: Circuit Short To Ground	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1446:15	Front Park Lamps Output: Circuit Short To Battery or Open	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1447:11	Parklamp On Switch Input: Circuit Short To Ground	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1448:11	Right Rear Stop/Position Lamp Output: Circuit Short To Ground	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1448:15	Right Rear Stop/Position Lamp Output: Circuit Short To Battery or Open	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1449:12	Trailer Tow Park/Tail Lamp Output: Circuit Short To Ground	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1449:14	Trailer Tow Park/Tail Lamp Output: Circuit Short To Battery or Open	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B145C:11	Ambient Lighting Power Supply Output: Circuit Short To Ground	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B145C:15	Ambient Lighting Power Supply Output: Circuit Short To Battery or Open	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1465:00	Ambient Lighting Bus 1:	

	No Sub Type Information	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1466:00	Ambient Lighting Bus 2: No Sub Type Information	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1467:00	Ambient Lighting Bus 3: No Sub Type Information	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1472:12	Ignition Key Removal Inhibit: Circuit Short To Battery	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
B1472:14	Ignition Key Removal Inhibit: Circuit Short To Ground or Open	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
B1489:11	Battery Monitoring System (BMS) Sensor Power: Circuit Short To Ground	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
B1A79:11	Rear Fog Lamp: Circuit Short To Ground	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A79:15	Rear Fog Lamp: Circuit Short To Battery or Open	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A85:11	Ambient Light Sensor: Circuit Short To Ground	REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A85:13	Ambient Light Sensor: Circuit Open	REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1C55:12	Horn Relay: Circuit Short To Battery	REFER to: Horn (413-06 Horn, Diagnosis and Testing).
B1C55:14	Horn Relay: Circuit Short To Ground or Open	REFER to: Horn (413-06 Horn, Diagnosis and Testing).
B1D00:11	Left Low Beam: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D00:15	Left Low Beam: Circuit Short To Battery or Open	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D01:11	Right Low Beam: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D01:15	Right Low Beam: Circuit Short To Battery or Open	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D02:11	Left High Beam Circuit: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D02:15	Left High Beam Circuit: Circuit Short To Battery or Open	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D03:11	Right High Beam Circuit: Circuit Short To Ground	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D03:15	Right High Beam Circuit: Circuit Short To Battery or Open	REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D35:11	Hazard Switch: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
C0040:12	Brake Pedal Switch "A": Circuit Short To Battery	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
C113A:11	Wakeup Control: Circuit Short To Ground	• With keyless vehicle system, REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing). REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing). • Without keyless vehicle system, REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
C113A:15	Wakeup Control: Circuit Short To Battery or Open	• With keyless vehicle system, REFER to: Starting System (303-06A Starting System - 2.5L Duratec-HE (122kW/165PS) - MI4, Diagnosis and Testing). REFER to: Starting System (303-06B Starting System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma, Diagnosis and Testing). REFER to: Starting System (303-06C Starting System - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Diagnosis and Testing). • Without keyless vehicle system, REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
C1A56:51	Left Front Tire Pressure Sensor and Transmitter Assembly: Not Programmed	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .
C1A58:51	Right Front Tire Pressure Sensor and Transmitter	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .

	Assembly: Not Programmed	
C1D00:11	Park Brake Apply Switch : Circuit Short To Ground	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
P0230:12	Fuel Pump Primary Circuit: Circuit Short To Battery	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual., section 5 and PERFORM pinpoint test for DTC P025A.
P0230:14	Fuel Pump Primary Circuit: Circuit Short To Ground or Open	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual., section 5 and PERFORM pinpoint test for DTC P025A.
P830:11	Clutch Pedal Switch A Circuit: Circuit Short To Ground	REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
U0100:87	Lost Communication With ECM/PCM "A": Missing Message	GO to Pinpoint Test A
U0101:87	Lost Communication With TCM: Missing Message	GO to Pinpoint Test B
U0121:87	Lost Communication With Anti-Lock Brake System (ABS) Control Module: Missing Message	GO to Pinpoint Test C
U0131:87	Lost Communication With Power Steering Control Module: Missing Message	GO to Pinpoint Test D
U0137:87	Lost Communication With Trailer Brake Control Module: Missing Message	GO to Pinpoint Test U
U0151:87	Lost Communication With Restraints Control Module: Missing Message	GO to Pinpoint Test E
U0155:87	Lost Communication With Instrument Panel Cluster (IPC) Control Module: Missing Message	GO to Pinpoint Test F
U0184:87	Lost Communication With Radio: Missing Message	GO to Pinpoint Test G
U0199:87	Lost Communication With "Door Control Module A": Missing Message	GO to Pinpoint Test H
U0200:87	Lost Communication With "Door Control Module B": Missing Message	GO to Pinpoint Test I
U0208:87	Lost Communication With "Seat Control Module A": Missing Message	GO to Pinpoint Test M
U0212:87	Lost Communication With Steering Column Control Module: Missing Message	GO to Pinpoint Test O
U0253:87	Lost Communication With Accessory Protocol Interface Module: Missing Message	GO to Pinpoint Test P
U0256:87	Lost Communication With Front Controls Interface Module "A" : Missing Message	GO to Pinpoint Test Q
U0258:87	Lost Communication With Radio Transceiver: Missing Message	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
U1000:00	Solid State Driver Protection Active: Driver Disabled: No Sub Type Information	GO to Pinpoint Test R
U1007:31	Lost Communication With Battery Monitoring Sensor A: No Signal	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
U1A4C:55	Build / End of Line mode Active: Not Configured	• If the IPC message center indicates the vehicle has entered factory mode, REFER to: Transport and Factory Mode Deactivation (419-10 Multifunction Electronic Modules, General Procedures). • If the IPC message center does not indicate the vehicle has entered factory mode, CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC is retrieved again, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

U2005:85	Vehicle Speed: Signal Above Allowable Range	Make sure the vehicle is stationary and the BCM entry level requirements (found on the diagnostic scan tool self-test screen) are met prior to performing the self-test. A speed signal is detected during the self-test. DIAGNOSE any observable symptoms that are present. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the BCM self-test. If the DTC returns, diagnose any PCM or ABS Diagnostic Trouble Codes (DTCs) causing a false vehicle speed signal.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CHECK the vehicle service history for recent service actions related to this module. This DTC sets due to incomplete or incorrect PMI procedures. INSTALL As-Built data from Professional Technician Society (PTS) following diagnostic scan tool instructions under Module Programming>As-Built.
U2200:00	Control Module Configuration Memory Corrupt: No Sub Type Information	INSTALL As-Built data from Professional Technician Society (PTS) following diagnostic scan tool instructions under Module Programming>As-Built. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If BCM U2200:00 is retrieved again, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	ADDRESS all other Diagnostic Trouble Codes (DTCs) first. CLEAR the Diagnostic Trouble Codes (DTCs). REPEAT the self-test. If no BCM Diagnostic Trouble Codes (DTCs) are retrieved, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U3006:16	Control Module Input Power "A": Circuit Voltage Below Threshold	GO to Pinpoint Test K
U3006:17	Control Module Input Power "A": Circuit Voltage Above Threshold	GO to Pinpoint Test L
U3006:1C	Control Module Input Power "A": Circuit Voltage Out of Range	GO to Pinpoint Test S
U3007:16	Control Module Input Power "B": Circuit Voltage Below Threshold	GO to Pinpoint Test K
U3007:17	Control Module Input Power "B": Circuit Voltage Above Threshold	GO to Pinpoint Test L
U300A:01	Ignition Switch: General Electrical Failure	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
U3013:16	Control Module Input Power "C": Circuit Voltage Below Threshold	GO to Pinpoint Test K
U3013:17	Control Module Input Power "C": Circuit Voltage Above Threshold	GO to Pinpoint Test L
U3014:16	Control Module Input Power "D": Circuit Voltage Below Threshold	GO to Pinpoint Test K
U3014:17	Control Module Input Power "D": Circuit Voltage Above Threshold	GO to Pinpoint Test L

Symptom Chart

Symptom Chart: Multifunction Electronic Modules

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Action
A module does not respond to the diagnostic scan tool	• Fuse • Wiring, terminals or connectors • Module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Pinpoint Tests

U0100:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:87	Lost Communication With ECM/PCM "A": Missing Message	A continuous memory DTC that sets in the BCM if powertrain data messages from the PCM over the HS-CAN are missing.

Possible Sources

- Communication network concern
- Charging system concern
- PCM
- BCM

PINPOINT TEST A : U0100:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

A1 VERIFY THE DIAGNOSTIC SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect the diagnostic scan tool.
- Check that a vehicle session can be established using the diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to A2
No	DIAGNOSE the PCM not communicating with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:87 or U0101:87 retrieved again?

Yes	GO to A3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any voltage system related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to A4

A4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the BCM DTC Chart in this section.
No	GO to A5

A5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100 set in any other module?

Yes	GO to A6
No	GO to A7

A6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)

- damaged or bent pins - install new terminals/pins
- pushed-out pins - install new pins as necessary

- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0101:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101:87	Lost Communication With TCM: Missing Message	A continuous memory DTC that sets in the BCM if powertrain data messages from the TCM over the HS-CAN are missing.

Possible Sources

- Communication network concern
- Charging system concern
- PCM
- BCM

PINPOINT TEST B : U0101:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

B1 VERIFY THE DIAGNOSTIC SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect the diagnostic scan tool.
- Check that a vehicle session can be established using the diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to B2
No	DIAGNOSE the PCM not communicating with the diagnostic scan tool. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

B2 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.

- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100:87 or U0101:87 retrieved again?

Yes	GO to B3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

B3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any voltage system related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma) .
No	GO to B4

B4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the BCM DTC Chart in this section.
No	GO to B5

B5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0100 set in any other module?

Yes	GO to B6
No	GO to B7

B6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

B7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0121:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121:87	Lost Communication With Anti-Lock Brake System (ABS) Control Module: Missing Message	A continuous memory DTC that sets in the BCM if messages from the ABS module through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- ABS module
- BCM

PINPOINT TEST C : U0121:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

C1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to C2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

C2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the ABS module pass the network test?

Yes	GO to C3
No	DIAGNOSE no communication with the ABS module. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

C3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to C4

C4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any voltage system related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).

No	GO to C5

C5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0121:87 still present?

Yes	GO to C6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

C6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0121 set in any other module?

Yes	GO to C7
No	GO to C8

C7 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Disconnect and inspect the ABS module connector.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control, Diagnosis and Testing).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

C8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0131:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

U0131:87	Lost Communication With Power Steering Control Module: Missing Message	A continuous memory DTC that sets in the BCM if messages from the PSCM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- PSCM
- BCM

PINPOINT TEST D : U0131:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

D1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to D2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

D2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the PSCM pass the network test?

Yes	GO to D3
No	DIAGNOSE no communication with the PSCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

D3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to D4

D4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PSCM (POWER STEERING CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PSCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Power Steering (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Diagnosis and Testing).
No	GO to D5

D5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0131:87 still present?

Yes	GO to D6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

D6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0131 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.

- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0131 set in any other module?

Yes	GO to D7
No	GO to D8

D7 CHECK FOR CORRECT PSCM (POWER STEERING CONTROL MODULE) OPERATION

- Disconnect and inspect the PSCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PSCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PSCM. REFER to: Steering Gear - LHD RWD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation). REFER to: Steering Gear - LHD 4WD (211-02B Power Steering - Vehicles With: Electronic Power Assist Steering (EPAS), Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

D8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0151:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0151:87	Lost Communication With Restraints Control Module: Missing Message	A continuous memory DTC that sets in the BCM if SRS messages from the RCM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- RCM
- BCM

PINPOINT TEST E : U0151:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

E1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to E2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

E2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the RCM pass the network test?

Yes	GO to E3
No	DIAGNOSE no communication with the RCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

E3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to E4

E4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the RCM self-test.

Are any voltage system related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to E5

E5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0151:87 still present?

Yes	GO to E6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

E6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0151 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0151 set in any other module?

Yes	GO to E7
No	GO to E8

E7 CHECK FOR CORRECT RCM (RESTRAINTS CONTROL MODULE) OPERATION

- Disconnect and inspect the RCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

E8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0155:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:87	Lost Communication With Instrument Panel Cluster (IPC) Control Module: Missing Message	A continuous memory DTC that sets in the BCM if messages from the IPC through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- IPC
- BCM

PINPOINT TEST F : U0155:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

F1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to F2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

F2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the IPC pass the network test?

Yes	GO to F3
No	DIAGNOSE no communication with the IPC. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

F3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to F4

F4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform the IPC self-test.

Are any voltage system related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to F5

F5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155:87 still present?

Yes	GO to F6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

F6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0155 set in any other module?

Yes	GO to F7
No	GO to F8

F7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Disconnect and inspect the IPC connector.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPC connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPC. REFER to: Instrument Panel Cluster (IPC) - LHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation). REFER to: Instrument Panel Cluster (IPC) - RHD (413-01 Instrumentation, Message Center and Warning Chimes, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

F8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0184:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0184:87	Lost Communication With Radio: Missing Message	A continuous memory DTC that sets in the BCM if messages from the ACM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- ACM
- BCM

PINPOINT TEST G : U0184:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

G1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to G2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

G2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the ACM pass the network test?

Yes	GO to G3
No	DIAGNOSE no communication with the ACM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

G3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to G4

G4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE ACM (AUDIO FRONT CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the ACM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD) . REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to G5

G5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0184:87 still present?

Yes	GO to G6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

G6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0184 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0184 set in any other module?

Yes	GO to G7
No	GO to G8

G7 CHECK FOR CORRECT ACM (AUDIO FRONT CONTROL MODULE) OPERATION

- Disconnect and inspect the ACM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the ACM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new ACM. REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation). REFER to: Audio Front Control Module (ACM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

G8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0199:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0199:87	Lost Communication With "Door Control Module A": Missing Message	A continuous memory DTC that sets in the BCM if messages from the DDM over the MS-CAN through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- DDM
- BCM

PINPOINT TEST H : U0199:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

H1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to H2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

H2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the DDM pass the network test?

Yes	GO to H3
No	DIAGNOSE no communication with the DDM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

H3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to H4

H4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE DDM (DRIVER DOOR MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the DDM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
No	GO to H5

H5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0199:87 still present?

Yes	GO to H6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

H6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0199 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0199 set in any other module?

Yes	GO to H7
No	GO to H8

H7 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Disconnect and inspect the DDM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

H8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0200:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0200:87	Lost Communication With "Door Control Module B": Missing Message	A continuous memory DTC that sets in the BCM if messages from the PDM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- PDM
- BCM

PINPOINT TEST I : U0200:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

I1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to I2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

I2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the PDM pass the network test?

Yes	GO to I3
No	DIAGNOSE no communication with the PDM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

I3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to I4

I4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PDM (PASSENGER DOOR MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the PDM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
No	GO to I5

I5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0200:87 still present?

Yes	GO to I6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0200 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0200 set in any other module?

Yes	GO to I7
No	GO to I8

I7 CHECK FOR CORRECT PDM (PASSENGER DOOR MODULE) OPERATION

- Disconnect and inspect the PDM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PDM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

I8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P0230:14

Refer to Wiring Diagrams Cell 23 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM provides a ground to the coil side of the BJB fuel pump relay.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0230:14	Fuel Pump Primary Circuit: Circuit Short To Ground or Open	A continuous and on-demand DTC that sets when the BCM detects a short to ground or open from the fuel pump relay coil circuit.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Fuel pump relay
- BCM

Visual Inspection and Diagnostic Pre-Checks

Inspect BJB fuse(s).

PINPOINT TEST J : P0230:14

J1 CHECK THE FUEL PUMP RELAY

- Ignition OFF.
- Swap the fuel pump relay with a known good relay.
- Ignition ON.
- Using a diagnostic scan tool, clear the BCM Diagnostic Trouble Codes (DTCs).
- Perform the BCM self-test.

Is DTC P0230:14 still present?

Yes	GO to J1
No	INSTALL a new the fuel pump relay.

J2 CHECK FOR VOLTAGE AT THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect: BCM C2280C.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280C-12		Ground

Is the voltage greater than 11 volts?

Yes	GO to J3
No	VERIFY BJB fuse(s) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagram manual to identify the possible causes for the short circuit.

J3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BCM Input Power Voltage Below Threshold

Vehicle Ground Information

Refer to Wiring Diagrams Cell 10 for schematic and connector information.

Vehicle Power Information

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM receives voltage at all times from the BJB.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3006:16	Control Module Input Power “A”: Circuit Voltage Below Threshold	A continuous and on-demand DTC that sets in the BCM if the BCM detects lower than expected battery voltage on the voltage supply input circuit.
U3007:16	Control Module Input Power "B": Circuit Voltage Below Threshold	A continuous DTC that sets in the BCM if the BCM detects lower than expected battery voltage on the voltage supply input circuit.
U3013:16	Control Module Input Power "C": Circuit Voltage Below Threshold	A continuous DTC that sets in the BCM if the BCM detects lower than expected battery voltage on the voltage supply input circuit.
U3014:16	Control Module Input Power "D": Circuit Voltage Below Threshold	A continuous DTC that sets in the BCM if the BCM detects lower than expected battery voltage on the voltage supply input circuit.

Possible Sources

- Wiring, terminals or connectors
- Charging system concern
- Battery concern
- BJB
- BCM

PINPOINT TEST K : BCM (BODY CONTROL MODULE) INPUT POWER VOLTAGE BELOW THRESHOLD

K1 RECHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC U3006:16, U3007:16, U3013:16 or U3014:16 still present?

Yes	GO to K2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition. CLEAR the DTC.

K2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) SET IN OTHER MODULES

- Using a diagnostic scan tool, retrieve all Diagnostic Trouble Codes (DTCs).

Are any charging system Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the charging system concern.

	REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to K3

K3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

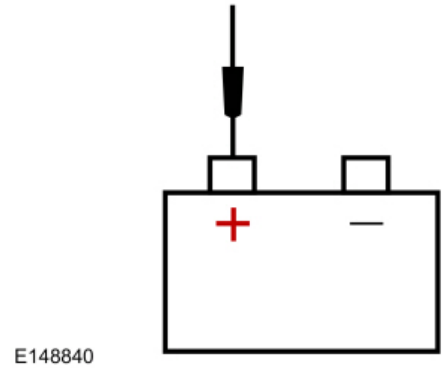
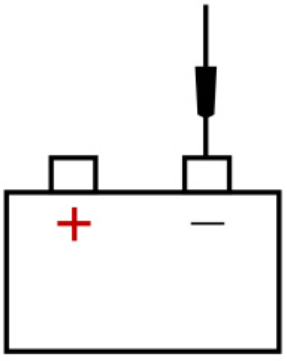
- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery OK and fully charged?

Yes	GO to K4
No	If the battery is discharged, DIAGNOSE the cause of the low battery condition. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing). If the battery condition fails, INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

K4 COMPARE THE BCM (BODY CONTROL MODULE) BATTERY VOLTAGE (V_BATT_BCM) PID (PARAMETER IDENTIFICATION) WITH THE ACTUAL BATTERY VOLTAGE

- Start the engine.
- Turn on accessories (climate control blower on high speed, exterior lights).
- With the engine running at idle, measure and record battery voltage:

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

- Using a diagnostic scan tool, view the BCM PID V_BATT_BCM.

Is the recorded battery voltage within 0.2 volt of the PID?

Yes	TURN the engine off, GO to K7
No	GO to K5

K5 CHECK THE BCM (BODY CONTROL MODULE) VOLTAGE SUPPLY CIRCUITS

- Ignition OFF.
- Disconnect BCM C2280A.
- Disconnect BCM C2280D.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280GD-17		Ground
C2280D-21		Ground
C2280D-22		Ground

Positive Lead	Measurement / Action	Negative Lead

C2280A-1		Ground

Are the voltages within 0.2 volt of the recorded battery voltage?

Yes	GO to K6
No	REPAIR the circuit in question for high resistance.

K6 CHECK THE BCM (BODY CONTROL MODULE) PROCESSOR GROUNDS

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-6	Ω	Ground
C2280F-7	Ω	Ground
C2280F-10	Ω	Ground

Are the resistances less than 3 ohms?

Yes	GO to K7
No	REPAIR the circuit in question for high resistance.

K7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect all BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

BCM Input Power Voltage Above Threshold

Vehicle Ground Information

Refer to Wiring Diagrams Cell 10 for schematic and connector information.

Vehicle Power Information

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3006:17	Control Module Input Power “A”: Circuit Voltage Above Threshold	A continuous and on-demand DTC that sets in the BCM if the BCM detects higher than expected battery voltage on the voltage supply input circuit.
U3007:17	Control Module Input Power "B": Circuit Voltage Above Threshold	A continuous DTC that sets in the BCM if the BCM detects higher than expected battery voltage on the voltage supply input circuit.
U3013:17	Control Module Input Power "C": Circuit Voltage Above Threshold	A continuous DTC that sets in the BCM if the BCM detects higher than expected battery voltage on the voltage supply input circuit.
U3014:17	Control Module Input Power "D": Circuit Voltage Above Threshold	A continuous DTC that sets in the BCM if the BCM detects higher than expected battery voltage on the voltage supply input circuit.

Possible Sources

- Charging system concern
- BCM

PINPOINT TEST L : BCM (BODY CONTROL MODULE) INPUT POWER VOLTAGE ABOVE THRESHOLD

NOTE: *U3006:17, U3007:17, U3013:17 or U3014:17 may be stored in the module memory due to previous battery charging or vehicle jump starting events.*

L1 CHECK FOR OVERCHARGING DIAGNOSTIC TROUBLE CODES (DTCS) SET IN OTHER MODULES

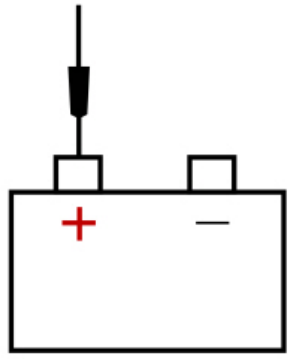
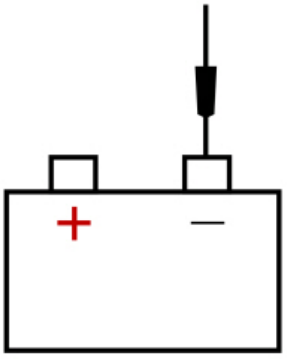
- Ignition ON.
- Using a diagnostic scan tool, retrieve **all** Diagnostic Trouble Codes (DTCs).

Are any charging system Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the charging system concern. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to L2

L2 CHECK THE BATTERY VOLTAGE

- Turn off all interior/exterior lights and accessories.
- Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.

Positive Lead	Measurement / Action	Negative Lead
 E148840		 E148841

Does the battery voltage rise to 16 volts or higher?

Yes	DIAGNOSE the over-charging system concern. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to L3

L3 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:17, U3007:17, U3013:17 or U3014:17 present?

Yes	GO to L4
No	The system is operating correctly at this time. The DTC may have been caused by module connections or may have been set previously during battery charging or while jump starting the vehicle. ADDRESS the root cause of any connector or pin issues.

L4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0208:87

Refer to Wiring Diagrams Cell 120 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0208:87	Lost Communication With "Seat Control Module A": Missing Message	A continuous memory DTC that sets in the BCM if messages from the DSM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- DSM
- BCM

PINPOINT TEST M : U0208:87

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI or the PMI may not have been carried out.*

M1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to M2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

M2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the DSM pass the network test?

Yes	GO to M3
No	DIAGNOSE no communication with the DSM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

M3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to M4

M4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE DSM (DRIVER FRONT SEAT MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the DSM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Seats (501-10A Seating, Diagnosis and Testing).
No	GO to M5

M5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0208:87 still present?

Yes	GO to M6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0208 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0208 set in any other module?

Yes	GO to M7
No	GO to M8

M7 CHECK FOR CORRECT DSM (DRIVER FRONT SEAT MODULE) OPERATION

- Disconnect and inspect the DSM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DSM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DSM.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

B143A:11

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

The BCM transmits an event notification signal which communicates crash status and SRS deployment status to the PCM. When the PCM receives an event notification signal which indicates a crash, it initiates fuel cut-off.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B143A:11	Crash Event Detection Output: Circuit Short To Ground	A continuous memory and on-demand DTC that sets in the BCM if the BCM senses a short to ground on the event notification signal circuit to the PCM.

Possible Sources

- Wiring, terminals or connectors
- PCM
- BCM

PINPOINT TEST N : B143A:11

N1 CONFIRM THAT THE DTC (DIAGNOSTIC TROUBLE CODE) RESETS

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B143A:11 still present?

Yes	GO to N2
No	The system is operating correctly at this time. The DTC may have been falsely set by a BCM self-test, causing the signal to momentarily stop and set the DTC.

N2 CHECK THE PCM (POWERTRAIN CONTROL MODULE) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect PCM C1232A (Diesel).
- Disconnect PCM C175B (2.5L Petrol).
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B143A:11 still present?

Yes	GO to N3
No	GO to N4

N3 CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280H.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-29	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to N5
No	REPAIR the circuit.

N4 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Disconnect and inspect all PCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14A Electronic Engine Controls - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14B Electronic Engine Controls - 2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N5 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0212:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0212:87	Lost Communication With Steering Column Control Module: Missing Message	A continuous memory DTC that sets in the BCM if messages from the SCCM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- SCCM
- BCM

PINPOINT TEST O : U0212:87

O1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to O2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

O2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the SCCM pass the network test?

Yes	GO to O3
No	DIAGNOSE no communication with the SCCM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

O3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to O4

O4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE SCCM (STEERING COLUMN CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).
No	GO to O5

O5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0212:87 still present?

Yes	GO to O6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0212 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0212 set in any other module?

Yes	GO to O7
No	GO to O8

O7 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect the SCCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

O8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0253:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0253:87	Lost Communication With Accessory Protocol Interface Module: Missing Message	A continuous memory DTC that sets in the BCM if messages from the APIM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- APIM
- BCM

PINPOINT TEST P : U0253:87

P1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to P2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

P2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the APIM pass the network test?

Yes	GO to P3
No	DIAGNOSE no communication with the APIM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

P3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to P4

P4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the APIM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD) . REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to P4

P5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.

- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0253:87 still present?

Yes	GO to P6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

P6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0253 set in any other module?

Yes	GO to P7
No	GO to P8

P7 CHECK FOR CORRECT APIM (SYNC MODULE) OPERATION

- Disconnect and inspect the APIM connector.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the APIM connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0256:87

Refer to Wiring Diagrams Cell 14 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0256:87	Lost Communication With Front Controls Interface Module "A" : Missing Message	A continuous memory DTC that sets in the BCM if messages from the FCIM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- GWM concern
- FCIM
- BCM

PINPOINT TEST Q : U0256:87

Q1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to Q2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

Q2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the FCIM pass the network test?

Yes	GO to Q3
No	DIAGNOSE no communication with the FCIM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Q3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to Q4

Q4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE FCIM (FRONT CONTROLS INTERFACE MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the FCIM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information - Vehicles With: AM/FM/CD) . REFER to: Information and Entertainment System (415-00C Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC/Touchscreen Display/Navigation System, Diagnosis and Testing).
No	GO to Q5

Q5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0256:87 still present?

Yes	GO to Q6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

Q6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0256 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0256 set in any other module?

Yes	GO to Q7
No	GO to Q8

Q7 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Disconnect and inspect the FCIM connector.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation). REFER to: Front Controls Interface Module (FCIM) (415-00B Information and Entertainment System - General Information - Vehicles With: AM/FM/CD/SYNC, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Q8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U1000:00

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

Normal Operation and Fault Conditions

The BCM uses solid state drivers (Field Effect Transistors (FET)) to control the output of several vehicle systems. When an overload occurs on any of these drivers, the BCM disables the output and tracks the number of repetitive faults on each of these circuits. The module compares this number of overloads to 3 progressive thresholds established for each circuit. At each threshold, DTC U1000:00 sets along with the DTC associated with the affected circuit.
REFER to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U1000:00	Solid State Driver Protection Active: Driver Disabled: No Sub Type Information	A continuous memory DTC that sets when the BCM has disabled a circuit due to a repetitive circuit overload and a progressive threshold is met.

Possible Sources

- BCM output circuit short
- BCM

PINPOINT TEST R : U1000:00

R1 REVIEW THE DIAGNOSTIC TROUBLE CODES (DTCS)

- Review the Diagnostic Trouble Codes (DTCs) from the BCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present besides U1000:00?

Yes	CORRECT the Diagnostic Trouble Codes (DTCs). REFER to the BCM DTC Chart in this section.
No	GO to R2

R2 REPEAT THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Repeat the BCM self-test.

Is DTC U1000:00 still present?

Yes	INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The circuit short has been repaired.

U3006:1C

Vehicle Ground Information

Refer to Wiring Diagrams Cell 10 for schematic and connector information.

Vehicle Power Information

Refer to Wiring Diagrams Cell 13 for schematic and connector information.

Normal Operation and Fault Conditions

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3006:1C	Control Module Input Power "A": Circuit Voltage Out of Range	A continuous memory DTC that sets in the BCM if the BCM detects out of range voltage on the voltage supply input circuits.

Possible Sources

- Wiring, terminals or connectors
- Charging system concern
- Battery concern
- BJB
- BCM

PINPOINT TEST S : U3006:1C

S1 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) IN THE BCM (BODY CONTROL MODULE)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any charging system Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to the BCM DTC Chart in this section.
No	GO to S2

S2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS) SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, retrieve all Diagnostic Trouble Codes (DTCs).

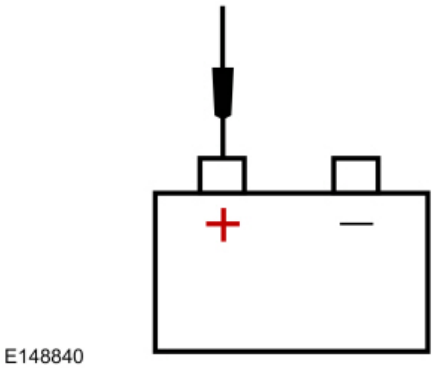
Are any charging system Diagnostic Trouble Codes (DTCs) recorded?

Yes	DIAGNOSE the charging system concern. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to S3

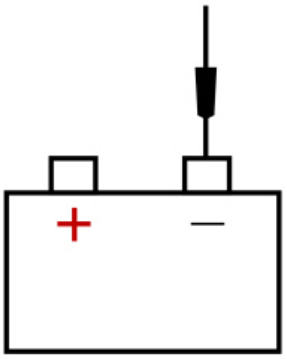
S3 CHECK THE BATTERY VOLTAGE

- Turn off all interior/exterior lights and accessories.
- Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.

Positive Lead	Measurement / Action	Negative Lead
		



E148840



E148841

Does the battery voltage rise to 16 volts or higher?

Yes	DIAGNOSE the over-charging system concern. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing).
No	GO to S4

S4 RECHECK THE BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Diagnostic Trouble Codes (DTCs).

Is DTC U3006:1C present?

Yes	GO to S5
No	The system is operating correctly at this time. The DTC may have been caused by module connections or may have been set previously during battery charging or while jump starting the vehicle. ADDRESS the root cause of any connector or pin issues.

S5 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery OK and fully charged?

Yes	GO to S6
No	If the battery is discharged, DIAGNOSE the cause of the low battery condition. REFER to: Charging System - 2.5L Duratec-HE (122kW/165PS) - MI4 (414-00 Charging System - General Information, Diagnosis and Testing). REFER to: Charging System - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/3.2L Duratorq-TDCi (148kW/200PS) - Puma (414-00 Charging System - General Information, Diagnosis and Testing). If the battery condition fails, INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

S6 COMPARE THE BCM (BODY CONTROL MODULE) BATTERY VOLTAGE (V_BATT_BCM) PID (PARAMETER IDENTIFICATION) WITH THE ACTUAL BATTERY VOLTAGE

- Start the engine.
- Turn on accessories (climate control blower on high speed, exterior lights).
- With the engine running at idle, measure and record battery voltage:

Positive Lead	Measurement / Action	Negative Lead
		

- Using a diagnostic scan tool, view the BCM PID V_BATT_BCM.

Is the recorded battery voltage within 0.2 volt of the PID?

Yes	TURN the engine off, GO to S9
No	GO to S7

S7 CHECK THE BCM (BODY CONTROL MODULE) VOLTAGE SUPPLY CIRCUIT

- Ignition OFF.
- Disconnect BCM C2280A.
- Disconnect BCM C2280D.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280D-17		Ground
C2280D-21		Ground
C2280D-22		Ground

Positive Lead	Measurement / Action	Negative Lead
C2280A-1		Ground

Is the voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to S8
No	REPAIR the circuit for high resistance.

S8 CHECK THE BCM (BODY CONTROL MODULE) PROCESSOR GROUNDS

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-6	Ω	Ground
C2280F-7	Ω	Ground
C2280F-10	Ω	Ground

Are the resistances less than 3 ohms?

Yes	GO to S9
No	REPAIR the circuit in question for high resistance.

S9 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Power Point Is Never / Always Powered

Refer to Wiring Diagrams Cell 44 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Module Controlled Functions - System Operation and Component Description (419-10 Multifunction Electronic Modules, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1430:12	Power Point Relay Reset Output: Circuit Short To Battery	A continuous and on-demand DTC that sets when the BCM detects a short to voltage from the power point relay coil circuit.
B1430:14	Power Point Relay Reset Output: Circuit Short To Ground or Open	A continuous and on-demand DTC that sets when the BCM detects a short to ground or open from the power point relay coil circuit.
B1435:12	Power Point Relay Set Output: Circuit Short To Battery	A continuous and on-demand DTC that sets when the BCM detects a short to voltage from the power point relay coil circuit.
B1435:14	Power Point Relay Set Output: Circuit Short To Ground or Open	A continuous and on-demand DTC that sets when the BCM detects a short to ground or open from the power point relay coil circuit.

Possible Sources

- Wiring, terminals or connectors
- Power point
- BCM
- BJB

Visual Inspection and Diagnostic Pre-Checks

Inspect BJB fuse(s).

PINPOINT TEST T : THE POWER POINT IS NEVER / ALWAYS POWERED

T1 VERIFY BATTERY

- Perform battery test.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Did battery pass test?

Yes	GO to T2
No	REPLACE battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

T2 CHECK BJB (BATTERY JUNCTION BOX) FUSES

- Check BJB fuse(s).

Are the fuses OK?

Yes	GO to T4
No	REPLACE fuses as necessary. GO to T3

T3 RECHECK BJB (BATTERY JUNCTION BOX) FUSES

- Check BJB fuse(s).

Are the fuses OK?

Yes	GO to T4
No	REPAIR the circuit short.

T4 CHECK THE POWER POINT WITH KEY OFF

- Ignition OFF.
- Connect a known good device to each power point.

Are all power points off?

Yes	GO to T5
No	GO to T6

T5 CHECK THE POWER POINT OPERATION WITH KEY ON

- Ignition ON.
- Connect a known good device to each power point and verify the device works.

Are all the power points operational?

Yes	GO to T6
No	If no power points are operational, GO to T6 If some, but not all, power points are operational, REFER to wiring diagram manual and correct open circuit as necessary.

T6 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, perform the BCM self-test.

Is BCM DTC B1430:12 , B1430:14, B1435:12, or B1435:14 present?

Yes	For BCM DTC B1430:12 or B1435:12, GO to T7 For BCM DTC B1430:14 or B1435:14, GO to T9
No	For all other BCM Diagnostic Trouble Codes (DTCs) BCM DTC Chart in this section. If no BCM Diagnostic Trouble Codes (DTCs) are found, the system is operating correctly at this time.

T7 CHECK THE BJB (BATTERY JUNCTION BOX) FOR INTERNAL SHORT

- Ignition OFF.
- Disconnect BJB C1035A.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the BCM self-test.

Is DTC B1430:12 or DTC B1435:12 still present?

Yes	GO to T8
No	INSTALL a new BJB.

T8 CHECK THE POWER POINT CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280H.
- Using the Terminal Release Kit, release and temporarily remove BCM C2280H-23 and C2280H-33.
- Connect BCM C2280H.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-23		Ground
C2280H-33		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	Turn ignition off. INSTALL C2280H-23 and C2280H-33. INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

T9 CHECK THE POWER POINT CONTROL CIRCUITS

- Ignition OFF.
- Disconnect BCM C2280C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-23		Ground
C2280H-33		Ground

Are voltages greater than 11.0V?

Yes	REPLACE the BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	GO to T10

T10 CHECK THE POWER POINT CONTROL CIRCUITS FOR SHORT TO GROUND

- Disconnect BJB C1035A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-23	Ω	Ground
C2280H-33	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to T11
No	REPAIR the circuit.

T11 CHECK THE POWER POINT CONTROL CIRCUITS FOR OPENS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280H-23	Ω	C1035A-21
C2280H-33	Ω	C1035A-30

Are the resistances less than 3 ohms?

Yes	REPLACE the BJB.
No	Repair the circuit.

U0137:87

Normal Operation and Fault Conditions

REFER to: Communications Network - Component Location (418-00 Module Communications Network, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0137:87	Lost Communication With Trailer Brake Control Module: Missing Message	A continuous memory DTC that sets in the BCM if messages from the TRM through the GWM are missing.

Possible Sources

- Communication network concern
- Battery voltage concern
- TRM
- BCM

PINPOINT TEST U : U0137:87

U1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to U2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition. CLEAR the DTC.

U2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform a network test.

Does the TRM pass the network test?

Yes	GO to U3
No	DIAGNOSE no communication with the TRM. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

U3 CHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U3006:16, U3006:17, U3007:16, U3007:17, U3013:16, U3013:17, U3014:16 or U3014:17 recorded?

Yes	For DTC U3006:16, U3007:16, U3013:16 or U3014:16, GO to Pinpoint Test K For DTC U3006:17, U3007:17, U3013:17 or U3014:17, GO to Pinpoint Test L
No	GO to U4

U4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE TRM (TRAILER MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TRM self-test.

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Trailer Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
No	GO to U5

U5 RECHECK THE BCM (BODY CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, check the BCM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0137:87 still present?

Yes	GO to U6
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

U6 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0137:87 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, retrieve **all** Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC U0137:87 set in any other module?

Yes	GO to U7
No	GO to U8

U7 CHECK FOR CORRECT TRM (TRAILER MODULE) OPERATION

- Disconnect and inspect the TRM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the TRM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TRM. REFER to: Trailer Module (TRM) (417-01 Exterior Lighting, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all BCM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Transport and Factory Mode Deactivation

Deactivation

1. Verify the battery is fully charged.
   Refer to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).
2. Place the ignition in the ON position.
3. **NOTE:** *Steps 3 and 4 must be carried out within 10 seconds.*

   Press and release the brake pedal 5 times.
4. Press and release the hazard switch 3 times.
5. Place the ignition in the OFF position.

Copyright © 2016 Ford Motor Company

Body Control Module (BCM) - RHD

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

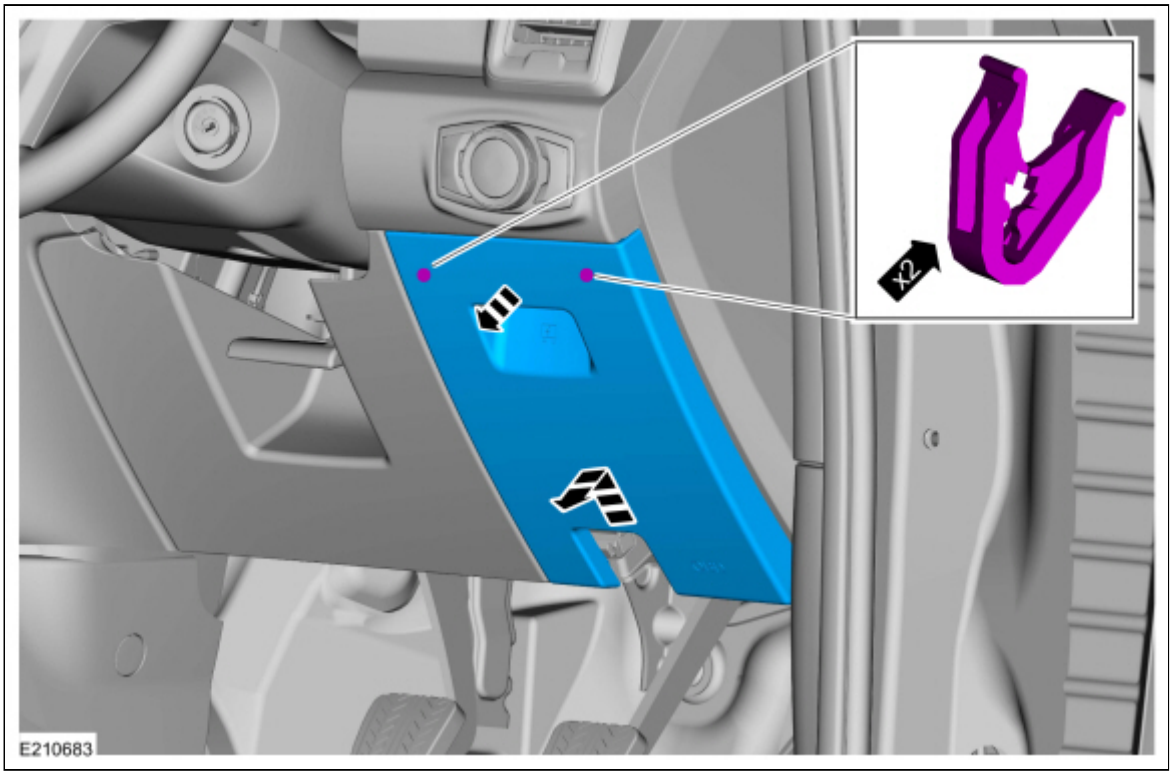
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *This step is only necessary when installing a new component.*

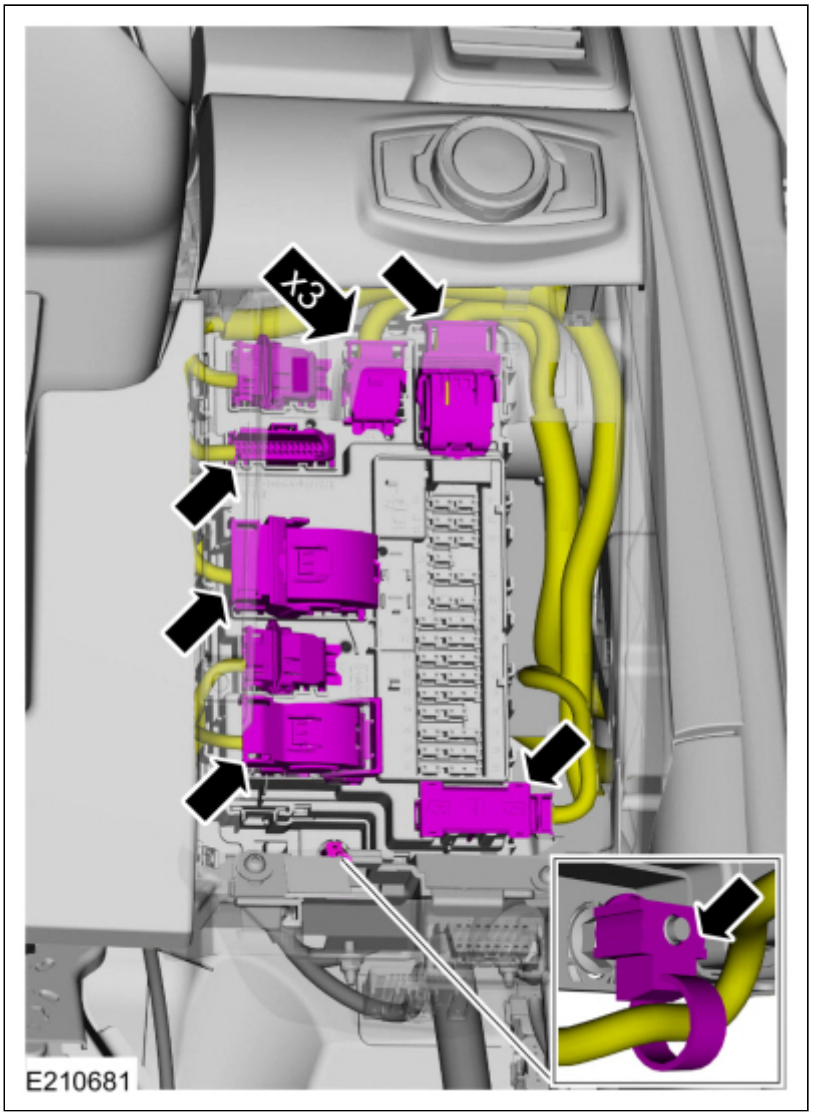
   Download the BCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

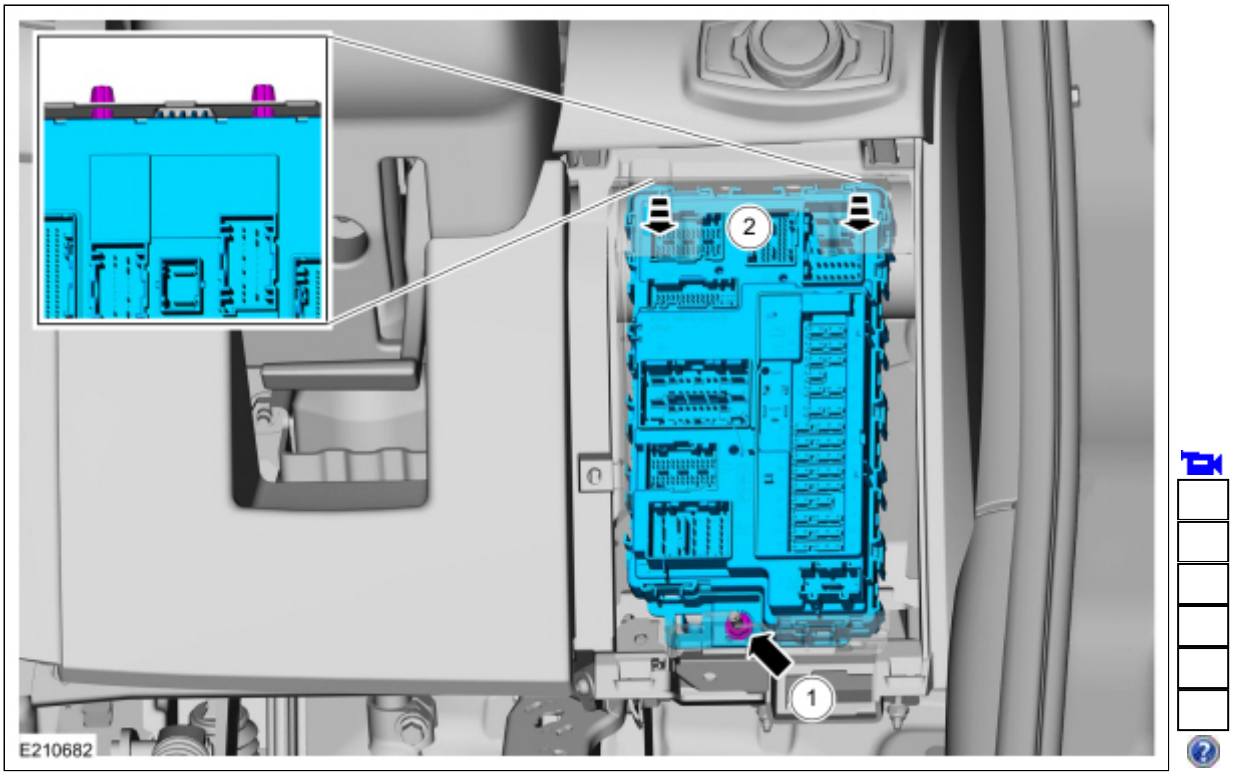
3. Refer to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).

4. 

5.



6. *Torque*: 4 Nm



Installation

1. To install, reverse the removal procedure.

2. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the BCM configuration information into the BCM, using the Programmable Modules Installation routine. Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Body Control Module (BCM) - LHD

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

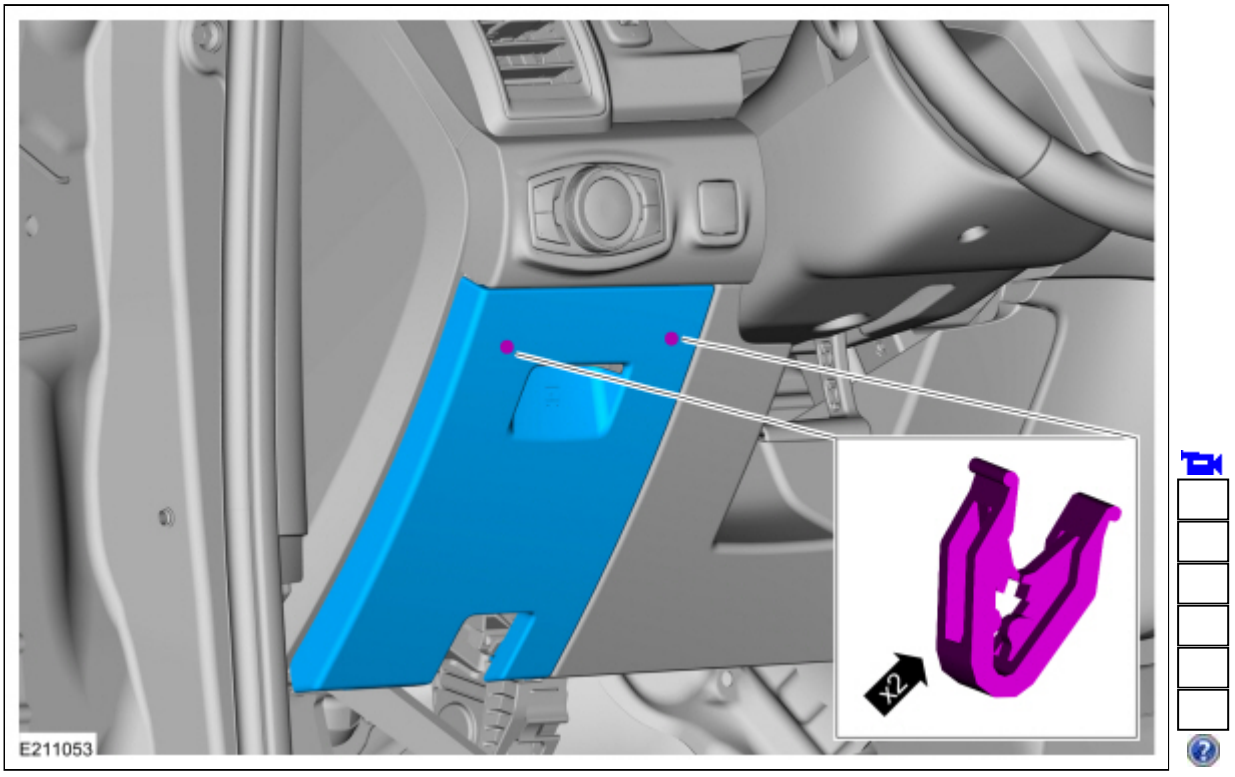
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *This step is only necessary when installing a new component.*

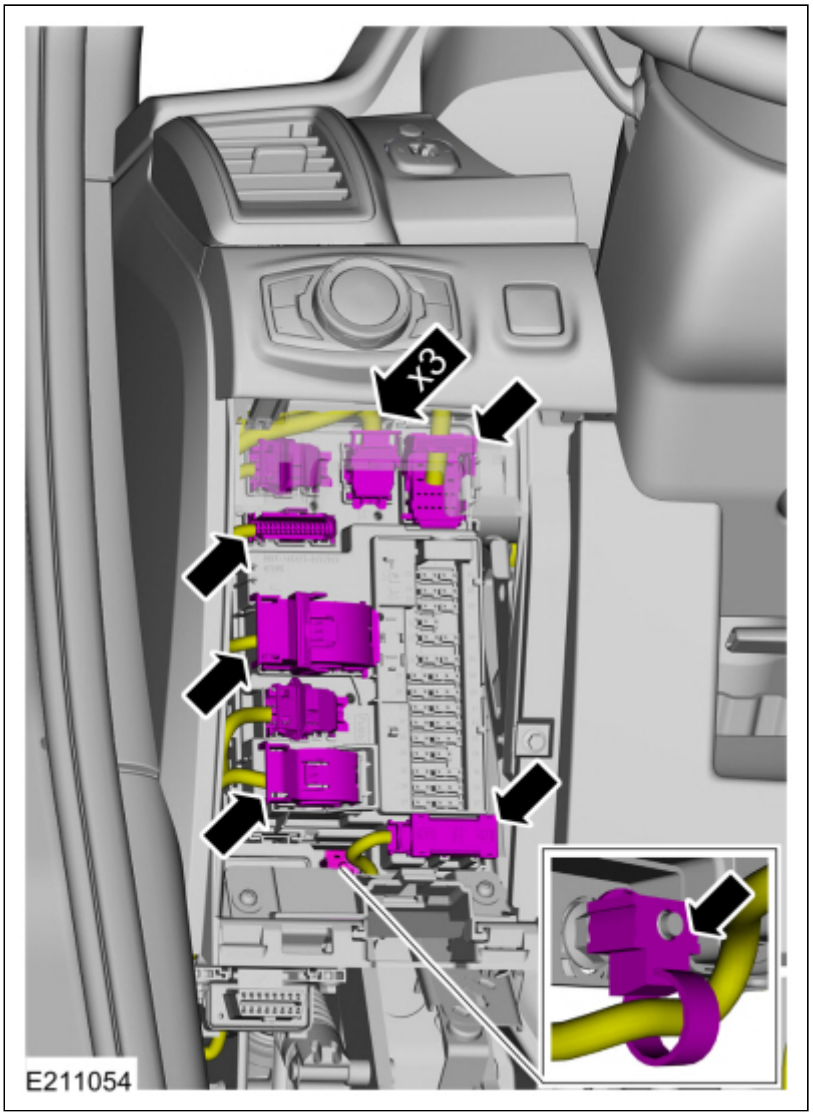
   Download the BCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

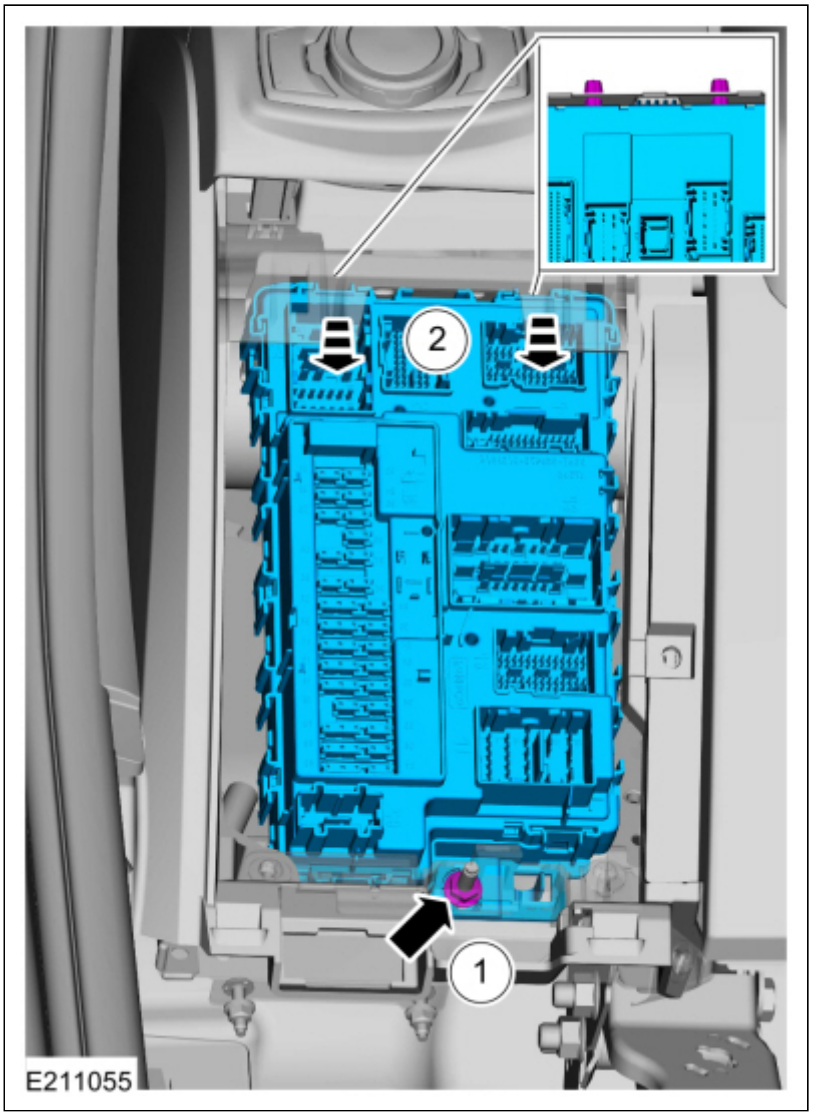
3. Refer to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).

4. 

5.



6.



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the BCM configuration information into the BCM, using the Programmable Modules Installation routine. Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Driver Door Module (DDM)

Removal

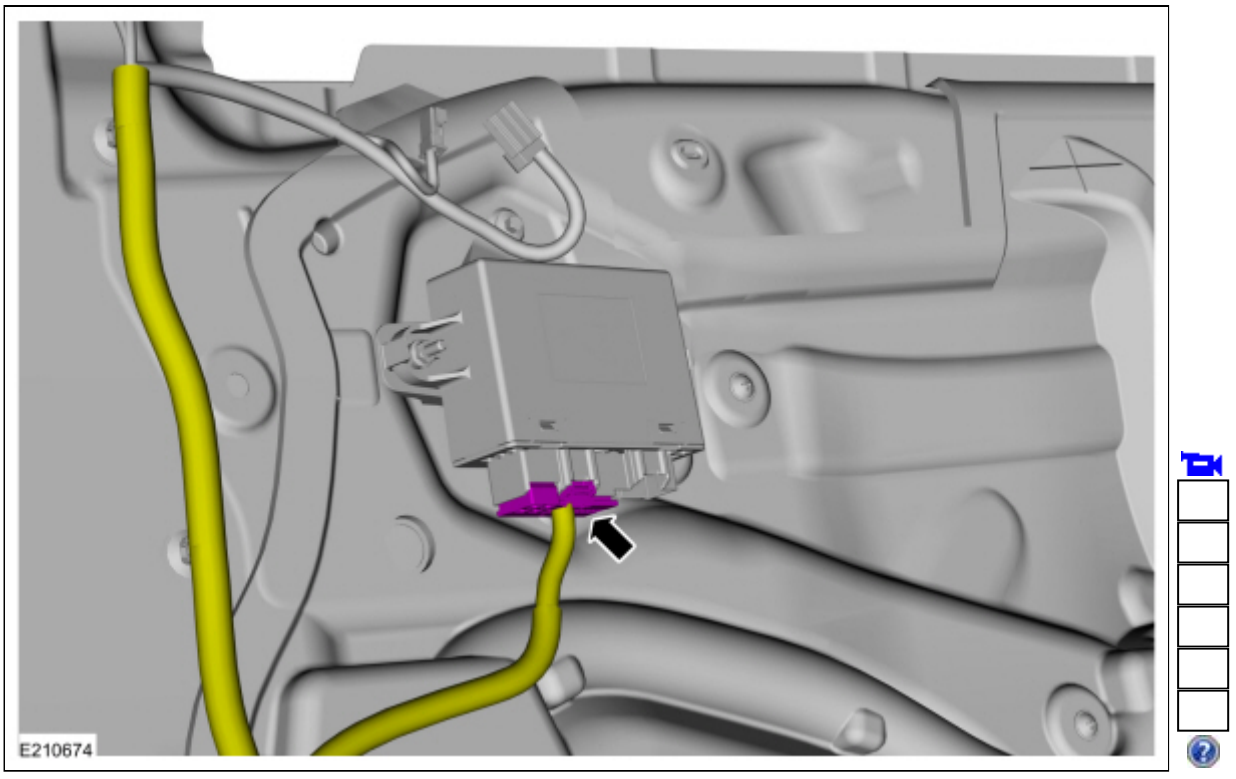
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the diagnostic scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

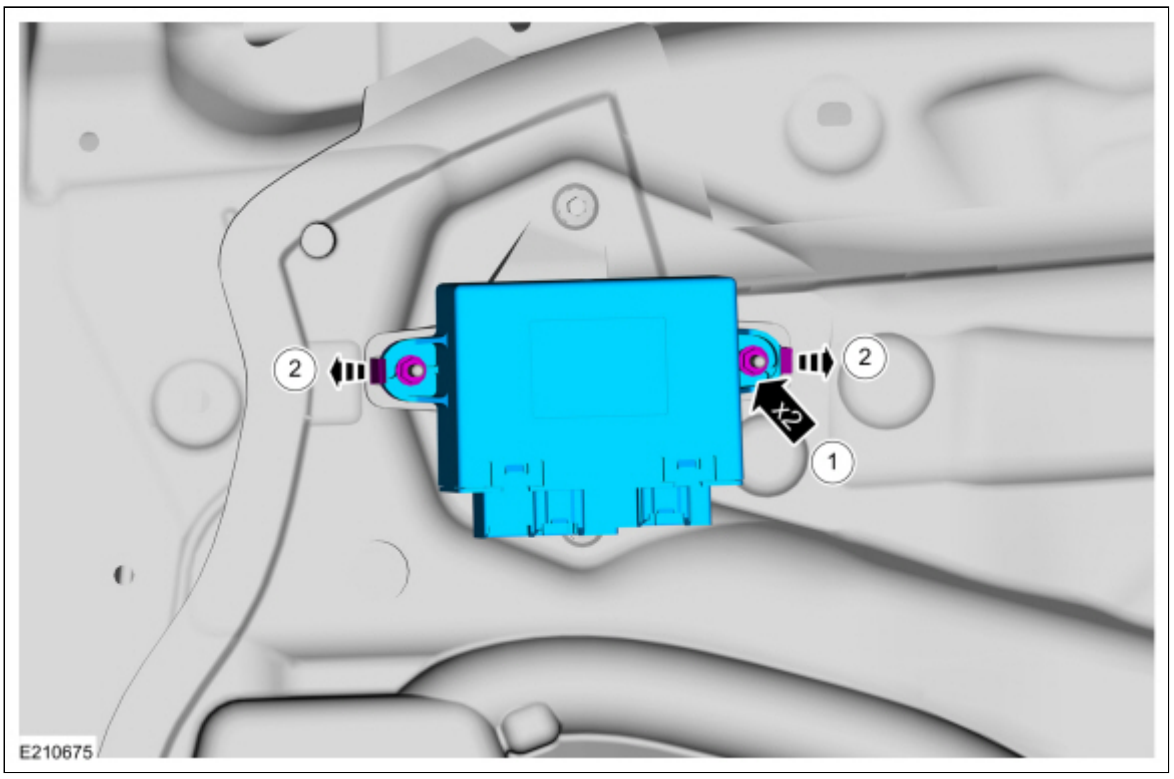
   Carry out the PMI procedure for the DDM.
   Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

2. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

   - Disconnect the electrical connector.



4. Remove the bolts and the RDM
   Torque: 2 Nm



Installation

1. To install, reverse the removal procedure.
2. Using the previous diagnostic scan tool session, carry out the PMI procedure for the DDM.
   Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

Copyright © 2016 Ford Motor Company

Passenger Door Module (PDM)

Removal

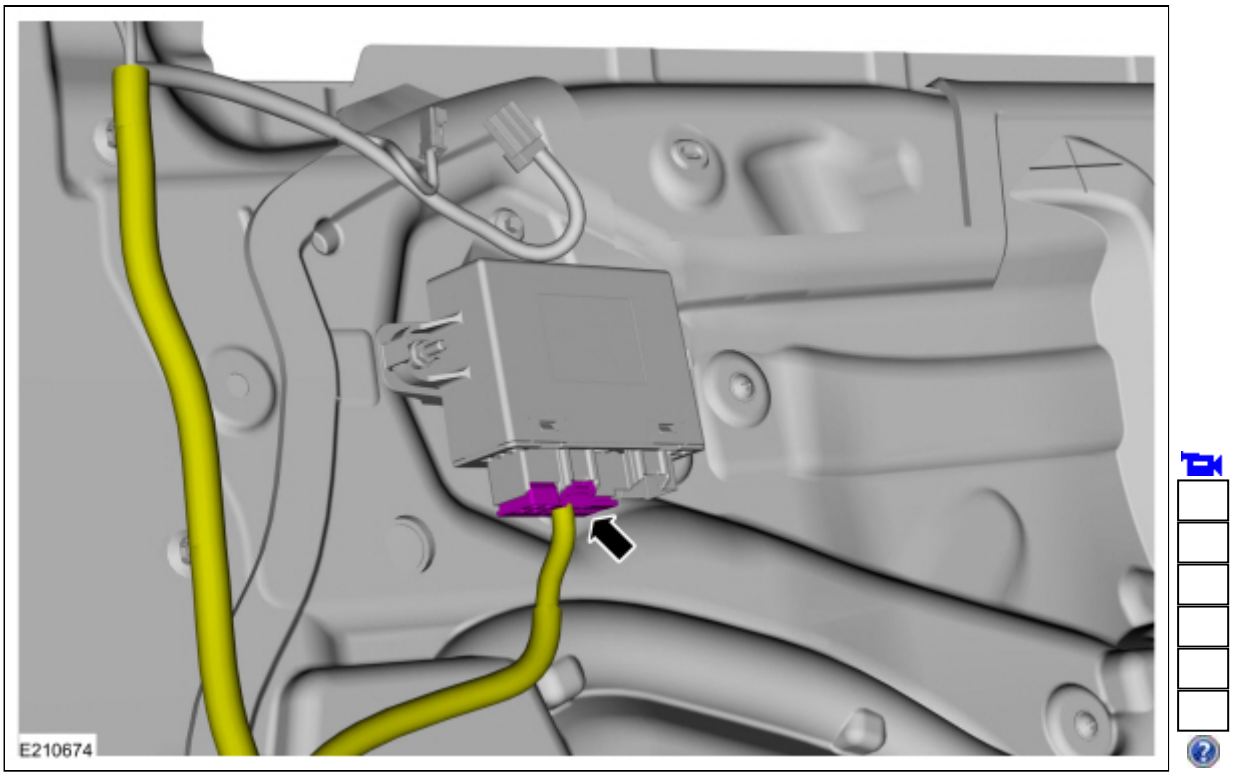
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the diagnostic scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

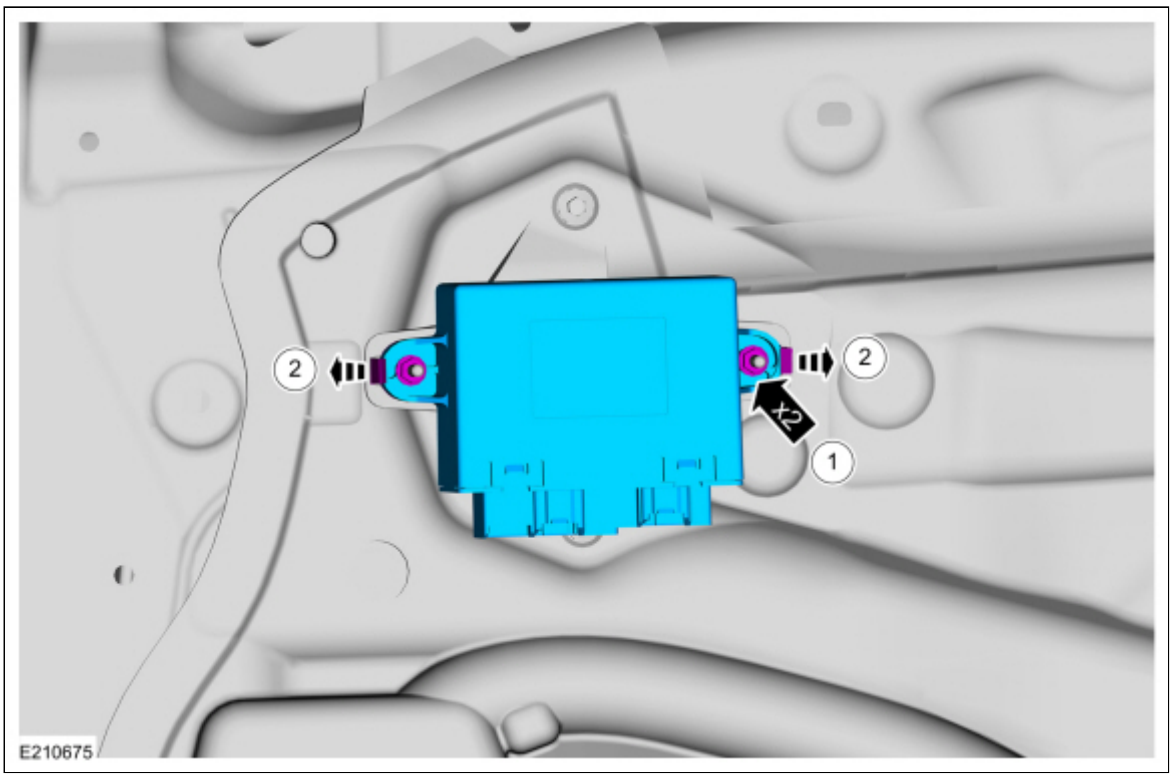
   Carry out the PMI procedure for the PDM
   Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

2. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

   - Disconnect the electrical connector.



4. Remove the bolts and the RDM
   Torque: 2 Nm



Installation

1. To install, reverse the removal procedure.
2. Using the previous diagnostic scan tool session, carry out the PMI procedure for the PDM.
   Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

Copyright © 2016 Ford Motor Company

Radio Transceiver Module (RTM)

Removal

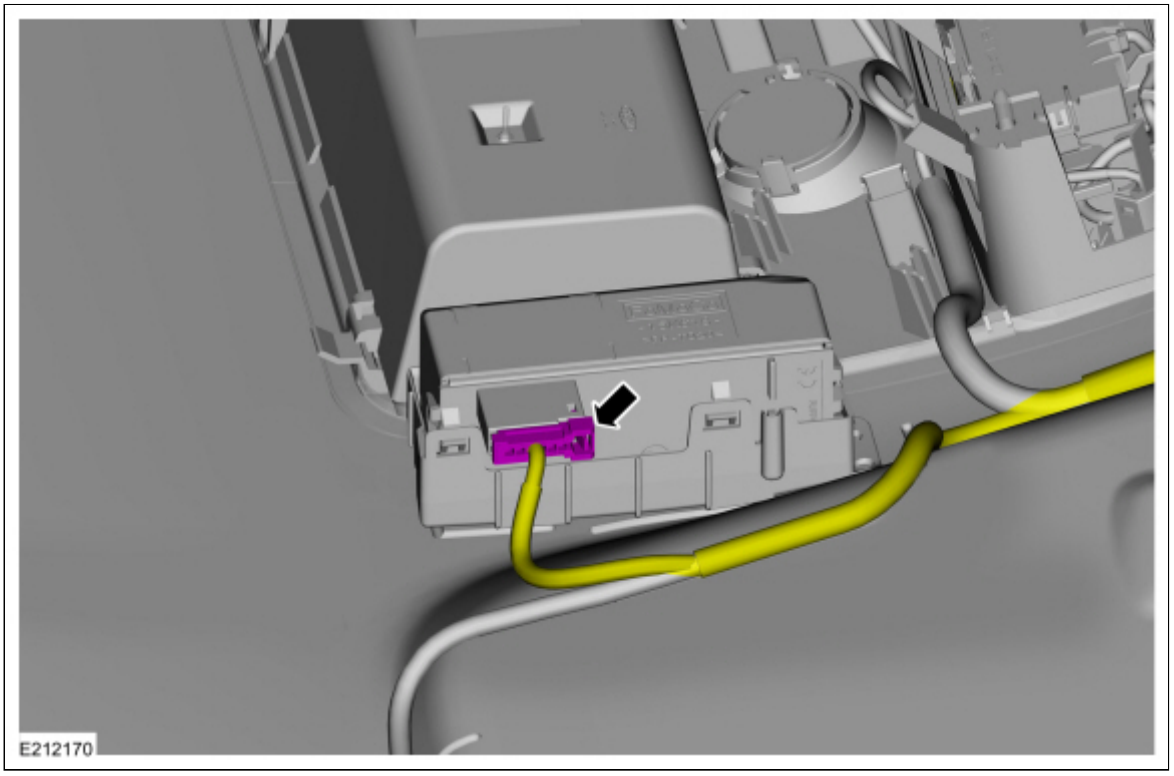
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the diagnostic scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

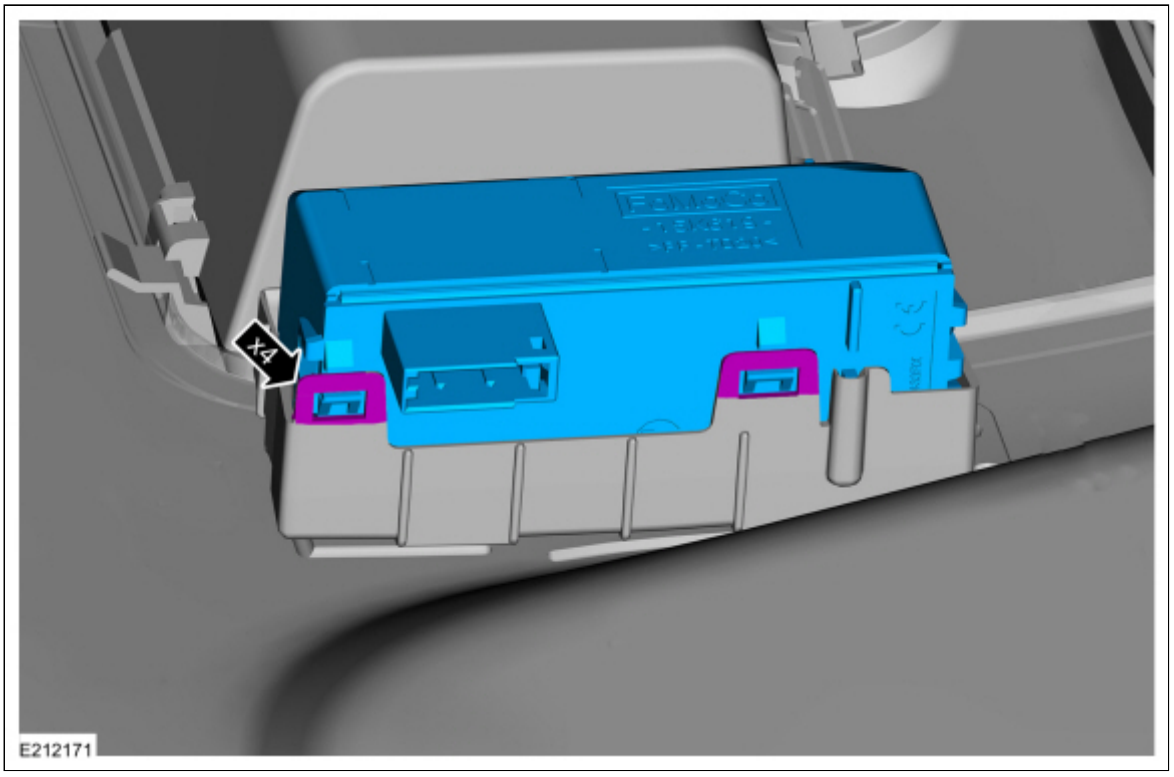
   Carry out the PMI procedure for the RTM.

2. Lower the headliner.
   Refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).

   1. Disconnect the electrical connectors.



   1. Release the tabs and remove the RTM.



Installation

1. To install, reverse the removal procedure.
2. Using the previous diagnostic scan tool session, carry out the PMI procedure for the RTM.

Copyright © 2016 Ford Motor Company

Rear Door Module (RDM)

Removal

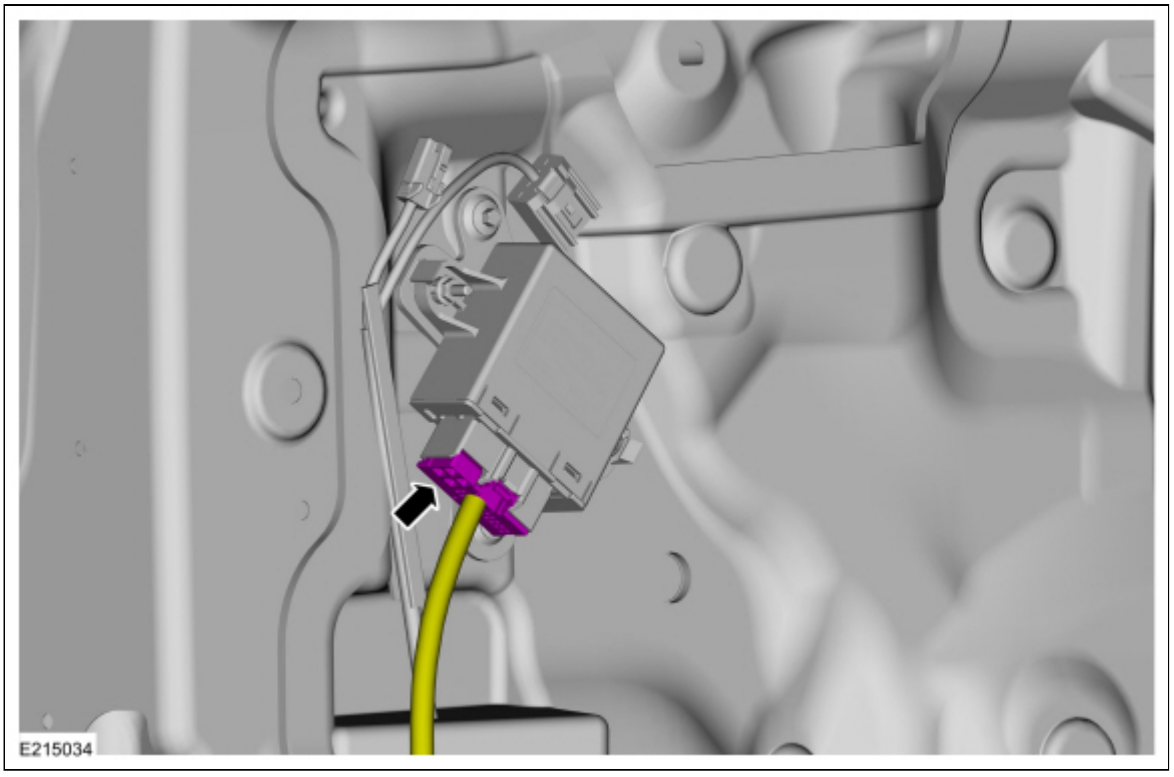
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *If installing a new module, it is necessary to upload the module configuration information to the diagnostic scan tool prior to removing the module. This information must be downloaded into the new module after installation.*

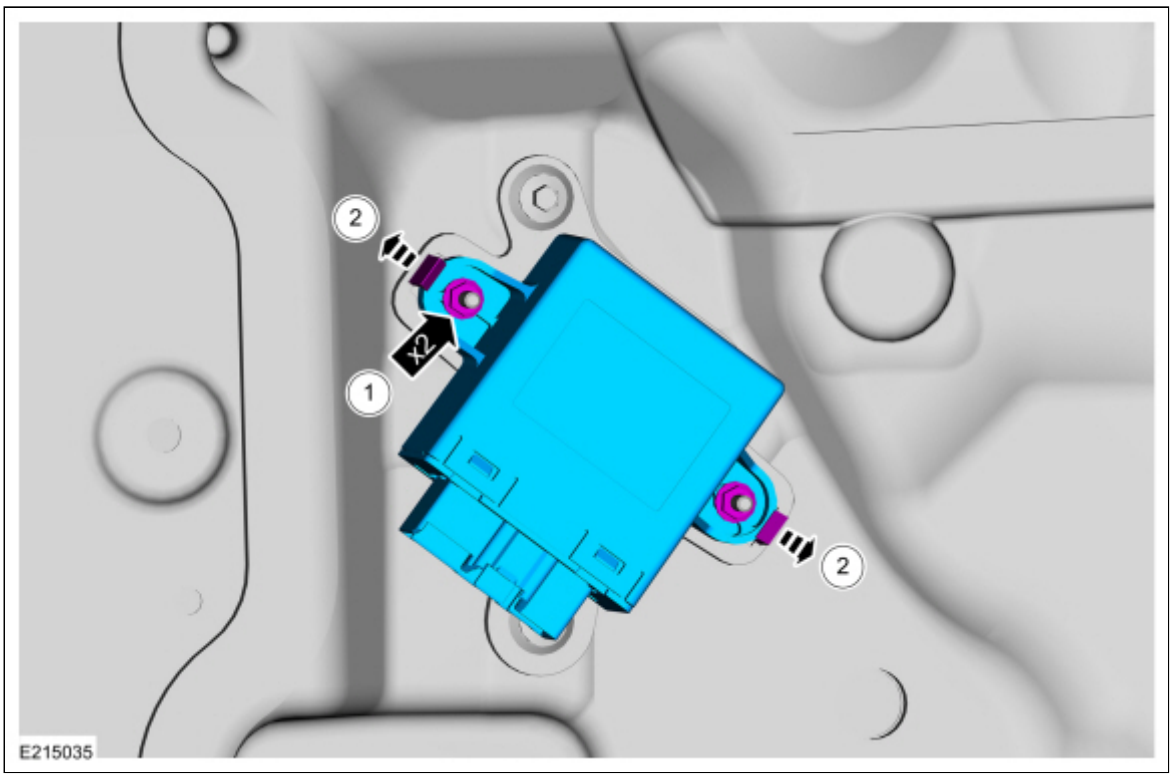
   Carry out the PMI procedure for the RDM.
   Refer to: Module Configuration - System Operation and Component Description (418-01 Module Configuration, Description and Operation).

2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).

   - Disconnect the electrical connector.



4. Remove the bolts and the RDM.
   - *Torque*: 2 Nm



Installation

1. To install, reverse the removal procedure.
2. Using the previous diagnostic scan tool session, carry out the PMI procedure for the RDM.

Copyright © 2016 Ford Motor Company

Specifications

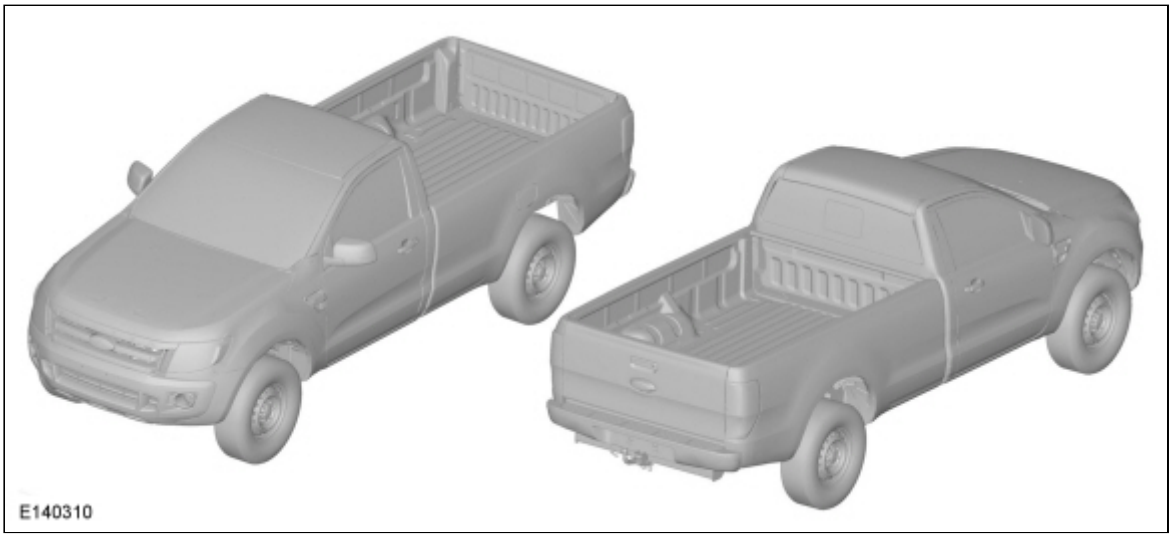
Materials

Name	Specification
Seam Sealant	-
Silicone Spray Lubricant	ESR-M13P4-A
Adhesive	-
Silicone Sealant	WSE-M4G323-A4

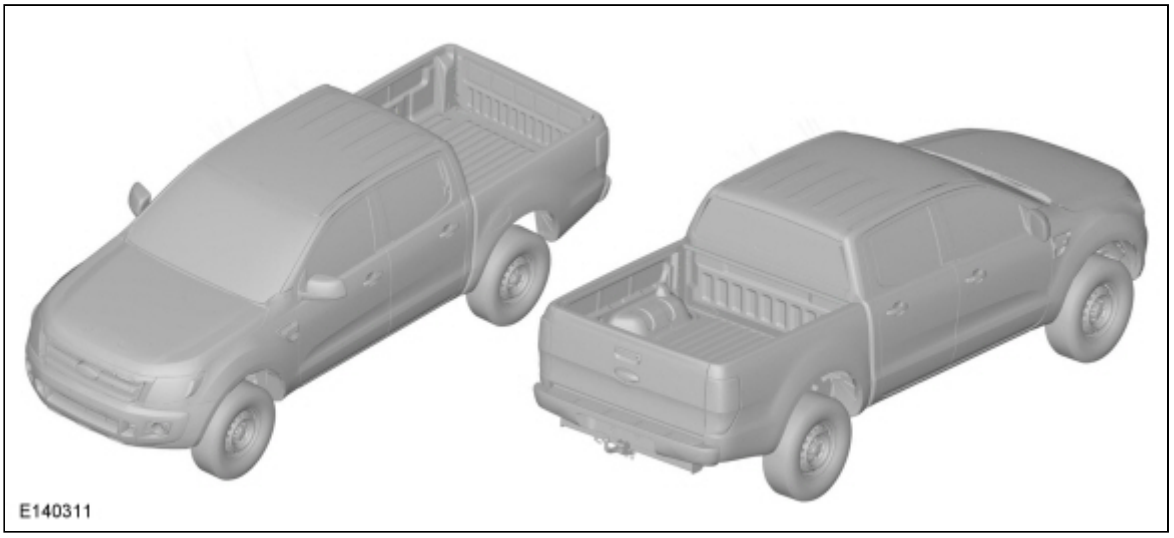
Copyright © 2016 Ford Motor Company

Body - Overview

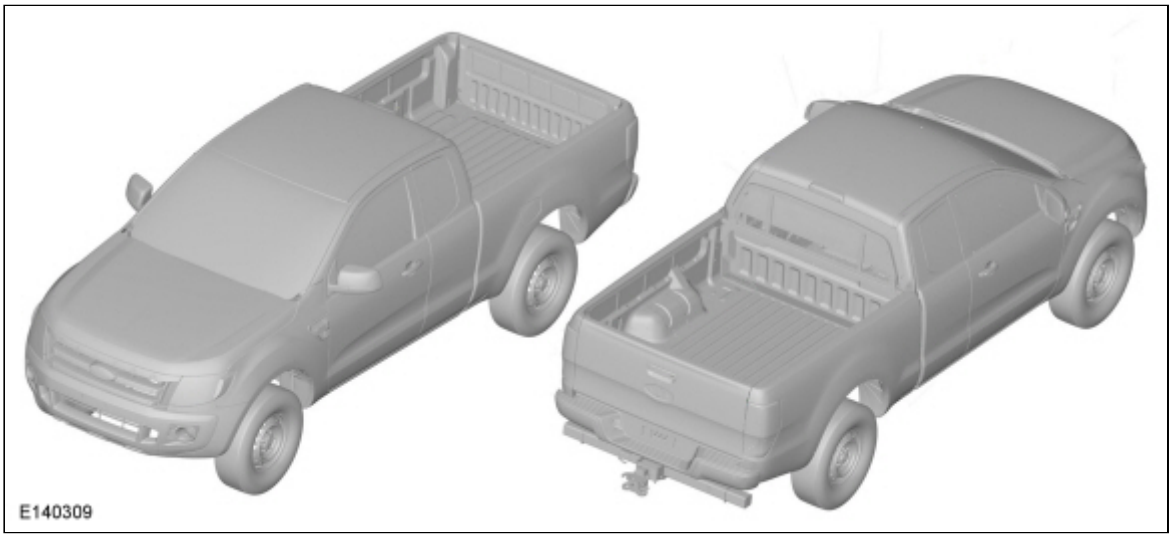
Single cab



Double cab



Stretch cab



Copyright © 2016 Ford Motor Company

Body - Overview

Insulation

Insulation is used as a sound-deadener to reduce exterior road and powertrain noises from the interior of the vehicle. Mastic insulators are also used as insulation. Insulation is installed:

- under the roof.
- above and below the instrument panel.
- at the cowl side panels.
- over the front and rear floorpans.
- inside the B-, C- and D-pillar sections.
- on the wheelhouse/quarter panel.
- behind the rear quarter trim panel.

Other forms of insulation include:

- front tunnel stiffening pad.
- dash panel stiffener.
- rear wheelhouse mastic pads.

It has heat-bonded mastic deadeners for improved NVH characteristics.

It also has sound dampeners located inside the D-pillar and plug holes in the inner rear quarter.

Body Sealer Types and Applications

Seam Sealer

- heavy-bodied, non-sag adhesive/sealer used on standing cosmetic seams, truck bed seams, tooled door skin seams and floorpans.
- can be used on water leaks and noise concerns.

Silicone Gasket and Sealant

- form-in-place gasket and multi-purpose adhesive/sealant.
- room temperature curing silicone rubber.

Silicone Spray Lubricant

- keeps the door and window weatherstrip pliable and soft.
- makes the door easier to close.
- retards weatherstrip squeaks.
- retards weatherstrip wear.
- helps retain door window alignment by reducing friction between the glass frame and the rubber weatherstrip.
- should not be used prior to painting.

Trim and Weatherstrip Adhesive

- quick drying, strong adhesive designed to hold weatherstripping onto all body panels and surrounding metal.

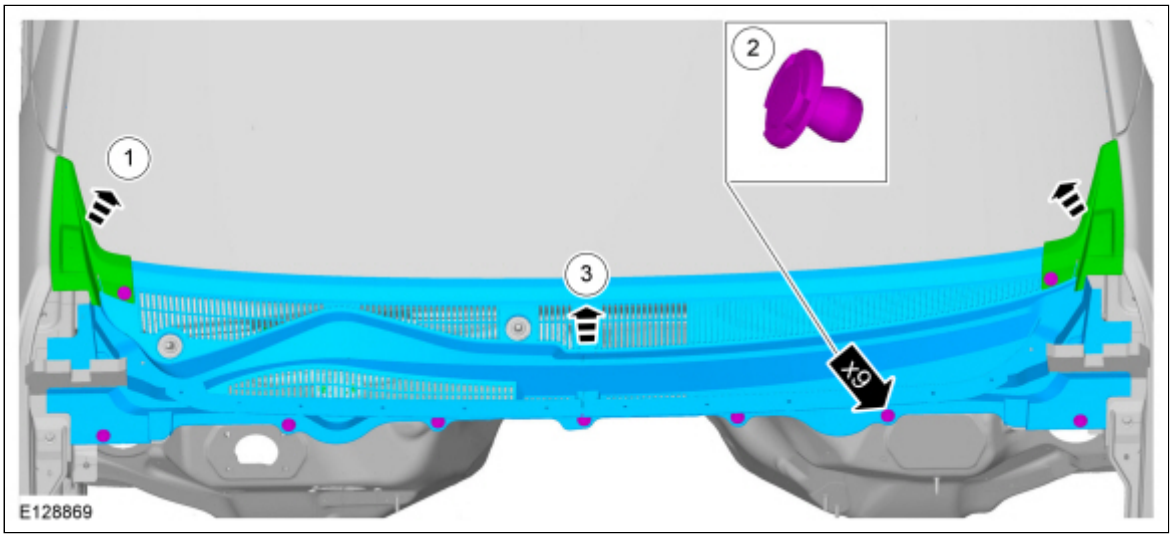
Copyright © 2016 Ford Motor Company

Cowl Panel Grille

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Windshield Wiper Pivot Arm (501-16 Wipers and Washers, Removal and Installation).
2.



Installation

1. **NOTICE: Make sure that the motor is in the park position.**

   To install, reverse the removal procedure.

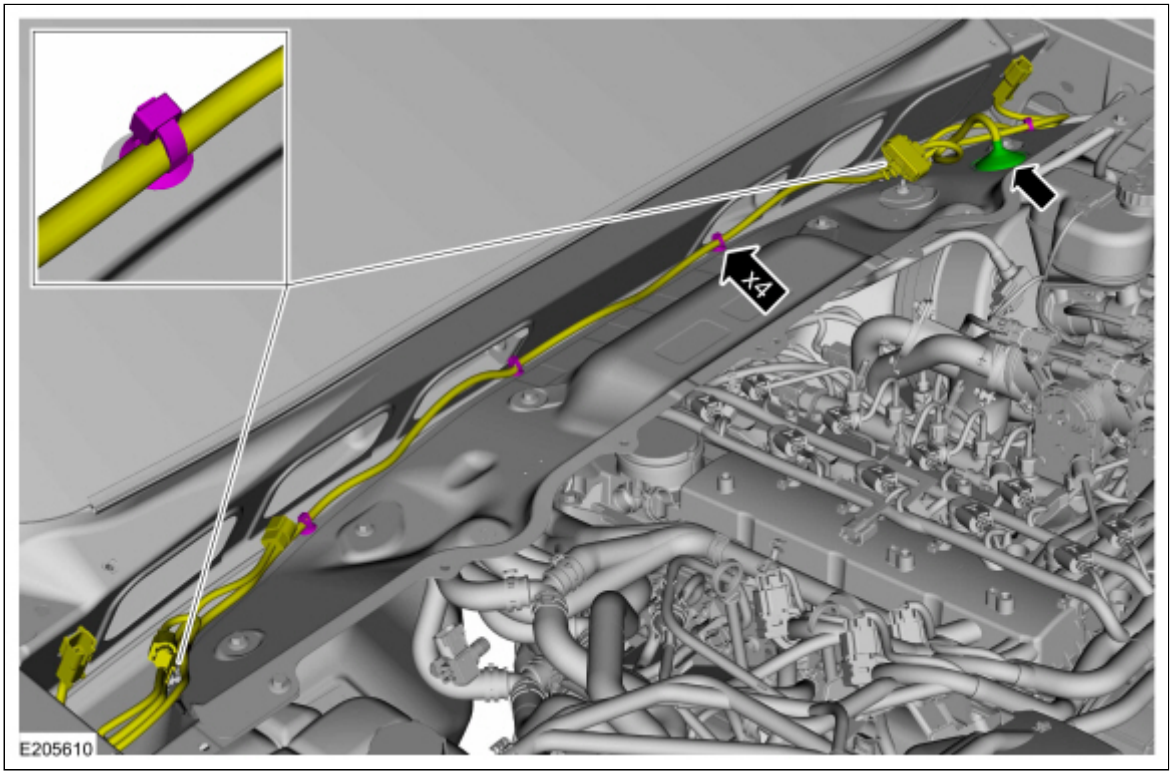
2. Refer to: Windshield Wiper Blade and Pivot Arm Adjustment (501-16 Wipers and Washers, General Procedures).

Copyright © 2016 Ford Motor Company

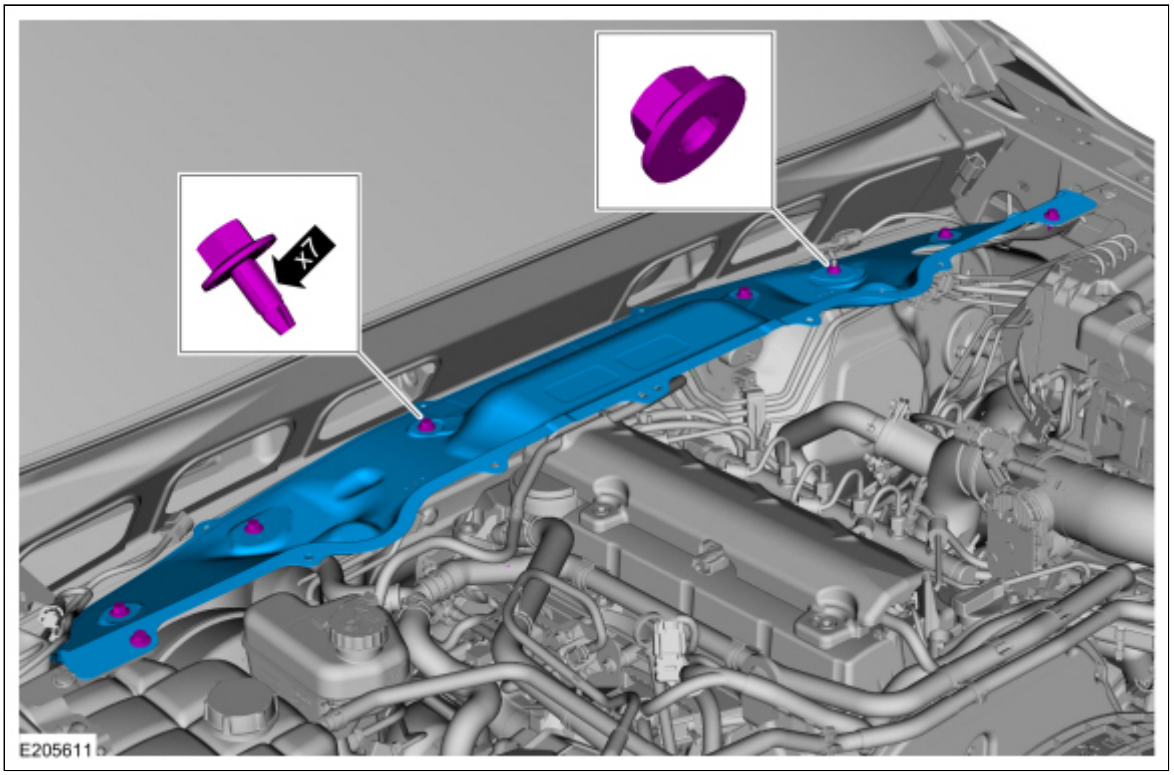
Cowl Panel

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
3. 

4. *Torque*: 11 Nm



Installation

1. To install, reverse the removal procedure.

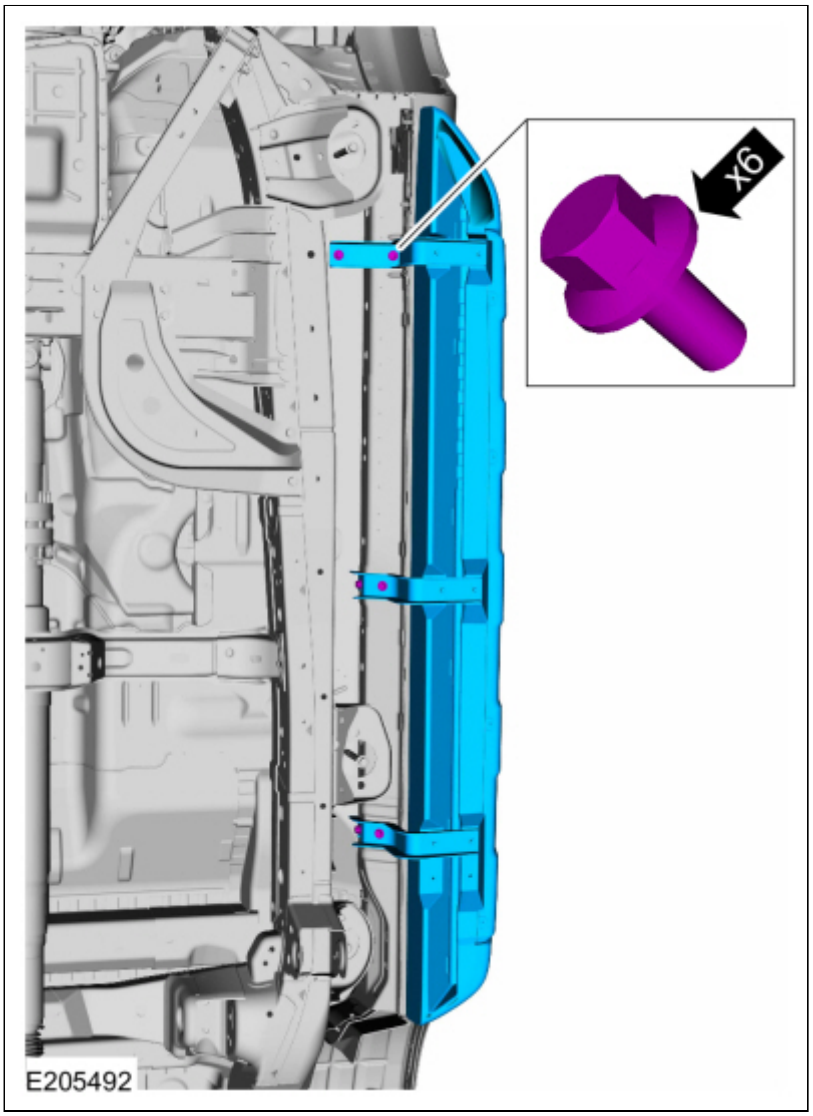
Copyright © 2016 Ford Motor Company

Fender

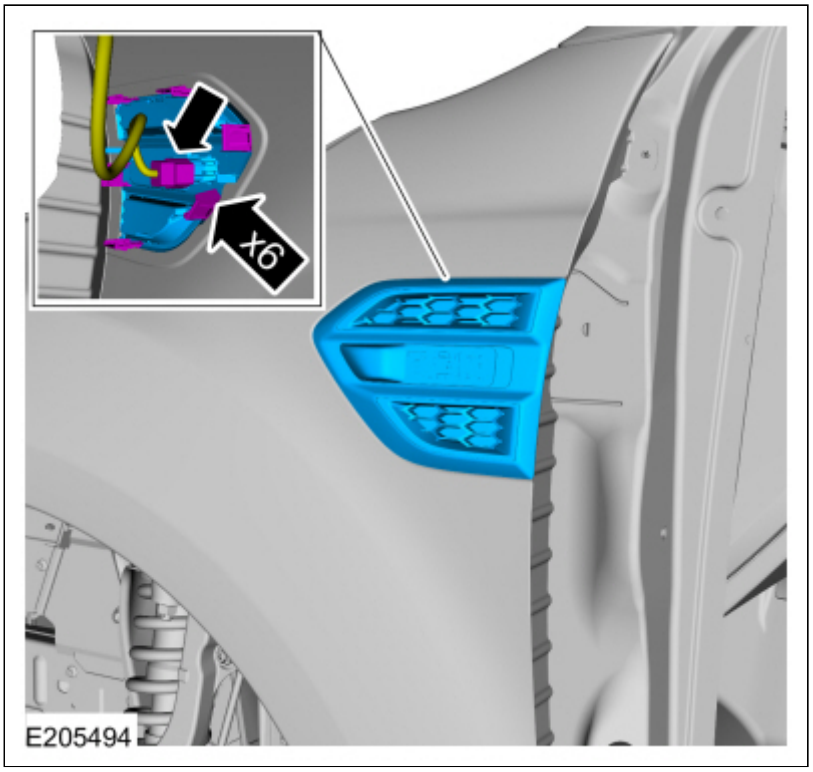
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

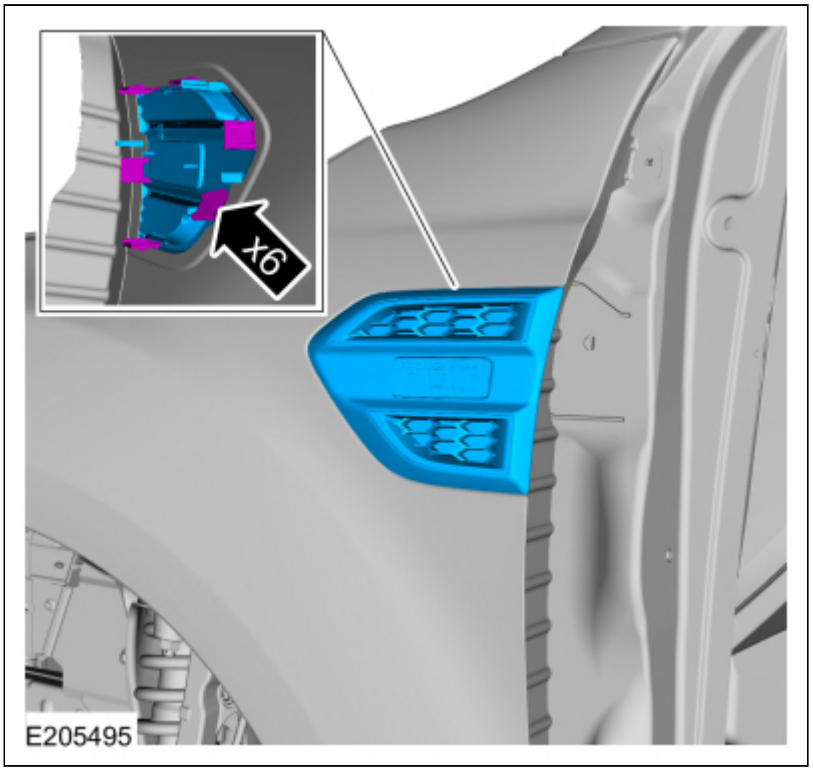
1. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).
4. Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
5. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
6. *Torque*: 48 Nm



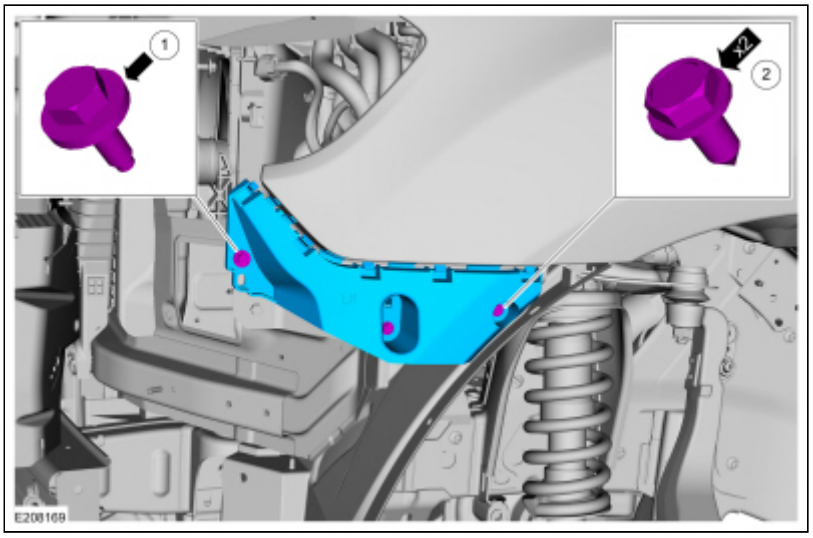
7.



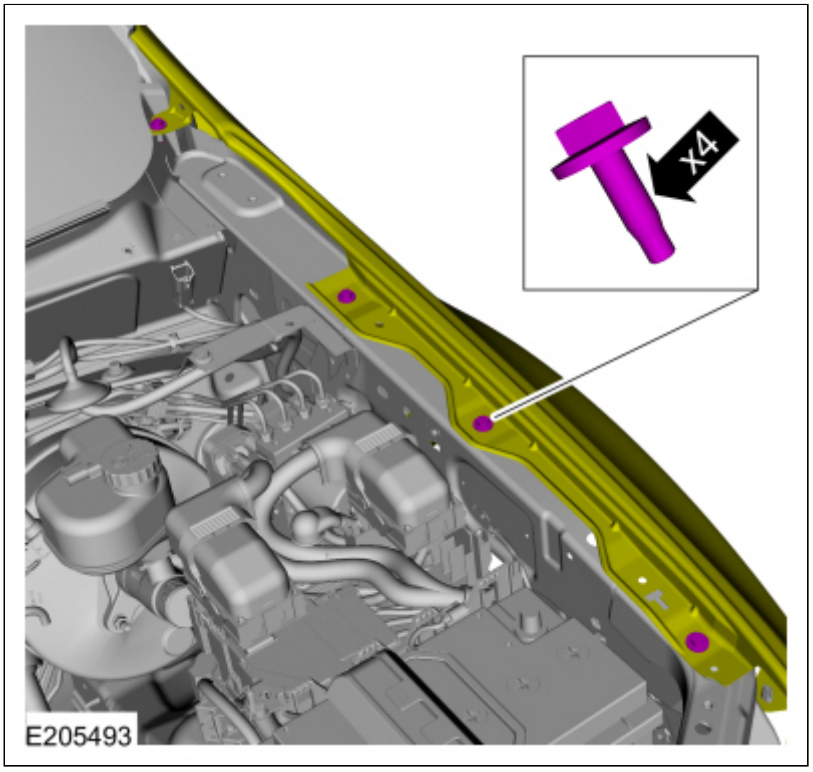
8.



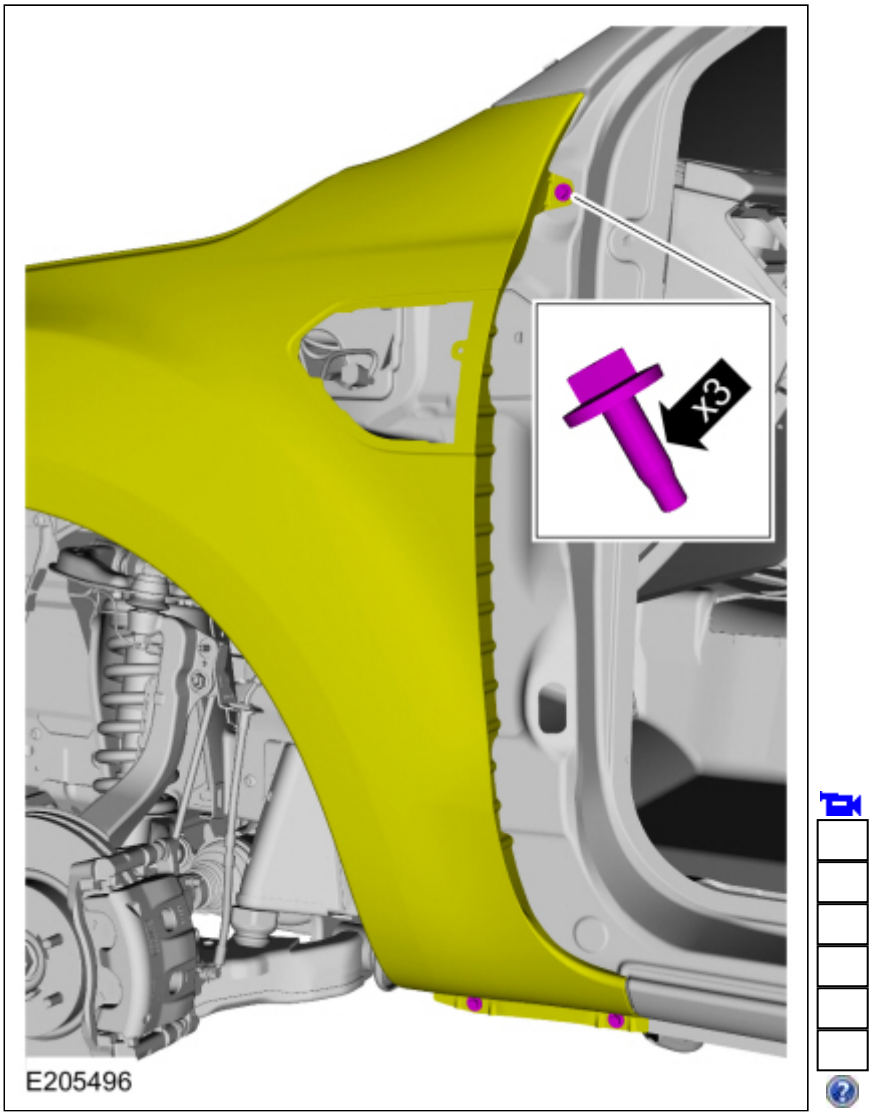
9. If equipped.
   Torque: 9 Nm



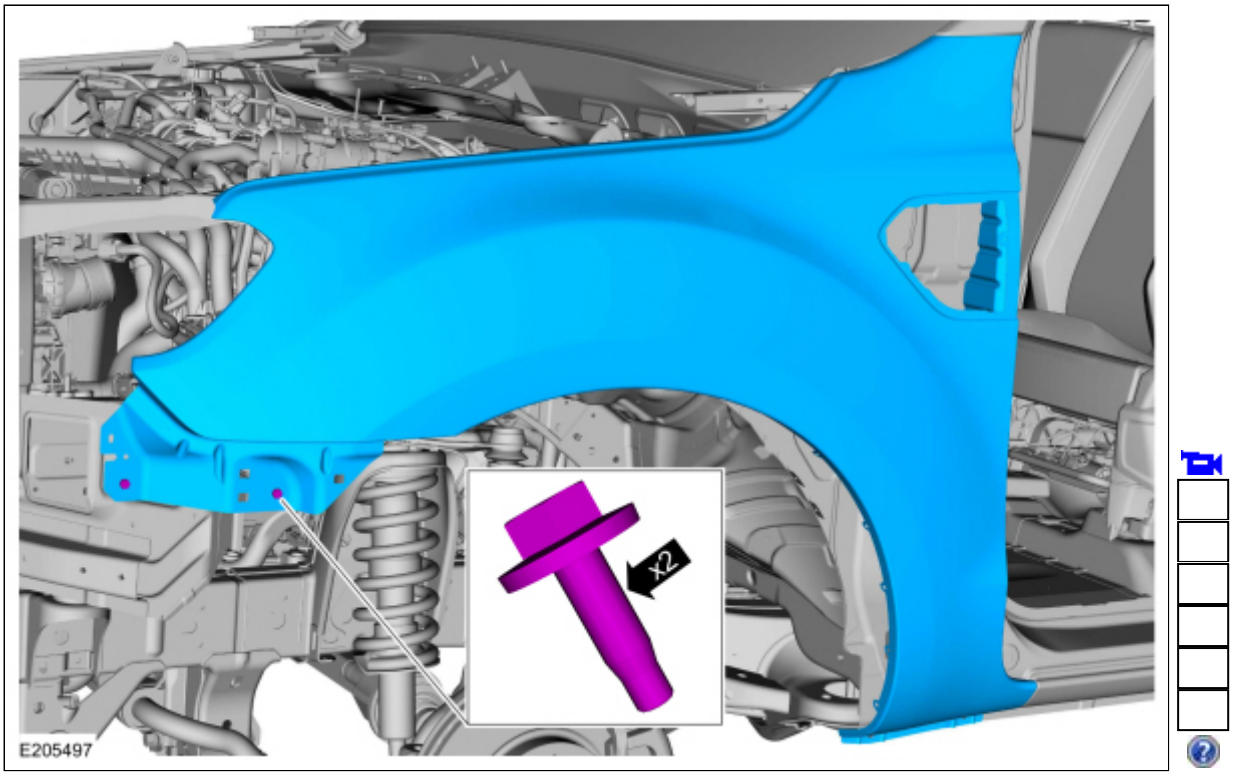
10. *Torque*: 9 Nm



11. *Torque*: 9 Nm



12. *Torque*: 9 Nm



Installation

1. To install, reverse the removal procedure.

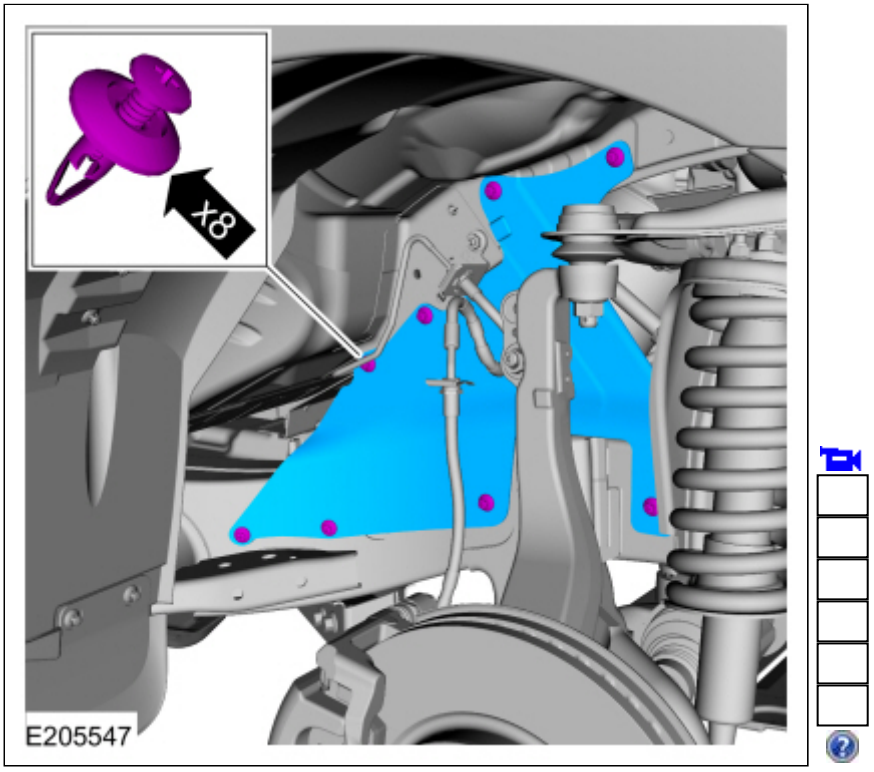
Copyright © 2016 Ford Motor Company

Fender Splash Shield

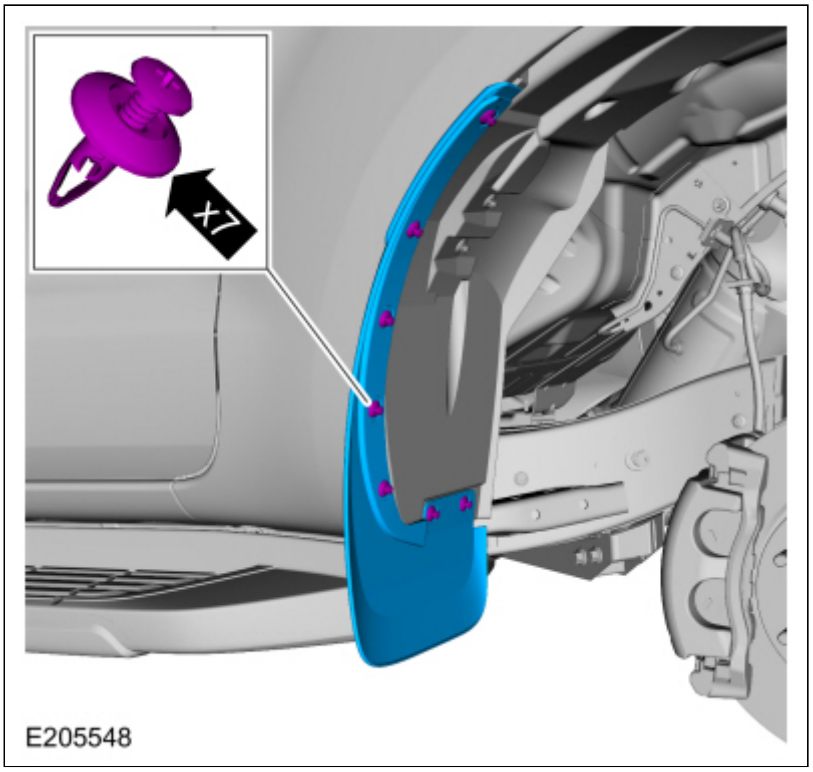
Base Part Number: 16054

Removal

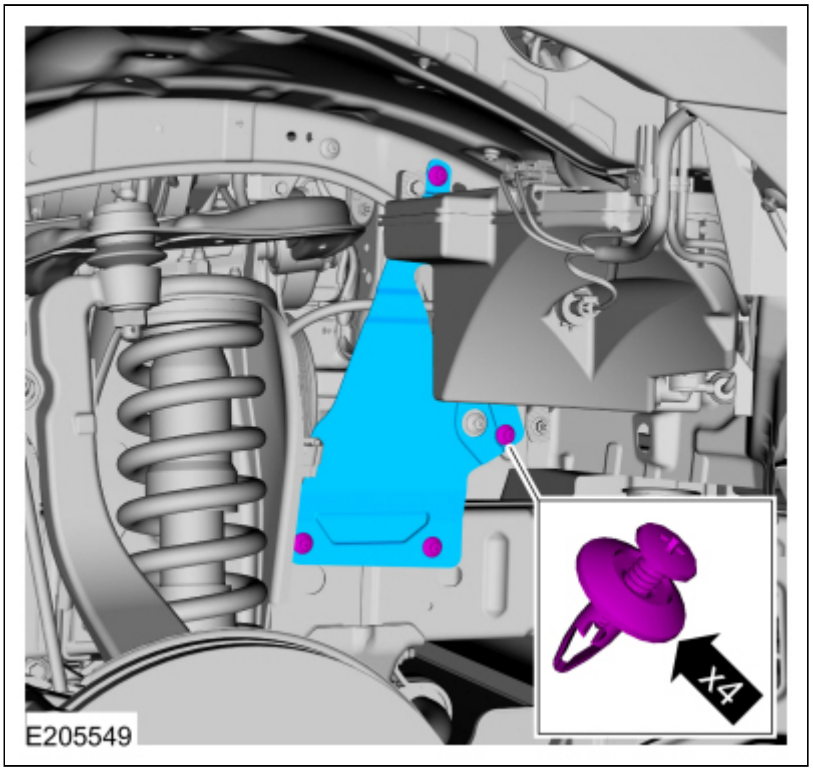
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
2. 

3.

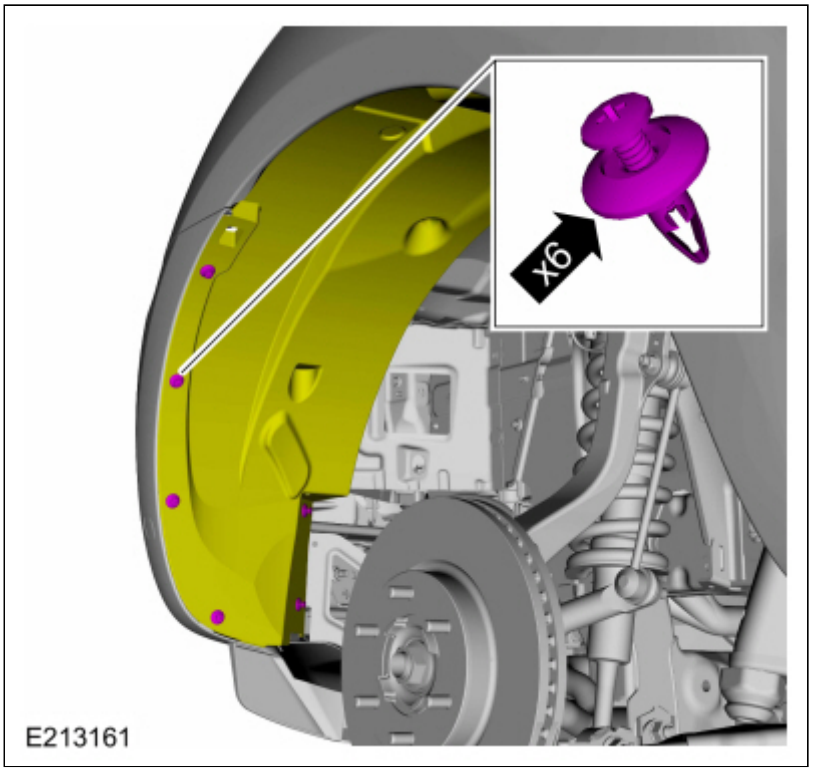


4.



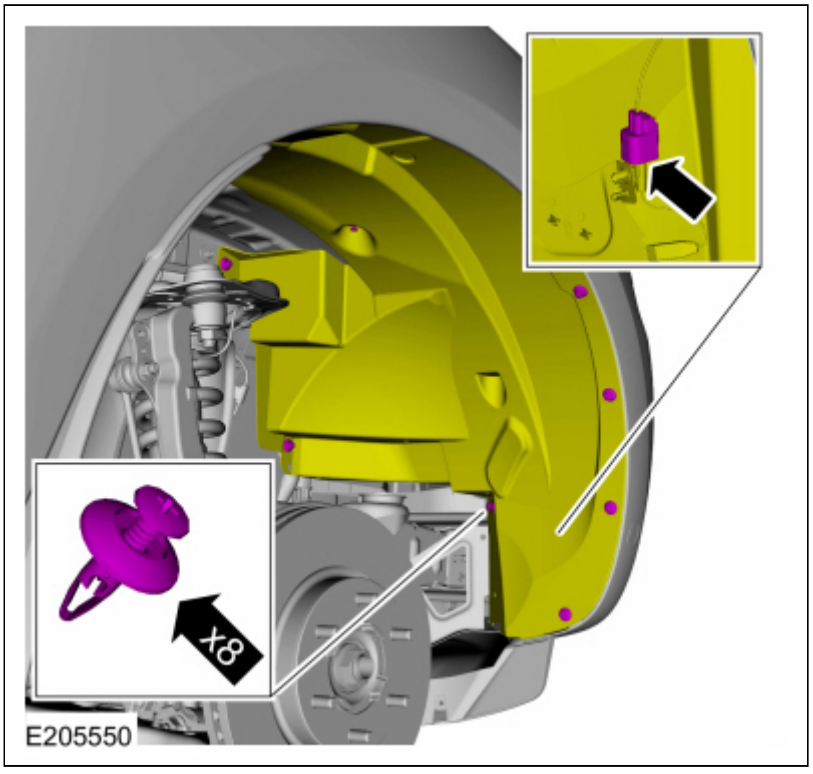
LH Side

5.



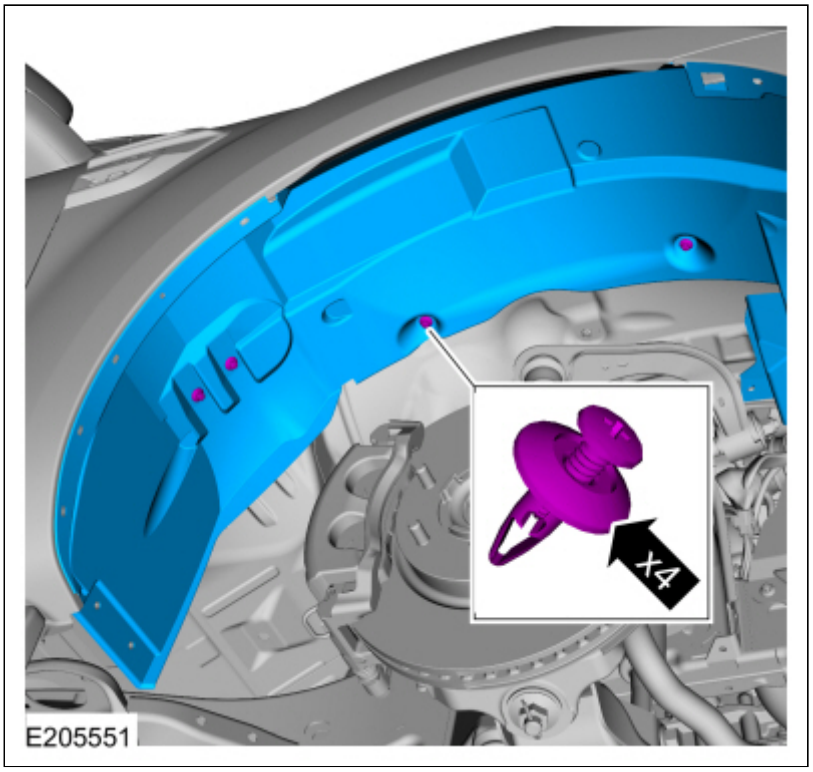
RH Side

6.



Both sides

7.



Installation

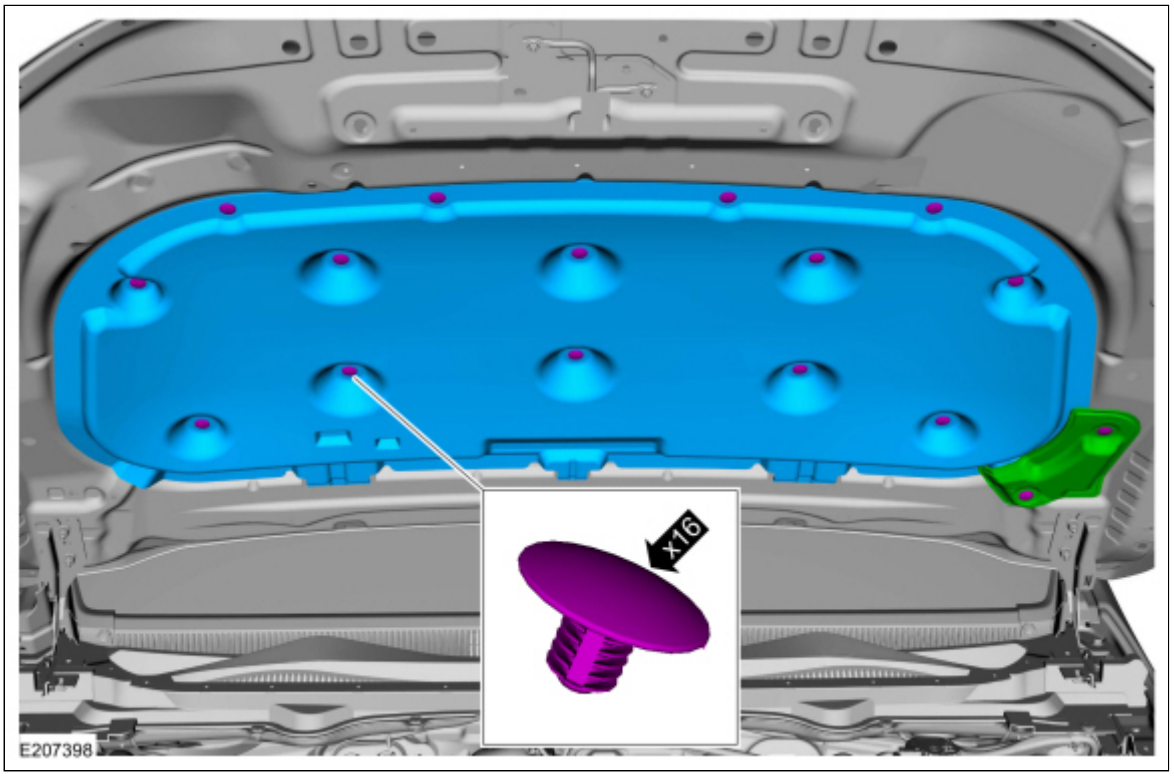
1. To install, reverse the removal procedure.

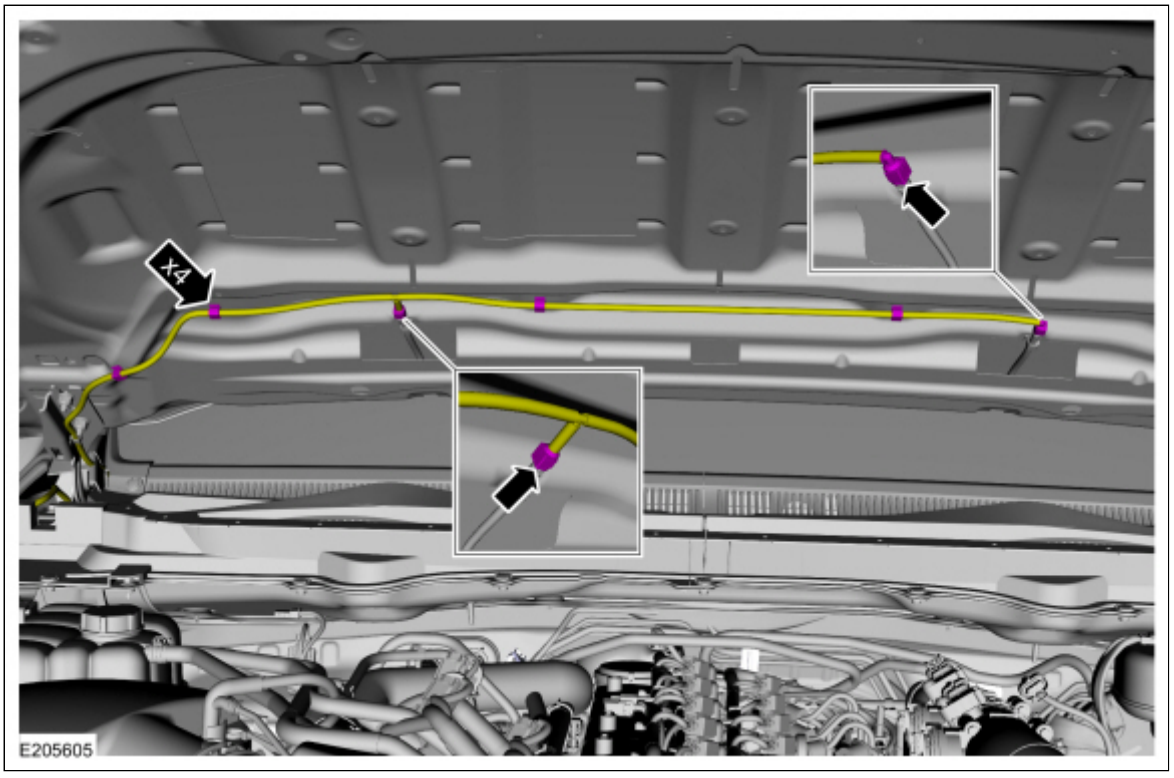
Copyright © 2016 Ford Motor Company

Hood

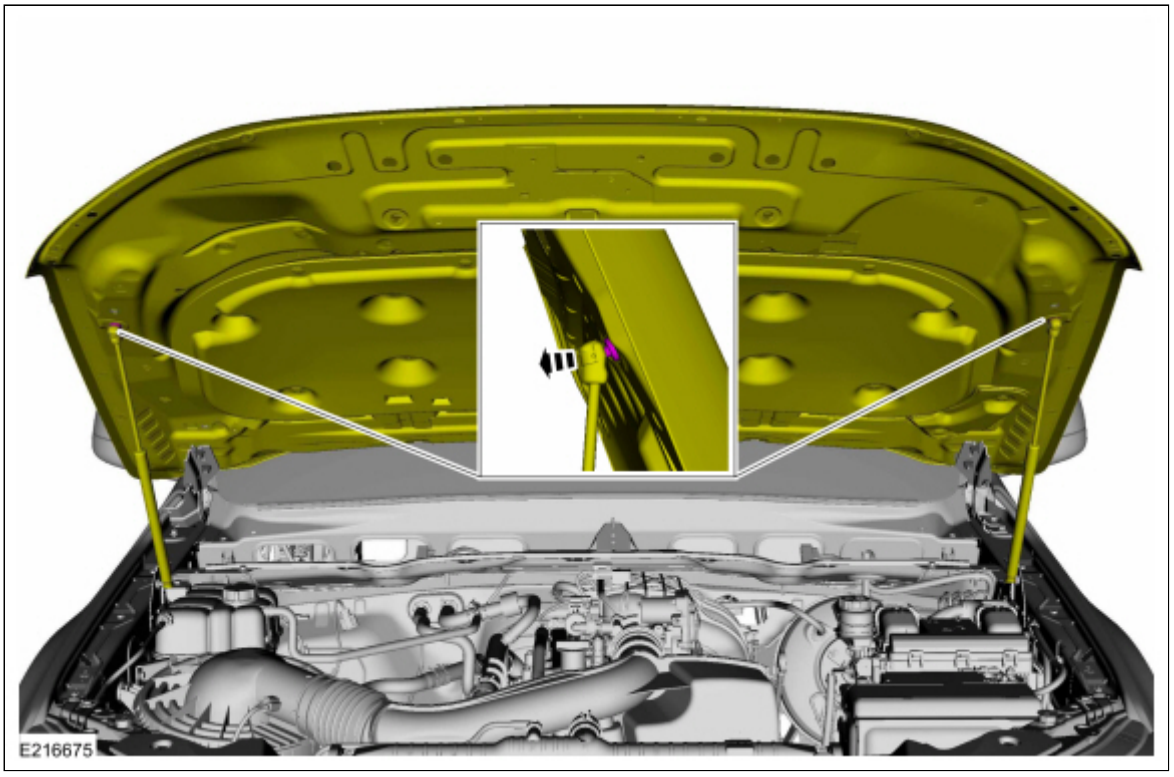
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

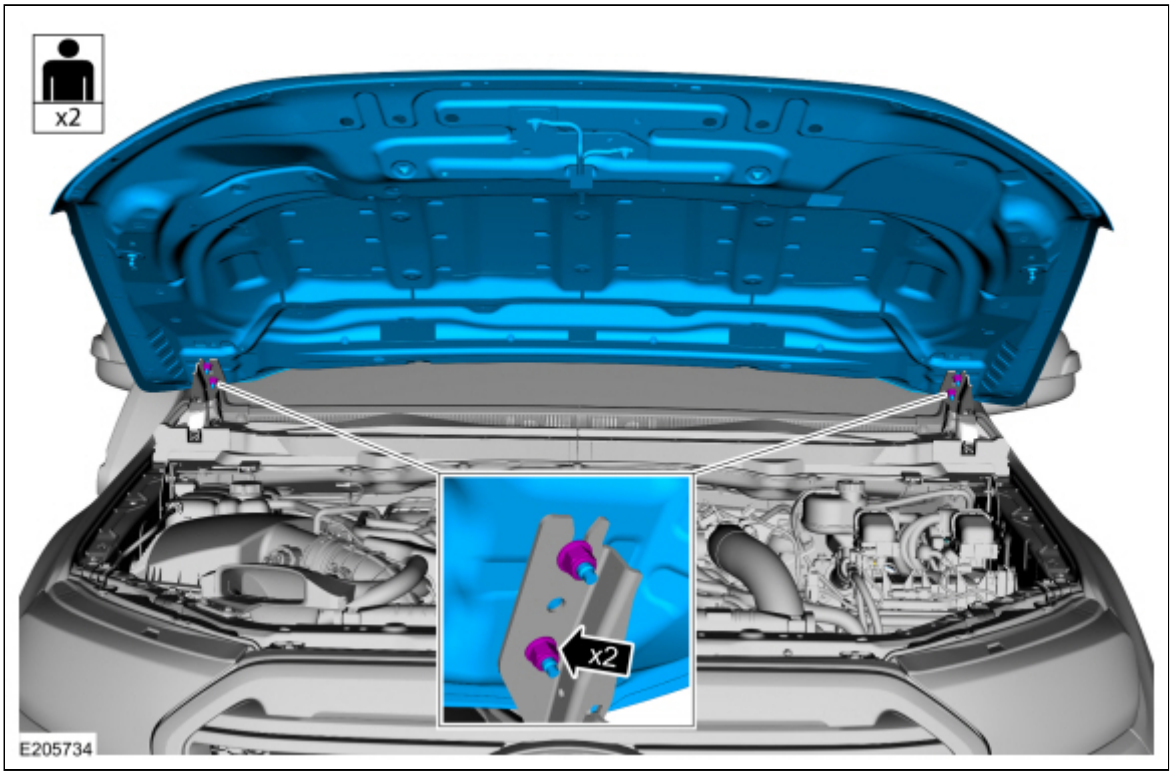
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. 

4.



5. *Torque*: 25 Nm



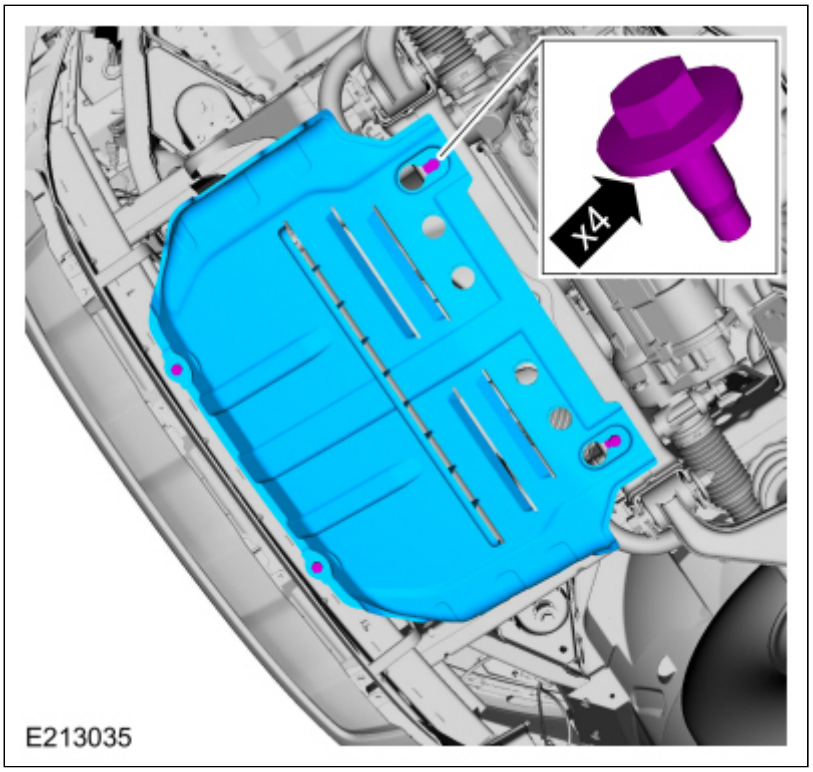
Installation

1. To install, reverse the removal procedure.
   Refer to: Hood Alignment (501-03 Body Closures, General Procedures).

Copyright © 2016 Ford Motor Company

Engine Undershield

1. *Torque*: 30 Nm

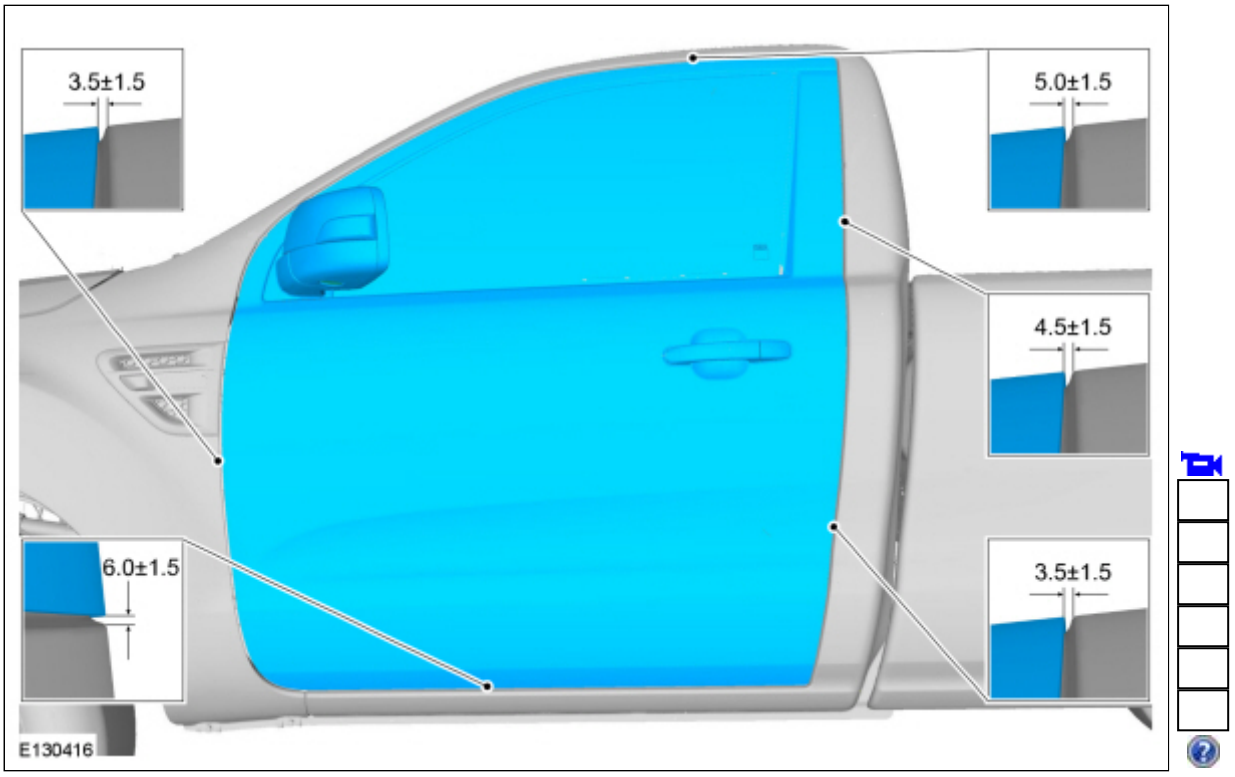


Copyright © 2016 Ford Motor Company

Door Alignment - Single Cab

Activation

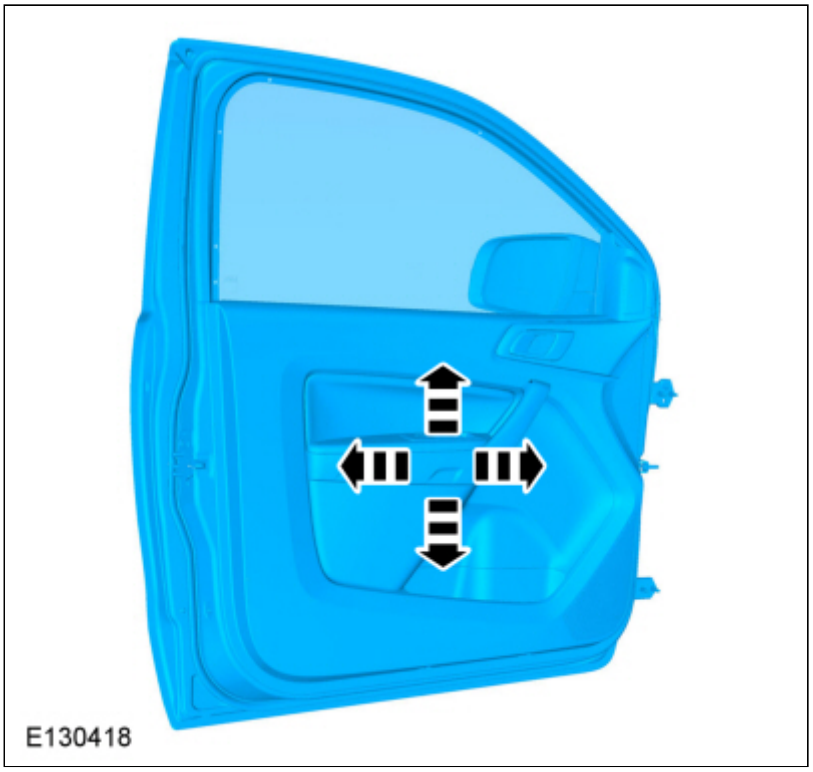
1. **NOTE:** *All the values are in mm.*



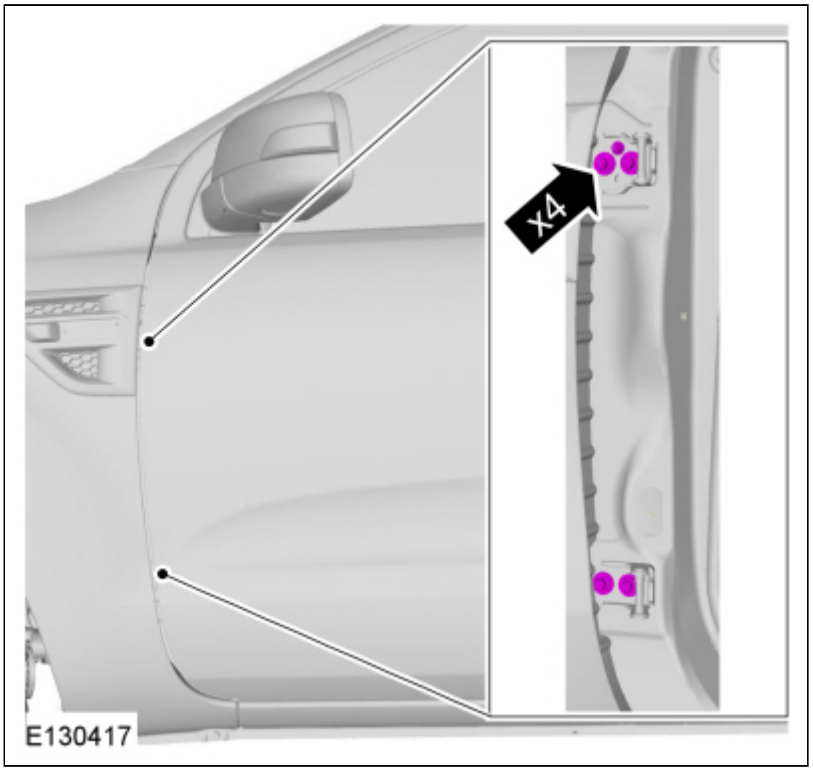
2. Loosen one complete turn.



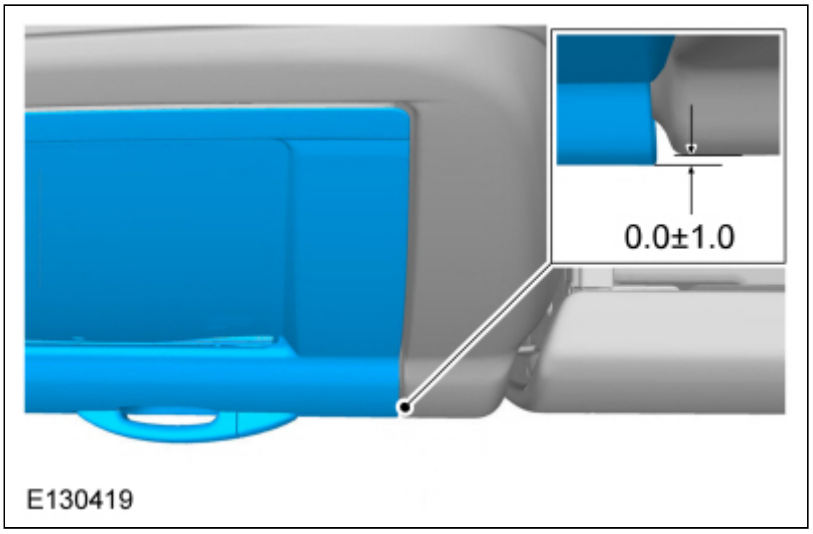
3.



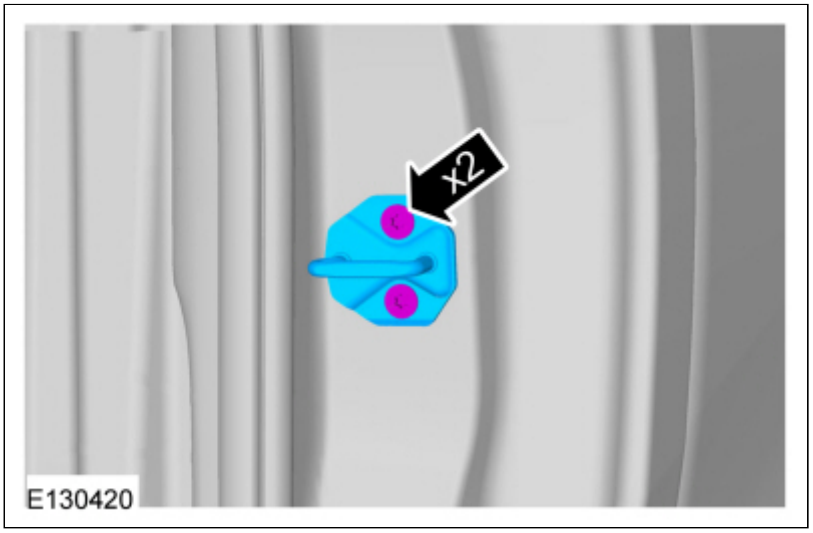
4. *Torque*: 25 Nm



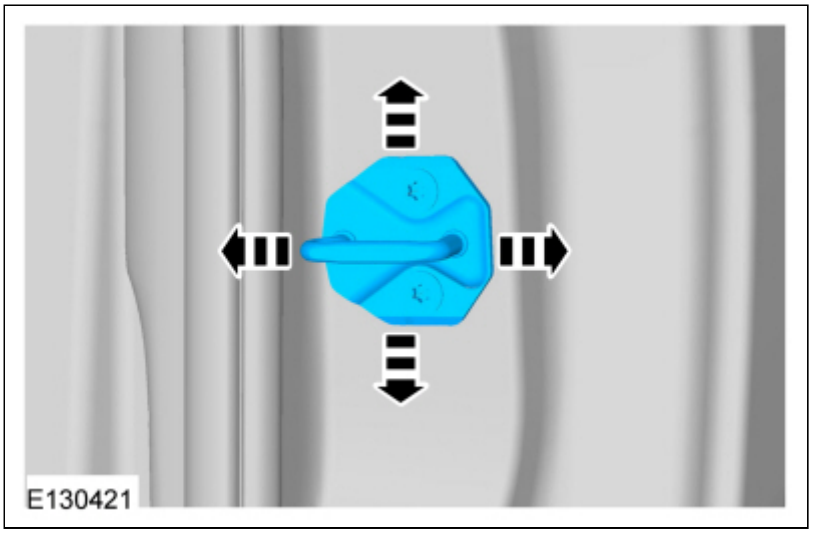
5. **NOTE:** *All the values are in mm.*



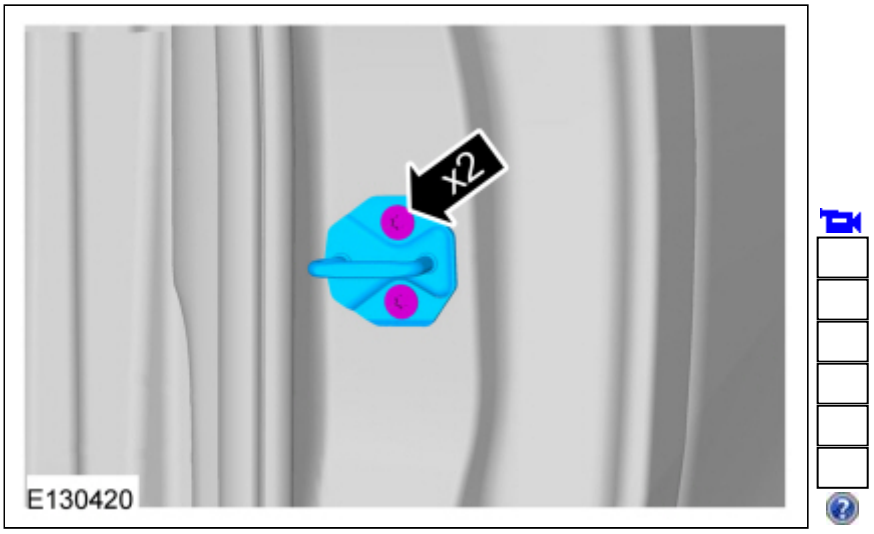
6. Loosen one complete turn.



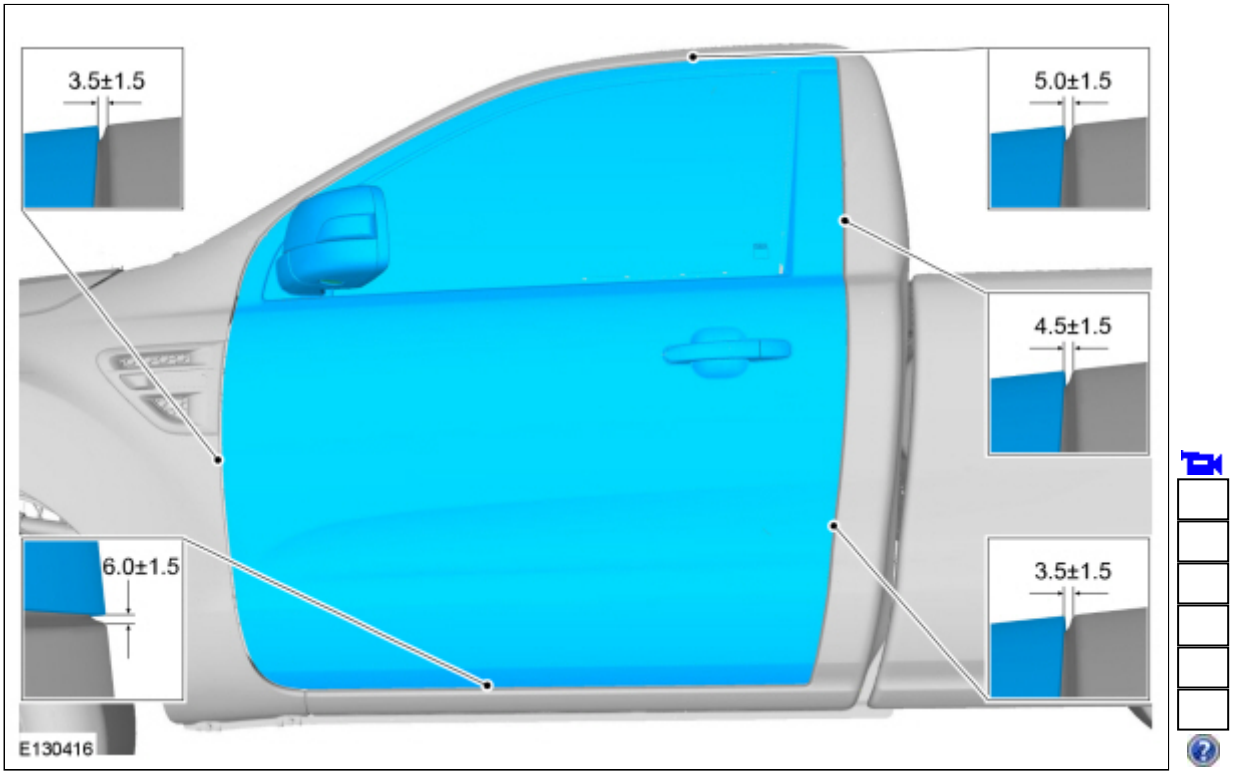
7.



8. *Torque*: 20 Nm



9. **NOTE:** *All the values are in mm.*



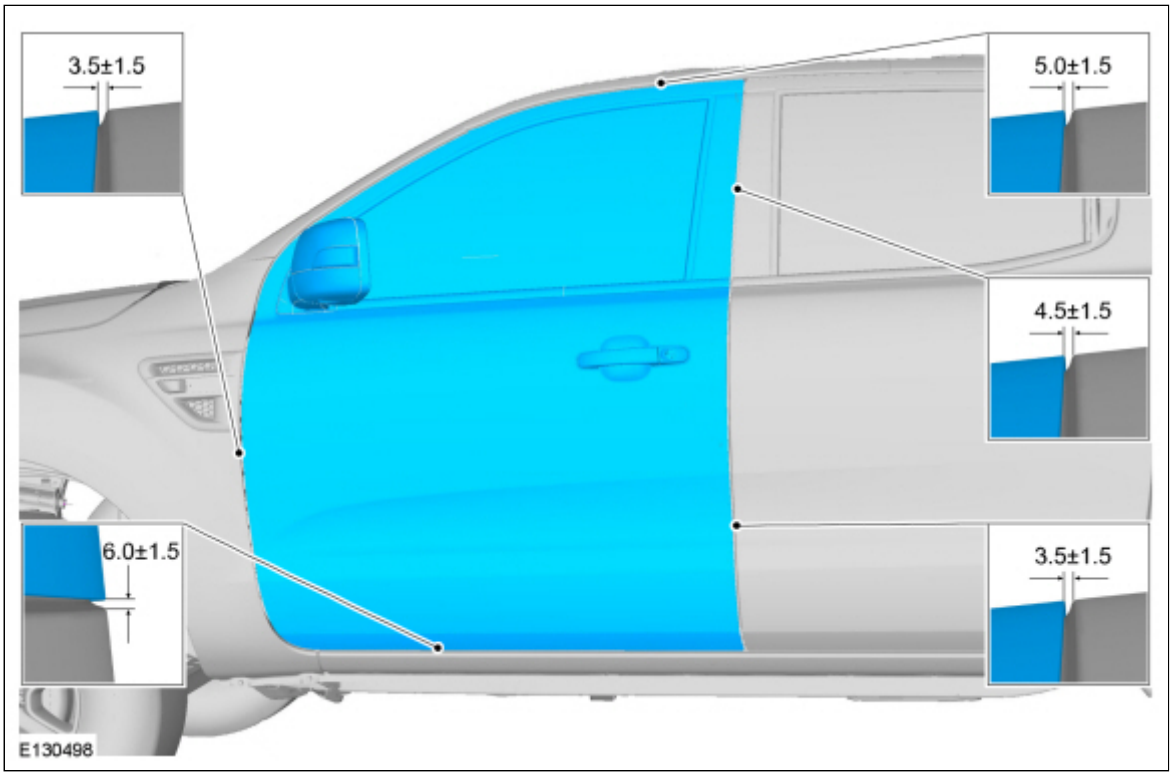
Copyright © 2016 Ford Motor Company

Front Door Alignment - Double Cab

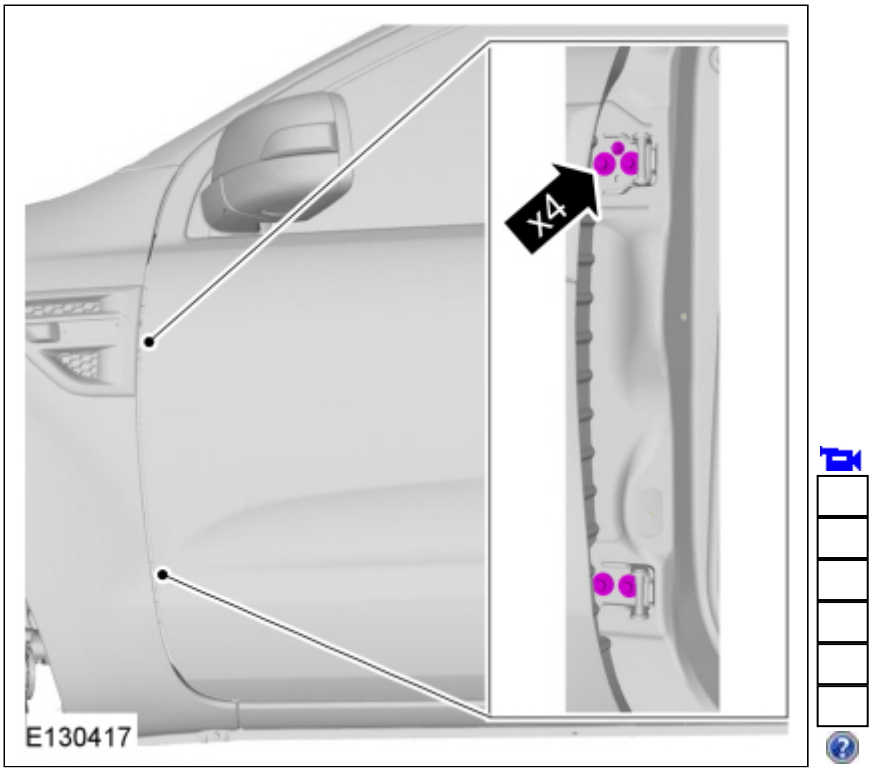
Base Part Number: 20124

Activation

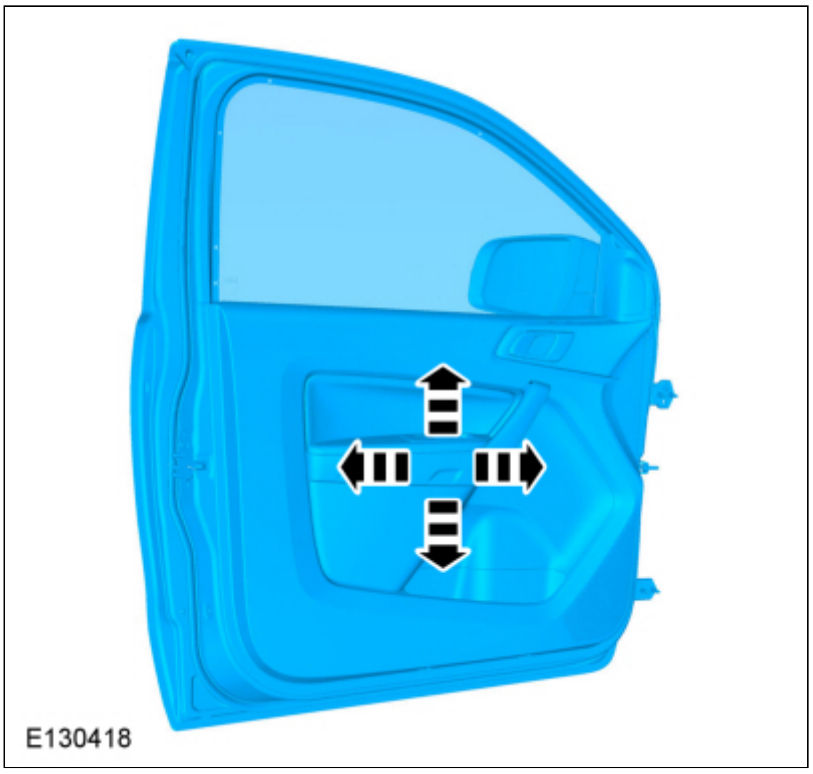
1. **NOTE:** *All the values are in mm.*



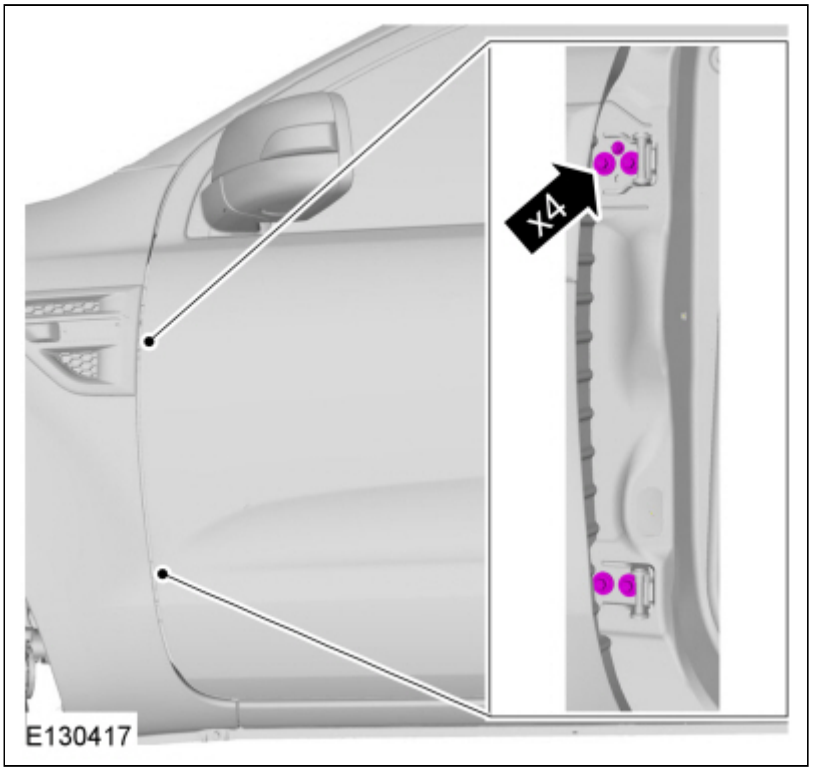
2. Loosen one complete turn.



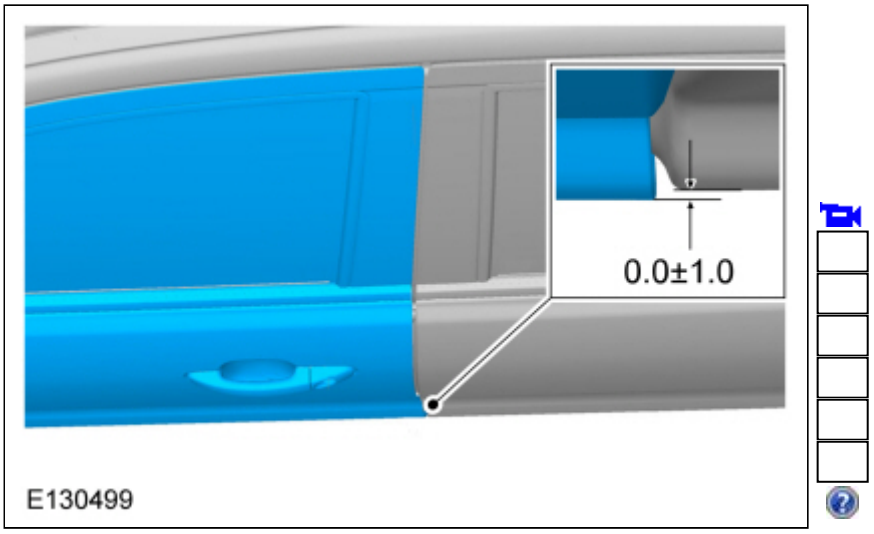
3.



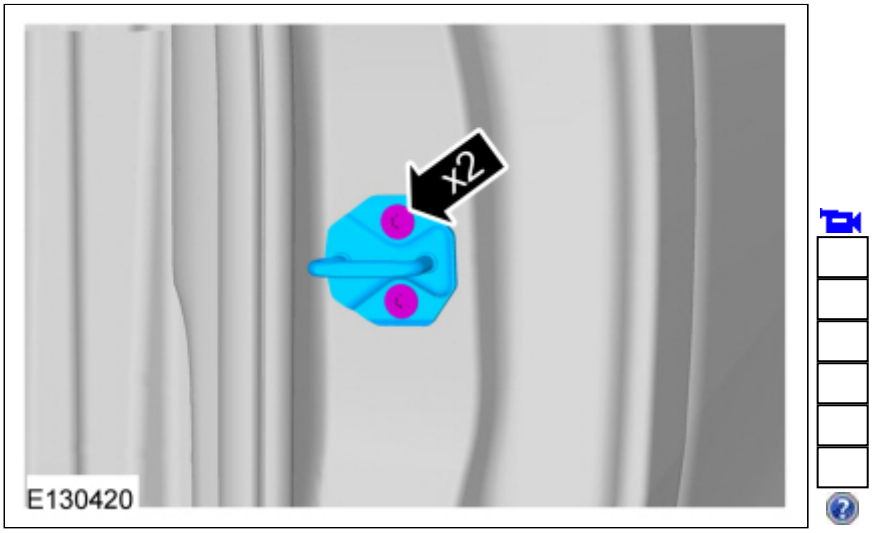
4. *Torque*: 25 Nm



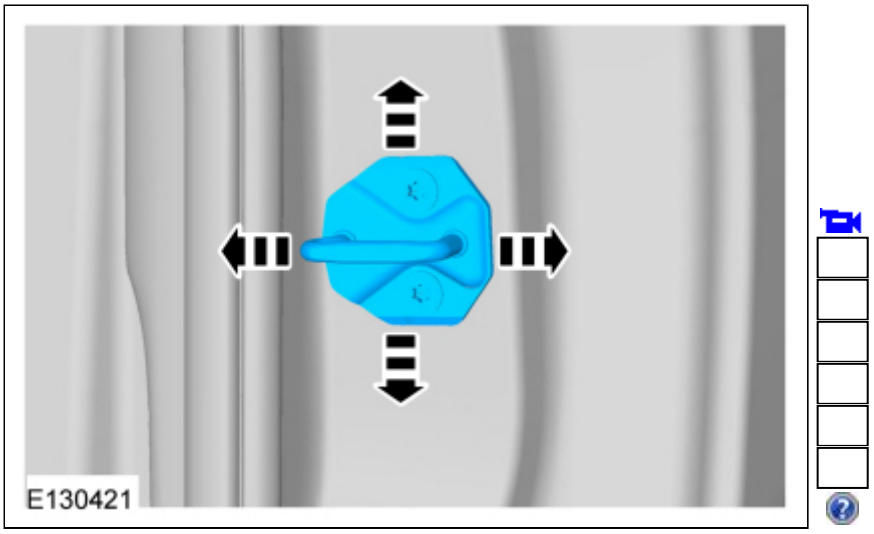
5. **NOTE:** *All the values are in mm.*



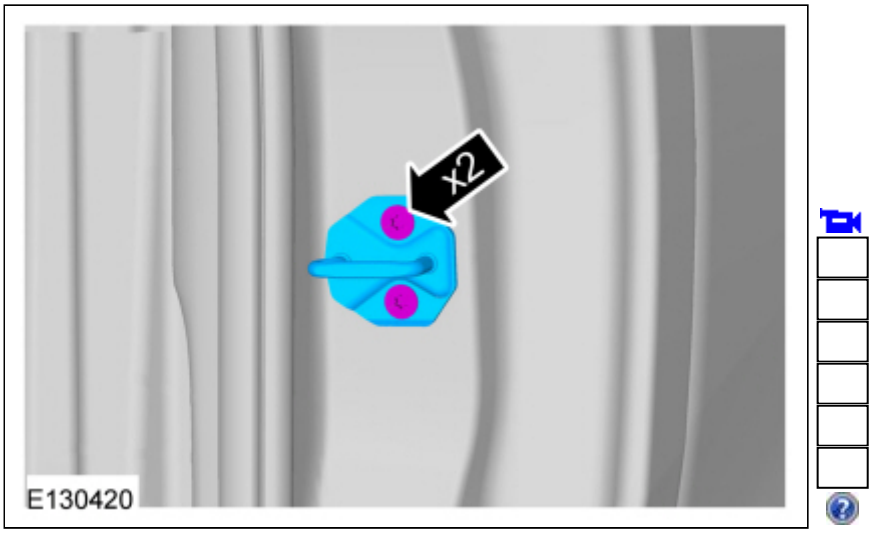
6. Loosen one complete turn.



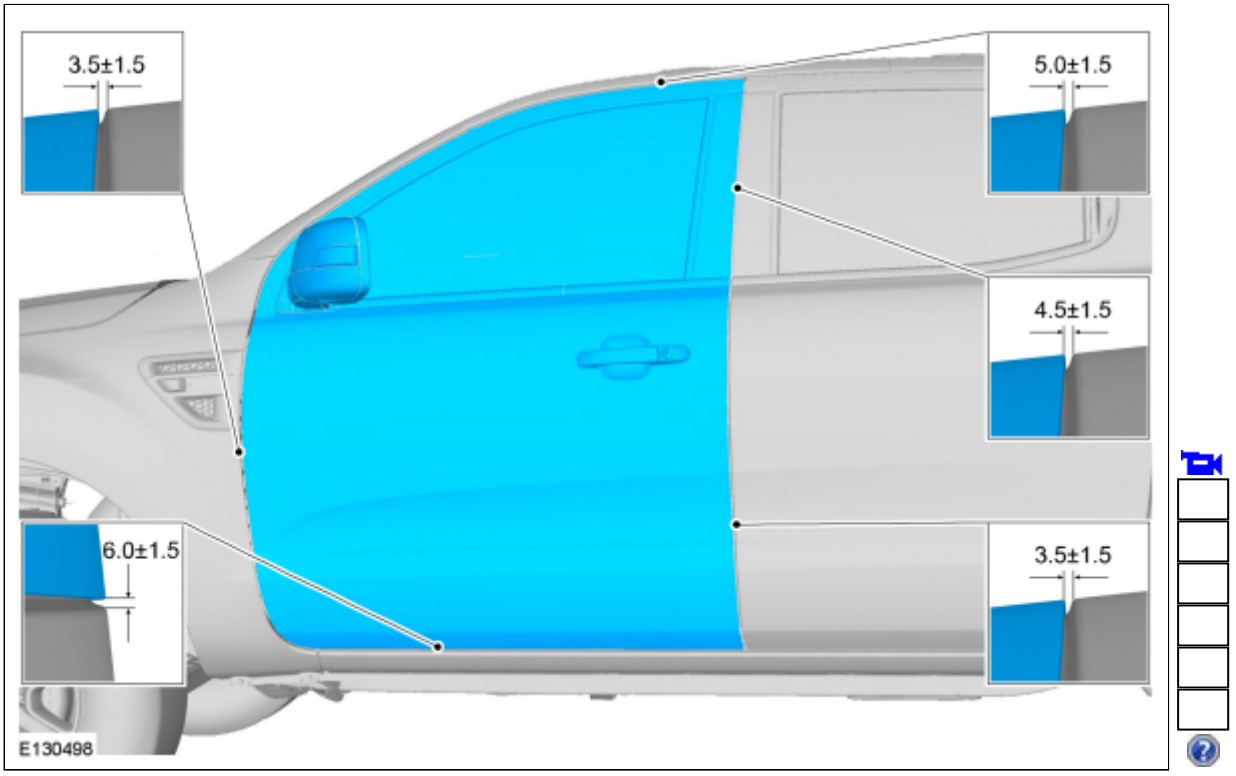
7.



8. *Torque*: 20 Nm



9. **NOTE:** *All the values are in mm.*



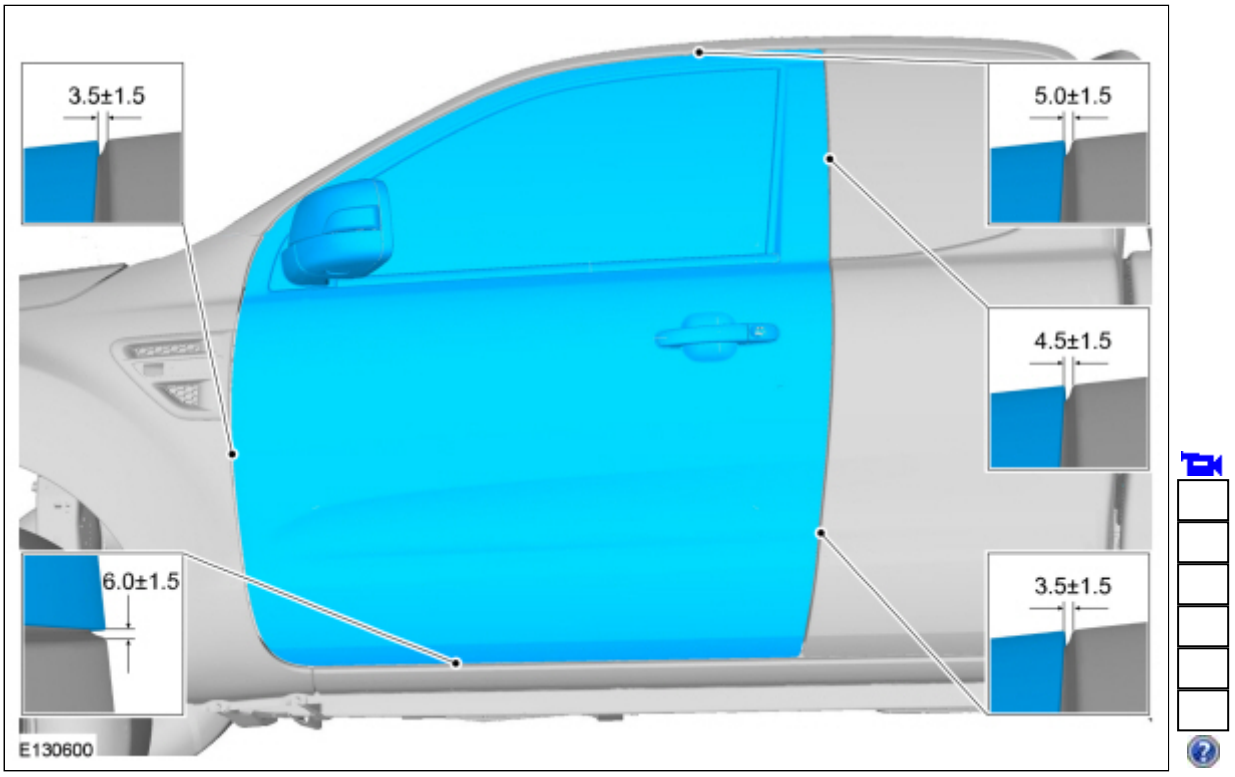
Copyright © 2016 Ford Motor Company

Front Door Alignment - Super Cab

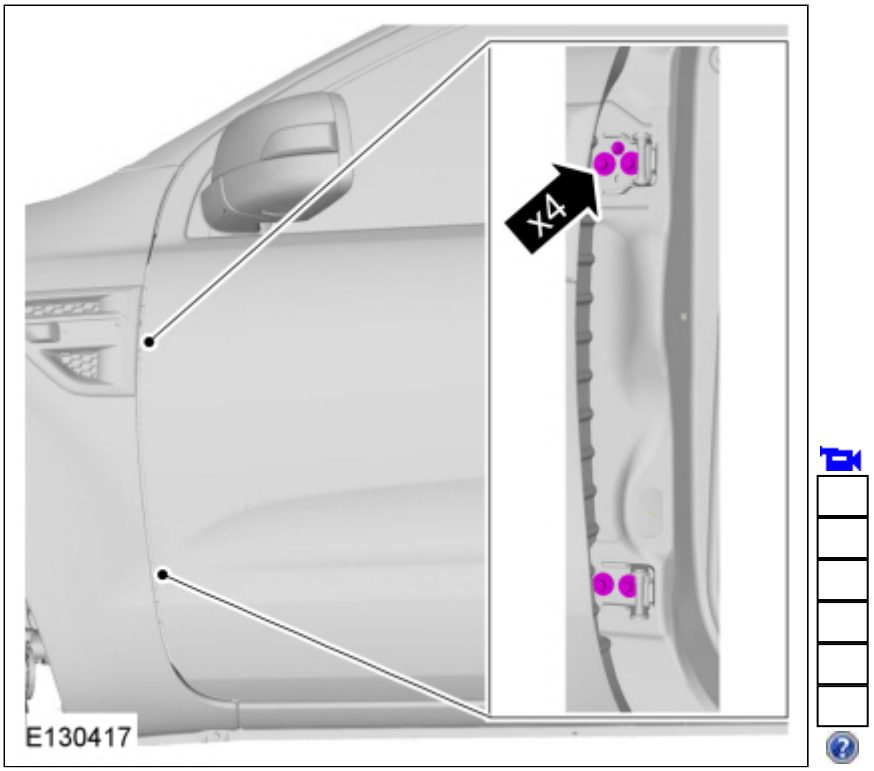
Base Part Number: 20124

Activation

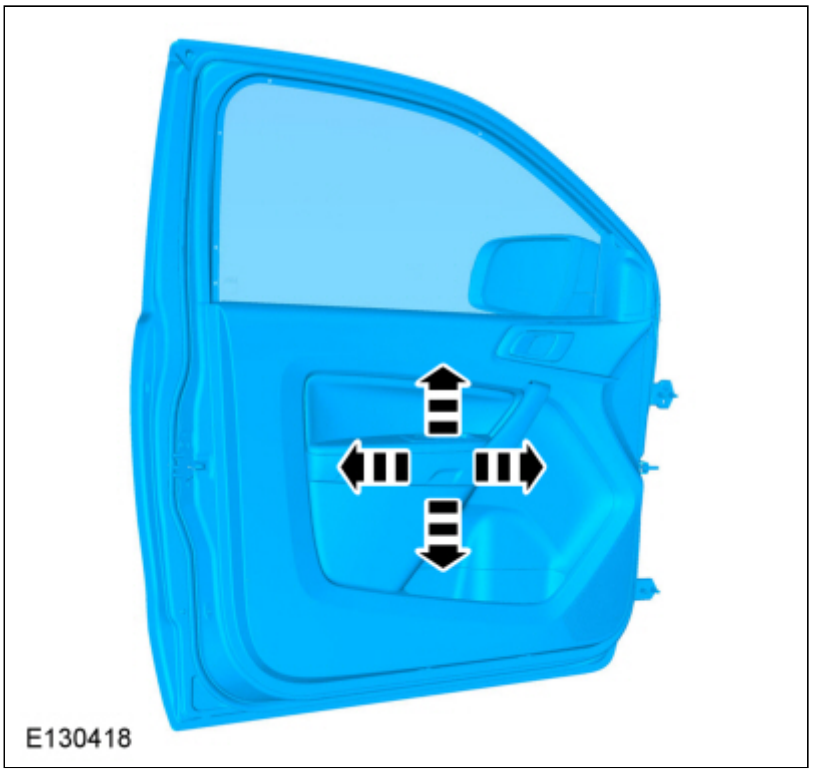
1. **NOTE:** *All the values are in mm.*



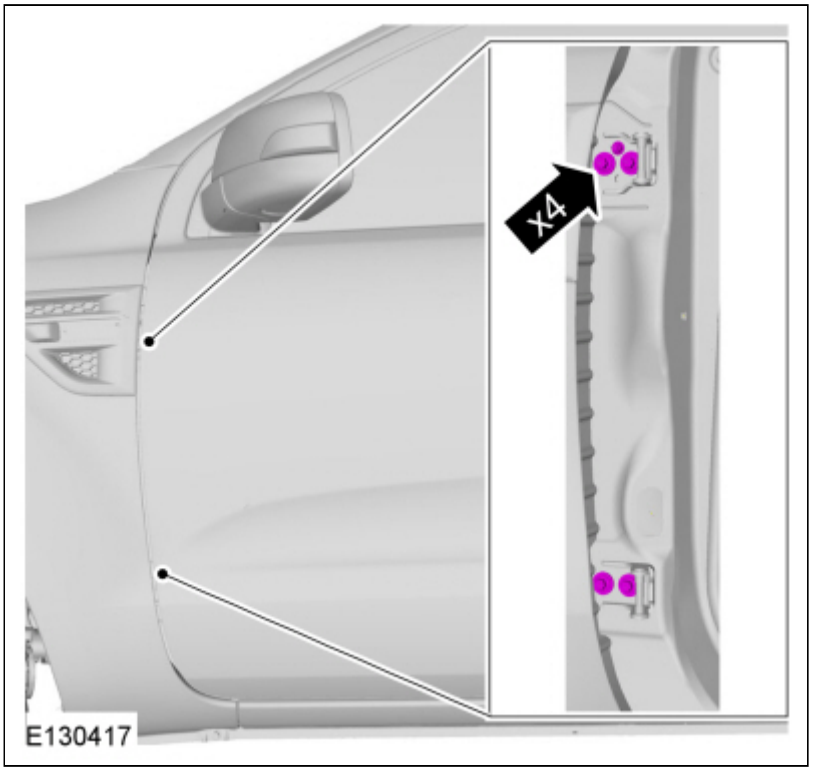
2. Loosen one complete turn.



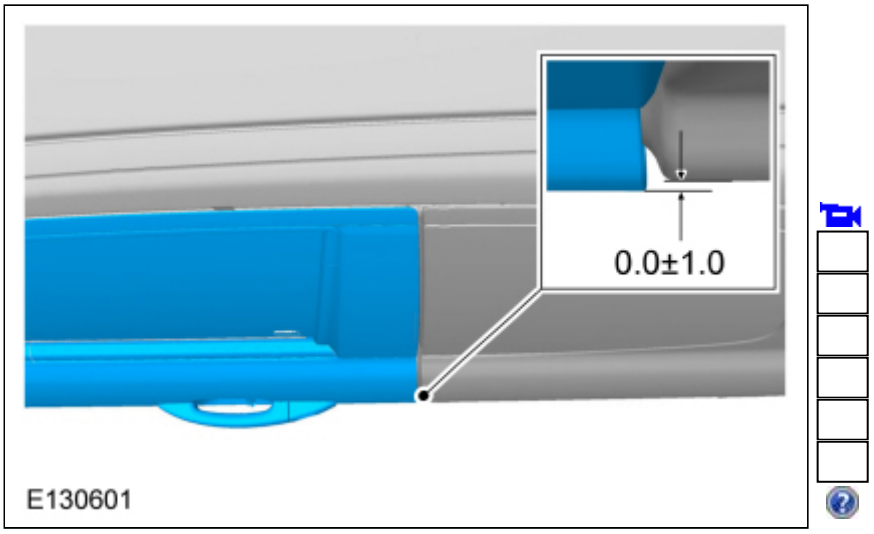
3.



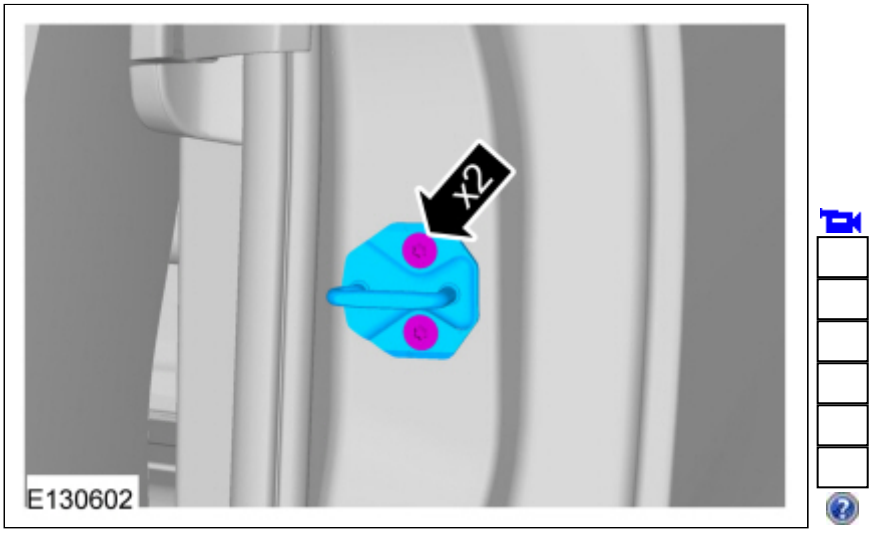
4. *Torque*: 25 Nm



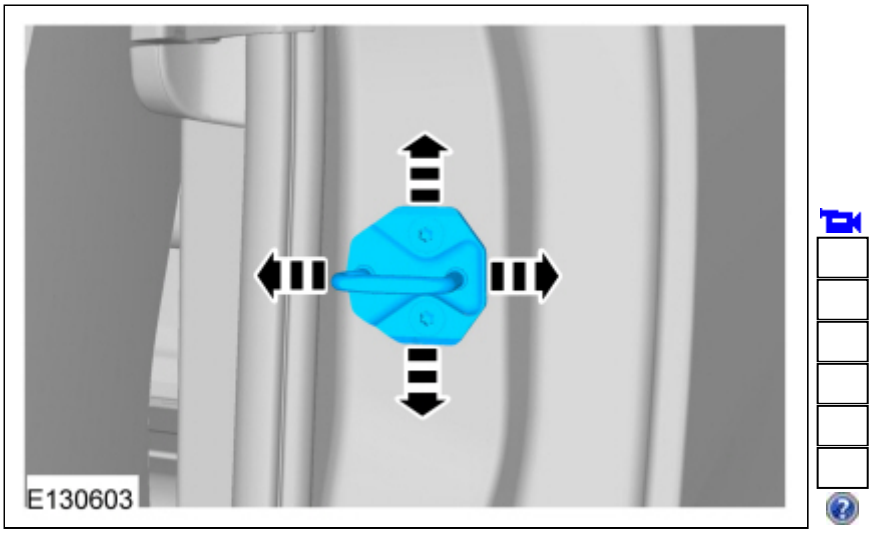
5. **NOTE:** *All the values are in mm.*



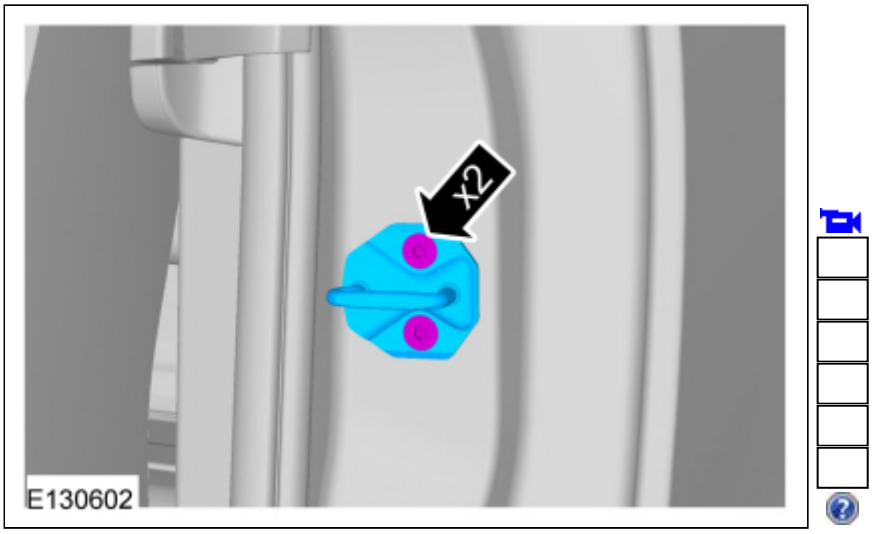
6. Loosen one complete turn.



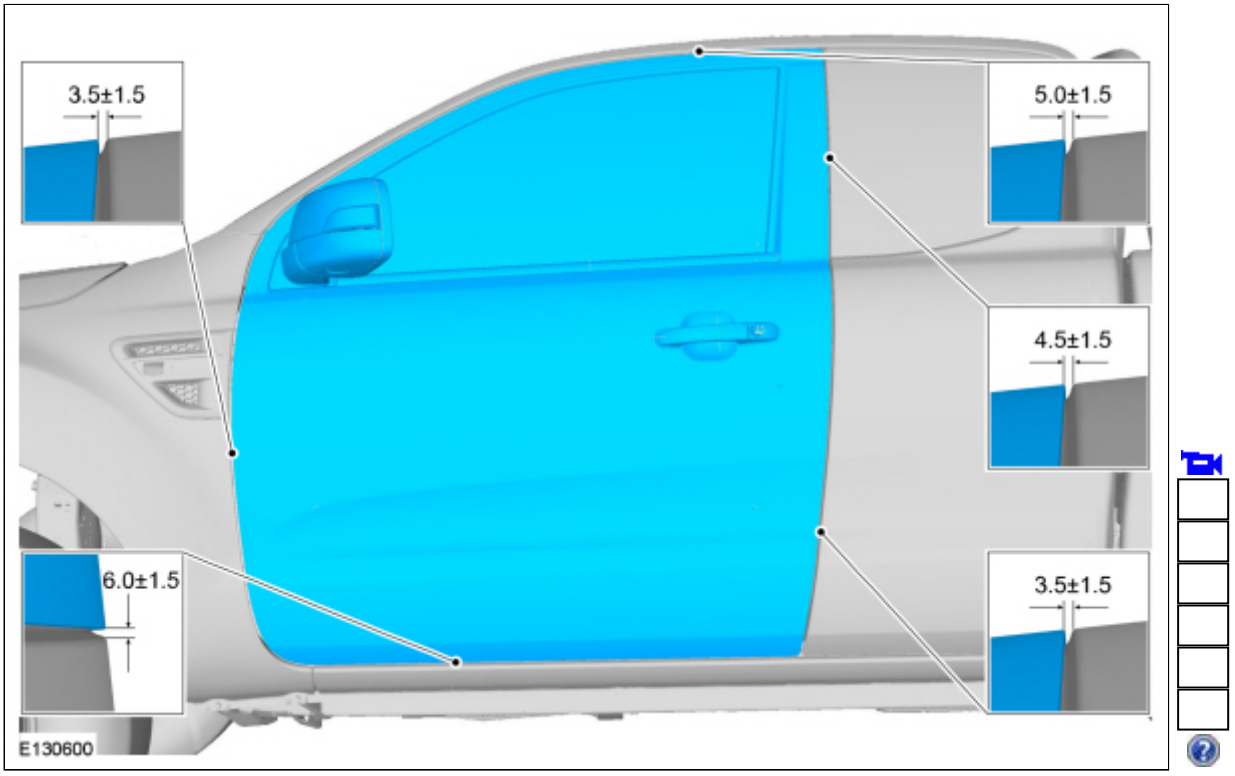
7.



8. *Torque*: 20 Nm



9. **NOTE:** *All the values are in mm.*



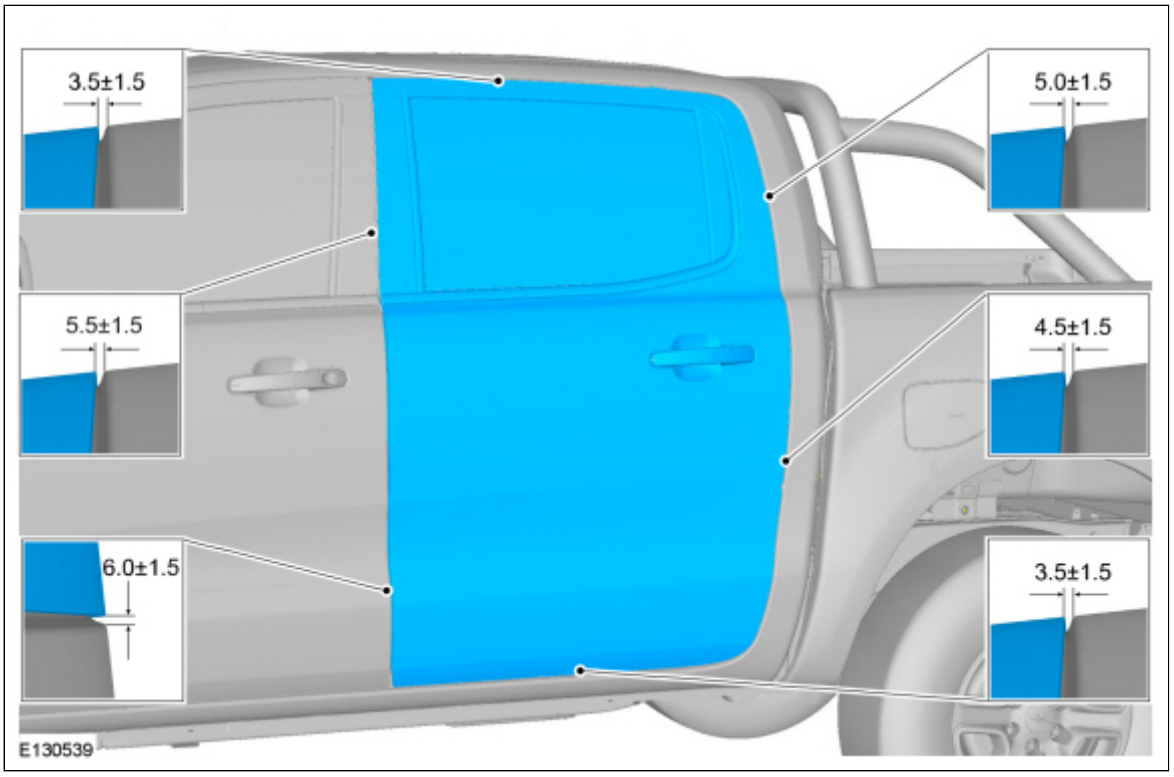
Copyright © 2016 Ford Motor Company

Rear Door Alignment - Double Cab

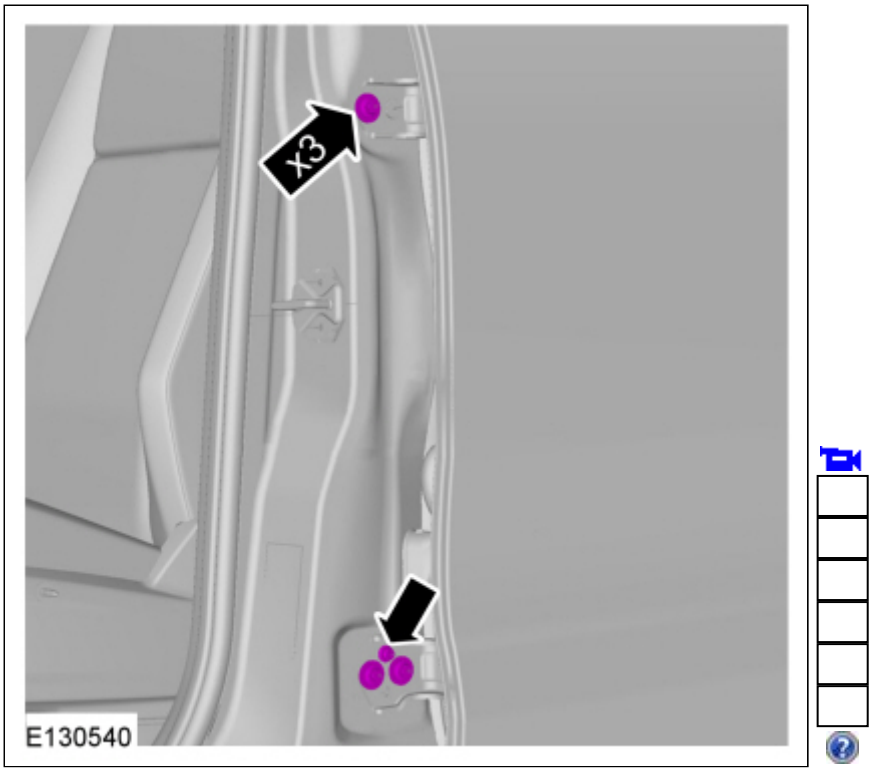
Base Part Number: 24630

Activation

1. **NOTE:** *All the values are in mm.*



2. Loosen one complete turn.

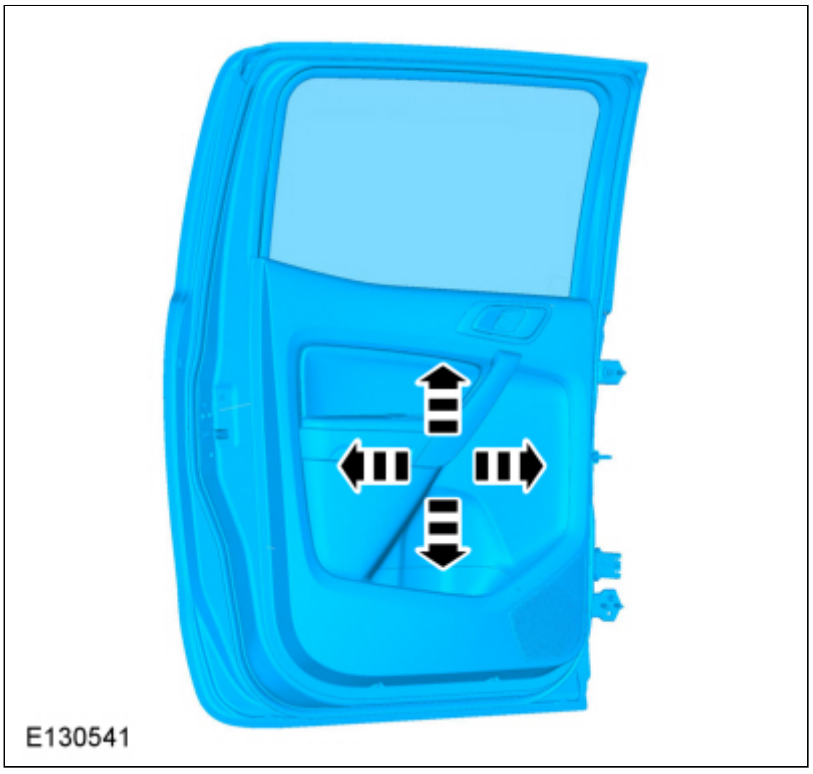


3. Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

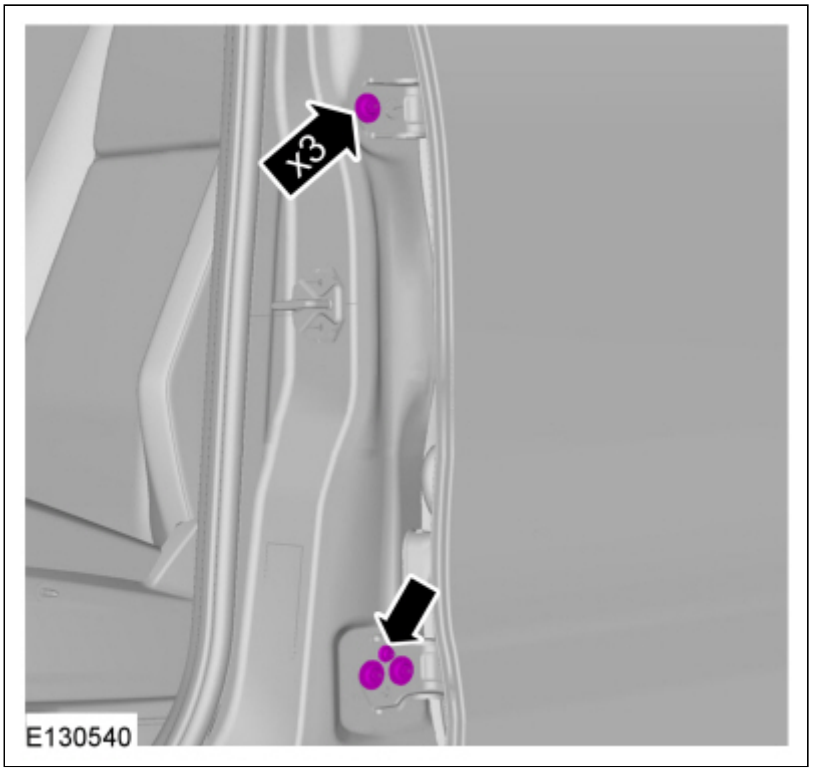
4. Loosen one complete turn.



5.



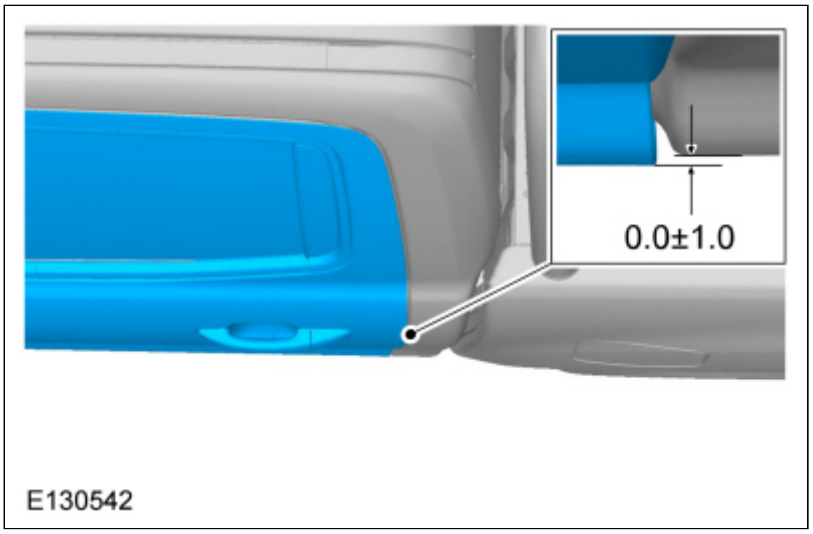
6. *Torque*: 35 Nm



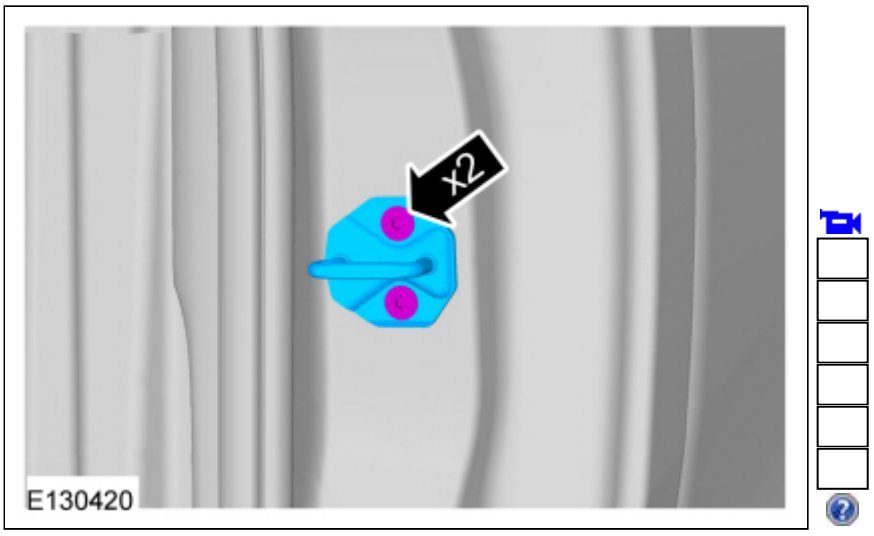
7. *Torque*: 35 Nm



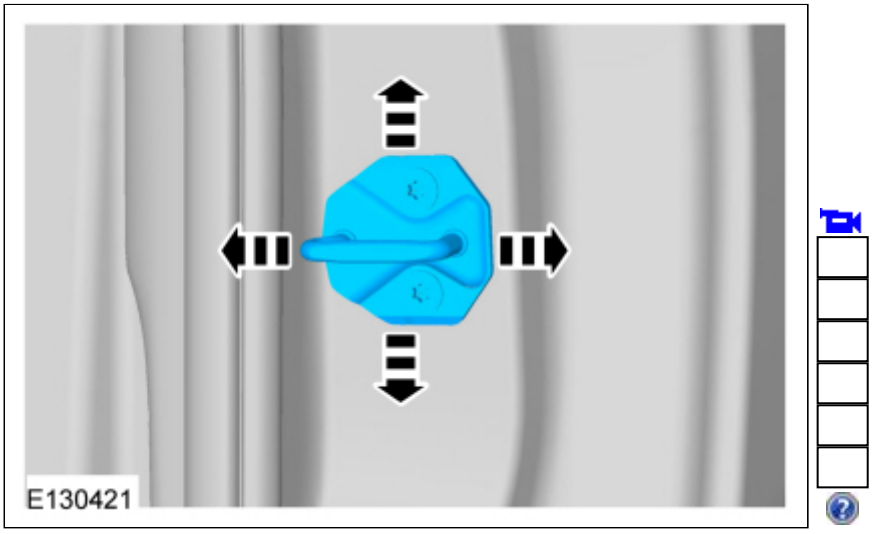
8. **NOTE:** *All the values are in mm.*



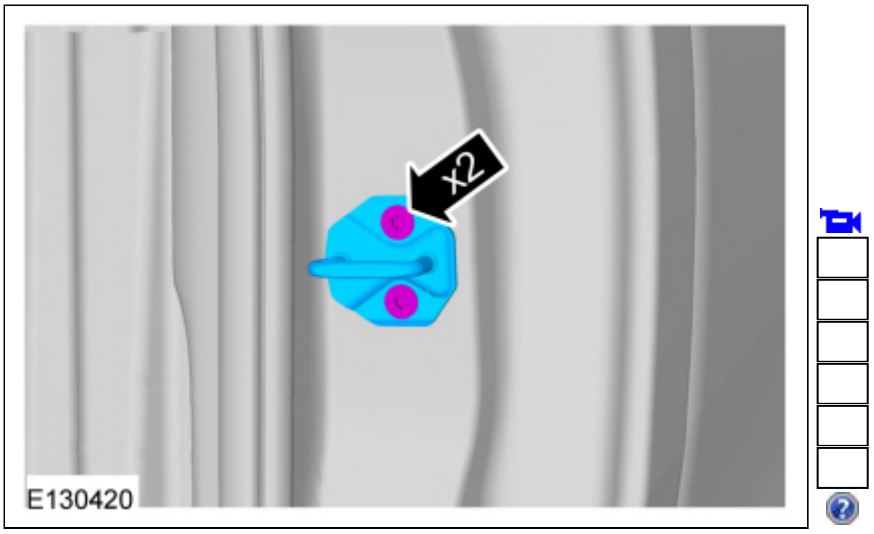
9. Loosen one complete turn.



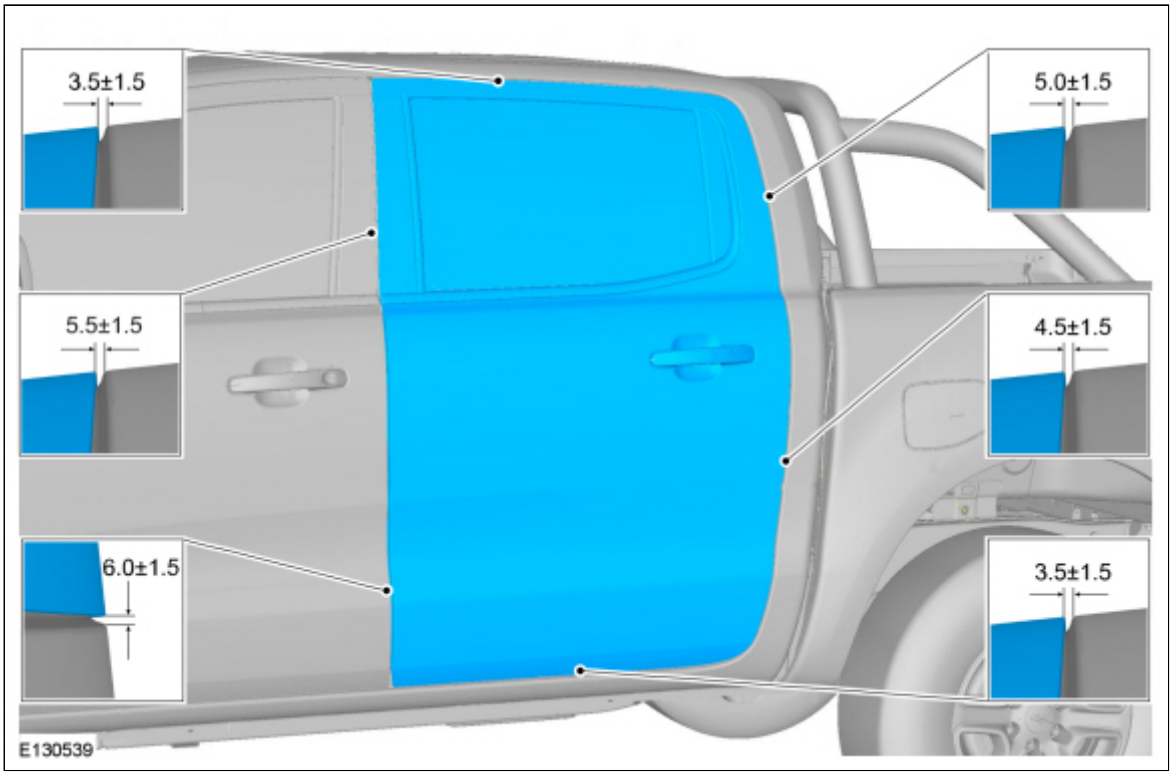
10.



11. *Torque*: 20 Nm



12. **NOTE:** *All the values are in mm.*



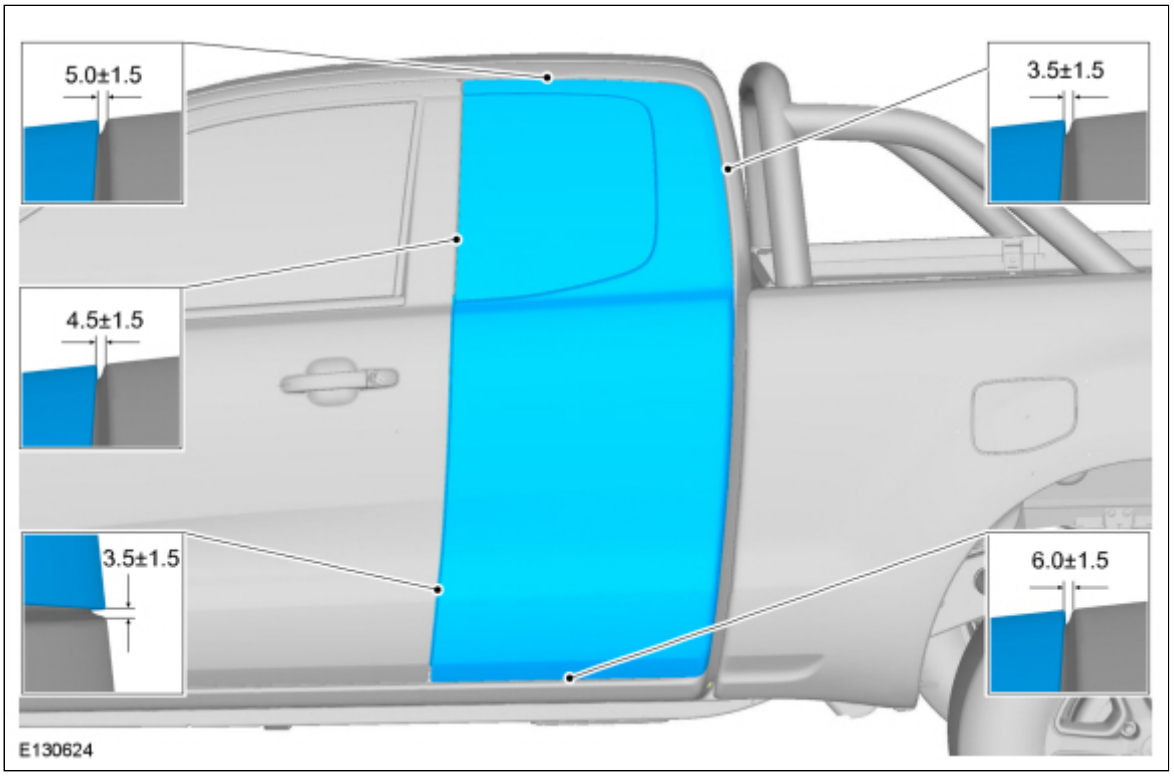
Copyright © 2016 Ford Motor Company

Rear Door Alignment - Super Cab

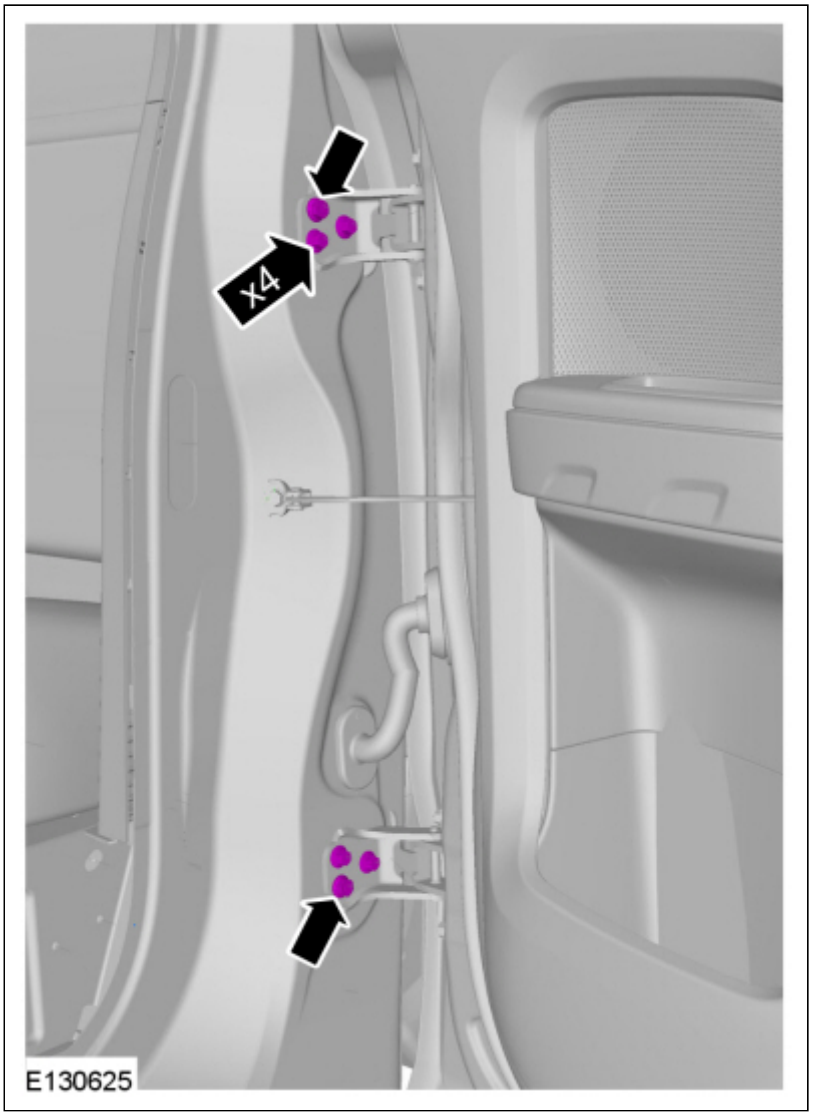
Base Part Number: 24630

Activation

1. **NOTE:** *All the values are in mm.*



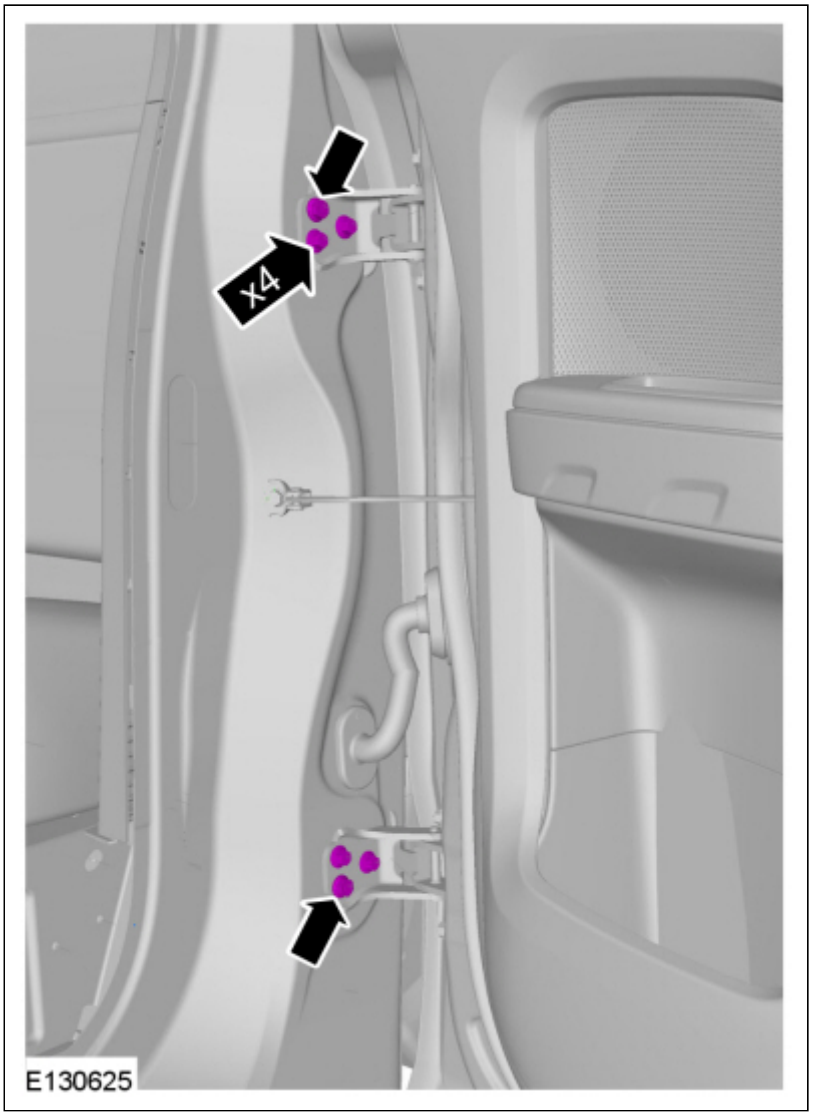
2. Loosen one complete turn.



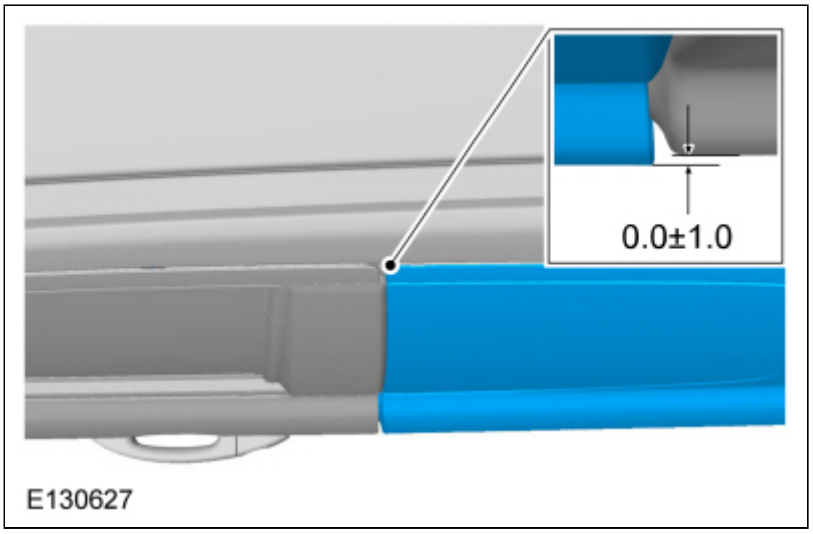
3.



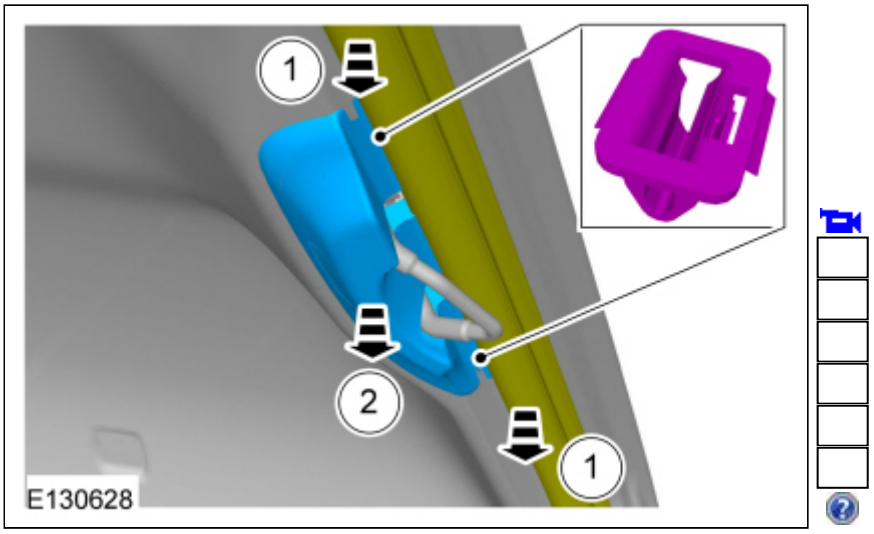
4. *Torque*: 35 Nm



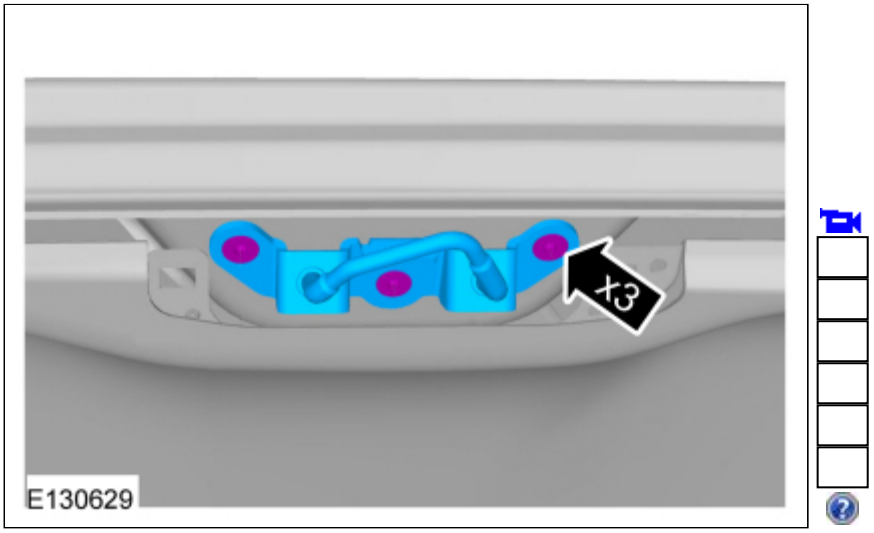
5. **NOTE:** *All the values are in mm.*



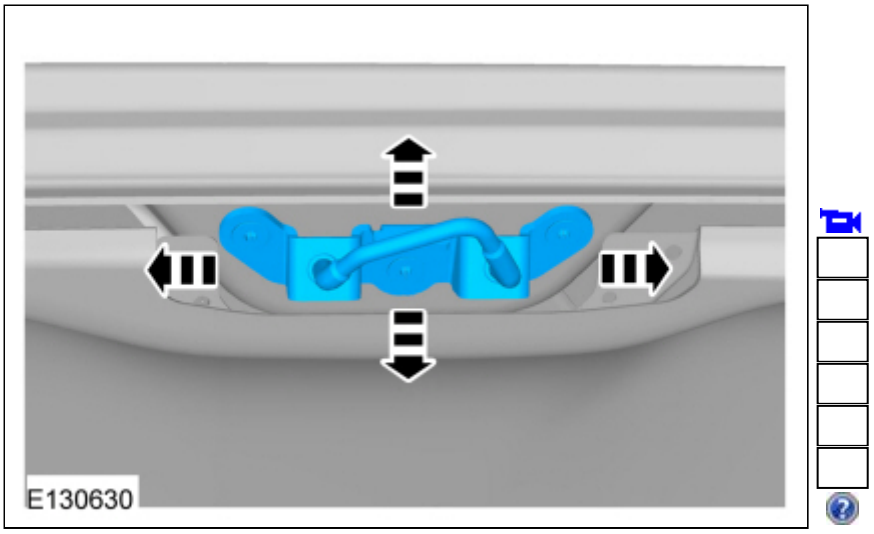
6.



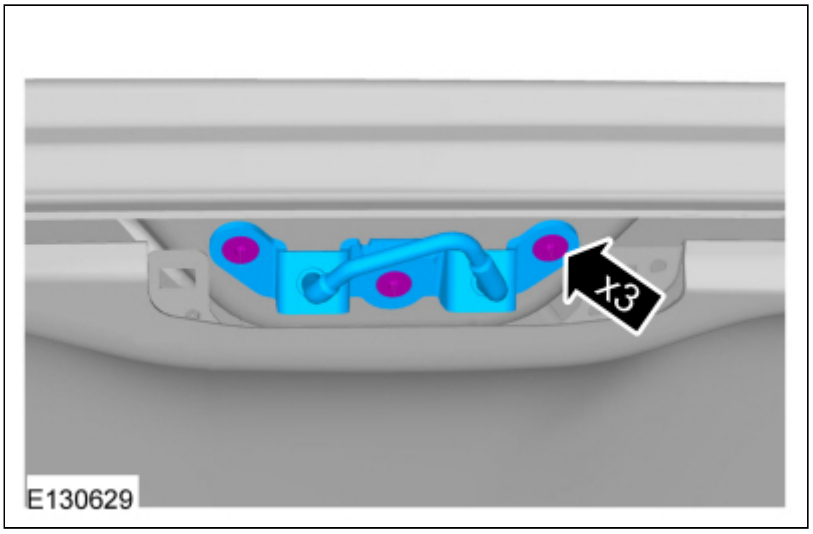
7. Loosen one complete turn.



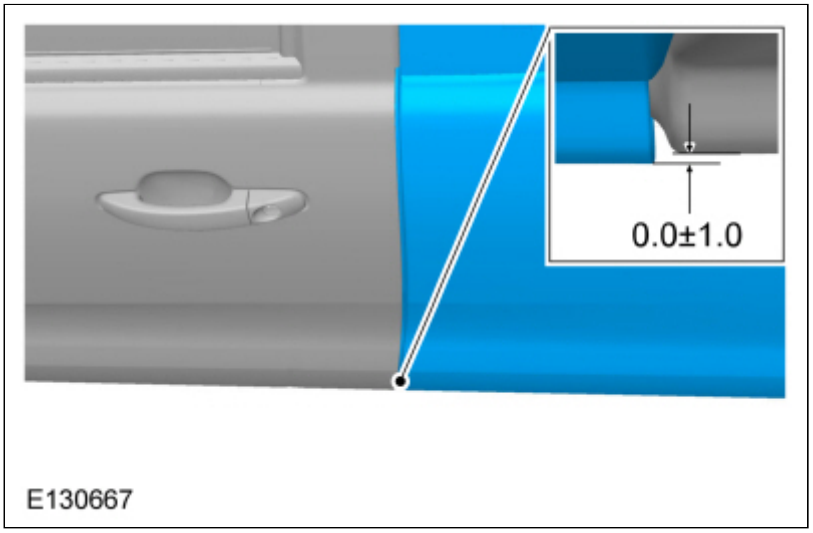
8.



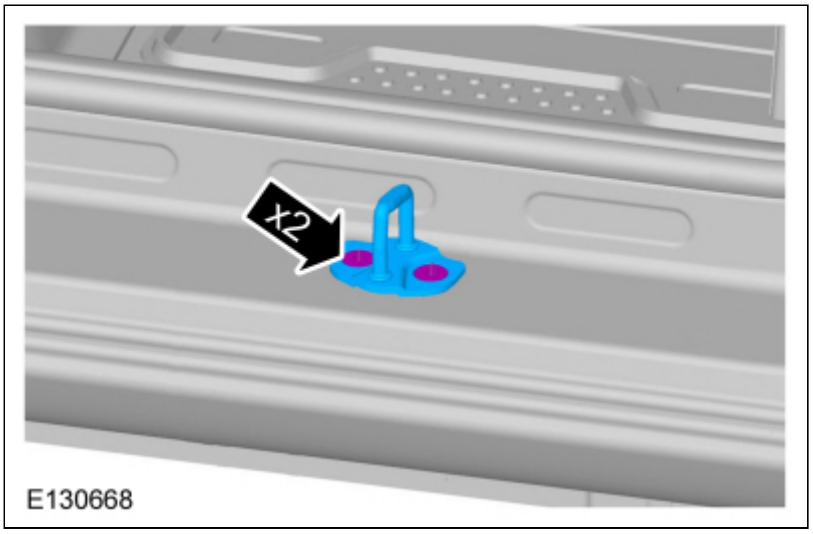
9. *Torque*: 10 Nm



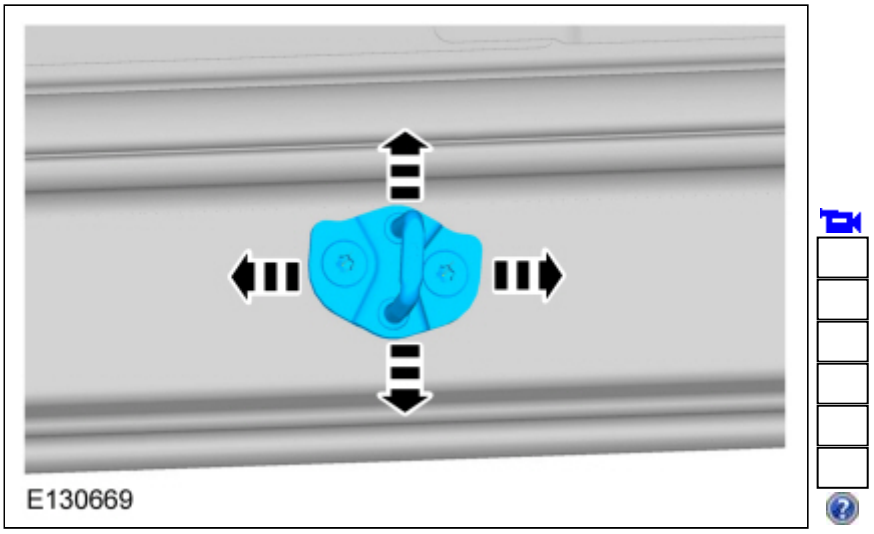
10.



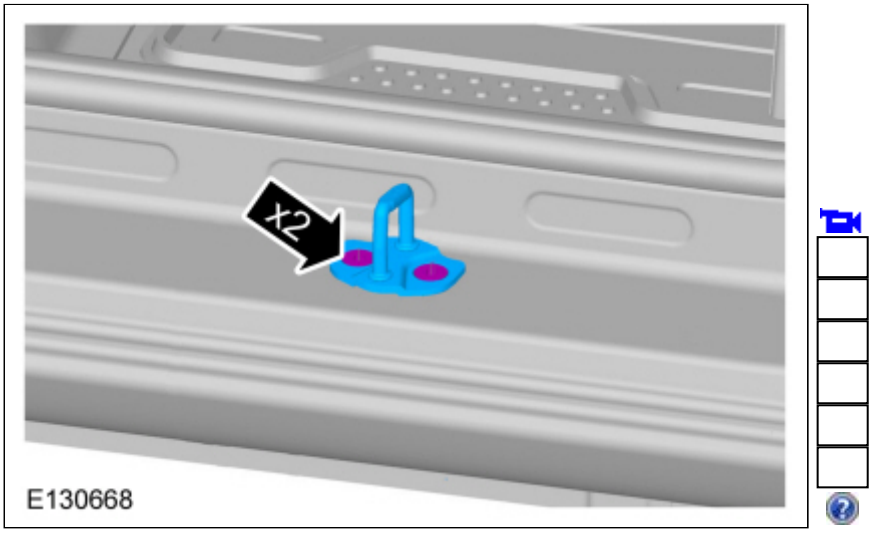
11. Loosen one complete turn.



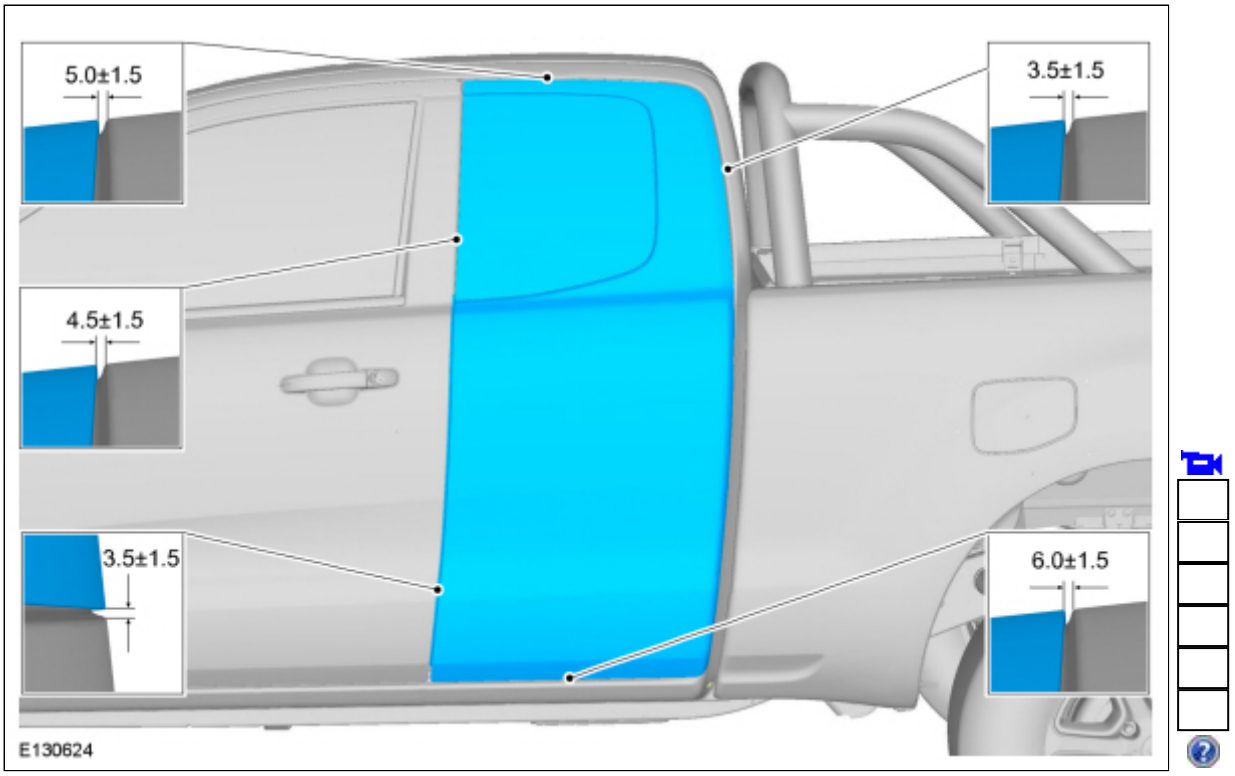
12. *Torque*: 20 Nm



13. *Torque*: 10 Nm



14. **NOTE:** *All the values are in mm.*



Copyright © 2016 Ford Motor Company

Liftgate Alignment

Activation

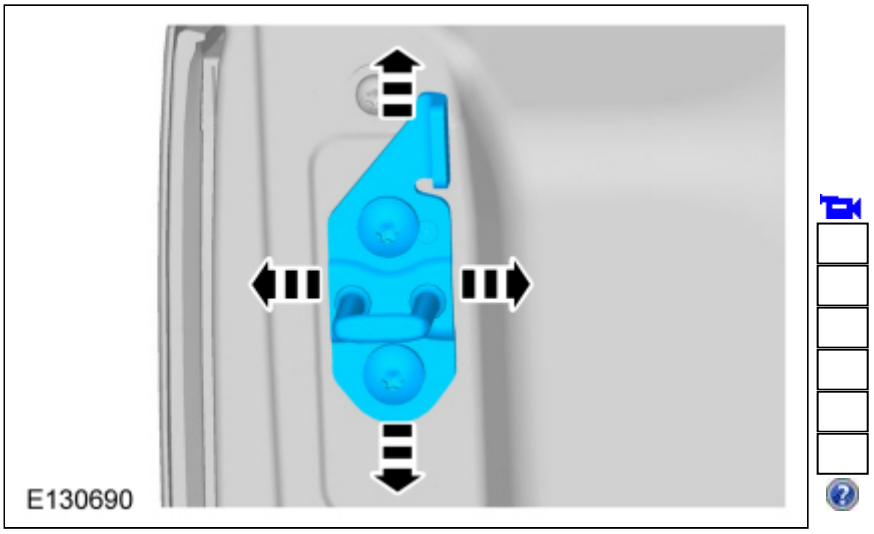
1.



2. **NOTE:** *Do not loosen the bolts more than 1 turn.*



3.



4. *Torque*: 10 Nm



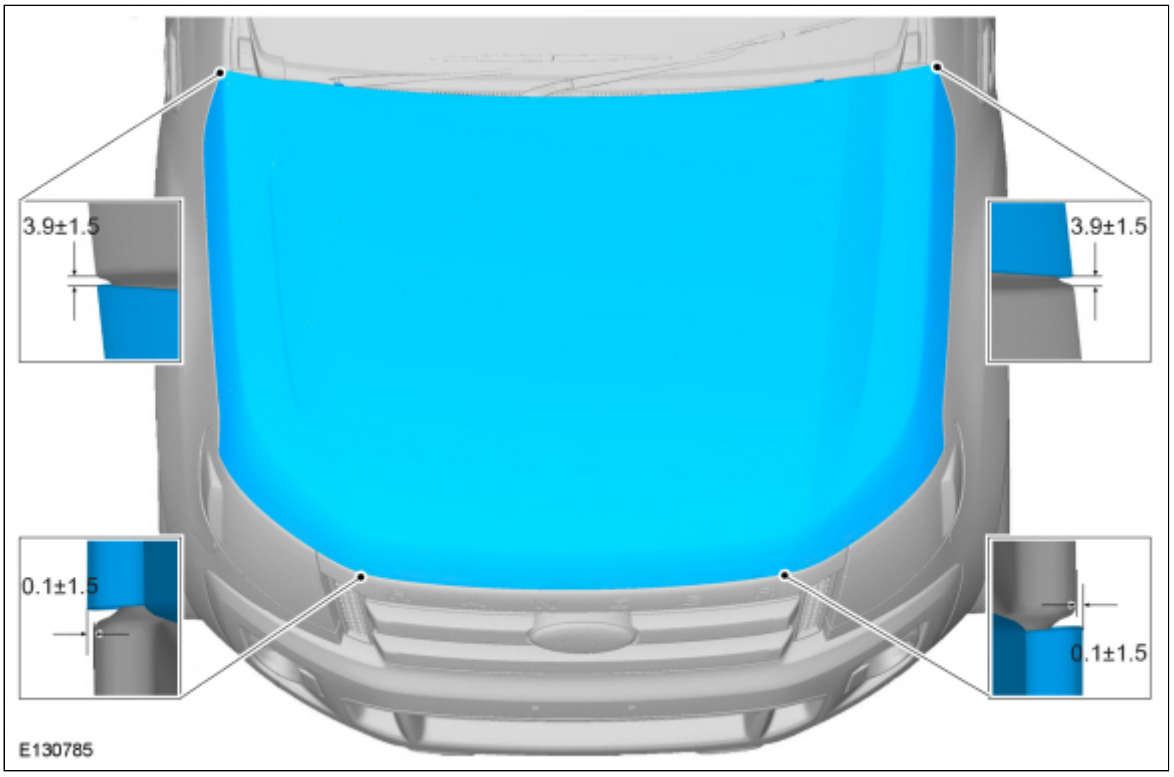
Copyright © 2016 Ford Motor Company

Hood Alignment

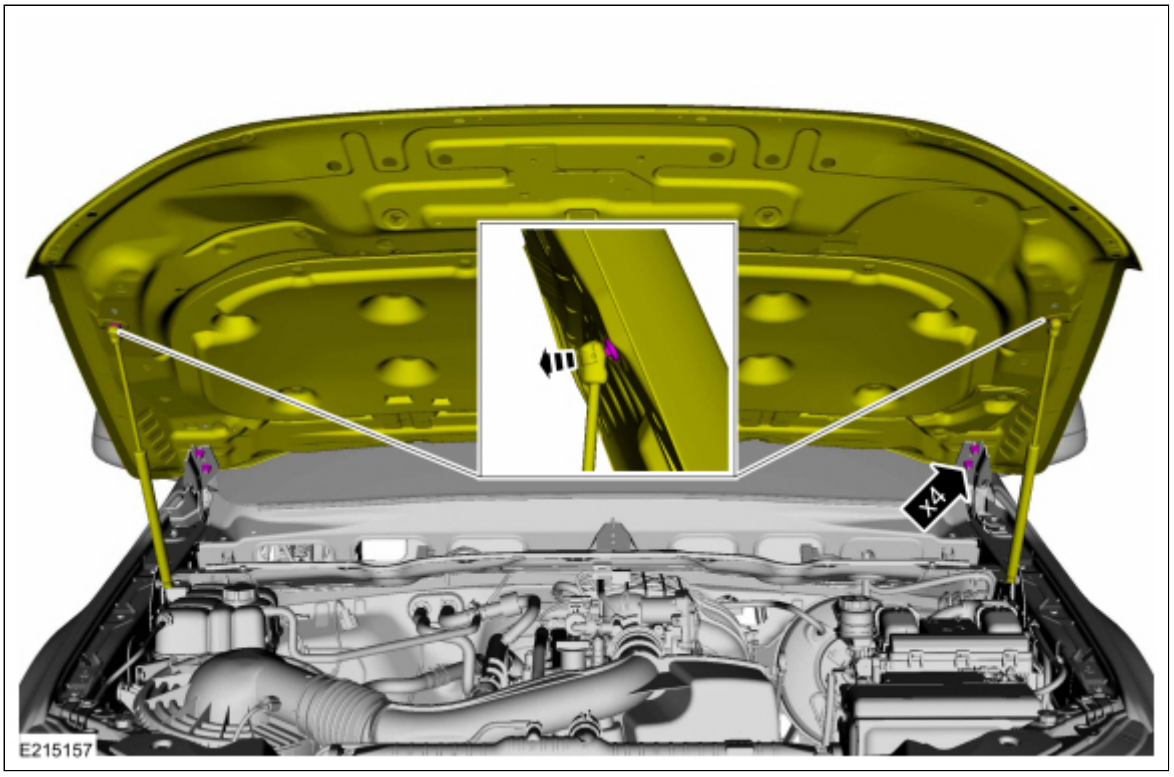
Base Part Number: 16000

Activation

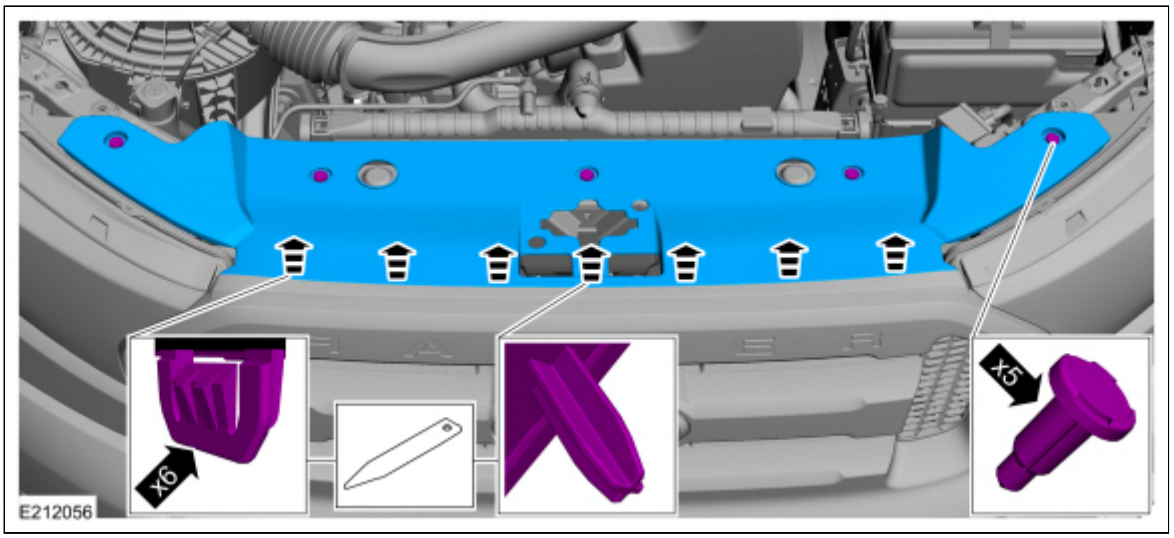
1. **NOTE:** *All the values are in mm.*



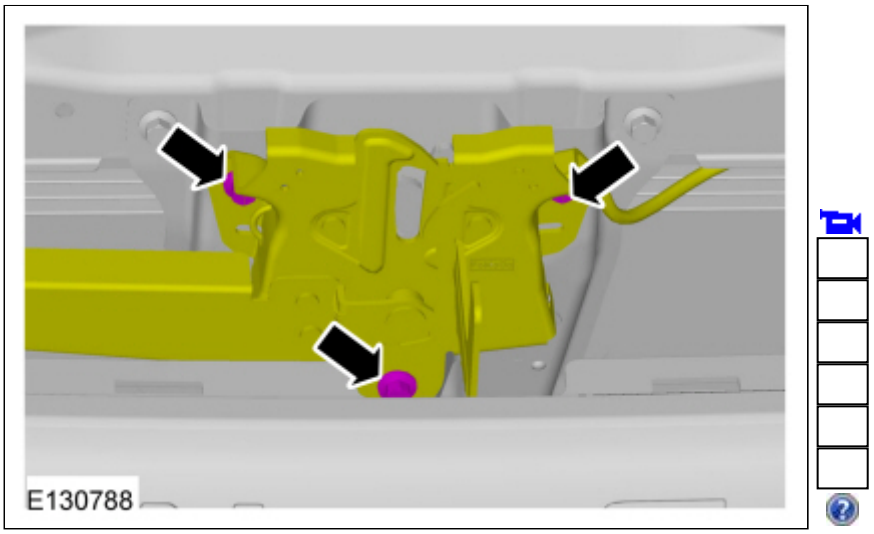
2. Loosen one complete turn.



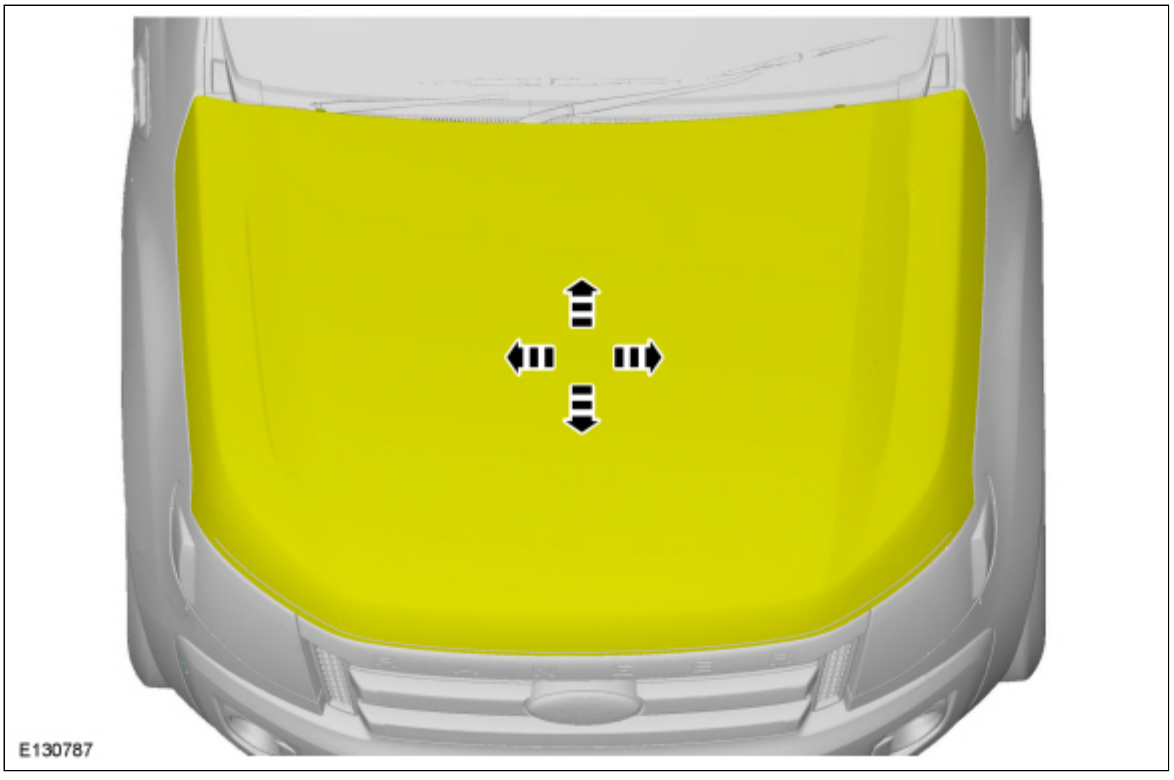
3.



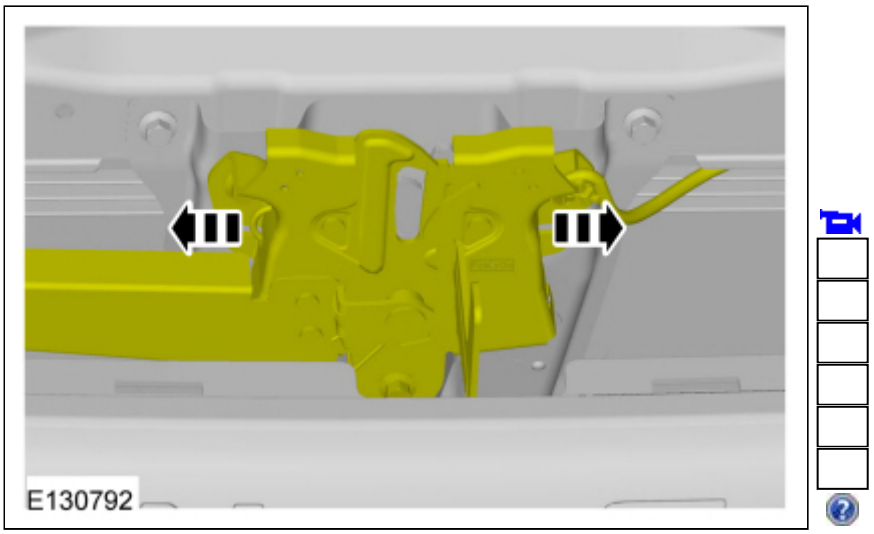
4. Loosen one complete turn.



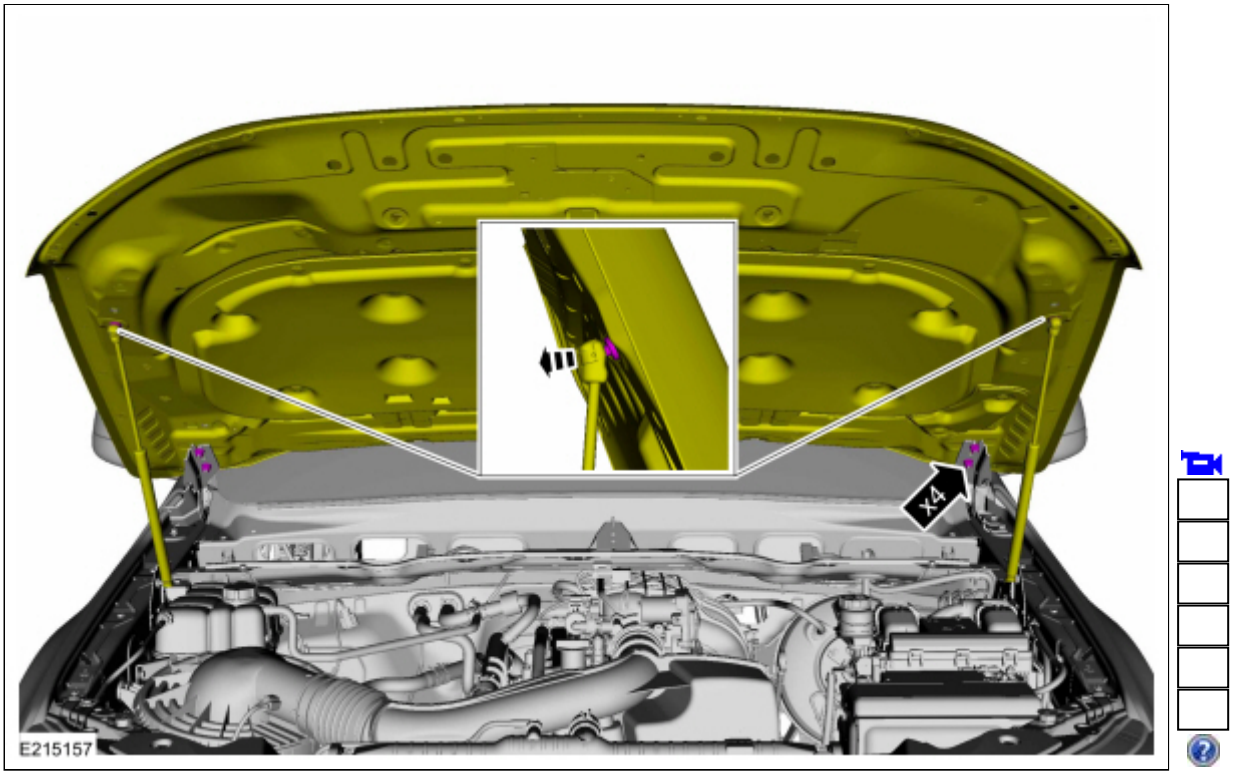
5.



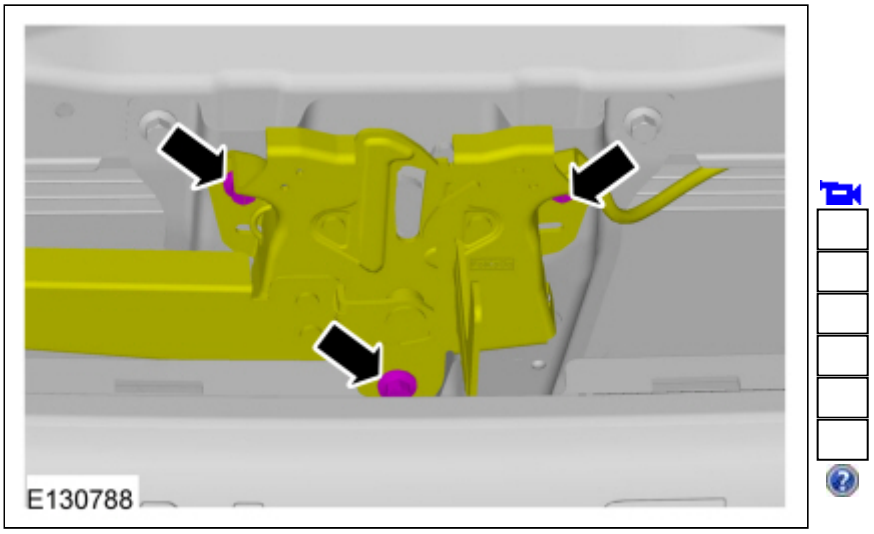
6.



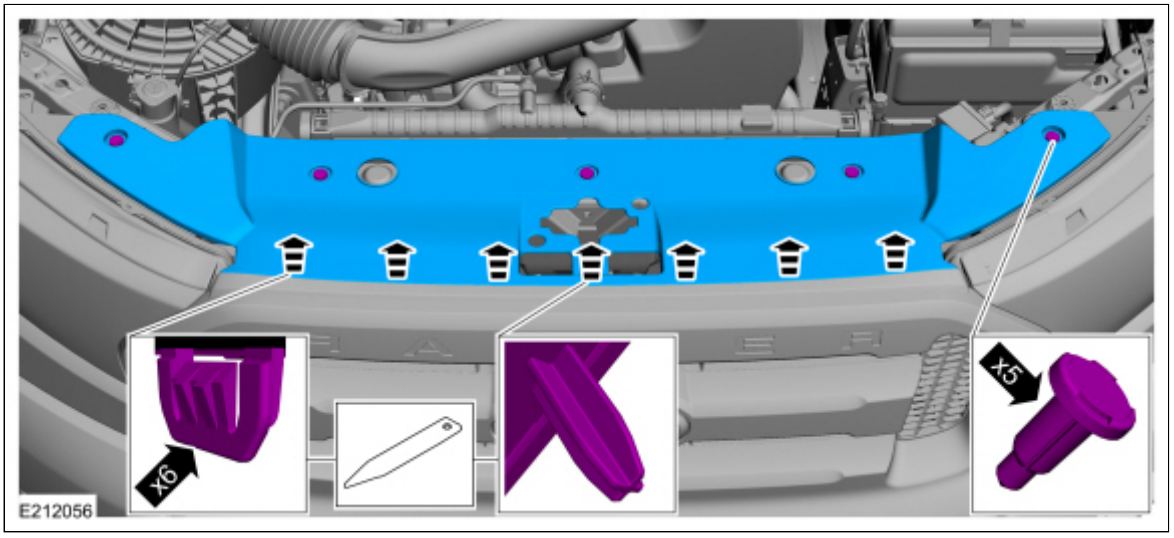
7. Check the area for paintwork damage and repair if necessary.
   Torque: 25 Nm



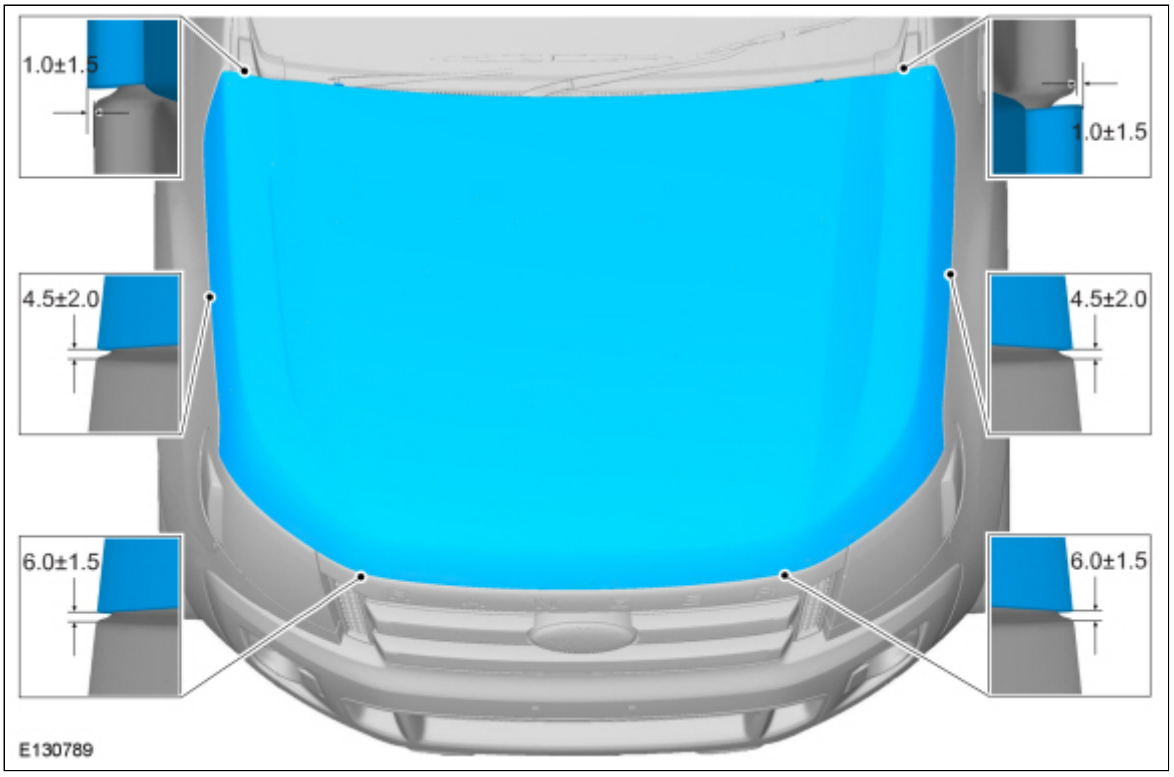
8. *Torque*: 10 Nm



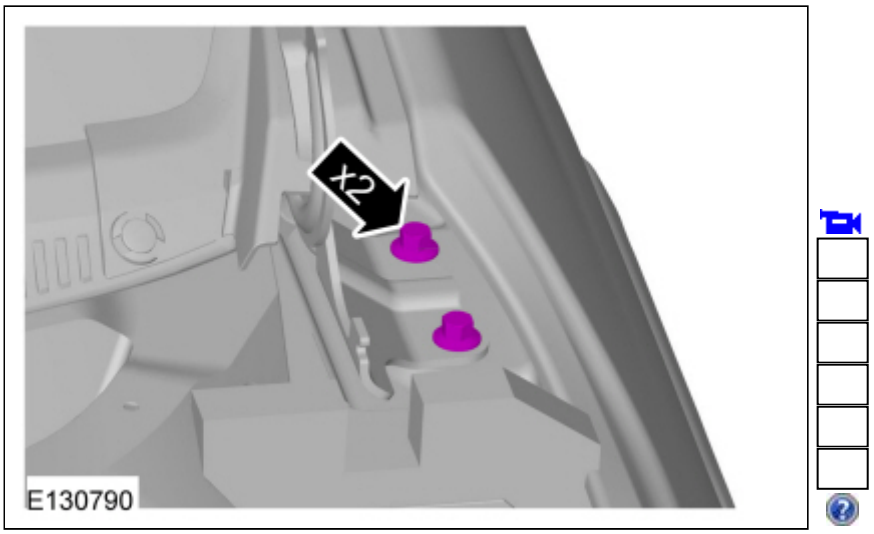
9.



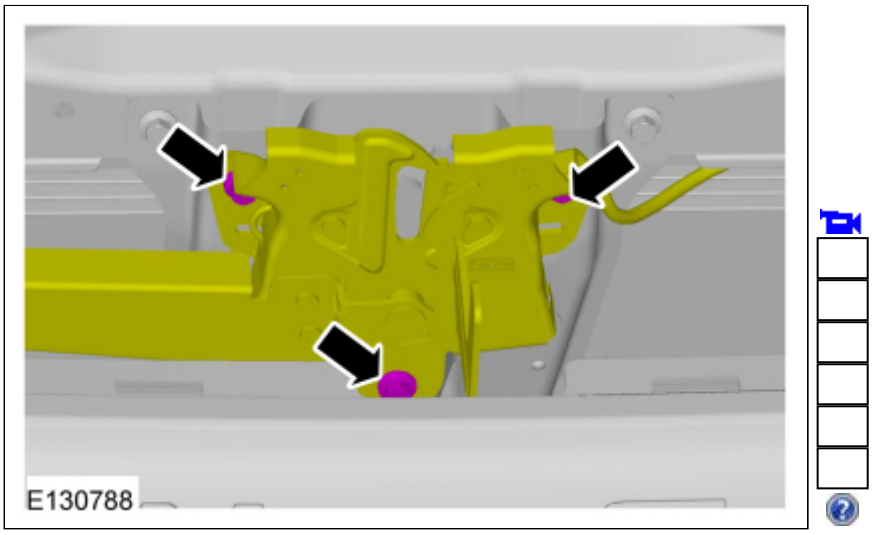
10. **NOTE:** *All the values are in mm.*



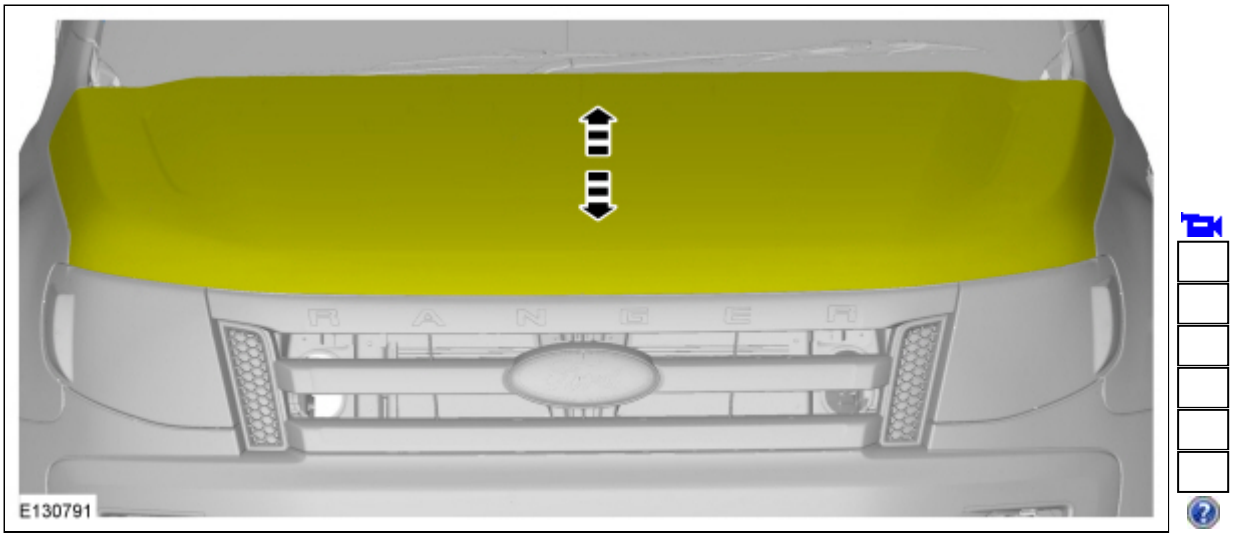
11. Loosen one complete turn.



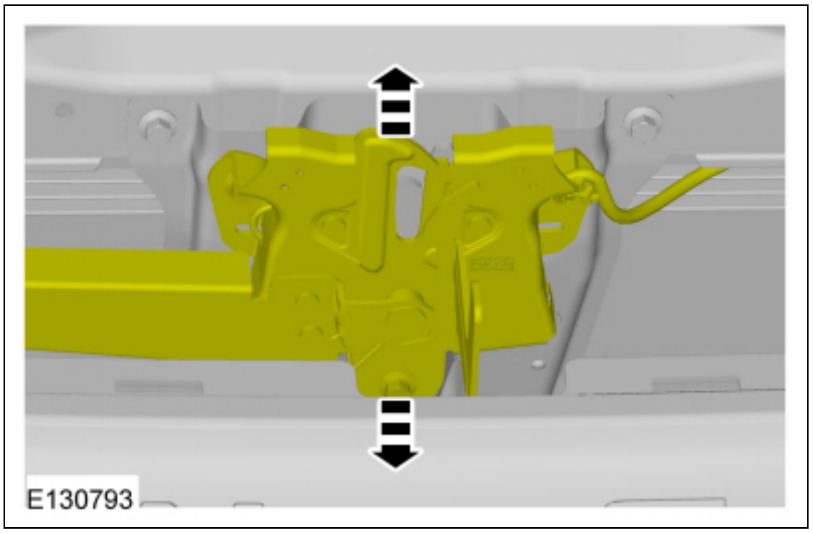
12. Loosen one complete turn.



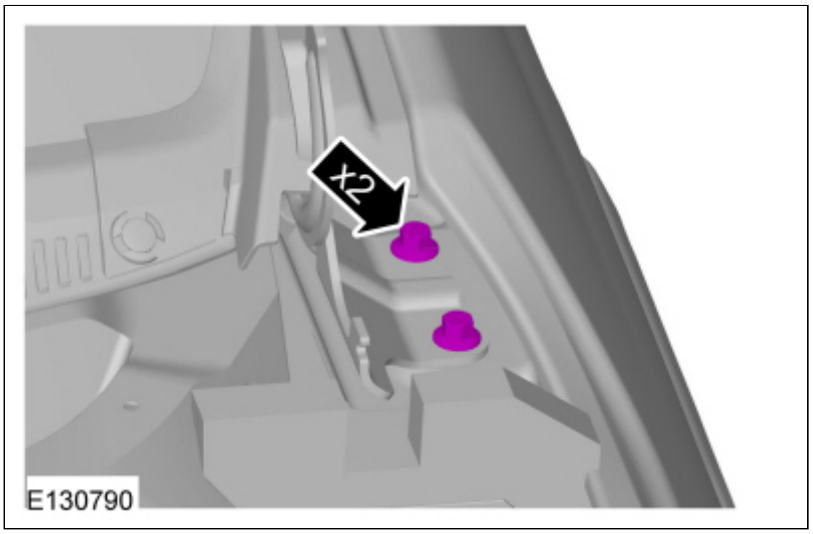
13.



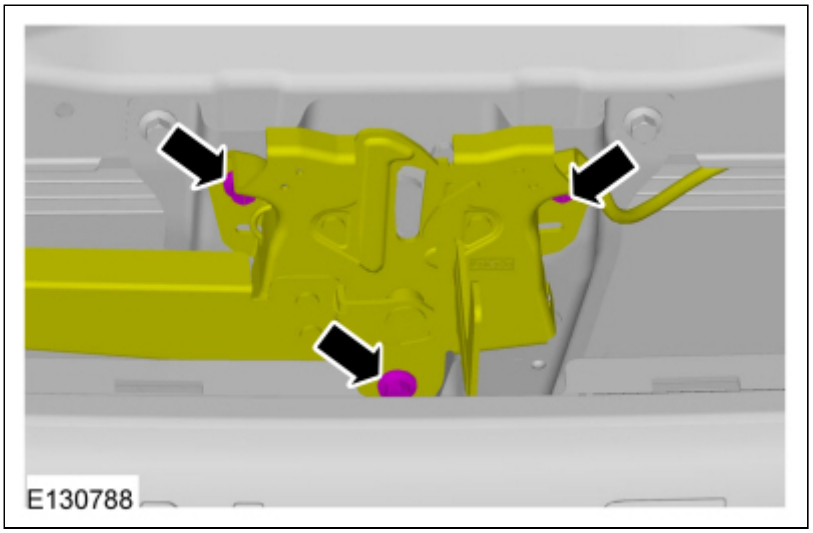
14.



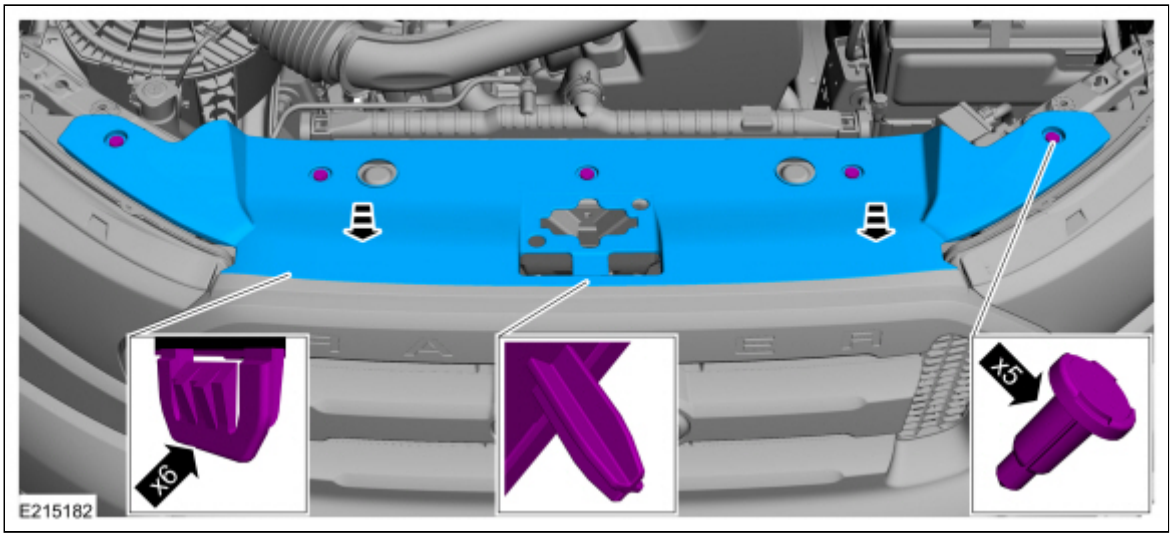
15. Check the area for paintwork damage and repair if necessary.
    Torque: 25 Nm



16. *Torque*: 10 Nm



17.

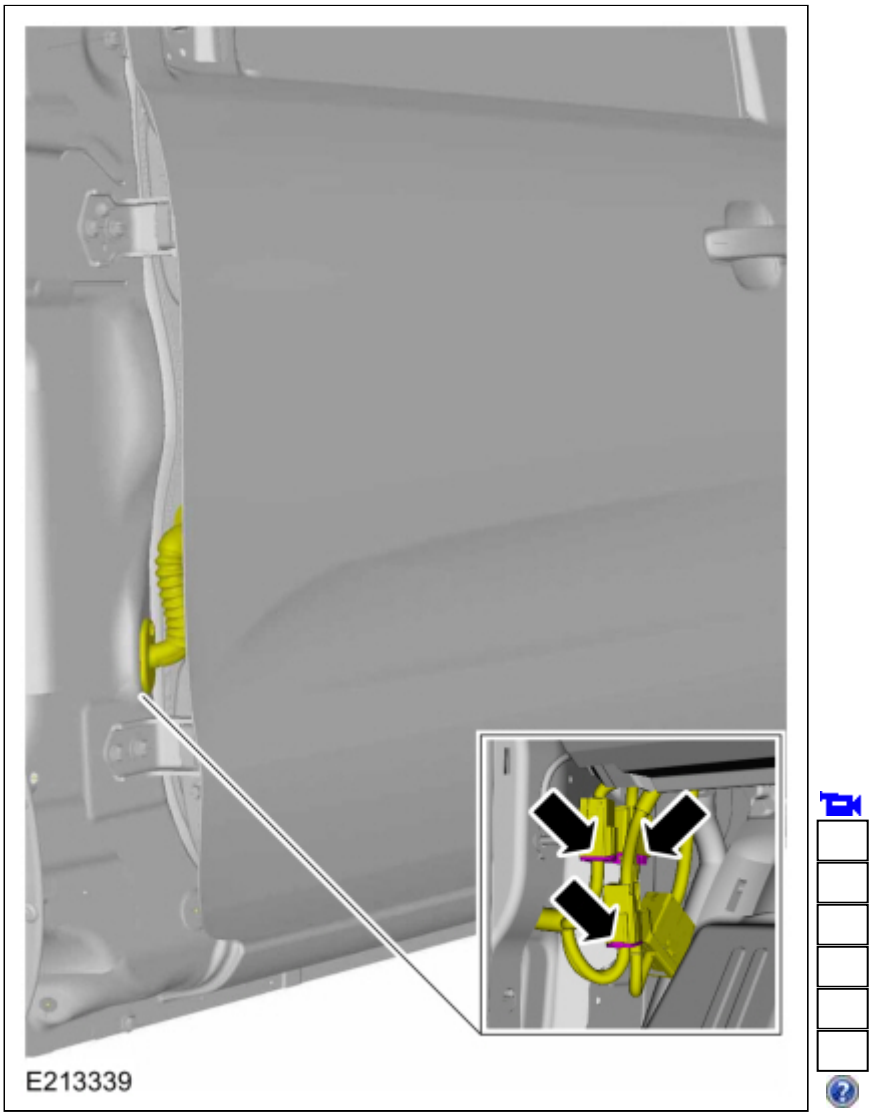


Copyright © 2016 Ford Motor Company

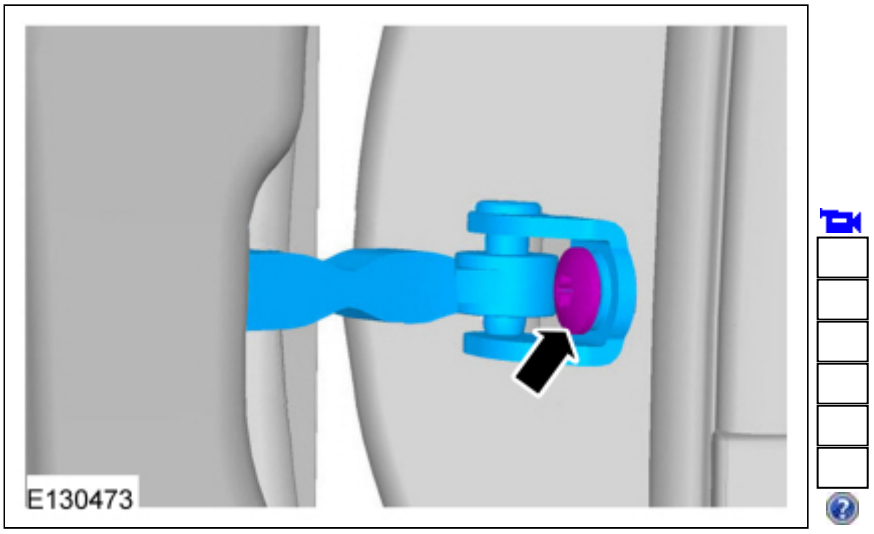
Door - Single Cab

Removal

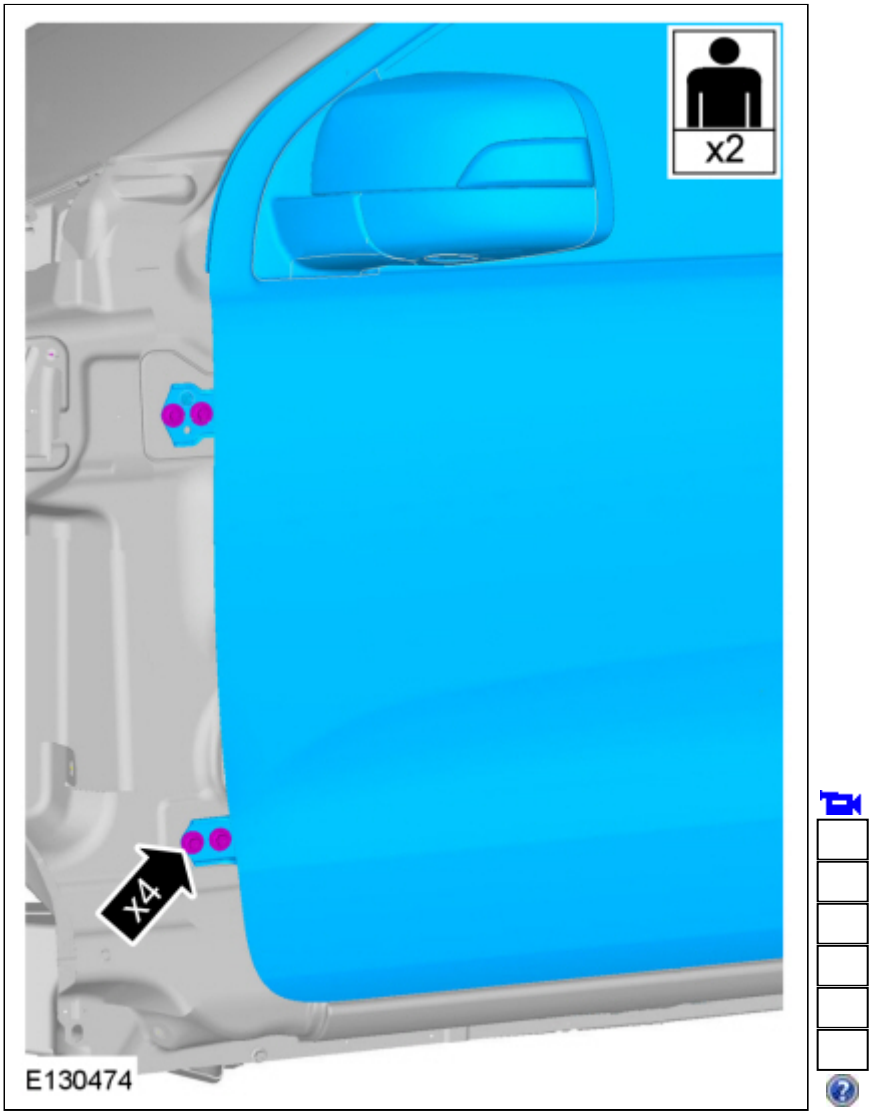
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
4. 

5. *Torque*: 25 Nm



6. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Door Alignment - Single Cab (501-03 Body Closures, General Procedures).

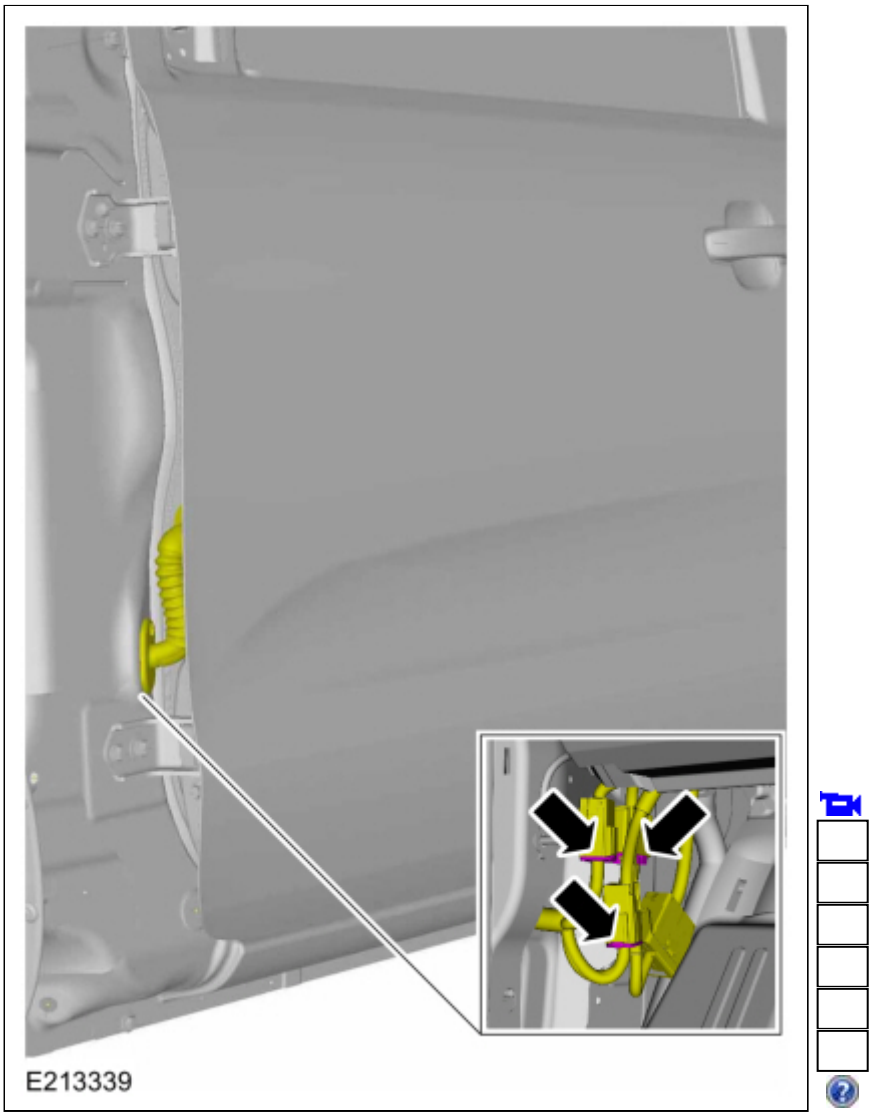
Copyright © 2016 Ford Motor Company

Front Door

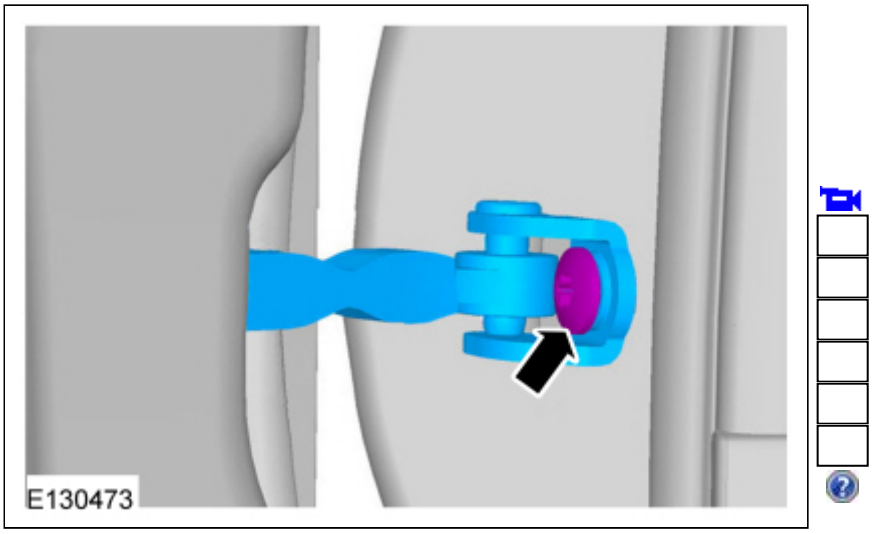
Base Part Number: 20124

Removal

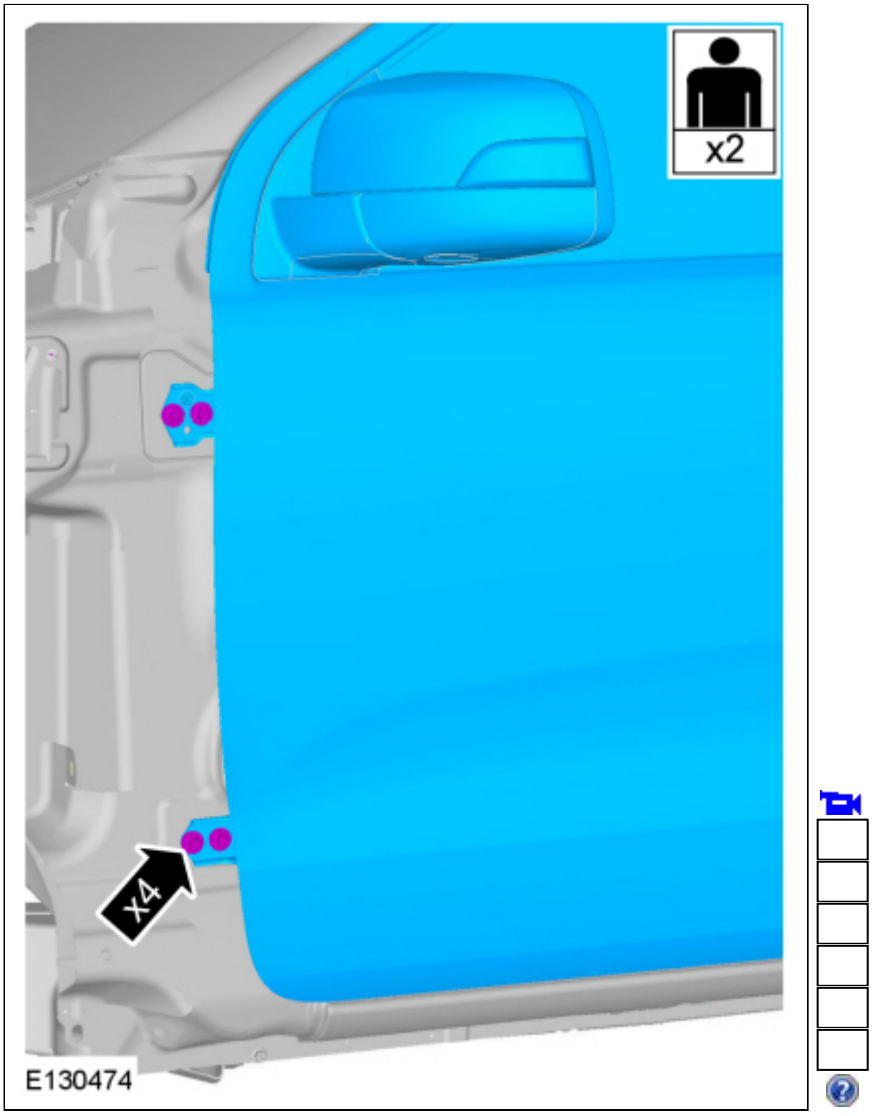
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
4. 

5. *Torque*: 25 Nm



6. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Front Door Alignment - Double Cab (501-03 Body Closures, General Procedures).
   Refer to: Front Door Alignment - Super Cab (501-03 Body Closures, General Procedures).

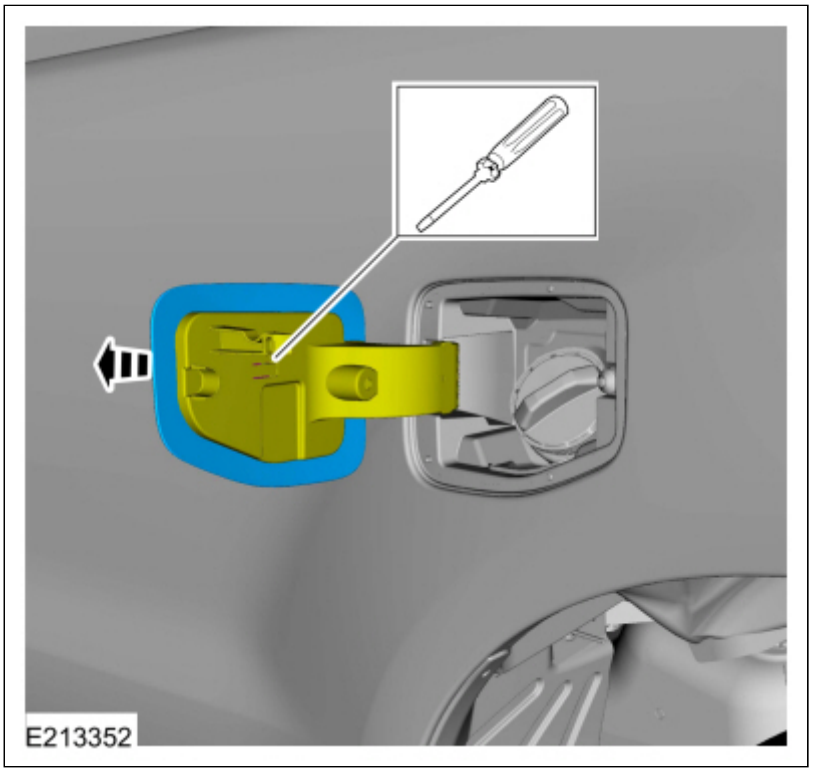
Copyright © 2016 Ford Motor Company

Fuel Filler Door

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Fuel Filler Door Assembly

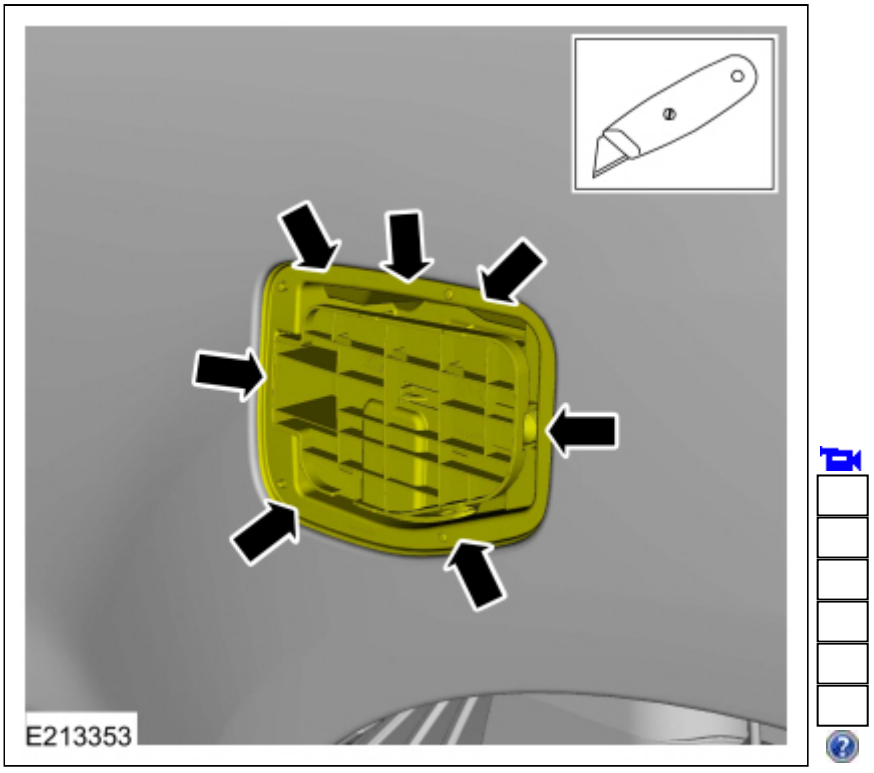
Special Tool(s) / General Equipment

Flat Headed Screw Driver
Knife

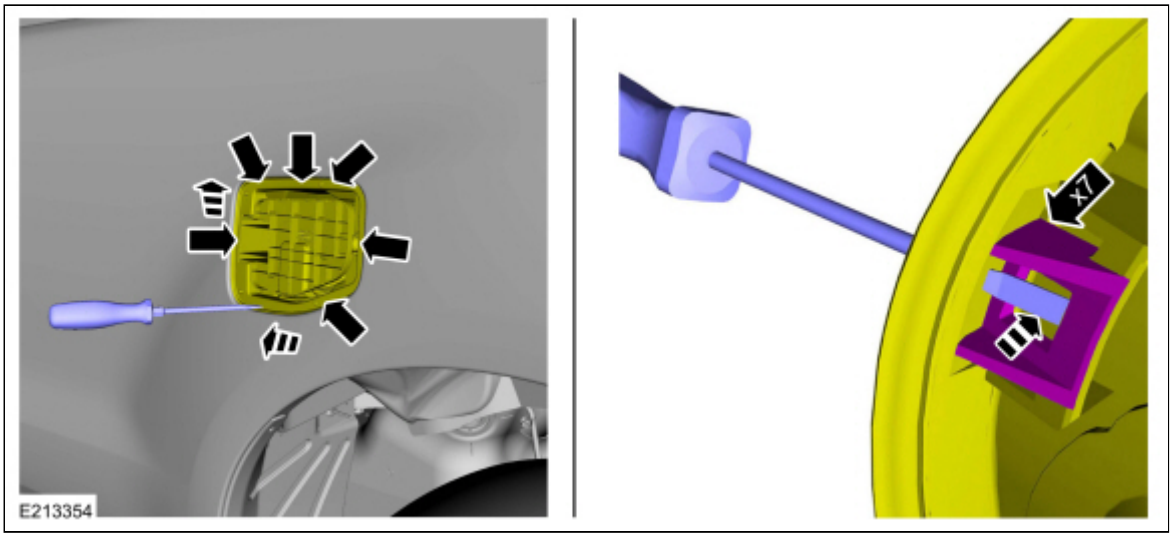
Removal

NOTE: *The fuel filler door assembly is damaged during the removal process and requires a new fuel filler door assembly installed.*

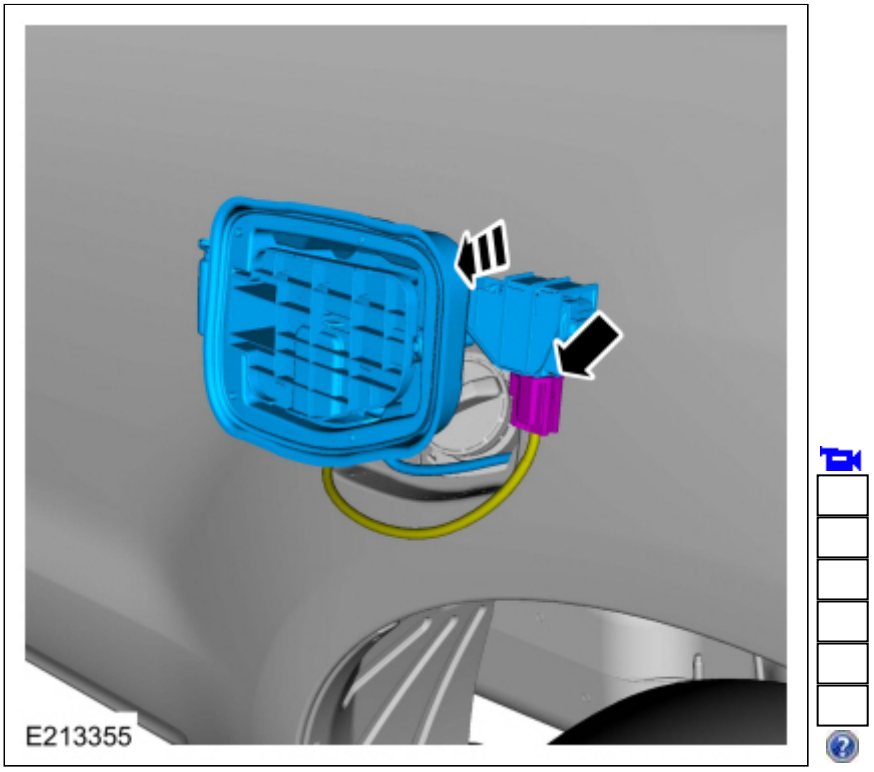
1. Refer to: Fuel Filler Door (501-03 Body Closures, Removal and Installation).
2. Refer to: Fuel Tank Filler Pipe - Chassis Cab (310-01A Fuel Tank and Lines - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
3. Use the General Equipment: Knife



4. Use the General Equipment: Flat Headed Screw Driver



5.



Installation

1. To install, reverse the removal procedure.

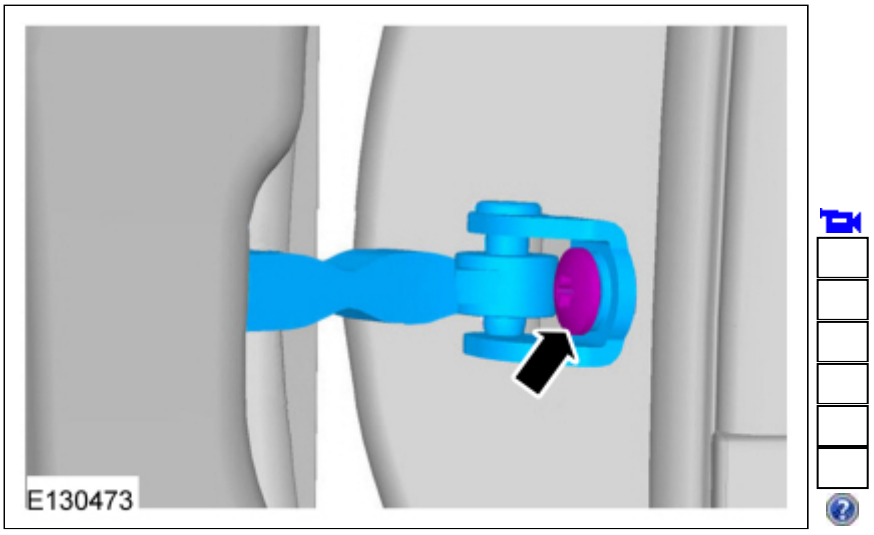
Copyright © 2016 Ford Motor Company

Rear Door - Double Cab

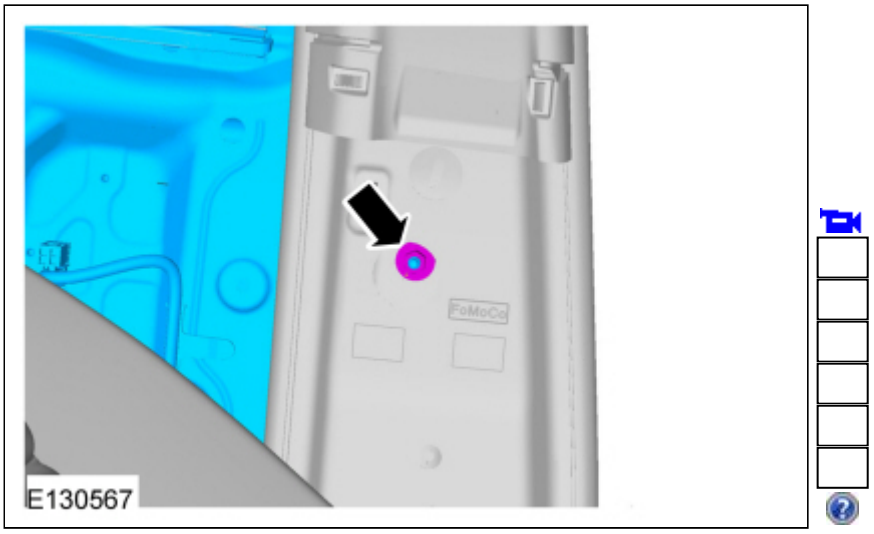
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

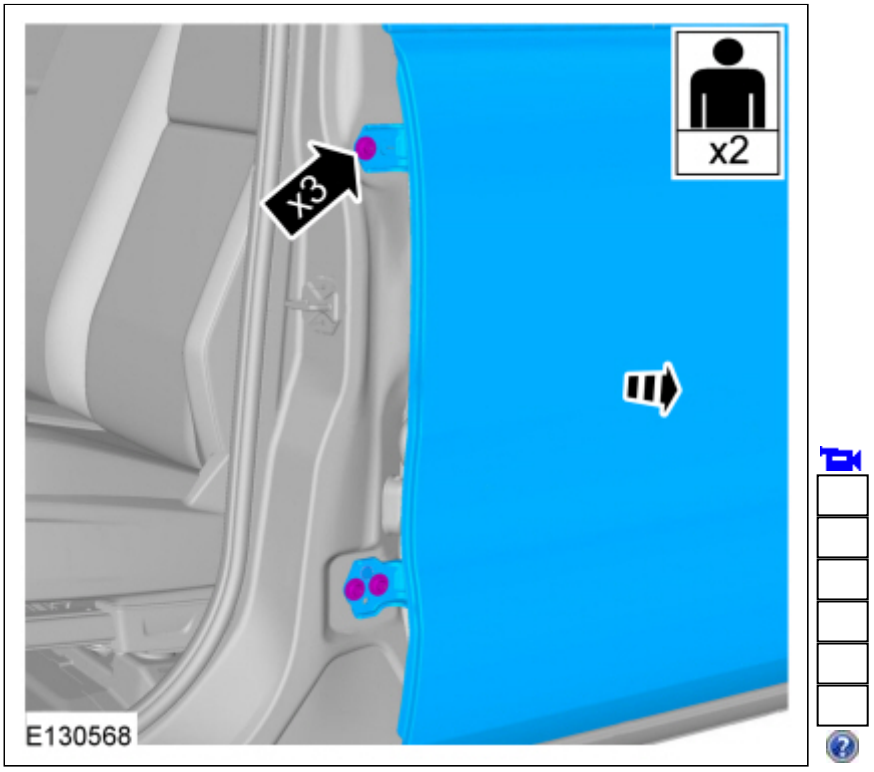
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. 

4. *Torque*: 25 Nm


5. *Torque*: 25 Nm



6. *Torque*: 25 Nm



Installation

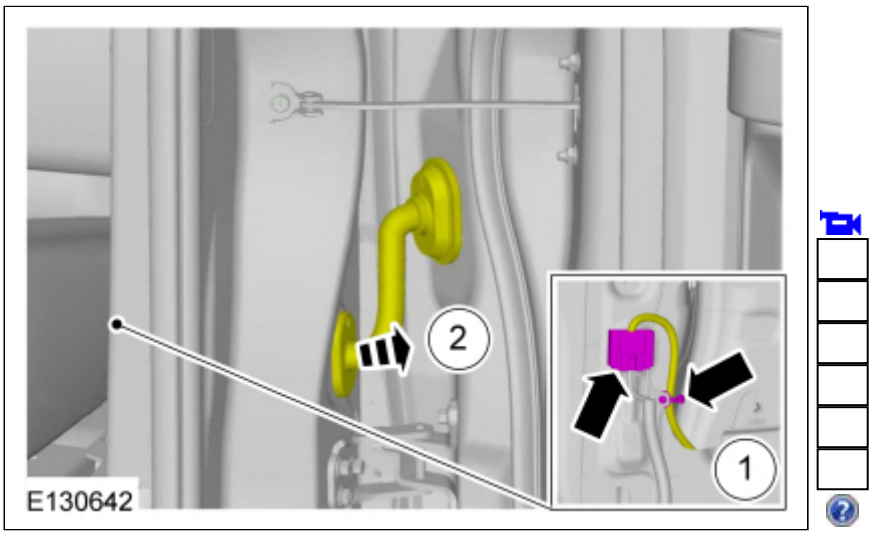
1. To install, reverse the removal procedure.
2. Refer to: Rear Door Alignment - Double Cab (501-03 Body Closures, General Procedures).

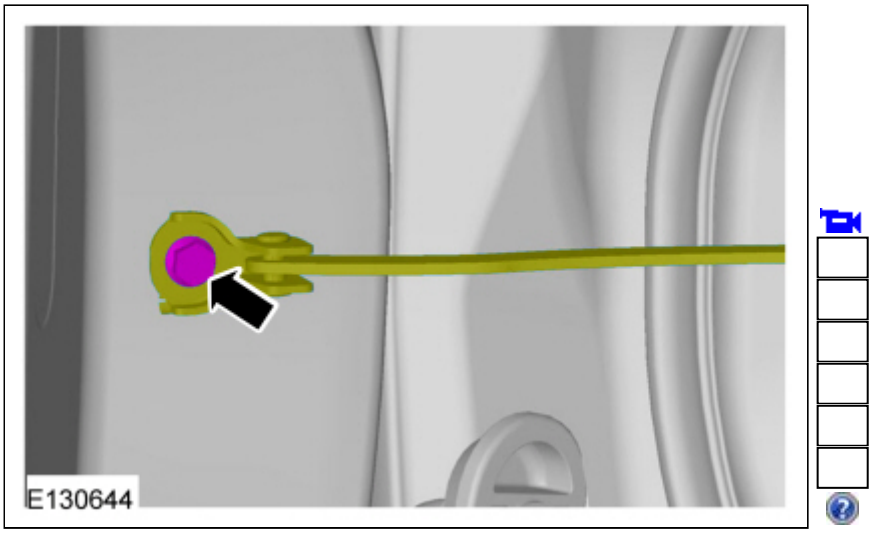
Copyright © 2016 Ford Motor Company

Rear Door - Super Cab

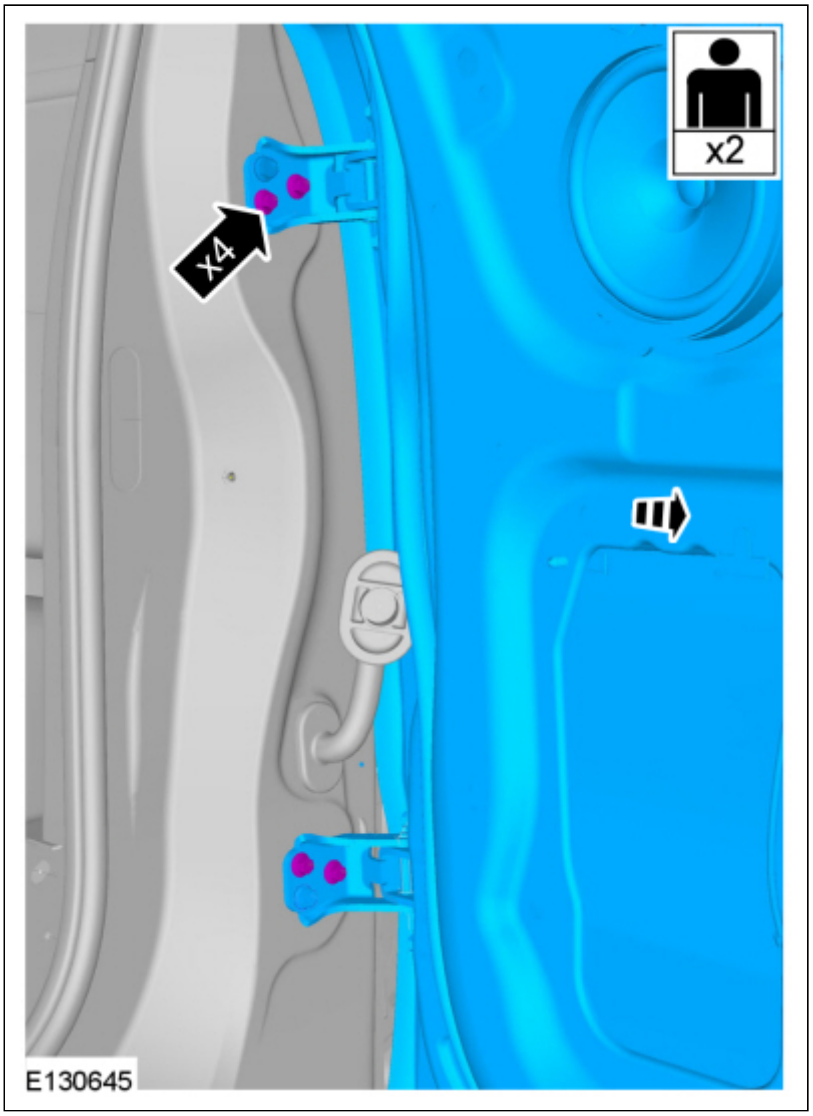
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. 

4. *Torque*: 10 Nm


5. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Rear Door Alignment - Super Cab (501-03 Body Closures, General Procedures).

Copyright © 2016 Ford Motor Company

Pickup Bed

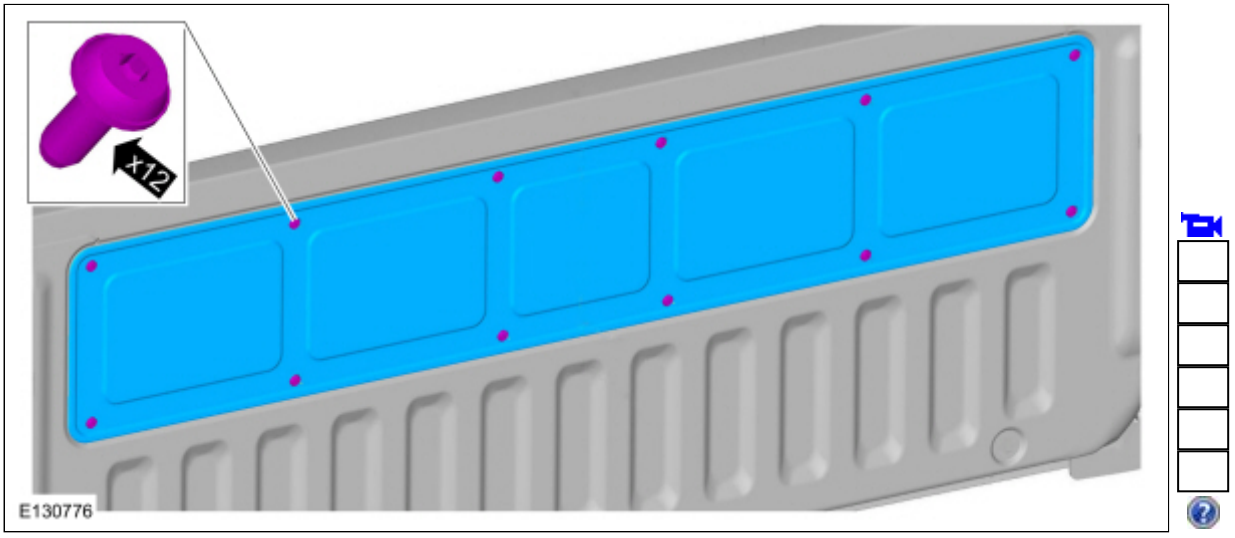
Special Tool(s) / General Equipment

Blind Rivet Gun
6 mm Drill Bit

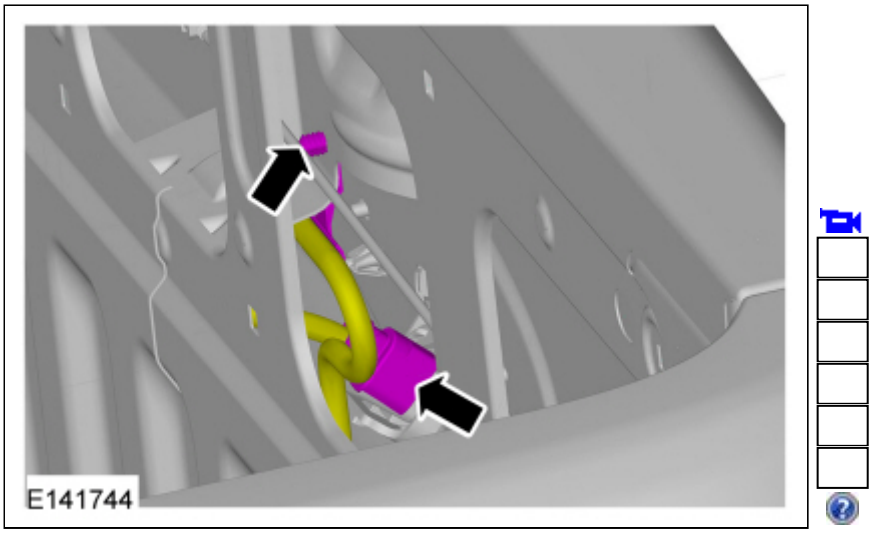
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

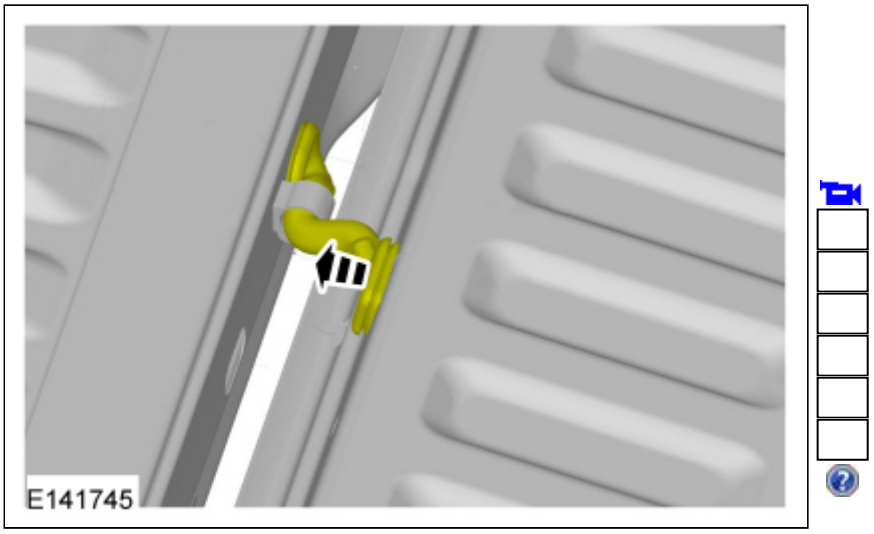
1.



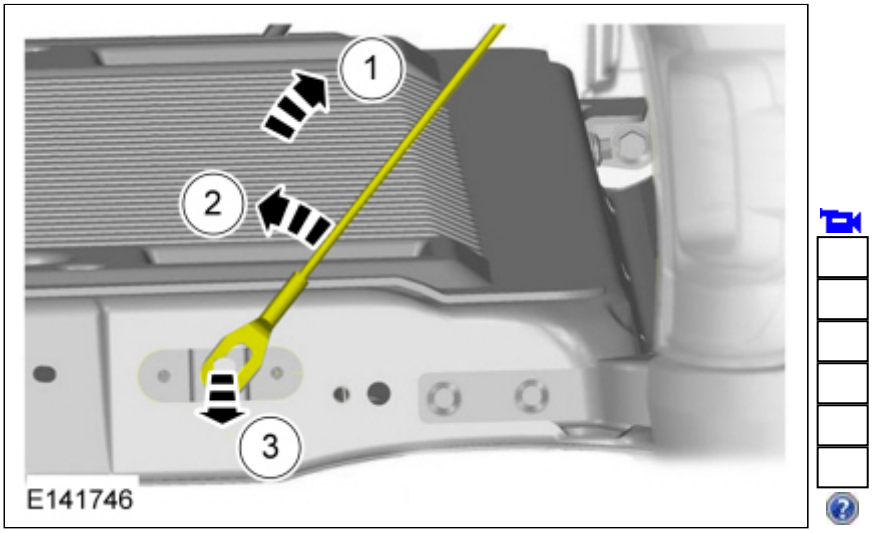
2.



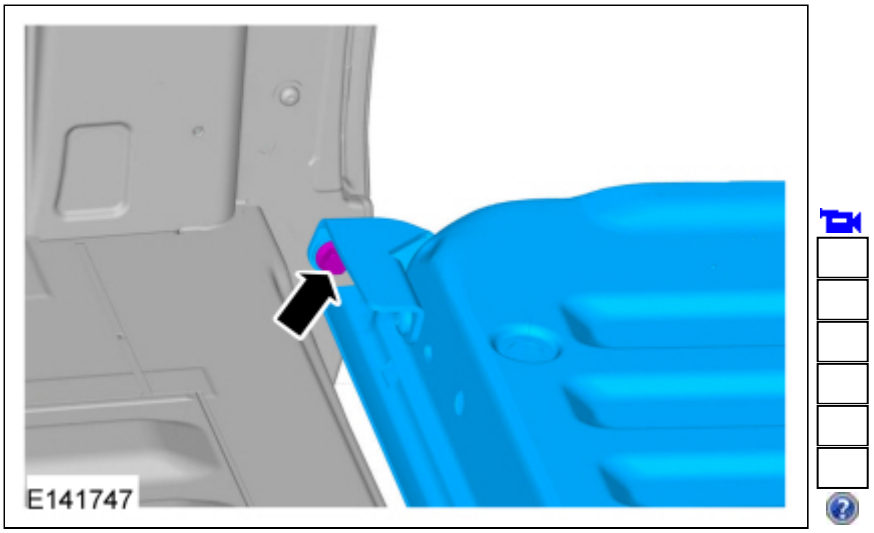
3.



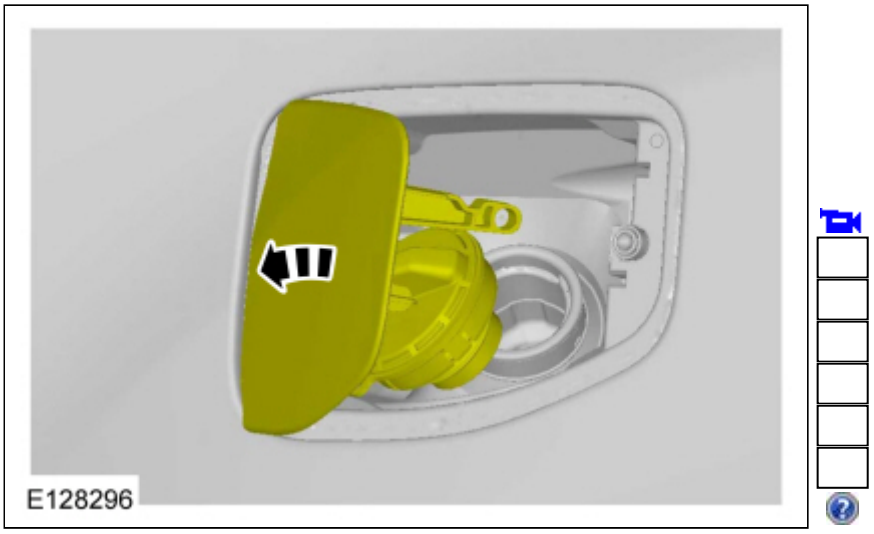
4. Both the sides.

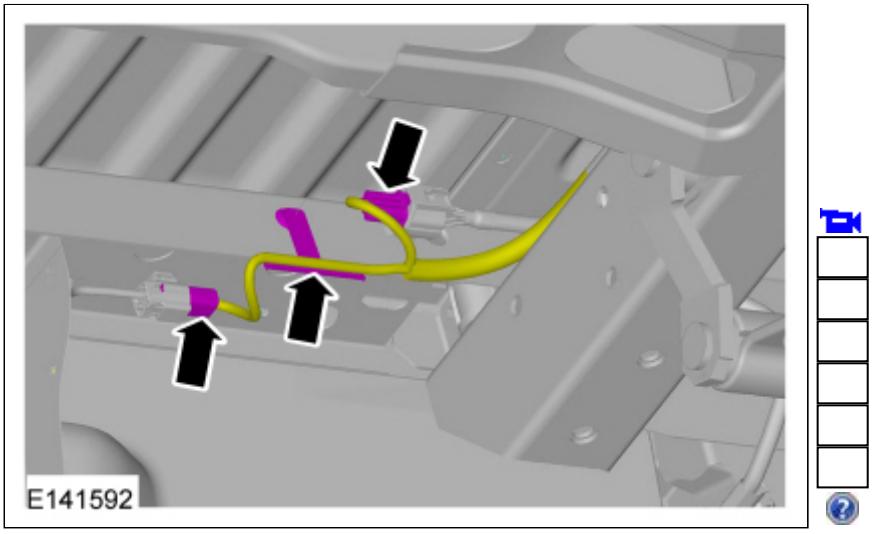


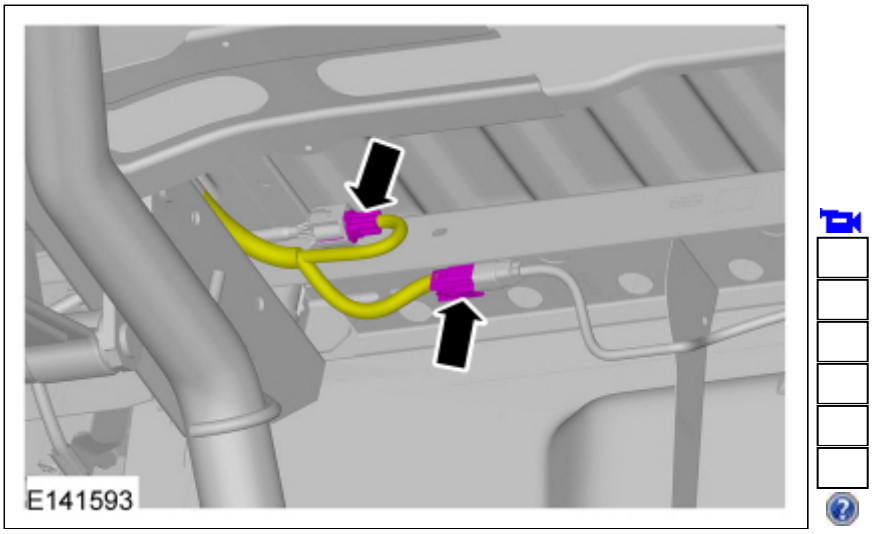
5. Both the sides.
   Torque: 50 Nm



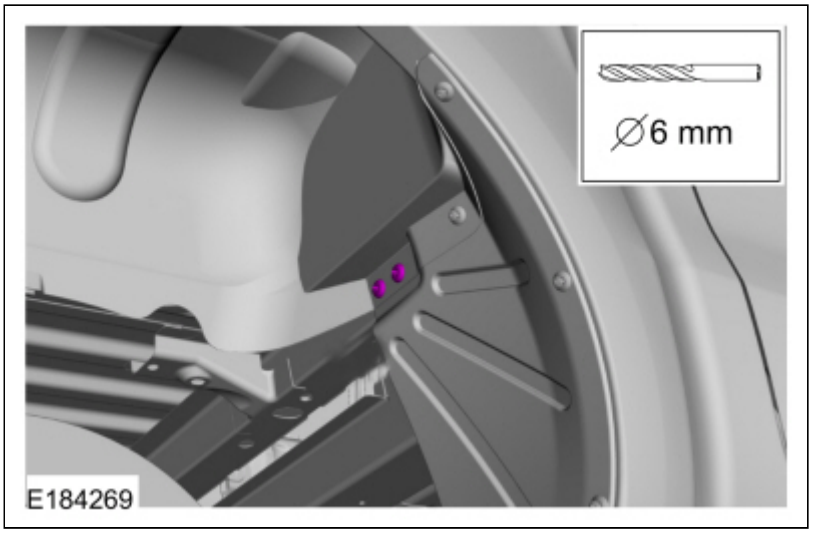
6. Fuel filler cap



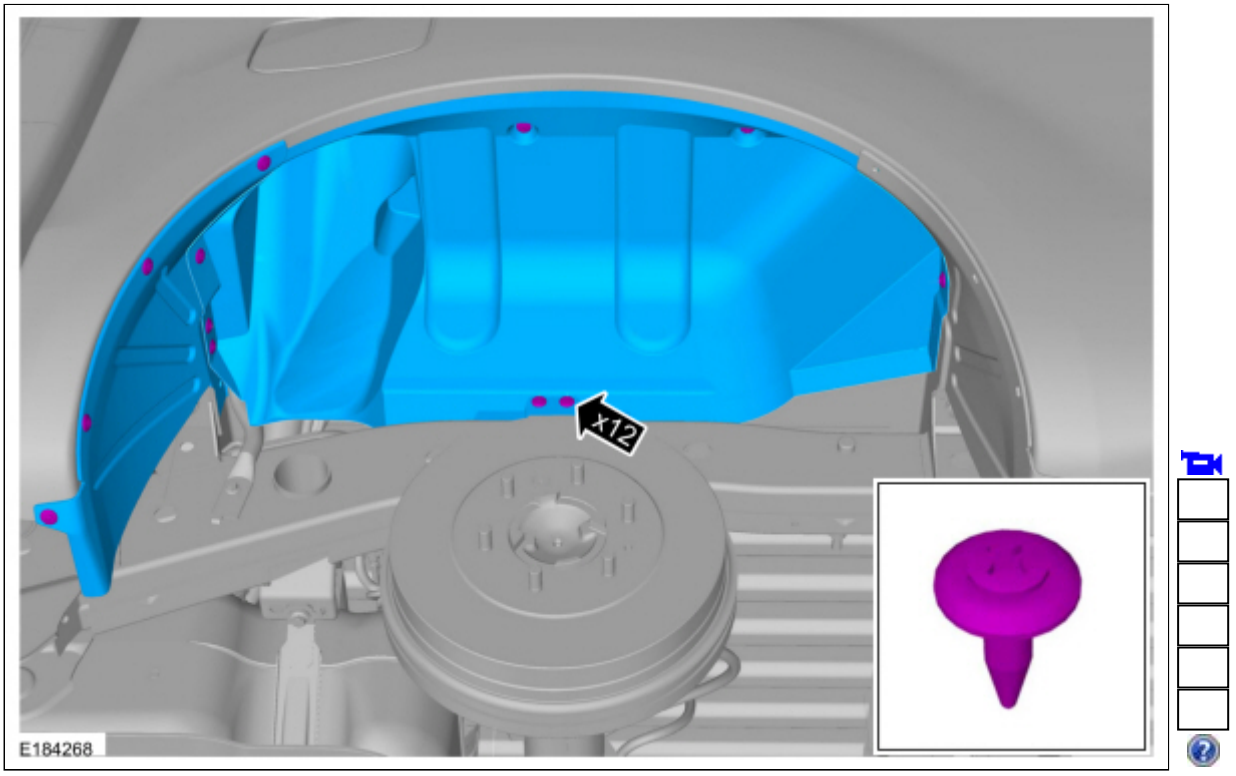
7. Refer to: Rear Lamp Assembly (417-01 Exterior Lighting, Removal and Installation).
8. 

9. 

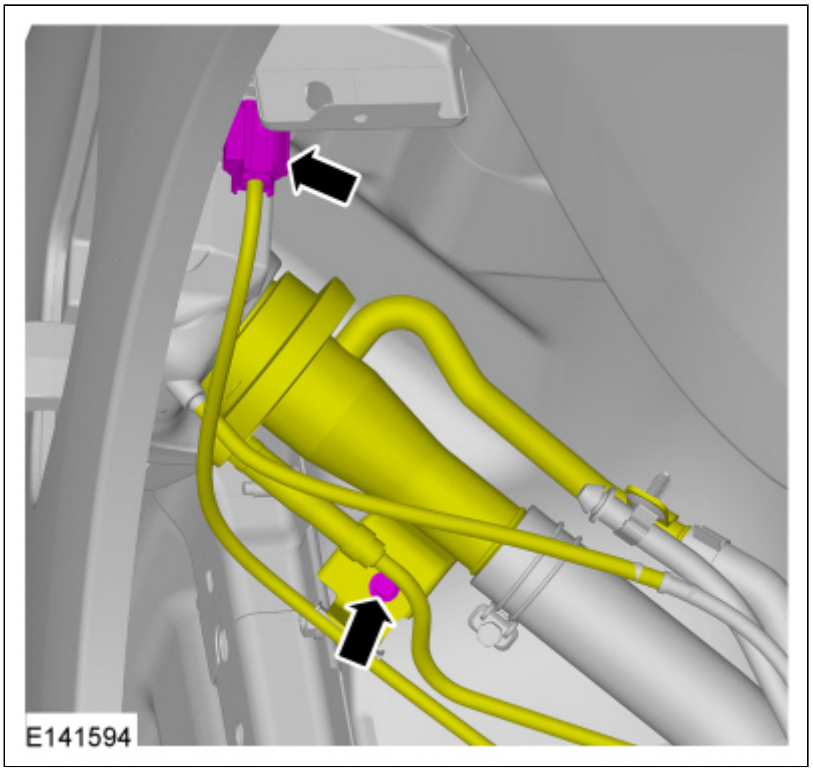
10. Refer to: Wheel and Tire (204-04A Wheels and Tires, Removal and Installation).
11. Use the General Equipment: 6 mm Drill Bit



12.

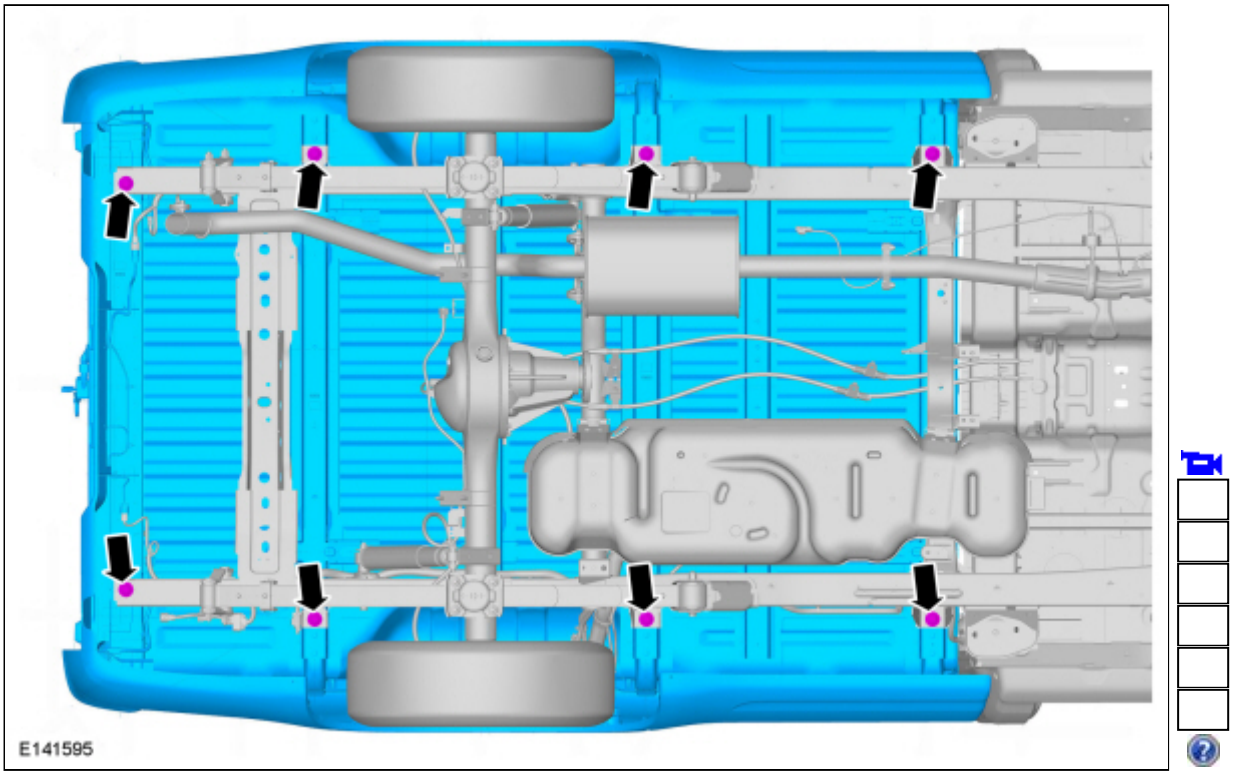


13. *Torque*: 11 Nm



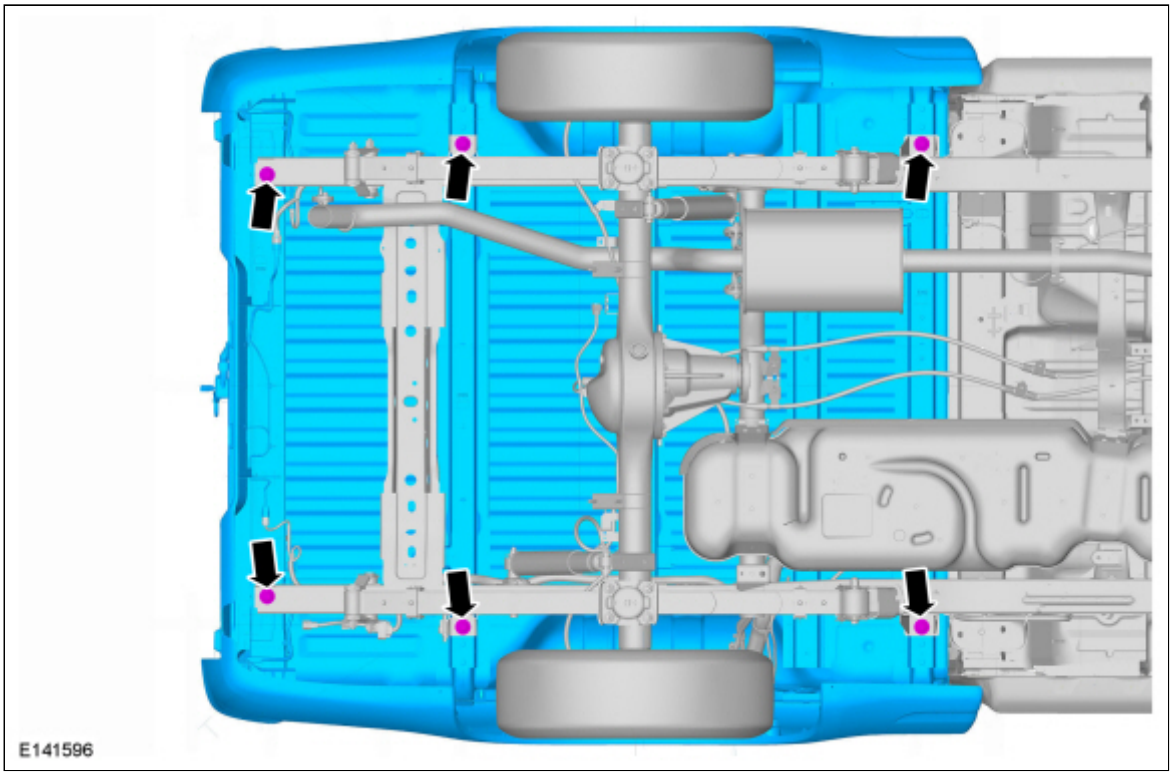
Single Cab

14. *Torque*: 140 Nm



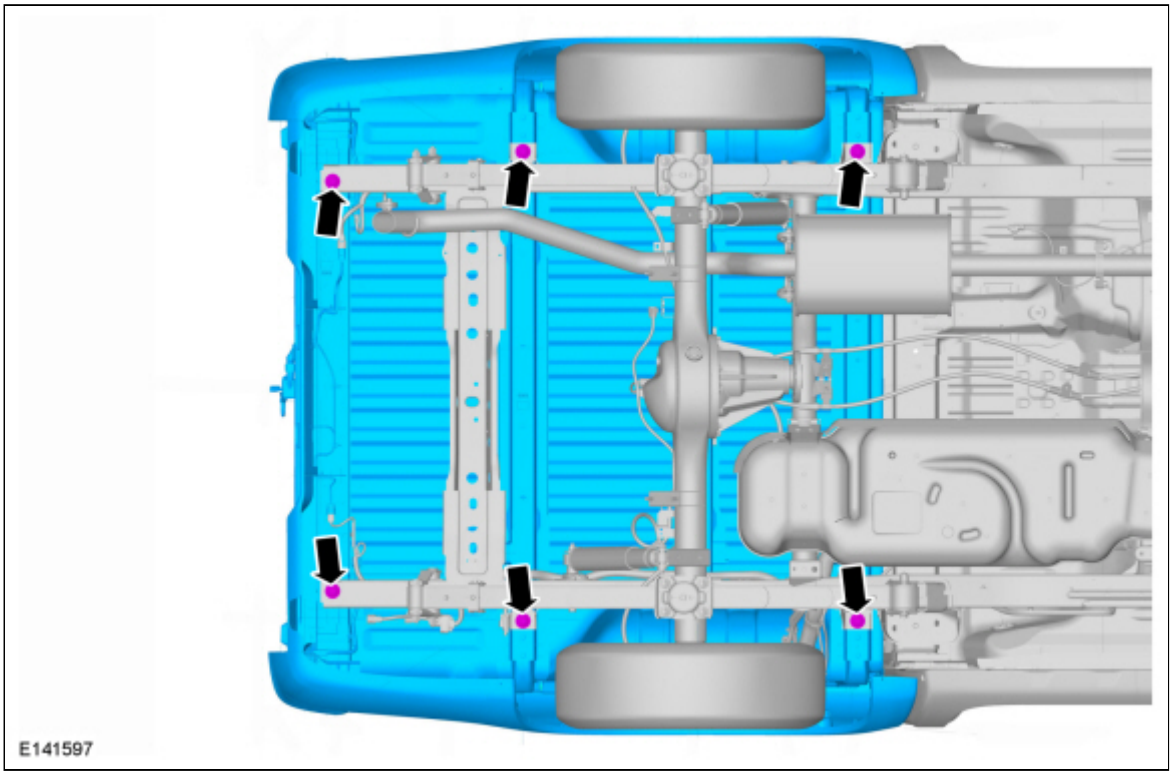
Stretched Cab

15. *Torque*: 140 Nm



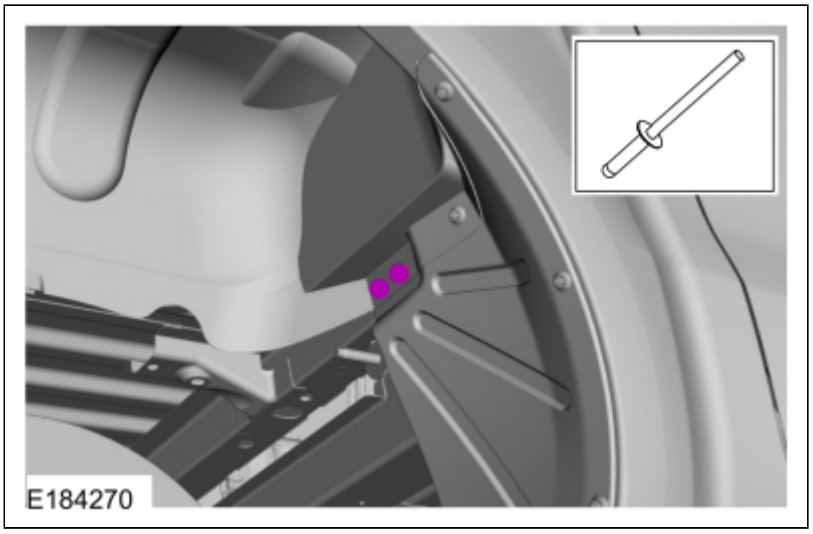
Double Cab

16. *Torque*: 140 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Body Tolerance Check (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, General Procedures).
3. Install the fasteners.
   Use the General Equipment: Blind Rivet Gun



Copyright © 2016 Ford Motor Company

Roller Shutter Assembly

Special Tool(s) / General Equipment

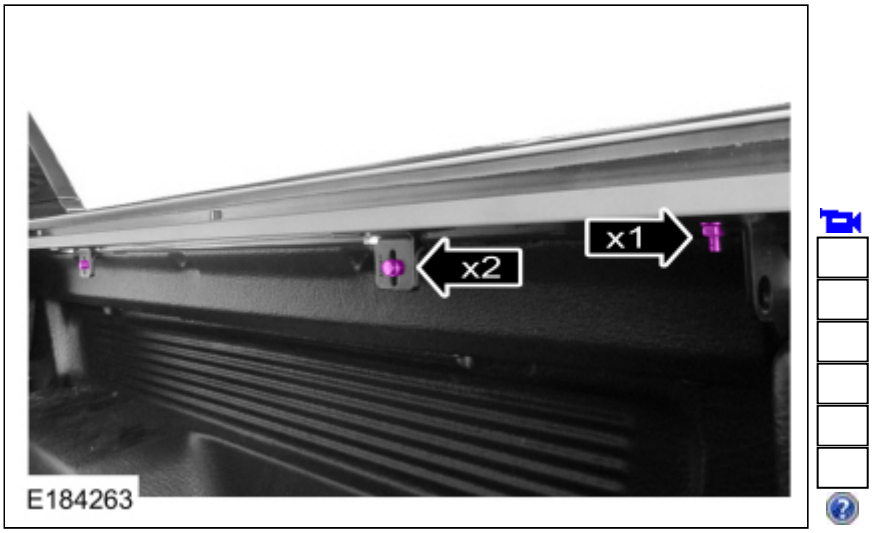
	501-414
	501-415

Materials

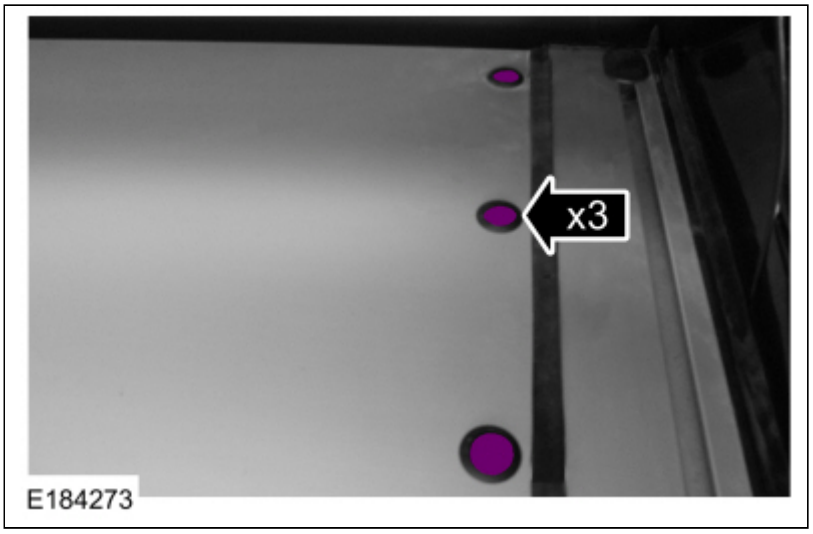
Name	Specification
Silicone Sealant	WSS-M4G323-A8

Removal

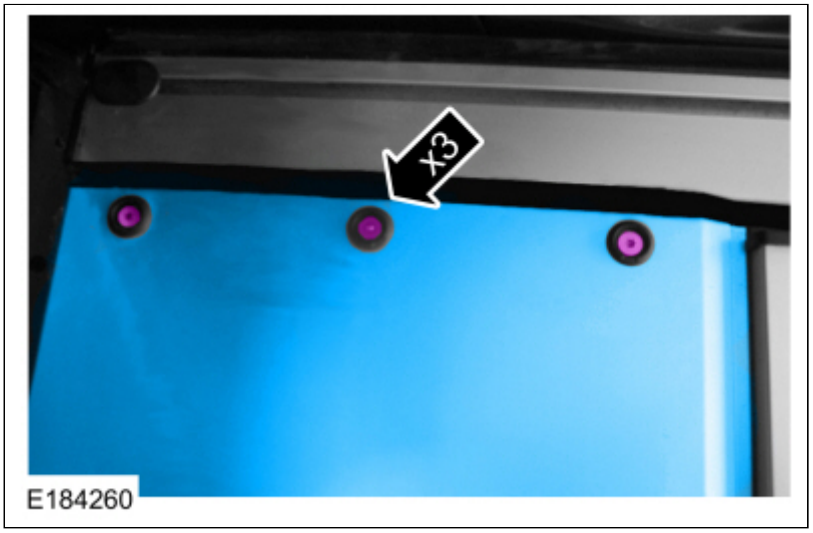
1. On both sides.



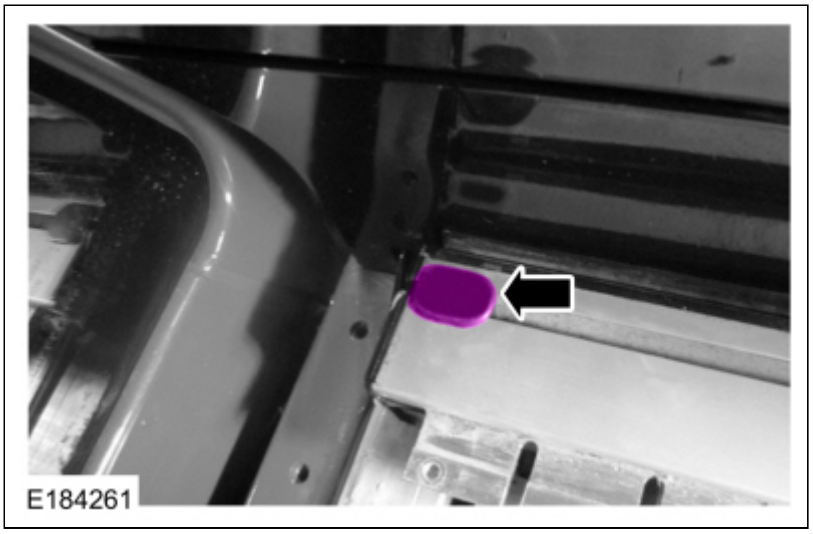
2. On both sides.



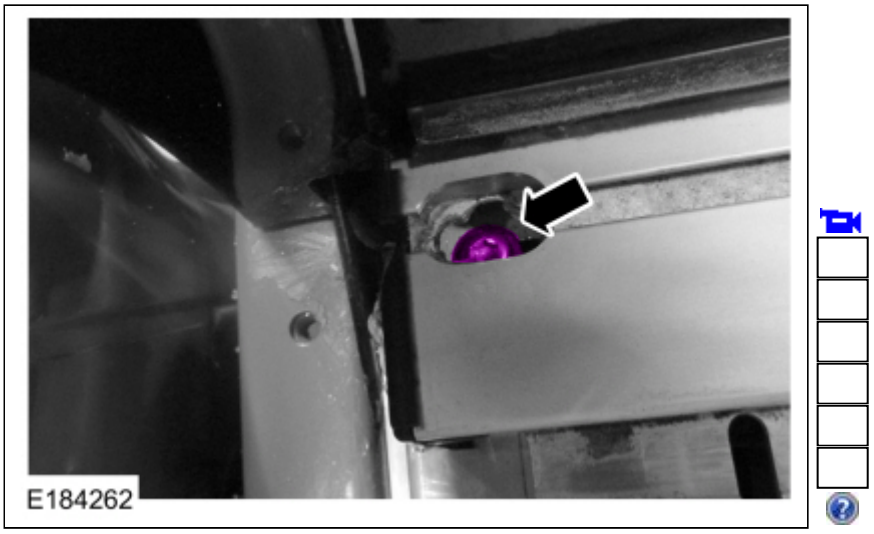
3. On both sides.



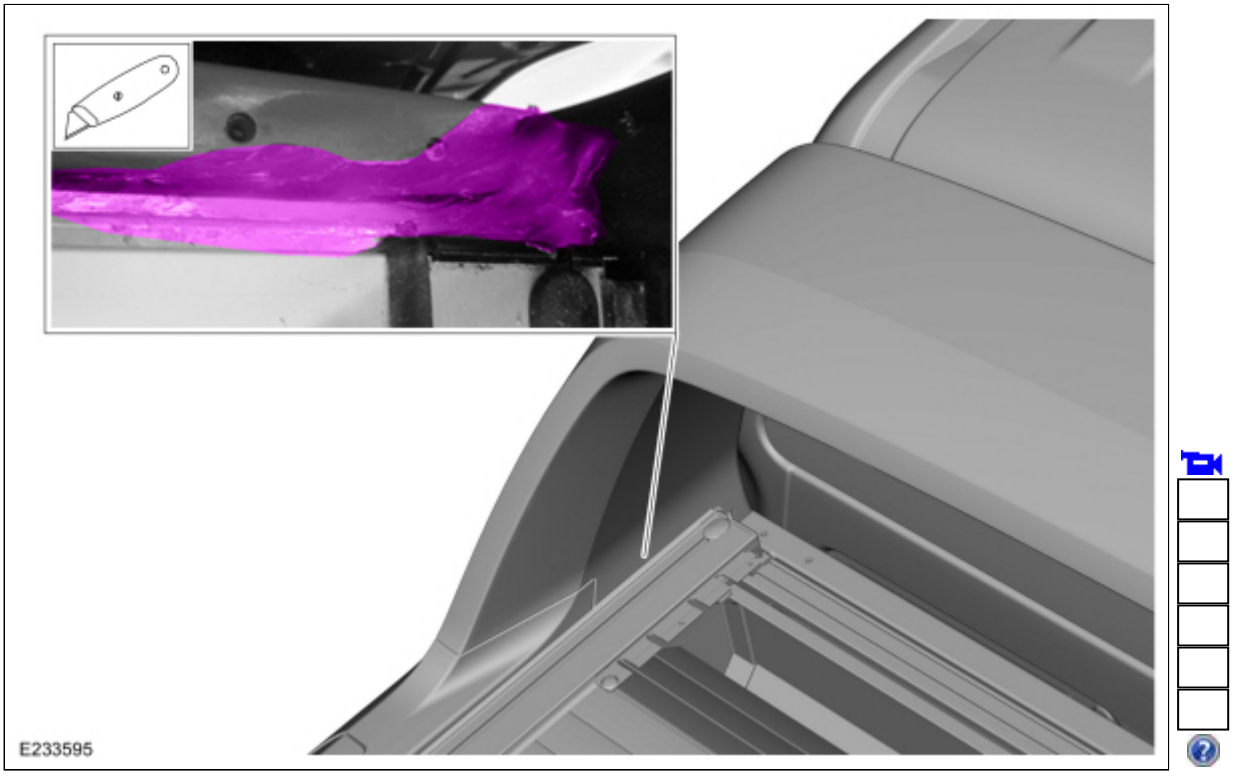
4. On both sides.



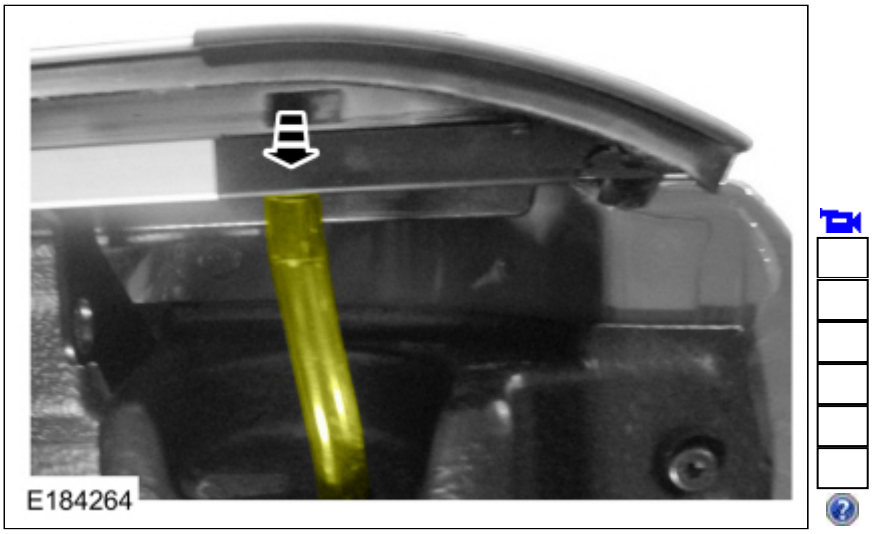
5. On both sides.



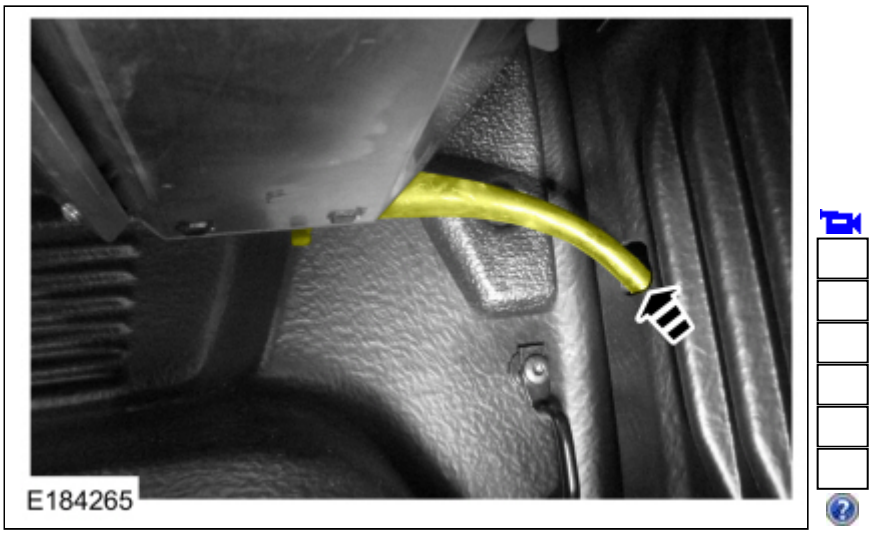
6. On both sides.



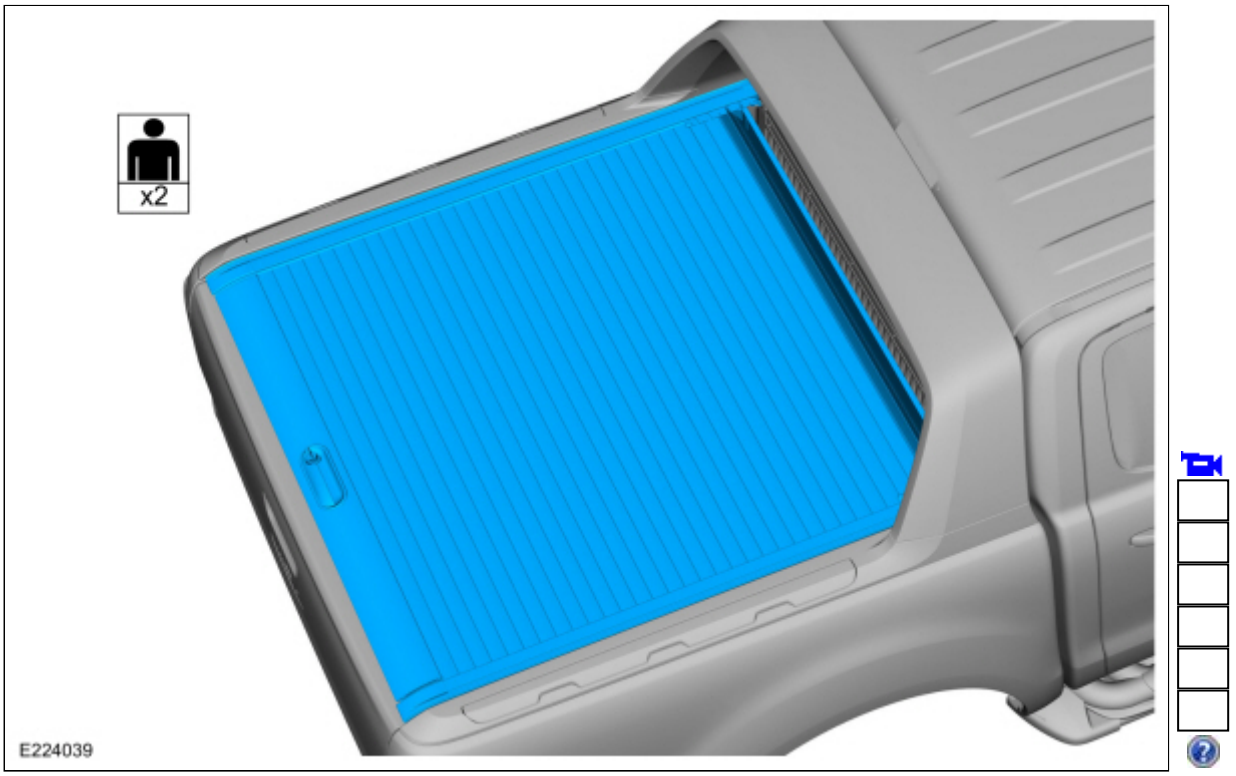
7. On both sides.



8. On both sides.

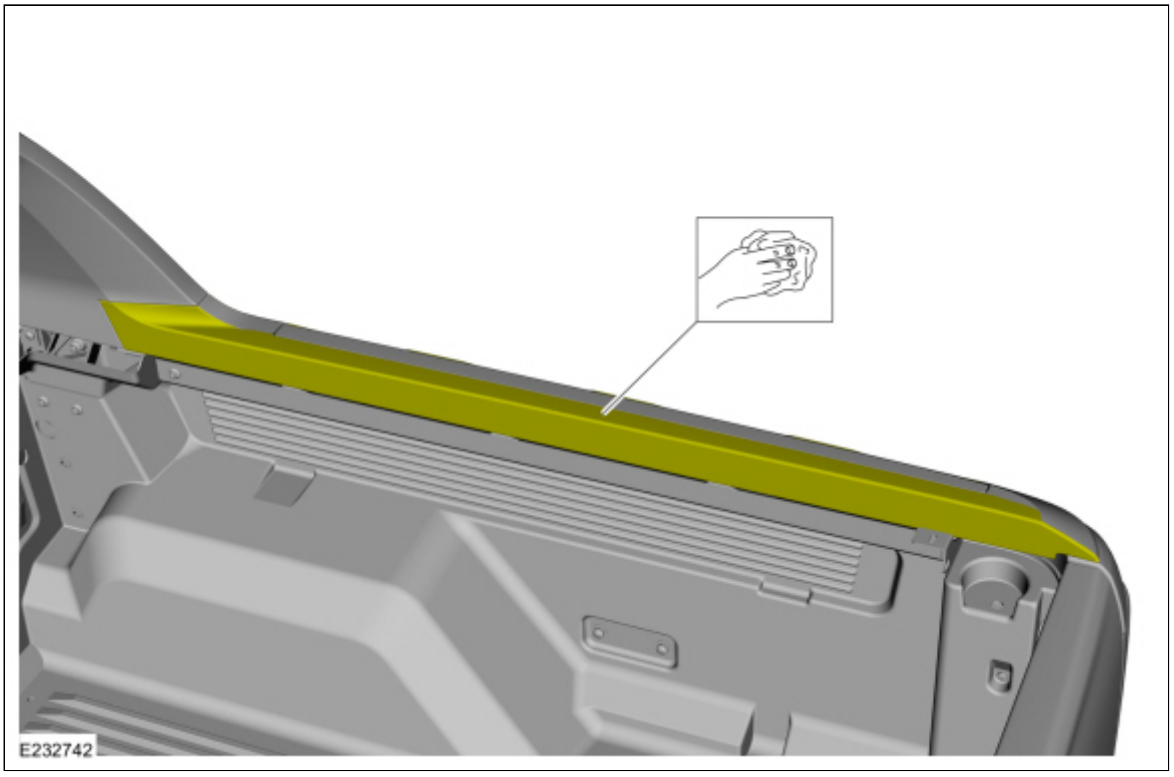


9.

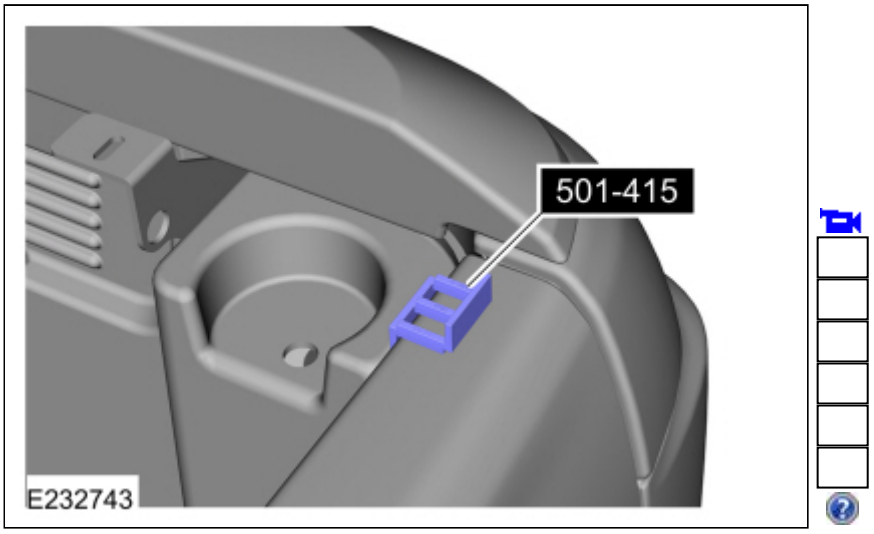


Installation

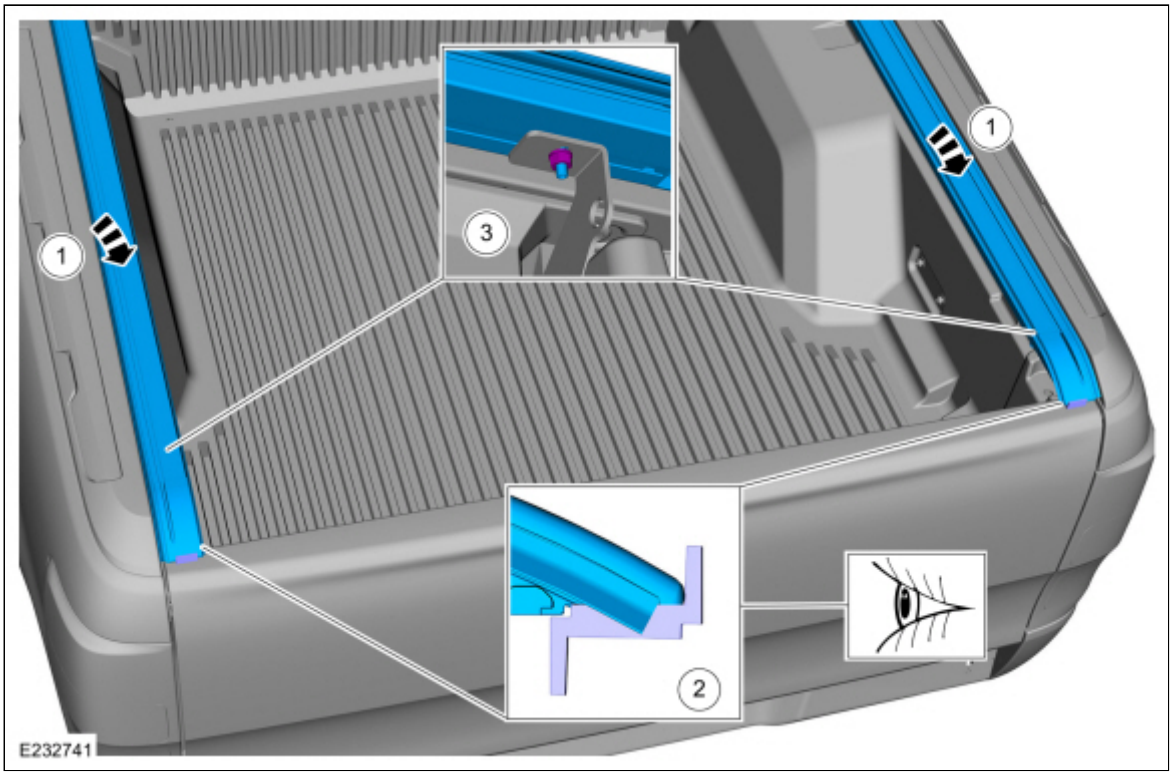
1. **NOTE:** *Make sure that the surface is clean and free of foreign material.*



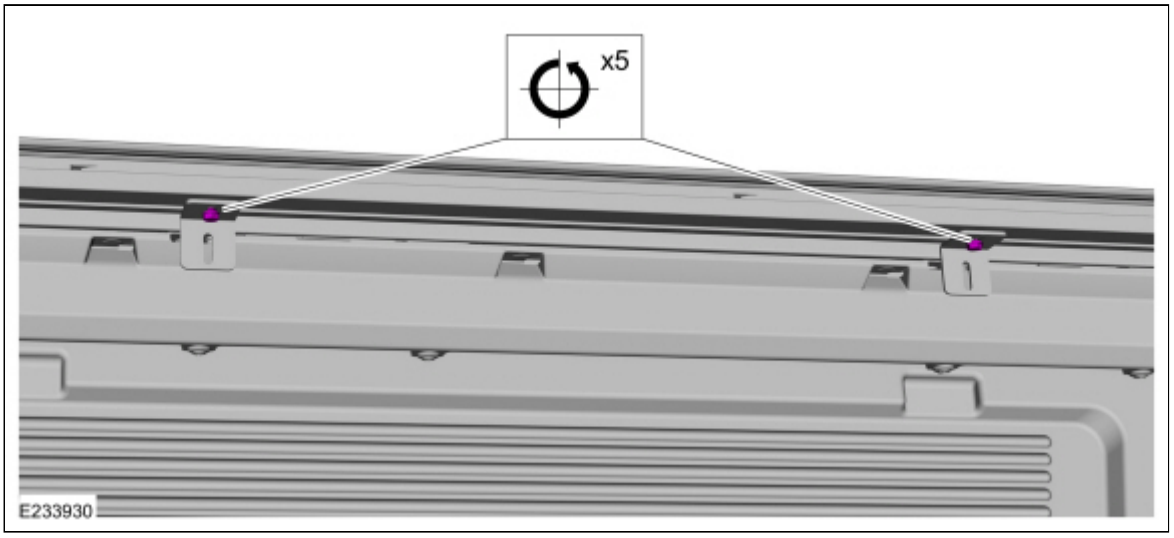
2. Use Special Service Tool: 501-415.



1. Install the roller shutter.
2. **NOTE:** *Make sure that the components are aligned.*
3. **NOTE:** *Only tighten the nuts finger tight at this stage.*

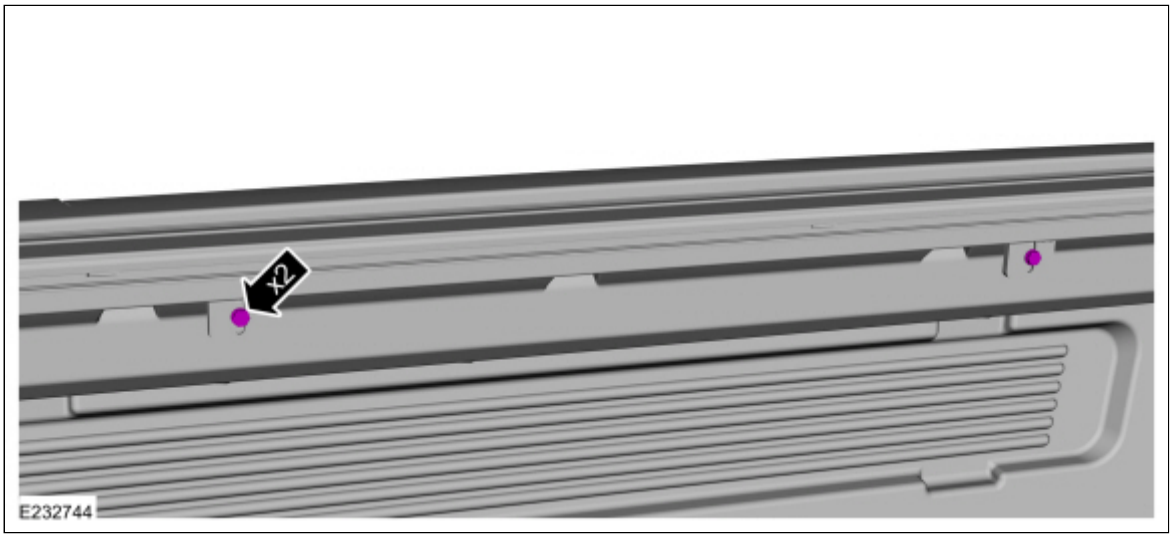


4.

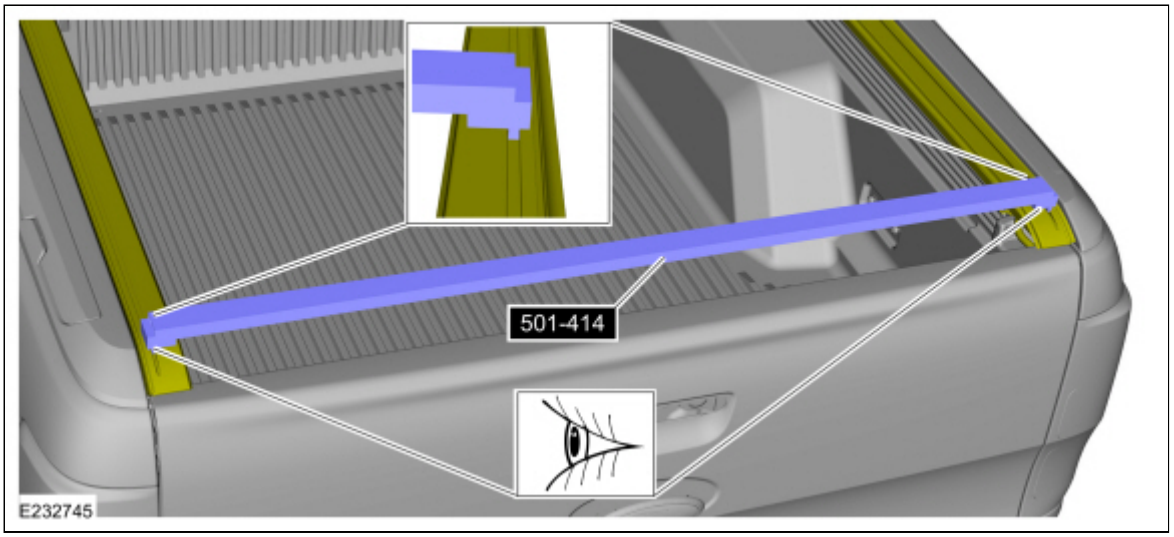


5. **NOTE:** *Only tighten the bolts finger tight at this stage.*

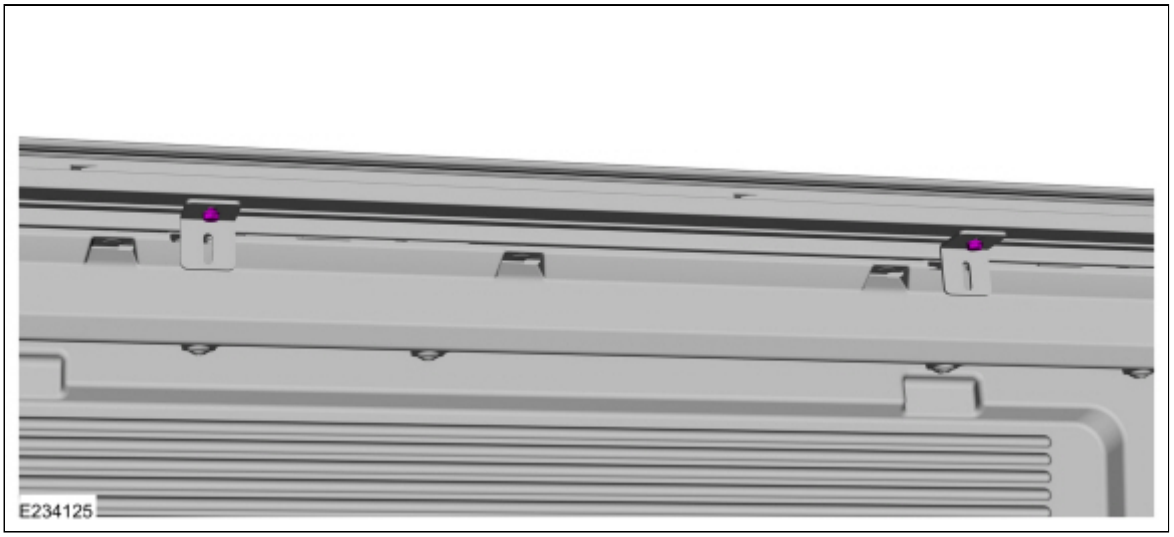
On both sides.



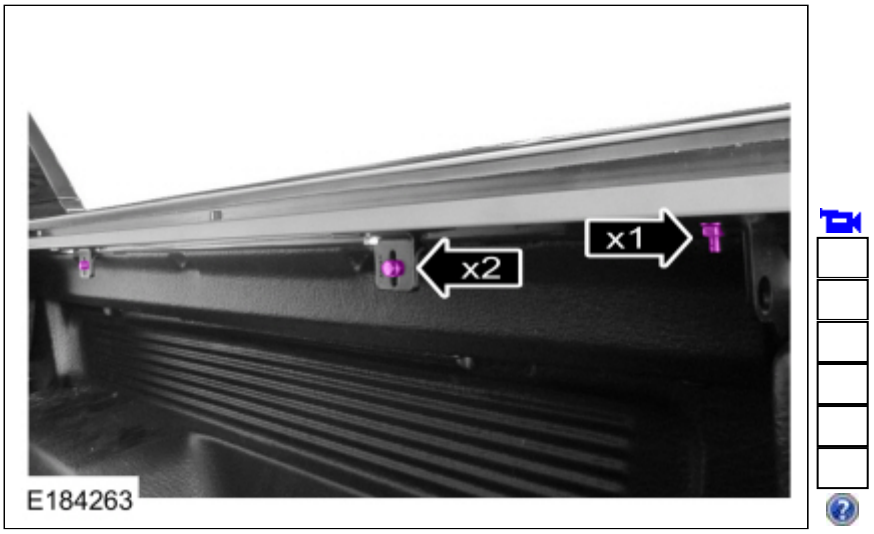
1. Use Special Service Tool: 501-414.
2. **NOTE:** *Make sure that the components are aligned.*



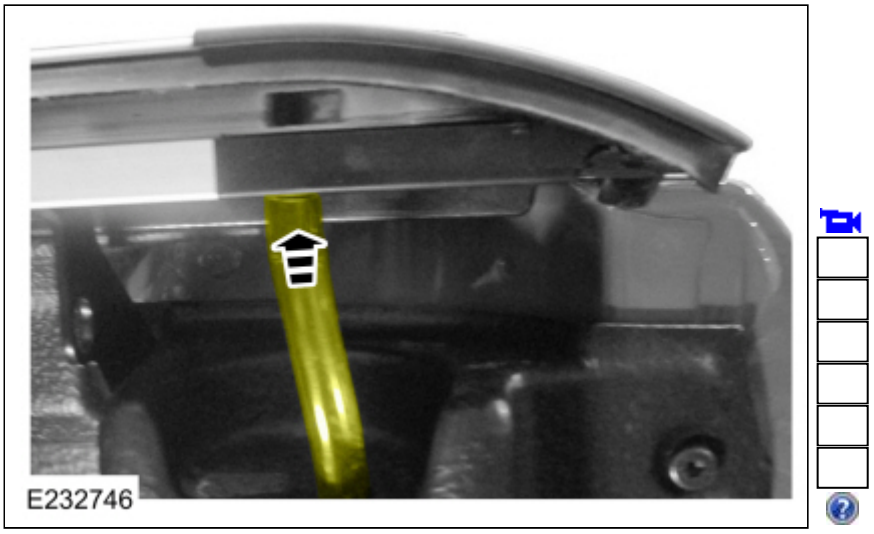
7. *Torque*: 11 Nm



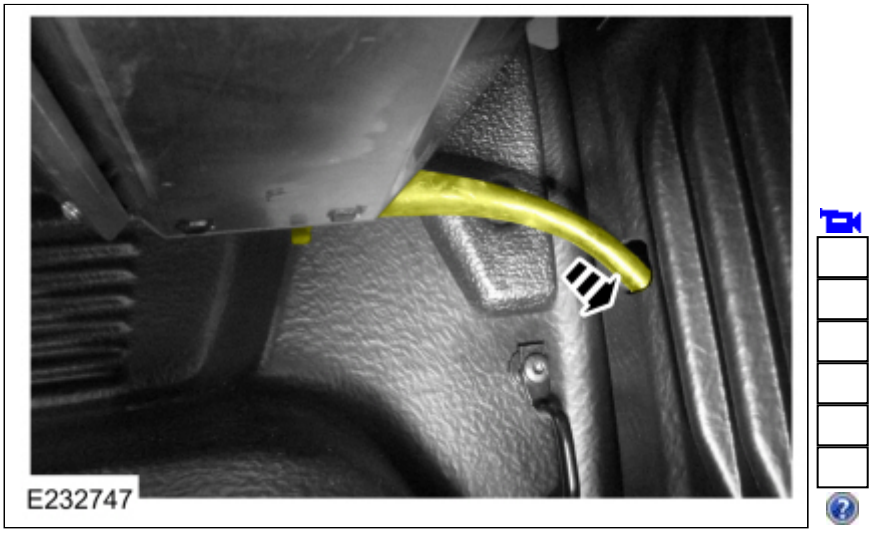
8. On both sides.
   Torque: 11 Nm



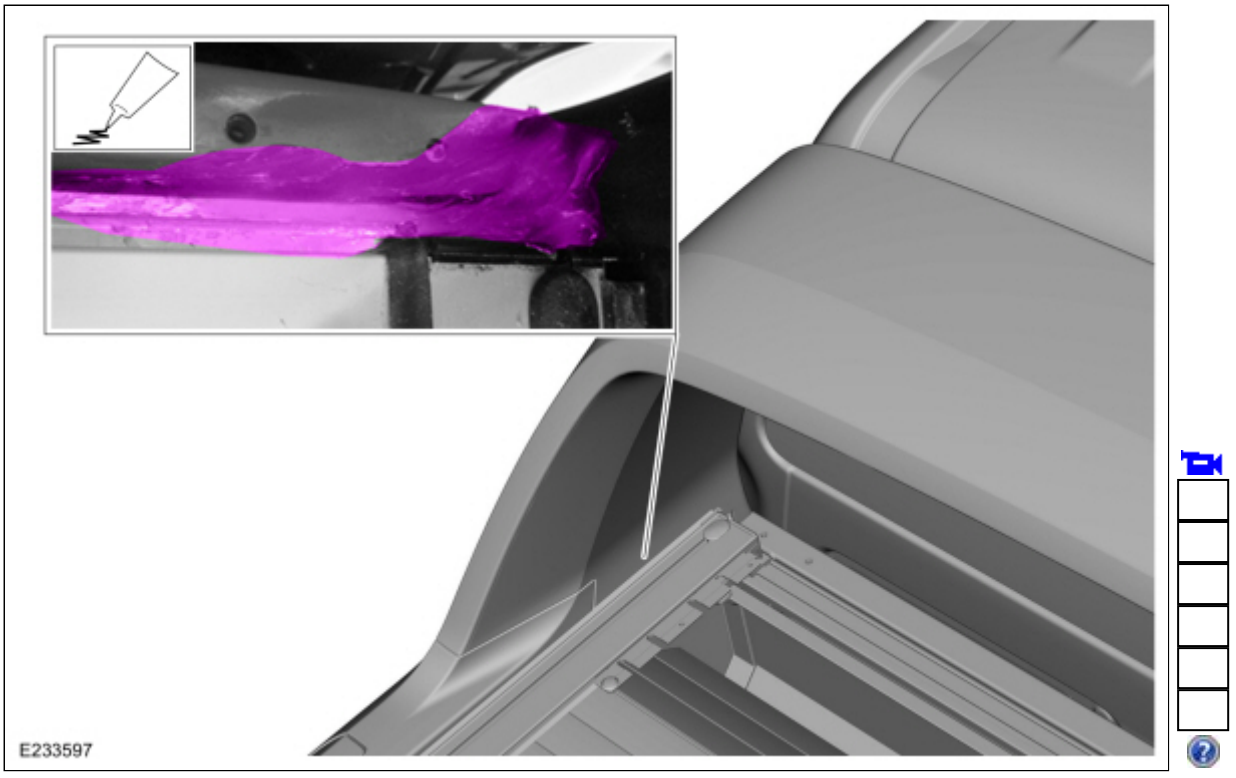
9. On both sides.



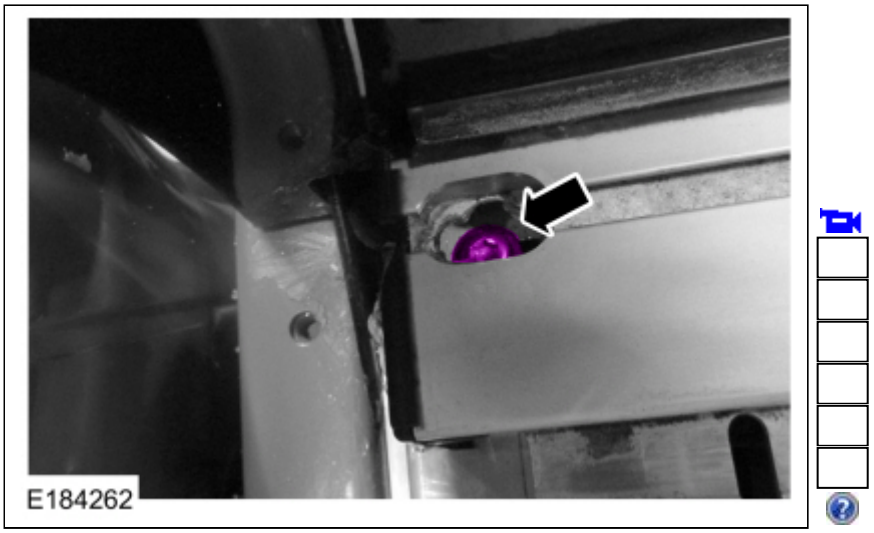
10. On both sides.



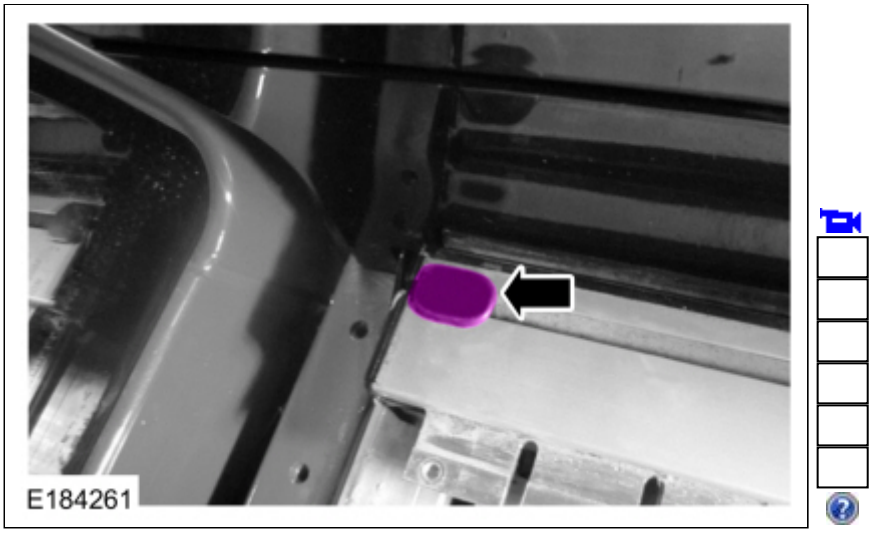
11. On both sides.
Material: Silicone Sealant (WSS-M4G323-A8)



12. On both sides.
    Torque: 5 Nm

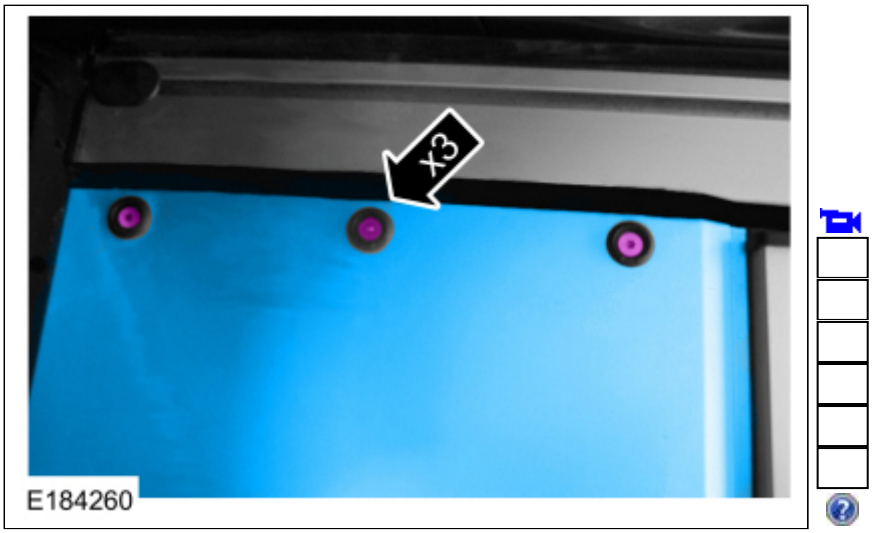


13. On both sides.

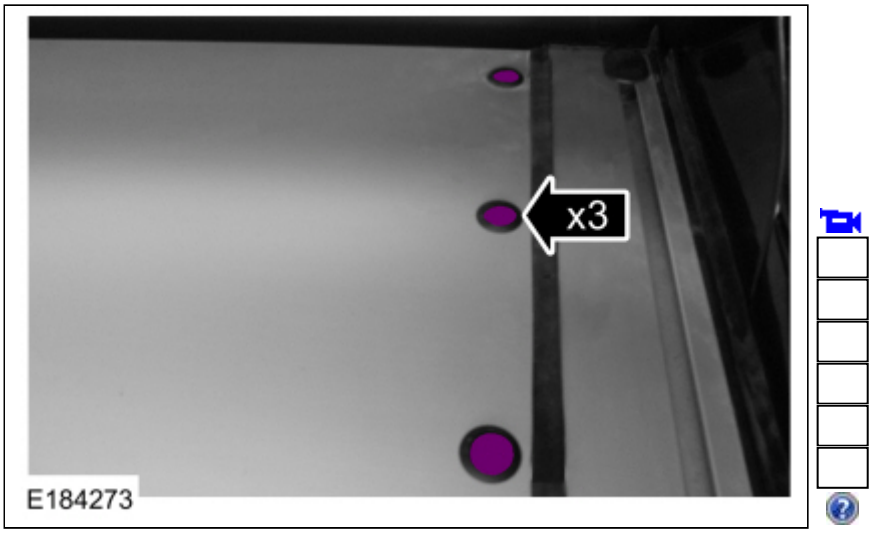


14. Remove Special Service Tool: 501-415. , 501-414.

15. On both sides.
    Torque: 2 Nm



16. On both sides.



Copyright © 2016 Ford Motor Company

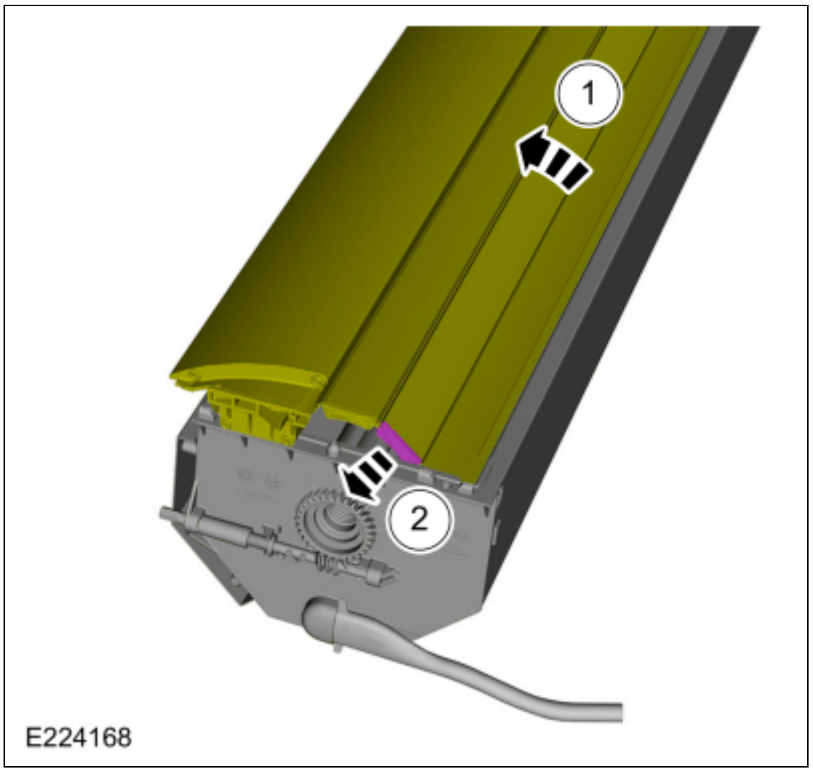
Roller Shutter Cover

Special Tool(s) / General Equipment

Flat Headed Screw Driver

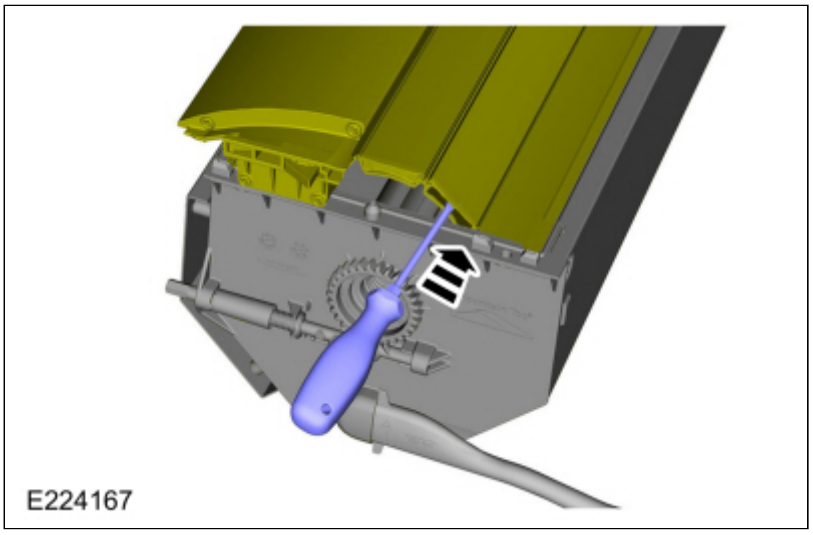
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

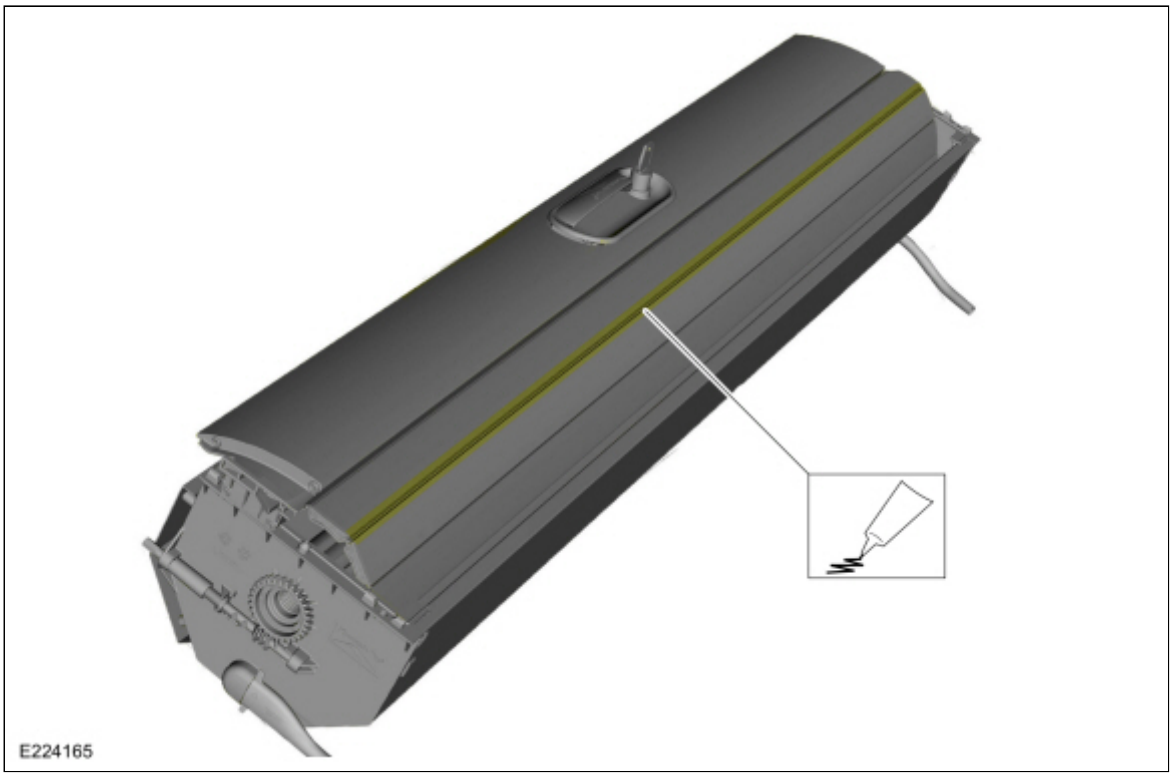
1. Refer to: Roller Shutter Side Rail (501-04 Pickup Bed and Platform Body, Removal and Installation).
2. 

3. **NOTE:** *Use a suitable tool to prevent the component from rotating.*

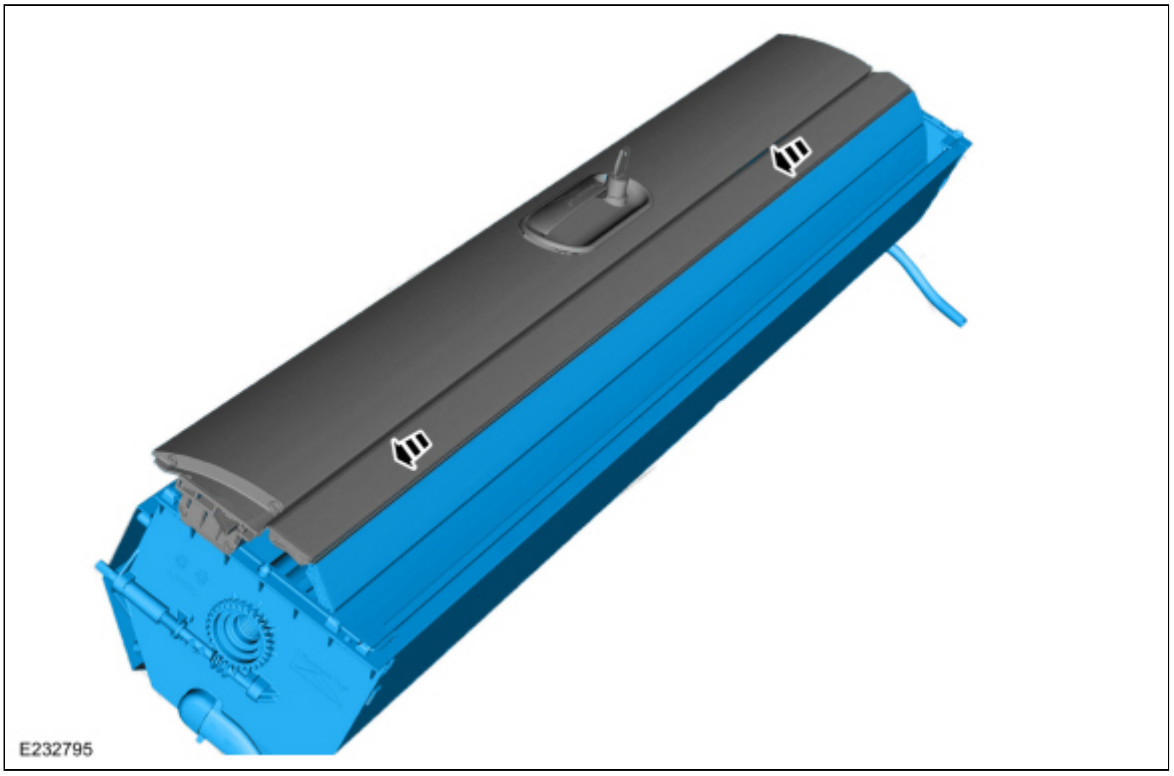
   Use the General Equipment: Flat Headed Screw Driver



4. **NOTE:** *Lubricate the seal with mild soap solution.*



5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Roller Shutter Side Rail

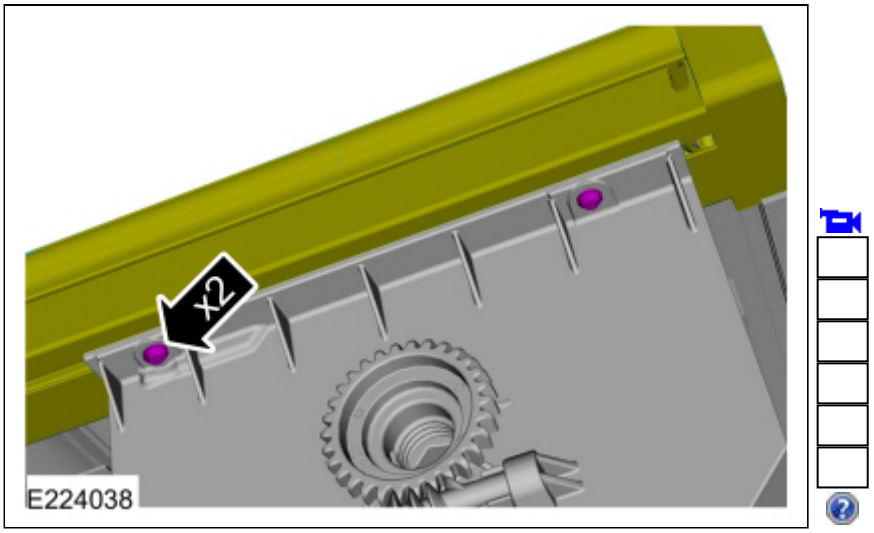
Materials

Name	Specification
RTV Silicone Sealant	-

Removal

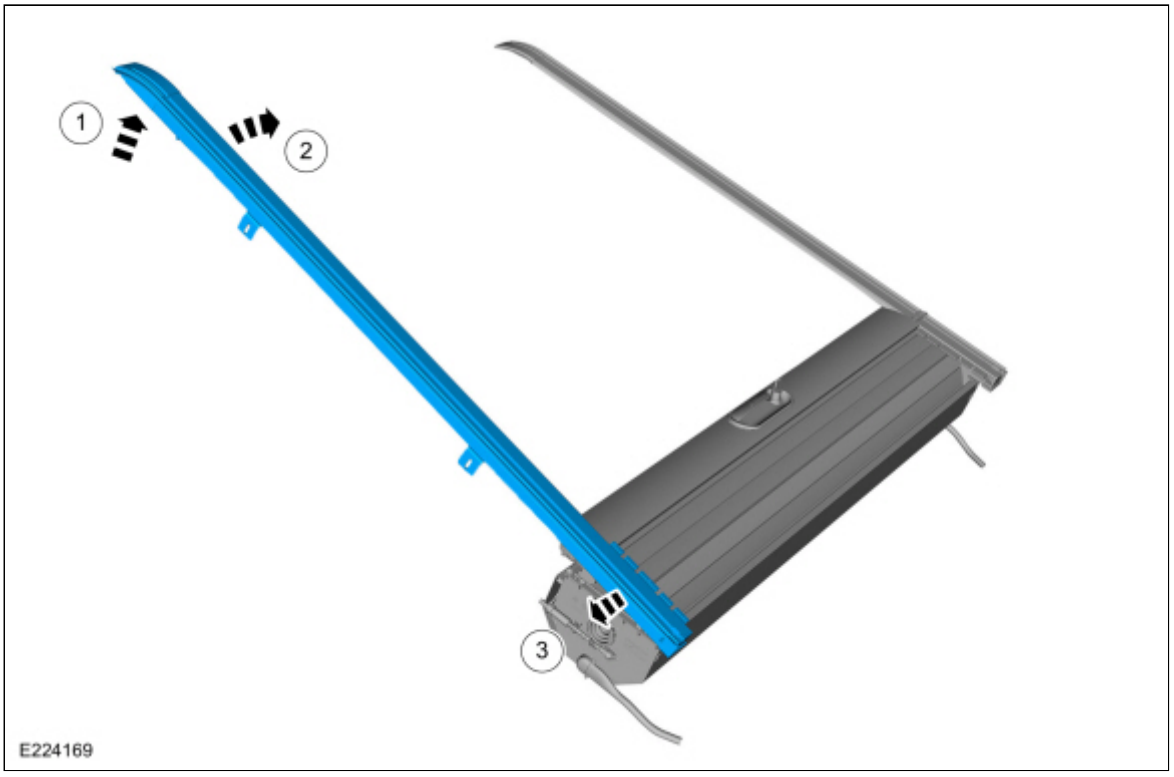
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Roller Shutter Assembly (501-04 Pickup Bed and Platform Body, Removal and Installation).
2. On both sides.
   Material: RTV Silicone Sealant
   Torque: 5 Nm



3. **NOTICE: Take extra care not to damage the component.**

   NOTE: *RH side shown , LH side similar.*



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

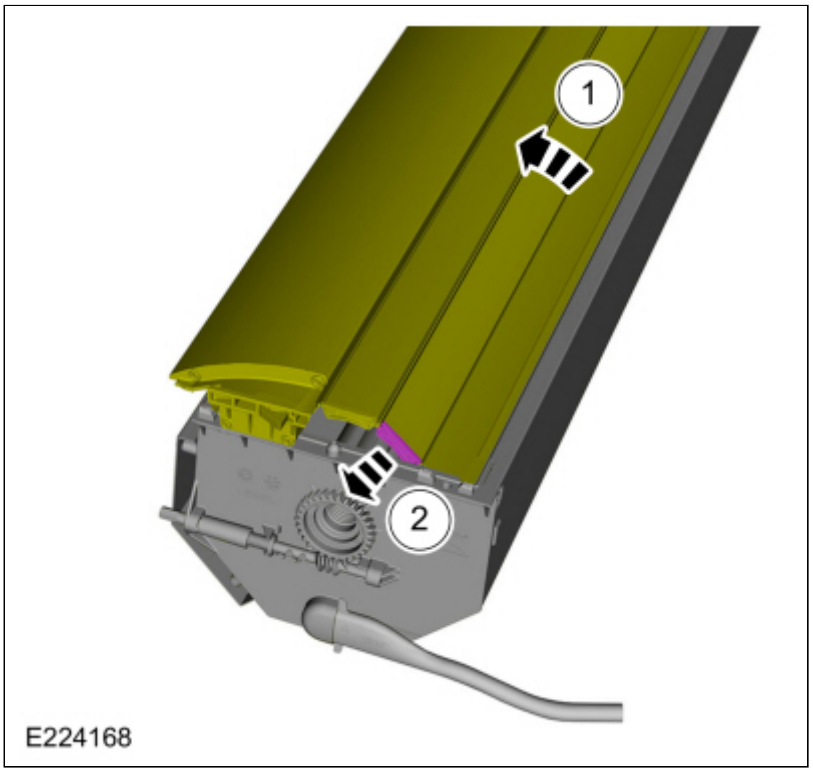
Roller Shutter Rear Bar Assembly

Special Tool(s) / General Equipment

Flat Headed Screw Driver

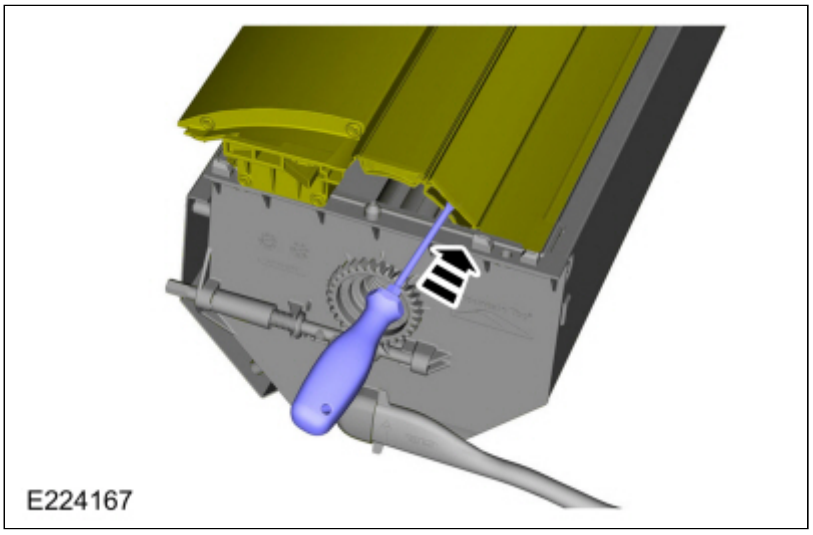
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

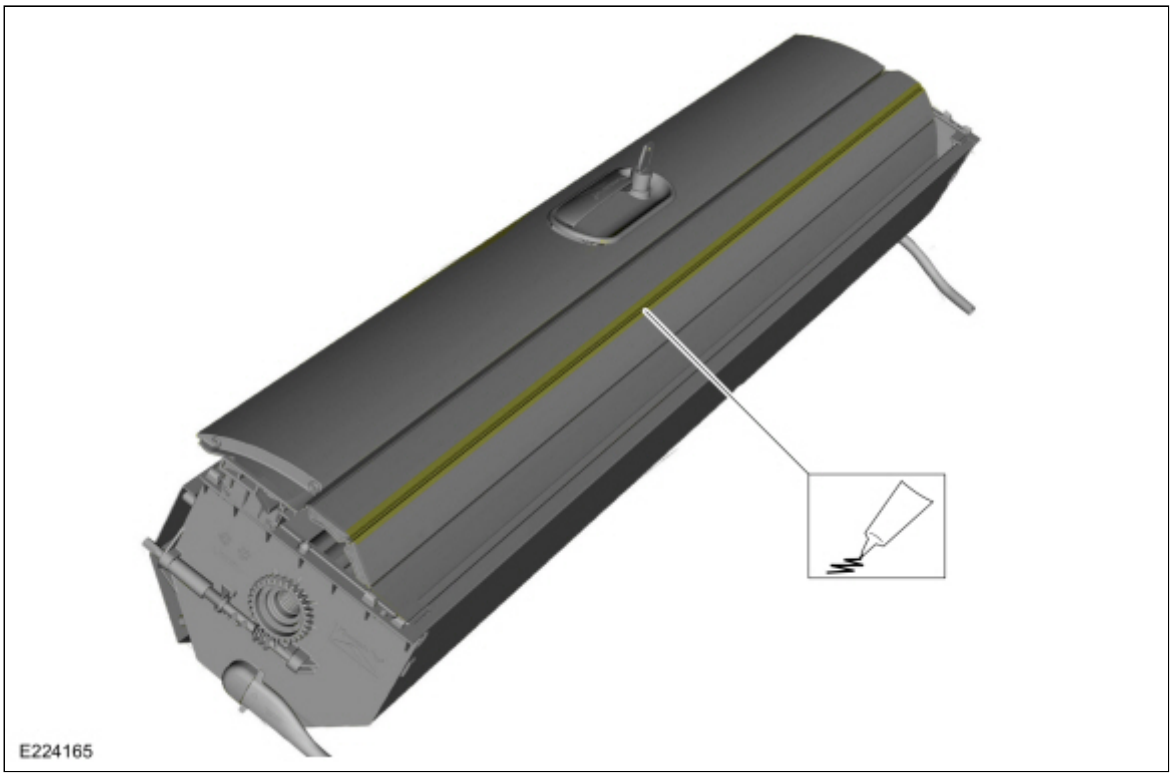
1. Refer to: Roller Shutter Side Rail (501-04 Pickup Bed and Platform Body, Removal and Installation).
2. 

3. **NOTE:** *Use a suitable tool to prevent the component from rotating.*

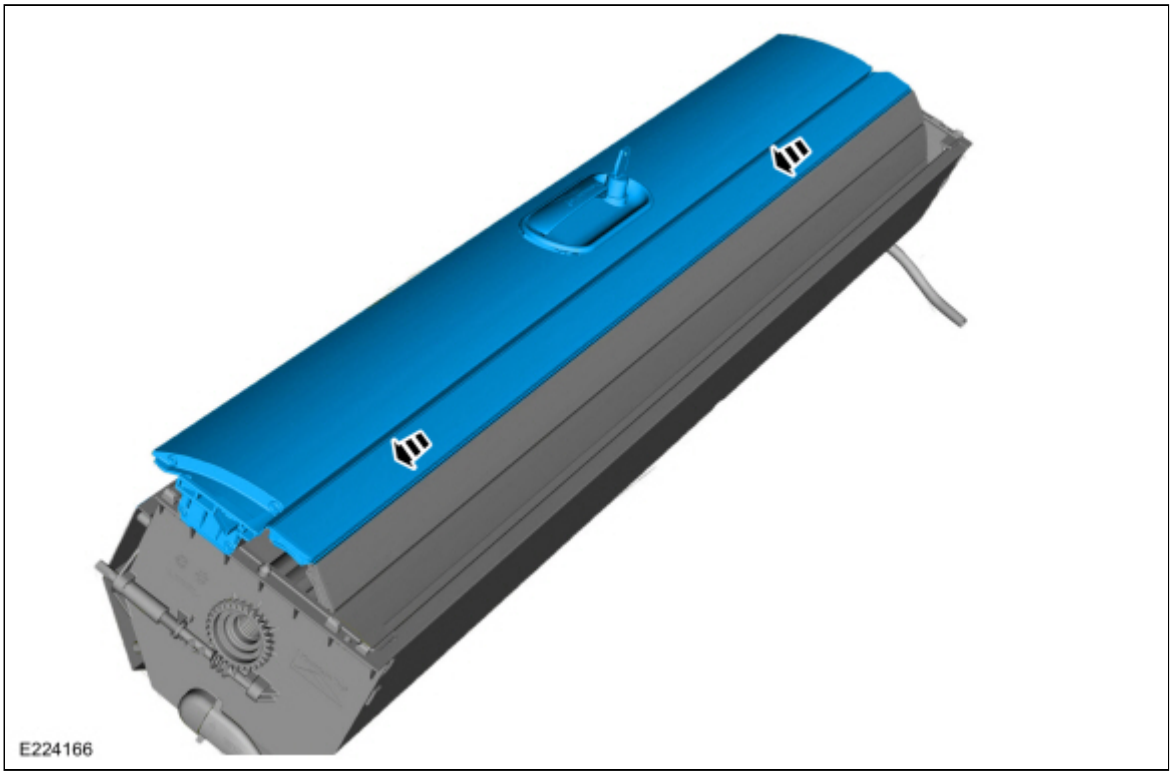
   Use the General Equipment: Flat Headed Screw Driver



4. **NOTE:** *Lubricate the seal with mild soap solution.*



5.



Installation

1. To install, reverse the removal procedure.

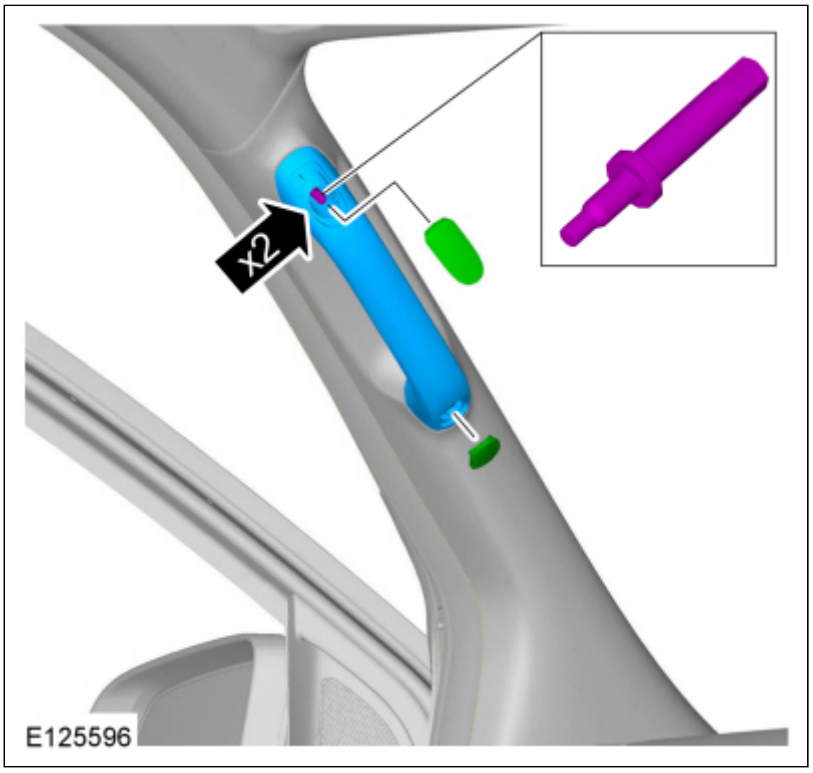
Copyright © 2016 Ford Motor Company

A-Pillar Trim Panel

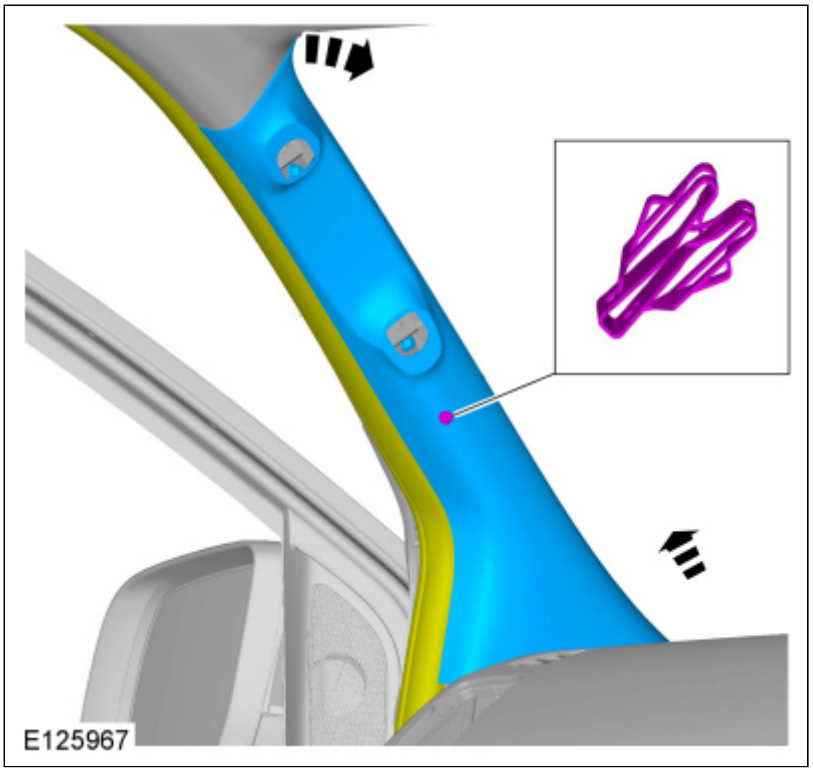
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*: 5 Nm



2.



Installation

1. To install, reverse the removal procedure.

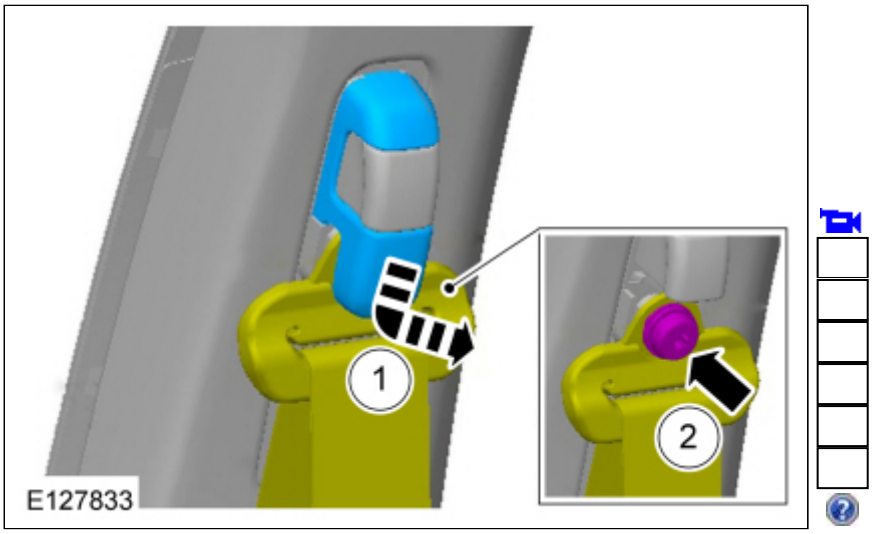
Copyright © 2016 Ford Motor Company

B-Pillar Upper Trim Panel

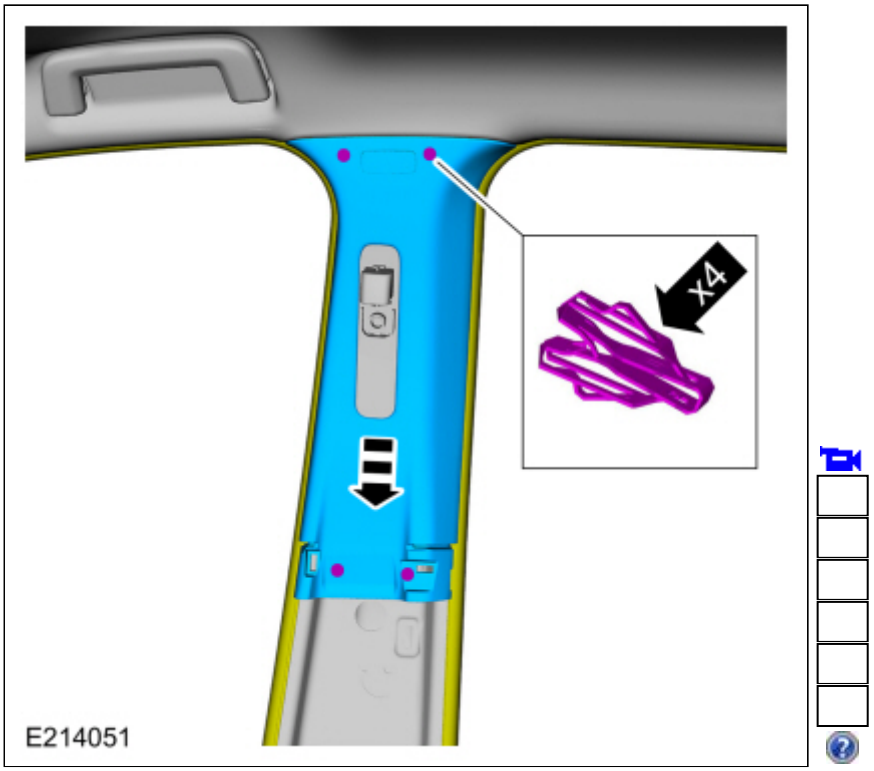
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*: 47 Nm



2. Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3.



Installation

1. To install, reverse the removal procedure.

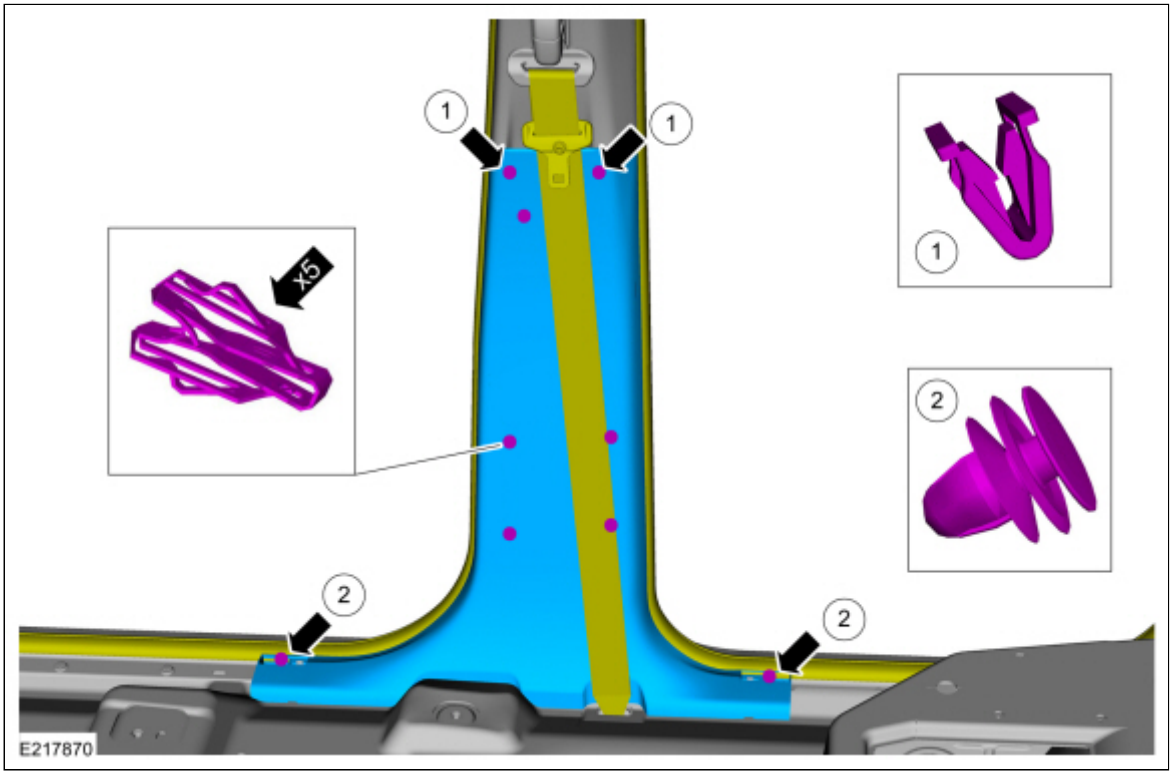
Copyright © 2016 Ford Motor Company

B-Pillar Lower Trim Panel

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: Rear Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

C-Pillar Lower Trim Panel

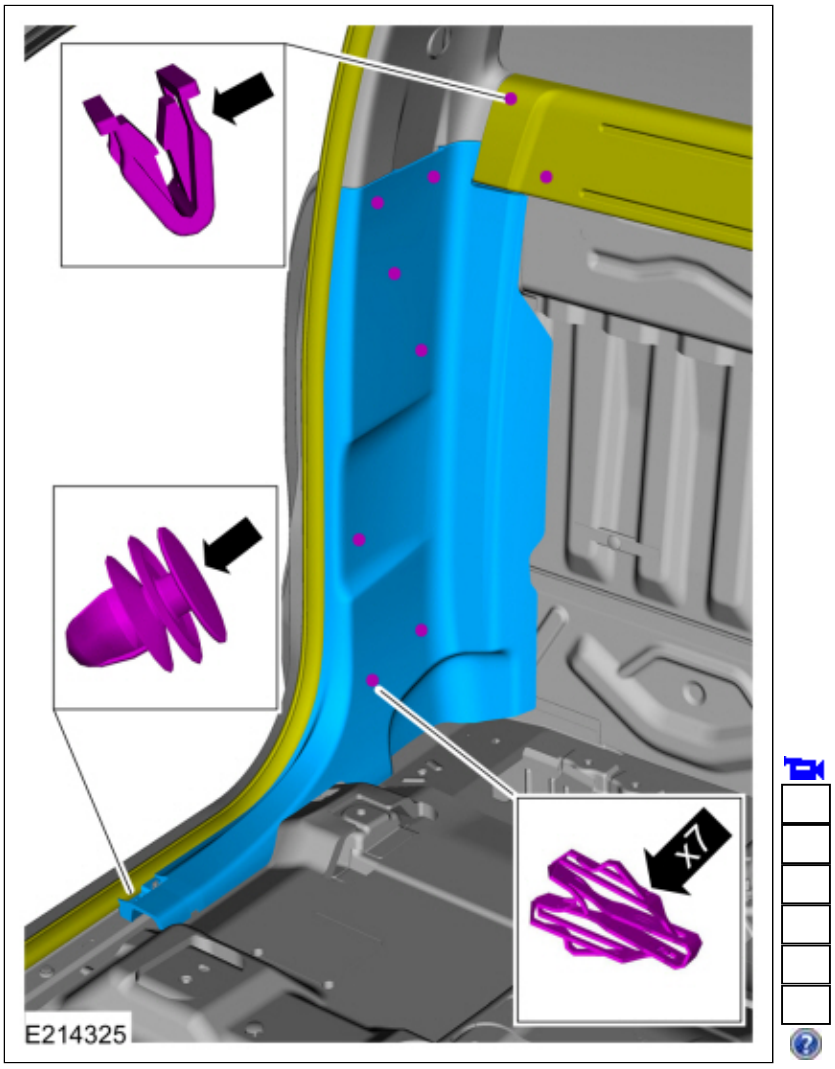
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

Single cab

1. Refer to: Rear Seat (501-10A Seating, Removal and Installation).
   Refer to: Rear Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

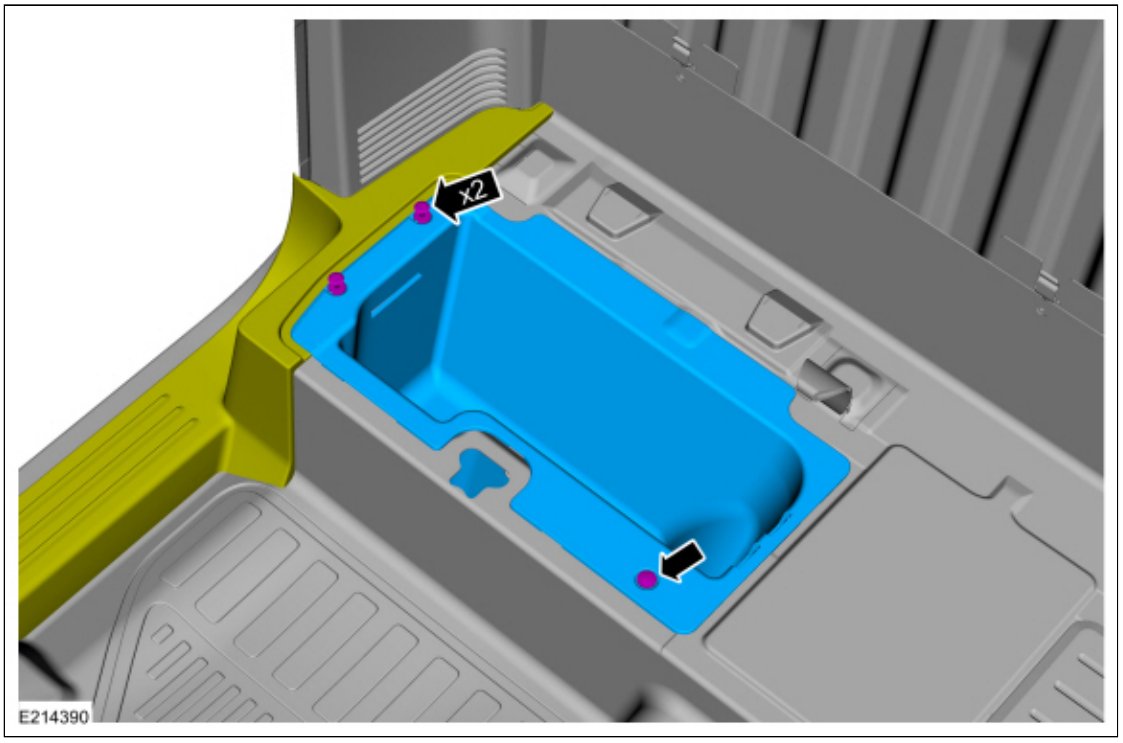
2.



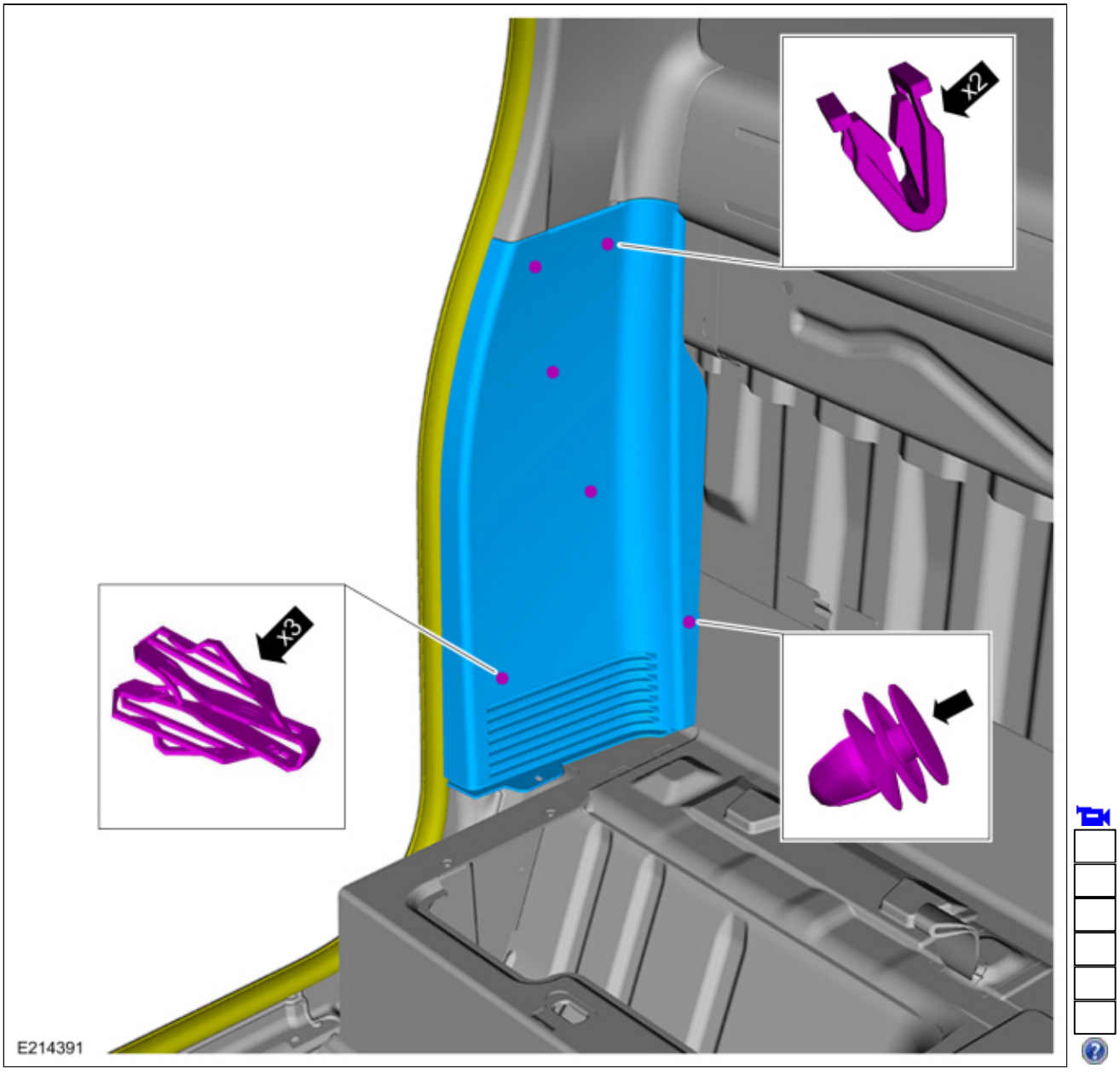
Stretch cab

3. Refer to: Rear Seat (501-10A Seating, Removal and Installation).

4.

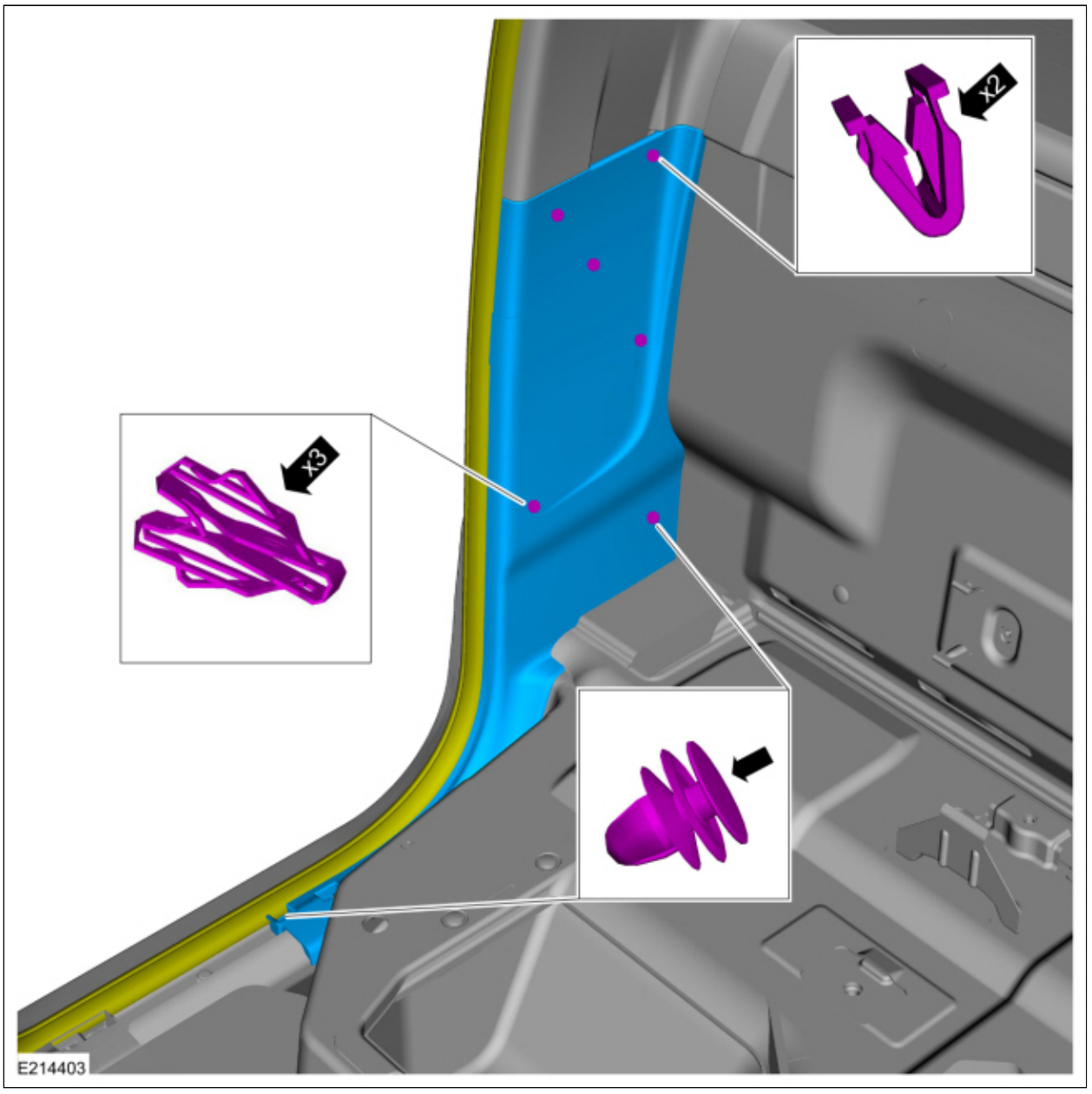


5.



Double cab

6. Refer to: Rear Seat (501-10A Seating, Removal and Installation).
   Refer to: Rear Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
7.



Installation

1. To install reverse the removal procedure

Copyright © 2016 Ford Motor Company

C-Pillar Upper Trim Panel

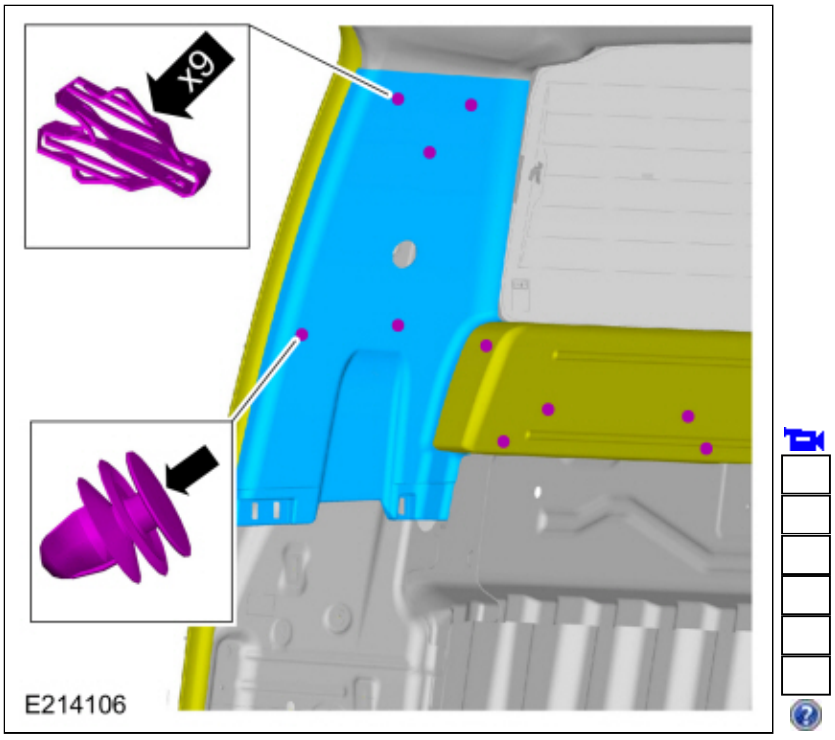
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Rear Seatbelt Retractor (501-20A Seatbelt Systems, Removal and Installation).
2. Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

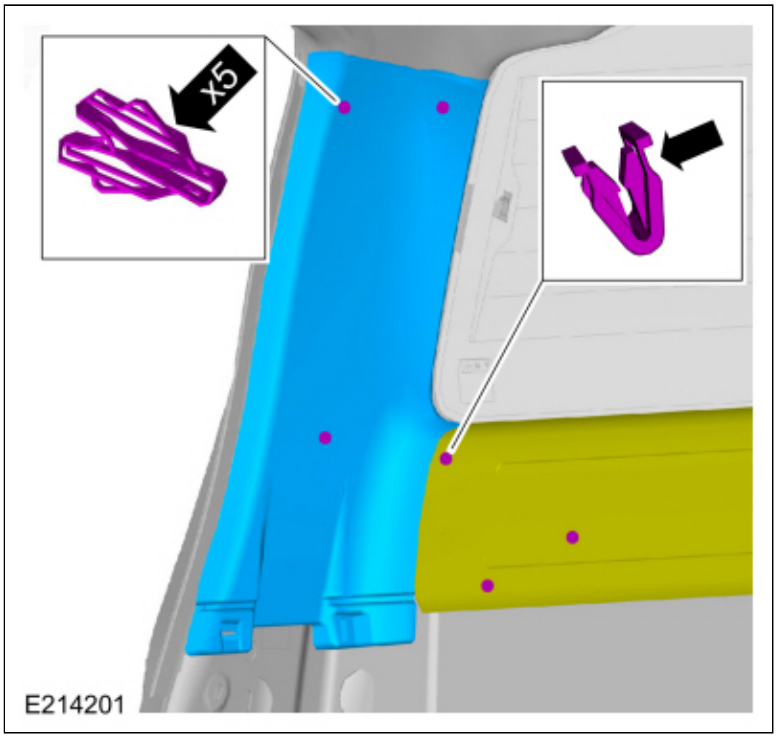
Single cab

3.

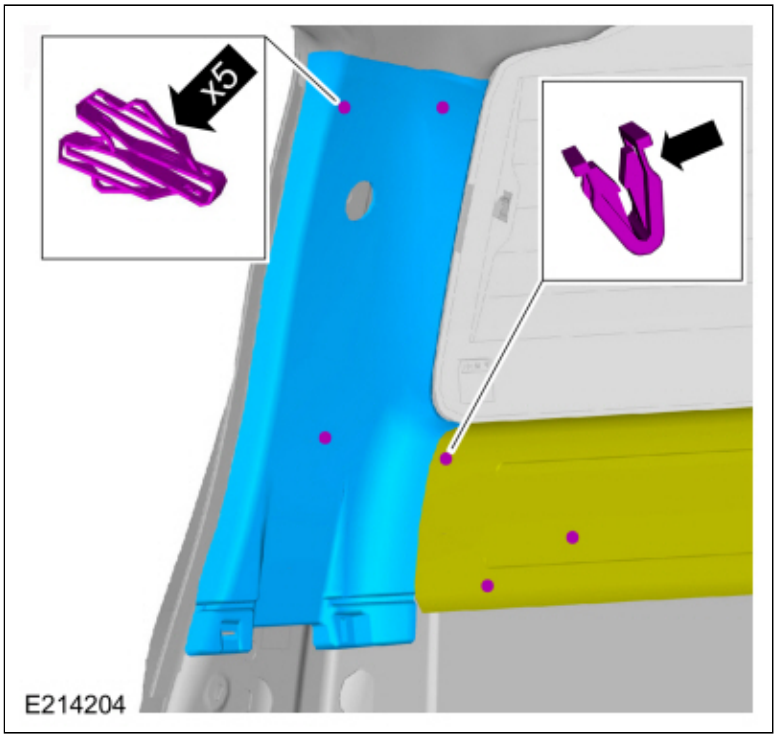


Stretch cab

4.

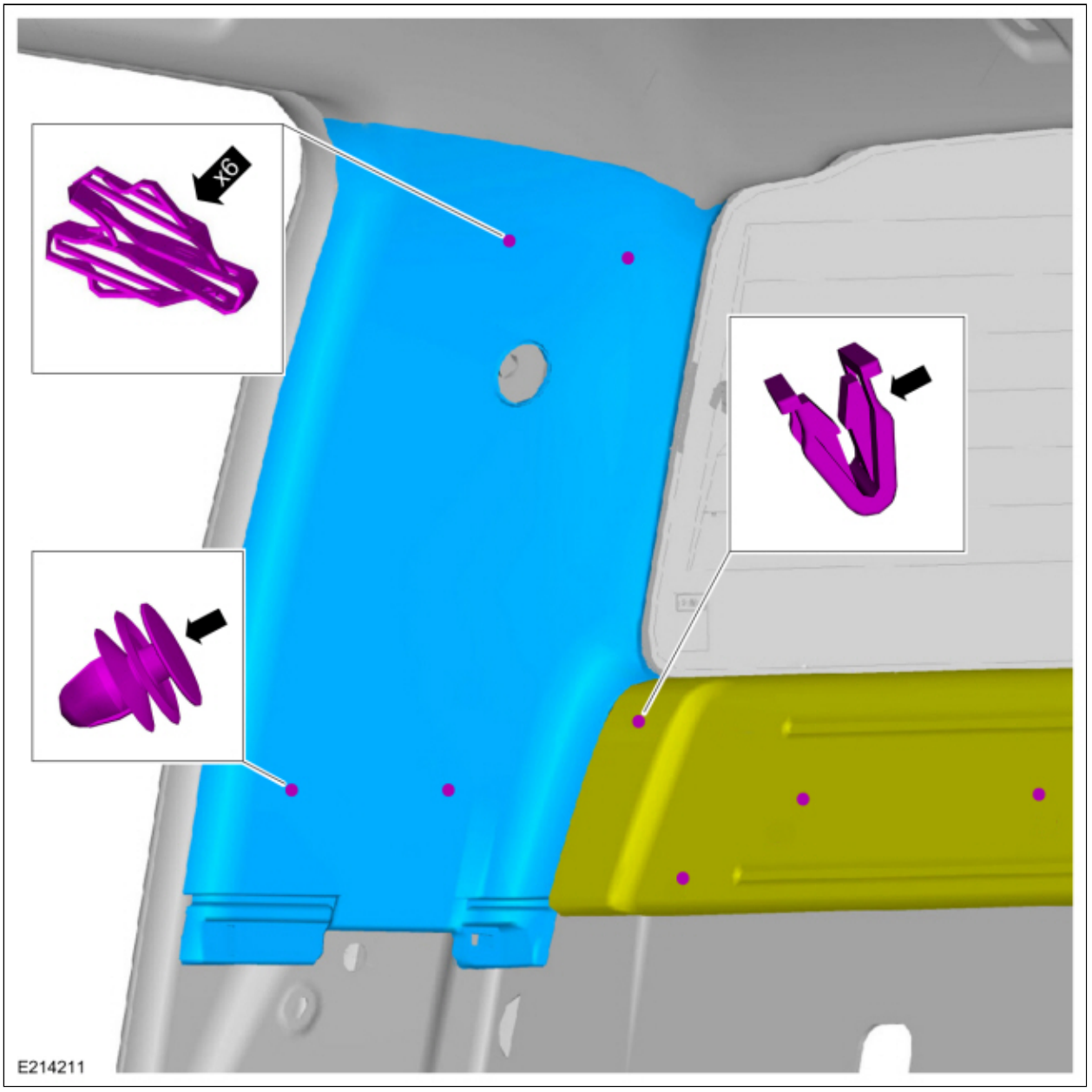


5.



Double cab

6.



Installation

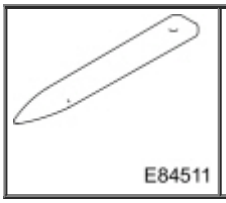
1. To install, reverse the removal procedure

Copyright © 2016 Ford Motor Company

Front Door Trim Panel

Base Part Number: 23942

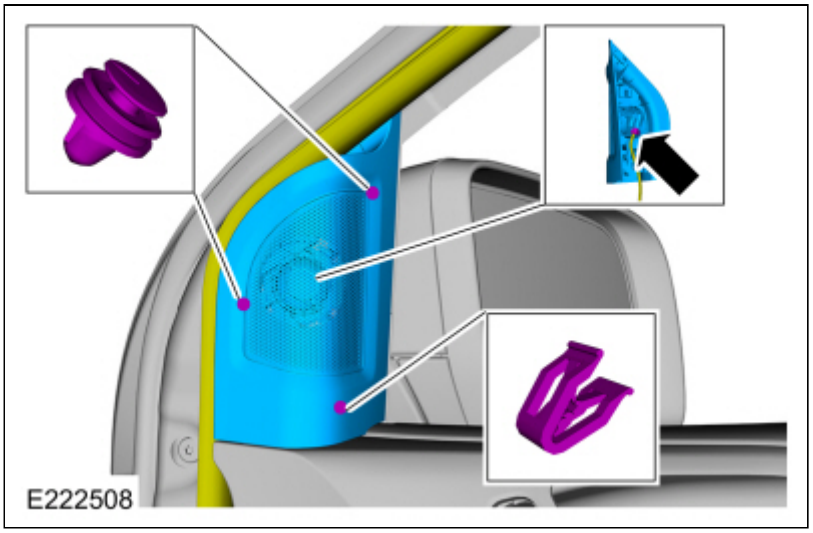
Special Tool(s) / General Equipment

 E84511	501-125 Remover, Grab Handle Cover

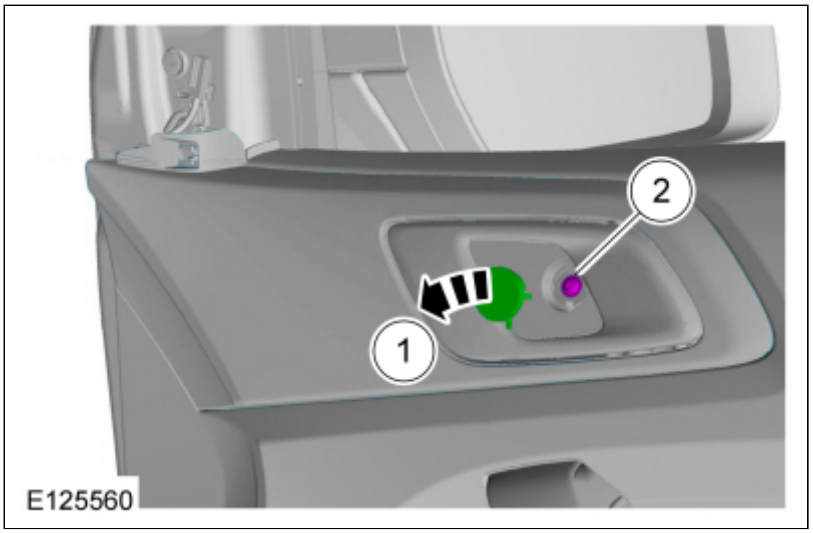
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.

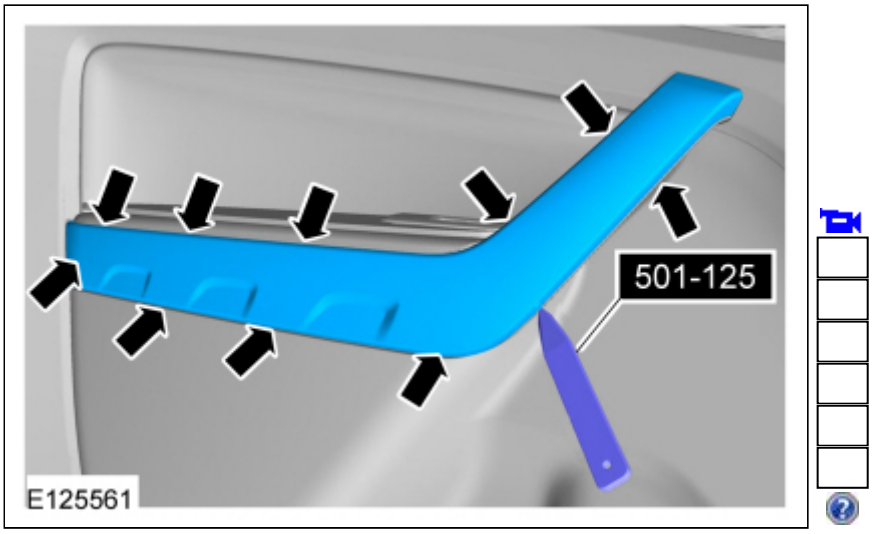


2.

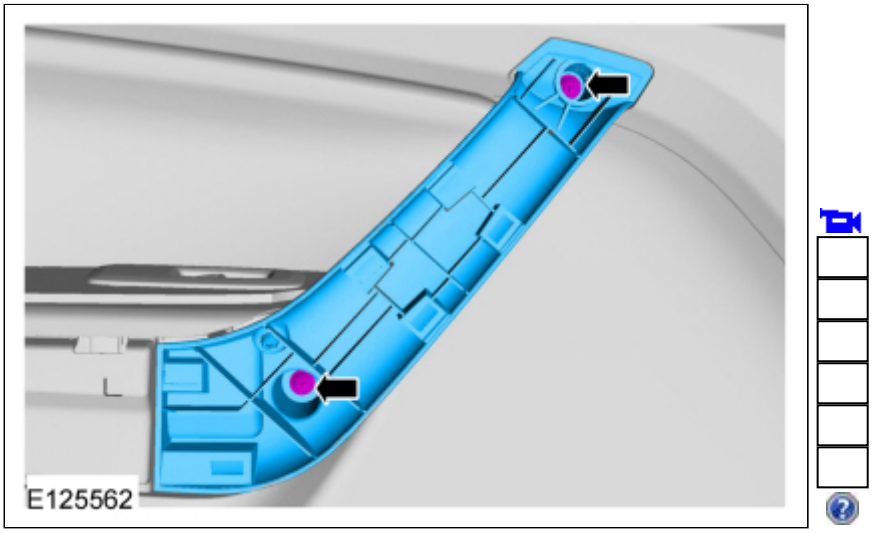


3. **NOTICE: Take extra care not to damage the edges of the component.**

   Use Special Service Tool: 501-125 Remover, Grab Handle Cover.

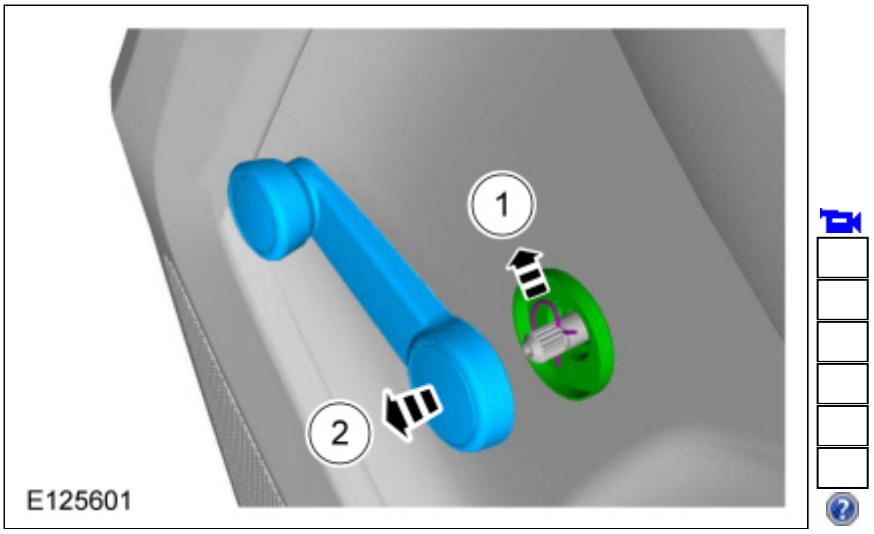


4.



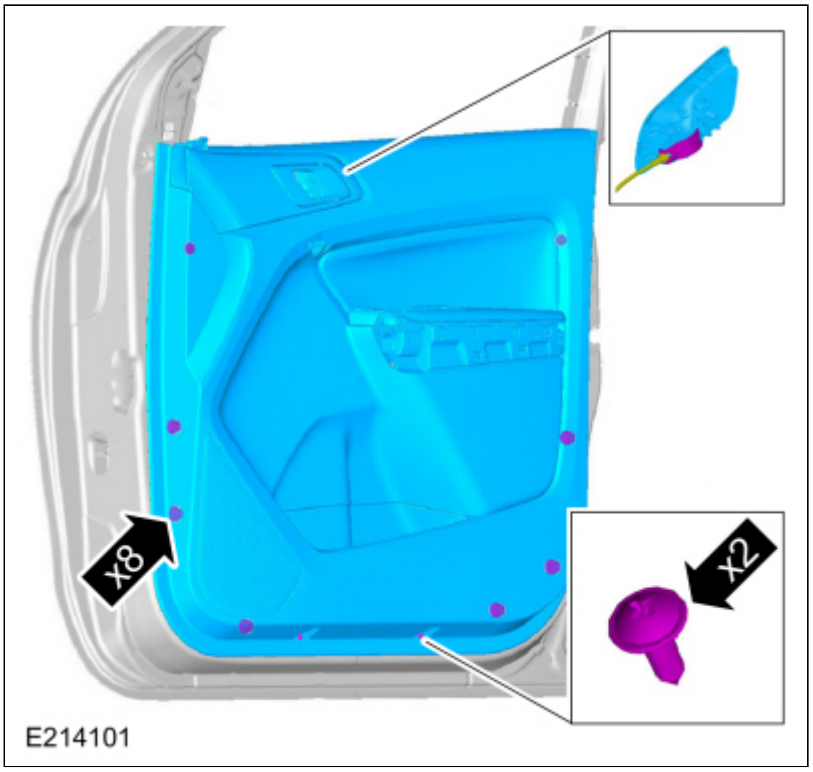
Vehicles with manual windows

5.



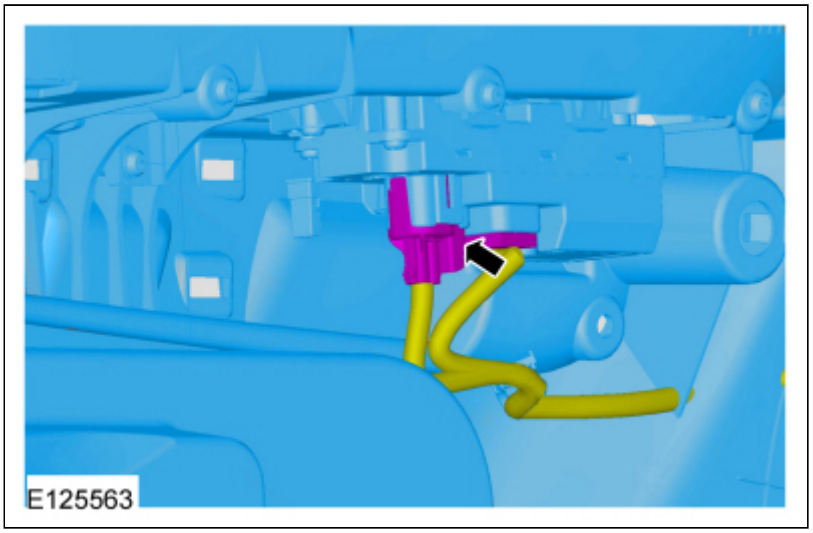
All vehicles

6.



Vehicles with power windows

7.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

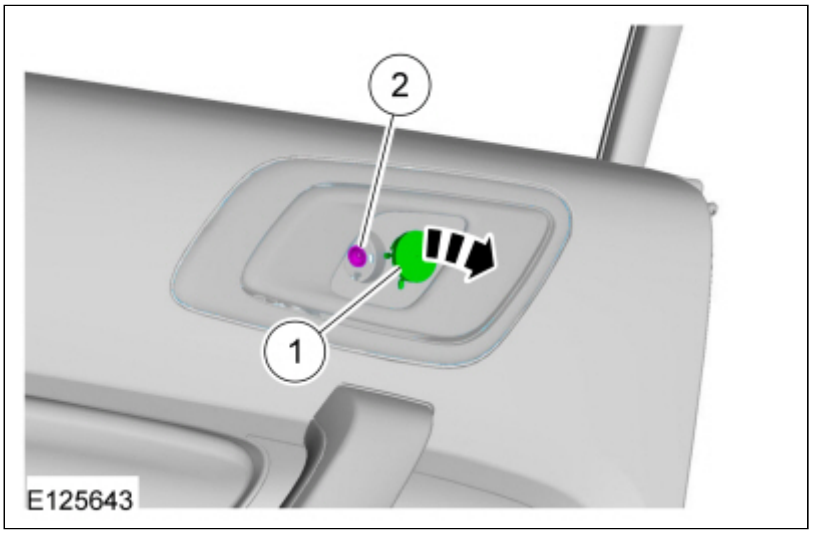
Rear Door Trim Panel - Double Cab

Base Part Number: 27406

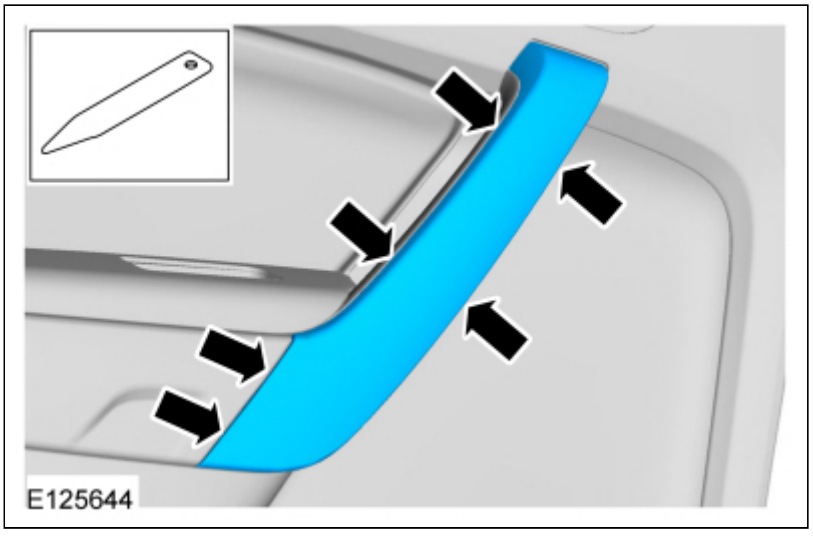
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

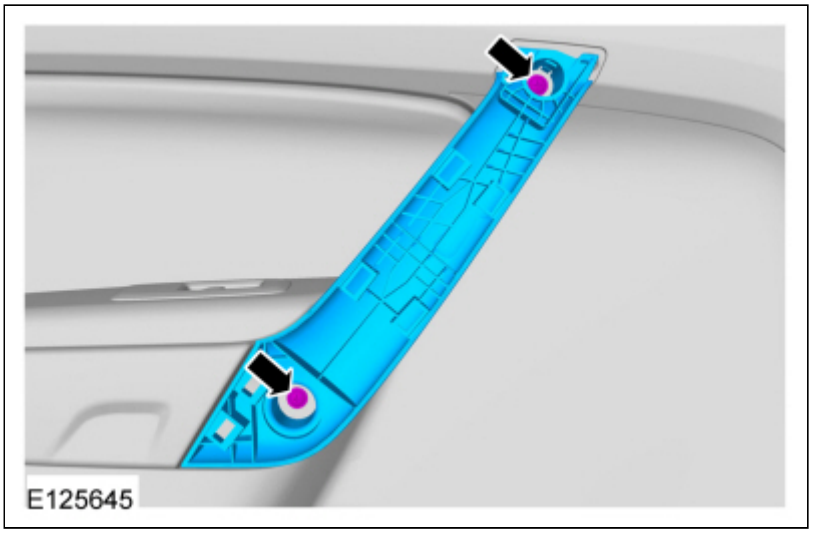
1.



2. **NOTICE: Take extra care not to damage the edges of the component.**

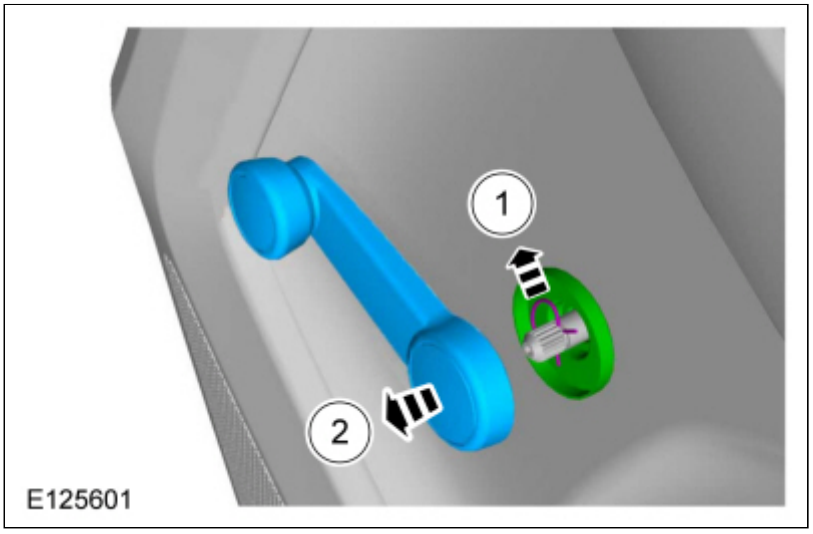


3.



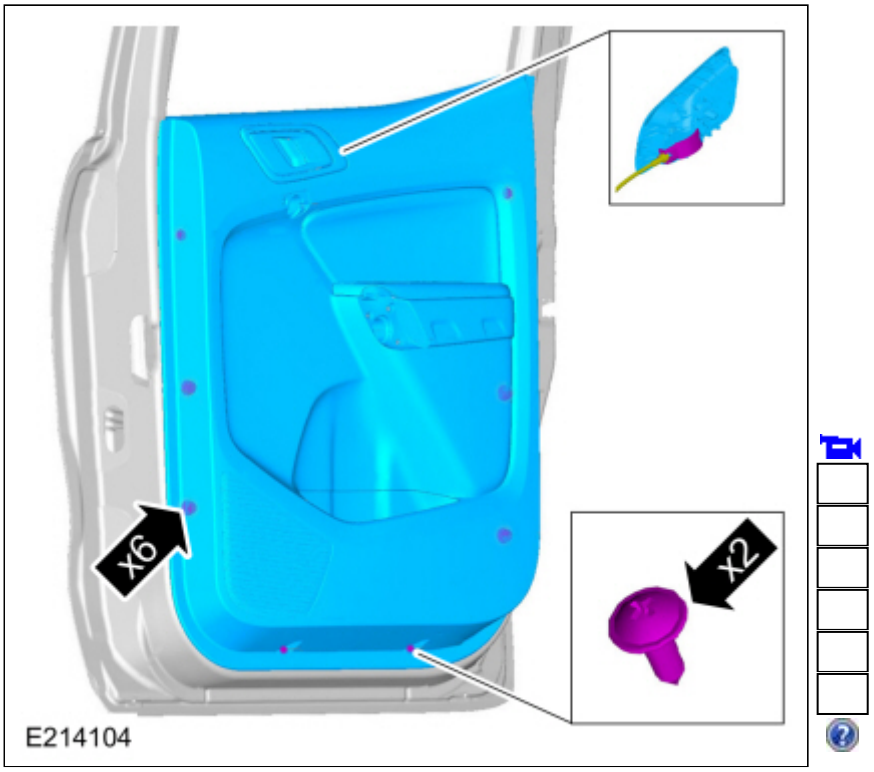
Vehicles with manual windows

4.



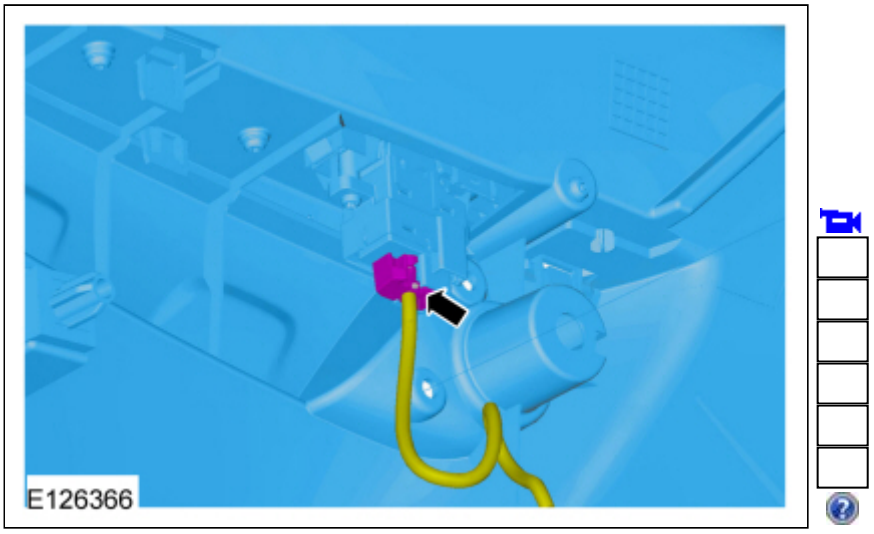
All vehicles

5.



Vehicles with power windows

6.



Installation

1. To install, reverse the removal procedure.

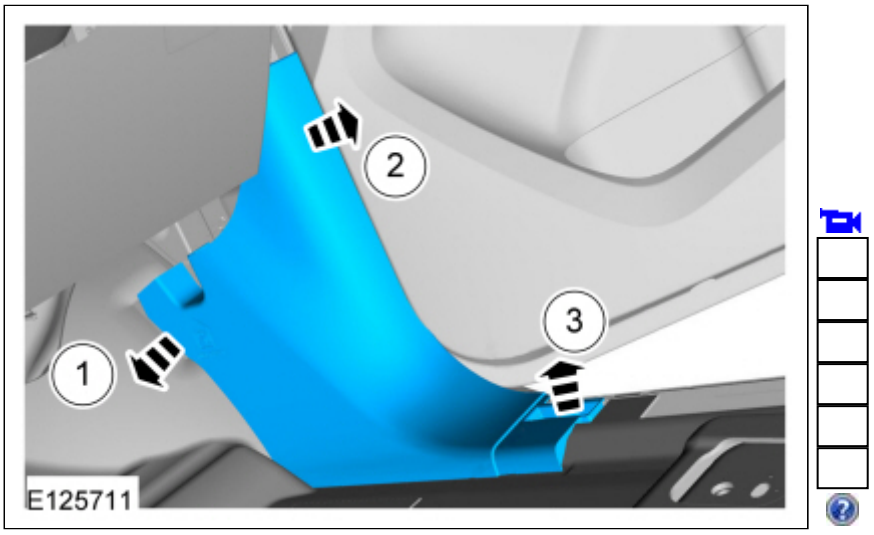
Copyright © 2016 Ford Motor Company

Cowl Side Trim Panel

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2.



Installation

1. To install, reverse the removal procedure.

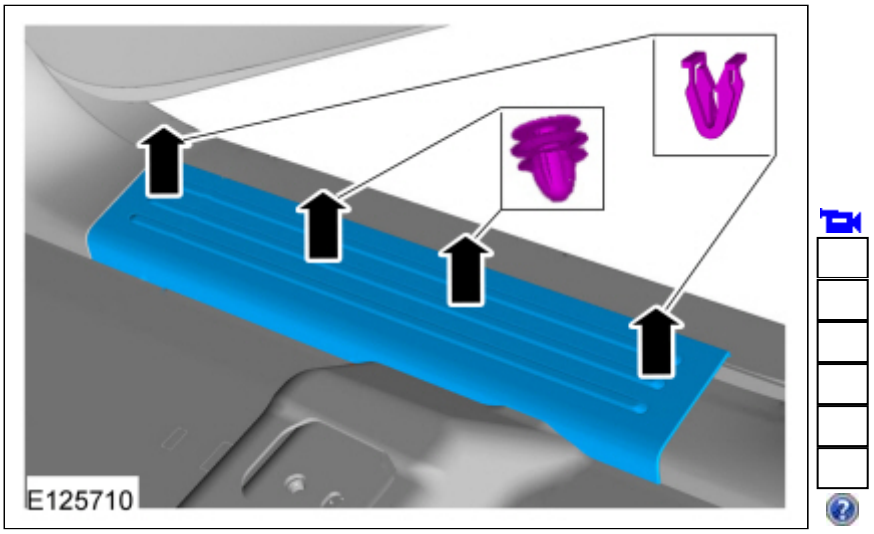
Copyright © 2016 Ford Motor Company

Front Scuff Plate Trim Panel

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



Installation

1. To install, reverse the removal procedure.

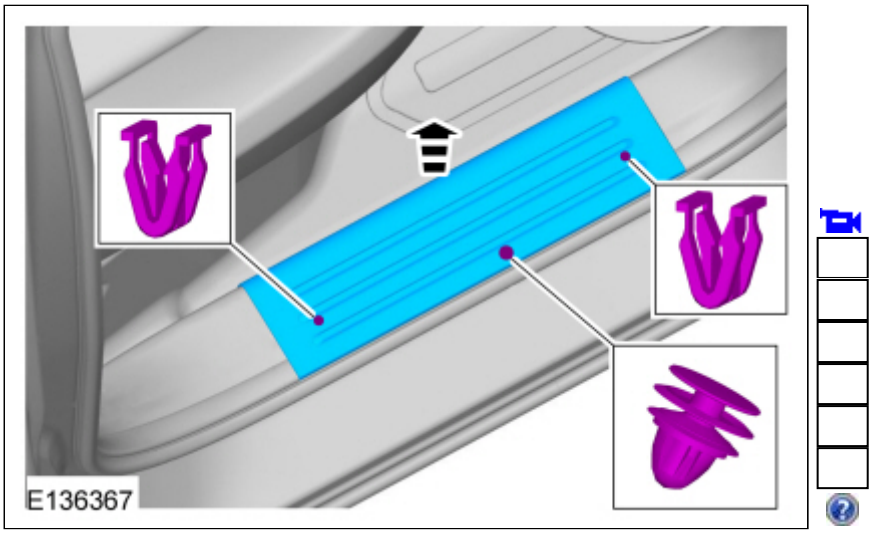
Copyright © 2016 Ford Motor Company

Rear Scuff Plate Trim Panel

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *Note the position of each fastener.*



Installation

1. **NOTE:** *Make sure that the fasteners are installed to the position noted before removal.*

   To install, reverse the removal procedure.

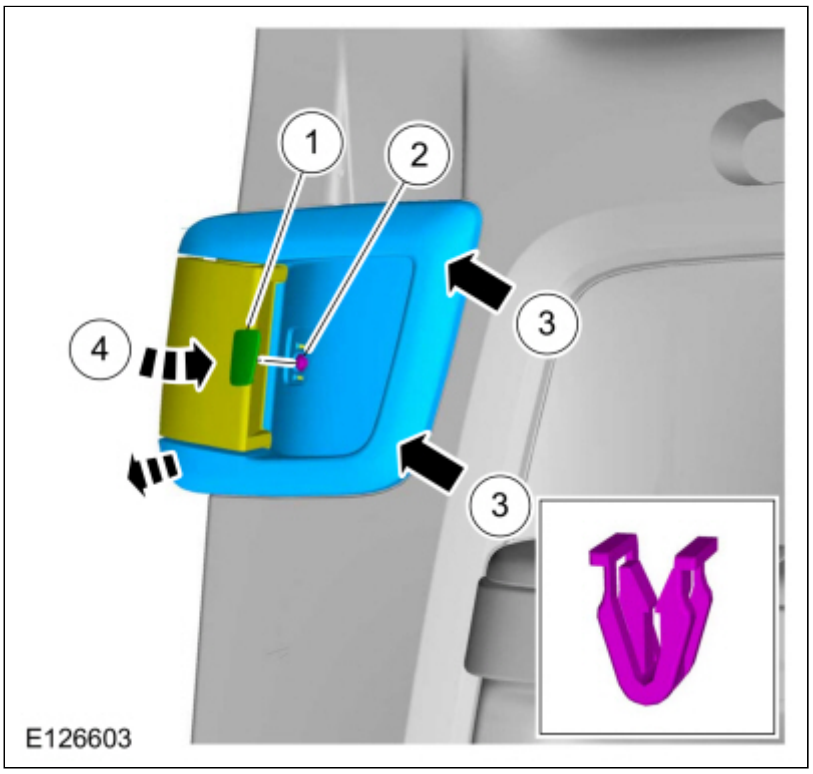
Copyright © 2016 Ford Motor Company

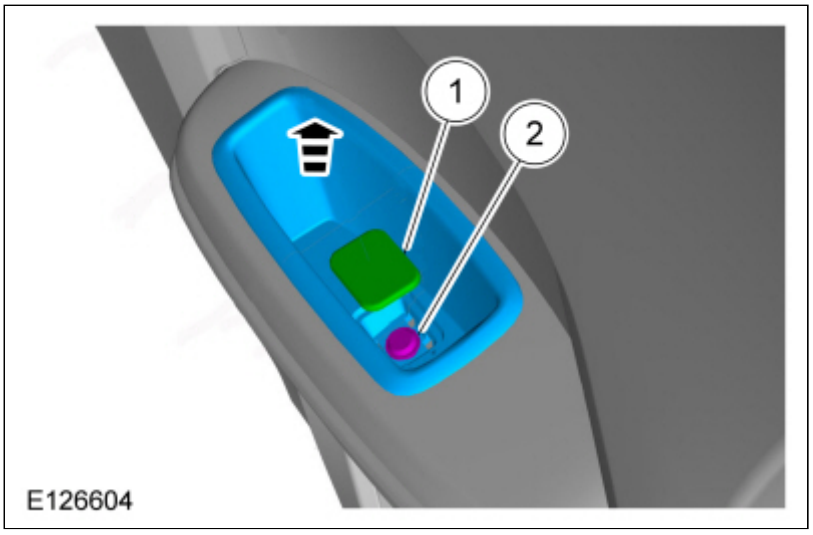
Rear Door Trim Panel - Super Cab

Base Part Number: 27406

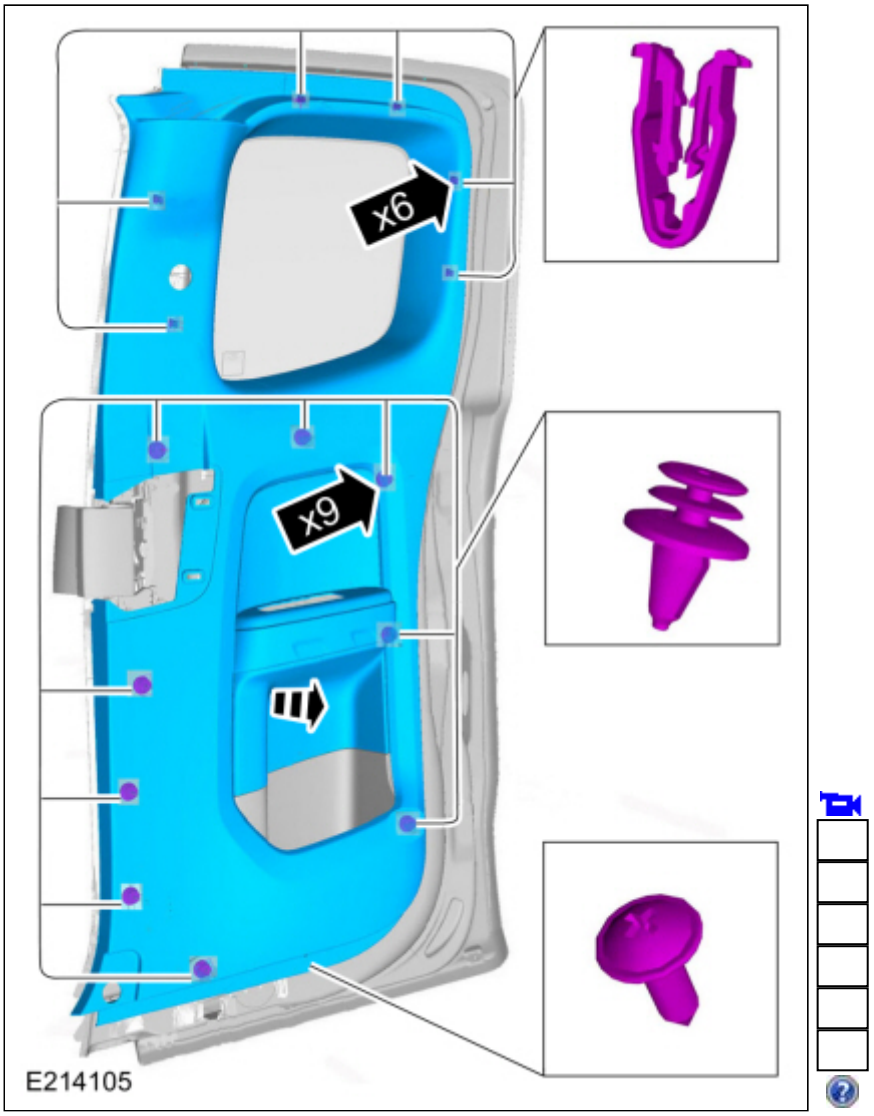
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seatbelt Retractor - Super Cab (501-20A Seatbelt Systems, Removal and Installation).
2. 

3. 

4.



Installation

1. To install, reverse the removal procedure.

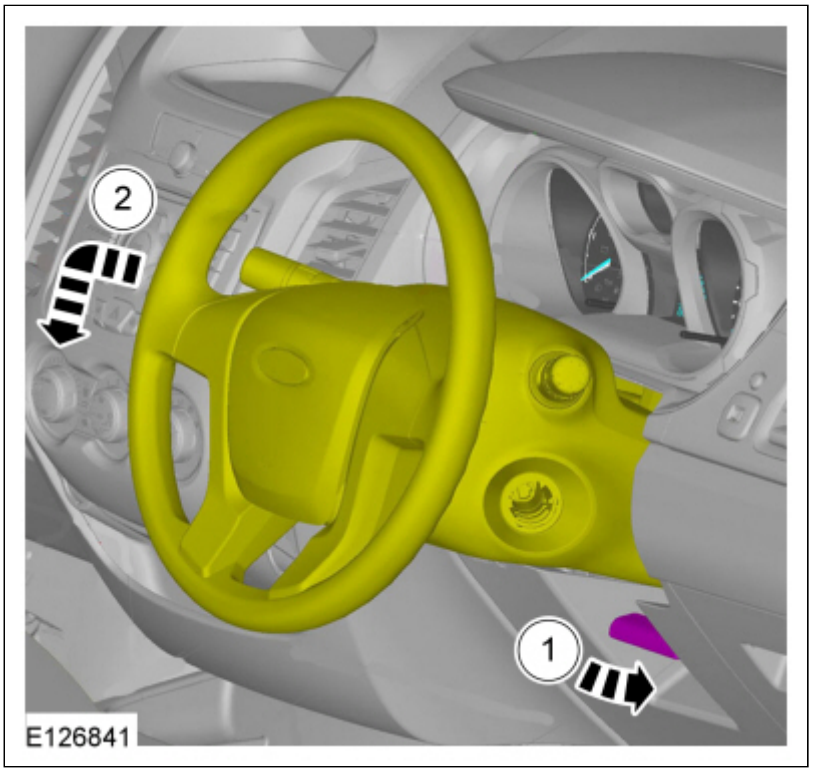
Copyright © 2016 Ford Motor Company

Steering Column Shrouds

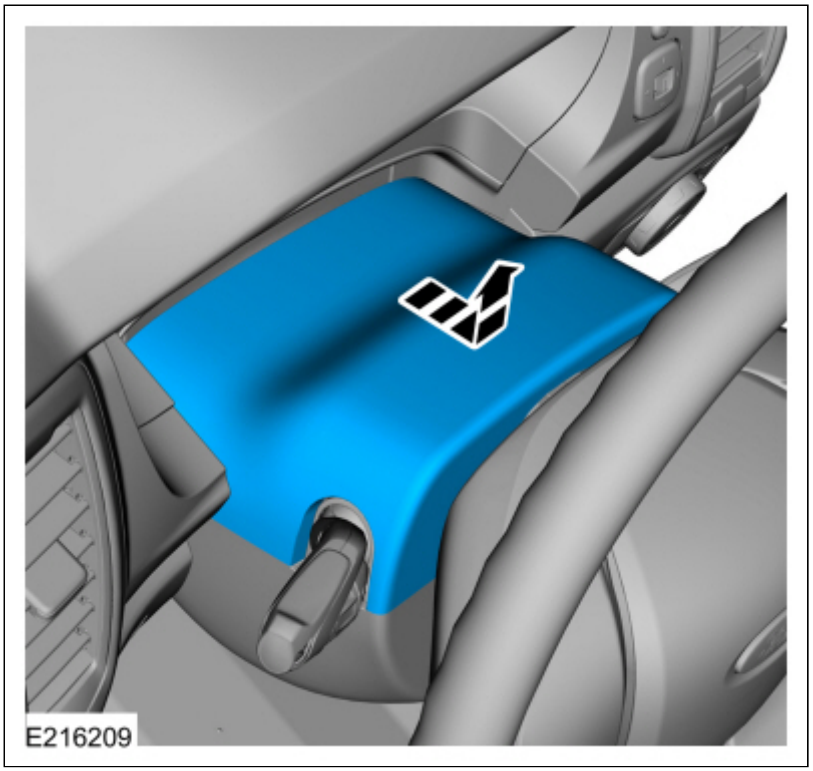
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

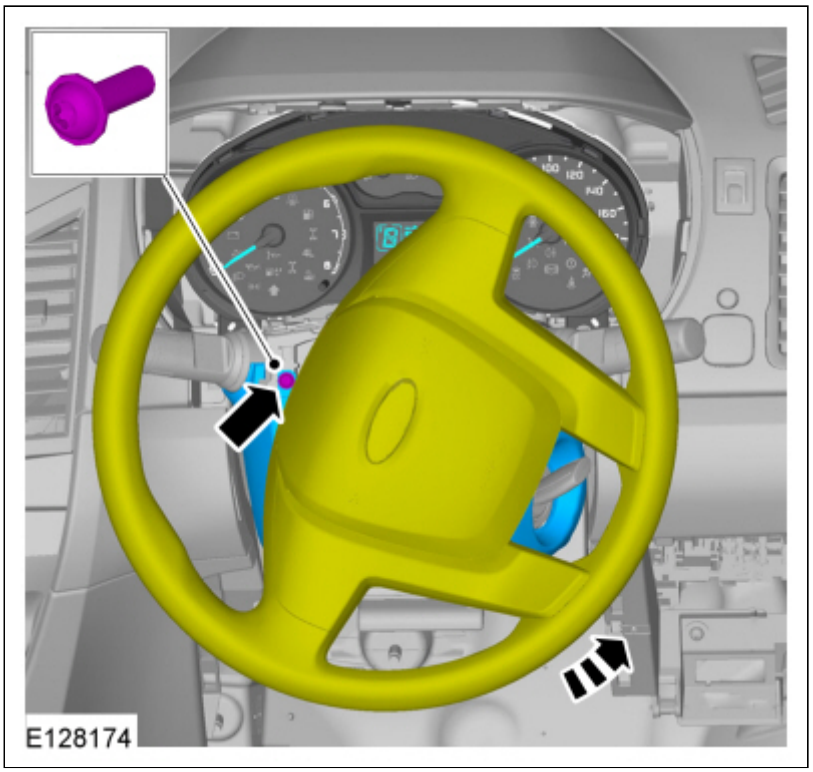
1.



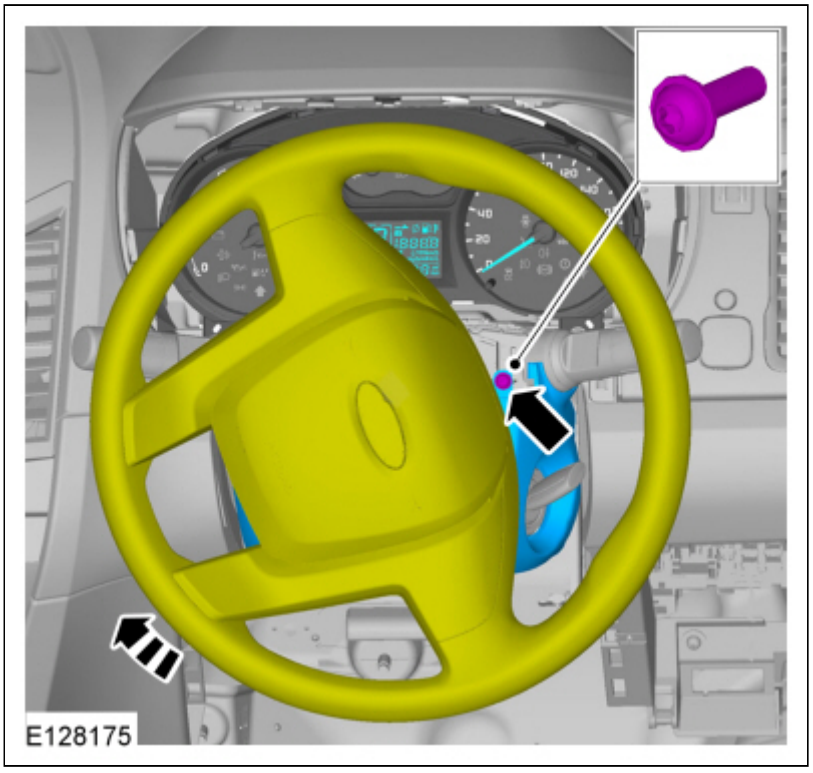
2.



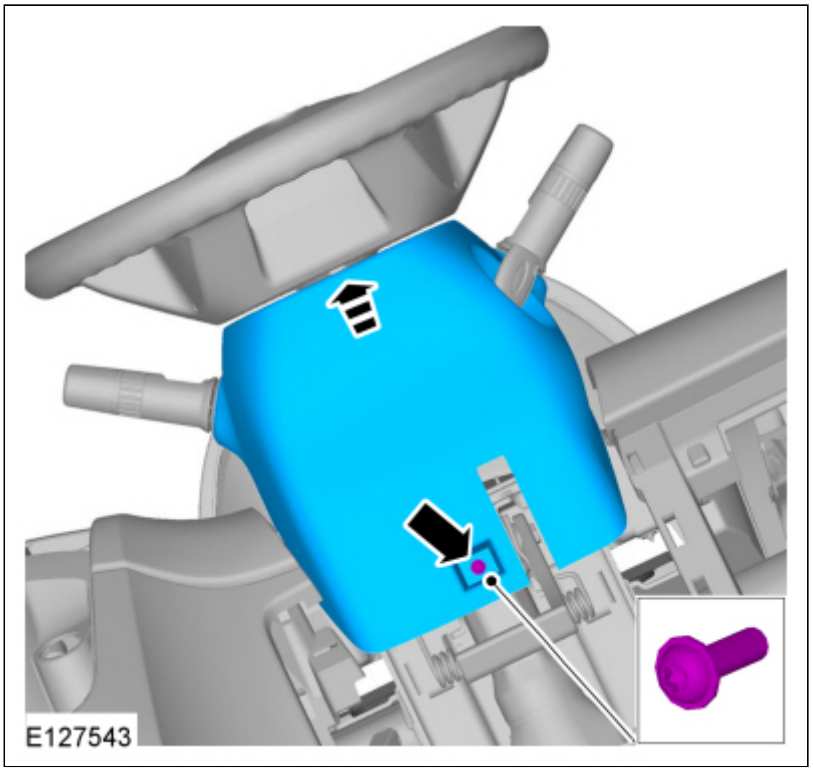
3.



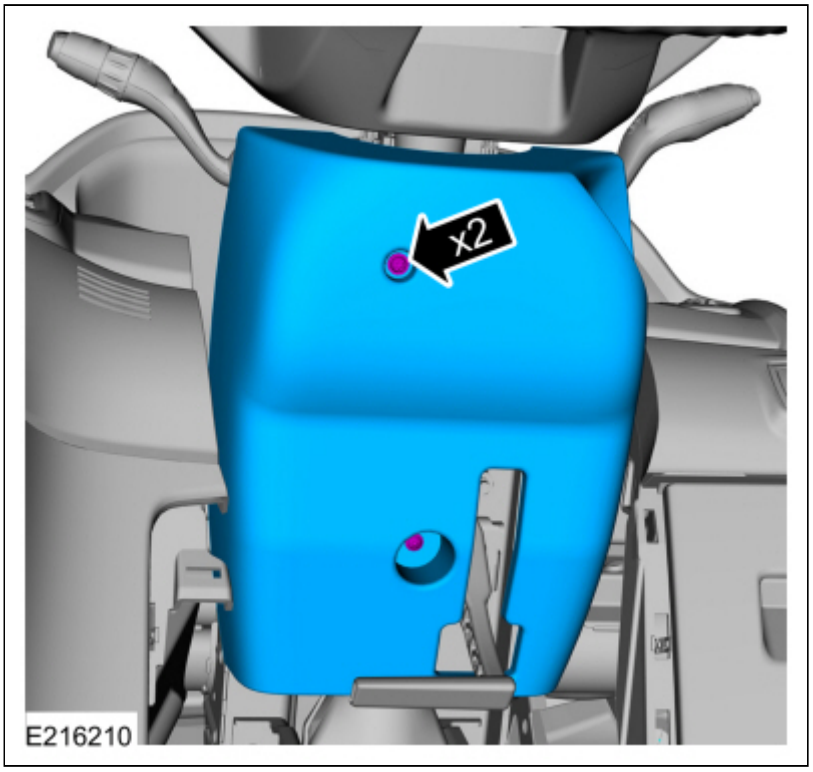
4.



5.



6. If equipped.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Headliner

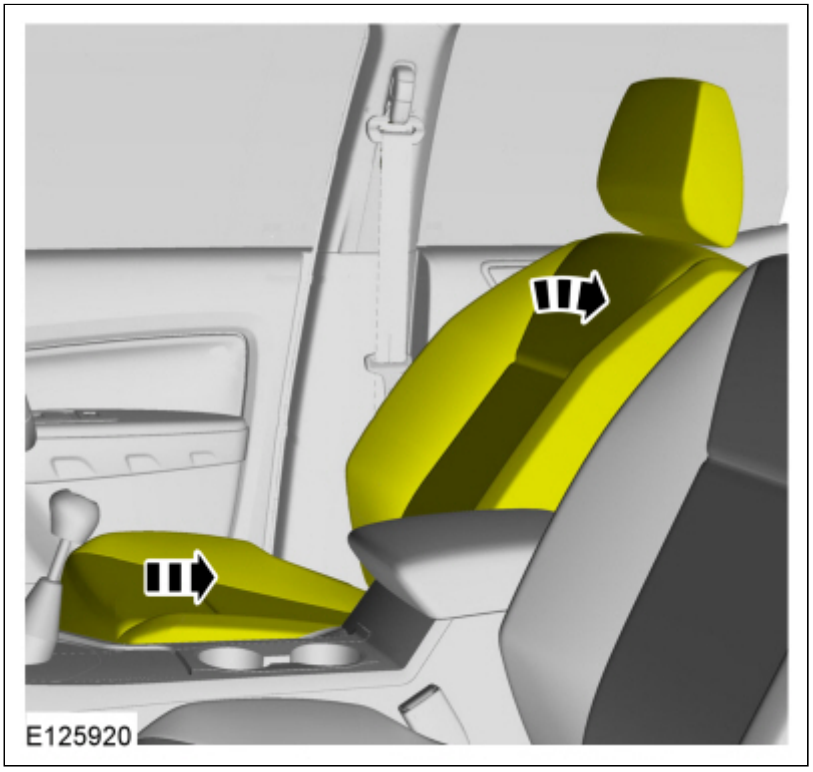
Base Part Number: 5451916

Removal

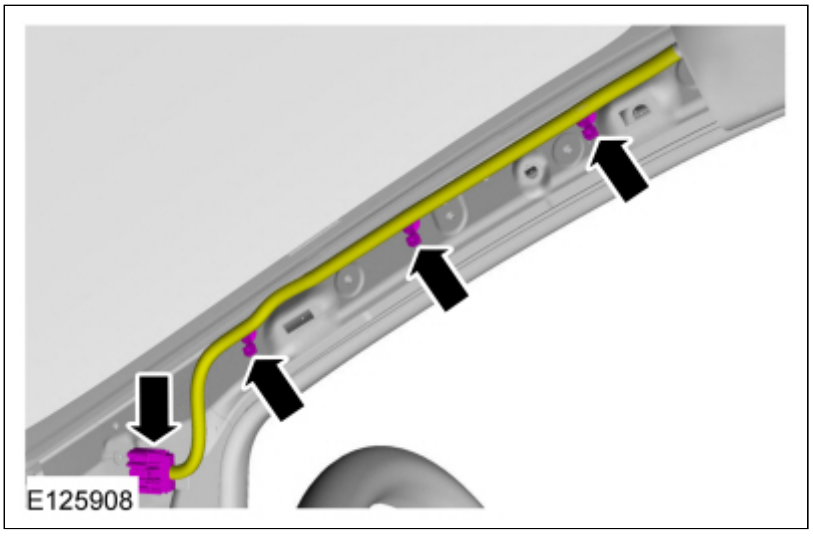
NOTE: *Removal steps in this procedure may contain installation details.*

1. On both the sides.
   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. On both the sides.



3.

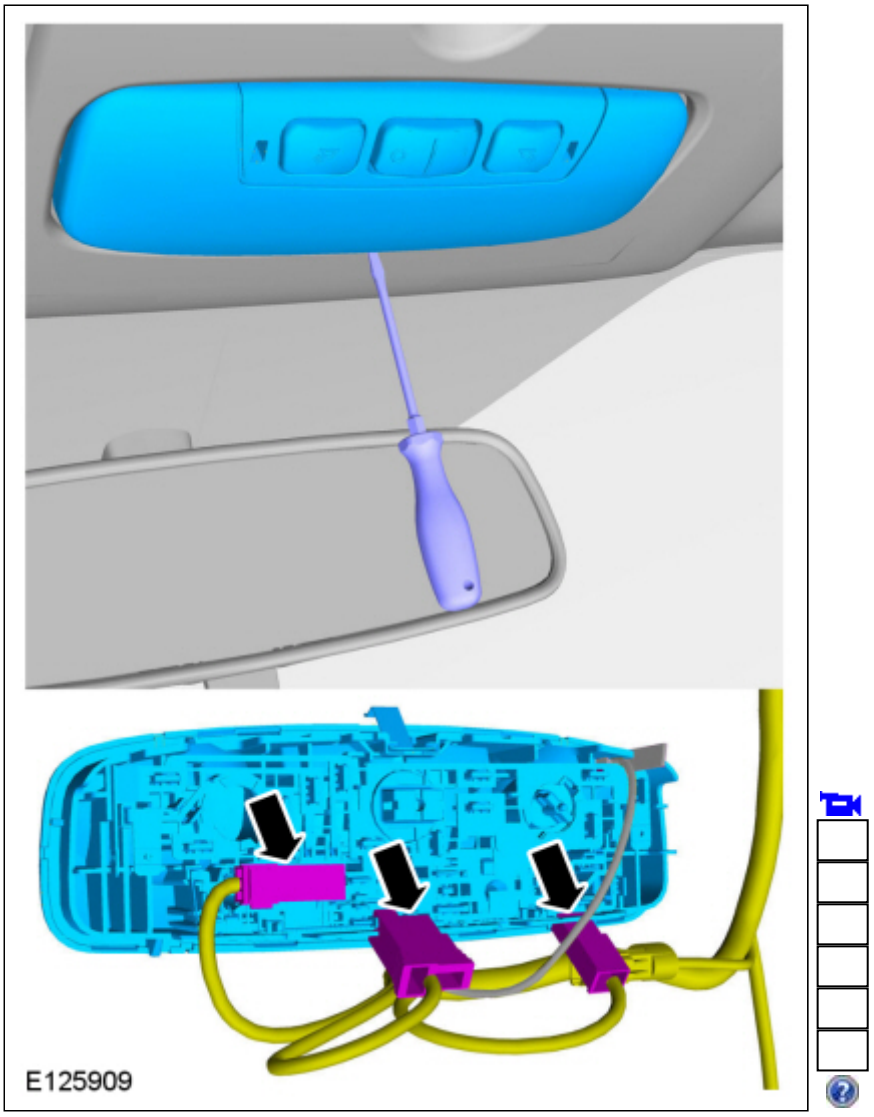


4. On both the sides.
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

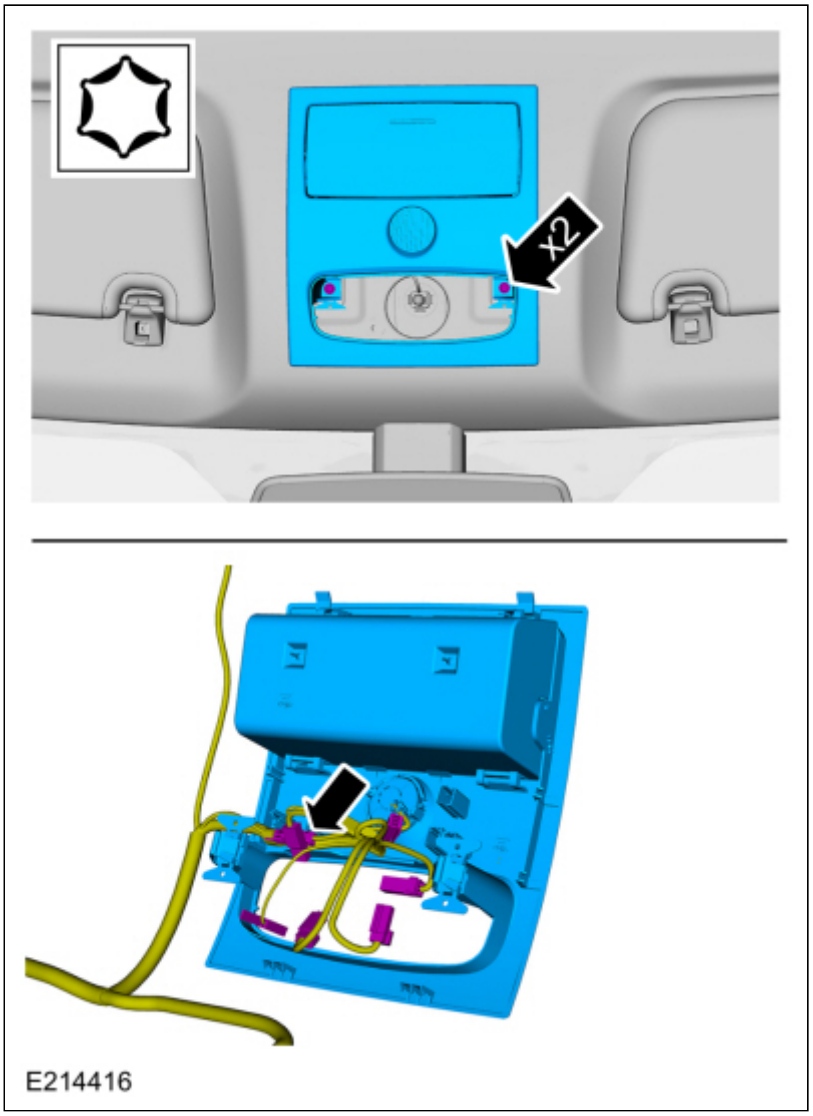
5. On both the sides.

Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

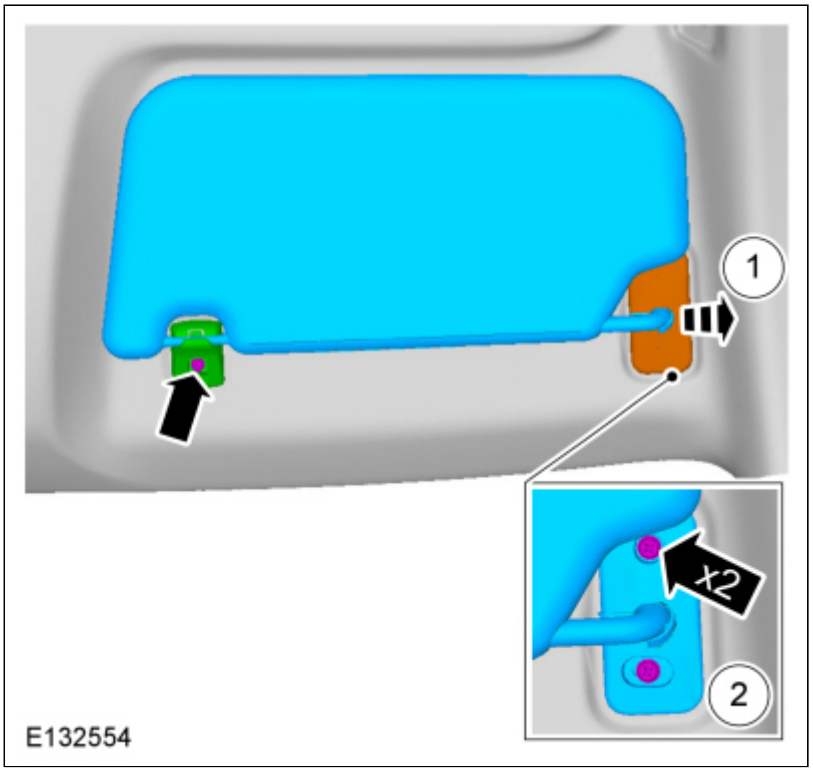
6.



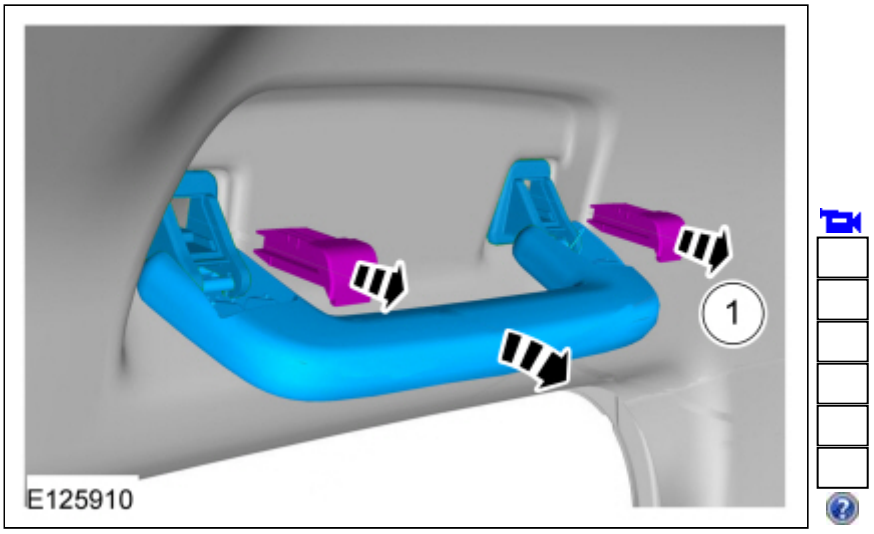
7. **NOTE:** *This step is not necessary when installing a new component.*



8. On both the side



9.



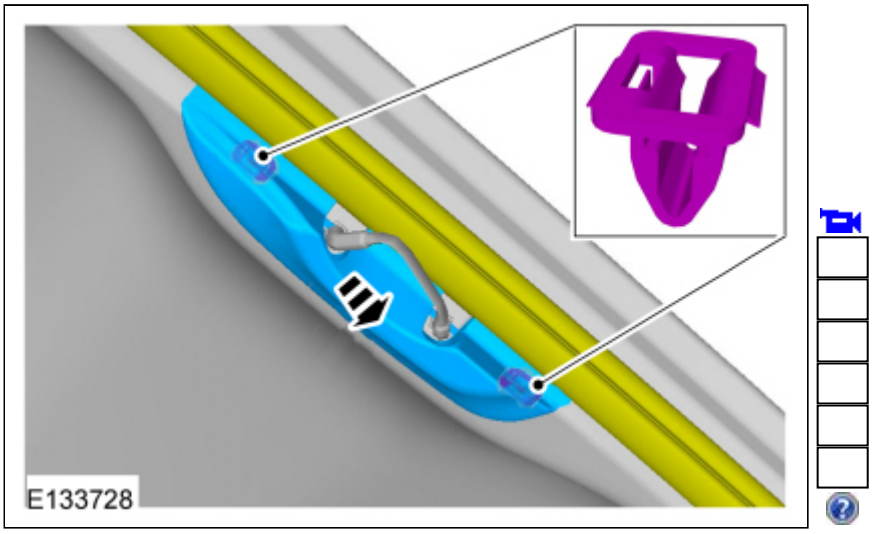
10. Refer to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

Stretch cab or Double cab

11. Refer to: Center Interior Lamp (417-02 Interior Lighting, Removal and Installation).

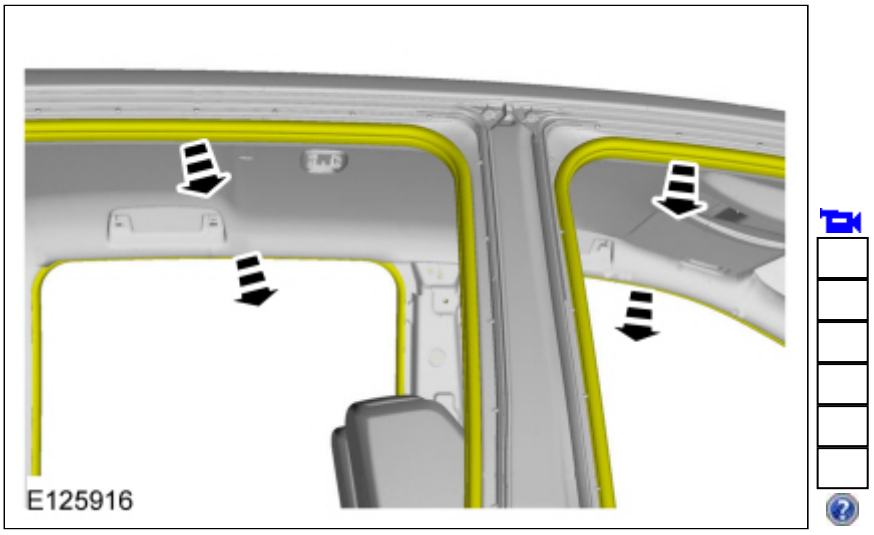
Stretch cab

12.



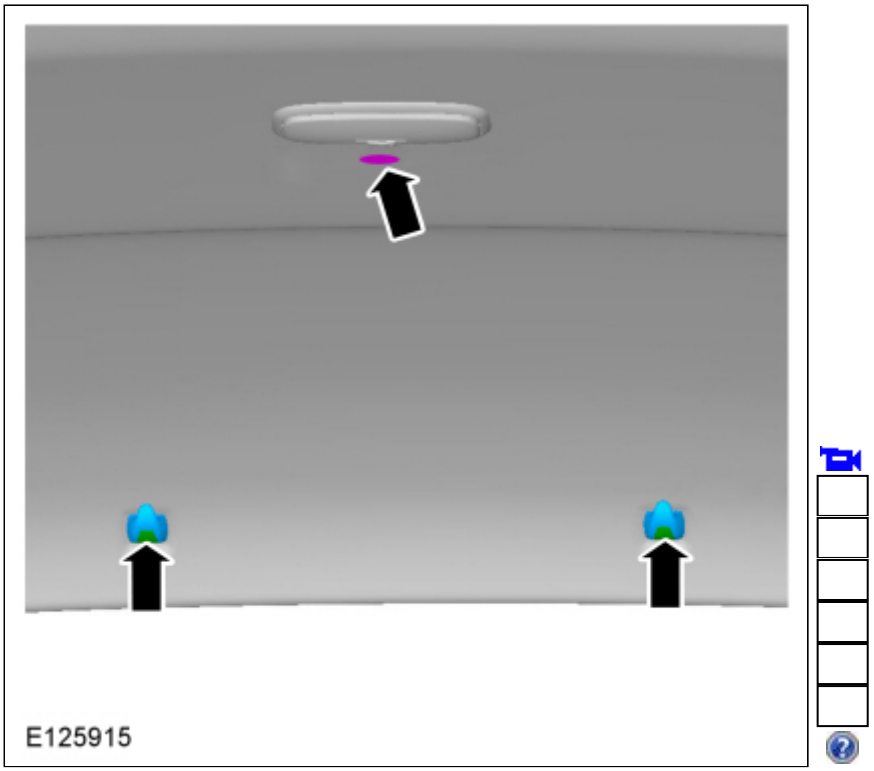
Double cab

13. Support the headliner.



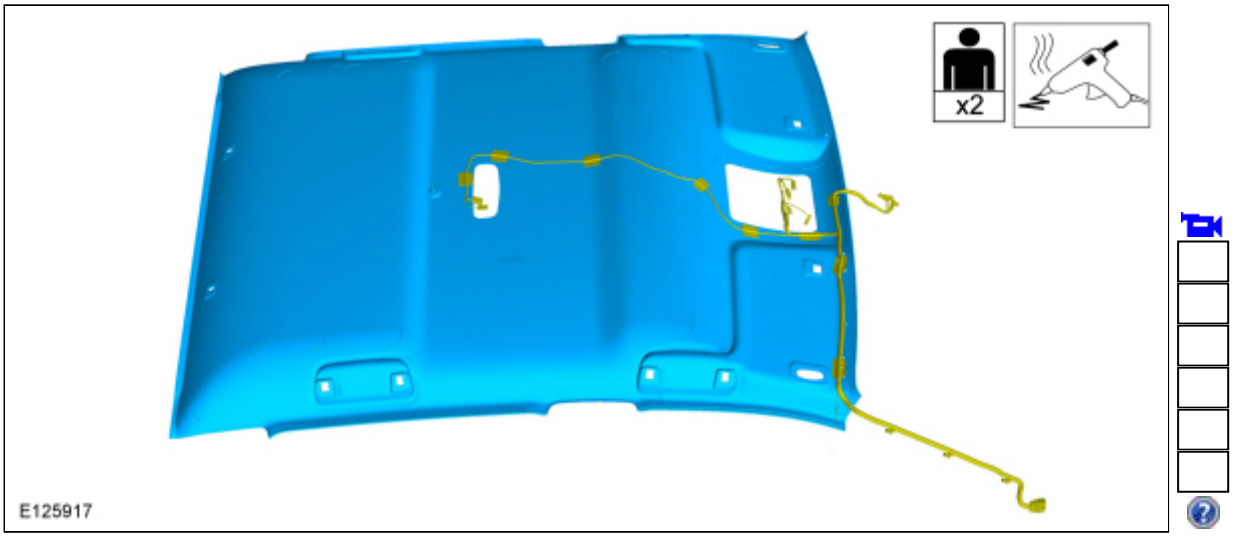
Stretch cab or Double cab

14.



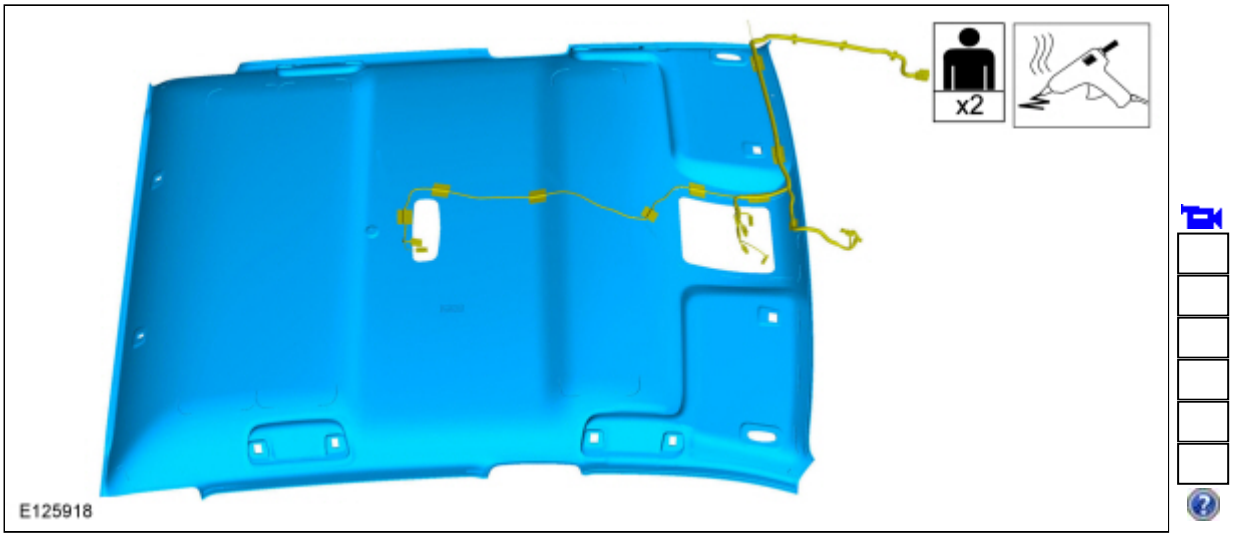
15. **NOTE:** *Right-hand drive vehicle.*

    NOTE: *Note the position of each component before removal.*



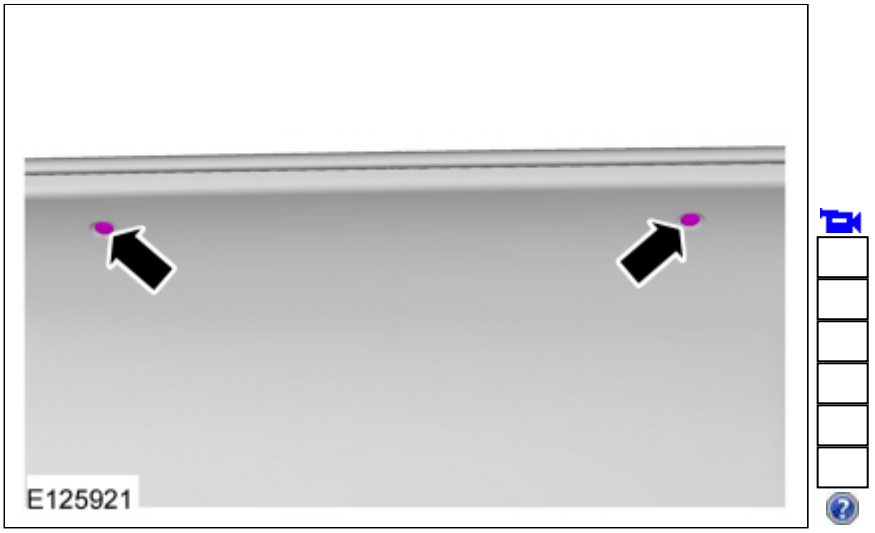
16. **NOTE:** *Left-hand drive vehicles.*

    NOTE: *Note the position of each component before removal.*



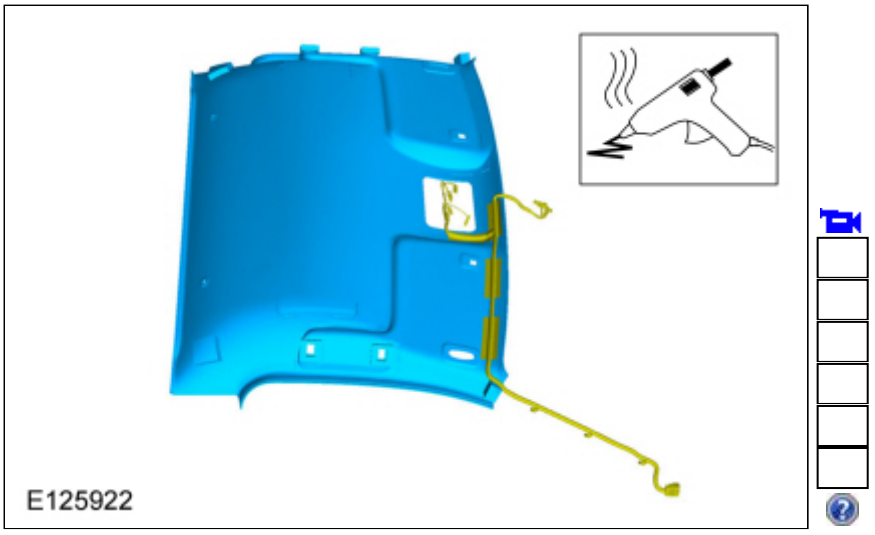
Single cab

17.



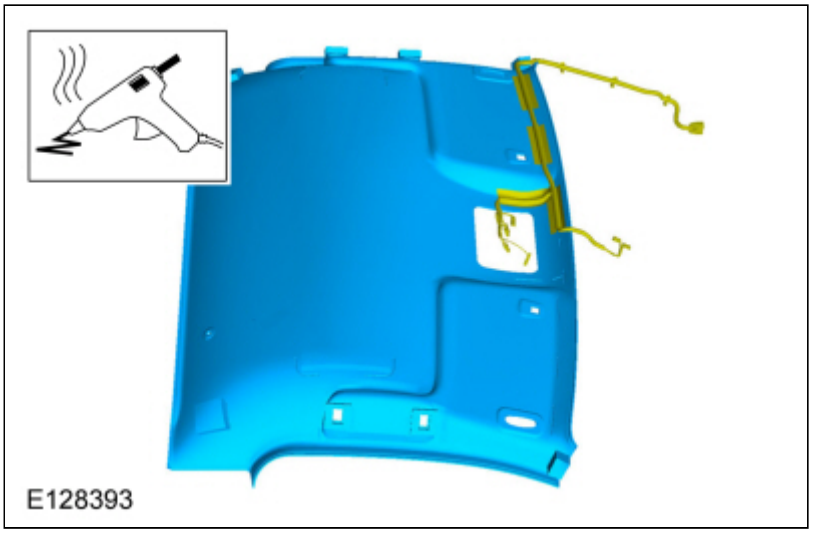
18. **NOTE:** *Right-hand drive vehicles.*

    NOTE: *Note the position of each component before removal.*



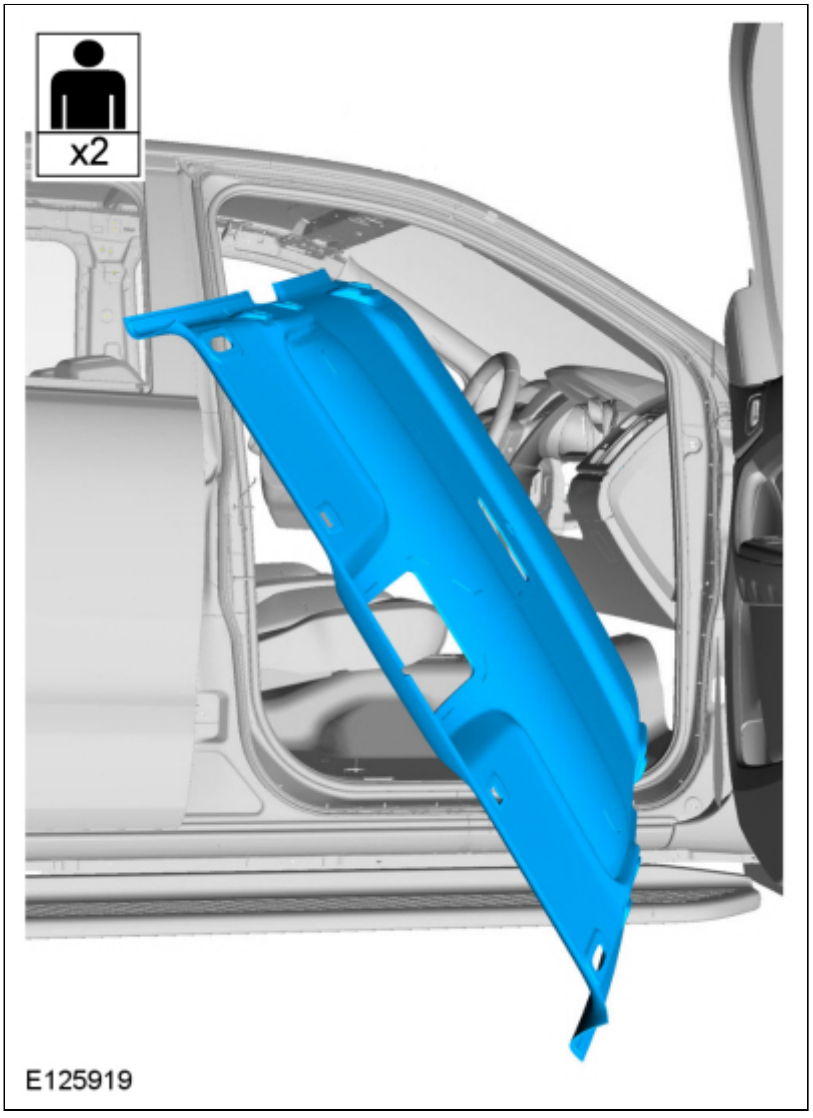
19. **NOTE:** *Left-hand drive vehicles.*

    NOTE: *Note the position of each component before removal.*



All vehicles

20. **NOTICE: Take extra care not to crease the headliner.**



Installation

1. **NOTE:** *Make sure that this component is installed to the noted removal position.*

   Using a suitable adhesive, bond the roof wiring harness to the headliner.

2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Radiator Grille

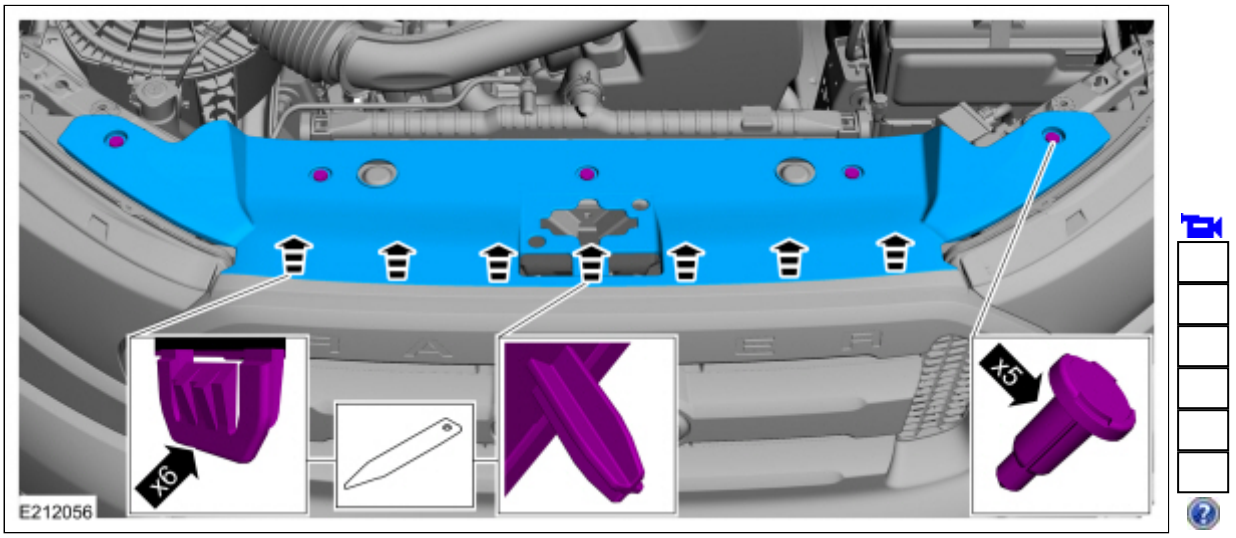
Special Tool(s) / General Equipment

Interior Trim Remover

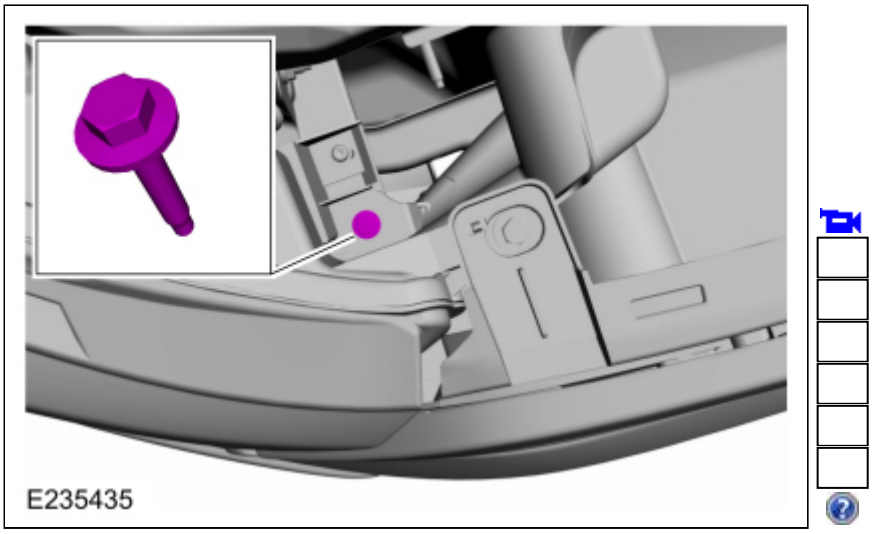
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

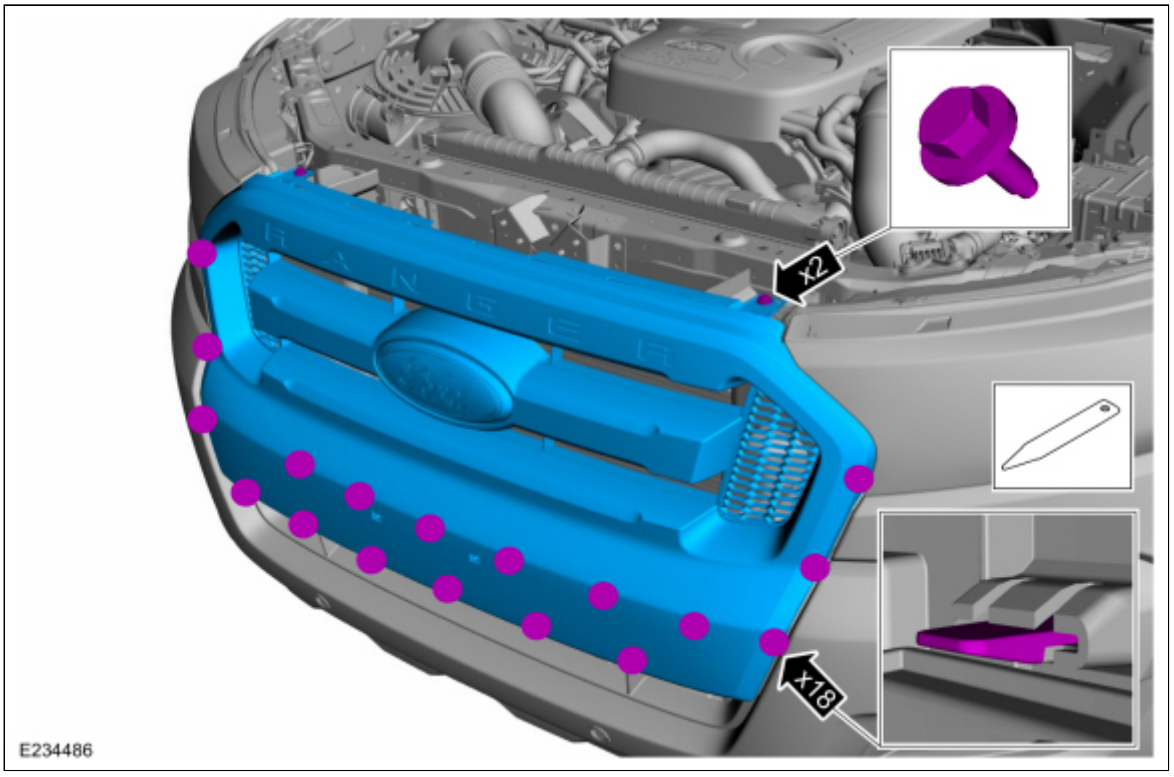
1. Use the General Equipment: Interior Trim Remover



2. On both the sides.
   Torque: 4 Nm



3. Use the General Equipment: Interior Trim Remover
   Torque: 4 Nm



Installation

1. To install, reverse the removal procedure.

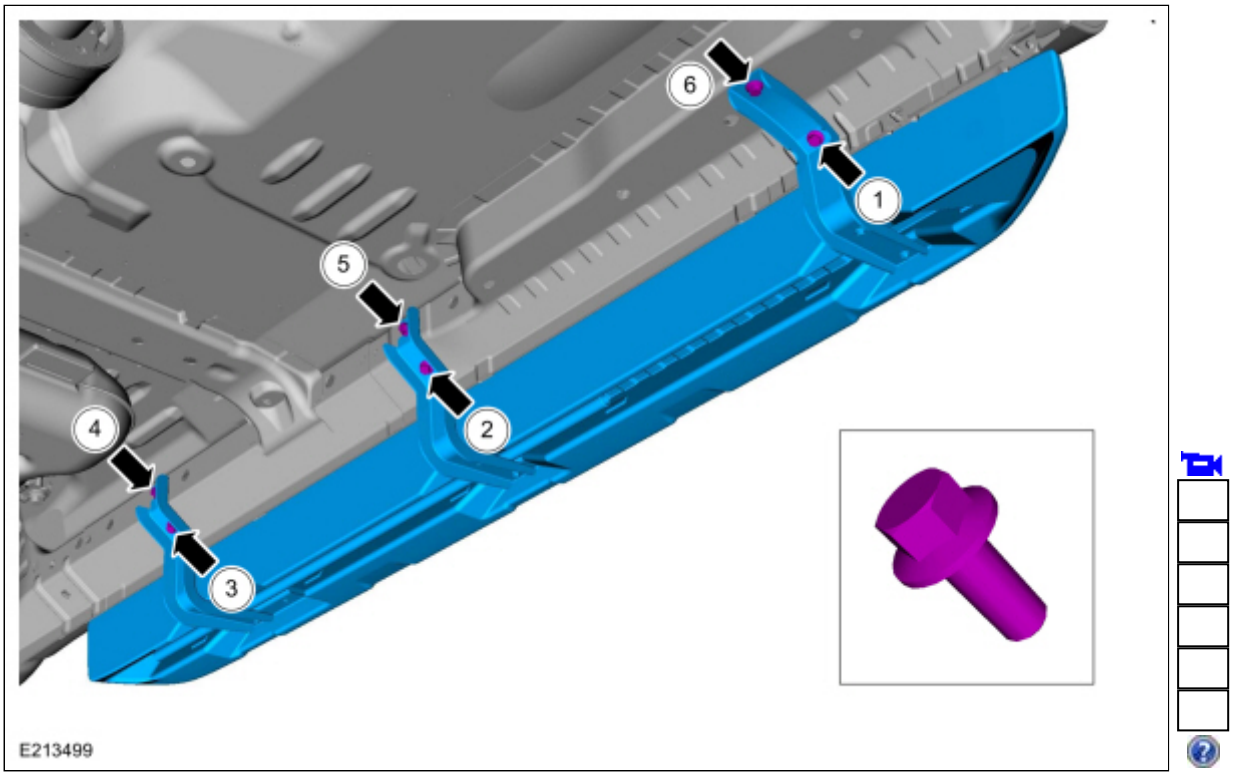
Copyright © 2016 Ford Motor Company

Running Board

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. On both sides
   Torque: 48 Nm



Installation

1. To install, reverse the removal procedure.

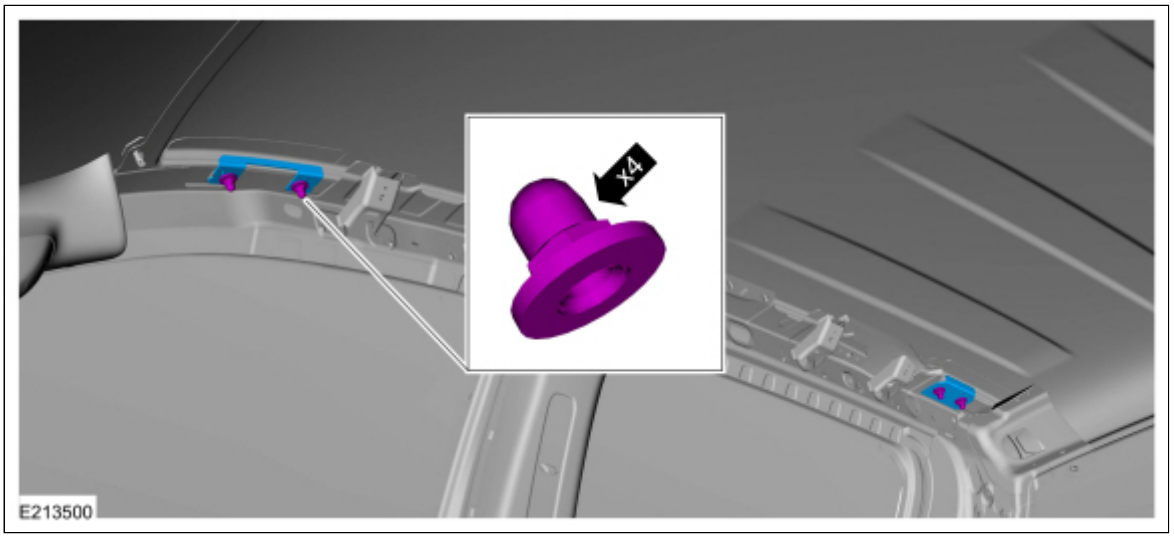
Copyright © 2016 Ford Motor Company

Roof Rail - Double Cab

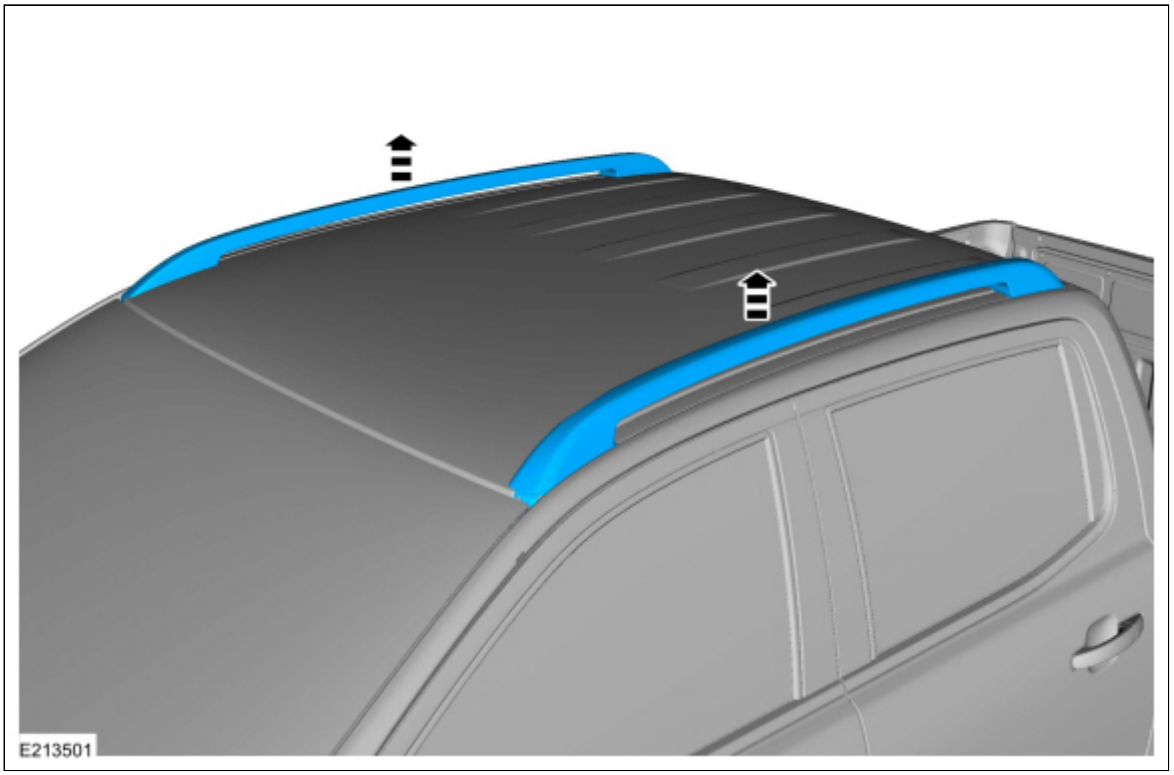
Removal

NOTE: *Removal steps in this procedure may include installation details.*

1. Refer to: Side Curtain Airbag (501-20B Supplemental Restraint System, Removal and Installation).
2. *Torque*: 11 Nm



3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

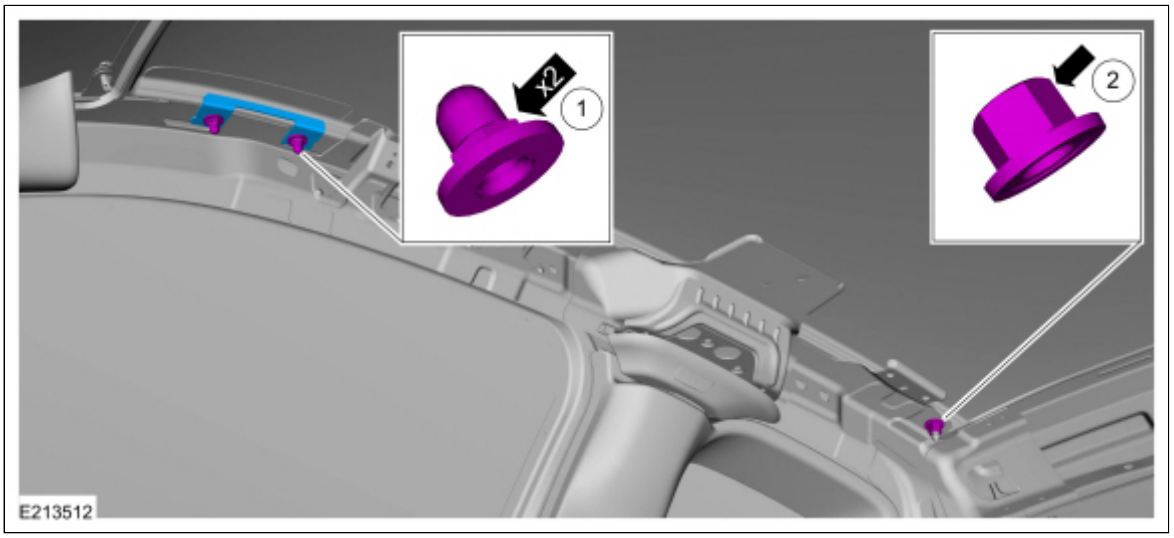
Roof Rail - Stretch Cab

Removal

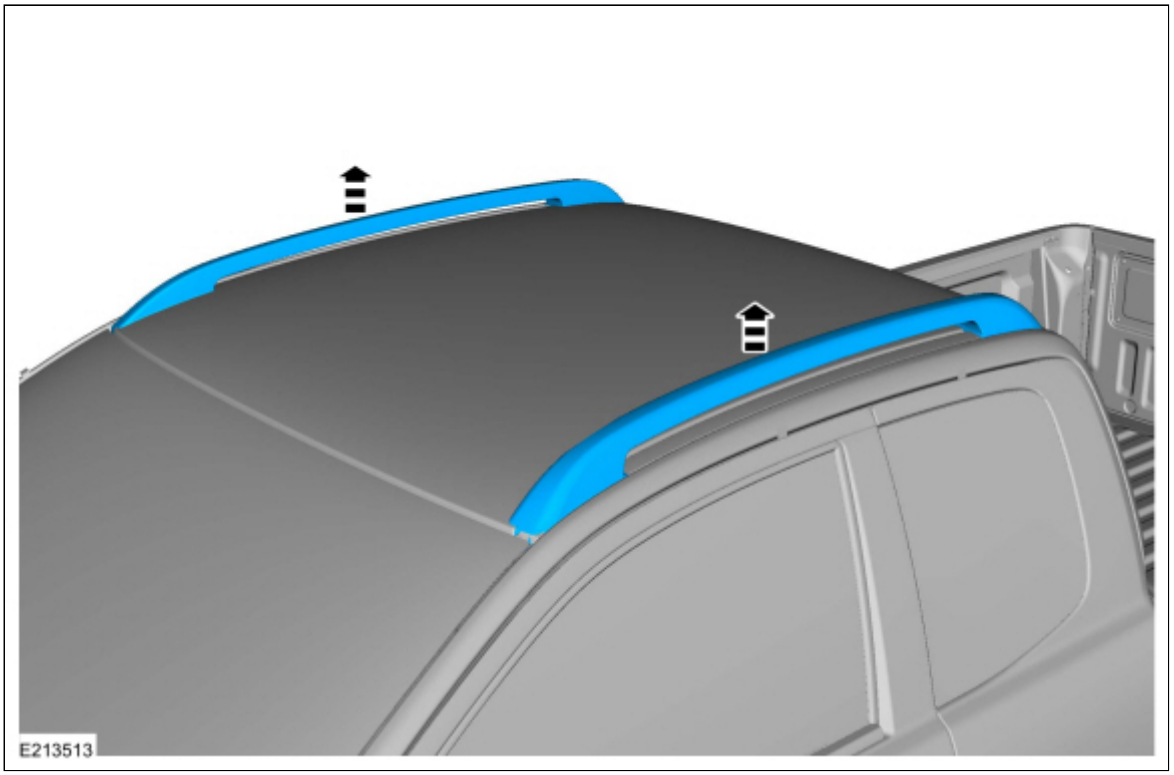
NOTE: *Removal steps in this procedure may include installation details.*

1. Refer to: Side Curtain Airbag (501-20B Supplemental Restraint System, Removal and Installation).

1. *Torque*: 11 Nm
2. *Torque*: 30 Nm



3.



Installation

1. To install, reverse the removal procedure.

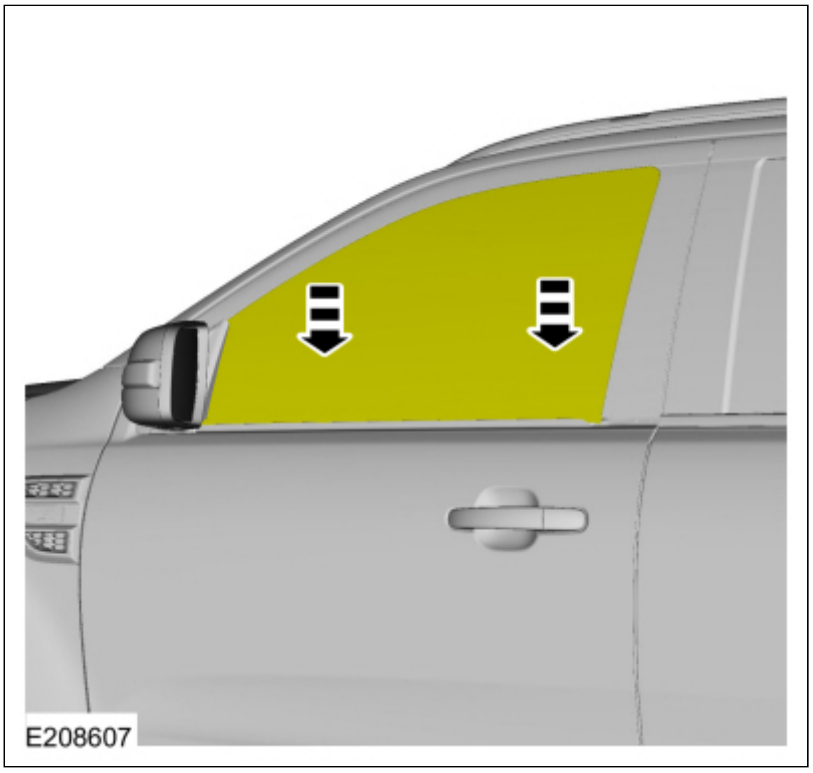
Copyright © 2016 Ford Motor Company

Front Door Upper Moulding - Double Cab

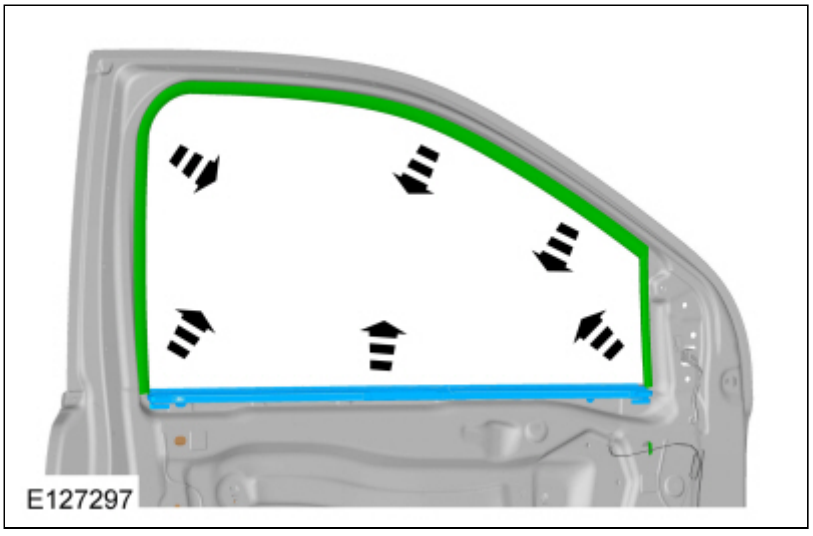
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

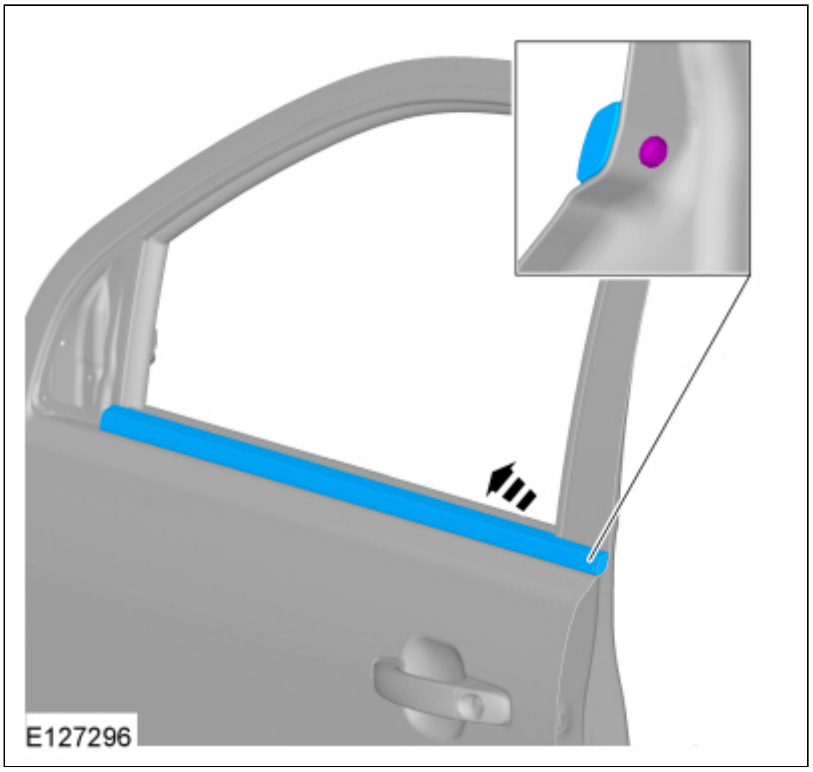
1.



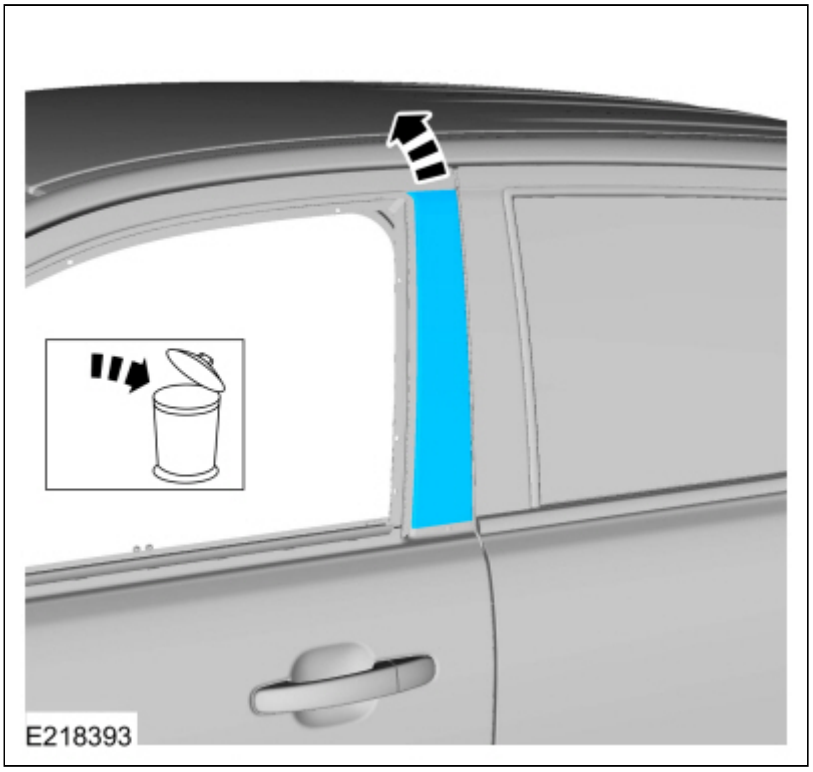
2.



3.

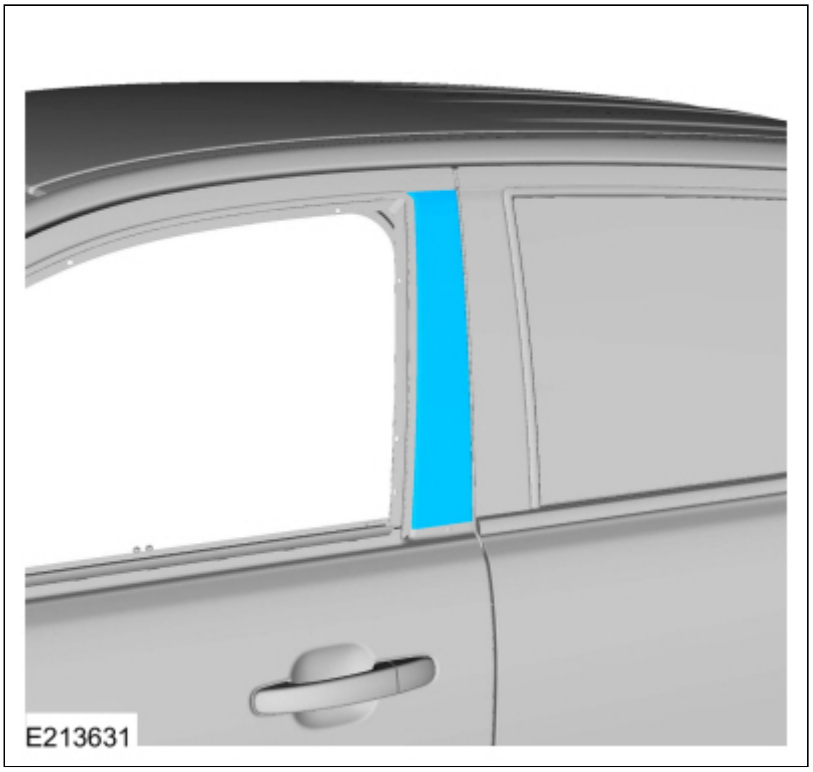


4.



Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. To install, reverse the removal procedure.

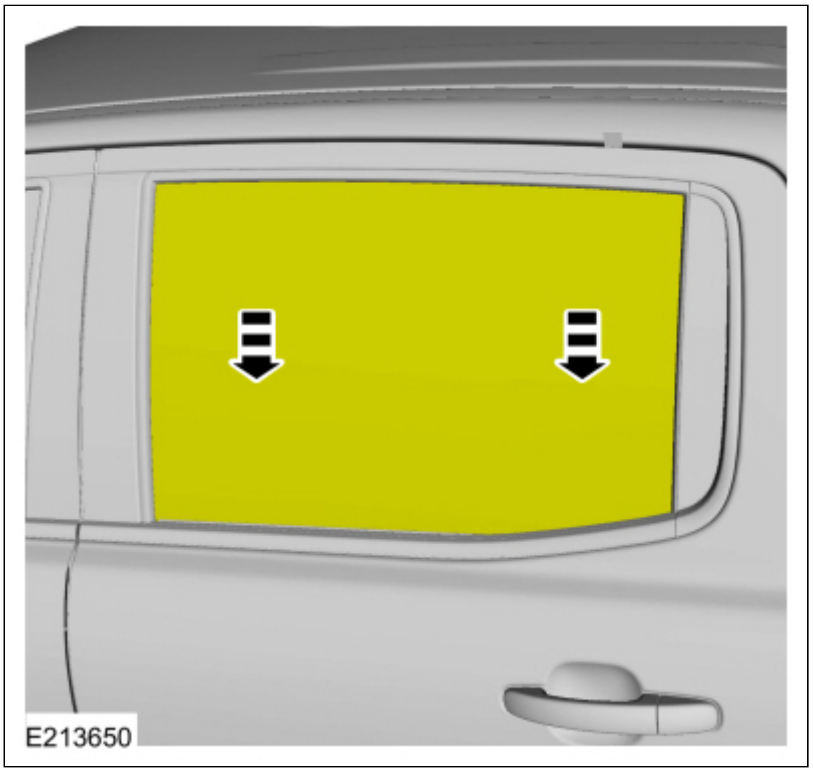
Copyright © 2016 Ford Motor Company

Rear Door Upper Moulding - Double Cab

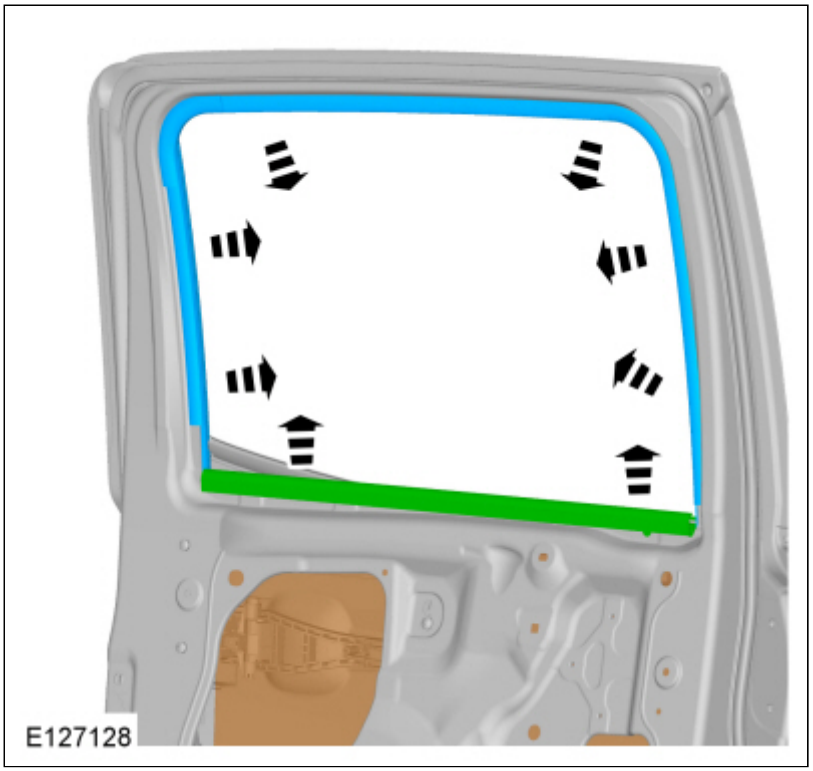
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

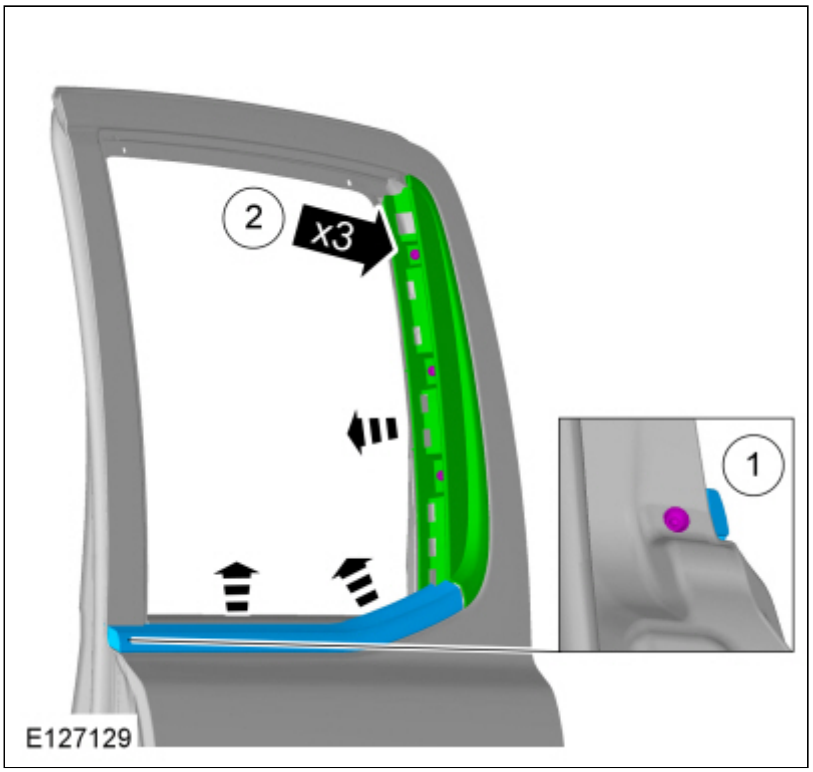
1.



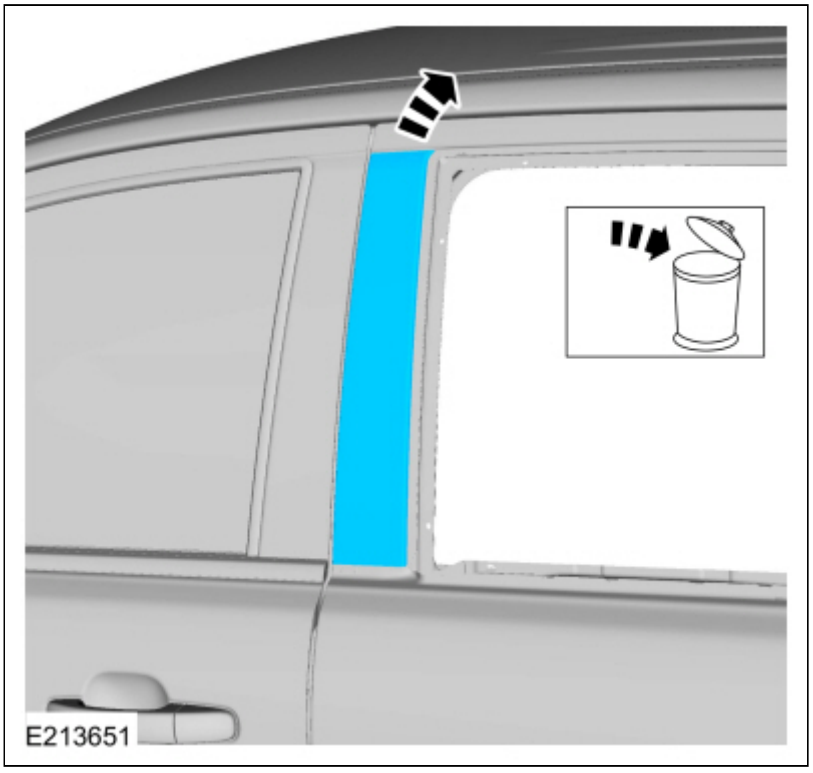
2.



3.

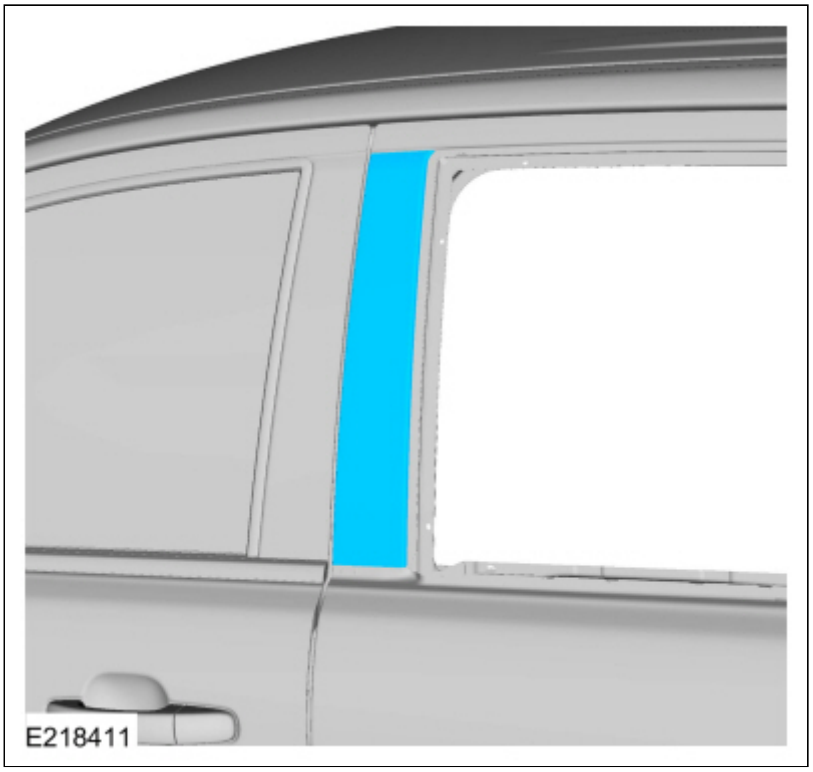


4.



Installation

1. **NOTE:** *Make sure that a new component is installed.*



2. To install, reverse the removal procedure.

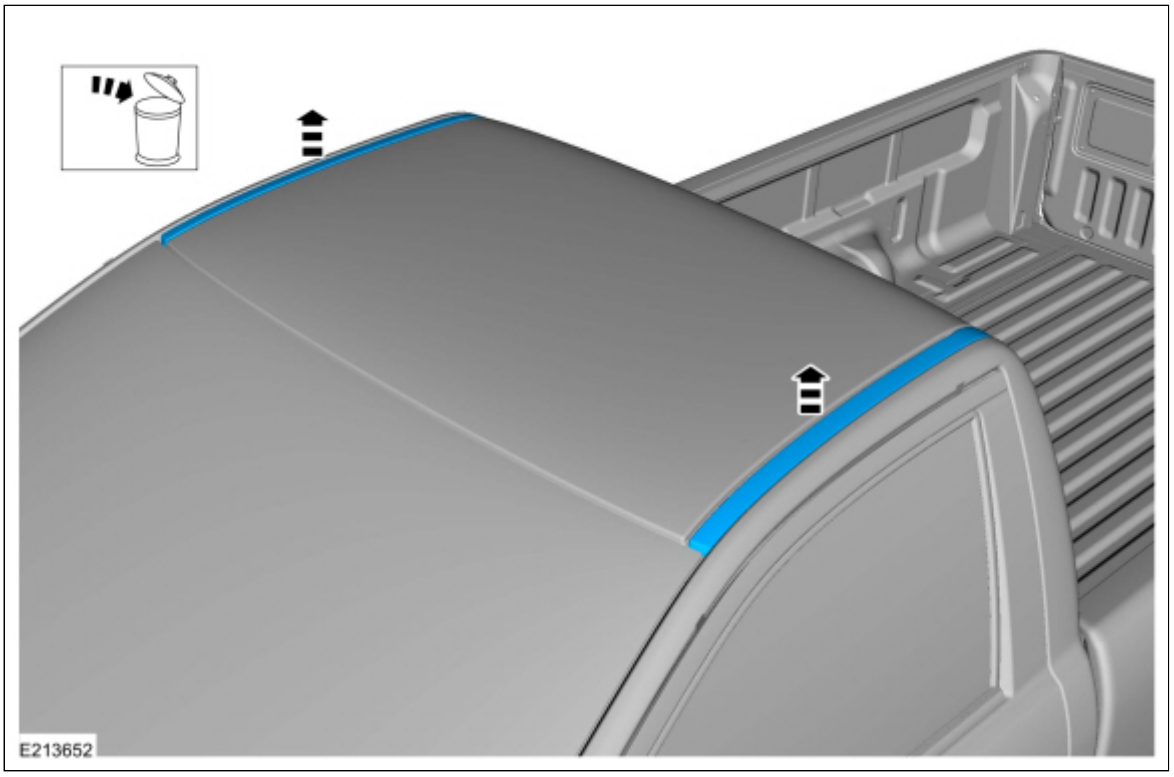
Copyright © 2016 Ford Motor Company

Roof Moulding - Single Cab

Removal

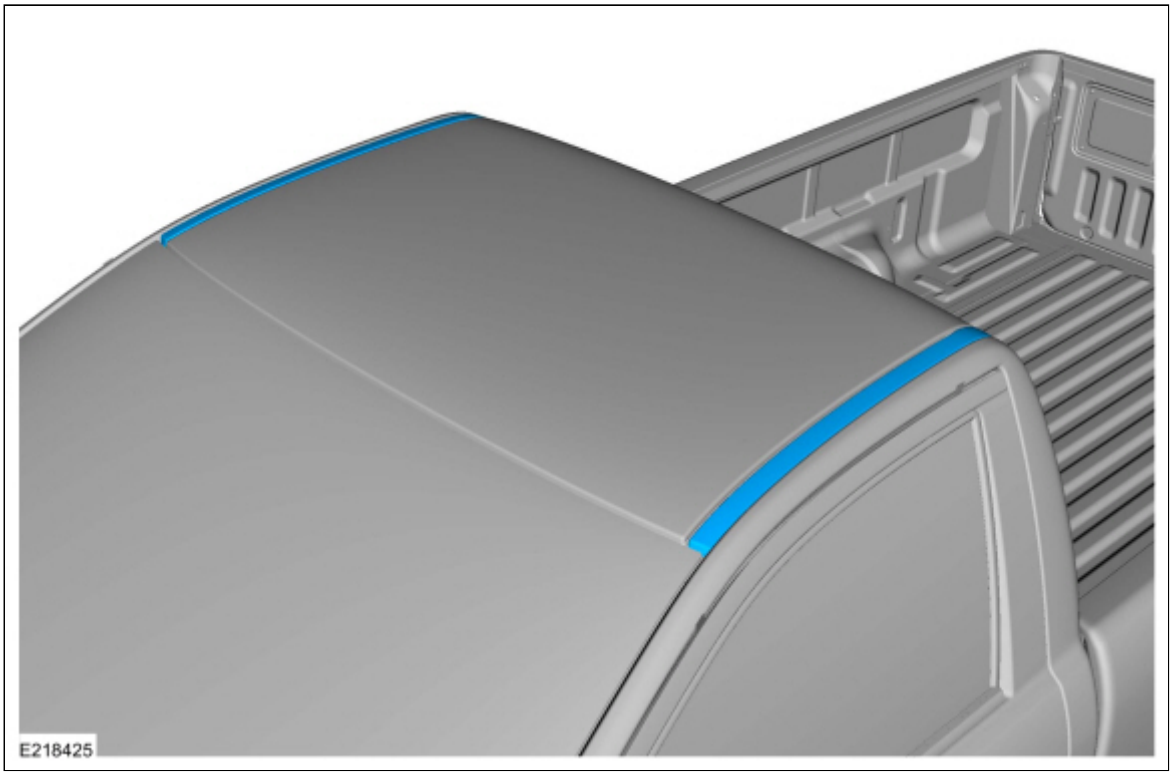
NOTE: *Removal steps in this procedure may contain installation details.*

1.



Installation

1. **NOTE:** *wipe the surface with rubbing Alcohol to clear any adhesive residue.*
2. **NOTE:** *Make sure that a new component is installed.*



3. To install, reverse the removal procedure.

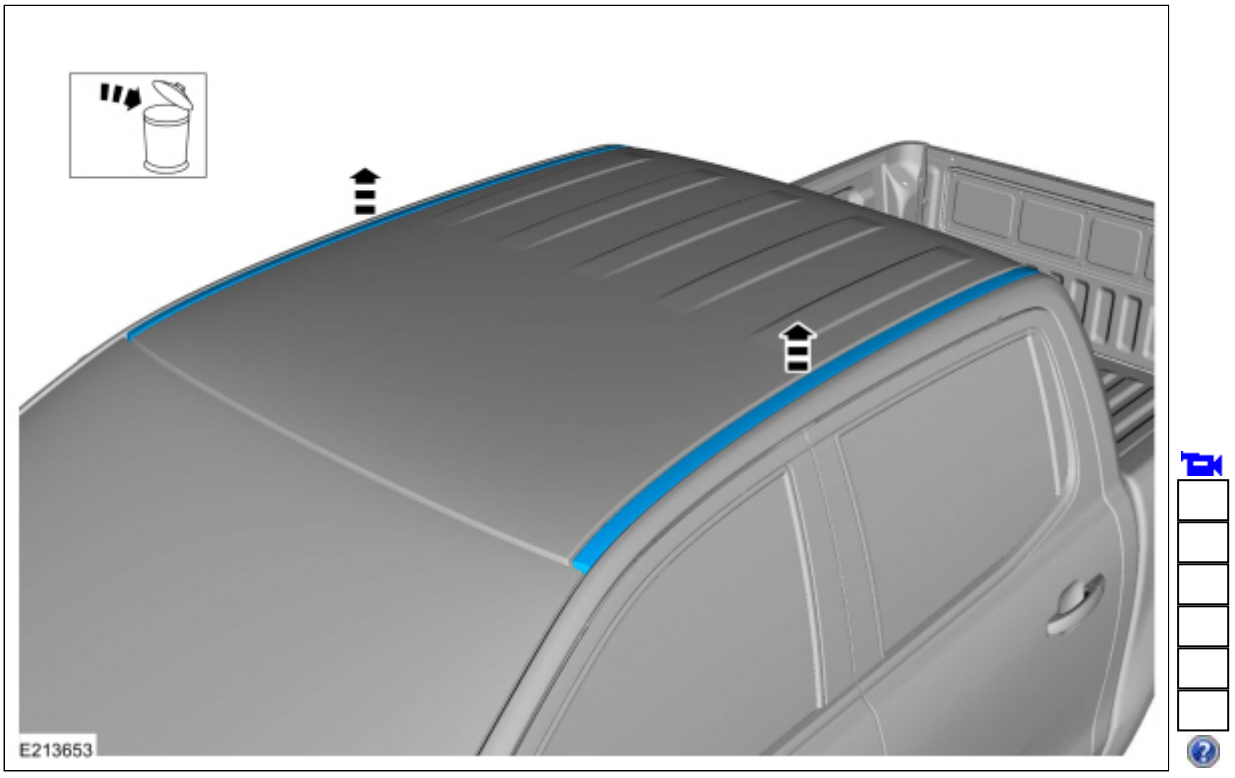
Copyright © 2016 Ford Motor Company

Roof Moulding - Double Cab

Removal

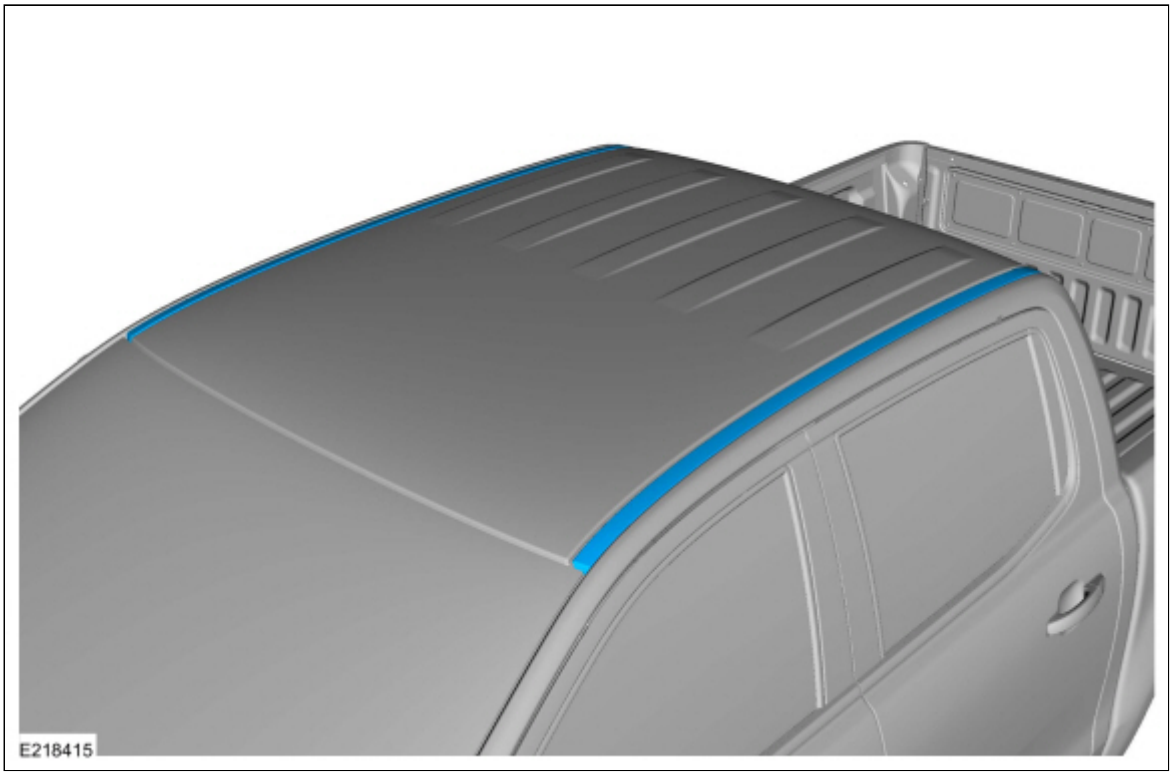
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Roof Rail - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).
2.



Installation

1. **NOTE:** *wipe the surface with rubbing Alcohol to clear any adhesive*
2. **NOTE:** *Make sure that a new component is installed.*



3. To install, reverse the removal procedure.

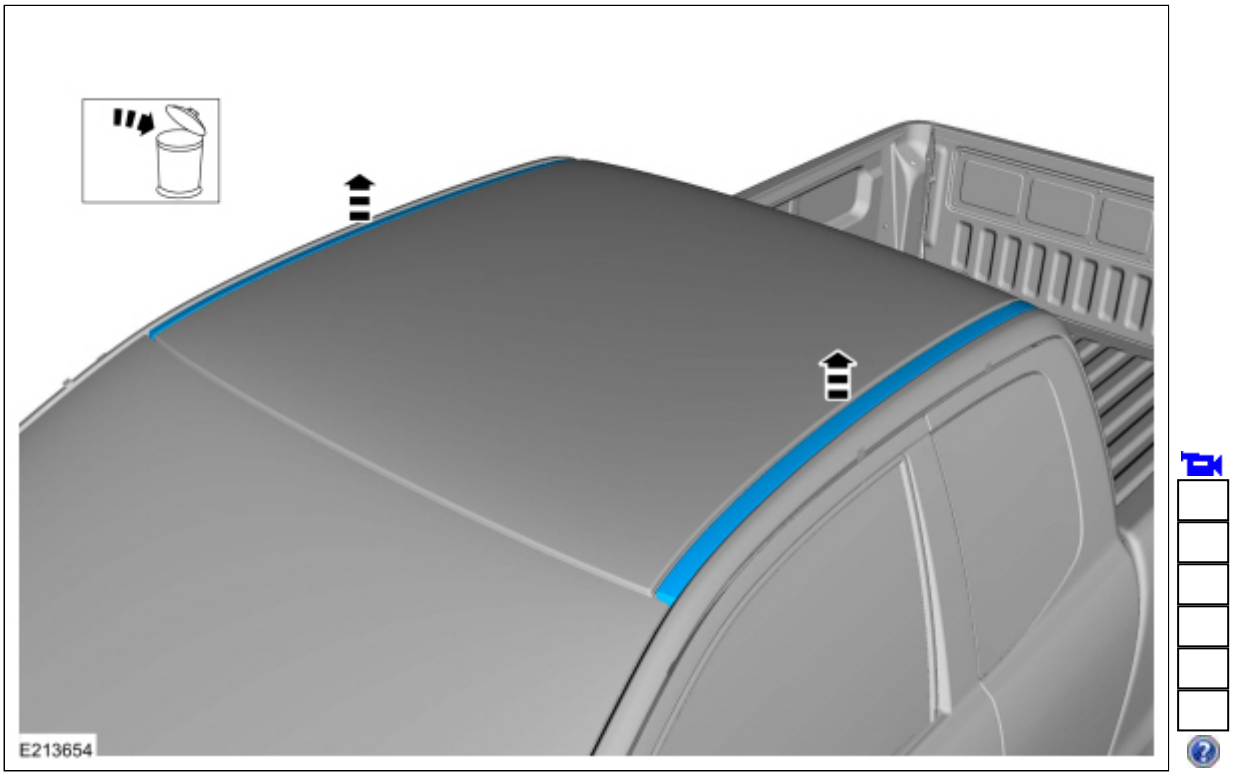
Copyright © 2016 Ford Motor Company

Roof Moulding - Stretch Cab

Removal

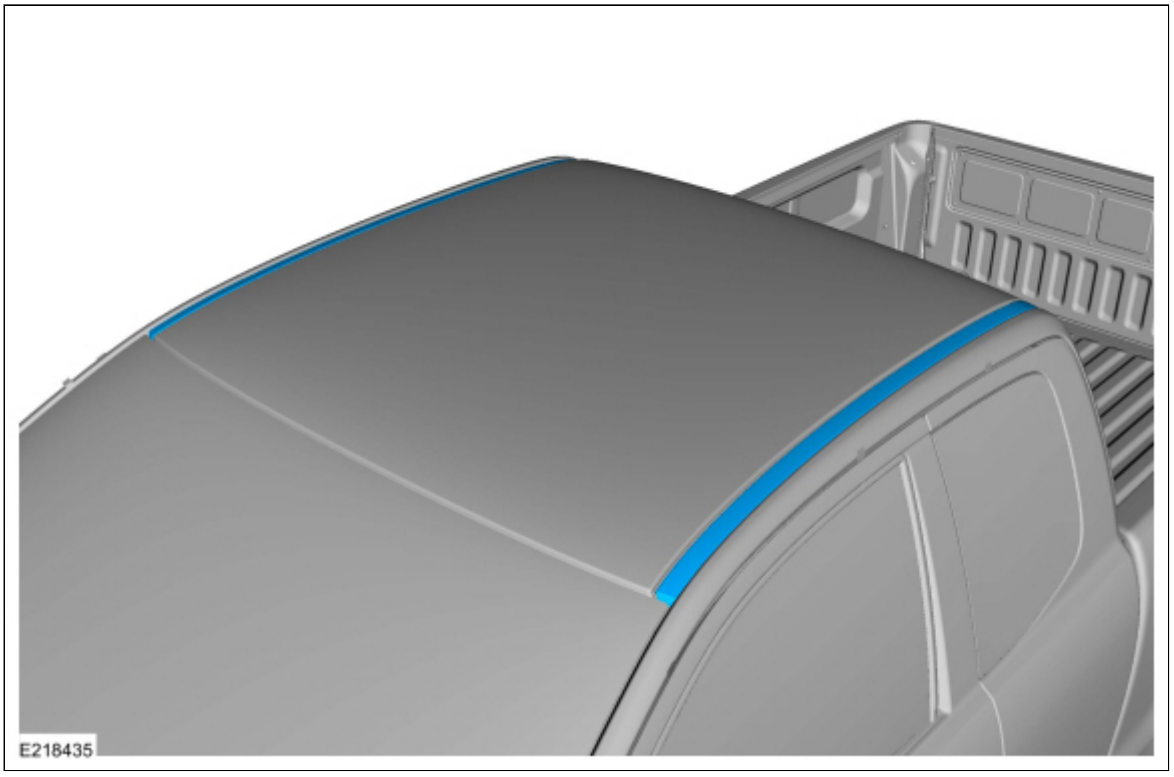
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Roof Rail - Stretch Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).
2.



Installation

1. **NOTE:** *wipe the surface with rubbing Alcohol to clear any adhesive.*
2. **NOTE:** *Make sure that a new component is installed.*



3. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Exterior Rear View Mirrors - Overview

Overview

Exterior, Manual

This vehicle may be equipped with LH and RH manual mirrors. The manual mirror system allows the exterior mirrors and exterior mirror glass to be positioned manually

Exterior, Power

This vehicle may be equipped with LH and RH power mirrors. The power mirror system allows the exterior mirror glass to be positioned electronically.

Exterior, Heated

This vehicle may be equipped with LH and RH heated mirror glass and with a LH and RH heated spotter glass. The heated mirror glass feature heats the mirror glass to remove frost, snow, ice and condensation.

Exterior, Power Folding

This vehicle may be equipped with LHand RH power folding mirrors. The power folding mirror feature allows the exterior mirrors to be electronically folded and unfolded.

Exterior, Turn Signals

The LH and RH exterior mirrors may be equipped with a mirror-mounted turn signal assembly. For repair procedures and information on the mirror-mounted turn signals,
Refer to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

Exterior, Puddle Lamps

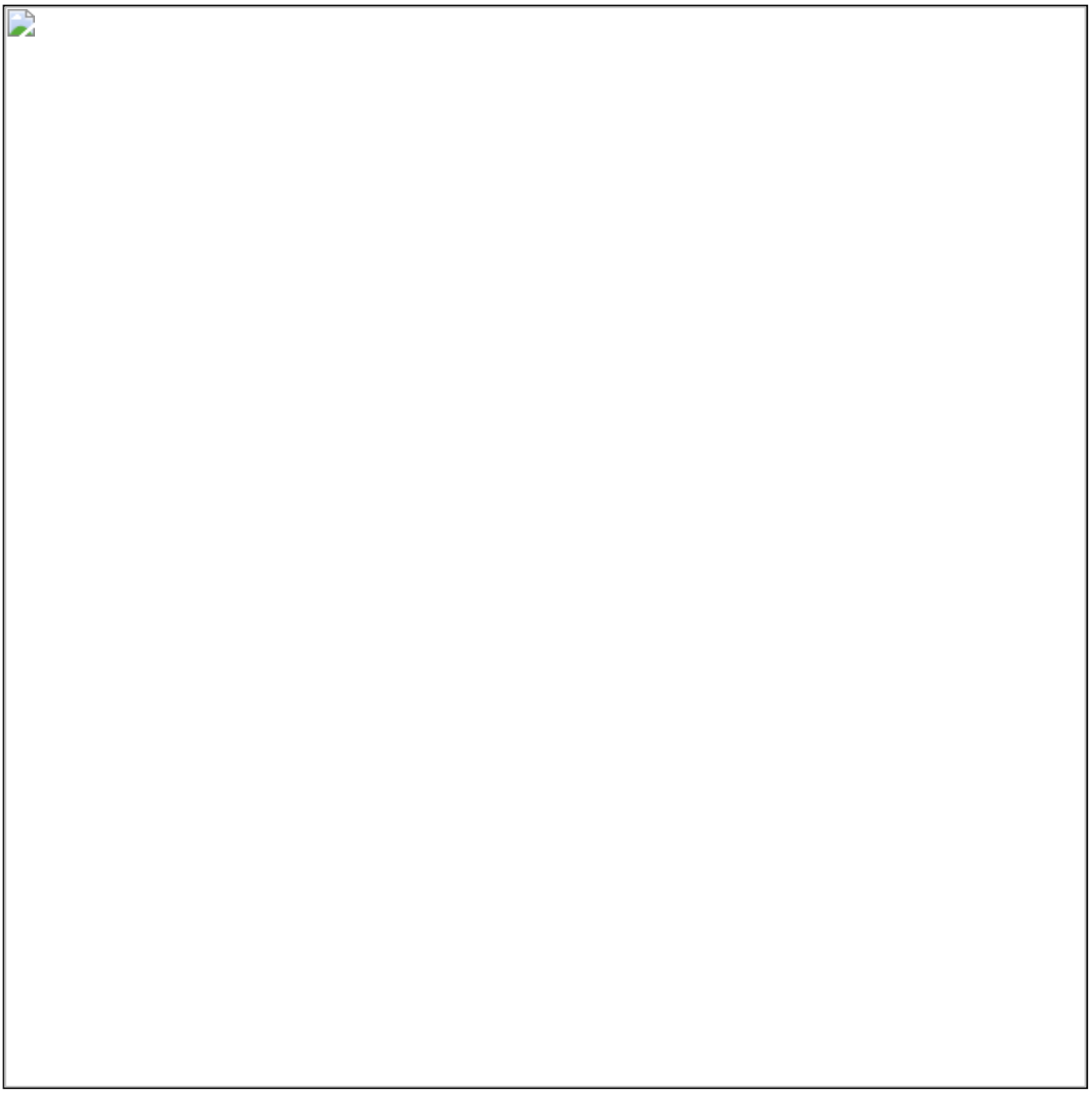
The LH and RH exterior mirrors may be equipped with a puddle lamp. For repair procedures and information on the mirror-mounted puddle lamps,
Refer to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Exterior Rear View Mirrors - System Operation and Component Description

System Operation

System Diagram - Exterior, Power

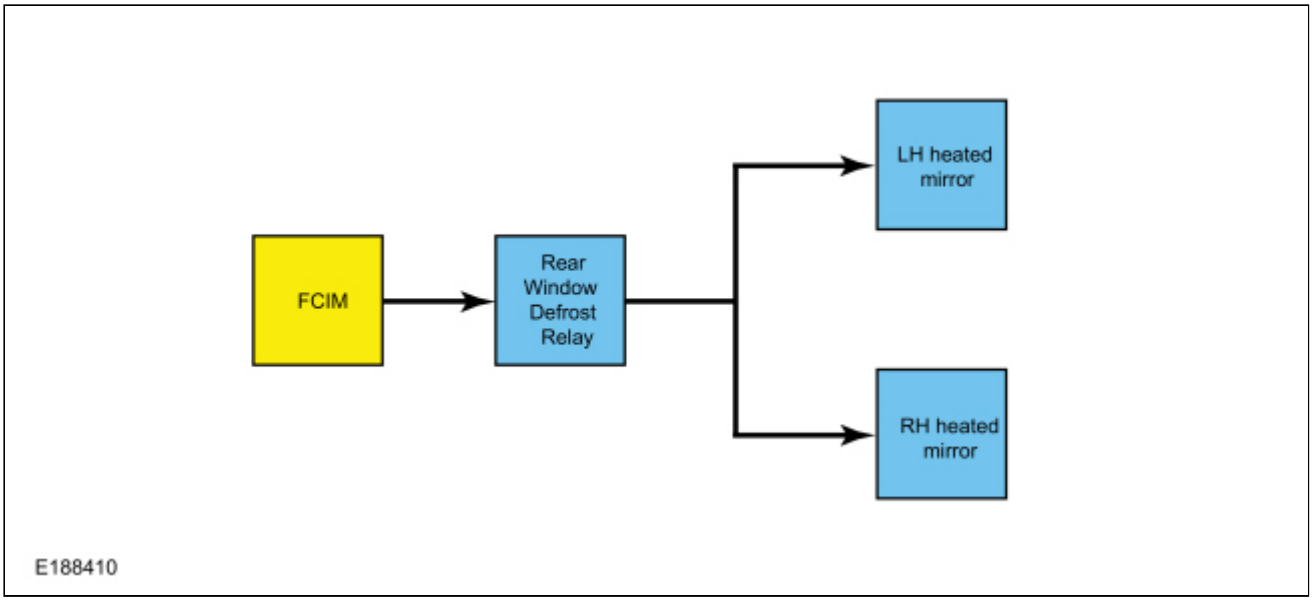


System Operation - Exterior, Power

All functions of the power mirror feature are integrated into one switch module. The left and right side selection button selects which side is active and a directional pad is used for directional control. Neutral is achieved by placing the selection button in the center position.

When the exterior mirror directional pad switch is pressed left, right, up or down with the LH or RH exterior mirror selected, the switch then supplies voltage and ground to the appropriate exterior mirror motor. The switch controls the glass movements by reversing polarity of the voltage and ground circuits being supplied to each motor.

System Diagram - Exterior, Heated



System Operation - Exterior, Heated

On vehicles equipped with rear window defrost, the heated exterior mirror glass operates when the rear defrost system is activated.

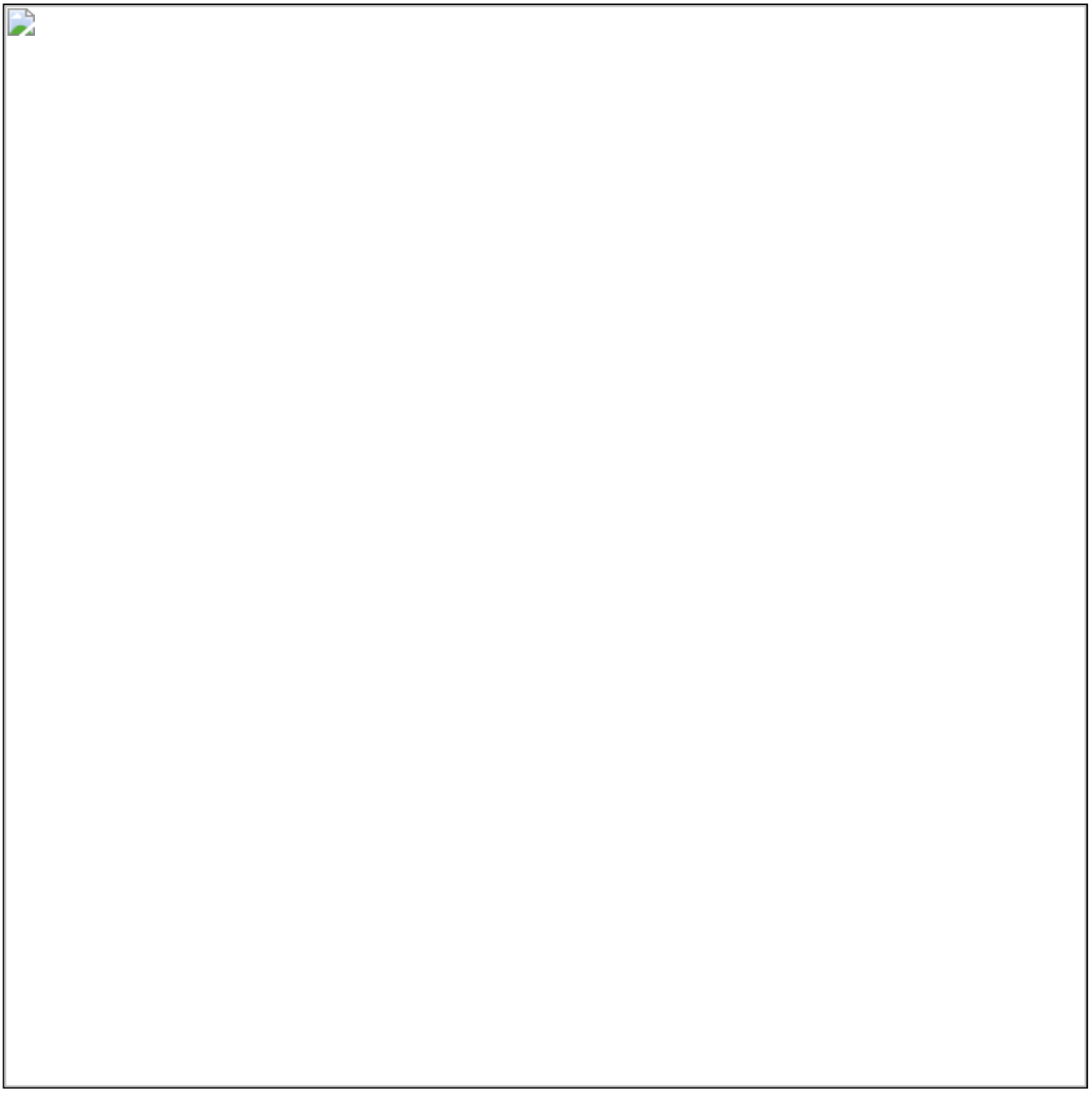
The heated mirrors are heated for a period of 10 minutes when the engine is running and the defrost system is activated.

The LH and RH heated exterior mirror glass voltage is supplied by the rear window defrost relay through BJB.

If equipped, the rear window defrost can also be commanded on and off by touching the rear window defrost button located on the touchscreen interface (FDIM). For additional information on voice or touchscreen commanded features, refer to the Owner's Literature.

For additional information on the rear window defrost system,
Refer to: Glass, Frames and Mechanisms - System Operation and Component Description (501-11 Glass, Frames and Mechanisms, Description and Operation).

System Diagram - Exterior, Power Fold



System Operation - Exterior, Power Fold

NOTE: *The power folding mirrors must be synchronized anytime the LH, RH or both power folding mirrors are folded or unfolded without using the power folding mirror control switch, or if a new power folding mirror has been installed. Refer to Power Folding Mirrors Synchronization in this section.*

The power folding exterior mirror feature allows both power exterior rear view mirrors to be folded or unfolded using the exterior mirror fold switch (integral to the mirror control switch). The LH and RH power folding mirrors fold or unfold at the same time and cannot be controlled independently.

Pushing the power fold button activates the fold function with no additional action required. The power folding mirror mode must be deactivated before going to the LH or RH exterior mirror glass adjust mode. When a left or right mirror adjust mode is active, pressing the folding mirror switch overrides the mirror adjust mode and goes directly to folding mode.

The power folding mirror motors are not replacable. If a power folding mirror motor is found to be inoperative, a new power folding exterior rear view mirror assembly must be installed.

Component Description

Exterior Mirror Control Switch

The exterior mirror control switch is a momentary contact switch. Adjusting the exterior mirror control switch to the LH or RH position determines which exterior mirror motor to control.

Exterior Mirror

Each exterior mirror has 2 bi-directional motors that are used to control the position of the exterior mirror glass. Adjusting the exterior mirror control switch to the LH or RH position determines which exterior mirror motor to control.

If equipped with heated exterior mirrors, heated exterior mirrors use heating elements that are integral to the exterior mirror glass. The exterior mirrors use a jumper harness between the vehicle wiring harness and the exterior mirror motors and the heated mirror glass. The exterior mirror jumper harness is integral to the exterior mirror. Before replacing an exterior mirror or motor, inspect the jumper harness for opens, shorted circuits or damaged and pushed-out pins. If a concern with the exterior mirror jumper harness exists, attempt to repair the jumper harness.

The exterior mirrors may include turn signals indicators. For additional information on the mirror-mounted turn signals indicators,
Refer to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

The exterior mirrors may include puddle lamps. For additional information on the mirror-mounted puddle lamps,
Refer to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Exterior Rear View Mirrors

Refer to Wiring Diagrams Section 501-09 for schematic and connector information.

Principles of Operation

Driver and passenger exterior mirror glass movement is controlled by the exterior mirror control switch and the exterior mirror motors. Adjusting the exterior mirror control switch to the LH or RH position determines which exterior mirror motor to control.

If equipped with power folding mirrors, the center position of the exterior mirror control switch controls the power folding mirrors.

The exterior mirrors use a jumper harness between the vehicle wire harness connector and the exterior mirror motor. The exterior mirror jumper harness is integral to the exterior mirror. Before replacing an exterior mirror or mirror motor, inspect the jumper harness for open and shorted circuits or damaged and pushed-out pins. If a concern with the exterior mirror jumper harness exists, an attempt to repair the jumper harness should be made.

Power Exterior Mirrors

The exterior mirror control switch logic is the selected movement request from the exterior mirror control switch. When the exterior mirror control switch is adjusted to the left, right, up or down position, the exterior mirror control switch supplies voltage and ground to the selected exterior mirror motor to move the exterior mirror glass to the desired position.

Heated Exterior Mirrors

The exterior mirror control switch controls the operation of the heated exterior rear view mirror glass. Voltage is supplied to the driver and passenger heated exterior mirrors by the rear window defrost relay located in the Battery Junction Box (BJB) . The heated mirrors are heated for a period of 10 minutes when the engine is running.

Power Folding Mirrors

The power folding mirror feature allows the driver and passenger power exterior rear view mirrors to be folded or unfolded from the exterior mirror control switch. The power folding mirrors are controlled by the power mirror fold relay. When the exterior mirror control switch is set to the center position and pressed rearward to the FOLD/UNFOLD position, the mirrors fold inward towards the door if they are folded out, or unfold outward if they are folded in. The driver and passenger power folding mirrors fold and unfold at the same time and cannot be controlled independently. The power folding mirrors contain a drive motor which is not replaceable. If a power folding mirror motor is found to be inoperative, a new power folding exterior rear view mirror assembly must be installed.

Inspection and Verification

1. Verify the customer concern by operating the power exterior mirrors or memory mirrors.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Exterior mirror • Exterior mirror control switch • Exterior mirror glass	• Fuse(s) • Exterior mirror control switch • Exterior mirror glass motor (part of the exterior mirror) • Exterior mirror power folding motor (part of the exterior mirror) • Exterior mirror glass • Loose or corroded connections • Wiring harness

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• The mirrors are inoperative	• Exterior mirror control switch. • Wiring, terminals or connectors.	• GO to Pinpoint Test A
• A single mirror is inoperative	• Exterior mirror control switch. • Wiring, terminals or connectors. • Exterior mirror motor.	• GO to Pinpoint Test B
• A single mirror does not operate correctly in all directions	• Exterior mirror control switch. • Wiring, terminals or connectors • Exterior mirror motor.	• GO to Pinpoint Test C
• The power folding mirrors do not operate or operate correctly	• Exterior mirror(s). • Exterior mirror control switch. • Wiring, terminals or connectors.	• GO to Pinpoint Test D
• The heated exterior mirror is inoperative	• Fuse. • Wiring, terminals or connectors. • Rear window defrost relay. • Exterior mirror glass.	• GO to Pinpoint Test E
• The mirror turn indicator is inoperative or always on	• Fuse. • Wiring, terminals or connectors. • Exterior mirror.	• REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
• The mirror puddle lamp is inoperative or always on	• Fuse. • Wiring, terminals or connectors. • Exterior mirror.	• REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).

Pinpoint Tests

PINPOINT TEST A : THE MIRRORS ARE INOPERATIVE

A1 CHECK THE VOLTAGE TO THE EXTERIOR MIRROR CONTROL SWITCH CIRCUIT
• Disconnect Exterior Rear View Mirror Switch C2124. • Ignition ON. • Measure:

Positive Lead	Measurement / Action	Negative Lead
C2124-7	V	Ground

Is the voltage greater than 10 volts?

Yes	GO to A2
No	VERIFY that circuit fuse(s) is OK. If OK, REPAIR the circuit for an open. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A2 CHECK FOR GROUND TO THE EXTERIOR MIRROR CONTROL SWITCH

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2124-6	Ω	Ground

Is the resistance less than 5 ohms?

Yes	GO to A3
No	REPAIR the circuit for an open. TEST the system for normal operation.

A3 CHECK THE MIRROR COMMON CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2124-8	V	Ground
C2124-9	V	Ground

Is any voltage present?

Yes	REPAIR the circuit. TEST the system for normal operation.
No	GO to A4

A4 CHECK THE MIRROR COMMON CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2124-8	Ω	Ground
C2124-9	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A5
No	REPAIR the circuit. TEST the system for normal operation.

A5 CHECK THE MIRROR COMMON CIRCUIT FOR AN OPEN

- Disconnect Driver Exterior Mirror C520 LHD / C626 RHD.
- Disconnect Passenger Exterior Mirror C6262 LHD / C5201 RHD.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-8	Ω	C520-6

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-8	Ω	C626-6

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-9	Ω	C6262-6

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-9	Ω	C5201-6

Is the resistance less than 5 ohms?

Yes	INSTALL a new exterior rear view mirror switch. TEST the system for normal operation.
No	REPAIR circuit. TEST the system for normal operation.

PINPOINT TEST B : A SINGLE MIRROR IS INOPERATIVE

B1 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Ignition OFF.
- Disconnect Exterior Rear View Mirror Switch C2124.
- Carry out the Exterior Mirror Control Switch component test. Refer to Wiring Diagrams Cell 149 for

component testing.

Did the exterior mirror control switch pass the component test?

Yes	If the driver exterior mirror is inoperative, GO to B2 If the passenger exterior mirror is inoperative, GO to B3
No	INSTALL a new exterior rear view mirror switch. TEST the system for normal operation.

B2 CHECK THE DRIVER MIRROR COMMON CIRCUIT FOR AN OPEN

- Disconnect Driver Exterior Mirror C520 LHD / C626 RHD.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-8	Ω	C520-6

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-8	Ω	C626-6

Is the resistance less than 5 ohms?

Yes	CHECK the inoperative exterior mirror jumper harness between the vehicle harness and the exterior mirror for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness is OK, INSTALL a new driver side exterior mirror motor. REFER to: Exterior Mirror Motor (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	REPAIR circuit. TEST the system for normal operation.

B3 CHECK THE PASSENGER MIRROR COMMON CIRCUIT FOR AN OPEN

- Disconnect Passenger Exterior Mirror C6262 LHD / C5201 RHD.
- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-9	Ω	C6262-6

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-9	Ω	C5201-6

Is the resistance less than 5 ohms?

Yes	CHECK the inoperative exterior mirror jumper harness between the vehicle harness and the exterior mirror for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness is OK, INSTALL a new passenger side exterior mirror motor. REFER to: Exterior Mirror Motor (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST C : A SINGLE MIRROR DOES NOT OPERATE CORRECTLY IN ALL DIRECTIONS

C1 CHECK THE MIRROR MOVEMENT

- Ignition ON.
- Operate the driver exterior mirror in the up, down, left and right directions.
- Operate the passenger exterior mirror in the up, down, left and right directions.

Do the mirrors operate in any direction?

Yes	If the driver exterior mirror does not operate correctly, GO to C2 If the passenger exterior mirror does not operate correctly, GO to C5
No	GO to Pinpoint Test B

C2 CHECK THE DRIVER EXTERIOR MIRROR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Driver Exterior Mirror C520 LHD / C626 RHD.
- Ignition ON.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-5	V	Ground
C520-6	V	Ground
C520-7	V	Ground

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-5	V	Ground
C626-6	V	Ground
C626-7	V	Ground

Is any voltage present?

Yes	REPAIR the affected circuit. TEST the system for normal operation.

No	GO to C3

C3 CHECK THE VOLTAGE TO THE DRIVER EXTERIOR MIRROR CIRCUITS

- Select the driver exterior mirror with the exterior mirror selection switch.
- While pressing the exterior mirror control switch in the right direction, measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-5		C520-6

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-5		C626-6

- Release the exterior mirror control switch.
- While pressing the exterior mirror control switch in the up direction, measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-7		C520-6

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-7		C626-6

Are the voltages greater than 11 volts when the switch is pressed in the right and up direction?

Yes	CHECK the harness between the exterior mirror control switch and the exterior mirror for open circuits and damaged or pushed-out pins. If the harness is OK, INSTALL a new driver exterior mirror motor. REFER to: Exterior Mirror Motor (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	GO to C4

C4 CHECK THE DRIVER MIRROR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Exterior Rear View Mirror Switch C2124.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-10	Ω	C520-5
C2124-9	Ω	C520-6
C2124-3	Ω	C520-7

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-10	Ω	C626-5
C2124-9	Ω	C626-6
C2124-3	Ω	C626-7

Are the resistances less than 3 ohms?

Yes	INSTALL a new exterior rear view mirror switch. TEST the system for normal operation.
No	REPAIR the circuit. TEST the system for normal operation.

C5 CHECK THE PASSENGER EXTERIOR MIRROR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Passenger Exterior Mirror C6262 LHD / C5201 RHD.
- Ignition ON.
- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C6262-5	V	Ground
C6262-6	V	Ground
C6262-7	V	Ground

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C5201-5	V	Ground
C5201-6	V	Ground
C5201-7	V	Ground

Is any voltage present?

Yes	REPAIR the affected circuit. TEST the system for normal operation.
No	GO to C6

C6 CHECK THE VOLTAGE TO THE PASSENGER EXTERIOR MIRROR CIRCUITS

- Select the passenger exterior mirror with the exterior mirror selection switch.
- While pressing the exterior mirror control switch in the right direction, measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C6262-5		C6262-6

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C5201-5		C5201-6

- Release the exterior mirror control switch.
- While pressing the exterior mirror control switch in the up direction, measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C6262-7		C6262-6

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C5201-7		C5201-6

Are the voltages greater than 11 volts when the switch is pressed in the right and up direction?

Yes	CHECK the harness between the exterior mirror control switch and the exterior mirror for open circuits and damaged or pushed-out pins. If the harness is OK, INSTALL a new passenger exterior mirror motor. REFER to: Exterior Mirror Motor (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	GO to C7

C7 CHECK THE PASSENGER MIRROR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Exterior Rear View Mirror Switch C2124.
- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-10	Ω	C6262-5
C2124-9	Ω	C6262-6
C2124-3	Ω	C6262-7

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-10	Ω	C5201-5
C2124-9	Ω	C5201-6
C2124-3	Ω	C5201-7

Are the resistances less than 3 ohms?

Yes	INSTALL a new exterior rear view mirror switch. TEST the system for normal operation.
No	REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST D : THE POWER FOLDING MIRRORS DO NOT OPERATE

D1 CHECK POWER FOLDING MIRROR OPERATION

- Press the exterior mirror control switch to the FOLD/UNFOLD position to activate the power folding mirrors.

Do the exterior mirror(s) fold/unfold properly?

Yes	The system is operating correctly at this time.
No	GO to D2

D2 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Ignition OFF.
- Disconnect Exterior Rear View Mirror Switch C2124.
- Carry out the Exterior Rear View Mirror Switch component test. Refer to Wiring Diagrams Cell 149 for component testing.

Did the exterior mirror control switch pass the component test?

Yes	If the driver exterior mirror does not operate correctly, GO to D3 If the passenger exterior mirror does not operate correctly, GO to D6
No	INSTALL a new exterior mirror control switch. TEST the system for normal operation.

D3 CHECK FOR VOLTAGE TO THE DRIVER EXTERIOR MIRROR CIRCUITS

- Ignition OFF.
- Connect Exterior Rear View Mirror Switch C2124.
- Disconnect Driver Exterior Mirror C520 LHD / C626 RHD.
- Ignition ON.
- While pressing the exterior mirror control switch, measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-8		C520-9

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-8		C626-9

Is the voltage greater than 10 volts when the exterior mirror control switch is operated and is the polarity reversed when the exterior mirror control switch is operated again?

Yes	CHECK the harness between the exterior mirror control switch and the exterior mirror for open and damaged circuits or pushed-out pins. If the harness is OK, INSTALL a new driver exterior mirror. REFER to: Exterior Mirror (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	GO to D4

D4 CHECK THE DRIVER EXTERIOR MIRROR CIRCUITS FOR A SHORT TO VOLTAGE

- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-8		Ground
C520-9		Ground

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-8		Ground
C626-9		Ground

Is any voltage present?

Yes	REPAIR the affected circuit. TEST the system for normal operation.
No	GO to D5

D5 CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE DRIVER EXTERIOR MIRROR

- Ignition OFF.

- Disconnect Exterior Rear View Mirror Switch C2124.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-5	Ω	C520-8
C2124-1	Ω	C520-9

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C2124-5	Ω	C626-8
C2124-1	Ω	C626-9

Is the resistance less than 3 ohms?

Yes	CHECK the harness between the exterior mirror control switch and the driver exterior mirror for open and damaged circuits or pushed-out pins. If the harness is OK, REFER to the Wiring Diagrams manual to identify the possible causes of a circuit short. TEST the system for normal operation.
No	REPAIR the circuit. TEST the system for normal operation.

D6 CHECK FOR VOLTAGE TO THE PASSENGER EXTERIOR MIRROR CIRCUITS

- Ignition OFF.
- Connect Exterior Rear View Mirror Switch C2124.
- Disconnect Passenger Exterior Mirror C5201 LHD / C6262 RHD.
- Ignition ON.
- While pressing the exterior mirror control switch, measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C5201-8	V	C5201-9

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C6262-8	V	C6262-9

Is the voltage greater than 10 volts when the exterior mirror control switch is operated and is the polarity reversed when the exterior mirror control switch is operated again?

Yes	CHECK the harness between the exterior mirror control switch and the exterior mirror for open and damaged circuits or pushed-out pins. If the harness is OK, INSTALL a new driver exterior mirror.

	REFER to: Exterior Mirror (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	GO to D7

D7 CHECK THE PASSENGER EXTERIOR MIRROR CIRCUITS FOR A SHORT TO VOLTAGE

- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C5201-8	V	Ground
C5201-9	V	Ground

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C6262-8	V	Ground
C6262-9	V	Ground

Is any voltage present?

Yes	REPAIR the affected circuit. TEST the system for normal operation.
No	GO to D8

D8 CHECK FOR CONTINUITY BETWEEN THE EXTERIOR MIRROR CONTROL SWITCH AND THE PASSENGER EXTERIOR MIRROR

- Ignition OFF.
- Disconnect Exterior Rear View Mirror Switch C2124.
- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-5	Ω	C5201-8
C2124-1	Ω	C5201-9

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C2124-5	Ω	C6262-8
C2124-1	Ω	C6262-9

Is the resistance less than 3 ohms?

Yes	CHECK the harness between the exterior mirror control switch and the passenger exterior mirror for open and damaged circuits or pushed-out pins. If the harness is OK, REFER to the Wiring Diagrams manual to identify the possible causes of a circuit short. TEST the system for normal operation.
No	REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST E : THE HEATED EXTERIOR MIRROR IS INOPERATIVE

E1 CHECK THE OPERATION OF THE REAR WINDOW DEFROST SYSTEM

- Start the engine.
- With the engine running, activate the rear window defroster.
- Using an infrared temperature gun or equivalent, measure the temperature of the rear window glass for approximately 30 seconds noting changes in temperature.

Does the temperature of the rear window glass rise?

Yes	GO to E2
No	DIAGNOSE the rear window defrost system. REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).

E2 CHECK THE OPERATION OF THE HEATED EXTERIOR MIRRORS

- With the rear window defrost ON, using an infrared temperature gun or equivalent, measure the temperature of the driver and passenger exterior mirror glass for approximately 30 seconds, noting changes in temperature.

Does at least one heated mirror operate correctly?

Yes	For inoperative driver heater mirror, GO to E3 For inoperative passenger heater mirror, GO to E5
No	VERIFY that fuse(s) is OK. If OK, REPAIR circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of a circuit short.

E3 CHECK THE VOLTAGE TO THE DRIVER HEATED EXTERIOR MIRROR

- Ignition OFF.
- Disconnect Driver Exterior Mirror C520 LHD / C626 RHD.
- Start the engine.
- Activate the rear window defrost.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-4		Ground

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-4		Ground

Is the voltage greater than 11 volts?

Yes	GO to E4
No	REPAIR the circuit for an open. TEST the system for normal operation.

E4 CHECK THE DRIVER EXTERIOR MIRROR GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Driver Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C520-1	Ω	Ground

Driver Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C626-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	CHECK the inoperative exterior mirror jumper harness between the vehicle harness and the exterior mirror for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness is OK, INSTALL a new driver side exterior mirror glass. REFER to: Exterior Mirror Glass (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	REPAIR the circuit. TEST the system for normal operation.

E5 CHECK THE VOLTAGE TO THE PASSENGER HEATED EXTERIOR MIRROR

- Ignition OFF.
- Disconnect Passenger Exterior Mirror C6262 LHD / C5201 RHD.
- Start the engine.
- Activate the rear window defrost.
- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C6262-4	V	Ground

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead

C5201-4	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to E6
No	REPAIR the circuit for an open. TEST the system for normal operation.

E6 CHECK THE PASSENGER EXTERIOR MIRROR GROUND CIRCUIT FOR AN OPEN

- Measure:

Passenger Exterior Mirror - LHD

Positive Lead	Measurement / Action	Negative Lead
C6262-1	Ω	Ground

Passenger Exterior Mirror - RHD

Positive Lead	Measurement / Action	Negative Lead
C5201-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	CHECK the inoperative exterior mirror jumper harness between the vehicle harness and the exterior mirror for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness is OK, INSTALL a new passenger exterior mirror glass. REFER to: Exterior Mirror Glass (501-09A Exterior Rear View Mirrors, Removal and Installation).
No	REPAIR the circuit. TEST the system for normal operation.

Copyright © 2016 Ford Motor Company

Exterior Mirror

Base Part Number: 17682

Removal

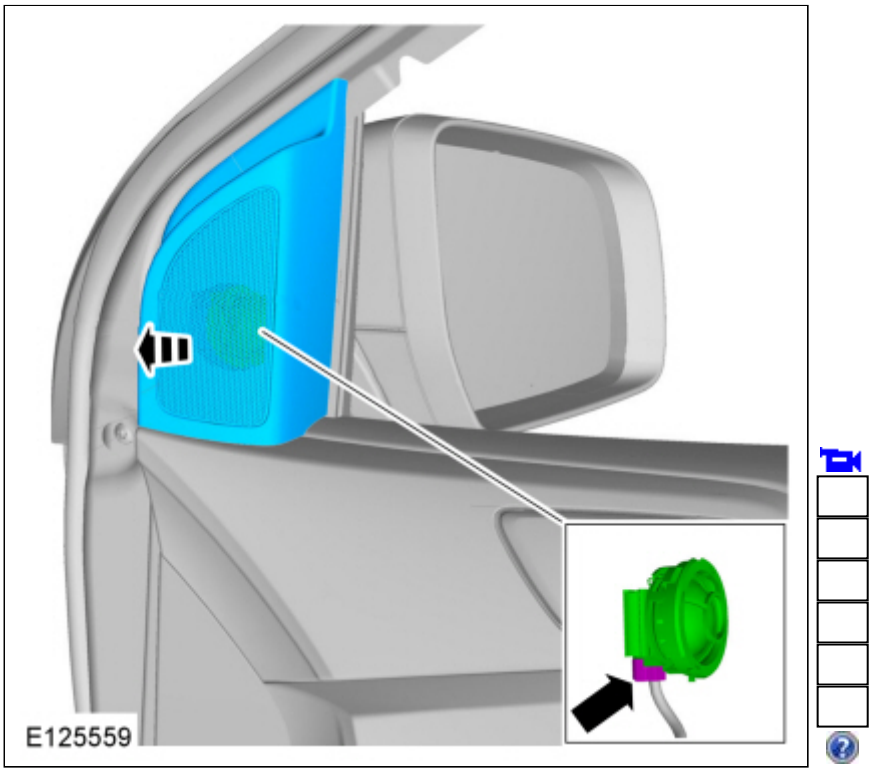
NOTE: *Removal steps in this procedure may contain installation details.*

Vehicles with power mirrors

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

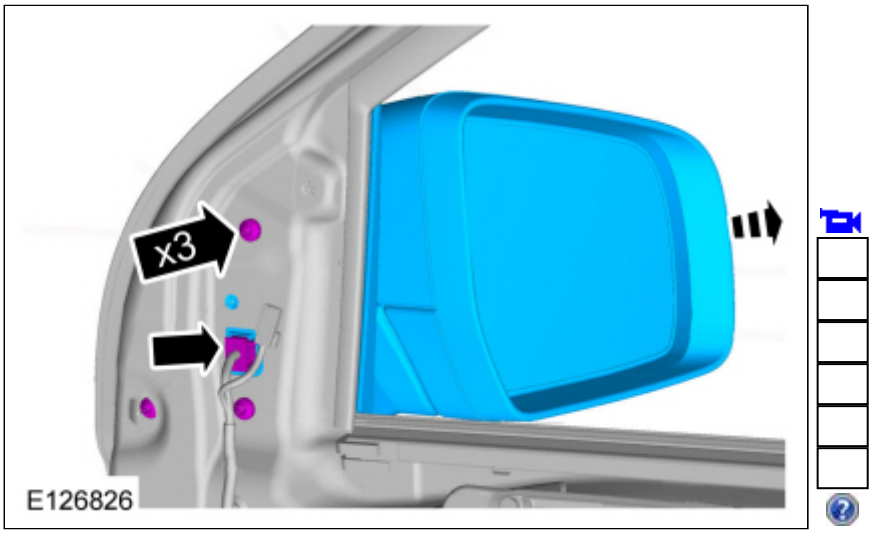
All vehicles

2.



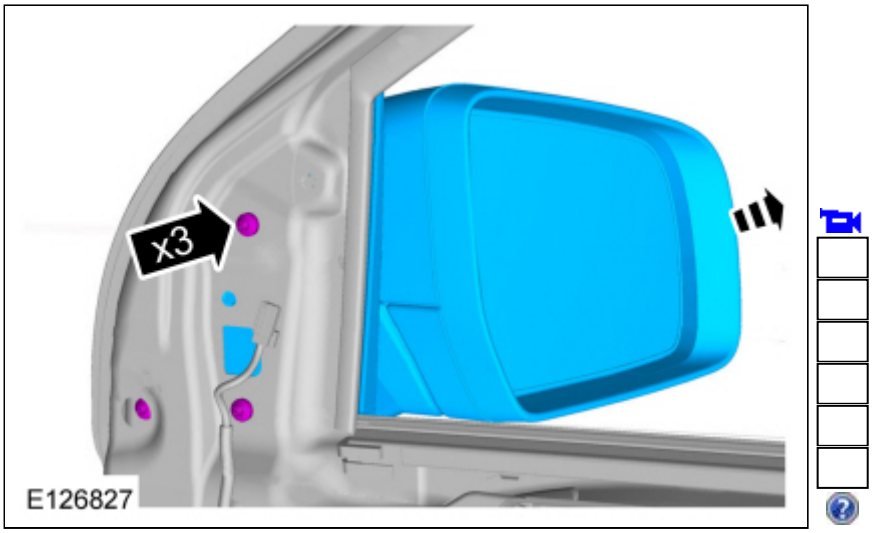
Vehicles with power mirrors

3. *Torque*: 11 Nm



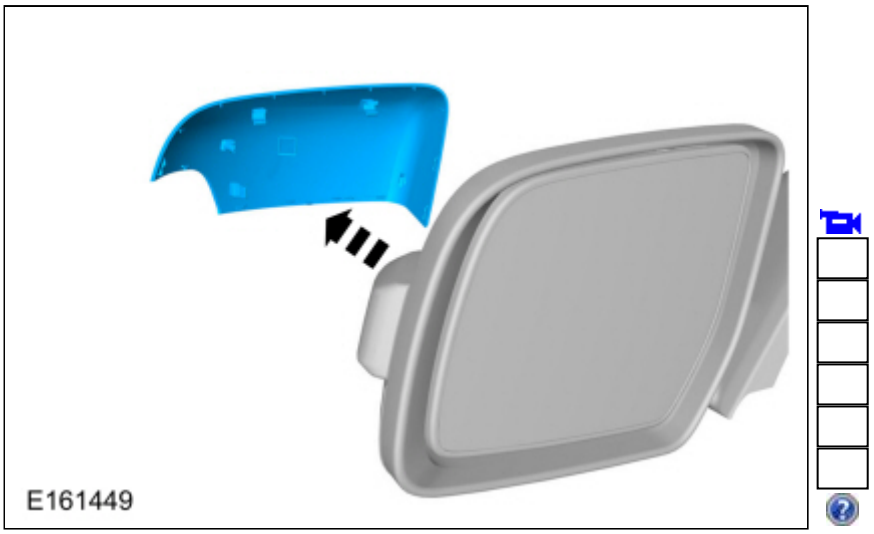
Vehicles with manual mirrors

4. *Torque*: 11 Nm

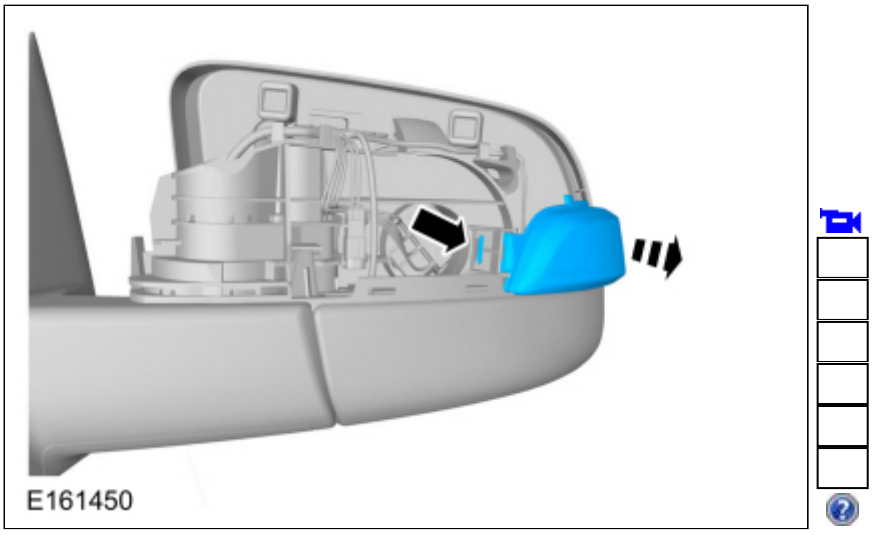


All vehicles

5.

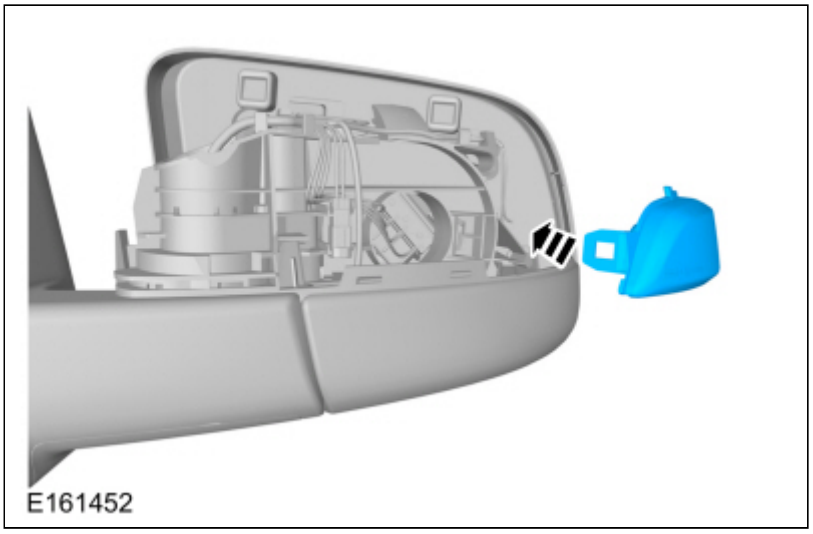


6.

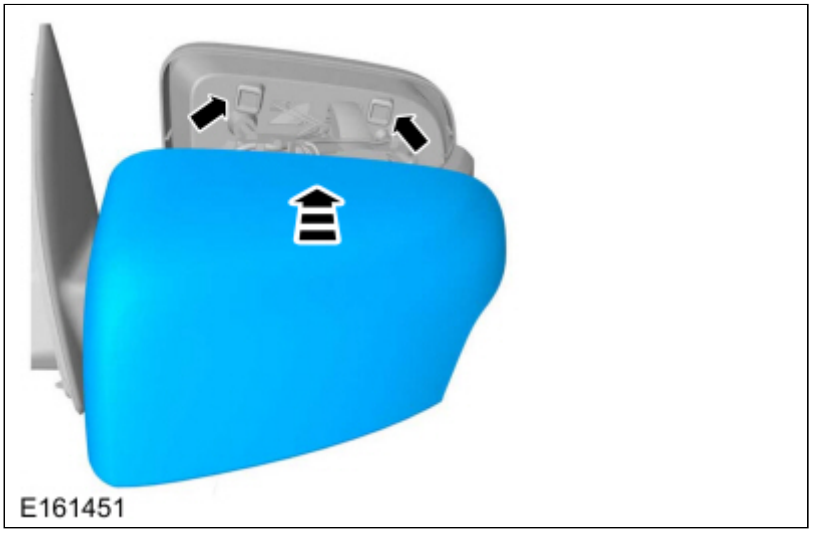


Installation

1.



2.



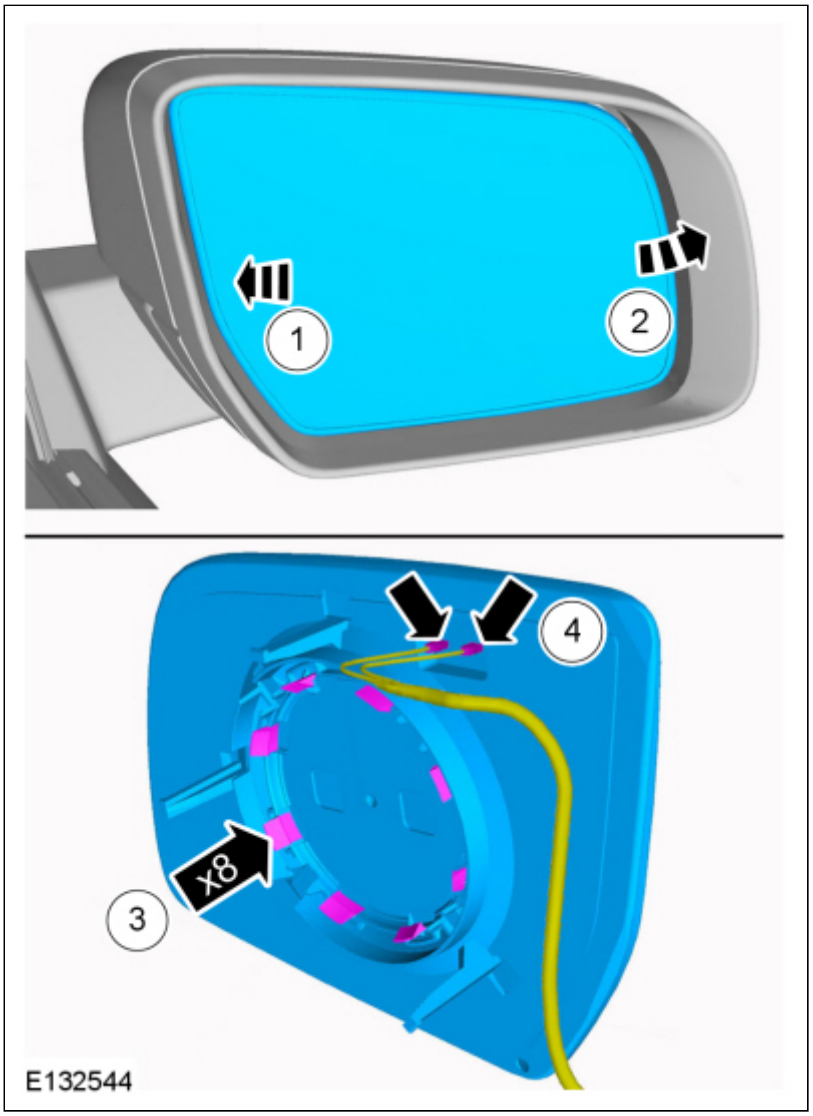
3. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

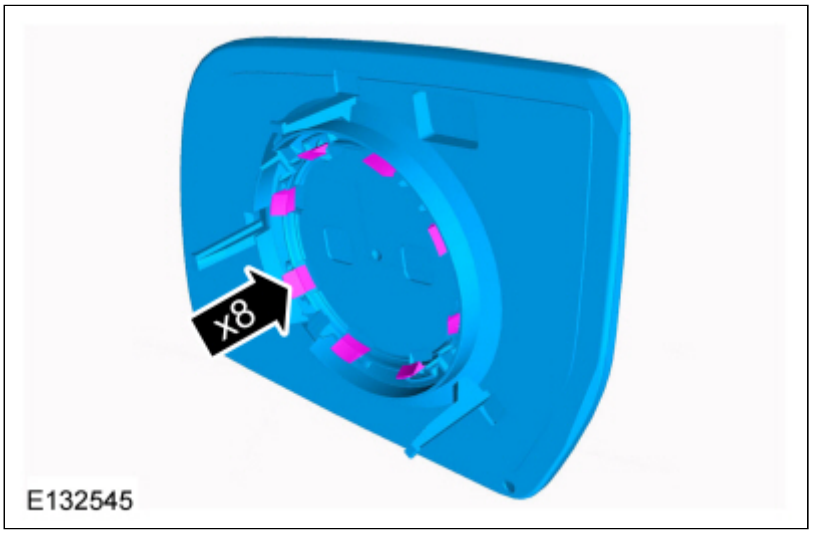
Exterior Mirror Glass

Removal

1.



2. **NOTE:** *Vehicles without heated mirror.*



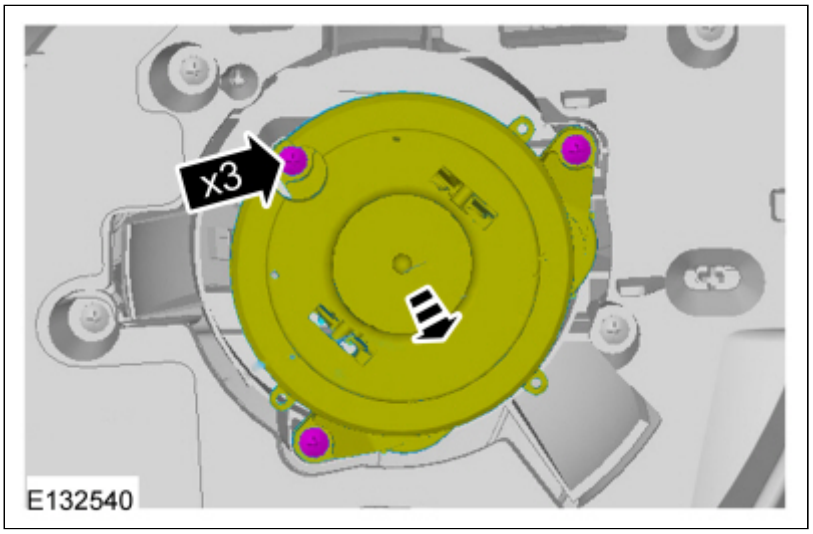
Installation

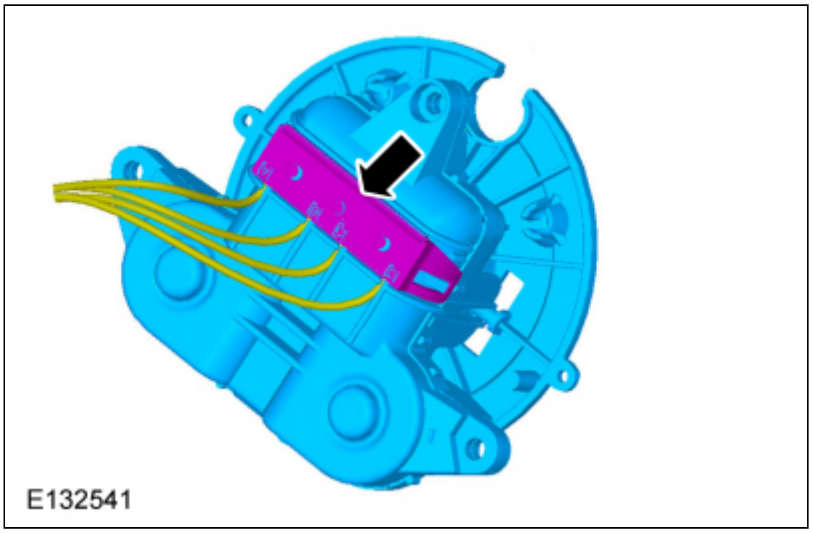
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Exterior Mirror Motor

Removal

1. Refer to: Exterior Mirror Glass (501-09A Exterior Rear View Mirrors, Removal and Installation).
2. 

3. 

Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Interior Rear View Mirrors - Overview

Overview

This vehicle may be equipped with a manual or auto-dimming interior rear view mirror. The manual dimming interior mirror has a lever at the bottom of the mirror assembly that must be pushed forward or pulled rearward to change the reflectance of the interior mirror glass. During nighttime conditions, the auto-dimming interior mirror automatically darkens the mirror glass when headlamps are detected from behind the vehicle to reduce unwanted glare.

Copyright © 2016 Ford Motor Company

Interior Rear View Mirrors - System Operation and Component Description

System Operation

System Operation- Interior Manual-Dimming

The manual interior rear view mirror can be adjusted from a day position to a night position to reduce unwanted glare caused by headlamps from behind the vehicle. Adjusting the interior mirror is accomplished by using the day/night tab, located on the bottom of the interior mirror. Pulling the tab rearward, towards the driver, adjusts the mirror to the night position. Pushing the tap forward, away from the driver, adjusts the mirror to the day position.

System Operation- Interior Auto-Dimming

The auto-dimming feature is active any time the ignition is ON. The interior auto-dimming mirror uses 2 integral photoelectric sensors to detect exterior lighting conditions. When the forward facing sensor detects daytime conditions, the rearward facing sensor is inactive and the mirror glass stays in a high reflectance mode. When the forward facing sensor detects nighttime conditions, the rearward facing sensor is active. When bright lights (glare) are detected by the rearward facing sensor, the mirror glass is electronically darkened. To provide increased visibility when backing up, the interior rear view mirror automatically returns to a high reflectance mode any time reverse gear is selected, regardless of exterior lighting conditions.

Component Description

Interior Rear View Mirror - Manual-Dimming

The manual dimming interior rear view mirror has a lever at the back of the mirror that must be pulled forward or pushed rearward by the driver to activate the manual dimming function. Manual dimming is completely controlled by the driver.

Interior Rear View Mirror - Auto-Dimming

The auto-dimming rear view mirror has 2 photoelectric sensors, one on the front of the mirror (facing the windshield) and one on the rear of the mirror (at the top of the mirror glass). Based on inputs from these sensors, the automatic dimming feature adjusts the reflectance level of the interior rear view mirror glass to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior mirror.

Copyright © 2016 Ford Motor Company

Interior Rear View Mirrors

Refer to Wiring Diagrams Section 501-09 for schematic and connector information.

Principles of Operation

The interior auto-dimming rear view mirror automatically reduces the glare caused by headlamps reflecting in the interior rear view mirror. The auto-dimming feature is disabled when the vehicle is in REVERSE. Power is supplied to the interior auto-dimming mirror when the ignition is in the RUN position or the accessory delay is active.

Interior Auto-Dimming Rear View Mirror

The interior auto-dimming rear view mirror has 2 photoelectric sensors that detect forward and rearward light conditions. Based on these inputs, the automatic dimming feature adjusts the reflectance level of the interior rear view mirror glass to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rearward glare in relation to ambient light conditions in front of the interior mirror.

When the forward sensor detects daytime conditions, the rearward sensor is inactive and the interior rear view mirror stays in a high reflectance mode. When the forward sensor detects nighttime conditions, the rearward sensor is active and detects glare from the headlights of vehicles approaching from the rear or other glare-producing light sources. To provide increased visibility when backing up, the interior rear view mirror automatically returns to a high reflectance mode whenever the vehicle is in REVERSE.

If the forward or rearward sensors are blocked, the automatic dimming interior mirror might not work correctly.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Interior mirror	• Fuse • Relay • Loose or corroded connections • Wiring harness • Interior mirror

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
• The interior mirror is blemished	• Interior mirror glass/housing is dirty • The interior mirror is damaged	• **NOTE:** *Do not clean the housing or glass of any mirror with harsh abrasives, fuel or other petroleum-based cleaning products.* • CLEAN the affected interior mirror surface. INSPECT the interior mirror damage. If needed, INSTALL a new interior rear view mirror.
• The auto-dimming mirror does not operate correctly	• Fuse • Wiring, terminals or connectors	• GO to Pinpoint Test A

correctly	or connectors. • Auto-dimming interior mirror	

• The auto-dimming mirror does not operate correctly - obstruction	• Obstructed rearward-facing sensor
	  • Stickers, window decals, tags
	  • Non-Original Equipment Manufacturer (OEM) window tinting
	• Obstructed forward-facing sensor
	  • Stickers, window decals, tags
	  • Non-Original Equipment Manufacturer (OEM) window tinting
		• If possible, remove the obstruction. If the obstruction cannot be removed, GO to Pinpoint Test A to TEST the interior rear view auto-dimming mirror for correct function.

• The auto-dimming mirror does not operate correctly - light source or vehicle location	• Light source near or inside of vehicle • Vehicle inside garage or tunnel	• The system is operating correctly. Any light source the rearward-facing sensor is exposed to can be considered glare. • The system is operating correctly. Ambient light conditions are similar to nighttime.

Pinpoint Tests

The Interior Auto-Dimming Mirror Does Not Operate Correctly

Refer to Wiring Diagrams Cell 124 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Exterior Rear View Mirrors - System Operation and Component Description (501-09A Exterior Rear View Mirrors, Description and Operation).

Possible Causes

- Fuse
- Wiring, terminals or connectors
- TR data concern
- Reverse lamp concern
- Interior auto-dimming mirror
- IPMA (integral to the interior auto-dimming mirror) if equipped

Visual Inspection and Diagnostic Pre-Checks

- Inspect BCM fuse(s).

PINPOINT TEST A : THE INTERIOR AUTO-DIMMING MIRROR DOES NOT OPERATE CORRECTLY

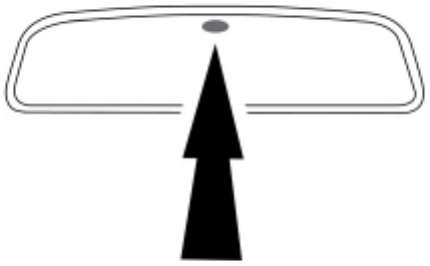
A1 VERIFY THE OPERATION OF THE REVERSE LAMPS
• Ignition ON. • **NOTE:** *If the TR sensor is malfunctioning and the reverse lamps are inoperative or always on, the interior auto-dimming mirror will not function properly.* Move the selector lever through the entire range while monitoring the reverse lamps. • Select PARK.

Do the reverse lamps illuminate ONLY in REVERSE?

Yes	GO to A2
No	DIAGNOSE the reversing lamps. REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

A2 INSPECT THE MIRROR FOR PROPER INSTALLATION

- Inspect the interior auto-dimming mirror to make sure the rearward facing sensor is at the top of the mirror glass.



E149165

Is the rearward facing sensor at the top of the interior auto-dimming mirror glass?

Yes	GO to A3
No	INSTALL the interior auto-dimming mirror with the rearward facing sensor at the top of the mirror glass. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

A3 VERIFY THE FORWARD AND REARWARD FACING SENSORS ARE NOT BLOCKED

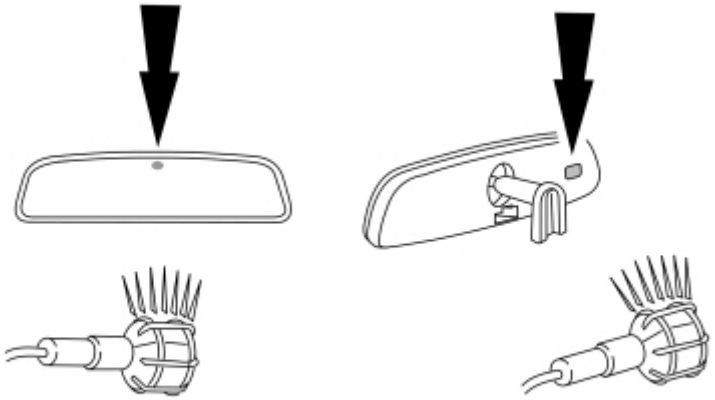
- Visually verify the forward and rearward facing sensors are not blocked or obstructed. Sources of obstruction can include:
  - Stickers, window decals or tags.
  - Toll road or parking passes.
  - Fold-down screens for TVs or DVD players.
  - Non-OEM window tinting.
  - Dirt and debris.
  - Camper shells.
  - Decorative objects hung from mirror.

Are either of the sensors blocked?

Yes	If possible, REMOVE the obstruction. If it is not possible to remove the obstruction, ADVISE the customer the blockage will affect the operation of the auto-dimming mirror.
No	GO to A4

A4 VERIFY THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - DAYLIGHT CONDITIONS

- **NOTE:** *Base electrochromatic mirror shown. IPMA mirror is similar.*
  Use a bright lamp to illuminate the forward facing sensor and the rearward facing sensor. The mirror should adjust to a high reflectance state (mirror will be clear).



E149159

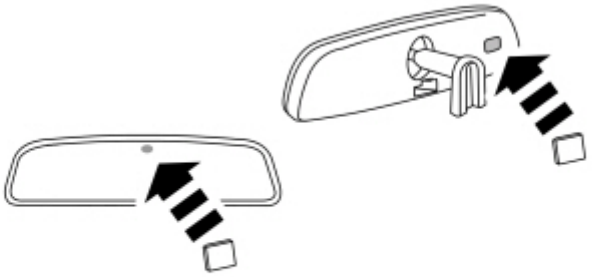
Did the mirror adjust to a high reflectance (clear) state?

Yes	GO to A5
No	INSTALL a new interior auto-dimming mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

A5 VERIFY THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHTTIME CONDITIONS

- **NOTE:** *Covering the sensor(s) with a finger or hand is not adequate for this step.*

  Cover the forward and rearward facing sensors with black electrical tape or other dark material. The mirror should adjust to a high reflectance state (mirror will be clear).



E149155

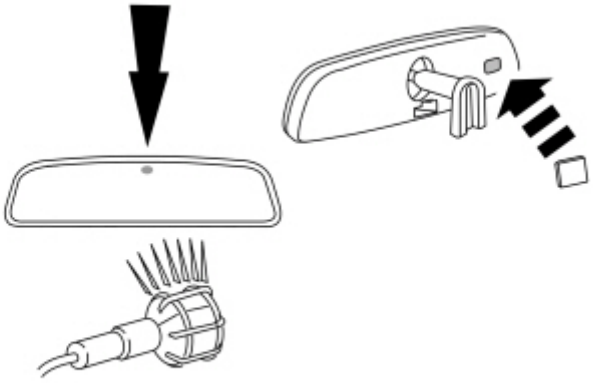
Did the mirror adjust to a high reflectance (clear) state?

Yes	GO to A6
No	INSTALL a new interior auto-dimming mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

A6 VERIFY THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHTTIME CONDITIONS WITH GLARE

- **NOTE:** *Covering the sensor(s) with a finger or hand is not adequate for this step.*

  Remove the black electrical tape or other dark material from the rearward facing sensor.



E149156

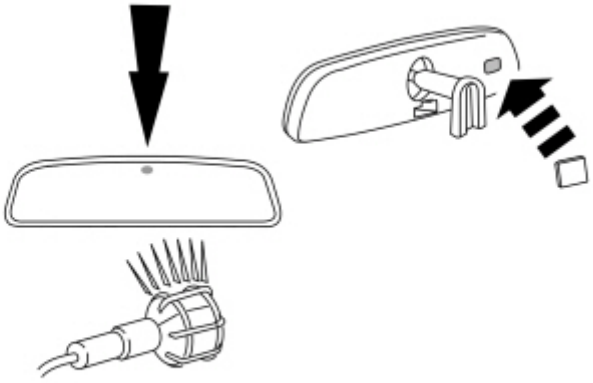
- Use a bright light to illuminate the rearward facing sensor. The mirror should adjust to a lower reflectance state (mirror will be dark).

Did the mirror adjust to a low reflectance (dark) state?

Yes	GO to A7
No	GO to A8

A7 VERIFY THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - VEHICLE IN REVERSE AND NIGHTTIME CONDITIONS WITH GLARE

- **NOTE:** *Covering the sensor(s) with a finger or hand is not adequate for this step.*
  Continue to illuminate the rearward facing sensor with the forward facing sensor covered.



E149156

- Select REVERSE.

Did the mirror adjust to a high reflectance (clear) state after reverse was selected?

Yes	Select PARK. The system is operating correctly at this time. REVIEW the operation of the interior auto-dimming mirror feature with the customer.
No	If the vehicle is equipped with an IPMA, GO to A11 If the vehicle is not equipped with an IPMA, GO to A10

A8 CHECK FOR VOLTAGE TO THE INTERIOR AUTO-DIMMING MIRROR

- Ignition OFF.
- Disconnect: Interior Auto-Dimming Mirror C911 (without IPMA) or Interior Auto-Dimming Mirror C9012 (with

IPMA).
- Ignition ON.
- Measure:

Without IPMA

Positive Lead	Measurement / Action	Negative Lead
C911-1	V	Ground

With IPMA

Positive Lead	Measurement / Action	Negative Lead
C9012-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A9
No	VERIFY that BCM fuse(s) is OK. If the fuse is OK, REPAIR the circuit. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A9 CHECK FOR GROUND AT THE INTERIOR AUTO-DIMMING MIRROR

- Ignition OFF.
- Measure:

Without IPMA

Positive Lead	Measurement / Action	Negative Lead
C911-2	Ω	Ground

With IPMA

Positive Lead	Measurement / Action	Negative Lead
C9012-7	Ω	Ground

Is the resistance less than 3 ohms?

Yes	Vehicles with an IPMA, GO to A12 Vehicles without an IPMA, GO to A10
No	REPAIR the circuit.

A10 CHECK THE REVERSE INHIBIT CIRCUIT FOR VOLTAGE AT THE INTERIOR AUTO-DIMMING MIRROR WITH THE VEHICLE IN REVERSE

- Ignition ON.
- Select REVERSE.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C911-3		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new interior auto-dimming mirror. REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
No	REPAIR the circuit.

A11 PERFORM A NETWORK TEST

- Select PARK.
- Using a diagnostic scan tool, perform a network test.

Do the PCM, GWM and IPMA pass the network test?

Yes	GO to A12
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A12 CHECK FOR IPMA (IMAGE PROCESSING MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Select REVERSE.
- Wait 15 seconds.
- Select PARK.
- Using a diagnostic scan tool, check the IPMA Diagnostic Trouble Codes (DTCs).

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Lane Keeping System (419-07 Lane Keeping System, Diagnosis and Testing).
No	GO to A13

A13 CHECK FOR CORRECT IPMA (IMAGE PROCESSING MODULE A) OPERATION

- Disconnect and inspect all IPMA connectors and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the IPMA connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system to determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new IPMA (integral to the interior auto-dimming mirror). REFER to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).

No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

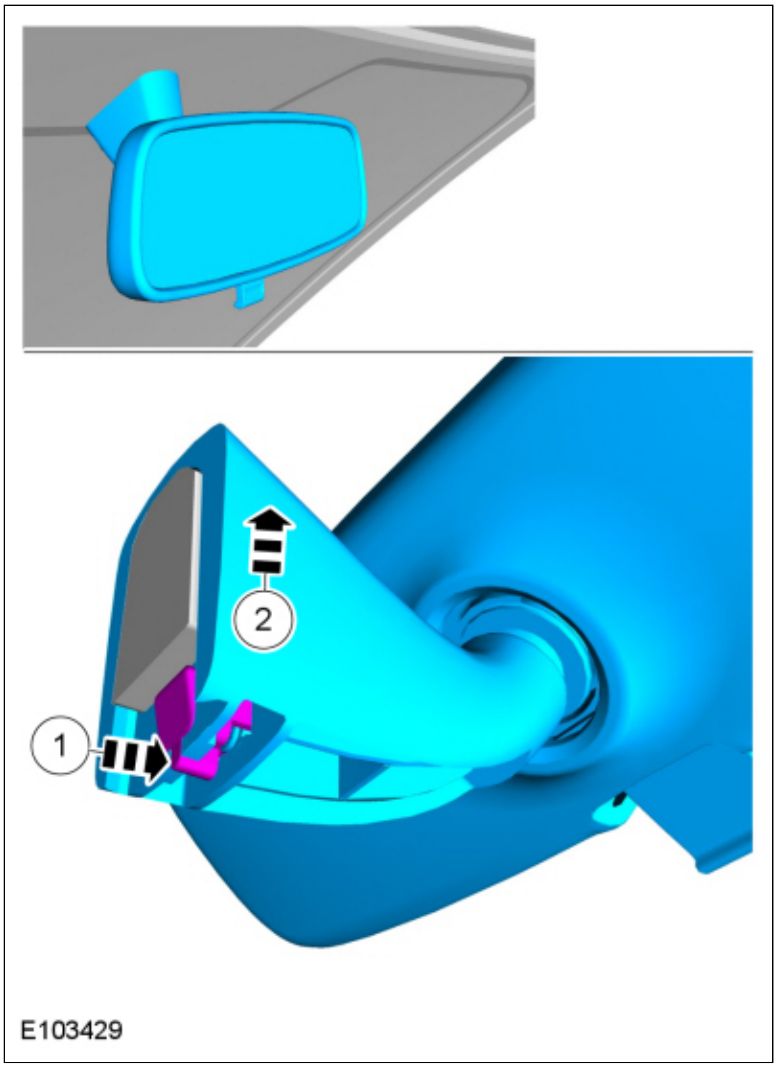
Interior Rear View Mirror

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

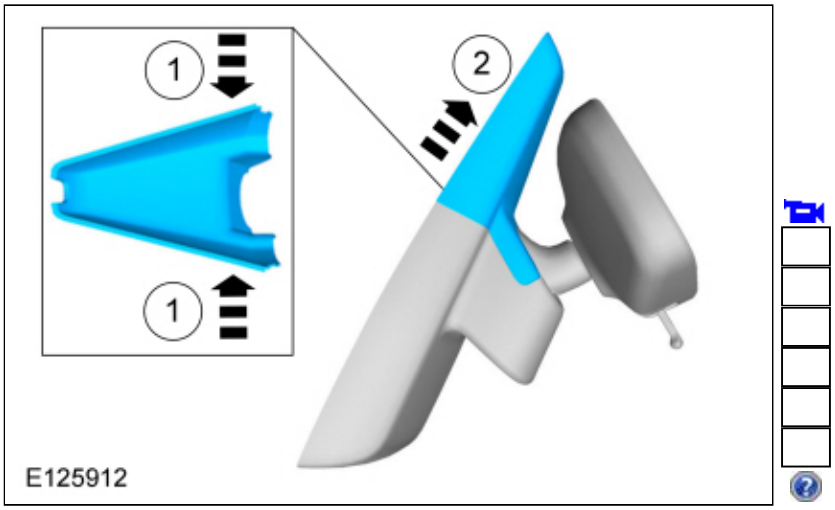
Mirror type 1

1. Remove the interior mirror.
    1. Release the locking tab.
    2. Slide the interior mirror off the mirror mount.

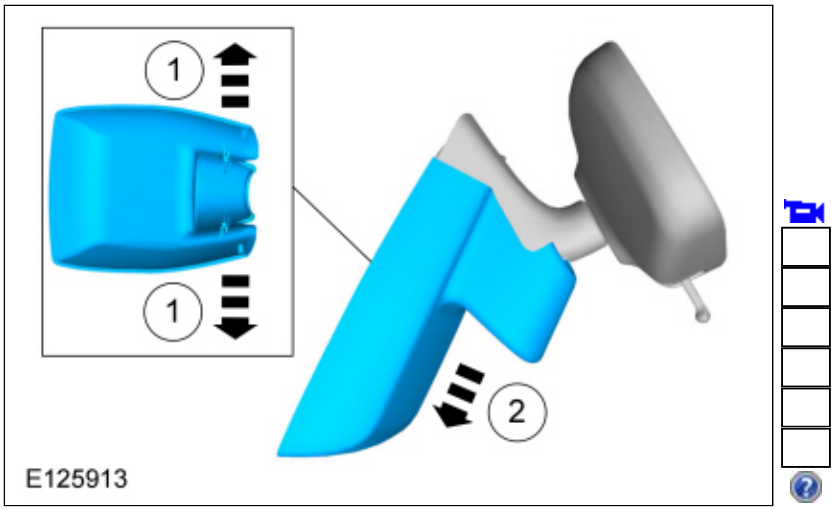


Mirror type 2

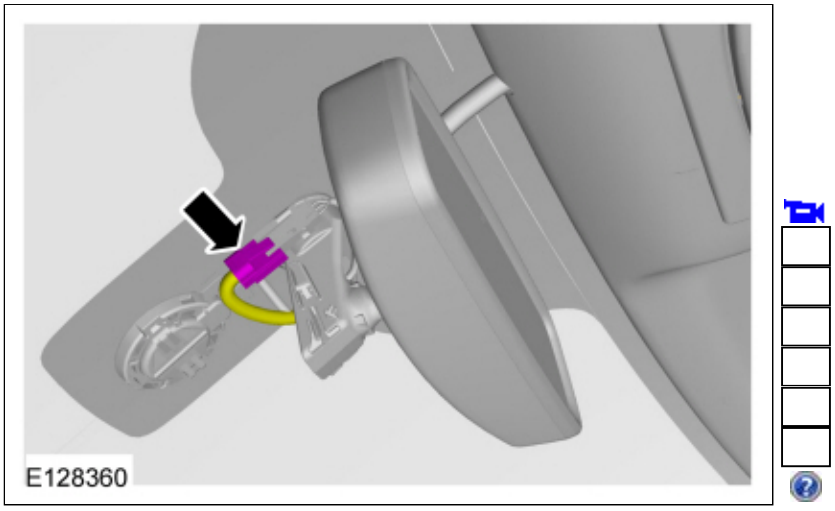
2. Remove the rain sensor covers.



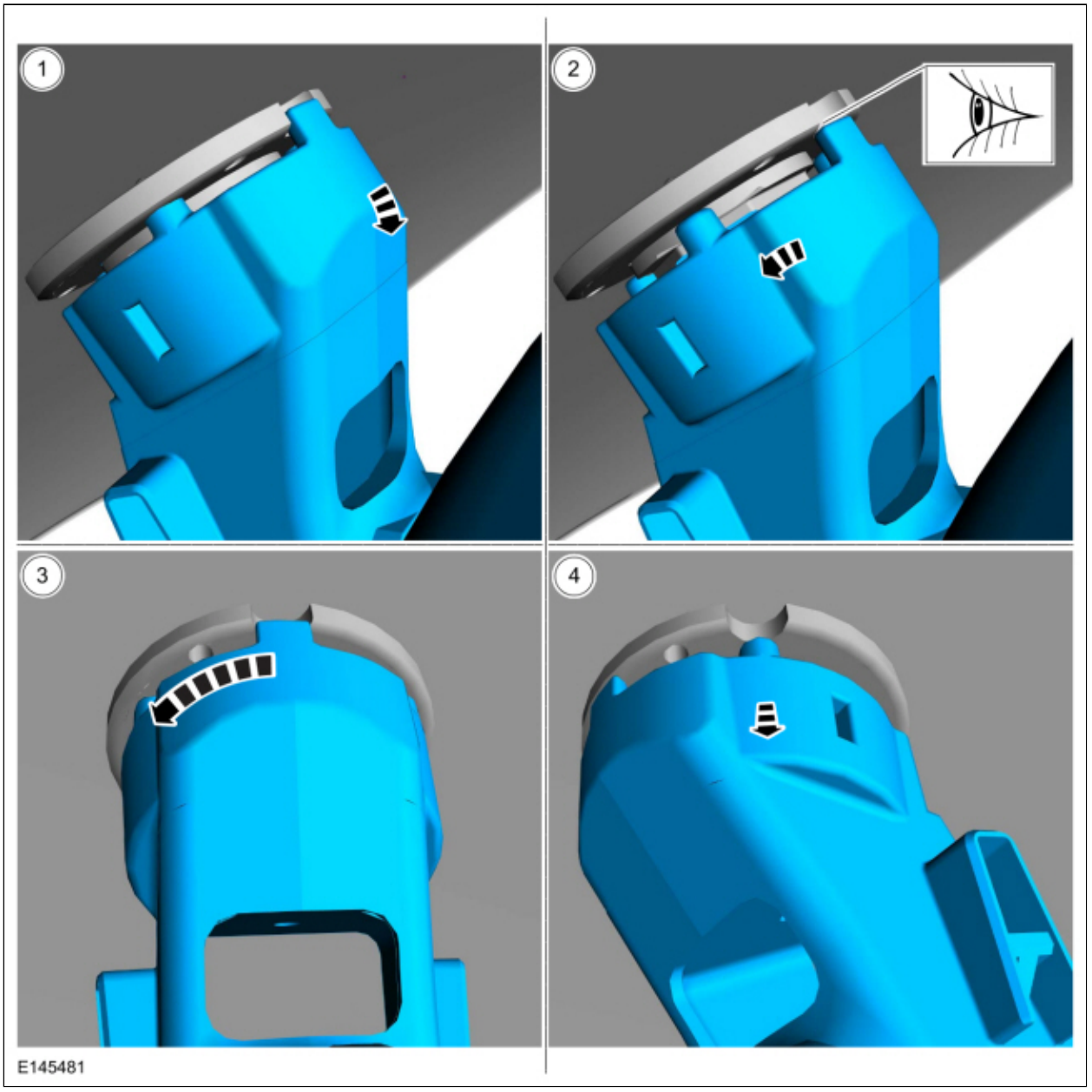
3. Remove the rain sensor covers.



4.



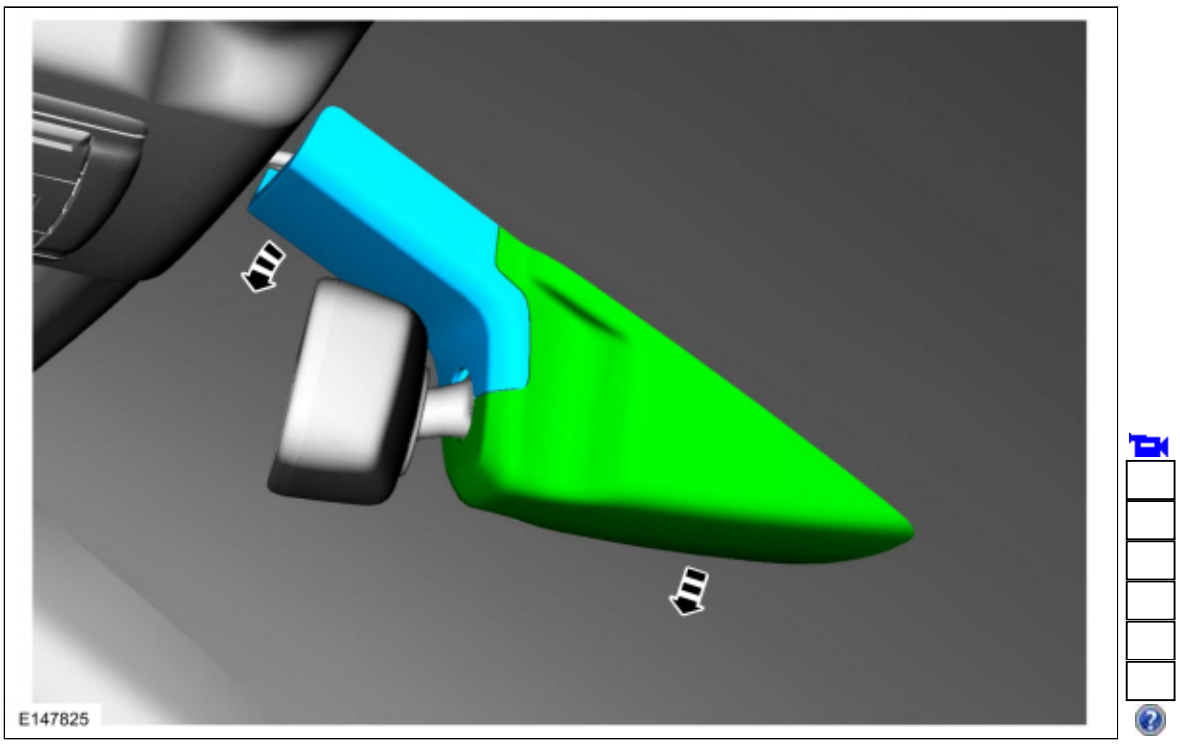
5. Remove the interior mirror.
    1. Position the interior mirror assembly to release the indexing tab.
    2. Inspect the indexing tab and turn the interior mirror slightly counter clock-wise.
    3. Turn the interior mirror 45 degrees counter clock-wise.
    4. Pull the interior mirror off the mirror mount.



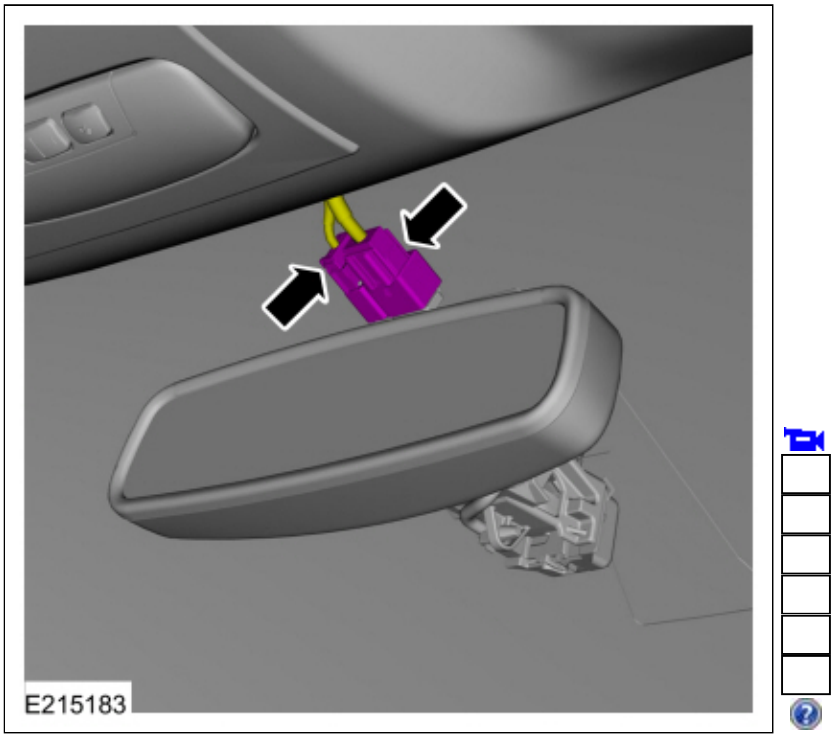
Mirror type 3

6. If a new mirror is being installed, use a diagnostic scan tool, begin the PMI process for the IPMAfollowing the on-screen instructions.

7. Remove the rain sensor covers.



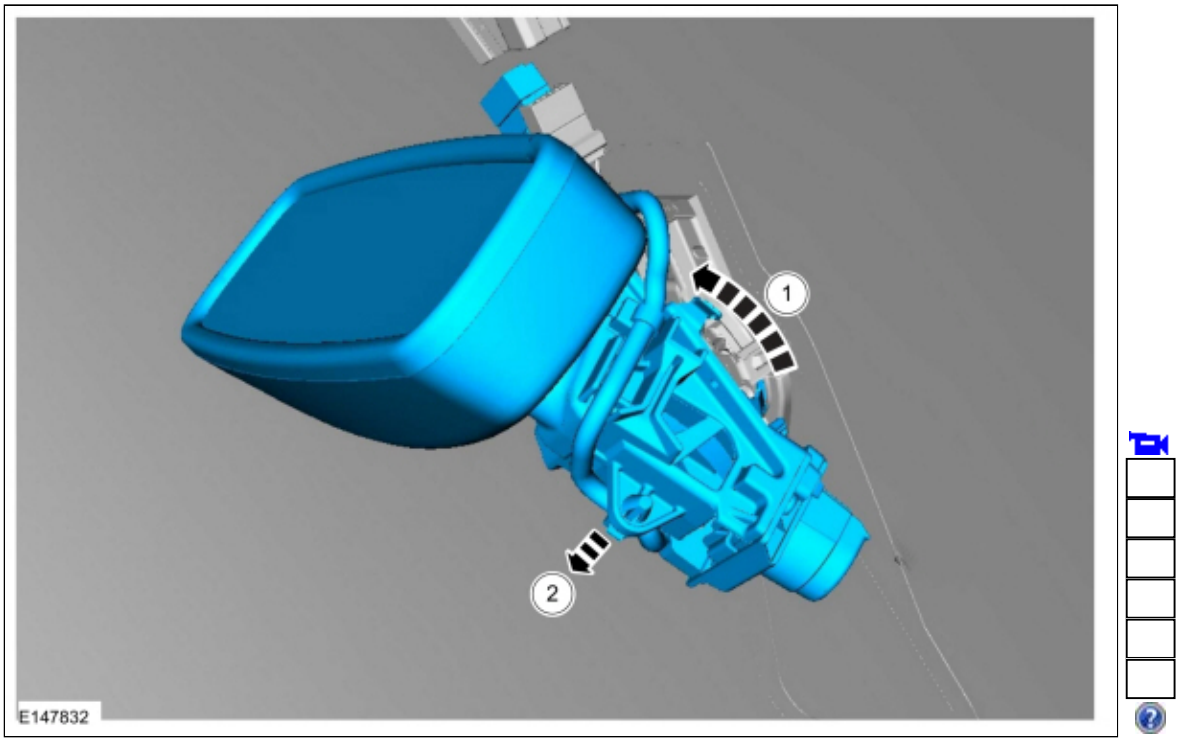
8. Disconnect the interior mirror electrical connector.



9. **NOTICE: Only turn at the base of the mirror.**

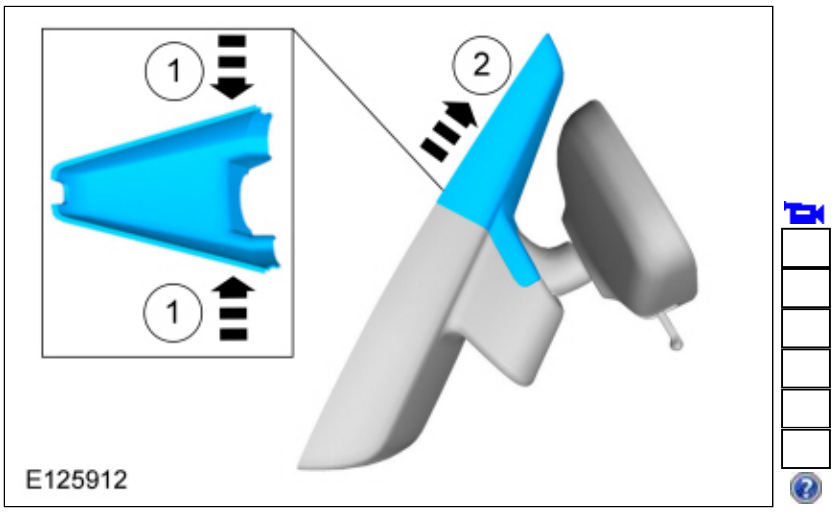
Remove the interior mirror.

1. Turn the interior mirror assembly counter clock-wise.
2. Remove the interior mirror off the mirror mount.

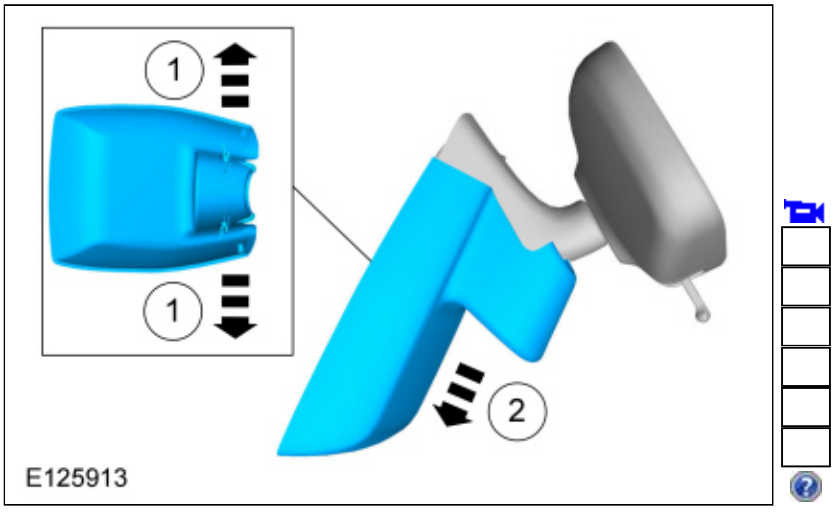


Mirror type 4

10. Remove the rain sensor covers.

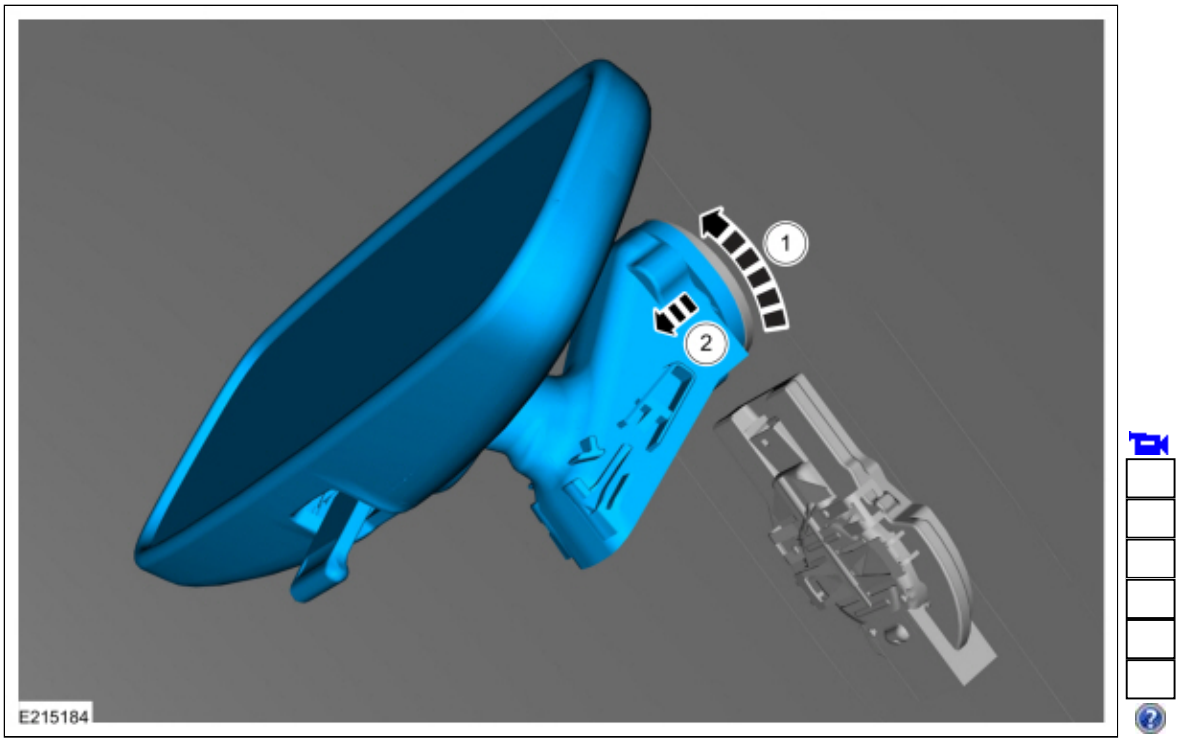


11. Remove the rain sensor covers.



12. Remove the interior mirror.
    1. Turn the interior mirror counter clock-wise.

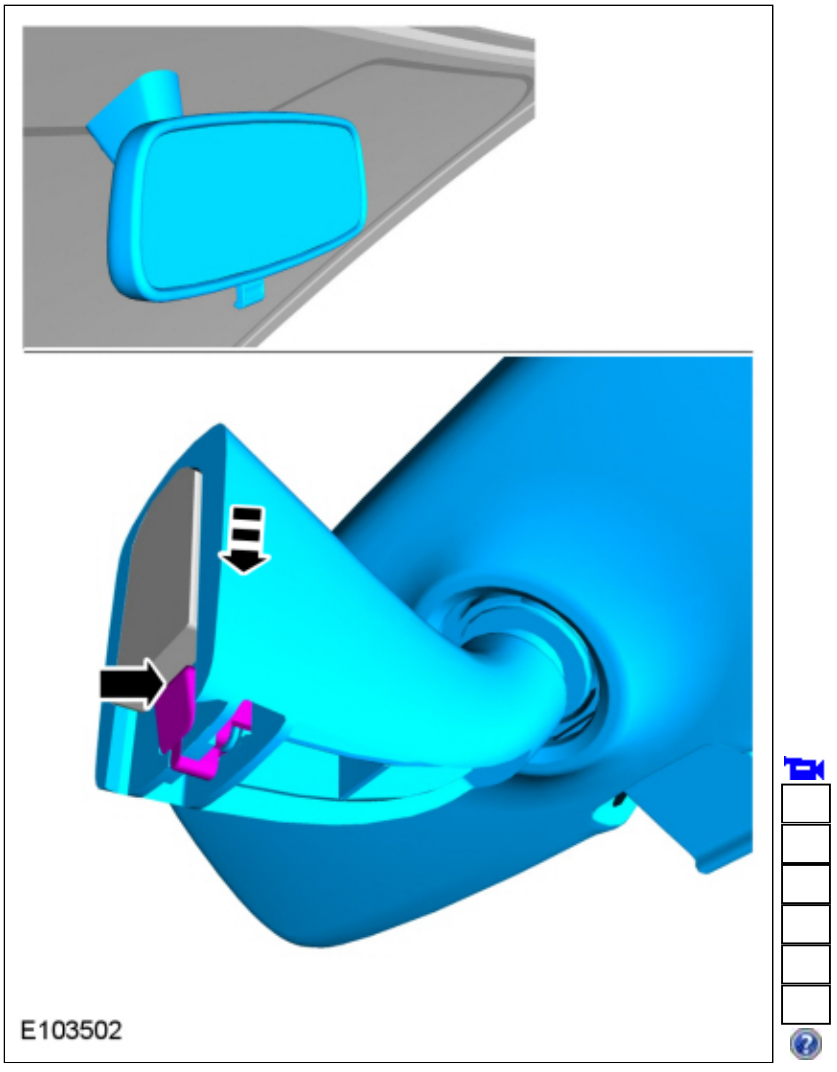
2. Pull the interior mirror off the mirror mount.



Installation

Mirror type 1

1. Slide the interior mirror onto the mirror mount until the locking tab is engaged.



Mirror type 2

2. To install, reverse the removal procedure.

Mirror type 3

3. To install, reverse the removal procedure.

- If a new mirror has been installed, use diagnostic scan tool, complete the PMI process for the IPMA following the on-screen instructions.
- If a new mirror has been installed, carry out the camera alignment using a scan tool.

Mirror type 4

5. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Seats

Base Part Number: 63100

General

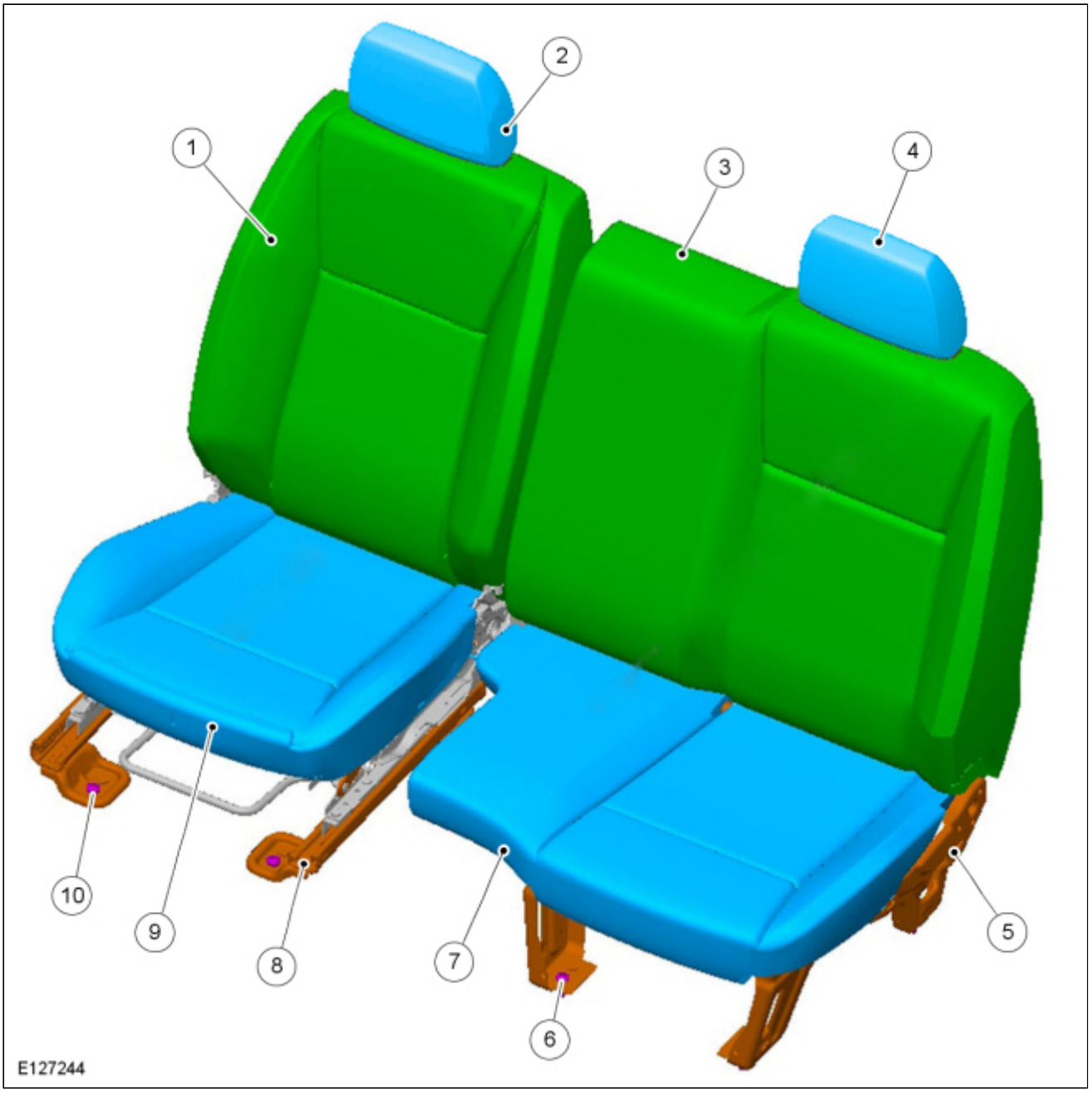
Side airbags and height adjustable head restraints are installed as standard equipment. Depending on the vehicle specification, either 2-way, 4-way or 8-way adjustable head restraints are installed as an option.

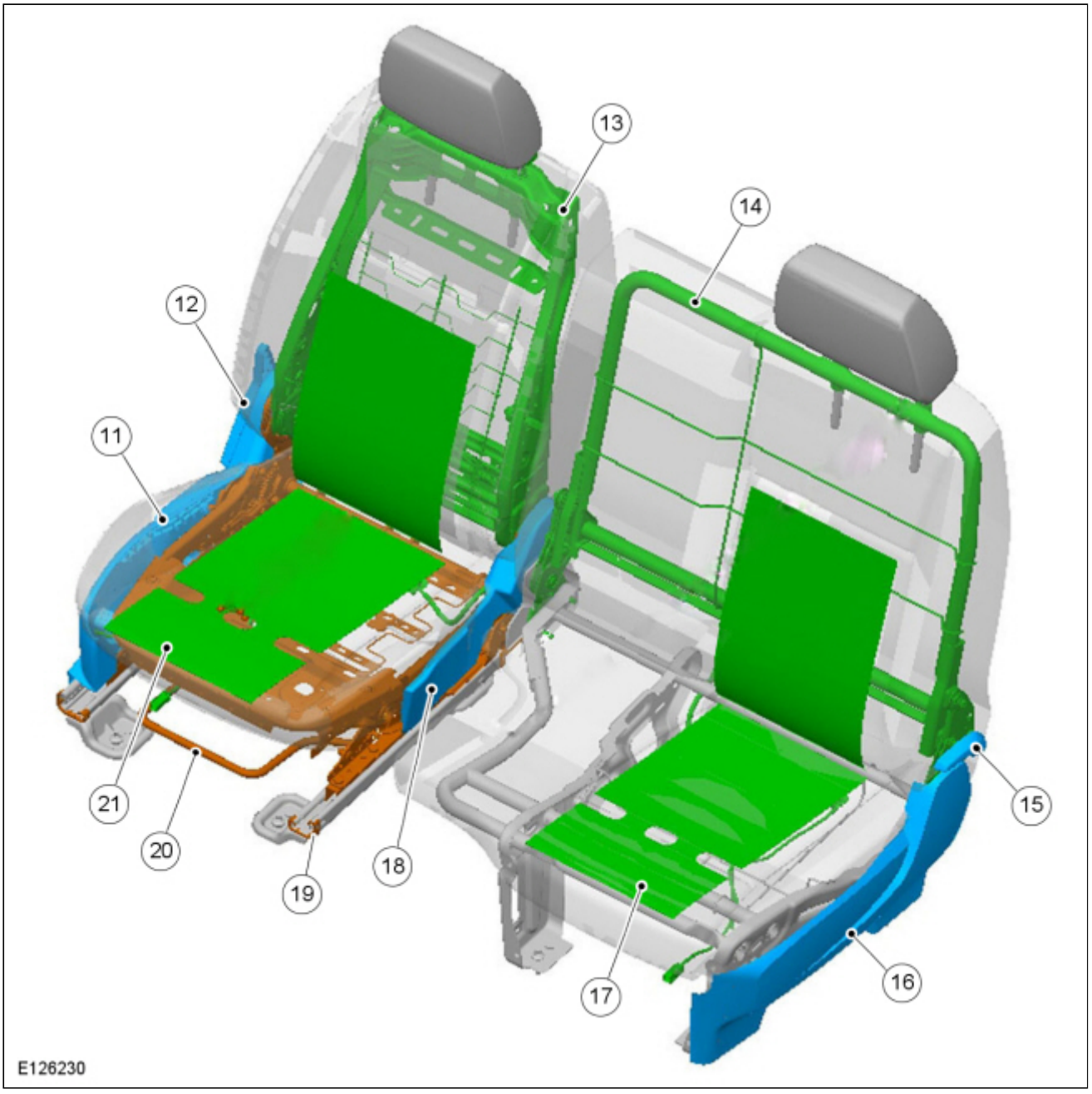
Depending on the vehicle specification, the front seats may be equipped with any one or combination of the following:

- Manual or power seat height adjustment
- Seat rails, forward and rearward motion
- Backrest recline
- Manually adjustable lumbar mat
- Heated cushion and backrest

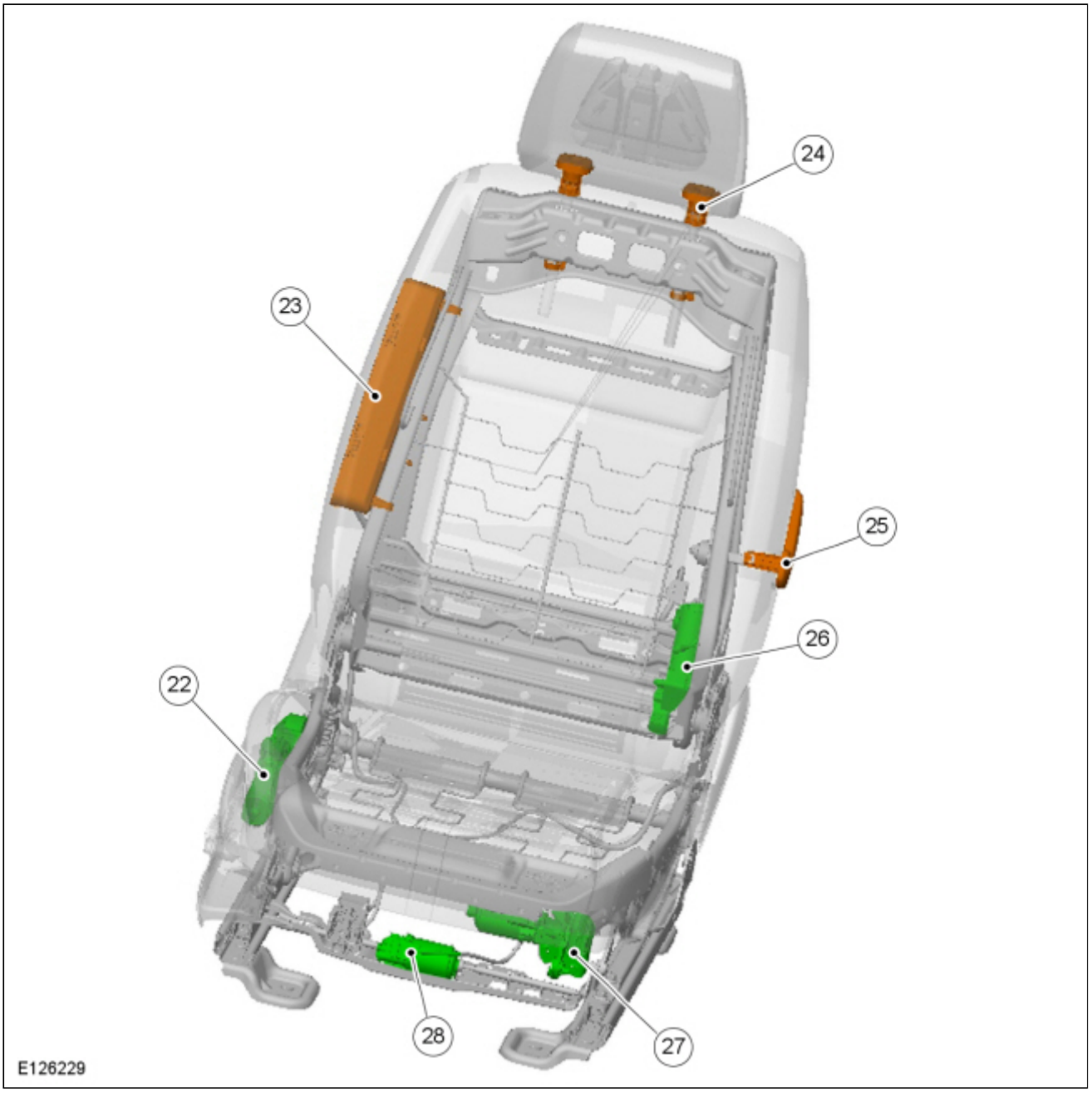
Always move the head restraints to the raised position if the rear seat is occupied by a passenger or is used for a child restraint system. The rear head restraints must be lowered to allow the seat to be folded down.

Single cab front seat


1
2
3
4
5
6
7
8
9
10
E127244



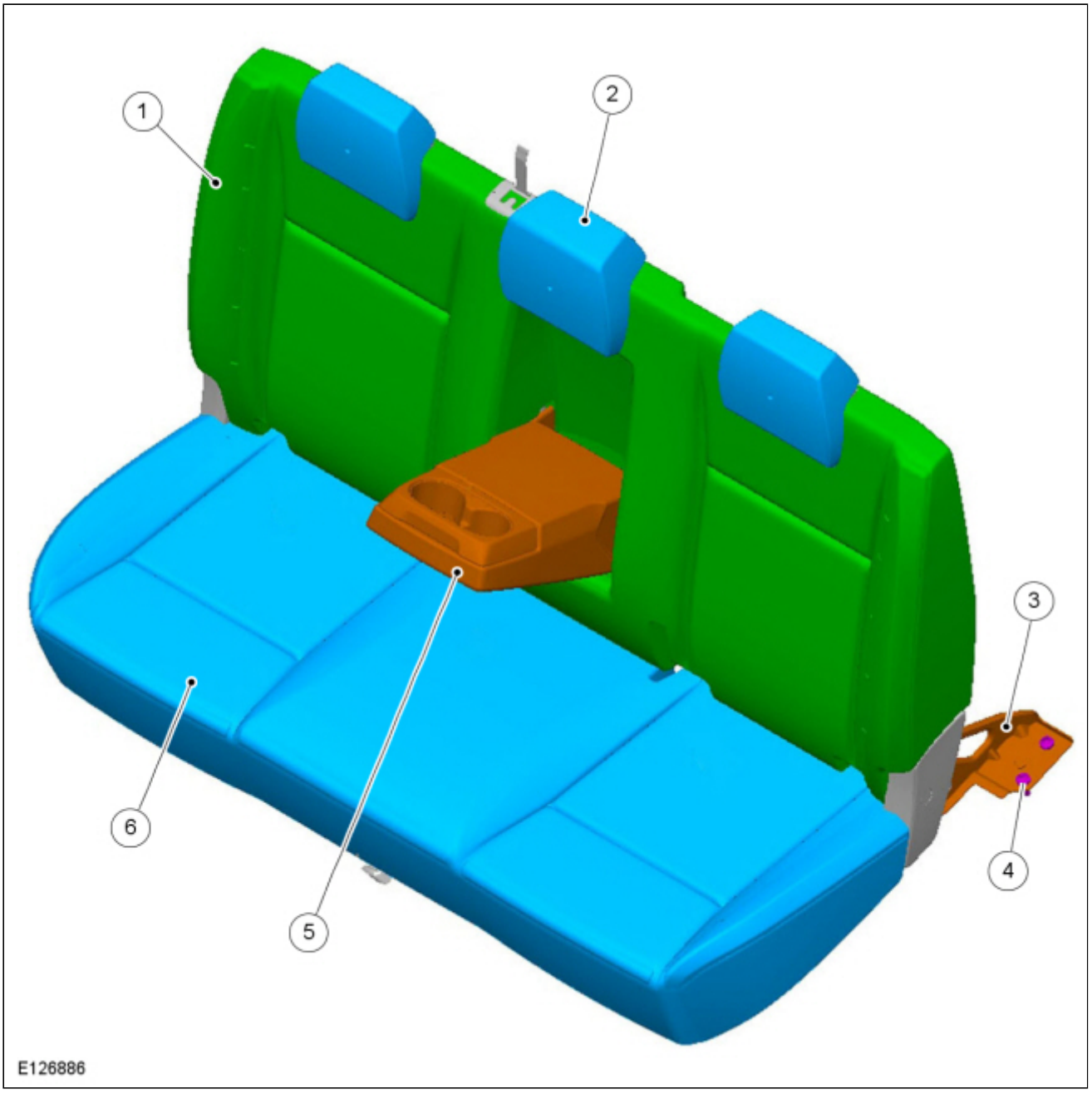
Double cab front power seat

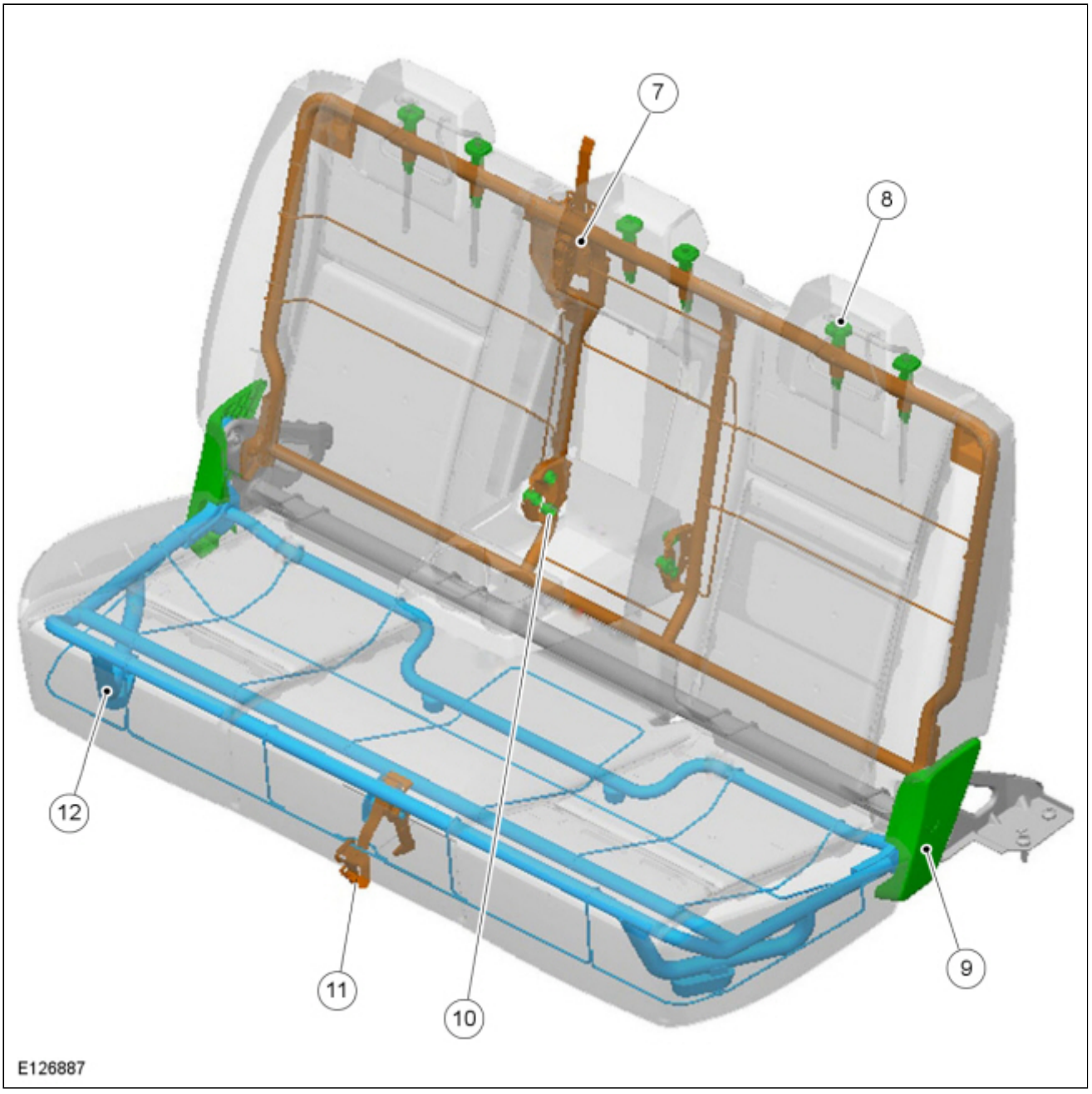


Item	Part Number	Description
1	—	Backrest trim cover
2	—	Head restraint adjustment
3	—	Front seat bench backrest trim cover
4	—	Head restraint adjustment
5	—	Front seat bench cushion frame
6	—	Front seat retaining bolts
7	—	Front seat bench cushion
8	—	Seat frame lower track
9	—	Front seat cushion cover
10	—	Front seat cushion base retaining bolts
11	—	Cushion side shield
12	—	Seat adjustment lever
13	—	Front seat backrest frame and lumbar support
14	—	Backrest front seat bench frame

15	—	Latch lever
16	—	Front bench cushion side shield
17	—	Front seat cushion heating mat
18	—	Cushion side shield
19	—	Lower track end cap
20	—	Manual seat track adjust
21	—	Front seat cushion and backrest heating mat
22	—	Switch group for electrically adjustable driver's seat
23	—	Side airbag
24	—	Head restraint guide
25	—	Manually adjustable lumbar lever
26	—	Servo motor, electrically adjustable backrest
27	—	Servo motors, seat height and seat angle electric adjustment
28	—	Servo motor, forward and rearward motion

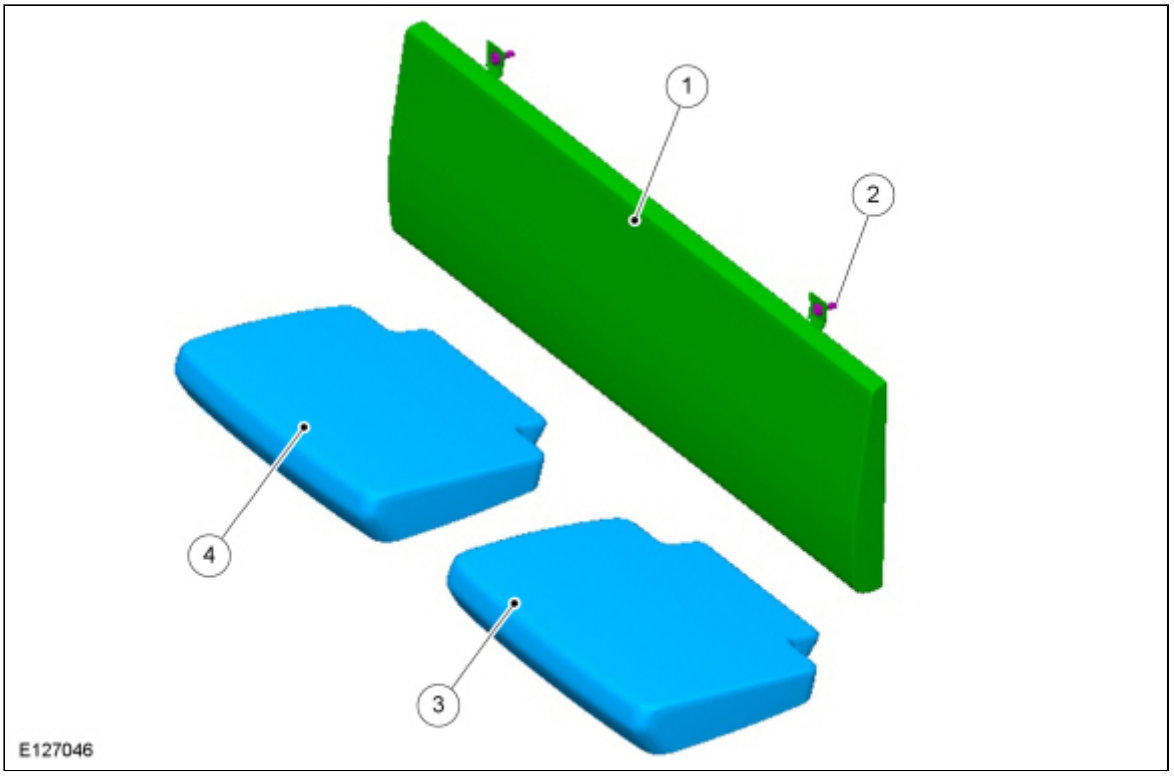
Double cab rear seat


1
2
3
4
5
6
E126886



Item	Part Number	Description
1	—	Rear seat backrest trim cover
2	—	Head restraint adjustment
3	—	Rear seat frame mounting bracket
4	—	Rear seat cushion retaining bolts
5	—	Armrest trim
6	—	Rear seat cushion trim cover
7	—	Rear seat backrest frame
8	—	Head restraint guide
9	—	Pivot cover rear seat back
10	—	Bush
11	—	Rear seat cushion frame floor hook
12	—	Rear seat cushion frame

Rap cab rear seat



Item	Part Number	Description
1	—	Rear seat backrest
2	—	Back rest upper bolts
3	—	Rear seat cushion trim
4	—	Rear seat cushion trim

Copyright © 2016 Ford Motor Company

Seats

Base Part Number: 63100

Refer to Wiring Diagrams Section 501-10 for schematic and connector information.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Switch(es) • Seat tracks • Seat latch • Hinge(s) • Frame	• Fuse(s) • Wiring harness • Electrical connector(s) • Switch(es) • Seat slide motor • Seat height motor • Seat recline motor • Battery junction box (BJB) • FCIM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Ford diagnostic equipment to diagnose the system.

DTC Chart: FCIM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

FCIM DTC Chart

DTC	Description	Action
B1034:11	Left Front Seat Heater Element: Circuit Short To Ground	• For LHD vehicles, GO to Pinpoint Test G • For RHD vehicles, GO to Pinpoint Test H
B1034:12	Left Front Seat Heater Element: Circuit Short To Battery	• For LHD vehicles, GO to Pinpoint Test G • For RHD vehicles, GO to Pinpoint Test H
B1034:13	Left Front Seat Heater Element: Circuit Open	• For LHD vehicles, GO to Pinpoint Test G • For RHD vehicles, GO to Pinpoint Test H

B1036:11	Right Front Seat Heater Element: Circuit Short To Ground	• For LHD vehicles, GO to Pinpoint Test H • For RHD vehicles, GO to Pinpoint Test G
B1036:12	Right Front Seat Heater Element: Circuit Short To Battery	• For LHD vehicles, GO to Pinpoint Test H • For RHD vehicles, GO to Pinpoint Test G
B1036:13	Right Front Seat Heater Element: Circuit Open	• For LHD vehicles, GO to Pinpoint Test H • For RHD vehicles, GO to Pinpoint Test G
B1038:11	Left Front Seat Heater Sensor: Circuit Short To Ground	• For LHD vehicles, GO to Pinpoint Test G • For RHD vehicles, GO to Pinpoint Test H
B1038:15	Left Front Seat Heater Sensor: Circuit Short To Battery or Open	• For LHD vehicles, GO to Pinpoint Test G • For RHD vehicles, GO to Pinpoint Test H
B103A:11	Right Front Seat Heater Sensor: Circuit Short To Ground	• For LHD vehicles, GO to Pinpoint Test H • For RHD vehicles, GO to Pinpoint Test G
B103A:15	Right Front Seat Heater Sensor: Circuit Short To Battery or Open	• For LHD vehicles, GO to Pinpoint Test H • For RHD vehicles, GO to Pinpoint Test G
All other Diagnostic Trouble Codes (DTCs)	-	Refer to the appropriate section in Group 415 for the procedure.

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
• The power seat is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test A
• The power seat moves but is noisy	• Refer to the Pinpoint Test	• GO to Pinpoint Test B
• The power seat moves but is loose	• Refer to the Pinpoint Test	• GO to Pinpoint Test C
• The power seat does not make full travel	• Refer to the Pinpoint Test	• GO to Pinpoint Test D
• The power seat does not move horizontally/vertically	• Refer to the Pinpoint Test	• GO to Pinpoint Test E
• The heated seats are inoperative — driver and passenger	• Refer to the Pinpoint Test	• GO to Pinpoint Test F
• The heated seat is inoperative/does not operate correctly — driver	• Refer to the Pinpoint Test	• GO to Pinpoint Test G
• The heated seat is inoperative/does not operate correctly	• Refer to the	• GO to Pinpoint

— passenger	Pinpoint Test	Test H

Pinpoint Tests

The Power Seat is Inoperative

Normal Operation

The seat control switch is supplied battery voltage from the PDB. The seat control switch then supplies voltage and ground to the appropriate circuits to operate the seat motors.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Seat control switch
- BCM

PINPOINT TEST A : THE POWER SEAT IS INOPERATIVE

A1 CHECK VOLTAGE TO THE SEAT CONTROL SWITCH

- Ignition OFF.
- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Seat C313.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-9	V	Ground

Is voltage greater than 10 volts?

Yes	GO to A2
No	VERIFY BJB fuse is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. GO to A3

A2 CHECK FOR AN OPEN GROUND CIRCUIT TO THE SEAT CONTROL SWITCH

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-10	Ω	Ground

Is the resistance less than 5 ohms?

Yes	INSTALL a new seat control switch. TEST the system for normal operation. GO to A3
No	REPAIR the circuit. TEST the system for normal operation. GO to A3

A3 VERIFY THE SRS (SUPPLEMENTAL RESTRAINT SYSTEM) PROVES OUT SUCCESSFULLY

- Depower the Supplemental Restraint System (SRS).

REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Connect Passenger Seat C314.
- Connect all previously disconnected connectors.
- Repower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

Did the SRS prove out successfully?

Yes	Repair is complete. RETURN the vehicle to the customer.
No	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).

The Power Seat Moves But is Noisy

Normal Operation

The power seat should move quietly during operation. Some noise is acceptable.

Possible Sources

- Seat track alignment
- Seat track obstruction
- Seat track

PINPOINT TEST B : THE POWER SEAT MOVES BUT IS NOISY

B1 CHECK SEAT TRACK ALIGNMENT

- Check the alignment of the track to the floor and the track to the seat.

Is the seat track alignment OK?

Yes	GO to B2
No	ALIGN the track. TEST the system for normal operation.

B2 CHECK THE SEAT TRACK INTEGRITY

- Operate the seat and inspect the seat track for binding and/or damage.

Does the seat track appear to be free from damage/binding?

Yes	GO to B3
No	INSTALL a new front seat track assembly. TEST the system for normal operation.

B3 CHECK THE SEAT MOTOR INTEGRITY

- Operate the seat and listen for excessive seat motor noise. Compare the noise to a similar vehicle for reference.

Is the seat motor noise excessive?

Yes	INSTALL a new front seat track assembly. TEST the system for normal operation.
No	Allow the customer to compare a similar vehicle for product motor noise characteristics. TEST the system for normal operation.

The Power Seat Moves But is Loose

Normal Operation

The power seat movement should be smooth and the seat cushion should not rock during or after operation.

Possible Sources

- Seat track fastening hardware
- Seat track

PINPOINT TEST C : THE POWER SEAT MOVES BUT IS LOOSE

C1 CHECK FOR LOOSE FASTENING HARDWARE
• Inspect for loose fastening hardware on the seat. **Is the fastening hardware tight?**

Yes	IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.
No	TIGHTEN all fastening hardware to specification. TEST the system for normal operation.

The Power Seat Does Not Make Full Travel

Normal Operation

The power seat should travel fully horizontal (forward/rearward) and vertical (front up/down and rear up/down).

Possible Sources

- Seat track obstruction
- Seat track

PINPOINT TEST D : THE POWER SEAT DOES NOT MAKE FULL TRAVEL

D1 CHECK FOR AN OBSTRUCTION IN THE SEAT TRACK
• Remove the driver seat. REFER to: Front Seat (501-10A Seating, Removal and Installation). • Check for obstruction in the seat track. **Is the seat track free from obstruction?**

Yes	IDENTIFY the cause and REPAIR as necessary. INSTALL the driver seat. REFER to: Front Seat (501-10A Seating, Removal and Installation). TEST the system for normal operation.
No	REMOVE the obstruction(s). INSTALL the driver seat. REFER to: Front Seat (501-10A Seating, Removal and Installation). TEST the system for normal operation.

The Power Seat Does Not Move Horizontally/Vertically

Normal Operation

The seat control switch is supplied battery voltage from the PDB. The seat control switch then supplies voltage and ground to the appropriate circuits to operate the seat motors.

Possible Sources

- Wiring, terminals or connectors
- Seat control switch
- Seat track motor

PINPOINT TEST E : THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY

E1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Ignition ON.
- Operate the seat control switch in the forward and rearward positions.

Does the seat move horizontally?

Yes	GO to E2
No	GO to E4

E2 DETERMINE SEAT HEIGHT ADJUST FAILURE

- Operate the seat control switch in the front up/down and rear up/down positions.

Does the seat front or rear height adjust up and down?

Yes	If only the front height adjust operates, GO to E6 If only the rear height adjust operates, GO to E8 If both the front height adjust and rear height adjust operate, GO to E3
No	INSTALL a new seat control switch. TEST the system for normal operation.

E3 DETERMINE SEAT TILT ADJUST FAILURE

- Operate the seat control switch in the tilt up/down positions.

Does the seat tilt adjust up and down?

Yes	GO to E10
No	The system is operating correctly at this time.

E4 CHECK VOLTAGE TO THE SEAT TRACK MOTOR

- Ignition OFF.
- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Seat Track Motor.
- Ignition ON.
- While operating the seat control switch forward and rearward, measure the voltage between both pins on the seat track motor harness connector.

Is voltage greater than 10 volts when the seat control switch is toggled in both directions and 0 volt in the rest position?

Yes	INSTALL a new seat track. GO to E12
No	GO to E5

E5 CHECK SEAT TRACK MOTOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Seat Control Switch.
- Measure the resistance on both circuits between the seat track motor harness connector and the seat control

switch harness connector.

Is resistance less than 5 ohms for both circuits?

Yes	INSTALL a new seat control switch. GO to E12
No	REPAIR the circuit. GO to E12

E6 CHECK VOLTAGE TO THE SEAT RECLINER MOTOR

- Ignition OFF.
- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Seat Recliner Motor.
- Ignition ON.
- While operating the seat control switch rear height adjust up and down, measure the voltage between both pins on the seat recliner motor harness connector.

Is voltage greater than 10 volts when the seat control switch is toggled in both directions and 0 volt in the rest position?

Yes	INSTALL a new seat track. GO to E12
No	GO to E7

E7 CHECK SEAT RECLINER MOTOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Seat Control Switch.
- Measure the resistance on both circuits between the seat recliner harness connector and the seat control switch harness connector.

Is resistance less than 5 ohms for both circuits?

Yes	INSTALL a new seat control switch. GO to E12
No	REPAIR the circuit. GO to E12

E8 CHECK VOLTAGE TO THE SEAT HEIGHT ADJUSTMENT MOTOR

- Ignition OFF.
- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Seat Height Adjustment Motor.
- Ignition ON.
- While operating the seat control switch front height adjust up and down, measure the voltage between both pins on the seat height adjustment motor harness connector.

Is voltage greater than 10 volts when the seat control switch is toggled in both directions and 0 volt in the rest position?

Yes	INSTALL a new seat track. GO to E12
No	GO to E9

E9 CHECK SEAT HEIGHT ADJUSTMENT MOTOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Seat Control Switch.
- Measure the resistance on both circuits between the seat height adjustment motor harness connector and

the seat control switch harness connector.

Is resistance less than 5 ohms for both circuits?

Yes	INSTALL a new seat control switch. GO to E12
No	REPAIR the circuit. GO to E12

E10 CHECK VOLTAGE TO THE SEAT TILT MOTOR

- Ignition OFF.
- Disconnect Seat Tilt Motor.
- Ignition ON.
- While operating the seat control switch tilt adjust up and down, measure the voltage between both pins on the seat tilt motor harness connector.

Is voltage greater than 10 volts when the seat control switch is toggled in both directions and 0 volt in the rest position?

Yes	INSTALL a new seat track. GO to E12
No	GO to E11

E11 CHECK SEAT TILT MOTOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect Seat Control Switch.
- Measure the resistance on both circuits between the seat tilt motor harness connector and the seat control switch harness connector.

Is resistance less than 5 ohms for both circuits?

Yes	INSTALL a new seat control switch. GO to E12
No	REPAIR the circuit. GO to E12

E12 VERIFY THE SRS (SUPPLEMENTAL RESTRAINT SYSTEM) PROVES OUT SUCCESSFULLY

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Connect Passenger Seat C314.
- Connect all previously disconnected connectors.
- Repower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

Did the SRS prove out successfully?

Yes	Repair is complete. RETURN the vehicle to the customer.
No	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).

The Heated Seats are Inoperative — Driver and Passenger

Refer to Wiring Diagrams Cell 119 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Seats (501-10A Seating, Description and Operation).

Possible Causes

- Fuse
- Wiring, terminals or connectors
- FCIM
- Touchscreen not operating correctly

Visual Inspection and Diagnostic Pre-checks

- Verify the BJB fuse(s) is OK.

PINPOINT TEST F : THE HEATED SEATS ARE INOPERATIVE — DRIVER AND PASSENGER

F1 CHECK FOR FCIM (FRONT CONTROLS INTERFACE MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Are any FCIM Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the FCIM DTC Chart.
No	GO to F2

F2 CHECK THE TOUCHSCREEN OPERATION

- Start the engine.
- Select each audio and climate control function using the touchscreen controls.

Do all touchscreen controls operate?

Yes	GO to F3
No	Refer to the appropriate section in Group 415 for the procedure.

F3 CHECK THE HEATED SEAT VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: FCIM C2402B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402B-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to F4
No	VERIFY BJB fuse(s) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

F4 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF

- Ignition OFF.
- Disconnect and inspect all of the FCIM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors. Make sure they seat and latch correctly.
- Reconnect all previously disconnected connectors.
- Ignition ON.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Heated Seat is Inoperative/Does Not Operate Correctly — Driver

Refer to Wiring Diagrams Cell 119 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Seats (501-10A Seating, Description and Operation).

DTC Fault Trigger Conditions - LHD

DTC	Description	Fault Trigger Conditions
B1034:11	Left Front Seat Heater Element: Circuit Short To Ground	Sets when the FCIM senses the left front heater element current draw has exceeded a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1034:12	Left Front Seat Heater Element: Circuit Short To Battery	Sets when the FCIM senses the left front heater circuit voltage is above a specified threshold when the driver is active. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1034:13	Left Front Seat Heater Element: Circuit Open	Sets when the FCIM senses the left front heater element current draw is less than a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1038:11	Left Front Seat Heater Sensor: Circuit Short To Ground	Sets when the FCIM senses the left front heater sensor voltage is out-of-range low. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1038:15	Left Front Seat Heater Sensor: Circuit Short To Battery or Open	Sets when the FCIM senses the left front heater sensor voltage is out-of-range high. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.

DTC Fault Trigger Conditions - RHD

DTC	Description	Fault Trigger Conditions
B1036:11	Right Front Seat Heater Element: Circuit Short	Sets when the FCIM senses the right front heater element current draw has exceeded a specified threshold. When this DTC sets, the FCIM disables the

	To Ground	circuit until the ignition is cycled.
B1036:12	Right Front Seat Heater Element: Circuit Short To Battery	Sets when the FCIM senses the right front heater circuit voltage is above a specified threshold when the driver is active. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1036:13	Right Front Seat Heater Element: Circuit Open	Sets when the FCIM senses the right front heater element current draw is less than a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B103A:11	Right Front Seat Heater Sensor: Circuit Short To Ground	Sets when the FCIM senses the right front heater sensor voltage is out-of-range low. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B103A:15	Right Front Seat Heater Sensor: Circuit Short To Battery or Open	Sets when the FCIM senses the right front heater sensor voltage is out-of-range high. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.

Possible Causes

- Wiring, terminals or connectors
- Heater mat
- FCIM
- Touchscreen not operating correctly

PINPOINT TEST G : THE HEATED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — DRIVER

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

G1 CHECK FOR FCIM (FRONT CONTROLS INTERFACE MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Are any FCIM Diagnostic Trouble Codes (DTCs) present?

Yes	For DTC B1034:11, B1034:12, B1034:13, B1036:11, B1036:12 or B1036:13, GO to G4 For DTC B1038:11, B1038:15, B103A:11 or B103A:15, GO to G6 For all other Diagnostic Trouble Codes (DTCs), REFER to the FCIM DTC Chart.
No	GO to G2

G2 CHECK THE TOUCHSCREEN OPERATION

- Start the engine.
- Select each audio and climate control function using the touchscreen controls.

Do all touchscreen controls operate?

Yes	GO to G3
No	Refer to the appropriate section in Group 415 for the procedure.

G3 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) DRIVER HEATED SEAT CONTROL SWITCH (CC_SW_D_HSEATS) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, monitor the FCIM CC_SW_D_HSEATS PID while operating the driver heated seat switch.

Does the PID state change when the driver heated seat switch is pressed and released?

Yes	GO to G4
No	INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.

G4 CHECK THE HEATED SEAT VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect FCIM C2402B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402B-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to G5
No	REPAIR the circuit.

G5 CHECK THE HEATER ELEMENT POWER CIRCUIT FOR AN OPEN OR SHORT TO GROUND

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Seat C313.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-7	Ω	Ground

- Measure:

Left Hand Drive (LHD)

Positive Lead	Measurement / Action	Negative Lead
C313-7	Ω	C2402B-16

Right Hand Drive (RHD)

Positive Lead	Measurement / Action	Negative Lead
C313-7	Ω	C2402B-17

Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground; and less than 3 ohms between the driver seat cushion heater mat and the FCIM?

Yes	GO to G9

No	REPAIR the circuit. GO to G13

G6 CHECK THE HEATED SEAT TEMPERATURE SENSOR CIRCUIT FOR AN OPEN OR SHORT TO GROUND

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect FCIM C2402B.
- Disconnect Driver Seat C313.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-3	Ω	Ground

- Measure:

Left Hand Drive (LHD)

Positive Lead	Measurement / Action	Negative Lead
C313-3	Ω	C2402B-30

Right Hand Drive (RHD)

Positive Lead	Measurement / Action	Negative Lead
C313-3	Ω	C2402B-15

Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground; and less than 3 ohms between the driver seat cushion heater mat and the FCIM?

Yes	GO to G7
No	REPAIR the circuit. GO to G13

G7 CHECK THE HEATED SEAT TEMPERATURE SENSOR RETURN CIRCUIT FOR AN OPEN OR SHORT TO GROUND

- Disconnect FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-4	Ω	Ground

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-4	Ω	C2402A-2

Is the resistance greater than 10,000 ohms between the driver seat cushion heater mat and ground; and less than 3 ohms between the driver seat cushion heater mat and the FCIM?

Yes	GO to G8
No	REPAIR the circuit. GO to G13

G8 CHECK THE HEATED SEAT TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit. GO to G13
No	GO to G11

G9 CHECK THE HEATER ELEMENT GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-8	Ω	Ground

Is the resistance less than 0.5 ohm?

Yes	GO to G10
No	REPAIR the circuit. GO to G13

G10 CHECK THE HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

- Measure the **component side resistance** between:

Positive Lead	Measurement / Action	Negative Lead
C313-7, Component Side	Ω	C313-8, Component Side
C313-7, Component Side	Ω	Ground

Is the resistance between 0.6 and 2 ohms between pins 7 and 8; and greater than 10,000 ohms between pin 7 and ground?

Yes	GO to G12
No	INSTALL a new driver seat heater mat. GO to G13

No	INSTALL a new driver seat heater mat. GO to G13

G11 CHECK THE HEATED SEAT TEMPERATURE SENSOR FOR AN OPEN OR SHORT TO GROUND

- Measure the **component side resistance** between:

Positive Lead	Measurement / Action	Negative Lead
C313-3, Component Side	Ω	C313-4, Component Side
C313-3, Component Side	Ω	Ground

Is the resistance between 300 and 300,000 ohms between pins 3 and 4; and greater than 10,000 ohms between pin 3 and ground?

Yes	GO to G12
No	INSTALL a new driver seat heater mat. GO to G13

G12 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all of the FCIM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors. Make sure they seat and latch correctly.
- Reconnect all previously disconnected connectors.
- Ignition ON.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.GO to G13
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. GO to G13

G13 VERIFY THE SRS (SUPPLEMENTAL RESTRAINT SYSTEM) PROVES OUT SUCCESSFULLY

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Connect Driver Seat C313.
- Connect all previously disconnected connectors.
- Repower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

Did the SRS prove out successfully?

Yes	Repair is complete. RETURN the vehicle to the customer.
No	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).

The Heated Seat is Inoperative/Does Not Operate Correctly — Passenger

Refer to Wiring Diagrams Cell 119 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Seats (501-10A Seating, Description and Operation).

DTC Fault Trigger Conditions - LHD

DTC	Description	Fault Trigger Conditions
B1036:11	Right Front Seat Heater Element: Circuit Short To Ground	Sets when the FCIM senses the right front heater element current draw has exceeded a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1036:12	Right Front Seat Heater Element: Circuit Short To Battery	Sets when the FCIM senses the right front heater circuit voltage is above a specified threshold when the driver is active. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1036:13	Right Front Seat Heater Element: Circuit Open	Sets when the FCIM senses the right front heater element current draw is less than a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B103A:11	Right Front Seat Heater Sensor: Circuit Short To Ground	Sets when the FCIM senses the right front heater sensor voltage is out-of-range low. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B103A:15	Right Front Seat Heater Sensor: Circuit Short To Battery or Open	Sets when the FCIM senses the right front heater sensor voltage is out-of-range high. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.

DTC Fault Trigger Conditions - RHD

DTC	Description	Fault Trigger Conditions
B1034:11	Left Front Seat Heater Element: Circuit Short To Ground	Sets when the FCIM senses the left front heater element current draw has exceeded a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1034:12	Left Front Seat Heater Element: Circuit Short To Battery	Sets when the FCIM senses the left front heater circuit voltage is above a specified threshold when the driver is active. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1034:13	Left Front Seat Heater Element: Circuit Open	Sets when the FCIM senses the left front heater element current draw is less than a specified threshold. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1038:11	Left Front Seat Heater Sensor: Circuit Short To Ground	Sets when the FCIM senses the left front heater sensor voltage is out-of-range low. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.
B1038:15	Left Front Seat Heater Sensor: Circuit Short To Battery or Open	Sets when the FCIM senses the left front heater sensor voltage is out-of-range high. When this DTC sets, the FCIM disables the circuit until the ignition is cycled.

Possible Causes

- Wiring, terminals or connectors

- Heater mat
- FCIM
- Touchscreen not operating correctly

PINPOINT TEST H : THE HEATED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY — PASSENGER

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

H1 CHECK FOR FCIM (FRONT CONTROLS INTERFACE MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform FCIM self-test.

Are any FCIM Diagnostic Trouble Codes (DTCs) present?

Yes	For DTC B1034:11, B1034:12, B1034:13, B1036:11, B1036:12 or B1036:13, GO to H4 For DTC B1038:11, B1038:15, B103A:11 or B103A:15, GO to H6 For all other Diagnostic Trouble Codes (DTCs), REFER to the FCIM DTC Chart.
No	GO to H2

H2 CHECK THE TOUCHSCREEN OPERATION

- Start the engine.
- Select each audio and climate control function using the touchscreen controls.

Do all touchscreen controls operate?

Yes	GO to H3
No	Refer to the appropriate section in Group 415 for the procedure.

H3 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) PASSENGER HEATED SEAT CONTROL SWITCH (CC_SW_P_HSEATS) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, monitor the FCIM CC_SW_P_HSEATS PID while operating the passenger heated seat switch.

Does the PID state change when the passenger heated seat switch is pressed and released?

Yes	GO to H4
No	INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.

H4 CHECK THE HEATED SEAT VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect FCIM C2402B.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402B-2		Ground

Is the voltage greater than 11 volts?

Yes	GO to H5
No	REPAIR the circuit.

H5 CHECK THE HEATER ELEMENT POWER CIRCUIT FOR AN OPEN OR SHORT TO GROUND

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Seat C314.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-7	Ω	Ground

- Measure:

Left Hand Drive (LHD)

Positive Lead	Measurement / Action	Negative Lead
C314-7	Ω	C2402B-17

Right Hand Drive (RHD)

Positive Lead	Measurement / Action	Negative Lead
C314-7	Ω	C2402B-16

Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and less than 3 ohms between the passenger seat cushion heater mat and the FCIM?

Yes	GO to H9
No	REPAIR the circuit. GO to H13

H6 CHECK THE HEATED SEAT TEMPERATURE SENSOR CIRCUIT FOR AN OPEN OR SHORT TO GROUND

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect FCIM C2402B.
- Disconnect Passenger Seat C314.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-3	Ω	Ground

- Measure:

Left Hand Drive (LHD)

Positive Lead	Measurement / Action	Negative Lead
C314-3	Ω	C2402B-15

Right Hand Drive (RHD)

Positive Lead	Measurement / Action	Negative Lead
C314-3	Ω	C2402B-30

Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and less than 3 ohms between the passenger seat cushion heater mat and the FCIM?

Yes	GO to H7
No	REPAIR the circuit. GO to H13

H7 CHECK THE HEATED SEAT TEMPERATURE SENSOR RETURN CIRCUIT FOR AN OPEN OR SHORT TO GROUND

- Disconnect: FCIM C2402A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-4	Ω	Ground

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-4	Ω	C2402A-2

Is the resistance greater than 10,000 ohms between the passenger seat cushion heater mat and ground; and less than 3 ohms between the passenger seat cushion heater mat and the FCIM?

Yes	GO to H8
No	REPAIR the circuit. GO to H13

H8 CHECK THE HEATED SEAT TEMPERATURE SENSOR CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit. GO to H13
No	GO to H11

H9 CHECK THE HEATER ELEMENT GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-8	Ω	Ground

Is the resistance less than 0.5 ohm?

Yes	GO to H10
No	REPAIR the circuit. GO to H13

H10 CHECK HEATED SEAT MAT FOR AN OPEN OR SHORT TO GROUND

- Measure the **component side resistance** between:

Positive Lead	Measurement / Action	Negative Lead
C314-7, Component Side	Ω	C314-8, Component Side
C314-7, Component Side	Ω	Ground

Is the resistance between 0.6 and 2 ohms between pins 7 and 8; and greater than 10,000 ohms between pin 7 and ground?

Yes	GO to H12
No	INSTALL a new passenger seat heater mat. GO to H13

H11 CHECK THE HEATED SEAT TEMPERATURE SENSOR FOR AN OPEN OR SHORT TO GROUND

- Measure the **component side resistance** between:

Positive Lead	Measurement / Action	Negative Lead
C314-4, Component Side	Ω	C314-4, Component Side
C314-4, Component Side	Ω	Ground

Is the resistance between 300 and 300,000 ohms between pins 3 and 4; and greater than 10,000 ohms between pin 3 and ground?

Yes	GO to H12
No	INSTALL a new driver seat heater mat. GO to H13

No	INSTALL a new driver seat heater mat. GO to H13

H12 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all of the FCIM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors. Make sure they seat and latch correctly.
- Reconnect all previously disconnected connectors.
- Ignition ON.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.GO to H13
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues. GO to H13

H13 VERIFY THE SRS (SUPPLEMENTAL RESTRAINT SYSTEM) PROVES OUT SUCCESSFULLY

- Depower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Connect Passenger Seat C314.
- Connect all previously disconnected connectors.
- Repower the Supplemental Restraint System (SRS).
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

Did the SRS prove out successfully?

Yes	Repair is complete. RETURN the vehicle to the customer.
No	REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Front Seat

Base Part Number: 63100

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

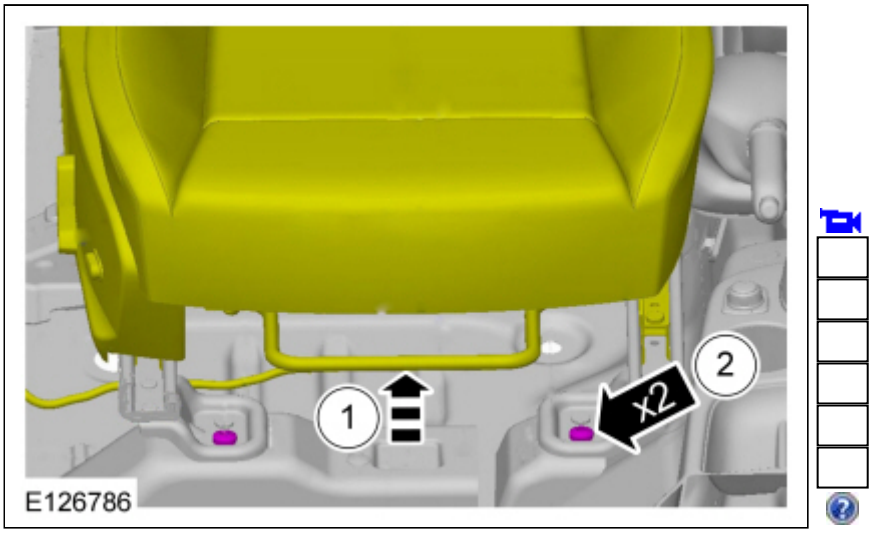
1. **WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.**

   WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

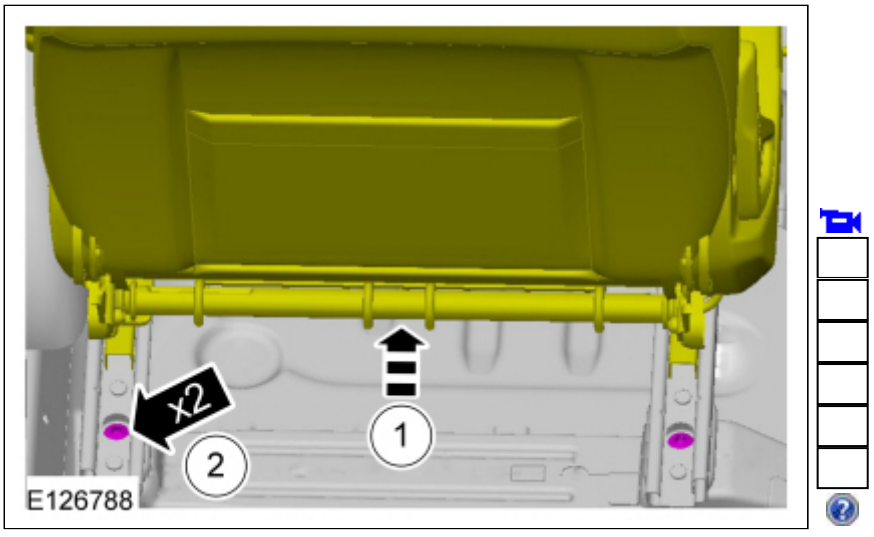
   Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

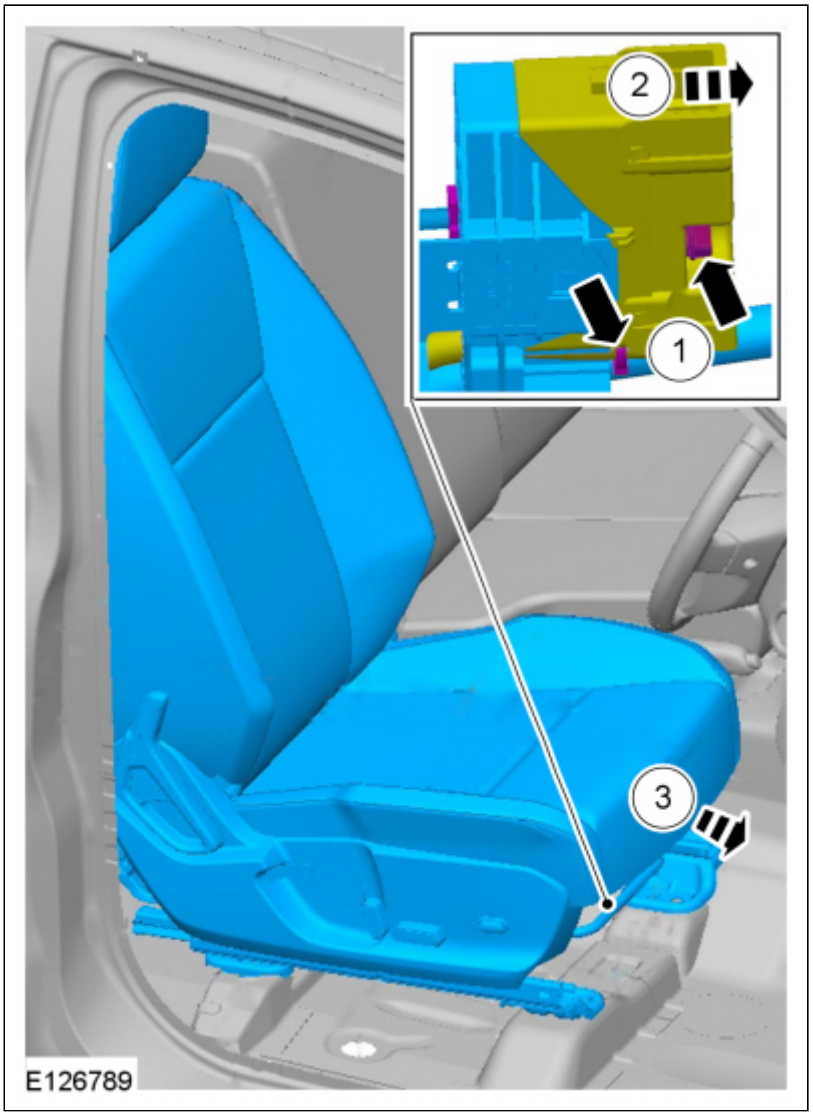
3. *Torque*: 48 Nm



4. *Torque*: 30 Nm



5. Disconnect the heated seat and side air bag module electrical connectors (if equipped).



Installation

1. To install, reverse the removal procedure.

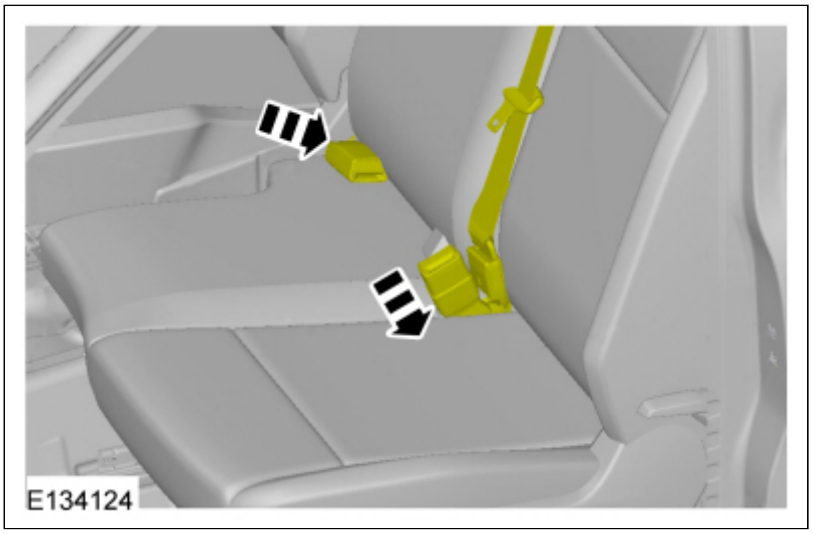
Copyright © 2016 Ford Motor Company

Front Bench Seat

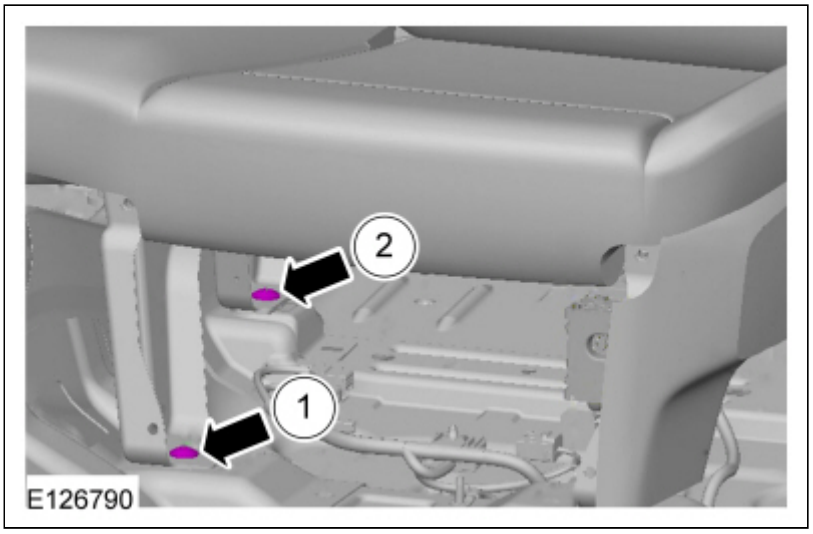
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

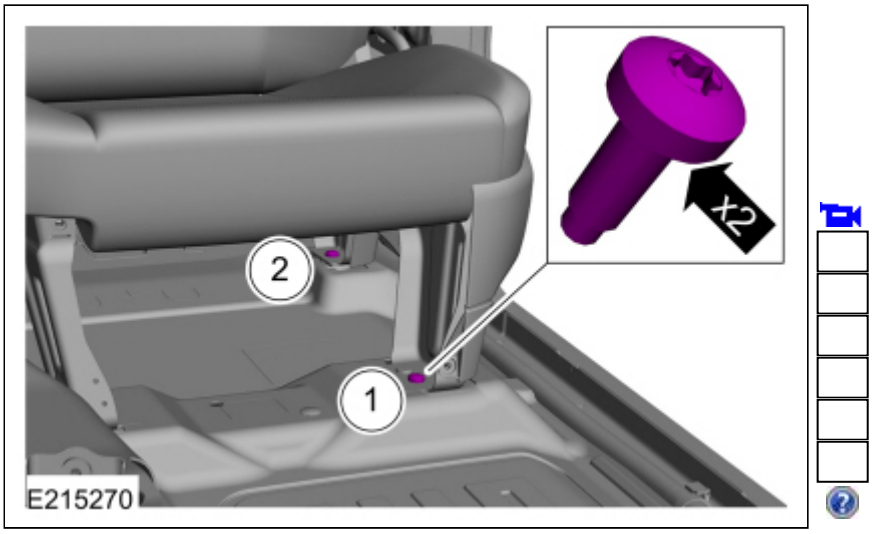
1.



1. *Torque*: 48 Nm
2. *Torque*: 30 Nm



1. *Torque*: 48 Nm
2. *Torque*: 30 Nm



4.



Installation

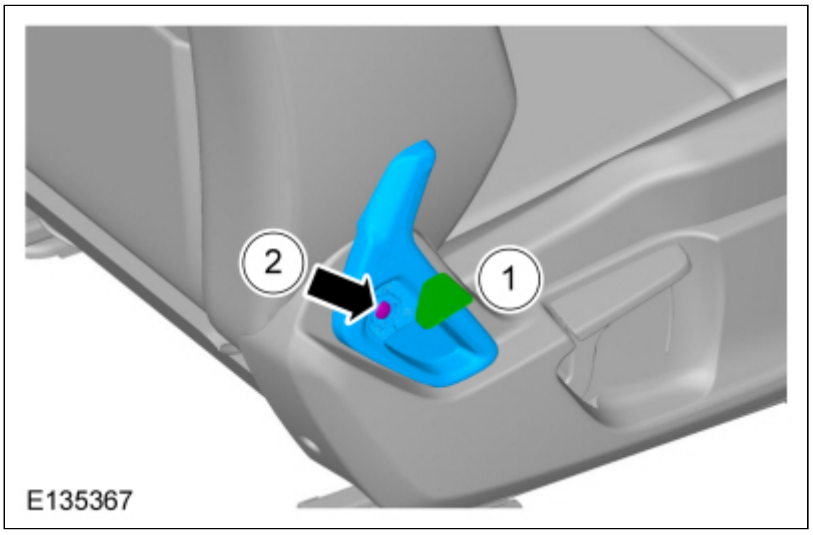
1. To install, reverse the removal procedure.

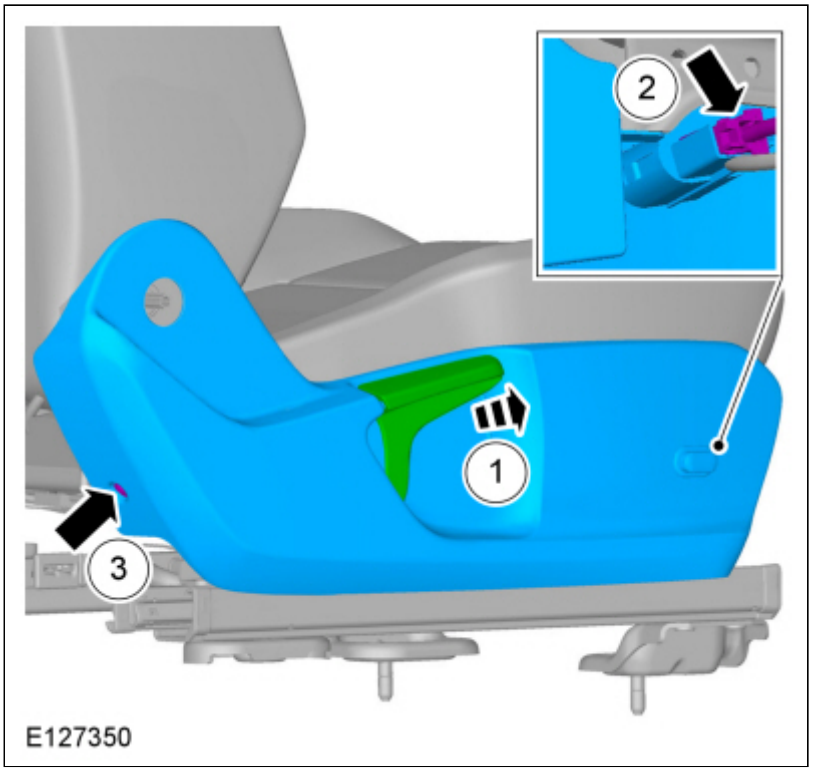
Copyright © 2016 Ford Motor Company

Front Seat Backrest

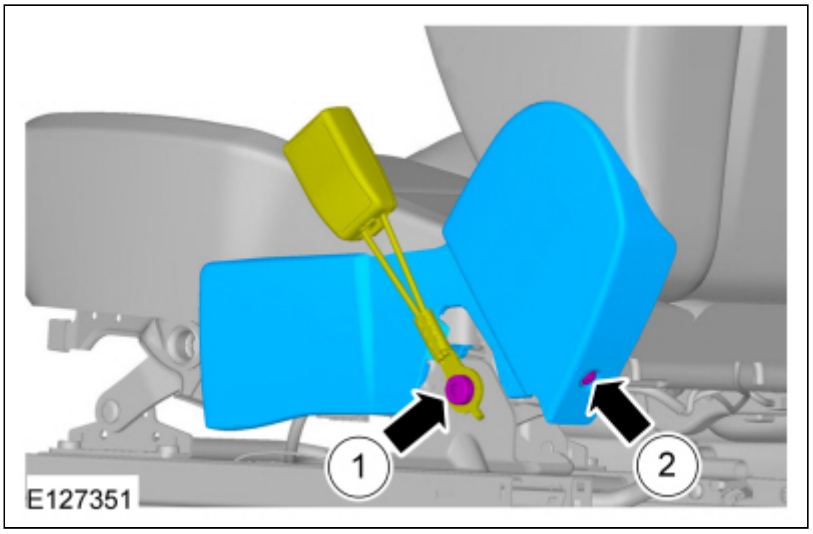
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

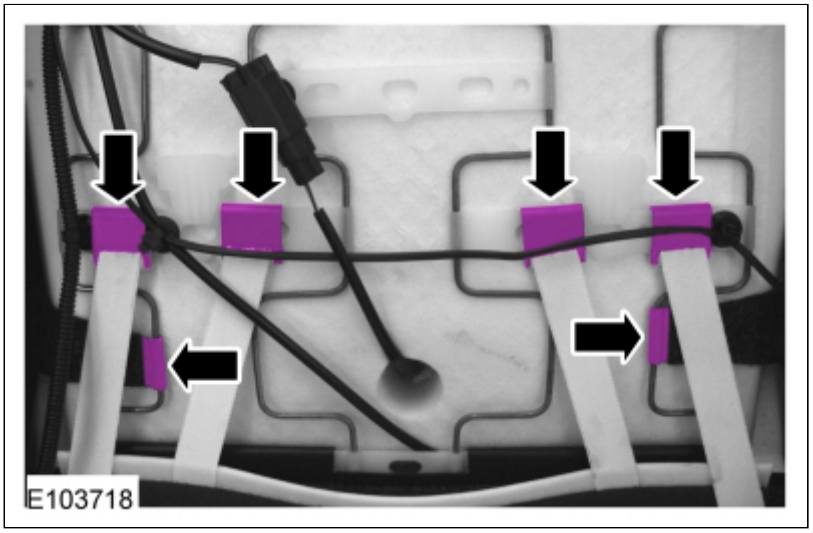
1. Refer to: Front Seat (501-10A Seating, Removal and Installation).
2. 

3. 

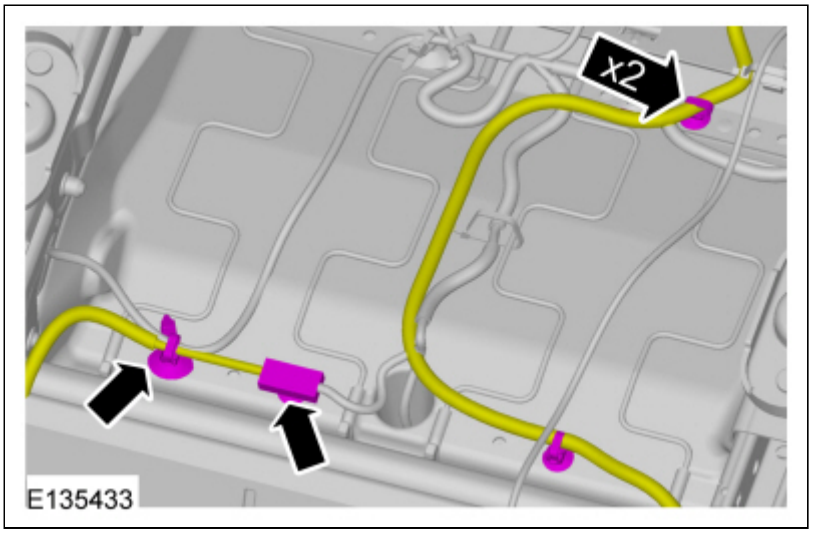
4. *Torque*: 38 Nm



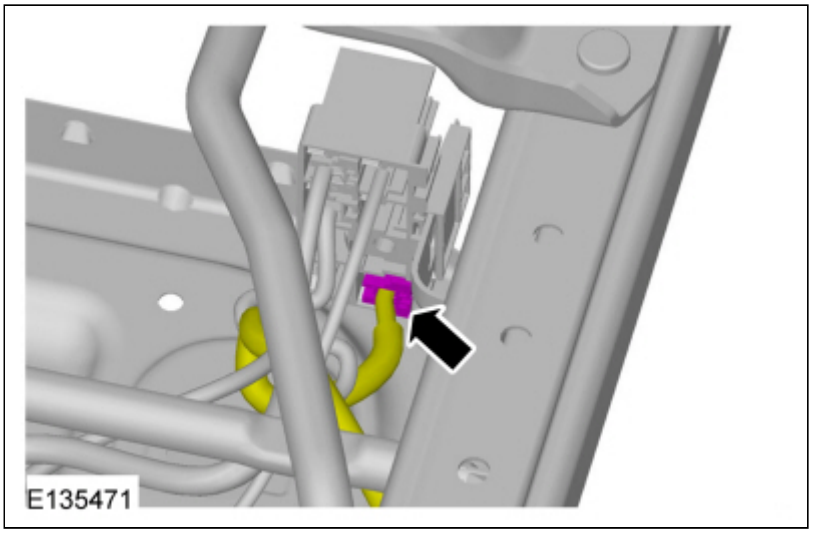
5.



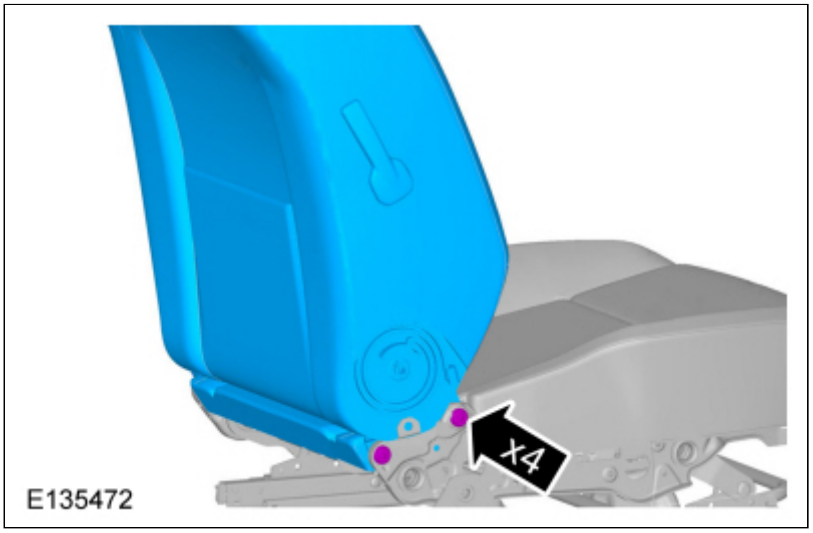
6.



7.



8. *Torque*: 45 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Seat

Base Part Number: 60026

Removal

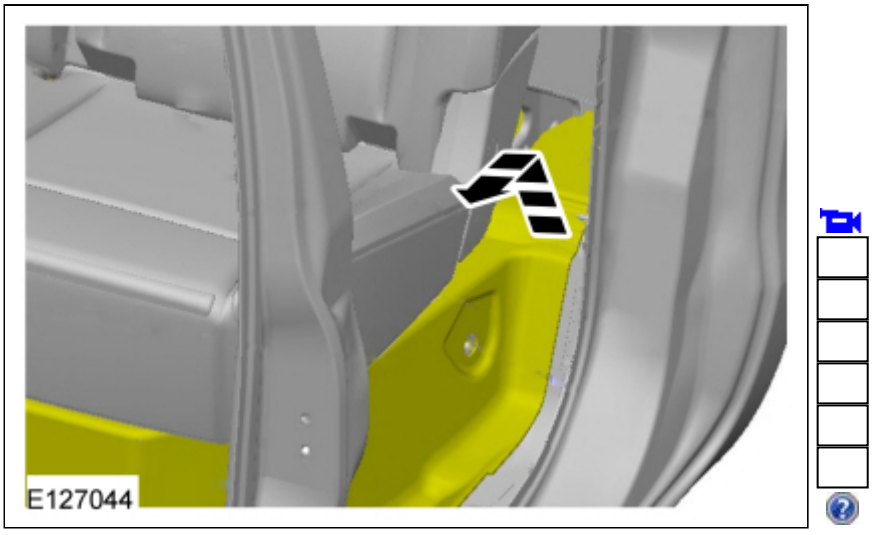
NOTE: *Removal steps in this procedure may contain installation details.*

Double cab

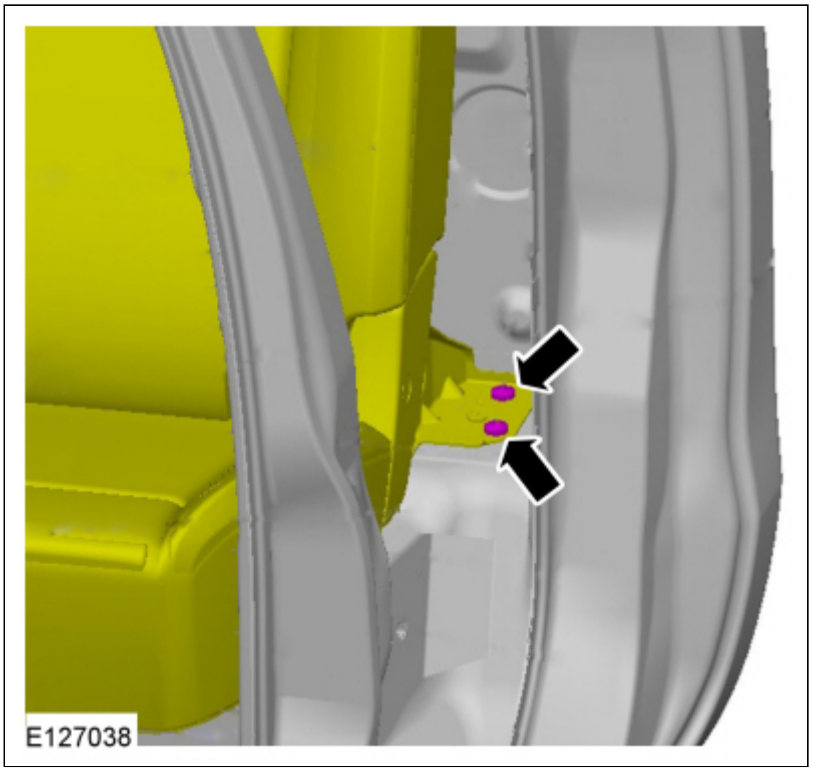
WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

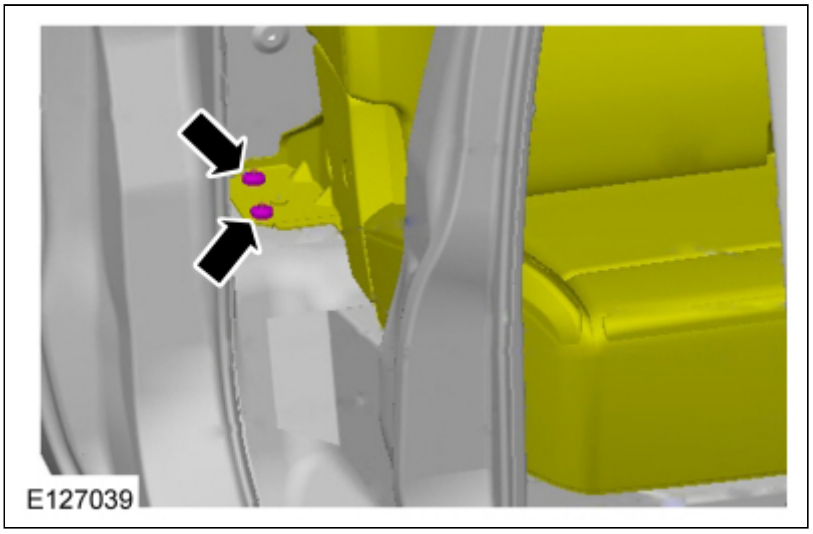
1.



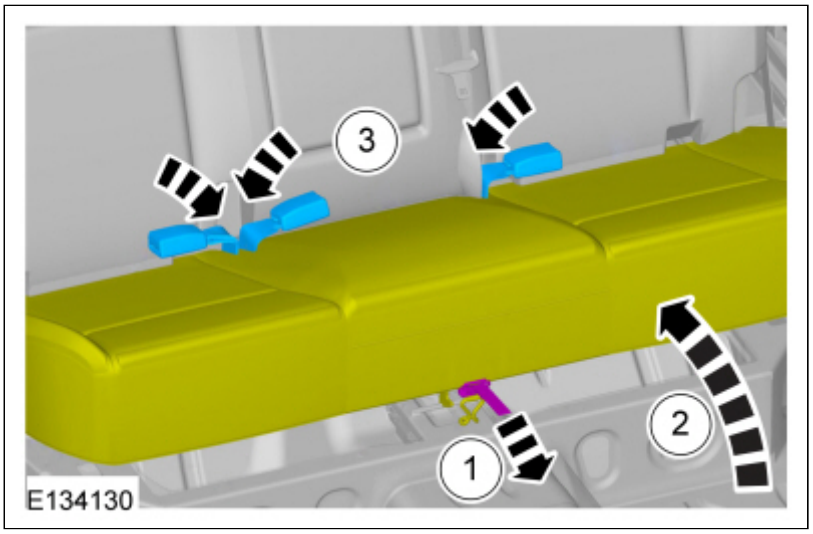
2. *Torque*: 48 Nm



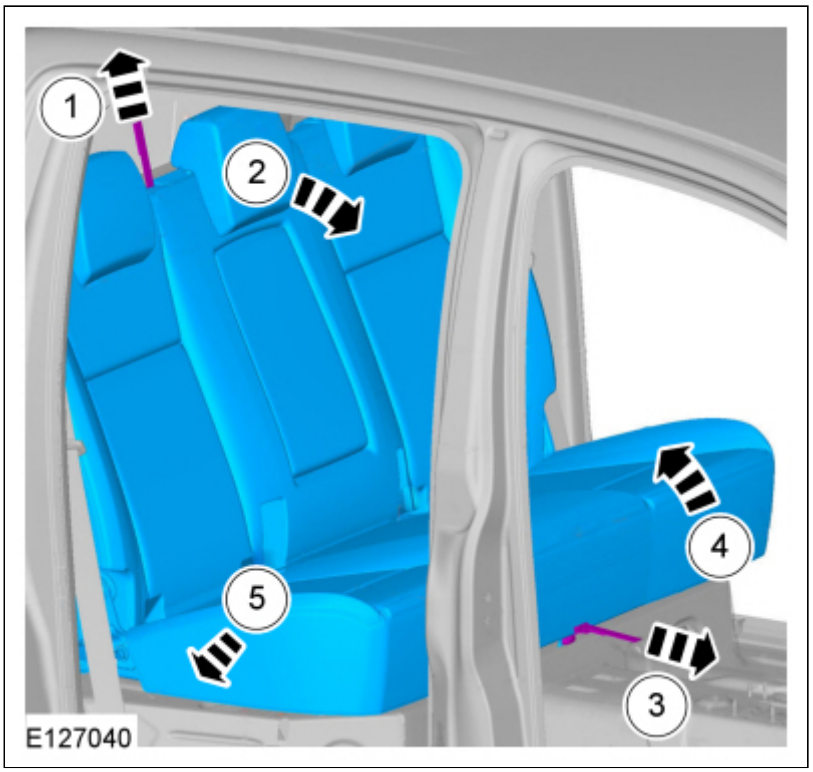
3. *Torque*: 48 Nm



4.

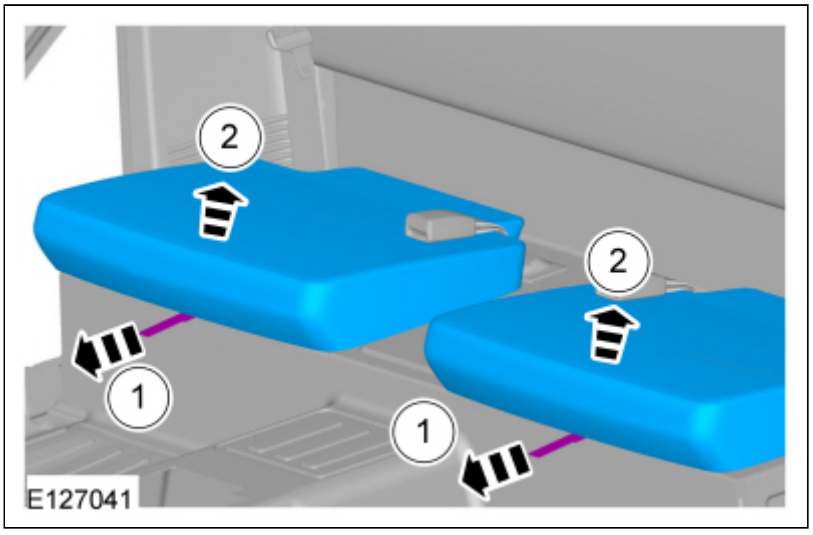


5.

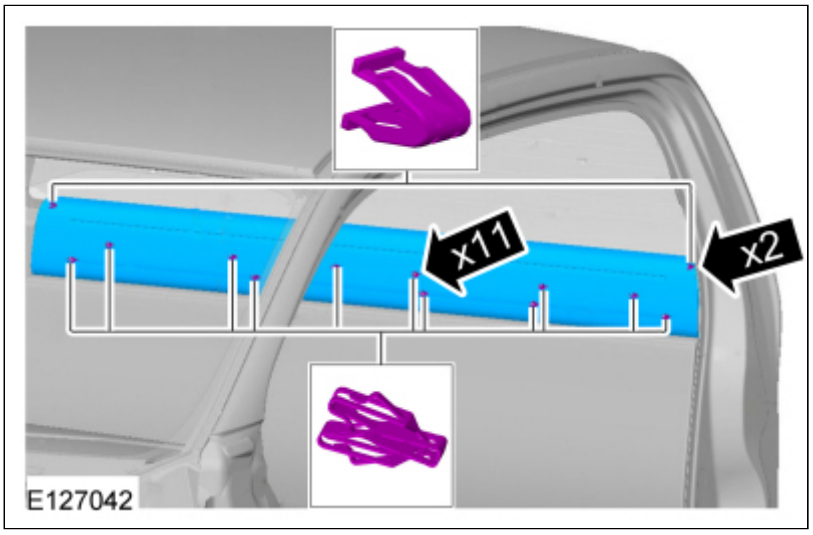


Stretch cab

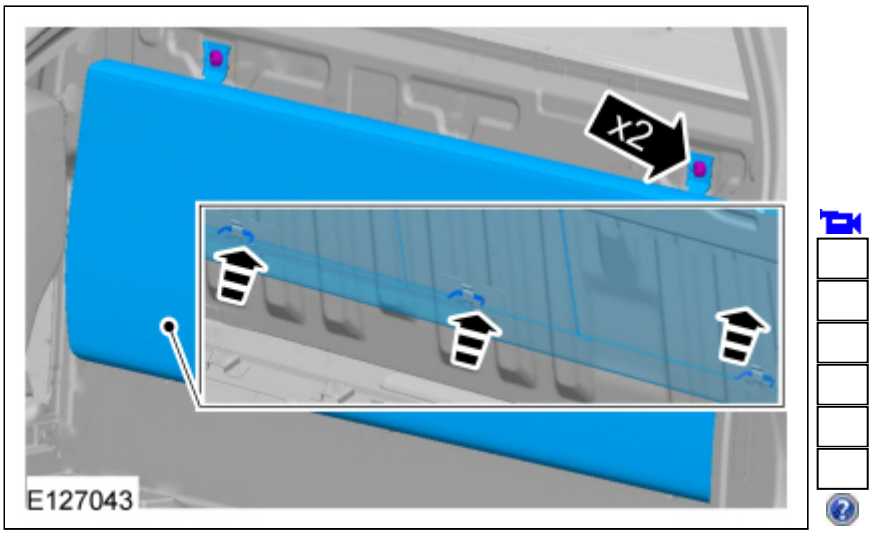
6.



7.



8. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

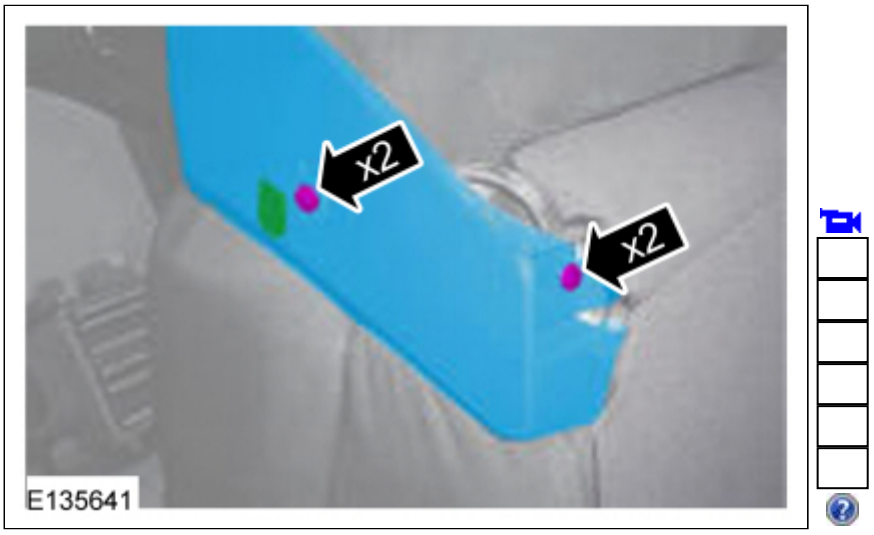
Copyright © 2016 Ford Motor Company

Rear Seat Backrest

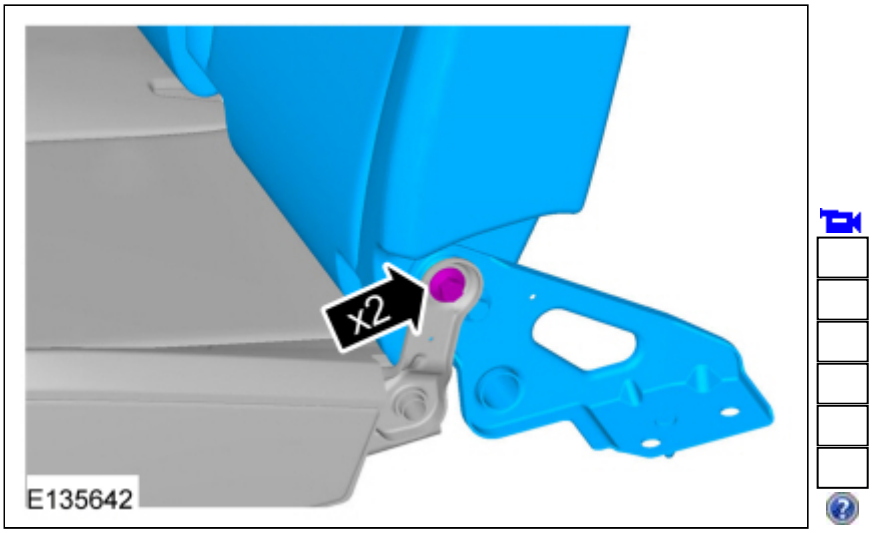
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Rear Seat (501-10A Seating, Removal and Installation).
2. On both sides.



3. On both sides.
   Torque: 25 Nm



Installation

1. To install, reverse the removal procedure.

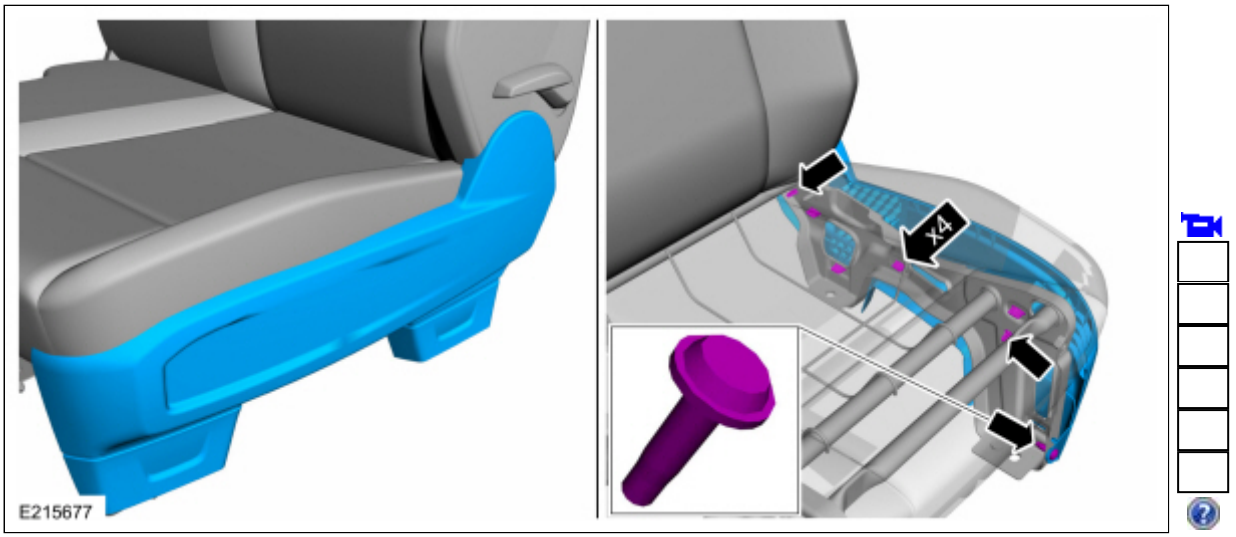
Copyright © 2016 Ford Motor Company

Front Bench Seat Backrest

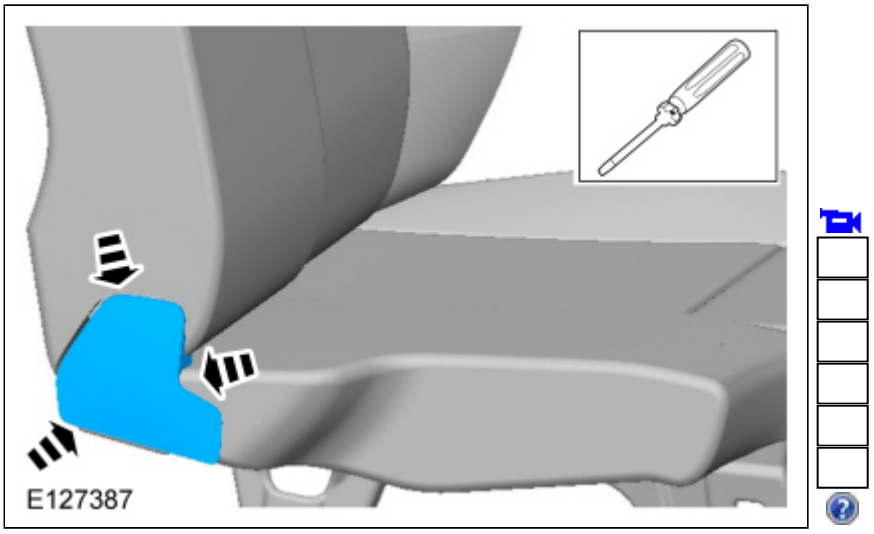
DISASSEMBLY

NOTE: *Disassembly steps in this procedure may contain assembly details.*

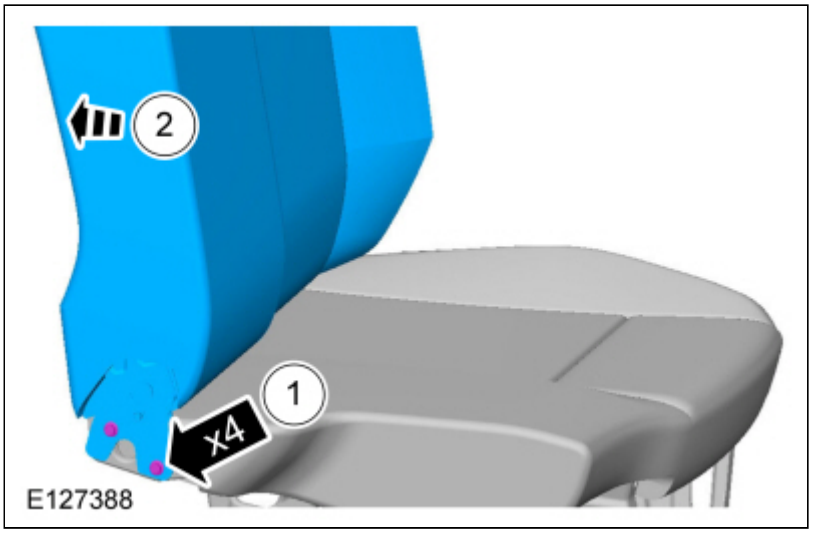
1. *Torque*: 3 Nm



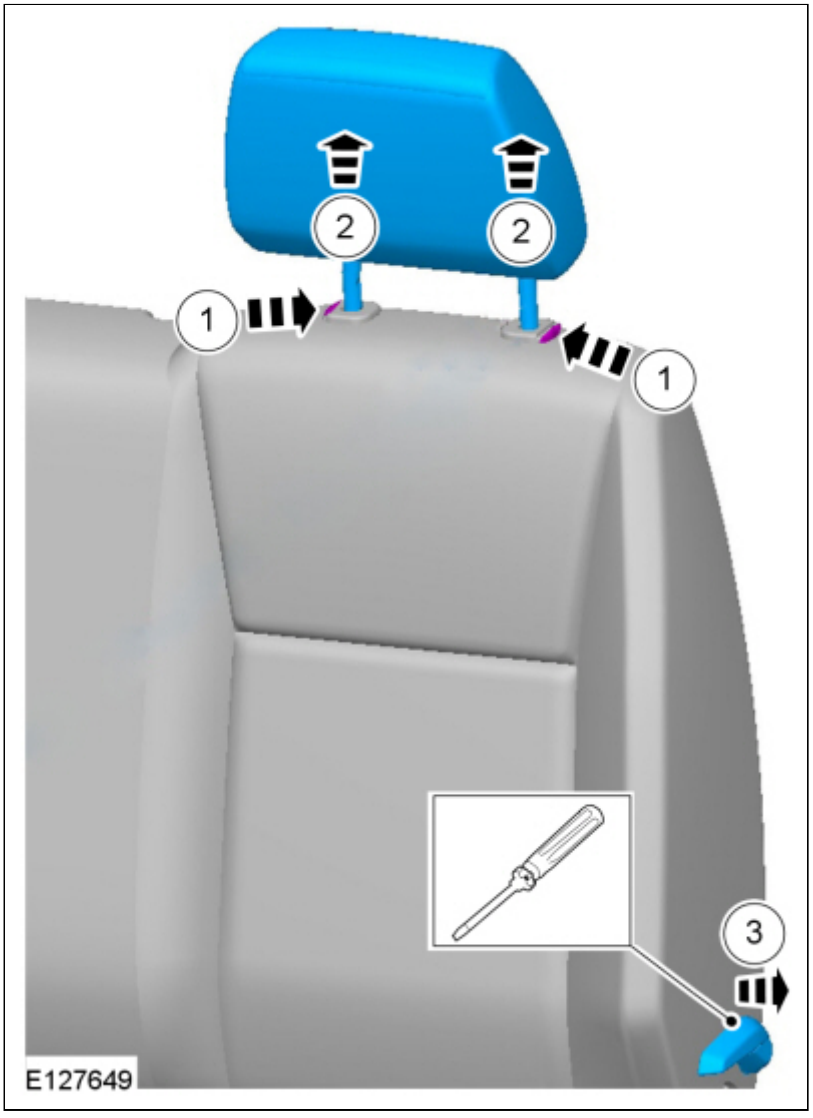
2.



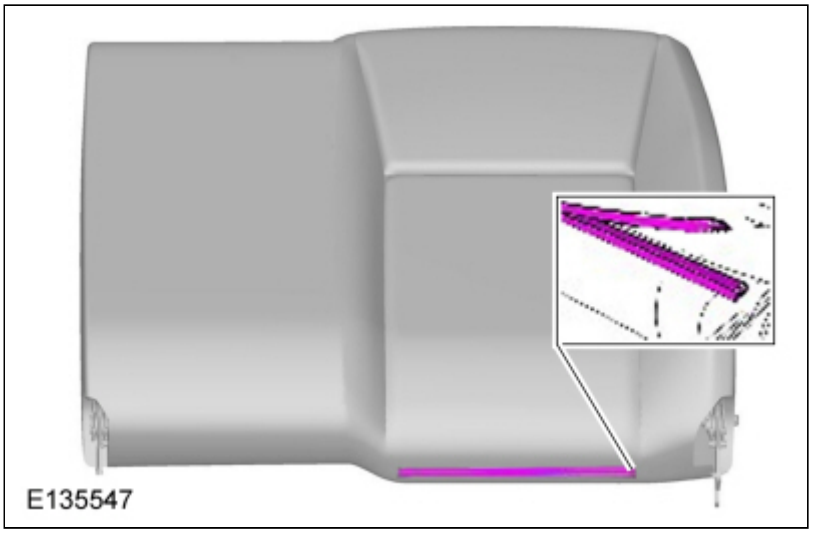
3. *Torque*: 35 Nm



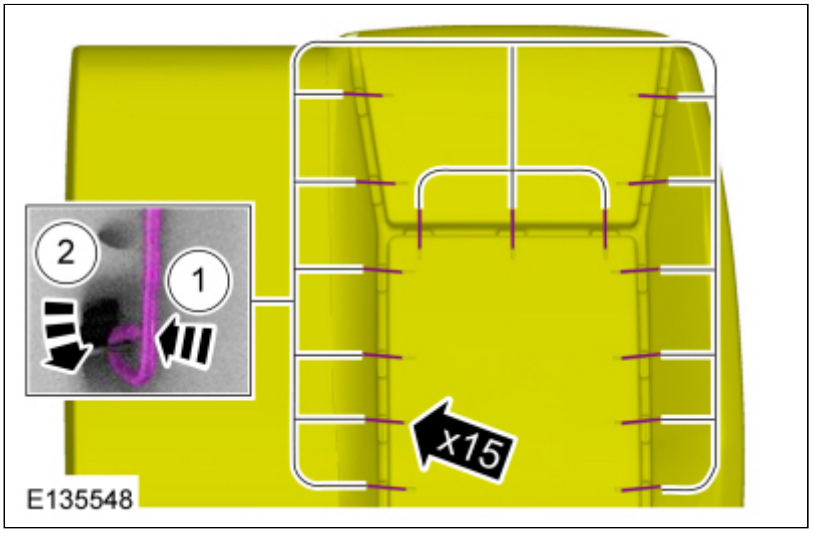
4.



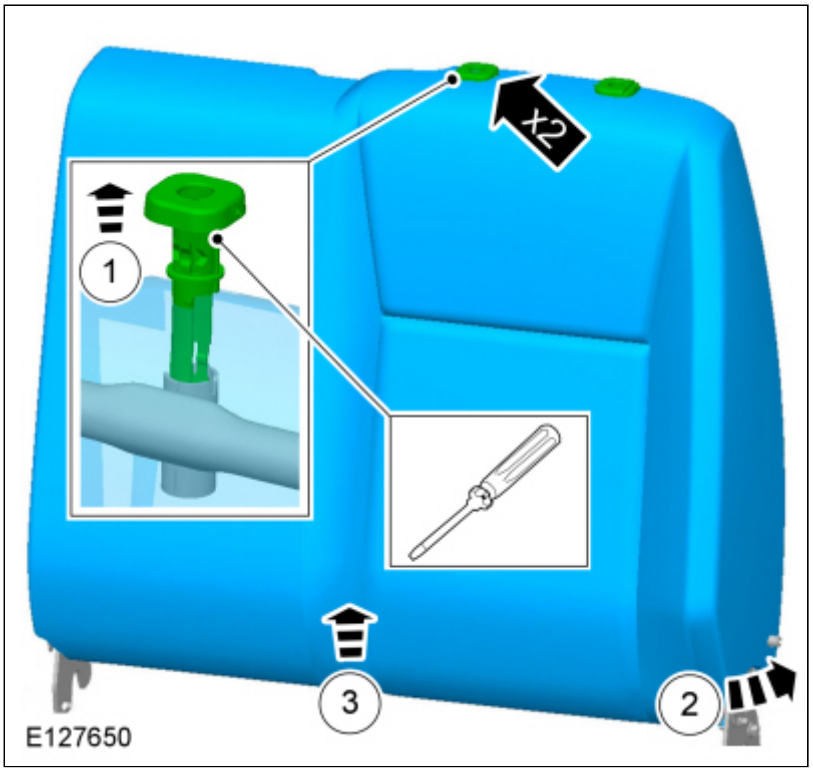
5.



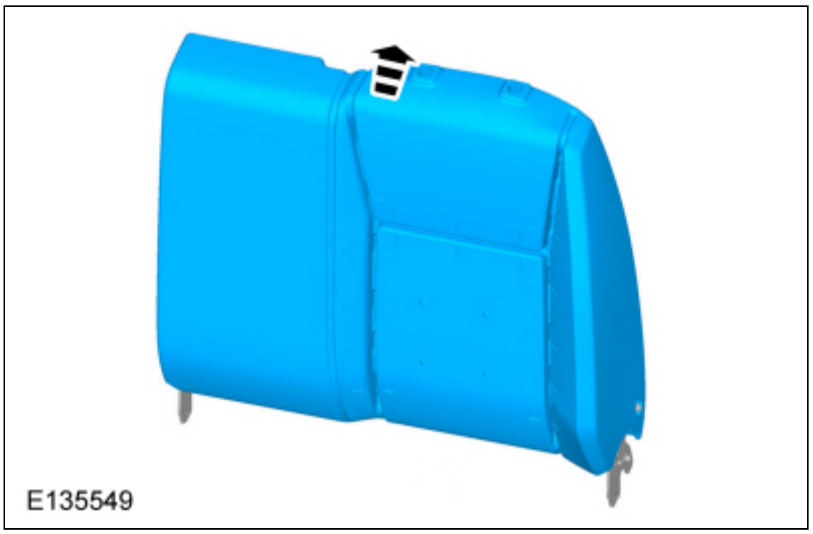
6.



7.



8.



9.



ASSEMBLY

1. To assemble, reverse the disassembly procedure.

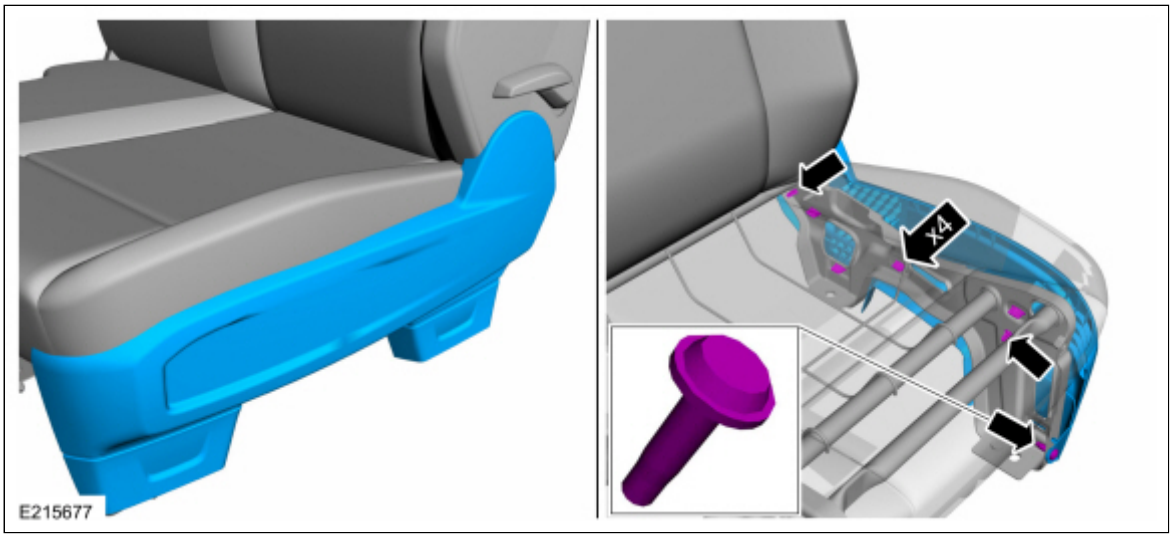
Copyright © 2016 Ford Motor Company

Front Bench Seat Cushion

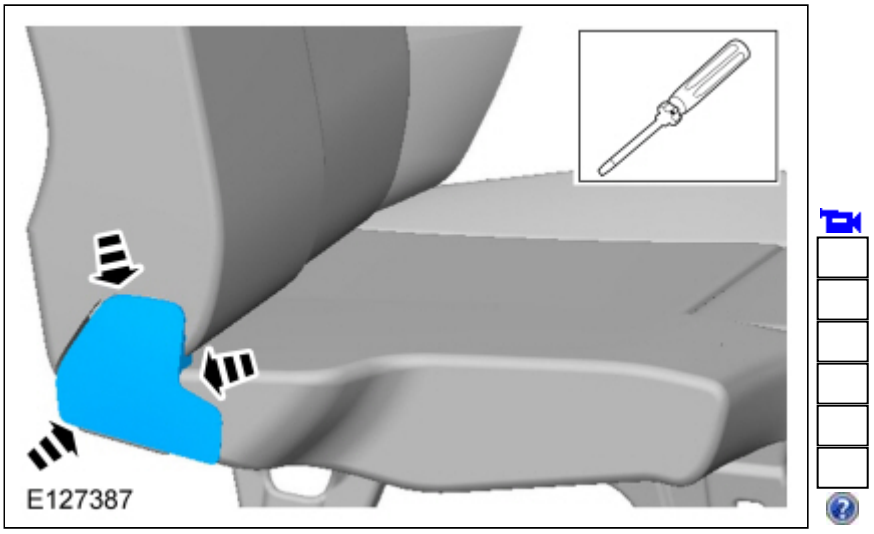
DISASSEMBLY

NOTE: *Disassembly steps in this procedure may contain assembly details.*

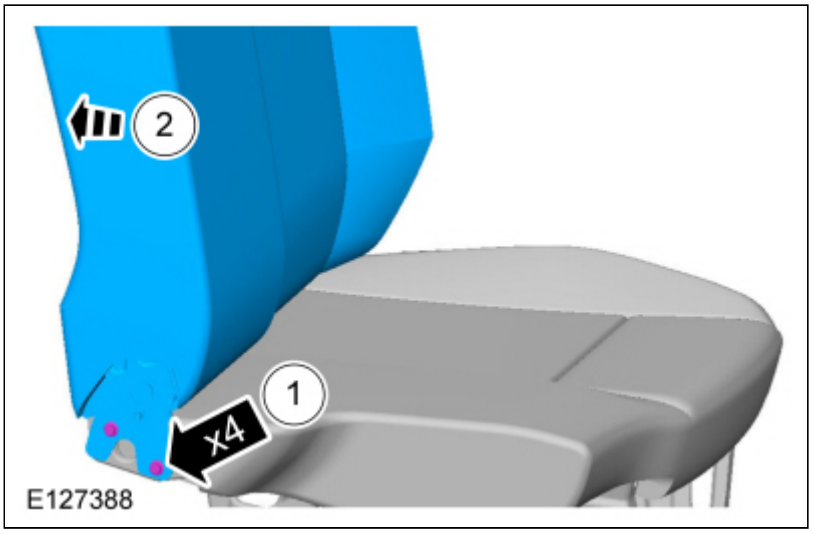
1.



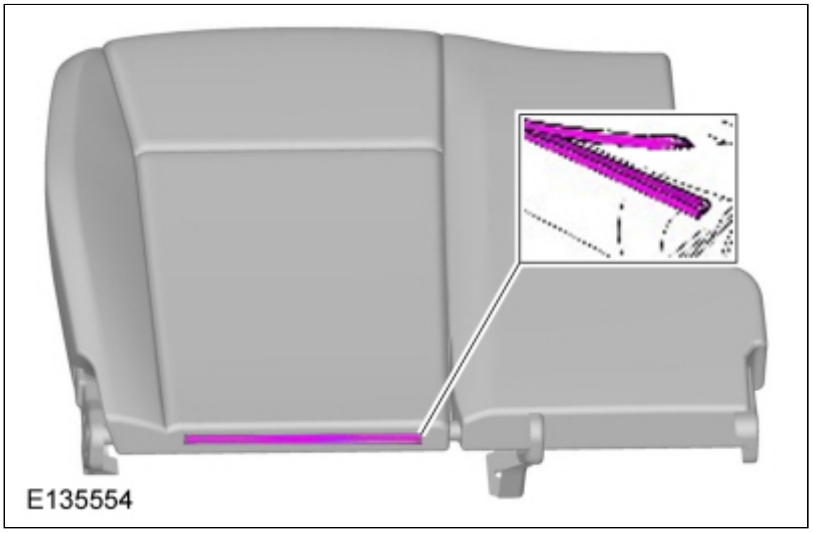
2.



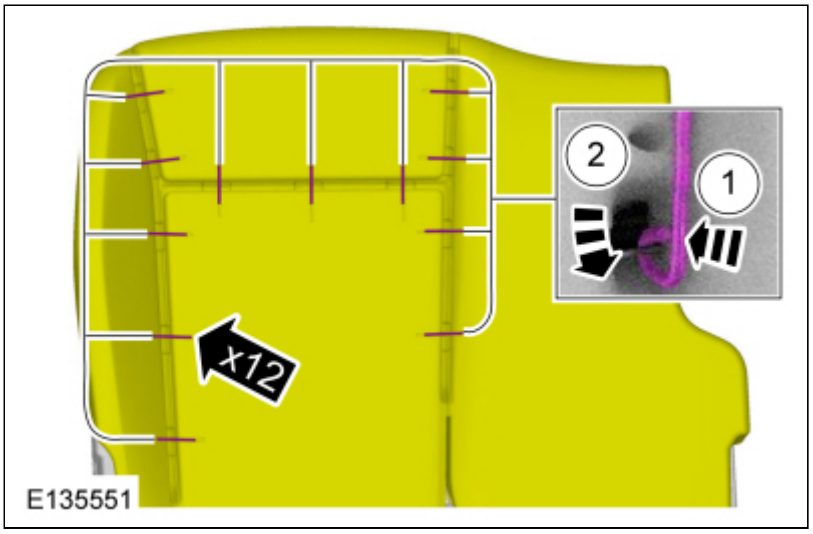
3. *Torque*: 35 Nm



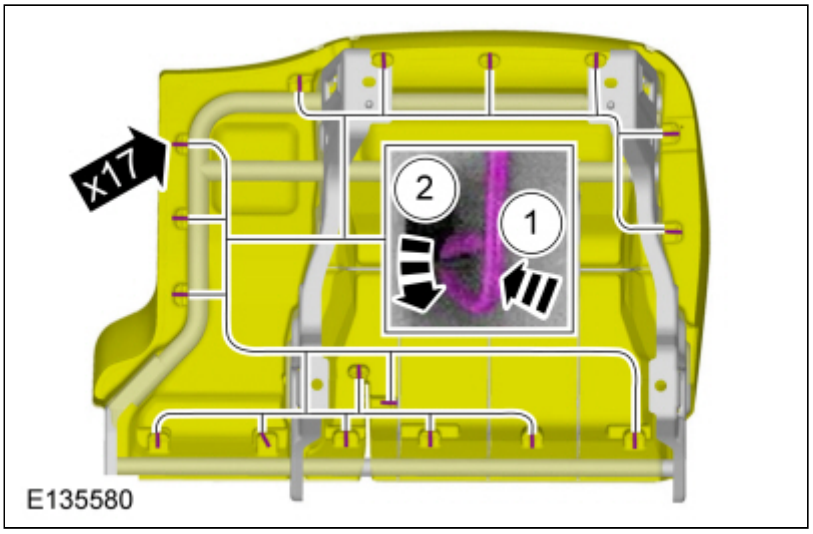
4.



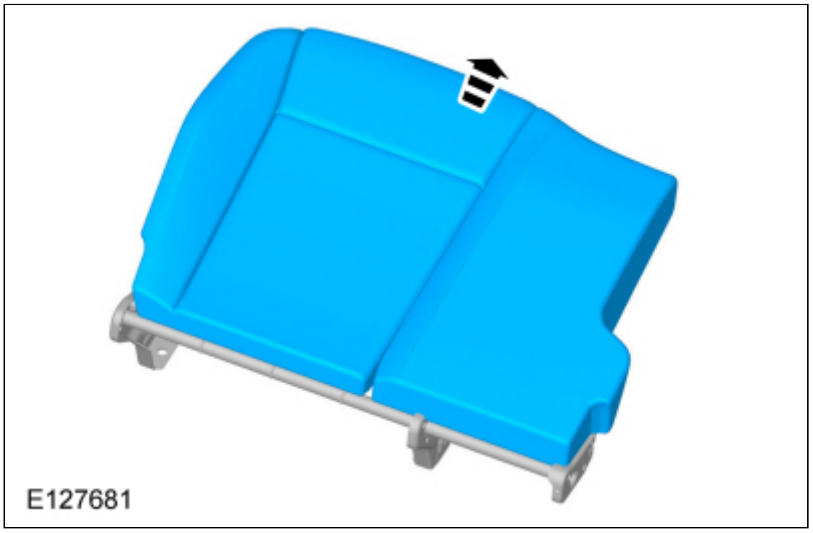
5.



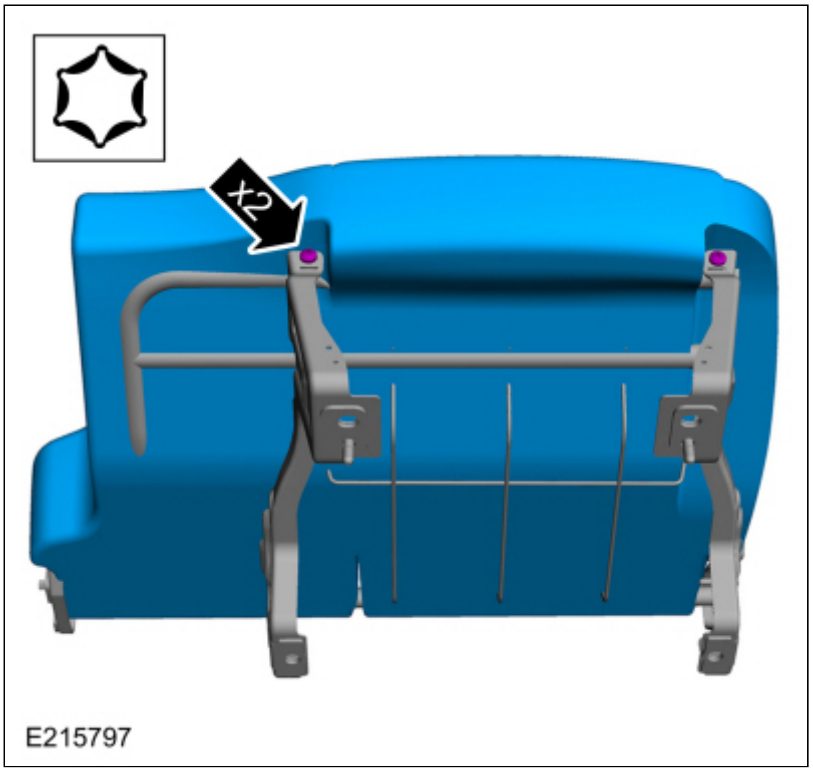
6.



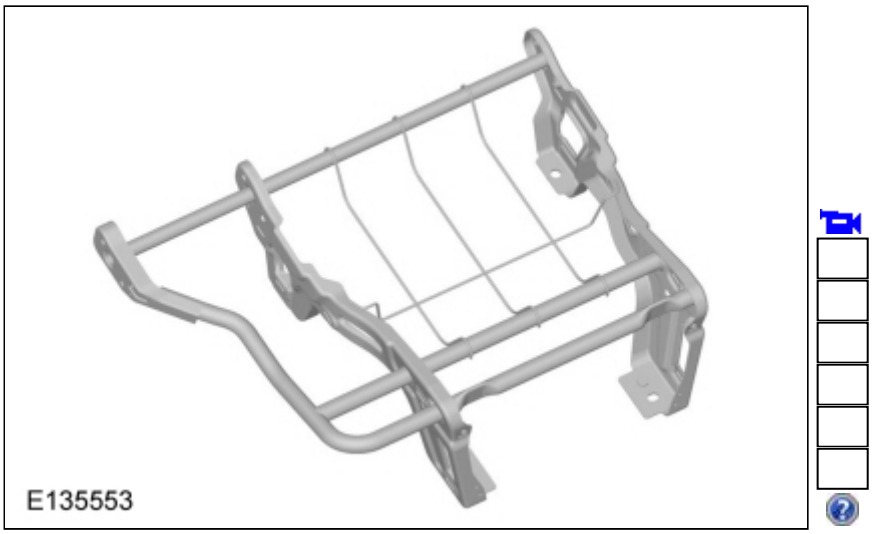
7.



8.



9.



ASSEMBLY

1. To assemble, reverse the disassembly procedure.

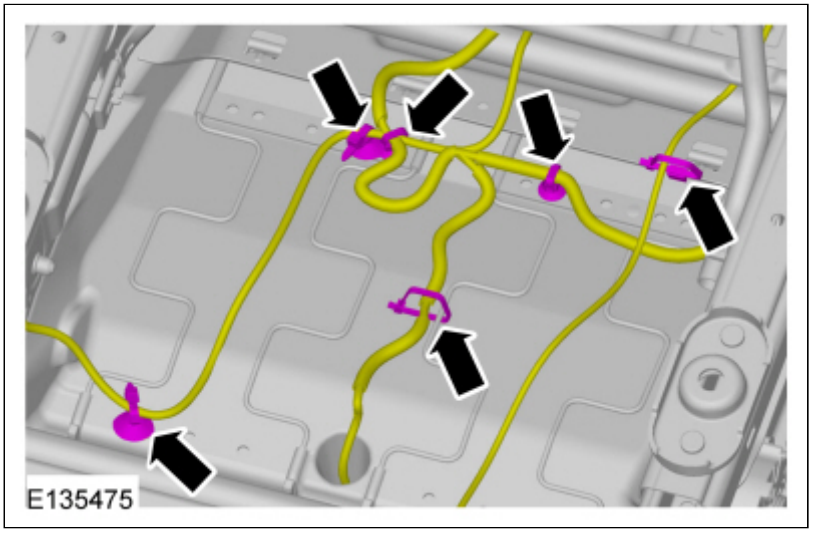
Copyright © 2016 Ford Motor Company

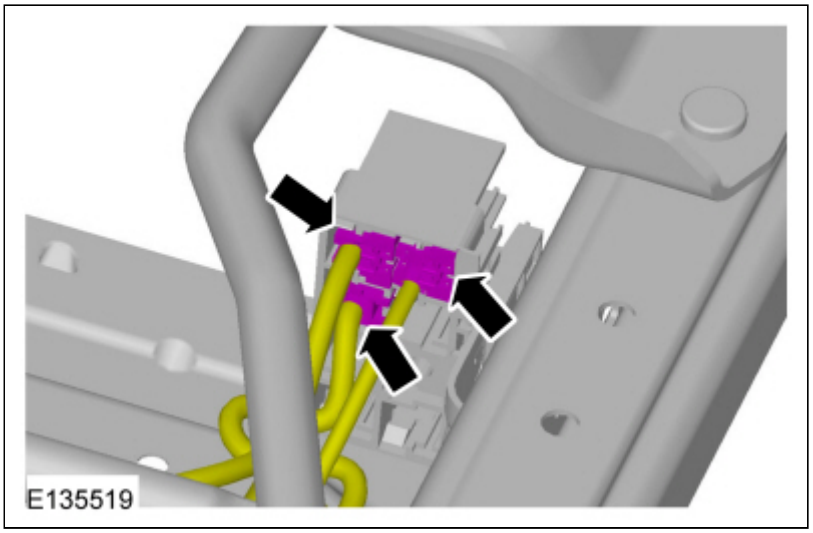
Front Seat Cushion

Base Part Number: 632A22

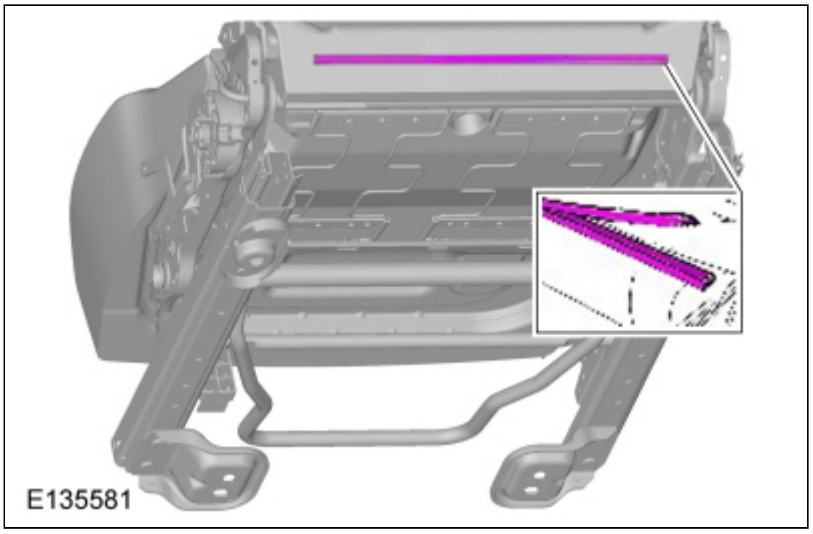
DISASSEMBLY

NOTE: *Disassembly steps in this procedure may contain assembly details.*

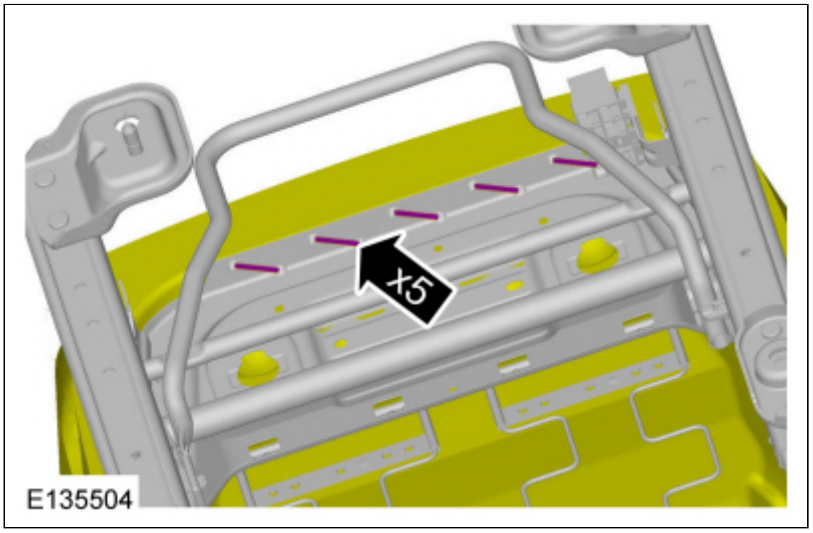
1. Refer to: Front Seat Backrest (501-10A Seating, Removal and Installation).
2. 

3. 

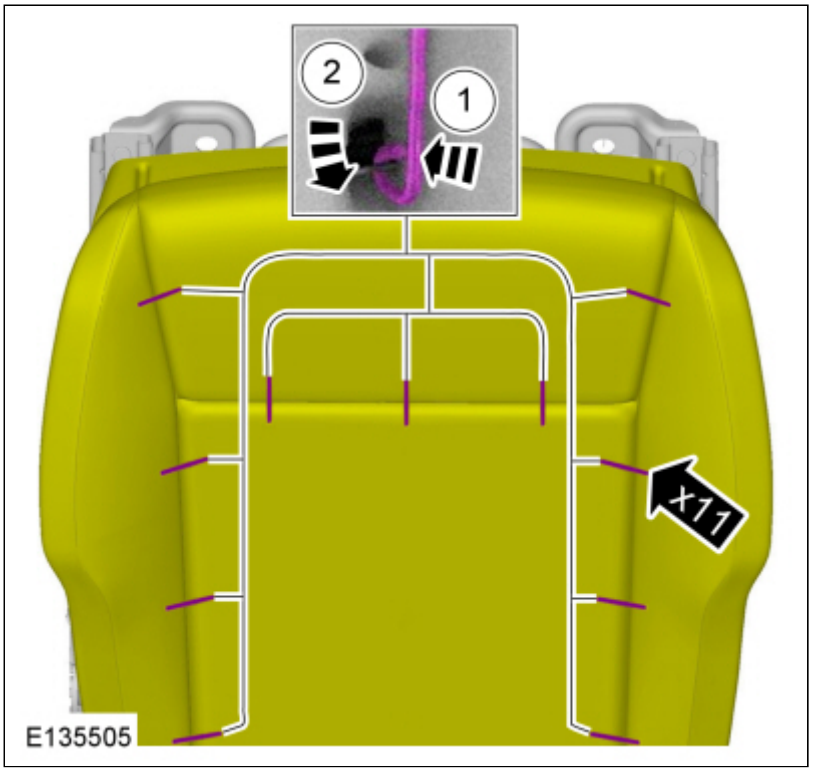
4.



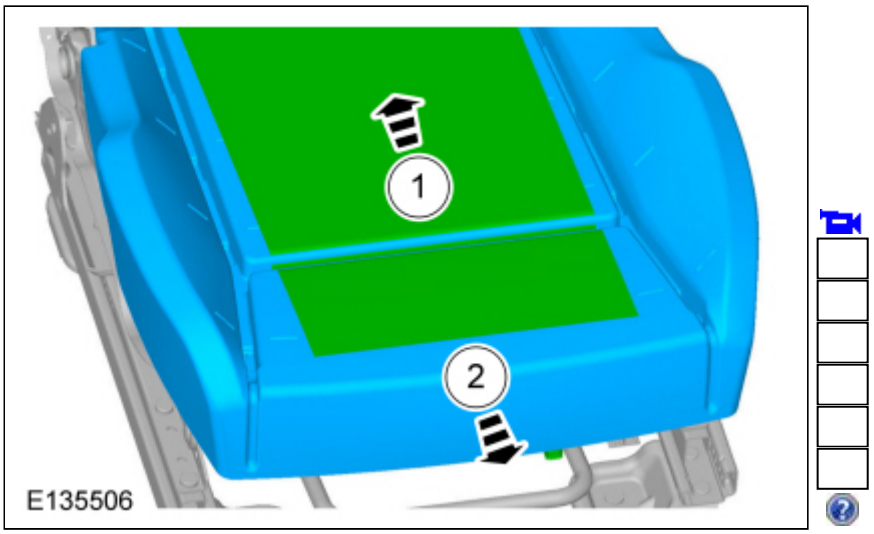
5.



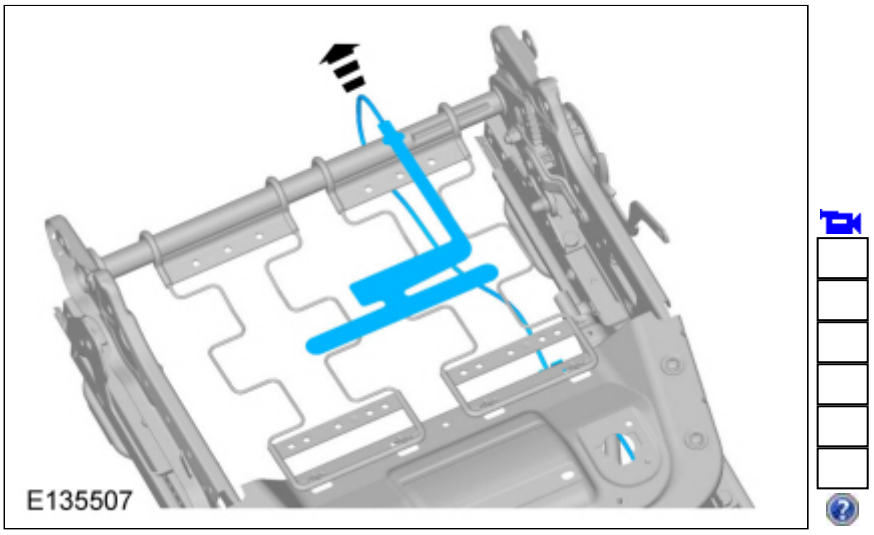
6.



7.



8.



ASSEMBLY

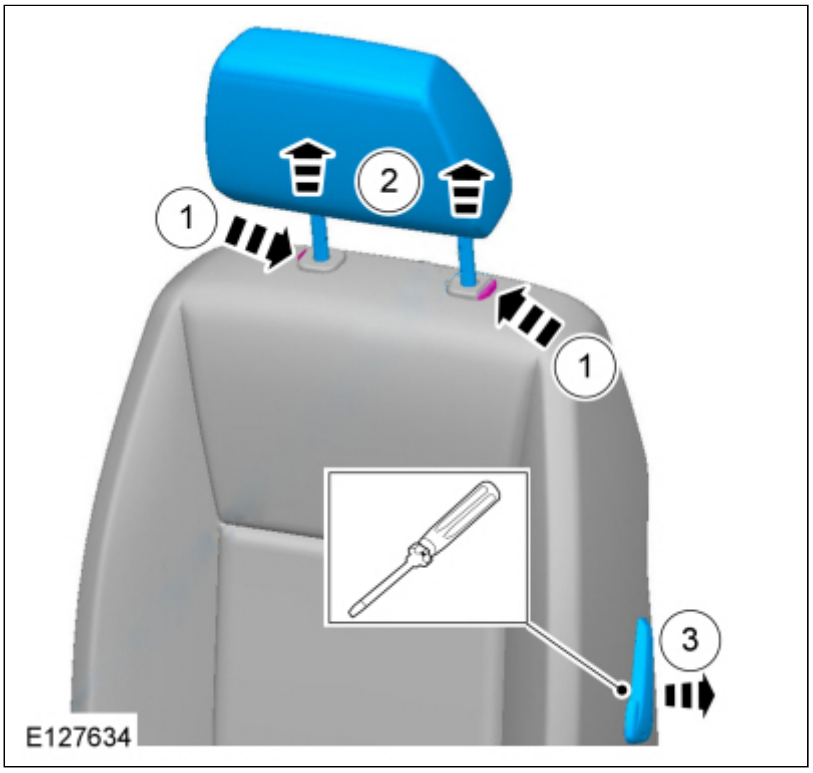
1. To assemble, reverse the disassembly procedure.

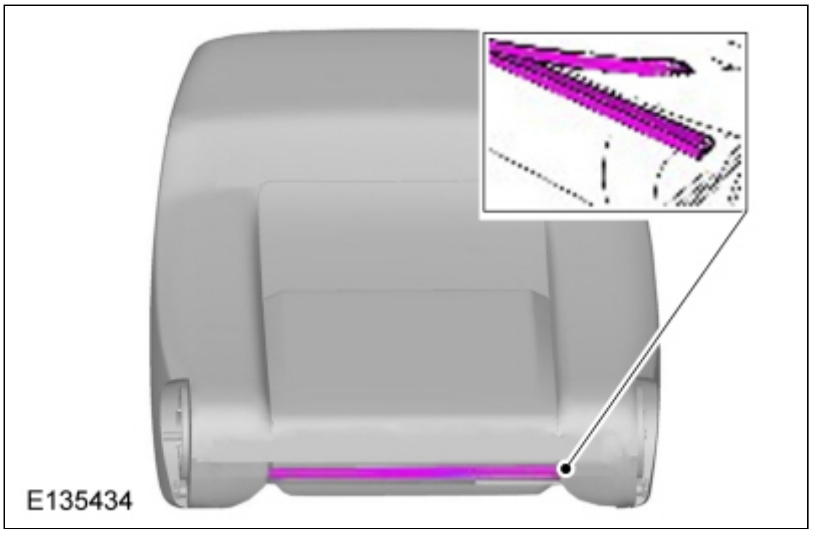
Copyright © 2016 Ford Motor Company

Front Seat Backrest

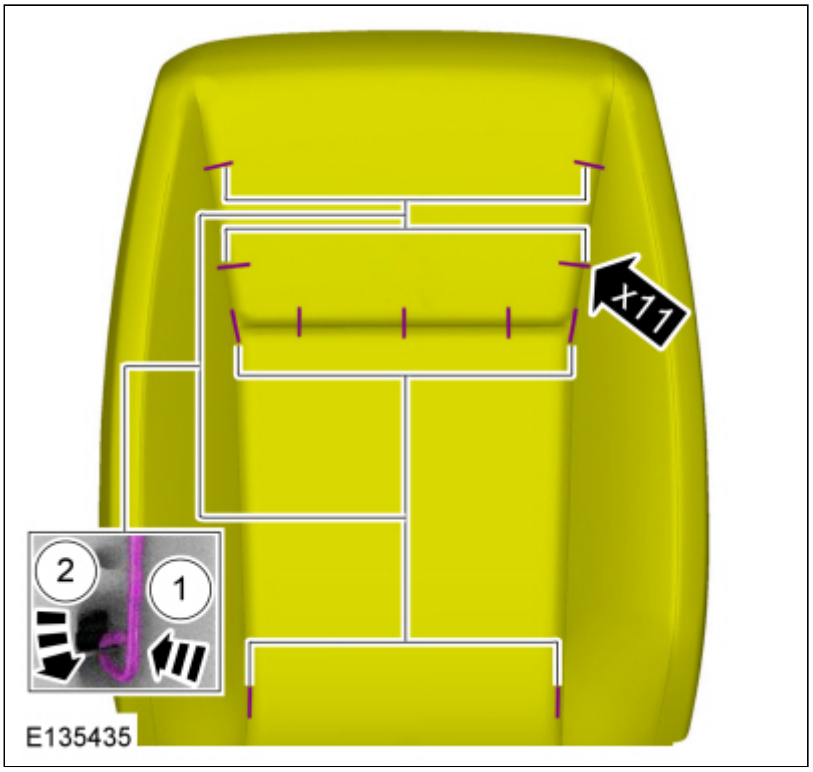
DISASSEMBLY

NOTE: *Disassembly steps in this procedure may contain assembly details.*

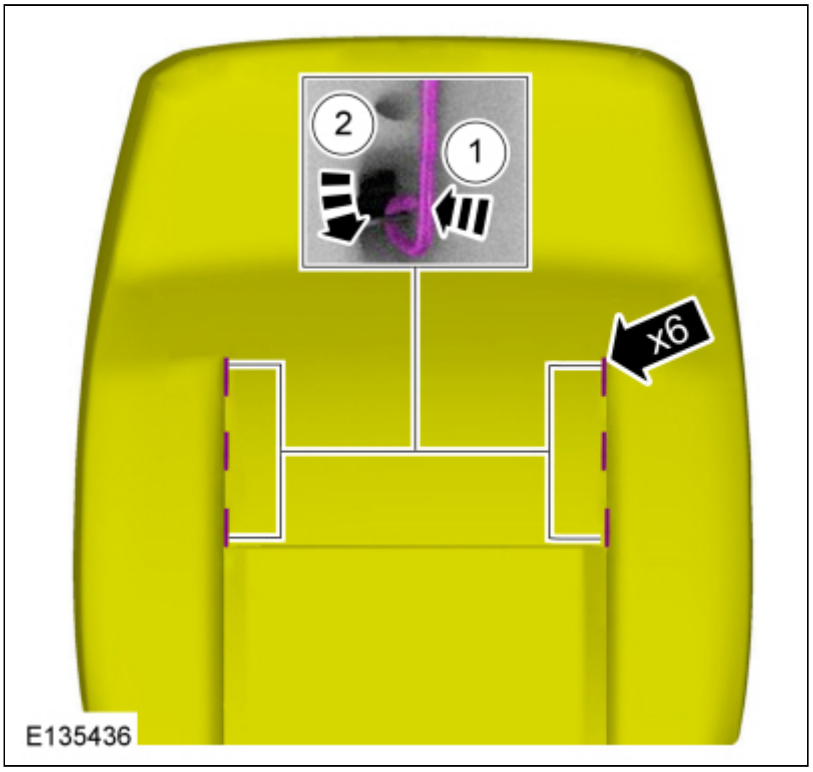
1. Refer to: Front Seat Backrest (501-10A Seating, Removal and Installation).
2. 

3. 

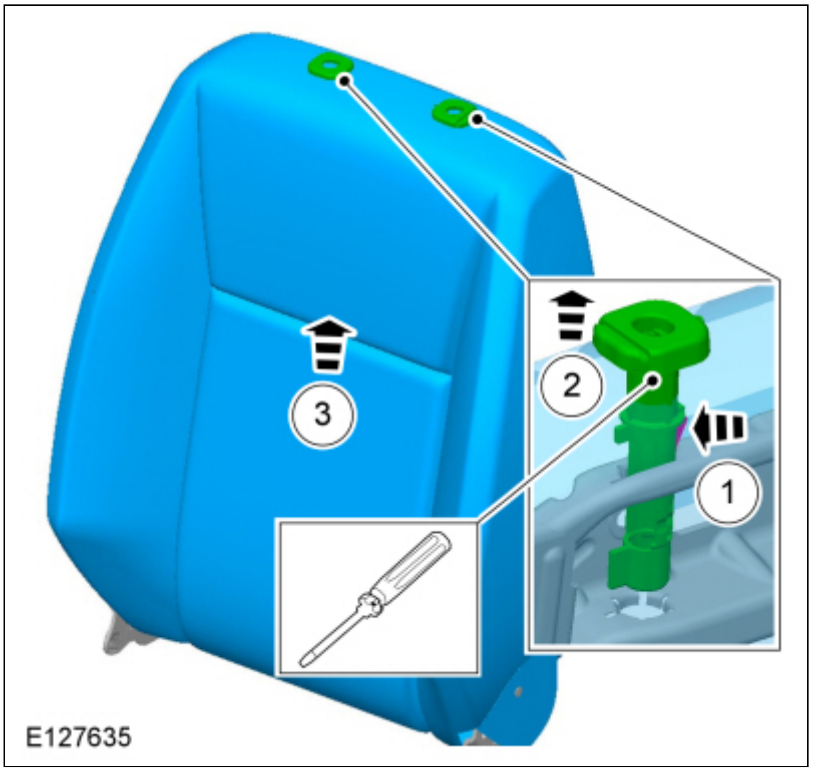
4.



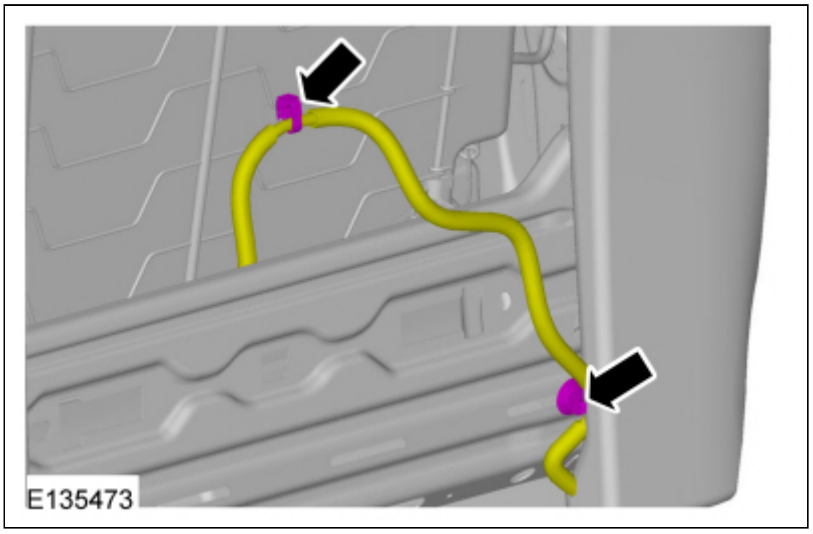
5.



6.



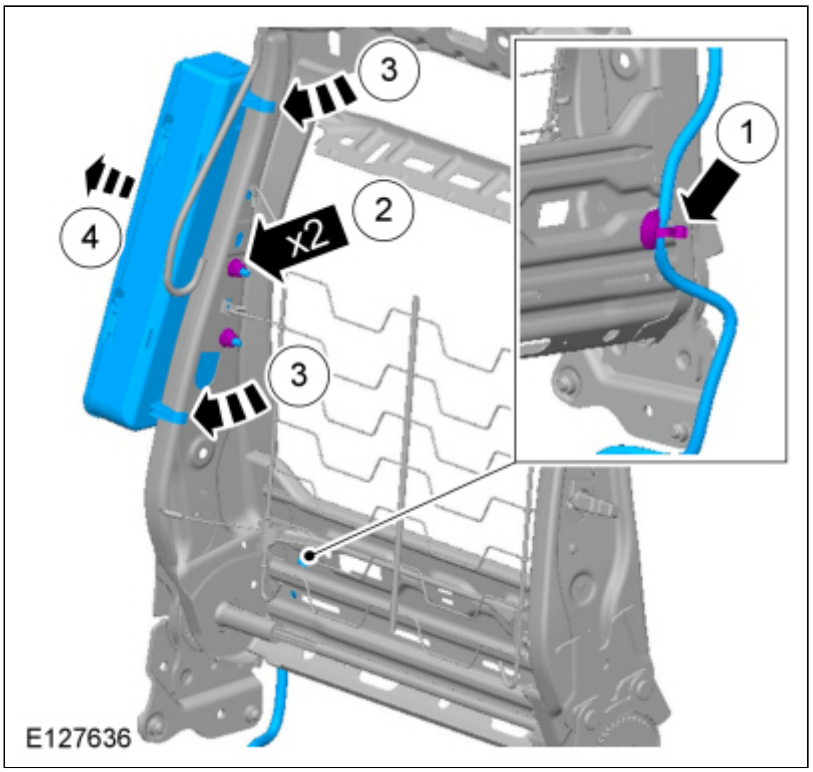
7.



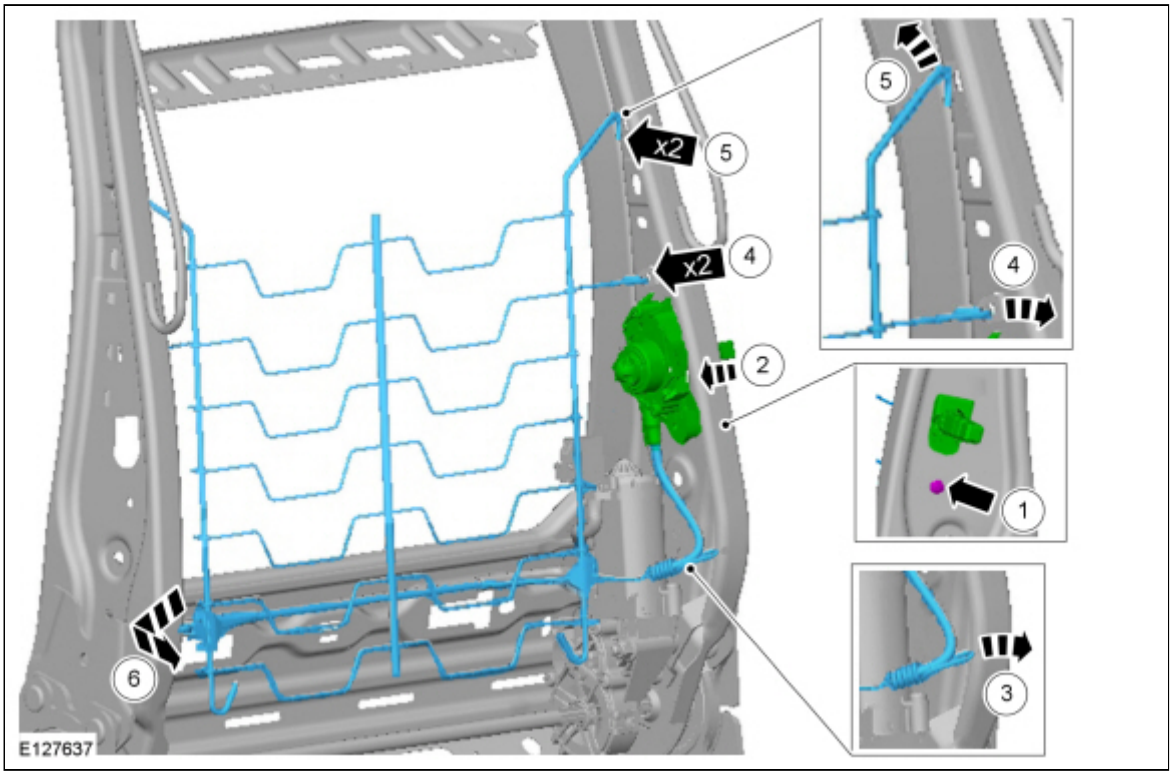
8.



9. *Torque*: 5 Nm



10. *Torque*: 3 Nm



ASSEMBLY

1. To assemble, reverse the disassembly procedure.

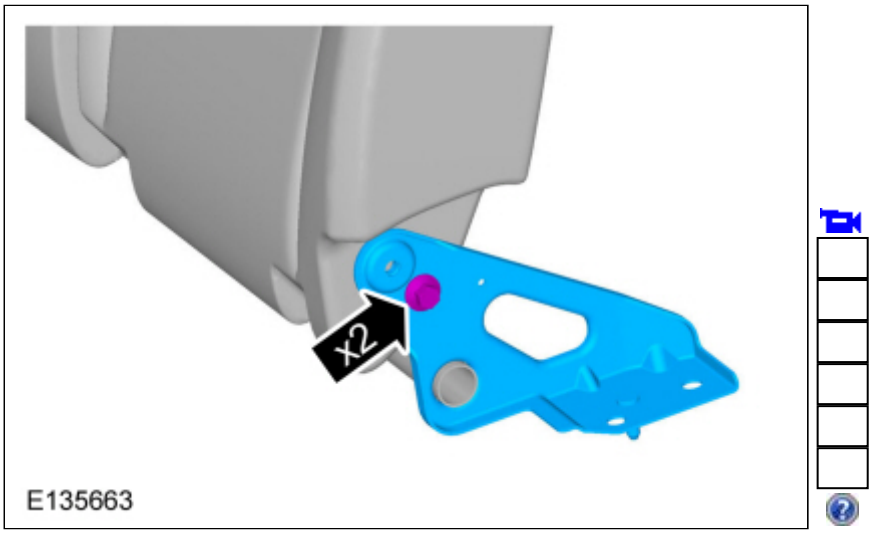
Copyright © 2016 Ford Motor Company

Rear Seat Backrest

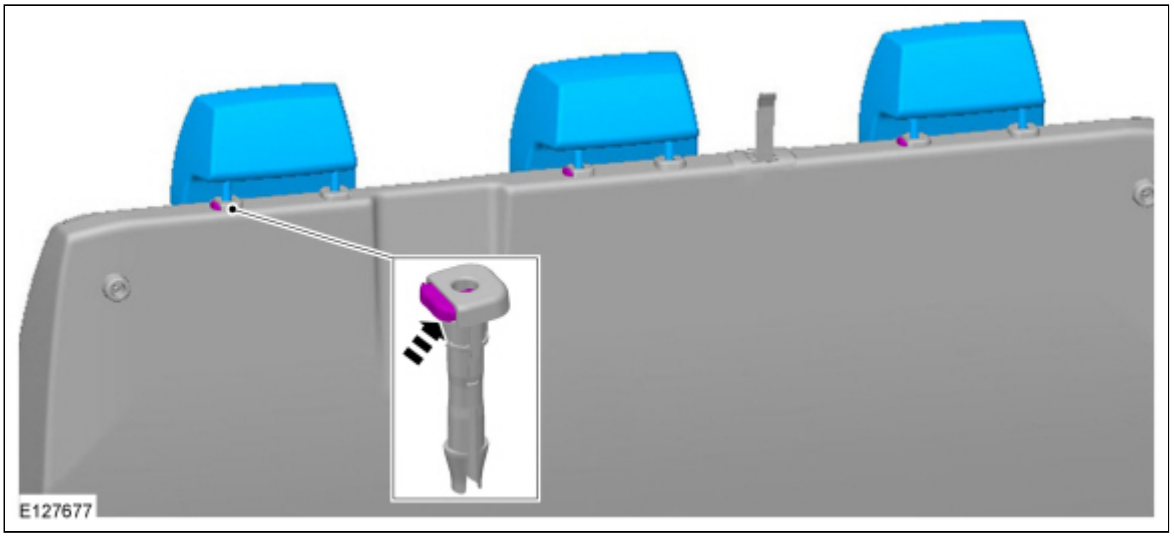
DISASSEMBLY

NOTE: *Disassembly steps in this procedure may contain assembly details.*

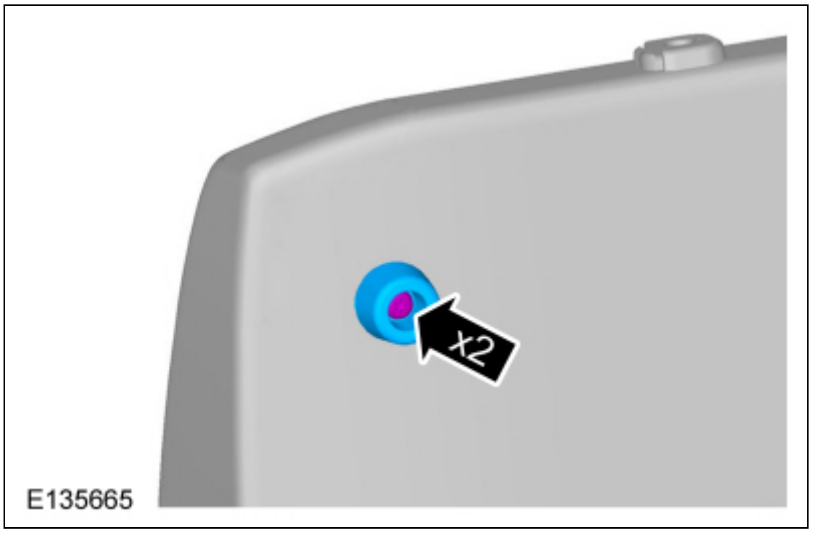
1. Refer to: Rear Seat Backrest (501-10A Seating, Removal and Installation).
2. *Torque*: 25 Nm



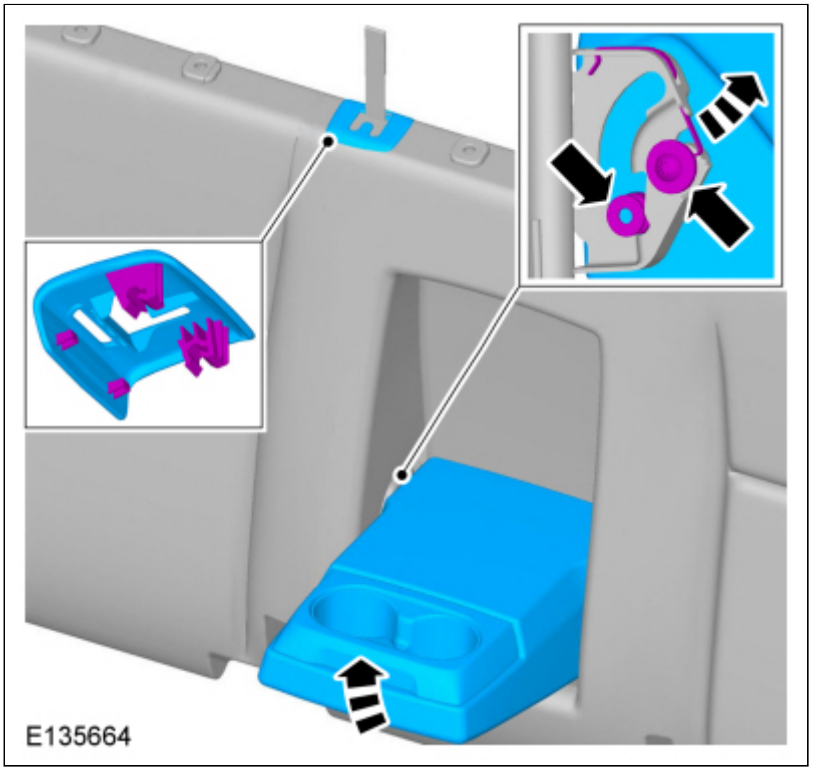
3.



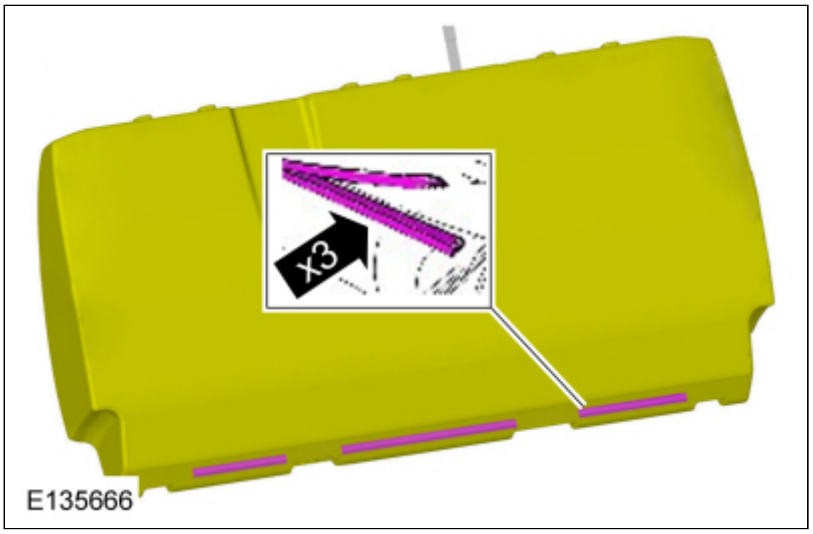
4. *Torque*: 10 Nm



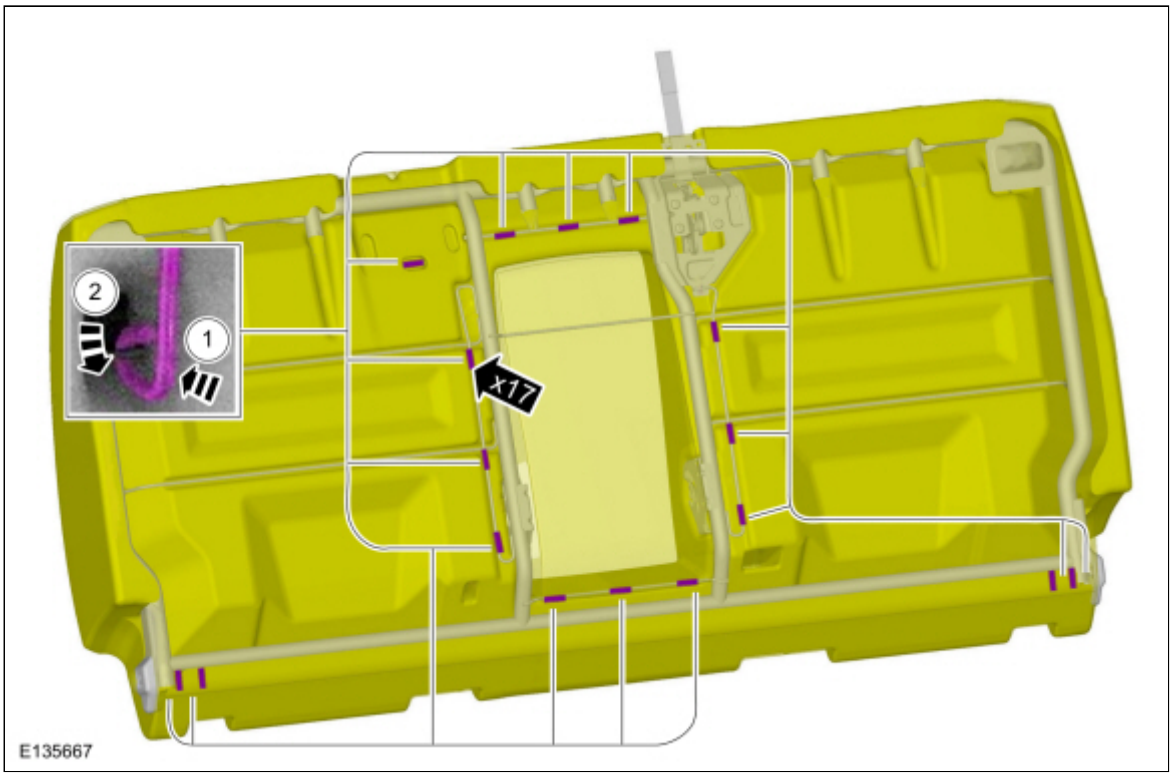
5. Release the armrest pivot pins on both sides.



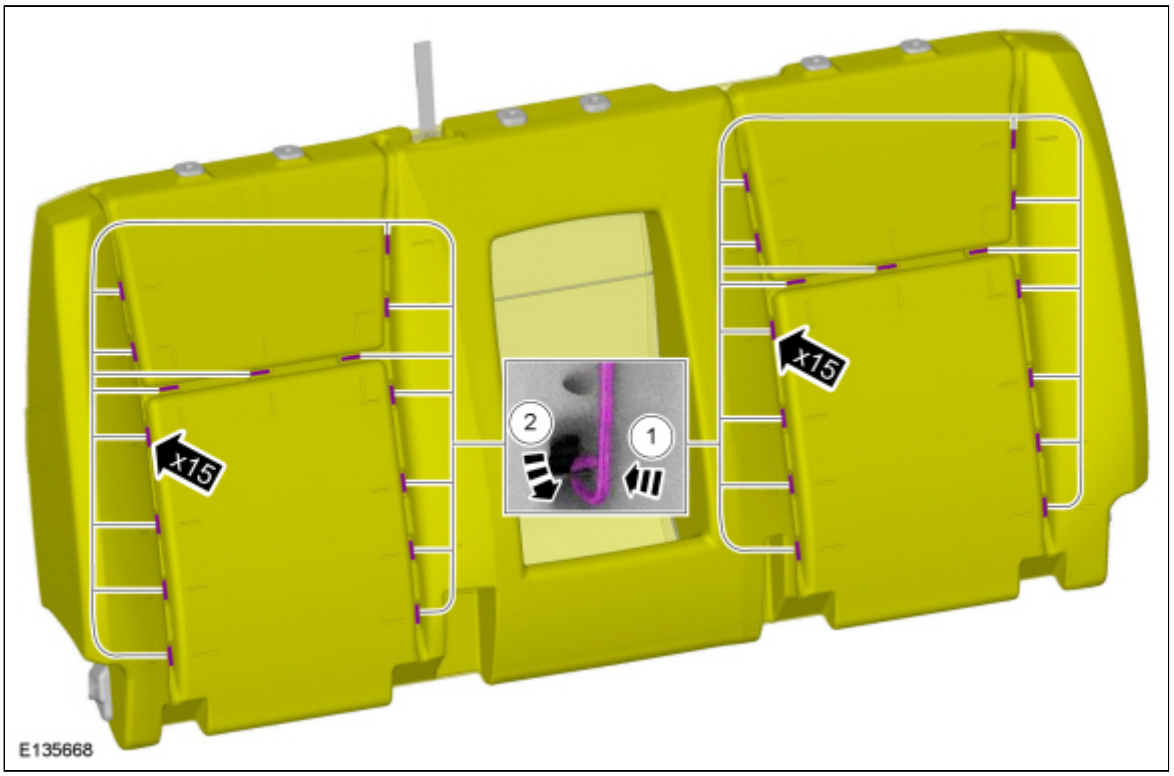
6.



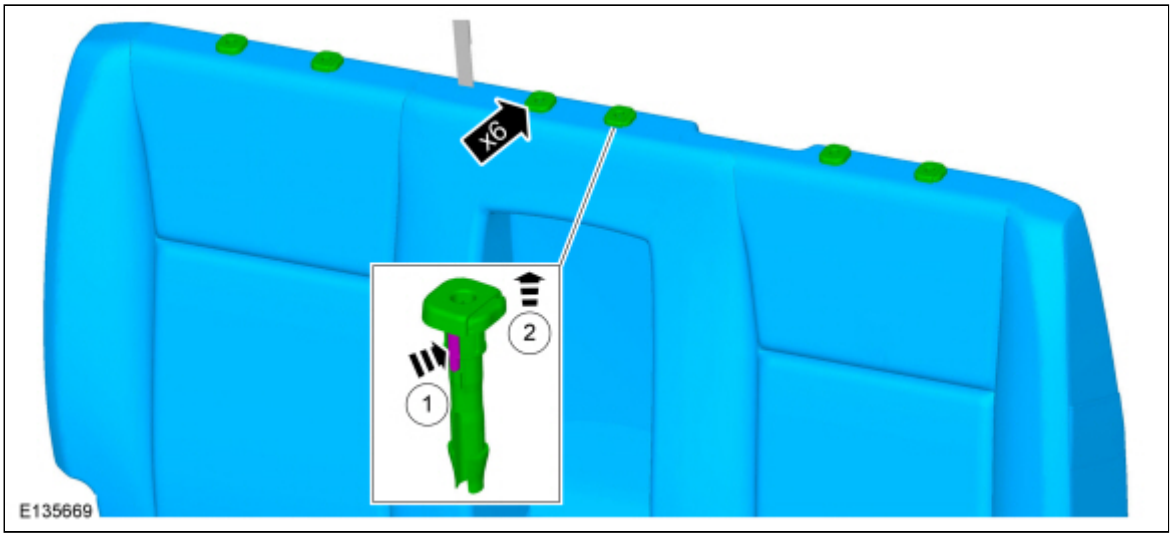
7.



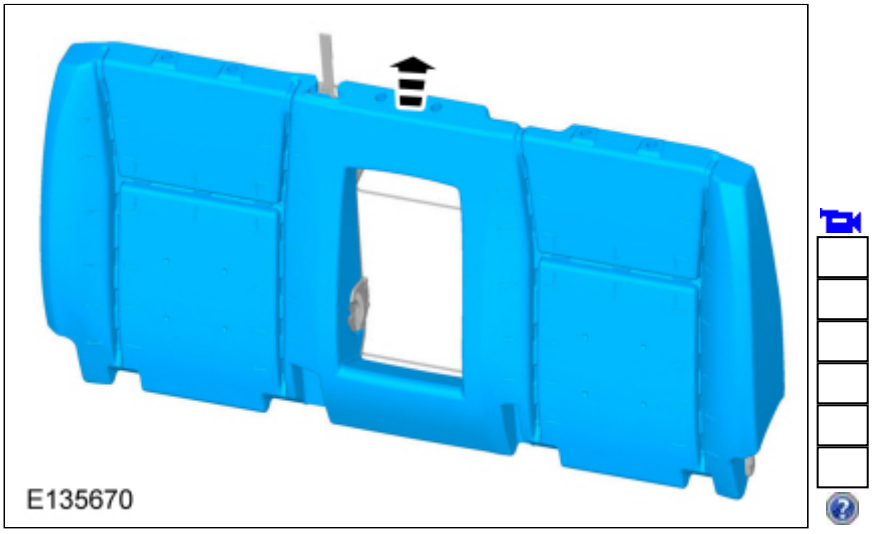
8.



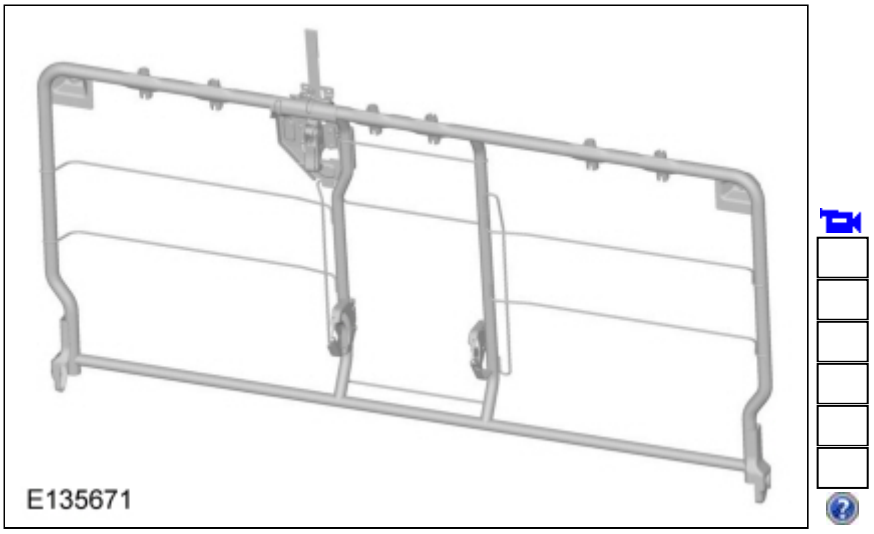
9.



10.



11.



ASSEMBLY

1. To assemble, reverse the disassembly procedure.

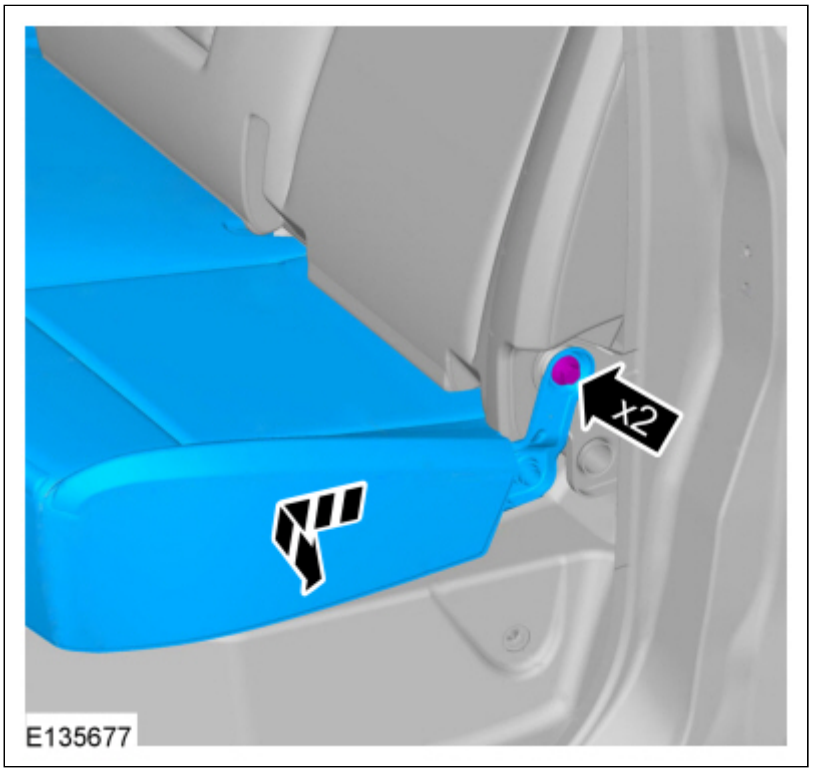
Copyright © 2016 Ford Motor Company

Rear Seat Cushion

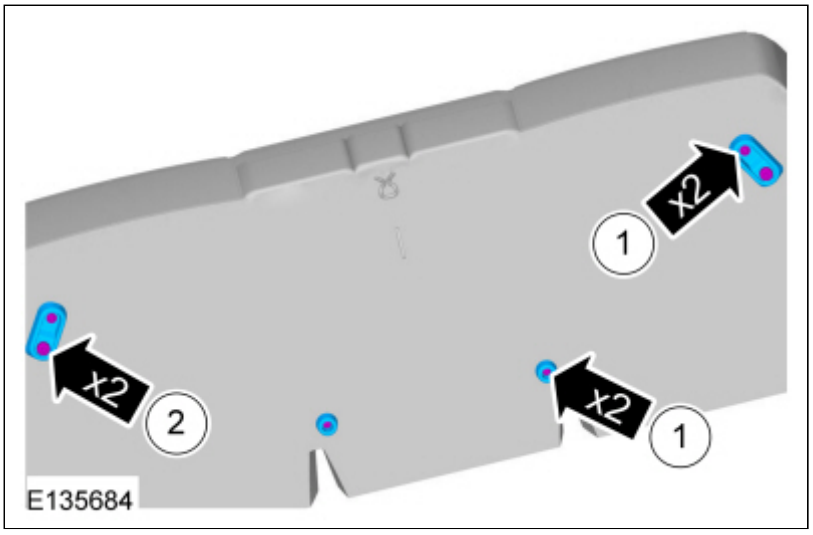
DISASSEMBLY

NOTE: *Disassembly steps in this procedure may contain assembly details.*

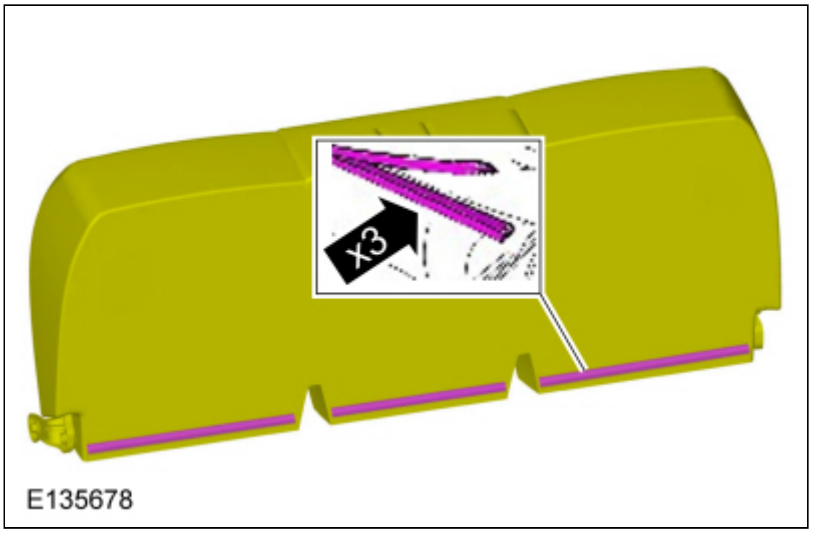
1. *Torque*: 25 Nm



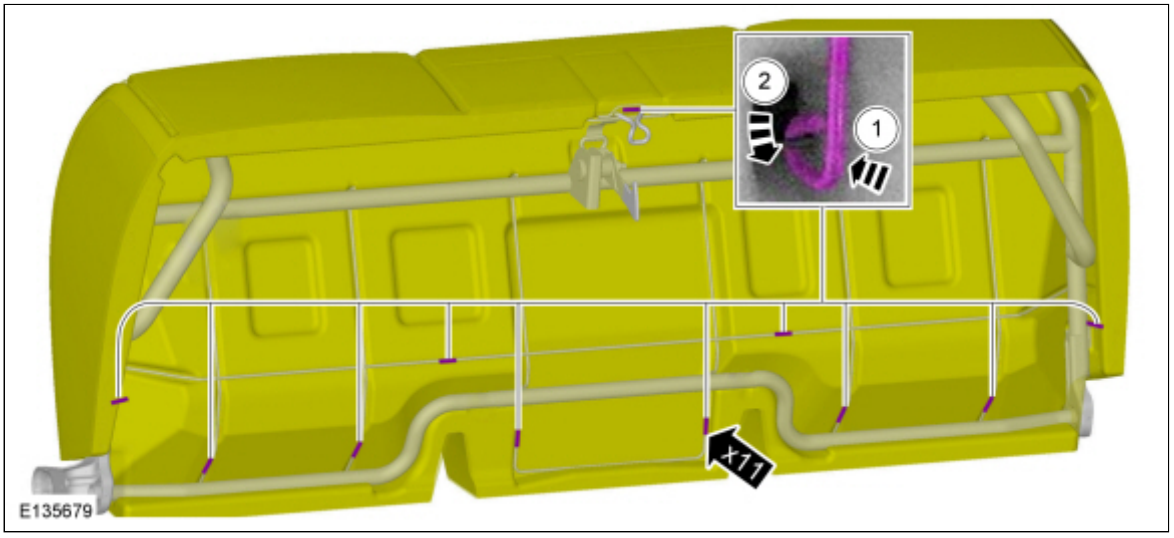
1. *Torque*: 10 Nm
2. *Torque*: 8 Nm



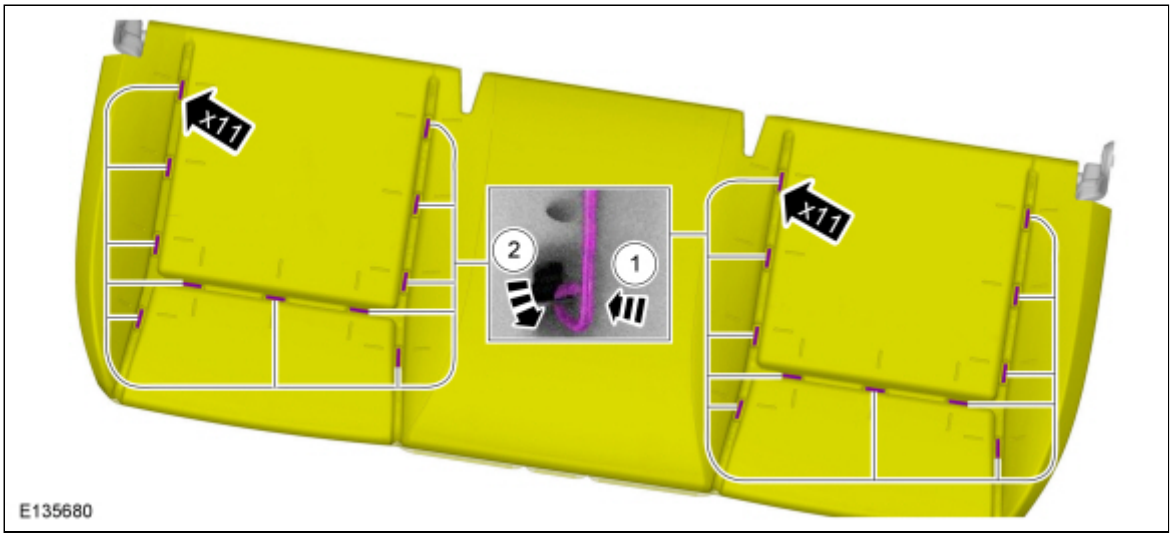
3.



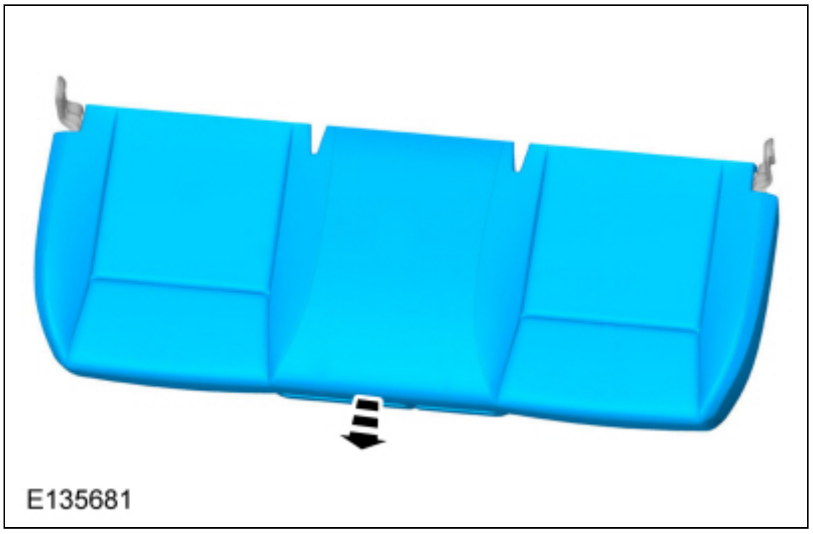
4.



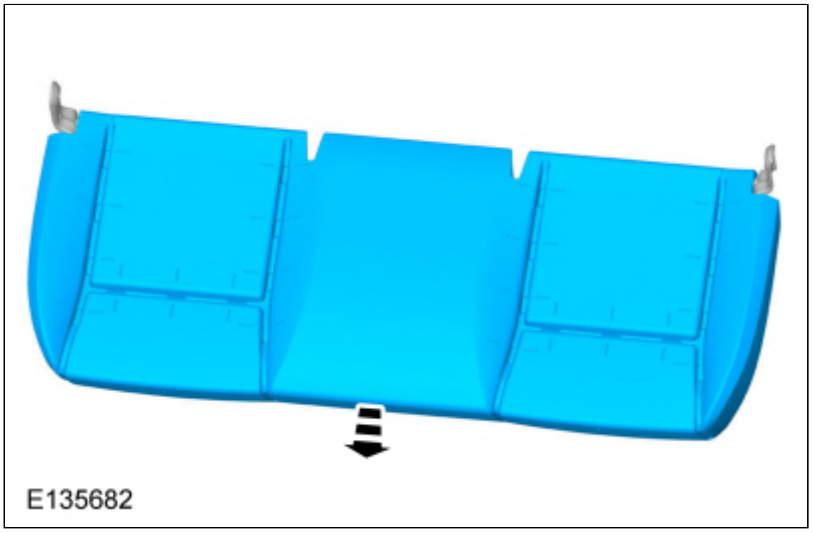
5.



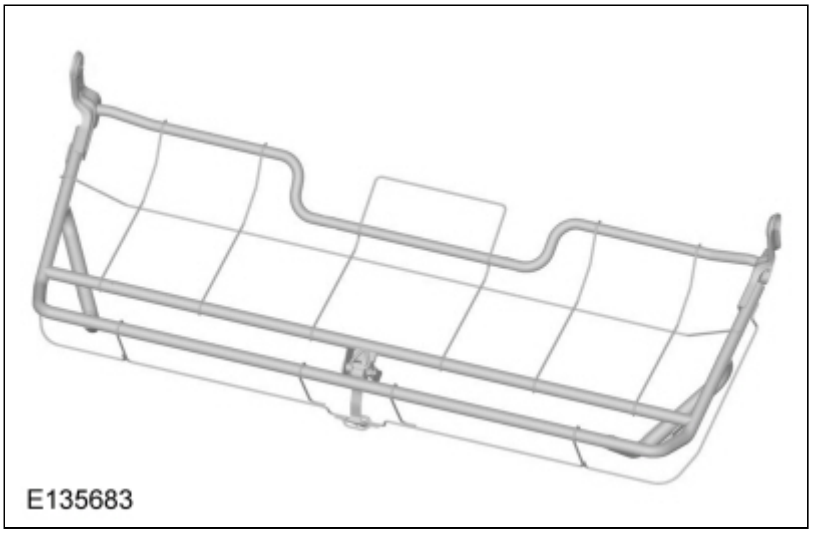
6.



7.



8.



ASSEMBLY

1. To assemble, reverse the disassembly procedure.

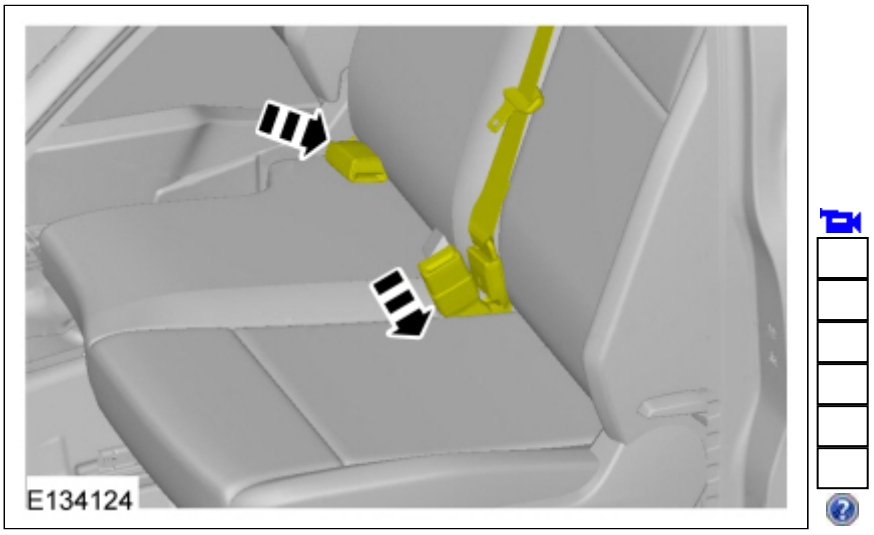
Copyright © 2016 Ford Motor Company

Front Bench Seat

Removal

1. Depower the SRS
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

2.

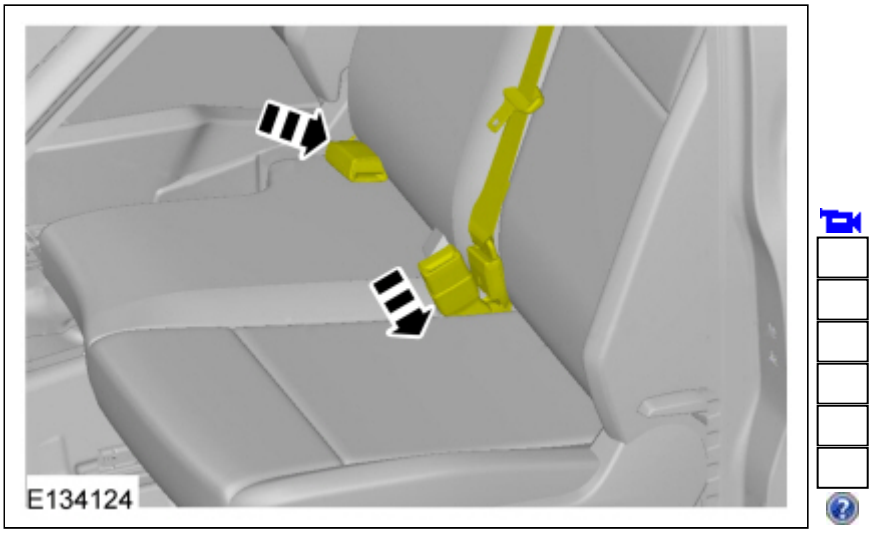


3.



Installation

1.



2. **NOTE:** *The component must be installed by hand before final tightening.*

   Torque:
   1.: 30 Nm
   2.: 30 Nm
   3.: 48 Nm



3. Repower the SRS
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

Copyright © 2016 Ford Motor Company

Front Bench Seat Backrest

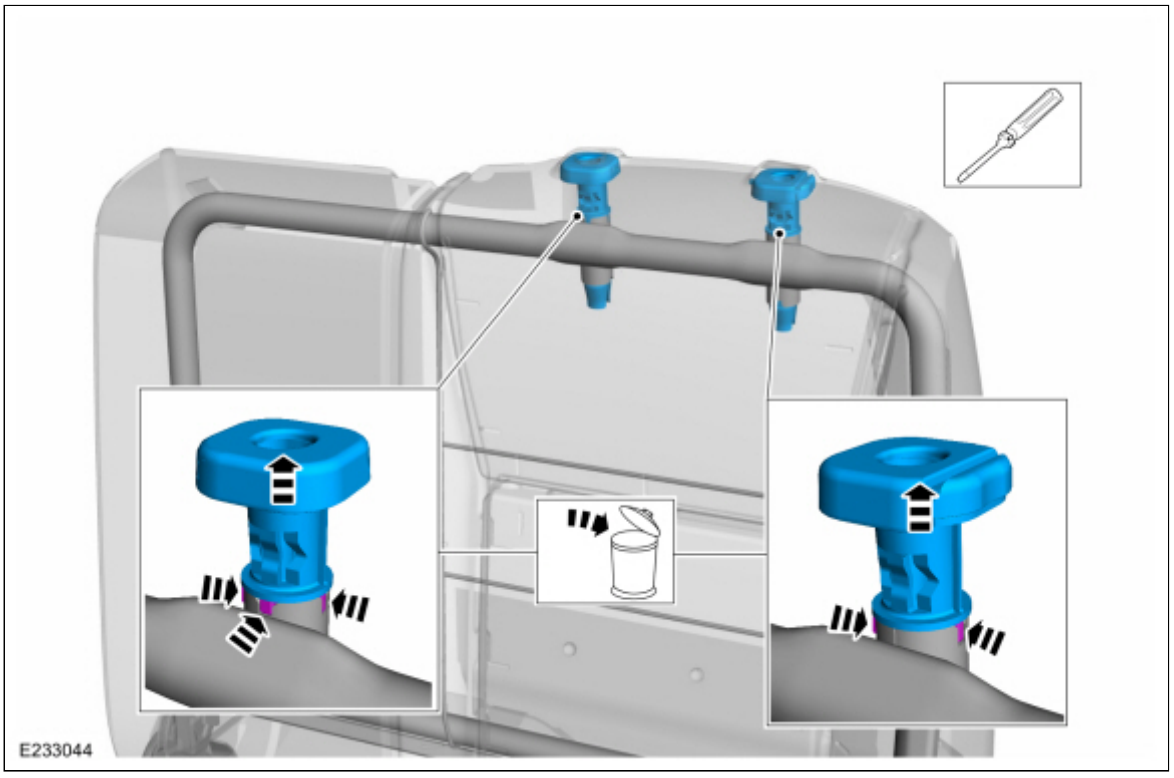
Special Tool(s) / General Equipment

Flat Headed Screw Driver

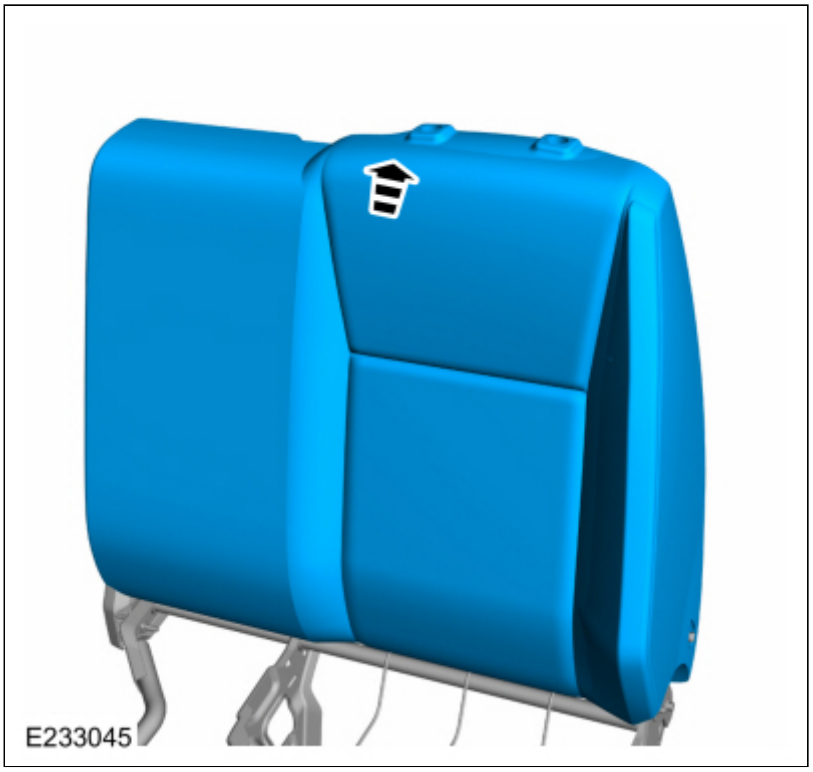
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Bench Seat Backrest Cover (501-10B Front Seats, Removal and Installation).
2. Use the General Equipment: Flat Headed Screw Driver



3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Bench Seat Backrest Cover

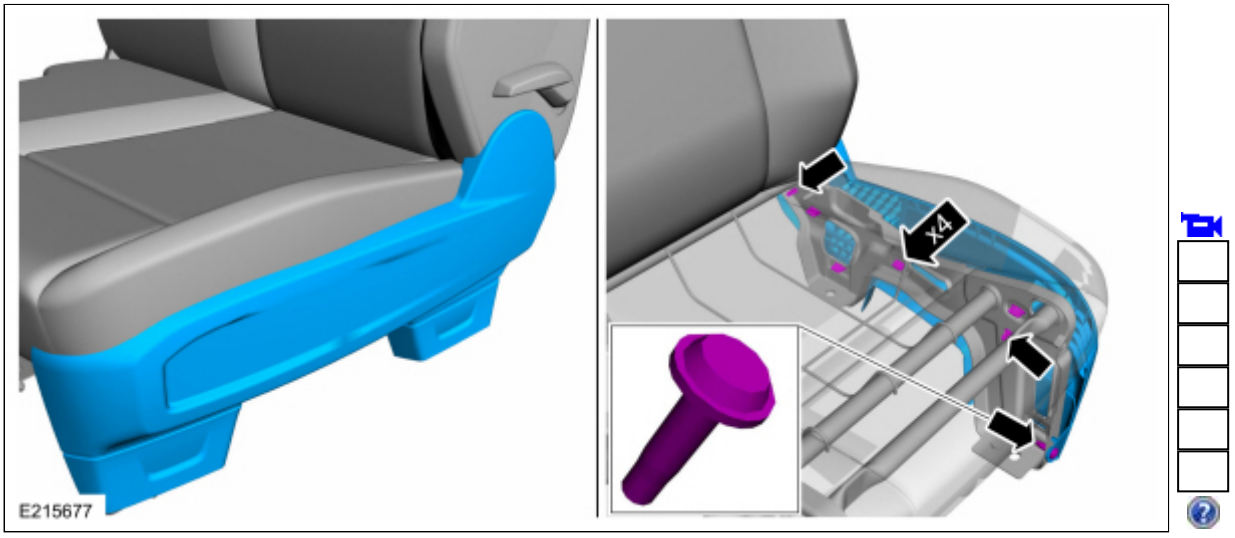
Special Tool(s) / General Equipment

Flat Headed Screw Driver
Hog Ring Plier

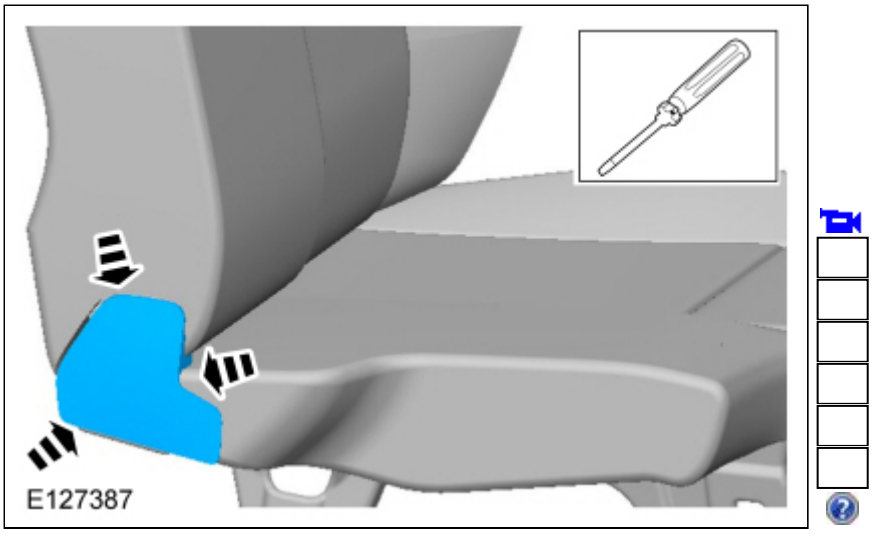
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

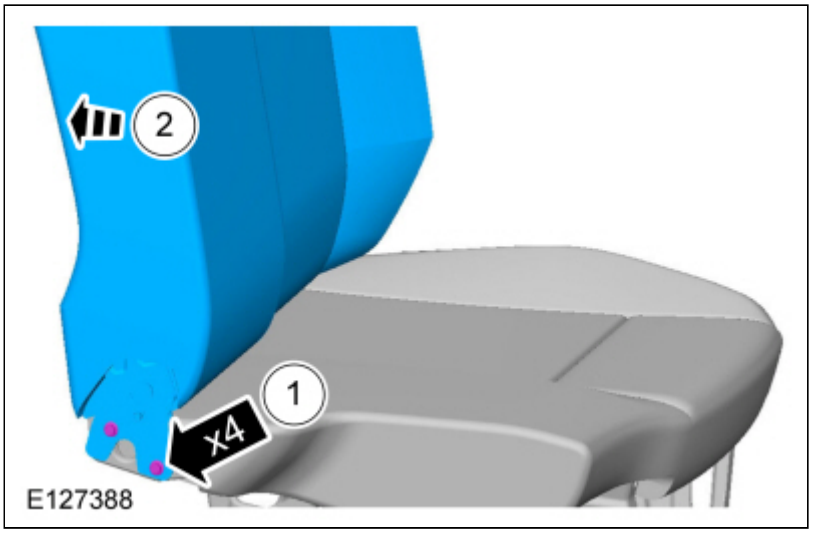
1. Refer to: Front Bench Seat (501-10A Seating, Removal and Installation).
2. *Torque*: 3 Nm



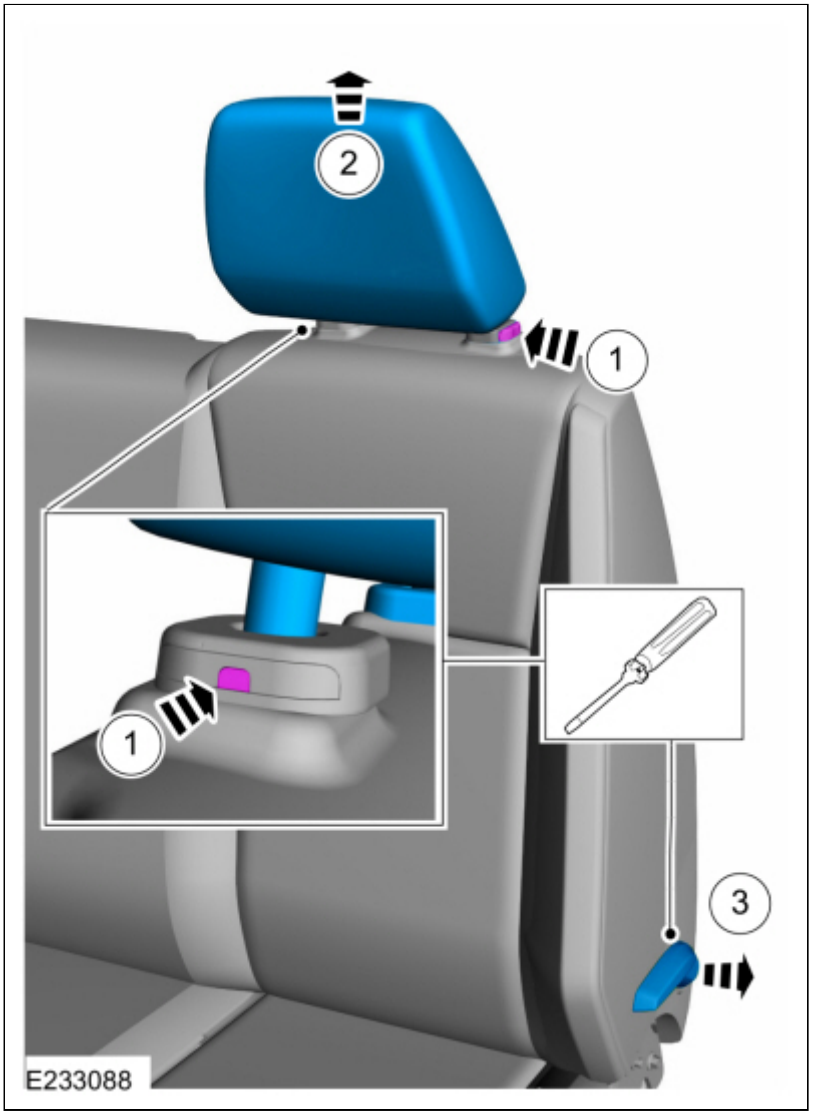
3. Use the General Equipment: Flat Headed Screw Driver



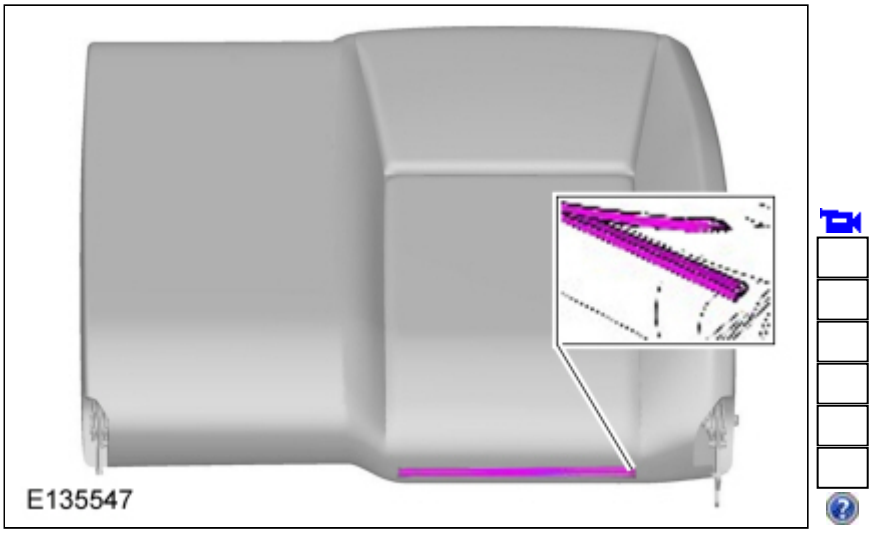
4. *Torque*: 35 Nm



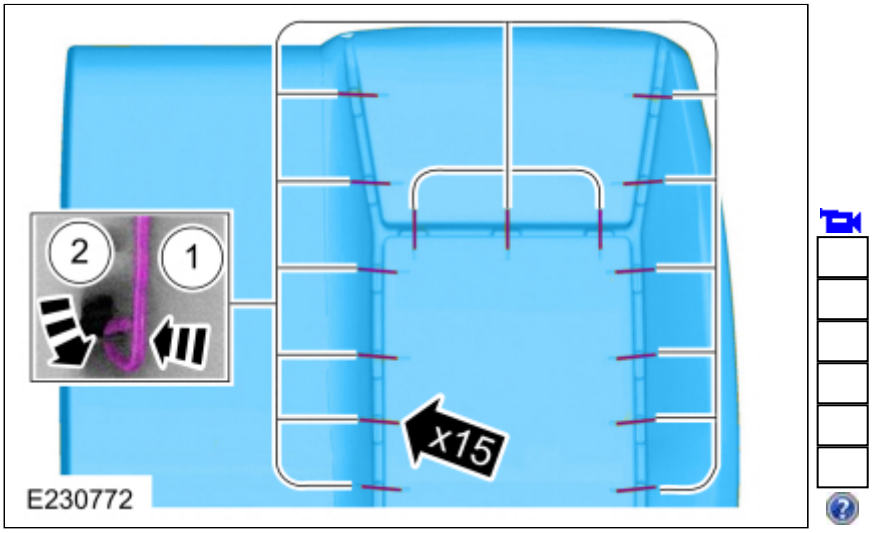
5. Use the General Equipment: Flat Headed Screw Driver



6.

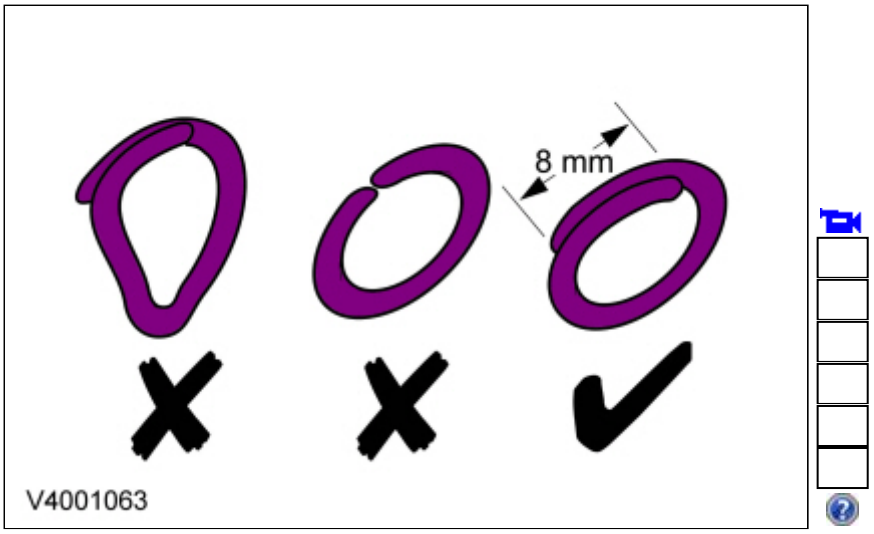


7.



Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier

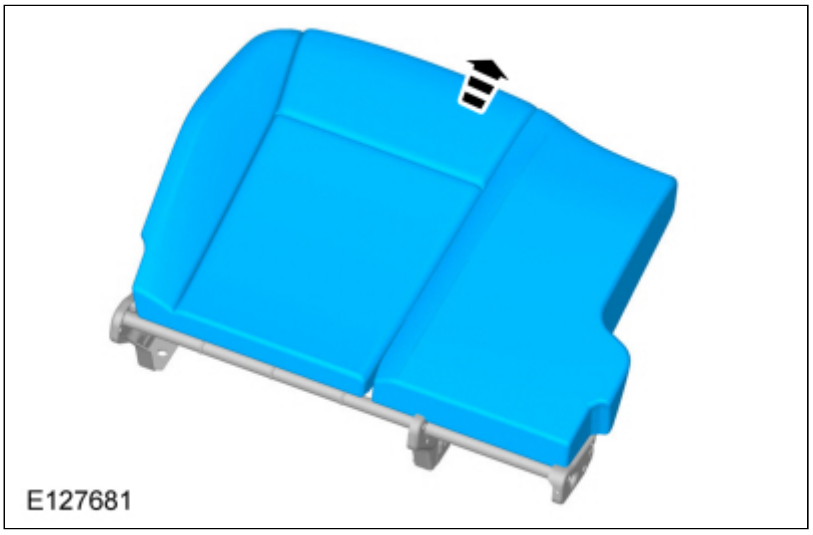


Copyright © 2016 Ford Motor Company

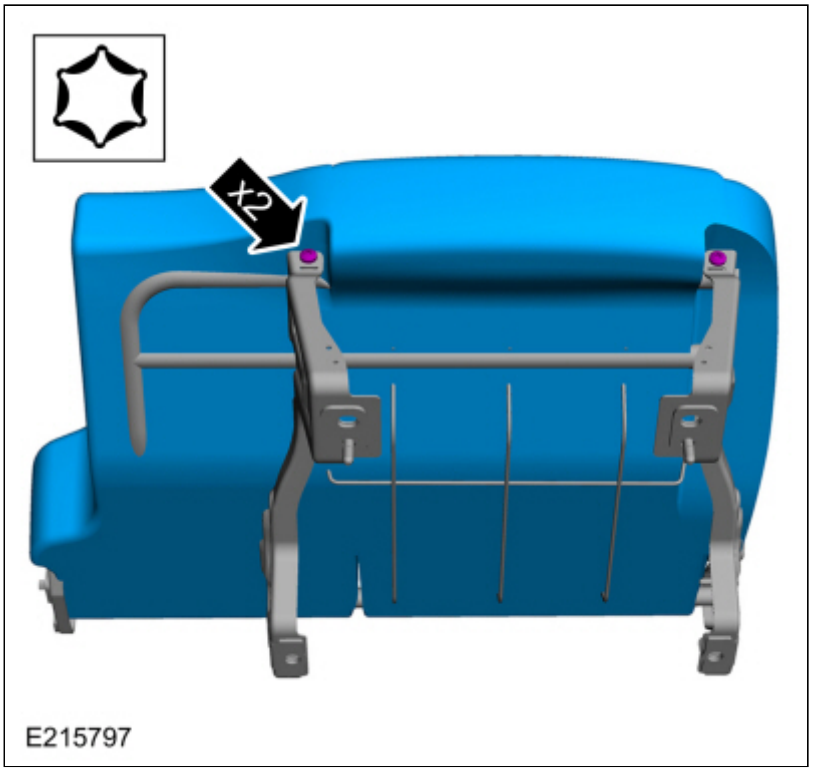
Front Bench Seat Cushion

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Bench Seat Cushion Cover (501-10B Front Seats, Removal and Installation).
2. 

3. *Torque*: 30 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

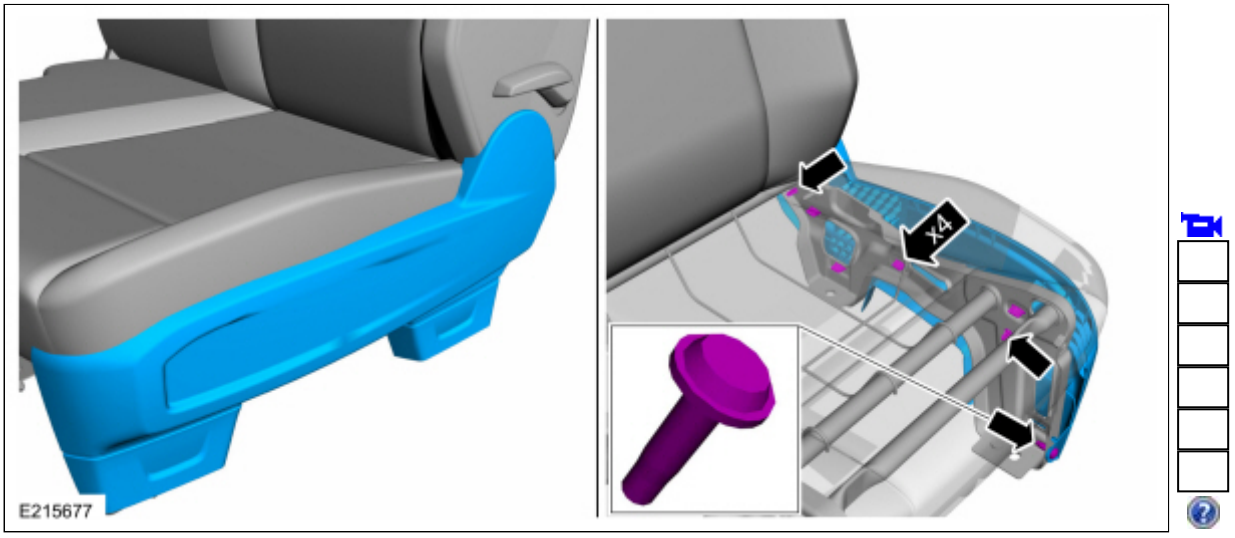
Front Bench Seat Cushion Cover

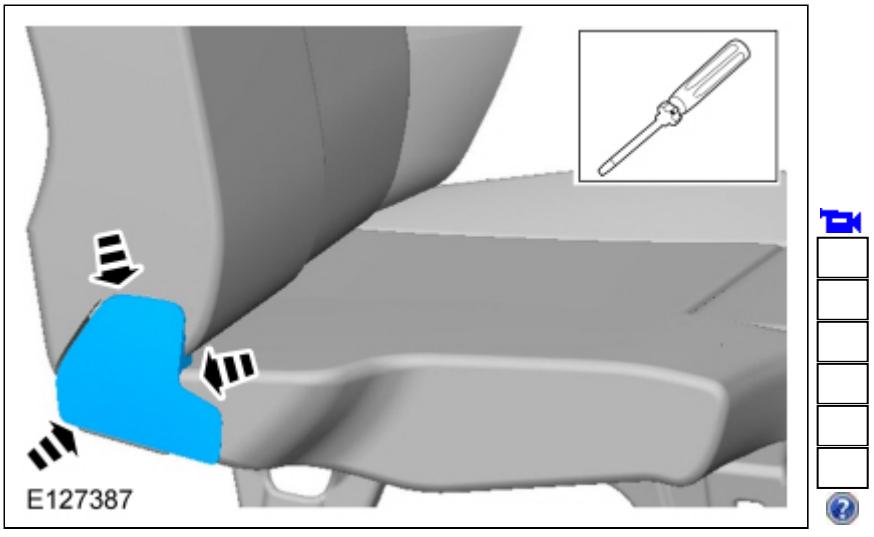
Special Tool(s) / General Equipment

Flat Headed Screw Driver
Hog Ring Plier

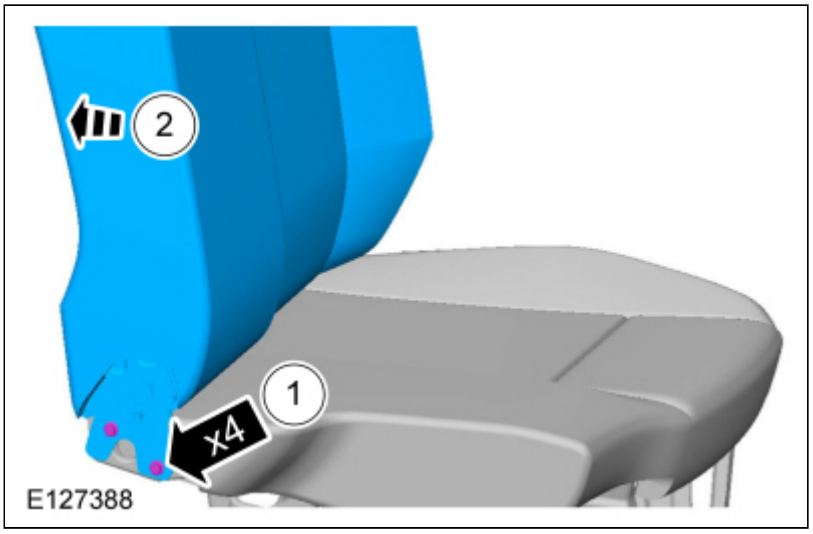
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

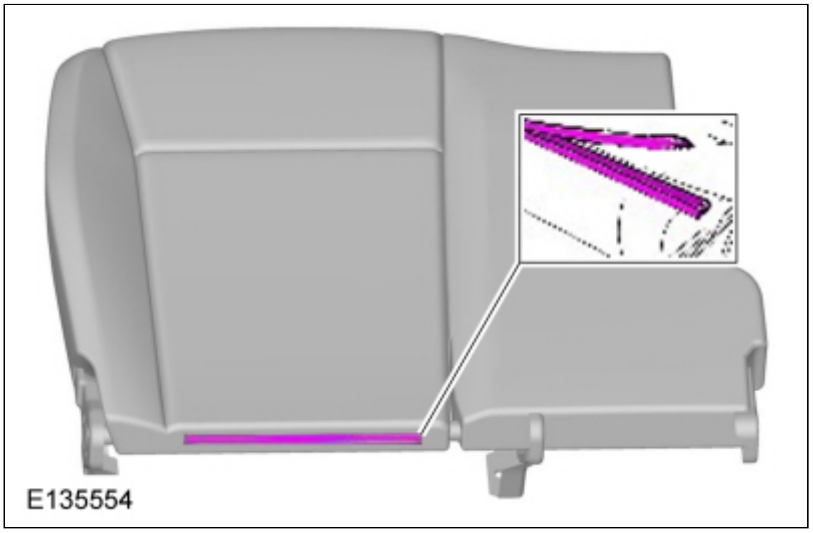
1. Refer to: Front Bench Seat (501-10A Seating, Removal and Installation).
2. 

3. Use the General Equipment: Flat Headed Screw Driver


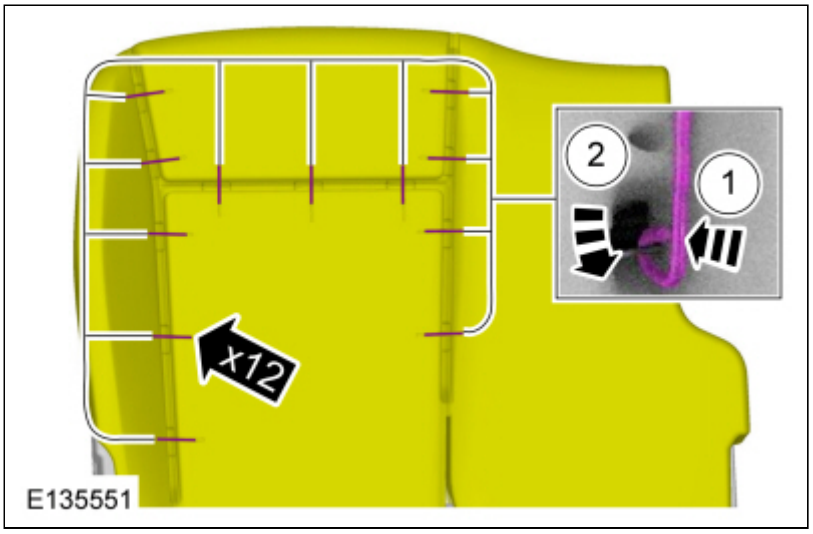
4. *Torque*: 35 Nm



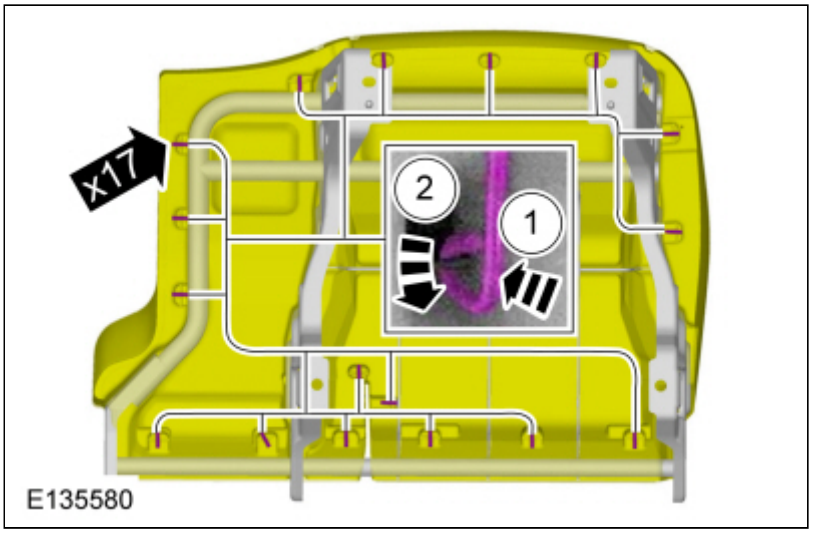
5.



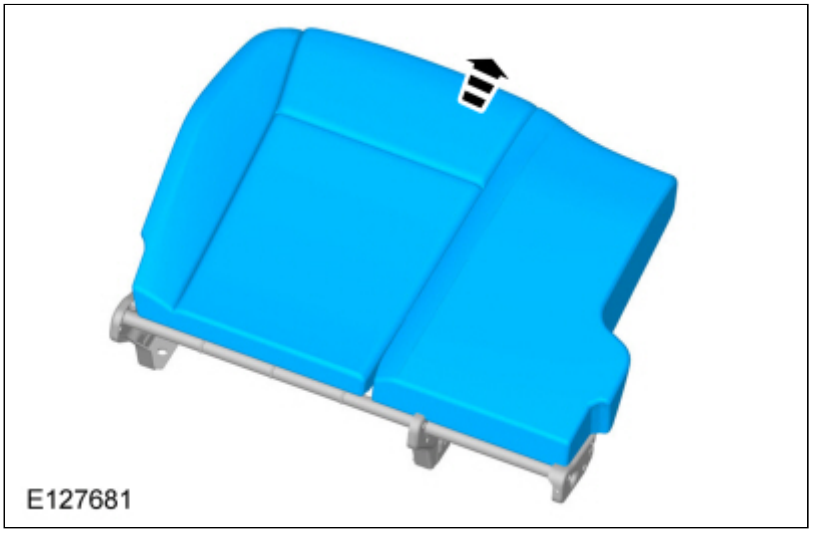
6.



7.

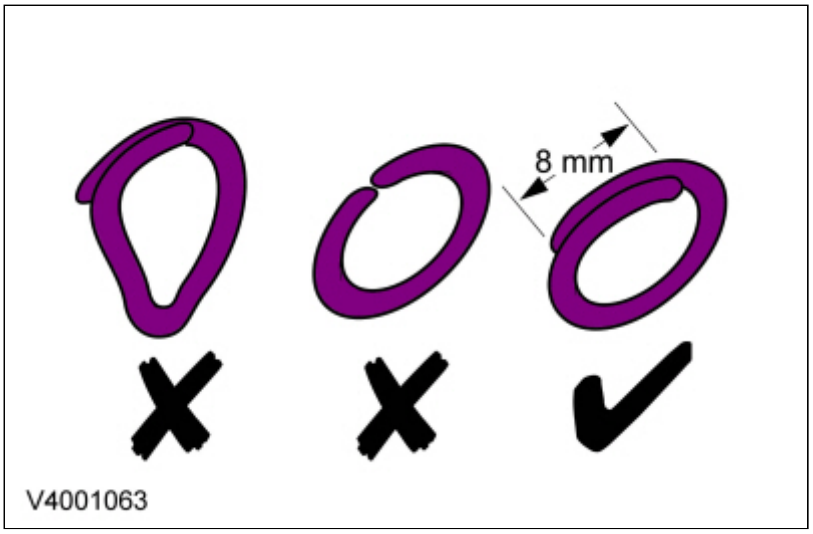


8.



Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier



Copyright © 2016 Ford Motor Company

Front Seat

Base Part Number: 63100

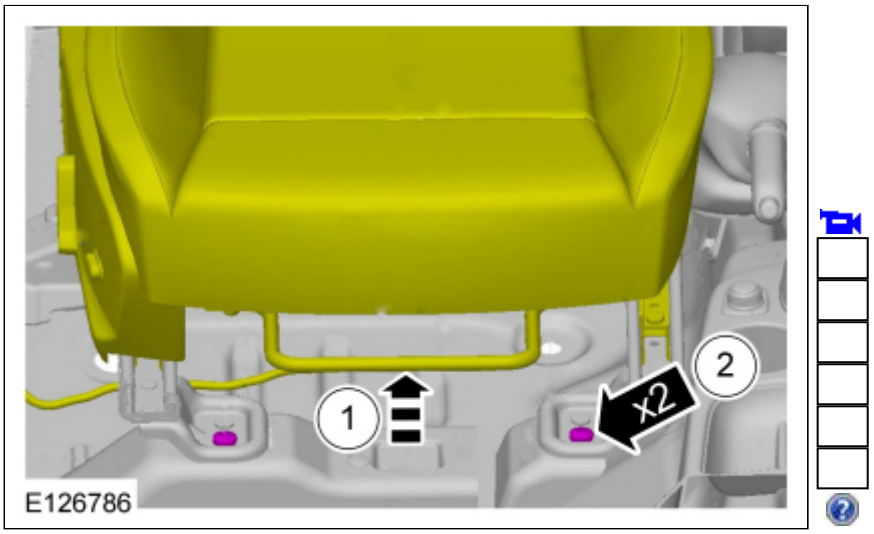
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

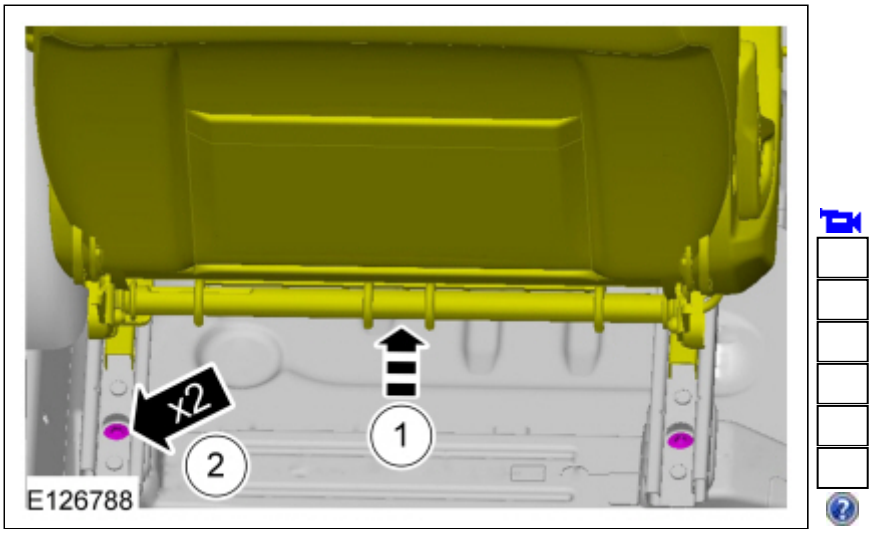
All vehicles

1. Depower the SRS
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

2. *Torque*: 48 Nm

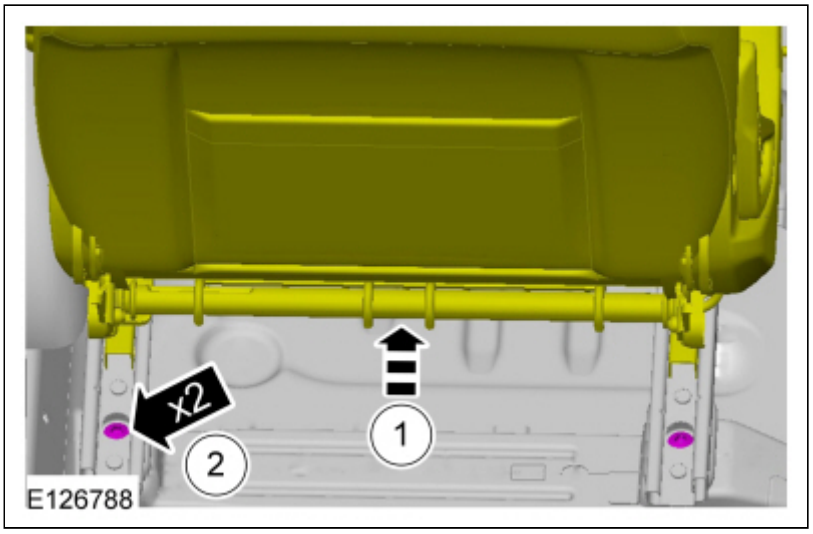


3. *Torque*:
   2.: 48 Nm



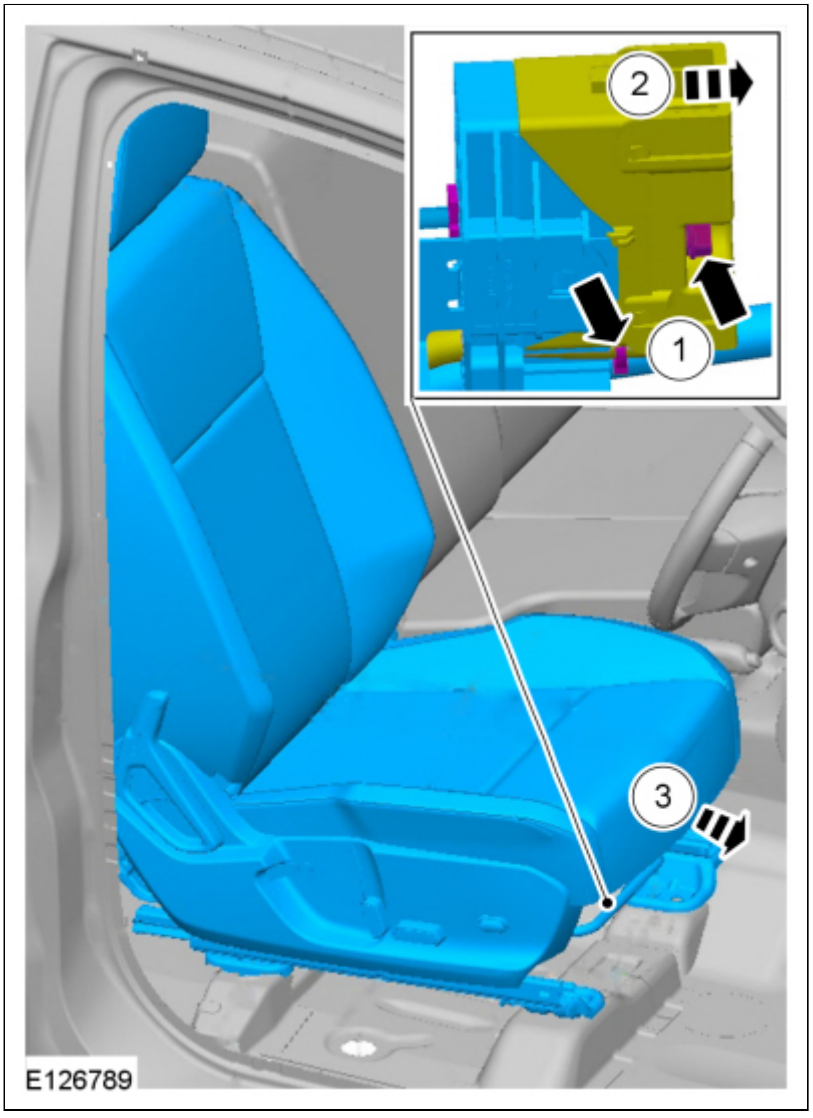
Single Cab

4. *Torque*:
   2.: 30 Nm



All vehicles

5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seat - Vehicles With: Driver 8-Way Power Seat

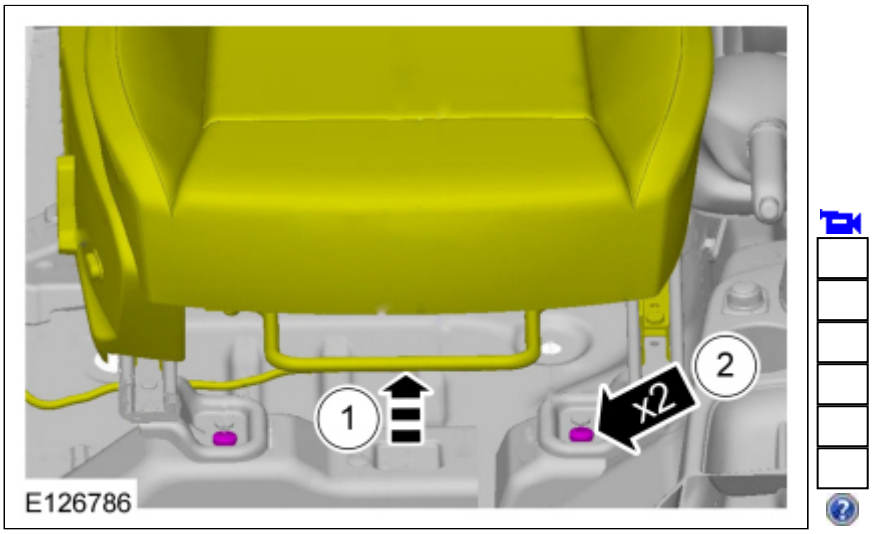
Base Part Number: 63100

Removal

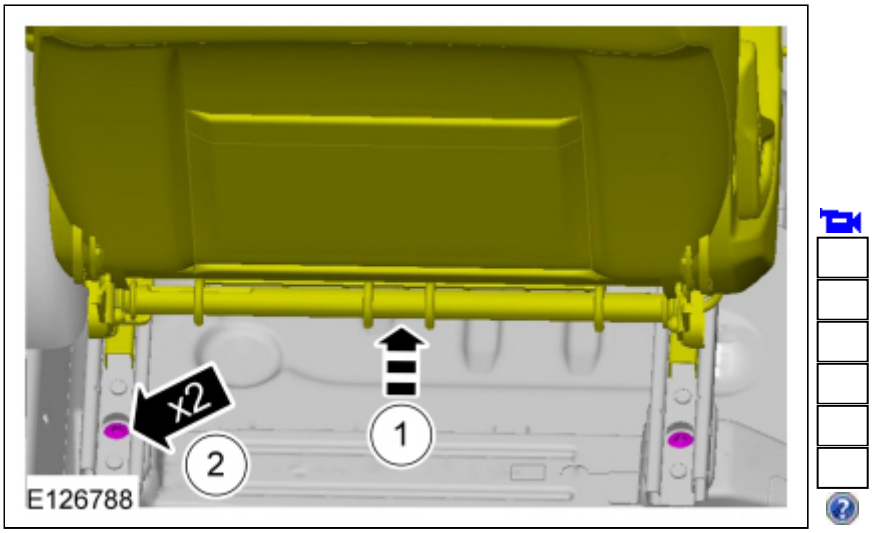
NOTE: *Removal steps in this procedure may contain installation details.*

1. Depower the SRS
   Refer to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

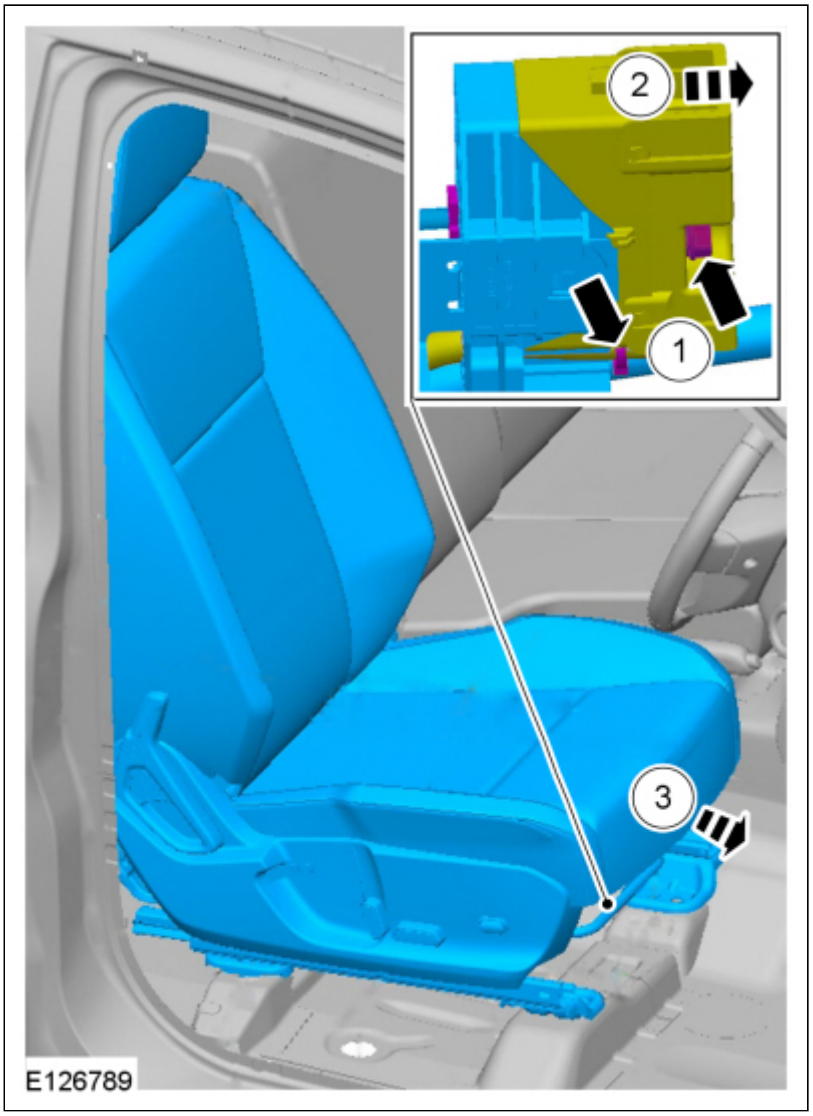
2. *Torque*: 48 Nm



3. *Torque*: 30 Nm



4.



Installation

1. To install, reverse the removal procedure.

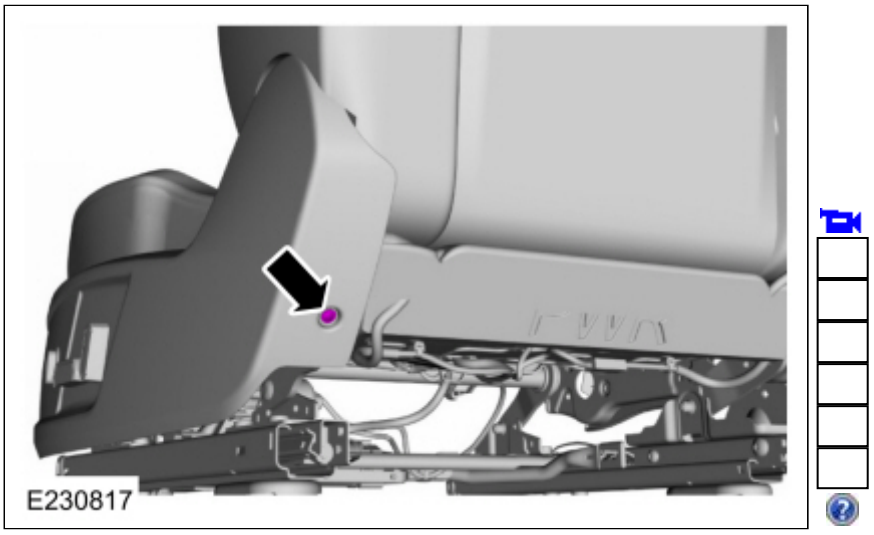
Copyright © 2016 Ford Motor Company

Front Seat Backrest - Vehicles With: Driver 8-Way Power Seat

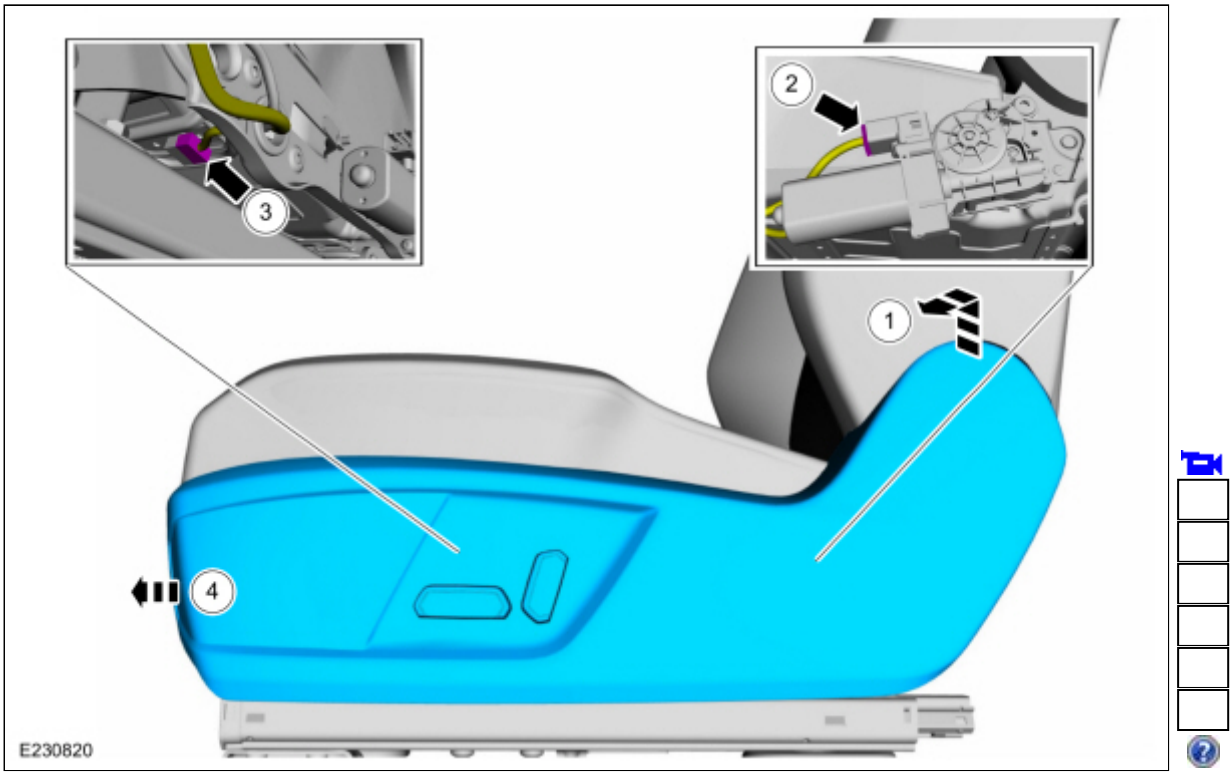
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

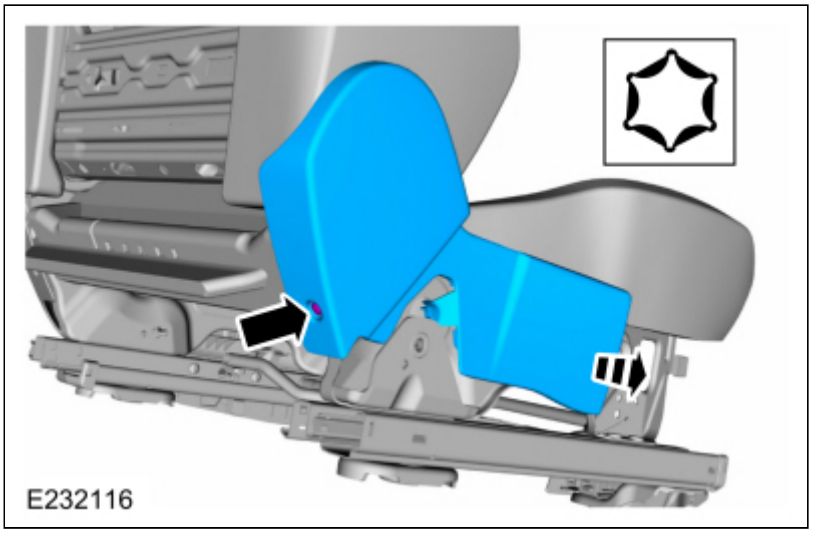
1. Refer to: Front Seat (501-10A) .
2. *Torque*: 3 Nm



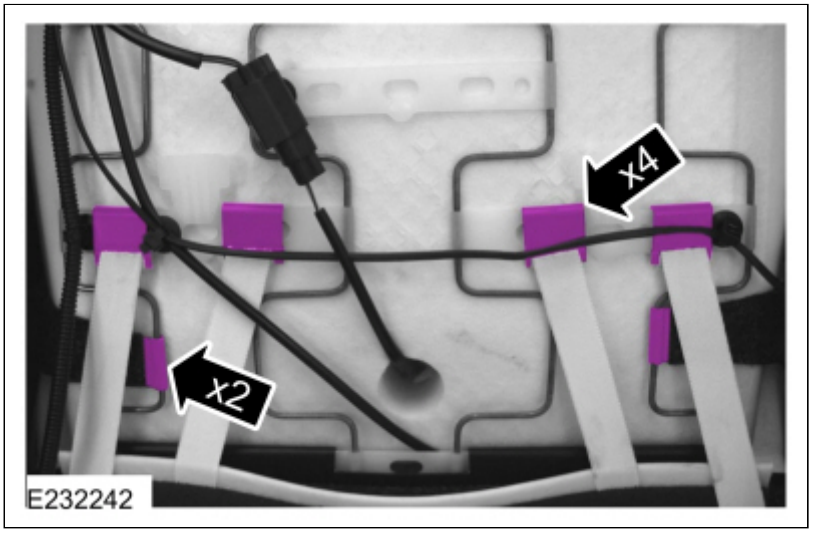
3.



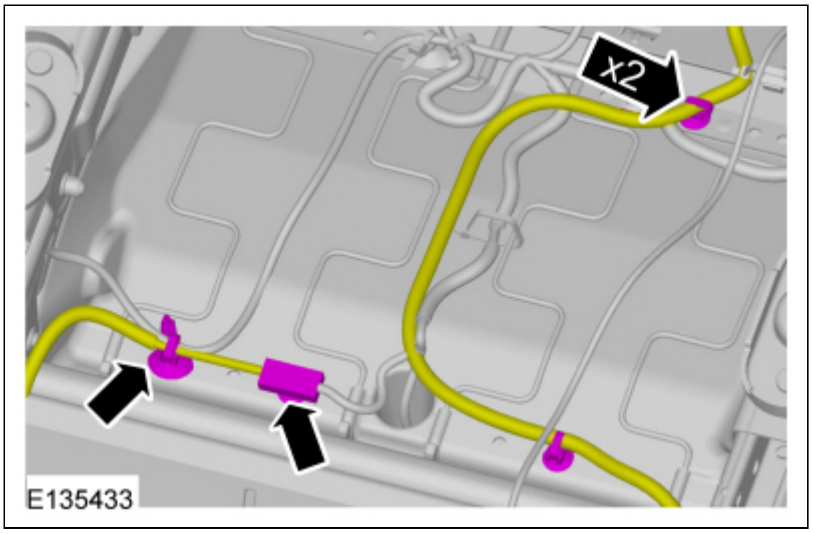
4. *Torque*: 3 Nm



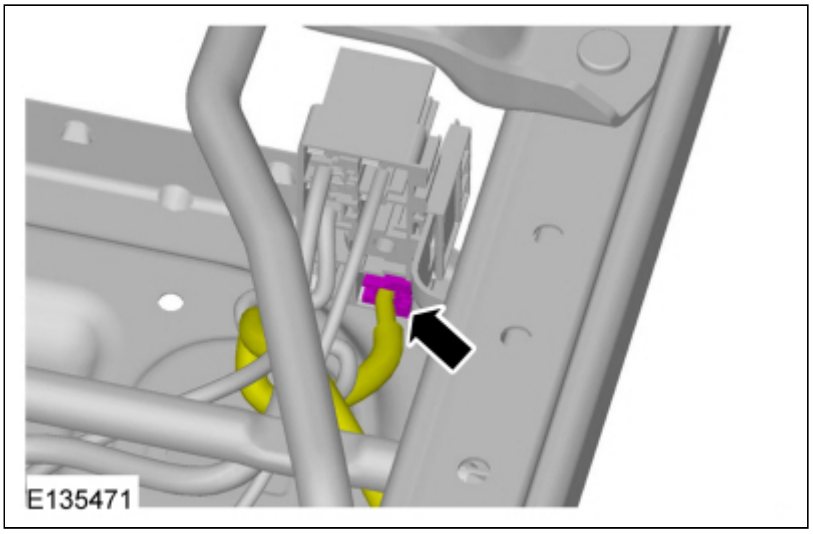
5.



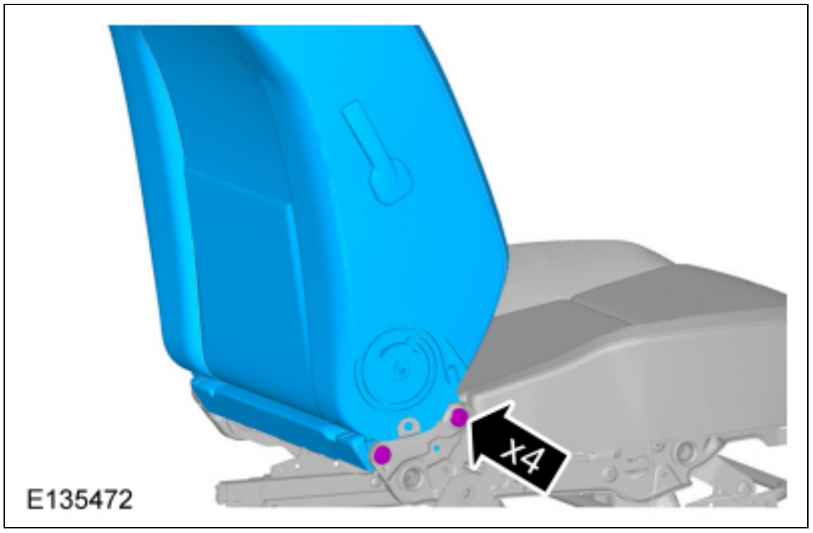
6.



7.



8. *Torque*: 35 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seat Cushion - Vehicles With: Driver 8-Way Power Seat

Base Part Number: 632A22

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seat Cushion Heater Mat (501-10B Front Seats, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seat Backrest Cover

Base Part Number: 64416

Special Tool(s) / General Equipment

Flat Headed Screw Driver
Interior Trim Remover
Hog Ring Plier

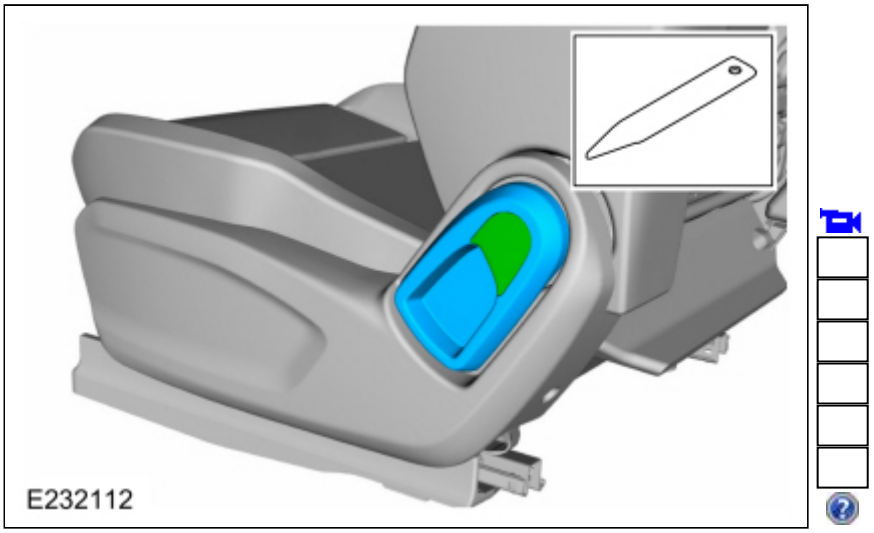
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

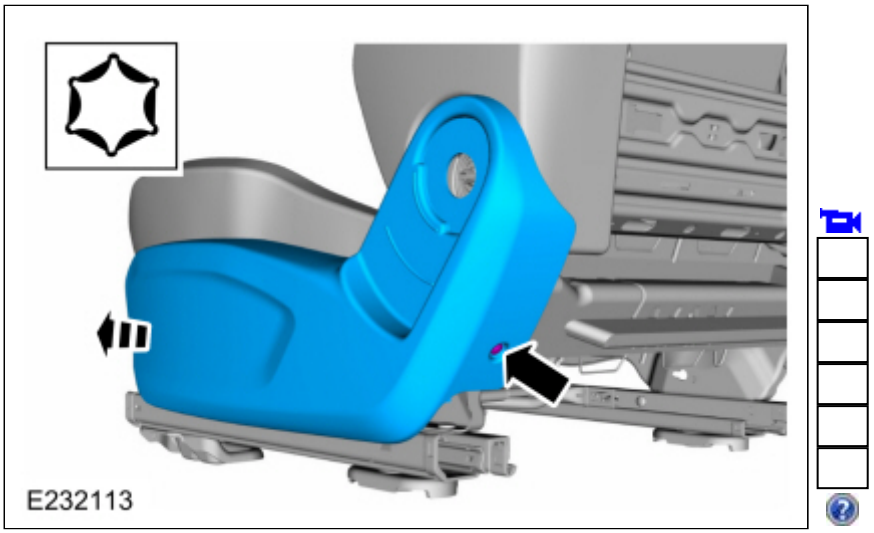
1. Refer to: Front Seat (501-10A) .
2. Refer to: Front Head Restraint Guide Sleeve (501-10A) .

Manual seat

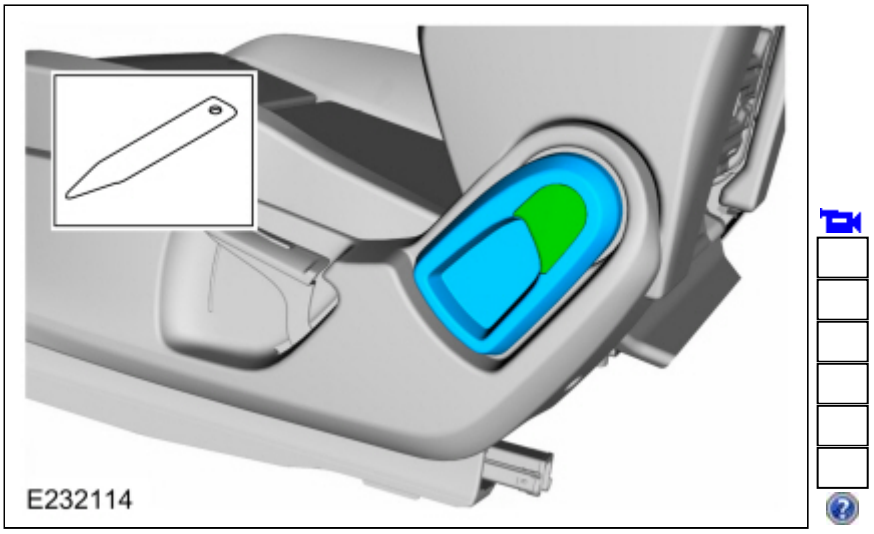
3. If equipped.
   Use the General Equipment: Interior Trim Remover



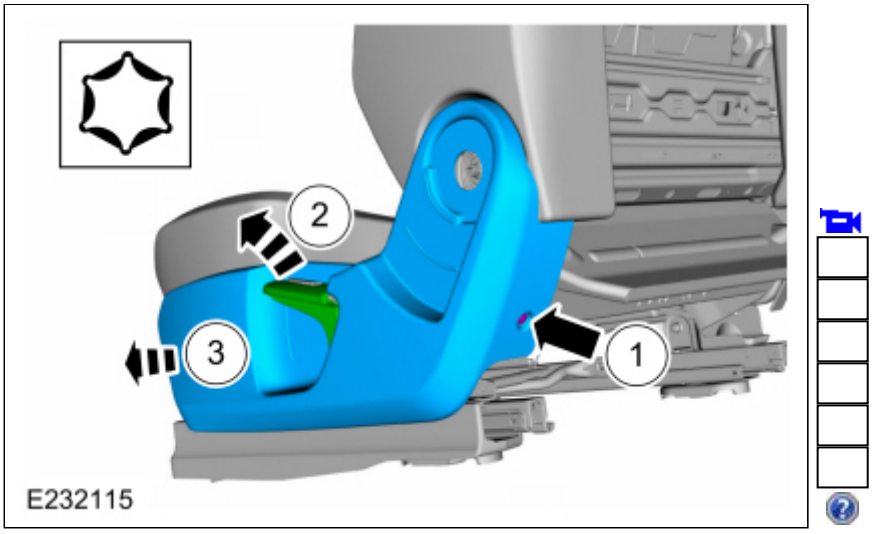
4. *Torque*: 3 Nm



5. If equipped.
   Use the General Equipment: Interior Trim Remover

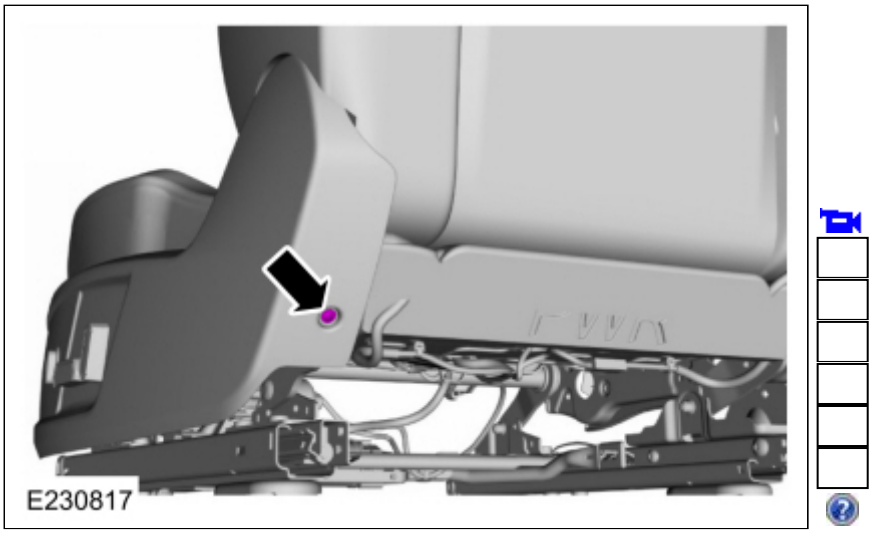


6. *Torque*: 3 Nm

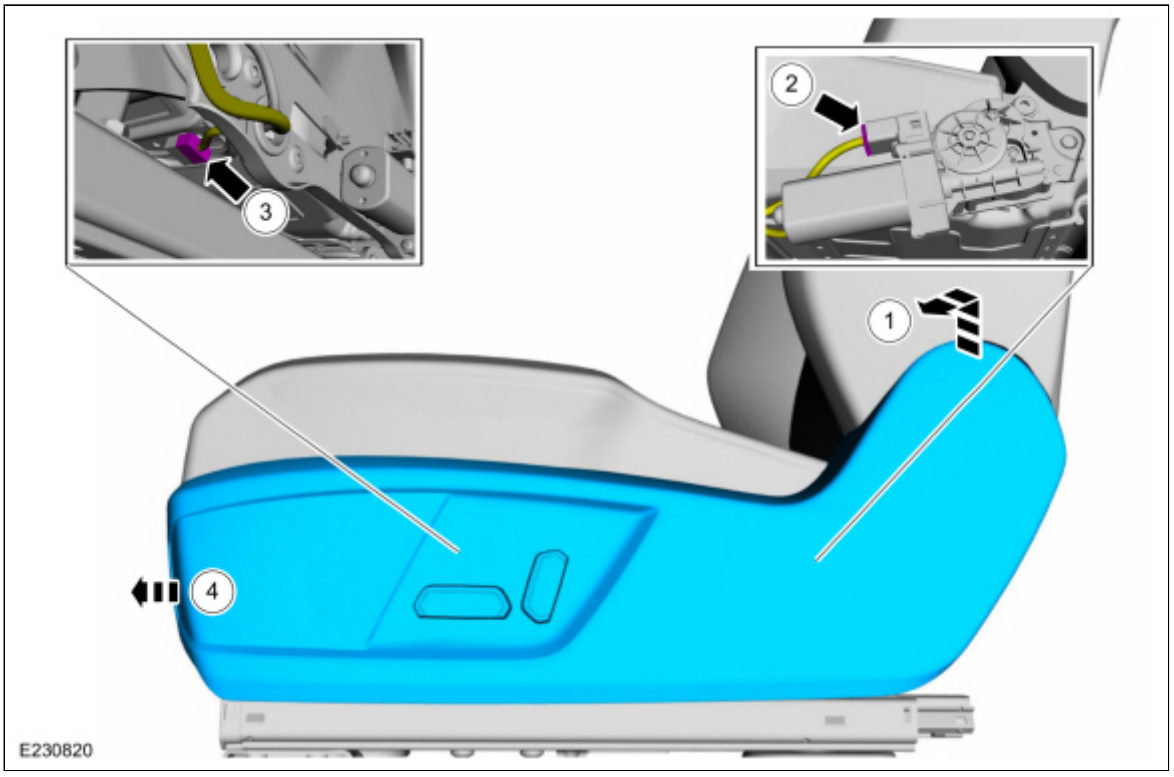


Power seat

7. *Torque*: 3 Nm

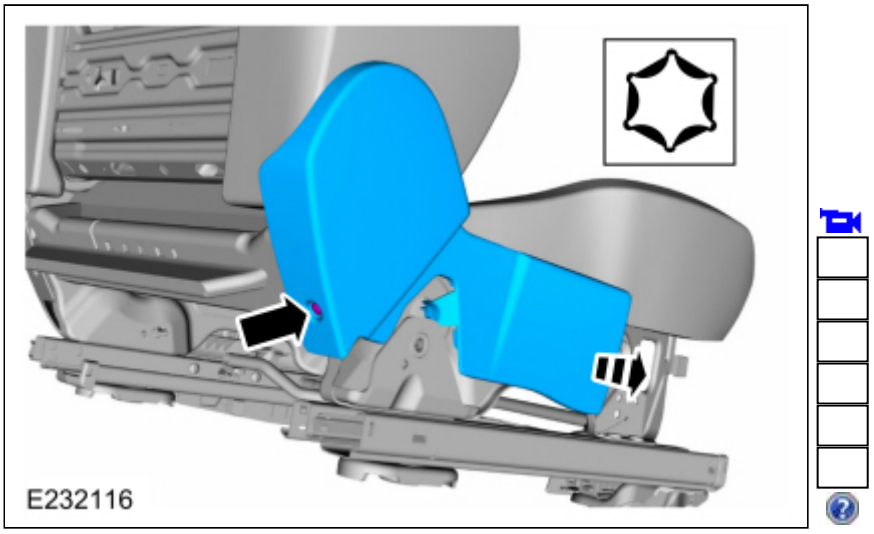


8.

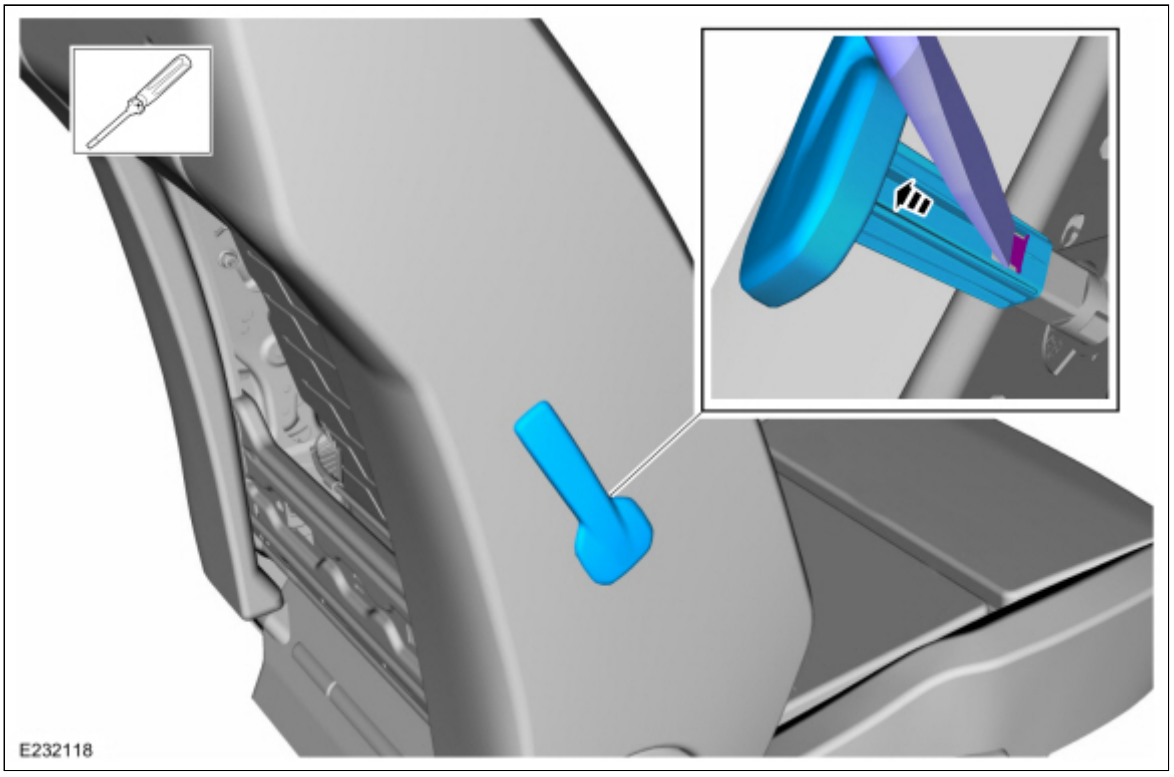


All seats

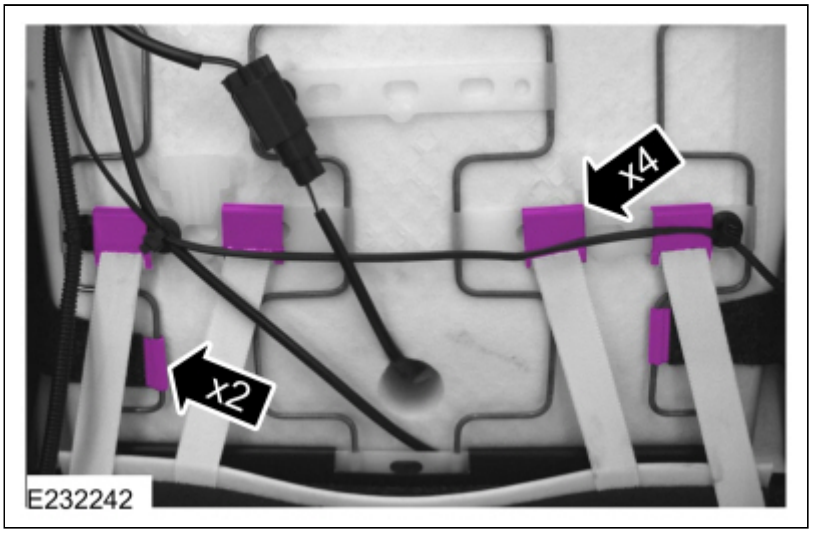
9. *Torque*: 3 Nm



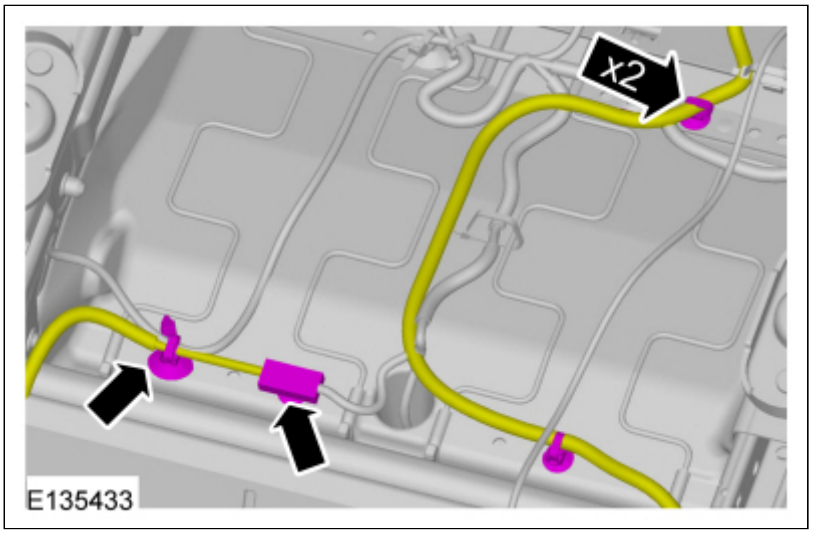
10. Use the General Equipment: Flat Headed Screw Driver



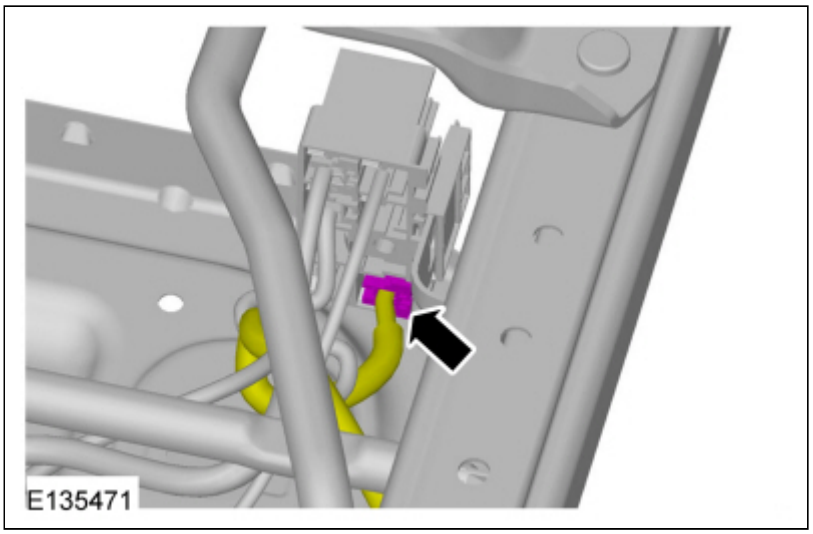
11.



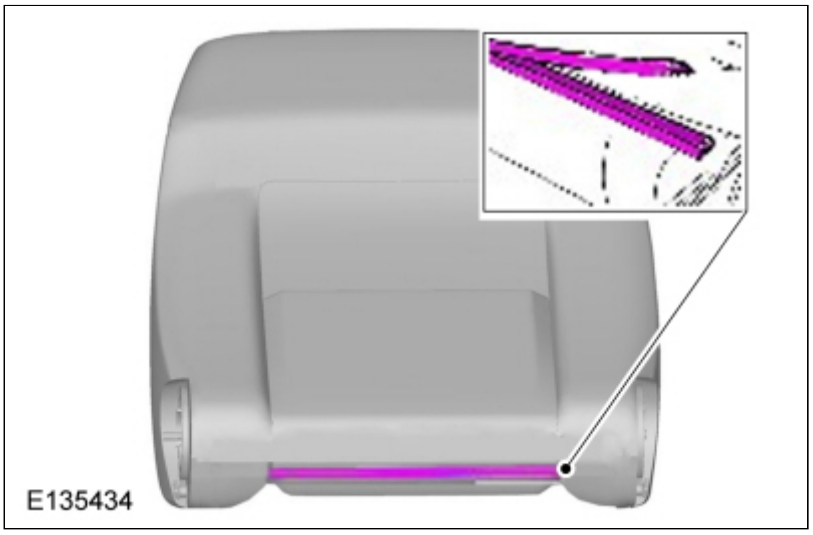
12.



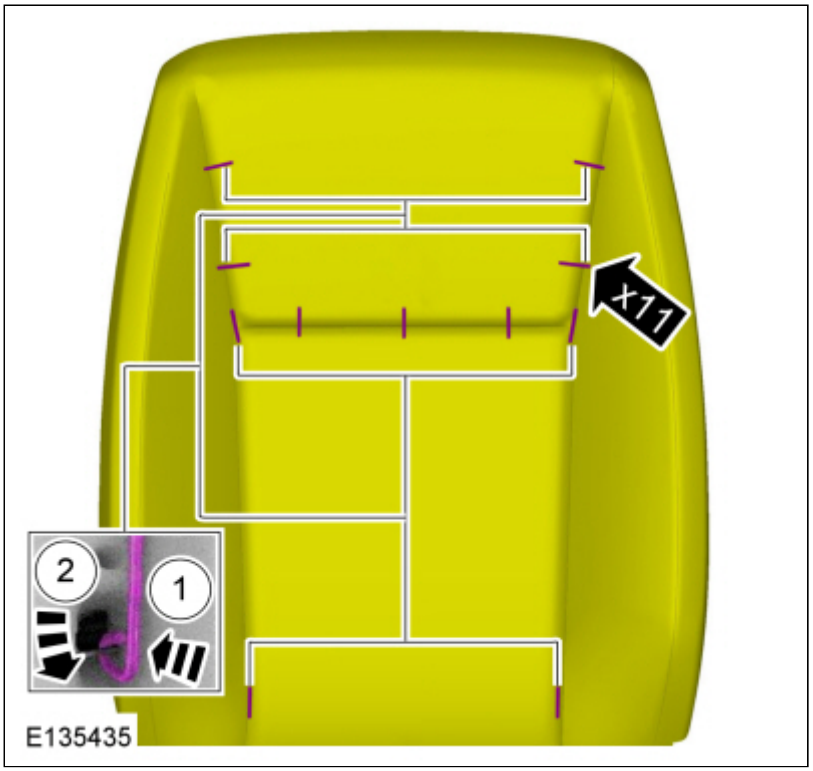
13.



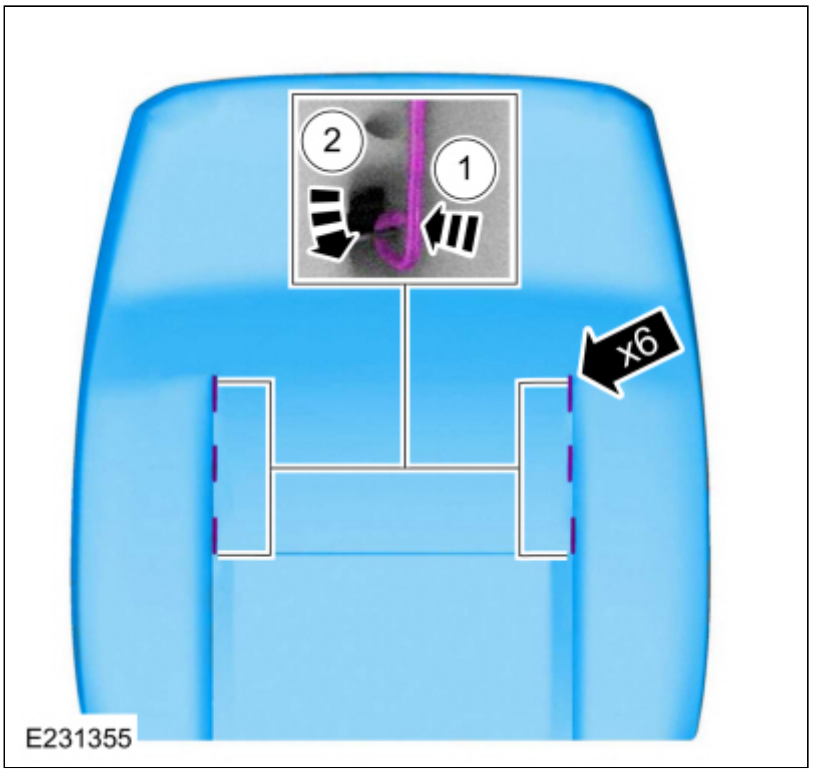
14.



15.

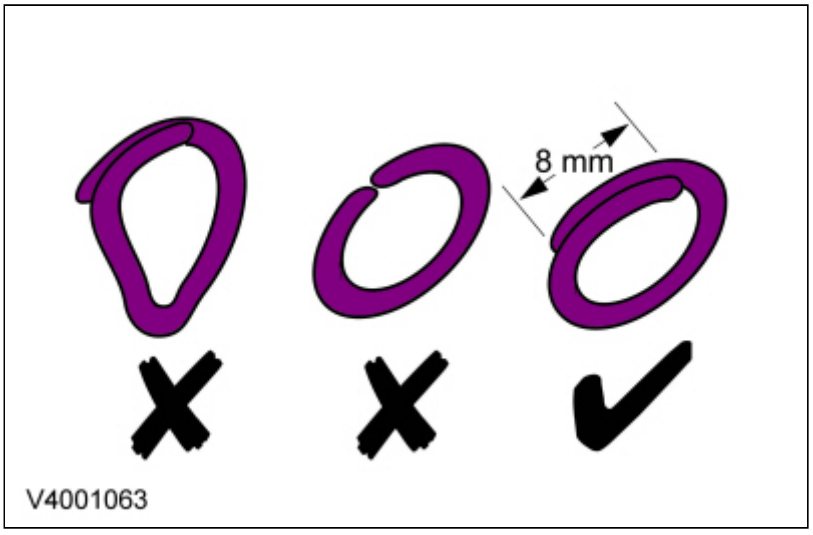


16.



Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier



Copyright © 2016 Ford Motor Company

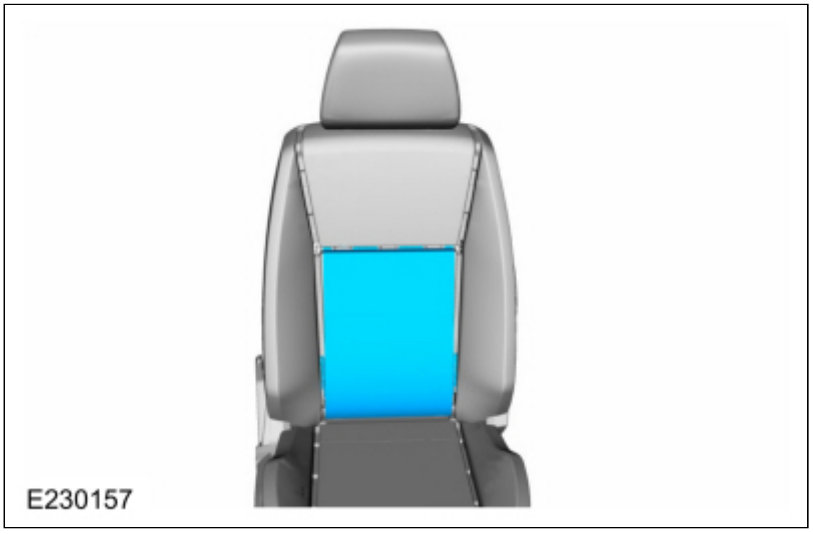
Front Seat Backrest Heater Mat

Base Part Number: 14C724

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seat Backrest Cover (501-10A) .
2.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seat Control Switch

Base Part Number: 14A701

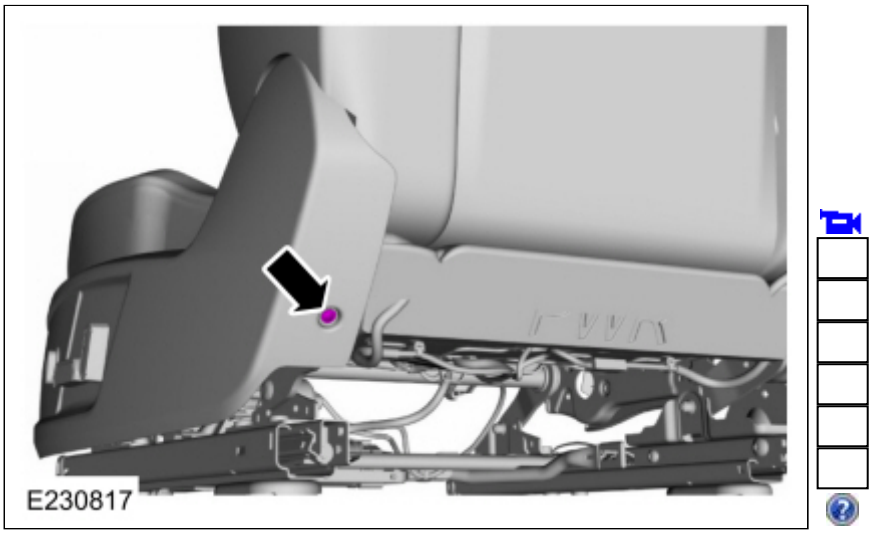
Special Tool(s) / General Equipment

Interior Trim Remover

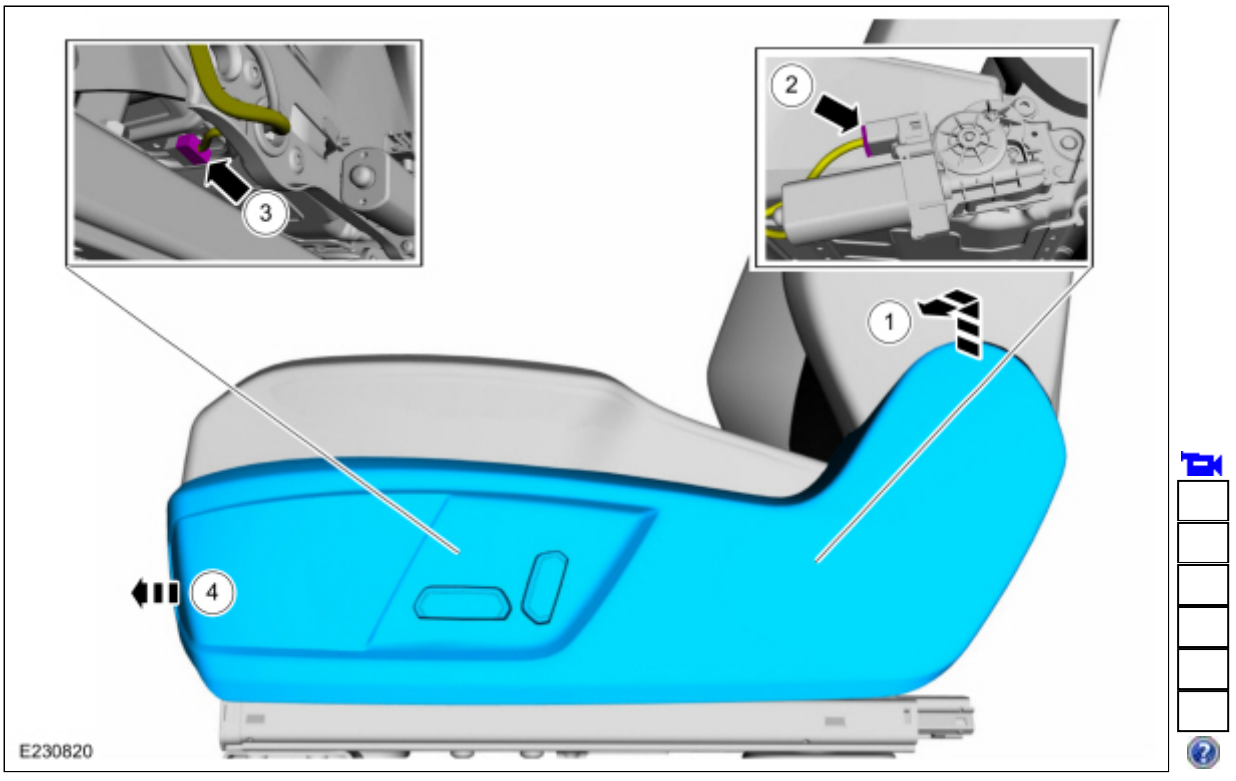
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

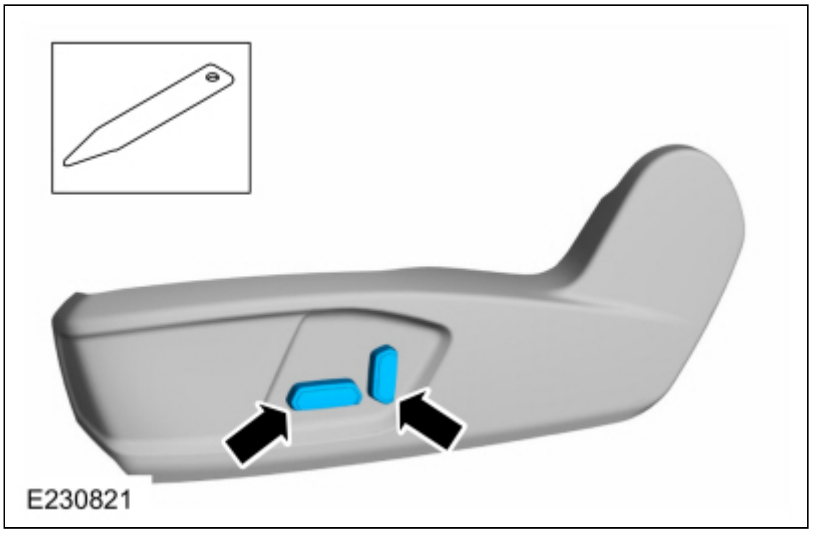
1. *Torque*: 3 Nm



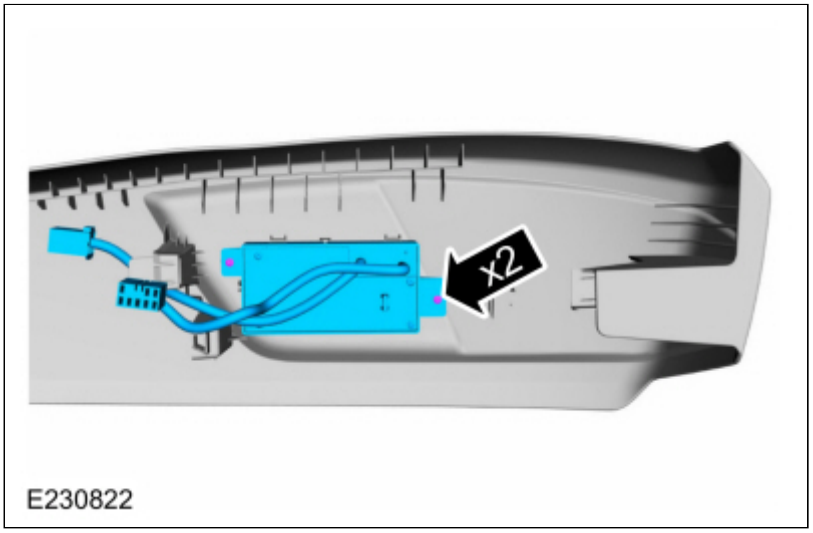
2.



3. Use the General Equipment: Interior Trim Remover



4. *Torque*: 1.3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seat Cushion

Base Part Number: 632A22

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seat Cushion Cover (501-10A) .
2.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

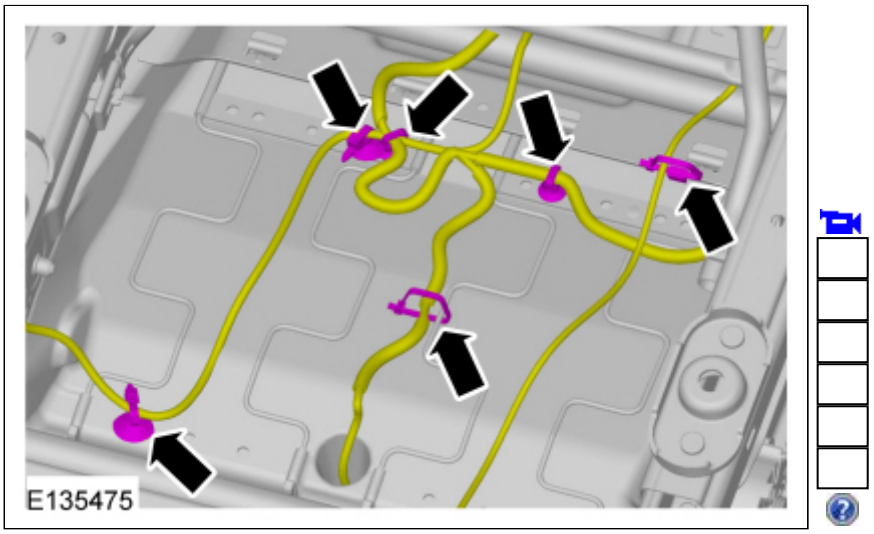
Front Seat Cushion Cover

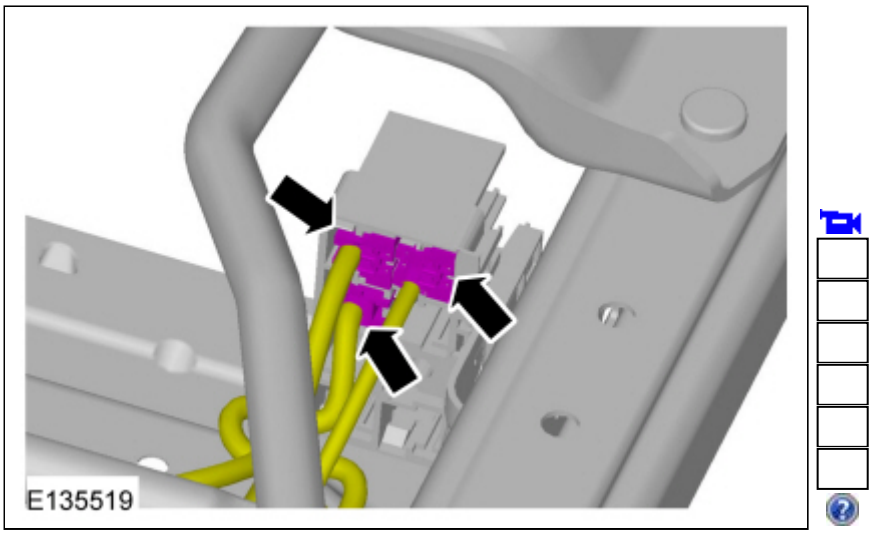
Special Tool(s) / General Equipment

Hog Ring Plier

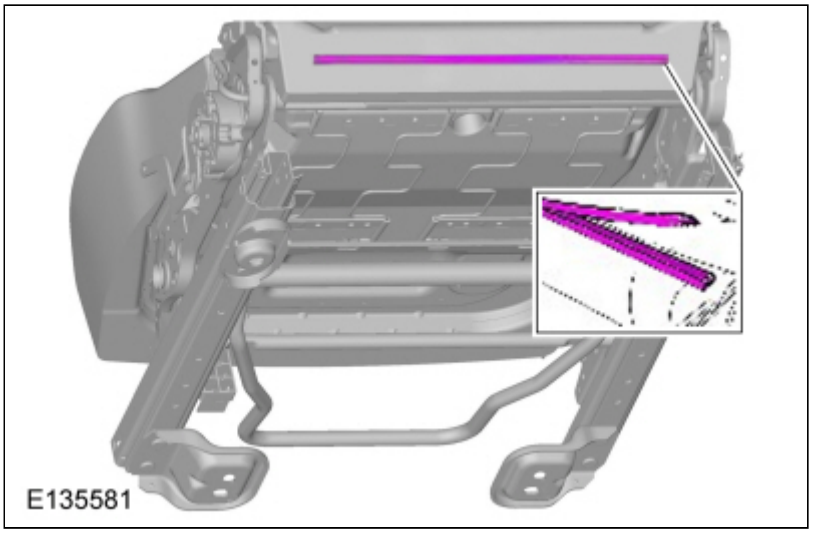
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

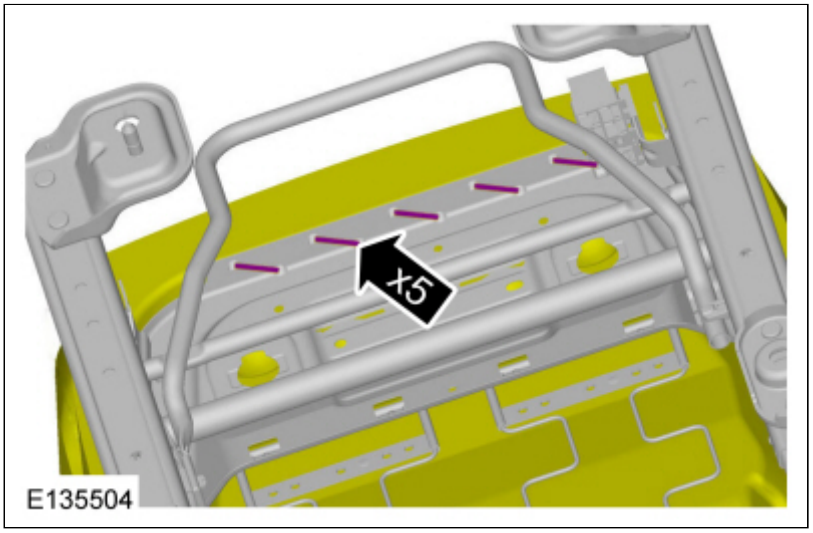
1. Refer to: Front Seat Backrest (501-10A Seating, Removal and Installation).
2. 

3. 

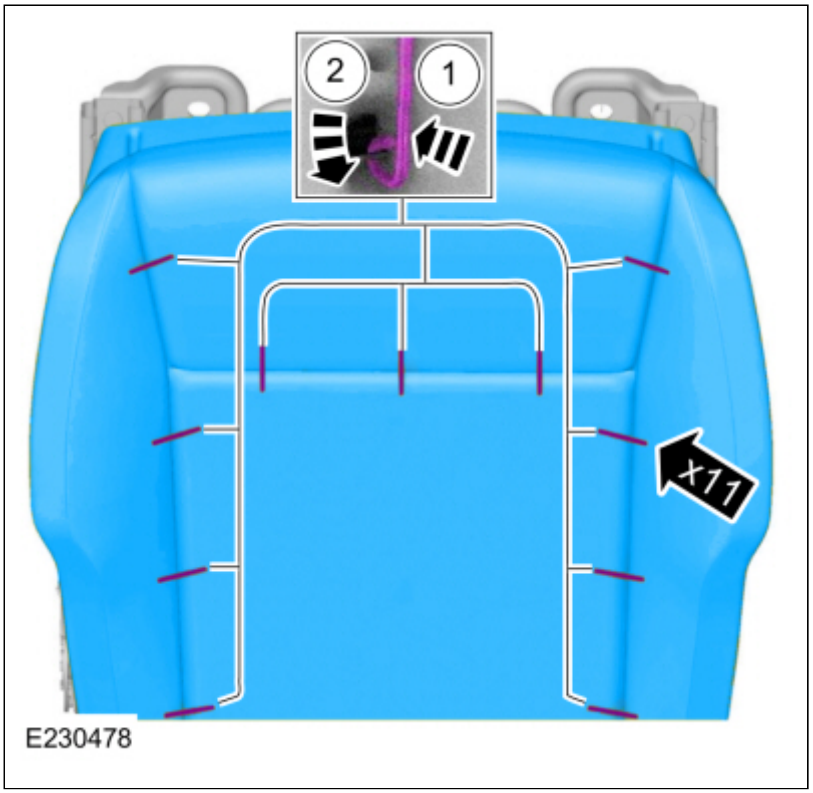
4.



5.

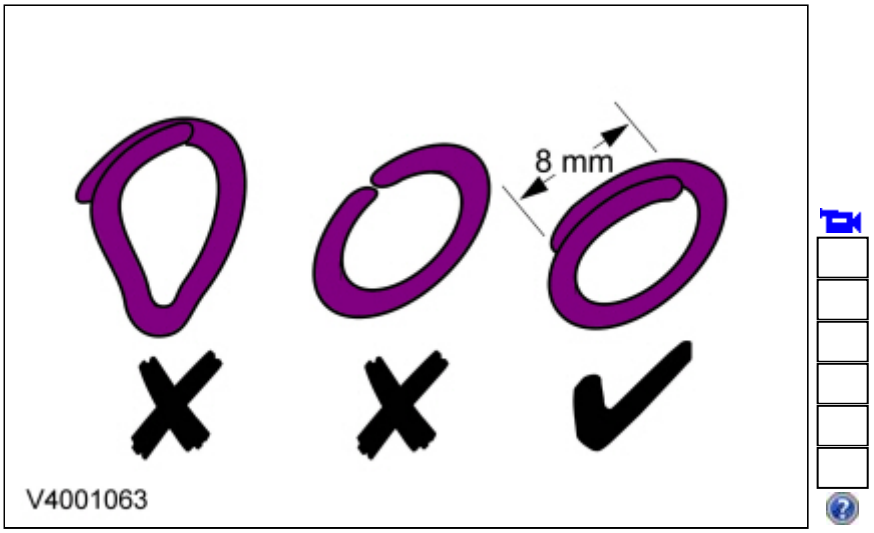


6.



Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier



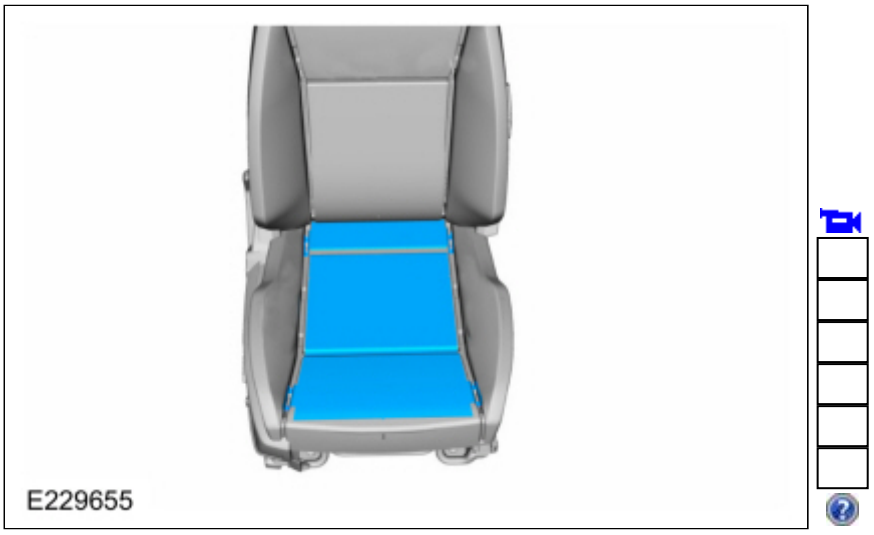
Copyright © 2016 Ford Motor Company

Front Seat Cushion Heater Mat

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seat Cushion Cover (501-10) .
2.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seat Track

Base Part Number: 61704

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seat Cushion (501-10A) .

Installation

1. To install, reverse the removal procedure.

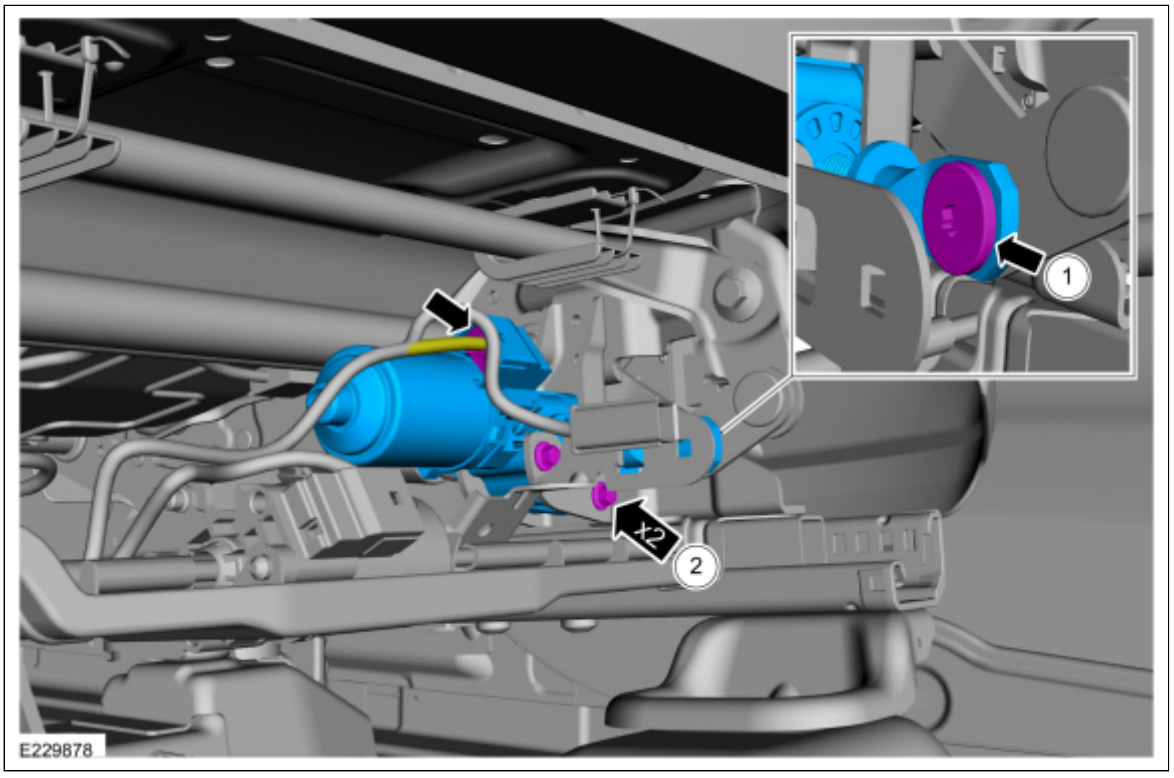
Copyright © 2016 Ford Motor Company

Front Seat Tilt Motor

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*:
   1.: 24 Nm
   2.: 2.5 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *Check for correct operation after installation.*

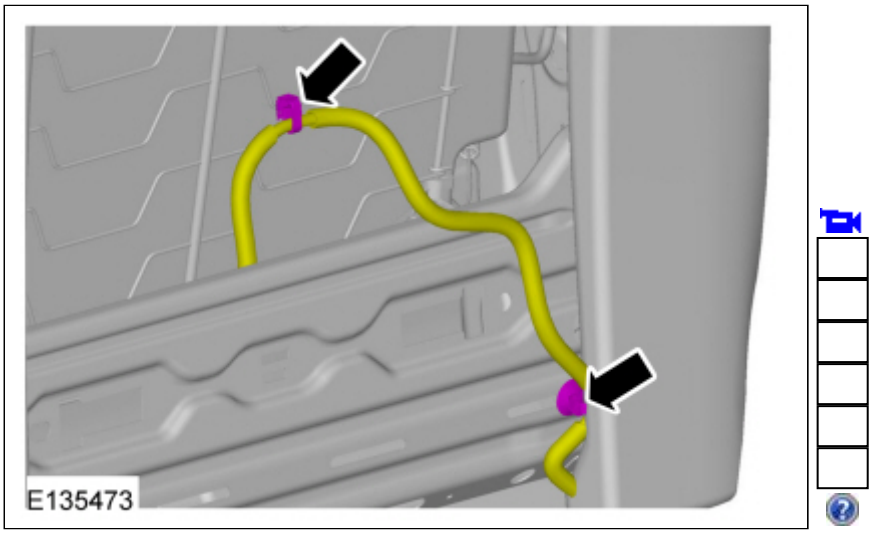
Copyright © 2016 Ford Motor Company

Front Seat Lumbar Assembly

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Front Seat Backrest Cover (501-10A) .
2.



Manual seat

3.



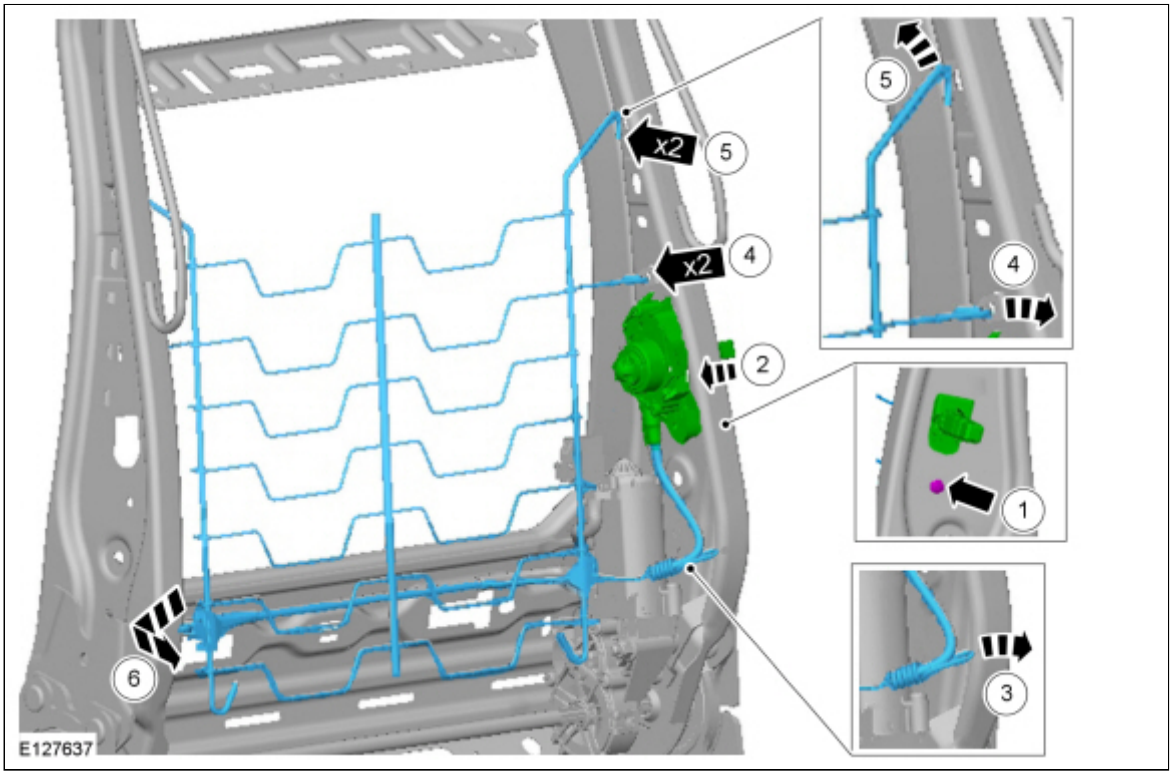
Power seat

4.



All seats

5. *Torque*: 3 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Head Restraint Guide Sleeve

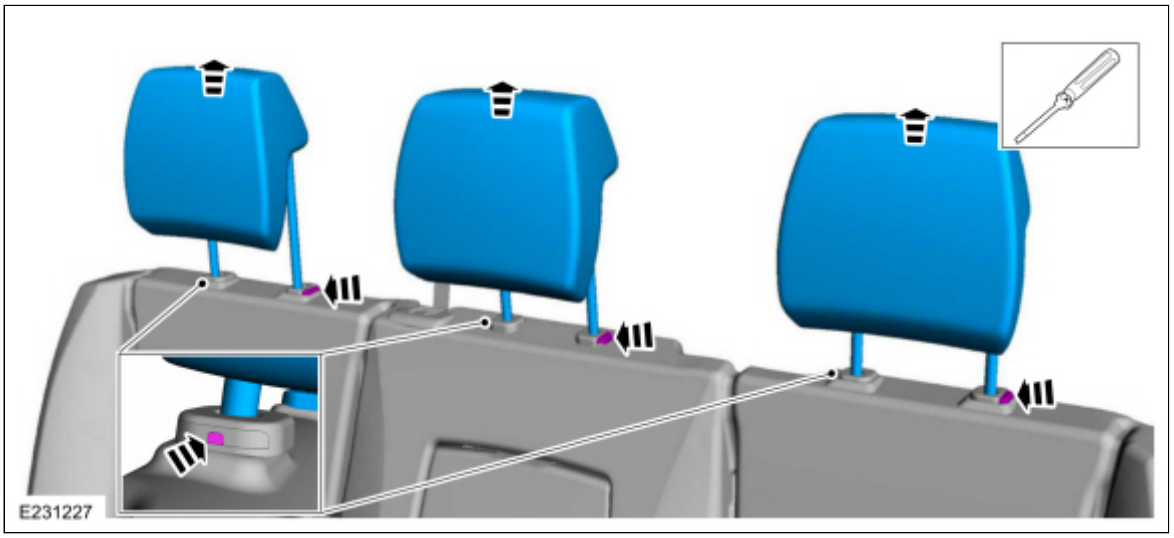
Special Tool(s) / General Equipment

Flat Headed Screw Driver

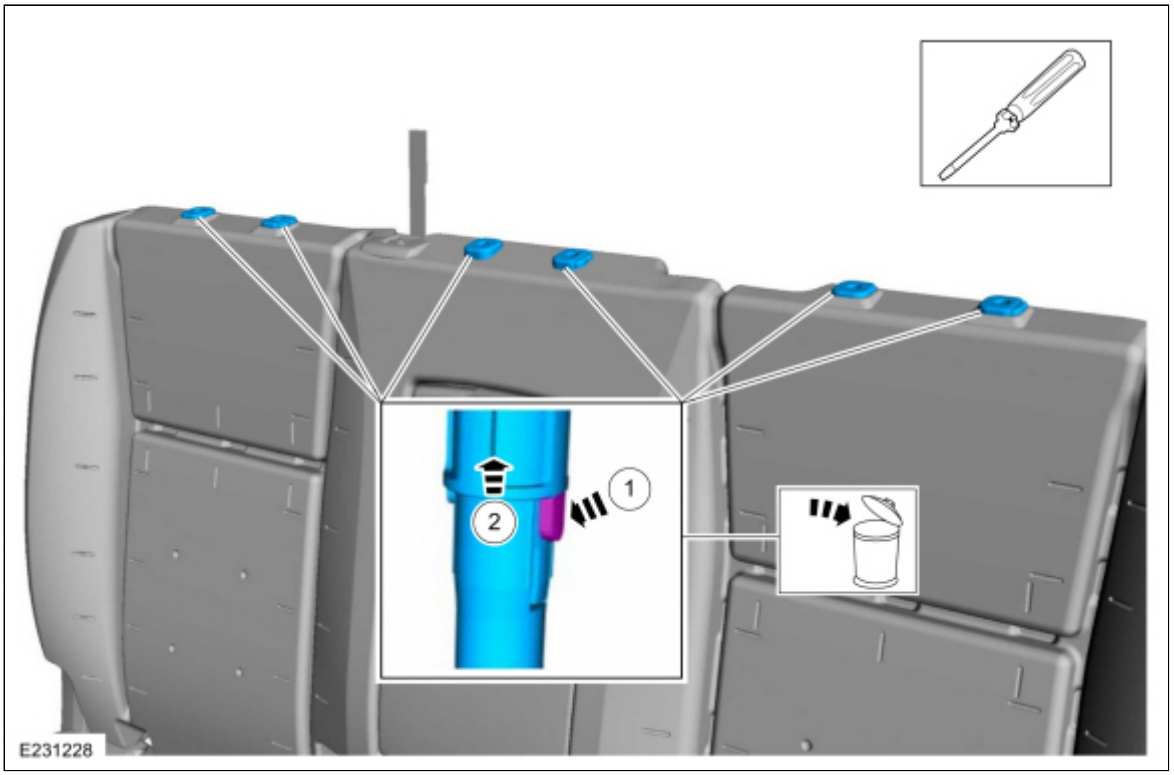
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Use the General Equipment: Flat Headed Screw Driver



2. Use the General Equipment: Flat Headed Screw Driver



Installation

1. To install, reverse the removal procedure.

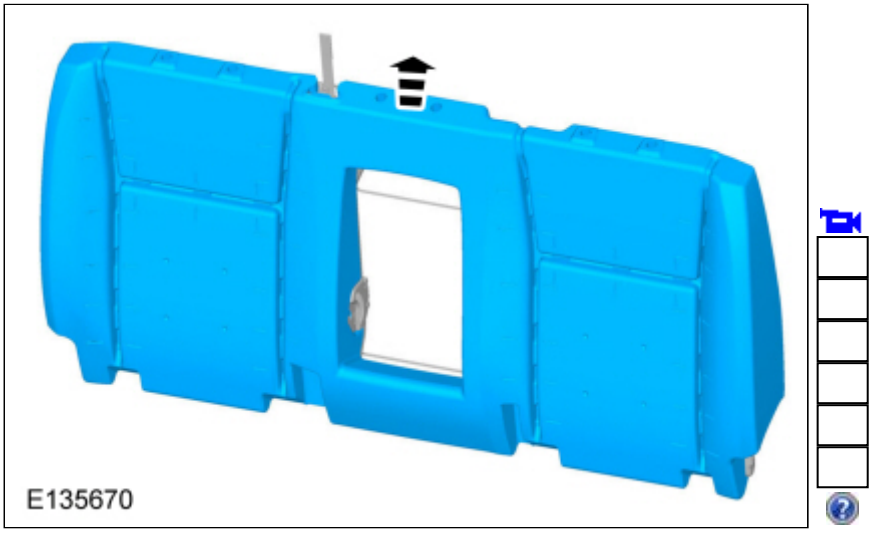
Copyright © 2016 Ford Motor Company

Rear Seat Backrest

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Rear Seat (501-10A Seating, Removal and Installation).
2. Refer to: Rear Seat Backrest Cover (501-10C Rear Seats, Removal and Installation).
3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Seat Backrest Cover

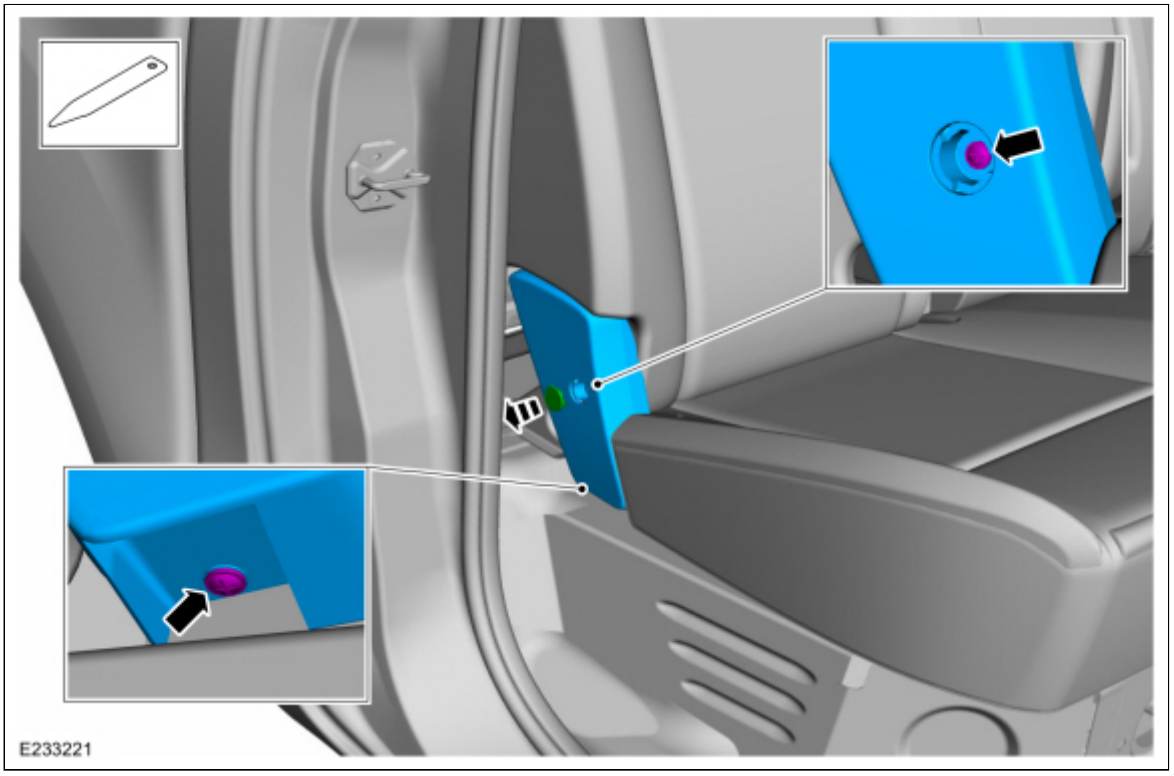
Special Tool(s) / General Equipment

Flat Headed Screw Driver
Interior Trim Remover
Hog Ring Plier

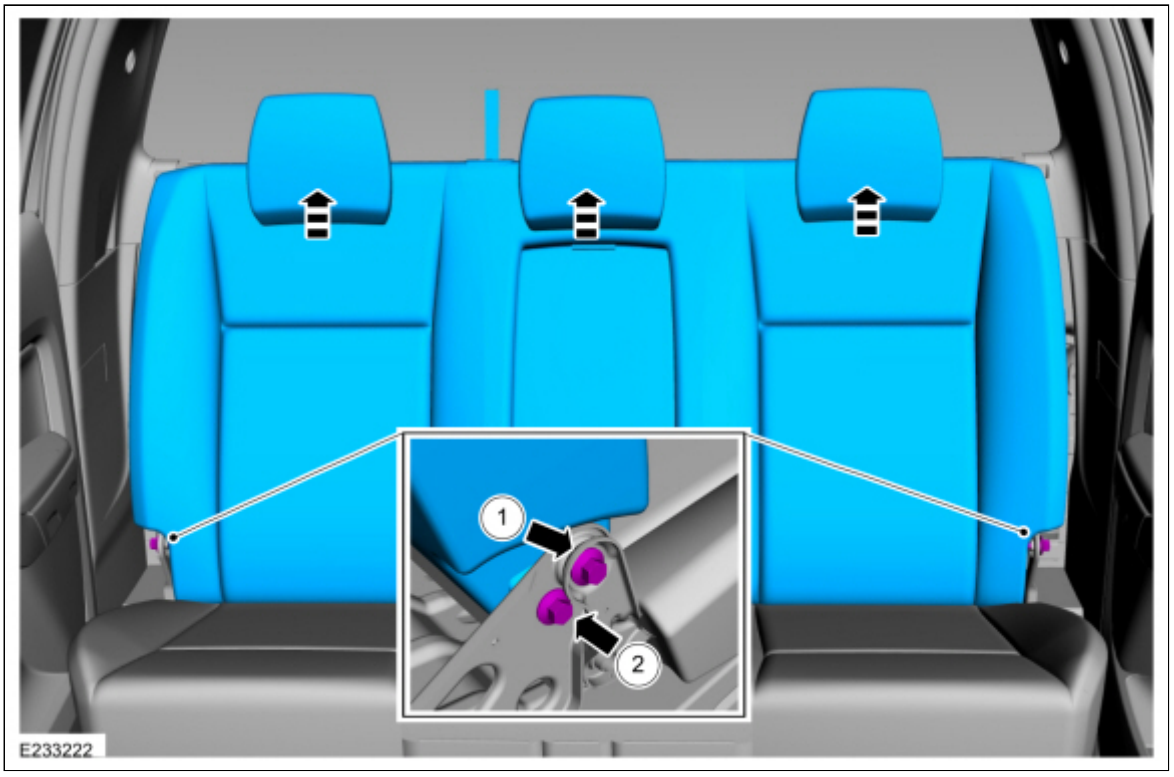
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

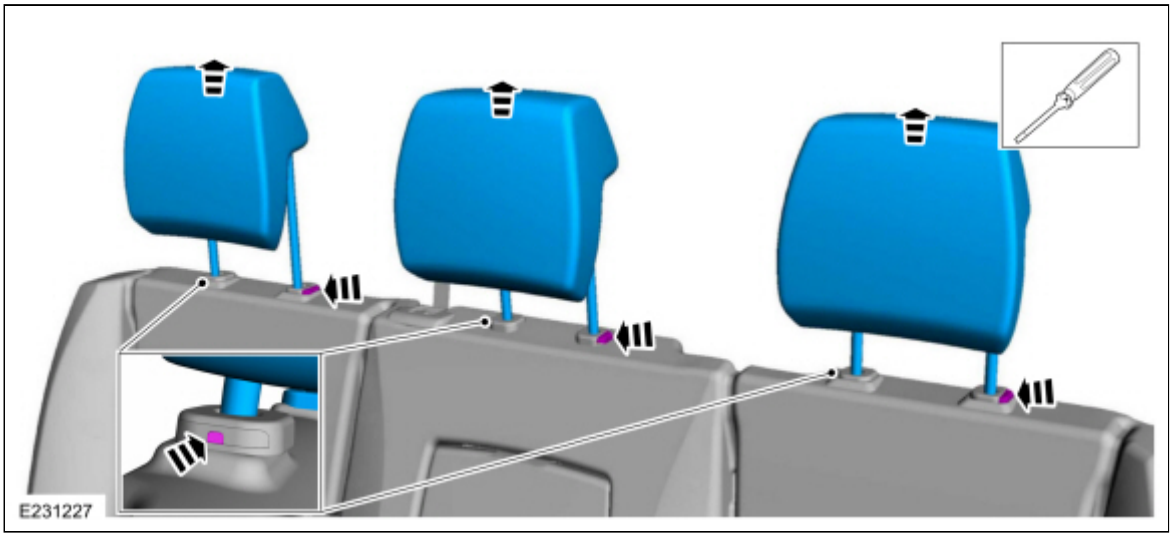
1. On both sides.
   Use the General Equipment: Interior Trim Remover
   Torque: 3.5 Nm



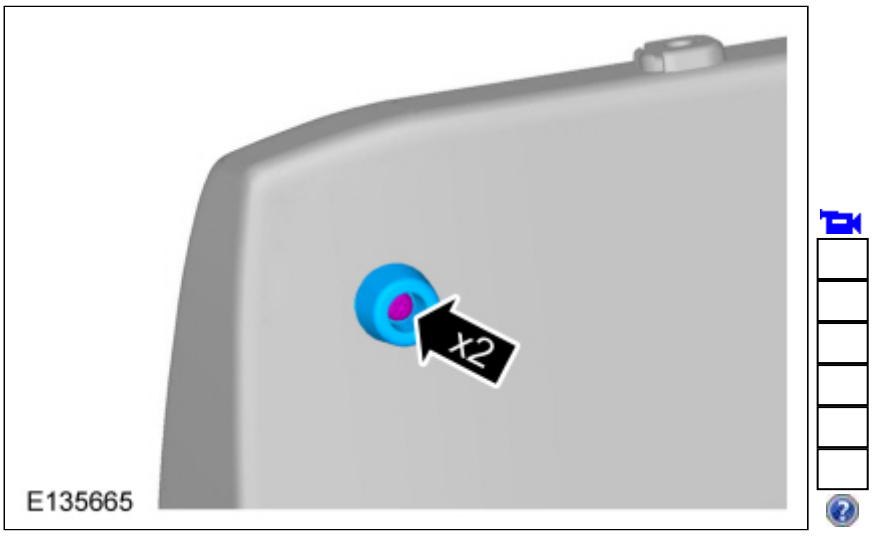
2. *Torque*:
   1.: 25 Nm
   2.: 25 Nm



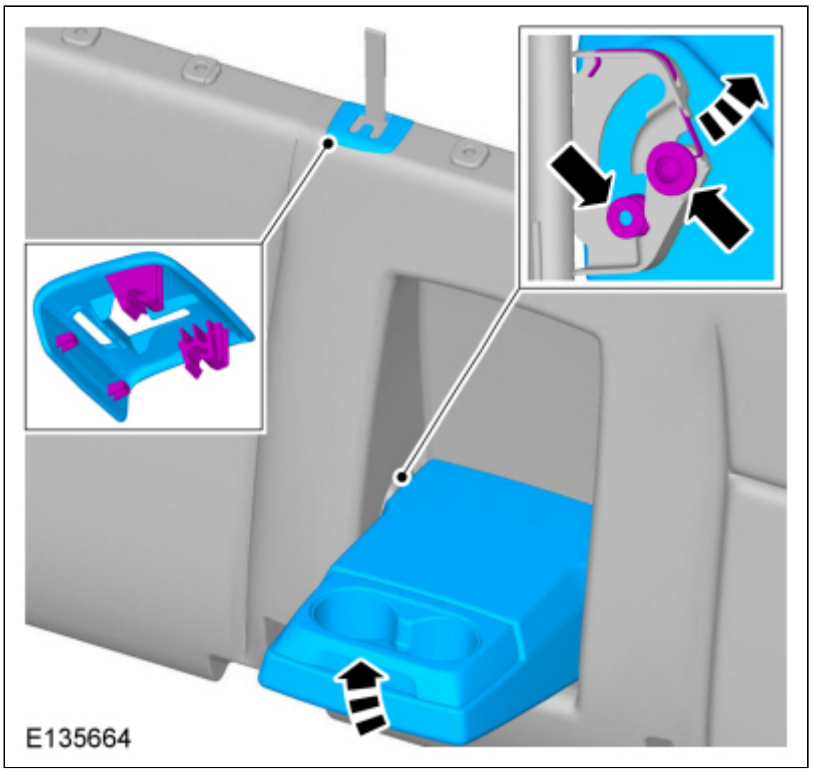
3. Use the General Equipment: Flat Headed Screw Driver



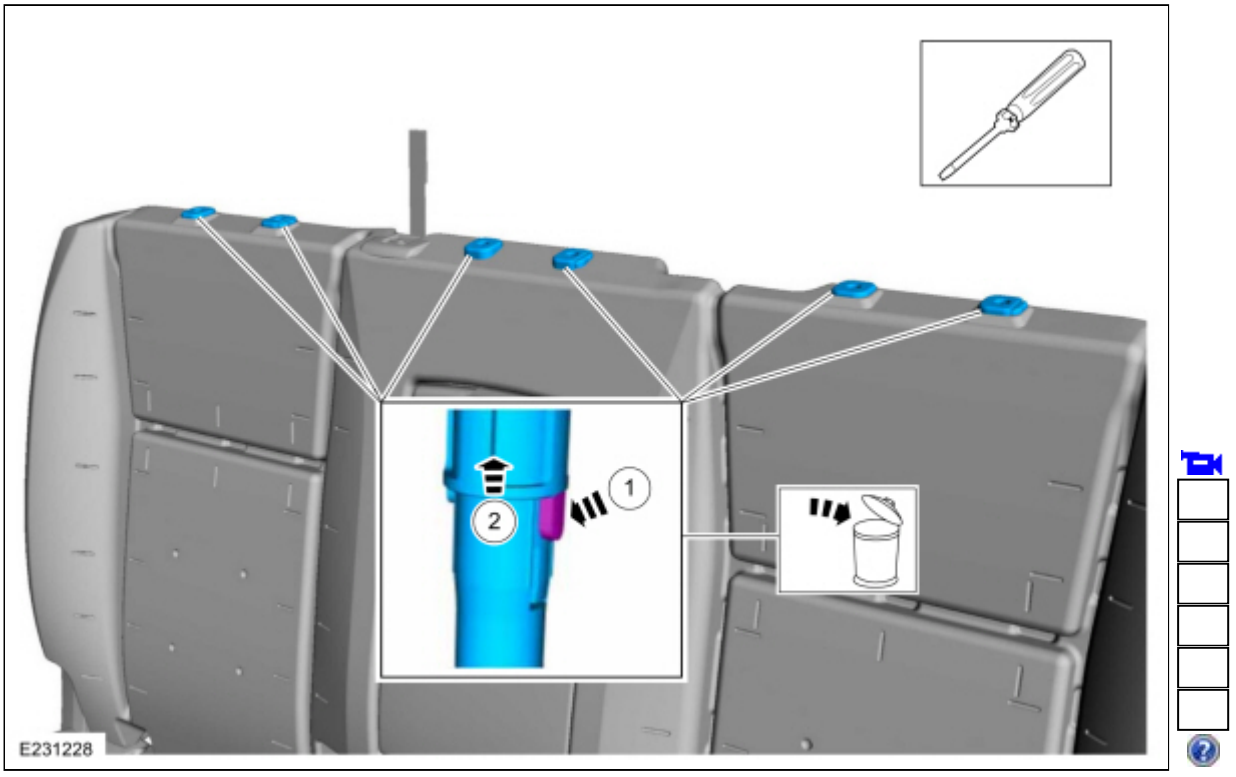
4. On both sides.
   Torque: 10 Nm



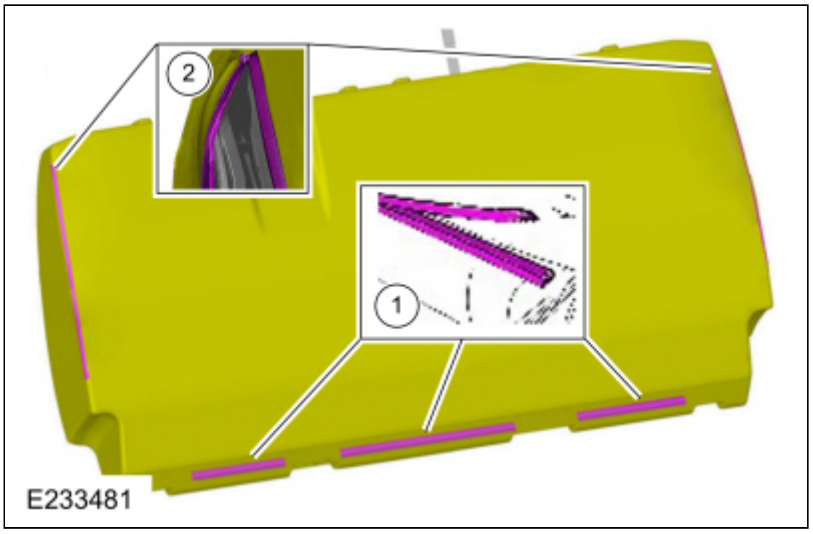
5.



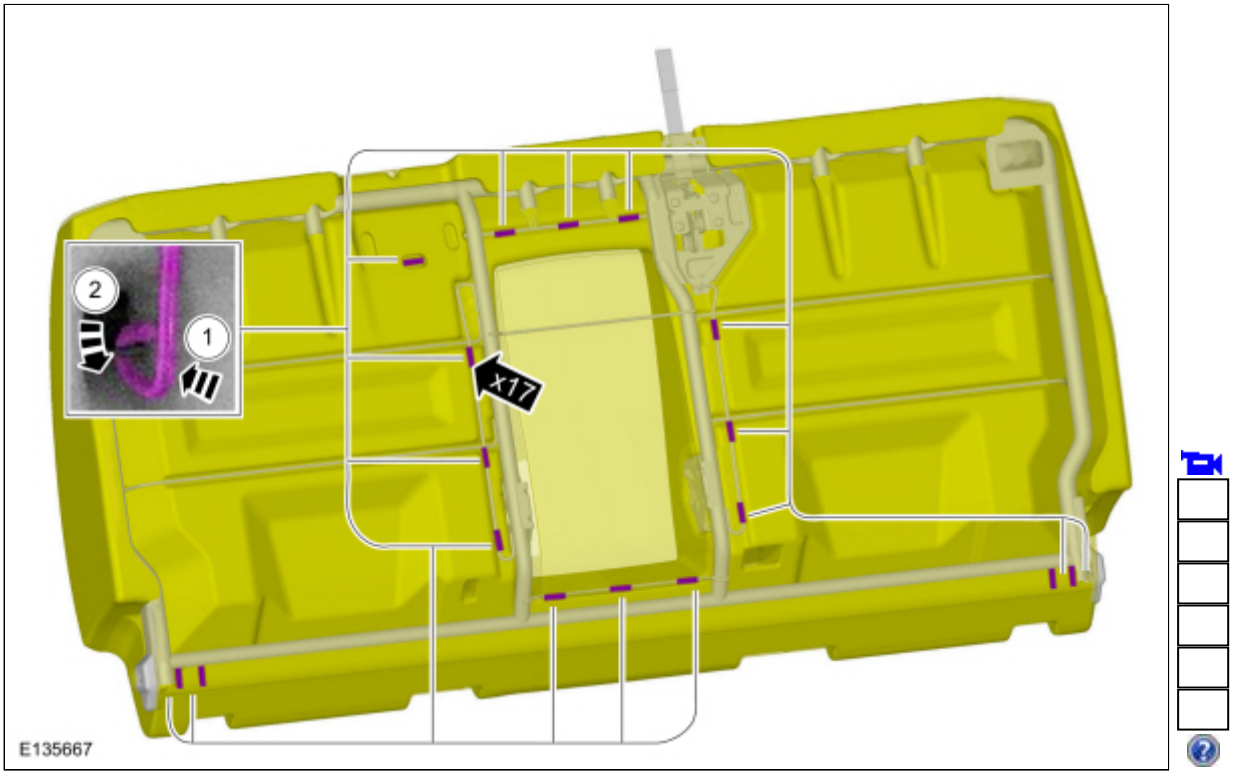
6. Use the General Equipment: Flat Headed Screw Driver



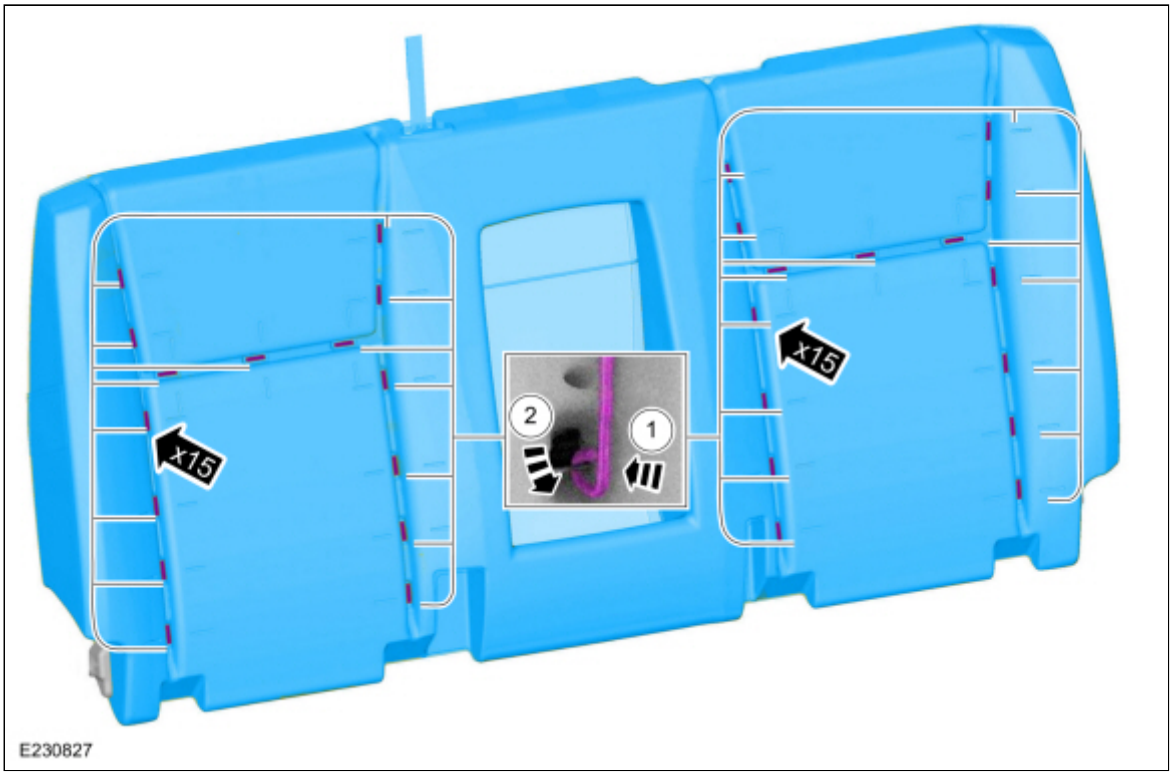
7.



8.

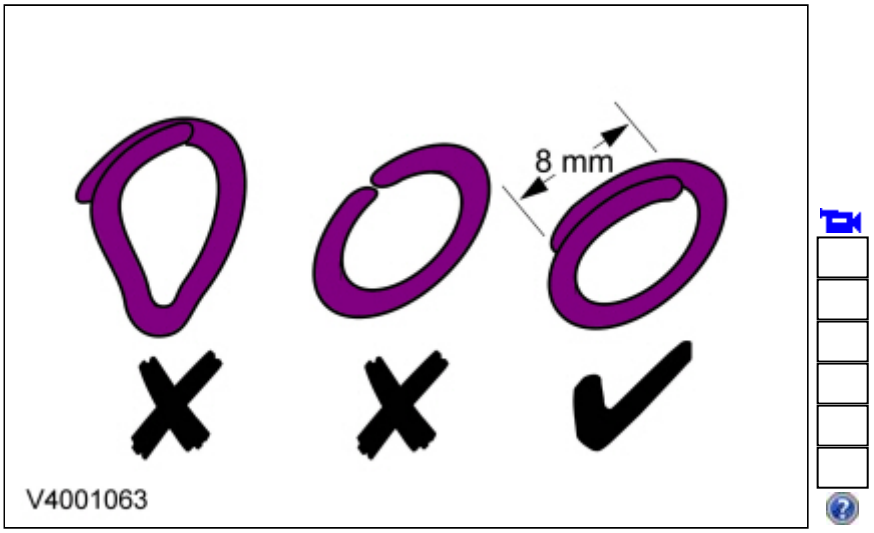


9.



Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier



Copyright © 2016 Ford Motor Company

Rear Seat Cushion

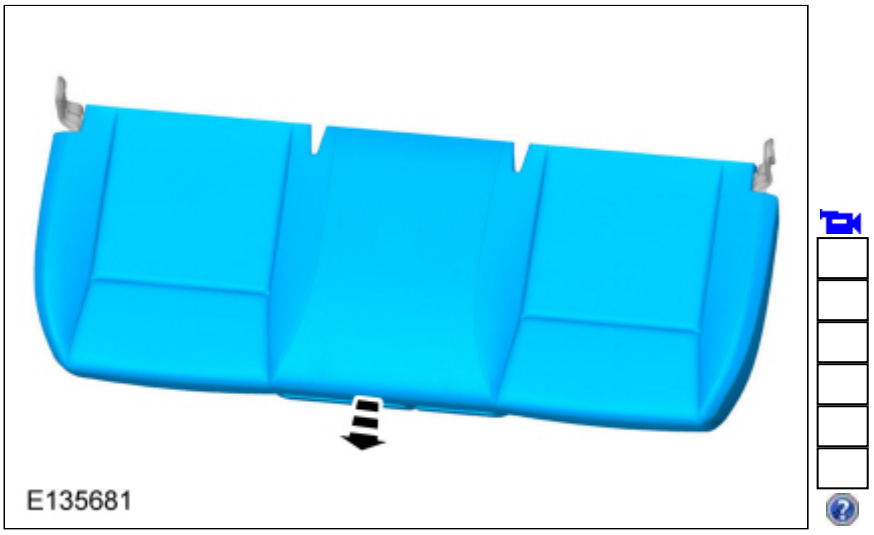
Special Tool(s) / General Equipment

Hog Ring Plier

Removal

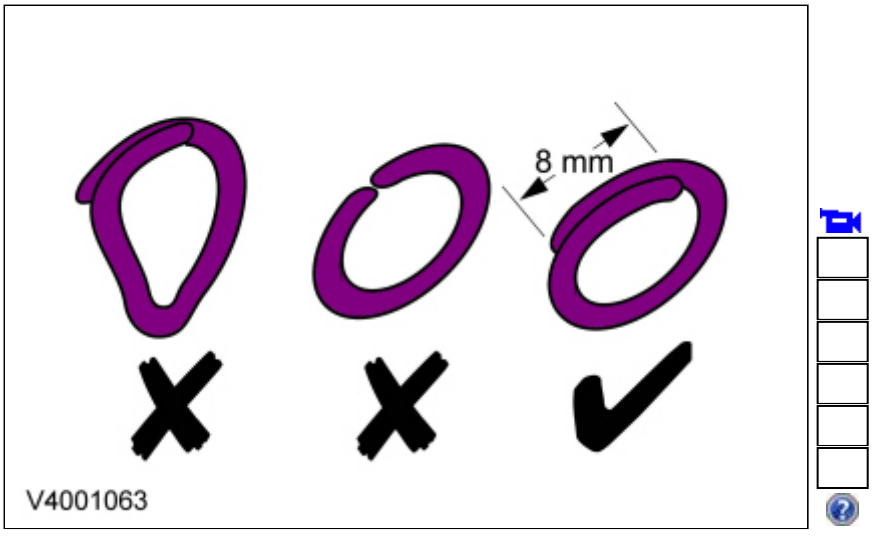
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Rear Seat Cushion Cover (501-10C Rear Seats, Removal and Installation).
2.



Installation

1. To instal, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier



Copyright © 2016 Ford Motor Company

Rear Seat Cushion Cover

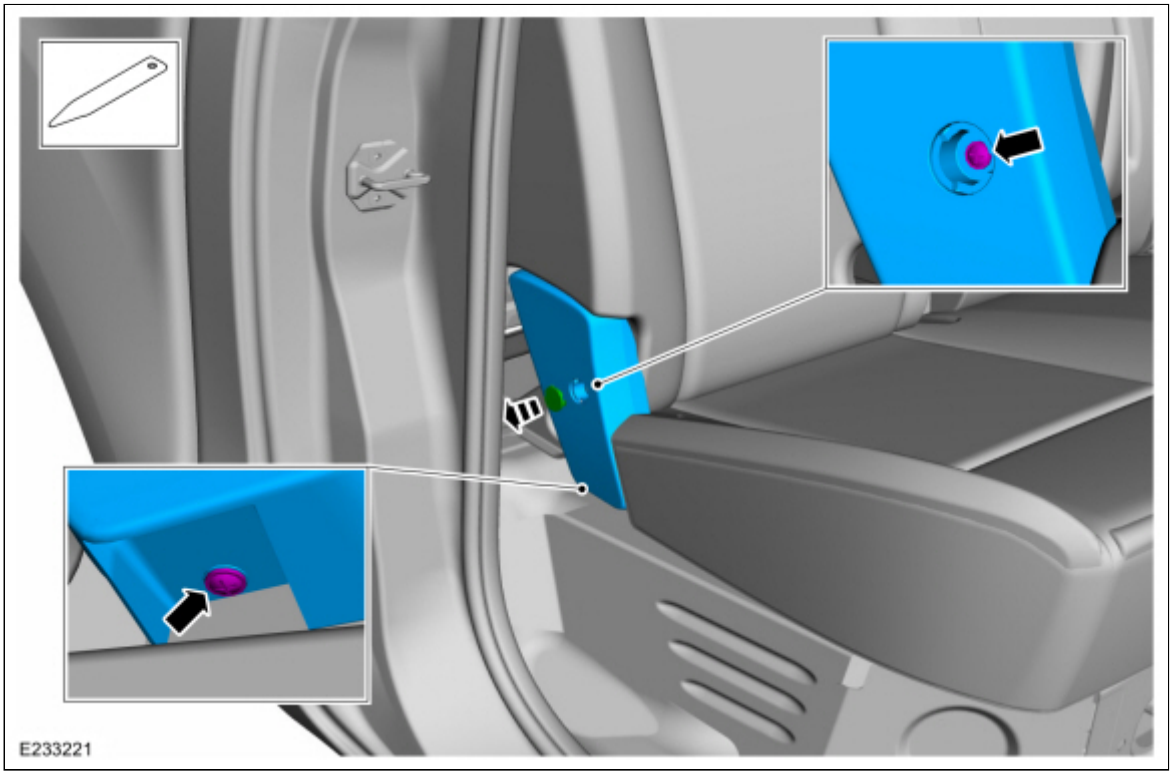
Special Tool(s) / General Equipment

Interior Trim Remover
Hog Ring Plier

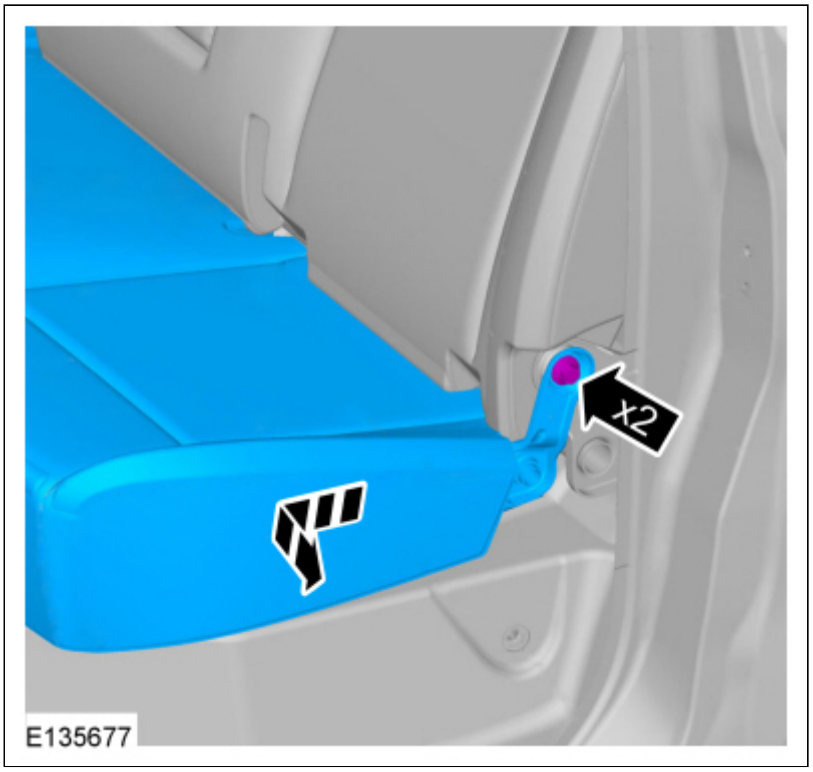
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

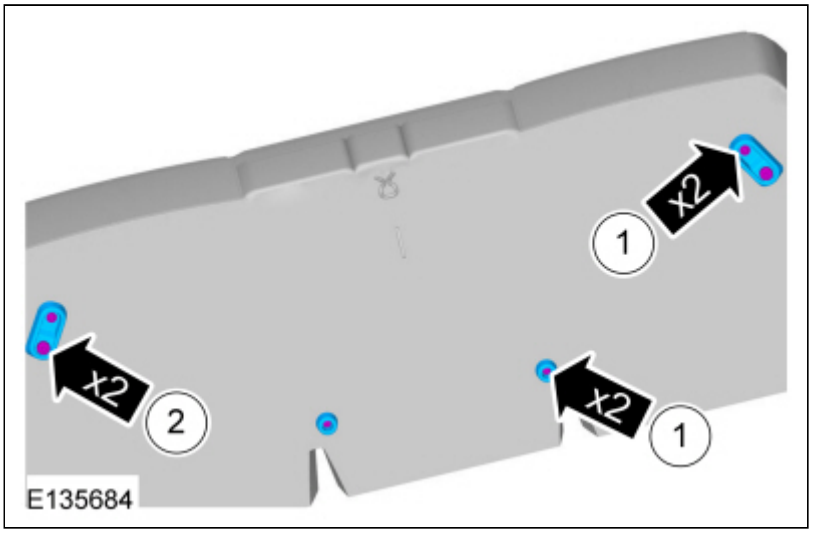
1. On both sides.
   Use the General Equipment: Interior Trim Remover
   Torque: 3.5 Nm



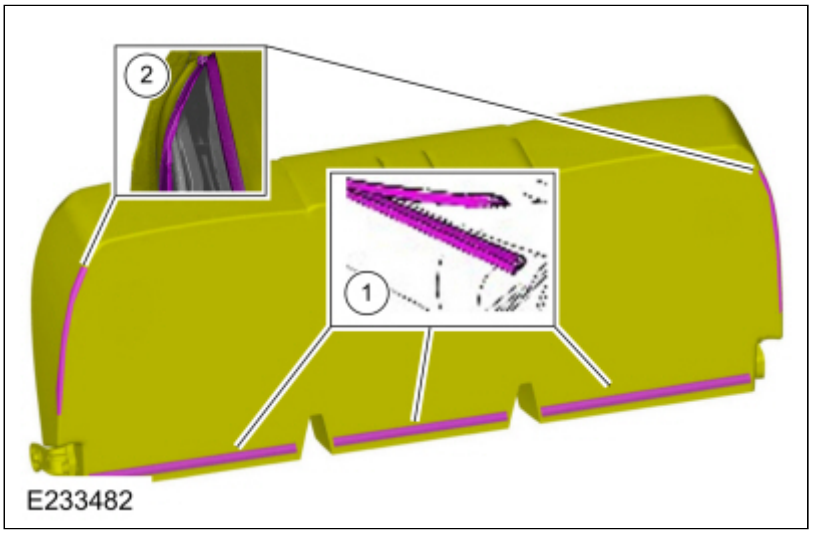
2. On both sides.
   Torque: 25 Nm



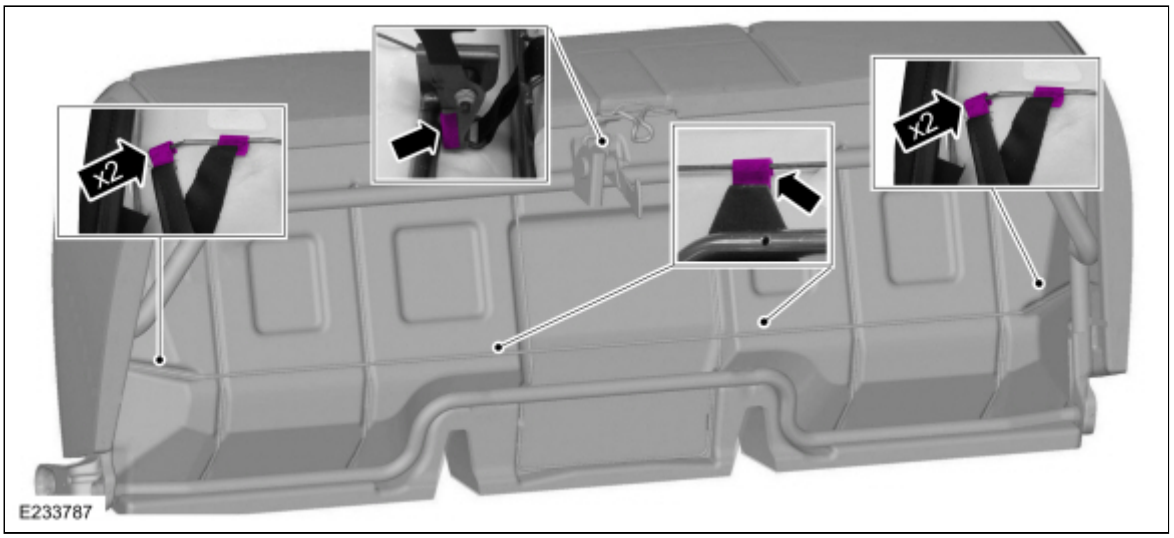
3. *Torque*:
   1.: 10 Nm
   2.: 8 Nm



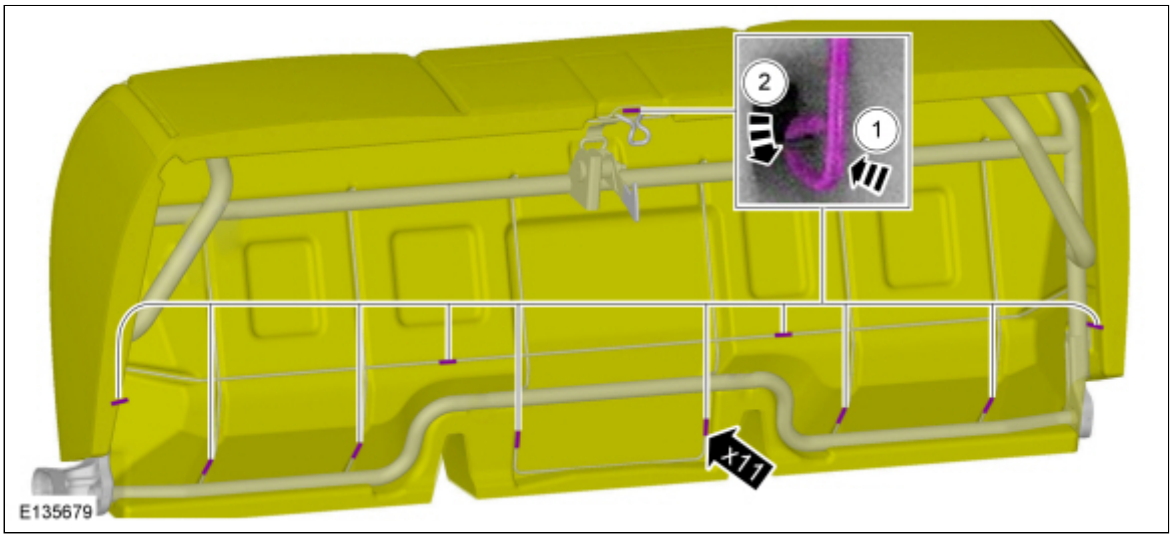
4.



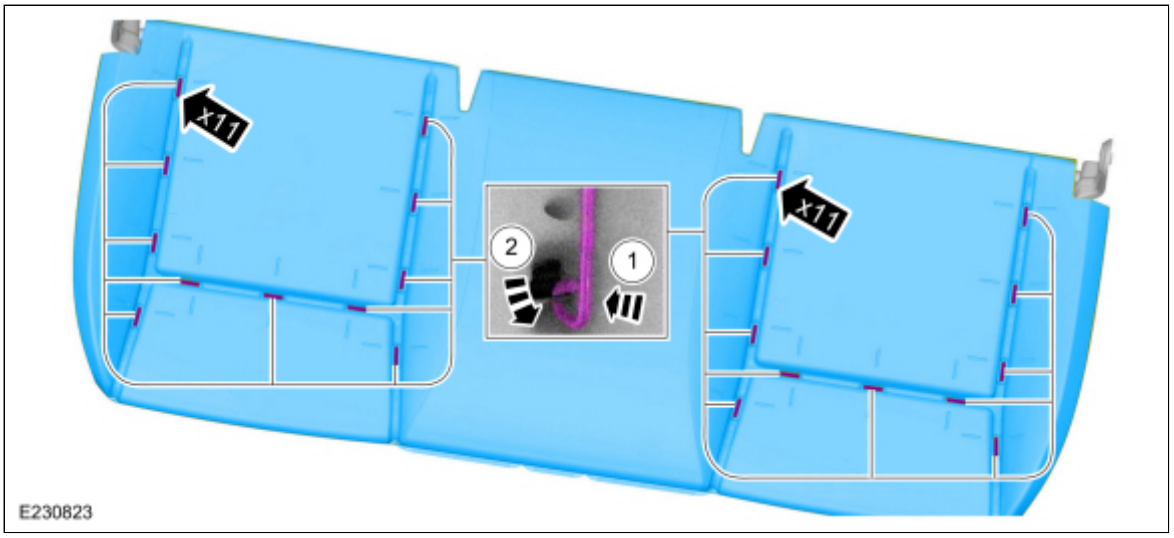
5.



6.

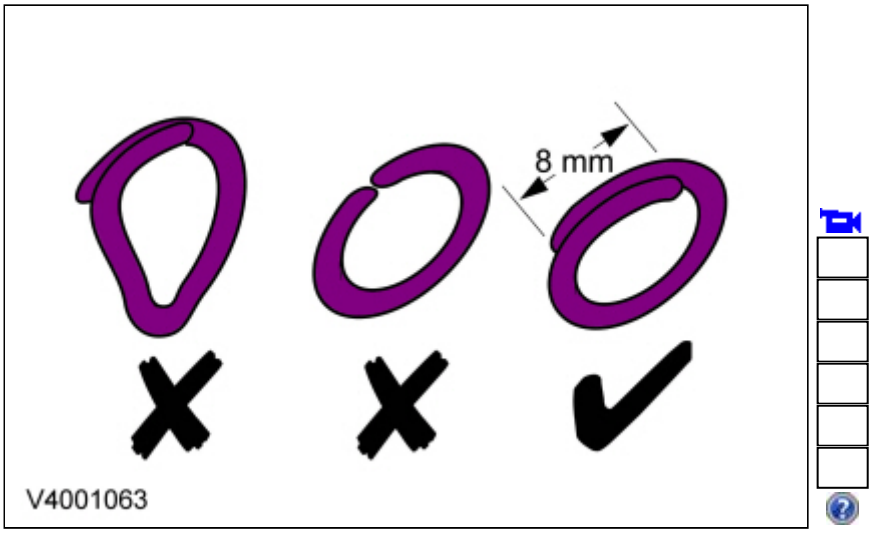


7.



Installation

1. To install, reverse the removal procedure.
2. Use the General Equipment: Hog Ring Plier



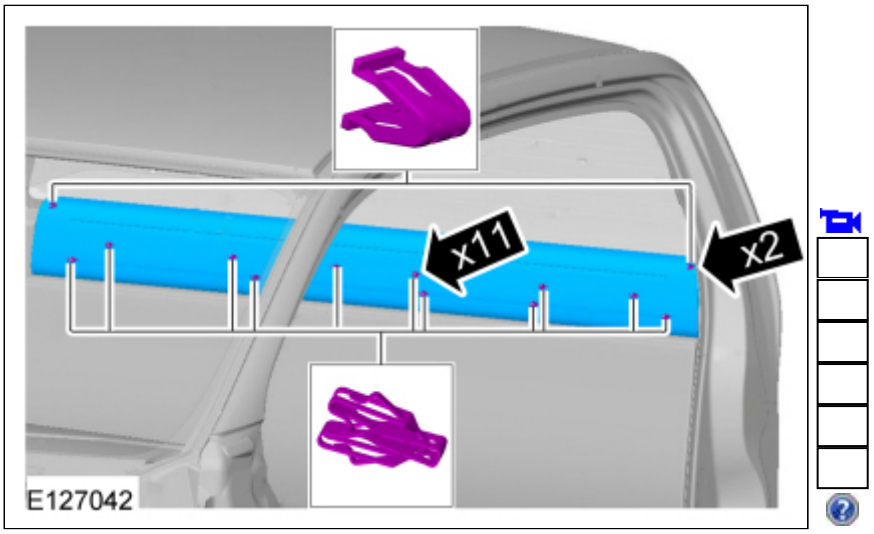
Copyright © 2016 Ford Motor Company

Rear Bench Seat Backrest

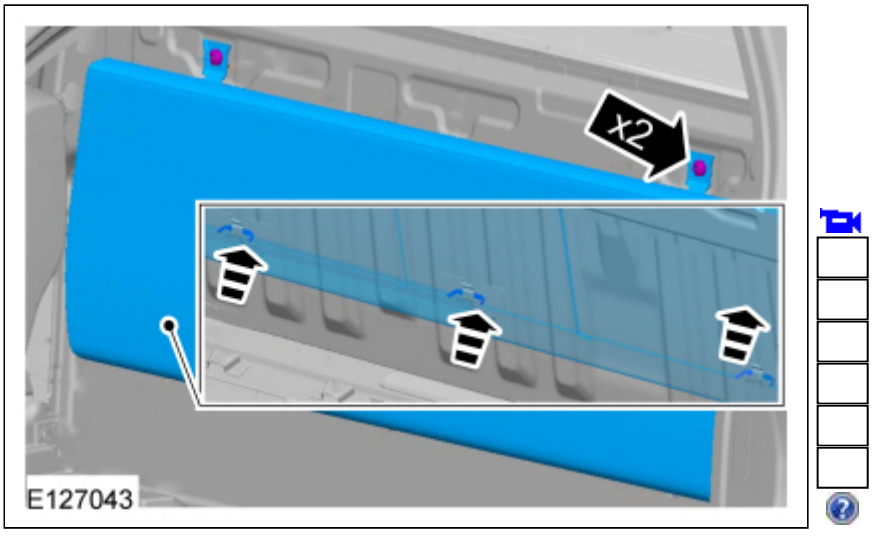
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



2. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Glass, Frames and Mechanisms - Overview

Overview

Power Windows

Standard front door power window features include one-touch up and one-touch down operation.

The window control switch:

- can be used to manually or automatically raise/lower all windows from the driver door window control switch or the individual passenger window from the corresponding door switch.
- has a rear passenger window lock-out feature (located on the driver door window control switch).

Rear Window Defrost

When the rear window defrost button (integral to the FCIM) is pressed, the FCIM activates the rear window defrost relay (integral to the BJB). When the rear window defrost relay is active, the rear window defrost grid is energized.

If equipped, the rear window defrost feature can also be activated/deactivated by using a touchscreen interface or voice commands.

Remote Start - Rear Window Defrost Operation (if equipped)

The customer can select different climate control modes/preferences when the vehicle is started using the remote start feature. This can be accessed through the message center. For additional information on setting the remote start preferences, refer to the Owner's Literature. When the rear window defrost is set to AUTO mode, the rear window defrost activates when the outside temperature is less than 0° C (32° F) and the vehicle is started using the remote start feature. No climate control adjustments are recognized during remote start operation. Once the ignition is cycled to the ON position, the climate control system returns to the previous settings (last ignition ON cycle) and adjustments can be made normally. If the previous setting was off, the climate control system turns off.

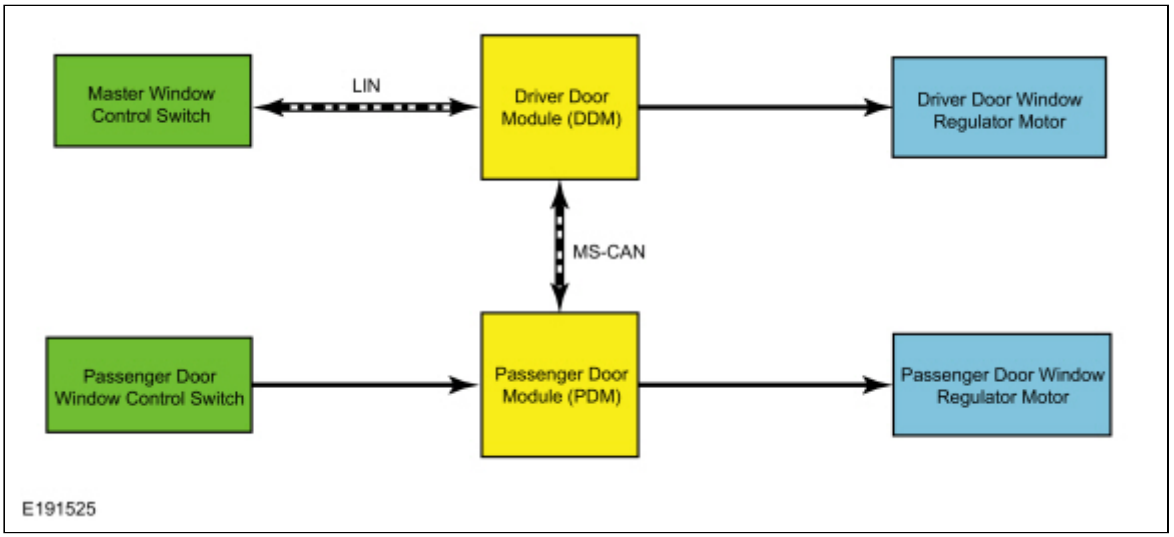
Copyright © 2016 Ford Motor Company

Glass, Frames and Mechanisms - System Operation and Component Description

System Operation

System Diagram - Power Windows

Front Power Windows

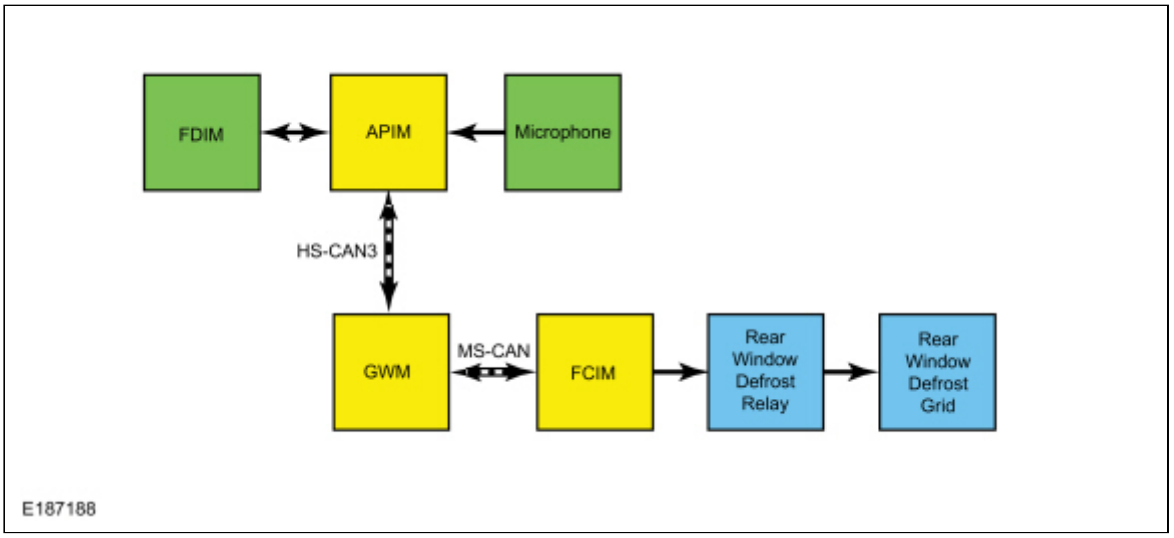


Network Message Chart - Front Power Windows

Passenger Door Module (PDM) Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Passenger window command	DDM	When activating the front passenger window from the master window control switch, the passenger window command is sent from the DDM to the PDM.

System Diagram - Rear Window Defrost



Network Message Chart - Rear Window Defrost

Front Controls Interface Module (FCIM) Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Climate control requests	APIM (if equipped with touchscreen)	The climate control requests message contains the rear window defrost request information. When the rear window defrost function is requested using voice command or the button is selected on the touchscreen, this input activates the rear window defrost system.

Power Window Operation - Front

NOTE: *If the vehicle battery is disconnected while the window is moving, the one-touch up and one-touch down feature (and obstacle detection) is disabled prior to initialization.*

Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

The power windows operate when the delayed accessory relay is active. The delayed accessory relay (non-serviceable) is located in the BCM. Both front windows are equipped with obstacle detection and one-touch up and one-touch down functionality. If an obstacle has been detected as the window glass is moving upward, the window motor automatically reverses direction and moves the glass downward.

Driver Door Window Operation

The master window control switch communicates to the DDM through a LIN. When commanded by the master window control switch, the DDM supplies power and ground to operate the driver door window regulator motor in the desired direction. The DDM monitors the window glass position through feedback from 2 Hall-effect sensors (integral to the driver door window regulator motor). If there is an issue with the Hall-effect sensor circuit(s), the DDM only moves the window in 500 ms intervals (the master window control switch must be released and activated again to move the window).

Passenger Door Window Operation

The master window control switch communicates to the DDM through a LIN. The DDM communicates to the PDM through the MS-CAN.

When commanded by the master window control switch or the passenger door window control switch, the PDM supplies power and ground to operate the passenger door window regulator motor in the desired direction. The PDM monitors window glass position through feedback from 2 Hall-effect sensors (integral to the passenger door window regulator motor). If there is an issue with the Hall-effect sensor circuit(s), the PDM only moves the window in 500 ms intervals (the passenger or master window control switch must be released and activated again to move the window).

Rear Door Window Operation

The rear window control switches contain 2 relays, which when at rest (inactive), provide a ground path to their respective power window motor circuit(s). The rear window control switches receive voltage (high current circuit) from the delayed accessory relay whenever it is active. When the rear window control switches receive a voltage signal from the master window control switch and/or when the rear door window control switch is activated, the rear door window control switch supplies high current voltage (and ground) to operate the power window motor in the desired direction.

Passenger Windows Lock-Out

When the lock-out switch (part of the master window control switch) is in the LOCK position, the rear passenger power windows only operate from the master window control switch.

Global Open

NOTE: *The global open feature may be enabled/disabled by the customer following a procedure listed in the Owner's Literature.*

The global open feature only activates when the ignition is off and the delayed accessory feature is not active. When the unlock button on the RKE transmitter is pressed and held, the windows begin opening.

Rear Window Defrost

When the rear window defrost switch (integral to the FCIM) is activated, the FCIM activates the rear window defrost relay (integral to the BJB).

If equipped, the rear window defrost can also be commanded on and off using voice commands or by touching the rear window defrost button located on the touchscreen interface (FDIM). For additional information on voice or touchscreen commanded features, refer to the Owner's Literature.

The FCIM deactivates the rear window defrost relay when one of these conditions is met:

- The rear window defrost switch is pressed when the feature is active.
- If equipped, the rear window defrost is commanded off using voice command or the touchscreen interface when the feature is active.
- Ignition state is changed from ON to OFF.
- A predetermined timer completes.
- Battery voltage has dropped below a specified threshold (load management strategy).

Component Description

Master Window Control Switch

The master window control switch receives voltage whenever the delayed accessory relay is active. The master window control switch is grounded through the DDM. The master window control switch communicates to the DDM through a LIN.

The master window control switch supplies low current voltage signal through momentary contacts to activate the internal relays within each of the rear passenger window control switches to operate the rear windows.

Passenger Door Window Control Switch

The passenger door window control switch contains momentary contacts (one for each window switch direction). The PDM provides a return (ground) for the passenger door window control switch. When the control switch is activated, a ground signal is supplied to the PDM to operate the passenger door window regulator motor in the desired direction.

Rear Door Window Control Switch

The rear window control switches receive voltage (high current circuit) from the delayed accessory relay whenever it is active. The rear window control switches receive voltage (low current circuit) from the master window control switch when the lock-out switch is in the UNLOCK position. The rear window control switches each have a dedicated ground circuit. The rear window control switches contain 2 relays, which when at rest (inactive), provide a ground path to their respective power window motor circuit(s).

When a rear window control switch is activated, the corresponding relay located within the rear window control switch is energized which supplies voltage (high current) to operate the power window motor in the desired direction.

Front Door Window Regulator Motor

The door window regulator motor is bi-directional. Window direction is determined by the polarity of the voltage being supplied to the motor from the associated door module. The door window regulator motor contains 2 Hall-effect sensors. The Hall-effect sensor power supply and return circuits are provided by the associated door module.

Rear Door Window Regulator Motor

The rear door window regulator motor is bi-directional. Window direction is determined by the polarity of the voltage and ground being supplied to the motor from the window control switch.

Front Controls Interface Module (FCIM)

The FCIM contains the rear window defrost button and also controls the rear window defrost relay. PMI is required if installing a new module.

Front Display Interface Module (FDIM)

The FDIM contains a redundant rear window defrost button on the touchscreen display. The FDIM plugs directly into the APIM, and does not communicate directly on any network.

Driver Door Module (DDM)

The DDM receives power window commands from the master window control switch through a LIN. The DDM supplies voltage and ground to operate the driver door window regulator motor.

The DDM also communicates master window control switch requests to the PDM through the Medium Speed Controller Area Network (MS-CAN) to operate the passenger door window regulator motor. PMI is required if installing a new module.

Passenger Door Module (PDM)

The PDM receives power window commands from the passenger door window control switch or from the DDM through the Medium Speed Controller Area Network (MS-CAN). The PDM supplies voltage and ground to operate the passenger door window regulator motor. PMI is required if installing a new module.

Copyright © 2016 Ford Motor Company

Glass, Frames and Mechanisms

DTC Chart: Front Controls Interface Module (FCIM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

FCIM DTC Chart

DTC	Description	Action
B1C83:12	Rear Defog Relay: Circuit Short to Battery	GO to Pinpoint Test A
B1C83:13	Rear Defog Relay: Circuit Open	• If the rear window defrost system is inoperative, GO to Pinpoint Test A • If the rear window defrost is always active, GO to Pinpoint Test B
All other Diagnostic Trouble Codes (DTCs)	-	Refer to the appropriate section in Group 415 for the procedure.

DTC Chart: Driver Door Module (DDM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DDM DTC Chart

DTC	Description	Action
B1088:83	LIN Bus "B": Value of Signal Protection Calculation Incorrect	GO to Pinpoint Test C
B1088:87	LIN Bus "B": Missing Message	GO to Pinpoint Test C
B117E:07	Front Power Window Up: Mechanical Failure	INITIALIZE the driver door window regulator motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).
B117E:92	Front Power Window Up: Performance or Incorrect Operation	INITIALIZE the driver door window regulator motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).
B1189:29	Front Window Position Sensor: Signal Invalid	GO to Pinpoint Test C
B12C5:71	Front Window Lifter Motor Up Relay: Actuator Stuck	GO to Pinpoint Test C
B12C8:71	Front Window Lifter Motor Down Relay: Actuator Stuck	GO to Pinpoint Test C
B13F1:4B	Driver Power Window Motor: Over Temperature	CLEAR the DTC. WAIT 10 minutes to allow the window motor to cool. INITIALIZE the driver door window regulator motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames

		and Mechanisms, General Procedures). VERIFY the DTC is no longer present. If the DTC returns, INSPECT the window seals, glass runs and window regulator for a binding condition. REPAIR as necessary.
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	GO to Pinpoint Test C
C1B14:15	Sensor Supply Voltage A: Circuit Short To Battery or Open	GO to Pinpoint Test C
U2013:24	Switch Pack: Signal Stuck High	INSTALL a new driver door window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

DTC Chart: Passenger Door Module (PDM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PDM DTC Chart

DTC	Description	Action
B117E:07	Front Power Window Up: Mechanical Failure	INITIALIZE the passenger door window regulator motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).
B117E:92	Front Power Window Up: Performance or Incorrect Operation	INITIALIZE the passenger door window regulator motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).
B1189:29	Front Window Position Sensor: Signal Invalid	GO to Pinpoint Test D
B12C5:71	Front Window Lifter Motor Up Relay: Actuator Stuck	GO to Pinpoint Test D
B12C8:71	Front Window Lifter Motor Down Relay: Actuator Stuck	GO to Pinpoint Test D
B13F2:4B	Passenger Power Window Motor: Over Temperature	WAIT 10 minutes to allow the window motor to cool. INITIALIZE the passenger door window regulator motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures). VERIFY the DTC is no longer present. If the DTC returns, INSPECT the window seals, glass runs and window regulator for a binding condition. REPAIR as necessary.
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	GO to Pinpoint Test D
C1B14:15	Sensor Supply Voltage A: Circuit Short To Battery or Open	GO to Pinpoint Test D
U2002:24	Switch: Signal Stuck High	GO to Pinpoint Test D
All other	-	

Diagnostic Trouble Codes (DTCs)		REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Glass, Frames and Mechanisms

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
Both front door power windows are inoperative from the master window control switch	• Wiring, terminals or connectors • Master window control switch • DDM	• DIAGNOSE any related DDM Diagnostic Trouble Codes (DTCs) first. REFER to the DDM DTC Chart in this section. • If there are no related Diagnostic Trouble Codes (DTCs) present, INSTALL a new driver door window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
Both rear passenger power windows are inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test H
A single power window is inoperative/does not operate correctly - LH front	• Refer to the Pinpoint Test	• GO to Pinpoint Test C
A single power window is inoperative/does not operate correctly - RH front	• Refer to the Pinpoint Test	• GO to Pinpoint Test D
A single power window is inoperative/does not operate correctly - LH rear	• Refer to the Pinpoint Test	• GO to Pinpoint Test F
A single power window is inoperative/does not operate correctly - RH rear	• Refer to the Pinpoint Test	• GO to Pinpoint Test G
The one-touch up feature is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test E
The global open function is inoperative	• Global open not enabled in the message	• VERIFY the global open feature (Remote Open) is enabled in the message center. REFER to the Owner's Literature. • VERIFY the RKE lock/unlock function operates correctly using all of the RKE transmitters. REFER to: Locks, Latches and Entry Systems (501-14 Handles,

	• center • RKE transmitter • Door window regulator motor not initialized	Locks, Latches and Entry Systems, Diagnosis and Testing). to diagnose any inoperative RKE transmitter(s). • INITIALIZE the inoperative door window regulator motor(s). REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).
The defrost system is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test A
The defrost system does not shut off automatically	• Refer to the Pinpoint Test	• GO to Pinpoint Test B
The defrost system does not respond to voice command only	• Refer to the Pinpoint Test	• VERIFY the rear window defrost operation using the instrument panel rear window defrost switch. If the rear window defrost is still inoperative, GO to Pinpoint Test A If the rear window defrost operates, DIAGNOSE the inoperative voice command system. Refer to the appropriate section in Group 415 for the procedure.
The defrost system does not respond to touchscreen command only	• Refer to the Pinpoint Test	• VERIFY the rear window defrost operation using the instrument panel rear window defrost switch. If the rear window defrost is still inoperative, GO to Pinpoint Test A If the rear window defrost operates, DIAGNOSE the inoperative touchscreen system. Refer to the appropriate section in Group 415 for the procedure.

Pinpoint Test(s)

The Defrost System is Inoperative

Refer to Wiring Diagrams Cell 56 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1C83:12	Rear Defog Relay: Circuit Short to Battery	This DTC sets when the FCIM detects a short to voltage on the rear window defrost relay control circuit.
B1C83:13	Rear Defog Relay: Circuit Open	This DTC sets when the FCIM detects an open on the rear window defrost relay control circuit.

Possible Causes

- Fuse
- Wiring, terminals or connectors
- Rear window defrost grid
- Rear window glass
- BJB

- FCIM

Visual Inspection and Diagnostic Pre-checks

- Verify BJB fuse 68 (40A) is OK.
- Inspect the rear window defrost grid and electrical connectors for damage.

PINPOINT TEST A : THE DEFROST SYSTEM IS INOPERATIVE

A1 CHECK THE REAR WINDOW DEFROST FUSE

- Ignition OFF.
- Inspect the BJB fuse 68 (40A).

Is the fuse OK?

Yes	GO to A2
No	REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

A2 CHECK THE REAR WINDOW DEFROST GRID VOLTAGE

- Ignition OFF.
- Disconnect: Heated Rear Window Element C402A.
- Start the engine.
- Activate the rear window defrost switch.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C402A-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A3
No	GO to A4

A3 CHECK THE REAR WINDOW DEFROST GRID GROUND

- Ignition OFF.
- Disconnect: Heated Rear Window Element C402B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C402B-1	Ω	Ground

Is the resistance less than 3 ohms?

Yes	CARRY OUT the Grid Wire Test. REFER to Grid Wire Test. REPAIR the rear window defrost grid or INSTALL a new rear window glass. REFER to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit.

A4 CHECK THE REAR WINDOW DEFROST RELAY CONTROL CIRCUIT FOR VOLTAGE

A4 CHECK THE REAR WINDOW DEFROST RELAY CONTROL CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect: FCIM C2402A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-7	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A6
No	GO to A5

A5 CHECK THE REAR WINDOW DEFROST RELAY CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: BJB C1035A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2402A-7	Ω	C1035A-32

Is the resistance less than 3 ohms?

Yes	INSTALL a new BJB.
No	REPAIR the circuit.

A6 CHECK THE REAR WINDOW DEFROST RELAY OPERATION

- **NOTE:** *If the jumper wire fuse fails when it is connected, refer to the Wiring Diagrams manual to identify the possible causes of the circuit short to voltage.*

  Connect a fused jumper wire:

Positive Lead	Measurement / Action	Negative Lead
C2402A-7		Ground

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C402A-1	V	Ground

Is the voltage greater than 11 volts?

Yes	REMOVE the fused jumper wire. GO to A8
No	REMOVE the fused jumper wire. GO to A7

A7 CHECK THE REAR WINDOW DEFROST RELAY OUTPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: BJB C1035A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1035A-4	Ω	C402A-1

Is the resistance less than 3 ohms?

Yes	INSTALL a new BJB.
No	REPAIR the circuit.

A8 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCIM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors and all previously disconnected rear window defrost system connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Defrost System Does Not Shut Off Automatically

Refer to Wiring Diagrams Cell 56 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1C83:13	Rear Defog Relay: Circuit Open	This DTC sets when the FCIM detects an open on the rear window defrost relay control circuit.

Possible Causes

- Wiring, terminals or connectors
- BJB
- FCIM

PINPOINT TEST B : THE DEFROST SYSTEM DOES NOT SHUT OFF AUTOMATICALLY

B1 CHECK THE FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect: Heated Rear Window Element C402A.
- Disconnect: FCIM C2402A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C402A-1		Ground

Is any voltage present?

Yes	GO to B2
No	GO to B4

B2 CHECK THE REAR WINDOW DEFROST RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: BJB C1035A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1035A-32	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B3
No	REPAIR the circuit.

B3 CHECK THE REAR WINDOW DEFROST RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1035A-4		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	INSTALL a new BJB.

B4 CHECK FOR CORRECT FCIM (FRONT CONTROLS INTERFACE MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the FCIM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the FCIM connectors and all previously disconnected rear window defrost system connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new FCIM. Refer to the appropriate section in Group 415 for the procedure.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Single Power Window Is Inoperative/Does Not Operate Correctly - LH Front

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1088:83	LIN Bus "B": Value of Signal Protection Calculation Incorrect	This DTC sets when the DDM has received invalid data from the driver door window control switch.
B1088:87	LIN Bus "B": Missing Message	This DTC sets when the DDM has lost communication from the driver door window control switch.
B1189:29	Front Window Position Sensor: Signal Invalid	This DTC sets when the DDM detects a difference with one or both of the Hall-effect sensor circuits. When this DTC is present, the front window only operates in short steps.
B12C5:71	Front Window Lifter Motor Up Relay: Actuator Stuck	This DTC sets when the DDM detects the UP relay (integral to the DDM) is stuck or a short to voltage is present in the UP window motor circuit. When this DTC is present, the front window does not operate.
B12C8:71	Front Window Lifter Motor Down Relay: Actuator Stuck	This DTC sets when the DDM detects the DOWN relay (integral to the DDM) is stuck or a short to voltage is present in the DOWN window motor circuit. When this DTC is present, the front window does not operate.
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	This DTC sets when the DDM detects a short to ground in the Hall-effect sensor power supply circuit. When this DTC is present, the front window only operates in short steps.

C1B14:15	Sensor Supply Voltage A: Circuit Short To Battery or Open	This DTC sets when the DDM detects a short to voltage or open in the Hall-effect sensor power supply circuit. When this DTC is present, the front window only operates in short steps.

Possible Causes

- Wiring, terminals or connectors
- Master window control switch
- Driver door window regulator motor
- DDM

Visual Inspection and Diagnostic Pre-checks

- Verify BCM fuse 23 (10A) is OK.

PINPOINT TEST C : A SINGLE POWER WINDOW IS INOPERATIVE/DOES NOT OPERATE CORRECTLY-LH FRONT

C1 CHECK FOR DDM (DRIVER DOOR MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform DDM self-test.

Are any DDM Diagnostic Trouble Codes (DTCs) present?

Yes	For DTC C1B14:11, GO to C9 For DTC B1189:29 or C1B14:15, GO to C7 For DTC B12C5:71 or B12C8:71, GO to C3 For DTC B1088:83 and B1088:87, GO to C14 For all other Diagnostic Trouble Codes (DTCs), REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
No	GO to C2

C2 CHECK THE FRONT LEFT DOOR WINDOW SWITCH (FL_WDW) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view DDM Parameter Identifications (PIDs).
- Monitor the DDM PID FL_WDW while pressing and releasing the driver door window control switch in the up and down positions.

Does the PID status agree with the driver door window control switch as it is pressed and released?

Yes	GO to C3
No	INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

C3 CHECK FOR A SHORT TO VOLTAGE IN THE WINDOW UP/DOWN CIRCUITS

- Ignition OFF.
- Disconnect: Driver Door Window Regulator Motor C518LHD or C636RHD.
- Disconnect: DDM C501ALHD or C653ARHD.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-1		Ground
LHD C518-4		Ground

RHD C636-1		Ground
RHD C636-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to C4

C4 CHECK FOR A SHORT TO GROUND IN THE WINDOW UP/DOWN CIRCUITS

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-1	Ω	Ground
LHD C518-4	Ω	Ground
RHD C636-1	Ω	Ground
RHD C636-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to C5
No	REPAIR the circuit in question.

C5 CHECK FOR AN OPEN IN THE WINDOW UP/DOWN CIRCUITS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-1	Ω	C501A-13
LHD C518-4	Ω	C501A-14
RHD C636-1	Ω	C653A-13
RHD C636-4	Ω	C653A-14

Are the resistances less than 3 ohms?

Yes	GO to C6
No	REPAIR the circuit in question.

C6 CHECK THE DDM (DRIVER DOOR MODULE) OUTPUT

NOTICE: The following step uses a test light to simulate normal circuit loads. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

NOTE: *Because the power window motor electrical connector (Hall-effect sensor input) is disconnected, the*

DDM only activates the window output for approximately 500 ms then turns off.

- Connect: DDM C501ALHD or C653ARHD.
- Ignition ON.
- Activate the driver door window control switch in the up and down positions while observing the test light.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-1		C518-4
RHD C636-1		C636-4

Does the test light momentarily illuminate when the driver door window control switch is activated in both up and down positions?

Yes	INSTALL a new driver door window regulator motor. REFER to: Front Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	GO to C20

C7 CHECK THE HALL-EFFECT POWER AND RETURN CIRCUITS

NOTICE: The following step uses a test light to simulate normal circuit loads. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

- Ignition OFF.
- Disconnect: Driver Door Window Regulator Motor C518LHD or C636RHD.
- Ignition ON.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-3		C518-6
RHD C636-3		C636-6

Does the test light illuminate?

Yes	GO to C11
No	GO to C8

C8 CHECK FOR AN OPEN IN THE HALL-EFFECT POWER AND RETURN CIRCUITS

- Ignition OFF.
- Disconnect: DDM C501ALHD or C653ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-3	Ω	C501A-16
LHD C518-6	Ω	C501A-22
RHD C636-3	Ω	C653A-16
RHD C636-6	Ω	C653A-22

Are the resistances less than 3 ohms?

Yes	GO to C20
No	REPAIR the circuit in question.

C9 CHECK THE HALL-EFFECT POWER CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: DDM C501ALHD or C653ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C501A-16	Ω	Ground
RHD C653A-16	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C20
No	GO to C10

C10 CHECK THE HALL-EFFECT POWER CIRCUIT FOR A SHORT TO GROUND WITH THE POWER WINDOW MOTOR DISCONNECTED

- Disconnect: Driver Door Window Regulator Motor C518LHD or C636RHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C501A-16	Ω	Ground
RHD C653A-16	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new driver door window regulator motor. REFER to: Front Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit.

C11 CHECK FOR A SHORT TO VOLTAGE IN THE HALL-EFFECT SIGNAL CIRCUITS

- Ignition OFF.
- Disconnect: DDM C501ALHD or C653ARHD.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-2		Ground

LHD C518-5	V	Ground
RHD C636-2	V	Ground
RHD C636-5	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to C12

C12 CHECK FOR A SHORT TO GROUND IN THE HALL-EFFECT SIGNAL CIRCUITS

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-2	Ω	Ground
LHD C518-5	Ω	Ground
RHD C636-2	Ω	Ground
RHD C636-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to C13
No	REPAIR the circuit in question.

C13 CHECK FOR AN OPEN IN THE HALL-EFFECT SIGNAL CIRCUITS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C518-2	Ω	C501A-21
LHD C518-5	Ω	C501A-11
RHD C636-2	Ω	C653A-21
RHD C636-5	Ω	C653A-11

Are the resistances less than 3 ohms?

Yes	INSTALL a new driver door window regulator motor. REFER to: Front Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to C20
No	REPAIR the circuit in question.

C14 CHECK FOR VOLTAGE TO THE MASTER WINDOW CONTROL SWITCH

- Ignition OFF.
- Disconnect: Master Window Control Switch C504LHD or C604RHD.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C504-1		Ground
RHD C604-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to C15
No	VERIFY BCM fuse 23 (10A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

C15 CHECK THE MASTER WINDOW CONTROL SWITCH GROUND CIRCUIT

NOTICE: The following step uses a test light to simulate normal circuit loads. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

- Ignition ON.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
LHD C504-1		C504-3
RHD C604-1		C604-3

Does the test light illuminate?

Yes	GO to C17
No	GO to C16

C16 CHECK THE MASTER WINDOW CONTROL SWITCH GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: DDM C501ALHD or C653ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C504-4	Ω	C501A-17
RHD C604-4	Ω	C653A-17

Is the resistance less than 3 ohms?

Yes	GO to C20
No	REPAIR the circuit.

C17 CHECK THE MASTER WINDOW CONTROL SWITCH LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: DDM C501ALHD or C653ARHD.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C504-1	V	Ground
RHD C604-1	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to C18

C18 CHECK THE MASTER WINDOW CONTROL SWITCH LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C504-3	Ω	Ground
RHD C604-3	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to C19
No	REPAIR the circuit.

C19 CHECK THE MASTER WINDOW CONTROL SWITCH LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C504-3	Ω	C501A-5
RHD C604-3	Ω	C653A-5

Is the resistance less than 3 ohms?

Yes	INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

	CLEAR the Diagnostic Trouble Codes (DTCs). TEST the system for normal operation. If the concern is still present, GO to C20
No	REPAIR the circuit.

C20 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the DDM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM connectors. Make sure they seat and latch correctly.
- Reconnect all previously disconnected connectors.
- Ignition ON.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Single Power Window Is Inoperative/Does Not Operate Correctly - RH Front

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1189:29	Front Window Position Sensor: Signal Invalid	This DTC sets when the PDM detects a difference with one or both of the Hall-effect sensor circuits. When this DTC is present, the front window only operates in short steps.
B12C5:71	Front Window Lifter Motor Up Relay: Actuator Stuck	This DTC sets when the PDM detects the UP relay (integral to the PDM) is stuck or a short to voltage is present in the UP window motor circuit. When this DTC is present, the front window does not operate.
B12C8:71	Front Window Lifter Motor Down Relay: Actuator Stuck	This DTC sets when the PDM detects the DOWN relay (integral to the PDM) is stuck or a short to voltage is present in the DOWN window motor circuit. When this DTC is present, the front window does not operate.
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	This DTC sets when the PDM detects a short to ground in the Hall-effect sensor power supply circuit. When this DTC is present, the front window only operates in short steps.
C1B14:15	Sensor Supply Voltage A: Circuit Short To Battery or	This DTC sets when the PDM detects an open or short to voltage in the Hall-effect sensor power supply circuit. When this DTC is present, the front window only operates in short steps.

	Open	
U2002:24	Switch: Signal Stuck High	This DTC sets when the PDM detects the window control switch is stuck in the UP or DOWN position or a short to ground is present on the input circuit for greater than 10 seconds.

Possible Causes

- Wiring, terminals or connectors
- Master window control switch
- Passenger door window control switch
- Passenger door window regulator motor
- PDM

PINPOINT TEST D : A SINGLE POWER WINDOW IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - RH FRONT

D1 CHECK FOR PDM (PASSENGER DOOR MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform PDM self-test.

Are any PDM Diagnostic Trouble Codes (DTCs) present?

Yes	For DTC C1B14:11, GO to D15 For DTC B1189:29 or C1B14:15, GO to D13 For DTC B12C5:71 or B12C8:71, GO to D9 For DTC U2002:24, GO to D6 For all other Diagnostic Trouble Codes (DTCs), REFER to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).
No	GO to D2

D2 CHECK THE WINDOW OPERATION FROM THE PASSENGER DOOR WINDOW CONTROL SWITCH

- Attempt to operate the RH door window from the passenger door window control switch.

Does the RH door window operate correctly from the passenger door window control switch?

Yes	INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	GO to D3

D3 CHECK THE PASSENGER DOOR WINDOW CONTROL SWITCH

- Ignition OFF.
- Disconnect: Passenger Door Window Control Switch C624LHD or C592RHD.
- Carry out the passenger door window control switch component test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the passenger door window control switch pass the component test?

Yes	GO to D4
No	INSTALL a new passenger door window control switch. REFER to: Passenger Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

D4 CHECK THE WINDOW CONTROL SWITCH UP/DOWN CIRCUITS

- Ignition ON.
- Connect a fused jumper wire temporarily while observing the window operation:

Positive Lead	Measurement / Action	Negative Lead
LHD C624-3 (DOWN)		Ground
LHD C624-2 (UP)		Ground
RHD C592-3 (DOWN)		Ground
RHD C592-2 (UP)		Ground

Does the window operate upward and downward when the fused jumper wire is in place?

Yes	GO to D5
No	GO to D8

D5 CHECK THE WINDOW CONTROL SWITCH RETURN CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C624-1	Ω	C652A-17
RHD C592-1	Ω	C590A-17

Is the resistance less than 3 ohms?

Yes	GO to D20
No	REPAIR the circuit.

D6 CHECK THE WINDOW CONTROL SWITCH CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-8	Ω	Ground
LHD C652A-9	Ω	Ground
RHD C590A-8	Ω	Ground
RHD C590A-9	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to D20

No	GO to D7

D7 CHECK THE WINDOW CONTROL SWITCH CIRCUITS FOR A SHORT TO GROUND WITH THE WINDOW CONTROL SWITCH DISCONNECTED

- Disconnect: Passenger Door Window Control Switch C624LHD or C592RHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-8	Ω	Ground
LHD C652A-9	Ω	Ground
RHD C590A-8	Ω	Ground
RHD C590A-9	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	INSTALL a new passenger door window control switch. REFER to: Passenger Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit in question.

D8 CHECK THE WINDOW CONTROL SWITCH CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C624-2	Ω	C652A-8
LHD C624-3	Ω	C652A-9
RHD C592-2	Ω	C590A-8
RHD C592-3	Ω	C590A-9

Are the resistances less than 3 ohms?

Yes	GO to D9
No	REPAIR the circuit in question.

D9 CHECK FOR A SHORT TO VOLTAGE IN THE WINDOW UP/DOWN CIRCUITS

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD (if not previously disconnected).
- Disconnect: Passenger Door Window Regulator Motor C6013LHD or C5013RHD.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-1		Ground

LHD C6013-4		Ground
RHD C5013-1		Ground
RHD C5013-4		Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to D10

D10 CHECK FOR A SHORT TO GROUND IN THE WINDOW UP/DOWN CIRCUITS

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-1	Ω	Ground
LHD C6013-4	Ω	Ground
RHD C5013-1	Ω	Ground
RHD C5013-4	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to D11
No	REPAIR the circuit in question.

D11 CHECK FOR AN OPEN IN THE WINDOW UP/DOWN CIRCUITS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-1	Ω	C652A-13
LHD C6013-4	Ω	C652A-14
RHD C5013-1	Ω	C590A-13
RHD C5013-4	Ω	C590A-14

Are the resistances less than 3 ohms?

Yes	GO to D12
No	REPAIR the circuit in question.

D12 CHECK THE PDM (PASSENGER DOOR MODULE) OUTPUT

NOTICE: The following step uses a test light to simulate normal circuit loads. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use

the test light probe directly on any connector.

NOTE: *Because the power window motor electrical connector (Hall-effect sensor input) is disconnected, the PDM only activates the window output for approximately 500 ms then turns off.*

- Ignition OFF.
- Connect: PDM C652ALHD or C590ARHD.
- Connect: Passenger Door Window Control Switch C624LHD or C592RHD (if previously disconnected).
- Ignition ON.
- Activate the passenger door window control switch in the up and down positions while observing the test light.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-1		C6013-4
RHD C5013-1		C5013-4

Does the test light momentarily illuminate when the window control switch is activated in both up and down positions?

Yes	INSTALL a new passenger door window regulator motor. REFER to: Front Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	GO to D20

D13 CHECK THE HALL-EFFECT POWER AND RETURN CIRCUITS

NOTICE: The following step uses a test light to simulate normal circuit loads. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector.

- Ignition OFF.
- Disconnect: Passenger Door Window Regulator Motor C6013LHD or C5013RHD.
- Connect: Passenger Door Window Control Switch C624LHD or C592RHD (if previously disconnected).
- Ignition ON.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-3		C6013-6
RHD C5013-3		C5013-6

Does the test light illuminate?

Yes	GO to D17
No	GO to D14

D14 CHECK FOR AN OPEN IN THE HALL-EFFECT POWER AND RETURN CIRCUITS

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD.
- Connect:

Positive Lead	Measurement / Action	Negative Lead

LHD C6013-3	Ω	C652A-16
LHD C6013-6	Ω	C652A-22
RHD C5013-3	Ω	C590A-16
RHD C5013-6	Ω	C590A-22

Are the resistances less than 3 ohms?

Yes	GO to D20
No	REPAIR the circuit in question.

D15 CHECK THE HALL-EFFECT POWER CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-16	Ω	Ground
RHD C590A-16	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to D20
No	GO to D16

D16 CHECK THE HALL-EFFECT POWER CIRCUIT FOR A SHORT TO GROUND WITH THE PASSENGER DOOR WINDOW REGULATOR MOTOR DISCONNECTED

- Disconnect: Passenger Door Window Regulator Motor C6013LHD or C5013RHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-16	Ω	Ground
RHD C590A-16	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new passenger door window regulator motor. REFER to: Front Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit.

D17 CHECK FOR A SHORT TO VOLTAGE IN THE HALL-EFFECT SIGNAL CIRCUITS

- Ignition OFF.
- Disconnect: PDM C652ALHD or C590ARHD.
- Ignition ON.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-2	V	Ground
LHD C6013-5	V	Ground
RHD C5013-2	V	Ground
RHD C5013-5	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to D18

D18 CHECK FOR A SHORT TO GROUND IN THE HALL-EFFECT SIGNAL CIRCUITS

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-2	Ω	Ground
LHD C6013-5	Ω	Ground
RHD C5013-2	Ω	Ground
RHD C5013-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to D19
No	REPAIR the circuit in question.

D19 CHECK FOR AN OPEN IN THE HALL-EFFECT SIGNAL CIRCUITS

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C6013-2	Ω	C652A-11
LHD C6013-5	Ω	C652A-21
RHD C5013-2	Ω	C590A-11
RHD C5013-5	Ω	C590A-21

Are the resistances less than 3 ohms?

Yes	INSTALL a new passenger door window regulator motor. REFER to: Front Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to D20

No	REPAIR the circuit in question.

D20 CHECK FOR CORRECT PDM (PASSENGER DOOR MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all the PDM connectors.
- Repair:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins as necessary
  - pushed-out pins - install new pins as necessary
- Reconnect the PDM connectors. Make sure they seat and latch correctly.
- Reconnect all previously disconnected connectors.
- Ignition ON.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The One-Touch Up/Down Feature Is Inoperative

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

Possible Causes

- Window regulator motor not initialized
- Window control switch
- DDM
- PDM

PINPOINT TEST E : THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE

E1 INITIALIZE THE SUSPECT POWER WINDOW

- Carry out the initialization procedure on the suspect power window.
  REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

Is the one-touch up feature operating correctly?

Yes	The system is operating normally at this time. The window lost initialization.
No	If the one-touch up/down feature is inoperative for the LH front window, INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

	If the one-touch up/down feature is inoperative for the Passenger front window, INSTALL a new window control switch. REFER to: Passenger Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

A Single Power Window Is Inoperative/Does Not Operate Correctly - LH Rear

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- Master window control switch
- LH rear door window control switch
- LH rear door window regulator motor

Visual Inspection and Diagnostic Pre-checks

- Verify the lock-out switch is in the UNLOCK position.

PINPOINT TEST F : A SINGLE POWER WINDOW IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - LH REAR

F1 CHECK THE LH (LEFT-HAND) REAR DOOR WINDOW OPERATION FROM THE MASTER WINDOW CONTROL SWITCH

- Ignition ON.
- Attempt to operate the LH rear door window from the master window control switch.

Does the LH rear door window operate correctly from the master window control switch?

Yes	GO to F2
No	GO to F3

F2 CHECK THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH LOCK-OUT CIRCUIT FEED FOR VOLTAGE

- Ignition OFF.
- Disconnect: LH Rear Door Window Control Switch C701.
- Ignition ON.
- Make sure the window lock-out switch is in the UNLOCK position.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C701-3		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new LH rear door window control switch.

	REFER to: Rear Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit.

F3 CHECK THE LH (LEFT-HAND) REAR DOOR WINDOW OPERATION FROM LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH

- Make sure the window lock-out switch is in the UNLOCK position.
- Attempt to operate the LH rear door window from the LH rear door window control switch.

Does the LH rear door window operate when using the LH rear door window control switch?

Yes	GO to F4
No	GO to F6

F4 CHECK THE WINDOW CONTROL SWITCH UP/DOWN CIRCUITS

- Ignition OFF.
- Disconnect: Master Window Control Switch C504LHD or C604RHD.
- Ignition ON.
- Connect a fused jumper wire temporarily while observing the window operation:

Lead	Measurement / Action	Lead
LHD C504-17 (DOWN)		C504-4
LHD C504-18 (UP)		C504-4
RHD C604-17 (DOWN)		C604-4
RHD C604-18 (UP)		C604-4

Does the window operate upward and downward when the fused jumper wire is in place?

Yes	REMOVE the jumper wire. INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REMOVE the jumper wire. GO to F5

F5 CHECK THE WINDOW CONTROL CIRCUITS FOR AN OPEN BETWEEN THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH AND THE MASTER WINDOW CONTROL SWITCH

- Ignition OFF.
- Disconnect: LH Rear Door Window Control Switch C701.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C701-1	Ω	C504-18
LHD C701-4	Ω	C504-17
RHD C701-1	Ω	C604-18
RHD C701-4	Ω	C604-17

Are the resistances less than 3 ohms?

Yes	INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit in question.

F6 CHECK FOR POWER TO THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH FOR AN OPEN

- Ignition OFF.
- Disconnect: LH Rear Door Window Control Switch C701.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C701-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to F7
No	REPAIR the circuit.

F7 CHECK THE GROUND TO THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C701-4	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to F8
No	REPAIR the circuit.

F8 CHECK THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH

- Carry out the LH rear door window control switch component test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the LH rear door window control switch pass the component test?

Yes	GO to F9
No	INSTALL a new LH rear door window control switch. REFER to: Rear Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

F9 CHECK FOR AN OPEN BETWEEN THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL

SWITCH AND THE WINDOW MOTOR

- Disconnect: LH Rear Door Window Regulator Motor C703.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C701-7	Ω	C703-1
C701-6	Ω	C703-2

Are the resistances less than 3 ohms?

Yes	INSTALL a new LH rear door window regulator motor. REFER to: Rear Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit in question.

A Single Power Window Is Inoperative/Does Not Operate Correctly - RH Rear

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- Master window control switch
- RH rear door window control switch
- RH rear door window regulator motor

Visual Inspection and Diagnostic Pre-checks

- Verify the lock-out switch is in the UNLOCK position.

PINPOINT TEST G : A SINGLE POWER WINDOW IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - RH REAR

G1 CHECK THE RH (RIGHT-HAND) REAR DOOR WINDOW OPERATION FROM THE MASTER WINDOW CONTROL SWITCH

- Ignition ON.
- Attempt to operate the RH rear door window from the master window control switch.

Does the RH rear door window operate correctly from the master window control switch?

Yes	GO to G2
No	GO to G3

G2 CHECK THE RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH LOCK-OUT CIRCUIT FEED FOR VOLTAGE

- Ignition OFF.
- Disconnect: RH Rear Door Window Control Switch C801.
- Ignition ON.

- Make sure the window lock-out switch is in the UNLOCK position.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C801-1		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new RH rear door window control switch. REFER to: Rear Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit.

G3 CHECK THE RH (RIGHT-HAND) REAR DOOR WINDOW OPERATION FROM RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH

- Make sure the window lock-out switch is in the UNLOCK position.
- Attempt to operate the RH rear door window from the RH rear door window control switch.

Does the RH rear door window operate when using the RH rear door window control switch?

Yes	GO to G4
No	GO to G6

G4 CHECK THE WINDOW CONTROL SWITCH UP/DOWN CIRCUITS

- Ignition OFF.
- Disconnect: Master Window Control Switch C504LHD or C604RHD.
- Ignition ON.
- Connect a fused jumper wire temporarily while observing the window operation:

Lead	Measurement / Action	Lead
LHD C504-14 (DOWN)		C504-1
LHD C504-13 (UP)		C504-1
RHD C604-14 (DOWN)		C504-1
RHD C604-13 (UP)		C504-1

Does the window operate upward and downward when the fused jumper wire is in place?

Yes	REMOVE the jumper wire. INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REMOVE the jumper wire. GO to G5

G5 CHECK THE WINDOW CONTROL CIRCUITS FOR AN OPEN BETWEEN THE RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH AND THE MASTER WINDOW CONTROL SWITCH

- Ignition OFF.
- Disconnect: RH Rear Door Window Control Switch C801.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C801-1	Ω	C504-13
LHD C801-4	Ω	C504-14
RHD C801-1	Ω	C604-13
RHD C801-4	Ω	C604-14

Are the resistances less than 3 ohms?

Yes	INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit in question.

G6 CHECK FOR POWER TO THE RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH FOR AN OPEN

- Ignition OFF.
- Disconnect: RH Rear Door Window Control Switch C801.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C801-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to G7
No	REPAIR the circuit.

G7 CHECK THE GROUND TO THE RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C801-4	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to G8
No	REPAIR the circuit.

G8 CHECK THE RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH

- Carry out the RH rear door window control switch component test.
  Refer to Wiring Diagrams Cell 149 for schematic and connector information.

Did the RH rear door window control switch pass the component test?

Yes	GO to G9
No	INSTALL a new RH rear door window control switch. REFER to: Rear Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).

G9 CHECK FOR AN OPEN BETWEEN THE RH (RIGHT-HAND) REAR DOOR WINDOW CONTROL SWITCH AND THE WINDOW MOTOR

- Disconnect: RH Rear Door Window Regulator Motor C828.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C801-7	Ω	C828-3
C801-6	Ω	C828-6

Are the resistances less than 3 ohms?

Yes	INSTALL a new RH rear door window regulator motor. REFER to: Rear Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit in question.

Both Rear Passenger Power Windows Are Inoperative

Refer to Wiring Diagrams Cell 100 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Glass, Frames and Mechanisms - Overview (501-11 Glass, Frames and Mechanisms, Description and Operation).

Possible Causes

- Circuit breaker
- Wiring, terminals or connectors
- Master window control switch

Visual Inspection and Diagnostic Pre-checks

- Verify the lock-out switch is in the UNLOCK position.

PINPOINT TEST H : BOTH REAR PASSENGER POWER WINDOWS ARE INOPERATIVE

H1 CHECK FOR POWER TO THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH

- Ignition OFF.
- Disconnect: LH Rear Door Window Control Switch C701.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C701-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to H3
No	GO to H2

H2 CHECK FOR A SHORT TO GROUND IN THE HIGH CURRENT POWER CIRCUIT TO THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH

- Ignition OFF.
- Disconnect: BCM Circuit Breaker 38 (30A).
- Install a fused jumper wire in place of BCM Circuit Breaker 38 (30A).
- Connect: LH Rear Door Window Control Switch C701.
- Ignition ON.
- Attempt to operate each individual rear door power window in both directions from each of the rear passenger door switches.

Did the jumper wire fuse open during the test?

Yes	REMOVE the fused jumper wire. REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.
No	If the rear power windows operated correctly with the fused jumper wire in place, INSTALL a new circuit breaker. If the rear power windows did not operate with the fused jumper wire in place, REPAIR the circuit.

H3 CHECK THE LOW CURRENT POWER CIRCUIT TO THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: Master Window Control Switch C504LHD or C604RHD.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C701-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to H4
No	REPAIR the circuit.

H4 CHECK THE LOW CURRENT POWER CIRCUIT TO THE LH (LEFT-HAND) REAR DOOR WINDOW CONTROL SWITCH FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C701-1	Ω	C504-1

RHD C701-1	Ω	C604-1

Is the resistance less than 3 ohms?

Yes	INSTALL a new master window control switch. REFER to: Driver Door Window Control Switch (501-11 Glass, Frames and Mechanisms, Removal and Installation).
No	REPAIR the circuit.

Component Test- Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the grid wire from the exterior. A broken grid wire appears as a brown spot.
2. Run the engine at idle. Activate the rear window defrost switch. The indicator light should come on.
3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window (positive lead to B+ side and the negative lead to ground side). The meter should read 10-13 volts. A lower voltage reading indicates a loose ground connection.
4. Contact a good ground point with the negative lead of the meter. The voltage reading should not change.
5. With the negative lead of the meter grounded, touch each grid line of the heated rear window glass at its midpoint with the positive lead. A reading of approximately 6 volts indicates the line is good. A reading of 0 volt indicates the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates the circuit is broken between the midpoint of the grid line and ground.
6. Pinpointing the exact position of the break can be accomplished (if the voltmeter reads 0 volt when the midpoint of the grid line is touched with the positive lead of the voltmeter) by moving the positive lead of the voltmeter toward the B+ side of the grid line and touching the grid line until the voltmeter reads 12 volts. If the voltmeter reads 12 volts when the midpoint of the grid line is touched with the positive lead of the voltmeter, simply move the positive lead of the voltmeter toward the ground connection of the grid line and touch the grid line until the voltmeter reads 0 volt.

Copyright © 2016 Ford Motor Company

Door Window Motor Initialization

NOTE: *Make sure that the window runs are correctly installed and free of foreign material.*

NOTE: *If the power to a power window switch has been disconnected, that window regulator motor must be initialized.*

NOTE: *Wait for a minimum of 1 minute before connecting the battery, fuse or electrical connector.*

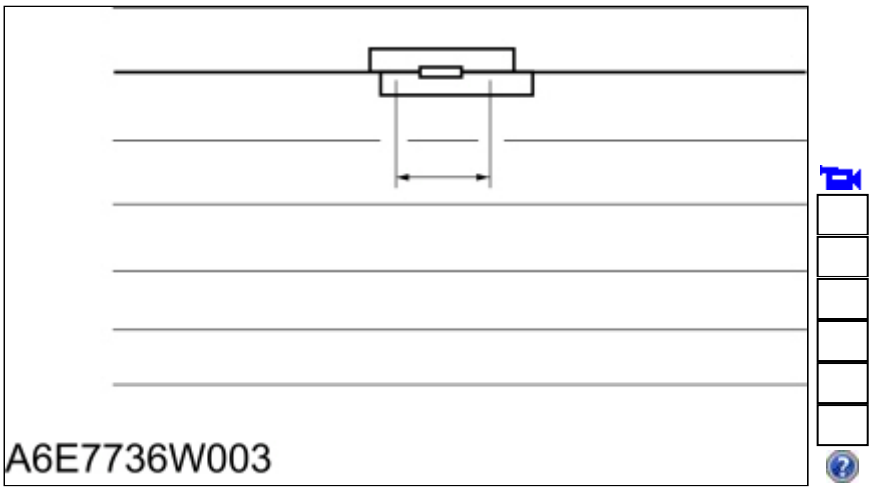
1. Switch on the ignition to operate the electric windows.
2. From an open position lift the switch using the second detent position until the window is fully closed. Hold the switch for two more seconds and release.
3. Open the window using the first detent position and try to close it automatically using the second detent position.
4. Repeat the procedure if the window does not open/close automatically when the switch is actuated to the open/close second detent positions.

Copyright © 2016 Ford Motor Company

Heated Window Grid Wire Repair

Base Part Number: 42006

1. Clean the filament using isopropyl alcohol.
2. Attach tape to both sides of the filament.



3. Using a small brush or marking pen, apply silver paint.
4. **NOTICE: Do not operate the rear window defroster until the paint is completely dry. It may cause other malfunctions if it is used before the paint is dry.**

   After 2—3 min, carefully remove the tape without damaging the applied area.

5. Dry the repaired part according to the following procedure.
   - When the room temperature is 25 °C {77 °F}, leave to dry for 24 h.
   - When a hot air blower is used, dry with air at a temperature of 150 °C {302 °F} or 30 min.

Copyright © 2016 Ford Motor Company

Windshield Glass

Base Part Number: S03100

Special Tool(s) / General Equipment

Direct Glazing Removal/Replacement Equipment
Knife
Adhesive Tape

Materials

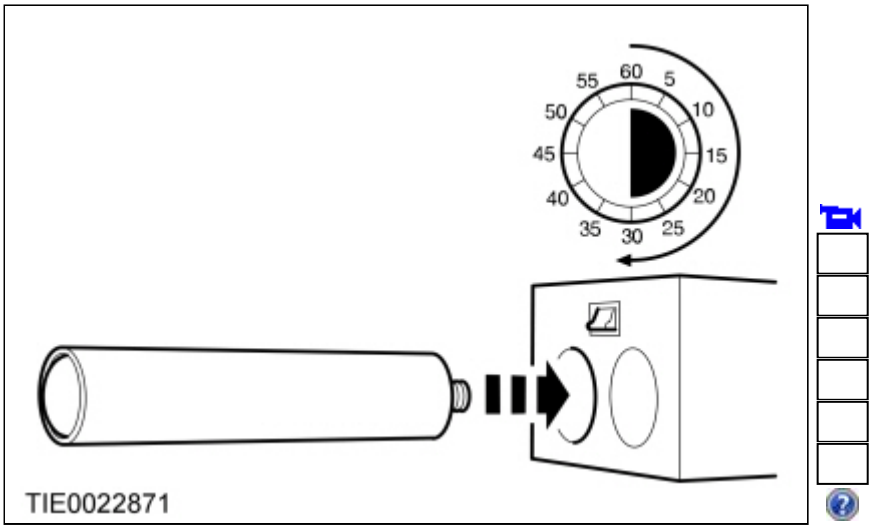
Name	Specification
Adhesive	WSK-M11P57-A3
Adhesive	WSS-M11P57-A5

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

   - *Material*: Adhesive (WSK-M11P57-A3)
   - Remove the polyurethane (PU) adhesive cap and heat the 2K-PU adhesive for a minimum of 30 minutes.
     Use the General Equipment: Direct Glazing Removal/Replacement Equipment
   - Repairs under warranty:
     Material: Adhesive (WSS-M11P57-A5)

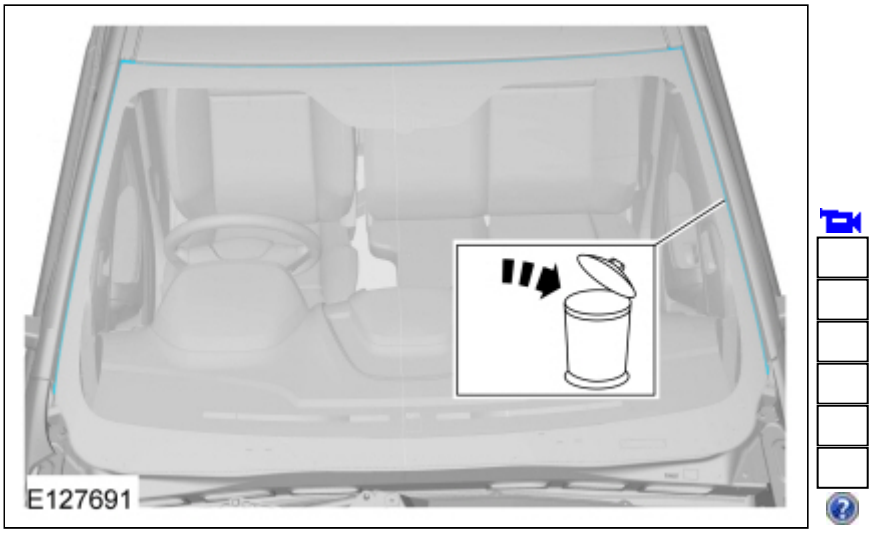


3. **NOTICE: Make sure that the motor is in the park position.**

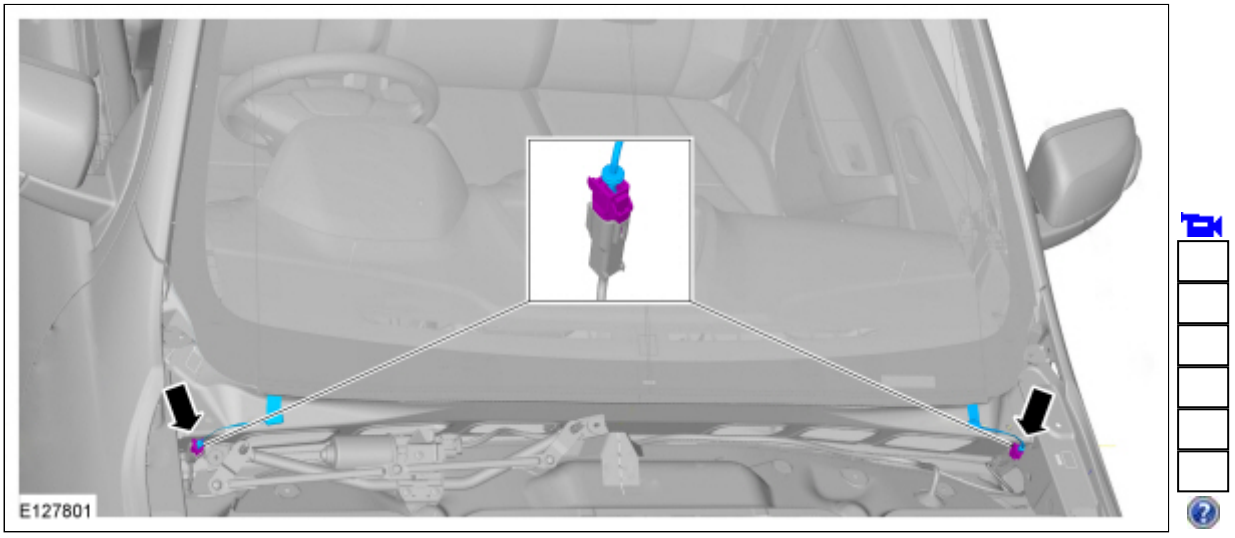
   Refer to: Wiper Linkage Assembly (501-16 Wipers and Washers, Removal and Installation).

4. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

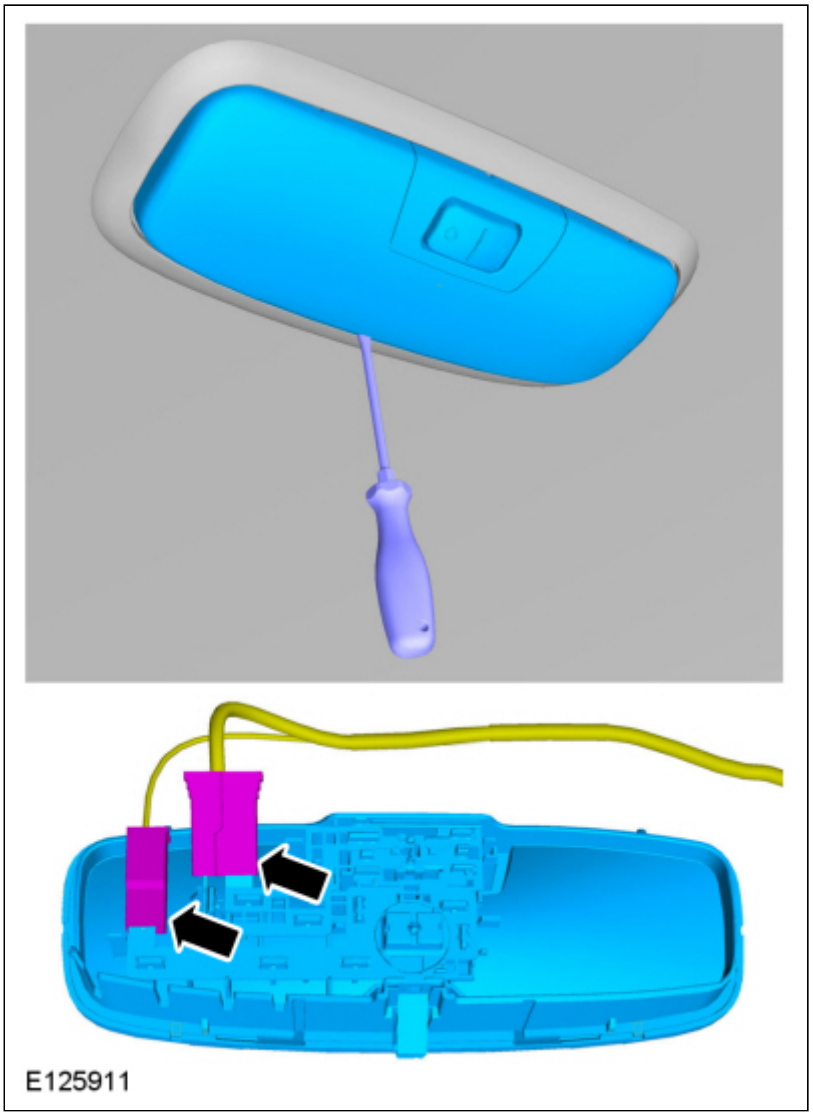
5.



6. **NOTE:** *Vehicles with heated windsheild only.*

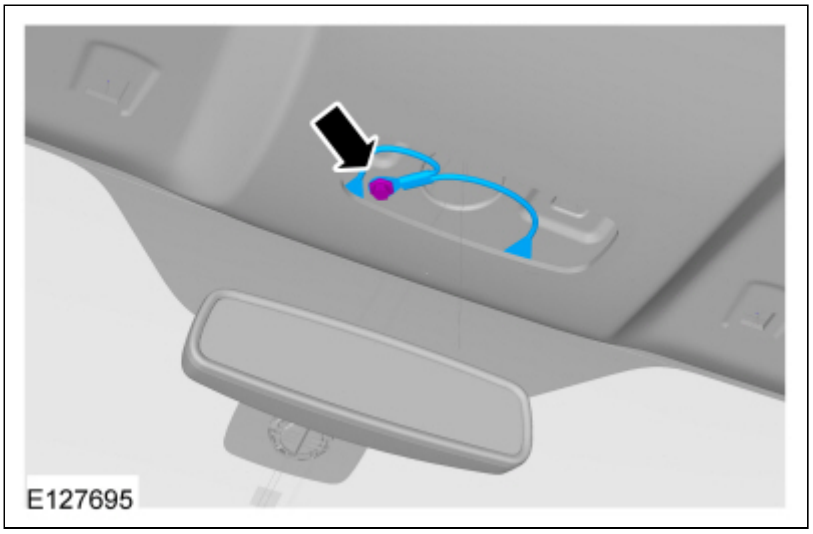


7. **NOTE:** *Vehicles with heated windsheild only.*

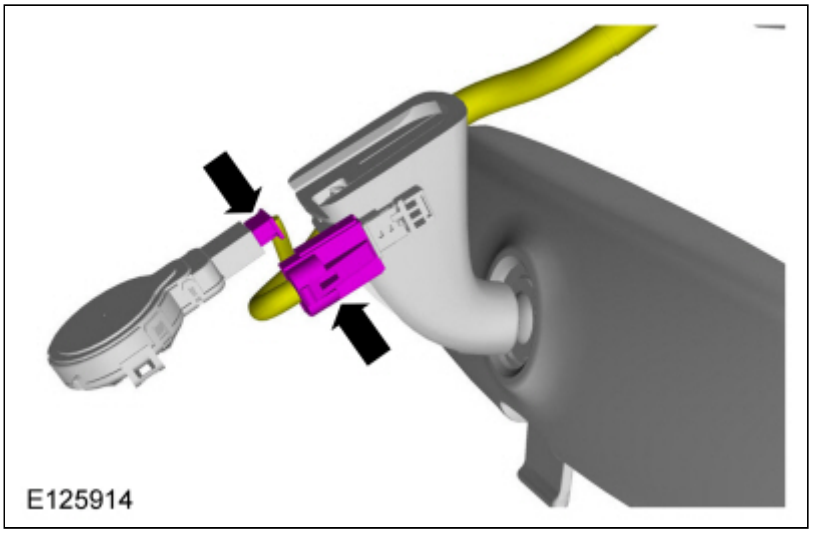


8. **NOTE:** *Vehicles with heated windsheild only.*

   Torque: 10 Nm



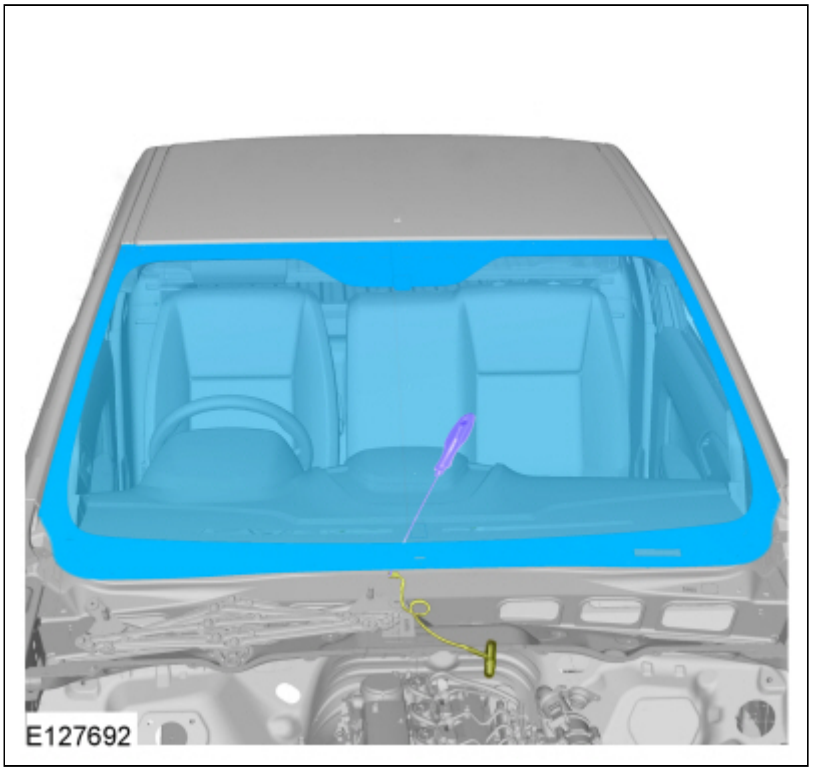
9. **NOTE:** *Vehicles with auto-dimming interior mirror and rain sensor only.*



10. Refer to interior rear view mirror removal

11. 


Use a suitable awl to thread the cutting wire.
Use the General Equipment: Direct Glazing Removal/Replacement Equipment

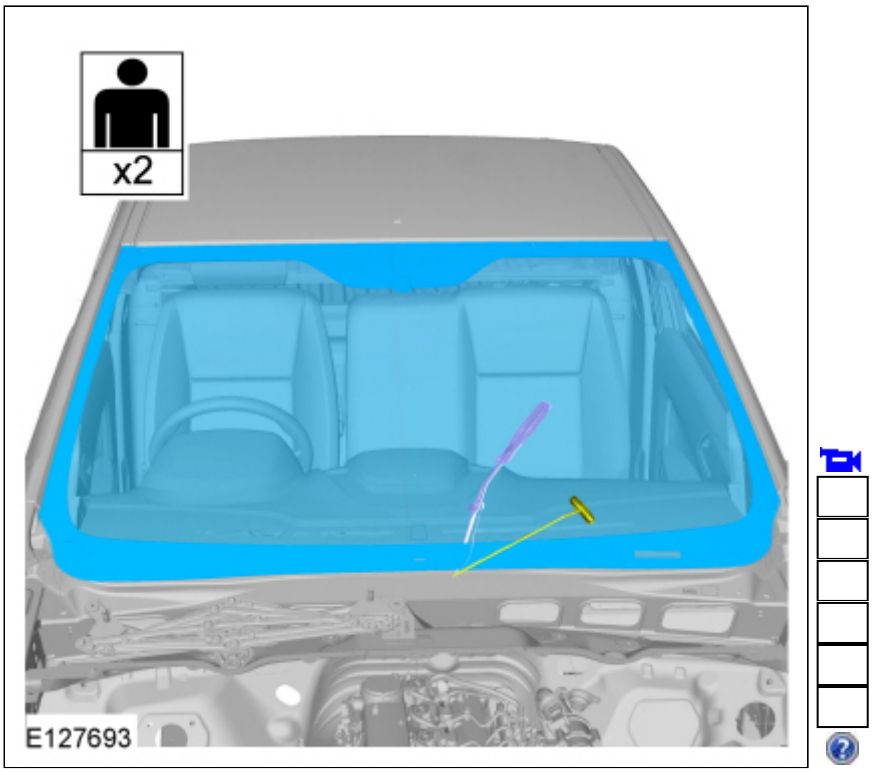


12. 

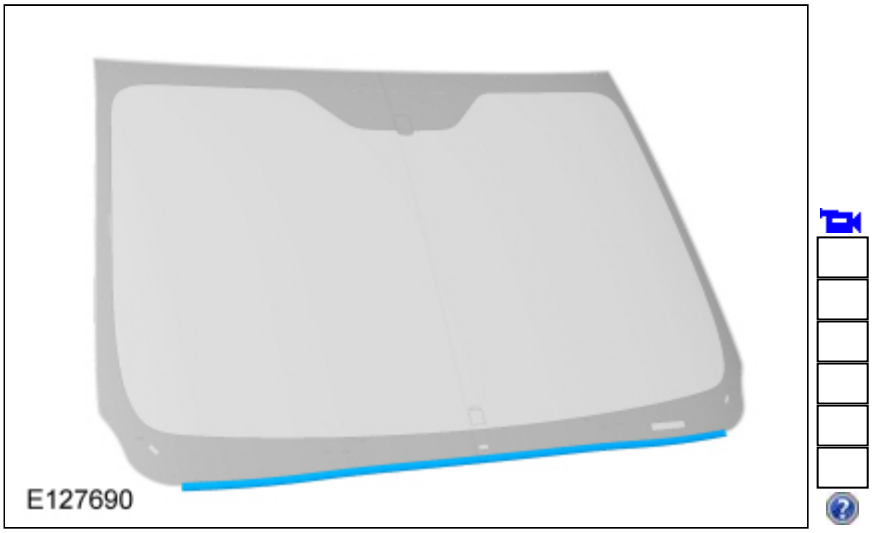

NOTICE: If the original window glass is to be installed, take care not to damage the electrical connectors and the weatherstrip (if equipped).

Use a suitable brace to prevent trim damages.

Use the General Equipment: Direct Glazing Removal/Replacement Equipment

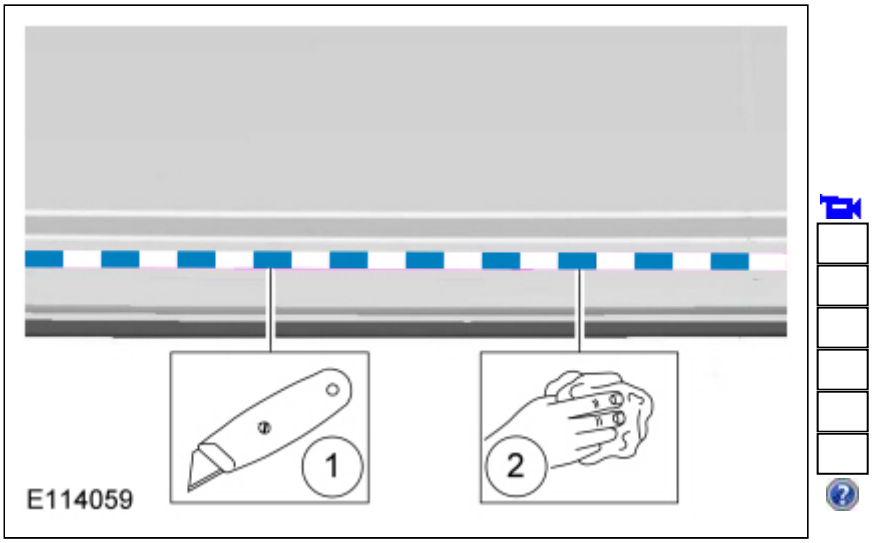


13.

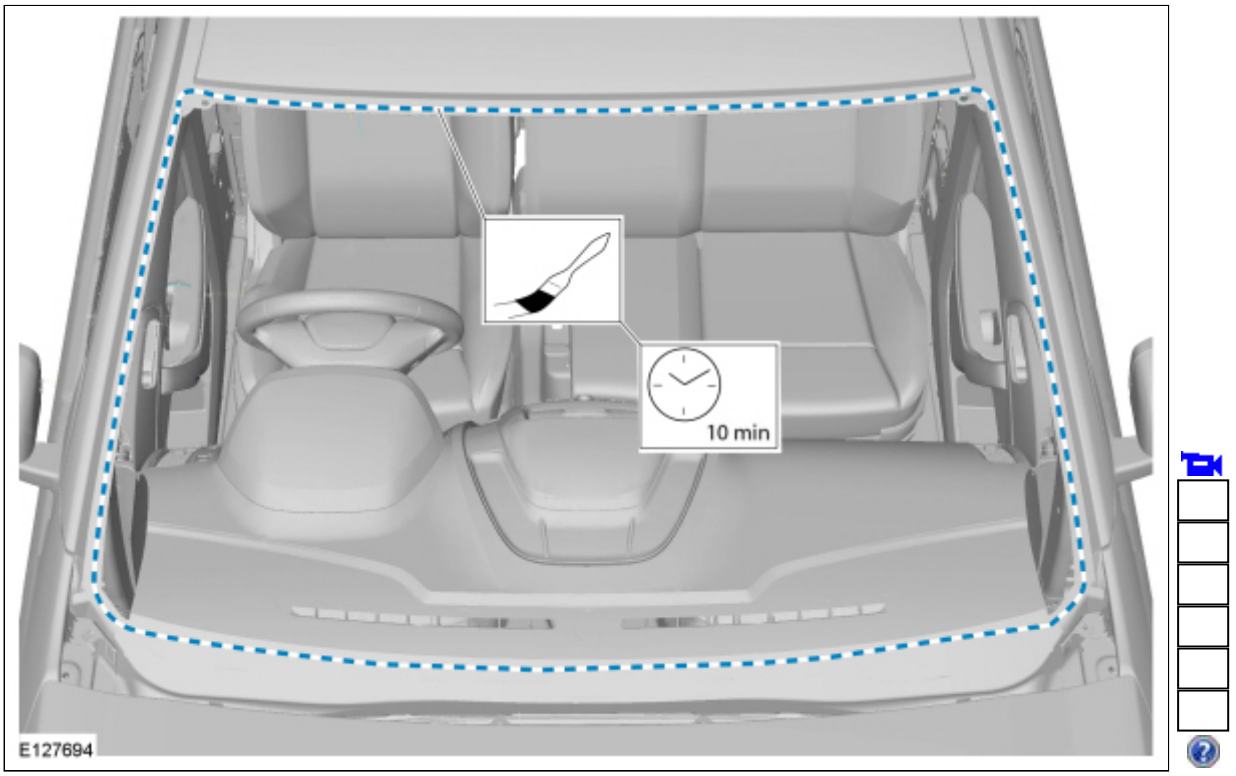


Installation

1. **NOTE:** *Minimum 1 mm bead thickness.*
    - Use the General Equipment: Knife
    - **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*
    - **NOTE:** *Touching the adhesive surface will impair rebonding.*
    - Prepare the windshield glass, windshield glass flange and trimmed PU adhesive in accordance with the instructions supplied with the glass adhesive kit.

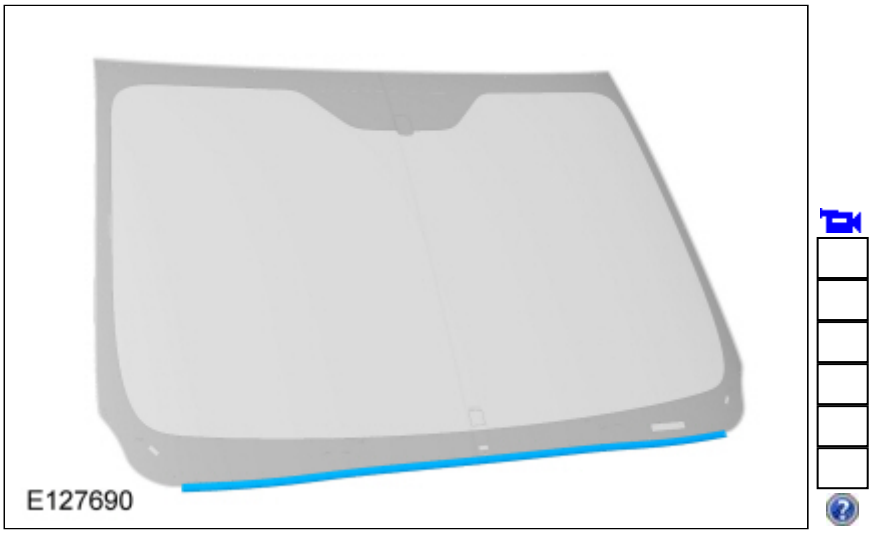


2. Apply the activator/primer in accordance with the instructions supplied with the glass adhesive kit.

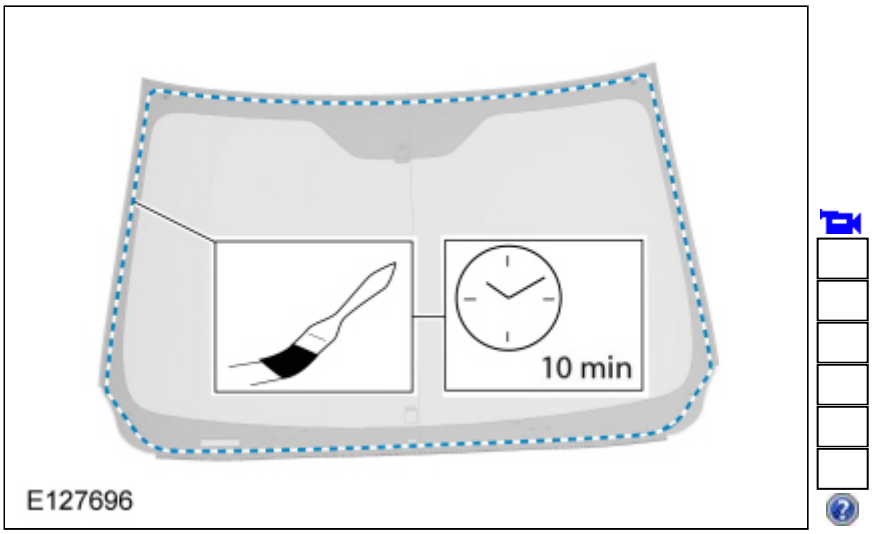


3. **NOTE:** *Touching the adhesive surface will impair rebonding.*

   NOTE: *Make sure that the mating faces are clean and free of foreign material.*



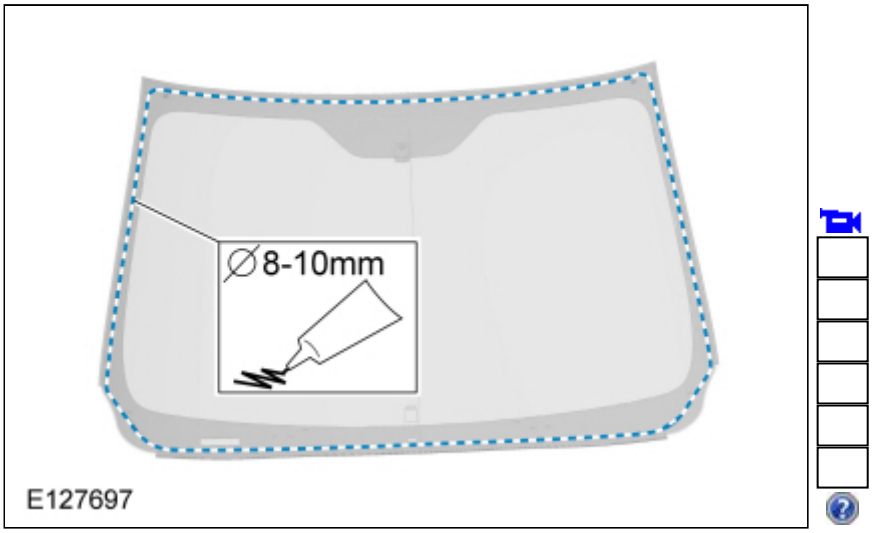
4. Apply the activator/primer in accordance with the instructions supplied with the glass adhesive kit.



5. **NOTE:** *Discard the first 100 mm of adhesive as this may have a reduced working time.*

   NOTE: *Make sure that any breakage in the continuous bead of adhesive is overlapped by 20 mm.*

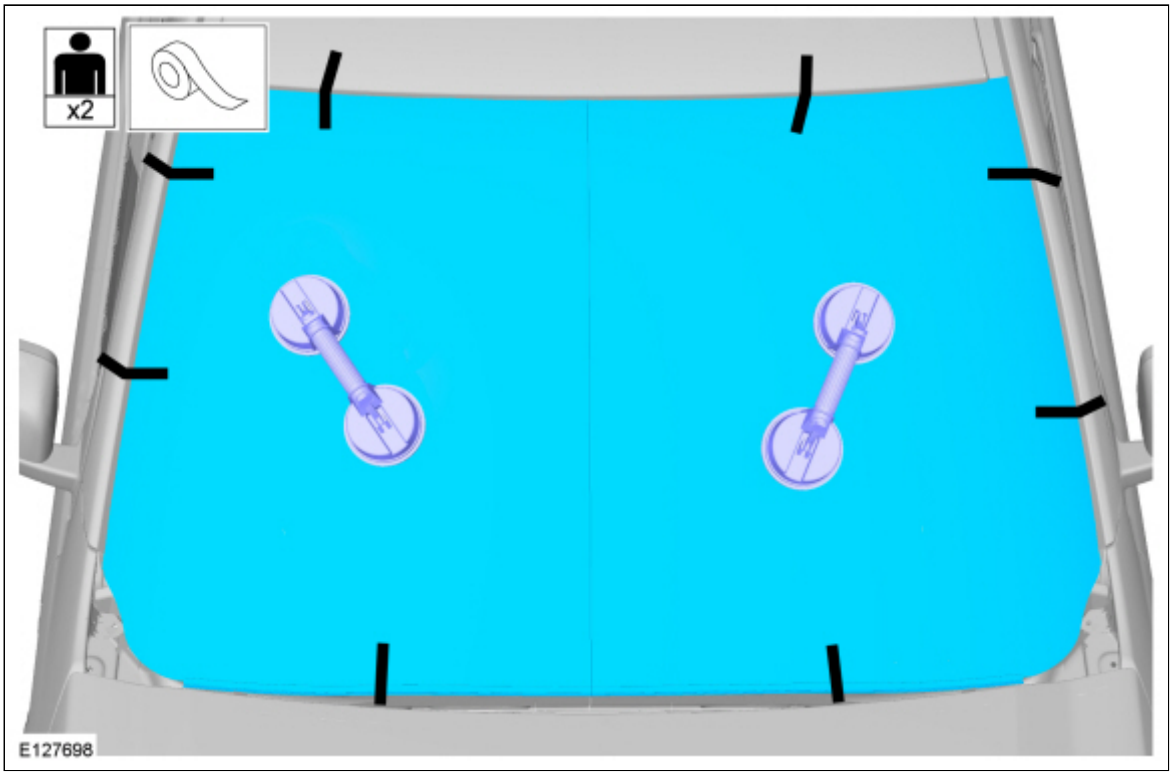
   Use the General Equipment: Direct Glazing Removal/Replacement Equipment
   Material: Adhesive (WSK-M11P57-A3)
   Material: Adhesive (WSS-M11P57-A5)



6. **NOTICE: Make sure that equal pressure is applied to the full length of the component.**

   NOTICE: During the curing time of the polyurethane (PU) adhesive, the door windows must be left open.

   Using tape, secure the Windshield glass in the correct position until the PU adhesive has cured.
   Use the General Equipment: Adhesive Tape



7. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Door Window Glass

Base Part Number: 21410

Special Tool(s) / General Equipment

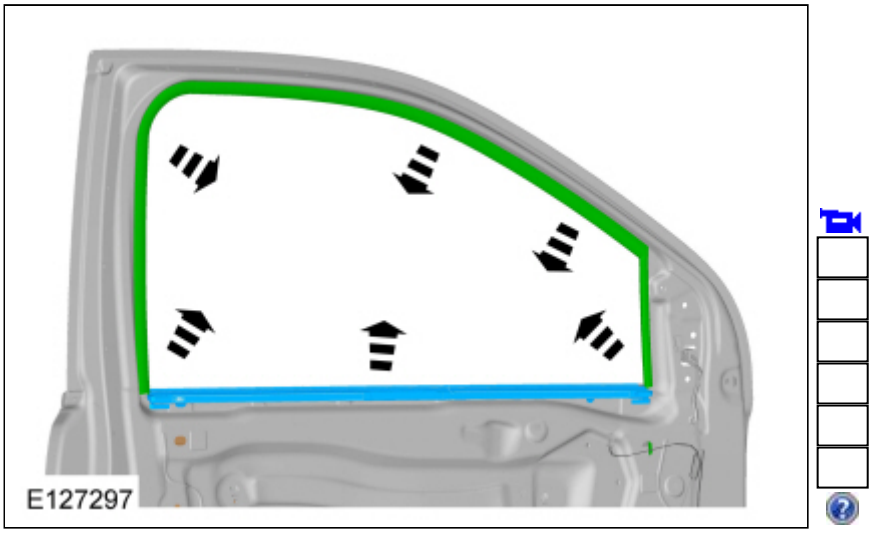
	501-114 Release Lever, Door Glass

Removal

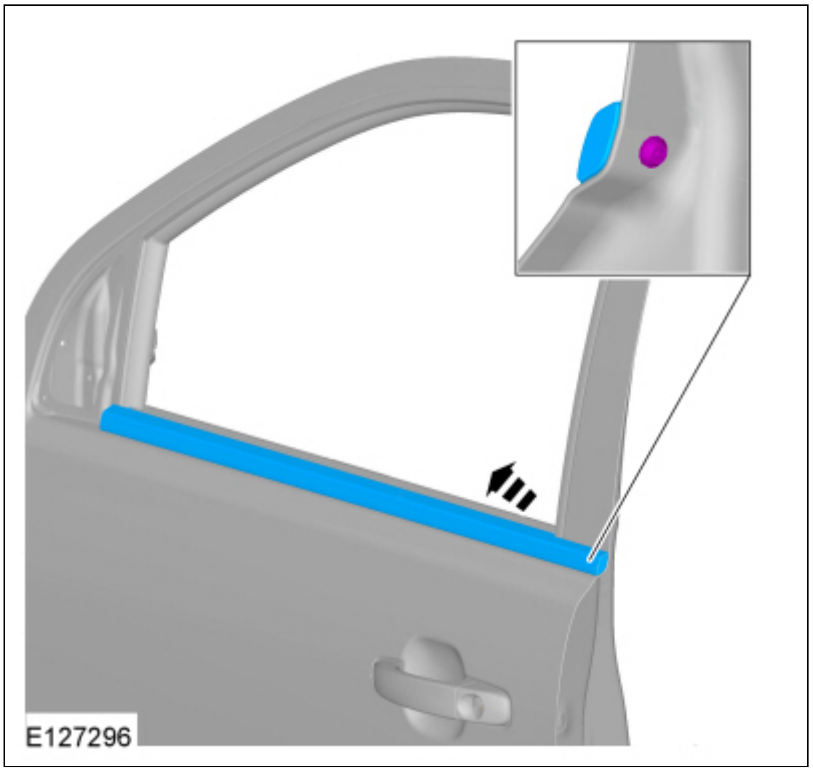
NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *Ensure that the front door window glass is in the lowered position.*

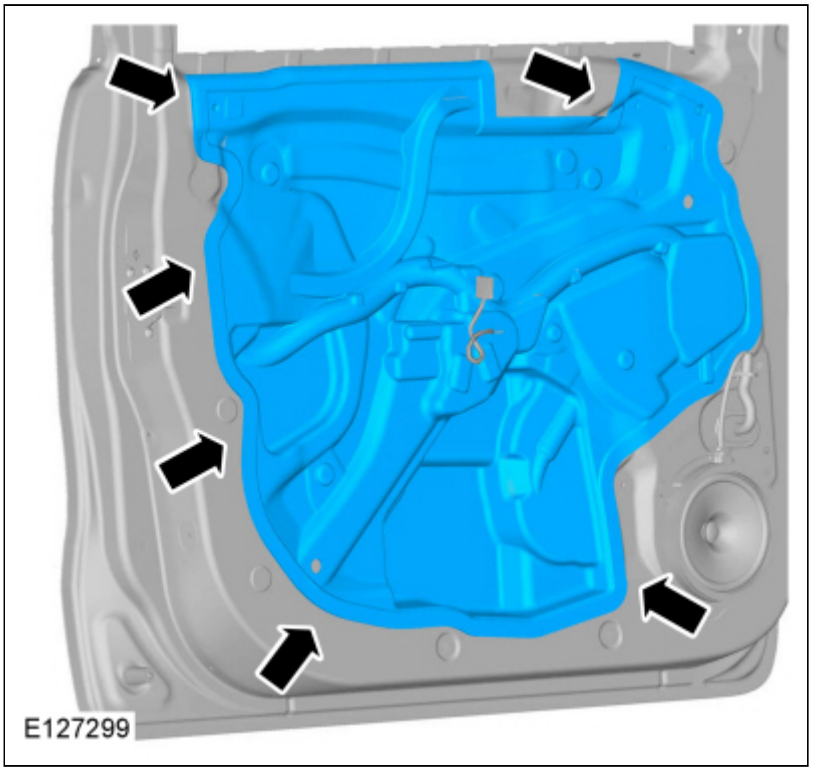
   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. 

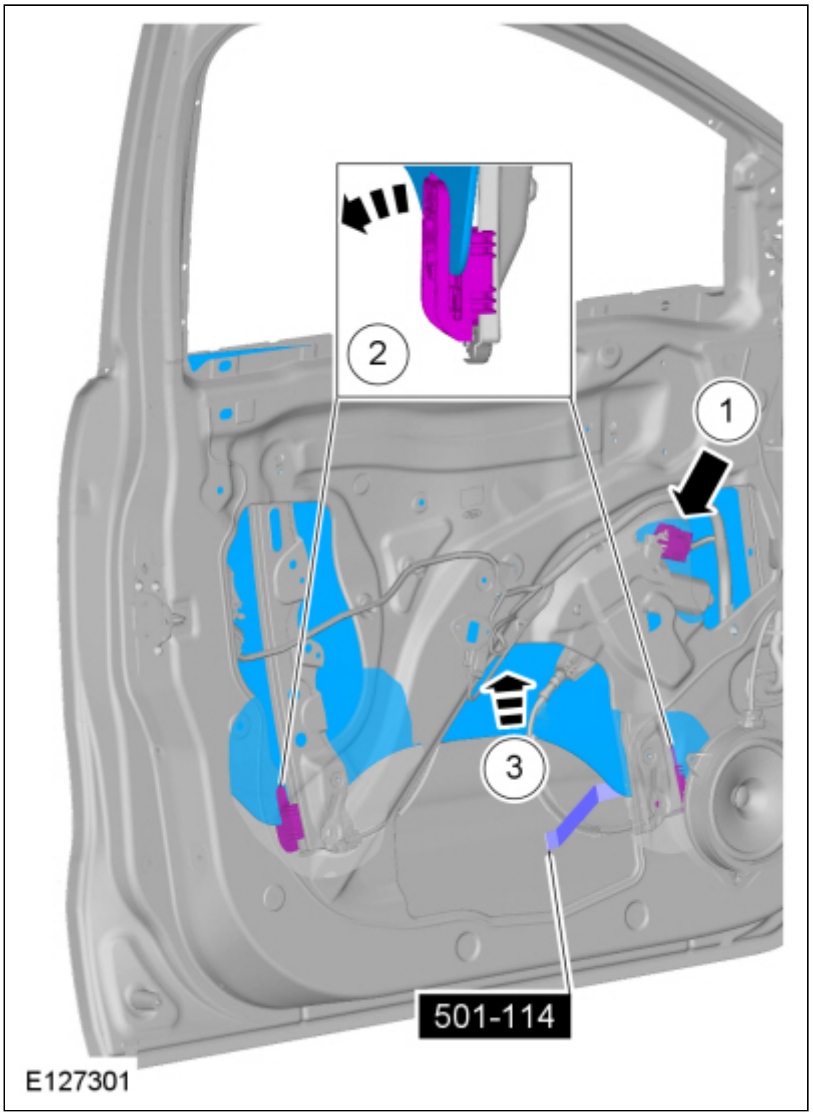
3.



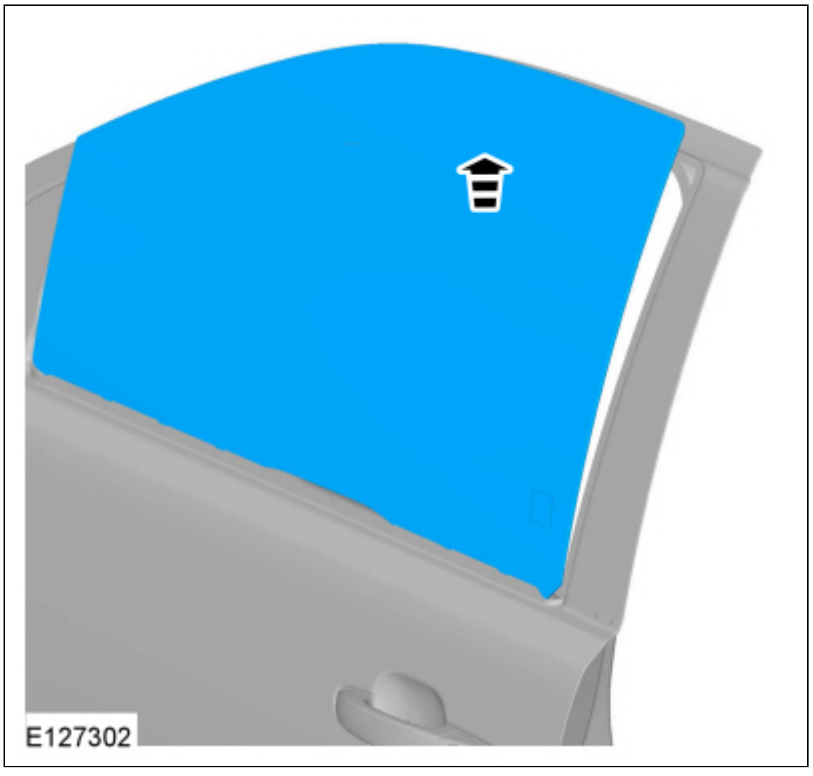
4. **NOTICE: Do not touch the adhesive surface as re-bonding will be impaired.**



5. Use Special Service Tool: 501-114 Release Lever, Door Glass.



6.



Installation

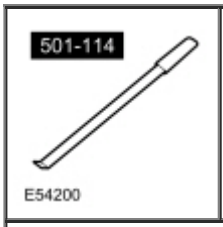
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Door Window Regulator

Base Part Number: 1523200

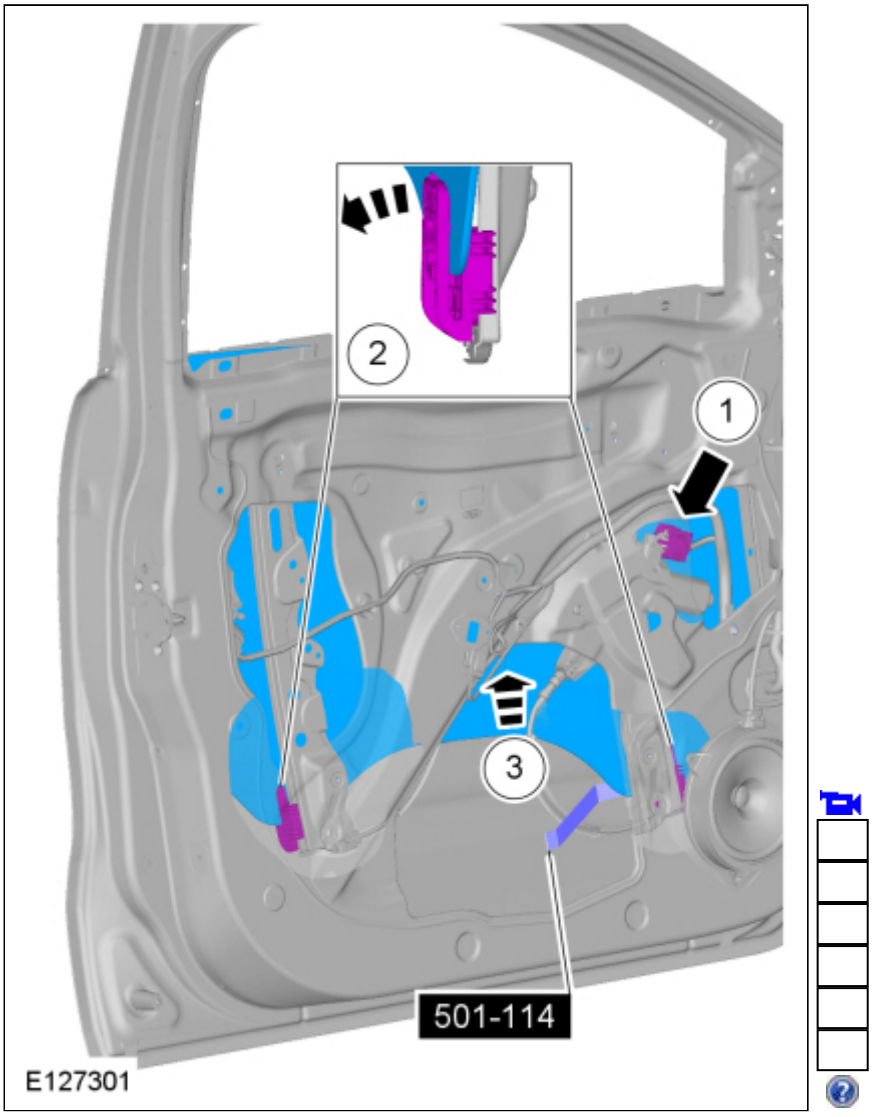
Special Tool(s) / General Equipment

	501-114 Release Lever, Door Glass
Adhesive Tape	

Removal

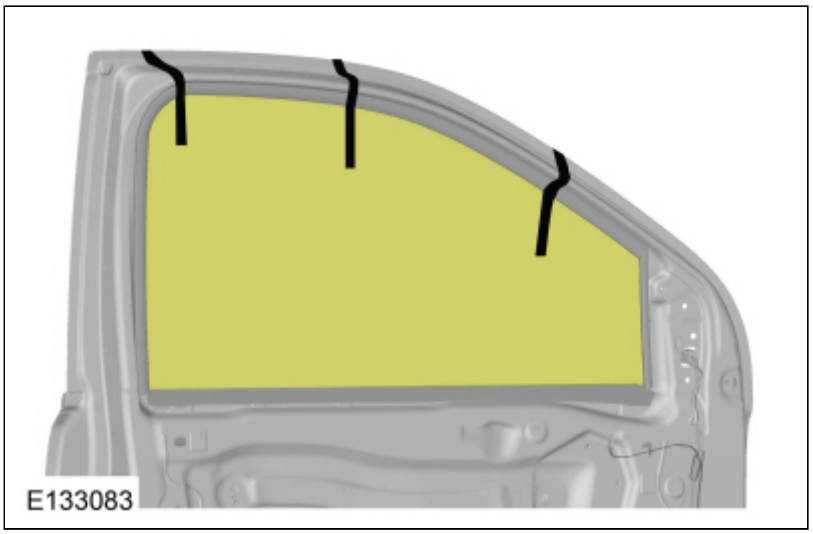
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Use Special Service Tool: 501-114 Release Lever, Door Glass.



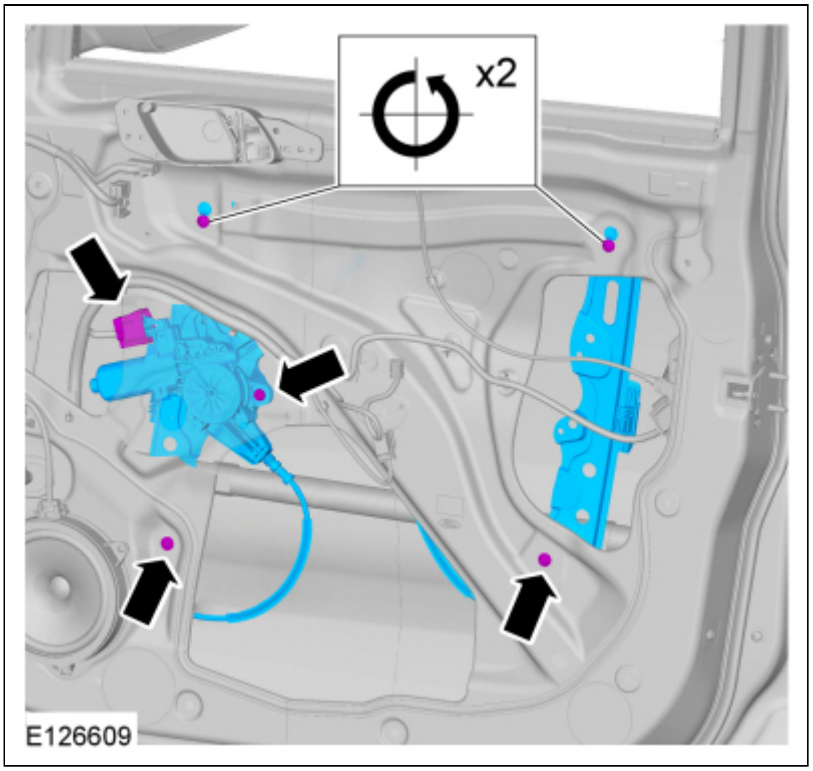
4. Using tape, secure the window glass.

Use the General Equipment: Adhesive Tape

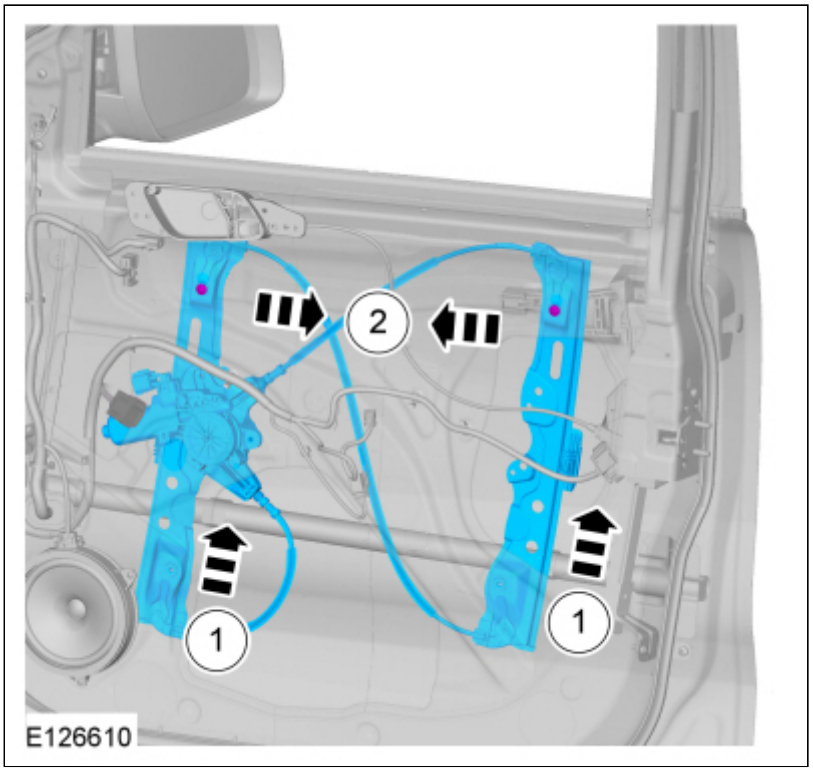


Vehicles with power windows

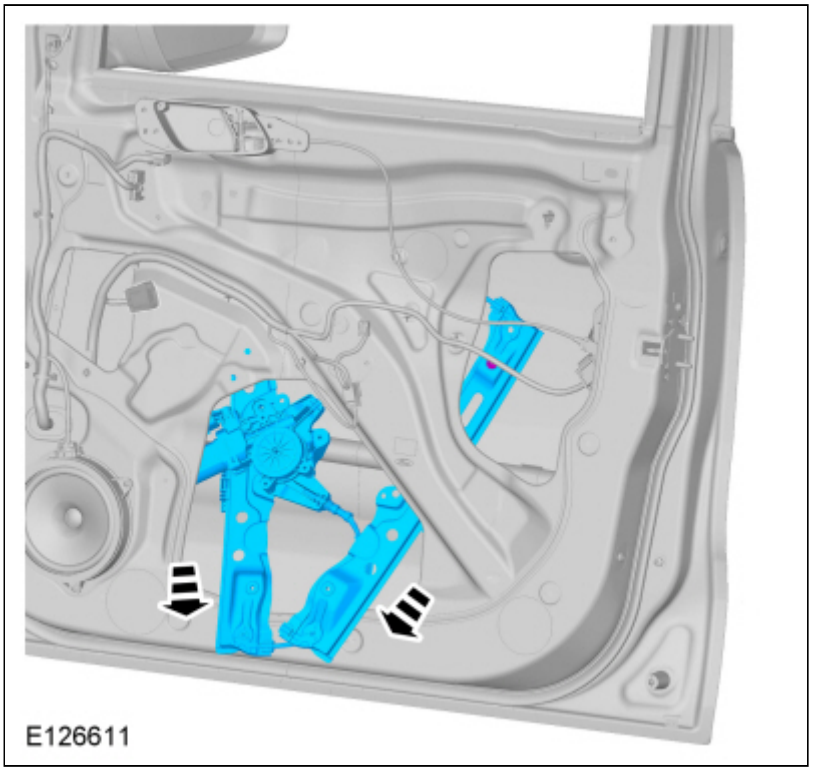
5.



6.

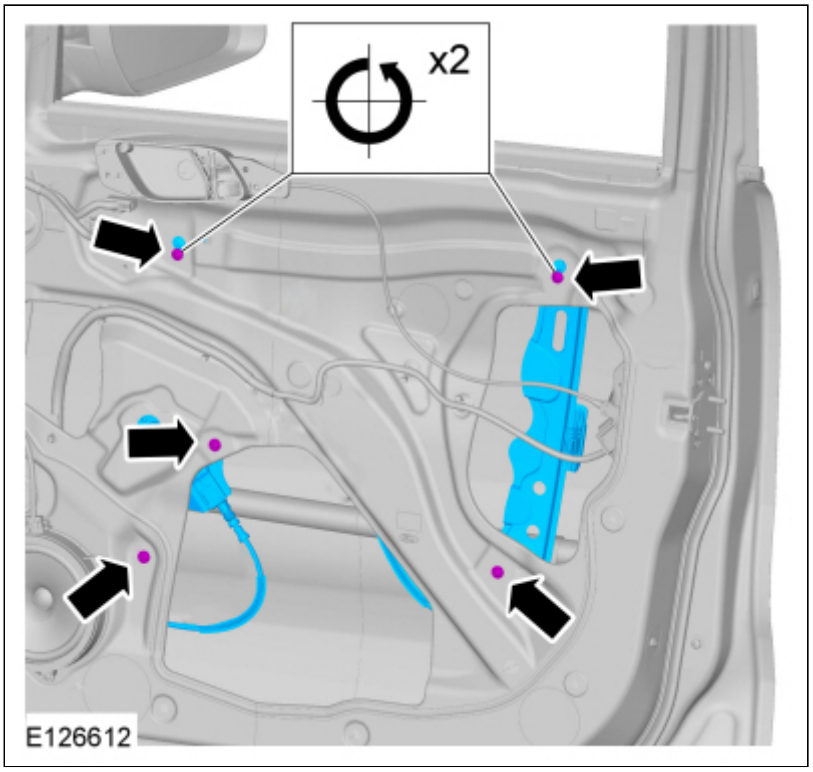


7.

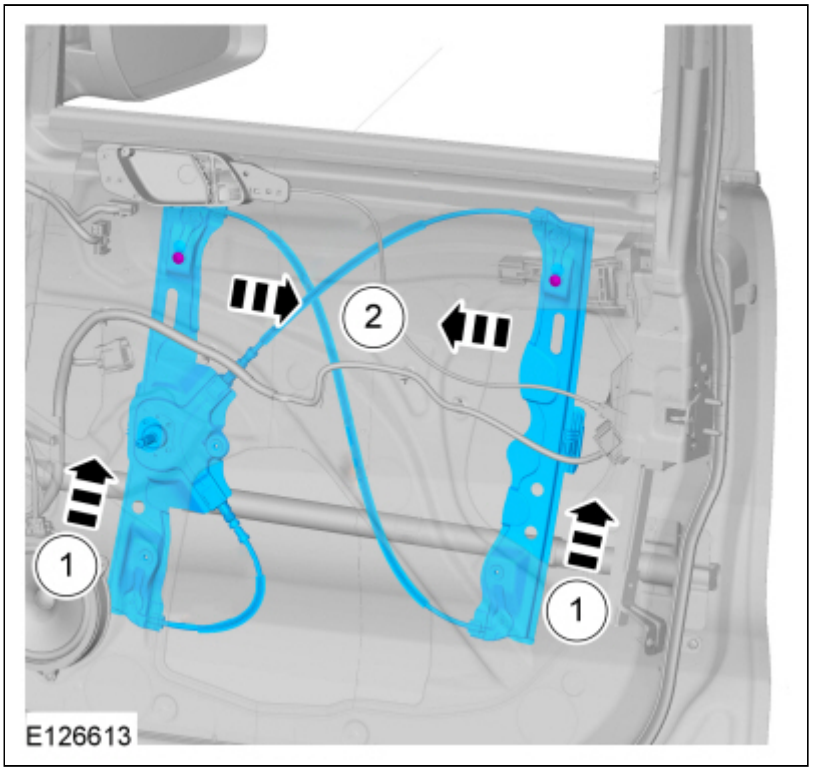


Vehicles with manual windows

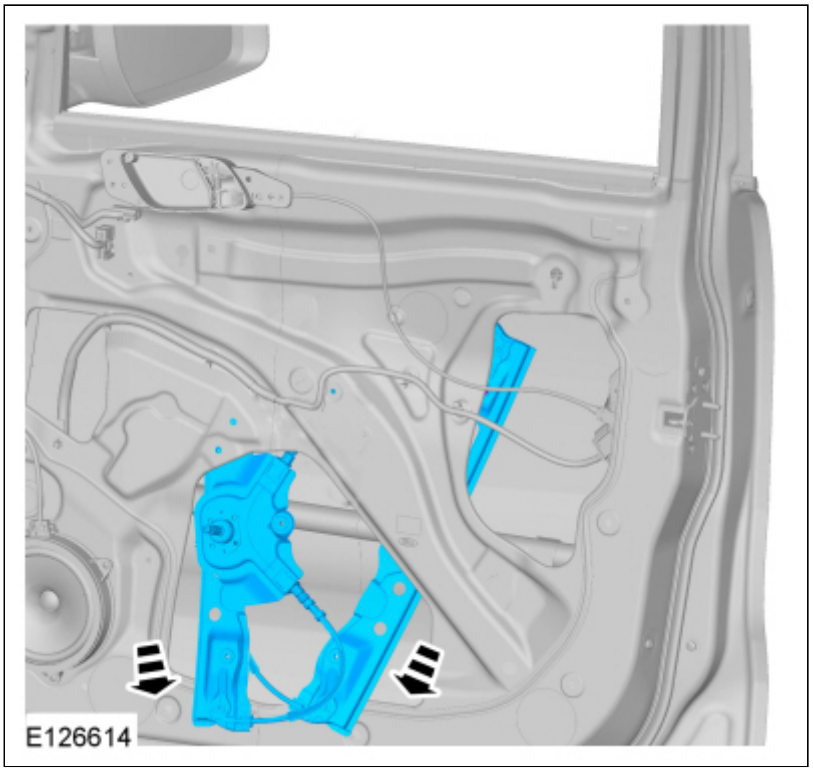
8. Remove the 3 front door window regulator retaining bolts.



9.



10.



Installation

1. To install, reverse the removal procedure.

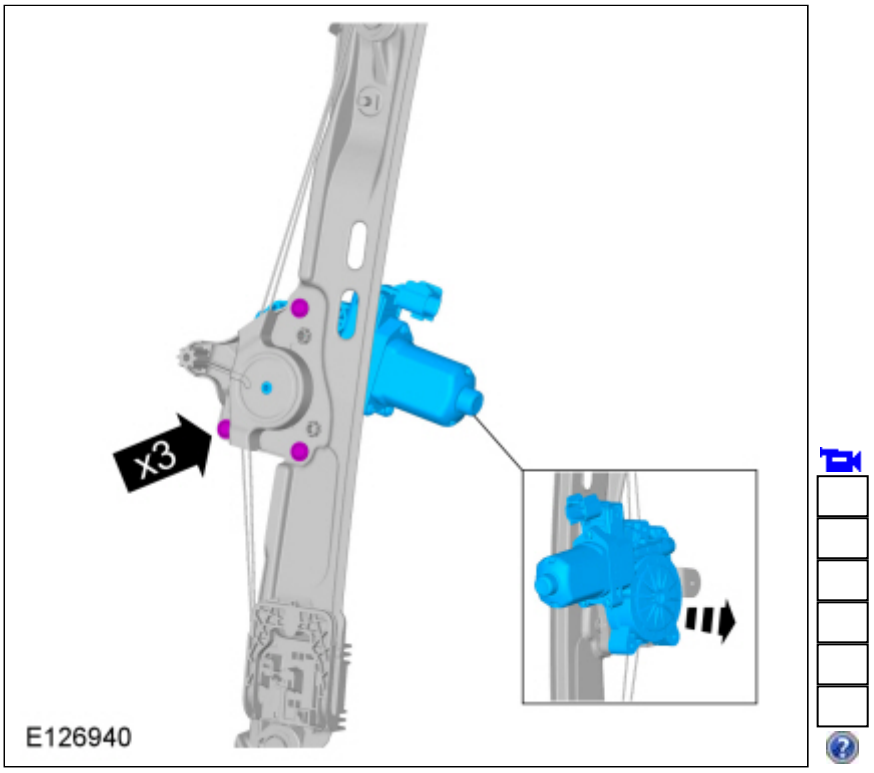
Copyright © 2016 Ford Motor Company

Rear Door Window Regulator Motor

Base Part Number: R27144

Removal

1. Refer to: Rear Door Window Regulator (501-11 Glass, Frames and Mechanisms, Removal and Installation).
2.



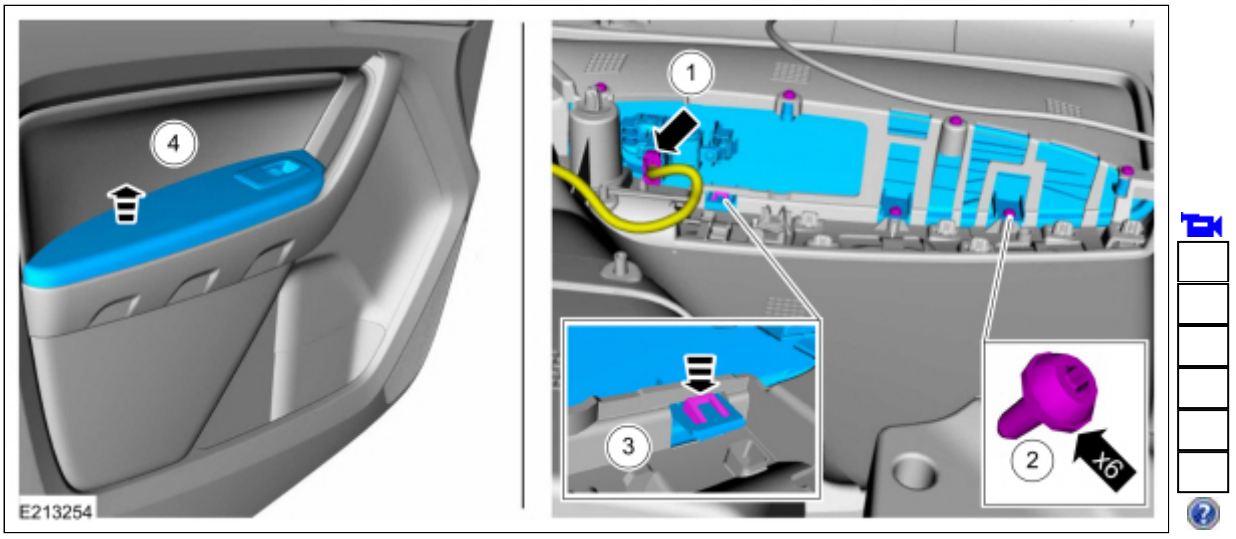
Installation

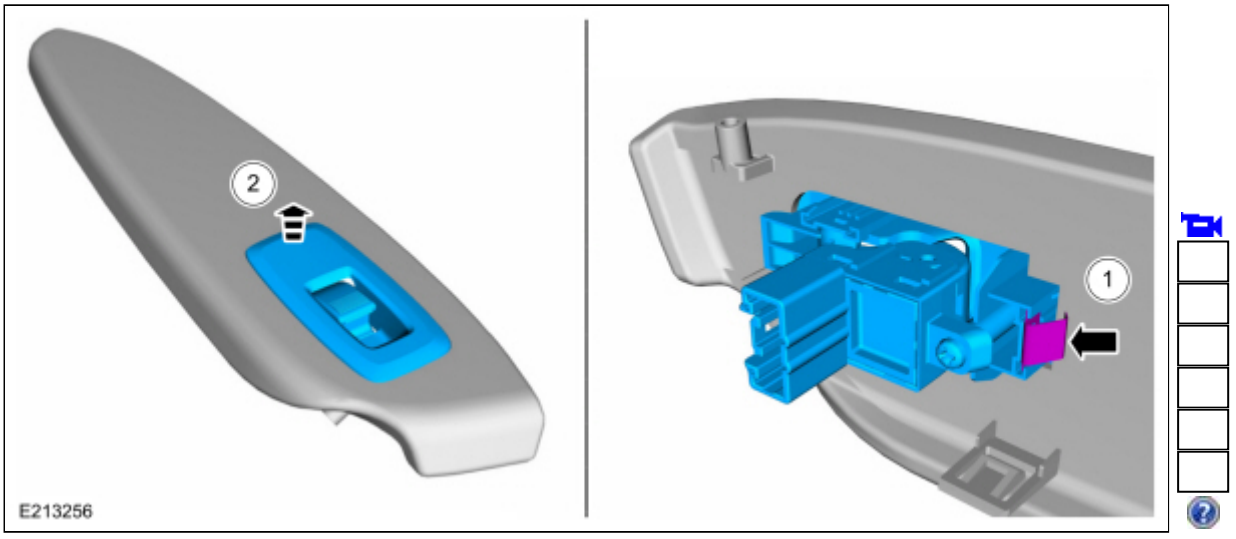
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Passenger Door Window Control Switch

Removal

1. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

3. 

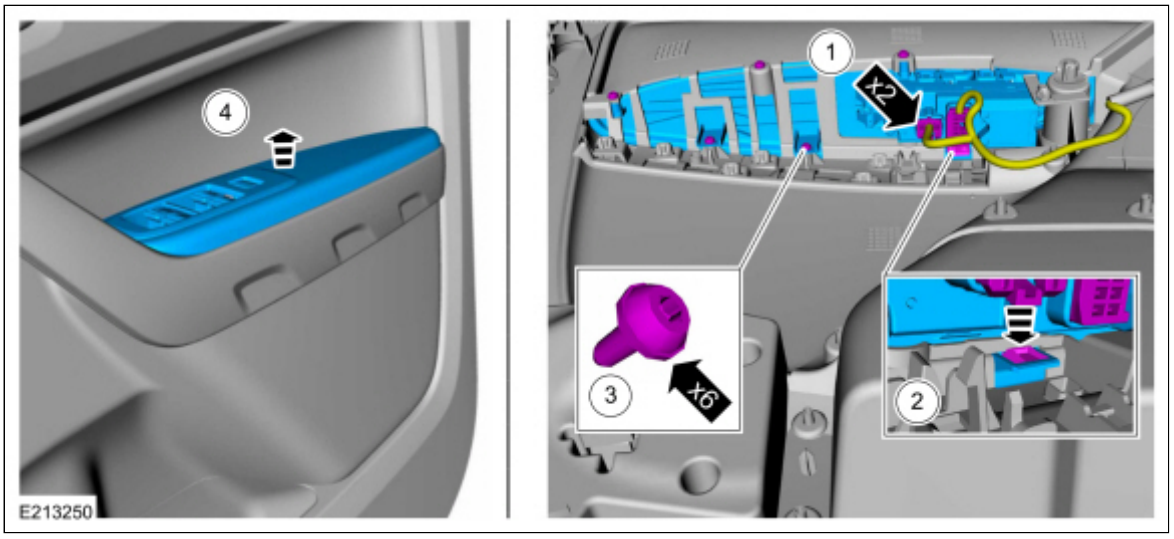
Installation

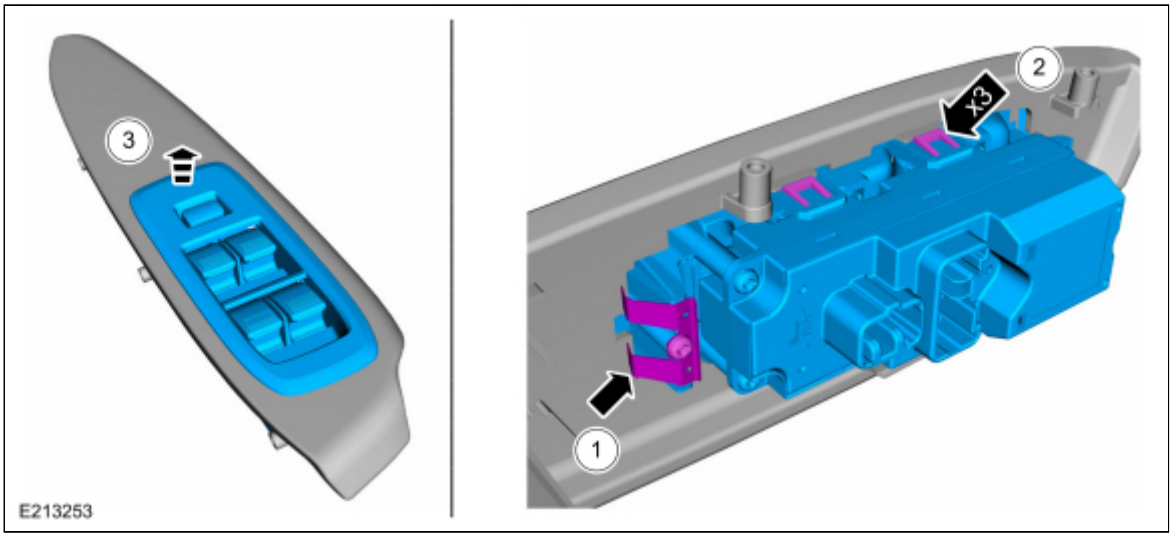
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Driver Door Window Control Switch

Removal

1. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

3. 

Installation

1. To install, reverse the removal procedure.

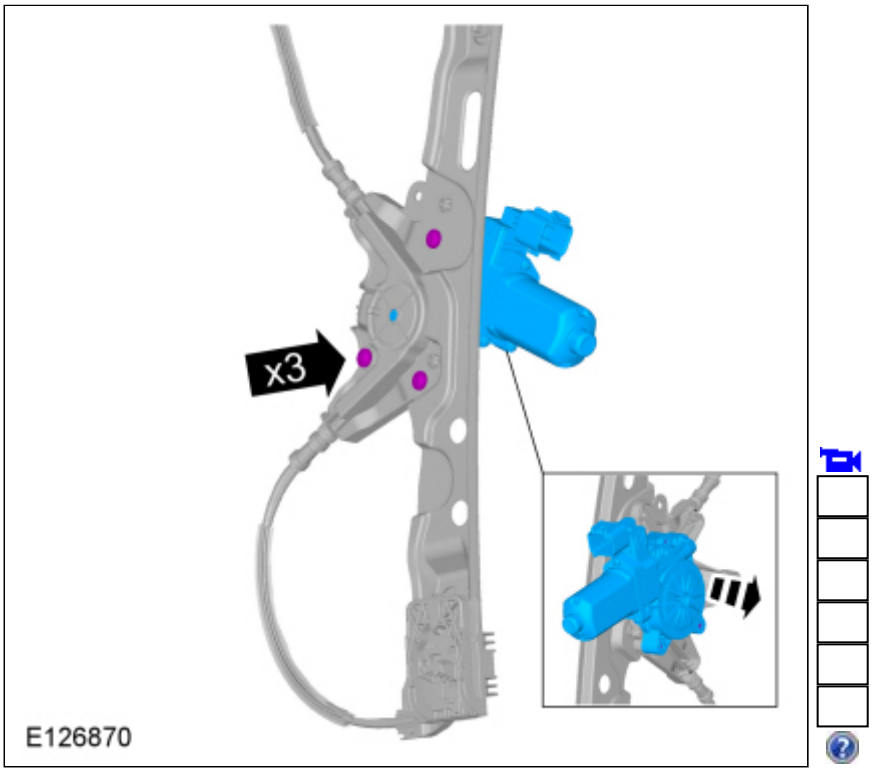
Copyright © 2016 Ford Motor Company

Front Door Window Regulator Motor

Base Part Number: 1523200

Removal

1. Refer to: Front Door Window Regulator (501-11 Glass, Frames and Mechanisms, Removal and Installation).
2.



Installation

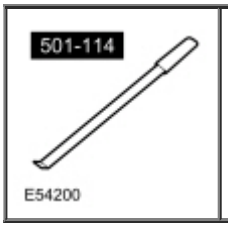
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Window Glass

Base Part Number: 25712

Special Tool(s) / General Equipment

	501-114 Release Lever, Door Glass

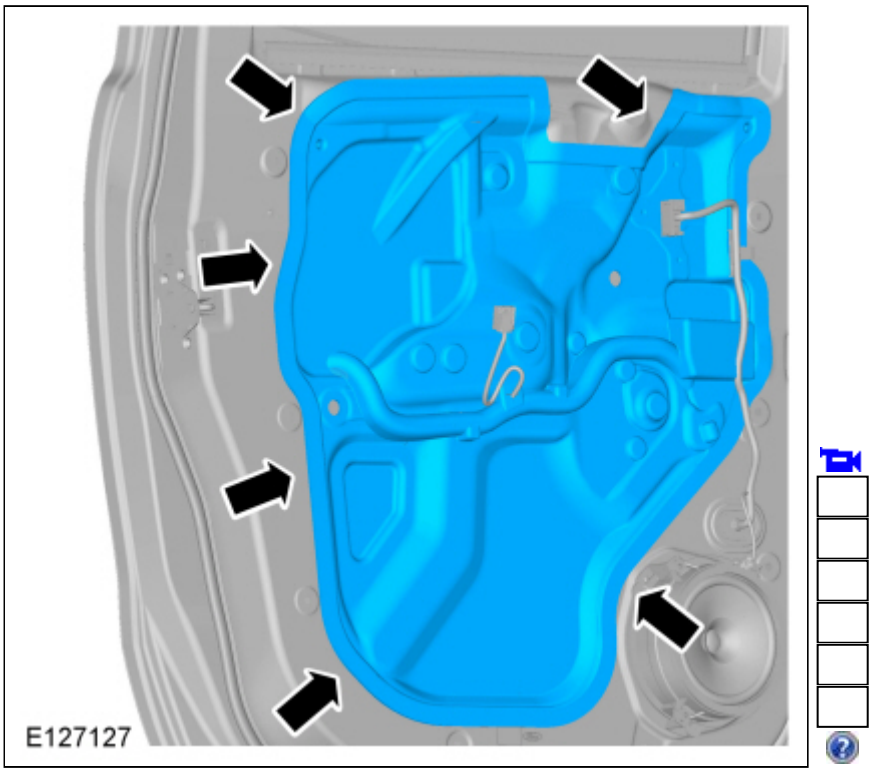
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

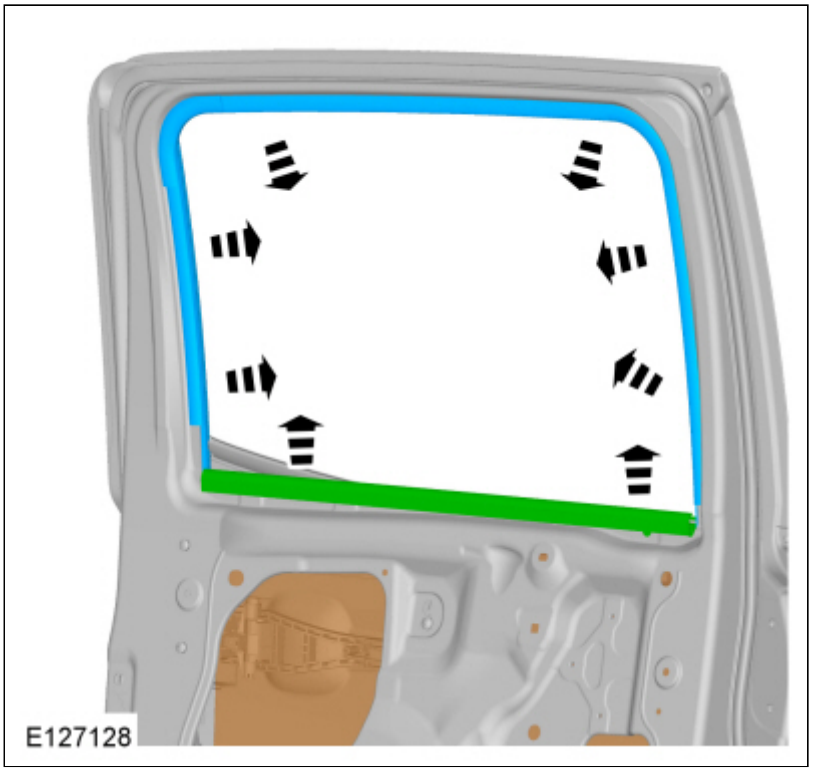
1. **NOTE:** *Ensure that the rear door window glass is in the lowered position.*

   Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).

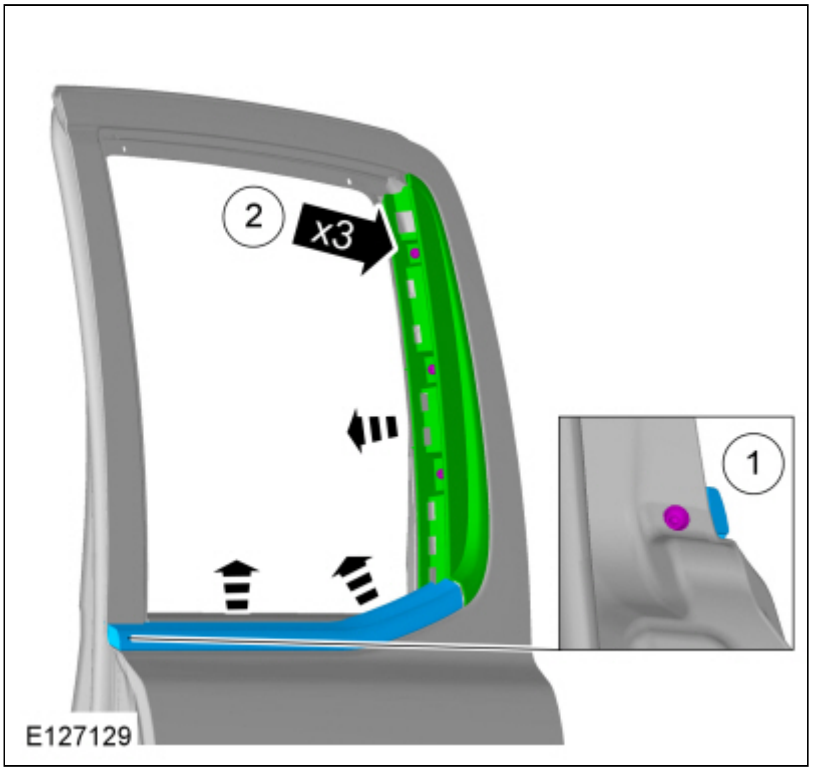
2. **NOTICE: Do not touch the adhesive surface as re-bonding will be impaired.**



3.

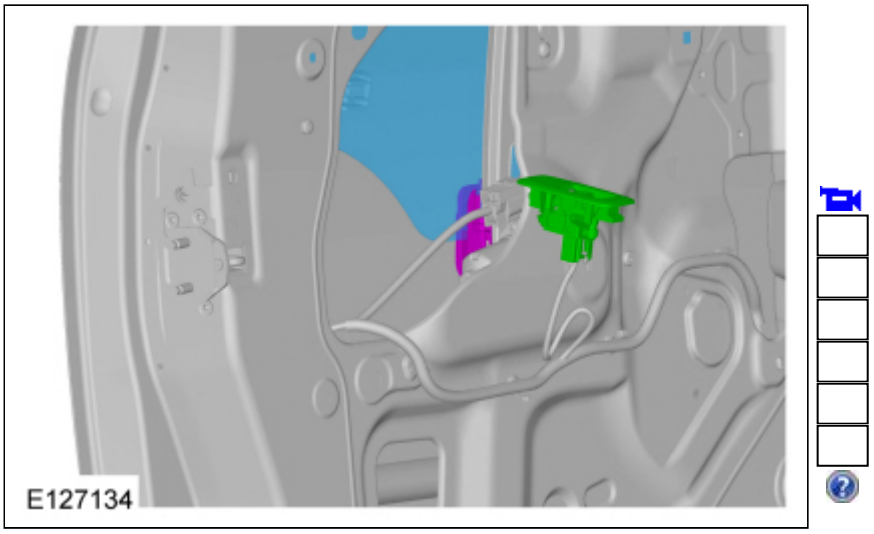


4.



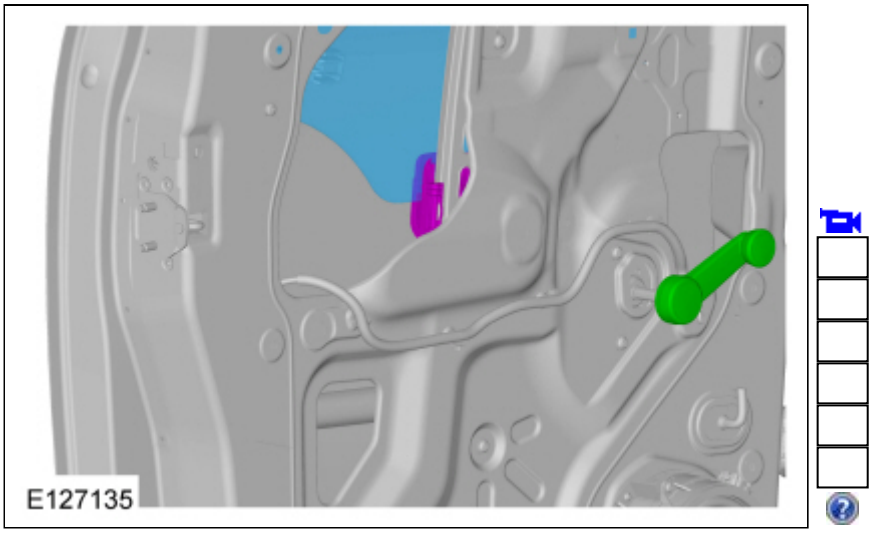
5. **NOTE:** *Vehicle with power windows only*

- Connect the rear door window regulator motor switch.
- Raise the rear door window glass upto the access hole
- Disconnect the rear door window regulator motor switch.

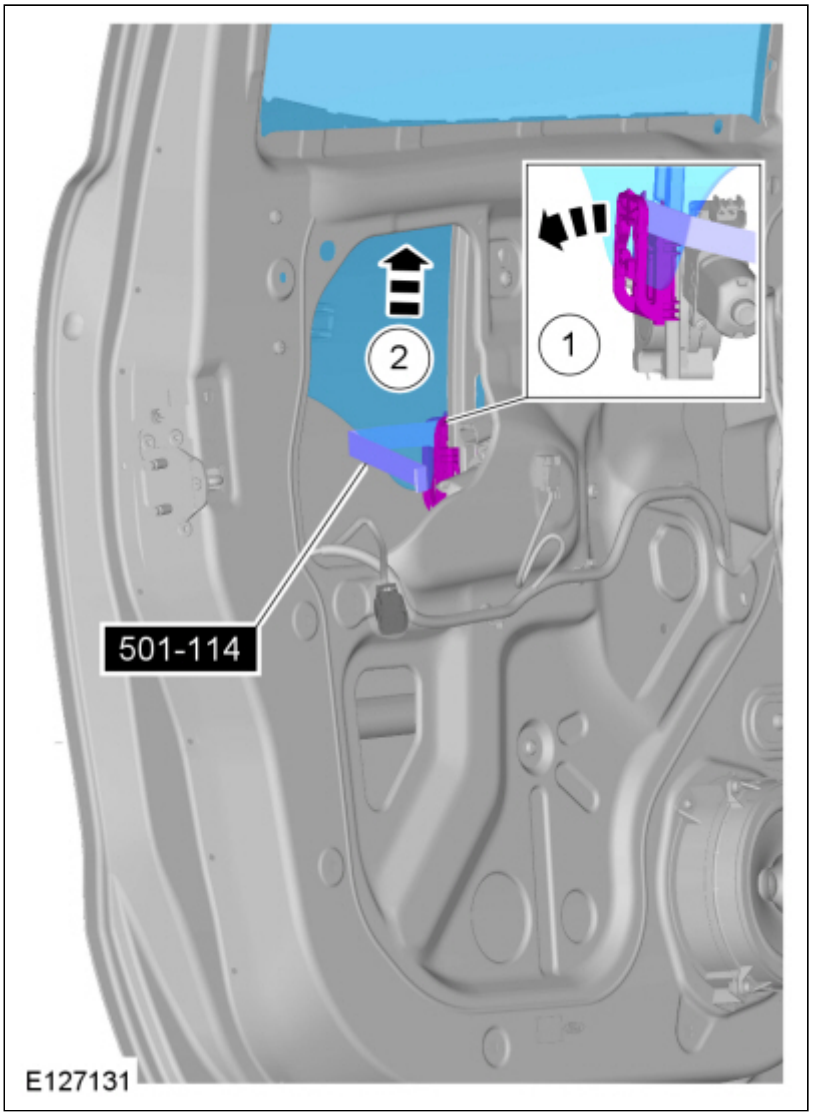


6. **NOTE:** *Vehicle with manual windows only*

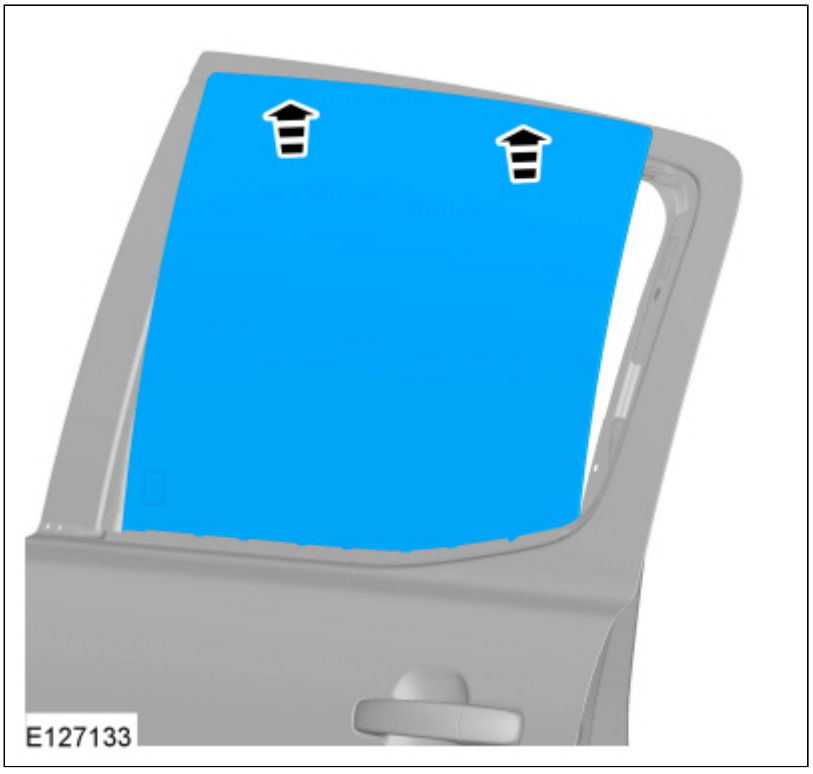
- Install the rear door window regulator crank handle.
- Raise the rear door window glass upto the access hole
- Remove the rear door window regulator crank handle.



7. Use Special Service Tool: 501-114 Release Lever, Door Glass.



8.



Installation

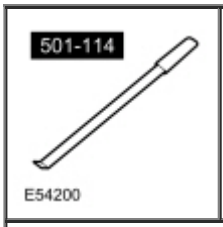
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Door Window Regulator

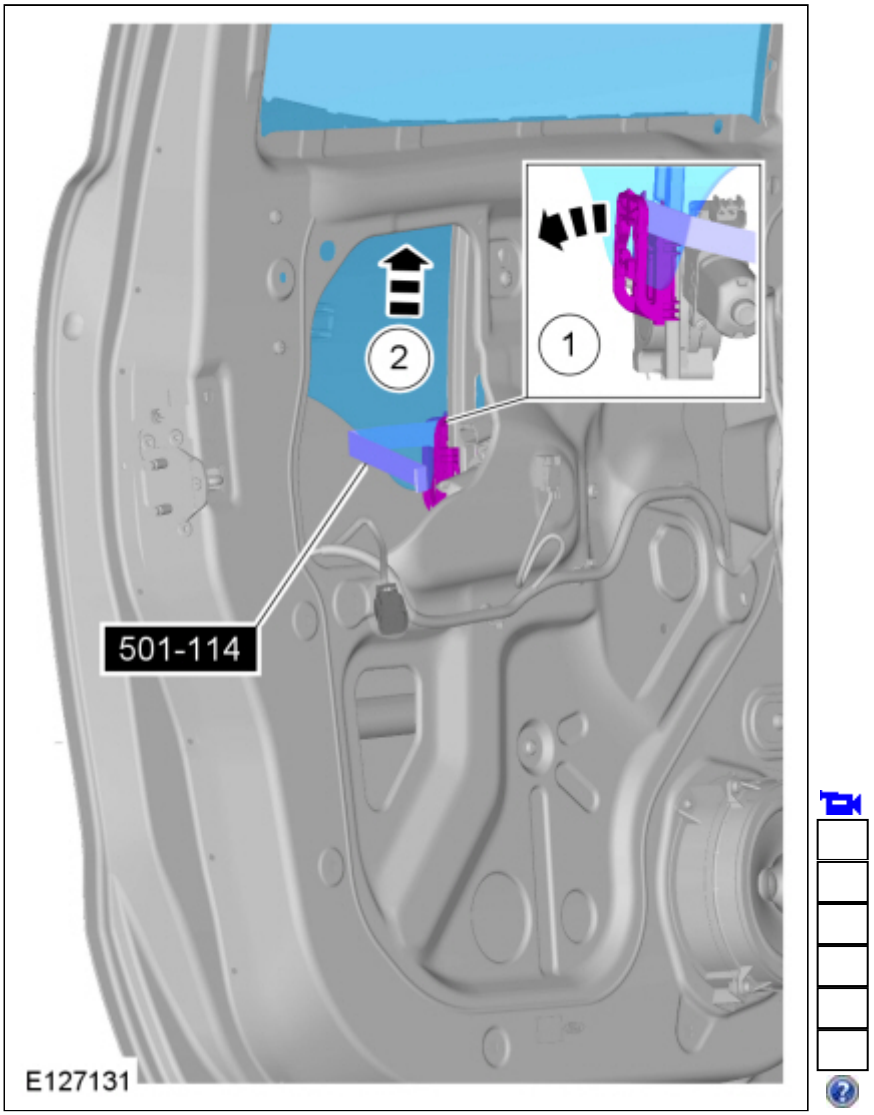
Base Part Number: R27144

Special Tool(s) / General Equipment

	501-114 Release Lever, Door Glass
Adhesive Tape	

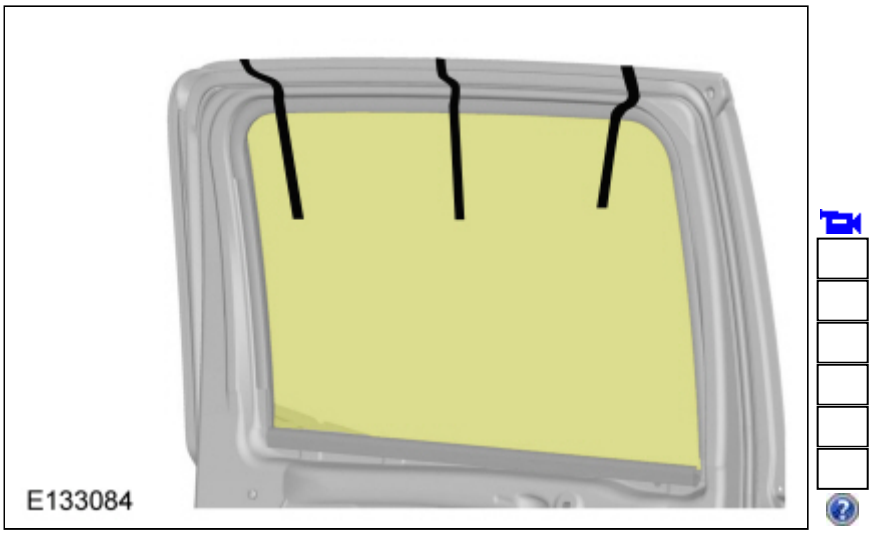
Removal

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Use Special Service Tool: 501-114 Release Lever, Door Glass.



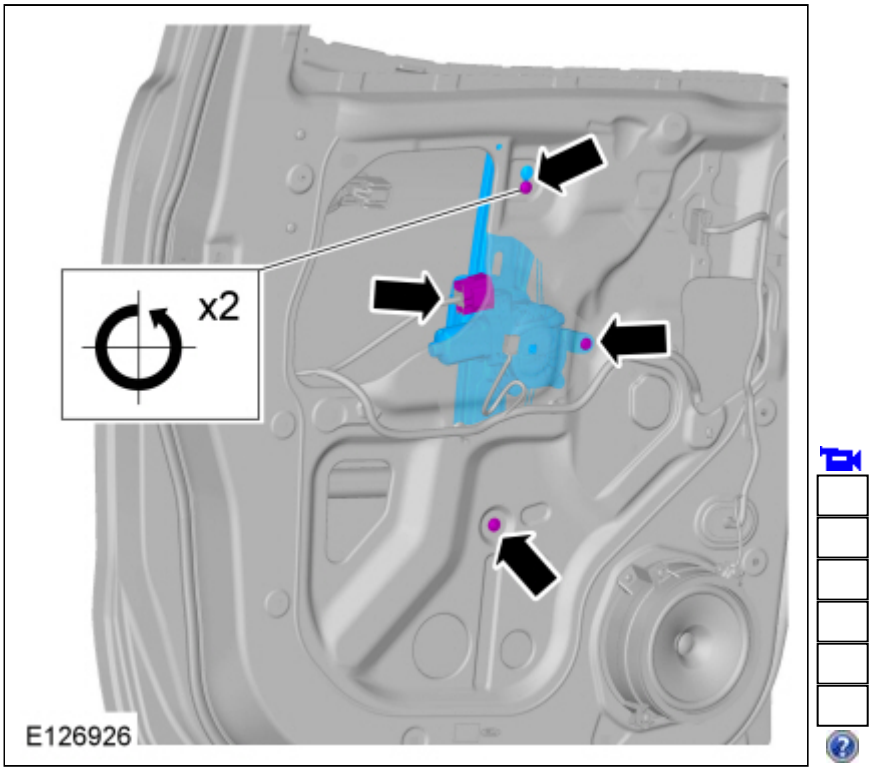
4. Using tape, secure the window glass.

Use the General Equipment: Adhesive Tape

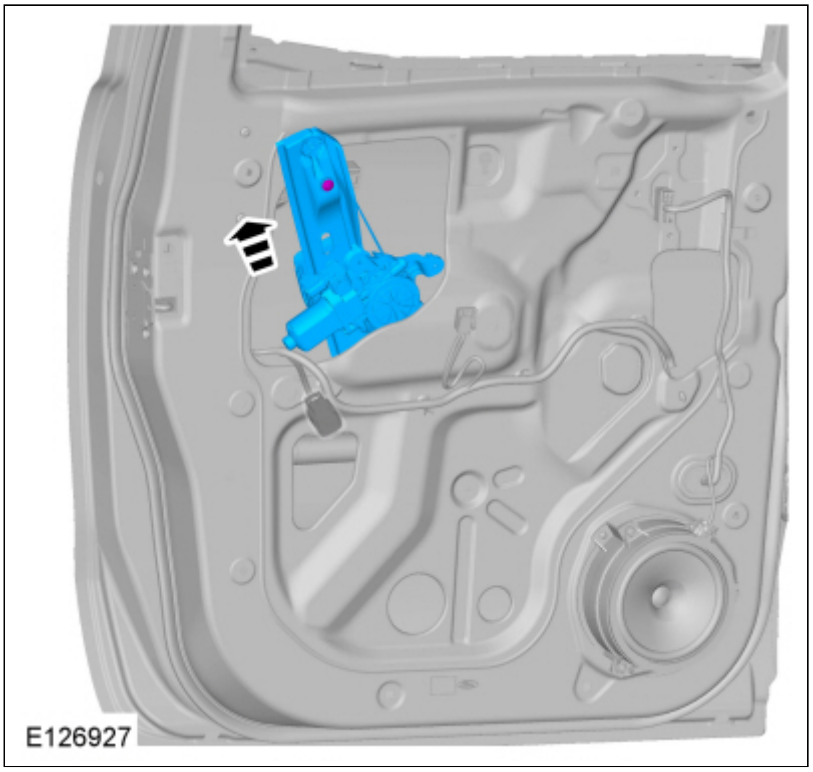


Vehicles with power windows

- Disconnect the front door window regulator motor electrical connector.
- Remove the 2 rear door window regulator retaining bolts.

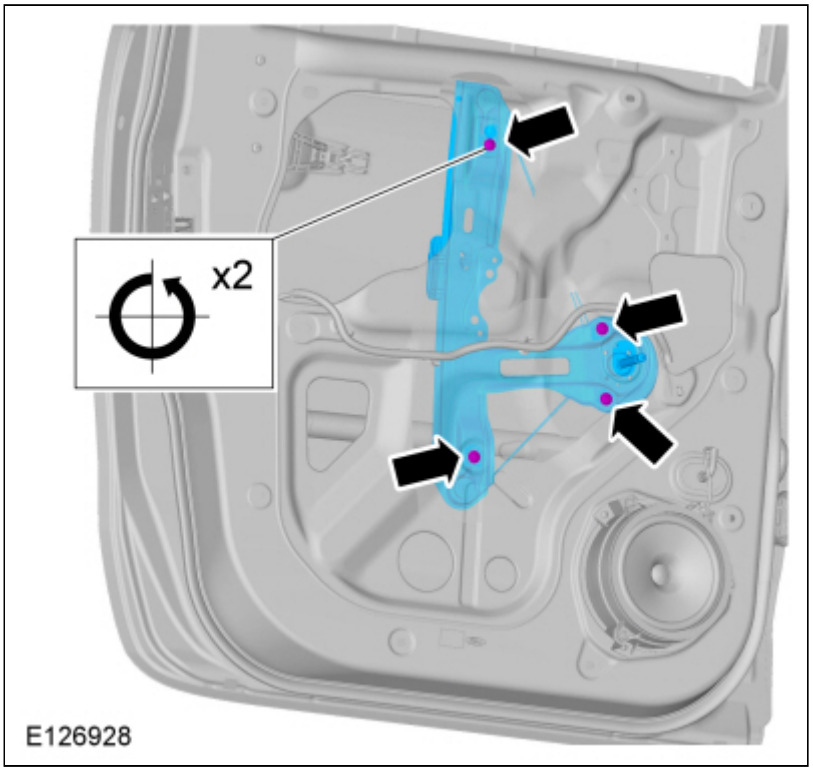


6.

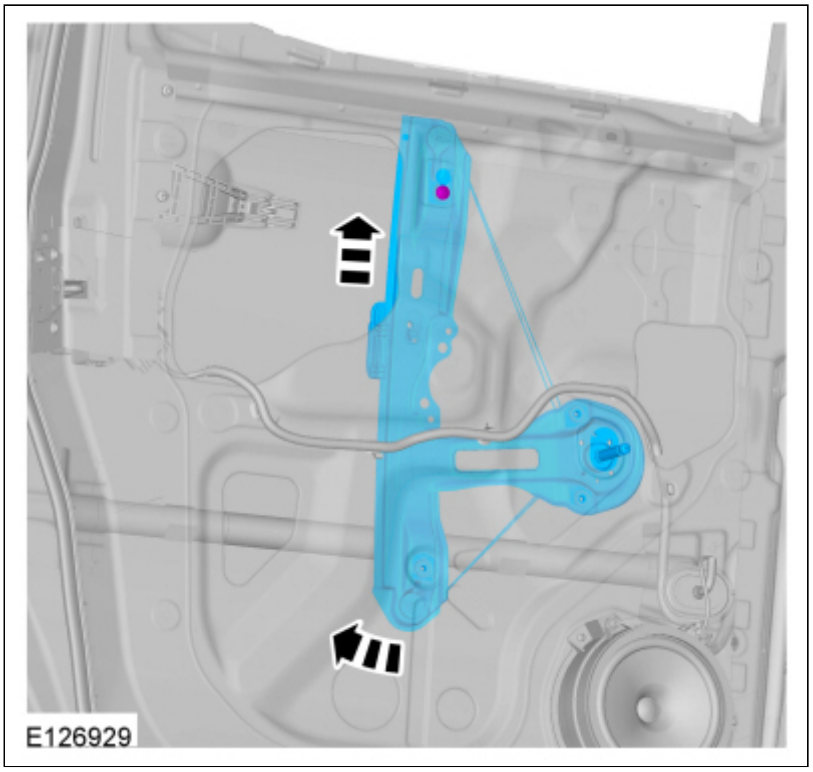


Vehicles with manual windows

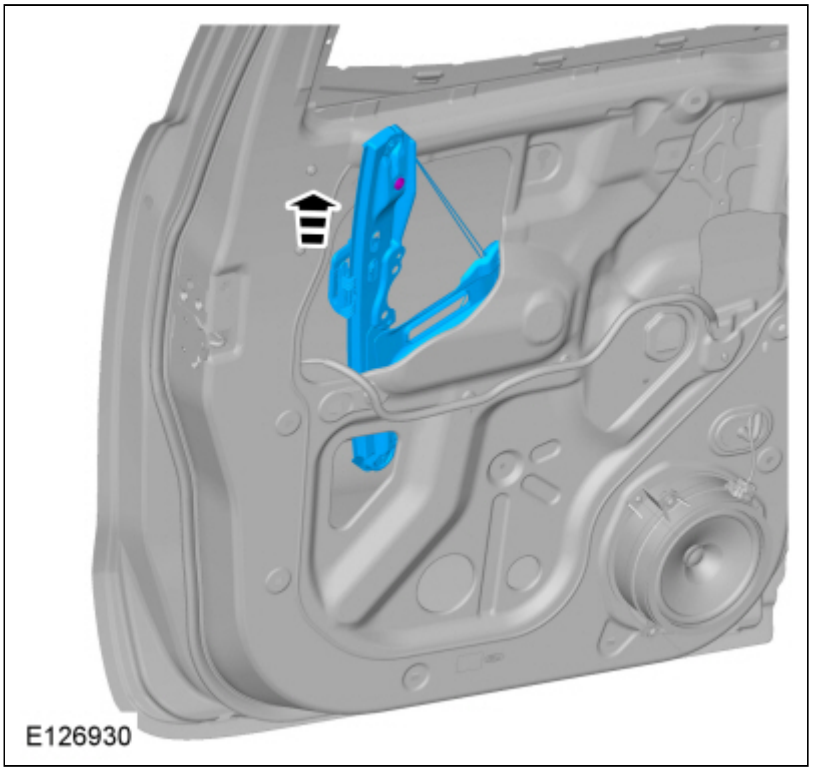
7. Remove the 3 rear door window regulator retaining bolts.



8.



9.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Window Glass

Special Tool(s) / General Equipment

Direct Glazing Removal/Replacement Equipment
Knife
Adhesive Tape

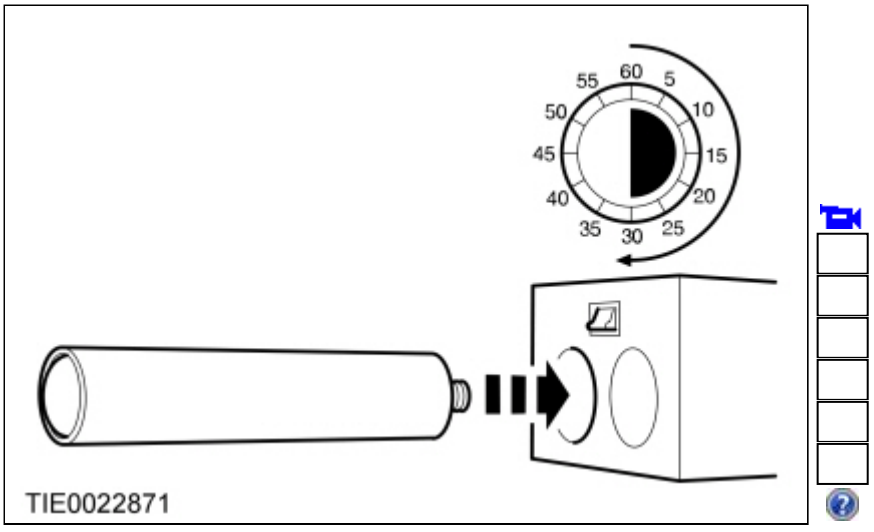
Materials

Name	Specification
Adhesive	WSK-M11P57-A3
Adhesive	WSS-M11P57-A5

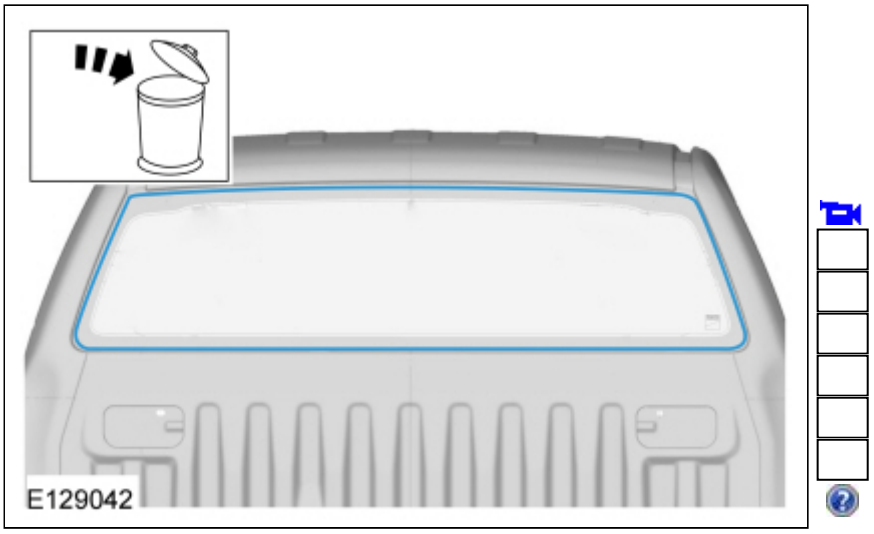
Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Refer to: Rear Seat (501-10A Seating, Removal and Installation).

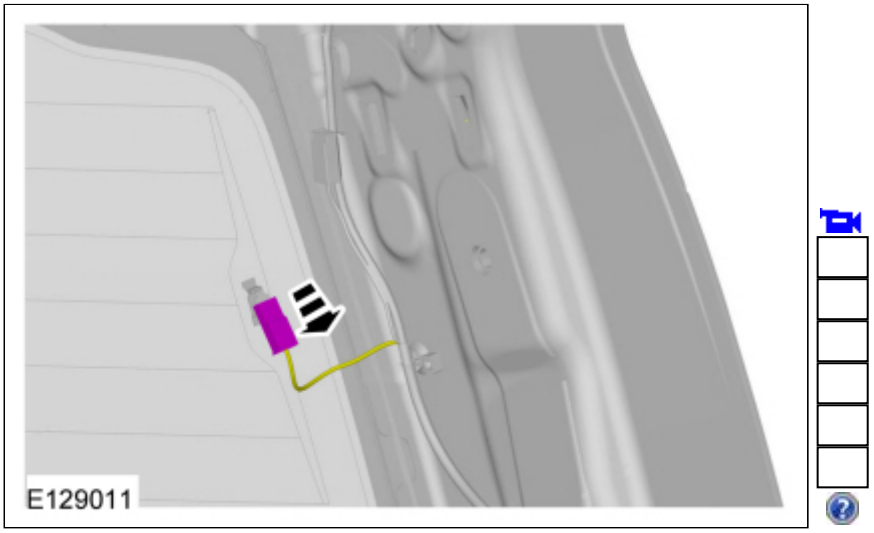
- *Material*: Adhesive (WSK-M11P57-A3)
- Remove the polyurethane (PU) adhesive cap and heat the 2K-PU adhesive for a minimum of 30 minutes.
  Use the General Equipment: Direct Glazing Removal/Replacement Equipment
- Repairs under warranty:
  Material: Adhesive (WSS-M11P57-A5)



6.

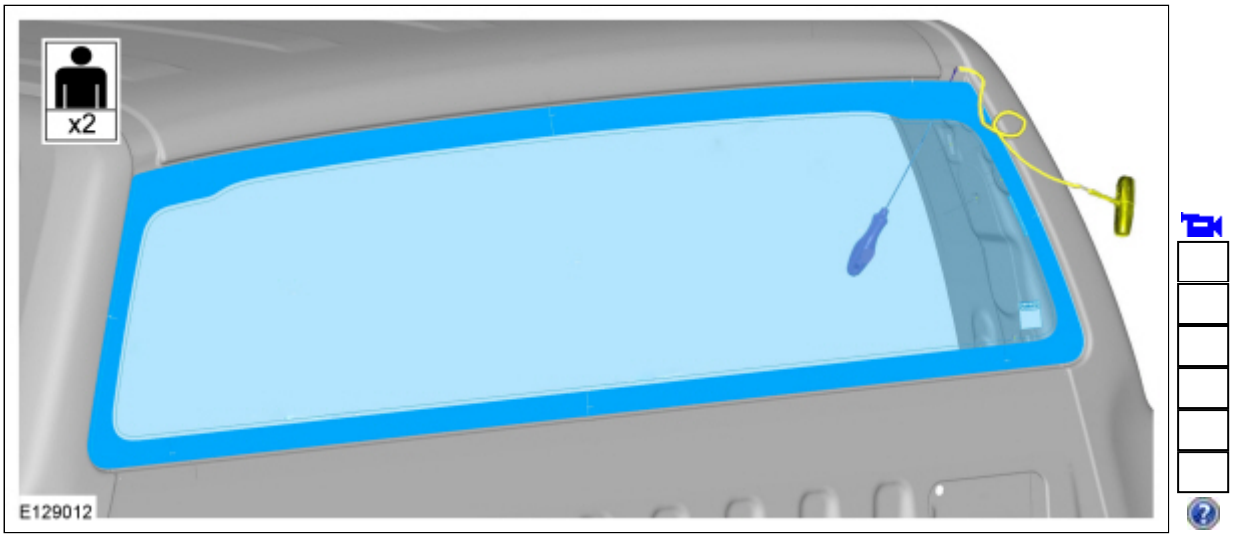


7. **NOTE:** *Vehicles with heated windsheild only.*



8. 

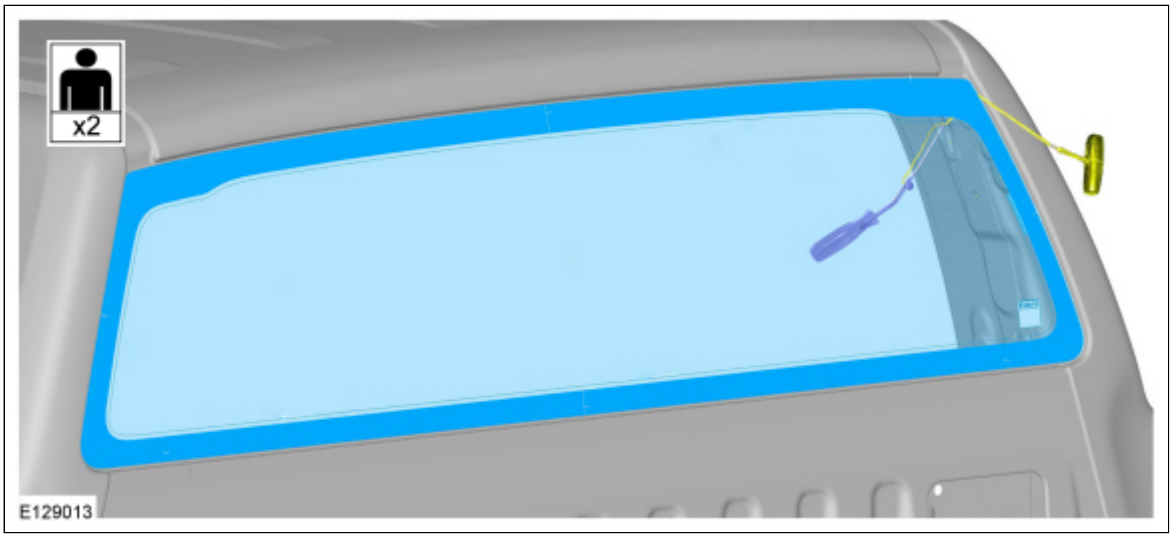
Use a suitable awl to thread the cutting wire.
Use the General Equipment: Direct Glazing Removal/Replacement Equipment



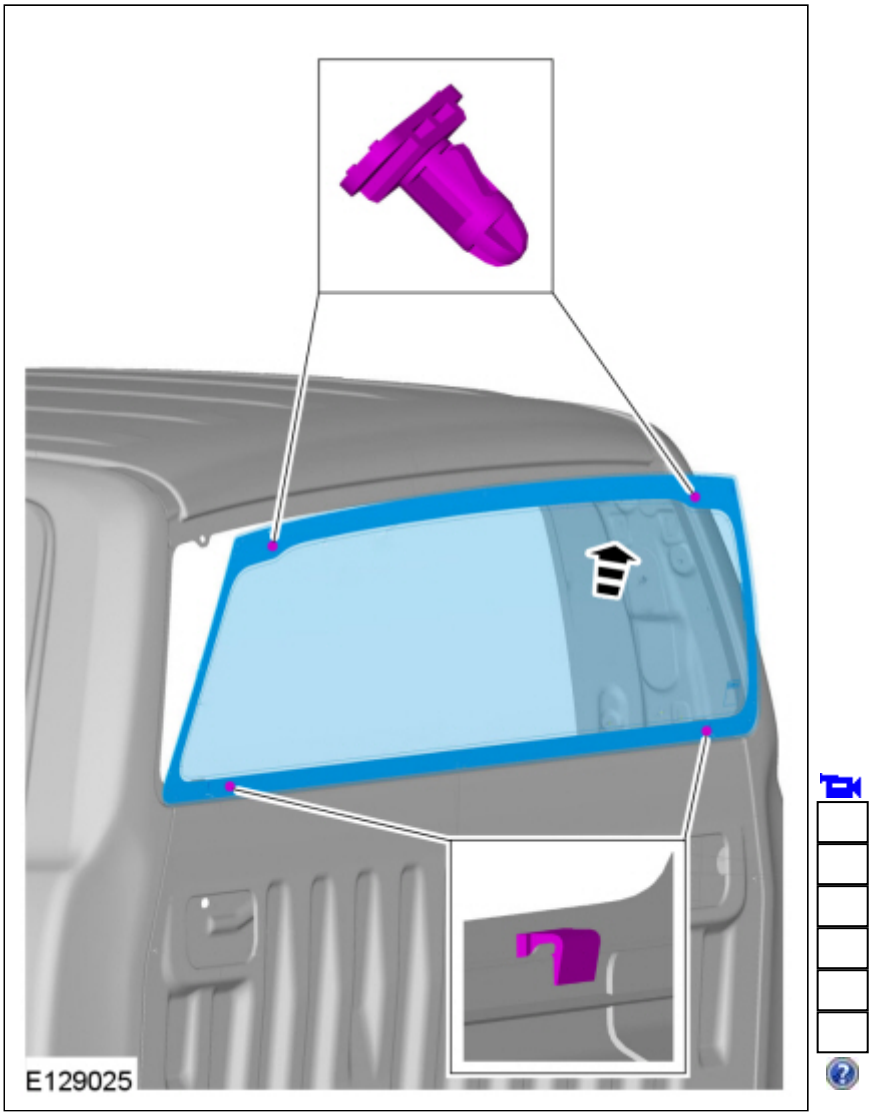
9. 

NOTICE: If the original window glass is to be installed, take care not to damage the electrical connectors and the weatherstrip (if equipped).

Use a suitable brace to prevent trim damages.
Use the General Equipment: Direct Glazing Removal/Replacement Equipment

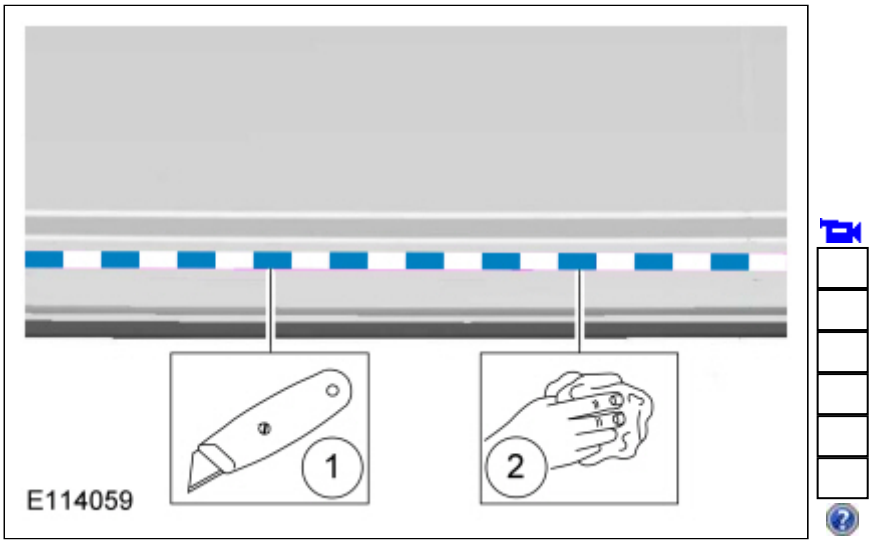


10.

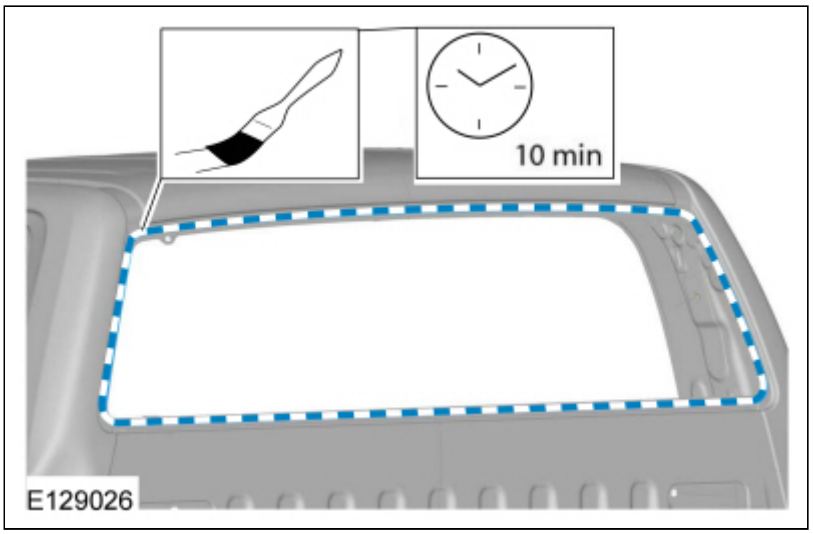


Installation

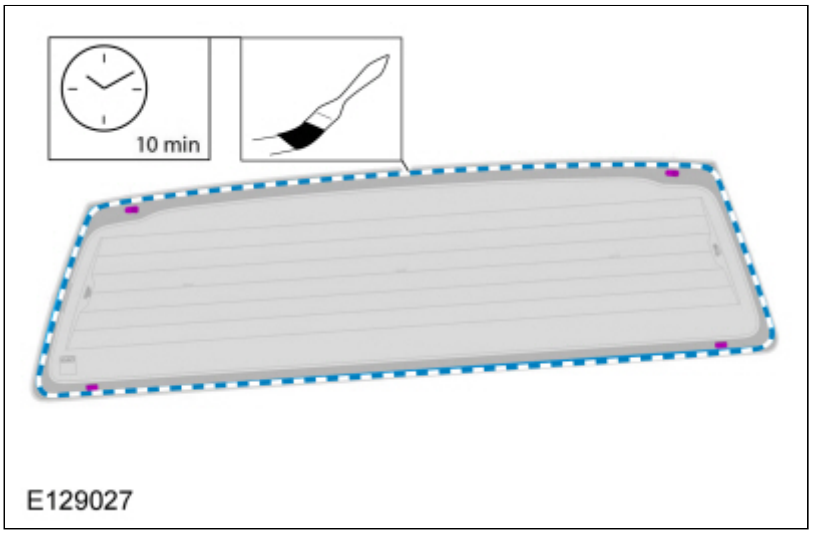
1. **NOTE:** *Minimum 1 mm bead thickness.*
    - Use the General Equipment: Knife
    - **NOTE:** *Make sure that the mating faces are clean and free of foreign material.*
    - **NOTE:** *Touching the adhesive surface will impair rebonding.*
    - Prepare the windshield glass, windshield glass flange and trimmed PU adhesive in accordance with the instructions supplied with the glass adhesive kit.



2. Apply the activator/primer in accordance with the instructions supplied with the glass adhesive kit.



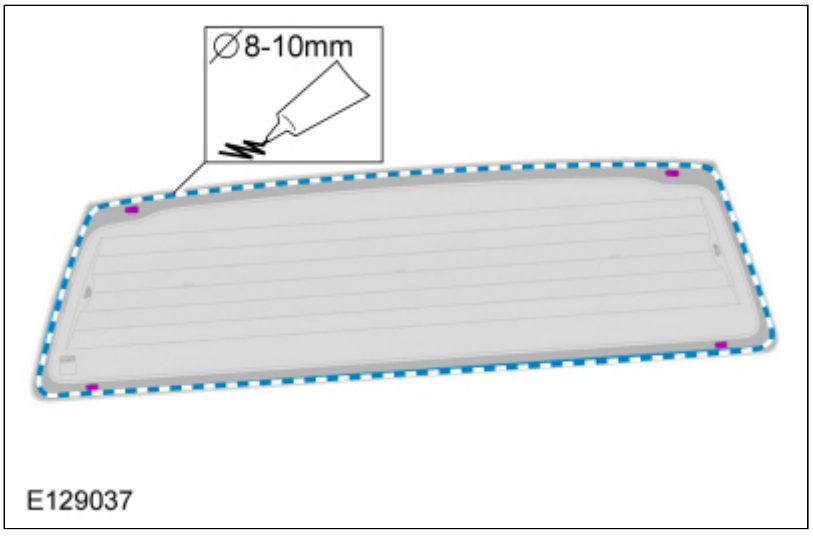
3. Apply the activator/primer in accordance with the instructions supplied with the glass adhesive kit.



4. **NOTE:** *Discard the first 100 mm of adhesive as this may have a reduced working time.*

   NOTE: *Make sure that any breakage in the continuous bead of adhesive is overlapped by 20 mm.*

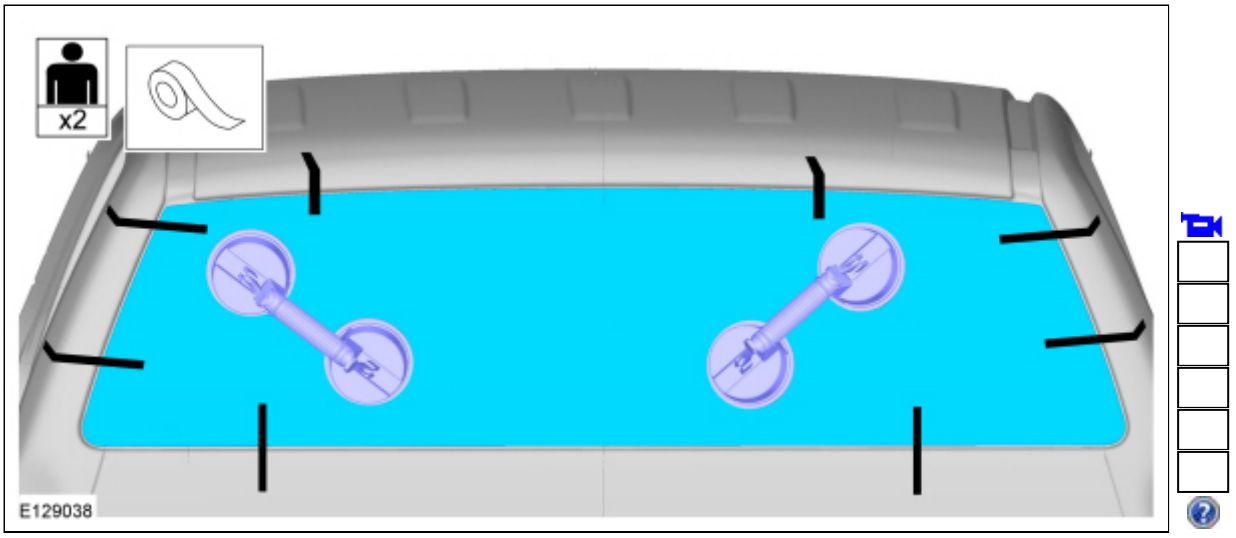
   Use the General Equipment: Direct Glazing Removal/Replacement Equipment
   Material: Adhesive (WSK-M11P57-A3)
   Material: Adhesive (WSS-M11P57-A5)



5. **NOTICE: Make sure that equal pressure is applied to the full length of the component.**

NOTICE: During the curing time of the polyurethane (PU) adhesive, the door windows must be left open.

Using tape, secure the windshield glass in the correct position until the PU adhesive has cured.Adhesive tape
Use the General Equipment: Adhesive Tape



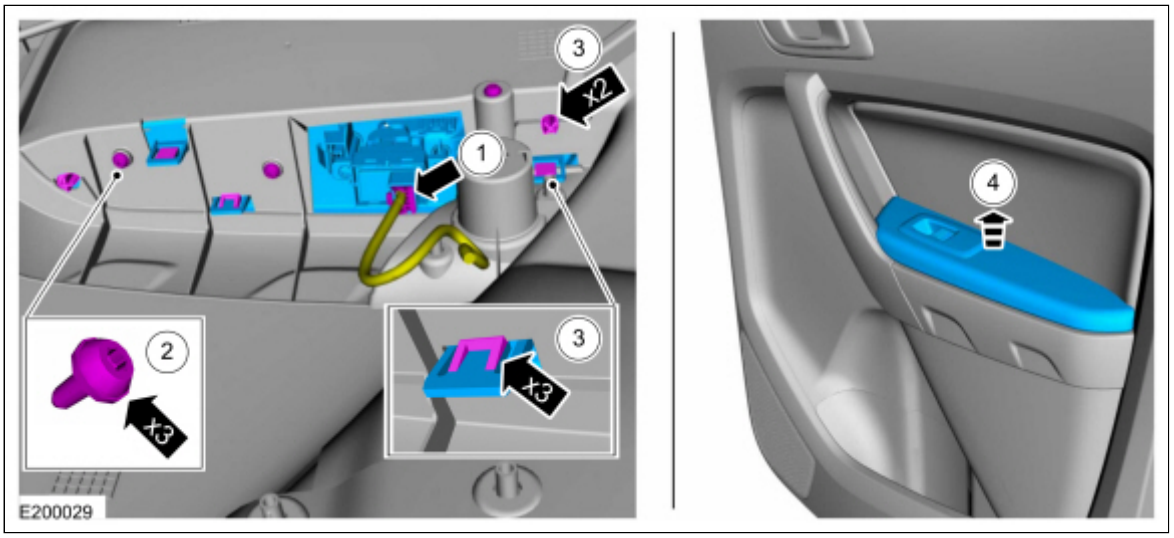
6. To install reverse the removal procedure.

Copyright © 2016 Ford Motor Company

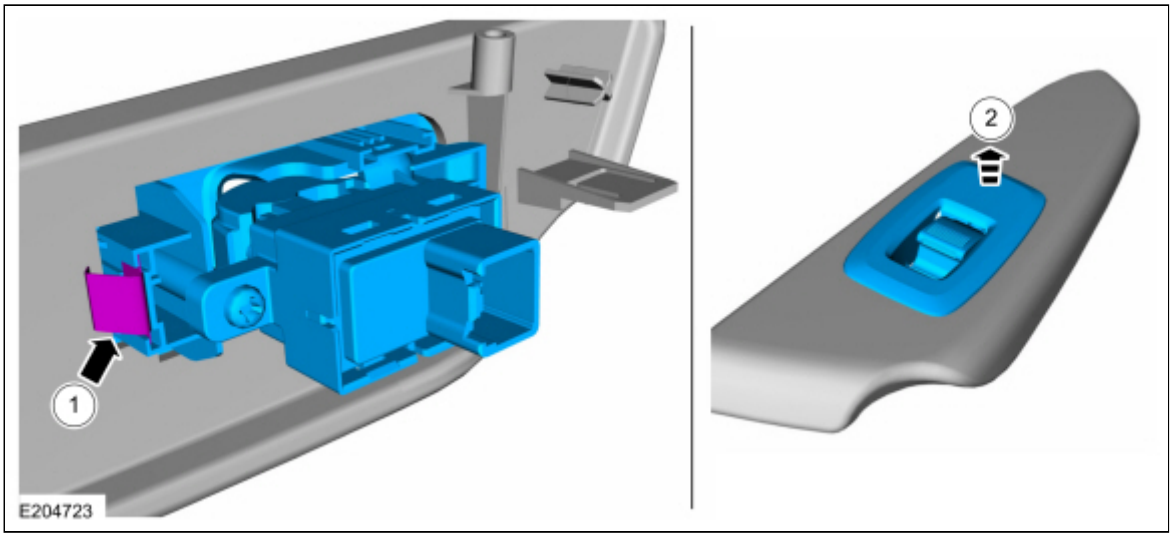
Rear Door Window Control Switch

Removal

1. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. **NOTE:** *LH side shown, RH side similar.*



3.



Installation

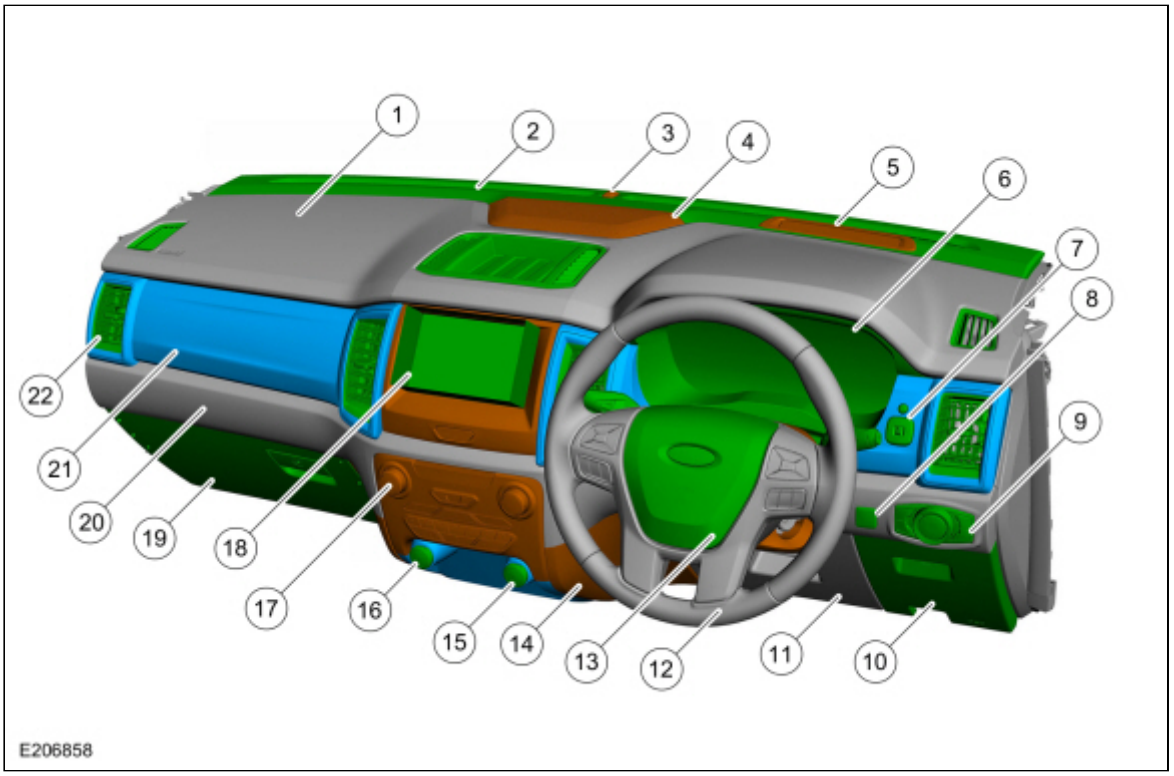
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Instrument Panel - Component Location

Base Part Number: S04305

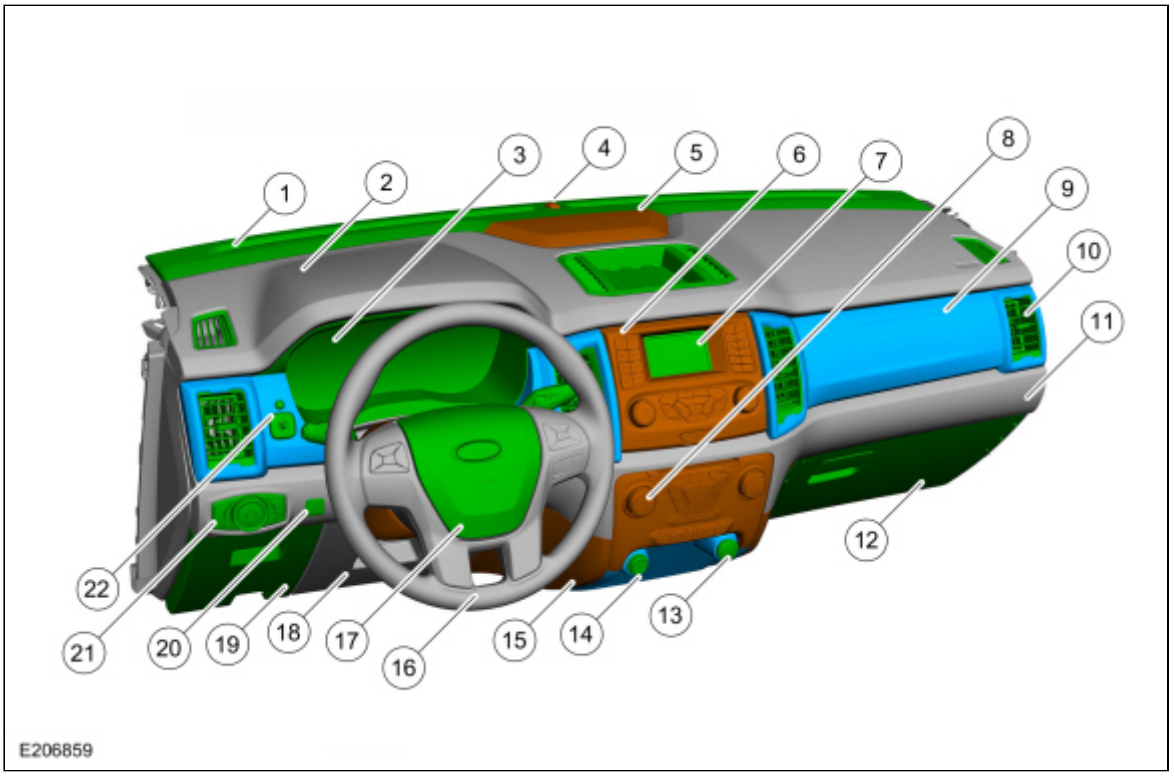
Instrument panel - RHD



Item	Part Number	Description
1	—	Instrument panel
2	—	Defroster panel
3	—	Sunload sensor
4	—	Speaker grill
5	—	Head-up display module
6	—	Instrument cluster
7	—	Mirror switch
8	—	Power lift gate switch
9	—	Lighting switch
10	—	Fuse box panel
11	—	Driver lower air bag module
12	—	Steering wheel
13	—	Driver air bag module
14	—	Side panel center stack
15	—	Power point
16	—	Front cigar lighter
17	—	Heater / AC control
18	—	Display module
19	—	Passenger glove compartment

20	—	Lower air resister spear
21	—	Upper air resister spear
22	—	Ventilator grill

Instrument panel - LHD



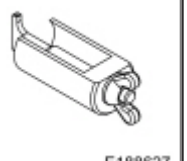
Item	Part Number	Description
1	—	Defroster panel
2	—	Instrument panel
3	—	Instrument cluster
4	—	Sunload sensor
5	—	Speaker grill
6	—	Audio system control unit
7	—	Display moduleHead-up display module
8	—	Heater / AC control
9	—	Upper air resister spear
10	—	Ventilator grillFuse box panel
11	—	Lower air resister spear
12	—	Passenger glove compartment
13	—	Power point
14	—	Front cigar lighter
15	—	Side panel center stack
16	—	Steering wheel
17	—	Driver air bag module
18	—	Driver lower air bag module
19	—	Fuse box panel
20	—	Power lift gate switch

21	—	Lighting switch
22	—	Mirror switch

Copyright © 2016 Ford Motor Company

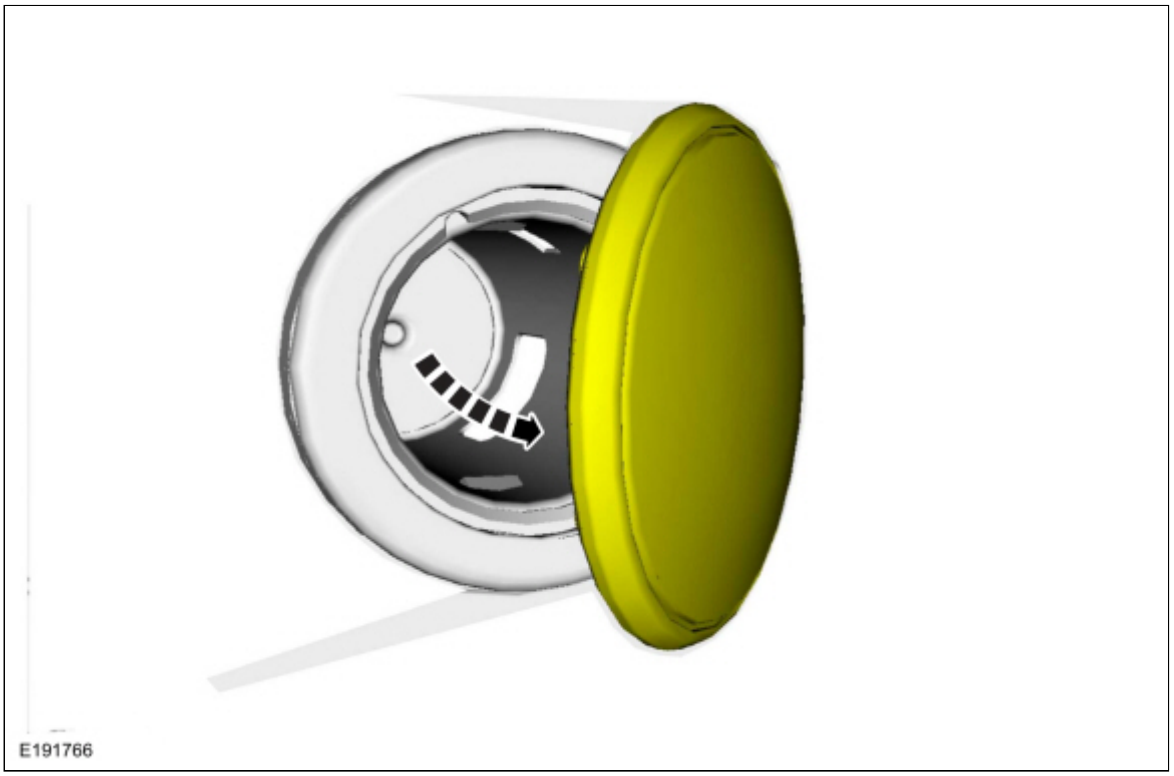
Auxiliary Power Point

Special Tool(s) / General Equipment

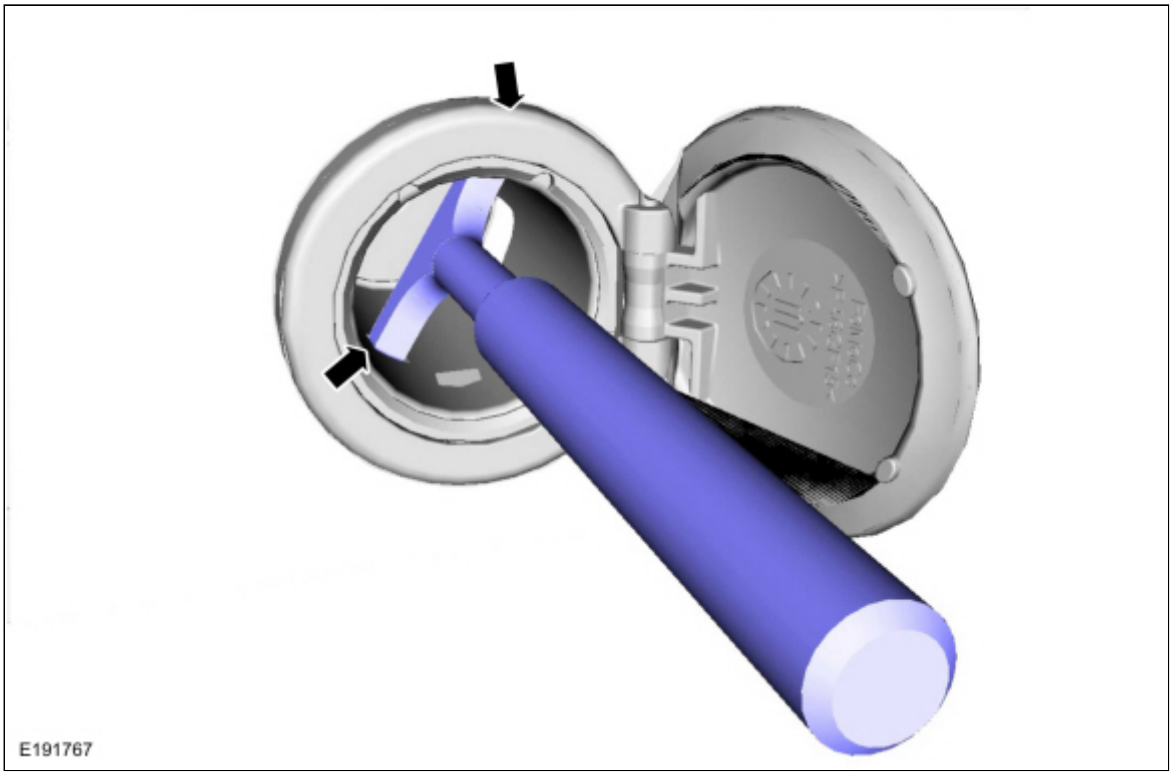
 E188627	501-194 Remover, Power Point

Removal

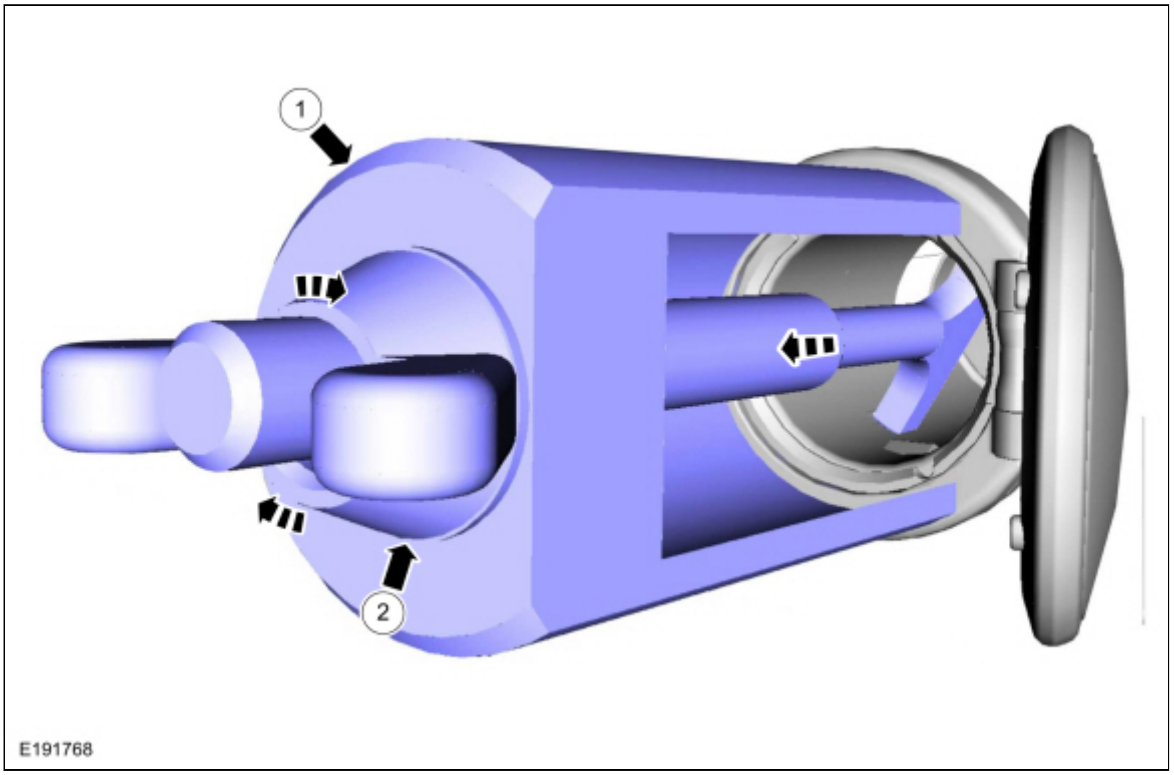
1. Open the power point cover



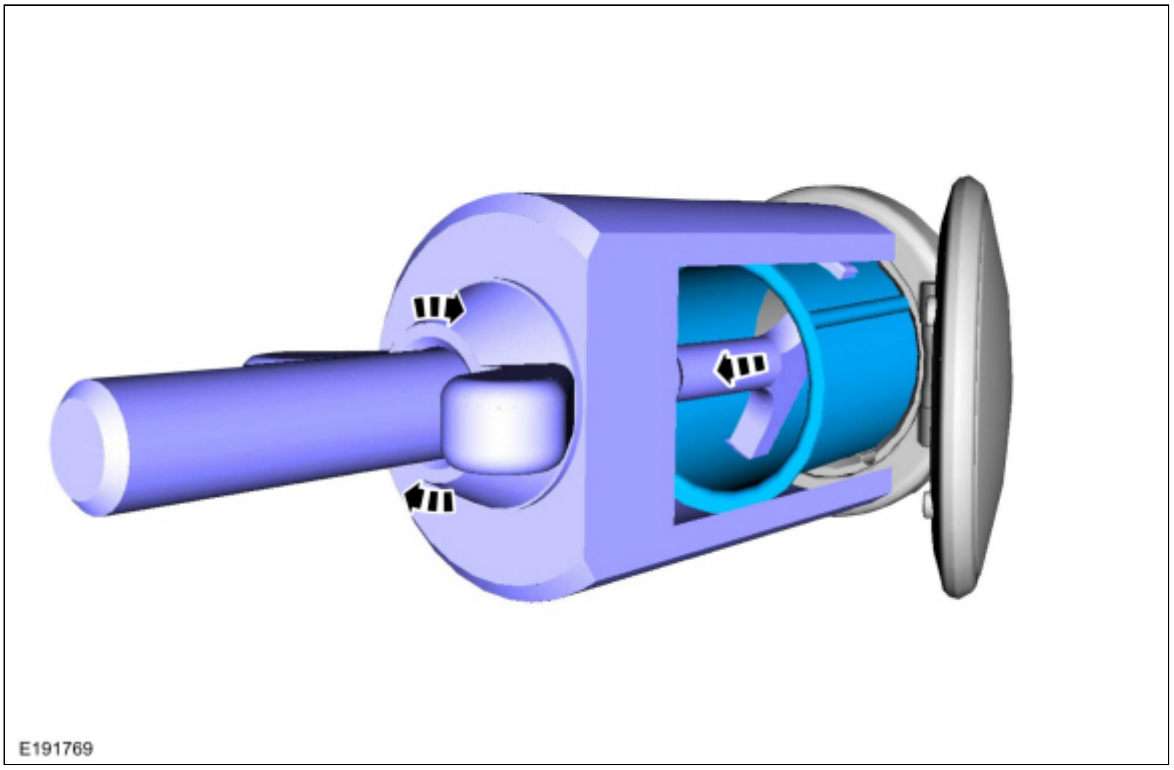
2. Position the power point extractor so that it engages in the adjacent slots in the power point socket. Use Special Service Tool: 501-194 Remover, Power Point.



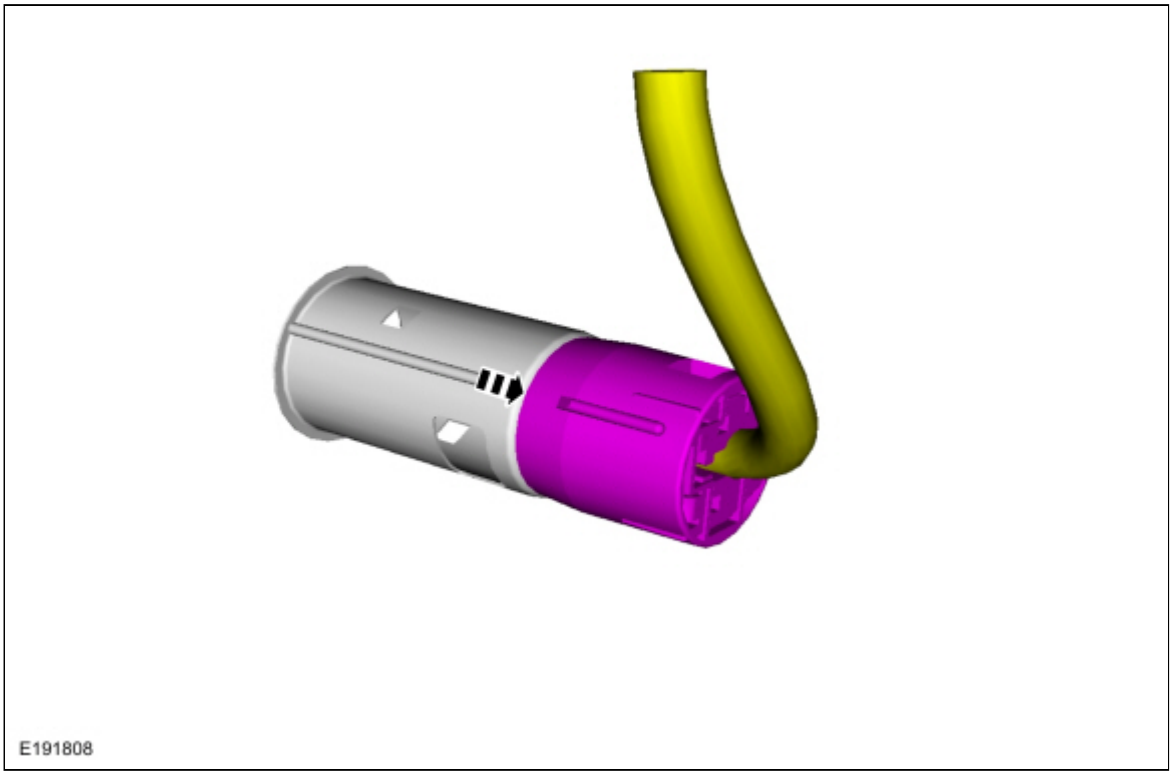
1. Install the receiver cup
2. Install and tighten the wing nut.
   Use Special Service Tool: 501-194 Remover, Power Point.



4. Tighten the wing nut to pull the power point socket out of the retainer.



5. Disconnect the electrical connector.



Installation

1. Connect the electrical connector and push the new power point socket into the retainer.

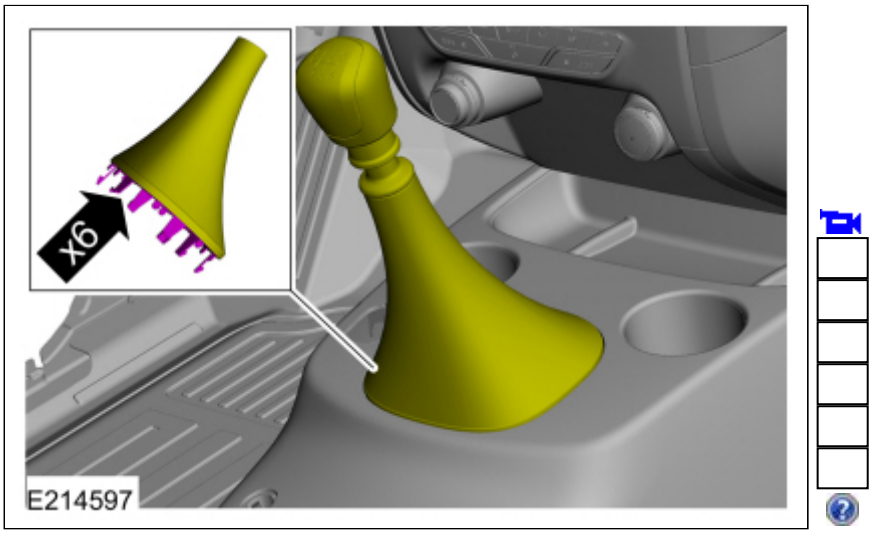
Copyright © 2016 Ford Motor Company

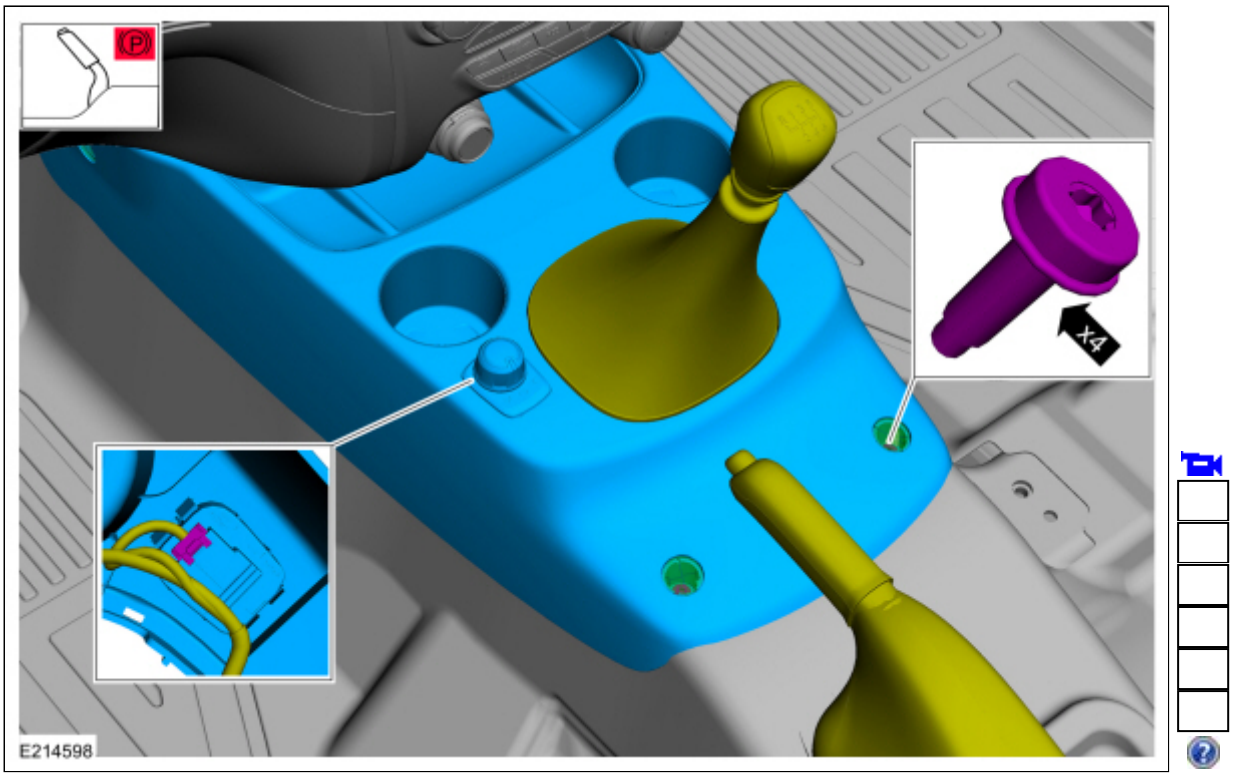
Floor Console - Single Cab

Base Part Number: S043B04

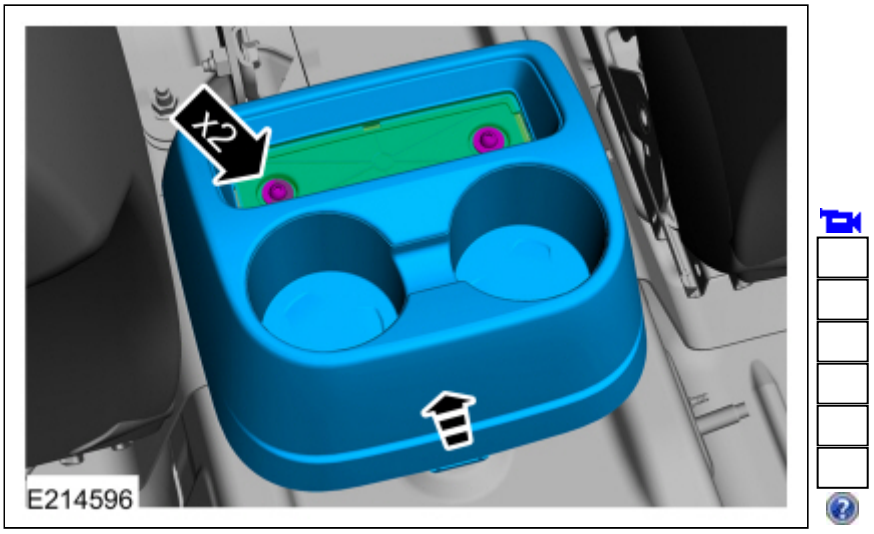
Removal

NOTE: *Removal steps in this procedure may contain installtion details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

4. 

5.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Floor Console - Double Cab

Base Part Number: S043B04

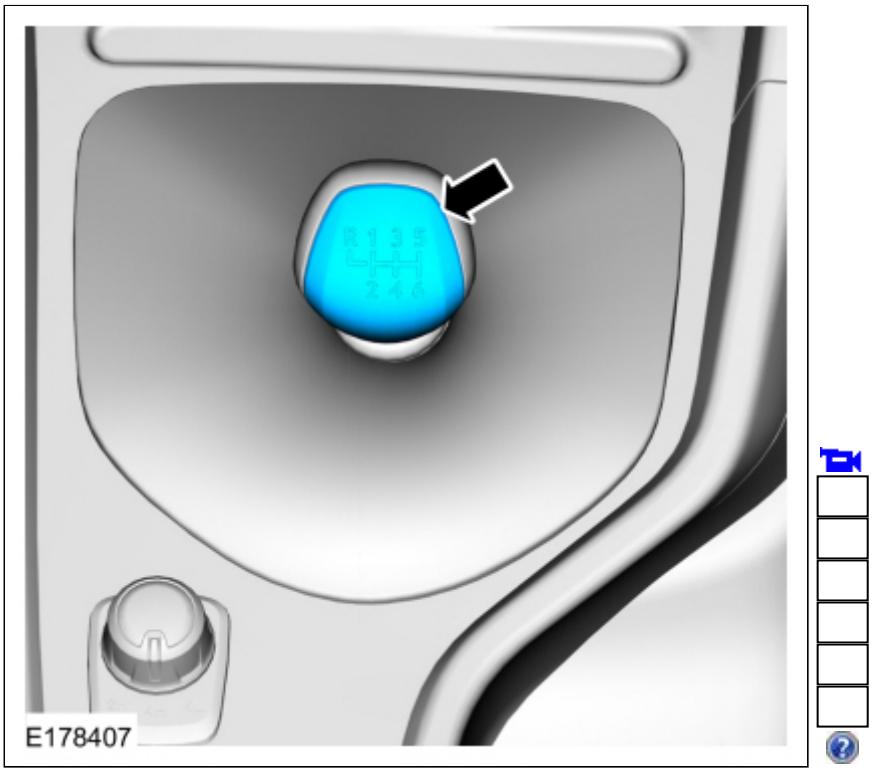
Removal

NOTE: *Removal steps in this procedure may contain installtion details.*

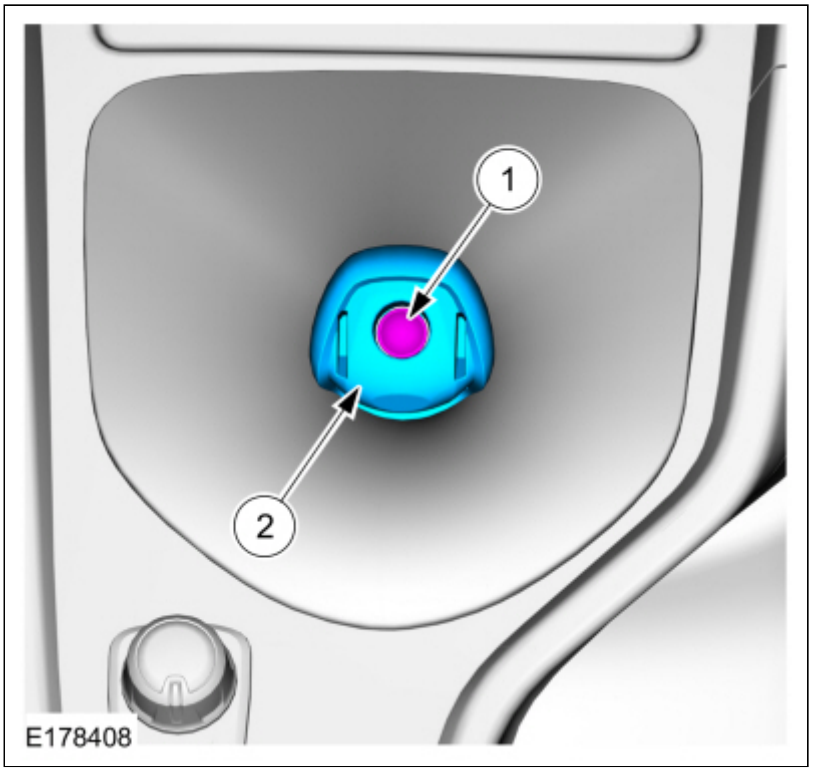
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

6-Speed Manual Transmission - MT82

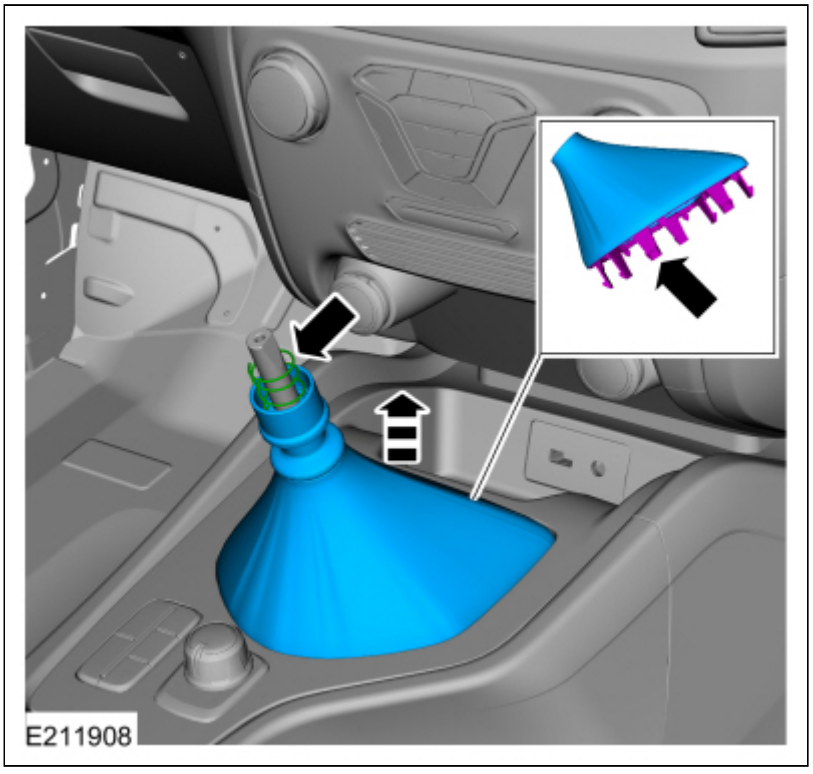
3.



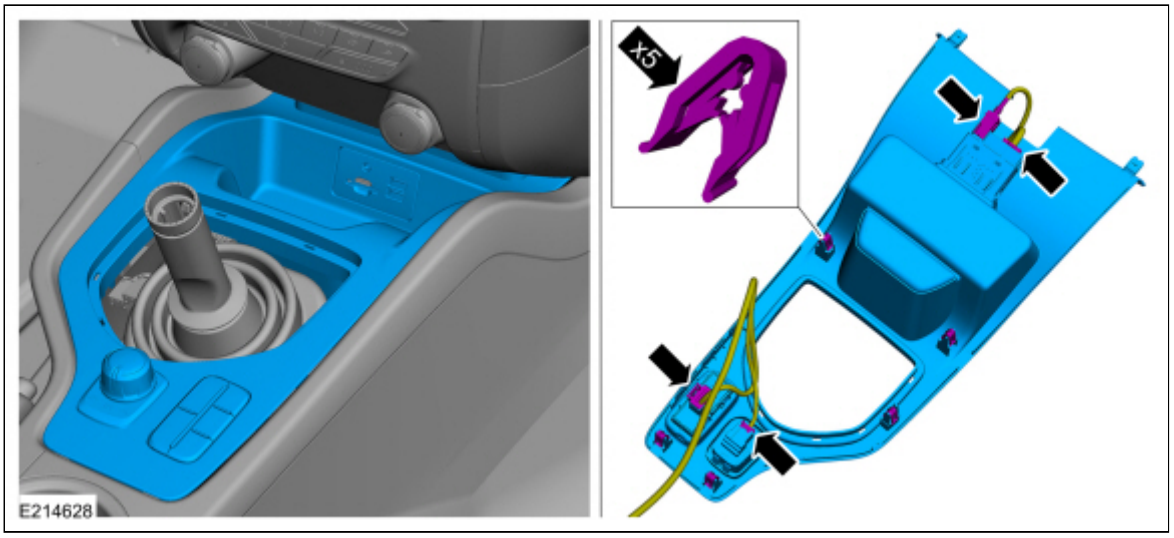
4. *Torque*: 7 Nm



5.

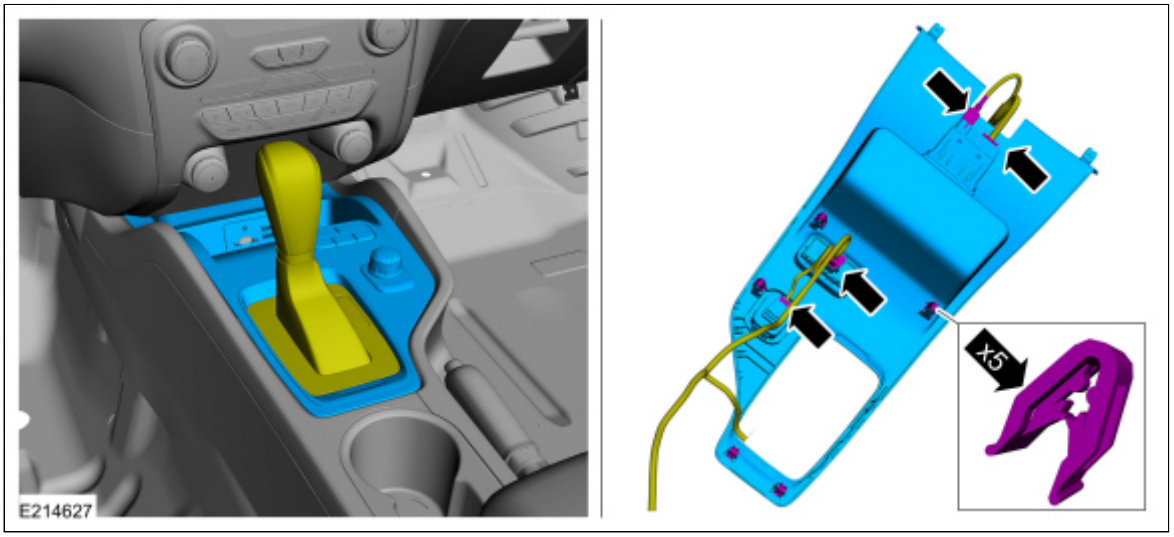


6.

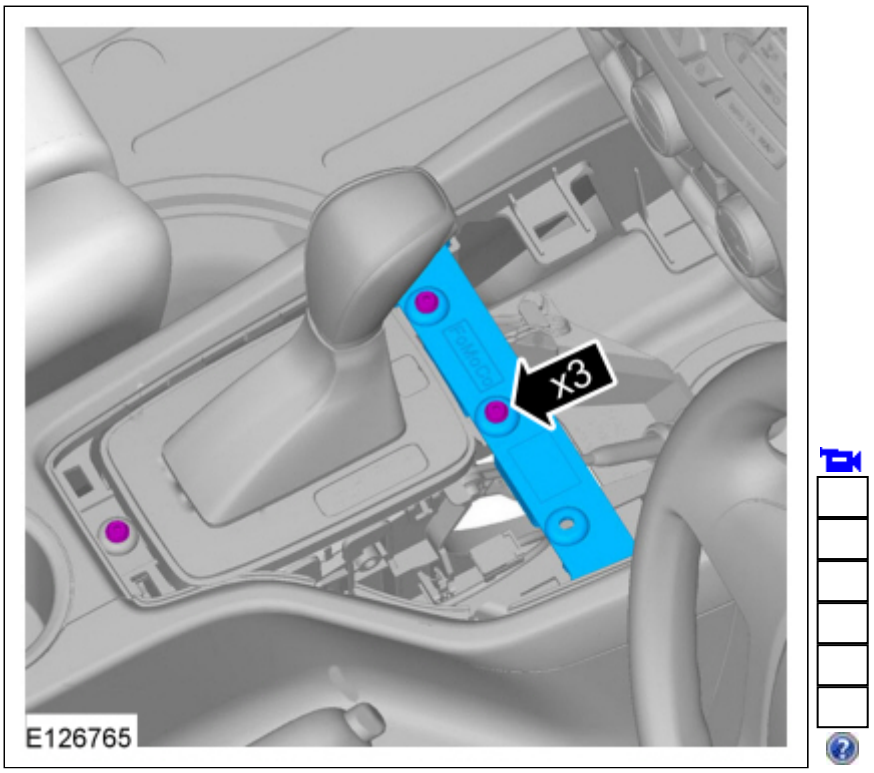


6-Speed Automatic Transmission - 6R80

7.

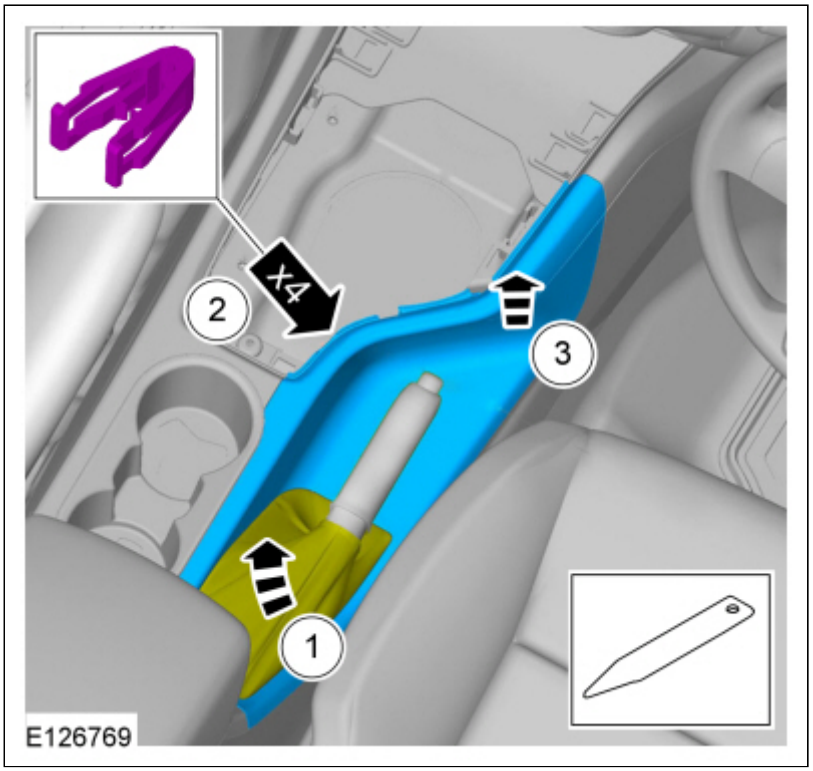


8. *Torque*: 2 Nm

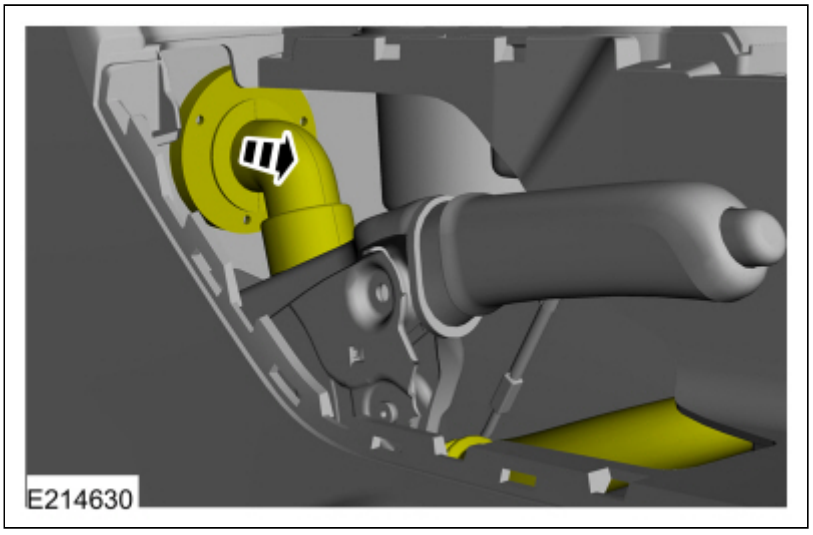


All vehicles

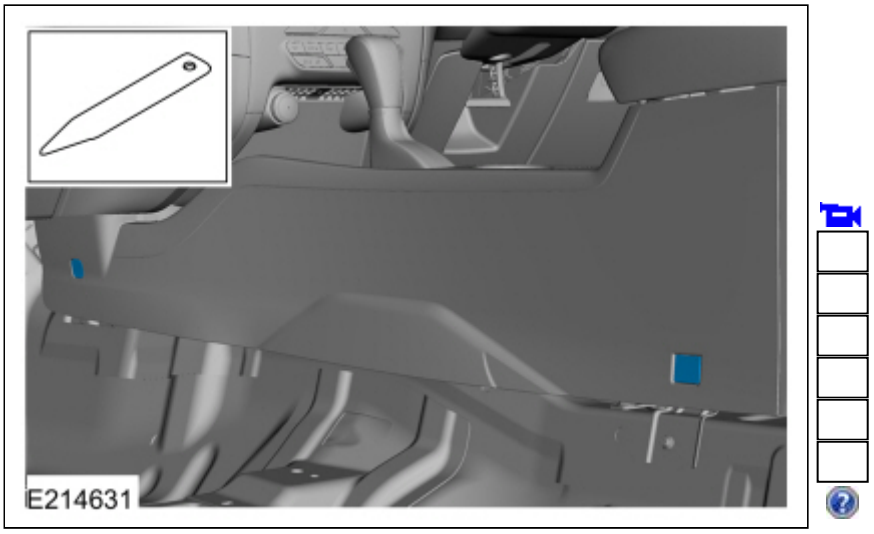
9.



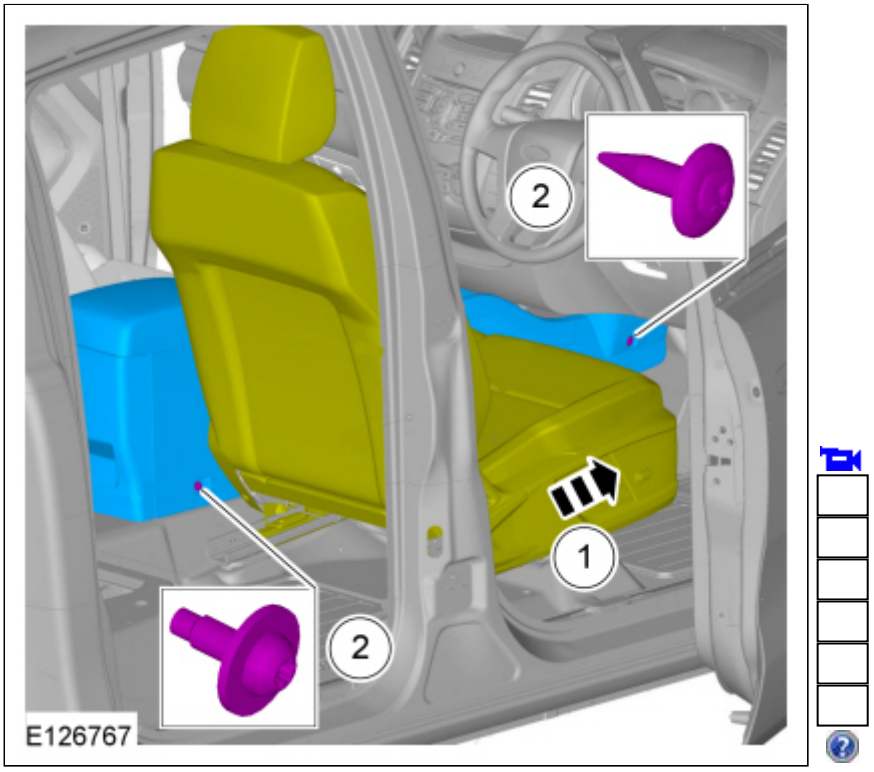
10.



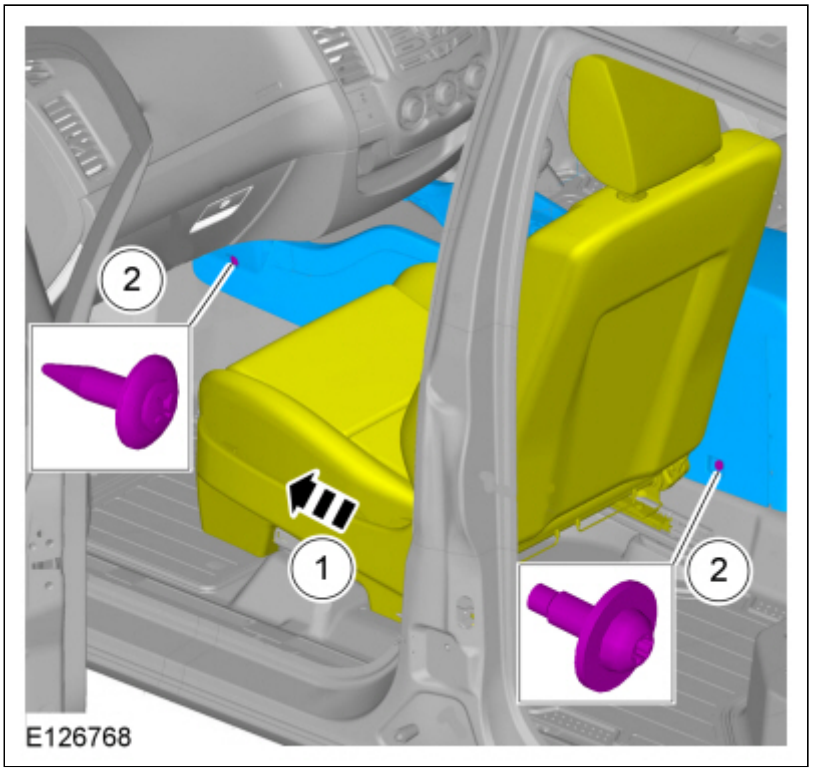
11. On both sides.



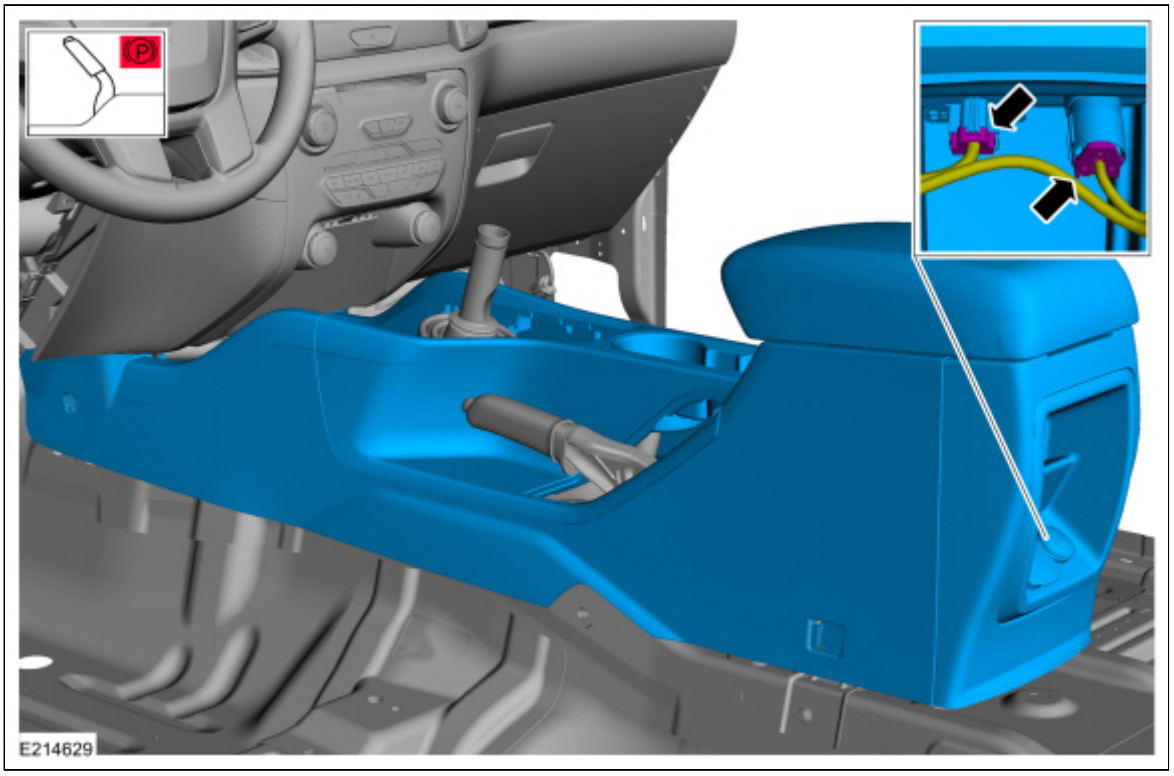
12. *Torque*: 6 Nm



13. *Torque*: 6 Nm



14.



Installation

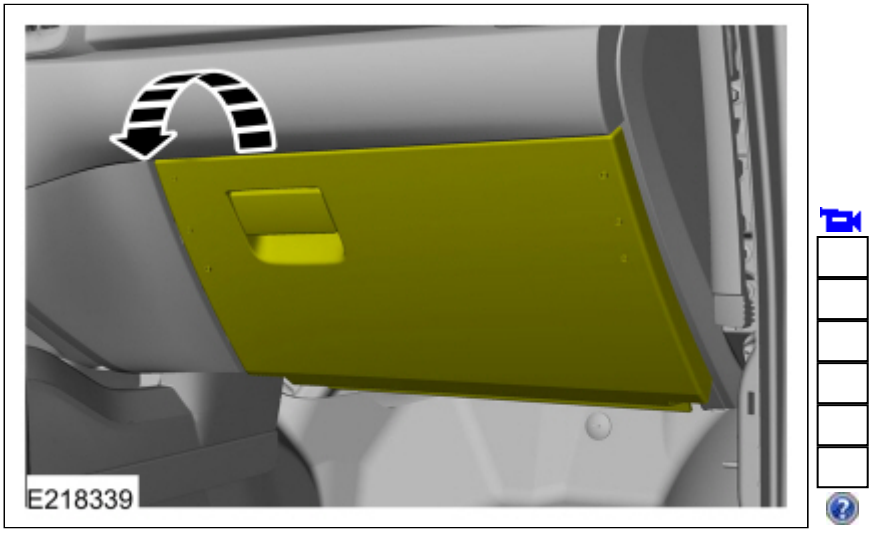
1. To install, reverse the removal procedure.

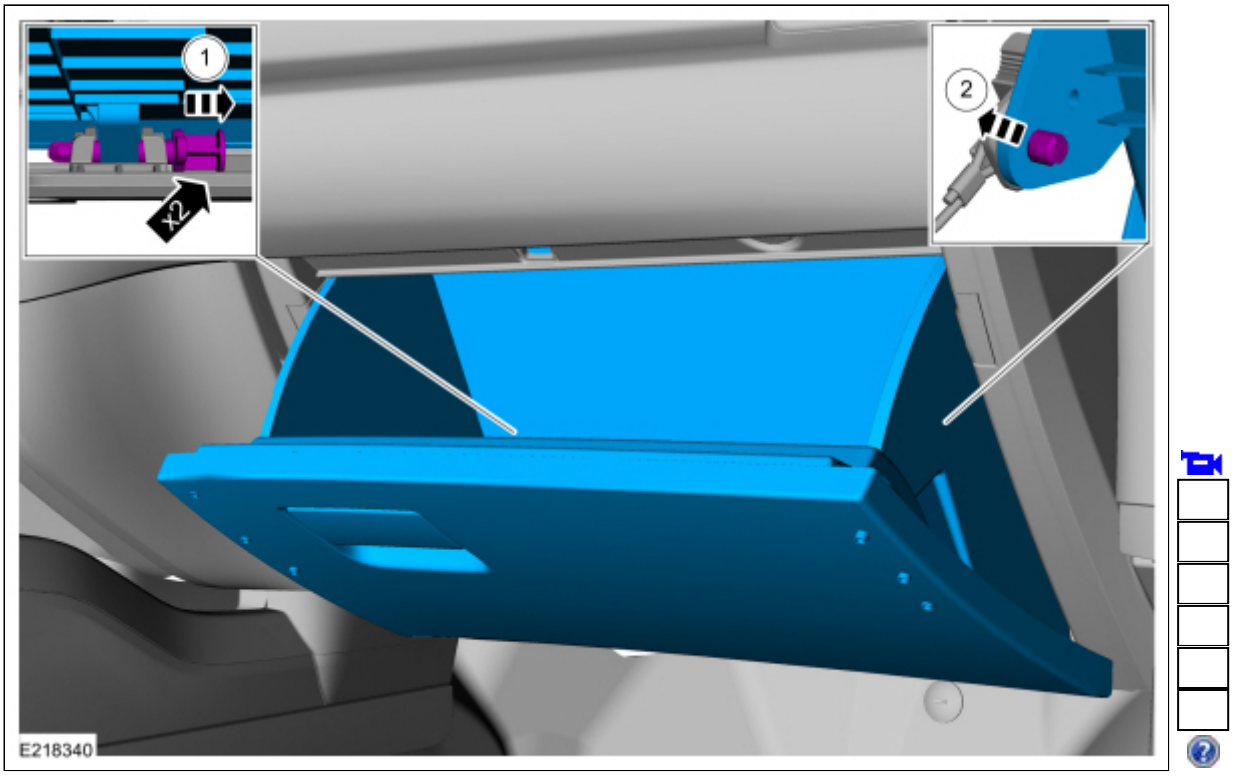
Copyright © 2016 Ford Motor Company

Glove Compartment - LHD

Removal

NOTE: *Removal steps in this procedure may contain installtion details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3. 

Installation

NOTE: *Make sure that the passenger glove box lamp is correctly located.*

1. To install, reverse the removal procedure.

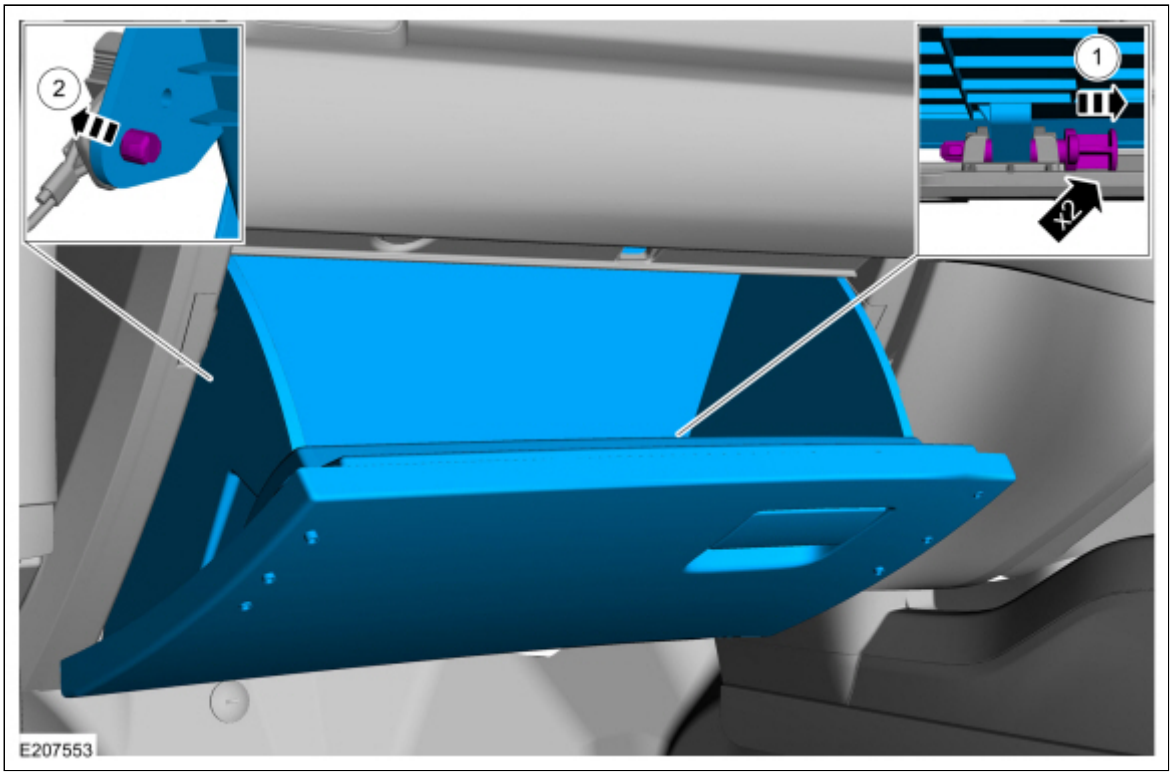
Copyright © 2016 Ford Motor Company

Glove Compartment - RHD

Removal

NOTE: *Removal steps in this procedure may contain installtion details.*

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3. 

Installation

NOTE: *Make sure that the passenger glove box lamp is correctly located.*

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Instrument Panel - LHD

Base Part Number: S04305

Removal

WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Single cab

2. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Double cab

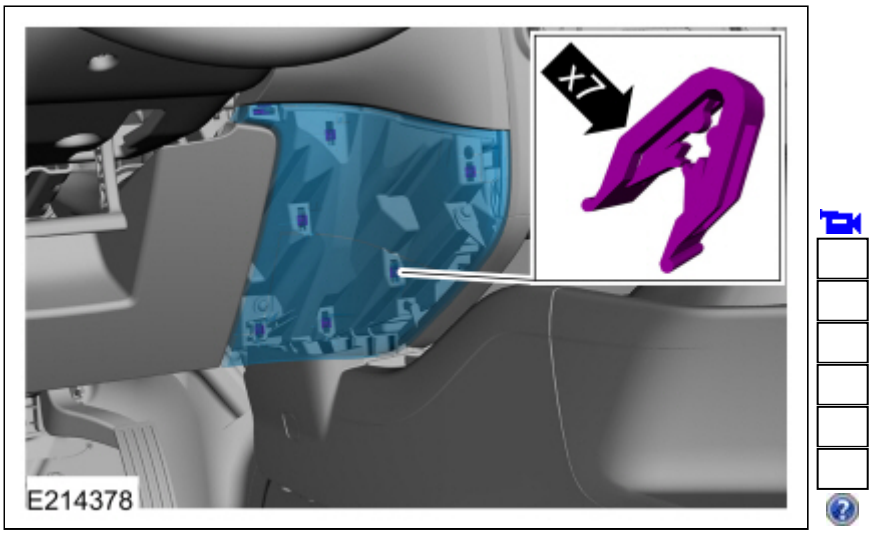
3. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Vehicles with driver lower air bag

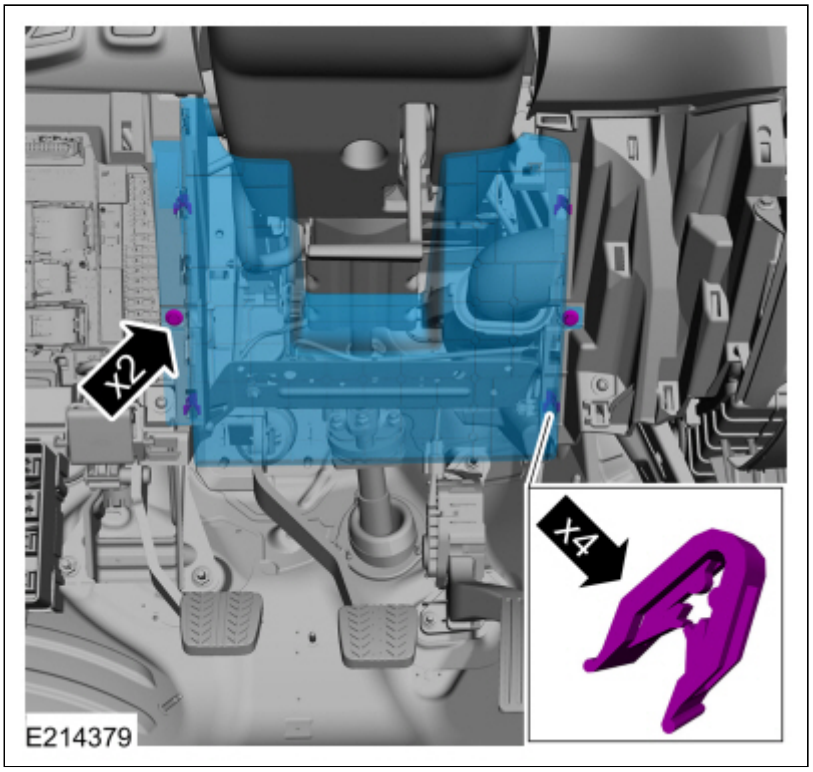
4. Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

Vehicles without driver lower air bag

5.

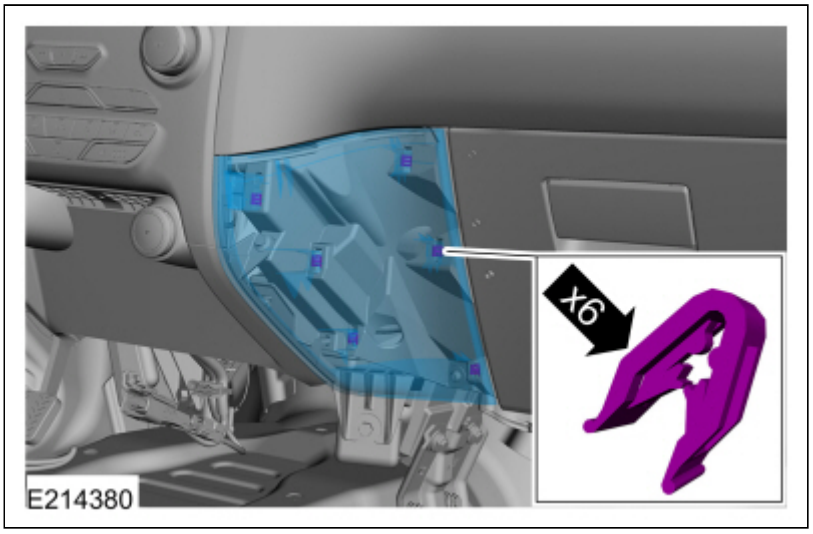


6. *Torque*: 2 Nm

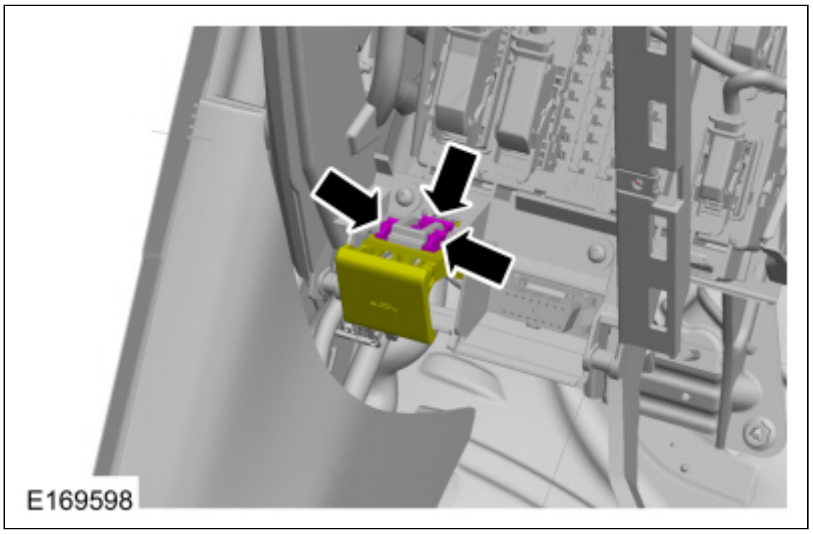


All vehicles

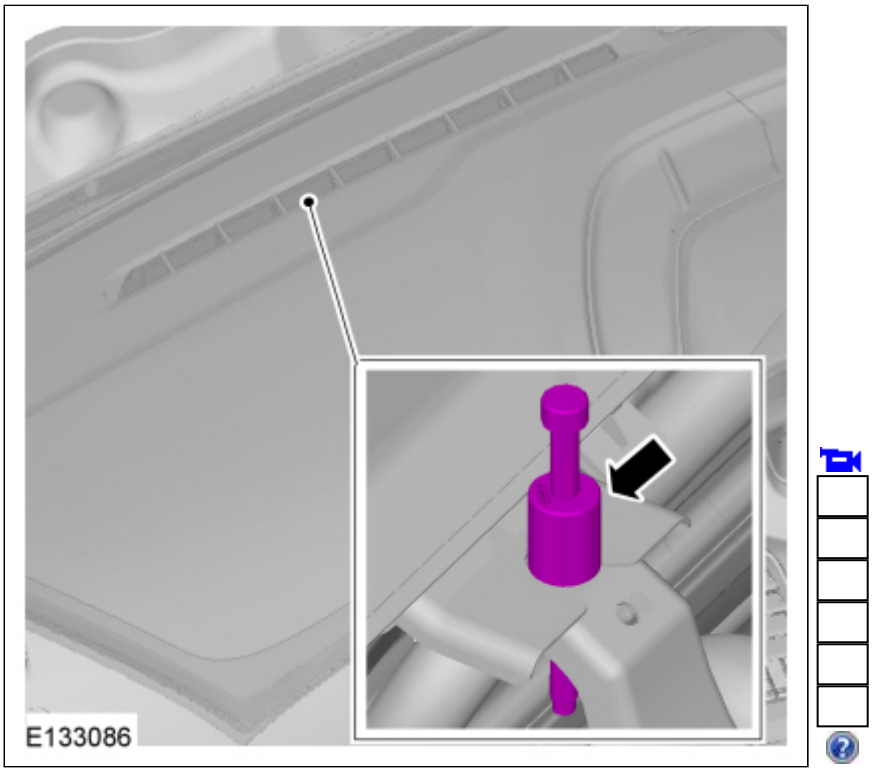
7.



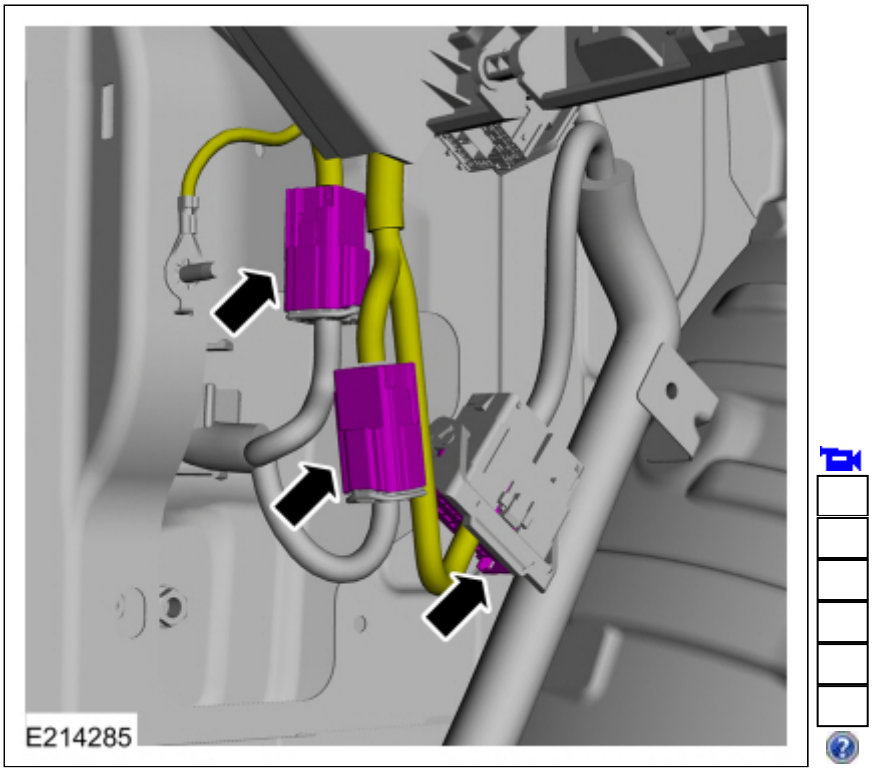
8.



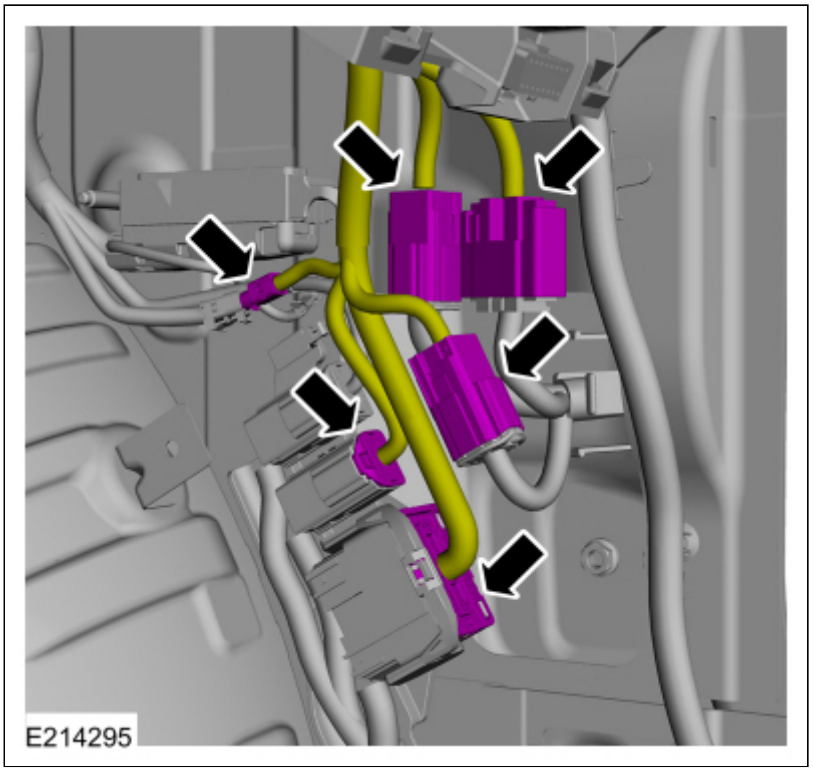
9. Refer to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
10. Refer to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
11. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Refer to: Steering Column (211-04 Steering Column, Removal and Installation).
13. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
14. *Torque*: 11 Nm



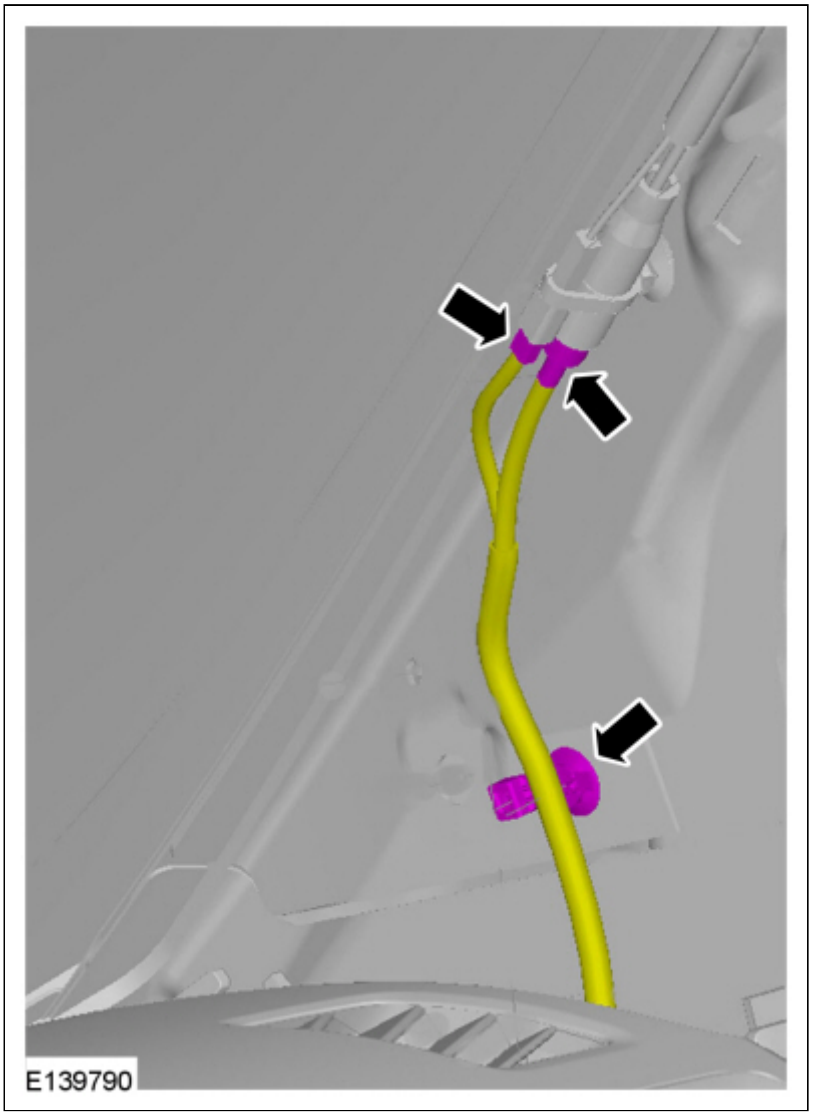
15.



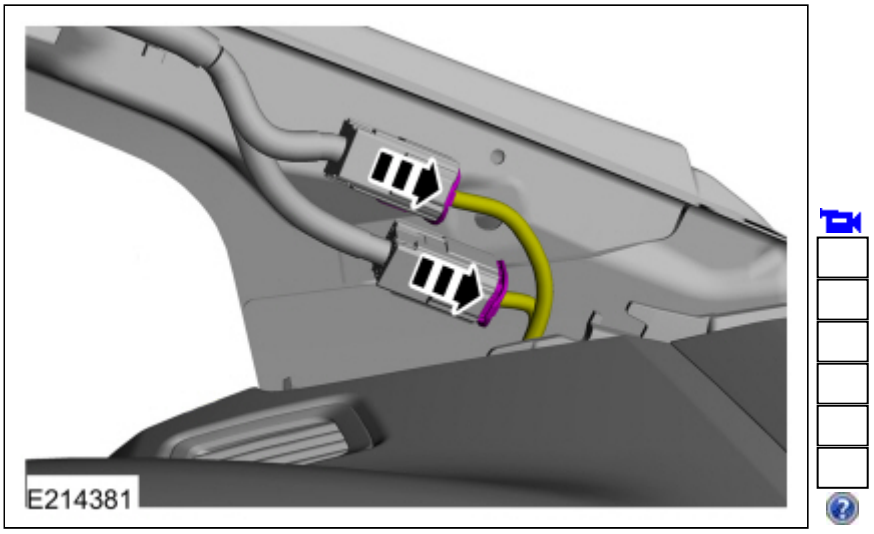
16.



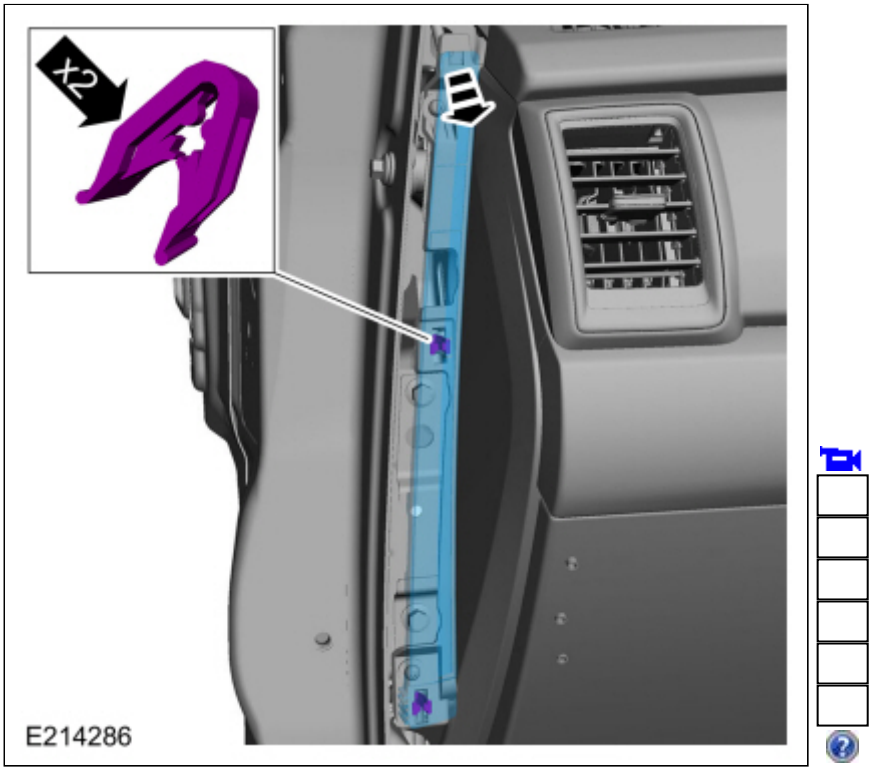
17.



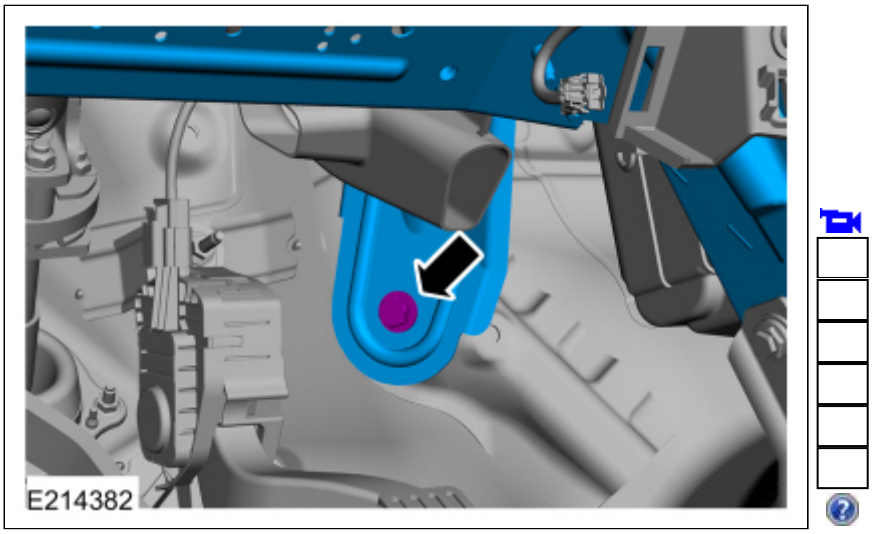
18.



19. On both sides.

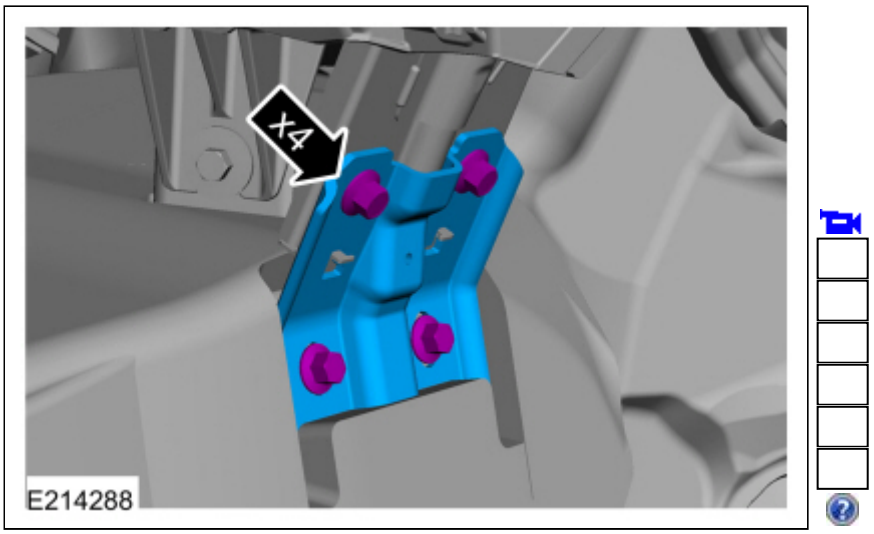


20. *Torque*: 30 Nm

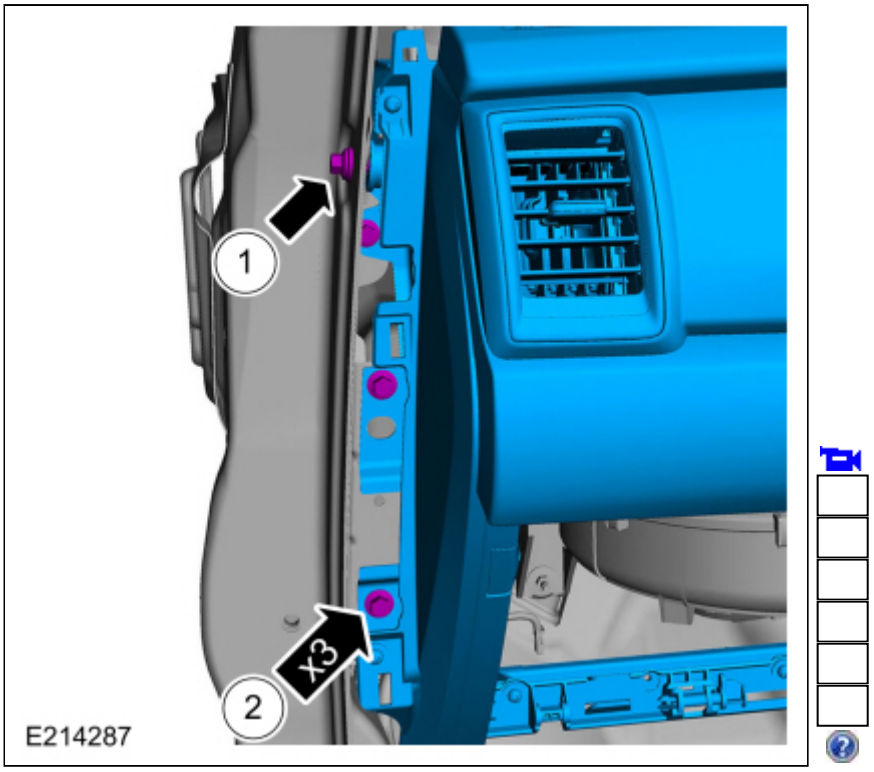


21. On both sides.

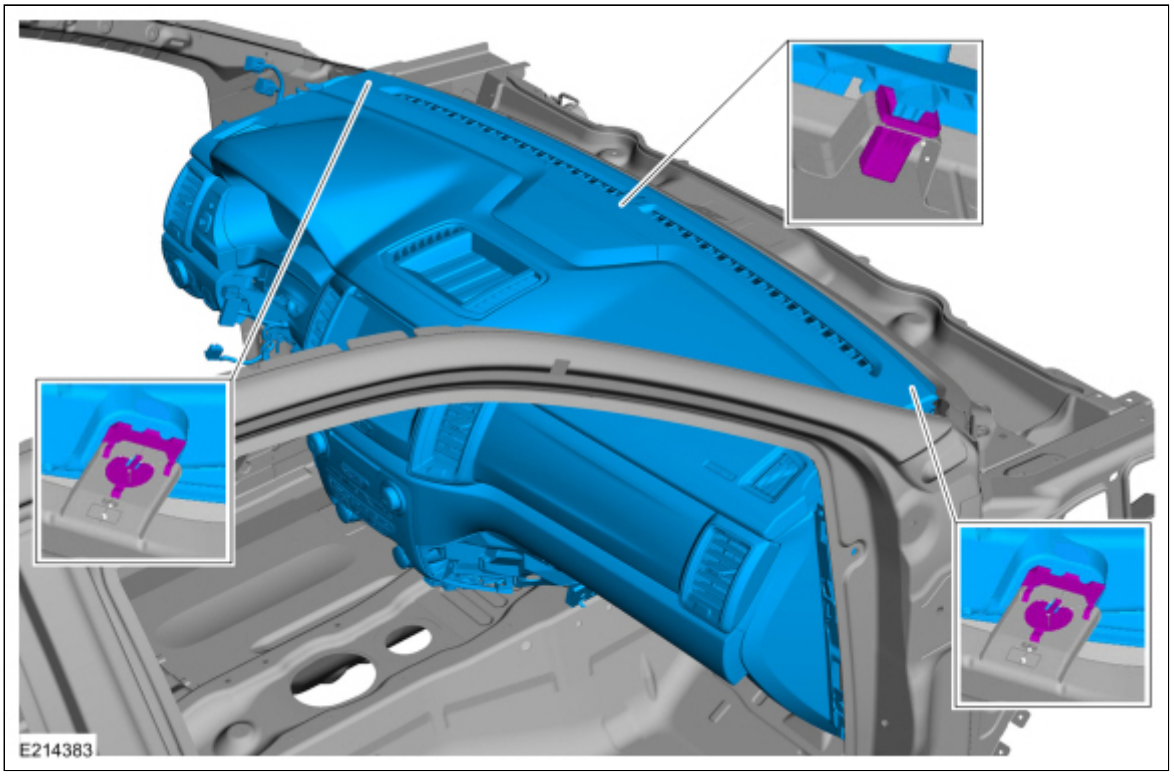
Torque: 30 Nm



1. On both sides.
   Torque: 30 Nm
2. On both sides.
   Torque: 30 Nm



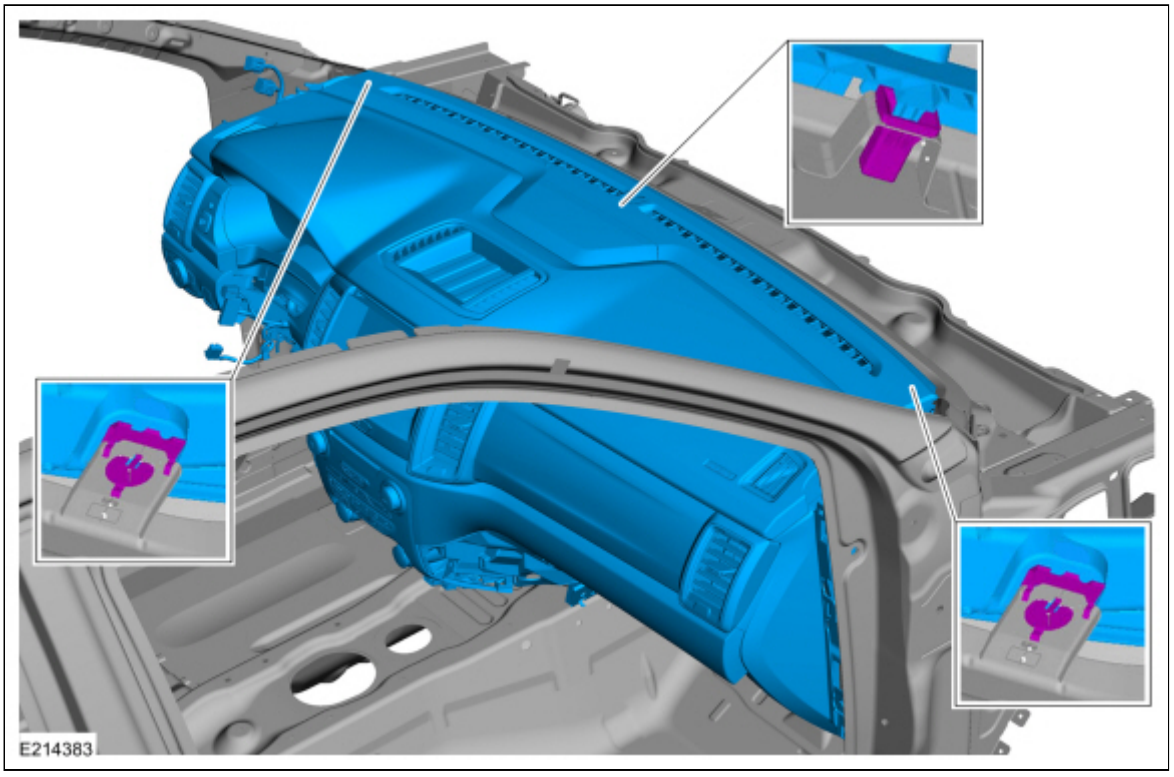
23. **NOTE:** *Note the position of the component before removal.*



Installation

1. **NOTICE: Make sure that the three locking positions are locked correctely.**

   NOTE: *Make sure that the adjuster is correctely alighned.*



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Instrument Panel - RHD

Base Part Number: S04305

Removal

WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Single cab

2. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Double cab

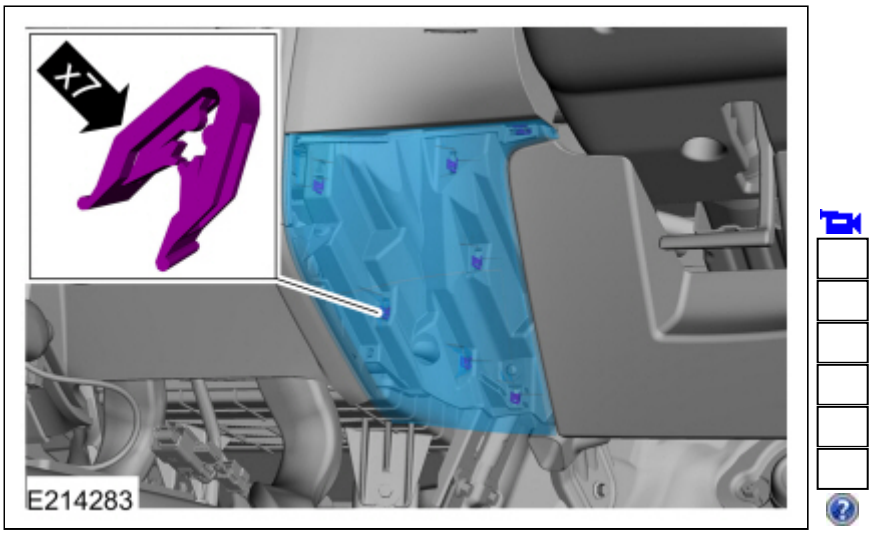
3. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Vehicles with driver lower air bag

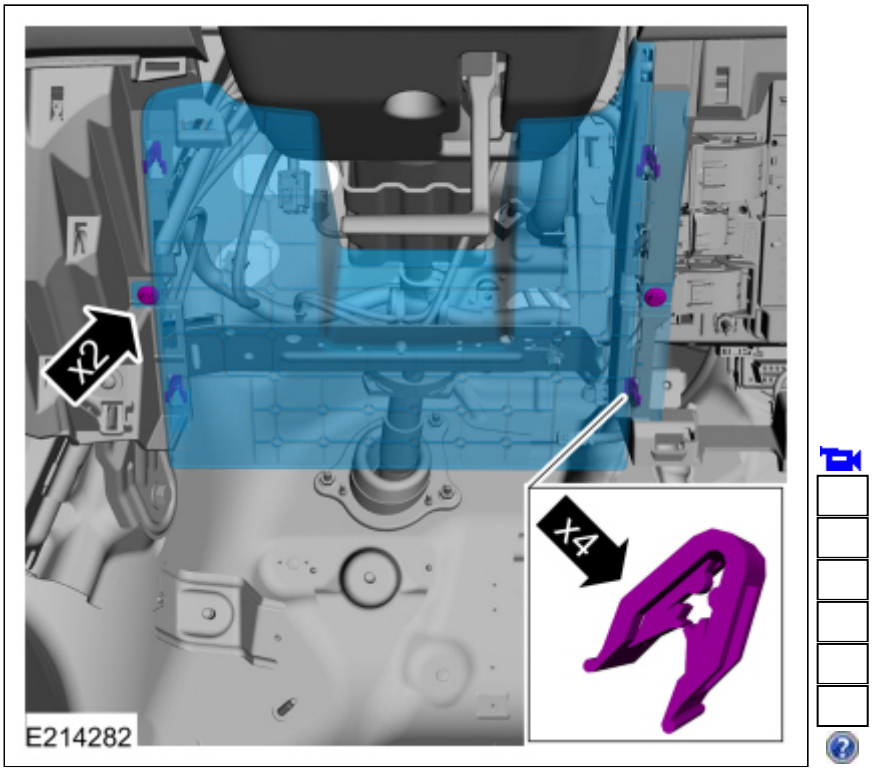
4. Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).

Vehicles without driver lower air bag

5.

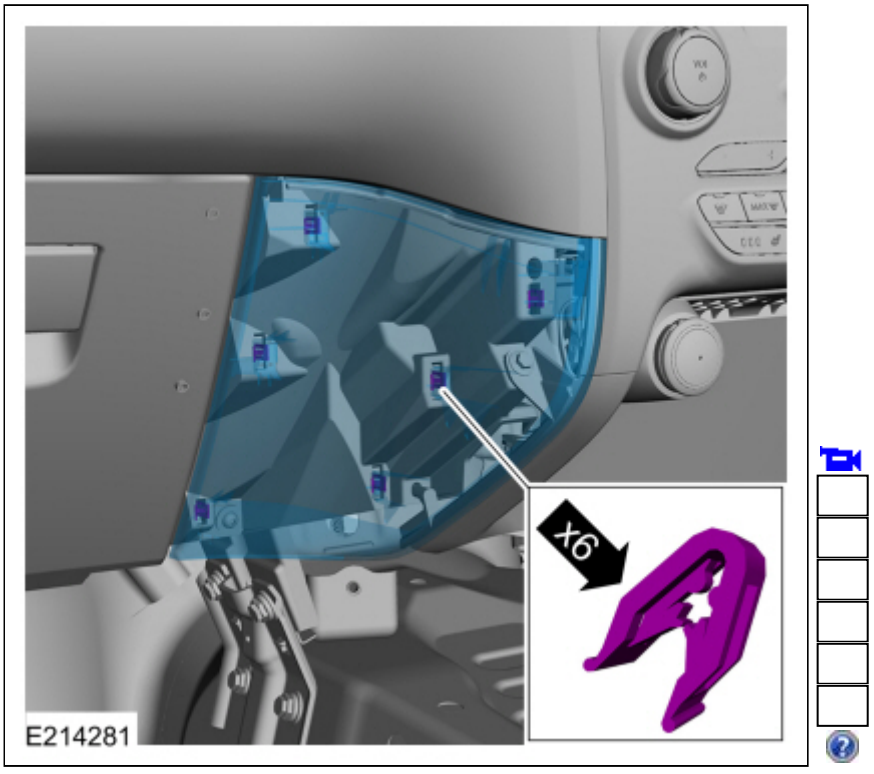


6. *Torque*: 2 Nm



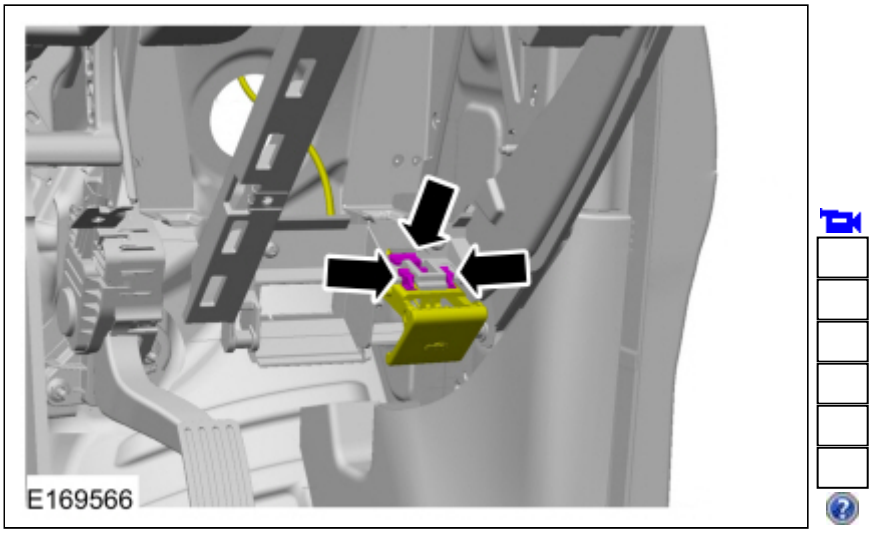
All vehicles

7.

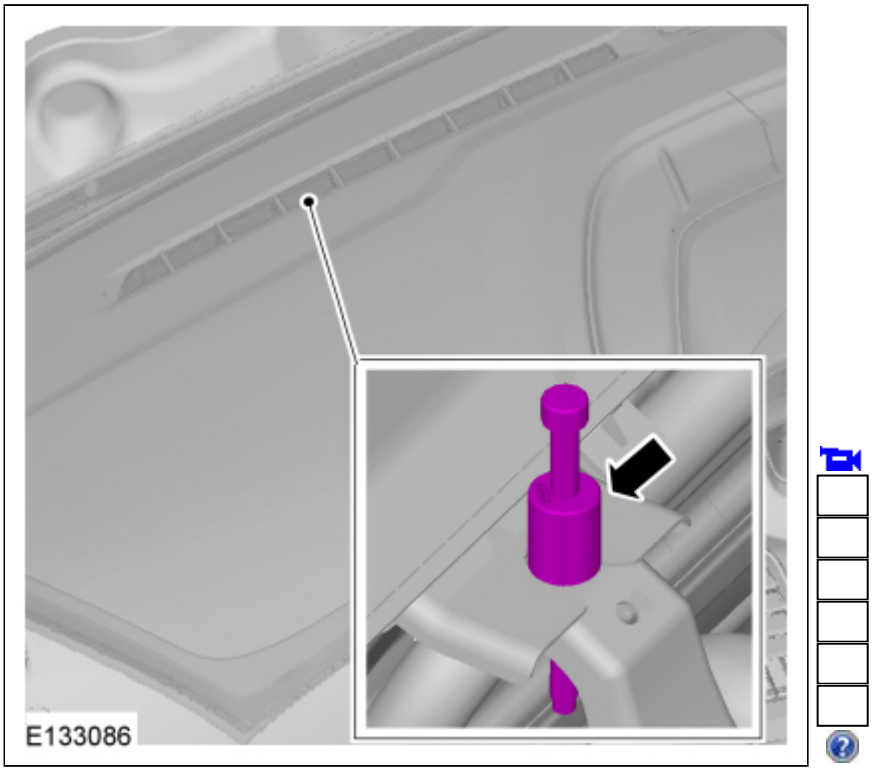


8. Refer to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).

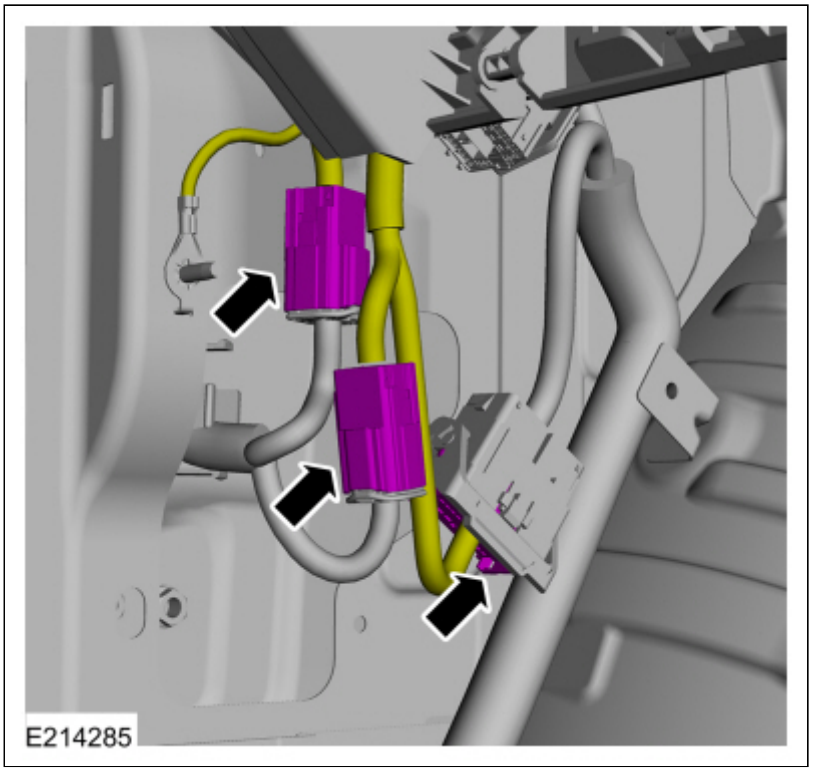
9.



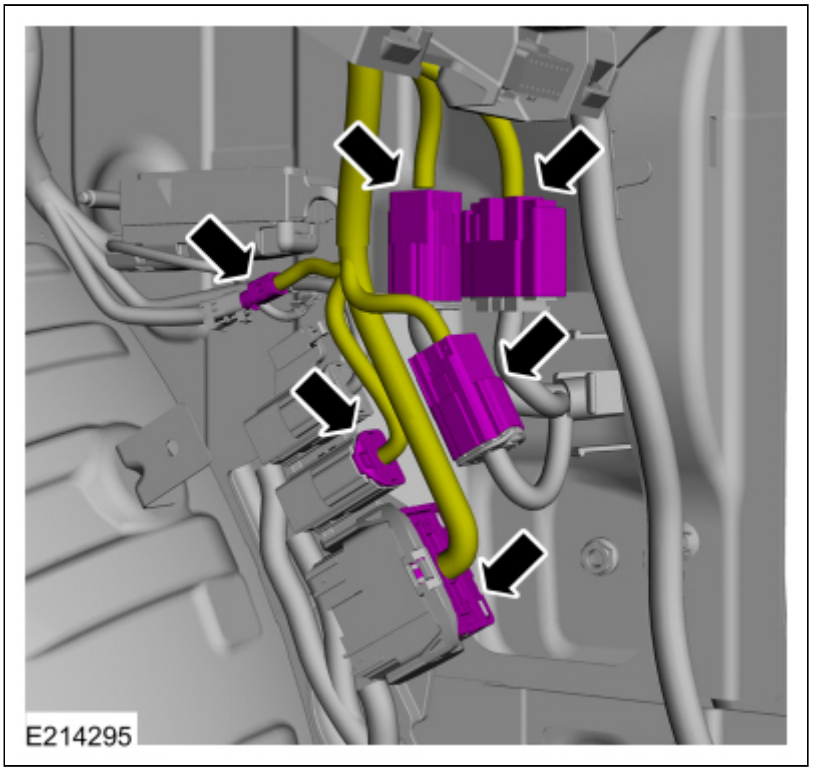
10. Refer to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
11. Refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Refer to: Steering Column (211-04 Steering Column, Removal and Installation).
13. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
14. *Torque*: 11 Nm



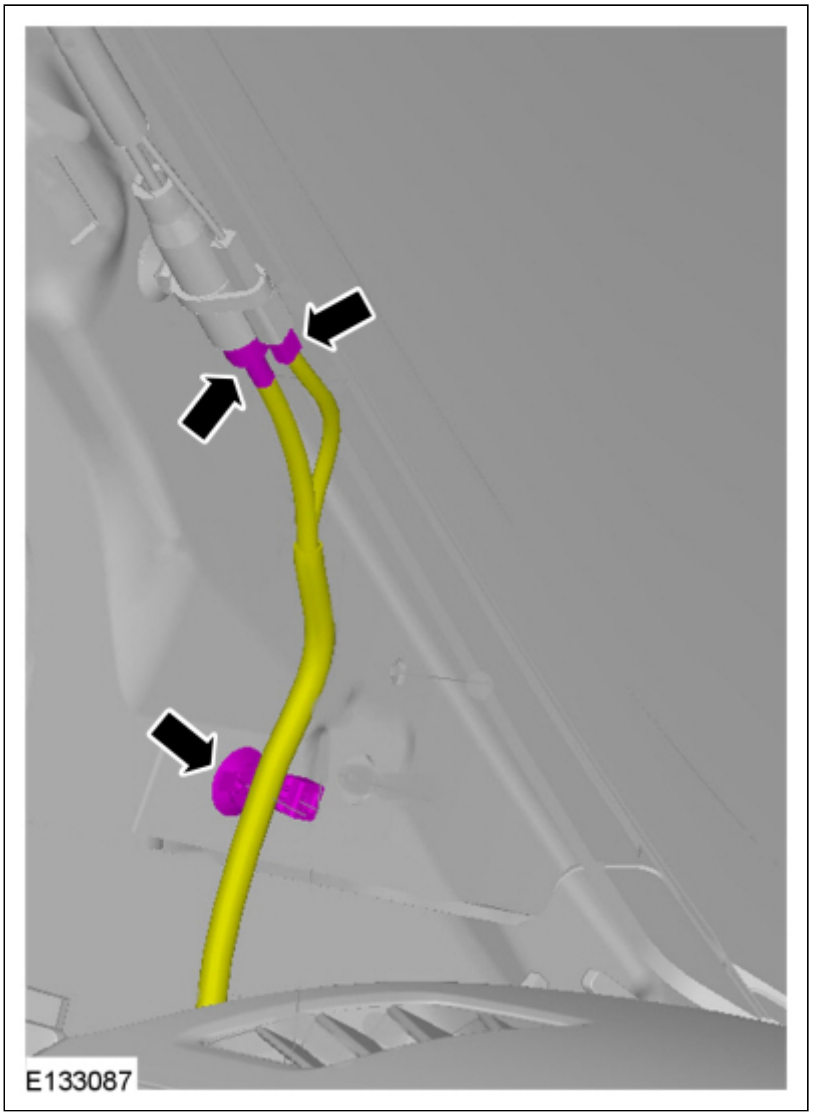
15.



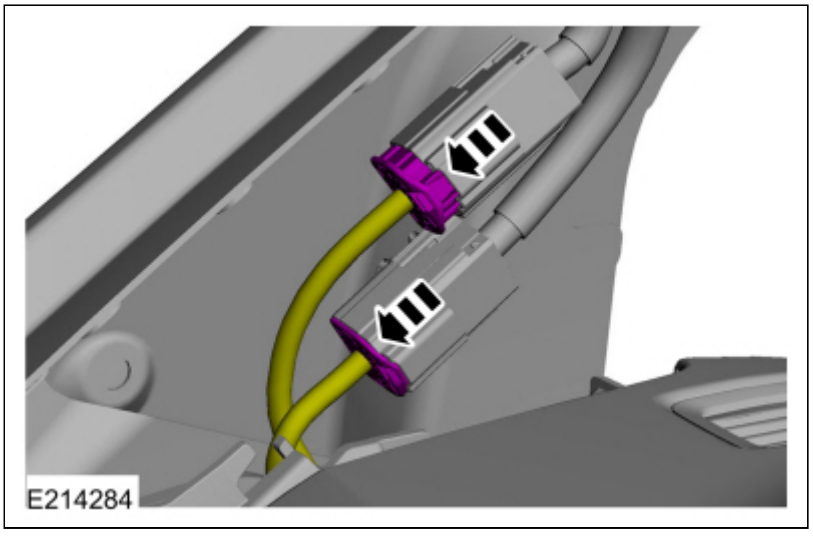
16.



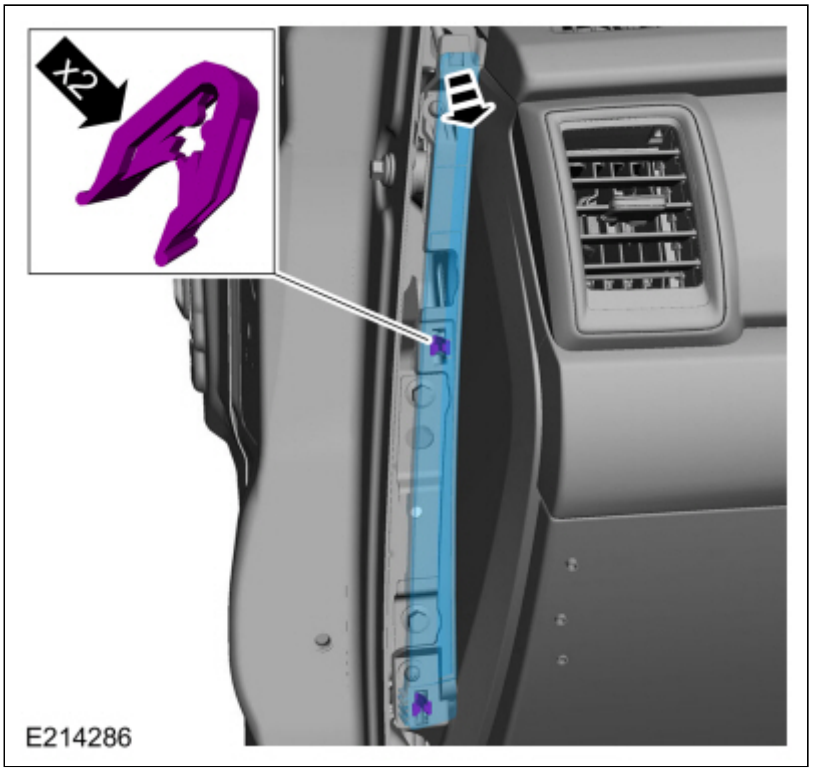
17.



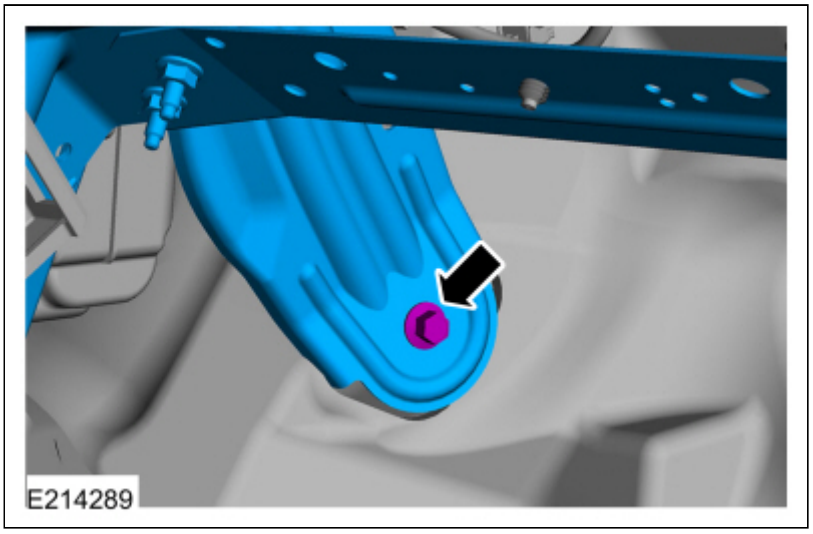
18.



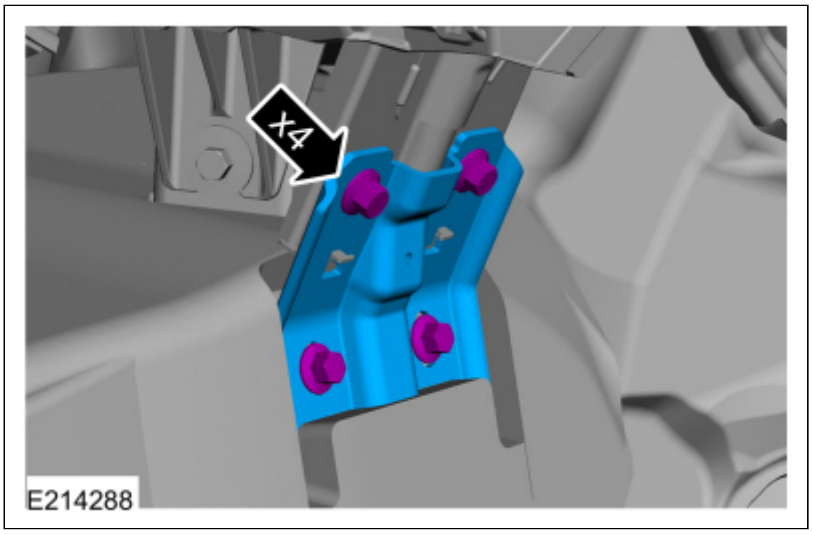
19. On both sides.



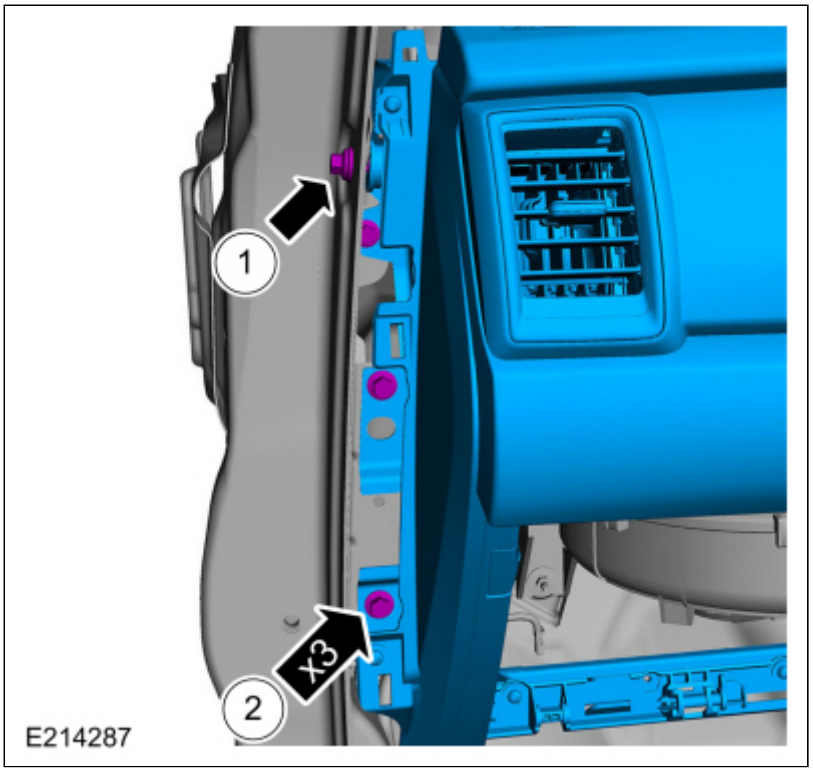
20. *Torque*: 30 Nm



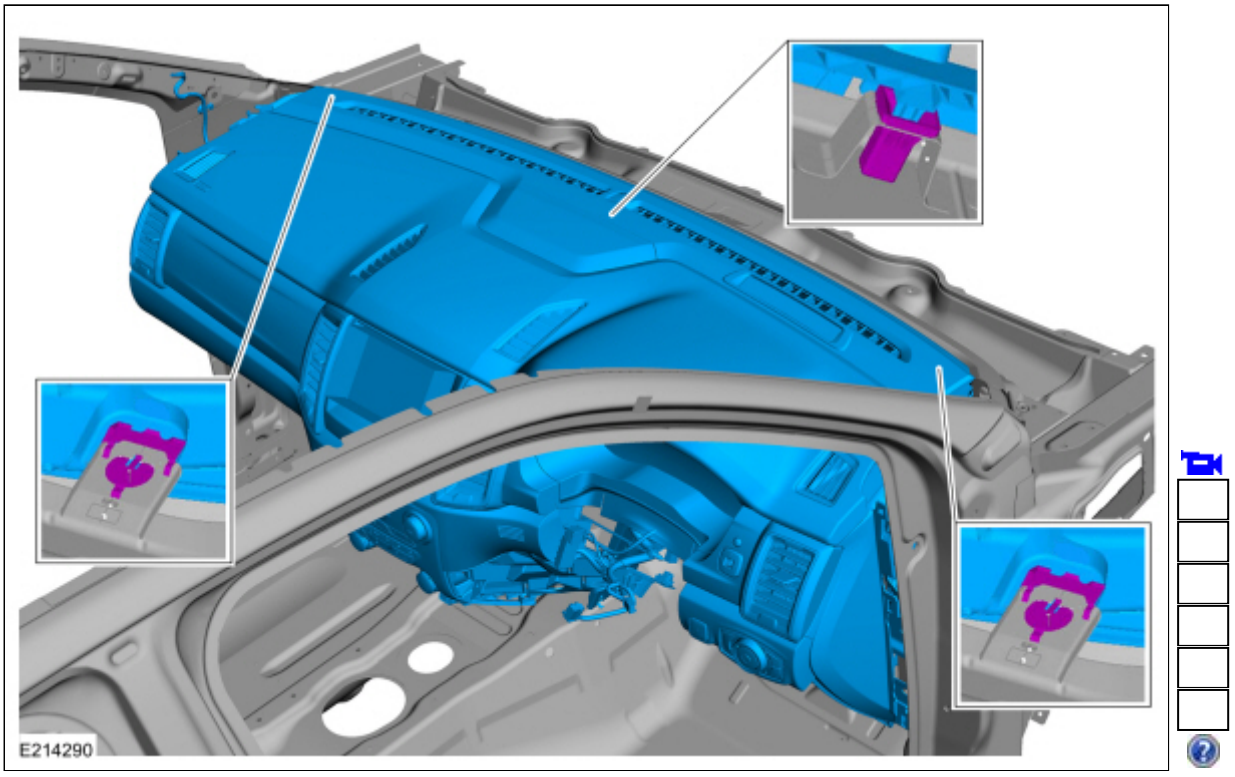
21. On both sides.
    Torque: 30 Nm



1. On both sides.
   Torque: 30 Nm
2. On both sides.
   Torque: 30 Nm



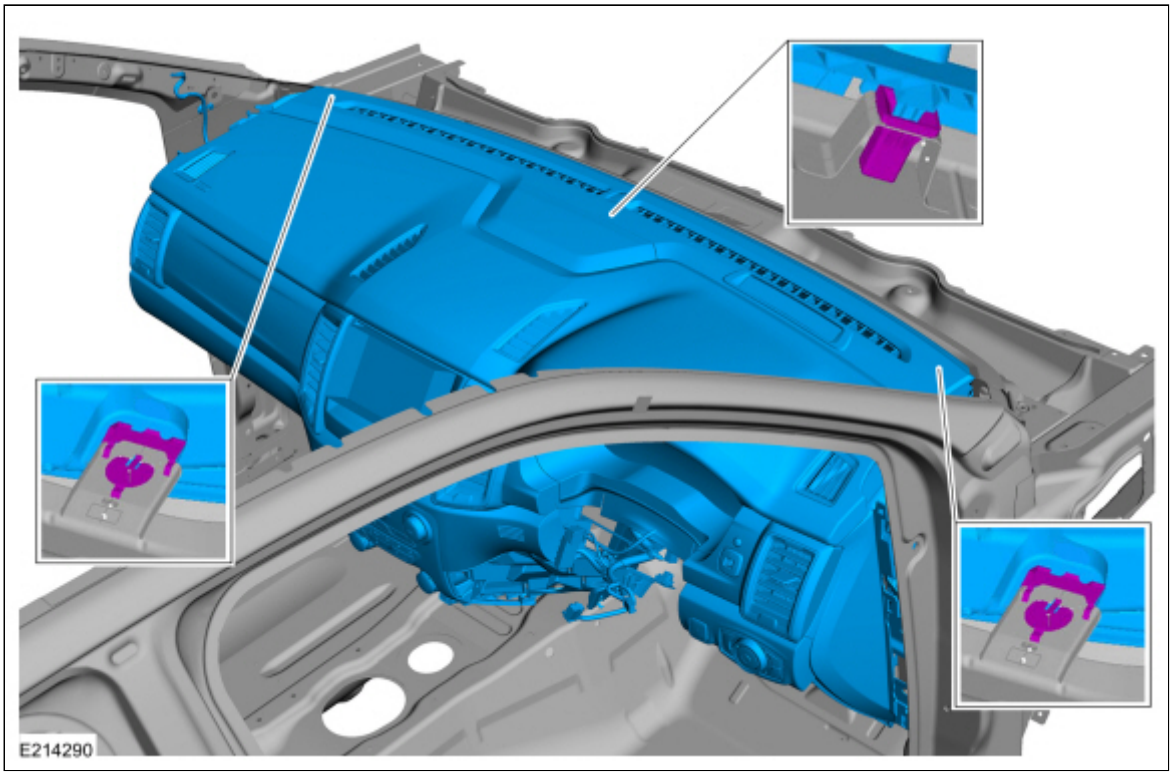
23. **NOTE:** *Note the position of the component before removal.*



Installation

1. **NOTICE: Make sure that the three locking positions are locked correctely.**

   NOTE: *Make sure that the adjuster is correctely alighned.*



2. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Overhead Console

Base Part Number: 519A58

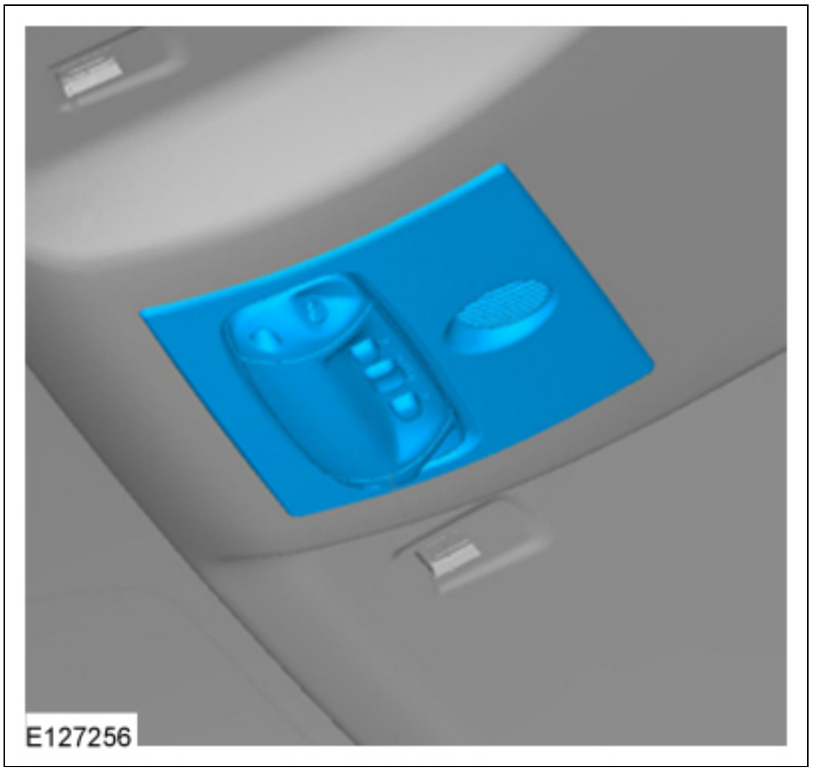
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

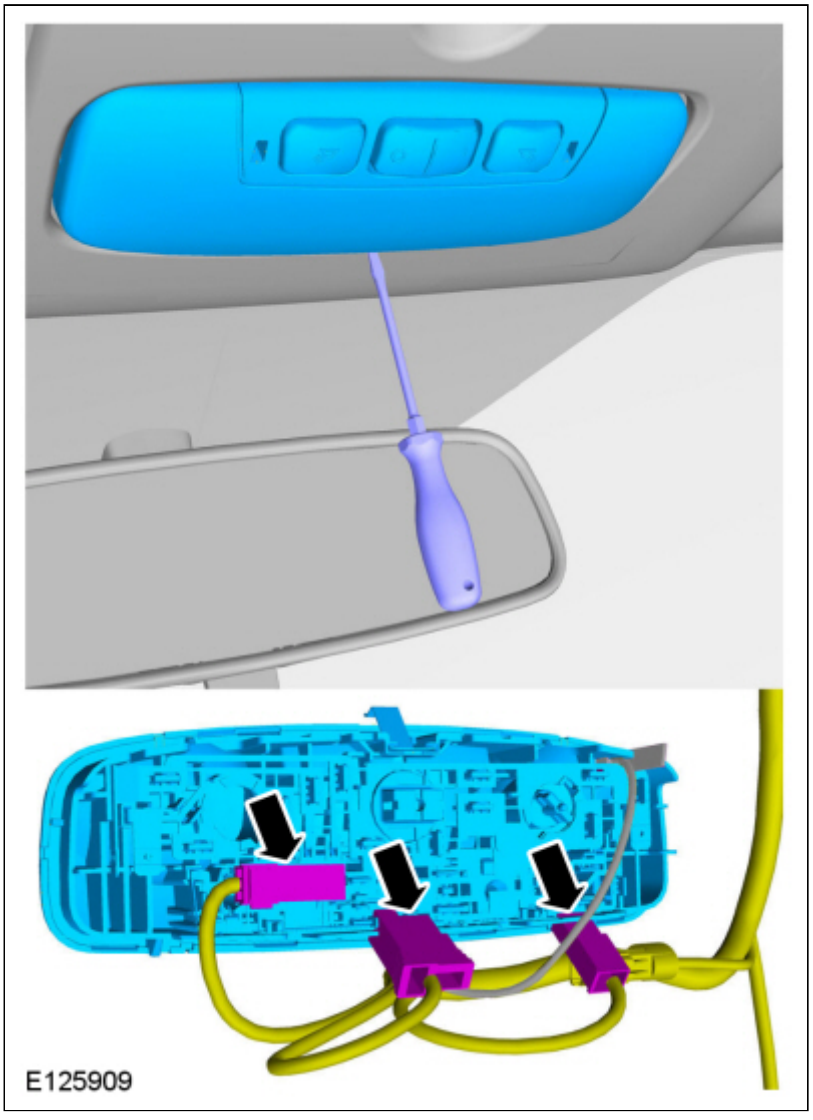
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Long over head console.



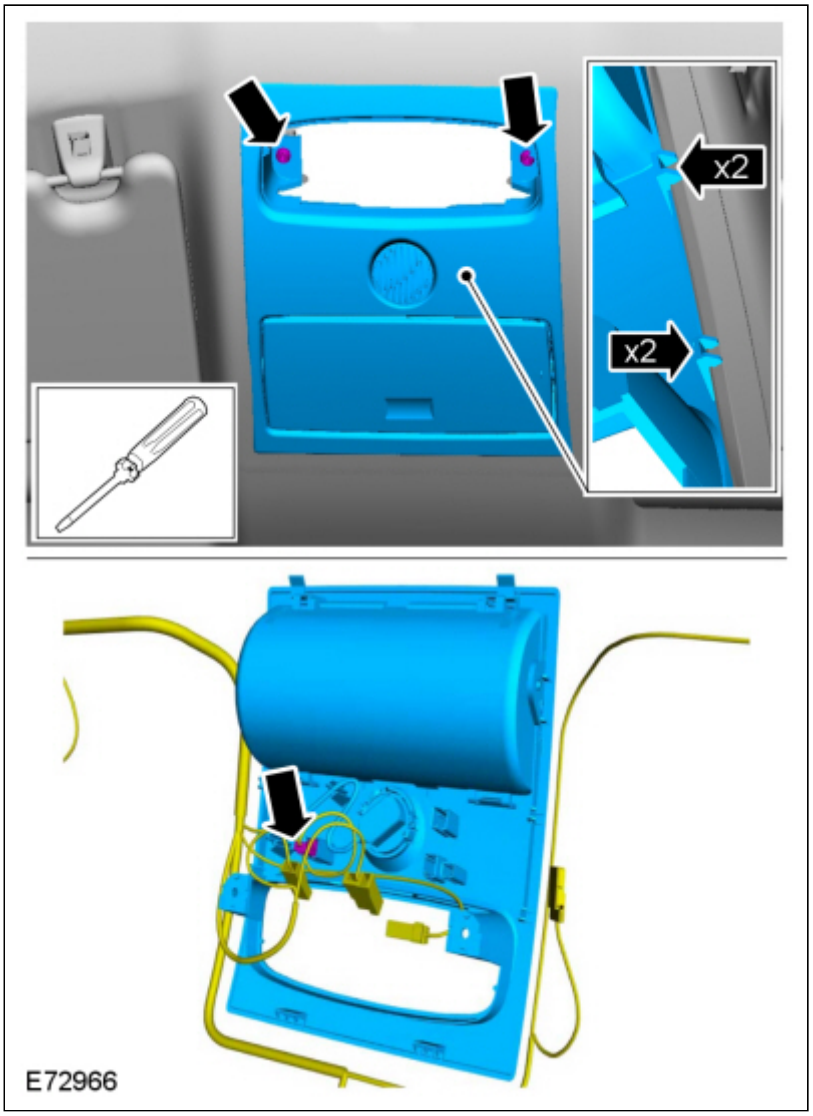
4. Short over head console.



5.



6. *Torque*: 4 Nm

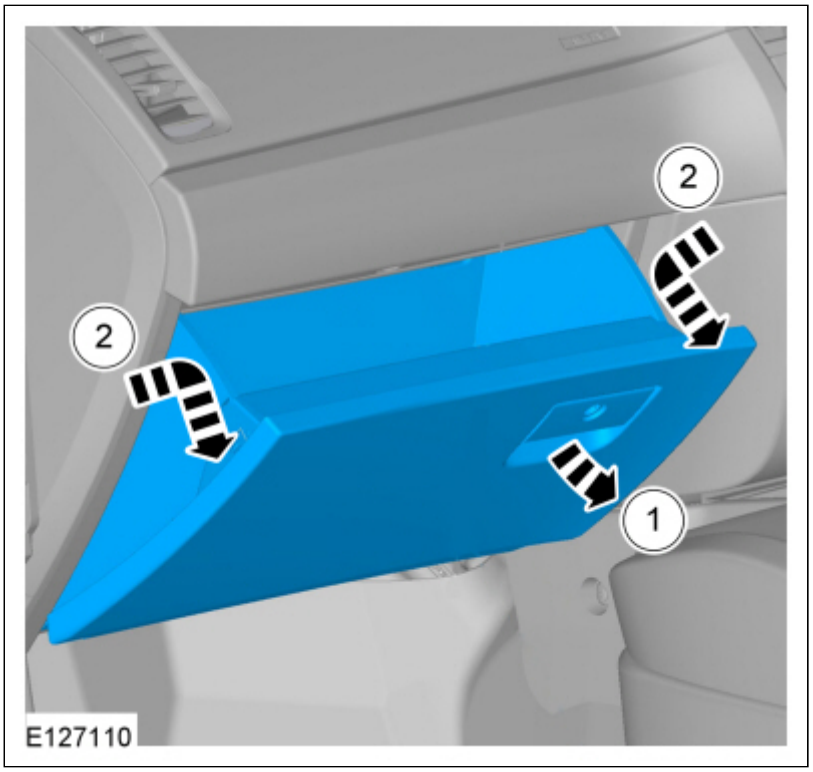


Installation

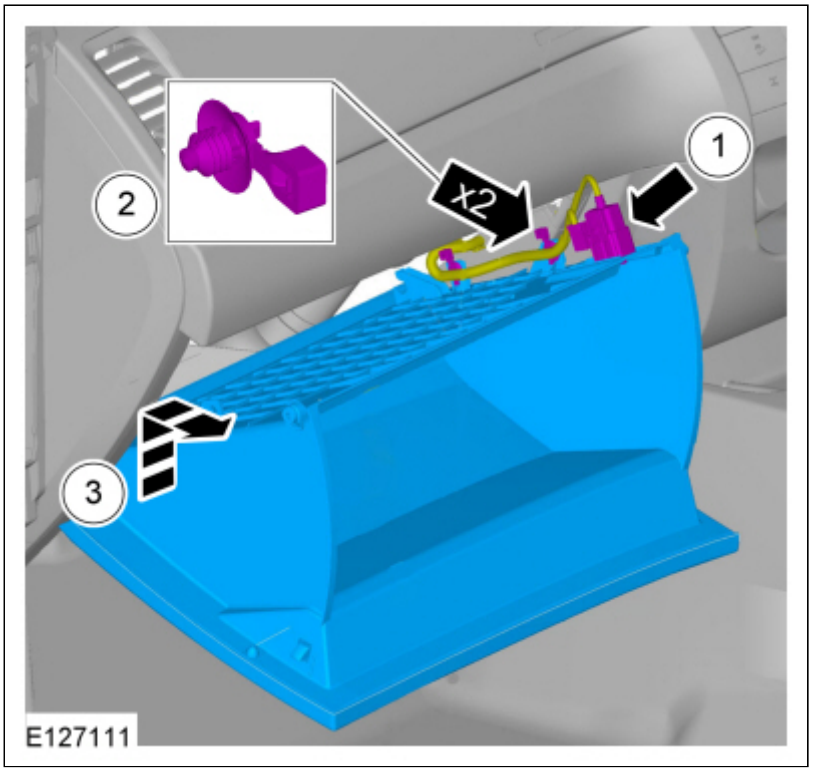
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Glove Compartment - Remove for Access

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3. **NOTE:** *Make sure that the passenger glove box lamp is correctly located.*

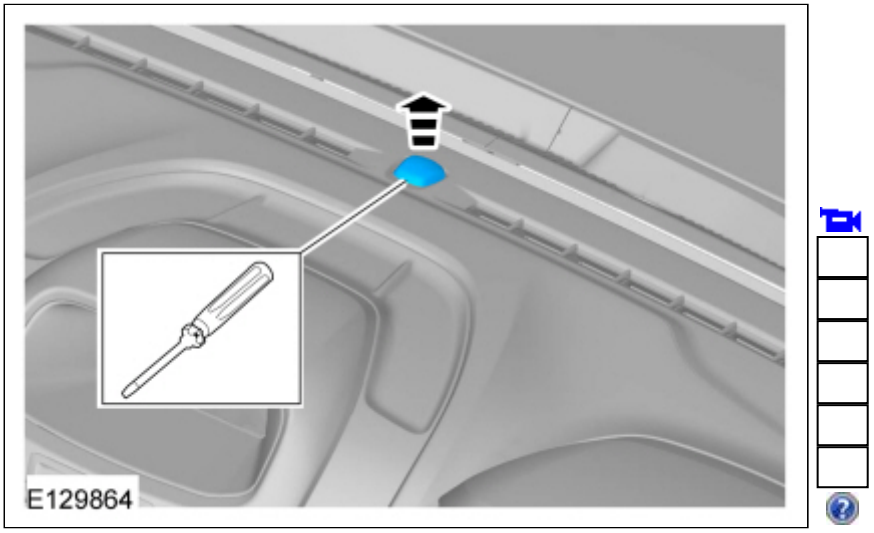


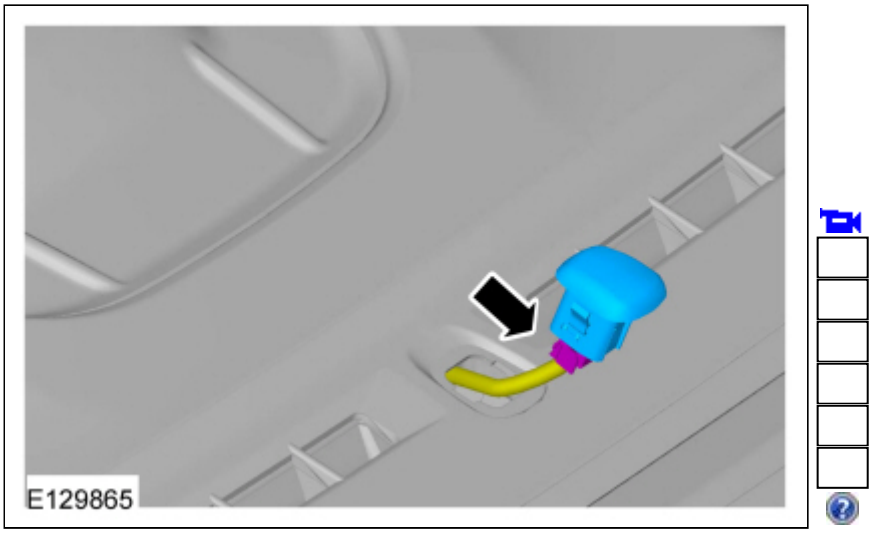
Copyright © 2016 Ford Motor Company

Instrument Panel

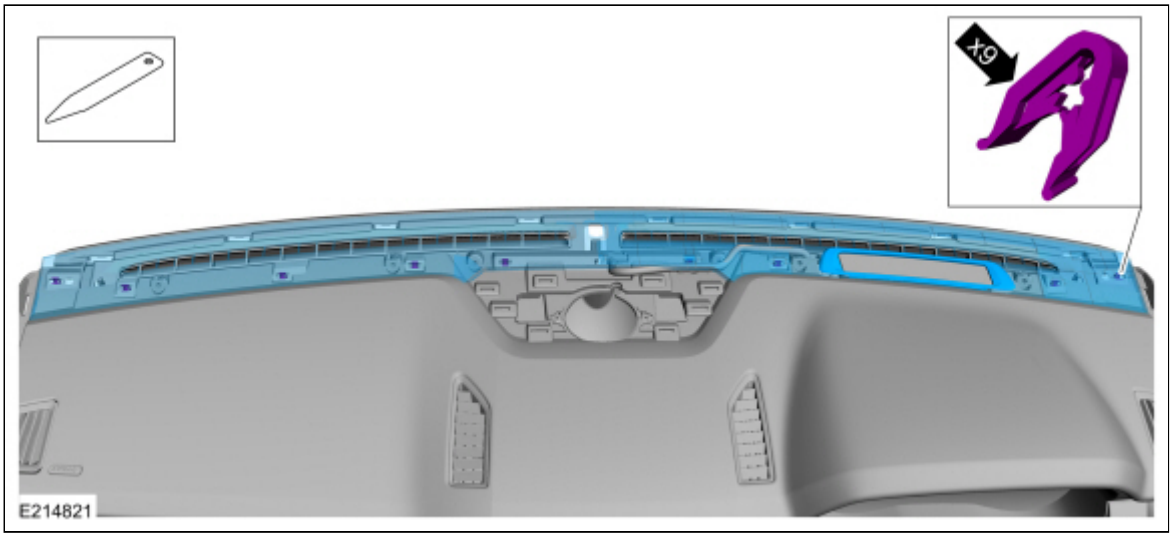
Base Part Number: S04305

DISASSEMBLY

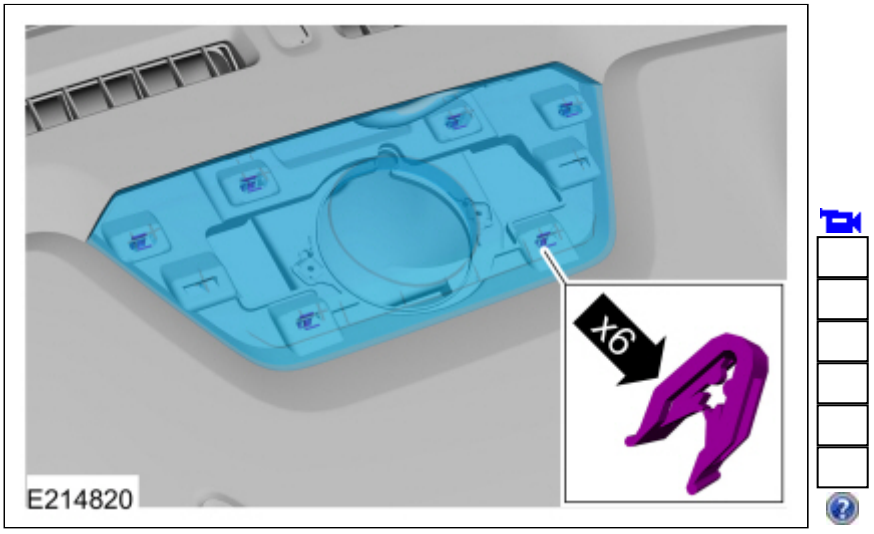
1. Refer to: Instrument Panel - LHD (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Instrument Panel - RHD (501-12 Instrument Panel and Console, Removal and Installation).
2. 

3. 

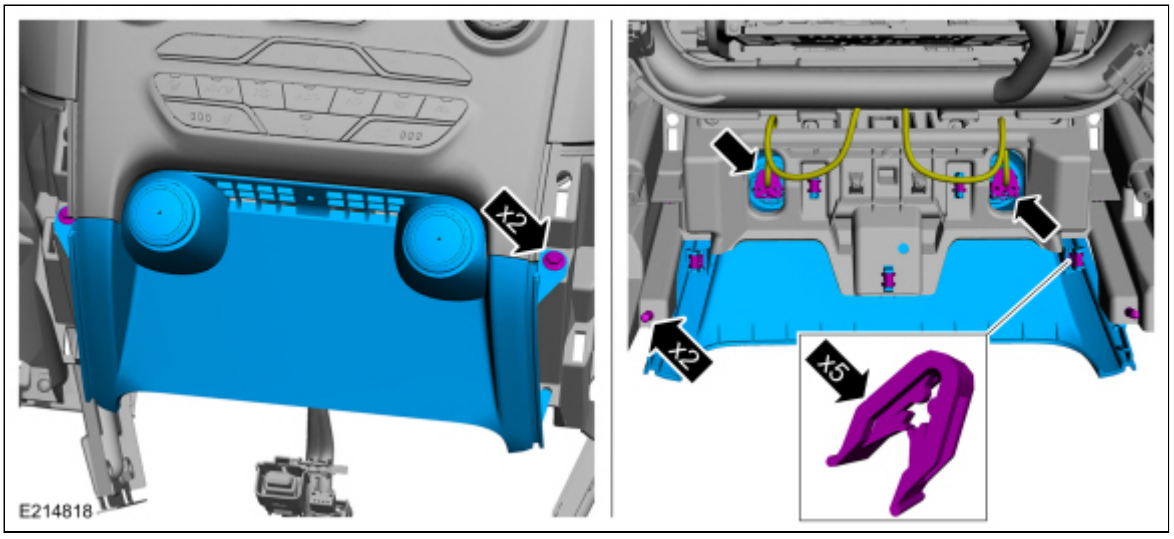
4.



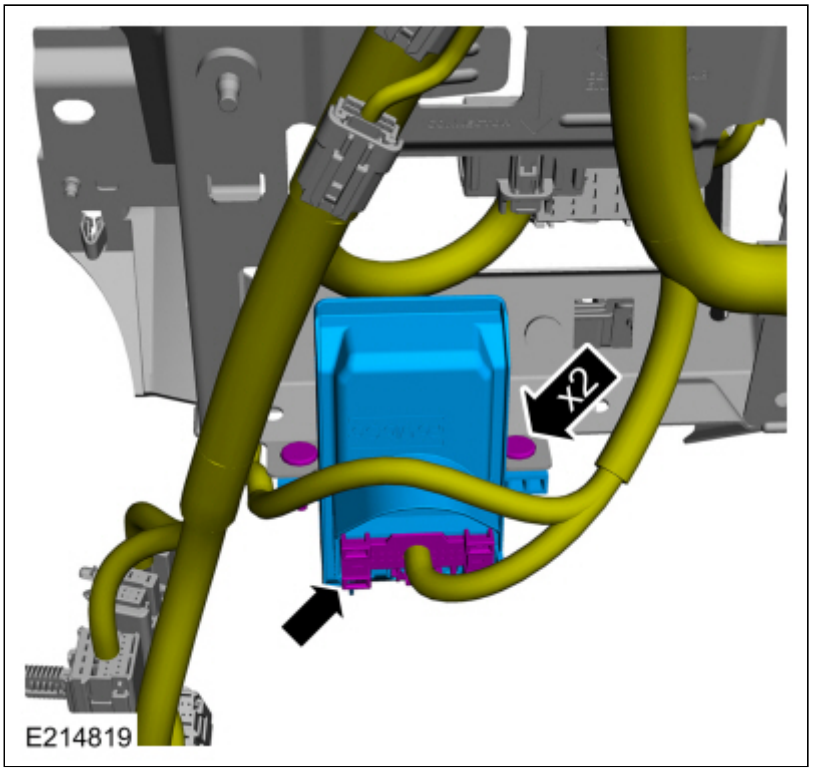
5.



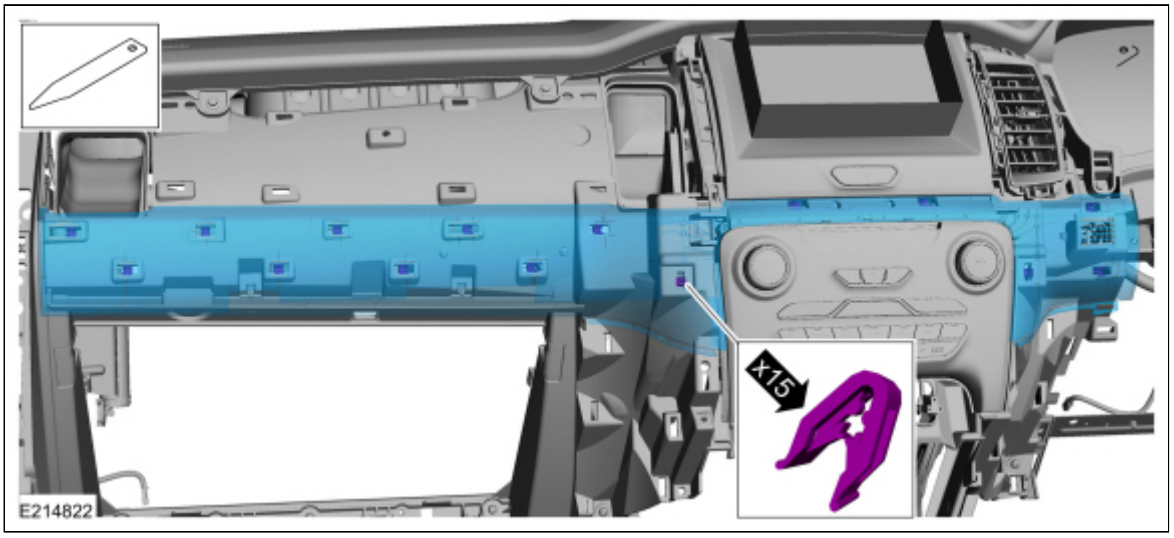
6.



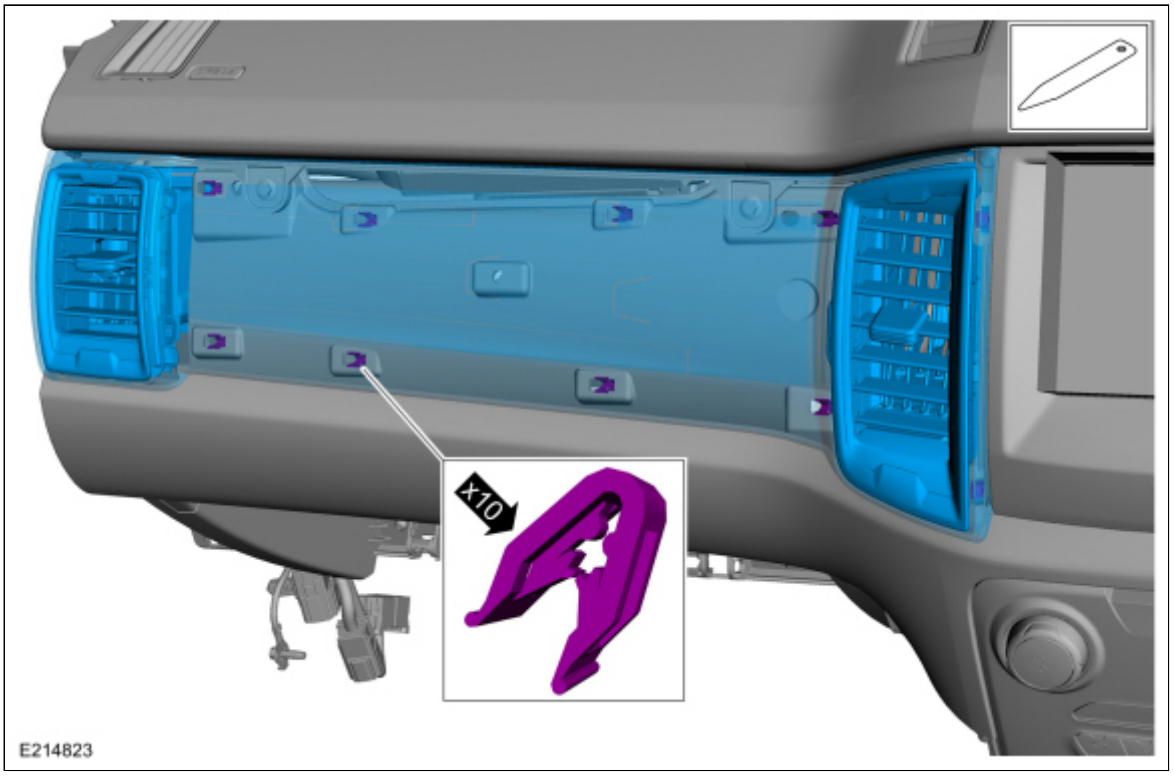
7.



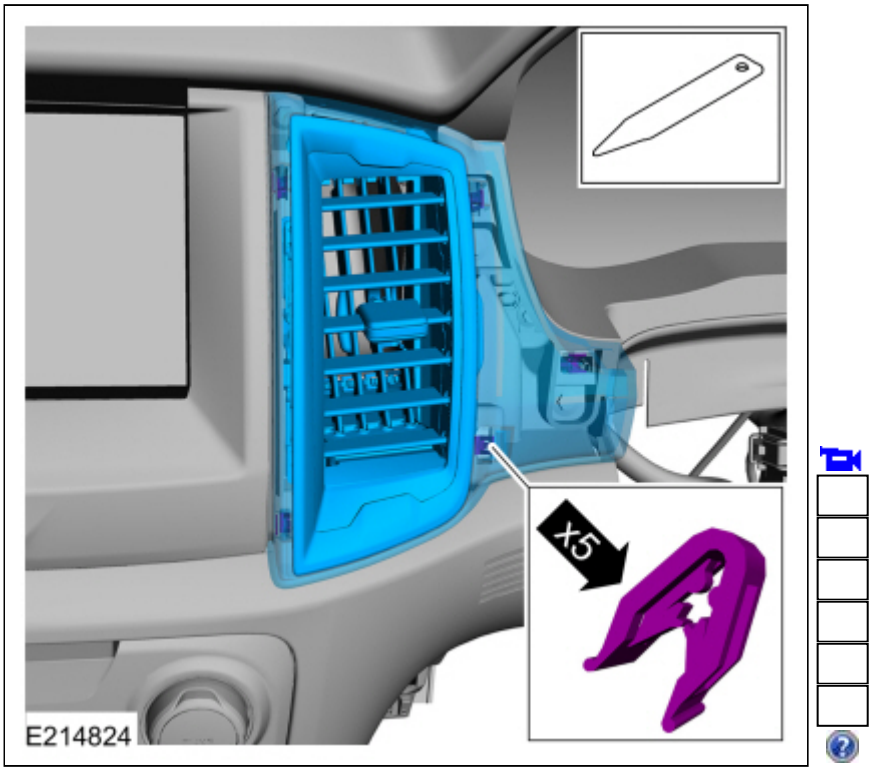
8.



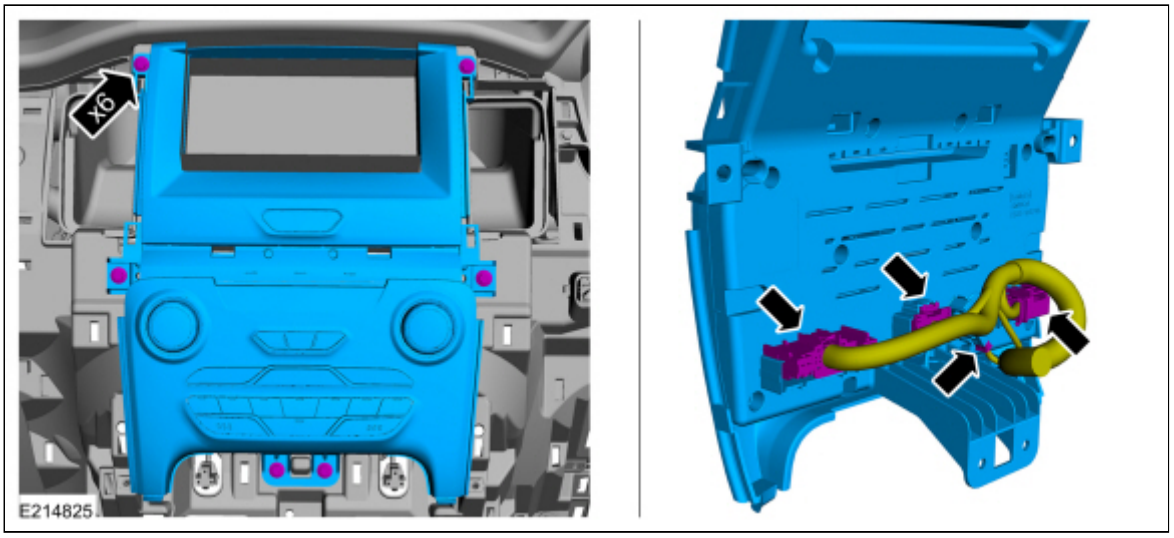
9.



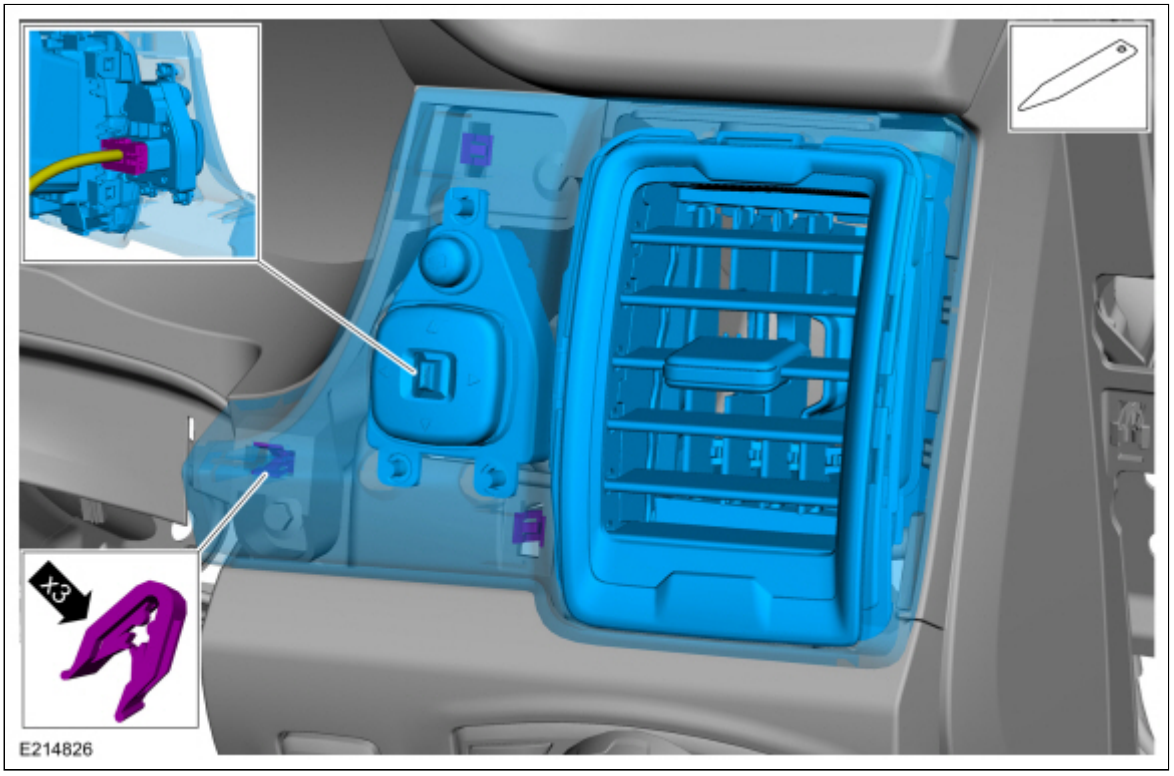
10.



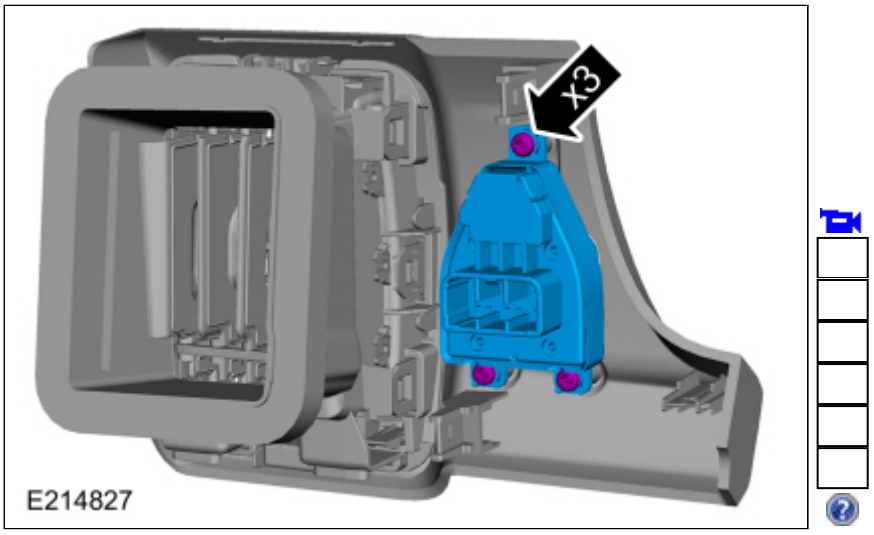
11. *Torque*: 3 Nm



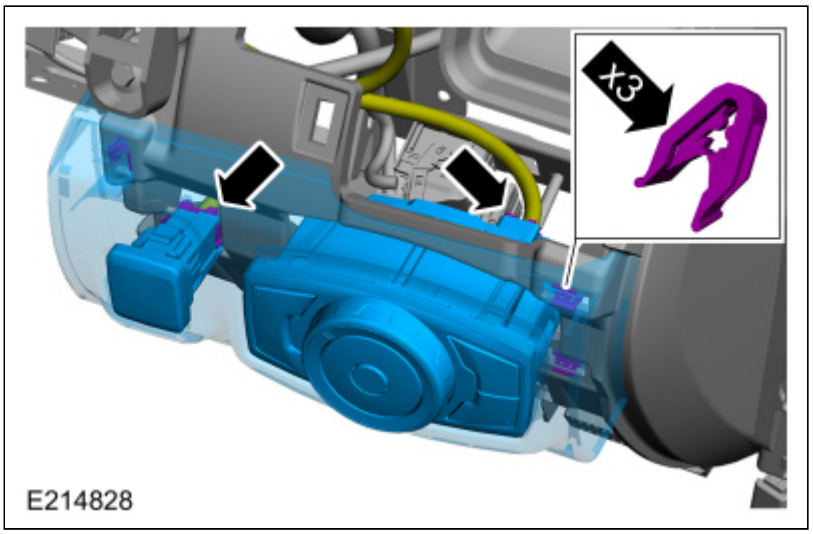
12.



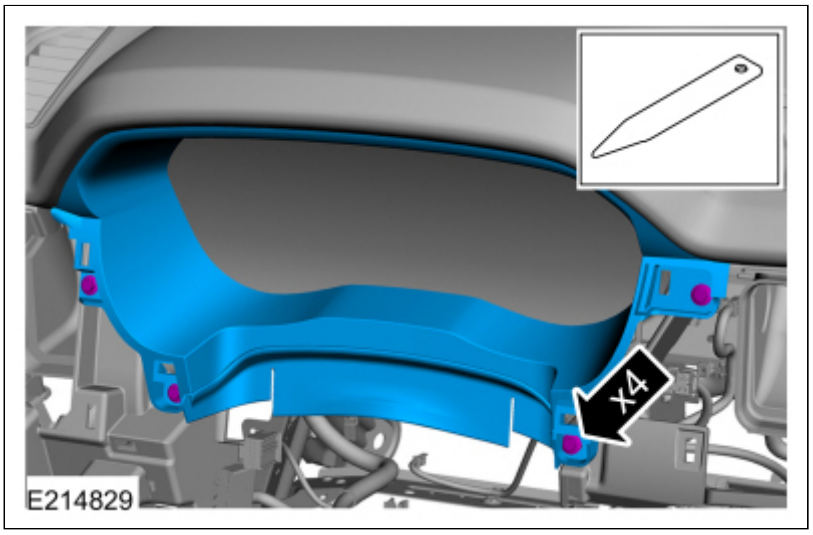
13. *Torque*: 1 Nm



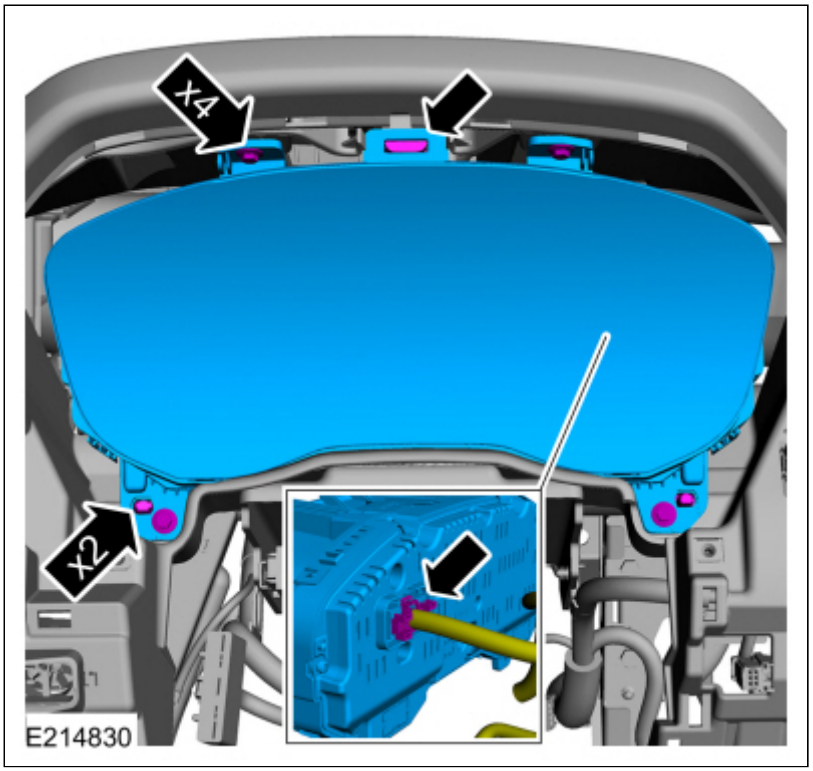
14.



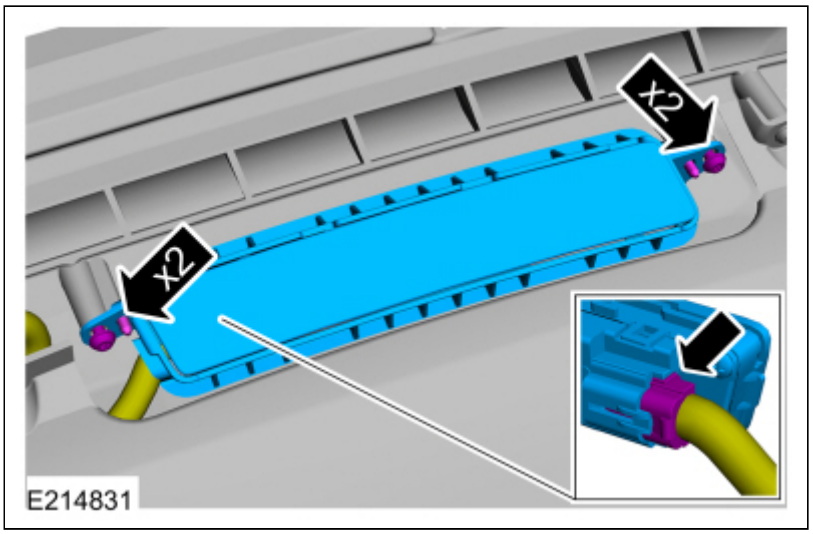
15. *Torque*: 3 Nm



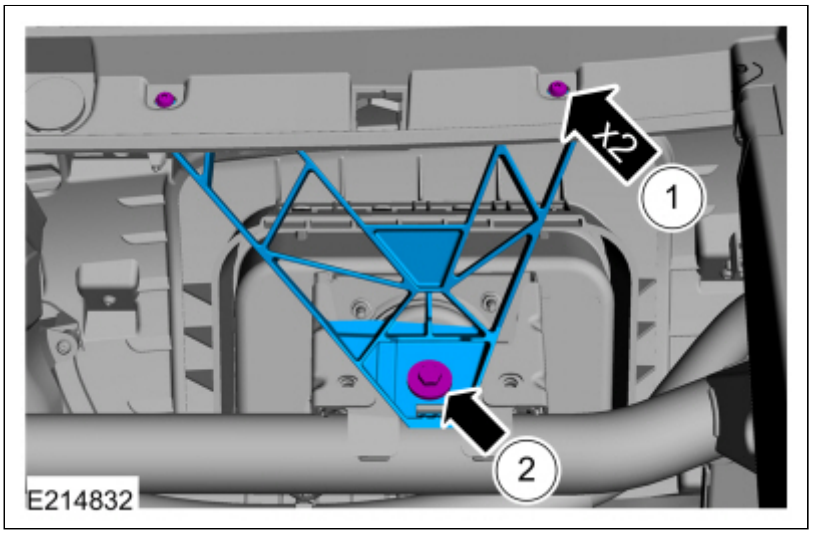
16. *Torque*: 3 Nm



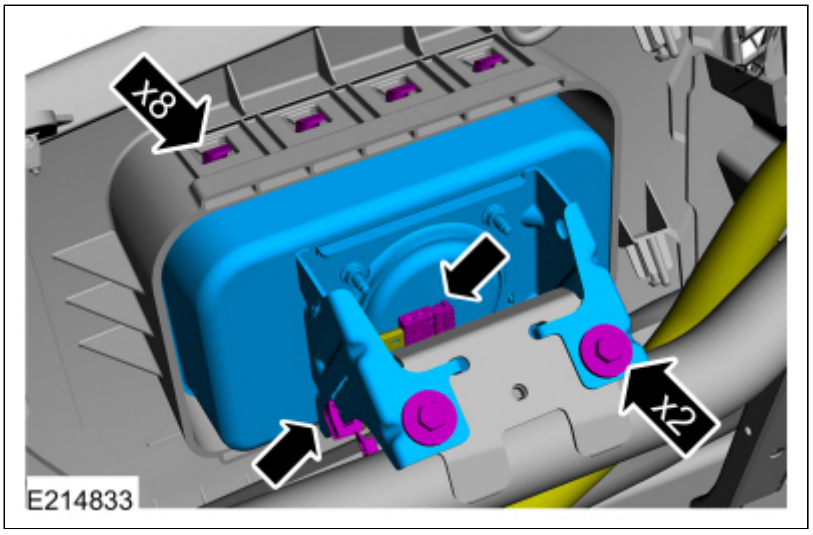
17. *Torque*: 1 Nm



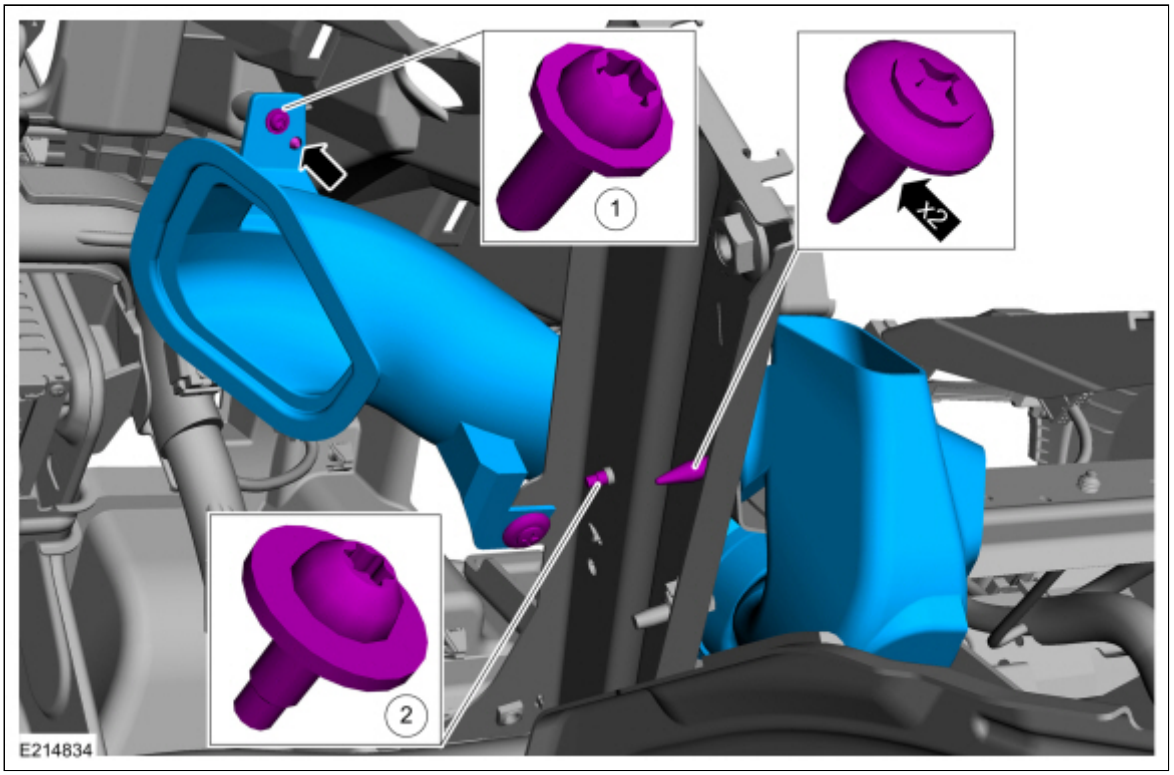
18. *Torque*:
    Stage 1: 1 Nm
    Stage 2: 7 Nm



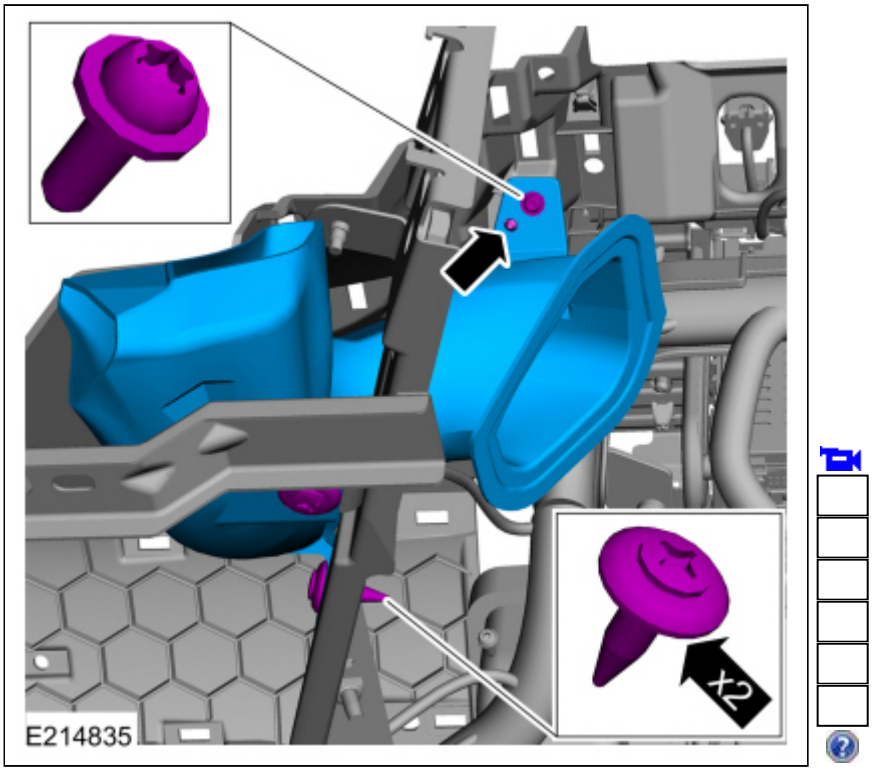
19. *Torque*: 7 Nm



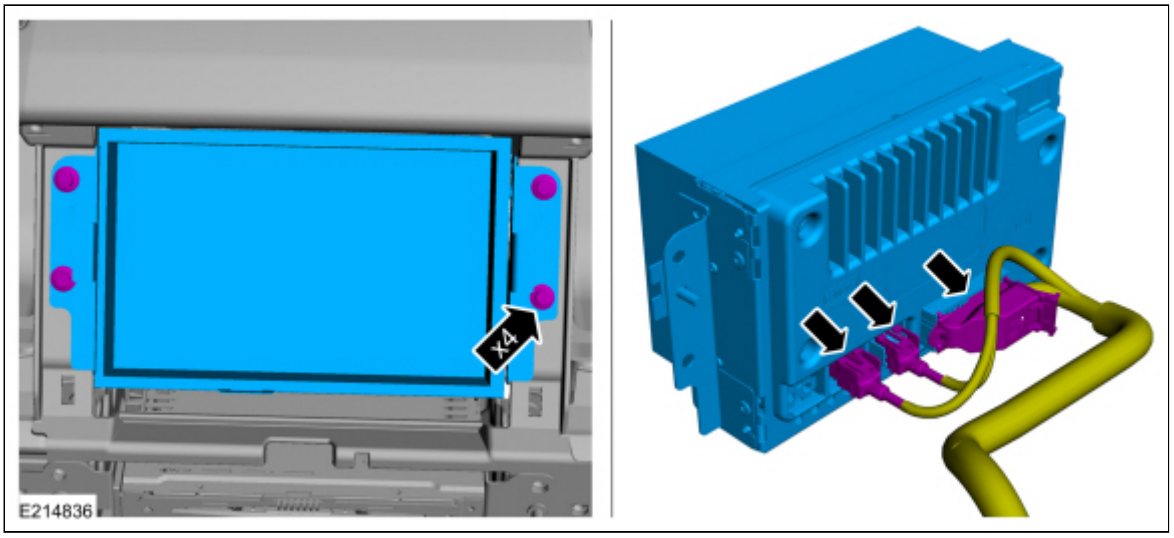
20. *Torque*:
    Stage 1: 1 Nm
    Stage 2: 2 Nm



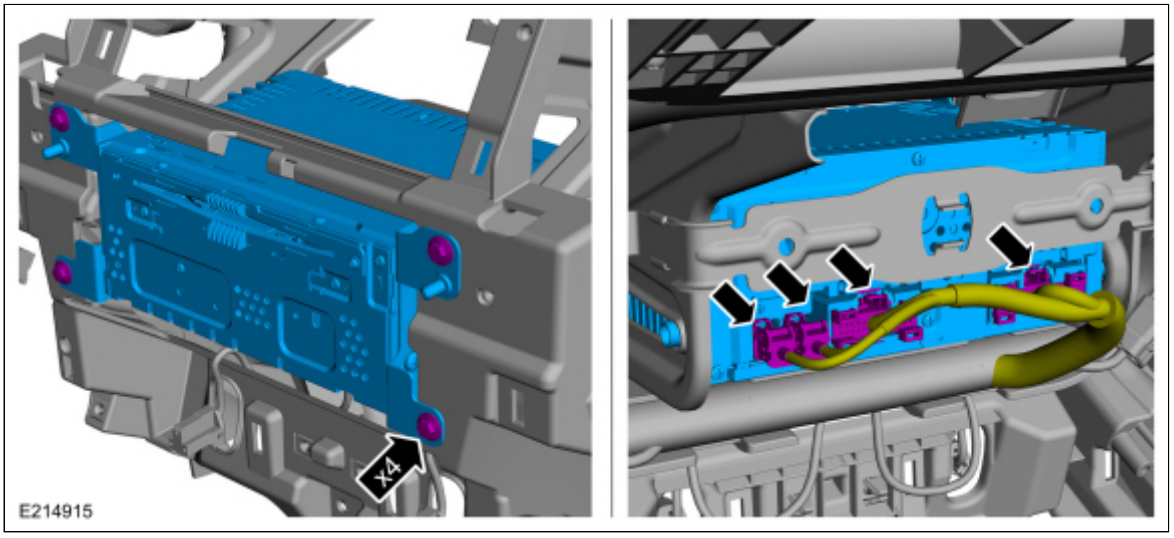
21. *Torque*: 1 Nm



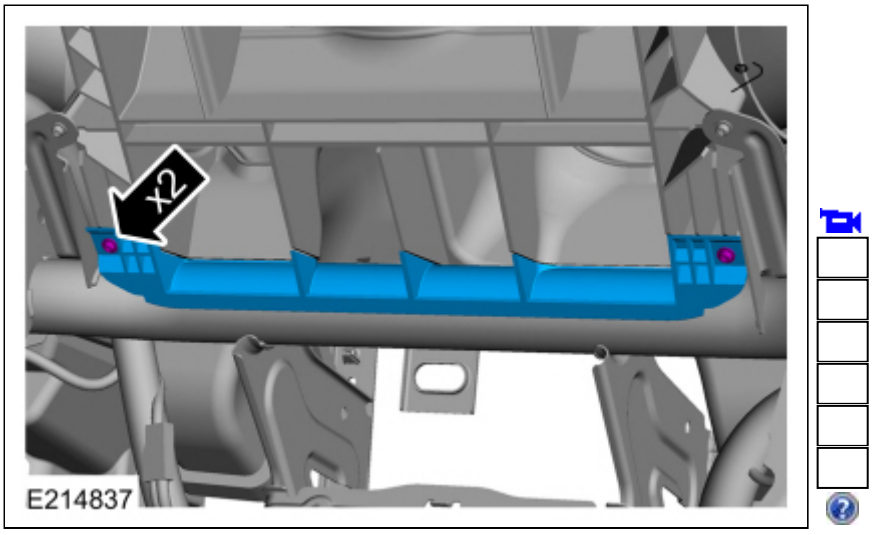
22. *Torque*: 3 Nm



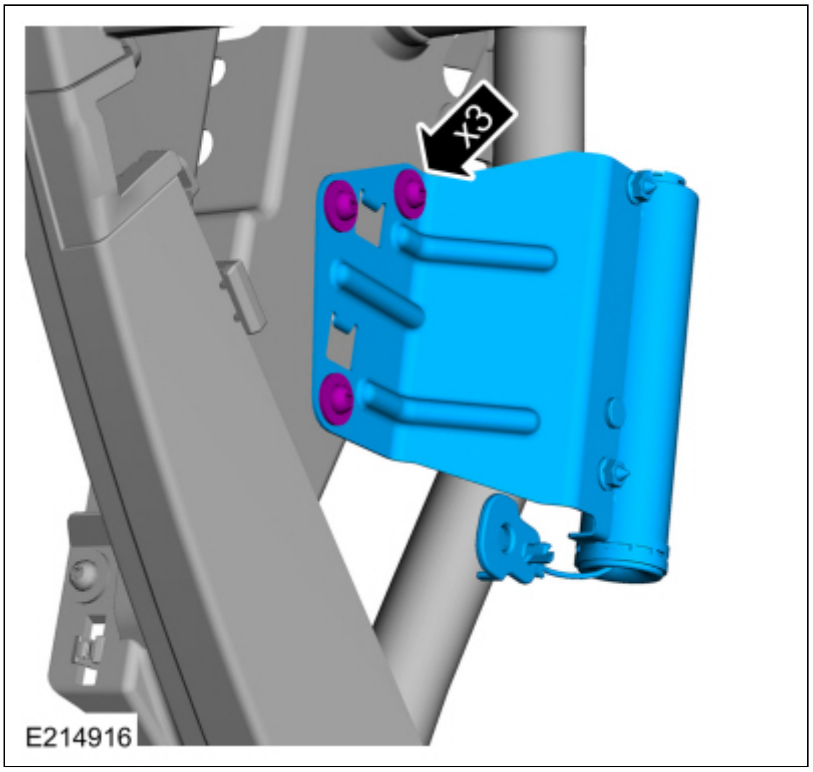
23. *Torque*: 3 Nm



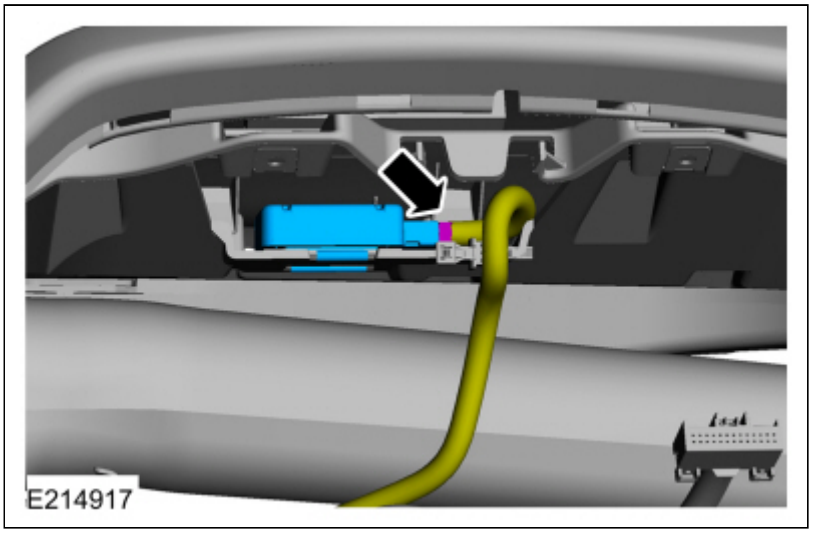
24. *Torque*: 1 Nm



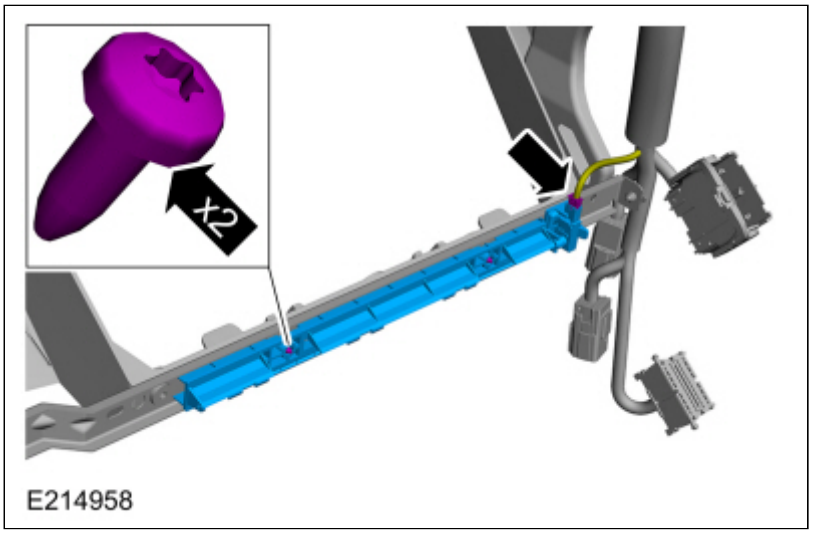
25. *Torque*: 3 Nm



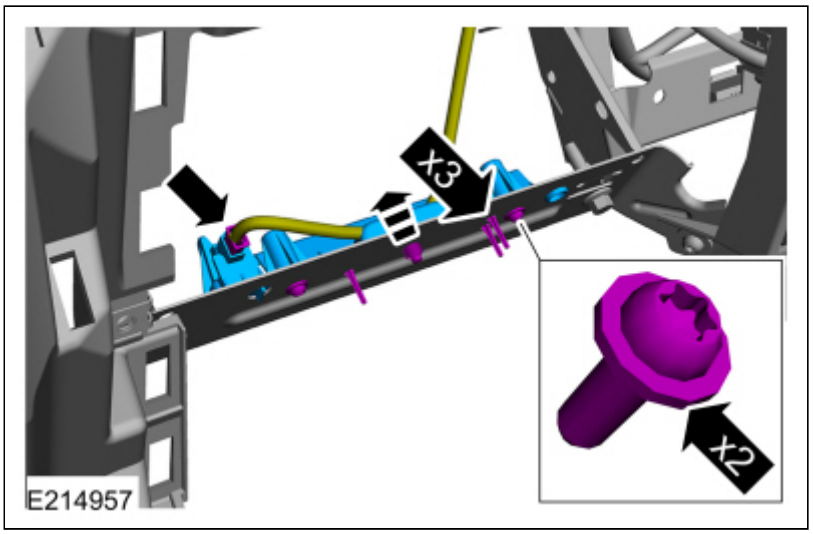
26.



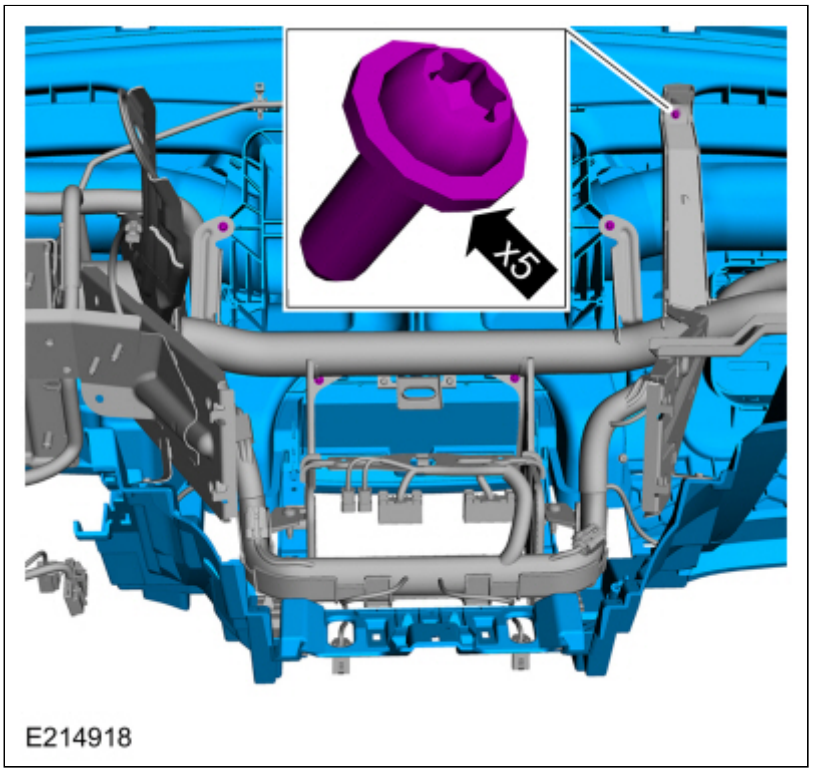
27. *Torque*: 3 Nm



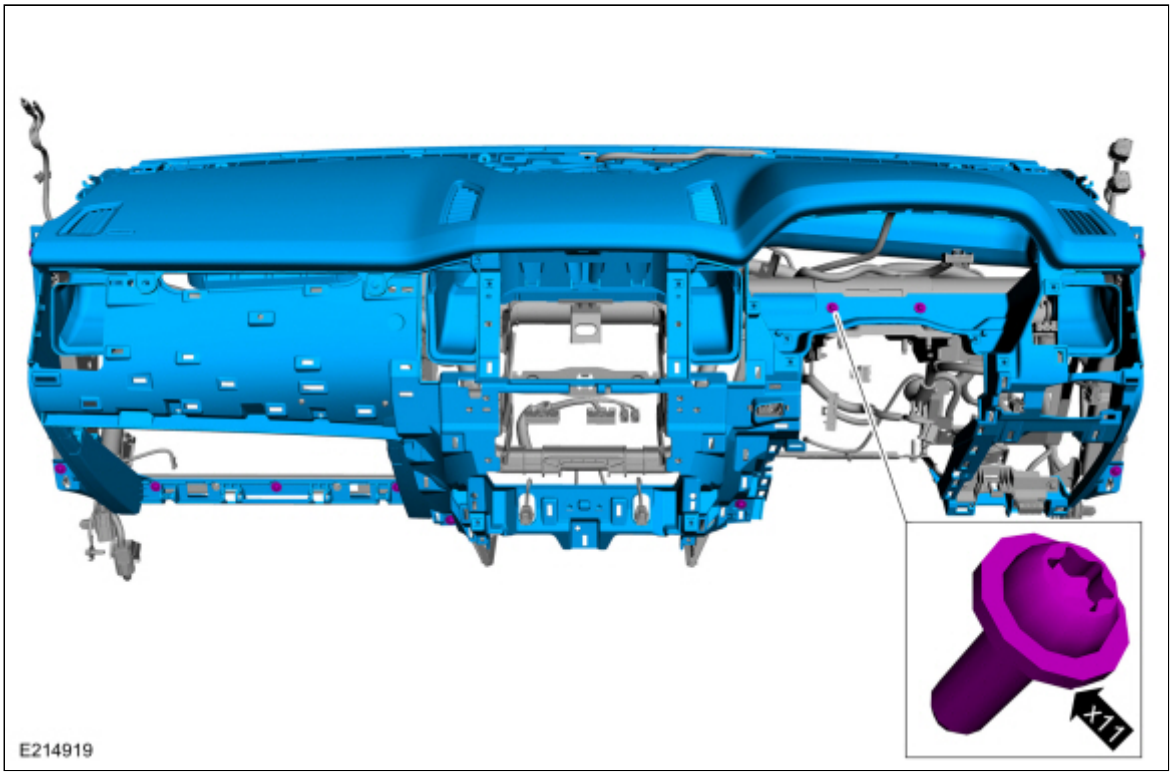
28. *Torque*: 1 Nm



29. *Torque*: 1 Nm



30. *Torque*: 3 Nm



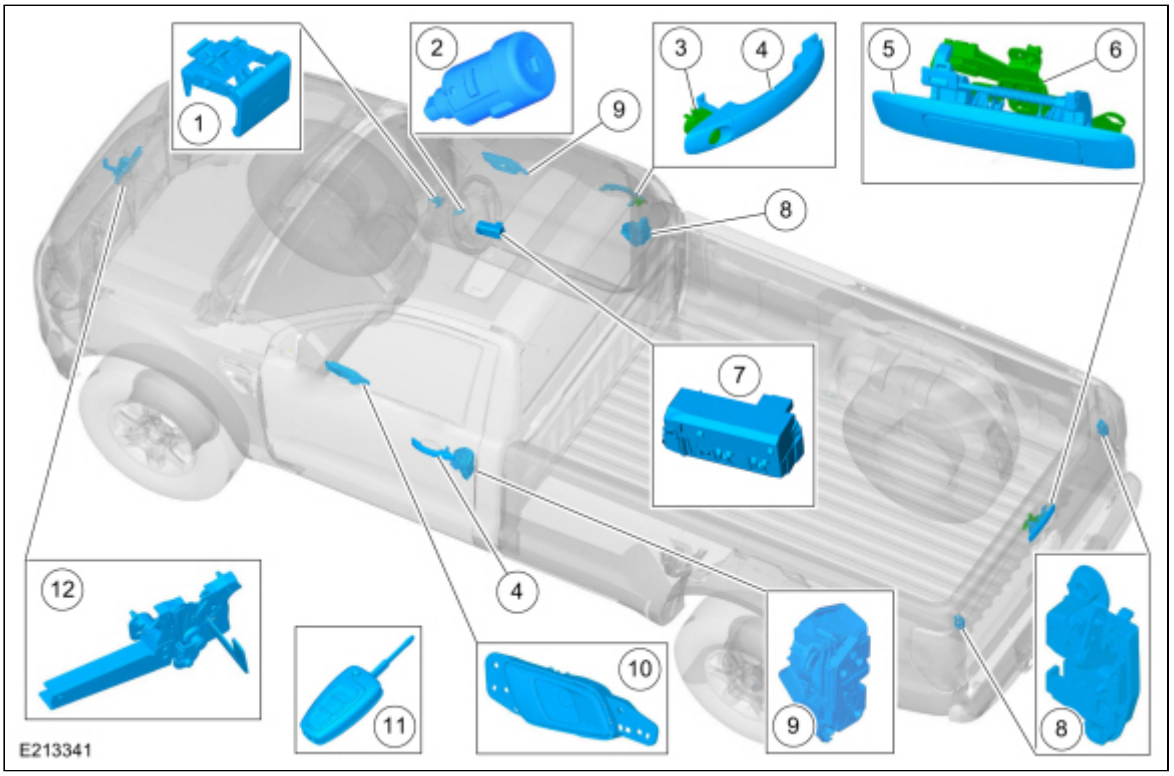
ASSEMBLY

1. To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

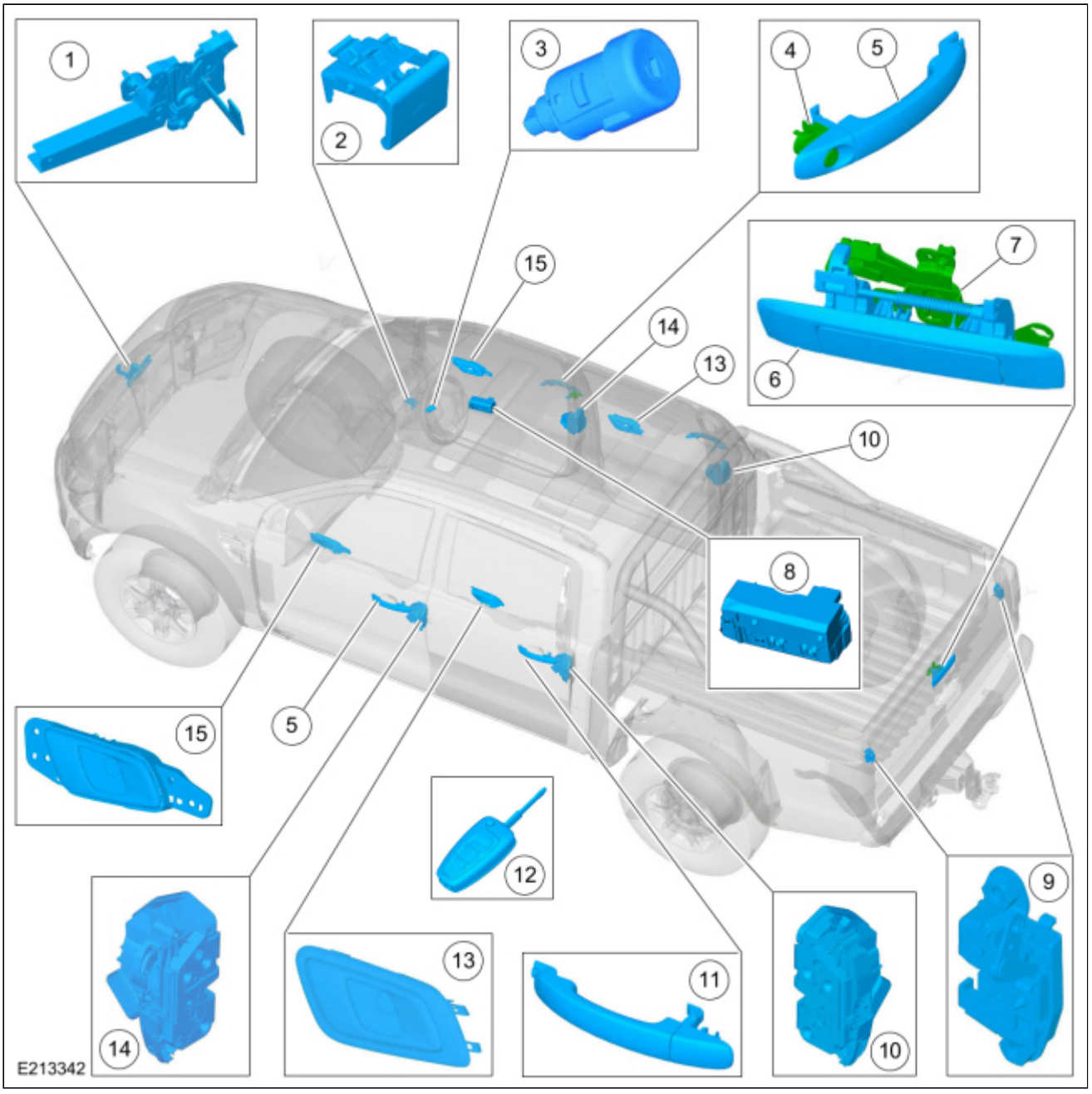
Handles, Locks, Latches and Entry Systems - Component Location

Vehicles with RKE (remote keyless entry) single cab



Item	Part Number	Description
1	—	Hood latch release handle
2	—	Steering column ignition cylinder
3	—	Door lock cylinder
4	—	Exterior door handle
5	—	Tailgate handle
6	—	Tailgate release handle
7	—	RTM (radio transceiver module) (if equipped)
8	—	Tailgate latch
9	—	Door latch
10	—	Interior door handle
11	—	Flip key
12	—	Hood latch

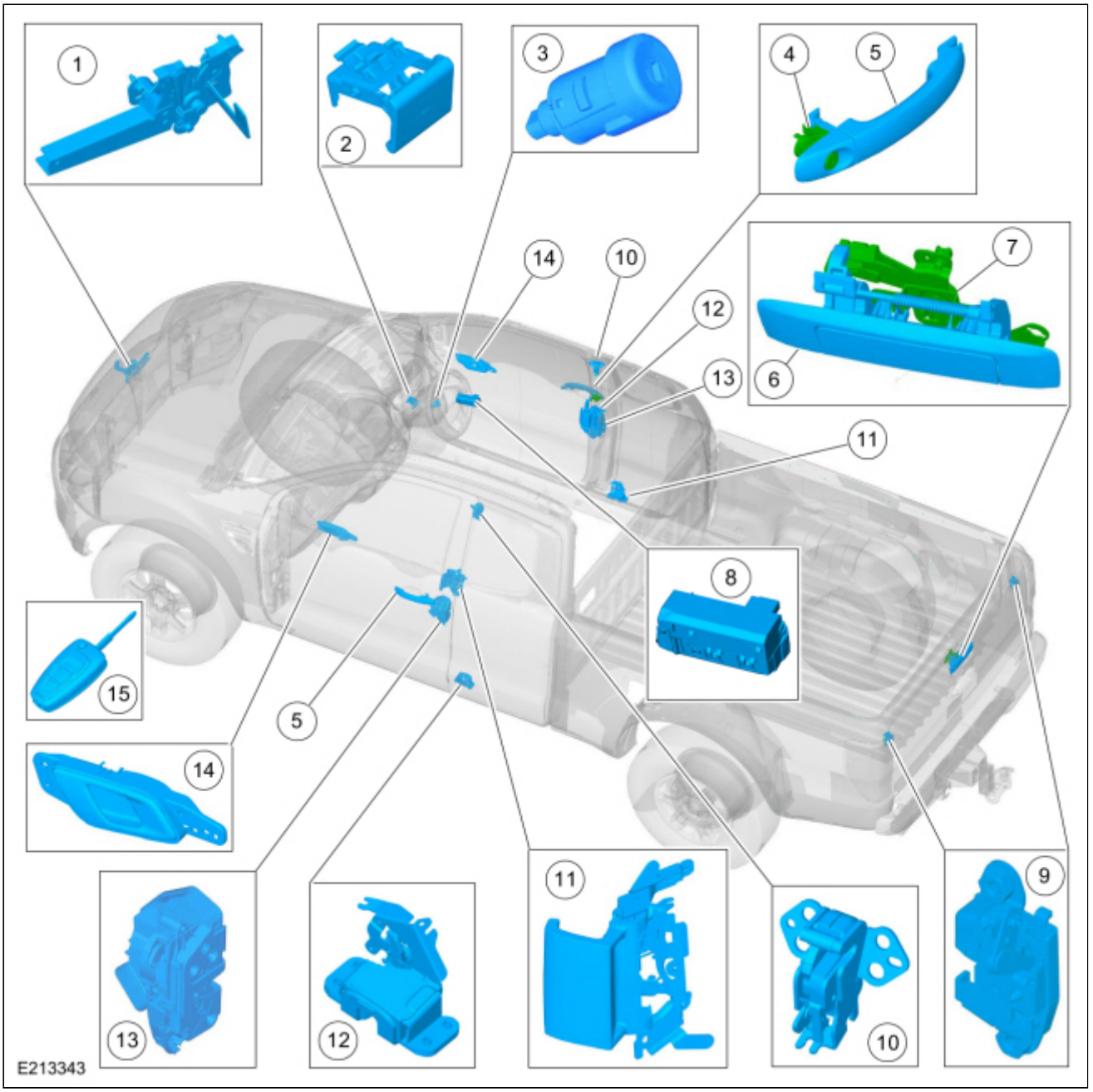
Vehicles with RKE (remote keyless entry) double cab



Item	Part Number	Description
1	—	Hood latch
2	—	Hood latch release handle
3	—	Steering column ignition cylinder
4	—	Door lock cylinder
5	—	Front exterior door handle
6	—	Tailgate handle
7	—	Tailgate release handle
8	—	RTM (radio transceiver module) (if equipped)
9	—	Tailgate latch
10	—	Rear door latch
11	—	Rear exterior door handle
12	—	Flip key
13	—	Rear interior door handle
13	—	Front door latch
14	—	Front door latch

15	—	Front interior door handle

Vehicles with RKE (remote keyless entry) super cab



Item	Part Number	Description
1	—	Hood latch
2	—	Hood latch release handle
3	—	Steering column ignition cylinder
4	—	Door lock cylinder
5	—	Front exterior door handle
6	—	Tailgate handle
7	—	Tailgate release handle
8	—	RTM (radio transceiver module) (if equipped)
9	—	Tailgate latch
10	—	Rear door upper latch

11	—	Rear interior door handle
12	—	Rear door lower latch
13	—	Front door latch
14	—	Front interior door handle
15	—	Flip key

General

When one of the buttons on the remote control is pressed, a coded HF radio signal is sent from the transmitter in the mechanical key. This signal is received by the RTM or RF receiver located in the BCM (body control module), which decodes the signal. If the coded signal is valid, the BCM will operate the latches.

Unlocking is confirmed by one long flash of the turn signal lamps, when the unlocking is completed.

There are various circumstances in which remote unlocking is not possible:

- The radio transmitter or receiver is overloaded because of radio interference.
- The key (electronics) is damaged.
- The battery in the key is discharged.
- The overload protection of the door latches is active (after too many operations).

As well as remote keyless entry, the vehicle can be locked and unlocked using the lock cylinder in the driver's door. If RKE is not fitted, the vehicle can also been unlocked using the lock cylinder in the passenger's door. The lock cylinder is mechanically connected to a switch, which is linked to the BCM.

Double Locking

The double locking system has the same functionality of central locking but also prevents the doors from being opened from inside using the interior door handles.

The double locking function is actuated if one of the following conditions is satisfied:

- A key is inserted into a door cylinder lock and turned to the "locking" position twice within 3 seconds.
- The locking button on the remote transmitter is pressed twice within 3 seconds.

Confirmation that the vehicle is double locked is also given by two short flashes of the turn signal lamps, when the double locking process is completed. The ordinary central locking in this case will be signaled by a single short flash of the turn signal lamps.

Door latch for single cab

The front door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The front doors are locked/unlocked by the Remote Keyless Entry (RKE) transmitter, lock/unlock button inside the vehicle or the driver door lock cylinder.

The door latches have electric motors to operate the locking and double locking function. The electric motors are actuated directly by the BCM.

When the door latch is locked, the exterior door handle is disengaged from the door latch.

A control switch is incorporated in the door latch in the driver's door. This control switch monitors the position of the door latch and reports the information to the BCM. This information is sent to the BCM for use in warning systems, locking functions and anti-theft alarm systems.

Door latch for double cab

The front door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The front doors are locked/unlocked by the Remote Keyless Entry (RKE) transmitter, lock/unlock button inside the vehicle or the driver door lock cylinder.

The rear door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The rear doors can

be locked/unlocked by the RKE transmitter, lock/unlock button inside the vehicle. The rear doors have a child safety lock feature, which is a manual lock on the inside of the rear door frame. When the child safety feature is on, the rear doors cannot be opened from the interior door handle.

The door latches have electric motors to operate the locking and double locking function. The electric motors are actuated directly by the BCM.

When the door latch is locked, the exterior door handle is disengaged from the door latch.

A control switch is incorporated in the driver's door latch. This control switch monitors the position of the door latch and reports the information to the BCM. This information is sent to the BCM for use in warning systems, locking functions and anti-theft alarm systems.

Door latch for super cab

The front door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch and door lock actuator. The front doors are locked/unlocked by the Remote Keyless Entry (RKE) transmitter, lock/unlock button inside the vehicle or the driver door lock cylinder.

The front door latches have electric motors to operate the locking and double locking function. The electric motors are actuated directly by the BCM.

When the front door latch is locked, the exterior door handle is disengaged from the door latch.

A control switch is incorporated in the driver's door latch. This control switch monitors the position of the door latch and reports the information to the BCM. This information is sent to the BCM for use in warning systems, locking functions and anti-theft alarm systems.

The rear door entry system contains a latch that is fastened to the inside of the door frame and is controlled by the exterior and interior door handles. The latch contains the door ajar switch . No lock actuators or mechanisms are fitted to the rear doors, as the front door must be open in order to access the rear door latch.

Tailgate latch

The lock cylinder is optional. If equipped, the tailgate release handle is integrated with a lock cylinder. The tailgate is not linked to the central locking system.

Hood Latch

The hood latch system contains a latch fastened to the body and a hood latch striker attached to the hood. The latch is controlled by the hood latch release handle and cable.

Copyright © 2016 Ford Motor Company

Handles, Locks, Latches and Entry Systems - Overview

Overview

The power lock/unlock feature locks or unlocks the doors upon a customer request from a door lock control switch, the keyless entry keypad (if equipped) , the passive entry system (if equipped) or a RKE transmitter. Each door can also be locked manually using the mechanical access opening just above the door latch.

If equipped, the passive entry feature automatically locks or unlocks the doors, or releases the liftgate latch (manual liftgate) or power opens the liftgate (power liftgate).

Copyright © 2016 Ford Motor Company

Locks, Latches and Entry Systems

DTC Charts

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B10AB:00	Remote Keyless Entry Synchronization: No Sub Type Information	GO to Pinpoint Test O
B11C6:01	Passenger Door External Antenna: General Electrical Failure	GO to Pinpoint Test S
B11CA:01	Driver Door External Antenna: General Electrical Failure	GO to Pinpoint Test S
B1218:00	Transmitter Identification Code: No Sub Type Information	GO to Pinpoint Test O
B121A:11	Keypad Illumination Output: Circuit Short To Ground	GO to Pinpoint Test M
B121A:15	Keypad Illumination Output: Circuit Short To Battery or Open	– If the keypad illumination is inoperative, GO to Pinpoint Test M – If the keypad illumination is always on, GO to Pinpoint Test N
B121B:01	Keypad Input Switch: General Electrical Failure	GO to Pinpoint Test L
B126A:01	Drivers Door Interior Lock Switch: General Electrical Failure	GO to Pinpoint Test J
B1381:11	Left Front Door Handle Proximity Sensor: Circuit Short To Ground	GO to Pinpoint Test S
B1381:15	Left Front Door Handle Proximity Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test S
B1381:29	Left Front Door Handle Proximity Sensor: Signal Invalid	GO to Pinpoint Test S
B1382:11	Right Front Door Handle Proximity Sensor: Circuit Short To Ground	GO to Pinpoint Test S
B1382:15	Right Front Door Handle Proximity Sensor: Circuit Short To Battery or Open	GO to Pinpoint Test S
B1382:29	Right Front Door Handle Proximity Sensor: Signal Invalid	GO to Pinpoint Test S
U0258:87	Lost Communication With Radio Transceiver: Missing Message	GO to Pinpoint Test U
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

RTM DTC Chart

DTC	Description	Action
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	GO to Pinpoint Test T
U1A00:00	Private Communication Network: No Sub Type Information	GO to Pinpoint Test U
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Tire Pressure Monitoring System (TPMS) (204-04 Tire Pressure Monitoring System (TPMS)) .

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

DDM DTC Chart

DTC	Description	Action
B1088:83	LIN Bus "B": Value of Signal Protection Calculation Incorrect	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1088:87	LIN Bus "B": Missing Message	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B108F:23	Cabin Lock/Unlock Switch: Signal Stuck Low	GO to Pinpoint Test J
B1163:11	Left Mirror Heater Output: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1163:15	Left Mirror Heater Output: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1165:11	Left Front Puddle Lamp Output: Circuit Short To Ground	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1165:15	Left Front Puddle Lamp Output: Circuit Short To Battery or Open	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B117E:4B	Front Power Window Up: Over Temperature	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117E:92	Front Power Window Up: Performance or Incorrect Operation	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1189:29	Front Window Position Sensor: Signal Invalid	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B118C:11	Left Blind Spot Warning Indicator: Circuit Short To Ground	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B11F6:11	Driver Folding Mirror Motor: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B11F6:15	Driver Folding Mirror Motor: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B12C5:71	Front Window Lifter Motor Up Relay: Actuator Stuck	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B12C8:71	Front Window Lifter Motor Down Relay: Actuator Stuck	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B13F1:4B	Driver Power Window Motor: Over Temperature	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1C09:11	Driver Left/Right Mirror Motor: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C09:15	Driver Left/Right Mirror Motor: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C10:11	Driver Up/Down Mirror Motor: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C10:15	Driver Up/Down Mirror Motor: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C13:11	Driver Up/Down Mirror Motor Feedback: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C13:15	Driver Up/Down Mirror Motor Feedback: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C14:11	Driver Left/Right Mirror Motor Feedback: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C14:15	Driver Left/Right Mirror Motor Feedback: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1D06:11	Left Turn Indicator: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B14:15	Sensor Supply Voltage A: Circuit Short To Battery or Open	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B15:11	Sensor Supply Voltage B: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
C1B15:15	Sensor Supply Voltage B: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .

U0010:00	Medium Speed CAN Communication Bus: No Sub Type Information	The module was unable to communicate on the network at a point in time. The fault is not currently present (the module had to communicate with the scan tool to report this DTC). VERIFY the continuity of the connectors and wiring. Refer to Wiring Diagrams Cell 14 Module Communications Network for schematic and connector information.
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test V
U0208:00	Lost Communication With "Seat Control Module A": No Sub Type Information	GO to Pinpoint Test W
U0300:00	Internal Control Module Software Incompatibility: No Sub Type Information	CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC is retrieved again, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U0300:4A	Internal Control Module Software Incompatibility: Incorrect Component Installed	CARRY OUT the PMI using as-built data. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) from the BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U2010:00	Switch Illumination: No Sub Type Information	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
U2013:24	Switch Pack: Signal Stuck High	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms) .
U2014:00	Control Module Hardware: No Sub Type Information	INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CARRY OUT the PMI using as-built data. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U3000:04	Control Module: System Internal Failure	INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PDM DTC Chart

DTC	Description	Action
B108F:23	Cabin Lock/Unlock Switch: Signal Stuck Low	GO to Pinpoint Test J
B1164:11	Right Mirror Heater Output: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1164:15	Right Mirror Heater Output: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1166:11	Right Front Puddle Lamp Output: Circuit Short To Ground	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1166:15	Right Front Puddle Lamp Output: Circuit Short To Battery or Open	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B117E:07	Front Power Window Up: Mechanical Failure	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117E:92	Front Power Window Up: Performance or Incorrect Operation	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1189:29	Front Window Position Sensor: Signal Invalid	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B11F7:11	Passenger Folding Mirror Motor: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B11F7:15	Passenger Folding Mirror Motor: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B12C5:71	Front Window Lifter Motor Up Relay: Actuator Stuck	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B12C8:71	Front Window Lifter Motor Down Relay: Actuator Stuck	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B13F2:4B	Passenger Power Window Motor: Over Temperature	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1C11:11	Passenger Left/Right Mirror Motor: Circuit Short	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .

	To Ground	
B1C11:15	Passenger Left/Right Mirror Motor: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C12:11	Passenger Up/Down Mirror Motor: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C12:15	Passenger Up/Down Mirror Motor: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C15:11	Passenger Up/Down Mirror Motor Feedback: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C15:15	Passenger Up/Down Mirror Motor Feedback: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C16:11	Passenger Left/Right Mirror Motor Feedback: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1C16:15	Passenger Left/Right Mirror Motor Feedback: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
B1D07:11	Right Turn Indicator: Circuit Short To Ground	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
C1B14:11	Sensor Supply Voltage A: Circuit Short To Ground	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B14:15	Sensor Supply Voltage A: Circuit Short To Battery or Open	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B15:11	Sensor Supply Voltage B: Circuit Short To Ground	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
C1B15:15	Sensor Supply Voltage B: Circuit Short To Battery or Open	REFER to: Exterior Rear View Mirrors (501-09 Exterior Rear View Mirrors) .
U0010:00	Medium Speed CAN Communication Bus: No Sub Type Information	The module was unable to communicate on the network at a point in time. The fault is not currently present (the module had to communicate with the scan tool to report this DTC). VERIFY the continuity of the connectors and wiring. Refer to Wiring Diagrams Cell 14 Module Communications Network for schematic and connector information.
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	GO to Pinpoint Test V
U0208:00	Lost Communication With "Seat Control Module A": No Sub Type Information	GO to Pinpoint Test W
U0300:00	Internal Control Module Software Incompatibility: No Sub Type Information	CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC is retrieved again, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U0300:4A	Internal Control Module Software Incompatibility: Incorrect Component Installed	CARRY OUT the PMI using as-built data. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	RETRIEVE and REPAIR all non-network Diagnostic Trouble Codes (DTCs) from the BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U2002:24	Switch: Signal Stuck High	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
U2010:00	Switch Illumination: No Sub Type Information	REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
U2014:00	Control Module Hardware: No Sub Type Information	CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CARRY OUT the PMI using as-built data. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
U3000:04	Control Module: System Internal Failure	CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the DTC returns, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action

P1594	Forced Engine Shutdown - Remote Start System Fault, No Unattended Vehicle Timeout	GO to Pinpoint Test X
P1595	Forced Engine Shutdown - Remote Start System Fault, Transmission Range Not In Park Position	GO to Pinpoint Test X
All other Diagnostic Trouble Codes (DTCs)	-	REFER to the PCM DTC Chart in the appropriate 303-14 section.

Symptom Charts

Symptom Chart: Handles, Locks, Latches and Entry Systems - Mechanical

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Actions
Hard to open or close a door from either door handle	• Refer to the Pinpoint Test	• GO to Pinpoint Test A
A door is difficult or does not open from the exterior door handle	• Refer to the Pinpoint Test	• GO to Pinpoint Test B
A door is difficult or does not open from the interior door handle	• Refer to the Pinpoint Test	• GO to Pinpoint Test C
The exterior door release handle sticks	• Refer to the Pinpoint Test	• GO to Pinpoint Test D
The interior door release handle sticks	• Refer to the Pinpoint Test	• GO to Pinpoint Test E
Squeak-rattle-chucking noise from door	• Refer to the Pinpoint Test	• GO to Pinpoint Test F
The manual door lock cylinder is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test G

Symptom Chart: Handles, Locks, Latches and Entry Systems - Electrical

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Actions
All door locks are inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test H
A single or more than one door lock is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test I
The door locks operate only one way	• Refer to the Pinpoint Test	• GO to Pinpoint Test J
All door locks are inoperative from one door lock control switch	• Refer to the Pinpoint Test	• GO to Pinpoint Test K
The doors unlock by swiping the keyless entry keypad 2 times	• Unintentional sequential codes programmed	• ERASE all personal codes, and program new codes. PROGRAM any unused slots with the factory code. REFER to the Owner's Literature.
The doors do not lock or unlock using the keyless entry keypad	• Refer to the Pinpoint Test	• GO to Pinpoint Test L
The keyless entry keypad illumination is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test M
The keyless entry keypad illumination is always on	• Refer to the Pinpoint Test	• GO to Pinpoint Test N
The RKE transmitter is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test O
An individual button/feature is inoperative from the RKE transmitter	• Refer to the Pinpoint Test	• GO to Pinpoint Test P
The RKE transmitter has poor range performance	• Refer to the Pinpoint Test	• GO to Pinpoint Test Q
The remote start feature is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test R

The remote start feature operates, but the remote start feedback LED (light emitting diode) is inoperative	• Passive key	• DISCARD the suspect passive key. PROGRAM a new passive key. REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
The memory seat does not operate using the RKE transmitter	• RKE transmitter not programmed to the memory seat	• Program the RKE transmitter to the desired memory button. REFER to the Memory Function in the Owner's Literature.
The smart unlock is inoperative	• Refer to the Pinpoint Test	• For vehicles not equipped with push button start, DIAGNOSE the key-in-ignition warning chime. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). • For vehicles equipped with push button start, DIAGNOSE the passive key not starting the vehicle from various areas within the interior of the vehicle. REFER to: Passive Anti-Theft System (PATS) (419-01B Passive Anti-Theft System (PATS), Diagnosis and Testing).
The 2-stage door unlocking does not operate correctly	• The 2-stage door unlocking is disabled	• ENABLE the 2-step door unlocking. REFER to: Remote Keyless Entry (RKE) Transmitter Programming (501-14 Handles, Locks, Latches and Entry Systems, General Procedures).
A door passive entry feature is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test S

Pinpoint Tests

Hard To Open Or Close a Door From Either Door Handle

Normal Operations and Fault Conditions

The door latch can be actuated from the interior or exterior door handle. When actuated, the door latch releases and allows the door to open. If the door latch or the door hinges have insufficient lubrication or if the striker or door are misaligned, it causes extra force to be used when opening or closing the door.

Possible Causes

- Door alignment
- Door hinges
- Striker adjustment
- Door latch

PINPOINT TEST A : HARD TO OPEN OR CLOSE A DOOR FROM EITHER DOOR HANDLE

A1 CHECK THE LATCH OPERATION FROM BOTH DOOR HANDLES

- Open the door using both the interior and exterior door handles.

Does the door open normally from one of the door handles?

Yes	If the door is difficult/does not open from the exterior door handle, GO to Pinpoint Test B If the door is difficult/does not open from the interior door handle, GO to Pinpoint Test C
No	GO to A2

A2 CHECK THE LATCH OPERATION

- Open the door.
- Using a screwdriver, fully close the latch (2 clicks).
- Verify the latch releases easily while pulling on the interior/exterior door handle.

Does the latch release easily?

Yes	GO to A4
No	GO to A3

A3 CHECK THE LATCH OPERATION AFTER LUBRICATION

- Lubricate the door latch.
- Using a screwdriver, fully close the latch (2 clicks).
- Verify the latch releases easily while pulling on the interior/exterior door handle.

Does the latch release easily?

Yes	The concern was caused by an insufficiently lubricated door latch.
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

A4 CHECK THE STRIKER ADJUSTMENT

- Check the adjustment of the striker.

Is the striker adjusted correctly?

Yes	GO to A5
No	ADJUST the striker as necessary.

A5 CHECK THE DOOR ALIGNMENT

- Check the alignment of the door.

Is the door aligned correctly?

Yes	LUBRICATE the door hinges.
No	ADJUST the door as necessary. REFER to: Front Door Alignment - Double Cab (501-03 Body Closures, General Procedures). REFER to: Front Door Alignment - Super Cab (501-03 Body Closures, General Procedures). REFER to: Rear Door Alignment - Double Cab (501-03 Body Closures, General Procedures). REFER to: Rear Door Alignment - Super Cab (501-03 Body Closures, General Procedures).

A Door Is Difficult Or Does Not Open From The Exterior Door Handle

Normal Operations and Fault Conditions

The exterior door handle is connected to the door latch with an actuating cable. When the exterior door handle is pulled, the actuating cable pulls on the latch lever. When the latch lever moves, the door latch releases, allowing the door to open.

Possible Causes

- Broken or binding linkage
- Exterior door handle reinforcement
- Door latch

PINPOINT TEST B : A DOOR IS DIFFICULT OR DOES NOT OPEN FROM THE EXTERIOR DOOR HANDLE

B1 CHECK THE LATCH OPERATION FROM BOTH DOOR HANDLES

- Open and close the door using both the interior and exterior door handles.

Does the door open normally from one of the door handles?

Yes	If the door is difficult/does not open from only the exterior door handle, GO to B2 If the door is difficult/does not open from only the interior door handle, GO to Pinpoint Test C
No	GO to Pinpoint Test A

B2 CHECK THE EXTERIOR DOOR HANDLE AND CABLE OPERATION

- Disconnect the exterior door handle actuating cable from the door latch.
- Operate the exterior door handle while observing the linkage and cable.

Are any of the exterior door handle components or linkages binding or broken?

Yes	GO to B3
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

B3 CHECK THE EXTERIOR DOOR HANDLE REINFORCEMENT

- Disconnect the exterior door handle actuating cable from the exterior door handle reinforcement.
- Pull and release the exterior door handle.

Does the exterior door handle operate correctly?

Yes	INSTALL a new exterior door handle cable.
No	INSTALL a new exterior door handle reinforcement. REFER to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Exterior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

A Door Is Difficult Or Does Not Open From The Interior Door Handle

Normal Operations and Fault Conditions

The interior door handle is connected to the door latch by an actuating cable. When the interior door handle is pulled, the cable pulls on the latch lever. When the latch lever moves, the door latch releases, allowing the door to open.

Possible Causes

- Broken or binding cable/linkage
- Door latch

Visual Inspection and Diagnostic Pre-checks

- For the rear doors, make sure the child safety lock is in the unlock position.

PINPOINT TEST C : A DOOR IS DIFFICULT OR DOES NOT OPEN FROM THE INTERIOR DOOR HANDLE

C1 CHECK THE LATCH OPERATION FROM BOTH DOOR HANDLES

NOTE: *Make sure the child safety lock is in the unlock position for the rear doors.*

- **NOTE:** *The rear door interior door handle must be pulled twice to unlock and unlatch.*

  Open the door using both the interior and exterior door handles.

Does the door open normally from one of the door handles?

Yes	If the door is difficult/does not open from only the interior door handle, GO to C2 If the door is difficult/does not open from only the exterior door handle, GO to Pinpoint Test B
No	GO to Pinpoint Test A

C2 CHECK THE INTERIOR DOOR HANDLE AND CABLE/LINKAGE OPERATION

- Remove the door trim panel.
- Install the interior door handle back onto the release cable.
- Operate the interior door handle while observing the cable/linkage.

Are any of the interior door handle components or cable/linkages binding or broken?

Yes	REPAIR as necessary.
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

The Exterior Door Release Handle Sticks

Normal Operations and Fault Conditions

The exterior door handle is connected to the door latch with an actuating cable. When the exterior door handle is pulled, the actuating cable pulls on the latch lever. When the latch lever moves, the door latch releases, allowing the door to open. The handle has a return spring to make sure the handle returns to a closed position.

Possible Causes

- Binding linkage
- Broken handle return spring
- Door latch

PINPOINT TEST D : THE EXTERIOR DOOR RELEASE HANDLE STICKS

D1 CHECK FOR A BROKEN RETURN SPRING

- Remove the window regulator and motor.
  REFER to: Front Door Window Regulator (501-11 Glass, Frames and Mechanisms, Removal and Installation).
  REFER to: Rear Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
  REFER to: Rear Door Window Regulator (501-11 Glass, Frames and Mechanisms, Removal and Installation).
  REFER to: Rear Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Install the exterior door handle strap back onto the exterior door handle reinforcement.
- Disconnect the exterior door handle actuating rod from the door latch.
- Pull and release the exterior door handle

Does the exterior door handle return to a closed position once released?

Yes	GO to D2
No	INSTALL a new exterior door handle reinforcement. REFER to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Exterior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

D2 CHECK THE EXTERIOR DOOR HANDLE AND LINKAGE OPERATION

- Operate the exterior door handle while observing the linkage.

Are any of the exterior door handle components or linkages binding?

Yes	REPAIR as necessary.
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

The Interior Door Release Handle Sticks

Normal Operations and Fault Conditions

The interior door handle is connected to the door latch by an actuating cable. When the interior door handle is pulled, the cable pulls on the latch lever. When the latch lever is moved, the door latch releases, allowing the door to open. The handle has a return spring to make sure the handle returns to a closed position.

Possible Causes

- Binding cable
- Broken handle return spring
- Door latch

PINPOINT TEST E : THE INTERIOR DOOR RELEASE HANDLE STICKS

E1 CHECK FOR A BROKEN RETURN SPRING

- Remove the interior door handle.
  REFER to: Interior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
  REFER to: Interior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
- Pull and release the interior door handle.

Does the interior door handle return to a closed position once released?

Yes	GO to E2
No	INSTALL a new interior door handle. REFER to: Interior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Interior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

E2 CHECK THE INTERIOR DOOR HANDLE CABLE OPERATION

- Remove the interior door latch release cable.
- Observe the door latch release cable for any damage or binding.

Is the door latch release cable OK?

Yes	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	INSTALL a new interior door handle cable.

Squeak-Rattle-Chucking Noise From Door

Possible Causes

- Door alignment
- Striker adjustment
- Door latch

PINPOINT TEST F : SQUEAK-RATTLE-CHUCKING NOISE FROM DOOR

F1 CHECK FOR ANY LOOSE COMPONENTS

- Remove the door trim panel.
  REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  REFER to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Inspect inside the door for any loose components.

Are there any loose components inside the door?

Yes	REPAIR as necessary.
No	GO to F2

F2 CHECK THE STRIKER ADJUSTMENT

- Check the adjustment of the striker.

Is the striker adjusted correctly?

Yes	GO to F3
No	ADJUST the striker as necessary.

F3 CHECK THE DOOR ALIGNMENT

- Check the alignment of the door.

Is the door aligned correctly?

Yes	GO to F4
No	ADJUST the door as necessary. REFER to: Front Door Alignment - Double Cab (501-03 Body Closures, General Procedures). REFER to: Front Door Alignment - Super Cab (501-03 Body Closures, General Procedures). REFER to: Rear Door Alignment - Double Cab (501-03 Body Closures, General Procedures). REFER to: Rear Door Alignment - Super Cab (501-03 Body Closures, General Procedures).

F4 CHECK THE LATCH OPERATION AFTER LUBRICATION

- Lubricate the door latch.
- Using a screwdriver, fully close the latch (2 clicks).
- Operate the door latch and listen for the noise.

Is the original noise still present after the latch is lubricated?

Yes	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	The concern was caused by an insufficiently lubricated door latch.

The Manual Door Lock Cylinder Inoperative

Normal Operations and Fault Conditions

The door lock cylinder is connected to the door latch via a lock rod and can be used to manually lock/unlock the door.

Possible Causes

- Bent or binding lock rod and lever
- Door lock cylinder
- Door latch

PINPOINT TEST G : THE MANUAL DOOR LOCK CYLINDER INOPERATIVE

G1 CHECK THE LOCK AND UNLOCK OPERATION

- Insert a key into the lock cylinder and rotate the lock cylinder to the lock and unlock positions.

Does the door lock cylinder freely rotate without locking and unlocking the door?

Yes	GO to G2
No	GO to G4

G2 CHECK THE DOOR LOCK CYLINDER (FREE-SPIN)

- Remove the door lock cylinder.
  REFER to: Door Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Disassembly and Assembly).
- Operate the door lock cylinder with the key while holding the lever on the lock cylinder.

Does the key in the door lock cylinder rotate freely while the lever is stationary?

Yes	INSTALL a new door lock cylinder. REFER to: Door Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Disassembly and Assembly).
No	GO to G3

G3 CHECK THE DOOR LOCK CYLINDER LINKAGE CONNECTION

- Inspect the door lock cylinder linkage.

Is the door lock cylinder rod and lever disconnected?

Yes	CONNECT the door lock cylinder rod and lever.
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

G4 CHECK THE LOCK CYLINDER OPERATION AFTER LUBRICATION

- Spray a lock lubricant (such as Motorcraft® XL-1) into the lock cylinder opening for a couple of seconds.
- Operate the door lock cylinder with the key.

Does the door lock and unlock using the door lock cylinder?

Yes	The concern was caused by an insufficiently lubricated lock cylinder. SPRAY a multi-purpose grease (such as Motorcraft® XL-5) into the lock cylinder for a couple seconds to provide long term lubrication.

No	GO to G5

G5 CHECK THE DOOR LOCK CYLINDER FOR BINDING

- Remove the door lock cylinder.
  REFER to: Door Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Disassembly and Assembly).
- Operate the door lock cylinder with the key.

Does the door lock cylinder rotate freely?

Yes	GO to G6
No	INSTALL a new door lock cylinder. REFER to: Door Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Disassembly and Assembly).

G6 CHECK THE DOOR LOCK CYLINDER LINKAGE

- Operate the door lock using the door lock cylinder linkage.
- Operate the door lock cylinder with the key.

Is the door lock cylinder rod and lever binding, damaged or disconnected?

Yes	REPAIR as necessary.
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

All Door Locks Are Inoperative

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- BCM

PINPOINT TEST H : ALL DOOR LOCKS ARE INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK FOR BCM (BODY CONTROL MODULE) , DDM (DRIVER DOOR MODULE) AND PDM (PASSENGER DOOR MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.
- Using a diagnostic scan tool, carry out the DDM self-test.
- Using a diagnostic scan tool, carry out the PDM self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the BCM DTC Chart, the DDM DTC Chart or the PDM DTC Chart in this section.
No	GO to H2

H2 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES

- Press the lock and unlock buttons on both door lock control switches while observing the door lock operation.

Does any door lock operate?

Yes	GO to H3
No	GO to H4

H3 CHECK IF THE LOCKS OPERATE IN ONLY ONE DIRECTION

- Press the lock and unlock buttons from the driver door lock control switch and then the passenger door lock control switch while observing the door locks.

Are all the door locks inoperative from both switch positions (lock and unlock) of either door lock control switch?

Yes	GO to Pinpoint Test K
No	GO to Pinpoint Test J

H4 CHECK THE BCM (BODY CONTROL MODULE) DOOR LOCK GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure

Positive Lead	Measurement / Action	Negative Lead
C2280F-10	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to H5
No	REPAIR the circuit.

H5 CHECK THE ALL DOOR LOCK CIRCUIT FOR AN OPEN

- Disconnect Left Front Door Latch LHD C5005 or RHD C6005.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280F-35	Ω	LHD C5005-7
C2280F-35	Ω	RHD C6005-7

Is the resistance less than 3 ohms?

Yes	GO to H6
No	REPAIR the circuit.

H6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A Single or More Than One Door Lock Is Inoperative

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Possible Causes

- Fuse
- Wiring, terminals or connectors
- Door latch
- BCM

PINPOINT TEST I : A SINGLE OR MORE THAN ONE DOOR LOCK IS INOPERATIVE

I1 CHECK THE DOOR LATCH FOR BINDING

- Lock and unlock the inoperative door lock using the manual door lock located just above the door latch opening.

Does the door lock and unlock?

Yes	GO to I2
No	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

I2 CHECK THE BCM (BODY CONTROL MODULE) ALL LOCK OUTPUT CIRCUIT FOR AN OPEN

NOTICE: The following step uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250-300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.

- Ignition OFF.
- Disconnect suspect door latch.
- For the suspect door latch, connect:

Left Front Door Latch

Positive Lead	Measurement / Action	Negative Lead
LHD C5005-7		Ground
RHD C6005-7		Ground

Right Front Door Latch

Positive Lead	Measurement / Action	Negative Lead
LHD C6011-2		Ground
RHD C5011-2		Ground

Left Rear Door Latch

Positive Lead	Measurement / Action	Negative Lead
C705-7		Ground

Right Rear Door Latch

Positive Lead	Measurement / Action	Negative Lead
C805-2		Ground

- **NOTE:** *The BCM only supplies voltage to the actuator momentarily. It is important to monitor the test lamp while pressing the door lock control switch.*

  While pressing the door lock control switch in the lock position, monitor the test lamp.

Does the test lamp momentarily illuminate?

Yes	GO to I3
No	REPAIR the circuit.

I3 CHECK THE BCM (BODY CONTROL MODULE) UNLOCK OUTPUT CIRCUIT FOR AN OPEN

NOTICE: The following step uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250-300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.

- For the suspect door latch, connect:

Left Front Door Latch

Positive Lead	Measurement / Action	Negative Lead
LHD C5005-8		Ground
RHD C6005-8		Ground

Right Front Door Latch

Positive Lead	Measurement / Action	Negative Lead
LHD C6011-1		Ground

RHD C5011-1		Ground

Left Rear Door Latch

Positive Lead	Measurement / Action	Negative Lead
C705-8		Ground

Right Rear Door Latch

Positive Lead	Measurement / Action	Negative Lead
C805-1		Ground

- **NOTE:** *The BCM only supplies voltage to the actuator momentarily. It is important to monitor the test lamp while pressing the door lock control switch.*

  While pressing the door lock control switch in the unlock position, monitor the test lamp.

Does the test lamp momentarily illuminate?

Yes	INSTALL a new door latch. REFER to: Front Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch - Double Cab (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). REFER to: Rear Door Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	REPAIR the circuit.

The Door Locks Operate Only One Way

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B126A:01	Drivers Door Interior Lock Switch: General Electrical Failure	Sets during an on-demand self-test if the BCM is receiving a lock or unlock request.

DDM/ PDM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B108F:23	Cabin Lock/Unlock Switch: Signal Stuck Low	Sets when the DDM/ PDM detects a short to ground from one of the door lock control switch input circuits.

Possible Causes

- Fuse
- Wiring, terminals or connectors
- Door lock control switch
- PDM
- DDM

Visual Inspection and Diagnostic Pre-checks

- Check the BCM fuses 3 (20A) and 24 (30A) and make sure they are OK.

PINPOINT TEST J : THE DOOR LOCKS OPERATE ONLY ONE WAY

J1 CHECK FOR DDM (DRIVER DOOR MODULE) / PDM (PASSENGER DOOR MODULE) DTC (DIAGNOSTIC TROUBLE CODE) B108F:23

- Ignition ON.
- Using a diagnostic scan tool, carry out the DDM and the PDM self-tests.

Is DTC B108F:23 present?

Yes	GO to J2
No	VERIFY the BCM fuses 3 (20A) and 24 (30A) are OK. If OK, GO to J4 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

J2 ISOLATE THE DOOR LOCK CONTROL SWITCH

- Ignition OFF.
- Disconnect Driver Door Lock Control Switch LHD C505 or RHD C605 (DTC set in DDM).
- Disconnect Passenger Door Lock Control Switch LHD C605 or RHD C541 (DTC set in PDM).
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the DDM or the PDM self-test.

Is DTC B108F:23 still present?

Yes	GO to J3
No	INSTALL a new front door lock control switch.

J3 CHECK THE DOOR LOCK CONTROL SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect DDM LHD C501A or RHD C653A (DTC set in DDM).
- Disconnect PDM LHD C652A or RHD C590A (DTC set in PDM).
- If the DTC set in the DDM, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C501A-10	Ω	Ground
LHD C501A-20	Ω	Ground
RHD C653A-10	Ω	Ground
RHD C653A-20	Ω	Ground

- If the DTC set in the PDM, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C652A-10	Ω	Ground
LHD C652A-20	Ω	Ground
RHD C590A-10	Ω	Ground
RHD C590A-20	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	For the PDM, GO to J8 For the DDM, GO to J9
No	REPAIR the circuit in question.

J4 CHECK THE LOCK REQUEST INPUT CIRCUIT

- Ignition OFF.
- Disconnect suspect door lock control switch.
- For the driver door lock control switch, connect:

Lead 1	Measurement / Action	Lead 2
LHD C505-2		C505-5
RHD C605-4		C605-1

- For the passenger door lock control switch, connect:

Lead 1	Measurement / Action	Lead 2
LHD C605-4		C605-1
RHD C541-2		C541-5

- Remove the fused jumper wire

Do the doors lock?

Yes	GO to J6

No	GO to J5

J5 CHECK THE LOCK REQUEST INPUT CIRCUIT FOR AN OPEN

- Disconnect DDM LHD C501A or RHD C653A (driver door lock control switch).
- Disconnect PDM LHD C652A or RHD C590A (passenger door lock control switch).
- For the driver door lock control switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C505-2	Ω	C501A-20
RHD C605-4	Ω	C653A-20

- For the passenger door lock control switch, measure:

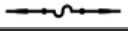
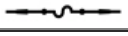
Positive Lead	Measurement / Action	Negative Lead
LHD C605-4	Ω	C652A-20
RHD C541-2	Ω	C590A-20

Is the resistance less than 3 ohms?

Yes	For the concern with the passenger door lock control switch, GO to J8 For the concern with the driver door lock control switch, GO to J9
No	REPAIR the circuit.

J6 CHECK THE UNLOCK REQUEST INPUT CIRCUIT

- For the driver door lock control switch, connect:

Lead 1	Measurement / Action	Lead 2
LHD C505-4		C505-5
RHD C605-2		C605-1

- For the passenger door lock control switch, connect:

Lead 1	Measurement / Action	Lead 2
LHD C605-2		C605-1
RHD C541-4		C541-5

- Remove the fused jumper wire

Do the doors unlock?

Yes	INSTALL a new front door lock control switch.
No	GO to J7

J7 CHECK THE UNLOCK REQUEST INPUT CIRCUIT FOR AN OPEN

- Disconnect DDM LHD C501A or RHD C653A (driver door lock control switch).
- Disconnect PDM LHD C652A or RHD C590A (passenger door lock control switch).
- For the driver door lock control switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C505-2	Ω	C501A-10
RHD C605-2	Ω	C653A-10

- For the passenger door lock control switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C605-2	Ω	C652A-10
RHD C541-4	Ω	C590A-10

Is the resistance less than 3 ohms?

Yes	For the concern with the passenger door lock control switch, GO to J8 For the concern with the driver door lock control switch, GO to J9
No	REPAIR the circuit.

J8 CHECK FOR CORRECT PDM (PASSENGER DOOR MODULE) OPERATION

- Disconnect and inspect all the PDM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the PDM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

J9 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Disconnect and inspect all the DDM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

All Door Locks Are Inoperative From One Door Lock Control Switch

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Possible Causes

- Wiring, terminals or connectors
- Door lock control switch
- PDM
- DDM

Visual Inspection and Diagnostic Pre-checks

- Check the door lock control switch for damage.

PINPOINT TEST K : ALL DOOR LOCKS ARE INOPERATIVE FROM ONE DOOR LOCK CONTROL SWITCH

K1 CHECK FOR COMMUNICATION TO THE DDM (DRIVER DOOR MODULE) AND PDM (PASSENGER DOOR MODULE)

- Ignition ON.
- Using a diagnostic scan tool, carry out the network test.

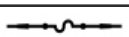
Does the DDM and the PDM pass the network test?

Yes	GO to K2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

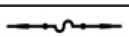
K2 BYPASS THE DOOR LOCK CONTROL SWITCH

- Ignition OFF.

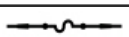
- Disconnect suspect door lock control switch.
- For the driver door lock control switch, connect:

Lead 1	Measurement / Action	Lead 2
LHD C505-2		C505-5
RHD C605-4		C605-1

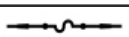
- For the passenger door lock control switch, measure:

Lead 1	Measurement / Action	Lead 2
LHD C605-4		C605-1
RHD C541-2		C541-5

- Remove the fused jumper wire.
- For the driver door lock control switch, connect:

Lead 1	Measurement / Action	Lead 2
LHD C505-4		C505-5
RHD C605-2		C605-1

- For the passenger door lock control switch, measure:

Lead 1	Measurement / Action	Lead 2
LHD C605-2		C605-1
RHD C541-4		C541-5

- Remove the fused jumper wire.

Do the doors lock and unlock?

Yes	INSTALL a new front door lock control switch.
No	GO to K3

K3 CHECK THE DOOR LOCK CONTROL SWITCH GROUND CIRCUIT FOR AN OPEN

- Disconnect DDM LHD C501A or RHD C653A (driver door lock control switch).
- Disconnect PDM LHD C652A or RHD C590A (passenger door lock control switch).
- For the driver door lock control switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C505-5	Ω	C501A-17
RHD C605-1	Ω	C653A-17

- For the passenger door lock control switch, measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C605-1	Ω	C652A-17
RHD C541-5	Ω	C590A-17

Is the resistance less than 3 ohms?

Yes	For the concern with the driver door lock control switch, GO to K5 For the concern with the passenger door lock control switch, GO to K4
No	REPAIR the circuit.

K4 CHECK FOR CORRECT PDM (PASSENGER DOOR MODULE) OPERATION

- Disconnect and inspect all the PDM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary

- Reconnect the PDM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PDM. REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

K5 CHECK FOR CORRECT DDM (DRIVER DOOR MODULE) OPERATION

- Disconnect and inspect all the DDM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the DDM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new DDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Doors Do Not Lock Or Unlock Using The Keyless Entry Keypad

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B121B:01	Keypad Input Switch: General Electrical Failure	Sets when the BCM detects a short to ground from any of the keyless entry keypad input circuits.

Possible Causes

- Fuse
- Wiring, terminals or connectors
- Keyless entry keypad
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the front door window moulding for damage.
- Check the BCM fuse 10 (5A) and make sure it is OK.

PINPOINT TEST L : THE DOORS DO NOT LOCK OR UNLOCK USING THE KEYLESS ENTRY KEYPAD

L1 CHECK POWER LOCK OPERATION FROM THE DOOR LOCK CONTROL SWITCH

- Press the lock and unlock button on the door lock control switch.

Do the doors lock and unlock?

Yes	GO to L2
No	REFER to the Symptom Chart: Handles, Locks, Latches and Entry Systems - Electrical in this section.

L2 CHECK THE KEYLESS ENTRY KEYPAD ILLUMINATION

- Touch the keyless entry keypad in several places.

Do the keypad numbers illuminate?

Yes	GO to L7
No	GO to L3

L3 CHECK THE KEYLESS ENTRY KEYPAD INDICATOR

- **NOTE:** *The round indicator above the numbers illuminates when the sensors detect a button is being touched.*

  Touch the keyless entry keypad in several places.

Does the round indicator on the top of the keypad illuminate?

Yes	GO to Pinpoint Test M
No	GO to L4

L4 CHECK THE KEYLESS ENTRY KEYPAD VOLTAGE SUPPLY CIRCUIT FOR VOLTAGE

- Ignition OFF.
- Disconnect Keyless Entry Keypad C500.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-1		Ground

Is the voltage greater than 11 volts?

Yes	GO to L6
No	VERIFY the BCM fuse 10 (5A) is OK. If OK, GO to L5 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

L5 CHECK THE KEYLESS ENTRY KEYPAD VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280F.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-1	Ω	C2280F-16

Is the resistance less than 3 ohms?

Yes	GO to L15
No	REPAIR the circuit.

L6 CHECK THE KEYLESS ENTRY KEYPAD GROUND CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-1		C500-6

Is the voltage greater than 11 volts?

Yes	INSTALL a new front door moulding. REFER to: Front Door Upper Moulding - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).
No	REPAIR the circuit.

L7 CARRY OUT THE BCM (BODY CONTROL MODULE) SELF-TEST

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC B121B:01 present?

Yes	GO to L8
No	GO to L10

L8 ISOLATE THE KEYLESS ENTRY KEYPAD

- Ignition OFF.
- Disconnect Keyless Entry Keypad C500.

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the BCM self-test.

Is DTC B121B:01 still present?

Yes	GO to L9
No	INSTALL a new front door moulding. REFER to: Front Door Upper Moulding - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).

L9 CHECK THE KEYLESS ENTRY KEYPAD INPUT CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280D.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-3	Ω	Ground
C500-4	Ω	Ground
C500-5	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to L15
No	REPAIR the circuit in question.

L10 CHECK THE BCM (BODY CONTROL MODULE) KEYPAD BUTTON PARAMETER IDENTIFICATIONS (PIDS)

- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- **NOTE:** *When monitoring the capacitive sensor Parameter Identifications (PIDs), it is best to select a graph view. When a sensor is touched, the PID state rapidly switches between ON and OFF.*

  Press each keyless entry keypad button while observing the BCM keypad button Parameter Identifications (PIDs) (KYPD_BTN_1/2, KYPD_BTN_3/4, KYPD_BTN_5/6, KYPD_BTN_7/8 and KYPD_BTN_9/0).

Do the Parameter Identifications (PIDs) indicate the buttons operate correctly?

Yes	GO to L11
No	GO to L12

L11 CHECK THE BCM (BODY CONTROL MODULE) KEYPAD CODE

- Using a diagnostic scan tool, view the factory keyless entry code.
- Enter the 5-digit factory set entry code on the keyless entry keypad, then touch the 3/4 button.
- Simultaneously touch the 7/8 and 9/0 buttons for 3 seconds.

Do the doors unlock when the factory code is entered and lock when the 7/8 and 9/0 buttons are touched for 3 seconds?

Yes	The system is operating as designed. INFORM the customer of the correct system operation.
No	GO to L15

L12 CHECK THE KEYLESS ENTRY KEYPAD INPUT CIRCUITS USING THE BCM (BODY CONTROL MODULE) KEYPAD BUTTON PARAMETER IDENTIFICATIONS (PIDS)

- Ignition OFF.
- Disconnect Keyless Entry Keypad C500.
- Ignition ON.
- **NOTE:** *When monitoring the capacitive sensor Parameter Identifications (PIDs), it is best to select a graph view. When a sensor is touched, the PID state rapidly switches between ON and OFF.*

  Using a diagnostic scan tool, monitor the BCM keypad button Parameter Identifications (PIDs) (KYPD_BTN_1/2, KYPD_BTN_7/8 and KYPD_BTN_9/0).
- Connect:

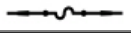
1/2 Button

Lead 1	Measurement / Action	Lead 2
C500-3		C597-6

- Remove the fused jumper wire.
- Connect:

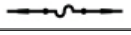
7/8 Button

Lead 1	Measurement / Action	Lead 2

C500-4		C597-6

- Remove the fused jumper wire.
- Connect:

9/0 Button

Lead 1	Measurement / Action	Lead 2
C500-5		C597-6

- Remove the fused jumper wire.

Do the Parameter Identifications (PIDs) correctly indicate Active with the fused jumper wire connected?

Yes	INSTALL a new front door moulding. REFER to: Front Door Upper Moulding - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).
No	GO to L13

L13 CHECK THE KEYLESS ENTRY KEYPAD INPUT CIRCUITS FOR A SHORT TO EACH OTHER

- Ignition OFF.
- Disconnect BCM C2280D.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-3	Ω	C500-4
C500-3	Ω	C500-5
C500-4	Ω	C500-5

Are the resistances greater than 10,000 ohms?

Yes	GO to L14
No	REPAIR the circuits in question.

L14 CHECK THE KEYLESS ENTRY KEYPAD INPUT CIRCUITS FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-3	Ω	C2280D-28
C500-4	Ω	C2280D-2
C500-5	Ω	C2280D-15

Are the resistances less than 3 ohms?

Yes	GO to L15
No	REPAIR the circuit in question.

L15 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Keyless Entry Keypad Illumination Is Inoperative

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B121A:11	Keypad Illumination Output: Circuit Short To Ground	Sets when the BCM detects a short to ground from the keyless entry keypad illumination output circuit.
B121A:15	Keypad Illumination Output: Circuit Short To Battery Or Open	Sets when the BCM detects an open from the keyless entry keypad illumination output circuit.

Possible Causes

- Wiring, terminals or connectors
- Keyless entry keypad
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the front door window moulding for damage.

PINPOINT TEST M : THE KEYLESS ENTRY KEYPAD ILLUMINATION IS INOPERATIVE

M1 CHECK THE KEYLESS ENTRY KEYPAD OPERATION

- Press the 7/8 and 9/0 buttons simultaneously on the keyless entry keypad.

Do the doors lock using the keyless entry keypad?

Yes	GO to M2
No	GO to Pinpoint Test L

M2 CHECK FOR BCM (BODY CONTROL MODULE) DTC (DIAGNOSTIC TROUBLE CODE) B121A:11

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC B121A:11 present?

Yes	GO to M3
No	GO to M5

M3 CHECK THE KEYLESS ENTRY KEYPAD FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Keyless Entry Keypad C500.
- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Using a diagnostic scan tool, carry out the BCM self-test.

Is DTC B121A:11 still present?

Yes	GO to M4
No	INSTALL a new front door moulding. REFER to: Front Door Upper Moulding - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).

M4 CHECK THE KEYPAD ILLUMINATION OUTPUT CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BCM C2280D.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to M7
No	REPAIR the circuit.

M5 CHECK THE BCM (BODY CONTROL MODULE) OUTPUT USING THE KEYPAD LAMP OUTPUT STATUS (KEY_PAD_LMP) PID (PARAMETER IDENTIFICATION)

- Ignition OFF.
- Disconnect Keyless Entry Keypad C500.
- Ignition ON.
- Using a diagnostic scan tool, command the BCM KEY_PAD_LMP PID on.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-2		Ground

Is the voltage greater than 11 volts?

Yes	INSTALL a new front door moulding. REFER to: Front Door Upper Moulding - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).
No	GO to M6

M6 CHECK THE BCM (BODY CONTROL MODULE) KEYPAD ILLUMINATION OUTPUT CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BCM C2280D.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-2	Ω	C2280D-35

Is the resistance less than 3 ohms?

Yes	GO to M7
No	REPAIR the circuit.

M7 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Keyless Entry Keypad Illumination Is Always On

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

B121A:15	Keypad Illumination Output: Circuit Short To Battery Or Open	Sets when the BCM detects a short to voltage from the keyless entry keypad illumination output circuit.

Possible Causes

- Wiring, terminals or connectors
- Keyless entry keypad
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the front door window moulding for damage.

PINPOINT TEST N : THE KEYLESS ENTRY KEYPAD ILLUMINATION IS ALWAYS ON

N1 CHECK THE KEYLESS ENTRY KEYPAD ILLUMINATION

NOTE: *It is normal operation for the keypad to illuminate when the illuminated entry/exit feature is active. Make sure all the doors are closed and the feature times out.*

- Ignition ON.
- Wait 45 seconds and observe the keyless entry keypad illumination.

Is the keyless entry keypad illumination always on?

Yes	GO to N2
No	The system is operating correctly. INFORM the customer of the normal keypad illumination operation.

N2 ISOLATE THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect BCM C2280D.
- Ignition ON.

Does the keypad continue illuminate?

Yes	GO to N3
No	GO to N4

N3 CHECK THE BCM (BODY CONTROL MODULE) KEYPAD ILLUMINATION OUTPUT CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Keyless Entry Keypad C500.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C500-2		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	INSTALL a new front door moulding. REFER to: Front Door Upper Moulding - Double Cab (501-08 Exterior Trim and Ornamentation, Removal and Installation).

N4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The RKE Transmitter Is Inoperative

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10AB:00	Remote Keyless Entry Synchronization: No Sub Type Information	Sets when the BCM detects the rolling counter received from a RKE transmitter is out of synchronization with the rolling counter stored in the module.
B1218:00	Transmitter Identification Code: No Sub Type Information	Sets when the BCM detects and invalid Transmitter Identification Code (TIC).

Possible Causes

- Key batteries
- Key
- Key button pressed a substantial amount of times while outside the range of the vehicle
- Key programming
- Network concern

Visual Inspection and Diagnostic Pre-checks

- Inspect the key for damage.
- Check for aftermarket keys.

PINPOINT TEST O : THE RKE (REMOTE KEYLESS ENTRY) TRANSMITTER IS INOPERATIVE

NOTE: *All customer keys need to be present when diagnosing the RKE system.*

O1 CHECK FOR THE CORRECT KEYS

- Verify all keys present are the correct type for the vehicle. Refer to the PATS Job Aid in the Service Tips tab on the Professional Technician Society (PTS) web page or the parts catalog.

Are the correct keys present?

Yes	GO to O2
No	The system cannot be tested without the correct keys. INFORM the customer that all of the correct keys must be present to proceed with diagnosis of the system.

O2 CHECK FOR REDUCED RANGE

NOTE: *Make sure the vehicle is in an open area with no other large metal objects near, such as other vehicles or steel buildings.*

- Check all keys for normal range performance (approximately 30m (100 ft) for passive key).

Do the keys experience poor range?

Yes	GO to Pinpoint Test Q
No	GO to O3

O3 CHECK THE RKE (REMOTE KEYLESS ENTRY) FUNCTIONALITY OF THE KEYS

- Press each RKE button on a key. Repeat this step on a second key.

Are all the RKE functions inoperative from both keys?

Yes	GO to O11
No	GO to O4

O4 CHECK THE RKE (REMOTE KEYLESS ENTRY) FUNCTIONALITY OF THE SUSPECT KEY

- Press each RKE button (twice for the liftgate latch release) on the suspect key.

Does any RKE function operate?

Yes	GO to Pinpoint Test P
No	GO to O5

O5 CHECK THE NO (TIC) OUT OF SYNC (TIC-NONE_OOS) PID (PARAMETER IDENTIFICATION)

- Ignition ON.
- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, monitor the BCM PID TIC-NONE_OOS.

Does the PID indicate On?

Yes	GO to O8
No	GO to O6

O6 RESYNCHRONIZE THE INOPERATIVE PASSIVE KEY

- Ignition OFF.
- Place the suspect key in the backup starting location.
  REFER to: Passive Anti-Theft System (PATS) - Overview (419-01B Passive Anti-Theft System (PATS), Description and Operation).
- Ignition ON.
- Wait 10 seconds.
- Ignition OFF.
- Within 30 seconds, press any button on the suspect key 4 times consecutively.

Does the suspect key operate correctly now?

Yes	The system is OK. The concern was caused by a key out of synchronization.
No	GO to O7

O7 RESYNCHRONIZE THE INOPERATIVE KEY USING THE SECOND KEY

- Press any button on the operational key.
- Within 30 seconds and then press any button on the suspect key.
- Check the suspect key for correct operation.

Does the suspect key operate correctly now?

Yes	The system is OK. The concern was caused by a key out of synchronization.
No	GO to O10

O8 CHECK THE (RKE) REMOTE BATTERY LOW (RKE_BATT_LOW) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, monitor the BCM PID RKE_BATT_LOW.

Does the PID indicate Off?

Yes	GO to O10
No	GO to O9

O9 CHECK THE PASSIVE KEY BATTERIES

NOTE: *Do not clean off any grease from the battery terminals on the back surface of the circuit board.*

- Remove the passive key batteries. Refer to the Owner Guide for battery removal instructions.
- Verify the correct batteries are used (CR2025).
- Remove both key batteries and measure the voltage.

Are the voltages greater than 2.5 volts?

Yes	REPLACE the suspect key. PROGRAM a new passive key. REFER to: Passive Anti-Theft System (PATS) - Overview (419-01B Passive Anti-Theft System (PATS), Description and Operation).
No	REPLACE both key batteries (make sure the batteries are seated correctly). DO NOT reprogram the key (damaged or dead batteries do not erase keys from memory).

O10 PROGRAM THE SUSPECT KEY

- Program the suspect key.
  REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
- Check the RKE functionality of the suspect key.

Does the RKE functionality operate?

Yes	The system is OK. The concern was caused by an unprogrammed key.
No	REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

O11 CHECK FOR COMMUNICATION WITH THE BCM (BODY CONTROL MODULE) AND THE RTM (RADIO TRANSCEIVER MODULE)

- Ignition ON.
- Using a diagnostic scan tool, carry out a network test.

Does the BCM and the RTM pass the network test?

Yes	GO to O12
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

O12 CHECK FOR RTM (RADIO TRANSCEIVER MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the RTM module self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the RTM DTC Chart in this section.
No	GO to O13

O13 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out a BCM module self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the BCM DTC Chart in this section.
No	GO to Pinpoint Test U

An Individual Button/Feature Is Inoperative From The RKE Transmitter

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Possible Causes

- Door lock system concern
- Liftgate latch release system concern
- Power liftgate system concern
- Horn system concern
- Turn signal system concern
- Remote start system concern
- Key

Visual Inspection and Diagnostic Pre-checks

- Inspect the key for damage.

PINPOINT TEST P : AN INDIVIDUAL BUTTON/FEATURE IS INOPERATIVE FROM THE RKE (REMOTE KEYLESS ENTRY) TRANSMITTER

P1 VERIFY THE DOOR LOCK OPERATION

- Press the lock and unlock button on the door lock control switch while observing the door lock operation.

Do the door locks operate?

Yes	GO to P2
No	REFER to the Symptom Chart: Handles, Locks, Latches and Entry Systems - Electrical in this section.

P2 VERIFY THE HORN OPERATION USING THE BCM (BODY CONTROL MODULE) PID (PARAMETER IDENTIFICATION) (HORN_RELAY)

- Ignition ON.
- Using a diagnostic scan tool, view the BCM Parameter Identifications (PIDs).
- Select the BCM horn PID (HORN_RELAY) and active command the horn on then off.

Does the horn sound when commanded on?

Yes	GO to P3
No	REFER to: Horn (413-06 Horn, Diagnosis and Testing).

P3 VERIFY THE HAZARD LAMP OPERATION

- Activate the hazard lamp function.

Do the hazard lamps operate correctly?

Yes	GO to P4
No	REFER to: Turn Signal and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

P4 CHECK THE LOCK AND UNLOCK BUTTONS

- Ignition OFF.
- Press the lock and then unlock button on the suspect key.

Do the doors lock and unlock?

Yes	GO to P5
No	REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

P5 CHECK THE LIFTGATE RELEASE BUTTON

- Press the liftgate release button twice on the suspect key.

Does the liftgate latch release (manual liftgate) or the power open (power liftgate)?

Yes	If not equipped with factory remote start, REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures). If equipped with factory remote start, GO to P6
No	REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

P6 VERIFY THE REMOTE START OPERATION

- Close all the doors, the hood and the liftgate.
- **NOTE:** *Each button press must be done within 3 seconds of each other.*

  From outside the vehicle using the key:
  - Press the door lock button.
  - Press the remote start button twice.

Does the vehicle remotely start?

Yes	The RKE transmitter is operating correctly. INFORM the customer of the RKE transmitter operation.
No	REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

The RKE Transmitter Has Poor Range Performance

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Possible Causes

- Key
- Key batteries
- Aftermarket system
- Consumer electronic device
- High power devices
- TV/radio transmission towers
- RTM

Visual Inspection and Diagnostic Pre-checks

- Inspect the key for damage.
- Inspect the key batteries.
- Inspect for aftermarket RKE systems.

PINPOINT TEST Q : THE RKE (REMOTE KEYLESS ENTRY) TRANSMITTER HAS POOR RANGE PERFORMANCE

NOTE: *At least 2 programmed keys must be present to begin diagnosis of the RKE system.*

Q1 CHECK FOR THE CORRECT KEYS

- Check that the correct keys are used with the vehicle. Refer to the PATS Job Aid in the Service Tips tab on the Professional Technician Society (PTS) web page or the parts catalog.

Are the correct keys present?

Yes	GO to Q2
No	The system cannot be tested without the correct keys. INFORM the customer the correct keys must be present to proceed with diagnosis of the system.

Q2 CHECK ALL KEYS FOR POOR RANGE PERFORMANCE

NOTE: *Make sure the vehicle is in an open area with no other large metal objects near, such as other vehicles or steel buildings.*

- Check all keys for normal range performance (approximately 30m (100 ft) for a passive key).

Do all keys experience poor range?

Yes	GO to Q4
No	For a passive key, GO to Q3

Q3 CHECK THE PASSIVE KEY BATTERIES

NOTE: *Do not clean off any grease from the battery terminals on the back surface of the circuit board.*

- Remove the passive key batteries. Refer to the Owner Guide for battery removal instructions.
- Verify the correct batteries are used (CR2025).
- Measure the key batteries voltage.

Are the voltages greater than 2.5 volts?

Yes	REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).
No	REPLACE both key batteries (make sure the batteries are seated correctly). DO NOT reprogram the key (weak or dead batteries do not erase keys from memory).

Q4 CHECK THE LOCATION OF THE VEHICLE AND THE APPROACH ANGLES AROUND THE VEHICLE

- Make sure the poor performance is consistent in nature and is not from one approaching angle.
- The RKE transmitter range performance may be degraded in certain locations. For example, if the vehicle or RKE transmitter is within range of high-power devices, radio/TV towers, 2-way radios, cell phone charger or other radio communication device, the operating distance of the keys may be reduced.

Is the poor range performance consistent around the vehicle?

Yes	INSTALL a new RTM. REFER to: Radio Transceiver Module (RTM) (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The range may have been affected by environmental interference such as high-power devices or other radio communication device.

The Remote Start Feature Is Inoperative

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Possible Causes

- Remote start feature not enabled
- Key
- Hood ajar switch input concern
- Door ajar switch input concern
- TR input concern
- Powertrain concern

Visual Inspection and Diagnostic Pre-checks

- Inspect the passive key for damage.

PINPOINT TEST R : THE REMOTE START FEATURE IS INOPERATIVE

NOTE: *This pinpoint test does not diagnose dealer installed remote start systems.*

R1 CHECK THE REMOTE START FEATURE ENABLE/DISABLE SETTING

- Ignition ON.
- Using the steering wheel control switch, check the remote start feature setting in the message center.

Is the remote start feature enabled?

Yes	GO to R2
No	ENABLE the remote start feature.

R2 CHECK FOR POWERTRAIN DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the PCM KOEO and KOER self-tests.

Are any PCM Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the PCM DTC chart in this section.
No	GO to R3

R3 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the BCM self-test.

Are any BCM Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the BCM DTC chart in this section.

No	GO to R4

R4 CHECK THE RKE (REMOTE KEYLESS ENTRY) FUNCTIONALITY

- Ignition OFF.
- Using the RKE function of the passive key, press the liftgate release button twice, the lock button and then the unlock button.

Do all the functions tested of the RKE transmitter operate (lock, unlock and liftgate latch release or power liftgate open)?

Yes	GO to R5
No	If all of the functions are inoperative, GO to Pinpoint Test O If an individual function is inoperative, GO to Pinpoint Test P

R5 VERIFY THE REMOTE START FUNCTION IS INOPERATIVE

- Close all the doors, the hood and the liftgate.
- Using the key:
  - Press the door lock button.
  - Press the remote start button twice.

Does the vehicle remotely start?

Yes	The system is operating correctly. INFORM the customer of the correct vehicle remote start operation.
No	REPLACE the suspect key. PROGRAM the new key. REFER to: Anti-Theft Security Access (419-01B Passive Anti-Theft System (PATS), General Procedures).

A Door Passive Entry Feature Is Inoperative

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operations and Fault Conditions

REFER to: Handles, Locks, Latches and Entry Systems - Overview (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B11C6:01	Passenger Door External Antenna: General Electrical Failure	Sets when the BCM detects a fault from one of the circuits to the passenger side keyless entry antenna (internal to the front passenger exterior door handle).
B11CA:01	Driver Door External Antenna: General Electrical Failure	Sets when the BCM detects a fault from one of the circuits to the driver side keyless entry antenna (internal to the front driver exterior door handle).
B1381:11	Left Front Door Handle Proximity Sensor: Circuit Short To Ground	Sets when the BCM detects a fault from one of the circuits to the left front exterior door handle.
B1381:15	Left Front Door Handle Proximity Sensor: Circuit Short To Battery or Open	Sets when the BCM detects a fault from one of the circuits to the left front exterior door handle.
B1381:29	Left Front Door Handle Proximity Sensor: Signal Invalid	Set when the BCM detects an activated touch sensor for more than 5 minutes.
B1382:11	Right Front Door Handle Proximity Sensor: Circuit Short To Ground	Sets when the BCM detects a fault from one of the circuits to the right exterior door handle.
B1382:15	Right Front Door Handle Proximity Sensor: Circuit Short To Battery or Open	Sets when the BCM detects a fault from one of the circuits to the right exterior door handle.
B1382:29	Right Front Door Handle Proximity Sensor: Signal Invalid	Set when the BCM detects an activated touch sensor for more than 5 minutes.

Possible Causes

- Wiring, terminals or connectors
- Door lock system concern
- RKE system concern
- Exterior door handle
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the exterior door handles for damage.

PINPOINT TEST S : A DOOR PASSIVE ENTRY FEATURE IS INOPERATIVE

S1 CHECK THE DOOR LOCK OPERATION

- Lock and unlock the doors using a door lock control switch.

Do the doors lock and unlock?

Yes	GO to S2
No	REFER to the Symptom Chart: Handles, Locks, Latches and Entry Systems - Electrical in this section.

S2 CHECK THE RKE (REMOTE KEYLESS ENTRY) OPERATION

- Press the lock and unlock buttons on a key.

Do the doors lock and unlock?

Yes	GO to S3
No	GO to Pinpoint Test O

S3 CHECK THE PASSIVE ENTRY OPERATION FROM BOTH FRONT DOORS

- Operate the passive entry feature from the left and right doors.

Is the passive entry feature inoperative from both front doors?

Yes	GO to S4
No	GO to S7

S4 CHECK THE EXTERIOR DOOR HANDLE GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280E.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-20		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to S5

S5 CHECK THE EXTERIOR DOOR HANDLE GROUND CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-20	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to S6
No	REPAIR the circuit.

S6 CHECK THE EXTERIOR DOOR HANDLE GROUND CIRCUIT FOR AN OPEN (BOTH FRONT DOORS PASSIVE ENTRY INOPERATIVE)

- Disconnect Left Front Exterior Door Handle C543.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C543-4	Ω	C2280E-20

Is the resistance less than 3 ohms?

Yes	GO to S16
No	REPAIR the circuit.

S7 CHECK FOR VOLTAGE TO THE EXTERIOR DOOR HANDLE

- Ignition OFF.

- Disconnect suspect exterior door handle.
- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-1	V	Ground

Right Front

Positive Lead	Measurement / Action	Negative Lead
C634-1	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to S10
No	GO to S8

S8 CHECK THE EXTERIOR DOOR HANDLE VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Disconnect BCM C2280E.
- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-1	Ω	Ground

Right Front

Positive Lead	Measurement / Action	Negative Lead
C634-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to S9
No	REPAIR the circuit.

S9 CHECK THE EXTERIOR DOOR HANDLE VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-1	Ω	C2280E-21

Right Front

Positive Lead	Measurement / Action	Negative Lead
C634-1	Ω	C2280E-5

Is the resistance less than 3 ohms?

Yes	GO to S16
No	REPAIR the circuit.

S10 CHECK THE EXTERIOR DOOR HANDLE GROUND CIRCUIT FOR AN OPEN

- Disconnect BCM C2280E.
- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-4	Ω	C2280E-20

Right Front

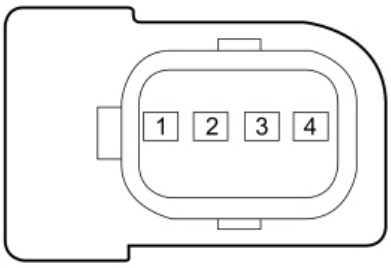
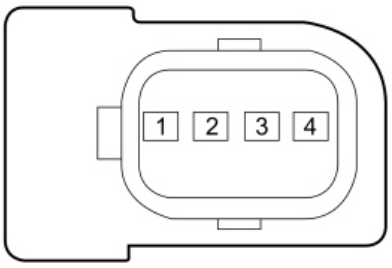
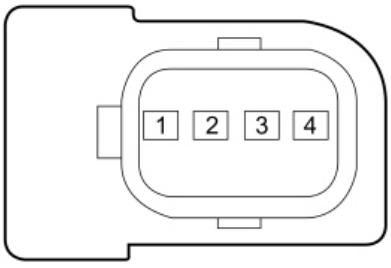
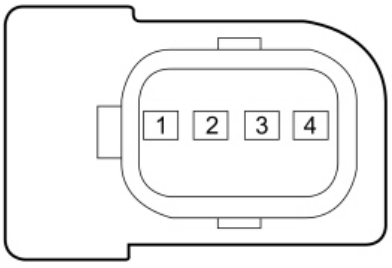
Positive Lead	Measurement / Action	Negative Lead
C634-4	Ω	C2280E-20

Is the resistance less than 3 ohms?

Yes	GO to S11
No	REPAIR the circuit.

S11 CHECK THE EXTERIOR DOOR HANDLE INTERNAL ANTENNA

- Measure:

Positive Lead	Measurement / Action	Negative Lead
 E158730 C543, pin 2, component side	Ω	 E158730 C543, pin 3, component side
 E158730 C634, pin 2, component side	Ω	 E158730 C634, pin 3, component side

Is the resistance between 1 and 3 ohms?

Yes	GO to S12
No	INSTALL a new front exterior handle. REFER to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

S12 CHECK THE EXTERIOR DOOR HANDLE

- Remove the opposite side exterior door handle.
  REFER to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
- Transfer the exterior door handle from the opposite side of the vehicle to the suspect exterior door. For example, if the left front exterior door handle is suspect, transfer the right front exterior door handle to the left front door.

- Connect BCM C2280E.
- Operate the keyless entry feature from the suspect door.

Does the keyless entry feature operate from the suspect door?

Yes	INSTALL a new exterior handle. REFER to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
No	GO to S13

S13 CHECK THE EXTERIOR DOOR HANDLE ANTENNA CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect BCM C2280E.
- Ignition ON.
- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-2	V	Ground
C543-3	V	Ground

Right Front

Positive Lead	Measurement / Action	Negative Lead
C634-2	V	Ground
C634-3	V	Ground

Is any voltage present?

Yes	REPAIR the circuit in question.
No	GO to S14

S14 CHECK THE EXTERIOR DOOR HANDLE ANTENNA CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-2	Ω	Ground
C543-3	Ω	Ground

Right Front

Positive Lead	Measurement / Action	Negative Lead
C634-2	Ω	Ground
C634-3	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to S15
No	REPAIR the circuit in question.

S15 CHECK THE EXTERIOR DOOR HANDLE ANTENNA CIRCUITS FOR AN OPEN

- Measure:

Left Front

Positive Lead	Measurement / Action	Negative Lead
C543-2	Ω	C2280E-13

C543-3	Ω	C2280E-28

Right Front

Positive Lead	Measurement / Action	Negative Lead
C634-2	Ω	C2280E-12
C634-3	Ω	C2280E-29

Are the resistances less than 3 ohms?

Yes	GO to S16
No	REPAIR the circuit in question.

S16 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0146:00

Normal Operations and Fault Conditions

The RTM communicates with the GWM over the CAN. If the RTM does not receive messages from the GWM, features such as the passive entry can be inoperative.

RTM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0146:00	Lost Communication With Gateway "A": No Sub Type Information	Sets when the RTM detects data messages are missing from the GWM over the CAN.

Possible Causes

- Network communication concern
- RTM
- GWM

PINPOINT TEST T : U0146:00

T1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to T2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

T2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, carry out a network test.

Does the GWM pass the network test?

Yes	GO to T3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

T3 CHECK FOR CHARGING SYSTEM RELATED DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, retrieve all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any battery voltage or charging system related Diagnostic Trouble Codes (DTCs) retrieved?

Yes	DIAGNOSE the charging system. REFER to the appropriate 303-14 section.
No	GO to T4

T4 RECHECK THE RTM (RADIO TRANSCEIVER MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during PMI or the PMI may not have been performed.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the RTM self-test.

Is DTC U0146:00 still present?

Yes	GO to T5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

T5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0146 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 30 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0146 set in other modules?

Yes	INSTALL a new GWM. REFER to: Gateway Module A (GWM) (418-00 Module Communications Network, Removal and Installation).
No	INSTALL a new RTM. REFER to: Radio Transceiver Module (RTM) (419-10 Multifunction Electronic Modules, Removal and Installation).

U0258:87 or U1A00:00

Refer to Wiring Diagrams Cell 117 for schematic and connector information.

Normal Operation and Fault Conditions

The RTM communicates with the BCM over a LIN-based circuit and, when the network is awake, over the CAN.

RTM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U1A00:00	Private Communication Network: No Sub Type Information	Sets when the RTM detects a fault with the LIN-based circuit to the BCM.

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0258:87	Lost Communication With Radio Transceiver: Missing Message	Sets when the BCM detects a communication fault with the RTM over the LIN-based circuit.

Possible Causes

- Wiring, terminals or connectors
- RTM
- BCM

PINPOINT TEST U : U0258:87 OR U1A00:00

U1 CHECK IF THE RTM (RADIO TRANSCEIVER MODULE) AND THE BCM (BODY CONTROL MODULE) PASS THE NETWORK TEST

- Ignition ON

- Ignition ON.
- Using a diagnostic tool, carry out the network test.

Does the RTM and the BCM pass the network test?

Yes	GO to U2
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

U2 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect RTM C9026.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9026-2	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to U3

U3 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Connect BCM C2280G.
- Ignition OFF.
- Disconnect BCM C2280G.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9026-2	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to U4
No	REPAIR the circuit.

U4 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C9026-2	Ω	C2280G-26

Is the resistance less than 3 ohms?

Yes	GO to U5
No	REPAIR the circuit.

U5 CHECK FOR CORRECT RTM (RADIO TRANSCEIVER MODULE) OPERATION

- Disconnect and inspect the RTM connector.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the RTM connector and make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RTM. REFER to: Radio Transceiver Module (RTM) (419-10 Multifunction Electronic Modules, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to U6
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0140:00

Normal Operation and Fault Conditions

The DDM/ PDM communicates with the BCM over the CAN. If the DDM/ PDM does not receive messages from the BCM, features such as the puddle lamps, exterior mirror turn signal and door switch illumination can be inoperative.

DDM/ PDM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub-Type Information	Sets when the DDM/ PDM detects data messages are missing from the BCM.

Possible Causes

- Network communication concern
- DDM/ PDM
- BCM

PINPOINT TEST V : U0140:00

V1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to V2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, carry out a network test.

Does the BCM pass the network test?

Yes	GO to V3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

V3 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, carry out the BCM self-test.

Are any voltage related Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to V4

V4 RECHECK THE DDM (DRIVER DOOR MODULE) OR PDM (PASSENGER DOOR MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during PMI or the PMI may not have been performed.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the DDM/ PDM self-test.

Is DTC U0140:00 still present?

Yes	GO to V5
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 30 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0140 set in other modules?

Yes	INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	INSTALL a new DDM or PDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

U0208:00

Normal Operation and Fault Conditions

The DDM/ PDM communicate with the DSM over the CAN. If the DDM/ PDM does not receive messages from the DSM, features such as the memory mirror position can be inoperative.

DDM/ PDM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0208:00	Lost Communication With "Seat Control Module A": No Sub-Type Information	Sets when the DDM/ PDM detects data messages are missing from the DSM.

Possible Causes

- Network communication concern
- DDM/ PDM
- DSM

PINPOINT TEST W : U0208:00

W1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to W2
No	The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

W2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, carry out a network test.

Does the DSM pass the network test?

Yes	GO to W3
No	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

W3 RECHECK THE DDM (DRIVER DOOR MODULE) OR PDM (PASSENGER DOOR MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during PMI or the PMI may not have been performed.*

- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs) and repeat the DDM/ PDM self-test.

Is DTC U0208:00 still present?

Yes	GO to W4
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

W4 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0208 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 30 seconds.
- Using a diagnostic scan tool, retrieve the Continuous Memory Diagnostic Trouble Codes (CMDTCs) from all modules.

Is DTC U0208 set in other modules?

Yes	INSTALL a new DSM.
No	INSTALL a new DDM or PDM. REFER to: Driver Door Module (DDM) (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Passenger Door Module (PDM) (419-10 Multifunction Electronic Modules, Removal and Installation).

P1594 OR P1595

Normal Operation and Fault Conditions

When the BCM receives a request to remote start the vehicle, it first checks to make sure conditions exist to allow it to start (for example, the hood and doors closed, vehicle in PARK, no powertrain concerns). If the required conditions are correct, the BCM starts the vehicle and allows it to run for a predetermined amount of time, determined by the setting selected from the message center.

PCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1594	Forced Engine Shutdown - Remote Start System Fault, No Unattended Vehicle Timeout	Sets when the PCM detects the remote start has been active for more than 30 minutes continuously.
P1595	Forced Engine Shutdown - Remote Start System Fault, Transmission Range Not In Park Position	Sets when the PCM detects the remote start is active with the transmission not in PARK.

Possible Causes

- Network communication concern
- Powertrain concern
- BCM

PINPOINT TEST X : P1594 OR P1595

X1 CHECK FOR OTHER PCM (POWERTRAIN CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Review the results from the PCM self-test.

Are any other PCM Diagnostic Trouble Codes (DTCs) present?

Yes	DIAGNOSE all other PCM Diagnostic Trouble Codes (DTCs) first. REFER to the PCM DTC Chart in the appropriate 303-14 section.
No	GO to X2

X2 CHECK FOR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, carry out the BCM self-test.

Are any BCM Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to the BCM DTC Chart in this section.
No	GO to X4

X3 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

X4 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM connectors.
- Repair:
  - corrosion (install new connectors or terminals - clean module pins)
  - damaged or bent pins - install new terminals pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors and make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Copyright © 2016 Ford Motor Company

Remote Keyless Entry (RKE) Transmitter Programming

Programming

NOTE: *You can program a maximum of eight remote controls to your vehicle. This includes any that were supplied with your vehicle. The remote controls must remain inside your vehicle during the programming procedure. Fasten the front safety belts and close all doors to make sure that conflicting chimes do not sound during programming.*

1. Turn the ignition key from position 0 to position II four times within six seconds.
2. Turn the ignition to position 0. A tone sounds to indicate that it is now possible to program a remote control.
3. Press any button on a new remote control within 10 seconds. A tone will sound as confirmation.
4. Repeat step three within 10 seconds for each new remote control. Do not remove the key from the ignition when pressing the button on the remote control.
5. Switch the ignition back on (position II) or wait for 10 seconds without programming another remote control to end the key programming. Only the remote controls which you have just programmed are now able to lock and unlock your vehicle.

Copyright © 2016 Ford Motor Company

Remote Transmitter Programming

1. **NOTE:** *You can program a maximum of eight remote controls to your vehicle. Programming must be done at the same time for all the transmitters.*

   NOTE: *To enter programming mode, first make sure that the vehicle battery is fully charged and the anti-theft system is not armed or triggered (if equipped).*

   Close all doors to make sure conflicting chimes do not sound during programming.
2. Turn the ignition key from position 0 to position II four times within six seconds.
3. Turn the ignition to position 0. A tone sounds to indicate that it is now possible to program a remote control.
4. Press any button on a new remote control within 10 seconds. A tone will sound as confirmation.
5. Repeat step four within 10 seconds for each new remote control. Do not remove the key from the ignition when pressing the button on the remote control.
6. After each successful programming, another 10 second learning mode is automatically entered, up to a maximum of eight times.
7. To program additional remote transmitters, repeat step 5.
8. The system will leave the learning mode after the ignition switch is turned to position III, or if no new transmitter is programmed during the 10 seconds, or if eight remote transmitters have been programmed.
9. **NOTE:** *An incorrect programming procedure does not affect the stored codes.*

   After successful programming, only the new programmed transmitters will be accepted.
10. Test all the programmed transmitters, by activating and deactivating the locking/unlocking functions.

Copyright © 2016 Ford Motor Company

Ignition Lock Cylinder

Base Part Number: F3677

Special Tool(s) / General Equipment

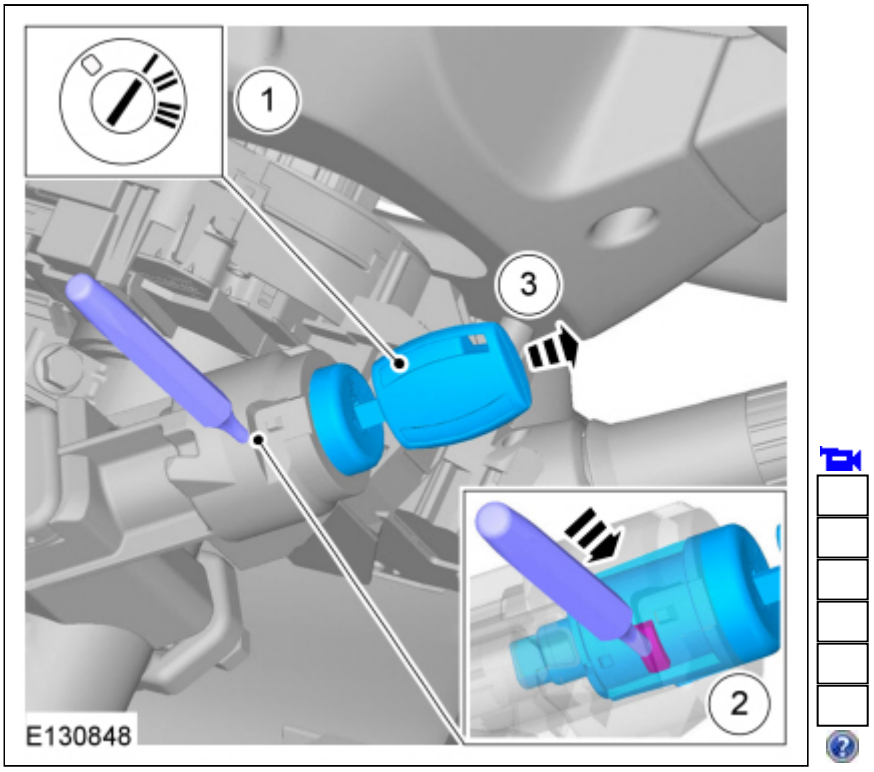
Punch

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Passive Anti-Theft System (PATS) Transceiver (419-01B Passive Anti-Theft System (PATS), Removal and Installation).

1. Turn the ignition key to position I.
2. Using a suitable punch, release the locking tang.
   Use the General Equipment: Punch



Installation

1. **NOTICE: Make sure that the ignition switch and the ignition lock cylinder are aligned before installation.**

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Door Latch

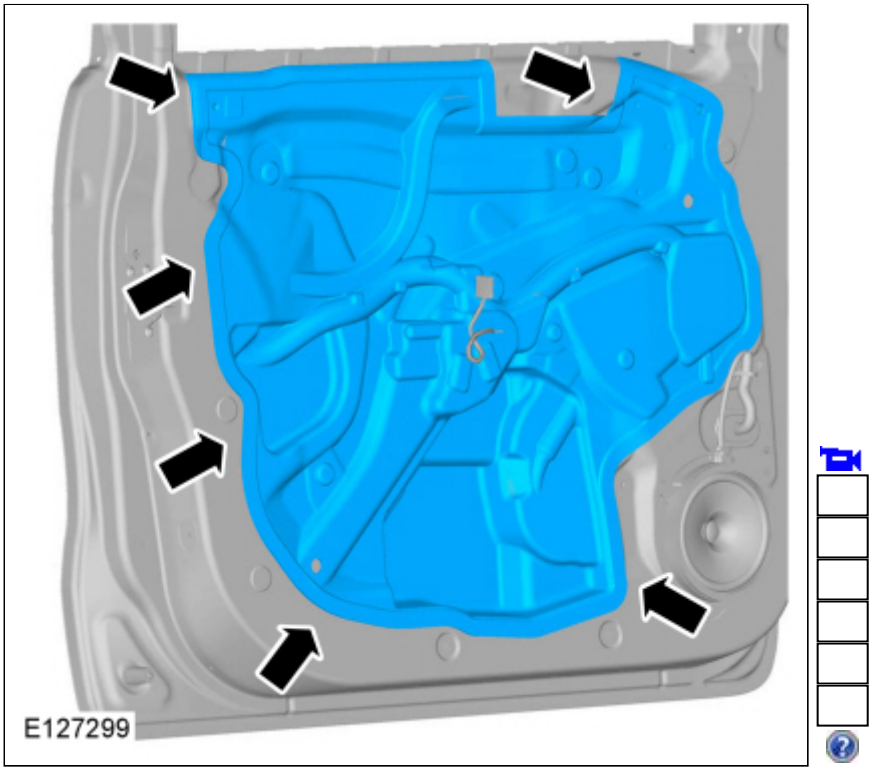
Base Part Number: 21812

Removal

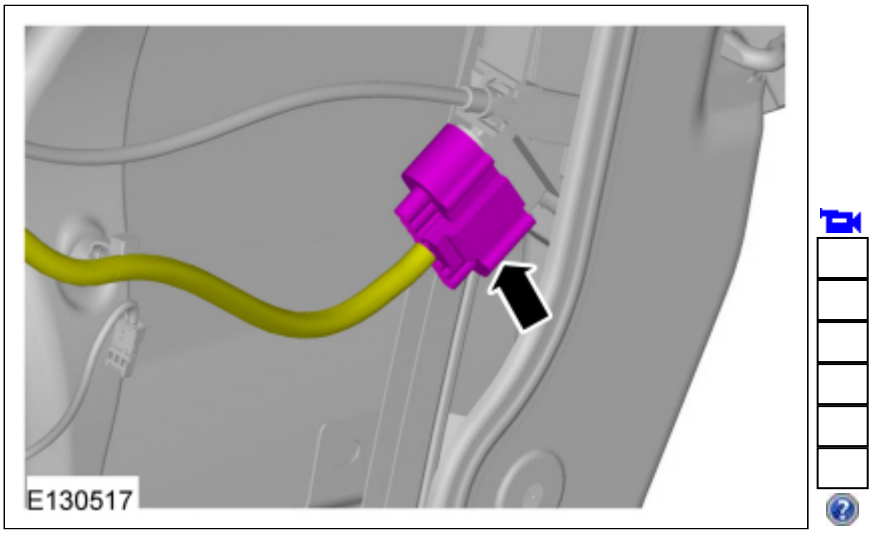
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Make sure that door window glass remains in the close position.*

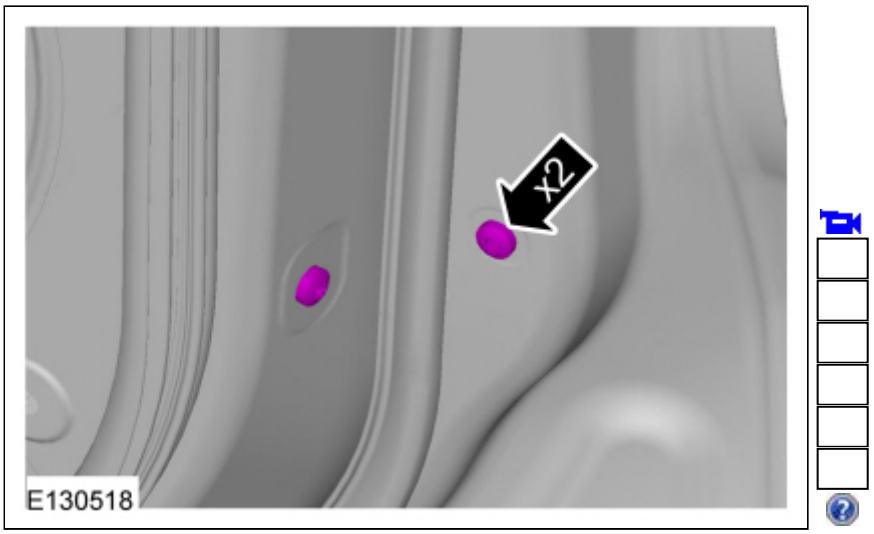
1. Refer to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
2. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. **NOTICE: Do not touch the adhesive surface as re-bonding will be impaired.**



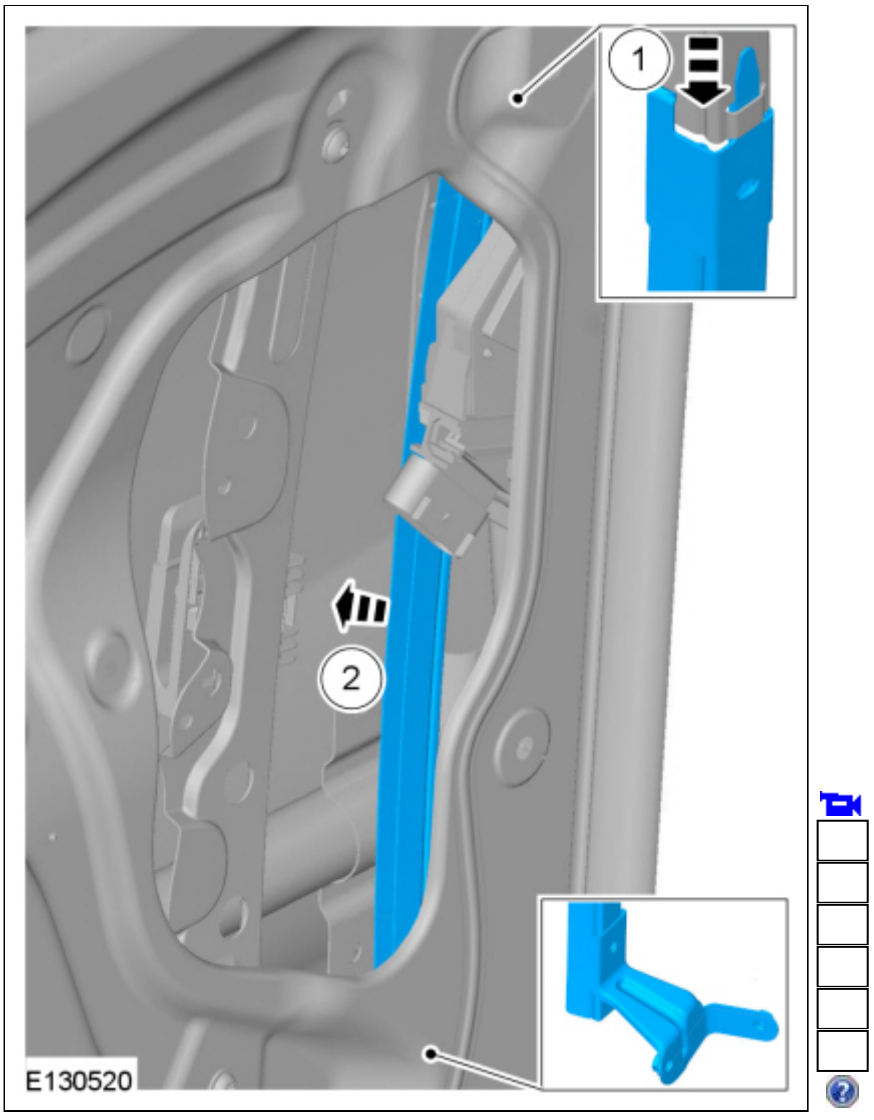
4.



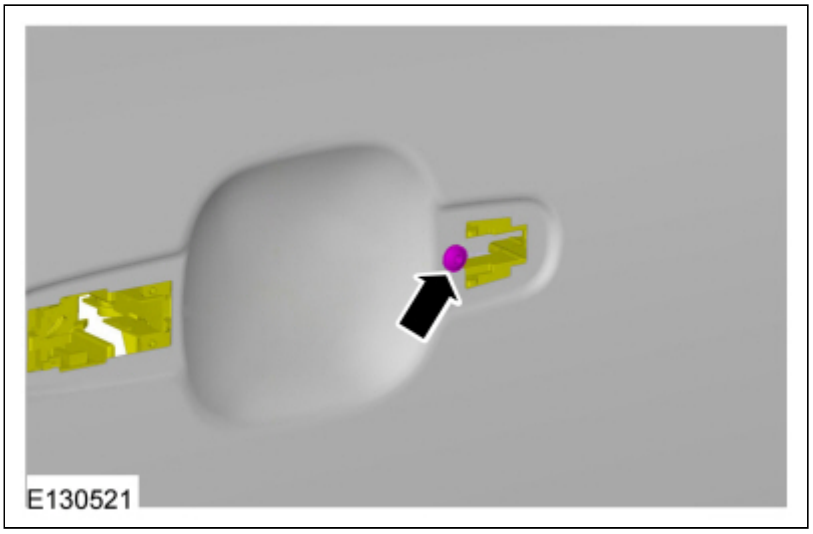
5. *Torque*: 10 Nm



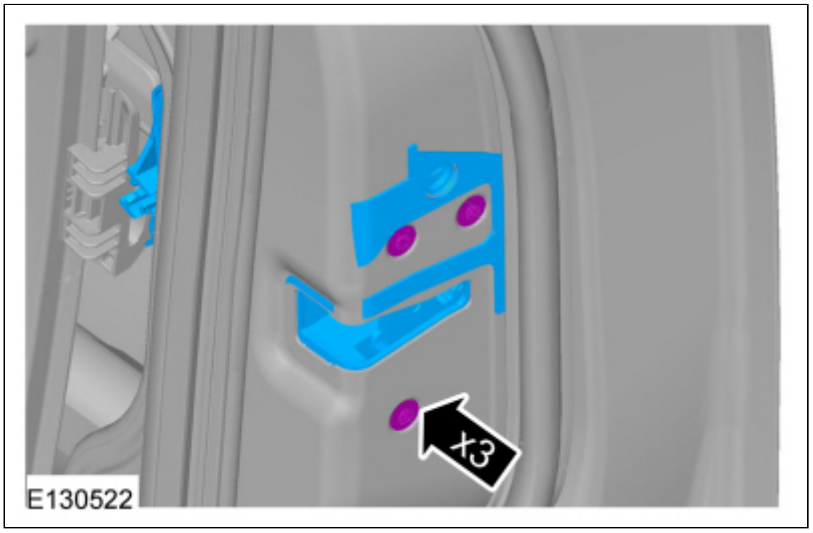
6.



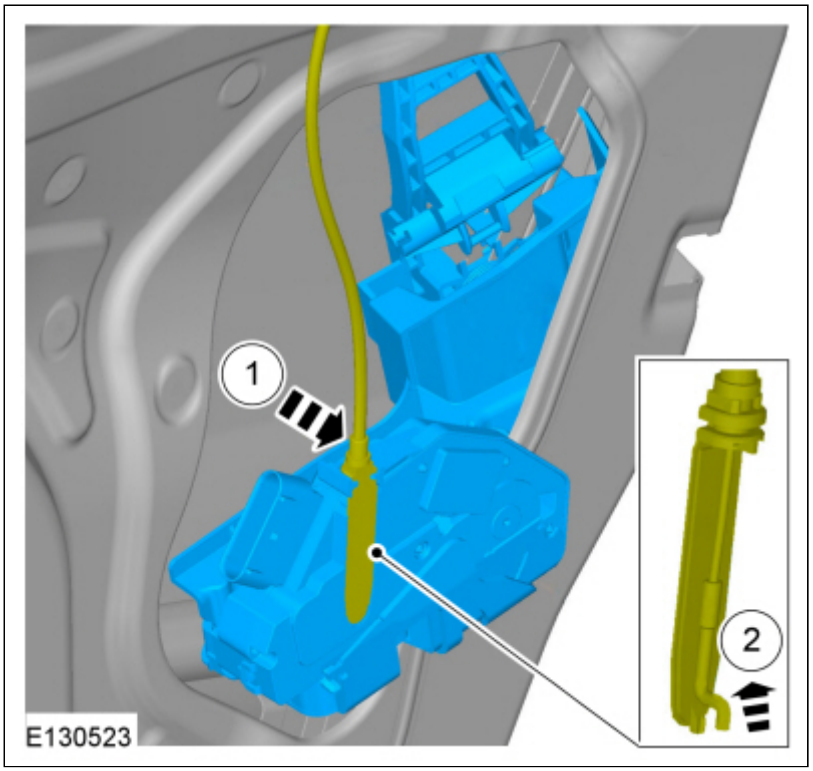
7.



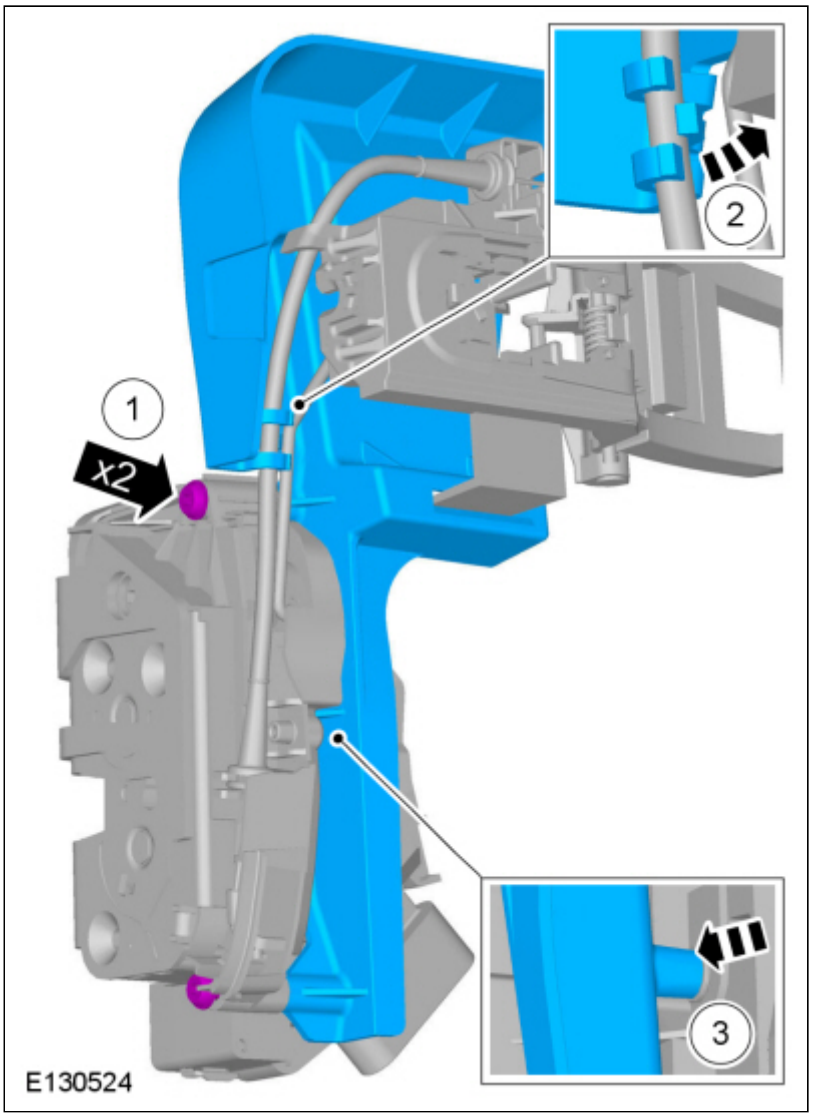
8. *Torque*: 12 Nm



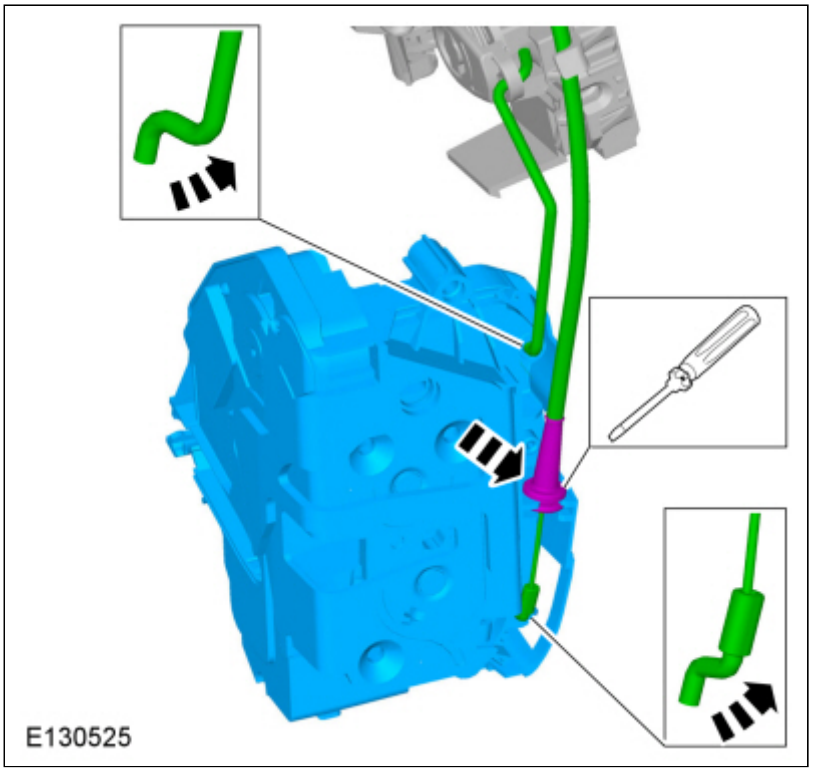
9.



10.



11.



Installation

1. To install, reverse the removal procedure.

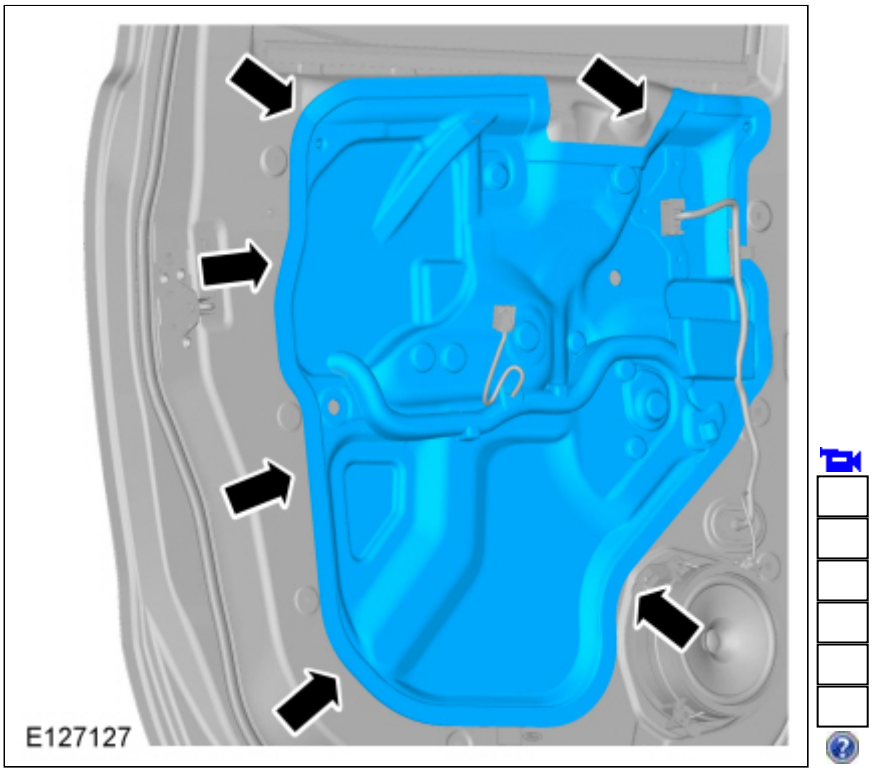
Copyright © 2016 Ford Motor Company

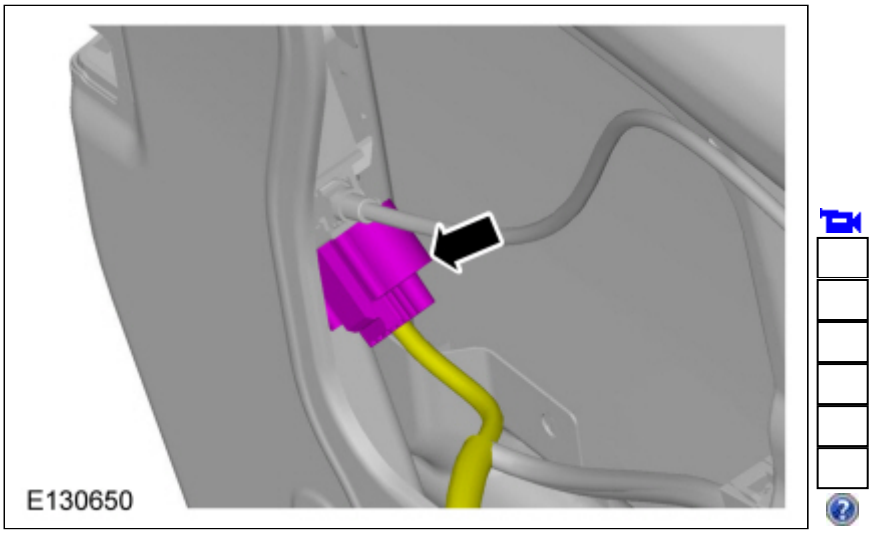
Rear Door Latch - Double Cab

Base Part Number: 26412

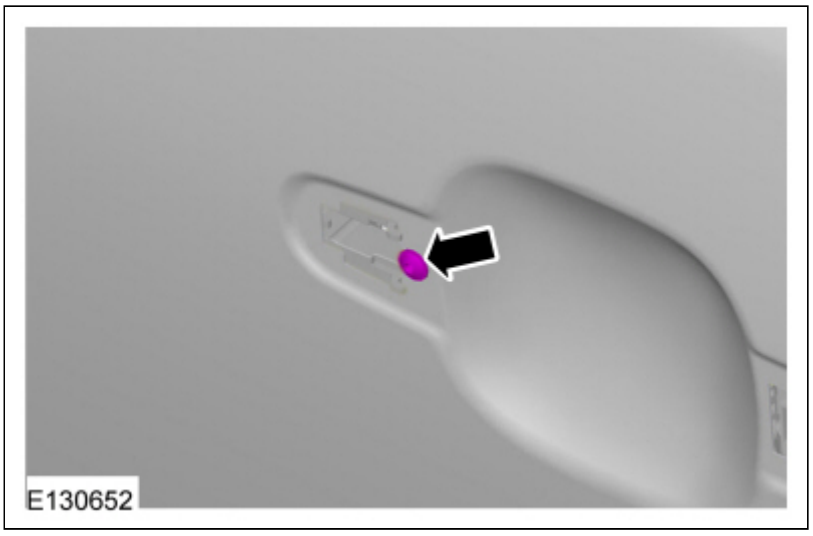
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

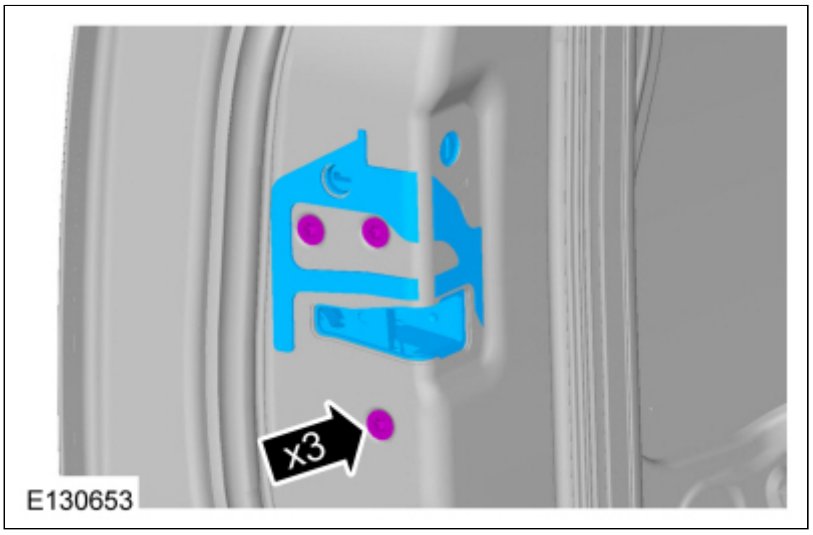
1. Refer to: Exterior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
2. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. 

4. 

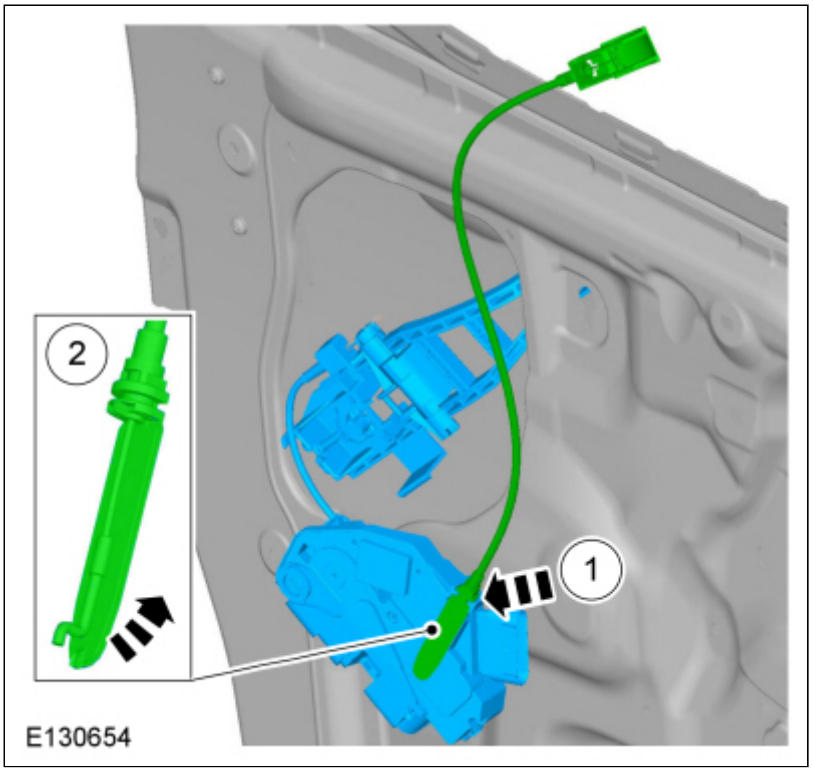
5.



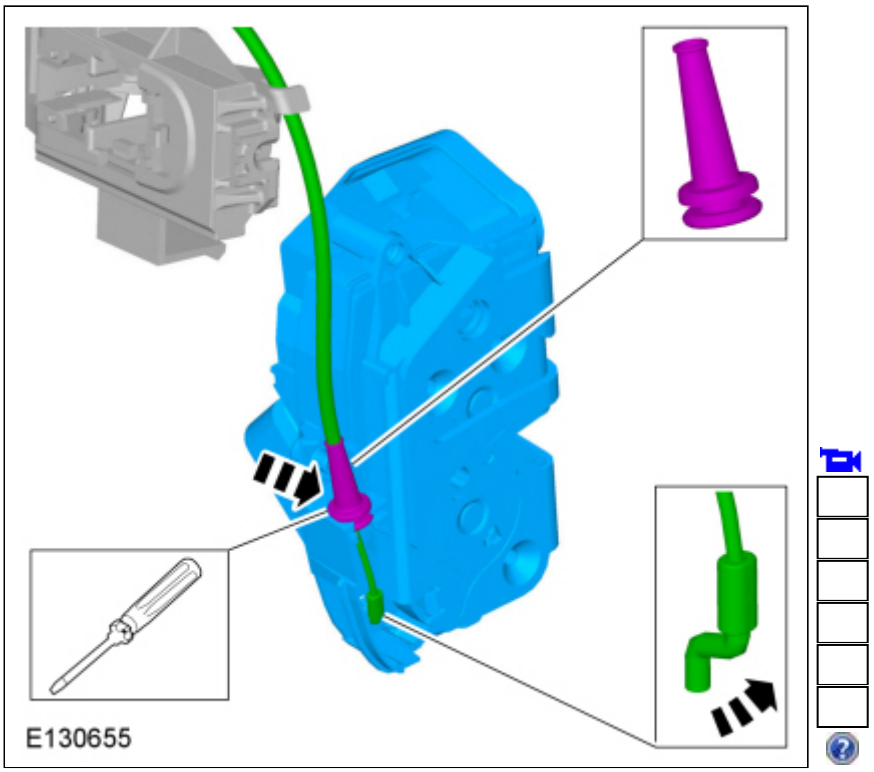
6. *Torque*: 12 Nm



7.



8.



Installation

1. To install, reverse the removal procedure.

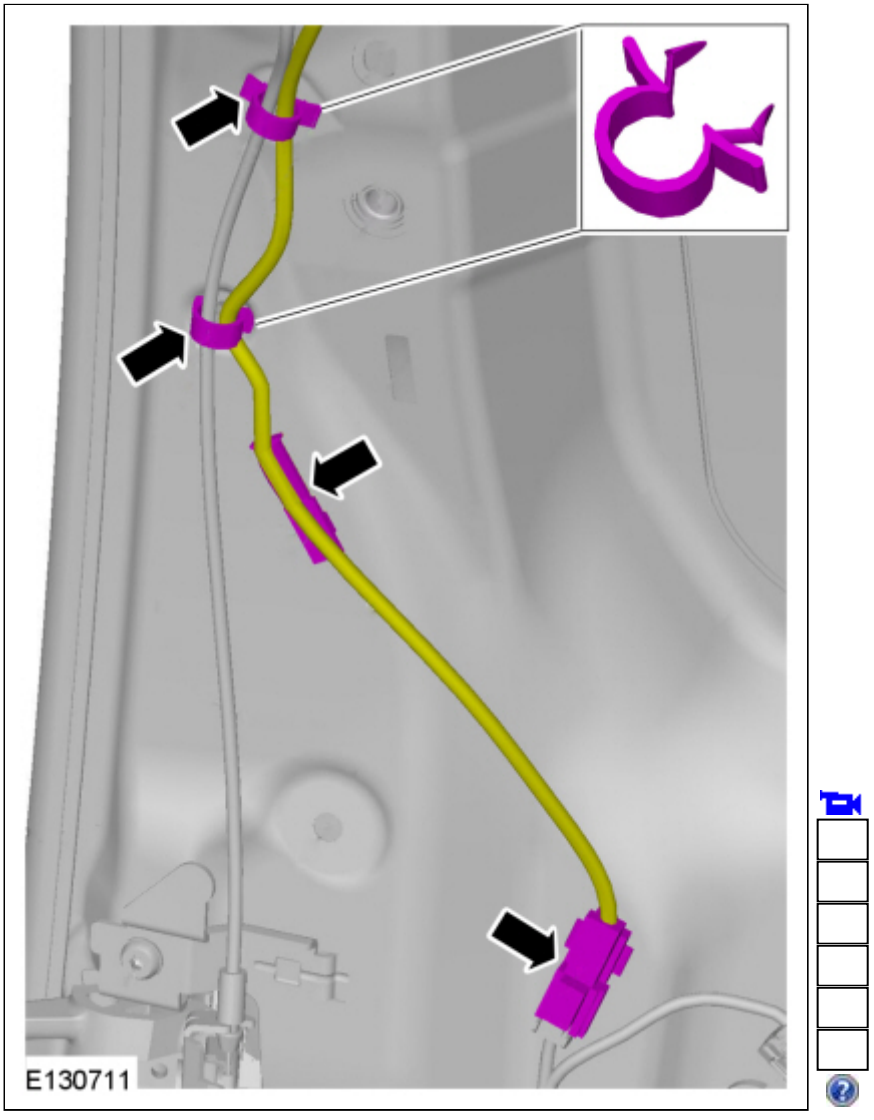
Copyright © 2016 Ford Motor Company

Rear Door Latch

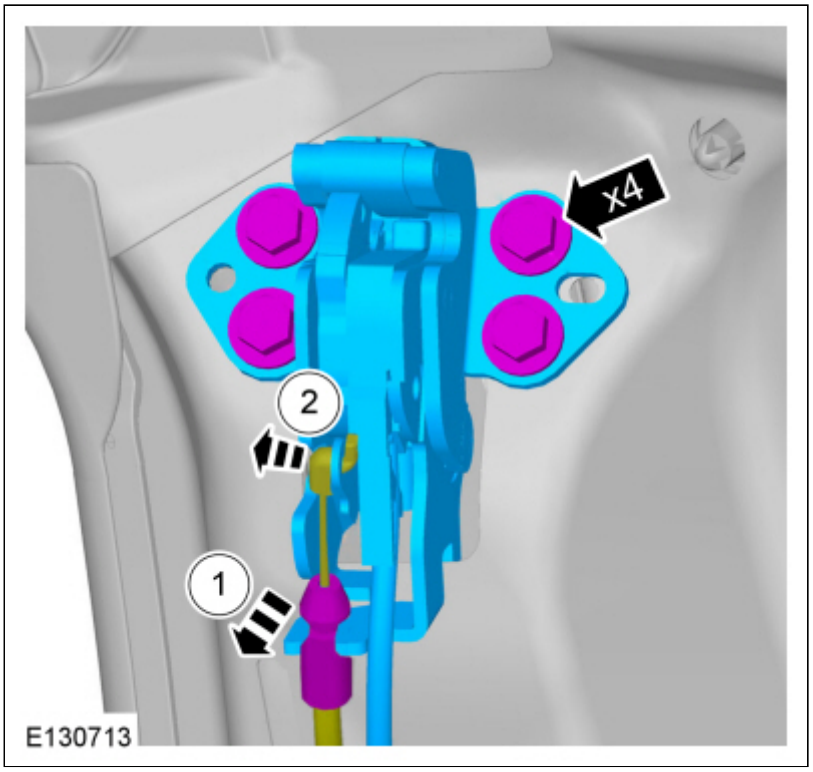
Base Part Number: 26412

Removal

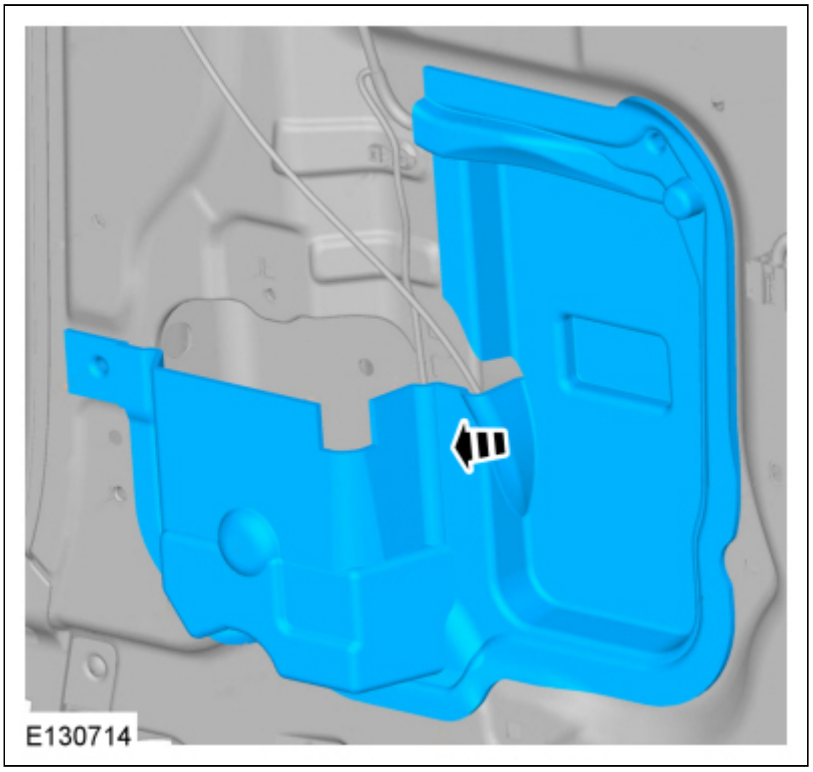
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

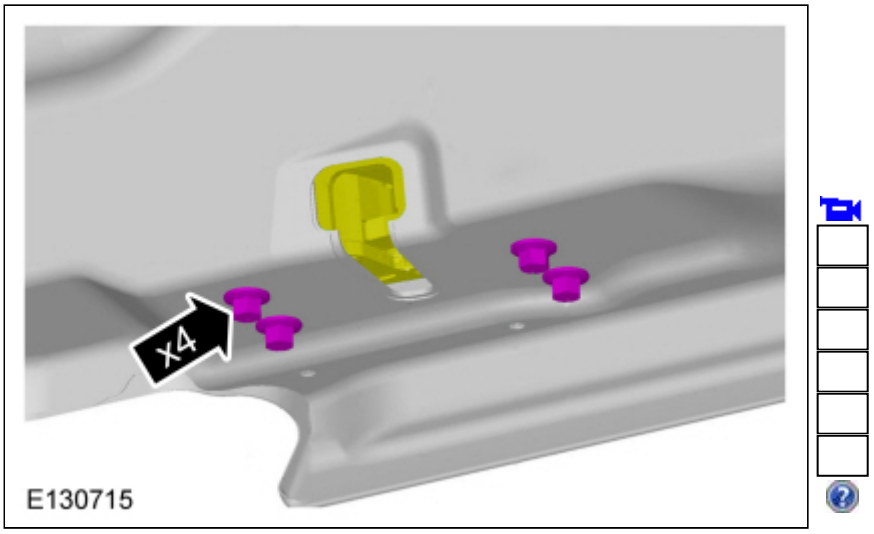
3. *Torque*: 10 Nm



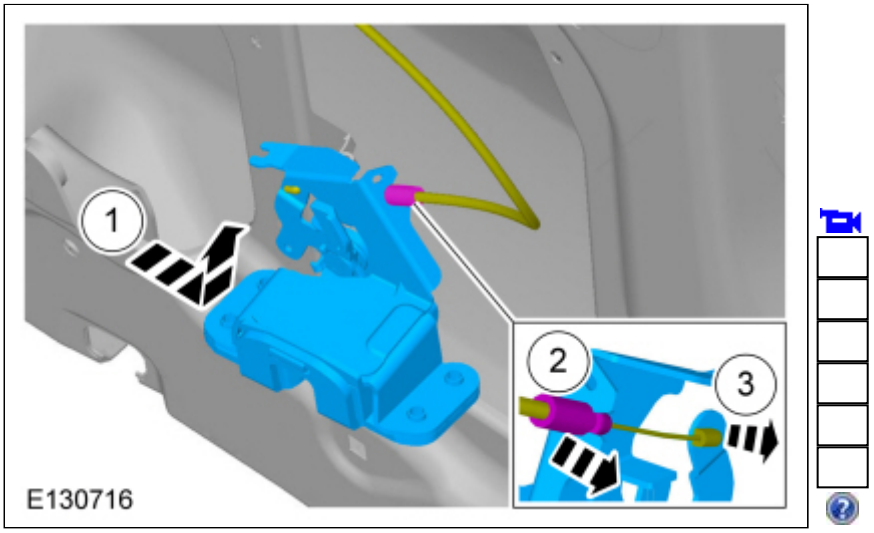
4.



5. *Torque*: 12 Nm



6.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

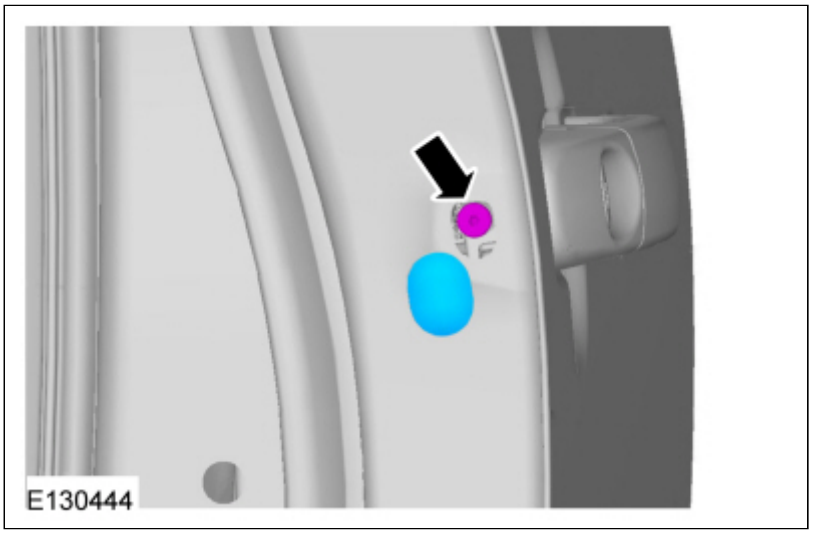
Exterior Front Door Handle

Base Part Number: 22404

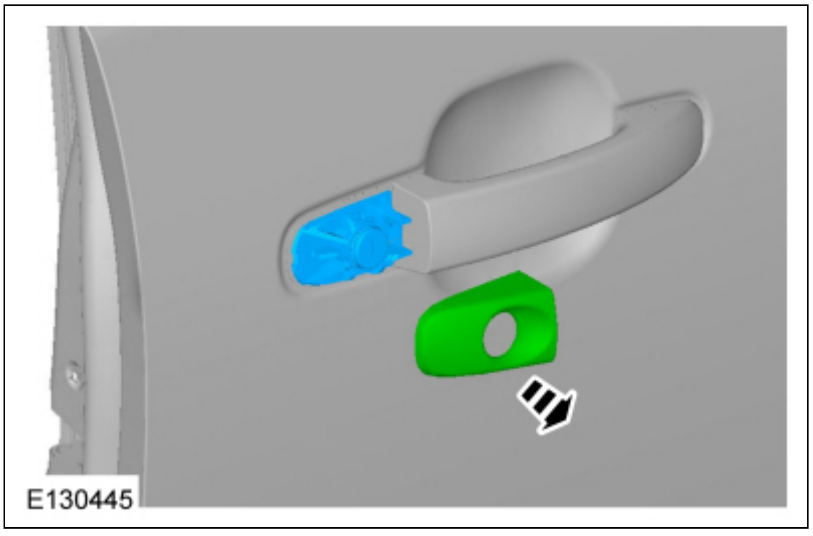
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

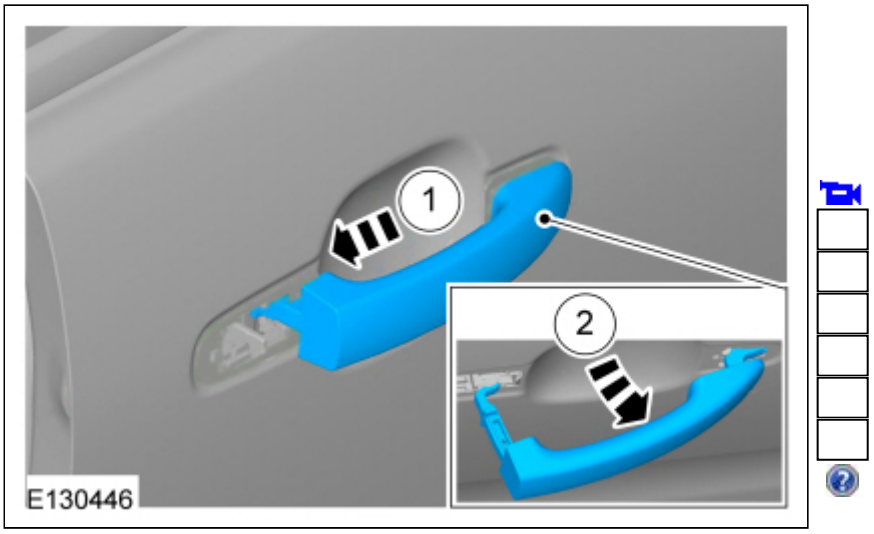
1. **NOTE:** *Use suitable tool to remove the cover.*



2.



3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

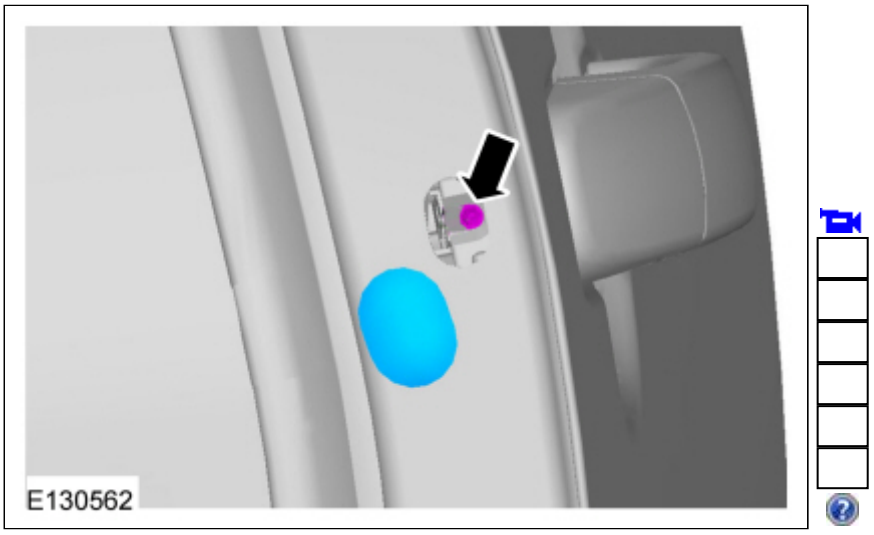
Exterior Rear Door Handle

Base Part Number: 22404

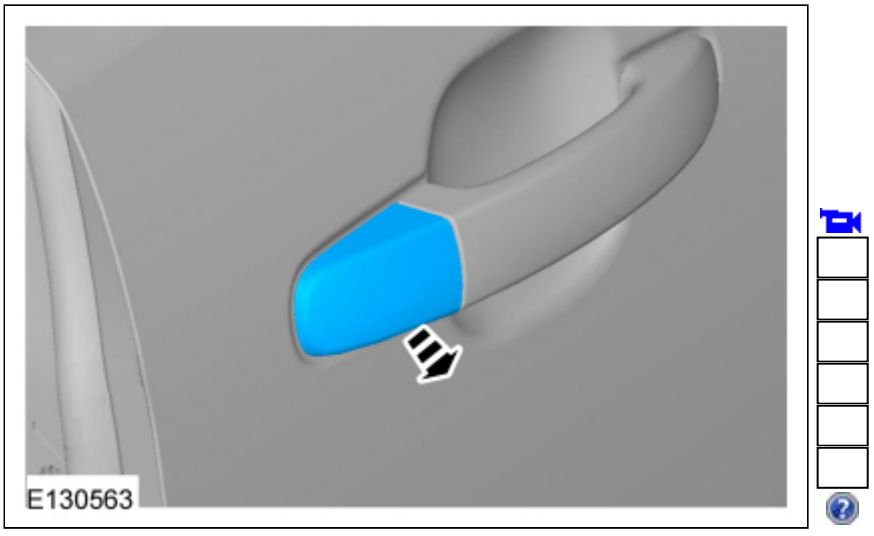
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

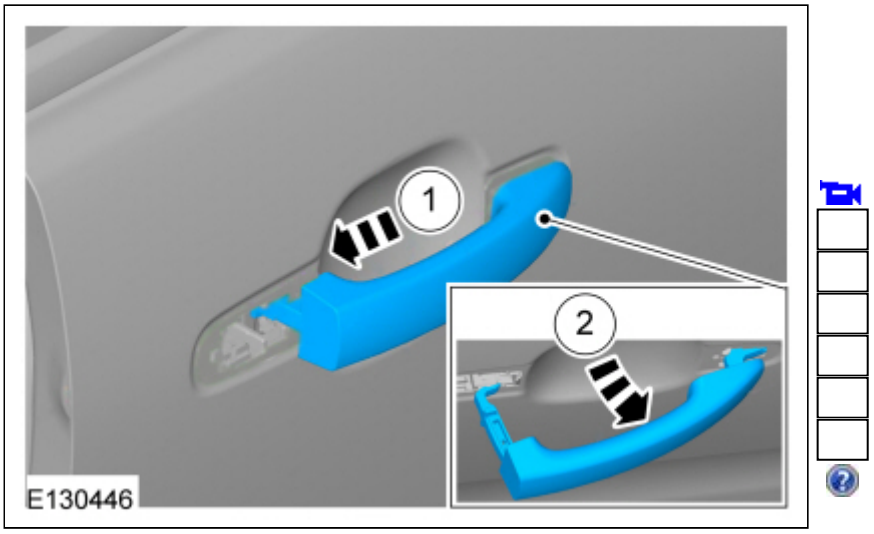
1. **NOTE:** *Use suitable tool to remove the cover.*



2.



3.



Installation

1. To install, reverse the removal procedure.

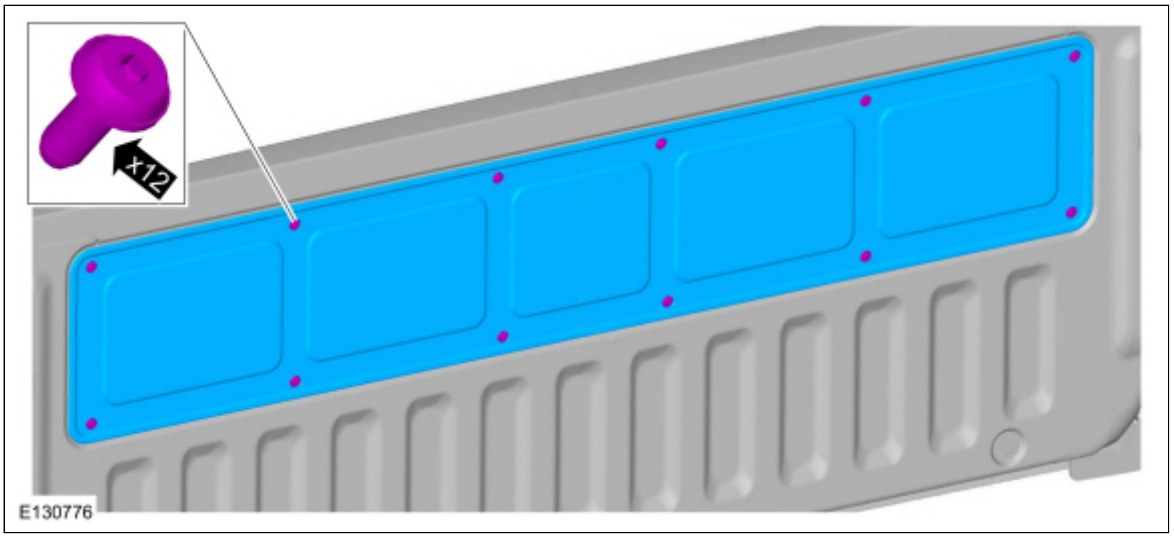
Copyright © 2016 Ford Motor Company

Tailgate Latch

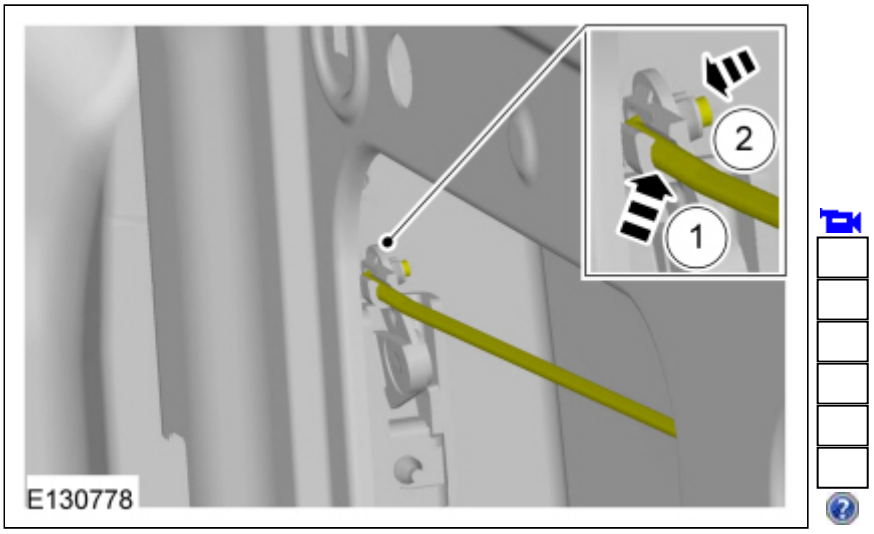
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

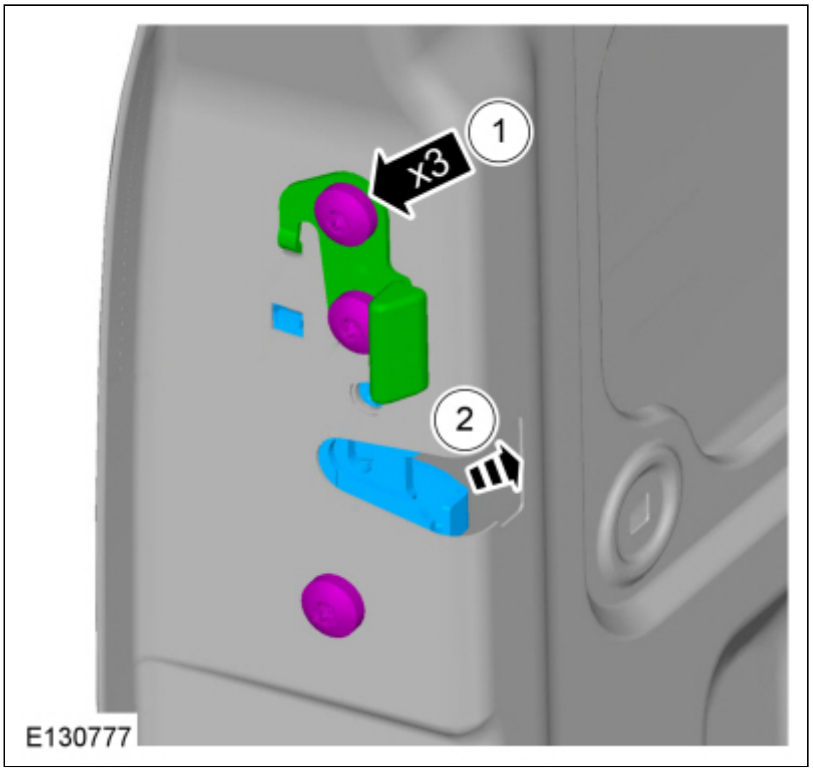
1.



2.



3. *Torque*: 25 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Key Blade

Special Tool(s) / General Equipment

Plastic Mallet
Punch

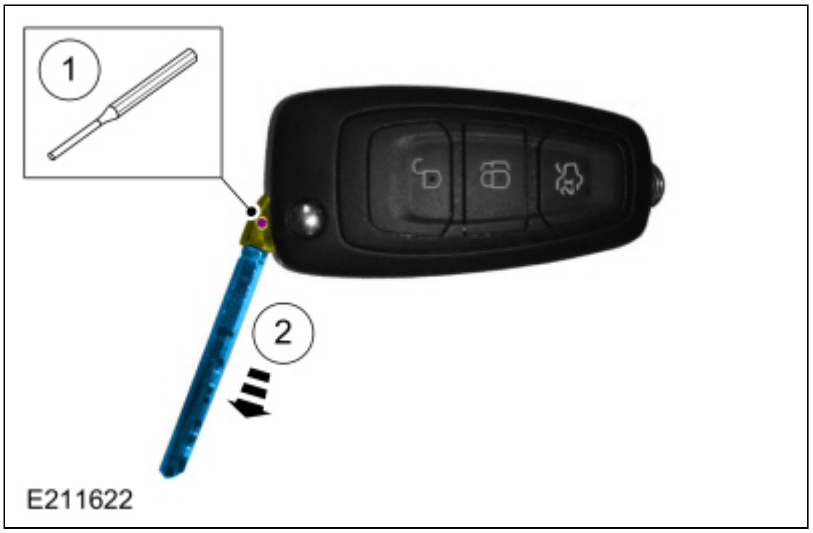
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1.



2. Use the General Equipment: Punch
   Use the General Equipment: Plastic Mallet



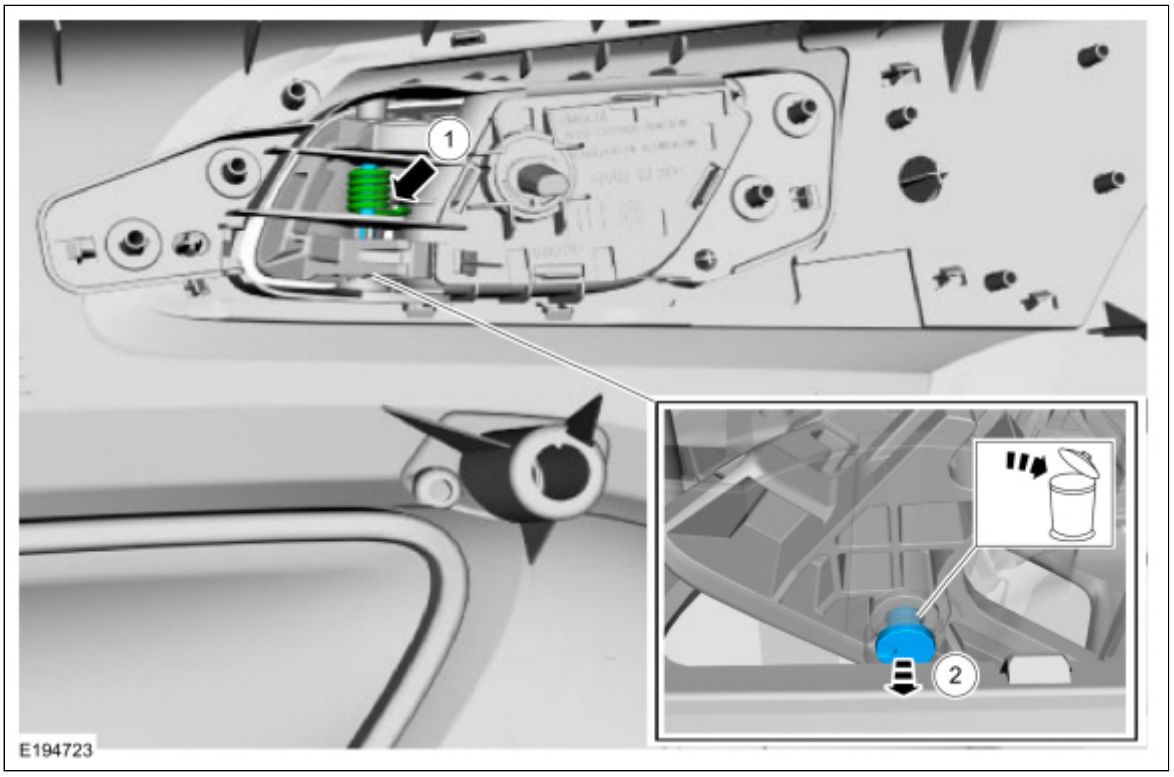
Installation

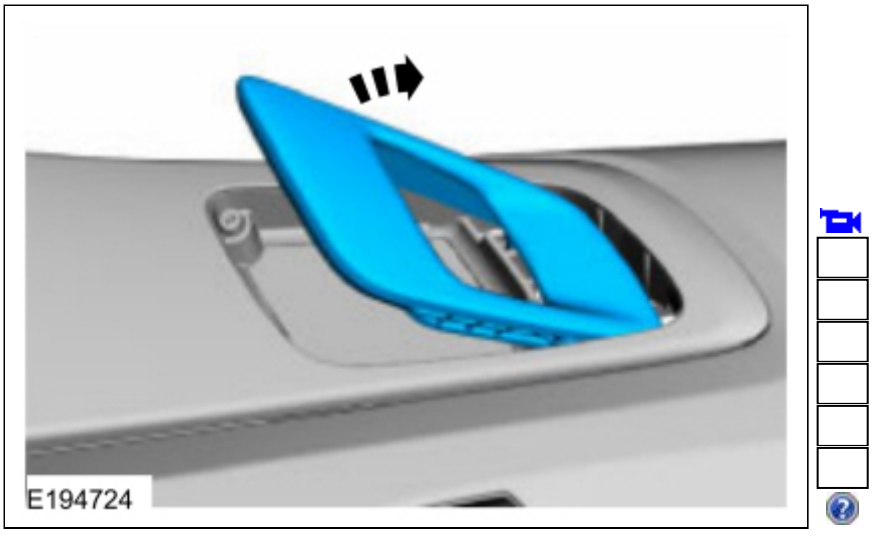
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Interior Front Door Handle

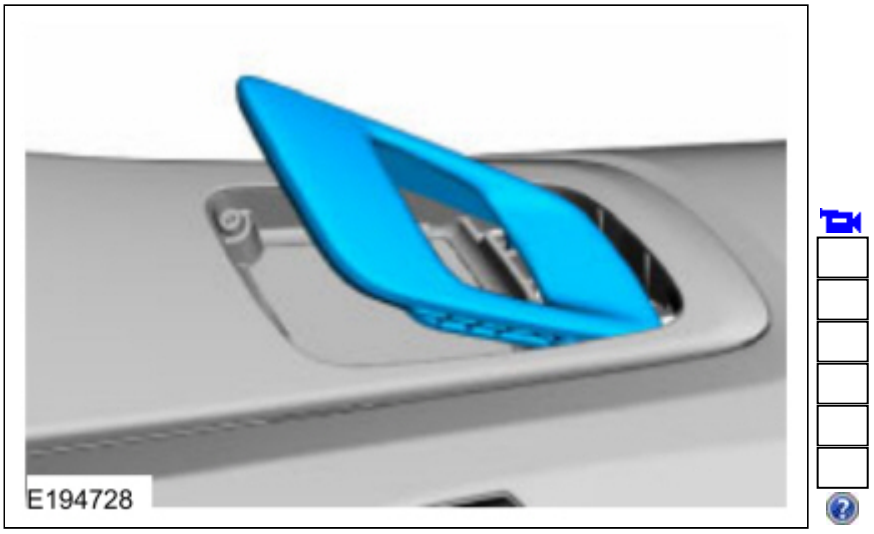
Removal

1. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

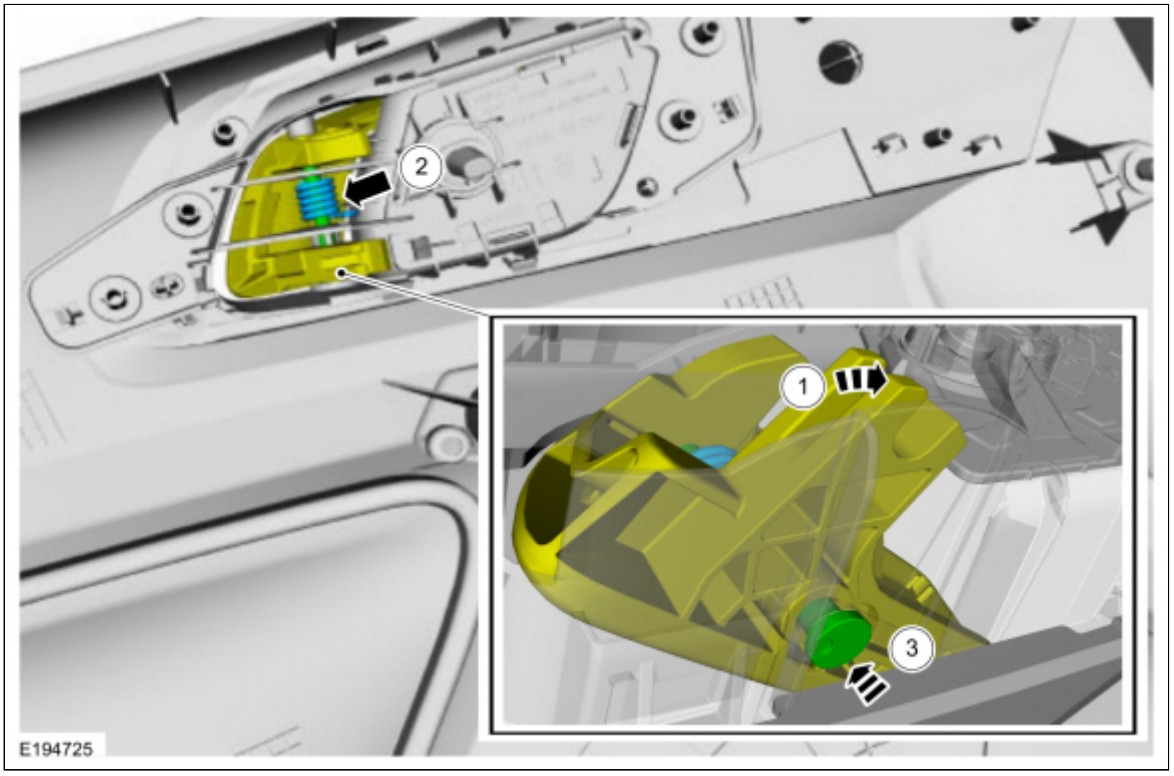
3. 

Installation

1.



2. **NOTE:** *Make sure that a new pivot pin is installed.*



3. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Copyright © 2016 Ford Motor Company

Roller Shutter Lock Cylinder

Removal

1. Refer to: Roller Shutter Rear Bar Assembly (501-04 Pickup Bed and Platform Body, Removal and Installation).

Installation

1. Refer to: Roller Shutter Rear Bar Assembly (501-04 Pickup Bed and Platform Body, Removal and Installation).

Copyright © 2016 Ford Motor Company

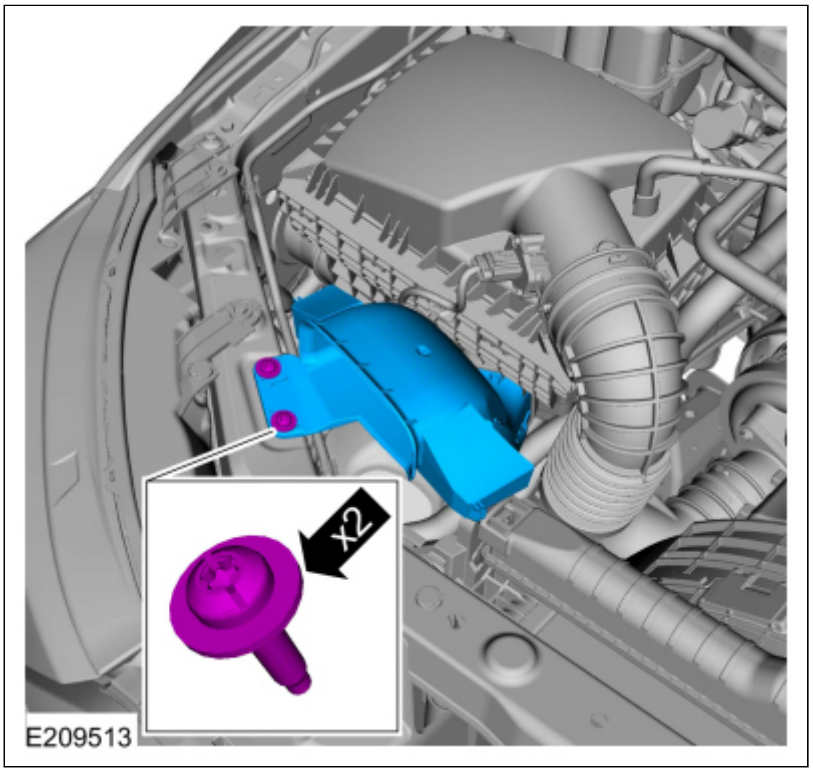
Hood Latch

Base Part Number: 16700

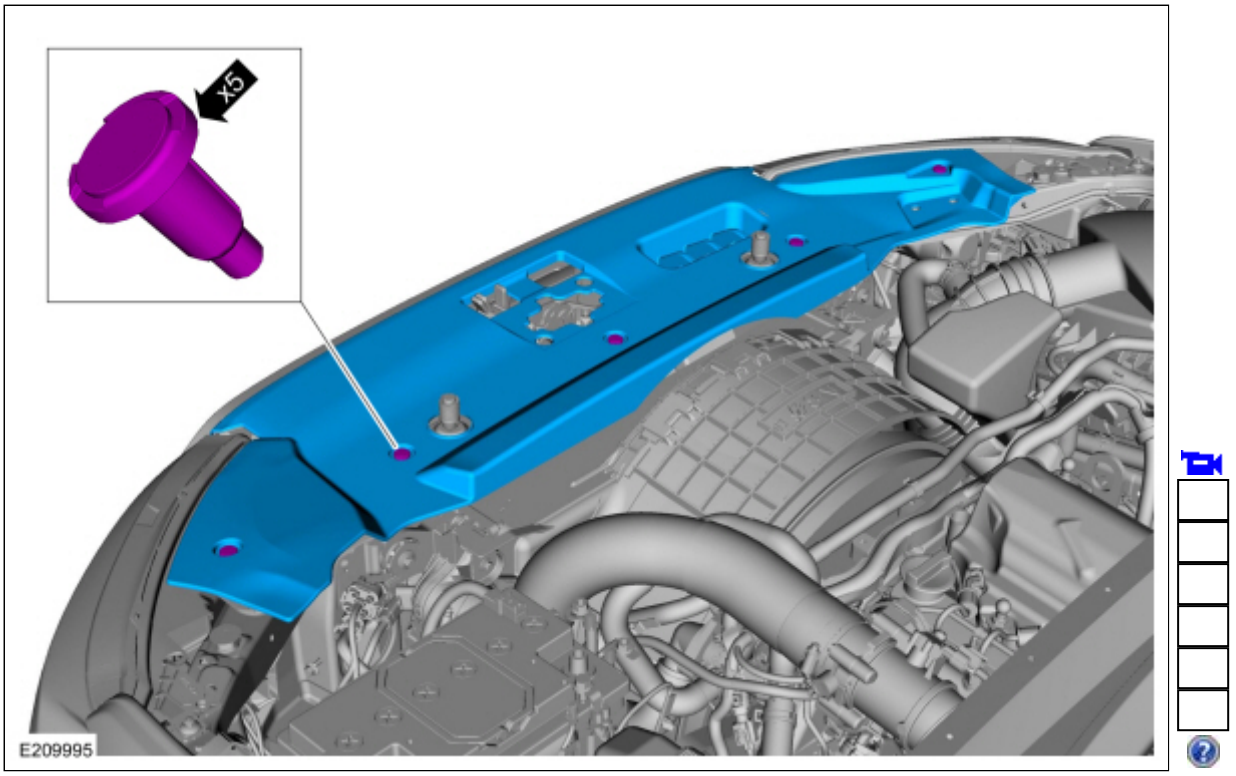
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

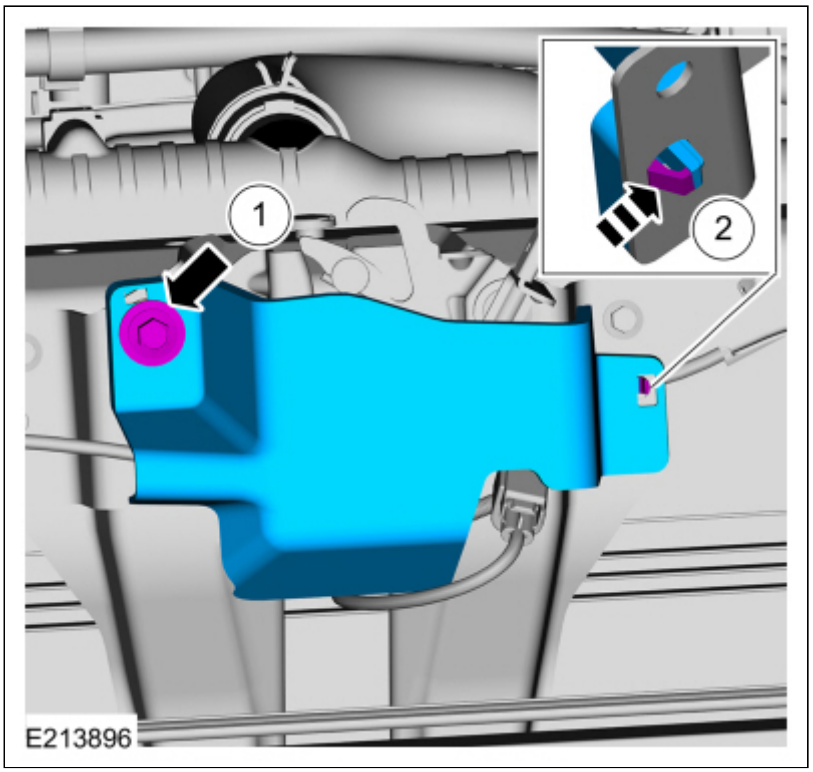
1.



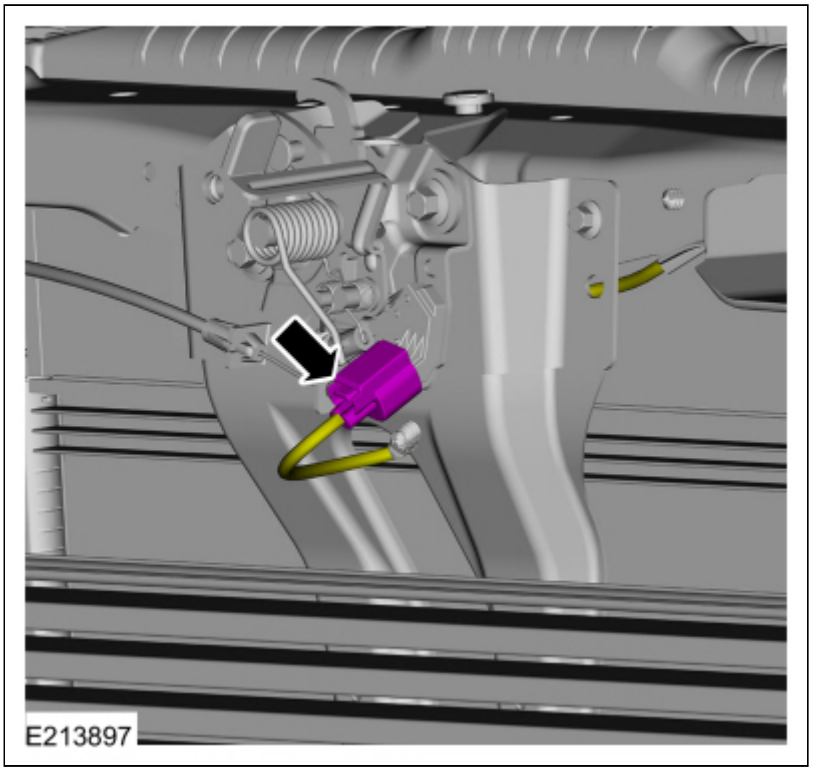
2.



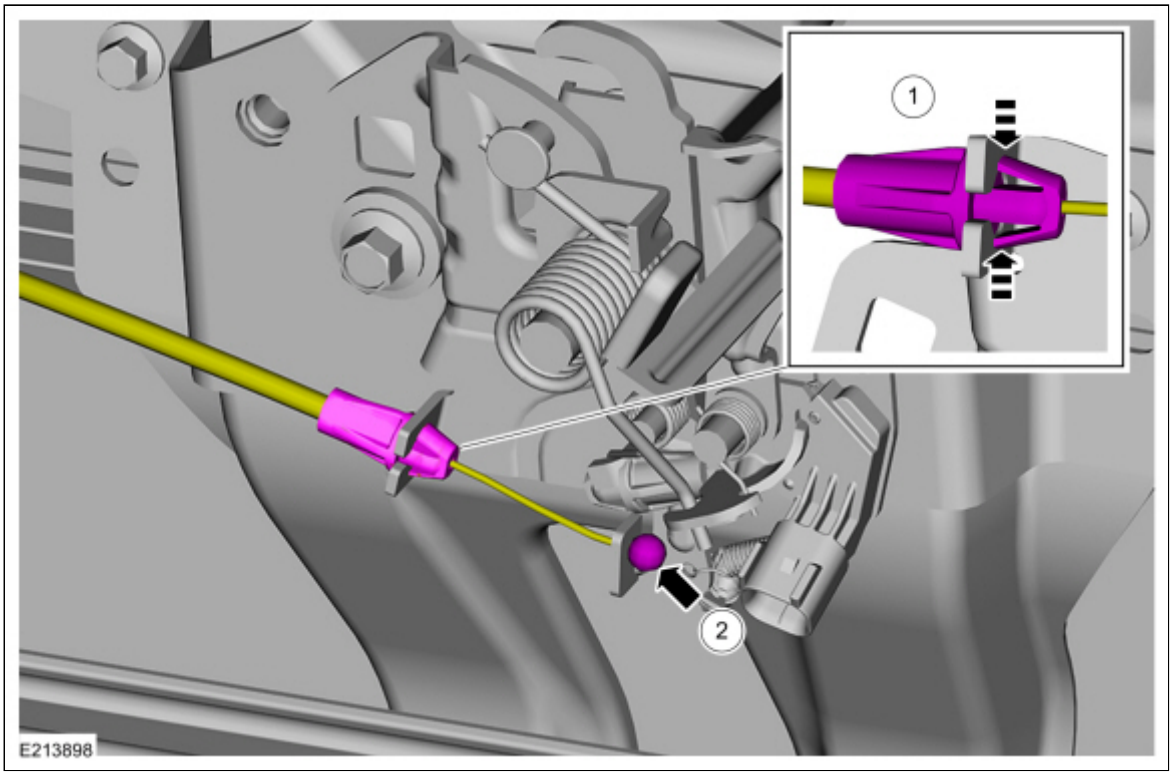
3. *Torque*: 12 Nm



4.

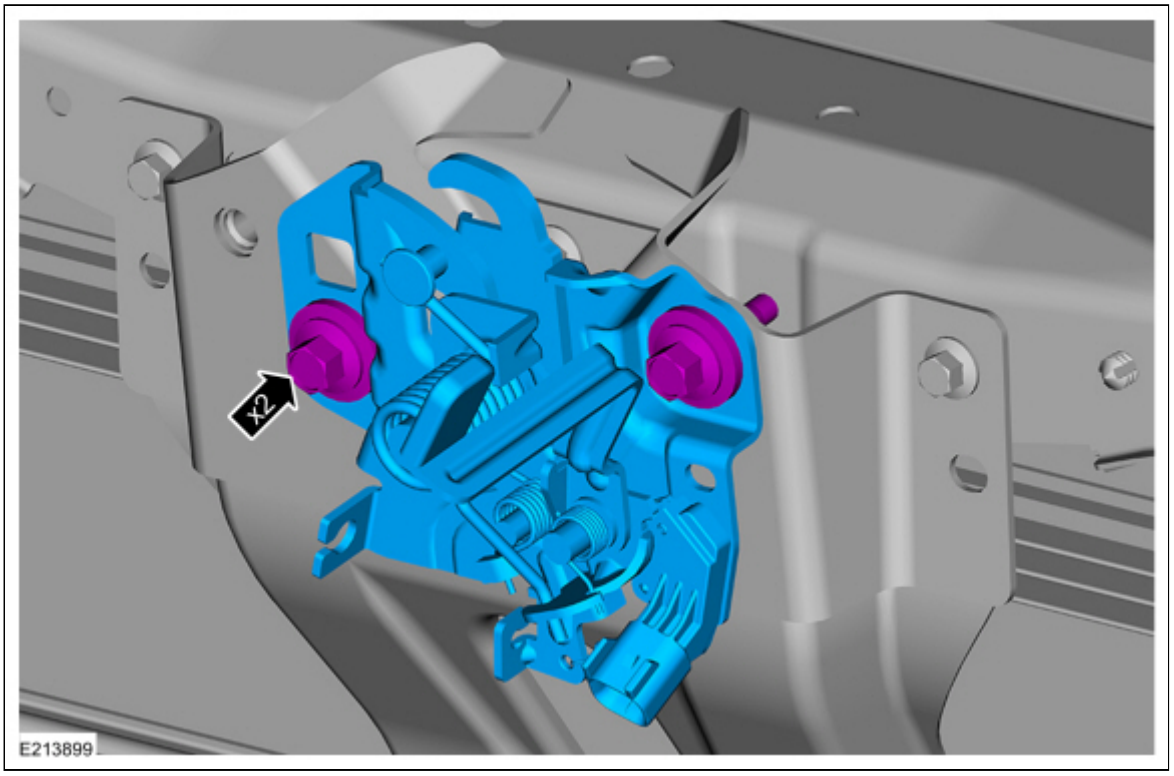


5.



6. **NOTE:** *Mark the position of the hood latch prior to removing the hood latch bolts to aid positioning during installation.*

   Torque: 25 Nm



Installation

1. **NOTICE: Make sure that the clearance on either side of the hood is equal and no strain is placed on the hood latch.**

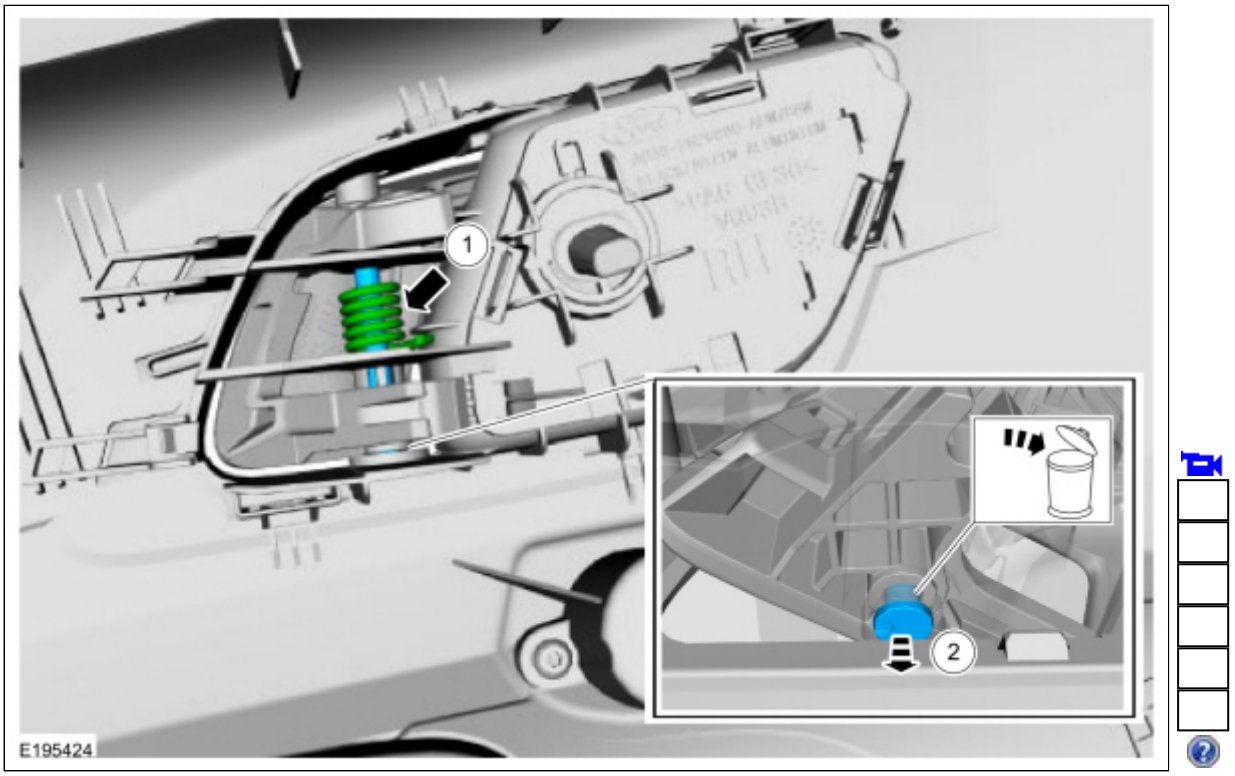
   NOTE: *Check the latch adjustment to make sure the latch was installed and aligned correctly.*

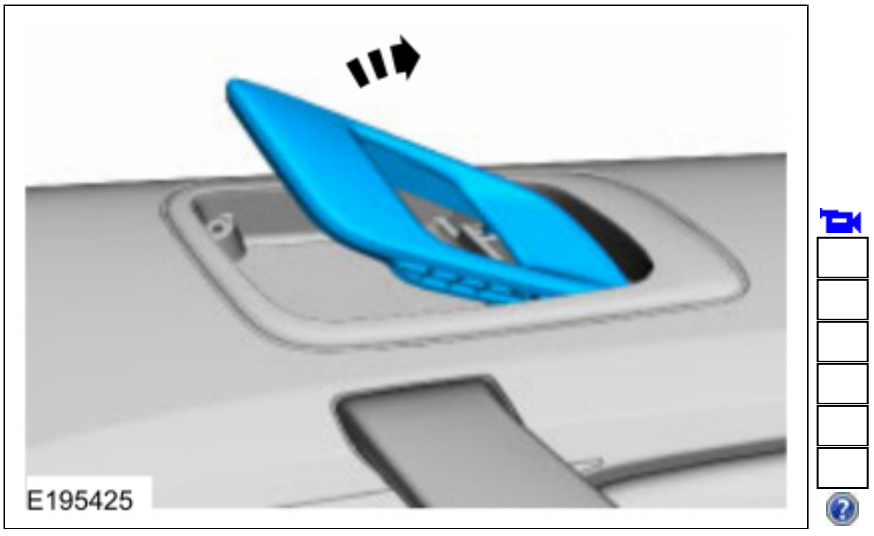
   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Interior Rear Door Handle

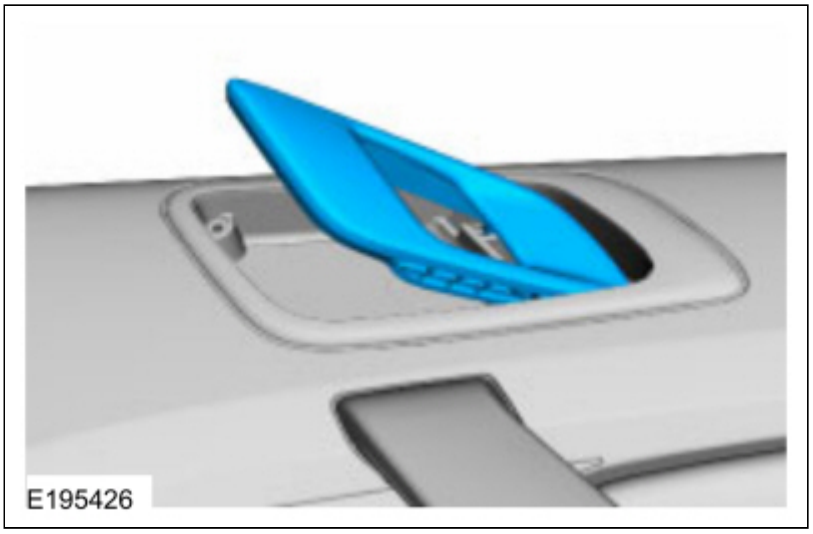
Removal

1. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

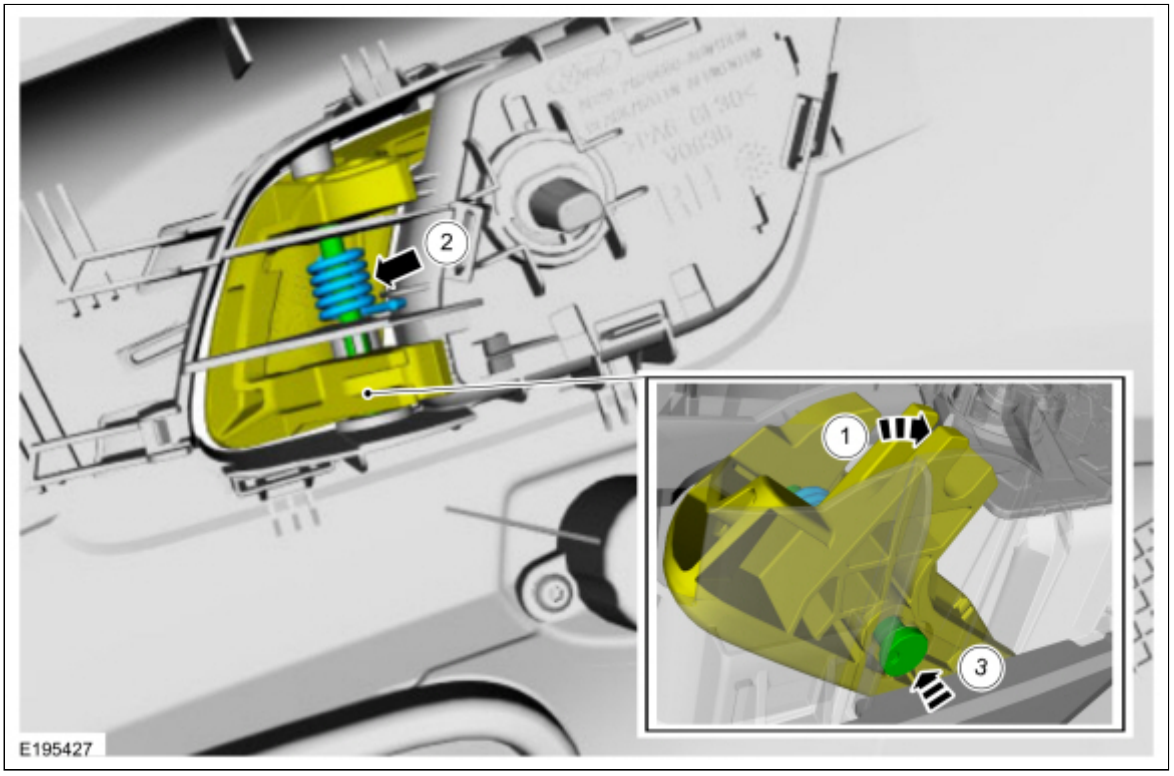
3. 

Installation

1.



2. **NOTE:** *Make sure that a new pivot pin is installed.*



3. Refer to: Rear Door Trim Panel - Double Cab (501-05 Interior Trim and Ornamentation, Removal and Installation).

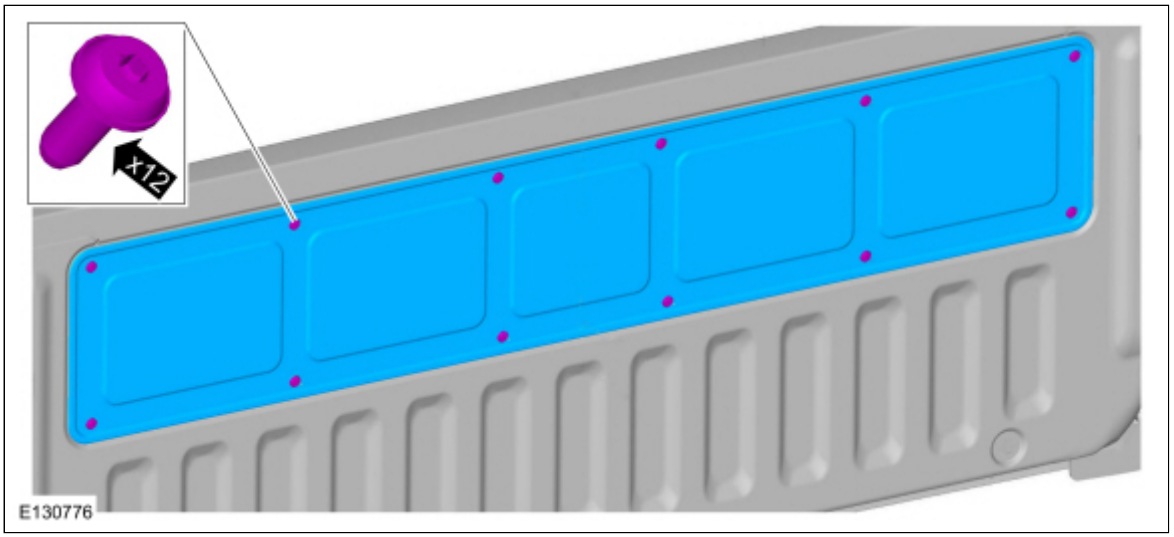
Copyright © 2016 Ford Motor Company

Tailgate Release Handle

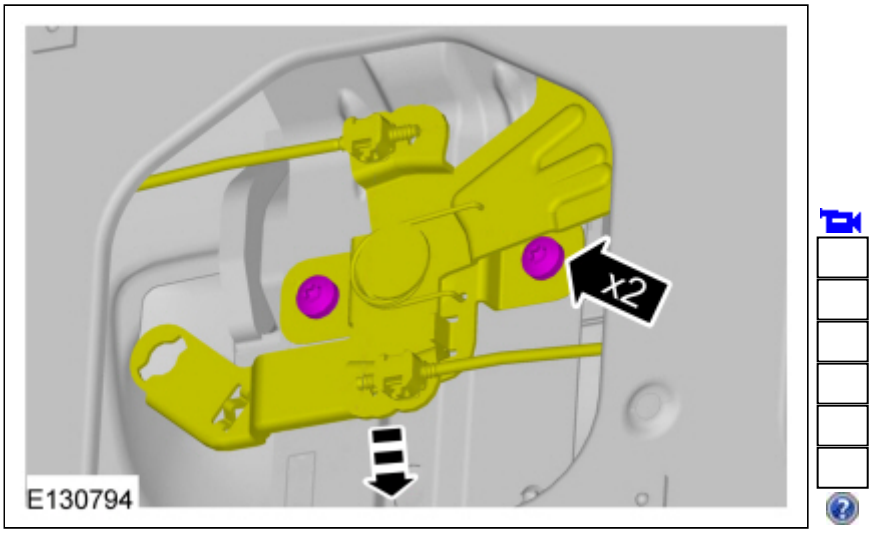
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

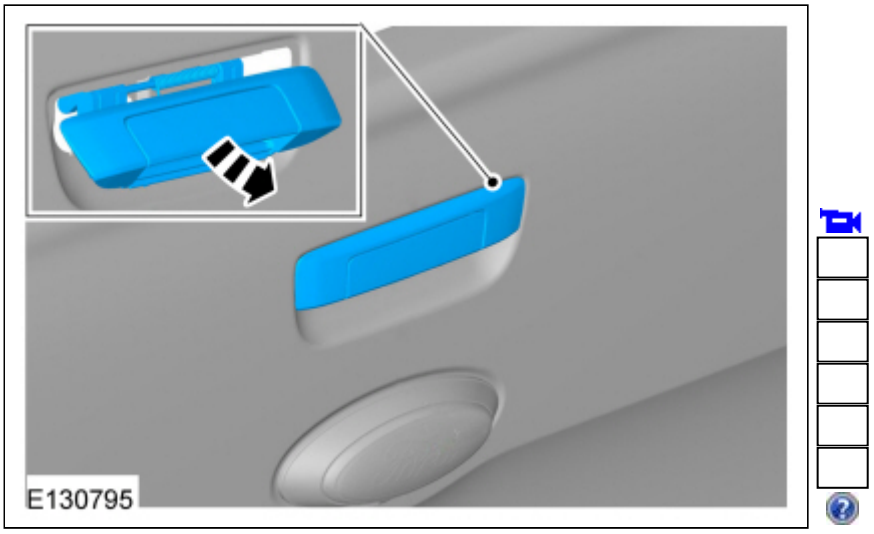
1.



2. *Torque*: 8 Nm



3.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

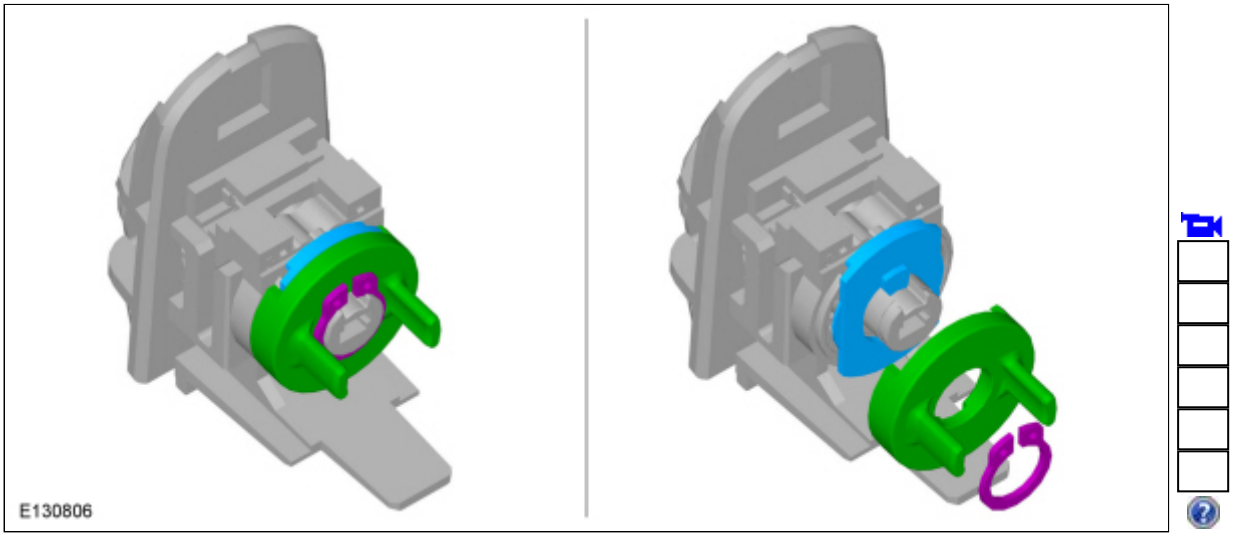
Door Lock Cylinder

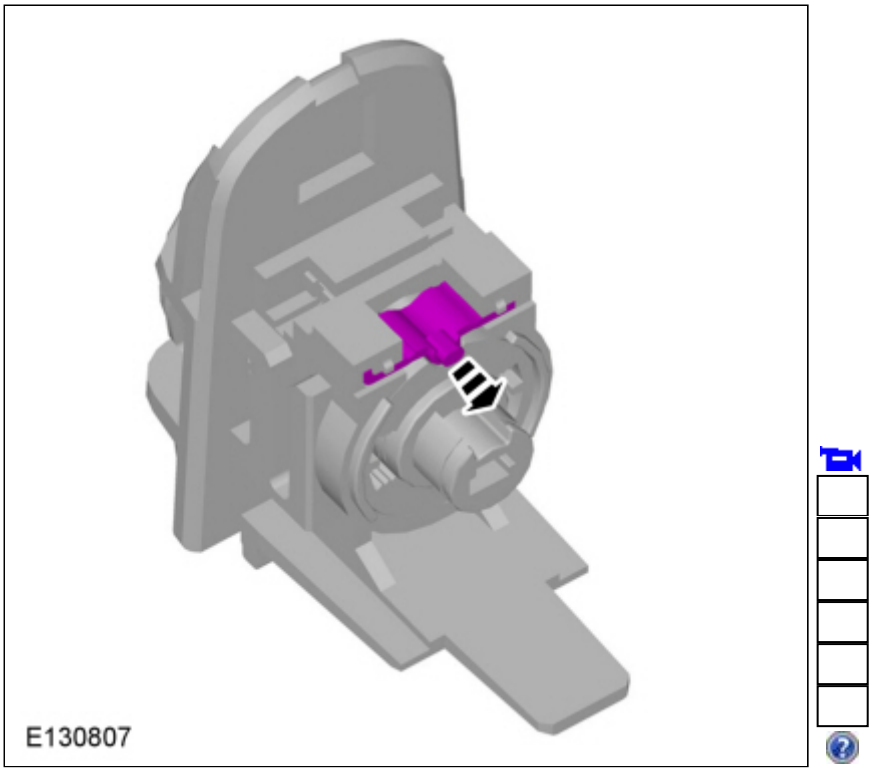
Special Tool(s) / General Equipment

2 mm Punch

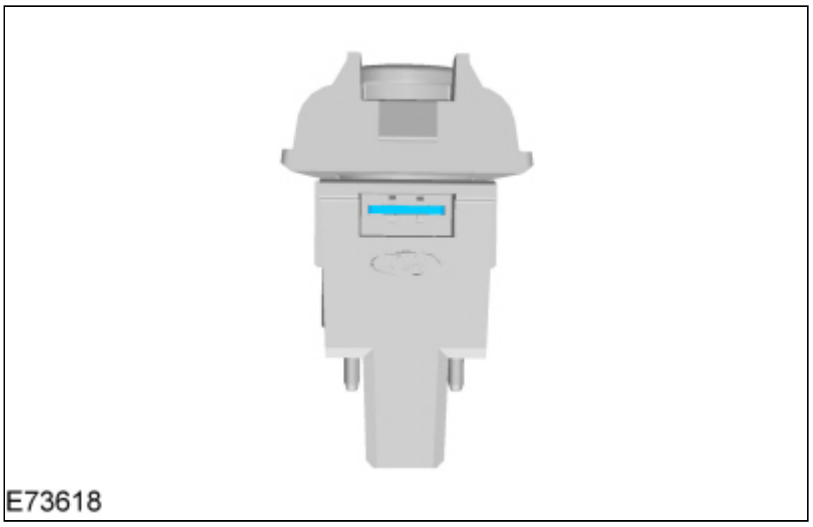
DISASSEMBLY

NOTE: *Removal steps in this procedure may contain installation details.*

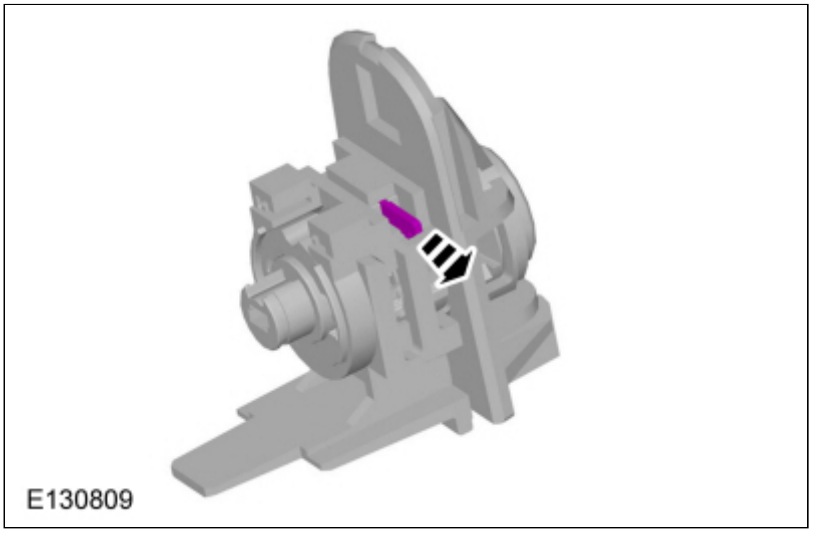
1. Refer to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
2. 

3. 

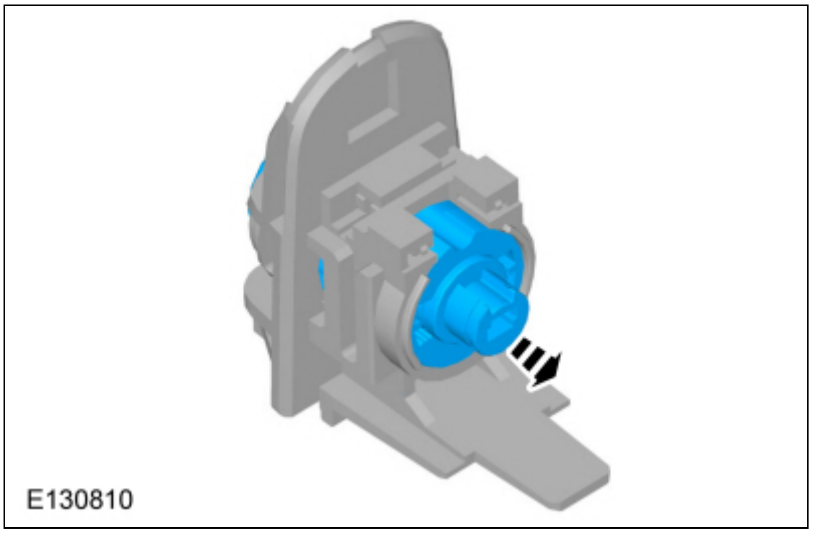
4.



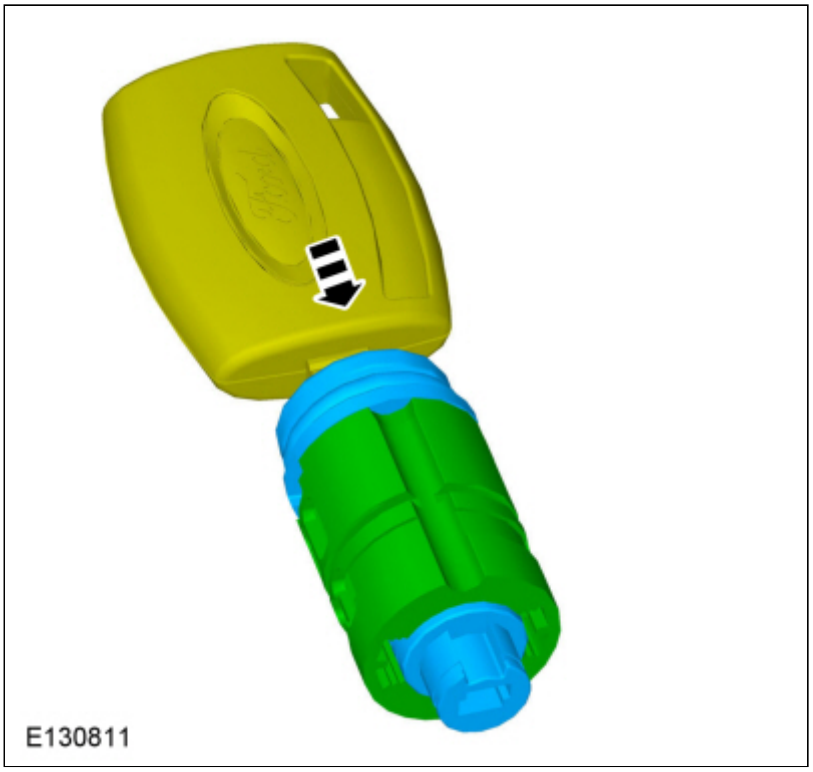
5. Use the General Equipment: 2 mm Punch



6.

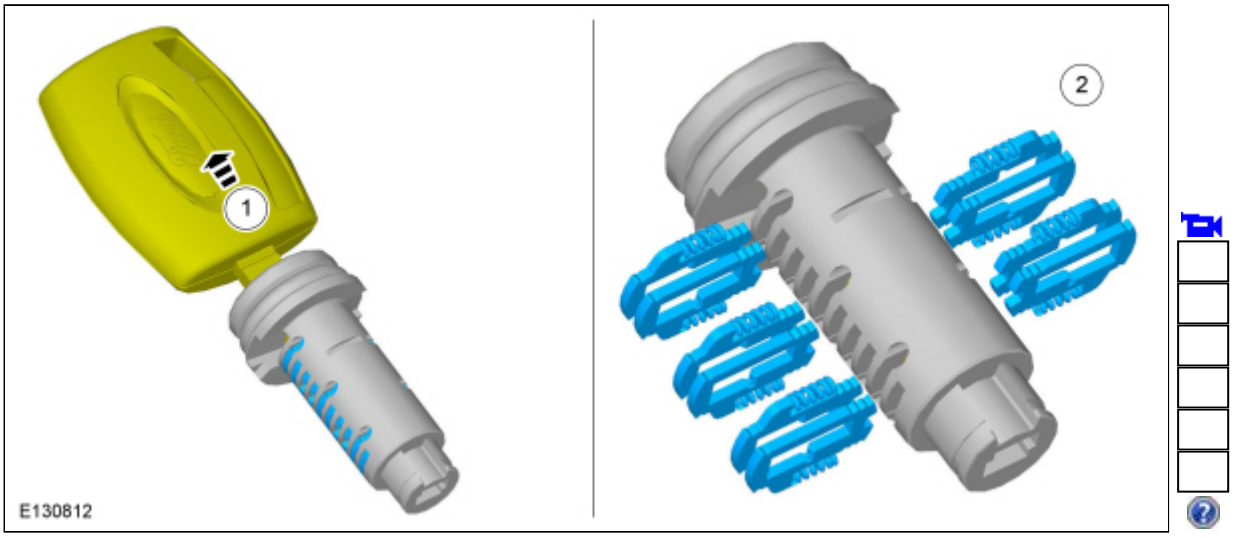


7.



8. **NOTICE: Note the position of the components before removal.**

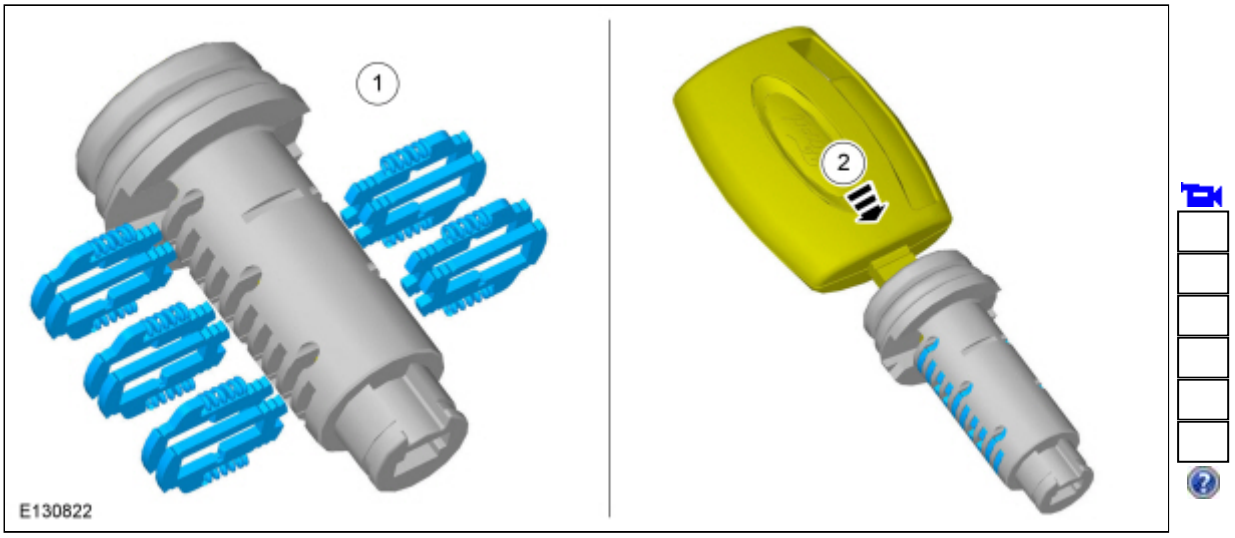
   Make sure to read the key code from the key entry to the end of the lock barrel in sequence.



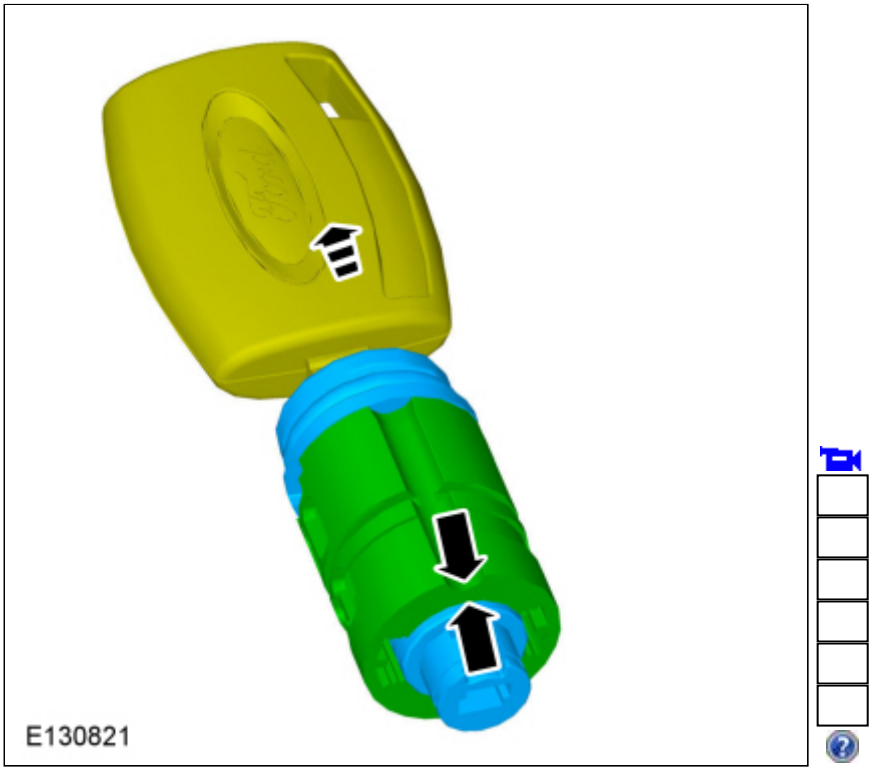
ASSEMBLY

NOTE: *Make sure that new components are installed.*

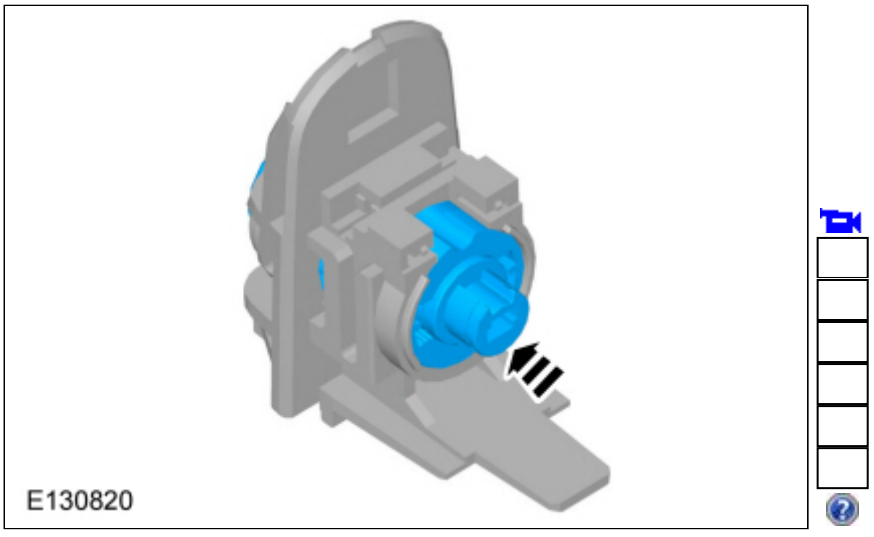
1. **NOTE:** *Make sure that the components are installed to the position noted before removal.*



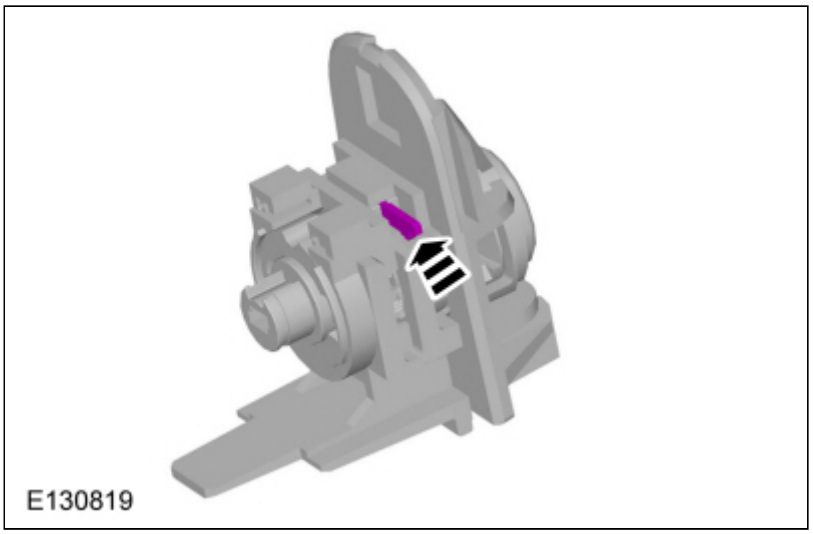
2.



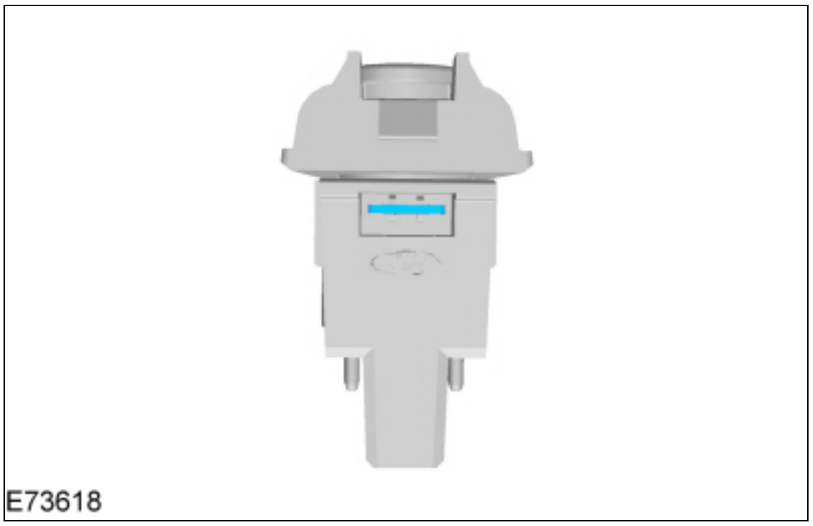
3.



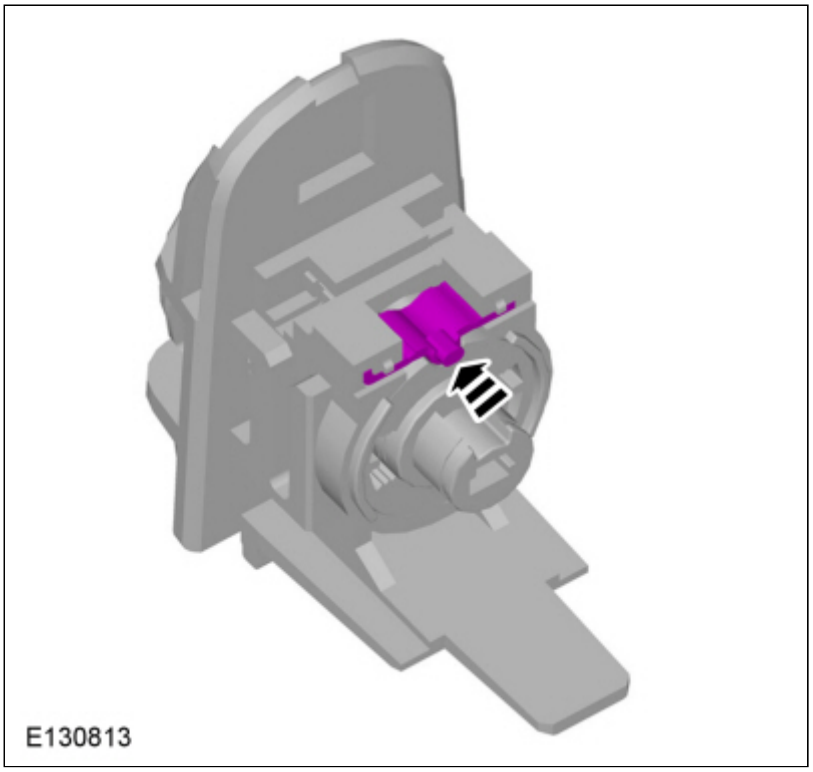
4. Use the General Equipment: 2 mm Punch



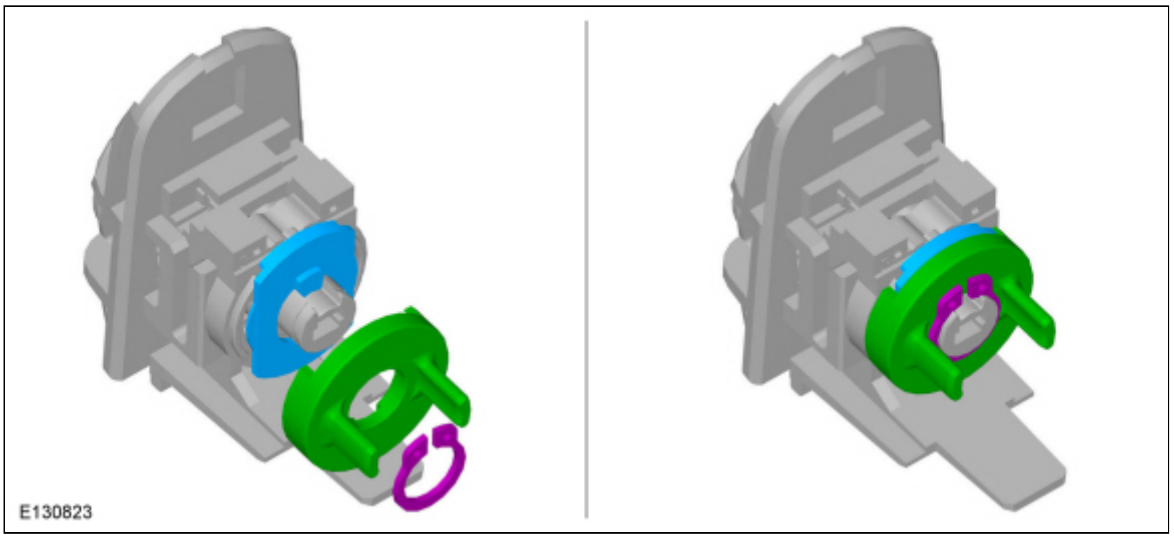
5.



6. **NOTE:** *The component can only be installed in 1 position.*



7.



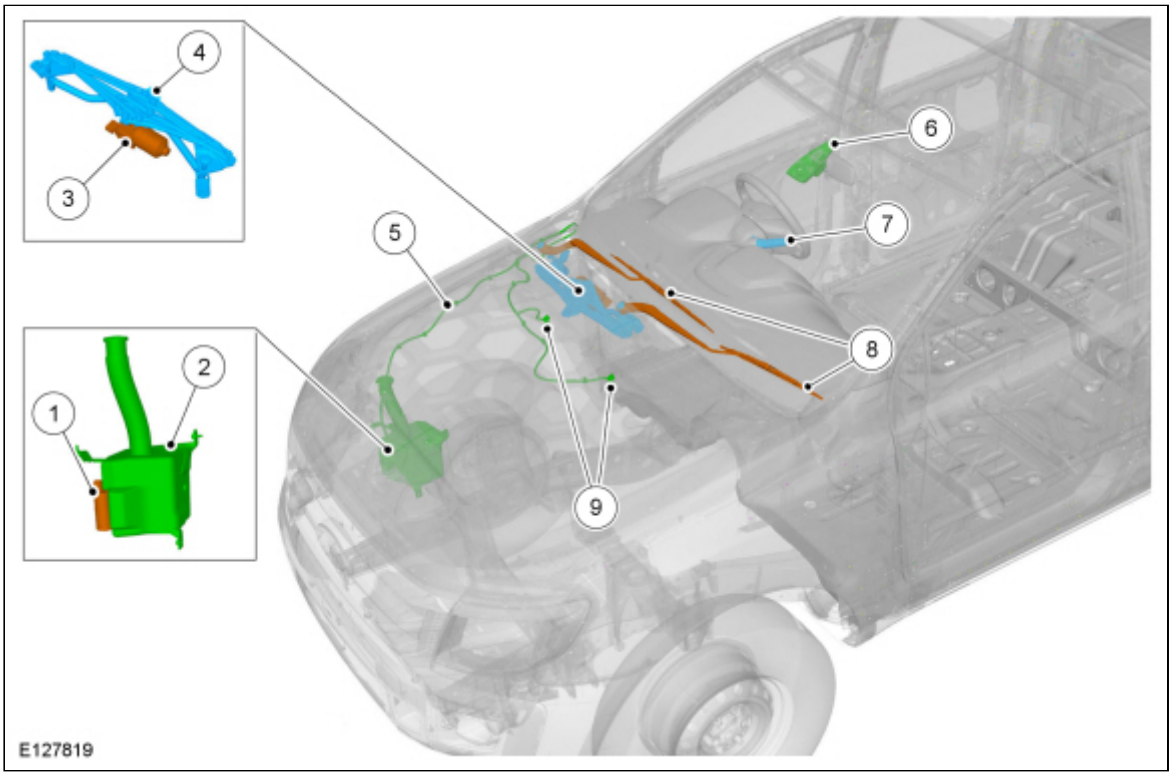
8. To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

Wipers and Washers

NOTICE: The automatic windshield wipers must be switched off before the vehicle is driven into a car wash.

NOTE: *The rain sensor is an optical measuring instrument. Contamination such as oil, grease or dust impair its correct operation. Before switching on the automatic windshield wipers, the windshield must be clean in the area of the rain sensor.*



Item	Part Number	Description
1	—	Windshield washer motor
2	—	Windshield washer tank
3	—	Windshield wiper motor
4	—	Windshield wiper linkage assembly
5	—	Windshield washer hose
6	—	Rain sensor
7	—	Windshield wiper and washer switch
8	—	Windshield wiper pivot arm and blade
9	—	Windshield washer nozzle

There is a mechanical linkage called the windshield wiper linkage assembly (4) between the windshield wiper motor (3) and the windshield wiper pivot arms and blades (8).

The rain sensor (6) is integrated in a housing which is mounted behind the rear view mirror on the windshield.

The rain sensor comprises an opto-electronic measuring and evaluation circuit. A gel-type lens is used as the interface between the rain sensor and the windshield. Depending on the type of rain sensor the gel-type lens can be replaced separately. The sensor can calculate the amount of precipitation falling on the windshield and request that the windshield wipers are switched on.

On the basis of the information provided by the rain sensor, the windshield wipers are then set to the required wipe speed.

The windshield wash/wipe system will only operate if the ignition switch is in the position "I" or "II".

Five wash functions are available: "Off", "Flick-wipe", "Speed 1", "Speed 2" and "Intermittent" or "Automatic wipe" (depending on the vehicle specification).

In "Speed 1" or "Speed 2" mode, the wipers are operating continuously at either normal speed or fast speed.

When the intermittent wipe mode is switched on the windshield wipers operate at normal speed with the following wiper delays:

- Wiper delay 1: 1 second
- Wiper delay 2: 3.5 seconds
- Wiper delay 3: 6 seconds
- Wiper delay 4: 9,5 seconds
- Wiper delay 5: 15.5 seconds
- Wiper delay 6: 22 seconds

NOTE: *In the event of a failure, or if the control resistor is not connected the default time for the wiper delay is 8 seconds.*

The windshield wiper motor contains a 2-speed motor and a wiper run/park circuit. The BCM controls the windshield wiper motor by activating the windshield wiper on/off and low/high speed relays located within the EJB when the ignition is on.

The BCM monitors the windshield wiper run/park circuit. Based on the input, the BCM deactivates the windshield wiper on/off relay to park the wipers on the lower portion of the windshield.

The windshield washer pump is controlled by the BCM. The washer pump delivers washer fluid to the windshield when the BCM activates the front washer relay located within the BCM, which provides voltage to the washer pump. Ground for the washer pump is isolated and located in the fender.

When the windshield washer switch is operated washer fluid is sprayed onto the windshield. After a short delay designed to protect the wiper blades the wipers perform 2 or 3 wipes at low speed.

If when the windshield washer switch is activated the windshield wipers are switched off, then a single wipe is performed 4 seconds after the wipers have returned to the home position after performing the 2 or 3 wipes.

If when the windshield washer switch is activated the wipers are in intermittent mode, and if the selected wiper delay time is longer than 6 seconds, then a single wipe is performed 6 seconds after the wipers have returned to the home position after performing the 2 or 3 wipes. If the selected delay time is less than 6 seconds then no post wipe is required.

The post wipe function on the windshield ensures that any water remaining on the windshield after washing is wiped away. It is only required if the wipers are switched off or they are set to intermittent mode.

Copyright © 2016 Ford Motor Company

Wipers and Washers

DTC Chart: BCM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

BCM DTC Chart

DTC	Description	Action
B130F:12	Run Accessory Control: Circuit Short To Battery	GO to Pinpoint Test A
B130F:14	Run Accessory Control: Circuit Short To Ground or Open	• If the windshield wipers are inoperative, GO to Pinpoint Test A • If the windshield wipers operate with the ignition off, GO to Pinpoint Test D
B10AD:9A	Rain Sensor: Component or System Operating Conditions	DIAGNOSE the symptom present with the wiper/washer system. REFER to the Symptom Chart in this section.
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

DTC Chart: SCCM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

SCCM DTC Chart

DTC	Description	Action
B1008:09	Wiper Mode Switch: Component Failure	• If the windshield wipers are inoperative, INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). CLEAR the DTC and repeat the self-test. If DTC B1008:09 is retrieved again, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation). • If the windshield wipers are on continuously, GO to Pinpoint Test D
B10AD:02	Rain Sensor: General Signal Failure	GO to Pinpoint Test F
B10AD:08	Rain Sensor: Bus Signal / Message Failure	GO to Pinpoint Test F
B10AD:49	Rain Sensor: Internal Electronic Failure	INSTALL a new rain sensor. REFER to: Rain Sensor (501-16 Wipers and Washers, Removal and Installation).

B10AD:55	Rain Sensor: Not Configured	CARRY OUT the Programmable Module Installation (PMI) for the SCCM using as built data.
B1131:01	Wiper motor module: General Electrical Failure	GO to Pinpoint Test B
B1131:02	Wiper motor module: General Signal Failure	GO to Pinpoint Test B
B1131:08	Wiper motor module: Bus Signal / Message Failure	GO to Pinpoint Test B
B1131:9A	Wiper motor module: Component or System Operating Conditions	DIAGNOSE the symptom present with the wiper/washer system. REFER to the Symptom Chart in this section.
B1131:11	Wiper motor module: Circuit Short To Ground	GO to Pinpoint Test B
B1131:49	Wiper motor module: Internal Electronic Failure	If the wiper motor is inoperative, INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
B1131:55	Wiper motor module: Not Configured	CARRY OUT the Programmable Module Installation (PMI) for the SCCM using as built data.
B12F7:09	Single Wipe Switch: Component Failure	• INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). • CLEAR the DTC and repeat the self-test. If DTC B12F7:09 is retrieved again, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
All other Diagnostic Trouble Codes (DTCs)	-	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Column Switches, Diagnosis and Testing).

Symptom Chart

Symptom Chart: Wiper and Washer

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
All windshield wiper modes are inoperative from windshield wiper motor	• Refer to the Pinpoint Test	• GO to Pinpoint Test A
The intermittent and/or low speed windshield wipers are inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test B
The high speed windshield wipers are inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test C
The windshield wipers stay on continuously	• Refer to the Pinpoint Test	• GO to Pinpoint Test D
The windshield wipers do not operate correctly in the	• Refer to the Pinpoint Test	• GO to Pinpoint Test E

intermittent mode		
The rain sensitive wiper feature is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test F
The rain sensitive wipers have erratic/inconsistent operation	• Refer to the Pinpoint Test	• GO to Pinpoint Test F
The rain sensitive wipers are too sensitive/not sensitive enough to moisture	• Refer to the Pinpoint Test	• GO to Pinpoint Test F
The windshield wipers do not park at the correct position	• Refer to the Pinpoint Test	• GO to Pinpoint Test G
The windshield washer is inoperative	• Refer to the Pinpoint Test	• GO to Pinpoint Test H
The windshield washer is always on	• Refer to the Pinpoint Test	• GO to Pinpoint Test I

Pinpoint Tests

All Windshield Wiper Modes Are Inoperative

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B130F:12	Run Accessory Control: Circuit Short To Battery	Sets when the BCM detects a short to voltage from the wiper relay control circuit.
B130F:14	Run Accessory Control: Circuit Short To Ground or Open	Sets when the BCM detects an open from the wiper relay control circuit.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- BJB
- Windshield wiper motor
- SCCM
- BCM

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuses 83 (25A) and 3 (15A) make sure they are OK.

PINPOINT TEST A : ALL WINDSHIELD WIPER MODES ARE INOPERATIVE

A1 CHECK THE WINDSHIELD WIPER MOTOR OPERATION
• Ignition ON.

- Cycle the wiper/washer switch from off through to the low speed setting, and then back to off.

Does the driver side windshield wiper motor operate?

Yes	Check the BJB for an intermittent. If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. GO to A2
No	VERIFY the BJB fuse 83 (25A) is OK. If OK, GO to A5 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. GO to A2

A2 CHECK FOR VOLTAGE TO THE WINDSHIELD WIPER MOTOR

- Ignition OFF.
- Disconnect Windshield Wiper Motor C1656.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-8		Ground

Is the voltage greater than 11 volts?

Yes	GO to A4
No	GO to A3

A3 CHECK THE WINDSHIELD WIPER MOTOR VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BJB C1035A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-8	Ω	C1035A-1

Is the resistance less than 3 ohms?

Yes	INSTALL a new BJB.
No	REPAIR the circuit.

A4 CHECK THE WINDSHIELD WIPER MOTOR GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-6	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A5
No	REPAIR the circuit.

A5 CHECK FOR BCM (BODY CONTROL MODULE) DTC (DIAGNOSTIC TROUBLE CODE) B130F:12 OR B130F:14

- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B130F:12 or B130F:14 present?

Yes	For DTC B130F:12, GO to A6 For DTC B130F:14, GO to A7
No	GO to A9

A6 CHECK THE WIPER RELAY CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect BCM C2280C.
- Disconnect BJB C1035A.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1035A-34		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	INSTALL a new BJB. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If DTC B130F:12 is retrieved again, GO to A15

A7 CHECK FOR WIPER RELAY CONTROL CIRCUIT VOLTAGE TO THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect BCM C2280C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280C-24		Ground

Is the voltage greater than 11 volts?

Yes	GO to A15
No	GO to A8

A8 CHECK THE WIPER RELAY CONTROL CIRCUIT FOR AN OPEN

- Disconnect BJB C1035A

- Disconnect BJB C1035A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280C-24	Ω	C1035A-34

Is the resistance less than 3 ohms?

Yes	INSTALL a new BJB.
No	REPAIR the circuit.

A9 CHECK THE INPUT TO THE SCCM (STEERING COLUMN CONTROL MODULE)

- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, view the following SCCM wiper/washer switch Parameter Identifications (PIDs):
  - WIPE_SINGLE
  - F_WASH_SW
  - F_WIP_INT_D1
  - F_WIP_INT_D2
  - F_WIP_INT_D3
  - F_WIP_INT_D4
  - F_WIP_INT_D5
  - F_WIP_INT_D6
  - F_WIP_SLO_SW
  - F_WIPE_FAST_SW
- Cycle the wiper/washer switch from off to the high speed setting and then back to off.

Do the Parameter Identifications (PIDs) correspond correctly with each setting selection?

Yes	GO to A10
No	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

A10 CHECK FOR VOLTAGE TO THE WINDSHIELD WIPER MOTOR

- Ignition OFF.
- Disconnect Windshield Wiper Motor C1656.
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-8	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to A11
No	GO to A12

A11 CHECK THE WINDSHIELD WIPER MOTOR GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-6	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to A12
No	REPAIR the circuit.

A12 CHECK THE FAIL-SAFE HIGH SPEED WIPER GROUND CIRCUIT CONTROL

NOTICE: The following Pinpoint Test uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250-300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.

- Connect:

Positive Lead	Measurement / Action	Negative Lead
C1656-1		C1656-8

- Ignition ON.
- Place the wiper/washer switch to the high speed setting.

Does the test lamp illuminate?

Yes	INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
No	GO to A13

A13 CHECK THE FAIL-SAFE HIGH SPEED WIPER GROUND CIRCUIT FOR AN OPEN

NOTE: *If steps A1-A17 did not identify the cause of the concern, a double fault is present. After the fail-safe ground is diagnosed and repaired, it is necessary check all operation modes and diagnose any symptom still present.*

- Ignition OFF.
- Disconnect SCCM C226A.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-1	Ω	C226A-2

Is the resistance less than 3 ohms?

Yes	INSTALL a new wiper/washer switch.

	REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to A14
No	REPAIR the circuit.

A14 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all the SCCM and related in-line connectors:
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the SCCM connectors. Make sure they seat and latch correctly.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

A15 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM and related in-line connectors:
- Repair:
  - corrosion (install new connector or terminals – clean module pins)
  - damaged or bent pins – install new terminals/pins
  - pushed-out pins – install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. LHD refer to REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). RHD refer to REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

The Intermittent And/Or Low Speed Windshield Wipers Are Inoperative

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

SCCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1131:02	Wiper motor module: General Signal Failure	Sets when the SCCM detects a communication fault with the windshield wiper motor over the LIN.
B1131:08	Wiper motor module: Bus Signal / Message Failure	Sets when the SCCM detects a communication fault with the windshield wiper motor over the LIN.
B1131:11	Wiper motor module: Circuit Short to Ground	Sets when the SCCM detects a short to ground from the windshield wiper motor LIN.

Possible Sources

- Wiring, terminals or connectors
- Wiper/washer switch
- windshield wiper motor
- Rain sensor
- SCCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the wiper/washer switch for damage.

PINPOINT TEST B : THE INTERMITTENT AND/OR LOW SPEED WINDSHIELD WIPERS ARE INOPERATIVE

NOTE: *It may be necessary to disconnect and then reconnect the battery after the repair to enable the wiper operation.*

B1 CHECK THE HIGH SPEED WIPER OPERATION

- Ignition ON.
- Place the wiper/washer switch to the high speed setting and observe the windshield wipers. Place the wiper/washer switch to the off setting.

Do the windshield wipers operate with the wiper/washer switch in the high speed setting?

Yes	GO to B2
No	GO to Pinpoint Test A

B2 CHECK THE LOW SPEED WIPER OPERATION

- Place the wiper/washer switch to the low speed setting and observe the windshield wipers. Place the wiper/washer switch to the off setting.

Do the windshield wipers operate with the wiper/washer switch in the low speed setting?

Yes	If not equipped with a rain sensor, GO to Pinpoint Test E If equipped with a rain sensor, GO to Pinpoint Test F
No	GO to B3

B3 CHECK THE INPUT TO THE SCCM (STEERING COLUMN CONTROL MODULE)

- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, view the following SCCM F_WIP_SLO_SW PID.
- Place the wiper/washer switch to the low speed setting.

Does the PID indicate the wiper/washer switch is in the low speed setting?

Yes	If equipped with a rain sensor, GO to B4 If not equipped with a rain sensor, GO to B5
No	INSTALL a new wiper/washer switch.

	REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

B4 ISOLATE THE RAIN SENSOR

- Ignition OFF.
- Disconnect Rain Sensor For Lane Keeping Assist (LKA) refer to C9805, Without LKA refer toC914.
- Ignition ON.
- Place the wiper/washer switch to the low speed setting and observe the windshield wipers. Place the wiper/washer switch to the off setting.

Do the windshield wipers operate with the wiper/washer switch in the low speed setting?

Yes	INSTALL a new rain sensor. REFER to: Rain Sensor (501-16 Wipers and Washers, Removal and Installation).
No	GO to B5

B5 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Driver Side Windshield Wiper Motor C1656..
- Disconnect SCCM C226A..
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-4		Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to B6

B6 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-4	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to B7
No	REPAIR the circuit.

B7 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-4	Ω	C226A-8

Is the resistance less than 3 ohms?

Yes	INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to B8
No	REPAIR the circuit.

B8 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The High Speed Windshield Wipers Are Inoperative

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Possible Sources

- Driver side windshield wiper motor
- Wiper/washer switch
- SCCM

PINPOINT TEST C : THE HIGH SPEED WINDSHIELD WIPERS ARE INOPERATIVE

C1 CHECK THE INPUT TO THE SCCM (STEERING COLUMN CONTROL MODULE)

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, view the SCCM F_WIPE_FAST_SW PID.
- Place the wiper/washer switch to the high speed setting.

Does the PID indicate the wiper/washer switch is in the high speed setting?

Yes	INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
No	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

The Windshield Wipers Stay On Continuously

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

BCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B130F:14	Run Accessory Control: Circuit Short To Ground or Open	Sets when the BCM detects a short to ground from the wiper relay control circuit.

Possible Sources

- Wiring, terminals or connectors
- Wiper/washer switch
- BJB
- windshield wiper motor
- SCCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the wiper/washer switch for damage.

PINPOINT TEST D : THE WINDSHIELD WIPERS STAY ON CONTINUOUSLY

D1 CHECK THE WINDSHIELD WIPER OPERATION WITH THE IGNITION OFF

- Ignition OFF.
- Observe the windshield wiper operation.

Do the windshield wipers operate with the ignition off?

Yes	GO to D5
No	GO to D3

D2 CHECK THE WINDSHIELD WIPER OPERATION WITH THE SCCM (STEERING COLUMN CONTROL MODULE) DISCONNECTED

- Ignition ON.
- Disconnect SCCM C226A.

- Ignition ON.
- Observe the windshield wiper operation.

Do the windshield wipers continue to operate?

Yes	GO to D3
No	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, GO to D9

D3 CHECK THE HIGH SPEED FAIL-SAFE CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Driver Side Windshield Wiper Motor C1656.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-1	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
No	REPAIR the circuit.

D4 CHECK FOR BCM (BODY CONTROL MODULE) DTC (DIAGNOSTIC TROUBLE CODE) B130F:14

- Ignition ON.
- Using a diagnostic scan tool, perform the BCM self-test.

Is DTC B130F:14 present?

Yes	GO to D5
No	If equipped with a rain sensor, GO to D7 If not equipped with a rain sensor,GO to D8

D5 ISOLATE THE BCM (BODY CONTROL MODULE)

- Ignition OFF.
- Disconnect BCM C2280C.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280C-24	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to D10
No	GO to D6

D6 CHECK THE WIPER RELAY CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect BJB C1035B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280C-24	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new BJB.
No	REPAIR the circuit.

D7 CHECK THE RAIN SENSOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Rain Sensor without Lane Keeping Assistance (LKA) C914.
- Disconnect Rain Sensor with Lane Keeping Assistance (LKA) C9805.
- Measure:

Rain Sensor without LKA

Positive Lead	Measurement / Action	Negative Lead
C914-1	V	Ground

Rain Sensor with LKA

Positive Lead	Measurement / Action	Negative Lead
C9805-4	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to D8

D8 CHECK THE WINDSHIELD WIPER MOTOR VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C1656-8	V	Ground

Is any voltage present?

Yes	REPAIR the circuit.
No	INSTALL a new BJB.

D9 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the SCCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

D10 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Disconnect and inspect all the BCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the BCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. For RHD: REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). For LHD: REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Windshield Wipers Do Not Operate Correctly In The Intermittent Mode

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Possible Sources

- Wiper/washer switch
- windshield wiper motor
- SCCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the wiper/washer switch for damage.

PINPOINT TEST E : THE WINDSHIELD WIPERS DO NOT OPERATE CORRECTLY IN THE INTERMITTENT MODE

E1 VERIFY IF THE VEHICLE IS EQUIPPED WITH A RAIN SENSOR

- Inspect the vehicle for a rain sensor.

Is the vehicle equipped with a rain sensor?

Yes	GO to E2
No	GO to E3

E2 VERIFY THE RAIN SENSITIVE WIPER FEATURE IS DISABLED IN THE VEHICLE MESSAGE CENTER

- Ignition ON.
- Access the vehicle settings in the message center using the steering wheel controls and check the rain sensitive feature setting.

Is the rain sensitive feature enabled?

Yes	GO to Pinpoint Test F
No	GO to E3

E3 CHECK THE LOW SPEED WIPER OPERATION

- Ignition ON.
- Place the wiper/washer switch to the low speed setting and observe the windshield wipers. Place the wiper/washer switch to the off setting.

Do the low speed wipers operate when the low speed setting is selected?

Yes	GO to E4
No	GO to Pinpoint Test B

E4 CHECK THE INPUT FROM THE WIPER/ WASHER SWITCH

- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, view the following SCCM wiper/washer switch Parameter Identifications (PIDs):
  - F_WIP_INT_D1
  - F_WIP_INT_D2
  - F_WIP_INT_D3
  - F_WIP_INT_D4
  - F_WIP_INT_D5
  - F_WIP_INT_D6
- Cycle the wiper/washer switch from off through each of the intermittent settings.

Do the PIDs correspond correctly with each setting selection?

Yes	INSTALL a new windshield wiper motor. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation).
No	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation).

	TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

The Rain Sensitive Wiper Feature Is Inoperative/Does Not Operate Correctly

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

SCCM DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B10AD:02	Rain Sensor: General Signal Failure	Sets when the SCCM detects a communication fault with the rain sensor.
B10AD:08	Rain Sensor: Bus Signal / Message Failure	Sets when the SCCM detects a communication fault with the rain sensor.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Rain sensitive feature not enabled
- Foreign material on windshield, such as dirt, dust or bugs
- Wiper blades
- Windshield glass
- Wiper/washer switch
- Windshield wiper motor
- Rain sensor gel-type lens
- Rain sensor
- SCCM

Visual Inspection and Diagnostic Pre-checks

- Inspect BJB fuse 3 (15A) and make sure it is OK.
- Inspect the windshield for damage.
- Inspect the rain sensor mounting for damage.

PINPOINT TEST F : THE RAIN SENSITIVE WIPER FEATURE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

F1 CHECK THE LOW SPEED WIPER OPERATION

- Ignition ON.
- Place the wiper/washer switch to the low speed setting and observe the windshield wipers. Place the wiper/washer switch to the off setting.

Do the low speed wipers operate when the low speed setting is selected?

Yes	GO to F2
No	GO to Pinpoint Test B

F2 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) B10AD:02 OR B10AD:08

- Using a diagnostic scan tool, perform the SCCM self-test.

Are any Diagnostic Trouble Codes (DTCs) present?

Yes	For DTC B10AD:02 or B10AD:08, GO to F11 For all other Diagnostic Trouble Codes (DTCs), REFER to the SCCM DTC Chart in this section.
No	GO to F3

F3 VERIFY THE RAIN SENSITIVE WIPER FEATURE IS ENABLED IN THE VEHICLE MESSAGE CENTER

- Access the vehicle settings in the message center using the steering wheel controls. Make sure the rain sensitive feature is enabled.

Is the rain sensitive feature enabled?

Yes	GO to F4
No	ENABLE the rain sensitive feature. INFORM the customer how to enable/disable the rain sensitive feature.

F4 CHECK THE INPUT FROM THE WIPER/WASHER SWITCH

- Using a diagnostic scan tool, monitor the following SCCM wiper/washer switch PIDs:
  - F_WIP_INT_D1
  - F_WIP_INT_D2
  - F_WIP_INT_D3
  - F_WIP_INT_D4
  - F_WIP_INT_D5
  - F_WIP_INT_D6
- Cycle the wiper/washer switch from off through each of the auto/intermittent sensitivity settings.

Do the Parameter Identifications (PIDs) correspond correctly with each setting selection?

Yes	GO to F5
No	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

F5 CHECK THE WINDSHIELD FOR DAMAGE

- Ignition OFF.
- Inspect the windshield glass for any cracks, pits or other visible damage around the area of the rain sensor.

Is any windshield damage present near the area of the rain sensor?

Yes	INSTALL a new windshield. REFER to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation). .
No	GO to F6

F6 CHECK THE WINDSHIELD GLASS FOR STREAKING

- Ignition ON.

- Turn the wiper/washer switch to the low speed wiper setting and while applying water to the windshield surface. Observe the wipe quality, especially around the area of the rain sensor.

Is any streaking present on the windshield around the area of the rain sensor?

Yes	GO to F7
No	GO to F9

F7 CHECK THE WINDSHIELD WIPER BLADES FOR STREAKING

- Ignition OFF.
- Clean the windshield glass with glass cleaner.
- Clean the wiper blades with isopropyl alcohol swabs. Wipe the entire length of the wiper blades.
- Ignition ON.
- Place the wiper/washer switch to the low speed wiper setting and while applying water to the windshield surface. Observe the wipe quality, especially around the area of the rain sensor.

Was there noticeable improvement in the wipe quality after cleaning the glass and the wiper blades?

Yes	GO to F8
No	INSTALL new wiper blades. GO to F8

F8 RECHECK THE RAIN SENSITIVE WIPERS OPERATION

- Place the wiper/washer switch to the auto/intermittent 5 setting (most sensitive to moisture) while applying water on the windshield above the rain sensor.

Do the wipers operate when water is applied to the windshield surface?

Yes	The system is operating correctly at this time. The concern may have been caused by poor wipe quality on the windshield around the rain sensor.
No	GO to F9

F9 CHECK FOR THE PRESENCE OF THE LENS GEL

- Ignition OFF.
- Lightly press the rain sensor against the windshield and release the rain sensor clips.

Does the rain sensor remain adhered to the windshield?

Yes	ATTACH the retaining clips. GO to F10
No	The sensor gel-type lens is missing or damaged. INSTALL a new rain sensor. REFER to: Rain Sensor (501-16 Wipers and Washers, Removal and Installation).

F10 INSPECT THE RAIN SENSOR MOUNTING AREA

NOTE: *The rain sensor gel-type lens can be damaged or contaminated during rain sensor removal, rain sensor bracket separation or incorrect installation.*

- From the outside of the vehicle, inspect the area of the windshield glass where the rain sensor is mounted. The rain sensor contact area should appear black, with no bubbles, air pockets or contaminants between the windshield glass and the rain sensor.

Does the rain sensor contact area appear black, with no bubbles, air pockets or contaminants between the windshield glass and the rain sensor?

Yes	GO to F11
No	REMOVE and INSTALL the rain sensor correctly.

	REFER to: Rain Sensor (501-16 Wipers and Washers, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

F11 CHECK FOR VOLTAGE TO THE RAIN SENSOR

- Ignition OFF.
- Disconnect Rain Sensor with Lane Keeping Assist (LKA) C9805, Rain Sensor without Lane Keeping Assist (LKA) C914.
- Ignition ON.
- Measure:

Rain Sensor without LKA

Positive Lead	Measurement / Action	Negative Lead
C914-1	V	Ground

Rain Sensor with LKA

Positive Lead	Measurement / Action	Negative Lead
C9805-4	V	Ground

Is the voltage greater than 11 volts?

Yes	GO to F13
No	VERIFY BJB fuse 3 (15A) is OK. If OK, GO to F12 If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short.

F12 CHECK THE RAIN SENSOR VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect BJB C1035B.
- Measure:

Rain Sensor without LKA

Positive Lead	Measurement / Action	Negative Lead
C914-1	Ω	C1035B-12

Rain Sensor with LKA

Positive Lead	Measurement / Action	Negative Lead
C9805-4	Ω	C1035B-12

Is the resistance less than 3 ohms?

Yes	INSTALL a new BJB.
No	REPAIR the circuit.

F13 CHECK THE RAIN SENSOR GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure:

Rain Sensor without LKA

Positive Lead	Measurement / Action	Negative Lead
C914-3	Ω	Ground

Rain Sensor with LKA

Positive Lead	Measurement / Action	Negative Lead
C9805-6	Ω	Ground

Rain Sensor with LKA at mirror flylead of harness

Positive Lead	Measurement / Action	Negative Lead
C9805-3	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to F14
No	REPAIR the circuit.

F14 CHECK THE LIN (LOCAL INTERCONNECT NETWORK) CIRCUIT FOR AN OPEN

- Disconnect SCCM C226A.
- Measure:

Rain Sensor without LKA

Positive Lead	Measurement / Action	Negative Lead
C914-2	Ω	C226A-8

Rain Sensor with LKA

Positive Lead	Measurement / Action	Negative Lead

C9805-5	Ω	C226A-8

Rain Sensor with LKA at mirror flylead of harness

Positive Lead	Measurement / Action	Negative Lead
C9805-2	Ω	Ground

Is the resistance less than 3 ohms?

Yes	GO to F15
No	REPAIR the circuit.

F15 CHECK FOR CORRECT SCCM (STEERING COLUMN CONTROL MODULE) OPERATION

- Disconnect and inspect all the SCCM and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect all the SCCM connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Windshield Wipers Do Not Park At The Correct Position

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Possible Sources

- Wiper mounting arm and pivot shaft
- Windshield wiper motor

Visual Inspection and Diagnostic Pre-checks

- Inspect the mounting arm and pivot shaft for damage.

PINPOINT TEST G : THE WINDSHIELD WIPERS DO NOT PARK AT THE CORRECT POSITION

G1 CHECK THE WIPER MOUNTING ARM AND PIVOT SHAFT FOR DAMAGE

- Ignition OFF.
- Inspect the wiper mounting arm and pivot shaft for damage.

Is the wiper mounting arm and pivot shaft OK?

Yes	GO to G2
No	INSTALL a wiper mounting arm and pivot shaft. REFER to: Windshield Wiper Pivot Arm (501-16 Wipers and Washers, Removal and Installation).

G2 CHECK THE WINDSHIELD WIPER PARK RELAY OPERATION

- Ignition ON.
- Place the wiper/washer switch to the low speed setting. When the wiper blades are in the middle of a wipe, place the wiper/washer switch off.

Do the windshield wipers immediately stop when the wiper/washer switch is turned off?

Yes	INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
No	ADJUST the pivot arms. REFER to: Windshield Wiper Blade and Pivot Arm Adjustment (501-16 Wipers and Washers, General Procedures).

The Windshield Washer Is Inoperative

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Possible Sources

- Wiring, terminals or connectors
- Washer pump
- Wiper/washer switch
- Windshield wiper motor
- SCCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the wiper/washer switch for damage.

PINPOINT TEST H : THE WINDSHIELD WASHER IS INOPERATIVE

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK THE AMBIENT AIR TEMPERATURE

- Check the ambient air temperature.

Is the ambient air temperature below freezing?

Yes	GO to H2
No	GO to H4

H2 CHECK THE WASHER SOLVENT

- Check the washer solvent and make sure it is of the correct type to use for the temperature conditions present.

Is the correct type of washer solvent present?

Yes	GO to H3
No	ALLOW the vehicle to warm to room temperature. DRAIN and REFILL the windshield washer reservoir with the correct washer solvent type. INFORM the customer of the correct type of washer solvent to use for the temperature conditions present.

H3 CHECK FOR WASHER SOLVENT TO THE WASHER JETS

- Disconnect the washer hoses from the windshield washer jets and place them in a container to capture fluid.
- Ignition ON.
- Momentarily activate the windshield washer function.

Is washer fluid emitted at the washer hoses?

Yes	INSTALL a new washer jet in question.
No	GO to H4

H4 CHECK FOR WASHER PUMP ACTIVATION

- Ignition ON.
- Momentarily activate the windshield washer function. While listening for washer pump activation near the right front of the vehicle, have an assistant activate the windshield washer function.

Does the washer pump activate?

Yes	GO to H5
No	GO to H6

H5 CHECK FOR DAMAGED WASHER HOSES

- Inspect the washer hoses for kinks or damage.

Are the washer hoses OK?

Yes	INSTALL a new washer pump. REFER to: Windshield Washer Pump (501-16 Wipers and Washers, Removal and Installation).
No	REPAIR the washer hoses as necessary.

H6 CHECK THE WIPER/WASHER SWITCH INPUT

- Ignition ON.
- Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs).
- Using a diagnostic scan tool, view the SCCM F_WASH_SW PID.
- Activate and release the wash function on the wiper/washer switch.

Does the PID indicate correctly when the switch is activated and released?

Yes	GO to H7
No	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

H7 CHECK FOR VOLTAGE TO THE WASHER PUMP

NOTICE: The following Pinpoint Test uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250-300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.

- Ignition OFF.
- Disconnect Washer Pump C137.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C137-1		Ground

- Ignition ON.
- Use the wiper/washer switch to activate the washer pump.

Does the test lamp illuminate when the washer is activated?

Yes	GO to H8
No	GO to H9

H8 CHECK THE WASHER PUMP GROUND CIRCUIT FOR AN OPEN

NOTICE: The following Pinpoint Test uses a test lamp to simulate normal circuit loads. Use only a Rotunda Test Lamp (SGT27000) or 250-300mA incandescent bulb test lamp. To avoid connector terminal damage, use the Rotunda Flex Probe kit for the test lamp probe connection to the vehicle. Do not use the test lamp probe directly on any connector.

- Connect:

Positive Lead	Measurement / Action	Negative Lead
C137-1		C137-2

- Ignition ON.
- Use the wiper/washer switch to activate the washer pump.

Does the test lamp illuminate when the washer is activated?

Yes	INSTALL a new washer pump. REFER to: Windshield Washer Pump (501-16 Wipers and Washers, Removal and Installation).
No	REPAIR the circuit.

H9 CHECK THE WASHER PUMP VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Windshield Wiper Motor C1656.
- Connect:

Positive Lead	Measurement / Action	Negative Lead
C1656-8	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to H10
No	REPAIR the circuit.

H10 CHECK THE WASHER PUMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Connect:

Positive Lead	Measurement / Action	Negative Lead
C1656-7	Ω	C137-1

Is the resistance less than 3 ohms?

Yes	GO to H11
No	REPAIR the circuit.

H11 CHECK FOR CORRECT WINDSHIELD WIPER MOTOR OPERATION

- Disconnect and inspect the windshield wiper motor and related in-line connectors.
- Repair:
  - corrosion (install new connector or terminal - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Reconnect the windshield wiper motor connector. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW the TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new windshield wiper motor. REFER to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. ADDRESS the root cause of any connector or pin issues.

The Windshield Washer Is Always On

Refer to Wiring Diagrams Cell 81 for schematic and connector information.

Normal Operation and Fault Conditions

REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Possible Sources

- Wiper/washer switch
- Windshield wiper motor
- SCCM

Visual Inspection and Diagnostic Pre-checks

- Inspect the wiper/washer switch for damage.

PINPOINT TEST I : THE WASHER PUMP IS ALWAYS ON

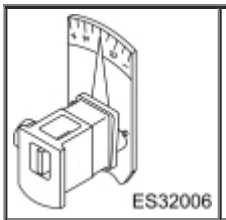
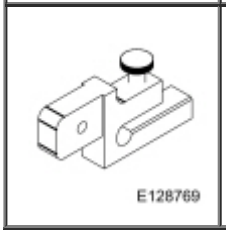
I1 CHECK THE WIPER/WASHER SWITCH INPUT
• Ignition ON. • Using a diagnostic scan tool, view the SCCM Parameter Identifications (PIDs). • Using a diagnostic scan tool, view the SCCM F_WASH_SW PID. **Does the PID indicate correctly when the switch is activated and released?**

Yes	INSTALL a new wiper/washer switch. REFER to: Steering Column Multifunction Switch RH (211-05 Steering Column Switches, Removal and Installation). TEST the system for normal operation. If the concern is still present, INSTALL a new SCCM. REFER to: Steering Column Control Module (SCCM) (211-05 Steering Column Switches, Removal and Installation).

Copyright © 2016 Ford Motor Company

Windshield Wiper Blade and Pivot Arm Adjustment

Special Tool(s) / General Equipment

	501-027 Aligner, Wiper Arm
	501-027-02 Adapter for 501-027

Adjustment

1. **NOTICE: Make sure that the wiper motor is in the park position.**

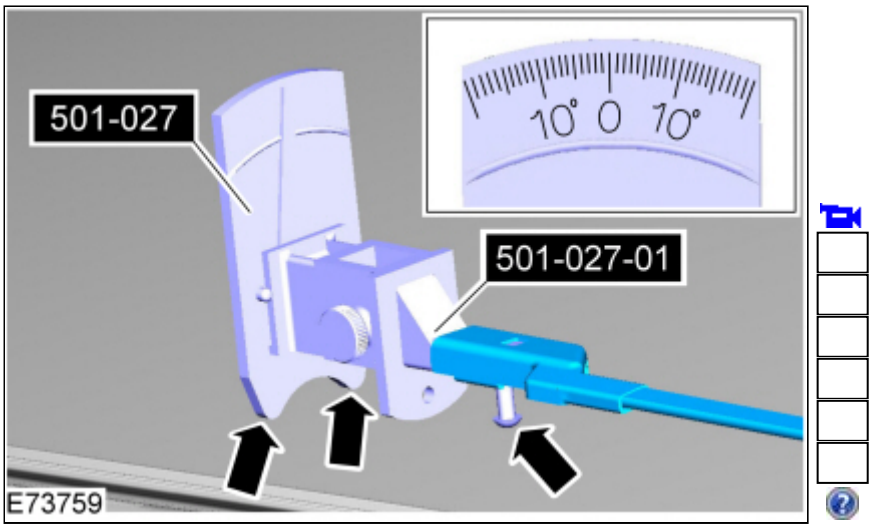
   Remove the wiper blade.

2. **NOTE:** *The angle of the wiper on the scale must point from the zero centre line to the centre of the windshield/rear window. The alignment tool shows negative (-) for LHD and positive (+) for RHD.*

3. **NOTE:** *LHD shown, reverse for RHD.*

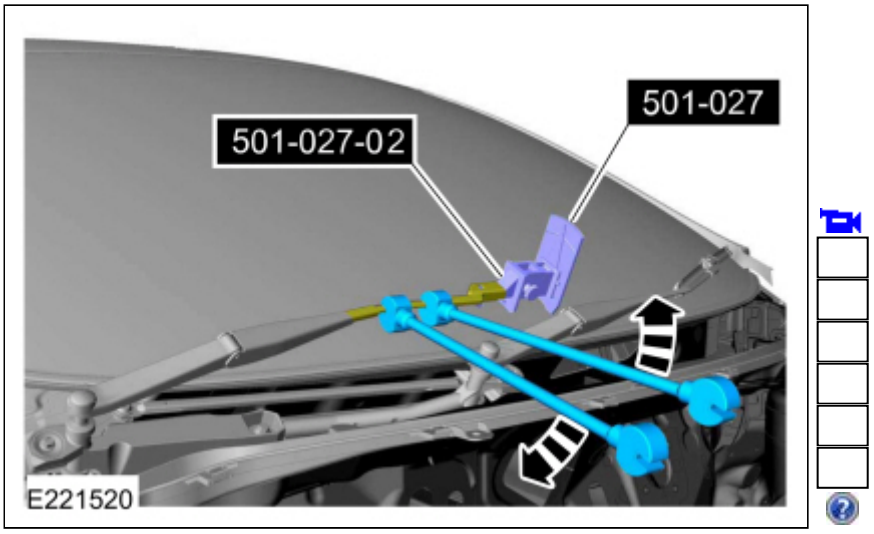
   NOTE: *Make sure that the 3 marked points of the special tool are in contact with the glass.*

   Using the special tool, read off the angle between the wiper arm and the glass.
   Use Special Service Tool: 501-027 Aligner, Wiper Arm.



4. **NOTICE: Make sure that the special tool is lifted off the glass when adjusting the angle.**

   Driver side : 4.8° ± 3° ; Passenger side 3.8° ± 3°
   Use Special Service Tool: 501-027 Aligner, Wiper Arm. , 501-027-02 Adapter for 501-027.



Copyright © 2016 Ford Motor Company

Wiper Park Position Adjustment

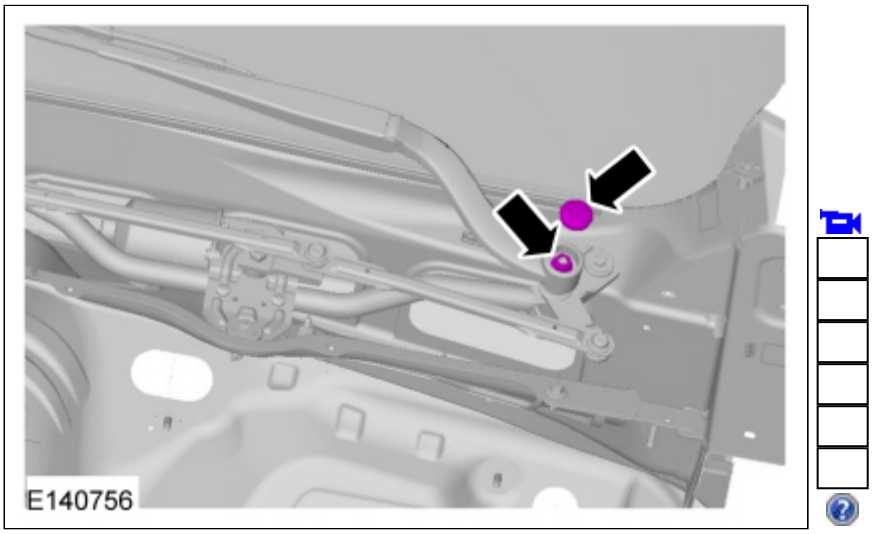
Special Tool(s) / General Equipment

Two Leg Puller

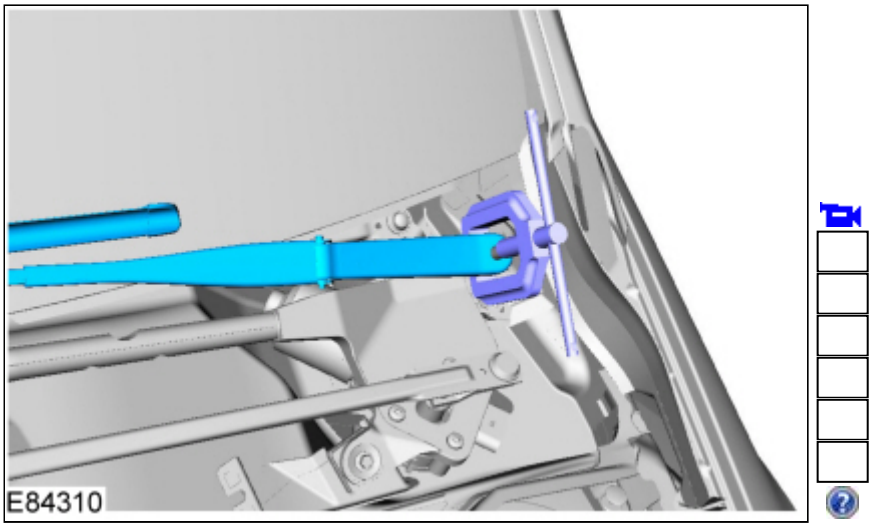
Adjustment

NOTICE: Make sure that the motor is in the park position.

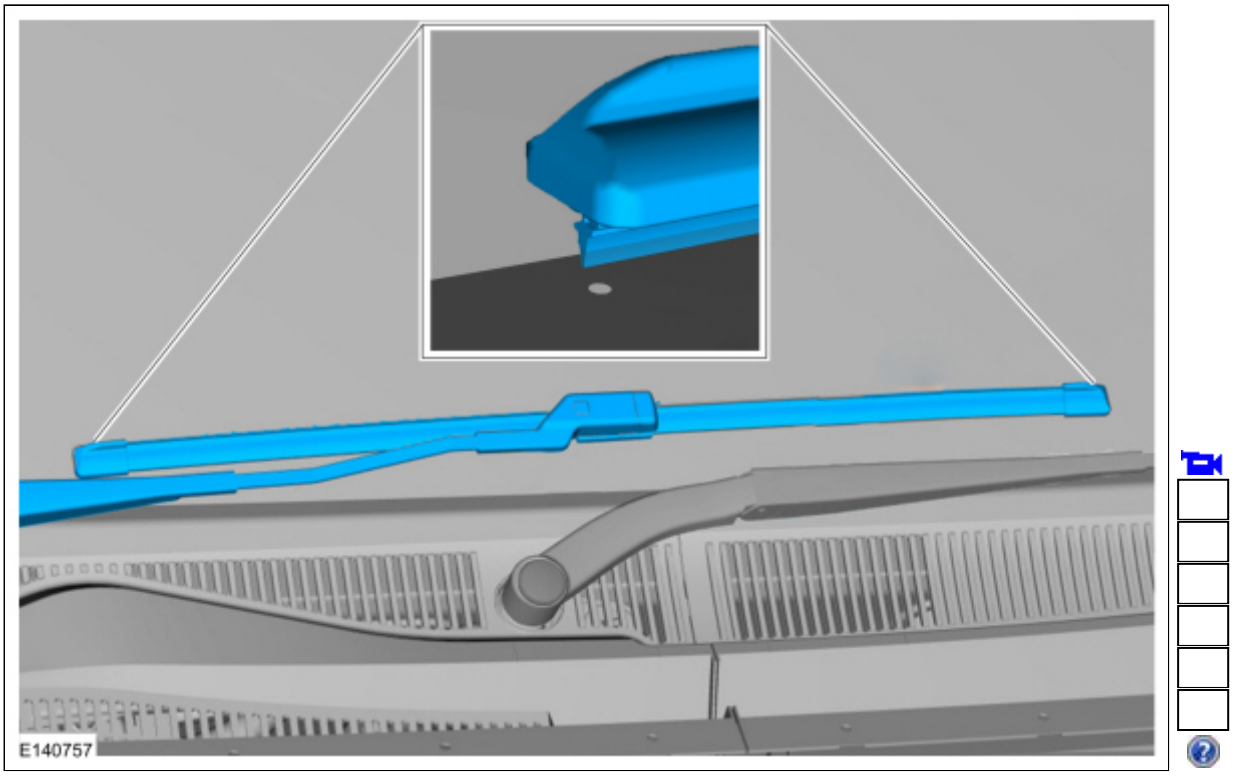
1.



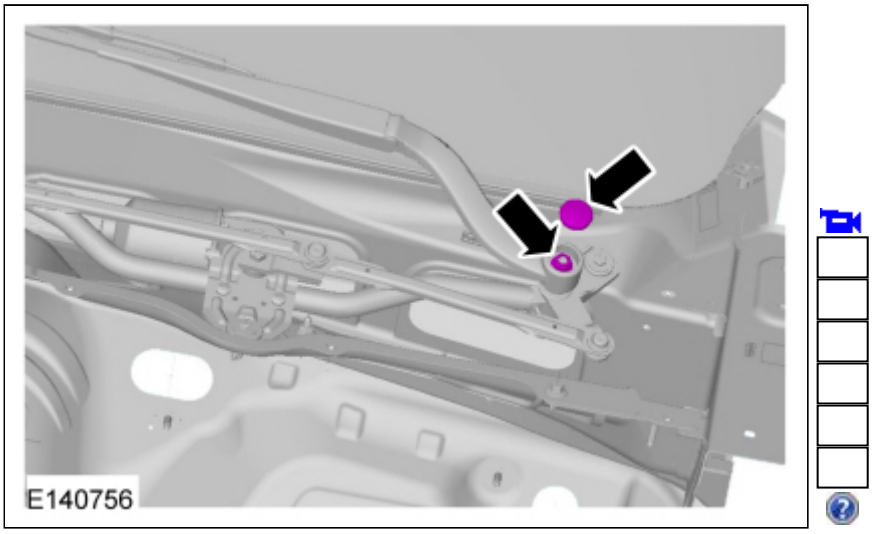
2. Use the General Equipment: Two Leg Puller



3. Make sure that the wiper blades align with the alignment marks.



4. *Torque*: 23 Nm



5. Refer to: Windshield Wiper Blade and Pivot Arm Adjustment (501-16 Wipers and Washers) .

Copyright © 2016 Ford Motor Company

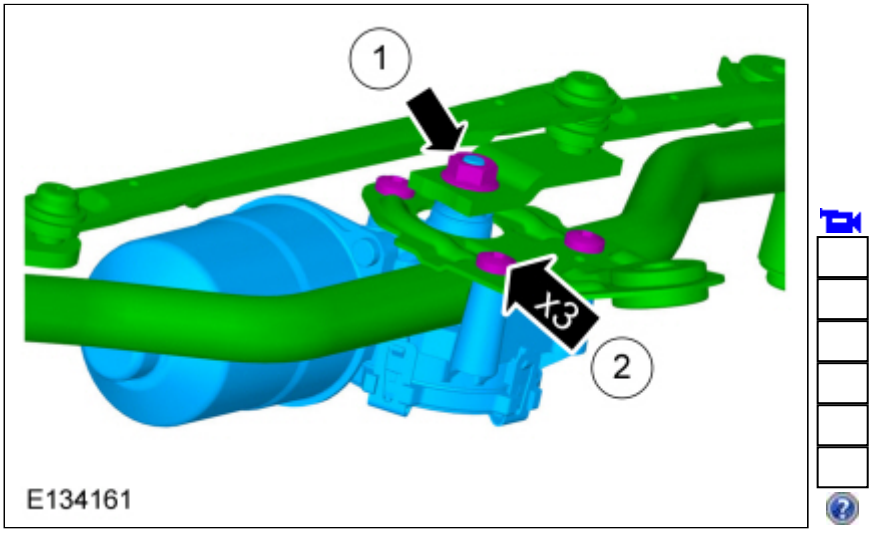
Windshield Wiper Motor

Base Part Number: 17508

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Wiper Linkage Assembly (501-16 Wipers and Washers, Removal and Installation).
2. *Torque*:
   1: 9 Nm



Installation

1. To install, reverse the removal procedure.

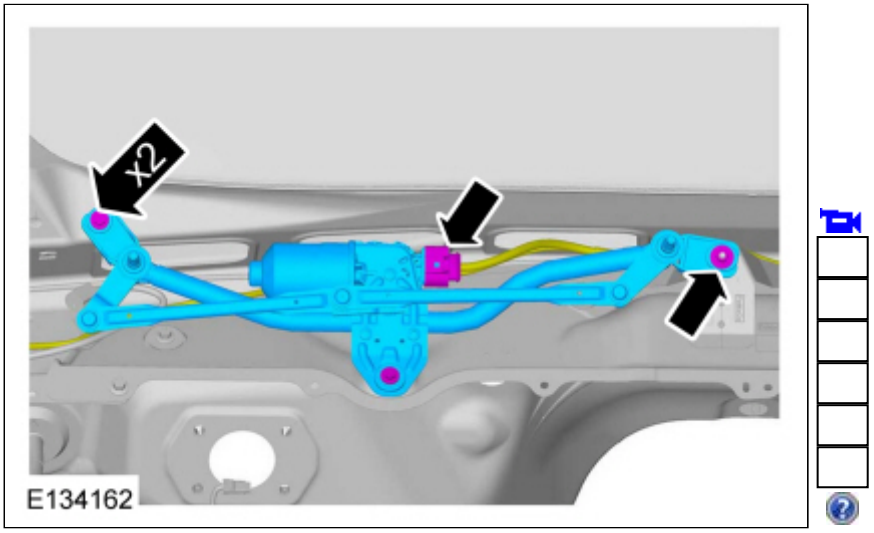
Copyright © 2016 Ford Motor Company

Wiper Linkage Assembly

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
3. *Torque*: 11 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

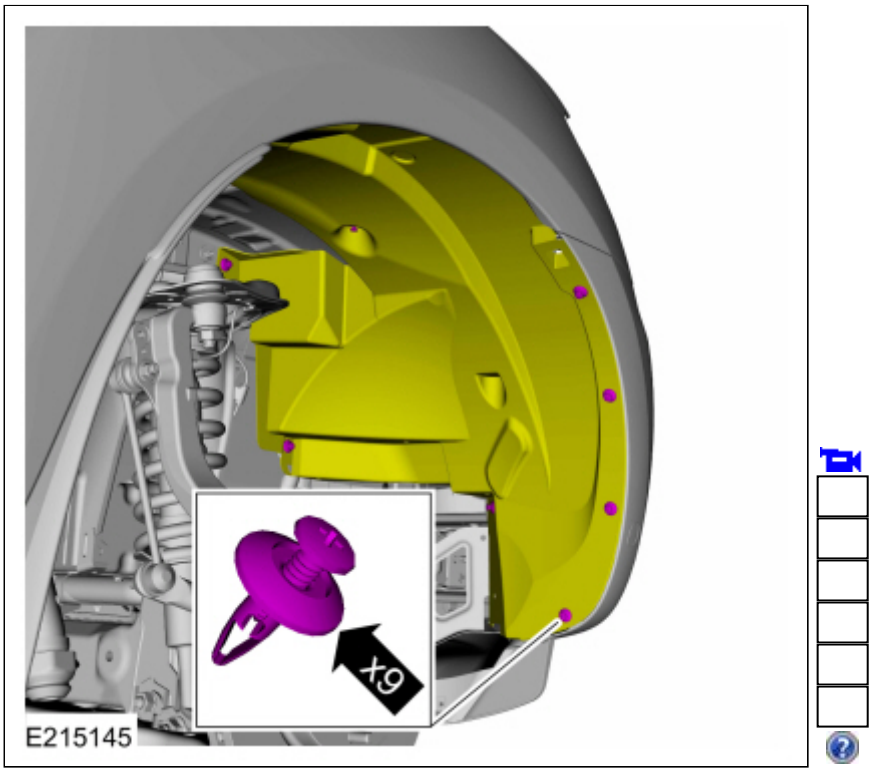
Windshield Washer Reservoir

Removal

NOTICE: When servicing the windshield washer pump, be careful not to damage the windshield washer pump seal.

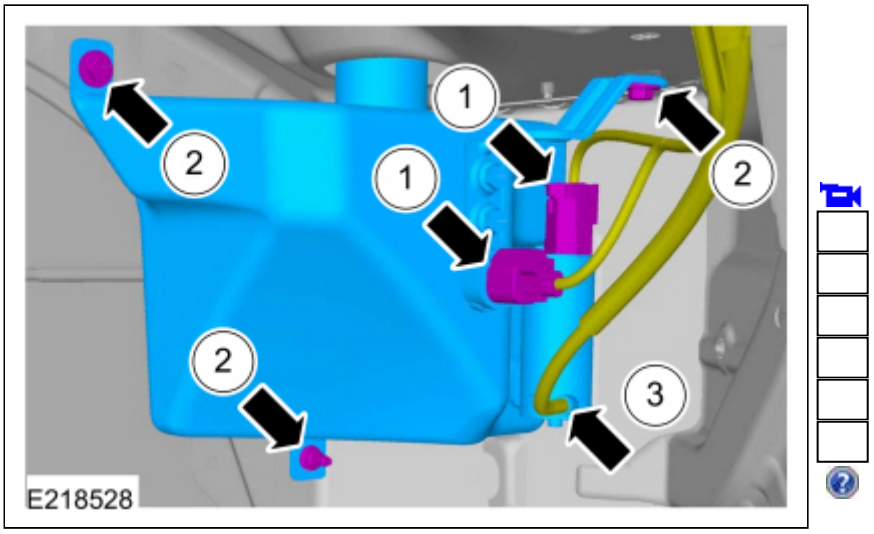
NOTICE: Do not operate the windshield washer pump before filling the windshield washer reservoir. Failure to do so could result in premature pump failure.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

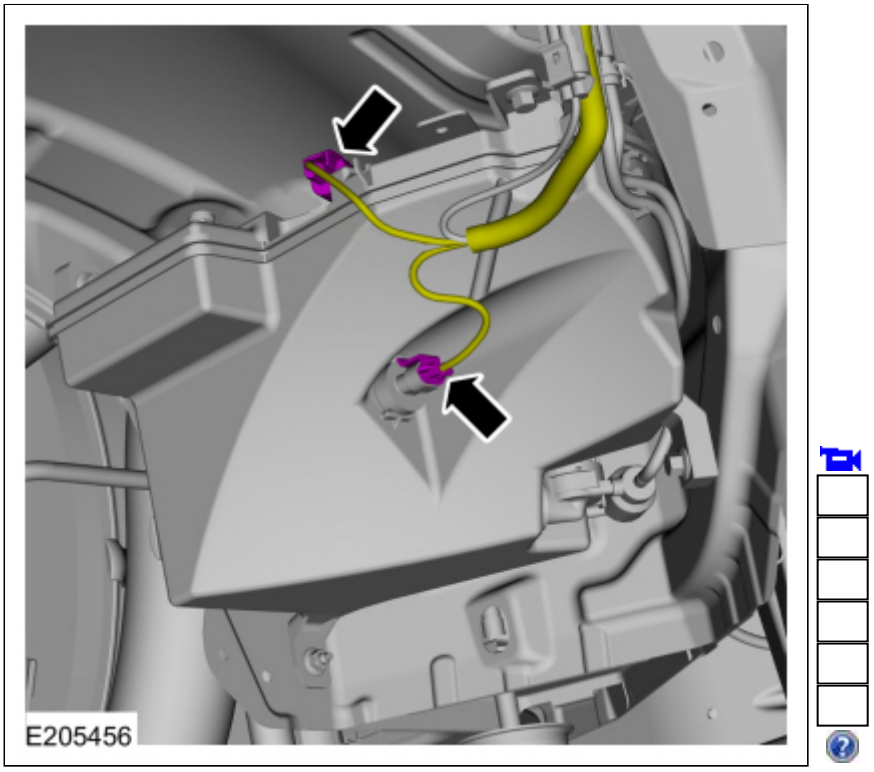
NOTE: ***Type 1***

3. *Torque*:
   2: 4 Nm

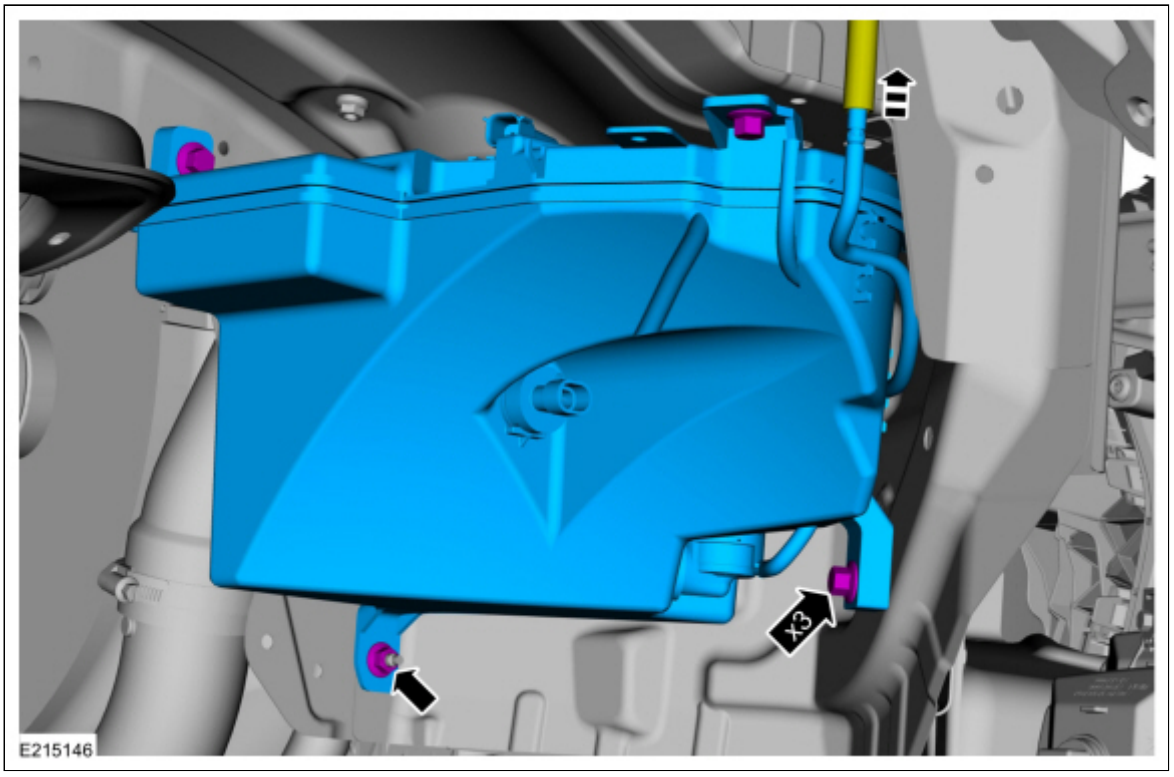


NOTE: ***Type 2***

4.



5. *Torque*: 4 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Windshield Washer Pump

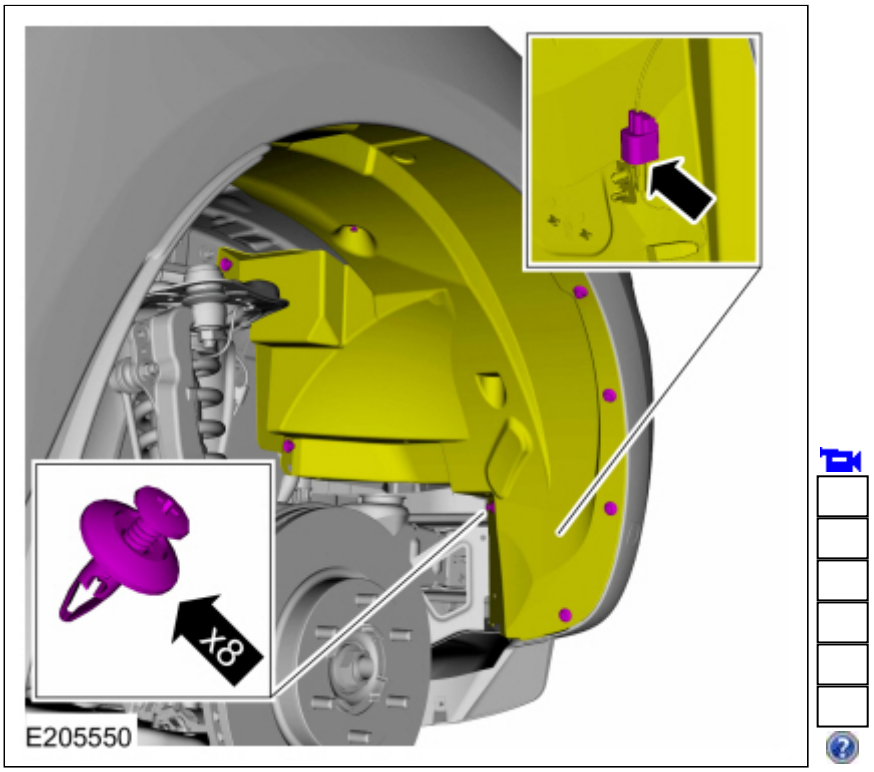
Removal

NOTICE: When servicing the windshield washer pump, be careful not to damage the windshield washer pump seal.

NOTICE: Do not operate the windshield washer pump before filling the windshield washer reservoir. Failure to do so could result in premature pump failure.

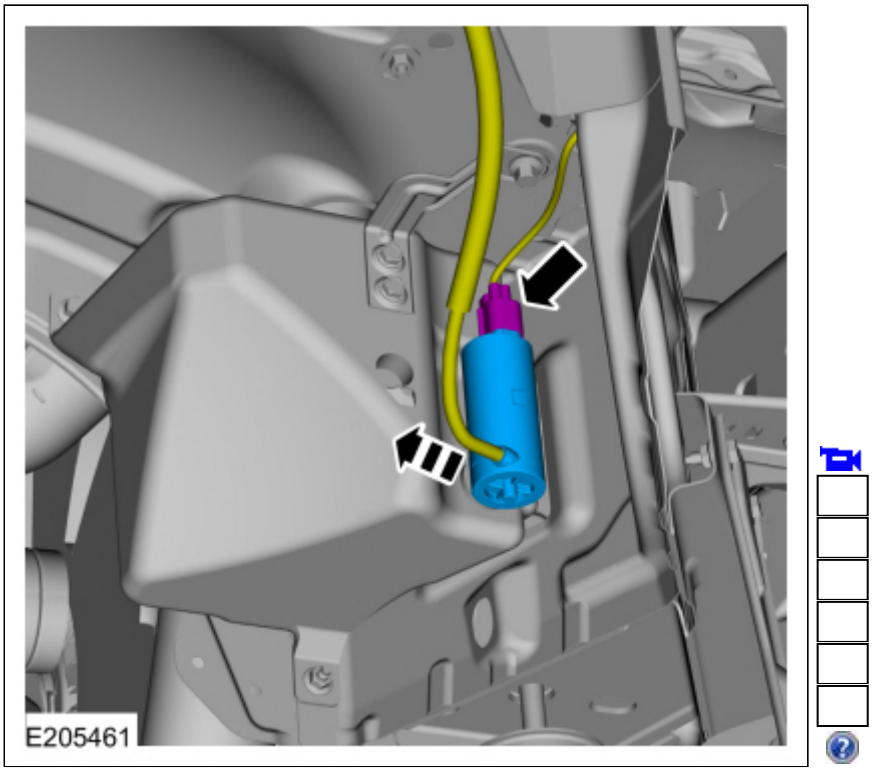
NOTE: *Removal steps in this procedure may contain installation details.*

1.



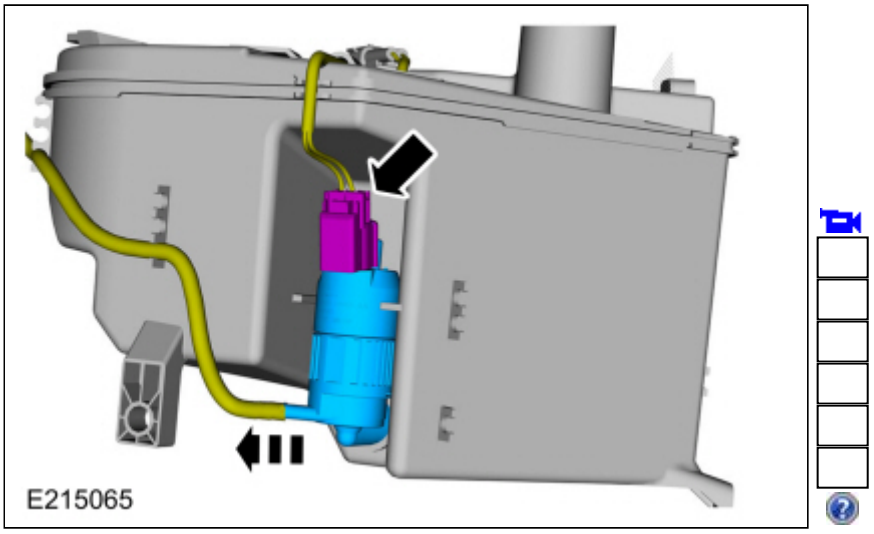
NOTE: ***Type 1***

2.



NOTE: ***Type 2***

3. Refer to: Windshield Washer Reservoir (501-16 Wipers and Washers, Removal and Installation).
4.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Windshield Wiper Pivot Arm

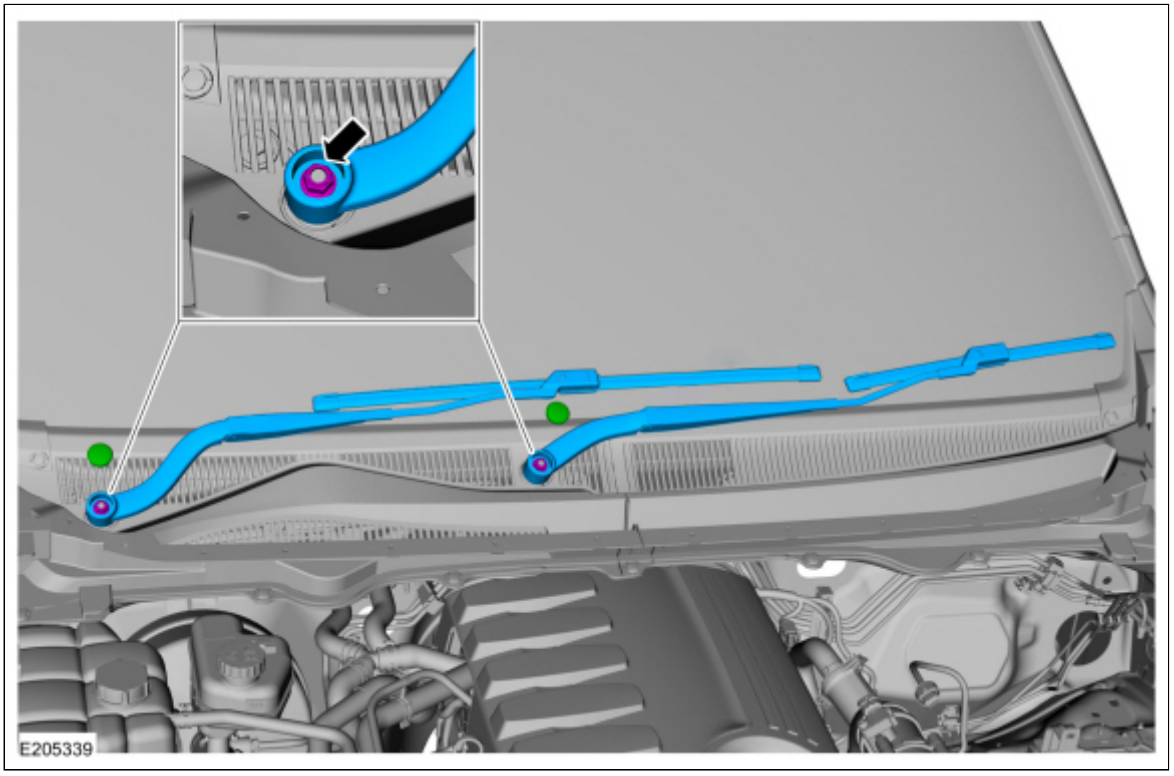
Special Tool(s) / General Equipment

Two Leg Puller

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Use the General Equipment: Two Leg Puller
   Torque: 23 Nm



Installation

1. **NOTE:** *Make sure that the windshield wipers are in the PARK position.*

   NOTE: *During installation align the wiper pivot arms with the marks on the windshield.*

   To install, reverse the removal procedure.
   Refer to: Windshield Wiper Blade and Pivot Arm Adjustment (501-16 Wipers and Washers, General Procedures).
   Refer to: Wiper Park Position Adjustment (501-16 Wipers and Washers, General Procedures).

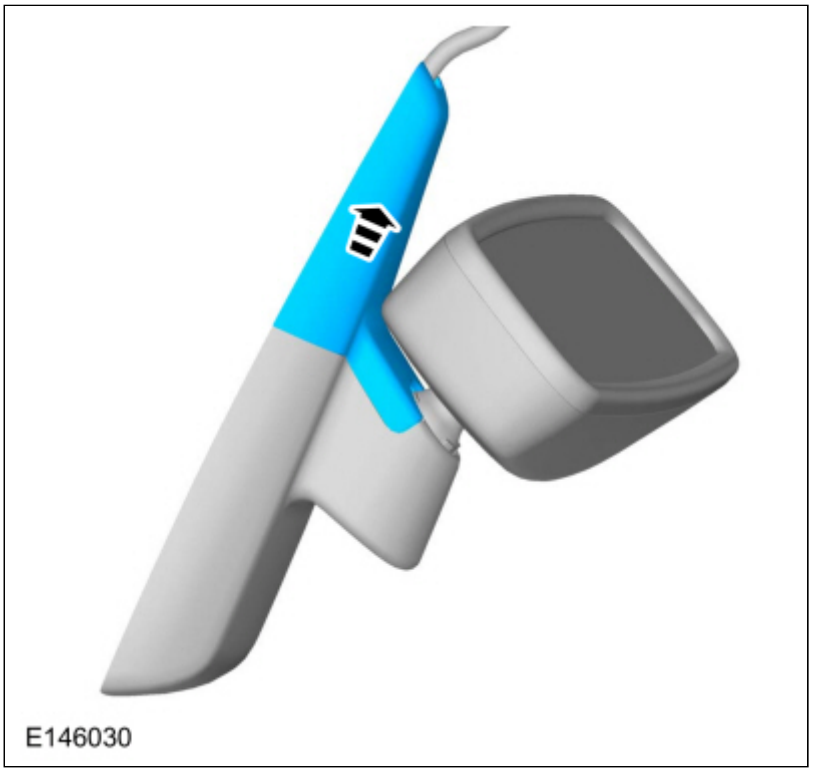
Copyright © 2016 Ford Motor Company

Rain Sensor

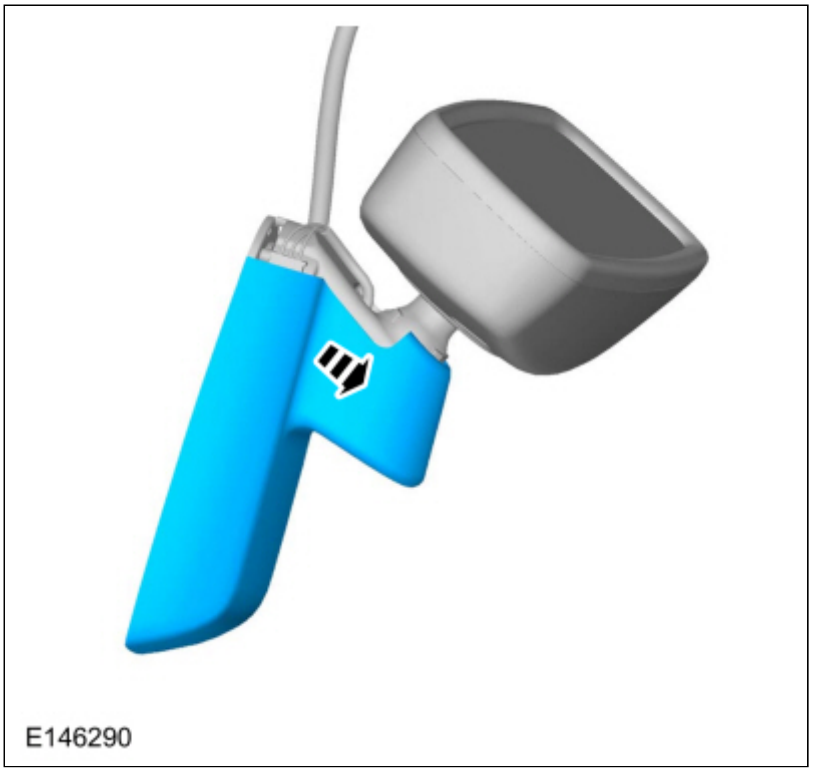
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

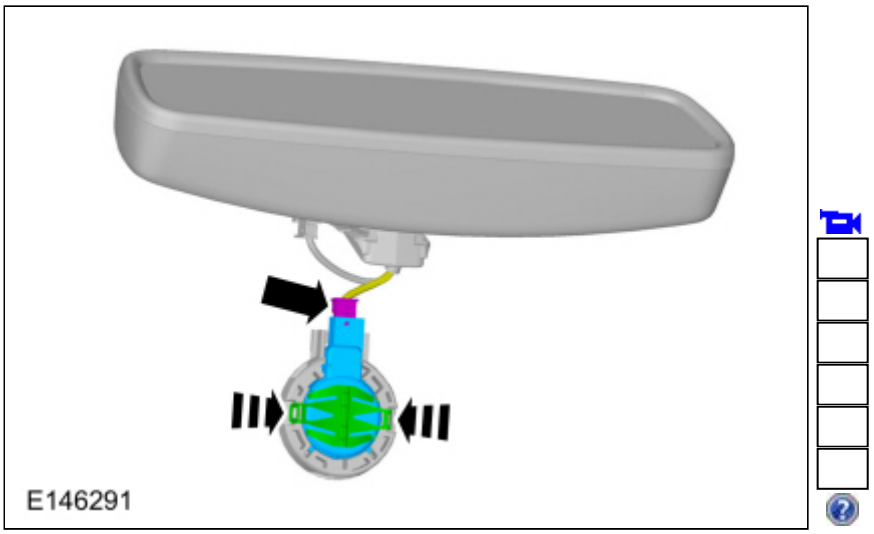
1.



2.

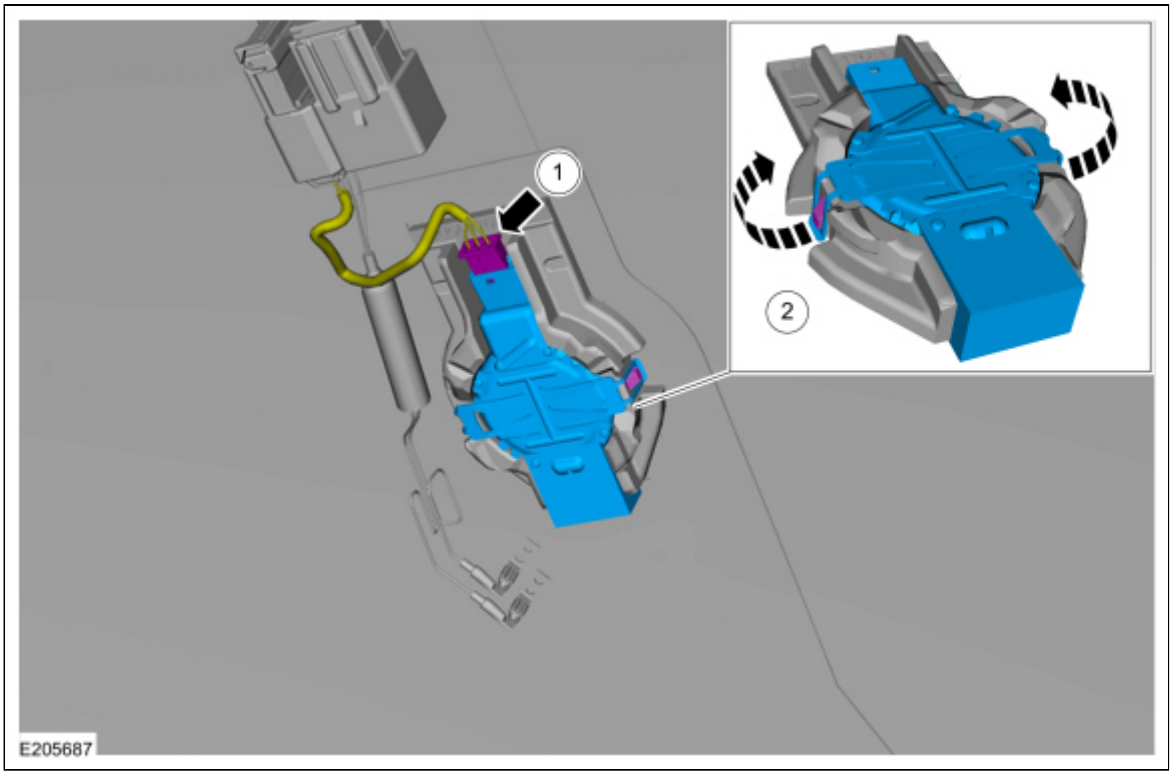


3.



Vehicles With: Interior Mirror With Camera Display

4. Refer to: Interior Rear View Mirror (501-09B Interior Rear View Mirrors, Removal and Installation).
5.



Installation

1. **WARNING: Make sure that the mating faces are clean and free of foreign material.**

   To install, reverse the removal procedure.

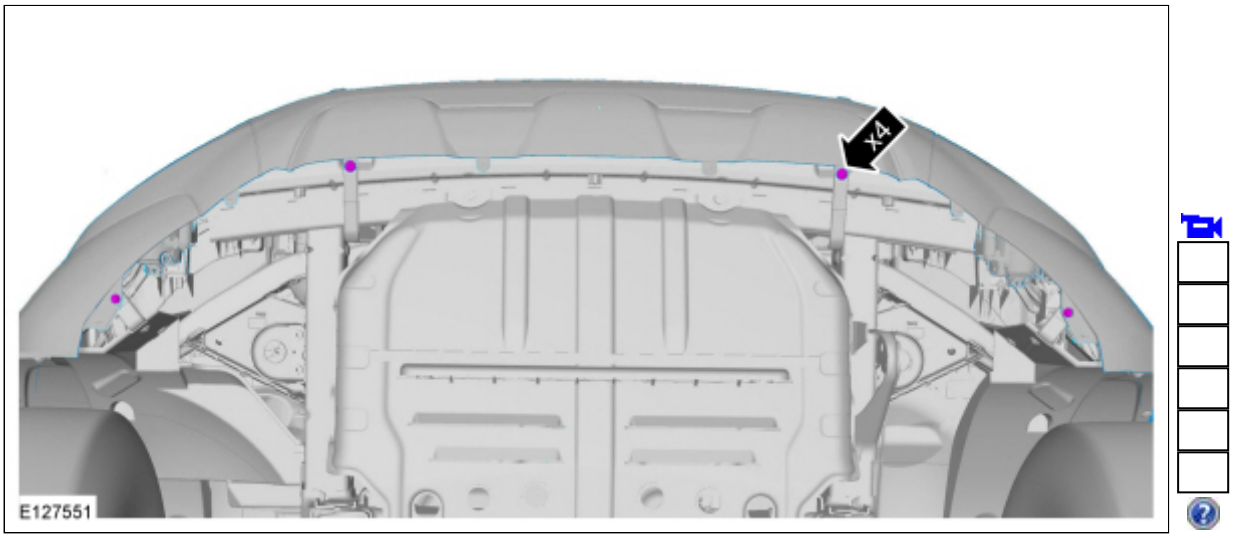
Copyright © 2016 Ford Motor Company

Front Bumper Cover

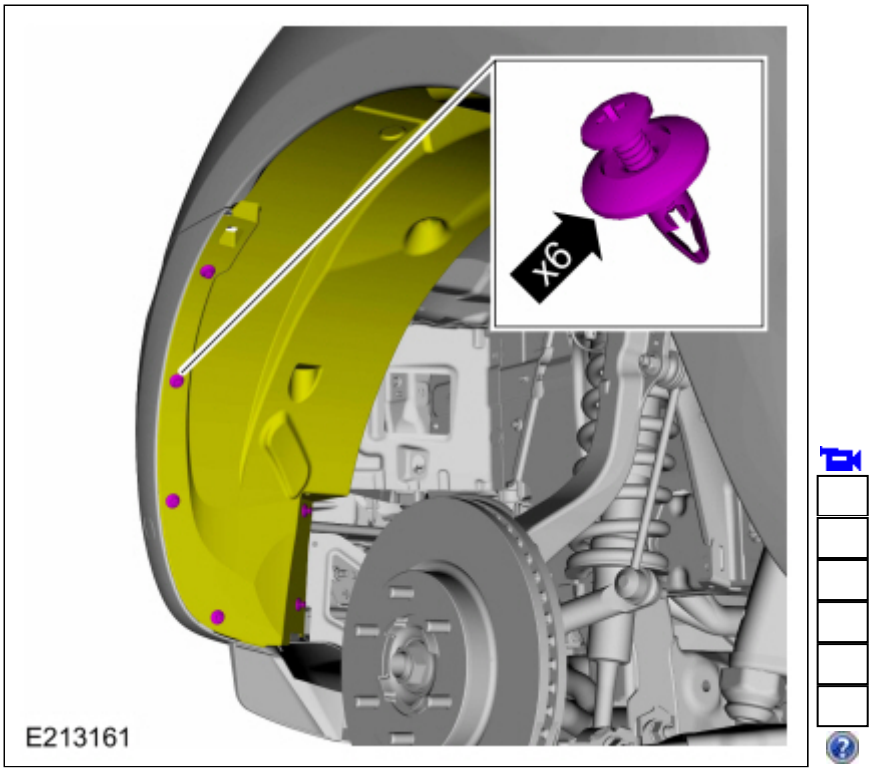
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

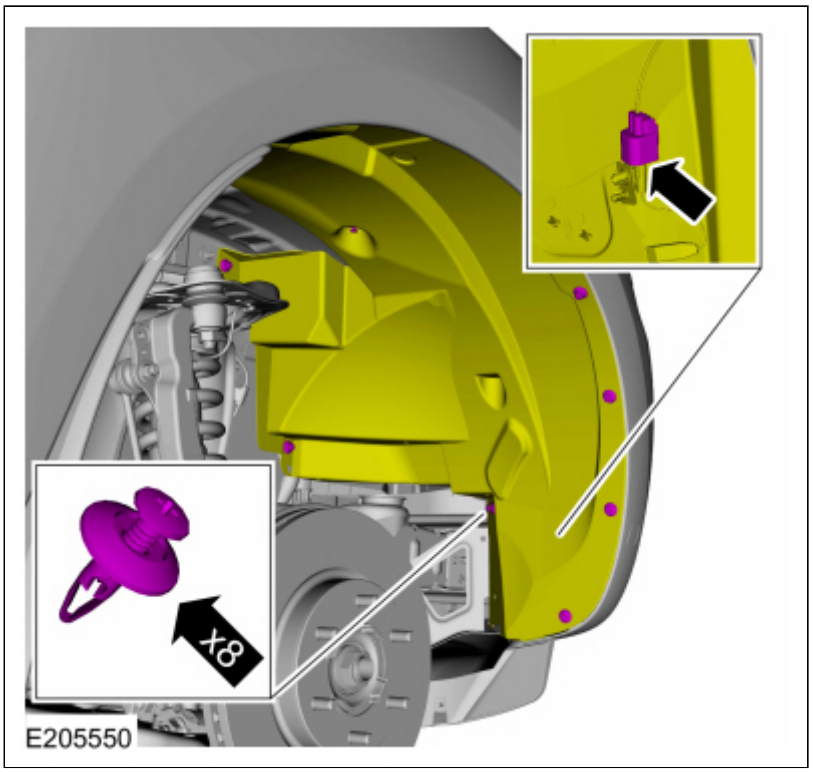
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).
4. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
5. *Torque*: 4 Nm



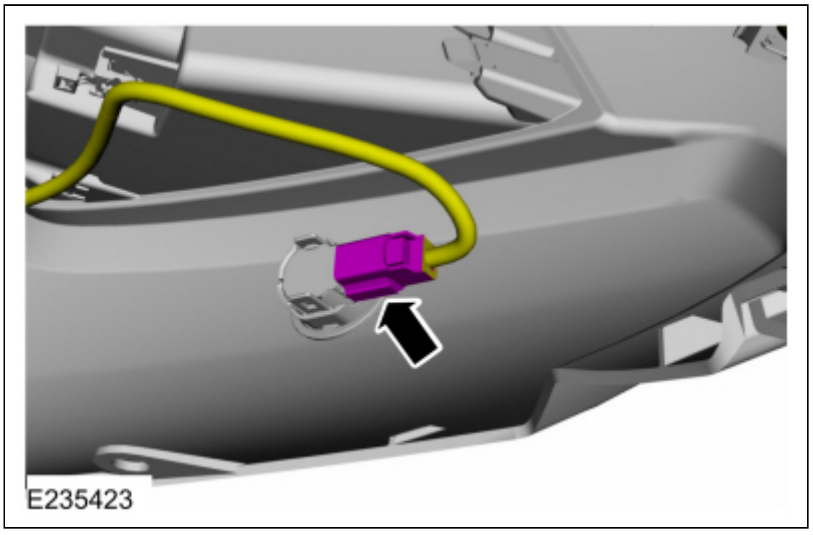
6. LH side.



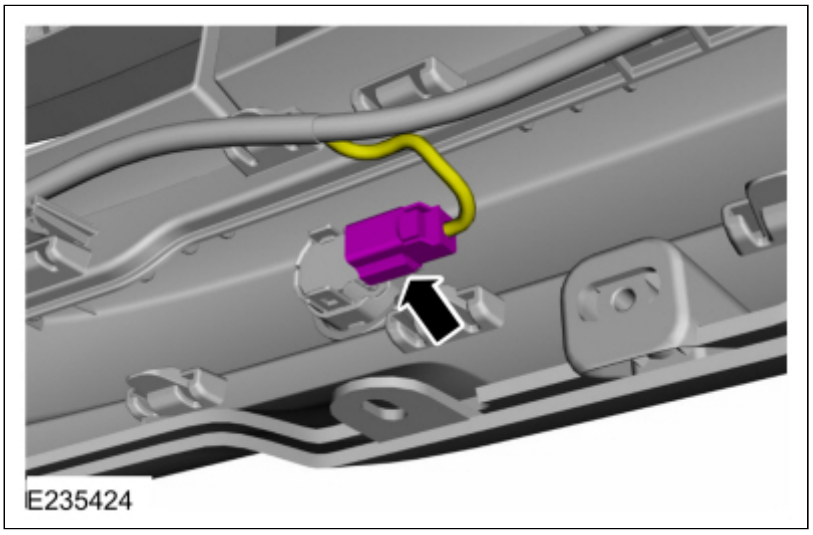
7. RH side.



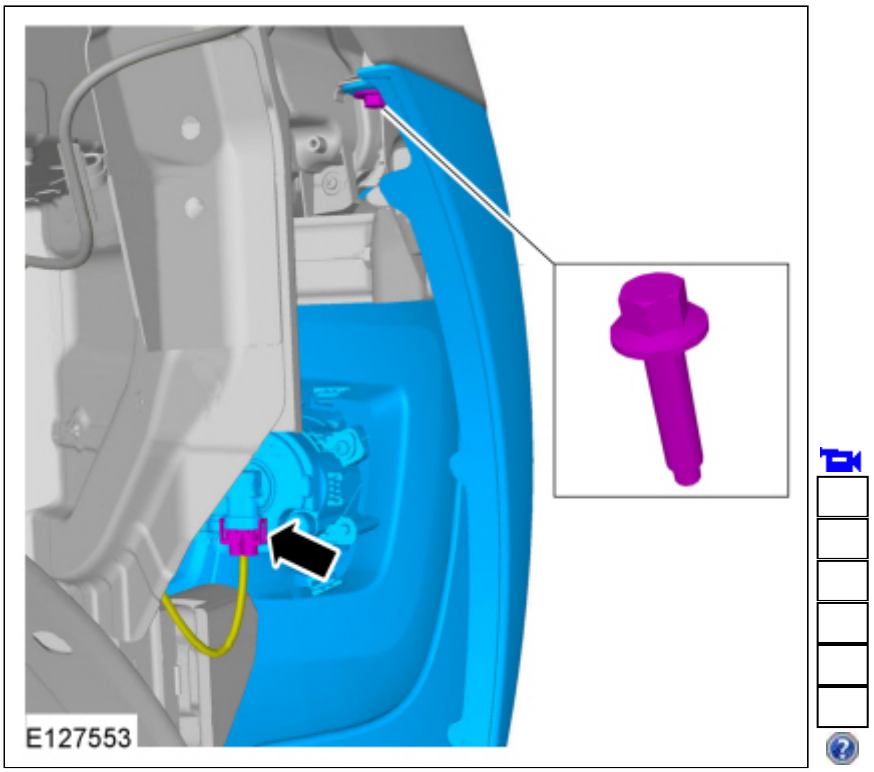
8. Refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).
9. On both the sides.



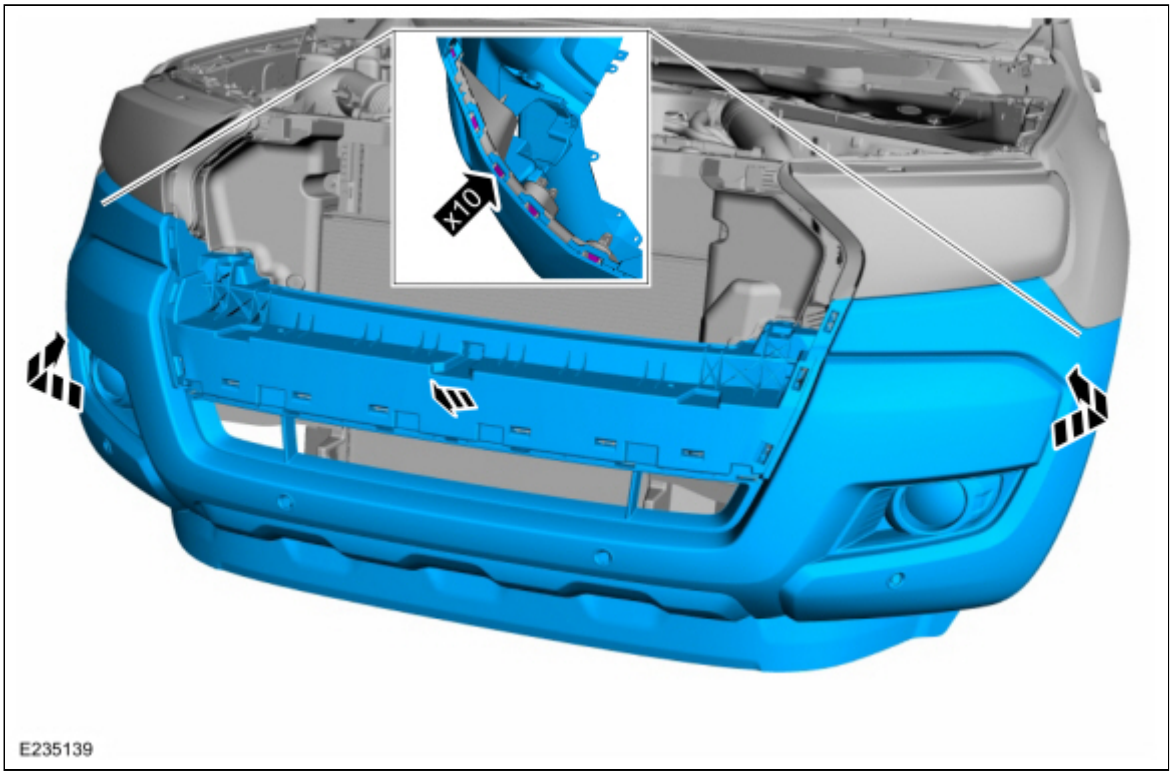
10.



11. On both the sides.



12. Lower the vehicle
13.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

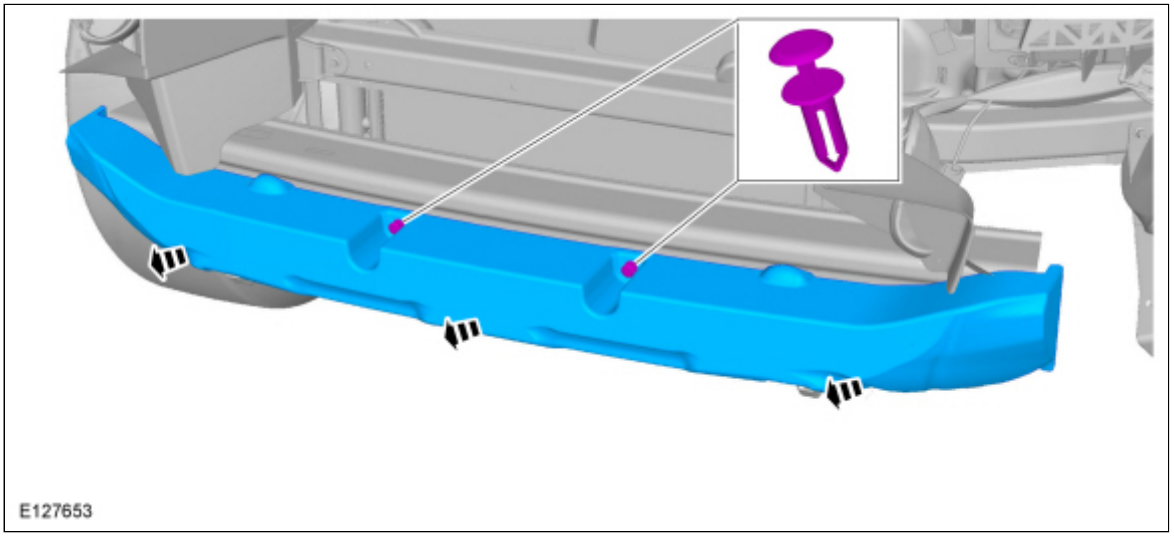
Front Bumper

Base Part Number: 17757

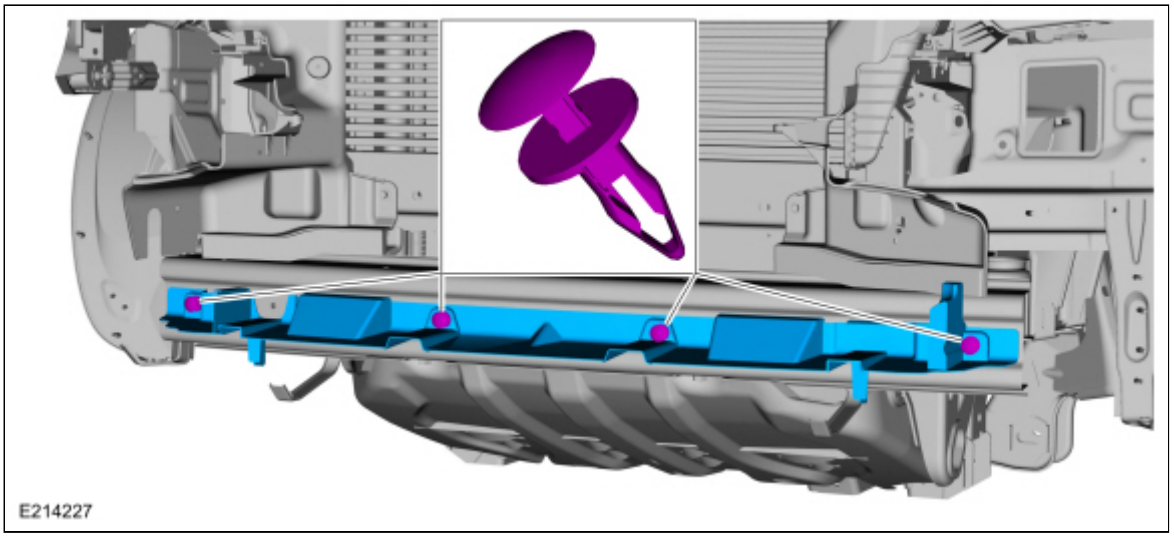
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

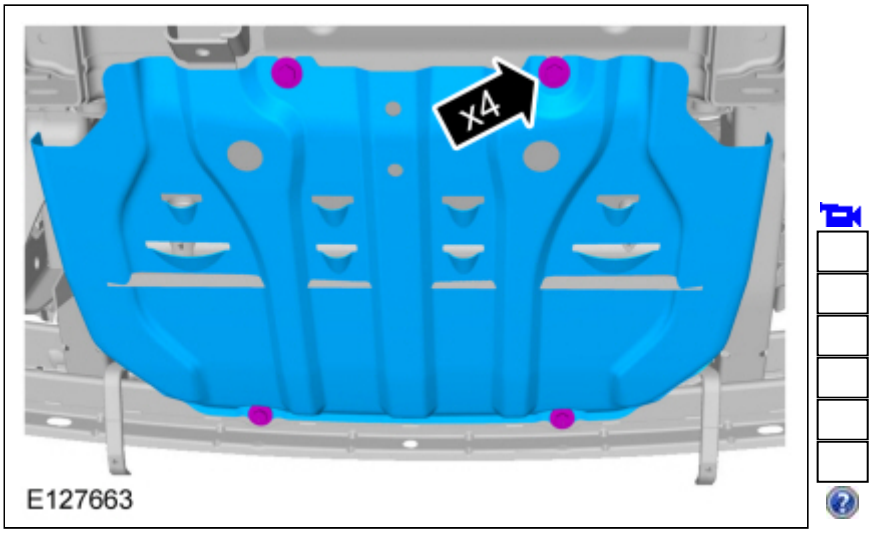
1. Refer to: Front Bumper Cover (501-19 Bumpers, Removal and Installation).
2. If equipped



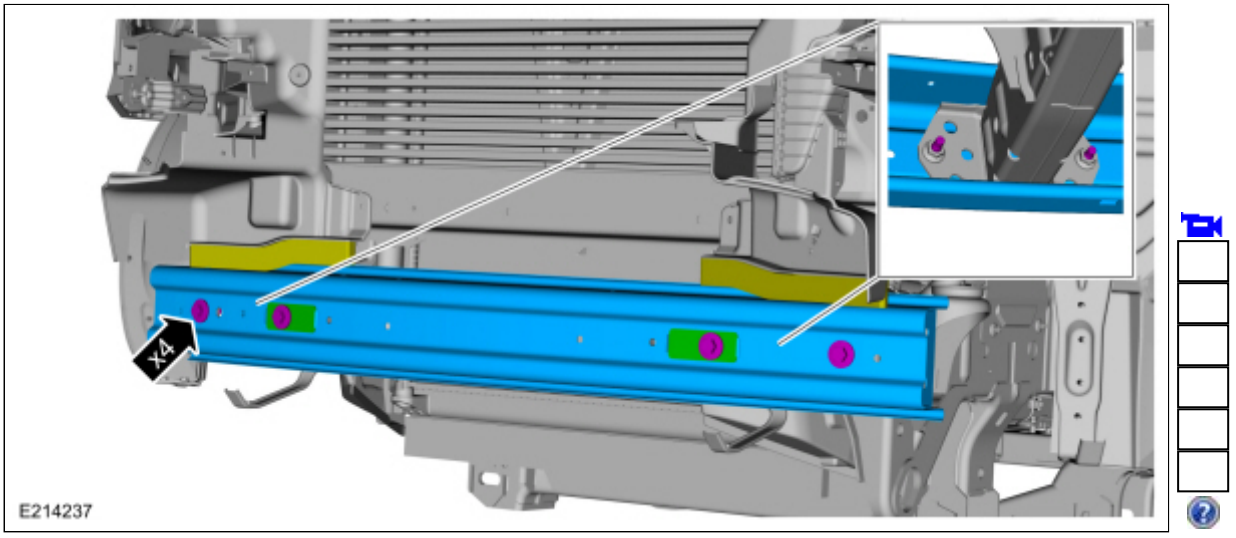
3. If equipped



4. *Torque*: 30 Nm



5. *Torque*: 47 Nm



Installation

1. To install, reverse the removal procedure.

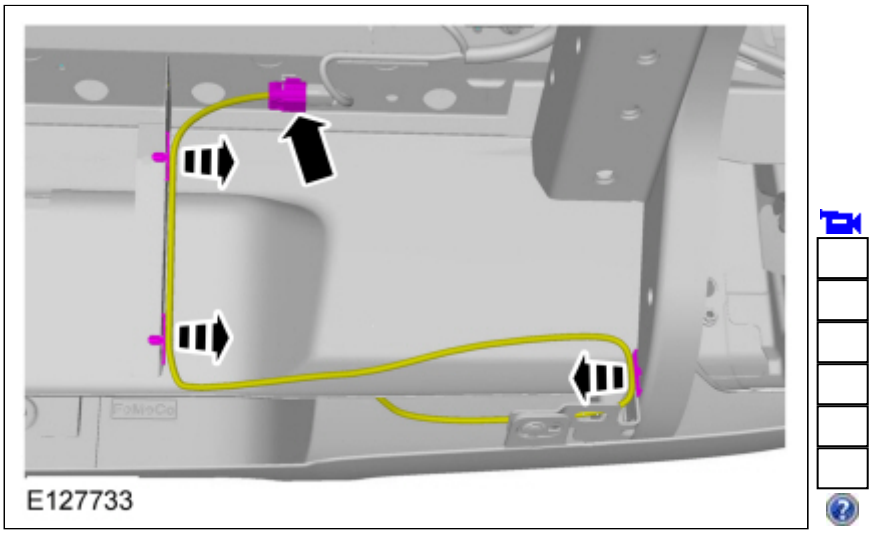
Copyright © 2016 Ford Motor Company

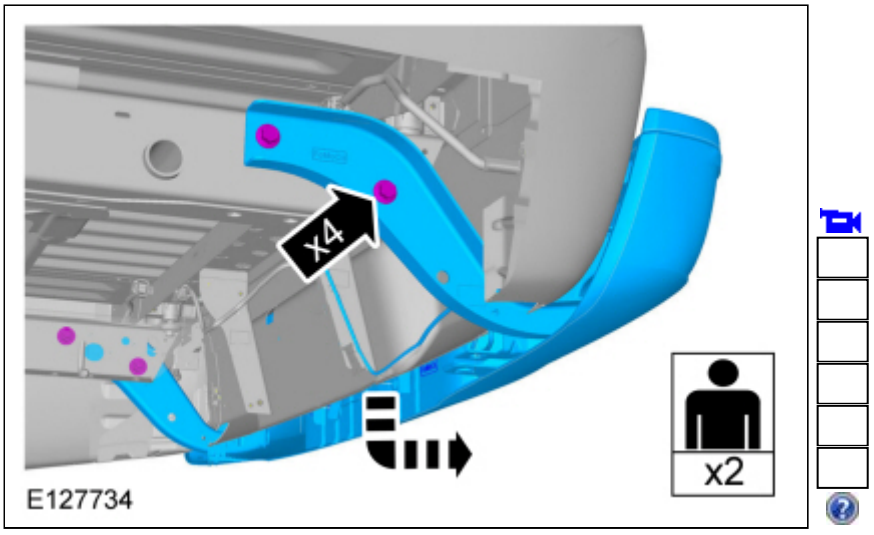
Rear Bumper

Base Part Number: 17F838

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
3. 

4. *Torque*: 105 Nm


Installation

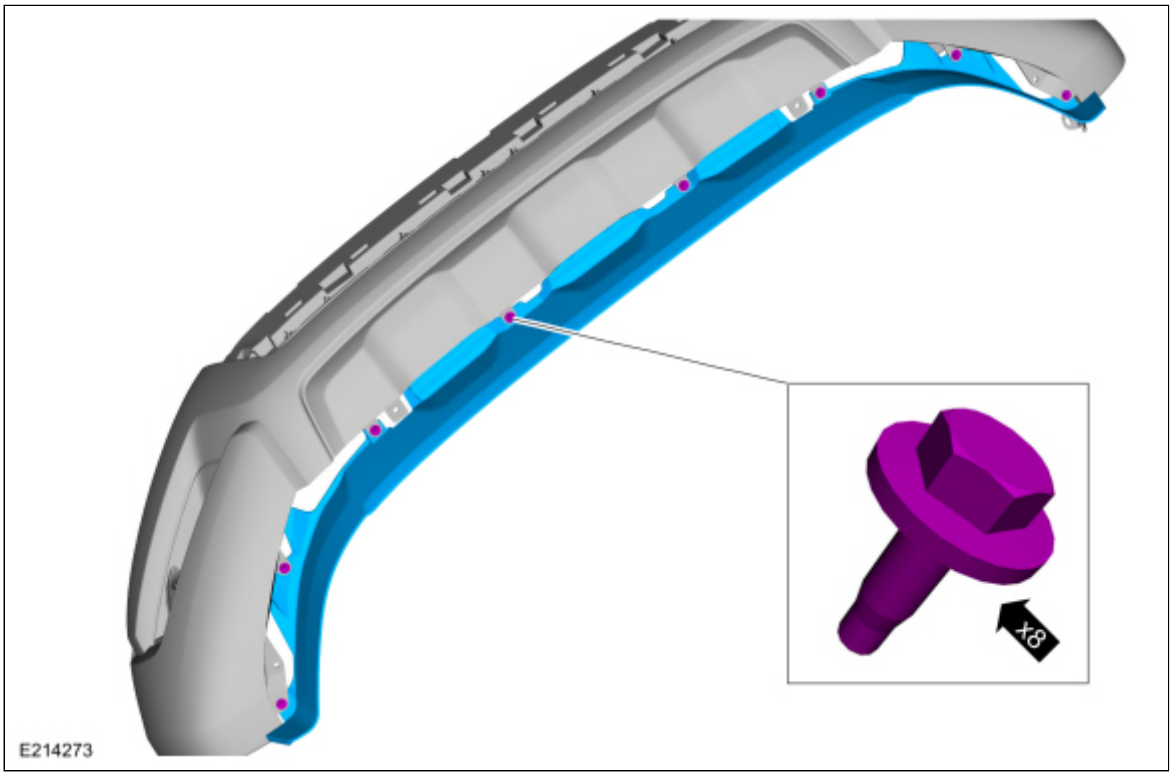
1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

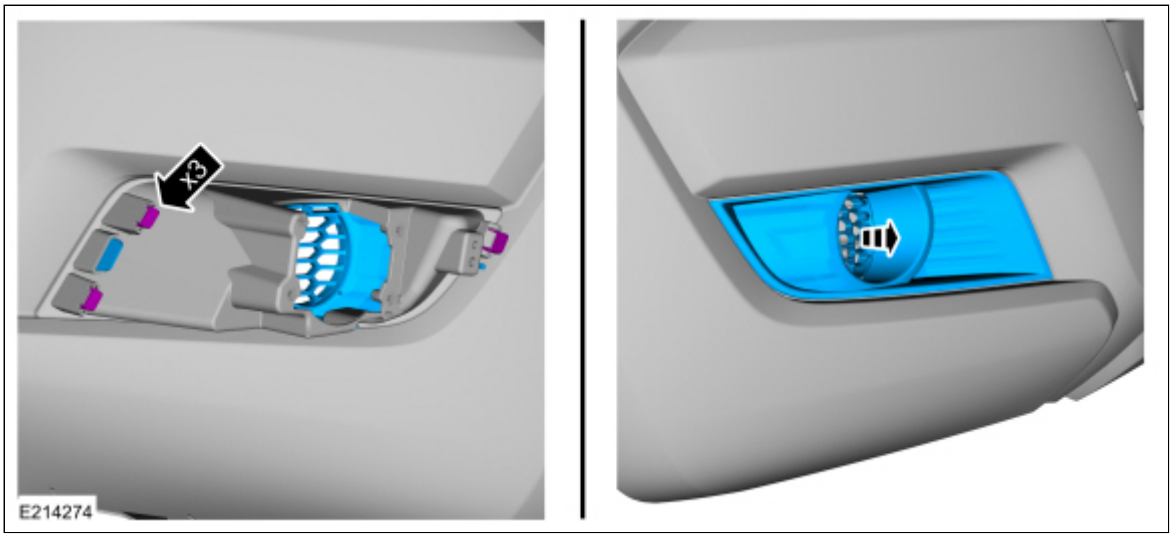
Front Bumper Cover

DISASSEMBLY

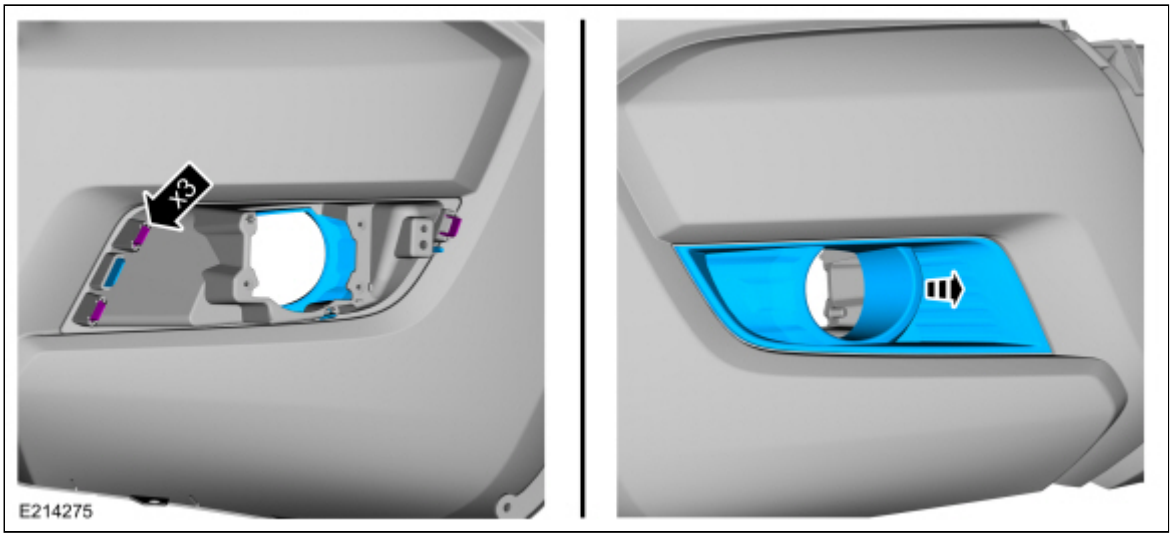
1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).
3. *Torque*: 4 Nm



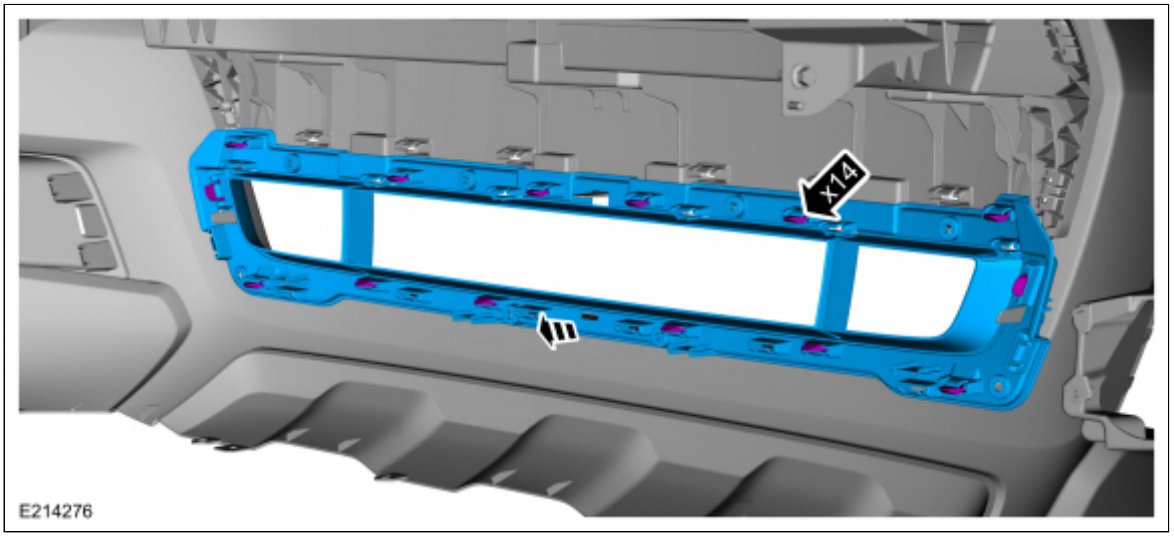
4. If equipped



5. If equipped



6.



ASSEMBLY

1. To assemble, reverse the disassembly procedure.

Copyright © 2016 Ford Motor Company

Seatbelt Systems

System Overview

WARNING: All safety belt assemblies (including retractors, buckles, shoulder belt height adjusters [if equipped], child safety seat tether attachments and attaching hardware) should be inspected after any collision. All new belt assemblies should be installed unless a qualified technician finds the assemblies show no damage and operate correctly. Belt assemblies not in use during a collision should also be inspected and new assemblies installed if either damage or incorrect operation is noted. Failure to install a new belt and retractor assembly could increase the risk of injury in collisions.

WARNING: The safety belt retractor pretensioner is a pyrotechnic device. Always wear safety glasses when repairing an air bag equipped vehicle and when handling a safety belt buckle pretensioner or safety belt retractor pretensioner. Never probe a pretensioner electrical connector. Doing so could result in pretensioner or air bag deployment and could result in personal injury.

NOTICE: Do not attempt to repair or lubricate the retractor / buckle mechanisms or modify the belts.

The safety belt system utilizes three-point lap and diagonal safety belts in all outboard seat positions and two point lap or three-point safety belts in the centre positions.

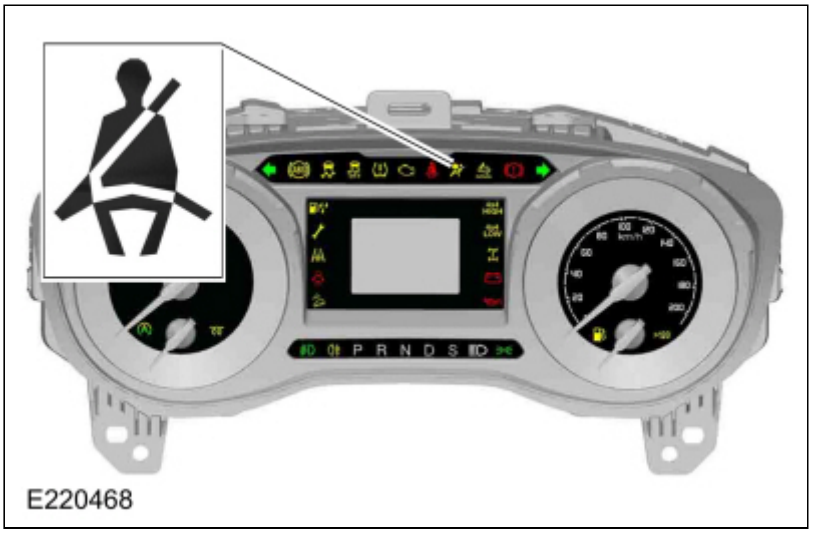
The front safety belt retractors incorporate a load limiting device, which allows progressive payout of additional safety belt webbing when the force exerted exceeds a predetermined limit.

The front safety belt upper anchors are connected to safety belt shoulder height adjusters mounted in the B-pillar (DBL cab only).

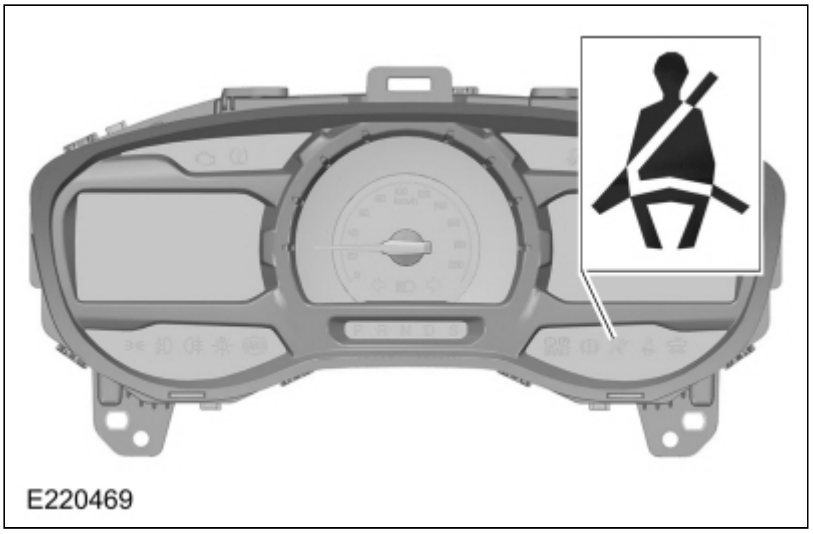
A beltminder function is fitted to some vehicles. If the driver's seatbelt is not fastened, the belt warning lamp will illuminate at key on for 6 seconds, or until the seatbelt is fastened, whichever is the first. The beltminder warning is triggered when the vehicle speed is at 25 km/h (15 mph), or greater, and the driver and/or passenger safety belt(s) are not fastened. The warning will continue for 5 minutes or until the safety belt(s) are fastened, whichever is the first.

The safety belt minder feature can be disabled.

Base instrument panel cluster



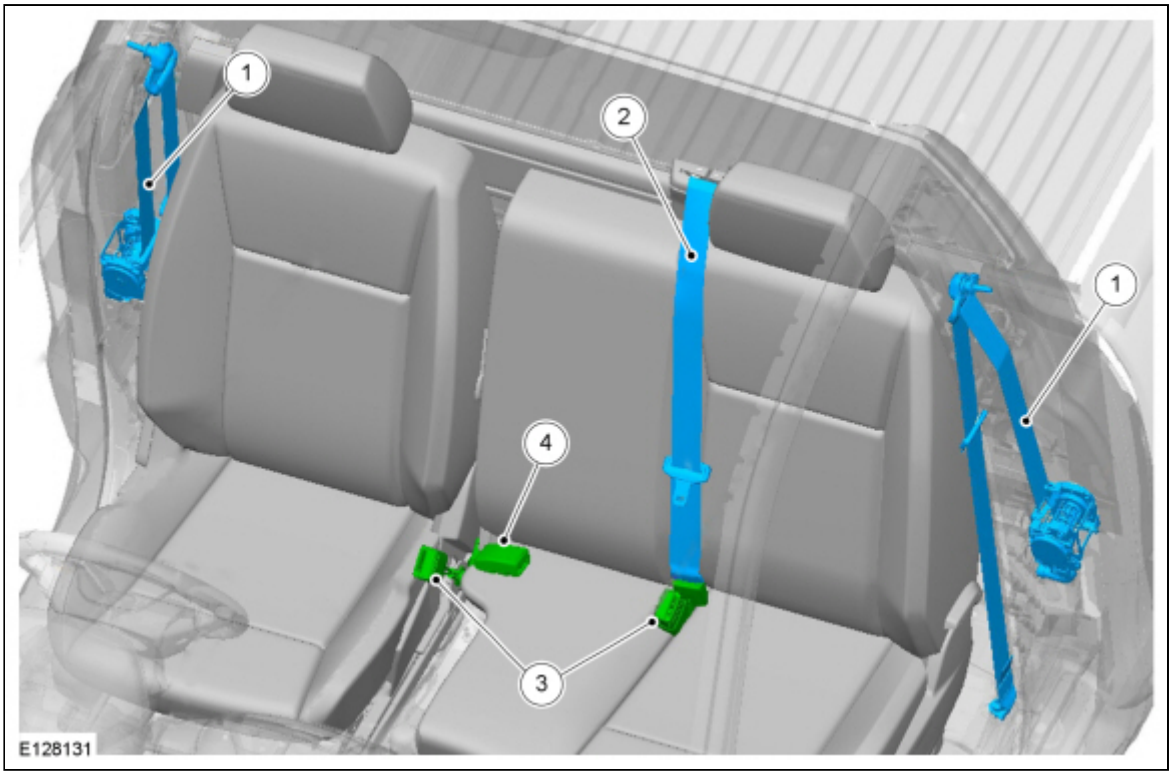
High-Level instrument panel cluster

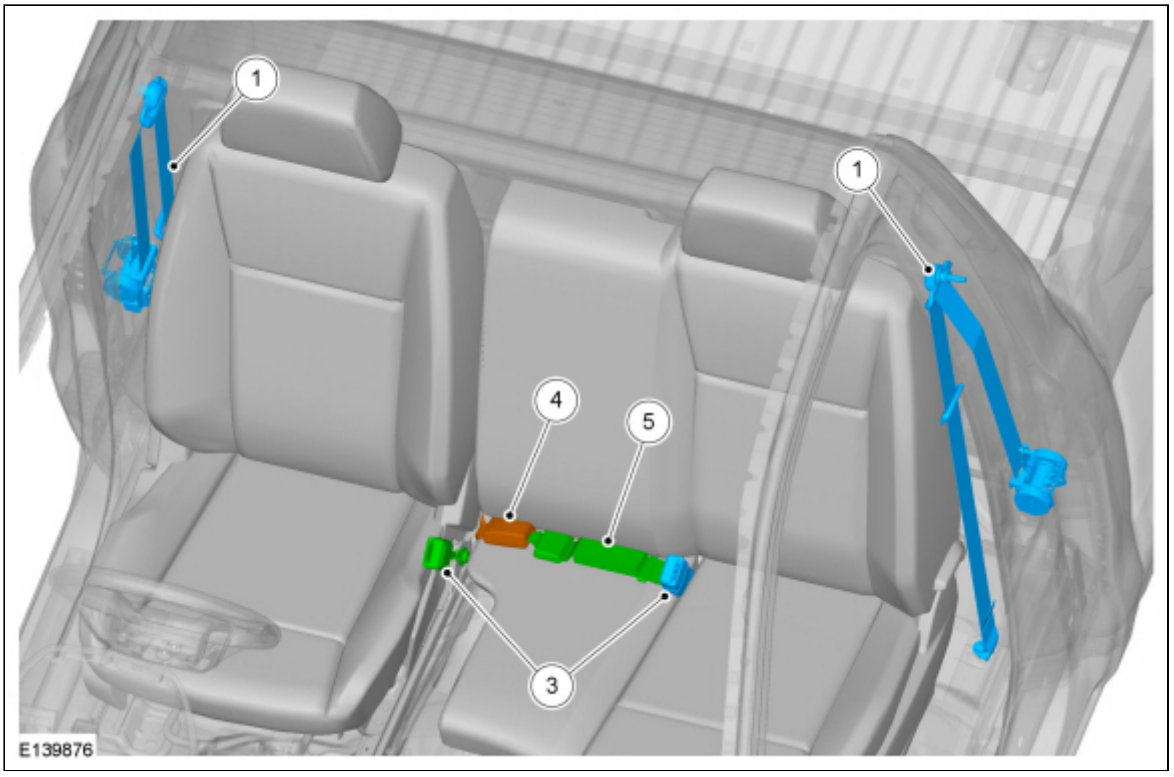


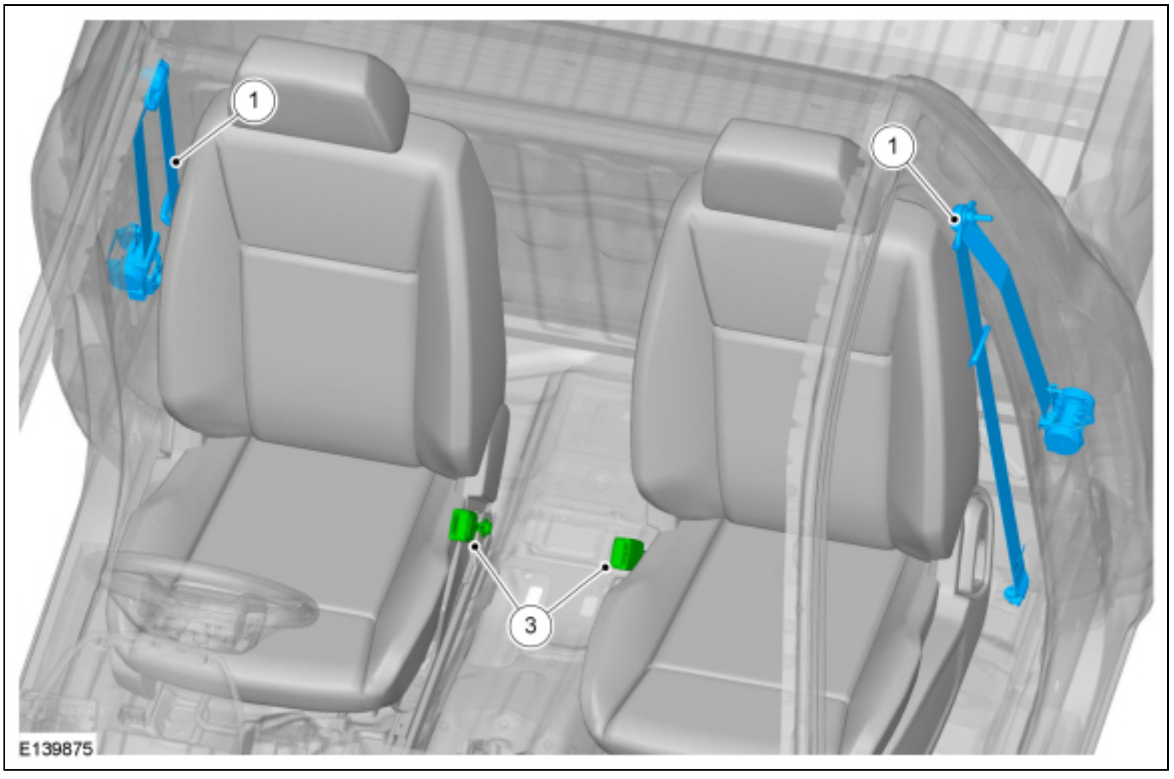
The safety belt retractor pretensioners have a lower deployment threshold than that required by the air bags. Hence it is possible that during a minor collision, which exceeds the deployment threshold, only the safety belt retractor pretensioners will deploy. The safety belt retractor pretensioners will also deploy when the side airbags are deployed but not deploy in a rear collision.

Rear seat safety belt retractors and buckles are of the conventional type.

Single cab

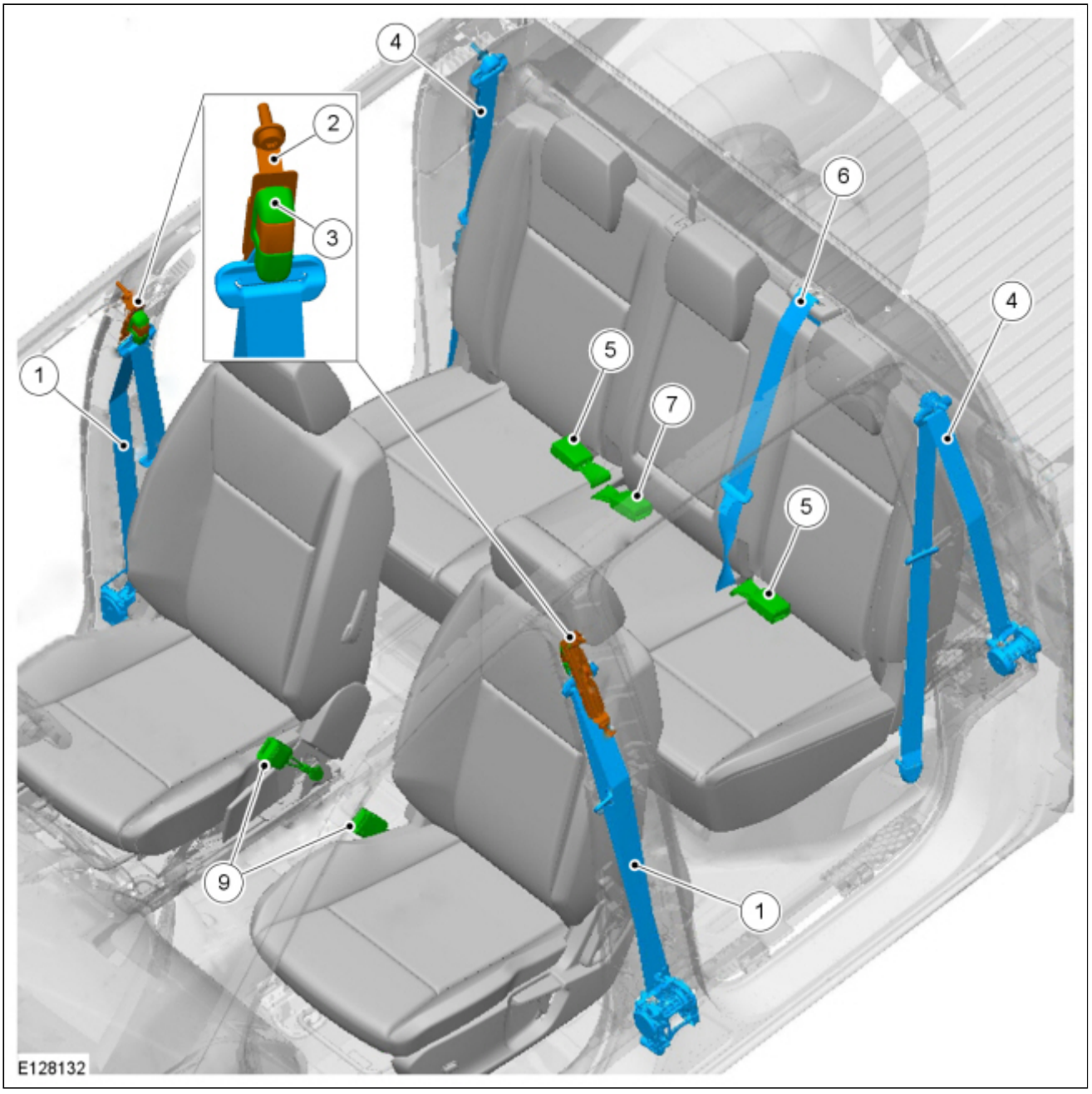


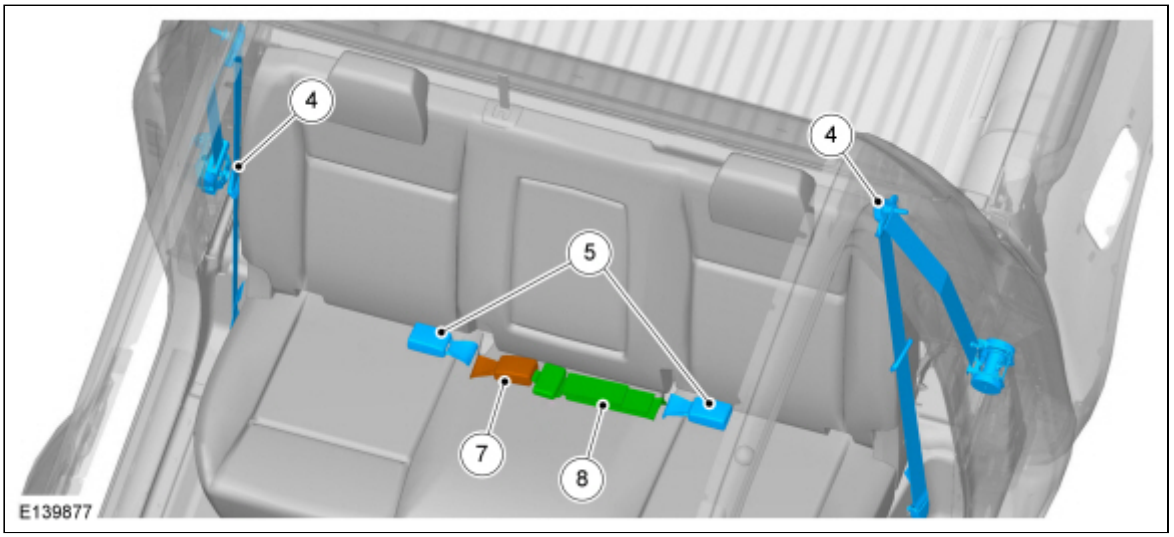




Item	Part Number	Description
1	—	Front safety belt retractor
2	—	Front three point center safety belt retractor
3	—	Front safety belt buckle
4	—	Front center safety belt buckle
5	—	Front two point center safety belt

Double cab

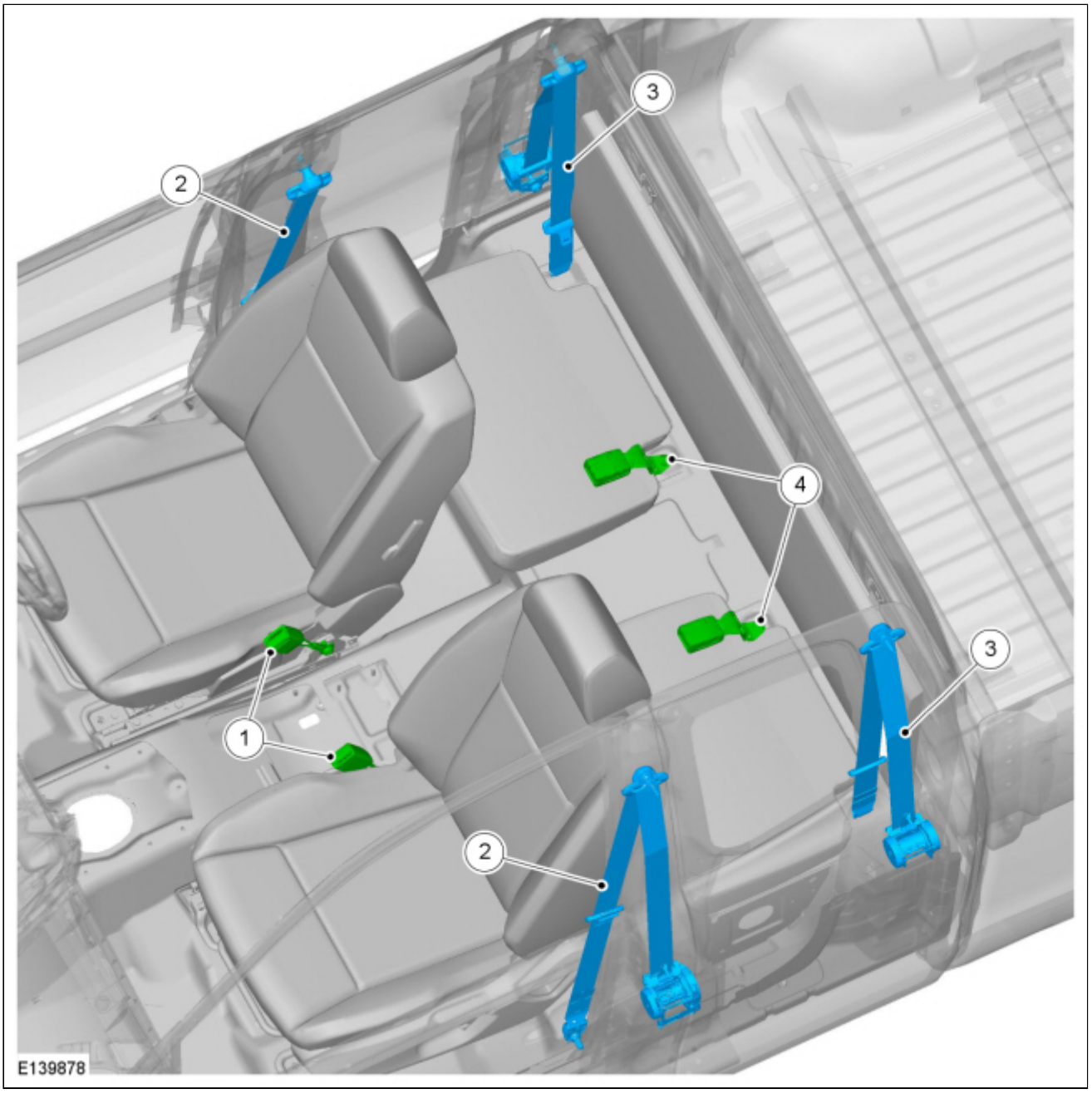




Item	Part Number	Description
1	—	Front safety belt retractor
2	—	Safety belt shoulder height adjuster

3	—	Safety belt shoulder height adjusting cover
4	—	Rear safety belt retractor
5	—	Rear safety belt buckle
6	—	Rear three point center safety belt retractor
7	—	Rear center safety belt buckle
8	—	Rear two point center safety belt
9	—	Front safety belt buckle

Super cab



Item	Part Number	Description
1	—	Front safety belt buckle
2	—	Front safety belt retractor
3	—	Rear safety belt retractor
4	—	Rear safety belt buckle

Copyright © 2016 Ford Motor Company

Seatbelt Systems

Symptom Chart(s)

Preliminary Inspection

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Before diagnosing or repairing the safety belt system, inspect the following items:

- Safety belt webbing integrity (torn, frayed, cut or stretched)
- Safety belt buckle and tongue assembly

Symptom Chart: Safety Belt System

Symptom Chart

Condition	Possible Sources	Actions
The safety belt warning indicator does not operate	• Burned-out indicator • Wiring, terminals or connectors • IPC • RCM	If the airbag warning indicator is illuminated, REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). If the airbag warning indicator is not illuminated, REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
The safety belt warning chime does not operate	• Wiring, terminals or connectors • Safety belt switch • IPC • RCM	If the airbag warning indicator is illuminated, REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing). If the airbag warning indicator is not illuminated, REFER to: Instrument Panel and Interior Switches Illumination (413-00 Instrument Panel and Interior Switches Illumination, Diagnosis and Testing).
The safety belt retractor webbing does not extract at the rear outboard positions	• Safety belt retractor is in web sensing mode	
The safety belt retractor webbing does not extract or exhibits excessive pressure on the occupant during use	• Safety belt retractor binding internally	CARRY OUT the appropriate component test. REFER to Functional Test - Safety Belt Retractor, Road Test Inspection in this section as appropriate. INSTALL new components as directed.
The safety belt retractor webbing does not retract or has excessive slack during use	• Twisted or incorrectly routed safety belt webbing • Safety belt retractor binding internally • The safety belt webbing is dirty or soiled and/or there has been dirt build up on the D-ring and/or around the tongue webbing slot	CORRECT the twisted safety belt webbing. REFER to: Seatbelt Tongue Rotated On Belt (501-20A Seatbelt Systems, General Procedures). REFER to: Seatbelt Twisted at the Seatbelt Guide (501-20A Seatbelt Systems, General Procedures). CARRY OUT the appropriate component test. REFER to Functional Test - Safety Belt Retractor in this section, or REFER to Functional Test - Safety Belt Retractor, Road Test Inspection as appropriate. REFER to: Seatbelt Cleaning (501-20A Seatbelt Systems, General Procedures).
The Belt-Minder® feature is inoperative	• Belt-Minder® feature is deactivated • Wiring, terminals or	To activate the Belt-Minder® feature, REFER to the Seating and Safety Restraints section of the Owner's Literature or REFER to: Seatbelt Minder Deactivating/Activating (413-09

	connectors	Warning Chimes, General Procedures).
The safety belt tongue is rotated at the webbing	Twisted or incorrectly routed safety belt webbing	REFER to: Seatbelt Tongue Rotated On Belt (501-20A Seatbelt Systems, General Procedures).
The safety belt webbing is dirty or soiled	Dirty or soiled safety belt webbing	REFER to: Seatbelt Cleaning (501-20A Seatbelt Systems, General Procedures).

Functional Test - Safety Belt Buckle and Tongue

WARNING: All safety belt components must be inspected and corrected as part of any collision repair. Inspect all safety belt components as prescribed by Safety Belt Inspection and Repair After a Collision found in Section 501-20A General Procedures of this manual. Failure to follow this instruction may result in incorrect operation of the safety belt system and increase the risk of serious personal injury or death in a crash.

NOTE: *The safety belt buckle and tongue assembly must operate freely during the latching and unlatching function. Fasten the safety belt by inserting the tongue (male portion) into the buckle (female portion).*

1. Verify the following during the latching sequence:

- Tongue insertion does not require excessive effort.
- A click is heard when the safety belt buckle latches the tongue.

2. Verify the system integrity by forcefully pulling on the safety belt webbing.

3. Unlatch the safety belt by fully pressing the safety belt buckle release button and allowing the safety belt to release and retract.

4. Verify the following during the unlatching process:

- Pressing the push button does not require excessive effort.
- The tongue can be removed easily from the buckle.

5. Repeat the above steps 3 times.

6. If the functional test reveals a concern(s), install a new safety belt buckle or safety belt retractor as required.

Functional Test - Safety Belt Retractor

WARNING: All safety belt components must be inspected and corrected as part of any collision repair. Inspect all safety belt components as prescribed by Safety Belt Inspection and Repair After a Collision found in Section 501-20A General Procedures of this manual. Failure to follow this instruction may result in incorrect operation of the safety belt system and increase the risk of serious personal injury or death in a crash.

NOTE: *The safety belt retractor must operate freely for extraction and retraction of the safety belt webbing between full extension and in-vehicle stowed positions.*

1. Extract and retract the safety belt between the full extension and stowed positions.

2. Verify the safety belt retractor operates without excessive effort or binding.

3. Install a new safety belt retractor if any concern is found or the complaint has been verified.

Functional Test - Safety Belt Retractor, Road Test Inspection

WARNING: All safety belt components must be inspected and corrected as part of any collision repair. Inspect all safety belt components as prescribed by Safety Belt Inspection and Repair After a Collision found in Section 501-20A General Procedures of this manual. Failure to follow this instruction may result in incorrect operation of the safety belt system and increase the risk of serious personal injury or death in a crash.

NOTE: *Make sure there is no excessive slack in the safety belt webbing across the torso during testing.*

NOTE: *Do not jerk on the safety belt webbing when carrying out this test.*

1. Fasten the safety belts and proceed to a safe area.
2. Reach a speed of 24 km/h (14.9 mph).

WARNING: Apply maximum brake force only on dry concrete or equivalent hard surface, never on wet pavement or gravel. Failure to follow this instruction may result in serious personal injury.

3. Grasp the shoulder harness, lean forward and apply the brakes, making a maximum braking application without a skid.
4. The safety belts should lock up with minimum webbing extension.
5. If there is a lockup of all safety belt retractors being tested, the safety belt retractors are functioning correctly. If any safety belt retractor fails to lock up, install a new safety belt retractor(s).

Copyright © 2016 Ford Motor Company

Seatbelt Cleaning

Cleaning

WARNING: Do not bleach or re-dye the safety belt webbing, as the webbing may weaken. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.

1. Clean the safety belt webbing, D-ring and tongue with a mild soap solution recommended for cleaning upholstery or carpets. Follow the manufacturer's instructions provided with the soap.

Copyright © 2016 Ford Motor Company

Seatbelt Maintenance

Inspection

WARNING: All safety belt components must be inspected and corrected as part of any collision repair. Inspect all safety belt components as prescribed by Safety Belt Inspection and Repair After a Collision found in Section 501-20A General Procedures of this manual. Failure to follow this instruction may result in incorrect operation of the safety belt system and increase the risk of serious personal injury or death in a crash.

1. Periodically inspect the safety belt assemblies for damage and that they remain in correct operating condition, particularly if they have been subjected to severe stress.
2. Before installing the new safety belt assembly, inspect the safety belt retaining areas for damage and distortion. If the retaining points are damaged and distorted, work the sheet metal back to its original shape and structural integrity.
3. Install the new safety belt(s) using the appropriate instructions. Carry out the appropriate Functional Test procedure for all seating positions.
   Refer to: Seatbelt Systems (501-20A Seatbelt Systems, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Seatbelt Procedure After a Collision

Inspection

WARNING: All safety belt components must be inspected and corrected as part of any collision repair. Inspect all safety belt components as prescribed by Safety Belt Inspection and Repair After a Collision found in Section 501-20A General Procedures of this manual. Failure to follow this instruction may result in incorrect operation of the safety belt system and increase the risk of serious personal injury or death in a crash.

1. Before installing the new safety belt assembly, inspect the safety belt attaching areas for damage and distortion. If the attaching points are damaged and distorted, work the sheet metal back to its original shape and structural integrity.

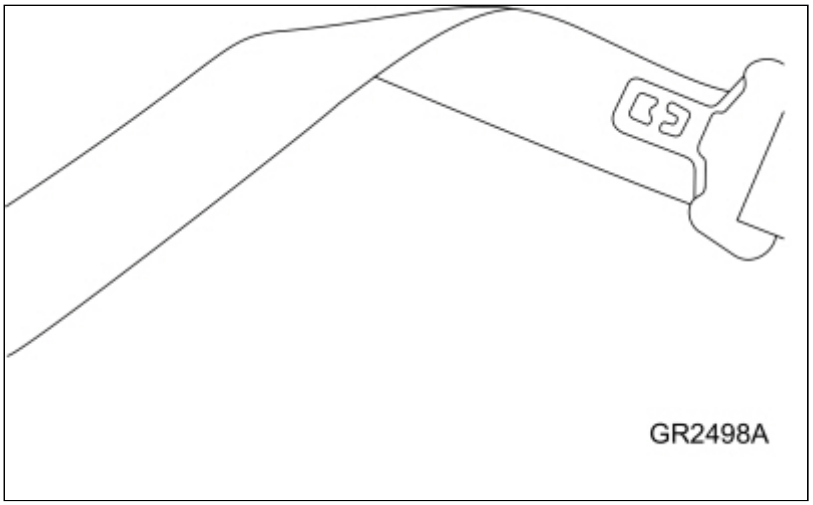
2. Install new safety belt(s) at any seating position(s) where deployment has occurred and the safety belt(s) were used. Carry out the appropriate Functional Test procedure for all seating positions.
   Refer to: Seatbelt Systems (501-20A Seatbelt Systems, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

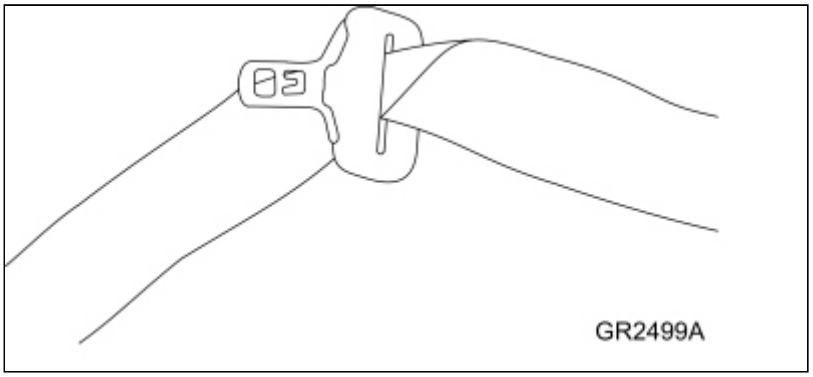
Seatbelt Tongue Rotated On Belt

Adjustment

1. Fold the safety belt as indicated.



2. Pull the safety belt tongue over the fold in the safety belt.



Copyright © 2016 Ford Motor Company

Seatbelt Twisted at the Seatbelt Guide

Adjustment

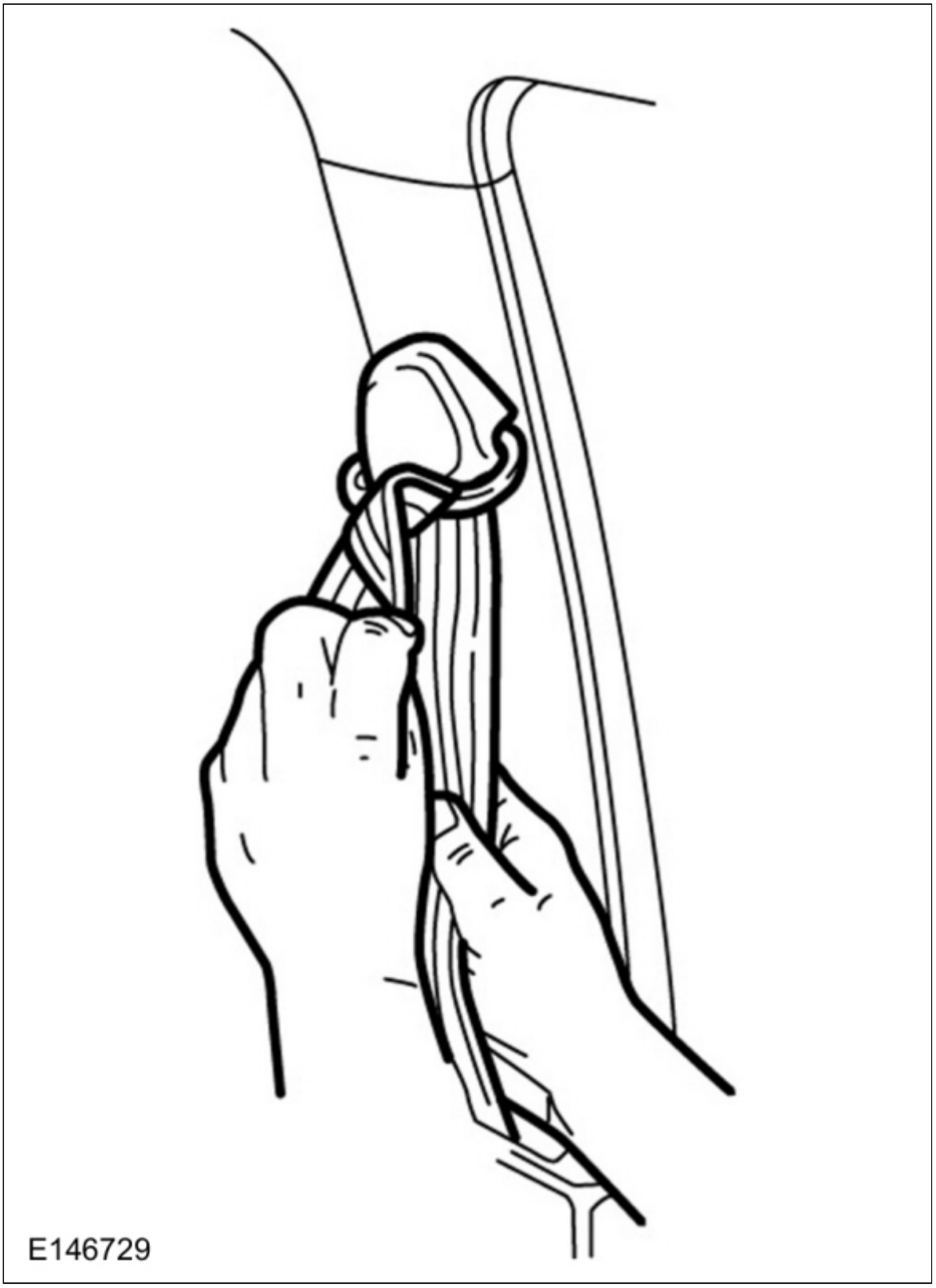
1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

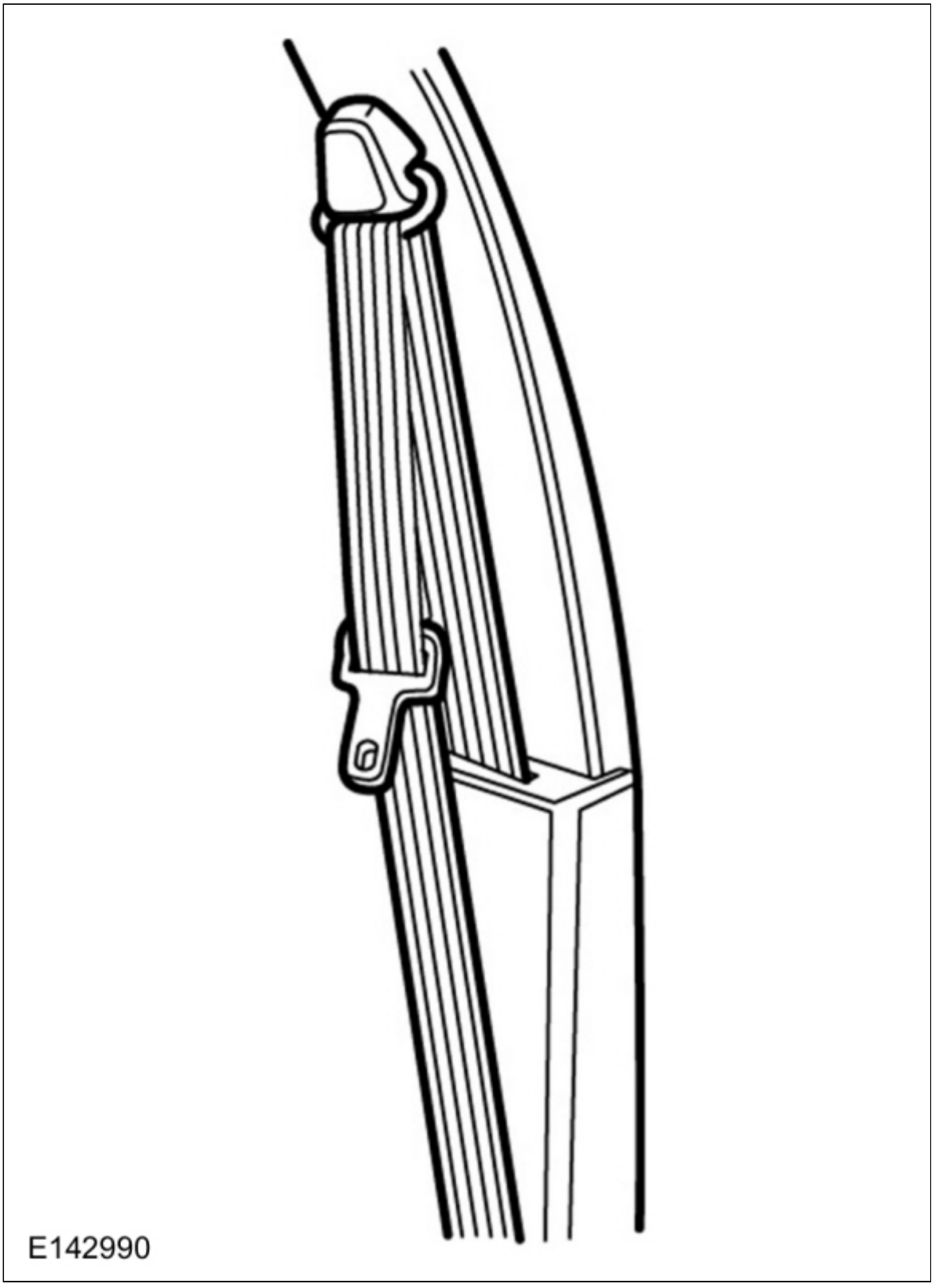
2. If necessary, remove the B-pillar trim panel.
   Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. **NOTE:** *Typical D-ring shown, others similar.*

   Grasp the safety belt webbing at the D-ring and fold the twisted portion of the safety belt webbing over itself.



4. Feed the folded portion of the safety belt webbing through the D-ring to remove the twist from the safety belt webbing.



Copyright © 2016 Ford Motor Company

Front Seatbelt Retractor - Single Cab, Vehicles With: Double Passenger Seat

Base Part Number: 611B08

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.**

   WARNING: Handling the seat belt (pre-tensioner seat belt) improperly can accidentally deploy the pre-tensioner seat belt, which may seriously injure you. Read the service warnings and cautions before handling the seat belt (pre-tensioner seat belt).

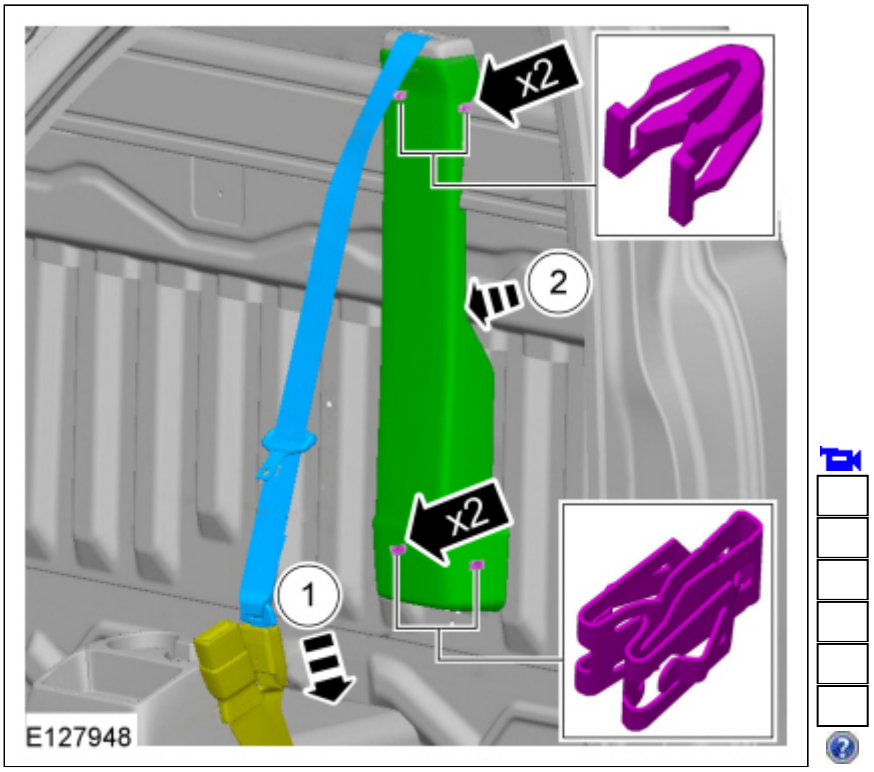
   WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

   NOTICE: The ELR (emergency locking retractor) has a spring that will unwind if the retractor cover is removed. The spring cannot be rewound by hand. If this occurs, the ELR will not work properly. Therefore, do not disassemble the retractor.

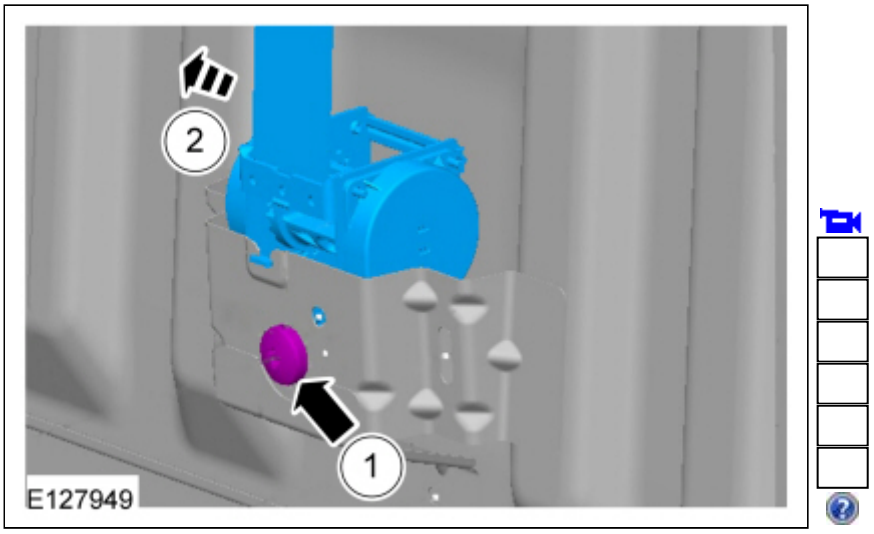
   Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

3. **NOTE:** *Note the position of the component before removal.*



4. *Torque*: 48 Nm



Installation

1. **NOTE:** *Make sure that this component is installed to the noted removal position.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seatbelt Retractor - Double Cab

Base Part Number: 611B08

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.**

   WARNING: Handling the seat belt (pre-tensioner seat belt) improperly can accidentally deploy the pre-tensioner seat belt, which may seriously injure you. Read the service warnings and cautions before handling the seat belt (pre-tensioner seat belt).

   WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

   NOTICE: The ELR (emergency locking retractor) has a spring that will unwind if the retractor cover is removed. The spring cannot be rewound by hand. If this occurs, the ELR will not work properly. Therefore, do not disassemble the retractor.

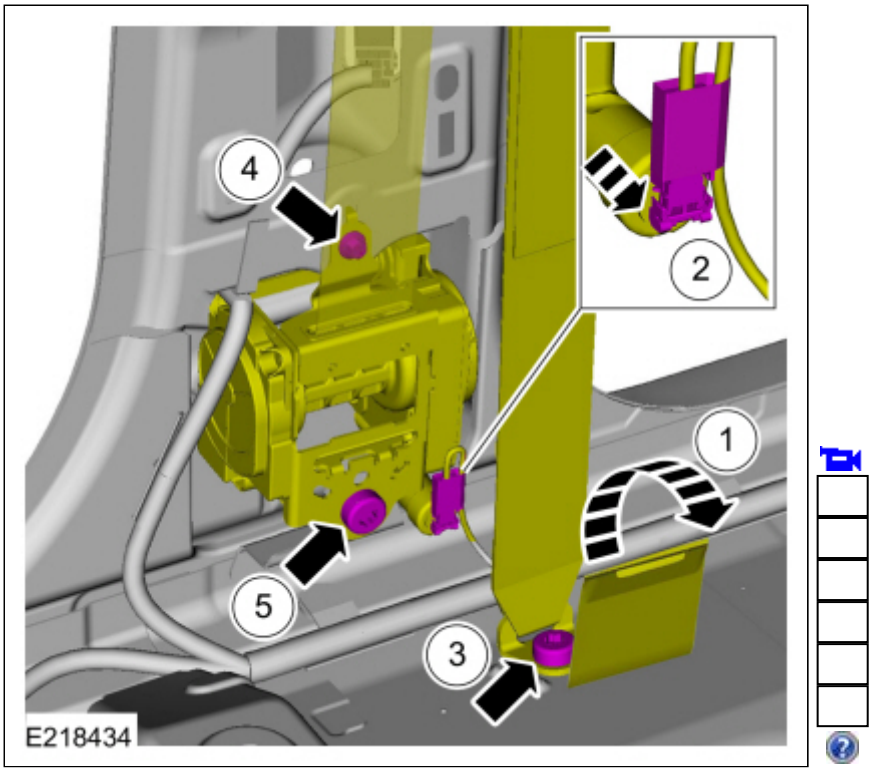
   Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

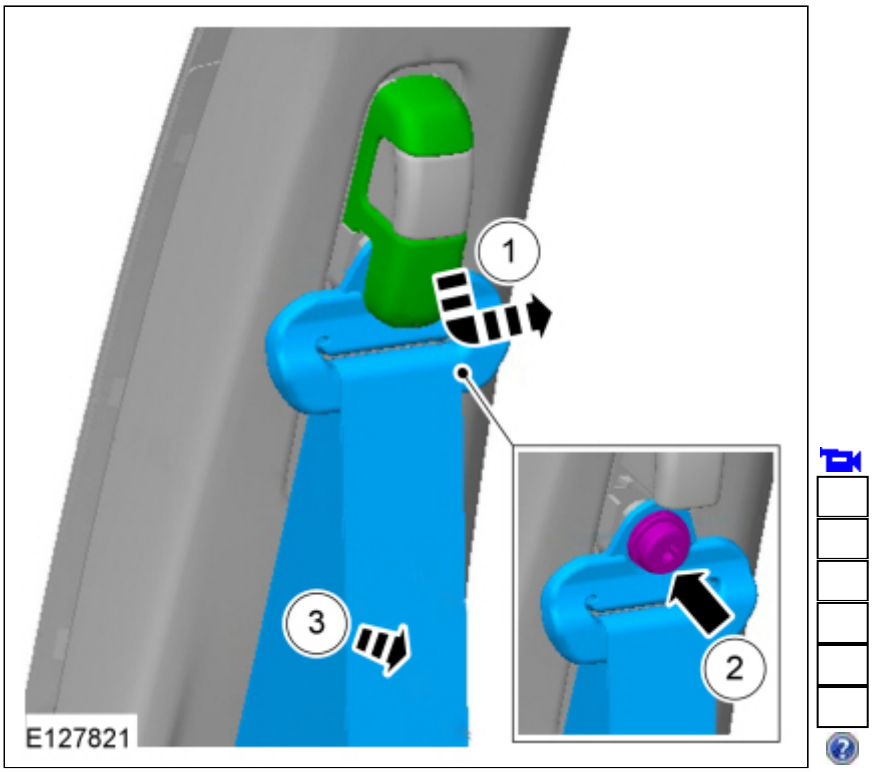
3. Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

4. **NOTE:** *Note the position of the component before removal.*

   3. *Torque*: 48 Nm
   4. *Torque*: 11 Nm
   5. *Torque*: 48 Nm



5. *Torque*: 48 Nm



Installation

1. **NOTE:** *Make sure that this component is installed to the noted removal position.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seatbelt Retractor - Super Cab

Base Part Number: 611B08

Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. **WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.**

   WARNING: Handling the seat belt (pre-tensioner seat belt) improperly can accidentally deploy the pre-tensioner seat belt, which may seriously injure you. Read the service warnings and cautions before handling the seat belt (pre-tensioner seat belt).

   WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

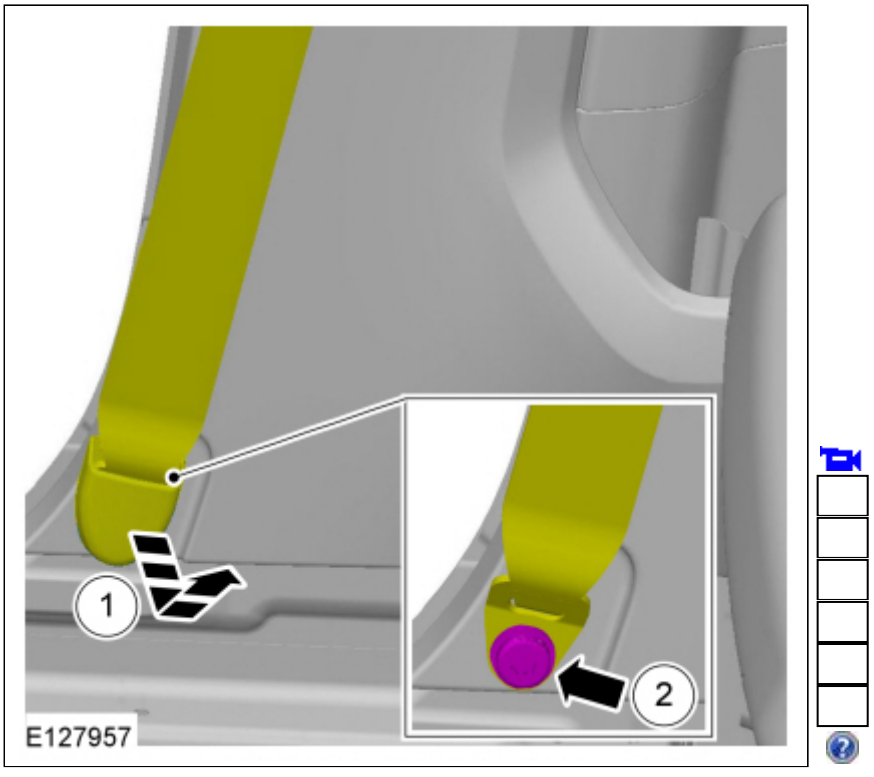
   NOTICE: The ELR (emergency locking retractor) has a spring that will unwind if the retractor cover is removed. The spring cannot be rewound by hand. If this occurs, the ELR will not work properly. Therefore, do not disassemble the retractor.

   Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).

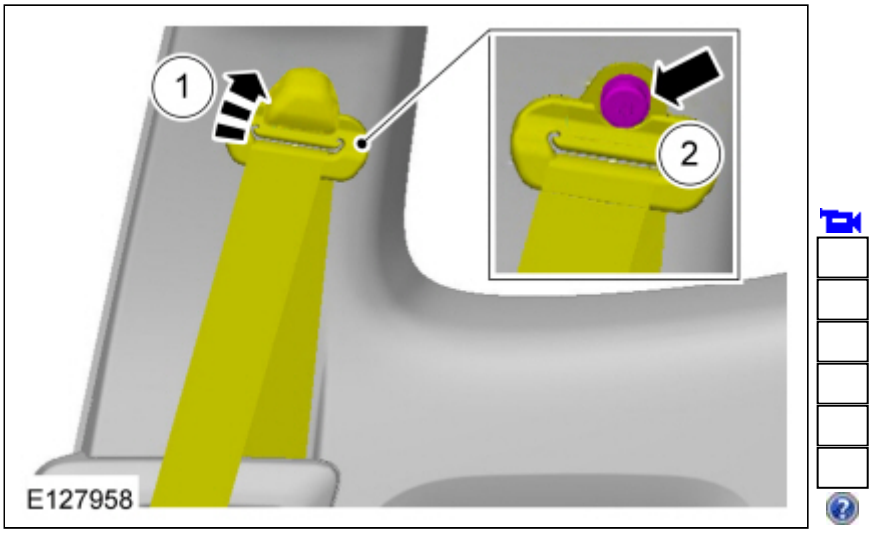
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables) .

3. **NOTE:** *Note the position of the component before removal.*

   Torque: 48 Nm



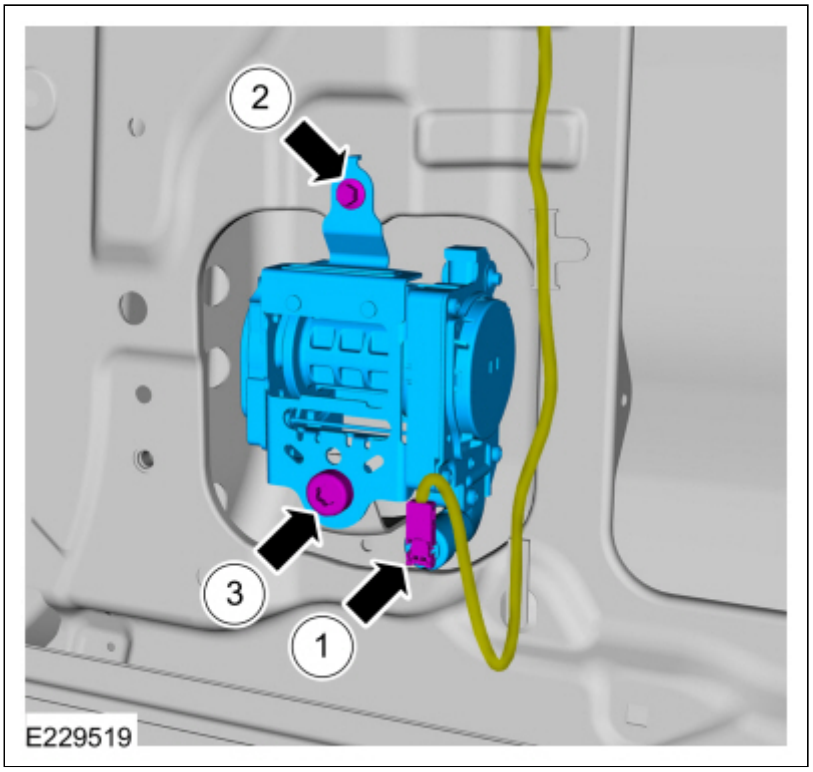
4. *Torque*: 48 Nm



5. Refer to: Rear Door Trim Panel - Super Cab (501-05 Interior Trim and Ornamentation) .
6.



2. *Torque*: 11 Nm
3. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Seatbelt Buckle

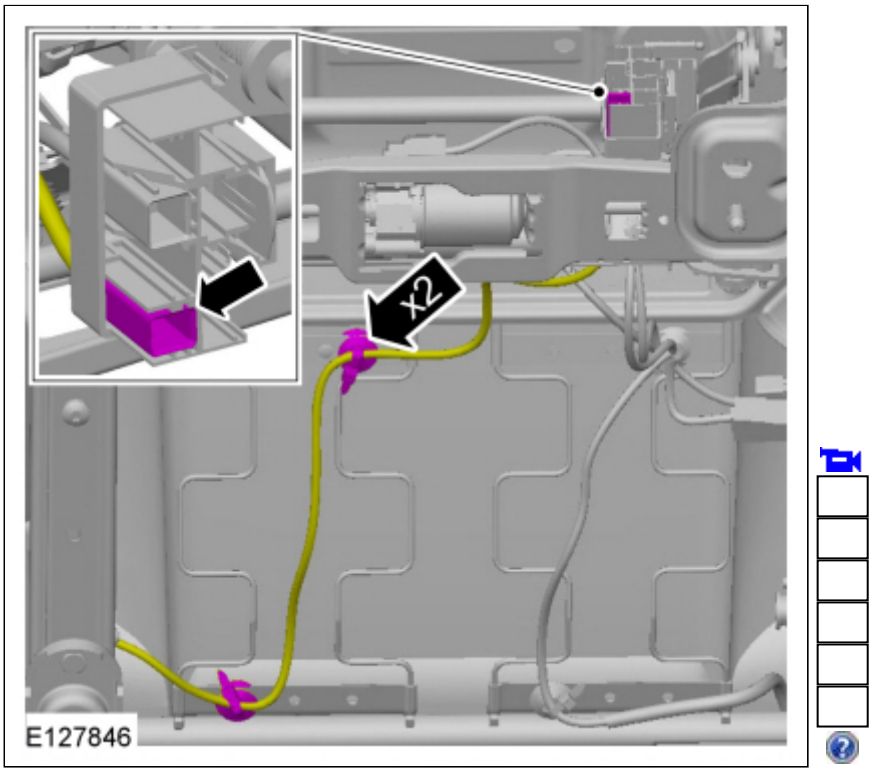
Base Part Number: 61202

Removal

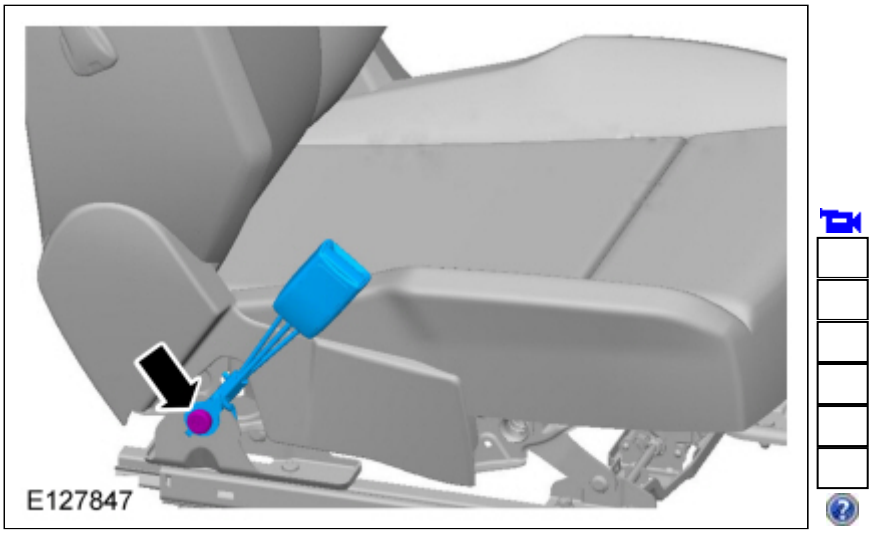
NOTE: *Removal steps in this procedure may contain installation details.*

Double cab

1. Refer to: Front Seat (501-10A Seating, Removal and Installation).
2. **NOTICE: Note the position of the component before removal.**

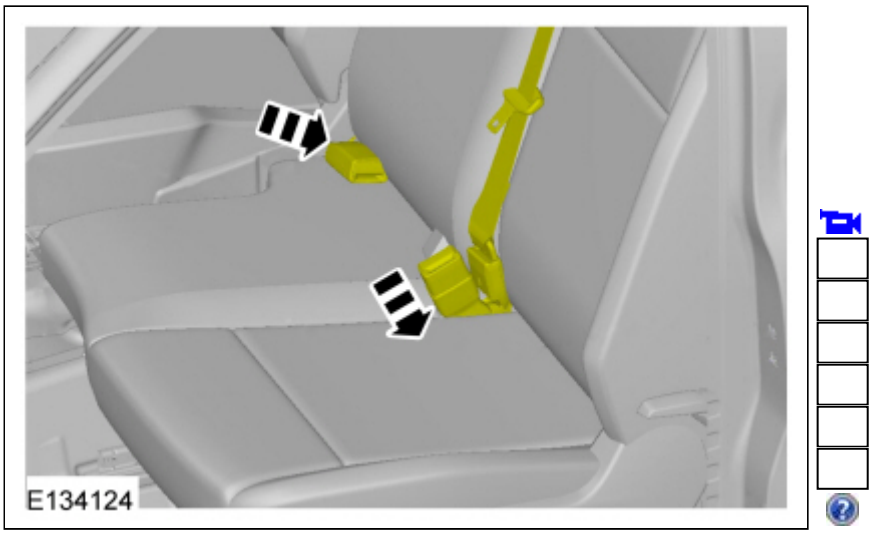


3. *Torque*: 50 Nm

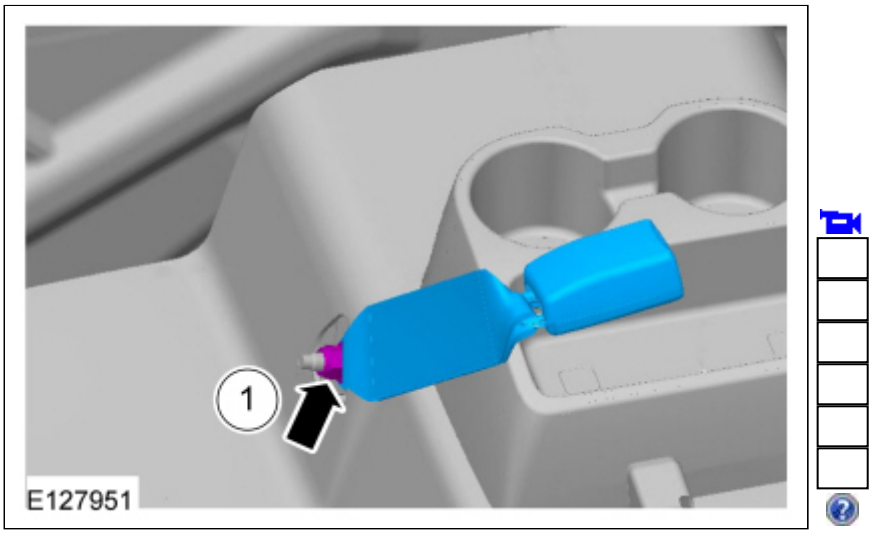


Single cab

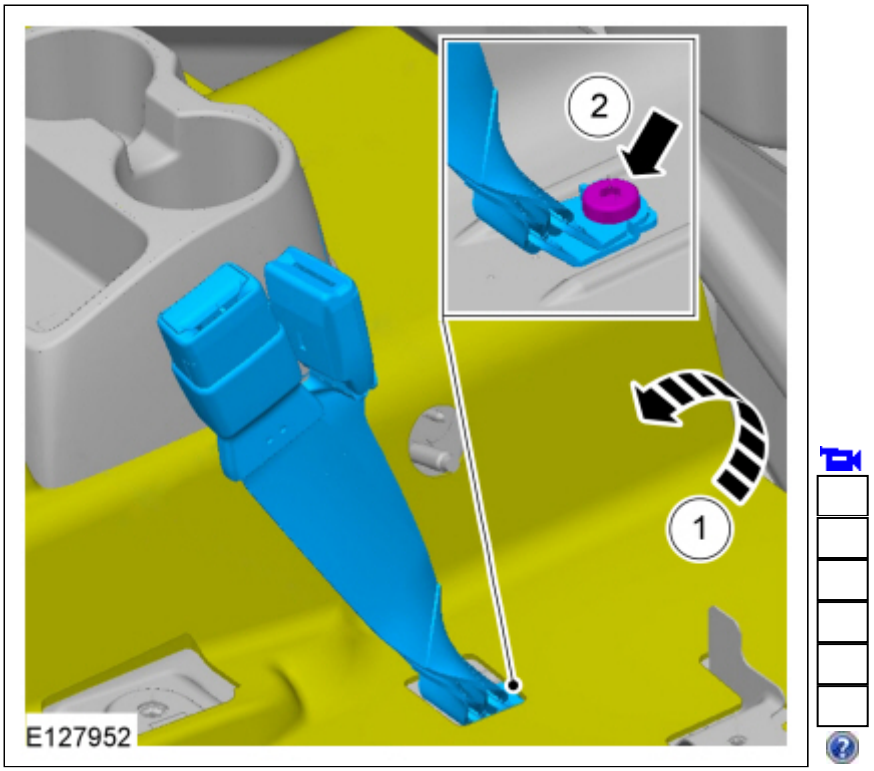
4.



5. *Torque*: 48 Nm



6. *Torque*: 48 Nm



Installation

1. **NOTE:** *Make sure the safety belt webbing is not twisted prior to repositioning the seat.*

   NOTE: *Make sure that the safety belt buckles are accessible after repositioning the seat.*

   To install, reverse the removal procedure.

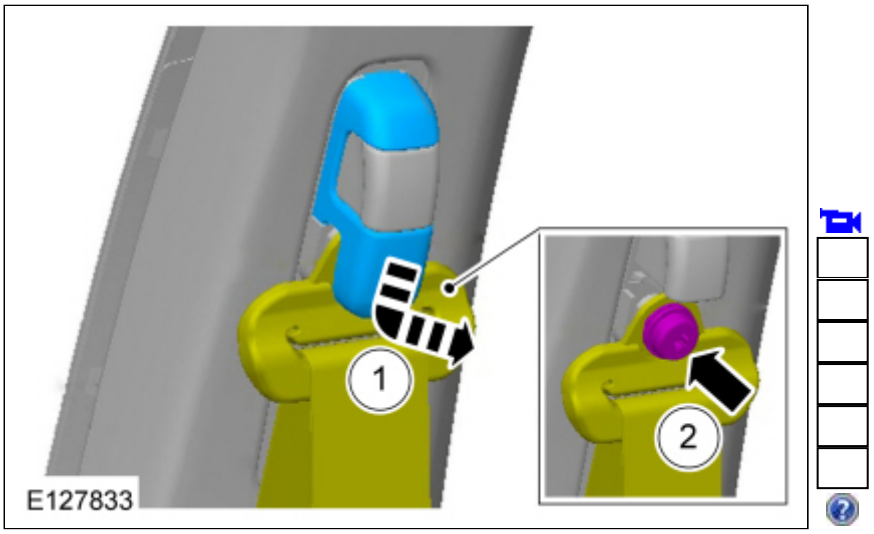
Copyright © 2016 Ford Motor Company

Seatbelt Shoulder Height Adjuster

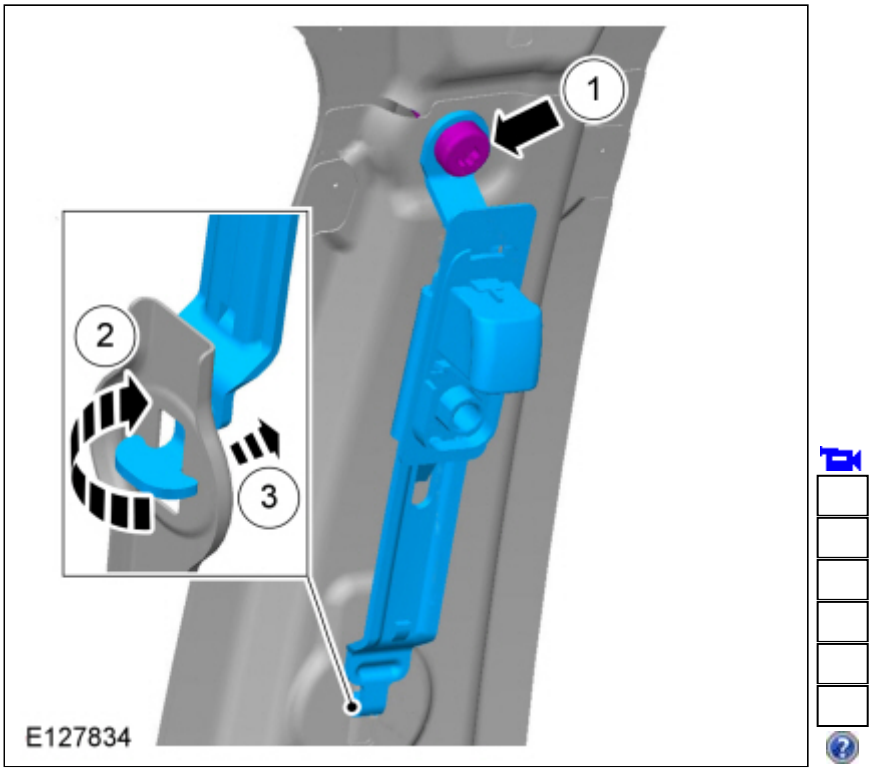
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

1. *Torque*: 48 Nm



2. Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Seatbelt Retractor

Base Part Number: 611B64

Removal

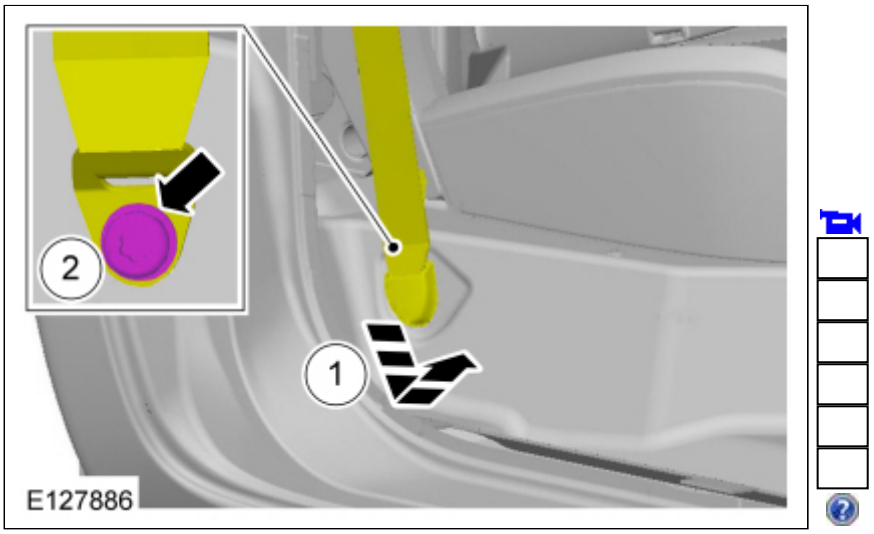
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

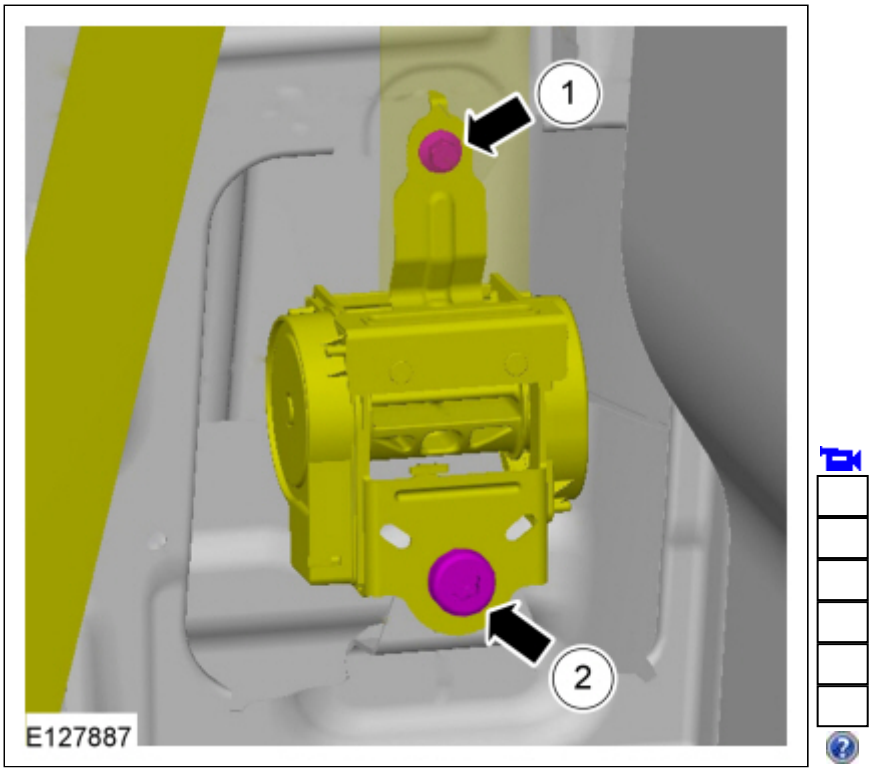
Double cab

2. **NOTE:** *Note the position of the component before removal.*

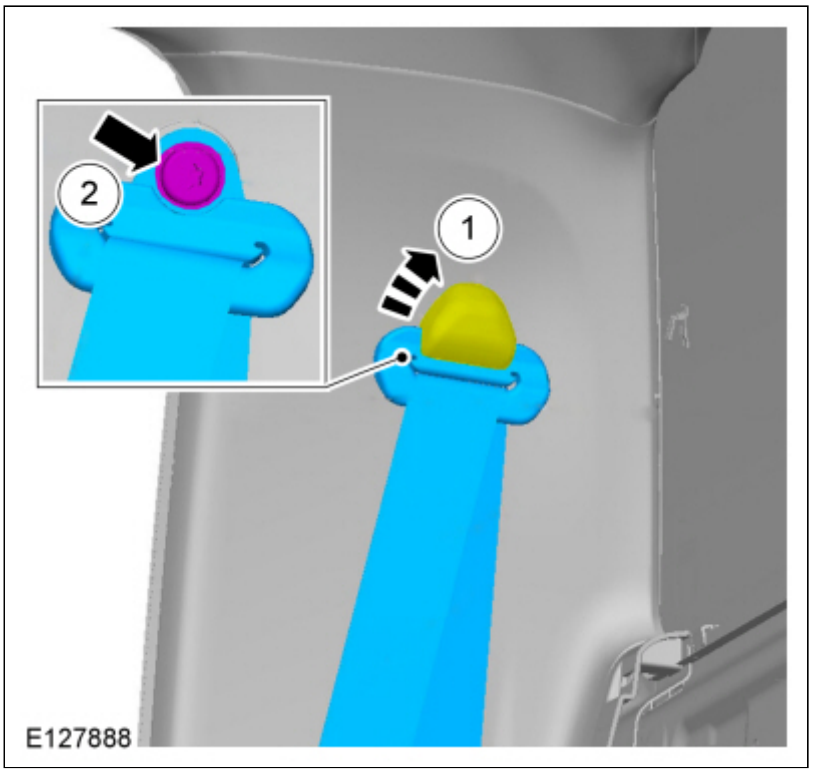
   Torque: 48 Nm



1. *Torque*: 11 Nm
2. *Torque*: 48 Nm

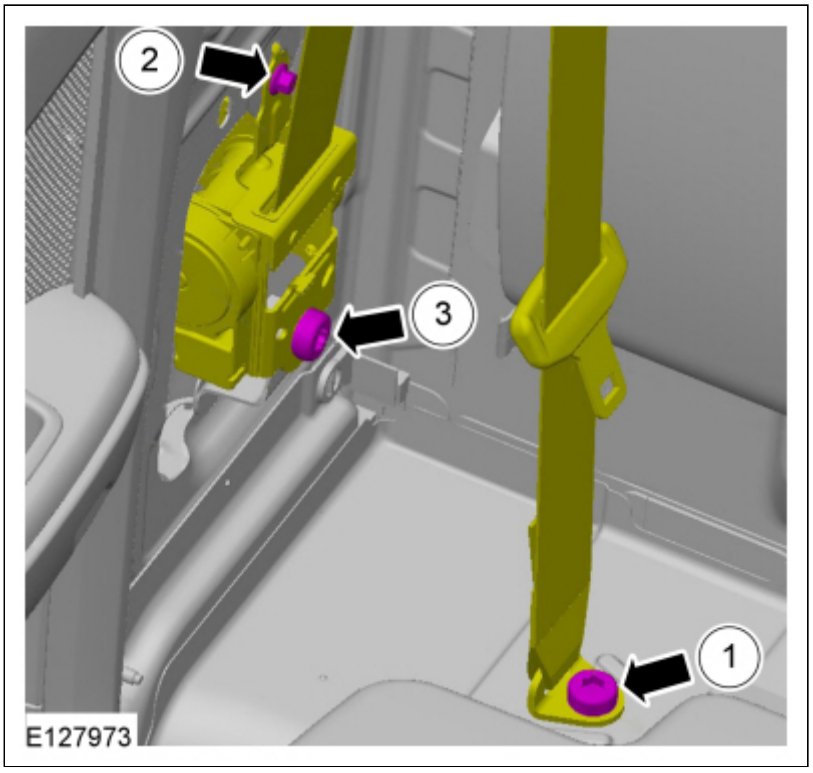


4. *Torque*: 48 Nm

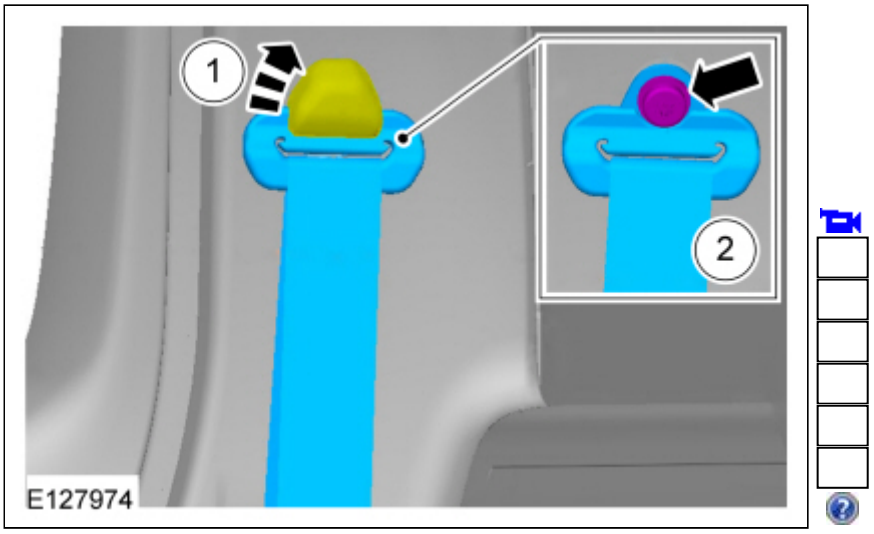


Stretch cab

1. *Torque*: 48 Nm
2. *Torque*: 11 Nm
3. *Torque*: 48 Nm



6. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

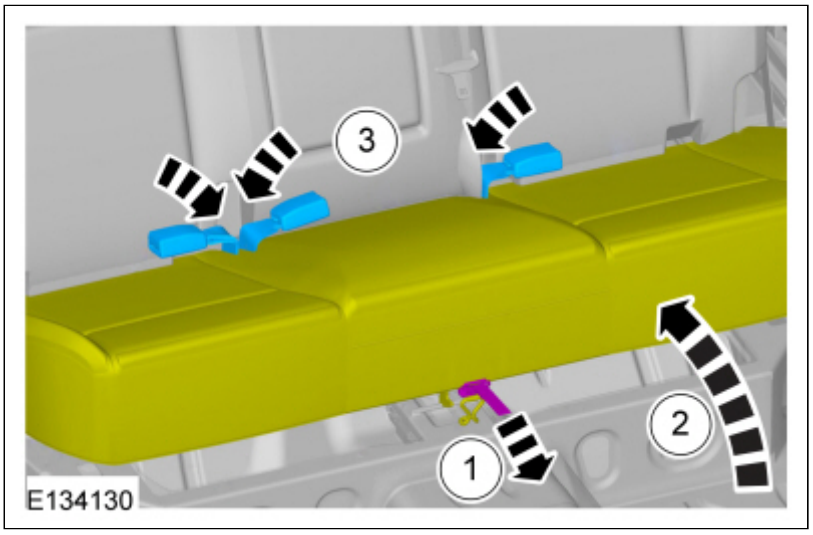
Rear Center Seatbelt Retractor

Base Part Number: 611B08

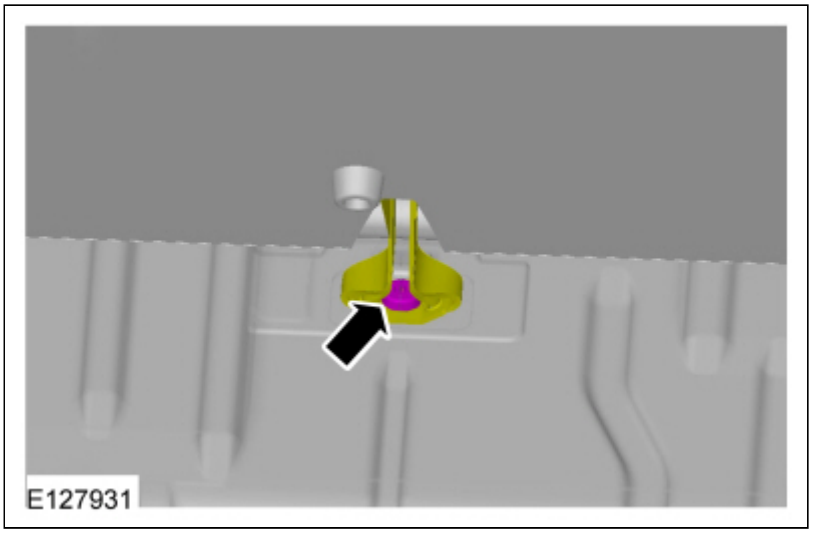
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

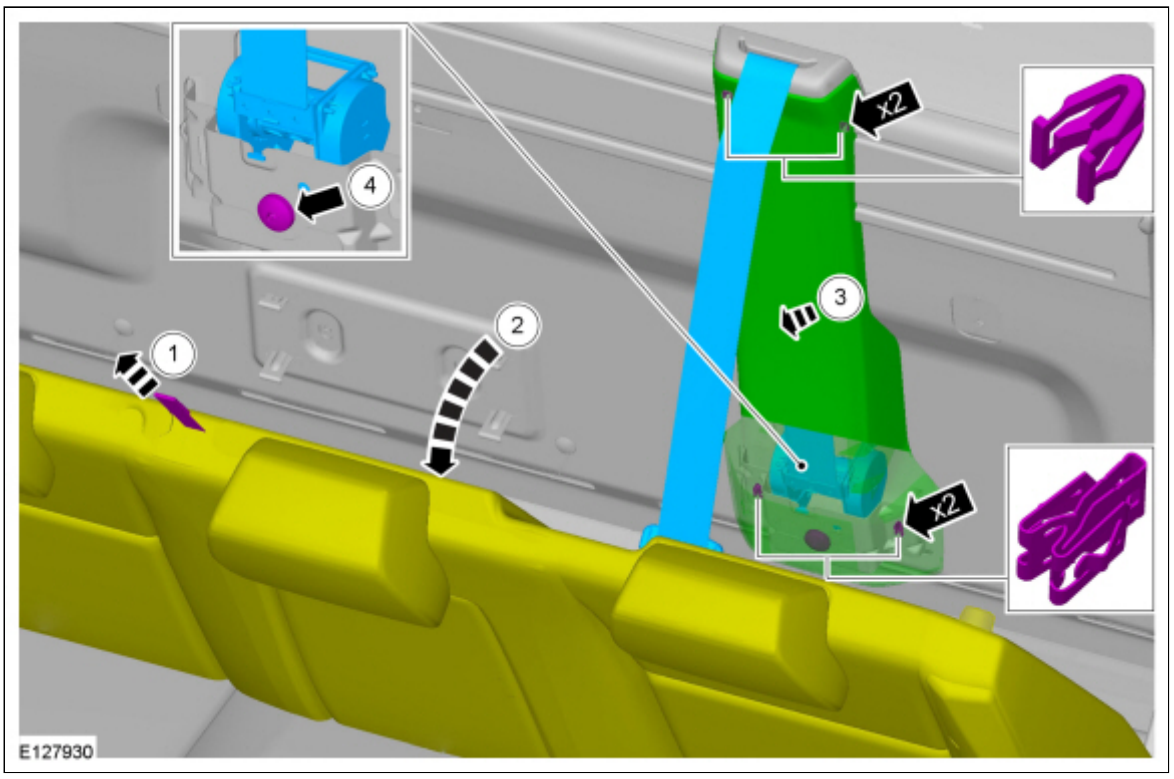
1.



2. *Torque*: 48 Nm



4. *Torque*: 48 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Rear Seatbelt Buckle

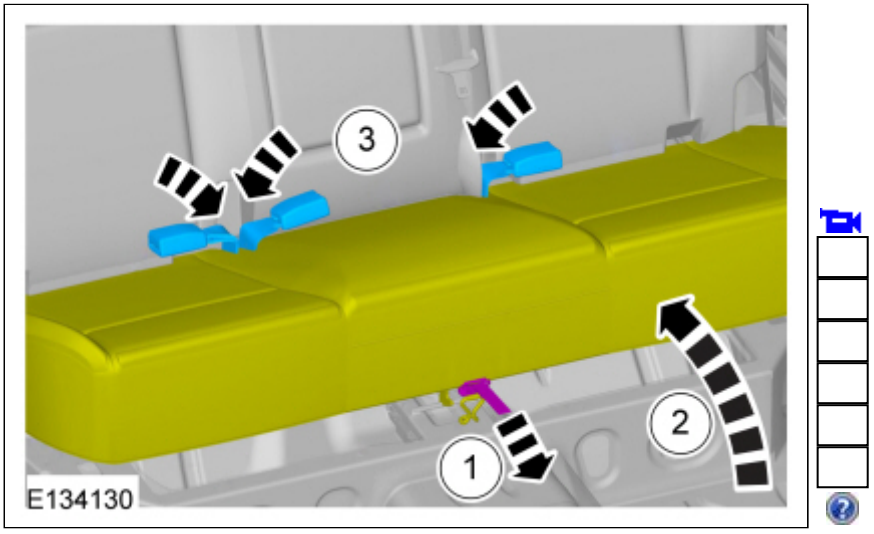
Base Part Number: 60044

Removal

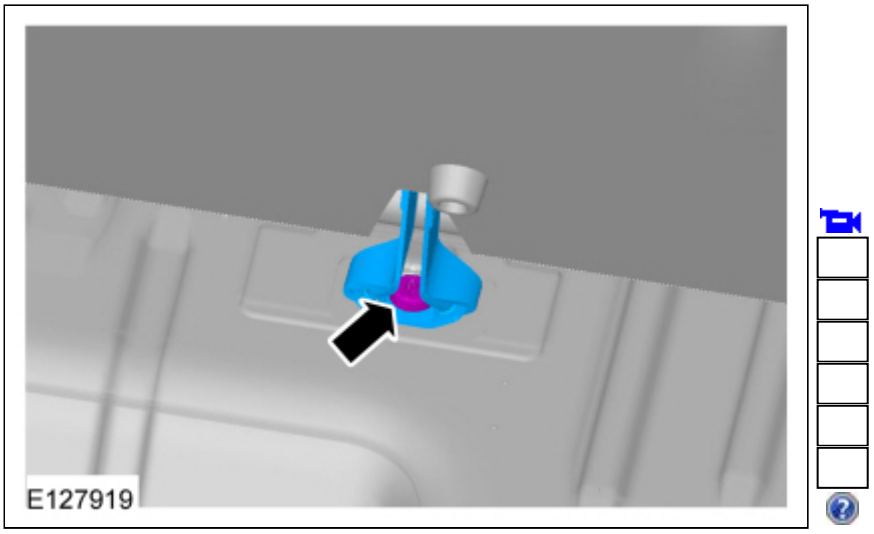
Double cab

NOTE: *Removal steps in this procedure may contain installation details.*

1.

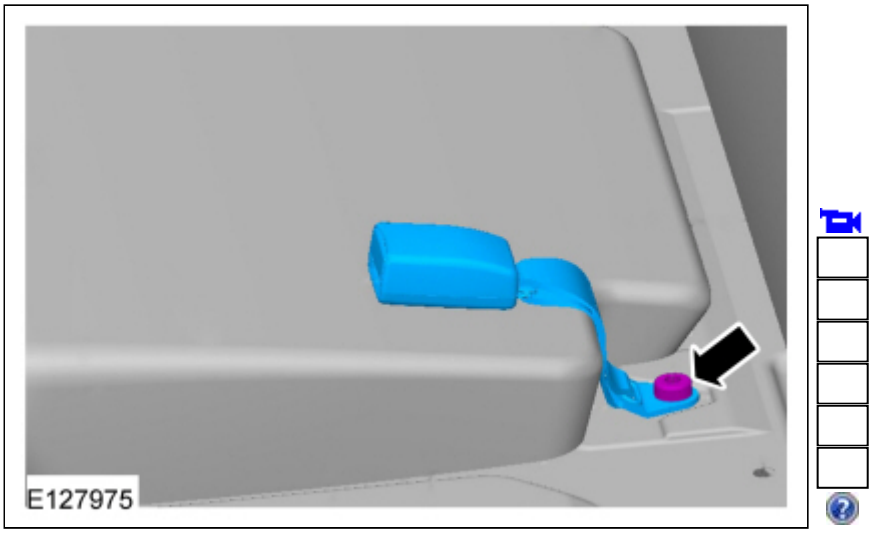


2. *Torque*: 48 Nm



Stretch cab

3. *Torque*: 48 Nm



Installation

1. **NOTE:** *Make sure the safety belt webbing is not twisted prior to repositioning the seat.*

   NOTE: *Make sure that the safety belt buckles are accessible after repositioning the seat.*

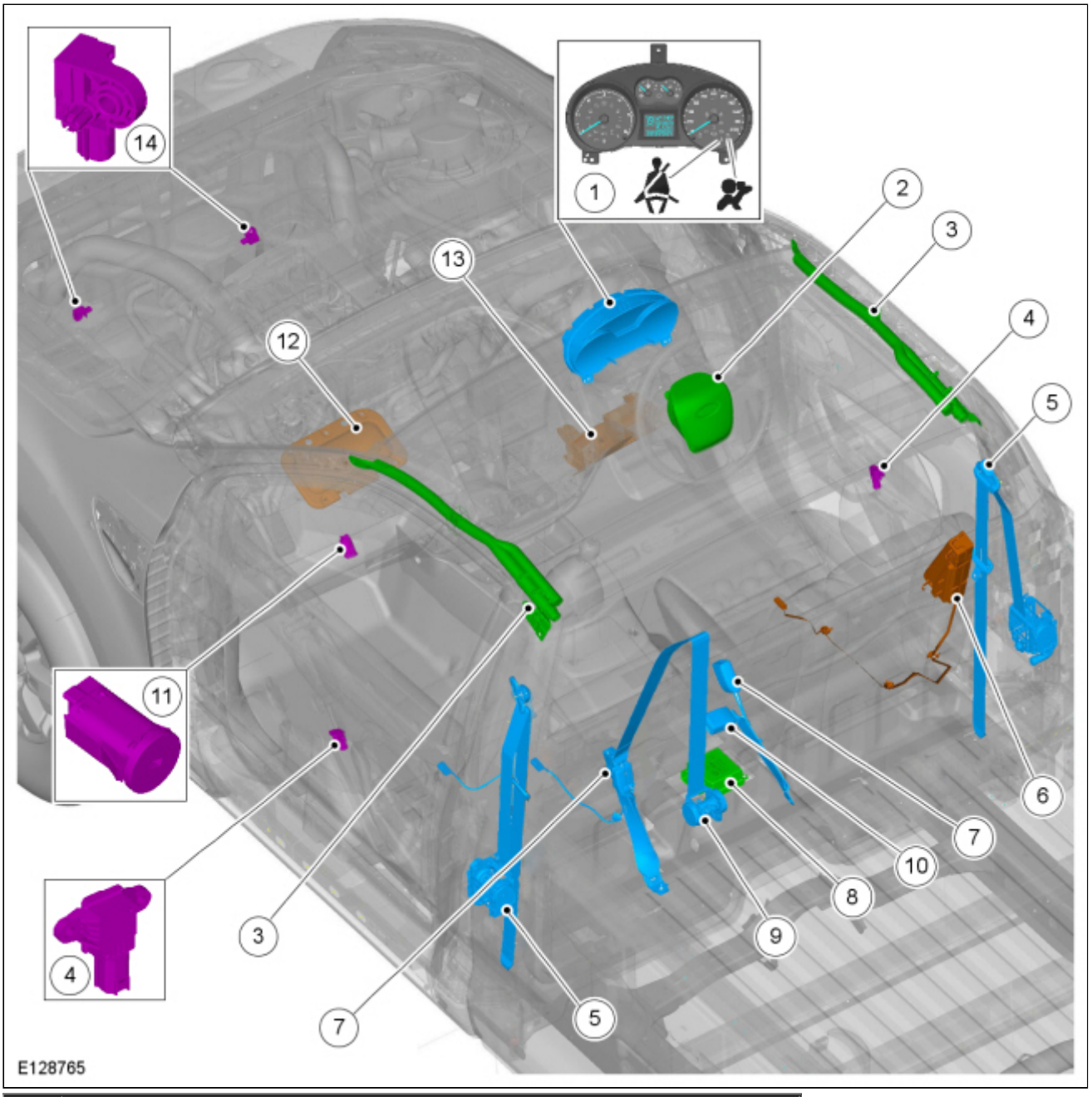
   NOTE: *Make sure to tighten the bolt to specification.*

   To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Airbag and Seatbelt Pretensioner Supplemental Restraint System (SRS) - Component Location

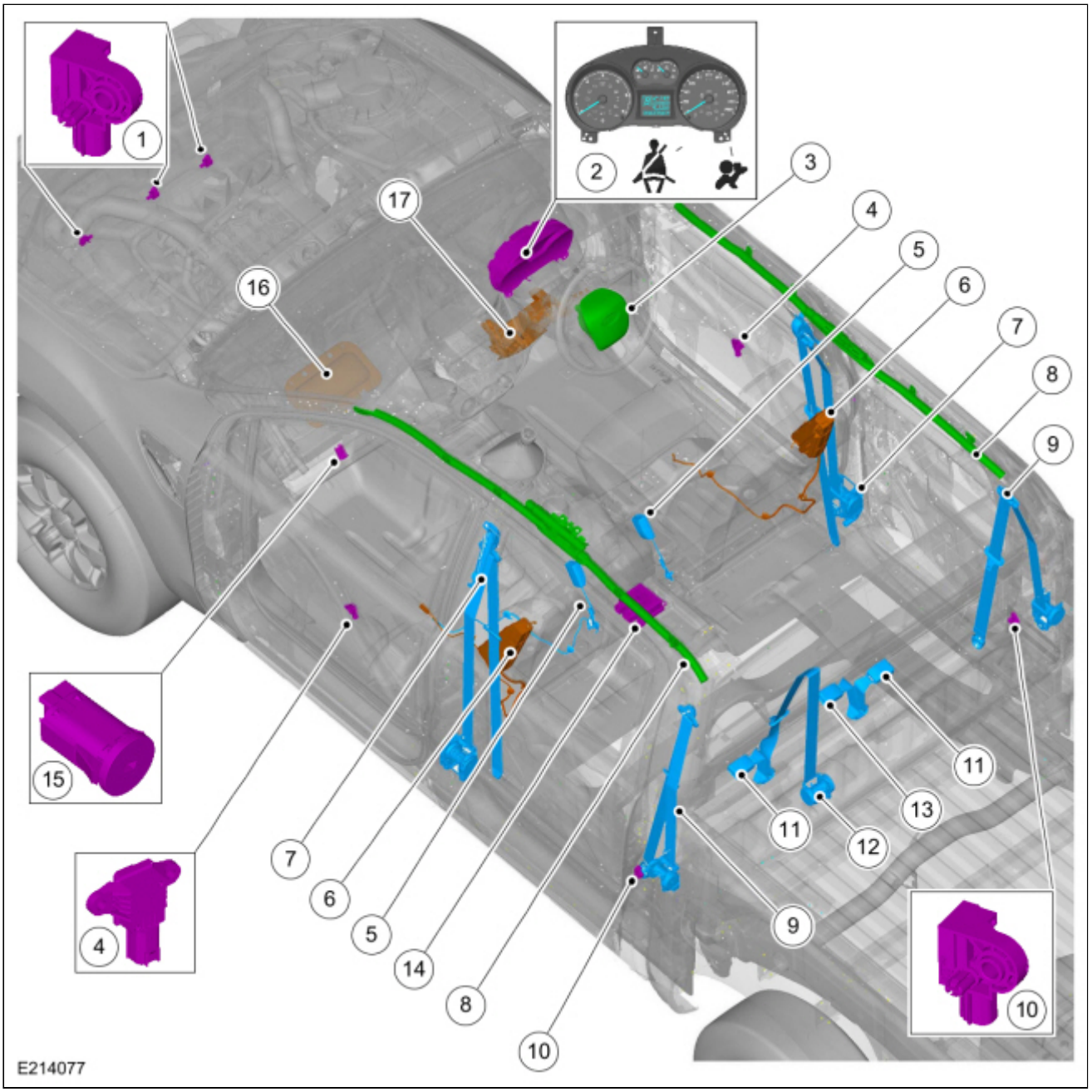
Single cab



Item	Description
1	Instrument cluster with air bag indicator light and safety belt warning light
2	Driver air bag module
3	Side air curtain module
4	Side impact sensor
5	Front safety belt retractor
6	Side air bag module
7	Front safety belt buckle
8	Restraints control module (RCM)
9	Front center safety belt retractor

10	Front center safety belt buckle
11	Passenger airbag deactivation (PAD) switch
12	Passenger air bag module
13	Driver lower air bag module
14	Front impact severity sensor

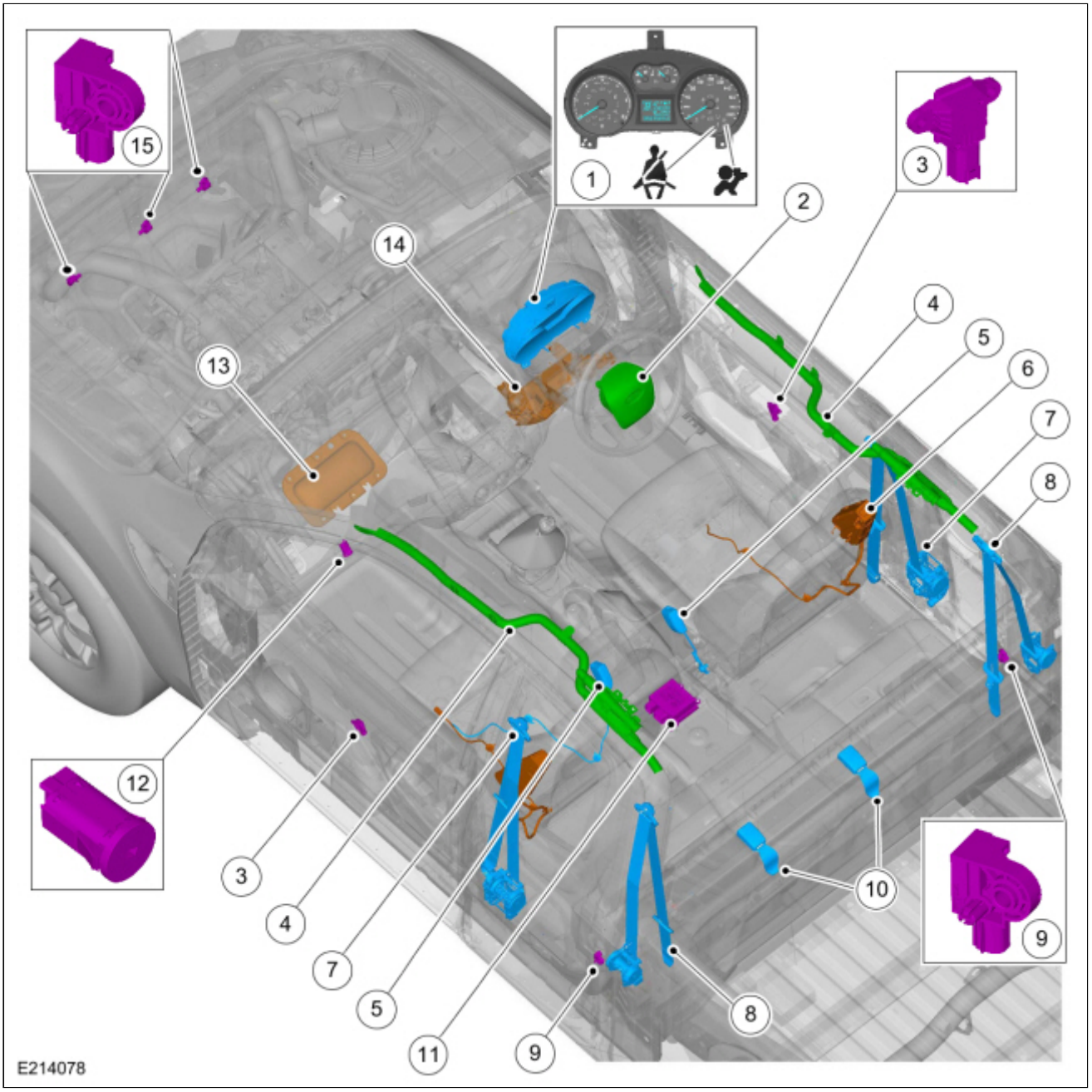
Double cab



Item	Description
1	Front impact severity sensor
2	Instrument cluster with air bag indicator light and safety belt warning light
3	Driver air bag module
4	Side impact sensor
5	Front safety belt buckle
6	Side air bag module
7	Front safety belt retractor

8	Side air curtain module
9	Rear safety belt retractor
10	Side impact sensor (rear)
11	Rear safety belt buckle
12	Rear center safety belt retractor
13	Rear center safety belt buckle
14	Restraints control module (RCM)
15	Passenger airbag deactivation (PAD) switch
16	Passenger air bag module
17	Driver lower air bag module

Stretch cab



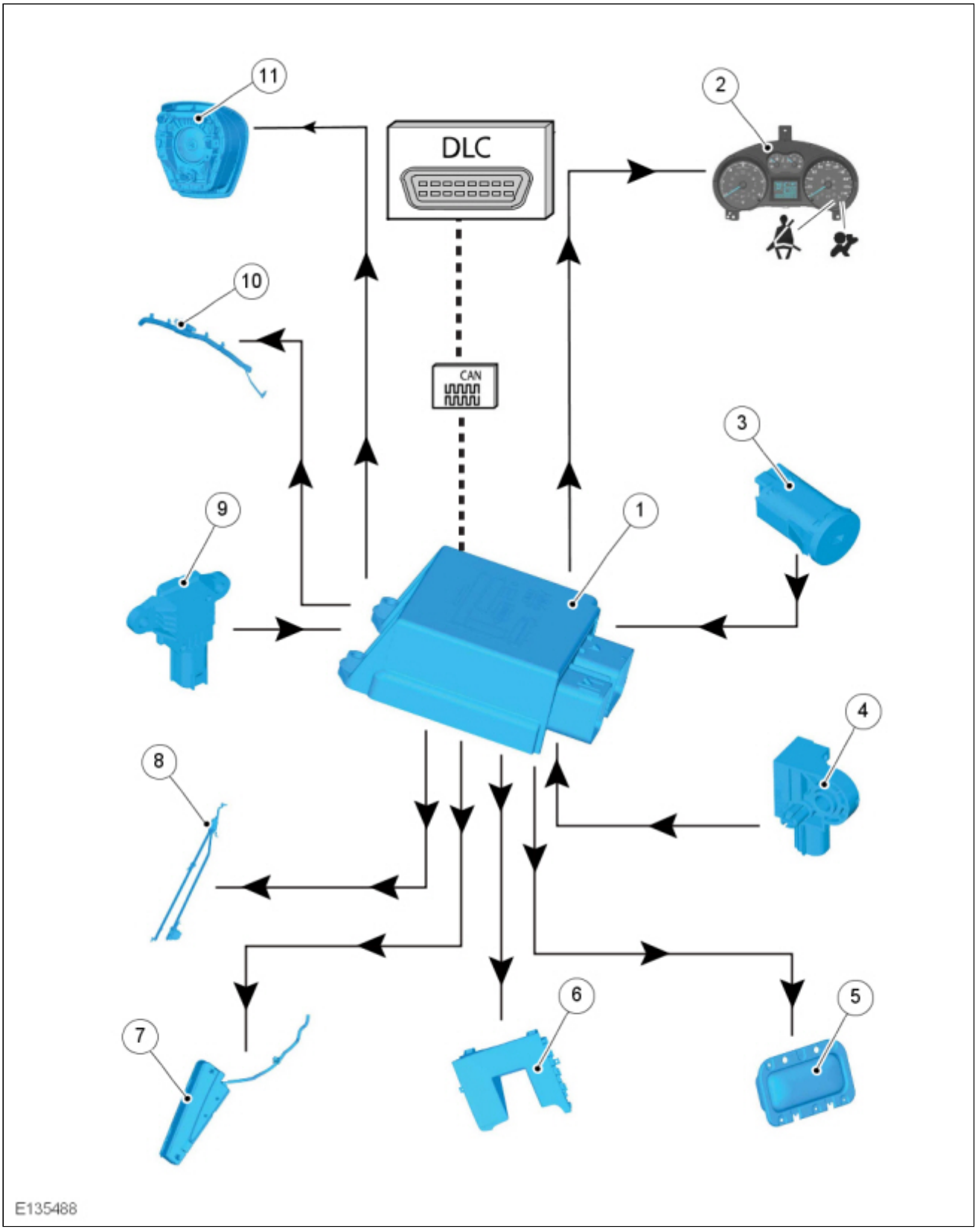
Item	Description
1	Instrument cluster with air bag indicator light and safety belt warning light
2	Driver air bag module

3	Side impact sensor
4	Side air curtain module
5	Front safety belt buckle
6	Side air bag module
7	Front safety belt retractor
8	Rear safety belt retractor
9	Side impact sensor (rear)
10	Rear safety belt buckle
11	Restraints control module (RCM)
12	Passenger airbag deactivation (PAD) switch
13	Passenger air bag module
14	Driver lower airbag module
15	Front impact severity sensor

Copyright © 2016 Ford Motor Company

Airbag and Seatbelt Pretensioner Supplemental Restraint System (SRS) - Overview

System overview



Item	Part Number	Description
1	—	RCM (Restraint Control Module)

2	—	Air bag warning indicator
3	—	Passenger airbag deactivation (PAD) switch
4	—	Front impact severity sensor
5	—	Passenger air bag module
6	—	Driver lower airbag module
7	—	Side airbag module
8	—	Safety belt retractor and pretensioner
9	—	Side impact sensor
10	—	Side air curtain module
11	—	Driver airbag module

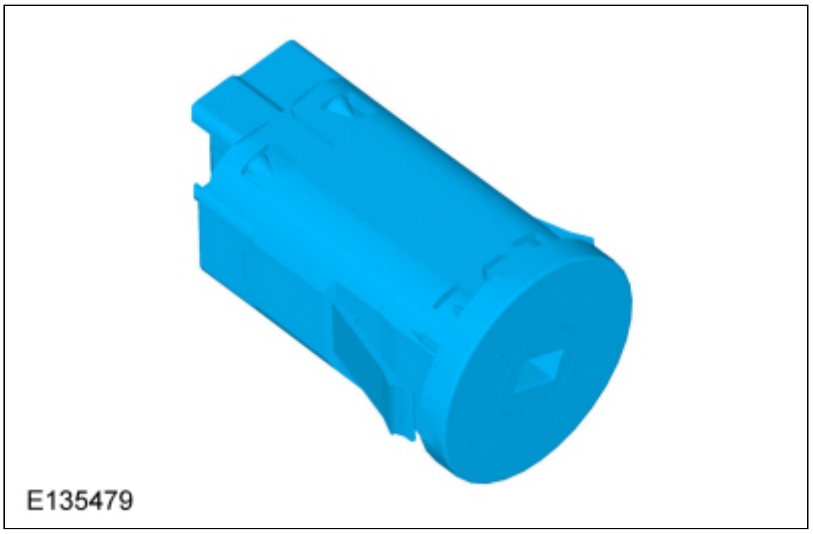
RCM (Restraint Control Module)



Electronic sensors are incorporated into the RCM; these measure the vehicle acceleration / deceleration in the event of a collision. The calculated value is evaluated by the RCM to determine the severity of the impact.

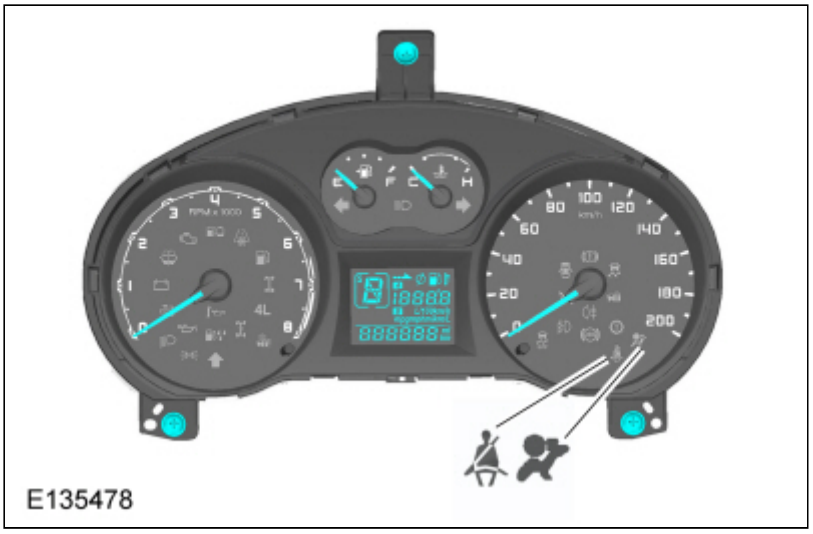
The RCM compares the values it receives from the crash sensor, side impact sensors and the internal electronic sensors. If the deceleration, due to a frontal or side impact, exceeds the stored value the RCM will trigger the air bag modules and the safety belt pretensioners as required. The RCM can be used again after a collision, provided the RCM is not physically damaged and it passes a self-test.

Passenger air bag deactivation switch



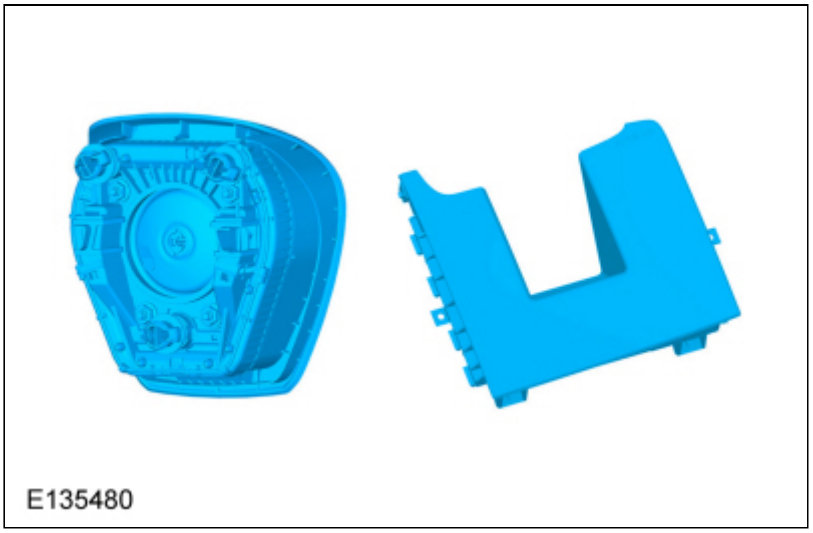
When the ignition is switched on, a warning lamp in the instrument panel indicates that the passenger air bag module has been deactivated.

Air bag warning indicator



The airbag warning indicator is active when an airbag system Fault has occurred or the airbag module is disconnected. The indicator will have a predetermined bulb prove- out following ignition being turned to 'Run' configurable with restraints system.

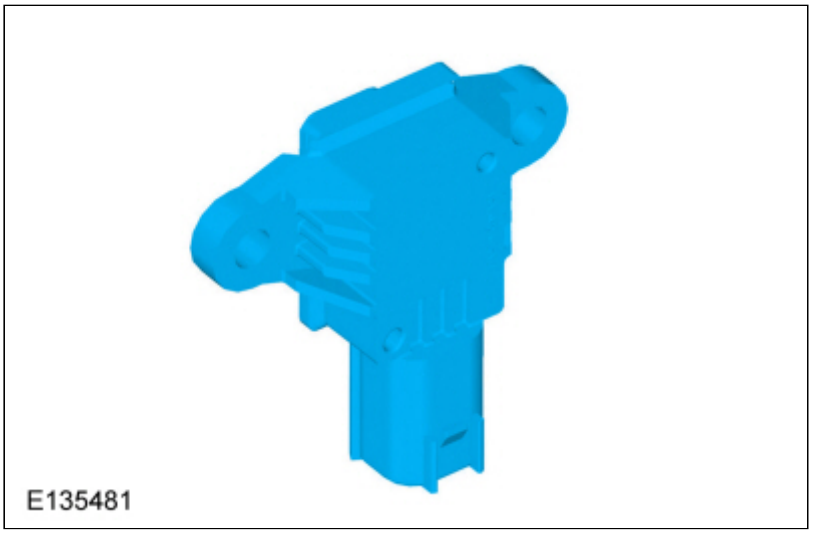
Driver air bag and driver lower air bag



This vehicle line is available with a steering wheel mounted driver air bag and a driver lower air bag (knee air bag).

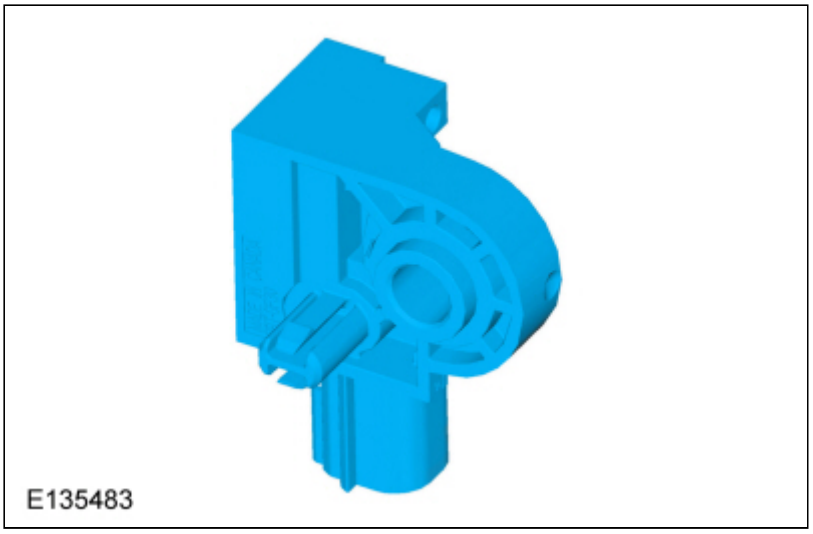
Side impact sensors

1. Side impact sensor (Front doors)



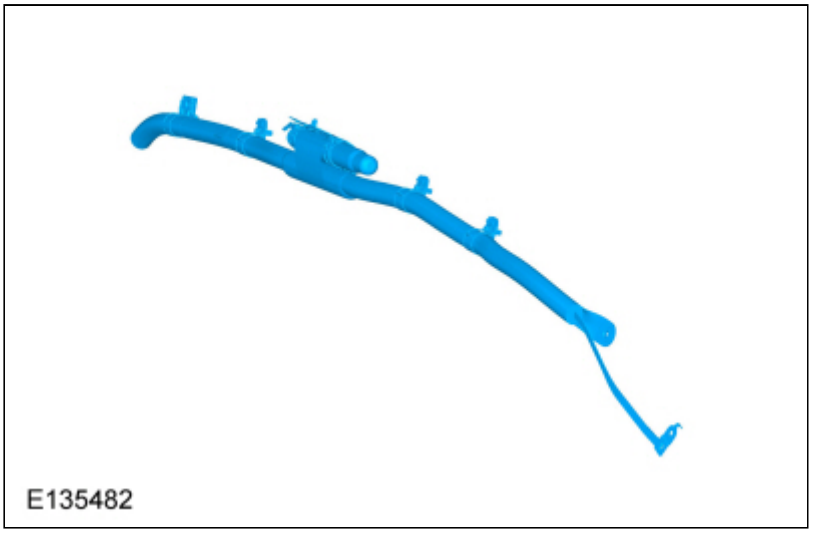
There are two side impact sensors located in the front driver and passenger doors. The sensors transmit digitally encoded pressure information to the RCM, where it is evaluated to assess the severity of a side impact. Power is supplied to the sensor by the RCM. If the sensor fails, the RCM stores a diagnostic trouble code (DTC).

2. Side impact sensor (Rear side)



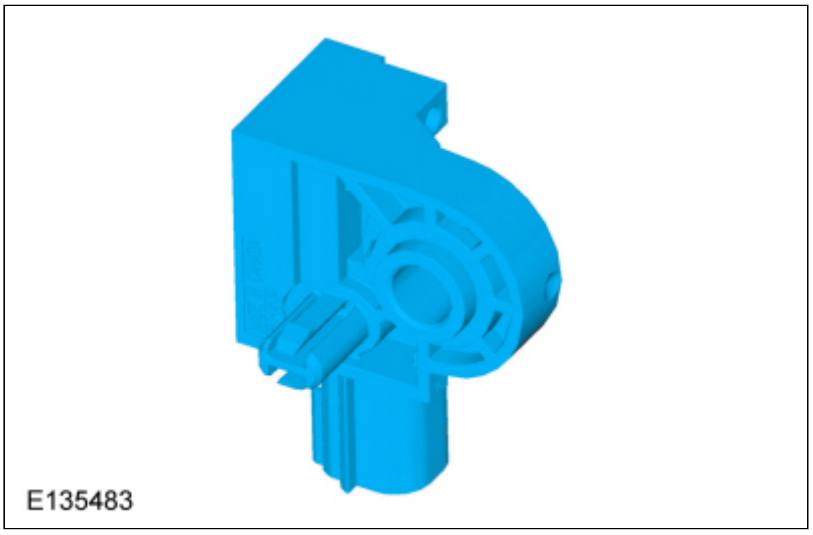
There are two side impact sensors located at the bottom of the C-pillars in stretch cab and double cab variants. The sensors transmit digitally encoded acceleration information to the RCM, where it is evaluated to assess the severity of a side impact. Power is supplied to the side impact sensor by the RCM. If the senor fails, the RCM stores a diagnostic trouble code (DTC).

Side air curtain



In the event of a side impact, the side air curtains (curtain air bags) deploy from the headliner, protecting the first and second row outboard occupants during a side impact.

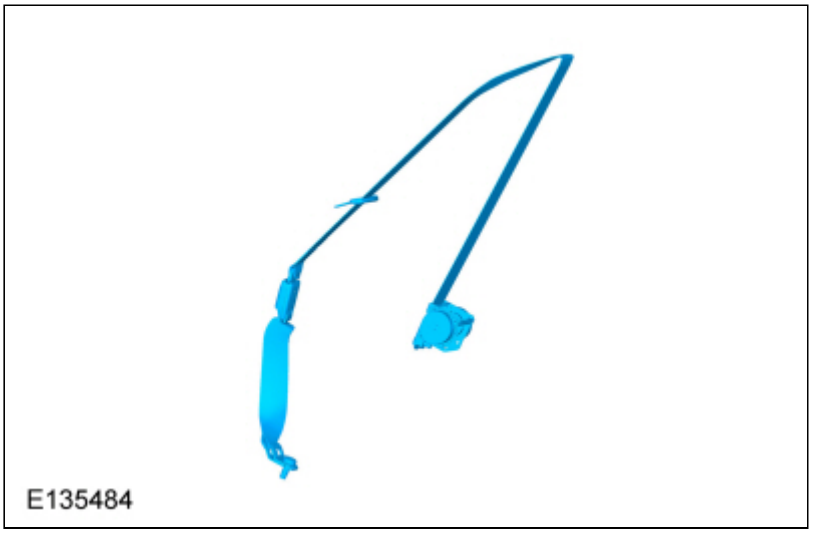
Front impact severity sensor



There are two front impact severity sensors located at the front of the vehicle, behind the radiator grille. The sensors

transmit digitally encoded acceleration information to the RCM, where it is evaluated to assess the severity of a front impact. Power is supplied to the sensor by the RCM. If the sensor fails, the RCM stores a diagnostic trouble code (DTC).

Safety belt retractor and pretensioners



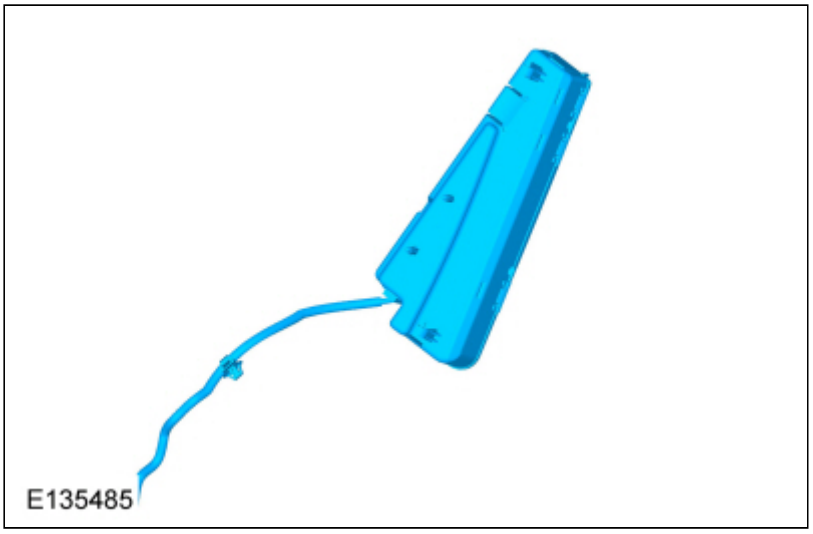
The front outboard seat belts are available equipped with a retractor pretensioner and load limiter. In the event of a collision, the safety belt pretensioner deploy in one of two ways:

• On their own.

• Simultaneously with the front air bag module(s).

Safety belt use is necessary to obtain the best occupant protection and to receive the full advantage of the SRS.

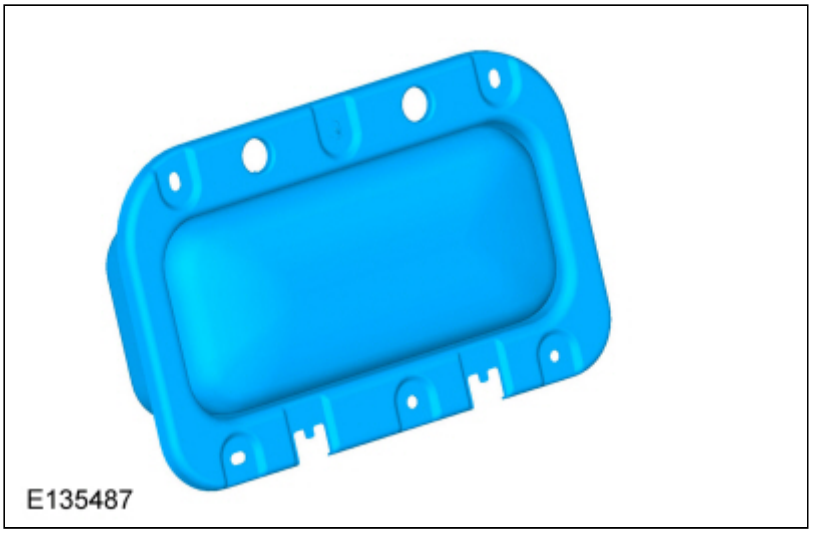
Side air bag



The side air bags are incorporated in the front seat backrests and side air bag modules deploy from the outboard of front seat backrest upon a side impact.

When a side air bag is deployed, the seam of the seat cover tears open enabling the side air bag to inflate unhindered from the front seat backrest.

Passenger air bag



The passenger air bag is designed to provide increased collision protection for front seat passengers.

Copyright © 2016 Ford Motor Company

Airbag Supplemental Restraint System (SRS)

DTC Chart: Restraint Control Module (RCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

NOTE: *Unlisted Diagnostic Trouble Codes (DTCs) are often retrieved as a result of incorrect repair procedures. Before attempting any repairs for unlisted Diagnostic Trouble Codes (DTCs), check the vehicle service history for recent repairs. For RCM Diagnostic Trouble Codes (DTCs) not listed in this chart,*

- Repair all other RCM Diagnostic Trouble Codes (DTCs) before attempting to repair any Diagnostic Trouble Codes (DTCs) not listed in this chart.
- If no other RCM Diagnostic Trouble Codes (DTCs) are retrieved, CLEAR the RCM Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If the RCM Diagnostic Trouble Codes (DTCs) return, VERIFY that the RCM is the correct part number for the vehicle application, and INSTALL As-Built data following scan tool instructions under Module Programming > As-Built.
- Inspect the RCM and RCM connectors for any damaged pins or connections.

RCM DTC Chart

DTC	Description	Action
B0001:11	Driver Frontal Stage 1 Deployment Control: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: A (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0001:12	Driver Frontal Stage 1 Deployment Control: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: A (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0001:13	Driver Frontal Stage 1 Deployment Control: Circuit Open	REFER to: Pinpoint Test - DTC: A (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0001:1A	Driver Frontal Stage 1 Deployment Control: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: A (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0001:2B	Driver Frontal Stage 1 Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0001:4A	Driver Frontal Stage 1 Deployment Control: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0004:11	Driver Knee Bolster Deployment Control: Circuit Short to Ground	
B0004:12	Driver Knee Bolster Deployment Control: Circuit Short to Battery	
B0004:13	Driver Knee Bolster Deployment Control: Circuit Open	
B0004:1A	Driver Knee Bolster Deployment Control: Circuit Resistance Below Threshold	

B0004:2B	Driver Knee Bolster Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0004:4A	Driver Knee Bolster Deployment Control: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0010:11	Passenger Frontal Stage 1 Deployment Control: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: D (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0010:12	Passenger Frontal Stage 1 Deployment Control: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: D (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0010:13	Passenger Frontal Stage 1 Deployment Control: Circuit Open	REFER to: Pinpoint Test - DTC: D (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0010:1A	Passenger Frontal Stage 1 Deployment Control: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: D (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0010:2B	Passenger Frontal Stage 1 Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0010:4A	Passenger Frontal Stage 1 Deployment Control: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0070:11	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: I (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0070:12	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: I (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0070:13	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Open	REFER to: Pinpoint Test - DTC: I (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0070:1A	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: I (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0070:2B	Driver Seatbelt Pretensioner "A" Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0070:4A	Driver Seatbelt Pretensioner "A" Deployment Control: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0072:11	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: J (501-20B Supplemental Restraint System, Diagnosis and Testing).

B0072:12	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: J (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0072:13	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Open	REFER to: Pinpoint Test - DTC: J (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0072:1A	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: J (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0072:2B	Passenger Seatbelt Pretensioner "A" Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B0072:4A	Passenger Seatbelt Pretensioner "A" Deployment Control: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1193:00	Crash Event Storage Full and Locked: No Sub Type Information	This DTC indicates the vehicle has been in a crash. INSTALL a new RCM and impact sensors. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
B11D8:12	Restraint Event Notification: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: R (501-20B Supplemental Restraint System, Diagnosis and Testing).
B11D8:14	Restraint Event Notification: Circuit Short to Ground or Open	REFER to: Pinpoint Test - DTC: R (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1202:01	Restraint System Passenger Enable Indicator: General Electrical Failure	The RCM has received a fault message from the Front Controls Interface Module-B (FCIM-B) indicating a fault in the PAD indicator. CARRY OUT a self-test of the Front Controls Interface Module-B (FCIM-B) and REPAIR any Diagnostic Trouble Codes (DTCs). Refer to the appropriate section in Group 415 for the procedure.
B1202:4A	Restraint System Passenger Enable Indicator: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1404:11	Driver Side Airbag Deployment Control: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: S (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1404:12	Driver Side Airbag Deployment Control: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: S (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1404:13	Driver Side Airbag Deployment Control: Circuit Open	REFER to: Pinpoint Test - DTC: S (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1404:1A	Driver Side Airbag Deployment Control: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: S (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1404:2B	Driver Side Airbag Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1404:4A	Driver Side Airbag Deployment Control:	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System,

	Incorrect Component Installed	Diagnosis and Testing).
B1405:11	Driver Side Curtain Deployment Control 1: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: T (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1405:12	Driver Side Curtain Deployment Control 1: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: T (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1405:13	Driver Side Curtain Deployment Control 1: Circuit Open	REFER to: Pinpoint Test - DTC: T (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1405:1A	Driver Side Curtain Deployment Control 1: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: T (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1405:2B	Driver Side Curtain Deployment Control 1: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1405:4A	Driver Side Curtain Deployment Control 1: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1407:11	Passenger Side Airbag Deployment Control: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: U (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1407:12	Passenger Side Airbag Deployment Control: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: U (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1407:13	Passenger Side Airbag Deployment Control: Circuit Open	REFER to: Pinpoint Test - DTC: U (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1407:1A	Passenger Side Airbag Deployment Control: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: U (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1407:2B	Passenger Side Airbag Deployment Control: Signal Cross Coupled	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1407:4A	Passenger Side Airbag Deployment Control: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1408:11	Passenger Side Curtain Deployment Control 1: Circuit Short to Ground	REFER to: Pinpoint Test - DTC: V (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1408:12	Passenger Side Curtain Deployment Control 1: Circuit Short to Battery	REFER to: Pinpoint Test - DTC: V (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1408:13	Passenger Side Curtain Deployment Control 1: Circuit Open	REFER to: Pinpoint Test - DTC: V (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1408:1A	Passenger Side Curtain Deployment Control 1: Circuit Resistance Below Threshold	REFER to: Pinpoint Test - DTC: V (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1408:2B	Passenger Side Curtain Deployment	REFER to: Pinpoint Test - DTC: AE (501-20B Supplemental Restraint System,

	Control 1: Signal Cross Coupled	Diagnosis and Testing).
B1408:4A	Passenger Side Curtain Deployment Control 1: Incorrect Component Installed	REFER to: Pinpoint Test - DTC: AF (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1413:81	Driver Frontal Restraints Sensor: Invalid Serial Data Received	INSTALL a new Driver Side front impact severity sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1413:96	Driver Frontal Restraints Sensor: Component Internal Failure	INSTALL a new Driver Side front impact severity sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1414:81	Driver Side Restraints Sensor 1: Invalid Serial Data Received	INSTALL a new Driver door side impact sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1414:96	Driver Side Restraints Sensor 1: Component Internal Failure	INSTALL a new Driver door side impact sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1415:81	Driver Side Restraints Sensor 2: Invalid Serial Data Received	INSTALL a new Driver Side C-pillar side impact sensor.
B1415:96	Driver Side Restraints Sensor 2: Component Internal Failure	INSTALL a new Driver Side C-pillar side impact sensor.
B1417:81	Passenger Frontal Restraints Sensor: Invalid Serial Data Received	INSTALL a new Passenger Side front impact severity sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1417:96	Passenger Frontal Restraints Sensor: Component Internal Failure	INSTALL a new Passenger Side front impact severity sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1418:81	Passenger Side Restraints Sensor 1: Invalid Serial Data Received	INSTALL a new Passenger Door side impact sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1418:96	Passenger Side Restraints Sensor 1: Component Internal Failure	INSTALL a new Passenger Door side impact sensor. REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1419:81	Passenger Side Restraints Sensor 2: Invalid Serial Data Received	INSTALL a new Passenger Side C-pillar side impact sensor.
B1419:96	Passenger Side Restraints Sensor 2: Component Internal Failure	INSTALL a new Passenger Side C-pillar side impact sensor.
B142D:00	Pyrotechnic End of Life Activation Performed: No Sub Type Information	INSTALL a new RCM and CARRY OUT PMI. Use As-Built data when carrying out PMI for this DTC. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
U0100:00	Lost Communication with ECM/PCM A: No Sub Type Information	REFER to: Pinpoint Test - DTC: AH (501-20B Supplemental Restraint System, Diagnosis and Testing).
U0140:00	Lost Communication with Body Control Module: No Sub Type	REFER to: Pinpoint Test - DTC: AI (501-20B Supplemental Restraint System, Diagnosis and Testing).

	Information	
U0154:00	Lost Communication with Restraints Occupation Classification System Module: No Sub Type Information	
U0155:00	Lost Communication with Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	REFER to: Pinpoint Test - DTC: AK (501-20B Supplemental Restraint System, Diagnosis and Testing).
U0253:00	Lost Communication With Accessory Protocol Interface Module: No Sub Type Information	REFER to: Pinpoint Test - DTC: AL (501-20B Supplemental Restraint System, Diagnosis and Testing).
U0300:00	Internal Control Module Software Incompatibility: No Sub Type Information	CARRY OUT PMI. RETRIEVE RCM Diagnostic Trouble Codes (DTCs). If RCM DTC U0300:00 is retrieved on-demand during self-test, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
U0401:00	Invalid Data Received From ECM/PCM A: No Sub Type Information	**NOTE:** *This DTC sets in a module that is reporting a missing or invalid message from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new RCM as part of the repair unless directed to do so in a pinpoint test.* CHECK for additional RCM and PCM Diagnostic Trouble Codes (DTCs). DIAGNOSE and REPAIR any Diagnostic Trouble Codes (DTCs) that are retrieved. For RCM Diagnostic Trouble Codes (DTCs), REFER to the RCM DTC Chart. To diagnose PCM Diagnostic Trouble Codes (DTCs), Refer to the appropriate section in Group 303 for the procedure.
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	**NOTE:** *This DTC sets in a module that is reporting a missing or invalid message from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new RCM as part of the repair unless directed to do so in a pinpoint test.* CHECK for additional RCM and BCM Diagnostic Trouble Codes (DTCs). DIAGNOSE and REPAIR any Diagnostic Trouble Codes (DTCs) that are retrieved. For RCM Diagnostic Trouble Codes (DTCs), REFER to the RCM DTC Chart. For BCM Diagnostic Trouble Codes (DTCs), REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U0422:81	Invalid Data Received From Body Control Module: Invalid Serial Data Received	**NOTE:** *This DTC sets in a module that is reporting a missing or invalid message from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new RCM as part of the repair unless directed to do so in a pinpoint test.* CHECK for additional RCM and BCM Diagnostic Trouble Codes (DTCs). DIAGNOSE and REPAIR any Diagnostic Trouble Codes (DTCs) that are retrieved. For RCM Diagnostic Trouble Codes (DTCs), REFER to the RCM DTC Chart. For BCM Diagnostic Trouble Codes (DTCs), REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation).
U0554:00	Invalid Data Received From Accessory Protocol Interface Module: No Sub Type Information	CHECK for additional RCM and APIM Diagnostic Trouble Codes (DTCs). For RCM Diagnostic Trouble Codes (DTCs), REFER to the RCM DTC Chart. For APIM Diagnostic Trouble Codes (DTCs), Refer to the appropriate section in Group 415 for the procedure.
U0557:82	Invalid Data Received From Front Controls	CHECK for additional RCM and FCIM Diagnostic Trouble Codes (DTCs). For RCM Diagnostic Trouble Codes (DTCs), RETURN to the beginning of this

	Interface Module "A": No Sub Type Information	chart. For FCIM Diagnostic Trouble Codes (DTCs), Refer to the appropriate section in Group 415 for the procedure.
U2100:00	Initial Configuration Not Complete: No Sub Type Information	CHECK vehicle history for recent service actions related to this module. This DTC sets due to incomplete or improper PMI procedures. If there have been recent service actions with this module, REPEAT the PMI procedure as directed by the diagnostic scan tool using As-Built data.
U2101:00	Control Module Configuration Incompatible: No Sub Type Information	CARRY OUT PMI using As-Built data. RETRIEVE RCM Diagnostic Trouble Codes (DTCs). If RCM DTC U2101:00 is retrieved on-demand, INSTALL a new RCM. Use As-Built data when carrying out PMI for this DTC. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
U2200:00	Control Module Configuration Memory Corrupt: No Sub Type Information	INSTALL a new RCM. Use As-Built data when CARRYING OUT PMI during the RCM installation. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
U2300:55	Central Configuration: Not Configured	REFER to: Pinpoint Test - DTC: AM (501-20B Supplemental Restraint System, Diagnosis and Testing).
U2300:64	Central Configuration: Signal Plausibility Failure	REFER to: Pinpoint Test - DTC: AM (501-20B Supplemental Restraint System, Diagnosis and Testing).
U3000:46	Control Module: Calibration / Parameter Memory Failure	INSTALL a new RCM. Use As-Built data when CARRYING OUT PMI during the RCM installation. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	INSTALL a new RCM. Using a diagnostic scan tool, CARRY OUT RCM PMI. If DTC U2200:00 is also present, USE As-Built data when CARRYING OUT PMI during the RCM installation. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing).
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing).

Symptom Chart(s)

Symptom Chart: Supplemental Restraint System

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Symptom Chart

Condition	Possible Sources	Actions
A module does not respond to the diagnostic scan tool	• Fuse • Diagnostic scan tool • DLC • Wiring, terminals or connectors • Module	• REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
An audible tone sounds within 60	• SRS fault or airbag	• CARRY OUT the RCM and IPC self-tests. For RCM Diagnostic Trouble Codes (DTCs), REFER to DTC Chart:

seconds of ignition ON	warning indicator fault	RCM. For IPC Diagnostic Trouble Codes (DTCs), REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
The airbag indicator is flashing	• SRS fault	• CARRY OUT the RCM self tests. REFER to DTC Chart: RCM.
The airbag warning indicator is illuminated continuously	• Fuse • Wiring, terminals or connectors • IPC • RCM	• CARRY OUT the RCM self tests. REFER to DTC Chart: RCM. • If no Diagnostic Trouble Codes (DTCs) were retrieved from the RCM , REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). • If the RCM does not respond to the diagnostic scan tool, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: A

B0001:11, B0001:12, B0001:13 and B0001:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

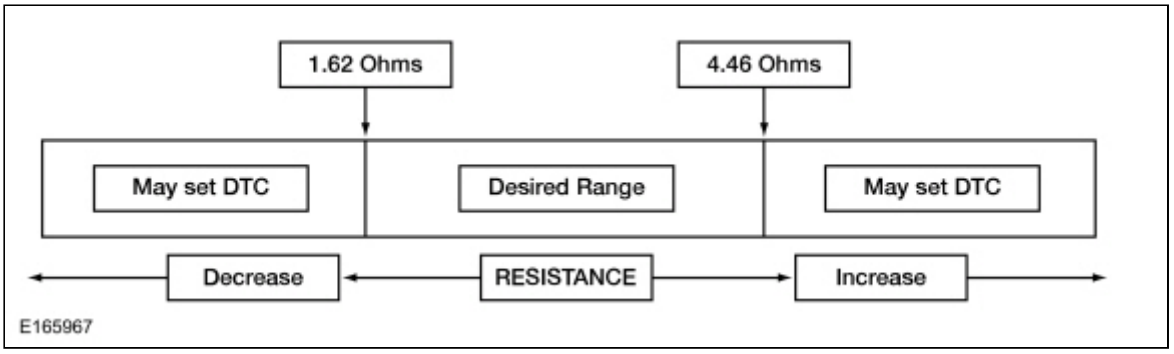
The RCM continuously monitors the driver airbag stage 1 circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted driver airbag

If a fault is detected, the RCM stores DTC B0001:11, B0001:12, B0001:13 or B0001:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Clockspring
- Driver airbag
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0001:11	Driver Frontal Stage 1 Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either driver airbag stage 1 circuit for more than 6 seconds.
B0001:12	Driver Frontal Stage 1 Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either driver airbag stage 1 circuit for more than 6 seconds.
B0001:13	Driver Frontal Stage 1 Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance range between driver airbag stage 1 circuits for more than 6 seconds.
B0001:1A	Driver Frontal Stage 1 Deployment Control: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance range between driver airbag stage 1 circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Clockspring
- Driver airbag
- RCM

PINPOINT TEST A : B0001:11, B0001:12, B0001:13 AND B0001:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog or equivalent to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0001:11, B0001:12, B0001:13 or B0001:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is retrieved on-demand, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver airbag Diagnostic Trouble Codes (DTCs). For DTC B0001:13 or B0001:1A, GO to A2 For DTC B0001:11, GO to A12 For DTC B0001:12, GO to A15
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is retrieved on-demand, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver airbag Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B0001:13 or B0001:1A, GO to A20 For DTC B0001:11, GO to A21 For DTC B0001:12, GO to A22

A2 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL RESISTANCE

(DEPLOY_00_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_00_R PID.

Does the PID value read between 1.62 and 4.46 ohms?

Yes	GO to A19
No	GO to A3

A3 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL RESISTANCE (DEPLOY_00_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- Remove the steering column shrouds to access the clockspring connectors.
  REFER to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
- While monitoring the DEPLOY_00_R PID, carry out the harness test of the driver airbag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.62 and 4.46 ohms while carrying out the harness test?

Yes	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24
No	For PID value less than 1.62 ohms, GO to A4 For PID value greater than 4.46 ohms, GO to A8

A4 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver airbag disconnected, open circuit faults are normally retrieved on stage 1.

Did the on-demand DTC change from B0001:1A to B0001:13?

Yes	GO to A17
No	GO to A5

A5 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED) (CLOCKSPRING

DISCONNECTED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect the SCCM C226B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the SCCM/clockspring disconnected, open circuit faults are normally retrieved on stage 1.

Did the on-demand DTC change from B0001:1A to B0001:13?

Yes	GO to A18
No	GO to A6

A6 CHECK FOR A SHORT BETWEEN DRIVER AIRBAG STAGE 1 CIRCUITS

- Ignition OFF.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226B-11	Ω	C226B-12

Is the resistance greater than 10,000 ohms?

Yes	GO to A19
No	GO to A7

A7 CHECK THE RCM (RESTRAINTS CONTROL MODULE) FOR LOW RESISTANCE

- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A, pin 29, component side	Ω	C310A, pin 30, component side

Is the resistance greater than 10,000 ohms?

Yes	REPAIR the driver airbag stage 1 circuit(s) for a short together. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24
No	GO to A19

A8 CHECK THE DRIVER AIRBAG STAGE 1 CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-29	Ω	C216A-1
C310A-30	Ω	C216A-2

Are the resistances less than 1 ohm?

Yes	GO to A10
No	GO to A9

A9 CHECK THE DRIVER AIRBAG STAGE 1 CIRCUITS FOR AN OPEN (CLOCKSPRING DISCONNECTED)

- Disconnect SCCM C226B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-29	Ω	C226B-12
C310A-30	Ω	C226B-11

Are the resistances less than 0.5 ohm?

Yes	GO to A18
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24

A10 CHECK THE DRIVER AIRBAG STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C216A-1		C216A-2

- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver airbag stage 1 circuits shorted together, a low resistance fault is normally retrieved on stage 1.

Was DTC B0001:1A retrieved on-demand during self-test?

Yes	REMOVE the fused jumper wire and GO to A17
No	REMOVE the fused jumper wire and GO to A11

A11 CHECK THE DRIVER AIRBAG STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect SCCM C226B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C226B-11		C226B-12

- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver airbag stage 1 circuits shorted together, a low resistance fault is normally retrieved on stage 1.

Was DTC B0001:1A retrieved on-demand during self-test?

Yes	REMOVE the fused jumper wire and GO to A18
No	REMOVE the fused jumper wire and GO to A19

A12 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver airbag disconnected,

open circuit faults are normally retrieved on stage 1.

Did the on-demand DTC change from B0001:11 to B0001:13?

Yes	GO to A17
No	GO to A13

A13 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED) (SCCM/CLOCKSPRING DISCONNECTED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Disconnect SCCM C226B.
  - Remove the steering column shrouds to access the SCCM connectors.
    REFER to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the SCCM/clockspring disconnected, open circuit faults are normally retrieved on stage 1.

Did the on-demand DTC change from B0001:11 to B0001:13?

Yes	GO to A18
No	GO to A14

A14 CHECK THE DRIVER AIRBAG STAGE 1 CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226B-11	Ω	Ground
C226B-12	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A19
No	Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24

A15 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO BATTERY INDICATED) (SCCM/CLOCKSPRING DISCONNECTED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault*

condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect SCCM C226B.
  - Remove the steering column shrouds to access the SCCM/clockspring connectors.
    REFER to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the SCCM/clockspring disconnected, open circuit faults are normally retrieved on stage 1.

Did the on-demand DTC change from B0001:12 to B0001:13?

Yes	GO to A18
No	GO to A16

A16 CHECK THE DRIVER AIRBAG STAGE 1 CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C226B-11		Ground
C226B-12		Ground

Is any voltage present?

Yes	Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24
No	GO to A19

A17 CONFIRM THE DRIVER AIRBAG FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.

REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damaged, pinched, cut or pierced wires.
  - inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - inspect Driver Airbag C216A and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Install the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new driver airbag. REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A24
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0001:13 or B0001:1A, GO to A20 For DTC B0001:11, GO to A21 For DTC B0001:12, GO to A22

A18 CONFIRM THE SCCM/CLOCKSPRING FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damaged, pinched, cut or pierced wires.
  - inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect the SCCM C226B.
- Install the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation). GO to A24
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not

	install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0001:13 or B0001:1A, GO to A20 For DTC B0001:11, GO to A21 For DTC B0001:12, GO to A22

A19 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damaged, pinched, cut or pierced wires.
  - inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Install the driver airbag (if previously removed).
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Connect the SCCM C226B (if previously disconnected).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A24
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0001:13 or B0001:1A, GO to A20 For DTC B0001:11, GO to A21 For DTC B0001:12, GO to A22

A20 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL RESISTANCE (DEPLOY_00_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Ignition OFF.
- Remove the steering column shrouds to access the SCCM/clockspring connectors.
  REFER to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Ignition ON.
- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_00_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.62 and 4.46 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS

	components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A23
No	If the driver airbag PID indicates incorrect resistance only when the steering wheel is rotated, INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation). For all other faults, DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24

A21 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Ignition OFF.
- Remove the steering column shrouds to access the SCCM/clockspring connectors.
  REFER to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0001:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A23

A22 CHECK THE DRIVER FRONTAL STAGE 1 DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Remove the steering column shrouds to access the SCCM/clockspring connectors.
  REFER to: Steering Column Shrouds (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0001:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information.

	GO to A24
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A23

A23 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver airbag.
  REFER to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Airbag C216A Connector Position Assurance (CPA) tab to verify that it is correctly seated and free of damage.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A24
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A24

A24 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: D

B0010:11, B0010:12, B0010:13 and B0010:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

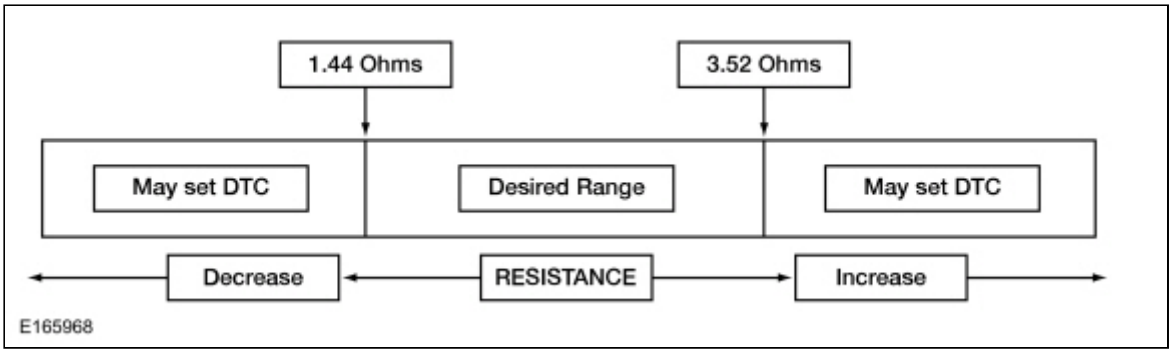
The RCM continuously monitors the passenger airbag stage 1 circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted passenger airbag

If a fault is detected, the RCM stores DTC B0010:11, B0010:12, B0010:13 or B0010:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Passenger airbag
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0010:11	Passenger Frontal Stage 1 Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either passenger airbag stage 1 circuit for more than 6 seconds.
B0010:12	Passenger Frontal Stage 1 Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either passenger airbag stage 1 circuit for more than 6 seconds.
B0010:13	Passenger Frontal Stage 1 Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance range between the passenger airbag stage 1 circuits for more than 6 seconds.
B0010:1A	Passenger Frontal Stage 1 Deployment Control: Circuit	A fault is indicated when the RCM measures less than the desired resistance range between the passenger airbag stage 1 circuits for

	Resistance Below Threshold	more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Passenger airbag
- RCM

Visual Inspection and Diagnostic Pre-checks

- Inspect for damaged wiring harness(es).
- Inspect for loose or damaged connectors.

PINPOINT TEST A : B0010:11, B0010:12, B0010:13 AND B0010:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0010:11, B0010:12, B0010:13 or B0010:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is retrieved on-demand, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the passenger airbag Diagnostic Trouble Codes (DTCs). For DTC B0010:13 or B0010:1A, GO to A2 For DTC B0010:11, GO to A9 For DTC B0010:12, GO to A11
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is retrieved on-demand, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the passenger airbag Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B0010:13 or B0010:1A, GO to A14

	For DTC B0010:11, GO to A15 For DTC B0010:12, GO to A16

A2 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL RESISTANCE (DEPLOY_05_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_05_R PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A13
No	GO to A3

A3 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL RESISTANCE (DEPLOY_05_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- Remove the glove compartment.
  REFER to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
  REFER to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
- While monitoring the DEPLOY_05_R PID, carry out the harness test of the passenger airbag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A7

A4 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Airbag C337.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger airbag disconnected, open circuit faults are normally retrieved on passenger airbag stage 1.

Did the on-demand DTC change from B0010:1A to B0010:13?

Yes	GO to A12
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN PASSENGER AIRBAG STAGE 1 CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C337-1	Ω	C337-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A13
No	GO to A6

A6 CHECK THE RCM (RESTRAINTS CONTROL MODULE) FOR LOW RESISTANCE

- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-28 component side	Ω	C310A-27 component side

Is the resistance greater than 10,000 ohms?

Yes	REPAIR the passenger airbag stage 1 circuits for a short together. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18
No	GO to A13

A7 CHECK THE PASSENGER AIRBAG STAGE 1 CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Airbag C337.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-27	Ω	C337-2
C310A-28	Ω	C337-1

Are the resistances less than 0.5 ohm?

Yes	GO to A8
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information.

	GO to A18

A8 CHECK THE PASSENGER AIRBAG STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C337-1		C337-2

- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger airbag stage 1 circuits shorted together, a low resistance fault is normally retrieved on stage 1.

Did the on-demand DTC change from B0010:13 to B0010:1A?

Yes	REMOVE the fused jumper wire and GO to A12
No	REMOVE the fused jumper wire and GO to A13

A9 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Airbag C337.
  - Remove the glove compartment.
    REFER to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
    REFER to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger airbag disconnected, open circuit faults are normally retrieved on passenger airbag stages 1.

Did the on-demand DTC change from B0010:11 to B0010:13?

Yes	GO to A12
No	GO to A10

A10 CHECK THE PASSENGER AIRBAG STAGE 1 CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C337-1	Ω	Ground
C337-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A13
No	Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18

A11 CHECK THE PASSENGER AIRBAG STAGE 1 CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Airbag C337.
  - Remove the glove compartment.
    REFER to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
    REFER to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
- Disconnect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C337-1	V	Ground
C337-2	V	Ground

Is any voltage present?

Yes	Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar. REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18
No	GO to A13

A12 CONFIRM THE PASSENGER AIRBAG FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damaged, pinched, cut or pierced wires.
  - inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - inspect Passenger Airbag C337 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Airbag C337 (if previously disconnected).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new passenger airbag. REFER to: Passenger Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A18
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0010:13 or B0010:1A, GO to A14 For DTC B0010:11, GO to A15 For DTC B0010:12, GO to A16

A13 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damaged, pinched, cut or pierced wires.
  - inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Airbag C337 (if previously disconnected).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for

	this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A18
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0010:13 or B0010:1A, GO to A14 For DTC B0010:11, GO to A15 For DTC B0010:12, GO to A16

A14 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL RESISTANCE (DEPLOY_05_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Remove the glove compartment.
  REFER to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
  REFER to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_05_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17
No	DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18

A15 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Remove the glove compartment.
  REFER to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
  REFER to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0010:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A16 CHECK THE PASSENGER FRONTAL STAGE 1 DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).

- Disconnect Passenger Airbag C337.
  - Remove the glove compartment.
    REFER to: Glove Compartment - LHD (501-12 Instrument Panel and Console, Removal and Installation).
    REFER to: Glove Compartment - RHD (501-12 Instrument Panel and Console, Removal and Installation).
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0010:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Airbag C337.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Airbag C337 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A18
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A18

A18 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: I

B0070:11, B0070:12, B0070:13, B0070:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

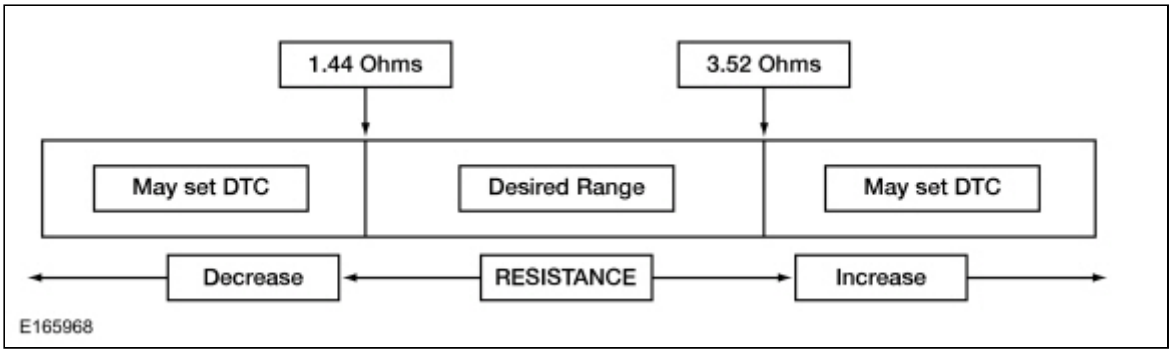
The RCM continuously monitors the driver safety belt anchor pretensioner circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted driver safety belt anchor pretensioner

If a fault is detected, the RCM stores DTC B0070:11, B0070:12, B0070:13 or B0070:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Driver safety belt anchor pretensioner
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0070:11	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either driver safety belt anchor pretensioner circuit for more than 6 seconds.
B0070:12	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either driver safety belt anchor pretensioner circuit for more than 6 seconds.
B0070:13	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the driver safety belt anchor pretensioner circuits for more than 6 seconds.
B0070:1A	Driver Seatbelt Pretensioner "A" Deployment Control: Circuit	A fault is indicated when the RCM measures less than the desired resistance between the driver safety belt anchor pretensioner

	Resistance Below Threshold	circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Driver safety belt anchor pretensioner
- RCM

PINPOINT TEST A : B0070:11, B0070:12, B0070:13 AND B0070:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0070:11, B0070:12, B0070:13 and B0070:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver safety belt anchor pretensioner Diagnostic Trouble Codes (DTCs). For DTC B0070:13 or B0070:1A, GO to A2 For DTC B0070:11, GO to A8 For DTC B0070:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver safety belt anchor pretensioner Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B0070:13 or B0070:1A, GO to A13 For DTC B0070:11, GO to A14 For DTC B0070:12, GO to A15

A2 CHECK THE DRIVER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL

A2 CHECK THE DRIVER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL (DEPLOY_29_RES) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_29_RES PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE DRIVER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL (DEPLOY_29_RES) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_29_RES PID, carry out the harness test of the driver safety belt anchor pretensioner circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Safety Belt Anchor Pretensioner C3065.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver safety belt anchor pretensioner disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B0070:1A to B0070:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE DRIVER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3065-2	Ω	C3065-1

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Safety Belt Anchor Pretensioner C3065.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310B-51	Ω	C3065-2
C310B-52	Ω	C3065-1

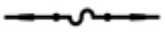
Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuits. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C3065-2		C3065-1

- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver safety belt anchor pretensioner circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B0070:13 to B0070:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Safety Belt Anchor Pretensioner C3065.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver safety belt anchor pretensioner disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B0070:11 to B0070:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3065-2	Ω	Ground
C3065-1	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.

- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Safety Belt Anchor Pretensioner C3065.
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3065-2		Ground
C3065-1		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE DRIVER SAFETY BELT ANCHOR PRETENSIONER FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Safety Belt Anchor Pretensioner C3065 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Driver Safety Belt Anchor Pretensioner C3065.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new driver safety belt anchor pretensioner. GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0070:13 or B0070:1A, GO to A13 For DTC B0070:11, GO to A14 For DTC B0070:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Driver Safety Belt Anchor Pretensioner C3065 (if previously disconnected).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0070:13 or B0070:1A, GO to A13 For DTC B0070:11, GO to A14 For DTC B0070:12, GO to A15

A13 CHECK THE DRIVER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL (DEPLOY_29_RES) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_29_RES PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire

harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0070:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE DRIVER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Safety Belt Anchor Pretensioner C3065.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0070:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Safety Belt Anchor Pretensioner C3065.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Safety Belt Anchor Pretensioner C3065 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint

	test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: J

B0072:11, B0072:12, B0072:13, B0072:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

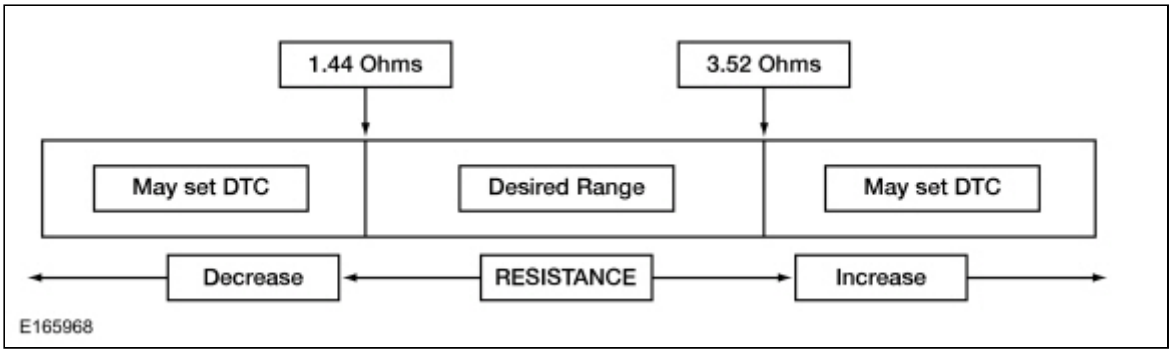
The RCM continuously monitors the passenger safety belt anchor pretensioner circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted passenger safety belt anchor pretensioner

If a fault is detected, the RCM stores DTC B0072:11, B0072:12, B0072:13 or B0072:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Passenger safety belt anchor pretensioner
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0072:11	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either passenger safety belt anchor pretensioner circuit for more than 6 seconds.
B0072:12	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either passenger safety belt anchor pretensioner circuit for more than 6 seconds.
B0072:13	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the passenger safety belt anchor pretensioner circuits for more than 6 seconds.
B0072:1A	Passenger Seatbelt Pretensioner "A" Deployment Control: Circuit	A fault is indicated when the RCM measures less than the desired resistance between the passenger safety belt anchor pretensioner

	Resistance Below Threshold	circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Passenger safety belt anchor pretensioner
- RCM

PINPOINT TEST A : B0072:11, B0072:12, B0072:13 AND B0072:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0072:11, B0072:12, B0072:13 and B0072:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the passenger safety belt anchor pretensioner Diagnostic Trouble Codes (DTCs). For DTC B0072:13 or B0072:1A, GO to A2 For DTC B0072:11, GO to A8 For DTC B0072:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the passenger safety belt anchor pretensioner Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B0072:13 or B0072:1A, GO to A13 For DTC B0072:11, GO to A14 For DTC B0072:12, GO to A15

A2 CHECK THE PASSENGER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL

A2 CHECK THE PASSENGER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL (DEPLOY_30_RES) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_30_RES PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE PASSENGER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL (DEPLOY_30_RES) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_30_RES PID, carry out the harness test of the passenger safety belt anchor pretensioner circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Safety Belt Anchor Pretensioner C3066.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger safety belt anchor pretensioner disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B0072:1A to B0072:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3066-1	Ω	C3066-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Safety Belt Anchor Pretensioner C3066.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310B-49	Ω	C3066-1
C310B-50	Ω	C3066-2

Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuits. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C3066-1		C3066-2

- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger safety belt anchor

pretensioner circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B0072:13 to B0072:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Safety Belt Anchor Pretensioner C3066.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger safety belt anchor pretensioner disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B0072:11 to B0072:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3066-1	Ω	Ground
C3066-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Safety Belt Anchor Pretensioner C3066.
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C3066-1		Ground
C3066-2		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Safety Belt Anchor Pretensioner C3066 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Safety Belt Anchor Pretensioner C3066.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new passenger safety belt anchor pretensioner. GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0072:13 or B0072:1A, GO to A13 For DTC B0072:11, GO to A14 For DTC B0072:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Safety Belt Anchor Pretensioner C3066 (if previously disconnected).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0072:13 or B0072:1A, GO to A13 For DTC B0072:11, GO to A14 For DTC B0072:12, GO to A15

A13 CHECK THE PASSENGER SEATBELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL (DEPLOY_30_RES) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_30_RES PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL

CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0072:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE PASSENGER SAFETY BELT ANCHOR PRETENSIONER DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Safety Belt Anchor Pretensioner C3066.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0072:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Safety Belt Anchor Pretensioner C3066.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Safety Belt Anchor Pretensioner C3066 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: R

B11D8:12 and B11D8:14

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

The RCM transmits an event notification signal which communicates crash status and SRS deployment status to the BCM. When the BCM receives an event notification signal which indicates a crash, it initiates fuel cut-off.

The RCM monitors the event notification signal circuit for the following faults:

- Short to voltage
- Short to ground
- Open circuit

If a fault is detected, the RCM stores DTC B11D8:12 or B11D8:14 in memory. The airbag warning indicator does not illuminate if B11D8:12 or B11D8:14 is set.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B11D8:12	Restraint Event Notification: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on the event notification signal circuit for more than 15 seconds.
B11D8:14	Restraint Event Notification: Circuit Short to Ground or Open	A fault is indicated when the RCM senses a short to ground or an open on the event notification signal circuit for more than 15 seconds.

Possible Sources

- Wiring, terminals or connectors
- BCM
- RCM

PINPOINT TEST A : B11D8:12 AND B11D8:14

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.
NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.
NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*
NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*
NOTE: *Install new components only when directed to do so in the pinpoint test.*
NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*
NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*
A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

- REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform the RCM self-test to retrieve Diagnostic Trouble Codes (DTCs).

Was DTC B11D8:12 or B11D8:14 retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during the self-test. For DTC B11D8:14, GO to A2 For DTC B11D8:12, GO to A5
No	This is an intermittent fault when present as a CMDTC only. GO to A8

A2 CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Disconnect BCM C2280E.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310B-42	Ω	C2280E-49

Is the resistance less than 3 ohms?

Yes	GO to A3
No	REPAIR the circuit. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A9

A3 CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT FOR A SHORT TO GROUND

- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-49	Ω	Ground

Is the resistance greater than 10,000 ohms?

Yes	GO to A4
No	REPAIR the circuit. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A9

A4 CONFIRM THE BCM (BODY CONTROL MODULE) OR RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS electrical connectors and the BCM electrical connector are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect BCM C2280E.
- Connect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform the RCM self-test to retrieve Diagnostic Trouble Codes (DTCs).

Was DTC B11D8:14 retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). CLEAR the RCM Diagnostic Trouble Codes (DTCs) and REPEAT the RCM self-test. If DTC B11D8:14 returns, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A9 If DTC B11D8:14 does not return, GO to A9
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test. GO to A8

A5 CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Disconnect BCM C2280E.
- Using a diagnostic scan tool, perform the RCM self-test to retrieve Diagnostic Trouble Codes (DTCs).

Was DTC B11D8:12 retrieved on-demand during self-test?

Yes	GO to A6
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new BCM. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). REFER to: Body Control Module (BCM) - LHD (419-10 Multifunction Electronic Modules, Removal and Installation). GO to A9

A6 CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2280E-49		Ground

Is any voltage present?

Yes	REPAIR the circuit. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A9
No	GO to A7

A7 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS electrical connectors and the BCM electrical connector are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect BCM C2280E.
- Connect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform the RCM self-test to retrieve Diagnostic Trouble Codes (DTCs).

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A9
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test. GO to A8

A8 CHECK FOR AN INTERMITTENT FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect BCM C2280E.
- Disconnect RCM C310A and C310B.
  - inspect connector(s) (including any inline connectors) for loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
  - repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect BCM C2280E.
- Connect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform the RCM self-test to retrieve Diagnostic Trouble Codes (DTCs).

Was DTC B11D8:12 or B11D8:14 retrieved on-demand during self-test?

Yes	The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during the self-test. For DTC B11D8:14, GO to A2 For DTC B11D8:12, GO to A5
No	CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. ACTIVATE other systems in the same wire harness. Do not install any new SRS components at this time. Only install SRS components when directed to do so in the pinpoint test. REPAIR any intermittent concerns found. GO to A9

A9 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all connectors (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, Diagnostic Trouble Codes (DTCs) are retrieved from the RCM.*

  Using a diagnostic scan tool, perform the **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: S

B1404:11, B1404:12, B1404:13, B1404:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

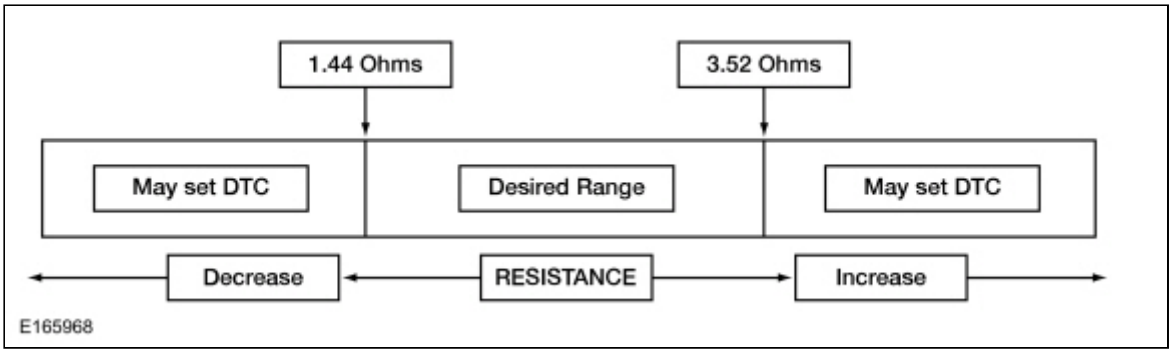
The RCM continuously monitors the driver side airbag circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted driver side airbag

If a fault is detected, the RCM stores DTC B1404:11, B1404:12, B1404:13 or B1404:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Driver side airbag
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1404:11	Driver Side Airbag Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either driver side airbag circuit for more than 6 seconds.
B1404:12	Driver Side Airbag Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either driver side airbag circuit for more than 6 seconds.
B1404:13	Driver Side Airbag Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the driver side airbag circuits for more than 6 seconds.
B1404:1A	Driver Side Airbag Deployment Control: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance between the driver side airbag circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Driver side airbag
- RCM

PINPOINT TEST A : B1404:11, B1404:12, B1404:13 AND B1404:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1404:11, B1404:12, B1404:13 and B1404:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver side airbag Diagnostic Trouble Codes (DTCs). For DTC B1404:13 or B1404:1A, GO to A2 For DTC B1404:11, GO to A8 For DTC B1404:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver side airbag Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B1404:13 or B1404:1A, GO to A13 For DTC B1404:11, GO to A14 For DTC B1404:12, GO to A15

A2 CHECK THE LEFT SIDE AIRBAG DEPLOYMENT CONTROL RESISTANCE (DEPLOY_10_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_10_R PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE LEFT SIDE AIRBAG DEPLOYMENT CONTROL RESISTANCE (DEPLOY_10_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_10_R PID, carry out the harness test of the driver side airbag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Airbag (Inline seat connector) C313.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver side airbag disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1404:1A to B1404:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE DRIVER SIDE AIRBAG CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-1	Ω	C313-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE DRIVER SIDE AIRBAG CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Airbag (Inline seat connector) C313.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310B-25	Ω	C313-1
C310B-26	Ω	C313-2

Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C313-1		C313-2

- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver side airbag circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B1404:13 to B1404:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Airbag (Inline seat connector) C313.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver side airbag disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1404:11 to B1404:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE DRIVER SIDE AIRBAG CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-1	Ω	Ground
C313-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE DRIVER SIDE AIRBAG CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.

  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental

Restraint System, General Procedures).
- Disconnect Driver Side Airbag (Inline seat connector) C313.
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C313-1		Ground
C313-2		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE DRIVER SIDE AIRBAG FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Driver Side Airbag (Inline seat connector) C313.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	REMOVE and INSPECT the driver seat backrest harness for damage. REFER to: Side Airbag (501-20B Supplemental Restraint System, Removal and Installation). If a concern is found, REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17 If a concern is not found, INSTALL a new driver side airbag. REFER to: Side Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1404:13 or B1404:1A, GO to A13 For DTC B1404:11, GO to A14

	For DTC B1404:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Driver Side Airbag (Inline seat connector) C313 (if previously disconnected).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time. For vehicles equipped with the police package, REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1404:13 or B1404:1A, GO to A13 For DTC B1404:11, GO to A14 For DTC B1404:12, GO to A15

A13 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL RESISTANCE (DEPLOY_10_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_10_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN

A14 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1404:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE DRIVER SIDE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Airbag (Inline seat connector) C313.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1404:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Airbag (Inline seat connector) C313.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Side Airbag C313 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: U

B1407:11, B1407:12, B1407:13, B1407:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

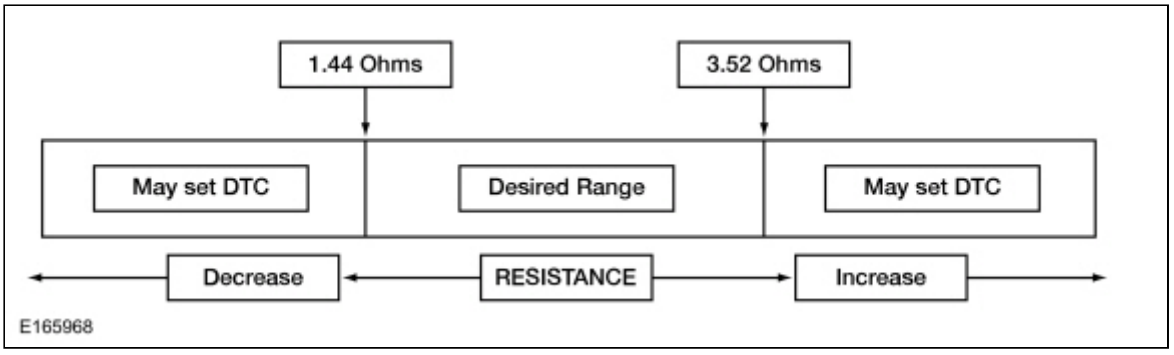
The RCM continuously monitors the passenger side airbag circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted passenger side airbag

If a fault is detected, the RCM stores DTC B1407:11, B1407:12, B1407:13 or B1407:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Passenger side airbag
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1407:11	Passenger Side Airbag Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either passenger side airbag circuit for more than 6 seconds.
B1407:12	Passenger Side Airbag Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either passenger side airbag circuit for more than 6 seconds.
B1407:13	Passenger Side Airbag Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the passenger side airbag circuits for more than 6 seconds.
B1407:1A	Passenger Side Airbag Deployment Control: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance between the passenger side airbag circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Passenger side airbag
- RCM

PINPOINT TEST A : B1407:11, B1407:12, B1407:13 AND B1407:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1407:11, B1407:12, B1407:13 and B1407:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the passenger side airbag Diagnostic Trouble Codes (DTCs). For DTC B1407:13 or B1407:1A, GO to A2 For DTC B1407:11, GO to A8 For DTC B1407:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the passenger side airbag Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B1407:13 or B1407:1A, GO to A13 For DTC B1407:11, GO to A14 For DTC B1407:12, GO to A15

A2 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL RESISTANCE (DEPLOY_13_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_13_R PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL RESISTANCE (DEPLOY_13_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_13_R PID, carry out the harness test of the passenger side airbag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Airbag (Inline seat connector) C314.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger side airbag disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1407:1A to B1407:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE PASSENGER SIDE AIRBAG CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-1	Ω	C314-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE PASSENGER SIDE AIRBAG CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Airbag (Inline seat connector) C314.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-28	Ω	C314-1
C310A-27	Ω	C314-2

Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C314-1		C314-2

- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger side airbag circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B1407:13 to B1407:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Airbag (Inline seat connector) C314.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the passenger side airbag disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1407:11 to B1407:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE PASSENGER SIDE AIRBAG CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-1	Ω	Ground
C314-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE PASSENGER SIDE AIRBAG CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.

  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental

Restraint System, General Procedures).
- Disconnect Passenger Side Airbag (Inline seat connector) C314.
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C314-1		Ground
C314-2		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE PASSENGER SIDE AIRBAG FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Side Airbag C314 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Side Airbag (Inline seat connector) C314.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	REMOVE and INSPECT the driver seat backrest harness for damage. REFER to: Side Airbag (501-20B Supplemental Restraint System, Removal and Installation). If a concern is found, REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17 If a concern is not found, INSTALL a new driver side airbag. REFER to: Side Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test.

	For DTC B1407:13 or B1407:1A, GO to A13 For DTC B1407:11, GO to A14 For DTC B1407:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Side Airbag (Inline seat connector) C314.
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1407:13 or B1407:1A, GO to A13 For DTC B1407:11, GO to A14 For DTC B1407:12, GO to A15

A13 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL RESISTANCE (DEPLOY_13_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_13_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1407:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE PASSENGER SIDE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Airbag (Inline seat connector) C314.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1407:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Airbag (Inline seat connector) C314.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Side Airbag C314 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AF

BXXXX:4A (any BXXXX DTC with a 4A failure type) Incorrect Component Installed

Normal Operation and Fault Conditions

The RCM monitors all SRS device connections. If the RCM detects a connection or device connected that is not stored in memory or is not configured for the component, the RCM sets a DTC and sends a message to the IPC to illuminate the airbag warning indicator.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0001:4A	Driver Frontal Stage 1 Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B0004:4A	Driver Knee Bolster Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B0010:4A	Passenger Frontal Stage 1 Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B0070:4A	Driver Seatbelt Pretensioner "A" Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B0072:4A	Passenger Seatbelt Pretensioner "A" Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B1202:4A	Restraint System Passenger Enable Indicator: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B1404:4A	Driver Side Airbag Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B1405:4A	Driver Curtain Deployment Control 1: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B1407:4A	Passenger Side Airbag Deployment Control: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.
B1408:4A	Passenger Curtain Deployment Control 1: Incorrect Component Installed	This DTC sets if the RCM detects the device but it is not configured for this component.

Possible Sources

- RCM not configured or configured incorrectly
- Incorrect RCM installed
- Incorrect impact sensor installed

Visual Inspection and Diagnostic Pre-checks

- Review recent service history to identify repairs where an incorrect component may have been installed.

PINPOINT TEST A : BXXXX:4A (ANY BXXXX DTC (DIAGNOSTIC TROUBLE CODE) WITH A 4A FAILURE TYPE) INCORRECT COMPONENT INSTALLED

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Were any incorrect component installed Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during self-test. If DTC U3003:16 or U3003:17 is retrieved on-demand as well, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). For all other incorrect component installed Diagnostic Trouble Codes (DTCs), GO to A2
No	If DTC U3003:16 or U3003:17 is retrieved on-demand as well, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 are not retrieved on-demand, DIAGNOSE the Continuous Memory Diagnostic Trouble Codes (CMDTCs). This is an intermittent fault when present as a CMDTC only. GO to A5

A2 CHECK THE RCM (RESTRAINTS CONTROL MODULE) PART NUMBER

- Ignition ON.
- Check the vehicle repair history. Using the Log Viewer function of the diagnostic scan tool, retrieve and record the RCM part number.
- Check the part number recorded against the number listed in the Ford parts catalog and verify the correct RCM is installed in the vehicle.

Is the correct RCM installed?

Yes	GO to A3
No	INSTALL the correct RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A6

A3 VERIFY THE RCM (RESTRAINTS CONTROL MODULE) CONFIGURATION

- Carry out PMI for the RCM. Use As-Built data when carrying out PMI. Refer to the scan tool instructions to carry out PMI.
- Using a diagnostic scan tool, perform RCM self-test.

Were any incorrect component installed Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	For DTC B1413:4A, B1414:4A, B1415:4A, B1417:4A, B1418:4A or B1419:4A, GO to A4 For all other incorrect component installed Diagnostic Trouble Codes (DTCs), CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A6
No	The fault is corrected. GO to A6

A4 VERIFY THE SUSPECT IMPACT SENSOR PART NUMBER

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Gain access to the suspect impact sensor(s) for which incorrect component installed Diagnostic Trouble Codes (DTCs) were retrieved. Refer to the table for the appropriate procedure(s).

DTC	Component	Procedure
B1413:4A	LH front impact severity sensor	REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1414:4A	Driver front door side impact sensor	REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1415:4A	LH C-pillar side impact sensor	
B1417:4A	RH front impact severity sensor	REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1418:4A	Passenger front door side impact sensor	REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
B1419:4A	RH C-pillar side impact sensor	

- Record the part number from each suspect impact sensor.
- Check the part number(s) recorded against the number listed in the Ford parts catalog and verify that each suspect impact sensor installed in the vehicle is correct.

Do the part numbers of all suspect impact sensors match the part numbers listed in the Ford parts catalog?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A6
No	INSTALL the correct impact sensor(s) as necessary. For DTC B1413:4A or B1417:4A, REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation). For DTC B1414:4A or B1418:4A, REFER to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation). For vehicles with DTC B1415:4A or B1419:4A, GO to A6

A5 CHECK FOR AN INTERMITTENT FAULT

- Using a diagnostic scan tool, clear RCM Diagnostic Trouble Codes (DTCs).
- Using a diagnostic scan tool, perform RCM self-test to retrieve Diagnostic Trouble Codes (DTCs).

Were any incorrect component installed Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A6
No	Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A6

A6 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- If previously directed to depower the SRS, repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	CLEAR all RCM Continuous Memory Diagnostic Trouble Codes (CMDTCs). PROVE OUT the SRS. The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AI

U0140:00

Normal Operation and Fault Conditions

The RCM uses information contained in messages from the BCM sent on the HS-CAN2.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication with Body Control Module: No Sub Type Information	This DTC sets if the RCM does not receive an expected message from the BCM.

Possible Sources

- Network traffic
- BCM
- RCM

PINPOINT TEST A : U0140:00

WARNING: Do not handle, move or change the original horizontal mounting position of the Restraints Control Module (RCM) while the Restraints Control Module (RCM) is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 CHECK THE COMMUNICATION NETWORK

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**
- Ignition ON.
- Using a diagnostic scan tool, carry out a network test.

Does the BCM pass the network test?

Yes	GO to A2
No	To diagnose no communication with the BCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC

TROUBLE CODES (CMDTCS)

- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- Using a diagnostic scan tool, clear RCM Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform RCM self-test.

Is DTC U0140:00 retrieved again?

Yes	GO to A3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Check the recorded Diagnostic Trouble Codes (DTCs) from the RCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to A4

A4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform BCM self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the BCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to A5

A5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140:00 SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, perform self-test for all modules.

Is DTC U0140:00 set in the ABS Module or in the IPC?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (BCM).
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AK

U0155:00

Normal Operation and Fault Conditions

The RCM uses information contained in messages from the IPC sent on the HS-CAN.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155:00	Lost Communication with Instrument Panel Cluster (IPC) Control Module: No Sub Type Information	This DTC sets if the RCM does not receive an expected message from the IPC for 6 seconds.

Possible Causes

- Network traffic
- IPC
- RCM

PINPOINT TEST A : U0155:00

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 CHECK THE COMMUNICATION NETWORK

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, carry out a network test.

Does the IPC pass the network test?

Yes	GO to A2
No	To diagnose no communication with the IPC, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, perform RCM self-test.
- Using a diagnostic scan tool, clear RCM Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform RCM self-test.

Is DTC U0155:00 retrieved again?

Yes	GO to A3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Check the recorded Diagnostic Trouble Codes (DTCs) from the RCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to: Pinpoint Test - DTC: AK (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to A4

A4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE IPC (INSTRUMENT PANEL CLUSTER) SELF-TEST

- Using a diagnostic scan tool, perform IPC self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the IPC self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to A5

A5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155:00 SET IN OTHER MODULES

- Using a diagnostic scan tool, perform self-test for all modules.

Is DTC U0155:00 set in the BCM, ACM, or APIM (if equipped)?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (IPC).
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AL

U0253:00

Normal Operation and Fault Conditions

The RCM uses information contained in messages from the APIM sent on the High Speed Controller Area Network 2 (HS2-CAN).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0253:00	Lost Communication with Accessory Protocol Interface Module: No Sub Type Information	This DTC sets if the RCM does not receive an expected message from the APIM.

Possible Sources

- Network traffic
- APIM
- RCM

PINPOINT TEST A : U0253:00

WARNING: Do not handle, move or change the original horizontal mounting position of the Restraints Control Module (RCM) while the Restraints Control Module (RCM) is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 CHECK THE COMMUNICATION NETWORK

- Ignition ON.
- Using a diagnostic scan tool, carry out a network test.

Does the APIM pass the network test?

Yes	GO to A2
No	To diagnose no communication with the APIM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Ignition ON.

- Using a diagnostic scan tool, perform RCM self-test.
- Using a diagnostic scan tool, clear RCM Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform RCM self-test.

Is DTC U0253:00 retrieved again?

Yes	GO to A3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Check for recorded Diagnostic Trouble Codes (DTCs) from the RCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to A4

A4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE APIM (SYNC MODULE) SELF-TEST

- Using a diagnostic scan tool, perform APIM self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the APIM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to the appropriate section to DIAGNOSE the battery voltage Diagnostic Trouble Codes (DTCs). Refer to the appropriate section in Group 415 for the procedure.
No	GO to A5

A5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0253:00 SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, perform self-test for all modules.

Is DTC U0253:00 set in the ACM?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new APIM. Refer to the appropriate section in Group 415 for the procedure.
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AM

U2300:55, U2300:64

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

NOTE: *DTC U2300:55 is set in every new RCM that has not previously been installed or that has previously been installed but has not yet successfully received configuration data messages from the BCM. DO NOT replace any components for this DTC unless directed to do so by the following pinpoint test.*

Normal Operation and Fault Conditions

The RCM receives a configuration data message from the BCM when the RCM proves out during the very first ignition cycle after it is installed. During prove-out at the beginning of each subsequent ignition cycle, the BCM sends configuration data to the RCM and the RCM compares the message to the message that was received during the very first ignition cycle.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U2300:55	Central Configuration: Not Configured	This DTC is present in every new RCM. Once the new RCM is installed and it successfully receives a configuration data message from the BCM, this DTC reports as a Continuous Memory Diagnostic Trouble Code (CMDTC). If the RCM reports this DTC on-demand, it means that the configuration data message has not been received from the BCM.
U2300:64	Central Configuration: Signal Plausibility Failure	If the RCM receives a configuration data message that does not match the configuration data that was previously received and stored, it sets this DTC. This DTC can set on-demand during the RCM prove-out, but change to a Continuous Memory Diagnostic Trouble Code (CMDTC) later on in the ignition cycle if the correct message is eventually received. If PMI has not been carried out for the BCM, this DTC sets.

Possible Sources

- RCM or BCM configuration
- BCM
- RCM

PINPOINT TEST A : U2300:55, U2300:64

WARNING: Do not handle, move or change the original horizontal mounting position of the Restraints Control Module (RCM) while the Restraints Control Module (RCM) is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the Safety Canopy® and cause serious personal injury or death.
NOTE: *SRS components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*
NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*
NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*
A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)
WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal

injury.

- REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- Record the RCM Diagnostic Trouble Codes (DTCs) that were retrieved during the self-test.

Is DTC U2300:55 or U2300:64 retrieved on-demand?

Yes	GO to A2
No	If DTC U2300:55 or U2300:64 is retrieved as a Continuous Memory Diagnostic Trouble Code (CMDTC), CLEAR the RCM Diagnostic Trouble Codes (DTCs) and REPEAT the self-test. If DTC U2300:55 or U2300:64 does not return, RELEASE the vehicle to the customer. If DTC U2300:55 or U2300:64 returns on-demand, GO to A2

A2 CHECK FOR THE CORRECT BCM (BODY CONTROL MODULE)

- Using the Log Viewer function of the diagnostic scan tool, retrieve and record the BCM part number.
- Check the recorded part number against the number listed in the Ford parts catalog.

Does the recorded part number match the number listed in the Ford parts catalog?

Yes	GO to A3
No	INSTALL the correct BCM and USE As-Built data when carrying out PMI. REFER to: Body Control Module (BCM) - RHD (419-10 Multifunction Electronic Modules, Removal and Installation). GO to A4

A3 CHECK FOR THE CORRECT RCM (RESTRAINTS CONTROL MODULE)

- Using the Log Viewer function of the diagnostic scan tool, retrieve and record the RCM part number.
- Check the recorded part number against the number listed in the Ford parts catalog.

Does the recorded part number match the number listed in the Ford parts catalog?

Yes	CARRY OUT PMI for the BCM using As-Built data. CLEAR the Diagnostic Trouble Codes (DTCs) and REPEAT the RCM self-test. If DTC U2300:55 or U2300:64 are retrieved, CARRY OUT PMI for the RCM using As-Built data. GO to A4
No	INSTALL the correct RCM and use As-Built data when carrying out PMI. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A4

A4 CHECK FOR ADDITIONAL RCM (RESTRAINTS CONTROL MODULE) OR BCM (BODY CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- Using a diagnostic scan tool, perform BCM self-test.

Were any Diagnostic Trouble Codes (DTCs) retrieved from the RCM or BCM during self-test?

Yes	If RCM Diagnostic Trouble Codes (DTCs) were retrieved, do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint

	System, Diagnosis and Testing). If BCM Diagnostic Trouble Codes (DTCs) were retrieved, diagnose the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). PROVE OUT the SRS. The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AN

U3003:16 and U3003:17

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

NOTE: *Diagnostic Trouble Codes (DTCs) U3003:16 and U3003:17 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.*

Normal Operation - RCM

The RCM continuously monitors the input voltage for correct operation. If the RCM detects input voltage below 9.0 volts while a fault is present, or below 6.0 volts, whether or not a fault is present, it stores DTC U3003:16 in memory. If the RCM detects input voltage above 16 volts while a fault is present, or above 18 volts, regardless of fault status, it stores DTC U3003:17 in memory. If the RCM sets DTC U3003:16 or U3003:17, it sends a message to the IPC to illuminate the airbag warning indicator.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U3003:16	Battery Voltage: Circuit Voltage Below Threshold	This DTC sets if the RCM detects voltage below 9 volts with certain SRS faults present or below 6 volts, whether or not a SRS fault exists.
U3003:17	Battery Voltage: Circuit Voltage Above Threshold	This DTC sets if the RCM detects voltage above 16 volts with certain SRS faults present or above 18 volts without a SRS fault.

Possible Sources

- Wiring, terminals or connectors
- RCM

Visual Inspection and Diagnostic Pre-checks

- Inspect for damaged wiring harness(es).
- Inspect for loose or damaged connectors.

PINPOINT TEST A : U3003:16 AND U3003:17

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.
NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.
NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*
NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*
NOTE: *Install new components only when directed to do so in the pinpoint test.*
NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE ALL CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS) IN ALL MODULES

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

- REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, retrieve ALL Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Is DTC B1317, B1318, B1676, U3003:16 or U3003:17 present in one or more modules AND are any charging system Diagnostic Trouble Codes (DTCs) present in the PCM?

Yes	DIAGNOSE the charging system. Refer to the appropriate section in Group 414 for the procedure.
No	GO to A2

A2 TEST BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery Condition Test.
  REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Did the battery pass the condition test?

Yes	If the battery passed the condition test but required a recharge, DIAGNOSE the charging system. Refer to the appropriate section in Group 414 for the procedure. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs). If the battery passed the condition test and did not require a recharge, GO to A3
No	INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation). CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

A3 CHECK THE CHARGING SYSTEM VOLTAGE

- Start the engine.
- Measure the voltage of the battery.
- For DTC U3003:17, turn off all accessories while measuring the battery voltage.
- For DTC U3003:16, turn on headlights and HVAC fan on high while measuring the battery voltage.

Is the voltage between 13 and 15.2 volts?

Yes	For DTC U3003:16, GO to A4 For DTC U3003:17, GO to A6
No	DIAGNOSE the charging system. Refer to the appropriate section in Group 414 for the procedure. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

A4 CHECK FOR HIGH RESISTANCE ON THE IGNITION CIRCUIT TO THE MODULE

- Ignition OFF.
- Depower the SRS. Refer to
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect the module with the concern:
  - For the RCM, disconnect C310A and C310B.
- For the RCM, disconnect BCM C2280A.
- For the RCM, measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-19	Ω	C2280A-4

Is the resistance less than 1 ohm?

Yes	GO to A5
No	REPAIR the circuit as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. CLEAR all Continuous Memory Diagnostic Trouble Codes (CMDTCs).

A5 CHECK FOR HIGH RESISTANCE ON THE MODULE GROUND

- For the RCM, measure:

Positive Lead	Measurement / Action	Negative Lead
RCM mounting bracket	Ω	Ground

Is the resistance less than 1 ohm?

Yes	GO to A6
No	For the RCM, VERIFY there is no corrosion between the RCM and the mounting surface. VERIFY the fasteners are clean and tightened to specification with no corrosion. REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information.

A6 CHECK FOR MODULE OPERATION

- Ignition OFF.
- If not previously directed to do so, depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect the module with the concern:
  - For the RCM, disconnect C310A and C310B (if not previously disconnected).
- Check for the following:
  - corrosion (install new connector or terminals - clean module pins)
  - damaged or bent pins - install new terminals/pins
  - pushed-out pins - install new pins as necessary
- Connect the module with the concern:
  - For the RCM, connect C310A and C310B. Make sure the connector seats correctly and engages the Connector Position Assurance (CPA) lever/lock.
- Repower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, clear all RCM Diagnostic Trouble Codes (DTCs).
- **NOTE:** *When selecting Restraints from the Self Test menu, Diagnostic Trouble Codes (DTCs) are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions.

	If no Technical Service Bulletins (TSBs) address this concern and DTC U3003:16 or U3003:17 was present in the RCM, INSTALL a new RCM. REFER to REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: F

B0004:11, B0004:12, B0004:13, B0004:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

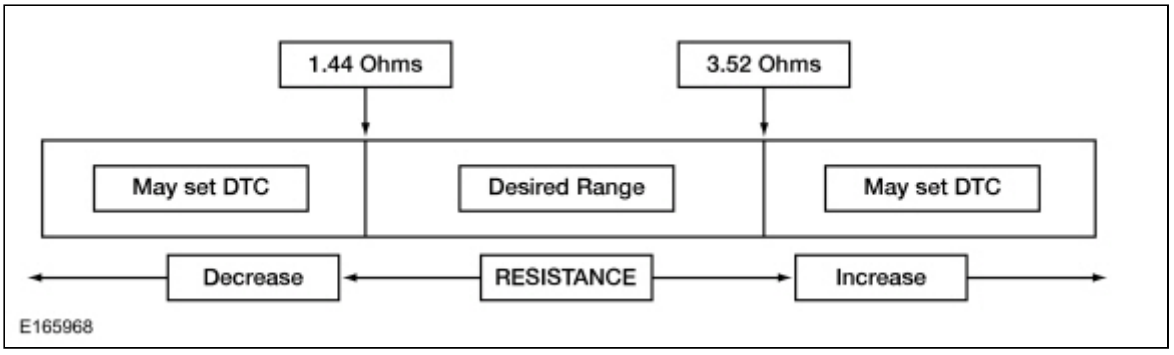
The RCM continuously monitors the driver knee airbag circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted driver knee airbag

If a fault is detected, the RCM stores DTC B0004:11, B0004:12, B0004:13 or B0004:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Driver knee airbag
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0004:11	Driver Knee Bolster Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either driver knee airbag circuit for more than 6 seconds.
B0004:12	Driver Knee Bolster Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either driver knee airbag circuit for more than 6 seconds.
B0004:13	Driver Knee Bolster Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the driver knee airbag circuits for more than 6 seconds.
B0004:1A	Driver Knee Bolster Deployment Control: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance between the driver knee airbag circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Driver knee airbag
- RCM

PINPOINT TEST A : B0004:11, B0004:12, B0004:13 AND B0004:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0004:11, B0004:12, B0004:13 and B0004:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver knee airbag Diagnostic Trouble Codes (DTCs). For DTC B0004:13 or B0004:1A, GO to A2 For DTC B0004:11, GO to A8 For DTC B0004:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the driver knee airbag Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B0004:13 or B0004:1A, GO to A13 For DTC B0004:11, GO to A14 For DTC B0004:12, GO to A15

A2 CHECK THE DRIVER KNEE BOLSTER DEPLOYMENT CONTROL (DEPLOY_02_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_02_R PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE DRIVER KNEE BOLSTER DEPLOYMENT CONTROL (DEPLOY_02_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_02_R PID, carry out the harness test of the driver knee airbag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE DRIVER KNEE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver knee airbag disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B0004:1A to B0004:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE DRIVER KNEE AIRBAG CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2432-1	Ω	C2432-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE DRIVER KNEE AIRBAG CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C310A-21	Ω	C2432-1
C310A-22	Ω	C2432-2

Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuits. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE DRIVER KNEE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C2432-1		C2432-2

- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver knee airbag circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B0004:13 to B0004:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE DRIVER KNEE AIRBAG DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the driver knee airbag disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B0004:11 to B0004:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE DRIVER KNEE AIRBAG CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2432-1	Ω	Ground
C2432-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE DRIVER KNEE AIRBAG CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.

- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
C2432-1		Ground
C2432-2		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE DRIVER KNEE AIRBAG FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Knee Airbag C2432 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Install the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new driver knee airbag. REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test.

	For DTC B0004:13 or B0004:1A, GO to A13 For DTC B0004:11, GO to A14 For DTC B0004:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Install the driver knee airbag (if previously removed).
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B0004:13 or B0004:1A, GO to A13 For DTC B0004:11, GO to A14 For DTC B0004:12, GO to A15

A13 CHECK THE DRIVER KNEE BOLSTER DEPLOYMENT CONTROL (DEPLOY_02_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_02_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE DRIVER KNEE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0004:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE DRIVER KNEE AIRBAG DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B0004:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Remove the driver knee airbag.
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.

- Inspect Driver Knee Airbag C2607 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- Install the driver knee airbag (if previously removed).
  REFER to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: T

B1405:11, B1405:12, B1405:13, B1405:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

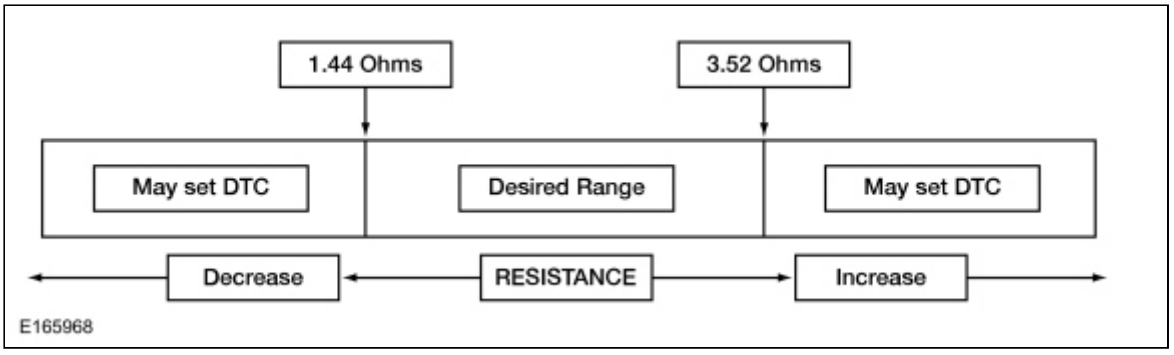
The RCM continuously monitors the Driver side air curtain circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted Driver side air curtain

If a fault is detected, the RCM stores DTC B1405:11, B1405:12, B1405:13 or B1405:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Driver side air curtain
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1405:11	Driver Side Curtain Deployment Control 1: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either Driver side air curtain circuit for more than 6 seconds.
B1405:12	Driver Side Curtain Deployment Control 1: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either Driver side air curtain circuit for more than 6 seconds.
B1405:13	Driver Side Curtain Deployment Control 1: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the Driver side air curtain circuits for more than 6 seconds.
B1405:1A	Driver Side Curtain Deployment Control 1: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance between the Driver side air curtain circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Driver side air curtain
- RCM

PINPOINT TEST A : B1405:11, B1405:12, B1405:13 AND B1405:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1405:11, B1405:12, B1405:13 and B1405:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the Driver side air curtain Diagnostic Trouble Codes (DTCs). For DTC B1405:13 or B1405:1A, GO to A2 For DTC B1405:11, GO to A8 For DTC B1405:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the Driver side air curtain Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B1405:13 or B1405:1A, GO to A13 For DTC B1405:11, GO to A14 For DTC B1405:12, GO to A15

A2 CHECK THE DRIVER SIDE CURTAIN DEPLOYMENT CONTROL 1 RESISTANCE (DEPLOY_11_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_11_R PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE DRIVER SIDE CURTAIN DEPLOYMENT CONTROL 1 RESISTANCE (DEPLOY_11_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_11_R PID, carry out the harness test of the Driver side air curtain circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE DRIVER SIDE AIR CURTAIN DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the Driver side air curtain disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1405:1A to B1405:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE DRIVER SIDE AIR CURTAIN CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C3321-1	Ω	C3321-2
RHD C3329-1	Ω	C3329-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE DRIVER SIDE AIR CURTAIN CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C310B-40	Ω	C3321-1
LHD C310B-39	Ω	C3321-2
RHD C310B-37	Ω	C3329-1
RHD C310B-38	Ω	C3329-2

Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuits. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE DRIVER SIDE AIR CURTAIN DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
C3321-1		C3321-2
C3329-1		C3329-2

- Repower the SRS. **Do not** prove out the SRS at this time.

REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the Driver side air curtain circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B1405:13 to B1405:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE DRIVER SIDE AIR CURTAIN DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the Driver side air curtain disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1405:11 to B1405:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE DRIVER SIDE AIR CURTAIN CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C3321-1	Ω	Ground
LHD C3321-2	Ω	Ground
RHD C3329-1	Ω	Ground
RHD C3329-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s).

	Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE DRIVER SIDE AIR CURTAIN CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C3321-1		Ground
LHD C3321-2		Ground
RHD C3329-1		Ground
RHD C3329-2		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE DRIVER SIDE AIR CURTAIN FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Side Air Curtain LHD C3321 or RHD C3329 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new Driver side air curtain. REFER to: Side Curtain Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1405:13 or B1405:1A, GO to A13 For DTC B1405:11, GO to A14 For DTC B1405:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1405:13 or B1405:1A, GO to A13 For DTC B1405:11, GO to A14 For DTC B1405:12, GO to A15

A13 CHECK THE DRIVER CURTAIN DEPLOYMENT CONTROL 1 RESISTANCE (DEPLOY_11_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_11_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint

	test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE DRIVER SIDE AIR CURTAIN DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1405:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE DRIVER SIDE AIR CURTAIN DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Driver Side Air Curtain LHD C3321 or RHD C3329.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1405:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental

Restraint System, General Procedures).

- Disconnect Driver Side Air Curtain LHD C3321 or RHD C3329.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Driver Side Air Curtain LHD C3321 or RHD C3329 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: V

B1408:11, B1408:12, B1408:13, B1408:1A

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

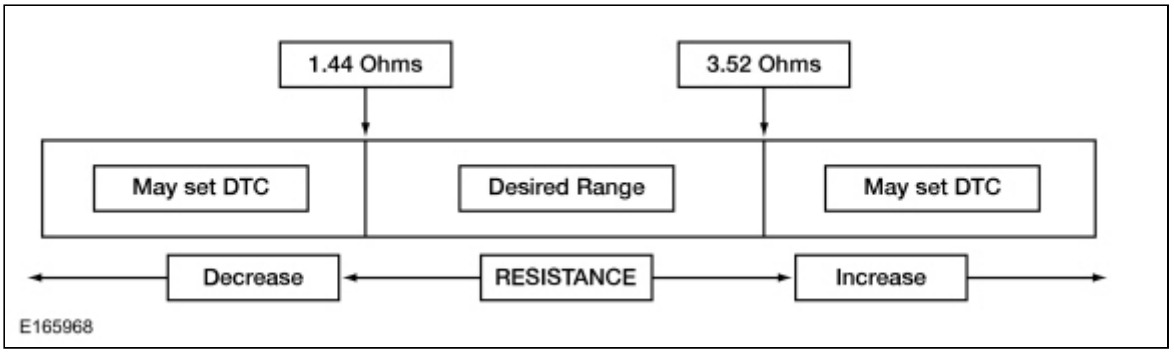
The RCM continuously monitors the Passenger side air curtain circuits for the following faults:

- Resistance out of range
- Unexpected voltage
- Short to ground
- Faulted Passenger side air curtain

If a fault is detected, the RCM stores DTC B1408:11, B1408:12, B1408:13 or B1408:1A in memory and sends a message to the IPC to illuminate the airbag warning indicator.

The RCM analyzes the deployment loop resistance to determine if a fault exists. The value displayed in the PID is the deployment loop resistance measured by the RCM. If the value displayed is lower or higher than the desired range (refer to diagram below), the RCM can set a DTC. As the deployment loop resistance drifts farther outside the desired range, the chance for a DTC increases. Small variations in resistance can occur due to the effect of road vibrations on terminal fit. Crimps and terminals can be affected by stress and harness movement and can cause an increase in resistance due to wire strain. These variables can result in an intermittent fault. For this reason, the test requires the PID value to be within the desired range before the fault is considered repaired, regardless if the module is reporting an on-demand DTC at the time of diagnosis. Following this direction helps make sure that minor changes in resistance do not create a repeat concern. This test uses process of elimination to diagnose each part of the deployment loop circuit including:

- Wiring
- Connections
- Passenger side air curtain
- RCM



DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B1408:11	Passenger Side Curtain Deployment Control 1: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either Passenger side air curtain circuit for more than 6 seconds.
B1408:12	Passenger Side Curtain Deployment Control 1: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either Passenger side air curtain circuit for more than 6 seconds.
B1408:13	Passenger Side Curtain Deployment Control 1: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the Passenger side air curtain circuits for more than 6 seconds.
B1408:1A	Passenger Side Curtain Deployment Control 1: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance between the Passenger side air curtain circuits for more than 6 seconds.

Possible Sources

- Wiring, terminals or connectors
- Passenger side air curtain
- RCM

PINPOINT TEST A : B1408:11, B1408:12, B1408:13 AND B1408:1A

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1408:11, B1408:12, B1408:13 and B1408:1A retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the RH side air curtain Diagnostic Trouble Codes (DTCs). For DTC B1408:13 or B1408:1A, GO to A2 For DTC B1408:11, GO to A8 For DTC B1408:12, GO to A10
No	This is an intermittent fault when present as a CMDTC only. If DTC U3003:16 or U3003:17 is also retrieved on-demand, REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 is not retrieved on-demand during self-test, DIAGNOSE the Passenger side air curtain Continuous Memory Diagnostic Trouble Codes (CMDTCs). For DTC B1408:13 or B1408:1A, GO to A13 For DTC B1408:11, GO to A14 For DTC B1408:12, GO to A15

A2 CHECK THE PASSENGER SIDE CURTAIN DEPLOYMENT CONTROL 1 RESISTANCE (DEPLOY_14_R) PID (PARAMETER IDENTIFICATION)

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- Monitor and record the resistance value displayed by the DEPLOY_14_R PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	GO to A12
No	GO to A3

A3 CHECK THE PASSENGER SIDE CURTAIN DEPLOYMENT CONTROL 1 RESISTANCE (DEPLOY_14_R) PID (PARAMETER IDENTIFICATION) WHILE CARRYING OUT THE HARNESS TEST

- While monitoring the DEPLOY_14_R PID, carry out the harness test of the Passenger side air curtain circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness and connectors frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms while carrying out the harness test?

Yes	DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	For PID value less than 1.44 ohms, GO to A4 For PID value greater than 3.52 ohms, GO to A6

A4 CHECK THE PASSENGER SIDE AIR CURTAIN DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (LOW RESISTANCE INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the Passenger side air curtain disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1408:1A to B1408:13?

Yes	GO to A11
No	GO to A5

A5 CHECK FOR A SHORT BETWEEN THE PASSENGER SIDE AIR CURTAIN CIRCUITS

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C3329-1	Ω	C3329-2
RHD C3321-1	Ω	C3321-2

Is the resistance greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A6 CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUITS FOR AN OPEN

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C310B-37	Ω	C3329-1
LHD C310B-38	Ω	C3329-2
RHD C310B-40	Ω	C3321-1
RHD C310B-39	Ω	C3321-2

Are the resistances less than 0.5 ohm?

Yes	GO to A7
No	REPAIR the circuits. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A7 CHECK THE PASSENGER SIDE AIR CURTAIN DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (OPEN INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Connect RCM C310A and C310B.
- Connect a fused jumper wire:

Lead 1	Measurement / Action	Lead 2
LHD C3329-1		C3329-2
RHD C3321-1		C3321-2

- Repower the SRS. **Do not** prove out the SRS at this time.

REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the Passenger side air curtain circuits shorted together, a low resistance fault is normally retrieved.

Did the on-demand DTC change from B1408:13 to B1408:1A?

Yes	REMOVE the fused jumper wire and GO to A11
No	REMOVE the fused jumper wire and GO to A12

A8 CHECK THE PASSENGER SIDE AIR CURTAIN DEPLOYMENT CONTROL DTC (DIAGNOSTIC TROUBLE CODE) FOR A FAULT STATUS CHANGE (SHORT TO GROUND INDICATED)

NOTE: *This pinpoint test step attempts to change the fault reported by the RCM by inducing a different fault condition. If the reported fault changes, this indicates the RCM is functioning correctly and is not the source of the fault.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.
- **DIAGNOSTIC TIP:** When viewing Diagnostic Trouble Codes (DTCs) with the Passenger side air curtain disconnected, an open circuit fault is normally retrieved.

Did the on-demand DTC change from B1408:11 to B1408:13?

Yes	GO to A11
No	GO to A9

A9 CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C3329-1	Ω	Ground
LHD C3329-2	Ω	Ground
RHD C3321-1	Ω	Ground
RHD C3321-2	Ω	Ground

Are the resistances greater than 10,000 ohms?

Yes	GO to A12
No	REPAIR the circuit(s).

	Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A10 CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Disconnect RCM C310A and C310B.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Measure:

Positive Lead	Measurement / Action	Negative Lead
LHD C3329-1		Ground
LHD C3329-2		Ground
RHD C3321-1		Ground
RHD C3321-2		Ground

Is any voltage present?

Yes	REPAIR the circuit(s). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	GO to A12

A11 CONFIRM THE PASSENGER SIDE AIR CURTAIN FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Side Air Curtain LHD C3329 or RHD C3321and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	INSTALL a new Passenger side air curtain. REFER to: Side Curtain Airbag (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1408:13 or B1408:1A, GO to A13 For DTC B1408:11, GO to A14 For DTC B1408:12, GO to A15

A12 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damaged, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Connect RCM C310A and C310B (if previously disconnected).
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Was the original DTC retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A17
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. For DTC B1408:13 or B1408:1A, GO to A13 For DTC B1408:11, GO to A14 For DTC B1408:12, GO to A15

A13 CHECK THE PASSENGER SIDE CURTAIN DEPLOYMENT CONTROL 1 RESISTANCE (DEPLOY_14_R) PID (PARAMETER IDENTIFICATION) FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT FAULT

- Using a diagnostic scan tool, view RCM Parameter Identifications (PIDs).
- While monitoring the DEPLOY_14_R PID, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently. Record the resistance value indicated by the PID.

Does the PID value read between 1.44 and 3.52 ohms?

Yes	The fault is not present and cannot be recreated at this time. Do not install any new SRS

	components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16
No	DEPOWER the SRS. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17

A14 CHECK THE PASSENGER SIDE AIR CURTAIN DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO GROUND FAULT

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1408:11 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A15 CHECK THE PASSENGER SIDE AIR CURTAIN DEPLOYMENT CONTROL CIRCUITS FOR AN INTERMITTENT SHORT TO BATTERY FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect Passenger Side Air Curtain LHD C3329 or RHD C3321.
- Repower the SRS. **Do not** prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness frequently.
- Using a diagnostic scan tool, perform RCM self-test.

Was DTC B1408:12 retrieved on-demand during self-test?

Yes	DEPOWER the SRS and REPAIR as necessary. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures). Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A16

A16 CHECK THE HARNESS AND CONNECTORS

- Ignition OFF.
- Depower the SRS.

REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental

Restraint System, General Procedures).
- Disconnect Passenger Side Air Curtain LHD C3329 or RHD C3321.
  - Inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Inspect Passenger Side Air Curtain LHD C3329 or RHD C3321 and make sure the Connector Position Assurance (CPA) tabs are not broken and the clip is not damaged.

Were any concerns found?

Yes	REPAIR as necessary. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A17
No	The fault is not present and cannot be recreated at this time. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A17

A17 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. DIAGNOSE and REPAIR the RCM Diagnostic Trouble Codes (DTCs). REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AE

BXXXX:2B (any BXXXX DTC with a 2B failure type) Signal Cross Coupled

Refer to Wiring Diagrams Cell 46 for schematic and connector information.

Normal Operation and Fault Conditions

The RCM monitors all deployable device and sensor circuits for a signal cross coupled (short) between components. Signal cross coupled Diagnostic Trouble Codes (DTCs) are present when one or both circuits of a component are shorted to one or both circuits of another component. Signal cross coupled Diagnostic Trouble Codes (DTCs) do not set when the circuits of a single device are shorted together, a different DTC is present (for example, a DTC for circuit resistance below threshold). The RCM sends a message to the IPC to illuminate the airbag warning indicator. When a normal loop fault is present (one loop is either shorted to battery/ground, open circuit or low resistance), then signal cross coupled diagnostics are not active. Once the normal loop fault is repaired, the signal cross coupled diagnostics resume.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B0001:2B	Driver Frontal Stage 1 Deployment Control: Signal Cross Coupled	If the RCM detects a short between the driver airbag stage 1 circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B0004:2B	Driver Knee Bolster Deployment Control: Signal Cross Coupled	If the RCM detects a short between the driver knee airbag circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B0010:2B	Passenger Frontal Stage 1 Deployment Control: Signal Cross Coupled	If the RCM detects a short between the passenger airbag stage 1 circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B0070:2B	Driver Seatbelt Pretensioner "A" Deployment Control: Signal Cross Coupled	If the RCM detects a short between the driver safety belt anchor pretensioner circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B0072:2B	Passenger Seatbelt Pretensioner "A" Deployment Control: Signal Cross Coupled	If the RCM detects a short between the passenger safety belt anchor pretensioner circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B1404:2B	Driver Side Airbag Deployment Control: Signal Cross Coupled	If the RCM detects a short between the driver side airbag circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B1405:2B	Driver Curtain Deployment Control 1: Signal Cross Coupled	If the RCM detects a short between the LH side air curtain circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B1407:2B	Passenger Side Airbag Deployment Control: Signal Cross Coupled	If the RCM detects a short between the passenger side airbag circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.
B1408:2B	Passenger Curtain Deployment Control 1: Signal Cross Coupled	If the RCM detects a short between the RH side air curtain circuits and the circuits of another SRS component, it sets this DTC and the DTC of the corresponding SRS component.

Possible Sources

- Wiring, terminals or connectors
- RCM

Visual Inspection and Diagnostic Pre-Checks

- Inspect the affected wiring harness(es) for damage, if accessible.

PINPOINT TEST A : BXXXX:2B (ANY BXXXX DTC (DIAGNOSTIC TROUBLE CODE) WITH A 2B FAILURE TYPE) SIGNAL CROSS COUPLED

WARNING: Incorrect repair techniques or actions can cause an accidental Supplemental Restraint System (SRS) deployment. Never compromise or depart from these instructions. Failure to precisely follow all instructions could result in serious personal injury from an accidental deployment.

NOTICE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may cause damage to the connector.

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

A1 RETRIEVE RCM (RESTRAINTS CONTROL MODULE) DIAGNOSTIC TROUBLE CODES (DTCS)

- **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

  REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Were any signal cross coupled Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. If DTC U3003:16 or U3003:17 is also retrieved on-demand, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 are not retrieved on-demand, GO to A2
No	If DTC U3003:16 or U3003:17 is retrieved on-demand as well, DIAGNOSE those Diagnostic Trouble Codes (DTCs) first. REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing). If DTC U3003:16 or U3003:17 are not retrieved on-demand, DIAGNOSE the signal cross-coupled Continuous Memory Diagnostic Trouble Codes (CMDTCs). This is an intermittent fault when present as a CMDTC only. GO to A4

A2 CHECK THE AFFECTED CIRCUITS FOR A SIGNAL CROSS COUPLED FAULT

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect RCM C310A and C310B.
- Using the signal cross coupled Diagnostic Trouble Codes (DTCs) present on-demand, identify the affected SRS devices.
- **NOTE:** *Most signal cross coupled faults are due to connector and/or wiring harness damage. Carry out a thorough inspection of connector(s) and/or wiring harness for damage.*

  Disconnect all of the affected SRS devices.

- Using the following table, measure the resistance between the circuits of one affected SRS device to the other affected SRS device.
  - Example: If Diagnostic Trouble Codes (DTCs) B0001:2B and B0002:2B are being diagnosed, measure the resistance between circuit CR101 to circuits CR102 and RR102. Then measure the resistance between circuit RR101 to circuits CR102 and RR102.

Device/Loop (DTC)	Connector
Driver airbag stage 1 (B0001:2B)	• LHD C216A-1 • LHD C216A-2 • RHD C256A-1 • RHD C256A-2
Driver knee airbag (B0004:2B)	• C2432-1 • C2432-2
Passenger airbag stage 1 (B0010:2B)	• LHD C256A-1 • LHD C256A-2 • RHD C216A-1 • RHD C216A-2
Driver safety belt buckle (B0050:2B)	• LHD C313-13 • LHD C313-14 • RHD C314-13 • RHD C314-14
Passenger safety belt buckle (B0052:2B)	• LHD C314-13 • LHD C314-14 • RHD C313-13 • RHD C313-14
Driver safety belt anchor pretensioner (B0070:2B)	• LHD C3065-1 • LHD C3065-2 • RHD C3066-1 • RHD C3066-2
Passenger safety belt anchor pretensioner (B0072:2B)	• LHD C3066-1 • LHD C3066-2 • RHD C3065-1 • RHD C3065-2
Driver side airbag (B1404:2B)	• LHD C313-1 • LHD C313-2 • RHD C314-1 • RHD C314-2
Driver side air curtain (B1405:2B)	• LHD C3321-1 • LHD C3321-2 • RHD C3329-1 • RHD C3329-2
Passenger side airbag (B1407:2B)	• LHD C314-1 • LHD C314-2 • RHD C313-1 • RHD C313-2
Passenger side air curtain (B1408:2B)	• LHD C3329-1 • LHD C3329-2 • RHD C3321-1 • RHD C3321-2

Are the resistances greater than 10,000 ohms between the affected circuits?

Yes	GO to A3
No	REPAIR the affected circuits. Refer to Wiring Diagrams Cell 46 for schematic and connector information. GO to A5

A3 CONFIRM THE RCM (RESTRAINTS CONTROL MODULE) FAULT

NOTE: *Make sure all SRS components and the RCM electrical connectors are connected before carrying out the self-test. If not, Diagnostic Trouble Codes (DTCs) will be recorded.*

- Prior to reconnecting any previously disconnected SRS component:
  - Inspect connector(s) (including any inline connectors) for pushed-out, loose or spread terminals and loose or frayed wire connections at terminals.
  - Inspect wire harness for any damage, pinched, cut or pierced wires.
  - Inspect RCM C310A and C310B Connector Position Assurance (CPA) lever/lock for correct operation.
  - Repair any concerns found.
    Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Connect all previously disconnected restraint system component(s).
- Connect RCM C310A and C310B.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Were any signal cross coupled Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). GO to A5
No	In the process of diagnosing the fault, the fault condition has become intermittent. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A4

A4 CHECK FOR AN INTERMITTENT FAULT

NOTE: *Most cross link faults are due to connector and/or wiring harness damage. Carry out a thorough inspection of connector(s) and/or wiring harness for damage.*

- Ignition OFF.
- Depower the SRS.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Disconnect all of the affected SRS devices.
  Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Inspect the wiring harness(es) for any type of damage. If damage is found, repair as necessary.
  Refer to Wiring Diagrams Cell 46 for schematic and connector information.
- Repower the SRS. Do not prove out the SRS at this time.
  REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- Using a diagnostic scan tool, perform RCM self-test.

Were any signal cross coupled Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	This fault cannot be cleared until it is corrected and the DTC is no longer retrieved on-demand during self-test. GO to A2
No	The fault is not present and cannot be recreated at this time. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition frequently. Do not install any new SRS components at this time. Install SRS components only when directed to do so in the pinpoint test. GO to A5

A5 CHECK FOR ADDITIONAL SRS (SUPPLEMENTAL RESTRAINT SYSTEM) DIAGNOSTIC

TROUBLE CODES (DTCS)

- Ignition OFF.
- Reconnect all SRS components (if previously disconnected).
- If previously directed to depower the SRS, repower the SRS. Do not prove out the SRS at this time. REFER to: Supplemental Restraint System (SRS) Depowering and Repowering (501-20B Supplemental Restraint System, General Procedures).
- Ignition ON.
- **NOTE:** *When selecting Restraints from the Self Test menu, DTCs are retrieved from the RCM.*

  Using a diagnostic scan tool, perform **Restraints** self-test.

Are any RCM Diagnostic Trouble Codes (DTCs) retrieved on-demand during self-test?

Yes	Do not clear any Diagnostic Trouble Codes (DTCs) until all Diagnostic Trouble Codes (DTCs) have been resolved. REFER to: Airbag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	The repair is complete. RETURN the vehicle to the customer.

Copyright © 2016 Ford Motor Company

Pinpoint Test - DTC: AH

U0100:00

Normal Operation and Fault Conditions

The RCM uses information contained in messages from the PCM sent on the HS-CAN.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100:00	Lost Communication with ECM/PCM "A": No Sub Type Information	This DTC sets if the RCM does not receive an expected message from the PCM.

Possible Causes

- Network traffic
- PCM
- RCM

PINPOINT TEST A : U0100:00

NOTE: *Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.*

NOTE: *Only disconnect or reconnect SRS components when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.*

NOTE: *Always make sure the correct SRS component is being installed. Parts released for other vehicles may not be compatible even if they appear physically similar. Check the part number listed in the Ford parts catalog to make sure the correct component is being installed. If an incorrect SRS component is installed, Diagnostic Trouble Codes (DTCs) may set.*

A1 VERIFY DIAGNOSTIC SCAN TOOL COMMUNICATION WITH THE PCM (POWERTRAIN CONTROL MODULE)

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

- REFER to: Health and Safety Precautions (100-00 General Information, Description and Operation).
- Ignition ON.
- Connect the diagnostic scan tool.
- Check that a vehicle session can be established using the diagnostic scan tool.

Can a vehicle session be established?

Yes	If DTC U0100:00 was retrieved from the RCM, GO to A2
No	To diagnose no communication with the PCM, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

A2 CHECK THE RCM (RESTRAINTS CONTROL MODULE) CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODES (CMDTCS)

- Using a diagnostic scan tool, perform RCM self-test.
- Using a diagnostic scan tool, clear RCM Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform RCM self-test.

Is DTC U0100:00 retrieved again?

Yes	GO to A3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

A3 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform PCM self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the PCM KOEO self-test.

Is DTC P0562 or P0563 recorded?

Yes	DIAGNOSE the PCM Diagnostic Trouble Codes (DTCs). Refer to the appropriate section in Group 303 for the procedure.
No	If DTC U0100:00 was originally retrieved from the RCM, GO to A4

A4 RETRIEVE THE RECORDED DIAGNOSTIC TROUBLE CODES (DTCS) FROM THE RCM (RESTRAINTS CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform RCM self-test.
- Check for recorded Diagnostic Trouble Codes (DTCs) from the RCM self-test.

Is DTC U3003:16 or U3003:17 recorded?

Yes	REFER to: Pinpoint Test - DTC: AN (501-20B Supplemental Restraint System, Diagnosis and Testing).
No	GO to A5

A5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0100:00 SET IN OTHER MODULES OTHER THAN THE RCM (RESTRAINTS CONTROL MODULE)

- Using a diagnostic scan tool, perform self-test for all modules.

Is DTC U0100:00 set in the ABS module?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new PCM. Refer to the appropriate section in Group 303 for the procedure.
No	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation).

Copyright © 2016 Ford Motor Company

Clockspring Adjustment

Special Tool(s) / General Equipment

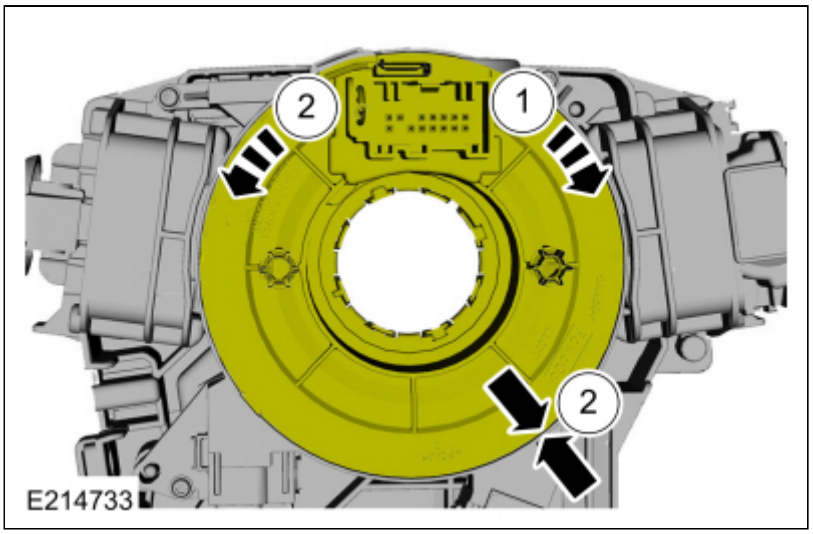
Adhesive Tape

WARNING: If there is a break between installing the clockspring and steering wheel rotation sensor assembly and installing the steering wheel, the centralizing of the clockspring must be repeated.

WARNING: If the centralization of the clockspring is in doubt, the centralizing of the clockspring must be repeated.

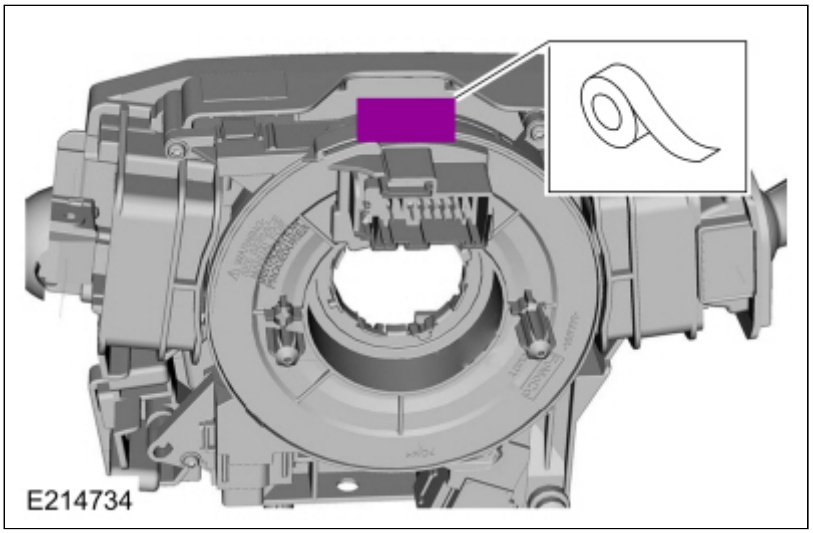
NOTE: *Make sure that the road wheels are in the straight ahead position.*

1. Turn the clockspring in a clockwise direction until a resistance is felt.
2. Turn the clockspring in a counterclockwise direction 2.5 revolutions, until the arrow marked on the rotor of the clockspring aligns with the raised 'V' section on the outer cover of the clockspring.



2. **NOTICE: Make sure that the clockspring rotor does not rotate.**

   Use the General Equipment: Adhesive Tape



Copyright © 2016 Ford Motor Company

Deployed Airbag Disposal

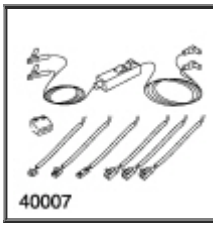
WARNING: After deployment, the air bag module surface may contain deposits of sodium hydroxide, a product of the gas generate combustion, that is irritating to the skin. Use protective gloves when handling any deployed air bag module. Failure to follow this instruction may result in personal injury.

1. Remove the deployed air bag module(s). For additional information, refer to the relevant procedure in this section.
2. Seal the deployed air bag module(s) in the packaging from the new air bag module(s) or a suitable polythene bag, and then dispose of in accordance with local contaminated waste regulations.

Copyright © 2016 Ford Motor Company

Scrapped Vehicle Airbag and Seatbelt Pretensioner Disposal - In-Vehicle Disposal

Special Tool(s) / General Equipment

 40007	418-S055C Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt

Disposal

WARNING: To avoid accidental deployment, the restraints control module (RCM) backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the SRS. Failure to follow this instruction may result in personal injury.

WARNING: Before deploying the air bag module or safety belt pretensioner pyrotechnic make sure that all personnel in the vicinity are aware that a loud noise (bang) is about to occur. Do not let anybody approach closer than 6 meters. Failure to follow this instruction may result in personal injury.

WARNING: The air bag module or the safety belt pretensioner should not be handled immediately following deployment as the air bag module will be very hot. Failure to follow this instruction may result in personal injury.

WARNING: After deployment, the inflator(s) becomes inert, direct contact to the skin or eyes of any free pyrotechnic residues should be avoided. Failure to follow this instruction may result in personal injury.

WARNING: Always wear gloves and safety glasses when handling deployed air bag modules and safety belt pretensioners, Failure to follow this instruction may result in personal injury.

WARNING: If the air bag module or safety belt pretensioner pyrotechnic residue should contact the eyes, wash the eyes with clean water and seek medical assistance. Failure to follow this instruction may result in personal injury.

WARNING: If a large amount of air bag or safety belt pretensioner pyrotechnic residue is inhaled, seek medical assistance. Failure to follow this instruction may result in personal injury.

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Double cab

2. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Stretch cab

3. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Single cab

4. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).

Vehicles with front bench seat

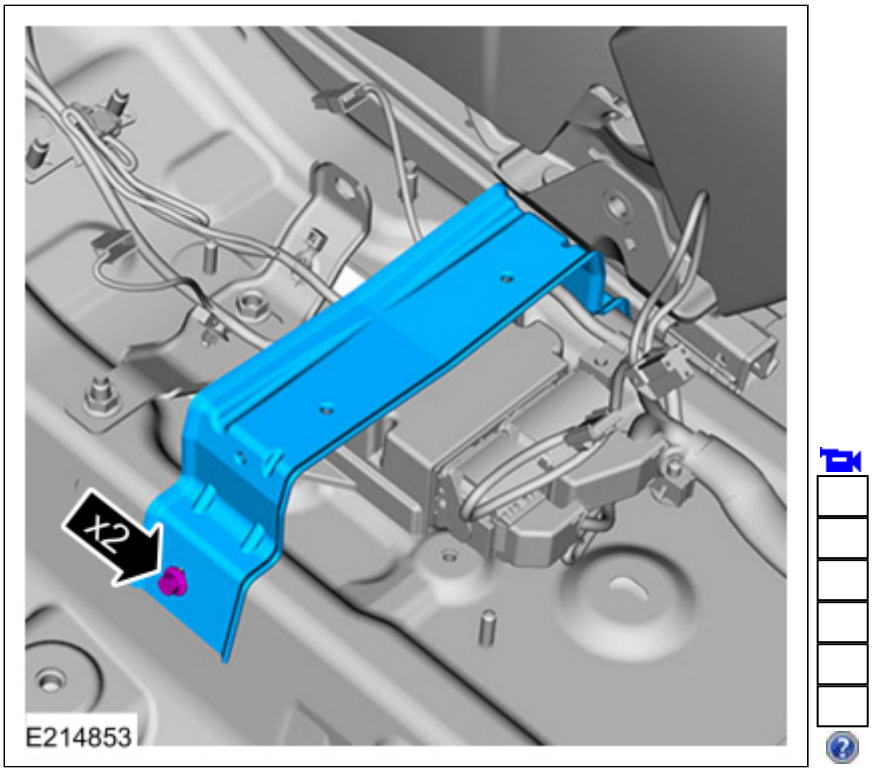
5. **NOTE:** *Remove front bench seat only.*

   Refer to: Front Seat (501-10A Seating, Removal and Installation).

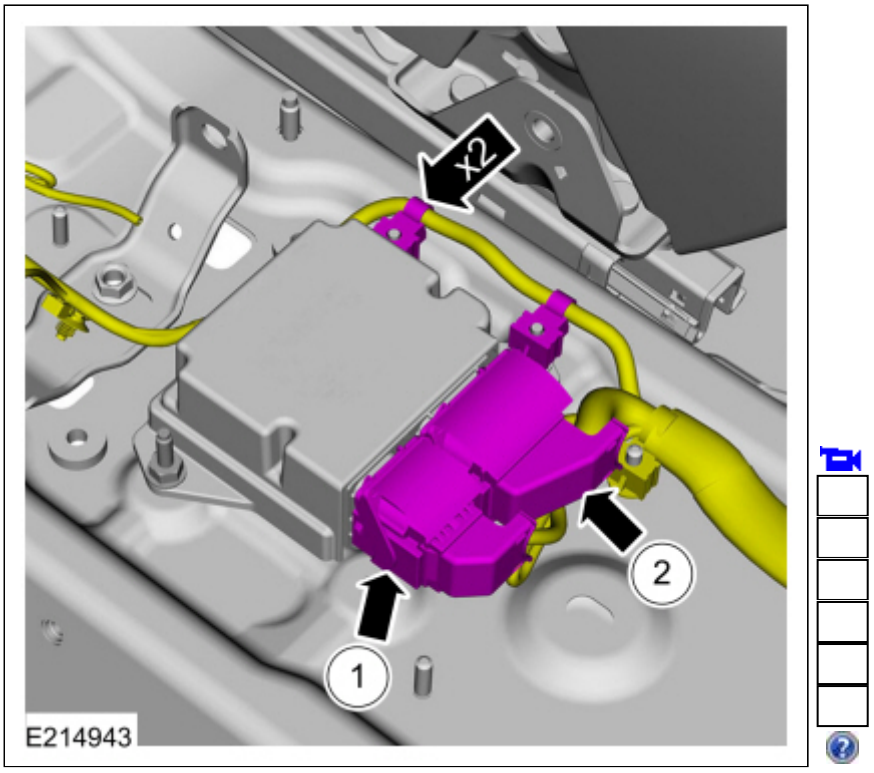
All vehicles

6. **NOTE:** *Both seats must be move forward before removing the RCM module.*

   On both sides.
   Torque: 11 Nm



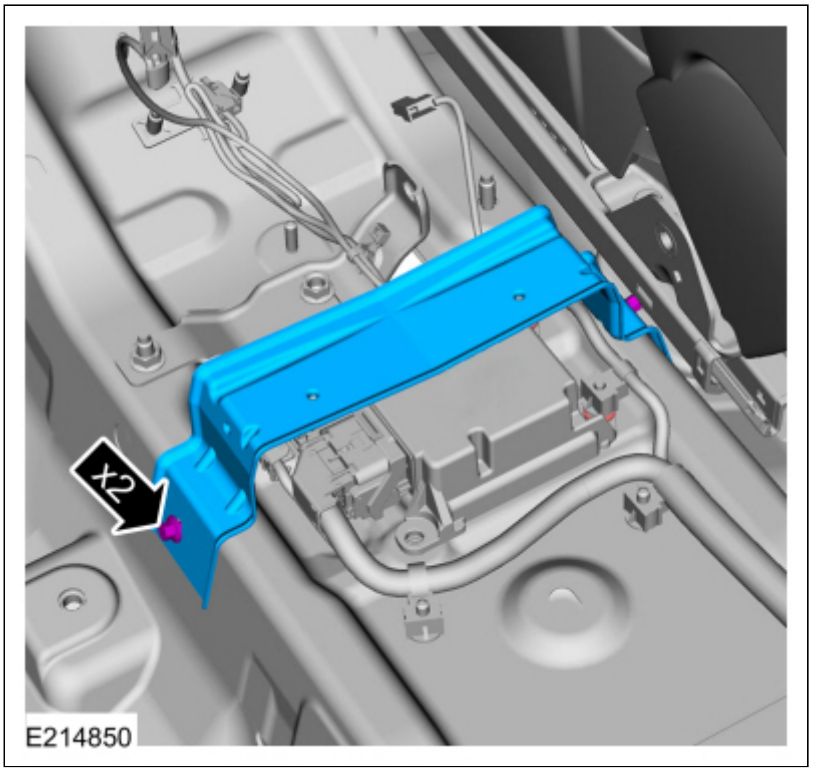
7.



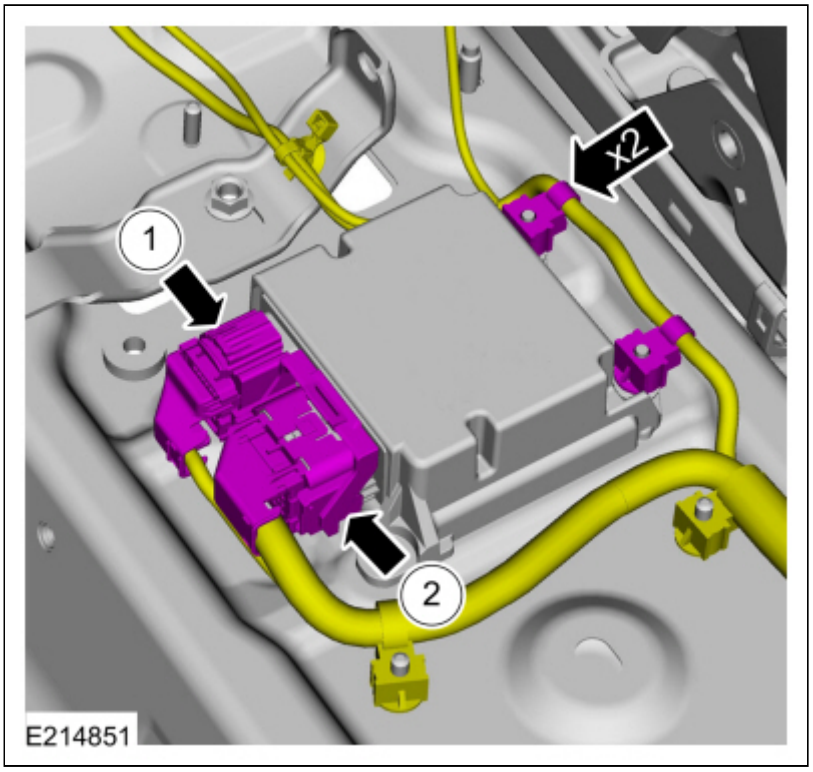
8. **NOTE:** *Only heavy duty vehicle*

   NOTE: *Both seats must be move forward before removing the RCM module.*

On both sides.
Torque: 11 Nm

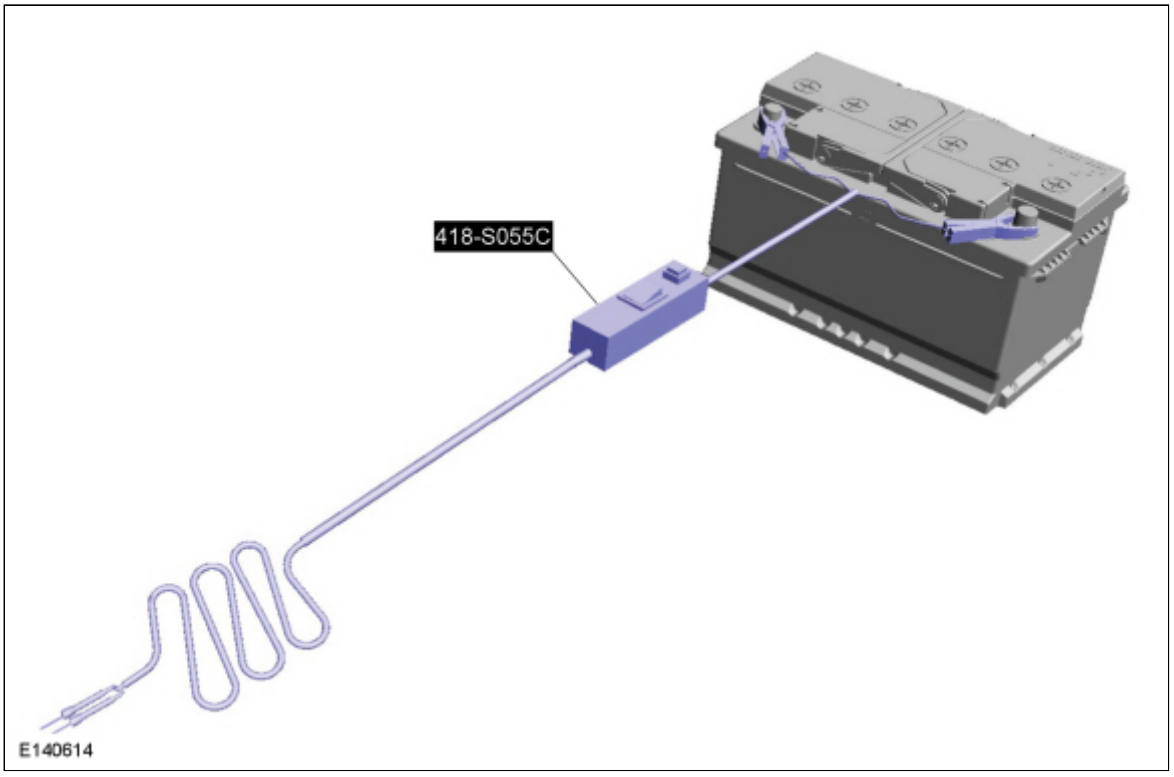


9. **NOTE:** *Only heavy duty vehicle*



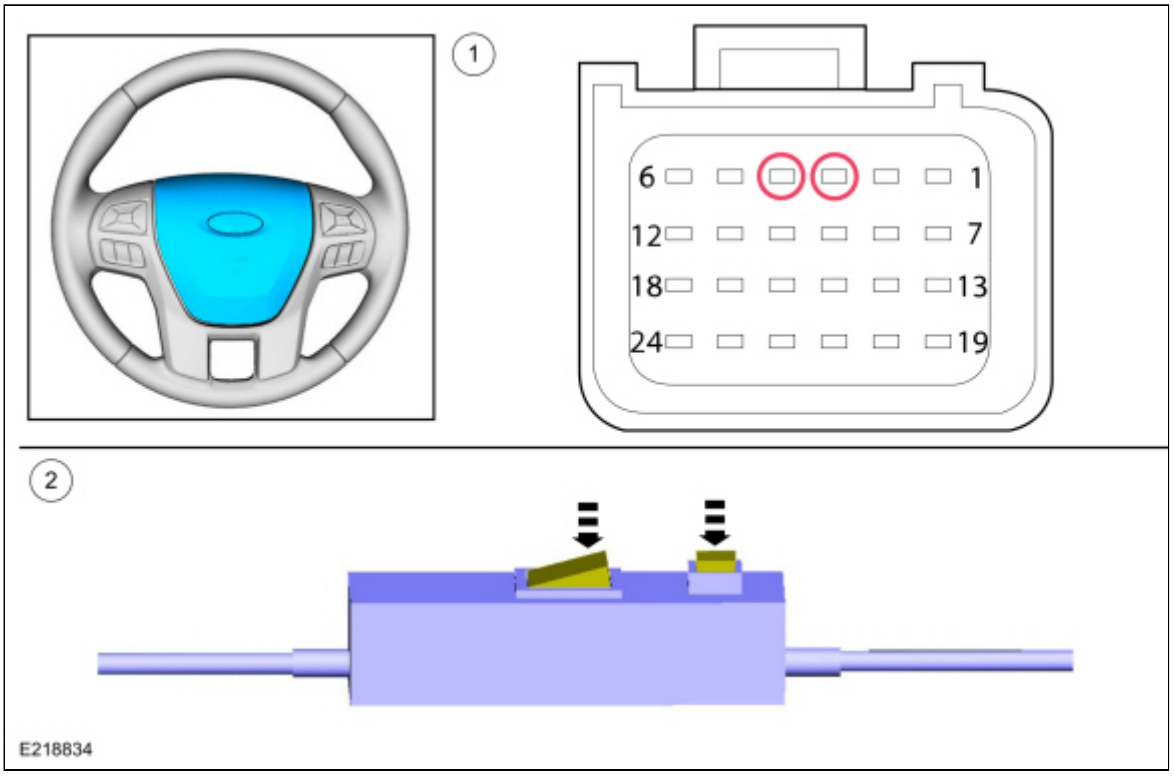
All vehicles

1. 12 volt battery.
   Use Special Service Tool: 418-S055C Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt.



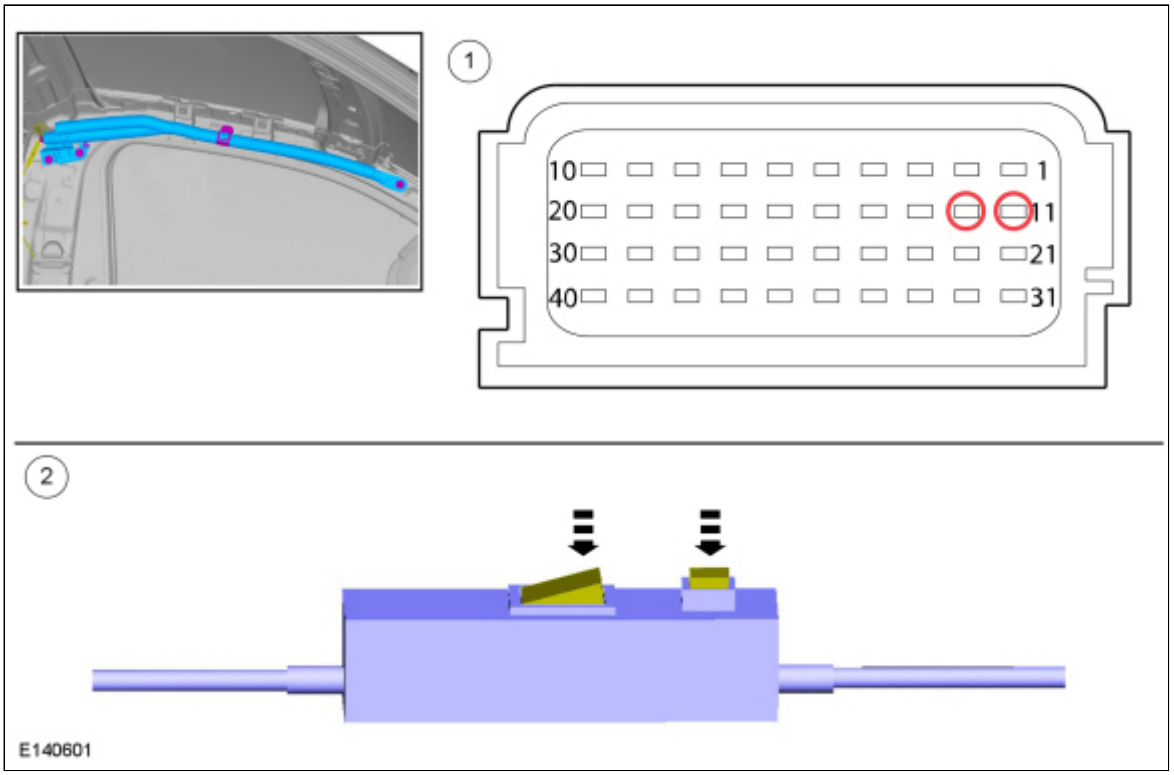
1. Driver air bag.

2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**

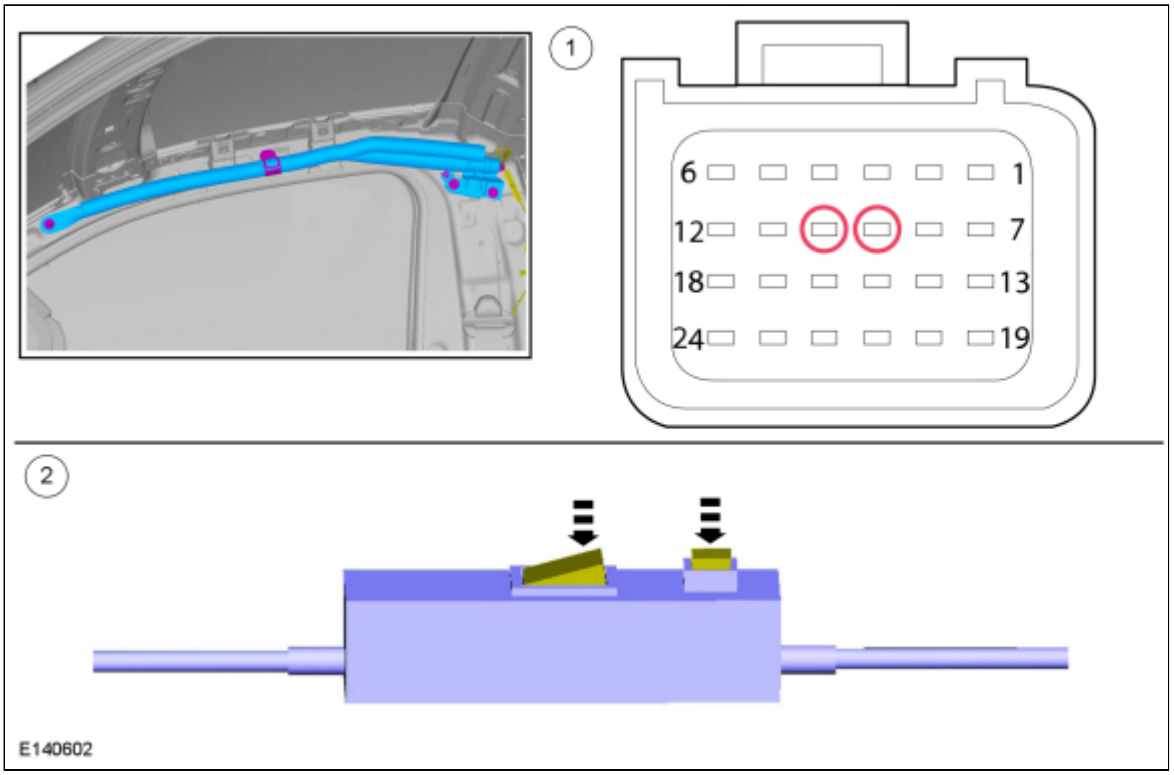


1. Single Cab shown, Double cab and Super cab is similar.

2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**

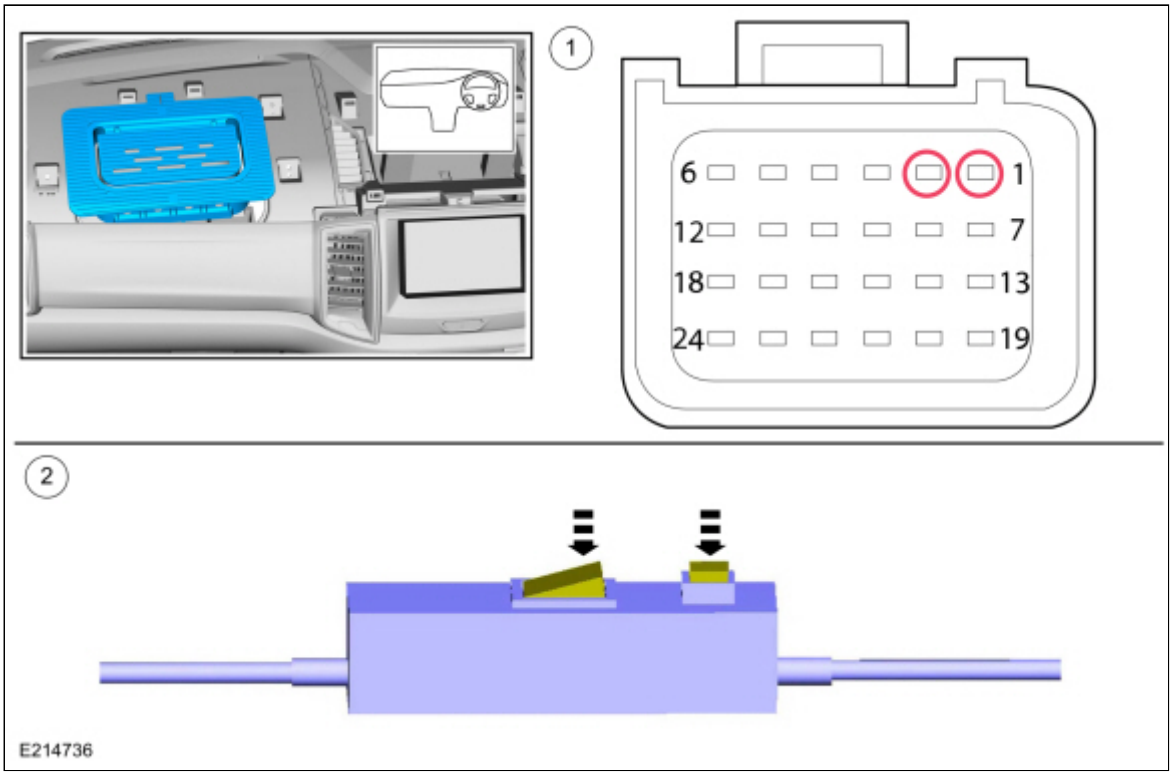


1. Single Cab shown, Double cab and Super cab is similar.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



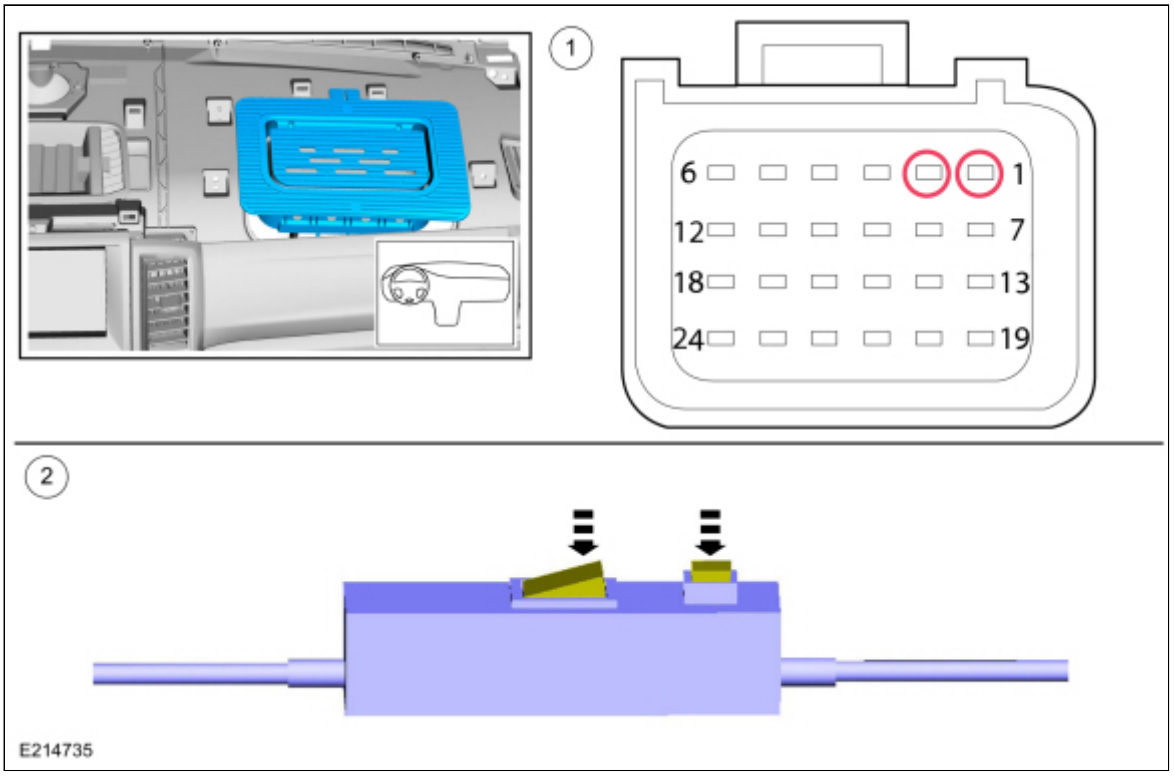
RHD

1. Passenger air bag.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



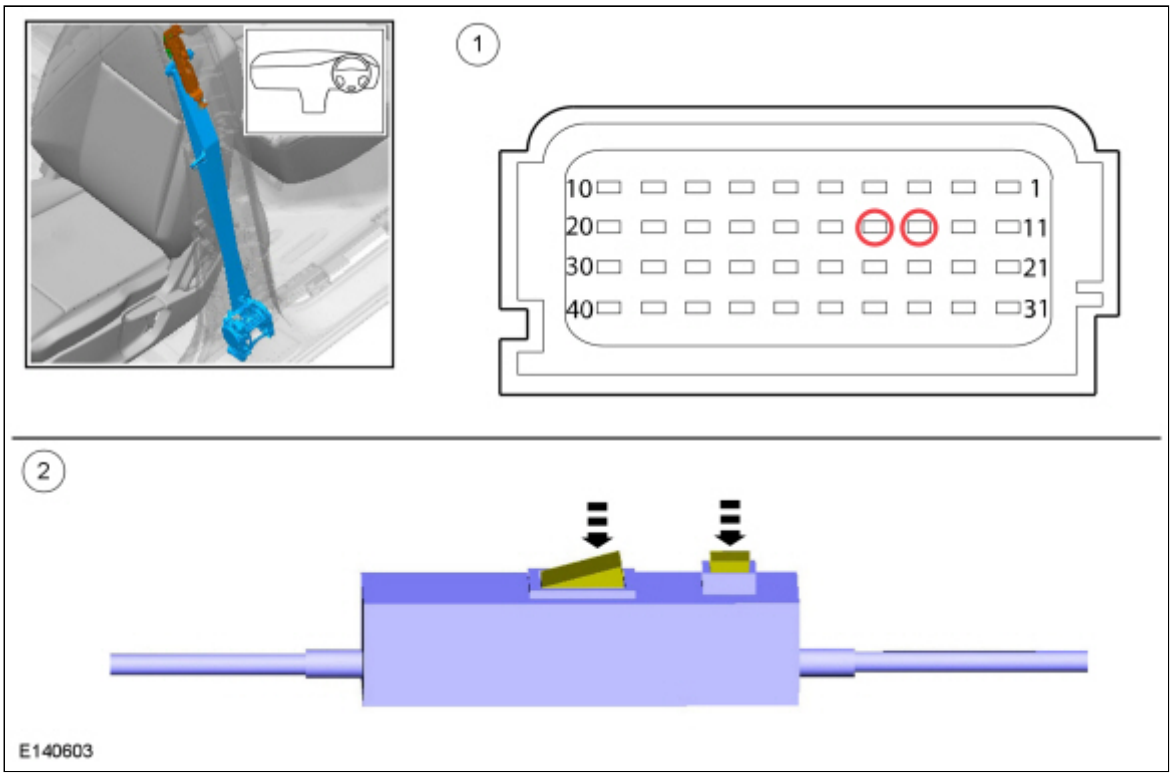
LHD

1. Passenger air bag.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



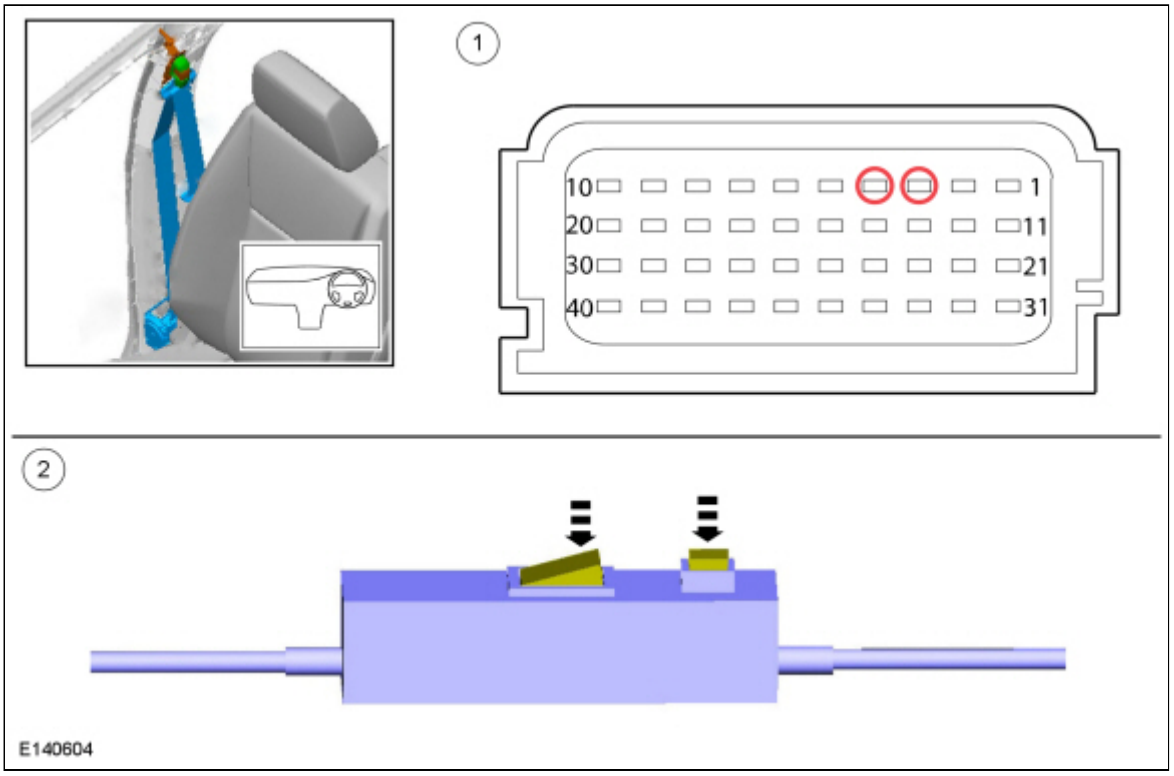
RHD

1. Passenger retractor pretensioner.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



1. Driver retractor pretensioner.

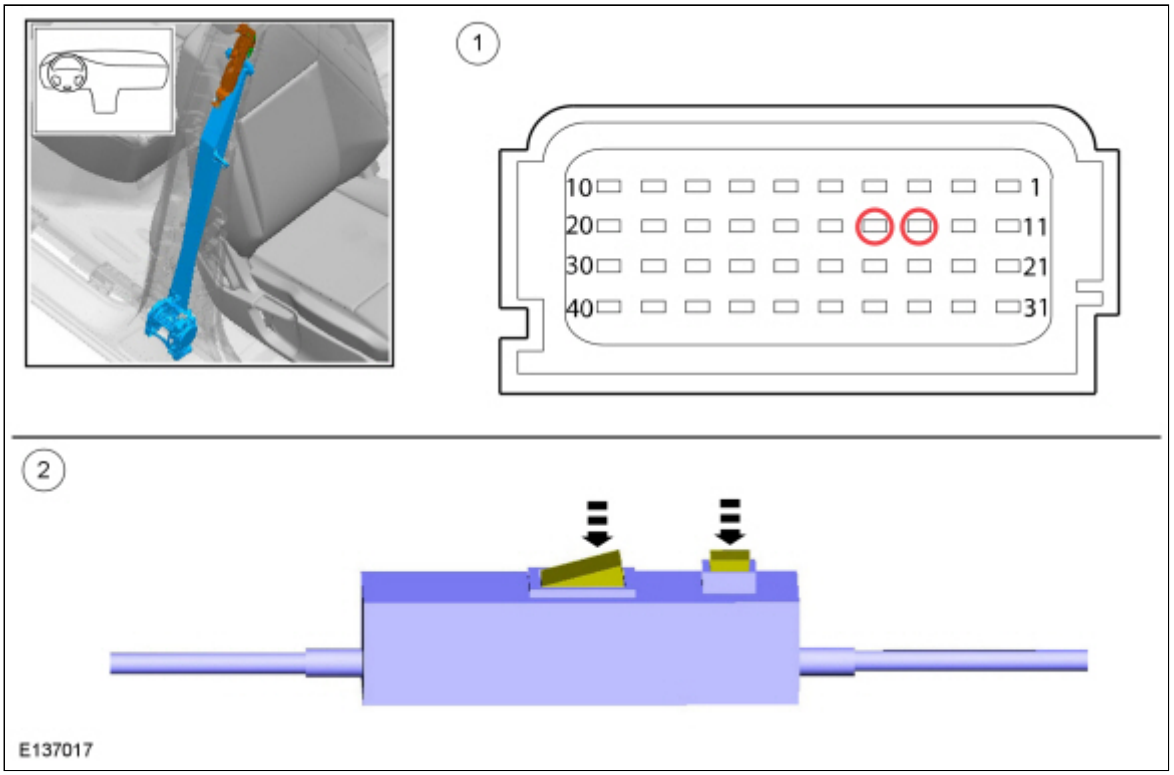
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



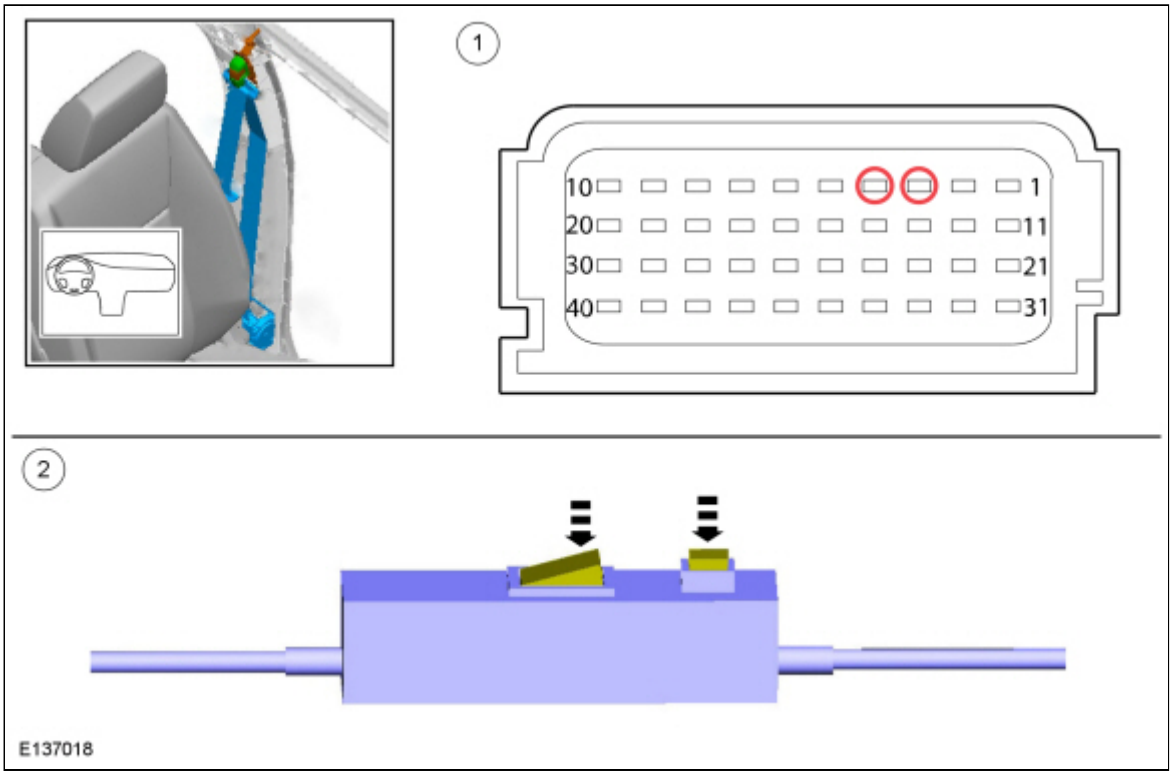
LHD

1. Passenger retractor pretensioner.

2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**

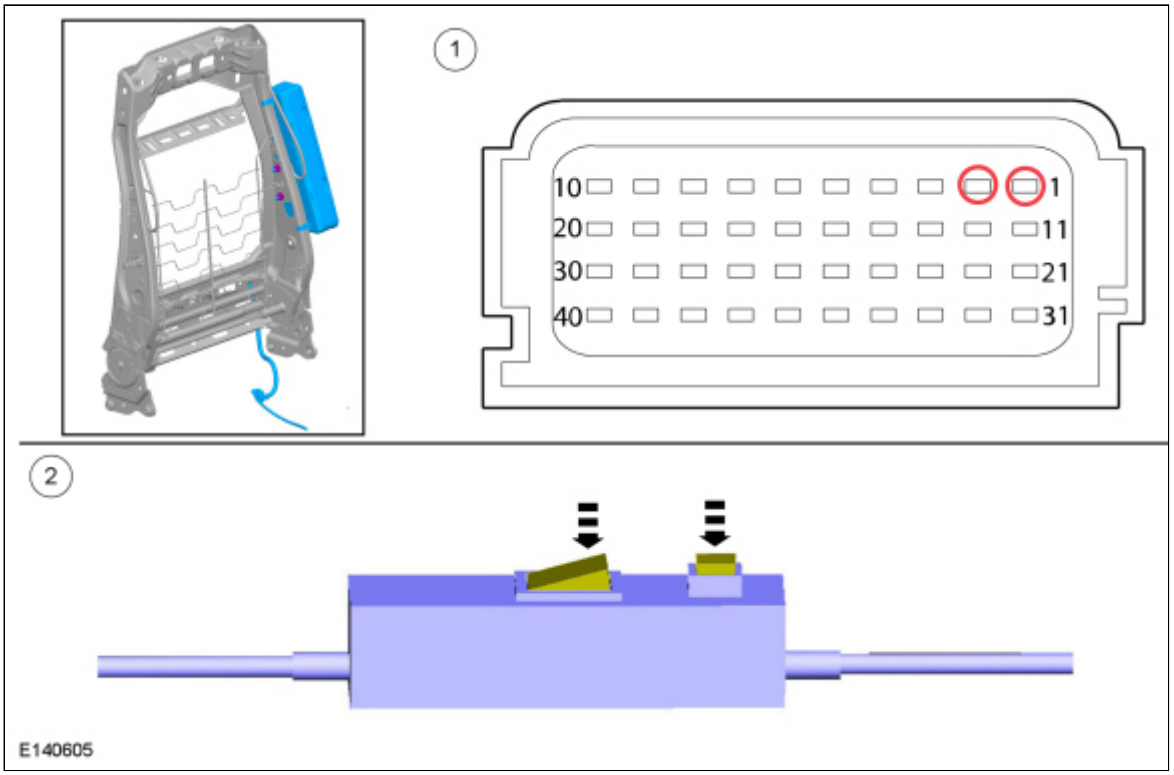


1. Driver retractor pretensioner.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**

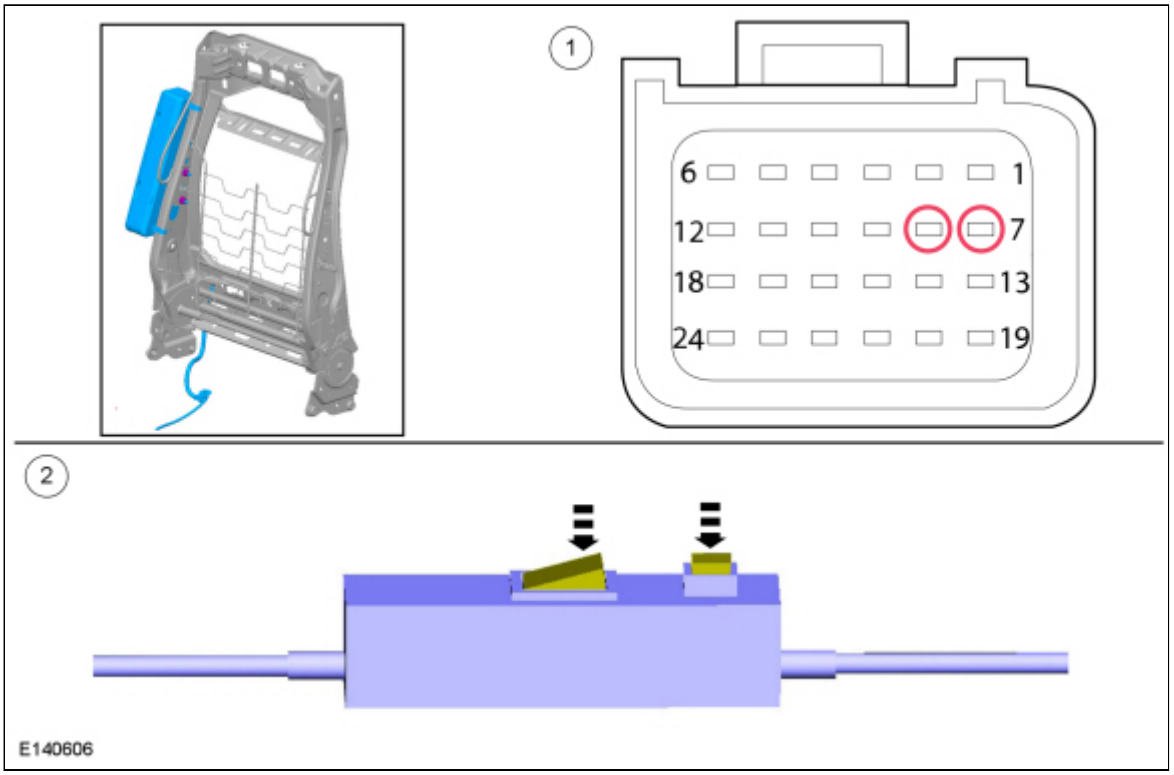


All vehicles

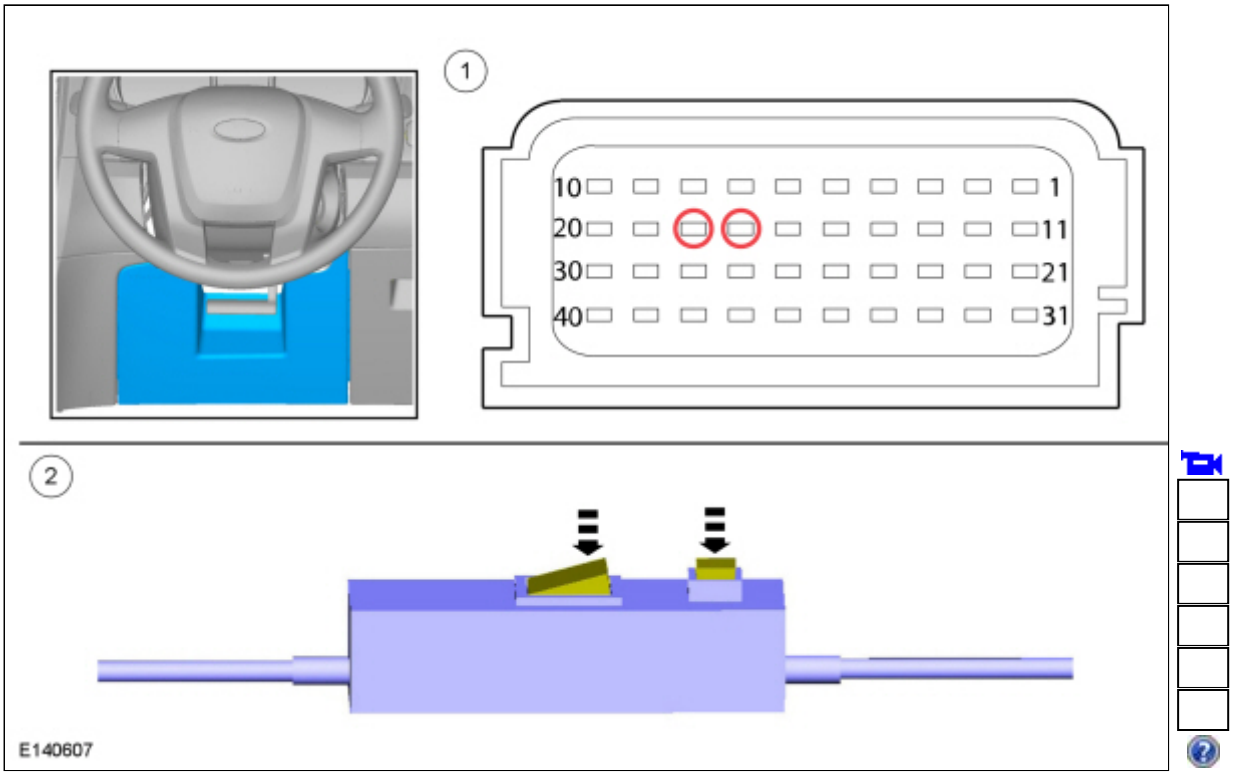
1. Passenger side air bag.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



1. Driver side air bag.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



1. Driver lower air bag.
2. **WARNING: Make sure to be a minimum distance of 6 meters from pyrotechnic components during deployment. If possible stand behind a wall.**



23. Deployed air bag module(s) and safety belt pretensioners should be sealed in suitable bags and then disposed of in accordance with local contaminated waste regulations.

24. **NOTE:** *All unserviceable air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules should be treated the same as any unserviceable live air bag module being returned.*

    Refer to: Front Seatbelt Retractor - Single Cab (501-20A Seatbelt Systems, Removal and Installation).
    Refer to: Front Seatbelt Retractor - Single Cab, Vehicles With: Double Passenger Seat (501-20A Seatbelt Systems, Removal and Installation).
    Refer to: Front Seatbelt Retractor - Double Cab (501-20A Seatbelt Systems, Removal and Installation).
    Refer to: Front Seatbelt Retractor - Super Cab (501-20A Seatbelt Systems, Removal and Installation).
    Refer to: Driver Airbag (501-20B Supplemental Restraint System, Removal and Installation).
    Refer to: Passenger Airbag (501-20B Supplemental Restraint System, Removal and Installation).
    Refer to: Driver Knee Airbag (501-20B Supplemental Restraint System, Removal and Installation).
    Refer to: Side Airbag (501-20B Supplemental Restraint System, Removal and Installation).
    Refer to: Side Curtain Airbag (501-20B Supplemental Restraint System, Removal and Installation).

25. **WARNING: Under no circumstances is an unserviceable air bag module or safety belt pretensioner to be returned through the local mailing system. Failure to follow this instruction may result in personal injury.**

    If an air bag module or safety belt pretensioner fails to deploy, seal the unserviceable air bag module or safety belt pretensioner in suitable packaging and return to the exchange plan center, as appointed through the local national sales company.

Copyright © 2016 Ford Motor Company

Supplemental Restraint System (SRS) Depowering and Repowering

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Depower

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   WARNING: Never probe the electrical connectors on Side Airbag or Side Curtain assemblies. Failure to follow this instruction may result in the accidental deployment of these assemblies, which increases the risk of serious personal injury or death.

   WARNING: Never disassemble or tamper with seat belt deployable components. Never back probe deployable device electrical connectors. Tampering or back probing may cause an accidental deployment and result in personal injury or death.

   WARNING: To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

   NOTE: *The airbag warning indicator illuminates when the correct RCM fuse is removed and the ignition is ON.*

   NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Turn all vehicle accessories OFF.

3. Turn the ignition OFF.

4. At the CEM (Central Electronics Module), located on the drivers side lower instrument panel, remove the fuse panel cover and fuse 86 (10A) from the CEM (Central Electronics Module). Refer to Wiring Diagram Section 501-20B, for Schematic and Connector information.

5. Turn the ignition ON and monitor the airbag warning indicator for at least 30 seconds. The airbag warning indicator remains lit continuously (no flashing) if the correct RCM fuse is removed. If the airbag warning indicator is not lit continuously, remove the correct RCM fuse before proceeding.

6. Turn the ignition OFF.

7. **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

   Disconnect the battery.
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

8. Wait at least one minute before continuing vehicle service.

Repower

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   WARNING: To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE: *The airbag warning indicator illuminates when the correct RCM fuse is removed and the ignition is ON.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

Vehicles with Intelligent Access (IA)

2. Install RCM fuse 86 (10A) in the CEM (Central Electronics Module).

3. **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any airbag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

   Connect the battery.
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

4. Prove out the RCM as follows: Turn the ignition from ON to OFF. Wait 1O seconds, then turn the ignition back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will illuminate continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will: **fail to light**, **remain illuminated**, **flash.** The air bag warning indicator might not illuminate until approximately 3O seconds after the ignition has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime sounds in a pattern of 5 sets of 5 beeps. If this occurs, diagnose and repair the air bag warning indicator and any SRS faults discovered.

5. Clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from the RCM using
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Supplemental Restraint System (SRS) Depowering and Repowering

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Depower

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   WARNING: Never probe the electrical connectors on Side Airbag or Side Curtain assemblies. Failure to follow this instruction may result in the accidental deployment of these assemblies, which increases the risk of serious personal injury or death.

   WARNING: Never disassemble or tamper with seat belt deployable components. Never back probe deployable device electrical connectors. Tampering or back probing may cause an accidental deployment and result in personal injury or death.

   WARNING: To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

   NOTE: *The airbag warning indicator illuminates when the correct RCM fuse is removed and the ignition is ON.*

   NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

   Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

2. Turn all vehicle accessories OFF.
3. Turn the ignition OFF.
4. At the CEM (Central Electronics Module), located on the drivers side lower instrument panel, remove the fuse panel cover and fuse 35 (5A) from the CEM (Central Electronics Module). Refer to Wiring Diagram Section 501-20B, for Schematic and Connector information.
5. Turn the ignition ON and monitor the airbag warning indicator for at least 30 seconds. The airbag warning indicator remains lit continuously (no flashing) if the correct RCM fuse is removed. If the airbag warning indicator is not lit continuously, remove the correct RCM fuse before proceeding.
6. Turn the ignition OFF.
7. **WARNING: Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

   Disconnect the battery.
   Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .
8. Wait at least one minute before continuing vehicle service.

Repower

1. **WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.**

   WARNING: To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE: *The airbag warning indicator illuminates when the correct RCM fuse is removed and the ignition is ON.*

NOTE: *The SRS must be fully operational and free of faults before releasing the vehicle to the customer.*

Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

Vehicles With: Keyless Entry

2. Install RCM fuse 35 (5A) in the CEM (Central Electronics Module).

3. **WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any airbag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

   Connect the battery.
   Refer to: Battery Disconnect and Connect - Vehicles Built Up To: 16-08-2015 (414-01 Battery, Mounting and Cables) .

4. Prove out the RCM as follows: Turn the ignition from ON to OFF. Wait 1O seconds, then turn the ignition back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will illuminate continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will: **fail to light**, **remain illuminated**, **flash.** The air bag warning indicator might not illuminate until approximately 3O seconds after the ignition has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime sounds in a pattern of 5 sets of 5 beeps. If this occurs, diagnose and repair the air bag warning indicator and any SRS faults discovered.

5. Clear all Continuous Memory Diagnostic Trouble Codes (CMDTCs) from the RCM using
   Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Unserviceable Airbag Disposal

1. **WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.**

   WARNING: To prevent premature deployment, live air bag modules must only be placed on work benches which have been ground bonded. Failure to follow this instruction may result in personal injury.

   NOTE: *All unserviceable air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules should be treated the same as any unserviceable live air bag module being returned.*

   Remove the unserviceable air bag module. For additional information, refer to the relevant procedure in this section.

2. **WARNING: Under no circumstances is an unserviceable air bag module(s) to be returned through the local mailing system. Failure to follow this instruction may result in personal injury.**

   Seal the unserviceable air bag module(s) in the packaging from the new air bag module(s) and address to the appropriate manufacturer. The package should then be forwarded to the Exchange Plan Center (as appointed through the national sales company) who will arrange forwarding to the manufacturer.

3. **NOTE:** *Autoliv passenger air bag modules, side air bag modules, side air curtain modules and driver lower air bag modules.*

   Autoliv Southern Africa, 19 Fransen Street, Chamdor, South Africa.

4. **NOTE:** *TRW driver air bag modules.*

   TRW Steering & Suspension Co. Ltd. , 64/2 Moo 4 Eastern Seaboard Industrial Estate, Tumbol Pluakdaeng, Amphur Pluakdaeng, Rayong 21140, Thailand.

5. **NOTE:** *Ashimori seatbelt pretensioners*

   Ashimori (Thailand) Company Ltd. , Quality Assurance Dept, 89 Moo 9, Wellgrow Industrial Estate Bangna-Trad Rd, K.M.36, Tambol Bangwua Bangpakong District, Chachoengsao 24180, Thailand.

Copyright © 2016 Ford Motor Company

Driver Airbag

Special Tool(s) / General Equipment

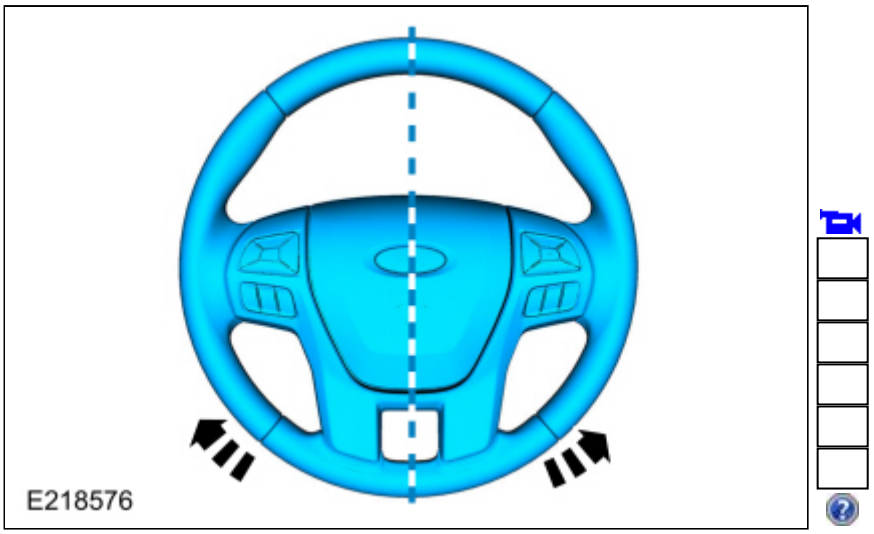
Flat Headed Screw Driver

Removal

WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

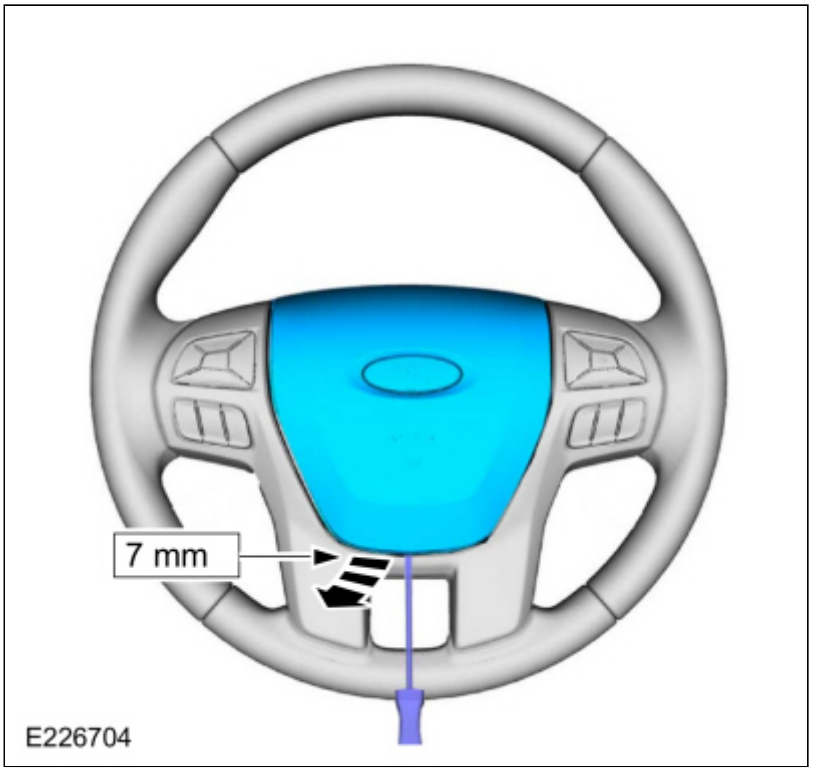
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. **NOTE:** *Make sure that the road wheels are in straight ahead position.*

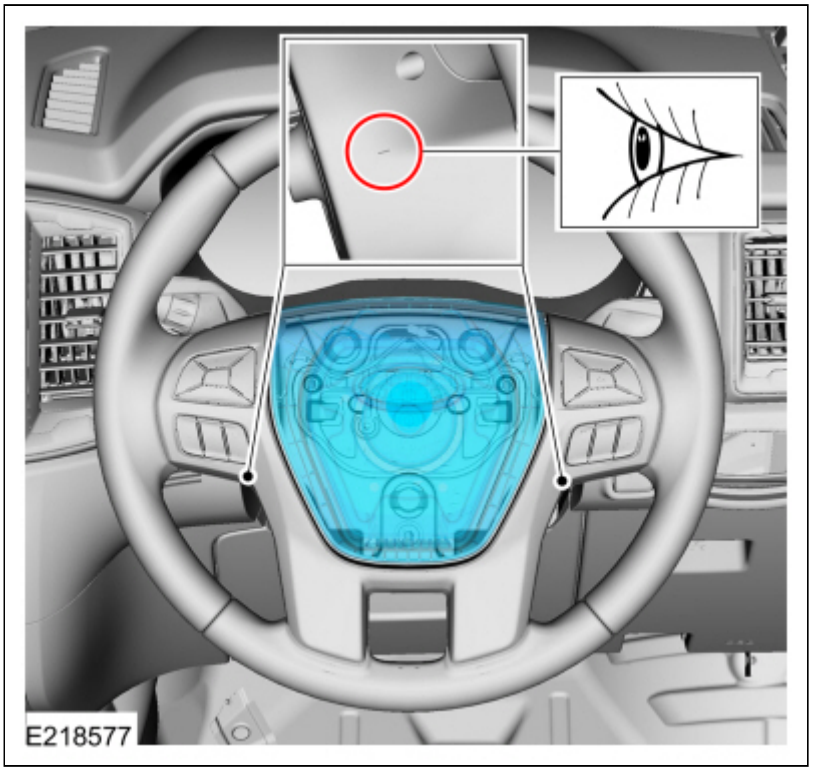


4. **NOTE:** *Use a cloth to place in the horn gap to protect the bezel.*

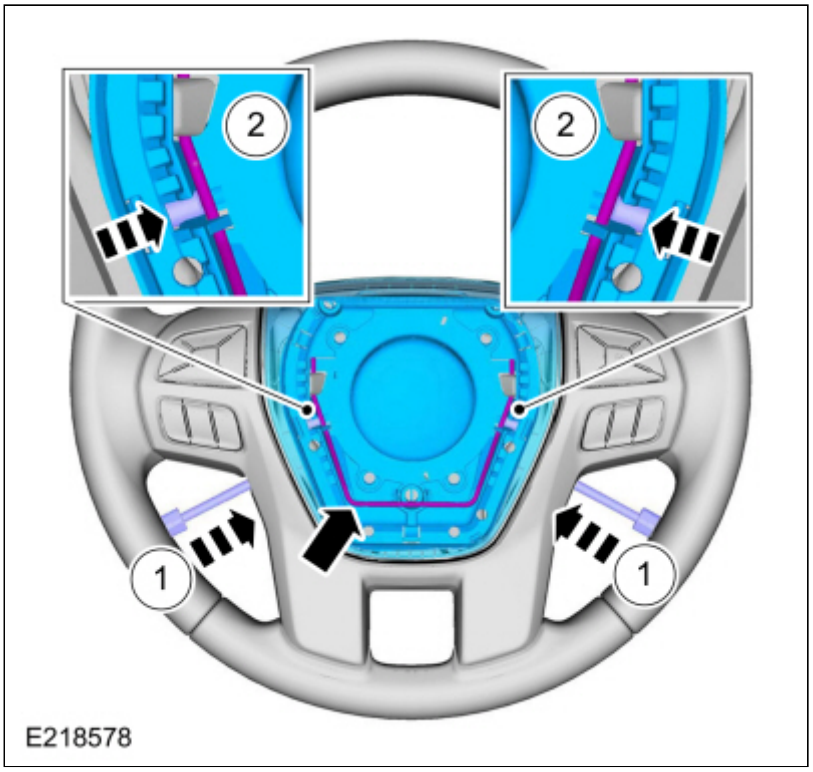
   Use the General Equipment: Flat Headed Screw Driver



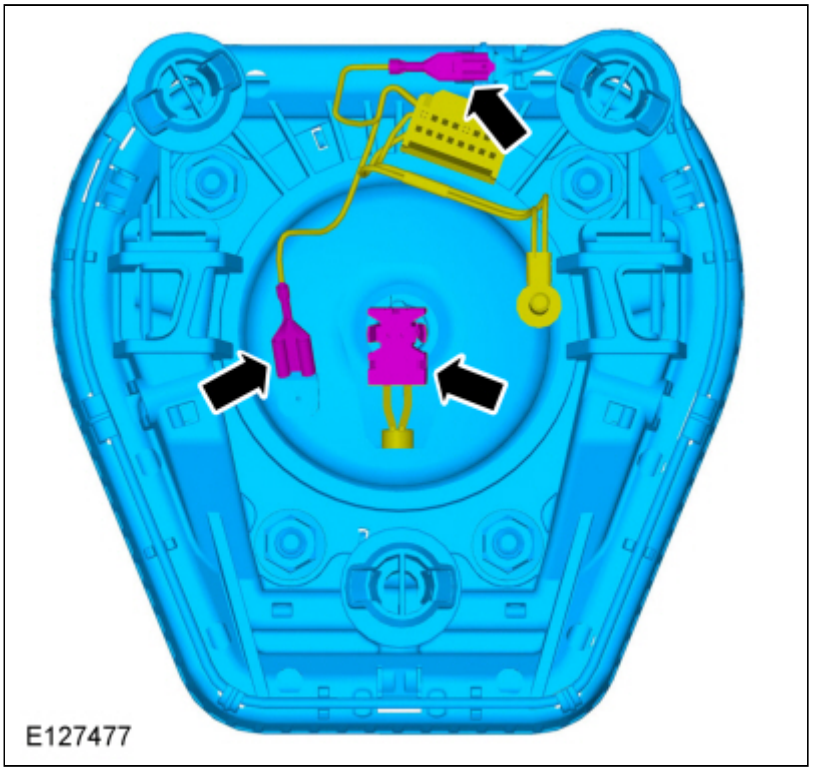
5. Depending on the vehicle variant, steering wheels with a different design for cut marks can be fitted.



6. Use the General Equipment: Flat Headed Screw Driver



7.



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Passenger Airbag

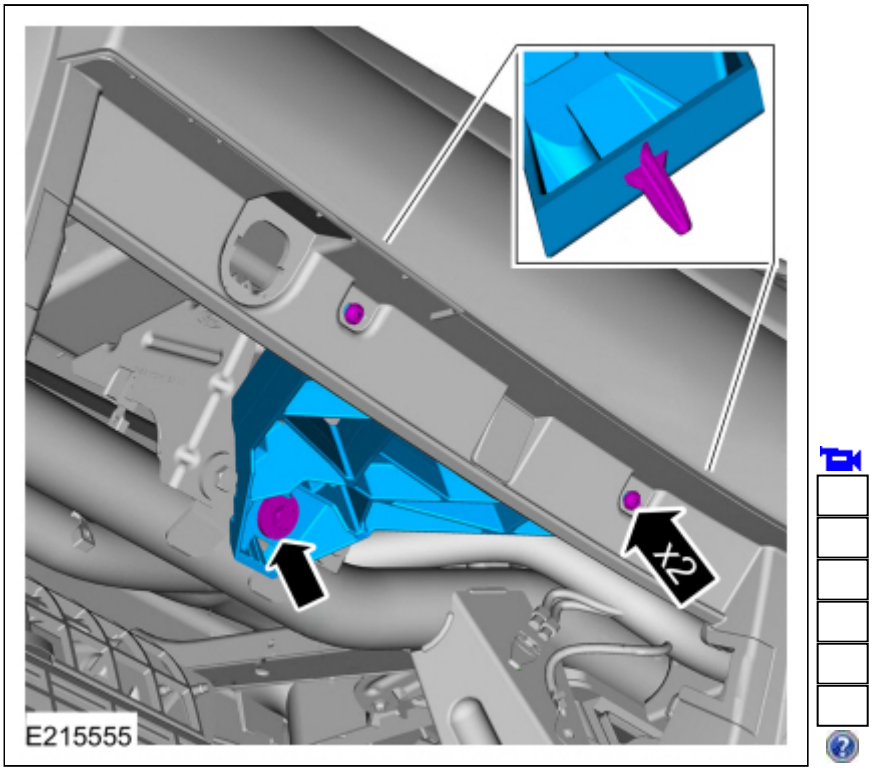
Base Part Number: 044A74

Removal

WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

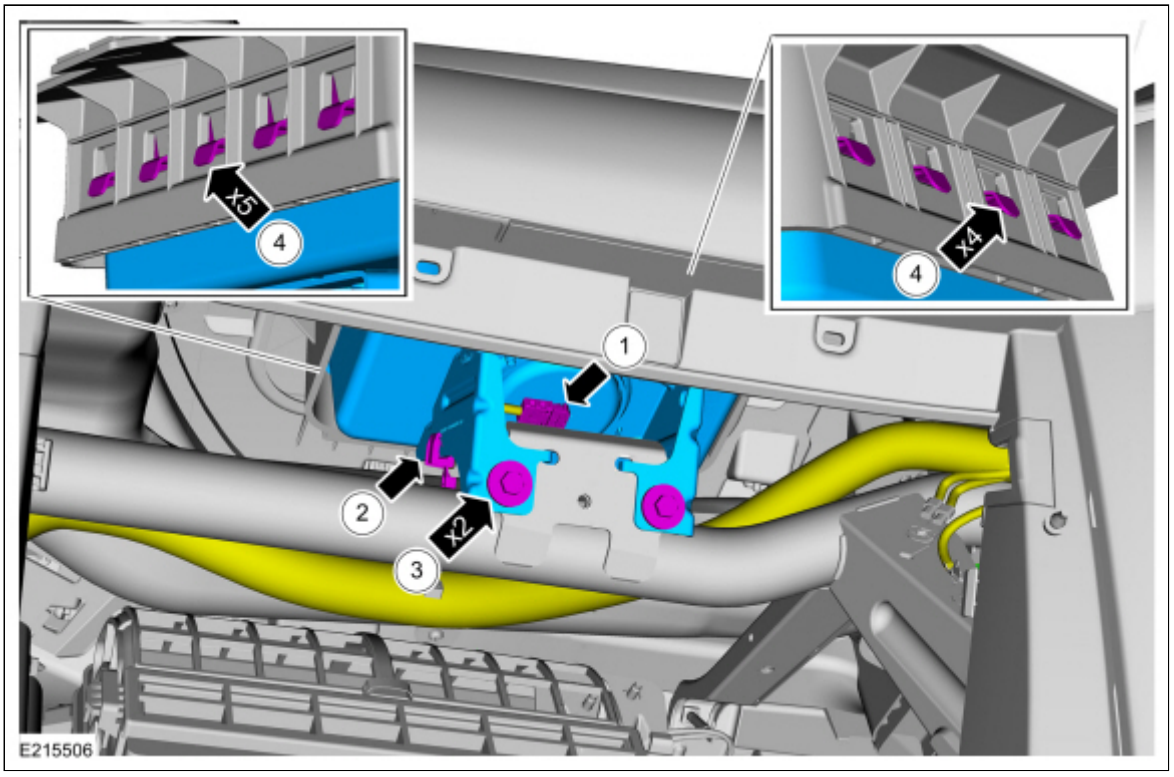
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Glove Compartment - Remove for Access (501-12 Instrument Panel and Console, Removal and Installation).
4. *Torque*: 4 Nm



5. **NOTICE: Take extra care when handling the component.**

    3. *Torque*: 18 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Driver Knee Airbag

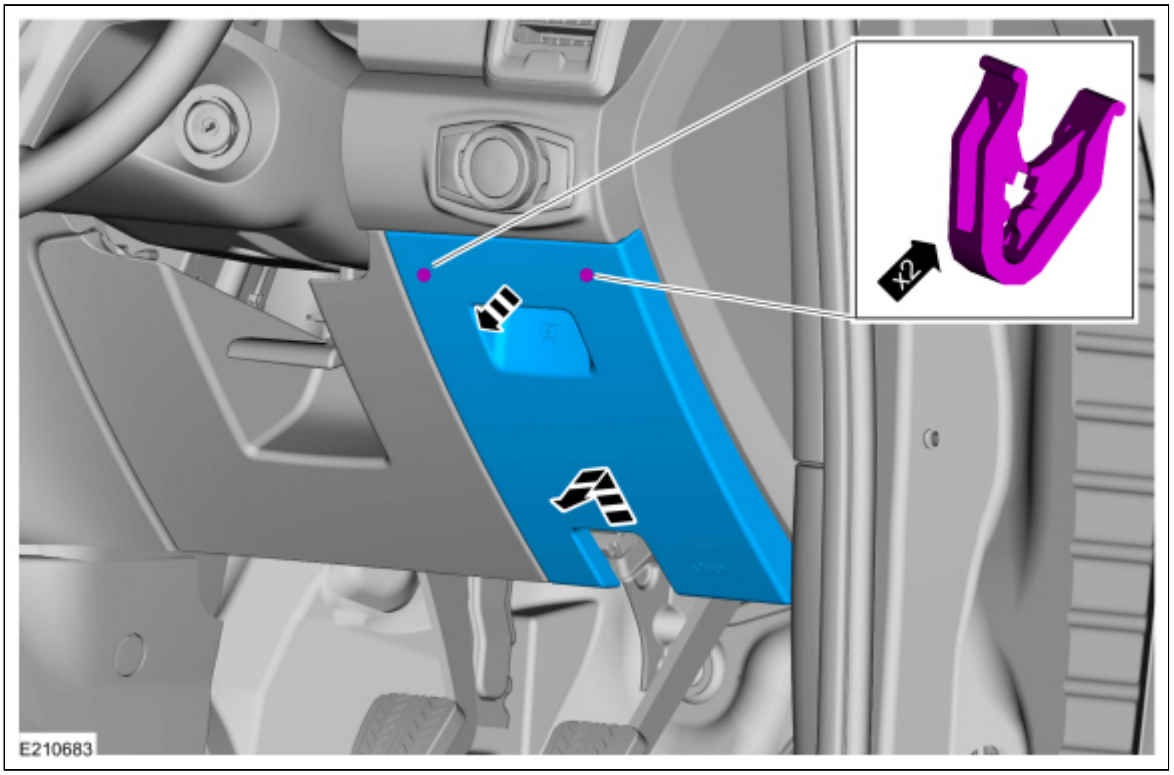
Base Part Number: 044A74

Removal

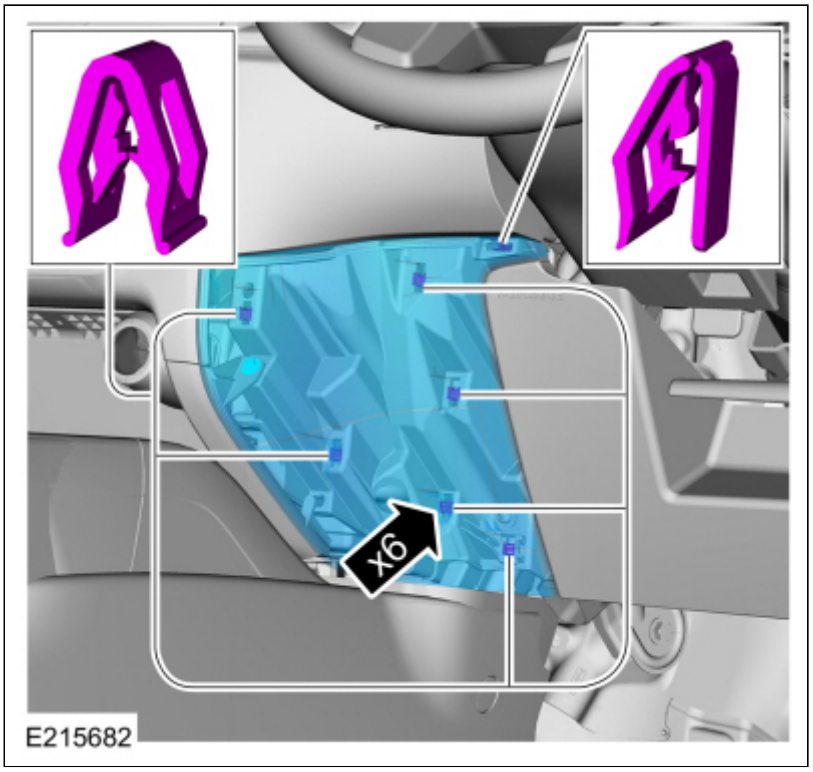
WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

WARNING: Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

NOTE: *Removal steps in this procedure may contain installation details.*

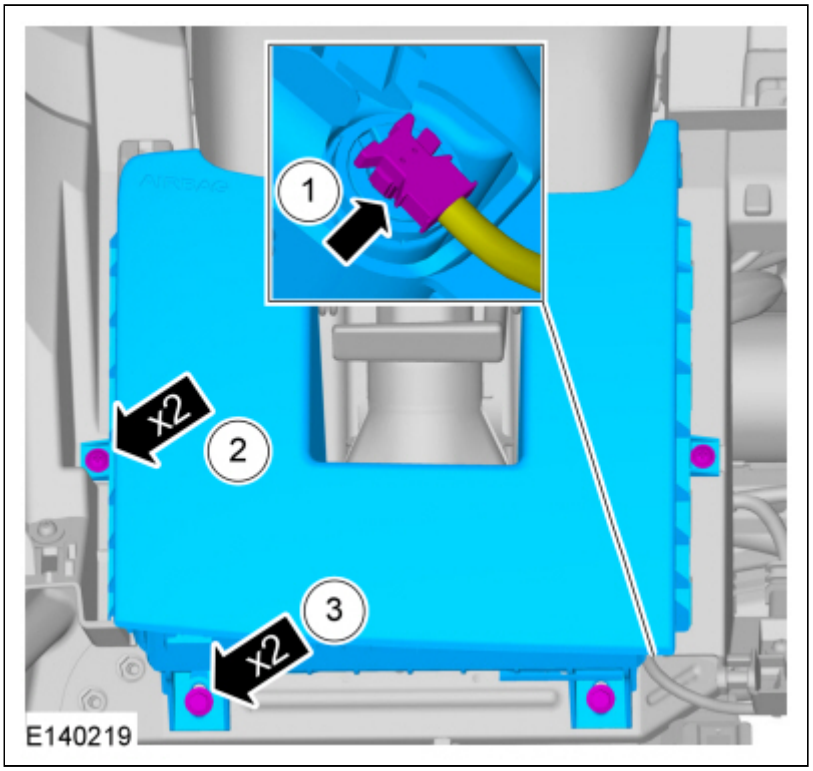
1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. 

4.

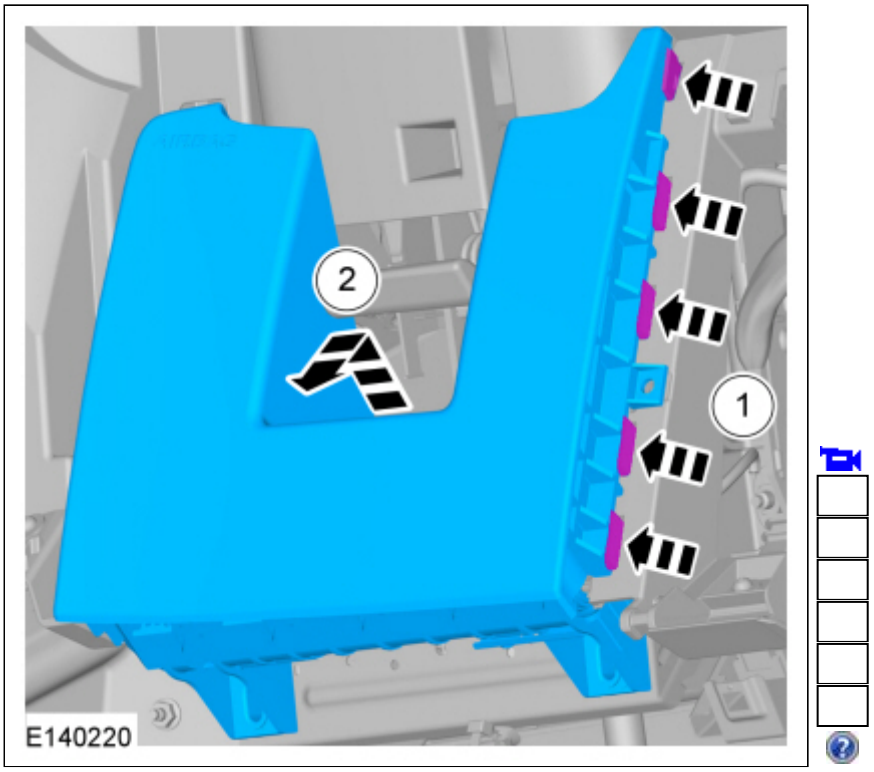


5. **NOTE:** *Make sure that the steering column adjustment arm is in normal position.*

2. *Torque*: 2 Nm
3. *Torque*: 11 Nm



1. On both sides.



Installation

1. To install, reverse the removal procedure.

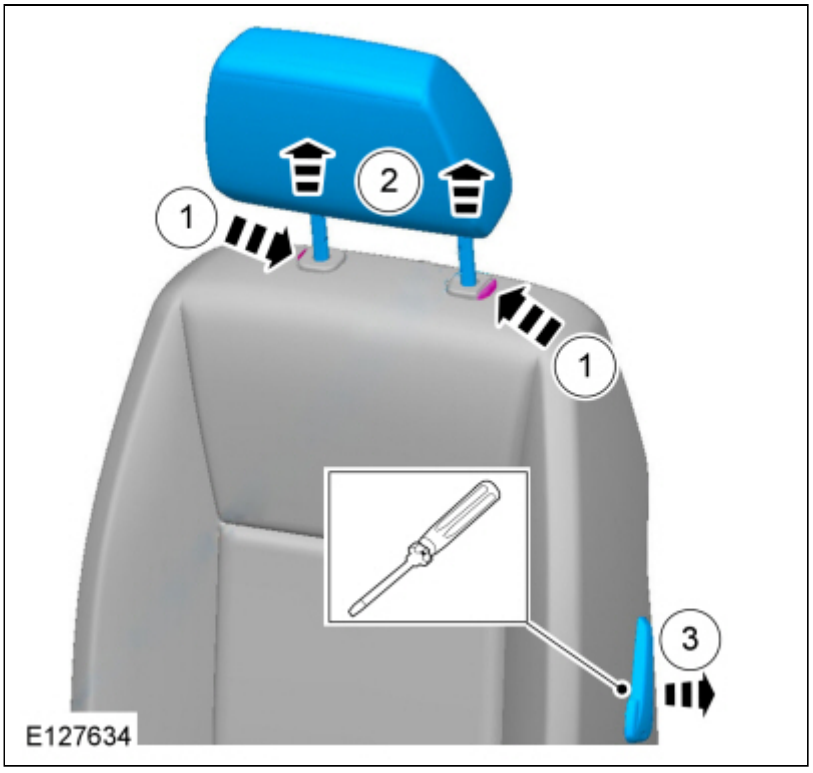
Copyright © 2016 Ford Motor Company

Side Airbag

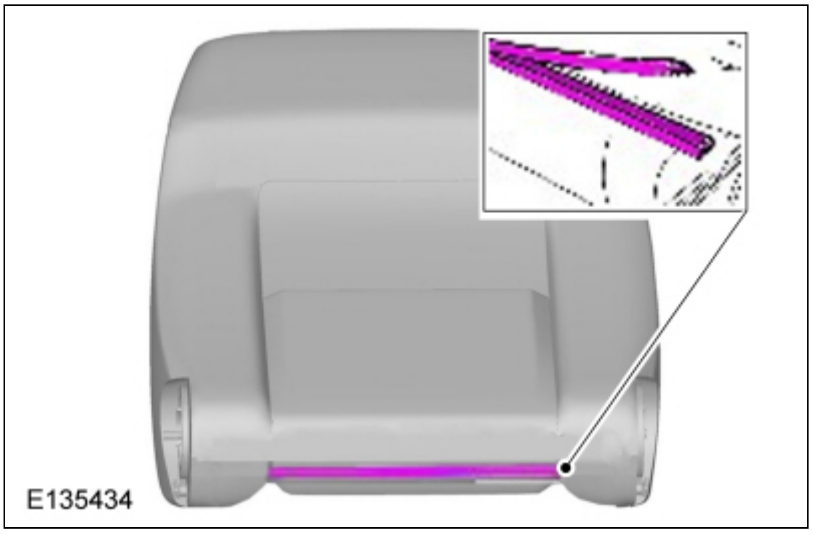
Removal

WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

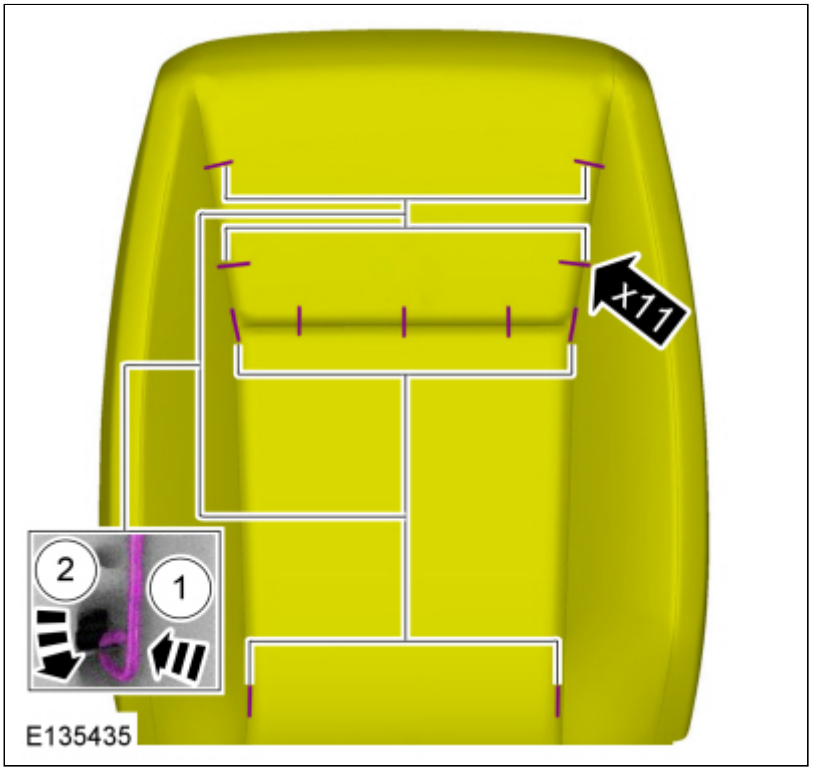
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Front Seat Backrest (501-10A Seating, Removal and Installation).
4. 

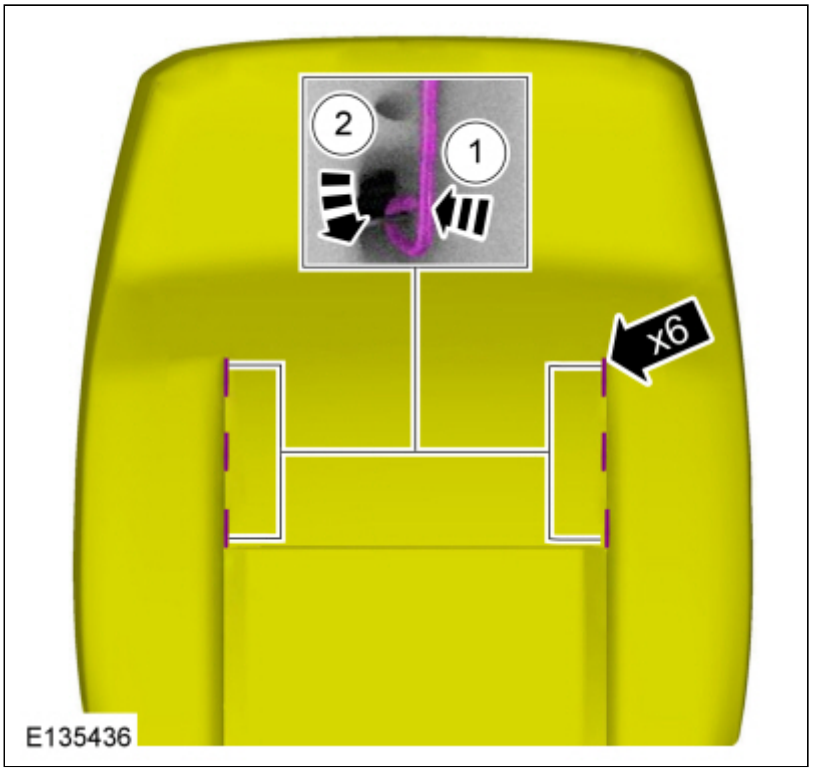
5.



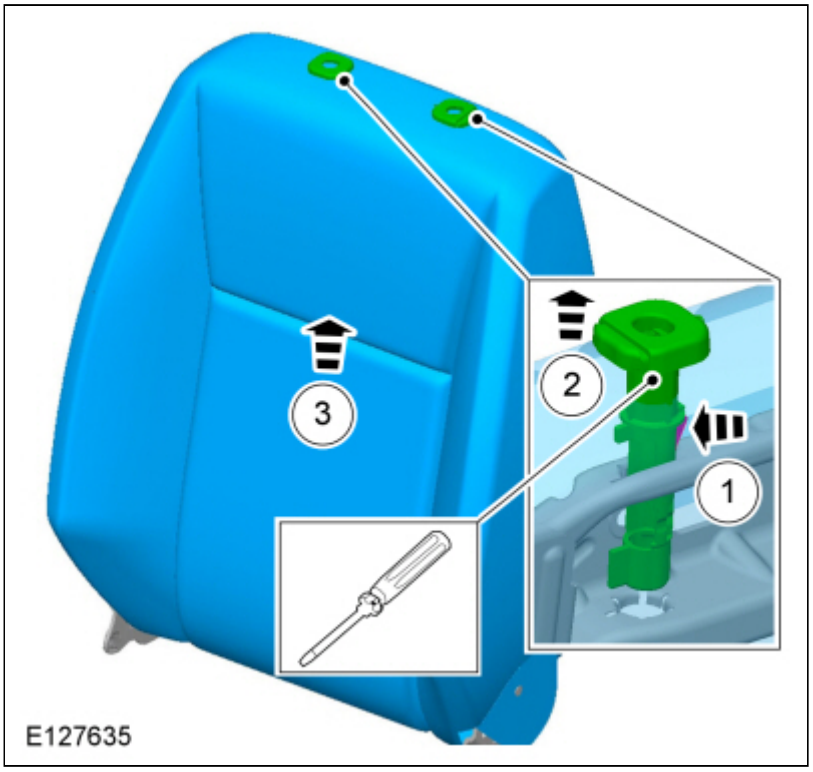
6.



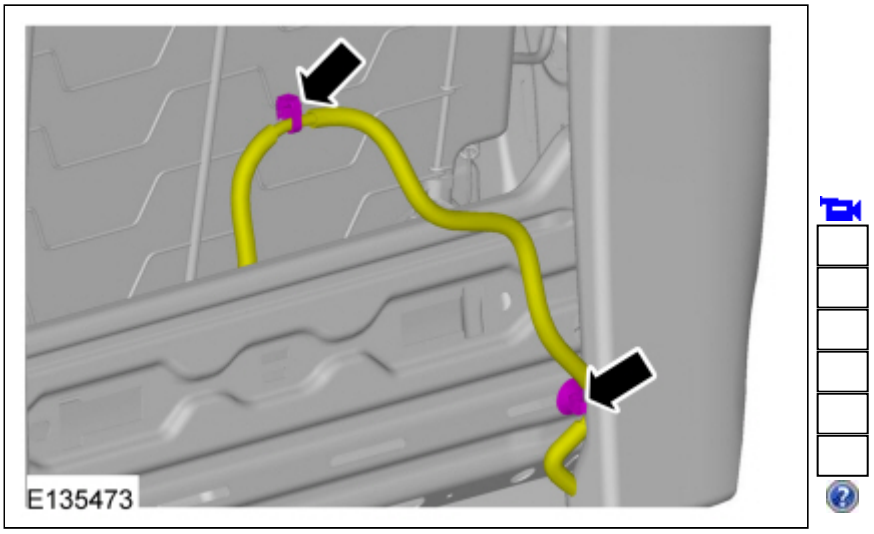
7.



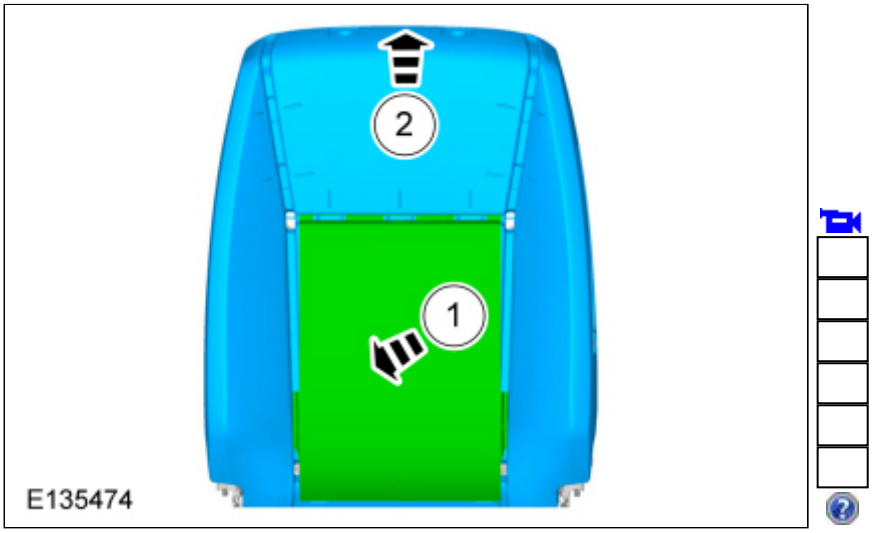
8.



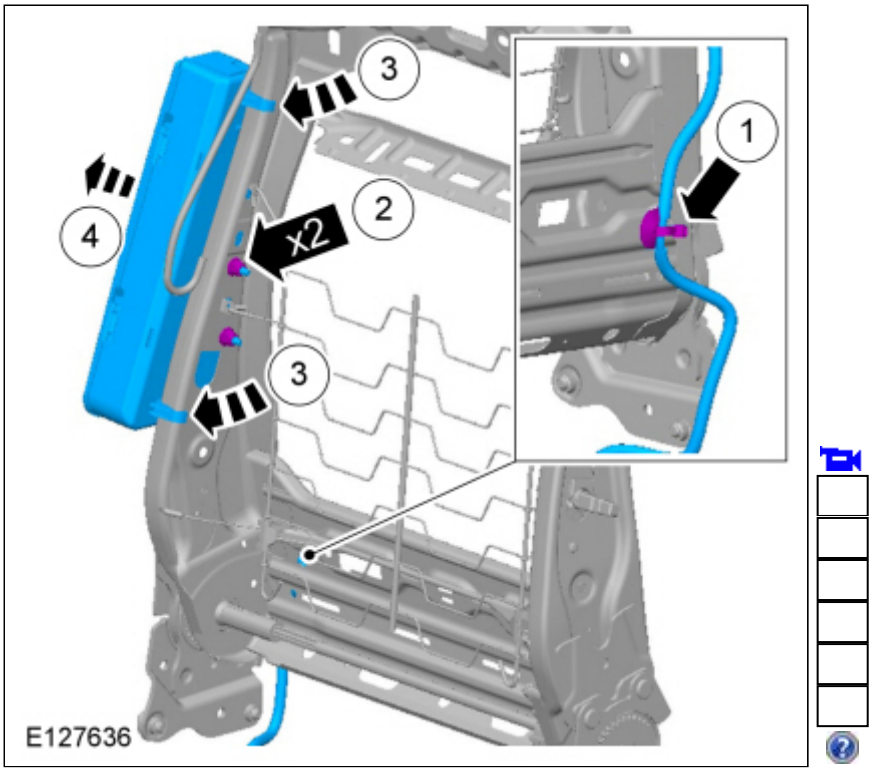
9.



10.



11. *Torque*: 6 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Side Curtain Airbag

Base Part Number: 042D94

Special Tool(s) / General Equipment

Long Nose Pliers

Removal

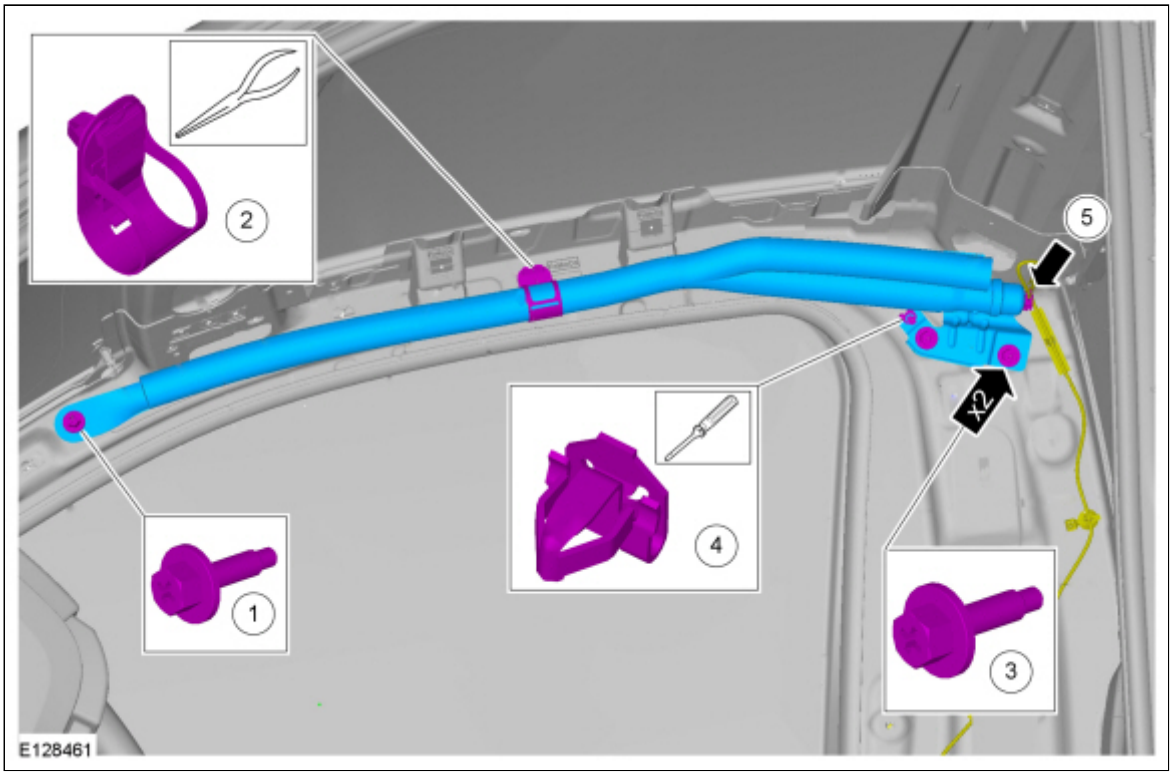
WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).

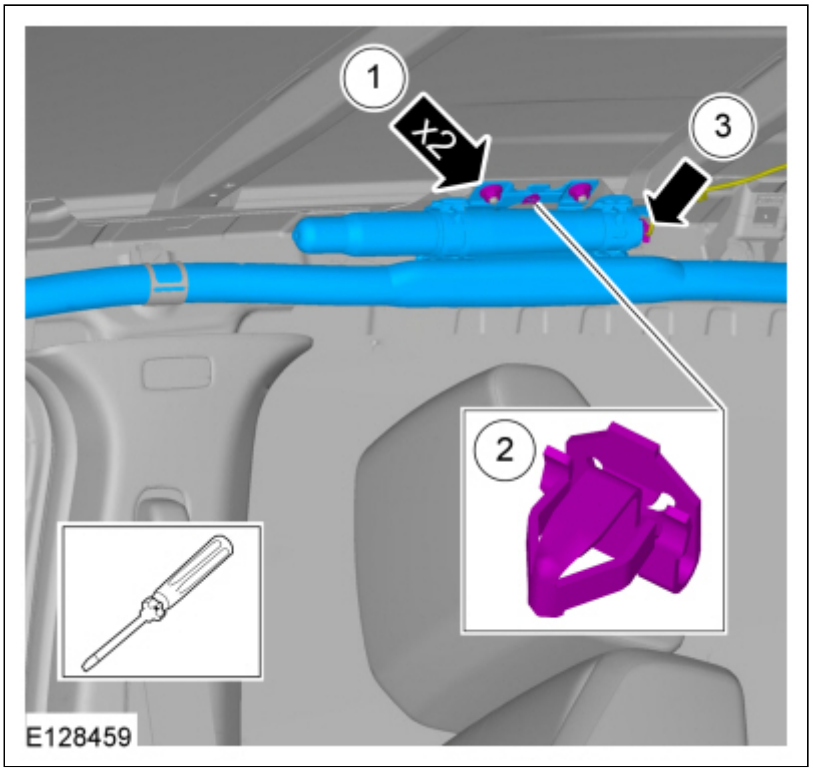
Single cab

1. *Torque*: 10 Nm
2. Use the General Equipment: Long Nose Pliers
3. *Torque*: 10 Nm

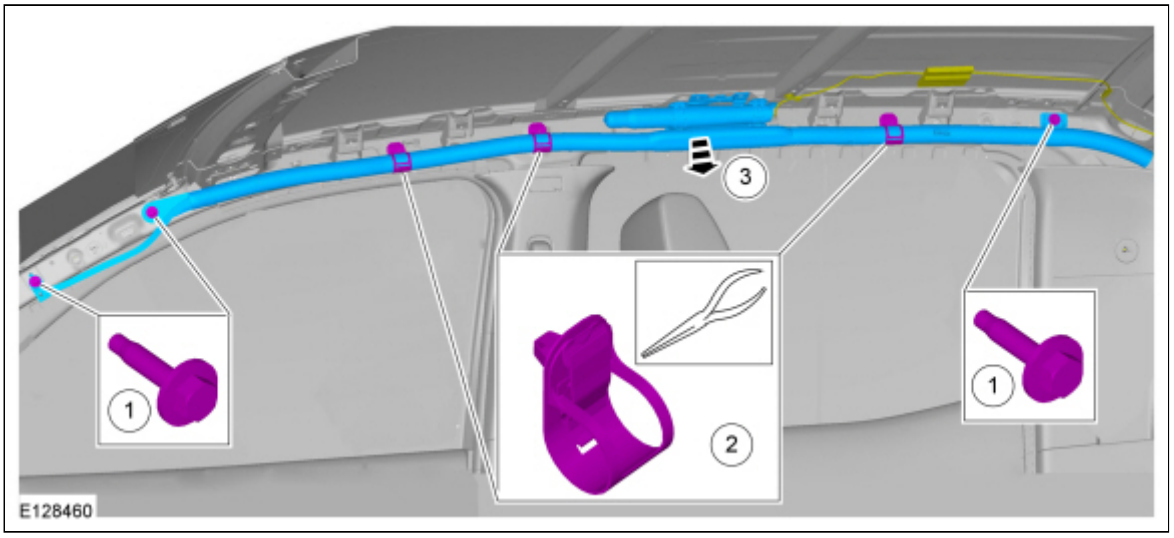


Double cab

5. On both sides.
   Torque: 10 Nm

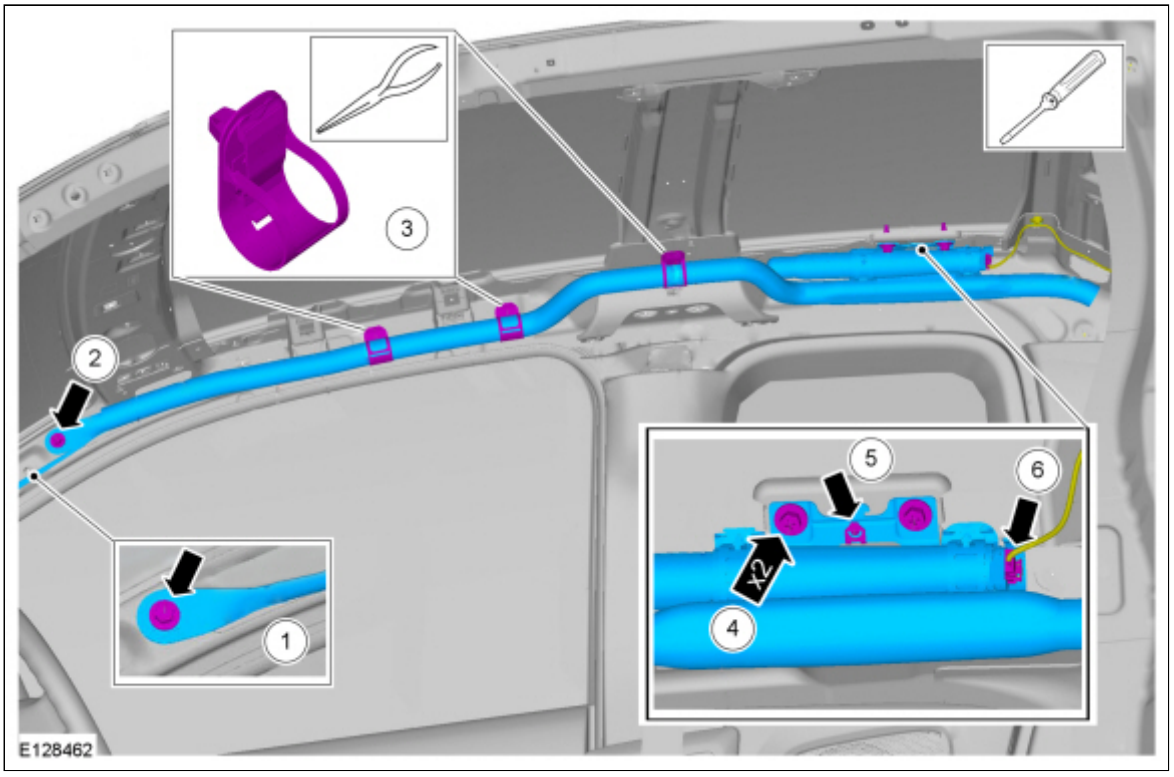


1. On both sides.
   Use the General Equipment: Long Nose Pliers
   Torque: 10 Nm



Stretch cab

1. *Torque*: 10 Nm
2. *Torque*: 10 Nm
3. Use the General Equipment: Long Nose Pliers
4. *Torque*: 10 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Clockspring

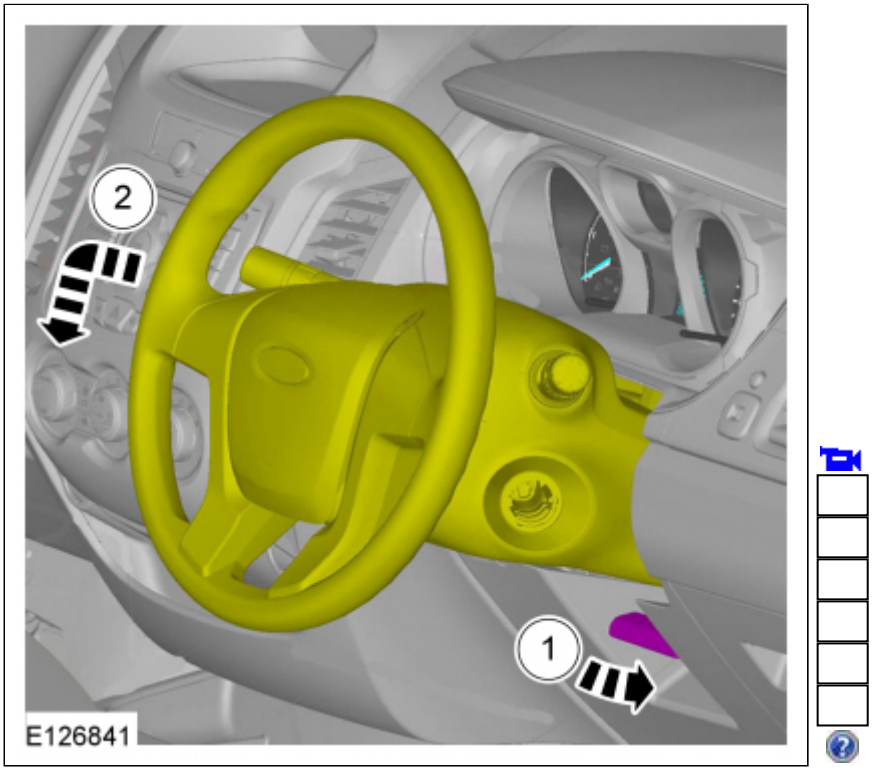
Base Part Number: 14A664

Removal

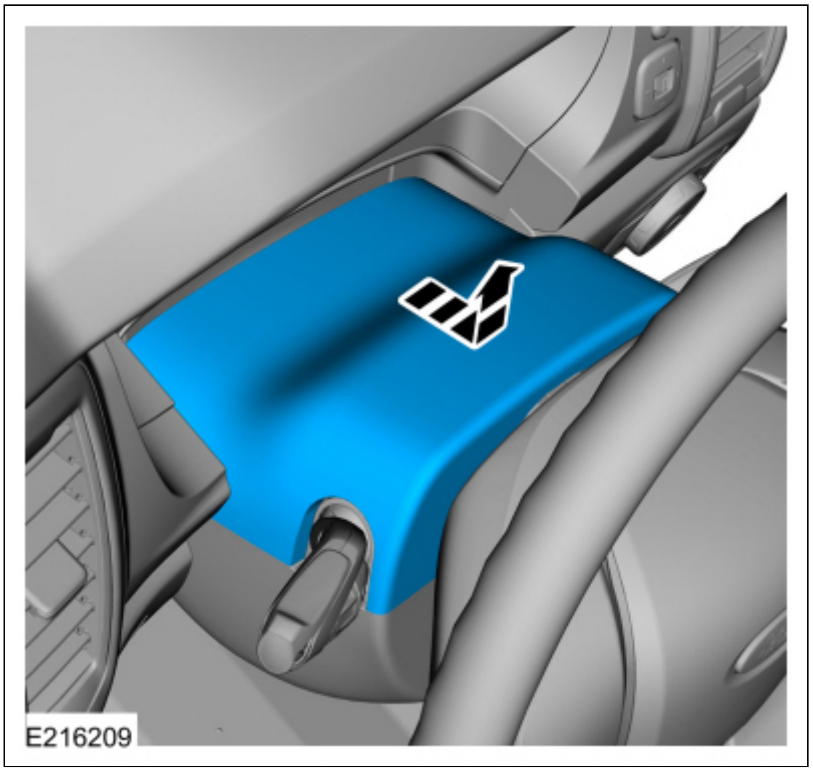
NOTE: *Removal steps in this procedure may contain installation details.*

All vehicles

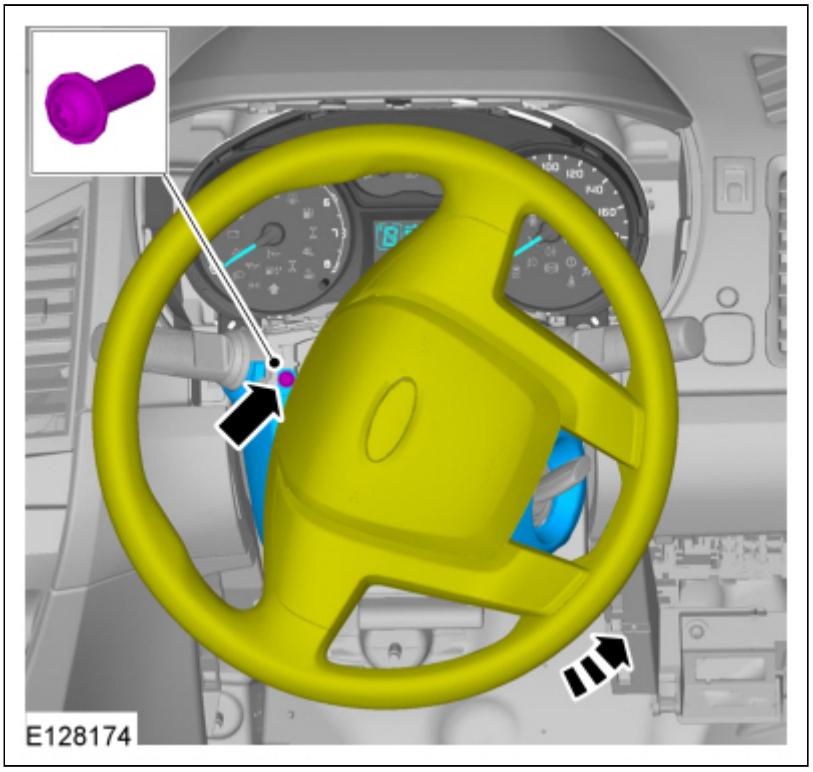
1.



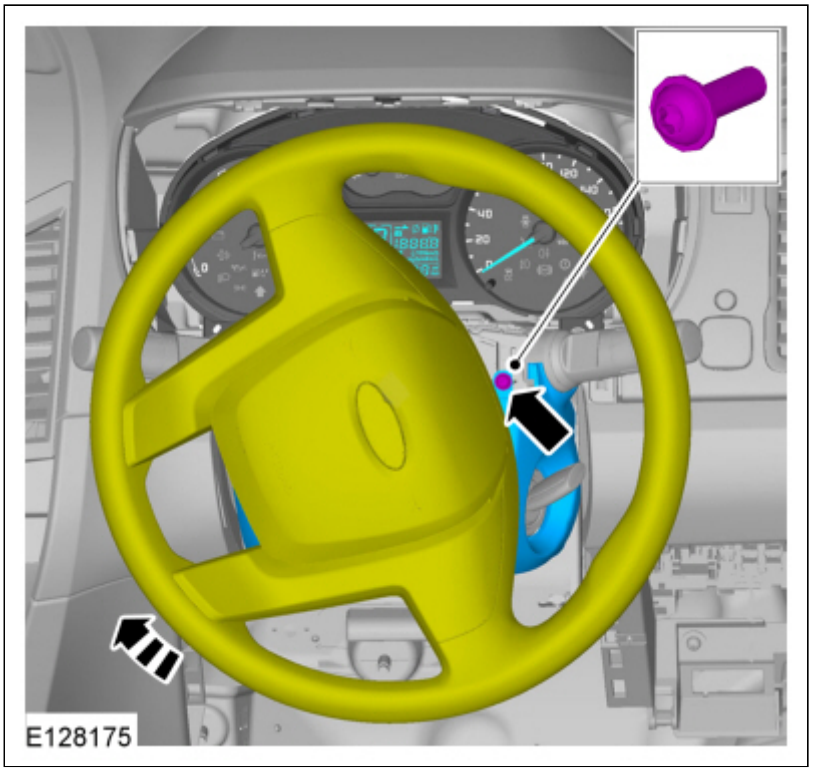
2.



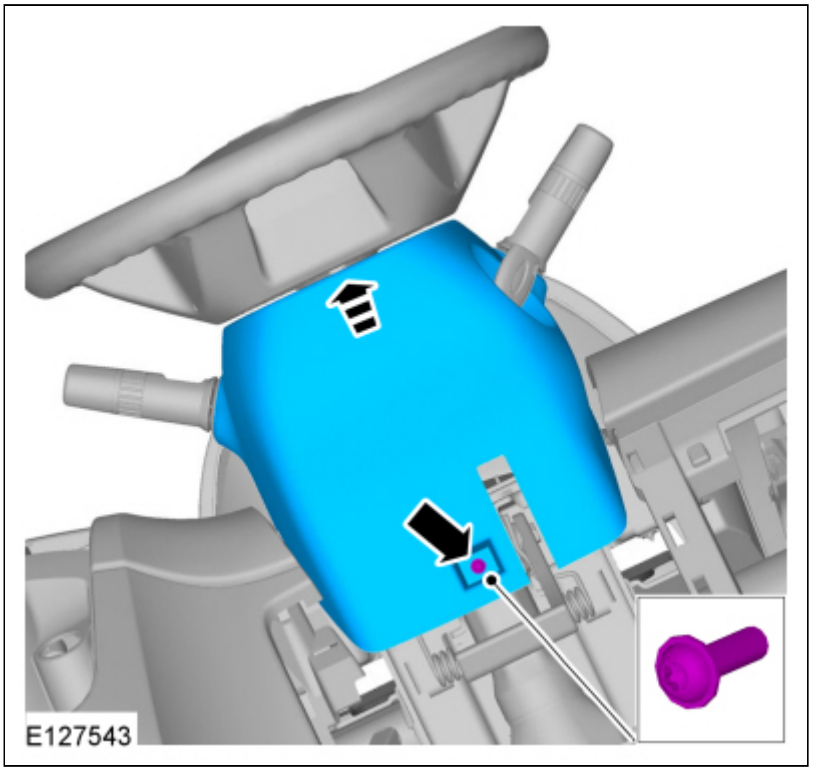
3.



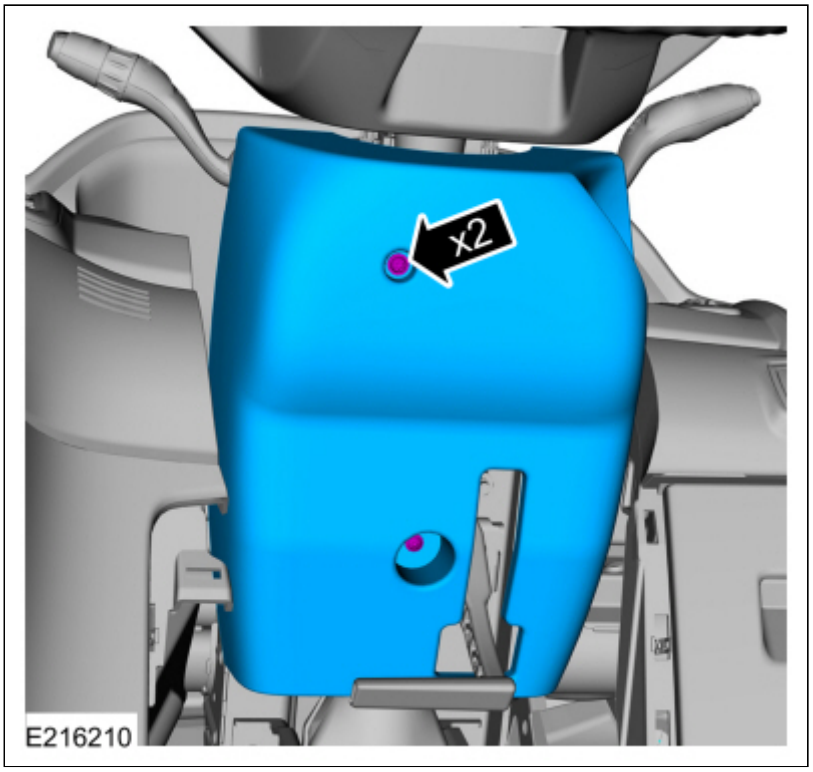
4.



5.

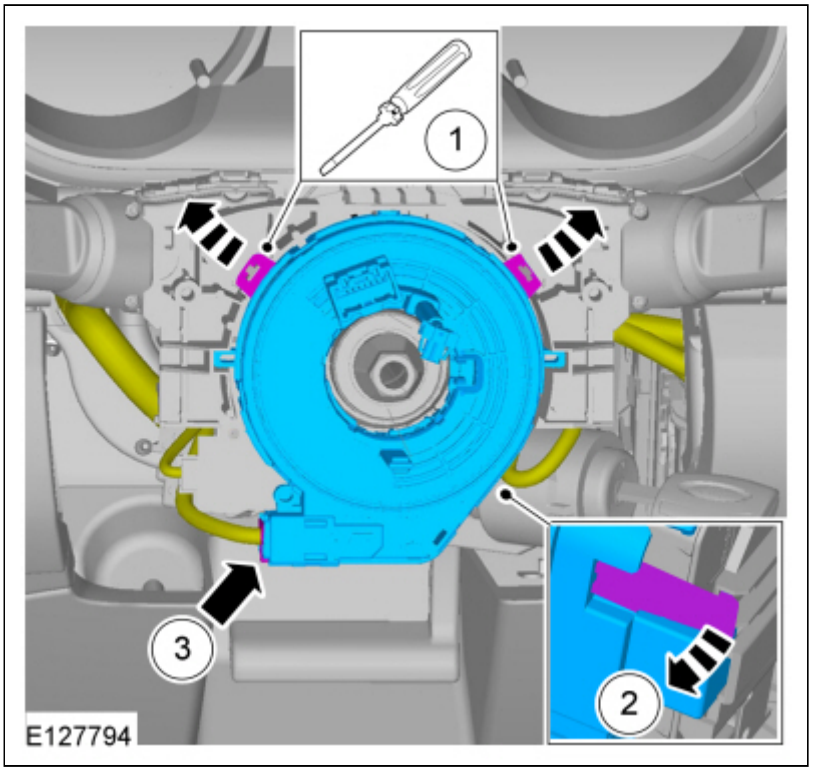


6. If equipped.



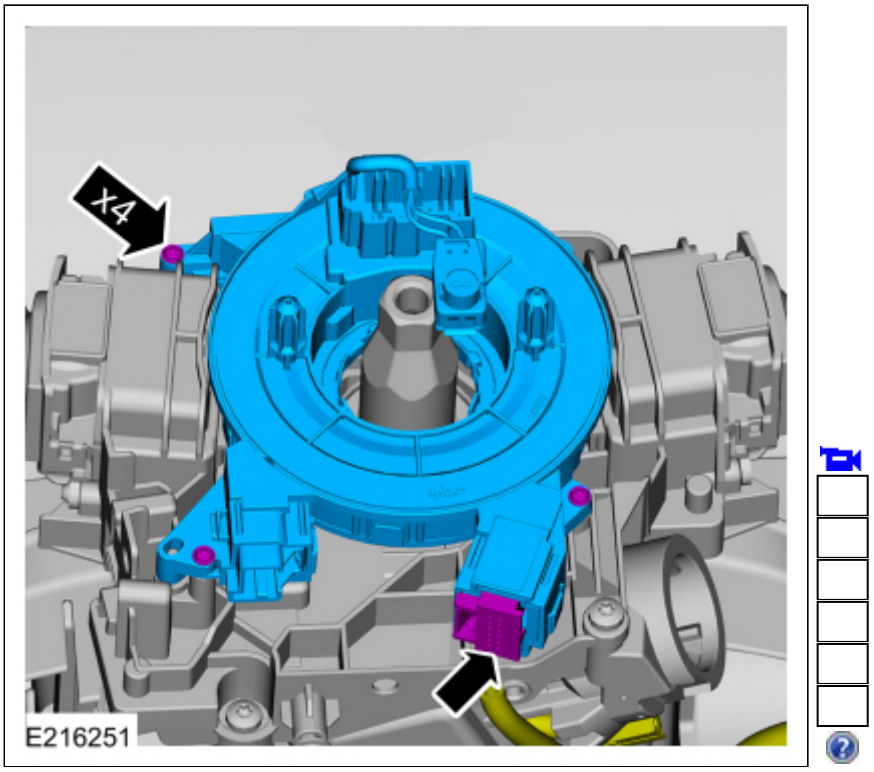
7. Refer to: Steering Wheel (211-04 Steering Column) .

8.



Double Cab

9. *Torque*: 00 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Clockspring Adjustment (501-20B Supplemental Restraint System, General Procedures).

Copyright © 2016 Ford Motor Company

Restraints Control Module (RCM)

Base Part Number: 14B321

Special Tool(s) / General Equipment

Ford Diagnostic Equipment

Removal

WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

NOTE: *Removal steps in this procedure may contain installation details.*

1. **NOTE:** *This step is only necessary when installing a new component.*

   Download the RCM configuration information into the diagnostic tool, using the Programmable Modules Installation routine.
   Use the General Equipment: Ford Diagnostic Equipment

2. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).

3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Double cab

4. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Stretch cab

5. Refer to: Floor Console - Double Cab (501-12 Instrument Panel and Console, Removal and Installation).

Single cab

6. Refer to: Floor Console - Single Cab (501-12 Instrument Panel and Console, Removal and Installation).

Vehicles with front bench seat

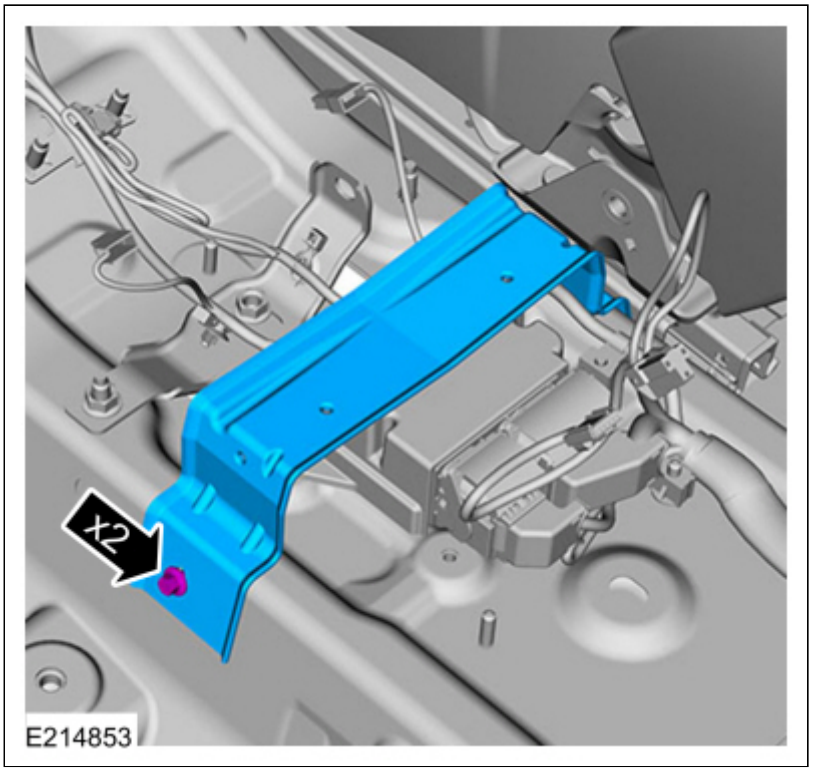
7. **NOTE:** *Remove front bench seat only.*

   Refer to: Front Seat (501-10A Seating, Removal and Installation).

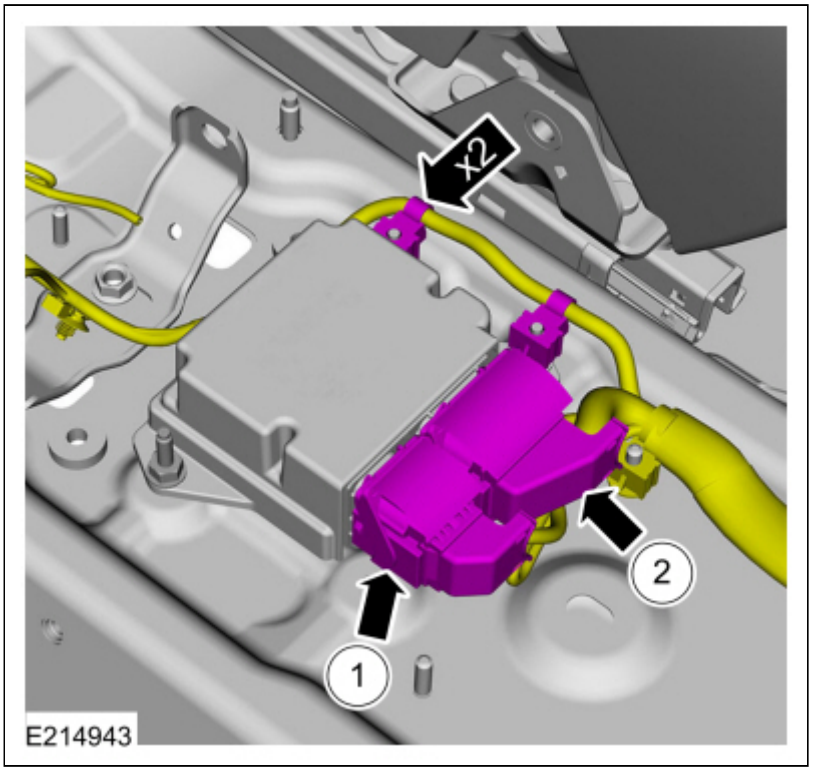
All vehicles

8. **NOTE:** *Both seats must be move forward before removing the RCM module.*

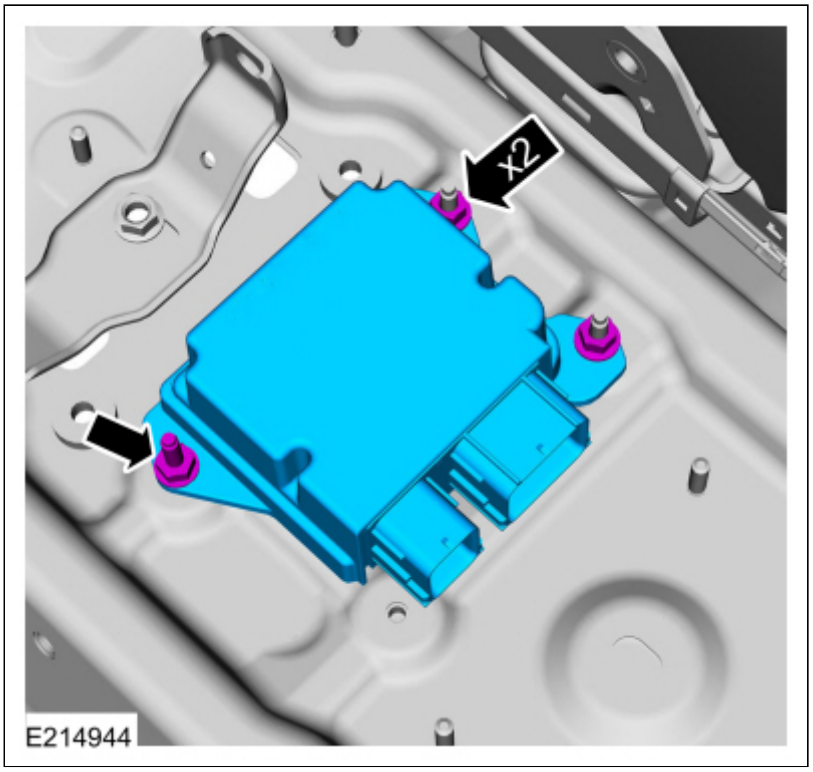
   On both sides.
   Torque: 11 Nm



9.



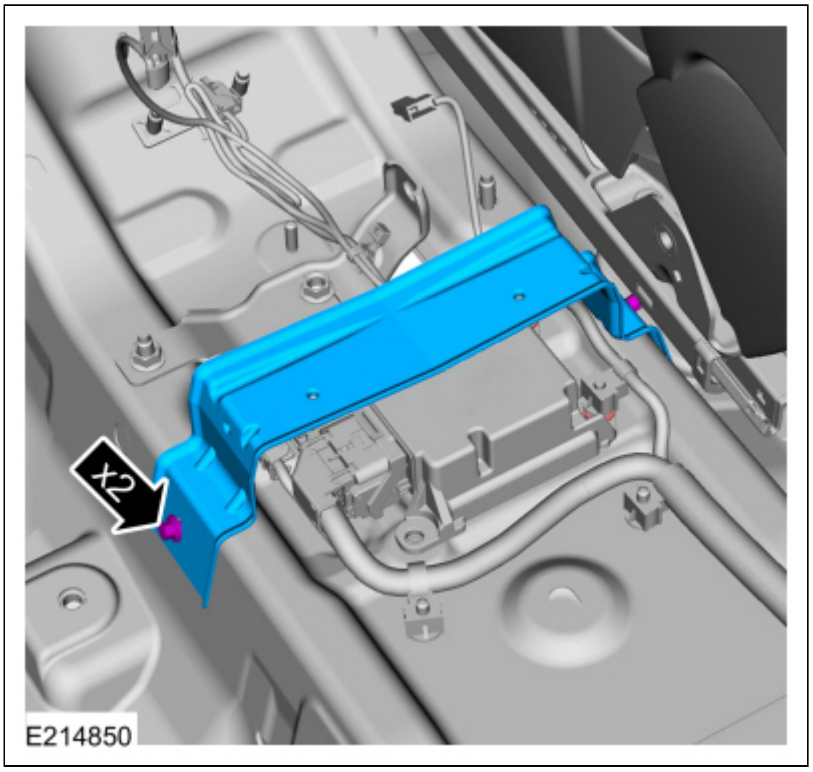
10. *Torque*: 12 Nm



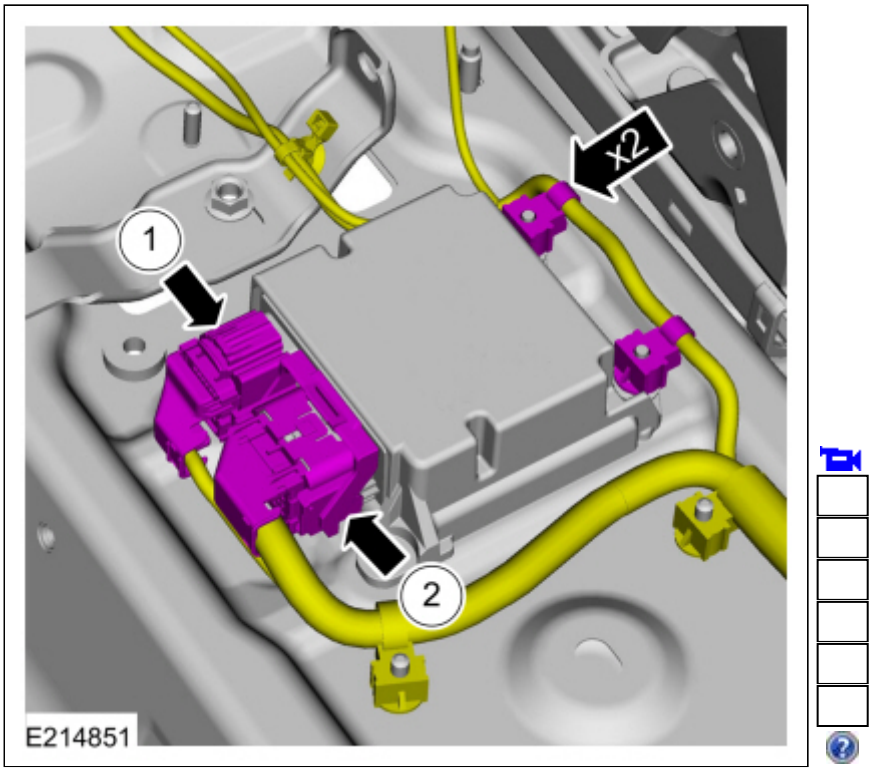
11. **NOTE:** *Only heavy duty vehicle*

    NOTE: *Both seats must be move forward before removing the RCM module.*

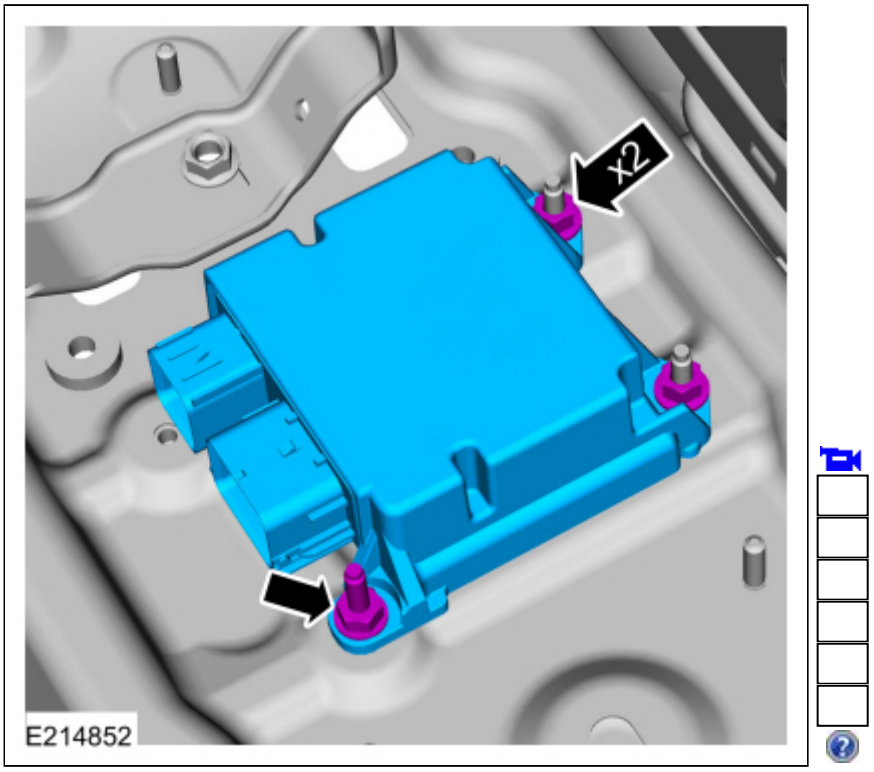
    On both sides.
    Torque: 11 Nm



12. **NOTE:** *Only heavy duty vehicle*



13. *Torque*: 12 Nm



Installation

1. To install, reverse the removal procedure.
2. **NOTE:** *This step is only necessary when installing a new component.*

   Upload the RCM configuration information into the RCM, using the Programmable Modules Installation routine. Use the General Equipment: Ford Diagnostic Equipment

Copyright © 2016 Ford Motor Company

Side Impact Sensor

Removal

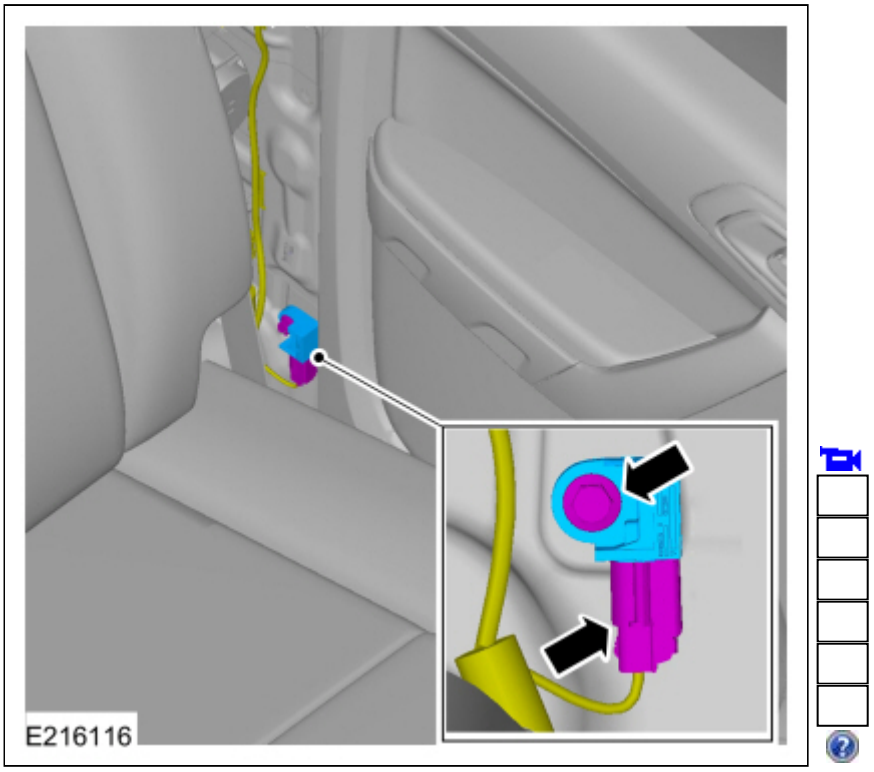
WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

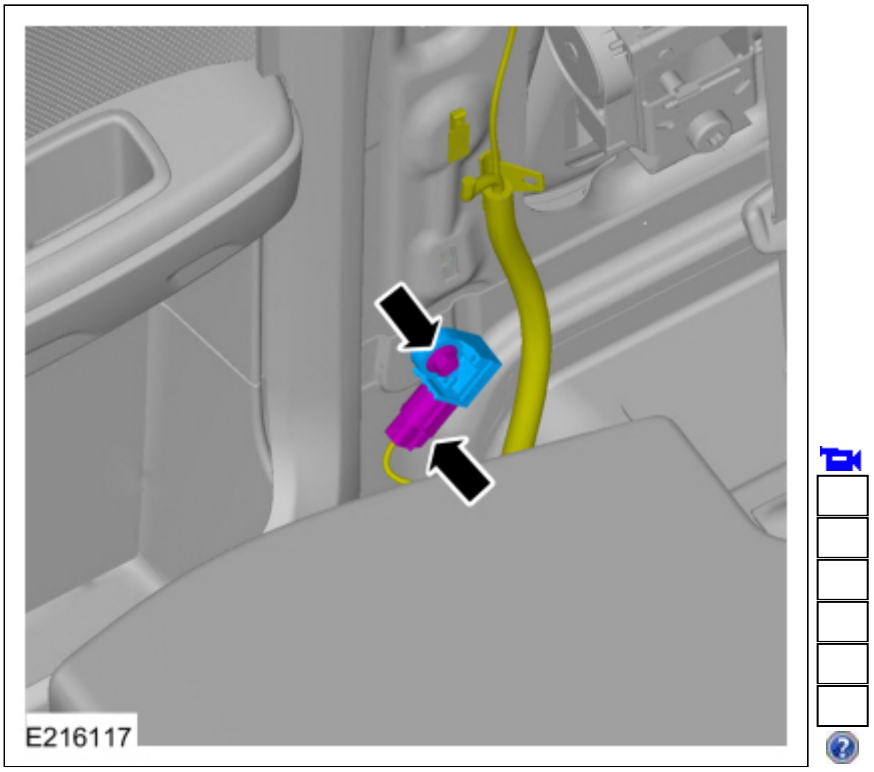
Double cab

3. Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. On both sides.
   Torque: 10 Nm



Stretch cab

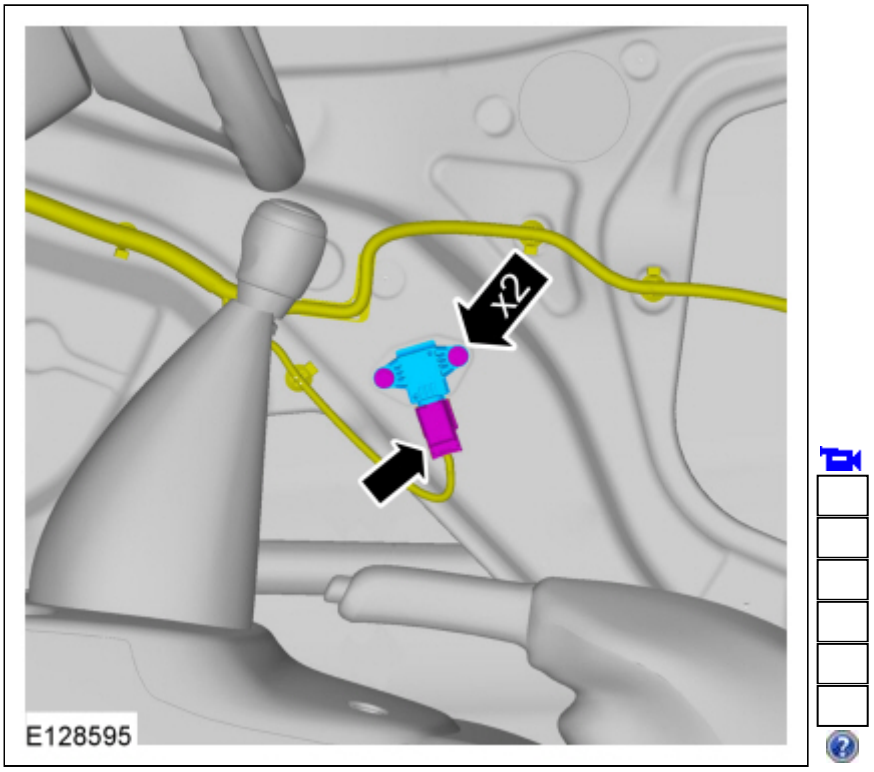
5. Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. On both sides.
   Torque: 10 Nm



All vehicles

7. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. On both sides.
   Torque: 2 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Front Impact Severity Sensor

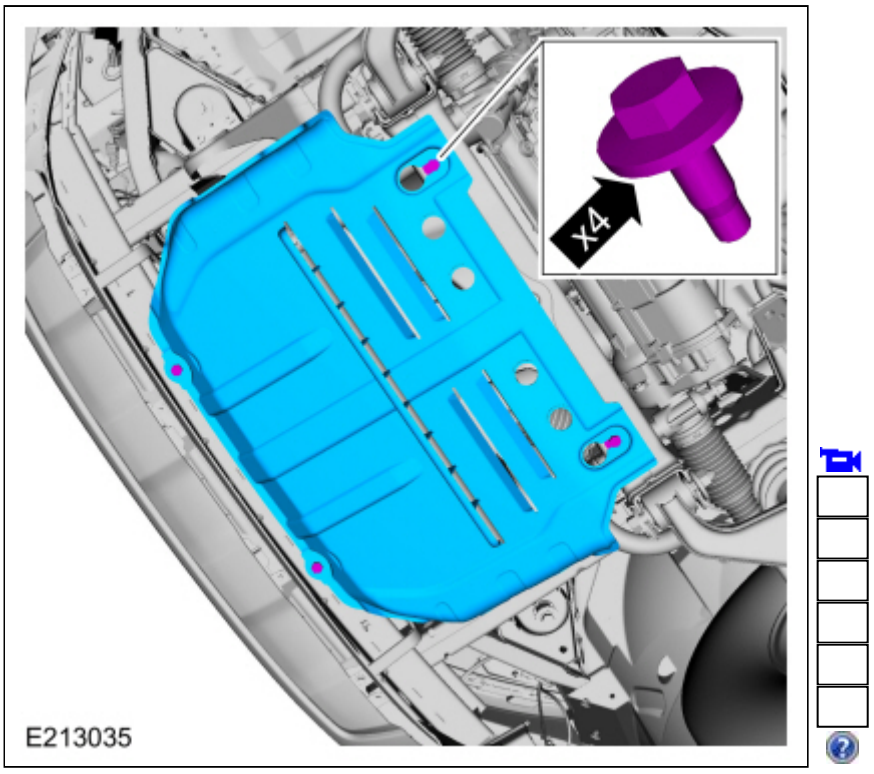
Base Part Number: 14B004

Removal

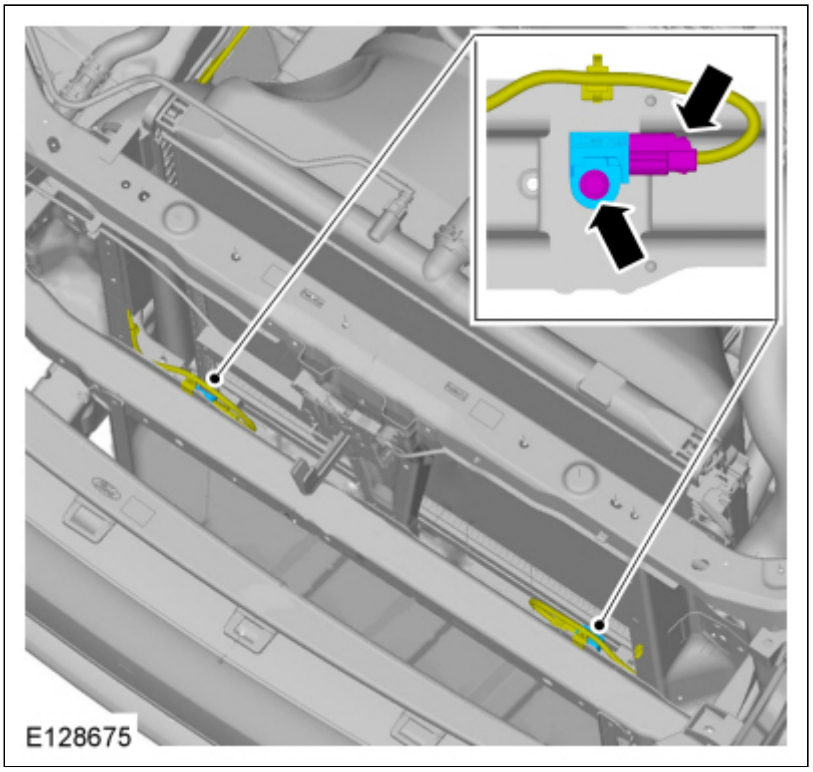
WARNING: The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Pyrotechnic Device Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Refer to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation).
4. *Torque*: 30 Nm



5. *Torque*: 12 Nm



Installation

1. To install, reverse the removal procedure.

Copyright © 2016 Ford Motor Company

Specifications

Description	Item number	FINIS	Specification
Stone chip underbody protection	AU7J-M5G39-AA	1720930	WSK-M5G39-B
Corrosion protection wax HP	2U7J-M7C89-AA	1219834	WSK-M7C89-A
Cavity wax T-HV4	BU7J-M7C80-AA	1742584	N/A
Profiled butyl seal	YS5J-M3G4620-AA	1128983	S-M3G4620-A
Clinched flange protection	1S5J-M4G245-AB	1790195	WSK-M4G245-B
Metal adhesive kit, 2-component	2U7J-M2G400-AA	1203241	Set
Sealant DH-BR	3U7J-M4G4631-AA	1233502	S-M4G4631-A
Spoiler adhesive kit - 2-component	2U7J-M2G376-AA	1219837	Set
Body sealant T-SMP	AU7J-M4G245-AA	1726412	N/A
Glass adhesive H-PU (2K)	9U7J-M2G322-DA	1726389	WSK-M2G322-B1 (WSK-M11P57-A3)
Glass adhesive set - 2K	9U7J-T03863-AA	1633780	WSK-M11P57-A3
Glass adhesive D2 (1K)	BU7J-M2G316-AA	1749325	WSS-M2G316-B5 (WSS-M11P57-A5)
Glass adhesive set - 1K IM	BU7J-T03863-AA	1749324	WSS-M11P57-A5
Multi-purpose sealing compound	1S5J-M4G329-AA	1140216	WSK-M4G329-A

Copyright © 2016 Ford Motor Company

Description and Usage of Body Repair Literature

The purpose of this document is to give the vehicle body specialist a general overview of possible repair techniques for body repair on Ford vehicles. Likewise, information about materials and tools to be used is given.

No model-specific information is given. Such information is saved in the respective Ford Etis workshop manual. Supplementary or updated information can be found in the Technical Service Information.

Information on repair techniques, materials or tools, which are not necessary for body repair on Ford vehicles or which are not considered as conventionally in use, are not listed in this document.

Layout:

The general section is divided into the following subject areas:

- How to use the document, with information on the symbols used
- Health and safety information on using materials and tools
- Information on bodywork construction and materials used
- Workshop equipment and use of tools
- Damage Assessment and determining the extent of the repair area
- Explanation of possible repair techniques for body repair
- Possibilities of the repair or remedying leaks, noises

Training:

The Ford Service Organization offers basic and more in-depth training on much of the content of this document. You can obtain an overview of the entire training offering from the Ford Service Organisation or on the Internet at www.ford-training.de.

Copyright © 2016 Ford Motor Company

Symbols

Warnings and hazard notices

Warnings and hazard notices are shown in this literature by WARNING, CAUTION and NOTE indicators. These notices are always shown before a job step which can be associated with an immediate personal or material danger.

WARNING: This notice is used when failure to exactly follow the instructions given in this literature or failure to follow them at all may result in a hazard to persons and/or in persons being injured.

NOTICE: This notice is used when failure to exactly follow the instructions or test procedures given in this literature or failure to follow them at all may result in damage to the vehicle or to components.

NOTE: *This notice is used when the operator should be made aware of special or extra information.*

Symbols used

Symbols are used to graphically represent additional information about the operation, tool or materials. This information will not be shown separately again as text.

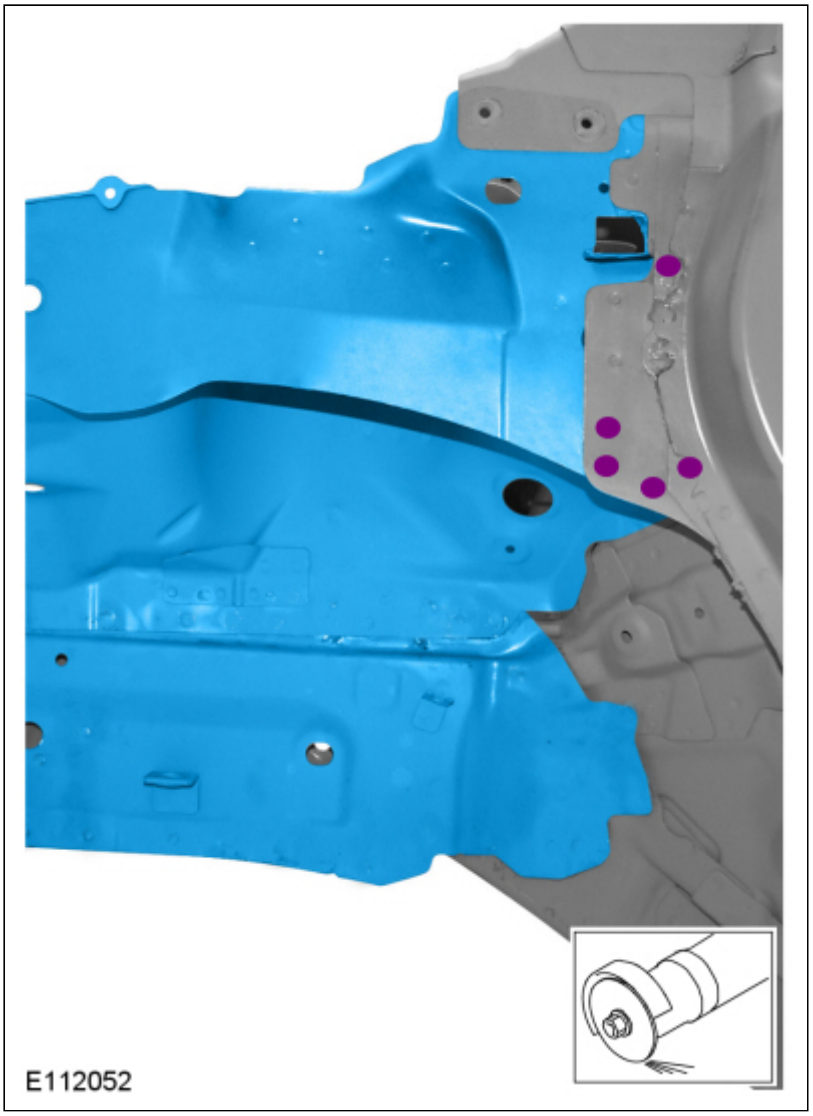
The symbols used in this and other body repair manuals may be used alone as well as in combination in a diagram.

All the symbols used in these documents can be found in the General Information section.

For additional information, refer to: Symbols Glossary (100-00 General Information, Description and Operation).

Color coding

Different colors or shading can be used to depict special areas and components.



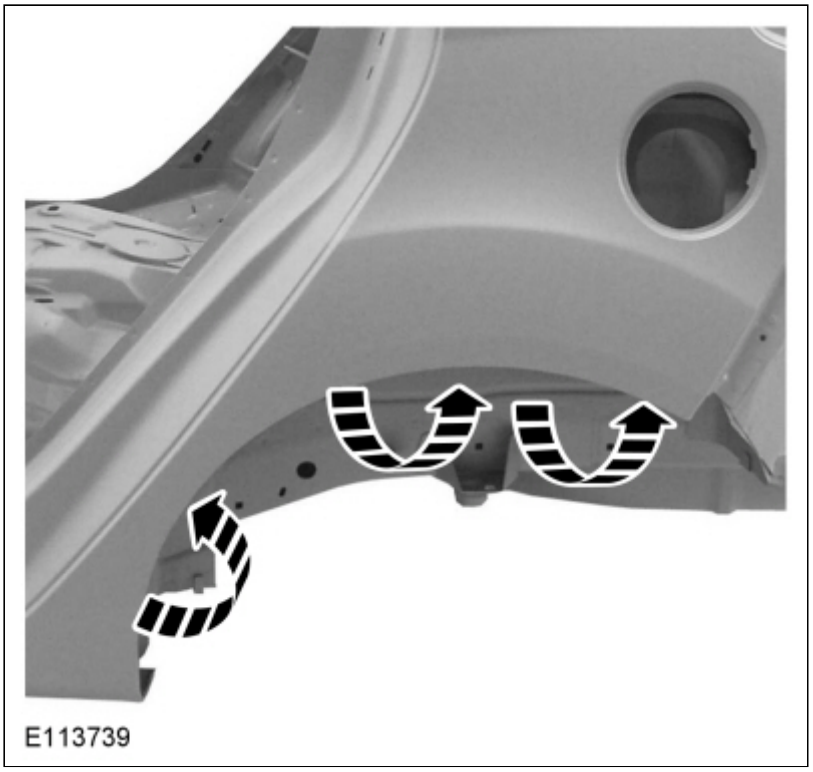
- Blue: Main component which will be removed or installed. Only actual movements will be shown in blue in the diagram.
- Magenta: Materials or fixings, e.g. bolts, clips, spot welds or adhesives.
- Yellow: Component which is being cleaned or loosened, moved or fastened, but remains in the vehicle.
- Light blue: Color for special tools and color for equipment.

In an assembly operation, the colors show the sequence of removal steps.

- Blue: Main component which is being installed, removed, taken away or added.
- Green: Component which, in addition to the main component (blue) is being installed, removed, taken away or added.
- Brown: Component which, in addition to the main component (blue) and the additional component (green) is being installed, removed, taken away or added.

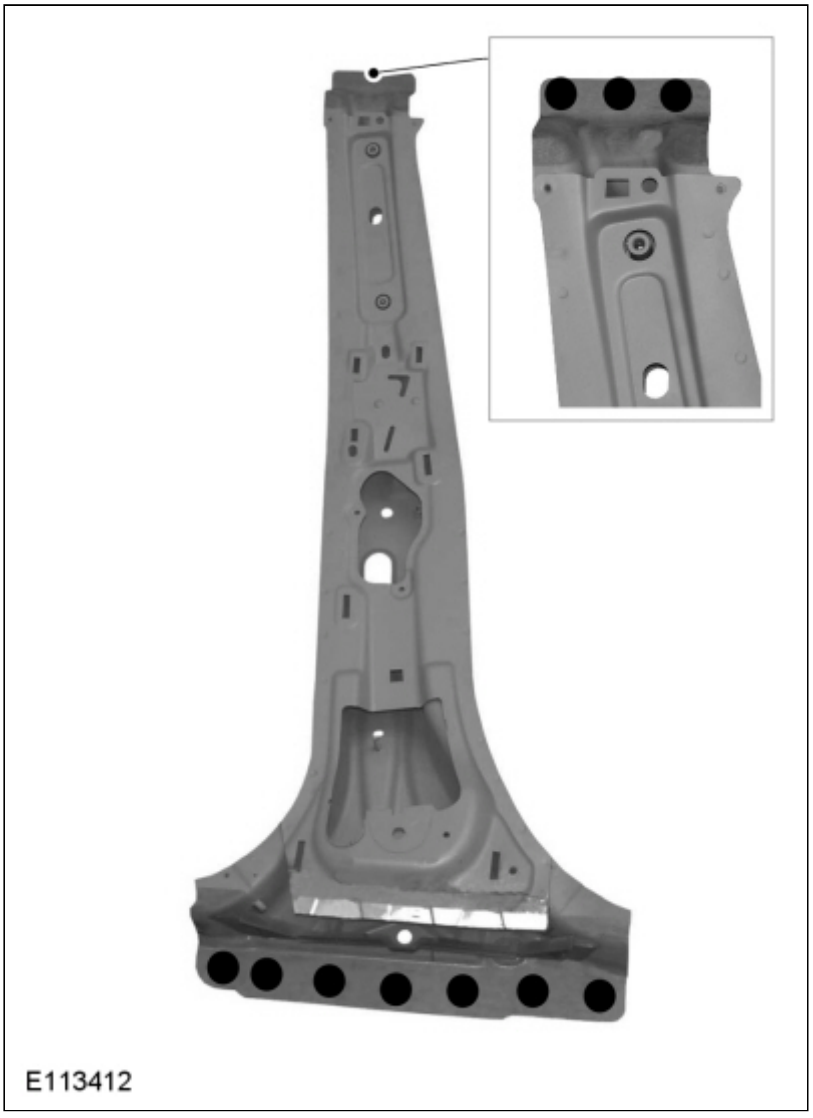
Movement arrows

Necessary work such as clinching flanges or moving lugs etc. will be represented by broken arrows.


E113739

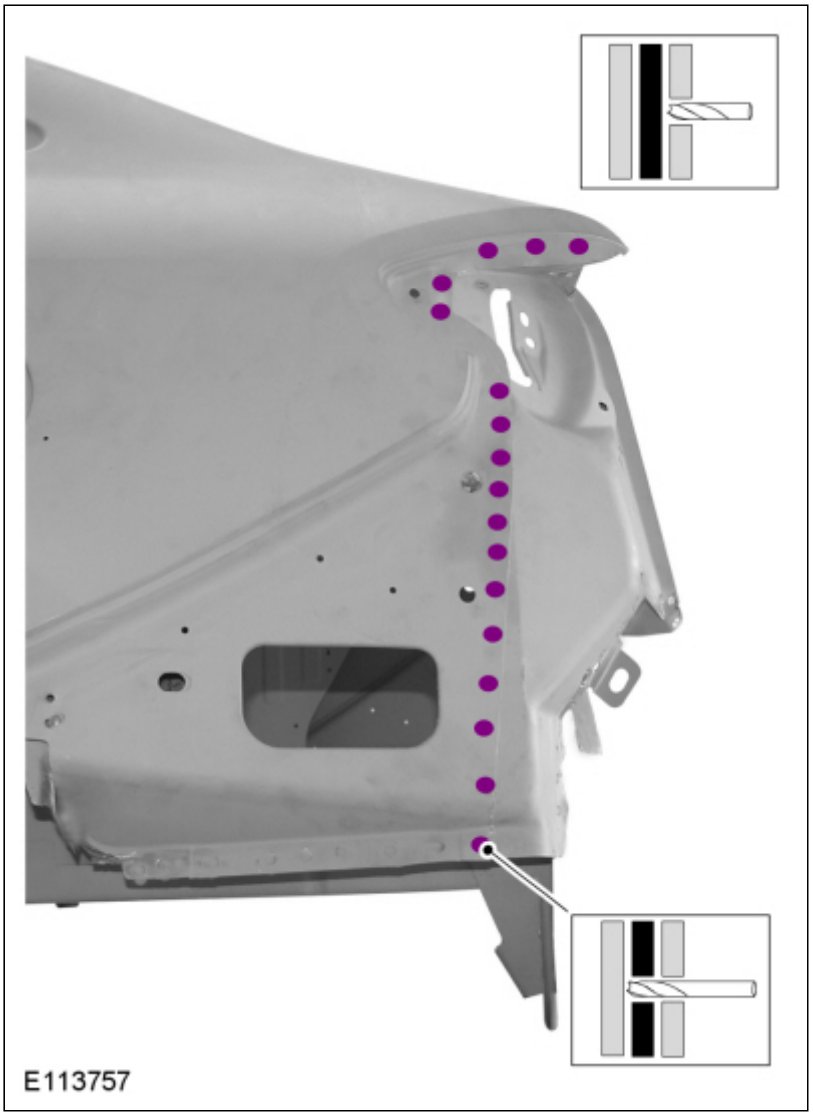
Magnified and detailed views

If a detail cannot be clearly seen in the illustration because of its size or location, it is shown enlarged in a separate window.


E113412

Position lines within a diagram

A position line is used to indicate a special position or a component. A spot weld which must be drilled out through two panel thicknesses is indicated here, different to all the others.



Copyright © 2016 Ford Motor Company

Health and Safety Precautions

General

Appropriate repair methods and their correct implementation are very important for both vehicle operating safety and personal safety.

WARNING: There is danger of injury through:

- **High voltage when electrical welding.**
  - **Do not perform welding work in a damp environment or on a wet substrate. Use suitable insulation underneath.**
- **Flammable substances in the welding area.**
  - **Remove flammable substances from the danger area. Remove the fuel tank and, where required, those components which supply fuel.**
  - **Completely remove the battery before carrying out any welding in that area.**
- **Welding fumes, which are harmful to health.**
  - **Always ventilate the workplace well and use an extraction system.**
- **Welding spatter and UV radiation.**
  - **Wear protective clothing, gloves and welding mask or welding goggles.**
- **Pyrotechnic components.**
  - **Disconnect the battery negative clamp and cover the battery terminal. Remove any airbag components.**

All the regulations governing Health and Safety at Work must be complied with during body repairs.

Personal protection

Welding gases and grinding dusts can be harmful to the health. For this reason, make sure that rooms are well ventilated and work using the welding fumes extraction system. Sealants, underbody protection and paint residues must not be burnt down with an unshielded flame, as this will produce gases which are damaging to health. A dedicated extraction system must always be used when welding or brazing.

When working with substances containing solvents, good ventilation must be provided, respiratory protection must be worn and an extraction system must be used.

Do not weld in damp areas, if necessary use an insulation mat. Welding and grinding work near the battery presents the danger of explosion. For this reason, it must be removed before the work is started.

Cutting, grinding and alignment work on metal panels can cause a noise level of 85 to 90 dB (A) or even more. For this reason, you must always wear ear defenders.

The various body areas are subject to very high forces during realignment work. Should any component suddenly become detached during this process, there is a very great danger of injury. For this reason, pulling chains and pulling shackles must be secured with arrester cables.

NOTE: *Work on airbag systems may only be performed by persons who have a relevant certificate of competence.*

Some special instructions must be followed when working on airbag systems:

- Always stand to the side of it when removing or installing an airbag.
- Always store an airbag or an airbag/steering wheel with the airbag side pointing upwards and in a safe place.
- Only install the airbag again when the vehicle is fully repaired and the complete electrical systems has been tested.
- Take into account the location of air curtains and shoulder airbags.

Protection of the vehicle

Protect affected areas from weld spatter and dust during all welding and grinding work on the vehicle. If metallic dust stays on the vehicle for some time, there is the likelihood of film rust formation. Grinding or sanding work produce tiny spots of damage to the paint surface, which may cause corrosion.

For this reason, make sure to:

- Use carbon fibre blankets to protect the vehicle body.

- Use covering film to protect the vehicle body from sanding dust and metal dust.
- Take appropriate measures to protect the interior equipment of the vehicle during any repair work.

In addition, take into account:

- Remove fuel supply components as necessary.
- Protect working areas which are in danger of catching fire with a fireproof blanket.
- The welding must not cause components of the air conditioning system to become heated.
- Removal of any attached components in the space adjoining the repair area.
- Use covering paper to protect the interior from grinding dust.
- Create a definite barrier between the work area and the interior by using a carbon fibre blanket.

Protective equipment

The following protective equipment must always be used:

- Protective helmet or welding mask.
- Ear defenders and breathing protection.
- Protective gloves and safety boots.
- Welding fume extraction.

Electronic components

Increased use of comfort and safety electronics in modern motor vehicles also requires the greatest attention to be paid during body work. Overvoltages produced during welding and in alignment work during bodyshell rectification may cause electronic systems to be damaged. In particular, the safety instructions for performing welding work on vehicles with airbag systems must be adhered to.

NOTE: *After disconnecting the power supply and before performing further work, a wait time of up to 15 minutes must be maintained, depending on the vehicle. Work on airbag systems may only be performed by persons who have a relevant certificate of competence.*

Pay attention to the following points:

- Disconnect the battery negative clamp and cover the battery terminal.
- Disconnect the electrical connector at the airbag control module.
- If welding is to be performed directly near a control module, it must be removed beforehand.
- Never connect the negative cable of the welder near an airbag or a control module.
- Connect the negative cable of the welder close to the location of the weld.

For additional information, see: **501-20B Supplemental Restraint System**

Liquefied gas vehicles

Alternative fuel vehicles often require special handling in the workshop area. Above all, assembly operations to some extent require particular knowledge when dealing with the special technology and the safety regulations.

NOTE: *Only fully trained personnel are permitted to work on alternative fuel vehicles.*

These special requirements must be understood and taken into account in the body shop as well.

NOTICE: Danger of fire and explosion. The safety instructions must always be followed when performing service work on fuel/gas systems. Failure to observe this instruction can lead to injury.

If the smell of liquefied petroleum gas (LPG) or compressed natural gas (CNG) is noticed in the workshop, instruct everyone present as follows:

- No smoking and extinguish all naked flames.
- Shut off all electrical and air powered equipment.
- Evacuate the area.
- Ventilate the area.
- Contact the fire control authorities.
- Move the vehicle to a dedicated, well ventilated area.

Alternative fuels require special handling:

- Handle them in a specially dedicated, well ventilated area, which is only accessible to authorized persons.
- Identify the designated area with new warning notices.
- If possible close the main shut-off valve and run the vehicle on alternative fuel until it switches automatically to petrol operation. Only then is it allowed to drive the vehicle into the workshop or service area.
- If possible do not allow any liquefied gas (LPG) to escape.

- The ambient temperatures must not exceed 40°C. For this reason the LPG and CNG fuel tanks must be removed on vehicles with LPG or CNG operation before using a drying oven to dry the paint where the temperature exceeds 40°C.

Avoid situations in which fuel from an LPG or CNG fuel tank can escape. These situations include:

- Extremely hot ambient temperatures.
- Parking near a heating device.
- Raising the vehicle near a ceiling heater.

Refrigerated conversion vehicles

Apart from the special materials used in building the structure of the refrigerated compartment, such vehicles have special energy and refrigeration systems which require special handling during repair.

NOTICE: Danger of injury. Work on the 230 volt system of the refrigeration equipment must only be carried out by trained specialist personnel.

NOTICE: The refrigeration system is filled with refrigerant R134a. This can cause frostbite if it contacts the skin. Pay attention to the corresponding warning notices and instructions in the chapter Air Conditioning Systems.

NOTE: *Work on the refrigerant circuit may only be performed by persons who have a relevant certificate of competence.*

Vehicles with a refrigerated compartment are often used to transport foodstuffs. For this reason, additional hygiene regulations must be complied with during repair work.

Aluminum and plastic are used to construct the two different types of compartment found on refrigerated vehicles.

The aluminum conversion is a very stable and technically perfect variant. However, against this the relatively high production costs and a lower payload must be taken into account, because of the weight of the aluminum conversion itself.

NOTE: *Basic and in-depth training is offered on the following topics. You will find an overview of the complete range listed in the Training brochure published by the Ford Service Organization.*

The plastic conversion has developed into a light, clean and economical alternative because of constant further development of materials and working techniques.

NOTE: *The material combinations, the workmanship and the working methods must comply with the current food hygiene regulations. For this reason, service and repair work on the refrigerated conversion may only be performed by authorized and specially trained technicians.*

Refrigerated compartment constructions are often made using both materials. The floor pan is made of structured, slip-proof aluminum panels and the wall and ceiling cladding is made of smooth surfaced plastic elements.

NOTICE: PUR hard foam is flammable. If PUR hard foam is overheated, it will burn on its own with a brilliant yellowish flame. It produces unpleasant choking and toxic fumes. Special measures must be taken when welding the vehicle body.

Polyurethane wall and ceiling elements are manufactured using a sandwich principle. An insulating polyurethane core is coated with food grade ABS plastic on one side.

PUR hard foam does not decompose, is rot resistant and is odorless. These properties make it suitable for use as insulation.

Because of its closed cell structure, water uptake by PUR hard foam is for the most part only a problem at edges. Cut edges or other mechanically worked surfaces must however be sealed with the greatest care.

The conversion to a refrigerated vehicle is performed as made-to-order production. The large surfaces of the wall and ceiling cladding can be changed and are particularly easy to repair.

If access to the back of a body panel section is needed because of body straightening work, in some circumstances it is cheaper to perform a cut-out repair instead of removing an element.

The repair process is fully described in the Student Information booklet Refrigeration System Technology, Transit 2000.5 Freshline.

Copyright © 2016 Ford Motor Company

Environmental Regulations

Orderly and responsible waste management is not only very important for the protection of health and the environment, but it also has great importance where saving natural resources is concerned.

In body repair shops, since the introduction of the EU directives on the avoidance of vehicle waste and the promotion of return, re-use and recycling of vehicles and their components (2000/53/EU), more rigorous attention than before is also paid to avoidance and recycling of waste materials.

NOTE: *The organization of disposal in the operation must comply with the country specific waste regulations:*

In this respect, body repair shops must take into account and comply with the following requirements:

- Separate waste according to its recycling and disposal methods.
- Produce evidence for the correct transport and disposal of waste.

NOTE: *The organization of disposal in the plant must comply with the requirements of the Waste Avoidance and Management Act.*

The avoidance and recycling of waste must always take priority. However, despite all measures which may be taken, waste cannot be completely avoided.

NOTE: *Useable waste which is not allowed in household rubbish, must be disposed of as special waste*

All remaining waste must be treated as commercial waste and disposed of according to the local requirements.

Only applies to the EU:

The vehicle manufacturer is also under a legal obligation since the older vehicle legislation came into force throughout Europe in 2002.

This law covers the surrender, withdrawal and environmentally friendly disposal of older vehicles through the manufacturer.

The older vehicle legislation contains all the necessary information for the environmentally compatible disposal of older vehicles, starting with preliminary handling involving the removal of all operating fluids, deactivation of pyrotechnic components, elimination of pollutants and then further handling by dismantling components for re-use and recycling.

Copyright © 2016 Ford Motor Company

Body Construction

General

Under bodywork construction, a general distinction is made between monocoque and non-monocoque bodywork. The safety of the occupants is the main consideration for all types of bodywork construction. The front and rear sections are designed so that they absorb the energy of the impact via crumple zones. The use of modern design and manufacturing methods and the use of newly developed body panels (relating to their deformation and strength properties) mean that, despite the continuous weight-savings, all safety-related requirements made of the construction can be met.

Integral body-frame

In this method of construction, coverings, reinforcements, retaining panels and profiles are permanently joined together using a variety of joining techniques (gluing, spot welding, laser welding, soft soldering or brazing). The load-bearing function of the structure must always be achieved in each case.

There is no distinction made between components which are purely subject to bending/torsion or thrust loads and parts which perform sealing/covering functions (as in non-monocoque bodywork for example). In modern passenger vehicles, monocoque bodywork is very widespread and offers the advantages of a lightweight and low-cost construction.


E59084

The rigidity of the bodywork is achieved by a panel skin and panel cross-section with the largest possible profile and therefore the largest resisting torque (such as for instance the rocker panel). Swage lines in the outer area of the bodywork increase the stiffness and the natural vibration frequency, to prevent possible drumming noises. The mounting points for ancillary components such as doors and wings are permanently built into the monocoque bodywork.

High rigidity of the bodywork is vitally important to keep the elastic deformations low at the joins to the ancillary components and to prevent noise when driving. Small gap dimensions are therefore only possible on vehicles with very stiff bodywork. With high bodywork stiffness, the construction can exert an influence on the handling of the vehicle (e.g. on poor road surfaces).

Advantages of monocoque bodywork:

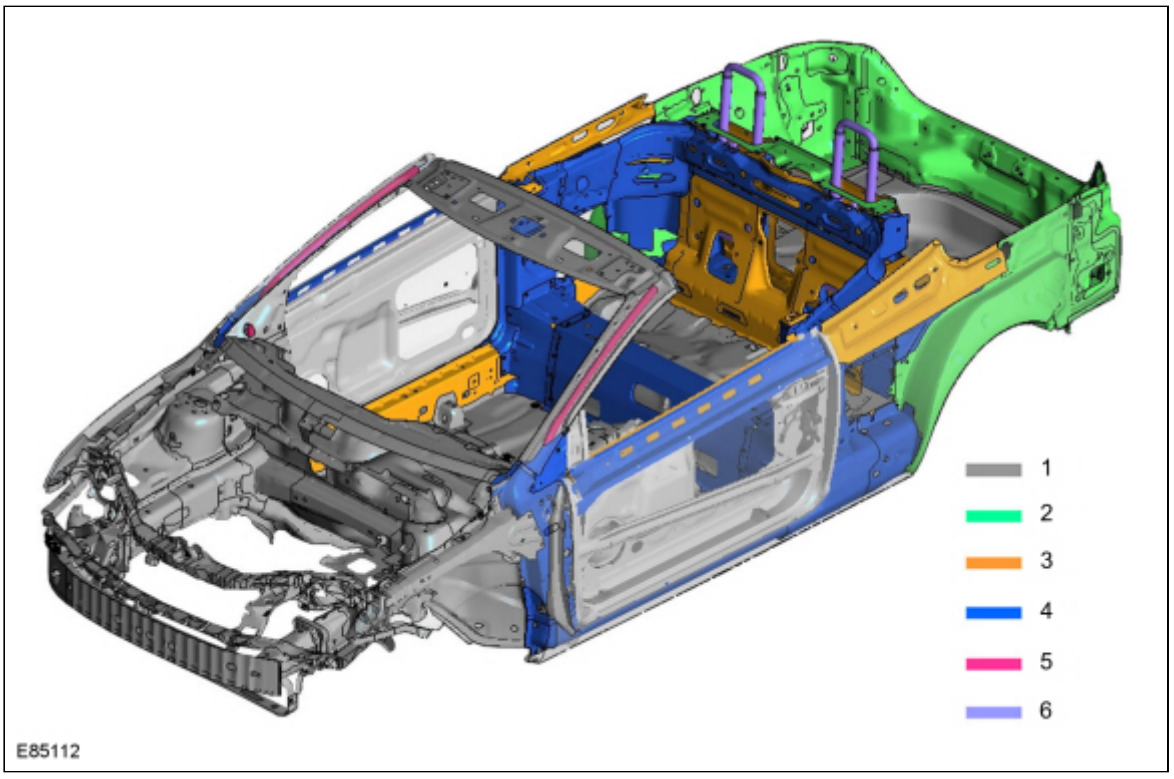
- Weight reduction.
- Economical manufacturing technology.
- High torsional rigidity and high flexural strength.

- Defined deformation behavior at the front and rear.
- Maximum passive safety due to the strong passenger compartment

The protected passenger compartment with strong pillars, rocker panels and doors with integral side impact protection increase occupant protection. Opening of the doors is ensured, even if there is extreme deformation.

NOTE: *Repair work must always be performed according to the established workshop literature. All the safety requirements must be guaranteed after any repair work has been performed !*

Convertible



Description	Description
1	Body components adopted from the Focus 2004.75 (07/2004-)
2	Conventional bodywork construction steel
3	High-strength sheet steel
4	Super-high strength sheet steel
5	Maximum-strength sheet steel
6	Aluminium, can be subjected to high stresses

The body of a convertible differs from the principle of the integral body-frame of a saloon due to the lack of a roof construction. The body has a high degree of torsional stiffness. This is achieved by using high, super-high and maximum-strength sheet steel and body reinforcements in specifically-targeted areas.

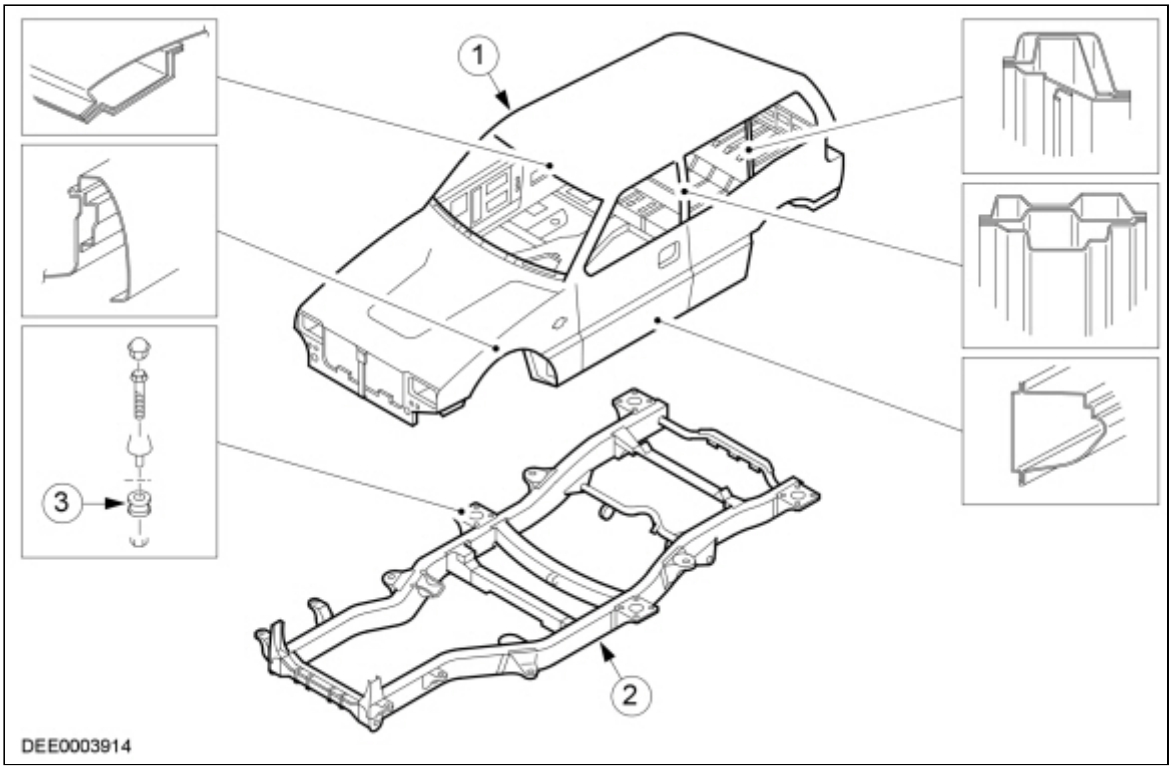
These reinforcements can be installed in the area of the doors (diagonal braces etc.) or on the underfloor. In contrast to the saloon (or other non-convertibles) with square-section side members (closed profile), these reinforcements have a profile which is open on the underside (U-section).

Special constructional changes within the bodywork structure:

- Reinforcing or increase in the thickness of the sheet steel in the pillar area.
- Reinforcing or increase in the thickness of the sheet steel in the floor pan structure (rocker panel area).
- Use of heavily structured reinforcing panels in the rocker panel and pillar area.
- In the area of the windshield frame and A-pillars, thick-walled reinforcing tubes are used (roll-over protection).
- Because there is no roof, the bridge construction principle cannot be used as it is on the saloon for example. Flexural and torsional rigidity must be ensured by other components.

Non-monocoque bodywork

Non-monocoque bodywork is built onto a frame or a chassis. Frames used for this have various construction forms, e.g. the ladder frame or tube frame. Non-monocoque bodywork is the original way of constructing vehicles.



Description	Description
1	Vehicle body.
2	Frame Assembly
3	Bolted connection

The ladder frame is still commonly used today for truck and off-road vehicles. The bodywork is placed on the frame or chassis. The total load which occurs while driving is transferred to the chassis.

More sporting vehicles can be built with non-monocoque bodywork, mostly using a lattice tube frame. Limitations in the design are accepted for the benefit of low weight. The outer skin here is usually made of plastic or alloy. This type of construction is also common in touring car racing for instance.

Special features of non-monocoque bodywork construction:

- Partly large surface panels and high volume shaped parts.
- Thicker materials and greater reinforcements in the frame area.
- Floor pan as frame structure with high torsional rigidity and flexural strength.
- Side panels only make a small contribution to the overall stability of the body.

Instructions for repair:

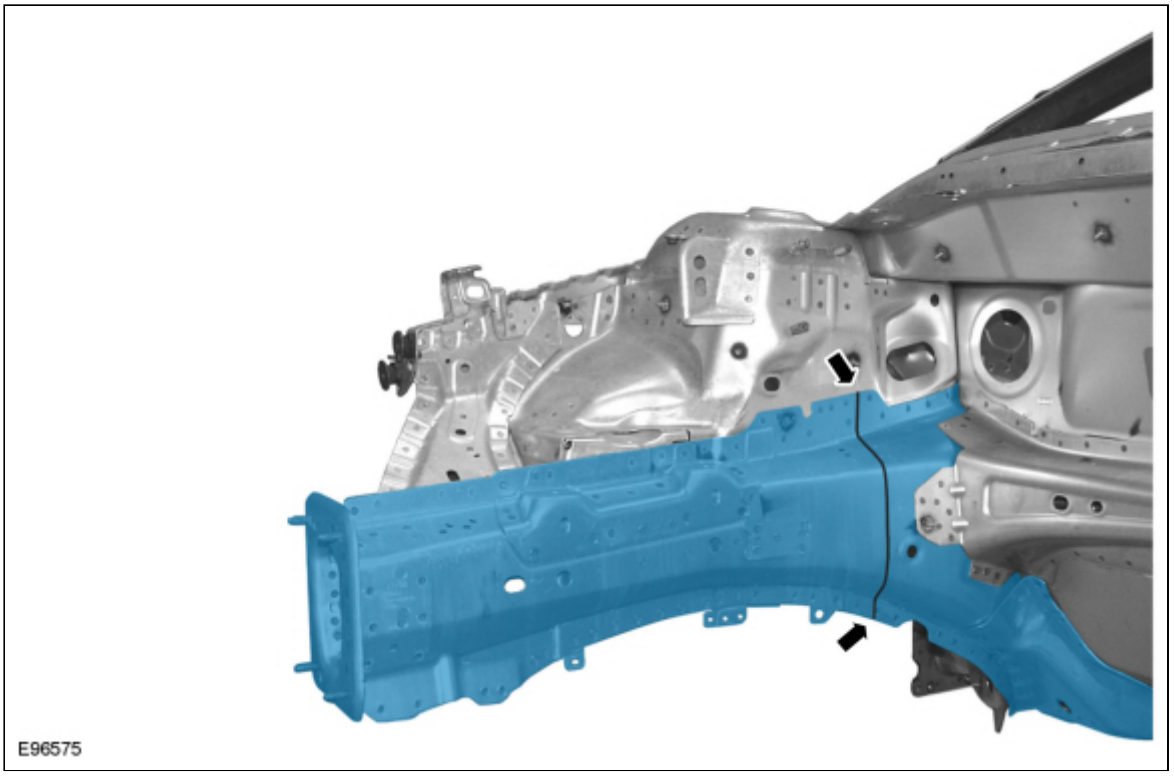
A different repair technique is necessary during repairs. A deformed frame structure requires high suction power during straightening repairs. Frequently, the body also has to be detached from the frame structure in order to carry out separate repair.

Due to the very stable frame structure, please note that the straightening behavior is completely different to that of a passenger vehicle. The frame and the attached body must be repaired independently of each other.

Further information can be found in the respective body repair manual.

Special points:

Tailored blanks



Blue: Tailored blank

Arrows: Laser weld seam

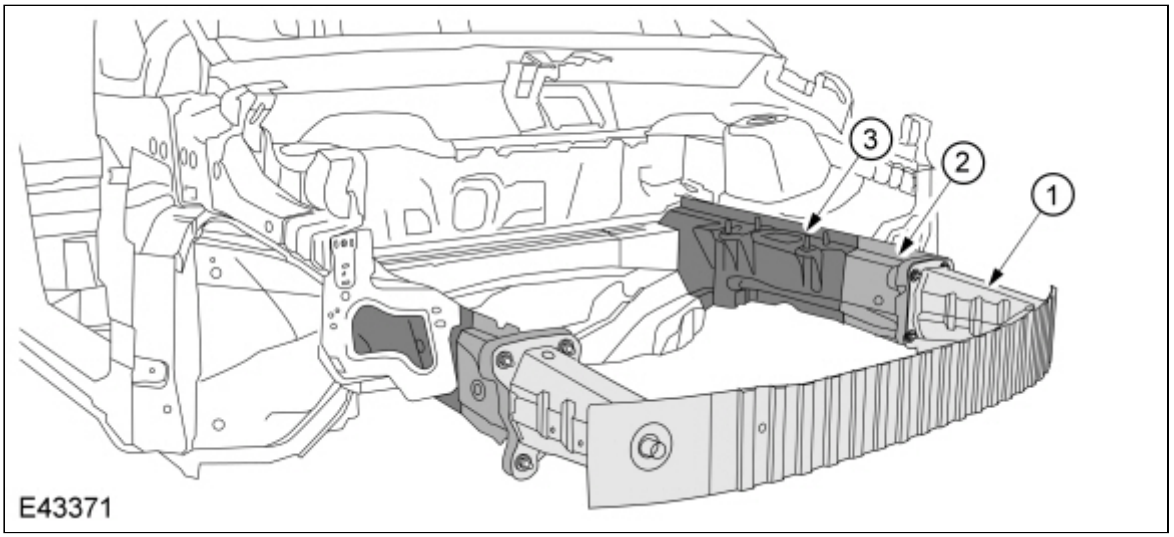
The term "tailored blanks" describes the connection of two different panel thicknesses and/or strengths in the bodywork carcass. This connection is done using laser weld seams. Cut locations exactly on the laser weld seams are not permitted, as at present no joining techniques are approved for use in repair procedures that would re-create joins of the same quality.

NOTE: *No cutting, no welding and therefore no sectional repairs are permitted in the immediate area of the laser weld seams. The model specific requirements are documented in the respective Body Repair Manuals.*

Typical application areas are:

- Side member
- Door inner reinforcement/door frames
- Wheelhouses
- Rocker panel inner reinforcement
- Roof rail inner reinforcement

Deformation behavior



Description	Description

1	Bolted crash element
2	Front side member
3	Rear side member

Different materials and design features lead to staged deformation of the front and rear of the vehicle in an accident.

Crash element:

At the front of the vehicle there is a crash element which is connected to the side member by threaded connections. This crash element can absorb light impacts of up to about 15 km/hr. Because of the threaded connections, the crash element can be changed very quickly.

NOTE: *Deformed crash elements must not be straightened or repaired.*

Heavier impacts which can no longer be absorbed by the crash element must be absorbed by the side members or the floor pan structure. Depending on the extent of the damage, a part or complete replacement can be performed on the side member.

The rear of the vehicle, like the front of the vehicle, has structures which protect the passenger cell through staged deformation in the event of an accident. The design layouts, however, are adapted to the requirements of the rear area.

Copyright © 2016 Ford Motor Company

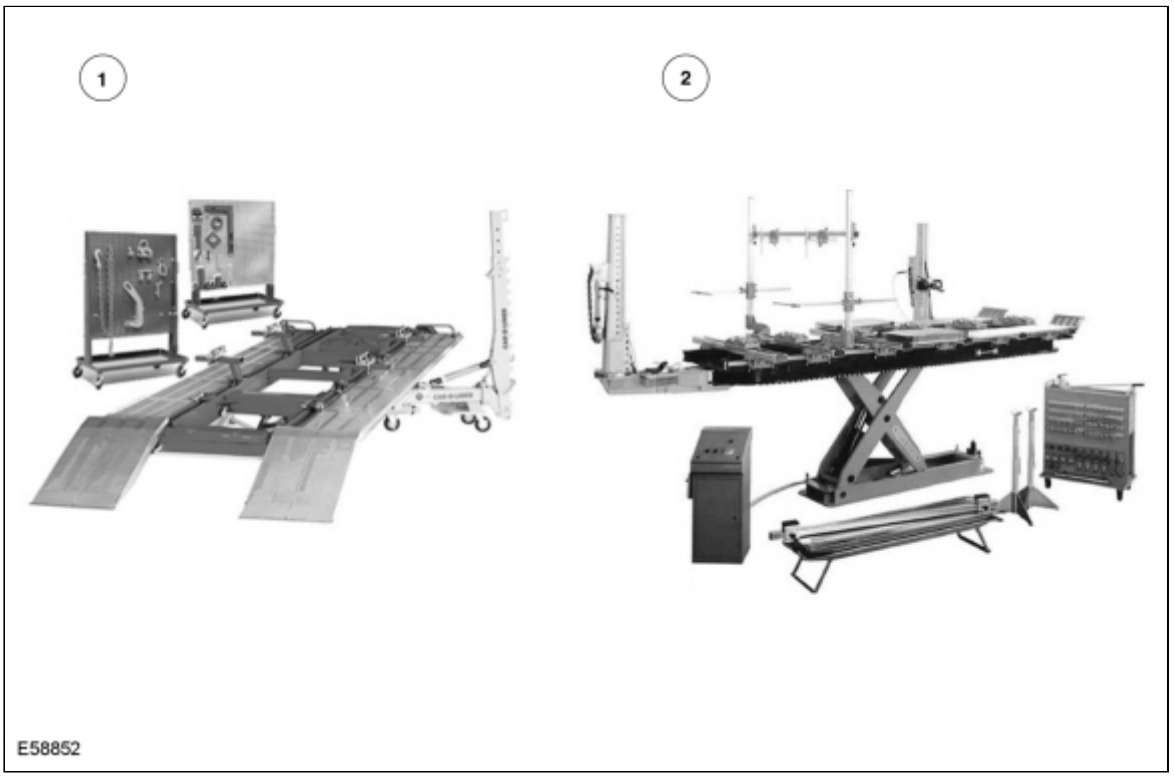
Tools and Equipment for Body Repairs

Alignment systems

NOTE: *All the equipment for body work and painting work can be ordered online via the Wielander & Schill service portal http://fo.oem.wielanderschill.com.*

Straightening and alignment repairs are often required to restore a vehicle body to its original shape after accident damage.

Universal aligning and measuring systems and universal alignment angle systems are suitable for this work.



Description	Description
1	Universal aligning and measuring system
2	Universal alignment angle system

Basically, the aligning and measuring system must satisfy the following requirements:

- Universally applicable to all types of passenger car. Can also be used on light commercial and off-road vehicles.
- Accepts the forces involved during straightening.
- High stability and mobility.
- Can accept all or part of the weight of the vehicle.
- Quick to set up.
- Simple to use.
  - Stationary design with drive-on ramp.
  - Height-adjustable aligning platform.
  - Universal gauge extensions with fast anchoring ability around the whole circumference of the aligning platform.
- Facility to test individual body measurement points, with or without aggregates being removed.

Alignment angle devices survey the vehicle at several points on the body. These are usually points which are also used in production. In addition, a recording over the rocker panels is possible. A measuring system is not needed,

because the necessary body points are specified with gauges. For this purpose, vehicle specific or universal gauges are available.

Universal alignment systems consist of a vehicle mounting (universal clamps at the rocker panels) and a pulling device. In addition, a measuring system is required.

NOTE: *Because universal clamps are used, the rocker panel area must be reworked for optical and corrosion protection reasons after the repair is completed.*

Pay attention to the following points:

- Clean the attachment areas.
- Anchor the vehicle free of stress on the relevant system.
- Support the aggregates to take strain off the body.

Measuring systems

In order to exactly diagnose a damaged vehicle body, measuring systems are required. Depending on the measuring method, the systems vary in having mechanical, optical, acoustic and electronic measuring devices. In some cases, hybrid versions of particular systems are found.

NOTE: *When working with each measuring system, the manufacturer's instructions provided in the description of the measuring equipment must be followed.*

Basically, the measuring systems must meet the following requirements:

- Universally applicable to all types of passenger car. Also can be used on light commercial and off-road vehicles.
- Suitable for all accident damage.
- Fast capture of body measurement points in the underfloor and external areas.
- Data catalog to record all measurement points (length, width and height) both with and without the aggregates being installed.

NOTE: *Basic and in-depth training is offered on the following topics. You will find an overview of the complete range of training offered in the Ford Service Organization training brochure.*

Beam compass

The beam compass is a very practical and straightforward aid for measuring bodywork and especially floor assemblies. The beam compass can be used to detect dimensional variations across the length and the width by means of comparison measurements and diagonal measurements.

As a basic principal, body reference points should be chosen which are shown in the body frame measurement data sheet.

NOTE: *To be able to determine difference in measurements, the same reference points must always be chosen on both sides. For this purpose the beam compass must be positioned symmetrically.*

Comparison measurements can also be made on the outside of the body. Depending on the damage, left/right measurements (symmetry measurements) and diagonal measurements can be made using the beam compass, telescopic rod or a measuring tape.

Laser measuring systems

These systems use laser beams which are projected in one or more planes.



E59220

By the use of two parallel laser heads which can be turned, symmetrical points of a vehicle body can be tested and compared. Using the linear scales which are attached to the measuring points, the measurement data is read off with the aid of the projected laser beams.

The integral inclination gauge also allows differences in height to be quickly checked.

Mechanical measuring system

The use of mechanical measuring equipment is an easy and effective way to check a vehicle frame and chassis assembly quickly, exactly and reliably.

In many cases an assessment of the damage can be made with the help of this system, without the need for elaborate setting up.



E59888

Because of its self-centering mount, measurement can be carried out by one person.

Further advantages:

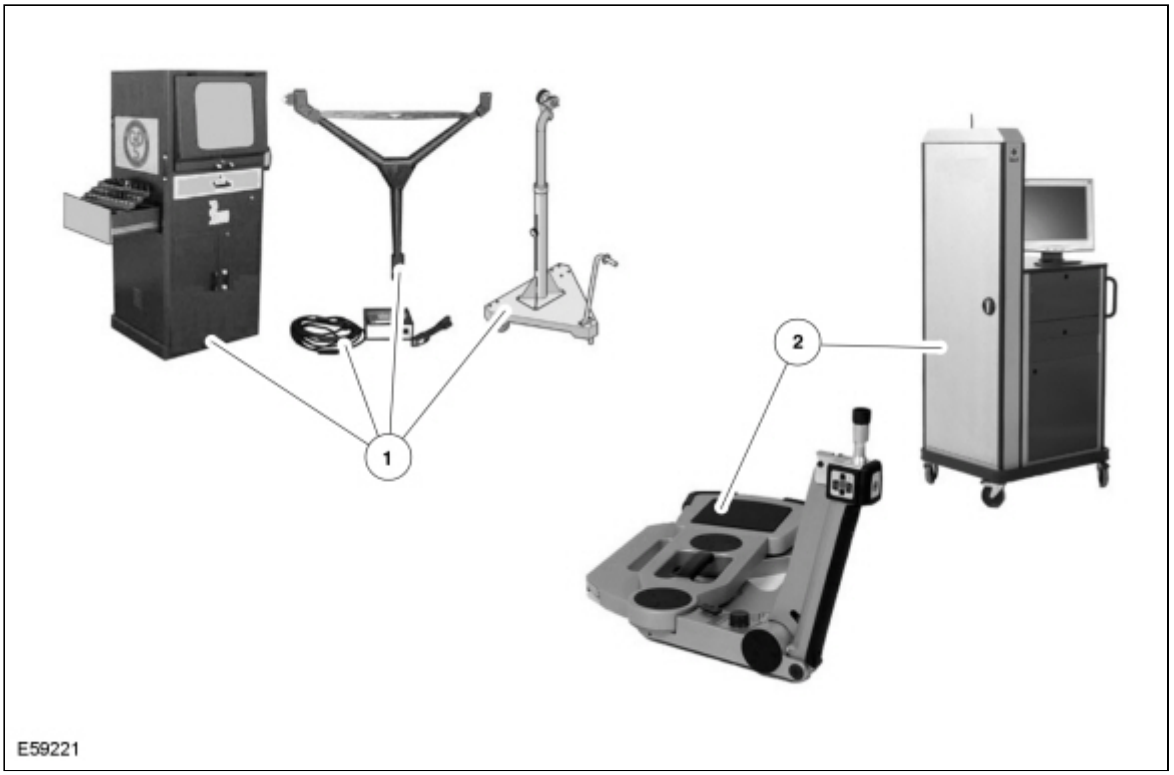
- Fast deployment.
- Simple to use.
- Can be extended using adapters, measuring probes and measuring tubes.

Measuring systems which are firmly mounted on an aligning platform require more work in setting them up. They are used to constantly check measurements during alignment work.

This type of mechanical measuring system has measuring scales and measuring slides in three measuring axes. So that the body can be measured, the vehicle is secured on the aligning platform base frame using four universal chassis clamps. The exact fixing points are given in each respective data sheet.

Ultrasonic and mechanical-electronic measuring systems

These measuring systems can be combined with all current aligning platforms. In addition these measuring systems can be used independently of an aligning platform by using a vehicle lift or suitable support stands.



Description	Description
1	Ultrasound measuring instrument
2	Mechanical-electronic measuring system

Acoustic or ultrasonic measuring systems use ultrasonic emitters and sensors to survey a body.

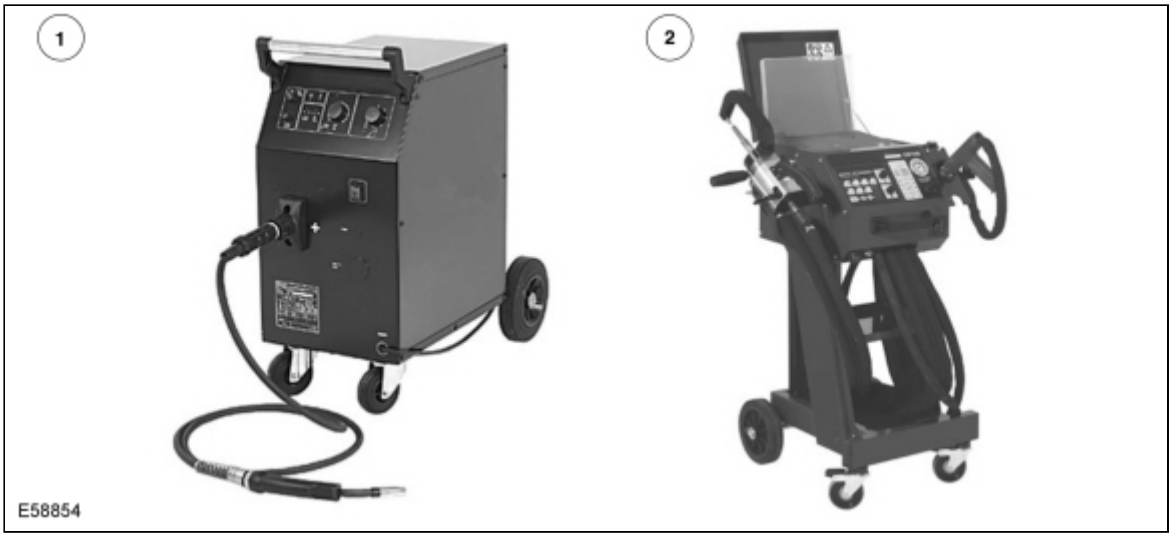
To do this, ultrasonic emitters are mounted on the vehicle using special attachments. During the measuring process the ultrasonic emitters constantly send out signals which are received by sensors (microphones) and then passed to a computer. The measurements are displayed on the computer screen and are compared with the required values supplied by the vehicle manufacturer.

The ways in which mechanical-electronic measuring systems can be used are similar to those of the acoustic measuring systems. They can also be set up on a suitable understructure, without an alignment jig. After this system has been arranged under the vehicle floor and adjusted to three undamaged vehicle measuring points, the measuring arm is brought up to the required measuring points and the readings compared with the reference values. The data is transmitted to a computer where it is evaluated and the results displayed on a screen.

Welding gear

As in the past, the dominant process in body construction is **resistance welding**, in particular spot welding. Depending on body type, up to 5000 spot welds are applied, either by welding robots or in the multi-point welding machine.

Resistance spot welding permits very high energy to be concentrated on a relatively small area of the workpiece in the shortest possible time and when high pressure is applied, a permanent joint is formed. During repairs the resistance spot welds used in production must be re-created accordingly.



Description	Description
1	MIG welding machine
2	Resistance spot welding machine

NOTE: *If a suitably powerful welding machine is not available and multi-layer panel joints with a total thickness of over 3 mm need to be made, puddle welding must be used.*

Although in principle, high and ultra-high-strength panels are adequately or well suited to resistance spot welding, considerable problems may arise because of low welding power, especially where thicker panels or triple or multi-layer panels have to be welded together in the workshop. In particular, older welding equipment does not have the latest welding technology nor welding power and therefore cannot reliably join panel thicknesses greater than 3 mm.

NOTE: *When installing body components made of ultra-high strength steel (e.g. boron), only* ***inverter welding equipment*** *certified by Ford may be used.*

Equipment with inverter technology allows better spot weld quality because of a constant high welding current. In addition the high welding current makes shorter welding times possible and the electrodes therefore have a longer working life. Inverter welding is a further development of electrode welding. In addition, a much higher electrode force (contact pressure of welding tongs) can be achieved with modern equipment.

Further advantages of the new inverter welding equipment are:

- good welding performance with constant quality, even with high switch-on times
- recognition of and compensation for disruptive factors: e.g. primer, adhesive, rust-prevention paint
- own and pre-set welding programs which can be saved and called up
- quality confirmation through logging of all important welding data
- fast changing of spot welding clamps or spot welding guns as required

The following functions can be controlled and monitored by programming the welding equipment:

- Control of the start conditions by resistance measurement (dirt, paint, bodywork adhesive, shunt circuit through the next spot weld).
- Ensuring the optimum welded connection.
- Checking the energy balance, resistance and quality.

In the case of resistance spot welded connections, faults in the weld are difficult to see from the outside. It is therefore absolutely vital to know the particular properties of the welding machine being used. A test weld with subsequent peeling test will provide information on the quality of the weld. The spot weld itself must not separate, it must tear away leaving a hole unless the sheets are two equal gauge high strength steel panels or large gauges.

In the production of vehicle bodies, **MIG welding** plays a minor role as a joining technique. It is used for components subject to high demands, such as threaded plates for axle mountings, or at locations which cannot be spot welded for access reasons.

Copyright © 2016 Ford Motor Company

Alignment Check

General

If there is concern that the body has been deformed, the body must be measured. Several measuring procedures and tools can be used for this purpose.

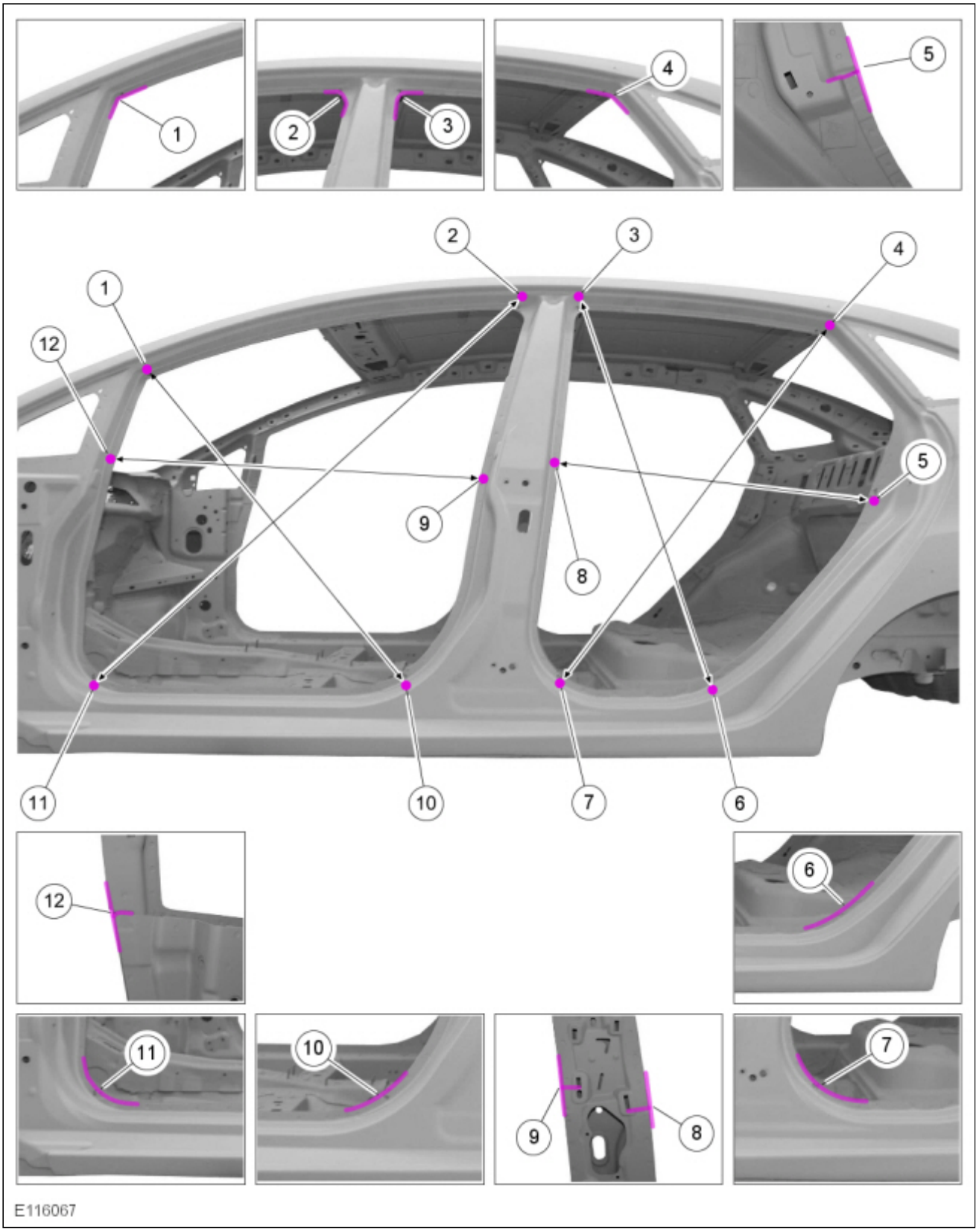
With simple measuring systems, it is possible in most cases to draw a conclusion about the extent of the damage through a quick measurement without time-consuming assembly work (straightening jig).

NOTE: *For the floor pan and the exterior of the vehicle, measuring data is contained in the vehicle-specific repair instructions for each vehicle. Manufacturers of measuring and straightening jigs create data sheets for this purpose for each vehicle.*

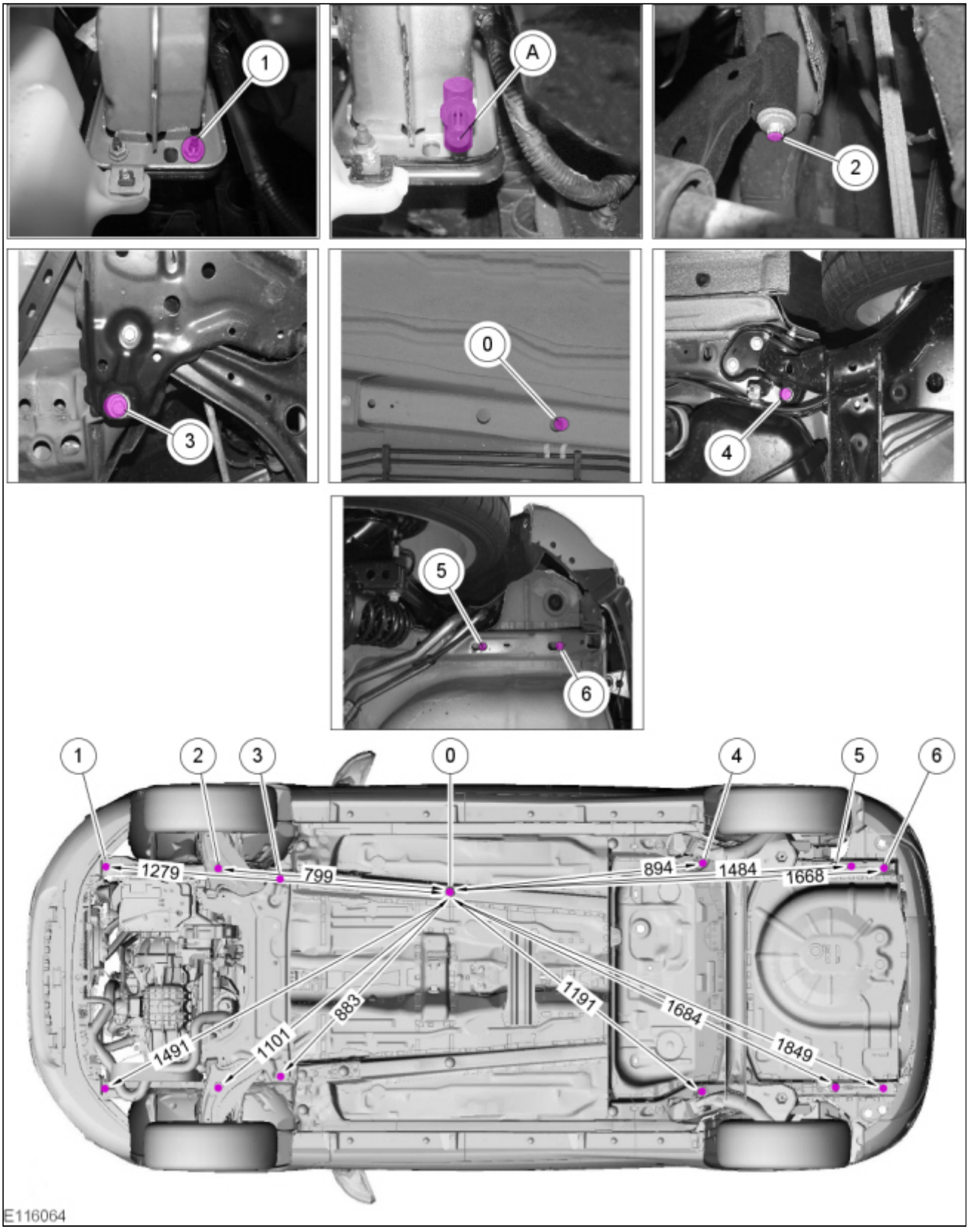
Data sheets with the body frame dimensions for body measurement are specified in the model-specific repair instructions in each case. Pay attention to the position of the measuring probes for each of the measurements given. A tolerance of ± 3 mm applies to all specified dimensions.

Measuring points that are specified in a curve are to be measured so that the greatest distance from the opposite measuring point is reflected. For exact determination of the measuring points, enlarged sections are shown.

Example of measuring the vehicle superstructure



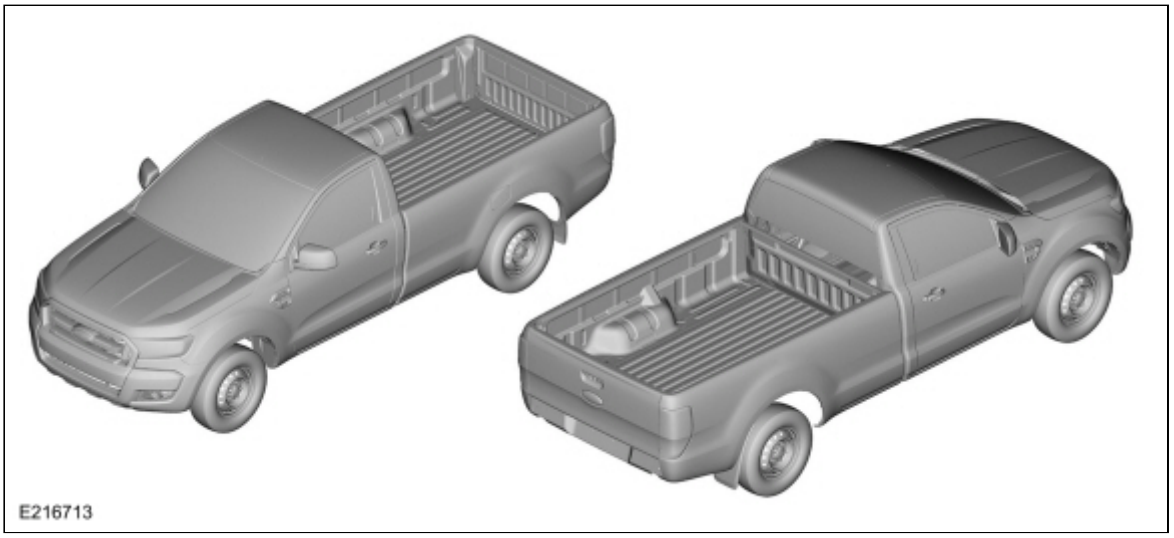
Example of measuring the floor pan



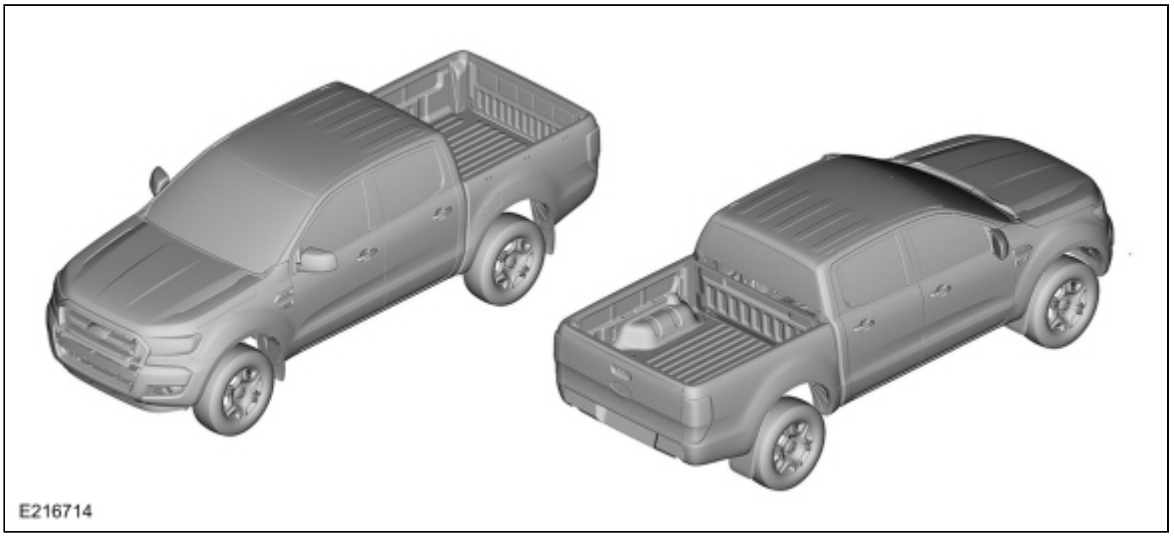
Copyright © 2016 Ford Motor Company

Body and Frame - Component Location

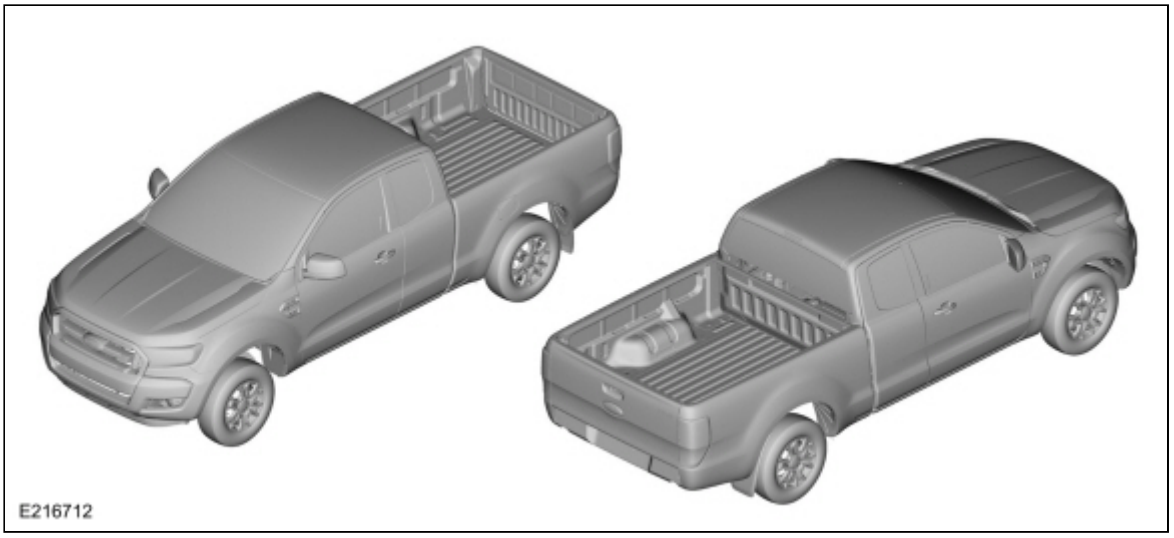
Body, single cab

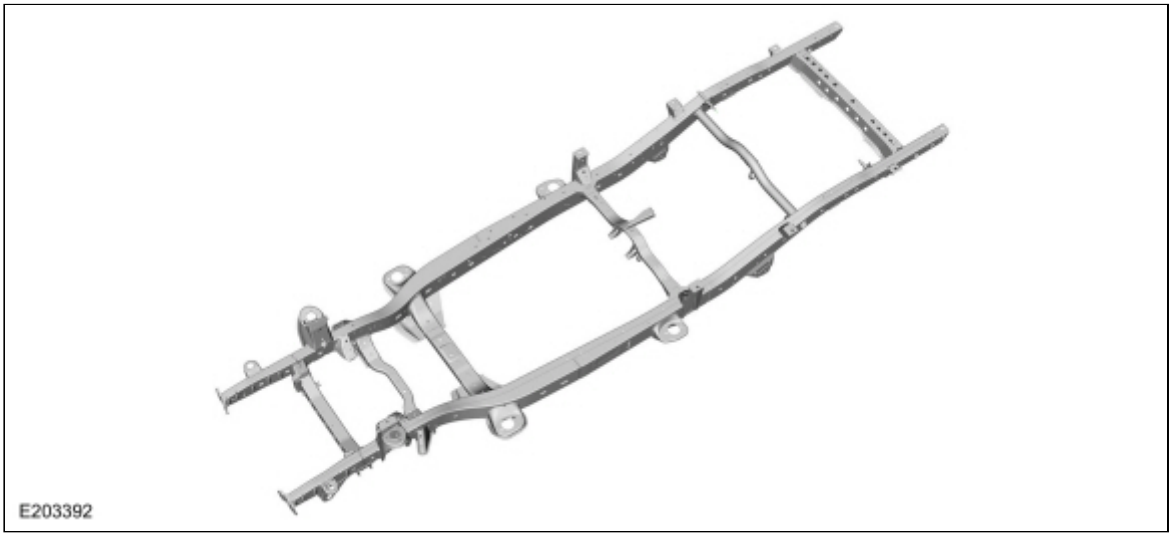


Body, double cab

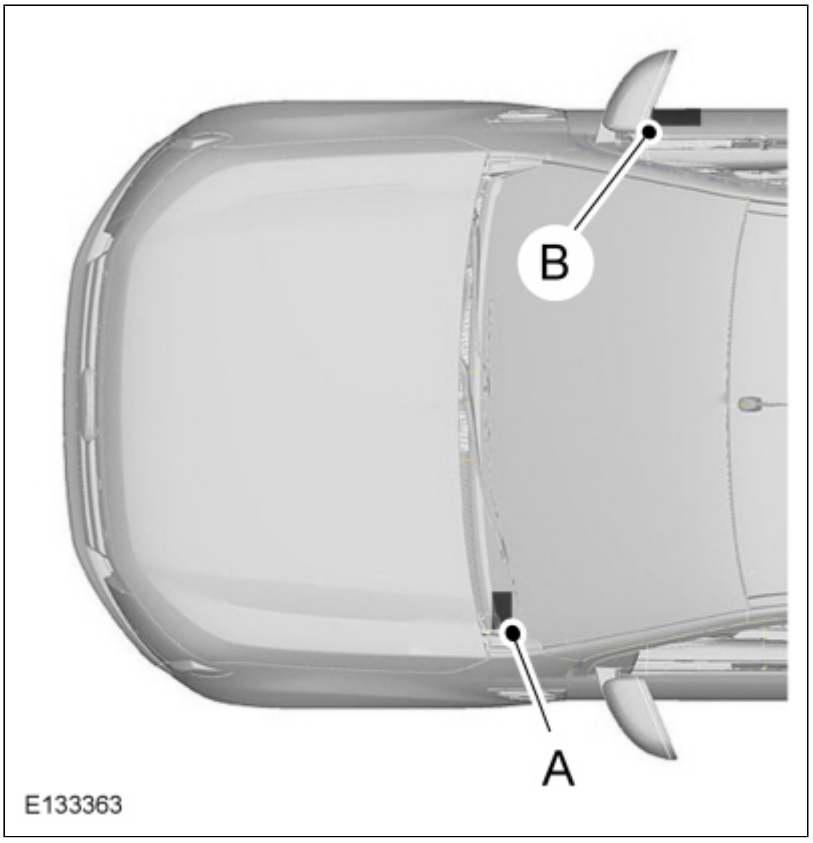


Body, stretch cab





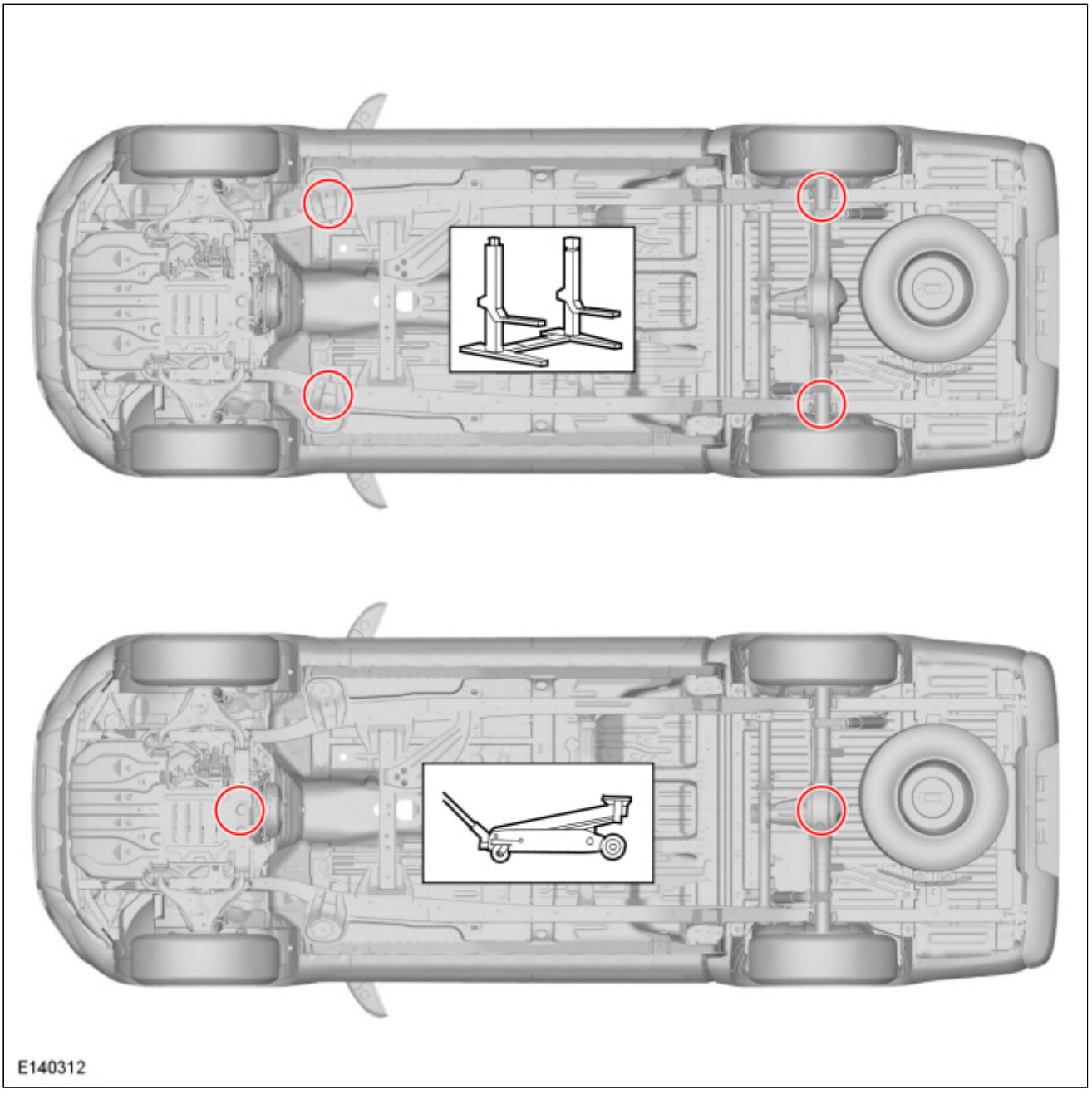
Location of the VIN plate



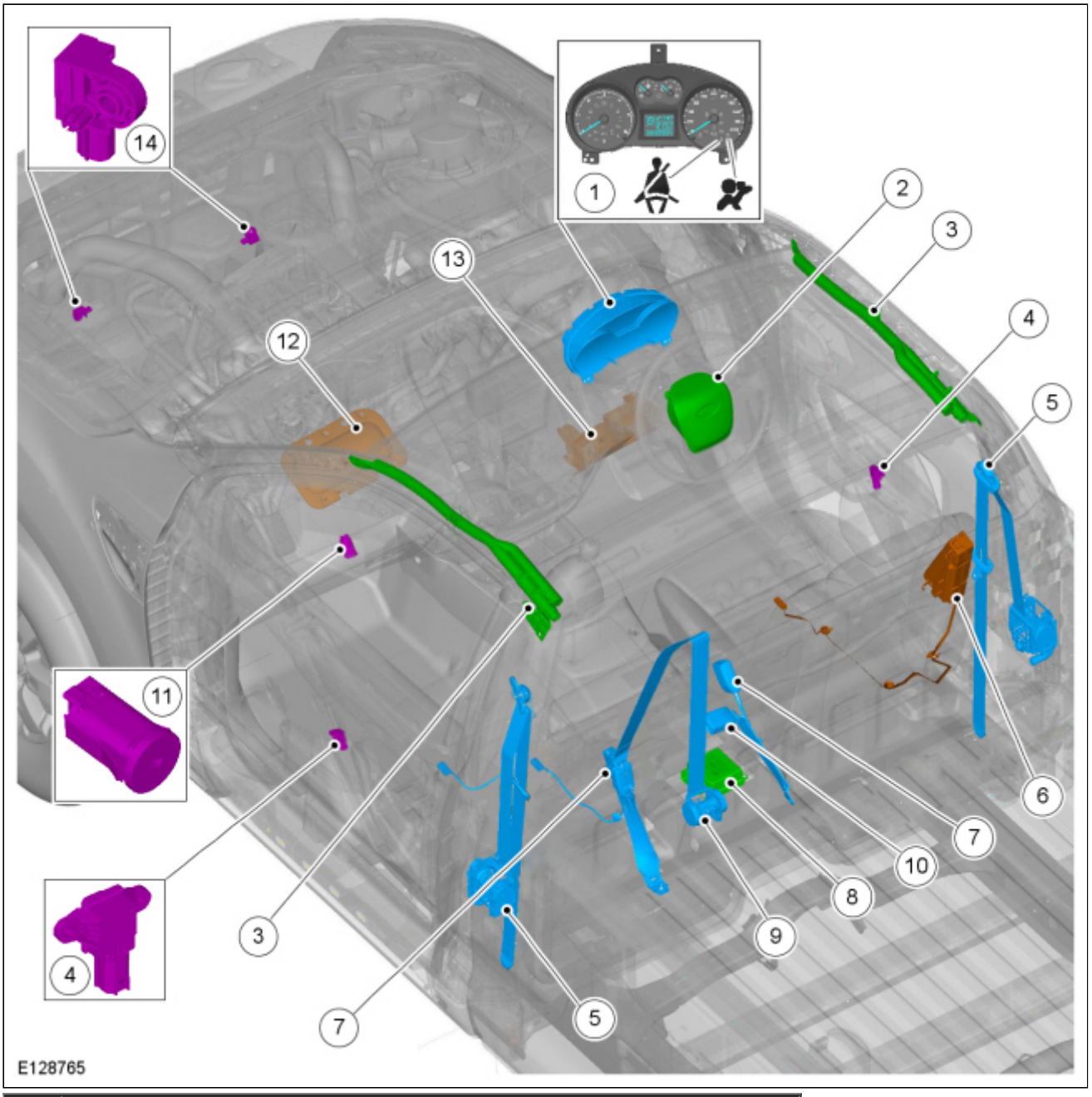
Item	Description

A	Left-hand side of the instrument panel.
B	Right-hand side beneath the front door on the chassis.

Lifting points

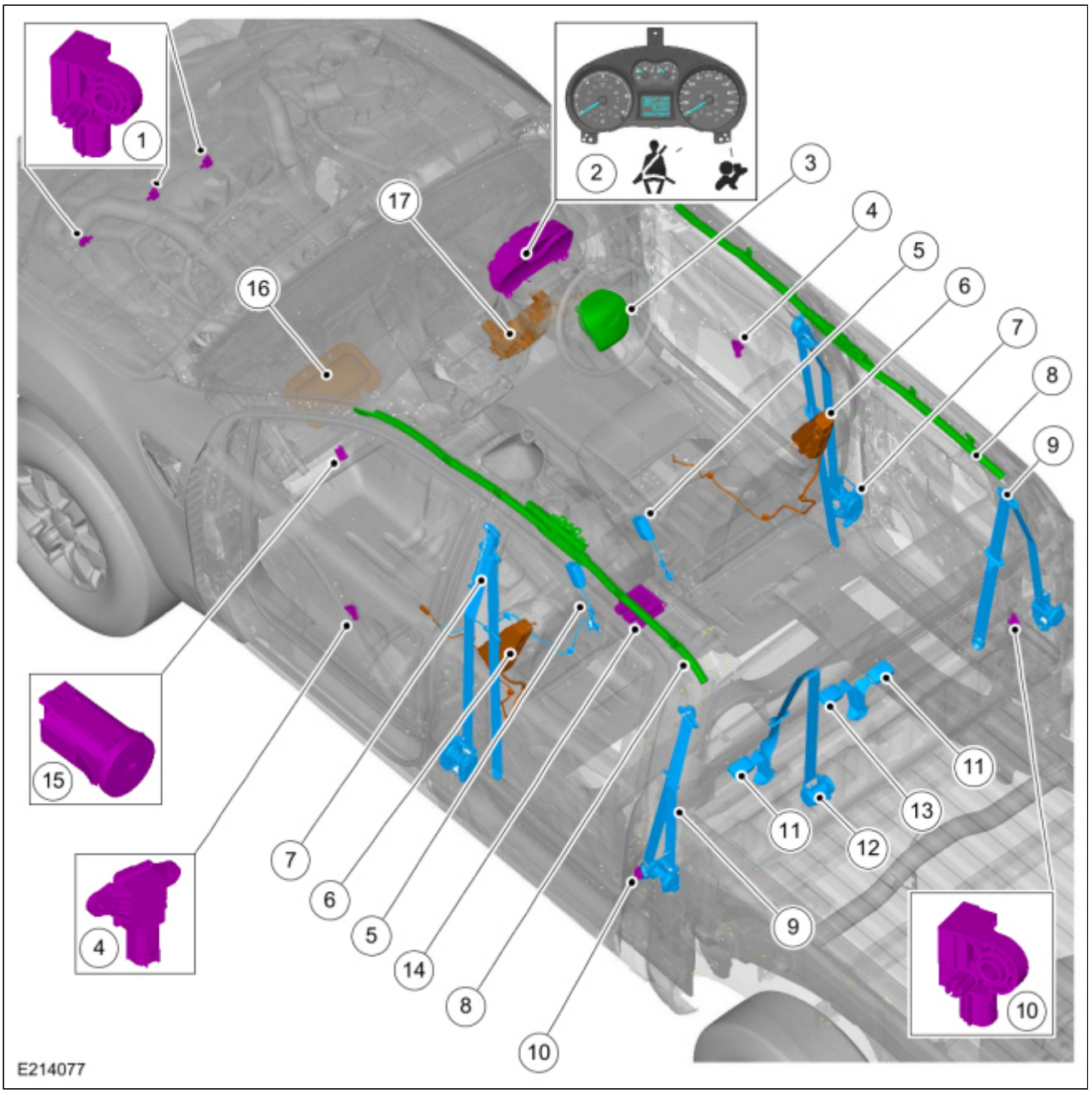


Single cab



Item	Description
1	Instrument cluster with air bag indicator light and safety belt warning light
2	Driver air bag module
3	Side air curtain module
4	Side impact sensor
5	Front safety belt retractor
6	Side air bag module
7	Front safety belt buckle
8	Restraints control module (RCM)
9	Front center safety belt retractor
10	Front center safety belt buckle
11	Passenger airbag deactivation (PAD) switch
12	Passenger air bag module
13	Driver lower air bag module
14	Front impact severity sensor

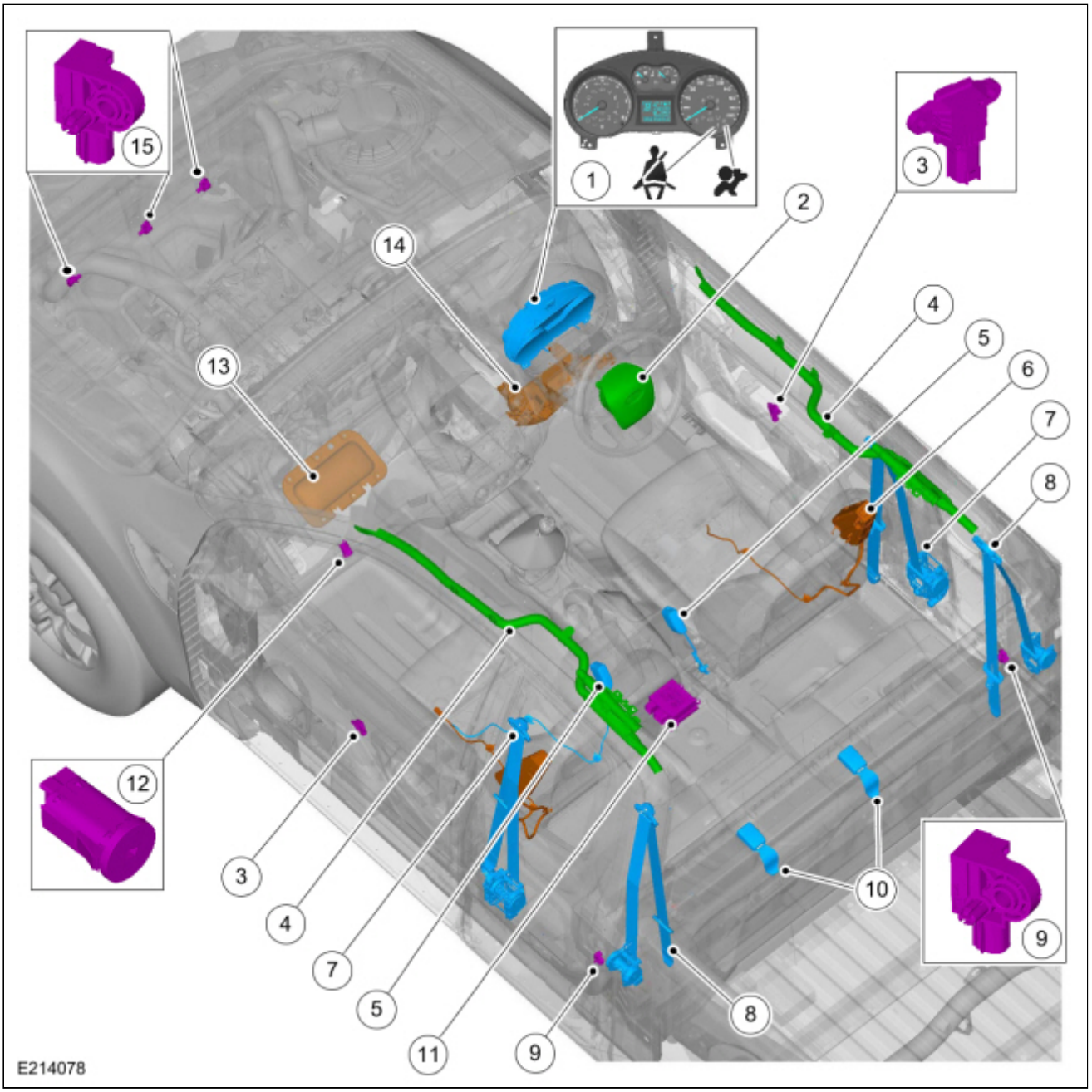
Double cab



Item	Description
1	Front impact severity sensor
2	Instrument cluster with air bag indicator light and safety belt warning light
3	Driver air bag module
4	Side impact sensor
5	Front safety belt buckle
6	Side air bag module
7	Front safety belt retractor
8	Side air curtain module
9	Rear safety belt retractor
10	Side impact sensor (rear)
11	Rear safety belt buckle
12	Rear center safety belt retractor
13	Rear center safety belt buckle

14	Restraints control module (RCM)
15	Passenger airbag deactivation (PAD) switch
16	Passenger air bag module
17	Driver lower air bag module

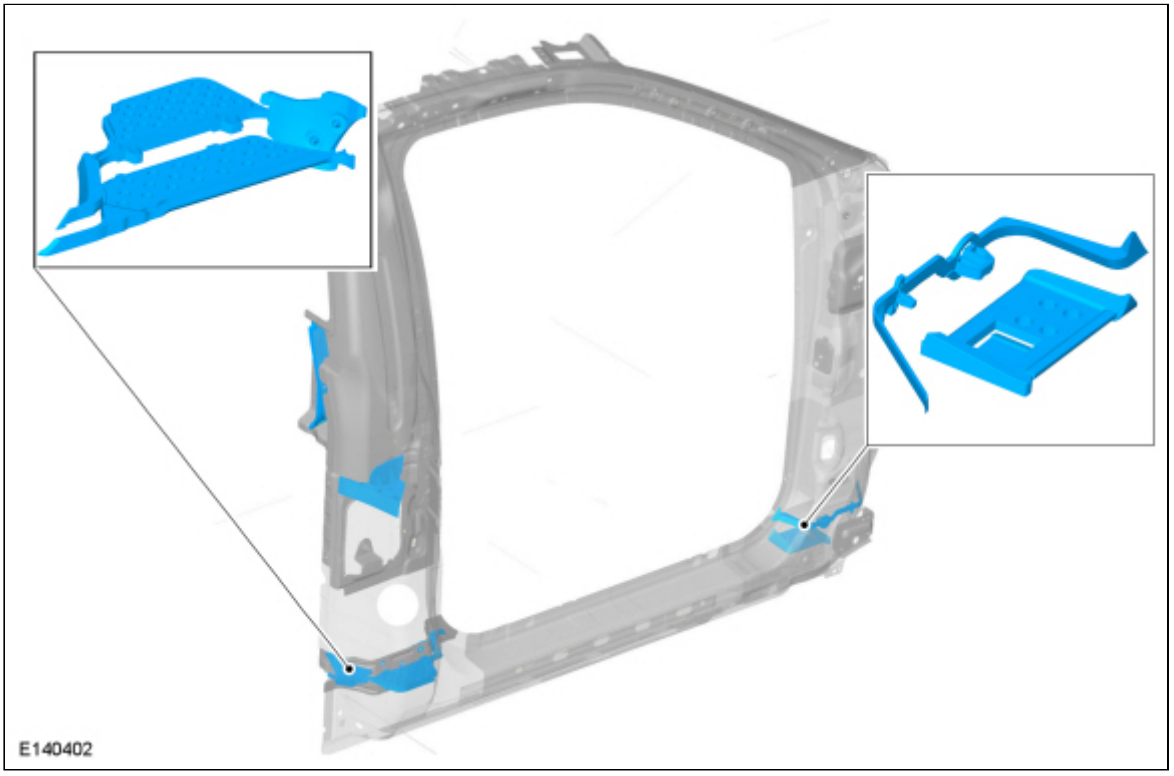
Stretch cab



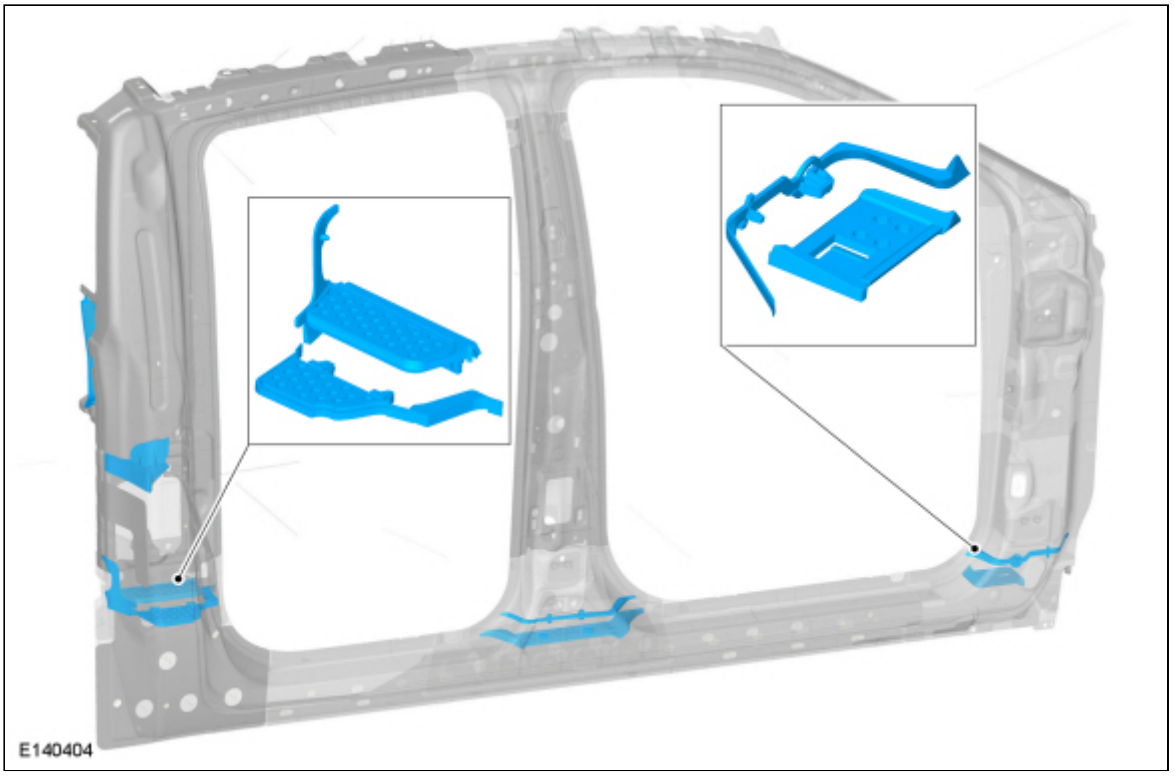
Item	Description
1	Instrument cluster with air bag indicator light and safety belt warning light
2	Driver air bag module
3	Side impact sensor
4	Side air curtain module
5	Front safety belt buckle
6	Side air bag module
7	Front safety belt retractor
8	Rear safety belt retractor

9	Side impact sensor (rear)
10	Rear safety belt buckle
11	Restraints control module (RCM)
12	Passenger airbag deactivation (PAD) switch
13	Passenger air bag module
14	Driver lower airbag module
15	Front impact severity sensor

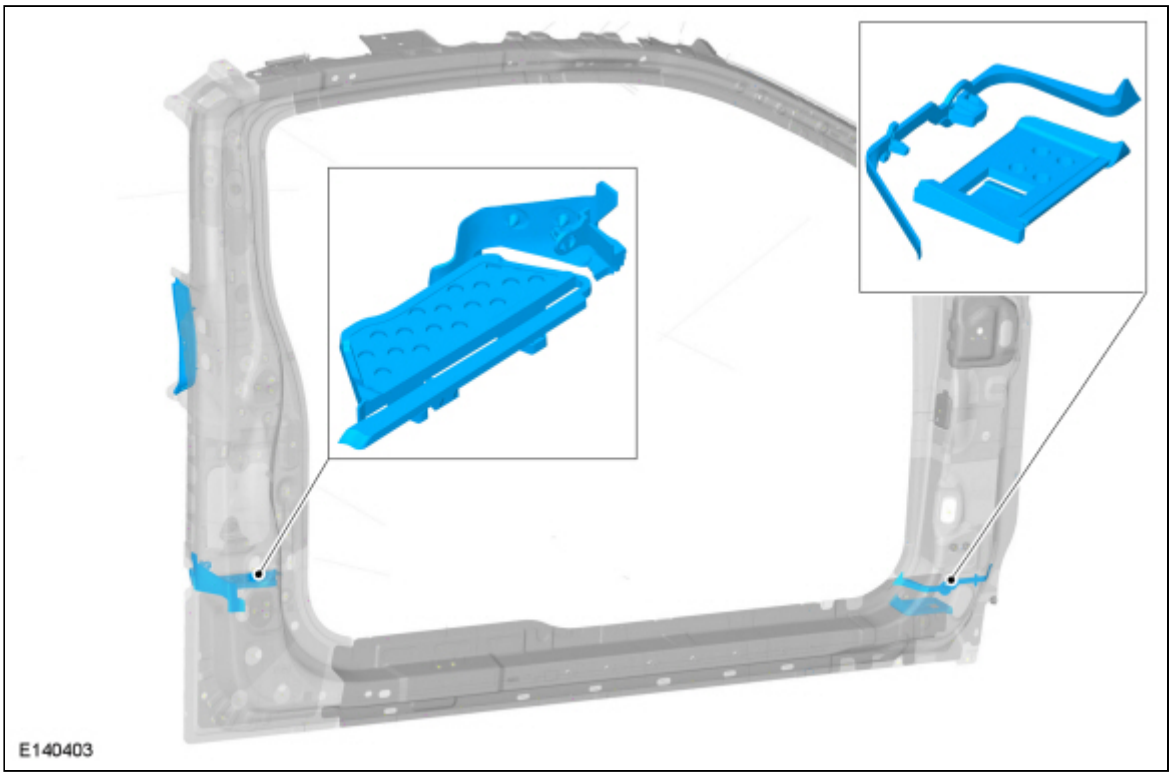
NVH elements, single cab



NVH elements, double cab



NVH elements, stretch cab



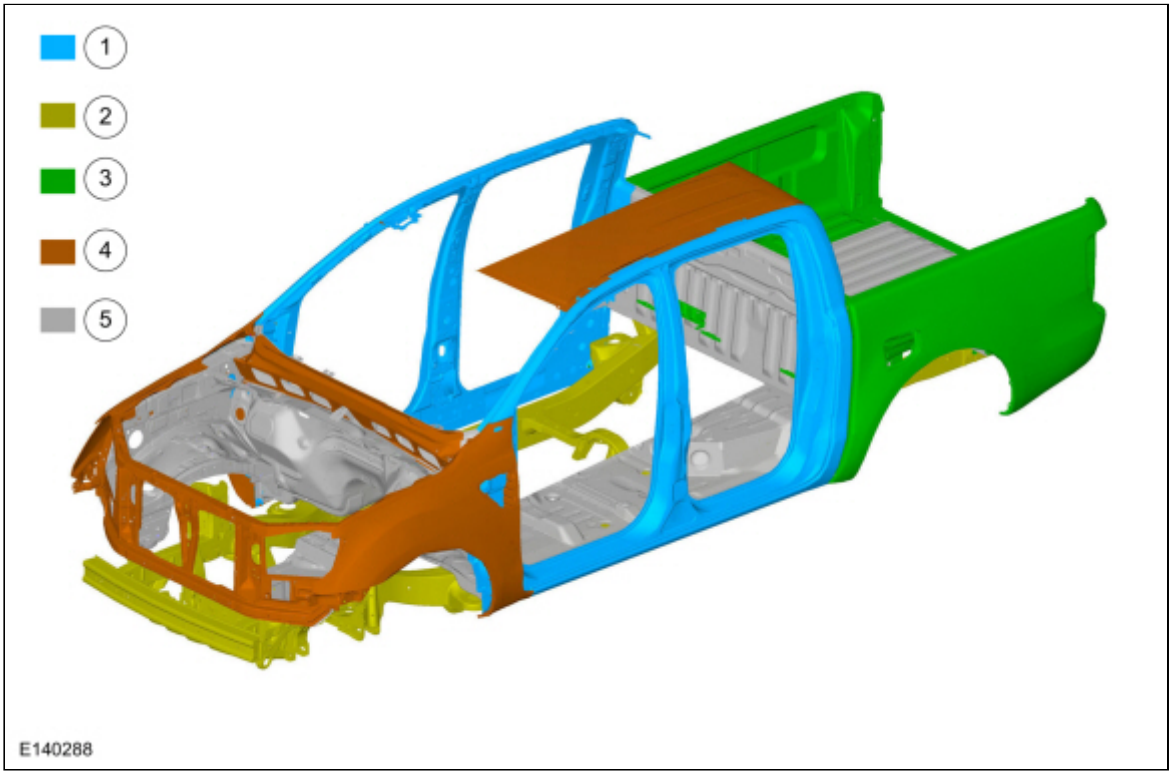
Copyright © 2016 Ford Motor Company

Body and Frame - Overview

Introduction

With the 2011.25 model year, the Ford Ranger is superseded by a completely new vehicle. The T6 is based on the U1 platform which has been developed in co-operation with Mazda. 2-door and 4-door body versions are offered. Within the company the model designation is P375. Overall the vehicle weighs less than its predecessor. However, it offers increased occupant safety through the use of high-strength and super-high-strength steels. The high-strength and super-high-strength steels used make extra demands on the tools to be employed for some body repairs.

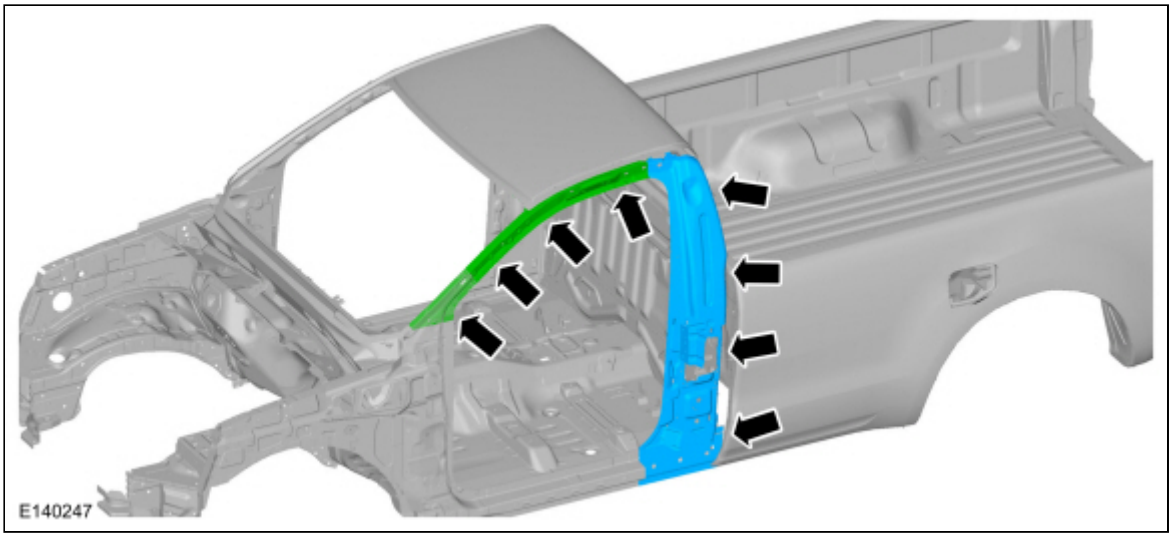
High-strength and super-high-strength steels



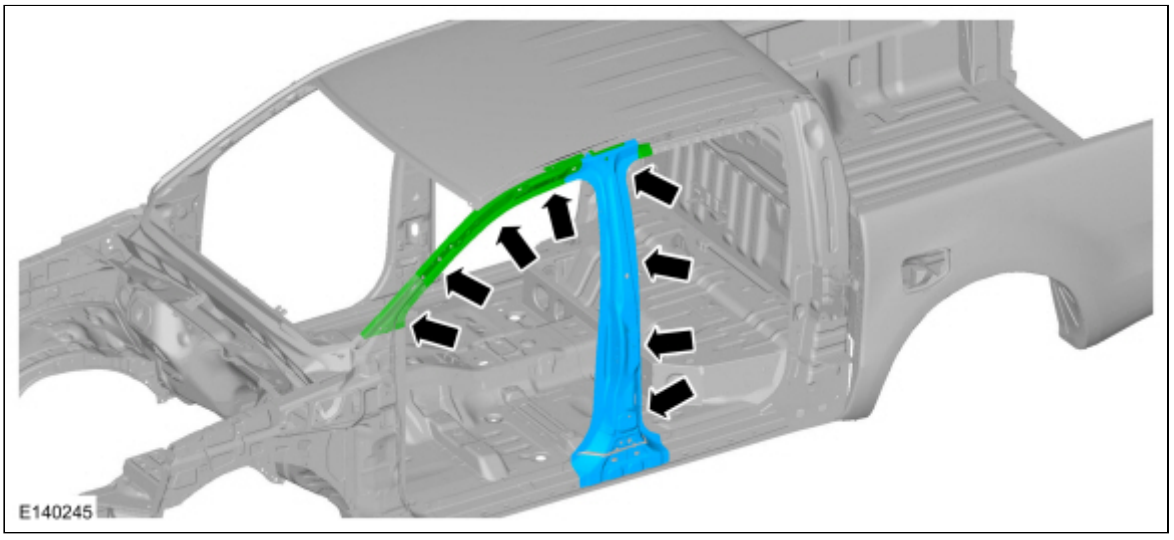
Item	Description
1 UHSS (> 800 MPa)	
2 EHSS (380 - 800 MPa)	
3 VHSS (280 - 380 MPa)	
4 HSS (180 - 280 MPa)	
5 MS (< 180 MPa)	

Usibor steel

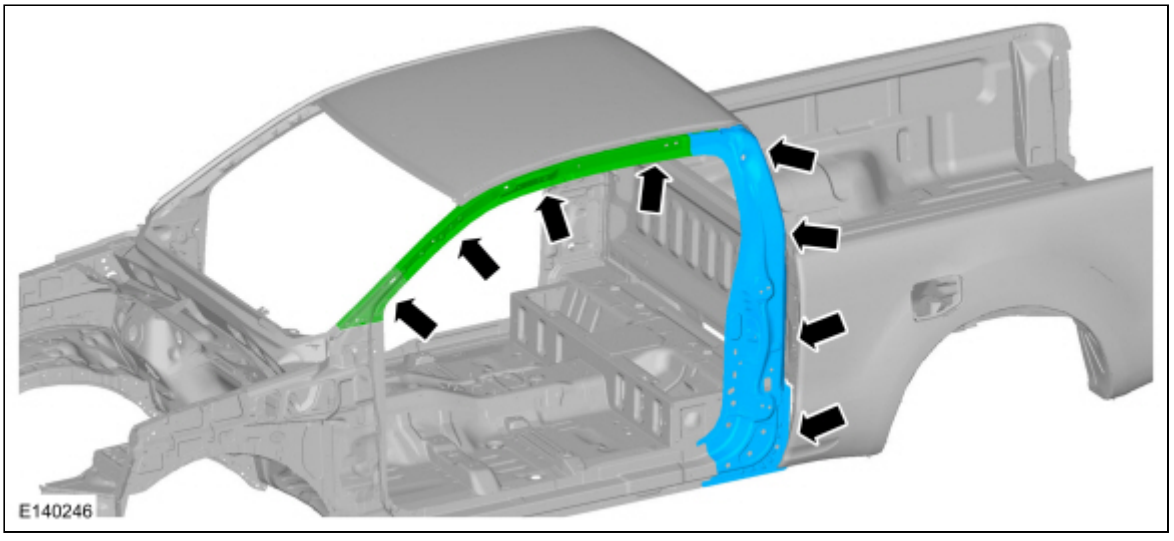
Single cab



Double cab



Super cab



The reinforcements at the A- and B- pillars are made of Usibor steel. This material has a yield strength of 1300 MPa.

Sectional repairs must NOT be performed on components made of Usibor !

The required continuous MIG weld seam in the cut area would cause structural changes in the steel and lead to a significant loss in strength.

In the event of damage, the complete component must therefore always be renewed.

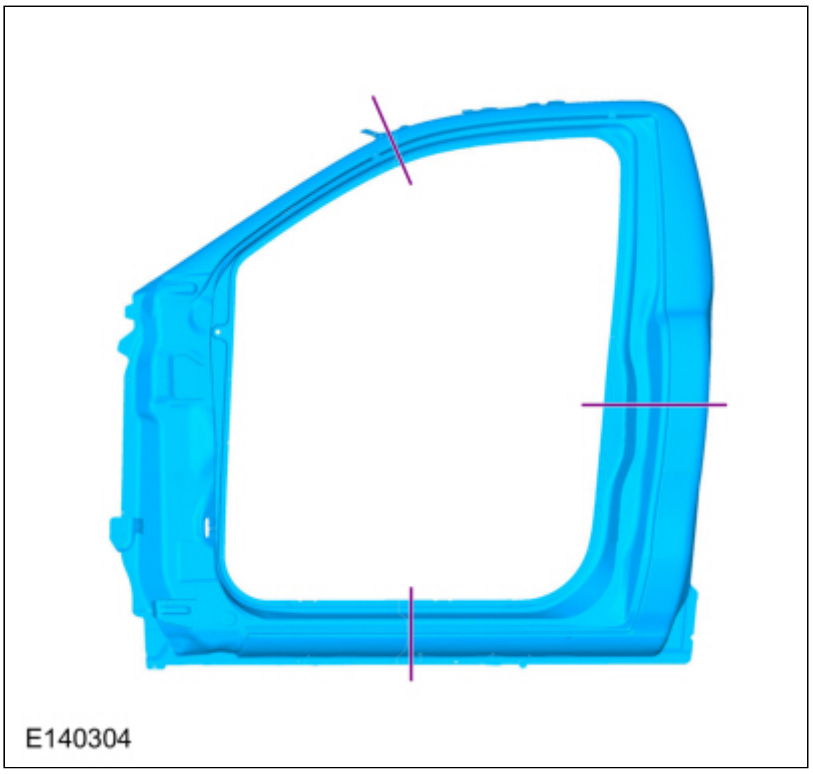
Also, because of the strength of these components, it is not always possible to work them with conventional body

repair tools.

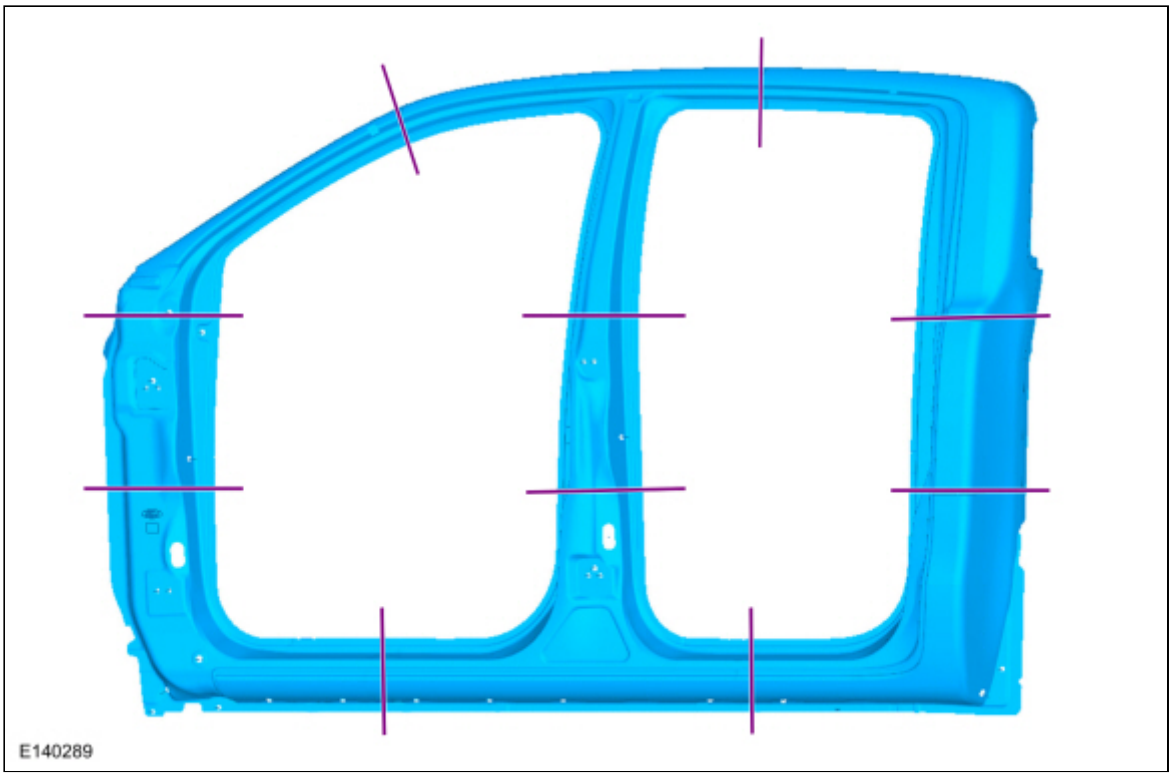
or welding work (resistance spot welding and inert gas puddle welding), additional preparation work and/or special welding equipment are required.

Sheet metal parts for quarter panel partial replacement

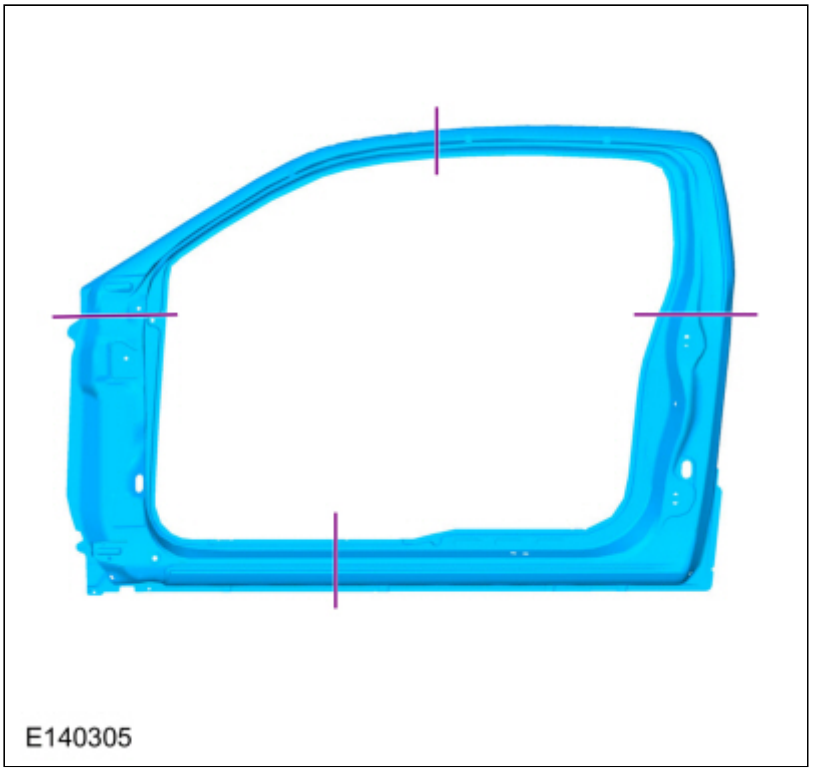
Single cab



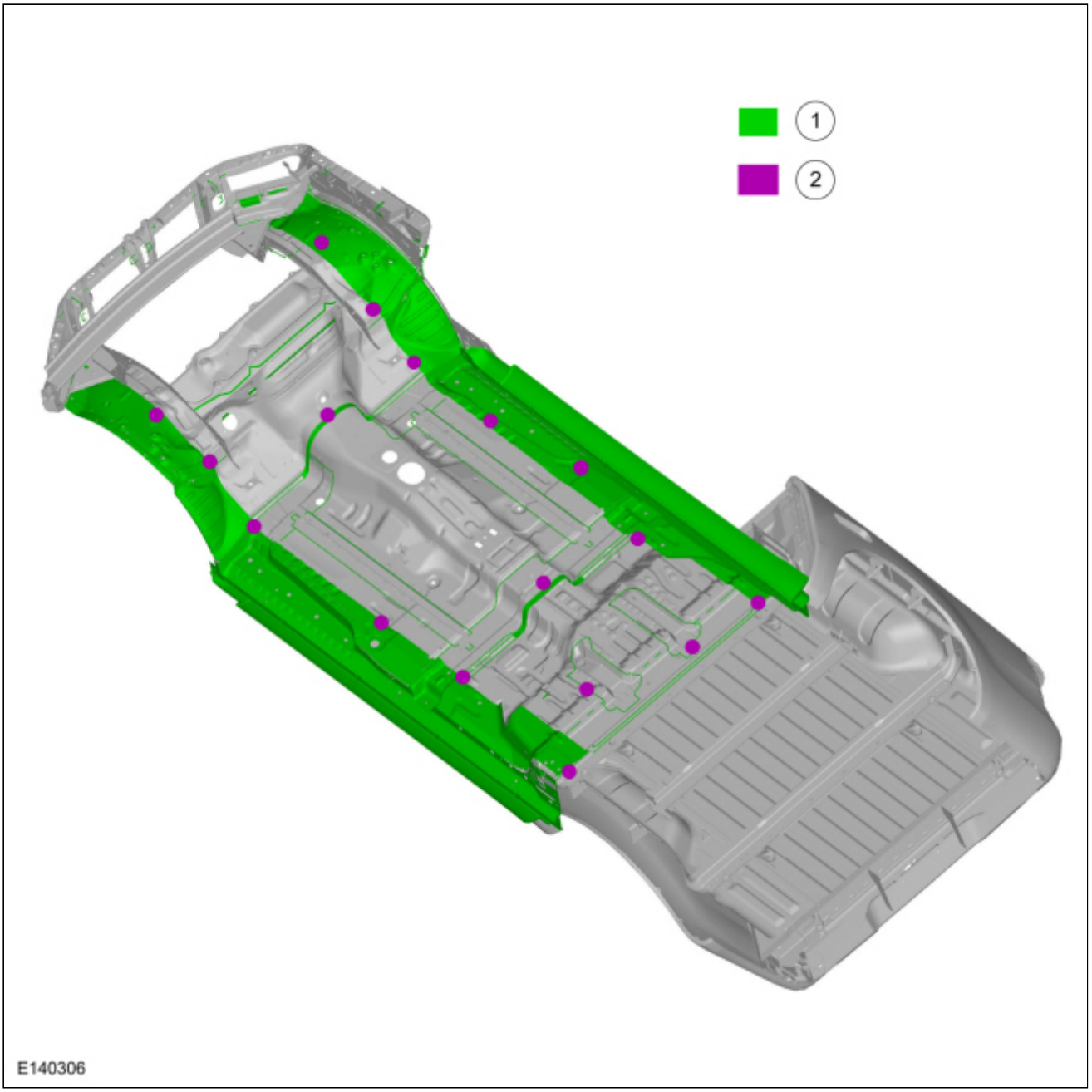
Double cab



Super cab



Anti corrosion protection



Item	Description
1 Underbody PVC stone chip protection	
2 Injection points for cavity wax protection	

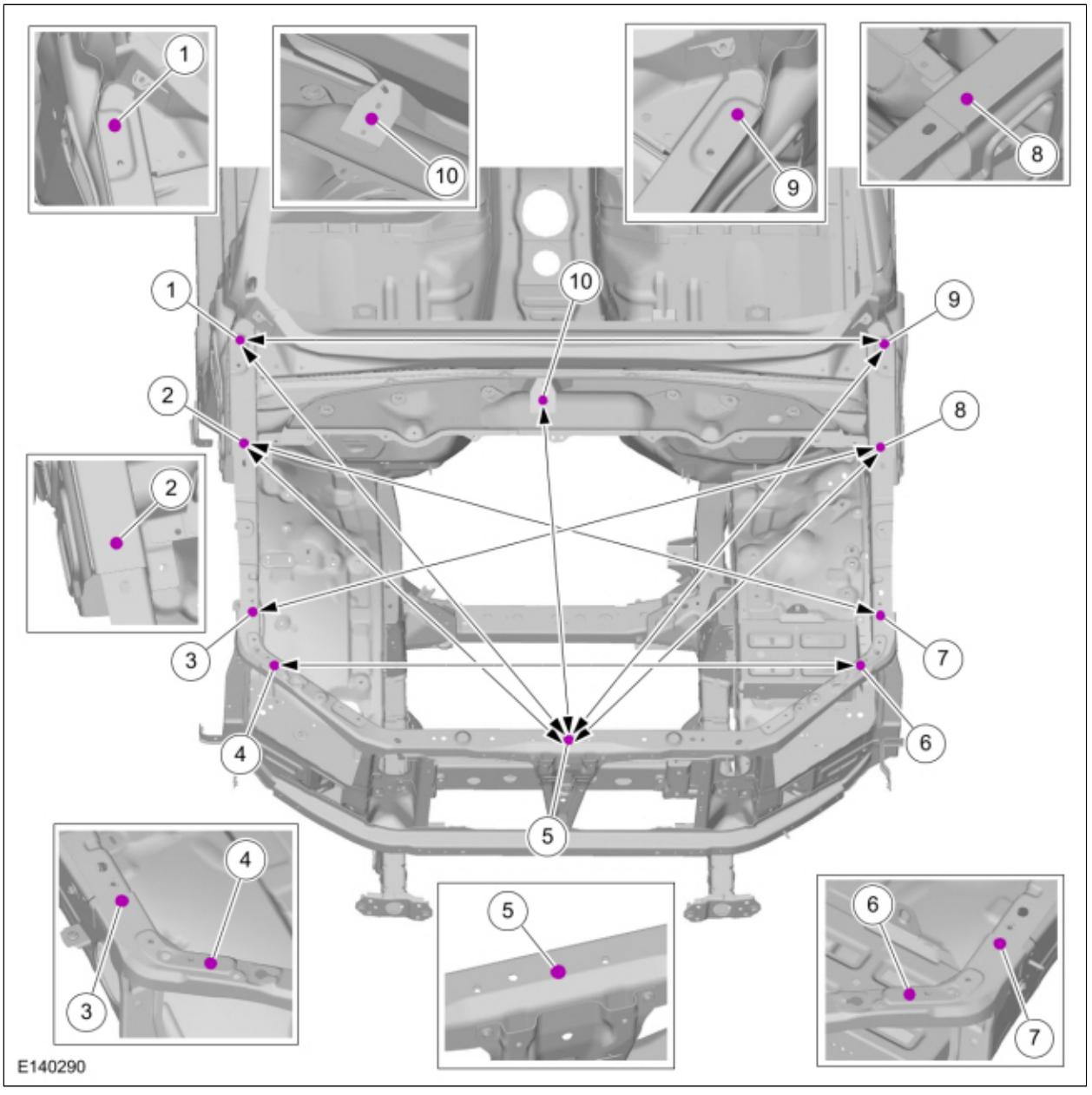
Copyright © 2016 Ford Motor Company

Body Tolerance Check

1. Front end body dimensions, all vehicles
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the centre of each hole or panel edge using a symmetrically adjusted measuring gauge.

Measuring points and dimensions

1 - 5 = 1258 mm	4 - 6 = 1282 mm
1 - 9 = 1527 mm	5 - 8 = 1064 mm
2 - 5 = 1062 mm	5 - 9 = 1264 mm
2 - 7= 1553 mm	5 - 10 = 845 mm
3 - 8 = 1553 mm	

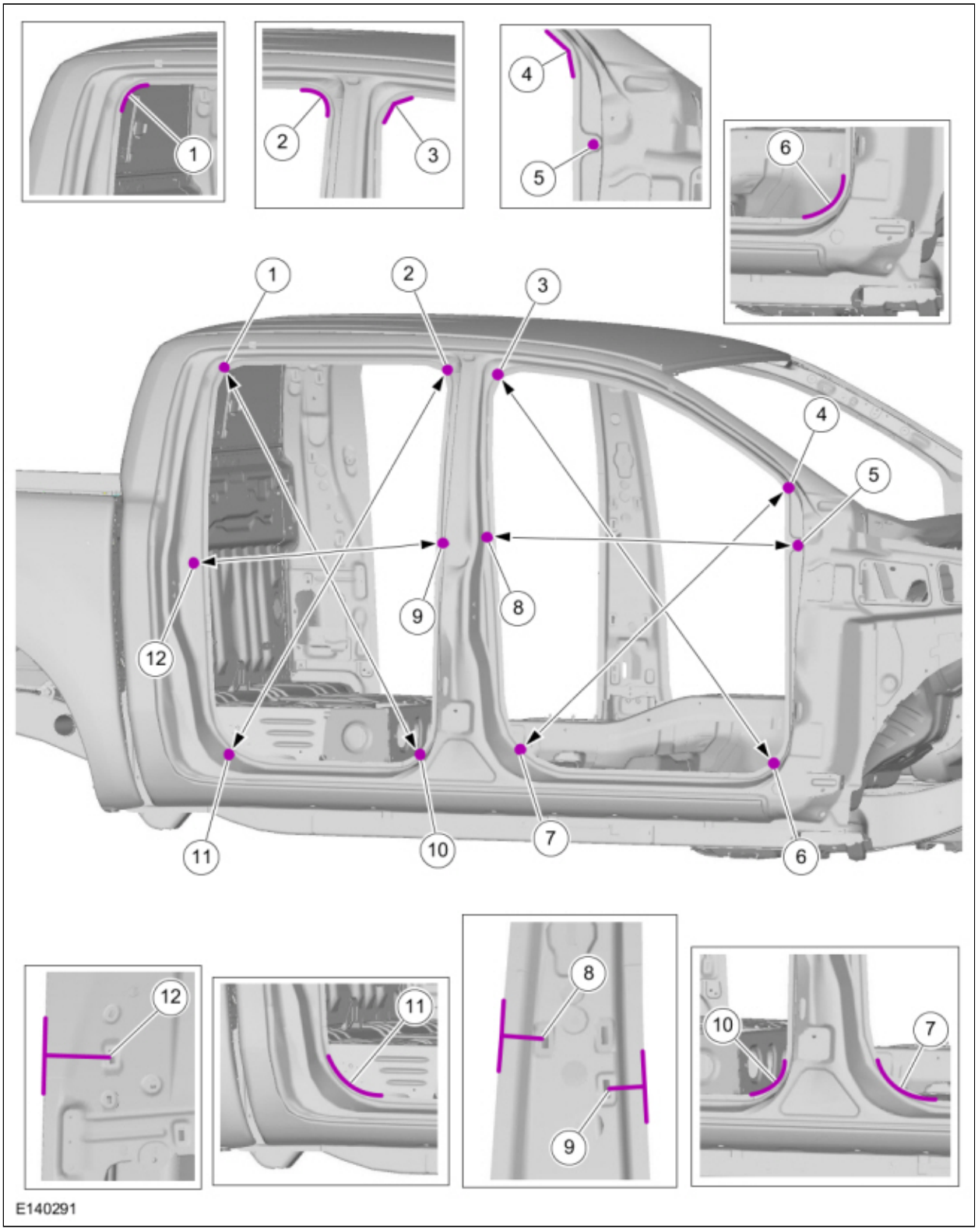


2. Body dimensions, side view double cab

- All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the edge of the steel panel using a symmetrically adjusted measuring gauge.
- Measuring points 1, 2, 3, 4, 6, 7, 10 and 11 are measured in the curve and represent the greatest distance to the measuring point opposite.
- The detailed views of measuring points 8, 9 and 12 are shown looking from the vehicle interior outwards.
- The detailed view of measuring point 5 is measured in the hole and represent the greatest distance to the measuring point opposite.

Measuring points and dimensions

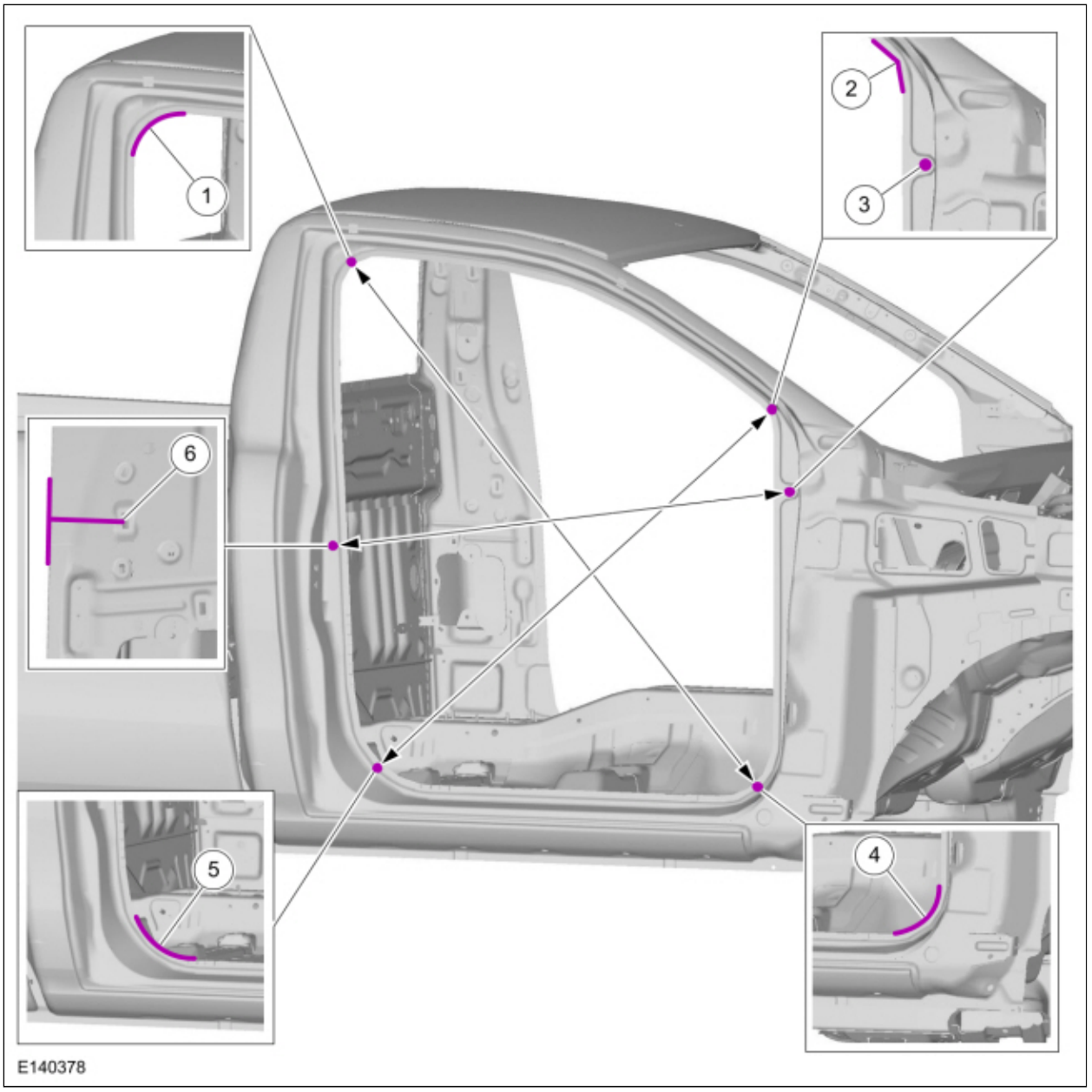
1 - 10 = 1243 mm	4 - 7 = 1054 mm
2 - 11 = 1280 mm	5 - 8 = 1116 mm
3 - 6 = 1380 mm	9 - 12 = 812 mm



3. Body dimensions, side view single cab
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the edge of the steel panel using a symmetrically adjusted measuring gauge.
   - Measuring points 1, 2, 4 and 5 are measured in the curve and represent the greatest distance to the measuring point opposite.
   - The detailed view of measuring point 3 is measured in the hole and represent the greatest distance to the measuring point opposite.
   - The detailed view of measuring point 6 is shown looking from the vehicle interior outwards.

Measuring points and dimensions

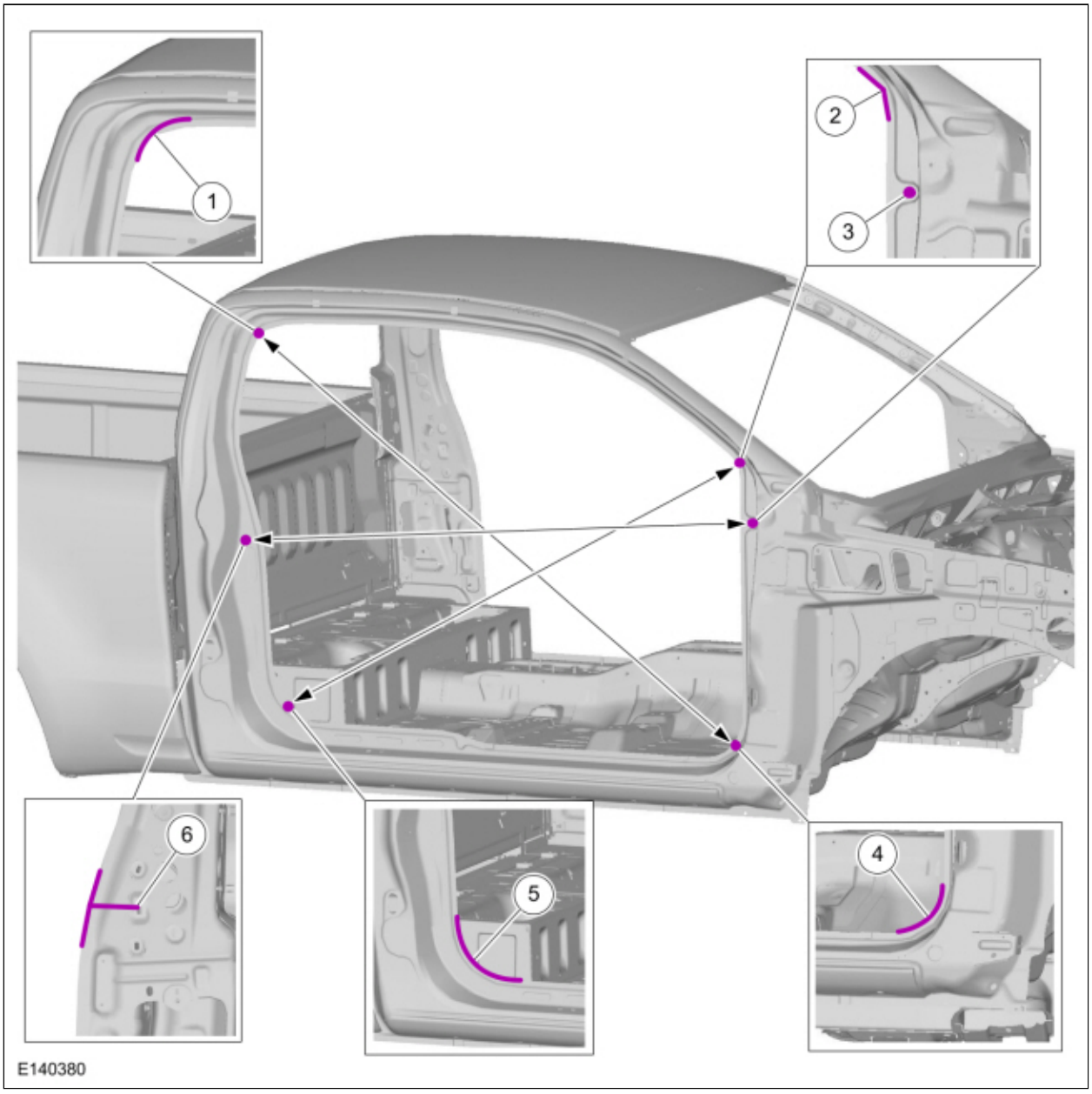
1 - 4 = 1323 mm	3 - 6 = 1323 mm
2 - 5 = 949 mm	



4. Body dimensions, side view stretch cab
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the edge of the steel panel using a symmetrically adjusted measuring gauge.
   - Measuring points 1, 2, 4 and 5 are measured in the curve and represent the greatest distance to the measuring point opposite.
   - The detailed view of measuring point 3 is measured in the hole and represent the greatest distance to the measuring point opposite.
   - The detailed view of measuring point 6 is shown looking from the vehicle interior outwards.

Measuring points and dimensions

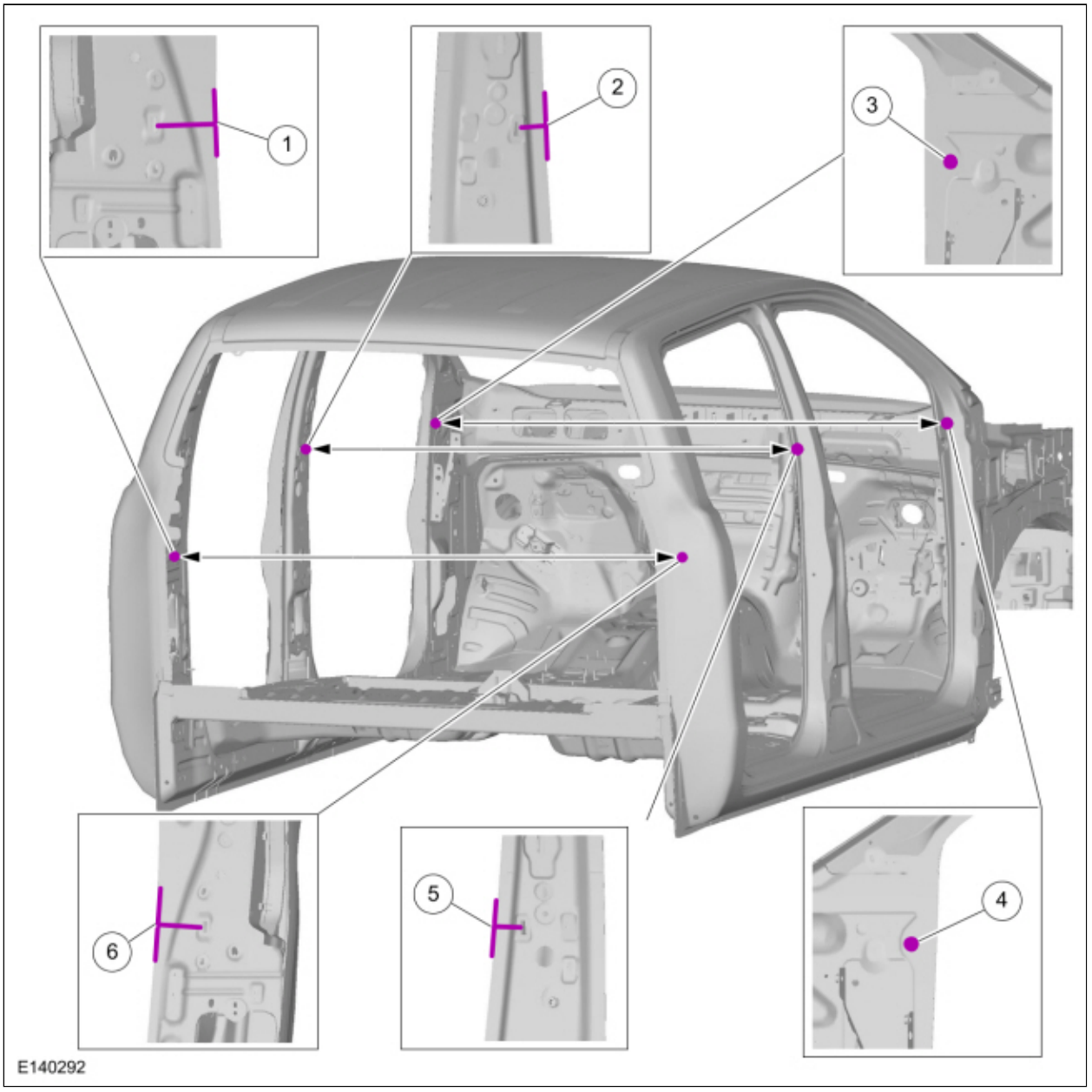
1 - 4 = 1799 mm	3 - 6 = 1543 mm
2 - 5 = 1516 mm	



5. Body dimensions, interior double cab
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.
   - Measuring points 3 and 4are measured in the hole and represent the greatest distance to the measuring point opposite.
   - The detailed views of measuring points 1, 2, 5 and 6 are shown looking from the vehicle interior outwards.

Measuring points and dimensions

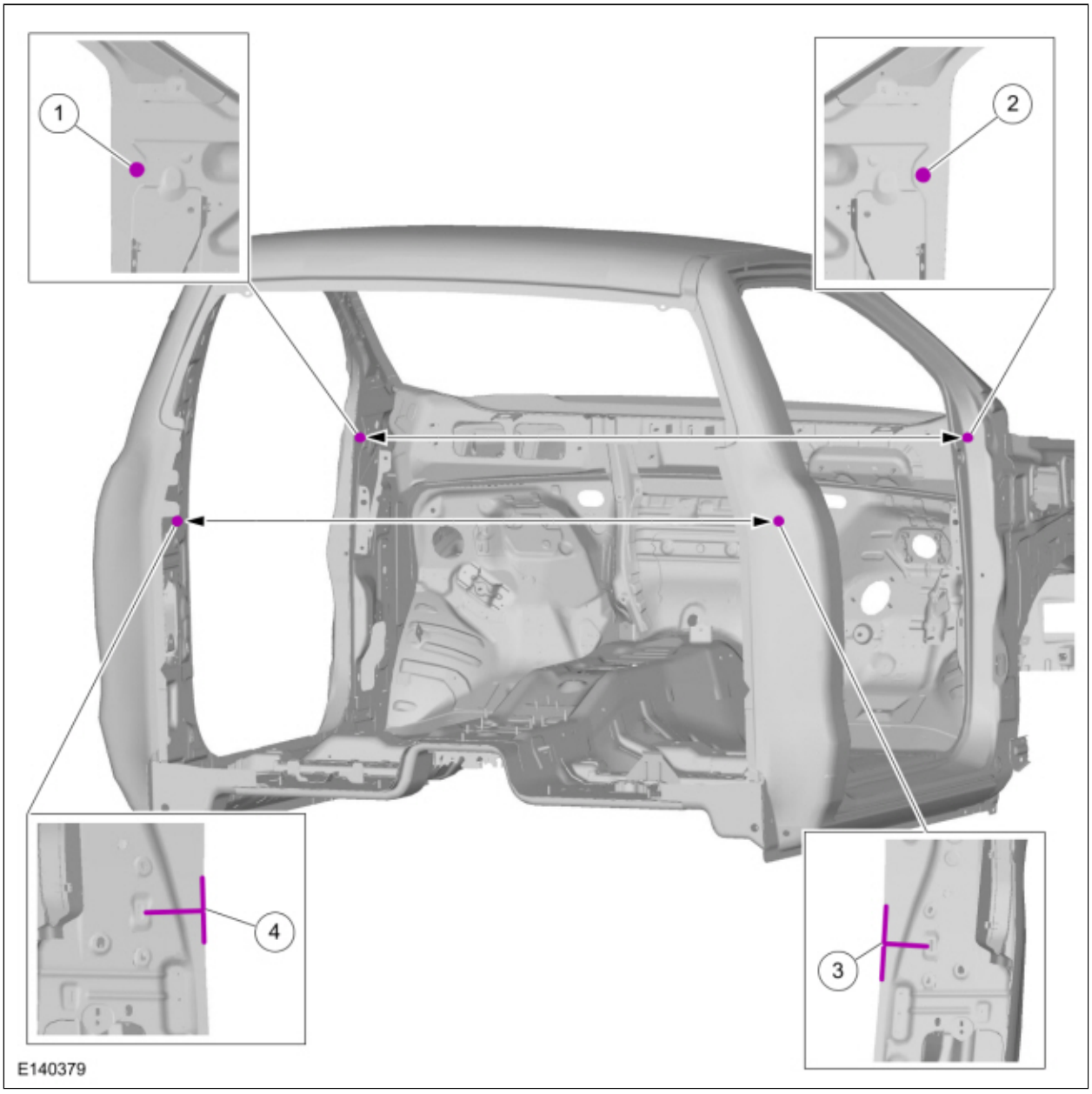
1 - 6 = 1513 mm	3 - 4 = 1459 mm
2 - 5 = 1478 mm	



6. Body dimensions, interior single cab
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.
   - Measuring points 1 and 2 are measured in the hole and represent the greatest distance to the measuring point opposite.
   - The detailed views of measuring points 3 and 4 are shown looking from the vehicle interior outwards.

Measuring points and dimensions

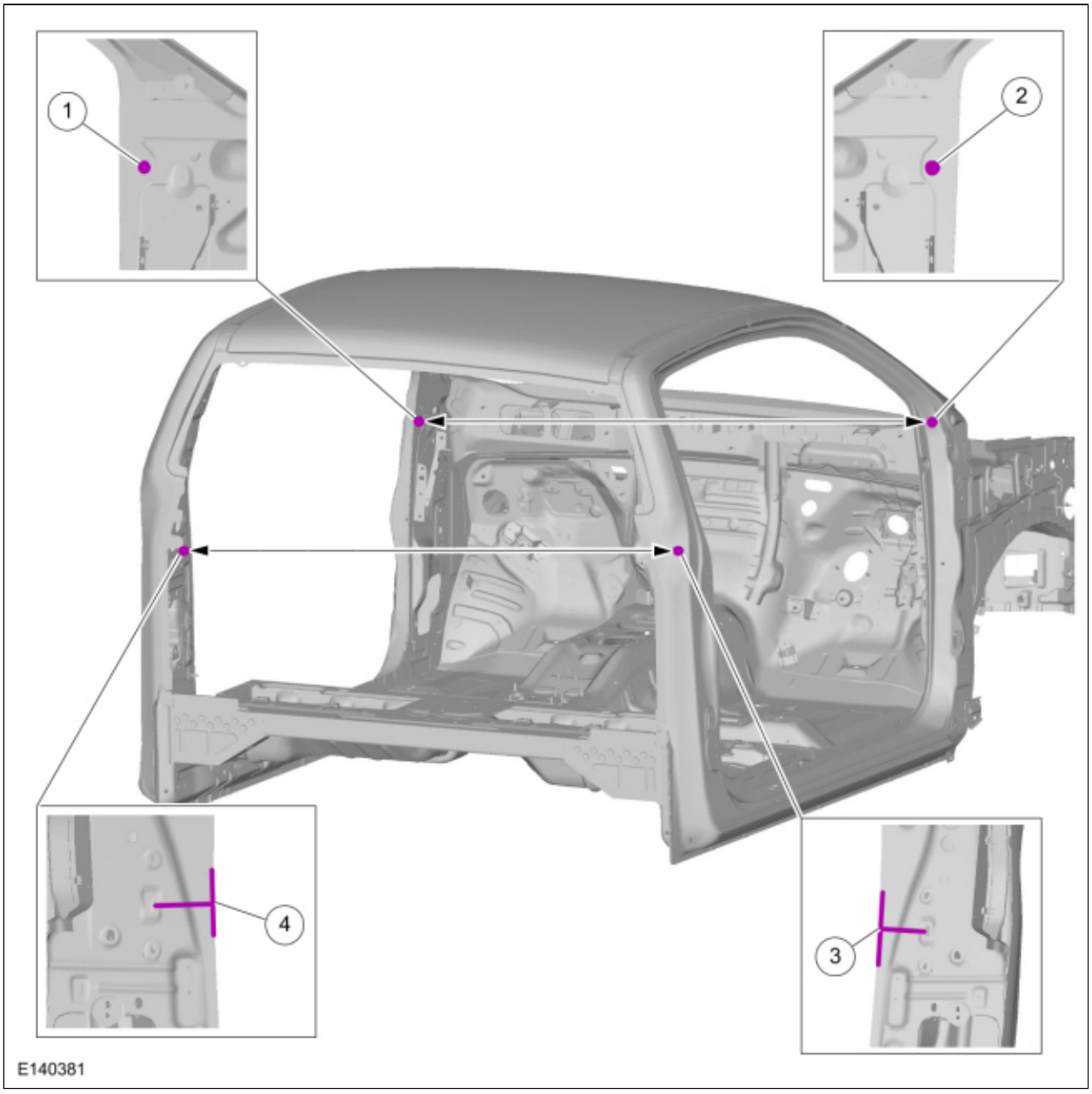
1 - 2 = 1489 mm	3 - 4 = 1460 mm



7. Body dimensions, interior strecth cab
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.
   - Measuring points 1 and 2 are measured in the hole and represent the greatest distance to the measuring point opposite.
   - The detailed views of measuring points 3 and 4 are shown looking from the vehicle interior outwards.

Measuring points and dimensions

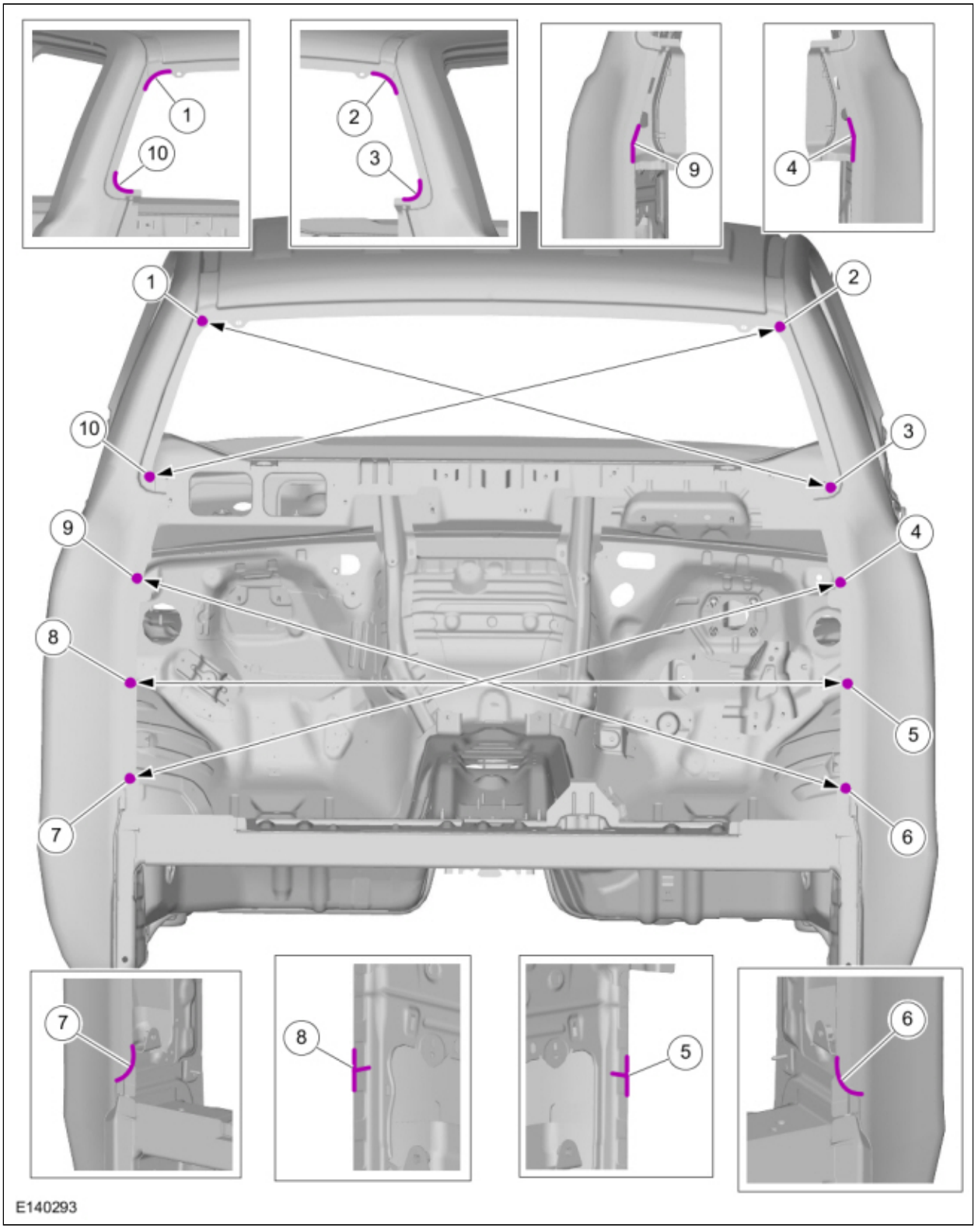
1 - 2 = 1460 mm	3 - 4 = 1472 mm



8. Body dimensions, rear all vechicles
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.
   - Measuring points 1, 2, 3, 4, 6, 9, and 10 are measured in the curve and represent the greatest distance to the measuring point opposite.
   - The detailed views of measuring points 5 and 8 are shown looking from the vehicle interior outwards.

Measuring points and dimensions

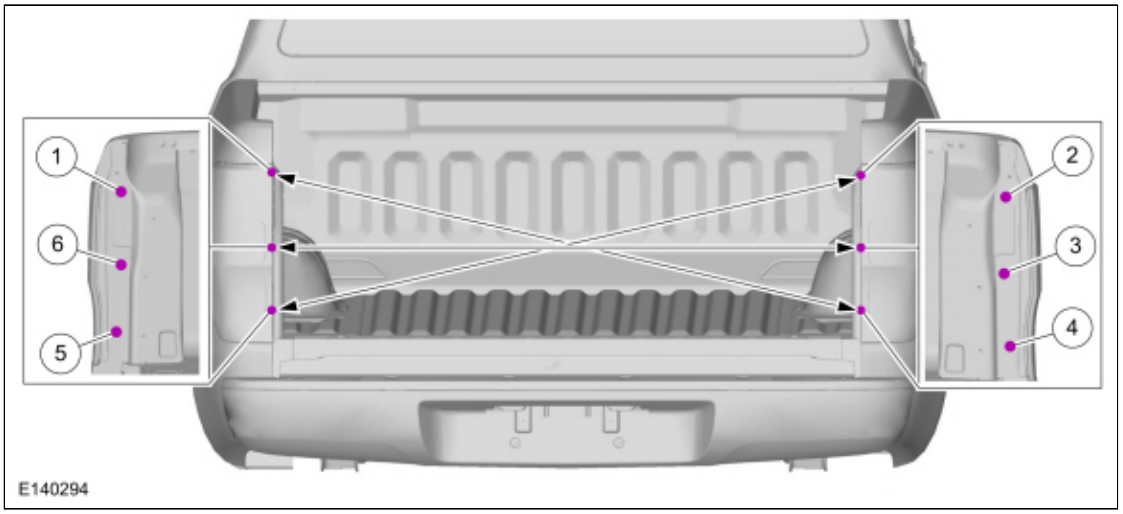
1 - 3 = 1292 mm	4 - 7 = 1455 mm
2 - 10 = 1292 mm	5 - 8 = 1412 mm
6 - 9 = 1453 mm	



9. Tailgate opening dimensions, all vechicles
    - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.

Measuring points and dimensions

1 - 4 = 1456 mm	5 - 2 = 1456 mm
6 - 3 = 1409 mm	

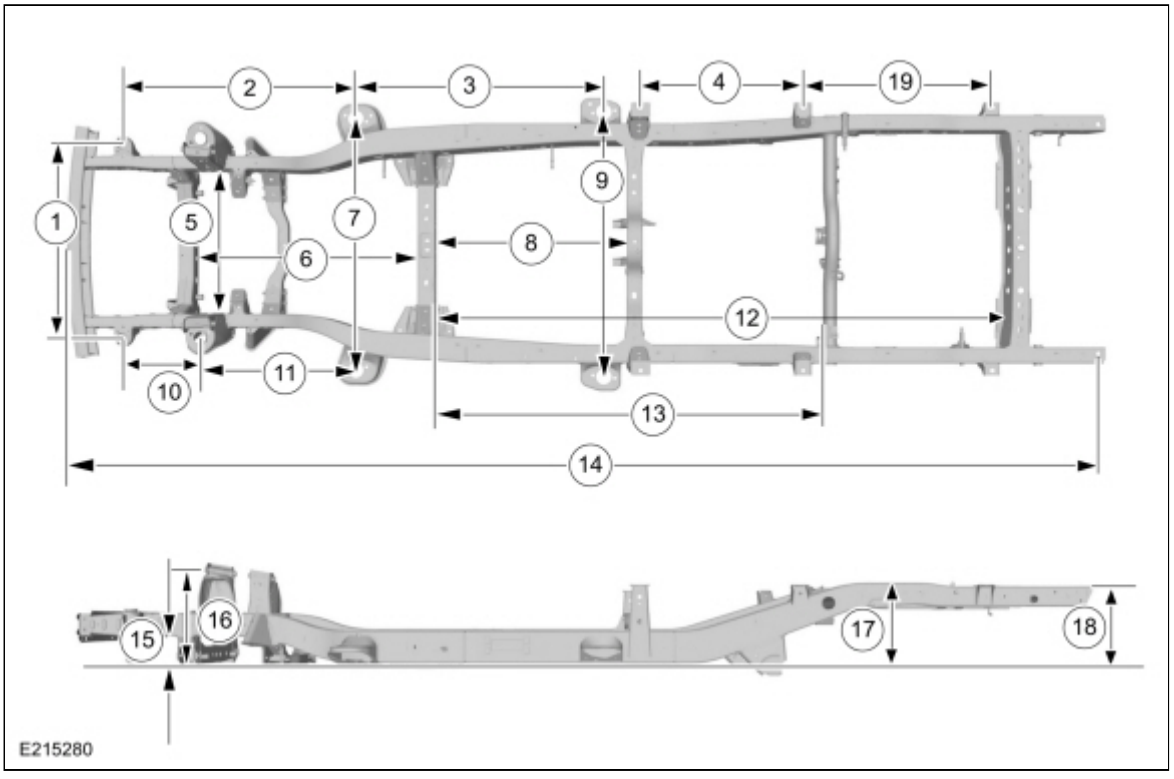


Copyright © 2016 Ford Motor Company

Frame Tolerance Check

1. Frame Dimensions (Underbody single Cab 2WD)

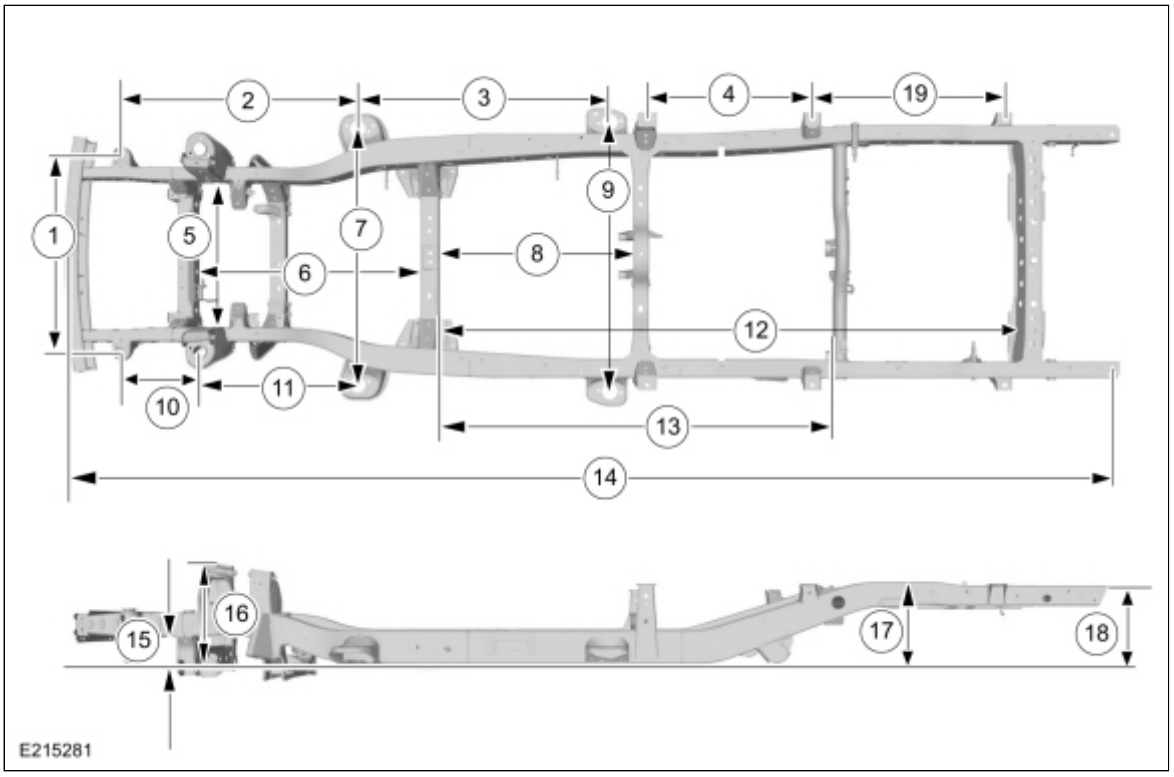
Item	Dimensions in mm	Item	Dimensions in mm
1	942	11	668
2	1092	12	2791
3	1228	13	1879
4	768	14	4929
5	700	15	217
6	1082	16	554
7	1248	17	372
8	968	18	354
9	1270	19	892
10	424		



2. Frame Dimensions (Underbody single Cab 4WD)

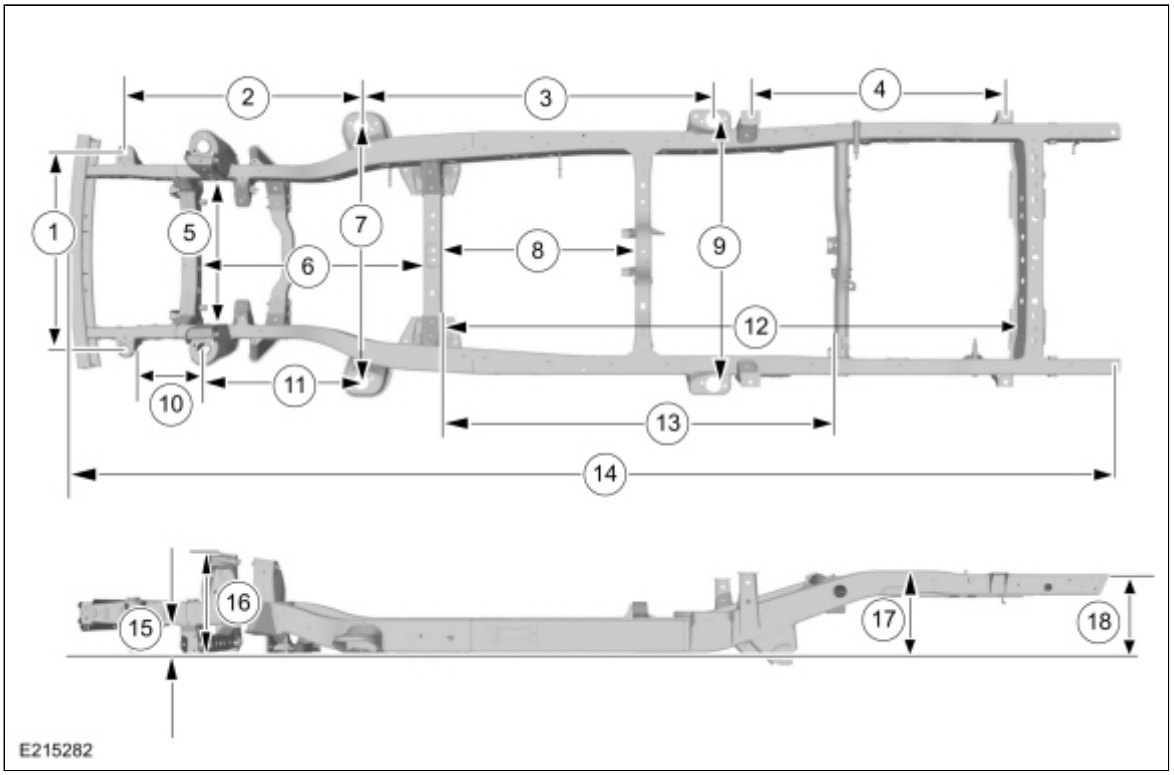
Item	Dimensions in mm	Item	Dimensions in mm
1	942	11	668
2	1092	12	2791
3	1228	13	1879
4	768	14	4929

5	700	15	217
6	1082	16	554
7	1248	17	372
8	968	18	354
9	1270	19	892
10	424		



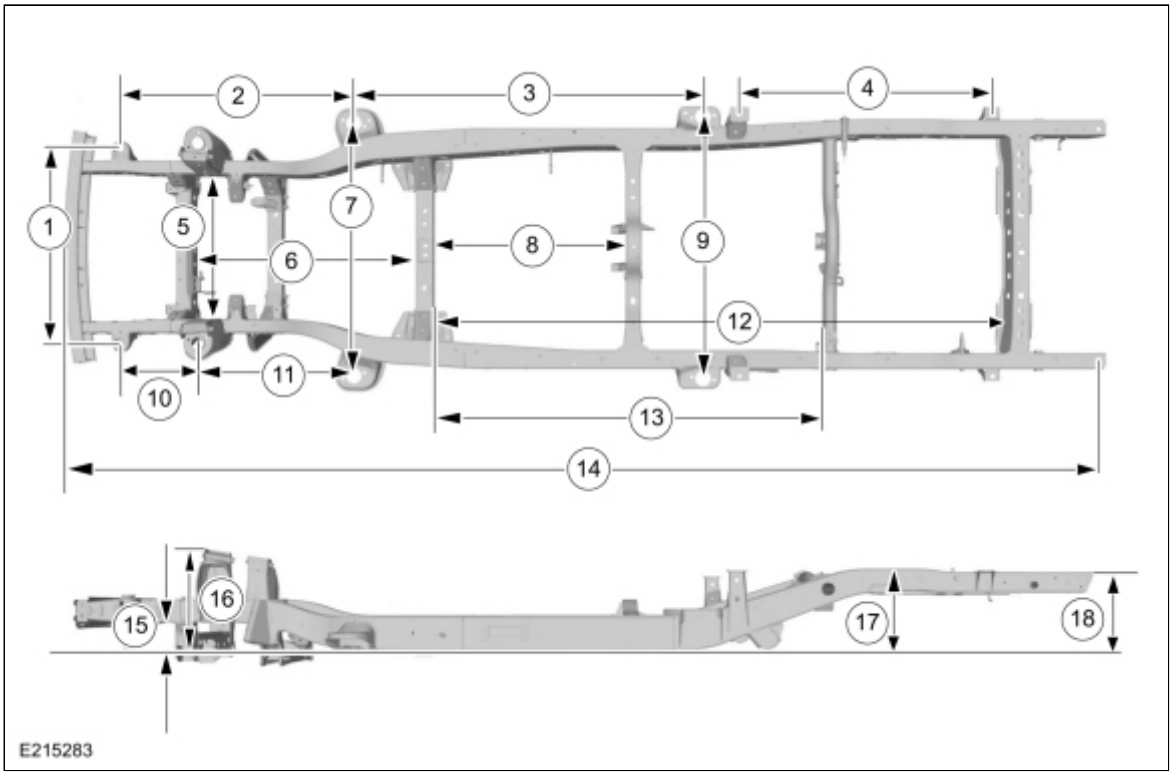
3. Frame Dimensions (Underbody Stretch Cab 2WD)

Item	Dimensions in mm	Item	Dimensions in mm
1	942	10	424
2	1092	11	668
3	1713	12	2764
4	1191	13	1895
5	700	14	4929
6	1089	15	217
7	1248	16	554
8	969	17	372
9	1270	18	354



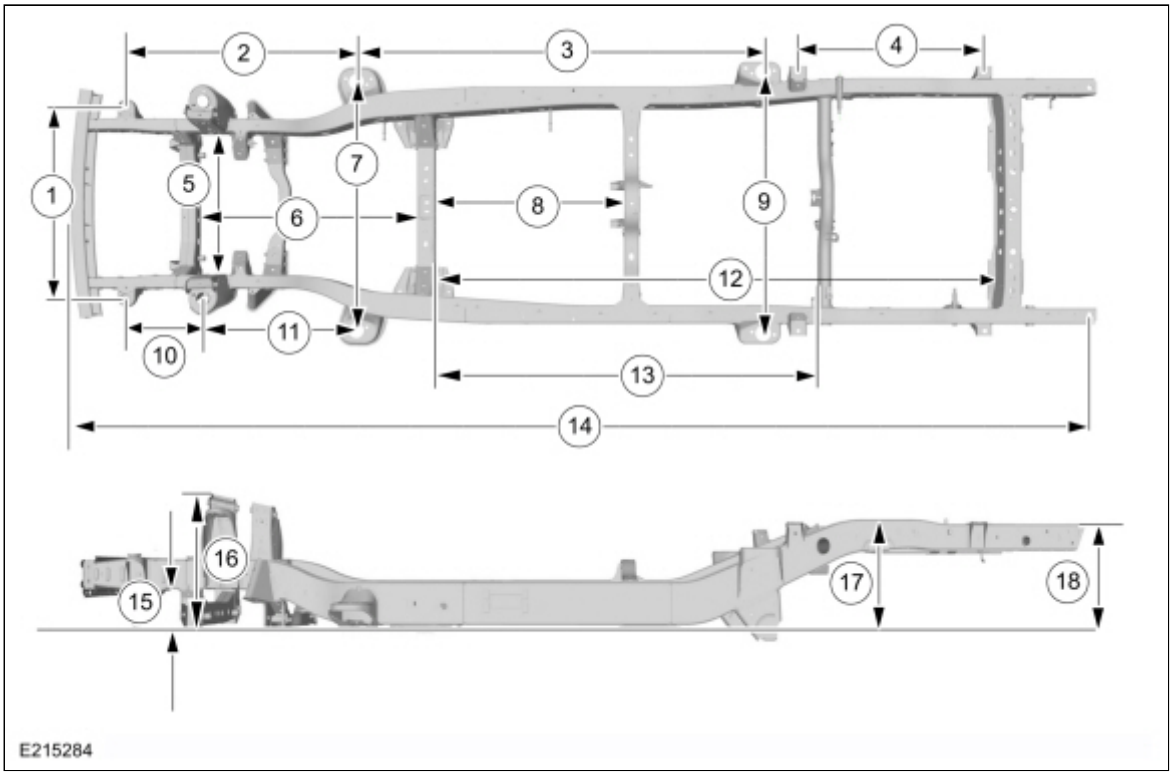
4. Frame Dimensions (Underbody Stretch Cab 4WD)

Item	Dimensions in mm	Item	Dimensions in mm
1	942	10	424
2	1092	11	668
3	1713	12	2764
4	1191	13	1895
5	700	14	4929
6	1089	15	217
7	1248	16	554
8	969	17	372
9	1270	18	354



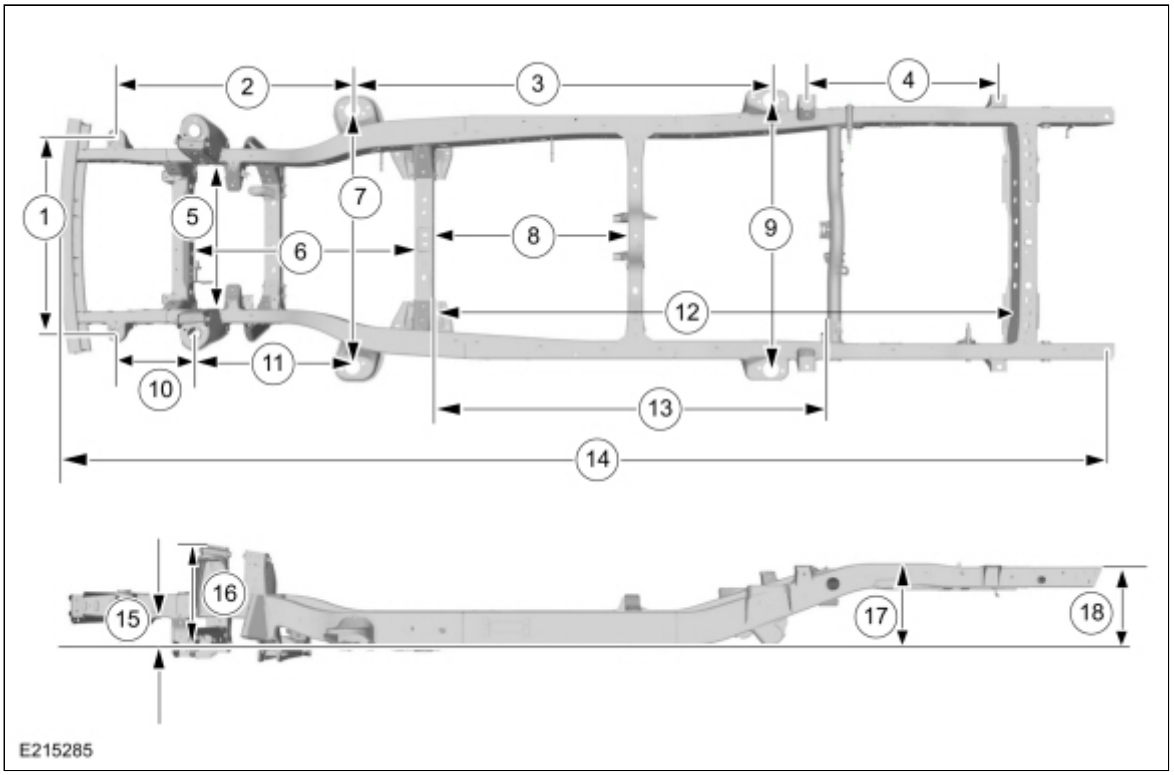
5. Frame Dimensions (Underbody Double Cab 2WD)

Item	Dimensions in mm	Item	Dimensions in mm
1	942	10	424
2	1092	11	668
3	2011	12	2778
4	892	13	1879
5	700	14	4929
6	1082	15	217
7	1248	16	554
8	972	17	372
9	1270	18	354



6. Frame Dimensions (Underbody Double Cab 4WD)

Item	Dimensions in mm	Item	Dimensions in mm
1	942	10	424
2	1092	11	668
3	2011	12	2778
4	892	13	1879
5	700	14	4929
6	1082	15	217
7	1248	16	554
8	972	17	372
9	1270	18	354



Copyright © 2016 Ford Motor Company

Fender Apron Panel Reinforcement

Special Tool(s) / General Equipment

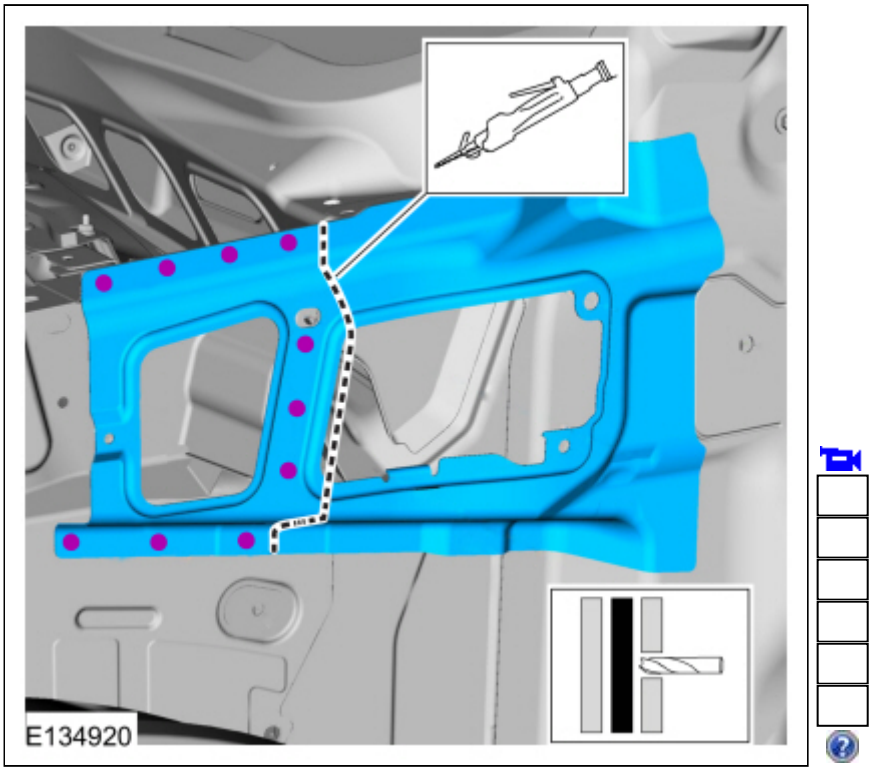
Air Body Saw
Spot Weld Drill Bit

Removal

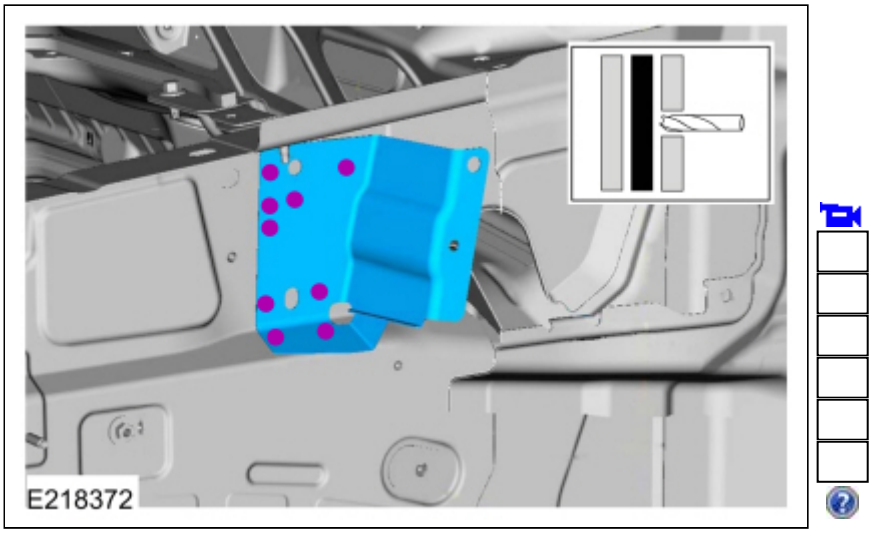
NOTE: *Removal steps in this procedure may contain installation details.*

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).

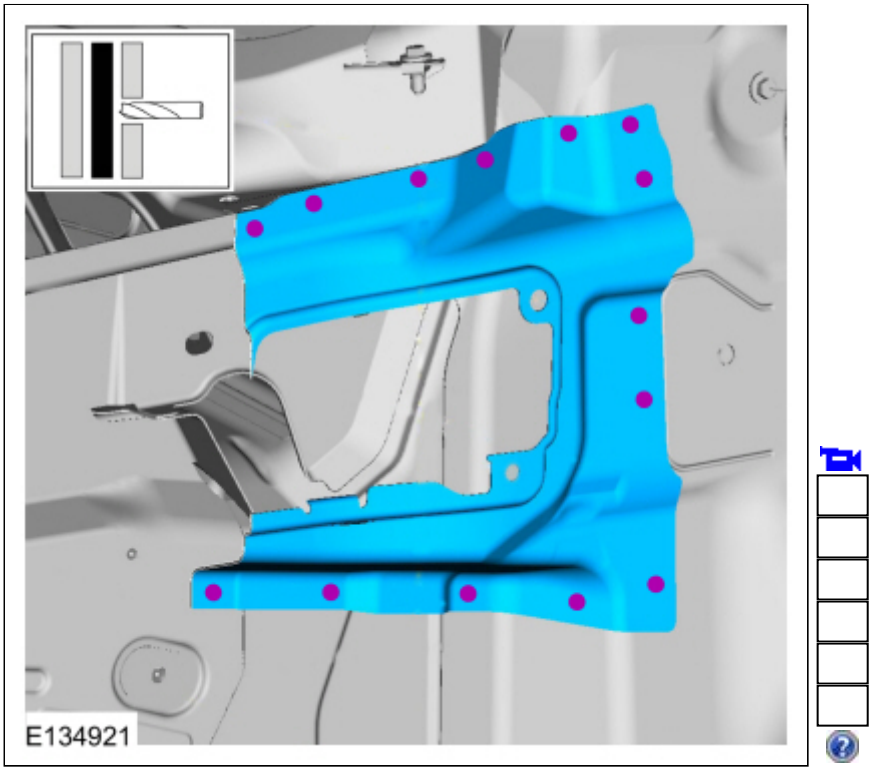
- **Partial Replacement**
- Possible cut line.
  Use the General Equipment: Air Body Saw
- Mill out the spot welds.
  Use the General Equipment: Spot Weld Drill Bit



- Mill out the spot welds.
  Use the General Equipment: Spot Weld Drill Bit



- Mill out the spot welds.
  Use the General Equipment: Spot Weld Drill Bit



Installation

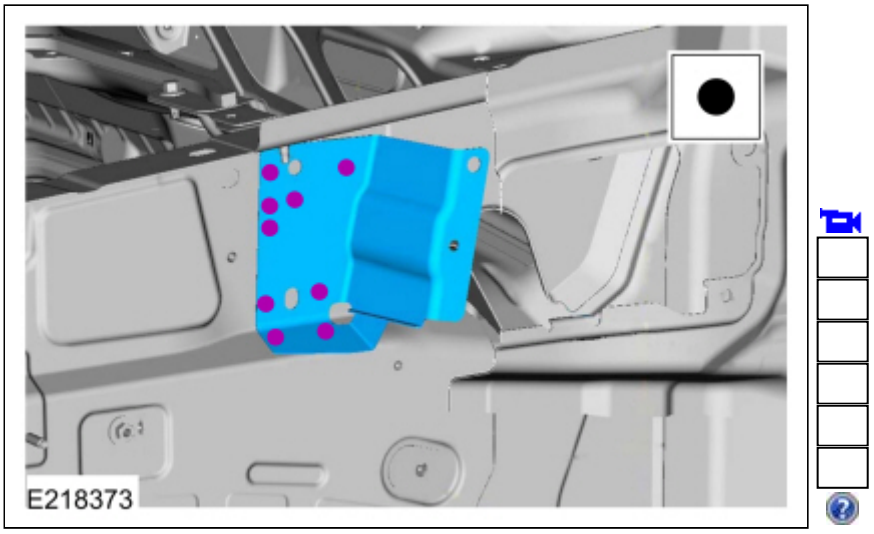
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

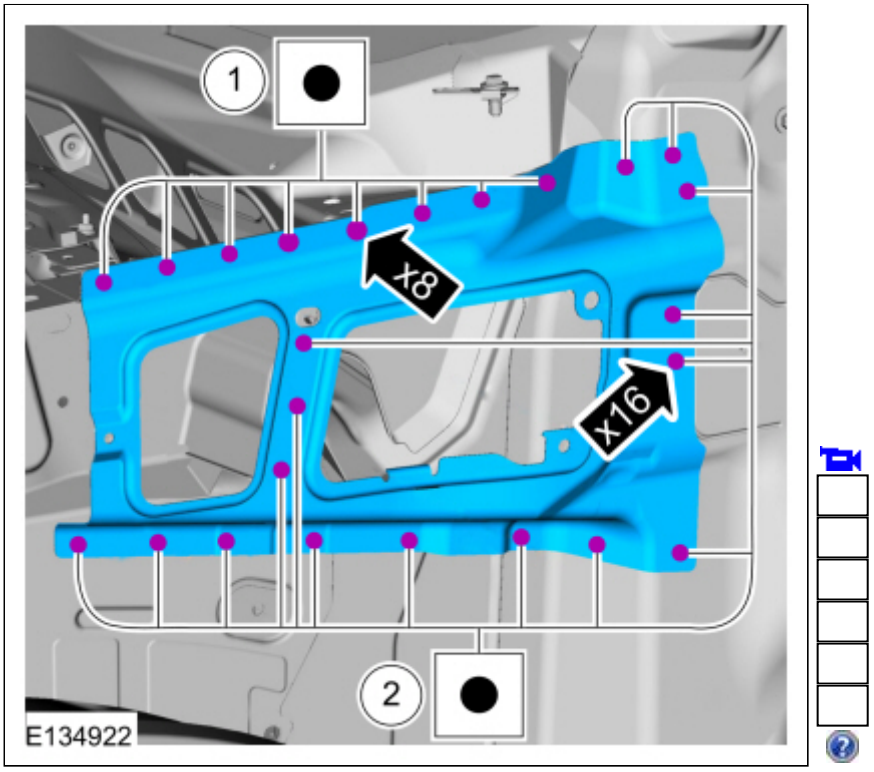
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

   - Resistance plug weld - Panel thickness 3 mm and greater.



1. Resistance spot weld - Panel thickness 3 mm and greater.
2. Resistance plug weld - Panel thickness 3 mm and greater.



Copyright © 2016 Ford Motor Company

A-Pillar Assembly

Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
Hot Air Gun
6 mm Drill Bit
MIG/MAG Welding Equipment
Spot Weld Drill Bit

Materials

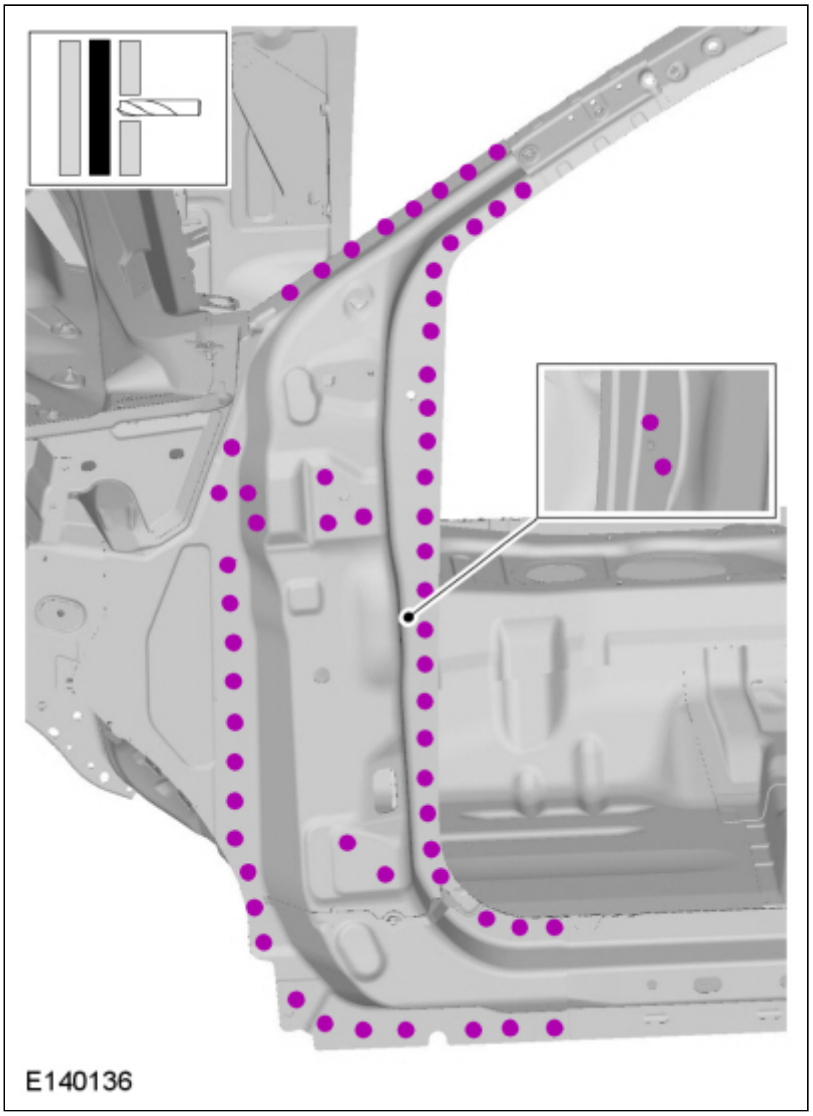
Name	Specification
Adhesive	WSK-M11P57-A3

Removal

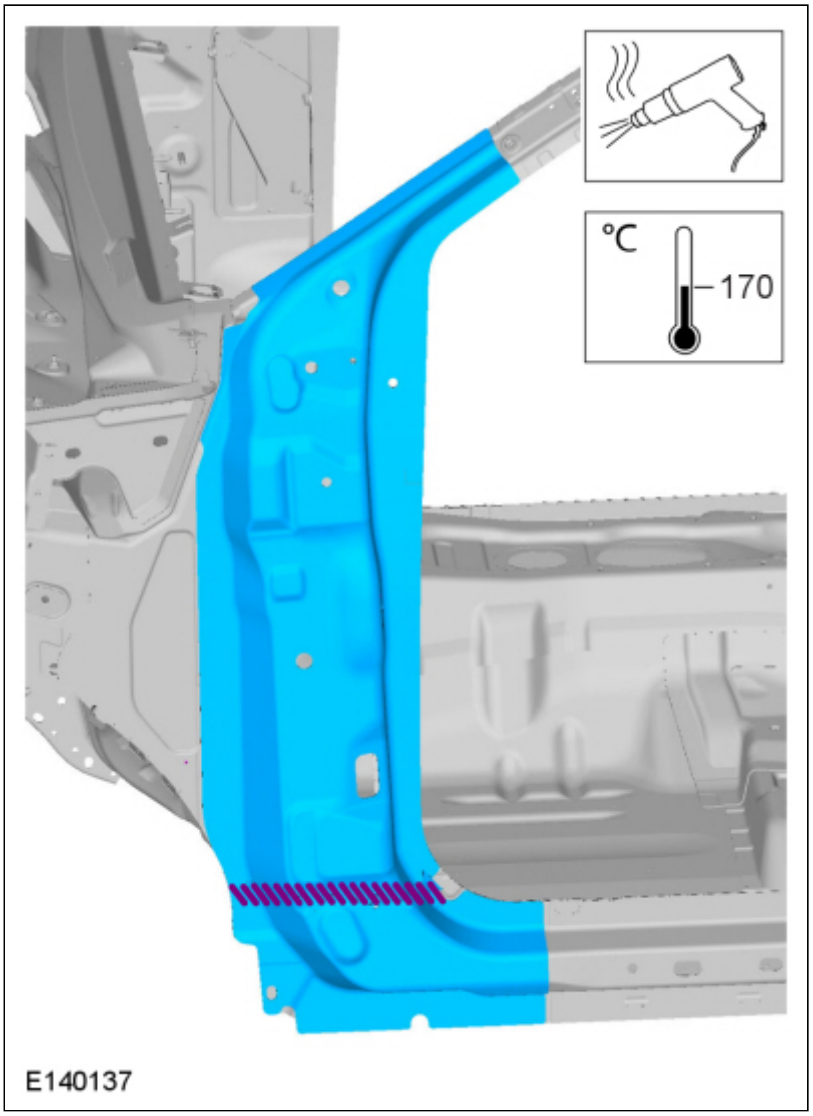
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Windshield
  Refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Front Door
  Refer to: Front Door (501-03 Body Closures, Removal and Installation).
- Door Hinges
- Weatherstrip
- A-pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Driver or passenger seat
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Refer to: Fender Apron Panel Reinforcement (501-27 Front End Sheet Metal Repairs, Removal and Installation).
- Reposition the carpeting and the wiring harness away from the working area.

- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Hot Air Gun



Installation

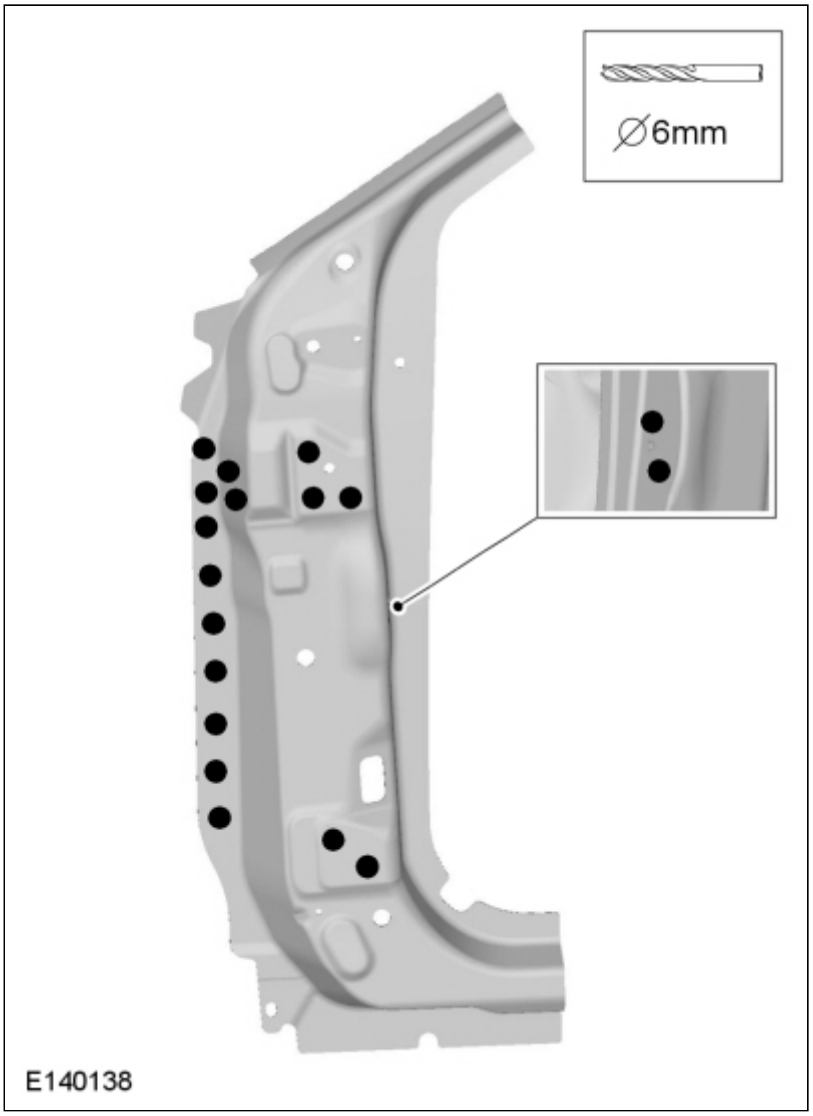
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

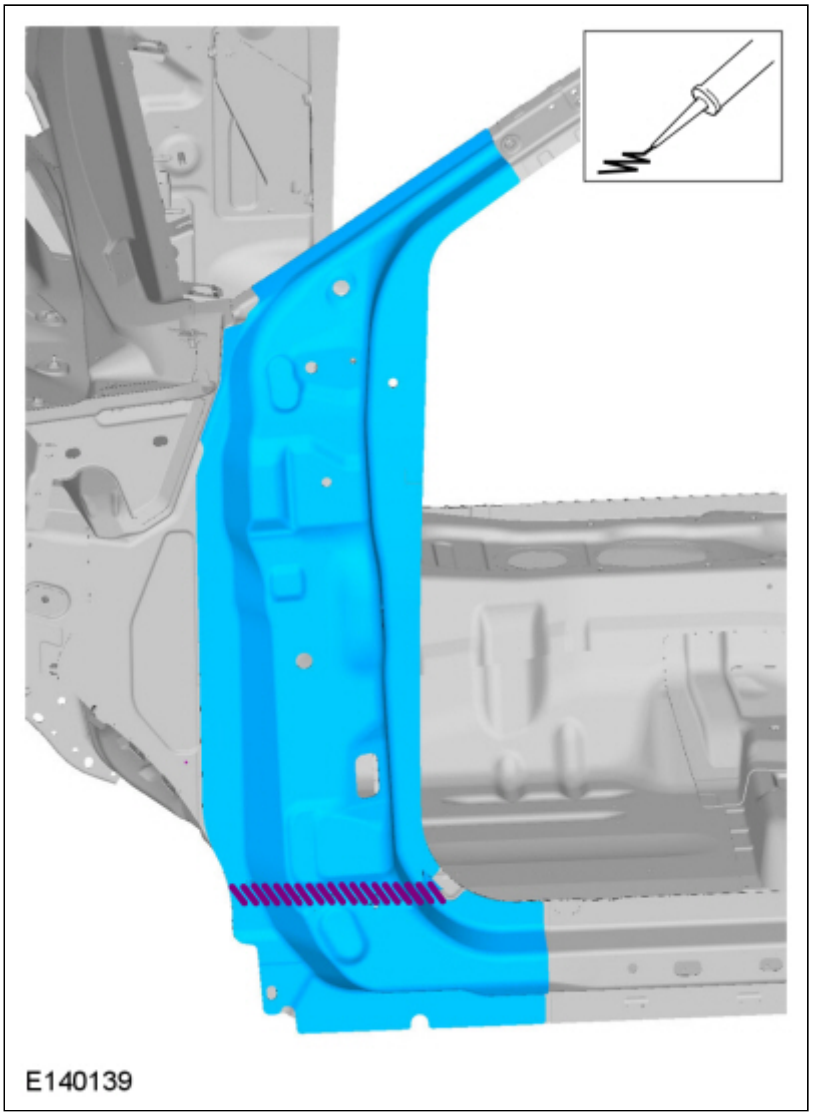
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

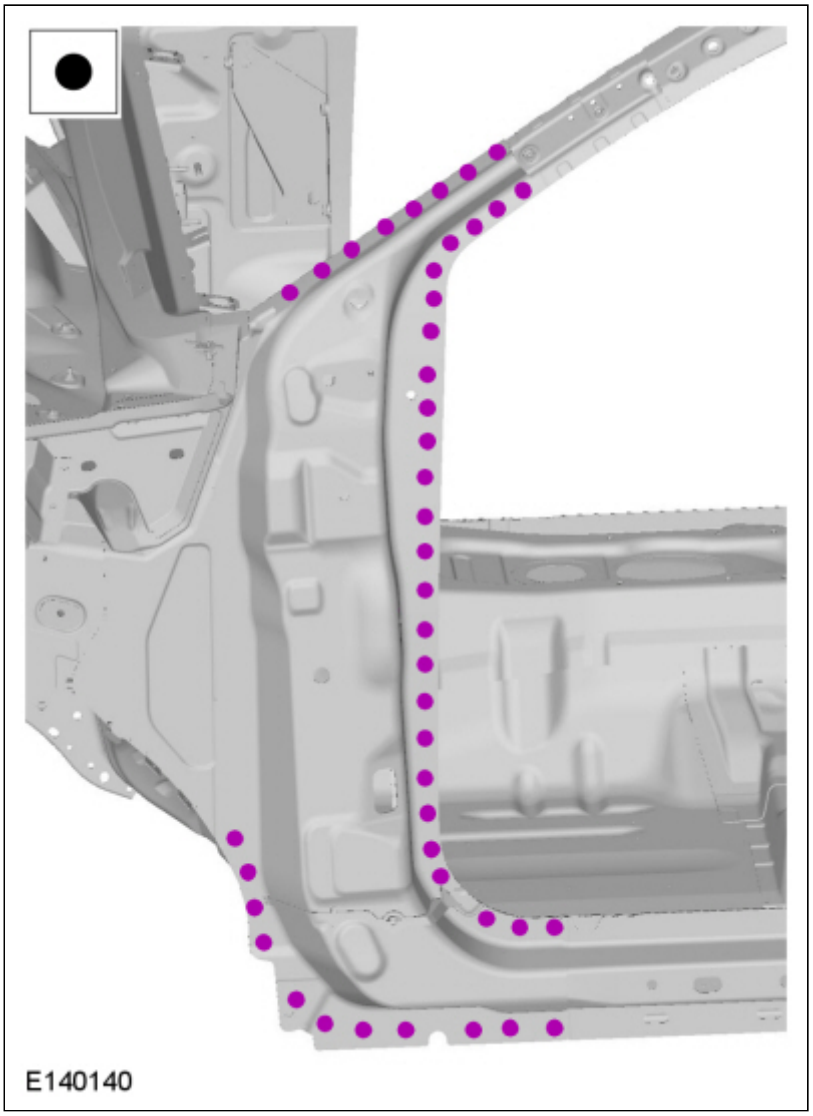
   - Use the General Equipment: 6 mm Drill Bit



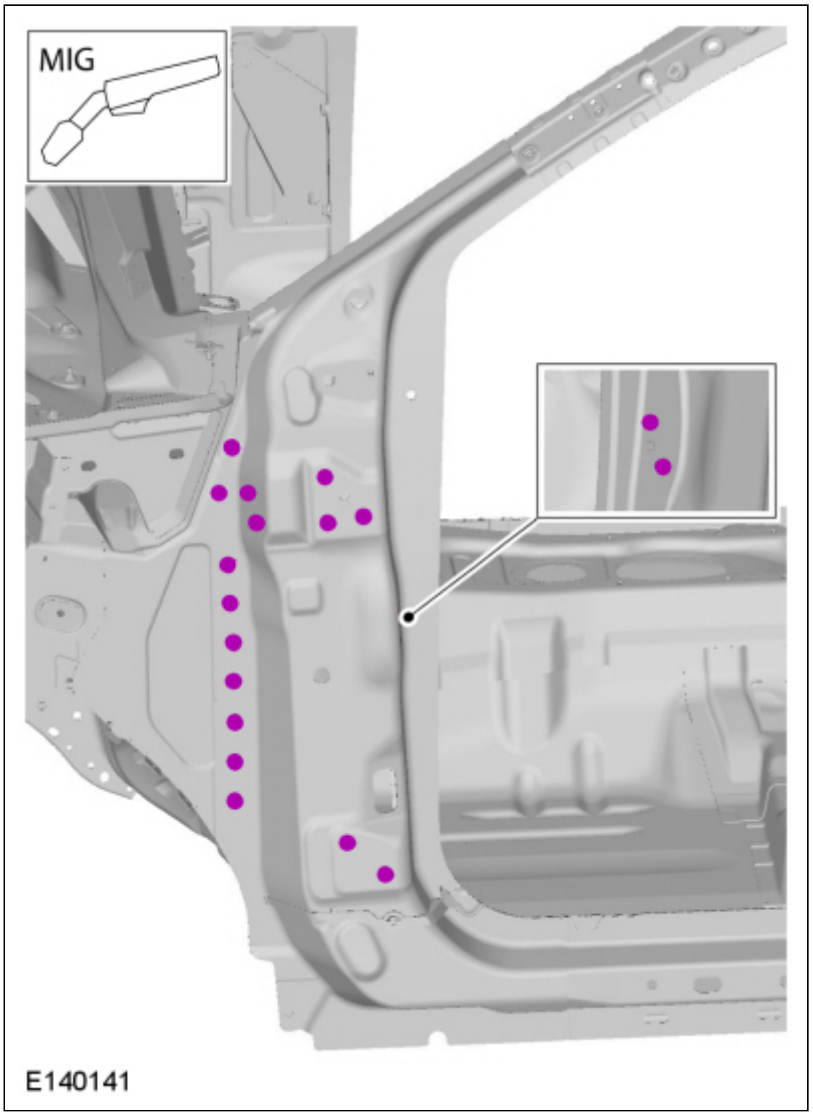
- *Material*: Adhesive (WSK-M11P57-A3)



- Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Windshield
  Refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Front Door
  Refer to: Front Door (501-03 Body Closures, Removal and Installation).
- Door Hinges
- Weatherstrip
- A-pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Driver or passenger seat
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Refer to: Fender Apron Panel Reinforcement (501-27 Front End Sheet Metal Repairs, Removal and Installation).

Copyright © 2016 Ford Motor Company

A-Pillar Outer Panel

Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
Hot Air Gun
Knife
6 mm Drill Bit
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

Materials

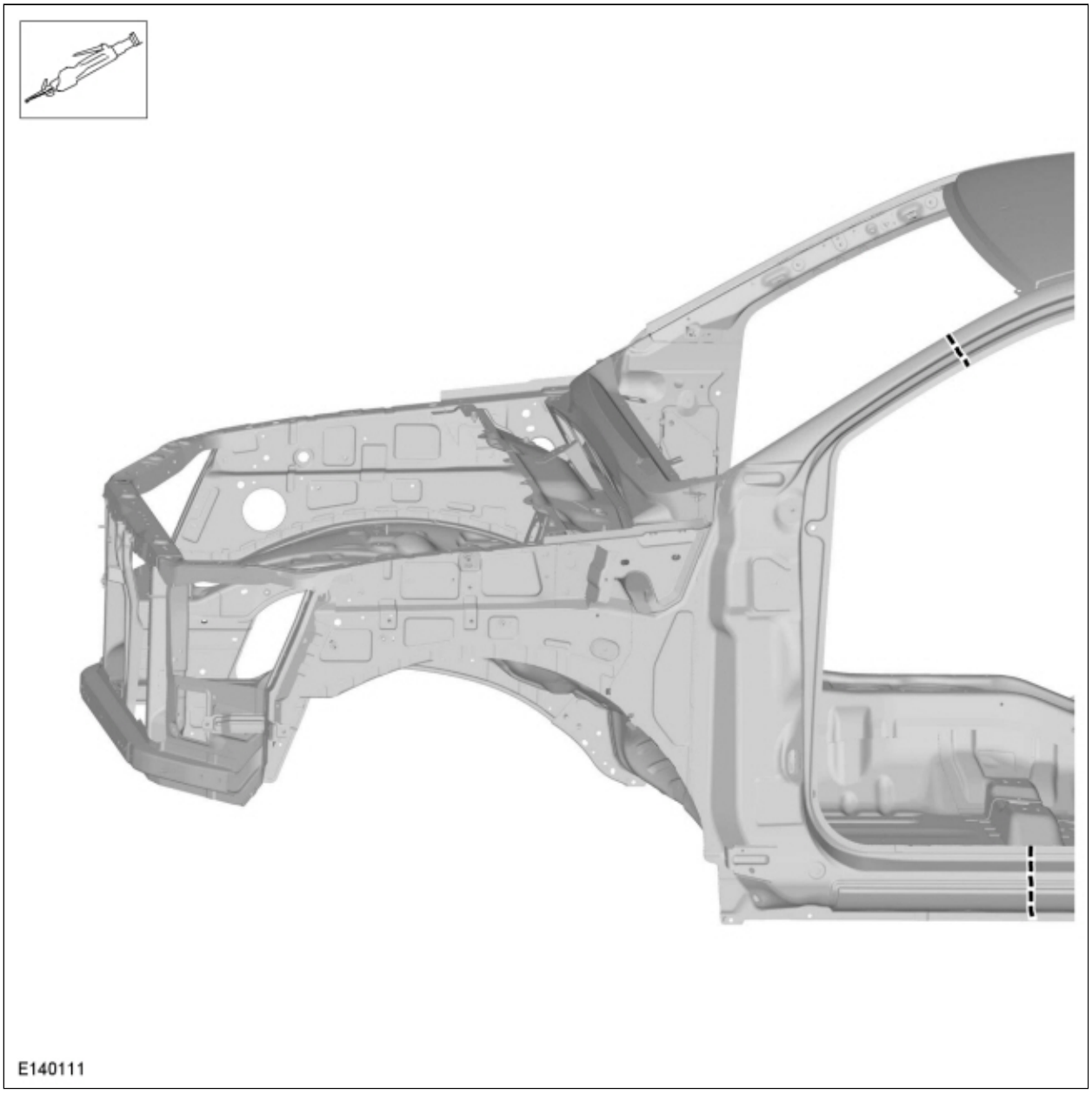
Name	Specification
Adhesive	WSK-M11P57-A3

Removal

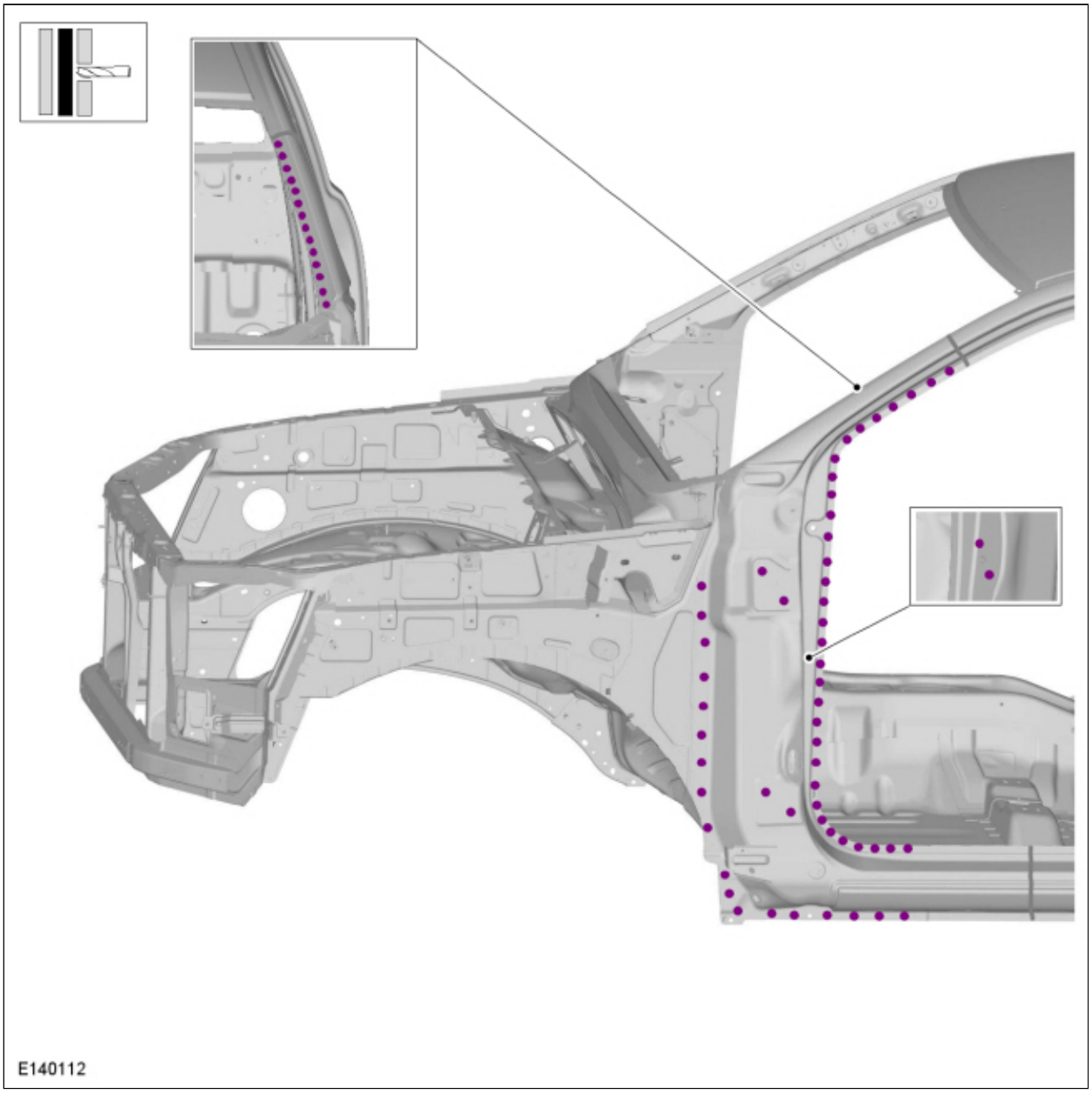
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

- Windshield
  Refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Front Door
  Refer to: Front Door (501-03 Body Closures, Removal and Installation).
- Door Hinges
- Weatherstrip
- A-pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Driver or passenger seat
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Refer to: Fender Apron Panel Reinforcement (501-27 Front End Sheet Metal Repairs, Removal and Installation).
- Reposition the carpeting and the wiring harness away from the working area.

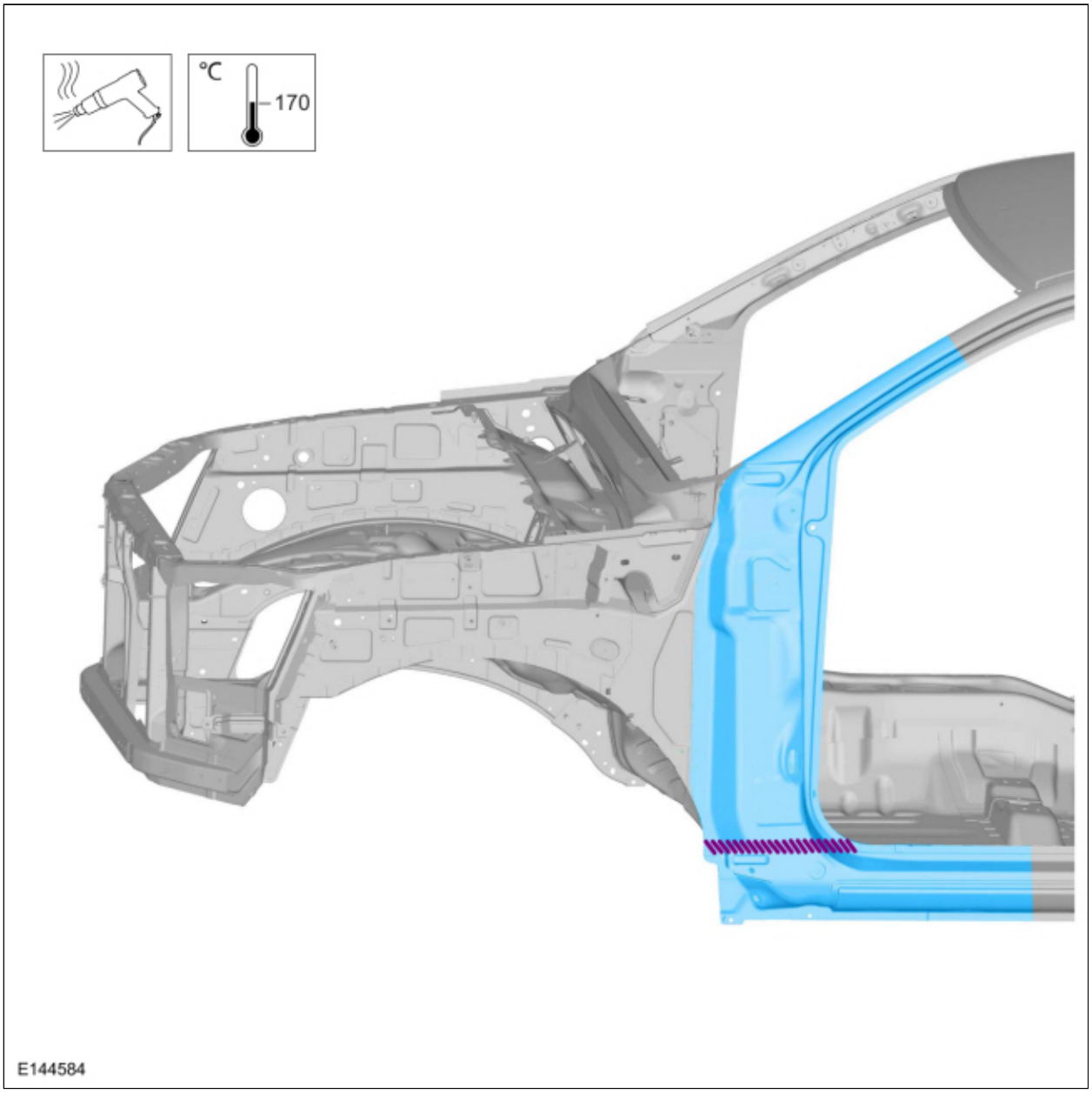
- Use the General Equipment: Air Body Saw



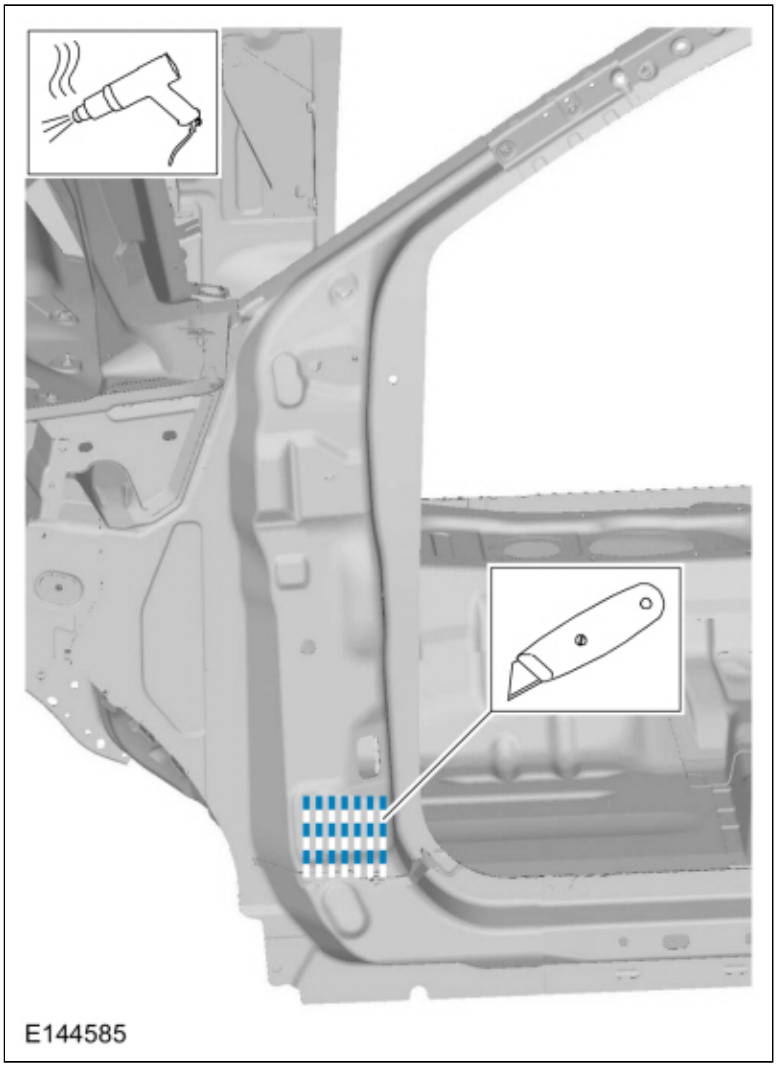
- Use the General Equipment: Spot Weld Drill Bit



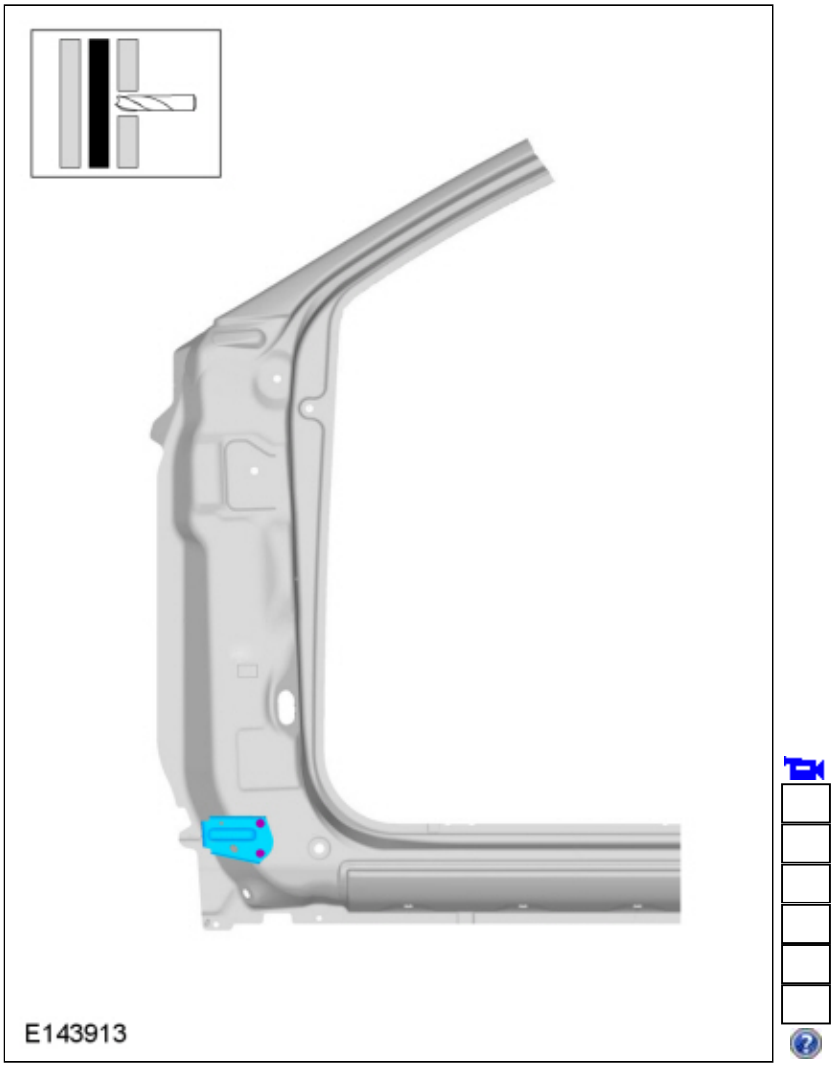
- Use the General Equipment: Hot Air Gun



- Use the General Equipment: Knife
  Use the General Equipment: Hot Air Gun



7. Use the General Equipment: Spot Weld Drill Bit



Installation

1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

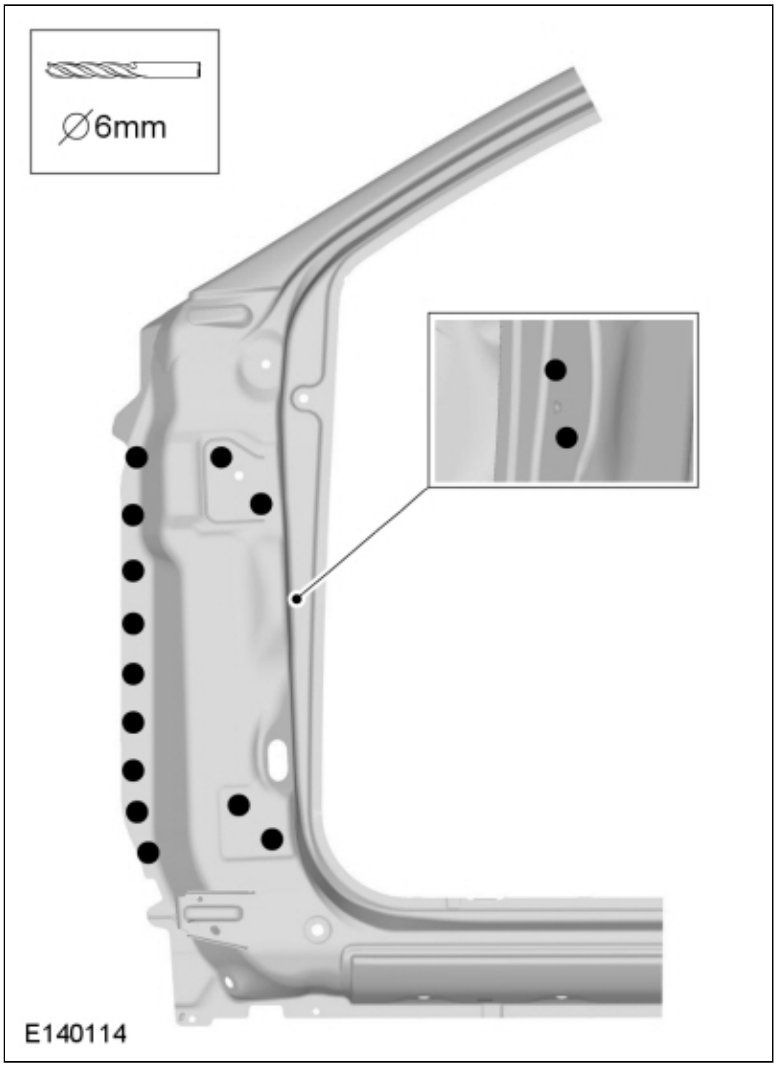
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

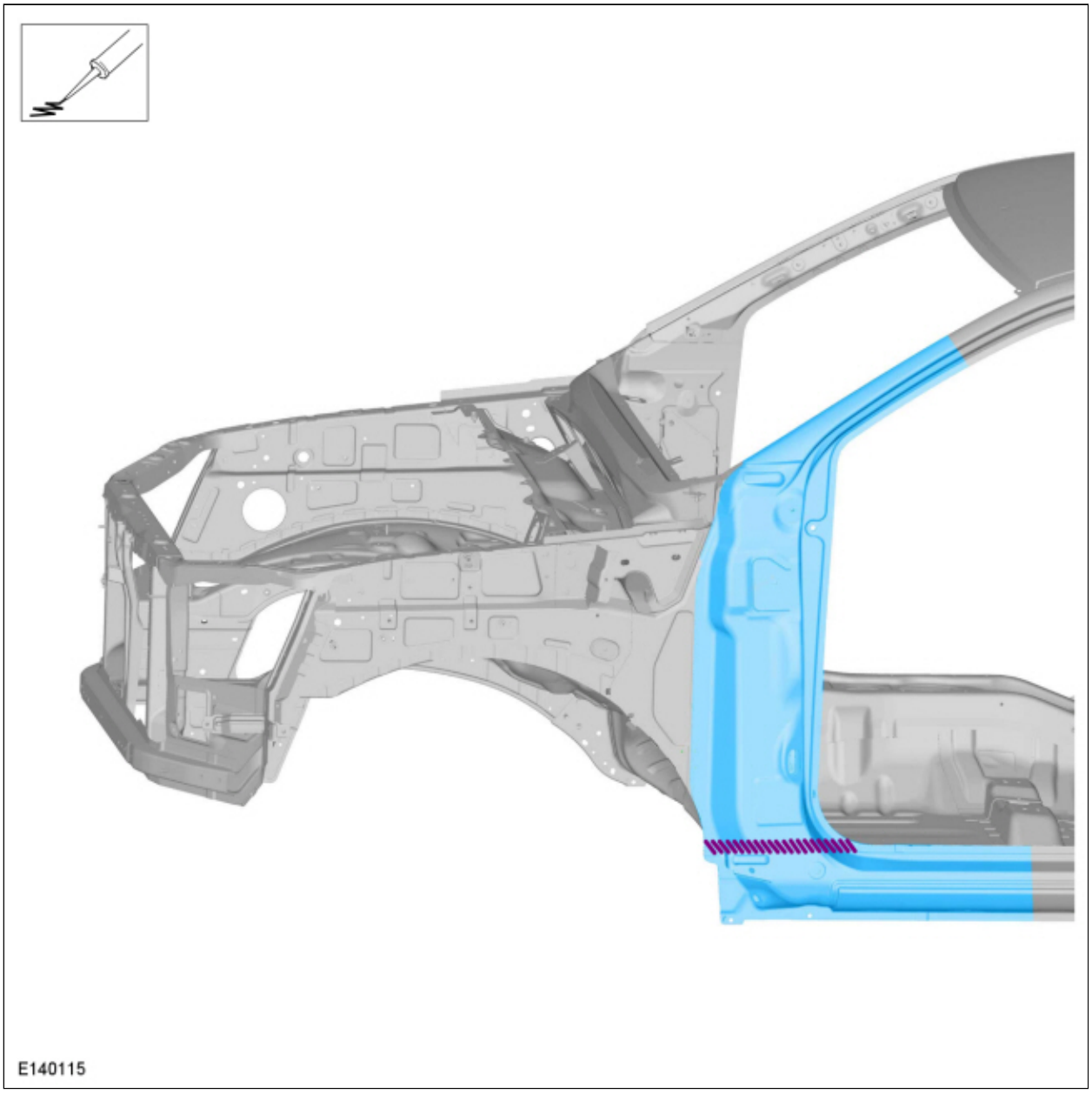
3. Use the General Equipment: MIG/MAG Welding Equipment



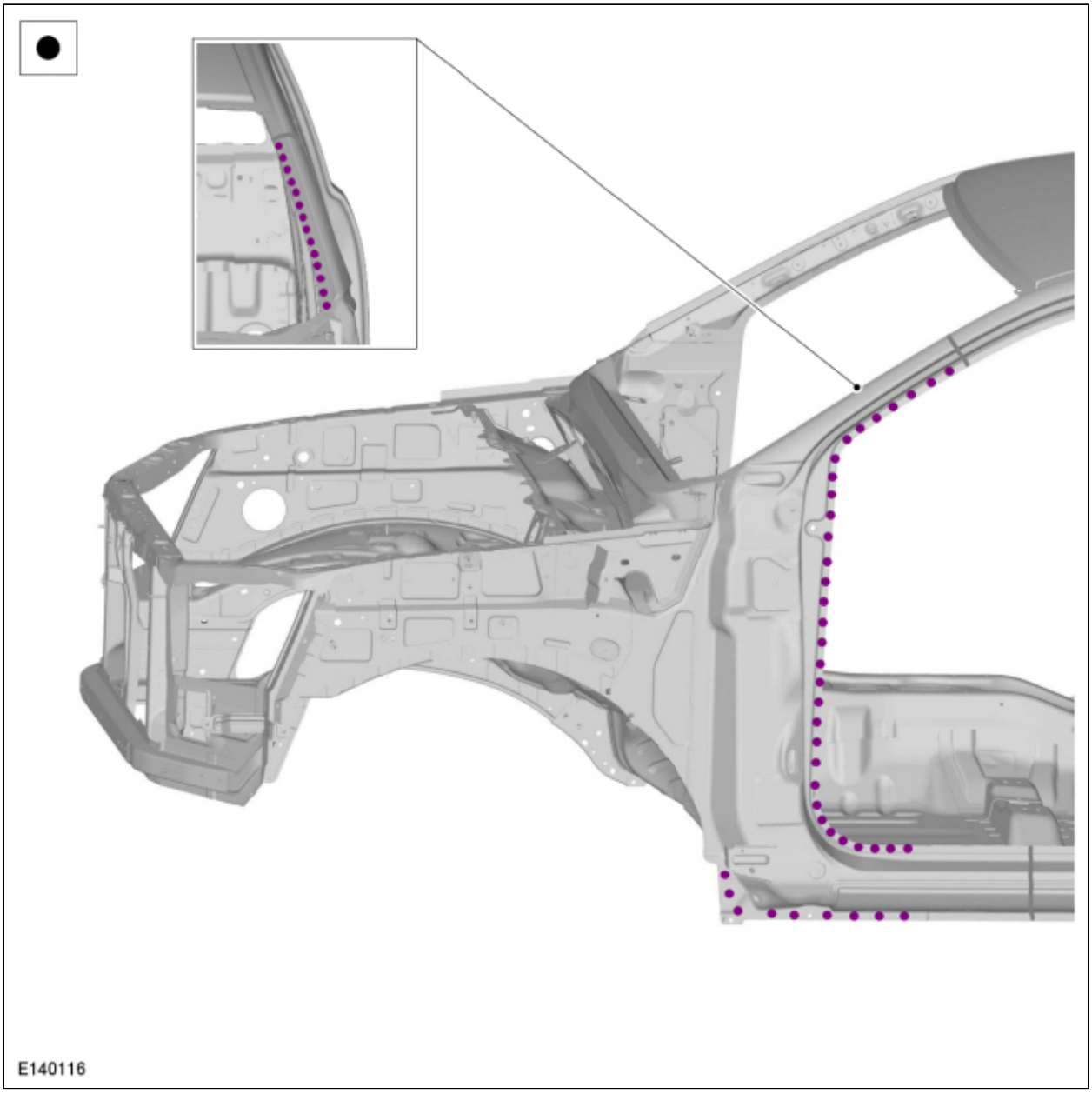
- Use the General Equipment: 6 mm Drill Bit



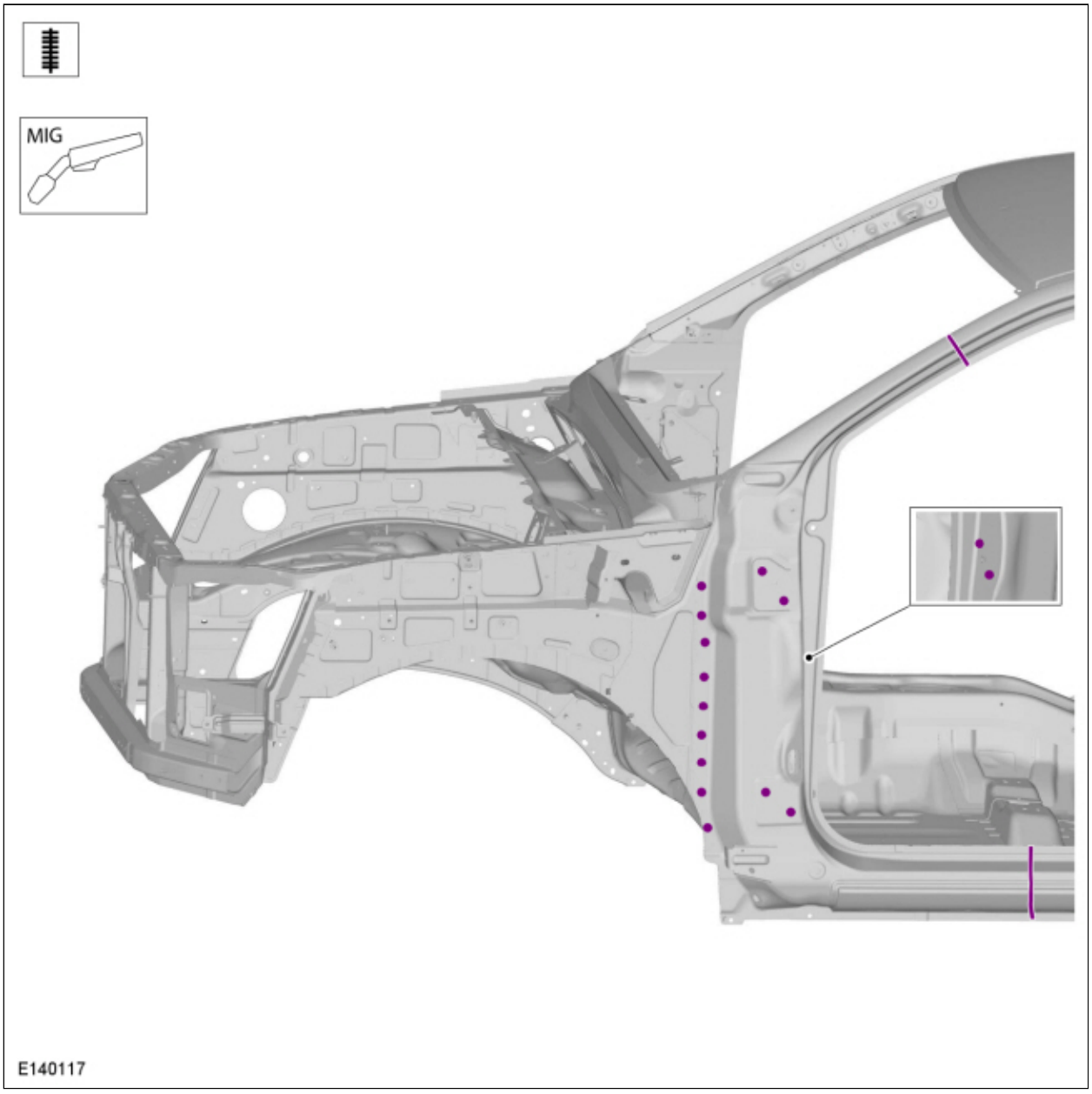
- *Material*: Adhesive (WSK-M11P57-A3)



- Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Windshield
  Refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Front Door
  Refer to: Front Door (501-03 Body Closures, Removal and Installation).
- Door Hinges
- Weatherstrip
- A-pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Driver or passenger seat
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Refer to: Fender Apron Panel Reinforcement (501-27 Front End Sheet Metal Repairs, Removal and Installation).

Copyright © 2016 Ford Motor Company

B-Pillar and Reinforcement - Double Cab

Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
Hot Air Gun
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

Materials

Name	Specification
Adhesive	WSK-M11P57-A3

Removal

NOTE: *Equipment:*

Measurement and alignment angle system

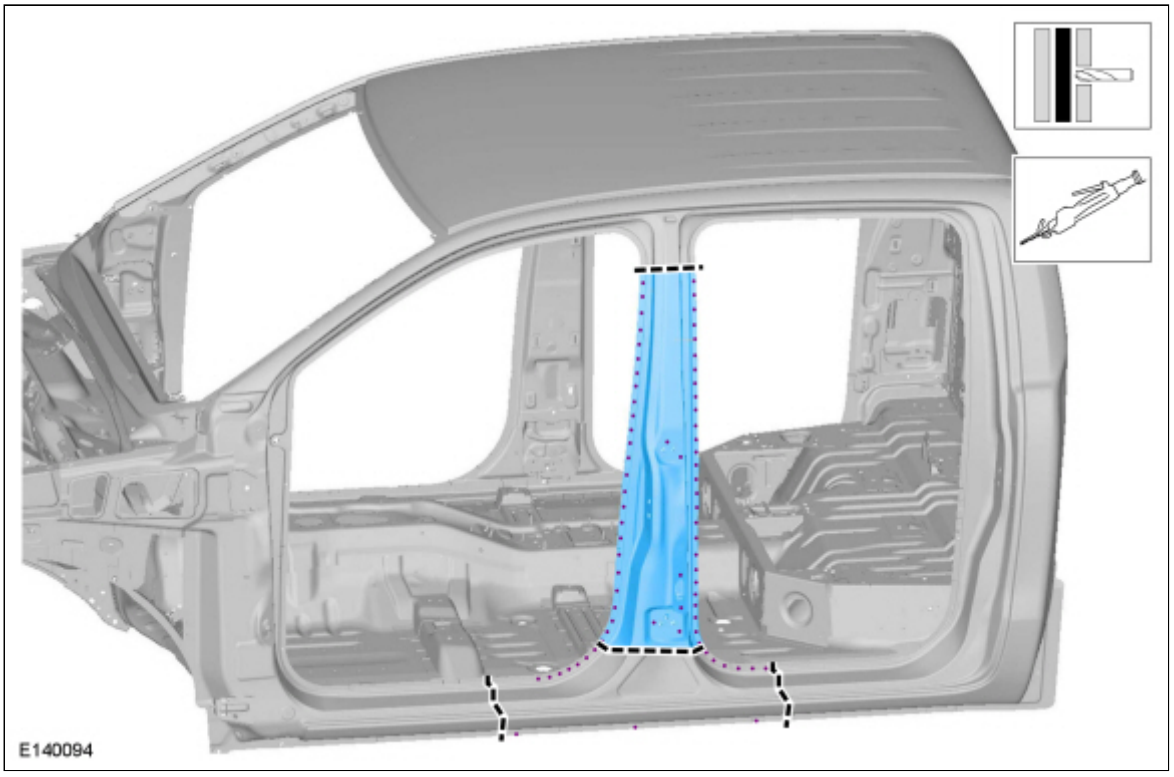
1. **WARNING: High-strength steel (Usibor 1500)**

   - **A suitably powerful resistance spot welding device with inverter technology must be used for this repair. Observe the manufacturer's welding equipment instructions and sub-section 501-25.**
   - **The B-pillar reinforcement is made of high-strength steel plate (Usibor 1500).**
   - **A partial replacement of the B-pillar reinforcement is not permissible. The required continuous MIG weld seam in the area of the cut causes structural changes which result in significant loss of strength in the B-pillar reinforcement.**
   - **Due to its strength, the B-pillar reinforcement can not always be worked on with conventional body tools.**
   - **Additional preparations are required for MIG puddle welding.**

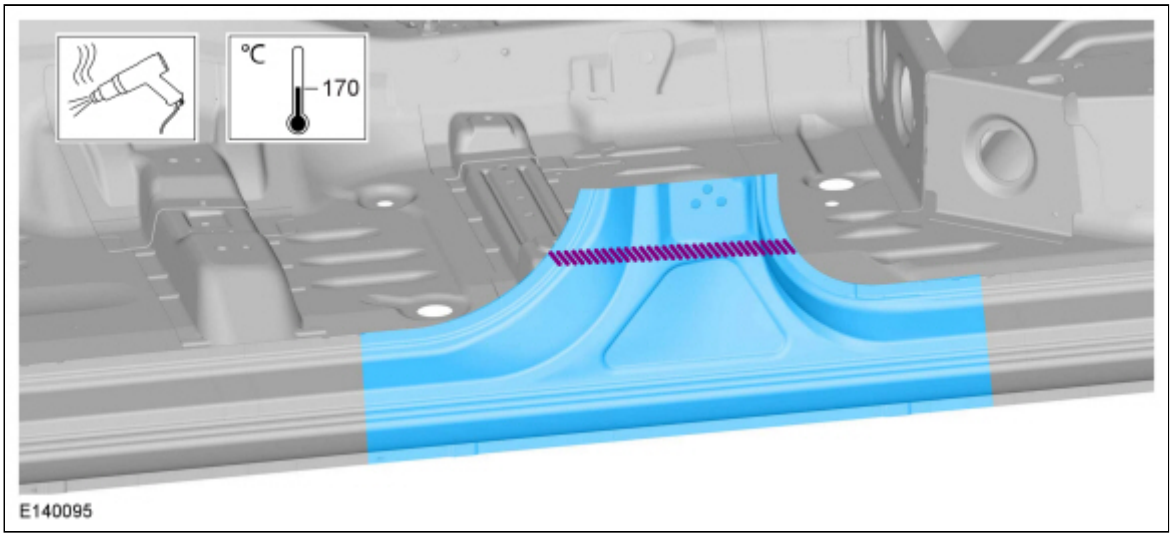
   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

   - Rocker Panel Trim
     Refer to: Front Seat (501-10A Seating, Removal and Installation).
     Refer to: Rear Seat Cushion (501-10A Seating, Disassembly and Assembly).
     Refer to: Rear Seat Backrest (501-10A Seating, Disassembly and Assembly).
     Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
     Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
     Refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).
   - Front and Rear Door
   - Reposition the carpeting and the wiring harness away from the working area.

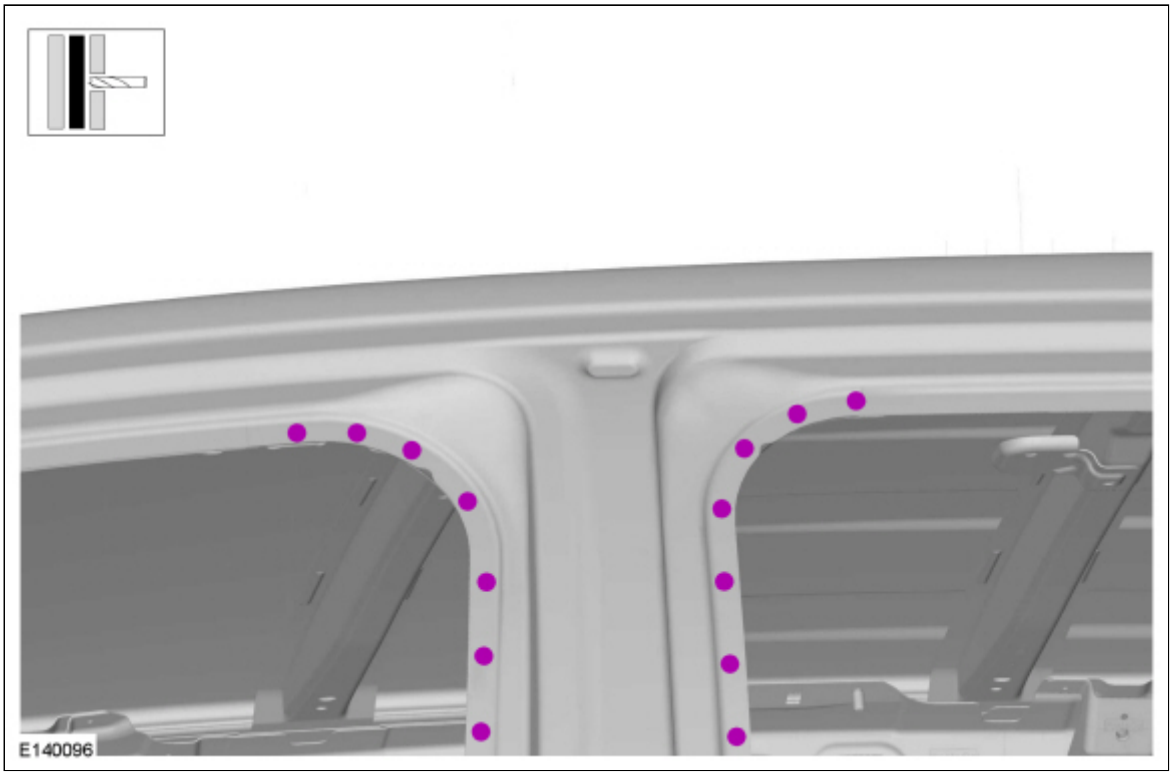
   - Use the General Equipment: Air Body Saw
     Use the General Equipment: Spot Weld Drill Bit



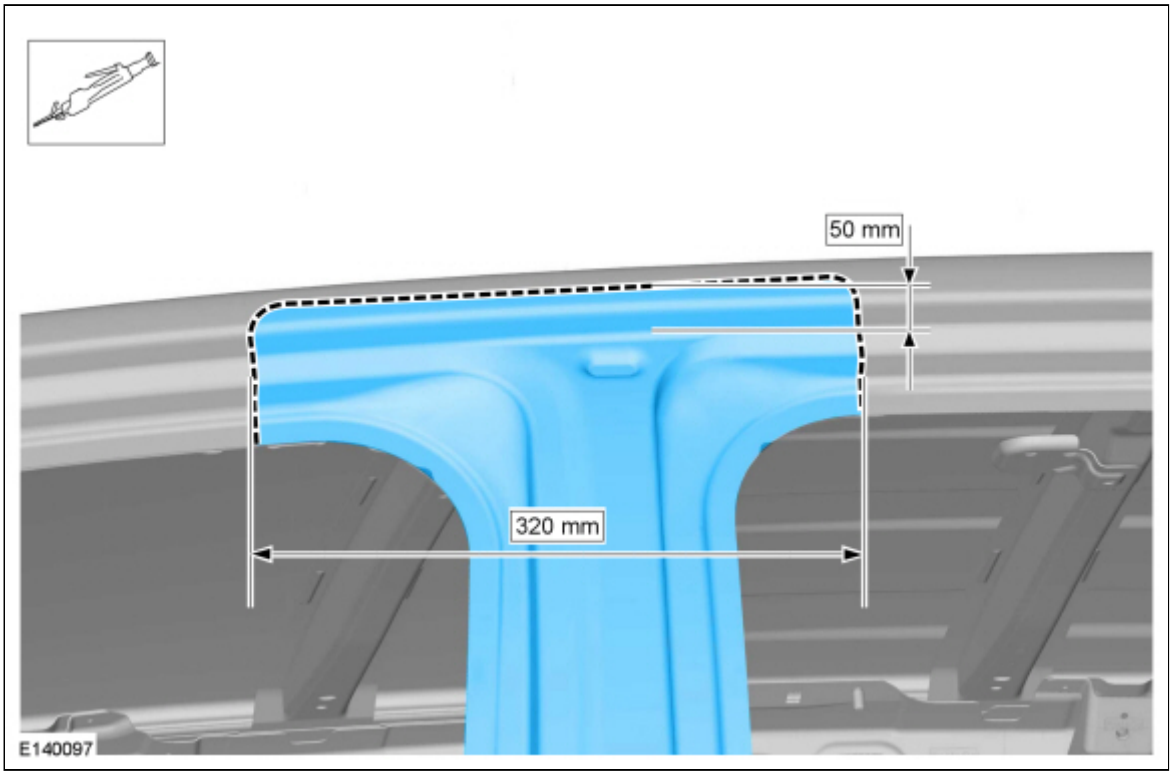
- Use the General Equipment: Hot Air Gun



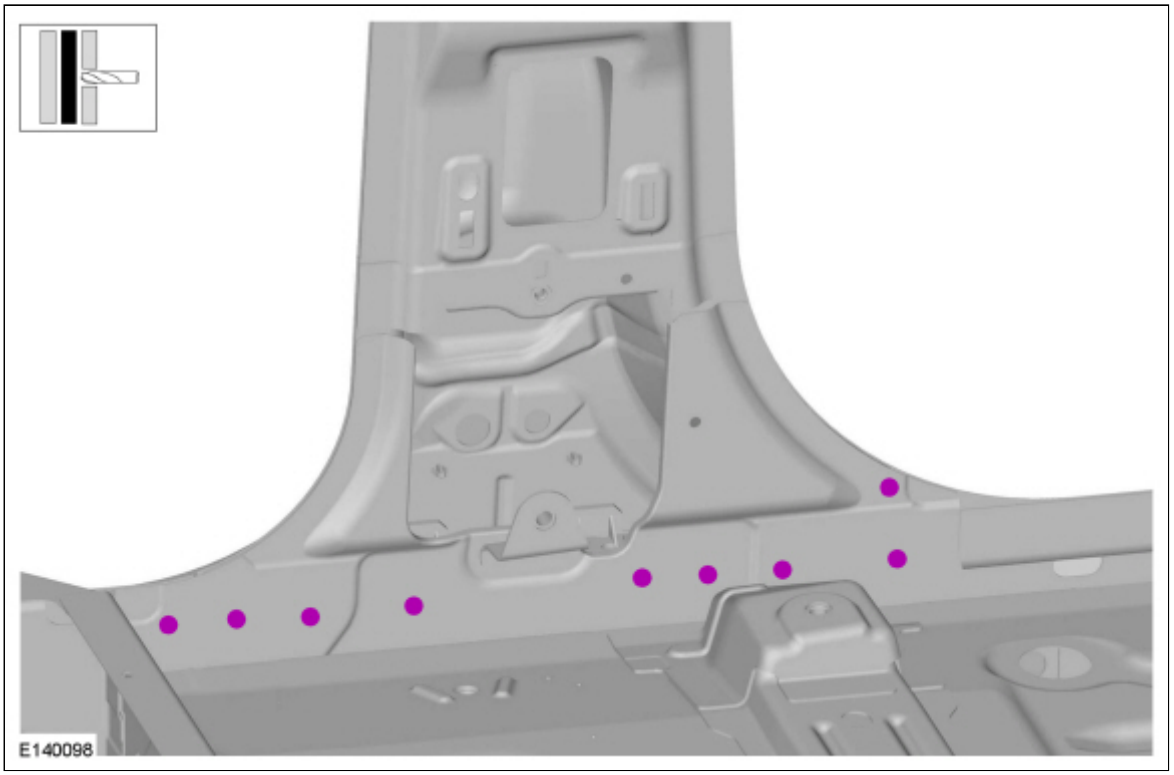
- Use the General Equipment: Spot Weld Drill Bit



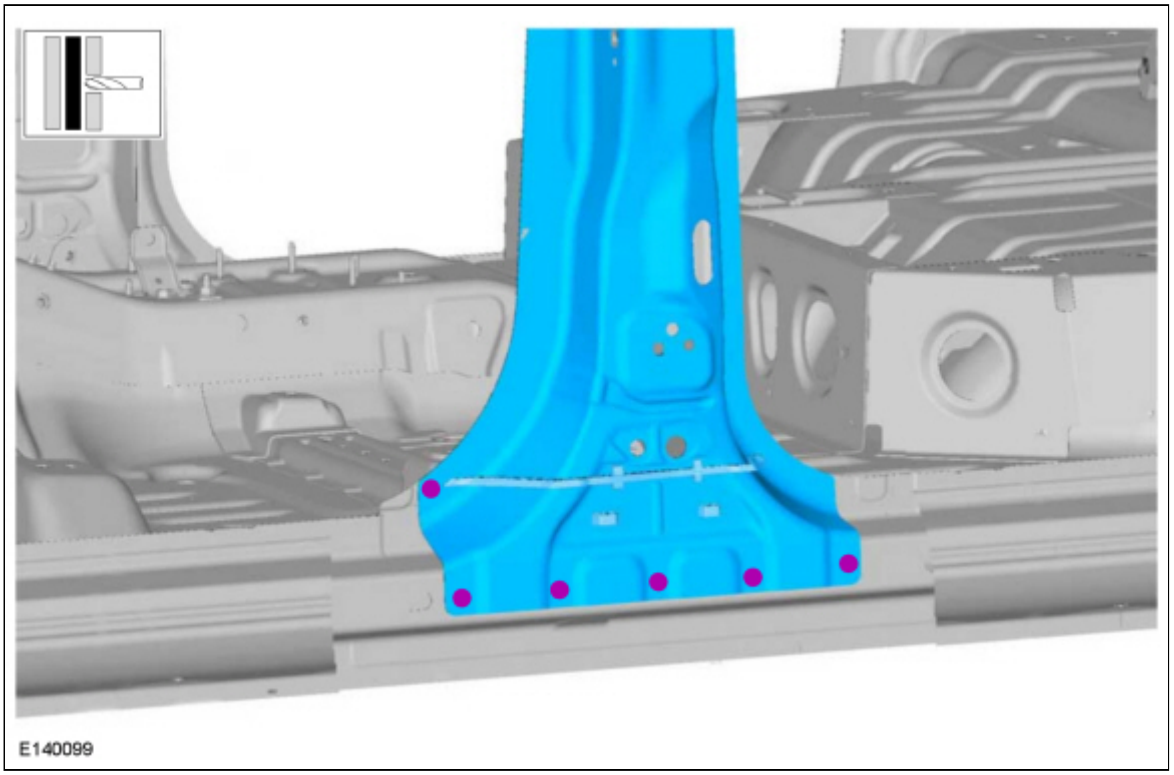
- Use the General Equipment: Air Body Saw



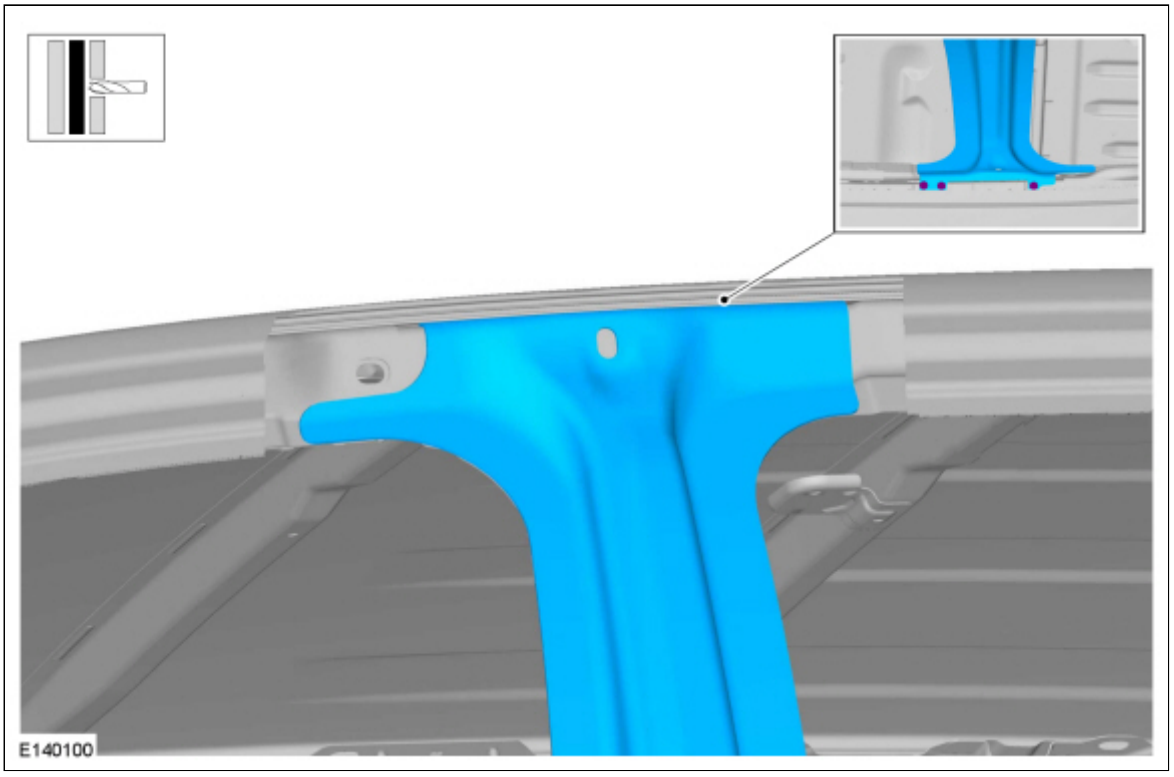
- Use the General Equipment: Air Body Saw
  Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Spot Weld Drill Bit



Installation

1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

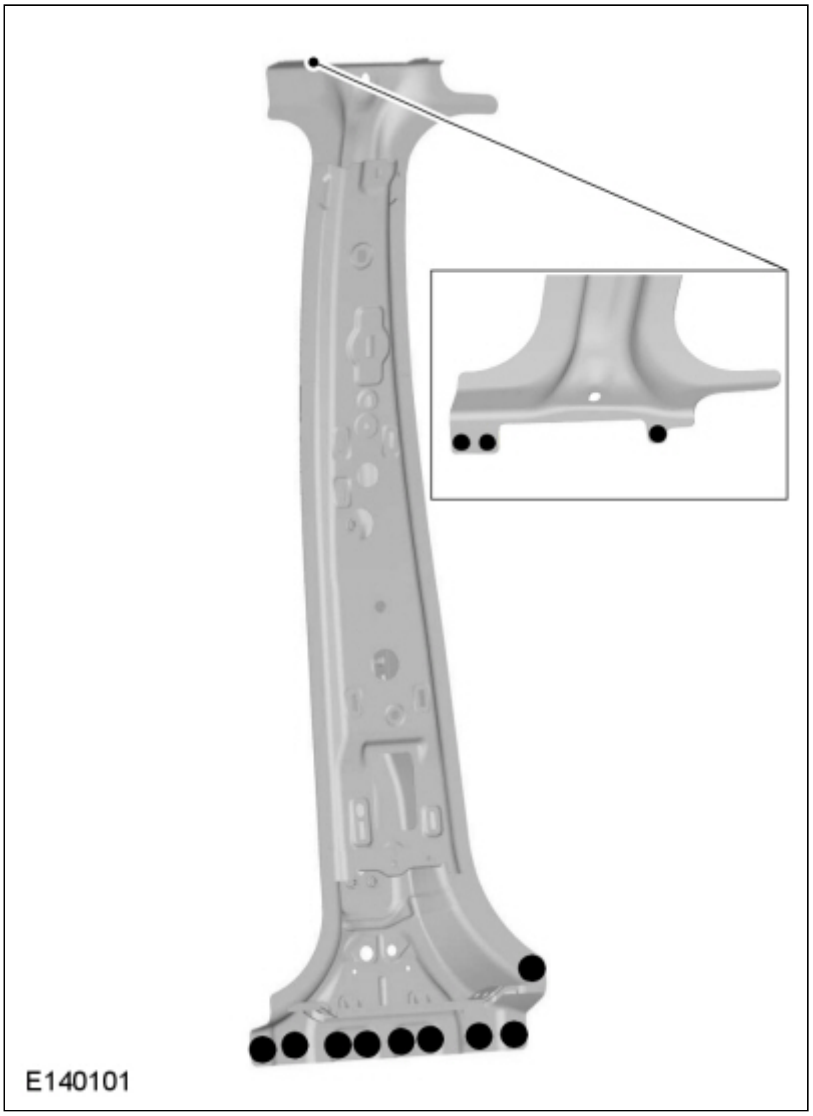
   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

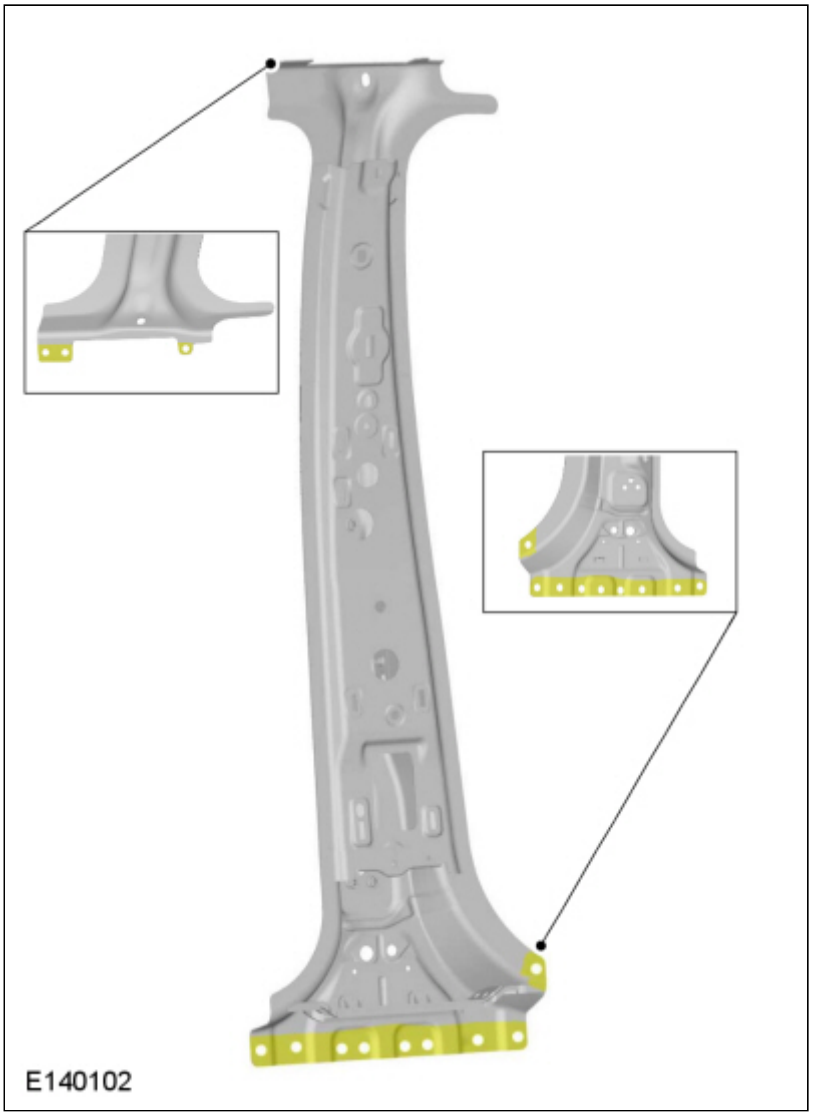
   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

   - **NOTE:**
     - *The holes need to be pre-milled with a spherical cutter with a small diameter. Afterwards these holes are then milled out to the required diameter with a spindle milling cutter. This method is essential in order to ensure that the material in the edge area of the milled holes is not weakened.*

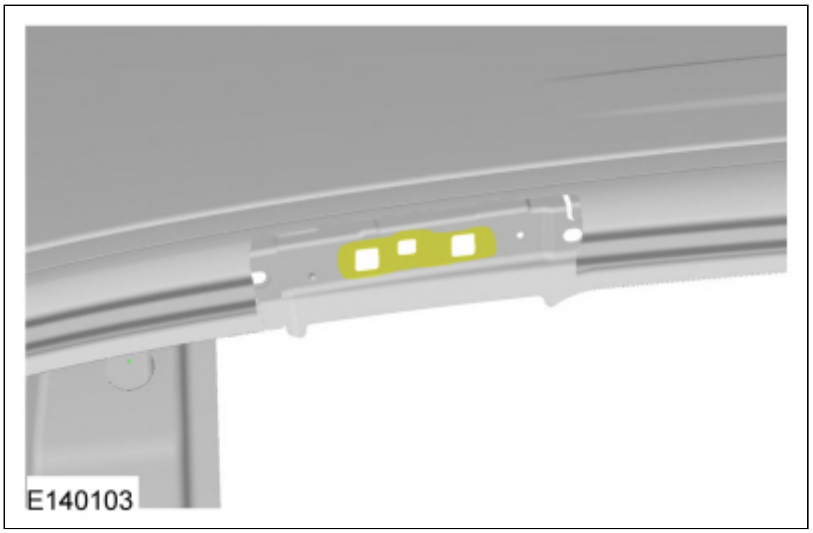
   Equipment: Spherical cutter
   - Equipment: spindle milling cutter



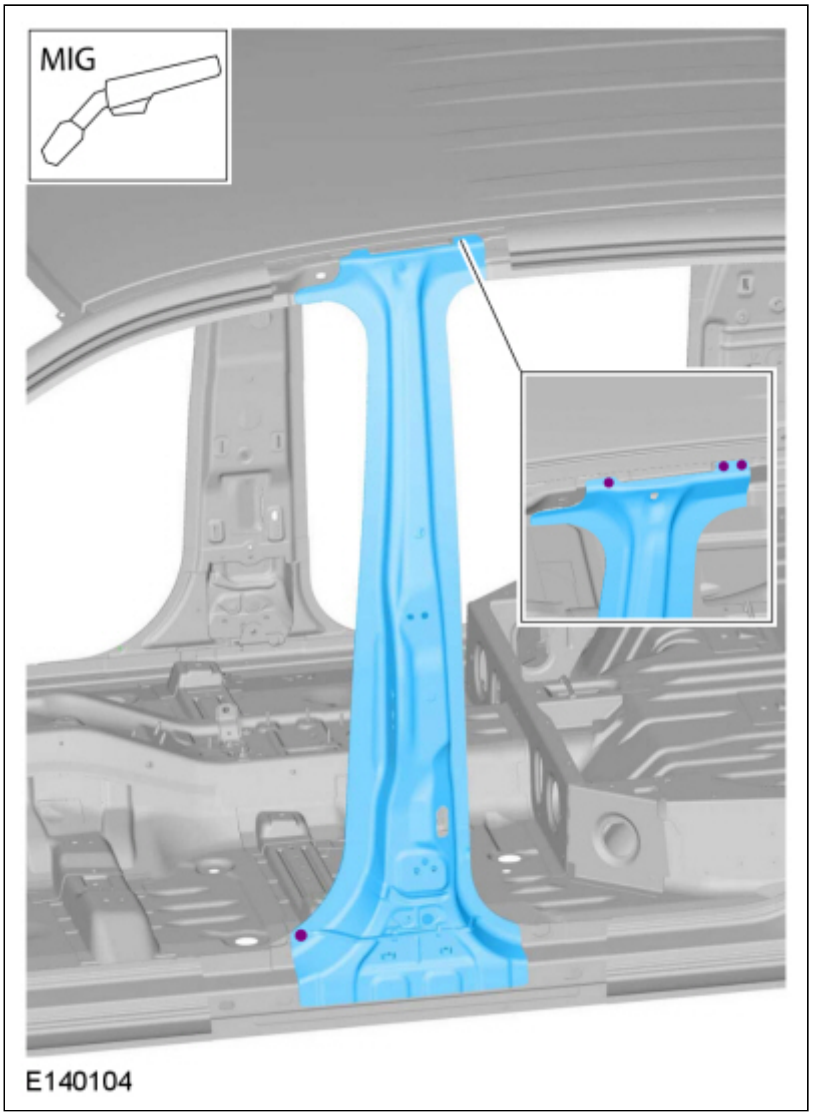
- **WARNING: The B-pillar reinforcement is covered with a hot-dip aluminized coating on its entire surface. This coating needs to be fully ground off on the welding flanges on the front and rear using a fibre grinding disc. Any contamination due to parts of the coating in the welding bath will weaken the welded joint.**



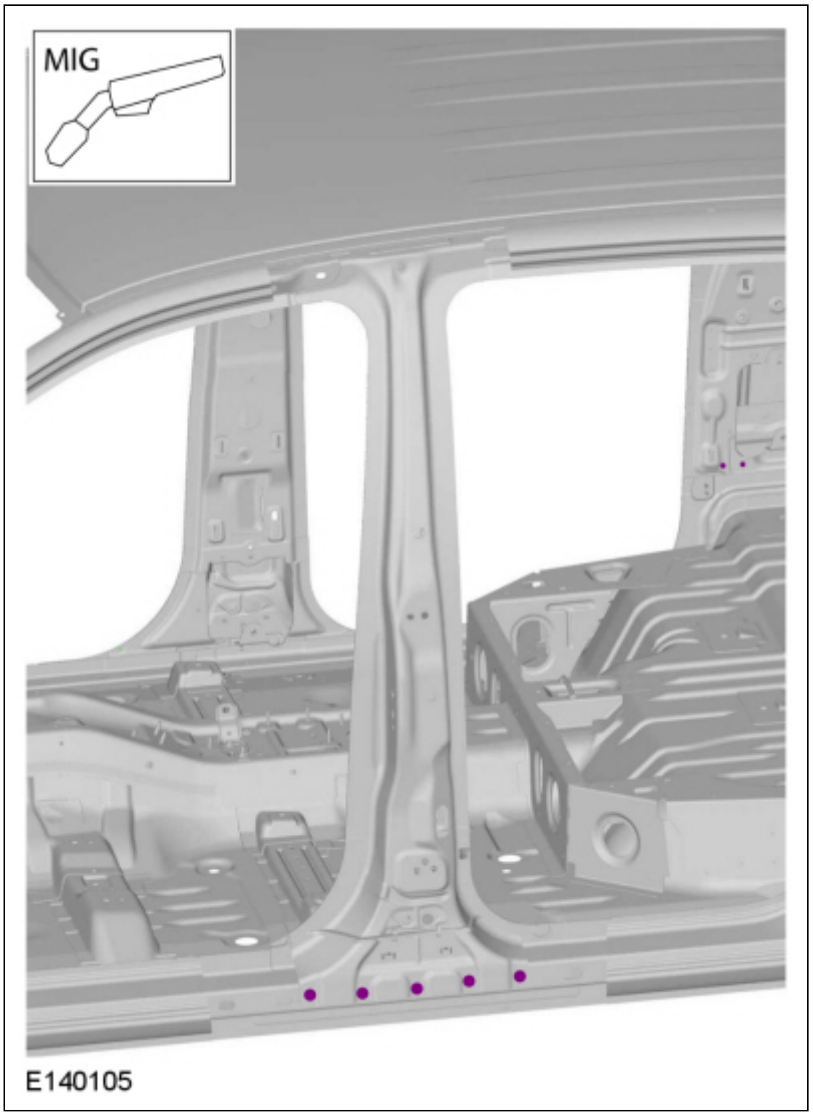
- **WARNING: The A-pillar reinforcement is covered with a hot-dip aluminized coating on its entire surface. This coating needs to be fully ground off on the welding flanges on the front using a fibre grinding disc. Any contamination due to parts of the coating in the welding bath will weaken the welded joint.**



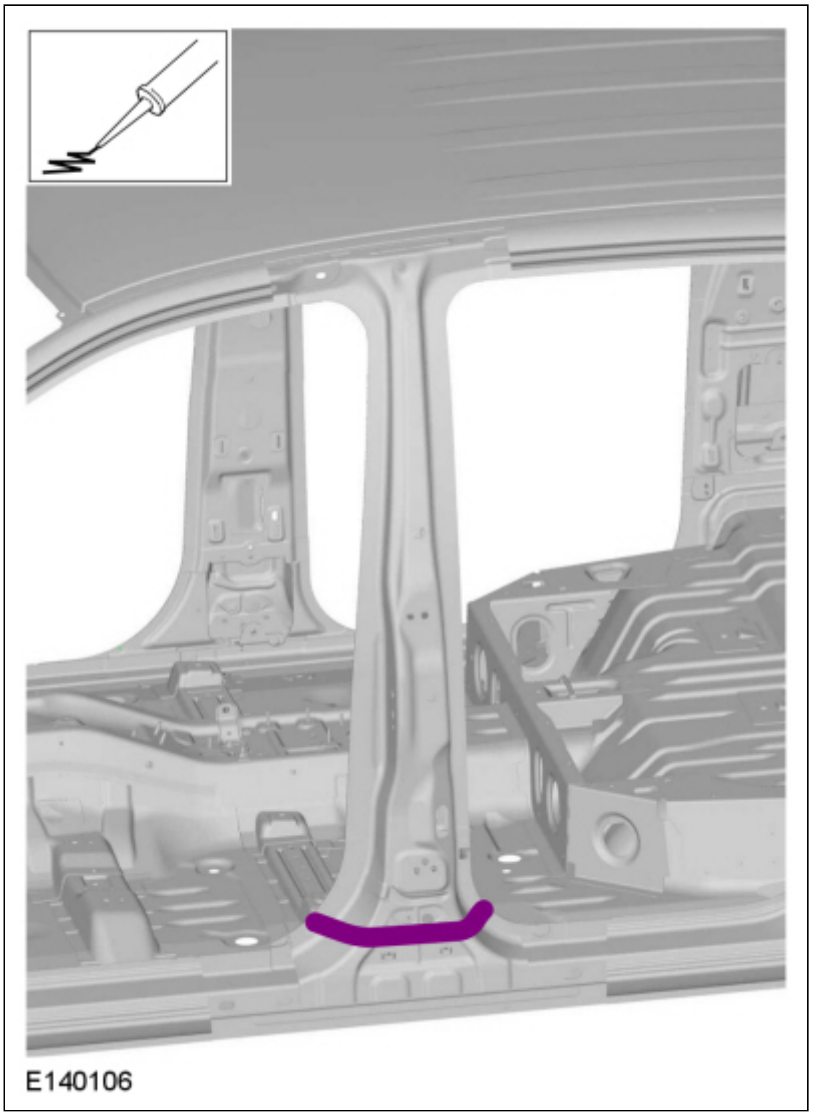
- Resistance spot weld - Panel thickness 3 mm and greater!
  Use the General Equipment: Resistance Spotwelding Equipment



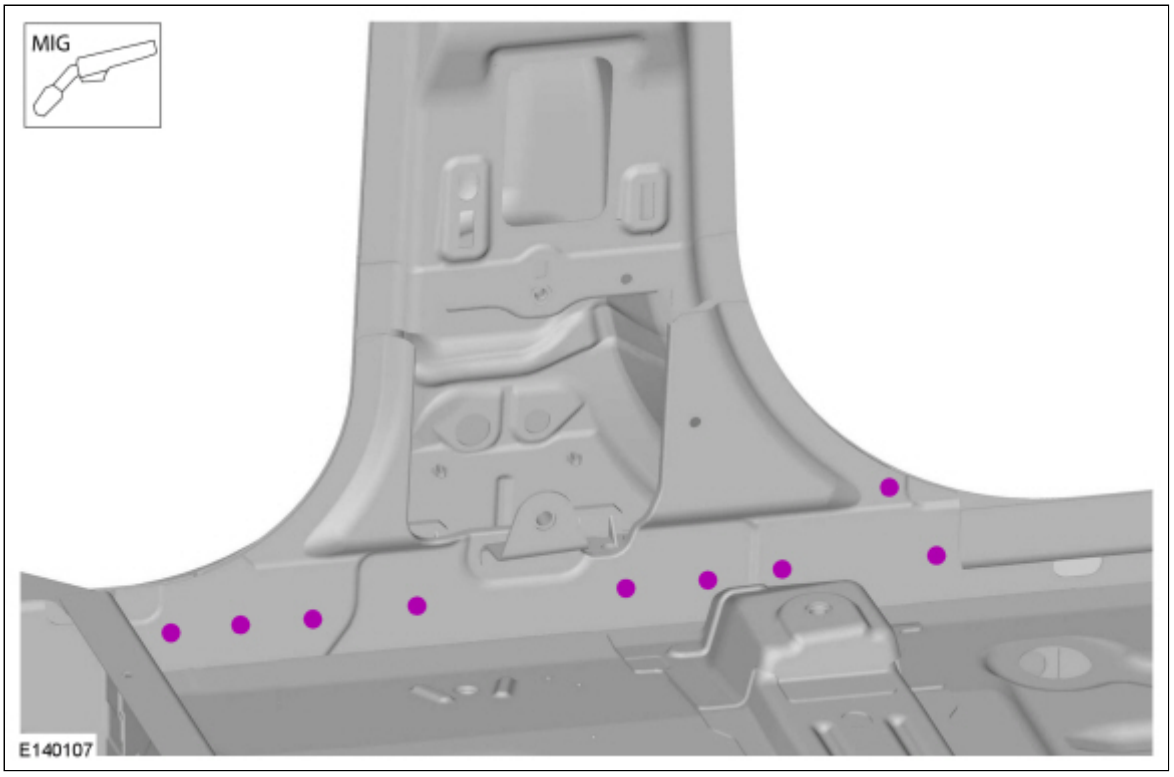
- Use the General Equipment: MIG/MAG Welding Equipment



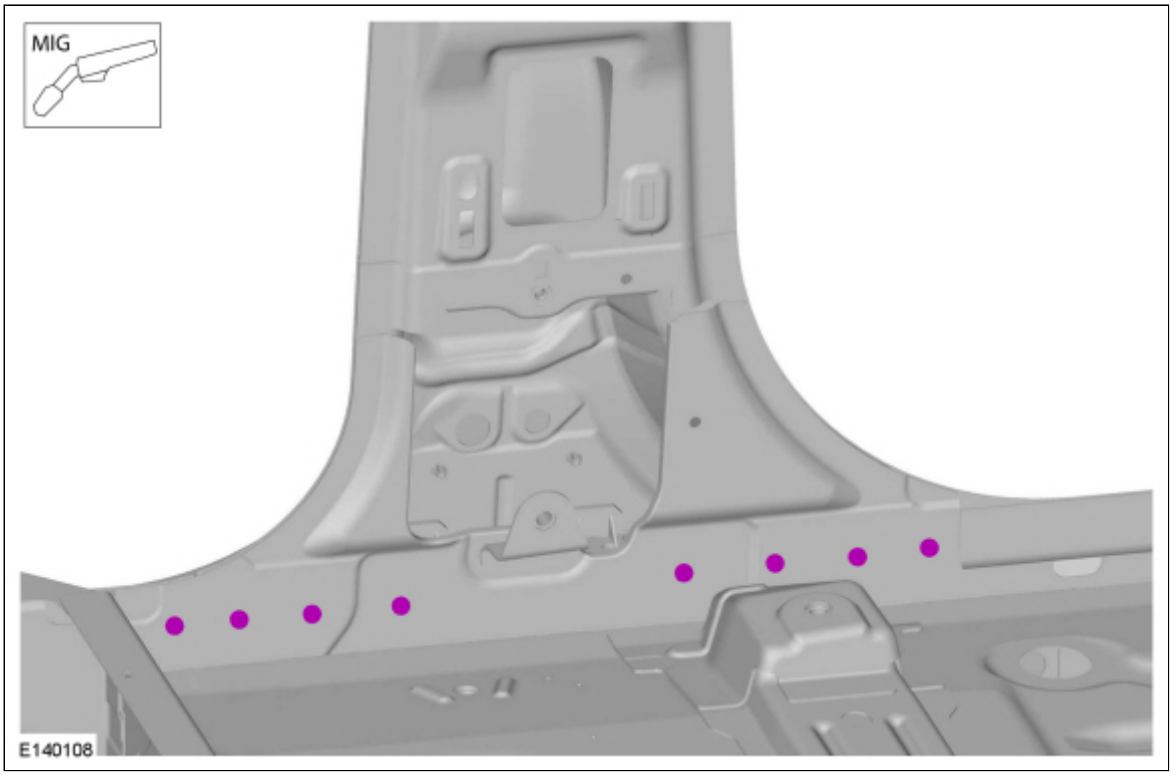
- *Material*: Adhesive (WSK-M11P57-A3)



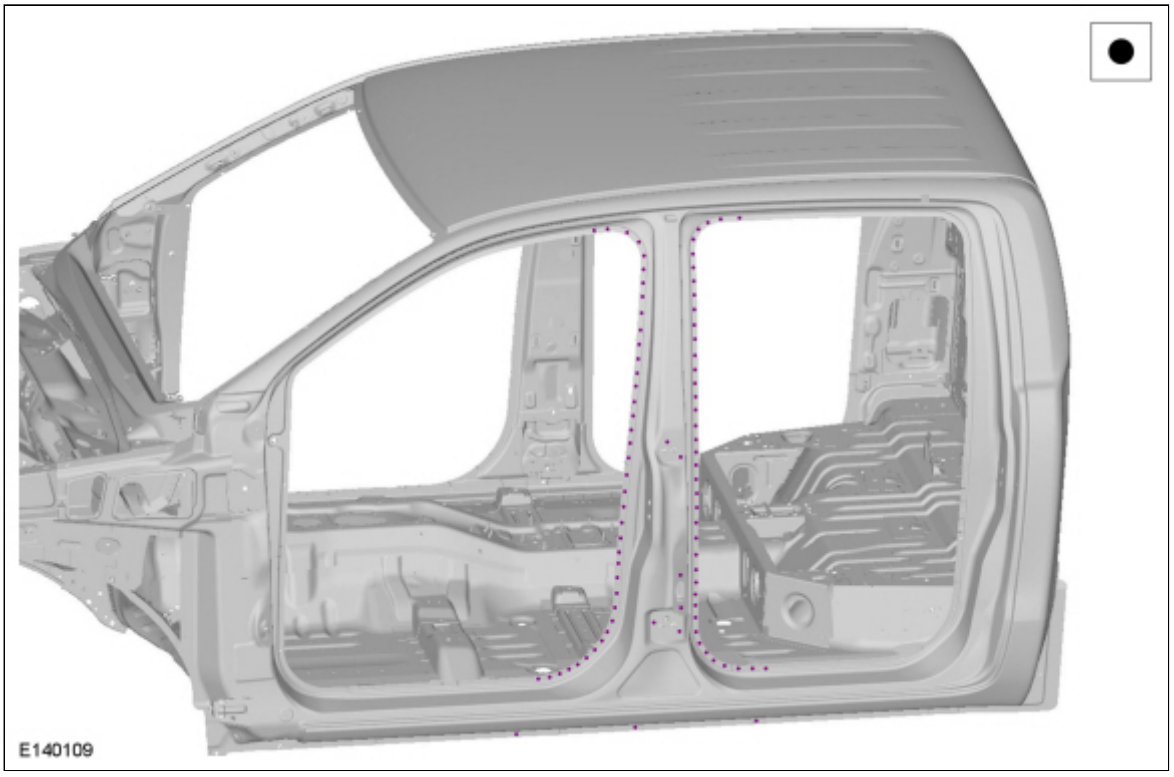
- Puddle weld **2** panel layer.
  Use the General Equipment: MIG/MAG Welding Equipment



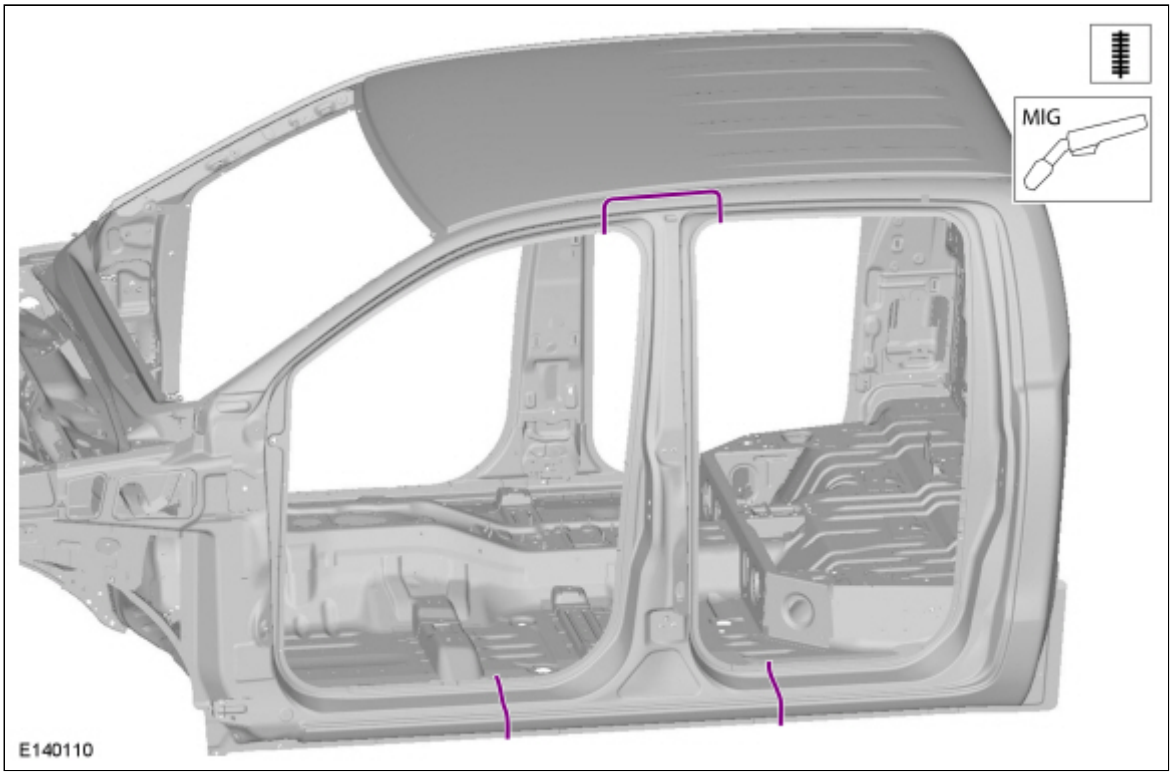
- Puddle weld **3** panel layer.
  Use the General Equipment: MIG/MAG Welding Equipment



- Resistance spot weld - Panel thickness 3 mm and greater!
  Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Rocker Panel Trim
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat Cushion (501-10A Seating, Disassembly and Assembly).
  Refer to: Rear Seat Backrest (501-10A Seating, Disassembly and Assembly).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Front and Rear Door

Copyright © 2016 Ford Motor Company

B-Pillar Outer Panel - Double Cab

Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
Hot Air Gun
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

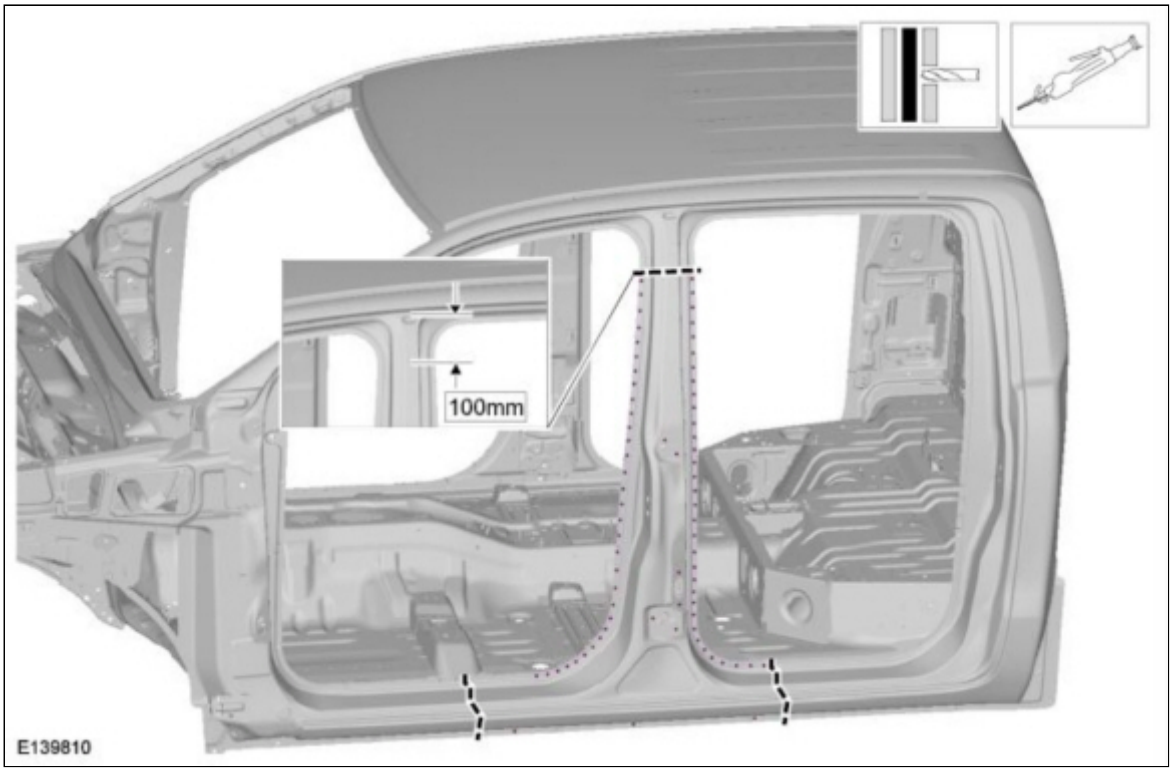
Materials

Name	Specification
Adhesive	WSK-M11P57-A3

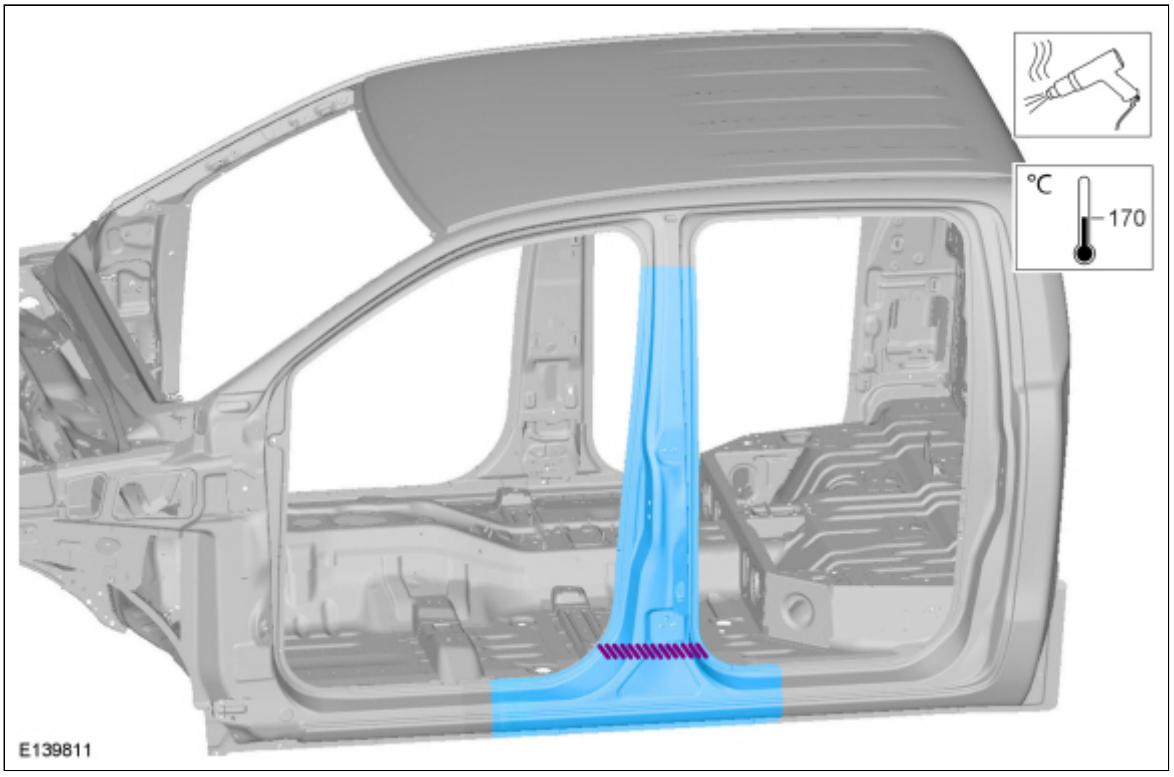
Removal

- Rocker Panel Trim
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Front and Rear Door
- Reposition the carpeting and the wiring harness away from the working area.

- Use the General Equipment: Air Body Saw
  Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Hot Air Gun



Installation

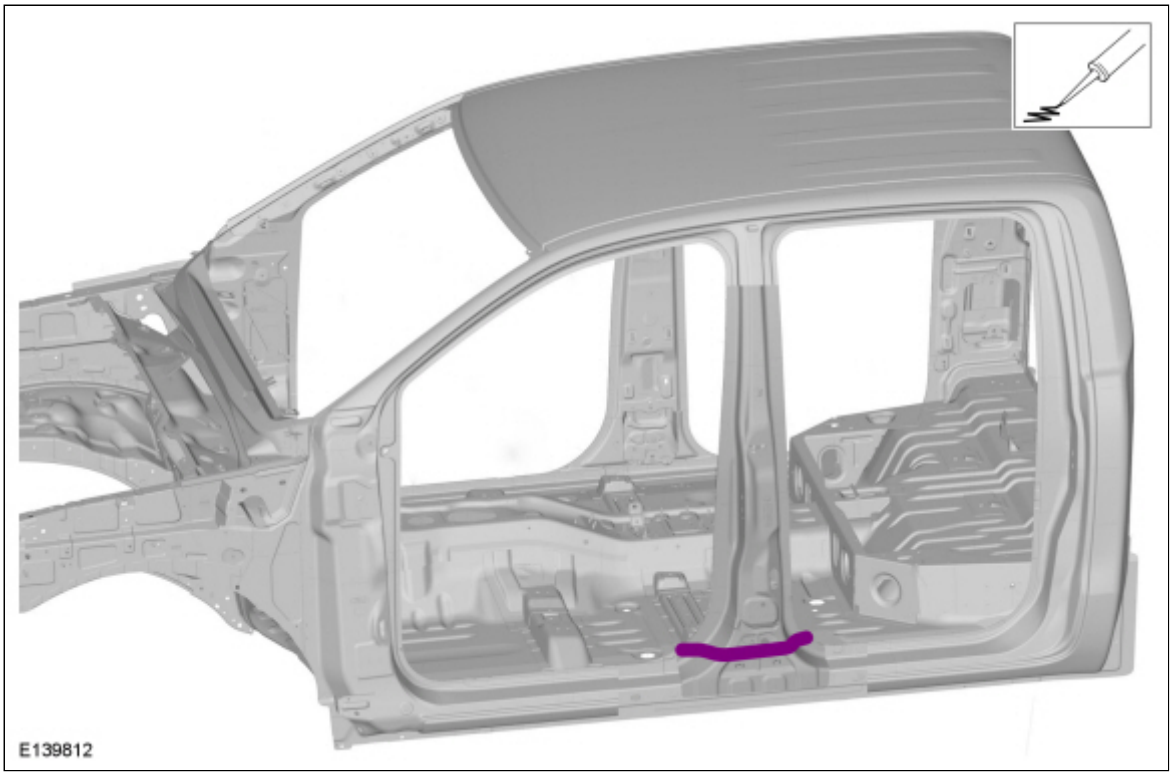
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

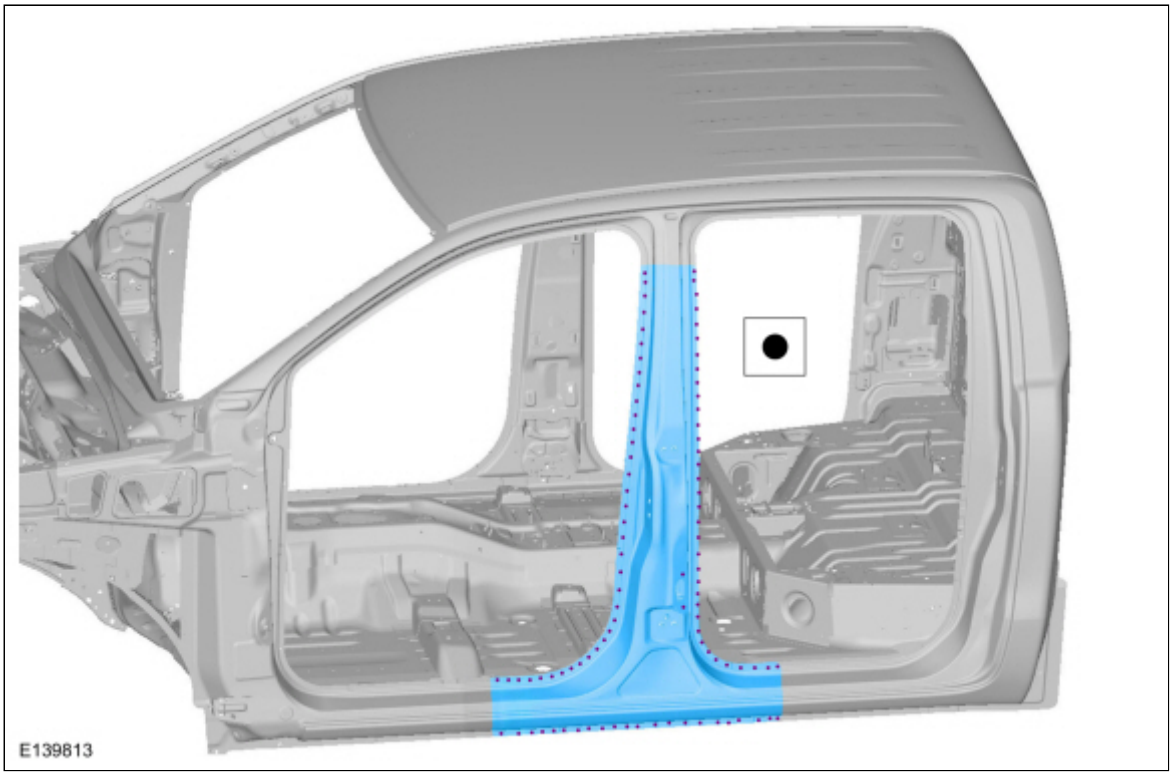
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

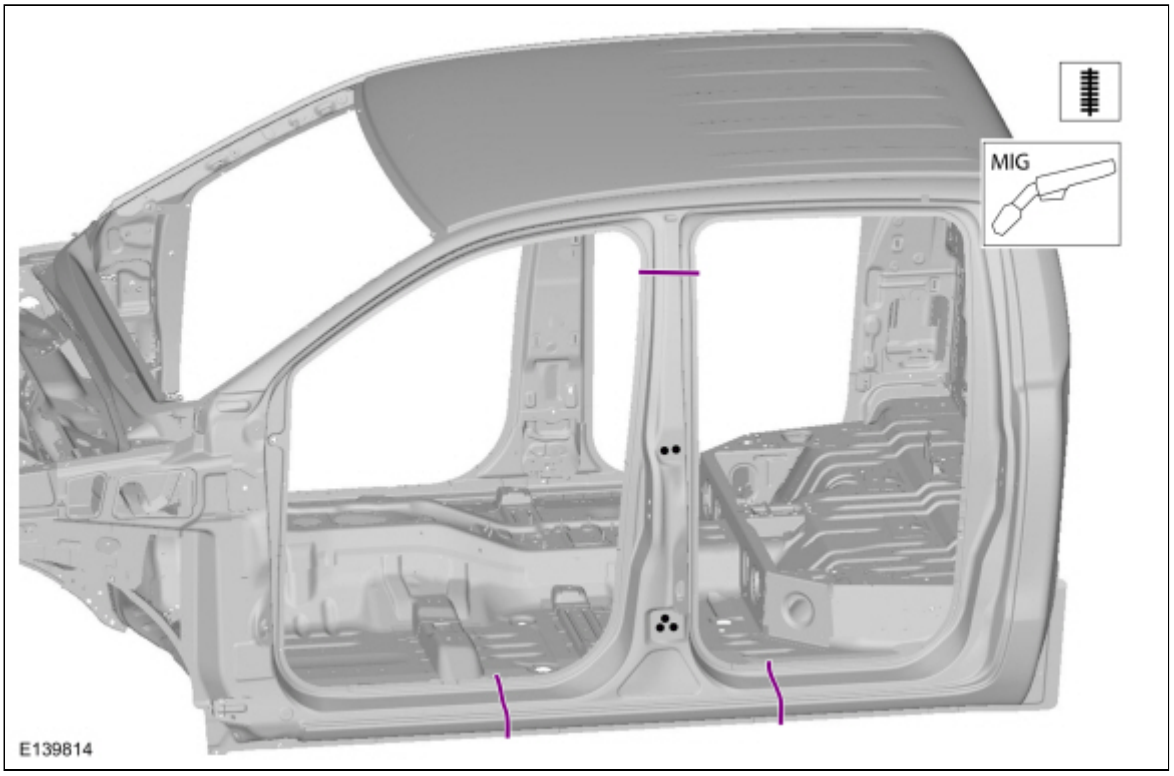
   - *Material*: Adhesive (WSK-M11P57-A3)



- Resistance spot weld - Panel thickness 3 mm and greater!
  Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Rocker Panel Trim
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Front and Rear Door

Copyright © 2016 Ford Motor Company

Rocker Panel - Double Cab

Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
Hot Air Gun
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

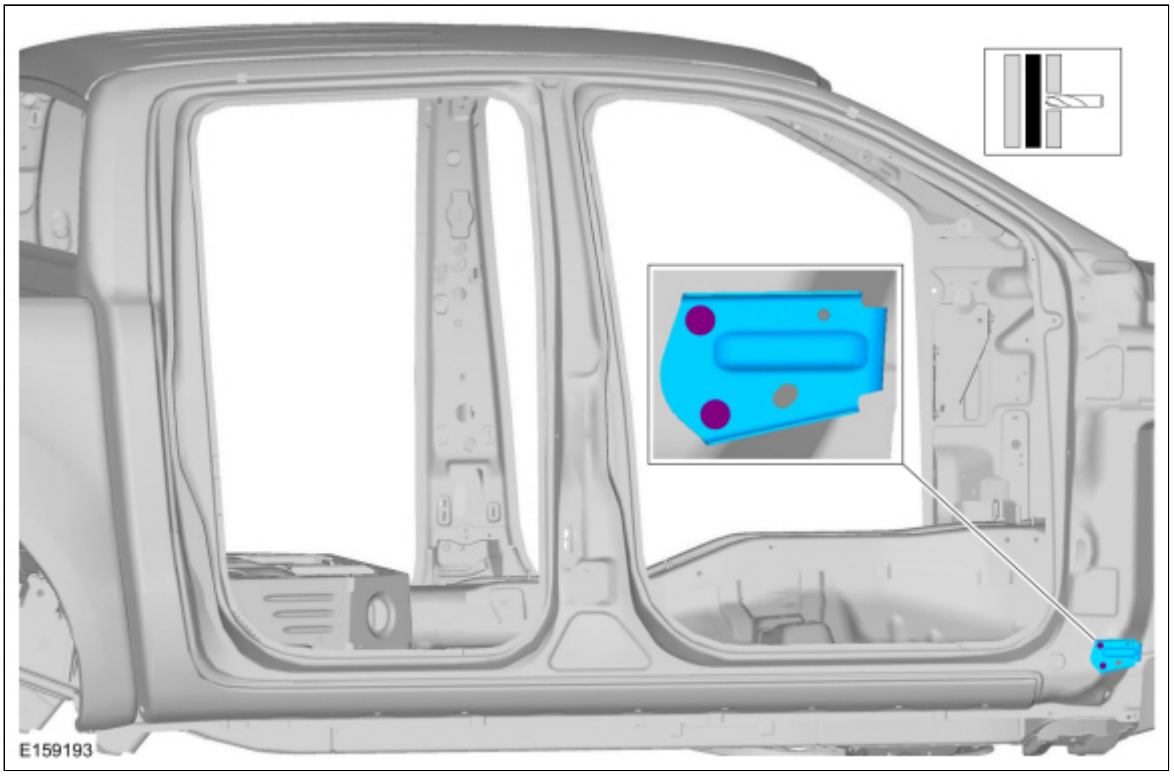
Materials

Name	Specification
Adhesive	WSK-M11P57-A3

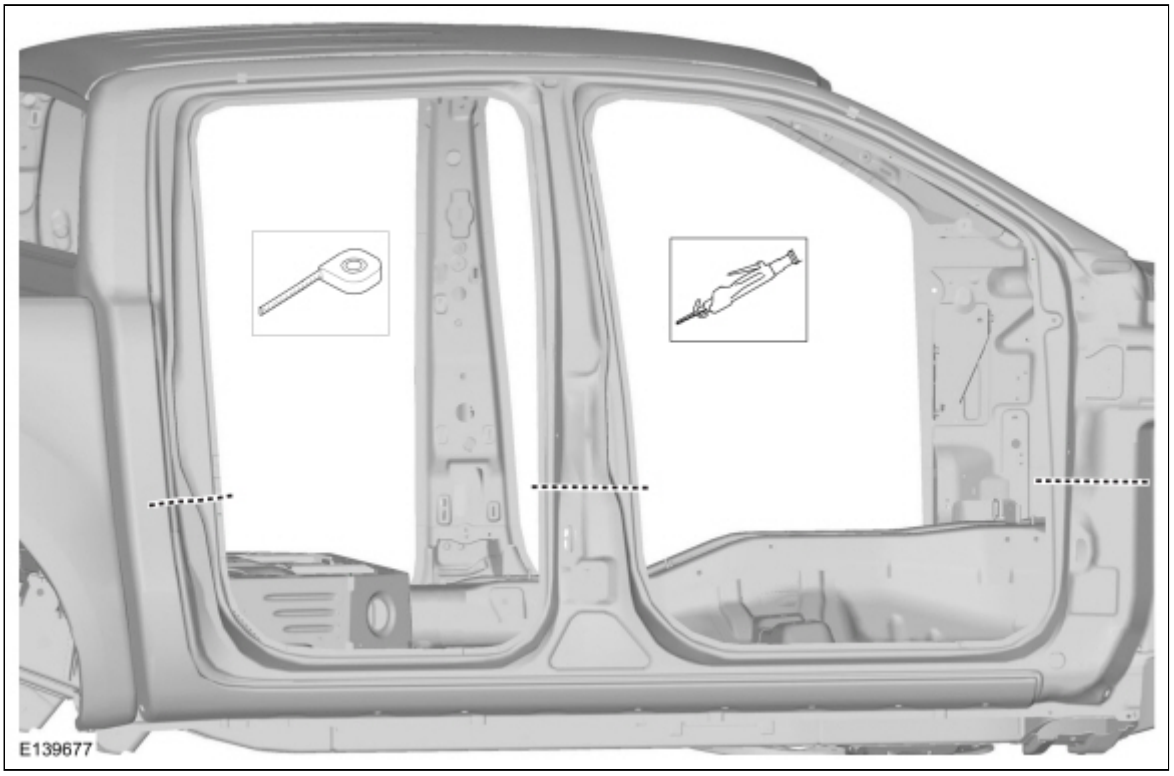
Removal

- Refer to: Front Door (501-03 Body Closures, Removal and Installation).
  Refer to: Rear Door - Double Cab (501-03 Body Closures, Removal and Installation).
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Rear Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).
- Remove the load body from the vechicle.
- Reposition the carpeting and the wiring harness away from the working area.

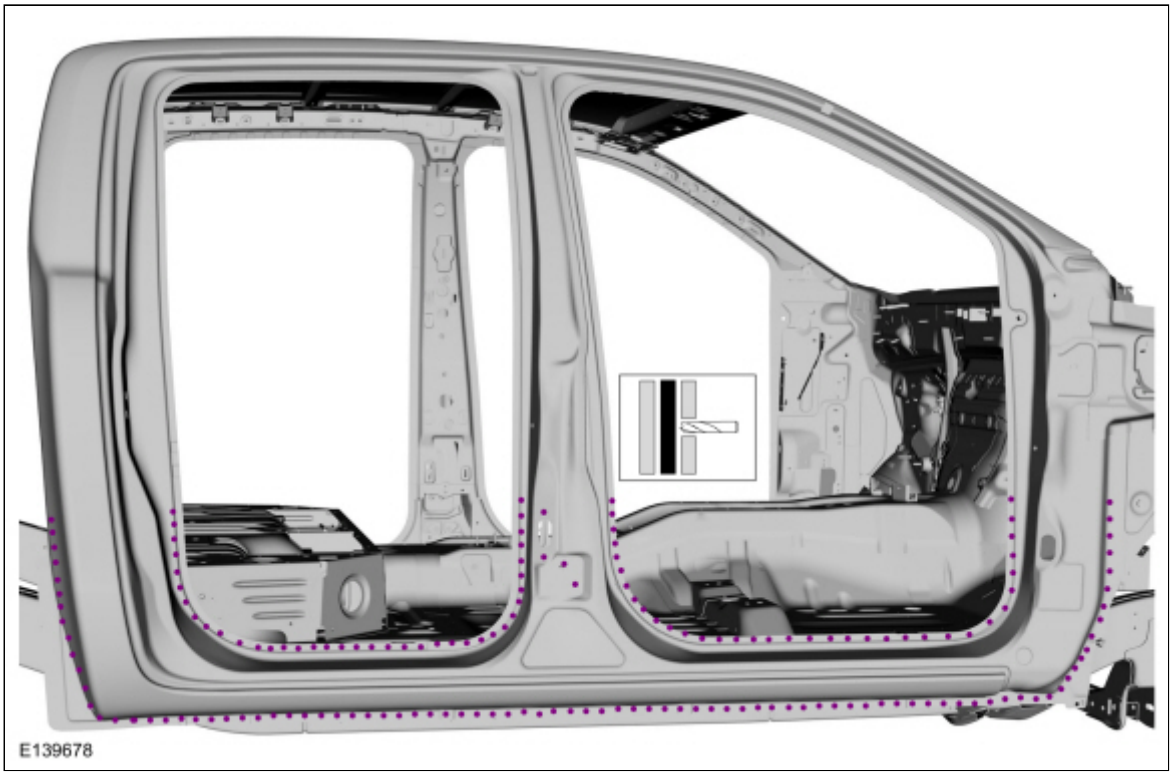
2. Use the General Equipment: Spot Weld Drill Bit



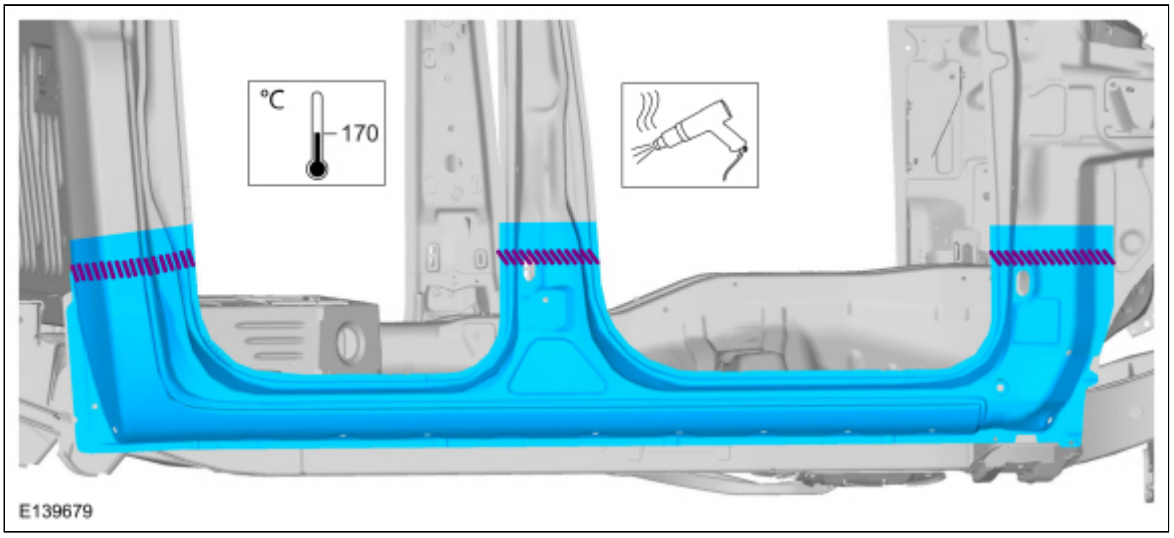
- Use the General Equipment: Air Body Saw



- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Hot Air Gun



Installation

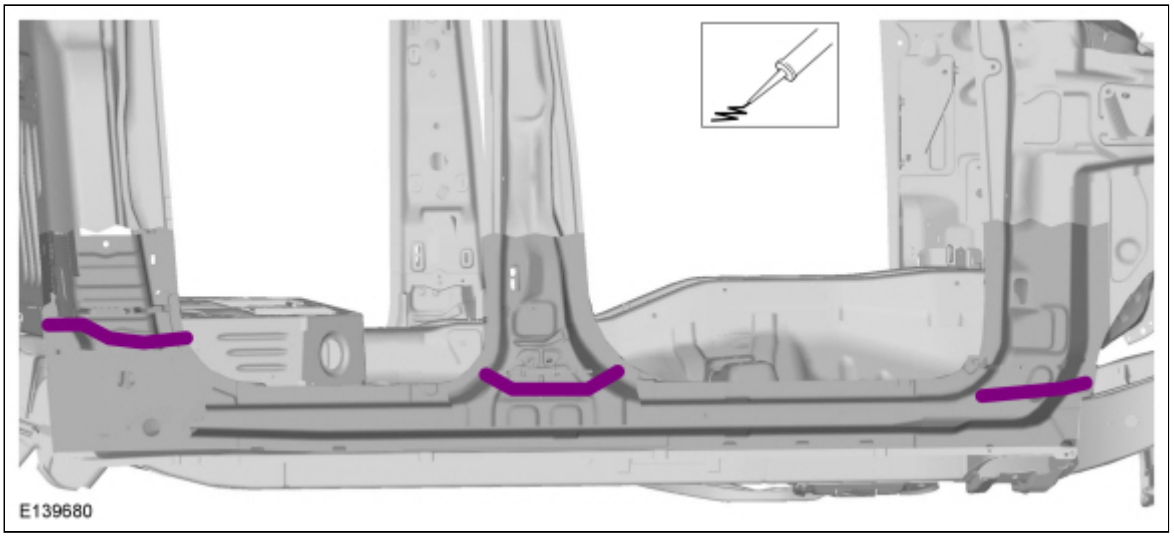
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

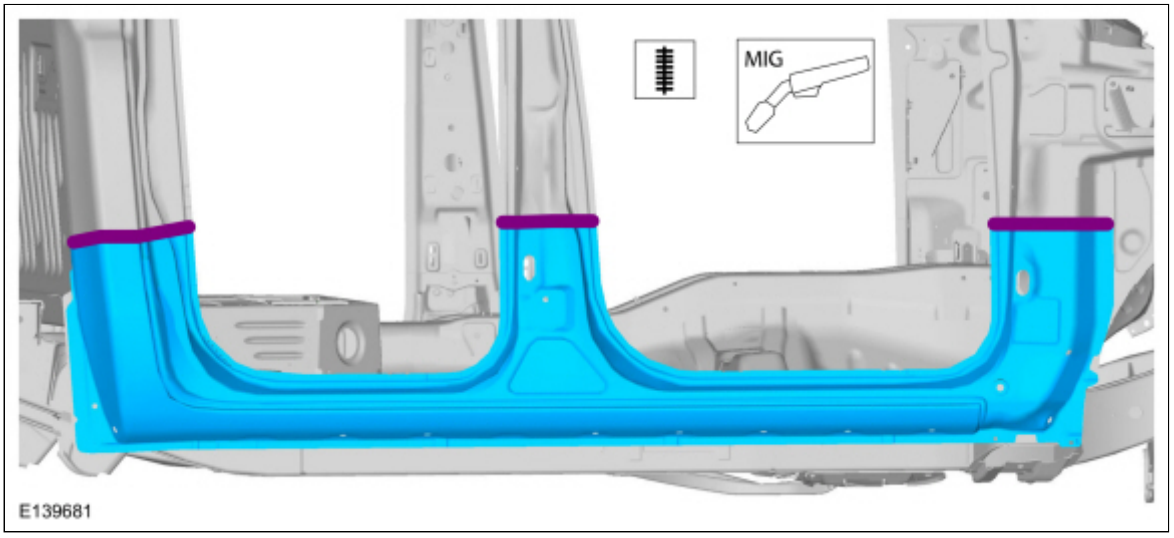
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

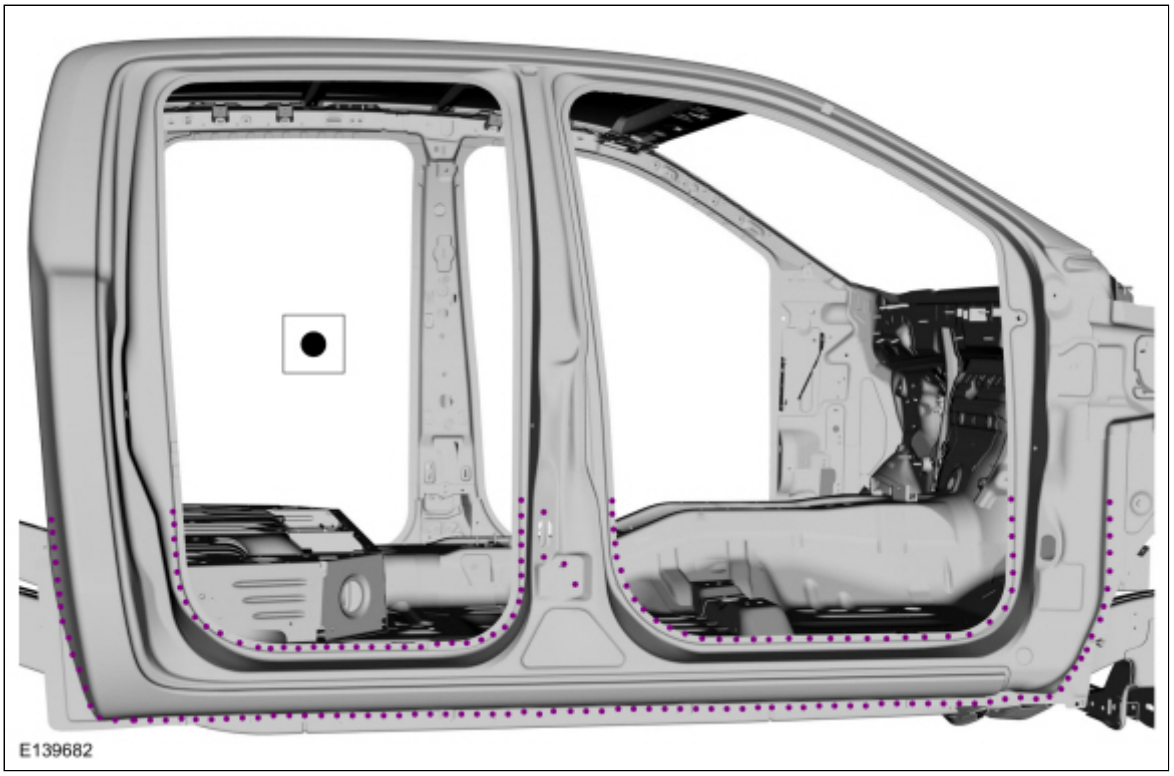
   - *Material*: Adhesive (WSK-M11P57-A3)



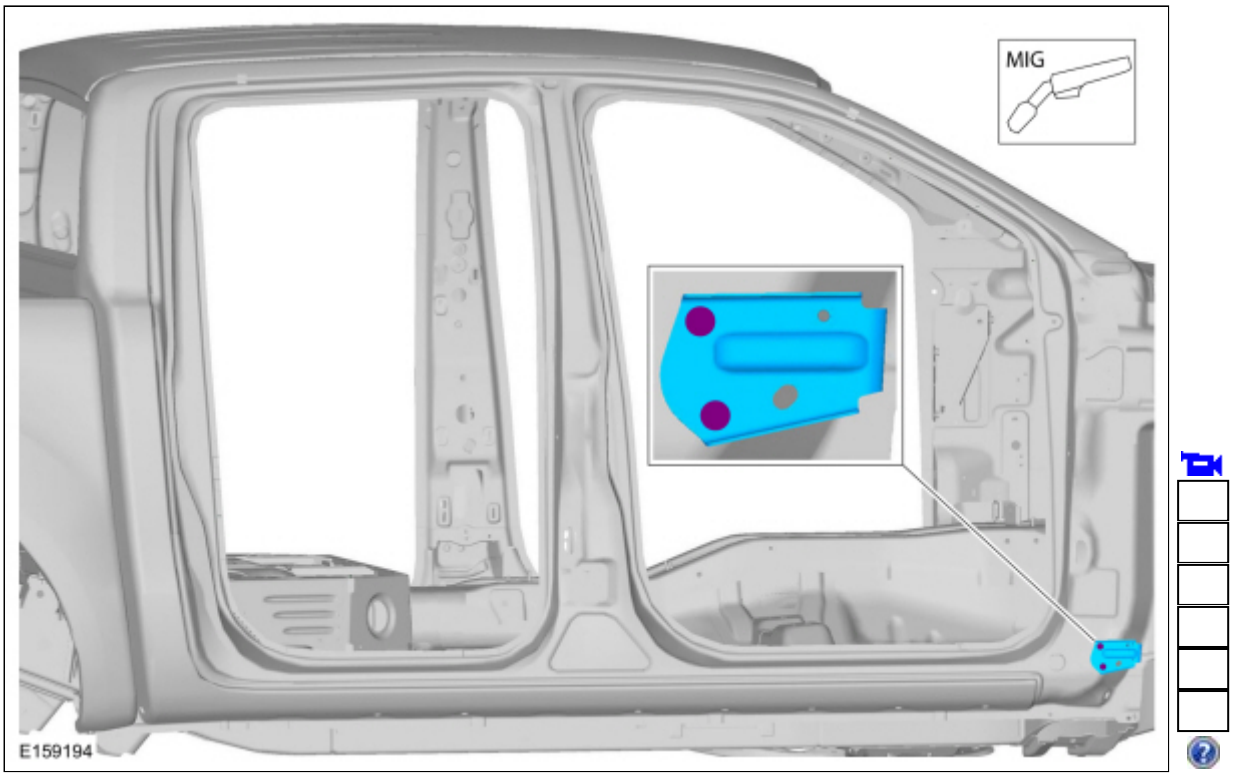
- Use the General Equipment: MIG/MAG Welding Equipment



- Use the General Equipment: Resistance Spotwelding Equipment



6. Use the General Equipment: MIG/MAG Welding Equipment



- Refer to: Front Door (501-03 Body Closures, Removal and Installation).
  Refer to: Rear Door - Double Cab (501-03 Body Closures, Removal and Installation).
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Rear Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).
- Install the load body into the vechicle.

Copyright © 2016 Ford Motor Company

Rocker Panel - Single Cab

Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
Hot Air Gun
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

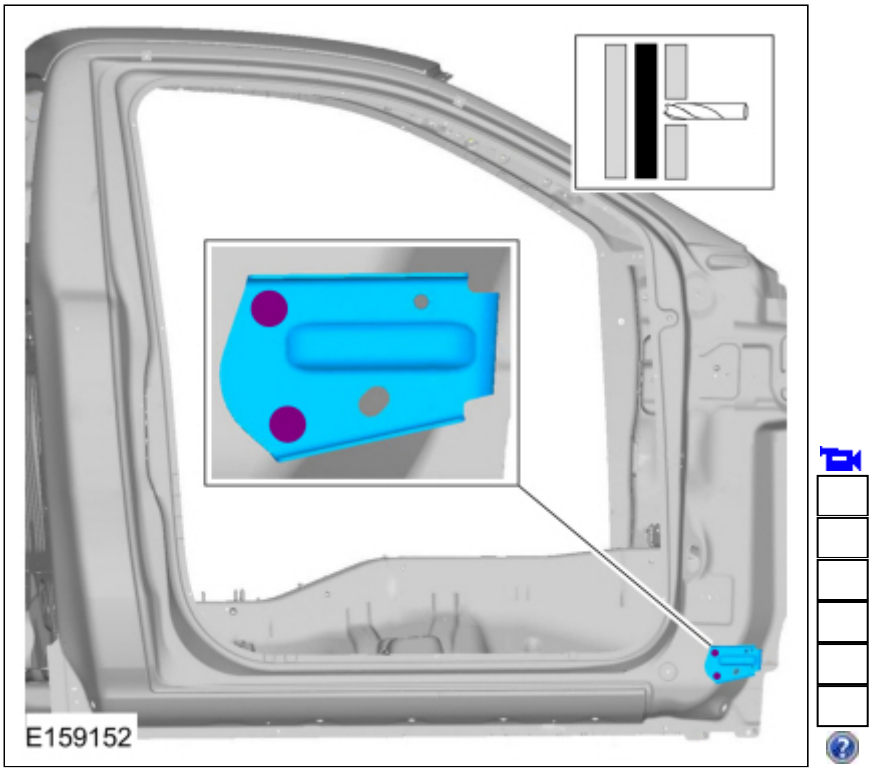
Materials

Name	Specification
Adhesive	WSK-M11P57-A3

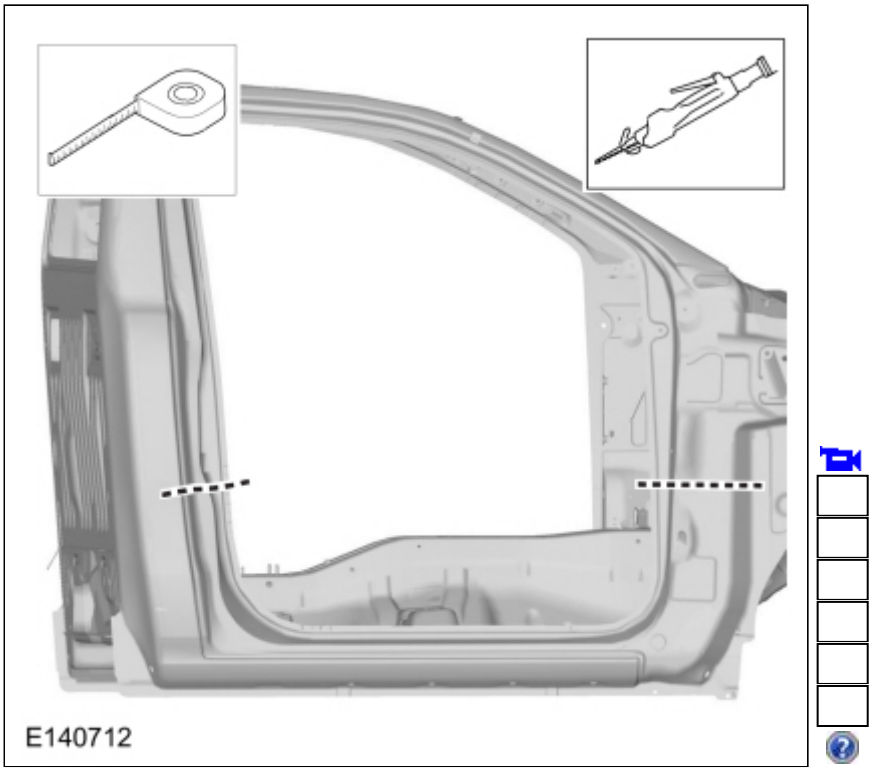
Removal

- Refer to: Front Door (501-03 Body Closures, Removal and Installation).
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Remove the load body from the vechicle.
- Reposition the carpeting and the wiring harness away from the working area.

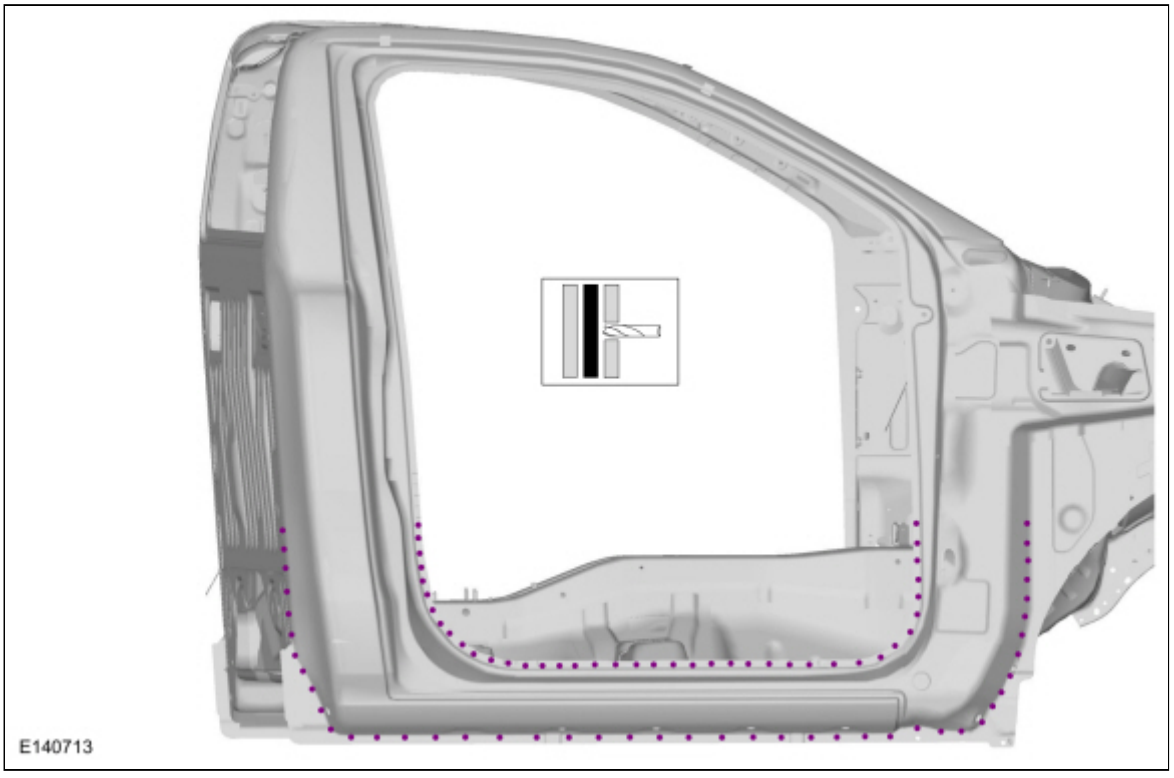
2. Use the General Equipment: Spot Weld Drill Bit



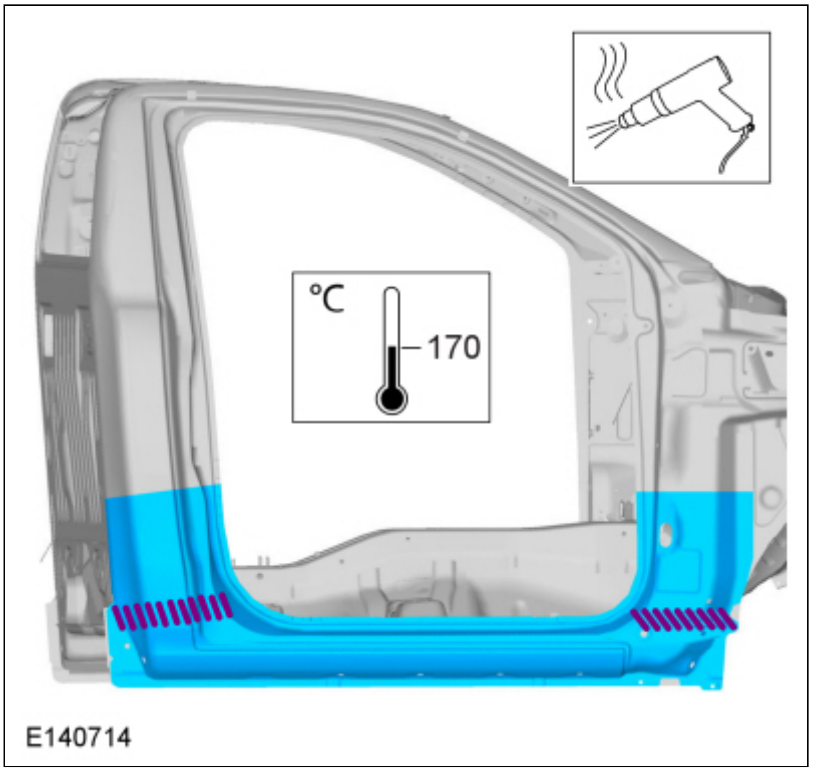
- Use the General Equipment: Air Body Saw



- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Hot Air Gun



Installation

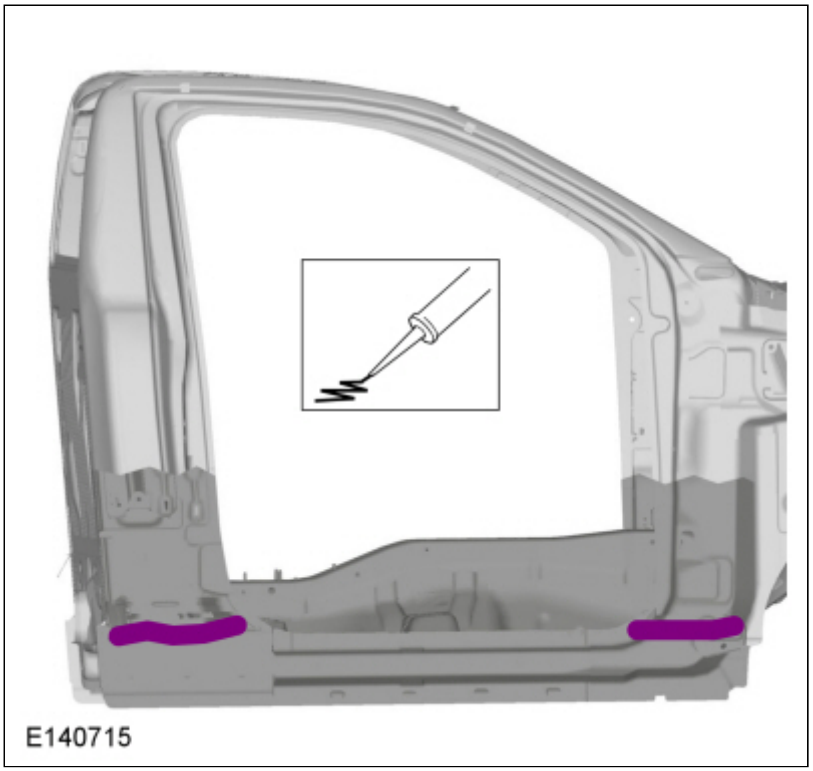
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

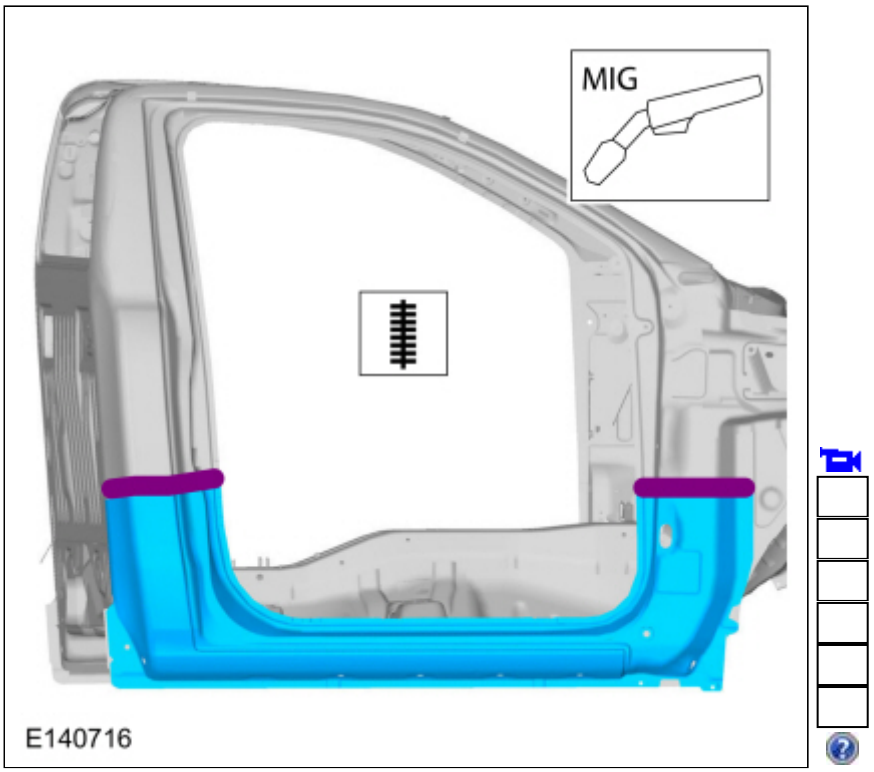
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

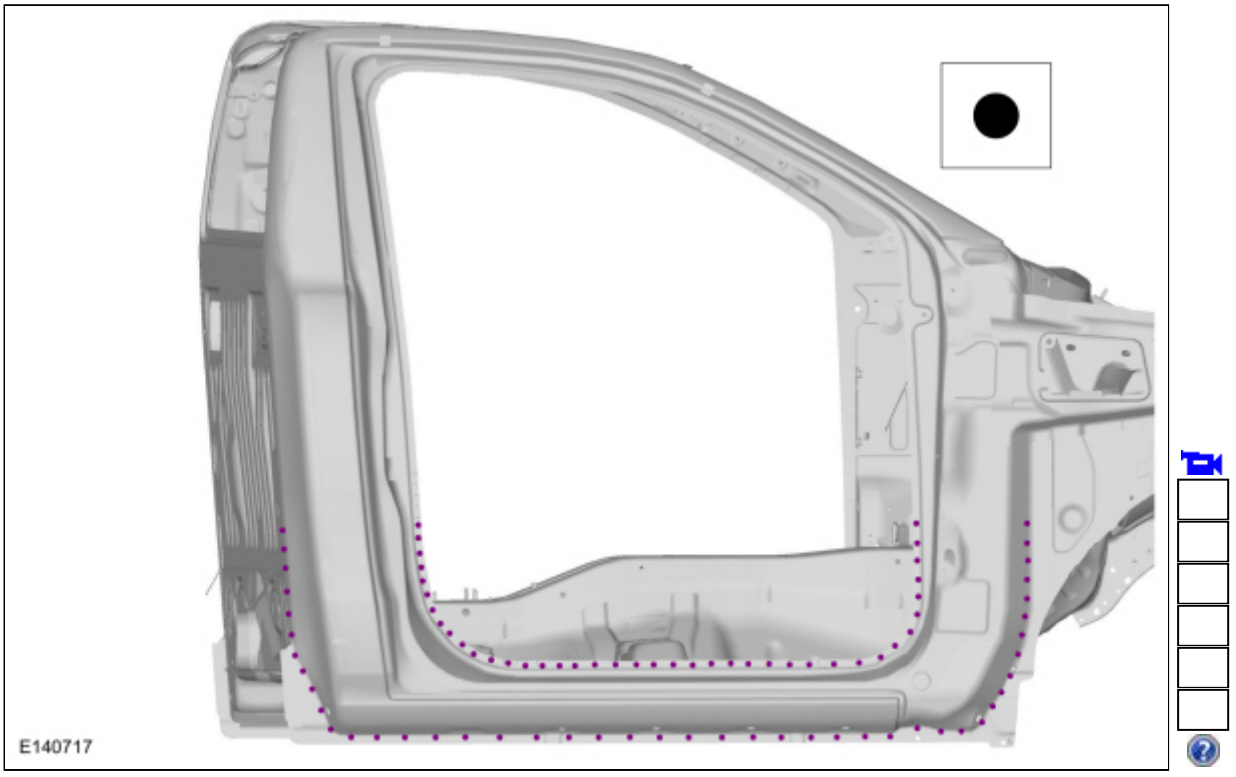
   - *Material*: Adhesive (WSK-M11P57-A3)



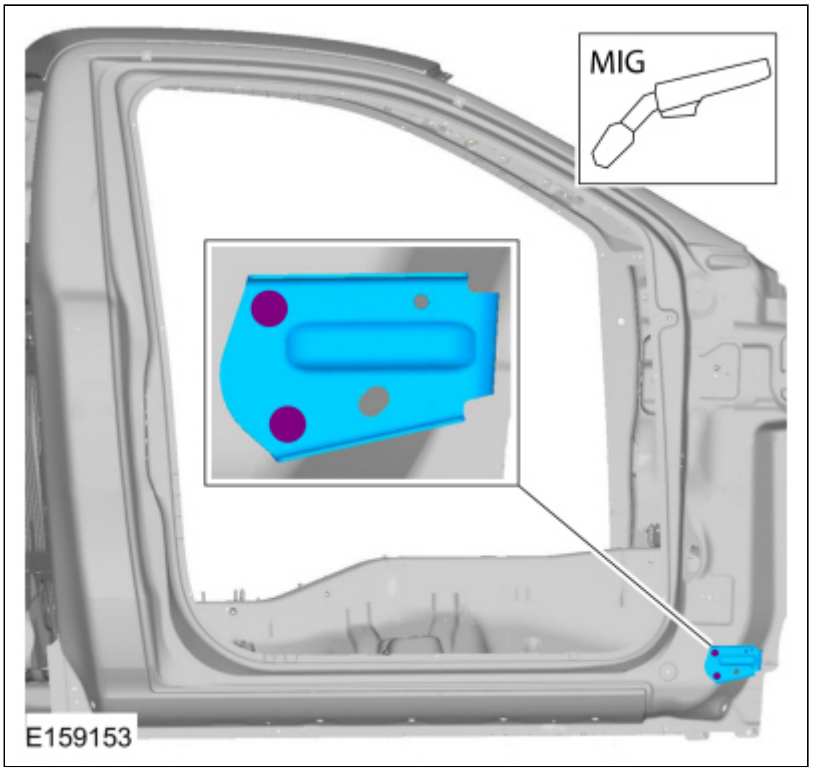
- Use the General Equipment: MIG/MAG Welding Equipment



- Use the General Equipment: Resistance Spotwelding Equipment



6. Use the General Equipment: MIG/MAG Welding Equipment



- Refer to: Front Door (501-03 Body Closures, Removal and Installation).
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Install the load body into the vechicle.

Copyright © 2016 Ford Motor Company

Rocker Panel Inner Reinforcement - Double Cab

Special Tool(s) / General Equipment

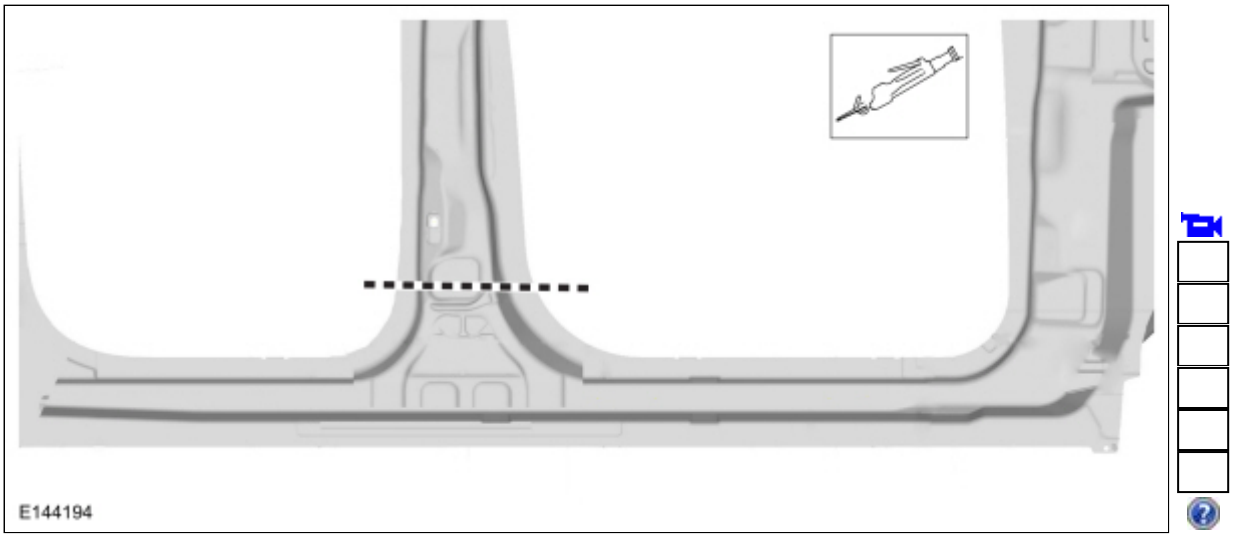
Resistance Spotwelding Equipment
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

Removal

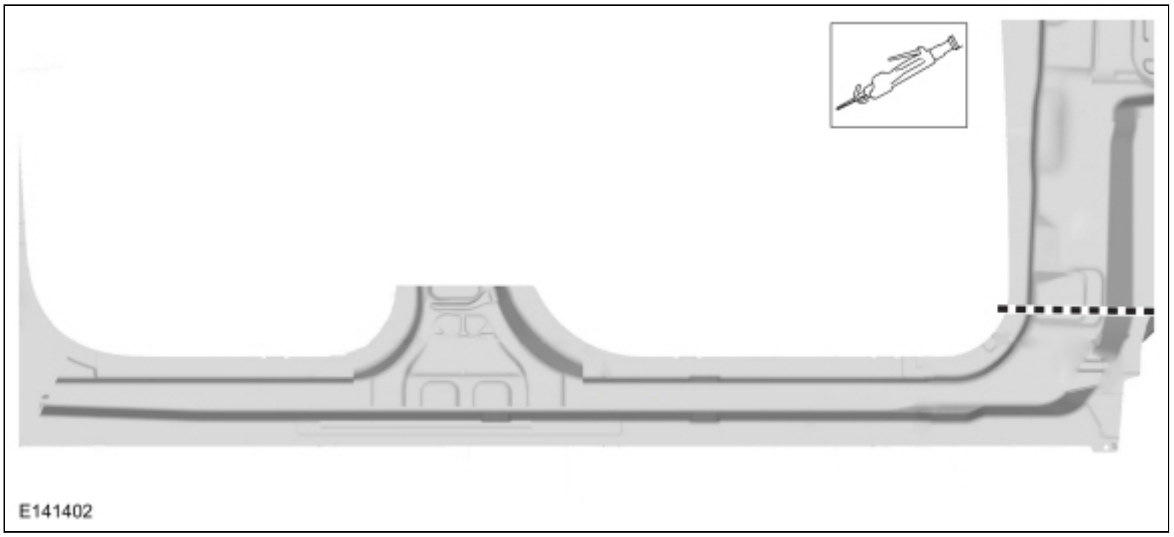
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

- Refer to: A-Pillar Assembly (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Rocker Panel
- Door Hinges
- Front and Rear Door
- Front Wheel Arch Trim
- Rear Wheel Arch Trim
- A- B- and C-Pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Rocker Panel - Double Cab
  Refer to: Rocker Panel - Double Cab (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).
- B-Pillar Reinforcement
  Refer to: B-Pillar and Reinforcement - Double Cab (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Reposition the carpeting and the wiring harness away from the working area.

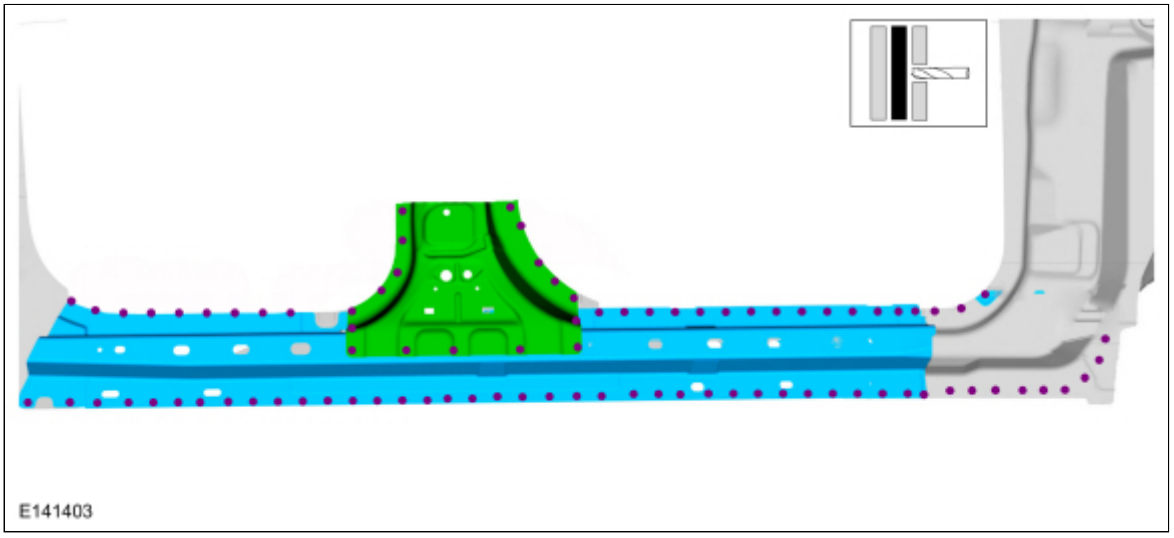
3.



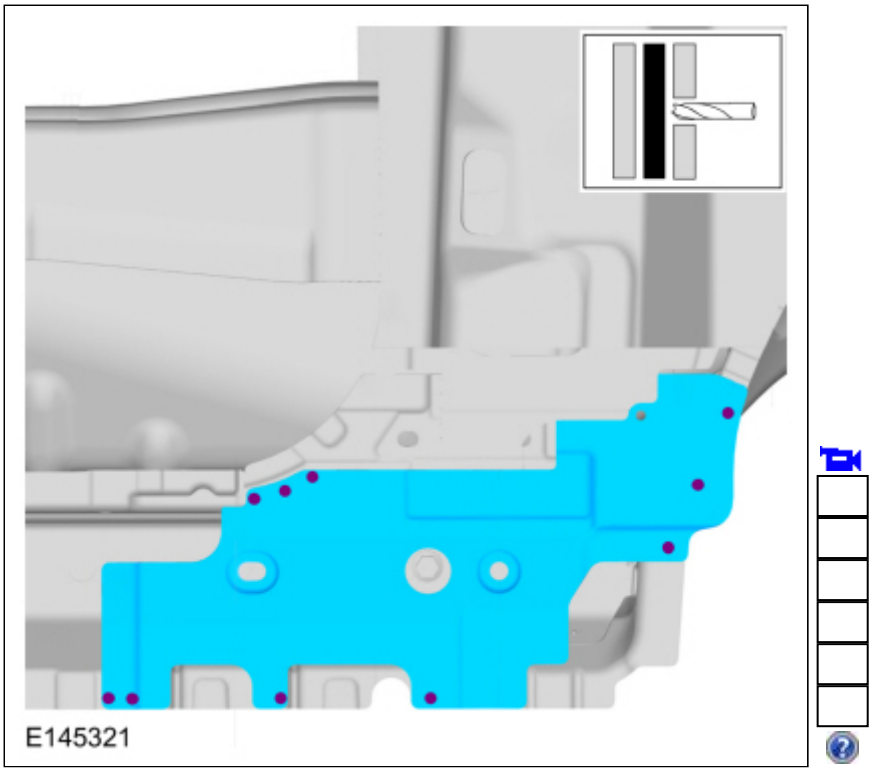
- Use the General Equipment: Air Body Saw



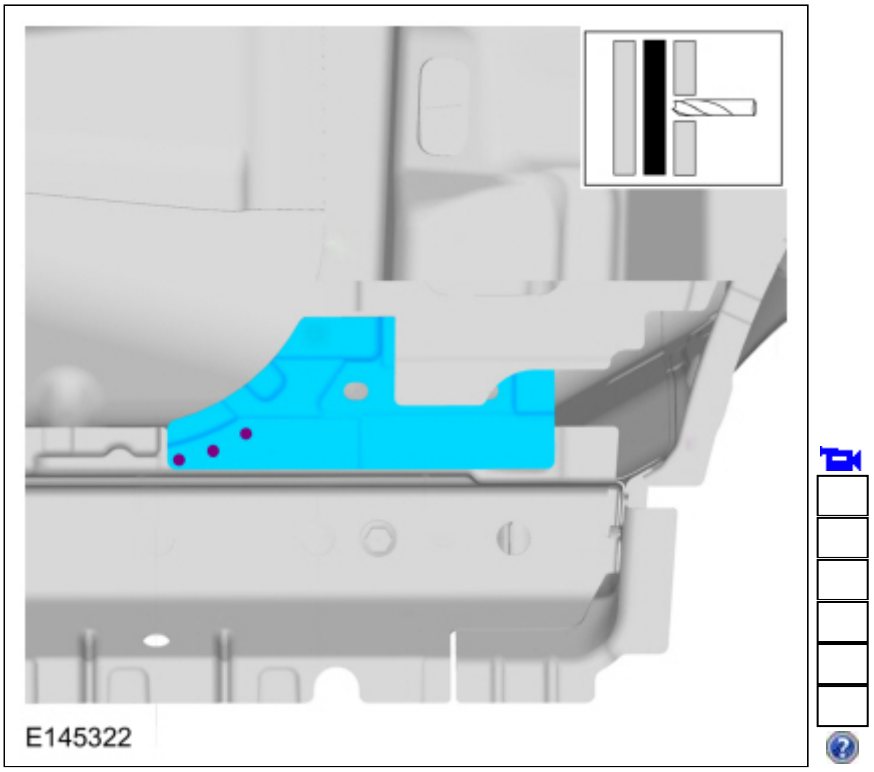
- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Spot Weld Drill Bit



Installation

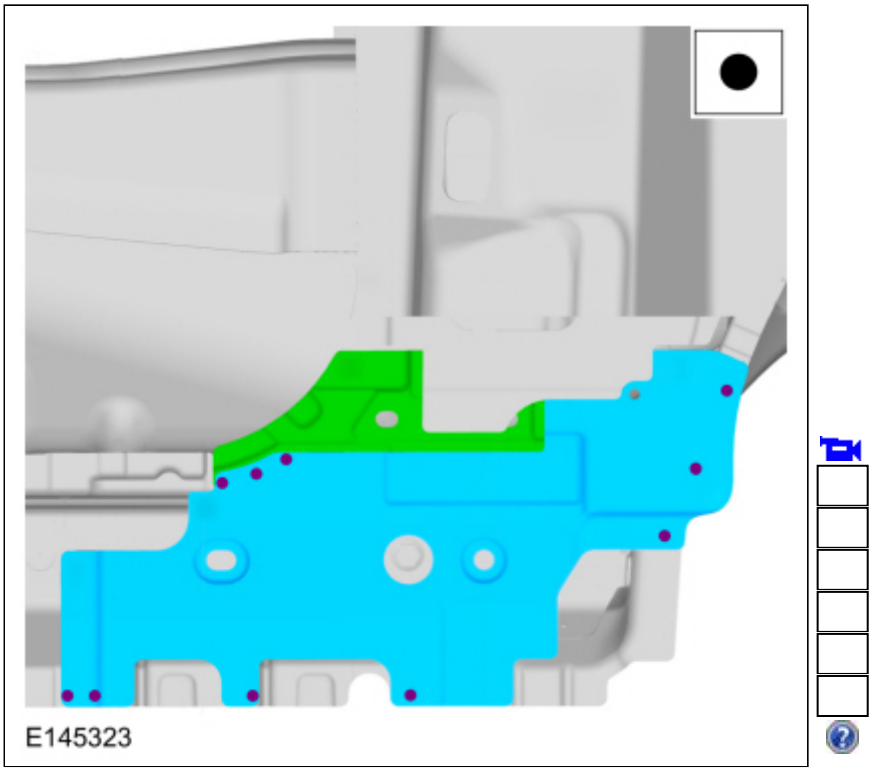
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

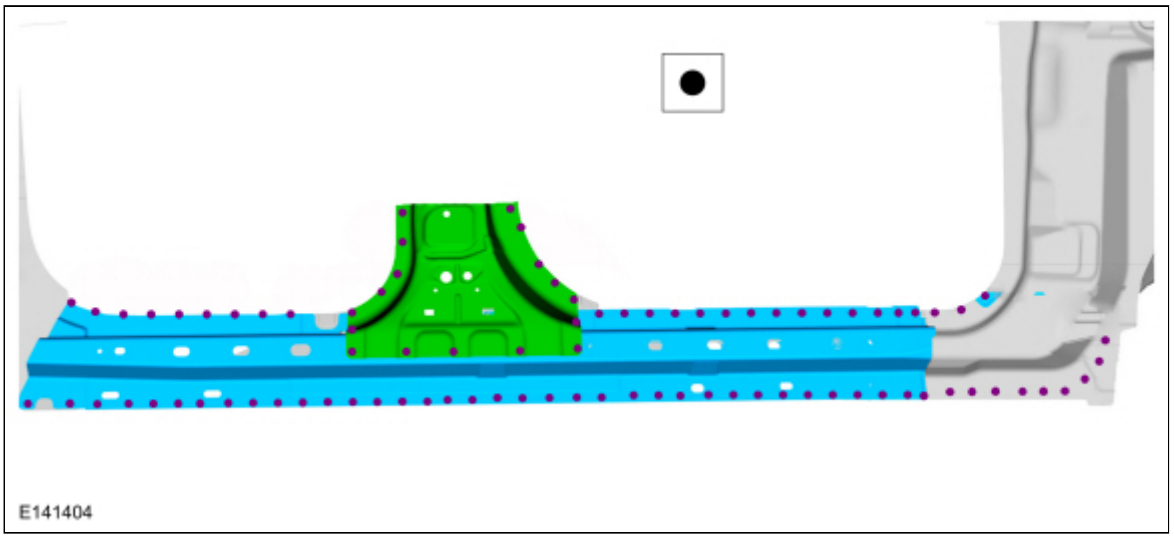
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

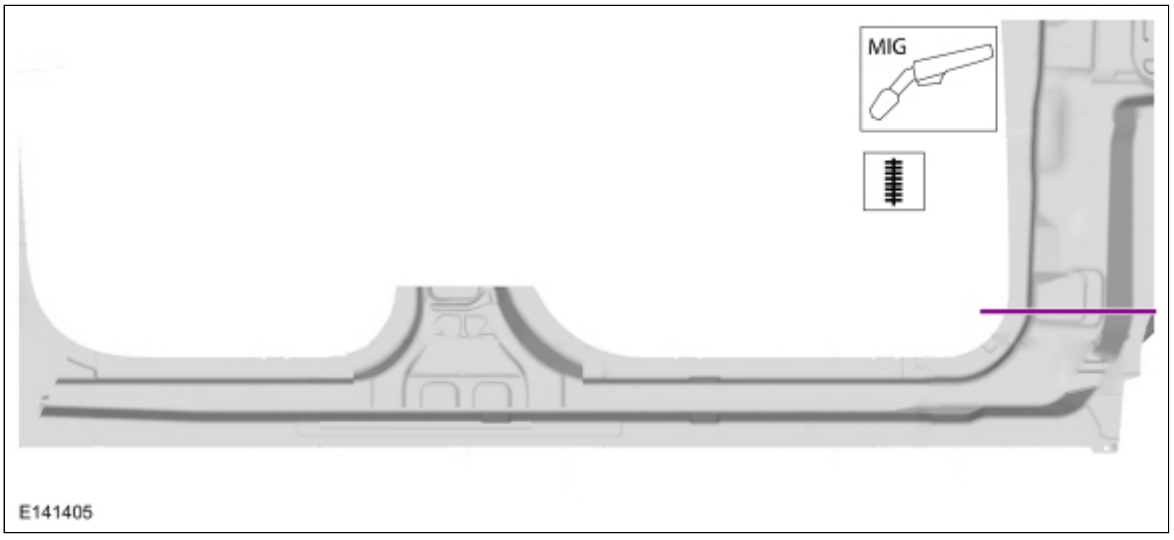
   - Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Refer to: A-Pillar Assembly (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Rocker Panel
- Door Hinges
- Front and Rear Door
- Front Wheel Arch Trim
- Rear Wheel Arch Trim
- A- B- and C-Pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).

Copyright © 2016 Ford Motor Company

Rocker Panel Inner Reinforcement - Single Cab

Special Tool(s) / General Equipment

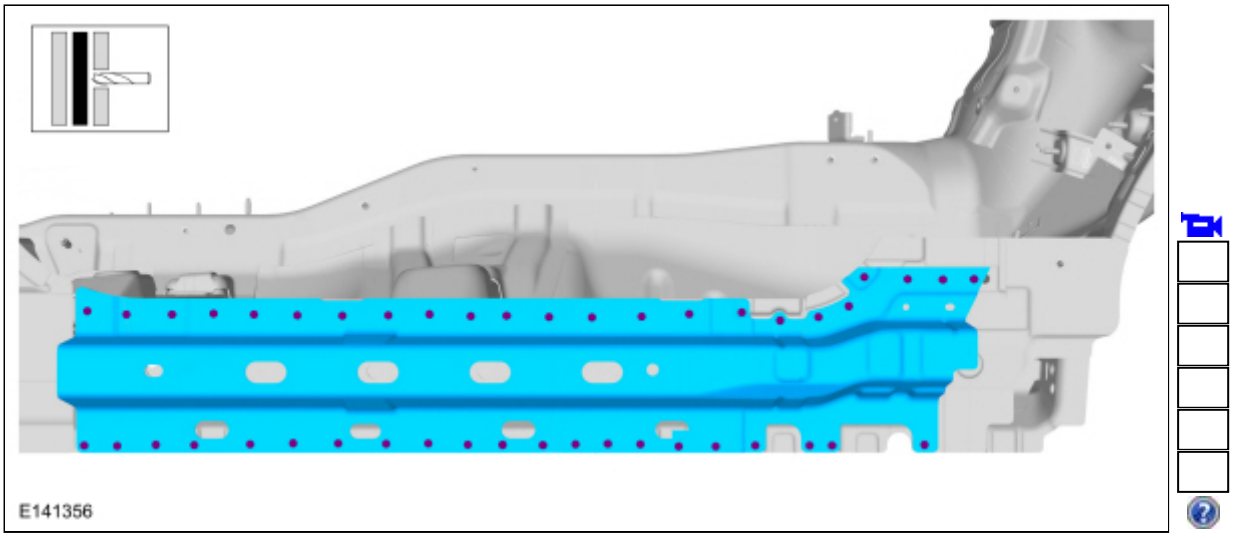
Resistance Spotwelding Equipment
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

Removal

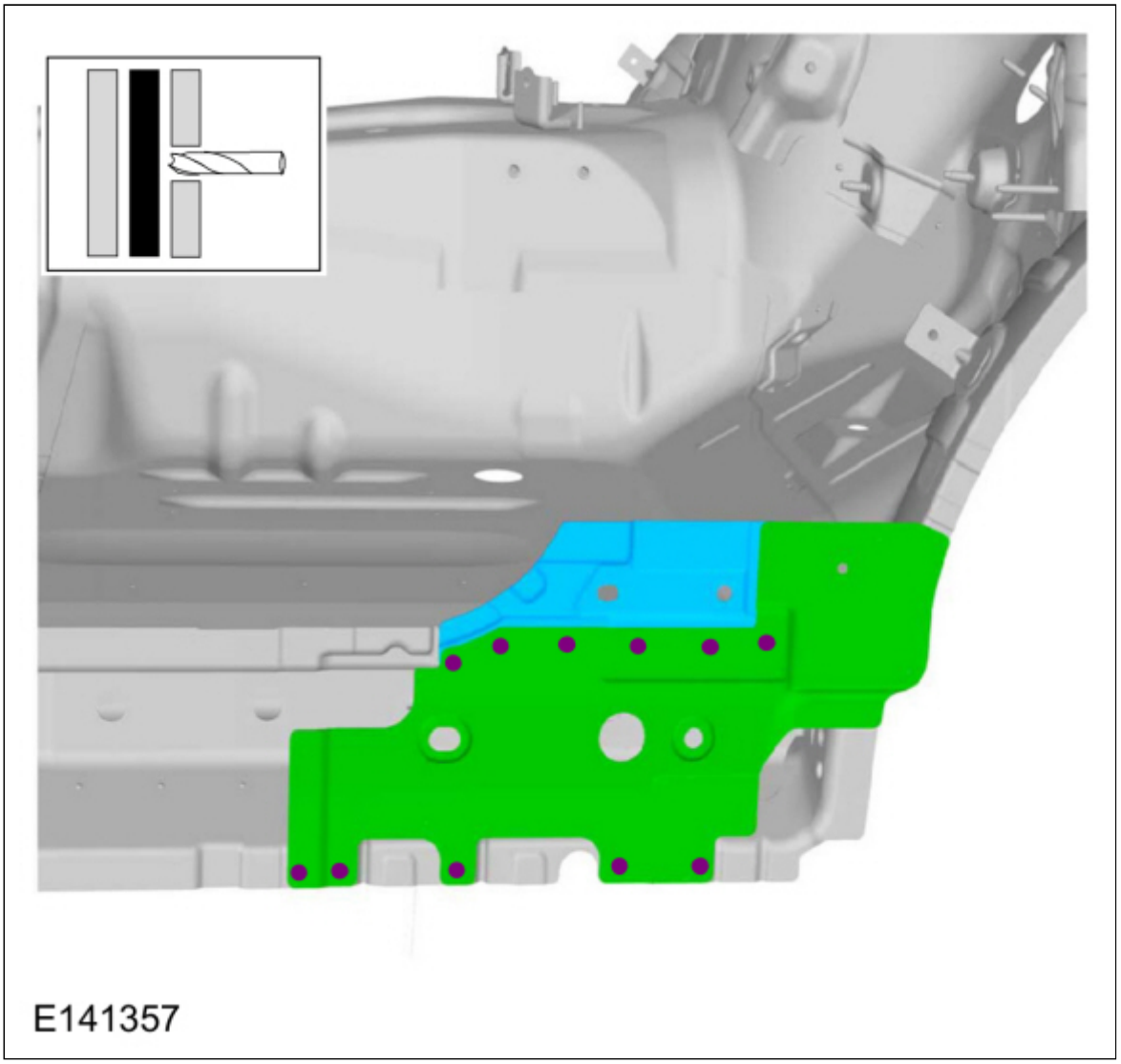
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

- Refer to: A-Pillar Assembly (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Rocker Panel
- Door Hinges
- Front Door
- Front Wheel Arch Trim
- Rear Wheel Arch Trim
- Rocker Panel Trim
- A- and C-Pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Reposition the carpeting and the wiring harness away from the working area.

- Use the General Equipment: Air Body Saw



- Use the General Equipment: Spot Weld Drill Bit



Installation

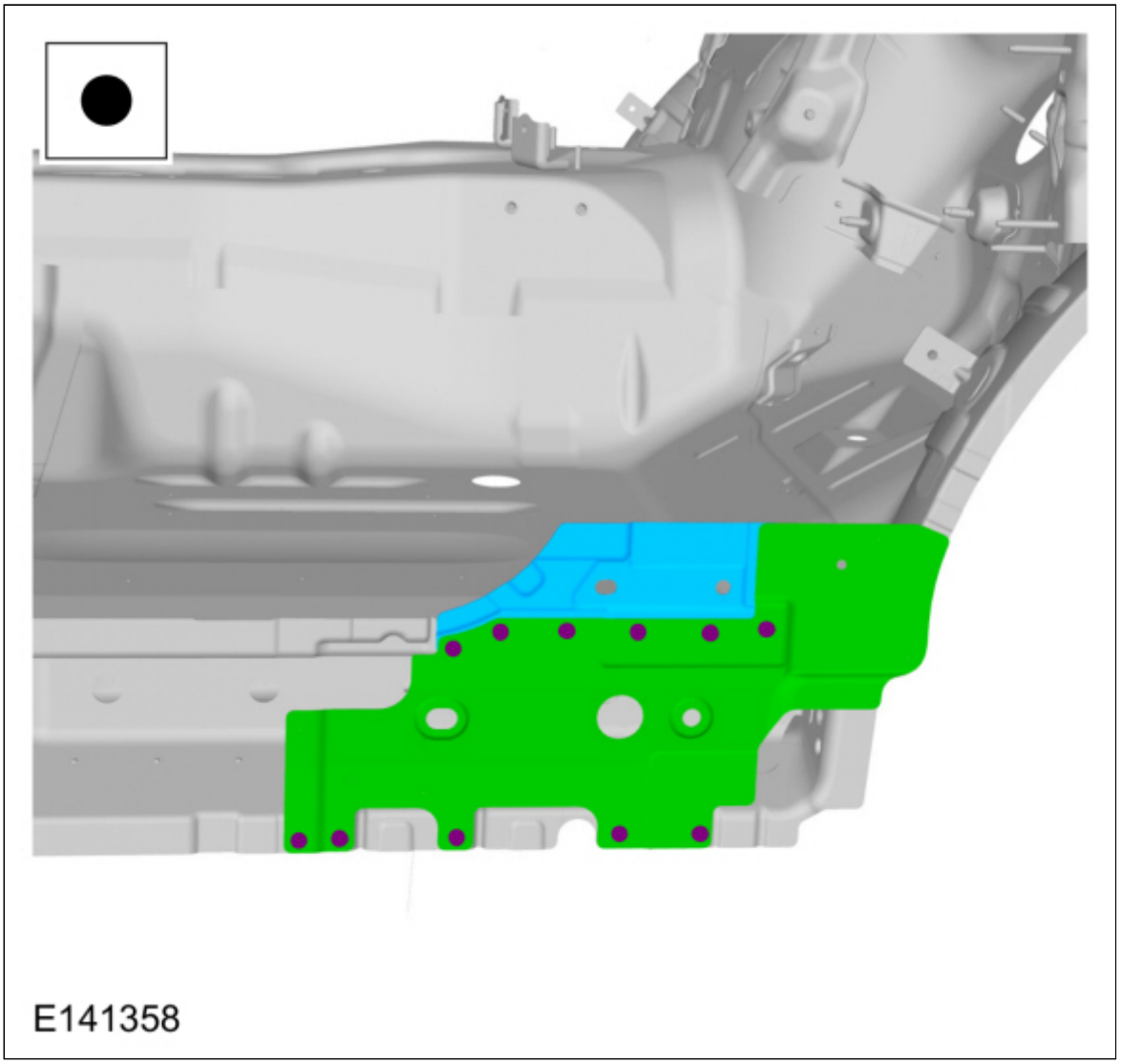
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

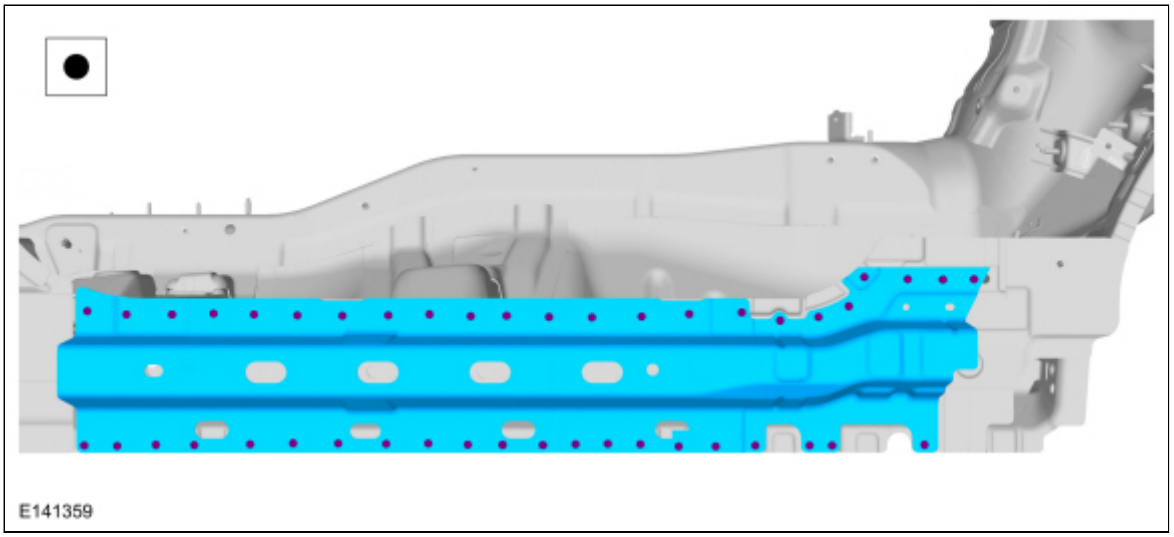
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

   - Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Refer to: A-Pillar Assembly (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Rocker Panel
- Door Hinges
- Front Door
- Front Wheel Arch Trim
- Rear Wheel Arch Trim
- Rocker Panel Trim

- A- and C-Pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Refer to: Front Seat (501-10A Seating, Removal and Installation).

Copyright © 2016 Ford Motor Company

Rocker Panel Inner Reinforcement - Stretch Cab

Special Tool(s) / General Equipment

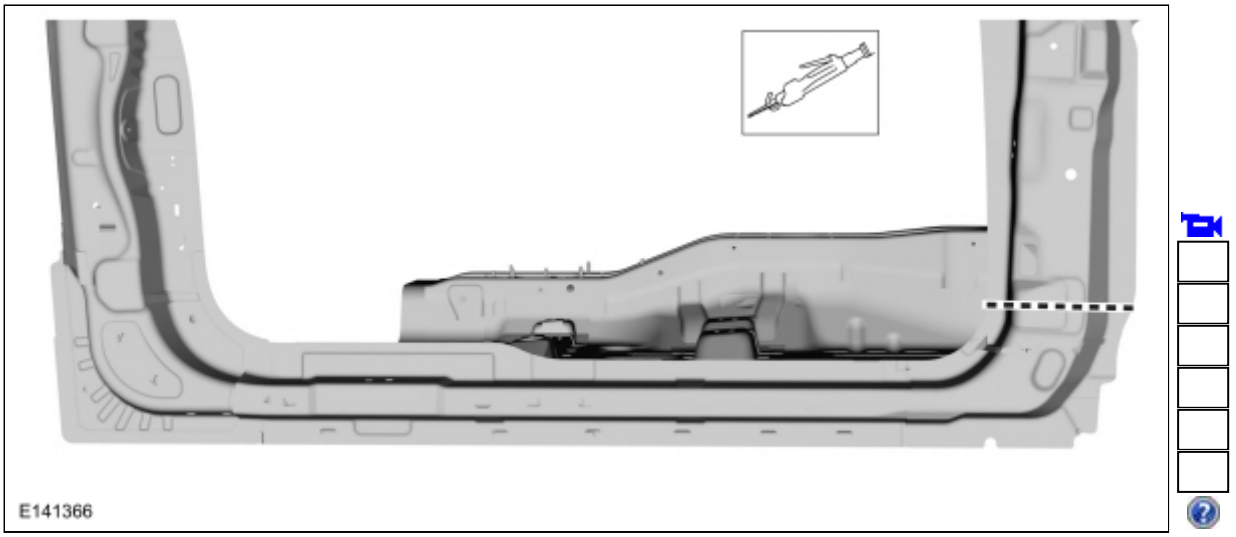
Resistance Spotwelding Equipment
Air Body Saw
MIG/MAG Welding Equipment
Spot Weld Drill Bit

Removal

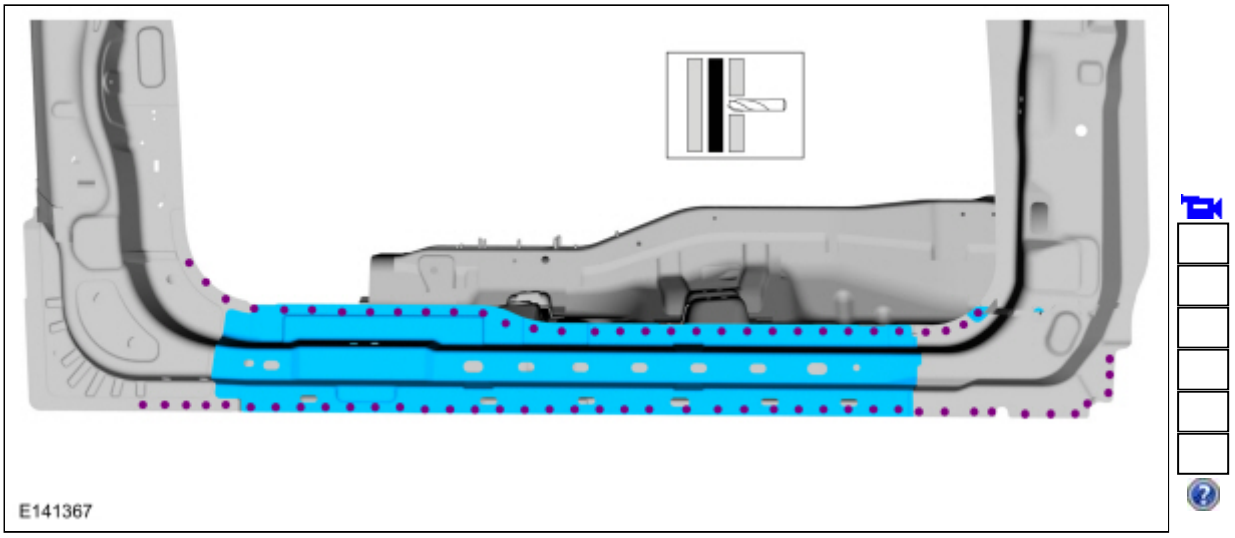
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

- Refer to: A-Pillar Assembly (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Rocker Panel
- Door Hinges
- Front and Rear Door
- Front Wheel Arch Trim
- Rear Wheel Arch Trim
- A- and C-Pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).
- Reposition the carpeting and the wiring harness away from the working area.

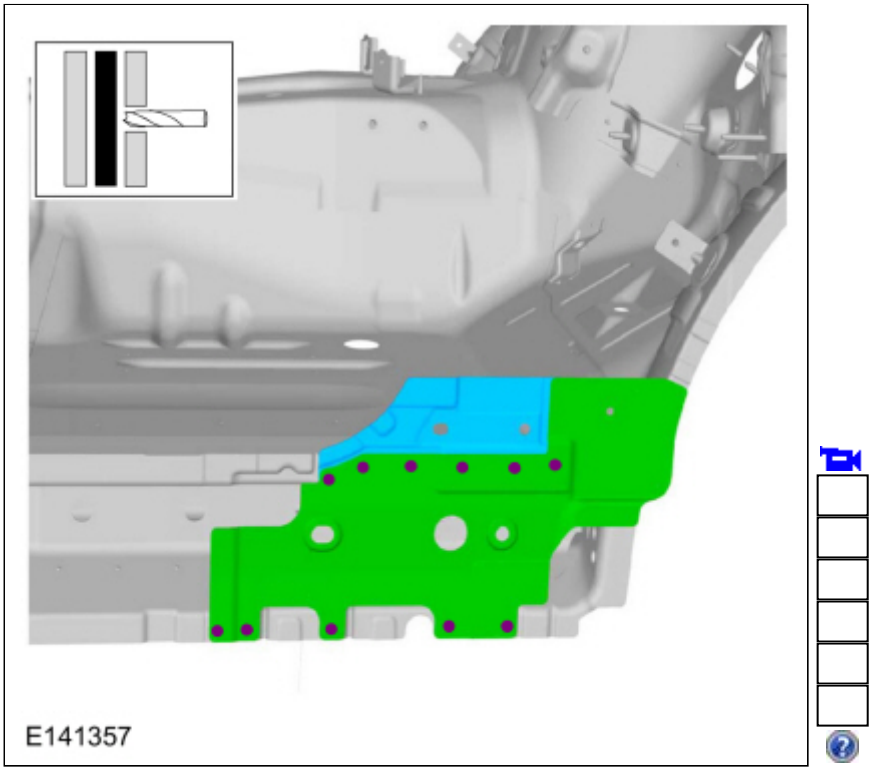
- Use the General Equipment: Air Body Saw



- Use the General Equipment: Spot Weld Drill Bit



- Use the General Equipment: Spot Weld Drill Bit



Installation

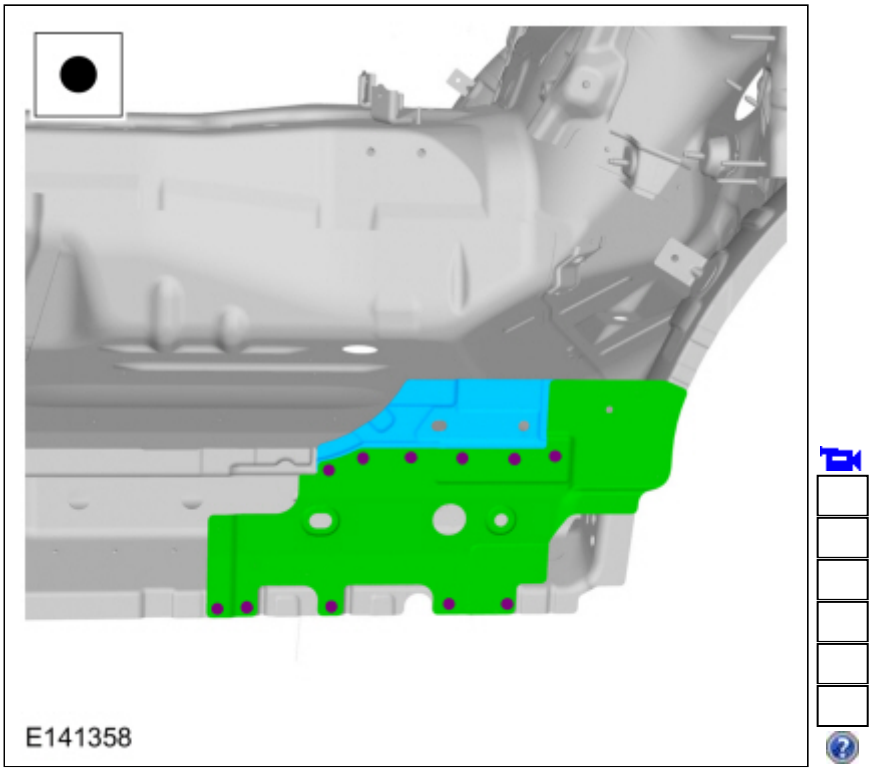
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

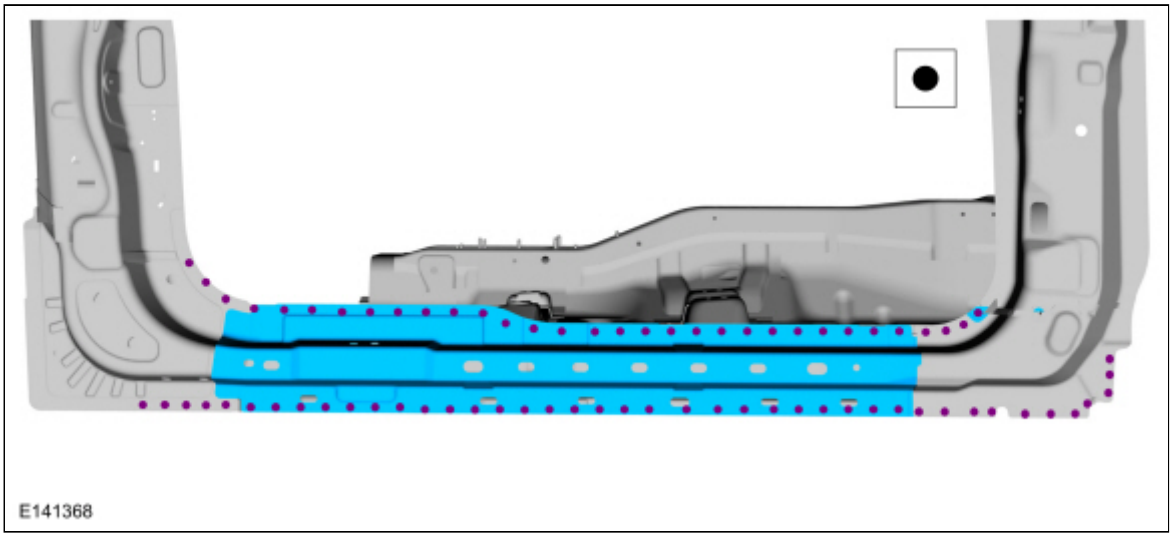
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information) .

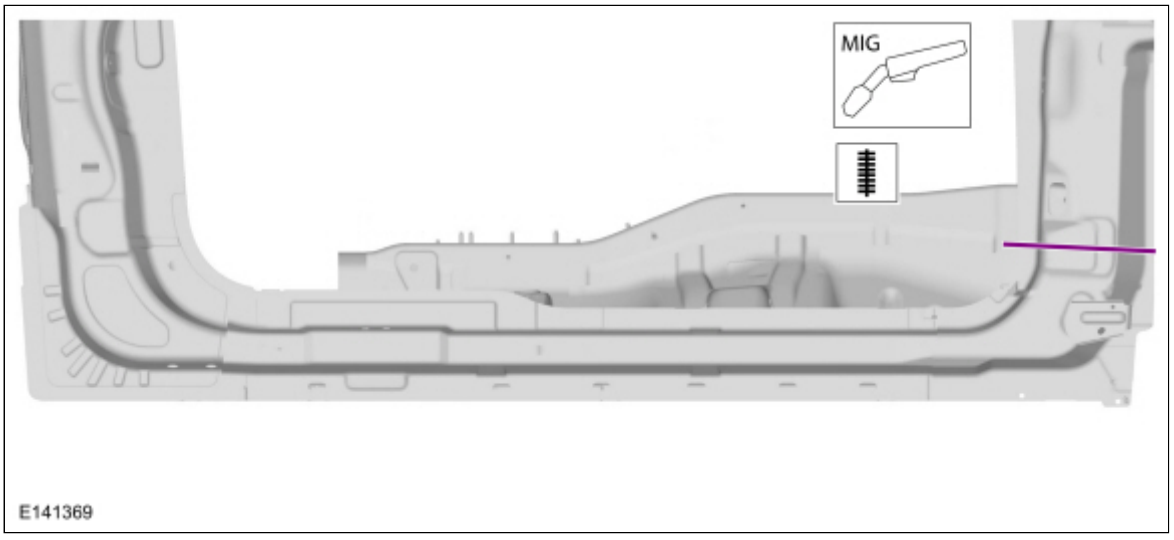
- Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: Resistance Spotwelding Equipment



- Use the General Equipment: MIG/MAG Welding Equipment



- Refer to: A-Pillar Assembly (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Refer to: A-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).
- Rocker Panel
- Door Hinges
- Front and Rear Door
- Front Wheel Arch Trim
- Rear Wheel Arch Trim
- A- and C-Pillar Trim
  Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rocker Panel Trim
- Refer to: Front Seat (501-10A Seating, Removal and Installation).
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).

Copyright © 2016 Ford Motor Company

Back Panel - Single Cab

Special Tool(s) / General Equipment

Hot Air Gun
Spot Weld Drill Bit

Materials

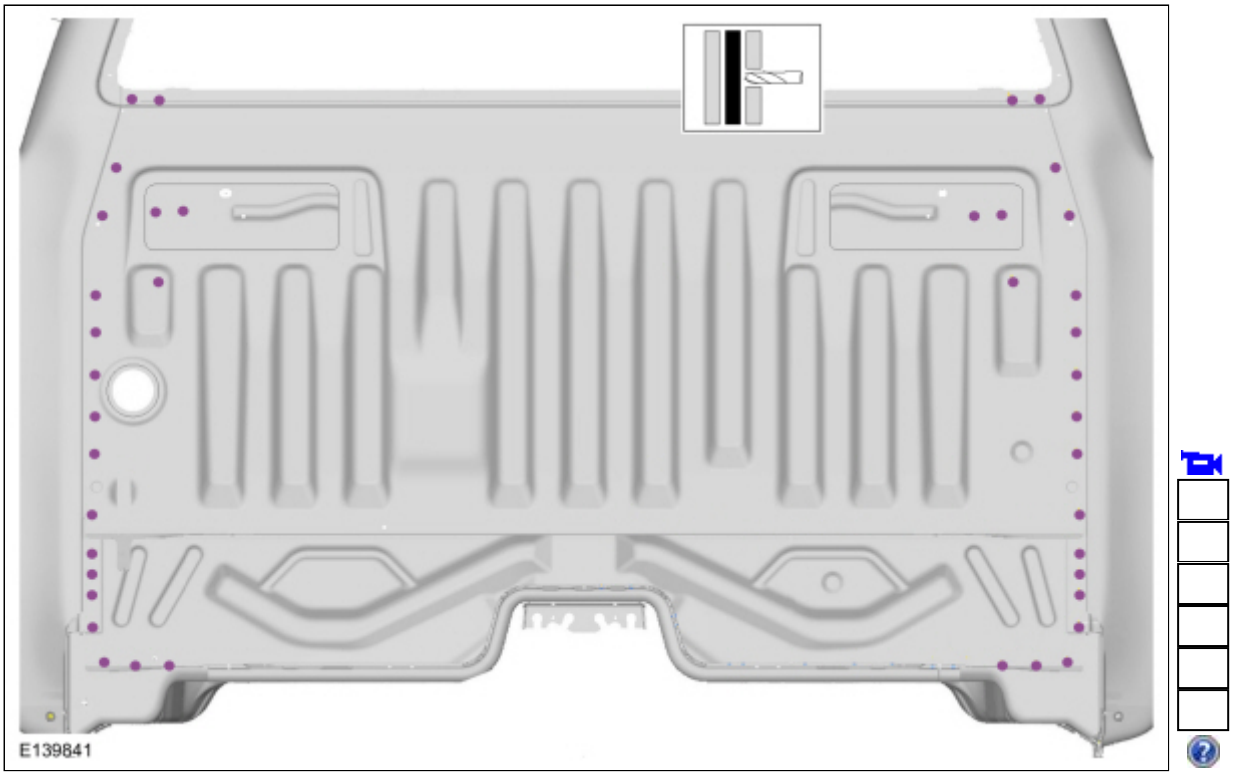
Name	Specification
Adhesive	WSK-M11P57-A3

Removal

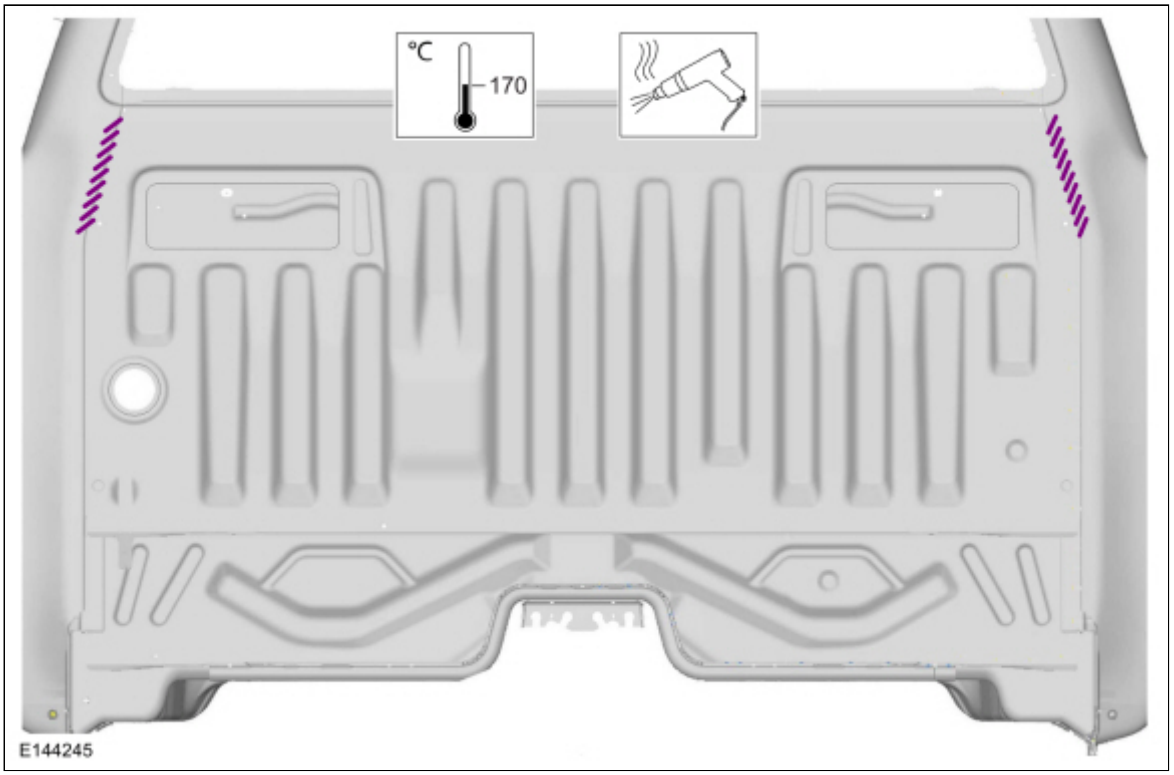
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

   - C-Pillar Trim
     Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
     Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
   - Rear Windshield
     Refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
   - Driver or passenger seat
     Refer to: Front Seat (501-10A Seating, Removal and Installation).
   - Rocker Panel Trim
   - Remove the load body.
   - Reposition the carpeting and the wiring harness away from the working area.

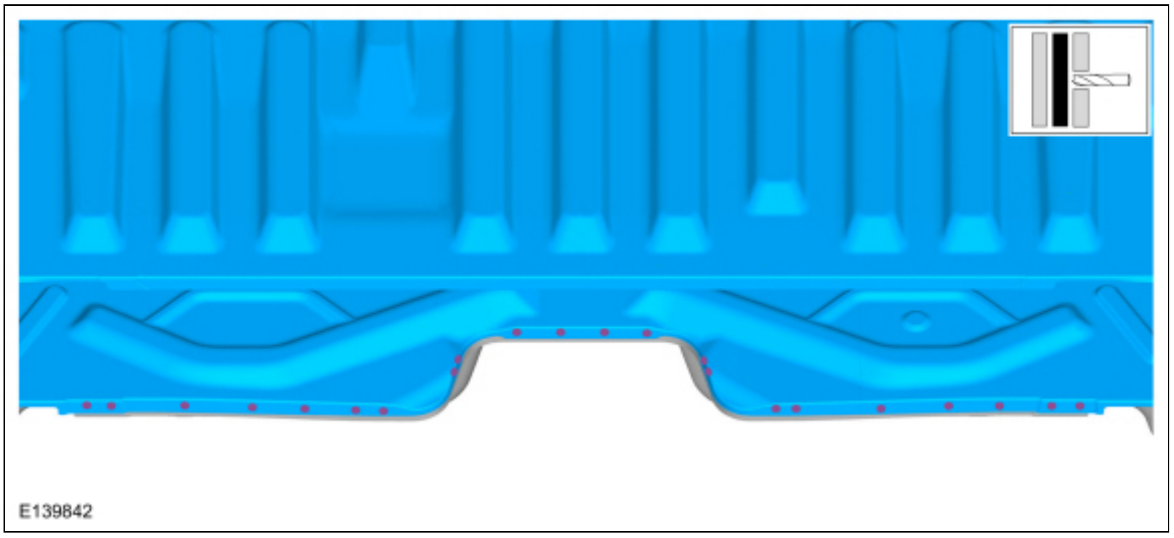
3. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



4. Use the General Equipment: Hot Air Gun



5. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



Installation

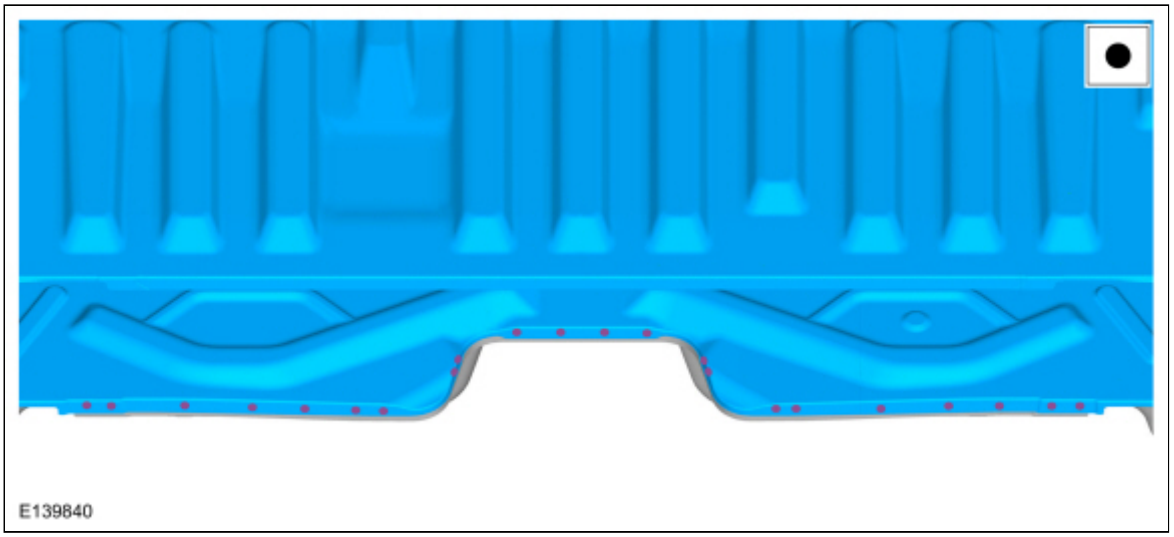
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

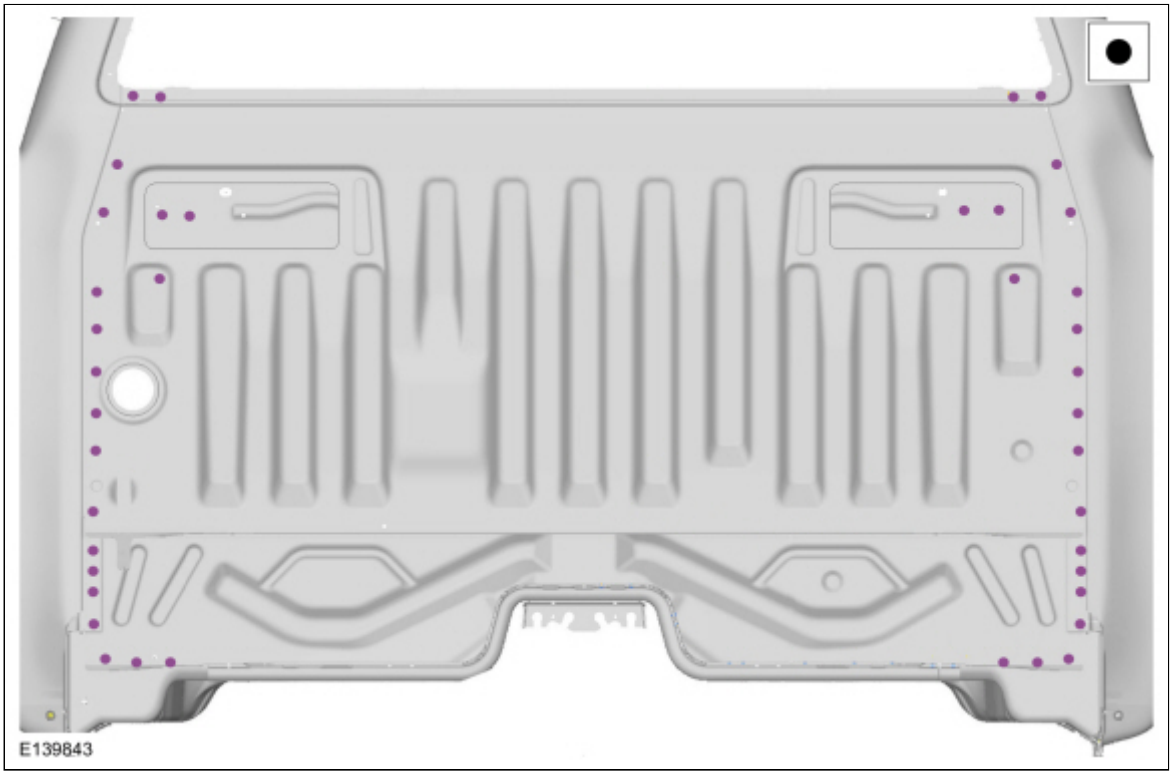
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25) .

   - Resistance spot weld - Panel thickness 3 mm and greater.

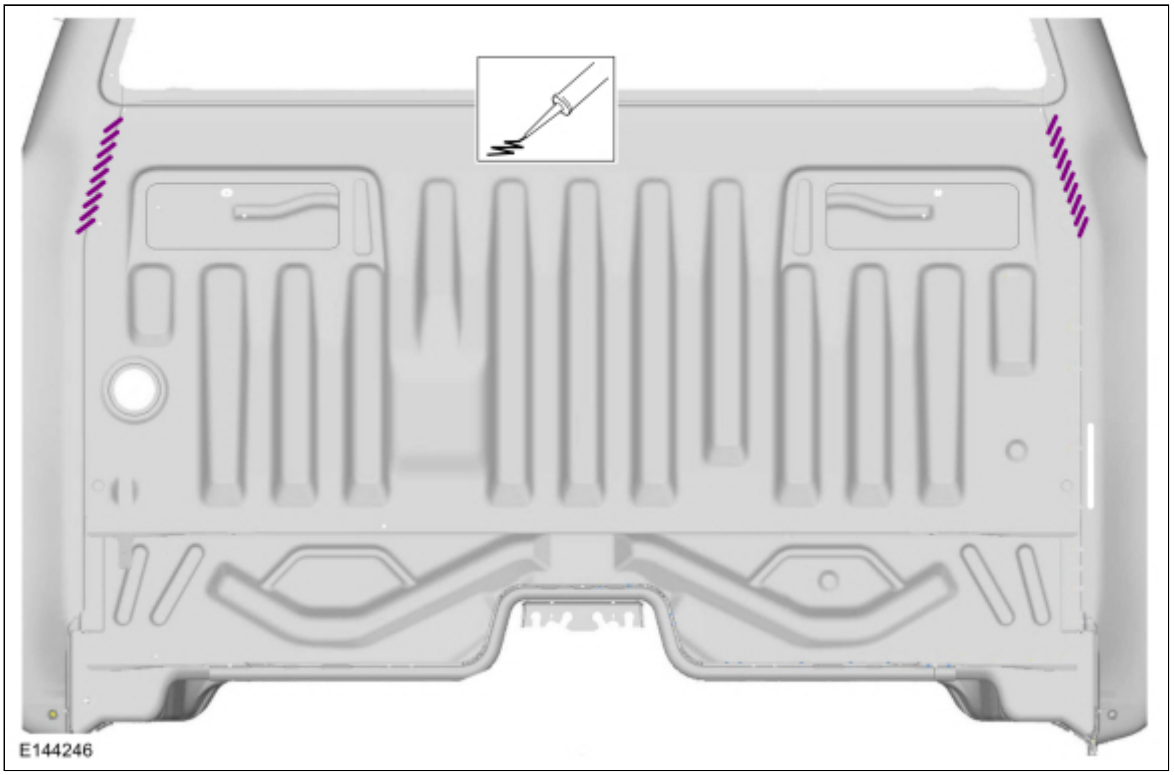


- Resistance spot weld - Panel thickness 3 mm and greater.



5. **NOTE:** *Apply the sealant to the back panel cavity via the vent holes in the back panel.*

   Material: Adhesive (WSK-M11P57-A3)



- C-Pillar Trim
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rear Windshield
  Refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Driver or passenger seat
  Refer to: Front Seat (501-10A Seating, Removal and Installation).
- Rocker Panel Trim

7. Install the load body.

Copyright © 2016 Ford Motor Company

Back Panel - Double Cab

Special Tool(s) / General Equipment

Hot Air Gun
Spot Weld Drill Bit

Materials

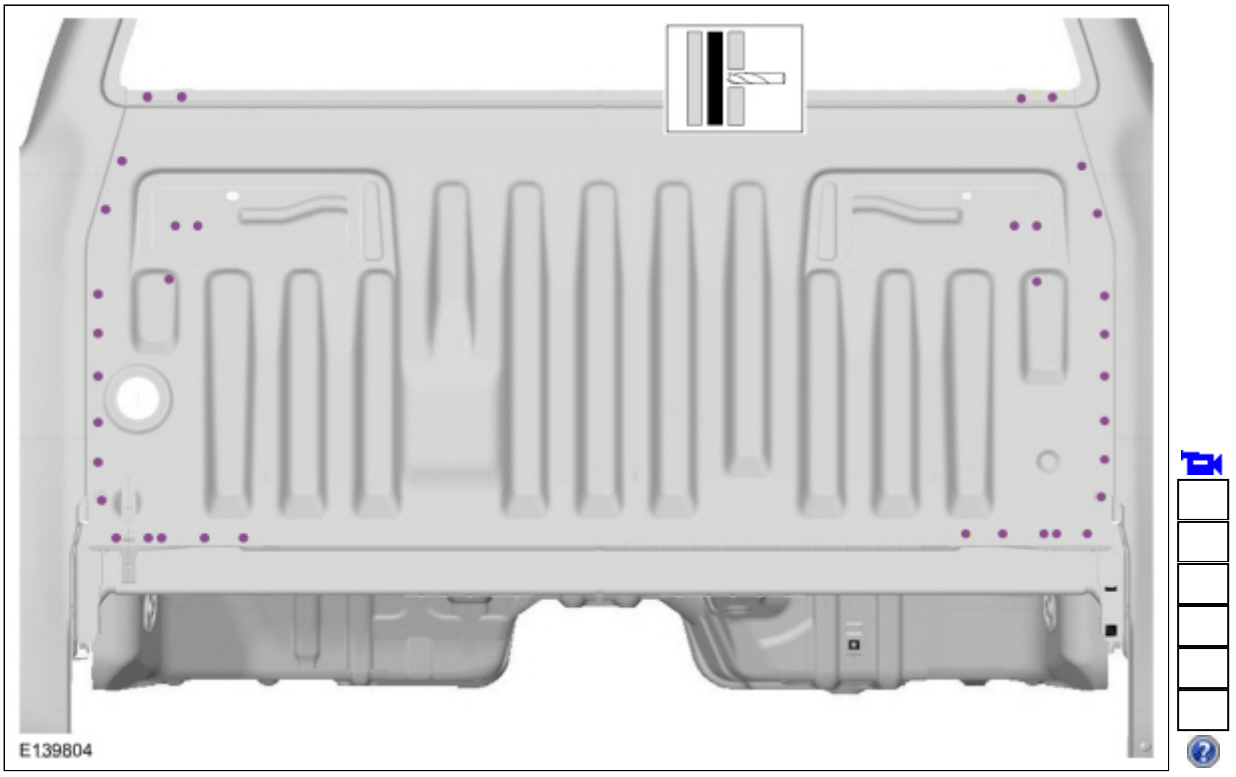
Name	Specification
Adhesive	WSK-M11P57-A3

Removal

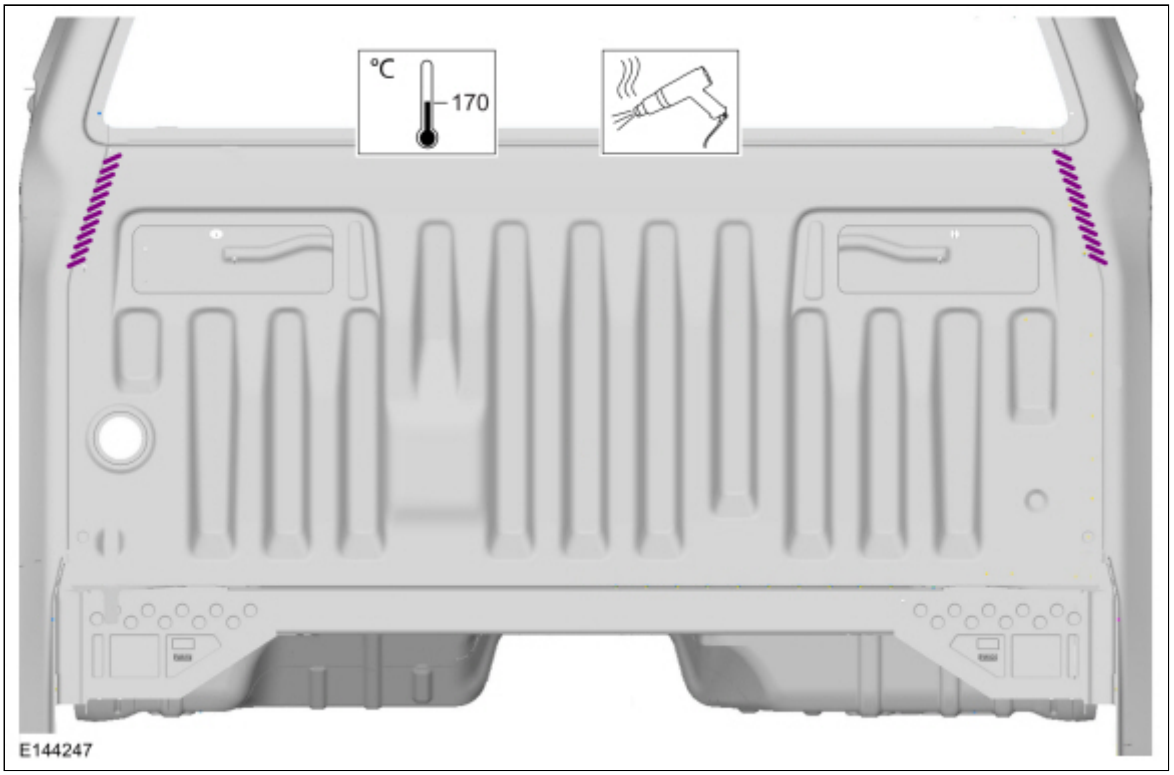
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

   - C-Pillar Trim
     Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
     Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
   - Rear Windshield
     Refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
   - Rear Seat
     Refer to: Rear Seat (501-10A Seating, Removal and Installation).
   - Rocker Panel Trim
   - Remove the load body.
   - Reposition the carpeting and the wiring harness away from the working area.

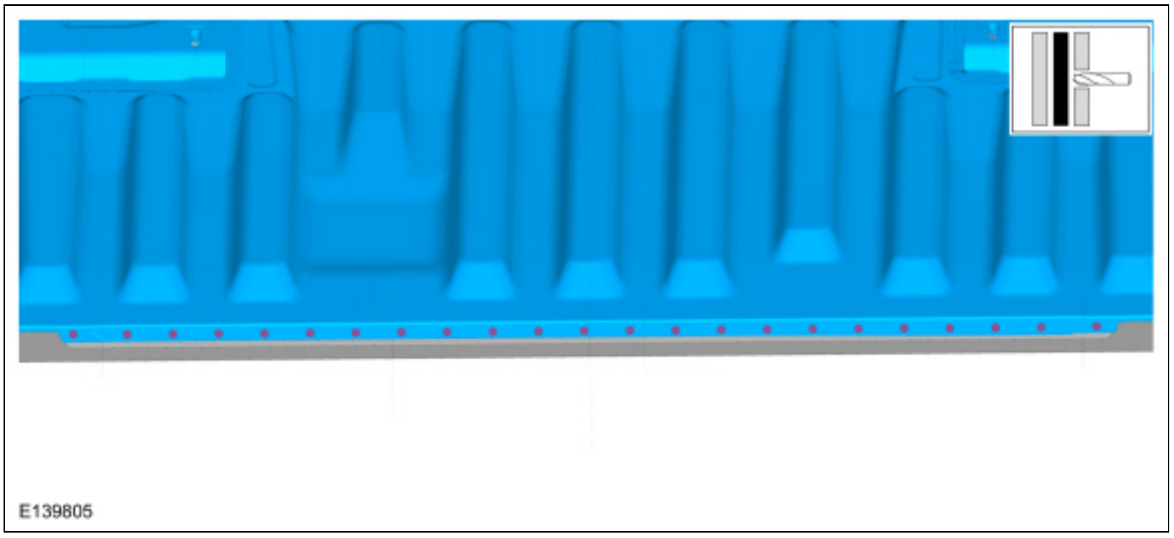
3. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



4. Use the General Equipment: Hot Air Gun



5. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



Installation

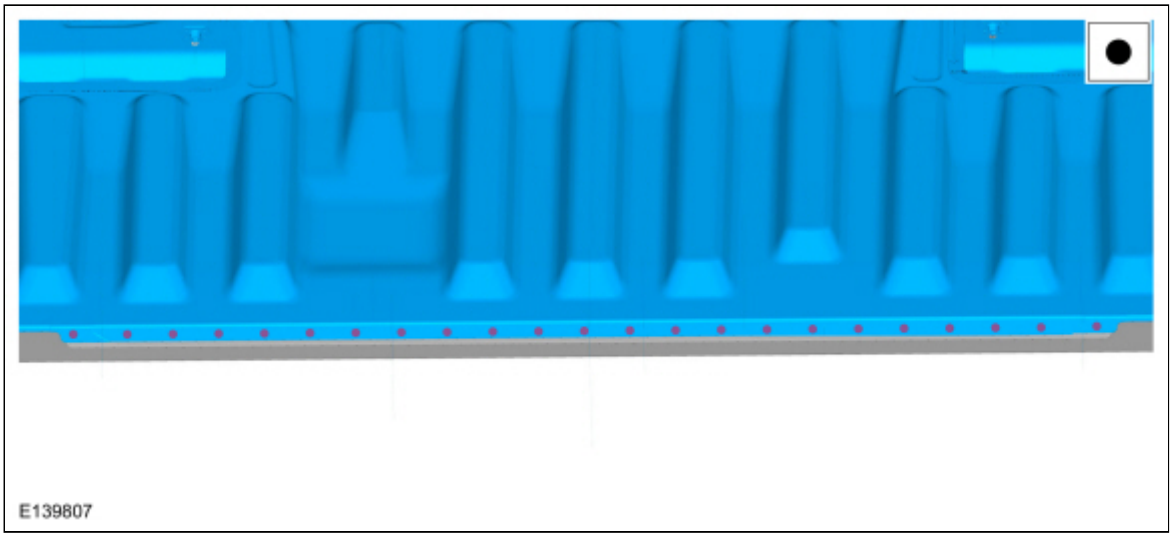
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

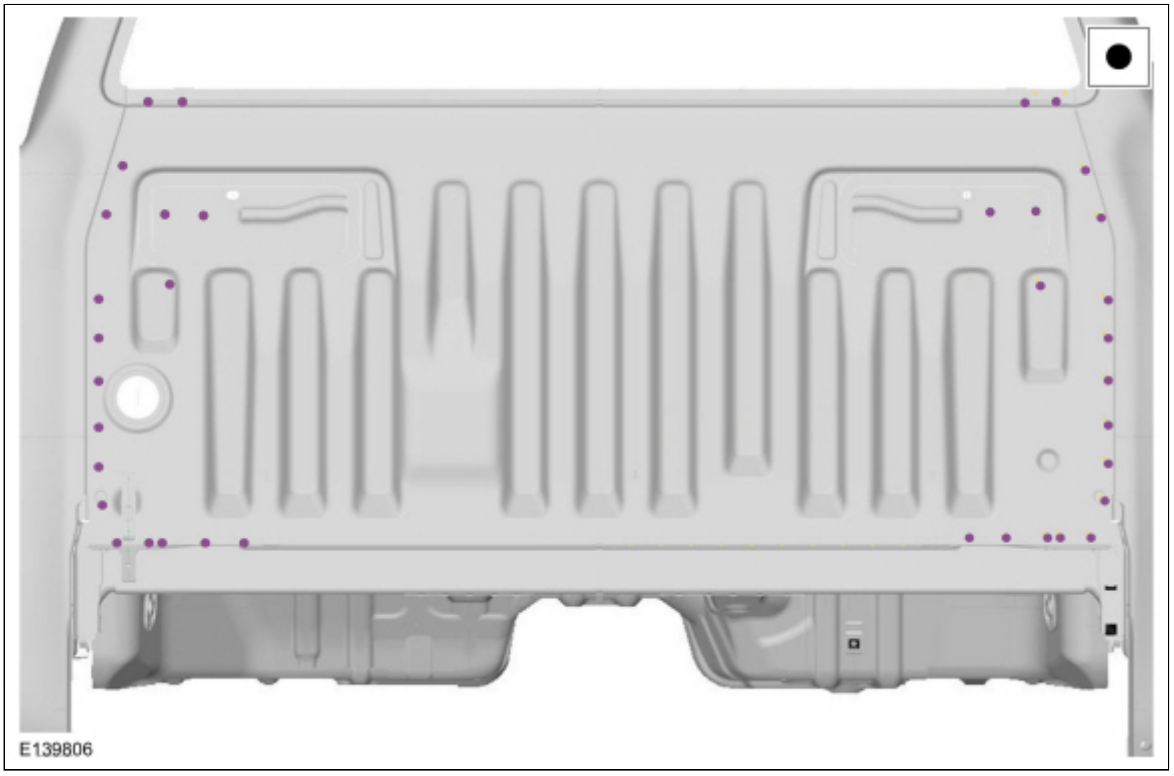
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25) .

   - Resistance spot weld - Panel thickness 3 mm and greater.

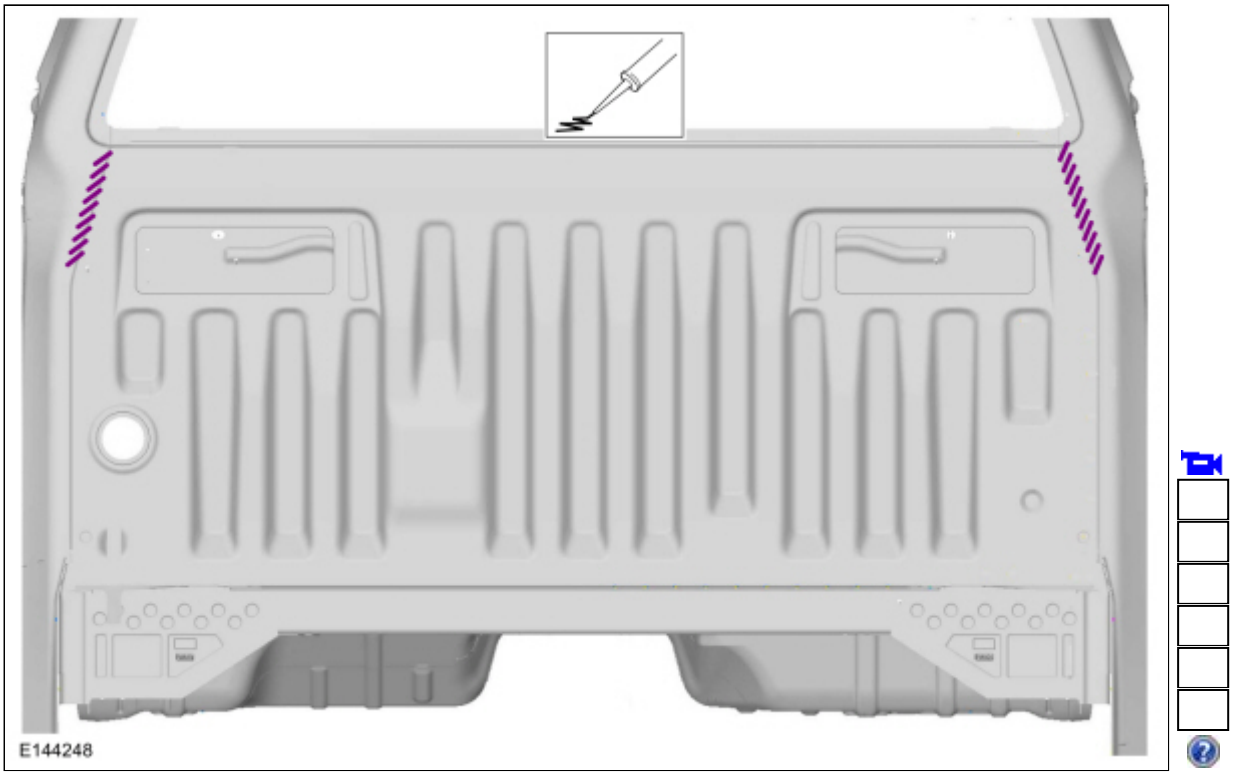


- Resistance spot weld - Panel thickness 3 mm and greater.



5. **NOTE:** *Apply the sealant to the back panel cavity via the vent holes in the back panel.*

- *Material*: Adhesive (WSK-M11P57-A3)



- C-Pillar Trim
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rear Windshield
  Refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Rear Seat
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).
- Rocker Panel Trim

7. Install the load body.

Copyright © 2016 Ford Motor Company

Back Panel - Stretch Cab

Special Tool(s) / General Equipment

Hot Air Gun
Spot Weld Drill Bit

Materials

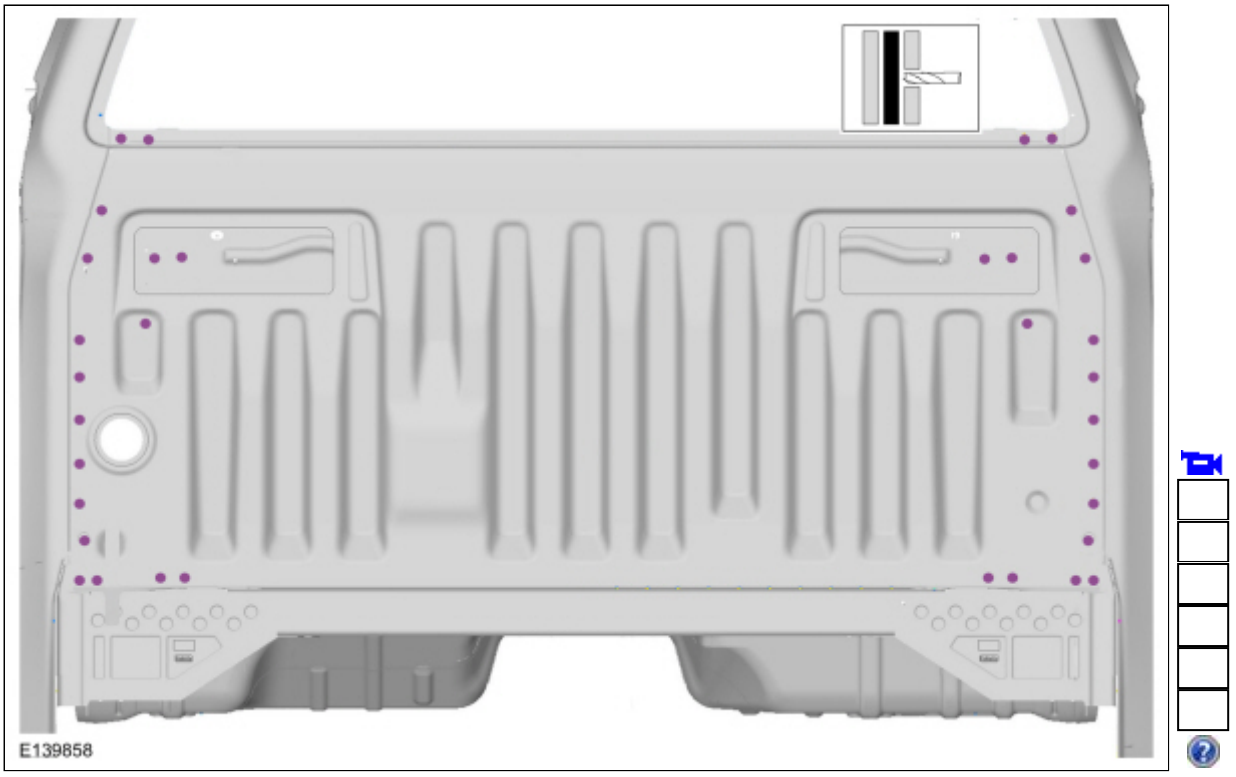
Name	Specification
Adhesive	WSK-M11P57-A3

Removal

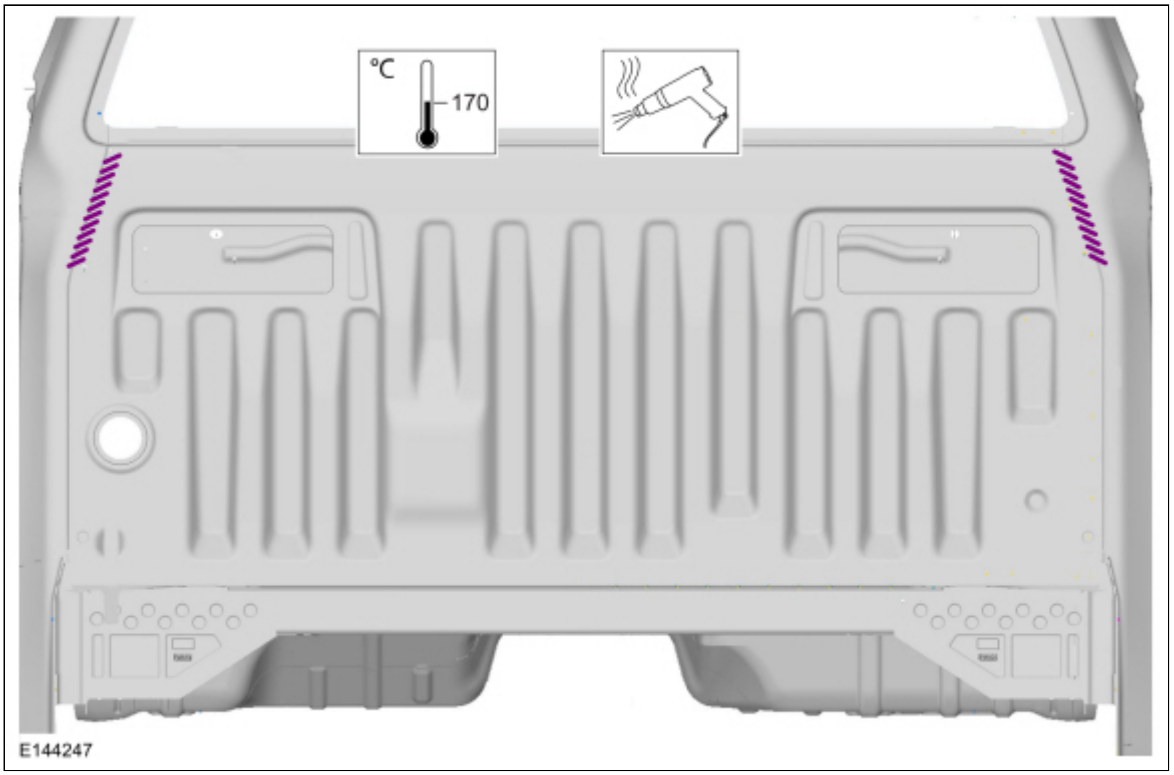
1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

   - C-Pillar Trim
     Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
     Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
   - Rear Windshield
     Refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
   - Rear Seat
     Refer to: Rear Seat (501-10A Seating, Removal and Installation).
   - Rocker Panel Trim
   - Remove the load body.
   - Reposition the carpeting and the wiring harness away from the working area.

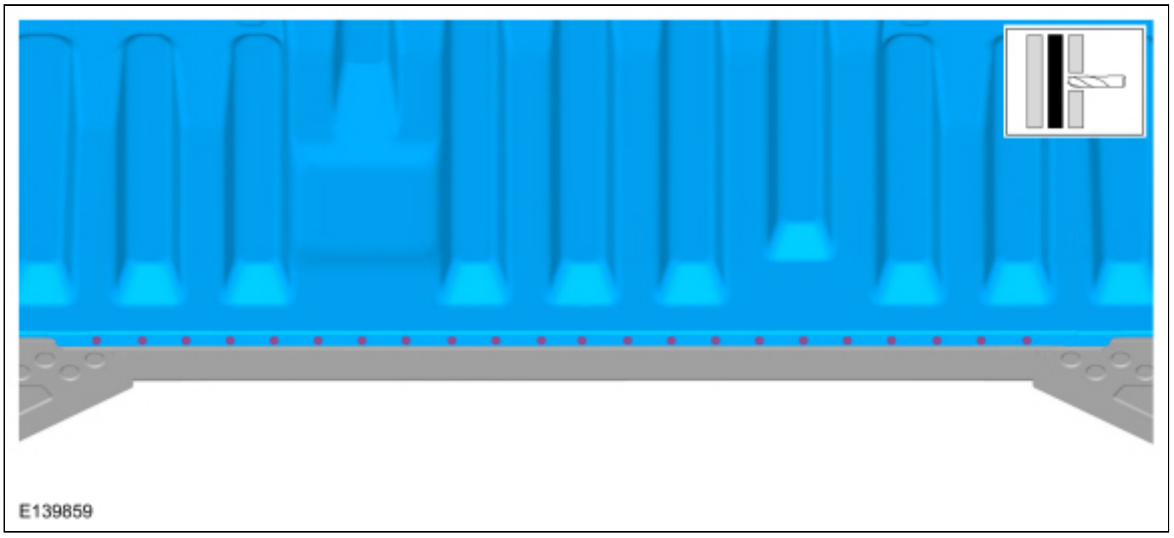
3. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



4. Use the General Equipment: Hot Air Gun



5. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



Installation

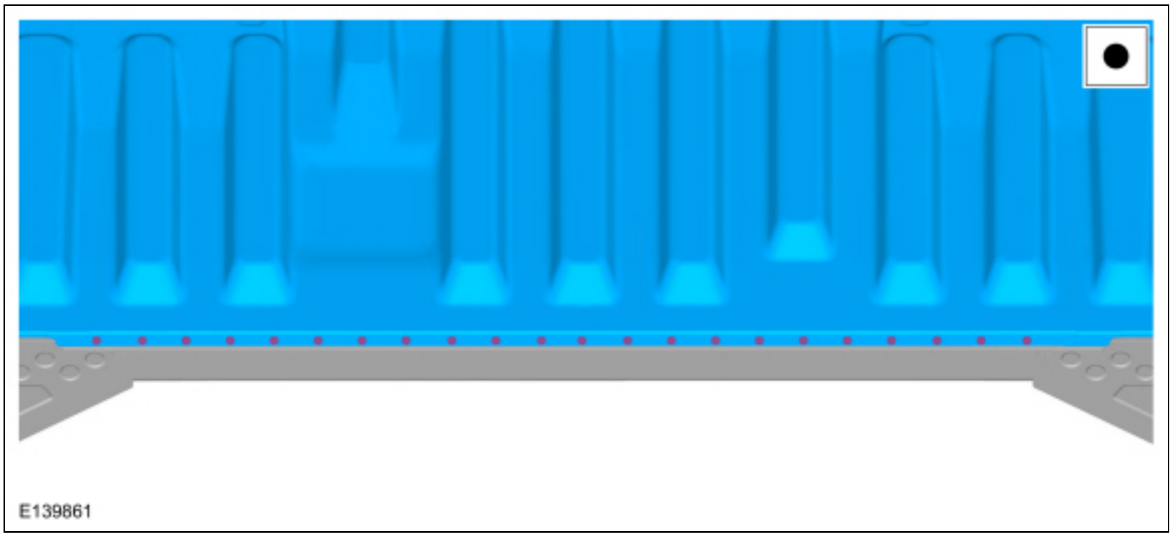
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

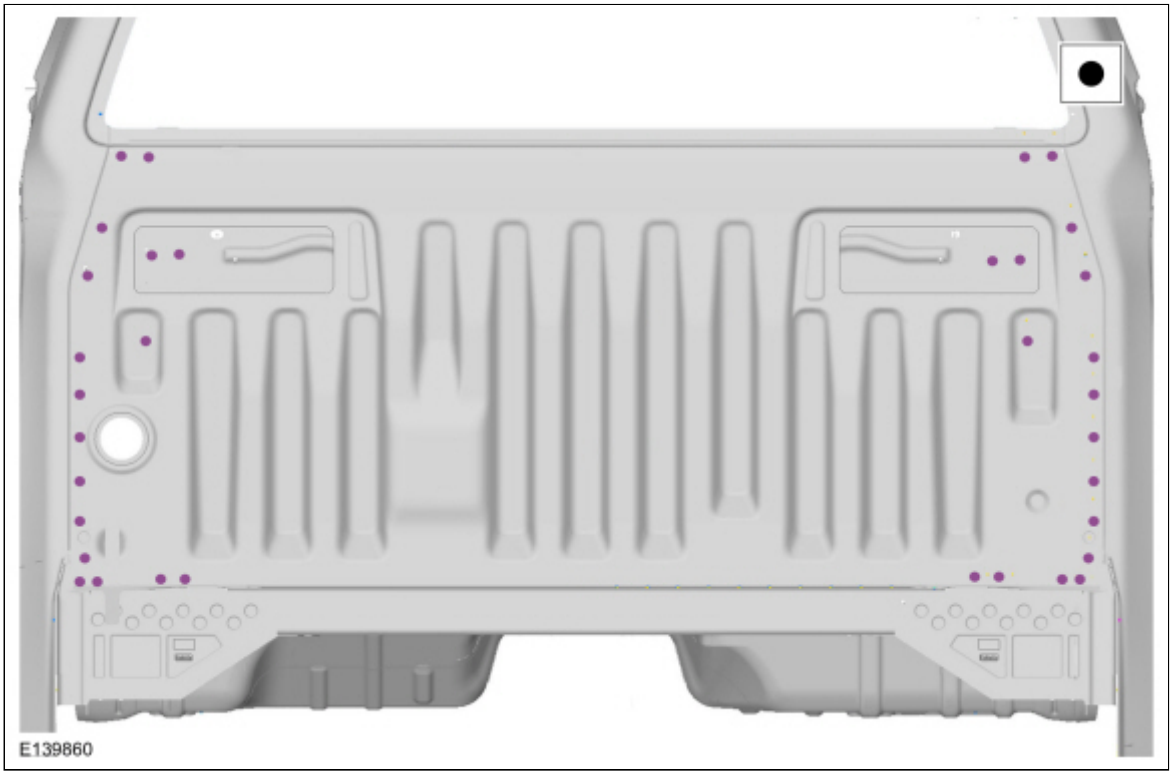
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25) .

   - Resistance spot weld - Panel thickness 3 mm and greater.

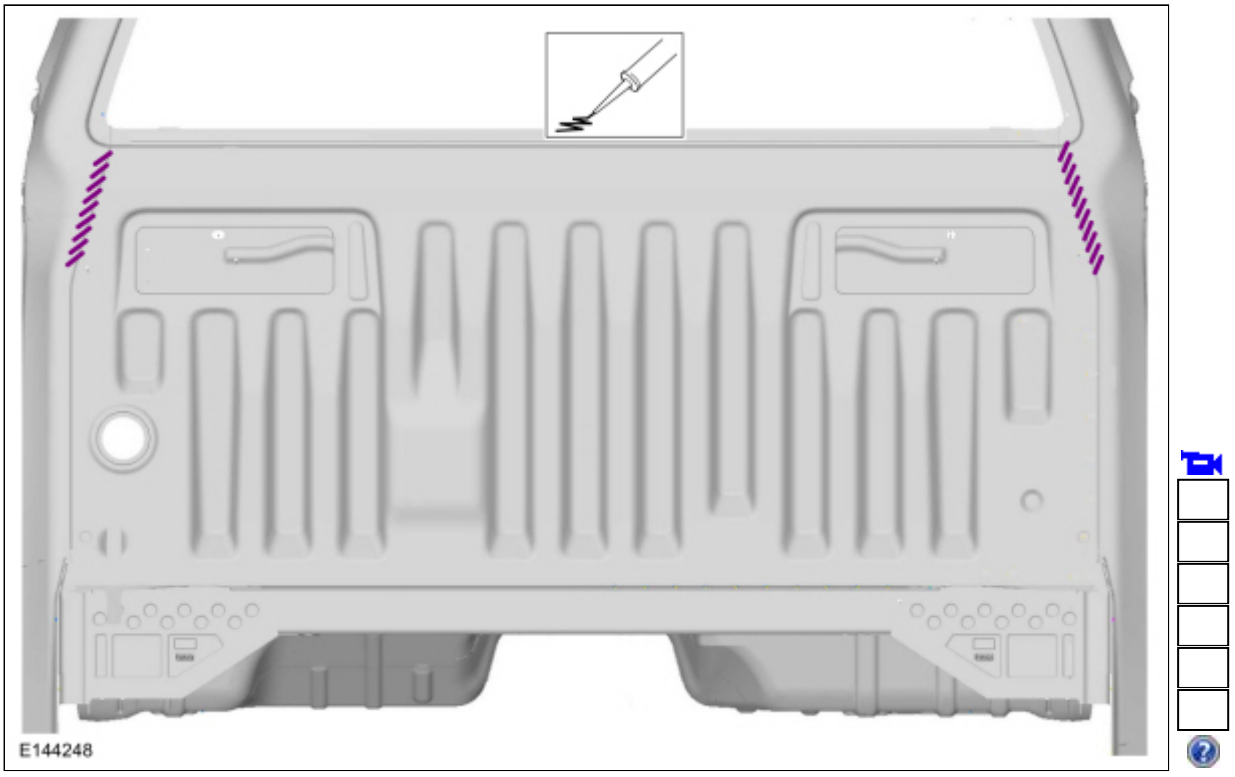


- Resistance spot weld - Panel thickness 3 mm and greater.



5. **NOTE:** *Apply the sealant to the back panel cavity via the vent holes in the back panel.*

- *Material*: Adhesive (WSK-M11P57-A3)



- C-Pillar Trim
  Refer to: C-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: C-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
- Rear Windshield
  Refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
- Rear Seat
  Refer to: Rear Seat (501-10A Seating, Removal and Installation).
- Rocker Panel Trim

7. Install the load body.

Copyright © 2016 Ford Motor Company

Pickup Box Outer Side Panel

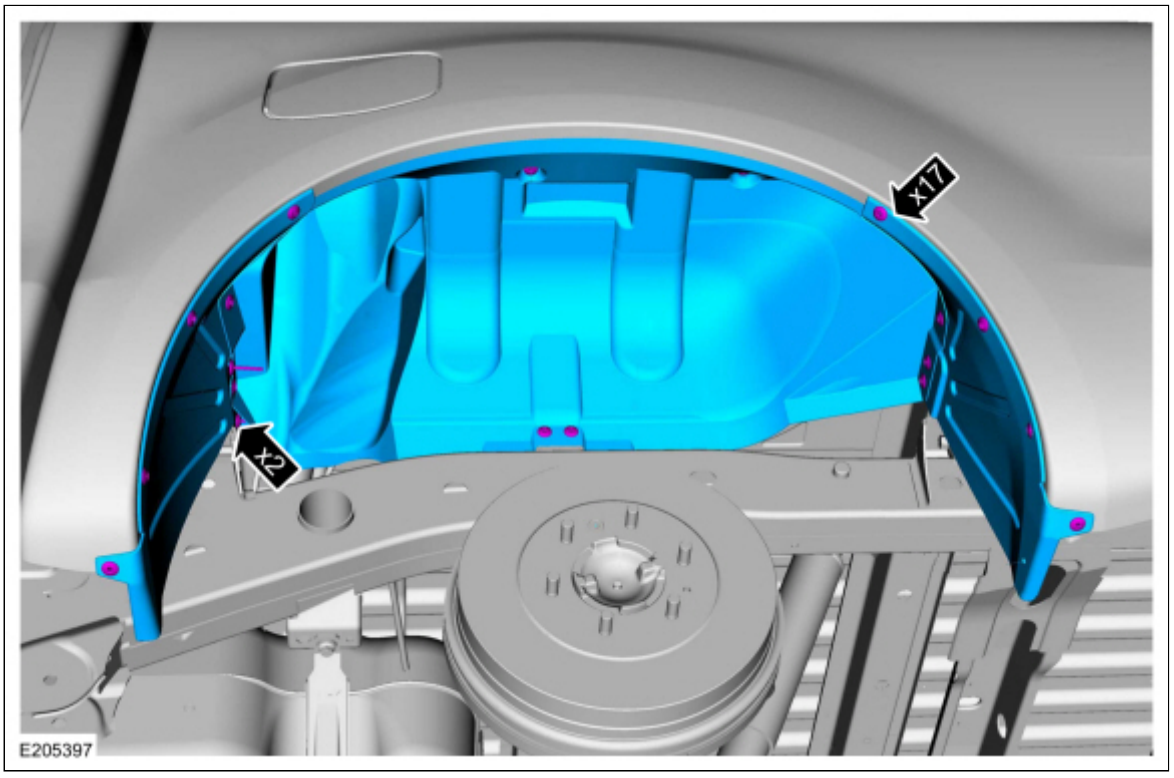
Special Tool(s) / General Equipment

Spot Weld Drill Bit

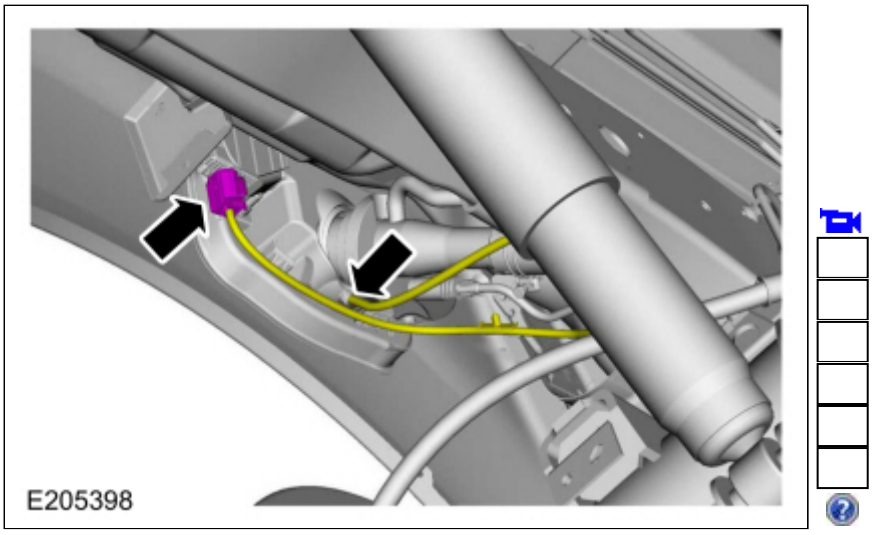
Removal

NOTE: *Removal steps in this procedure may contain installation details.*

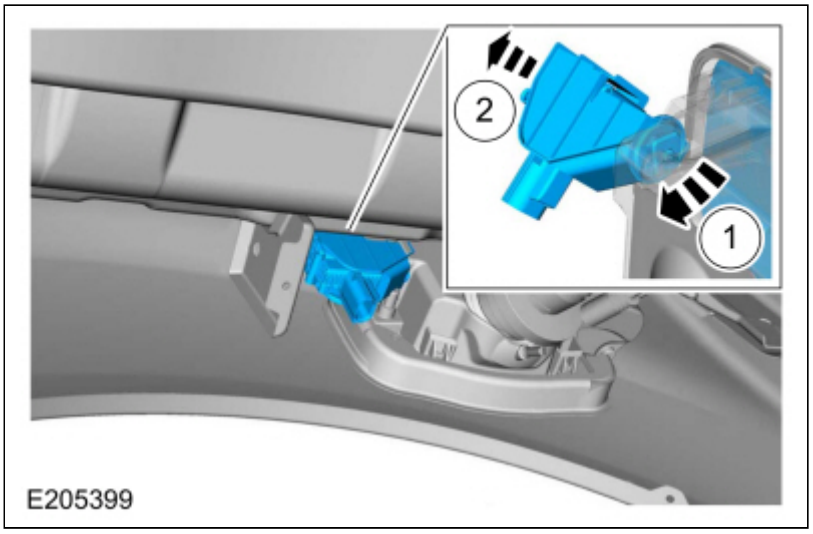
1.



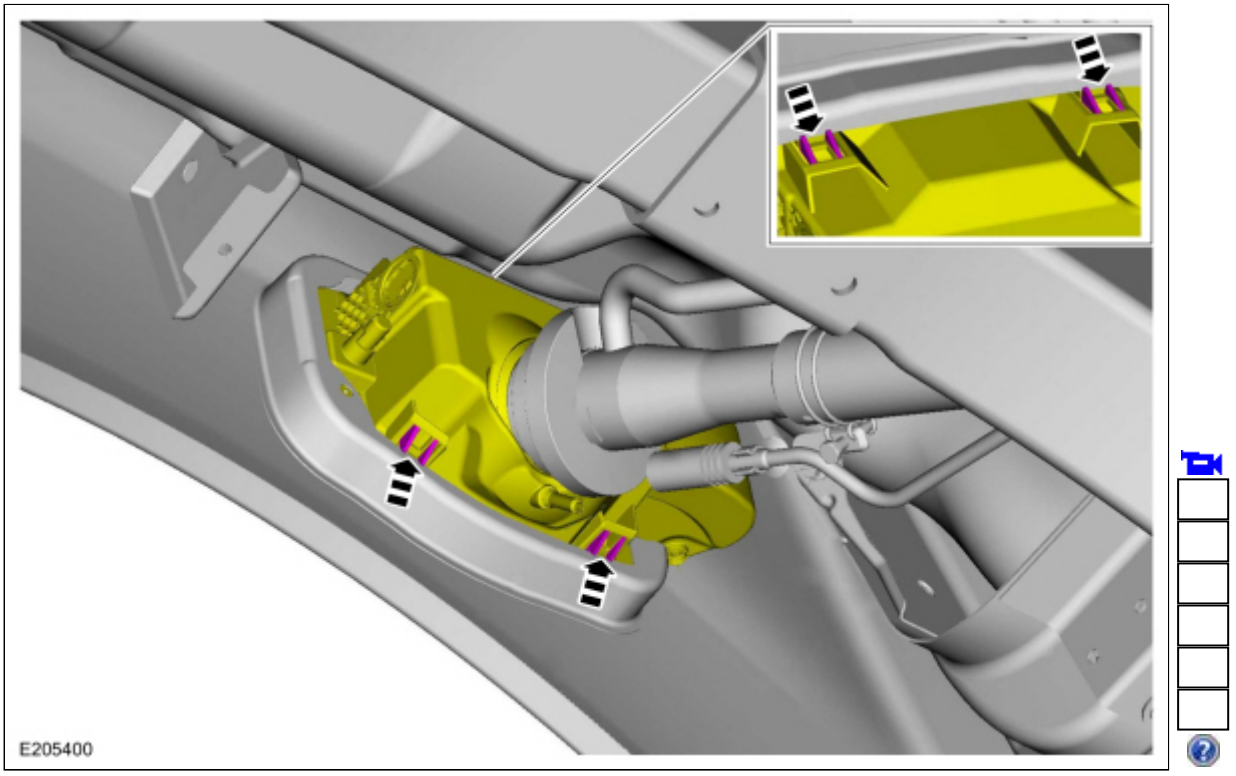
2.



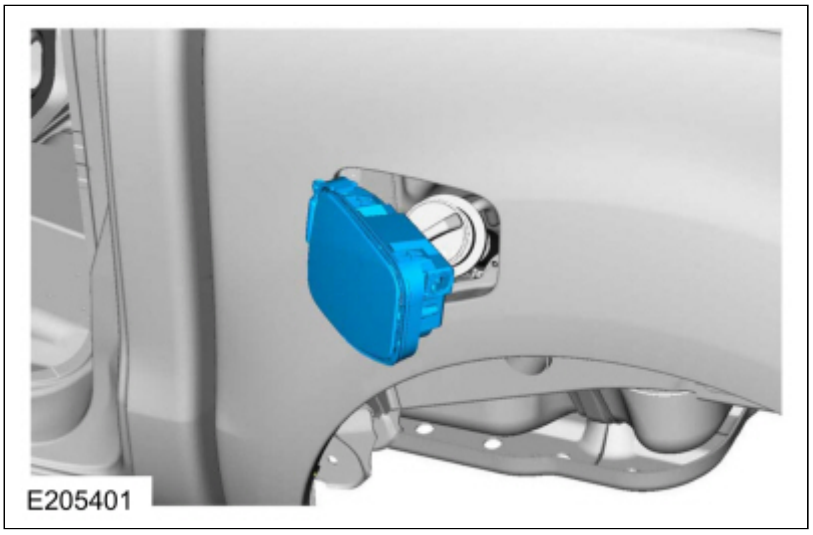
3.



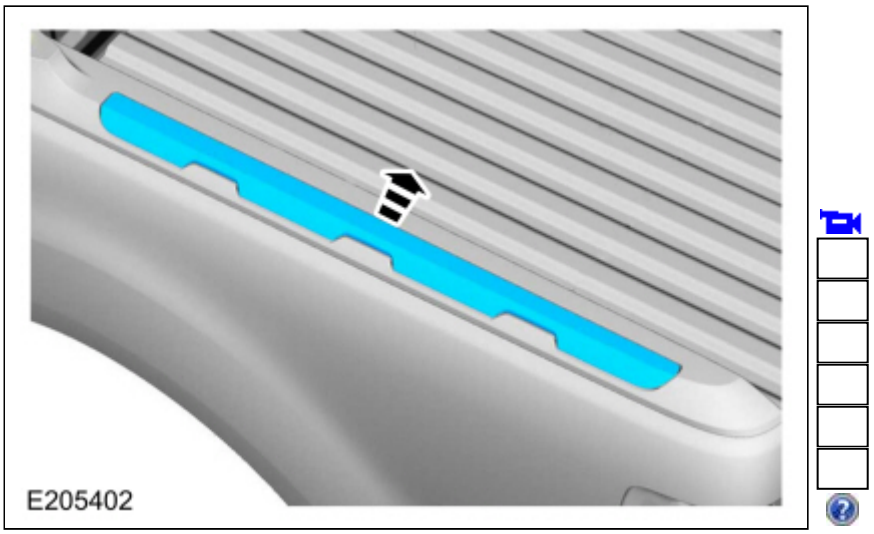
4.



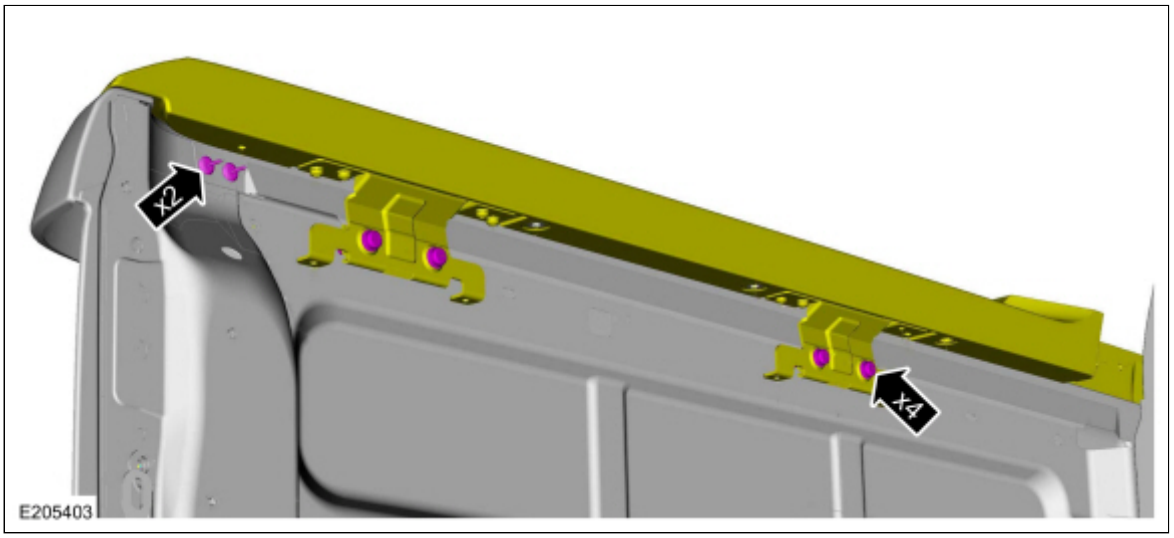
5.



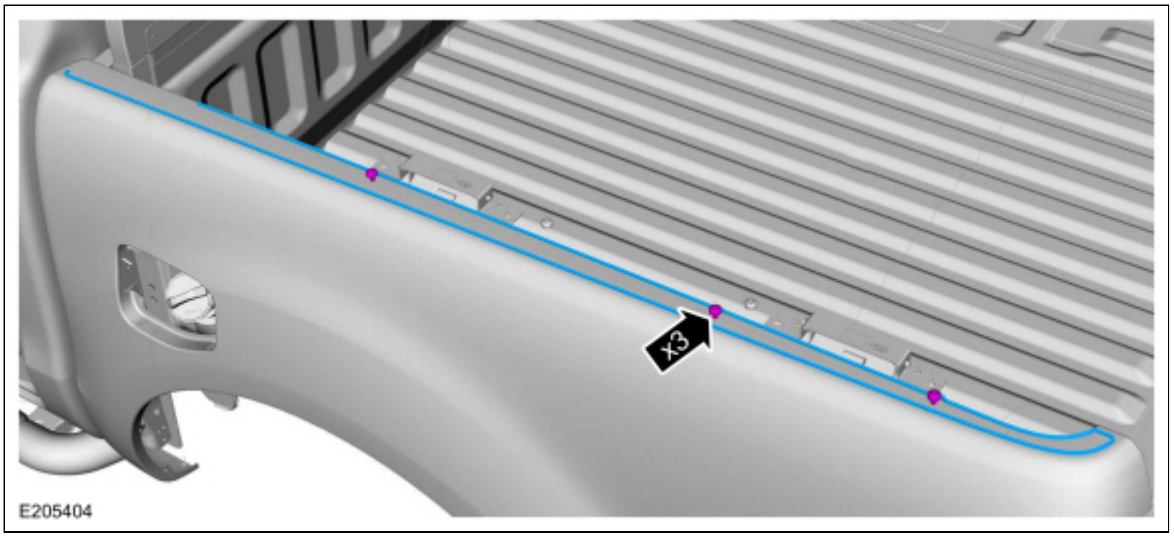
6.



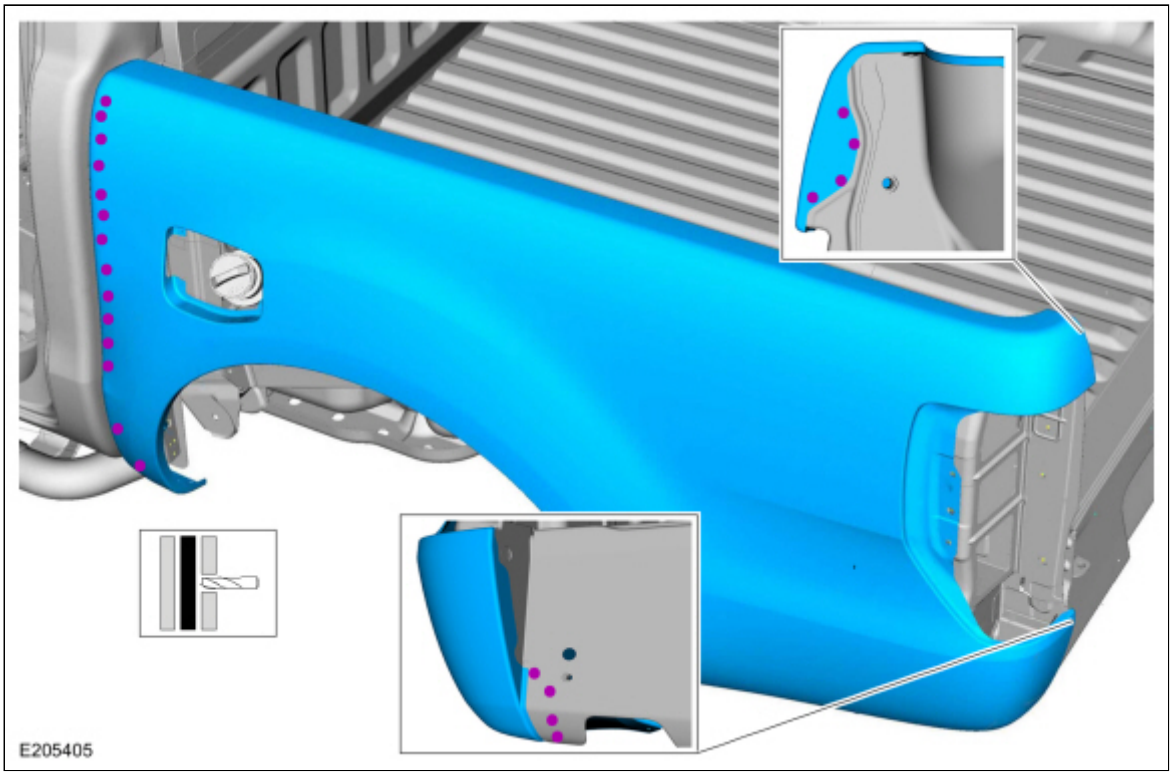
7. *Torque*: 15 Nm



8. *Torque*: 9 Nm



9. Refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).
10. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).
11. Mill out the spot welds.
    Use the General Equipment: Spot Weld Drill Bit



Installation

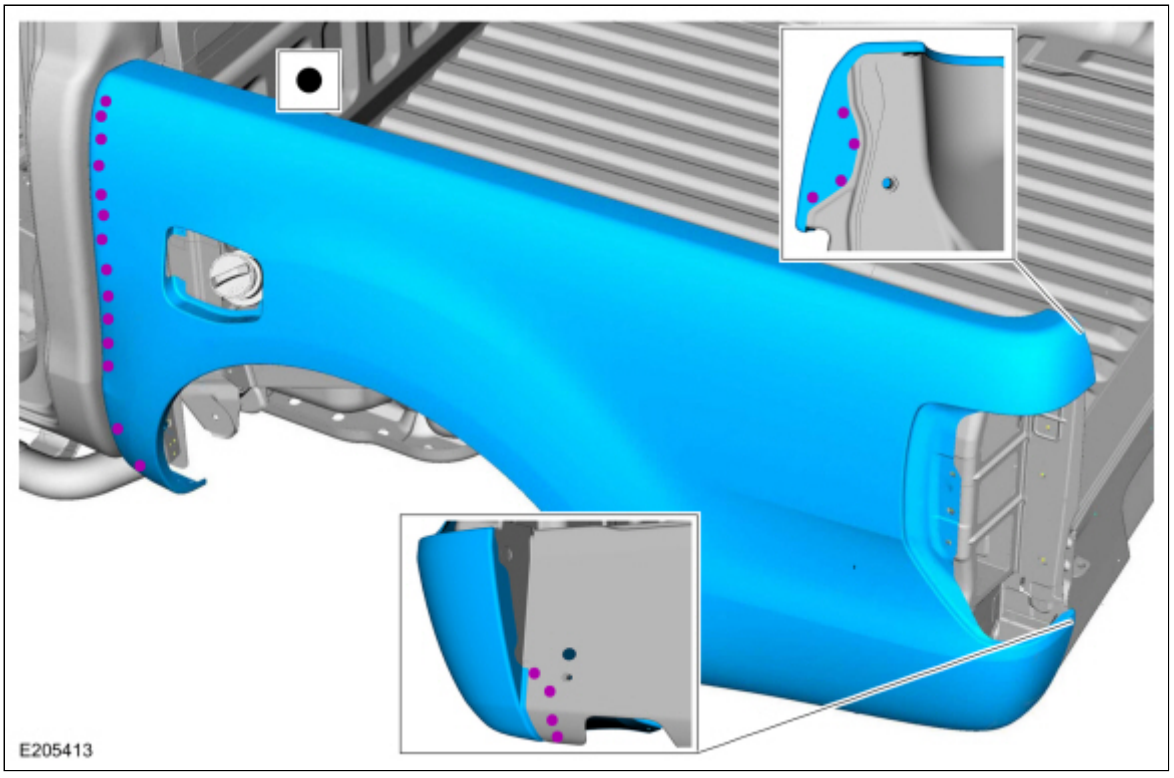
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25) .

3. Resistance spot weld - Panel thickness 3 mm and greater.



4. To install, reverse the removal procedure.

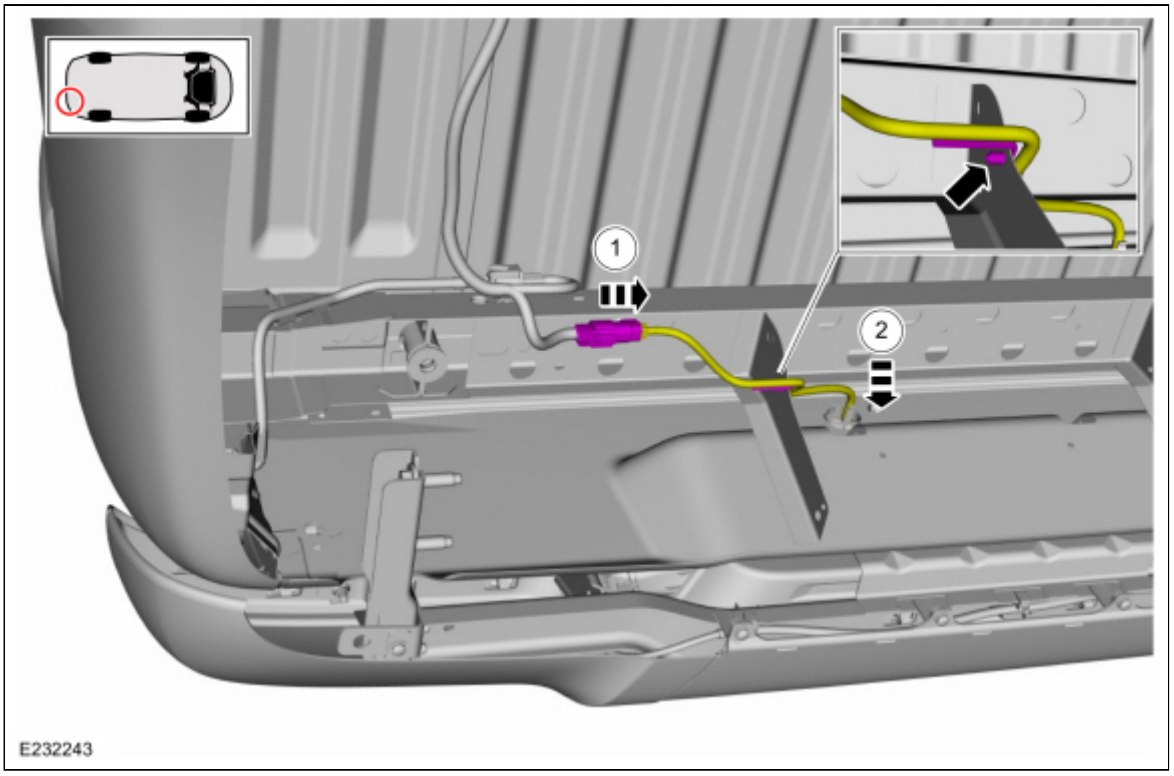
Copyright © 2016 Ford Motor Company

Pickup Box Back Panel

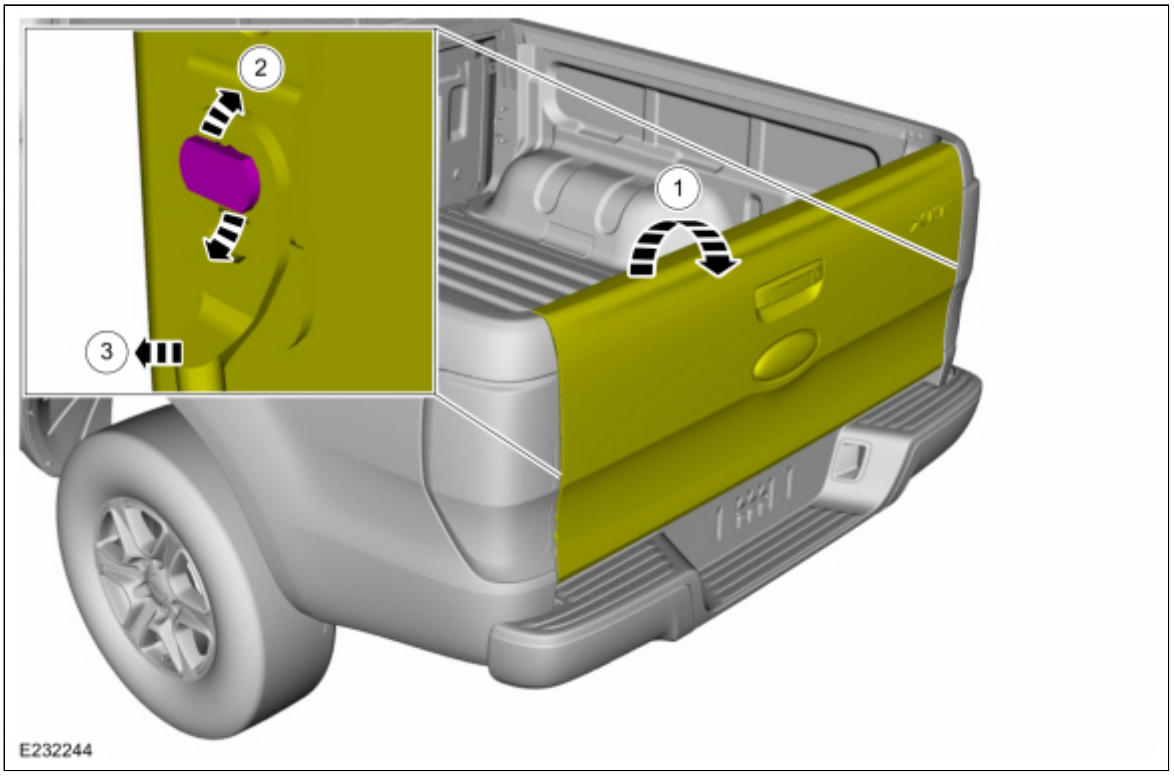
Special Tool(s) / General Equipment

Resistance Spotwelding Equipment
8 mm Drill Bit
MIG/MAG Welding Equipment
Spot Weld Drill Bit

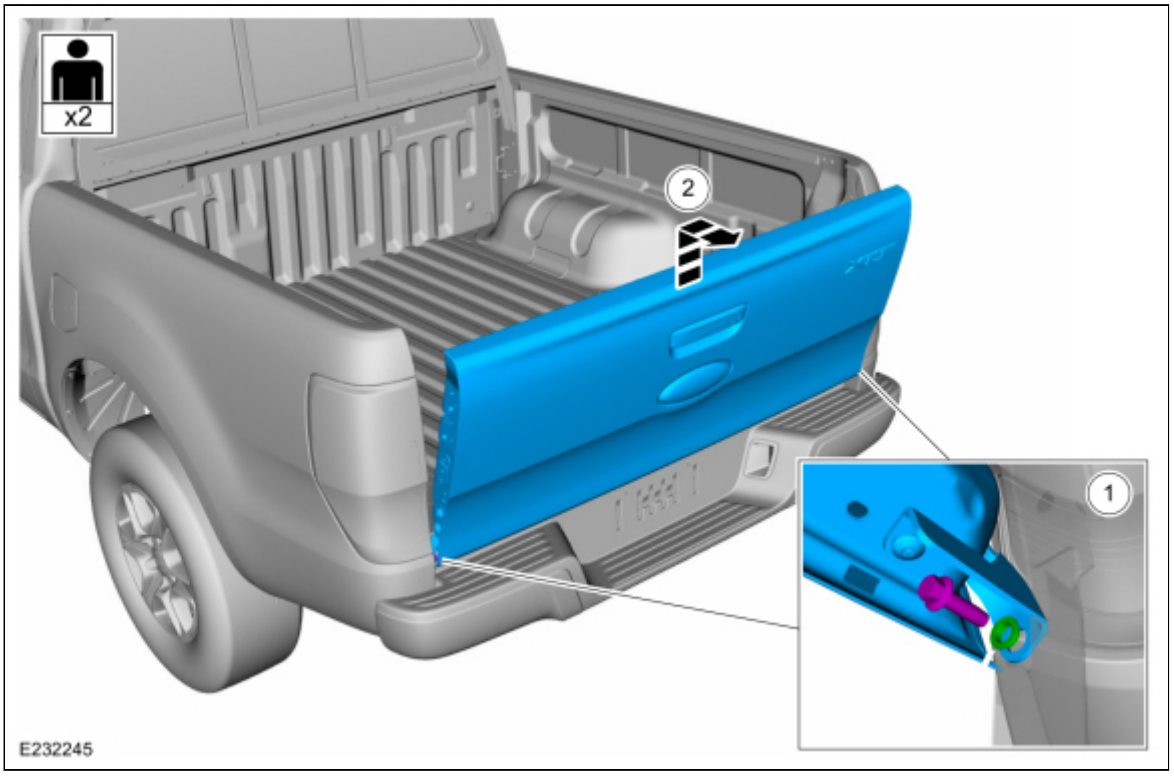
Removal

1. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).
2. Refer to: Jacking and Lifting (100-02) .
3. 

4. **NOTE:** *Make sure that the component paintwork is not damaged.*

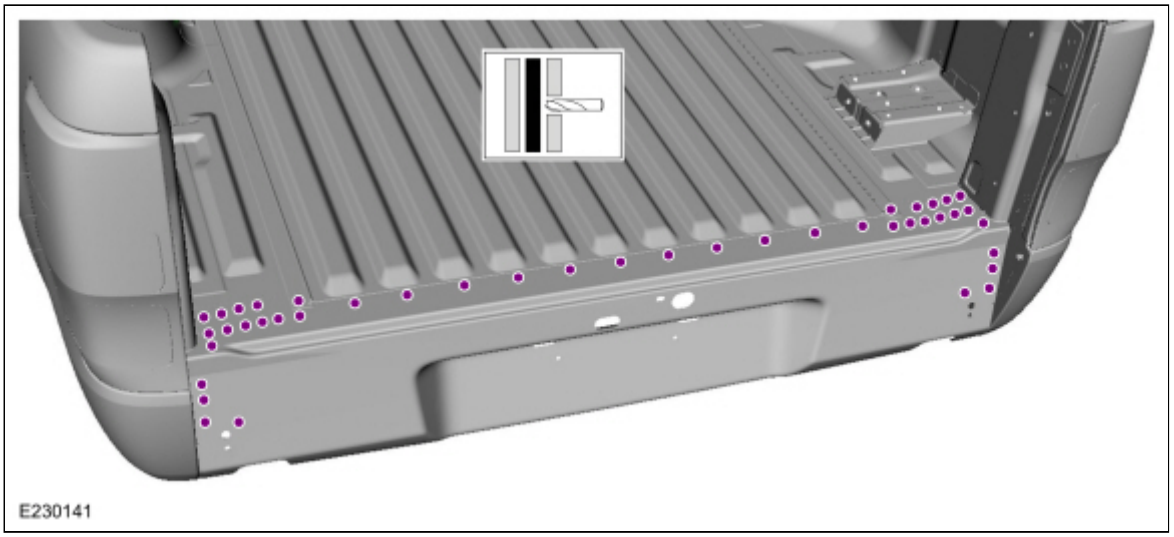


5.

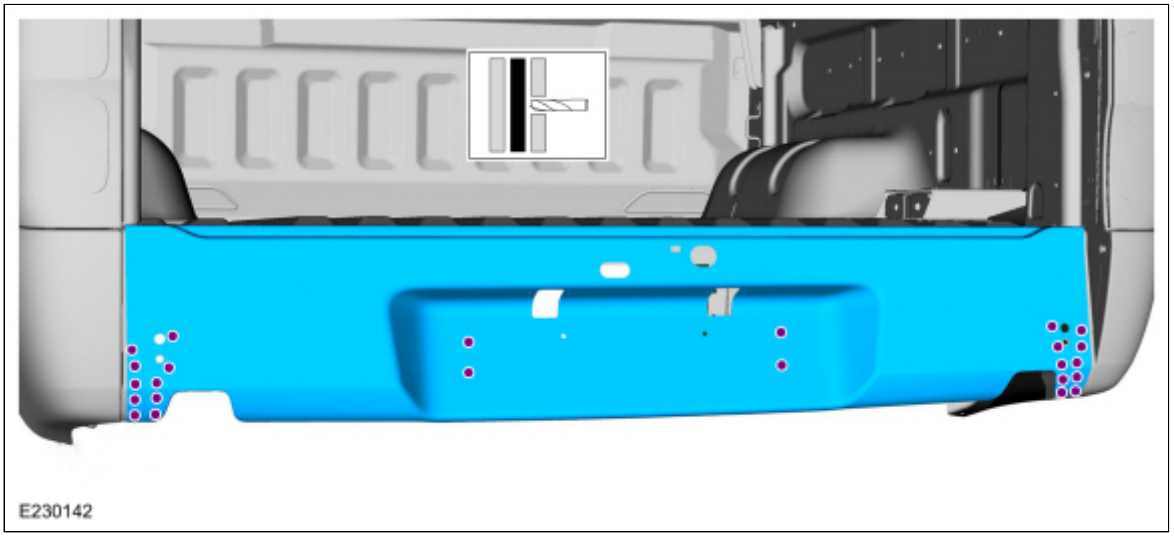


6. Refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).

7. Mill out the spot welds.
   Use the General Equipment: Spot Weld Drill Bit



8. Use the General Equipment: Spot Weld Drill Bit



Installation

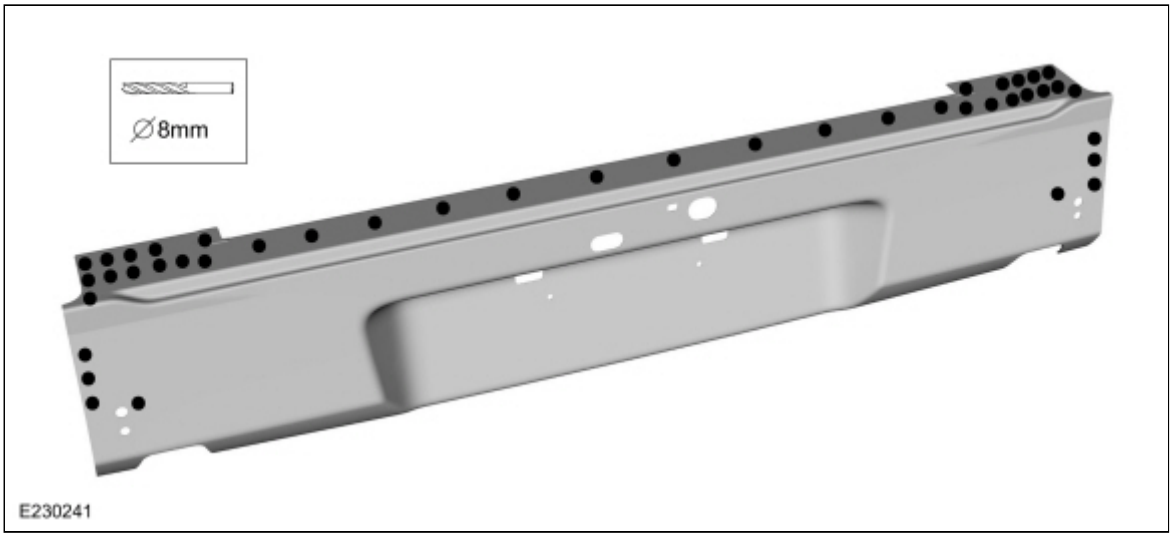
1. **NOTE:** *Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.*

   Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).

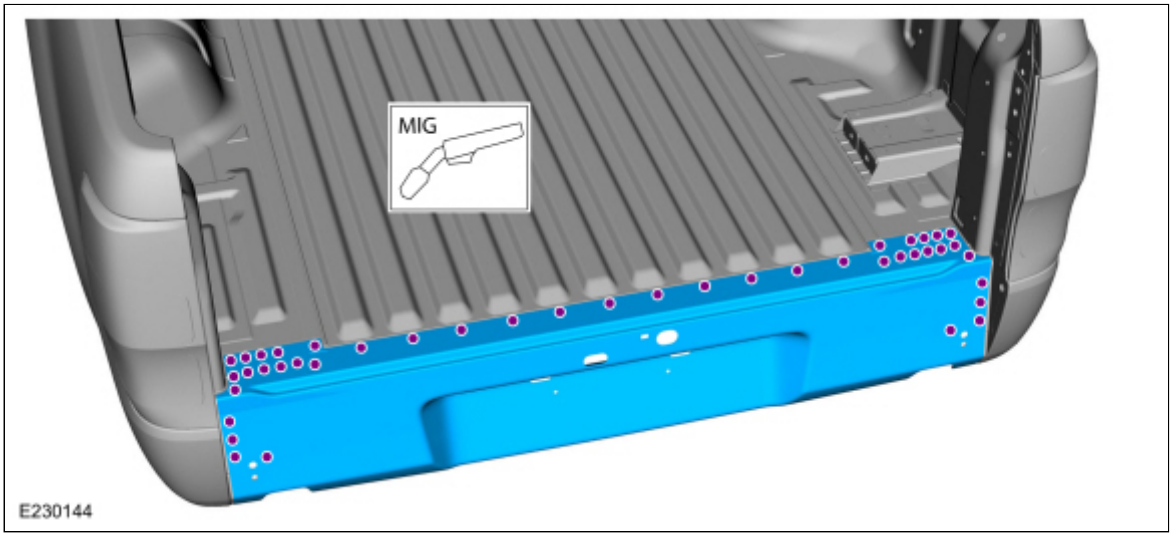
2. **NOTE:** *Sealer or adhesive must not be applied in welding zones. Areas which were bonded or sealed needs to be thoroughly sealed afterwards.*

   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information, Description and Operation).

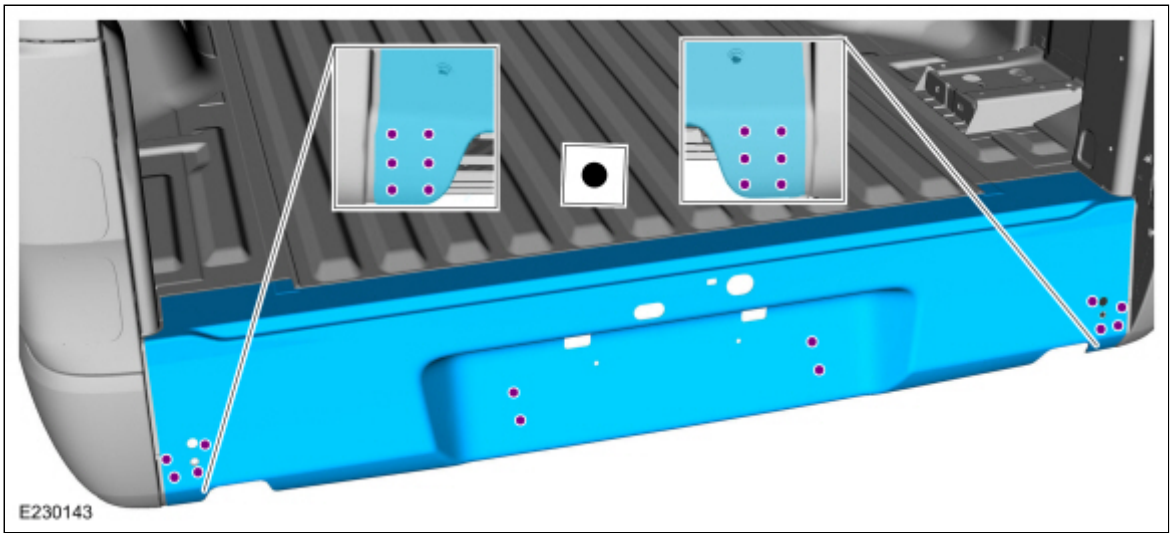
3. Use the General Equipment: 8 mm Drill Bit



4. Use the General Equipment: MIG/MAG Welding Equipment



5. Resistance spot weld - Panel thickness 3 mm and greater.
   Use the General Equipment: Resistance Spotwelding Equipment



6. Metal finish all panel sectioning seams using typical metal finishing techniques.

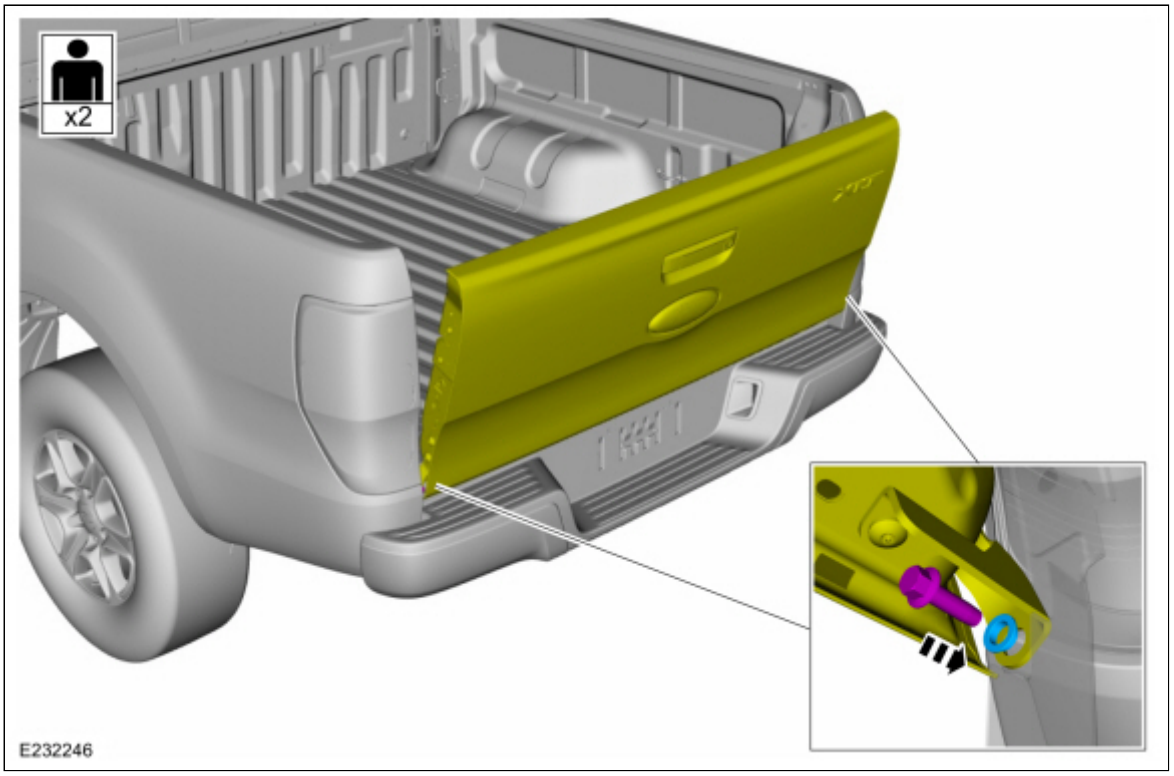
7. Refinish using a Ford approved paint system.

8. Sealing work: All areas must be sealed to production level.
   Refer to: Corrosion Prevention (501-36 Paint - General Information, Description and Operation).

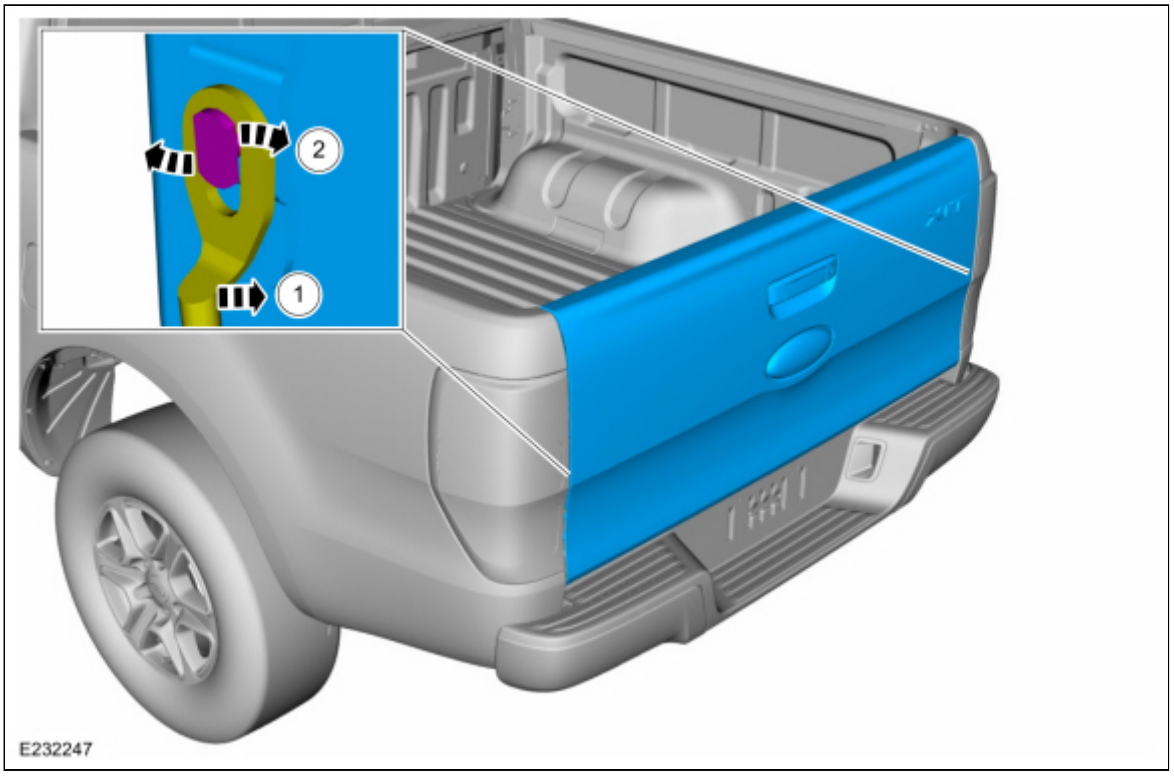
9. Refer to: Refinishing Materials (501-36 Paint - General Information, Description and Operation).

10. Refer to: Rear Bumper (501-19 Bumpers, Removal and Installation).

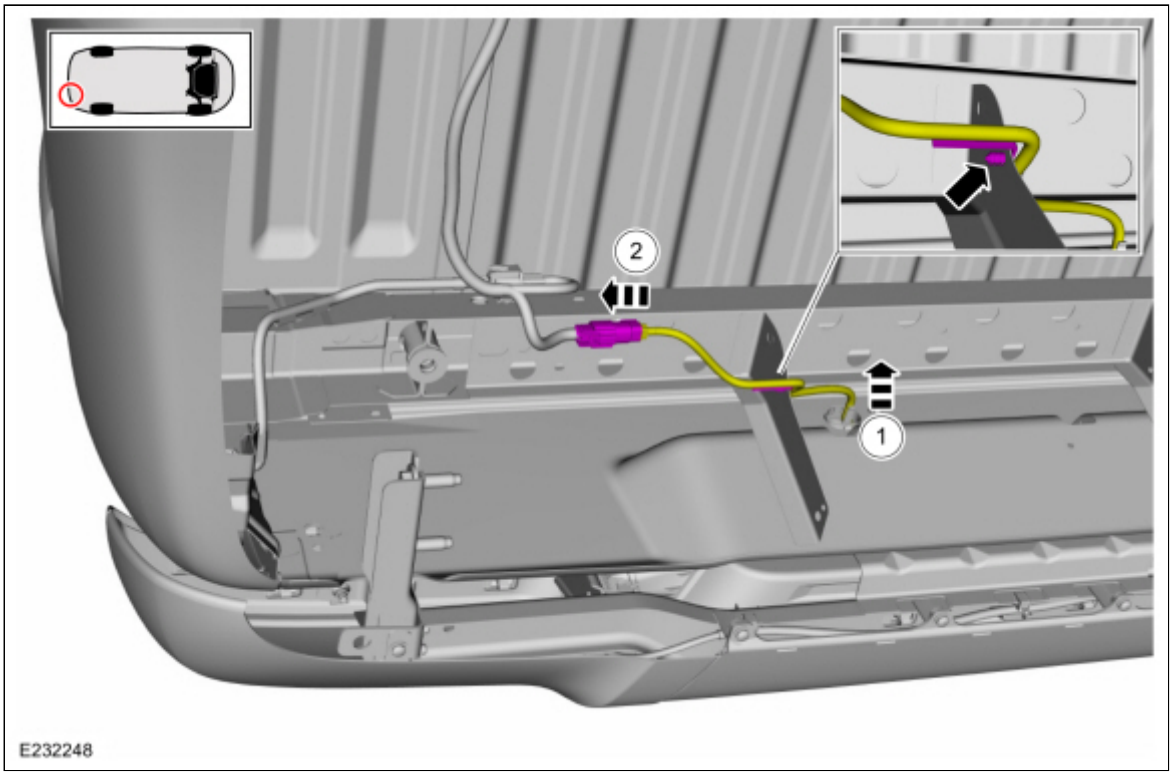
11. *Torque*: 48 Nm



12.



13.



14. Refer to: Jacking and Lifting (100-02) .
15. Refer to: Liftgate Alignment (501-03 Body Closures, General Procedures).

Copyright © 2016 Ford Motor Company

Description and Usage of Paint Literature

Vehicle paints are subject to severe demands caused by external influences. Moisture, air-borne deposits in the form of various chemicals and UV light constantly affect a paint surface. Furthermore, mechanical damage occurs through grit, stones and sand. Bird droppings, insect residues, pollen and tree sap also attack the paint surface.

The present literature not only informs the specialist about current repair painting techniques, but also provides tips and instructions on modern and economical repair processes.

High quality bodywork paints require the use of the most modern technologies and regular updating of the technician's knowledge of painting techniques, because of the constantly new developments in paint technology.

Information about different materials is listed under Specification.

Furthermore, information on the fundamental principles of repair painting and paint materials is provided in several chapters. The safety instructions indicate the possible health hazards and other sources of danger. There are also notes about tools and materials as well as on basic painting methods.

In the model specific repair instructions, only the most important repair steps or special features are referred to. Detailed information on the generally applicable painting procedures is given in this paint manual.

Direct supply of repair paints by Ford has been discontinued. There is however an agreement with many paint manufacturers, which ensures fast and problem-free supply to the dealer undertakings.

Paint suppliers:

- DuPont
- Glasurit
- PPG
- Sikkens
- Spies Hecker
- Standox

When using painting materials, it should be taken into account that the manufacturers have exactly matched their products between each other. In order to avoid quality defects, difficulties in working and losses in corrosion protection, these may not be substituted with other products.

NOTE: *The Ford Service Organization organizes basic and more in-depth training on much of the content of this paint manual. As well as the practical part of the training, a further component is the Student Information document, which offers supplementary information in the form of a brochure.*

During all work it must always be ensured that personal safety and the operational capability of the vehicle are not threatened by the choice of methods, tools and components.

The information given in the diagrams in the chapter "Paint Damage" is provided by the repair paint manufacturer.

Copyright © 2016 Ford Motor Company

Symbols

General

Various symbols, signs, instructions and illustrations are used in this literature. Warnings and cautions have different meanings and require different ways of proceeding. Diagrammatic representations are provided with instructional signs for improved clarity. These are briefly explained below:

WARNING: This caption is used when failure to follow instructions exactly or failure to follow them at all may result in a hazard to persons or in persons being injured.

NOTICE: This caption is used when incorrectly following the test procedures or instructions or failure to follow them at all could lead to damage to the vehicle or components.

NOTE: *This caption is used when attention needs to be drawn to special or extra information.*

When reading this handbook, you will come across the points WARNING, CAUTION AND NOTE. These instructions are always given immediately before the corresponding job steps.

Hazardous materials designations

Many accidents occur because of ignorance. In the area of personal health protection, it is particularly important to clearly emphasize sources of danger and their effects on human organs.

Only with knowledge of hazardous material designations can it be certain that the necessary precautions are taken when handling substances which are harmful to health.

NOTE: *Pay attention to the manufacturer's data on the containers and given in the Safety Data Sheet.*

Hazardous material symbols



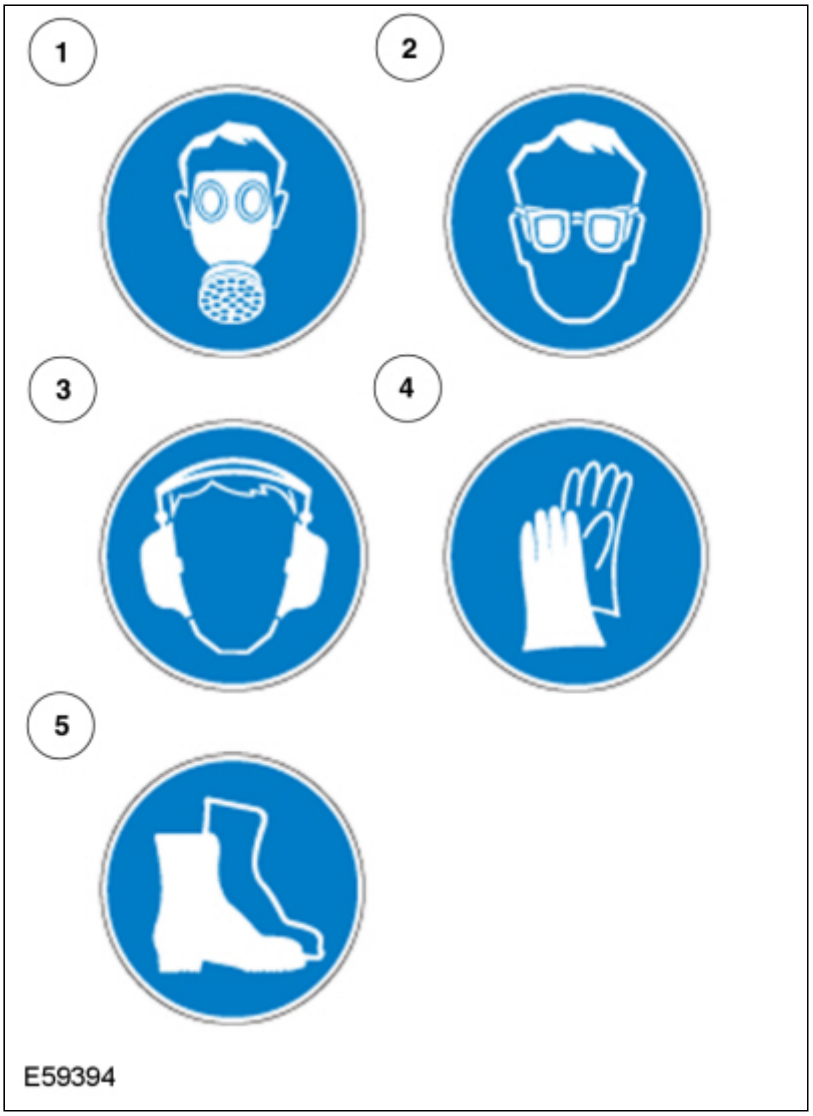
Item	Part Number	Description
1	—	Very poisonous, T+ (extremely toxic), small quantities can be fatal.
2	—	Poisonous, T (toxic), causes serious damage to health
3	—	Corrosive, C (corrosive), destroys living tissue.
4	—	Harmful to health, Xn (noxious).
5	—	Irritant, Xi (irritant), can cause inflammation.
6	—	Explosive
7	—	Highly flammable, F+ (extremely flammable), already flammable at temperatures below 0° C.
8	—	Flammable, F (flammable), forms a flammable mixture with air.
9	—	Oxidizing, O (oxidizing), reacts with combustible substances.

As well as the danger symbols, there is more comprehensive manufacturer's information to be found on the containers and in the Safety Data Sheets, and you must pay attention to this information.

Instructions on measures to be taken for personal protection.

As well as the information about sources of danger, there are mandatory instructions which draw your attention to the personal protection measures to be taken.

Mandatory symbol

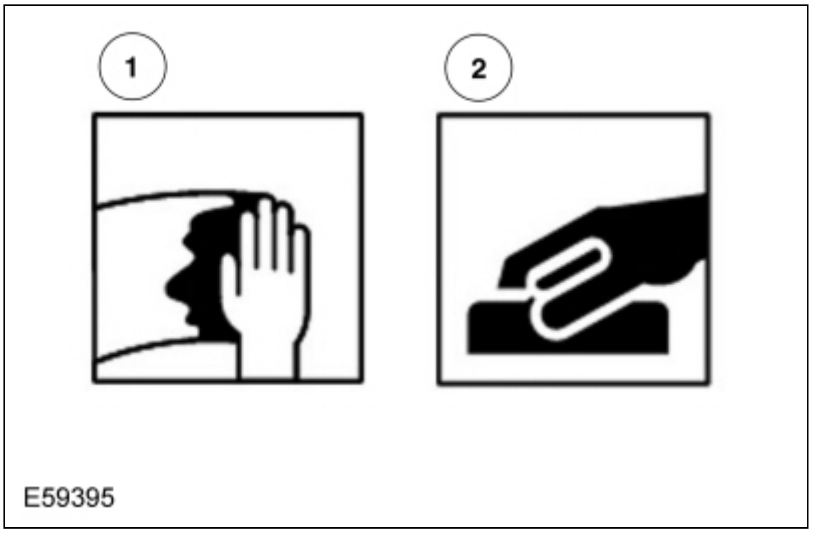


Item	Part Number	Description
1	—	Breathing protection must be worn
2	—	Eye protection must be worn
3	—	Ear protection must be worn
4	—	Protective gloves must be worn
5	—	Protective footwear must be worn

Icons

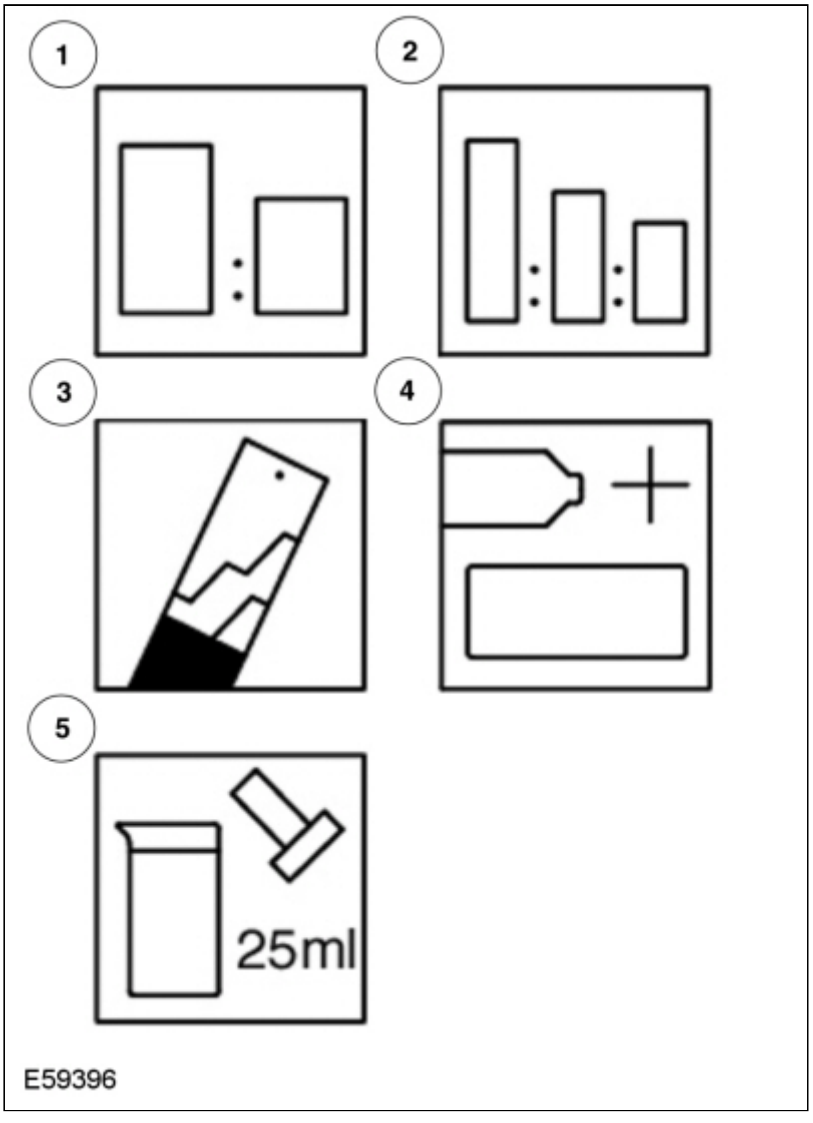
So that the necessary information for optimal handling is clear, unambiguous and can be quickly understood, the leading paint manufacturers have agreed a standard symbolic language. Language independent representations in the form of icons provide handling instructions which are supplemented with quantity or time information.

Pretreatment



Item	Part Number	Description
1	—	Clean
2	—	Sand

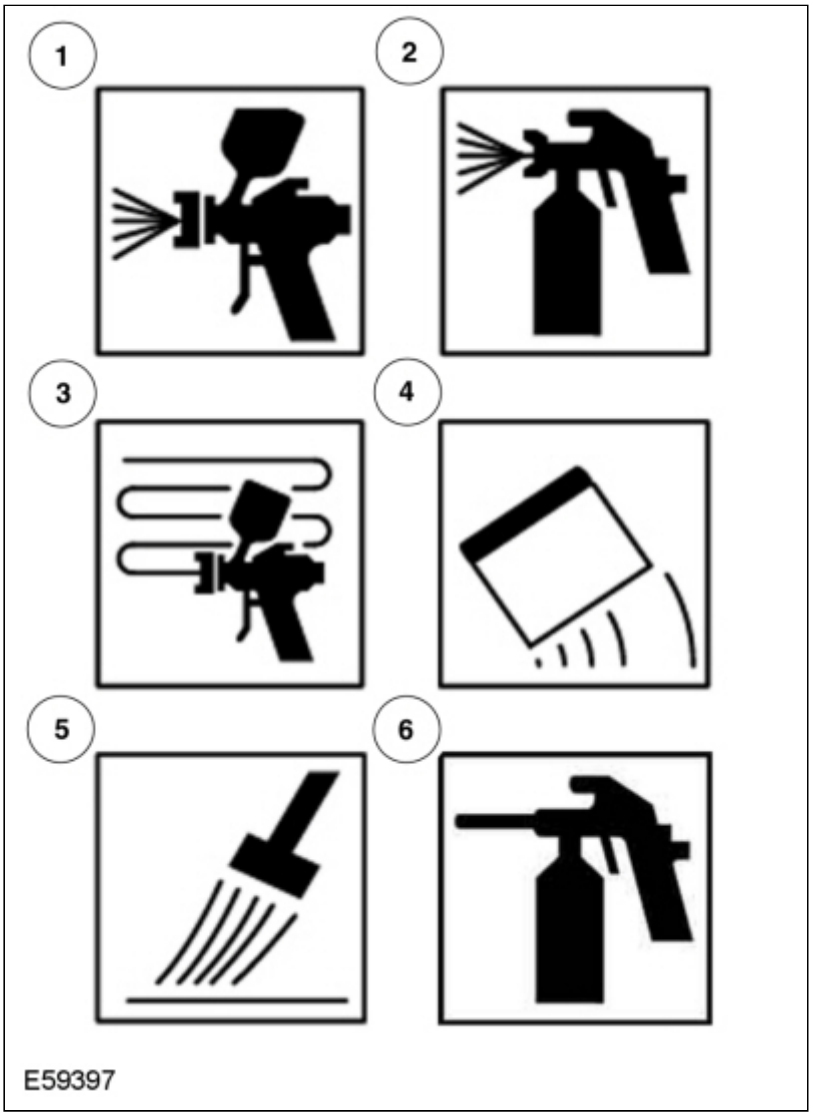
Mix



Item	Part Number	Description

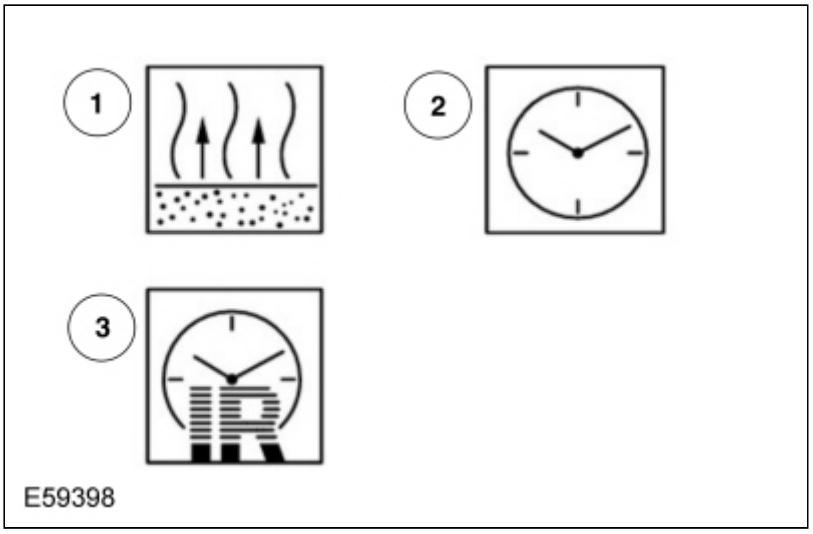
1	—	2 component mixture
2	—	3 component mixture
3	—	Use a measuring rod
4	—	Addition of hardener
5	—	Addition of additives

Process



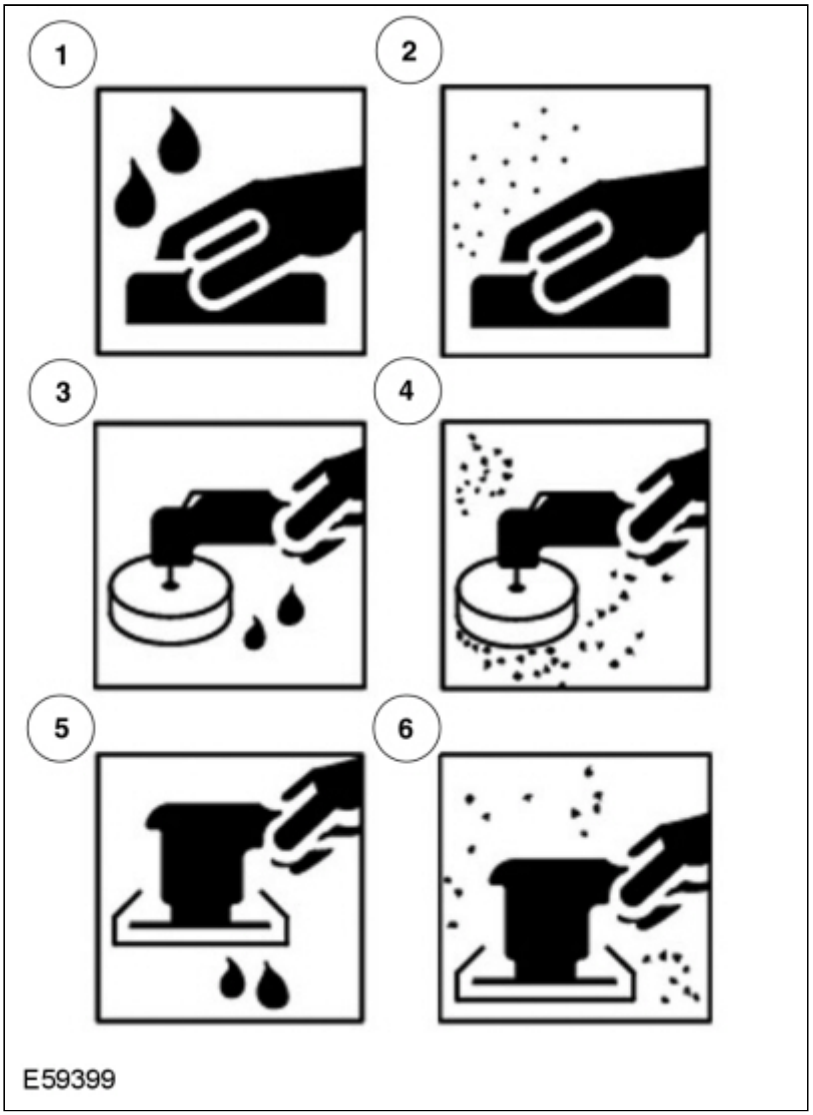
Item	Part Number	Description
1	—	Flow-beaker spray gun
2	—	Suction-beaker spray gun
3	—	Spray passes
4	—	Filler
5	—	Coat
6	—	Underbody protection spray gun

Dry



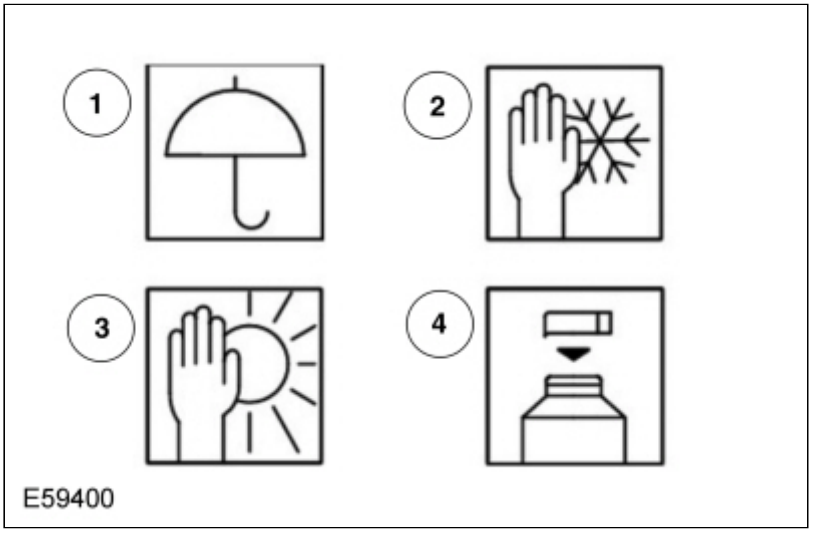
Item	Part Number	Description
1	—	Ventilate
2	—	Drying time
3	—	Drying time with infra-red dryer

Further processing



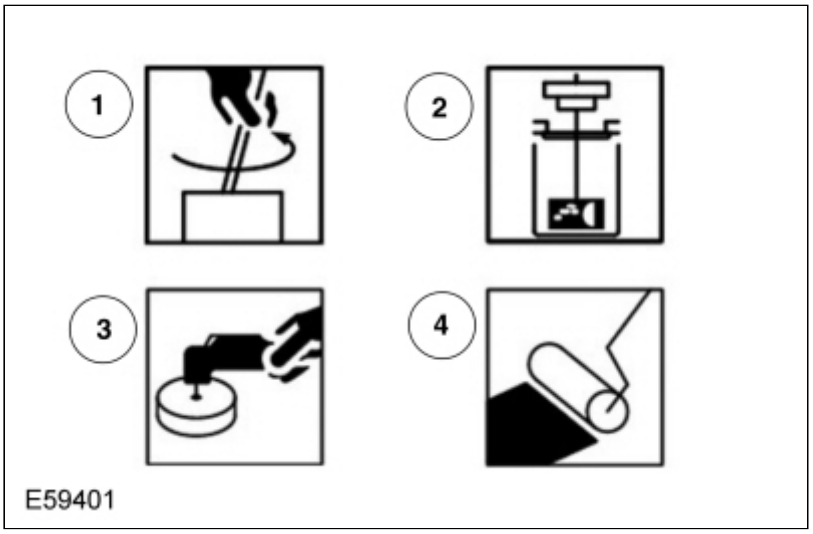
Item	Part Number	Description
1	—	Hand abrade (wet)
2	—	Hand abrade (dry)
3	—	Eccentric sander (wet)
4	—	Eccentric sander (dry)
5	—	Oscillating sander (wet)
6	—	Oscillating sander (dry)

Store



Item	Part Number	Description
1	—	Protect from moisture
2	—	Store in a frost-free environment
3	—	Store in a cool place
4	—	Close the container

Other



Item	Part Number	Description

1	—	Stir by hand
2	—	Stir using a mixing machine
3	—	Polish
4	—	Roll

Copyright © 2016 Ford Motor Company

Health and Safety Precautions

General instructions for the paint shop and handling paint materials

Hazardous areas in repair paint shops:

- Danger from fires, explosions and hot surfaces.
- Dangers to health and safety from the effects of harmful substances because of their absorption through the skin and/or inhalation.
- Dangers caused by electricity, compressed air, power tools and noise.

WARNING: During painting work there is an increased danger of fire or explosion. Prevent any sparks being created. Fire, naked lights and smoking are forbidden.

Measures:

- Wear protective footwear made from anti-static material.
- Only use tools made of wood, brass or copper to clean stands and extraction ducts. Do not use tools made of steel.

Only fill or decant paint materials in a specially marked area.

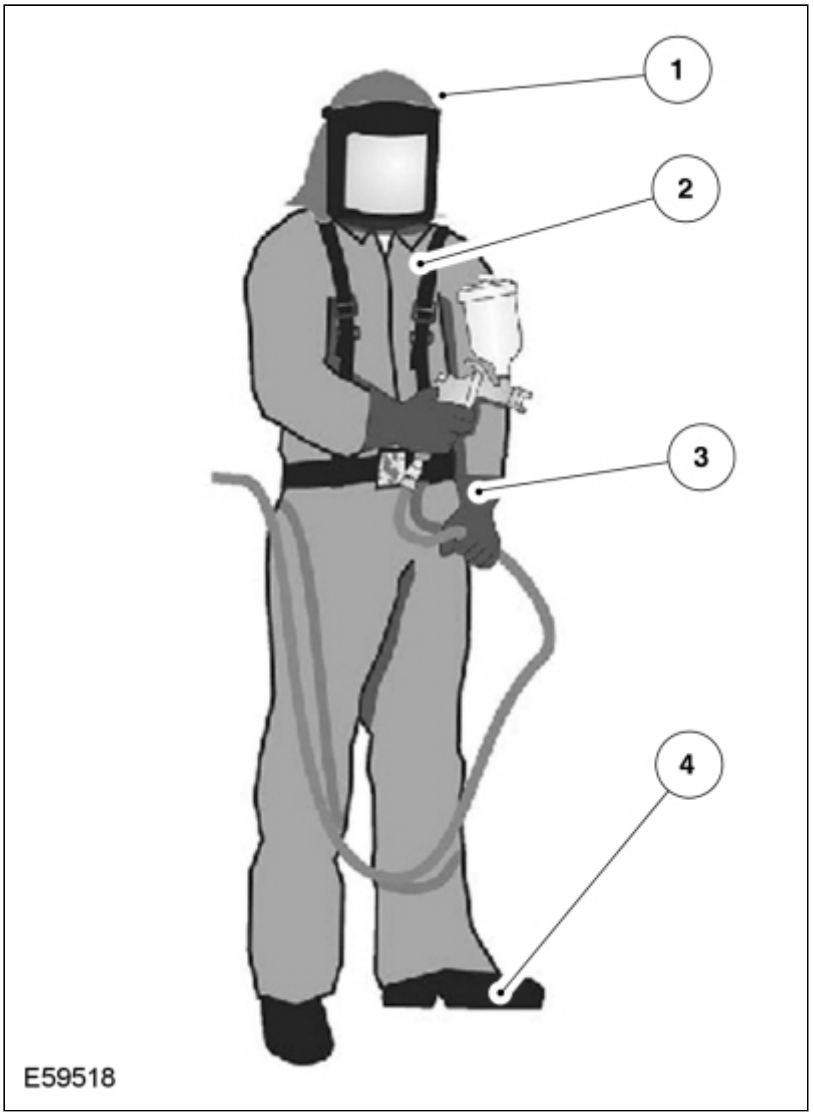
As well as these general instructions on the dangers in repair paint shops, all national and international regulations must be observed:

- Health and Safety at Work Act
- Ordinance on Hazardous Substances
- Technical Rules for Hazardous Substances
- Regulations for the Prevention of Industrial Accidents
- EU Directive on Hazardous Substances, 98/24/EU
- EU Directive on Noise, 2003/10/EU
- EU Directive on Volatile Organic Compounds (VOC), 1999/13/EU, 2001/81/EU, 2004/42/EU
- Safety instructions of equipment and tool manufacturers

Personal protection

Besides the body and limbs, several organs vital to life are in very particular danger. Because damage is mostly irreparable, special attention and comprehensive protection are necessary.

WARNING: Solvents cause damage to the health through inhalation. Splashes in the eyes or on the skin can cause bodily harm. When working with solvents, always use suitable means of protection.

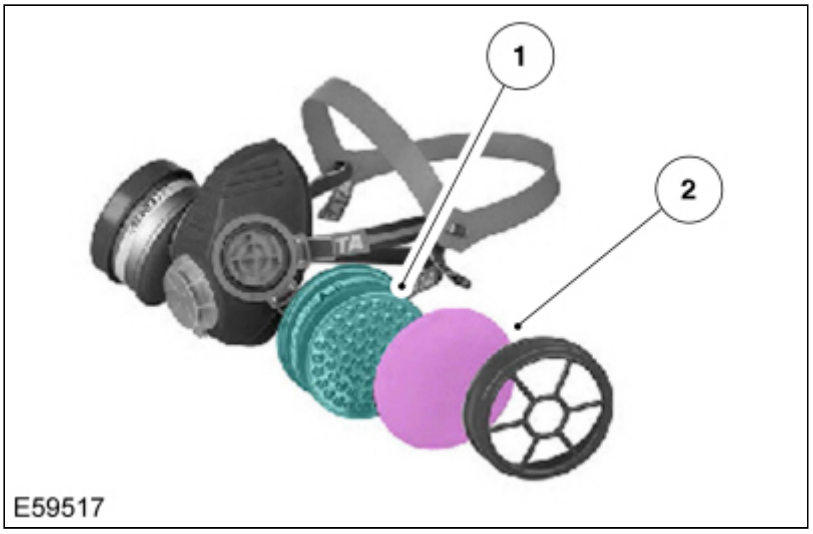


Item	Part Number	Description
1	—	Protective hood with fresh air supply
2	—	Protective clothing
3	—	Protective gloves
4	—	Protective footwear

Breathing protection

During painting work and in the preparations for painting, gases, vapors, mists or dusts can appear in dangerous concentrations in the areas where fellow employees breath.

For short periods of work or minimal concentrations of hazardous substances, breathing protection devices with a combination filter are suitable as breathing protection equipment.



Item	Part Number	Description
1	—	Activated charcoal filter
2	—	Coarse filter

For higher concentrations of harmful substances, breathing protection devices which are independent of the local atmosphere are suitable.

In these types of isolation systems, a compressed air hose carries natural air from the compressor line into the protective mask. During supply, the air undergoes pressure reduction, water removal, fine filtration and usually warming to natural breath temperature.

WARNING: Vapor or spray mist containing isocyanate as a paint base or hardener can cause toxic respiratory disease (conditions similar to asthma) leading to permanent damage, even when inhaled in the lowest concentrations.

Filter masks with wadding, sponge or colloid filters and also paper masks are all unsuitable for working with coating materials because they do not stop solvent vapors.

The instructions for use provided by the manufacturer must be observed when working with breathing protection equipment.

Skin protection

Spray painters who are subject to considerable exposure to coating materials must wear suitable protective work clothing (flame-proof and anti-static).

NOTE: *Also, when working with water based materials, comprehensive skin protection must be worn, because these materials are very easily absorbed through the skin.*

The protective clothing must be changed at the proper intervals. Items of clothing which are contaminated with coating materials can easily catch fire.

When selecting protective clothing, it must be taken into account that cloth containing a high proportion of easily melted plastic thread considerably increases the degree of burns injury (melted plastic on the skin!). This must also be taken into account in the choice of underwear.

For areas of skin which are not covered by protective clothing, suitable skin protection, skin cleaning and skin care agents must be used.

Eye protection

Working with portable hand sanding machines on which the tools move unguarded, at speed and with power is fundamentally dangerous.

Goggles must be worn not only when sanding, but also when working with paints and their additives. These contain substances which are harmful to the eyes. Damage ranging from irritation of the cornea to incurable illnesses are possible.

The protective goggles must be inert toward splashes of solvent, and fully enclose the areas at the side of the eyes

on both sides. The best protection during spray painting is offered by full mask respirators or helmet respirators with a built-in visor.

Ear protection

Noise disturbance in repair paint shops caused by various sources is particularly high. Sanding and compressed air machines, paint cabin extractor fans (compressors) and extractor ducts in the work rooms are the causes of the high levels of noise.

WARNING: Avoid damage to your hearing! Wear ear protection.

Suitable ear protection is offered by ear plugs or ear defenders.

Copyright © 2016 Ford Motor Company

Environmental Regulations

Waste disposal in the repair paint shop

More than ever before, since the introduction of EU directives, rigorous attention is paid to the avoidance of waste materials and to recycling in repair paint shops. In this respect, repair paint shops must take into account and comply with the following requirements:

- Separate waste according to its recycling and disposal methods.
- Produce evidence for the correct transport and disposal of waste.

NOTE: *The organization of disposal in the plant must comply with the requirements of the Waste Avoidance and Management Act: The avoidance and recycling of waste must always take priority.*

However, despite all measures which may be taken, waste cannot be completely avoided.

NOTE: *Waste which is not allowed in household rubbish, and which can no longer be utilized, must be disposed of as special waste.*

Paint residues containing solvent, application residues, sanding dust, waste containing peroxides, solvents, soiled cleaning cloths and paint slurry all count as special waste. Each of these must be collected in a separate, sealed and suitably labeled metal container and properly disposed of using a specialist company.

Careful separation allows some waste to be usefully re-used.

- Empty metal containers can be sent for scrap instead of being disposed of as waste.
- Contaminated cleaning thinners can be separated by distillation.
- Packing material and masking paper can be added to the recycled paper collection.

Residues which cannot be used must be correctly disposed of.

All remaining waste must be treated as commercial waste and disposed of according to the local regulations.

The new VOC (Volatile Organic Compounds) solvent regulation

Keeping the air clean protects the environment and the population from the heath-damaging effects of air pollutants.

In certain atmospheric conditions, volatile organic compounds contribute to summer smog.

NOTE: *For comprehensive information, please refer to the European VOC Directive, 1999/13/EU. Furthermore, the effective national regulations must be complied with.*

The European VOC (Volatile Organic Compounds) Directive has controlled the limits for such compounds since August 2001. It applies to production coating companies and those which undertake repair painting of private and commercial vehicles.

Not least because of the VOC legislation, modern, low solvent and solvent-free lacquers and paints are finding greatly increased distribution across industry and the trade. Up to the year 2007, emissions from painting work will drop by at least 40%.

At the same time, the paint manufacturers guarantee for example that they will produce a ready-to-spray product consisting of base paint + hardener + thinners, with a permitted VOC level.

A company in business today can conform with the stipulated requirements by introducing water-based paints and using the other necessary products from the relevant paint manufacturers.

For more detailed information, please refer to the EU VOC Directive.

Copyright © 2016 Ford Motor Company

Factory Paint Application

General fundamentals of paint technology

Paint is a pigment-containing liquid which undergoes chemical and/or physical processes after it has been applied to a surface, so changing into a solid film covering.

Repair paint consists of binder, pigments, filler and solvent.

NOTE: *Organic solvent is being replaced by solvent based on water.*

Constituents of paint

- Binder
  - Mostly semi-fluid resins which bind together the other components of the paint when it dries.
  - Makes the paint durable.
  - Ensures good surface coverage.
- Pigments
  - Fine, colored powders, which give color to the paint.
  - Cover the components below (covering power).
- Additives
  - Additives give the paint special properties.
  - e.g. flow improver, softener, drying accelerator, thickener.
- Solvent
  - Thins the paint and allows it to flow more freely.
  - Evaporates during drying.

Painting process and corrosion protection.

In production, painting consists of individual steps which are optimally matched to each other.

Bodywork consists almost entirely of steel panels which have been pre-coated with zinc. The zinc layer is between 5-10 µm thick and acts as the first corrosion protection layer of the steel panel.

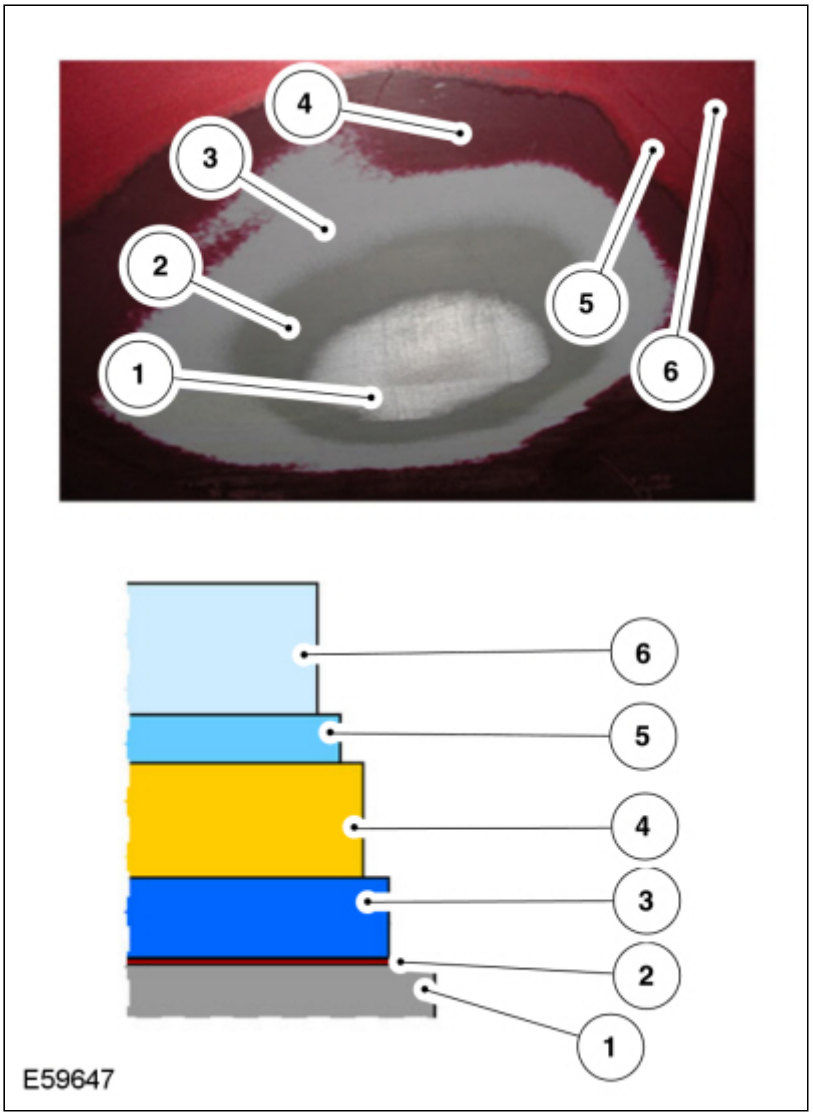
Production sequence:

- Clean and de-grease
  - In the first step, the bare bodywork is initially dipped in a cleaning bath and cleaned with a degreasing solution.
- Phosphatising
  - The cleaned bodywork is dipped in a bath containing various phosphate salt solutions. This creates a crystalline metal-phosphate layer which offers the optimal prepared surface and also corrosion protection.
- CDP base
  - The cataphoretic dip paint (CDP) base acts as a further corrosion protection layer.
  - In this process the bodywork is completely immersed in a bath consisting of a paint and electrolyte solution.
  - By application of an electric voltage, an electric field is created.
  - Positively charged paint particles settle on the negatively charged bodywork and form a protective layer up to 20 µm thick.
  - Next the bodywork is placed in a dryer, where the CDP base is hardened at 180°C.
- Sealing, stone-chip protection
  - Edges, seams and but joints are sealer with a sealing compound.
  - Vulnerable areas are coated with stone-chip protection.
- Filler
  - Filler protects the body panels from stone impacts. Furthermore, any unevenness of the metal surface is flattened out, in order to create the most homogenous and fault-free undersurface possible.
  - Once the filler is dry, it serves as the base on which paint is applied.
- Top coat
  - The top coat is applied as a single layer or two layers of paint.
  - When working with two layer paint, in the first job step the initial colored base paint is applied. In the second job step, a clear lacquer is applied, giving the base paint shine and hardness.

The structure of an original paint finish

During construction of the original paint, a total surface thickness of between 120 and 130 µm is achieved. The thicknesses of the layers may vary however, because they are greater for horizontal surfaces than vertical ones.

Paint layers



Item	Part Number	Description
1	—	Steel panel
2	—	Phosphate layer 2.9 g/m², corresponding to 2 µm.
3	—	Cathodic dip paint 30-35 µm
4	—	Filler 30-35 µm
5	—	Base paint 15-20 µm
6	—	Clear varnish 55 µm

Colored fillers applied in production

Filler which gives color is used in production. Its use makes the base paint and clear varnish unnecessary on certain vehicle interior surfaces (engine, doors).

Not every exterior paint has its own matching filler. It is more that the tones of the filler are color compatible, i.e. they have similar intensity to the top coat.

During repair painting the filler color tones must be used according to the manufacturer's instructions.

Copyright © 2016 Ford Motor Company

Paintwork Defects and Damage

Diagnosis and Damage Assessment

Paint concerns, regardless of their causes, are part of the everyday work in the paint shop. Correct damage assessment and determination of the cause are preconditions for a professional resolution of a paint concern.

Paint concerns can still occur through a variety of causes, despite improved paint materials and new spray methods.

NOTE: *A first appraisal of the paint damage should be done before cleaning. External factors such as rust, droppings, incorrect or insufficient paint care can then be more easily detected.*

Diagnosis is best done in daylight but not in direct sunlight. Exact evaluation can also be done under artificial light from special luminescent lamps.

Paint damage guide

The most important paint damage concerns which make a paint repair necessary are:

- Damage from biological paint contamination such as bird or insect droppings, tree resin and aphids.
- Chemical paint damage caused by industrial contaminants such as smoke, fuel, acids, oils.
- Mechanical damage caused by stone impact during operation, scratches in the car wash and parking.
- Damage caused by faults in treatment. Application defects such as paint runs or orange peel.
- Dirt inclusions in the paint layer, e.g. caused by dust in top coat or textile lint.
- Damage due to corrosion.

Before repair of such paint concerns, exact diagnosis must be performed to determine the cause exactly. On the spot diagnoses using simple aids and processes are often enough.

Diagnosis without disturbing the paint is done by:

- Optical inspection without visual aids, under suitable light conditions from a suitable angle and correct distance.
- Optical inspection with the help of a magnifying glass.
- pH paper.
- Measurement of the thickness using FE / NFE coating thickness meters for ferrous (FE) and non-ferrous metals and non-magnetic steel (NFE) - magnetic process on steel panels, eddy current process on non-metals.

A test method where the traces of testing can be easily removed again is the finger nail test. With suitable experience the existing hardness of the paint can be determined.

Test methods where the paint is partially destroyed are:

- Pencil hardness test.
- Adhesion test using adhesive tape.
- Lattice cut test process to check the strength of adhesion.

Under certain circumstances these test methods are not enough for a certain diagnosis. In this case, paint diagnosis under laboratory conditions must be performed.

Measuring and testing equipment for painted surfaces

Coating thickness measuring devices

Magnifying glass

pH paper (together with water)

Suitable photographic equipment with macro lens

Shine measuring equipment

Paint damage caused by environmental factors

- Bee droppings
- Bird droppings

- Insects
- Tree resin and sap
- Aphid secretions
- Tar spots
- Cement, plaster and slaked lime
- Rust film/deposits from industrial fallout
- Battery acid
- Brake fluid

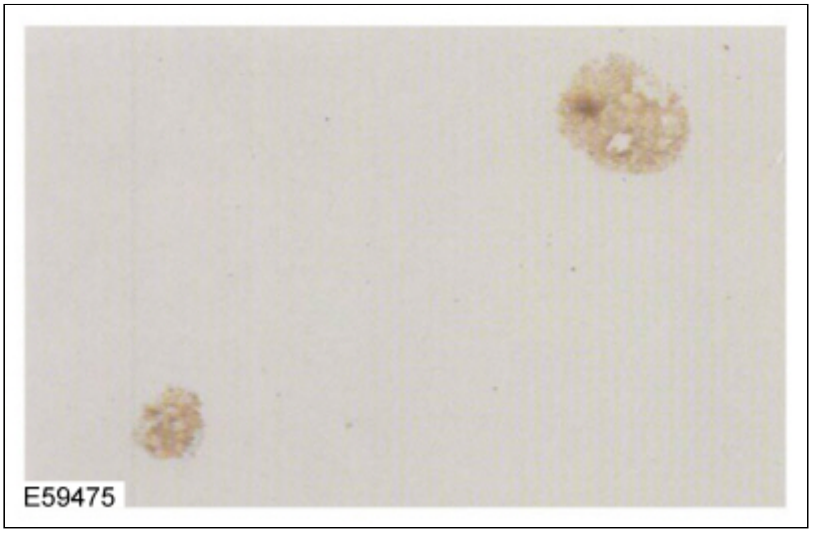
In all the cases of paint damage described below, if the damage is irreversible a new paint finish must be applied.

Paint damage cause by bee droppings

Bee droppings can be recognized on a paint surface through its yellow or brown color and sausage or drop-like shape with a diameter of 3-4 mm.

Cause/damage pattern:

- In combination with heat and high air humidity, bee droppings leave discolorations and cause paint decomposition.
- The paint can be destroyed down to the filler.



Repair of damage:

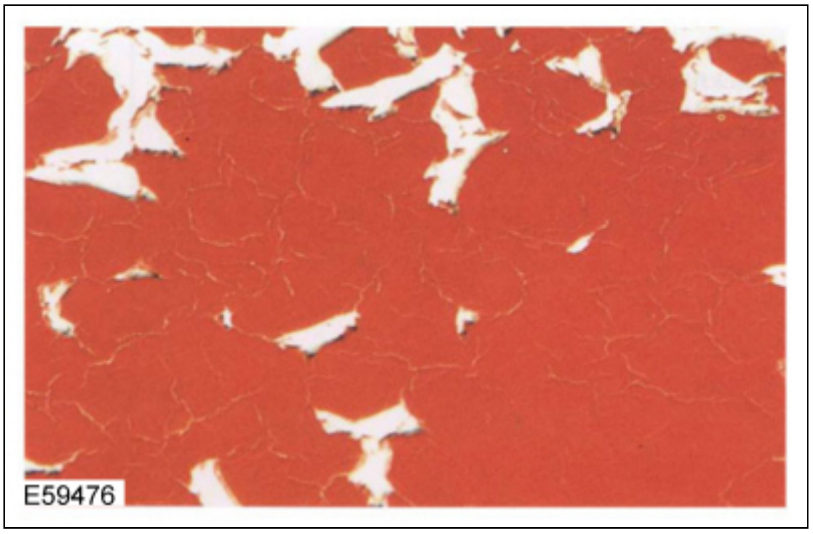
- If the damage is light, perform a polishing repair.

Paint damage caused by bird droppings

Bird dropping damage appears most often as matt, etched topcoat areas of various sizes. If left on the vehicle for a long time, crack formation and etching down to the filler will occur.

Cause/damage pattern:

- Bird droppings are particularly harmful in combination with heat and moisture. The urea (white part) has a very high salt content and is very aggressive.
- The intensity of the damage varies depending on the type, quantity, contact time and extent.
- Cracks, etching, marks up to dissolution of the top coat are the results.



Repair of damage:

- If the damage is light, perform a polishing repair.

Paint damage caused by insects

At insect impact locations on the hood, roof and bumper, small etched or etched through paint marks with partially visible spots of filler.

Cause/damage pattern:

- The top coat layer is destroyed in a short time by surface swelling and etching.
- Colliding insects stick to the paint surface. In combination with moisture and heat, because of the resulting acids the insect bodies sink into the paint top coat.
- The corrosion is G, C, U or O shaped and is only a few millimeters thick.



Repair of damage:

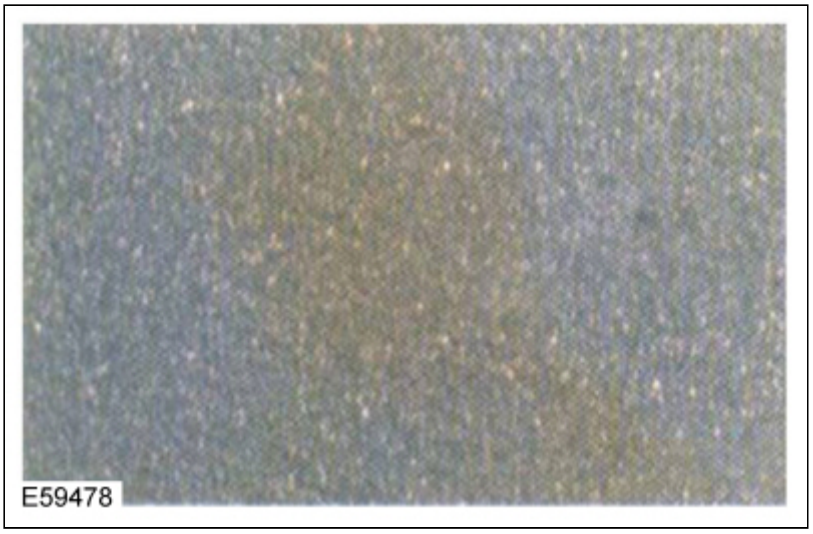
- Wash the vehicle, treat the affected area with insect remover. Clean the paint surface several times.
- Protect with hard wax.

Paint damage caused by tree resin or sap

Small yellow-brown marks or drops on the horizontal parts of the vehicle. The drops melt in sunlight. Resin damage only occurs in the warm summer months.

Cause/damage pattern:

- Because of their chemical composition, tree resins combine with or adhere very well to paint top coats and cause them to swell. The higher the temperature, the more intensive is the chemical bonding between the resin and the paint topcoat surface.



Repair of damage:

- Soak several times using a cloth saturated with a petrol & paraffin mixture.

NOTE: *After successful cleaning the top coat must be preserved.*

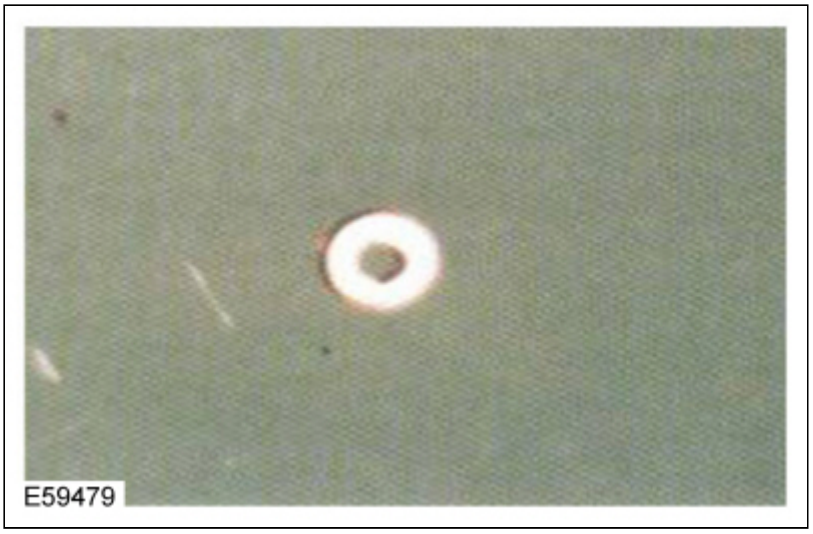
- Swellings can be removed by warming.

Paint damage from aphid secretions

Small, round, matt marks about 1 mm diameter and etching with small islands down to the filler. Fresh aphid excrement looks like small drops of honey.

Cause/damage pattern:

- Aphids produce a mixture of starch, leaf acid and sugar from sap in leaves. Under the effects of warming and moisture this can turn into alcohol.
- The round shape of the damage and the island of intact paint are typical.



Repair of damage:

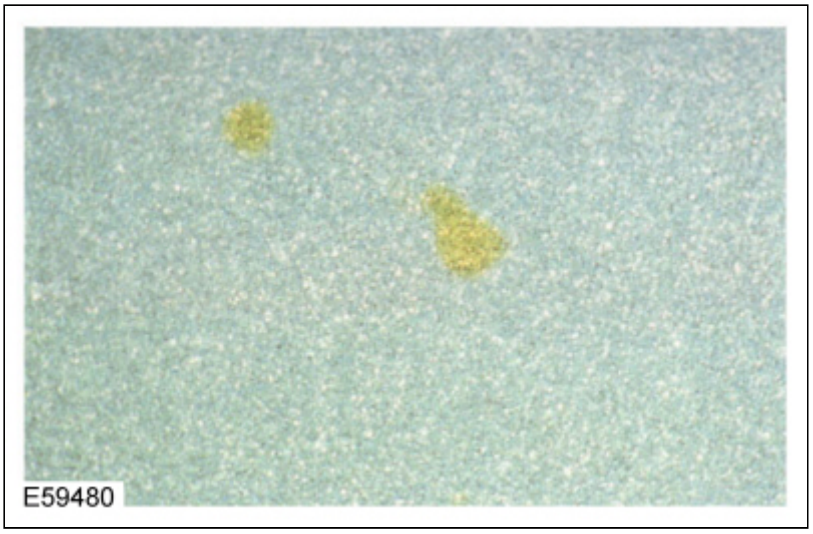
- Remove the excrement as soon as possible.
- Small single matt locations without etching can be repaired using a polishing repair.

Paint damage caused by tar spots

Yellow or dark marks.

Cause/damage pattern:

- Firmly stuck spots of tar which lead to discoloration of the surface. In some cases penetration through the clear lacquer into the top coat.



Repair of damage:

- Clean the paint surface with tar remover and polish.

Paint damage caused by cement, plaster and slaked lime

Damage appears as whitish matt marks on the top coat.

Cause/damage pattern:

- Corrosive alkaline compounds interacting with moisture.



Repair of damage:

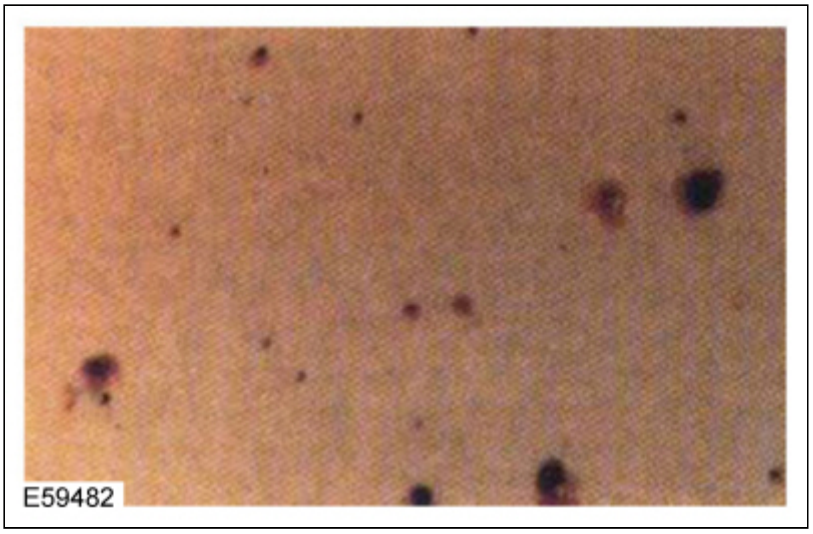
- Wash immediately if the contamination is fresh.
- If the contamination has dried on, dissolve and neutralise it with vinegar, then thoroughly wash off with water and rinse.
- Rectify mild damage using a polishing repair.

Rust film/deposits from industrial fallout

Small round marks, about 1 mm in size, in all shades from black, grey, blue to reddish, on the horizontal surfaces of the vehicle.

Cause/damage pattern:

- Deposits from oil fired systems and industrial plant, especially at high humidities and inversion weather conditions, cause damage to the paint top coat.
- As the activity time increases so called rust halos form. They spread as long as the deposits corrode.
- Industrial fallout containing iron will no longer be removable after a few days!



Repair of damage:

- Remove the dust using an industrial fallout remover and thoroughly wash.
- Polish the paint surface.

NOTE: *Never try to remove the particles of industrial fallout by polishing or rubbing!*

- Use cleaning dough.

Damage caused by battery acid.

Splashes of battery acid caused by carelessly topping up the battery.

WARNING: Batteries contain sulphuric acid. When working near the battery, or where there is battery acid on the vehicle body, protect the skin and eyes from contact with the acid. If battery acid contacts the skin or enters the eyes, flush the affected area immediately with water (flush for at least 15 minutes) and call a doctor without delay. If acid is swallowed, call a doctor immediately. Failure to follow these instructions may result in personal injury.

NOTE: *High temperatures accelerate the attack on the top coat. At 50°C the top coat layer breaks down after about 15 minutes!*

Cause/damage pattern:

- Etching of the paint layer to decomposition of the paint finish.



Repair of damage:

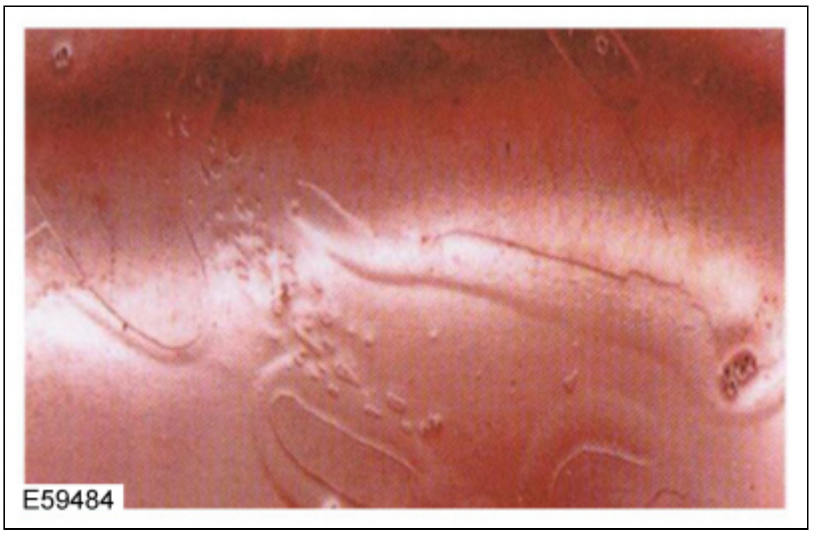
- Flush the acid splashes with plenty of water and neutralize with car washing liquid.
- If the contact time of the acid was short, perform a polishing repair.

Paint damage caused by brake fluid.

Careless handling of brake fluid. The glycols contained in the fluid cause swellings.

Cause/damage pattern:

- The temperature and contact time are critical. Splashes lead to loss of shine and lightening of color.



Repair of damage:

- Flush immediately with plenty of water.
- The swellings can often be made to recede completely by treatment with the radiant heater or in the paint drying oven at max. 60°C for about 1 hour.

Mechanical damage

Stone impact damage or mechanical damage

Mechanical damage caused by impact of stones or other hard objects and extending down to the metal panel lead very quickly to corrosion and rusting under the paint on the adjoining surface.

Cause/damage pattern:

- Paint damage caused from the outside, down to filler, primer or metal panel.



Repair of damage:

- Sand or blast out.
- Use anti-corrosion primer.
- Apply top coat.

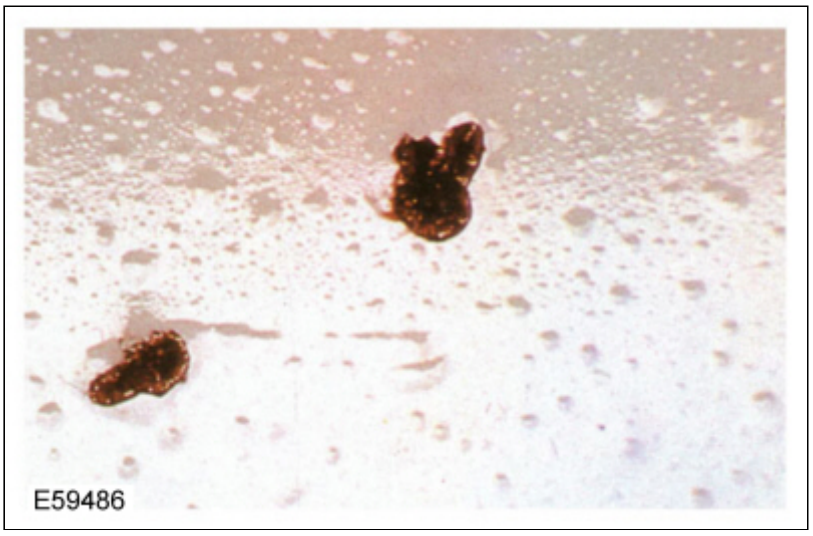
Damage due to corrosion

Blistering/rusting below

Air or water filled blister-shaped raised areas in the paint film.

Cause/damage pattern:

- Overpainting corroded steel panel.
- Condensation in the spray air.
- Sanding water not dried out or salt crystal residues.
- Road chippings and road winter grit containing salt.



Repair of damage:

- Sand the affected area of damage or the body component and re-create the paint finish.
- More severe and larger areas of rusting below must be repaired using the corresponding repair painting, Repair Level III or IV.

Damage caused by faults in treatment

- Craters
- Paint boils
- Adhesion defects
- Adhesion defects - clear lacquer
- Sanding scores
- Formation of stripes
- Peeling/blistering on plastic parts
- Blistering on polyester material
- Peroxide marks in metallic paints
- Crack formation
- Shrinking back/zone edge marks
- Blistering
- Etching
- Paint wrinkles/puckering
- Cloud formation
- Spots/metallics
- Metamerism/color deviations
- Washing out
- Loss of gloss
- Covering ability/areas of thin paint
- Flow problems/orange peel
- Dirt embedded in metallic base paint
- Dirt embedded in top coat
- Water marks
- Paint runs
- Swirl marks

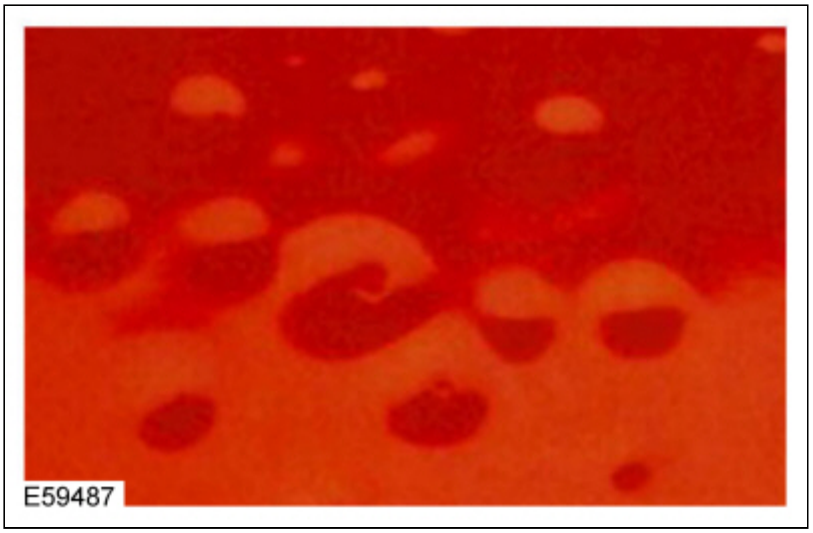
Craters

Crater-like single or extensively occurring depressions with raised edges, in top coat or the intermediate layers.

Cause/damage pattern:

- Substrate not adequately cleaned with silicone remover.
- Spray air contaminated by oil residues and water accumulations.
- Filter ceiling not adequate for requirements.
- Use of polishes, cleaning agents or sprays (e.g. interior sprays) containing silicone.

- Oil, wax, grease, silicone containing residues.
- Working clothes contaminated by materials containing silicone.



Repair of damage:

- Sand paint surface, clean with silicone remover and apply one thin spray pass. Let it begin to dry well, then apply several thin and dry sprayed passes.

Paint boils

Small, hard, closed or burst blisters in the paint top coat. They appear locally in groups or spread individually across the whole surface. Sanding opens up a larger cavity, under which the primer can often be seen.

Cause/damage pattern:

- Paint applied in layers which were too thick.
- Specified flash-off and drying times between coats were not adhered to.
- Specified working viscosity and spray pressure were not adhered to.
- Use of unsuitable hardener and thinner materials. (Solvent combinations in paint system not optimally matched).
- Poor booth conditions.



Repair of damage:

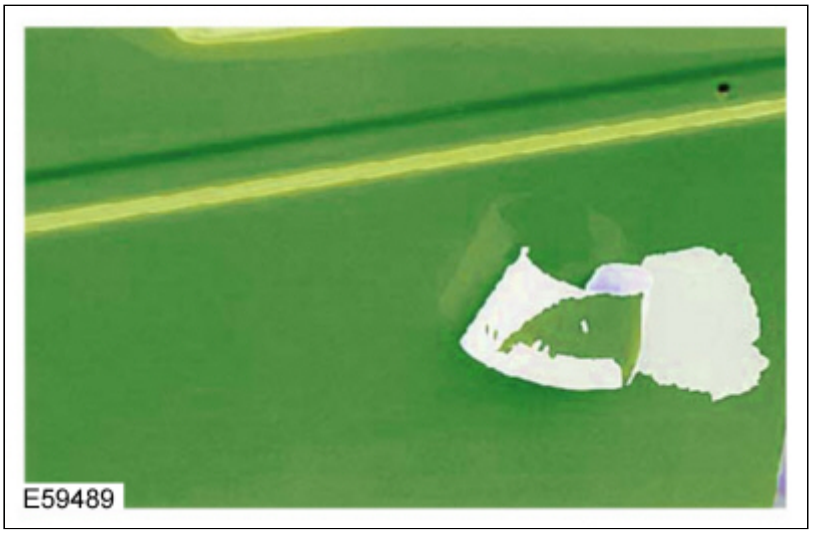
- Single boil blisters can be removed using polishing.
- After thorough drying, sand the top coat at the affected areas, clean with silicone remover and re-paint. Fill any fine pores still present with 2-component acrylic filler.
- On larger areas of damaged topcoat, sand completely away and apply new paint finish.

Adhesion defects

Whole coating detached from substrate or individual layers one from another. Sometimes adhesion defects can only be noticed after an external influence such as stone impact.

Cause/damage pattern:

- Substrate not adequately prepared (rust, grease, moisture, sanding, cleaning).
- Unsuitable material used.
- Drying times, flash-off times too short.
- Base paint not sprayed wet-in-wet, instead the intermediate drying times were too long.
- Failure to intermediate sand.
- Condensation formed because of temperature fluctuations.
- Unprofessional preparation (especially on plastics).
- Overheated CDP/intermediate filler.



Repair of damage:

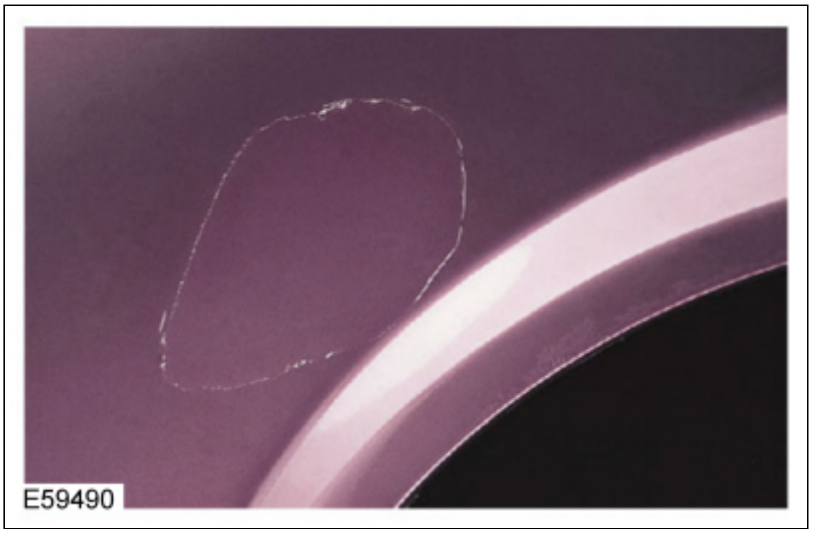
- Sand out the damage and recreate the paint finish. Create the paint finish strictly in accordance with the general technical information.

Adhesion defects in clear lacquer.

Clear lacquer detched from base paint.

Cause/damage pattern:

- Base paint layer too thick.
- Intermediate and final flash-off times of base paint too long.
- Incorrect mixture ratio clear lacquer/hardner.



Repair of damage:

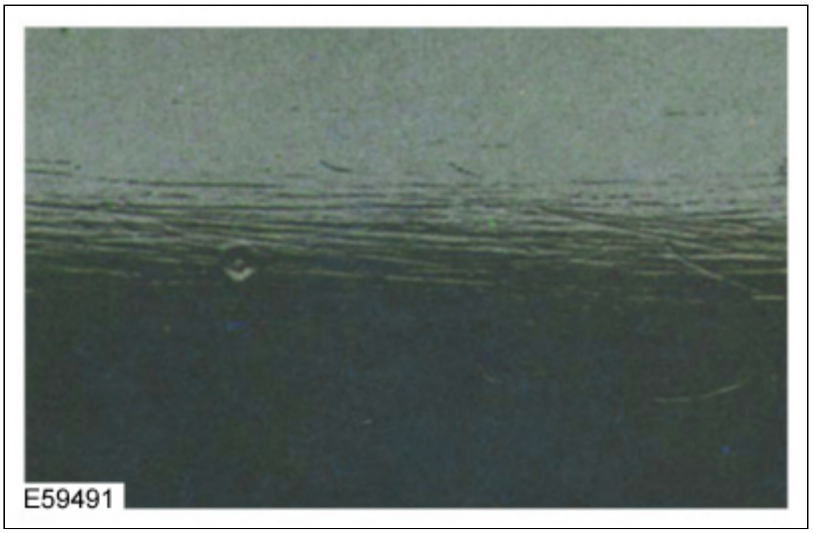
- Refinish sanding and recreate the paint finish.

Sanding scores

Single or wide area clusters of scoring or sanding marks, often with raised edges. Noticeable on metallic paints as light-dark stripes.

Cause/damage pattern:

- Stopper sanded too coarsely.
- Filler sanded too coarsely.
- Filler not thoroughly dried bfore sanding.
- Old paint sanded too coarsely.
- Soft elastic substrates, e.g. TPA base, treated with thinners which was too aggressive and therefore etched.
- Top coat applied too thinly.



Repair of damage:

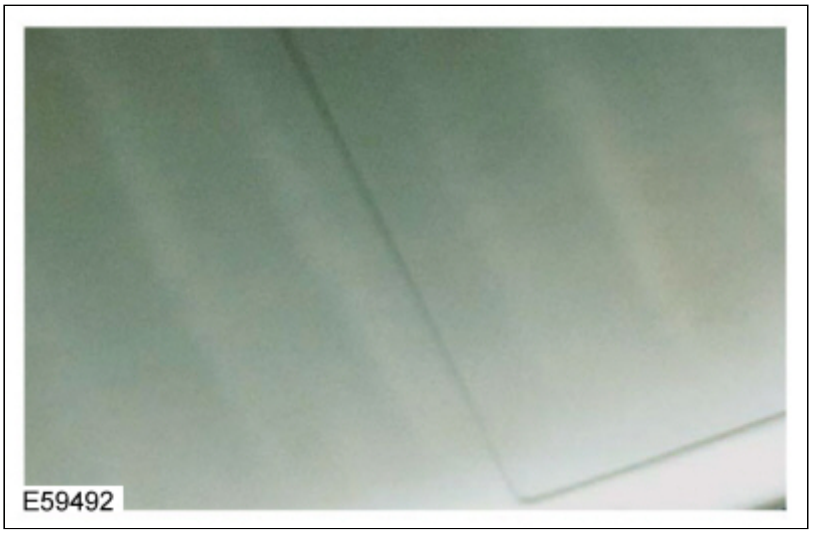
- If the damage pattern is minimal, after the top coat has dried fine sand the paint surface and refurbish by polishing.
- If the damage is great or on metallic paints, sand the paint surface or substrates and if necessary remove them, then cover the bare metal and re-paint.

Formation of stripes

Differing, stripe shaped color/effect formations in dark/light areas of a metallic paint finish.

Cause/damage pattern:

- Spray gun (nozzle) not perfect.
- Incorrect spray pressure.
- Thinners not suitable.
- Incorrect spray viscosity.
- Flash-off time too short.
- Unsuitable working temperature.



Repair of damage:

- Apply base paint evenly.
- Repair spray gun.

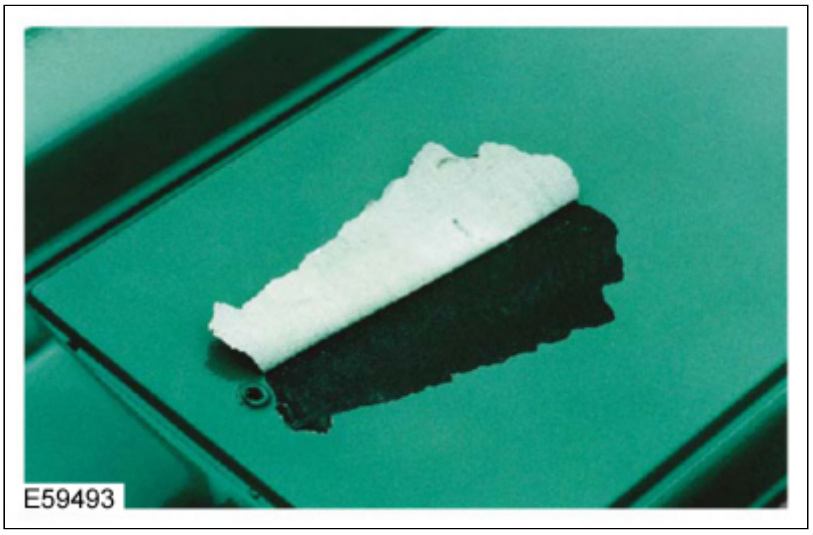
- After clear lacquer has thoroughly dried, sand surface and paint again.

Peeling/blistering on plastic parts

Paint adhesion insufficient between top coat and filler and/or primer layer. It often happens that the whole of the paint finish detaches from the plastic.

Cause/damage pattern:

- Plastic item not cleaned sufficiently, not or inadequately tempered.
- Unsuitable cleaning agent used.
- Unsuitable materials used.
- Moisture.
- Paint finish underbaked or overbaked.
- Poor or lack of intermediate sanding.



Repair of damage:

- Sand away faulty paint coats and re-apply paint finish.
- In extreme cases use a new part.

Blistering on polyester material

Color shade differences or marks in paintwork subsequently applied to previously unpainted plastic material.

Cause/damage pattern:

- Plastic material is not suitable for painting.
- Incorrect bonding agent.
- Paint used not solvent resistant.

Repair of damage:

- Repaint using suitable materials.
- Install unpainted new part (after consulting customer).

Peroxide marks in metallic paints

After longer period of drying, abnormal marks where the color shade varies.

Cause/damage pattern:

- Too much hardener added to polyester stopper (over 3% can cause this damage pattern).
- Polyester stopper not well enough mixed.



Repair of damage:

- Sand, fill with polyester or epoxide filler and re-paint.

Crack formation

Cracks of different lengths and depths running in all directions.

Cause/damage pattern:

- Layers too thick.
- Painted several times.
- Temperature fluctuations.
- Mechanical effects e.g. distortions.
- Substrate not thoroughly hardened.
- Old paint not completely dried out.
- No or insufficient hardener added.
- 2-component materials used on nitro or TPA.



Repair of damage:

- Sand away layers until sound substrate is reached and create new paint finish (prime, fill, apply topcoat).

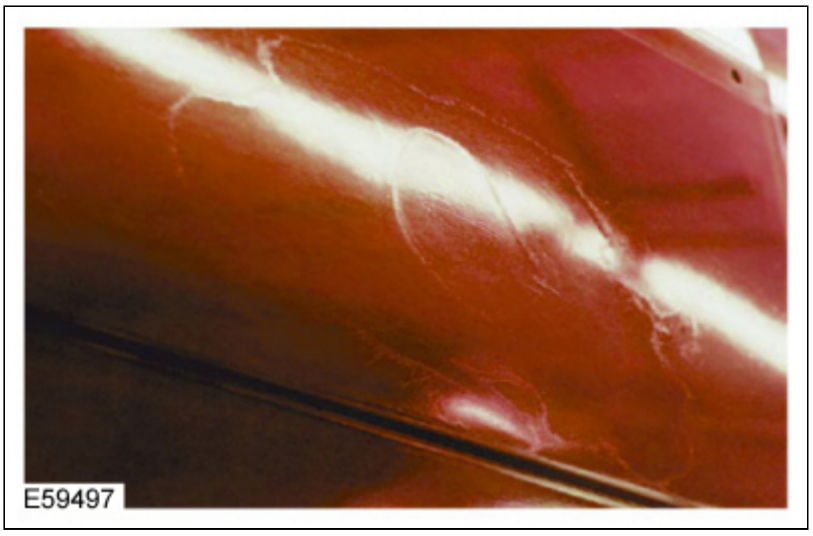
Shrinking back/zone edge marks

Lifting or dropping in of edge zones (edges which accentuate themselves in the top coat), flow problems and loss of shine in top coat.

Cause/damage pattern:

- Old paintwork not rubbed down to a seamless transition.
- Stopper and filler on a viscoplastic base primer.
- Filler sanded and overpainted when not thoroughly hard.
- Previous materials overworked too early, substrate not sufficiently hardened.

- Primer applied in layers which were too thick, and not dried for long enough.
- Sanding paper too coarse.
- Top coat thinned too much.



Repair of damage:

- After hardening off the top coat, fine sand the surface and polish up, apply filler if necessary and paint once more.

Blistering

Small, spot-like, air-filled or water-filled blister shaped high-spots in the paint construction. Their dimensions can range from pin-head to pin-point size in a closed paint film. Arrangement and accumulation very variable. In the advanced stages, circular flaking of the paint from the substrate. These are neither boils nor corrosion.

Cause/damage pattern:

- Moisture absorption by substrate.
- Insufficient drying of the substrate after wet sanding (especially on polyester material).
- Humidity too high before painting; condensation formation because of temperature fluctuations.
- Pores/sink holes in substrate not sanded out.
- Polyester material not covered.
- Sweat from hands.
- Salts and minerals in sanding water.
- Spray air contaminated.



Repair of damage:

- Sand away damage, matt sand remainder of surface, clean with silicone remover, fill and re-paint.

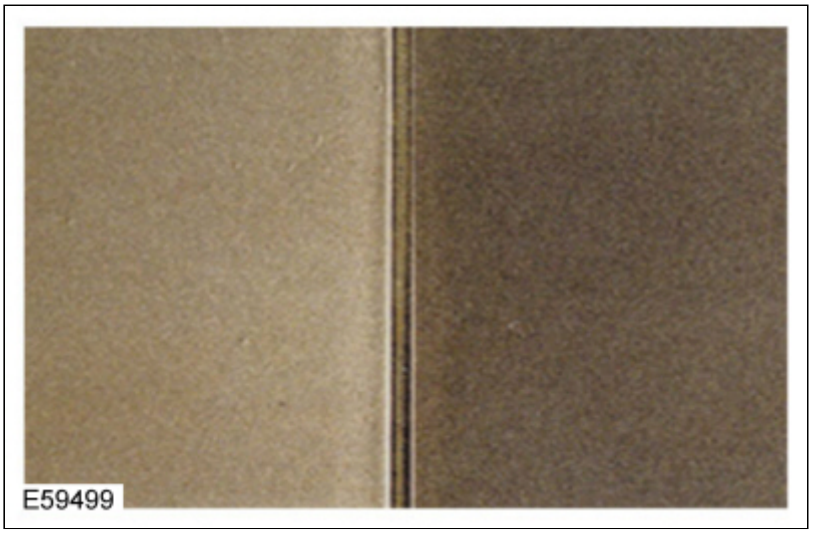
Etching

The base paint is etched by the clear lacquer. This causes the aluminum pigments to change their alignments. The color of the etched base paint seems more grey than that of normal base paint. Result is that the surface structure of

the clear lacquer becomes increasingly more matt.

Cause/damage pattern:

- Base painted too wet.
- No intermediate flash-off time.
- Layers too thick.



Repair of damage:

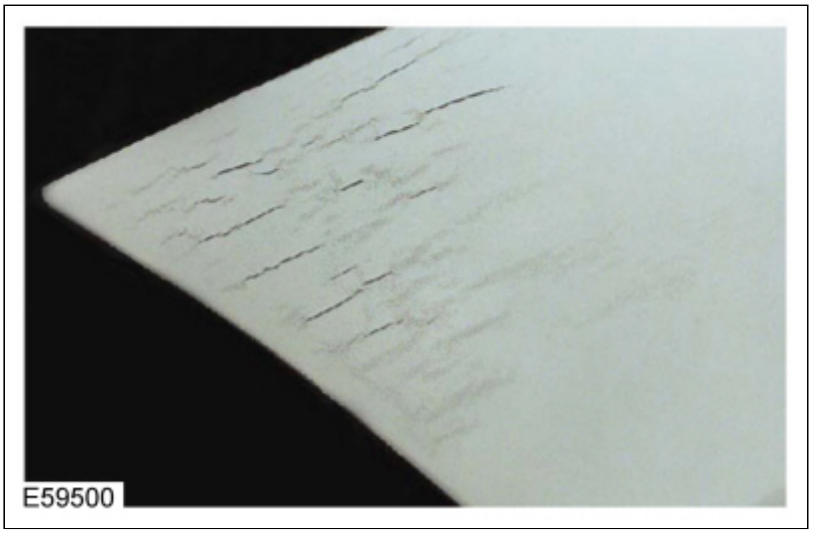
- Sand and re-paint.

Paint wrinkles/puckering

Lifting/puckering of the paint surface.

Cause/damage pattern:

- First paint not hardened through or can be etched.
- Areas of clear lacquer which were sanded through to base paint have not been not isolated with filler, or with unsuitable filler.
- Unsuitable substrate (e.g. spray can painting with TPA or nitro).
- Use of unsuitable primer, paint and thinner materials.
- Paint systems not matched to each other.
- In wet-in-wet process, specified flash-off times not adhered to.
- Synthetic resin top coat (alkyd resin) worked over too soon.



Repair of damage:

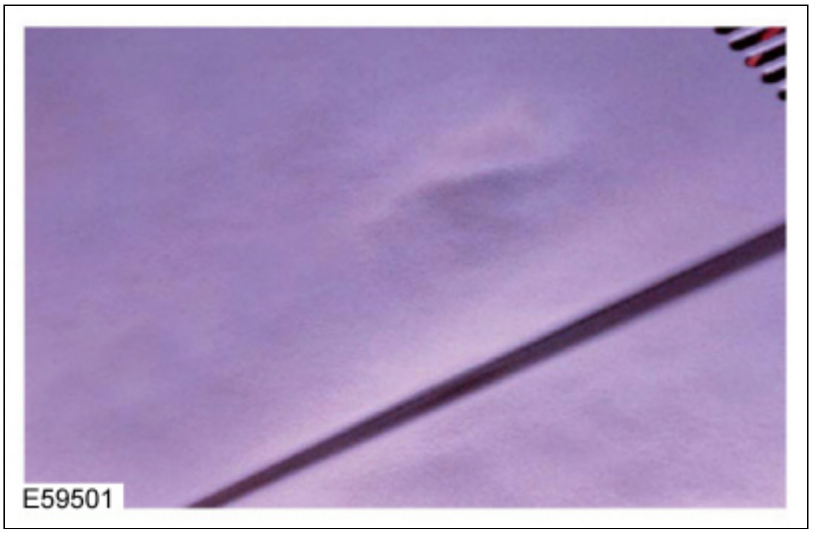
- After thorough drying, completely remove the top coat together with the attacked substrate at the affected areas and re-create a new paint finish.
- Before applying top coat, rub down the complete surface.

Cloud formation

Differing, blotchy color/effect formations in dark/light areas of a metallic paint finish.

Cause/damage pattern:

- Spray gun, spray nozzle, spray pressure not perfect.
- Varying spray viscosity, spraying method, flash-off times, spray booth temperature.
- Thinners not suitable.



Repair of damage:

- Droplet method before clear lacquer application.
- After clear lacquer has thoroughly dried, sand surface and re-paint.

Spots

Points rising up from the paint film.

Cause/damage pattern:

- Metallic base paint sprayed too dry, so that the metal particles could not incorporate into the paint. The clear lacquer could not cover these vertical standing particles because the spray air was too hot or the booth temperature was too high.



Repair of damage:

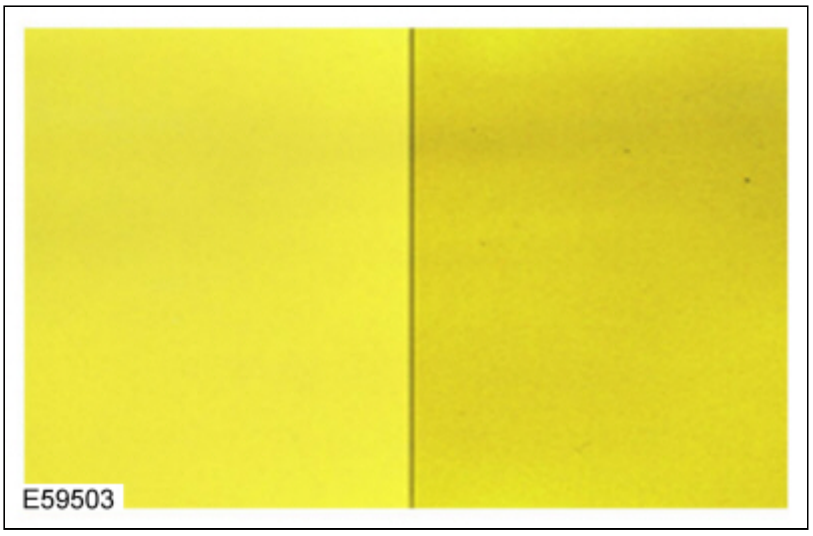
- After the paint surface has dried, lightly sand it with grade P800 sanding paper, clean with silicone remover and re-apply clear lacquer.

Metamerism/color deviations

Noticeable when identical color shades undergo a change of hue as the light source changes (daylight/artificial light). Different pigment composition between original and repair paint.

Cause/damage pattern:

- Use of paints with pigmentation which was not compatible with the standard, e.g. a green can be formulated from yellow and blue, or directly from green.
- Use of an unsuitable mixed or ready made paint to re-tone.



Repair of damage:

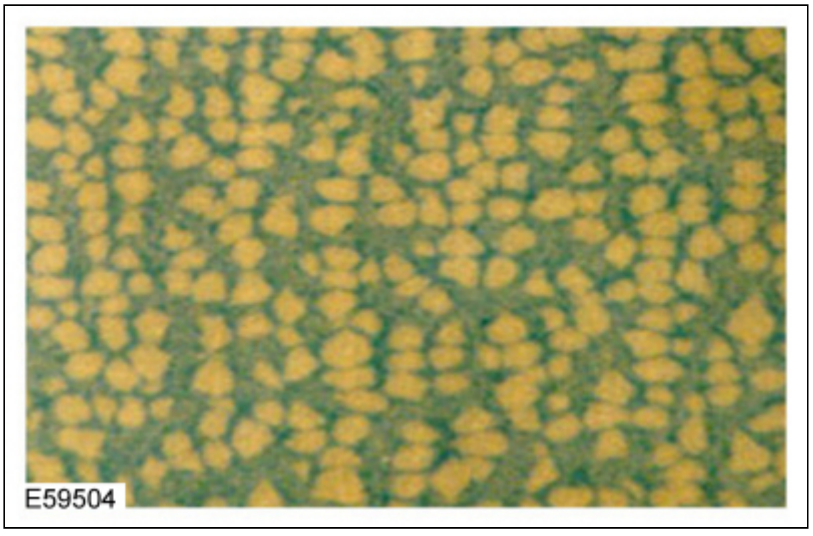
- Repaint using the correct paint.

Washing out

On paint which has been newly applied but not yet dried, the interaction of surface tension and very different specific gravities of the different pigments can lead to swirl-like turbulence which results in separation of the pigments.

Cause/damage pattern:

- Layer too thick, paint not stirred enough.



Repair of damage:

- Sand and re-paint.

Loss of gloss

Milky, dreary tarnishing of the paint with more or less even loss of gloss.

Cause/damage pattern:

- Cold with low air humidity.
- Heat with high air humidity.
- Substrate can be etched.
- Hardener fault or wrong hardener used.
- Paint thinned too much.
- Proportion of pigment too high because of poor stirring.
- Not optimum drying.



Repair of damage:

- After drying, remove the matt effect by polishing. If unsuccessful, rub down complete area and paint again.

Covering ability/areas of thin paint

Different color shades in the surface. The minimum layer thickness is not achieved here. The effects range from local minor shade variations through mottled spray zones to completely missing top coat.

Cause/damage pattern:

- No correct, uniform substrate (effect paint).
- On three-layer systems, wrong filler.
- Insufficient top coat application.



Repair of damage:

- Sand surface and recreate the paint finish.

Flow problems/orange peel

Surface structure bumpy, grained. The surface is similar to the peel of an orange.

Cause/damage pattern:

- Paint viscosity too high.
- Use of fast evaporating, highly volatile thinners.
- Booth temperature too high.
- Spray gun distance too great, too little material applied.
- Nozzle too large.
- Incorrect spray pressure.



Repair of damage:

- Small surfaces: fine sand and polish.
- Sand out the surface and recreate the paint finish.

Dirt embedded in metallic base paint.

Inclusions of contamination in metallic base paint, of different sizes and shapes (grains or lint).

Cause/damage pattern:

- Dust was not properly removed from the surface to be painted.
- Paint material not sieved.
- Function of the painting facilities not optimum.
- Filter contaminated.
- Wearing unsuitable clothing.

Repair of damage:

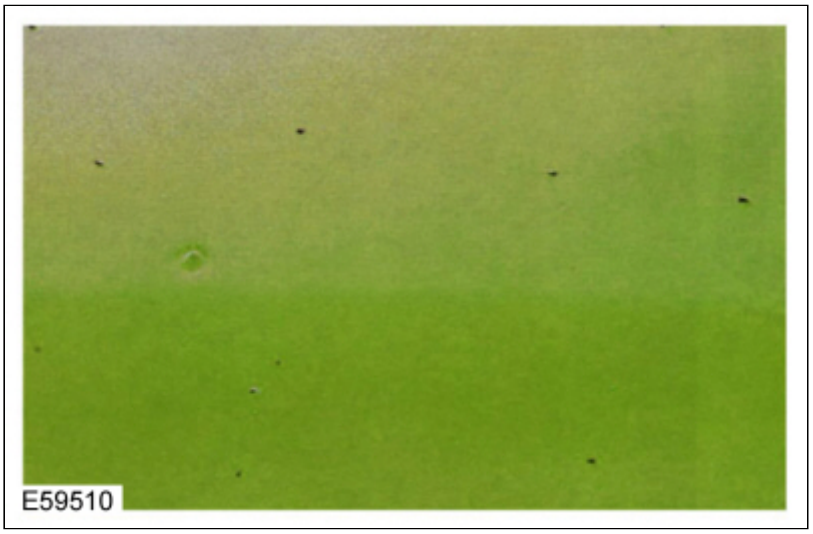
- Sand and repaint.

Dirt embedded in top coat

Inclusions of contamination in top coat or under paint layers, of different sizes and shapes (grains or lint). Optical adverse effect.

Cause/damage pattern:

- Dust was not properly removed from the surface to be painted.
- Paint material not sieved.
- Function of the painting facilities not optimum.
- Filter contaminated.
- Wearing unsuitable clothing.



Repair of damage:

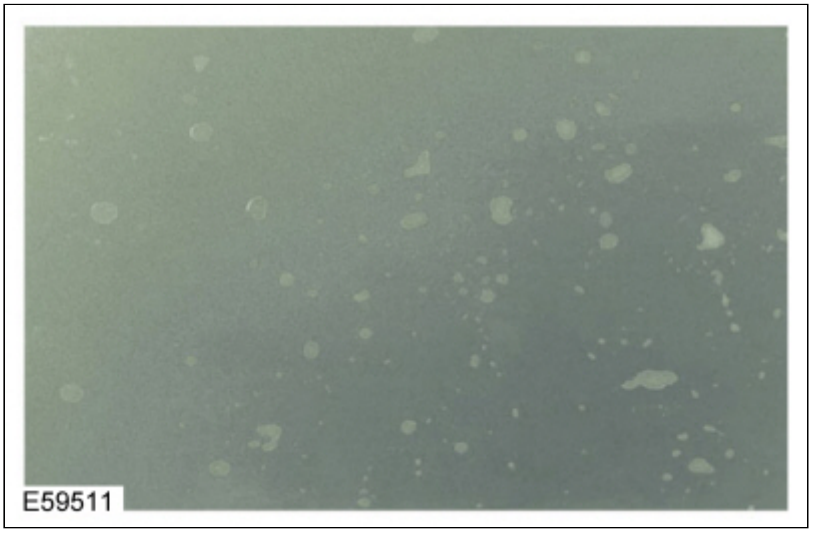
- Single inclusions: after thorough hardening, sand out using 1200 - 1500 grade paper and repolish using a suitable silicone-free sanding or painting paste.
- Large area contamination: sand and repaint.

Water marks

Ring shaped marks appearing on the paint surface.

Cause/damage pattern:

- Evaporation of water droplets on freshly painted and not yet fully hardened paint finishes (mostly only found on horizontal surfaces).
- Layer too thick.
- Drying time too short.
- Hardening faults or hardener no longer useable.
- Use of unsuitable thinners.



Repair of damage:

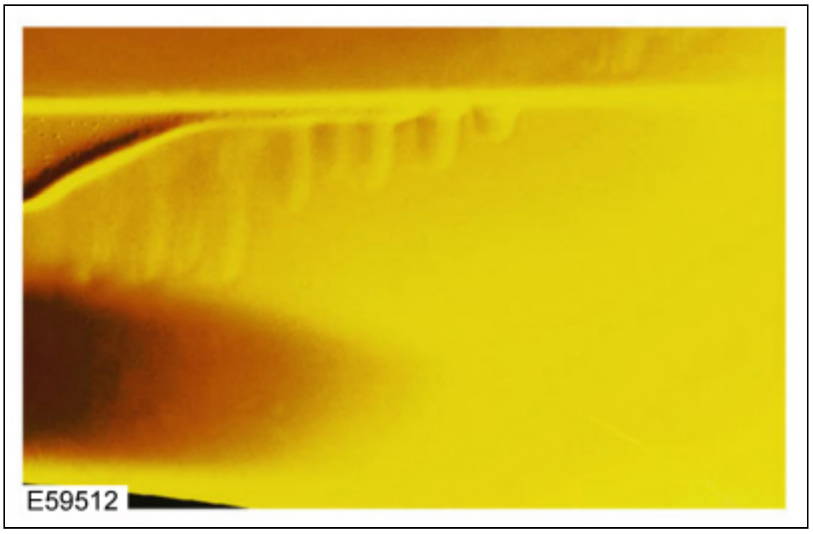
- Rub down only slight marks with sanding paper grade P1000 - P1200 and then polish.
- For heavy marking, sand the surface matt, clean with silicone remover and repaint.

Paint runs

Wave-like paint run tracks in top coat or in an intermediate layer on vertical surfaces. Mostly in the area of swage lines, seams or openings (there they are paint runs, otherwise curtains).

Cause/damage pattern:

- Uneven paint application.
- The specified viscosity was not complied with.
- Use of unsuitable thinner materials.
- Air, material or room temperature too low.
- Layers too thick.
- Spray gun (nozzle) not perfect.



Repair of damage:

- After thorough drying, sand unevenness flat, if necessary leave to dry afterwards.
- Small areas of damage can be equalised using the paint plane, then sand, polish or repaint.

Swirl marks

Three dimensional appearance in the paint surface in the form of smears or blotches. This effect is intensified in direct sunlight.

Cause/damage pattern:

- Polishing using polishing machine on paint which has not yet hardened throughout.
- Polishing intervals too long or none at all.
- Pressure too high while polishing.
- Incorrect polishing material or polishing tool.



Repair of damage:

- Allow the paint to harden completely and then polish.
- If the damage is irreversible, rub down and apply new clear lacquer.

Copyright © 2016 Ford Motor Company

Tools and Equipment for Paint Repairs

General work equipment

In the repair paint shop there is a range of painting tools which make the work of the painter easier and improve the quality of the repair paintwork.

Among these are small tools which are used for the following work:

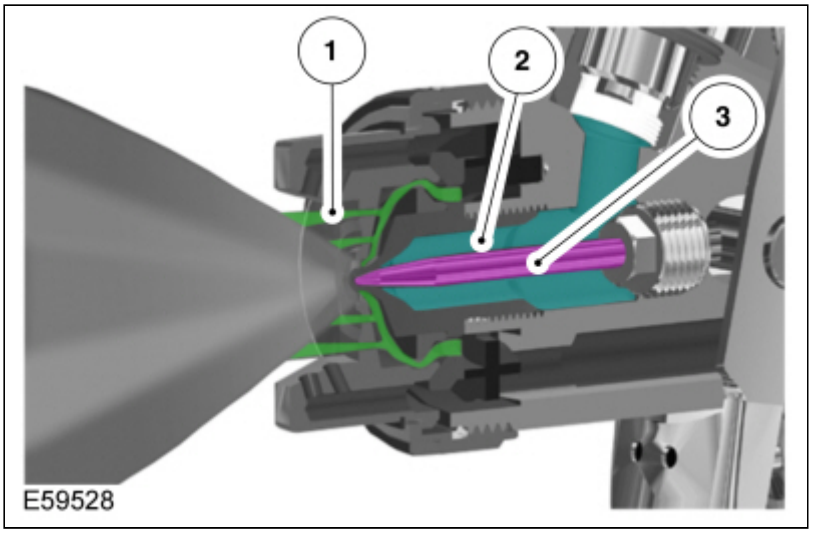
- **Measuring beakers** to measure and mix various paint materials.
- **Measuring rods** with which the required combination amounts of paint and primer filler are gauged and mixed.
- **Viscosity measuring beaker** with a calibrated opening of 4mm, used to set the correct paint viscosity.
- **Paint filter/paint sieve** for filtering foreign bodies out of mixed paint or primer. Care must be taken that the correct filter is used for each paint.
- **Color sample plates** onto which the mixed paint is applied, and the shade is then compared to that of the vehicle. Other aids which should help the painter to find the correct shade are **color sample cards** and **color panels**, which are offered by many paint manufacturers.
- **Dust bonding cloths** which are impregnated with a tacky resin and which pick up dust particles particularly well. A surface to be painted must be cleaned with a dust binding cloth immediately before paint is applied.
- **Compressed air guns** are used to remove sanding residues and to dry sanded surfaces.

Filler and spray guns

NOTE: *Regular maintenance, cleaning after use and careful handling of all individual parts of the spray gun are essential for a high-quality paint finish.*

The spray gun is the most important implement in the paint shop. Application of paint using the spray gun can produce a layer with absolutely constant thickness and a smooth paint surface.

Principle of operation

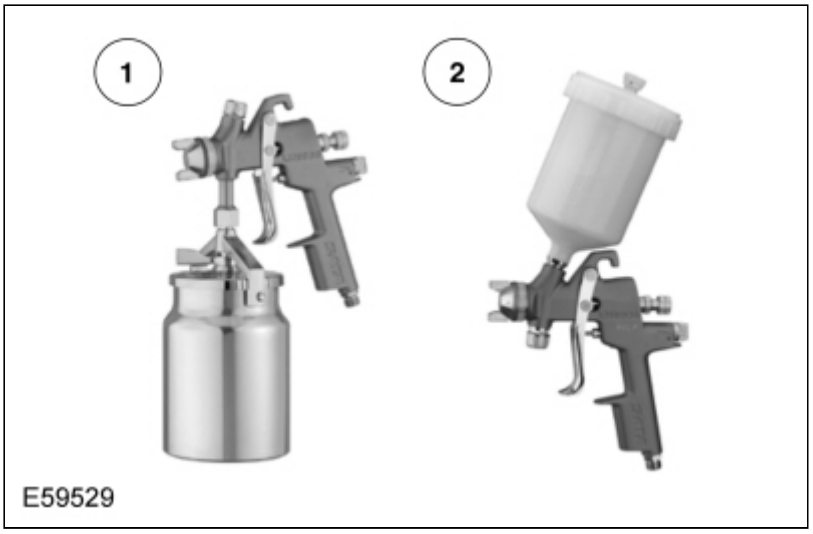


Item	Part Number	Description
1	—	Air supply
2	—	Paint supply
3	—	Nozzle needle

Because of the construction design and with the aid of compressed air, a spray-ready paint mixture is dragged out of the container to the nozzle by the venturi effect, and is applied to the surface being worked.

When the trigger of the spray gun is pressed to the first pressure point, only the compressed air passage opens. If the trigger is pressed further, the nozzle needle displaces and the air stream drags paint with it at high speed. This produces a spray mist consisting of micro-droplets of paint.

Types of spray gun



Item	Part Number	Description
1	—	Suction-beaker spray gun
2	—	Flow-beaker spray gun

In the flow-beaker spray gun, the paint container is mounted above the spray gun. On the suction-beaker spray gun, it is below.

Furthermore, spray guns are categorized by their air pressure requirement into high and low pressure guns.

High pressure guns have the disadvantage that they exhibit high consumption of energy and materials. The spray pressure they require is between 1 - 6 bar.

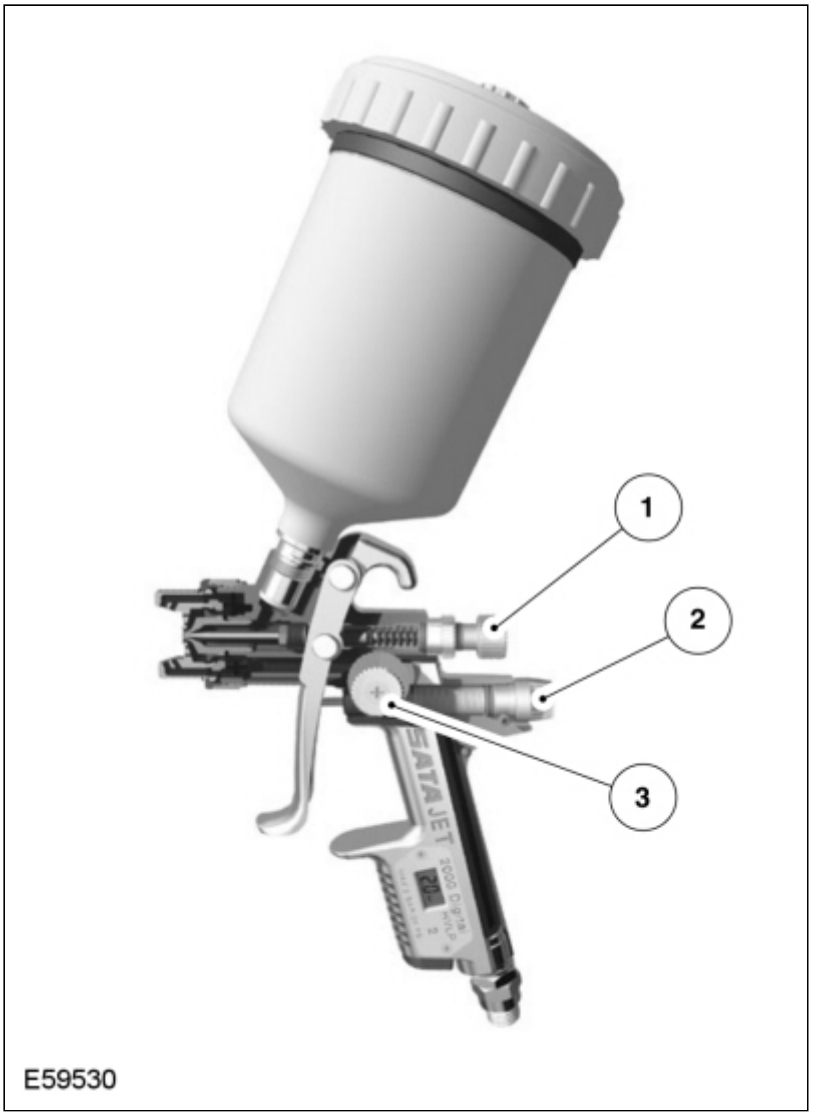
Because of the high air pressure and the large amount of air needed, the result is a powerful paint mist formation (paint transfer rate approx. 35%).

Current practice is mainly to work with reduced mist spray systems (RP and HVLP systems).

Reduced pressure (RP) guns are optimized high pressure guns which have an input pressure at the gun of approx. 2.5 bar and an atomization pressure at the air cap of 1 - 2 bar. In practice this spray technology is preferred for spraying clear lacquer because of the finer atomization.

Low pressure guns have the advantage that they exhibit minimal paint mist formation and because of this the paint transfer rate rises to approx. 65%. The spray pressure required in this case is between 1 - 5 bar. Nozzle sizes from 1 - 2.2 mm can be used.

HVLP spray guns



Item	Part Number	Description
1	—	Quantity control
2	—	Working pressure control
3	—	Spray pattern control

The high volume low pressure (HVLP) spray gun is a high performance spray gun which forms a soft, fine and homogenous spray pattern. The atomization pressure at the air cap is 0.7 bar when the input pressure at the gun is 2.0 bar.

The low atomization pressure of 0.7 bar together with greatly reduced spray mist provide high material ejection. The low nozzle internal pressure minimizes rebound of the paint droplets from the object and thus the proportion of overspray.

This spray technology has a very high application efficiency. By matching the size of the nozzle, the HVLP spray gun can be used for all repair painting materials.

HVLP spray guns are often used in practice for the application of water based paints.

Mini spray guns are often used for small, localized touching-up work. Use of HVLP spray technology and nozzle sizes of 0.3 - 1.2 mm permits very fine work, so that the area of the repair can be kept as small as possible.

In order to ensure that a spray gun operates efficiently for a long time, careful cleaning is absolutely vital after use.

NOTE: *During cleaning you must distinguish between water based and solvent based materials.*

Cleaning by hand:

- Empty the paint beaker immediately after use.
- Flush the gun with cleaner.

- Clean it inside and outside with a brush.
- Dismantle the gun to clean it thoroughly.
- Clean the air cap using a suitable brush.
- Use nozzle cleaning needles to clean bores and nozzles.

A spray gun washing machine is recommended if the painting work is highly intensive.

New types of paint processing systems are replacing the conventional mixing beaker, filter and spray gun flow beaker. This reduces the amount of solvent required for cleaning and the amount of routine waste which remains.

Paint preparation system (PPS)



Item	Part Number	Description
1	—	Beaker
2	—	Color bag

With this system, which is suitable for both suction and flow beaker spray guns, only one beaker is required for mixing and painting.

A bag is inserted in the beaker, in which paint can be mixed, processed and stored after use or completely disposed of.

The small quantity of paint remaining in the gun is removed using a minimum quantity of solvent from the pipette bottle.

The amount of cleaner used is reduced because only the spray gun needs to be cleaned.

Hand and machine sanding tools

Sanding is used to prepare a surface for application of a paint layer, enabling it to adhere well. Sanding materials have a great influence on the quality of a repair paint finish. The correct sanding medium must therefore be chosen for every material.

During sanding, material is mechanically removed from a surface.

In the paint shop, carborundum or silicon carbide abrasive on a substrate of paper or cloth are the most common sanding materials used.

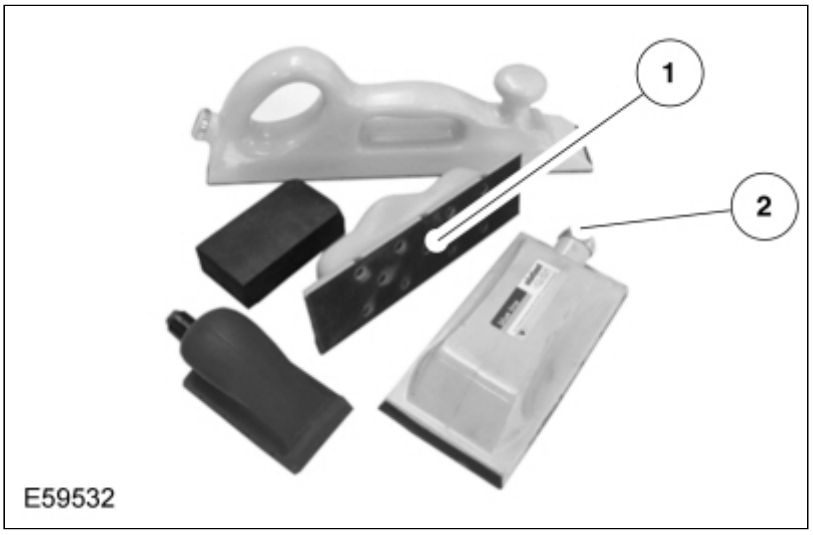
Carborundum is a very hard mineral consisting mostly of aluminum oxide. During use carborundum becomes blunt and wears away.

Silicon carbide has a very high degree of hardness, but is more brittle than carborundum. When silicon carbide is used, the mineral grains break. New long and pointed profiles are formed.

Use of the correct sanding paper depends on the application, the substrates and the tools used. The following table can be used as a guideline, but the recommendations of the supplier of the auxiliary materials and additive materials must be followed.

Application	Working area	Grade	Sanding system
Body work, corrosion damage	Equalizing paint system transition	to P150	Orbital sander, dry
			Hand sanding, dry
Stopper	Rough sand	P80 - P150	Orbital sander, dry
	Fine sand	P240 - P320	Orbital sander, dry
			Hand sanding, dry
Spray stopper	Rough sand	P120 - P180	Orbital sander, dry
	Fine sand	P240 - P320	Orbital sander, dry
			Hand sanding, dry
Filler sanding work	Filler fine sand	P400 - P500	Orbital sander, dry
		P800 - P1200	Hand sand, wet
Top coat	Old paint	P400 - P500	Orbital sand, dry
		P800 - P1200	Hand sand, wet
	Touch-up paint surfaces	P1000 - P2000	Hand sand, wet
Paint damage	Sanding out faults	P2000 - P3000	Hand sand, wet

Soft Pads are recommended for manual refinishing of contours, curves and difficult to reach areas. On a Soft Pad the abrasive is found on a coarse structured fleece. Because of this, it is very flexible, does not kink and does not slip in the hand. This enables a fine and even finish to be achieved.



Item	Part Number	Description
1	—	Extraction bores
2	—	Connection for extraction equipment

Notes on working with sanding tools:

- Tools with a rigid backing pad do not adjust to fit the surface. They are used for flat surfaces.
- Tools with a flexible backing pad are used for fine sanding of a surface because they adjust to the shape of the surface.
- Build up an even working pressure over the sanding surface.
- Keep the sanding paper tight on the tool (use self-gripping systems).
- Align the extraction holes in the sanding paper with the holes in the tool.
- Guide the tool flat over the surface to be worked. Do not tilt it.

Hand sanding can be carried out dry but also wet. Wet and dry paper with particle size P 80 to P 1200 is used for this in the paint field.

Ways of sanding

Sanding tools are driven either by electricity or compressed air.



Item	Part Number	Description
1	—	Sanding machine
2	—	Polishing machine
3	—	Orbital sander

The disadvantage of electrically driven machines is that their own weight is high compared with pneumatic systems. They also become warm during work. They do not however need any special operating equipment for their energy supply.

Sanding machines are categorized by their type of sanding movement.

Rotational sanders

On these machines the sanding paper turns.

- Advantage:
  - Ideal for heavy sanding work.
  - Fast and aggressive sanding possible.
- Disadvantage:
  - Large amount of heat developed.
  - Difficulty sanding flat surfaces.
- Application:
  - Removal of old paint layers.
  - Preparation of panel for stopper.

- Removal of rust.

Oscillating sander

On these machines the sanding paper oscillates. The backing pad is rectangular.

- Advantage:
  - Large sanding surface.
  - Ideal for large and flat surfaces.
- Disadvantage:
  - Hardly useable on rounded surfaces.
  - Flexible backing pad not possible.
  - Vibrations because of the poor support of the backing pad.
- Application:
  - Sanding of polyester stopper.
  - Sanding processes on flat surfaces.

Orbital sander

On these machines the sanding paper turns and oscillates.

- Advantage:
  - Easy to handle and good sanding power.
  - Minimal heat development.
- Disadvantage:
  - Not suitable for sanding stopper on flat surfaces.
  - Smooth guidance important, otherwise sanding marks will occur.
- Application:
  - Sanding of paint layers.
  - Well suited for final preparation of a primer.

NOTE: *Comply with the manufacturer's recommendations when setting the orbital sander.*

On the orbital sander, stroke settings of approx. 3 mm for fine sanding work and approx. 5 - 7 mm for coarse sanding work have been established.

Polishing and finishing tools

The term polishing in the context of paint repairs means the elimination of paint flaws and high shine polishing of neighboring parts.

During polishing the fine sanded surface is returned to a high shine using a special abrasive polish.

Before the actual polishing, all flaws in the paint surface must be removed and the following working procedures must be adhered to:

- Thoroughly clean the vehicle.
- Remove spray mist from all surfaces.
- Sand out and polish particle inclusions.
- Sand down paint runs and polish them out.
- Examine the exactness of the color match in daylight.
- Remove masking edges.
- Remove sanding water, sanding dust and polish residues.

After the polishing process the results must be tested using a special test spray.

Infrared drying technology

The drying process in a painting/drying cabin occurs through heat conductance (convection). When an infrared dryer is used, the drying process is through heat radiation.



The infrared rays penetrate the air and the paint layer without warming them. Because the infrared rays are reflected from the steel panel, the paint coat is warmed from the inside outwards.

Advantages of infrared drying:

- The drying process occurs from the inside to the outside.
- The drying time is shorter than for warm air systems.
- Because the infrared dryer consists of several cassettes which can be switched on independently, the drying area can be optimally controlled.

Independent of the manufacturer's instructions, pay attention to the following:

- Flash-off time of the paint before switching on the infrared dryer.
- Distance between the infrared dryer and the surface.
- Duration of the irradiation.

The most common use of the infrared dryer is to dry stopper and primers. The wait time between the job steps is shortened without having to use the painting/drying cabin.

The painting/drying cabin can then be used exclusively for application and drying of topcoat.

There are two types of infrared dryer:

- Infrared dryer with short wavelength radiation.
- Infrared dryer with medium wavelength radiation.

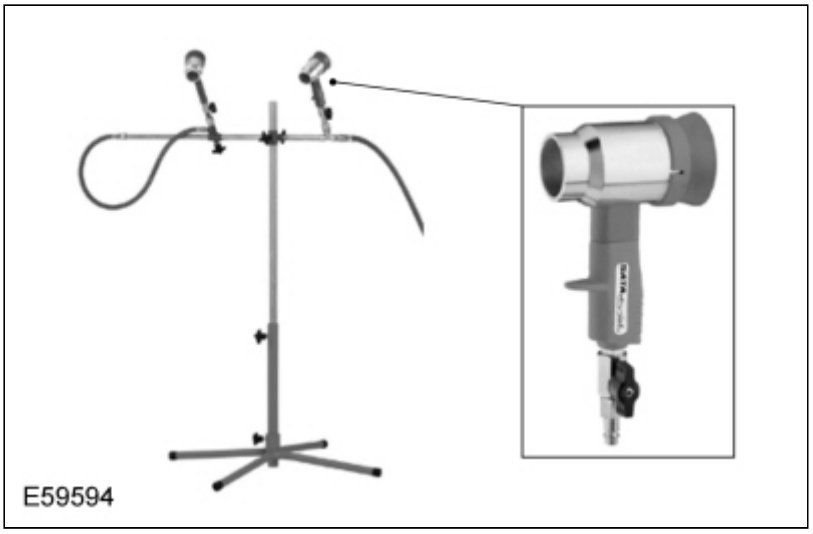
As an indication, the following drying times are listed for some materials (at 80 cm distance):

NOTE: *Observe the material manufacturer's and supplier's specifications.*

- Polyester stopper 2 minutes.
- Spray stopper 2 to 7 minutes.
- Water based primer-filler 7 to 9 minutes.
- Primer 3 to 8 minutes.
- Top coat 7 to 10 minutes.

Air dryers

The air dryer is suitable in places where drying needs to be done, but without great outlay (painting/drying cabin or infrared dryer).



NOTE: *Air from the compressor is often too cold for effective drying.*

Air dryers use the venturi effect to blow the warm ambient air over the paint surface in a gentle air flow.

Paint mixing system

Because of the many different color variants, it is now seldom possible to store all color shades as ready-made mixtures.

For this reason, vehicle manufacturers make the mixture proportions of their paints available as color codes. The required color shade can be obtained from the paint mixing system using this color code.

All the color components are combined according to their proportions by weight using a precise computer scales to produce a finished color shade.

Painting cabin

The air requirement in a painting cabin is large. The outside air which is drawn in must be passed through filtering and warming equipment. This particularly applies during colder times of the year and especially for combined types of building where the painting cabin is also used as a drying cabin.

It is primarily used to keep the air free of dust. At the same time, explosive solvent-air mixture concentrations are prevented

NOTE: *Vacuum will lead to contamination of the newly applied paint. The outside air flows through door gaps, wall joints and other openings and as it does so, brings dust deposits with it.*

The air supply quantity depends on the size of the painting space and the quantity of extracted air. Enough air must be supplied to cause positive pressure in the painting space. An air extraction : air supply ratio of about 1 : 1.05 is sufficient.

The filters should have a dust-removal grade of not less than 99.8% and must always be kept clean.

It is especially important that the air supply does not cause strong air currents in the painting cabin. If not, the following problems could occur:

- Paint contamination cause by paint mist, which persists in air eddies and gradually falls on the fresh paintwork.
- Flow problems in the paint because of the high speed of the air, causing the paint to thicken very quickly on the surface.
- Loss of gloss and wrinkle formation because the surface dries too fast.
- Painter disturbance while working.

In modern paint cabins the air supply is provided from the complete surface of the ceiling. The air speed should be 0.3 m/sec (measured in the unrestricted cross-section of the spray cabin). At the same time, the air in the cabin should change about 350 times per hour.

Air extraction is best achieved through extraction channels in the floor of the painting cabin.

NOTE: *Refer to the manufacturer's specifications for the operating instructions, safety instructions and notes on the maintenance of a paint cabin.*

Smooth walls in the paint cabin should prevent dust deposits. Regular cleaning is necessary however.

Special easily washed adhesive-bonding paint can be applied to the walls to protect the cabin from paint mist.

Copyright © 2016 Ford Motor Company

Refinishing Materials

The manufacturer's instructions must always be followed when dealing with all materials! The information given in the following text is data which is independent of the manufacturer, and it should only be used as an indication.

Stopper materials

- 1-component nitro-combination stopper
- 2-component polyester stopper
- 2-component plastic stopper

Use suitable primer to protect from corrosion areas which have been sanded bare before applying stopper.

1-component nitro-combination stopper

Nitro-combination stopper has mostly been superseded by 2-component polyester stopper.

Fast drying fine stopper for the smoothing of irregularities.

The working properties of 1-component nitro-combination stopper can be improved by the addition of nitro thinners.

Drying time increases with thickness of the layer.

Application	1-component nitro-combination stopper
Layer thickness	Max. 80 µm
Drying time	up to 2 hours at 20°C
Sand	P240 - P400

2-component polyester general stopper

NOTICE: Do not exceed the quantity of hardener specified by the manufacturer, excess peroxide can cause staining of the paint top coat.

NOTICE: Mix the stopper base and the hardener well to avoid a marble-like effect.

Check that the manufacturer permits use on the substrate to which it will be applied.

2-component polyester stopper is available in coarse and fine grades. The coarse stopper can be used for very uneven areas and surfaces and fine stopper or spray stopper should be applied afterwards.

Application	2-component polyester coarse stopper
Use	Rough equalization of unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 4 - 6 minutes
Drying	20°C approx. 12 minutes
	Short wavelength infrared approx. 4 minutes
	Medium wavelength infrared approx. 5 - 10 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150

Application	2-component polyester fine stopper
Use	Equalization of unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 4 - 6 minutes
Drying	20°C approx. 12 minutes
	Short wavelength infrared approx. 4 minutes
	Medium wavelength infrared approx. 5 - 10 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P240

Application	2-component polyester glass fiber stopper
Use	Equalization of unevenness; blending in of vehicle extensions; repair of GRP components
Hardener quantity	approx. 3 - 5%
Working time	approx. 4 - 6 minutes
Drying	20°C approx. 12 minutes
	Short wavelength infrared approx. 4 minutes
	Medium wavelength infrared approx. 5 - 10 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150

2-component polyester fine stopper should always be applied after 2-component polyester glass fiber stopper.

Application	2-component polyester spray stopper
Use	Equalization of unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 25 - 30 minutes
Layer thickness	200 µm or 4 - 8 spray passes
Drying	20°C approx. 3 hours
	Short wavelength infrared approx. 10 minutes
	Medium wavelength infrared approx. 15 - 20 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150; fine sand - P280

Application	2-component plastic stopper for flexible thermoplastic
Use	Equalization of scratches or unevenness
Hardener quantity	approx. 3 - 5%

Working time	approx. 25 - 30 minutes
Drying	20°C approx. 15 - 30 minutes
	60°C approx. 15 min
	(Short wavelength infrared approx. 8 minutes)*
	(Medium wavelength infrared approx. 8-10 minutes)*
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150; fine sand - P280

***Infrared drying may adversely affect adhesion, therefore check the manufacturer's instructions.**

Plastic stopper has a very great tendency to shrink back, so that the edge of the stopper repair becomes visible.

Plastic stoppers are flexible and universally applicable on all types of plastic (except for pure PE and PP, these are plastics which cannot be painted). The manufacturer's instructions must be very exactly followed in order that no adhesion problems occur. A special plastic etch primer is specified for some materials.

Primers

Application	1-component primer
Use	Isolation of bare sanded areas.
Spray gun	HVLP 1.3 mm
Spray pressure	2.0 bar
Drying	20°C approx. 15 - 20 minutes
	60°C approx. 10 min
Coat application	Wet on wet, no intermediate sanding

Application	2-component primer
Use	Corrosion protection and bonding agent (steel sheet, zinc coated steel sheet, aluminum)
Spray gun	HVLP 1.3 mm
Spray pressure	2.0 bar
Drying	20°C approx. 15 - 20 minutes
	60°C approx. 10 min
Coat application	Wet on wet, no intermediate sanding

HS primer filler and HS tinted filler

Note:

- Primer filler is available as 1-component and 2-component water based and solvent based forms.
- 1-component products are only suitable for isolation of sanded through bare areas and new painting.
- Water based products are also used for the skinning of thermoplastics and substrates which are sensitive to solvents.
- Tinted fillers can be individually matched to the top coat color and therefore find uses in effect paints and paints with poor covering power.
- Use dry sand or wet sand filler according to application in order to avoid unnecessary sanding work.
- On critical substrates the use of epoxy resin base filler is recommended in order to avoid adhesion problems.

Application	HS primer filler and HS tinted filler
Use	Equalization of unevenness, edge zones, sanding scores
Spray gun	HVLP 1.6 - 1.9 mm
Spray pressure	2.0 bar
Layer thickness	50 - 70 µm to 150 µm possible
Drying	20°C approx. 2.5 hours
	(60°C approx. 25 min)*
	(Short wavelength infrared approx. 8 minutes)*
	(Medium wavelength infrared approx. 10-15 minutes)*
Coat application	Wet on wet, no intermediate sanding

***In order to avoid boiling out, drying should be performed slowly.**

Paint

The base and the clear lacquer must be matched to one another.

Application	Water based paint
Use	Two layer metallic effect paint and Uni-paint finishes
Spray viscosity	At 20°C 18 - 20 s
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar
Layer thickness	15 - 20 µm
Drying	20°C approx. 2.5 hours
	60°C approx. 25 min
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes
Coat application	Wet on wet
Ventilation time	approx. 5 minutes

The base paint must be dried matt before the clear lacquer is applied.

Application	2-component HS clear lacquer
Use	Gloss providing protective coat for base coat substrate
Spray viscosity	At 20°C 18 - 20 s
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar
Layer thickness	50 - 70 µm
Drying	20°C approx. 10 hours
	60°C approx. 30 min
	Short wavelength infrared approx. 8 minutes

	Medium wavelength infrared approx. 10 - 15 minutes

Application	2K HS Uni top coat
Use	Color and gloss providing paint layer
Spray viscosity	At 20°C 20 - 22 s
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar - 3.0 bar
Layer thickness	50 - 70 µm
Drying	20°C approx. 8 hours
	60°C approx. 30 min
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 -15 minutes

Copyright © 2016 Ford Motor Company

Additional Materials

The manufacturer's instructions must always be followed when dealing with any materials! The information given in the following text is data which is independent of the manufacturer, and it should only used as an indication.

Adhesive sealants

Adhesive sealants are permanently elastic, long-lived, can be painted and accept filler.

Application: Sealing of visible and normal seams.

Can be over-painted with 2-component paint, primer and fillers after having dried throughout.

Contamination can be removed using cleaner and thinner.

1-component PUR adhesive sealant

Note:

- Hardens using oxygen from the air. For that reason, it must only be stripped after it has completely dried through.

2-component MS polymer adhesive sealant

2-component MS polymer adhesive sealant is free of isocyanate, solvent and silicones and can be spot-welded.

MS polymer adhesive sealant

Can be over painted with water-based paints.

Suitable for spraying and brushing to obtain a composition true to the original.

MS polymer adhesive sealant is free of isocyanate, solvent and silicones and can be spot-welded.

Underbody protection

Underbody protection products are immune to abrasion, permanently elastic, adhere well and are suitable for a true to original texture.

Underbody protection based on solvent

Application:

- Underbody protection for visible areas.

Properties:

- Can be over-painted, also with 2-component paint.
- Can be colored with a proportion of up to 40% paint.

Note:

- Contamination can be removed using cleaner and thinner.

Water based underbody protection

Can be over-painted with water based paint.

Can be colored with water based paint.

Contamination can be removed using water.

Application	Water based underbody protection

Use	**Underbody protection** for visible areas
Spray viscosity	ready to use
Spray gun	Suction beaker HVLP gun 3 - 4 mm
Spray pressure	4 - 6 bar
Layer thickness	500 - 1000 µm
Drying	approx. 6 hours at 20°C
	approx. 45 - 60 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	Water based underbody protection
Use	**Isolation primer** for peroxide marks, bloomed old paintwork and thermoplastics.
Spray viscosity	Thin as necessary with distilled water
Spray gun	HVLP gun 1.9 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	40 - 50 µm
Drying	approx. 2 hours at 20°C
	approx. 30 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Paint additives

Application	Sanding test color
Use	To test sanding results
Spray gun	HVLP 1.7 - 1.9 mm
Spray pressure	2.0 bar
Layer thickness	Spray drifted

Application	Fixer additive
Use	Converts solid top coat into two layer solid; multicolor painting
Spray viscosity	18 - 20 secs at 20°C
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	max. 30 µm
Coat application	Wet on wet
Ventilation time	approx. 15 - 30 minutes

Maintain maximum layer thickness without fail.

Must always next be overpainted with clear lacquer.

Application	Drying accelerator
Use	Accelerates drying with only minimal reduction in working life
Working life	approx. 5 hours at 20°C
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 6 hours at 20°C
	approx. 25 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Cannot be used in all paints, read the manufacturer's instructions.

Particularly suitable for partial painting.

Application	Elastifier additive in primer material
Use	Elastifies the complete paint structure on plastics.
Addition	Up to 25%
Spray gun	HVLP 1.7 - 1.9 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 µm
Drying	approx. 4 hours at 20°C
	approx. 40 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	Elastifier additive in top coat
Use	Elastifies the complete paint structure on plastics.
Addition	Up to 25%
Spray gun	HVLP 1.7 - 1.9 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 60 µm
Drying	approx. 16 hours at 20°C
	approx. 45 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	Matting additive in solid paint
Use	Elastifies the complete paint structure on plastics.
Semi-gloss addition	Up to 25% in the paint without hardener and thinner
Silk gloss addition	Up to 35% in the paint without hardener and thinner
Silk matt addition	Up to 45% in the paint without hardener and thinner
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 8 hours at 20°C
	approx. 30 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

NOTICE: Do not dry using infrared.

Application	Matting additive in clear lacquer
Use	Elastifies the complete paint structure on plastics.
Semi-gloss addition	Up to 25% in the paint without hardener and thinner
Silk gloss addition	Up to 35% in the paint without hardener and thinner
Silk matt addition	Up to 45% in the paint without hardener and thinner
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 8 hours at 20°C
	approx. 30 minutes at 60°C

Note:

- When mixing, first put in the matting additive, then the hardener and thinners.
- Stir immediately after adding the matting additive.
- Do not store after addition of the matting additive, storage will change the degree of gloss.
- Also suitable for use on plastics without addition of elastifier additive.

Application	Matting paste
Use	Matts, elasticizes and gives structure to solid paint and clear lacquer during painting of bumpers or hard plastic.
Addition	1:1 or 2:1 depending on manufacturer in solid paint without hardener or thinners.
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar

Layer thickness	50 - 70 µm
Drying	approx. 6 - 10 hours at 20°C
	approx. 30 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Note:

- **The paint must not be filtered.**

Application	Anti-silicone additive
Use	Prevents silicone craters
Addition	2% to maximum 5%

Note:

- Only add away from the paint cabin and immediately remove contaminated cloths.
- If anti-silicone additive is used in the first coat, then it must be used in the following coats, and in at least the same proportions.

Additive materials

Variety of adhesive tapes

For profile, fine and large area masking work.

Properties:

- Withstands heat.
- Withstands water-based paint.
- Accepts paint.
- Easily removed without leaving adhesive residues.

Masking film.

For masking of large areas on vehicles.

Properties:

- Accepts 2-component and water-based paints.
- Withstands heat.
- Withstands water spray and condensation.
- Withstands solvent.
- Easily cut.
- Environmentally friendly and can be recycled.

Polishing materials.

Polishing means microfine sanding. For this reason, polishes must only contain abrasives, and no silicones.

During polishing repair, a good shine is achieved through the step-by-step use of polishes, starting with a highly abrasive polish and ending with a polish having very slight abrasive action.

Polishes are available in graduations from coarse to fine.

Abrasives

Please refer to the "Tools" chapter for information on abrasives.

Copyright © 2016 Ford Motor Company

Paint Repairs

General information

There is a great difference between painting in production and repair painting.

In production, only the bodyshell is painted, it has no trim, upholstery or assemblies. Because of this, other paints, tools and processing techniques can be used.

In contrast to that used in production, paint used in the workshop must dry at low temperatures. Plastics and the vehicle electronics must not be subjected to temperatures greater than 70°C.

The painting process in the case of repair work consists of two phases:

- Pre-treatment of the surface for corrosion protection and the smoothing of irregularities.
- Top coat application.

The precondition for a professional paint finish on a vehicle is the permanently maintained cleanliness of work spaces, tools and equipment,

Original materials must be worked according to the manufacturer's instructions, so that no problems arise in the processing nor during drying.

The room temperature must be 20 - 25°C and the humidity must be low. Temperatures which are too low or too high can lead to porosity, poor flow and boiling. High humidity leads to paint damage such as tarnishing of the paint film (matt film), adhesion problems and craters.

Pre-treatment of the surface

Perfect preparation of the subsurface is the precondition for a brilliant paintwork result. Faults in the preliminary stages delay completion and cause unnecessary extra work. The working steps described here demonstrate how important it is to follow these instructions step by step.

NOTE: *Thorough cleaning of the vehicle and especially of the area being repaired is particularly important because of the danger of contamination of the paint.*

Clean the area of the damage



Clean the damaged surface thoroughly, to allow the extent of the damage to be seen. Use silicone remover to produce a grease-free surface.

NOTE: *The treated surface must be rubbed with a clean dry cloth before the solvent evaporates, otherwise there will be no cleaning effect.*

Effective de-greasing is important not only before the application of paint, but also before all sanding stages, for two reasons:

- During sanding of grease contaminated surfaces, globules may form with the sanding dust. Sanding marks will occur and the sanding medium quickly becomes unuseable.
- Oil and grease are embedded by the action of the abrasive particles, and are then very difficult to remove.

Establish the area of damage and the repair stages. In doing so, establish how much disassembly work must be undertaken. Perform a color test at this stage.

Mask off the area of the repair ready for preparatory work.

Sand out the damage location



When sanding, produce smooth transitions from the painted area to the bare metal.

Use an eccentric sander and P80 or P120 abrasive sheets. Finish off sanding with P150 or P180. The remaining adhering sanding dust must be completely removed.

Cleaning, de-greasing



Use silicone remover to thoroughly clean the surface in order to remove grease residues, sweat from the hands and other contamination.

NOTE: *Use a solvent test to establish whether the old paint can be etched. Apply 2-component thinners to the damaged area using a clean cloth and rub lightly for about 1 minute. If the subsurfaces can be etched away, special pre-treatment is necessary. See "Tips and Tricks"*

Apply primer filler



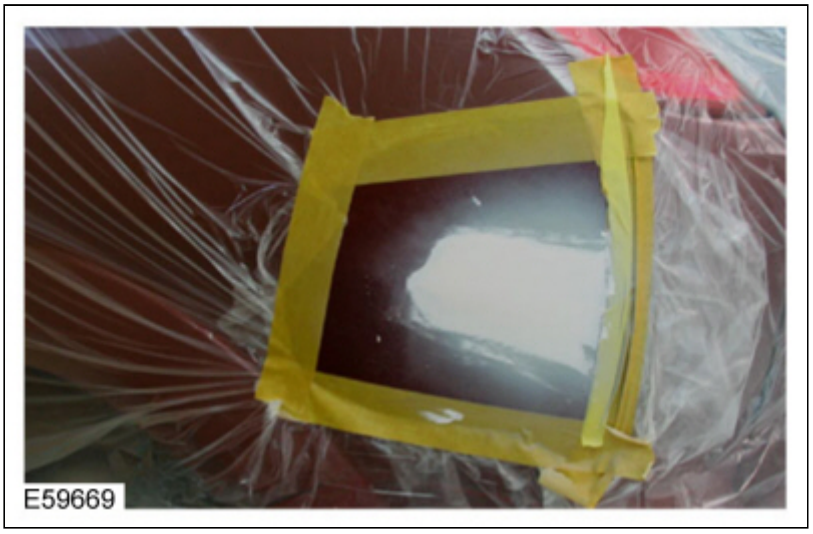
Before applying stopper, apply primer to the sanded and bare surface.

Allow the primer to dry and then lightly sand by hand using P220 - P400 dry.

NOTE: *Most stopper can be applied directly to bare metal. But application of a primer filler provides better corrosion protection.*

NOTE: *Avoid sanding through to the bare metal. Points which are sanded through must be retreated with primer filler.*

Stopper application

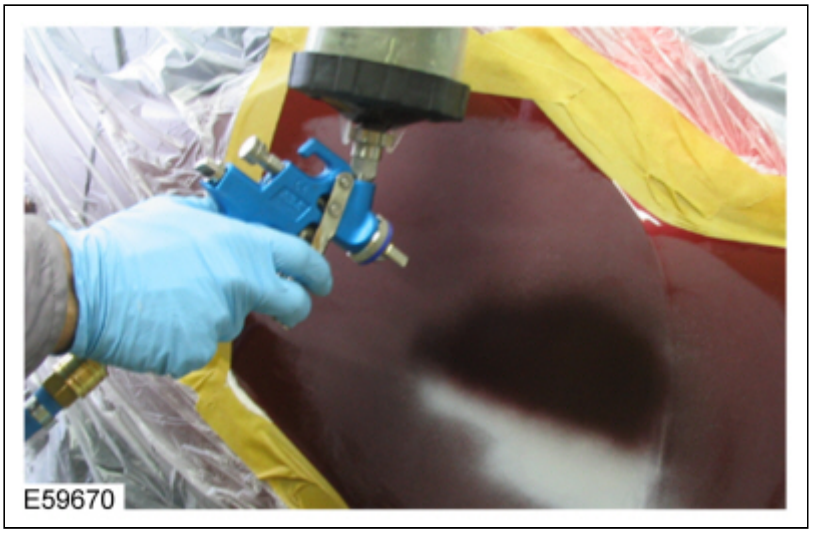


Pre-sand the hardened stopper using an eccentric sander and P80 dry, then final-sand using P120 - P140 dry. Clean the sanded surface using silicone remover.

Apply 2-component stopper to the filled surface. The stopper compound must only be applied thinly.

NOTE: *Use of a testing powder is recommended so that the sanding process can be more easily checked.*

Apply filler



Filler can now be applied to the dried repair area. Choose the correctly toned filler according to the manufacturer's instructions.

NOTE: *Alternatively, filler with the correct tone can be mixed with the aid of colour matching cards.*

Sand the filler.



The working area is expanded by applying new masking. This makes it possible to even out the transition from the damage area to the vehicle paintwork.

NOTE: *The primer filler must be carefully sanded. Faults in the primer filler layer will be visible in the top coat.*

The sanding process consists of two stages. Coarse sanding levels out the surface of the filler primer. Fine sanding ensures the necessary surface structure which allows the top coat to adhere well and cover sanding marks.

Sand the filler using the eccentric sander and P400 - P500 used dry. Clean the sanded filler finished surface using silicone remover.

The painted area is matted using a fine matting sponge, and then thoroughly cleaned.

Surface ready for paint



The surface which has been repaired and then prepared according to the manufacturer's instructions is now ready for basic paint application.

Top coat application

It is important for a good paint result that the recommended process data is adhered to, i.e. mixture proportions, layer thickness, viscosity, drying time etc.

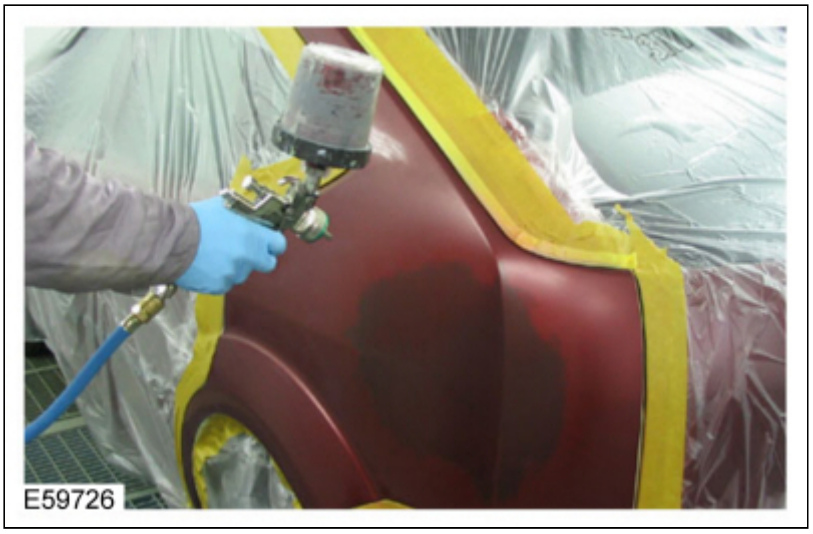
First of all the work area is carefully masked ready for paint application. The correct adhesive materials and techniques must be used so that no hard transitions and edges are created during painting.

NOTE: *The chapter "Tips and Tricks" gives in-depth information on masking work.*

Thoroughly check the surface once more and rub-off with a dust-bonding cloth.

NOTE: *Once more check the paint material and that the spray gun is correctly adjusted before applying the paint.*

Paint application



The base paint is applied in two or three steps. First of all only the repair area is painted with the first paint application.

Flash off



Allow the paint application to flash off until the surface has a matt appearance. So that the transition to the original paint is optimally created, the next paint application is applied to a wider area.

After the base paint has dried for the specified time, the clear lacquer is applied. Next the transitions to the original paintwork are treated with fade-out remover. This removes the spray mist and forms an ideal paint surface.

Repair stages for repair painting

The required time and material data is divided into four painting levels for calculations concerning repair painting. Proceed according to these divisions for every calculation.

Level 1 - Painting of new components

On new components, all inner surfaces, seams and edges which will no longer be seen after assembly must be primed and pre-painted.

NOTE: *The cathodic dip primer must not be sanded away. Cleaning with silicone remover or light sanding of the primer is all that is required.*

Job steps:

- Wash off, prime and pre-paint inner surfaces, seams and edges which cannot be reached at all or only partly after the component is installed.
- Sand new component with P280 - P320 or a fine sanding pad.
- Clean subsurface with silicone remover.
- Carry out masking work (when painting an installed component).
- Apply one spray run of filler, dry.
- Sand the filler. P1200 wet or P500 dry.
- Clean filler application with silicone remover.

Then the prepared surface can be painted with solid or 2-component paint.

If the new part has mild transport damage, this must be rectified beforehand.

To do so, add the following steps:

- Grind out the scratch.
- Finely sand the surrounding surfaces.
- Use a steel cleaning agent to thoroughly clean and then rub dry.
- Apply corrosion protection primer to the bare areas.

Level II - Top surface painting (color tone matching)

Complete bodywork surfaces which are to be painted without the need to apply stopper belong to this group. In addition, surfaces with faults in the top coat surface which cannot be removed by polishing.

The following faults are included:

- Loss of gloss.
- Sanding scores.
- Heavy paint runs.
- Large dust and dirt inclusions.

The scope of the work is as follows:

- Sand the surface.
- Sand out paint damage and faults.
- Treatment of small areas which have been sanded through.
- Masking work (when painting an installed component).
- Apply top coat according to the painting process (one or several coat process).
- Dry the top coat and perform finishing work.

Level III - Repair painting with stopper applied to up to 50% of the surface.

If in addition to painting, work with stopper application must be performed, then the repair levels III or IV must be used.

In repair level III, apart from painting the complete bodywork surface, partial stopper work is carried out on up to 50% of the surface to be painted. The necessary primer and filler work are also included.

The following damage must be rectified in this level:

- Slight panel unevenness.
- Damage due to corrosion.
- Dented body surfaces.
- Weld locations.
- Deep scores or scratches.

The scope of the work is as follows:

- Fine sand pre-treated bodywork surfaces (e.g. lead-loaded areas).
- Sand out existing damage.
- Perform all necessary masking operations on the vehicle.
- Apply primer.
- Partial stopper application on up to 50% of the surface to be painted (two to a maximum of three stopper applications).
- Fill the repair area.
- Apply stone chip protection (when present in production).
- Apply top coat according to the painting process (one or several coat process).
- Dry the top coat and perform finishing work.

Level IV - Repair painting with stopper applied to more than 50% of the surface.

In repair level IV, apart from painting the complete bodywork surface, partial stopper work is carried out on more than 50% of the surface to be painted. The necessary primer and filler work are also included.

The following damage must be rectified in this level:

- Damage due to hail.
- More extensive stone chip damage.
- Extensively dented body panels.
- Sectional repairs with large weld seams.
- Surfaces with severe corrosion damage.

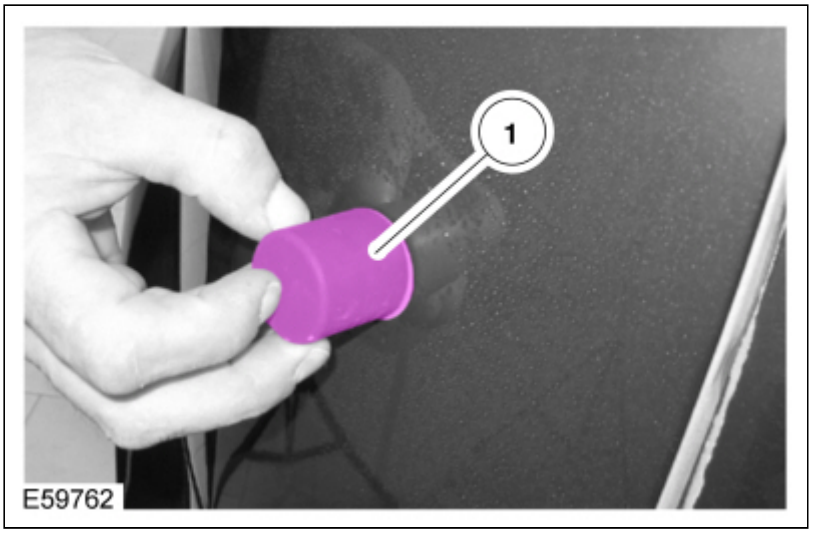
The scope of the work is different to level III because of the partial application of stopper to more than 50% of the area to be painted. In addition, more extensive sanding work is usually required.

Polish

In order to achieve faultless quality, it is sometimes necessary afterwards to polish a newly painted surface.

Even after the most careful painting, it sometimes happens that dirt inclusions and paint runs occur in work with top coat or clear lacquer. Before polishing, such paint faults must be removed with the sanding cylinder ("Finiball") and hand sanding or eccentric sander in a wet sanding process.

Sanding cylinder



The special sanding compound **-1-** (sanding bloom) for the sanding cylinder is self-adhering and available in grades from P1000 to P2500.

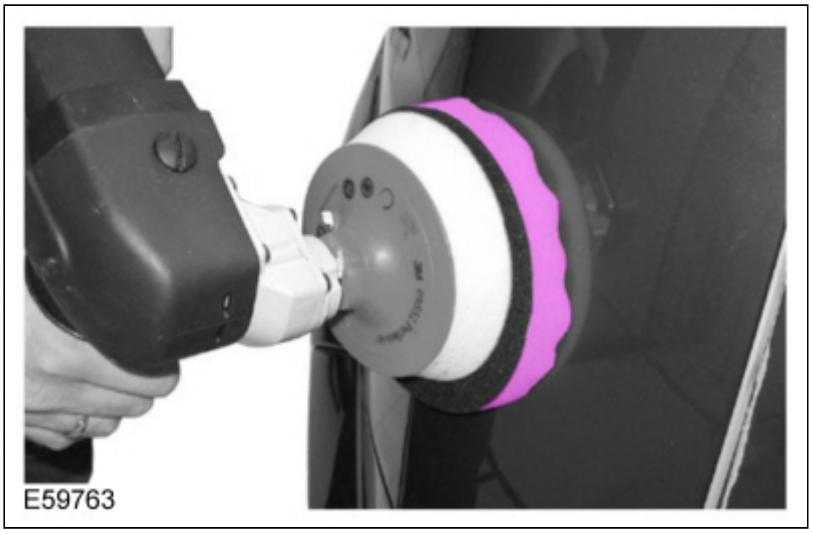
- P1000 - P1500 for pre-sanding of runs and large imperfections in the paint.
- P1500 - P3000 for subsequent sanding of runs and sanding out of dust inclusions.

A small eccentric sander can be used for more extensive working areas. When doing so, first of all put the eccentric sander in place and then switch it on, so that the danger of sanding through on edge is reduced.

Finally polish the sanded area to a high gloss with suitable polish. To this end the various manufacturers recommend materials and process techniques which are specially suited to their products.

NOTE: *The polishing is to be done in the same way as that used to remove swirl marks.*

Polish



NOTE: *Before using the nap sponge for the first time and after any long pauses in working, dampen the nap sponge with polish.*

Job steps:

- Clean and degrease the area to be polished using silicone remover.
- Apply the polish to the polishing disc and spread it.
- Place the polishing machine down flat on the area to be polished and before switching it on, gently distribute the polish over the underlying surface.
- Polish out the location for 10 - 15 seconds with the edge, working with a criss-cross motion.
- Subsequently polish the location for about 10 seconds with the machine laid down flat.
- Wash off and clean the polished location using the professional polishing cloth and then clean the polished surface.
- It is absolutely vital to carry out a visual check after finishing the polishing procedure. If any swirl marks are not completely removed by the first polishing procedure, then process must be repeated.

Aids

Cleaning putty

Cleaning putty allows deposits on the paint surface to be removed easily and gently. The following paint faults can be removed using cleaning putty:

- Metal deposits and iron dust.
- Paint or color mist.
- Tree resin and tar.
- Insect residues.

The surface to be worked must be thoroughly cleaned before the cleaning putty can be applied. Then the surface is sprayed with soapy water. Now the cleaning putty can be slid over the surface until all unevenness is removed.

Copyright © 2016 Ford Motor Company

Painting Plastic Parts

General

Although these days plastics can be produced in all colors and with a matt or gloss surface, painting is often necessary.

NOTE: *Manufacturer's limitations concerning the feasibility of painting certain components must always be observed.*

Reasons in favor of applying paint to plastic are:

- Individual coloring, matching the body paint.
- More gloss and color brilliance through painting.
- Removal of production imperfections.
- Protection from atmospheric exposure.

Nowadays painting plastic presents no problems because the materials are known and matched to the paint. In order that the painter can use the correct painting materials, the type of plastic must first be correctly determined.

To allow this, plastics are marked on the rear in accordance with the recommendations of the Association of Vehicle Manufacturers.

Once the type of plastic is determined it is an easy matter to assign special paint recommendations, matched to that particular plastic. Unmarked plastics require knowledge of materials so that a correct choice of paint materials can be made and the component can be reliably painted.

Plastic groups

Thermoplastics

When warmed these undergo a reversible transformation into a plastic deformable state and once cooled they maintain their shape. They consist of string-like (linear) or only slightly branched molecular chains.

Thermosets

Thermosets are hard and have the form of a close-meshed network in all directions. They do not undergo plastic deformation, are especially resistant to chemicals, are difficult to swell and are insoluble. At normal temperatures they are hard to brittle. At first the material does not undergo any change when heated, but when it reaches a critical point, the thermoset is totally destroyed.

Elastomers

Elastomers are characterized by high elasticity over a wide temperature range. They have properties like rubber or a sponge and after compression or distension they return to their original state.

Types of plastic

The plastics used in the automotive area:

- ABS - Acrylonitrile butadiene styrene (polymer)
- PA - Polyamide
- PC - Polycarbonate
- PE - Polyethylene
- PP - Polypropylene
- PP/EPDM - Polypropylene/ethylene propylene diene copolymer
- PC/PBT - Polycarbonate/Polybutylene terephthalate
- PBT/PC - Polybutylene terephthalate/Polycarbonate
- PUR - Polyurethane
- GRP - Glass reinforced plastic

NOTE: *PE and PP are plastics which cannot be painted, or can only be painted using special techniques.*

As well as the pure plastics, so-called 'blends' are also used. This means combinations of different plastics. If we were dealing with metals they would be called alloys.

Plastic identification

Normally the identifier is marked on the plastic components used in vehicle construction.

One method to determine the plastic group is the sanding test. In this a place is chosen which will not be visible later, and the finger belt sander is used to sand the plastic.

The plastic group can be determined using the pattern left by the sanding and the dust:

- Thermosets produce a white dust.
- Thermoplastics smear and do not produce dust.

The plastic group can be determined by a sound test:

- Degree of hardness - the higher-pitched the sound, the harder the plastic.
- Elasticity - the more muffled the sound, the higher the elasticity of the plastic.

Cleaning plastic

Plastic components are manufactured using complicated moulds and presses or other highly engineered tools, mostly using an injection moulding process or reactive injection moulding process.

In order to be able to remove the component from a particular tool, a separating agent is used, which in some cases adheres very strongly to the plastic.

This separating agent on the plastic components must be completely removed before any surface coating is applied.

Warm storage (tempering) before actual cleaning brings the following advantages:

- The separating agent sweats out of the plastic.
- Tensions in the plastic are released.
- Air inclusions can be recognized and removed.

Intensively clean the item several times using a pad and fresh cleaning agent.

NOTE: *A single wipe, even with cleaning agent, is not usually sufficient in most cases. Clean textured components with the aid of a soft brush.*

After cleaning, it is absolutely vital that cleaning agent absorbed by the plastic should be expelled by tempering again. If the ventilation is good and the room temperature is about 20°C the solvent can be evaporated away by overnight storage.

Painting new components

It is absolutely vital that the substrate of an unpainted new component is free of separating agent. Paint can only be applied directly to very few plastics. The plastic must first be identified exactly and then worked with a repair system which is matched to the type of plastic. In most cases a plastic etch primer must be applied as adhesion base to all plastics which can be painted.

NOTE: *Plastics have a tendency to become electrostatically charged. This can easily cause contamination during painting. Special antistatic cleaning cloths prevent electrostatic charging.*

Work process for thermoplastics:

- Thoroughly clean the surface.
- Temper the plastic.
- Afterwards clean with antistatic cleaner or antistatic cloths.
- Apply the bonding agent.
- Apply elastic filler. After it has dried, sand and clean.
- Apply one coat Uni-paint with elasticizer additive. For two layer painting the elasticizer additive is in the clear lacquer.

NOTE: *Follow the paint manufacturer's guidelines during all work.*

Work process for thermosets:

- As a rule, thermosets can be handled in the same way as normal body components.

Work process for PUR soft foam:

- The work process is the same as for thermoplastic.
- Instead of using bonding agent, a filler wash is applied to close the pores of the PUR soft foam.

The primer which has been applied to a primed new component can vary greatly. If no manufacturer's data is

available, the composition and suitability for further working must be tested.

Painted components with an already ascertained and intact paint coat present no problems for possible repainting. After sanding and careful cleaning with plastic cleaner or thinners, painting can be done directly.

Unknown primer

When dealing with unknown substrates it is important to carry out an adhesion test on the existing paint before any repainting is attempted. First of all a mechanical test must be carried out, for instance using a lattice cut and tear-off band. If the adhesion of the old paint is not acceptable, it must be mechanically removed and new paint finish applied.

If the adhesion is acceptable, then an etch test is performed using 2-component thinners. If no etching can be detected in this test, application of the the paint finish can be started directly. Otherwise the old paint must be removed and a new paint finish created.

With the help of universal or special plastic primers and with only a few materials complementary to those previously present anyway, the painter can now apply a long-lasting paint finish to all popular vehicle attachments made of plastic.

Paint faults on plastic substrates

NOTE: *Paint faults are fully described in the chapter Paint Defects and Damage.*

The most common paint faults which can occur when painting plastic components and the methods of repair are briefly described.

Discoloration

Cause/damage pattern:

- Plastic material is not suitable for painting.
- Incorrect bonding agent.
- Paint used not solvent resistant.

Repair of damage:

- Repaint using suitable materials.
- Install a new unpainted component.

Softening

Cause/damage pattern:

- Substrate not carefully cleaned.
- Air humidity too high or working temperature too low.
- Drying time incorrect (too short).
- Materials for substrate not correctly matched to each other or not mixed correctly.

Repair of damage:

- Dry out, sand, re-isolate and paint.
- Sand away faulty paint coats and re-apply paint finish.

Paint damage caused by detachment, poor adhesion

Cause/damage pattern:

- Insufficient paint adhesion between top coat and filler. The whole of the paint finish detaches from the plastic.
- Plastic not cleaned sufficiently, not or inadequately tempered.
- Unsuitable cleaning agent or materials used.
- Poor or lack of intermediate sanding.
- Paint finish underbaked or overbaked.

Repair of damage:

- Sand away faulty paint coats and re-apply paint finish.

Paint damage caused by blisters, craters, sink holes

Cause/damage pattern:

- Painting on PUR plastic which was not painted in production.

- Surface of the plastic material too porous.
- Flash-off time not adhered to.
- Drying temperature too high.
- Moisture in plastic material.
- Layers too thick.

Repair of damage:

- Clean the damaged area, sand, re-isolate and paint.
- Remove the paint layers and re-paint.

Crack formation

Cause/damage pattern:

- Overexpansion of painted PUR plastic components.
- Use of unsuitable paint materials.
- Paint materials not suited to each other or incorrect mixture ratio.

Repair of damage:

- It is not possible to repair overexpanded PUR plastic components.
- On other plastics, sand away damaged layers, isolate and repaint.

Copyright © 2016 Ford Motor Company

Spot Repairs

General

In general, partial surface painting at a point is called a spot repair. Using this technique, minor paint damage can be resolved economically and to time.

Advantage of this method

Because this application remains confined to the area of the damage, it is often unnecessary to remove components or color match against neighboring components. The material used is very much reduced because only a part of the repair area is coated.

Practical application areas

Only occasionally can satisfactory results be achieved in the centre of larger surfaces and/or on difficult colors. In addition, unprofessional application may cause tear-off edges to appear in clear lacquer. Only certain application areas are recommended.

NOTE: *The final decision on whether to spot repair or paint the component must be made by an expert.*

Application areas:

- 2-layer paint.
- Depending on the damage zone, paint damage up to a diameter of 3.5 cm or a length of 10 cm.
- Scratches.
- Clear lacquer application up to an area of DIN A4 max.
- Smaller areas which are optically broken up by other components such as trim strip, tail lights, swage lines and edges.
- Boundary zones and edge areas of larger components.

The best application areas have proven to be optical break lines such as corners, narrow surfaces, fenders and wheel arches.



Because of their locations, the violet colored areas are the most suitable for spot repair painting. The turquoise areas are only marginally suitable and the rest of the areas are not suitable for spot repairs.

Repair process

Perfect preparation of the subsurface is the precondition for a brilliant paintwork result. Faults in the preliminary stages delay completion and cause unnecessary extra work. The working steps described here demonstrate how important it is to follow these instructions step by step.

Illustration of damage



A typical case for spot repair is a small stone chip on the fender.

Cleaning



First of all the component is thoroughly cleaned using silicone remover and refurbished using abrading and polishing paste. This re-creates the original degree of shine and ensures exact color matching on the touch-up surface.

Sand out



Sand out the damaged location using P180 - P320. Only small sanding blocks and small sanding machines must be used, so that the area of the repair remains as small as possible.

Sanding is completed by rubbing down the surrounding surface with a fine sanding pad or P1000 paper. Remove sanding residues and clean the repair area with silicone remover. The peripheral zone must then be masked for application of the filler.

NOTE: *The size of the repair area must be kept as small as possible (maximum size DIN A4).*

Filling



The filler layer is applied in stages. First of all, filler is only applied to the location which has been sanded away. After a wait time for flashing off, the second coat is applied so that it spreads over onto the existing paintwork.

The filler must be dried according to the instructions of the material supplier.

Rubbing down



The repair location is now rubbed down with P400 - P500 and the bordering surface with P2000 - P4000. Remove sanding residues and clean the repair area with silicone remover.

Paint



Before painting, clean the area for the final time using a dust-bonding cloth. Then apply the basic paint in thin layers using a spray gun until enough coverage is achieved.

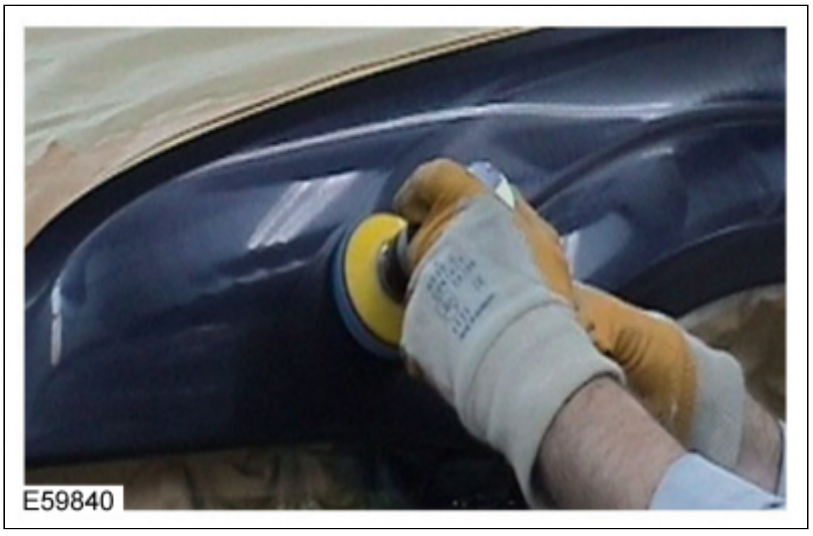
After drying, apply clear lacquer in 1 or 2 coats (depending on product). In doing so, spray so that only the newly applied basic paint is completely covered. Finally a touch-up thinners is sprayed over the edge of the clear lacquer to dissolve the clear lacquer spray mist.

Dry



Now dry the clear lacquer according to the manufacturer's instructions using an infrared gun.

Polish



Polish the component using a polisher and polish and check the polished area for any swirl marks which may be present. Polish away any swirl marks which are present.

Dirt inclusions

Sand out



Minor damage can be removed with a small sanding machine or preferably with an eccentric sander with P1500 - P2000. Very fine spray mist can be removed using P2000 - P4000 paper and a larger eccentric sander.

Copyright © 2016 Ford Motor Company

Corrosion Prevention

General

Although corrosion protection measures and painting processes in production have reached a very high technical standard and will be continuously developed further, in the long term corrosion on a vehicle cannot be totally avoided. Further demands are therefore made of the paint specialist besides his knowledge of normal repainting of vehicles which have been repaired after an accident, in addition specialist knowledge is required for assessing and rectifying damage due to corrosion.

During repair painting, take care over the maintenance and re-creation of the corrosion protection applied in production, in view of the long-term warranty on Ford vehicles. Only those repair materials which are approved by Ford may be used for body repair work and repair painting.

For detailed information on corrosion protection measures during body repairs, please refer to chapter 501-25.

Furthermore, information on corrosion protection measures is repeated in individual chapters of the paint manual.

In particular, pay attention that the layer thicknesses specified in production are maintained. The complete system of solid one-layer on galvanized steel panels must equal at least 90 µm and the total system of two-layer on galvanized steel panels must equal at least 105 µm.

It is important that sealing operations, as far as they are necessary, should be undertaken after the application of the paint to specification, in order to ensure the best corrosion protection. All components which form hollow cavities such as pillars, rails, side components etc. must be provided with a coating of cavity protection wax.

Causes of corrosion

Corrosion of steel is an electrochemical process during which the steel combines with oxygen. The following factors lead to corrosion:

- Acidic compounds contained in the air, such as carbonic acid and sulphur dioxide, combined with oxygen from the air and/or water. Salts such as sodium chloride used as road salt accelerate the corrosion process.
- Mechanical damage such as stone chips and scratches which penetrate through to the steel panel.
- Lack of care by the vehicle owner of the painted and corrosion proofed surfaces or areas on the vehicle.
- Unfavorable weather or environmental conditions, as may occur in areas with high humidity, high salt content in the air or serious air pollution due to aggressive gases and dusts.

In the case of mechanical damage, formation of rust can often be seen, beginning to spread into the painted surface from a point (stone chip) or from a line (scratch). If these faults are not professionally rectified in good time, the result is rusting through from the outside to the inside. Rusting penetration from the inside to the outside occurs when for instance the cavity protection was inadequate.

Operations after painting

NOTE: *The manufacturer's instructions must be followed when working with the various corrosion protection materials.*

- After painting, treat all cavities in the repair area with cavity protection wax. In doing so, pay particular attention to the weld seams. In dead-end applications with a panel insert, the cavity protection wax must be applied so that it also reaches the area of the panel insert.
- Seals which were applied in production and not over painted must be reapplied. Seals protect vulnerable parts of the bodywork, keep moisture away, reduce wind and road noise and dampen vibrations.
- Apply transparent wax.

Definition of the degree of rust

In workshop practice, in order to be able to carry out a consistent and objective evaluation of the scope of the damage, a degree of rust on the scale of 1 to 5 is determined by the DIN 53 210 standard. The main criterion here is the extent to which rust exists under the paint structure. It is determined in millimeters (mm).

Underlying rust grade: R1 < 1 mm

Corrosion starting with up to 1 mm of rust underlying (in the form of a spot or a line).

The damage can be rectified by cleaning the defective location and mechanically removing the underlying rust. For a

small extent, apply a primer using a brush and allow it to dry. Touch-up the location with a paint pen or provide a new paint coating.

Underlying rust grade R2 < 1 - 2 mm

Advanced corrosion with up to 2 mm underlying rust.

Rectifying the damage:

- Clean the defective location.
- Remove the underlying rust mechanically down to the paintwork carrier.
- Apply 1-component filler and then 2-component "Vario" filler.
- Provide the damage location with new paint coat on visible outer surfaces. Only locally touch-up areas which are not optically conspicuous.

Underlying rust grade R3 < 2 - 4 mm

More advanced corrosion with up to 4 mm underlying rust. The damage must be rectified in the same way as for R2. A permanent cure of this type of damage pattern is still just possible

Underlying rust grade R4 < 4 - 5 mm

Notably advanced corrosion with up to 5 mm underlying rust. The damage must be rectified in the same way as for R2. If it is found that for whole areas this is only possible with a great deal of work, or is not possible at all, then a new component must be used.

Underlying rust grade R5 > 5 mm

Extreme corrosion, with more than 5mm underlying rust (panels, flanges or load-bearing components partially rusted or rusted through).

Such damage can no longer be repaired because in many cases the constructional strength of the component can no longer be produced. The risk in making a repair is too great. Install a new component and paint it.

Copyright © 2016 Ford Motor Company

Color Identification and Chromatics

Basic color theory

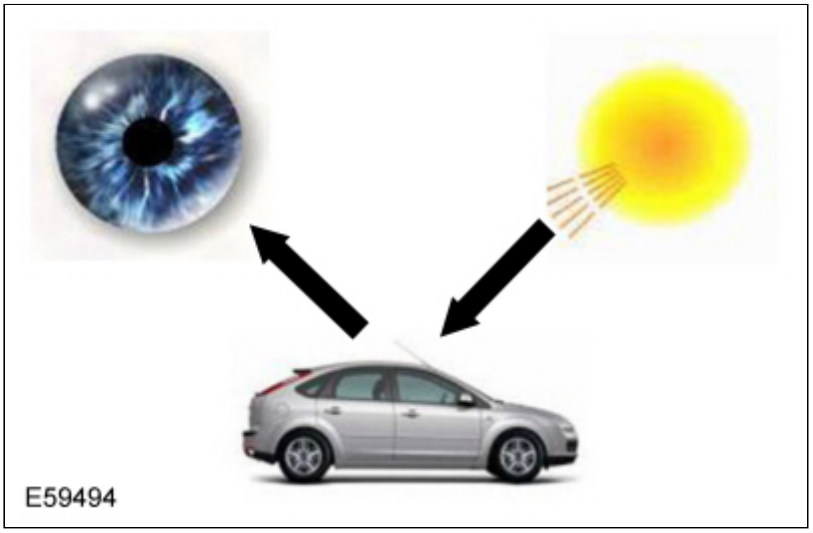
In order to achieve optically perfect painting results it is vital to understand the physical principles of the origin of color impression.

Color

Color itself is a sensory perception.

This perception arises through the combined effect of the following components:

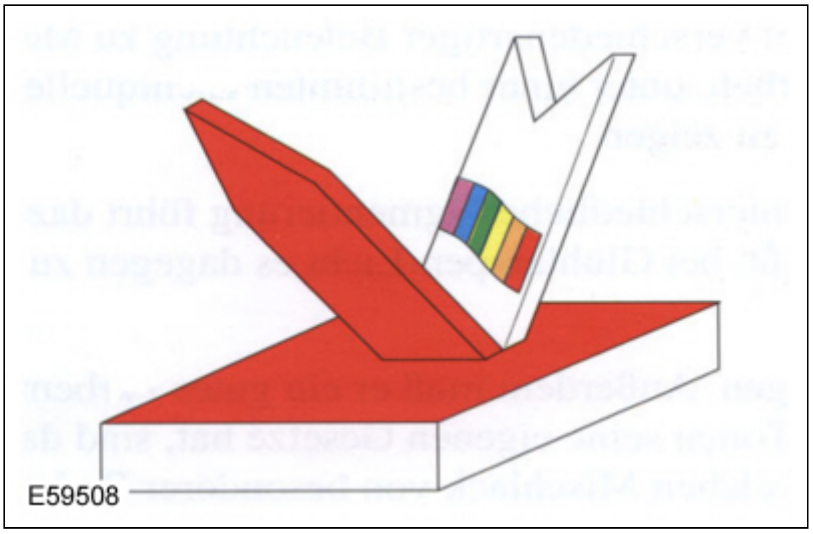
- Light (sunlight or artificial light irradiates the object).
- Surface of the object (reflection from the object of certain constituent parts of the light).
- Eye (perception of the reflections from the object).



Because the sensory impression of color is produced by all three of these components, it is dependent on the type, quality and function of the individual components. Practical examples make this clear:

- If a particular article is subjected to artificial light, then it gives a different impression of color to that which it gives in sunlight.
- An object with uniform color but different surface textures appears to have different colors (grained or ungrained dashboard).
- A person with perception disorder (colorblindness) cannot recognize certain colors or distinguish between them e.g. red-green weakness).

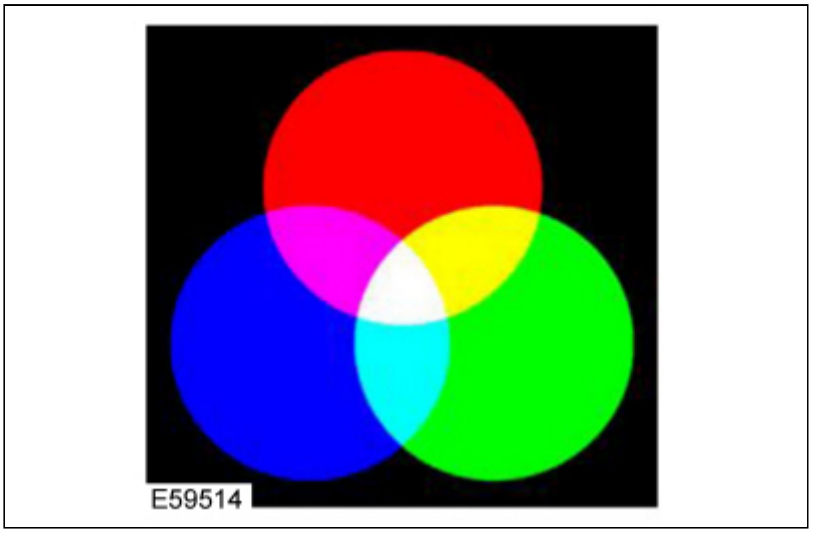
In turn the type of color is determined by the light absorption ability of an object. Light shines with all color components (spectral colors) onto an object, certain components of the light are absorbed (taken in) and other components are reflected (sent on). The components which are reflected produce the specific color impression.



The colors as we see them are the result of a combination of reflected colors from the spectrum. Physically speaking, these are electromagnetic waves with different wavelengths (and frequencies). The healthy human eye can recognize wavelengths between 0.36 µm (violet) and 0.78 µm (red).

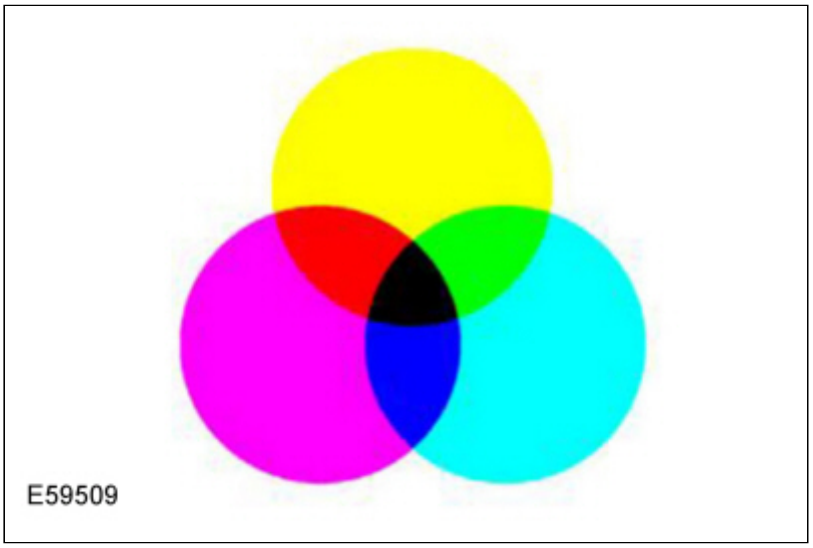
If all the perceptible wavelengths of the spectrum impinge on the human eye at the same time, the impression of white light is produced.

Additive and subtractive color mixing



Additive color mixing is the combination of light from different sources to give white. Different intensities of the additive primary colors red, green and blue allow millions of different colors to be represented (RGB colors).

Additive color mixing is always therefore used when light should enter the eye directly (without reflection off an object). Such as in the case of computer monitors or overhead beamers.



Subtractive color mixing means mixing the primary colors cyan, magenta and yellow to form a desired color (CMY colors).

Subtractive color mixing is used when light should enter the eye of an observer after reflection from an object. Such as happens with painting or in printing.

Oswald color circle



The Oswald color circle is based on subtractive color mixing, and enables the behavior of paints when they are mixed together to be represented.

Colors lying opposite each other are complementary colors and should not be mixed together as this will produce a dull (i.e. grey) shade. If green is added to red, the red becomes greyer, not greener.

Color shades which are side by side are partner colors and produce a mixed color shade. For instance, mixing red and blue produces a pure violet.

In addition, black and/or white may be necessary to produce a particular color shade.

- White makes the color shade lighter.
- Black makes the color shade darker.
- With black and white the color shade becomes more dreary or greyer.

Metamerism

Metamerism is the name of the effect which occurs when two colors appear identical in a particular light (e.g. artificial light), but the colors appear different under another light source (e.g. daylight).

The cause is the fact that the human brain, aided by the eyes, does not evaluate the wavelength, instead it evaluates the spectral intensity of the reflected light.

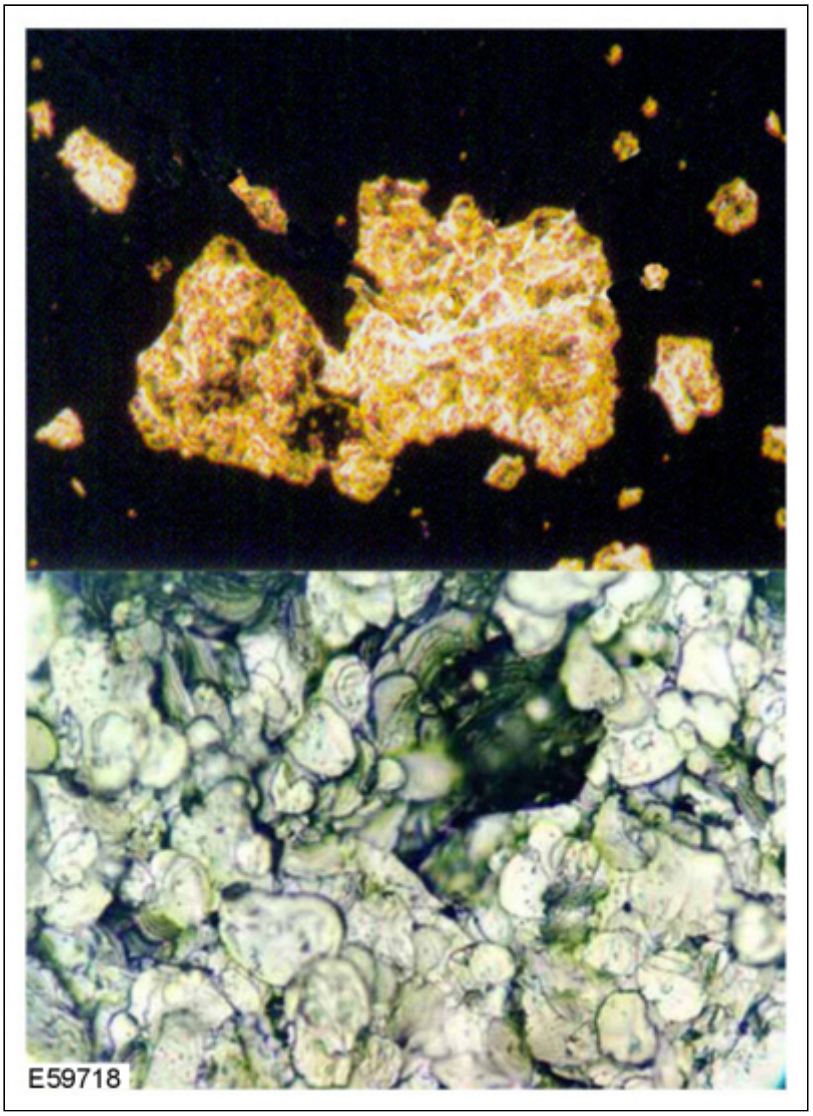
It is for this reason that color matching in practice must only ever be performed in daylight, or under special artificial light which is based on daylight.

Metallic and pearl pigments

Colored paints achieve their color effect by the addition of pigments. Pigments are colored, solid, very fine organic and inorganic particles which are insoluble in the binding material.

Metallic pigments

Aluminum platelets are added as pigment to form metallic paint.



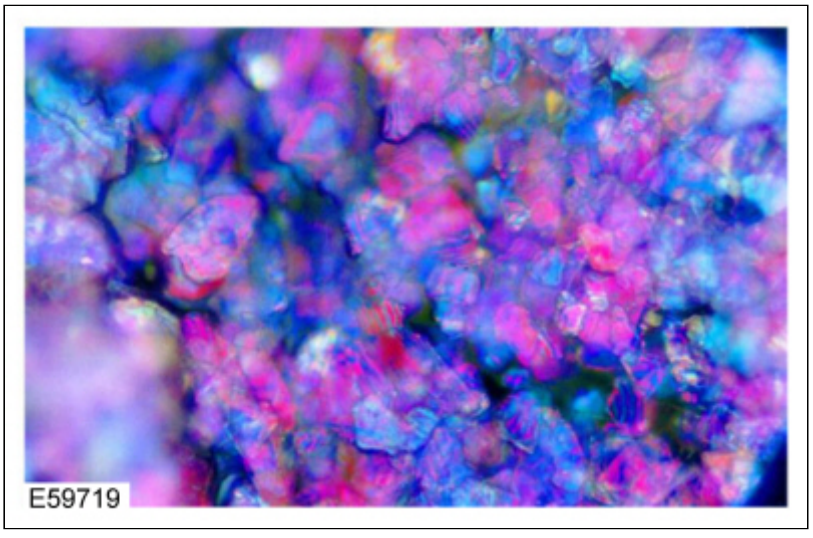
Depending on the size and shape of the aluminum platelets, different metallic effects can be achieved:

- Cornflake aluminum (1) causes very strong dispersion because of rough edges, low brilliance, very low flop and produces grey-silver shades.
- Dollar aluminum (2) causes hardly any dispersion because of the smooth surface, high brilliance, produces very light, almost white silver shades.

With metallic paints however, only a light-dark light reflection effect occurs.

Colored metallic paints are produced by the extra addition of color pigments to the metallic paint.

Pearl pigments



The basis of pearl pigments is formed by mica, which is metallized with a silver or gold layer.

Depending on the angles of light and observation, the mica platelets reflect different proportions of light. Because of this, the color of the paint appears to the observer to change.

Pearl pigments produce a colored and light-dark reflected light effect.

Color codes and their determination on Ford vehicles

It is necessary to determine the correct color shade of the original paintwork in order to perform a professional and perfect paint repair.

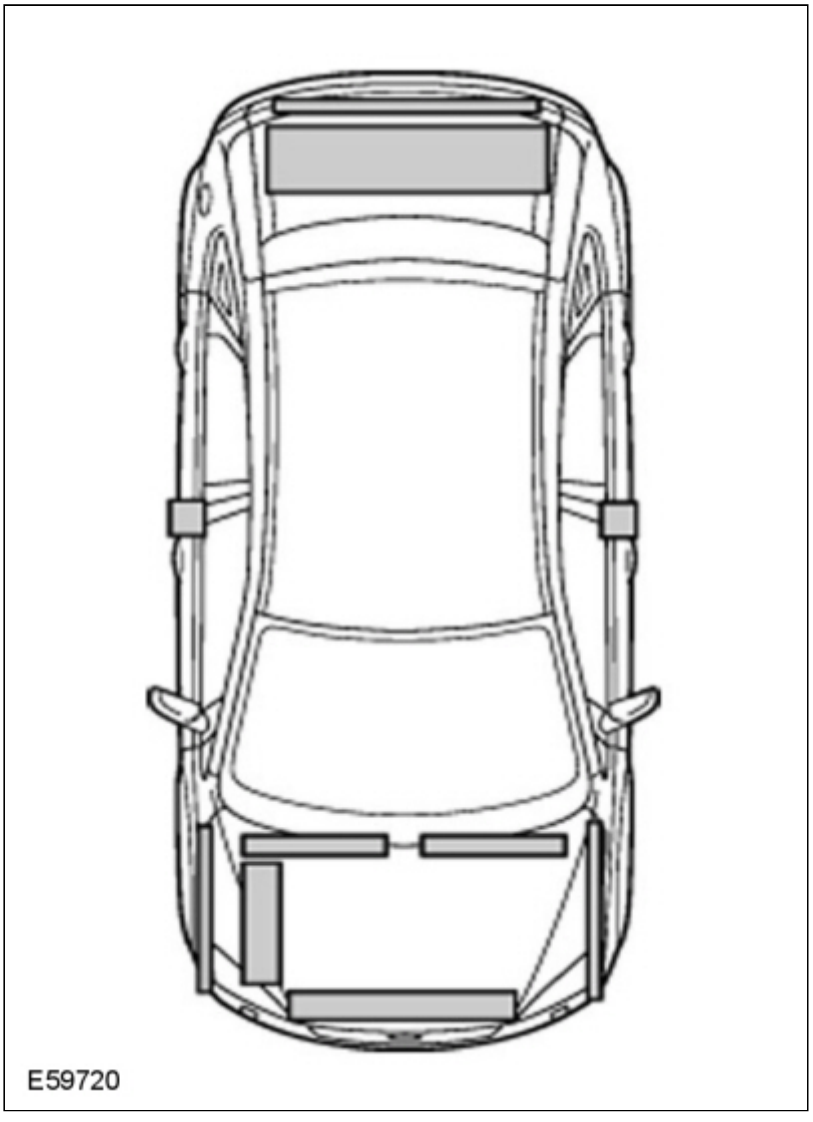
The original paint color shade can be found by:

- Inspection of the vehicle type plate with the color code stamped on it.
  - Later design
  - Earlier design
- Color shade catalog or color shade system of the manufacturer.
- The bare bodyshell plate with color designation.

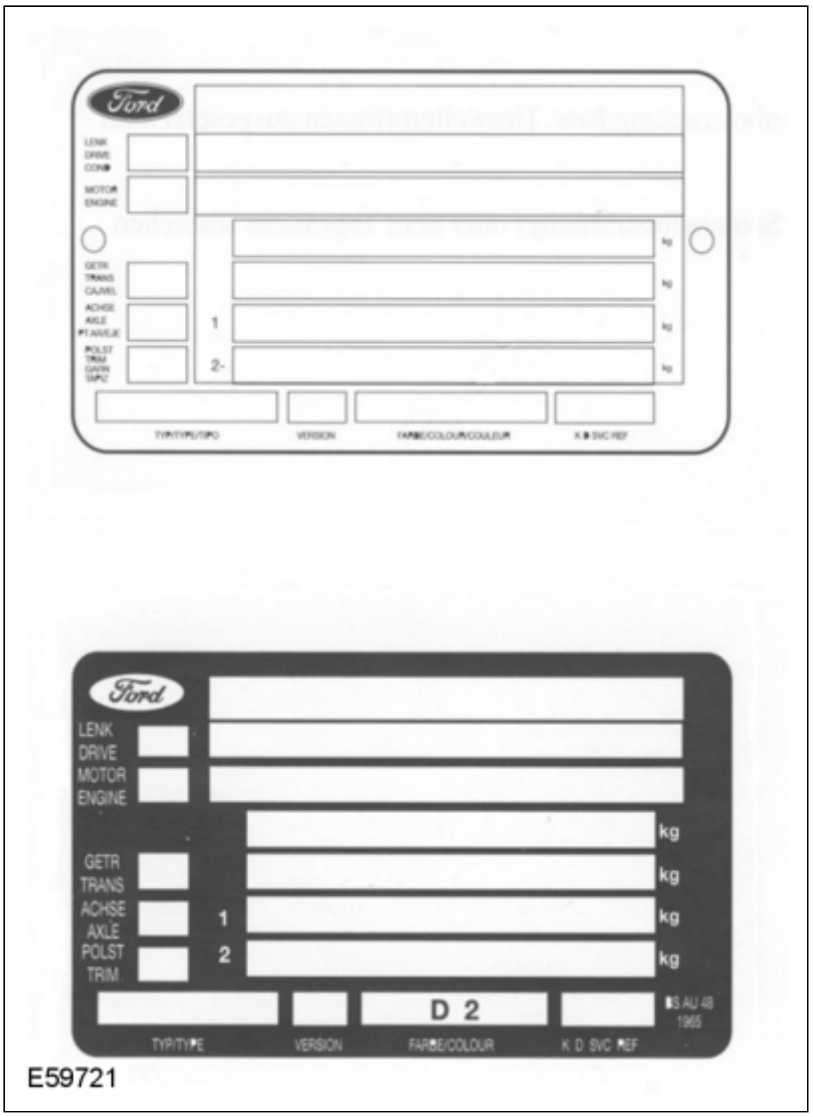
Type plate

Type plate - location on Ford vehicles:

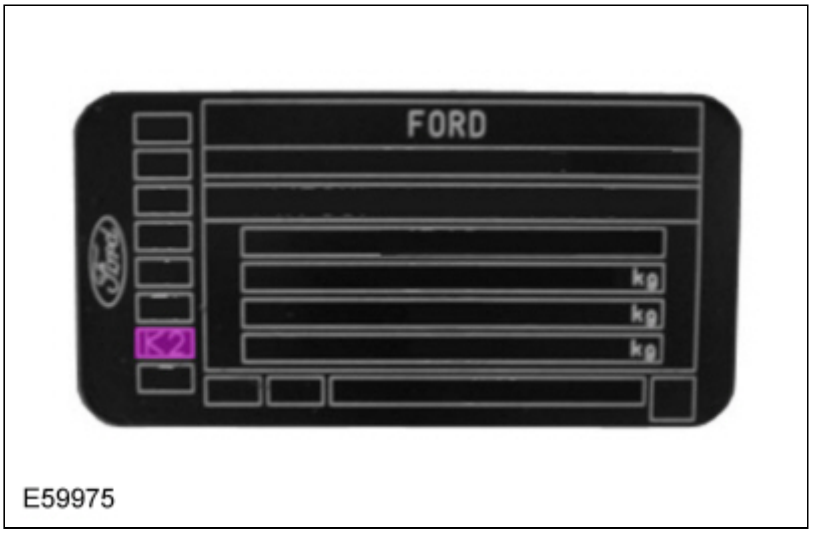
- Right-hand B-pillar - door rebate
- Left-hand B-pillar - door rebate
- Hood lock panel
- Left-hand vertical edge of inner front wing
- Right-hand vertical edge of inner front wing
- Right-hand engine compartment side member
- Left-hand bulkhead
- Right-hand bulkhead
- Luggage compartment interior
- Inner rear panel - luggage compartment



The type plate gives the color code in the last row.



On the newer type plates, the color code is given in the left-hand column, at the penultimate position.



Color shade catalog or color shade system of the repair paint manufacturer.

The repair paint manufacturers offer a variety of possible systems for the determining the production color shade of motor vehicles. There are electronic systems, color card systems and manuals for the determination of color shades.

Most repair paint manufacturers use the following systems:

- A tabular system based on the following parameters:
  - Color code
  - Make

  - Model
  - Build year
  - Color or color name
  - Ancillary codes
- A system with color cards based on the following parameters:
  - Make
  - Color shade
  - Build year

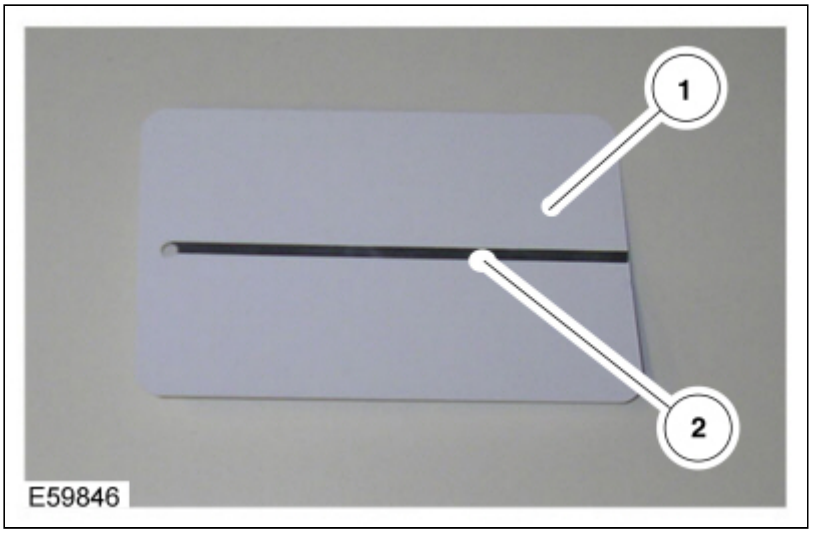


Because of the many parameters used, in a tabular system the color shade can also be determined by the lack of a parameter.

When using the color cards, emphasis is placed on matching of the original color shade with the color shade samples. For this reason this method is very helpful when the other parameters are not available.

Comparison of the results of both methods increases the certainty of using the correct original color shade and its formulation.

Additional certainty can be achieved during color shade determination by making a color sample plate. Here it is however important to apply the complete paint structure with base paint and clear lacquer onto a sample plate (1) in order to carry out a color shade and color coverage test.



The color shade comparison is done by comparing the vehicle paintwork with the sample plate (1). The color coverage test is possible by using the black test stripe (2): If the test stripe (2) is still visible after test painting of the sample plate (1), the coverage is not good enough.

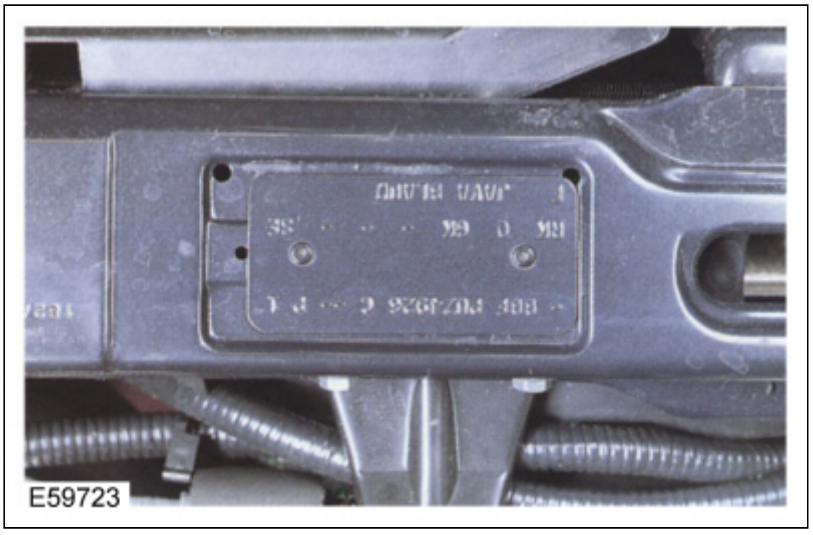
By using this determination of the original color shade, the formulation and information on any very slight fine adjustments which may be necessary can be established.

Bare bodyshell plate

The bare bodyshell plate is located:

- On the hood lock panel.
- Near the type plate.

The color name is stamped on in the last row.



Matching tinted filler to the color code

NOTE: *Color samples must always be made from the same materials as the subsequent repair painting. Perform color shade matching in the fully hardened state, in natural light or under suitable artificial light.*

Various tinted fillers are used during factory painting. In order to achieve the exact color shade of the factory applied paint, attention should be paid that the correctly matched fillers are used.



The repair paint manufacturers offer suitable precolored primers. The use of filler color cards allows the matching color shade to be determined.

Copyright © 2016 Ford Motor Company

Tips and Tricks

Comparing paint structures

It may happen that an area remains visible, especially when the area of the repair is small. The reason for this is the structural variation in the paint surface at the repair location compared with the original paint finish. The original paint finish has a slight orange peel effect while the repair areas is extremely smooth.

This effect can be reduced by fine sanding using P3000 of the area around the repair location and then polishing.

Etching substrate

If the substrate can be etched during the solvent test, suitable preparation must be done.

Job steps:

NOTE: *Follow the manufacturer specific instructions.*

- Sand the damaged area extensively using an eccentric sander and P80 or P120 abrasive sheets. Finish off sanding with P150 or P180.
- Remove the sanding dust and clean the area of the damage using silicone remover.
- Apply polyester stopper to the bare panel and to the damaged area.
- Sand the dried polyester stopper to an even surface using P80 - P150. Finish sanding using P180 - P240. If required apply more stopper, again only on the bare panel.
- Wet sand the residual old paint finish using P600 - P800. Transitions with P400 - P600. Clean with silicone remover.
- Prime bare metal areas with acid primer.
- After the acid primer has been left exposed to the air for the correct evaporation time, apply 2-component primer filler in thin layers over the complete repair area, leaving enough air exposure time in between coats.
- After the filler has dried, sand wet with P800 or sand dry with P400. Sanded through areas must be covered again with 2-component Nonstop filler primer.

Another possible method of preventing etching of the substrate is to use waterbased primer and filler materials.

Masking the vehicle

Masking and covering work are among the most important preparations required to achieve a high quality paint finish. Paint application onto neighboring components, paint mist and sharp paint transitions are quality faults. For this reason it is extremely important to take special care and to use suitable masking materials.

NOTE: *When water based paints are used, all materials must be stable towards water.*

Plan the masking work:

- Determine the sequence of masking work. Sometimes after masking film has been applied, it is difficult or impossible to reach certain areas.
- Prepare the masking material.
- Start with small difficult areas.

Pay special attention to the areas of profiled seals, edges, openings and paint transitions.

Masking tape

Masking tape is available in various widths for special application areas. In practice however, a wide tape has proved best for almost all areas, also taking into account the time required for masking work.

NOTE: *Use of differing masking materials is often much more time-consuming.*

Advantages

- Good coverage. Narrower tapes must often be applied in several layers.
- More resistant to tearing.
- Wide tapes can be applied deep into joints and therefore protect from paint mist and contamination.
- Removal is often easier.

Masking film

Transparent plastic film has become accepted as a practical method to mask large areas of a whole vehicle. It can quickly and easily be applied to the vehicle from the roll.

NOTE: *Only mask the vehicle when it is dry. Moisture under the film can lead to matt paint in the drying process.*

Using masking film

- Clean the vehicle before masking it.
- Pull the film over the vehicle. Because of the static charge, the film lies on the vehicle like a second skin.
- Cut out the repair area using the film knife and then mask it.

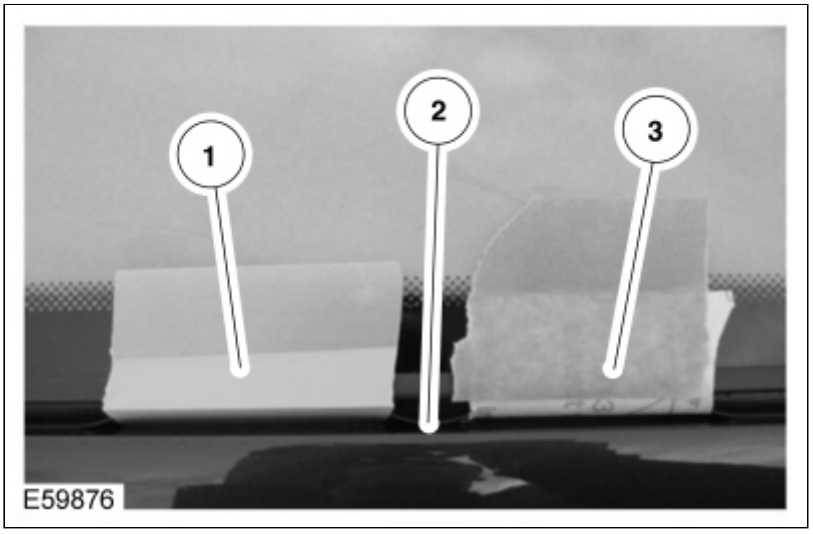
Other ways of masking a vehicle are:

- Masking using masking paper.
- Painting cloth (mostly used during filling work).

Profiled seals

If it is not possible to remove a profiled seal, then it must be masked in such a way that no edges can form due to paint accumulation.

To do this, the seal is lifted slightly and masked. The following techniques are possible:



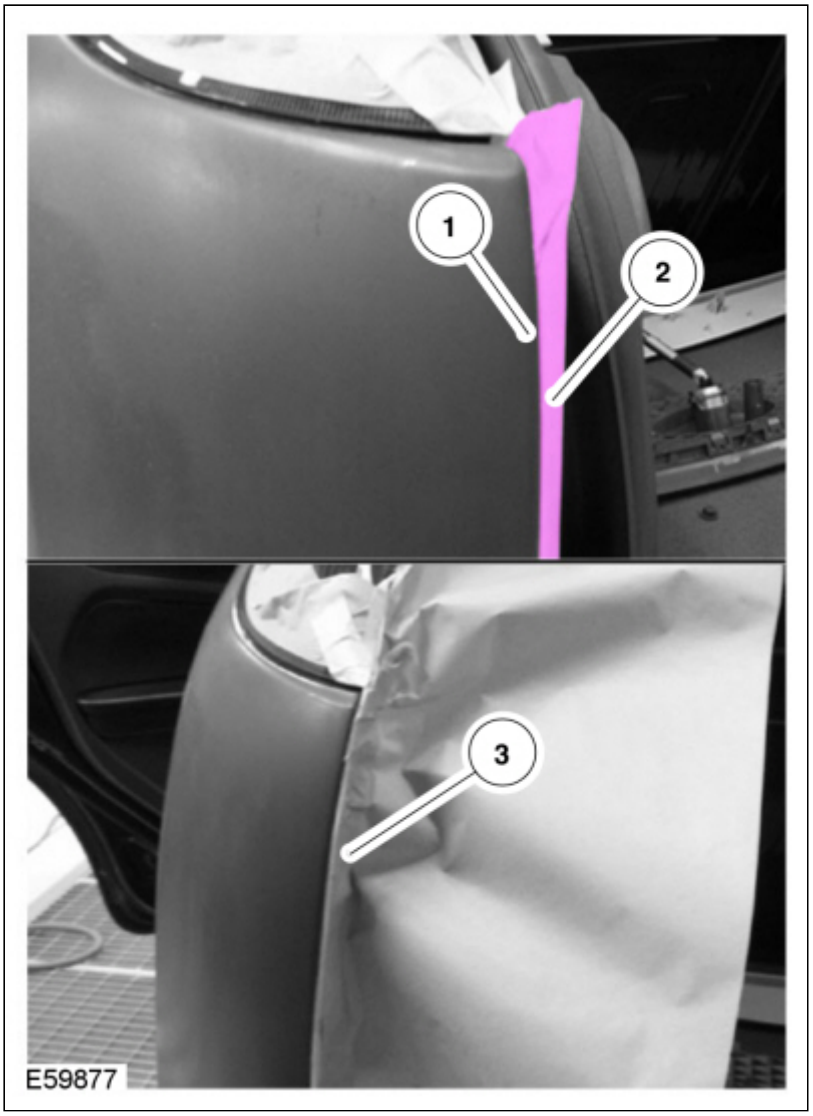
Item	Part Number	Description
1	—	Masking tape with plastic strips
2	—	Sealing lip
3	—	Sandpaper with masking tape

- Laying a string or cord under the seal. Suitable for soft and elastic seal lips.
- Special masking tape with plastic strips for hard seal lips.
- Instead of using plastic strips, fine sandpaper cut into strips can be inserted and secured using normal masking tape.
- If the seal can be easily displaced, normal masking tape can also be used.

Edges/openings

Smooth paint transitions can be produced by positioning adhesive tapes.

NOTE: *Pull the adhesive tapes away immediately after the paint has been applied and check the paint transitions.*



Item	Part Number	Description
1	—	Vehicle edge
2	—	Adhesive surface
3	—	Masking paper

Possible variations

- At edges apply one strip of masking tape half on the area not to be painted and mask using a second strip.
- On surfaces, two masking strips can be attached, each affixed by half their adhesive surface. The adhesive strip which arises is then applied with one half on the edge of the area to be painted. The other half is aligned and fixed in addition in the curves.
- Affix masking paper on one side over the area to be painted. Double back the masking paper and secure it.
- Affix round profiled foam at the edge of the area to be painted using masking tape.

Foam strips are suitable for affixing to openings such as door gaps.



NOTE: *Choose a suitable profile diameter. A profile which is too thick will protrude from the opening, one which is too thin will leave a gap.*

Clean the door opening well and affix the matching shape.

Color shade problems

If a vehicle color shade is taken from a vehicle on a hot summer day and the mixed color applied, this may cause color shade problems. Some colors change so much at higher temperatures that it can lead to an incorrect result. Red color shades are particularly prone to this shade behavior.

This means that color determination should always be done on the bodywork when it is at about the same temperature as the later working temperature will be. The best temperature of the item is between 15° and 25° C.

Isopropanol and water

Painted surfaces are very easily cleaned using a mixture of 70% water and 30% isopropanol (can be obtained through a laboratory supplies specialist or a pharmacist).

Temperature reduction spray

If finishing work must be performed on touched-up surfaces and newly painted plastic parts, problems may arise. The paint and the transitions are not yet fully hardened.

NOTE: *When working with the polishing machine, make certain that each operating run lasts no longer than about 5 - 10 seconds, in order to prevent the paint becoming warm.*

Even so, in order to be able to polish over transitions, temperature reduction spray must be applied to the surface. The transition area is then alternately sprayed and polished until a perfect transition surface is achieved.

Paint faults on soft plastic components where elasticizer additive has been used in painting must be wet sanded using grade P2000 - P2500 paper.

In doing this the sanding location and the surroundings are sprayed with temperature reduction spray and the paint faults sanded out by hand. Afterwards the location is polished as described above.

Paint plane

Dirt inclusions and paint runs can be removed with the sanding cylinder ("Finiball") and hand sanding or eccentric sander in a wet sanding process.

Another practical tool for removal of paint faults which lie proud of the surface is the paint plane.

NOTE: *Guide the tool carefully with the minimum of force. It must not tilt, otherwise more serious damage may easily be caused.*



This tool allows paint faults to be carefully removed in shavings. Afterwards the surface must be polished using suitable materials.

Shading

Even when all the rules, steps and corresponding instructions have been followed concerning possible shades, it may happen that the mixed color shade does not exactly match the vehicle color.

In these cases, shading must be done. Because there is no fixed formula for this, experience and a trained eye are important. Some rules must be followed for shading.

NOTE: *Self-made color sample plates of the current colors are very helpful for determining the color shade. Refer to the chapter Color Determination and Color Theory.*

- When shading, if possible only use the paint mixture that is also allotted in the color shade formula.
- Observe the rules concerning contrary colors (complementary colors) and partner colors according to the Oswald color circle.
- Complementary colors are not recommended during shading because they mutually inhibit and lead to muddy mixtures.

Sanding marks

In certain circumstances, the recommended sanding methods up to now are no longer suitable for light metallic color shades. Wet sanding with grade P1200 paper or a grey sanding pad can cause sanding scratches which can become very visible under certain lights.

In order to achieve an excellent paint result on difficult color shades, follow these working rules:

- Sand filler as before, rub down area to be painted with 3M ultra fine matting sponge and 3M matting gel.
- Sand filler as before, rub down area to be painted with soaked 3M wet sand paper P1500 - P2000.
- Sand filler as before, rub down area to be painted with 3M 260 L P1000 eccentric (Interface Pad).

Improving touch-up work

During application of special effect base paints, the effect particles align themselves exactly parallel to the surface in the paint layer while it is still liquid. This means a particular thickness of the paint layer is required.

Because during painting the layer thickness in the transition zones reduces from normal to zero, the effect particles can no longer align themselves. This leads to lighter, darker or cloudy zones.

If 1-component clear lacquer is sprayed before the base coat, this effect is prevented. An optically perfect transition will result.

Copyright © 2016 Ford Motor Company

Frame Members-Front Frame Section

Special Tool(s) / General Equipment

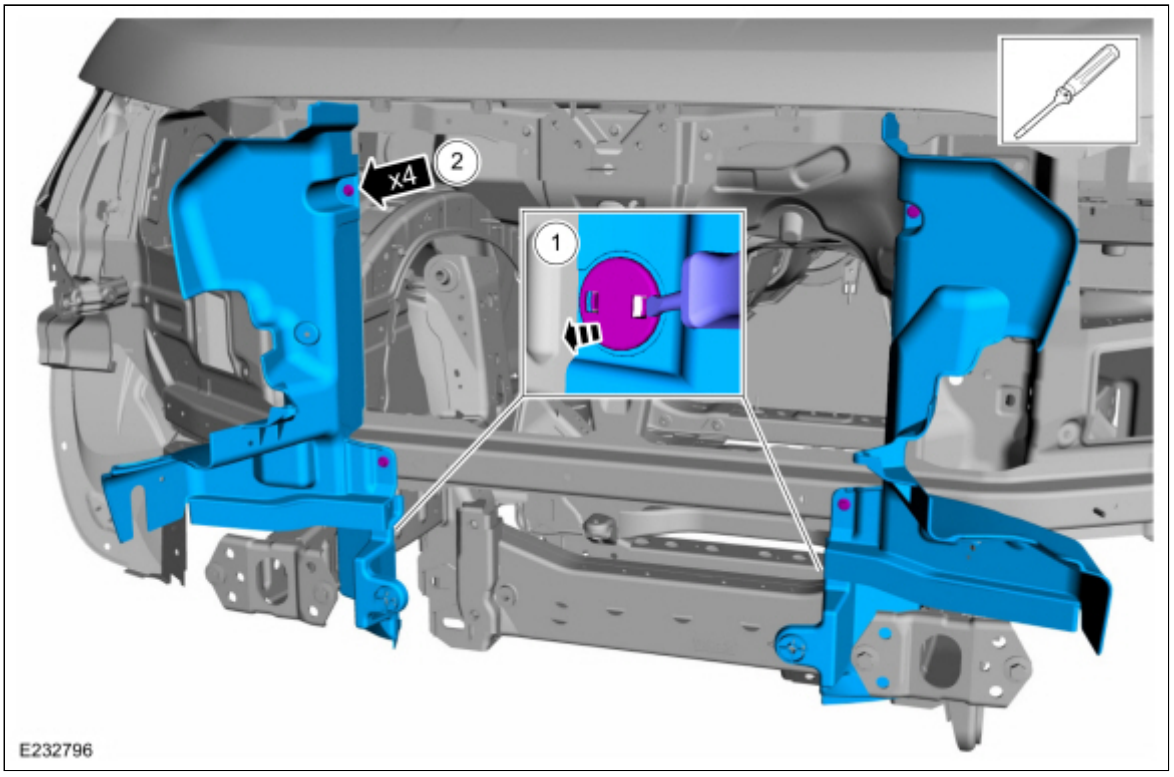
Grinder
Plasma Cutter
Flat Headed Screw Driver
MIG/MAG Welding Equipment
Locking Pliers

Removal

WARNING: Frame rail crush zones absorb crash energy during a collision and must be replaced if damaged. Prior to replacement of frame rail crush zones, straighten damaged frame rails to correct frame dimensions. Failure to follow these instructions may adversely affect frame rail crush zone performance and may result in serious personal injury to vehicle occupants in a crash.

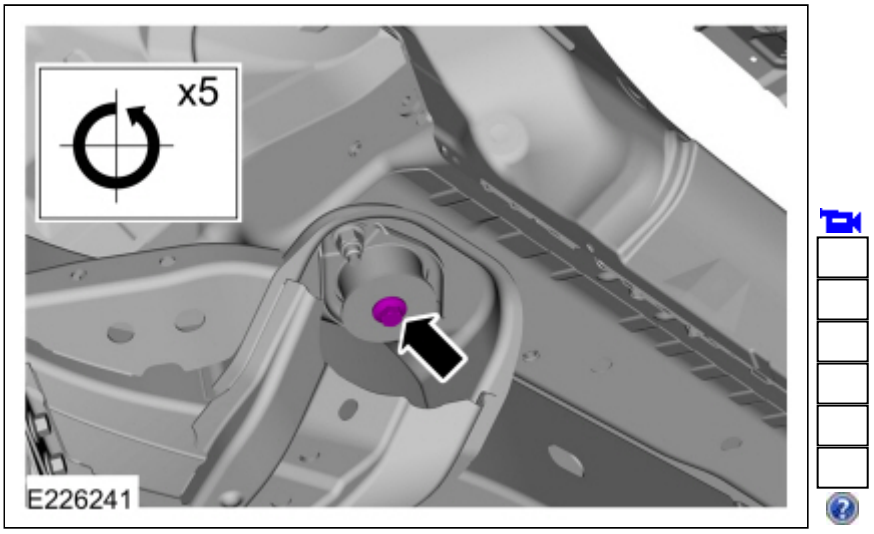
1. Refer to: Health and Safety Precautions (501-25 Body Repairs - General Information, Description and Operation).
2. Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).
3. Remove the following items:
    1. Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).
    2. Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
    3. Refer to: Engine - 6-Speed Automatic Transmission - 6R80 (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal).
    Refer to: Engine - 6-Speed Automatic Transmission - 6R80 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal).
    Refer to: Engine - 5-Speed Manual Transmission - MT75 (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal).
    Refer to: Engine - 5-Speed Manual Transmission - MT75 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation).
    Refer to: Engine - 6-Speed Manual Transmission - MT82 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal).
    Refer to: Engine - 6-Speed Manual Transmission - MT82 (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal).
    4. Refer to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
    Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
    Refer to: Radiator (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
    5. Refer to: Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation).

    1. Use the General Equipment: Flat Headed Screw Driver

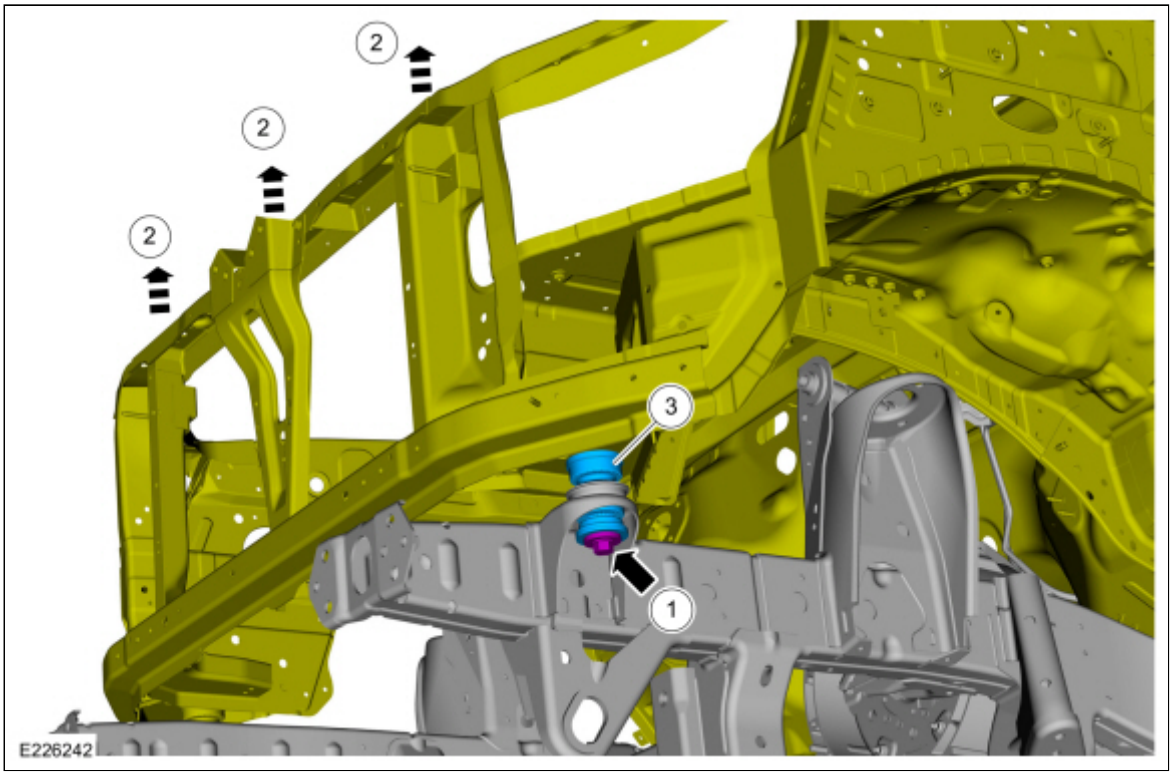


5. Anchor the vehicle to a frame rack.

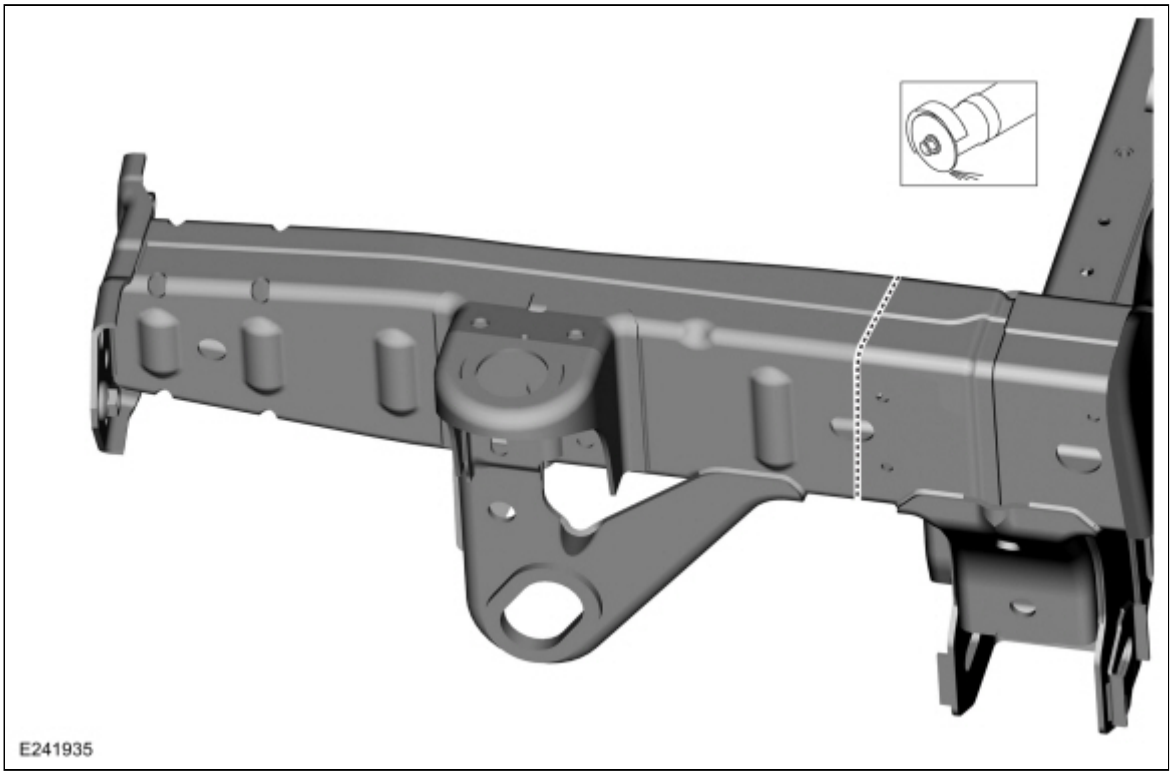
6. On both sides.
   Loosen: 5 turn(s)



1. On both sides, remove the mounting bolts.
2. Using the frame rack towers and light tension, support the front radiator support of the vehicle by raising it slightly above the frame rail mounts.
3. Remove the body-frame mounting bushes.

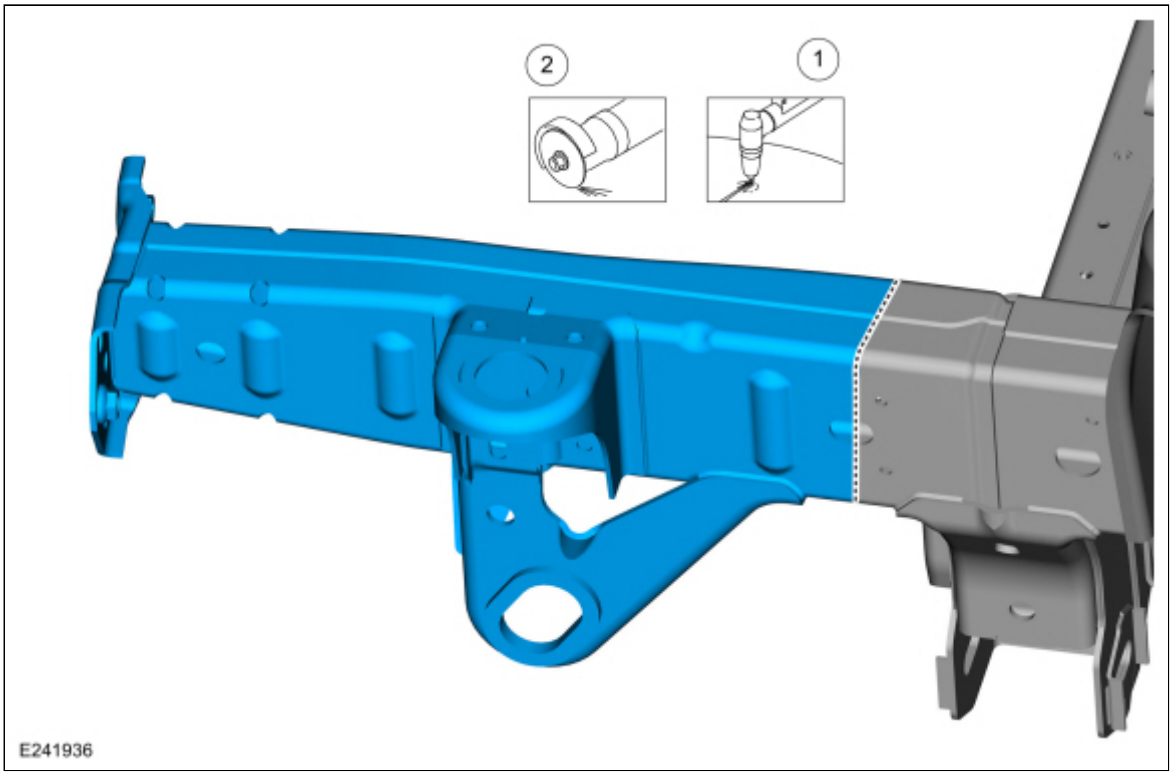


8. Locate the vertical weld line of the front frame horn to front rail.
   Use the General Equipment: Grinder

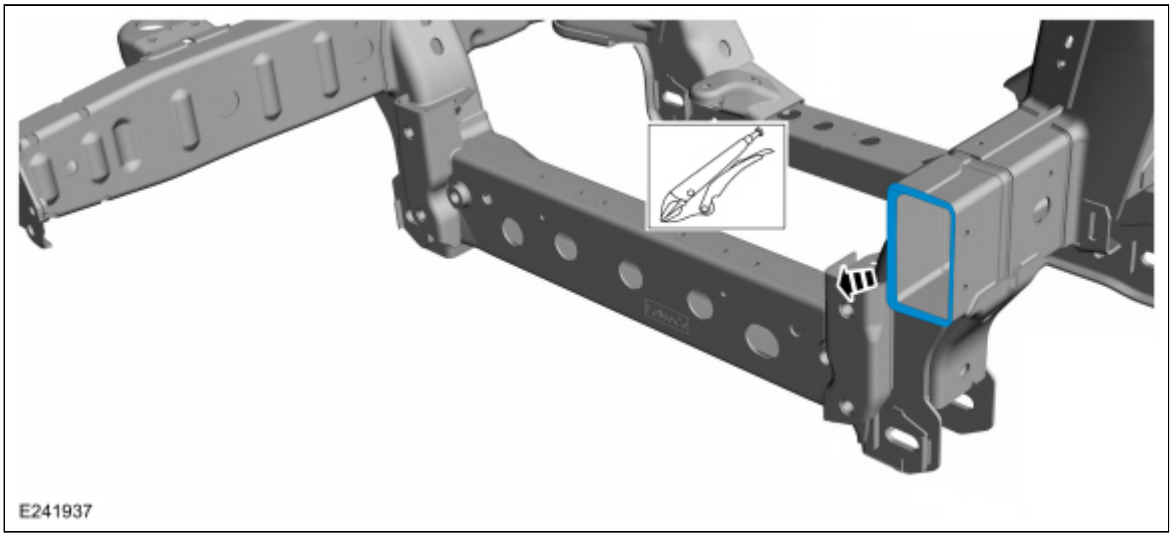


9. **NOTE:** *Do not cut directly along the center of the weld line. Leave enough material on the front side of the weld centerline to allow the remaining weld and frame material to be ground back to the front edge of the front mid rail. This is necessary to make sure of correct fit between the frame and the replacement frame section.*

    1. Using a plasma cutter, reciprocating saw or cut-off wheel, remove the damaged front frame horn section.
       Use the General Equipment: Plasma Cutter
    2. Grind off the excess welding material that remains around the perimeter of the front edge of the front frame rail of the frame assembly.
       Use the General Equipment: Grinder

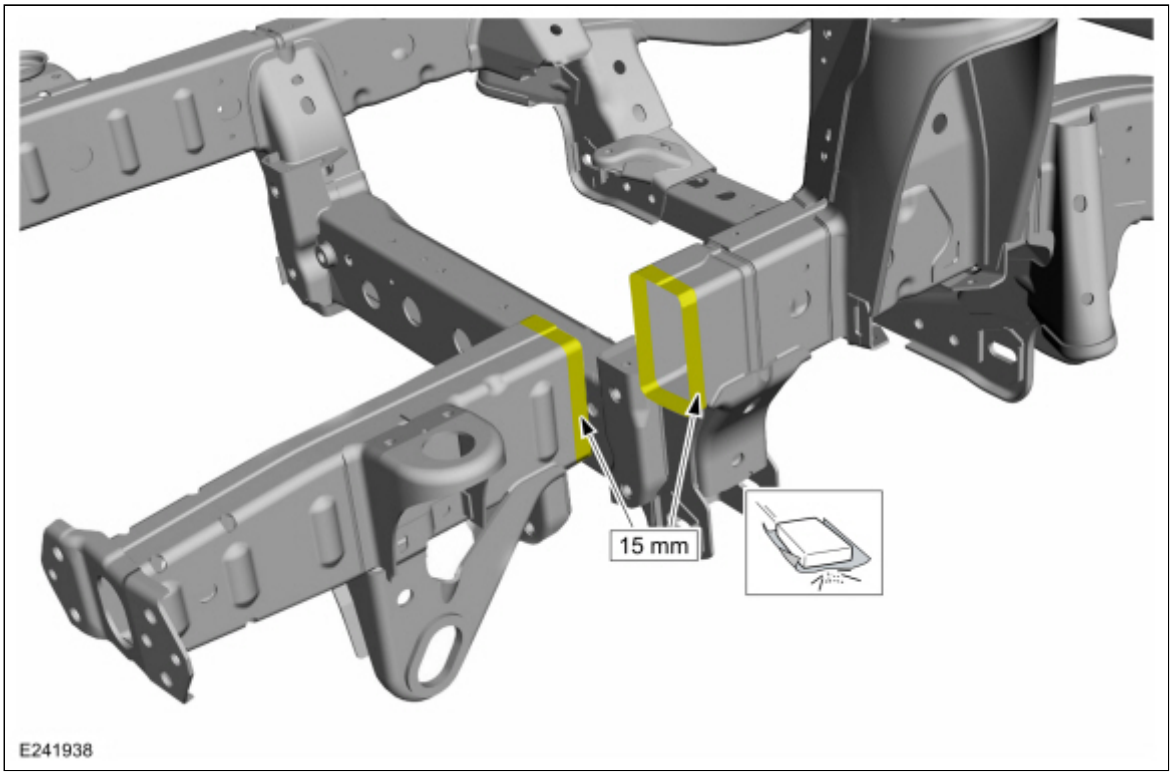


10. Remove the remaining portion of the frame section from inside the frame rail.
    Use the General Equipment: Locking Pliers



Installation

1. Using a wire brush or sandpaper, remove the ecoat paint from the existing frame and the replacement horn section near the edges to be
   welded on the inner and outer surfaces within approximately 15 mm (0.5 in.) of the repair joint.

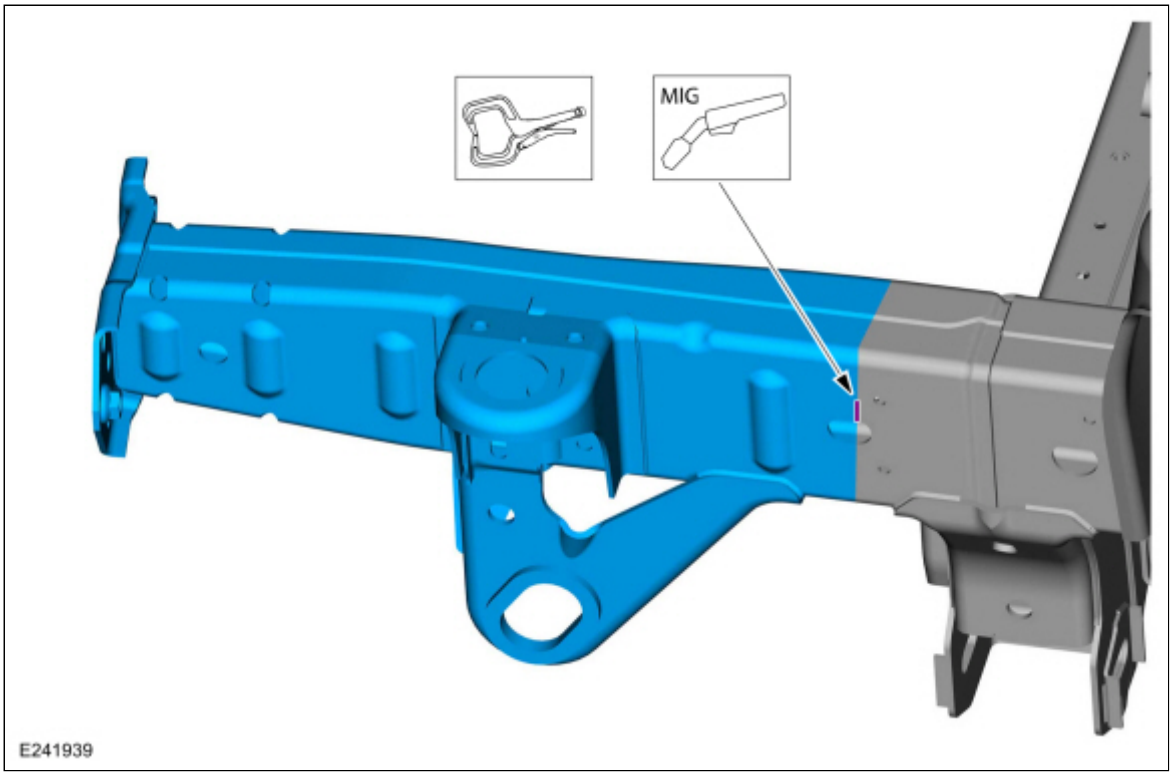


2. Verify dimensional accuracy before performing any welding operations.
   Refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

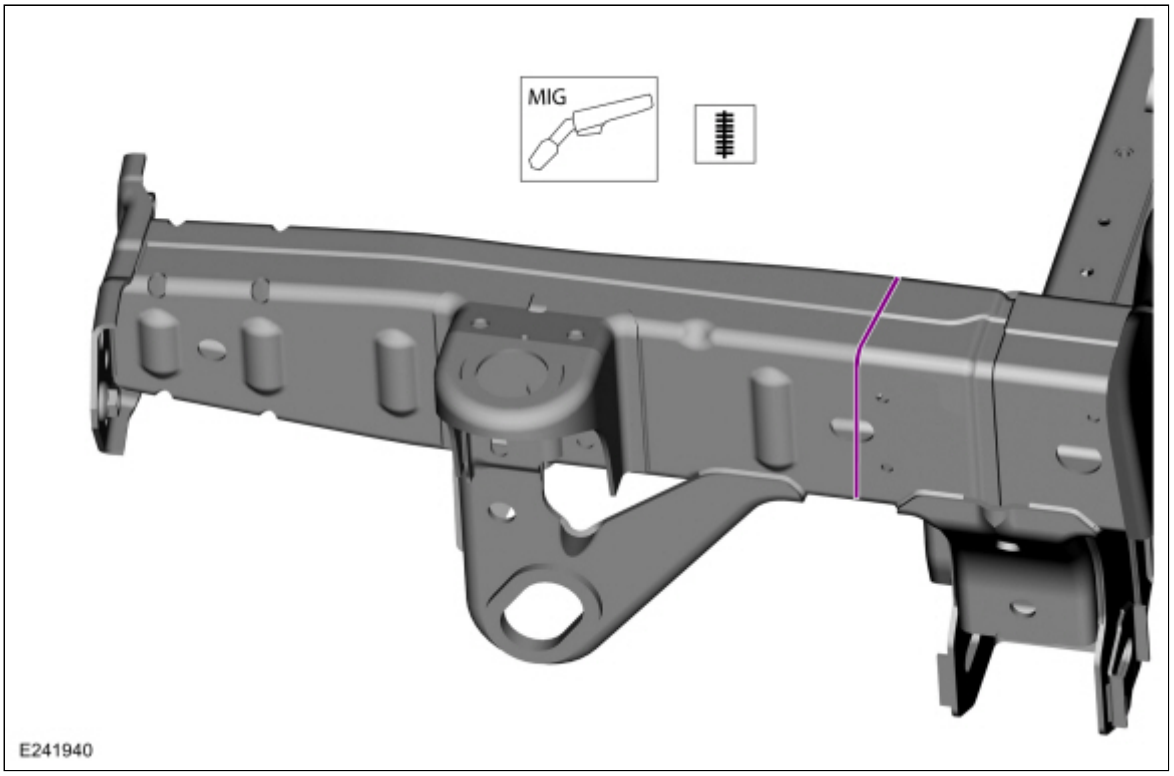
3. Sealer or adhesive must be applied with a minimum height of 6 mm.
   Refer to: Sealer, Underbody Protection Material and Adhesives (501-25 Body Repairs - General Information, Description and Operation).

4. **NOTE:** *Check that the Front End Sheet Metal (FESM) body mount bracket lines up with the sheet metal hole for the body mount bolt.*

   Install the front frame section inside the mid front rail of the frame and tack weld at 4 locations.
   Refer to: Joining Techniques (501-25 Body Repairs - General Information, Description and Operation).
   Use the General Equipment: MIG/MAG Welding Equipment
   Use the General Equipment: Locking Pliers



5. Re-check the frame replacement alignment by lowering the body, and then raise it. Weld the joint completely if this alignment is correct.
   Use the General Equipment: MIG/MAG Welding Equipment

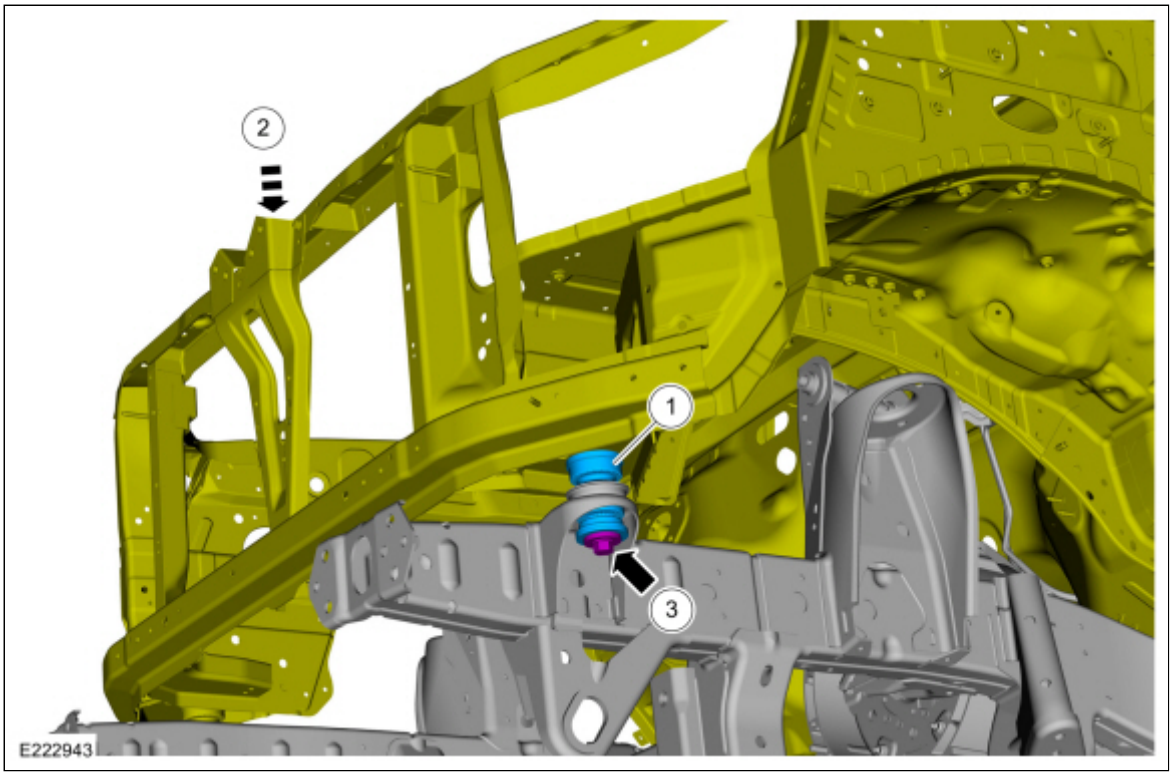


6. Metal finish the repair area using typical metal finishing techniques.

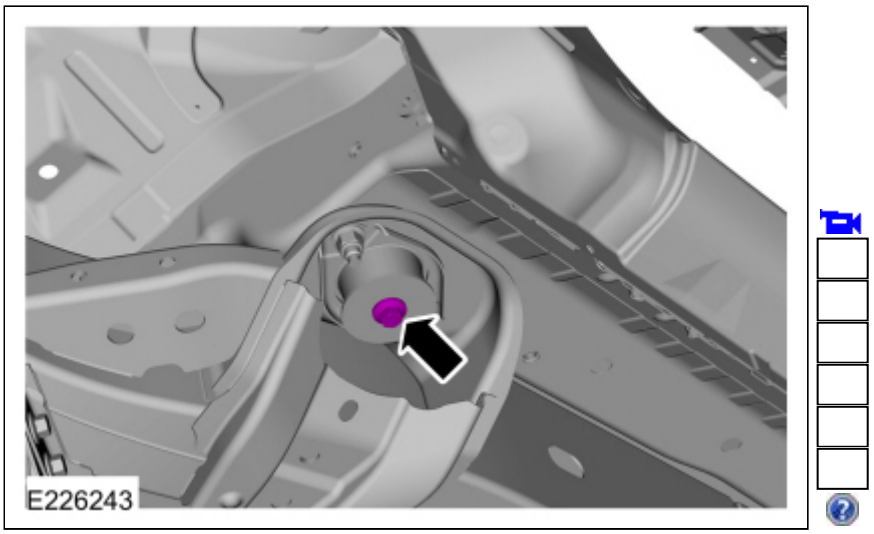
7. Refer to: Refinishing Materials (501-36 Paint - General Information, Description and Operation).

8. Sealing work: All areas must be sealed to production level.
   Refer to: Corrosion Prevention (501-36 Paint - General Information, Description and Operation).

1. Install the body-frame mounting bushes.
2. Using the frame rack towers, lower the radiator support to align with the frame rail bolts.
3. On both sides, install the mounting bolts.
   Torque: 80 Nm

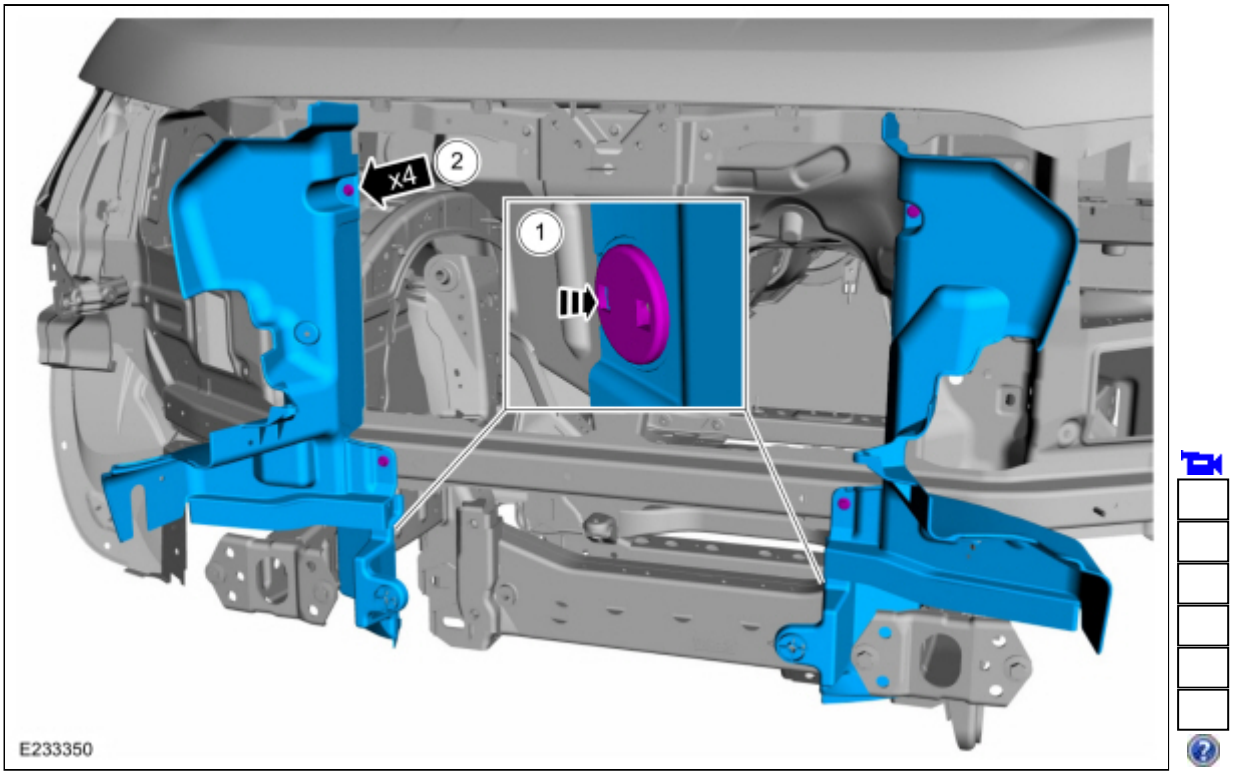


10. *Torque*: 108 Nm



11. Remove the vehicle from the frame rack.

12. *Torque*:
    2.: 5 Nm



13. Install the following items:
    1. Refer to: Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation).
    2. Refer to: Radiator (303-03C Engine Cooling - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal and Installation).
       Refer to: Radiator (303-03B Engine Cooling - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal and Installation).
       Refer to: Radiator (303-03A Engine Cooling - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal and Installation).
    3. Refer to: Engine - 6-Speed Automatic Transmission - 6R80 (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Removal).
       Refer to: Engine - 6-Speed Automatic Transmission - 6R80 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Removal).
       Refer to: Engine - 5-Speed Manual Transmission - MT75 (303-01A Engine - 2.5L Duratec-HE (122kW/165PS) - MI4, Removal).
       Refer to: Engine - 5-Speed Manual Transmission - MT75 (303-01B Engine - 2.2L Duratorq-TDCi

(88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation).
Refer to: Engine - 6-Speed Manual Transmission - MT82 (303-01B Engine - 2.2L Duratorq-TDCi (88kW/120PS) - Puma/2.2L Duratorq-TDCi (96kW/130PS) - Puma/2.2L Duratorq-TDCi (110kW/150PS) - Puma/2.2L Duratorq-TDCi (118kW/160PS) - Puma, Installation).
Refer to: Engine - 6-Speed Manual Transmission - MT82 (303-01C Engine - 3.2L Duratorq-TDCi (148kW/200PS) - Puma, Installation).

4. Refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
5. Refer to: Front Bumper (501-19 Bumpers, Removal and Installation).

Copyright © 2016 Ford Motor Company